Technical Document – Confidential

GSM GENERAL PACKET RADIO SERVICES

MESSAGE SEQUENCE CHARTS

LLC

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[ISO 9000:2000] International Organization for Standardization. Quality management systems - Fundamentals and vocabulary. December 2000

1.1 References

[1] GSM 05.02 version 8.0.0 Release 1999
Digital cellular telecommunications system (Phase 2+);
Multiplexing and multiple access on the radio path

[2] GSM 04.60 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Mobile Station (MS) - Base Station System (BSS) interface;
Radio Link Control/ Medium Access Control (RLC/MAC) protocol

[3] GSM 04.08 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Mobile radio interface layer 3 specification

[4] GSM 03.64 version 6.1.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Overall description of the GPRS radio interface; Stage 2

[5] GSM 03.60 version 6.3.1 Release 1997
Digital cellular telecommunications system (Phase 2+);
General Packet Radio Service (GPRS);
Service description; Stage 2

[6] GSM 04.07 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Mobile radio interface signalling layer 3; General aspects

[7] GSM 04.64 version 6.7.0 Release 1997
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

[8] GSM 05.08 version 6.4.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Radio subsystem link control

[9] GSM 05.10 version 6.3.0 Release 1997
Digital cellular telecommunications system (Phase 2+);
Radio subsystem synchronization

[10] GSM 03.20 TS 100 929: July 1998 (GSM 03.20 version 6.0.1)
Security related network functions, ETSI

[11] Draft GSM 03.22: August 1998 (GSM 03.22 version 6.1.0)
Functions related to Mobile Station (MS) in idle mode and group receive mode, ETSI

[12] GSM 04.65 V6.3.0: Subnetwork Dependant Convergence Protocol
ETSI, March 1999

[13] ITU-T V42bis ITU-T, Recommendation V.42 bis 1990

[14] GSM 09.60 GPRS Tunneling Protocol (GTP) across the Gn and Gp Interface

[15] RFC 1661 IETF STD 51 July 1994
The Point-to-Point Protocol (PPP)

[16] RFC 1662 IETF STD 51 July 1994
PPP in HDLC-like Framing

[17] RFC 1570 January 1994
PPP LCP Extensions

[18] RFC 1989 August 1996
PPP Link Quality Monitoring

[19] RFC 1332 May 1992
The PPP Internet Protocol Control Protocol (IPCP)

[20] RFC 1877 December 1995
PPP IPCP Extensions for Name Server Addresses

[21] RFC 2153 May 1997
PPP Vendor Extensions

[22] RFC 1334 October 1992
PPP Authentication Protocols (for Password Authentication Protocol only)

[23] RFC 1994 August 1996
PPP Challenge Handshake Authentication Protocol (CHAP)

[24] TIA/EIA-136-370
Packet-Data Services – Enhanced General Packet Radio for TIA/EIA-136 (EGPRS-136) - Overview, Telecommunications Industry Association

[25] TIA/EIA-136-376
Packet-Data Services – EGPRS-136 Mobility Management, Telecommunications Industry Association

[26] TIA/EIA-136-972
Packet-Data Services – Stage 2 Description, Telecommunications Industry Association

1.2 Abbreviations

ACI Application Control Interface
AGCH Access Grant Channel
AT Attention sequence "AT" to indicate valid commands of the ACI

BCCH Broadcast Control Channel
BS Base Station
BSIC Base Station Identification Code

C/R Command/Response
C1 Path Loss Criterion
C2 Reselection Criterion
CBCH Cell Broadcast Channel
CBQ Cell Bar Qualify
CC Call Control
CCCH Common Control Channel
CCD Condat Coder Decoder
CCI Compression and Ciphering Interface
CHAP Challenge Handshake Authentication Protocol
CKSN Ciphering Key Sequence Number
CRC Cyclic Redundancy Check

DCCH Dedicated Control Channel
DCOMP Identifier of the user data compression algorithm used for the N-DPU
DISC Disconnect Frame
DL Data Link Layer
DM Disconnected Mode Frame
DTX Discontinuous Transmission

E Extension bit
EA Extension Bit Address Field
EL Extension Bit Length Field
EMMI Electrical Man Machine Interface

F Final Bit
FACCH Fast Associated Control Channel
FHO Forced Handover

GACI GPRS Application Control Interface
GMM GPRS Mobility Management
GP Guard Period
GRR GPRS RR
GSM Global System for Mobile Communication

HDLC High-level Data Link Control
HISR High level Interrupt Service Routine
HPLMN Home Public Land Mobile Network

I Information Frame
IMEI International Mobile Equipment Identity
IMSI International Mobile Subscriber Identity
IP Internet Protocol
IPCP Internet Protocol Control Protocol
ITU International Telecommunication Union
IWF Interworking Function

Kc Ciphering Key

L Length Indicator
LAI Location Area Information
LCP Link Control Protocol
LISR Low level Interrupt Service Routine

LLC	Logical Link Control
LPD	Link Protocol Discriminator
LQM	Link Quality Monitoring
M	More bit used to indicate the last segment of N-DPU
MAC	Medium Access Control
MCC	Mobile Country Code
MM	Mobility Management
MMI	Man Machine Interface
MNC	Mobile Network Code
MS	Mobile Station
MT	Mobile Termination
N(R)	Receive Number
N(S)	Send Number
NC	Network Control
NCC	National Colour Code
NCP	Network Control Protocol
NECI	New Establishment Causes included
N-PDU	Network Protocol Data Unit
NSAPI	Network Layer Service Access Point Identifier
OTD	Observed Time Difference
P	Poll Bit
P/F	Poll/Final Bit
PACCH	Packet Associated Control Channel
PAP	Password Authentication Protocol
PBCCH	Packet BCCH
PCCCH	Packet CCCH
PCOMP	Identifier of the protocol control information compression algorithm used for the N-DPU
PDCH	Packet Data Channel
PDP	Packet Data Protocol e.g. IP or X.25
PDTCH	Packet Data Traffic Channel
PRACH	Packet RACH
PSI	Packet System Information
PCH	Paging Channel
PCO	Point of Control and Observation
PDU	Protocol Data Unit
PL	Physical Layer
PLMN	Public Land Mobile Network
PPC	Packet Physical Convergence
PPP	Point-to-Point Protocol
PTP	Point to Point
QoS	Quality of Service
RACH	Random Access Channel
REJ	Reject Frame
RLC	Radio Link Control
RNR	Receive Not Ready Frame
RR	Radio Resource Management
RR	Receive Ready Frame
RTD	Real Time Difference
RTOS	Real Time Operating System
SABM	Set Asynchronous Balanced Mode
SACCH	Slow Associated Control Channel
SAP	Service Access Point
SAPI	Service Access Point Identifier
SDCCH	Stand alone Dedicated Control Channel
SDU	Service Data Unit
SGSN	Serving GPRS Support Node

SIM	Subscriber Identity Module
SM	Session Management
SMS	Short Message Service
SMSCB	Short Message Service Cell Broadcast
SNDCP	Subnetwork Dependant Convergence Protocol
SNSM	SNDCP-SM
SS	Supplementary Services
TAP	Test Application Program
TBF	Temporary Block Flow
TCH	Traffic Channel
TCH/F	Traffic Channel Full Rate
TCH/H	Traffic Channel Half Rate
TCP	Transmission Control Protocol
TDMA	Time Division Multiple Access
TE	Terminal Equipment - e. g. a PC
TFI	Temporary Flow Identifier
TLLI	Temporary Logical Link Identifier
TMSI	Temporary Mobile Subscriber Identity
TOM	Tunnelling of Messages
TQI	Temporary Queuing Identifier
UA	Unnumbered Acknowledgement Frame
UART	Universal Asynchronous Receiver Transmitter
UI	Unnumbered Information Frame
USF	Uplink State Flag
V(A)	Acknowledgement State Variable
V(R)	Receive State Variable
V(S)	Send State Variable
VPLMN	Visited Public Land Mobile Network

1.3 Terms

Entity:	Program which executes the functions of a layer
Message:	A message is a data unit which is transferred between the entities of the same layer (peer-to-peer) of the mobile and infrastructure side. Message is used as a synonym to protocol data unit (PDU). A message may contain several information elements.
Primitive:	A primitive is a data unit which is transferred between layers on one component (mobile station or infrastructure). The primitive has an operation code which identifies the primitive and its parameters.
Service Access Point:	A Service Access Point is a data interface between two layers on one component (mobile station or infrastructure).

2 Overview

The Protocol Stacks are used to define the functionality of the GSM protocols for interfaces. The GSM specifications are normative when used to describe the functionality of interfaces, but the stacks and the subdivision of protocol layers does not imply or restrict any implementation.

The protocol stack for GPRS consists of several entities. Each entity has one ore more service access points, over which the entity provides a service for the upper entity.

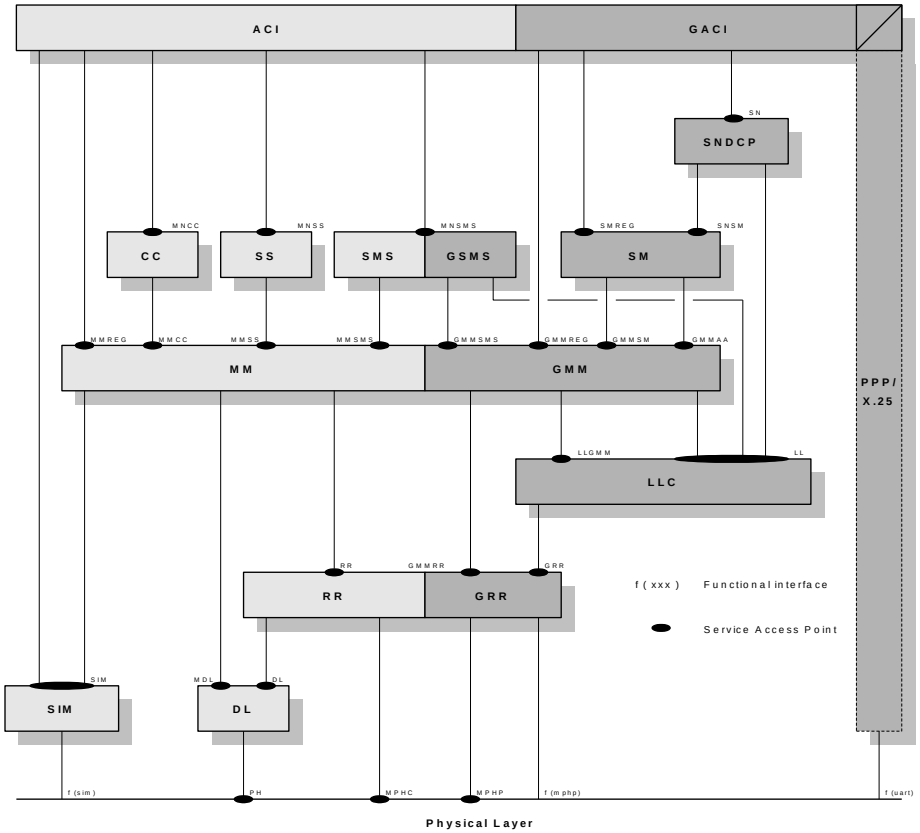


Figure 2-1: Architecture of the GSM/GPRS protocol stack

The information units passed via the SAPs are called primitives and consists of an operation code and several parameters. See the Users Guide for details.

The entities of the GPRS protocol stack are:

2.1 GRR (RLC/MAC) – Radio Link Control/Medium Access Control

This layer contains two functions: The Radio Link Control function provides a radio-solution-dependent reliable link. The Medium Access Control function controls the access signalling (request and grant) procedures for the radio channel, and the mapping of LLC frames onto the GSM physical channel.

2.2 LLC – Logical Link Control

The LLC entity provides multiple highly reliable logical links for asynchronous data transfer between the MS and the network. It supports variable-length information frames, acknowledged and unacknowledged data transfer, flow and sequence control, error detection and recovery, notification of unrecoverable errors, user identity confidentiality, and ciphering of user and signaling data.

2.3 GMM – GPRS Mobility Management

The GMM entity provides procedures for the mobility of the MS, such as informing the network of its present location, and user identity confidentiality. It manages the GMM context (attach, detach, routing area updating), supports security functions such as authentication of user and MS, controls ciphering of data, and initiates the response to paging messages.

2.4 SM – Session Management

The main function of the session management (SM) is to support PDP context handling of the user terminal. Session Management activates, modifies and deletes the contexts for packet data protocols (PDP). Session Management services are provided at the SMREG-SAP and the SNSM-SAP for anonymous and non-anonymous access. The non-anonymous and anonymous access procedures for PDP context activation and PDP context deactivation are available at the SMREG-SAP. In addition there exists a PDP context modification for non-anonymous PDP contexts.

2.5 SNDCP - Subnetwork Dependant Convergence Protocol

SNDCP carries out all functions related to transfer of Network layer Protocol Data Units (N-PDUs) over GPRS in a transparent way. SNDCP helps to improve channel efficiency 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.

2.6 GACI – GPRS Application Control Interface

The GACI is the GPRS extension of the ACI. It is specified in GSM 07.07 and 07.60. It is responsible for processing of the GPRS related AT Commands to setup, activate and deactivate the PDP context parameter. It also provides functionality for the interworking between GMM/SM/SNDCP and a packet oriented protocol like PPP.

2.7 USART - Universal Synchronous Asynchronous Receiver Transmitter Driver

The USART is a hardware component that facilitates a connection between the mobile station and terminal equipment (e.g. a PC). This interface uses some of the circuits described in V.24.

The data exchange provided by this unit is serial and asynchronous (synchronous communication is not in the scope of this document). A driver that uses interrupts to manage a circular buffer for the sending and receiving direction is necessary in order to use this component in the GPRS. The driver has to be able to perform flow control.

2.8 TOM – Tunnelling of Messages

The TOM entity is present if and only if HS136 is supported (the feature flag FF_HS136 is enabled).

The main function of TOM is to tunnel non-GSM signalling messages between the MS and the SGSN. The only non-GSM signalling which is currently supported by TOM is for the EGPRS-136 system (according to TIA/EIA-136-376). Data transfer

in both uplink and downlink direction is possible. Two different priorities (high, low) of signalling data transfer are supported. TOM uses the unacknowledged mode of LLC and the acknowledged mode of GRR (RLC/MAC).

3 Introduction

3.1 Modes

An LLE entity can be in one of two modes

- Asynchronous Balanced Mode (ABM)
- Asynchronous Disconnected Mode (ADM)

3.1.1 Asynchronous Balanced Mode (ABM)

This is the operational mode of the LLC layer. Commands can be sent at any time from either side without explicit permission of the other side. In ABM mode of operation, acknowledged information transfer is allowed.

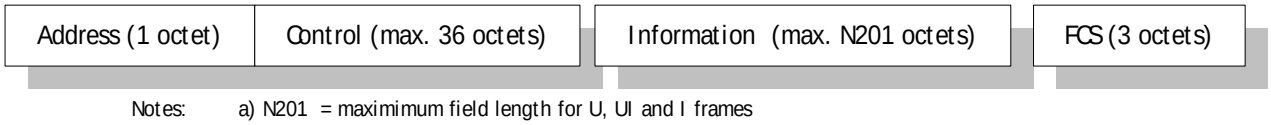
3.1.2 Asynchronous Disconnected Mode (ADM)

This is the disconnected mode of the LLC layer. The set of possible commands and responses is restricted to SABM, UA, DISC, DM, FRMR and XID. Data can be exchanged by unacknowledged information only. Acknowledged information transfer is limited to ABM.

3.2 Basic frame structure

The frame header shall consist of the address and control field, and is a minimum of 2 octets and a maximum of 37 octets. The address field consists of a single octet. The address field contains the SAPI. The control field typically consists of between one and three octets. The SACK supervisory frame also includes a variable-length bitmap field of up to 32 octets.

The information field (max. N201 octets) of a frame, when present, follows the control field.



Notes: a) N201 = maximimum field length for U, UI and I frames

Figure 3-1: Frame Structure

3.2.1 Order of transmission

Frames are transferred between the LLC layer and underlying protocol layers in units of octets, in ascending numerical octet order (i.e., octet 1, 2, ..., n-1, n).

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 then one octet, the order of bit values within each octet progressively decreases as the octet number increase. In that part of the field contained in a given octet the lowest bit number represents the lowest-order value.

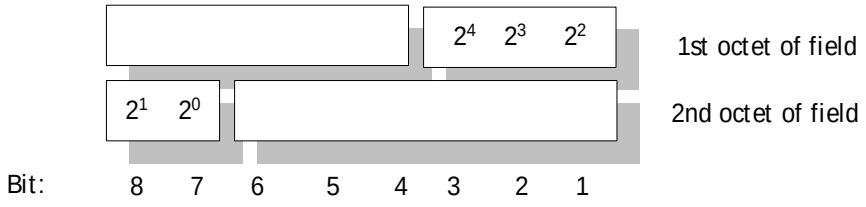


Figure 3-2: Field mapping convention

An exception to the preceding field mapping convention is the FCS field. In this case bit 1 of the first octets is the high-order bit and bit 8 of the last octet is the low-order bit.

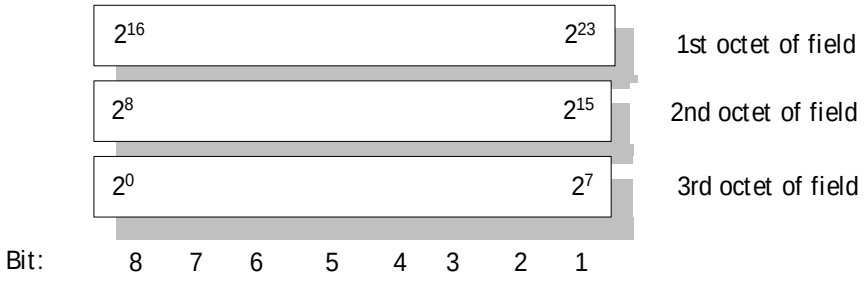


Figure 3-3: FCS mapping convention

3.2.2 Invalid Frames

An invalid frame is a frame that:

- contains fewer octets than necessary to include the address field, control field, information field, and FCS field necessary to constitute a complete frame to the contents of the control field;
- has the PD bit set to 1;
- contains a reserved SAPI, (i.e., SAPI = 0, 2, 4, 6, 8, 10, 12, 13, 14, 15); or
- contains an FCS error.

3.2.3 Address Field

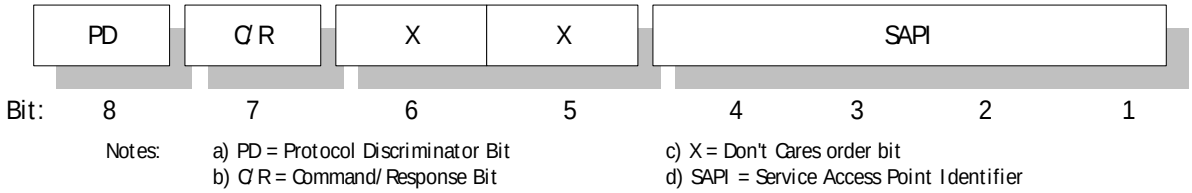


Figure 3-4: Address Field Structure

3.2.3.1 Protocol Discriminator bit, PD

The PD bit indicates whether a frame is an LCC frame or belongs to a different protocol. LCC frames shall have the PD bit set to 0. If a frame with the PD bit is set to 1 received, then it shall be treated as an invalid frame.

3.2.3.2 Command/response bit, C/R

This bit indicates, whether the frame is a command or a response. The MS shall send commands with the C/R bit set to 0, and responses with the C/R bit set to 1. The SGSN side shall do the opposite.

Type	Direction	C/R
Command	SGSN → MS	1
Command	MS → SGSN	0
Response	SGSN → MS	0
Response	MS → SGSN	1

Table 3-1: C/R Field bit usage

3.2.3.3 SAPI

SAPI identifies a point at which LLE services are provide by an LLE to a layer-3 entity.

SAPI	Related Services	SAP Name
0000	Reserved	-
0001	GPRS Mobility Management	LL
0010	Reserved	-
0011	User data 1 (SNDCP)	LL
0100	Reserved 1	-
0101	User data 2 (SNDCP)	LL
0110	Reserved	-
0111	SMS	LL
1000	Reserved	-
1001	User data 3 (SNDCP)	LL
1010	Reserved	-
1011	User data 4 (SNDCP)	LL
1100	Reserved	-
1101	Reserved	-
1110	Reserved	-
1111	Reserved	-

Table 3-2: Allocation of SAPI values

3.2.4 Control field

An LLC Control field identifies the type of frame. Four types of control field formats are specified:

- unnumbered protocol control functions (U frames),
- unconfirmed information transfer (UI frames),
- supervisory functions (S frames) and
- confirmed information transfer (I+S frames).

In order to provide a reliable transfer of user data, sequence numbers N(U), N(R) and N(S) are used (numbered information transfer only).

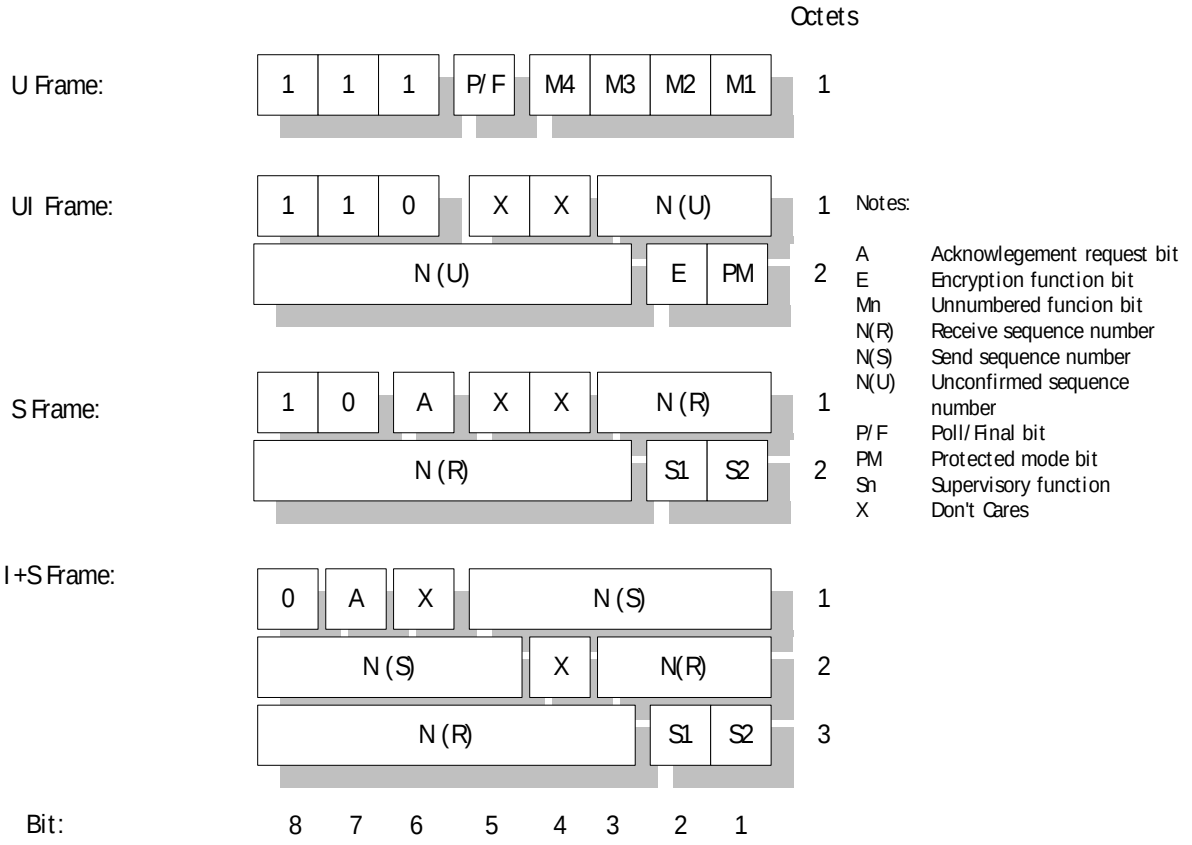
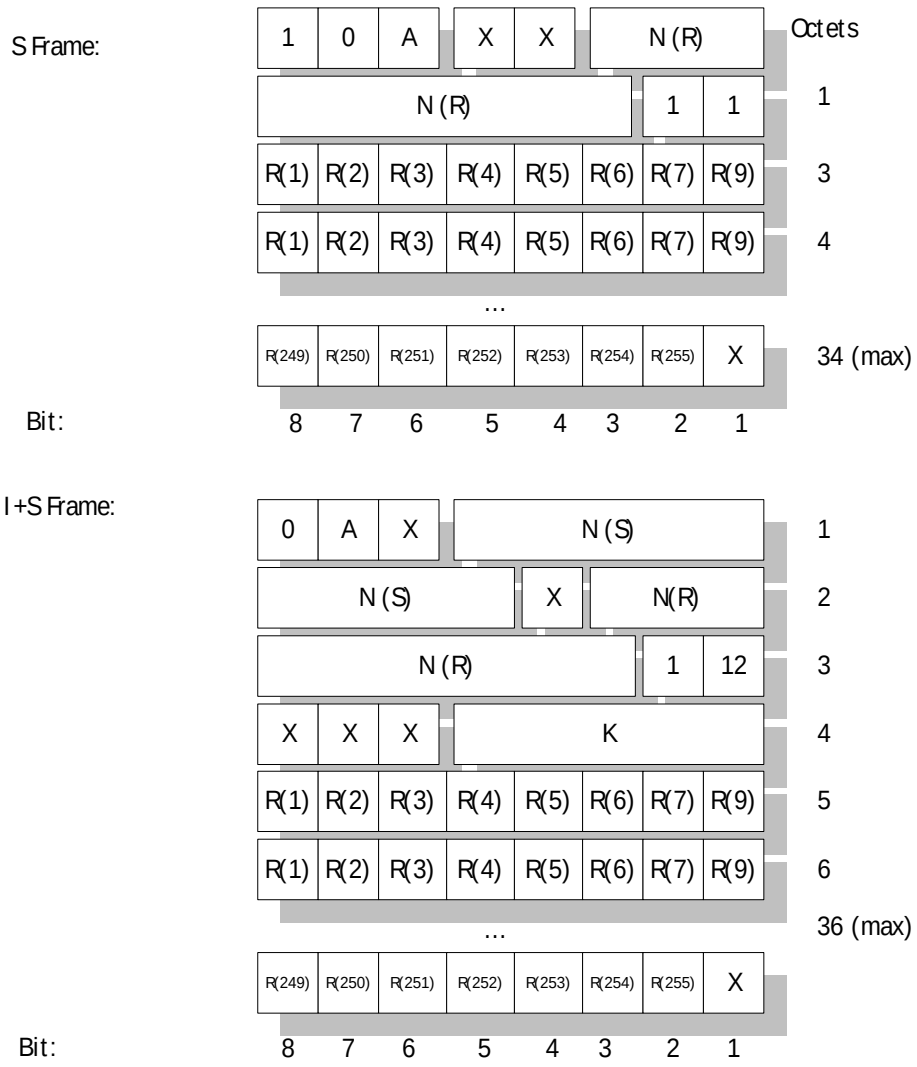


Figure 3-5: Control field format



Notes: a) K = Bitmap length indicator
b) R(n) = Bitmap bit

Figure 3-6: SACK S and I+S control field format

3.2.5 Frame Check Sequence (FCS) field

The FCS field shall consist of a 24 bit cyclic redundancy check (CRC) code. The CRC-24 is used to detect bit errors in the frame header and information fields.

