GSM General Packet Radio Services

Message Sequence Charts

GRR

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Date: 11-October-2000
Document No.: 6363.214.00.001
File: GRR.DOC

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0 Document Control

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0.1 Document History

Document Id.	Date	Author	Remarks
6363.214.00.001	11-Oct-2000	SL	MSC/RLC.DOC, MSC/MAC.DOC, NotesOnPPC imported to create an initial version

0.2 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 6.3.0 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)

0.3 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

0.4 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).

1 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 fax and data transmission consists of several entities. Each entity has one ore more service access points, over which the entity provides a service for the upper entity. The entity, which is described in this document, is coloured grey in the following figure :

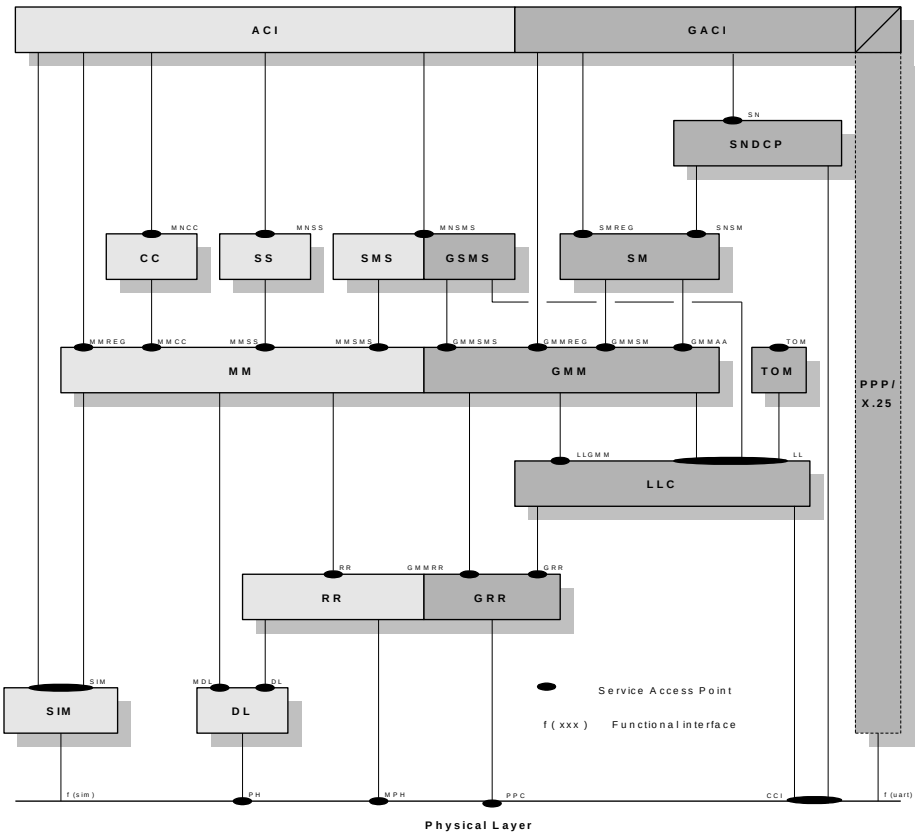


Figure 1-1: Architecture of the GSM/GPRS protocol stack

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:

1.1 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.

1.2 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.

1.3 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.

1.4 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.

1.5 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.

1.6 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.

1.7 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.

1.8 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 IS-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).

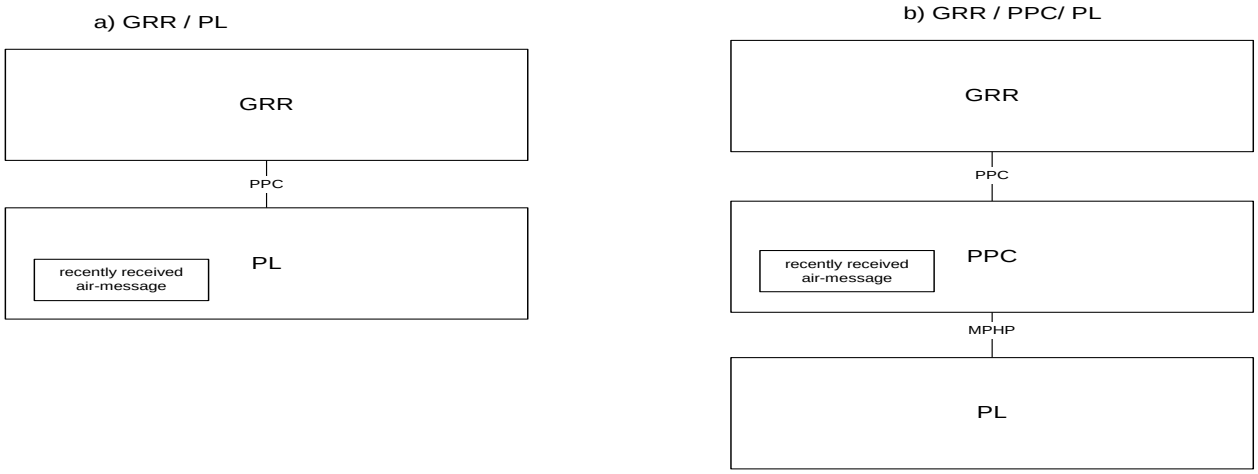
2 Introduction

2.1 GRR Configuration

There are two possibilities to configure GRR.

