3GPP TSG CN Plenary Meeting #21 **NP-030416**
17th - 19th September 2003. Frankfurt, Germany.

Source: **TSG CN WG 1**

Title: **CRs to Rel-5 (with mirror CRs) on Work Item TEI5 towards 24.008 and 44.065**

Agenda item: **8.8**

Document for: **APPROVAL**

Introduction:

This document contains **10** CRs, **Rel-5 to** Work Item **"TEI5"**, that have been agreed by **TSG CN WG1 in CN1#31 meeting**, and are forwarded to TSG CN Plenary meeting #21 for approval.

TDoc #	Tdoc Title	Spec	CR #	Rev	CAT	C_Version	Rel
N1-030998	Correction of the static conditions for the backup bearer capability IE contents	24.008	747		F	5.8.0	Rel-5
N1-030999	Correction of the static conditions for the backup bearer capability IE contents	24.008	787		A	6.1.0	Rel-6
N1-031004	Deletion of EFRPLMNAcT	24.008	792		F	5.8.0	Rel-5
N1-031005	Deletion of EFRPLMNAcT	24.008	793		A	6.1.0	Rel-6
N1-031225	Clarification of handover - BC-IE	24.008	794	1	F	5.8.0	Rel-5
N1-031226	Clarification of handover - BC-IE	24.008	795	1	A	6.1.0	Rel-6
N1-031311	Introduction of mobile station multislot power classes	24.008	814	1	F	5.8.0	Rel-5
N1-031312	Introduction of mobile station multislot power classes	24.008	815	1	A	6.1.0	Rel-6
N1-031229	Correction to References	44.065	006	2	F	5.0.0	Rel-5
N1-031074	Correction to References	44.065	007		A	6.0.0	Rel-6

3GPP TSG-CN1 Meeting #31 **Tdoc N1-031229**
Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **44.065** **CR** **006** ⌘ **rev** **2** ⌘ Current version: **5.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Correction to References
Source:	⌘	Nortel Networks
Work item code:	⌘	TEI5
Date:	⌘	15/08/2003
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	From the Change History, 44.065 v5.0.0 was created from 44.065 v4.1.0. After this, CR 002 on Correction of References was agreed and included in 44.065 v4.2.0. However, this change was not made to 44.065 v5.0.0 and then to v6.0.0.
Summary of change:	⌘	Implement CR 002 on Correction of References.
Consequences if not approved:	⌘	Incorrect specification.

Clauses affected:	⌘				
Other specs affected:	⌘	**Y**	**N**		
			X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

1 Scope

The present document provides the description of the Subnetwork Dependent Convergence Protocol (SNDCP) for the General Packet Radio Service (GPRS).

The user of the services provided by SNDCP is a packet data protocol (PDP) at the mobile Station (MS) or the Relay at the Serving GPRS Support Node (SGSN). Additionally, a control entity, e.g. AT command interpreter, may be an SNDCP user. SNDCP uses the services provided by the Logical Link Control (LLC) layer [4] and the Session Management (SM) sub-layer [2].

The main functions of SNDCP are:

- Multiplexing of several PDPs.
- Compression / decompression of user data.
- Compression / decompression of protocol control information.
- Segmentation of a network protocol data unit (N-PDU) into Logical Link Control Protocol Data Units (LL-PDUs) and re-assembly of LL-PDUs into an N-PDU.

3GPP TS ~~04.65~~44.065 is applicable to GPRS MS and SGSN.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service Description; Stage 1".

[3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".

[4] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[5] 3GPP TS 44.018: "Mobile radio interface; Layer 3 specification; Radio Resource Control Protocol".

[5a] 3GPP TS 24.008: "Mobile radio interface; Layer 3 specification; Core Network Protocols; Stage 3".

[6] 3GPP TS 44.064: "General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".

[7] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

~~[1] 3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".~~

~~[2] 3GPP TS 02.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service Description; Stage 1".~~

~~[3] 3GPP TS 03.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service Description; Stage 2".~~

~~[4] 3GPP TS 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".~~

~~[5] 3GPP TS 04.08: "Digital cellular telecommunications system (Phase 2+), Mobile radio interface; Layer 3 specification".~~

~~[6] 3GPP TS 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".~~

~~[7] 3GPP TS 09.60: "Digital cellular telecommunications system (Phase 2+), General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".~~

[8] ITU-T Recommendation V.42 bis: "Data compression procedures for data circuit-terminating equipment (DCE) using error correcting procedures".

[9] IETF RFC 1144: "Compressing TCP/IP headers for low-speed serial links", V. Jacobson.

[10] IETF RFC 2507: "IP Header Compression", M. Degermark, B. Nordgren, S. Pink.

[11] ITU-T Recommendation V.44: "Data compression procedures".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS ~~01.04~~21.905 [1] and 3GPP TS ~~02.60~~22.060 [2] and the following apply:

N201: LLC layer parameter (see 3GPP TS ~~04.64~~44.064 for clarity).
Defines maximum number of octets in the information field of LL-PDU. Separate values are applicable for I (see N201-I), U and UI (see N201-U) LL-PDUs.

N201-I: LLC layer parameter (see 3GPP TS ~~04.64~~44.064 for clarity).
Defines maximum number of octets available to a SN-DATA PDU for a specific SAPI.

N201-U: LLC layer parameter (see 3GPP TS ~~04.64~~44.064 for clarity).
Defines maximum number of octets available to a SN-UNITDATA PDU for a specific SAPI.

N-PDU number: a sequence number assigned to N-PDUs per NSAPI.

NSAPI: for each SN-PDU the NSAPI is an index to the PDP context of the PDP that is using the services provided by the SNDCP layer.

Receive N-PDU number: the value of the N-PDU number expected in the next N-PDU received by an NSAPI using acknowledged peer-to-peer LLC operation.

Recovery state: a state for an NSAPI in which duplicated received N-PDUs shall be detected and discarded. The recovery state only applies to NSAPIs using acknowledged peer-to-peer LLC operation.

SAPI: identifies the Service Access Point that the SN-PDU is using at the LLC layer.

Segment number: a sequence number assigned to SN-UNITDATA PDUs carrying segments of an N-PDU.

Send N-PDU number: the value to be assigned as the N-PDU number to the next N-PDU received from the SNDCP user by an NSAPI using acknowledged peer-to-peer LLC operation.

Send N-PDU number (unacknowledged): the value to be assigned as the N-PDU number to the next N-PDU received from the SNDCP user by an NSAPI using unacknowledged peer-to-peer LLC operation**.**

SNDCP entity: handles the service functions provided by the SNDCP layer. The SNDCP entity is temporary logical link identity specific.

SNDCP management entity: handles communication with SM sub-layer and controls the operation of the SNDCP entity.

SNDCP user: protocol entity that is using the services provided by the SNDCP layer. PDP entities and control entities, e.g. AT command interpreter, are the SNDCP users at the MS. Relay entity is the SNDCP user at the SGSN.

SNDCP XID block: the collection of SNDCP XID parameters being negotiated. It is transferred by the LL-XID and LL-ESTABLISH primitives between SNDCP and LLC.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TS ~~01.04~~21.905 [1], 3GPP TS ~~02.60~~22.060 [2], and 3GPP TS ~~03.60~~23.060 [3], and the following apply:

DCOMP	Identifier of the user data compression algorithm used for the N-PDU
F	First segment indicator bit
GMM	GPRS Mobility Management
IP	Internet Protocol
LLC	Logical Link Control
M	More bit used to indicate the last segment of N-PDU
N-PDU	Network Protocol Data Unit
NSAPI	Network Layer Service Access Point Identifier
P	Propose bit
PCOMP	Identifier of the protocol control information compression algorithm used for the N-PDU
PDP	Packet Data Protocol (e.g. IPv4 or IPv6)
PDU	Protocol Data Unit
PTP	Point to Point
QoS	Quality of Service
SAPI	Service Access Point Identifier
SDU	Service Data Unit
SGSN	Serving GPRS Support Node
SM	Session Management
SNDCP	Subnetwork Dependent Convergence Protocol
SNSM	SNDCP-SM
TCP	Transmission Control Protocol
TLLI	Temporary Logical Link Identifier
X	Spare bit

4 General

The present document describes the functionality of the GPRS SNDCP. The overall GPRS logical architecture is defined in 3GPP TS ~~03.60~~23.060 [3]. Location of the SNDCP in GPRS protocol stack can be seen in figure 1.

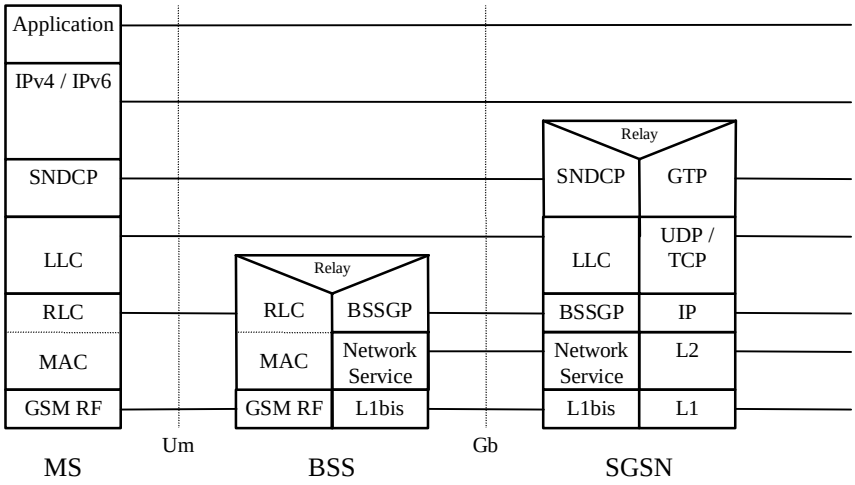

Figure 1: GPRS protocol stack

Network layer protocols are intended to be capable of operating over services derived from a wide variety of subnetworks and data links. GPRS supports several network layer protocols providing protocol transparency for the users of the service. Introduction of new network layer protocols to be transferred over GPRS shall be possible without any changes to GPRS. Therefore, all functions related to transfer of Network layer Protocol Data Units (N-PDUs) shall be carried out in a transparent way by the GPRS network entities. This is one of the requirements for GPRS SNDCP.

Another requirement for the SNDCP is to provide functions that help to improve channel efficiency. This requirement is fulfilled by means of compression techniques.

The set of protocol entities above SNDCP consists of commonly used network protocols. They all use the same SNDCP entity, which then performs multiplexing of data coming from different sources to be sent using the service provided by the LLC layer (figure 2). The Network Service Access Point Identifier (NSAPI) is an index to the PDP context (see 3GPP TS ~~03.60~~23.060 [3]) of the PDP that is using the services provided by SNDCP. One PDP may have several PDP contexts and NSAPIs. However, it is possible that each allocated NSAPI is used by separate PDP. Each active NSAPI shall use the services provided by the Service Access Point Identifier (SAPI) in the LLC layer. Several NSAPIs may be associated with the same SAPI.

Since the adaptation of different network layer protocols to SNDCP is implementation dependent, it is not defined in the present document.

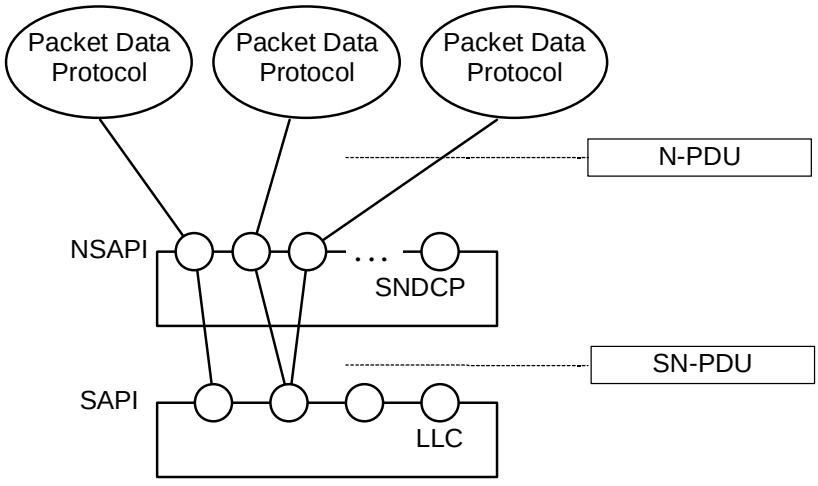

Figure 2: Example for multiplexing of different protocols

5 Service primitives and functions

5.1 Service primitives

This subclause explains the service primitives used for communication between the SNDCP layer and other layers. See also 3GPP TS ~~04.07~~24.007 [4] to get an overall picture of the service primitives. Figure 3 illustrates the service access points through which the primitives are carried out.

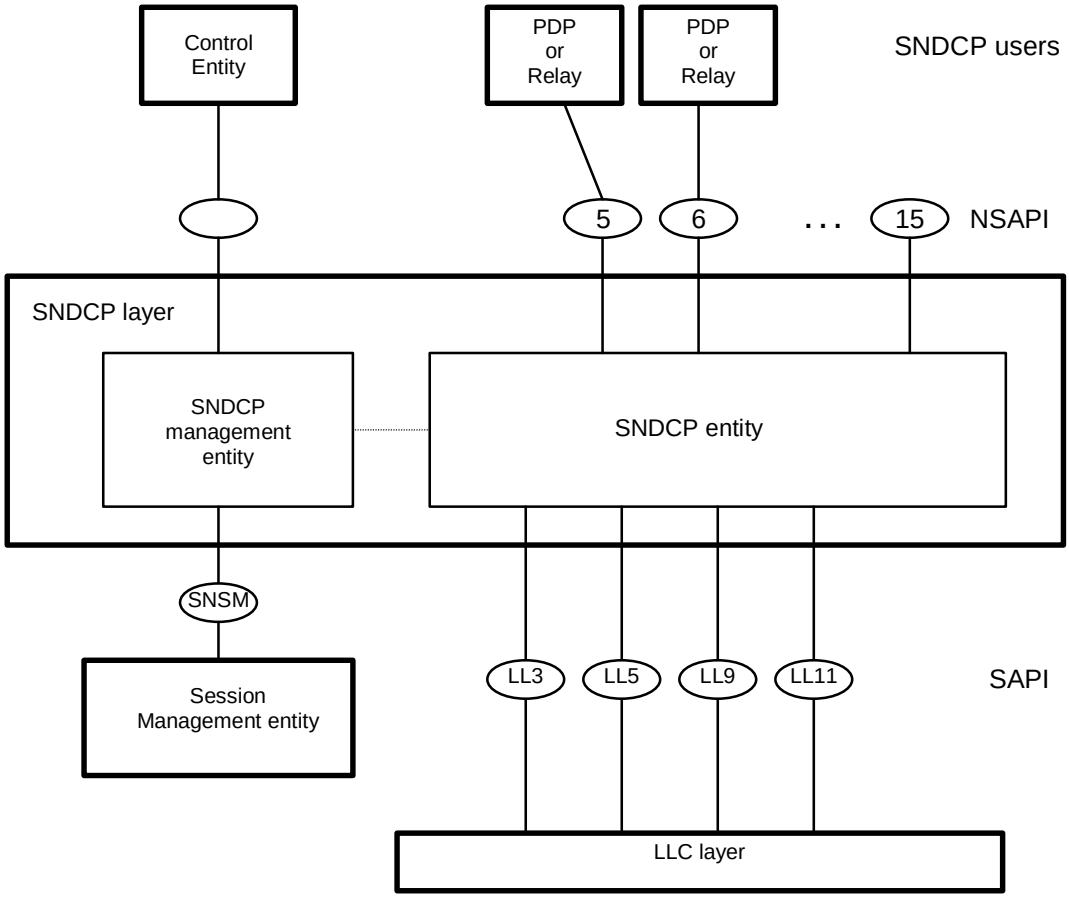

Figure 3: Service Access Points provided and used by SNDCP

5.1.1 SNDCP service primitives

The primitives provided by the SNDCP layer are listed in table 1.

Table 1: SNDCP layer service primitives

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
SNDCP User (PDP or the SGSN Relay) ↔ SNDCP					
SN-DATA	X	-	-	-	N-PDU, NSAPI, N-PDU Number
SN-DATA	-	X	-	-	N-PDU, NSAPI
SN-UNITDATA	X	X	-	-	N-PDU, NSAPI
SN-XID	X	X	-	-	Requested SNDCP XID Parameters
SN-XID	-	-	X	X	Negotiated SNDCP XID Parameters

5.1.1.1 SN-DATA.request

Request used by the SNDCP user for acknowledged transmission of N-PDU. The successful transmission of SN-PDU shall be confirmed by the LLC layer. The SN-DATA.request primitive conveys NSAPI to identify the PDP using the service. N-PDU Number, if present, indicates the N-PDU number previously assigned to this N-PDU.

NOTE: An N-PDU number may have been assigned to an N-PDU by the old SGSN before an inter-SGSN routeing area update.

5.1.1.2 SN-DATA.indication

Indication used by the SNDCP entity to deliver the received N-PDU to the SNDCP user. Successful reception has been acknowledged by the LLC layer.

5.1.1.3 SN-UNITDATA.request

Request used by the SNDCP user for unacknowledged transmission of N-PDU. The SN-UNITDATA.request primitive conveys NSAPI to identify the PDP using the service.

5.1.1.4 SN-UNITDATA.indication

Indication used by the SNDCP entity to deliver the received N-PDU to the SNDCP user.

5.1.1.5 SN-XID.request

Request used by the SNDCP user at the initiating entity to deliver the list of requested XID parameters to the peer entity.

5.1.1.6 SN-XID.indication

Indication used by the SNDCP entity to deliver the list of requested XID parameters to the SNDCP user.

5.1.1.7 SN-XID.response

Response used by the SNDCP user to deliver the list of negotiated XID parameters to the peer entity.

5.1.1.8 SN-XID.confirm

Confirm used by the SNDCP entity to deliver the list of negotiated XID parameters to the SNDCP user.

5.1.2 Service primitives used by SNDCP layer

The SNDCP layer uses the service primitives provided by the SM sublayer and the LLC layer (see table 2). SM is specified in 3GPP TS ~~04.08~~24.008 [5a] and LLC in 3GPP TS ~~04.64~~44.064 [6].

Table 2: Service primitives used by the SNDCP entity

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
SNDCP ↔ LLC					
LL-RESET	-	X	-	-	TLLI
LL-ESTABLISH	X	-	-	-	TLLI, XID Requested
LL-ESTABLISH	-	X	-	-	TLLI, XID Requested, N201-I, N201-U
LL-ESTABLISH	-	-	X	-	TLLI, XID Negotiated
LL-ESTABLISH	-	-	-	X	TLLI, XID Negotiated, N201-I, N201-U
LL-RELEASE	X	-	-	-	TLLI, Local
LL-RELEASE	-	X	-	-	TLLI, Cause
LL-RELEASE			-	X	TLLI
LL-XID	X	-	-	-	TLLI, XID Requested
LL-XID	-	X	-	-	TLLI, XID Requested, N201-I, N201-U
LL-XID	-	-	X	-	TLLI, XID Negotiated
LL-XID	-	-	-	X	TLLI, XID Negotiated, N201-I, N201-U
LL-DATA	X	-	-	-	TLLI, SN-PDU, Reference, QoS Parameters, Radio Priority
LL-DATA	-	X	-	-	TLLI, SN-PDU
LL-DATA	-	-	-	X	TLLI, Reference
LL-UNITDATA	X	-	-	-	TLLI, SN-PDU, QoS Parameters, Radio Priority, Cipher
LL-UNITDATA	-	X	-	-	TLLI, SN-PDU
LL-STATUS	-	X	-	-	TLLI, Cause
SNDCP ↔ SM					
SNSM-ACTIVATE		X	-	-	TLLI, NSAPI, QoS profile, SAPI, Radio Priority
SNSM-ACTIVATE	-	-	X		TLLI, NSAPI
SNSM-DEACTIVATE	-	X	-	-	TLLI, NSAPI(s), LLC Release Indicator
SNSM-DEACTIVATE	-	-	X	-	TLLI, NSAPI
SNSM-MODIFY	-	X	-	-	TLLI, NSAPI, QoS Profile, SAPI, Radio Priority, Send N-PDU Number, Receive N-PDU Number
SNSM-MODIFY	-	-	X	-	TLLI, NSAPI
SNSM-STATUS	X	-	-	-	TLLI, SAPI, Cause
SNSM-SEQUENCE	-	X	X	-	TLLI, NSAPI, Receive N-PDU Number
SNSM-STOP-ASSIGN	-	X	-	-	TLLI, NSAPI

5.1.2.1 LL-RESET.indication

Indication used by the LLC layer in the SGSN to indicate to the SNDCP layer that the Reset XID parameter has been transmitted, and by the LLC layer in the MS to indicate to the SNDCP layer that the Reset XID parameter has been received.

Upon receipt of the LL-RESET.indication, the SNDCP layer shall:

- treat all outstanding SNDCP ↔ LLC request type primitives as not sent;
- reset all SNDCP XID parameters to their default values;
- in the MS, for every NSAPI using unacknowledged peer-to-peer LLC operation, set the Send N-PDU number (unacknowledged) to 0; and

- for every NSAPI using acknowledged peer-to-peer LLC operation, enter the recovery state and suspend the transmission of SN-PDUs until an SNSM-SEQUENCE.indication primitive is received for the NSAPI. In the SGSN the SNDCP layer shall re-establish acknowledged peer-to-peer operation for the affected SAPIs in the LLC layer.

5.1.2.2 LL-ESTABLISH.request

Request used by the SNDCP layer to establish or re-establish acknowledged peer-to-peer operation for a SAPI in the LLC layer. XID Requested is used to deliver the requested SNDCP XID parameters to the LLC layer.

5.1.2.3 LL-ESTABLISH.indication

Indication used by the LLC layer to inform the SNDCP layer about establishment or re-establishment of acknowledged peer-to-peer operation for a SAPI in the LLC layer. XID Requested is used to deliver the requested SNDCP XID parameters to the SNDCP layer. In case of a re-establishment, all NSAPIs mapped to the affected SAPI shall enter the recovery state, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting with the oldest N-PDU when the link is re-established. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.4 LL-ESTABLISH.response

Response used by the SNDCP layer after reception of the LL-ESTABLISH.indication. XID Negotiated is used to deliver the negotiated SNDCP XID parameters to the LLC layer.

5.1.2.5 LL-ESTABLISH.confirm

Confirmation used by the LLC layer to inform the SNDCP layer about successful initiation of acknowledged peer-to-peer operation for a SAPI in the LLC layer. XID Negotiated is used to deliver the negotiated SNDCP XID parameters to the SNDCP layer. In case of a re-establishment, all NSAPIs mapped to the affected SAPI shall enter the recovery state, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting with the oldest N-PDU when the link is re-established. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.6 LL-RELEASE.request

Request used by the SNDCP layer to release acknowledged peer-to-peer operation for a SAPI in the LLC layer. The Local parameter indicates whether the termination shall be local (see 3GPP TS ~~04.64~~44.064 for details).

5.1.2.7 LL-RELEASE.indication

Indication used by the LLC layer to inform the SNDCP layer about termination of acknowledged peer-to-peer operation for a SAPI in the LLC layer. The Cause parameter indicates the cause for the termination.

On receipt of LL-RELEASE.indication, compressed N-PDUs queuing to be forwarded to the affected SAPI are deleted from the SNDCP layer. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.8 LL-RELEASE.confirm

Confirmation used by the LLC layer to inform the SNDCP layer about termination of acknowledged peer-to-peer operation for a SAPI in the LLC layer. On receipt of LL-RELEASE.confirm, compressed N-PDUs queuing to be forwarded to the affected SAPI are deleted from the SNDCP layer. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.9 LL-XID.request

Request used by the SNDCP layer to deliver the requested SNDCP XID parameters to the LLC layer.

5.1.2.10 LL-XID.indication

Indication used by the LLC layer to deliver the requested SNDCP XID parameters to the SNDCP layer.

5.1.2.11 LL-XID.response

Response used by the SNDCP layer to deliver the negotiated SNDCP XID parameters to the LLC layer.

5.1.2.12 LL-XID.confirm

Confirm used by the LLC layer to deliver the negotiated SNDCP XID parameters to the SNDCP layer.

5.1.2.13 LL-DATA.request

Request used by the SNDCP layer for acknowledged transmission of an SN-PDU. The SNDCP entity shall associate a reference parameter for each LL-DATA.request. QoS Parameters in the SGSN includes precedence class, delay class, and peak throughput. QoS Parameters in the MS includes peak throughput. QoS Parameters is defined as part of the Quality of Service information element in 3GPP TS ~~04.08~~24.008 [5a]. Radio Priority is included only in the MS, and indicates the radio priority level to be used by RLC/MAC.

Acknowledged peer-to-peer LLC operation for the SAPI used shall be established using the LL-ESTABLISH primitives, before the LL-DATA.request may be used.

5.1.2.14 LL-DATA.indication

Indication used by the LLC layer to deliver the successfully received SN-PDU to the SNDCP layer.

5.1.2.15 LL-DATA.confirm

Confirm used by the LLC layer to inform SNDCP layer about successful transmission of SN-PDU. The primitive includes a reference parameter from which the SNDCP entity shall identify the LL-DATA.request this confirmation was associated with. All buffered N-PDUs whose complete reception is confirmed are deleted.

5.1.2.16 LL-UNITDATA.request

Request used by the SNDCP layer for unacknowledged transmission of a SN-PDU. Unconfirmed transmission shall be used by the LLC layer.

Acknowledged peer-to-peer LLC operation does not need to be established before unacknowledged transmission is allowed.

QoS Parameters in the SGSN includes precedence class, delay class, reliability class, and peak throughput. QoS Parameters in the MS includes peak throughput and reliability class. Reliability class indicates whether the LLC frame carrying the SN-PDU shall be transmitted in protected or unprotected mode, and whether RLC/MAC acknowledged or unacknowledged mode shall be used. Radio Priority is included only in the MS, and indicates the radio priority level to be used by RLC/MAC.

5.1.2.17 LL-UNITDATA.indication

Indication used by the LLC layer to deliver the received SN-PDU to the SNDCP layer. There is no need for acknowledged peer-to-peer LLC operation for unacknowledged transmission of SN-PDU.

5.1.2.18 LL-STATUS.indication

Indication used by the LLC layer to inform SNDCP when an LLC error that cannot be corrected by the LLC layer has occurred. The Cause parameter indicates the cause of the failure.

On receipt of LL-STATUS.indication, SNDCP shall inform the SM sub-layer by means of the SNSM-STATUS.request primitive.

5.1.2.19 SNSM-ACTIVATE.indication

Indication used by the SM entity to inform the SNDCP entity that an NSAPI has been activated for data transfer. It also informs the SNDCP entity about the negotiated QoS profile (see 3GPP TS ~~04.08~~24.008 [5a]), the SAPI assigned for this NSAPI, and, in the MS, the radio priority level to be used by RLC/MAC.

If the NSAPI activated uses the acknowledged peer-to-peer LLC operation, the NSAPI shall enter the recovery state.

Upon reception of the SNSM-ACTIVATE.indication from the SM sublayer, the SNDCP entity shall, if necessary, establish the acknowledged peer-to-peer LLC operation for the indicated SAPI. The establishment criteria and procedure are described in subclause 6.2.1.

5.1.2.20 SNSM-ACTIVATE.response

Response used by the SNDCP layer to inform SM entity that the indicated NSAPI is now in use and that the acknowledged peer-to-peer LLC operation for the indicated SAPI is established, if necessary.

5.1.2.21 SNSM-DEACTIVATE.indication

Indication used by the SM entity to inform the SNDCP entity that an NSAPI has been deallocated and cannot be used by the SNDCP entity anymore. All buffered N-PDUs corresponding to this NSAPI are deleted.

Upon reception of the SNSM-DEACTIVATE.indication, the SNDCP entity shall, if necessary, release the acknowledged peer-to-peer LLC operation for the associated SAPI. The release criteria and procedure are described in subclause 6.2.2.

5.1.2.22 SNSM-DEACTIVATE.response

Response used by the SNDCP layer to inform SM entity that the NSAPI indicated is no longer in use and that the acknowledged peer-to-peer LLC operation for the associated SAPI is released, if necessary.

5.1.2.23 SNSM-MODIFY.indication

Indication used by the SM entity to trigger change of the QoS profile (see 3GPP TS ~~04.08~~24.008 [5a]) for an NSAPI and indication of the SAPI to be used. It is also used by the SM entity in the SGSN to inform the SNDCP entity that an NSAPI shall be created, together with the (re-)negotiated QoS profile, the SAPI assigned, and, in the MS, the radio priority level to be used by RLC/MAC.

NOTE: The latter is performed in the new SGSN during an Inter-SGSN Routeing Area Update.

Upon reception of the SNSM-MODIFY.indication from the SM sublayer:

- the SNDCP entity shall, if necessary, establish the acknowledged peer-to-peer LLC operation for the indicated SAPI (the establishment criteria and procedure are described in subclause 6.2.1); and

- the SNDCP entity shall also, if necessary, release the acknowledged peer-to-peer LLC operation for the originally-assigned SAPI (the release criteria and procedure are described in subclause 6.2.2).

If the SNSM-MODIFY.indication applies to an existing NSAPI, and:

- if the peer-to-peer LLC operation mode is changed from acknowledged to unacknowledged, then all buffered N-PDUs shall be deleted, and the Send N-PDU number (unacknowledged) shall be set to 0; and

- if the peer-to-peer LLC operation mode is changed from unacknowledged to acknowledged, then the Send N-PDU number and Receive N-PDU number shall be set to 0.

In addition, if the newly-assigned SAPI is different from the original SAPI:

- LL-DATA.indication, LL-DATA.confirm and LL-UNITDATA.indication received on the old SAPI shall be ignored;

- LL-DATA.request and LL-UNITDATA.request shall be sent on the new SAPI; and

- if acknowledged peer-to-peer LLC operation is used both before and after the receipt of the SNSM-MODIFY.indication, then the NSAPI shall enter the recovery state, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting from the oldest N-PDU.

If the SNSM-MODIFY.indication signifies the creation of an NSAPI (i.e. the specified NSAPI does not exist), and:

- if unacknowledged peer-to-peer LLC operation is specified in the QoS profile, then the Send N-PDU number (unacknowledged) shall be set to 0; and
- if acknowledged peer-to-peer LLC operation is specified in the QoS profile, then the Send N-PDU number and the Receive N-PDU number variables shall be set to the values stated in the primitive.

5.1.2.24 SNSM-MODIFY.response

Response used by the SNDCP entity to inform the SM entity that the indicated NSAPI and QoS profile are now in use and the acknowledged peer-to-peer LLC operations for the appropriate SAPIs are established and/or released, if necessary.

5.1.2.25 SNSM-STATUS.request

This primitive is used by the SNDCP layer to inform the SM sub-layer that SNDCP cannot continue its operation due to errors at the LLC layer (as indicated with LL-RELEASE.indication) or at the SNDCP layer. The Cause parameter indicates the cause of the error.

5.1.2.26 SNSM-SEQUENCE.indication

This primitive is used during an inter-SGSN routeing area update and applies only to NSAPIs using acknowledged peer-to-peer LLC operation. When the primitive is used in the MS, the Receive N-PDU number parameter indicates the Receive N-PDU number in the SGSN. When the primitive is used in the SGSN, the Receive N-PDU number parameter indicates the Receive N-PDU number in the MS. If a buffered N-PDU is confirmed by the Receive N-PDU number parameter to have been received by the peer SNDCP entity, the N-PDU shall be deleted from the buffer. In addition, the receipt of this primitive by the SNDCP entity resumes the transmission of SN-PDUs for the NSAPI, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting from the oldest N-PDU. If acknowledged peer-to-peer LLC operation has not yet been established for the SAPI used by this NSAPI, the transmission of the buffered N-PDUs shall begin only after the receipt of the LL-ESTABLISH.indication or LL-ESTABLISH.confirm primitive.

5.1.2.27 SNSM-SEQUENCE.response

This primitive is used during an inter-SGSN routeing area update and applies only to NSAPIs using acknowledged peer-to-peer LLC operation. The primitive is used by the SNDCP layer in the MS following receipt of an SNSM-SEQUENCE.indcation, in order to return the Receive N-PDU number to the SGSN during an ongoing inter-SGSN routeing area update.

5.1.2.28 SNSM-STOP-ASSIGN.indication

This primitive is used during an inter-SGSN routeing area update in the old SGSN by the SM entity to inform the SNDCP entity to stop assigning N-PDU numbers to N-PDUs received through the SN-DATA.request primitive. The primitive is sent before the Send N-PDU number and the Receive N-PDU number are transferred to the new SGSN.

5.2 Service functions

SNDCP shall perform the following functions (see figure 4):

- Mapping of SN-DATA primitives onto LL-DATA primitives.
- Mapping of SN-UNITDATA primitives onto LL-UNITDATA primitives.
- Multiplexing of N-PDUs from one or several network layer entities onto the appropriate LLC connection.

- Establishment, re-establishment and release of acknowledged peer-to-peer LLC operation.
- Supplementing the LLC layer in maintaining data integrity for acknowledged peer-to-peer LLC operation by buffering and retransmission of N-PDUs.
- Management of delivery sequence for each NSAPI, independently.
- Compression of redundant protocol control information (e.g. TCP/IP header) at the transmitting entity and decompression at the receiving entity. The compression method is specific to the particular network layer or transport layer protocols in use.
- Compression of redundant user data at the transmitting entity and decompression at the receiving entity. Data compression is performed independently for each SAPI, and may be performed independently for each PDP context. Compression parameters are negotiated between the MS and the SGSN.
- Segmentation and reassembly. The output of the compressor functions is segmented to the maximum length of LL-PDU. These procedures are independent of the particular network layer protocol in use.
- Negotiation of the XID parameters between peer SNDCP entities using XID exchange.

Figure 4 shows the transmission flow through SNDCP layer. The order of functions is the following:

- Protocol control information compression.
- User data compression.
- Segmentation of compressed information into SN-DATA or SN-UNITDATA PDUs.

The order of functions is vice versa in the reception flow:

- Reassembly of SN-PDUs to N-PDUs.
- User data decompression.
- Protocol control information decompression.

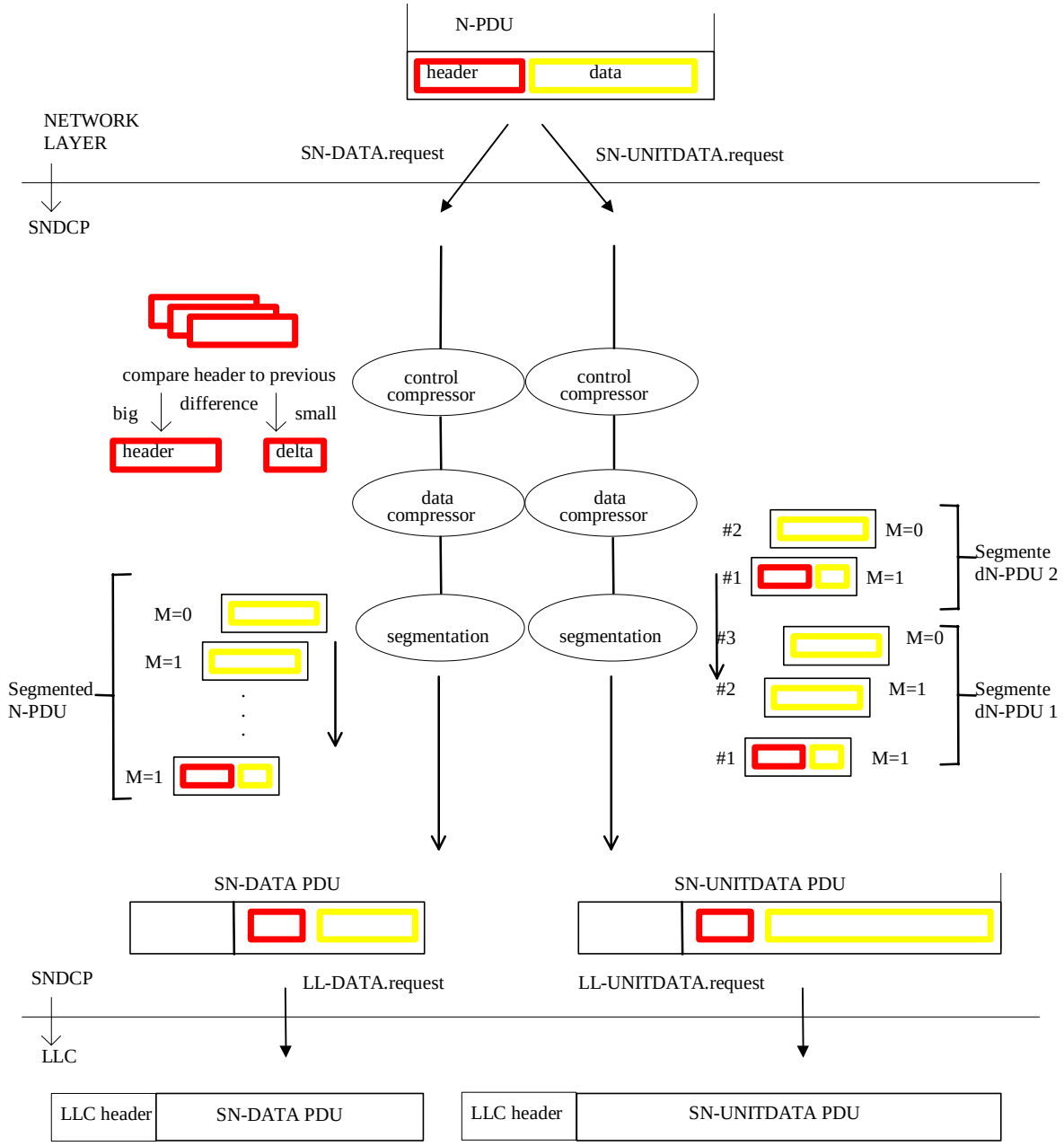

Figure 4: SNDCP model

The SNDCP layer expects the following services to be provided by the LLC layer. LLC layer functionality is defined in 3GPP TS ~~04.64~~44.064 [6]:

- Acknowledged and unacknowledged data transfer.
- Point-to-point and point-to-multipoint data transfer.
- In-order delivery of SN-PDUs per SAPI (i.e. SN-PDUs using the same SAPI shall appear at the receiving end in the same order as transmitted). This is required only for acknowledged service.
- QoS profile-based transfer of SN-PDUs.
- Support for variable length SN-PDUs.
- Transfer of SNDCP XID parameters.

The SNDCP layer expects the following services to be provided by the SM sublayer. SM sublayer functionality is defined in 3GPP TS ~~04.08~~24.008 [5a]:

- Activation and deactivation of PDP Contexts and informing the SNDCP layer when change in PDP context has happened.
- Carrying out Inter SGSN Routing Area Update and informing the SNDCP layer in the SGSN when the N-PDUs shall be tunnelled to the new SGSN.
- Notifying the SNDCP layer when there is need to change the QoS profile parameters of the PDP contexts.

6 Protocol functions

6.1 Multiplexing of N-PDUs

The NSAPI field shall be used for the identification of the specific PDP type and PDP address pair that is using the services provided by the SNDCP layer. The MS allocates NSAPIs dynamically at the PDP Context Activation. The NSAPI is delivered by the SM sub-layer to the SNDCP layer with the SNSM-ACTIVATE.indication primitive. The transmitting SNDCP entity shall insert the NSAPI value for each N-PDU. The peer SNDCP entity uses the NSAPI to identify the SNDCP user the N-PDU is targeted. Table 3 shows an example for the allocation of the NSAPIs.

Table 3: Example of the NSAPI allocation

PDP type	Allocated NSAPI	PDP address
IPv4	12	133.12.75.111 (4 octets)
IPv6	13	133.12. … .11.123 (16 octets)

6.2 Establishment and release of acknowledged peer-to-peer LLC operation

The SNDCP layer shall be responsible for establishing, re-establishing and releasing the acknowledged peer-to-peer LLC operation.

Re-establishment and release of the acknowledged peer-to-peer LLC operation may also be initiated by the LLC layer. The conditions under which this may happen are described in 3GPP TS ~~04.64~~44.064.

Negotiation of SNDCP XID parameters may be carried out in conjunction with the establishment or re-establishment procedure. It is also possible to negotiate SNDCP XID parameters independently from the establishment or re-establishment procedure, by using the LL-XID primitives.

6.2.1 Establishment of acknowledged peer-to-peer LLC operation

6.2.1.1 Establishment criteria

If acknowledged peer-to-peer LLC operation is required by an NSAPI (as indicated by the QoS profile) but is not yet established for the SAPI used by the NSAPI, then the SNDCP layer shall initiate the establishment procedure.

The SNDCP layer at the MS shall initiate the establishment, using the procedure in subclause 6.2.1.3, upon receipt of the SNSM-ACTIVATE.indication primitive.

The SNDCP layer at the SGSN shall initiate the establishment upon receipt of the SNSM-MODIFY.indication primitive.

6.2.1.2 Re-establishment of the acknowledged peer-to-peer LLC operation

The SNDCP layer may initiate re-establishment of the acknowledged peer-to-peer LLC operation for a SAPI under certain situations, for example when an error is detected by a V.42 bis data compression entity used for acknowledged data transfer.

The LLC layer may also initiate re-establishment of the acknowledged peer-to-peer LLC operation for a SAPI under situations described in 3GPP TS ~~04.64~~44.064. The LLC layer informs the SNDCP layers of link re-establishment using the LL-ESTABLISH.indication primitive. This is shown in figure 5.

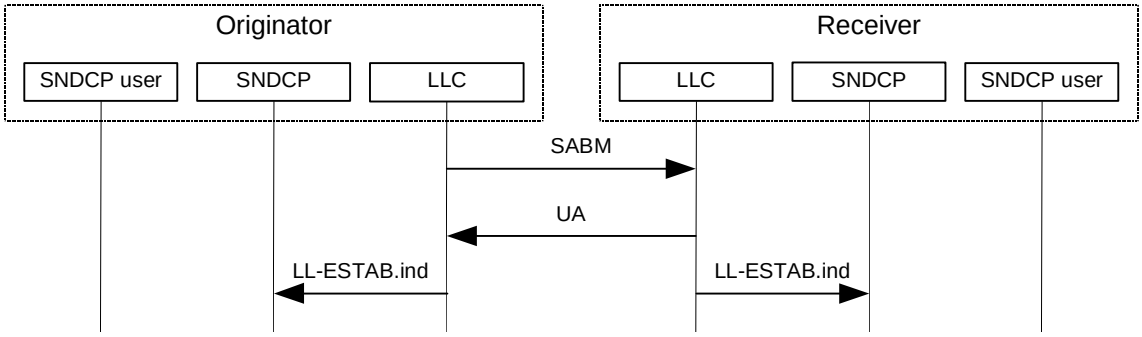

Figure 5: LLC-initiated re-establishment

6.2.1.3 Establishment procedure

The SNDCP layer shall initiate the establishment or re-establishment by sending an LL-ESTABLISH.request primitive to the relevant LLC SAP. SNDCP XID parameters may be included in an SNDCP XID block in the LL-ESTABLISH.request primitive. If no SNDCP XID parameter is to be included, an empty SNDCP XID block shall be included.

Following the sending of the LL-ESTABLISH.request primitive, the SNDCP layer shall suspend the transfer of SN-DATA and SN-UNITDATA primitives to the LLC SAP to which the LL-ESTABLISH.request is sent. Transfer of SN-DATA and SN-UNITDATA primitives shall resume when the establishment procedure ends through one of the following means:

- successful (receiving LL-ESTABLISH.confirm);
- failure (receiving LL-RELEASE.indication); or
- successful following collision resolution (receiving LL-ESTABLISH.indication and sending LL-ESTABLISH.response, see subclause 6.2.1.4).

Upon receipt of an LL-ESTABLISH.indication primitive, if an SNDCP XID block is present, the peer SNDCP entity shall respond with an LL-ESTABLISH.response primitive. SNDCP XID parameters may be included in an SNDCP XID block in the LL-ESTABLISH.response primitive. If no SNDCP XID parameter is to be included, an empty SNDCP XID block shall be included. If there is no SNDCP XID block in the LL-ESTABLISH.indication primitive, the peer SNDCP entity shall not respond with an LL-ESTABLISH.response primitive.

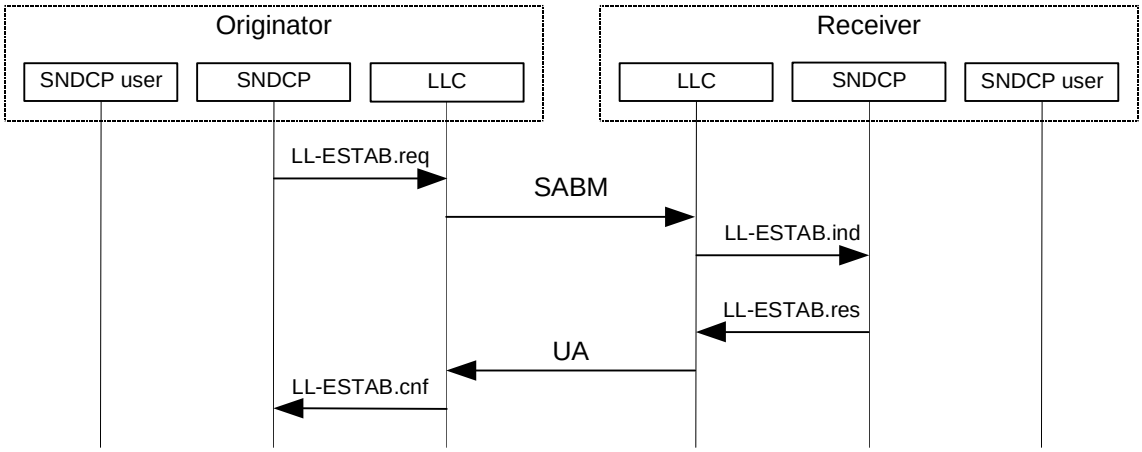

Figure 6: SNDCP-initiated establishment / re-establishment

6.2.1.4 Exceptional situations

If the originator of the establishment procedure receives an LL-RELEASE.indication with Cause "DM received", it shall inform the SM sub-layer using the SNSM-STATUS.request primitive with Cause "DM received". SM shall then deactivate all PDP contexts for that SAPI requiring acknowledged peer-to-peer LLC operation.

If the originator of the establishment procedure receives an LL-RELEASE.indication with Cause "invalid XID response" or an LL-STATUS.indication with Cause "invalid XID response", then it shall inform the SM sub-layer using the SNSM-STATUS.request primitive with Cause "invalid XID response". SM shall then deactivate all PDP contexts for that SAPI.

If the originator of the establishment procedure receives an LL-RELEASE.indication with Cause "no peer response" or an LL-STATUS.indication with Cause "no peer response", then it shall inform the SM sub-layer using the SNSM-STATUS.request primitive with Cause "no peer response", wait for an implementation-specific amount of time, and re-invoke the establishment procedure. Before the establishment procedure is re-invoked, N-PDUs arriving at the SNDCP layer for delivery to the LLC layer shall be buffered, if possible.

If the SNDCP layer receives an LL-RELEASE.indication with Cause "normal release", it shall buffer, if possible, all downlink N-PDUs for NSAPIs using the affected SAPI that requires acknowledged peer-to-peer LLC operation. Transfer of N-PDUs for NSAPIs that do not require acknowledged peer-to-peer LLC operation shall not be affected.