The FCS field contains the value of a CRC calculation that is performed over the entire contents of the header and information field, except for UI frames transmitted in unprotected mode, in which case the FCS field contains the value of a CRC calculation that is performed over the frame header and the first N202 octets of the information field only. CRC calculation shall be done before ciphering at the transmitting side, and after deciphering at the receiving side.

NOTE: The definition below is different from that in GSM 04.22 [10], since the LLC frame is variable-length with k bits. In GSM 04.22, the RLP frame is a fixed length 216 bits.

The CRC shall be the ones complement of the sum (modulo 2) of:

- the remainder of x^k ($x^{23} + x^{22} + x^{21} + ... + x^2 + x + 1$) divided (modulo 2) by the generator polynomial, where k is the number of bits of the information over which the CRC is calculated; and
- the remainder of the division (modulo 2) by the generator polynomial of the product of x^{24} by the information over which the CRC is calculated.

The CRC-24 generator polynomial is:

$G(x) = x^{24} + x^{23} + x^{21} + x^{20} + x^{19} + x^{17} + x^{16} + x^{15} + x^{13} + x^8 + x^7 + x^5 + x^4 + x^2 + 1$

The result of the CRC calculation is placed within the FCS field as described in subclause 5.7.3.

NOTE: As a typical implementation at the transmitter, the initial content of the register of the device computing the remainder of the division is pre-set to all "1's" and is then modified by division by the generator polynomial (as described above) of the information over which the CRC is to be calculated; the ones complement of the resulting remainder is put into the FCS field.

As a typical implementation at the receiver, the initial content of the register of the device computing the remainder of the division is pre-set to all "1's". The final remainder, after multiplication by x^{24} and then division (modulo 2) by the generator polynomial of the received frame, will be (in the absence of errors):

$C(x) = x^{22} + x^{21} + x^{19} + x^{18} + x^{16} + x^{15} + x^{11} + x^8 + x^5 + x^4$

3.3 Frame formats

3.3.1 Information transfer format – I

The I format shall be used to perform an information transfer between layer-3 entities. The functions of N(S), N(R), and A are independent; that is, each I frame has an send sequence number N(S), an receive sequence number N(R) that may or may not acknowledge additional I frames received by the LLE, and an A bit that may be set to 0 or 1.

Each I frame also contains supervisory information, in effect "piggy-backing" an S frame with each I frame, so that it may be considered to be an I+S frame.

3.3.2 Supervisory format - S

The S format shall be used to perform logical link supervisory control functions such as acknowledge I frames and request a temporary suspension of I frame transmission. The functions of N(R) and the A bit are independent; that is, each supervisory frame has an N(R) sequence number that may or may not acknowledge additional I frames received by the LLE, and an A bit that may be set to 0 or 1.

3.3.3 Unconfirmed Information format – UI

The UI format shall be used to perform an information transfer between layer-3 entities without acknowledgement. No verification of sequence numbers is performed for UI frames. Therefore, an UI frame may be lost without notification to the layer-3 entity if a logical link exception occurs during transmission of the frame. The information field may be encrypted or not as indicated by the E bit. The frame also includes an PM bit that allows the transfer of unprotected information.

3.3.4 Unnumbered format - U

The U format shall be used to provide additional logical link control functions. This format contains no sequence number. The format includes a P/F bit that may be set to 0 or 1.

3.4 Control field parameters and associated state variables

3.4.1 Poll/Final bit (P/F)

All U frames contain the Poll/Final (P/F) bit. The P/F bit serves a function in both command frames and response frames. In command frames the P/F bit is referred to as the P bit. In response frames it is referred to as the F bit.

The P bit set to 1 is used by an LLE to solicit (poll) a response frame from the peer LLE. The F bit set to 1 is used by an LLE to indicate the response frame transmitted as a result of a soliciting (poll) command.

3.4.2 Acknowledgement request bit (A)

All I and S frames contain the Acknowledgement Request (A) bit. The A bit set to 1 is used by an LLE to solicit an acknowledgement (i.e., an I+S or S frame) from the peer LLE. The A bit set to 0 is used by an LLE to indicate that the peer LLE is not requested to send an acknowledgement.

3.4.3 Modulus

Each I and UI frame is sequentially numbered by a sequence number that may have the value 0 through 511 <R.LLC.ABM_VAR.A.001>. Arithmetic acting on parameters and variables that are related to such sequence numbers operates modulo 512 (i.e., N(S), N(R), N(U), V(S), V(R), V(A), V(U), V(UR)) <R.LLC.ABM_VAR.A.002>.

3.4.4 ABM Variables and sequence numbers

3.4.4.1 Send state variable V(S)

In Asynchronous Balanced Mode, each LLE peer shall have an associated send state variable V(S) when using I frames. V(S) denotes the sequence number of the next in-sequence I frame to be transmitted. V(S) can take on the value 0 through 511. The value of V(S) shall be incremented by 1 with each successive I frame transmission, and shall not exceed V(A) by more than the maximum number of outstanding I frames k. The value of k may be in the range of $1 \leq k \leq 256$. V(S) shall not be incremented when an I frame is retransmitted.

<R.LLC.ABM_VAR.A.003>

3.4.4.2 Acknowledge state variable V(A)

In Asynchronous Balanced Mode, each LLE peer shall have an associated acknowledge state variable V(A) when using I frame and supervisory frame commands and responses. V(A) identifies the first I frame in the transmit window, so that V(A) - 1 equals N(S) of the last in-sequence acknowledged I frame. V(A) can take on the value 0 through 511. The value of V(A) shall be updated by the valid N(R) values received from its peer. A valid N(R) value is one that is in the range $V(A) \leq N(R) \leq V(S)$.

These inequalities shall be interpreted in the following way:

N(R) is valid if, and only if, $(N(R) - V(A)) \bmod 512 \leq (V(S) - V(A)) \bmod 512$.

Furthermore, $(V(S) - V(A)) \bmod 512 \leq k$.

<R.LLC.ABM_VAR.A.004>

3.4.4.3 Send sequence number N(S)

In Asynchronous Balanced Mode, only I frames contain N(S), the send sequence number of transmitted I frames. At the time that an in-sequence I frame is designated for transmission, the value of N(S) is set equal to the value of the send state variable V(S).

<R.LLC.ABM_VAR.A.005>

3.4.4.4 Receive state variable V(R)

In Asynchronous Balanced Mode, each LLE peer shall have an associated receive state variable V(R) when using I frame and supervisory frame commands and responses. V(R) denotes the sequence number of the next in-sequence I frame expected to be received. V(R) can take on the value 0 through 511. The value of V(R) shall be incremented by one with the receipt of an error-free, in-sequence I frame whose send sequence number N(S) equals V(R).

<R.LLC.ABM_VAR.A.006>

3.4.4.5 Receive sequence number N(R)

In Asynchronous Balanced Mode, all I frames and supervisory frames contain N(R), the expected send sequence number of the next in-sequence received I frame. At the time that a frame of the above types is designated for transmission, the value of N(R) is set equal to the value of the receive state variable V(R). N(R) indicates that the LLE transmitting the N(R) has correctly received all I frames numbered up to and including N(R) - 1.

<R.LLC.ABM_VAR.A.007>

3.4.4.6 SACK bitmap R(n)

In Asynchronous Balanced Mode, all I+S and S SACK frames contain R(n), the SACK bitmap. At the time that a SACK frame is designated for transmission, the value of each bit R(n) in the bitmap shall be set to 0 or 1 depending on whether I frame number N(R) + n has been received or not. R(n) = 1 indicates that the LLE transmitting the SACK frame has correctly received I frame number N(R) + n. R(n) = 0 indicates that the LLE transmitting the SACK frame has not correctly received I frame number N(R) + n.

The SACK bitmap contains a maximum of 255 bits, or 32 octets, as shown in Figure 9. The bitmap shall be truncated so that only bitmap octets up to and including the last bitmap octet containing at least one bit set to 1 are transmitted. The trailing bitmap octets shall not be transmitted.

The I+S SACK frame contains a bitmap length indicator K. K + 1 indicates the number of octets in the bitmap. K can take any value 0 through 31.

<R.LLC.ABM_VAR.A.008>

3.4.4.7 I frame buffer variable B

In Asynchronous Balanced Mode, each LLE peer shall have an associated I frame buffer variable B when using I frame and supervisory frame commands and responses. The value of B has a range of $0 \leq B \leq M$.

Function L(x) gives the total information field length in octets of the I frame with sequence number x. B shall be incremented with L(x) of each transmitted I frame. B shall be decremented by L(x) of each acknowledged I frame.

<R.LLC.ABM_VAR.A.010>

3.4.5 Unacknowledged operation variables and parameters

3.4.5.1 Encryption mode bit E

The E bit is used to indicate whether the information and FCS fields of the UI frame are encrypted (ciphered) to provide user data confidentiality. The E bit is set to 1 to indicate an encrypted frame. The E bit is set to 0 to indicate a frame sent without encryption.

<R.LLC.ADM_VAR.A.001>

3.4.5.2 Protected mode bit PM

The PM bit is used to indicate whether the FCS field shall be calculated using both the frame header and information fields.

The PM bit is set to 1 to indicate that the FCS covers the frame header and information fields.

The PM bit is set to 0 to indicate that the FCS covers only the frame header field and the first N202 octets of the information field. If the length of the information field is less than N202 octets then the FCS shall cover the complete information field. This permits UI frames to transport "unprotected" information, such that errors beyond the first N202 octets of the information field do not result in the frame being discarded.

<R.LLC.ADM_VAR.A.002>

PM	E	UI frame information field
0	0	unprotected, non-ciphered information
0	1	unprotected, ciphered information
1	0	protected, non-ciphered information
1	1	protected, ciphered information

Table 3-3: UI frame content

3.4.5.3 Unconfirmed send state variable V(U)

Each LLE peer shall have an associated unconfirmed send state variable V(U) when using UI frame commands. V(U) denotes the sequence number of the next UI frame to be transmitted. V(U) can take on the value 0 through 511. The value of V(U) shall be incremented by 1 with each successive UI frame transmission.

<R.LLC.ADM_VAR.A.003>

3.4.5.4 Unconfirmed sequence number N(U)

Only UI frames contain N(U), the unconfirmed sequence number of transmitted UI frames. At the time that a UI frame is designated for transmission, the value of N(U) is set equal to the value of the unconfirmed send state variable V(U).

<R.LLC.ADM_VAR.A.004>

3.4.5.5 Unconfirmed receive state variable V(UR)

Each LLE peer shall have an associated unconfirmed receive state variable V(UR) when using UI frame commands. V(UR) denotes the sequence number of the next in-sequence UI frame expected to be received. V(UR) can take on the value 0 through 511.

<R.LLC.ADM_VAR.A.005>

3.5 Commands and responses

The command or response type is encoded in the M4 - M1 and S1 – S2 fields according to the following tables.

Com-mand	Re-sponse	M4	M3	M2	M1
SABM		0	1	1	1
	UA	0	1	1	0
DISC		0	1	0	0
	DM	0	0	0	1
	FRMR	1	0	0	0
XID	XID	1	0	1	1

Table 3-4: Commands/Responses in U frames

Com-mand/Response	S1	S2
RR	0	0
ACK	0	1
RNR	1	0
SACK	1	1

Table 3-5: Commands/Responses in S and I+S Frames

3.5.1 Unnumbered frames, U

3.5.1.1 Set asynchronous balanced mode (SABM) command

The SABM unnumbered command shall be used to place the addressed MS or SGSN side into ABM acknowledged operation.

An LLE shall confirm acceptance of a SABM command by the transmission at the first opportunity of a UA response. Upon acceptance of this command, the LLE's send state variable V(S), acknowledge state variable V(A), and receive state variable V(R), shall be set to 0. The transmission of a SABM command indicates the clearance of any exception condition, and a busy condition that was reported by the earlier transmission of an RNR frame by that same LLE.

Previously transmitted I frames that are unacknowledged when this command is actioned shall be discarded. It is the responsibility of a higher layer to recover from the possible loss of the contents of such I frames.

An information field is permitted with the SABM command. If included, the information field shall contain XID parameters. This allows the LLC peers to negotiate LLC layer parameters and layer-3 parameters with the SABM command and UA response.

3.5.1.2 Disconnect (DISC) command

The DISC unnumbered command shall be transmitted in order to terminate the ABM operation.

No information field is permitted with the DISC command. Prior to executing the command, the LLE receiving the DISC command shall confirm the acceptance of a DISC command by the transmission of a UA response. The LLE sending the DISC command shall terminate the ABM operation when it receives the acknowledging UA or DM response.

Previously transmitted I frames that are unacknowledged when this command is executed shall remain unacknowledged and shall be discarded. It is the responsibility of a higher layer to recover from the possible loss of the contents of such I frames.

3.5.1.3 Unnumbered Acknowledgement (UA) response

The UA unnumbered response shall be used by an LLE to acknowledge the receipt and acceptance of the mode-setting commands (SABM or DISC). Received mode-setting commands are not actioned until the UA response is transmitted. An information field is only permitted when UA is the response to a SABM command. The UA response shall in this case contain XID parameters with negotiated XID values.

The transmission of the UA response indicates the clearance of any busy condition that was reported by the earlier transmission of an RNR frame by that same LLE.

3.5.1.4 Disconnected Mode (DM) response

The DM unnumbered response shall be used by an LLE to report to its peer that the LLE is in a state such that ABM operation cannot be performed. An LLE shall transmit a DM response to any valid command received that it cannot action.

No information field is permitted with the DM response.7

3.5.1.5 Frame Reject (FRMR) Response

The FRMR unnumbered response may be received by an LLE as a report of a frame rejection condition not recoverable by retransmission of the identical frame:

1) receipt of a command or response control field that is undefined or not implemented (see subclause 6.4, second paragraph);
2) receipt of a supervisory or unnumbered frame with incorrect length; or
3) receipt of an I frame with an information field that exceeds the maximum established length.

An undefined control field is any of the control field encodings that are not identified in Figure 3-5, Figure 3-6, Table 3-4, or Table 3-5. An information field that immediately follows the control field and that consists of 10 octets shall be returned with this response to provide the reason for the FRMR response. This information field format is given in Figure 10. Only the first 6 octets of the control field of the rejected frame shall be sent. If the control field of the rejected frame is fewer than 6 octets, then the unused octets shall be set to 0.

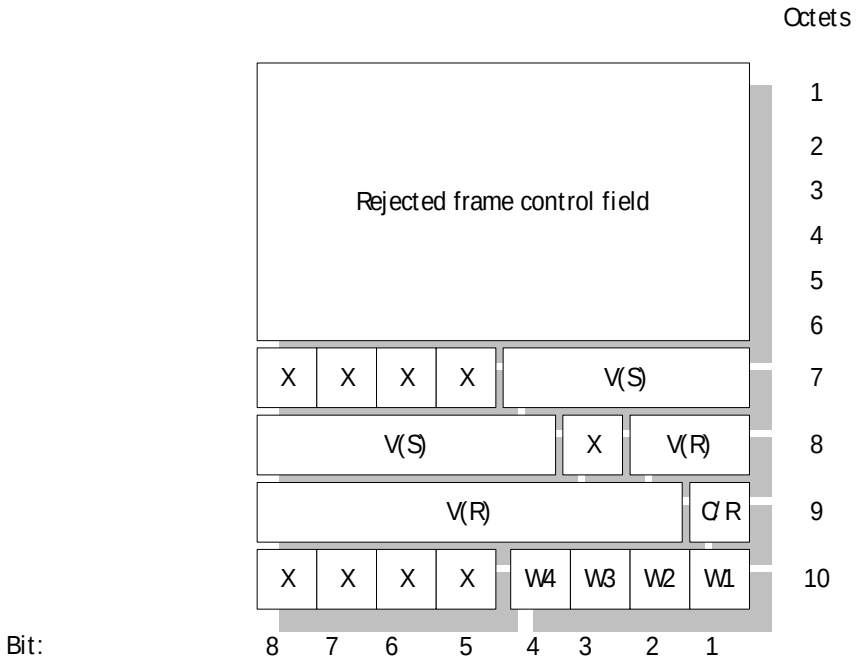


Figure 3-7: FRMR frame information field format

Field	Description
Reject frame control field	The control field of the received frame that caused the frame reject.
V(S)	The current send state variable of the LLE reporting the rejection condition.

V(R)	The current receive state variable value of the LLE reporting the rejection condition. V(R) shall not be treated as an acknowledgement of I frames.
C/R	Set to 1 if the frame rejected was a response and set to 0 if the frame reject was a command.
W1	Set to 1 to indicate that the control field received and returned in octets 1 and 2 was considered invalid because the frame contained an information field that is not permitted within this frame or is a supervisory or unnumbered frame with incorrect length. Bit W3 shall be set to 1 in conjunction with this bit.
W2	Set to 1 to indicate that the information field received exceeded the maximum established information field length (N201) of the LLE reporting the rejection condition.
W3	Set to 1 to indicate that the control field received and returned in octets 1 and 3 was undefined or not implemented.
W4	Set to 1 to indicate that the LLE was in ABM when reporting the rejection condition.

Table 3-6: FRMR frame fields

3.5.2 Exchange Identification (XID) command/response

This frame shall be used to negotiate and re-negotiate LLC layer parameters and layer-3 parameters. XID frames can be transmitted in ADM and ABM.

The negotiation procedure is one-step, i.e., one side shall start the process by sending an XID command, offering a certain set of parameters from the applicable parameter repertoire (see Table 6) the sending entity wants to negotiate, proposing values within the allowed range. In return, the other side shall send an XID response, either confirming these parameter values by returning the requested values, or offering higher or lower ones in their place. As an optimization, parameters confirming the requested values may be omitted from the XID response. See Table 6 for sense of negotiation. This shall end the negotiation process.

Parameters that are not included in neither the XID command nor in the XID response, shall retain their current values.

The responding side may respond with parameters that were not included in the XID command. The parameters that were not included in the XID command shall in this case be treated as if the current values of the parameters were included in the XID command, and the responding side shall explicitly include these parameters the next time it transmits an XID command.

Both entities shall support the negotiated values, however under certain conditions one or more parameters may need to be re-negotiated (e.g., in the case of a change in SGSN).

XID frames shall always be used with the P/F bit set to 1.

Without any prior XID exchange, default values shall apply. <R.LLC.PARAMTR2.A.001>

Negotiated XID parameters shall apply to the LLE identified by the DLCI of the XID frames used, except Version, Reset and IOV-UI that applies to an LLME (i.e., a TLLI), and except Layer-3 Parameters that apply to the layer 3 above the LLE.

The following Figure shows the format of the XID information field. Table 3-7 lists the negotiable LLC layer parameters.

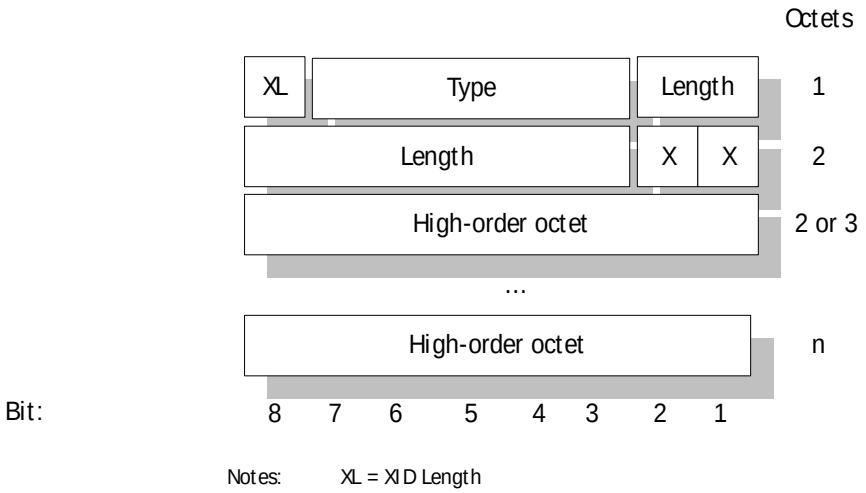


Figure 3-8: XID parameter field format

A parameter item consists of one or two type/length octets followed by the value of that parameter. The XID Length (XL) bit indicates whether the Length field is 2 bits or 8 bits long. If XL is set to 0, then Length consists of 2 bits and type/length occupies one octet. If XL is set to 1 then Length consists of 8 bits and type/length occupies two octets. The length indicator gives the number of octets that the value actually occupies. The parameter items can be arranged in arbitrary order. The parameter items shall begin in the first octet of the XID information field and follow on contiguously.

Parameter Name	Type	Length	Format (87654321)	Range	Units	Sense of Negotiation
Version (LLC version Number)	0	1	0000bbbb	0 through 15	-	down
IOV-UI (ciphering Input offset value for UI frames), common for all SAPIs of a TLLI	1	4	bbbbbbbb bbbbbbbb bbbbbbbb bbbbbbbb	0 through 2^{32} - 1	-	-
IOV-I (ciphering Input offset value for I frames), for the SAPI under negotiation	2	4	bbbbbbbb bbbbbbbb bbbbbbbb bbbbbbbb	0 through 2^{32} - 1	-	-
T200 (retransmission Time-out)	3	2	0000bbbb bbbbbbbb	1 through 4 095	0.1 seconds	up
N200 (maximum number of retransmissions)	4	1	0000bbbb	1 through 15	-	up
N201-U (maximum Information field length for U and UI frames)	5	2	00000bbb bbbbbbbb	140 through 1 520	octets	down
N201-I (maximum Information field length for I frames)	6	2	00000bbb bbbbbbbb	140 through 1 520	octets	down
mD (I frame buffer size in the downlink direction)	7	2	0bbbbbbb bbbbbbbb	0, 9 through 24 320	16 octets	down
mU (I frame buffer size in the uplink direction)	8	2	0bbbbbbb bbbbbbbb	0, 9 through 24 320	16 octets	down
KD (window size in the Downlink direction)	9	1	bbbbbbbb	1 through 255	frames	down
KU (window size in the uplink direction)	10	1	bbbbbbbb	1 through 255	frames	Down
Layer-3 Parameters	11	Variable	See GSM 04.65			
Reset	12	0	-	-	-	-

Notes: 1) The Range for N201-U for SAPI 1 is 400 through 1 520 octets, and for SAPI 7 270 through 1 520 octets.
2) All other Types and Ranges are reserved for future versions of the present document.
3) The length for Layer-3 Parameters shall be set equal to the number of octets received from layer 3. If an empty XID block is received from Layer 3, the LLE shall include a zero-length Layer-3 Parameters XID parameter in the XID parameter field to allow the receiving LLE to distinguish between LLC and Layer-3 initiated procedures.

Table 3-7: LLC layer parameter negotiation

Version shall not be negotiated while in ABM. IOV-UI shall only be negotiated in ADM, and only before ciphering is enabled.

IOV-I shall only be negotiated with XID parameters carried in SABM and UA frames. IOV-UI and IOV-I shall only be transmitted in the downlink direction. The lack of IOV-UI or IOV-I in the uplink direction shall not be understood as a request to use the default value.

T200, N200, and N201-U can be negotiated in ADM and ABM. The new values of T200 shall only apply to timers set after the negotiation has been completed. If N201-U is negotiated to a lower value than previously used, then any queued or new U and UI frames that violates the new value of N201-U should be discarded and not transmitted.

N201-I, mD, mU, kD, and kU can be negotiated to any value in Range in ADM. In ABM, N201-I, mD, mU, kD, and kU can only be negotiated to the same or higher value as previously used.

<R.LLC.PARAMTR2.A.001>, <R.LLC.LLC_PAR.A.001>, <R.LLC.LLC_PAR.A.002>, <R.LLC.LLC_PAR.A.003>, <R.LLC.LLC_PAR.A.004>, <R.LLC.LLC_PAR.A.005>, <R.LLC.LLC_PAR.A.006>, <R.LLC.LLC_PAR.A.007>,

<R.LLC.LLC_PAR.A.008>, <R.LLC.LLC_PAR.A.009>, <R.LLC.LLC_PAR.A.010>, <R.LLC.LLC_PAR.A.011>, <R.LLC.LLC_PAR.A.012> ,<R.LLC.LLC_PAR.A.013>, <R.LLC.LLC_PAR.A.014>

3.5.3 Unconfirmed Information (UI) frame

When a layer-3 entity requests unacknowledged information transfer, the UI command shall be used to send information to its peer. No verification of sequence numbers is performed for UI frames. Therefore, the UI frame may be lost without notification to the layer-3 entity if a logical link exception occurs during transmission of the command.

3.5.4 Combined Information (I) and Supervisory (S) frames

The function of the information (I) frame is to transfer, across a logical link connection, sequentially-numbered frames containing information fields provided by layer 3. This frame shall only be used in the ABM operation.

Numbered I frames shall also carry supervisory information, and are for this reason also called I+S frames. A separate S frame is sent when there is no information field to be transferred. Whether an I+S or S frame is transmitted as a command or as a response is insignificant in the ABM procedures.

3.5.4.1 Receive Ready (RR) command / response

The receive ready (RR) supervisory frame is used by an LLE to:

- indicate that it is ready to receive an I frame; and
- acknowledge previously received I frames numbered up to and including N(R) - 1.

In addition to indicate the status of an LLE, the RR frame with the A bit set to 1 may be used by the LLE to request an acknowledgement from its peer LLE.

The transmission of an RR frame shall also indicate the clearance of any busy condition within the sending LLE that was reported by the earlier transmission of an RNR frame by the same LLE.

3.5.4.2 Acknowledgement (ACK) command / response

The ACK supervisory frame shall be used by an LLE to acknowledge a single or multiple I frames. Frames up to and including N(R) - 1, and frame N(R) + 1, have been received correctly.

In addition to indicate the status of an LLE, the ACK frame with the A bit set to 1 may be used by the LLE to request an acknowledgement from its peer LLE.

The transmission of an ACK frame shall also indicate the clearance of any busy condition within the sending LLE that was reported by the earlier transmission of an RNR frame by the same LLE.

3.5.4.3 Selective Acknowledgement (SACK) command / response

The SACK supervisory frame shall be used by an LLE to acknowledge a single or multiple I frames. Frames up to and including N(R) - 1, and frames indicated by the SACK bitmap, have been received correctly.

In addition to indicate the status of an LLE, the SACK frame with the A bit set to 1 may be used by the LLE to request an acknowledgement from its peer LLE.

The transmission of a SACK frame shall also indicate the clearance of any busy condition within the sending LLE that was reported by the earlier transmission of an RNR frame by the same LLE.

3.5.4.4 Receive not ready (RNR) command / response

The receive not ready (RNR) supervisory frame shall be used by an LLE to indicate a busy condition; that is, a temporary inability to accept additional incoming I frames. The value of N(R) in the RNR frame acknowledges I frames numbered up to and including N(R) - 1. Subsequent frames, if any, shall not be considered confirmed. The acceptance status of those is a matter of further status exchange.

In addition to indicate the status of an LLE, the RNR frame with the A bit set to 1 may be used by the LLE to request an acknowledgement from its peer LLE.