In general the PL should be placed below the GRR. In that case the service access point PPC is used as a primitive/signal interface (see a)).

There is also the possibility to use the entity PPC as adaptation layer to the service access point MPHP described in S921.doc/S921bis.doc. In that case SAP PPC is used as a functional interface (see b)).



The recently received air message must be in the format defined by Condat's air message document "grr.doc". Therefore the usage of the Condat Coder Decoder (CCD) in PL or PPC is recommended.

2.2 Clarification PL/RR

In this document PL gets only primitives from GRR. The communication between PL and RR is described in the RR MSC.

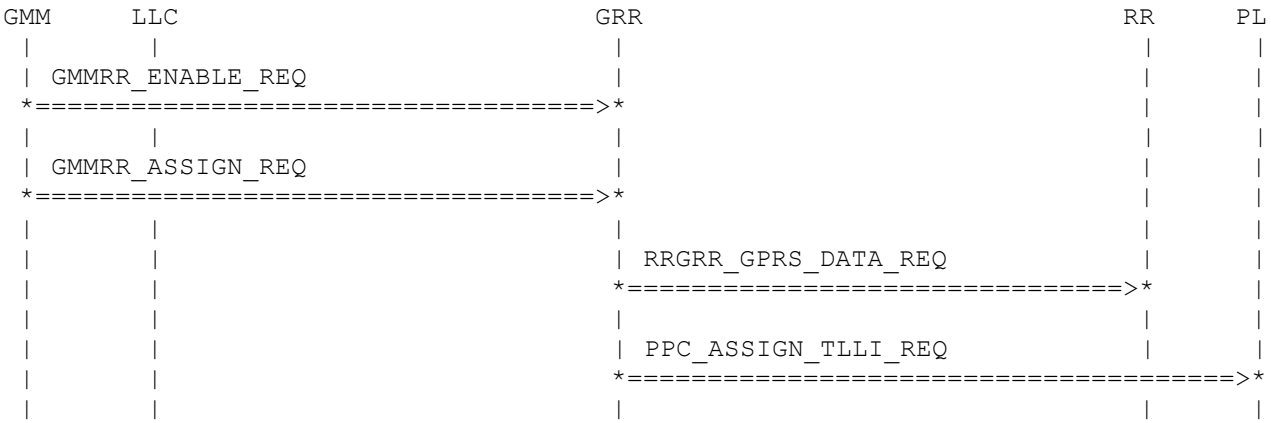