If the originator of the establishment procedure detects a collision (receiving an LL-ESTABLISH.indication primitive after sending an LL-ESTABLISH.request or LL-XID.request primitive, or receiving an LL-XID.indication primitive after sending an LL-XID.request primitive), it shall treat the LL-ESTABLISH.request or LL-XID.request primitive sent as not transmitted, and process the LL-ESTABLISH.indication or LL-XID.indication primitive received. If the LL-ESTABLISH.request or LL-XID.request contains one or more XID parameters, or one or more compression fields in an XID parameter, or one or more parameters in a compression field, that are not negotiated as part of the collision resolution, then negotiation of these XID parameters shall be performed at the earliest opportunity after conclusion of the collision resolution.

6.2.2 Release of acknowledged peer-to-peer LLC operation

6.2.2.1 Release criteria

If acknowledged peer-to-peer LLC operation is established for the SAPI used by a PDP context that is going to be deactivated or mapped to another SAPI, and if there is no other NSAPIs that require acknowledged peer-to-peer LLC operation using the original SAPI, then the SNDCP layer shall initiate the release procedure.

The SNDCP layer shall initiate the release, using the procedure described in subclause 6.2.2.2, upon receipt of the SNSM-DEACTIVATE.indication primitive.

The SNDCP layer at the SGSN shall also initiate the release upon receipt of the SNSM-MODIFY.indication primitive if an existing NSAPI is specified.

6.2.2.2 Release procedure

The SNDCP layer shall initiate the release by sending a LL-RELEASE.request primitive to the relevant LLC SAP. The Local parameter shall be set if the release is the result of receipt of the SNSM-DEACTIVATE.indication primitive, otherwise it shall not be set.

6.2.2.3 Release initiated by the LLC layer

The LLC layer may initiate release of the acknowledged peer-to-peer LLC operation for a SAPI under situations described in 3GPP TS ~~04.64~~44.064. The LLC layer shall inform the SNDCP layers of the release of acknowledged peer-to-peer LLC operation using the LL-RELEASE.indication primitive. SNDCP shall process the LL-RELEASE.indication primitive as described in subclause 6.2.1.4.

6.3 N-PDU buffering

The N-PDUs shall be buffered in the SNDCP layer before they are compressed segmented and transmitted to the LLC layer. The reception of an SNSM-DEACTIVATE.indication shall trigger the deletion of the buffer for the related NSAPI.

For acknowledged data transfer, the SNDCP entity shall buffer an N-PDU until successful reception of all SN-PDUs carrying segments of the N-PDU have been confirmed. The confirmation is carried out using the LL-DATA.confirm primitive from the LLC layer or the SNSM-SEQUENCE.indication primitive from the SM layer. Buffered N-PDUs which have been completely received as indicated by the acknowledgements in an LL-DATA.confirm primitive shall be discarded. During the Inter-SGSN RA Update, buffered N-PDUs whose complete reception by the MS has been confirmed in the SNSM-SEQUENCE.indication primitive shall be discarded, as defined in 3GPP TS ~~09.60~~29.060 [7] and 3GPP TS ~~03.60~~23.060 [3].

For unacknowledged data transfer, the SNDCP shall delete an N-PDU immediately after it has been delivered to the LLC layer.

6.4 Management of delivery sequence

The SNDCP layer shall retain the delivery sequence of N-PDUs of each NSAPI between the peer entities. The delivery sequence of N-PDUs from different NSAPIs may be changed according to the QoS profiles.

6.5 Protocol control information compression

Protocol control information compression is an optional SNDCP feature.

Negotiation of the supported algorithms and their parameters is carried out between MS and SGSN using the SNDCP XID parameters (see clause 8).

6.5.1 Negotiation of multiple protocol control information compression types

Each SNDCP entity that supports protocol control information compression shall be able to negotiate one or several protocol control information compression entities with the compression field format shown in figure 7. The negotiation shall be carried out using the XID parameter negotiation specified in subclause 6.8. The initiating entity defines a set of requested compression entities, together with the algorithm and parameters for each compression entity. The set of entities and their algorithms and parameters shall be transmitted to the peer entity. The peer entity responds with the set of negotiated entities and their algorithms and parameters. The peer entity shall select the proposed parameter values or other appropriate values for the negotiated entities.

6.5.1.1 Format of the protocol control information compression field

Bit	8	7	6	5	4	3	2	1
Octet 1	P	X	X	Entity number				
Octet 2	X	X	X	Algorithm type				
Octet 3	Length=n-3							
Octet 4	PCOMP1				PCOMP2			
…	…				…			
Octet x	High-order octet							
…	…							
Octet n	Low-order octet							

Figure 7: Protocol control information compression field format for SNDCP XID negotiation

6.5.1.1.1 Spare bit (X)

The X bit shall be set to 0 by the transmitting SNDCP entity and shall be ignored by the receiving SNDCP entity.

6.5.1.1.2 Propose bit (P)

The P bit shall be set to 1 if a new compression entity is being proposed, otherwise it shall be set to 0. If the P bit is set to 1, then all octets shall be included, otherwise octet 2 and octets 4 to x-1 shall not be included. If the P bit is set to 1, then only enough number of octets shall be included to contain the number of PCOMP values needed by the corresponding compression algorithm (e.g. PCOMP3 and PCOMP4 shall not be included if the number of PCOMP values needed by a compression algorithm is one or two). If an odd number of PCOMP values are used by a compression algorithm, then the last PCOMP value shall be set to 0 in the compression field by the transmitting SNDCP entity, and it shall be ignored by the receiving SNDCP entity.

6.5.1.1.3 Entity number

The entity number shall be used to identify a protocol control information compression entity on a SAPI. The entity number shall be assigned using the following rules:

- The entity number shall be an integer from 0 to 31.
- The entity number shall be assigned independently on each of the SAPIs.
- An entity number shall be in one of the three states: unassigned, selected, or assigned.
- When a new compression entity is to be proposed, an unassigned entity number shall become selected. If there is no unassigned entity number left, the compression entity shall not be proposed.
- A selected entity number shall become assigned if the corresponding proposed compression entity is created as a result of the XID negotiation, otherwise it shall become unassigned.
- An assigned entity number shall become unassigned when the corresponding compression entity is deleted as a result of an XID negotiation, or upon the receipt of the LL-RESET.indication primitive.
- In the case of a collision (see subclause 6.2.1.4) in which an entity number is currently selected:
  - If the selected entity number is included with the P bit set to 0 in the incoming SNDCP XID block, then it shall be assumed that the peer SNDCP entity agreed to the creation of the proposed entity but the response was lost. Therefore the selected entity number shall become assigned, any selected PCOMP and DCOMP values for the algorithm of the entity shall become assigned, and the compression entity shall be created, before the incoming SNDCP XID block is processed. After the incoming SNDCP XID block is processed, the compression entity shall be negotiated again if necessary, as defined in subclause 6.2.1.4.

- Otherwise (i.e. if the selected entity number is not included, or is included with the P bit set to 1 in the incoming SNDCP XID block), the selected entity number shall become unassigned, and any selected PCOMP and DCOMP values for the algorithm of the entity shall become unassigned, before the incoming SNDCP XID block, if any, is processed. Following the collision resolution procedure, the originally-proposed compression entity shall be proposed again (i.e. the originally-proposed compression entity shall not be considered created even if the originally-selected entity number is proposed in the incoming SNDCP XID block) by sending the appropriate primitive (LL-ESTABLISH.request or LL-XID.request). The originally-selected entity number, PCOMP and DCOMP values shall be used for the compression entity being re-proposed if they are unassigned, otherwise a new entity number, PCOMP or DCOMP value shall be selected.

- In the case of a collision in which an entity number is currently assigned:

  - If the peer SNDCP entity proposes a new compression entity with the same entity number, then it shall be assumed that the peer SNDCP entity negotiated the deletion of the entity but the response was lost, and the entity number is being reused. Therefore the original compression entity shall be deleted, the entity number shall become unassigned, PCOMP and DCOMP values shall be unassigned if necessary (see subclause 6.5.1.1.5), and then the proposed compression entity shall be responded to as usual.

  - Otherwise (i.e. if the assigned entity number is not included, or is included with the P bit set to 0 in the incoming SNDCP XID block), the usual rules regarding collision handling shall apply.

- In the case of a collision in which a PCOMP or DCOMP value is currently assigned to a compression algorithm:

  - If the peer SNDCP entity proposes a new compression entity with the same PCOMP or DCOMP assigned to a different algorithm, then it shall be assumed that the peer SNDCP entity negotiated the deletion of all entities using the algorithm to which the PCOMP or DCOMP value was assigned, but the response was lost, and the PCOMP or DCOMP value is being reused. Therefore, all compression entities using that algorithm shall be deleted, all corresponding entity numbers shall become unassigned, and all PCOMP or DCOMP values assigned to the algorithm shall become unassigned, and then the proposed compression entity shall be responded to as usual.

  - Otherwise (i.e. if the assigned PCOMP or DCOMP is not included, or is included and assigned to the same algorithm), the usual rules regarding collision handling shall apply.

6.5.1.1.4 Algorithm type

Table 4 show the list of protocol control information compression algorithms supported by the SNDCP layer. When new compression algorithms are needed for SNDCP, table 4 shall be updated.

Table 4: List of protocol control information compression algorithms supported by SNDCP

Compression algorithm	Algorithm type (Range 0 to 31)
RFC 1144	0
RFC 2507	1
-	Other values Reserved

6.5.1.1.5 PCOMP

One or more PCOMP values shall be assigned dynamically to a compression algorithm, based on the negotiation of the XID parameters for protocol control information compression. Each of the assigned PCOMP values denotes one compressed frame type of that compression algorithm.

The assignment of the PCOMP values follows the following general rules:

- PCOMP shall be an integer from 0 to 15.

- PCOMP value 0 is reserved permanently for no compression.

- PCOMP shall be assigned independently on each of the SAPIs.

- An assigned PCOMP value applies to all NSAPIs mapped to the same SAPI.

- PCOMP values shall be assigned to compression algorithms, not to compression entities (i.e. the same PCOMP value(s) shall be used by different compression entities on the same SAPI using the same compression algorithm).

- A PCOMP value shall be in one of the three states: unassigned, selected, or assigned.

- When a new compression entity is to be proposed, and if PCOMP values have not yet been assigned to the corresponding compression algorithm, then the appropriate number of unassigned PCOMP values shall be selected. If there is not enough unassigned PCOMP values left, the compression entity shall not be proposed.

- A selected PCOMP value shall become assigned if the corresponding proposed compression entity is created as a result of the XID negotiation, otherwise it shall become unassigned.

- An assigned PCOMP value shall become unassigned when the corresponding compression algorithm is no longer in use by any compression entity, or upon the receipt of the LL-RESET.indication primitive.

- In the case of a collision (see subclause 6.2.1.4), the handling of PCOMP values shall be in accordance with subclause 6.5.1.1.3.

While transferring data, the compressed frame type for an N-PDU is conveyed in the PCOMP field of the SNDCP header of the first SN-PDU belonging to the N-PDU. Any successfully negotiated algorithm may be used for compression of an N-PDU.

6.5.1.2 Resetting compression entities following SNDCP XID negotiation

The LL-Establish primitives shall be used for the negotiation of protocol control information compression if:

- one or more parameters, excluding the applicable NSAPIs, of existing compression entities used with acknowledged peer-to-peer LLC operation are changed by the originator of the negotiation; or

- one or more NSAPIs are removed, by the originator of the negotiation, from existing compression entities used with acknowledged peer-to-peer LLC operation, except when all NSAPIs using the compression entity are removed, or when LLC is already in ADM.

Otherwise, either the LL-Establish primitives or the LL-XID primitives may be used.

If the LL-XID primitives are used for XID negotiation, then in addition to restrictions specified elsewhere in the present document, the following parameters of the protocol control information compression entities are non-negotiable by the responding SNDCP entity:

- any parameter of existing compression entities used with acknowledged peer-to-peer LLC operation.

If one or more parameters, other than the applicable NSAPIs, of a compression entity used with unacknowledged peer-to-peer LLC operation are changed, the compression entity shall be reset locally upon completion of the SNDCP XID negotiation.

6.5.1.3 Parameters for compression entities

On negotiating a compression entity, not all the parameters of the entity have to be specified. If a parameter is to be included, all the preceding parameters shall also be specified, and the length field shall be set to the sum of the lengths of all the parameters specified. If any of the parameters is not specified, the rules in subclause 6.8.2 shall apply.

6.5.2 TCP/IP header compression (RFC1144)

The protocol control information compression method is specific for each network layer protocol type. TCP/IP (IPv4) header compression is specified in RFC 1144 [9].

6.5.2.1 Parameters

Table 5 contains the parameters defined for a compression entity using TCP/IP header compression. They may be negotiated during SNDCP XID negotiation.

Table 5: RFC 1144 TCP/IP header compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
RFC 1144	0	0, 2 or 3 if P bit is 0, 1, 3 or 4 if P bit is 1.	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			S_0 - 1	bbbbbbbb	0 through 255	down	15

6.5.2.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.5.2.1.2 S_0

The number of state slots, as defined in [9]. The S_0 range is 1 through 256, with 16 as default value.

6.5.2.2 Assignment of PCOMP values

The underlying service shall be able to distinguish the three types of compressed N-PDUs (i.e. Type IP, Uncompressed TCP, and Compressed TCP), as defined in RFC 1144 [9]. These three N-PDU types are differentiated by using different PCOMP values.

Two PCOMP values shall be assigned to the TCP/IP header compression algorithm. PCOMP1 shall contain the PCOMP value for the frame type "Uncompressed TCP", and PCOMP2 shall contain the PCOMP value for the frame type "Compressed TCP".

The PCOMP value of 0 shall be used for the frame type "Type IP".

6.5.2.3 Error Recovery

When TCP/IP header compression is used with unacknowledged peer-to-peer LLC operation, the decompression entity shall be notified in case an N-PDU is dropped, so that error recovery procedure (see RFC 1144 [9]) can be invoked.

6.5.3 TCP/IP and UDP/IP header compression (RFC 2507)

Detailed operation of the RFC 2507 header compression for IPv4 and IPv6 is described in clause 3 of the IETF specification RFC 2507 [10].

6.5.3.1 Parameters

Table 6 contains the parameters defined for a compression entity using RFC2507 header compression. They may be negotiated during SNDCP XID negotiation.

Table 6: RFC 2507 TCP/IP and UDP/IP header compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
RFC 2507	1	0, 2, 4, 5, 6, 7 or 9 if P bit is 0, 3, 5, 7, 8, 9, 10 or 12 if P bit is 1.	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			F_MAX_PERIOD	bbbbbbbb bbbbbbbb	1-65535	down	256
			F_MAX_TIME	bbbbbbbb	1-255	down	5
			MAX_HEADER	bbbbbbbb	60-255	down	168
			TCP_SPACE	bbbbbbbb	3-255	down	15
			NON_TCP_SPACE	bbbbbbbb bbbbbbbb	3-65535	down	15

The explanation of the individual parameters can be found in the clause 14 of the IETF specification RFC 2507 [10].

6.5.3.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.5.3.2 Assignment of PCOMP values for RFC2507

The following PCOMP values shall be assigned to the RFC 2507 header compression. The PCOMP value 0 shall be used for regular IPv4 and IPv6 packets.

Table 7: PCOMP values assigned to RFC 2507 header compression algorithm

PID value	Packet type
PCOMP1	Full header
PCOMP2	Compressed TCP
PCOMP3	Compressed TCP non-delta
PCOMP4	Compressed non-TCP
PCOMP5	Context state

6.5.3.3 Error Recovery

The mechanisms related to error recovery and packet reordering are described in clauses 10 and 11 of the RFC 2507[10].

6.6 Data compression

Data compression is an optional SNDCP feature. Data compression applies to both SN-DATA and SN-UNITDATA primitives.

Data compression, if used, shall be performed on the entire N-PDU, including the possibly compressed protocol control information.

Figure 8 shows an example how the SNDCP functions may be used. Several NSAPIs may use a common data compression entity, i.e. the same compression algorithm and the same dictionary. Separate data compression entities shall be used for acknowledged (SN-DATA) and unacknowledged (SN-UNITDATA) data transfer. Several NSAPIs may be associated with one SAPI, i.e. they may use the same QoS profile.

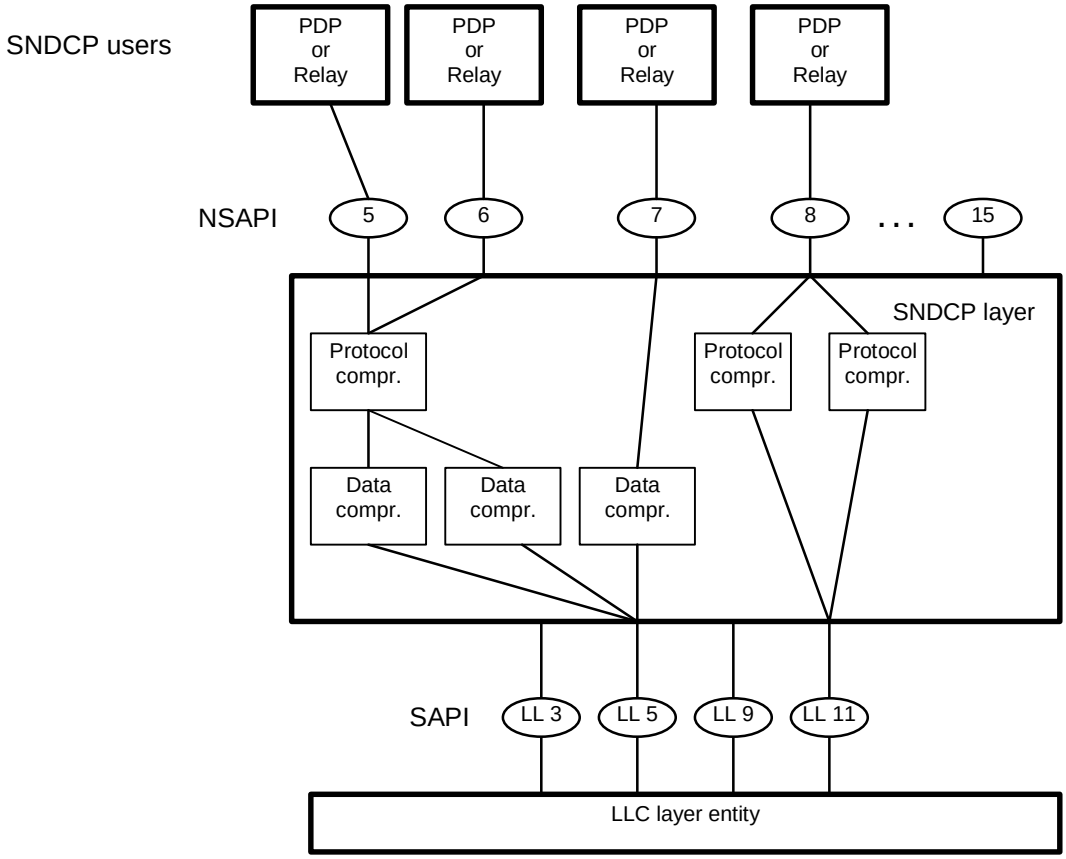

Figure 8: An example for the usage of NSAPIs, SNDCP functions, and SAPIs

6.6.1 Negotiation of multiple data compression types

Each SNDCP entity that supports data compression shall be able to negotiate one or several data compression entities with the compression field format shown in figure 9. The negotiation shall be carried out using the XID parameter negotiation specified in subclause 6.8. The initiating entity defines a set of requested compression entities, together with the algorithm and parameters for each compression entity. The set of entities and their algorithms and parameters shall be transmitted to the peer entity. The peer entity responds with the set of negotiated entities and their algorithms and parameters. The peer entity shall select the proposed parameter values or other appropriate values for the negotiated entities.

For each NSAPI one or more data compression are chosen. This choice is also indicated in the SNDCP XID. Only NSAPIs that are using the same SAPI may use the same data compression entity. If more than one compression entity is chosen for an NSAPI, these entities must use different data compression algorithms. However, only one data compression entity is used for one N-PDU; i.e. the used data compression entity may be changed from N-PDU to N-PDU.

6.6.1.1 Format of the data compression field

Bit	8	7	6	5	4	3	2	1
Octet 1	P	X	X	Entity number				
Octet 2	X	X	X	Algorithm type				
Octet 3	Length=n-3							
Octet 4	DCOMP1				DCOMP2			
…	…				…			
Octet x	High-order octet							
…	…							
Octet n	Low-order octet							

Figure 9: Data compression field format for SNDCP XID negotiation

6.6.1.1.1 Spare bit (X)

The X bit shall be set to 0 by the transmitting SNDCP entity and shall be ignored by the receiving SNDCP entity.

6.6.1.1.2 Propose bit (P)

The P bit shall be set to 1 if a new compression entity is being proposed, otherwise it shall be set to 0. If the P bit is set to 1, then all octets shall be included, otherwise octet 2 and octets 4 to x-1 shall not be included. If the P bit is set to 1, then only enough number of octets shall be included to contain the number of DCOMP values needed by the corresponding compression algorithm (e.g. DCOMP3 and DCOMP4 shall not be included if the number of DCOMP values needed by a compression algorithm is one or two). If an odd number of DCOMP values are used by a compression algorithm, then the last DCOMP value shall be set to 0 in the compression field by the transmitting SNDCP entity, and it shall be ignored by the receiving SNDCP entity.

6.6.1.1.3 Entity number

The entity number shall be used to identify a data compression entity on a SAPI. See subclause 6.5.1.1.3 for the rules for assigning entity numbers. The assignment of entity numbers for protocol control information compression entities and data compression entities shall be independent.

6.6.1.1.4 Algorithm type

Table 6a shows the list of data compression algorithms supported by the SNDCP layer. When new compression algorithms are needed for SNDCP, table 6a shall be updated.

Table 6a: List of data compression algorithms supported by SNDCP

Data compression algorithm	Algorithm type (Range 0-31)
V.42 bis	0
V.44	1
-	Other values Reserved

6.6.1.1.5 DCOMP

One or more DCOMP values shall be assigned dynamically to a compression algorithm, based on the negotiation of the XID parameters for data compression. Each of the assigned DCOMP values denotes one compressed frame type of that compression algorithm.

The assignment of the DCOMP values shall follow the rules for the assignment of PCOMP values in subclause 6.5.1.1.5.

While transferring data, the compressed frame type for an N-PDU is conveyed in the DCOMP field of the SNDCP header of the first SN-PDU belonging to the N-PDU. Any successfully negotiated algorithm may be used for compression of an N-PDU.

6.6.1.2 Resetting compression entities following SNDCP XID negotiation

The LL-Establish primitives shall be used for the negotiation of data compression if:

- one or more parameters, excluding the applicable NSAPIs, of existing compression entities used with acknowledged peer-to-peer LLC operation are changed by the originator of the negotiation; or
- one or more NSAPIs are removed, by the originator of the negotiation, from existing compression entities used with acknowledged peer-to-peer LLC operation, except when all NSAPIs using the compression entity are removed, or when LLC is already in ADM.

Otherwise, either the LL-Establish primitives or the LL-XID primitives may be used.

If the LL-XID primitives are used for XID negotiation, then in addition to restrictions specified elsewhere in the present document, the following parameters of the data compression entities are non-negotiable by the responding SNDCP entity:

- any parameter of existing compression entities used with acknowledged peer-to-peer LLC operation.

If one or more parameters, other than the applicable NSAPIs, of a compression entity used with unacknowledged peer-to-peer LLC operation are changed, the compression entity shall be reset locally upon completion of the SNDCP XID negotiation.

6.6.1.3 Parameters for compression entities

On negotiating a compression entity, not all the parameters of the entity have to be specified. If a parameter is to be included, all the preceding parameters shall also be specified, and the length field shall be set to the sum of the lengths of all the parameters specified. If any of the parameters is not specified, the rules in subclause 6.8.2 shall apply.

6.6.2 Management of V.42 bis data compression

ITU-T Recommendation V.42 bis [8] data compression may be used with SN-DATA primitives and SN-UNITDATA primitives.

6.6.2.1 Parameters

Table 7a contains the parameters defined for a compression entity using ITU-T Recommendation V.42 bis data compression. They may be negotiated during SNDCP XID negotiation.

Table 7a: V.42 bis data compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
V.42 bis	0	0, 2, 3, 5, or 6 if P bit is 0, 1, 3, 4, 6, or 7 if P bit is 1.	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			P_0	000000bb	0 through 3	down (each direction separately)	3
			P_1	bbbbbbbb bbbbbbbb	512 through 65535	down	2048
			P_2	bbbbbbbb	6 through 250	down	20

6.6.2.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.6.2.1.2 P_0

Two bits are used to indicate the usage of compression, one bit for each direction.

00 compress neither direction.

01 compress MS-to-SGSN direction only.

10 compress SGSN-to-MS direction only.

11 compress both directions.

6.6.2.1.3 P_1

Maximum number of codewords in the compressor dictionary (see [8]).

6.6.2.1.4 P_2

Maximum number of characters in an uncompressed data string that is accepted to be encoded.

6.6.2.2 Assignment of DCOMP values

One DCOMP value shall be assigned (as DCOMP1) to the V.42 bis data compression algorithm.

6.6.2.3 Operation of V.42 bis data compression

When V.42 bis is used with SN-DATA primitives, the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [8]) and added to the compressed N-PDU before the compressed N-PDU is sent.

When V.42 bis is used with SN-UNITDATA primitives, the compression entity shall be reset (using the C-INIT primitive defined in [8]) before an N-PDU is compressed or decompressed. After compression, the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [8]) and added to the compressed N-PDU before the compressed N-PDU is sent. The LLC protocol shall operate in the protected mode of operation.

When V.42 bis is used with SN-DATA primitives and an error is detected by the decoder, the SNDCP entity shall use LL-ESTABLISH.request primitive to reset the acknowledged peer-to-peer LLC operation for the SAPI used.

6.6.3 Management of V.44 data compression

ITU-T Recommendation V.44 data compression, as described in [11], may be used with SN-DATA primitives and SN-UNITDATA primitives. Annex B of ITU-T Recommendation V.44 describes two methods of implementation and operation of V.44 in packet networks: Packet Method and Multi-Packet Method. Multi-Packet Method is a superset of Packet Method and an MS or SGSN that supports Multi-Packet Method must also support Packet Method.

6.6.3.1 Parameters

Table 7c contains the parameters defined for a compression entity using V.44 data compression. They may be negotiated during SNDCP XID negotiation. During V.44 data compression negotiation, unless both the MS and SGSN support Multi-Packet Method, Packet Method is used. Parameter C_0 indicates support of Packet Method (10000000) or both methods (11000000).

NOTE 1: V.44 data compression negotiation is not required. If V.44 is selected and no compression parameters are specified, then Packet Method with defaults as defined in subclauses 6.6.3.1.4 and 6.6.3.1.5 and in [11] annex B, clause B.1.2, is used.

Table 7c: V.44 data compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
V.44	1	0, 2, 3, 5 or 6	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			C_0	bb000000	10000000 or 11000000	11000000 down to 10000000	10000000
			P_0	000000bb	0 through 3	down (each direction separately)	3
			P_{1T}	bbbbbbbb bbbbbbbb	256 through 65535	down	Refer to subclause 6.6.3.1.4
			P_{1R}	bbbbbbbb bbbbbbbb	256 through 65535	down	Refer to subclause 6.6.3.1.5
			P_{3T}	bbbbbbbb bbbbbbbb	$\geq (2 \times P_{1T})$	down	$3 \times P_{1T}$
			P_{3R}	bbbbbbbb bbbbbbbb	$\geq (2 \times P_{1R})$	down	$3 \times P_{1R}$

NOTE 2: V.44 parameters P_{2T} and P_{2R} are set to 255 and not negotiated in packet networks.

6.6.3.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.6.3.1.2 C_0

Two bits are used to indicate the V.44 method of operation supported (refer to [11] Annex B).

10 Packet Method supported.

11 Packet Method and Multi-Packet Method supported.

If parameter C_0 is not specified then Packet Method is selected with its default parameter values (refer to subclauses 6.6.3.1.4 and 6.6.3.1.5 and in [11] annex B, clause B.1.2).

6.6.3.1.3 P_0

Two bits are used to indicate the usage of compression, one bit for each direction.

00 compress neither direction.

01 compress MS-to-SGSN direction only.

10 compress SGSN-to-MS direction only.

11 compress both directions.

6.6.3.1.4 P_{1T}

Maximum number of codewords for the transmit direction (i.e. in the encoder dictionary). Refer to ITU-T Recommendation V.44 [11].

The Packet Method default is 1 600 codewords.

The Multi-Packet Method default is 2 048 codewords.

NOTE: Both defaults above are different from the defaults specified in ITU-T Recommendation V.44 [11] annex B. This is partially due to the fact that data compression in SNDCP includes the control header as well as the information field.

6.6.3.1.5 P_{1R}

Maximum number of codewords for the receive direction (i.e. in the decoder dictionary). Refer to [11].

The Packet Method default is 1 600 codewords.

The Multi-Packet Method default is 2 048 codewords.

NOTE: Both defaults above are different from the defaults specified in ITU-T Recommendation V.44 [11] annex B. This is partially due to the fact that data compression in SNDCP includes the control header as well as the information field.

6.6.3.1.6 P_{3T}

Number of characters in the history for the transmit direction. Refer to [11].

This parameter is not used in Packet Method.

6.6.3.1.7 P_{3R}

Number of characters in the history for the receive direction. Refer to [11].

This parameter is not used in Packet Method.

6.6.3.2 Assignment of DCOMP values

The underlying service shall be able to distinguish three types of N-PDUs processed by V.44 data compression (i.e. not V.44 compressed, V.44 Packet Method compressed, and V.44 Multi-Packet Method compressed). These three V.44 processed N-PDU types are differentiated by using different DCOMP values.

Two DCOMP values shall be assigned to the V.44 compression algorithm, the smaller one of which for Packet Method compressed, and the larger one for Multi-Packet Method compressed.

The DCOMP value of 0 shall be used for SN-PDUs belonging to N-PDUs that expanded during V.44 compression and are sent in their original form (i.e. not V.44 compressed).

6.6.3.3 Operation of V.44 data compression

V.44 data compression has two possible methods of operation in SNDCP, Packet Method and Multi-Packet Method.

6.6.3.3.1 Packet Method

Refer to [11] annex B, clause B.1, for a general description of the operation of V.44 packet method.

When V.44 Packet Method is used with SN-DATA primitives:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.
- If the length of the N-PDU after compression is greater or equal to the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.
- In between processing of N-PDU, the dictionary shall be re-initialised as defined in [11].
- If an error is detected by the decoder, the SNDCP entity shall use LL-ESTABLISH.request primitive to reset the acknowledged peer-to-peer LLC operation for the SAPI used.

When V.44 Packet Method is used with SN-UNITDATA primitives:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.
- If the length of the N-PDU after compression is greater or equal to the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.
- After an N-PDU is sent, the dictionary shall be re-initialised as defined in [11].
- The LLC protocol shall operate in the protected mode of operation.

6.6.3.3.2 Multi-Packet Method

Refer to [11] annex B, clause B.2, for a general description of the operation of V.44 multi-packet method.

When V.44 Multi-Packet Method is used with SN-DATA primitive:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.
- If the length of the N-PDU after compression is greater than the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.
- In the case above of not V.44 compressed where the original N-PDU is sent, after the N-PDU is sent the encoder dictionary shall be re-initialised as defined in [11]. The peer entity, upon receipt of an N-PDU with the DCOMP field set to 0, not V.44 compressed, shall re-initialise its decoder dictionary.
- If an error is detected by the decoder, the SNDCP entity shall use LL-ESTABLISH.request primitive to reset the acknowledged peer-to-peer LLC operation for the SAPI used.

When V.44 Multi-Packet Method is used with SN-UNITDATA primitives:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.
- After an N-PDU is sent the dictionary shall be re-initialised as defined in [11].
- If the length of the N-PDU after compression is greater or equal to the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.
- The LLC protocol shall operate in the protected mode of operation.

6.7 Segmentation and reassembly

Segmentation shall be performed by the SNDCP entity to ensure that any SN-PDU transmitted is no longer than N201 (see 3GPP TS ~~04.64~~44.064 [6]). The receiving SNDCP entity shall reassemble the segments back to the original (possibly compressed) N-PDU.

The segmentation and reassembly procedures are different for acknowledged and unacknowledged mode of operation.

6.7.1 General

6.7.1.1 Segmentation

A (possibly compressed) N-PDU shall be segmented into one or more SN-PDUs. The length of each SN-PDU shall not be greater than N201-I (for acknowledged mode) or N201-U (for unacknowledged mode).

The F bit in the SNDCP header shall be set to 1 for the first segment, and 0 for all subsequent segments.

For unacknowledged peer-to-peer LLC operation, DCOMP and PCOMP shall be included in the header when the F bit is set to 1, and shall not be included when the F bit is set to 0.

For acknowledged peer-to-peer LLC operation, DCOMP, PCOMP and N-PDU number shall be included in the header when the F bit is set to 1, and shall not be included when the F bit is set to 0.

If an SN-PDU is received with the F bit set to 1 when a non-first segment is expected, and if DCOMP, PCOMP and (in the acknowledged mode) the N-PDU number all remain unchanged comparing to the first segment, then the SN-PDU shall be processed as normal.

The M bit in the SNDCP header shall be set to 0 for the last segment, and 1 for all previous segments.

If only one SN-PDU is generated for an N-PDU, the F bit shall be set to 1 and the M bit set to 0.

6.7.1.2 Reassembly

During reassembly, DCOMP and PCOMP for an N-PDU shall be retrieved from the first segment (F bit set to 1). For acknowledged peer-to-peer LLC operation, the N-PDU number shall also be retrieved from the first segment.

The receiving SNDCP entity shall be in one of the following three receiving states:

- the Receive First Segment state, in which the SNDCP entity shall expect the F bit set to 1 in the next received SN-PDU;
- the Receive Subsequent Segment state, in which the SNDCP entity shall expect the F bit set to 0 in the next received SN-PDU; or
- the Discard state, in which the SNDCP entity shall discard any SN-PDU received.

The Receive First Segment state shall be entered:

- upon receipt of an SNSM-ACTIVATE.indication;
- upon receipt of an SNSM-MODIFY.indication which indicates a change in SAPI or a change in peer-to-peer LLC operation mode;
- upon receipt of an LL-ESTABLISH.indication or an LL-ESTABLISH.confirm; or
- when the M bit is set to 0 in the received SN-PDU, except for situations specified in subclause 6.7.4.

The Receive Subsequent Segment state shall be entered:

- when the M bit is set to 1 in the received SN-PDU, except for situations specified in subclause 6.7.4.

6.7.2 Segmentation and reassembly in acknowledged mode

Segmentation and reassembly in acknowledged mode shall follow the general procedures stated in subclause 6.7.1.

6.7.3 Segmentation and reassembly in unacknowledged mode

In addition to the general procedure in subclause 6.7.1, a segment number shall be used due to the unreliable nature of the unacknowledged mode.

The Segment number is a sequence number assigned to each SN-UNITDATA PDU. The sequence number shall be set to 0 in the first SN-UNITDATA PDU of an N-PDU, and incremented by 1 for each subsequent SN-UNITDATA PDU. Modulo 16 operation is applied.

The received segments belonging to the same N-PDU shall be re-ordered, if possible. If a timer (implementation dependent) elapses before all segments are received, the segments shall be discarded. Reassembly operation described in subclauses 6.7.1 and 6.7.4 shall be performed after re-ordering.

6.7.4 Exception situations

6.7.4.1 Receive First Segment state

If an SN-UNITDATA PDU is received with the F bit set to 0, the SN-UNITDATA PDU shall be discarded. The Receive First Segment state shall be entered if the M bit is set to 0, otherwise the Discard state shall be entered.

If an SN-DATA PDU is received with the F bit set to 0, the SN-DATA PDU shall be discarded, and the acknowledged LLC operation shall be re-established for the SAPI used.

6.7.4.2 Receive Subsequent Segment state

If an SN-UNITDATA PDU is received with the F bit set to 1, and if DCOMP or PCOMP is different from those in the first segment, then the SN-UNITDATA PDU and all previous segments belonging to the same N-PDU shall be discarded. The Received First Segment state shall be entered if the M bit is set to 0, otherwise the Discard state shall be entered.

If an SN-DATA PDU is received with the F bit set to 1, and if DCOMP, PCOMP or N-PDU number is different from those in the first segment, then the SN-DATA PDU and all previous segments belonging to the same N-PDU shall be discarded, and the acknowledged LLC operation shall be re-established for the SAPI used.

6.7.4.3 Discard state

If an SN-PDU is received with the M bit set to 1, the SN-PDU shall be discarded and the SNDCP entity shall remain in the Discard state.

If an SN-PDU is received with the M bit set to 0, the SN-PDU shall be discarded and the Receive First Segment state entered.

6.8 XID parameter negotiation

Negotiation of XID parameters between peer SNDCP entities may be carried out to ensure optimal information transfer. The parameters are called SNDCP exchange identity (XID) parameters.

SNDCP XID parameter negotiation may be initiated by the SNDCP entity at the MS or at the SGSN. If SNDCP XID parameters are to be changed, SNDCP XID negotiation shall be initiated prior to data transfer - the MS shall initiate SNDCP XID negotiation upon receipt of SNSM-ACTIVATE.indication; the SGSN shall initiate SNDCP XID negotiation upon receipt of the SNSM-MODIFY.indication primitive if an NSAPI has been put into use (in the case of an Inter-SGSN Routeing Area Update), or if the change in QoS profile to an existing NSAPI results in a change in compressor(s) used by the NSAPI.

When an NSAPI no longer uses a compression entity due to a PDP context deactivation or a PDP context modification, an SNDCP XID negotiation shall be performed to remove the NSAPI from the Applicable NSAPIs of the compression entity. The negotiation shall be initiated by the MS upon receipt of the SNSM-DEACTIVATE.indication in the case of PDP context deactivation, or by the SGSN upon receipt of the SNSM-MODIFY.indication in the case of PDP context modification.

The XID negotiation is a one-step procedure; i.e. the initiating end proposes parameter values, and the responding end either accepts these or offers different values in their place according to the XID negotiation rules described in the present document; the rules limit the range of parameter values as well as the sense of negotiation. The initiating end accepts (or rejects) the values in the response; this concludes the negotiation.

The block format for the SNDCP XID parameter negotiation is shown in figure 10. Not all parameters have to be included in the XID block, only parameters that are negotiated. Parameters may be included in any order. Also it shall be possible to negotiate parameters for more than one NSAPI in one XID block since more than one NSAPI can use the same SAPI.

Bit	8	7	6	5	4	3	2	1
Octet 1	Parameter type=0							
Octet 2	Length=1							
Octet 3	Version number							
Octet 4	Parameter type=1							
Octet 5	Length=n-5							
Octet 6	P	X	X	Entity number				
Octet 7 (optional)								
Octet 8	Length=k-8							
Octet 9 … (optional)								
Octet j	High-order octet							
…	…							
Octet k	Low-order octet							
Octet k+1	P	X	X	Entity number				
Octet k+2 (optional)								
Octet k+3	Length=m-(k+3)							
Octet k+4… (optional)								
Octet k+y	High-order octet							
…	…							
Octet m	Low-order octet							
…	…							
Octet n	Low-order octet							
Octet n+1	Parameter type=2							
Octet n+2	Length=r-(n+2)							
Octet n+3	P	X	X	Entity number				
Octet n+4 (optional)								
Octet n+5	Length=p-(n+5)							
Octet n+6… (optional)								
Octet n+w	High-order octet							
…	…							
Octet p	Low-order octet							
Octet p+1	P	X	X	Entity number				
Octet p+2 (optional)								
Octet p+3	Length=q-(p+3)							
Octet p+4… (optional)								
Octet p+v	High-order octet							
…	…							
Octet q	Low-order octet							
…	…							
Octet r	Low-order octet							

Figure 10: Example of SNDCP XID block format

The SNDCP user uses SN-XID.request to initiate the negotiation of the XID parameters. The SNDCP entity sends the proposed SNDCP XID parameters to the LLC SAP with the LL-XID.request or LL-ESTABLISH.request. The LLC SAP shall issue an XID command containing the SNDCP XID parameters (see 3GPP TS ~~04.64~~44.064). The peer LLC SAP shall, upon receipt of the XID command, indicate the SNDCP XID parameters to SNDCP entity using LL-XID.indication or LL-ESTABLISH.indication. The peer SNDCP entity shall select appropriate values for the proposed parameters or negotiate the appropriate values with the SNDCP user entity with the SN-XID.indication and SN-XID.response primitives. When the appropriate parameter values are known by the peer SNDCP entity, it shall use the LL-XID.response or LL-ESTABLISH.response primitive to continue negotiation. Upon reception of the response, the LLC SAP shall send the received parameters to the SNDCP entity using the LL-XID.confirm or LL-ESTABLISH.confirm primitive. The SNDCP entity delivers the negotiated parameters to the SNDCP user. This is illustrated in figure 11. The originator of the negotiation shall apply the new parameter values after it has received the 'confirm' primitive. The responding end of the negotiation shall apply the new parameter values after it has sent the replying 'response' primitive.

Following the sending of the LL-XID.request primitive, the SNDCP layer shall suspend the transfer of SN-DATA and SN-UNITDATA primitives to the LLC SAP to which the LL-XID.request is sent. Transfer of SN-DATA and SN-UNITDATA primitives shall resume when the SNDCP XID negotiation ends through one of the following means:

- successful (receiving LL-XID.confirm);
- failure (receiving LL-RELEASE.indication, or LL-STATUS.indication); or
- successful following collision resolution (receiving LL-ESTABLISH.indication and sending LL-ESTABLISH.response, or receiving LL-XID.indication and sending LL-XID.response, see subclause 6.2.1.4).

LLC may also initiate LLC XID negotiation, in which case LLC may send an LL-XID.indication to inform SNDCP the values of N201-I and N201-U. This is illustrated in figure 12. If the SNDCP entity receives an LL-XID.indication without an SNDCP XID block, it shall not respond with the LL-XID.response primitive.

Negotiation of SNDCP version number is always between the peer SNDCP entities. The version number is not known by the SNDCP user. However, negotiation of the parameters for compression algorithms may be carried out between the SNDCP user entities.

Negotiation of SNDCP XID parameters for an NSAPI shall be carried out in the SAPI to which the NSAPI is mapped.

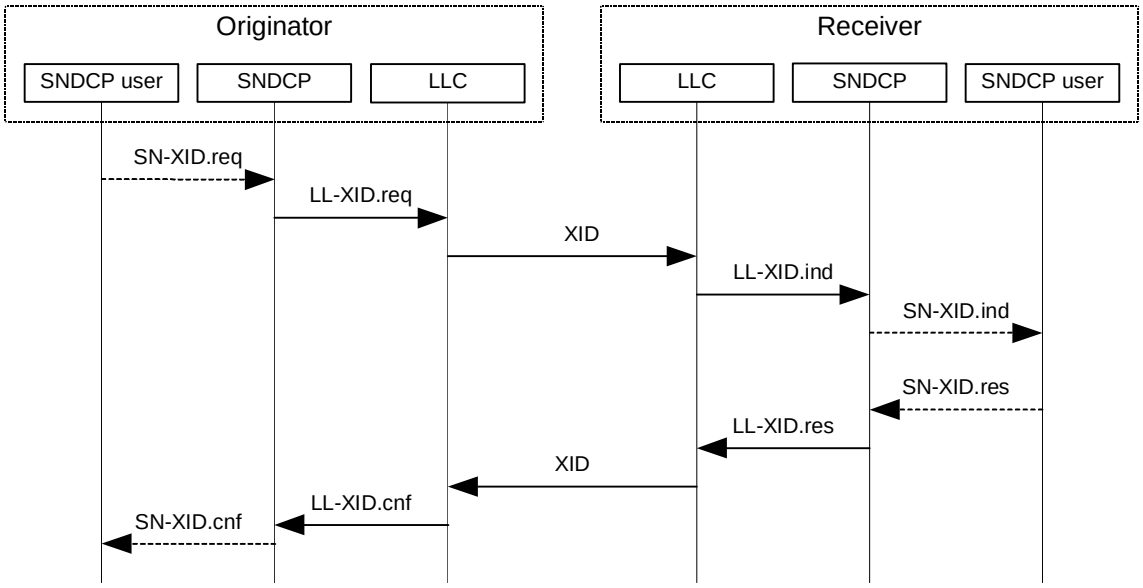

Figure 11: SNDCP XID negotiation procedure

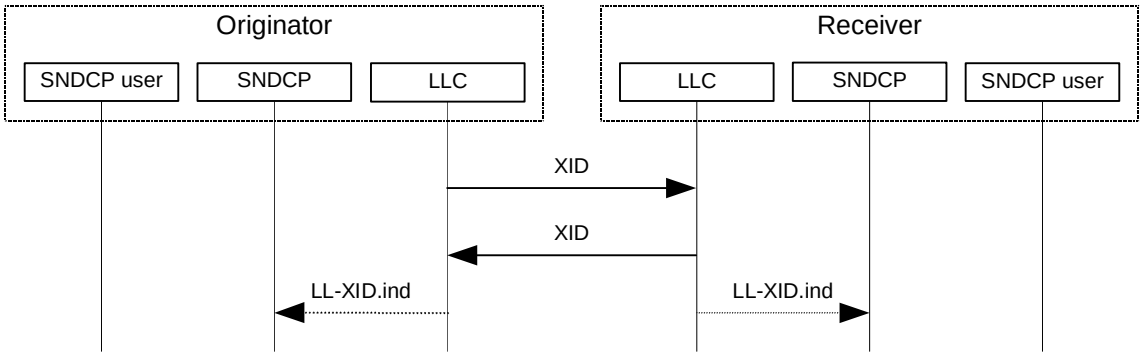

Figure 12: LLC XID negotiation procedure

6.8.1 Negotiation of compression entities

For parameter type 1 and 2, multiple compression fields (as shown in figure 7 and figure 9) may be specified. Each compression field corresponds to a compression entity.

In each compression field, the "Applicable NSAPIs" parameter indicates the NSAPIs that uses the compression entity. The parameter, if included, shall consist of 2 octets. Multiple NSAPIs may share the same compression entity by setting multiple bits in the parameter. NSAPIs requiring acknowledged peer-to-peer LLC operation and unacknowledged peer-to-peer LLC operation shall not share the same compressor (see subclause 6.10).

During SNDCP XID negotiation or re-negotiation, if a parameter type is specified in the SNDCP XID block, compression entities currently in use and compression entities proposed to be added may be included in the SNDCP XID block. Not all entities need to be included in the SNDCP XID block. If a compression entity is not included, the value of its parameters shall be determined by the rules defined in subclause 6.8.2.

If, implicitly or explicitly (see subclause 6.8.2), a compression entity is specified in the responding SNDCP XID block with one or more bits set to 1 in the "Applicable NSAPIs" parameter, the compression entity shall be created (if it does not exist yet).

If, implicitly or explicitly, a compression entity is specified in the responding SNDCP XID block with no bit set to 1 in the "Applicable NSAPIs" parameter, the compression entity shall be deleted (if it currently exists).

If, implicitly or explicitly, one or more bits are set to 1 in the "Applicable NSAPIs" parameter of a compression entity in the responding SNDCP XID block, the NSAPIs corresponding to these bits shall start using (or continue to use) the compression entity.

If, implicitly or explicitly, one or more bits are set to 0 in the "Applicable NSAPIs" parameter of a compression entity in the responding SNDCP XID block, the NSAPIs corresponding to these bits shall release the compression entity (if they have been using the compression entity).

6.8.2 Values of SNDCP XID parameters

In this subclause, the term "parameter" refers to an SNDCP XID parameter, a compression field (for parameter type 1 or 2), or a parameter for a compression field.