4 Protocol

<R.LLC.GEN_REQS.A.001>, <R.LLC.GEN_REQS.A.002>, <R.LLC.GEN_REQS.A.003>, <R.LLC.GEN_REQS.A.004>, <R.LLC.GEN_REQS.A.005>, <R.LLC.GEN_REQS.A.006>, <R.LLC.GEN_REQS.A.007>, <R.LLC.GEN_REQS.A.008>, <R.LLC.GEN_REQS.A.009>, <R.LLC.GEN_REQS.A.011>, <R.LLC.GEN_REQS.A.012>, <R.LLC.LL_REQS.A.001>, <R.LLC.LL_REQS.A.002>

4.1 Flow Control

Data transfer between the layers of the protocol stack (layer 3, LLC, RLC/MAC) has to be coordinated, in order to ensure that the layers are able to process the data and no buffer overflow occurs.

Therefore a number of primitives are introduced as extension to the specified GPRS primitives. In detail, flow control is necessary for uplink data transfer (acknowledged and unacknowledged) between all layers, and for downlink data transfer between LLC and layer 3. The only exception to this rule is SAPI 1, for which no flow control is being applied. This means that GMM is allowed to send data primitives to LLC without having received LL_UNITREADY_IND. On the other hand LLC is also allowed to send received data primitives to GMM without having received LL_GETUNITDATA_REQ.

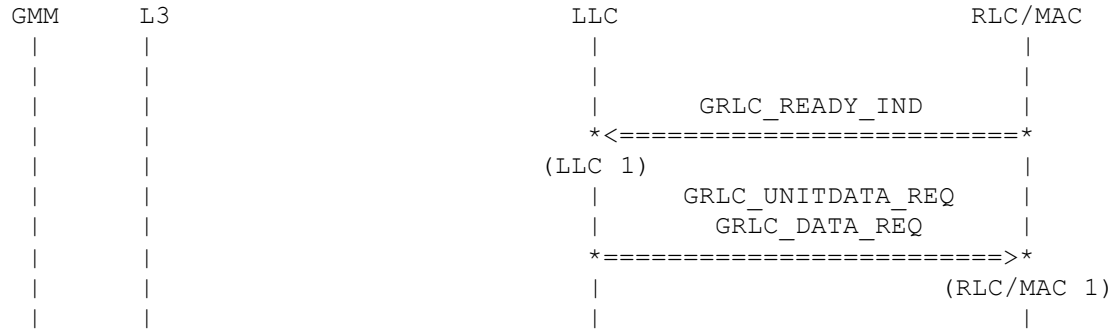
This section contains only the flow control primitives for uplink data transfer between LLC and RLC/MAC (see section 4.1.1), for downlink LLC-acknowledged data transfer between LLC and SNDCP (see section 4.1.2), and for downlink LLC-unacknowledged data transfer between LLC and layer 3 (see section 4.1.3).

Flow control primitives for uplink data transfer between layer 3 and LLC are described in the appropriate sections. Before layer 3 is allowed to send data frames to LLC, LLC has to indicate to layer 3 that it is ready to receive data. In this case, the variable ll_receive_ready or ll_receive_unitready (depending on the transfer mode) is set to TRUE. After receiving a data frame from the upper layer the corresponding variable is set to FALSE and if possible, the receive ready procedure is started again.

No flow control can be applied for downlink data transfer between RLC/MAC and LLC.

4.1.1 Uplink data transfer between LLC and RLC/MAC

LLC is only permitted to send a data frame to RLC/MAC if the RLC/MAC layer indicates to LLC that it is ready to receive the next one. If LLC receives such an indication and if no frame is waiting for transmission, LLC sets the variable ll_send_ready to TRUE, so that the possibility to send a frame is stored until a frame is available. After a frame has been sent to RLC/MAC, the variable ll_send_ready is set to FALSE.



(LLC 1)
RLC/MAC indicates to LLC that RLC/MAC is ready to receive data frames. The variable ll_send_ready is set to TRUE.

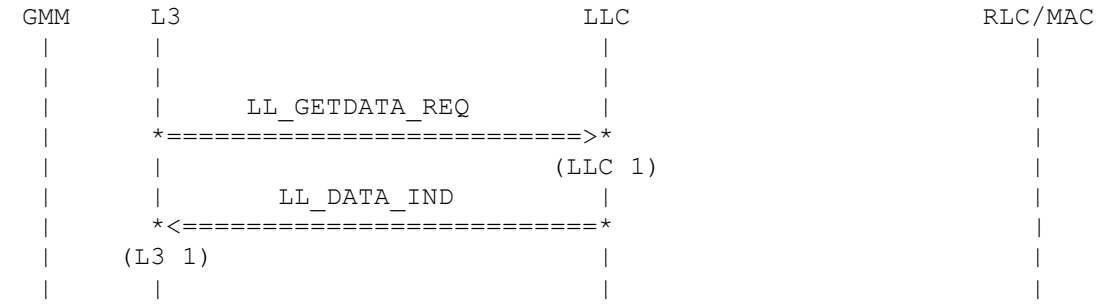
(RLC/MAC 1)
If there is a frame for transmission or retransmission, then:

- If this frame is an U frame containing a command, then LLC sets timer T200 and sends the frame with the primitive GRLC_DATA_REQ to RLC/MAC.
- If this frame is an U frame containing a response, then LLC sends the frame with the primitive GRLC_DATA_REQ to RLC/MAC.
- If this frame is an I frame, LLC is not in 'peer receiver busy condition', and LLC is in state 'ABM' then LLC sends the frame with the primitive GRLC_DATA_REQ to RLC/MAC. If acknowledgement should be requested for this frame, the A bit is set in the frame before transmission, and timer T201 is started.
- If this frame is an S frame and LLC is in state 'ABM', then LLC sends the frame with the primitive GRLC_DATA_REQ to RLC/MAC. If acknowledgement should be requested for this frame, the A bit is set in the frame before transmission, and timer T201 is started.
- If this frame is an UI frame for SAPI 3, 5, 9, or 11, and LLC is not in state 'ABM' for this SAPI, then LLC sends the frame with primitive GRLC_UNITDATA_REQ to RLC/MAC, otherwise the GRLC_DATA_REQ primitive is used.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.R_UNTDATA.M.002>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.TX_IFRM.A.001>, <R.LLC.TX_IFRM.M.014>, <R.LLC.TX_IFRM.A.016>, <R.LLC.TX_IFRM.A.007>, <R.LLC.TX_IFRM.A.021>, <R.LLC.TX_IFRM.A.022>

4.1.2 Downlink LLC-acknowledged data transfer between LLC and SNDCP

SNDCP has to indicate to LLC when it is ready to receive an acknowledged data frame from LLC. If LLC receives the indication and no frame is available for SNDCP, LLC sets the variable ll_send_ready to TRUE, so that the possibility to send a frame to SNDCP is stored until one is available. After a frame has been sent to SNDCP, the variable ll_send_ready is set to FALSE.



(LLC 1)
SNDCP indicates to LLC that it is ready to receive a data frame. The variable ll_send_ready is set to TRUE.

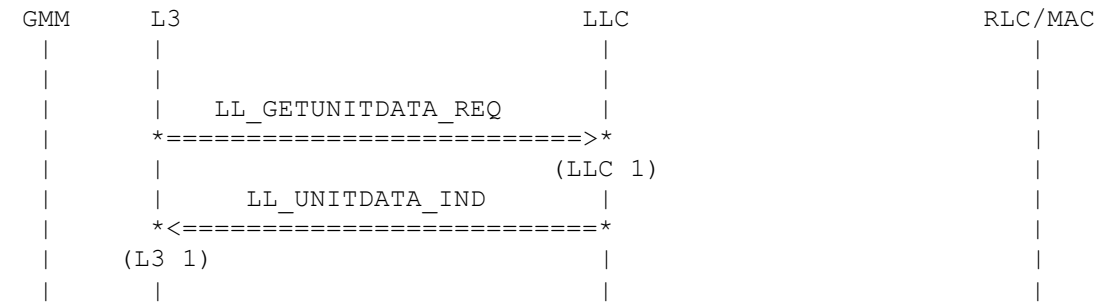
(L3 1)
If there is a received I frame to send to SNDCP then the data is passed to the upper layer. The variable ll_send_ready is set to FALSE in this case.

<R.LLC.L_DATA.A.001>

4.1.3 Downlink LLC-unacknowledged data transfer between LLC and layer 3

Layer 3 has to indicate to LLC when it is ready to receive an acknowledged data frame from LLC. If LLC receives the indication and no frame is available for layer 3, LLC sets the variable ll_send_unitready to TRUE, so that the possibility to send a frame to layer 3 is stored until one is available. After a frame has been sent to layer 3, the variable ll_send_unitready is set to FALSE.

NOTE: No flow control can be applied for SAPI1, thus no LL_GETUNITDATA_REQ will be sent by GMM.



(LLC 1)
Layer 3 indicates to LLC that it is ready to receive a data frame. The variable ll_send_unitready is set to TRUE.

(L3 1)
If there is a received UI frame to send to layer 3 then the data is passed to the upper layer. The variable ll_send_unitready is set to FALSE in this case.

<R.LLC.L_DATA.A.001>

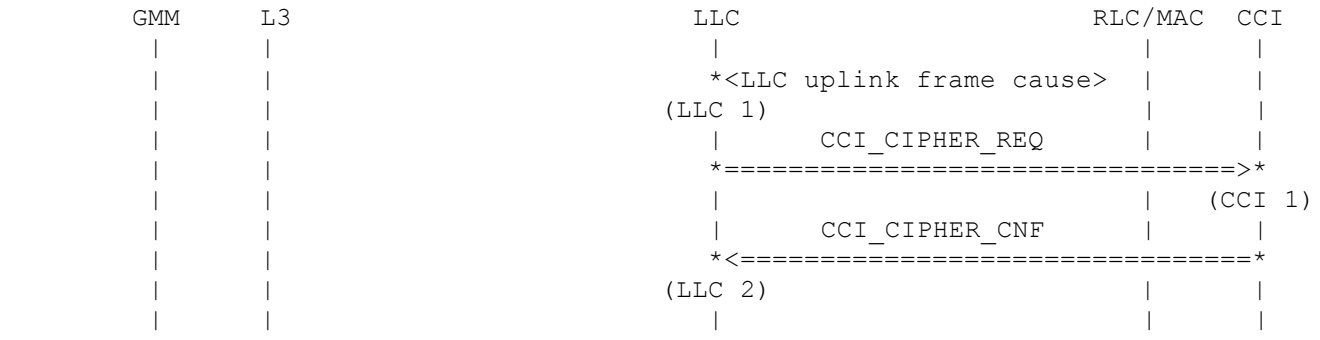
4.2 Ciphering and Compression Interface

The Ciphering and Compression Interface (CCI) is used by LLC for ciphering/deciphering of every frame. Additionally, FCS is calculated/checked in CCI. Thus, each time a frame has to be sent to RLC/MAC, or a frame has been received from RLC/MAC, this frame is processed through CCI. In order to keep the MSCs simple, ciphering and deciphering of frames is not included in every single MSC, but in this section.

Ciphering and calculating FCS is used in uplink direction (see section 4.2.1), whereas deciphering and checking FCS is used in downlink direction (see section 4.2.2). If all queued frames in LLC must be discarded, LLC orders CCI to also discard possibly queued frames. This is shown in section 4.2.3.

4.2.1 Uplink direction (ciphering, apply FCS)

In uplink direction, each frame is sent to CCI with CCI_CIPHER_REQ. After FCS has been applied, and, if requested, the frame has been ciphered, it is sent back to LLC with CCI_CIPHER_CNF. The frame is then ready to be sent to RLC/MAC.



(LLC 1)
LLC wants to send an uplink frame to RLC/MAC (either LL_UNITDATA_REQ or LL_DATA_REQ have been received, or an LLC signalling frame has to be sent). LLC sends the frame with CC_CIPHER_REQ to CCI.

<R.LLC.GEN_REQS.A.008>, <R.LLC.GEN_REQS.A.012>, <R.LLC.TXUI_ADM.A.002>, <R.LLC.TXUI_ADM.A.003>, <R.LLC.TXUI_ADM.A.004>

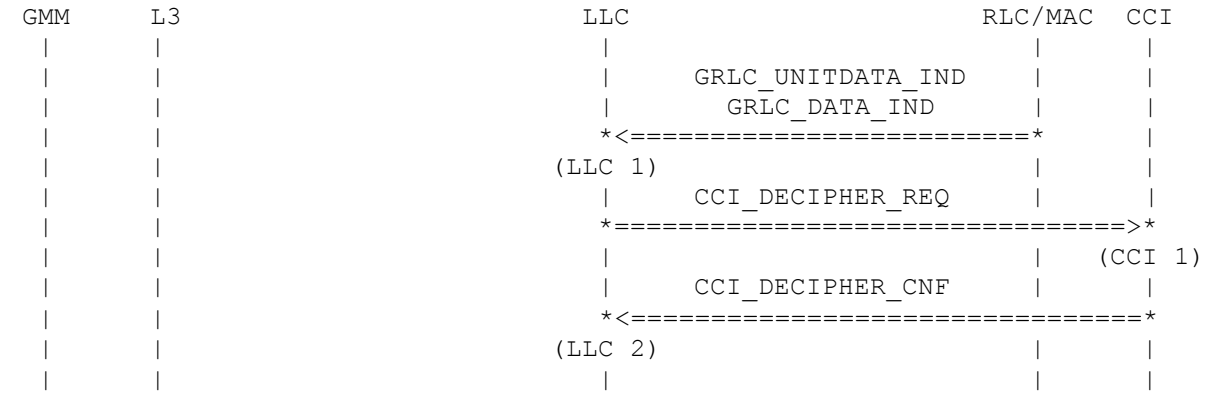
(CCI 1)
CCI receives the primitive CCI_CIPHER_REQ containing an uplink LLC frame (without FCS, and optionally to be ciphered). The received frame is queued for processing.

<R.LLC.GEN_REQS.A.008>, <R.LLC.GEN_REQS.A.012>, <R.LLC.TXUI_ADM.A.002>, <R.LLC.TXUI_ADM.A.003>, <R.LLC.TXUI_ADM.A.004>

(LLC 2)
After the uplink LLC frame has been processed by CCI (FCS has been calculated and the frame has optionally been ciphered), LLC receives the frame in a CCI_CIPHER_CNF primitive. The frame is then either sent directly to RLC/MAC or stored in LLC, depending on the variable ll_send_ready.

4.2.2 Downlink direction (deciphering, check FCS)

In downlink direction (see section), each frame which has been received from RLC/MAC, is also sent to CCI with CCI_DECIPHER_REQ. After FCS has been checked, and, if necessary, the frame has been deciphered, it is sent back to LLC with CCI_DECIPHER_CNF. The frame is then ready to be further processed by LLC.



(LLC 1)
LLC receives the primitive GRLC_UNITDATA_IND or GRLC_DATA_IND containing a received LLC frame. LLC sends the received frame to CCI for deciphering and FCS-checking.

<R.LLC.GEN_REQS.A.008>, <R.LLC.GEN_REQS.A.012>, <R.LLC.RXUI_ADM.A.001>, <R.LLC.RXUI_ADM.A.002>, <R.LLC.RXUI_ADM.A.003>

(CCI 1)
CCI receives the primitive CCI_DECIPHER_REQ containing a downlink LLC frame (with FCS, and optionally ciphered). The received frame is queued for processing.

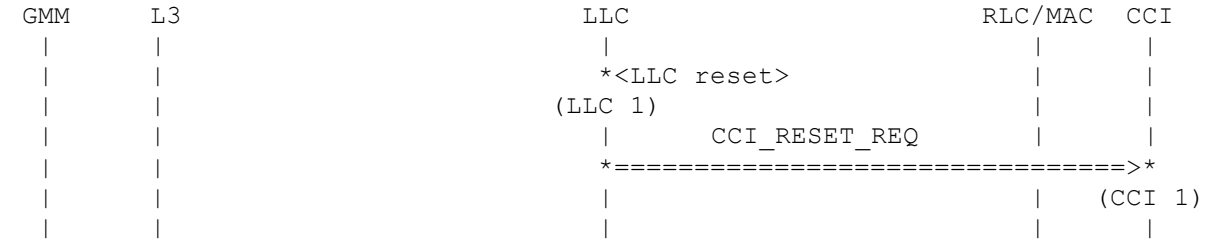
<R.LLC.GEN_REQS.A.008>, <R.LLC.GEN_REQS.A.012>, <R.LLC.RXUI_ADM.A.001>, <R.LLC.RXUI_ADM.A.002>, <R.LLC.RXUI_ADM.A.003>

(LLC 2)
After the downlink LLC frame has been processed by CCI (FCS has been checked and the frame has optionally been deciphered), LLC receives the frame in a CCI_DECIPHER_CNF primitive. The frame is then processed further in LLC, depending on the contents. See the specified sections below.

<R.LLC.XCEPTION.A.001>

4.2.3 LLC reset

If LLC is being reset due to a received 'Reset' XID parameter, LLC sends the primitive CCI_RESET_REQ to CCI.



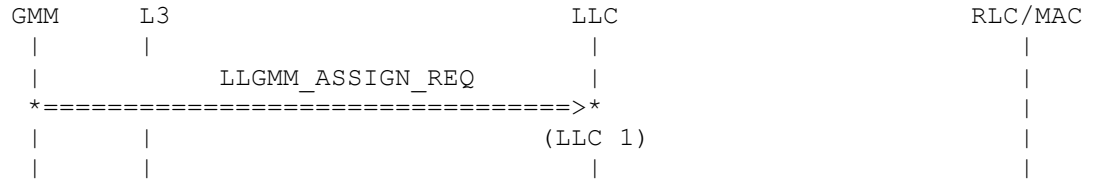
(LLC 1)
LLC is being reset. All queued frames are discarded in LLC. LLC sends CCI_RESET_REQ to CCI to discard any frames that may be queued in CCI.

<R.LLC.XIDRESET.A.008>

(CCI 1)
CCI receives the primitive CCI_RESET_REQ. All queued frames are being discarded.

<R.LLC.XIDRESET.A.008>

4.3 TLLI assignment/unassignment



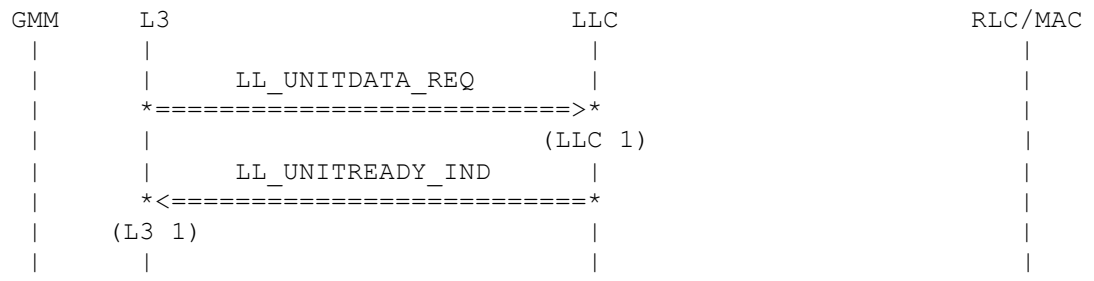
(LLC 1)
The LLC receives the primitive LLGMM_ASSIGN_REQ. Depending on the parameters of the primitive and the actual state, LLC enters the state 'TLLI Assigned/ADM' resp. 'TLLI Unassigned'.

<R.LLC.M_ASSIGN.A.001>, <R.LLC.M_ASSIGN.A.002>, <R.LLC.M_ASSIGN.A.003>, <R.LLC.M_ASSIGN.A.004>, <R.LLC.M_ASSIGN.A.005>, <R.LLC.M_ASSIGN.A.006>, <R.LLC.M_ASSIGN.A.007>, <R.LLC.M_ASSIGN.A.008>, <R.LLC.M_ASSIGN.A.009>, <R.LLC.TLLI_ASS.A.001>, <R.LLC.TLLI_ASS.A.002>, <R.LLC.TLLI_ASS.A.003>, <R.LLC.TLLI_ASS.A.004>, <R.LLC.TLLI_ASS.A.005>, <R.LLC.TLLI_ASS.A.006>, <R.LLC.TLLI_ASS.A.007>, <R.LLC.TLLI_ASS.A.008>, <R.LLC.TLLI_CHA.A.001>, <R.LLC.TLLI_CHA.A.002>, <R.LLC.TLLI_CHA.A.003>, <R.LLC.TLLI_CHA.A.004>, <R.LLC.TLLI_CHA.A.005>, <R.LLC.TLLI_UNA.A.001>, <R.LLC.TLLI_UNA.A.002>, <R.LLC.TLLI_UNA.A.003>, <R.LLC.ADMSTATE.A.013> (<R.LLC.XCEPTION.A.007>)

4.4 Unacknowledged information transfer

Unacknowledged frames can be exchanged in any state, except in state 'TLLI Unassigned'.

4.4.1 Transmission of unacknowledged information frames

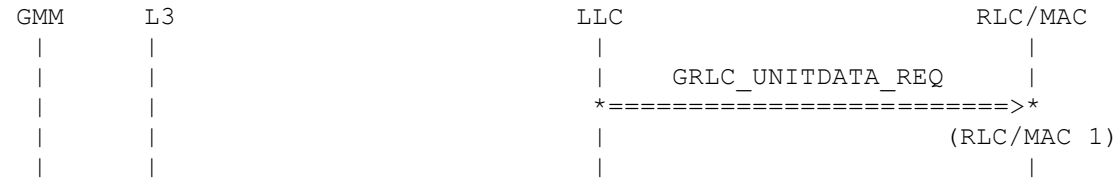


(LLC 1)
LLC receives data for unacknowledged transmission. Thus, LLC has already sent an LL_UNITREADY_IND primitive for this SAPI, or SAPI is 1, where flow control can not be applied. LLC sends an UI frame with RLC/MAC acknowledged or unacknowledged mode to RLC/MAC at the next opportunity. The variable ll_receive_unitready is set to FALSE.

<R.LLC.L_UNTDTA.A.001>, <R.LLC.TXUI_ADM.A.001>, <R.LLC.TXUI_ADM.A.002>, <R.LLC.TXUI_ADM.A.003>, <R.LLC.TXUI_ADM.A.004>, <R.LLC.TXUI_ADM.M.005>, <R.LLC.TXUI_ADM.M.006>

(L3 1)
If SAPI is not 1 and if enough space is available for another UI frame in the local LLC UI frame buffer, LLC sends the primitive LL_UNITREADY_IND to layer 3 and the variable ll_receive_unitready is set to TRUE.

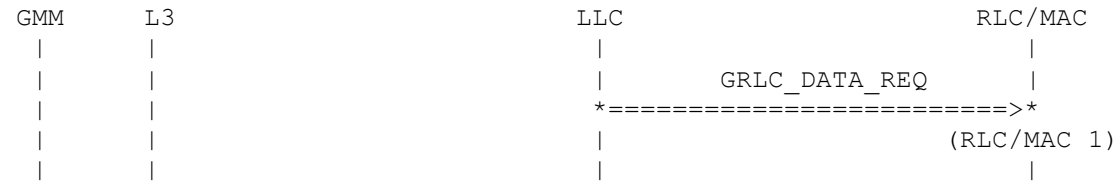
4.4.1.1 RLC/MAC unacknowledged mode



(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the frame is buffered until it can be sent (see section 4.1.1). Otherwise LLC sends the received data in an UI frame to RLC/MAC using the primitive GRLC_UNITDATA_REQ. The variable ll_send_ready is set to FALSE.

<R.LLC.R_UNTDTA.M.001>, <R.LLC.R_UNTDTA.M.002>, <R.LLC.TXUI_ADM.M.006>

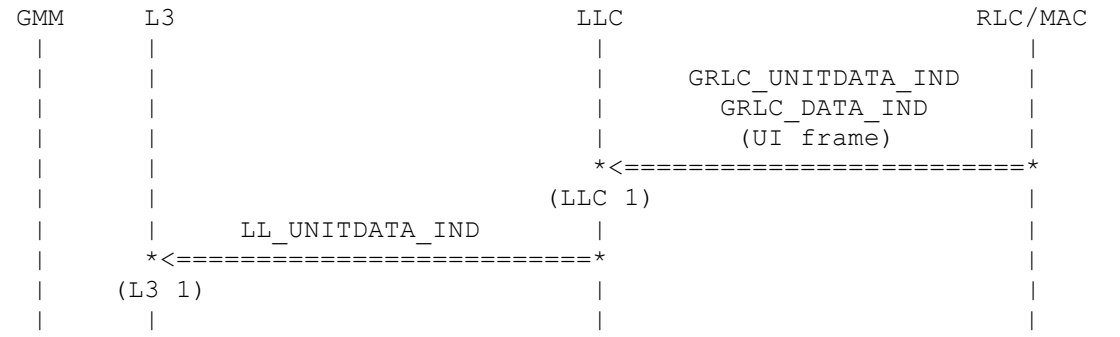
4.4.1.2 RLC/MAC acknowledged mode



(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the frame is buffered until it can be sent (see section 4.1.1). Otherwise LLC sends the received data in an UI frame to RLC/MAC using the primitive GRLC_DATA_REQ. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.TXUI_ADM.M.005>

4.4.2 Receipt of unacknowledged information



(LLC 1)
LLC receives unacknowledged information in an UI frame with the primitive GRLC_UNITDATA_IND (RLC/MAC unacknowledged mode) or GRLC_DATA_IND (RLC/MAC acknowledged mode).

<R.LLC.R_DATA.M.002>, <R.LLC.R_UNTDATA.M.001>, <R.LLC.ADMSTATE.A.007>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
If SAPI is not 1 and if the variable ll_send_unitready is FALSE, no further actions are taken, i.e. the frame is buffered until it can be sent (see section 4.1.3). Otherwise, the data is passed to the upper layer and ll_send_unitready is set to FALSE, except:

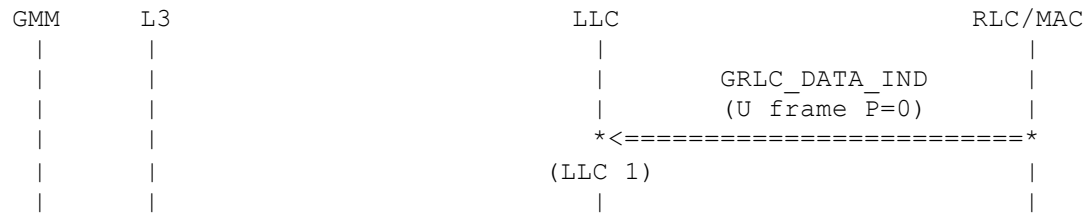
- the DLCI of the received UI frame is not supported by the receiver; or
- N(U) of the received UI frame is in the range (V(UR)-32) ≤ N(U) < V(UR), and an UI frame with the same N(U) has already been received.

In either cases, the UI frame is discarded without further actions.