3 Initialization

3.1 Configuration

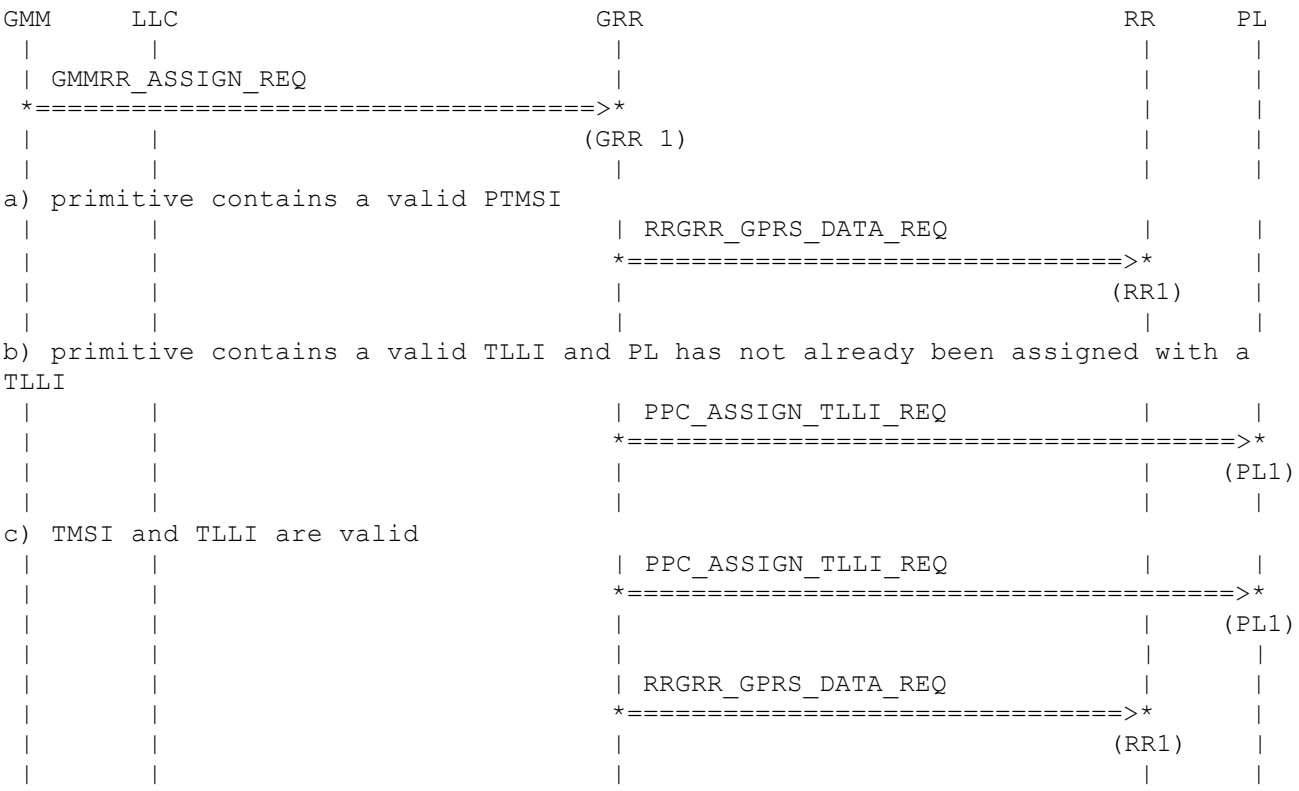
3.1.1 Example: Configuration Procedure

This is an example of a successful configuration procedure. Details are described in the following chapter.

After this procedure GRR is waiting for input from RR, who is reading the BCCH



3.1.2 Address Assignment



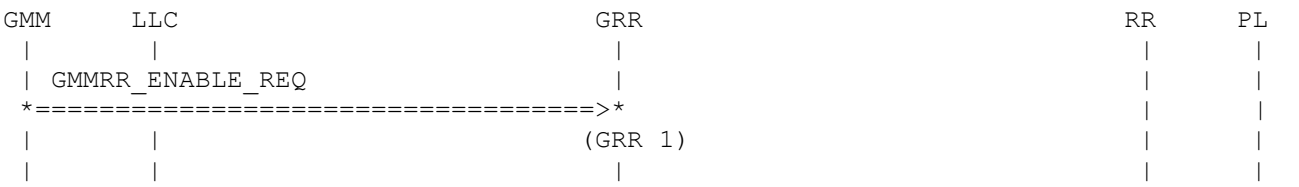
(GRR 1)
GMM assigns new TLLI, PTMSI, TMSI and IMSI. GRR stores IMSI and PTMSI.

(RR1)
If the TMSI is valid, GRR assigns the new TMSI to RR. RR stores the TMSI

(PL1)
If the TLLI is valid, GRR assigns the new TLLI to PL. PL adds the TLLI to TLLI list. PL shall check incoming air messages against the TLLI list.