If an SNDCP XID parameter has not been negotiated, default values shall apply. The default value for a compression field (entity) is "non-existing".

If the originating SNDCP XID block does not include a parameter (implicit command), it shall be treated as equivalent to requesting for the current value for the parameter. The responder may explicitly include this parameter in its response. If the responder explicitly includes the parameter in the response, then it shall also explicitly include this parameter in every SNDCP XID response until the parameter has been explicitly negotiated, either by responding to an SNDCP XID command that included the parameter, or by explicitly including the parameter the next time an SNDCP XID command is transmitted.

If a parameter is included in the originating SNDCP XID block and the responder does not include the parameter in its response (implicit response), it shall be treated as equivalent to responding with the value proposed by the originator.

If both the originator and the responder do not include a parameter in the negotiation, the value of the parameter is not changed.

6.8.3 Exception handling

In this subclause, the term "parameter" may refer, wherever applicable, to an SNDCP XID parameter, a compression field (for parameter type 1 or 2), or a parameter for a compression field.

If the originating SNDCP XID block includes a parameter with unrecognised Type field, the parameter shall be ignored by the responder.

If the originating SNDCP XID block includes a parameter with unsupported length or an out-of-range value, then the responder shall respond to the parameter with lengths and values set according to the responder's preference.

If the originating SNDCP XID block includes parameter type 1 or 2 which violates the rules in subclause 6.8.1, the responder shall treat the parameter as not transmitted by the originator, and responds according to subclause 6.8.2.

If the originating SNDCP XID block includes a parameter with duplicated instances, the subsequent instances of the duplicated parameter shall be ignored.

If the originating SNDCP XID block is sent on LL-XID primitives and contains prohibited changes (see subclauses 6.5.1.2 and 6.6.1.2) to the parameters of compression entities used with acknowledged peer-to-peer LLC operation, then the responder shall respond with these parameters set to their previously-negotiated values.

In the originating SNDCP XID block, excluding the collision scenarios described in subclause 6.5.1.1.3, when an assigned entity number is included with the P bit set to 1, the algorithm and the PCOMP and DCOMP fields shall be ignored if they are the same as the previously-assigned values. If the algorithm and PCOMP or DCOMP fields are not the same as the previously-assigned values, then the Applicable NSAPIs field of the compression field in question shall be set to 0 in the response, and an SNSM-STATUS.request primitive with Cause "invalid XID command" shall be sent to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

In the originating SNDCP XID block, if an unassigned entity number is included with the P bit set to 0, then the Applicable NSAPIs field in the response shall be set to 0.

In the originating SNDCP XID block, excluding the collision scenarios described in subclause 6.5.1.1.3, if one or more of the PCOMP or DCOMP specified is already assigned to a different compression algorithm, then the Applicable NSAPIs field of the compression field in question shall be set to 0 in the response, and an SNSM-STATUS.request primitive with Cause "invalid XID command" shall be sent to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

In the originating SNDCP XID block, if one or more new PCOMP or DCOMP values are specified for an existing compression algorithm, then the Applicable NSAPIs field of the compression field in question shall be set to 0 in the response, and an SNSM-STATUS.request primitive with Cause "invalid XID command" shall be sent to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

If the responding SNDCP XID block includes a parameter with unrecognised Type field, unsupported length, an out-of-range value or a value violating the sense of negotiation, a parameter type 1 or 2 which violates the rules in subclause 6.8.1, a parameter with duplicated instances, contains prohibited changes (see subclauses 6.5.1.2 and 6.6.1.2) to the parameters of compression entities used with acknowledged peer-to-peer LLC operation when the SNDCP XID block is sent on LL-XID primitives, or a compression field with the P bit set to 1, then the originator shall ignore the block and reinitiate the negotiation. If the renegotiation fails for an implementation-specific number of times, the originating SNDCP layer shall send an SNSM-STATUS.request primitive with Cause "invalid XID response" to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

If the LLC layer indicates that the XID parameter negotiation failed, by sending an LL-RELEASE.indication with Cause "no peer response" or an LL-STATUS.indication with Cause "no peer response", then, as an implementation option, the SNDCP layer may wait for an implementation-specific amount of time and re-invoke the XID negotiation procedure.

6.9 Data transfer

6.9.1 Acknowledged mode

The SNDCP entity shall initiate acknowledged data transmission only if the PDP context for the NSAPI identified in the SN-DATA.request has been activated and if acknowledged LLC operation has been established.

The N-PDU number in acknowledged mode is a number assigned to each N-PDU received by SNDCP through an SN-DATA.request. N-PDU numbers for different NSAPIs shall be assigned independently. The N-PDU number shall be included in the SNDCP header of the first segment of an N-PDU.

Two variables, the Send N-PDU number and the Receive N-PDU number, shall be maintained for each NSAPI using acknowledged peer-to-peer LLC operation. When an NSAPI using acknowledged peer-to-peer LLC operation is activated, the Send N-PDU number and the Receive N-PDU number shall be set to 0. The Send N-PDU number and Receive N-PDU number shall also be set as described in subclause 5.1.2.22. Modulo 256 operation shall be applied to the Send N-PDU number and the Receive N-PDU number.

Upon reception of an SN-DATA.request, the SNDCP entity shall assign to the N-PDU received the current value of the Send N-PDU number as the N-PDU number, increment the Send N-PDU number by 1, perform the compression and segmentation functions, then forward the SN-PDU(s) in LL-DATA.request to the LLC layer. If an N-PDU number is already present in the SN-DATA.request, then no new N-PDU number shall be assigned to the N-PDU, and the Send N-PDU number shall not be incremented. The N-PDU shall be stored into a buffer in the SNDCP entity. The buffered N-PDU shall be deleted when the SN-DATA PDU carrying the last segment of the N-PDU is confirmed by an LL-DATA.confirm primitive, or when the entire N-PDU is confirmed by an SNSM-SEQUENCE.indication primitive.

During normal operation (i.e. not in the recovery state), when the peer SNDCP entity receives the SN-PDU(s) in an LL-DATA.indication primitive, the SNDCP entity shall reassemble and decompress the SN-PDU(s) to obtain the N-PDU, increment the Receive N-PDU number by 1, and forward the N-PDU to the SNDCP user with the SN-DATA.indication. The correct SNDCP user is identified by the NSAPI field in the SN-PDU(s).

In the recovery state, after reassembling and decompressing the SN-PDU(s):

- if the N-PDU number of the received N-PDU is equal to the Receive N-PDU number, then the Receive N-PDU number shall be incremented by 1, the recovery state shall be exited and normal operation shall resume for the received N-PDU and all subsequently-received N-PDUs; and

- otherwise, the N-PDU shall be discarded.

After the SNDCP entity in the SGSN receives an SNSM-STOP-ASSIGN.indication primitive for an NSAPI using acknowledged peer-to-peer LLC operation, it shall stop assigning N-PDU number to N-PDUs received through the SN-DATA.request primitive.

If an SN-DATA PDU (T bit set to 0) is received by an NSAPI that does not use acknowledged mode, the PDU shall be ignored without error notification.

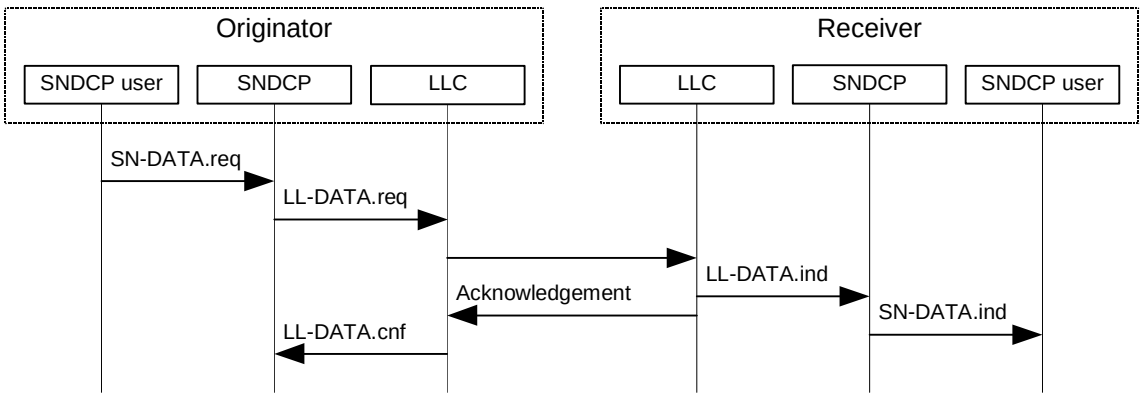

Figure 13: SNDCP acknowledged data transfer

6.9.2 Unacknowledged mode

The SNDCP entity shall initiate unacknowledged data transmission only if the PDP context for the NSAPI identified in the SN-DATA.request has been activated. The SNDCP entity may initiate unacknowledged data transmission even if the acknowledged peer-to-peer operation is not established for that NSAPI.

The N-PDU number in unacknowledged mode is a number assigned to each N-PDU received by SNDCP through an SN-UNITDATA.request. N-PDU numbers for different NSAPIs shall be assigned independently. The N-PDU number shall be included in the SNDCP header of every SN-UNITDATA PDU.

A variable, the Send N-PDU number (unacknowledged), shall be maintained for each NSAPI using unacknowledged peer-to-peer LLC operation. When an NSAPI using unacknowledged peer-to-peer LLC operation is activated, the Send N-PDU number (unacknowledged) shall be set to 0. The Send N-PDU number (unacknowledged) shall also be set as described in subclauses 5.1.2.1 and 5.1.2.22. Modulo 4096 operation shall be applied to the Send N-PDU number (unacknowledged).

Upon reception of an SN-UNITDATA.request, the SNDCP entity shall assign the current value of the Send N-PDU number (unacknowledged) as the N-PDU number of the N-PDU received, increment Send N-PDU number (unacknowledged) by 1, compress and segment the information, then forward the SN-PDU(s) in LL-UNITDATA.request to the LLC layer. The N-PDU shall be deleted immediately after the data has been delivered to the LLC layer.

When the peer SNDCP entity receives the SN-PDU(s) in the LL-UNITDATA.indication primitive, the SNDCP entity shall reassemble and decompress the SN-PDU(s) to obtain the N-PDU, then forwards it to the SNDCP user with the SN-UNITDATA.indication. The correct SNDCP user is identified by the NSAPI field in the SN-PDU(s).

If an SN-UNITDATA PDU (T bit set to 1) is received by an NSAPI that does not use unacknowledged mode, the PDU shall be ignored without error notification.

The SNDCP entity shall detect lost SN-PDUs. The SNDCP entity shall discard duplicate SN-PDUs and re-order out-of-sequence SN-PDUs, if possible.

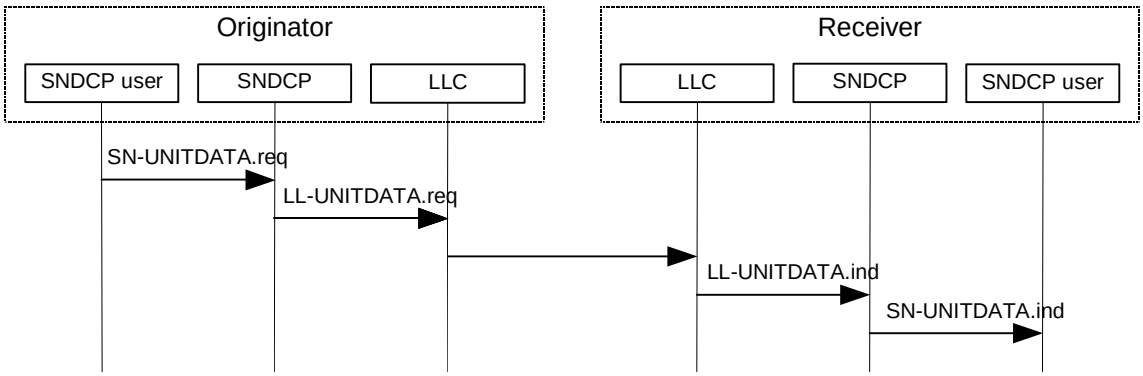

Figure 14: SNDCP unacknowledged data transfer

6.10 Possible combinations of SNDCP protocol functions and their connection to service access points

The following combinations of SNDCP protocol functions are allowed:

- One or several NSAPIs may use one SAPI.
- Only one SAPI shall be used by one NSAPI.
- One or several NSAPIs may use the same protocol control information compression entity.
- One NSAPI may use zero, one, or several protocol control information compression entities.
- One or several NSAPIs may use the same data compression entity.

- One NSAPI may use zero, one, or several data compression entities.
- Separate data compression entities shall be used for SN-DATA and SN-UNITDATA PDUs.
- Separate protocol control information compression entities shall be used for SN-DATA and SN-UNITDATA PDUs.
- One data compression entity shall be connected to one SAPI.
- One protocol control information compression entity shall be connected to one SAPI.
- One or several protocol control information compression entities may be connected to the same data compression entity.
- One protocol control information compression entity shall be connected to zero, one, or several data compression entities.

7 Definition of SN-PDU

7.1 Format convention

7.1.1 Numbering convention

The convention used in the present document is illustrated in figure 15. The bits are grouped into octets. The bits of an octet are shown horizontally and are numbered from 1 to 8. Multiple octets are shown vertically and are numbered from 1 to N.

Bit	8	7	6	5	4	3	2	1
Oct 1								
2								
…								
N-1								
N								

Figure 15: Format convention

7.1.2 Order of transmission

SN-PDUs are transferred between the SNDCP layer and LLC layer in units of octets, in ascending numerical octet order (i.e. octet 1, 2, …, N-1, N). The order of bit transmission is specific to the underlying protocols used across the Um interface and the Gb interface.

7.1.3 Field mapping convention

When a field is contained within a single octet, the lowest bit number of the field represents the lowest order value. When a field spans more than one octet, the order of bit values within each octet progressively decreases as the octet number increases. In that part of the field contained in a given octet the lowest bit number represents the lowest order value.

For example, a bit number can be identified as a couple (o, b) where o is the octet number and b is the relative bit number within the octet. Figure 16 illustrates a field that spans from bit (1, 3) to bit (2, 7). The high order bit of the field is mapped on bit (1, 3) and the low order bit is mapped on bit (2, 7).

Bit	8	7	6	5	4	3	2	1
1st octet of field						2^4	2^3	2^2
2nd octet of field	2^1	2^0						

Figure 16: Field mapping convention

Figure 17 illustrates an NSAPI field that spans from bit (1,8) to bit (2,1). NSAPI 15 is mapped to bit (1,8) and the other NSAPIs are mapped in decreasingly order until NSAPI 0 that is mapped to bit (2,1). A bit set to 0 means that the compression entity is not applicable to the corresponding NSAPI. A bit set to 1 means that the compression entity is applicable to the corresponding NSAPI.

Bit	8	7	6	5	4	3	2	1
1st octet of field	15	14	13	12	11	10	9	8
2nd octet of field	7	6	5	4	3	2	1	0

Figure 17: NSAPI mapping convention

7.2 SN-PDU Formats

Each SN-PDU shall contain an integral number of octets, and shall comprise a header part and a data part. An SN-PDU shall contain data from a single N-PDU only. Two different SN-PDU formats are defined. The SN-DATA PDU shall be used for acknowledged data transfer and SN-UNITDATA PDU for unacknowledged data transfer.

Bit	8	7	6	5	4	3	2	1
Oct 1	X	F	T	M	NSAPI			
2	DCOMP				PCOMP			
3	N-PDU number - acknowledged mode							
…	Data segment							
N								

Figure 18: SN-DATA PDU format

Bit	8	7	6	5	4	3	2	1
Oct 1	X	F	T	M	NSAPI			
2	DCOMP				PCOMP			
3	Segment number				N-PDU number - unacknowledged mode			
4	N-PDU number - unacknowledged mode (continued)							
…	Data segment							
N								

Figure 19: SN-UNITDATA PDU format

More bit (M):

0 Last segment of N-PDU.

1 Not the last segment of N-PDU, more segments to follow.

SN-PDU Type (T):

0 SN-DATA PDU.

1 SN-UNITDATA PDU.

First segment indicator bit (F):

0 This SN-PDU is not the first segment of an N-PDU.

The octet including DCOMP and PCOMP is not included in the SN-DATA PDU or SN-UNITDATA PDU format. Also the octet for N-PDU number for acknowledged mode is not included in the SN-DATA PDU format.

1 This SN-PDU is the first segment of an N-PDU. The octet for DCOMP and PCOMP is included in the SN-DATA PDU or SN-UNITDATA PDU format. Also the octet for N-PDU number for acknowledged mode is included in the SN-DATA PDU format.

Spare bit (X):

0 Shall be set to 0 by the transmitting SNDCP entity and ignored by the receiving SNDCP entity.

NSAPI:

0 Escape mechanism for future extensions.

1 Point-to-Multipoint Multicast (PTM-M) information.

2-4 Reserved for future use.

5-15 Dynamically allocated NSAPI value (see subclause 6.1).

SN-PDU with an unallocated NSAPI value shall be ignored by the receiving SNDCP entity without error notification.

Data compression coding (DCOMP):

0 No compression.

1-14 Points to the data compression identifier negotiated dynamically (see subclause 6.6).

15 Reserved for future extensions.

SN-PDU with an unallocated DCOMP value shall be ignored by the receiving SNDCP entity without error notification.

Protocol control information compression coding (PCOMP):

0 No compression.

1-14 Points to the protocol control information compression identifier negotiated dynamically (see subclause 6.5).

15 Reserved for future extensions.

SN-PDU with an unallocated PCOMP value shall be ignored by the receiving SNDCP entity without error notification.

Segment number:

0-15 Sequence number for segments carrying an N-PDU.

N-PDU number - acknowledged mode:

0-255 N-PDU number of the N-PDU.

N-PDU number - unacknowledged mode:

0-4095N-PDU number of the N-PDU.

8 SNDCP XID parameters

The SNDCP XID parameters are shown in table 8:

Table 8: SNDCP XID parameters

Parameter name	Parameter Type	Length	Format	Range	Default value	Units	Sense of negotiation
Version number	0	1	0000bbbb	0-15	0	-	down
Data Compression	1	variable	See subclause 6.6.1				
Protocol Control Information Compression	2	variable	See subclause 6.5.1				

NOTE: The current version of SNDCP is 0. This is also the default value for the version number. It is assumed that the future versions are backward compatible with former ones.

Annex A (informative): Change Request History

SMG#	CR#	REV.	NEW REV.	SUBJECT
SMG#31			8.0.0	Creation of the specification for R99 based on V7.3.0

TSG Meeting	TSG Doc number	TSG WG doc number	Spec	CR	Rv	Ph	Cat	Vers Old	Vers New	Subject	Work item	Remarks
NP-09								8.0.0	8.1.0			GSM to 3GPP format is changed
NP-09	NP-000441	N1-001019	04.65	A070	1	R99	F	8.0.0	8.1.0	Deletion of PDP type X.25	GPRS	GSM to 3GPP format is changed
NP-09	NP-000441	N1-001025	04.65	A071	1	R99	F	8.0.0	8.1.0	Supporting RFC2507 Header Compression in SNDCP	GPRS	
NP-10								8.1.0	4.0.0			This CR changes the specification to Release 4 as 44.065
NP-10	NP-000675	N1-001178	04.65	A072		Rel-4	C	8.1.0	4.0.0	Support of V.44 Data Compression in SNDCP	TEI4	
NP-13	NP-010492	N1-011200	44.065	001		Rel-4	A	4.0.0	4.1.0	Conditions for header compression	GPRS	
NP-16			44.065			Rel-5		4.1.0	5.0.0	CN plenary decision to make this TS also for Release 5. Some editorials from ETSI secretariat are introduced.		June 2002

3GPP TSG-CN1 Meeting #31 **Tdoc N1-031074**
Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **44.065** **CR** **007** ⌘ **rev** **-** ⌘ Current version: **6.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Correction to References
Source:	⌘	Nortel Networks
Work item code:	⌘	TEI5
Date:	⌘	15/08/2003
Category:	⌘	**A**
Release:	⌘	Rel-6~~5~~

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	From the Change History, 44.065 v5.0.0 was created from 44.065 v4.1.0. After this, CR 002 on Correction of References was agreed and included in 44.065 v4.2.0. However, this change was not made to 44.065 v5.0.0 and then to v6.0.0.
Summary of change:	⌘	Implement CR 002 on Correction of References.
Consequences if not approved:	⌘	Incorrect specification.

Clauses affected:	⌘				
Other specs affected:	⌘	**Y**	**N**		
			X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

1 Scope

The present document provides the description of the Subnetwork Dependent Convergence Protocol (SNDCP) for the General Packet Radio Service (GPRS).

The user of the services provided by SNDCP is a packet data protocol (PDP) at the mobile Station (MS) or the Relay at the Serving GPRS Support Node (SGSN). Additionally, a control entity, e.g. AT command interpreter, may be an SNDCP user. SNDCP uses the services provided by the Logical Link Control (LLC) layer [4] and the Session Management (SM) sub-layer [2].

The main functions of SNDCP are:

- Multiplexing of several PDPs.
- Compression / decompression of user data.
- Compression / decompression of protocol control information.
- Segmentation of a network protocol data unit (N-PDU) into Logical Link Control Protocol Data Units (LL-PDUs) and re-assembly of LL-PDUs into an N-PDU.

3GPP TS ~~04.65~~ 44.065 is applicable to GPRS MS and SGSN.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service Description; Stage 1".

[3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".

[4] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[5] 3GPP TS 44.018: "Mobile radio interface; Layer 3 specification; Radio Resource Control Protocol".

[5a] 3GPP TS 24.008: "Mobile radio interface; Layer 3 specification; Core Network Protocols; Stage 3".

[6] 3GPP TS 44.064: "General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".

[7] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".

~~[1] 3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".~~

~~[2] 3GPP TS 02.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service Description; Stage 1".~~

~~[3] 3GPP TS 03.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service Description; Stage 2".~~

~~[4] 3GPP TS 04.07: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".~~

~~[5] 3GPP TS 04.08: "Digital cellular telecommunications system (Phase 2+), Mobile radio interface; Layer 3 specification".~~

~~[6] 3GPP TS 04.64: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".~~

~~[7] 3GPP TS 09.60: "Digital cellular telecommunications system (Phase 2+), General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp Interface".~~

[8] ITU-T Recommendation V.42 bis: "Data compression procedures for data circuit-terminating equipment (DCE) using error correcting procedures".

[9] IETF RFC 1144: "Compressing TCP/IP headers for low-speed serial links", V. Jacobson.

[10] IETF RFC 2507: "IP Header Compression", M. Degermark, B. Nordgren, S. Pink.

[11] ITU-T Recommendation V.44: "Data compression procedures".

[12] IETF RFC 3095: "RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed". C. Bormann et al.

[13] IETF RFC 3241: "Robust Header Compression (ROHC) over PPP". C. Bormann.

[14] "RObust Header Compression (ROHC) Profile Identifiers". IANA registry at: *http://www.iana.org/assignments/rohc-pro-ids*

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS ~~01.04~~21.905 [1] and 3GPP TS ~~02.60~~22.060 [2] and the following apply:

N201: LLC layer parameter (see 3GPP TS ~~04.64~~44.064 for clarity).
Defines maximum number of octets in the information field of LL-PDU. Separate values are applicable for I (see N201-I), U and UI (see N201-U) LL-PDUs.

N201-I: LLC layer parameter (see 3GPP TS ~~04.64~~44.064 for clarity).
Defines maximum number of octets available to a SN-DATA PDU for a specific SAPI.

N201-U: LLC layer parameter (see 3GPP TS ~~04.64~~44.064 for clarity).
Defines maximum number of octets available to a SN-UNITDATA PDU for a specific SAPI.

N-PDU number: a sequence number assigned to N-PDUs per NSAPI.

NSAPI: for each SN-PDU the NSAPI is an index to the PDP context of the PDP that is using the services provided by the SNDCP layer.

Receive N-PDU number: the value of the N-PDU number expected in the next N-PDU received by an NSAPI using acknowledged peer-to-peer LLC operation.

Recovery state: a state for an NSAPI in which duplicated received N-PDUs shall be detected and discarded. The recovery state only applies to NSAPIs using acknowledged peer-to-peer LLC operation.

SAPI: identifies the Service Access Point that the SN-PDU is using at the LLC layer.

Segment number: a sequence number assigned to SN-UNITDATA PDUs carrying segments of an N-PDU.

Send N-PDU number: the value to be assigned as the N-PDU number to the next N-PDU received from the SNDCP user by an NSAPI using acknowledged peer-to-peer LLC operation.

Send N-PDU number (unacknowledged): the value to be assigned as the N-PDU number to the next N-PDU received from the SNDCP user by an NSAPI using unacknowledged peer-to-peer LLC operation**.**

SNDCP entity: handles the service functions provided by the SNDCP layer. The SNDCP entity is temporary logical link identity specific.

SNDCP management entity: handles communication with SM sub-layer and controls the operation of the SNDCP entity.

SNDCP user: protocol entity that is using the services provided by the SNDCP layer. PDP entities and control entities, e.g. AT command interpreter, are the SNDCP users at the MS. Relay entity is the SNDCP user at the SGSN.

SNDCP XID block: the collection of SNDCP XID parameters being negotiated. It is transferred by the LL-XID and LL-ESTABLISH primitives between SNDCP and LLC.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TS ~~01.04~~21.905 [1], 3GPP TS ~~02.60~~22.060 [2], and 3GPP TS ~~03.60~~23.060 [3], and the following apply:

CID	Context Identifier
DCOMP	Identifier of the user data compression algorithm used for the N-PDU
ESP	Encapsulating Security Payload
F	First segment indicator bit
GMM	GPRS Mobility Management
IP	Internet Protocol
LLC	Logical Link Control
LSB	Least Significant Bits
M	More bit used to indicate the last segment of N-PDU
N-PDU	Network Protocol Data Unit
MRRU	Maximum Reconstructed Reception Unit
MSB	Most Significant Bits
NSAPI	Network Layer Service Access Point Identifier
P	Propose bit
PCOMP	Identifier of the protocol control information compression algorithm used for the N-PDU
PDP	Packet Data Protocol (e.g. IPv4 or IPv6)
PDU	Protocol Data Unit
PID	Protocol Identifier
PTP	Point to Point
QoS	Quality of Service
ROHC	RObust Header Compression
RTP	Real Time Protocol
SAPI	Service Access Point Identifier
SDU	Service Data Unit
SGSN	Serving GPRS Support Node
SM	Session Management
SNDCP	Subnetwork Dependent Convergence Protocol
SNSM	SNDCP-SM
TCP	Transmission Control Protocol
TLLI	Temporary Logical Link Identifier
X	Spare bit

4 General

The present document describes the functionality of the GPRS SNDCP. The overall GPRS logical architecture is defined in 3GPP TS ~~03.60~~23.060 [3]. Location of the SNDCP in GPRS protocol stack can be seen in figure 1.

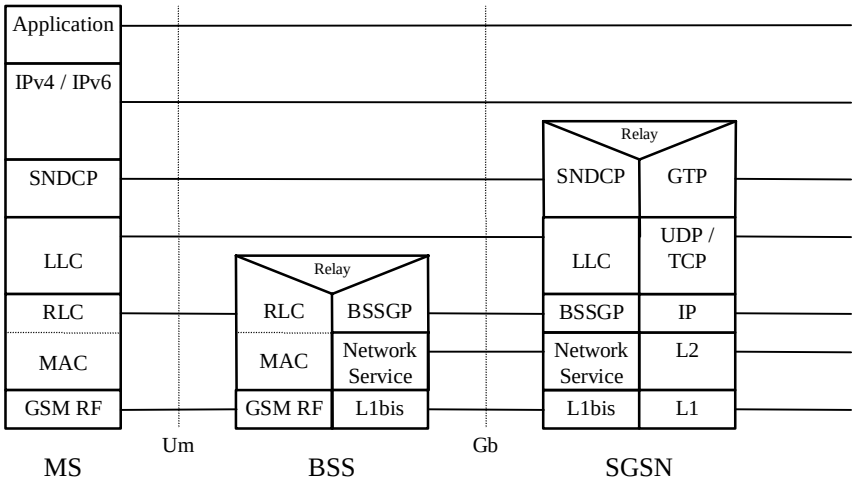

Figure 1: GPRS protocol stack

Network layer protocols are intended to be capable of operating over services derived from a wide variety of subnetworks and data links. GPRS supports several network layer protocols providing protocol transparency for the users of the service. Introduction of new network layer protocols to be transferred over GPRS shall be possible without any changes to GPRS. Therefore, all functions related to transfer of Network layer Protocol Data Units (N-PDUs) shall be carried out in a transparent way by the GPRS network entities. This is one of the requirements for GPRS SNDCP.

Another requirement for the SNDCP is to provide functions that help to improve channel efficiency. This requirement is fulfilled by means of compression techniques.

The set of protocol entities above SNDCP consists of commonly used network protocols. They all use the same SNDCP entity, which then performs multiplexing of data coming from different sources to be sent using the service provided by the LLC layer (figure 2). The Network Service Access Point Identifier (NSAPI) is an index to the PDP context (see 3GPP TS ~~03.60~~23.060 [3]) of the PDP that is using the services provided by SNDCP. One PDP may have several PDP contexts and NSAPIs. However, it is possible that each allocated NSAPI is used by separate PDP. Each active NSAPI shall use the services provided by the Service Access Point Identifier (SAPI) in the LLC layer. Several NSAPIs may be associated with the same SAPI.

Since the adaptation of different network layer protocols to SNDCP is implementation dependent, it is not defined in the present document.

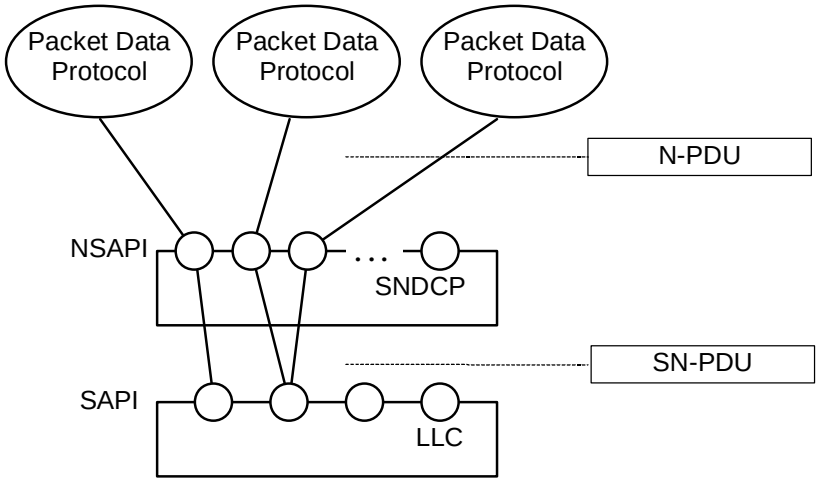

Figure 2: Example for multiplexing of different protocols

5 Service primitives and functions

5.1 Service primitives

This subclause explains the service primitives used for communication between the SNDCP layer and other layers. See also 3GPP TS ~~04.07~~24.007 [4] to get an overall picture of the service primitives. Figure 3 illustrates the service access points through which the primitives are carried out.

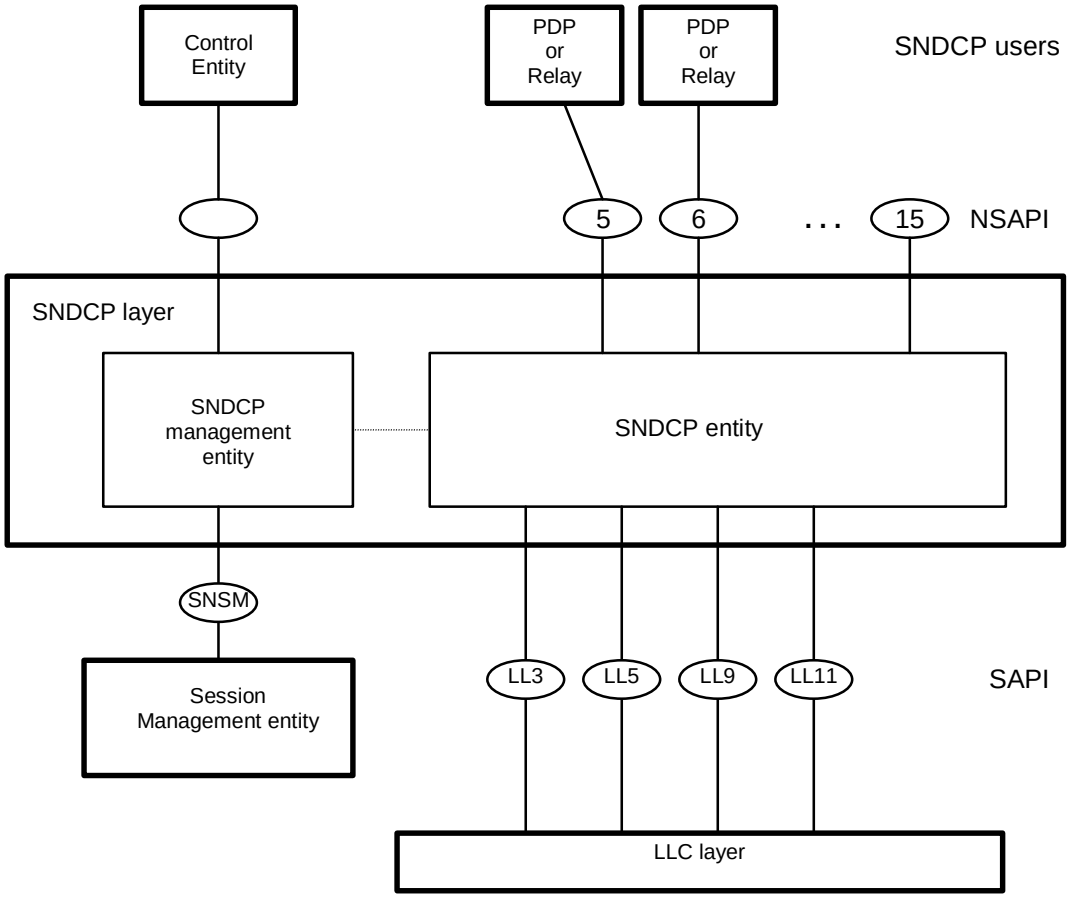

Figure 3: Service Access Points provided and used by SNDCP

5.1.1 SNDCP service primitives

The primitives provided by the SNDCP layer are listed in table 1.

Table 1: SNDCP layer service primitives

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
SNDCP User (PDP or the SGSN Relay) ↔ SNDCP					
SN-DATA	X	-	-	-	N-PDU, NSAPI, N-PDU Number
SN-DATA	-	X	-	-	N-PDU, NSAPI
SN-UNITDATA	X	X	-	-	N-PDU, NSAPI
SN-XID	X	X	-	-	Requested SNDCP XID Parameters
SN-XID	-	-	X	X	Negotiated SNDCP XID Parameters

5.1.1.1 SN-DATA.request

Request used by the SNDCP user for acknowledged transmission of N-PDU. The successful transmission of SN-PDU shall be confirmed by the LLC layer. The SN-DATA.request primitive conveys NSAPI to identify the PDP using the service. N-PDU Number, if present, indicates the N-PDU number previously assigned to this N-PDU.

NOTE: An N-PDU number may have been assigned to an N-PDU by the old SGSN before an inter-SGSN routeing area update.

5.1.1.2 SN-DATA.indication

Indication used by the SNDCP entity to deliver the received N-PDU to the SNDCP user. Successful reception has been acknowledged by the LLC layer.

5.1.1.3 SN-UNITDATA.request

Request used by the SNDCP user for unacknowledged transmission of N-PDU. The SN-UNITDATA.request primitive conveys NSAPI to identify the PDP using the service.

5.1.1.4 SN-UNITDATA.indication

Indication used by the SNDCP entity to deliver the received N-PDU to the SNDCP user.

5.1.1.5 SN-XID.request

Request used by the SNDCP user at the initiating entity to deliver the list of requested XID parameters to the peer entity.

5.1.1.6 SN-XID.indication

Indication used by the SNDCP entity to deliver the list of requested XID parameters to the SNDCP user.

5.1.1.7 SN-XID.response

Response used by the SNDCP user to deliver the list of negotiated XID parameters to the peer entity.

5.1.1.8 SN-XID.confirm

Confirm used by the SNDCP entity to deliver the list of negotiated XID parameters to the SNDCP user.

5.1.2 Service primitives used by SNDCP layer

The SNDCP layer uses the service primitives provided by the SM sublayer and the LLC layer (see table 2). SM is specified in 3GPP TS ~~04.08~~24.008 [5a] and LLC in 3GPP TS ~~04.64~~44.064 [6].

Table 2: Service primitives used by the SNDCP entity

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
SNDCP ↔ LLC					
LL-RESET	-	X	-	-	TLLI
LL-ESTABLISH	X	-	-	-	TLLI, XID Requested
LL-ESTABLISH	-	X	-	-	TLLI, XID Requested, N201-I, N201-U
LL-ESTABLISH	-	-	X	-	TLLI, XID Negotiated
LL-ESTABLISH	-	-	-	X	TLLI, XID Negotiated, N201-I, N201-U
LL-RELEASE	X	-	-	-	TLLI, Local
LL-RELEASE	-	X	-	-	TLLI, Cause
LL-RELEASE			-	X	TLLI
LL-XID	X	-	-	-	TLLI, XID Requested
LL-XID	-	X	-	-	TLLI, XID Requested, N201-I, N201-U
LL-XID	-	-	X	-	TLLI, XID Negotiated
LL-XID	-	-	-	X	TLLI, XID Negotiated, N201-I, N201-U
LL-DATA	X	-	-	-	TLLI, SN-PDU, Reference, QoS Parameters, Radio Priority
LL-DATA	-	X	-	-	TLLI, SN-PDU
LL-DATA	-	-	-	X	TLLI, Reference
LL-UNITDATA	X	-	-	-	TLLI, SN-PDU, QoS Parameters, Radio Priority, Cipher
LL-UNITDATA	-	X	-	-	TLLI, SN-PDU
LL-STATUS	-	X	-	-	TLLI, Cause
SNDCP ↔ SM					
SNSM-ACTIVATE		X	-	-	TLLI, NSAPI, QoS profile, SAPI, Radio Priority
SNSM-ACTIVATE	-	-	X		TLLI, NSAPI
SNSM-DEACTIVATE	-	X	-	-	TLLI, NSAPI(s), LLC Release Indicator
SNSM-DEACTIVATE	-	-	X	-	TLLI, NSAPI
SNSM-MODIFY	-	X	-	-	TLLI, NSAPI, QoS Profile, SAPI, Radio Priority, Send N-PDU Number, Receive N-PDU Number
SNSM-MODIFY	-	-	X	-	TLLI, NSAPI
SNSM-STATUS	X	-	-	-	TLLI, SAPI, Cause
SNSM-SEQUENCE	-	X	X	-	TLLI, NSAPI, Receive N-PDU Number
SNSM-STOP-ASSIGN	-	X	-	-	TLLI, NSAPI

5.1.2.1 LL-RESET.indication

Indication used by the LLC layer in the SGSN to indicate to the SNDCP layer that the Reset XID parameter has been transmitted, and by the LLC layer in the MS to indicate to the SNDCP layer that the Reset XID parameter has been received.

Upon receipt of the LL-RESET.indication, the SNDCP layer shall:

- treat all outstanding SNDCP ↔ LLC request type primitives as not sent;
- reset all SNDCP XID parameters to their default values;
- in the MS, for every NSAPI using unacknowledged peer-to-peer LLC operation, set the Send N-PDU number (unacknowledged) to 0; and

- for every NSAPI using acknowledged peer-to-peer LLC operation, enter the recovery state and suspend the transmission of SN-PDUs until an SNSM-SEQUENCE.indication primitive is received for the NSAPI. In the SGSN the SNDCP layer shall re-establish acknowledged peer-to-peer operation for the affected SAPIs in the LLC layer.

5.1.2.2 LL-ESTABLISH.request

Request used by the SNDCP layer to establish or re-establish acknowledged peer-to-peer operation for a SAPI in the LLC layer. XID Requested is used to deliver the requested SNDCP XID parameters to the LLC layer.

5.1.2.3 LL-ESTABLISH.indication

Indication used by the LLC layer to inform the SNDCP layer about establishment or re-establishment of acknowledged peer-to-peer operation for a SAPI in the LLC layer. XID Requested is used to deliver the requested SNDCP XID parameters to the SNDCP layer. In case of a re-establishment, all NSAPIs mapped to the affected SAPI shall enter the recovery state, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting with the oldest N-PDU when the link is re-established. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.4 LL-ESTABLISH.response

Response used by the SNDCP layer after reception of the LL-ESTABLISH.indication. XID Negotiated is used to deliver the negotiated SNDCP XID parameters to the LLC layer.

5.1.2.5 LL-ESTABLISH.confirm

Confirmation used by the LLC layer to inform the SNDCP layer about successful initiation of acknowledged peer-to-peer operation for a SAPI in the LLC layer. XID Negotiated is used to deliver the negotiated SNDCP XID parameters to the SNDCP layer. In case of a re-establishment, all NSAPIs mapped to the affected SAPI shall enter the recovery state, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting with the oldest N-PDU when the link is re-established. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.6 LL-RELEASE.request

Request used by the SNDCP layer to release acknowledged peer-to-peer operation for a SAPI in the LLC layer. The Local parameter indicates whether the termination shall be local (see 3GPP TS ~~04.64~~44.064 for details).

5.1.2.7 LL-RELEASE.indication

Indication used by the LLC layer to inform the SNDCP layer about termination of acknowledged peer-to-peer operation for a SAPI in the LLC layer. The Cause parameter indicates the cause for the termination.

On receipt of LL-RELEASE.indication, compressed N-PDUs queuing to be forwarded to the affected SAPI are deleted from the SNDCP layer. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.8 LL-RELEASE.confirm

Confirmation used by the LLC layer to inform the SNDCP layer about termination of acknowledged peer-to-peer operation for a SAPI in the LLC layer. On receipt of LL-RELEASE.confirm, compressed N-PDUs queuing to be forwarded to the affected SAPI are deleted from the SNDCP layer. Also all compression entities using acknowledged peer-to-peer LLC operation on this SAPI are reset.

5.1.2.9 LL-XID.request

Request used by the SNDCP layer to deliver the requested SNDCP XID parameters to the LLC layer.

5.1.2.10 LL-XID.indication

Indication used by the LLC layer to deliver the requested SNDCP XID parameters to the SNDCP layer.

5.1.2.11 LL-XID.response

Response used by the SNDCP layer to deliver the negotiated SNDCP XID parameters to the LLC layer.

5.1.2.12 LL-XID.confirm

Confirm used by the LLC layer to deliver the negotiated SNDCP XID parameters to the SNDCP layer.

5.1.2.13 LL-DATA.request

Request used by the SNDCP layer for acknowledged transmission of an SN-PDU. The SNDCP entity shall associate a reference parameter for each LL-DATA.request. QoS Parameters in the SGSN includes precedence class, delay class, and peak throughput. QoS Parameters in the MS includes peak throughput. QoS Parameters is defined as part of the Quality of Service information element in 3GPP TS ~~04.08~~24.008 [5a]. Radio Priority is included only in the MS, and indicates the radio priority level to be used by RLC/MAC.

Acknowledged peer-to-peer LLC operation for the SAPI used shall be established using the LL-ESTABLISH primitives, before the LL-DATA.request may be used.

5.1.2.14 LL-DATA.indication

Indication used by the LLC layer to deliver the successfully received SN-PDU to the SNDCP layer.

5.1.2.15 LL-DATA.confirm

Confirm used by the LLC layer to inform SNDCP layer about successful transmission of SN-PDU. The primitive includes a reference parameter from which the SNDCP entity shall identify the LL-DATA.request this confirmation was associated with. All buffered N-PDUs whose complete reception is confirmed are deleted.

5.1.2.16 LL-UNITDATA.request

Request used by the SNDCP layer for unacknowledged transmission of a SN-PDU. Unconfirmed transmission shall be used by the LLC layer.

Acknowledged peer-to-peer LLC operation does not need to be established before unacknowledged transmission is allowed.

QoS Parameters in the SGSN includes precedence class, delay class, reliability class, and peak throughput. QoS Parameters in the MS includes peak throughput and reliability class. Reliability class indicates whether the LLC frame carrying the SN-PDU shall be transmitted in protected or unprotected mode, and whether RLC/MAC acknowledged or unacknowledged mode shall be used. Radio Priority is included only in the MS, and indicates the radio priority level to be used by RLC/MAC.

5.1.2.17 LL-UNITDATA.indication

Indication used by the LLC layer to deliver the received SN-PDU to the SNDCP layer. There is no need for acknowledged peer-to-peer LLC operation for unacknowledged transmission of SN-PDU.

5.1.2.18 LL-STATUS.indication

Indication used by the LLC layer to inform SNDCP when an LLC error that cannot be corrected by the LLC layer has occurred. The Cause parameter indicates the cause of the failure.

On receipt of LL-STATUS.indication, SNDCP shall inform the SM sub-layer by means of the SNSM-STATUS.request primitive.

5.1.2.19 SNSM-ACTIVATE.indication

Indication used by the SM entity to inform the SNDCP entity that an NSAPI has been activated for data transfer. It also informs the SNDCP entity about the negotiated QoS profile (see 3GPP TS ~~04.08~~24.008 [5a]), the SAPI assigned for this NSAPI, and, in the MS, the radio priority level to be used by RLC/MAC.

If the NSAPI activated uses the acknowledged peer-to-peer LLC operation, the NSAPI shall enter the recovery state.

Upon reception of the SNSM-ACTIVATE.indication from the SM sublayer, the SNDCP entity shall, if necessary, establish the acknowledged peer-to-peer LLC operation for the indicated SAPI. The establishment criteria and procedure are described in subclause 6.2.1.

5.1.2.20 SNSM-ACTIVATE.response

Response used by the SNDCP layer to inform SM entity that the indicated NSAPI is now in use and that the acknowledged peer-to-peer LLC operation for the indicated SAPI is established, if necessary.

5.1.2.21 SNSM-DEACTIVATE.indication

Indication used by the SM entity to inform the SNDCP entity that an NSAPI has been deallocated and cannot be used by the SNDCP entity anymore. All buffered N-PDUs corresponding to this NSAPI are deleted.

Upon reception of the SNSM-DEACTIVATE.indication, the SNDCP entity shall, if necessary, release the acknowledged peer-to-peer LLC operation for the associated SAPI. The release criteria and procedure are described in subclause 6.2.2.

5.1.2.22 SNSM-DEACTIVATE.response

Response used by the SNDCP layer to inform SM entity that the NSAPI indicated is no longer in use and that the acknowledged peer-to-peer LLC operation for the associated SAPI is released, if necessary.

5.1.2.23 SNSM-MODIFY.indication

Indication used by the SM entity to trigger change of the QoS profile (see 3GPP TS 24.008 [5a]~~04.08~~) for an NSAPI and indication of the SAPI to be used. It is also used by the SM entity in the SGSN to inform the SNDCP entity that an NSAPI shall be created, together with the (re-)negotiated QoS profile, the SAPI assigned, and, in the MS, the radio priority level to be used by RLC/MAC.

NOTE: The latter is performed in the new SGSN during an Inter-SGSN Routeing Area Update.

Upon reception of the SNSM-MODIFY.indication from the SM sublayer:

- the SNDCP entity shall, if necessary, establish the acknowledged peer-to-peer LLC operation for the indicated SAPI (the establishment criteria and procedure are described in subclause 6.2.1); and

- the SNDCP entity shall also, if necessary, release the acknowledged peer-to-peer LLC operation for the originally-assigned SAPI (the release criteria and procedure are described in subclause 6.2.2).

