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Technical Specification

**Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Serving GPRS Support Node (SGSN) - Visitors Location
Register (VLR);
Gs interface network service specification
(GSM 09.16 version 6.0.1 Release 1997)**

GSM®
GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS



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Contents

| | |
|--|-----------|
| Intellectual Property Rights..... | 4 |
| Foreword | 4 |
| Introduction | 4 |
| 1 Scope..... | 5 |
| 2 References..... | 5 |
| 2.1 Normative references | 5 |
| 2.2 Informative references | 6 |
| 3 Definitions, symbols and abbreviations | 7 |
| 4 Configuration of the Gs interface | 7 |
| 5 Conformance to message transfer part (MTP)..... | 7 |
| 5.1 General..... | 7 |
| 5.2 MTP Level 1 | 8 |
| 5.3 MTP Level 2..... | 8 |
| 5.4 MTP Level 3..... | 8 |
| 5.4.1 General clauses..... | 8 |
| 5.4.2 Configuration dependent clauses..... | 9 |
| 5.4.3 Informative clauses..... | 11 |
| 6 Conformance to SCCP | 12 |
| 6.1 Overview..... | 12 |
| 6.2 SCCP Primitives (ITU-T Recommendation Q.711)..... | 12 |
| 6.3 SCCP messages (ITU-T Recommendation Q.712)..... | 13 |
| 6.4 SCCP formats and codes (ITU-T Recommendation Q.713)..... | 13 |
| 6.5 SCCP procedures (ITU-T Recommendation Q.714) | 13 |
| 7 Use of the SCCP | 14 |
| Annex A (Informative): Document History..... | 15 |
| History | 16 |

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Foreword

This Technical Specification (TS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This TS provides a mechanism giving reliable transfer of signalling messages between the Serving GPRS Support Node (SGSN) and the data base of a Visitors Location Register (VLR) for co-ordination between GSM circuit switched services and GSM packet data services within the digital cellular telecommunications system (Phase 2+).

The contents of this TS are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this TS it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 6.x.y

where:

- 6 GSM Phase 2+ Release 1997
- x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.
- y the third digit is incremented when editorial only changes have been incorporated in the specification.

Introduction

This document specifies or references the necessary information to provide a reliable transfer of signalling messages between the Serving GPRS Support Node (SGSN) and the Visitors Location Register (VLR). This reliable transfer of messages is provided by the Network Service Part (NSP) of the Signalling System No 7 (SS7). This document specifies or references the subset of MTP and SCCP to be used in the Gs interface.

1 Scope

This document specifies or references the subset of MTP and SCCP which is used for the reliable transport of BSSAP+ messages in the Gs interface. This document also specifies the SCCP addressing capabilities to be provided in the Gs interface.

This Technical Specification is divided into two main parts, Chapter 5 dealing with the use of MTP and chapters 6-7 dealing with the use of SCCP.

Clause 5 of this Technical Specification deals with the subset of the MTP that is required between an SGSN and a VLR. It is intended that this implementation of MTP is compatible with a full MTP implementation.

The SCCP is used to provide message routing between the SGSN and the VLR. The SCCP routing principles specified in this Technical Specification allow to connect one SGSN to several VLR. No segmentation at SCCP level is needed on the Gs interface. Only SCCP class 0 is used on the Gs interface. clauses 6-7 identify the SCCP subset that should be used between an SGSN and an VLR.

2 References

References may be made to:

- specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- all versions up to and including the identified version (identified by “up to and including” before the version identity); or
- all versions subsequent to and including the identified version (identified by “onwards” following the version identity); or
- publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

2.1 Normative references

- [1] GSM 01.04: “Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms”.
- [2] GSM 02.60: “Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 1”.
- [3] GSM 03.03: “Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification”.
- [4] GSM 03.22: “Digital cellular telecommunications system (Phase 2+); Functions related to Mobile Station (MS) in idle mode and group receive mode”.
- [5] GSM 03.60: “Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 2”.
- [6] GSM 08.06: “Digital cellular telecommunications system (Phase 2+); Signalling transport mechanism specification for the Base Station System - Mobile Switching Centre (BSS - MSC) interface”.
- [7] GSM 08.08: “Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface: Layer 3 specification”.