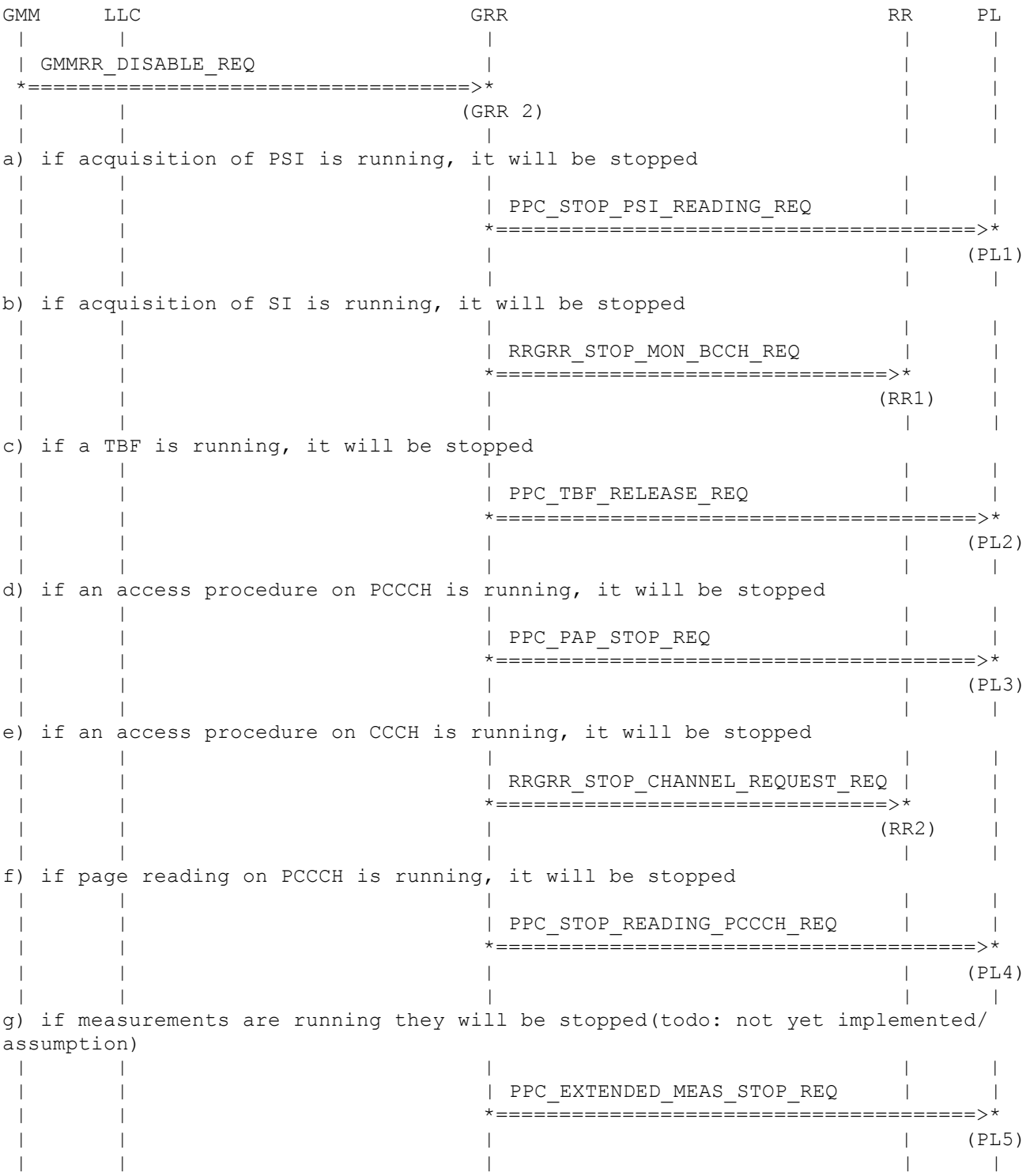
3.1.3 Enable/disable GPRS service

a)GPRS enable



(GRR 1)
GMM enables GPRS service, GRR saves this state. GRR is now idle and able to process primitives from LLC, GMM, RR, PL. Additional GRR receives mobile_class, access_ctrl_class and split_pg_cycle. These values are stored.

b)GPRS disable



(GRR 2)
GMM disables GPRS service. If GRR is disabled it will not react on any primitive from LLC, GMM, RR, PL but on GMMRR_ENABLE_REQ. GMMRR_DISABLE_REQ leads to a stop-all-activities procedure. Some or all of the following points may be done. Which depends on which activities are running. In case of TBF release GRR does an abnormal release procedure.

(PL1)
PL stops reading PSI and does not deliver remaining PSI to GRR.

(RR1)
RR stops reading the previous requested SI read procedure. Remaining SI shall be not delivered.

(PL2)
PL releases all existing TBF (Uplink TBF, Downlink TBF or both).

(PL3)
PL cancels all access-burst-send-requests.

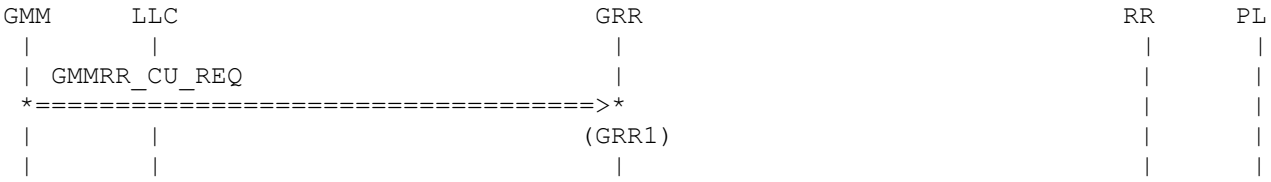
(RR 2)
RR cancels all CHANNEL REQUEST related procedures.

(PL4)
PL stops reading PCCCH and does not deliver remaining air messages.

(PL5)
todo

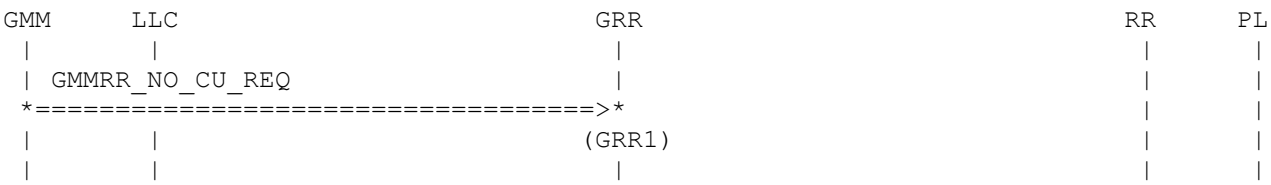
3.1.4 GMM state indication

a)GMM is in READY state



(GRR 1)
GMM enters state READY. The cell updating procedure is no longer blocked.

b)GMM enters the STANDBY state



(GRR 1)
GMM enters state STANDBY. No cell updating procedure is performed.