If the SNSM-MODIFY.indication applies to an existing NSAPI, and:

- if the peer-to-peer LLC operation mode is changed from acknowledged to unacknowledged, then all buffered N-PDUs shall be deleted, and the Send N-PDU number (unacknowledged) shall be set to 0; and

- if the peer-to-peer LLC operation mode is changed from unacknowledged to acknowledged, then the Send N-PDU number and Receive N-PDU number shall be set to 0.

In addition, if the newly-assigned SAPI is different from the original SAPI:

- LL-DATA.indication, LL-DATA.confirm and LL-UNITDATA.indication received on the old SAPI shall be ignored;

- LL-DATA.request and LL-UNITDATA.request shall be sent on the new SAPI; and

- if acknowledged peer-to-peer LLC operation is used both before and after the receipt of the SNSM-MODIFY.indication, then the NSAPI shall enter the recovery state, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting from the oldest N-PDU.

If the SNSM-MODIFY.indication signifies the creation of an NSAPI (i.e. the specified NSAPI does not exist), and:

- if unacknowledged peer-to-peer LLC operation is specified in the QoS profile, then the Send N-PDU number (unacknowledged) shall be set to 0; and
- if acknowledged peer-to-peer LLC operation is specified in the QoS profile, then the Send N-PDU number and the Receive N-PDU number variables shall be set to the values stated in the primitive.

5.1.2.24 SNSM-MODIFY.response

Response used by the SNDCP entity to inform the SM entity that the indicated NSAPI and QoS profile are now in use and the acknowledged peer-to-peer LLC operations for the appropriate SAPIs are established and/or released, if necessary.

5.1.2.25 SNSM-STATUS.request

This primitive is used by the SNDCP layer to inform the SM sub-layer that SNDCP cannot continue its operation due to errors at the LLC layer (as indicated with LL-RELEASE.indication) or at the SNDCP layer. The Cause parameter indicates the cause of the error.

5.1.2.26 SNSM-SEQUENCE.indication

This primitive is used during an inter-SGSN routeing area update and applies only to NSAPIs using acknowledged peer-to-peer LLC operation. When the primitive is used in the MS, the Receive N-PDU number parameter indicates the Receive N-PDU number in the SGSN. When the primitive is used in the SGSN, the Receive N-PDU number parameter indicates the Receive N-PDU number in the MS. If a buffered N-PDU is confirmed by the Receive N-PDU number parameter to have been received by the peer SNDCP entity, the N-PDU shall be deleted from the buffer. In addition, the receipt of this primitive by the SNDCP entity resumes the transmission of SN-PDUs for the NSAPI, and all buffered N-PDUs (i.e. the ones whose complete reception has not been acknowledged and the ones that have not been transmitted yet) shall be transmitted starting from the oldest N-PDU. If acknowledged peer-to-peer LLC operation has not yet been established for the SAPI used by this NSAPI, the transmission of the buffered N-PDUs shall begin only after the receipt of the LL-ESTABLISH.indication or LL-ESTABLISH.confirm primitive.

5.1.2.27 SNSM-SEQUENCE.response

This primitive is used during an inter-SGSN routeing area update and applies only to NSAPIs using acknowledged peer-to-peer LLC operation. The primitive is used by the SNDCP layer in the MS following receipt of an SNSM-SEQUENCE.indcation, in order to return the Receive N-PDU number to the SGSN during an ongoing inter-SGSN routeing area update.

5.1.2.28 SNSM-STOP-ASSIGN.indication

This primitive is used during an inter-SGSN routeing area update in the old SGSN by the SM entity to inform the SNDCP entity to stop assigning N-PDU numbers to N-PDUs received through the SN-DATA.request primitive. The primitive is sent before the Send N-PDU number and the Receive N-PDU number are transferred to the new SGSN.

5.2 Service functions

SNDCP shall perform the following functions (see figure 4):

- Mapping of SN-DATA primitives onto LL-DATA primitives.
- Mapping of SN-UNITDATA primitives onto LL-UNITDATA primitives.
- Multiplexing of N-PDUs from one or several network layer entities onto the appropriate LLC connection.

- Establishment, re-establishment and release of acknowledged peer-to-peer LLC operation.
- Supplementing the LLC layer in maintaining data integrity for acknowledged peer-to-peer LLC operation by buffering and retransmission of N-PDUs.
- Management of delivery sequence for each NSAPI, independently.
- Compression of redundant protocol control information (e.g. TCP/IP header) at the transmitting entity and decompression at the receiving entity. The compression method is specific to the particular network layer or transport layer protocols in use.
- Compression of redundant user data at the transmitting entity and decompression at the receiving entity. Data compression is performed independently for each SAPI, and may be performed independently for each PDP context. Compression parameters are negotiated between the MS and the SGSN.
- Segmentation and reassembly. The output of the compressor functions is segmented to the maximum length of LL-PDU. These procedures are independent of the particular network layer protocol in use.
- Negotiation of the XID parameters between peer SNDCP entities using XID exchange.

Figure 4 shows the transmission flow through SNDCP layer. The order of functions is the following:

- Protocol control information compression.
- User data compression.
- Segmentation of compressed information into SN-DATA or SN-UNITDATA PDUs.

The order of functions is vice versa in the reception flow:

- Reassembly of SN-PDUs to N-PDUs.
- User data decompression.
- Protocol control information decompression.

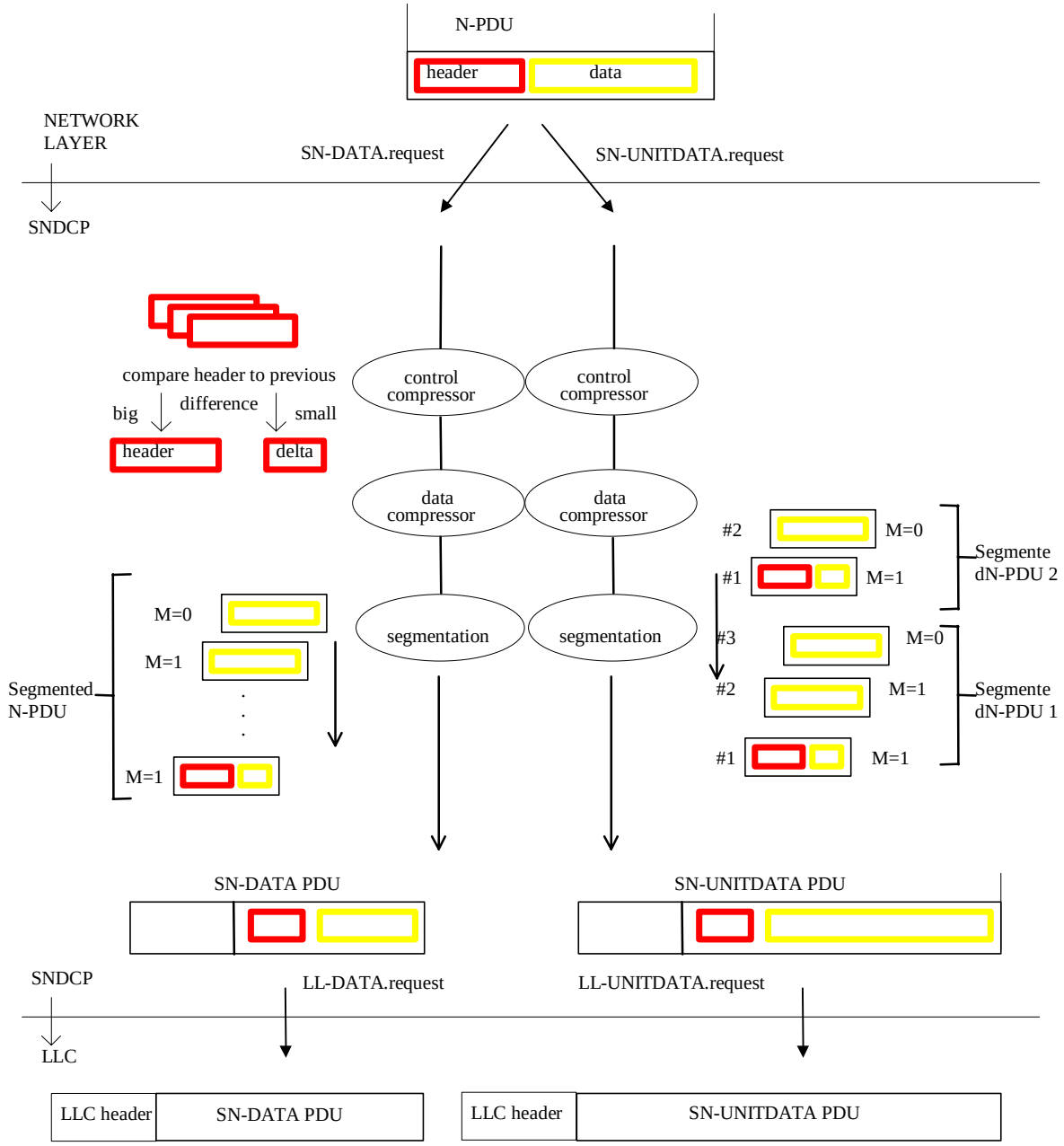

Figure 4: SNDCP model

The SNDCP layer expects the following services to be provided by the LLC layer. LLC layer functionality is defined in 3GPP TS ~~04.64~~44.064 [6]:

- Acknowledged and unacknowledged data transfer.
- Point-to-point and point-to-multipoint data transfer.
- In-order delivery of SN-PDUs per SAPI (i.e. SN-PDUs using the same SAPI shall appear at the receiving end in the same order as transmitted). This is required only for acknowledged service.
- QoS profile-based transfer of SN-PDUs.
- Support for variable length SN-PDUs.
- Transfer of SNDCP XID parameters.

The SNDCP layer expects the following services to be provided by the SM sublayer. SM sublayer functionality is defined in 3GPP TS ~~04.08~~24.008 [5a]:

- Activation and deactivation of PDP Contexts and informing the SNDCP layer when change in PDP context has happened.
- Carrying out Inter SGSN Routing Area Update and informing the SNDCP layer in the SGSN when the N-PDUs shall be tunnelled to the new SGSN.
- Notifying the SNDCP layer when there is need to change the QoS profile parameters of the PDP contexts.

6 Protocol functions

6.1 Multiplexing of N-PDUs

The NSAPI field shall be used for the identification of the specific PDP type and PDP address pair that is using the services provided by the SNDCP layer. The MS allocates NSAPIs dynamically at the PDP Context Activation. The NSAPI is delivered by the SM sub-layer to the SNDCP layer with the SNSM-ACTIVATE.indication primitive. The transmitting SNDCP entity shall insert the NSAPI value for each N-PDU. The peer SNDCP entity uses the NSAPI to identify the SNDCP user the N-PDU is targeted. Table 3 shows an example for the allocation of the NSAPIs.

Table 3: Example of the NSAPI allocation

PDP type	Allocated NSAPI	PDP address
IPv4	12	133.12.75.111 (4 octets)
IPv6	13	133.12. … .11.123 (16 octets)

6.2 Establishment and release of acknowledged peer-to-peer LLC operation

The SNDCP layer shall be responsible for establishing, re-establishing and releasing the acknowledged peer-to-peer LLC operation.

Re-establishment and release of the acknowledged peer-to-peer LLC operation may also be initiated by the LLC layer. The conditions under which this may happen are described in 3GPP TS ~~04.64~~44.064.

Negotiation of SNDCP XID parameters may be carried out in conjunction with the establishment or re-establishment procedure. It is also possible to negotiate SNDCP XID parameters independently from the establishment or re-establishment procedure, by using the LL-XID primitives.

6.2.1 Establishment of acknowledged peer-to-peer LLC operation

6.2.1.1 Establishment criteria

If acknowledged peer-to-peer LLC operation is required by an NSAPI (as indicated by the QoS profile) but is not yet established for the SAPI used by the NSAPI, then the SNDCP layer shall initiate the establishment procedure.

The SNDCP layer at the MS shall initiate the establishment, using the procedure in subclause 6.2.1.3, upon receipt of the SNSM-ACTIVATE.indication primitive.

The SNDCP layer at the SGSN shall initiate the establishment upon receipt of the SNSM-MODIFY.indication primitive.

6.2.1.2 Re-establishment of the acknowledged peer-to-peer LLC operation

The SNDCP layer may initiate re-establishment of the acknowledged peer-to-peer LLC operation for a SAPI under certain situations, for example when an error is detected by a V.42 bis data compression entity used for acknowledged data transfer.

The LLC layer may also initiate re-establishment of the acknowledged peer-to-peer LLC operation for a SAPI under situations described in 3GPP TS ~~04.64~~44.064. The LLC layer informs the SNDCP layers of link re-establishment using the LL-ESTABLISH.indication primitive. This is shown in figure 5.

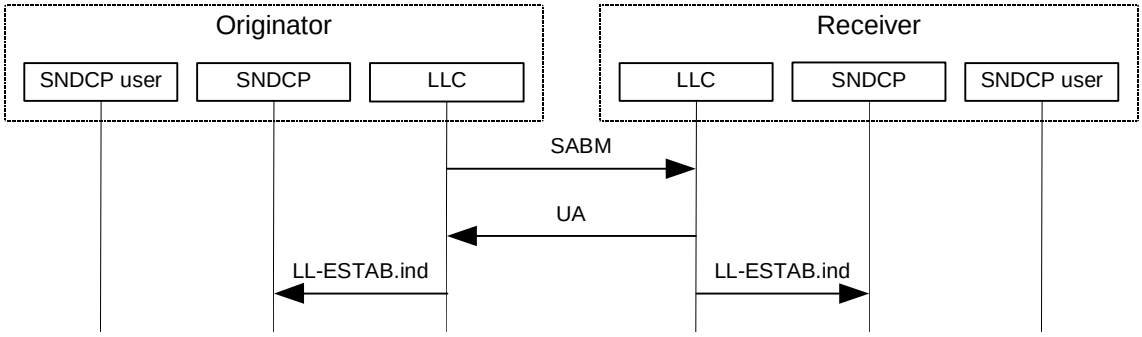

Figure 5: LLC-initiated re-establishment

6.2.1.3 Establishment procedure

The SNDCP layer shall initiate the establishment or re-establishment by sending an LL-ESTABLISH.request primitive to the relevant LLC SAP. SNDCP XID parameters may be included in an SNDCP XID block in the LL-ESTABLISH.request primitive. If no SNDCP XID parameter is to be included, an empty SNDCP XID block shall be included.

Following the sending of the LL-ESTABLISH.request primitive, the SNDCP layer shall suspend the transfer of SN-DATA and SN-UNITDATA primitives to the LLC SAP to which the LL-ESTABLISH.request is sent. Transfer of SN-DATA and SN-UNITDATA primitives shall resume when the establishment procedure ends through one of the following means:

- successful (receiving LL-ESTABLISH.confirm);
- failure (receiving LL-RELEASE.indication); or
- successful following collision resolution (receiving LL-ESTABLISH.indication and sending LL-ESTABLISH.response, see subclause 6.2.1.4).

Upon receipt of an LL-ESTABLISH.indication primitive, if an SNDCP XID block is present, the peer SNDCP entity shall respond with an LL-ESTABLISH.response primitive. SNDCP XID parameters may be included in an SNDCP XID block in the LL-ESTABLISH.response primitive. If no SNDCP XID parameter is to be included, an empty SNDCP XID block shall be included. If there is no SNDCP XID block in the LL-ESTABLISH.indication primitive, the peer SNDCP entity shall not respond with an LL-ESTABLISH.response primitive.

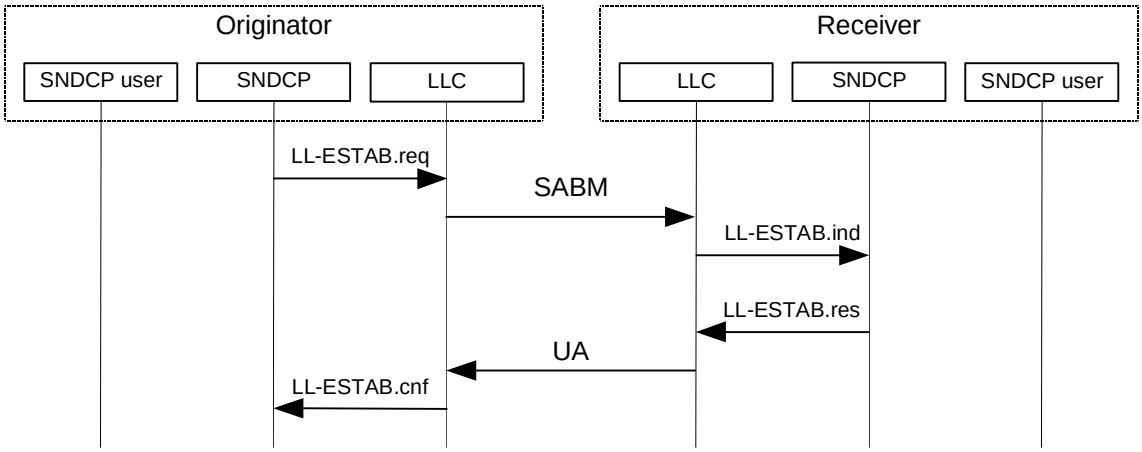

Figure 6: SNDCP-initiated establishment / re-establishment

6.2.1.4 Exceptional situations

If the originator of the establishment procedure receives an LL-RELEASE.indication with Cause "DM received", it shall inform the SM sub-layer using the SNSM-STATUS.request primitive with Cause "DM received". SM shall then deactivate all PDP contexts for that SAPI requiring acknowledged peer-to-peer LLC operation.

If the originator of the establishment procedure receives an LL-RELEASE.indication with Cause "invalid XID response" or an LL-STATUS.indication with Cause "invalid XID response", then it shall inform the SM sub-layer using the SNSM-STATUS.request primitive with Cause "invalid XID response". SM shall then deactivate all PDP contexts for that SAPI.

If the originator of the establishment procedure receives an LL-RELEASE.indication with Cause "no peer response" or an LL-STATUS.indication with Cause "no peer response", then it shall inform the SM sub-layer using the SNSM-STATUS.request primitive with Cause "no peer response", wait for an implementation-specific amount of time, and re-invoke the establishment procedure. Before the establishment procedure is re-invoked, N-PDUs arriving at the SNDCP layer for delivery to the LLC layer shall be buffered, if possible.

If the SNDCP layer receives an LL-RELEASE.indication with Cause "normal release", it shall buffer, if possible, all downlink N-PDUs for NSAPIs using the affected SAPI that requires acknowledged peer-to-peer LLC operation. Transfer of N-PDUs for NSAPIs that do not require acknowledged peer-to-peer LLC operation shall not be affected.

If the originator of the establishment procedure detects a collision (receiving an LL-ESTABLISH.indication primitive after sending an LL-ESTABLISH.request or LL-XID.request primitive, or receiving an LL-XID.indication primitive after sending an LL-XID.request primitive), it shall treat the LL-ESTABLISH.request or LL-XID.request primitive sent as not transmitted, and process the LL-ESTABLISH.indication or LL-XID.indication primitive received. If the LL-ESTABLISH.request or LL-XID.request contains one or more XID parameters, or one or more compression fields in an XID parameter, or one or more parameters in a compression field, that are not negotiated as part of the collision resolution, then negotiation of these XID parameters shall be performed at the earliest opportunity after conclusion of the collision resolution.

6.2.2 Release of acknowledged peer-to-peer LLC operation

6.2.2.1 Release criteria

If acknowledged peer-to-peer LLC operation is established for the SAPI used by a PDP context that is going to be deactivated or mapped to another SAPI, and if there is no other NSAPIs that require acknowledged peer-to-peer LLC operation using the original SAPI, then the SNDCP layer shall initiate the release procedure.

The SNDCP layer shall initiate the release, using the procedure described in subclause 6.2.2.2, upon receipt of the SNSM-DEACTIVATE.indication primitive.

The SNDCP layer at the SGSN shall also initiate the release upon receipt of the SNSM-MODIFY.indication primitive if an existing NSAPI is specified.

6.2.2.2 Release procedure

The SNDCP layer shall initiate the release by sending a LL-RELEASE.request primitive to the relevant LLC SAP. The Local parameter shall be set if the release is the result of receipt of the SNSM-DEACTIVATE.indication primitive, otherwise it shall not be set.

6.2.2.3 Release initiated by the LLC layer

The LLC layer may initiate release of the acknowledged peer-to-peer LLC operation for a SAPI under situations described in 3GPP TS ~~04.64~~44.064. The LLC layer shall inform the SNDCP layers of the release of acknowledged peer-to-peer LLC operation using the LL-RELEASE.indication primitive. SNDCP shall process the LL-RELEASE.indication primitive as described in subclause 6.2.1.4.

6.3 N-PDU buffering

The N-PDUs shall be buffered in the SNDCP layer before they are compressed segmented and transmitted to the LLC layer. The reception of an SNSM-DEACTIVATE.indication shall trigger the deletion of the buffer for the related NSAPI.

For acknowledged data transfer, the SNDCP entity shall buffer an N-PDU until successful reception of all SN-PDUs carrying segments of the N-PDU have been confirmed. The confirmation is carried out using the LL-DATA.confirm primitive from the LLC layer or the SNSM-SEQUENCE.indication primitive from the SM layer. Buffered N-PDUs which have been completely received as indicated by the acknowledgements in an LL-DATA.confirm primitive shall be discarded. During the Inter-SGSN RA Update, buffered N-PDUs whose complete reception by the MS has been confirmed in the SNSM-SEQUENCE.indication primitive shall be discarded, as defined in 3GPP TS ~~09.60~~29.060 [7] and 3GPP TS ~~03.60~~23.060 [3].

For unacknowledged data transfer, the SNDCP shall delete an N-PDU immediately after it has been delivered to the LLC layer.

6.4 Management of delivery sequence

The SNDCP layer shall retain the delivery sequence of N-PDUs of each NSAPI between the peer entities. The delivery sequence of N-PDUs from different NSAPIs may be changed according to the QoS profiles.

6.5 Protocol control information compression

Protocol control information compression is an optional SNDCP feature.

Negotiation of the supported algorithms and their parameters is carried out between MS and SGSN using the SNDCP XID parameters (see clause 8).

6.5.1 Negotiation of multiple protocol control information compression types

Each SNDCP entity that supports protocol control information compression shall be able to negotiate one or several protocol control information compression entities with the compression field format shown in figure 7. The negotiation shall be carried out using the XID parameter negotiation specified in subclause 6.8. The initiating entity defines a set of requested compression entities, together with the algorithm and parameters for each compression entity. The set of entities and their algorithms and parameters shall be transmitted to the peer entity. The peer entity responds with the set of negotiated entities and their algorithms and parameters. The peer entity shall select the proposed parameter values or other appropriate values for the negotiated entities. If more than one protocol control information compression algorithm for a specific NSAPI is proposed during the XID negotiation then the receiving peer entity shall only choose one algorithm for that NSAPI.

6.5.1.1 Format of the protocol control information compression field

Bit	8	7	6	5	4	3	2	1
Octet 1	P	X	X	Entity number				
Octet 2	X	X	X	Algorithm type				
Octet 3	Length=n-3							
Octet 4	PCOMP1				PCOMP2			
…	…				…			
Octet x	High-order octet							
…	…							
Octet n	Low-order octet							

Figure 7: Protocol control information compression field format for SNDCP XID negotiation

6.5.1.1.1 Spare bit (X)

The X bit shall be set to 0 by the transmitting SNDCP entity and shall be ignored by the receiving SNDCP entity.

6.5.1.1.2 Propose bit (P)

The P bit shall be set to 1 if a new compression entity is being proposed, otherwise it shall be set to 0. If the P bit is set to 1, then all octets shall be included, otherwise octet 2 and octets 4 to x-1 shall not be included. If the P bit is set to 1, then only enough number of octets shall be included to contain the number of PCOMP values needed by the corresponding compression algorithm (e.g. PCOMP3 and PCOMP4 shall not be included if the number of PCOMP values needed by a compression algorithm is one or two). If an odd number of PCOMP values are used by a compression algorithm, then the last PCOMP value shall be set to 0 in the compression field by the transmitting SNDCP entity, and it shall be ignored by the receiving SNDCP entity.

6.5.1.1.3 Entity number

The entity number shall be used to identify a protocol control information compression entity on a SAPI. The entity number shall be assigned using the following rules:

- The entity number shall be an integer from 0 to 31.
- The entity number shall be assigned independently on each of the SAPIs.
- An entity number shall be in one of the three states: unassigned, selected, or assigned.
- When a new compression entity is to be proposed, an unassigned entity number shall become selected. If there is no unassigned entity number left, the compression entity shall not be proposed.
- A selected entity number shall become assigned if the corresponding proposed compression entity is created as a result of the XID negotiation, otherwise it shall become unassigned.
- An assigned entity number shall become unassigned when the corresponding compression entity is deleted as a result of an XID negotiation, or upon the receipt of the LL-RESET.indication primitive.
- In the case of a collision (see subclause 6.2.1.4) in which an entity number is currently selected:
  - If the selected entity number is included with the P bit set to 0 in the incoming SNDCP XID block, then it shall be assumed that the peer SNDCP entity agreed to the creation of the proposed entity but the response was lost. Therefore the selected entity number shall become assigned, any selected PCOMP and DCOMP values for the algorithm of the entity shall become assigned, and the compression entity shall be created, before the incoming SNDCP XID block is processed. After the incoming SNDCP XID block is processed, the compression entity shall be negotiated again if necessary, as defined in subclause 6.2.1.4.

- Otherwise (i.e. if the selected entity number is not included, or is included with the P bit set to 1 in the incoming SNDCP XID block), the selected entity number shall become unassigned, and any selected PCOMP and DCOMP values for the algorithm of the entity shall become unassigned, before the incoming SNDCP XID block, if any, is processed. Following the collision resolution procedure, the originally-proposed compression entity shall be proposed again (i.e. the originally-proposed compression entity shall not be considered created even if the originally-selected entity number is proposed in the incoming SNDCP XID block) by sending the appropriate primitive (LL-ESTABLISH.request or LL-XID.request). The originally-selected entity number, PCOMP and DCOMP values shall be used for the compression entity being re-proposed if they are unassigned, otherwise a new entity number, PCOMP or DCOMP value shall be selected.

- In the case of a collision in which an entity number is currently assigned:

  - If the peer SNDCP entity proposes a new compression entity with the same entity number, then it shall be assumed that the peer SNDCP entity negotiated the deletion of the entity but the response was lost, and the entity number is being reused. Therefore the original compression entity shall be deleted, the entity number shall become unassigned, PCOMP and DCOMP values shall be unassigned if necessary (see subclause 6.5.1.1.5), and then the proposed compression entity shall be responded to as usual.

  - Otherwise (i.e. if the assigned entity number is not included, or is included with the P bit set to 0 in the incoming SNDCP XID block), the usual rules regarding collision handling shall apply.

- In the case of a collision in which a PCOMP or DCOMP value is currently assigned to a compression algorithm:

  - If the peer SNDCP entity proposes a new compression entity with the same PCOMP or DCOMP assigned to a different algorithm, then it shall be assumed that the peer SNDCP entity negotiated the deletion of all entities using the algorithm to which the PCOMP or DCOMP value was assigned, but the response was lost, and the PCOMP or DCOMP value is being reused. Therefore, all compression entities using that algorithm shall be deleted, all corresponding entity numbers shall become unassigned, and all PCOMP or DCOMP values assigned to the algorithm shall become unassigned, and then the proposed compression entity shall be responded to as usual.

  - Otherwise (i.e. if the assigned PCOMP or DCOMP is not included, or is included and assigned to the same algorithm), the usual rules regarding collision handling shall apply.

6.5.1.1.4 Algorithm type

Table 4 show the list of protocol control information compression algorithms supported by the SNDCP layer. When new compression algorithms are needed for SNDCP, table 4 shall be updated.

Table 4: List of protocol control information compression algorithms supported by SNDCP

Compression algorithm	Algorithm type (Range 0 to 31)
RFC 1144	0
RFC 2507	1
ROHC	2
-	Other values Reserved

6.5.1.1.5 PCOMP

One or more PCOMP values shall be assigned dynamically to a compression algorithm, based on the negotiation of the XID parameters for protocol control information compression. Each of the assigned PCOMP values denotes one compressed frame type of that compression algorithm.

The assignment of the PCOMP values follows the following general rules:

- PCOMP shall be an integer from 0 to 15.

- PCOMP value 0 is reserved permanently for no compression.

- PCOMP shall be assigned independently on each of the SAPIs.

- An assigned PCOMP value applies to all NSAPIs mapped to the same SAPI.

- PCOMP values shall be assigned to compression algorithms, not to compression entities (i.e. the same PCOMP value(s) shall be used by different compression entities on the same SAPI using the same compression algorithm).

- A PCOMP value shall be in one of the three states: unassigned, selected, or assigned.

- When a new compression entity is to be proposed, and if PCOMP values have not yet been assigned to the corresponding compression algorithm, then the appropriate number of unassigned PCOMP values shall be selected. If there is not enough unassigned PCOMP values left, the compression entity shall not be proposed.

- A selected PCOMP value shall become assigned if the corresponding proposed compression entity is created as a result of the XID negotiation, otherwise it shall become unassigned.

- An assigned PCOMP value shall become unassigned when the corresponding compression algorithm is no longer in use by any compression entity, or upon the receipt of the LL-RESET.indication primitive.

- In the case of a collision (see subclause 6.2.1.4), the handling of PCOMP values shall be in accordance with subclause 6.5.1.1.3.

While transferring data, the compressed frame type for an N-PDU is conveyed in the PCOMP field of the SNDCP header of the first SN-PDU belonging to the N-PDU. Any successfully negotiated algorithm may be used for compression of an N-PDU.

6.5.1.2 Resetting compression entities following SNDCP XID negotiation

The LL-Establish primitives shall be used for the negotiation of protocol control information compression if:

- one or more parameters, excluding the applicable NSAPIs, of existing compression entities used with acknowledged peer-to-peer LLC operation are changed by the originator of the negotiation; or

- one or more NSAPIs are removed, by the originator of the negotiation, from existing compression entities used with acknowledged peer-to-peer LLC operation, except when all NSAPIs using the compression entity are removed, or when LLC is already in ADM.

Otherwise, either the LL-Establish primitives or the LL-XID primitives may be used.

If the LL-XID primitives are used for XID negotiation, then in addition to restrictions specified elsewhere in the present document, the following parameters of the protocol control information compression entities are non-negotiable by the responding SNDCP entity:

- any parameter of existing compression entities used with acknowledged peer-to-peer LLC operation.

If one or more parameters, other than the applicable NSAPIs, of a compression entity used with unacknowledged peer-to-peer LLC operation are changed, the compression entity shall be reset locally upon completion of the SNDCP XID negotiation.

6.5.1.3 Parameters for compression entities

On negotiating a compression entity, not all the parameters of the entity have to be specified. If a parameter is to be included, all the preceding parameters shall also be specified, and the length field shall be set to the sum of the lengths of all the parameters specified. If any of the parameters is not specified, the rules in subclause 6.8.2 shall apply.

6.5.2 TCP/IP header compression (RFC1144)

The protocol control information compression method is specific for each network layer protocol type. TCP/IP (IPv4) header compression is specified in RFC 1144 [9].

6.5.2.1 Parameters

Table 5 contains the parameters defined for a compression entity using TCP/IP header compression. They may be negotiated during SNDCP XID negotiation.

Table 5: RFC 1144 TCP/IP header compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
RFC 1144	0	0, 2 or 3 if P bit is 0, 1, 3 or 4 if P bit is 1.	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			S_0 - 1	bbbbbbbb	0 through 255	down	15

6.5.2.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.5.2.1.2 S_0

The number of state slots, as defined in [9]. The S_0 range is 1 through 256, with 16 as default value.

6.5.2.2 Assignment of PCOMP values

The underlying service shall be able to distinguish the three types of compressed N-PDUs (i.e. Type IP, Uncompressed TCP, and Compressed TCP), as defined in RFC 1144 [9]. These three N-PDU types are differentiated by using different PCOMP values.

Two PCOMP values shall be assigned to the TCP/IP header compression algorithm. PCOMP1 shall contain the PCOMP value for the frame type "Uncompressed TCP", and PCOMP2 shall contain the PCOMP value for the frame type "Compressed TCP".

The PCOMP value of 0 shall be used for the frame type "Type IP".

6.5.2.3 Error Recovery

When TCP/IP header compression is used with unacknowledged peer-to-peer LLC operation, the decompression entity shall be notified in case an N-PDU is dropped, so that error recovery procedure (see RFC 1144 [9]) can be invoked.

6.5.3 TCP/IP and UDP/IP header compression (RFC 2507)

Detailed operation of the RFC 2507 header compression for IPv4 and IPv6 is described in clause 3 of the IETF specification RFC 2507 [10].

6.5.3.1 Parameters

Table 6 contains the parameters defined for a compression entity using RFC2507 header compression. They may be negotiated during SNDCP XID negotiation.

Table 6: RFC 2507 TCP/IP and UDP/IP header compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
RFC 2507	1	0, 2, 4, 5, 6, 7 or 9 if P bit is 0, 3, 5, 7, 8, 9, 10 or 12 if P bit is 1.	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			F_MAX_PERIOD	bbbbbbbb bbbbbbbb	1-65535	down	256
			F_MAX_TIME	bbbbbbbb	1-255	down	5
			MAX_HEADER	bbbbbbbb	60-255	down	168
			TCP_SPACE	bbbbbbbb	3-255	down	15
			NON_TCP_SPACE	bbbbbbbb bbbbbbbb	3-65535	down	15

The explanation of the individual parameters can be found in the clause 14 of the IETF specification RFC 2507 [10].

6.5.3.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.5.3.2 Assignment of PCOMP values for RFC2507

The following PCOMP values shall be assigned to the RFC 2507 header compression. The PCOMP value 0 shall be used for regular IPv4 and IPv6 packets.

Table 7: PCOMP values assigned to RFC 2507 header compression algorithm

PID value	Packet type
PCOMP1	Full header
PCOMP2	Compressed TCP
PCOMP3	Compressed TCP non-delta
PCOMP4	Compressed non-TCP
PCOMP5	Context state

6.5.3.3 Error Recovery

The mechanisms related to error recovery and packet reordering are described in clauses 10 and 11 of the RFC 2507[10].

6.5.4 Robust Header Compression (ROHC)

Robust Header Compression (ROHC) is a framework for header compression, on top of which compression schemes can be defined for the compression of various protocol headers. Both the SNDCP ROHC negotiation mechanisms and the SN-PDU ROHC identifiers are generally defined for the ROHC framework, and therefore capable of handling both existing and future ROHC compression protocols (profiles). RFC 3095 [12] defines the ROHC framework, as well as the compression schemes and profiles for RTP/UDP/IP, UDP/IP, ESP/IP and uncompressed.

6.5.4.1 Parameters

Table 8 contains the parameters defined for a compression entity using ROHC. They may be negotiated during SNDCP XID negotiation.

Table 8: Robust Header Compression (ROHC) parameters

Algorithm Name	Algorithm Type	Length	Parameter Name	Format	Range	Sense of Negotiation	Default Value
ROHC	2	0, 2, 4, 6, 8, 8+n*2 if P bit is 0, 2, 4, 6, 8, 10, 10+n*2 if P bit is 1. (where n is the number of profiles, the max. number of profiles is 16)	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			MAX_CID	00bbbbbb bbbbbbbb	0-16383	down	15
			MAX_HEADER	00000000 bbbbbbbb	60-255	down	168
			MRRU	bbbbbbbb bbbbbbbb	0-65535	down	0
			PROFILE 1	bbbbbbbb bbbbbbbb	0-65535	(see 6.5.4.1.5)	0
			PROFILE 2	bbbbbbbb bbbbbbbb	0-65535	(see 6.5.4.1.5)	0
			...	...	...	...	...
			PROFILE 16	bbbbbbbb bbbbbbbb	0-65535	(see 6.5.4.1.5)	0

6.5.4.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.5.4.1.2 MAX_CID

The MAX_CID parameter indicates the maximum number of context identifiers. A value N means N+1 context, e.g. 0 means 1 context.

6.5.4.1.3 MAX_HEADER

The MAX_HEADER parameter indicates the maximum number of octets of the protocol control information that may be compressed.

6.5.4.1.4 MRRU

If ROHC segmentation is used, the maximum reconstructed reception unit (MRRU) indicates the number of octets that the decompressor is expected to reassemble from the segments. If MRRU is negotiated to 0, ROHC segmentation is disabled.

6.5.4.1.5 PROFILE

The PROFILE parameter indicates the profile identifier. A list of up to 16 PROFILEs, indicating which ROHC profiles [14] are supported may be included. The negotiated list which is used for compression consists of the list of profiles supported by both peer entities, reduced to include at most ONE profile identifier with the same 8-bit LSB part. If both peer entities support more than one profile with the same 8-bit LSB part in its profile identifier, the set of these profiles shall be reduced to the profile with the highest MSB-value in its profile identifier.

Note: The reason for this is that the 8-bit MSB part of the profile identifier indicates the "variant" of the profile, and since only the 8-bit LSB part is sent in compressed headers, the set of available profiles must not include two profiles with the same 8-bit LSB part of the profile identifier.

6.5.4.2 Assignment of PCOMP values for ROHC

As opposed to other header compression schemes, the whole ROHC framework has only one packet type that has to be identified by the PDU format, and this packet type can be used by any ROHC compression profile. However, ROHC has two different context identification (CID) sizes. To avoid having to negotiate and potentially re-negotiate CID size, the mechanism from ROHC-over-PPP [13] is adopted in SNDCP, i.e. as shown in table 9, two packet types are defined for ROHC, one for small and one for large CIDs.

This implies that all CIDs within one ROHC packet shall be of the same size as indicated by the PID value, either small or large. In particular, embedded feedback shall have a CID of the same size as indicated by the PID value. For piggybacking feedback, a compressor must be able to control the feedback CID size used by the associated decompressor, ensure that all CIDs are of the same size, and indicate this size with the appropriate PID value. To make CID interpretation unambiguous when ROHC segmentation is used, all packets that contribute to a segment shall be sent with the same PID value, either PCOMP1 or PCOMP2, which then also applies to the CID size in the reconstructed unit. A unit reconstructed out of packets with PID values that differ shall be discarded.

Table 9: PCOMP values assigned to Robust Header Compression (ROHC)

PID value	Packet type
PCOMP1	ROHC small-CIDs
PCOMP2	ROHC large-CIDs

6.5.4.3 Error Recovery and other feedback

ROHC has built-in robustness mechanisms to avoid error events, as well as error recovery mechanisms using decompressor to compressor feedback. Such ROHC feedback is carried according to alternative 6) in section 5.2.1 of RFC 3095 [12].

6.6 Data compression

Data compression is an optional SNDCP feature. Data compression applies to both SN-DATA and SN-UNITDATA primitives.

Data compression, if used, shall be performed on the entire N-PDU, including the possibly compressed protocol control information.

Figure 8 shows an example how the SNDCP functions may be used. Several NSAPIs may use a common data compression entity, i.e. the same compression algorithm and the same dictionary. Separate data compression entities shall be used for acknowledged (SN-DATA) and unacknowledged (SN-UNITDATA) data transfer. Several NSAPIs may be associated with one SAPI, i.e. they may use the same QoS profile.

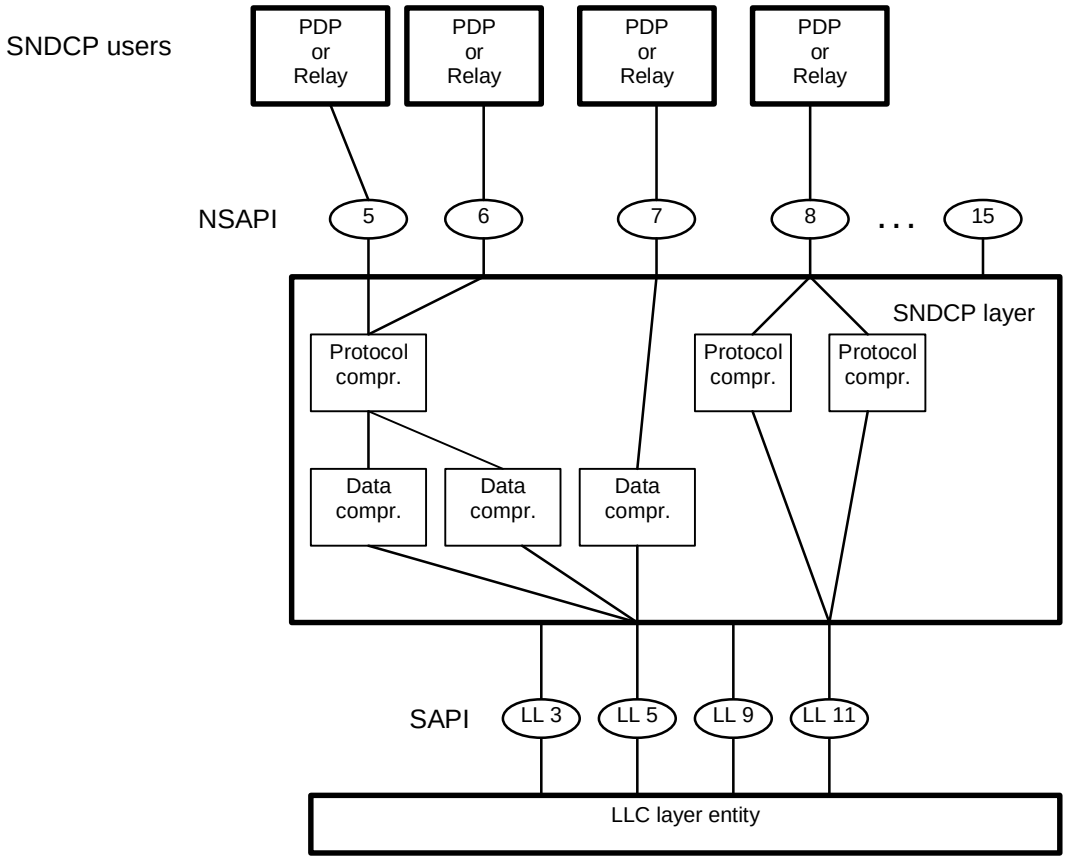

Figure 8: An example for the usage of NSAPIs, SNDCP functions, and SAPIs

6.6.1 Negotiation of multiple data compression types

Each SNDCP entity that supports data compression shall be able to negotiate one or several data compression entities with the compression field format shown in figure 9. The negotiation shall be carried out using the XID parameter negotiation specified in subclause 6.8. The initiating entity defines a set of requested compression entities, together with the algorithm and parameters for each compression entity. The set of entities and their algorithms and parameters shall be transmitted to the peer entity. The peer entity responds with the set of negotiated entities and their algorithms and parameters. The peer entity shall select the proposed parameter values or other appropriate values for the negotiated entities. If more than one data compression algorithm for a specific NSAPI is proposed during the XID negotiation then the receiving peer entity shall only choose one algorithm for that NSAPI.

6.6.1.1 Format of the data compression field

Bit	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Octet 1	P	X	X	Entity number				
Octet 2	X	X	X	Algorithm type				
Octet 3	Length=n-3							
Octet 4	DCOMP1				DCOMP2			
…	…				…			
Octet x	High-order octet							
…	…							
Octet n	Low-order octet							

Figure 9: Data compression field format for SNDCP XID negotiation

6.6.1.1.1 Spare bit (X)

The X bit shall be set to 0 by the transmitting SNDCP entity and shall be ignored by the receiving SNDCP entity.

6.6.1.1.2 Propose bit (P)

The P bit shall be set to 1 if a new compression entity is being proposed, otherwise it shall be set to 0. If the P bit is set to 1, then all octets shall be included, otherwise octet 2 and octets 4 to x-1 shall not be included. If the P bit is set to 1, then only enough number of octets shall be included to contain the number of DCOMP values needed by the corresponding compression algorithm (e.g. DCOMP3 and DCOMP4 shall not be included if the number of DCOMP values needed by a compression algorithm is one or two). If an odd number of DCOMP values are used by a compression algorithm, then the last DCOMP value shall be set to 0 in the compression field by the transmitting SNDCP entity, and it shall be ignored by the receiving SNDCP entity.

6.6.1.1.3 Entity number

The entity number shall be used to identify a data compression entity on a SAPI. See subclause 6.5.1.1.3 for the rules for assigning entity numbers. The assignment of entity numbers for protocol control information compression entities and data compression entities shall be independent.

6.6.1.1.4 Algorithm type

Table 6a shows the list of data compression algorithms supported by the SNDCP layer. When new compression algorithms are needed for SNDCP, table 6a shall be updated.

Table 6a: List of data compression algorithms supported by SNDCP

Data compression algorithm	Algorithm type (Range 0-31)
V.42 bis	0
V.44	1
-	Other values Reserved

6.6.1.1.5 DCOMP

One or more DCOMP values shall be assigned dynamically to a compression algorithm, based on the negotiation of the XID parameters for data compression. Each of the assigned DCOMP values denotes one compressed frame type of that compression algorithm.

The assignment of the DCOMP values shall follow the rules for the assignment of PCOMP values in subclause 6.5.1.1.5.

While transferring data, the compressed frame type for an N-PDU is conveyed in the DCOMP field of the SNDCP header of the first SN-PDU belonging to the N-PDU. Any successfully negotiated algorithm may be used for compression of an N-PDU.

6.6.1.2 Resetting compression entities following SNDCP XID negotiation

The LL-Establish primitives shall be used for the negotiation of data compression if:

- one or more parameters, excluding the applicable NSAPIs, of existing compression entities used with acknowledged peer-to-peer LLC operation are changed by the originator of the negotiation; or
- one or more NSAPIs are removed, by the originator of the negotiation, from existing compression entities used with acknowledged peer-to-peer LLC operation, except when all NSAPIs using the compression entity are removed, or when LLC is already in ADM.

Otherwise, either the LL-Establish primitives or the LL-XID primitives may be used.

If the LL-XID primitives are used for XID negotiation, then in addition to restrictions specified elsewhere in the present document, the following parameters of the data compression entities are non-negotiable by the responding SNDCP entity:

- any parameter of existing compression entities used with acknowledged peer-to-peer LLC operation.

If one or more parameters, other than the applicable NSAPIs, of a compression entity used with unacknowledged peer-to-peer LLC operation are changed, the compression entity shall be reset locally upon completion of the SNDCP XID negotiation.

6.6.1.3 Parameters for compression entities

On negotiating a compression entity, not all the parameters of the entity have to be specified. If a parameter is to be included, all the preceding parameters shall also be specified, and the length field shall be set to the sum of the lengths of all the parameters specified. If any of the parameters is not specified, the rules in subclause 6.8.2 shall apply.

6.6.2 Management of V.42 bis data compression

ITU-T Recommendation V.42 bis [8] data compression may be used with SN-DATA primitives and SN-UNITDATA primitives.

6.6.2.1 Parameters

Table 7a contains the parameters defined for a compression entity using ITU-T Recommendation V.42 bis data compression. They may be negotiated during SNDCP XID negotiation.

Table 7a: V.42 bis data compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
V.42 bis	0	0, 2, 3, 5, or 6 if P bit is 0, 1, 3, 4, 6, or 7 if P bit is 1.	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			P_0	000000bb	0 through 3	down (each direction separately)	3
			P_1	bbbbbbbb bbbbbbbb	512 through 65535	down	2048
			P_2	bbbbbbbb	6 through 250	down	20

6.6.2.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.6.2.1.2 P_0

Two bits are used to indicate the usage of compression, one bit for each direction.