- [8] GSM 08.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Base Station System (BSS): BSS GPRS Protocol (BSSGP)".
- [9] GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".
- [10] GSM 09.08: "Digital cellular telecommunications system (Phase 2+); Application of Base Station System Application Part (BSSAP) on the E-interface".
- [11] GSM 09.18: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Serving GPRS Support Node (SGSN) - Mobile Switching Center (MSC): Gs interface Layer 3 specification".
- [12] CCITT Recommendation E.164: "Numbering plan for the ISDN era".
- [13] CCITT Recommendation Q.702(3/93): "Specifications of Signalling System No. 7 - Signalling data link".
- [14] CCITT Recommendation Q.703(3/93): "Signalling link".
- [15] CCITT Recommendation Q.704(3/93): "Signalling network functions and messages".
- [16] CCITT Recommendation Q.707(3/93): "Specifications of Signalling System No. 7 - Testing and maintenance".
- [17] CCITT Recommendation Q.711(3/93): "Functional description of the signalling connection control part".
- [18] CCITT Recommendation Q.712(3/93): "Definition and function of SCCP messages".
- [19] CCITT Recommendation Q.713(3/93): "SCCP formats and codes".
- [20] CCITT Recommendation Q.714(3/93): "Signalling connection control part procedures".

2.2 Informative references

- [21] GSM 02.01: "Digital cellular telecommunications system (Phase 2+); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".
- [22] GSM 02.02: "Digital cellular telecommunications system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".
- [23] GSM 02.03: "Digital cellular telecommunications system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".
- [24] GSM 03.61: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Point to Multipoint Multicast Service Description; Stage 2".
- [25] GSM 03.62: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Point to Multipoint Group Call Service Description; Stage 2".
- [26] GSM 03.64: "Digital cellular telecommunications system (Phase 2+); Overall description of the General Packet Radio Service (GPRS) Radio interface; Stage 2".
- [27] GSM 04.02: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".
- [28] GSM 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".
- [29] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

- [30] GSM 04.65: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Subnetwork Dependent Convergence Protocol (SNDCP)".
- [31] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels."
- [32] GSM 09.60: "Digital cellular telecommunications system (Phase 2+), General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".
- [33] GSM 09.61: "Digital cellular telecommunications system (Phase 2+), General requirements on interworking between the Public Land Mobile Network (PLMN) supporting General Packet Radio Service (GPRS) and Packet Data Networks (PDN)".
- [34] GSM 12.00 (ETS 300 612-1): "Digital cellular telecommunications system (Phase 2); Objectives and structure of Network Management (NM)".
- [35] GSM 12.01: "Digital cellular telecommunications system (Phase 2); Common aspects of GSM Network Management (NM)".
- [36] GSM 12.13: "Digital cellular telecommunications system (Phase 2); Maintenance of the Mobile-services Switching Centre (MSC)".
- [37] GSM 12.14: "Digital cellular telecommunications system (Phase 2); Maintenance of location registers".
- [38] GSM 12.20: "Digital cellular telecommunications system (Phase 2); Network Management (NM) procedures and messages".

3 Definitions, symbols and abbreviations

Unless listed below, the definitions, symbols and abbreviations are listed in GSM 01.04 and GSM 03.60.

4 Configuration of the Gs interface

The Gs interface connects the Serving GPRS Support Node (SGSN) to the Visitors Location Register (VLR). This interface is defined in the 64 kbit/s boundary of an SGSN to a VLR or of a VLR to an SGSN. The configuration of the Gs interface shall not impose any restriction on the number of VLRs or SGSNs to be connected by the Gs interface. The Gs interface definition shall support an early implementation of GPRS when one SGSN may be connected to several VLRs or a more mature implementation when several SGSNs may be connected to one VLR. Therefore the interface shall support the use of an STP.

