N-Squared Software SIP Specialized Resource Platform SIGTRAN-TCAP-INAP Protocol Conformance Statement

Version 2.2

1 Document Information

1.1 Scope and Purpose

This document describes the implementation of the SIGTRAN, TCAP, and INAP protocols for real-time SRP flows for voice interaction control using the N-Squared (N2) SIP Specialized Resource Platform (SRP) when used in conjunction with an INAP Service Control Platform (SCP). It should be read in conjunction with the N2 SRP Technical Guide [R-1].

This document assumes a working knowledge of the relevant INAP and other telephony concepts, including the standard INAP interactions between an SCP, an SSP, and an SRP (or Intelligent Peripheral).

1.2 Definitions, Acronyms, and Abbreviations

Term	Meaning
AC	Application Context (in TCAP)
API	Application Programming Interface
ARI	Assist Request Instructions
ASN.1	Abstract Syntax Notation One
BER	Basic Encoding Rules
CAMEL	Customized Applications for Mobile Network Enhanced Logic
CAP	CAMEL Application Part
GT	Global Title
IETF	Internet Engineering Task Force
INAP	Intelligent Networking Application Part
IP	Intelligent Peripheral
M3UA	MTP3 User Adaption Layer
MTP3	Message Transfer Part Level 3
N2	N-Squared
PA	Play Announcement
PACUI	Prompt And Collect User Information
PC	Point Code
RFC	Request For Comments
RTP	Real-Time Transport Protocol
SCCP	Signalling Connection Control Part
SCP	Service Control Platform
SCTP	Stream Control Transmission Protocol
SIP	Session Initiation Protocol
SRP	Specialized Resource Platform
SRR	Specialized Resource Report
SSN	Sub-System Number
SSP	Service Switching Platform
SUA	SCCP User Adaption Layer

Term	Meaning
TCAP	Transaction Capabilities Application Part
TCP	Transmission Control Protocol
TS	Technical Specification

1.3 References

The following documents are referenced within this document:

Reference	Document
[R-1]	N2 SRP Technical Guide
[R-2]	N2 SVCD Technical Guide
[R-3]	N2 SRP SIP-SDP-RTP PCS
[R-10]	ETS 300 374-1 Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: Protocol specification
[R-11]	ITU-T Q.773 Transaction capabilities formats and encoding
[R-12]	IETF RFC 4666 Signaling System 7 (SS7) Message Transfer Part 3 (MTP3) - User Adaptation Layer (M3UA)
[R-13]	IETF RFC 3868 Signalling Connection Control Part User Adaptation Layer (SUA)

1.4 Ownership and Usage

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2 Contents

3 Introduction

3.1 N2 SRP Overview

The N-Squared SIP Specialized Resource Platform (SRP) is a software system for playing audio announcements and collecting DTMF digit input over a SIP/RTP session, under the control of an INAP Service Control Platform (SCP).

A standard N2SRP deployment contains several integration points:

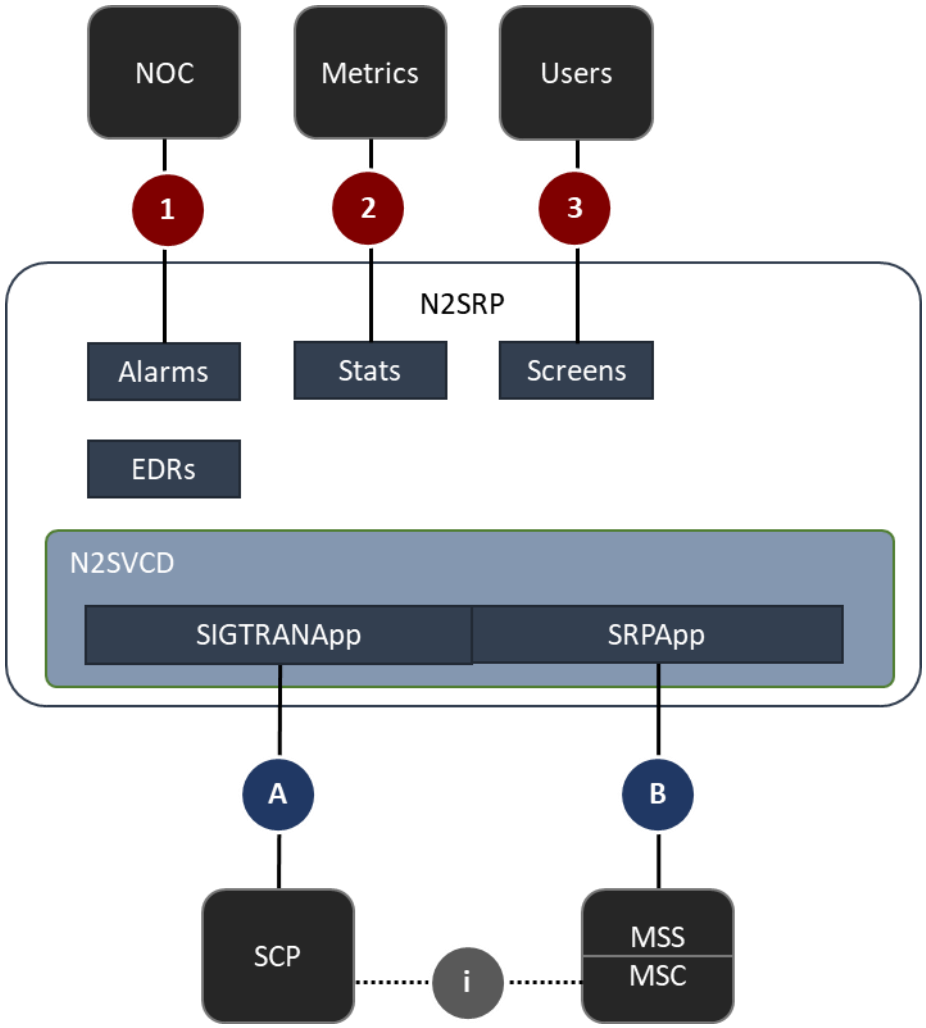

Figure A: N2 SRP Overview

This document describes the N2SRP Compliance for Interface "A", which has the following stack:

- INAP (or CAP)
- TCAP
- SCCP
- SIGTRAN M3UA
- SCTP/IP

4 INAP Compliance

4.1 INAP Overview

The N2SRP communicates with an INAP SCP to receive instructions for playing announcements and collecting DTMF input. In the mobile environment, the protocol for control may nominally be CAP, although in practical terms there is little difference between CAP and INAP.

N2SRP to SCP interface compliance is formally based on ETSI document "ETS 300 374-1 Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: Protocol specification" [R-10]. The N2SRP also supports a small subset of CAMEL parameters and some vendor-proprietary extensions as described herein.

4.2 INAP Operation Support

The N2SRP supports only the following INAP operations when communicating with the SCP.

Operation	Direction
AssistRequestInstructions	To SCP
Error (AssistRequestInstructions)	From SCP
PlayAnnouncement	From SCP
Error (PlayAnnouncement)	To SCP
SpecializedResourceReport	To SCP
Error (SpecializedResourceReport)	From SCP
PromptAndCollectUserInformation	From SCP
PromptAndCollectUserInformationResult	To SCP
Error (PromptAndCollectUserInformation)	To SCP

Table 1: INAP Operations

4.3 AssistRequestInstructions

The INAP AssistRequestInstructions operation is sent by the SRP to the SCP when it receives a valid inbound SIP session request.