<R.LLC.L_UNTDATA.A.001>, <R.LLC.RXUI_ADM.A.001>, <R.LLC.RXUI_ADM.A.002>, <R.LLC.RXUI_ADM.A.003>, <R.LLC.RXUI_ADM.A.004>, <R.LLC.RXUI_ADM.A.005>, <R.LLC.RXUI_ADM.A.006>

4.5 Special cases of receipt of frames

4.5.1 Receipt of commands with P bit set to 0

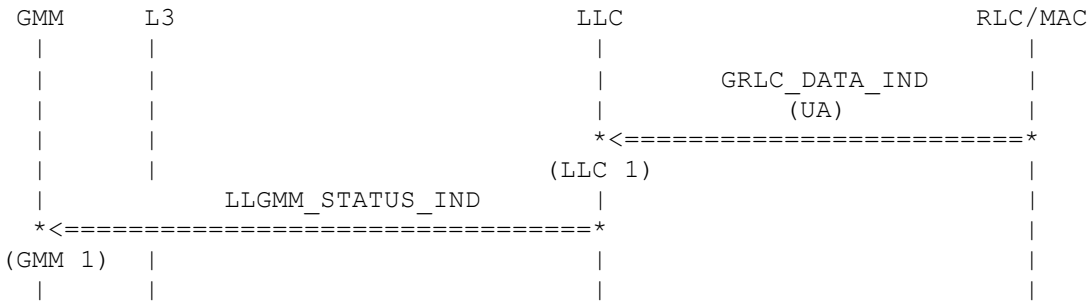


(LLC 1)
The LLC receives a command with the P bit set to 0. This U frame is discarded and no further actions are taken.

<R.LLC.ABMEST_I.A.001>, <R.LLC.ADMSTATE.A.013>

4.5.2 Receipt of responses

4.5.2.1 UA response with F bit set to 0



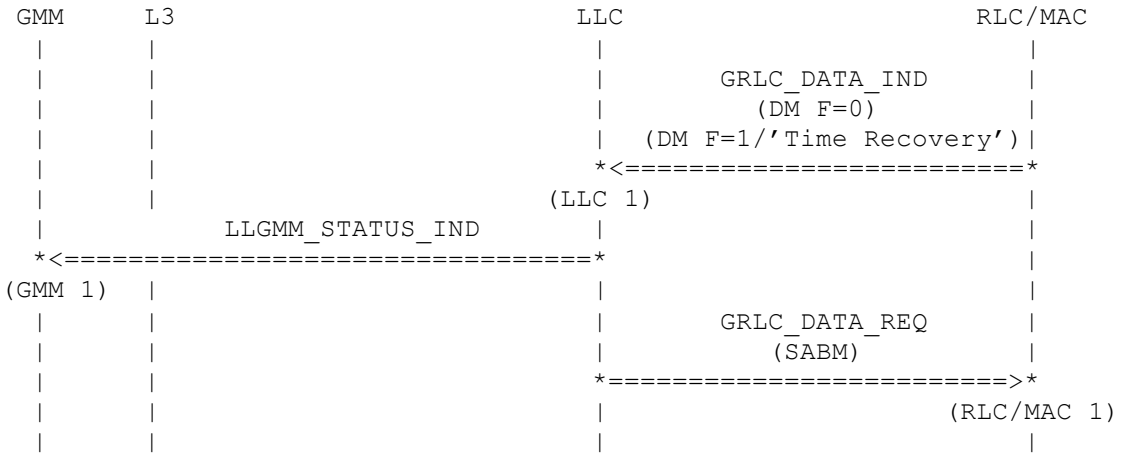
(LLC 1)
LLC receives the UA response with the F bit set to 0.

<R.LLC.R_DATA.M.002>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>

(GMM 1)
LLC indicates to GMM, that an invalid UA response was received (cause = 'invalid UA response').

<R.LLC.ABMEST_R.A.019>, <R.LLC.ABMEST_R.A.021>, <R.LLC.REESTPRO.A.006>

4.5.2.2 DM response with F bit set to 0 in state 'ABM' or with F bit = 1 in state 'Timer recovery'



(LLC 1)
LLC receives an unsolicited DM response with the F bit set to 0 and LLC is in state 'ABM', or with F bit set to 1 in state 'Timer recovery'. LLC initiates re-establishment. LLC discards all outstanding LL_DATA_REQ primitives and all queued I frames. LLC has to transmit the SABM command in an U frame at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.ABMEST_R.A.001>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.A.004>, <R.LLC.ABMEST_R.A.032>, <R.LLC.ABMEST_R.A.007>, <R.LLC.ABMEST_R.A.008>, <R.LLC.REESTCRI.A.006>, <R.LLC.REESTPRO.A.002>, <R.LLC.REESTPRO.A.003>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>, <R.LLC.TX_IFRM.A.022>

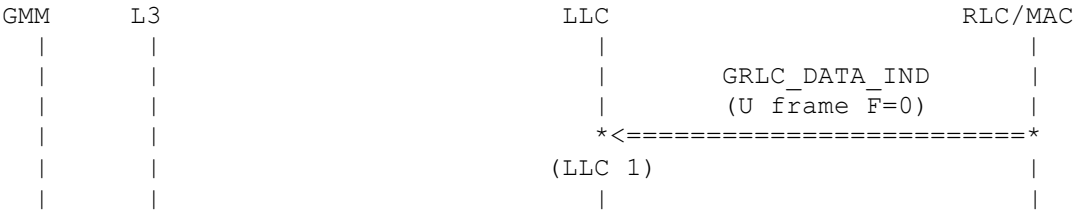
(GMM 1)
The LLC indicates to GMM that re-establishment is started (cause = 'unsolicited DM response with F bit 0; re-establishment procedure initiated' resp. 'unsolicited DM response with F bit 1 in state Timer Recovery; re-establishment procedure initiated')fc.

<R.LLC.REESTPRO.A.001>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the frame is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the SABM command in an U frame. Timer T200 is set and ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMEST_R.M.005>, <R.LLC.ABMEST_R.M.009>

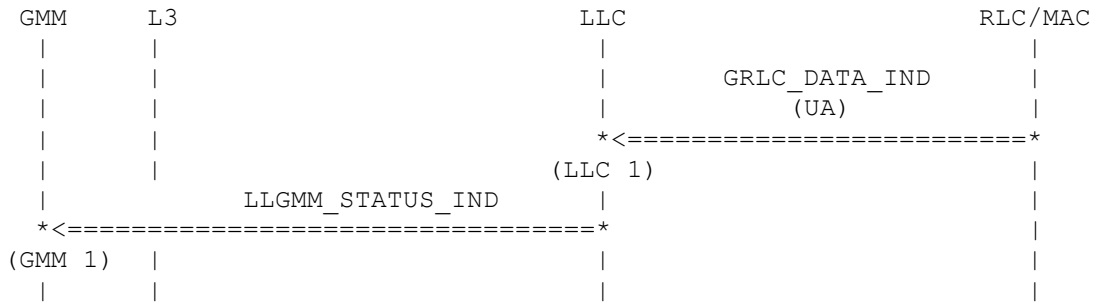
4.5.2.3 Other DM responses with the F bit set to 0



(LLC 1)
LLC receives a response with the F bit set to 0 and discards the frame without further notification.

<R.LLC.R_DATA.M.002>, <R.LLC.ABMEST_R.A.025>, <R.LLC.ADMSTATE.A.013>

4.5.2.4 Receipt of an unsolicited UA response in state 'TLLI Assigned / ADM' or 'ABM'



(LLC 1)
LLC receives an unsolicited UA response in state 'TLLI Assigned / ADM' or 'ABM'.

<R.LLC.R_DATA.M.002>, <R.LLC.XCEPTION.A.007>

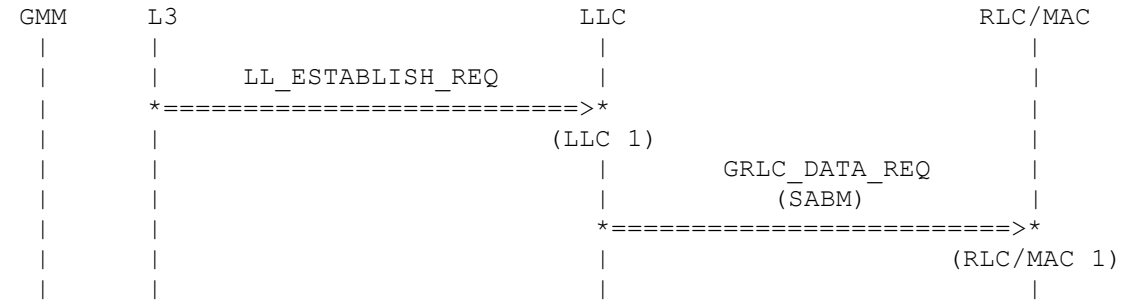
(GMM 1)
LLC indicates to layer 3, that an error has occurred (cause = 'possible multiple-assignment of a TLLI value').

<R.LLC.ADMSTATE.A.009>, <R.LLC.XCEPTION.A.006>, <R.LLC.XCEPTION.A.007>

4.6 Establishment of ABM operation

4.6.1 Mobile originated (re-) establishment of ABM operation

4.6.1.1 Initiation



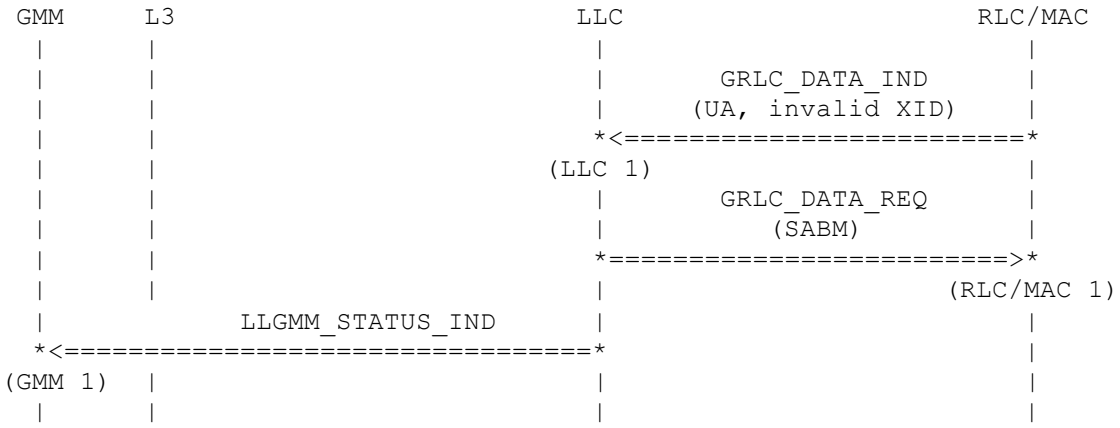
(LLC 1)
LLC is requested to establish a connection to its peer. LLC enters state 'Local Establishment'. LLC sends the SABM command at the next opportunity. The retransmission counter is reset.

<R.LLC.ABMEST_R.A.001>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.A.004>, <R.LLC.ABMEST_R.A.032>, <R.LLC.ABMEST_R.A.005>, <R.LLC.ABMEST_R.A.007>, <R.LLC.ABMEST_R.A.008>, <R.LLC.REESTCRI.A.002>, <R.LLC.OWNRBUSY.A.006>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the SABM command is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the SABM command in a U frame. Timer T200 is set and ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMEST_R.M.005>, <R.LLC.ABMEST_R.M.009>, <R.LLC.TX_IFRM.A.022>

4.6.1.2 Receipt of UA with layer-3 initiated (re-)establishment with invalid XID field



(LLC 1)
LLC receives the UA response with invalid XID field as an acknowledgement for the previously transmitted SABM command. The retransmission counter is reset. Timer T200 is set.

<R.LLC.R_DATA.M.002>, <R.LLC.ABMEST_R.A.001>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.A.004>, <R.LLC.ABMEST_R.A.032>, <R.LLC.ABMEST_R.A.007>, <R.LLC.ABMEST_R.A.010>, <R.LLC.ABMEST_R.A.017>, <R.LLC.ABMEST_R.A.018>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>, <XID_INVA.A.001>, <XID_INVA.A.002>, <XID_INVA.A.004>, <XID_INVA.A.005>, <XID_INVA.A.006>, <XID_INVA.A.007>, <XID_INVA.A.008>, <XID_INVA.A.009>

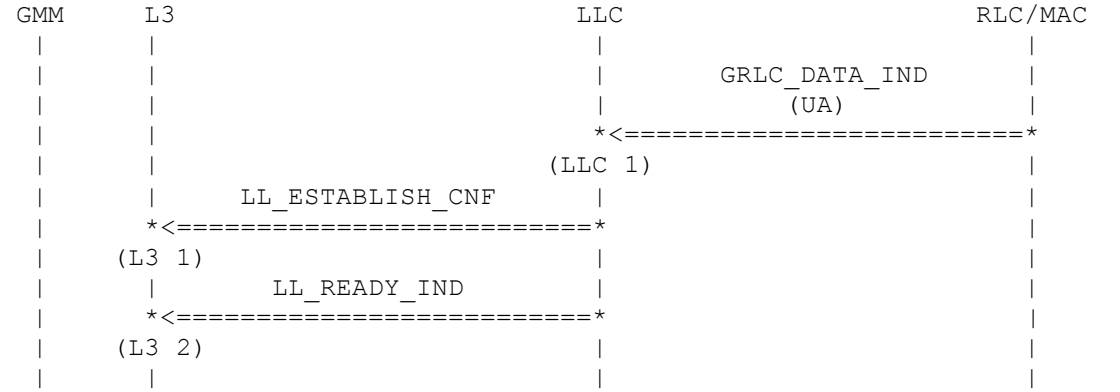
(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the SABM command is buffered until it can be sent (see section 4.1.1). Otherwise LLC retransmits the SABM command in a U frame. Timer T200 is set and ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMEST_R.M.005>, <R.LLC.ABMEST_R.A.009>, <R.LLC.ABMEST_R.A.013>, <R.LLC.TX_IFRM.A.022>

(GMM 1)
GMM 1If layer 3 started re-establishment of ABM operation (LLC was in state 'ABM' before), then LLC indicates to GMM that the re-establishment procedure is started (cause = 'invalid XID response during connection establishment').

<R.LLC.M_STATUS.A.001>

4.6.1.3 Receipt of UA with layer-3 initiated (re-)establishment



(LLC 1)
LLC receives the UA response with the F bit set to 1 as an acknowledgement for the previously transmitted SABM command. Timer T200 is reset.

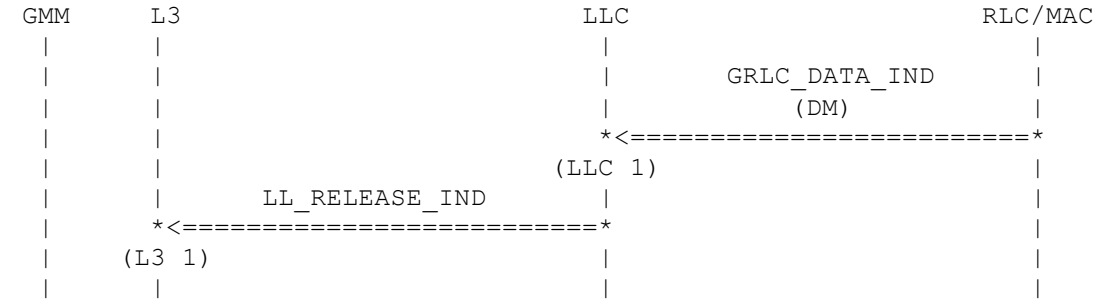
<R.LLC.R_DATA.M.002>, <R.LLC.ABMEST_R.A.010>, <R.LLC.ABMEST_R.A.017>, <R.LLC.ABMEST_R.A.018>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>

(L3 1)
LLC confirms the layer-3 initiated (re-)establishment of the connection to layer 3. LLC resets its internal variables and enters state 'ABM'.

<R.LLC.ABMEST_R.A.019>, <R.LLC.ABMEST_R.A.020>, <R.LLC.REESTPRO.A.006>

(L3 2)
LLC indicates to layer 3, that it is ready to receive the first I frame. The variable ll_receive_ready is set to TRUE.

4.6.1.4 Receipt of DM with F bit set to 1 in state 'Local Establishment'



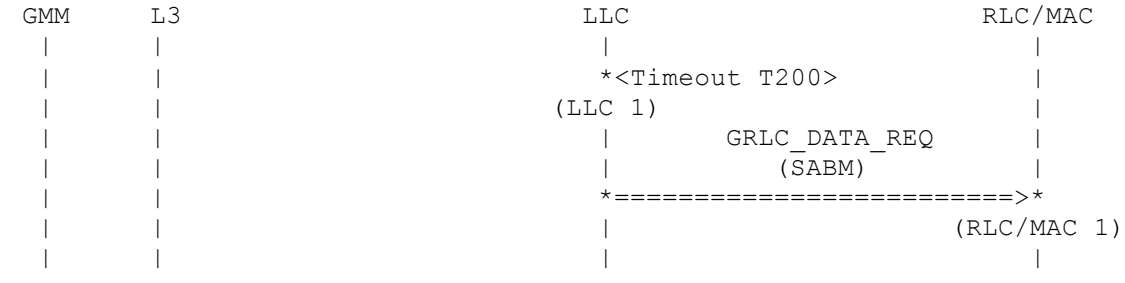
(LLC 1)
LLC receives the DM response with the F bit set to 1 as a rejection of the SABM command. That means the peer LLC is in a state where ABM operation cannot be performed.

<R.LLC.R_DATA.M.002>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>

(L3 1)
LLC indicates to layer 3 that the establishment of ABM operation has failed by sending the primitive LL_RELEASE_IND (Cause = 'DM received'). LLC resets timer T200 and enters state 'TLLI Assigned/ADM'.

<R.LLC.ABMEST.R.A.022>, <R.LLC.ABMEST.R.A.023>, <R.LLC.ABMEST.R.A.024>

4.6.1.5 Timeout of timer T200, max. retransmissions not reached in state 'Local Establishment'



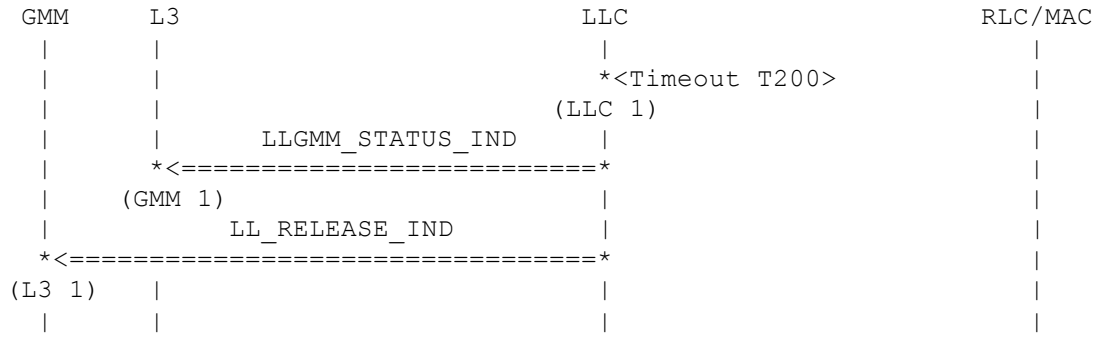
(LLC 1)
Timer T200 expires. If no collision of SABM commands occurred the retransmission counter is incremented. The retransmission counter does not exceed N200. LLC retransmits the SABM command at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.A.004>, <R.LLC.ABMEST_R.A.032>, <R.LLC.ABMEST_R.A.007>, <R.LLC.ABMEST_R.A.010>, <R.LLC.ABMEST_R.A.011>, <R.LLC.ABMEST_R.A.012>, <R.LLC.ABMEST_R.A.017>, <R.LLC.ABMEST_R.A.018>, <R.LLC.ABMEST_R.A.026>, <R.LLC.ABMEST_R.A.028>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.TX_IFRM.A.022>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the frame is buffered until it can be sent (see section 4.1.1). Otherwise LLC retransmits the SABM command in a U frame and sets timer T200. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMEST_R.A.009>, <R.LLC.ABMEST_R.A.013>, <R.LLC.ABMEST_R.A.027>

4.6.1.6 Timeout of timer T200, max. retransmissions reached in state 'Local Establishment'



(LLC 1)
Timer T200 expires. The retransmission counter is incremented and exceeds N200.

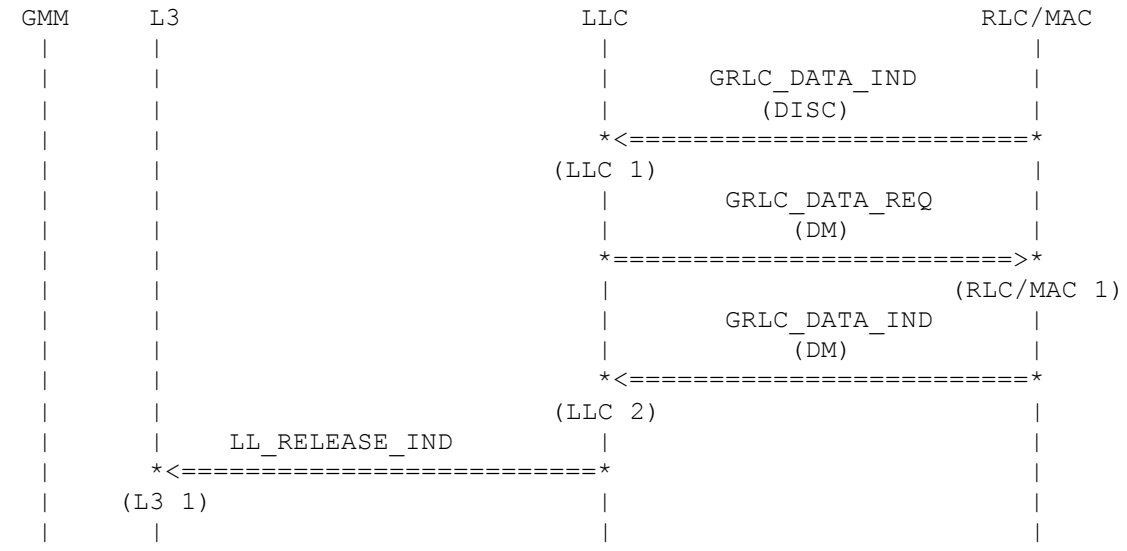
(GMM 1)
LLC indicates an error to GMM with the primitive LLGMM_STATUS_IND (cause = 'no peer response during connection establishment').

<R.LLC.M_STATUS.A.001>, <R.LLC.ABMEST_R.A.014>, <R.LLC.ABMEST_R.A.029>

(L3 1)
LLC indicates to layer 3 that the establishment of ABM operation has failed by sending the primitive LL_RELEASE_IND (cause = 'no peer response during connection establishment'). LLC enters state 'TLLI Assigned/ADM'.

<R.LLC.ABMEST_R.A.015>, <R.LLC.ABMEST_R.A.016>, <R.LLC.ABMEST_R.A.030>, <R.LLC.ABMEST_R.A.030>

4.6.1.7 Collision of ABM establishment and ABM termination



(LLC 1)
LLC receives the DISC command while in state 'Local Establishment'. LLC sends the DM response at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.COLDTXRX.A.001>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the DM response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the DM response in an U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.COLDXRX.M.002>, <R.LLC.TX_IFRM.A.022>

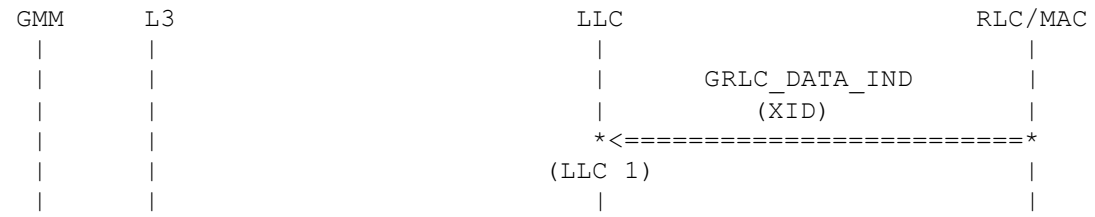
(LLC 2)
LLC receives the DM response from the peer LLC with the F bit set to 1. LLC enters state 'TLLI Assigned/ADM'.

<R.LLC.R_DATA.M.002>, <R.LLC.COLDXRX.A.004>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
LLC indicates the failure of establishment of ABM operation to layer 3, by sending the primitive LL_RELEASE_IND (Cause = 'normal release').

<R.LLC.COLDXRX.A.005>

4.6.1.8 Collision of ABM establishment and XID negotiation

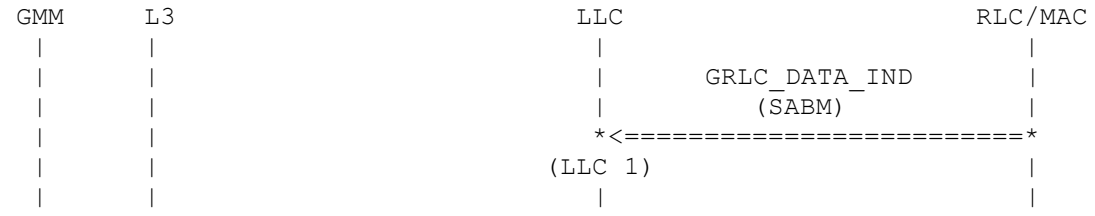


(LLC 1)
LLC receives the XID command while in state 'Local Establishment'. LLC ignores the received XID command.

<R.LLC.R_DATA.M.002>, <R.LLC.COLDXRX.A.007>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

4.6.1.9 Collision of both sides connection establishment

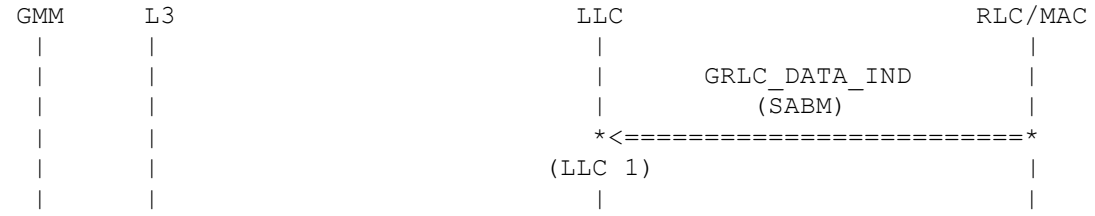
4.6.1.10 Layer 3 XID parameters are present both or neither



(LLC 1)
LLC receives the SABM command while in state 'Local Establishment'. LLC ignores the received SABM command.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.COLITXRX.A.024> , <R.LLC.PEERBUSY.A.016>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

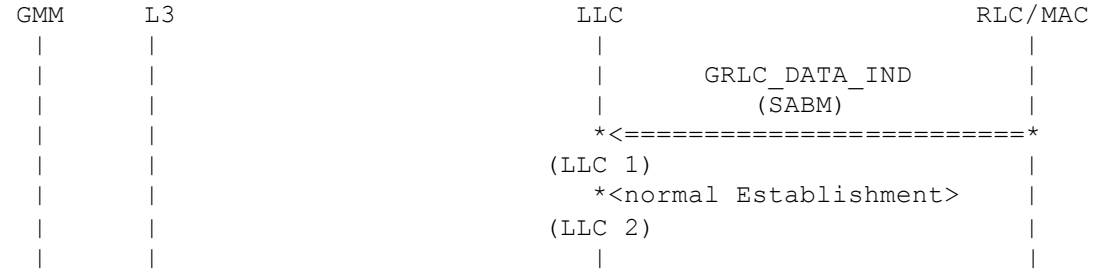
4.6.1.11 Layer 3 XID parameters are present in the MS command and not in the SGSN command



(LLC 1)
LLC receives the SABM command while in state 'Local Establishment'. LLC ignores the received SABM command.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.COLITXRX.A.025>, <R.LLC.PEERBUSY.A.016>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

4.6.1.12 Layer 3 XID parameters are present in the SGSN command and not in the MS command



(LLC 1)
LLC receives the SABM command while in state 'Local Establishment'. LLC treats the already transmitted SABM command as not transmitted. Timer 200 is reset.