The level of resilience in the Gs interface is determined by the operator, however it is recommended that the operator considers the use of more than one multiplex system between the SGSN and the VLR. Each multiplex system should be used to carry one signalling link and routing diversity should be provided among the signalling links to increase the resilience of the system.

5 Conformance to message transfer part (MTP)

5.1 General

The MTP functions as specified in CCITT Recommendations Q.702, Q.703, Q.704 and Q.707 are applicable. However, the following subclauses provide a minimum set of MTP requirements that shall be implemented at a SGSN or VLR to support the functionality required by the BSSAP+ protocol in the Gs interface. The set of exceptions and modifications to those recommendations maintain compatibility with the implementation of a full specification of the MTP. The CCITT recommendations concerning the MTP shall be taken as requirements unless covered by a statement in this Technical Specification.

5.2 MTP Level 1

The MTP level 1 exceptions and modifications to ITU-T Recommendation Q.702 can be found in GSM 08.06 subclause 3.2.

5.3 MTP Level 2

The MTP level 2 exceptions and modifications to ITU-T Recommendation Q.703 are listed below.

- ITU-T Recommendation Q.703; subclause 1.4
 - Only the basic error correction protocol is required.
- ITU-T Recommendation Q.703; clause 6
 - Not applicable, only basic error correction is required.
- ITU-T Recommendation Q.703; clause 7
 - Both the SGSN and the VLR may apply the emergency proving period or the normal proving period in the initial alignment procedure. If all the signalling links between the two entities are unavailable then the SGSN or the VLR shall apply the emergency proving period until one signalling link becomes available.
- ITU-T Recommendation Q.703; clause 8
 - The processor outage status indicator shall be recognised at the SGSN and the VLR and the procedures defined in ITU-T Recommendation Q.703 clause 8 supported. The SGSN and the VLR should support the generation of the processor outage indication towards the peer entity if this is appropriate.

5.4 MTP Level 3

The Gs interface may be configured as a point to point interface or may use an intermediate SS7 network. In this last case an SGSN or a VLR may act always as end points of the Gs interface (SP functionality) or may be configured to act as a transfer point between a VLR and an SGSN (SP and STP functionality). The MTP level 3 exceptions and modifications to ITU-T Recommendation Q.704 are listed regarding whether the SGSN and the VLR are connected by a point to point link or are configured to act as SPs in an SS7 network or if they support STP functionality.

Section 5.4.1 applies to all configurations of the Gs interface. In subclause 5.4.2 the exceptions and modifications to ITU-T Recommendation Q.704 are listed depending upon the configuration of the Gs interface, whether it is a point to point interface or the SGSN and VLR act as an SP only or as SP and STP. Section 5.4.3 provides points of clarification about the ITU-T Recommendation Q.704.

5.4.1 General clauses

The MTP level 3 exceptions and modifications to ITU-T Recommendation Q.704 regardless of whether the SGSN supports STP functionality are listed below.

- Q.704 subclause 2.3.5.
 - Either of the two methods of congestion control is acceptable. The most appropriate method is dependent on national CCITT No. 7 implementations.
- Q.704 subclause 2.4 Message discrimination
 - The signalling point code for an SGSN may be included in the national signalling point code scheme or in a separate signalling network.
- Q.704 subclause 3.8.2
 - There are two acceptable methods of congestion control defined in ITU-T Recommendation Q.704, in subclauses 3.8.2.1 a) and b). The most appropriate method is dependent on national ITU-T No. 7

implementations. Each administration should specify its congestion threshold setting algorithm and nodal congestion abatement procedures at system procurement.