00 compress neither direction.

01 compress MS-to-SGSN direction only.

10 compress SGSN-to-MS direction only.

11 compress both directions.

6.6.2.1.3 P_1

Maximum number of codewords in the compressor dictionary (see [8]).

6.6.2.1.4 P_2

Maximum number of characters in an uncompressed data string that is accepted to be encoded.

6.6.2.2 Assignment of DCOMP values

One DCOMP value shall be assigned (as DCOMP1) to the V.42 bis data compression algorithm.

6.6.2.3 Operation of V.42 bis data compression

When V.42 bis is used with SN-DATA primitives, the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [8]) and added to the compressed N-PDU before the compressed N-PDU is sent.

When V.42 bis is used with SN-UNITDATA primitives, the compression entity shall be reset (using the C-INIT primitive defined in [8]) before an N-PDU is compressed or decompressed. After compression, the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [8]) and added to the compressed N-PDU before the compressed N-PDU is sent. The LLC protocol shall operate in the protected mode of operation.

When V.42 bis is used with SN-DATA primitives and an error is detected by the decoder, the SNDCP entity shall use LL-ESTABLISH.request primitive to reset the acknowledged peer-to-peer LLC operation for the SAPI used.

6.6.3 Management of V.44 data compression

ITU-T Recommendation V.44 data compression, as described in [11], may be used with SN-DATA primitives and SN-UNITDATA primitives. Annex B of ITU-T Recommendation V.44 describes two methods of implementation and operation of V.44 in packet networks: Packet Method and Multi-Packet Method. Multi-Packet Method is a superset of Packet Method and an MS or SGSN that supports Multi-Packet Method must also support Packet Method.

6.6.3.1 Parameters

Table 7c contains the parameters defined for a compression entity using V.44 data compression. They may be negotiated during SNDCP XID negotiation. During V.44 data compression negotiation, unless both the MS and SGSN support Multi-Packet Method, Packet Method is used. Parameter C_0 indicates support of Packet Method (10000000) or both methods (11000000).

NOTE 1: V.44 data compression negotiation is not required. If V.44 is selected and no compression parameters are specified, then Packet Method with defaults as defined in subclauses 6.6.3.1.4 and 6.6.3.1.5 and in [11] annex B, clause B.1.2, is used.

Table 7c: V.44 data compression parameters

			Parameters				
Algorithm Name	**Algorithm Type**	**Length**	**Parameter Name**	**Format**	**Range**	**Sense of Negotiation**	**Default Value**
V.44	1	0, 2, 3, 5 or 6	Applicable NSAPIs	bbbbbbbb bbb00000	0, 32, 64, … , 65504	down (each bit separately)	0
			C_0	bb000000	10000000 or 11000000	11000000 down to 10000000	10000000
			P_0	000000bb	0 through 3	down (each direction separately)	3
			P_{1T}	bbbbbbbb bbbbbbbb	256 through 65535	down	Refer to subclause 6.6.3.1.4
			P_{1R}	bbbbbbbb bbbbbbbb	256 through 65535	down	Refer to subclause 6.6.3.1.5
			P_{3T}	bbbbbbbb bbbbbbbb	$\geq (2 \times P_{1T})$	down	$3 \times P_{1T}$
			P_{3R}	bbbbbbbb bbbbbbbb	$\geq (2 \times P_{1R})$	down	$3 \times P_{1R}$

NOTE 2: V.44 parameters P_{2T} and P_{2R} are set to 255 and not negotiated in packet networks.

6.6.3.1.1 Applicable NSAPIs

See subclause 7.1.3.

6.6.3.1.2 C_0

Two bits are used to indicate the V.44 method of operation supported (refer to [11] Annex B).

10 Packet Method supported.

11 Packet Method and Multi-Packet Method supported.

If parameter C_0 is not specified then Packet Method is selected with its default parameter values (refer to subclauses 6.6.3.1.4 and 6.6.3.1.5 and in [11] annex B, clause B.1.2).

6.6.3.1.3 P_0

Two bits are used to indicate the usage of compression, one bit for each direction.

00 compress neither direction.

01 compress MS-to-SGSN direction only.

10 compress SGSN-to-MS direction only.

11 compress both directions.

6.6.3.1.4 P_{1T}

Maximum number of codewords for the transmit direction (i.e. in the encoder dictionary). Refer to ITU-T Recommendation V.44 [11].

The Packet Method default is 1 600 codewords.

The Multi-Packet Method default is 2 048 codewords.

NOTE: Both defaults above are different from the defaults specified in ITU-T Recommendation V.44 [11] annex B. This is partially due to the fact that data compression in SNDCP includes the control header as well as the information field.

6.6.3.1.5 P_{1R}

Maximum number of codewords for the receive direction (i.e. in the decoder dictionary). Refer to [11].

The Packet Method default is 1 600 codewords.

The Multi-Packet Method default is 2 048 codewords.

NOTE: Both defaults above are different from the defaults specified in ITU-T Recommendation V.44 [11] annex B. This is partially due to the fact that data compression in SNDCP includes the control header as well as the information field.

6.6.3.1.6 P_{3T}

Number of characters in the history for the transmit direction. Refer to [11].

This parameter is not used in Packet Method.

6.6.3.1.7 P_{3R}

Number of characters in the history for the receive direction. Refer to [11].

This parameter is not used in Packet Method.

6.6.3.2 Assignment of DCOMP values

The underlying service shall be able to distinguish three types of N-PDUs processed by V.44 data compression (i.e. not V.44 compressed, V.44 Packet Method compressed, and V.44 Multi-Packet Method compressed). These three V.44 processed N-PDU types are differentiated by using different DCOMP values.

Two DCOMP values shall be assigned to the V.44 compression algorithm, the smaller one of which for Packet Method compressed, and the larger one for Multi-Packet Method compressed.

The DCOMP value of 0 shall be used for SN-PDUs belonging to N-PDUs that expanded during V.44 compression and are sent in their original form (i.e. not V.44 compressed).

6.6.3.3 Operation of V.44 data compression

V.44 data compression has two possible methods of operation in SNDCP, Packet Method and Multi-Packet Method.

6.6.3.3.1 Packet Method

Refer to [11] annex B, clause B.1, for a general description of the operation of V.44 packet method.

When V.44 Packet Method is used with SN-DATA primitives:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.
- If the length of the N-PDU after compression is greater or equal to the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.
- In between processing of N-PDU, the dictionary shall be re-initialised as defined in [11].
- If an error is detected by the decoder, the SNDCP entity shall use LL-ESTABLISH.request primitive to reset the acknowledged peer-to-peer LLC operation for the SAPI used.

When V.44 Packet Method is used with SN-UNITDATA primitives:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.
- If the length of the N-PDU after compression is greater or equal to the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.
- After an N-PDU is sent, the dictionary shall be re-initialised as defined in [11].
- The LLC protocol shall operate in the protected mode of operation.

6.6.3.3.2 Multi-Packet Method

Refer to [11] annex B, clause B.2, for a general description of the operation of V.44 multi-packet method.

When V.44 Multi-Packet Method is used with SN-DATA primitive:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.
- If the length of the N-PDU after compression is greater than the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.

- In the case above of not V.44 compressed where the original N-PDU is sent, after the N-PDU is sent the encoder dictionary shall be re-initialised as defined in [11]. The peer entity, upon receipt of an N-PDU with the DCOMP field set to 0, not V.44 compressed, shall re-initialise its decoder dictionary.

- If an error is detected by the decoder, the SNDCP entity shall use LL-ESTABLISH.request primitive to reset the acknowledged peer-to-peer LLC operation for the SAPI used.

When V.44 Multi-Packet Method is used with SN-UNITDATA primitives:

- the data in the compression entity shall be flushed (using the C-FLUSH primitive defined in [11]) after the last character of an N-PDU is passed to the encoder.

- After an N-PDU is sent the dictionary shall be re-initialised as defined in [11].

- If the length of the N-PDU after compression is greater or equal to the length of the original N-PDU, the original N-PDU is sent and the DCOMP field in the SN-PDU header of the first segment of the N-PDU is set to 0, not V.44 compressed.

- The LLC protocol shall operate in the protected mode of operation.

6.7 Segmentation and reassembly

Segmentation shall be performed by the SNDCP entity to ensure that any SN-PDU transmitted is no longer than N201 (see 3GPP TS ~~04.64~~44.064 [6]). The receiving SNDCP entity shall reassemble the segments back to the original (possibly compressed) N-PDU.

The segmentation and reassembly procedures are different for acknowledged and unacknowledged mode of operation.

6.7.1 General

6.7.1.1 Segmentation

A (possibly compressed) N-PDU shall be segmented into one or more SN-PDUs. The length of each SN-PDU shall not be greater than N201-I (for acknowledged mode) or N201-U (for unacknowledged mode).

The F bit in the SNDCP header shall be set to 1 for the first segment, and 0 for all subsequent segments.

For unacknowledged peer-to-peer LLC operation, DCOMP and PCOMP shall be included in the header when the F bit is set to 1, and shall not be included when the F bit is set to 0.

For acknowledged peer-to-peer LLC operation, DCOMP, PCOMP and N-PDU number shall be included in the header when the F bit is set to 1, and shall not be included when the F bit is set to 0.

If an SN-PDU is received with the F bit set to 1 when a non-first segment is expected, and if DCOMP, PCOMP and (in the acknowledged mode) the N-PDU number all remain unchanged comparing to the first segment, then the SN-PDU shall be processed as normal.

The M bit in the SNDCP header shall be set to 0 for the last segment, and 1 for all previous segments.

If only one SN-PDU is generated for an N-PDU, the F bit shall be set to 1 and the M bit set to 0.

6.7.1.2 Reassembly

During reassembly, DCOMP and PCOMP for an N-PDU shall be retrieved from the first segment (F bit set to 1). For acknowledged peer-to-peer LLC operation, the N-PDU number shall also be retrieved from the first segment.

The receiving SNDCP entity shall be in one of the following three receiving states:

- the Receive First Segment state, in which the SNDCP entity shall expect the F bit set to 1 in the next received SN-PDU;

- the Receive Subsequent Segment state, in which the SNDCP entity shall expect the F bit set to 0 in the next received SN-PDU; or

- the Discard state, in which the SNDCP entity shall discard any SN-PDU received.

The Receive First Segment state shall be entered:

- upon receipt of an SNSM-ACTIVATE.indication;
- upon receipt of an SNSM-MODIFY.indication which indicates a change in SAPI or a change in peer-to-peer LLC operation mode;
- upon receipt of an LL-ESTABLISH.indication or an LL-ESTABLISH.confirm; or
- when the M bit is set to 0 in the received SN-PDU, except for situations specified in subclause 6.7.4.

The Receive Subsequent Segment state shall be entered:

- when the M bit is set to 1 in the received SN-PDU, except for situations specified in subclause 6.7.4.

6.7.2 Segmentation and reassembly in acknowledged mode

Segmentation and reassembly in acknowledged mode shall follow the general procedures stated in subclause 6.7.1.

6.7.3 Segmentation and reassembly in unacknowledged mode

In addition to the general procedure in subclause 6.7.1, a segment number shall be used due to the unreliable nature of the unacknowledged mode.

The Segment number is a sequence number assigned to each SN-UNITDATA PDU. The sequence number shall be set to 0 in the first SN-UNITDATA PDU of an N-PDU, and incremented by 1 for each subsequent SN-UNITDATA PDU. Modulo 16 operation is applied.

The received segments belonging to the same N-PDU shall be re-ordered, if possible. If a timer (implementation dependent) elapses before all segments are received, the segments shall be discarded. Reassembly operation described in subclauses 6.7.1 and 6.7.4 shall be performed after re-ordering.

6.7.4 Exception situations

6.7.4.1 Receive First Segment state

If an SN-UNITDATA PDU is received with the F bit set to 0, the SN-UNITDATA PDU shall be discarded. The Receive First Segment state shall be entered if the M bit is set to 0, otherwise the Discard state shall be entered.

If an SN-DATA PDU is received with the F bit set to 0, the SN-DATA PDU shall be discarded, and the acknowledged LLC operation shall be re-established for the SAPI used.

6.7.4.2 Receive Subsequent Segment state

If an SN-UNITDATA PDU is received with the F bit set to 1, and if DCOMP or PCOMP is different from those in the first segment, then the SN-UNITDATA PDU and all previous segments belonging to the same N-PDU shall be discarded. The Received First Segment state shall be entered if the M bit is set to 0, otherwise the Discard state shall be entered.

If an SN-DATA PDU is received with the F bit set to 1, and if DCOMP, PCOMP or N-PDU number is different from those in the first segment, then the SN-DATA PDU and all previous segments belonging to the same N-PDU shall be discarded, and the acknowledged LLC operation shall be re-established for the SAPI used.

6.7.4.3 Discard state

If an SN-PDU is received with the M bit set to 1, the SN-PDU shall be discarded and the SNDCP entity shall remain in the Discard state.

If an SN-PDU is received with the M bit set to 0, the SN-PDU shall be discarded and the Receive First Segment state entered.

6.8 XID parameter negotiation

Negotiation of XID parameters between peer SNDCP entities may be carried out to ensure optimal information transfer. The parameters are called SNDCP exchange identity (XID) parameters.

SNDCP XID parameter negotiation may be initiated by the SNDCP entity at the MS or at the SGSN. If SNDCP XID parameters are to be changed, SNDCP XID negotiation shall be initiated prior to data transfer - the MS shall initiate SNDCP XID negotiation upon receipt of SNSM-ACTIVATE.indication; the SGSN shall initiate SNDCP XID negotiation upon receipt of the SNSM-MODIFY.indication primitive if an NSAPI has been put into use (in the case of an Inter-SGSN Routeing Area Update), or if the change in QoS profile to an existing NSAPI results in a change in compressor(s) used by the NSAPI.

When an NSAPI no longer uses a compression entity due to a PDP context deactivation or a PDP context modification, an SNDCP XID negotiation shall be performed to remove the NSAPI from the Applicable NSAPIs of the compression entity. The negotiation shall be initiated by the MS upon receipt of the SNSM-DEACTIVATE.indication in the case of PDP context deactivation, or by the SGSN upon receipt of the SNSM-MODIFY.indication in the case of PDP context modification.

The XID negotiation is a one-step procedure; i.e. the initiating end proposes parameter values, and the responding end either accepts these or offers different values in their place according to the XID negotiation rules described in the present document; the rules limit the range of parameter values as well as the sense of negotiation. The initiating end accepts (or rejects) the values in the response; this concludes the negotiation.

The block format for the SNDCP XID parameter negotiation is shown in figure 10. Not all parameters have to be included in the XID block, only parameters that are negotiated. Parameters may be included in any order. Also it shall be possible to negotiate parameters for more than one NSAPI in one XID block since more than one NSAPI can use the same SAPI.

Bit	8	7	6	5	4	3	2	1
Octet 1	Parameter type=0							
Octet 2	Length=1							
Octet 3	Version number							
Octet 4	Parameter type=1							
Octet 5	Length=n-5							
Octet 6	P	X	X	Entity number				
Octet 7 (optional)								
Octet 8	Length=k-8							
Octet 9 … (optional)								
Octet j	High-order octet							
…	…							
Octet k	Low-order octet							
Octet k+1	P	X	X	Entity number				
Octet k+2 (optional)								
Octet k+3	Length=m-(k+3)							
Octet k+4… (optional)								
Octet k+y	High-order octet							
…	…							
Octet m	Low-order octet							
…	…							
Octet n	Low-order octet							
Octet n+1	Parameter type=2							
Octet n+2	Length=r-(n+2)							
Octet n+3	P	X	X	Entity number				
Octet n+4 (optional)								
Octet n+5	Length=p-(n+5)							
Octet n+6… (optional)								
Octet n+w	High-order octet							
…	…							
Octet p	Low-order octet							
Octet p+1	P	X	X	Entity number				
Octet p+2 (optional)								
Octet p+3	Length=q-(p+3)							
Octet p+4… (optional)								
Octet p+v	High-order octet							
…	…							
Octet q	Low-order octet							
…	…							
Octet r	Low-order octet							

Figure 10: Example of SNDCP XID block format

The SNDCP user uses SN-XID.request to initiate the negotiation of the XID parameters. The SNDCP entity sends the proposed SNDCP XID parameters to the LLC SAP with the LL-XID.request or LL-ESTABLISH.request. The LLC SAP shall issue an XID command containing the SNDCP XID parameters (see 3GPP TS ~~04.64~~44.064). The peer LLC SAP shall, upon receipt of the XID command, indicate the SNDCP XID parameters to SNDCP entity using LL-XID.indication or LL-ESTABLISH.indication. The peer SNDCP entity shall select appropriate values for the proposed parameters or negotiate the appropriate values with the SNDCP user entity with the SN-XID.indication and SN-XID.response primitives. When the appropriate parameter values are known by the peer SNDCP entity, it shall use the LL-XID.response or LL-ESTABLISH.response primitive to continue negotiation. Upon reception of the response, the LLC SAP shall send the received parameters to the SNDCP entity using the LL-XID.confirm or LL-ESTABLISH.confirm primitive. The SNDCP entity delivers the negotiated parameters to the SNDCP user. This is illustrated in figure 11. The originator of the negotiation shall apply the new parameter values after it has received the 'confirm' primitive. The responding end of the negotiation shall apply the new parameter values after it has sent the replying 'response' primitive.

Following the sending of the LL-XID.request primitive, the SNDCP layer shall suspend the transfer of SN-DATA and SN-UNITDATA primitives to the LLC SAP to which the LL-XID.request is sent. Transfer of SN-DATA and SN-UNITDATA primitives shall resume when the SNDCP XID negotiation ends through one of the following means:

- successful (receiving LL-XID.confirm);
- failure (receiving LL-RELEASE.indication, or LL-STATUS.indication); or
- successful following collision resolution (receiving LL-ESTABLISH.indication and sending LL-ESTABLISH.response, or receiving LL-XID.indication and sending LL-XID.response, see subclause 6.2.1.4).

LLC may also initiate LLC XID negotiation, in which case LLC may send an LL-XID.indication to inform SNDCP the values of N201-I and N201-U. This is illustrated in figure 12. If the SNDCP entity receives an LL-XID.indication without an SNDCP XID block, it shall not respond with the LL-XID.response primitive.

Negotiation of SNDCP version number is always between the peer SNDCP entities. The version number is not known by the SNDCP user. However, negotiation of the parameters for compression algorithms may be carried out between the SNDCP user entities.

Negotiation of SNDCP XID parameters for an NSAPI shall be carried out in the SAPI to which the NSAPI is mapped.

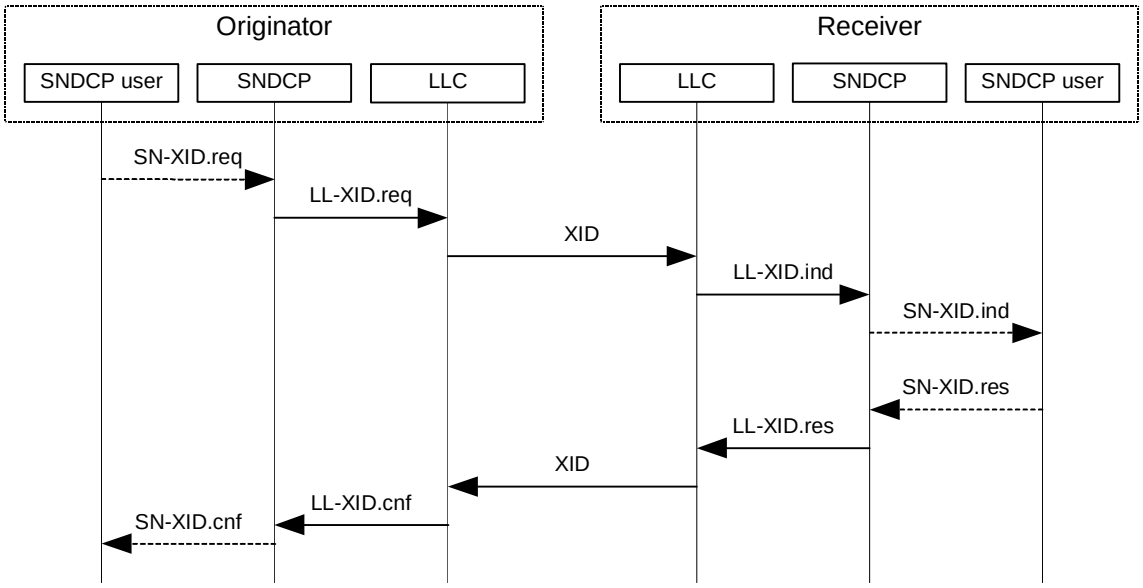

Figure 11: SNDCP XID negotiation procedure

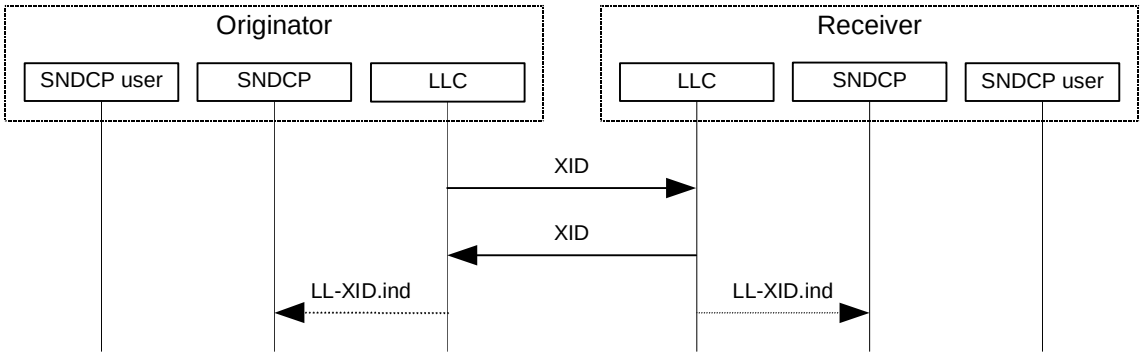

Figure 12: LLC XID negotiation procedure

6.8.1 Negotiation of compression entities

For parameter type 1 and 2, multiple compression fields (as shown in figure 7 and figure 9) may be specified. Each compression field corresponds to a compression entity.

In each compression field, the "Applicable NSAPIs" parameter indicates the NSAPIs that uses the compression entity. The parameter, if included, shall consist of 2 octets. Multiple NSAPIs may share the same compression entity by setting multiple bits in the parameter. NSAPIs requiring acknowledged peer-to-peer LLC operation and unacknowledged peer-to-peer LLC operation shall not share the same compressor (see subclause 6.10).

During SNDCP XID negotiation or re-negotiation, if a parameter type is specified in the SNDCP XID block, compression entities currently in use and compression entities proposed to be added may be included in the SNDCP XID block. Not all entities need to be included in the SNDCP XID block. If a compression entity is not included, the value of its parameters shall be determined by the rules defined in subclause 6.8.2.

If, implicitly or explicitly (see subclause 6.8.2), a compression entity is specified in the responding SNDCP XID block with one or more bits set to 1 in the "Applicable NSAPIs" parameter, the compression entity shall be created (if it does not exist yet).

If, implicitly or explicitly, a compression entity is specified in the responding SNDCP XID block with no bit set to 1 in the "Applicable NSAPIs" parameter, the compression entity shall be deleted (if it currently exists).

If, implicitly or explicitly, one or more bits are set to 1 in the "Applicable NSAPIs" parameter of a compression entity in the responding SNDCP XID block, the NSAPIs corresponding to these bits shall start using (or continue to use) the compression entity.

If, implicitly or explicitly, one or more bits are set to 0 in the "Applicable NSAPIs" parameter of a compression entity in the responding SNDCP XID block, the NSAPIs corresponding to these bits shall release the compression entity (if they have been using the compression entity).

6.8.2 Values of SNDCP XID parameters

In this subclause, the term "parameter" refers to an SNDCP XID parameter, a compression field (for parameter type 1 or 2), or a parameter for a compression field.

If an SNDCP XID parameter has not been negotiated, default values shall apply. The default value for a compression field (entity) is "non-existing".

If the originating SNDCP XID block does not include a parameter (implicit command), it shall be treated as equivalent to requesting for the current value for the parameter. The responder may explicitly include this parameter in its response. If the responder explicitly includes the parameter in the response, then it shall also explicitly include this parameter in every SNDCP XID response until the parameter has been explicitly negotiated, either by responding to an SNDCP XID command that included the parameter, or by explicitly including the parameter the next time an SNDCP XID command is transmitted.

If a parameter is included in the originating SNDCP XID block and the responder does not include the parameter in its response (implicit response), it shall be treated as equivalent to responding with the value proposed by the originator.

If both the originator and the responder do not include a parameter in the negotiation, the value of the parameter is not changed.

6.8.3 Exception handling

In this subclause, the term "parameter" may refer, wherever applicable, to an SNDCP XID parameter, a compression field (for parameter type 1 or 2), or a parameter for a compression field.

If the originating SNDCP XID block includes a parameter with unrecognised Type field, the parameter shall be ignored by the responder.

If the originating SNDCP XID block includes a parameter with unsupported length or an out-of-range value, then the responder shall respond to the parameter with lengths and values set according to the responder's preference.

If the originating SNDCP XID block includes parameter type 1 or 2 which violates the rules in subclause 6.8.1, the responder shall treat the parameter as not transmitted by the originator, and responds according to subclause 6.8.2.

If the originating SNDCP XID block includes a parameter with duplicated instances, the subsequent instances of the duplicated parameter shall be ignored.

If the originating SNDCP XID block is sent on LL-XID primitives and contains prohibited changes (see subclauses 6.5.1.2 and 6.6.1.2) to the parameters of compression entities used with acknowledged peer-to-peer LLC operation, then the responder shall respond with these parameters set to their previously-negotiated values.

In the originating SNDCP XID block, excluding the collision scenarios described in subclause 6.5.1.1.3, when an assigned entity number is included with the P bit set to 1, the algorithm and the PCOMP and DCOMP fields shall be ignored if they are the same as the previously-assigned values. If the algorithm and PCOMP or DCOMP fields are not the same as the previously-assigned values, then the Applicable NSAPIs field of the compression field in question shall be set to 0 in the response, and an SNSM-STATUS.request primitive with Cause "invalid XID command" shall be sent to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

In the originating SNDCP XID block, if an unassigned entity number is included with the P bit set to 0, then the Applicable NSAPIs field in the response shall be set to 0.

In the originating SNDCP XID block, excluding the collision scenarios described in subclause 6.5.1.1.3, if one or more of the PCOMP or DCOMP specified is already assigned to a different compression algorithm, then the Applicable NSAPIs field of the compression field in question shall be set to 0 in the response, and an SNSM-STATUS.request primitive with Cause "invalid XID command" shall be sent to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

In the originating SNDCP XID block, if one or more new PCOMP or DCOMP values are specified for an existing compression algorithm, then the Applicable NSAPIs field of the compression field in question shall be set to 0 in the response, and an SNSM-STATUS.request primitive with Cause "invalid XID command" shall be sent to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

If the responding SNDCP XID block includes a parameter with unrecognised Type field, unsupported length, an out-of-range value or a value violating the sense of negotiation, a parameter type 1 or 2 which violates the rules in subclause 6.8.1, a parameter with duplicated instances, contains prohibited changes (see subclauses 6.5.1.2 and 6.6.1.2) to the parameters of compression entities used with acknowledged peer-to-peer LLC operation when the SNDCP XID block is sent on LL-XID primitives, or a compression field with the P bit set to 1, then the originator shall ignore the block and reinitiate the negotiation. If the renegotiation fails for an implementation-specific number of times, the originating SNDCP layer shall send an SNSM-STATUS.request primitive with Cause "invalid XID response" to the SM sub-layer. SM shall then deactivate all PDP contexts for this SAPI.

If the LLC layer indicates that the XID parameter negotiation failed, by sending an LL-RELEASE.indication with Cause "no peer response" or an LL-STATUS.indication with Cause "no peer response", then, as an implementation option, the SNDCP layer may wait for an implementation-specific amount of time and re-invoke the XID negotiation procedure.

6.9 Data transfer

6.9.1 Acknowledged mode

The SNDCP entity shall initiate acknowledged data transmission only if the PDP context for the NSAPI identified in the SN-DATA.request has been activated and if acknowledged LLC operation has been established.

The N-PDU number in acknowledged mode is a number assigned to each N-PDU received by SNDCP through an SN-DATA.request. N-PDU numbers for different NSAPIs shall be assigned independently. The N-PDU number shall be included in the SNDCP header of the first segment of an N-PDU.

Two variables, the Send N-PDU number and the Receive N-PDU number, shall be maintained for each NSAPI using acknowledged peer-to-peer LLC operation. When an NSAPI using acknowledged peer-to-peer LLC operation is activated, the Send N-PDU number and the Receive N-PDU number shall be set to 0. The Send N-PDU number and Receive N-PDU number shall also be set as described in subclause 5.1.2.22. Modulo 256 operation shall be applied to the Send N-PDU number and the Receive N-PDU number.

Upon reception of an SN-DATA.request, the SNDCP entity shall assign to the N-PDU received the current value of the Send N-PDU number as the N-PDU number, increment the Send N-PDU number by 1, perform the compression and segmentation functions, then forward the SN-PDU(s) in LL-DATA.request to the LLC layer. If an N-PDU number is already present in the SN-DATA.request, then no new N-PDU number shall be assigned to the N-PDU, and the Send N-PDU number shall not be incremented. The N-PDU shall be stored into a buffer in the SNDCP entity. The buffered N-PDU shall be deleted when the SN-DATA PDU carrying the last segment of the N-PDU is confirmed by an LL-DATA.confirm primitive, or when the entire N-PDU is confirmed by an SNSM-SEQUENCE.indication primitive.

During normal operation (i.e. not in the recovery state), when the peer SNDCP entity receives the SN-PDU(s) in an LL-DATA.indication primitive, the SNDCP entity shall reassemble and decompress the SN-PDU(s) to obtain the N-PDU, increment the Receive N-PDU number by 1, and forward the N-PDU to the SNDCP user with the SN-DATA.indication. The correct SNDCP user is identified by the NSAPI field in the SN-PDU(s).

In the recovery state, after reassembling and decompressing the SN-PDU(s):

- if the N-PDU number of the received N-PDU is equal to the Receive N-PDU number, then the Receive N-PDU number shall be incremented by 1, the recovery state shall be exited and normal operation shall resume for the received N-PDU and all subsequently-received N-PDUs; and

- otherwise, the N-PDU shall be discarded.

After the SNDCP entity in the SGSN receives an SNSM-STOP-ASSIGN.indication primitive for an NSAPI using acknowledged peer-to-peer LLC operation, it shall stop assigning N-PDU number to N-PDUs received through the SN-DATA.request primitive.

If an SN-DATA PDU (T bit set to 0) is received by an NSAPI that does not use acknowledged mode, the PDU shall be ignored without error notification.

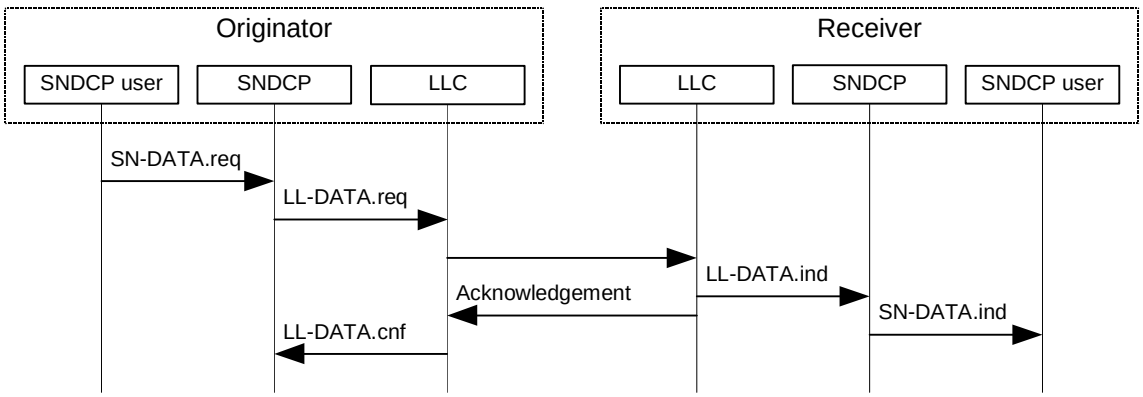

Figure 13: SNDCP acknowledged data transfer

6.9.2 Unacknowledged mode

The SNDCP entity shall initiate unacknowledged data transmission only if the PDP context for the NSAPI identified in the SN-DATA.request has been activated. The SNDCP entity may initiate unacknowledged data transmission even if the acknowledged peer-to-peer operation is not established for that NSAPI.

The N-PDU number in unacknowledged mode is a number assigned to each N-PDU received by SNDCP through an SN-UNITDATA.request. N-PDU numbers for different NSAPIs shall be assigned independently. The N-PDU number shall be included in the SNDCP header of every SN-UNITDATA PDU.

A variable, the Send N-PDU number (unacknowledged), shall be maintained for each NSAPI using unacknowledged peer-to-peer LLC operation. When an NSAPI using unacknowledged peer-to-peer LLC operation is activated, the Send N-PDU number (unacknowledged) shall be set to 0. The Send N-PDU number (unacknowledged) shall also be set as described in subclauses 5.1.2.1 and 5.1.2.22. Modulo 4096 operation shall be applied to the Send N-PDU number (unacknowledged).

Upon reception of an SN-UNITDATA.request, the SNDCP entity shall assign the current value of the Send N-PDU number (unacknowledged) as the N-PDU number of the N-PDU received, increment Send N-PDU number (unacknowledged) by 1, compress and segment the information, then forward the SN-PDU(s) in LL-UNITDATA.request to the LLC layer. The N-PDU shall be deleted immediately after the data has been delivered to the LLC layer.

When the peer SNDCP entity receives the SN-PDU(s) in the LL-UNITDATA.indication primitive, the SNDCP entity shall reassemble and decompress the SN-PDU(s) to obtain the N-PDU, then forwards it to the SNDCP user with the SN-UNITDATA.indication. The correct SNDCP user is identified by the NSAPI field in the SN-PDU(s).

If an SN-UNITDATA PDU (T bit set to 1) is received by an NSAPI that does not use unacknowledged mode, the PDU shall be ignored without error notification.

The SNDCP entity shall detect lost SN-PDUs. The SNDCP entity shall discard duplicate SN-PDUs and re-order out-of-sequence SN-PDUs, if possible.

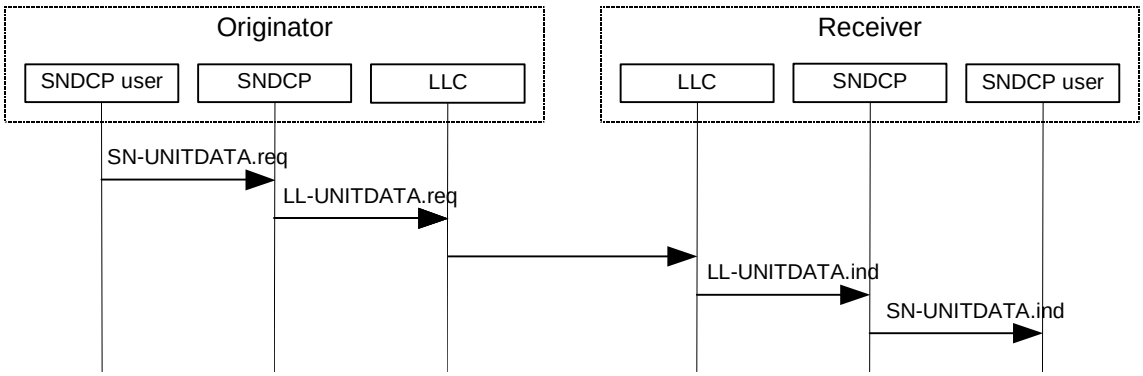

Figure 14: SNDCP unacknowledged data transfer

6.10 Possible combinations of SNDCP protocol functions and their connection to service access points

The following combinations of SNDCP protocol functions are allowed:

- One or several NSAPIs may use one SAPI.
- Only one SAPI shall be used by one NSAPI.
- One or several NSAPIs may use the same protocol control information compression entity.
- One NSAPI may use zero, one, or several protocol control information compression entities.
- One or several NSAPIs may use the same data compression entity.

- One NSAPI may use zero, one, or several data compression entities.
- Separate data compression entities shall be used for SN-DATA and SN-UNITDATA PDUs.
- Separate protocol control information compression entities shall be used for SN-DATA and SN-UNITDATA PDUs.
- One data compression entity shall be connected to one SAPI.
- One protocol control information compression entity shall be connected to one SAPI.
- One or several protocol control information compression entities may be connected to the same data compression entity.
- One protocol control information compression entity shall be connected to zero, one, or several data compression entities.

7 Definition of SN-PDU

7.1 Format convention

7.1.1 Numbering convention

The convention used in the present document is illustrated in figure 15. The bits are grouped into octets. The bits of an octet are shown horizontally and are numbered from 1 to 8. Multiple octets are shown vertically and are numbered from 1 to N.

Bit	8	7	6	5	4	3	2	1
Oct 1								
2								
…								
N-1								
N								

Figure 15: Format convention

7.1.2 Order of transmission

SN-PDUs are transferred between the SNDCP layer and LLC layer in units of octets, in ascending numerical octet order (i.e. octet 1, 2, …, N-1, N). The order of bit transmission is specific to the underlying protocols used across the Um interface and the Gb interface.

7.1.3 Field mapping convention

When a field is contained within a single octet, the lowest bit number of the field represents the lowest order value. When a field spans more than one octet, the order of bit values within each octet progressively decreases as the octet number increases. In that part of the field contained in a given octet the lowest bit number represents the lowest order value.

For example, a bit number can be identified as a couple (o, b) where o is the octet number and b is the relative bit number within the octet. Figure 16 illustrates a field that spans from bit (1, 3) to bit (2, 7). The high order bit of the field is mapped on bit (1, 3) and the low order bit is mapped on bit (2, 7).

Bit	8	7	6	5	4	3	2	1
1st octet of field						2^4	2^3	2^2
2nd octet of field	2^1	2^0						

Figure 16: Field mapping convention

Figure 17 illustrates an NSAPI field that spans from bit (1,8) to bit (2,1). NSAPI 15 is mapped to bit (1,8) and the other NSAPIs are mapped in decreasingly order until NSAPI 0 that is mapped to bit (2,1). A bit set to 0 means that the compression entity is not applicable to the corresponding NSAPI. A bit set to 1 means that the compression entity is applicable to the corresponding NSAPI.

Bit	8	7	6	5	4	3	2	1
1st octet of field	15	14	13	12	11	10	9	8
2nd octet of field	7	6	5	4	3	2	1	0

Figure 17: NSAPI mapping convention

7.2 SN-PDU Formats

Each SN-PDU shall contain an integral number of octets, and shall comprise a header part and a data part. An SN-PDU shall contain data from a single N-PDU only. Two different SN-PDU formats are defined. The SN-DATA PDU shall be used for acknowledged data transfer and SN-UNITDATA PDU for unacknowledged data transfer.

Bit	8	7	6	5	4	3	2	1
Oct 1	X	F	T	M	NSAPI			
2	DCOMP				PCOMP			
3	N-PDU number - acknowledged mode							
…	Data segment							
N								

Figure 18: SN-DATA PDU format

Bit	8	7	6	5	4	3	2	1
Oct 1	X	F	T	M	NSAPI			
2	DCOMP				PCOMP			
3	Segment number				N-PDU number - unacknowledged mode			
4	N-PDU number - unacknowledged mode (continued)							
…	Data segment							
N								

Figure 19: SN-UNITDATA PDU format

More bit (M):

0 Last segment of N-PDU.

1 Not the last segment of N-PDU, more segments to follow.

SN-PDU Type (T):

0 SN-DATA PDU.

1 SN-UNITDATA PDU.

First segment indicator bit (F):

0 This SN-PDU is not the first segment of an N-PDU.

The octet including DCOMP and PCOMP is not included in the SN-DATA PDU or SN-UNITDATA PDU format. Also the octet for N-PDU number for acknowledged mode is not included in the SN-DATA PDU format.

1 This SN-PDU is the first segment of an N-PDU. The octet for DCOMP and PCOMP is included in the SN-DATA PDU or SN-UNITDATA PDU format. Also the octet for N-PDU number for acknowledged mode is included in the SN-DATA PDU format.

Spare bit (X):

0 Shall be set to 0 by the transmitting SNDCP entity and ignored by the receiving SNDCP entity.

NSAPI:

0 Escape mechanism for future extensions.

1 Point-to-Multipoint Multicast (PTM-M) information.

2-4 Reserved for future use.

5-15 Dynamically allocated NSAPI value (see subclause 6.1).

SN-PDU with an unallocated NSAPI value shall be ignored by the receiving SNDCP entity without error notification.

Data compression coding (DCOMP):

0 No compression.

1-14 Points to the data compression identifier negotiated dynamically (see subclause 6.6).

15 Reserved for future extensions.

SN-PDU with an unallocated DCOMP value shall be ignored by the receiving SNDCP entity without error notification.

Protocol control information compression coding (PCOMP):

0 No compression.

1-14 Points to the protocol control information compression identifier negotiated dynamically (see subclause 6.5).

15 Reserved for future extensions.

SN-PDU with an unallocated PCOMP value shall be ignored by the receiving SNDCP entity without error notification.

Segment number:

0-15 Sequence number for segments carrying an N-PDU.

N-PDU number - acknowledged mode:

0-255 N-PDU number of the N-PDU.

N-PDU number - unacknowledged mode:

0-4095N-PDU number of the N-PDU.

8 SNDCP XID parameters

The SNDCP XID parameters are shown in table 8:

Table 8: SNDCP XID parameters

Parameter name	Parameter Type	Length	Format	Range	Default value	Units	Sense of negotiation
Version number	0	1	0000bbbb	0-15	0	-	down
Data Compression	1	variable	See subclause 6.6.1				
Protocol Control Information Compression	2	variable	See subclause 6.5.1				

NOTE: The current version of SNDCP is 0. This is also the default value for the version number. It is assumed that the future versions are backward compatible with former ones.

Annex A (informative): Change Request History

SMG#	CR#	REV.	NEW REV.	SUBJECT
SMG#31			8.0.0	Creation of the specification for R99 based on V7.3.0

TSG Meet-ing	TSG Doc numbe r	TSG WG doc number	Spec	CR	R v	Ph	C at	Vers Old	Vers New	Subject	Work item	Remarks
NP-09								8.0.0	8.1.0			GSM to 3GPP format is changed
NP-09	NP-000441	N1-001019	04.65	A070	1	R99	F	8.0.0	8.1.0	Deletion of PDP type X.25	GPRS	GSM to 3GPP format is changed
NP-09	NP-000441	N1-001025	04.65	A071	1	R99	F	8.0.0	8.1.0	Supporting RFC2507 Header Compression in SNDCP	GPRS	
NP-10								8.1.0	4.0.0			This CR changes the specification to Release 4 as 44.065
NP-10	NP-000675	N1-001178	04.65	A072		Rel-4	C	8.1.0	4.0.0	Support of V.44 Data Compression in SNDCP	TEI4	
NP-13	NP-010492	N1-011200	44.065	001		Rel-4	A	4.0.0	4.1.0	Conditions for header compression	GPRS	
NP-16			44.065			Rel-5		4.1.0	5.0.0	CN plenary decision to make this TS also for Release 5. Some editorials from ETSI secretariat are introduced.		June 2002
NP-20	NP-030284	N1-030934	44.065	004	4	Rel-6	B	5.0.0	6.0.0	Additional support of ROHC in SNDCP	TEI6	June 2003
NP-20	NP-030284	N1-030833	44.065	005	1	Rel-6	C	5.0.0	6.0.0	Multiple header compression algorithms handling	TEI6	June 2003

3GPP TSG-CN1 Meeting #31 **Tdoc N1-030998**
Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **747** ⌘ **rev** **-** ⌘ Current version: **5.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☒

Title:	⌘	Correction of the static conditions for the 'backup' bearer capability IE contents
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	30/07/2003
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The approved CR N1-030673 corrects the static conditions for the BC IE removing the condition "For GSM". However, this has to be corrected in the static conditions for the 'backup' BC IE too.
Summary of change:	⌘	Deletion of the words "For GSM" in the static confitions for the 'backup' BC IE section.
Consequences if not approved:	⌘	The text in the section 10.5.4.5.1 remains unclear (Is it allowed in UMTS to include octets 4, …, if octet 3 indicates "speech"?). Furthermore, the static conditions for the 'backup' BC IE and the BC IE are not aligned regarding the ITC parameter when indicating "speech", which may lead to confusion and misinterpretation when implementing in terminals and networks.

Clauses affected:	⌘	10.5.4.5.1

Other specs affected: ⌘	Y	N		⌘
		X	Other core specifications	
		X	Test specifications	
		X	O&M Specifications	

Other comments: ⌘

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST CHANGE

10.5.4.5.1 Static conditions for the backup bearer capability IE contents

~~For GSM, i~~If the information transfer capability field (octet 3) indicates "speech", octets 4, 5, 5a, 5b, 6, 6a, 6b, 6c, 6d, 6e, 6f, 6g and 7 shall not be included.

If the information transfer capability field (octet 3) indicates a value different from "speech", octets 4 and 5shall be included, octets 6, 6a, 6b, 6c, 6d, 6e, 6f and 6g are optional. In case octet 6 is included, octets 6a, 6b, and 6c shall also be included. In case octet 6d is included, octets 6e, 6f and 6g may be included. If the information transfer capability field (octet 3) indicates "facsimile group 3" and octet 6c is included, the modem type field (octet 6c) shall indicate "none".

If the information transfer capability field (octet 3) indicates "other ITC" or the rate adaption field (octet 5) indicates "other rate adaption", octet 5a shall be included.

The modem type field (octet 6c) shall not indicate "autobauding type 1" unless the connection element field (octet 6c) indicates "non transparent".

THIS SECTION IS PROVIDED FOR INFORMATION ONLY

10.5.4.5.1 Static conditions for the bearer capability IE contents

If the information transfer capability field (octet 3) indicates "speech", octets 4, 5, 5a, 5b, 6, 6a, 6b, 6c, 6d, 6e, 6f, 6g and 7 shall not be included.

If the information transfer capability field (octet 3) indicates "speech", octet 3a etc. shall be included only if the mobile station supports CTM text telephony or if it supports at least one speech version for GSM radio access other than:

- GSM full rate speech version 1; or
- GSM half rate speech version 1.

If the information transfer capability field (octet 3) indicates a value different from "speech", octets 4, 5, 6, 6a, 6b, and 6c shall be included, octets 6d, 6e, 6f and 6g are optional. In the network to MS direction in case octet 6d is included, octets 6e, 6f and 6g may be included. In the MS to network direction in case octet 6d is included octet 6e shall also be included and 6f and 6g may be included.

If the information transfer capability field (octet 3) indicates "facsimile group 3", the modem type field (octet 6c) shall indicate "none".

If the information transfer capability field (octet 3) indicates "other ITC" or the rate adaption field (octet 5) indicates "other rate adaption", octet 5a shall be included.

If the rate adaption field (octet 5) indicates "other rate adaption" and the other rate adaption field (octet 5a) indicates "V.120", octet 5b shall be included.

The modem type field (octet 6c) shall not indicate "autobauding type 1" unless the connection element field (octet 6c) indicates "non transparent".