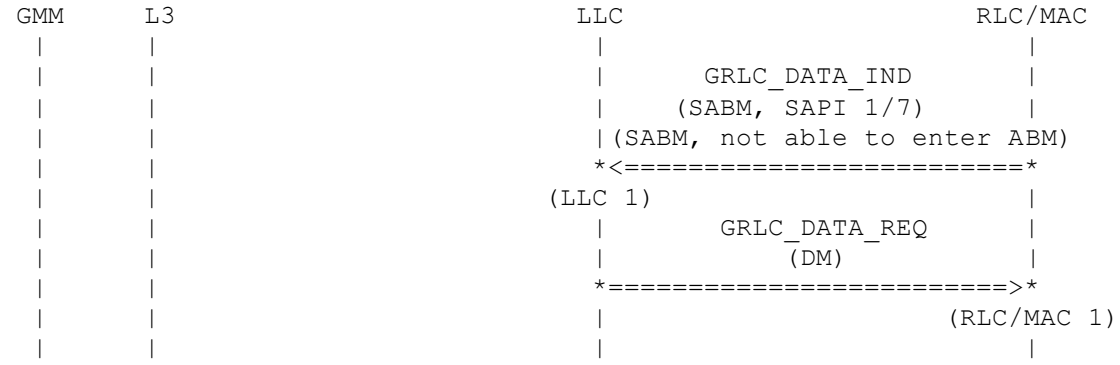
<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.COLITXRX.A.025>, <R.LLC.COL.A.001>, <R.LLC.PEERBUSY.A.016>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(LLC 2)
The procedure 'Network originated establishment of ABM operation' (see 4.6.2) is initiated.

<R.LLC.COLITXRX.A.025>

4.6.2 Network originated establishment of ABM operation

4.6.2.1 Receipt of SABM with peer initiated (re-)establishment with command for SAPI 1 or 7, or LLC is not able to enter state 'ABM'



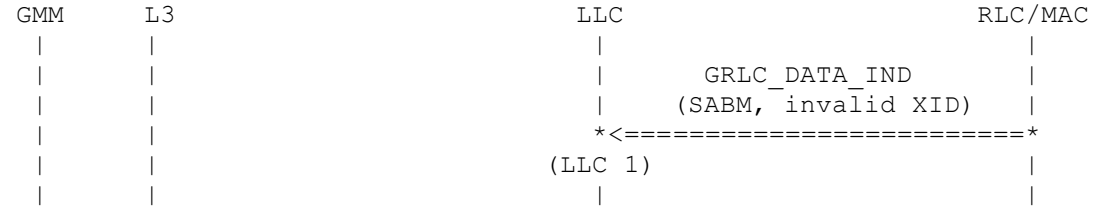
(LLC 1)
LLC receives the SABM command for SAPI 1 or 7, or LLC is not able to enter state 'ABM'. LLC has to send an U frame with F bit set to 1, containing the DM response, to RLC/MAC at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.ABMEST_I.A.003>, <R.LLC.ABMEST_I.A.004>, <R.LLC.ABMEST_I.A.007>, <R.LLC.ABMEST_I.A.016>, <R.LLC.ADMSTATE.A.004>, <R.LLC.ADMSTATE.A.004>, <R.LLC.PEERBUSY.A.016>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the DM response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the DM response. Timer T200 is set. The variable ll_send_ready is set to FALSE.

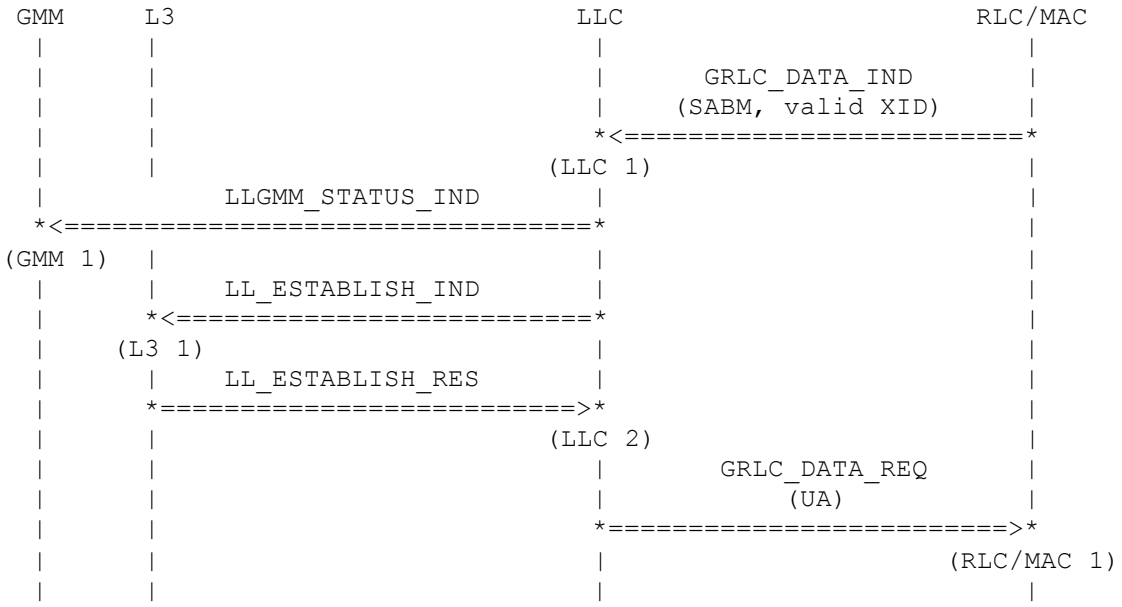
<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <M.LLC.ABMEST_I.A.017>, <R.LLC.TX_IFRM.A.022>

4.6.2.2 Receipt of SABM with peer initiated (re-)establishment with invalid XID field or P bit set to 0



(LLC 1)
The LLC receives an command with an invalid XID-field, or P bit set to 0. The U frame is discarded and no further actions are taken.
<R.LLC.ABMAST_I.A.002>, <R.LLC.PEERBUSY.A.016><, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <XID_INVA.A.001>, <XID_INVA.A.002>, <XID_INVA.A.003>, <XID_INVA.A.004>

4.6.2.3 Receipt of SABM with peer initiated (re-)establishment with valid XID-field and P bit set to 1



(LLC 1)
LLC receives the SABM command with the P bit set to 1. This command may include valid layer-3 XID parameters in the information field. LLC enters state 'Remote Establishment'.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.ABMEST_I.A.003>, <R.LLC.ABMEST_I.A.004>, <R.LLC.ABMEST_I.A.007>, <R.LLC.ADMSTATE.A.004>, <R.LLC.REESTCRI.A.001>, <R.LLC.REESTPRO.A.002>, <R.LLC.REESTPRO.A.003>, <R.LLC.PEERBUSY.A.016>, <R.LLC.OWNRBUSY.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(GMM 1)
If LLC was already in state 'ABM', LLC indicates to GMM that the re-establishment procedure is started, by sending the primitive LLGMM_STATUS_IND (cause = 'peer initiated re-establishment procedure').

<R.LLC.M_STATUS.A.001>, <R.LLC.REESTPRO.A.001>

(L3 1)
LLC indicates the establishment of ABM mode of operation to layer 3 by sending the primitive LL_ESTABLISH_IND. Received layer-3 XID parameters are included in the LL_ESTABLISH_IND primitive.

<R.LLC.ABMEST_I.A.005>

(LLC 2)
LLC waits for the receipt of the primitive LL_ESTABLISH_RES from layer 3. While waiting, all received LL_DATA_REQ are ignored (collision issue). The response must include the negotiated layer-3 XID parameters, if layer-3 XID parameters were included in the corresponding LL_ESTABLISH_IND. LLC has to transmit the UA-response with F bit set to 1, containing negotiated LLC and layer-3 XID parameters, to RLC/MAC at the next opportunity. LLC enters state 'ABM'.

<R.LLC.ABMEST_I.A.006>, <R.LLC.ABMEST_I.A.020>, <R.LLC.ABMEST_I.A.007>, <R.LLC.ABMEST_I.A.008>, <R.LLC.ABMEST_I.A.019>, <R.LLC.ABMEST_I.M.011>, <R.LLC.ABMEST_I.M.012>, <R.LLC.ABMEST_I.M.013>, <R.LLC.ABMEST_I.M.014>, <R.LLC.ABMEST_I.M.015>

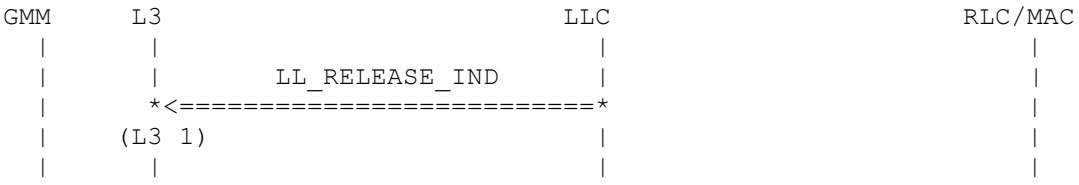
(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the UA response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the UA response. Timer T200 is set. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <M.LLC.ABMEST_I.A.009>, <R.LLC.TX_IFRM.A.022>

4.7 Termination of ABM operation

4.7.1 Mobile originated termination of ABM operation

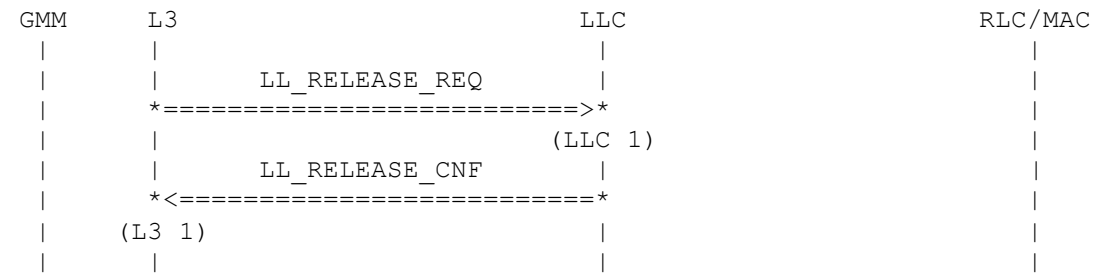
4.7.1.1 Persistent lower layer deactivation and no LL_RELEASE_REQ received



(L3 1)
LLC indicates the release to layer 3 (cause = 'lower layer deactivation').

<R.LLC.ABMTER_R.A.003>, <R.LLC.ABMTER_R.A.003>

4.7.1.2 Termination of ABM operation, local release



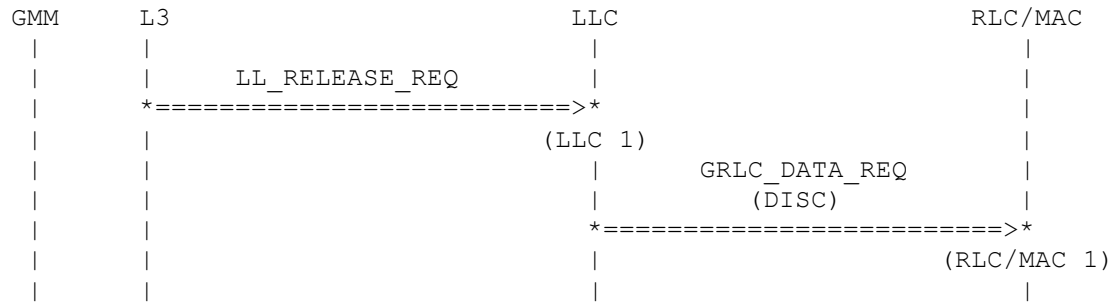
(LLC 1)
LLC receives the primitive LL_RELEASE_REQ (Local = 'local release'). LLC discards all outstanding LL_DATA_REQ primitives and all queued I frames, timer T200 is reset. LLC enters state 'TLLI Assigned/ADM'.

<R.LLC.ABMTER_R.A.002>, <R.LLC.ABMTER_R.A.004>, <R.LLC.ABMTER_R.A.005>, <R.LLC.ABMTER_R.A.006>, <R.LLC.ABMTER_R.A.007>

(L3 1)
LLC confirms the local release to layer 3.

<R.LLC.ABMTER_R.A.008>

4.7.1.3 Termination of ABM operation, not local release



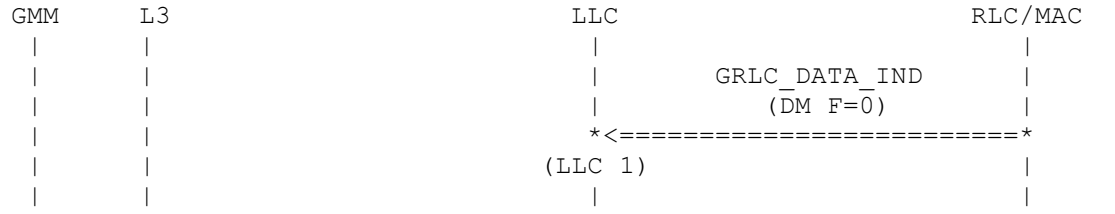
(LLC 1)
LLC receives the primitive LL_RELEASE_REQ (Local = 'not local release'). LLC discards all outstanding LL_DATA_REQ primitives and all queued I frames. The retransmission counter is reset. LLC enters state 'Local Release'. LLC sends the DISC command at the next opportunity. LLC enters state 'Local Release'.

<R.LLC.ABMTER_R.A.009>, <R.LLC.ABMTER_R.A.010>, <R.LLC.ABMTER_R.A.013>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the DISC command is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the DISC command in a U frame. Timer T200 is set and the variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMTER_R.A.012>, <R.LLC.TX_IFRM.A.022>

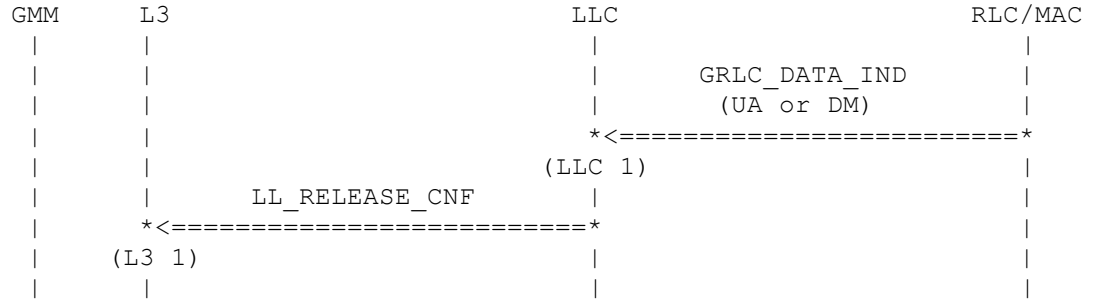
4.7.1.4 Receipt of DM response with F bit set to 0 in state 'Local Release'



(LLC 1)
LLC receives an DM response with the F bit set to 0 while in state 'Local Release'. LLC discards the U frame and no further actions are taken.

<R.LLC.R_DATA.M.002>, <R.LLC.XCEPTION.A.006>

4.7.1.5 Receipt of UA or DM response with F bit is set to 1 in state 'Local Release'



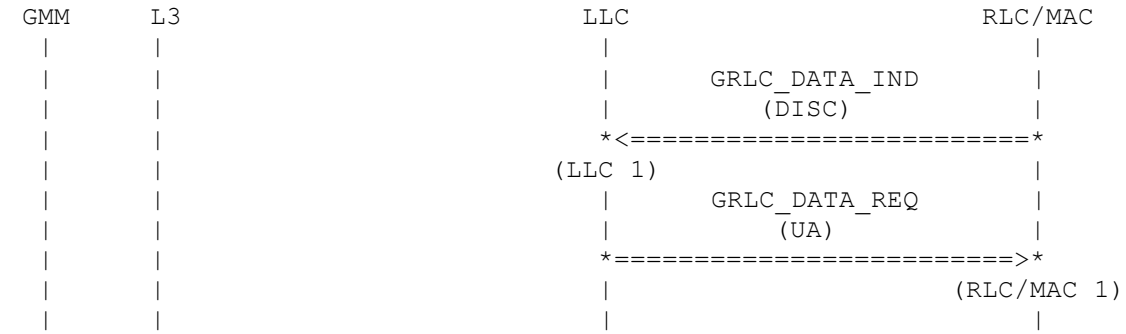
(LLC 1)
LLC receives the UA or DM response in a U frame with the F bit set to 1 while in state 'Local Release'. Timer T200 is reset. LLC enters state 'TLLI Assigned/ADM'.

<R.LLC.R_DATA.M.002>, <R.LLC.ABMTER_R.A.014>, <R.LLC.ABMTER_R.A.015>, <R.LLC.COLITXRX.A.012>, <R.LLC.COLDTXRX.A.006>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>

(L3 1)
LLC sends the primitive LL_RELEASE_CNF (Cause = 'normal release') to layer 3.

<R.LLC.ABMTER_R.A.016>, <R.LLC.COLITXRX.A.013>

4.7.1.6 Receipt of DISC command in state 'Local Release'



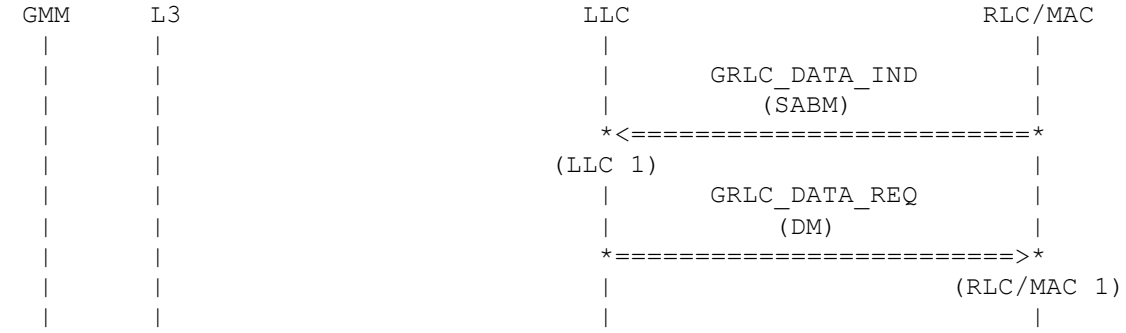
(LLC 1)
The DISC command is received in a U frame. LLC sends the UA response at the next opportunity. LLC remains in state 'Local Release'.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.COLITXRX.A.009>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the UA response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the UA response in a U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.002>, <R.LLC.COLITXRX.M.010>, <R.LLC.TX_IFRM.A.022>

4.7.1.7 Receipt of SABM command in state 'Local Release'



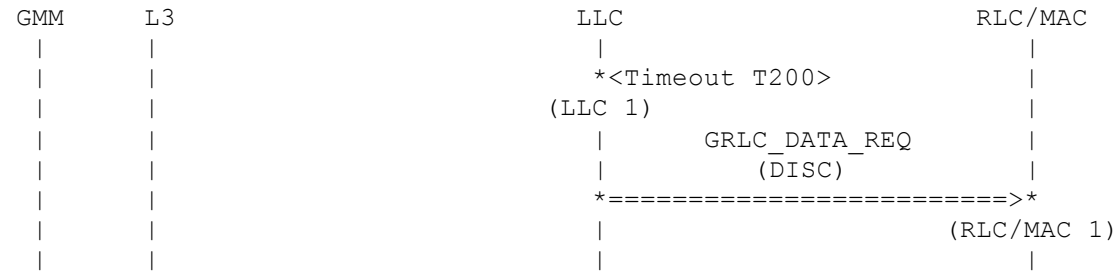
(LLC 1)
LLC is in state 'Local Release' and the SABM command is received in a U frame with the P bit set to 1. LLC sends the DM response at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.PEERBUSY.A.016>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the DM response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the DM response in a U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.002>, <R.LLC.TX_IFRM.A.022>

4.7.1.8 Timeout of timer T200, max. retransmission not reached in state 'Local Release'



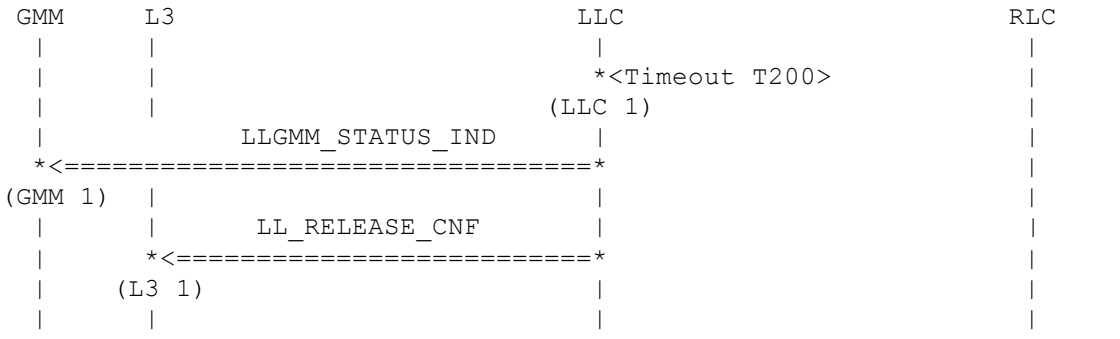
(LLC 1)
Timeout of timer T200. The retransmission counter is incremented and does not exceed N200. LLC retransmits the DISC command at the next opportunity.

<R.LLC.ABMTER_R.A.017>, <R.LLC.ABMTER_R.A.018>, <R.LLC.ABMTER_R.A.019>, <R.LLC.ABMTER_R.A.009>, <R.LLC.ABMTER_R.M.010>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the DISC command is buffered until it can be sent (see section 4.1.1). Otherwise LLC retransmits the DISC command in a U frame. Timer T200 is set. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.TX_IFRM.A.022>

4.7.1.9 Timeout of timer T200, max. retransmission reached in state 'Local Release'



(LLC 1)
Timeout of timer T200. The retransmission counter is incremented and exceeds N200. LLC enters state 'TLLI Assigned/ADM'.

<R.LLC.ABMTER_R.A.017>, <R.LLC.ABMTER_R.A.021>

(GMM 1)
LLC sends the primitive LLGMM_STATUS_IND (cause ='no peer response during release of connection') to GMM.

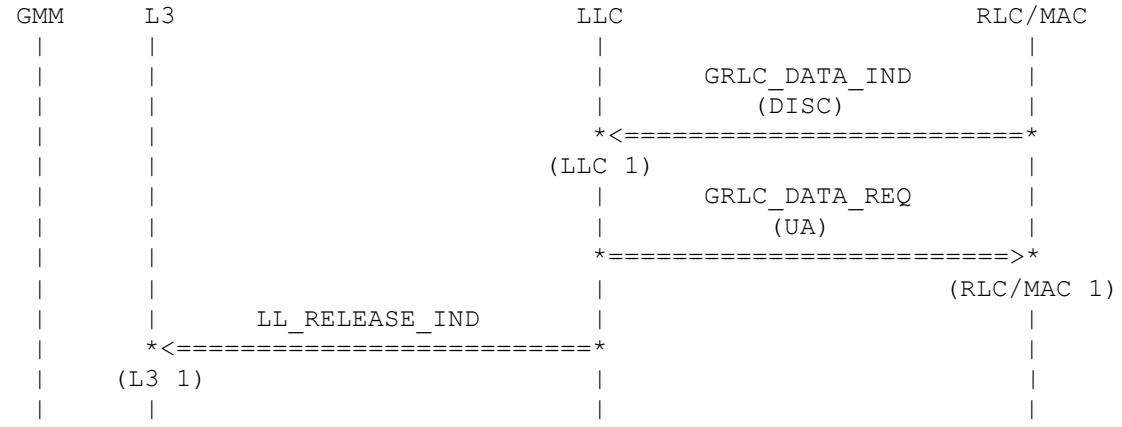
<R.LLC.M_STATUS.A.020>

(L3 1)
LLC sends the primitive LL_RELEASE_CNF to layer 3.

<R.LLC.ABMTER_R.A.022>

4.7.2 Network originated termination of ABM operation

4.7.2.1 Termination of ABM operation while in state 'ABM'



(LLC 1)
LLC is in state 'ABM' and the DISC command is received in a U frame with the P bit set to 1. LLC sends the UA response at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.ABMTER_I.A.001>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

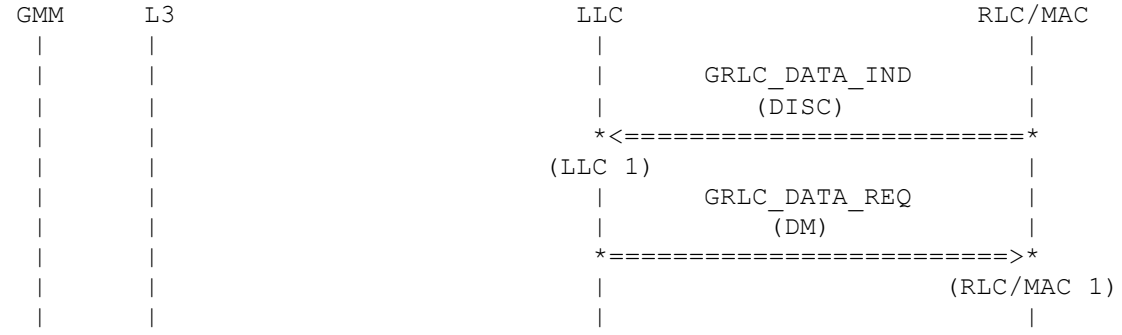
(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the UA response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the UA response in a U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.002>, <R.LLC.ABMTER_I.M.002>, <R.LLC.TX_IFRM.A.022>

(L3 1)
LLC sends the primitive LL_RELEASE_IND (Cause = 'normal release') to layer 3. LLC enters state 'TLLI Assigned/ADM'.

<R.LLC.ABMTER_I.A.004>, <R.LLC.ABMTER_I.A.005>

4.7.2.2 Termination of ABM operation while in state 'ADM'



(LLC 1)
LLC is in state 'ADM', LLC is not suspended and the DISC command is received in a U frame with the P bit set to 1. LLC sends the DM response at the next opportunity.