The SRP supports sending the following attributes in AssistRequestInstructions:

Attribute	Type	Notes
correlationID	Generic Number	Supported
.digits	Hex Digits	Extracted from inbound SIP INVITE called party address.
.noa	Integer	Nature of Address = 2 (unknown)
.nqi	Integer	Number Qualifier Indicator = 0
.ni	Integer	Number Incomplete Indicatory = 0 (complete)
.npi	Integer	Numbering Plan Indicator = 1 (ITU-T E.164)
.pri	Integer	Presentation Restricted Indicator = 1 (restricted)
.si	Integer	Screening Indicator = 0 (user provided, not verified)
iPAvailable	Octet String	Never Present
iPSSPCapabilities	Octet String	Never Present

Attribute	Type	Notes
Extensions	Extensions	Never Present

Table 2: INAP ARI Attributes

The SRP will extract the called party address from the SIP INVITE, as described in [R-3], expecting a called party in one of the following formats:

- *[fixed-length-routing-prefix]**<scp-id>**[optional-variable-length-filler]**<correlation-id>***
- *[variable-length-routing-prefix]**<scp-id><correlation-id>***
- *[variable-length-routing-prefix] **<correlation-id><scp-id>***

The <scp-id> and <correlation-id> values are fixed-length decimal digit values (leading-padded with zero if necessary).

The SRP will use the <scp-id> to determine the SCCP called party address (GT, PC, SSN) as described in the SCCP compliance section. The SRP will pass the <correlation-id> as the "digits" of the ARI correlationID. The other ARI operation fields are set to the indicated defaults and are not configurable.

4.3.1 ReturnError

The SCP may send a ReturnError for the ARI. The SRP will tear down the call.

4.4 PlayAnnouncement

The INAP PlayAnnouncement operation is sent from the SCP to the SRP to request the SRP to play an announcement without digit collection. When the PlayAnnouncement is complete, the SRP will return a SpecializedResourceReport.

The SRP supports receiving the following attributes in PlayAnnouncement:

Attribute	Type	Notes
informationToSend	Sequence	Supported
.inbandInfo	Sequence	Supported
.messageID	Sequence	Supported
.elementaryMessageID	Integer	Supported
.text	-	Not Supported
.elementaryMessageIDs	Array*Integer	Supported
.variableMessage	Sequence	Supported
.elementaryMessageID	Integer	Supported
.variableParts	Sequence Of	Supported
.integer	Integer	Supported
.number	Octet String	Supported
.time	Octet String	Not Supported
.date	Octet String	Supported
.price	Octet String	Not Supported
.numberOfRepetitions	Integer	Supported
.duration	Integer	Supported
.interval	Integer	Supported

Attribute	Type	Notes
.tone	-	Not Supported
.displayInformation	-	Not Supported
disconnectFromIPForbidden	Boolean	Must be TRUE (or absent).
requestAnnouncementComplete	Boolean	Must be TRUE (or absent).
extensions	Array/Sequence	See Language ID Extension.
.type	Integer	
.criticality	-	
.value	-	
connectedParty	ConnectedParty	Optional attribute from CS-2, CS-3. Ignored.

Table 3: INAP PA Attributes

Note: ASN.1 is not a backwards-compatible format. Other non-listed fields received in INAP operations will cause a decode error.

4.4.1 Language ID Extension

The SRP supports receipt of a "Language ID" extension for PlayAnnouncement and for PromptAndCollectUserInformation. This mechanism is not part of the ETSI/CAMEL standards, and so the implementation may vary from site to site.

The supported extension container attributes are:

- Type (Integer) – A pre-agreed Extension Number to denote the Language ID Extension.
- Criticality (Enumerated) – Ignored.
- Value (Encoding is specified by the individual SCP vendor).

At this time, the only supported encoding is the "NAP" encoding implemented by the Oracle OCNCC SLC (SCP) platform, which is encoded as follows:

4.4.1.1 OCNCC "NAP" Language Extension Encoding

- SEQUENCE (Universal)
  - **LanguageID** (Tag=0/Context, Implicit Integer, Mandatory)
  - **Extras** (Tag=1/Context, Implicit Sequence, Mandatory)
    - **Extra0** (Tag=0/Context, Implicit Integer, Optional)
    - **Extra1** (Tag=1/Context, Implicit Integer, Optional)
    - **Extra2** (Tag=2/Context, Implicit Integer, Optional)
    - **Extra3** (Tag=3/Context, Implicit Integer, Optional)

The LanguageID is mapped to a Language Name internally in N2SRP. The Extra fields are Ignored.