3.1.5 Remove TLLI in PL

not yet done, maybe not necessary

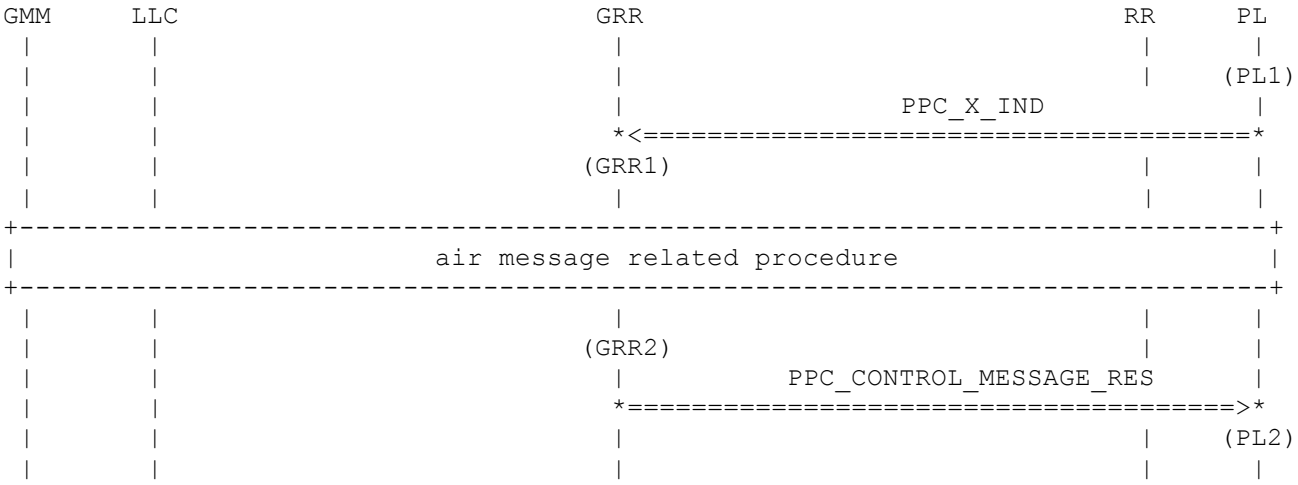
3.1.6 Air Message Buffer Management

Decoded air messages might have a size up to some kByte. GRR and PL use the same buffer to save ram and PCU time, which would be wasted by passing this huge data amount by primitives. The following procedure defines which entity is allowed to use (read and write) the decoded air message buffer.

This procedure applies to the following primitives:

- PPC_PSI_1_IND
- PPC_PSI_2_IND
- PPC_PSI_3_IND
- PPC_PSI_3BIS_IND
- PPC_PSI_4_IND

- PPC_PSI_5_IND
- PPC_PSI_1_ON_PACCH_IND
- PPC_PSI_2_ON_PACCH_IND
- PPC_PSI_3_ON_PACCH_IND
- PPC_PSI_3BIS_ON_PACCH_IND
- PPC_PSI_4_ON_PACCH_IND
- PPC_PSI_13_ON_PACCH_IND
- PPC_PAGING_REQ_ON_PCCCH_IND
- PPC_PAGING_REQ_ON_PACCH_IND
- PPC_POLLING_REQUEST_ON_PCCCH_IND
- PPC_QUEUING_NOTIFICATION_ON_PCCCH_IND
- PPC_UL_ASSIGNMENT_ON_PAGCH_IND
- PPC_DL_ASSIGNMENT_ON_PCCCH_IND
- PPC_ACCESS_REJECT_ON_PCCCH_IND
- PPC_TS_RECONFIGURE_ON_PACCH_IND
- PPC_PDCH_RELEASE_ON_PACCH_IND
- PPC_UL_ASSIGNMENT_ON_PACCH_IND
- PPC_DL_ASSIGNMENT_ON_PACCH_IND
- PPC_CTRL_PWR_TA_ON_PACCH_IND
- PPC_POLLING_REQUEST_ON_PACCH_IND
- PPC_ACCESS_REJECT_ON_PACCH_IND
- PPC_PACKET_TBF_RELEASE_IND
- PPC_PRACH_PAR_ON_PCCCH_IND
- PPC_CC_ORDER_ON_PACCH_IND
- PPC_CC_ORDER_ON_PCCCH_IND
- PPC_MEAS_ORDER_ON_PACCH_IND
- PPC_MEAS_ORDER_ON_PCCCH_IND
- PPC_PSI_6_ON_PACCH_IND
- PPC_PSI_6_IND
- PPC_PSI_7_ON_PACCH_IND
- PPC_PSI_7_IND



(PL1)
PL has received an air message. PL has decoded the message. The message is error free and has the correct address. In that case PL pass the air message with one of the above mentioned primitives to GRR. From sending this primitive until PL2 the physical layer is not allowed to use the air message buffer.