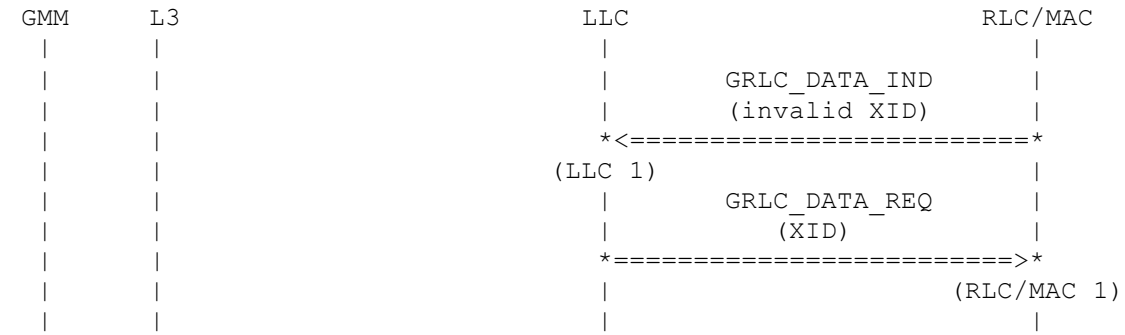
<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.ABMTER_I.A.006>, <R.LLC.ADMSTATE.A.001>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the DM response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the DM response in a U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMTER_I.M.007>, <R.LLC.ADMSTATE.A.002>, <R.LLC.TX_IFRM.A.022>

4.8 XID negotiation

4.8.1 Receipt of XID response/command with invalid XID field



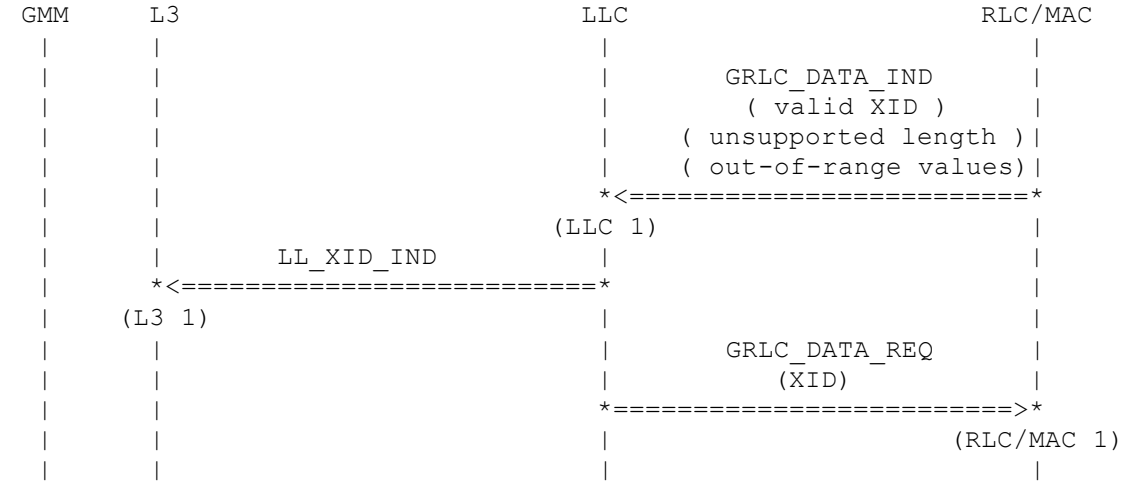
(LLC 1)
LLC receives a U frame, containing an invalid XID field. LLC discards the frame. If the U frame contains a XID response, the retransmission counter is incremented and LLC has to retransmit the sent XID command, if any.

<R.LLC.R_DATA.M.002>, <R.LLC.XIDNEG_O.A.011>, <R.LLC.XIDNEG_O.A.012>, <R.LLC.XIDNEG_O.A.012>, <R.LLC.XIDNEG_R.A.001>, <R.LLC.ADMSTATE.A.008>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <XID_INVA.A.001>, <XID_INVA.A.002>, <XID_INVA.A.004>, <XID_INVA.A.005>, <XID_INVA.A.006>, <XID_INVA.A.007>, <XID_INVA.A.008>, <XID_INVA.A.009>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID command is buffered until it can be sent (see section 4.1.1). Otherwise LLC retransmits the XID command in a U frame. Timer T200 is set. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_O.A.014>, <R.LLC.TX_IFRM.A.022>

4.8.2 Receipt of XID command with valid XID field but with unsupported length or out-of-range values



(LLC 1)
LLC receives a U frame, containing an valid XID field. LLC responds to with lengths and values set according to the responder's preferences.

<R.LLC.R_DATA.M.002>, <R.LLC.XIDNEG_R.A.003>, <R.LLC.XIDNEG_R.A.006>, <R.LLC.XIDNEG_R.A.007>, <R.LLC.XIDNEG_R.A.008>,<R.LLC.XIDNEG_R.A.012> <R.LLC.ADMSTATE.A.008>, <XID_INVA.A.001>, <XID_INVA.A.002>, <XID_INVA.A.004>, <XID_INVA.A.005>, <XID_INVA.A.006>, <XID_INVA.A.007>, <XID_INVA.A.008>, <XID_INVA.A.009>

(L3 1)
If the parameters N201-U or N201-I have been changed, the new values for these parameters are passed to layer 3 with the LL_XID_IND primitive.

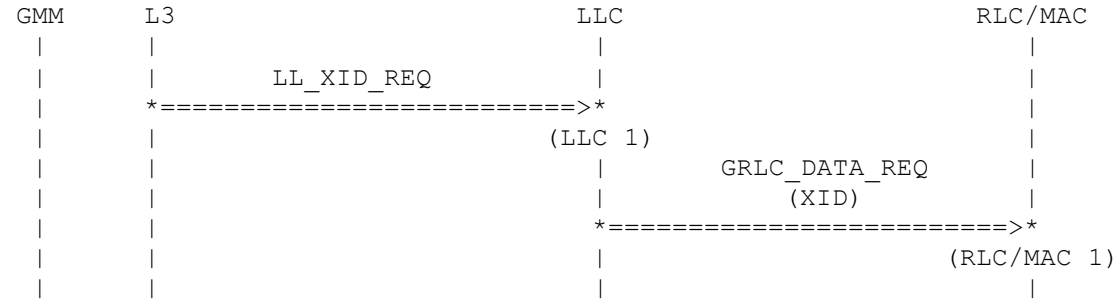
<R.LLC.XIDNEG_O.A.010>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID response is buffered until it can be sent (see section 4.1.1). Otherwise LLC retransmits the XID response in a U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_R.M.009>, <R.LLC.TX_IFRM.A.022>

4.8.3 Mobile originated XID negotiation

4.8.3.1 Layer-3 originated XID negotiation



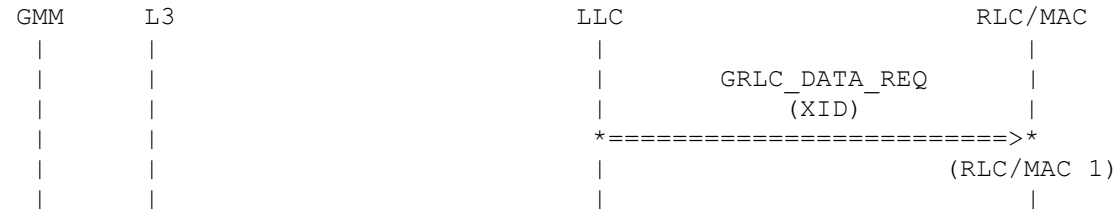
(LLC 1)
LLC receives the request to negotiate layer-3 XID parameters from layer 3. LLC sends the XID command containing the requested layer-3 XID parameters, at the next opportunity.

<R.LLC.XIDNEG_O.A.001>, <R.LLC.XIDNEG_O.A.002>, <R.LLC.XIDNEG_O.A.024>, <R.LLC.XIDNEG_O.A.003>, <R.LLC.XIDNEG_O.A.004>, <R.LLC.XIDNEG_O.A.025>, <R.LLC.XIDPAR.A.002>, <R.LLC.XIDPAR.A.003>, <R.LLC.XIDPAR.A.004>, <R.LLC.XIDPAR.A.005>, <R.LLC.XIDPAR.A.006>, <R.LLC.XIDPAR.A.007>, <R.LLC.XIDPAR.A.008>, <R.LLC.XIDPAR.A.009>, <R.LLC.XID_PARM.A.001>, <R.LLC.XID_PARM.A.003>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID command is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the XID command, sets timer T200, and sets the variable ll_send_ready to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_O.M.005>, , <R.LLC.TX_IFRM.A.022><R.LLC.XIDNEG_O.A.007>

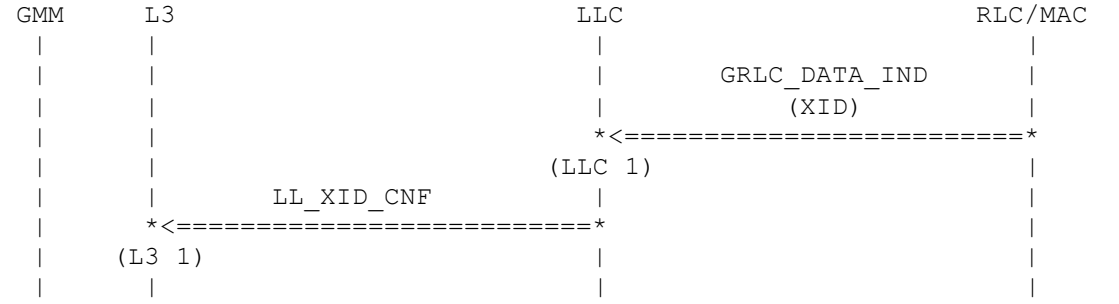
4.8.3.2 LLC originated XID negotiation



(RLC/MAC 1)
LLC transmits the XID command, containing LLC layer XID parameters that are to be negotiated, at the next opportunity. If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID command is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the XID command, sets timer T200 and the variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_O.A.003>, <R.LLC.XIDNEG_O.M.005>, <R.LLC.XIDNEG_O.A.007>, <R.LLC.XIDPAR.A.001>, <R.LLC.XIDPAR.A.002>, <R.LLC.XIDPAR.A.003>, <R.LLC.XIDPAR.A.004>, <R.LLC.XIDPAR.A.005>, <R.LLC.XIDPAR.A.006>, <R.LLC.XIDPAR.A.007>, <R.LLC.XIDPAR.A.008>, <R.LLC.XIDPAR.A.009>, <R.LLC.XID_PARM.A.001>, <R.LLC.XID_PARM.A.003>, <R.LLC.TX_IFRM.A.022>

4.8.3.3 Receipt of XID response with layer-3 originated XID negotiation



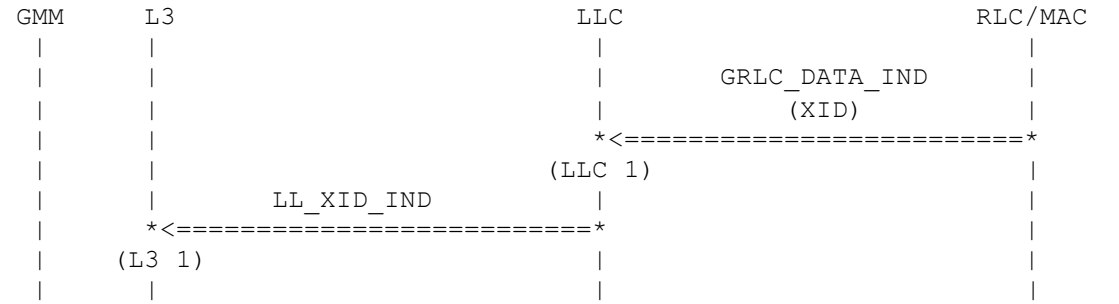
(LLC 1)
LLC receives the XID response with the F bit set to 1, containing the negotiated LLC layer/layer-3 XID parameters. Timer T200 is reset.

<R.LLC.R_DATA.M.002>, <R.LLC.XIDNEG_O.A.008>, <R.LLC.XID_PARM.A.001>, <R.LLC.ADMSTATE.A.008>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
The received layer-3 XID parameters are passed to layer 3 with the LL_XID_CNF primitive. Additionally, the parameters N201-U and N201-I are included in the primitive if they have been changed with the negotiation.

<R.LLC.XIDNEG_O.A.009>

4.8.3.4 Receipt of XID response with LLC originated XID negotiation



(LLC 1)
LLC receives the XID response with the F bit set to 1, containing the negotiated LLC layer XID parameters.

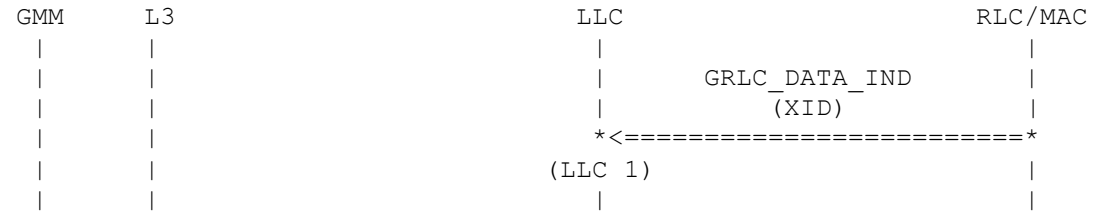
<R.LLC.R_DATA.M.002>, <R.LLC.XID_PARM.A.001>, <R.LLC.ADMSTATE.A.008>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
If the parameters N201-U or N201-I have been changed, the new values for these parameters are passed to layer 3 with the LL_XID_IND primitive.

<R.LLC.XIDNEG_O.A.010>

4.8.3.5 Collision of both sides XID negotiation

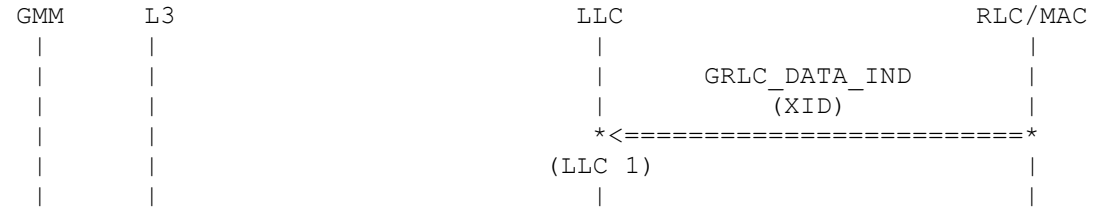
4.8.3.5.1 Layer 3 XID parameters are present both or neither



(LLC 1)
LLC has transmitted the XID command and also receives an XID command from the peer instead of the expected XID response. LLC ignores the received XID command and waits until the XID response is received from the peer.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.ADMSTATE.A.008>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.COLITXRX.A.022>

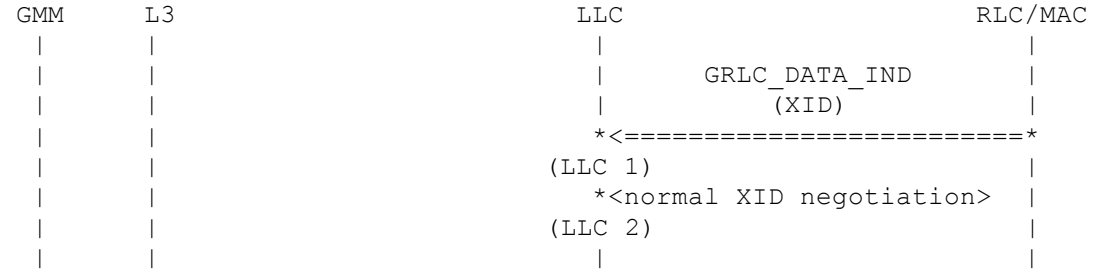
4.8.3.5.2 Layer 3 XID parameters are present in the MS command and not in the SGSN command



(LLC 1)
LLC has transmitted the XID command and also receives an XID command from the peer instead of the expected XID response. LLC ignores the received XID command and waits until the XID response is received from the peer.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.ADMSTATE.A.008>, <R.LLC.COLITXRX.A.023>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

4.8.3.5.3 Layer 3 XID parameters are present in the SGSN command and not in the MS command



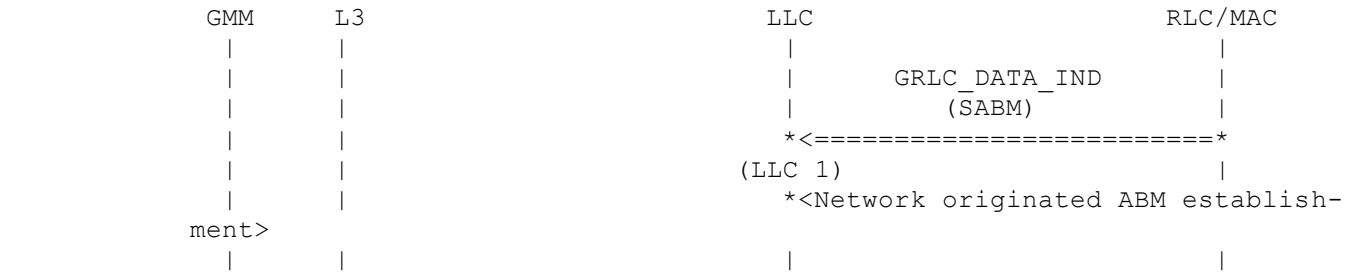
(LLC 1)
LLC has transmitted the XID command and also receives an XID command from the peer instead of the expected XID response. LLC treats the already transmitted XID command as not transmitted. Timer T200 is reset.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.ADMSTATE.A.008>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.COLITXRX.A.023>, <R.LLC.COL.A.001>

(LLC 2)
The procedure 'Network originated XID negotiation' (see 4.8.4) is initiated.

<R.LLC.COLITXRX.A.023>

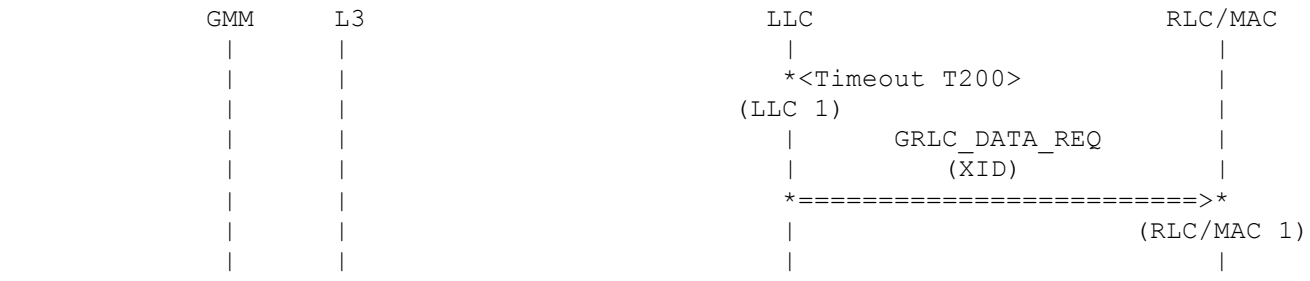
4.8.3.6 Collision of XID command and SABM command



(LLC 1)
LLC receives the SABM command instead of the expected XID response. If LLC is able to establish ABM mode of operation, the procedure 'Network originated establishment of ABM operation' (see 4.6.2) is initiated. Timer T200 is reset.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.COLDTXRX.A.008>, <R.LLC.COL.A.001>, <R.LLC.PEERBUSY.A.016>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

4.8.3.7 Timeout of timer T200, max. retransmission not reached



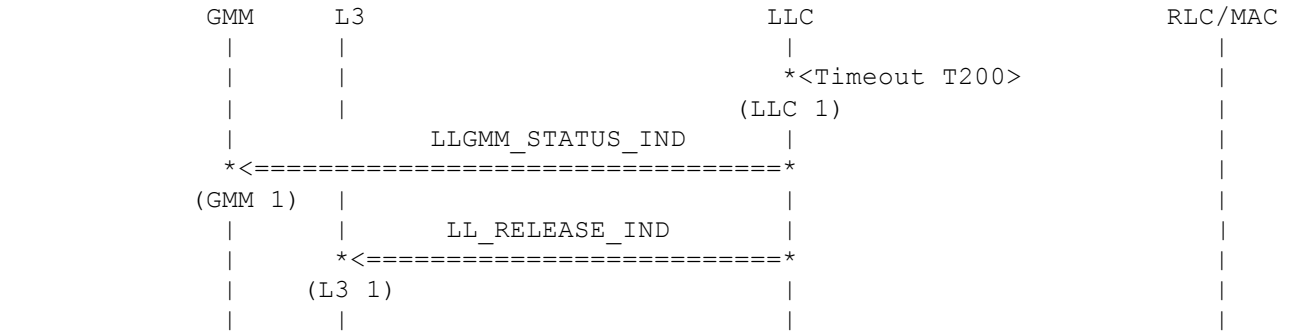
(LLC 1)
Timeout of timer T200. The retransmission counter is incremented and does not exceed N200. LLC sets timer T200 and retransmits the XID command at the next opportunity.

<R.LLC.XIDNEG_O.A.013>, <R.LLC.XIDNEG_O.A.001>, <R.LLC.XIDNEG_O.A.018>, <R.LLC.XIDNE G_O.A.019>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID command is buffered until it can be sent (see section 4.1.1). Otherwise LLC retransmits the XID command in a U frame. Timer T200 is set. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_O.A.014>, <R.LLC.TX_IFRM.A.022>

4.8.3.8 Timeout of timer T200, max. retransmission reached



(LLC 1)
Timeout of timer T200. The retransmission counter is incremented and exceeds N200. LLC enters state 'TLLI Assigned/ADM'.

<R.LLC.XIDNEG_O.A.017>, <R.LLC.XIDNEG_O.A.023>

(GMM 1)
LLC sends the primitive LLGMM_STATUS_IND (cause = 'no peer response during parameter negotiation') to GMM.

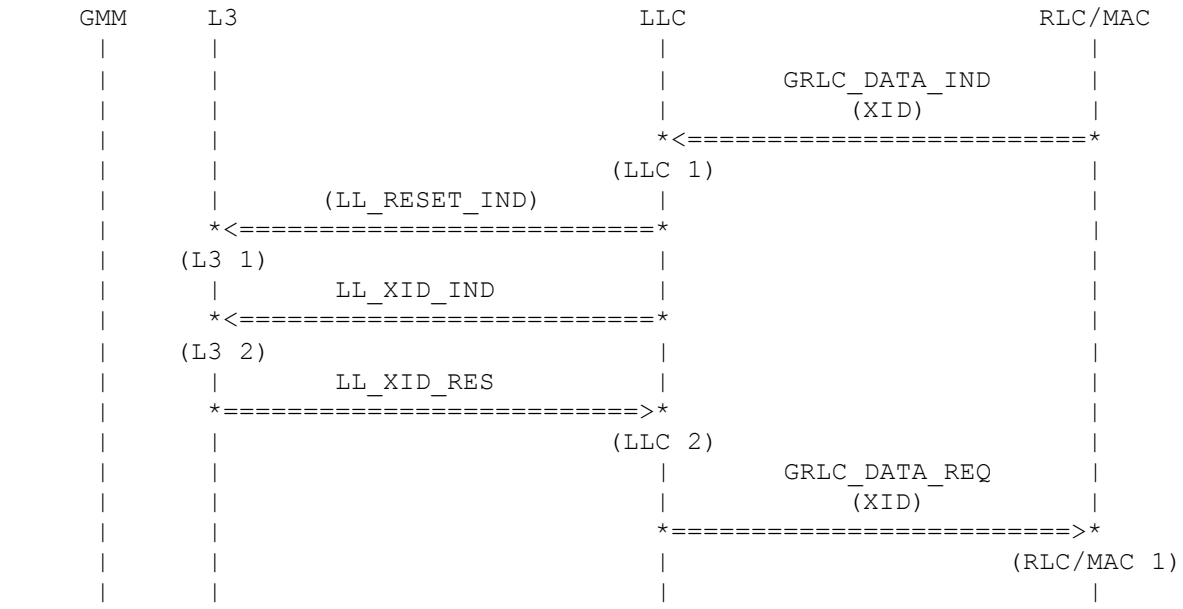
<R.LLC.M_STATUS.A.001>, <R.LLC.XIDNEG_O.A.015>, <R.LLC.XIDNEG_O.A.021>

(L3 1)
LLC sends the primitive LL_RELEASE_IND (Cause ='no peer response') to layer 3.

<R.LLC.XIDNEG_O.A.016>, <R.LLC.XIDNEG_O.A.022>

4.8.4 Network originated XID negotiation

4.8.4.1 Layer-3 XID parameter negotiation



(LLC 1)
LLC receives the XID command from the peer LLC. The LLC transmits the XID response at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.XIDNEG_R.A.002>, <R.LLC.XIDNEG_R.A.003>, <R.LLC.XID_PARM.A.001>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
If the first parameter is Reset, LLC is being reset and SNDCP will be informed with the LL_RESET_IND primitive.

<R.LLC.L_RESET.M.002>, <XIDRESET.A.008>, <XIDRESET.A.001>, <XIDRESET.A.002>, <XIDRESET.A.003>, <XIDRESET.A.004>, <XIDRESET.A.005>, <XIDRESET.A.006>, <XIDRESET.A.007>

(L3 2)
If the XID information field of the received XID command contained layer-3 XID parameters, or if the parameters N201-U or N201-I have been changed, these parameters are passed to layer 3 with the LL_XID_IND primitive.

<R.LLC.XIDNEG_R.A.004>

(LLC 2)
If the XID information field of the received XID command contained layer-3 XID parameters, LLC waits for the primitive LL_XID_RES from layer-3, containing the negotiated layer-3 XID parameters.

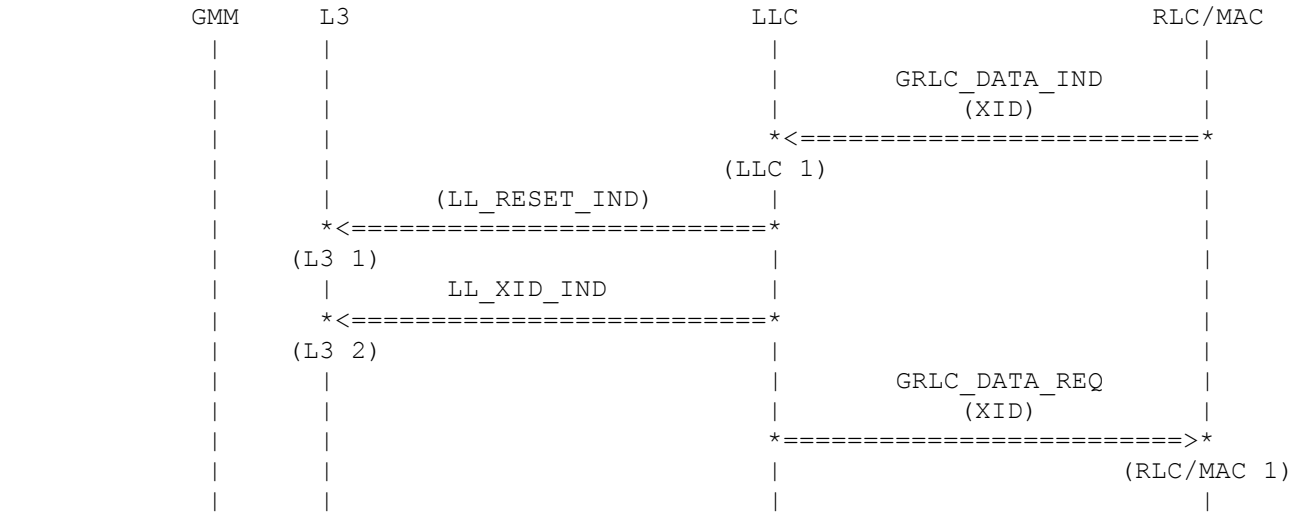
<R.LLC.XIDNEG_R.A.005>, <R.LLC.XIDNEG_R.A.013>, <R.LLC.XIDNEG_R.A.006>, <R.LLC.XIDNEG_R.A.007>, <R.LLC.XIDNEG_R.A.008>, <R.LLC.XIDNEG_R.A.012>, <R.LLC.XIDPAR.A.002>, <R.LLC.XIDPAR.A.003>, <R.LLC.XIDPAR.A.004>, <R.LLC.XIDPAR.A.005>, <R.LLC.XIDPAR.A.006>, <R.LLC.XIDPAR.A.007>, <R.LLC.XIDPAR.A.008>, <R.LLC.XIDPAR.A.009>, <R.LLC.XID_PARM.A.001>, <R.LLC.XID_PARM.A.002>, <R.LLC.XID_PARM.A.003>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the XID response, containing the negotiated LLC and/or layer-3 XID parameters. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_R.M.009>, <R.LLC.TX_IFRM.A.022>

4.8.4.2 No layer-3 XID parameter negotiation

4.8.4.2.1 N201-U or N201-I parameters changed



(LLC 1)
LLC receives the XID command from the peer LLC. The LLC transmits the XID response at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.XIDNEG_R.A.002>, <R.LLC.XIDNEG_R.A.003>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
If the first parameter is Reset, LLC is being reset and SNDCP will be informed with the LL_RESET_IND primitive.