3GPP TSG-CN1 Meeting #31 **Tdoc N1-030999**
Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **787** ⌘ **rev** **-** ⌘ Current version: **6.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [ ] Core Network [X]

Title:	⌘	Correction of the static conditions for the 'backup' bearer capability IE contents
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	30/07/2003
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*

Reason for change:	⌘	The approved CR N1-030673 corrects the static conditions for the BC IE removing the condition "For GSM". However, this has to be corrected in the static conditions for the 'backup' BC IE too.
Summary of change:	⌘	Deletion of the words "For GSM" in the static confitions for the 'backup' BC IE section.
Consequences if not approved:	⌘	The text in the section 10.5.4.5.1 remains unclear (Is it allowed in UMTS to include octets 4, …, if octet 3 indicates "speech"?). Furthermore, the static conditions for the 'backup' BC IE and the BC IE are not aligned regarding the ITC parameter when indicating "speech", which may lead to confusion and misinterpretation when implementing in terminals and networks.

Clauses affected:	⌘	10.5.4.5.1			
Other specs affected:	⌘	**Y**	**N**		⌘
			X	Other core specifications	
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST CHANGE

10.5.4.5.1 Static conditions for the backup bearer capability IE contents

~~For GSM, i~~If the information transfer capability field (octet 3) indicates "speech", octets 4, 5, 5a, 5b, 6, 6a, 6b, 6c, 6d, 6e, 6f, 6g and 7 shall not be included.

If the information transfer capability field (octet 3) indicates a value different from "speech", octets 4 and 5shall be included, octets 6, 6a, 6b, 6c, 6d, 6e, 6f and 6g are optional. In case octet 6 is included, octets 6a, 6b, and 6c shall also be included. In case octet 6d is included, octets 6e, 6f and 6g may be included. If the information transfer capability field (octet 3) indicates "facsimile group 3" and octet 6c is included, the modem type field (octet 6c) shall indicate "none".

If the information transfer capability field (octet 3) indicates "other ITC" or the rate adaption field (octet 5) indicates "other rate adaption", octet 5a shall be included.

The modem type field (octet 6c) shall not indicate "autobauding type 1" unless the connection element field (octet 6c) indicates "non transparent".

THIS SECTION IS PROVIDED FOR INFORMATION ONLY

10.5.4.5.1 Static conditions for the bearer capability IE contents

If the information transfer capability field (octet 3) indicates "speech", octets 4, 5, 5a, 5b, 6, 6a, 6b, 6c, 6d, 6e, 6f, 6g and 7 shall not be included.

If the information transfer capability field (octet 3) indicates "speech", octet 3a etc. shall be included only if the mobile station supports CTM text telephony or if it supports at least one speech version for GSM radio access other than:

- GSM full rate speech version 1; or
- GSM half rate speech version 1.

If the information transfer capability field (octet 3) indicates a value different from "speech", octets 4, 5, 6, 6a, 6b, and 6c shall be included, octets 6d, 6e, 6f and 6g are optional. In the network to MS direction in case octet 6d is included, octets 6e, 6f and 6g may be included. In the MS to network direction in case octet 6d is included octet 6e shall also be included and 6f and 6g may be included.

If the information transfer capability field (octet 3) indicates "facsimile group 3", the modem type field (octet 6c) shall indicate "none".

If the information transfer capability field (octet 3) indicates "other ITC" or the rate adaption field (octet 5) indicates "other rate adaption", octet 5a shall be included.

If the rate adaption field (octet 5) indicates "other rate adaption" and the other rate adaption field (octet 5a) indicates "V.120", octet 5b shall be included.

The modem type field (octet 6c) shall not indicate "autobauding type 1" unless the connection element field (octet 6c) indicates "non transparent".

3GPP TSG-CN1 Meeting #31 **Tdoc N1-031004**
Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **792** ⌘ **rev** **-** ⌘ Current version: **5.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [X] ME [X] Radio Access Network [ ] Core Network [ ]

Title:	⌘	Deletion of $EF_{RPLMNAcT}$
Source:	⌘	Ericsson, Nokia
Work item code:	⌘	TEI5
Date:	⌘	07/07/2003
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	In N1-021555 (IN LS from TSG T) TSG T asked whether T3 could go ahead on the deletion of $EF_{RPLMNAcT}$, because in the understanding of TSG T this field has only meaning for MS supporting GSM Compact and some problems of its usage and definition have been detected by TSG T. At the same time, TSG T pointed out that the deletion "would however require a small modification of TS 23.122 to change the storage of the information whether or not the last registered PLMN has been identified to support GSM Compact from the SIM/USIM to the ME". At the CN1#25 meeting CN1 noted the IN LS and stated in the minutes: "Noted. CN1 agreed the proposal in principle but no CRs were presented to this meeting yet. CRs from interested companies were invited for the next CN1 meeting". However, no contributions on this topic have been seen at CN1. Hence, CN1 has not fulfilled with the decision. At present, there are refences to $EF_{RPLMNAcT}$ in TS 24.008 from Rel-5 onwards. TS 24.008 mandates all kind of terminals to update this field at successful LA updating, GPRS attach, RAU and combined procedures (i.e. whenever EF_{LOCI} and EF_{PSLOCI} are stored). Finally, T3 repeats the request again in the IN LS N1-030970 / T3-030462.
Summary of change:	⌘	The references to $EF_{RPLMNAcT}$ are deleted everywhere in the specification.
Consequences if not approved:	⌘	CN1 continues not fulfilling an already taken decision on the deletion of $EF_{RPLMNAcT}$ and this field **still** remains in the CN1 specifications. Furthemore, currently, TS 24.008 mandates to update this field, when supported by the SIM/USIM, even though can only be meningful for GSM Compact terminals. Inconsistency among TS 24.008 and different T3 specifications e.g. TS 31.102, TS 11.11, ... which may lead to confusion and misinterpretation.

Clauses affected:	⌘	4.4.4.6, 4.7.3.1.3, 4.7.3.2.3.1, 4.7.5.1.3 and 4.7.5.2.3.1.			
Other specs affected:	⌘	**Y** / **N** **X** / ☐	Other core specifications	⌘	TS 11.11, TS 51.011 and TS 31.102.
		☐ / **X**	Test specifications		
		☐ / **X**	O&M Specifications		
Other comments:	⌘	This change is needed because of change in the SIM/USIM specs to remove the RPLMNAcT data field.			

How to create CRs using this form:

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1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST CHANGE

4.4.4.6 Location updating accepted by the network

If the location updating is accepted by the network a LOCATION UPDATING ACCEPT message is transferred to the mobile station.

In case the identity confidentiality service is active (see subclauses 4.3.1 and 4.4.4.4), the TMSI reallocation may be part of the location updating procedure. The TMSI allocated is then contained in the LOCATION UPDATING ACCEPT message together with the location area identifier LAI. The network shall in this case start the supervision timer T3250 as described in subclause 4.3.1.

If the network wishes to prolong the RR connection to allow the mobile station to initiate MM connection establishment (for example if the mobile station has indicated in the LOCATION UPDATING REQUEST that it has a follow-on request pending) the network shall send "follow on proceed" in the LOCATION UPDATING ACCEPT and start timer T3255.

The mobile station receiving a LOCATION UPDATING ACCEPT message shall store the received location area identification LAI ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stop timer T3210, reset the attempt counter and set the update status in the SIM/USIM to UPDATED. If the message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI in the SIM/USIM accordingly. If the message contains a TMSI, the mobile station is allocated this TMSI, and shall store this TMSI in the SIM/USIM and a TMSI REALLOCATION COMPLETE shall be returned to the network. If neither IMSI nor TMSI is received in the LOCATION UPDATING ACCEPT message, the old TMSI if any available shall be kept.
If the LAI or PLMN identity contained in the LOCATION UPDATING ACCEPT message is a member of any of the "forbidden lists" then any such entries shall be deleted.

The network may also send a list of "equivalent PLMNs" in the LOCATION UPDATING ACCEPT message. Each entry of the list contains a PLMN code (MCC+MNC). The mobile station shall store the list, as provided by the network, except that any PLMN code that is already in the "forbidden PLMN list" shall be removed from the "equivalent PLMNs" list before it is stored by the mobile station. In addition the mobile station shall add to the stored list the PLMN code of the network that sent the list. All PLMNs in the stored list shall be regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover. The stored list in the mobile station shall be replaced on each occurrence of the LOCATION UPDATING ACCEPT message. If no list is contained in the message, then the stored list in the mobile station shall be deleted. The list shall be stored in the mobile station while switched off so that it can be used for PLMN selection after switch on.

After that, the mobile station shall act according to the presence of the "Follow-on proceed" information element in the LOCATION UPDATING ACCEPT; if this element is present and the mobile station has a CM application request pending, it shall send a CM SERVICE REQUEST to the network and proceed as in subclause 4.5.1.1. Otherwise, it shall start timer T3240 and enter state WAIT FOR NETWORK COMMAND.

Furthermore, the network may grant authorisation for the mobile station to use GSM-Cordless Telephony System (CTS) in the Location Area and its immediate neighbourhood. The mobile should memorise this permission in non-volatile memory. If the "CTS permission" IE is not present in the message, the mobile is not authorised to use GSM-CTS, and shall accordingly delete any memorised permission.

NOTE 1: the interaction between CTS and GPRS procedures are not yet defined.

The network may also send a list of local emergency numbers in the LOCATION UPDATING ACCEPT, by including the Emergency Number List IE. The mobile equipment shall store the list, as provided by the network, except that any emergency number that is already stored in the SIM/USIM shall be removed from the list before it is stored by the mobile equipment. If there are no emergency numbers stored on the SIM/USIM, then before storing the received list the mobile equipment shall remove from it any emergency number stored permanently in the ME for use in this case (see 3GPP TS 22.101 [8]). The list stored in the mobile equipment shall be replaced on each receipt of a new Emergency Number List IE.

The emergency number(s) received in the Emergency Number List IE are valid only in networks with the same MCC as in the cell on which this IE is received. If no list is contained in the LOCATION UPDATING ACCEPT message, then the stored list in the mobile equipment shall be kept, except if the mobile equipment has successfully registered to a PLMN with an MCC different from that of the last registered PLMN.

The mobile equipment shall use the stored list of emergency numbers received from the network in addition to the emergency numbers stored on the SIM/USIM or ME to detect that the number dialled is an emergency number.

NOTE 2: The mobile equipment may use the emergency numbers list to assist the end user in determining whether the dialled number is intended for an emergency service or for another destination, e.g. a local directory service. The possible interactions with the end user are implementation specific.

The list of emergency numbers shall be deleted at switch off and removal of the SIM/USIM. The mobile equipment shall be able to store up to ten local emergency numbers received from the network.

SECOND CHANGE

4.7.3.1.3 GPRS attach accepted by the network

If the GPRS attach request is accepted by the network, an ATTACH ACCEPT message is sent to the MS.

The P-TMSI reallocation may be part of the GPRS attach procedure. When the ATTACH REQUEST includes the IMSI, the SGSN shall allocate the P-TMSI. The P-TMSI that shall be allocated is then included in the ATTACH ACCEPT message together with the routing area identifier. The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start timer T3350 as described in subclause 4.7.6. Furthermore, the network may assign a P-TMSI signature for the GMM context which is then also included in the ATTACH ACCEPT message. If the LAI or PLMN identity that has been transmitted in the ATTACH ACCEPT message is a member of any of the "forbidden" lists, any such entry shall be deleted. Additionally, the network shall include the radio priority level to be used by the MS for mobile originated SMS transfer in the ATTACH ACCEPT message.

In GSM, the Cell Notification information element shall be included in the ATTACH ACCEPT message by the network which indicates that the Cell Notification is supported by the network.

In UMTS, the network should prolong the PS signalling connection if the mobile station has indicated a follow-on request pending in ATTACH REQUEST. The network may also prolong the PS signalling connection without any indication from the mobile terminal.

The MS, receiving an ATTACH ACCEPT message, stores the received routing area identification ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3310, reset the GPRS attach attempt counter, reset the routing area updating attempt counter, enters state GMM-REGISTERED and sets the GPRS update status to GU1 UPDATED.

If the message contains a P-TMSI, the MS shall use this P-TMSI as the new temporary identity for GPRS services. In this case, an ATTACH COMPLETE message is returned to the network. The MS shall delete its old P-TMSI and shall store the new one. If no P-TMSI has been included by the network in the ATTACH ACCEPT message, the old P-TMSI, if any available, shall be kept.

If the message contains a P-TMSI signature, the MS shall use this P-TMSI signature as the new temporary signature for the GMM context. The MS shall delete its old P-TMSI signature, if any is available, and shall store the new one. If the message contains no P-TMSI signature, the old P-TMSI signature, if available, shall be deleted.

The network may also send a list of "equivalent PLMNs" in the ATTACH ACCEPT message. Each entry of the list contains a PLMN code (MCC+MNC). The mobile station shall store the list, as provided by the network, except that any PLMN code that is already in the "forbidden PLMN" list shall be removed from the "equivalent PLMNs" list before it is stored by the mobile station. In addition the mobile station shall add to the stored list the PLMN code of the network that sent the list. All PLMNs in the stored list shall be regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover. The stored list in the mobile station shall be replaced on each occurrence of the ATTACH ACCEPT message. If no list is contained in the message, then the stored list in the mobile station shall be deleted. The list shall be stored in the mobile station while switched off so that it can be used for PLMN selection after switch on.

After that in UMTS, if the mobile station has indicated follow-on request pending and has a CM application request pending, it shall send an appropriate message (for example ACTIVATE PDP CONTEXT REQUEST) to the network.

In GSM, if the ATTACH ACCEPT message contains the Cell Notification information element, then the MS shall start to use the LLC NULL frame to perform cell updates. The network receiving an ATTACH COMPLETE message stops timer T3350, changes to GMM-REGISTERED state and considers the P-TMSI sent in the ATTACH ACCEPT message as valid.

The network may also send a list of local emergency numbers in the ATTACH ACCEPT, by including the Emergency Number List IE. The mobile equipment shall store the list, as provided by the network, except that any emergency number that is already stored in the SIM/USIM shall be removed from the list before it is stored by the mobile equipment. If there are no emergency numbers stored on the SIM/USIM, then before storing the received list the mobile equipment shall remove from it any emergency number stored permanently in the ME for use in this case (see 3GPP TS 22.101 [8]). The list stored in the mobile equipment shall be replaced on each receipt of a new Emergency Number List IE.

The emergency number(s) received in the Emergency Number List IE are valid only in networks with the same MCC as in the cell on which this IE is received. If no list is contained in the ATTACH ACCEPT message, then the stored list in the mobile equipment shall be kept, except if the mobile equipment has successfully registered to a PLMN with an MCC different from that of the last registered PLMN.

The mobile equipment shall use the stored list of emergency numbers received from the network in addition to the emergency numbers stored on the SIM/USIM or ME to detect that the number dialled is an emergency number.

NOTE: The mobile equipment may use the emergency numbers list to assist the end user in determining whether the dialled number is intended for an emergency service or for another destination, e.g. a local directory service. The possible interactions with the end user are implementation specific.

The list of emergency numbers shall be deleted at switch off and removal of the SIM/USIM. The mobile equipment shall be able to store up to ten local emergency numbers received from the network.

THIRD CHANGE

4.7.3.2.3.1 Combined attach successful for GPRS and non-GPRS services

The description for IMSI attach for GPRS services as specified in subclause 4.7.3.1.3 shall be followed. In addition, the following description for IMSI attach for non-GPRS services applies.

The TMSI reallocation may be part of the combined GPRS attach procedure. The TMSI allocated is then included in the ATTACH ACCEPT message together with the location area identification (LAI). The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start timer T3350 as described in subclause 4.7.6.

The MS, receiving an ATTACH ACCEPT message, stores the received location area identification ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3310, reset the location update attempt counter and sets the update status to U1 UPDATED. If the message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI accordingly. If the message contains a TMSI, the MS shall use this TMSI as the new temporary identity. The MS shall delete its old TMSI and shall store the new TMSI. In this case, an ATTACH COMPLETE message is returned to the network. If neither a TMSI nor an IMSI has been included by the network in the ATTACH ACCEPT message, the old TMSI, if any available, shall be kept. The new MM state is MM IDLE, the new GMM state is GMM-REGISTERED.

Any timer used for triggering the location update procedure (e.g T3211, T3212) shall be stopped if running.

The network receiving an ATTACH COMPLETE message stops timer T3350, changes to state GMM-REGISTERED and considers the new TMSI as valid.

FOURTH CHANGE

4.7.5.1.3 Normal and periodic routing area updating procedure accepted by the network

If the routing area updating request has been accepted by the network, a ROUTING AREA UPDATE ACCEPT message shall be sent to the MS. The network may assign a new P-TMSI and/or a new P-TMSI signature for the MS. If a new P-TMSI and/or P-TMSI signature have been assigned to the MS, it/they shall be included in the ROUTING AREA UPDATE ACCEPT message together with the routing area identification.

If a new DRX parameter was included in the ROUTING AREA UPDATE REQUEST message, the network shall store the new DRX parameter and use it for the downlink transfer of signalling and user data.

In GSM the Cell Notification information element shall be included in the ROUTING AREA UPDATE ACCEPT message in order to indicate the ability of the network to support the Cell Notification.

The network shall change to state GMM-COMMON-PROCEDURE-INITIATED and shall start the supervision timer T3350 as described in subclause 4.7.6.

If the LAI or PLMN identity contained in the ROUTING AREA UPDATE ACCEPT message is a member of any of the "forbidden" lists then any such entry shall be deleted.

In UMTS, the network should prolong the PS signalling connection if the mobile station has indicated a follow-on request pending in ROUTING AREA UPDATE REQUEST. The network may also prolong the PS signalling connection without any indication from the mobile terminal.

If the PDP context status information element is included in ROUTING AREA UPDATE REQUEST message, then the network shall deactivate all those PDP contexts locally (without peer to peer signalling between the MS and the network), which are not in SM state PDP-INACTIVE on network side but are indicated by the MS as being in state PDP-INACTIVE.

Upon receipt of a ROUTING AREA UPDATE ACCEPT message, the MS stores the received routing area identification ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3330, shall reset the routing area updating attempt counter and sets the GPRS update status to GU1 UPDATED. If the message contains a P-TMSI, the MS shall use this P-TMSI as new temporary identity for GPRS services and shall store the new P-TMSI. If no P-TMSI was included by the network in the ROUTING AREA UPDATING ACCEPT message, the old P-TMSI shall be kept. Furthermore, the MS shall store the P-TMSI signature if received in the ROUTING AREA UPDATING ACCEPT message. If no P-TMSI signature was included in the message, the old P-TMSI signature, if available, shall be deleted.

If the ROUTING AREA UPDATE REQUEST message was used to update the network with a new DRX parameter IE, the MS shall start using the new DRX parameter upon receipt of the ROUTING AREA UPDATE ACCEPT message.

If the PDP context status information element is included in ROUTING AREA UPDATE ACCEPT message, then the MS shall deactivate all those PDP contexts locally (without peer to peer signalling between the MS and network), which are not in SM state PDP-INACTIVE in the MS but are indicated by the network as being in state PDP-INACTIVE.

In GSM, if the ROUTING AREA UPDATE ACCEPT message contains the Cell Notification information element, then the MS shall start to use the LLC NULL frame to perform cell updates.

The network may also send a list of "equivalent PLMNs" in the ROUTING AREA UPDATE ACCEPT message. Each entry of the list contains a PLMN code (MCC+MNC). The mobile station shall store the list, as provided by the network, except that any PLMN code that is already in the "forbidden PLMN" list shall be removed from the "equivalent PLMNs" list before it is stored by the mobile station. In addition the mobile station shall add to the stored list the PLMN code of the network that sent the list. All PLMNs in the stored list shall be regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover. The stored list in the mobile station shall be replaced on each occurrence of the ROUTING AREA UPDATE ACCEPT message. If no list is contained in the message, then the stored list in the mobile station shall be deleted. The list shall be stored in the mobile station while switched off so that it can be used for PLMN selection after switch on.

A ROUTING AREA UPDATE COMPLETE message shall be returned to the network if the ROUTING AREA UPDATE ACCEPT message contained:

- a P-TMSI; and/or
- Receive N-PDU Numbers (see 3GPP TS 44.065 [78] and 3GPP TS 25.322).

In the latter case the Receive N-PDU Numbers values valid in the MS, shall be included in the ROUTING AREA UPDATE COMPLETE message.

NOTE 1: In UMTS, after a routing area updating procedure, the mobile station can initiate Service Request procedure to request the resource reservation for the active PDP contexts if the resources have been released by the network or send upper layer message (e.g. ACTIVATE PDP CONTEXT REQUEST) to the network via the existing PS signaling connection.

After that in UMTS, if the mobile station has indicated follow-on request pending and has a CM application request pending, it shall send an appropriate message (for example ACTIVATE PDP CONTEXT REQUEST) to the network.

The network may also send a list of local emergency numbers in the ROUTING AREA UPDATE ACCEPT, by including the Emergency Number List IE. The mobile equipment shall store the list, as provided by the network, except that any emergency number that is already stored in the SIM/USIM shall be removed from the list before it is stored by the mobile equipment. If there are no emergency numbers stored on the SIM/USIM, then before storing the received list the mobile equipment shall remove from it any emergency number stored permanently in the ME for use in this case (see 3GPP TS 22.101 [8]). The list stored in the mobile equipment shall be replaced on each receipt of a new Emergency Number List IE.

The emergency number(s) received in the Emergency Number List IE are valid only in networks with the same MCC as in the cell on which this IE is received. If no list is contained in the ROUTING AREA UPDATE ACCEPT message, then the stored list in the mobile equipment shall be kept, except if the mobile equipment has successfully registered to a PLMN with an MCC different from that of the last registered PLMN.

The mobile equipment shall use the stored list of emergency numbers received from the network in addition to the emergency numbers stored on the SIM/USIM or ME to detect that the number dialled is an emergency number.

NOTE 2: The mobile equipment may use the emergency numbers list to assist the end user in determining whether the dialled number is intended for an emergency service or for another destination, e.g. a local directory service. The possible interactions with the end user are implementation specific.

The list of emergency numbers shall be deleted at switch off and removal of the SIM/USIM. The mobile equipment shall be able to store up to ten local emergency numbers received from the network.

FIFTH CHANGE

4.7.5.2.3.1 Combined routing area updating successful

The description for normal routing area update as specified in subclause 4.7.5.1.3 shall be followed. In addition, the following description for location area updating applies.

The handling at the receipt of the ROUTING AREA UPDATE ACCEPT depends on the value received in the update result IE as specified below.

The TMSI reallocation may be part of the combined routing area updating procedure. The TMSI allocated is then included in the ROUTING AREA UPDATE ACCEPT message together with the location area identification (LAI). The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start the timer T3350 as described in subclause 4.7.6.

The MS, receiving a ROUTING AREA UPDATE ACCEPT message, stores the received location area identification~~ and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3330, enters state MM IDLE, reset the location update attempt counter and sets the update status to U1 UPDATED. If the ROUTING AREA UPDATE ACCEPT message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI accordingly. If the ROUTING AREA UPDATE ACCEPT message contains a TMSI, the MS shall use this TMSI as new temporary identity. The MS shall delete its old TMSI and shall store the new TMSI. In this case, an ROUTING AREA UPDATE COMPLETE message is returned to the network. If neither a TMSI nor an IMSI has been included by the network in the ROUTING AREA UPDATE ACCEPT message, the old TMSI, if any is available, shall be kept.

Any timer used for triggering the location updating procedure (e.g. T3211, T3212) shall be stopped if running.

The network receiving a ROUTING AREA UPDATE COMPLETE message stops timer T3350, changes to GMM-REGISTERED state and considers the new TMSI as valid.

3GPP TSG-CN1 Meeting #31 **Tdoc N1-031005**
Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **793** ⌘ **rev** **-** ⌘ Current version: **6.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [X] ME [X] Radio Access Network [ ] Core Network [ ]

Title:	⌘	Deletion of $EF_{RPLMNAcT}$
Source:	⌘	Ericsson, Nokia
Work item code:	⌘	TEI5
Date:	⌘	07/07/2003
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	In N1-021555 (IN LS from TSG T) TSG T asked whether T3 could go ahead on the deletion of $EF_{RPLMNAcT}$, because in the understanding of TSG T this field has only meaning for MS supporting GSM Compact and some problems of its usage and definition have been detected by TSG T. At the same time, TSG T pointed out that the deletion "would however require a small modification of TS 23.122 to change the storage of the information whether or not the last registered PLMN has been identified to support GSM Compact from the SIM/USIM to the ME". At the CN1#25 meeting CN1 noted the IN LS and stated in the minutes: "Noted. CN1 agreed the proposal in principle but no CRs were presented to this meeting yet. CRs from interested companies were invited for the next CN1 meeting". However, no contributions on this topic have been seen at CN1. Hence, CN1 has not fulfilled with the decision. At present, there are refences to $EF_{RPLMNAcT}$ in TS 24.008 from Rel-5 onwards. TS 24.008 mandates all kind of terminals to update this field at successful LA updating, GPRS attach, RAU and combined procedures (i.e. whenever EF_{LOCI} and EF_{PSLOCI} are stored). Finally, T3 repeats the request again in the IN LS N1-030970 / T3-030462.
Summary of change:	⌘	The references to $EF_{RPLMNAcT}$ are deleted everywhere in the specification.
Consequences if not approved:	⌘	CN1 continues not fulfilling an already taken decision on the deletion of $EF_{RPLMNAcT}$ and this field **still** remains in the CN1 specifications. Furthemore, currently, TS 24.008 mandates to update this field, when supported by the SIM/USIM, even though can only be meningful for GSM Compact terminals. Inconsistency among TS 24.008 and different T3 specifications e.g. TS 31.102, TS 11.11, ... which may lead to confusion and misinterpretation.

Clauses affected:	⌘	4.4.4.6, 4.7.3.1.3, 4.7.3.2.3.1, 4.7.5.1.3 and 4.7.5.2.3.1.			
Other specs affected:	⌘	**Y** / **N** **X** / ☐	Other core specifications	⌘	TS 11.11, TS 51.011 and TS 31.102.
		☐ / **X**	Test specifications		
		☐ / **X**	O&M Specifications		
Other comments:	⌘	This change is needed because of change in the SIM/USIM specs to remove the RPLMNAcT data field.			

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST CHANGE

4.4.4.6 Location updating accepted by the network

If the location updating is accepted by the network a LOCATION UPDATING ACCEPT message is transferred to the mobile station.

In case the identity confidentiality service is active (see subclauses 4.3.1 and 4.4.4.4), the TMSI reallocation may be part of the location updating procedure. The TMSI allocated is then contained in the LOCATION UPDATING ACCEPT message together with the location area identifier LAI. The network shall in this case start the supervision timer T3250 as described in subclause 4.3.1.

If the network wishes to prolong the RR connection to allow the mobile station to initiate MM connection establishment (for example if the mobile station has indicated in the LOCATION UPDATING REQUEST that it has a follow-on request pending) the network shall send "follow on proceed" in the LOCATION UPDATING ACCEPT and start timer T3255.

The mobile station receiving a LOCATION UPDATING ACCEPT message shall store the received location area identification LAI ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stop timer T3210, reset the attempt counter and set the update status in the SIM/USIM to UPDATED. If the message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI in the SIM/USIM accordingly. If the message contains a TMSI, the mobile station is allocated this TMSI, and shall store this TMSI in the SIM/USIM and a TMSI REALLOCATION COMPLETE shall be returned to the network. If neither IMSI nor TMSI is received in the LOCATION UPDATING ACCEPT message, the old TMSI if any available shall be kept.
If the LAI or PLMN identity contained in the LOCATION UPDATING ACCEPT message is a member of any of the "forbidden lists" then any such entries shall be deleted.

The network may also send a list of "equivalent PLMNs" in the LOCATION UPDATING ACCEPT message. Each entry of the list contains a PLMN code (MCC+MNC). The mobile station shall store the list, as provided by the network, except that any PLMN code that is already in the "forbidden PLMN list" shall be removed from the "equivalent PLMNs" list before it is stored by the mobile station. In addition the mobile station shall add to the stored list the PLMN code of the network that sent the list. All PLMNs in the stored list shall be regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover. The stored list in the mobile station shall be replaced on each occurrence of the LOCATION UPDATING ACCEPT message. If no list is contained in the message, then the stored list in the mobile station shall be deleted. The list shall be stored in the mobile station while switched off so that it can be used for PLMN selection after switch on.

After that, the mobile station shall act according to the presence of the "Follow-on proceed" information element in the LOCATION UPDATING ACCEPT; if this element is present and the mobile station has a CM application request pending, it shall send a CM SERVICE REQUEST to the network and proceed as in subclause 4.5.1.1. Otherwise, it shall start timer T3240 and enter state WAIT FOR NETWORK COMMAND.

Furthermore, the network may grant authorisation for the mobile station to use GSM-Cordless Telephony System (CTS) in the Location Area and its immediate neighbourhood. The mobile should memorise this permission in non-volatile memory. If the "CTS permission" IE is not present in the message, the mobile is not authorised to use GSM-CTS, and shall accordingly delete any memorised permission.

NOTE 1: the interaction between CTS and GPRS procedures are not yet defined.

The network may also send a list of local emergency numbers in the LOCATION UPDATING ACCEPT, by including the Emergency Number List IE. The mobile equipment shall store the list, as provided by the network, except that any emergency number that is already stored in the SIM/USIM shall be removed from the list before it is stored by the mobile equipment. If there are no emergency numbers stored on the SIM/USIM, then before storing the received list the mobile equipment shall remove from it any emergency number stored permanently in the ME for use in this case (see 3GPP TS 22.101 [8]). The list stored in the mobile equipment shall be replaced on each receipt of a new Emergency Number List IE.

The emergency number(s) received in the Emergency Number List IE are valid only in networks with the same MCC as in the cell on which this IE is received. If no list is contained in the LOCATION UPDATING ACCEPT message, then the stored list in the mobile equipment shall be kept, except if the mobile equipment has successfully registered to a PLMN with an MCC different from that of the last registered PLMN.

The mobile equipment shall use the stored list of emergency numbers received from the network in addition to the emergency numbers stored on the SIM/USIM or ME to detect that the number dialled is an emergency number.

NOTE 2: The mobile equipment may use the emergency numbers list to assist the end user in determining whether the dialled number is intended for an emergency service or for another destination, e.g. a local directory service. The possible interactions with the end user are implementation specific.

The list of emergency numbers shall be deleted at switch off and removal of the SIM/USIM. The mobile equipment shall be able to store up to ten local emergency numbers received from the network.

SECOND CHANGE

4.7.3.1.3 GPRS attach accepted by the network

If the GPRS attach request is accepted by the network, an ATTACH ACCEPT message is sent to the MS.

The P-TMSI reallocation may be part of the GPRS attach procedure. When the ATTACH REQUEST includes the IMSI, the SGSN shall allocate the P-TMSI. The P-TMSI that shall be allocated is then included in the ATTACH ACCEPT message together with the routing area identifier. The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start timer T3350 as described in subclause 4.7.6. Furthermore, the network may assign a P-TMSI signature for the GMM context which is then also included in the ATTACH ACCEPT message. If the LAI or PLMN identity that has been transmitted in the ATTACH ACCEPT message is a member of any of the "forbidden" lists, any such entry shall be deleted. Additionally, the network shall include the radio priority level to be used by the MS for mobile originated SMS transfer in the ATTACH ACCEPT message.

In GSM, the Cell Notification information element shall be included in the ATTACH ACCEPT message by the network which indicates that the Cell Notification is supported by the network.

In UMTS, the network should prolong the PS signalling connection if the mobile station has indicated a follow-on request pending in ATTACH REQUEST. The network may also prolong the PS signalling connection without any indication from the mobile terminal.

The MS, receiving an ATTACH ACCEPT message, stores the received routing area identification ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3310, reset the GPRS attach attempt counter, reset the routing area updating attempt counter, enters state GMM-REGISTERED and sets the GPRS update status to GU1 UPDATED.

If the message contains a P-TMSI, the MS shall use this P-TMSI as the new temporary identity for GPRS services. In this case, an ATTACH COMPLETE message is returned to the network. The MS shall delete its old P-TMSI and shall store the new one. If no P-TMSI has been included by the network in the ATTACH ACCEPT message, the old P-TMSI, if any available, shall be kept.

If the message contains a P-TMSI signature, the MS shall use this P-TMSI signature as the new temporary signature for the GMM context. The MS shall delete its old P-TMSI signature, if any is available, and shall store the new one. If the message contains no P-TMSI signature, the old P-TMSI signature, if available, shall be deleted.

The network may also send a list of "equivalent PLMNs" in the ATTACH ACCEPT message. Each entry of the list contains a PLMN code (MCC+MNC). The mobile station shall store the list, as provided by the network, except that any PLMN code that is already in the "forbidden PLMN" list shall be removed from the "equivalent PLMNs" list before it is stored by the mobile station. In addition the mobile station shall add to the stored list the PLMN code of the network that sent the list. All PLMNs in the stored list shall be regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover. The stored list in the mobile station shall be replaced on each occurrence of the ATTACH ACCEPT message. If no list is contained in the message, then the stored list in the mobile station shall be deleted. The list shall be stored in the mobile station while switched off so that it can be used for PLMN selection after switch on.

After that in UMTS, if the mobile station has indicated follow-on request pending and has a CM application request pending, it shall send an appropriate message (for example ACTIVATE PDP CONTEXT REQUEST) to the network.

In GSM, if the ATTACH ACCEPT message contains the Cell Notification information element, then the MS shall start to use the LLC NULL frame to perform cell updates. The network receiving an ATTACH COMPLETE message stops timer T3350, changes to GMM-REGISTERED state and considers the P-TMSI sent in the ATTACH ACCEPT message as valid.

The network may also send a list of local emergency numbers in the ATTACH ACCEPT, by including the Emergency Number List IE. The mobile equipment shall store the list, as provided by the network, except that any emergency number that is already stored in the SIM/USIM shall be removed from the list before it is stored by the mobile equipment. If there are no emergency numbers stored on the SIM/USIM, then before storing the received list the mobile equipment shall remove from it any emergency number stored permanently in the ME for use in this case (see 3GPP TS 22.101 [8]). The list stored in the mobile equipment shall be replaced on each receipt of a new Emergency Number List IE.

The emergency number(s) received in the Emergency Number List IE are valid only in networks with the same MCC as in the cell on which this IE is received. If no list is contained in the ATTACH ACCEPT message, then the stored list in the mobile equipment shall be kept, except if the mobile equipment has successfully registered to a PLMN with an MCC different from that of the last registered PLMN.

The mobile equipment shall use the stored list of emergency numbers received from the network in addition to the emergency numbers stored on the SIM/USIM or ME to detect that the number dialled is an emergency number.

NOTE: The mobile equipment may use the emergency numbers list to assist the end user in determining whether the dialled number is intended for an emergency service or for another destination, e.g. a local directory service. The possible interactions with the end user are implementation specific.

The list of emergency numbers shall be deleted at switch off and removal of the SIM/USIM. The mobile equipment shall be able to store up to ten local emergency numbers received from the network.

THIRD CHANGE

4.7.3.2.3.1 Combined attach successful for GPRS and non-GPRS services

The description for IMSI attach for GPRS services as specified in subclause 4.7.3.1.3 shall be followed. In addition, the following description for IMSI attach for non-GPRS services applies.

The TMSI reallocation may be part of the combined GPRS attach procedure. The TMSI allocated is then included in the ATTACH ACCEPT message together with the location area identification (LAI). The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start timer T3350 as described in subclause 4.7.6.

The MS, receiving an ATTACH ACCEPT message, stores the received location area identification ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3310, reset the location update attempt counter and sets the update status to U1 UPDATED. If the message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI accordingly. If the message contains a TMSI, the MS shall use this TMSI as the new temporary identity. The MS shall delete its old TMSI and shall store the new TMSI. In this case, an ATTACH COMPLETE message is returned to the network. If neither a TMSI nor an IMSI has been included by the network in the ATTACH ACCEPT message, the old TMSI, if any available, shall be kept. The new MM state is MM IDLE, the new GMM state is GMM-REGISTERED.

Any timer used for triggering the location update procedure (e.g T3211, T3212) shall be stopped if running.

The network receiving an ATTACH COMPLETE message stops timer T3350, changes to state GMM-REGISTERED and considers the new TMSI as valid.

FOURTH CHANGE

4.7.5.1.3 Normal and periodic routing area updating procedure accepted by the network

If the routing area updating request has been accepted by the network, a ROUTING AREA UPDATE ACCEPT message shall be sent to the MS. The network may assign a new P-TMSI and/or a new P-TMSI signature for the MS. If a new P-TMSI and/or P-TMSI signature have been assigned to the MS, it/they shall be included in the ROUTING AREA UPDATE ACCEPT message together with the routing area identification.

If a new DRX parameter was included in the ROUTING AREA UPDATE REQUEST message, the network shall store the new DRX parameter and use it for the downlink transfer of signalling and user data.

In GSM the Cell Notification information element shall be included in the ROUTING AREA UPDATE ACCEPT message in order to indicate the ability of the network to support the Cell Notification.

The network shall change to state GMM-COMMON-PROCEDURE-INITIATED and shall start the supervision timer T3350 as described in subclause 4.7.6.

If the LAI or PLMN identity contained in the ROUTING AREA UPDATE ACCEPT message is a member of any of the "forbidden" lists then any such entry shall be deleted.

In UMTS, the network should prolong the PS signalling connection if the mobile station has indicated a follow-on request pending in ROUTING AREA UPDATE REQUEST. The network may also prolong the PS signalling connection without any indication from the mobile terminal.

If the PDP context status information element is included in ROUTING AREA UPDATE REQUEST message, then the network shall deactivate all those PDP contexts locally (without peer to peer signalling between the MS and the network), which are not in SM state PDP-INACTIVE on network side but are indicated by the MS as being in state PDP-INACTIVE.

Upon receipt of a ROUTING AREA UPDATE ACCEPT message, the MS stores the received routing area identification ~~and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3330, shall reset the routing area updating attempt counter and sets the GPRS update status to GU1 UPDATED. If the message contains a P-TMSI, the MS shall use this P-TMSI as new temporary identity for GPRS services and shall store the new P-TMSI. If no P-TMSI was included by the network in the ROUTING AREA UPDATING ACCEPT message, the old P-TMSI shall be kept. Furthermore, the MS shall store the P-TMSI signature if received in the ROUTING AREA UPDATING ACCEPT message. If no P-TMSI signature was included in the message, the old P-TMSI signature, if available, shall be deleted.

If the ROUTING AREA UPDATE REQUEST message was used to update the network with a new DRX parameter IE, the MS shall start using the new DRX parameter upon receipt of the ROUTING AREA UPDATE ACCEPT message.

If the PDP context status information element is included in ROUTING AREA UPDATE ACCEPT message, then the MS shall deactivate all those PDP contexts locally (without peer to peer signalling between the MS and network), which are not in SM state PDP-INACTIVE in the MS but are indicated by the network as being in state PDP-INACTIVE.

In GSM, if the ROUTING AREA UPDATE ACCEPT message contains the Cell Notification information element, then the MS shall start to use the LLC NULL frame to perform cell updates.

The network may also send a list of "equivalent PLMNs" in the ROUTING AREA UPDATE ACCEPT message. Each entry of the list contains a PLMN code (MCC+MNC). The mobile station shall store the list, as provided by the network, except that any PLMN code that is already in the "forbidden PLMN" list shall be removed from the "equivalent PLMNs" list before it is stored by the mobile station. In addition the mobile station shall add to the stored list the PLMN code of the network that sent the list. All PLMNs in the stored list shall be regarded as equivalent to each other for PLMN selection, cell selection/re-selection and handover. The stored list in the mobile station shall be replaced on each occurrence of the ROUTING AREA UPDATE ACCEPT message. If no list is contained in the message, then the stored list in the mobile station shall be deleted. The list shall be stored in the mobile station while switched off so that it can be used for PLMN selection after switch on.

A ROUTING AREA UPDATE COMPLETE message shall be returned to the network if the ROUTING AREA UPDATE ACCEPT message contained:

- a P-TMSI; and/or
- Receive N-PDU Numbers (see 3GPP TS 44.065 [78] and 3GPP TS 25.322).

In the latter case the Receive N-PDU Numbers values valid in the MS, shall be included in the ROUTING AREA UPDATE COMPLETE message.

NOTE 1: In UMTS, after a routing area updating procedure, the mobile station can initiate Service Request procedure to request the resource reservation for the active PDP contexts if the resources have been released by the network or send upper layer message (e.g. ACTIVATE PDP CONTEXT REQUEST) to the network via the existing PS signaling connection.

After that in UMTS, if the mobile station has indicated follow-on request pending and has a CM application request pending, it shall send an appropriate message (for example ACTIVATE PDP CONTEXT REQUEST) to the network.

The network may also send a list of local emergency numbers in the ROUTING AREA UPDATE ACCEPT, by including the Emergency Number List IE. The mobile equipment shall store the list, as provided by the network, except that any emergency number that is already stored in the SIM/USIM shall be removed from the list before it is stored by the mobile equipment. If there are no emergency numbers stored on the SIM/USIM, then before storing the received list the mobile equipment shall remove from it any emergency number stored permanently in the ME for use in this case (see 3GPP TS 22.101 [8]). The list stored in the mobile equipment shall be replaced on each receipt of a new Emergency Number List IE.

The emergency number(s) received in the Emergency Number List IE are valid only in networks with the same MCC as in the cell on which this IE is received. If no list is contained in the ROUTING AREA UPDATE ACCEPT message, then the stored list in the mobile equipment shall be kept, except if the mobile equipment has successfully registered to a PLMN with an MCC different from that of the last registered PLMN.

The mobile equipment shall use the stored list of emergency numbers received from the network in addition to the emergency numbers stored on the SIM/USIM or ME to detect that the number dialled is an emergency number.

NOTE 2: The mobile equipment may use the emergency numbers list to assist the end user in determining whether the dialled number is intended for an emergency service or for another destination, e.g. a local directory service. The possible interactions with the end user are implementation specific.

The list of emergency numbers shall be deleted at switch off and removal of the SIM/USIM. The mobile equipment shall be able to store up to ten local emergency numbers received from the network.

FIFTH CHANGE

4.7.5.2.3.1 Combined routing area updating successful

The description for normal routing area update as specified in subclause 4.7.5.1.3 shall be followed. In addition, the following description for location area updating applies.

The handling at the receipt of the ROUTING AREA UPDATE ACCEPT depends on the value received in the update result IE as specified below.

The TMSI reallocation may be part of the combined routing area updating procedure. The TMSI allocated is then included in the ROUTING AREA UPDATE ACCEPT message together with the location area identification (LAI). The network shall, in this case, change to state GMM-COMMON-PROCEDURE-INITIATED and shall start the timer T3350 as described in subclause 4.7.6.

The MS, receiving a ROUTING AREA UPDATE ACCEPT message, stores the received location area identification~~ and, if supported by the SIM/USIM, the currently selected access technology~~, stops timer T3330, enters state MM IDLE, reset the location update attempt counter and sets the update status to U1 UPDATED. If the ROUTING AREA UPDATE ACCEPT message contains an IMSI, the mobile station is not allocated any TMSI, and shall delete any TMSI accordingly. If the ROUTING AREA UPDATE ACCEPT message contains a TMSI, the MS shall use this TMSI as new temporary identity. The MS shall delete its old TMSI and shall store the new TMSI. In this case, an ROUTING AREA UPDATE COMPLETE message is returned to the network. If neither a TMSI nor an IMSI has been included by the network in the ROUTING AREA UPDATE ACCEPT message, the old TMSI, if any is available, shall be kept.

Any timer used for triggering the location updating procedure (e.g. T3211, T3212) shall be stopped if running.

The network receiving a ROUTING AREA UPDATE COMPLETE message stops timer T3350, changes to GMM-REGISTERED state and considers the new TMSI as valid.

3GPP TSG-CN1 Meeting #31

Tdoc N1-031225
Revision of N1-031006

Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **794** ⌘ **rev** **1** ⌘ Current version: **5.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Clarification of handover – BC-IE
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	25/082003
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	In the section 10.5.4.5 is stated that in UTRAN Iu mode, the MSC shall store the parameters required for setup of a multislot call (e.g. MaxNumTCH, ACC, …) and forward them at 'handover', even though these parameters are irrelevant for specifying the RAB, because the multislot mechanism is not deployed in UTRAN Iu mode. However, these multislot parameters are only needed when a handover to A/Gb or GERAN Iu mode occurs, not at any kind of handover. Even though, this was the real intention when introducing the text in the section 10.5.4.5, it's not clearly stated and therefore, it may be misinterpreted. A similar thing as described above can be found in the note 2 of the section 10.5.4.5, where it's stated that the WAIR, MaxNumTCH and UIMI parameters are relevant in UTRAN Iu mode for deciding which RLP version to negotiate in order to avoid renegotiation of RLP version in case of inter-system handover.
Summary of change:	⌘	It's clarified that the multislot parameters are used for handover to A/Gb or GERAN Iu mode. In the note 2 is clarified that at inter-system handover from UTRAN Iu mode to A/Gb or GERAN Iu mode is when the MaxNumTCH, WAIUR and UIMI parameters are needed in order to avoid renegotiation of RLP version. A reference to TS 23.034 is added in the section 2.
Consequences if not approved:	⌘	The text in the section 10.5.4.5 continues not describing exactly when (i.e. which type of handover) the multislot parameters are used and in which situation renegotiation of the RLP parameters might occur, if WAIR, MaxNumTCH and UIMI parameters are not taken into accout. This may lead to confusion and misinterpretation. This may result in wrong MSC implementations not using MaxNumTCH, ACC,

	ACCext and UIMI at inter-system handover from UTRAN Iu mode to A/Gb or GERAN Iu mode (in case of multislot parameters).

Clauses affected:	⌘	2, 10.5.4.5.			
		Y	**N**		
Other specs affected:	⌘		**X**	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST CHANGE

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] Void.

[2] Void.

[2a] 3GPP TR 21.905 "Vocabulary for 3GPP Specifications"

[3] 3GPP TS 22.002: "Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)".

[4] 3GPP TS 22.003: "Teleservices supported by a Public Land Mobile Network (PLMN)".

[5] 3GPP TS 42.009: "Security aspects".

[5a] 3GPP TS 33.102: "3G security; Security architecture".

[6] 3GPP TS 22.011: "Service accessibility".

[7] 3GPP TS 42.017: "Subscriber Identity Modules (SIM); Functional characteristics".

[8] 3GPP TS 22.101: "Service aspects; Service principles".

[8a] 3GPP TS 22.001: "Principles of circuit telecommunication services supported by a Public Land Mobile Network (PLMN)".

[8b] 3GPP TS 23.038: "Alphabets and language-specific information".

[9] 3GPP TS 23.101: "General UMTS Architecture".

[9a] 3GPP TS 23.108: "Mobile radio interface layer 3 specification core network protocols; Stage 2 (structured procedures)".

[10] 3GPP TS 23.003: "Numbering, addressing and identification".

[11] 3GPP TS 43.013: "Discontinuous Reception (DRX) in the GSM system".

[12] 3GPP TS 23.014: "Support of Dual Tone Multi-Frequency (DTMF) signalling".

[12a] Void.

[13] 3GPP TS 43.020: "Security-related network functions".

[14] 3GPP TS 23.122: "Non-Access-Stratum functions related to Mobile Station (MS) in idle mode".

[15] 3GPP TS 24.002: "GSM-UMTS Public Land Mobile Network (PLMN) access reference configuration".

[16] 3GPP TS 44.003: "Mobile Station - Base Station System (MS - BSS) interface; Channel structures and access capabilities".

[17] 3GPP TS 44.004: "Layer 1; General requirements".

[18] 3GPP TS 44.005: "Data Link (DL) layer; General aspects".