(GRR1)
GRR starts the procedures related to the received air message

(GRR2)
After GRR has finished the usage of the air message GRR sends PPC_CONTROL_MESSAGE_RES. After sending of this primitive any content of the air message becomes invalid.

(PL2)
After reception of PPC_CONTROL_MESSAGE_RES PL may continue with decoding the next air message.

4 System Information

4.1 BCCH

4.1.1 GPRS Indication

RRGRR_GPRS_IND indicates weather GPRS is supported in this cell or not.

(GRR1)
GRR has already been enabled with GMMRR_ENABLE_REQ. And is waiting for GPRS indication.

(RR1)
RR is reading the BCCH. As soon as RR detects information, weather the cell is supporting GPRS or not, RR indicates that to GRR. This information is in a S3, S4 and/or S8. If RR detects GPRS support, RR starts to read the EBCCH for a SI13

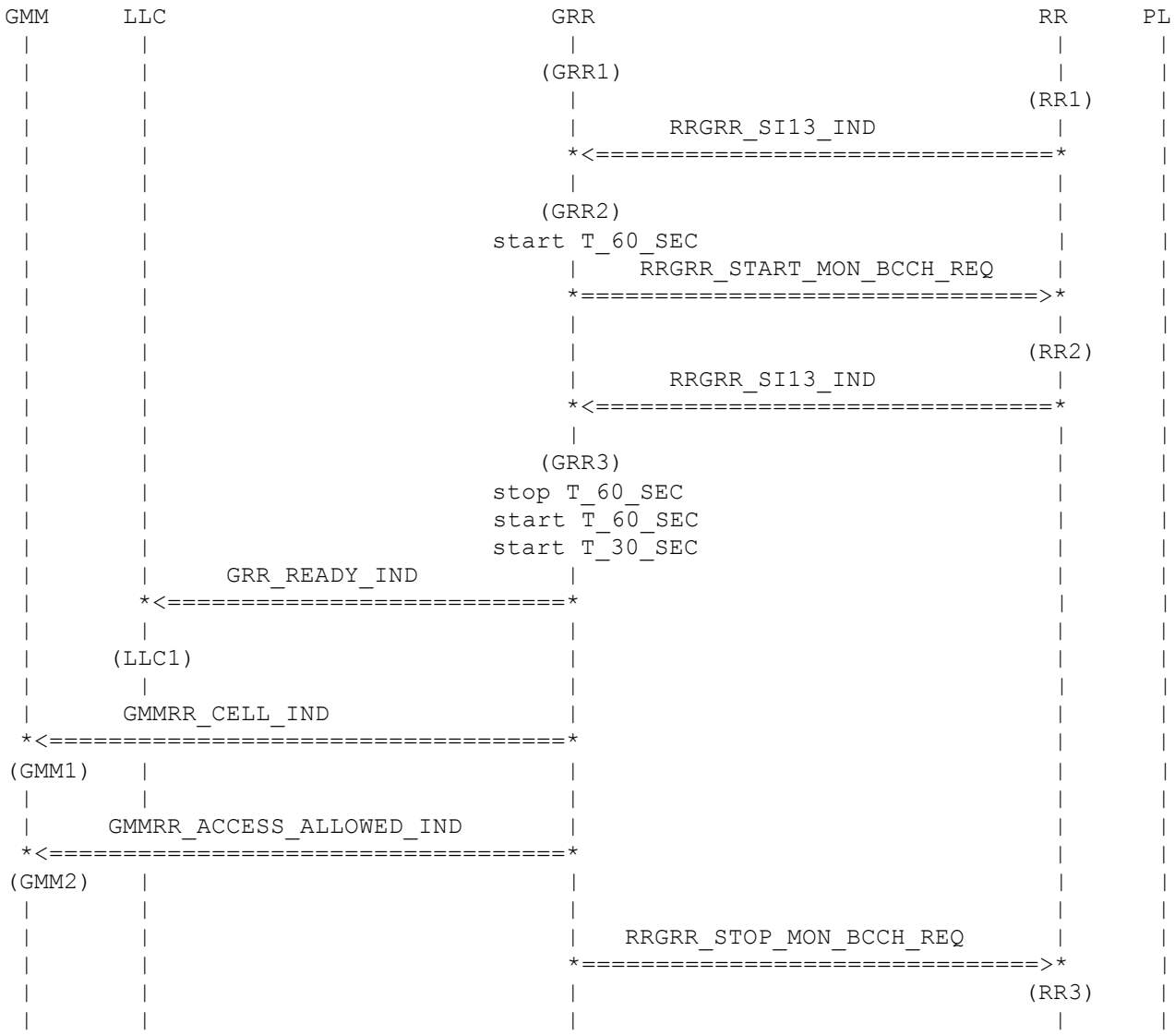
(GRR2)
GRR evaluates the RRGRR_GPRS_IND and sends a GMMRR_NO_CELL_IND to GMM if the cell does not support GPRS.