<R.LLC.L_RESET.M.002>, <XIDRESET.A.008>, <XIDRESET.A.001>, <XIDRESET.A.002>, <XIDRESET.A.003>, <XIDRESET.A.004>, <XIDRESET.A.005>, <XIDRESET.A.006>, <XIDRESET.A.007>

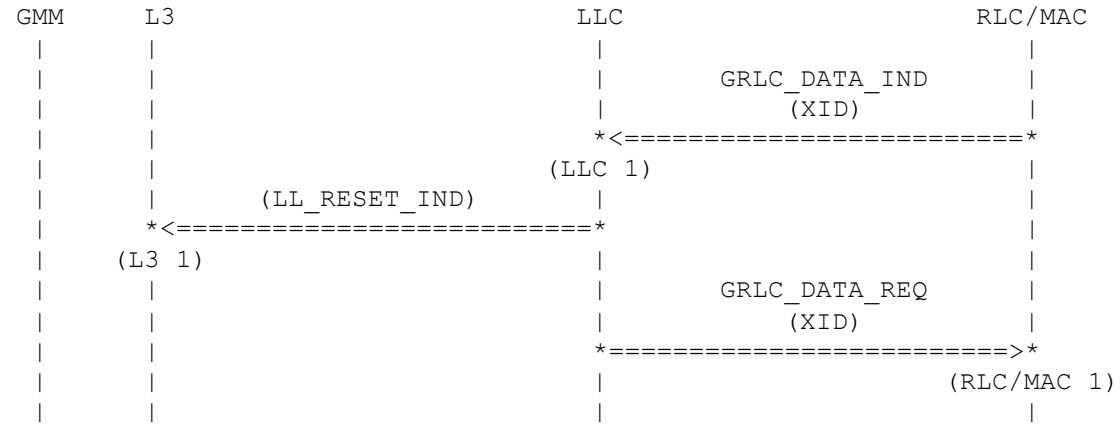
(L3 2)
If the parameters N201-U or N201-I have been changed, these parameters are passed to layer 3 with the LL_XID_IND primitive.

<R.LLC.XIDNEG_R.A.004>, <R.LLC.XIDNEG_R.A.011>, <R.LLC.XIDNEG_R.A.006>, <R.LLC.XIDNEG_R.A.007>, <R.LLC.XIDNEG_R.A.008>, <R.LLC.XIDNEG_R.A.012>, <R.LLC.XIDPAR.A.002>, <R.LLC.XIDPAR.A.003>, <R.LLC.XIDPAR.A.004>, <R.LLC.XIDPAR.A.005>, <R.LLC.XIDPAR.A.006>, <R.LLC.XIDPAR.A.007>, <R.LLC.XIDPAR.A.008>, <R.LLC.XIDPAR.A.009>, <R.LLC.XID_PARM.A.001>, <R.LLC.XID_PARM.A.002>, <R.LLC.XID_PARM.A.003>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the XID response. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_R.M.009>, <R.LLC.TX_IFRM.A.022>

4.8.4.3 N201-U or N201-I parameters not changed



(LLC 1)
LLC receives the XID command from the peer LLC. LLC transmits the XID response at the next opportunity.

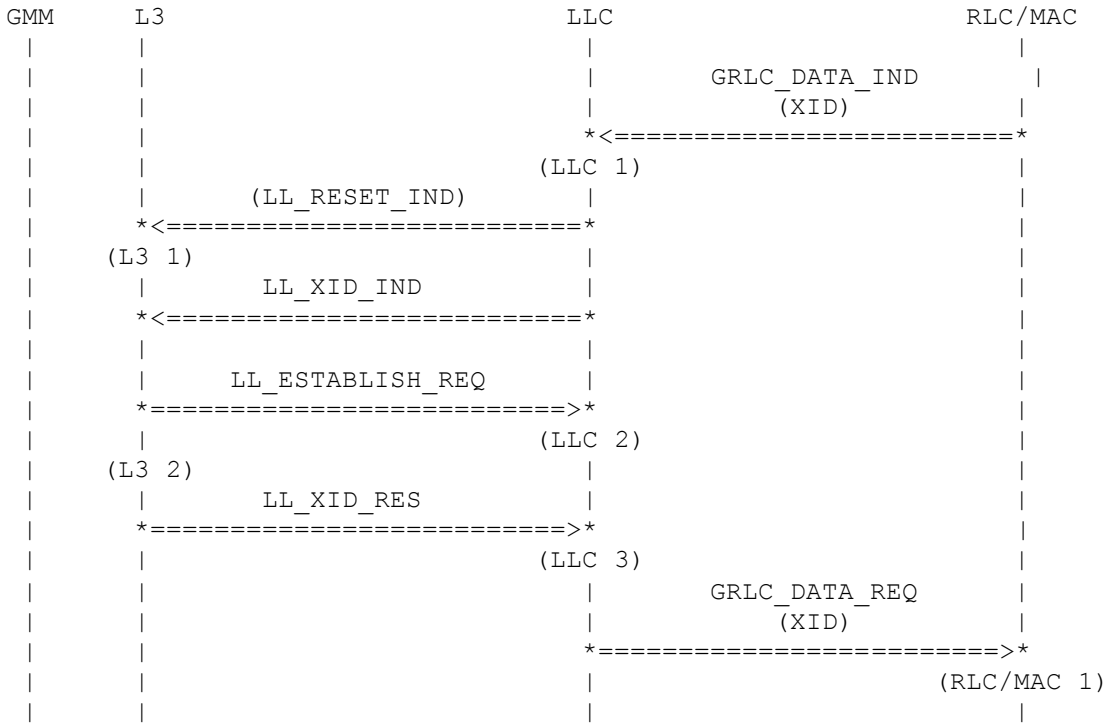
<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.XIDNEG_R.A.002>, <R.LLC.XIDNEG_R.A.003>, <R.LLC.XIDNEG_R.A.006>, <R.LLC.XIDNEG_R.A.007>, <R.LLC.XIDNEG_R.A.008>, <R.LLC.XIDNEG_R.A.012>, <R.LLC.XIDPAR.A.002>, <R.LLC.XIDPAR.A.003>, <R.LLC.XIDPAR.A.004>, <R.LLC.XIDPAR.A.005>, <R.LLC.XIDPAR.A.006>, <R.LLC.XIDPAR.A.007>, <R.LLC.XIDPAR.A.008>, <R.LLC.XIDPAR.A.009>, <R.LLC.XID_PARM.A.001>, <R.LLC.XID_PARM.A.002>, <R.LLC.XID_PARM.A.003>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
If the first parameter is Reset, LLC is being reset and SNDCP will be informed with the LL_RESET_IND primitive.

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the XID response. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_R.M.009>, <R.LLC.TX_IFRM.A.022>

4.8.4.4 Collision of XID command and SABM command



(LLC 1)
LLC receives the XID command from the peer LLC. The LLC transmits the XID response at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.XIDNEG_R.A.002>, <R.LLC.XIDNEG_R.A.003>, <R.LLC.XID_PARM.A.001>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
If the first parameter is Reset, LLC is being reset and SNDCP will be informed with the LL_RESET_IND primitive.

<R.LLC.L_RESET.M.002>, <XIDRESET.A.008>, <XIDRESET.A.001>, <XIDRESET.A.002>, <XIDRESET.A.003>, <XIDRESET.A.004>, <XIDRESET.A.005>, <XIDRESET.A.006>, <XIDRESET.A.007>

(L3 2)
If the XID information field of the received XID command contained layer-3 XID parameters, or if the parameters N201-U or N201-I have been changed, these parameters are passed to layer 3 with the LL_XID_IND primitive.

<R.LLC.XIDNEG_R.A.004>

(LLC 2)
SNDCP sends the primitive LL_ESTABLISH_REQ to LLC to request establishment of ABM. LLC is expecting XID response . LLC ignores this primitive and sends the XID response to the peer

<R.LLC.ABMEST_R.A.001>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.A.004>, <R.LLC.ABMEST_R.A.032>, <R.LLC.ABMEST_R.A.005>, <R.LLC.ABMEST_R.A.007>, <R.LLC.ABMEST_R.A.008>, <R.LLC.REESTCRI.A.002>, <R.LLC.OWNRBUSY.A.006>

(LLC 3)
If the XID information field of the received XID command contained layer-3 XID parameters, LLC waits for the primitive LL_XID_RES from layer-3, containing the negotiated layer-3 XID parameters.

<R.LLC.XIDNEG_R.A.005>, <R.LLC.XIDNEG_R.A.013>, <R.LLC.XIDNEG_R.A.006>, <R.LLC.XIDNEG_R.A.007>, <R.LLC.XIDNEG_R.A.008>, <R.LLC.XIDNEG_R.A.012>, <R.LLC.XIDPAR.A.002>, <R.LLC.XIDPAR.A.003>, <R.LLC.XIDPAR.A.004>, <R.LLC.XIDPAR.A.005>, <R.LLC.XIDPAR.A.006>, <R.LLC.XIDPAR.A.007>, <R.LLC.XIDPAR.A.008>, <R.LLC.XIDPAR.A.009>, <R.LLC.XID_PARM.A.001>, <R.LLC.XID_PARM.A.002>, <R.LLC.XID_PARM.A.003>

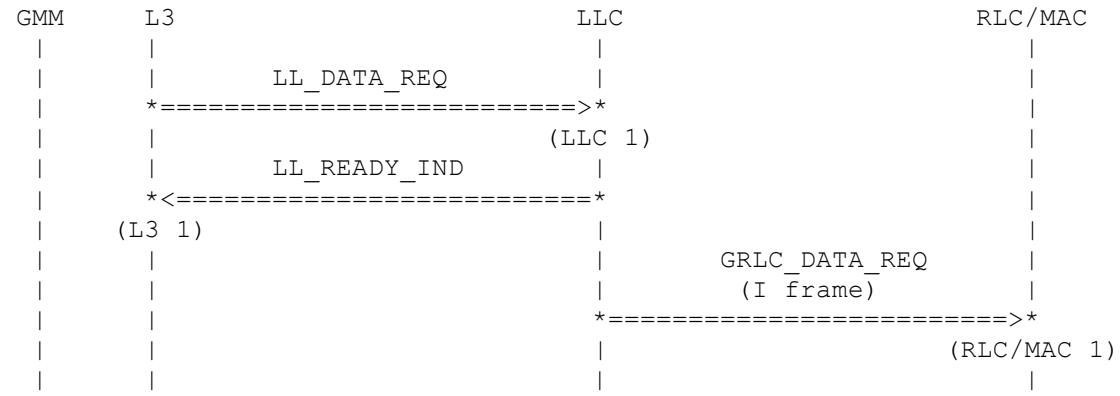
(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the XID response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the XID response, containing the negotiated LLC and/or layer-3 XID parameters. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.XIDNEG_R.M.009>, <R.LLC.TX_IFRM.A.022>

4.9 Acknowledged information transfer

4.9.1 Transmitting information frames

4.9.1.1 Request of information transmission



(LLC 1)
LLC receives the primitive LL_DATA_REQ (L3-PDU) from layer 3. The L3-PDU is stored as I frame in the local LLC I frame send buffer for transmission. The retransmission counter is reset.
If the window size has been reached or if any I frames in the local buffer are marked for retransmission, LLC retransmits the I frame with the lowest send sequence number N(S) at the next opportunity. Otherwise, if there is a new frame to transmit due to a previously received LL_DATA_REQ primitive, LLC transmits the new I frame at the next opportunity.

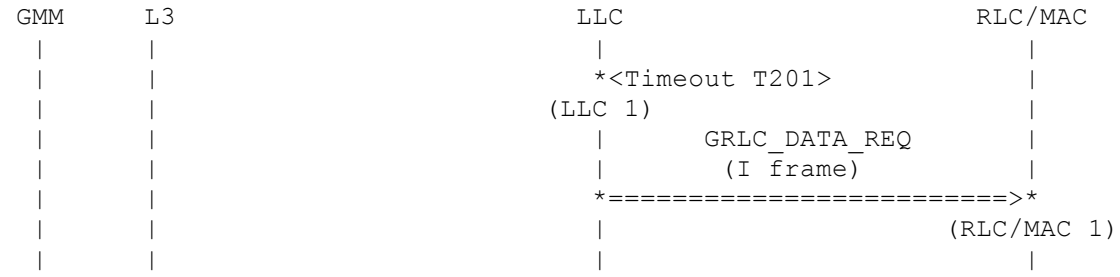
<R.LLC.L_DATA.A.001>, <R.LLC.ABM_OPER.A.001>, <R.LLC.ABM_OPER.A.002>, <R.LLC.ABM_OPER.A.003>, <R.LLC.TX_IFRM.A.001>, <R.LLC.TX_IFRM.A.002>, <R.LLC.TX_IFRM.A.003>, <R.LLC.TX_IFRM.A.004>, <R.LLC.TX_IFRM.A.005>, <R.LLC.TX_IFRM.A.006>, <R.LLC.TX_IFRM.A.011>, <R.LLC.TX_IFRM.A.013>, <R.LLC.TX_IFRM.A.016>, <R.LLC.TX_IFRM.A.021>

(L3 1)
If enough space is available for another frame in the local LLC I frame send buffer, LLC sends the primitive LL_READY_IND to layer 3.

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, or if LLC is suspended, or if the peer receiver is busy, no further actions are taken. Otherwise LLC sends the I frame to RLC/MAC. If timer T201 has to be started, timer T201 is set. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.TX_IFRM.A.001>, <R.LLC.TX_IFRM.M.014>, <R.LLC.TX_IFRM.A.012>, <R.LLC.TX_IFRM.A.022>

4.9.1.2 Timeout of timer T201, max. retransmission not reached



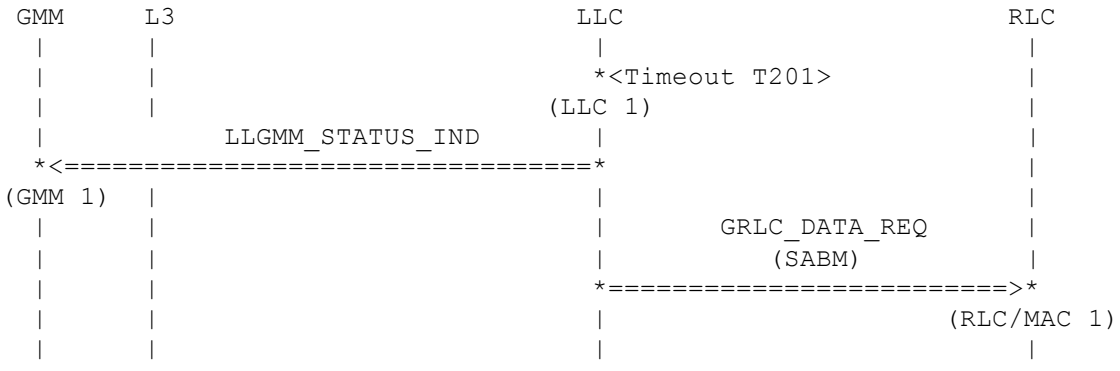
(LLC 1)
Timeout of timer T201. The retransmission counter for the I frame associated with timer T201 is incremented and does not exceed N200. LLC retransmits the I frame with the A bit set to 1 at the next opportunity.

<R.LLC.TX_IFRM.A.008>, <R.LLC.TX_ACK.A.002>, <R.LLC.TX_IFRM.A.022>, <R.LLC.TX_IFRM.A.023>, <R.LLC.TX_IFRM.A.024>, <R.LLC.TX_IFRM.A.025>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken. Otherwise LLC retransmits the I frame with the A bit set to 1. Timer T201 is set and the variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.TX_IFRM.A.022>, <R.LLC.TX_IFRM.A.026>

4.9.1.3 Timeout of timer T201, max. retransmission reached



(LLC 1)
Timeout of timer T201. The retransmission counter is incremented for the I frame associated with timer T201 and exceeds N200. LLC initiates the re-establishment procedure. LLC discards all outstanding LL_DATA_REQ primitives and all I frames in the local LLC frame buffer. LLC transmits the SABM command at the next opportunity. LLC enters state 'Local Establishment'.

<R.LLC.TX_IFRM.A.009>, <R.LLC.REESTCRI.A.003>, <R.LLC.REESTPRO.A.001>, <R.LLC.REESTPRO.A.002>, <R.LLC.REESTPRO.A.003>, <R.LLC.REESTPRO.A.004>, <R.LLC.ABMEST_R.A.001>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.M.004>, <R.LLC.TX_IFRM.A.022>, <R.LLC.TX_IFRM.A.027>

(GMM 1)
LLC indicates to GMM, that re-establishment is started (cause = 'no peer response during waiting for acknowledgement; re-establishment procedure initiated').

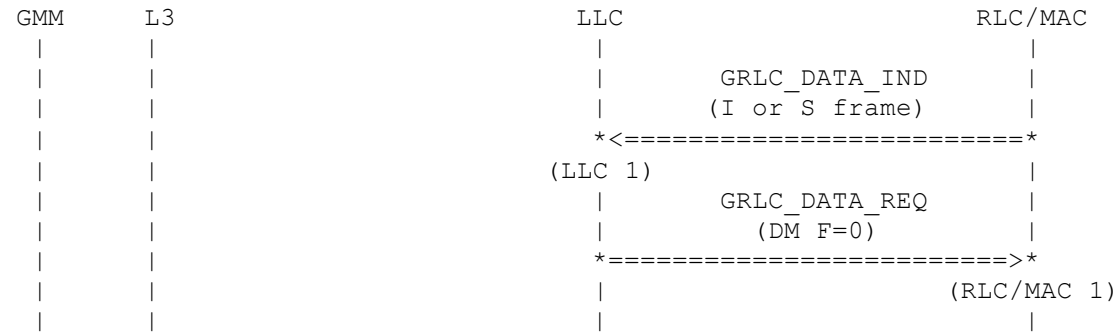
<R.LLC.REESTPRO.A.001>, <R.LLC.TX_IFRM.A.028>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the SABM command is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the SABM command in a U frame. Timer T200 is set, the retransmission counter is reset. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMEST_R.M.005>, <R.LLC.ABMEST_R.M.009>

4.9.2 Receiving information or supervisory frames

4.9.2.1 Receiving information or supervisory command in state 'ADM/TLLI Assigned'



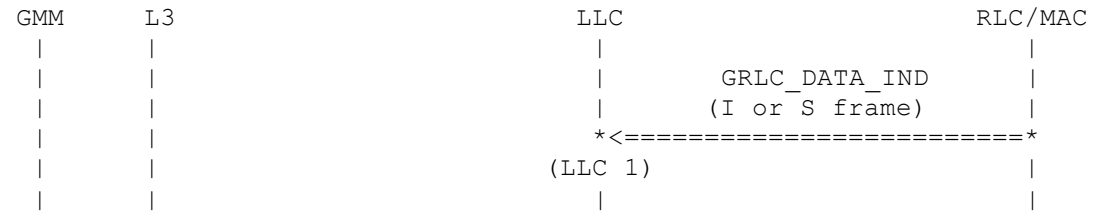
(LLC 1)
LLC receives an I or S frame in state 'ADM'. LLC has to send a DM response with the F bit is set to 0 at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.ADMSTATE.A.010>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>

(RLC/MAC 1)
If the GRLC is not in a READY state, no further actions are taken, i.e. the DM response is buffered until it can be sent (see section 4.1.1). Otherwise the DM responce is transmitted in an U frame to RLC/MAC. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.ADMSTATE.M.011>, <R.LLC.TX_IFRM.A.022>

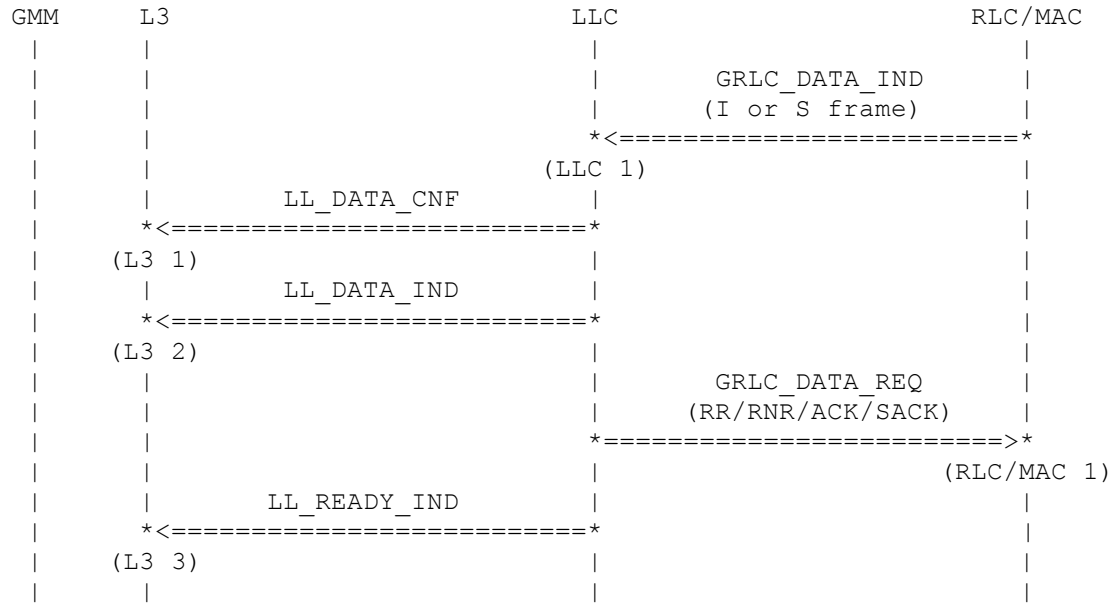
4.9.2.2 Receiving supervisory responses or I frames in state 'ADM/TLLI Assigned', 'Local Release' or 'Local Establishment'



(LLC 1)
LLC receives a S or I frame. LLC discards the frame and no further actions are taken.

<R.LLC.R_DATA.M.002>, <R.LLC.ABMEST_R.A.001>, <R.LLC.ABMTER_R.A.001>,<R.LLC.ABMTER_ R.A.004>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>

4.9.2.3 Receiving information or supervisory frames in state 'ABM'



(LLC 1)
LLC receives an I or S frame. The therein contained receive sequence number N(R) is treated as an acknowledgement for all transmitted I frames with N(S) < N(R). <R.LLC.RX_ACK.A.002>
If timer T201 is active and associated with an acknowledged I frame, then timer T201 is reset. <R.LLC.RX_ACK.A.007>
If the A bit in the received frame is set to 1, or if an transmission or sequence error was detected, then LLC transmits an acknowledgement (RR/RNR/ACK/SACK) at the next opportunity.

<R.LLC.SFRM_SEL.A.001>, <R.LLC.SFRM_SEL.A.002>, <R.LLC.SFRM_SEL.A.003>, <R.LLC.SFRM_SEL.A.004>, <R.LLC.PEERBUSY.A.011>, <R.LLC.OWNRBUSY.A.002>, <R.LLC.OWNRBUSY.A.003>, <R.LLC.OWNRBUSY.A.004>, , <R.LLC.OWNRBUSY.A.005>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.006>

If N(S) is in the range V(R) ≤ N(S) < V(R) + k, and if LLC is in not in own receiver busy condition, then:
- if N(S) = V(R), the data within the received I frame is passed to layer 3 at the next opportunity; or
- if N(S) is in the range V(R) < N(S) < V(R)+k, the data within the received I frame is not passed to layer 3. LLC stores all I frames from V(R) up to N(S)–1 inclusive until all frames are correctly received.

If N(R) within the received S frame is not valid, then
- LLC discards this frame and no further actions are taken.

<R.LLC.RX_ACK.A.003>

If N(R) within the received I frame is not valid, then
- LLC ignores N(R), the A bit and the SACK bitmap of the received frame.

<R.LLC.RX_ACK.A.004>

If LLC is in 'peer receiver busy condition', then:
- LLC resets timer T201 <R.LLC.PEERBUSY.A.012>.
- If the command in the received S frame was RR, ACK, SACK, then the 'peer receiver busy condition' is cleared. <R.LLC.PEERBUSY.A.013>, <R.LLC.PEERBUSY.A.014>, <R.LLC.PEERBUSY.A.015>

If LLC is not suspended and the command/response RNR was received, then:
- LLC sets 'peer receiver busy condition' <R.LLC.PEERBUSY.A.001>, <R.LLC.PEERBUSY.A.002> <R.LLC.PEERBUSY.A.003>
- LLC sets timer T201. <R.LLC.PEERBUSY.A.004>
- LLC resets the retransmission counter. <R.LLC.PEERBUSY.A.005>

<R.LLC.R_DATA.M.002>, <R.LLC.ABM_OPER.A.003>, <R.LLC.RX_IFRM.A.001>, <R.LLC.RX_IFRM.A.002>, <R.LLC.RX_IFRM.A.003>, <R.LLC.RX_IFRM.A.004>, <R.LLC.RX_IFRM.A.005>, <R.LLC.RX_IFRM.A.006>, <R.LLC.RX_IFRM.A.007>, <R.LLC.RX_IFRM.A.008>, <R.LLC.RX_IFRM.A.009>, <R.LLC.RX_IFRM.A.010>, <R.LLC.RX_IFRM.A.012>, <R.LLC.TX_IFRM.A.007>, <R.LLC.TX_ACK.A.001>, <R.LLC.TX_ACK.A.002>, <R.LLC.TX_ACK.A.003>, <R.LLC.TX_ACK.A.004>, <R.LLC.RX_ACK.A.001>, <R.LLC.RX_ACK.A.005>, <R.LLC.RX_ACK.A.006>, <R.LLC.RX_ACK.A.008>, <R.LLC.RX_ACK.A.009>, <R.LLC.RX_ACK.A.010>, <R.LLC.PEERBUSY.A.001>, <R.LLC.TX_IFRM.A.017>, <R.LLC.TX_IFRM.A.018>

(L3 1)
LLC sends the primitive LL_DATA_CNF to layer 3 for each acknowledged I frame.

<R.LLC.RX_ACK.A.011>

(L3 2)
If the variable ll_send_ready is FALSE or LLC is suspended no further actions are taken. Otherwise, if there is an I frame to send to layer 3, this frame is passed to layer 3 and ll_send_ready is set to FALSE.