4.4.2 ReturnError

The N2SRP supports sending ReturnError for PlayAnnouncement as follows:

Value	Error	Supported
0	Cancelled	Not Used
7	Missing Parameter	Used when none of our supported parameter alternatives are present in the PlayAnnouncement.
11	System Failure	Used when the N2SRP cannot load base configuration.
13	Unavailable Resource	Used when the requested message ID or the requested language is unknown, misconfigured, or missing audio.
14	Unexpected Component Sequence	Not Used
15	Unexpected Data Value	Not Used
16	Unexpected Parameter	Not Used

4.5 SpecializedResourceReport

The SRP does not support sending any attributes in SpecializedResourceReport.

4.5.1 ReturnError

The SCP may send a ReturnError for the SRR, which will cause the call to be torn-down.

4.6 PromptAndCollectUserInformation

The SCP sends INAP PromptAndCollectUserInformation to the SRP to request an announcement with digit collection. On completion, the SRP returns PromptedAndCollectUserInformationResult (success with digits collected) or an INAP ReturnError (success but no/insufficient digits collected).

The SRP supports receiving the following attributes in PromptedAndCollectUserInformation, which are in addition to those supported for PlayAnnouncement:

Attribute	Type	Notes
collectedInfo	Sequence	Supported
.collectedDigits	Sequence	Supported
.minimumNbOfDigits	Integer	Supported
.maximumNbOfDigits	Integer	Supported
.endOfReplyDigit	Octet String	Supported
.cancelDigit	Octet String	Supported
.startDigit	Octet String	Ignored
.firstDigitTimeout	Integer	Supported
.interDigitTimeout	Integer	Supported
.errortreatment	Enumerated	Ignored
.interruptableAnnInd	Boolean	Supported
.voiceInformation	Boolean	Ignored
.voiceBack	Boolean	Ignored
~~requestAnnouncementComplete~~	~~Boolean~~	Not Present for PACUI

Table 4: INAP PACUI Attributes

4.6.1 ReturnError

The N2SRP supports sending ReturnError for PromptAndCollectUserInformation as follows:

Value	Error	Supported
0	Cancelled	Not Used
4	Improper Caller Response	Used when collected DTMF digit string is missing/invalid.
7	Missing Parameter	Used when none of our supported parameter alternatives are present in the PromptAndCollectUserInformation.
11	System Failure	Used when the N2SRP cannot load base configuration.
13	Unavailable Resource	Used when the requested message ID or the requested language is unknown, misconfigured, or missing audio.
14	Unexpected Component Sequence	Not Used
15	Unexpected Data Value	Not Used
16	Unexpected Parameter	Not Used

4.7 INAP Message Flows

4.7.1 INAP Call Set-Up

The following diagram shows the standard INAP operation flow for SRP call setup. The SRP may perform call shutdown using TCAP Abort in the case of non-recoverable call error.