- Q.704 clause 12 Signalling link management
 - Only basic link management procedures are required.
- Q.704 subclause 14.2.1
 - Since all messages are passed using the SCCP, the service indicator for Gs interface operation will be:

| | | | | |
|------|---|---|---|---|
| bits | D | C | B | A |
| | 0 | 0 | 1 | 1 |
- Q.704 subclause 14.2.2
 - The sub service field for Gs interface operation will always be set to one of the following values:

| | | |
|------|------------------|---|
| bits | D | C |
| | 1 | 0 |
| | national network | |
| | 1 | 1 |
| | local network | |
- Q.704 clause 15
 - The formats and codes listed are only relevant to the messages that are required, i.e. those not excluded in the rest of this recommendation.

5.4.2 Configuration dependent clauses

The MTP level 3 exceptions and modifications to ITU-T Recommendation Q.704 are permitted if the SGSN or the VLR does not support STP functionality are listed below.

- ITU-T Recommendation Q.704; subclause 1.1.2
 - If the Gs interface is configured as a point to point interface, then there will be no signalling network management features which need to be considered.
- Q.704 clause 2
 - If STP functionality is not required the discrimination function of the MTP used for GPRS application can be significantly simplified.

NOTE: If the implementation of this interface is for point to point application the routing function within the MTP will be present to select the point code appropriate to the parent VLR.

- Q.704 subclause 2.3 Message routing function
 - If the implementation of the Gs interface is point to point, load sharing between linksets is not required since there will only be one linkset between SGSN and VLR.
- Q.704 subclause 2.4 Message discrimination
 - At an SGSN or VLR that does not implement STP functionality, only messages with a correctly checking DPC will be accepted. Others will be discarded. It is recommended that discarding a message because of an incorrectly set point code causes an incident report to be generated.
- Q.704 subclause 3.1.3 c)
 - In a point to point configuration there is no requirement for signalling route management.
- Q.704 subclause 3.3.2.3
 - In a point to point configuration there is no requirement for signalling route management.

- Q.704 subclause 3.3.3.3
 - In a point to point configuration there is no requirement for signalling route management.
- Q.704 subclause 3.3.4.3
 - In a point to point configuration there is no requirement for signalling route management.
- Q.704 subclause 3.4.3
 - Not applicable if no STP functionality is implemented by the SGSN or the VLR.
- Q.704 subclause 3.5.3
 - Not applicable if no STP functionality is implemented by the SGSN or the VLR.
- Q.704 subclause 3.8.5.2
 - The signalling-route-set-congestion-test procedure is not required
- Q.704 subclause 4.1.2
 - In a point to point configuration signalling routes are not applicable
- Q.704 subclause 4.2
 - The normal routing situation in a point to point configuration will be that there are 1 or more signalling links available between a SGSN and VLR, these will constitute a link set. They will be run in a load sharing mode and changeover, changeback procedures will be supported between these signalling links.
 - The normal routing situation if more than one route is available between the SGSN and the VLR will be that the load sharing, changeover and changeback procedures would be provided between signalling links within the same signalling linkset and between signalling linksets.
- Q.704 subclause 4.3.3.
 - There will be no alternative linkset in a point to point configuration of the Gs interface.
- Q.704 subclause 4.4.3.
 - Not applicable in a point to point configuration of the Gs interface.
- Q.704 subclause 4.5.
 - Not applicable in a point to point configuration of the Gs interface.
- Q.704 subclause 4.6.
 - Not applicable in a point to point configuration of the Gs interface.
- Q.704 subclause 4.7
 - Not applicable in a point to point configuration of the Gs interface.
- Q.704 clause 5 Changeover
 - Changeover between link sets is not applicable in a point to point configuration of the Gs interface.
- Q.704 clause 6 Changeback
 - Changeback between link sets is not applicable in a point to point configuration of the Gs interface.
- Q.704 clause 7
 - Forced re-routing is not applicable if there is only one signalling route existing between SGSN and VLR in a point to point configuration of the Gs interface.
- Q.704 clause 8