<R.LLC.L_DATA.A.001>, <R.LLC.RX_IFRM.A.011>

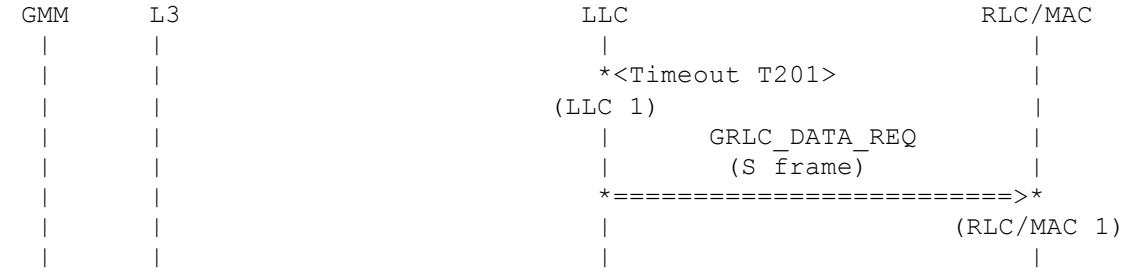
(RLC/MAC 1)
If the GRLC is not in a READY state, or if no acknowledgement is to be sent, no further actions are taken. Otherwise the appropriate acknowledge command (RR, RNR, ACK or SACK) is transmitted in an S frame to RLC/MAC. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.TX_IFRM.A.017>, <R.LLC.TX_IFRM.A.018>, <R.LLC.TX_IFRM.A.019>, <R.LLC.TX_IFRM.M.020>, <R.LLC.TX_IFRM.A.021>, <R.LLC.TX_IFRM.A.022>

(L3 3)
If enough space is available for another frame in the local LLC I frame send buffer, LLC sends the primitive LL_READY_IND to layer 3.

4.10 Peer receiver busy condition

4.10.1 Timeout of timer T201, max. retransmission not reached



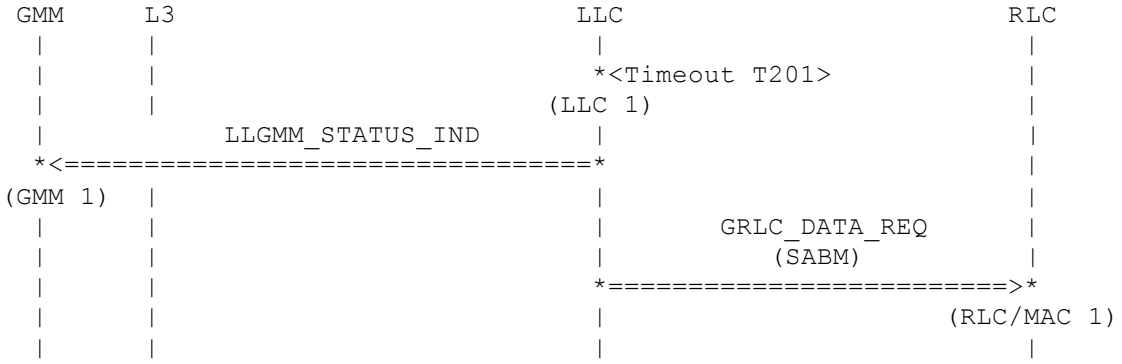
(LLC 1)
LLC is in 'peer receiver busy condition'. Timeout of timer T201. The retransmission counter is less than N200. LLC increments the retransmission counter. LLC transmits an appropriate S frame with the A bit set to 1 at the next opportunity.

<R.LLC.PEERBUSY.A.008>, <R.LLC.PEERBUSY.A.017>, <R.LLC.SFRM_SEL.A.001>, <R.LLC.SFRM_SEL.A.002>, <R.LLC.SFRM_SEL.A.003>, <R.LLC.SFRM_SEL.A.004>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the S frame is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the S frame. Timer T201 is set and the variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.PEERBUSY.A.007>, <R.LLC.TX_IFRM.A.022>

4.10.2 Timeout of timer T201, max. retransmission reached



(LLC 1)
LLC is in 'peer receiver busy condition'. Timeout of timer T201. The retransmission counter is not less than N200. LLC initiates the re-establishment procedure. LLC discards all outstanding LL_DATA_REQ primitives and all I frames in the local LLC frame buffer. LLC transmits the SABM command at the next opportunity. LLC enters state 'Local Establishment'.

<R.LLC.PEERBUSY.A.009>, <R.LLC.REESTCRI.A.003>, <R.LLC.REESTPRO.A.002>, <R.LLC.REESTPRO.A.003>, <R.LLC.REESTPRO.A.004>, <R.LLC.ABMEST_R.A.001>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.M.004>, <R.LLC.ABMEST_R.A.008>

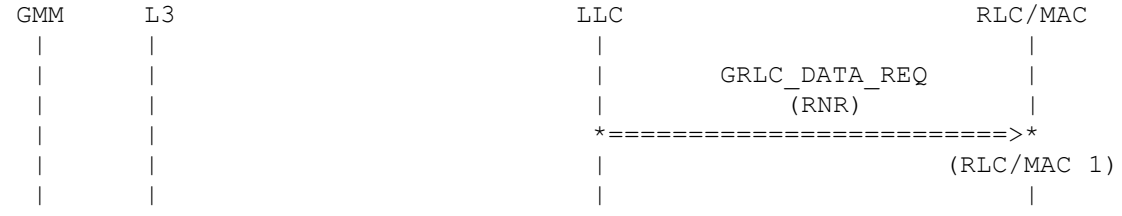
(GMM 1)
The LLC sends the primitive LLGMM_STATUS_IND (cause = 'peer receiver busy condition; re-establishment procedure initiated') to GMM.

<R.LLC.PEERBUSY.A.010>, <R.LLC.REESTPRO.A.001>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the SABM command is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the SABM command in a U frame. Timer T200 is set, the retransmission counter is reset. The variable ll_send_ready is set to FALSE.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMEST_R.M.005> <R.LLC.ABMEST_R.M.009>, <R.LLC.TX_IFRM.A.022>

4.11 Own receiver busy condition

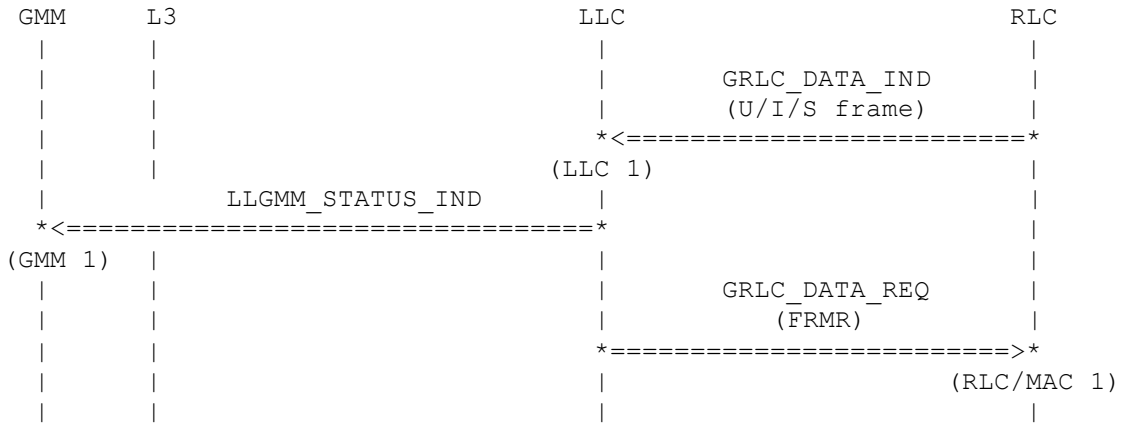


(RLC/MAC 1)
If LLC enters the own receiver busy condition, it transmits the RNR command at the next opportunity. If the GRLC is not in a READY state or if LLC is suspended, no further actions are taken, i.e. the frame is buffered until it can be sent (see section 4.1.1). Otherwise the RNR command is transmitted in an S frame.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.TX_IFRM.M.021>, <R.LLC.RX_IFRM.A.001>, <R.LLC.RX_IFRM.A.002>, <R.LLC.OWNRBUSY.A.001>, <R.LLC.TX_IFRM.A.022>

4.12 Frame rejection condition

4.12.1 Occurrence of 'Frame rejection condition' while not in state 'ABM'



(LLC 1)
LLC is not in state 'ABM' and a frame is received which is rejected. The frame is discarded.

<R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.011>

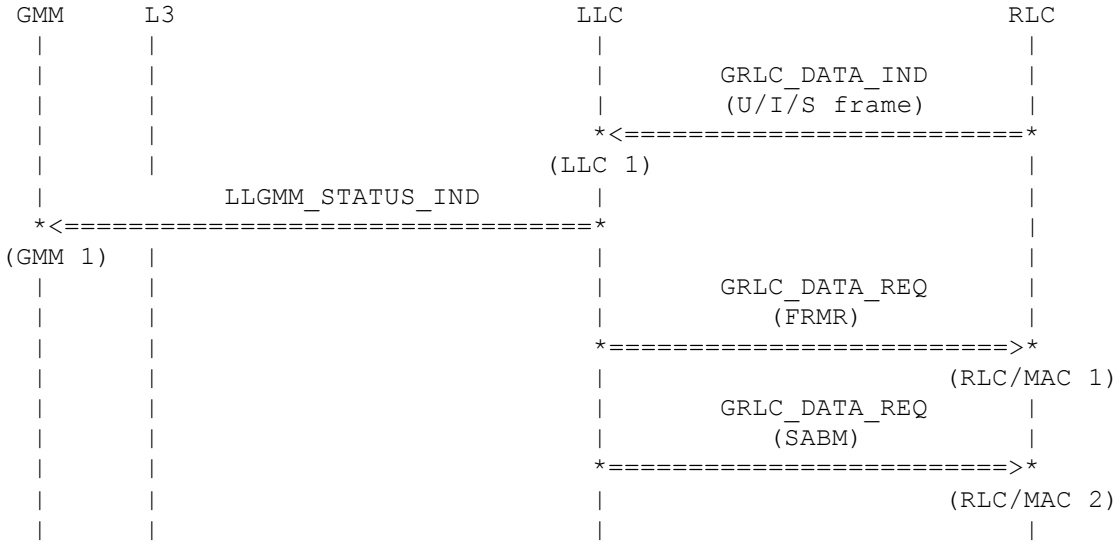
(GMM 1)
LLC sends the primitive LLGMM_STATUS_IND (cause = 'frame rejection condition; frame discarded') to GMM.

<R.LLC.REESTCRI.A.004>, <R.LLC.REESTPRO.A.001>, <R.LLC.XCEPTION.A.003>

(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the FRMR response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the FRMR response in a U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.XCEPTION.A.012>, <R.LLC.XCEPTION.A.008>, <R.LLC.XCEPTION.A.009>, <R.LLC.XCEPTION.A.010>, <R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>

4.12.2 Occurrence of 'Frame rejection condition' while in state 'ABM'



(LLC 1)
LLC is in state 'ABM' and a frame is received which is rejected. The frame is discarded. LLC initiates the re-establishment procedure. LLC discards all outstanding LL_DATA_REQ primitives and all I frames in the local LLC frame buffer. LLC transmits the SABM command at the next opportunity. LLC enters state 'Local Establishment'.

<R.LLC.XCEPTION.A.002>, <R.LLC.XCEPTION.A.011>, <R.LLC.REESTCRI.A.004>, <R.LLC.REESTPRO.A.001>, <R.LLC.REESTPRO.A.002>, <R.LLC.REESTPRO.A.003>, <R.LLC.REESTPRO.A.004>, <R.LLC.ABMEST_R.A.001>, <R.LLC.ABMEST_R.A.002>, <R.LLC.ABMEST_R.A.003>, <R.LLC.ABMEST_R.M.004>

(GMM 1)
LLC sends the primitive LLGMM_STATUS_IND (cause = 'frame rejection condition; re-establishment procedure initiated') to GMM.

<R.LLC.REESTCRI.A.004>, <R.LLC.REESTPRO.A.001>, <R.LLC.XCEPTION.A.003>

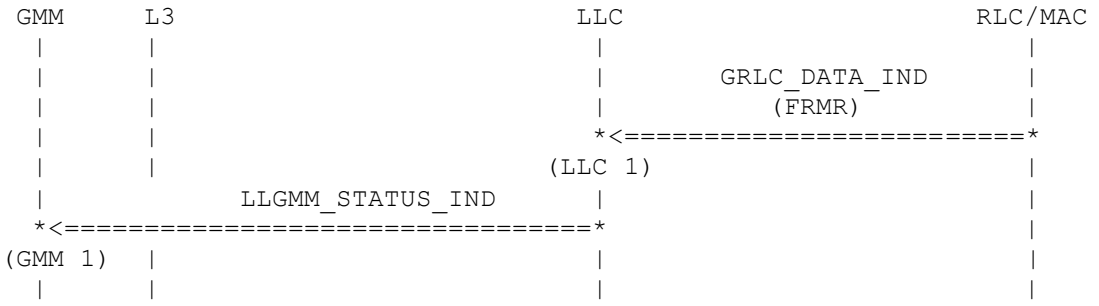
(RLC/MAC 1)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the FRMR response is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the FRMR response in a U frame. The variable ll_send_ready is set to FALSE.

<R.LLC.XCEPTION.A.012>, <R.LLC.XCEPTION.A.008>, <R.LLC.XCEPTION.A.009>, <R.LLC.XCEPTION.A.010>, <R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>

(RLC/MAC 2)
If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the SABM command is buffered until it can be sent (see section 4.1.1). Otherwise LLC transmits the SABM command in a U frame. Timer T200 is set, the retransmission counter is reset. The variable ll_send_ready is set to FALSE.

<R.LLC.XCEPTION.A.013>, <R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.ABMEST_R.M.005>, <R.LLC.ABMEST_R.M.009>

4.12.3 Frame reject (FRMR) response received



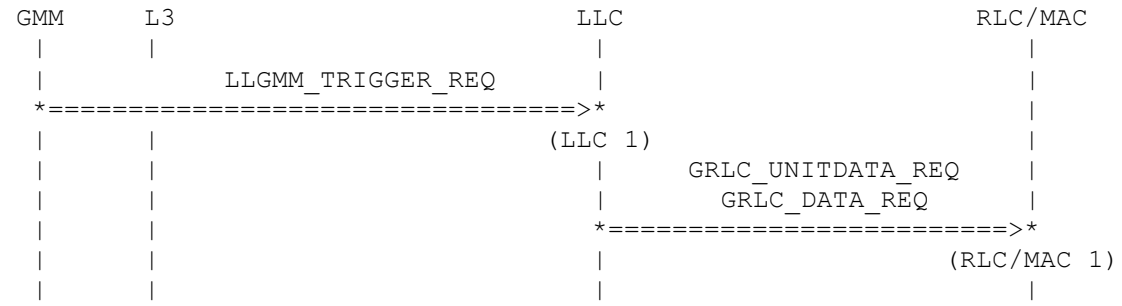
(LLC 1)
LLC receives the FRMR response in a U frame.

(GMM 1)
LLC sends the primitive LLGMM_STATUS_IND (Cause ='FRMR response received; frame discarded') to GMM.

<R.LLC.M_STATUS.A.001>, <R.LLC.XCEPTION.A.005>

4.13 GMM related procedures

4.13.1 Receipt of LLGMM_TRIGGER_REQ



(LLC 1)
GMM orders LLC to transmit any single frame at the next opportunity. If the parameter Cause indicate page response/ cell update, then the parameter Cause within the primitive GRLC_DATA_REQ also indicate page response/ cell update to RLC/MAC. The choice of frame depends on the following conditions:

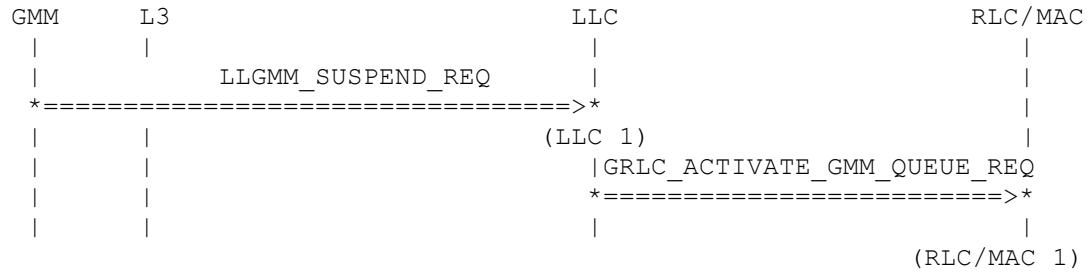
- if there is a frame waiting to be transmitted, this frame is sent; or
- if LLC is suspended, a UI frame with no information field is sent; or
- if LLC is in state 'ABM', an S frame is sent; or
- if LLC is in state 'ADM' a UI frame with no information field is sent.

<R.LLC.M_TRIGGER.M.001>, <R.LLC.M_TRIGGER.M.002>, <R.LLC.M_TRIGGER.M.003>, <R.LLC.M_TRIGGER.M.004>, <R.LLC.M_TRIGGER.M.005>, <R.LLC.M_TRIGGER.M.006>, <R.LLC.M_TRIGGER.M.007>, <R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.R_UNTDATA.M.002>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>

(RLC/MAC 1)
If the GRLC is not in a READY state no further actions are taken. Otherwise LLC transmits an appropriate frame. Depending on the SAPI and the frame type the primitive GRLC_UNITDATA_REQ or GRLC_DATA_REQ is sent to RLC/MAC.

<R.LLC.R_DATA.M.001>, <R.LLC.R_DATA.M.003>, <R.LLC.PF_BIT.A.001>, <R.LLC.PF_BIT.A.003>, <R.LLC.TX_IFRM.A.022>

4.13.2 Receipt of LLGMM_SUSPEND_REQ

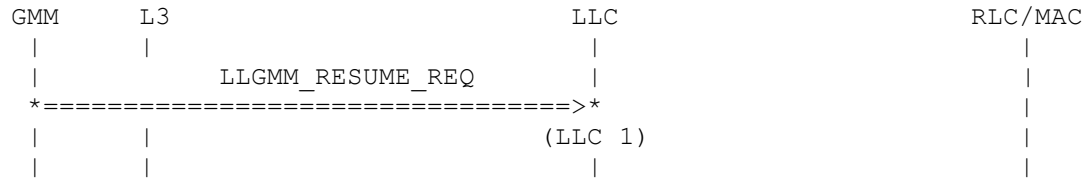


(LLC 1)
GMM orders LLC to suspend operation until the primitive LLGMM_RESUME_REQ is received from GMM. LLC stops frame transmission (except UI frames for SAPI 1 and U frames for ABM establishment and XID negotiation), frame reception is still possible. Timer T201 is reset.
<R.LLC.M_SUSPND.A.001>, <R.LLC.M_SUSPND.M.009>, <R.LLC.M_SUSPND.A.005>, <R.LLC.M_SUSPND.A.006>, <R.LLC.M_SUSPND.M.011>, <R.LLC.M_SUSPND.M.012>, <R.LLC.M_SUSPND.A.015>, <R.LLC.M_SUSPND.A.016>

(RLC/MAC 1)

LLC sends the primitive GRLC_ACTIVATE_GMM_QUEUE_REQ to activate the GMM queue used during Routing Area Update procedure after cell reselection.
GRLC_ACTIVATE_GMM_QUEUE_REQ is sent only in case of RAU if GRLC is not already suspended.
Incase of CALL when LLC is suspended this is not to be sent to GRLC.

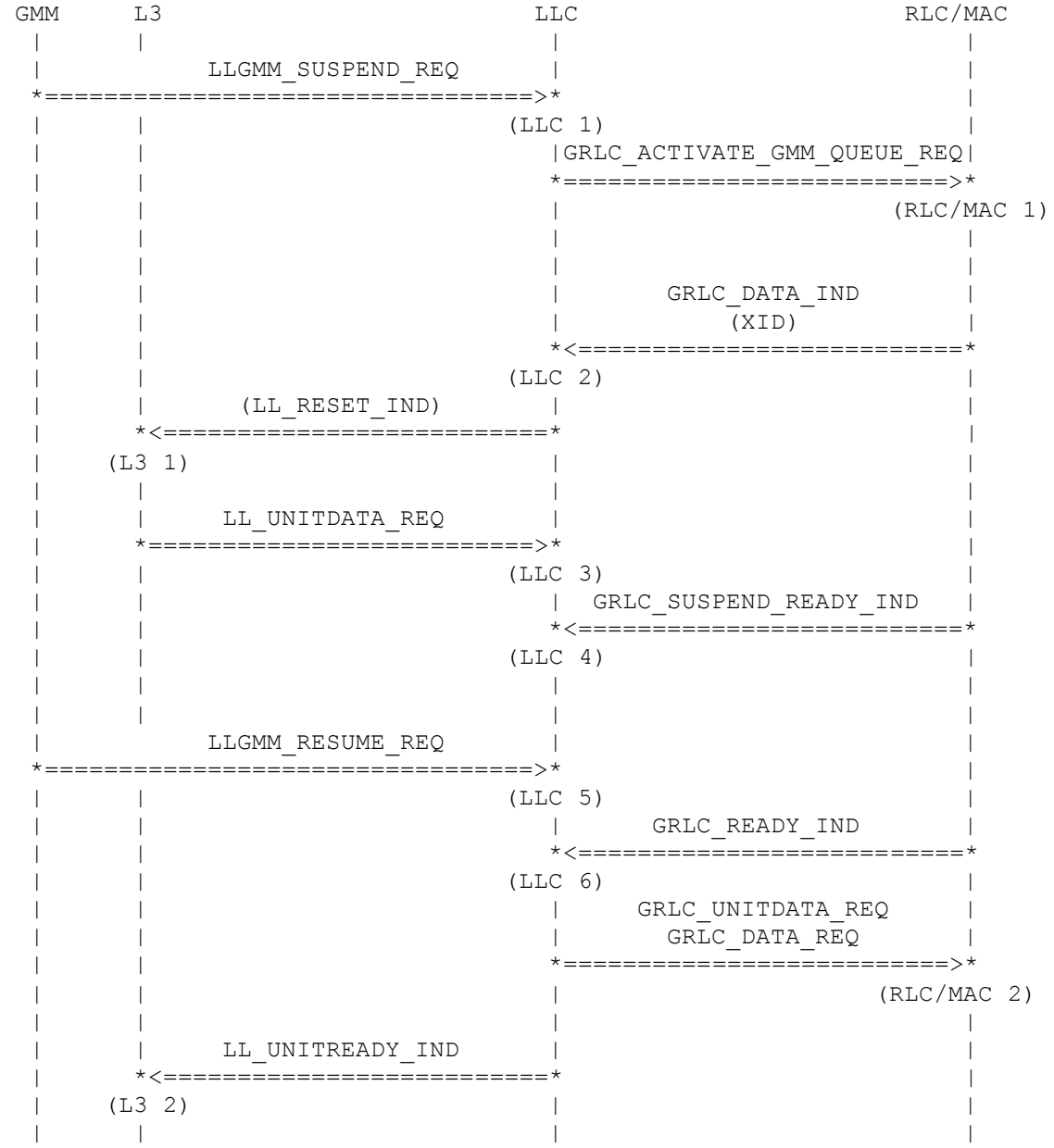
4.13.3 Receipt of LLGMM_RESUME_REQ



(LLC 1)
GMM orders LLC to resume suspended operation. If timer T201 was reset upon reception of LLGMM_SUSPEND_REQ then timer T201 is set.

<R.LLC.M_RESUME.A.001>, <R.LLC.M_RESUME.A.002>, <R.LLC.M_RESUME.A.003>

4.13.4 Receipt of LLGMM_SUSPEND_REQ, RESET and LLGMM_RESUME_REQ



(LLC 1)

GMM orders LLC to suspend operation until the primitive LLGMM_RESUME_REQ is received from GMM. LLC stops frame transmission (except UI frames for SAPI 1 and U frames for ABM establishment and XID negotiation), frame reception is still possible. Timer T201 is reset.
<R.LLC.M_SUSPND.A.001>, <R.LLC.M_SUSPND.M.009>, <R.LLC.M_SUSPND.A.005>, <R.LLC.M_SUSPND.A.006>, <R.LLC.M_SUSPND.M.011>, <R.LLC.M_SUSPND.M.012>, <R.LLC.M_SUSPND.A.015>, <R.LLC.M_SUSPND.A.016>

(RLC/MAC 1)
LLC sends the primitive GRLC_ACTIVATE_GMM_QUEUE_REQ to activate the GMM queue used during Routing Area Update procedure after cell reselection. It triggers the GRLC_SUSPEND_READY_IND from GRLC to LLC

(LLC 2)
LLC receives the XID command from the peer LLC. The LLC transmits the XID response at the next opportunity.

<R.LLC.R_DATA.M.002>, <R.LLC.PF_BIT.A.002>, <R.LLC.XIDNEG_R.A.002>, <R.LLC.XIDNEG_R.A.003>, <R.LLC.XID_PARM.A.001>, <R.LLC.XCEPTION.A.001>, <R.LLC.XCEPTION.A.002>

(L3 1)
If the first parameter is Reset, LLC is being reset and SNDCP will be informed with the LL_RESET_IND primitive.

<R.LLC.L_RESET.M.002>, <XIDRESET.A.008>, <XIDRESET.A.001>, <XIDRESET.A.002>, <XIDRESET.A.003>, <XIDRESET.A.004>, <XIDRESET.A.005>, <XIDRESET.A.006>, <XIDRESET.A.007>

(LLC 3)
LLC receives data for unacknowledged transmission.LLC is suspended so buffer the UI frame with RLC/MAC acknowledged or unacknowledged mode to RLC/MAC at the next opportunity. The variable ll_receive_unitready is set to FALSE.

<R.LLC.L_UNTDTA.A.001>, <R.LLC.TXUI_ADM.A.001>, <R.LLC.TXUI_ADM.A.002>, <R.LLC.TXUI_ADM.A.003>, <R.LLC.TXUI_ADM.A.004>, <R.LLC.TXUI_ADM.M.005>, <R.LLC.TXUI_ADM.M.006>

(LLC 4)
GRLC switches to GMM queue and sends GRR_SUSPEND_READY_IND to LLC

(LLC 5)
GMM orders LLC to resume suspended operation. If timer T201 was reset upon reception of LLGMM_SUSPEND_REQ then timer T201 is set.

<R.LLC.M_RESUME.A.001>, <R.LLC.M_RESUME.A.002>, <R.LLC.M_RESUME.A.003>

(LLC 6)
RLC/MAC indicates to LLC that RLC/MAC is ready to receive data frames. The variable ll_send_ready is set to TRUE.

(RLC/MAC 2)

If the variable ll_send_ready is FALSE, no further actions are taken, i.e. the frame is buffered until it can be sent (see section 4.1.1). Otherwise LLC sends the received data in an UI frame to RLC/MAC using the primitive GRLC_UNITDATA_REQ. The variable ll_send_ready is set to FALSE.

<R.LLC.R_UNTDTA.M.001>, <R.LLC.R_UNTDTA.M.002>, <R.LLC.TXUI_ADM.M.006>

(L3 2)

If SAPI is not 1 and if enough space is available for another UI frame in the local LLC UI frame buffer, LLC sends the primitive LL_UNITREADY_IND to layer 3 and the variable ll_receive_unitready is set to TRUE.

Appendices

A. Acronyms

DS-WCDMA Direct Sequence/Spread Wideband Code Division Multiple Access

B. Glossary

International Mobile Telecommunication 2000 (IMT-2000/ITU-2000) Formerly referred to as FPLMTS (Future Public Land-Mobile Telephone System), this is the ITU's specification/family of standards for 3G. This initiative provides a global infrastructure through both satellite and terrestrial systems, for fixed and mobile phone users. The family of standards is a framework comprising a mix/blend of systems providing global roaming. <URL: http://www.imt-2000.org/>