[19] 3GPP TS 44.006: "Mobile Station - Base Station System (MS - BSS) interface; Data Link (DL) layer specification".

[19a] 3GPP TS 25.321: "Medium Access Control (MAC) protocol specification".

[19b] 3GPP TS 25.322: "Radio Link Control (RLC) protocol specification".

[19c] 3GPP TS 25.413: "UTRAN Iu interface RANAP signalling".

[20] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[21] 3GPP TS 24.010: "Mobile radio interface layer 3; Supplementary services specification; General aspects".

[22] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[23] 3GPP TS 24.012: "Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".

[23a] 3GPP TS 44.071: "Location Services (LCS); Mobile radio interface layer 3 specification."

[23b] 3GPP TS 44.031 "Location Services LCS); Mobile Station (MS) - Serving Mobile Location Centre (SMLC); Radio Resource LCS Protocol (RRLP)".

[23c] 3GPP TS 25.331: "Radio Resource Control (RRC) protocol specification"

[24] 3GPP TS 24.080: "Mobile radio Layer 3 supplementary service specification; Formats and coding".

[25] 3GPP TS 24.081: "Line identification supplementary services; Stage 3".

[26] 3GPP TS 24.082: "Call Forwarding (CF) supplementary services; Stage 3".

[27] 3GPP TS 24.083: "Call Waiting (CW) and Call Hold (HOLD) supplementary services; Stage 3".

[28] 3GPP TS 24.084: "MultiParty (MPTY) supplementary services; Stage 3".

[29] 3GPP TS 24.085: "Closed User Group (CUG) supplementary services; Stage 3".

[30] 3GPP TS 24.086: "Advice of Charge (AoC) supplementary services; Stage 3".

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[32] 3GPP TS 45.002: "Multiplexing and multiple access on the radio path".

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[35] 3GPP TS 45.010: "Radio subsystem synchronization".

[36] 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

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[40] 3GPP TS 51.021: "GSM radio aspects base station system equipment specification".

[41] ISO/IEC 646 (1991): "Information technology - ISO 7-bit coded character set for information interchange".

[42] ISO/IEC 6429: "Information technology - Control functions for coded character sets".

[43] ISO 8348 (1987): "Information technology -- Open Systems Interconnection -- Network Service Definition".

[44] ITU-T Recommendation E.163: "Numbering plan for the international telephone service".

[45] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[46] ITU-T Recommendation E.212: "The international identification plan for mobile terminals and mobile users".

[47] ITU-T Recommendation F.69 (1993): "The international telex service - Service and operational provisions of telex destination codes and telex network identification codes".

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[50] ITU-T Recommendation I.450 (1989): "ISDN user-network interface layer 3 General aspects".

[51] ITU-T Recommendation I.500 (1993): "General structure of the ISDN interworking recommendations".

[52] ITU-T Recommendation T.50: "International Reference Alphabet (IRA) (Formerly International Alphabet No. 5 or IA5) - Information technology - 7-bit coded character set for information interchange".

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[56] ITU-T Recommendation V.22bis: "2400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

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[58] ITU-T Recommendation V.26ter: "2400 bits per second duplex modem using the echo cancellation technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

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[61] ITU-T Recommendation V.120: "Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing".

[62] ITU-T Recommendation X.21: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for synchronous operation on public data networks".

[63] Void.

[64] Void.

[65] ITU-T Recommendation X.30: "Support of X.21, X.21 bis and X.20 bis based Data Terminal Equipments (DTEs) by an Integrated Services Digital Network (ISDN)".

[66] ITU-T Recommendation X.31: "Support of packet mode terminal equipment by an ISDN".

[67] Void.

[68] Void.

[69] ITU-T Recommendation X.121: "International numbering plan for public data networks".

[70] ETSI ETS 300 102-1: "Integrated Services Digital Network (ISDN); User-network interface layer 3; Specifications for basic call control".

[71] ETSI ETS 300 102-2: "Integrated Services Digital Network (ISDN); User-network interface layer 3; Specifications for basic call control; Specification Description Language (SDL) diagrams".

[72] ISO/IEC 10646: "Information technology -- Universal Multiple-Octet Coded Character Set (UCS)".

[73] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service Description; Stage 1".

[74] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".

[75] 3GPP TS 43.064: "General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".

[76] 3GPP TS 44.060: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol".

[77] IETF RFC 1034: "Domain names - concepts and facilities".

[78] 3GPP TS 44.065: "Mobile Station (MS) - Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[78a] 3GPP TS 44.064: "Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) Layer Specification".

[79] ITU Recommendation I.460: "Multiplexing, rate adaption and support of existing interfaces".

[80] 3GPP TS 26.111: "Codec for Circuit Switched Multimedia Telephony Service; Modifications to H.324".

[81] 3GPP TS 23.107: "Quality of Service (QoS) concept and architecture".

[82] 3GPP TS 43.022: "Functions related to Mobile Station (MS) in idle mode and group receive mode".

[83] 3GPP TS 26.103: "Speech Codec List for GSM and UMTS".

[84] 3GPP TS 44.018: "Mobile radio interface layer 3 specification, Radio Resource Control Protocol".

[85] 3GPP TS 48.008: "Mobile-services Switching Centre – Base Station System (MSC – BSS) interface; layer 3 specification".

[86] 3GPP TS 48.018: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[87] 3GPP TS 43.055: "Dual Transfer Mode (DTM); Stage 2".

[88] 3GPP TS 23.067: "enhanced Multi-Level Precedence and Pre-emption service (eMLPP); Stage 2".

[88a] 3GPP TS 23.093: "Technical realization of Completion of Calls to Busy Subscriber (CCBS); Stage 2".

[89] 3GPP TS 22.042: "Network Identity and Time Zone (NITZ), Stage 1".

[90] 3GPP TS 23.040: "Technical realization of Short Message Service (SMS)".

[91] 3GPP TS 44.056: "GSM Cordless Telephony System (CTS), (Phase 1) CTS Radio Interface Layer 3 Specification".

[92] 3GPP TS 23.226: "Global Text Telephony; Stage 2 "

[93] 3GPP TS 26.226: "Cellular Text Telephone Modem (CTM), General Description "

[94] 3GPP TS 23.236: "Intra Domain Connection of RAN Nodes to Multiple CN Nodes"

[95] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP"

[96] 3GPP TS 23.205: "Bearer-independent circuit-switched core network; Stage 2".

[97] 3GPP TS 23.172: "UDI/RDI Fallback and Service Modification; Stage 2".

[98] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode"

[99] RFC 3513 (April 2003): "Internet Protocol Version 6 (IPv6) Addressing Architecture".

[100] 3GPP TS 29.207: "Policy control over Go interface".

[101] 3GPP TS 21.111: "USIM and IC card requirements".

[102] RFC 1661 (July 1994): "The Point-to-Point Protocol (PPP)".

[103] RFC 3232 (January 2002): "Assigned Numbers: RFC 1700 is Replaced by an On-line Database".

[104] 3GPP TS 23.034: "High Speed Circuit Switched Data (HSCSD) – Stage 2".

SECOND CHANGE

10.5.4.5 Bearer capability

The purpose of the bearer capability information element is to describe a bearer service. The use of the bearer capability information element in relation to compatibility checking is described in annex B.

The bearer capability information element is coded as shown in figure 10.5.88/3GPP TS 24.008 and tables 10.5.102/3GPP TS 24.008 to 10.5.115/3GPP TS 24.008.

The bearer capability is a type 4 information element with a minimum length of 3 octets and a maximum length of 16 octets.

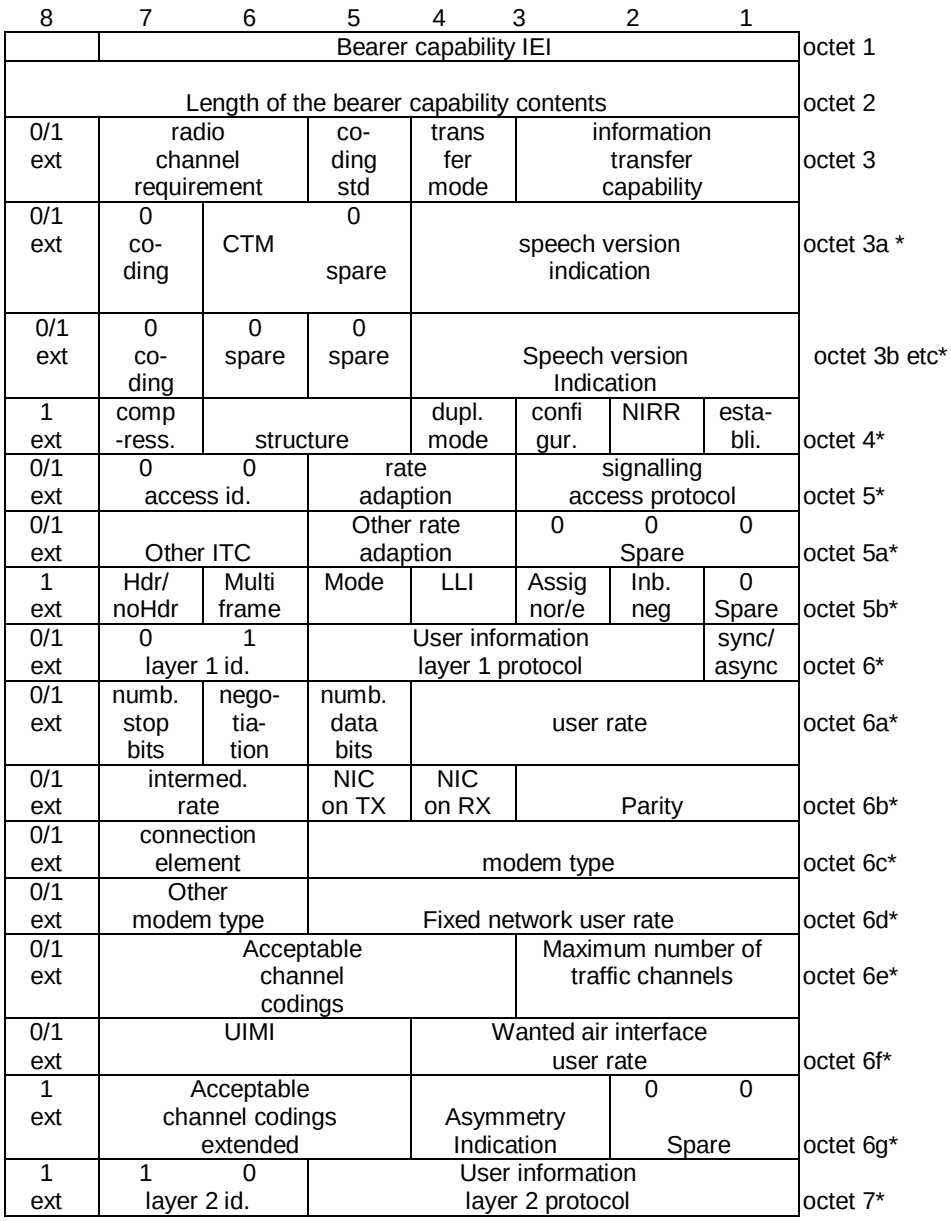

Figure 10.5.88/3GPP TS 24.008 Bearer capability information element

NOTE 1: The coding of the octets of the bearer capability information element is not conforming to ITU Q.931.

An MS shall encode the Bearer Capability infomation element according to A/Gb mode call control requirements also if it is requesting for a service in Iu mode, with the following exceptions:

1. A mobile station not supporting ~~GERAN~~ A/Gb and GERAN Iu mode shall set the following parameters to the value "0":
   - Maximum number of traffic channels (octet 6e, bits 1-3)
   - Acceptable Channel coding(s) (octet 6e, bits 4, 5 and 7)

2. Furthermore, a mobile station not supporting ~~GERAN~~ A/Gb and GERAN Iu mode shall also set the following parameters to the value "0", if the respective octets have to be included in the bearer capability information element according to subclause 10.5.4.5.1 and 3GPP TS 27.001 [36]:
   - UIMI, User initiated modification indication (octet 6f, bits 5-7)
   - Acceptable Channel Codings extended (octet 6g, bits 5-7)

For UTRAN Iu mode ~~access~~ the following parameters are irrelevant for specifying the radio access bearer, because multiple traffic channels (multislot) are not deployed, ~~[~~see 3GPP TS 23.034 [104]. However, the parameters if received,

shall be stored in the MSC, and used for~~forwarded at~~ handover to A/Gb or GERAN Iu mode:

- Maximum number of traffic channels (octet 6e, bits 1-3)
- Acceptable Channel coding(s) (octet 6e, bits 4, 5 and 7)
- UIMI, User initiated modification indication (octet 6f, bits 5-7)
- Acceptable Channel Codings extended (octet 6g, bits 5-7)

NOTE 2: The following parameters are relevant in UTRAN Iu mode for non transparent data calls for deciding which RLP version to negotiate in order to avoid renegotiation of RLP version in case of inter-system handover from UTRAN Iu mode to A/Gb or GERAN Iu mode, see 3GPP TS 24.022 [9]:

- Maximum number of traffic channels (octet 6e, bits 1-3)
- Wanted air interface user rate (octet 6f, bits 1- 4)
- UIMI, User initiated modification indication (octet 6f, bits 5-7)

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Sophia-Antipolis, France, 25 – 29 August 2003

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **795** ⌘ **rev** **1** ⌘ Current version: **6.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Clarification of handover – BC-IE
Source:	⌘	Ericsson
Work item code:	⌘	TEI5
Date:	⌘	27/08/2003
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*

Reason for change:	⌘	In the section 10.5.4.5 is stated that in UTRAN Iu mode, the MSC shall store the parameters required for setup of a multislot call (e.g. MaxNumTCH, ACC, …) and forward them at 'handover', even though these parameters are irrelevant for specifying the RAB, because the multislot mechanism is not deployed in UTRAN Iu mode. However, these multislot parameters are only needed when a handover to A/Gb or GERAN Iu mode occurs, not at any kind of handover. Even though, this was the real intention when introducing the text in the section 10.5.4.5, it's not clearly stated and therefore, it may be misinterpreted. A similar thing as described above can be found in the note 2 of the section 10.5.4.5, where it's stated that the WAIR, MaxNumTCH and UIMI parameters are relevant in UTRAN Iu mode for deciding which RLP version to negotiate in order to avoid renegotiation of RLP version in case of inter-system handover.
Summary of change:	⌘	It's clarified that the multislot parameters are used for handover to A/Gb or GERAN Iu mode. In the note 2 is clarified that at inter-system handover from UTRAN Iu mode to A/Gb or GERAN Iu mode is when the MaxNumTCH, WAIUR and UIMI parameters are needed in order to avoid renegotiation of RLP version. A reference to TS 23.034 is added in the section 2.
Consequences if not approved:	⌘	The text in the section 10.5.4.5 continues not describing exactly when (i.e. which type of handover) the multislot parameters are used and in which situation renegotiation of the RLP parameters might occur, if WAIR, MaxNumTCH and UIMI parameters are not taken into accout. This may lead to confusion and misinterpretation. This may result in wrong MSC implementations not using MaxNumTCH, ACC,

	ACCext and UIMI at inter-system handover from UTRAN Iu mode to A/Gb or GERAN Iu mode (in case of multislot parameters).

Clauses affected:	⌘	2, 10.5.4.5.			
		Y	**N**		
Other specs affected:	⌘		**X**	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

FIRST CHANGE

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] Void.

[2] Void.

[2a] 3GPP TR 21.905 "Vocabulary for 3GPP Specifications"

[3] 3GPP TS 22.002: "Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)".

[4] 3GPP TS 22.003: "Teleservices supported by a Public Land Mobile Network (PLMN)".

[5] 3GPP TS 42.009: "Security aspects".

[5a] 3GPP TS 33.102: "3G security; Security architecture".

[6] 3GPP TS 22.011: "Service accessibility".

[7] 3GPP TS 42.017: "Subscriber Identity Modules (SIM); Functional characteristics".

[8] 3GPP TS 22.101: "Service aspects; Service principles".

[8a] 3GPP TS 22.001: "Principles of circuit telecommunication services supported by a Public Land Mobile Network (PLMN)".

[8b] 3GPP TS 23.038: "Alphabets and language-specific information".

[9] 3GPP TS 23.101: "General UMTS Architecture".

[9a] 3GPP TS 23.108: "Mobile radio interface layer 3 specification core network protocols; Stage 2 (structured procedures)".

[10] 3GPP TS 23.003: "Numbering, addressing and identification".

[11] 3GPP TS 43.013: "Discontinuous Reception (DRX) in the GSM system".

[12] 3GPP TS 23.014: "Support of Dual Tone Multi-Frequency (DTMF) signalling".

[12a] Void.

[13] 3GPP TS 43.020: "Security-related network functions".

[14] 3GPP TS 23.122: "Non-Access-Stratum functions related to Mobile Station (MS) in idle mode".

[15] 3GPP TS 24.002: "GSM-UMTS Public Land Mobile Network (PLMN) access reference configuration".

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[86] 3GPP TS 48.018: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[87] 3GPP TS 43.055: "Dual Transfer Mode (DTM); Stage 2".

[88] 3GPP TS 23.067: "enhanced Multi-Level Precedence and Pre-emption service (eMLPP); Stage 2".

[88a] 3GPP TS 23.093: "Technical realization of Completion of Calls to Busy Subscriber (CCBS); Stage 2".

[89] 3GPP TS 22.042: "Network Identity and Time Zone (NITZ), Stage 1".

[90] 3GPP TS 23.040: "Technical realization of Short Message Service (SMS)".

[91] 3GPP TS 44.056: "GSM Cordless Telephony System (CTS), (Phase 1) CTS Radio Interface Layer 3 Specification".

[92] 3GPP TS 23.226: "Global Text Telephony; Stage 2 "

[93] 3GPP TS 26.226: "Cellular Text Telephone Modem (CTM), General Description "

[94] 3GPP TS 23.236: "Intra Domain Connection of RAN Nodes to Multiple CN Nodes"

[95] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP"

[96] 3GPP TS 23.205: "Bearer-independent circuit-switched core network; Stage 2".

[97] 3GPP TS 23.172: "UDI/RDI Fallback and Service Modification; Stage 2".

[98] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode"

[99] RFC 3513 (April 2003): "Internet Protocol Version 6 (IPv6) Addressing Architecture".

[100] 3GPP TS 29.207: "Policy control over Go interface".

[101] 3GPP TS 21.111: "USIM and IC card requirements".

[102] RFC 1661 (July 1994): "The Point-to-Point Protocol (PPP)".

[103] RFC 3232 (January 2002): "Assigned Numbers: RFC 1700 is Replaced by an On-line Database".

[104] 3GPP TS 23.034: "High Speed Circuit Switched Data (HSCSD) – Stage 2".

SECOND CHANGE

10.5.4.5 Bearer capability

The purpose of the bearer capability information element is to describe a bearer service. The use of the bearer capability information element in relation to compatibility checking is described in annex B.

The bearer capability information element is coded as shown in figure 10.5.88/3GPP TS 24.008 and tables 10.5.102/3GPP TS 24.008 to 10.5.115/3GPP TS 24.008.

The bearer capability is a type 4 information element with a minimum length of 3 octets and a maximum length of 16 octets.

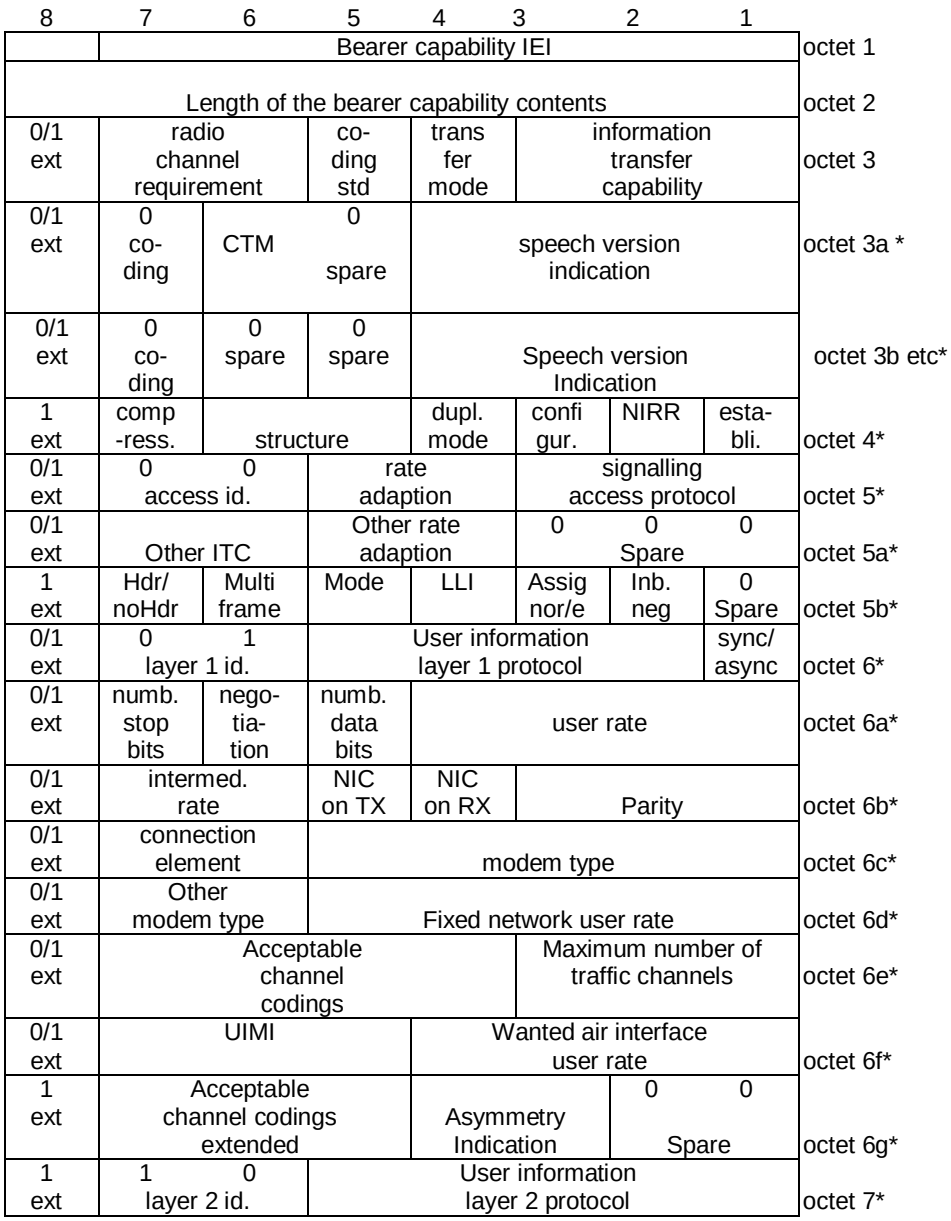

Figure 10.5.88/3GPP TS 24.008 Bearer capability information element

NOTE 1: The coding of the octets of the bearer capability information element is not conforming to ITU Q.931.

An MS shall encode the Bearer Capability infomation element according to A/Gb mode call control requirements also if it is requesting for a service in Iu mode, with the following exceptions:

1. A mobile station not supporting ~~GERAN~~ A/Gb and GERAN Iu mode shall set the following parameters to the value "0":
   - Maximum number of traffic channels (octet 6e, bits 1-3)
   - Acceptable Channel coding(s) (octet 6e, bits 4, 5 and 7)

2. Furthermore, a mobile station not supporting ~~GERAN~~ A/Gb and GERAN Iu mode shall also set the following parameters to the value "0", if the respective octets have to be included in the bearer capability information element according to subclause 10.5.4.5.1 and 3GPP TS 27.001 [36]:
   - UIMI, User initiated modification indication (octet 6f, bits 5-7)
   - Acceptable Channel Codings extended (octet 6g, bits 5-7)

For UTRAN Iu mode ~~access~~ the following parameters are irrelevant for specifying the radio access bearer, because multiple traffic channels (multislot) are not deployed, ~~[~~see 3GPP TS 23.034 [104]. However, the parameters if received,

shall be stored in the MSC, and used for~~forwarded at~~ handover to A/Gb or GERAN Iu mode:

- Maximum number of traffic channels (octet 6e, bits 1-3)
- Acceptable Channel coding(s) (octet 6e, bits 4, 5 and 7)
- UIMI, User initiated modification indication (octet 6f, bits 5-7)
- Acceptable Channel Codings extended (octet 6g, bits 5-7)

NOTE 2: The following parameters are relevant in UTRAN Iu mode for non transparent data calls for deciding which RLP version to negotiate in order to avoid renegotiation of RLP version in case of inter-system handover from UTRAN Iu mode to A/Gb or GERAN Iu mode, see 3GPP TS 24.022 [9]:

- Maximum number of traffic channels (octet 6e, bits 1-3)
- Wanted air interface user rate (octet 6f, bits 1- 4)
- UIMI, User initiated modification indication (octet 6f, bits 5-7)

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Tdoc ⌘N1-031311

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **814** ⌘ **rev** **1** ⌘ Current version: **5.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [X]

Title:	⌘	CR on introduction of mobile station multislot power classes.
Source:	⌘	Ericsson, Nokia
Work item code:	⌘	TEI5
Date:	⌘	26/08/2003
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	Addition of multislot power capability indication.
Summary of change:	⌘	Multislot power capability parameters added to Classmark 3 and MS RAC.
Consequences if not approved:	⌘	The mobile station could not indicate accurately uplink power capabilities for an uplink multislot configuration.

Clauses affected:	⌘	10.5.1.7, 10.55.12a			
Other specs affected:	⌘	**Y** / **N**	Other core specifications	⌘	45.005
		X /	Other core specifications		
		/ X	Test specifications		
		/ X	O&M Specifications		
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

<---------- first modified section ---------->

10.5.1.7 Mobile Station Classmark 3

The purpose of the *Mobile Station Classmark 3* information element is to provide the network with information concerning aspects of the mobile station. The contents might affect the manner in which the network handles the operation of the mobile station. The Mobile Station Classmark information indicates general mobile station characteristics and it shall therefore, except for fields explicitly indicated, be independent of the frequency band of the channel it is sent on.

The *MS Classmark 3* is a type 4 information element with a maximum of 14 octets length.

The value part of a *MS Classmark 3* information element is coded as shown in figure 10.5.7/3GPP TS 24.008 and table 10.5.7/3GPP TS 24.008.

NOTE: The 14 octet limit is so that the CLASSMARK CHANGE message will fit in one layer 2 frame.

SEMANTIC RULE: a multiband mobile station shall provide information about all frequency bands it can support. A single band mobile station shall not indicate the band it supports in the *Multiband Supported, GSM 400 Bands Supported, GSM 700 Associated Radio Capability, GSM 850 Associated Radio Capability or GSM 1900 Associated Radio Capability* fields in the MS Classmark 3. Due to shared radio frequency channel numbers between GSM 1800 and GSM 1900, the mobile should indicate support for either GSM 1800 band OR GSM 1900 band.

SEMANTIC RULE: a mobile station shall include the MS Measurement Capability field if the *Multi Slot Class* field contains a value of 19 or greater (see 3GPP TS 45.002 [32]).

Typically, the number of spare bits at the end is the minimum to reach an octet boundary. The receiver may add any number of bits set to "0" at the end of the received string if needed for correct decoding.

```
<Classmark 3 Value part> ::=
    < spare bit >
    {    < Multiband supported : { 000 } >
             < A5 bits >
    |    < Multiband supported : { 101 | 110 } >
             < A5 bits >
             < Associated Radio Capability 2 : bit(4) >
             < Associated Radio Capability 1 : bit(4) >
    |    < Multiband supported : { 001 | 010 | 100 } >
             < A5 bits >
             < spare bit >(4)
             < Associated Radio Capability 1 : bit(4) > }
    { 0 | 1 < R Support > }
    { 0 | 1 < HSCSD Multi Slot Capability > }
    < UCS2 treatment: bit >
    < Extended Measurement Capability : bit >
    { 0 | 1 < MS measurement capability > }
    { 0 | 1 < MS Positioning Method Capability > }
    { 0 | 1 < ECSD Multi Slot Capability > }
    { 0 | 1 < ECSD Struct > }
    { 0 | 1 < GSM 400 Bands Supported : { 01 | 10 | 11 } >
             < GSM 400 Associated Radio Capability: bit(4) > }

    { 0 | 1 <GSM 850 Associated Radio Capability : bit(4) > }
    { 0 | 1 <GSM 1900 Associated Radio Capability : bit(4) > }
    < UMTS FDD Radio Access Technology Capability : bit >
    < UMTS 3.84 Mcps TDD Radio Access Technology Capability : bit >
    < CDMA 2000 Radio Access Technology Capability : bit >

    { 0 | 1  < DTM GPRS Multi Slot Class : bit(2) >
             < MAC Mode Support : bit >
             {0 | 1< DTM EGPRS Multi Slot Class : bit(2) > } }
    { 0 | 1 < Single Band Support > } -- Release 4 starts here:
    { 0 | 1 <GSM 700 Associated Radio Capability : bit(4)>}

    < UMTS 1.28 Mcps TDD Radio Access Technology Capability : bit >
    < GERAN Feature Package 1 : bit >

    { 0 | 1 < Extended DTM GPRS Multi Slot Class : bit(2) >
             < Extended DTM EGPRS Multi Slot Class : bit(2) > }

    { 0 | 1 < High Multislot Capability : bit(2) > }---Release 5 starts here.

    < GERAN Iu Mode Capability : bit >
    < GERAN Feature Package 2 : bit >

    { 0 | 1  < GMSK_MULTISLOT_POWER_PROFILE : bit (2) >
             < 8-PSK_MULTISLOT_POWER_PROFILE : bit (2) > }
    < spare bit > ;

< A5 bits > ::=
    < A5/7 : bit > < A5/6 : bit > < A5/5 : bit > < A5/4 : bit >  ;

<R Support>::=
    < R-GSM band Associated Radio Capability : bit(3) > ;

< HSCSD Multi Slot Capability > ::=
    < HSCSD Multi Slot Class : bit(5) >  ;

< MS Measurement capability > ::=
    < SMS_VALUE : bit (4) >
    < SM_VALUE : bit (4) > ;

< MS Positioning Method Capability > ::=
    < MS Positioning Method : bit(5) > ;
```

```
< ECSD Multi Slot Capability > ::=
    < ECSD Multi Slot Class : bit(5) > ;

 < ECSD Struct> : :=
    < Modulation Capability : bit >
    { 0 | 1 < EDGE RF Power Capability 1: bit(2) > }
    { 0 | 1 < EDGE RF Power Capability 2: bit(2) > }

< Single Band Support > ::=
    < GSM Band : bit (4) > ;
```

Figure 10.5.7/3GPP TS 24.008 *Mobile Station Classmark 3* information element

Table 10.5.7/3GPP TS 24.008: *Mobile Station Classmark 3* information element

Multiband Supported (3 bit field)

Band 1 supported
Bit 1
0 P-GSM not supported
1 P-GSM supported

Band 2 supported
Bit 2
0 E-GSM or R-GSM not supported
1 E-GSM or R-GSM supported

Band 3 supported
Bit 3
0 GSM 1800 not supported
1 GSM 1800 supported

The indication of support of P-GSM band or E-GSM or R-GSM band is mutually exclusive.

When the 'Band 2 supported' bit indicates support of E-GSM or R-GSM, the presence of the <R Support> field, see below, indicates if the E-GSM or R-GSM band is supported.

In this version of the protocol, the sender indicates in this field either none, one or two of these 3 bands supported.

For single band mobile station or a mobile station supporting none of the GSM 900 bands(P-GSM, E-GSM and R-GSM) and GSM 1800 bands, all bits are set to 0.

A5/4
0 Encryption algorithm A5/4 not available
1 Encryption algorithm A5/4 available

A5/5
0 Encryption algorithm A5/5 not available
1 Encryption algorithm A5/5 available

A5/6
0 Encryption algorithm A5/6 not available
1 Encryption algorithm A5/6 available

A5/7
0 Encryption algorithm A5/7 not available
1 Encryption algorithm A5/7 available

Associated Radio capability 1 and 2 (4 bit fields)

If either of P-GSM or E-GSM or R-GSM is supported, the radio capability 1 field indicates the radio capability for P-GSM, E-GSM or R-GSM, and the radio capability 2 field indicates the radio capability for GSM 1800 if supported, and is spare otherwise.

If none of P-GSM or E-GSM or R-GSM are supported, the radio capability 1 field indicates the radio capability for GSM 1800, and the radio capability 2 field is spare.

The radio capability contains the binary coding of the power class associated with the band indicated in multiband support bits (see 3GPP TS 45.005 [33]).

(continued...)

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

R-GSM band Associated Radio Capability (3 bit field)

In case where the R-GSM band is supported the R-GSM band associated radio capability field contains the binary coding of the power class associated (see 3GPP TS 45.005) (regardless of the number of GSM bands supported). A mobile station supporting the R-GSM band shall also when appropriate, (see 10.5.1.6) indicate its support in the 'FC' bit in the Mobile Station Classmark 2 information element.

NOTE: The coding of the power class for P-GSM, E-GSM, R-GSM and GSM 1800 in radio capability 1 and/or 2 is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

HSCSD Multi Slot Class (5 bit field)

In case the MS supports the use of multiple timeslots for HSCSD then the HSCSD Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

UCS2 treatment (1 bit field)

This information field indicates the likely treatment by the mobile station of UCS2 encoded character strings. If not included, the value 0 shall be assumed by the receiver.

0 the ME has a preference for the default alphabet (defined in 3GPP TS 23.038 [8b]) over UCS2.
1 the ME has no preference between the use of the default alphabet and the use of UCS2.

Extended Measurement Capability (1 bit field)

This bit indicates whether the mobile station supports 'Extended Measurements' or not

0 the MS does not support Extended Measurements
1 the MS supports Extended Measurements

SMS_VALUE (Switch-Measure-Switch) (4 bit field)
The SMS field indicates the time needed for the mobile station to switch from one radio channel to another, perform a neighbour cell power measurement, and the switch from that radio channel to another radio channel.
Bits

4 3 2 1	
0 0 0 0	1/4 timeslot (~144 microseconds)
0 0 0 1	2/4 timeslot (~288 microseconds)
0 0 1 0	3/4 timeslot (~433 microseconds)
. . .	
1 1 1 1	16/4 timeslot (~2307 microseconds)

SM_VALUE (Switch-Measure) (4 bit field)
The SM field indicates the time needed for the mobile station to switch from one radio channel to another and perform a neighbour cell power measurement.
Bits

4 3 2 1	
0 0 0 0	1/4 timeslot (~144 microseconds)
0 0 0 1	2/4 timeslot (~288 microseconds)
0 0 1 0	3/4 timeslot (~433 microseconds)
. . .	
1 1 1 1	16/4 timeslot (~2307 microseconds)

MS Positioning Method (5 bit field)
This field indicates the Positioning Method(s) supported by the mobile station for the provision of location services (LCS) via the CS domain in A-mode.
MS assisted E-OTD
Bit 5

0 MS assisted E-OTD not supported
1 MS assisted E-OTD supported

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

MS based E-OTD
Bit 4
0 MS based E-OTD not supported
1 MS based E-OTD supported

MS assisted GPS
Bit 3
0 MS assisted GPS not supported
1 MS assisted GPS supported

MS based GPS
Bit 2
0 MS based GPS not supported
1 MS based GPS supported

MS Conventional GPS
Bit 1
0 conventional GPS not supported
1 conventional GPS supported

ECSD Multi Slot class (5 bit field)

In case the **ECSD** MS supports the use of multiple timeslots and the number of supported time slots is different from number of time slots supported for GMSK then the **ECSD** Multi Slot class field is included and is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

Modulation Capability

The Modulation Capability field indicates the modulation scheme the MS supports in addition to GMSK.
0 8-PSK supported for downlink reception only
1 8-PSK supported for uplink transmission and downlink reception

EDGE RF Power Capability 1 (2 bit field)
If 8-PSK modulation is supported for both uplink and downlink, the **EDGE RF Power Capability 1** field indicates the radio capability for 8-PSK modulation in GSM 400, GSM 700, GSM 850 or GSM 900.

EDGE RF Power Capability 2 (2 bit field)
If 8-PSK modulation is supported for both uplink and downlink, the **EDGE RF Power Capability 2** field indicates the radio capability for 8-PSK modulation in GSM 1800 or GSM 1900 if supported, and is not included otherwise.

The respective **EDGE RF Power Capability 1** and **EDGE RF Power Capability 2** fields contain the following coding of the 8-PSK modulation power class (see 3GPP TS 45.005 [33]):

Bits 2 1	
0 0	Reserved
0 1	Power class E1
1 0	Power class E2
1 1	Power class E3

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

GSM 400 Bands Supported (2 bit field)
See the semantic rule for the sending of this field.
Bits

2	1	
0	1	GSM 480 supported, GSM 450 not supported
1	0	GSM 450 supported, GSM 480 not supported
1	1	GSM 450 supported, GSM 480 supported

GSM 400 Associated Radio Capability (4 bit field)
If either GSM 450 or GSM 480 or both is supported, the GSM 400 Associated Radio Capability field indicates the radio capability for GSM 450 and/or GSM 480.

The radio capability contains the binary coding of the power class associated with the band indicated in GSM 400 Bands Supported bits (see 3GPP TS 45.005 [33]).

NOTE: The coding of the power class for GSM 450 and GSM 480 in GSM 400 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

GSM 850 Associated Radio Capability (4 bit field)
See the semantic rule for the sending of this field.
This field indicates whether GSM 850 band is supported and its associated radio capability.

The radio capability contains the binary coding of the power class associated with the GSM 850 band (see 3GPP TS 45.005 [33]).

Note: the coding of the power class for GSM 850 in GSM 850 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

GSM 1900 Associated Radio Capability (4 bit field)
See the semantic rule for the sending of this field.
This field indicates whether GSM 1900 band is supported and its associated radio capability.

The radio capability contains the binary coding of the power class associated with the GSM 1900 band (see 3GPP TS 45.005 [33]).

Note: the coding of the power class for GSM 1900 in GSM 1900 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

UMTS FDD Radio Access Technology Capability (1 bit field)
0 UMTS FDD not supported
1 UMTS FDD supported

UMTS 3.84 Mcps TDD Radio Access Technology Capability (1 bit field)
0 UMTS 3.84 Mcps TDD not supported
1 UMTS 3.84 Mcps TDD supported

CDMA 2000 Radio Access Technology Capability (1 bit field)
0 CDMA2000 not supported
1 CDMA2000 supported

DTM GPRS Multi Slot Class (2 bit field)
This field indicates the DTM GPRS multislot capabilities of the MS. It is coded as follows:
Bit
2 1
0 0 Multislot class 1 supported
0 1 Multislot class 5 supported
1 0 Multislot class 9 supported
1 1 Reserved for future extension. If received, the network shall interpret this as '00'

MAC Mode Support (1 bit field)
This field indicates whether the MS supports Dynamic and Fixed Allocation or only supports Exclusive Allocation. It is coded as follows:

0 Dynamic and Fixed Allocation not supported
1 Dynamic and Fixed allocation supported

DTM EGPRS Multi Slot Class (2 bit field)
This field indicates the DTM EGPRS multislot capabilities of the MS. This field shall be included only if the mobile station supports EGPRS DTM. This field is coded as the DTM GPRS Multi Slot Class field.

Single Band Support
This field shall be sent if the mobile station supports UMTS and one and only one GSM band with the exception of R-GSM; this field shall not be sent otherwise

GSM Band (4 bit field)
Bits
4 3 2 1
0 0 0 0 E-GSM is supported
0 0 0 1 P-GSM is supported
0 0 1 0 GSM 1800 is supported
0 0 1 1 GSM 450 is supported
0 1 0 0 GSM 480 is supported
0 1 0 1 GSM 850 is supported
0 1 1 0 GSM 1900 is supported
0 1 1 1 GSM 700 is supported
All other values are reserved for future use.

NOTE: When this field is received, the associated RF power capability is found in Classmark 1 or 2.

GSM 700 Associated Radio Capability (4 bit field)

See the semantic rule for the sending of this field.
This field indicates whether GSM 700 band is supported and its associated radio capability.

The radio capability contains the binary coding of the power class associated with the GSM 700 band (see 3GPP TS 45.005 [33]).

NOTE: The coding of the power class for GSM 700 in GSM 700 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

UMTS 1.28 Mcps TDD Radio Access Technology Capability (1 bit field)
0 UMTS 1.28 Mcps TDD not supported
1 UMTS 1.28 Mcps TDD supported

GERAN Feature Package 1 (1 bit field)
This field indicates whether the MS supports the GERAN Feature Package 1 (see 3GPP TS 44.060). It is coded as follows:

0 GERAN feature package 1 not supported.
1 GERAN feature package 1 supported.

Extended DTM GPRS Multi Slot Class (2 bit field)
This field indicates the extended DTM GPRS multislot capabilities of the MS and shall be interpreted in conjunction with the DTM GPRS Multi Slot Class field. It is coded as follows, where 'DGMSC' denotes the DTM GPRS Multi Slot Class field:

DGMSC Bit 2 1	Bit 2 1	
0 0	0 0	Multislot class 2 supported
0 0	0 1	Multislot class 3 supported
0 0	1 0	Multislot class 4 supported
0 0	1 1	Multislot class 8 supported
0 1	0 0	Multislot class 5 supported
0 1	0 1	Multislot class 6 supported
0 1	1 0	Multislot class 7 supported
0 1	1 1	Not used. If received, the network shall interpret it as '(01) 00'.
1 0	0 0	Multislot class 9 supported
1 0	0 1	Multislot class 10 supported
1 0	1 0	Multislot class 11 supported
1 0	1 1	Multislot class 12 supported

The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink.When this field is not present, the MS supports the multislot class indicated by the *DTM GPRS Multi Slot Class field*.

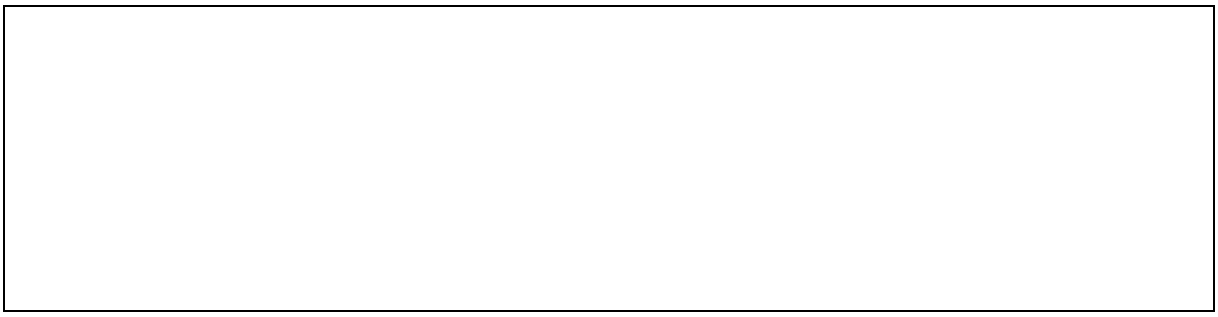
Extended DTM EGPRS Multi Slot Class (2 bit field)
This field is not considered when the DTM EGPRS Multi Slot Class field is not included. This field indicates the extended DTM EGPRS multislot capabilities of the MS and shall be interpreted in conjunction with the DTM EGPRS Multi Slot Class field. This field is coded as the Extended DTM GPRS Multi Slot Class field. The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink. When this field is not present, the MS supports the multislot class indicated by the *DTM GPRS Multi Slot Class* field.

High Multislot Capability (2 bit field)
This field indicates the support of multislot classes 30 to 45, see 3GPP TS 45.002.
The High Multislot Capability is individually combined with each multislot class field sent by the MS (the possible multislot class fields are: HSCSD multislot class, ECSD multislot class, GPRS multislot class, EGPRS multislot class, DTM GPRS multislot class, DTM EGPRS multislot class, extended DTM GPRS multislot class and extended DTM EGPRS multislot class) to extend the related multislot class with the rule described in the MS Radio Access Capability IE.

GERAN Iu Mode Capability (1 bit field)
Bit
0 GERAN Iu mode not supported
1 GERAN Iu mode supported

GERAN Feature Package 2 (1 bit field)
This field indicates the MS support of the GERAN Feature Package 2. The GERAN Feature Package 2 includes **Enhanced Power Control (EPC)** (see 3GPP TS 45.008).

0 GERAN feature package 2 not supported.
1 GERAN feature package 2 supported.



<---------- next modified section ---------->

10.5.5.12a MS Radio Access capability

The purpose of the *MS RA capability* information element is to provide the radio part of the network with information concerning radio aspects of the mobile station. The contents might affect the manner in which the network handles the operation of the mobile station.

The *MS RA capability* is a type 4 information element, with a maximum length of 52 octets.

The value part of a *MS RA capability* information element is coded a shown table 10.5.146/3GPP TS 24.008.

For the indication of the Access Technology Types the following conditions shall apply:

- Among the three Access Type Technologies GSM 900-P, GSM 900-E and GSM 900-R only one shall be present.
- Due to shared radio frequency channel numbers between GSM 1800 and GSM 1900, the mobile station should provide the relevant radio access capability for either GSM 1800 band OR GSM 1900 band, not both.
- The MS shall indicate its supported Access Technology Types during a single MM procedure.
- If the alternative coding by using the Additional access technologies struct is chosen by the mobile station, the mobile station shall indicate its radio access capability for the serving BCCH frequency band in the first included Access capabilities struct.
- The first Access Technology Type shall not be set to "1111".

For error handling the following shall apply:

– If a received Access Technology Type is unknown to the receiver, it shall ignore all the corresponding fields.

– If within a known Access Technology Type a receiver recognizes an unknown field it shall ignore it.

– For more details about error handling of MS radio access capability see 3GPP TS 48.018 [86].