(GMM1)
GMM enters sub state NO-CELL-AVALIABLE.

(GRR3)
In case of GPRS support GRR is waiting now for SI13.

(RR2)
RR is reading the BCCH for SI13

4.1.2 Initial SI13 Read Procedure (BCCH case)



(GRR1)
GRR has already been enabled with GMMRR_ENABLE_REQ. GPRS availability has been indicated by RR. GRR is waiting for the initial SI13.

(RR1)
RR is reading the EBCCH. As soon as RR detects a SI13, RR forwards this message to GRR.

(GRR2)

GRR receives a SI13 with a valid BCCH description. To make sure that there was at least one attempt to receive each SI before entering the idle mode RR requests a read of all SI with RRGRR_START_MON_BCCH_REQ. RR starts timer T_60_SEC. GRR have to receive another SI13 before T_60_SEC. expires.

(RR2)

RR detects a SI13 and forwards it to GRR with RRGRR_SI13_IND including reception states of SI1 and SI3.

(GRR3)

With the reception of a second correct SI13 GRR change to packet idle state (on BCCH) if RRGRR_SI13_IND also indicates success full reception of SI3 and SI1 (if has been sent). With a successful change to packet idle mode the T_60_SEC shall be restarted and T_30_SEC shall be started. T_30_SEC is used to start the next reading of SI13 (see chapter SI13 Read Procedure in Packet Idle Mode)

(LLC1)

With the reception of this primitive LLC knows that GRR is ready to transmit

(GMM1)

With the reception of this primitive GMM get some information about the cell. This trigger GMM procedures.

(GMM2)

This trigger GMM procedures (not yet implemented).

(RR3)

RR stops monitoring of EBCCH as well as BCCH.

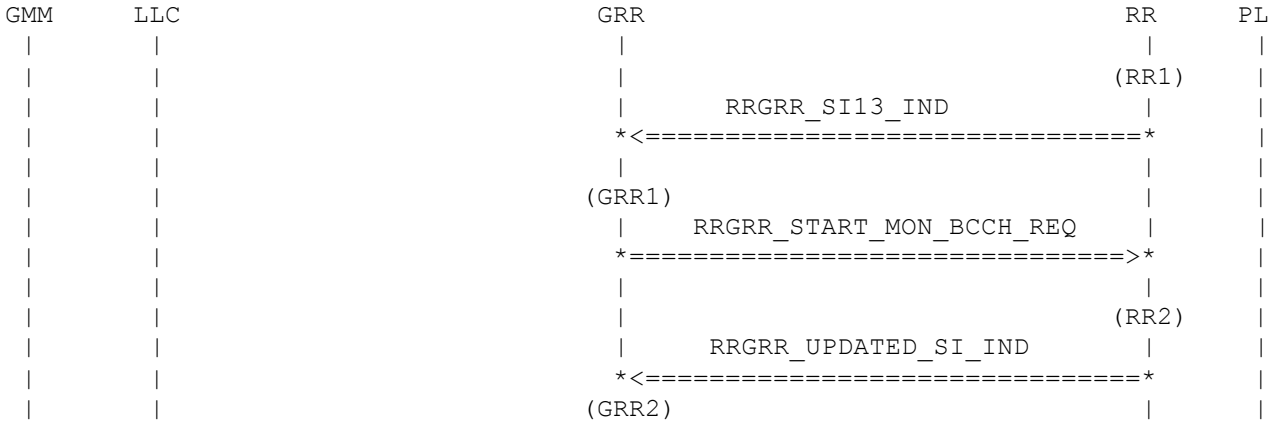
4.1.3 SI13 Read Procedure in Packet Idle Mode(BCCH)