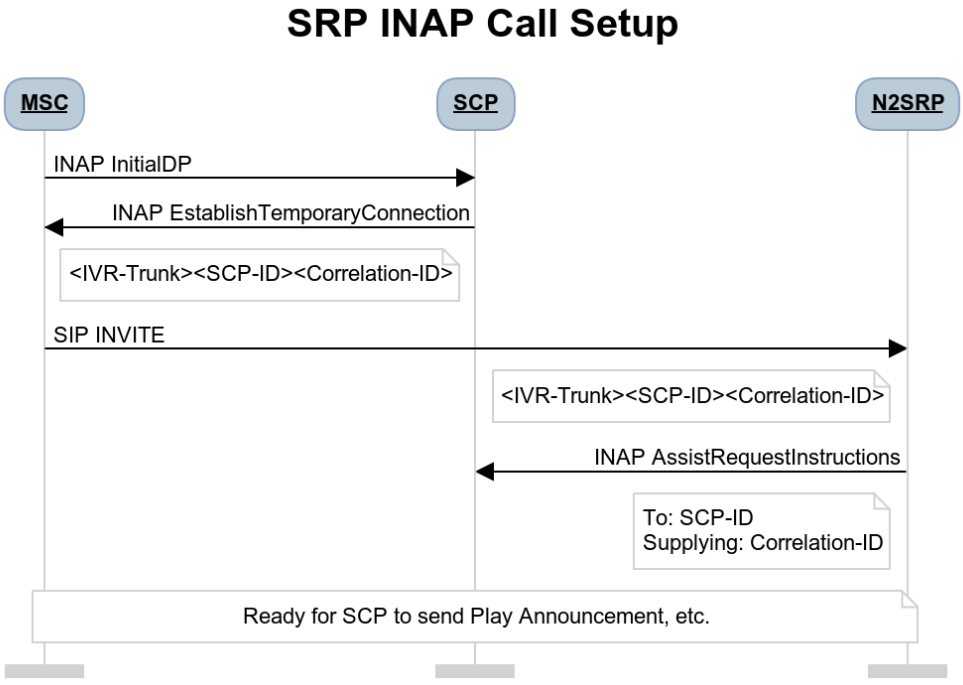

Figure B: SRP INAP Call Setup (ARI)

Note: Confirmation of SIP INVITE is not shown in this diagram.

4.7.2 INAP PlayAnnouncement

The following diagram shows the INAP operation flow for PlayAnnouncement. The SRP may perform call shutdown using TCAP Abort in the case of non-recoverable call error.

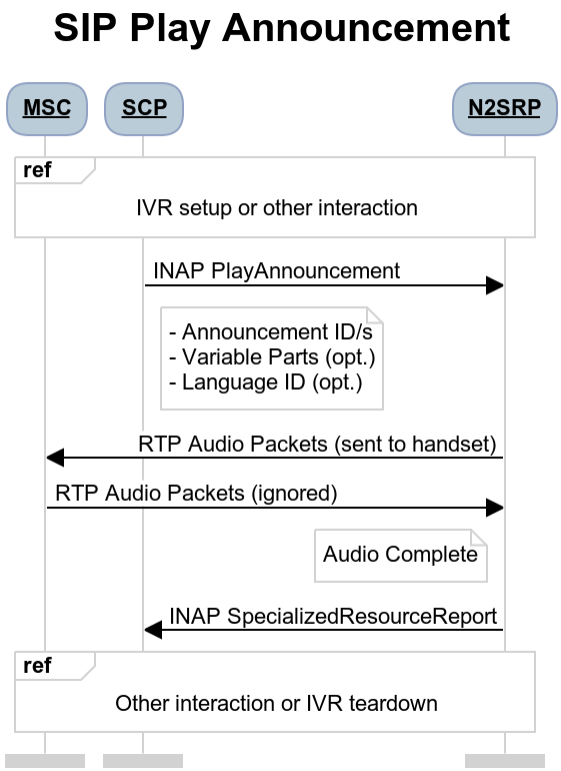

Figure C: SRP INAP Play Announcement (PA & SRR)

4.7.3 INAP PromptAndCollectUserInformation

The following diagram shows the INAP operation flow for PromptAndCollectUserInformation. The SRP may perform call shutdown using TCAP Abort in the case of non-recoverable call error.