Table 10.5.146/3GPP TS 24.008: *Mobile Station Radio Access Capability* Information Element

< MS Radio Access capability IE > ::=
<**MS Radio Access capability IEI** : 00100100 >
<**Length of MS RA capability**: <octet>> -- *length in octets of MS RA capability value part and spare bits*
<**MS RA capability value part** : < MS RA capability value part struct >>
<spare bits>**; -- *may be used for future enhancements*

<MS RA capability value part struct >::= --*recursive structure allows any number of Access technologies*
{ { < **Access Technology Type**: bit (4) > exclude 1111
< **Access capabilities** : <Access capabilities struct> > }

| { < **Access Technology Type**: bit (4) == 1111 > -- *structure adding Access technologies with same capabilities*
< **Length** : bit (7) > -- *length in bits of list of Additional access technologies and spare bits*
{ 1 < **Additional access technologies**: < Additional access technologies struct > > } ** 0
<spare bits>** } }

{ 0 | 1 <MS RA capability value part struct> } ;

< Additional access technologies struct > ::=
< **Access Technology Type** : bit (4) >
< **GMSK Power Class** : bit (3) >
< **8PSK Power Class** : bit (2) > ;

< Access capabilities struct > ::=
< **Length** : bit (7) > -- length in bits of Content and spare bits
<Access capabilities : <Content>>
<spare bits>** ; -- expands to the indicated length
-- may be used for future enhancements

< Content > ::=
< **RF Power Capability** : bit (3) >
{ 0 | 1 <**A5 bits** : <A5 bits> > } -- *zero means that the same values apply for parameters as in the immediately preceding Access capabilities field within this IE*
< **ES IND** : bit >
< **PS** : bit >
< **VGCS** : bit >
< **VBS** : bit >
{ 0 | 1 < **Multislot capability** : Multislot capability struct > } -- *zero means that the same values for multislot parameters as given in an earlier Access capabilities field within this IE apply also here*
-- *Additions in release 99*
{ 0 | 1 < **8PSK Power Capability** : bit(2) >} -- *'1' also means 8PSK modulation capability in uplink.*
< **COMPACT Interference Measurement Capability : bit >**
< **Revision Level Indicator** : bit >
< **UMTS FDD Radio Access Technology Capability** : bit > -- *3G RAT*
< **UMTS 3.84 Mcps TDD Radio Access Technology Capability** : bit > -- *3G RAT*
< **CDMA 2000 Radio Access Technology Capability** : bit > -- *3G RAT*
-- *Additions in release 4*
< **UMTS 1.28 Mcps TDD Radio Access Technology Capability**: bit > -- *3G RAT*
< **GERAN Feature Package 1** : bit >
{ 0 | 1 < **Extended DTM GPRS Multi Slot Class** : bit(2) >
< **Extended DTM EGPRS Multi Slot Class** : bit(2) > }
< Modulation based multislot class support : bit >
-- *Additions in release 5*
{ 0 | 1 < **High Multislot Capability** : bit(2) > }
< **GERAN Iu Mode Capability** : bit >;
{ 0 | 1 < GMSK_MULTISLOT_POWER_PROFILE : bit (2) >
< 8-PSK_MULTISLOT_POWER_PROFILE : bit (2) > };
-- error: struct too short, assume features do not exist
-- error: struct too long, ignore data and jump to next Access technology

Table 10.5.146/3GPP TS 24.008 (continued): *Mobile Station Radio Access Capability* IE

< Multislot capability struct > ::=
{ 0 | 1 < **HSCSD multislot class** : bit (5) > }
{ 0 | 1 < **GPRS multislot class** : bit (5) > < **GPRS Extended Dynamic Allocation Capability** : bit > }
{ 0 | 1 < **SMS_VALUE** : bit (4) > < **SM_VALUE** : bit (4) > }
-- *Additions in release 99*
{ 0 | 1 < **ECSD multislot class** : bit (5) > }
{ 0 | 1 < **EGPRS multislot class** : bit (5) > < **EGPRS Extended Dynamic Allocation Capability** : bit > }
{0 | 1 < **DTM GPRS Multi Slot Class**: bit(2)>
<MAC Mode Support : bit>
{0 | 1 <**DTM EGPRS Multi Slot Class** : bit(2)> } } ;
-- error: struct too short, assume features do not exist

<A5 bits> ::= < A5/1 : bit> <A5/2 : bit> <A5/3 : bit> <A5/4 : bit> <A5/5 : bit> <A5/6 : bit> <A5/7 : bit>; -- bits for circuit mode ciphering algorithms. These fields are not used by the network and may be excluded by the MS.

Access Technology Type
This field indicates the access technology type to be associated with the following access capabilities.

Bits
4 3 2 1
0 0 0 0 GSM P
0 0 0 1 GSM E --*note that GSM E covers GSM P*
0 0 1 0 GSM R --*note that GSM R covers GSM E and GSM P*
0 0 1 1 GSM 1800
0 1 0 0 GSM 1900
0 1 0 1 GSM 450
0 1 1 0 GSM 480
0 1 1 1 GSM 850
1 0 0 0 GSM 700
1 1 1 1 Indicates the presence of a list of Additional access technologies
All other values are treated as unknown by the receiver.

A MS which does not support any GSM access technology type shall set this field to '0000'.

RF Power Capability, GMSK Power Class (3 bit field)
This field contains the binary coding of the power class used for GMSK associated with the indicated Access Technology Type (see 3GPP TS 45.005).

A MS which does not support any GSM access technology type shall set this field to '000'.

8PSK Power Capability (2 bit field)
If 8-PSK modulation is supported for uplink, this field indicates the radio capability for 8-PSK modulation. The following coding is used (see 3GPP TS 45.005 [33]):
Bits 2 1
0 0 Reserved
0 1 Power class E1
1 0 Power class E2
1 1 Power class E3

8PSK Power Class (2 bit field)
This field indicates the radio capability for 8-PSK modulation. The following coding is used (see 3GPP TS 45.005):
Bits 2 1
0 0 8PSK modulation not supported for uplink
0 1 Power class E1
1 0 Power class E2
1 1 Power class E3

Additional access technologies struct
This structure contains the GMSK Power Class and 8PSK Power Class for an additional Access Technology. All other capabilities for this indicated Access Technology are the same as the capabilities indicated by the preceding Access capabilities struct.

A5/1
0 encryption algorithm A5/1 not available
1 encryption algorithm A5/1 available

A5/2
0 encryption algorithm A5/2 not available
1 encryption algorithm A5/2 available
A5/3
0 encryption algorithm A5/3 not available
1 encryption algorithm A5/3 available
A5/4
0 encryption algorithm A5/4 not available
1 encryption algorithm A5/4 available
A5/5
0 encryption algorithm A5/5 not available
1 encryption algorithm A5/5 available
A5/6
0 encryption algorithm A5/6 not available
1 encryption algorithm A5/6 available
A5/7
0 encryption algorithm A5/7 not available
1 encryption algorithm A5/7 available

ES IND – (Controlled early Classmark Sending)
0 "controlled early Classmark Sending" option is not implemented
1 "controlled early Classmark Sending" option is implemented

Table 10.5.146/3GPP TS 24.008 (concluded): *Mobile Station Radio Access Capability* IE

PS – (Pseudo Synchronisation)
0 PS capability not present
1 PS capability present

VGCS – (Voice Group Call Service)
0 no VGCS capability or no notifications wanted
1 VGCS capability and notifications wanted.

VBS – (Voice Broadcast Service)
0 no VBS capability or no notifications wanted
1 VBS capability and notifications wanted

HSCSD Multi Slot Class
The Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32]. This field is not used by the network and may be excluded by the MS.
Range 1 to 18, all other values are reserved.

GPRS Multi Slot Class
The GPRS Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

ECSD Multi Slot Class
The presence of this field indicates ECSD capability. Whether the MS is capable of 8-PSK modulation in uplink is indicated by the presence of 8-PSK Power Capability field. The Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32]. This field is not used by the network and may be excluded by the MS.
Range 1 to 18, all other values are reserved.

EGPRS Multi Slot Class
The presence of this field indicates EGPRS capability. Whether the MS is capable of 8-PSK modulation in uplink is indicated by the presence of 8-PSK Power Capability field. The EGPRS Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

GPRS Extended Dynamic Allocation Capability
0 Extended Dynamic Allocation Capability for GPRS is not implemented
1 Extended Dynamic Allocation Capability for GPRS is implemented

EGPRS Extended Dynamic Allocation Capability
0 Extended Dynamic Allocation Capability for EGPRS is not implemented
1 Extended Dynamic Allocation Capability for EGPRS is implemented

SMS_VALUE (Switch-Measure-Switch) (4 bit field)
The SMS field indicates the time needed for the mobile station to switch from one radio channel to another, perform a neighbor cell power measurement, and the switch from that radio channel to another radio channel. This field is not used by the network and may be excluded by the MS.
Bits
4 3 2 1
0 0 0 0 1/4 timeslot (~144 microseconds)
0 0 0 1 2/4 timeslot (~288 microseconds)
0 0 1 0 3/4 timeslot (~433 microseconds)
. . .
1 1 1 1 16/4 timeslot (~2307 microseconds)

(SM_VALUE) Switch-Measure (4 bit field)
The SM field indicates the time needed for the mobile station to switch from one radio channel to another and perform a neighbour cell power measurement. This field is not used by the network and may be excluded by the MS.
Bits
4 3 2 1
0 0 0 0 1/4 timeslot (~144 microseconds)
0 0 0 1 2/4 timeslot (~288 microseconds)
0 0 1 0 3/4 timeslot (~433 microseconds)
. . .
1 1 1 1 16/4 timeslot (~2307 microseconds)

DTM GPRS Multi Slot Class (2 bit field)
This field indicates the GPRS DTM multislot capabilities of the MS. It is coded as follows:

Bits 2 1	
0 0	Multislot class 1 supported
0 1	Multislot class 5 supported
1 0	Multislot class 9 supported
1 1	Reserved for future extension. If received, the network shall interpret this as '00'

MAC Mode Support (1 bit field)
This field indicates whether the MS supports Dynamic and Fixed Allocation or only supports Exclusive Allocation

Bit	
0	Dynamic and Fixed Allocation not supported
1	Dynamic and Fixed allocation supported

DTM EGPRS Multi Slot Class (2 bit field)
This field indicates the DTM EGPRS multislot capabilities of the MS. This field shall be included only if the mobile station supports EGPRS DTM. This field is coded as the DTM GPRS multislot Class field.

COMPACT Interference Measurement Capability (1 bit field)

0	COMPACT Interference Measurement Capability is not implemented
1	COMPACT Interference Measurement Capability is implemented

Revision Level Indicator (1 bit field)

Bit	
0	The ME is Release '98 or older
1	The ME is Release '99 onwards

UMTS FDD Radio Access Technology Capability (1 bit field)

Bit	
0	UMTS FDD not supported
1	UMTS FDD supported

UMTS 3.84 Mcps TDD Radio Access Technology Capability (1 bit field)

Bit	
0	UMTS 3.84 Mcps TDD not supported
1	UMTS 3.84 Mcps TDD supported

CDMA 2000 Radio Access Technology Capability (1 bit field)

Bit	
0	CDMA 2000 not supported
1	CDMA 2000 supported

UMTS 1.28 Mcps TDD Radio Access Technology Capability (1 bit field)

Bit	
0	UMTS 1.28 Mcps TDD not supported
1	UMTS 1.28 Mcps TDD supported

GERAN Feature Package 1 (1 bit field)
This field indicates whether the MS supports the GERAN Feature Package 1 (see 3GPP TS 44.060). It is coded as follows:

0	GERAN feature package 1 not supported.
1	GERAN feature package 1 supported.

Extended DTM GPRS Multi Slot Class (2 bit field)
This field indicates the extended DTM GPRS capabilities of the MS and shall be interpreted in conjunction with the DTM GPRS Multi Slot Class field. It is coded as follows, where 'DGMSC' denotes the DTM GPRS multislot class field:

DGMSC Bit	2 1	**Bit 2 1**	
	0 0	**0 0**	Multislot class 2 supported
	0 0	**0 1**	Multislot class 3 supported
	0 0	**1 0**	Multislot class 4 supported
	0 0	**1 1**	Multislot class 8 supported
	0 1	**0 0**	Multislot class 5 supported
	0 1	**0 1**	Multislot class 6 supported
	0 1	**1 0**	Multislot class 7 supported
	0 1	**1 1**	Not used. If received, the network shall interpret it as '01 **00**'.

1 0	**0 0**	Multislot class 9 supported
1 0	**0 1**	Multislot class 10 supported
1 0	**1 0**	Multislot class 11 supported
1 0	**1 1**	Multislot class 12 supported

The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink. When this field is not present, the MS supports the multislot class indicated by the *DTM GPRS Multi Slot Class* field.

Extended DTM EGPRS Multislot Class (2 bit field)
This field is not considered when the DTM EGPRS Multislot Class field is not included. This field indicates the extended DTM EGPRS multislot capabilities of the MS and shall be interpreted in conjunction with the DTM EGPRS Multislot Class field. This field is coded as the Extended DTM GPRS Multislot Class field. The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink. When this field is not present, the MS supports the multislot class indicated by the DTM GPRS Multi Slot Class field.

Modulation based multislot class support (1 bit field)
Bit
0 "Modulation based multislot class" not supported
1 "Modulation based multislot class" supported

High Multislot Capability (2 bit field)
The High Multislot Capability is individually combined with each multislot class field sent by the MS (the possible multislot class fields are: HSCSD multislot class, ECSD multislot class, GPRS multislot class, EGPRS multislot class, DTM GPRS multislot class, DTM EGPRS multislot class, extended DTM GPRS multislot class and extended DTM EGPRS multislot class) to extend the related multislot class to multislot classes 30 to 45, see 3GPP TS 45.002.
For each multislot class, the following mapping is done:
Bits

2 1	coded multislot class field	actual multislot class
0 0	8	30
0 0	10, 23, 28, 29	39
0 0	11, 20, 25	32
0 0	12, 21, 22, 26, 27	33
0 0	Any other	Multislot Class field value
0 1	8	35
0 1	10, 19, 24	36
0 1	11, 23, 28, 29	45
0 1	12, 21, 22, 26, 27	38
0 1	Any other	Multislot Class field value
1 0	8	40
1 0	10, 19, 24	41
1 0	11, 20, 25	42
1 0	12, 23, 28, 29	44
1 0	Any other	Multislot Class field value
1 1	12, 21, 22, 26, 27	43
1 1	11, 20, 25	37
1 1	10, 19, 24	31
1 1	9, 23, 28, 29	34
1 1	Any other	Multislot Class field value

GERAN Iu Mode Capability (1 bit field)
Bit
0 GERAN Iu mode not supported
1 GERAN Iu mode supported

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Tdoc ⌘N1-031312

CR-Form-v7

CHANGE REQUEST

⌘ **24.008** **CR** **815** ⌘ **rev** **1** ⌘ Current version: **6.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [X]

Title:	⌘	CR on introduction of mobile station multislot power classes.
Source:	⌘	Ericsson, Nokia
Work item code:	⌘	TEI5
Date:	⌘	26/08/2003
Category:	⌘	**A**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	Addition of multislot power capability indication.
Summary of change:	⌘	Multislot power capability parameters added to Classmark 3 and MS RAC.
Consequences if not approved:	⌘	The mobile station could not indicate accurately uplink power capabilities for an uplink multislot configuration.

Clauses affected:	⌘	10.5.1.7, 10.55.12a			
Other specs affected:	⌘	Y: X / N:	Other core specifications	⌘	45.005
		Y: / N: X	Test specifications		
		Y: / N: X	O&M Specifications		
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

*** First modified section ***

10.5.1.7 Mobile Station Classmark 3

The purpose of the *Mobile Station Classmark 3* information element is to provide the network with information concerning aspects of the mobile station. The contents might affect the manner in which the network handles the operation of the mobile station. The Mobile Station Classmark information indicates general mobile station characteristics and it shall therefore, except for fields explicitly indicated, be independent of the frequency band of the channel it is sent on.

The *MS Classmark 3* is a type 4 information element with a maximum of 14 octets length.

The value part of a *MS Classmark 3* information element is coded as shown in figure 10.5.7/3GPP TS 24.008 and table 10.5.7/3GPP TS 24.008.

NOTE: The 14 octet limit is so that the CLASSMARK CHANGE message will fit in one layer 2 frame.

SEMANTIC RULE: a multiband mobile station shall provide information about all frequency bands it can support. A single band mobile station shall not indicate the band it supports in the *Multiband Supported, GSM 400 Bands Supported, GSM 700 Associated Radio Capability, GSM 850 Associated Radio Capability or GSM 1900 Associated Radio Capability* fields in the MS Classmark 3. Due to shared radio frequency channel numbers between GSM 1800 and GSM 1900, the mobile should indicate support for either GSM 1800 band OR GSM 1900 band.

SEMANTIC RULE: a mobile station shall include the MS Measurement Capability field if the *Multi Slot Class* field contains a value of 19 or greater (see 3GPP TS 45.002 [32]).

Typically, the number of spare bits at the end is the minimum to reach an octet boundary. The receiver may add any number of bits set to "0" at the end of the received string if needed for correct decoding.

```
<Classmark 3 Value part> ::=
    < spare bit >
    {    < Multiband supported : { 000 } >
             < A5 bits >
    |    < Multiband supported : { 101 | 110 } >
             < A5 bits >
             < Associated Radio Capability 2 : bit(4) >
             < Associated Radio Capability 1 : bit(4) >
    |    < Multiband supported : { 001 | 010 | 100 } >
             < A5 bits >
             < spare bit >(4)
             < Associated Radio Capability 1 : bit(4) > }
    { 0 | 1 < R Support > }
    { 0 | 1 < HSCSD Multi Slot Capability > }
    < UCS2 treatment: bit >
    < Extended Measurement Capability : bit >
    { 0 | 1 < MS measurement capability > }
    { 0 | 1 < MS Positioning Method Capability > }
    { 0 | 1 < ECSD Multi Slot Capability > }
    { 0 | 1 < ECSD Struct > }
    { 0 | 1 < GSM 400 Bands Supported : { 01 | 10 | 11 } >
             < GSM 400 Associated Radio Capability: bit(4) > }

    { 0 | 1 <GSM 850 Associated Radio Capability : bit(4) > }
    { 0 | 1 <GSM 1900 Associated Radio Capability : bit(4) > }
    < UMTS FDD Radio Access Technology Capability : bit >
    < UMTS 3.84 Mcps TDD Radio Access Technology Capability : bit >
    < CDMA 2000 Radio Access Technology Capability : bit >

    { 0 | 1  < DTM GPRS Multi Slot Class : bit(2) >
             < MAC Mode Support : bit >
             {0 | 1< DTM EGPRS Multi Slot Class : bit(2) > } }
    { 0 | 1 < Single Band Support > } -- Release 4 starts here:
    { 0 | 1 <GSM 700 Associated Radio Capability : bit(4)>}

    < UMTS 1.28 Mcps TDD Radio Access Technology Capability : bit >
    < GERAN Feature Package 1 : bit >

    { 0 | 1 < Extended DTM GPRS Multi Slot Class : bit(2) >
             < Extended DTM EGPRS Multi Slot Class : bit(2) > }

    { 0 | 1 < High Multislot Capability : bit(2) > }---Release 5 starts here.

    < GERAN Iu Mode Capability : bit >
    < GERAN Feature Package 2 : bit >

    { 0 | 1  < GMSK_MULTISLOT_POWER_PROFILE : bit (2) >
             < 8-PSK_MULTISLOT_POWER_PROFILE : bit (2) > }

    { 0 | 1 < T-GSM 400 Bands Supported : { 01 | 10 | 11 } >
             < T-GSM 400 Associated Radio Capability: bit(4) > }

    { 0 | 1 < T-GSM 900 Associated Radio Capability: bit(4) > }

    < spare bit > ;

< A5 bits > ::=
    < A5/7 : bit > < A5/6 : bit > < A5/5 : bit > < A5/4 : bit >  ;

<R Support>::=
    < R-GSM band Associated Radio Capability : bit(3) > ;

< HSCSD Multi Slot Capability > ::=
    < HSCSD Multi Slot Class : bit(5) >  ;

< MS Measurement capability > ::=
```

```
    < SMS_VALUE : bit (4) >
    < SM_VALUE : bit (4) > ;

< MS Positioning Method Capability > ::=
    < MS Positioning Method : bit(5) > ;

< ECSD Multi Slot Capability > ::=
    < ECSD Multi Slot Class : bit(5) > ;

 < ECSD Struct> : :=
    < Modulation Capability : bit >
    { 0 | 1 < EDGE RF Power Capability 1: bit(2) > }
    { 0 | 1 < EDGE RF Power Capability 2: bit(2) > }

< Single Band Support > ::=
    < GSM Band : bit (4) > ;
```

Figure 10.5.7/3GPP TS 24.008 *Mobile Station Classmark 3* information element

Table 10.5.7/3GPP TS 24.008: *Mobile Station Classmark 3* information element

Multiband Supported (3 bit field)

Band 1 supported
Bit 1
0 P-GSM not supported
1 P-GSM supported

Band 2 supported
Bit 2
0 E-GSM or R-GSM not supported
1 E-GSM or R-GSM supported

Band 3 supported
Bit 3
0 GSM 1800 not supported
1 GSM 1800 supported

The indication of support of P-GSM band or E-GSM or R-GSM band is mutually exclusive.

When the 'Band 2 supported' bit indicates support of E-GSM or R-GSM, the presence of the <R Support> field, see below, indicates if the E-GSM or R-GSM band is supported.

In this version of the protocol, the sender indicates in this field either none, one or two of these 3 bands supported.

For single band mobile station or a mobile station supporting none of the GSM 900 bands(P-GSM, E-GSM and R-GSM) and GSM 1800 bands, all bits are set to 0.

A5/4
0 Encryption algorithm A5/4 not available
1 Encryption algorithm A5/4 available

A5/5
0 Encryption algorithm A5/5 not available
1 Encryption algorithm A5/5 available

A5/6
0 Encryption algorithm A5/6 not available
1 Encryption algorithm A5/6 available

A5/7
0 Encryption algorithm A5/7 not available
1 Encryption algorithm A5/7 available

Associated Radio capability 1 and 2 (4 bit fields)

If either of P-GSM or E-GSM or R-GSM is supported, the radio capability 1 field indicates the radio capability for P-GSM, E-GSM or R-GSM, and the radio capability 2 field indicates the radio capability for GSM 1800 if supported, and is spare otherwise.

If none of P-GSM or E-GSM or R-GSM are supported, the radio capability 1 field indicates the radio capability for GSM 1800, and the radio capability 2 field is spare.

The radio capability contains the binary coding of the power class associated with the band indicated in multiband support bits (see 3GPP TS 45.005 [33]).

(continued...)

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

R-GSM band Associated Radio Capability (3 bit field)

In case where the R-GSM band is supported the R-GSM band associated radio capability field contains the binary coding of the power class associated (see 3GPP TS 45.005) (regardless of the number of GSM bands supported). A mobile station supporting the R-GSM band shall also when appropriate, (see 10.5.1.6) indicate its support in the 'FC' bit in the Mobile Station Classmark 2 information element.

NOTE: The coding of the power class for P-GSM, E-GSM, R-GSM and GSM 1800 in radio capability 1 and/or 2 is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

HSCSD Multi Slot Class (5 bit field)

In case the MS supports the use of multiple timeslots for HSCSD then the HSCSD Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

UCS2 treatment (1 bit field)

This information field indicates the likely treatment by the mobile station of UCS2 encoded character strings. If not included, the value 0 shall be assumed by the receiver.

0 the ME has a preference for the default alphabet (defined in 3GPP TS 23.038 [8b]) over UCS2.
1 the ME has no preference between the use of the default alphabet and the use of UCS2.

Extended Measurement Capability (1 bit field)

This bit indicates whether the mobile station supports 'Extended Measurements' or not

0 the MS does not support Extended Measurements
1 the MS supports Extended Measurements

SMS_VALUE (Switch-Measure-Switch) (4 bit field)
The SMS field indicates the time needed for the mobile station to switch from one radio channel to another, perform a neighbour cell power measurement, and the switch from that radio channel to another radio channel.
Bits

4 3 2 1	
0 0 0 0	1/4 timeslot (~144 microseconds)
0 0 0 1	2/4 timeslot (~288 microseconds)
0 0 1 0	3/4 timeslot (~433 microseconds)
. . .	
1 1 1 1	16/4 timeslot (~2307 microseconds)

SM_VALUE (Switch-Measure) (4 bit field)
The SM field indicates the time needed for the mobile station to switch from one radio channel to another and perform a neighbour cell power measurement.
Bits

4 3 2 1	
0 0 0 0	1/4 timeslot (~144 microseconds)
0 0 0 1	2/4 timeslot (~288 microseconds)
0 0 1 0	3/4 timeslot (~433 microseconds)
. . .	
1 1 1 1	16/4 timeslot (~2307 microseconds)

MS Positioning Method (5 bit field)
This field indicates the Positioning Method(s) supported by the mobile station for the provision of location services (LCS) via the CS domain in A-mode.
MS assisted E-OTD
Bit 5

0 MS assisted E-OTD not supported
1 MS assisted E-OTD supported

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

MS based E-OTD
Bit 4
0 MS based E-OTD not supported
1 MS based E-OTD supported

MS assisted GPS
Bit 3
0 MS assisted GPS not supported
1 MS assisted GPS supported

MS based GPS
Bit 2
0 MS based GPS not supported
1 MS based GPS supported

MS Conventional GPS
Bit 1
0 conventional GPS not supported
1 conventional GPS supported

ECSD Multi Slot class (5 bit field)

In case the **ECSD** MS supports the use of multiple timeslots and the number of supported time slots is different from number of time slots supported for GMSK then the **ECSD** Multi Slot class field is included and is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

Modulation Capability

The Modulation Capability field indicates the modulation scheme the MS supports in addition to GMSK.
0 8-PSK supported for downlink reception only
1 8-PSK supported for uplink transmission and downlink reception

EDGE RF Power Capability 1 (2 bit field)
If 8-PSK modulation is supported for both uplink and downlink, the **EDGE RF Power Capability 1** field indicates the radio capability for 8-PSK modulation in GSM 400, GSM 700, GSM 850 or GSM 900.

EDGE RF Power Capability 2 (2 bit field)
If 8-PSK modulation is supported for both uplink and downlink, the **EDGE RF Power Capability 2** field indicates the radio capability for 8-PSK modulation in GSM 1800 or GSM 1900 if supported, and is not included otherwise.

The respective **EDGE RF Power Capability 1** and **EDGE RF Power Capability 2** fields contain the following coding of the 8-PSK modulation power class (see 3GPP TS 45.005 [33]):

Bits 2 1	
0 0	Reserved
0 1	Power class E1
1 0	Power class E2
1 1	Power class E3

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

GSM 400 Bands Supported (2 bit field)
See the semantic rule for the sending of this field.
Bits

2	1	
0	1	GSM 480 supported, GSM 450 not supported
1	0	GSM 450 supported, GSM 480 not supported
1	1	GSM 450 supported, GSM 480 supported

GSM 400 Associated Radio Capability (4 bit field)
If either GSM 450 or GSM 480 or both is supported, the GSM 400 Associated Radio Capability field indicates the radio capability for GSM 450 and/or GSM 480.

The radio capability contains the binary coding of the power class associated with the band indicated in GSM 400 Bands Supported bits (see 3GPP TS 45.005 [33]).

NOTE: The coding of the power class for GSM 450 and GSM 480 in GSM 400 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

GSM 850 Associated Radio Capability (4 bit field)
See the semantic rule for the sending of this field.
This field indicates whether GSM 850 band is supported and its associated radio capability.

The radio capability contains the binary coding of the power class associated with the GSM 850 band (see 3GPP TS 45.005 [33]).

Note: the coding of the power class for GSM 850 in GSM 850 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

GSM 1900 Associated Radio Capability (4 bit field)
See the semantic rule for the sending of this field.
This field indicates whether GSM 1900 band is supported and its associated radio capability.

The radio capability contains the binary coding of the power class associated with the GSM 1900 band (see 3GPP TS 45.005 [33]).

Note: the coding of the power class for GSM 1900 in GSM 1900 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

Table 10.5.1.7/3GPP TS 24.008 (continued): *MS Classmark 3* information element

UMTS FDD Radio Access Technology Capability (1 bit field)
0 UMTS FDD not supported
1 UMTS FDD supported

UMTS 3.84 Mcps TDD Radio Access Technology Capability (1 bit field)
0 UMTS 3.84 Mcps TDD not supported
1 UMTS 3.84 Mcps TDD supported

CDMA 2000 Radio Access Technology Capability (1 bit field)
0 CDMA2000 not supported
1 CDMA2000 supported

DTM GPRS Multi Slot Class (2 bit field)
This field indicates the DTM GPRS multislot capabilities of the MS. It is coded as follows:
Bit
2 1
0 0 Multislot class 1 supported
0 1 Multislot class 5 supported
1 0 Multislot class 9 supported
1 1 Reserved for future extension. If received, the network shall interpret this as '00'

MAC Mode Support (1 bit field)
This field indicates whether the MS supports Dynamic and Fixed Allocation or only supports Exclusive Allocation. It is coded as follows:

0 Dynamic and Fixed Allocation not supported
1 Dynamic and Fixed allocation supported

DTM EGPRS Multi Slot Class (2 bit field)
This field indicates the DTM EGPRS multislot capabilities of the MS. This field shall be included only if the mobile station supports EGPRS DTM. This field is coded as the DTM GPRS Multi Slot Class field.

Single Band Support
This field shall be sent if the mobile station supports UMTS and one and only one GSM band with the exception of R-GSM; this field shall not be sent otherwise

GSM Band (4 bit field)
Bits
4 3 2 1
0 0 0 0 E-GSM is supported
0 0 0 1 P-GSM is supported
0 0 1 0 GSM 1800 is supported
0 0 1 1 GSM 450 is supported
0 1 0 0 GSM 480 is supported
0 1 0 1 GSM 850 is supported
0 1 1 0 GSM 1900 is supported
0 1 1 1 GSM 700 is supported
All other values are reserved for future use.

NOTE: When this field is received, the associated RF power capability is found in Classmark 1 or 2.

GSM 700 Associated Radio Capability (4 bit field)

See the semantic rule for the sending of this field.
This field indicates whether GSM 700 band is supported and its associated radio capability.

The radio capability contains the binary coding of the power class associated with the GSM 700 band (see 3GPP TS 45.005 [33]).

NOTE: The coding of the power class for GSM 700 in GSM 700 Associated Radio Capability is different to that used in the Mobile Station Classmark 1 and Mobile Station Classmark 2 information elements.

UMTS 1.28 Mcps TDD Radio Access Technology Capability (1 bit field)
0 UMTS 1.28 Mcps TDD not supported
1 UMTS 1.28 Mcps TDD supported

GERAN Feature Package 1 (1 bit field)
This field indicates whether the MS supports the GERAN Feature Package 1 (see 3GPP TS 44.060). It is coded as follows:

0 GERAN feature package 1 not supported.
1 GERAN feature package 1 supported.

Extended DTM GPRS Multi Slot Class (2 bit field)
This field indicates the extended DTM GPRS multislot capabilities of the MS and shall be interpreted in conjunction with the DTM GPRS Multi Slot Class field. It is coded as follows, where 'DGMSC' denotes the DTM GPRS Multi Slot Class field:

DGMSC Bit 2 1	Bit 2 1	
0 0	0 0	Multislot class 2 supported
0 0	0 1	Multislot class 3 supported
0 0	1 0	Multislot class 4 supported
0 0	1 1	Multislot class 8 supported
0 1	0 0	Multislot class 5 supported
0 1	0 1	Multislot class 6 supported
0 1	1 0	Multislot class 7 supported
0 1	1 1	Not used. If received, the network shall interpret it as '(01) 00'.
1 0	0 0	Multislot class 9 supported
1 0	0 1	Multislot class 10 supported
1 0	1 0	Multislot class 11 supported
1 0	1 1	Multislot class 12 supported

The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink.When this field is not present, the MS supports the multislot class indicated by the *DTM GPRS Multi Slot Class field*.

Extended DTM EGPRS Multi Slot Class (2 bit field)
This field is not considered when the DTM EGPRS Multi Slot Class field is not included. This field indicates the extended DTM EGPRS multislot capabilities of the MS and shall be interpreted in conjunction with the DTM EGPRS Multi Slot Class field. This field is coded as the Extended DTM GPRS Multi Slot Class field. The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink. When this field is not present, the MS supports the multislot class indicated by the *DTM GPRS Multi Slot Class* field.

High Multislot Capability (2 bit field)
This field indicates the support of multislot classes 30 to 45, see 3GPP TS 45.002.
The High Multislot Capability is individually combined with each multislot class field sent by the MS (the possible multislot class fields are: HSCSD multislot class, ECSD multislot class, GPRS multislot class, EGPRS multislot class, DTM GPRS multislot class, DTM EGPRS multislot class, extended DTM GPRS multislot class and extended DTM EGPRS multislot class) to extend the related multislot class with the rule described in the MS Radio Access Capability IE.

GERAN Iu Mode Capability (1 bit field)
Bit
0 GERAN Iu mode not supported
1 GERAN Iu mode supported

GERAN Feature Package 2 (1 bit field)
This field indicates the MS support of the GERAN Feature Package 2. The GERAN Feature Package 2 includes **Enhanced Power Control (EPC)** (see 3GPP TS 45.008).

0 GERAN feature package 2 not supported.
1 GERAN feature package 2 supported.

*** Next modified section ***

10.5.5.12a MS Radio Access capability

The purpose of the *MS RA capability* information element is to provide the radio part of the network with information concerning radio aspects of the mobile station. The contents might affect the manner in which the network handles the operation of the mobile station.

The *MS RA capability* is a type 4 information element, with a maximum length of 52 octets.

The value part of a *MS RA capability* information element is coded a shown table 10.5.146/3GPP TS 24.008.

For the indication of the Access Technology Types the following conditions shall apply:

- Among the three Access Type Technologies GSM 900-P, GSM 900-E and GSM 900-R only one shall be present.
- Due to shared radio frequency channel numbers between GSM 1800 and GSM 1900, the mobile station should provide the relevant radio access capability for either GSM 1800 band OR GSM 1900 band, not both.
- The MS shall indicate its supported Access Technology Types during a single MM procedure.
- If the alternative coding by using the Additional access technologies struct is chosen by the mobile station, the mobile station shall indicate its radio access capability for the serving BCCH frequency band in the first included Access capabilities struct.

- The first Access Technology Type shall not be set to "1111".

For error handling the following shall apply:

- If a received Access Technology Type is unknown to the receiver, it shall ignore all the corresponding fields.
- If within a known Access Technology Type a receiver recognizes an unknown field it shall ignore it.
- For more details about error handling of MS radio access capability see 3GPP TS 48.018 [86].

Table 10.5.146/3GPP TS 24.008: *Mobile Station Radio Access Capability* Information Element

<**MS RA capability value part** : < MS RA capability value part struct >>
<spare bits>**; -- *may be used for future enhancements*

<MS RA capability value part struct >::= --*recursive structure allows any number of Access technologies*
{ { < **Access Technology Type**: bit (4) > exclude 1111
< **Access capabilities** : <Access capabilities struct> > }

| { < **Access Technology Type**: bit (4) == 1111 > -- *structure adding Access technologies with same capabilities*
< **Length** : bit (7) > -- *length in bits of list of Additional access technologies and spare bits*
{ 1 < **Additional access technologies**: < Additional access technologies struct > > } ** 0
<spare bits>** } }

{ 0 | 1 <MS RA capability value part struct> } ;

< Additional access technologies struct > ::=
< **Access Technology Type** : bit (4) >
< **GMSK Power Class** : bit (3) >
< **8PSK Power Class** : bit (2) > ;

< Access capabilities struct > ::=
< **Length** : bit (7) > -- length in bits of Content and spare bits
<Access capabilities : <Content>>
<spare bits>** ; -- expands to the indicated length
-- may be used for future enhancements

< Content > ::=
< **RF Power Capability** : bit (3) >
{ 0 | 1 <**A5 bits** : <A5 bits> > } -- *zero means that the same values apply for parameters as in the immediately preceding Access capabilities field within this IE*
< **ES IND** : bit >
< **PS** : bit >
< **VGCS** : bit >
< **VBS** : bit >
{ 0 | 1 < **Multislot capability** : Multislot capability struct > } -- *zero means that the same values for multislot parameters as given in an earlier Access capabilities field within this IE apply also here*
-- *Additions in release 99*
{ 0 | 1 < **8PSK Power Capability** : bit(2) >} -- *'1' also means 8PSK modulation capability in uplink.*
< **COMPACT Interference Measurement Capability : bit >**
< **Revision Level Indicator** : bit >
< **UMTS FDD Radio Access Technology Capability** : bit > -- *3G RAT*
< **UMTS 3.84 Mcps TDD Radio Access Technology Capability** : bit > -- *3G RAT*
< **CDMA 2000 Radio Access Technology Capability** : bit > -- *3G RAT*
-- *Additions in release 4*
< **UMTS 1.28 Mcps TDD Radio Access Technology Capability**: bit > -- *3G RAT*
< **GERAN Feature Package 1** : bit >
{ 0 | 1 < **Extended DTM GPRS Multi Slot Class** : bit(2) >
< **Extended DTM EGPRS Multi Slot Class** : bit(2) > }
< Modulation based multislot class support : bit >
-- *Additions in release 5*
{ 0 | 1 < **High Multislot Capability** : bit(2) > }
< **GERAN Iu Mode Capability** : bit >~~;~~
{ 0 | 1 < GMSK_MULTISLOT_POWER_PROFILE : bit (2) >
< 8-PSK_MULTISLOT_POWER_PROFILE : bit (2) > };

-- error: struct too short, assume features do not exist
-- error: struct too long, ignore data and jump to next Access technology

Table 10.5.146/3GPP TS 24.008 (continued): *Mobile Station Radio Access Capability* IE

< Multislot capability struct > ::=
{ 0 | 1 < **HSCSD multislot class** : bit (5) > }
{ 0 | 1 < **GPRS multislot class** : bit (5) > < **GPRS Extended Dynamic Allocation Capability** : bit > }
{ 0 | 1 < **SMS_VALUE** : bit (4) > < **SM_VALUE** : bit (4) > }
-- *Additions in release 99*
{ 0 | 1 < **ECSD multislot class** : bit (5) > }
{ 0 | 1 < **EGPRS multislot class** : bit (5) > < **EGPRS Extended Dynamic Allocation Capability** : bit > }
{0 | 1 < **DTM GPRS Multi Slot Class**: bit(2)>
<MAC Mode Support : bit>
{0 | 1 <**DTM EGPRS Multi Slot Class** : bit(2)> } } ;
-- error: struct too short, assume features do not exist

<A5 bits> ::= < A5/1 : bit> <A5/2 : bit> <A5/3 : bit> <A5/4 : bit> <A5/5 : bit> <A5/6 : bit> <A5/7 : bit>; -- bits for circuit mode ciphering algorithms. These fields are not used by the network and may be excluded by the MS.

Access Technology Type
This field indicates the access technology type to be associated with the following access capabilities.

Bits
4 3 2 1
0 0 0 0 GSM P
0 0 0 1 GSM E --*note that GSM E covers GSM P*
0 0 1 0 GSM R --*note that GSM R covers GSM E and GSM P*
0 0 1 1 GSM 1800
0 1 0 0 GSM 1900
0 1 0 1 GSM 450
0 1 1 0 GSM 480
0 1 1 1 GSM 850
1 0 0 0 GSM 700
1 0 0 1 GSM T 380
1 0 1 0 GSM T 410
1 0 1 1 GSM T 900
1 1 1 1 Indicates the presence of a list of Additional access technologies
All other values are treated as unknown by the receiver.

A MS which does not support any GSM access technology type shall set this field to '0000'.

RF Power Capability, GMSK Power Class (3 bit field)
This field contains the binary coding of the power class used for GMSK associated with the indicated Access Technology Type (see 3GPP TS 45.005).

A MS which does not support any GSM access technology type shall set this field to '000'.

8PSK Power Capability (2 bit field)
If 8-PSK modulation is supported for uplink, this field indicates the radio capability for 8-PSK modulation. The following coding is used (see 3GPP TS 45.005 [33]):
Bits 2 1
0 0 Reserved
0 1 Power class E1
1 0 Power class E2
1 1 Power class E3

8PSK Power Class (2 bit field)
This field indicates the radio capability for 8-PSK modulation. The following coding is used (see 3GPP TS 45.005):
Bits 2 1
0 0 8PSK modulation not supported for uplink
0 1 Power class E1
1 0 Power class E2
1 1 Power class E3

Additional access technologies struct
This structure contains the GMSK Power Class and 8PSK Power Class for an additional Access Technology. All other capabilities for this indicated Access Technology are the same as the capabilities indicated by the preceding Access capabilities struct.

A5/1
0 encryption algorithm A5/1 not available
1 encryption algorithm A5/1 available
A5/2
0 encryption algorithm A5/2 not available
1 encryption algorithm A5/2 available
A5/3
0 encryption algorithm A5/3 not available
1 encryption algorithm A5/3 available
A5/4
0 encryption algorithm A5/4 not available
1 encryption algorithm A5/4 available
A5/5
0 encryption algorithm A5/5 not available
1 encryption algorithm A5/5 available
A5/6
0 encryption algorithm A5/6 not available
1 encryption algorithm A5/6 available
A5/7
0 encryption algorithm A5/7 not available
1 encryption algorithm A5/7 available

ES IND – (Controlled early Classmark Sending)
0 "controlled early Classmark Sending" option is not implemented
1 "controlled early Classmark Sending" option is implemented

Table 10.5.146/3GPP TS 24.008 (concluded): *Mobile Station Radio Access Capability* IE

PS – (Pseudo Synchronisation)
0 PS capability not present
1 PS capability present

VGCS – (Voice Group Call Service)
0 no VGCS capability or no notifications wanted
1 VGCS capability and notifications wanted.

VBS – (Voice Broadcast Service)
0 no VBS capability or no notifications wanted
1 VBS capability and notifications wanted

HSCSD Multi Slot Class
The Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32]. This field is not used by the network and may be excluded by the MS.
Range 1 to 18, all other values are reserved.

GPRS Multi Slot Class
The GPRS Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

ECSD Multi Slot Class
The presence of this field indicates ECSD capability. Whether the MS is capable of 8-PSK modulation in uplink is indicated by the presence of 8-PSK Power Capability field. The Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32]. This field is not used by the network and may be excluded by the MS.
Range 1 to 18, all other values are reserved.

EGPRS Multi Slot Class
The presence of this field indicates EGPRS capability. Whether the MS is capable of 8-PSK modulation in uplink is indicated by the presence of 8-PSK Power Capability field. The EGPRS Multi Slot Class field is coded as the binary representation of the multislot class defined in 3GPP TS 45.002 [32].

GPRS Extended Dynamic Allocation Capability
0 Extended Dynamic Allocation Capability for GPRS is not implemented
1 Extended Dynamic Allocation Capability for GPRS is implemented

EGPRS Extended Dynamic Allocation Capability
0 Extended Dynamic Allocation Capability for EGPRS is not implemented
1 Extended Dynamic Allocation Capability for EGPRS is implemented

SMS_VALUE (Switch-Measure-Switch) (4 bit field)
The SMS field indicates the time needed for the mobile station to switch from one radio channel to another, perform a neighbor cell power measurement, and the switch from that radio channel to another radio channel. This field is not used by the network and may be excluded by the MS.
Bits
4 3 2 1
0 0 0 0 1/4 timeslot (~144 microseconds)
0 0 0 1 2/4 timeslot (~288 microseconds)
0 0 1 0 3/4 timeslot (~433 microseconds)
. . .
1 1 1 1 16/4 timeslot (~2307 microseconds)

(SM_VALUE) Switch-Measure (4 bit field)
The SM field indicates the time needed for the mobile station to switch from one radio channel to another and perform a neighbour cell power measurement. This field is not used by the network and may be excluded by the MS.
Bits
4 3 2 1
0 0 0 0 1/4 timeslot (~144 microseconds)
0 0 0 1 2/4 timeslot (~288 microseconds)
0 0 1 0 3/4 timeslot (~433 microseconds)
. . .
1 1 1 1 16/4 timeslot (~2307 microseconds)

DTM GPRS Multi Slot Class (2 bit field)
This field indicates the GPRS DTM multislot capabilities of the MS. It is coded as follows:

Bits 2 1	
0 0	Multislot class 1 supported
0 1	Multislot class 5 supported
1 0	Multislot class 9 supported
1 1	Reserved for future extension. If received, the network shall interpret this as '00'

MAC Mode Support (1 bit field)
This field indicates whether the MS supports Dynamic and Fixed Allocation or only supports Exclusive Allocation

Bit	
0	Dynamic and Fixed Allocation not supported
1	Dynamic and Fixed allocation supported

DTM EGPRS Multi Slot Class (2 bit field)
This field indicates the DTM EGPRS multislot capabilities of the MS. This field shall be included only if the mobile station supports EGPRS DTM. This field is coded as the DTM GPRS multislot Class field.

COMPACT Interference Measurement Capability (1 bit field)

0	COMPACT Interference Measurement Capability is not implemented
1	COMPACT Interference Measurement Capability is implemented

Revision Level Indicator (1 bit field)

Bit	
0	The ME is Release '98 or older
1	The ME is Release '99 onwards

UMTS FDD Radio Access Technology Capability (1 bit field)

Bit	
0	UMTS FDD not supported
1	UMTS FDD supported

UMTS 3.84 Mcps TDD Radio Access Technology Capability (1 bit field)

Bit	
0	UMTS 3.84 Mcps TDD not supported
1	UMTS 3.84 Mcps TDD supported

CDMA 2000 Radio Access Technology Capability (1 bit field)

Bit	
0	CDMA 2000 not supported
1	CDMA 2000 supported

UMTS 1.28 Mcps TDD Radio Access Technology Capability (1 bit field)

Bit	
0	UMTS 1.28 Mcps TDD not supported
1	UMTS 1.28 Mcps TDD supported

GERAN Feature Package 1 (1 bit field)
This field indicates whether the MS supports the GERAN Feature Package 1 (see 3GPP TS 44.060). It is coded as follows:

0	GERAN feature package 1 not supported.
1	GERAN feature package 1 supported.

Extended DTM GPRS Multi Slot Class (2 bit field)
This field indicates the extended DTM GPRS capabilities of the MS and shall be interpreted in conjunction with the DTM GPRS Multi Slot Class field. It is coded as follows, where 'DGMSC' denotes the DTM GPRS multislot class field:

DGMSC Bit	2 1	**Bit 2 1**	
	0 0	**0 0**	Multislot class 2 supported
	0 0	**0 1**	Multislot class 3 supported
	0 0	**1 0**	Multislot class 4 supported
	0 0	**1 1**	Multislot class 8 supported
	0 1	**0 0**	Multislot class 5 supported
	0 1	**0 1**	Multislot class 6 supported
	0 1	**1 0**	Multislot class 7 supported
	0 1	**1 1**	Not used. If received, the network shall interpret it as '01 **00**'.

1 0	**0 0**	Multislot class 9 supported
1 0	**0 1**	Multislot class 10 supported
1 0	**1 0**	Multislot class 11 supported
1 0	**1 1**	Multislot class 12 supported

The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink. When this field is not present, the MS supports the multislot class indicated by the *DTM GPRS Multi Slot Class* field.

Extended DTM EGPRS Multislot Class (2 bit field)
This field is not considered when the DTM EGPRS Multislot Class field is not included. This field indicates the extended DTM EGPRS multislot capabilities of the MS and shall be interpreted in conjunction with the DTM EGPRS Multislot Class field. This field is coded as the Extended DTM GPRS Multislot Class field. The presence of this field indicates that the MS supports combined fullrate and halfrate GPRS channels in the downlink. When this field is not present, the MS supports the multislot class indicated by the DTM GPRS Multi Slot Class field.

Modulation based multislot class support (1 bit field)
Bit
0 "Modulation based multislot class" not supported
1 "Modulation based multislot class" supported

High Multislot Capability (2 bit field)
The High Multislot Capability is individually combined with each multislot class field sent by the MS (the possible multislot class fields are: HSCSD multislot class, ECSD multislot class, GPRS multislot class, EGPRS multislot class, DTM GPRS multislot class, DTM EGPRS multislot class, extended DTM GPRS multislot class and extended DTM EGPRS multislot class) to extend the related multislot class to multislot classes 30 to 45, see 3GPP TS 45.002.
For each multislot class, the following mapping is done:
Bits

2 1	coded multislot class field	actual multislot class
0 0	8	30
0 0	10, 23, 28, 29	39
0 0	11, 20, 25	32
0 0	12, 21, 22, 26, 27	33
0 0	Any other	Multislot Class field value
0 1	8	35
0 1	10, 19, 24	36
0 1	11, 23, 28, 29	45
0 1	12, 21, 22, 26, 27	38
0 1	Any other	Multislot Class field value
1 0	8	40
1 0	10, 19, 24	41
1 0	11, 20, 25	42
1 0	12, 23, 28, 29	44
1 0	Any other	Multislot Class field value
1 1	12, 21, 22, 26, 27	43
1 1	11, 20, 25	37
1 1	10, 19, 24	31
1 1	9, 23, 28, 29	34
1 1	Any other	Multislot Class field value

GERAN Iu Mode Capability (1 bit field)
Bit
0 GERAN Iu mode not supported
1 GERAN Iu mode supported