- Not applicable if there is only one signalling route existing between SGSN and VLR in a point to point configuration of the Gs interface.
- Q.704 subclause 13.2 Transfer prohibited
 - The transfer prohibited function is not applicable if the SGSN or the VLR does not support STP functionality. At the reception of a TFP message, the SGSN or VLR acting as SP shall process the message.
- Q.704 subclause 13.3 Transfer allowed
 - The transfer allowed function is not applicable if the SGSN or the VLR does not support STP functionality. At the reception of a TFA-message, the SGSN or VLR acting as SP shall process the message.
- Q.704 subclause 13.4 Transfer restricted
 - The transfer restricted function is not applicable if the SGSN or the VLR does not support STP functionality. At the reception of the TFR message, the SGSN or VLR acting as SP shall process the message.
- Q.704 subclause 13.5 Signalling-route-set-test
 - The signalling-route-set-test procedure is not applicable.
- Q.704 subclauses 13.6, 13.7, 13.8 Transfer controlled
 - The transfer controlled function is not applicable if the SGSN or the VLR does not support STP functionality. At the reception of TFC message, the SGSN or VLR acting as SP shall process the message.
- Q.704 subclause 13.9 Signalling route-set-congestion-test
 - The signalling route-set-congestion-test function is not required.
 - At the reception of signalling-route-set-congestion-test message no action is required by the receiving entity.

5.4.3 Informative clauses

A list of clarifications to ITU-T Recommendation Q.704 are listed below.

- Q.704 subclause 2.3.4.
 - The load sharing procedures shall allow any value of the SLC field in the MTP3 network management messages that are not related to a specific signalling link. This allows compatibility between blue book implementations where only the 0000 value is used and white book implementations where load sharing may be applicable to network management messages
- Q.704 subclause 3.4.1
 - It should be noted that for point to point working, the signalling route will become unavailable when the associated link set fails.
- Q.704 subclause 3.4.2
 - It should be noted that for point to point working, the signalling route will become available when the associated link set is restored.
- Q.704 subclause 3.5.1
 - It should be noted that for point to point working the procedures used in connection with signalling route unavailability will be those specified for signalling route set unavailability in CCITT Recommendation Q.704 subclause 11.2.1.
- Q.704 subclause 3.5.2
 - It should be noted that for point to point interworking the procedures used in connection with signalling route availability will be those specified for signalling route set availability in CCITT Recommendation Q.704 subclause 11.2.2.

- Q.704 clause 9
 - The SGSN and the MSC/VLR shall implement the restart procedures specified in ITU-T Q.704 (03/93) MTP3. The restart procedure specified in ITU-T Q.704 (11/88) MTP3 shall not be used.
 - Q.704 clause 11
 - It should be noted that for point to point working the signalling route set will consist of one associated signalling route only.
-

6 Conformance to SCCP

6.1 Overview

The purpose of this clause is to identify the subset of the SCCP functions which are necessary to provide addressing, error detection and segmentation facilities in the Gs interface. If this subset of SCCP functions is implemented, compatibility with a full ITU-T SCCP shall be maintained. Only the needs of the user of SCCP (refer to GSM 09.18) are taken into account in this clause: the operations and maintenance requirements about SCCP functions are outside the scope of this technical specification.

No SCCP translation function is required in the VLR or the SGSN between the national and the local MTP. The Destination Point Code and Subsystem Number would allow direct routing by the local SCCP and MTP. Global Title addressing is supported on the Gs interface to provide flexibility in the addressing scheme implementation (note that the SGSN is assigned a global title in order to communicate with an HLR across an inter PLMN boundary).

Only connectionless class 0 SCCP services are used on the Gs interface. These simplifications are applicable to the signalling between an SGSN and a VLR in GSM PLMNs.

The minimum set of SCCP functions which apply are specified in the ITU-T Recommendations Q.711, Q.712, Q.713 and Q.714, with the qualifications specified in this Recommendation.