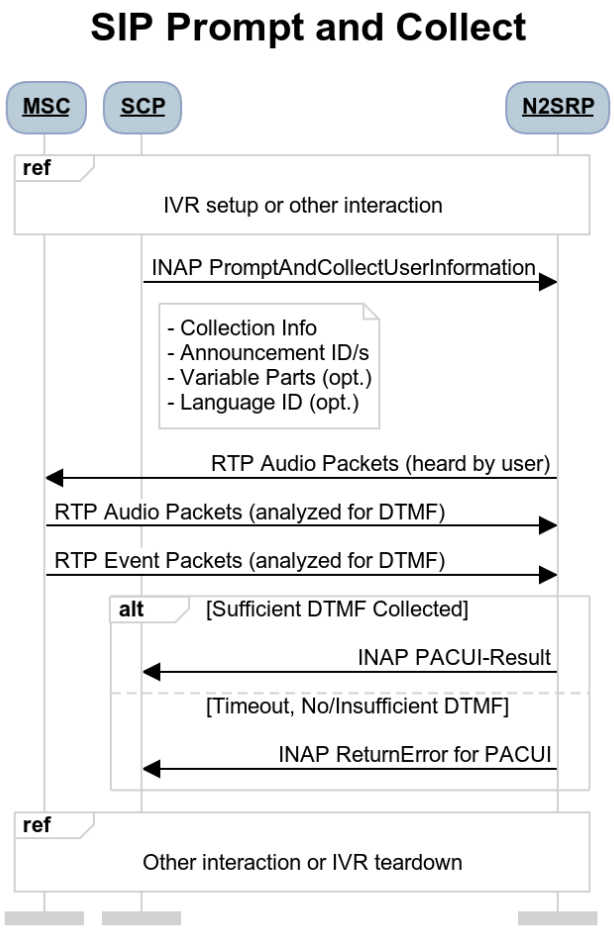

Figure D: SRP INAP Prompt & Collect (PACUI)

4.7.4 INAP Call Tear-Down (BYE from MSC)

When the call is terminated by the SCP at the end of interaction, clean call tear-down of the INAP dialog is performed by pre-arranged end. No INAP messages are sent for call tear-down.

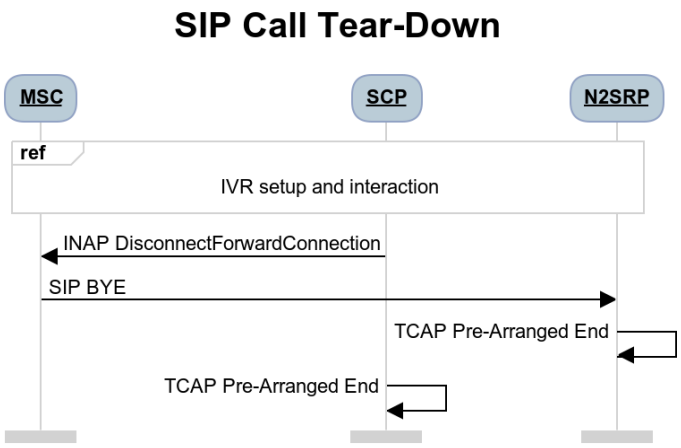

Figure E: SIP INAP Call Tear-Down (BYE from MSC)

Note: Confirmation of SIP BYE is not shown in this diagram.

4.7.5 Exception Scenarios

Various exception scenarios may occur in which TCAP-ABORT and/or SIP BYE are used to terminate all open connections. These scenarios are not shown individually.

Note that like any situation which involves a three-party simultaneous shutdown, race conditions are likely in which one or more end-points may generate a “Shutdown received for already terminated (or unknown) connection.

5 TCAP Compliance

The N2SVCD SigtranApp implements a TCAP layer based on the ITU-T Q.77x family of documents, specifically Q.773 ([R-11]).

5.1 TCAP Primitives

The following compliance is implemented for TCAP primitives:

Primitive	Notes
TC-UNI	Not Supported
TC-BEGIN	Supported
TC-CONTINUE	Supported
TC-END	Supported
TC-U-ABORT	Supported
TC-P-ABORT	Supported
Pre-Arranged End	Supported

Table 5: TCAP Primitive Compliance

5.2 TCAP Dialog

The following TCAP dialog attributes are supported.

Attribute	Notes
Application Context	Not Used – The SRP does not set the TCAP AC in the TCAP-BEGIN for ARI.
Originating Transaction ID	Supported
Destination Transaction ID	Supported

Table 6: TCAP Dialog Compliance

5.3 TCAP Components

The following TCAP component types are supported.