6.2 SCCP Primitives (ITU-T Recommendation Q.711)

- Q.711 subclause 1
 - No SCCP connection-oriented services are used.
- Q.711 subclause 2
 - No SCCP connection-oriented services are used. Only connectionless class 0 is used.
- Q.711 subclause 2.1
 - Not applicable.
- Q.711 subclause 4.1
 - Connection-oriented functions are not applicable

6.3 SCCP messages (ITU-T Recommendation Q.712)

- Q.712 subclause 1.1 to 1.14
 - Messages not used.
- Q.712 subclause 1.16
 - The Subsystem-Out-Of-Service-Grant (SOG) message is not used.
- Q.712 subclause 1.17
 - The Subsystem-Out-Of-Service-Request (SOR) message is not used.
- Q.712 subclause 2.4, 2.6, 2.7, 2.9, 2.11, 2.12, 2.13, 2.14, 2.16, 2.17
 - Parameters not used.

6.4 SCCP formats and codes (ITU-T Recommendation Q.713)

- Q.713 subclause 3.4
 - The called party address shall include the appropriate sub system number. All other aspects of SCCP addressing are network specific.
- Q.713 subclause 3.4.2.2
 - SSN value:
 - This is a national network concern.
- Q.713 subclause 3.5
 - The calling party address shall include the appropriate sub system number. All other aspects of SCCP addressing are network specific. .
- Q.713 subclause 3.6
 - Protocol class: the classes 1, 2 and 3 are not used.
- Q.713 subclauses 3.7 3.8, 3.9, 3.10, 3.11, 3.13, 3.14, 3.15
 - Parameters not used
- Q.713 subclauses 4.2 to 4.9 and 4.12 to 4.17
 - Messages not used.
- Q.713 subclause 5.1.1
 - SOR and SOG not needed.

6.5 SCCP procedures (ITU-T Recommendation Q.714)

- Q.714 subclauses 1.1.2, 1.1.3
 - Protocol classes 2 and 3 not used.
 - Connection-oriented services are not used.
- Q.714 subclause 1.2
 - Connection-oriented services are not used.

- Q.714 subclause 1.3
 - Protocol class 1 not used.
- Q.714 subclause 2.1
 - The two basic categories of addresses for connectionless messages are used.
- Q.714 subclause 2.2, 2.3
 - No connection-oriented message is used.
- Q.714 clause 3
 - Connection-oriented procedures are not used.
- Q.714 clause 5
 - Only those messages and procedures relating to non-replicated subsystems or nodes are required.

7 Use of the SCCP

The MTP and the SCCP are used to support signalling messages between the SGSN and the MSC. The BSSAP+ protocol specified in TS GSM 09.18 is the user of the SCCP. GSM 09.18 only uses the services of the class 0 of the SCCP.

The Gs interface connects an SGSN to a VLR within the same PLMN. The use of point codes or global titles is allowed for routing of SCCP messages.

The format and coding of address parameters carried by the SCCP for routing purpose shall comply with ITU-T Recommendation Q.713 with the following restrictions:

- The called party address shall include:
 - an SSN (see subclause 6.4)
 - All other aspects of the SCCP signalling are network specific as specified in GSM 09.02.
- The calling party address shall include:
 - an SSN (see subclause 6.4)

All other aspects of the SCCP signalling are network specific as specified in GSM 09.02.

When an SCCP message is sent, the Called Party Address is derived from the Called Address of the N-UNITDATA-REQUEST primitive issued by the local SCCP user.

When an SCCP message is received, the Calling Address within the N-UNITDATA-INDICATION primitive is derived from the Calling Party Address of the SCCP UNITDATA message received.

Only address information belonging to the E.164 numbering plan is allowed to be included as Global Title in the Called and Calling Party Address. The SGSN and the VLR store the address of the other entity using the format received in the Calling Party Address field or the address information received in the application part of the message.

Annex A (Informative): Document History

| Document history | | |
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