Component Type	Notes
Invoke	Supported
ReturnResult	Supported
ReturnError	Supported
Reject	Supported

Table 7: TCAP Component Compliance

6 SCCP & M3UA/SUA Compliance

The N2SVCD SigtranApp implements both:

- SCCP over M3UA using IETF RFC 4666 ([R-12]).
- SUA using IETF RFC 3868 ([R-13]).

6.1 M3UA Message Types

The following compliance is implemented for M3UA messages:

M3UA Message	Receive	Send
MGMT : ERR	Supported	Not Supported
MGMT : NTFY	Supported (AS-State Change only)	Supported (AS-State Change only)
Transfer : Data	Supported	Supported
ASPSM: ASPUP	Supported	Supported
ASPSM: ASPDOWN	Supported	Supported
ASPSM: BEAT	Supported	Not Supported
RKM: *	Not Supported	Not Supported
ASPTM: ASP Active	Supported	Supported
ASPTM: ASP Inactive	Supported	Supported
SSNM: DUNA	Ignored	Supported (in response to DAUD)
SSNM: DAVA	Ignored	Supported (in response to DAUD)
SSNM: DAUD	Supported	Not Supported
SSNM: SCON	Ignored	Not Supported
SSNM: DUPU	Ignored	Not Supported
SSNM: DRST	Ignored	Not Supported

Table 8: M3UA Message Type Compliance

6.2 SUA Message Types

The following compliance is implemented for SUA messages:

M3UA Message	Receive	Send
MGMT: ERR	Supported	Not Supported
MGMT: NTFY	Supported (AS-State Change only)	Supported (AS-State Change only)
Connectionless: CLDT	Supported	Supported
Connectionless : CLDR	Not Supported	Not Supported
ASPSM: ASPUP	Supported	Supported
ASPSM: ASPDOWN	Not Supported	Not Supported
ASPSM: BEAT	Not Supported	Not Supported
RKM: *	Not Supported	Not Supported
ASPTM: ASPAC	Supported	Supported
ASPTM: ASPIA	Not Supported	Not Supported
SNM: DUNA	Ignored	Not Supported

M3UA Message	Receive	Send
SNM: DAVA	Ignored	Not Supported
SNM: DAUD	Supported	Not Supported
SNM: SCON	Ignored	Not Supported
SNM: DUPU	Ignored	Not Supported
SNM: DRST	Ignored	Not Supported

Table 9: SUA Message Type Compliance

6.3 SCCP UnitData Types

The following compliance is implemented for SCCP UnitData types:

M3UA Message	Receive	Send
SCCP-UDT	Supported	Supported
SCCP-XUDT	Not Supported	Not Supported
SCCP-LUDT	Not Supported	Not Supported

Table 10: SCCP UD Types

6.4 SCCP Connection Classes

The following compliance is implemented for SCCP connection classes:

SCCP Connection Class	Receive	Send
Class 0	Supported	Supported
Class 1	Supported	Supported
Class 2	Not Supported	Not Supported
Class 3	Not Supported	Not Supported

Table 11: SCCP Connection Classes

6.5 SCCP Addressing

The N2SRP supports SCCP routing on PC + SSN, and/or Global Title (GT).

The following compliance is implemented for SCCP address indicators, Routing Indicator (RI) and Global Title Indicator (GTI):

SCCP Address Type	Receive	Send
RI = 0	Supported	Supported
RI = 1	Supported	Supported
GTI = 0	Supported	Supported
GTI = 1	Supported	Supported
GTI = 2	Supported	Supported
GTI = 3	Supported	Supported
GTI = 4	Supported	Supported

Table 12: SCCP Addressing

6.6 M3UA ASPTM ASPAC Traffic Mode

The following compliance is implemented for M3UA ASPTM ASPAP Traffic Mode.

Traffic Mode	Receive	Send
1 = Override	Ignored	Supported
2 = Loadshare	Supported	Supported (Default)
3 = Broadcast	Ignored	Supported

Table 1: M3UA ASPTM ASPAC Traffic Mode