not important for increment 11

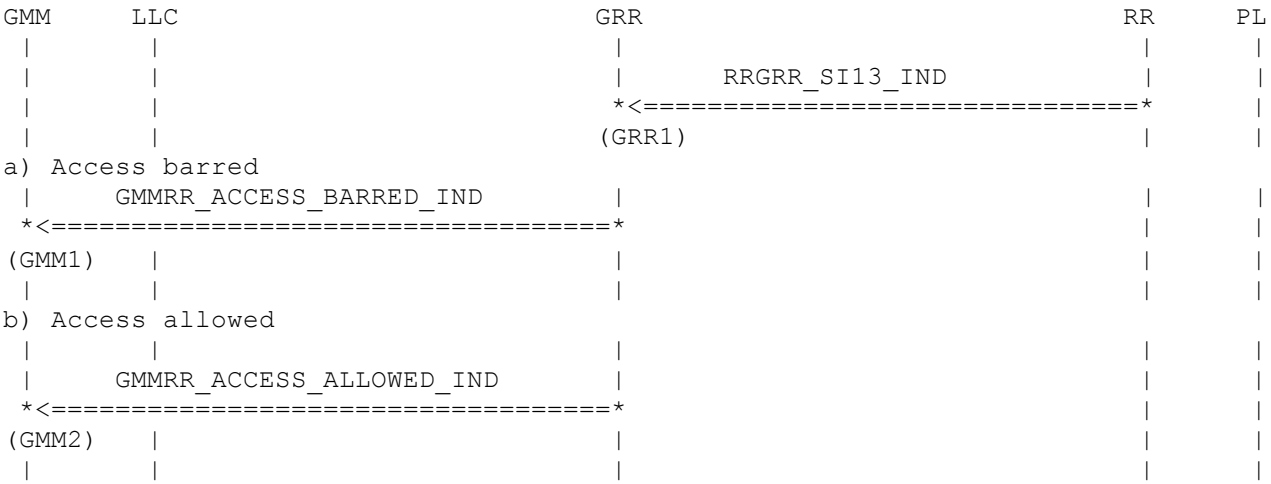
si13 reception, describe usual behavior, describe where received and what RR is doing in idle case, describe switch to PBCCH

4.1.4 Supervision of BCCH_CHANGE_MARK and update of BCCH information

Supervision BCCH_CHANGE_MARK has the same logical way as the supervision of PBCCH_CHANGE_MARK.



4.1.5 Indication of the access control information



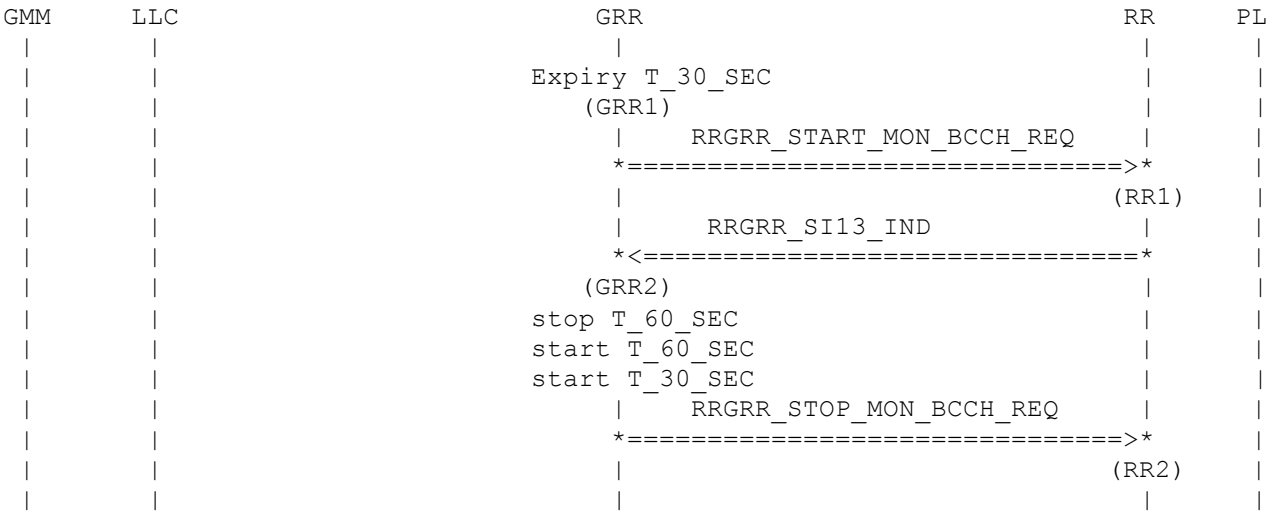
(GRR 1)
GRR receives PSI1 message or Packet Prach Parameters.

(GMM 1)
Access to the network is barred.

(GMM 2)
Access to the network is allowed

4.1.6 Expiry of T_30_SEC (BCCH)

If the mobile station has received neither the SI13 nor the PSI13 message within the last 30 seconds, it shall attempt to receive the SI13 message each time it is scheduled.



(GRR1)

If the mobile station has received neither the SI13 nor the PSI13 message within the last 30 seconds, it shall attempt to receive the SI13 message each time it is scheduled on BCCH. This is requested from RR by RRGRR_START_MON_BCCH_REQ.

(RR1)

As soon as RR has received a SI13, RR forwards this message to GRR.

(GRR2)

GRR handles the timer and stays in Packet Idle Mode on BCCH. For the case that no SI13 can be received until T_60_SEC expires see chapter Expiry of T_60_SEC.

(RR2)

RR stops the monitoring for SI13.

4.1.7 Expiry of T_60_SEC (BCCH)

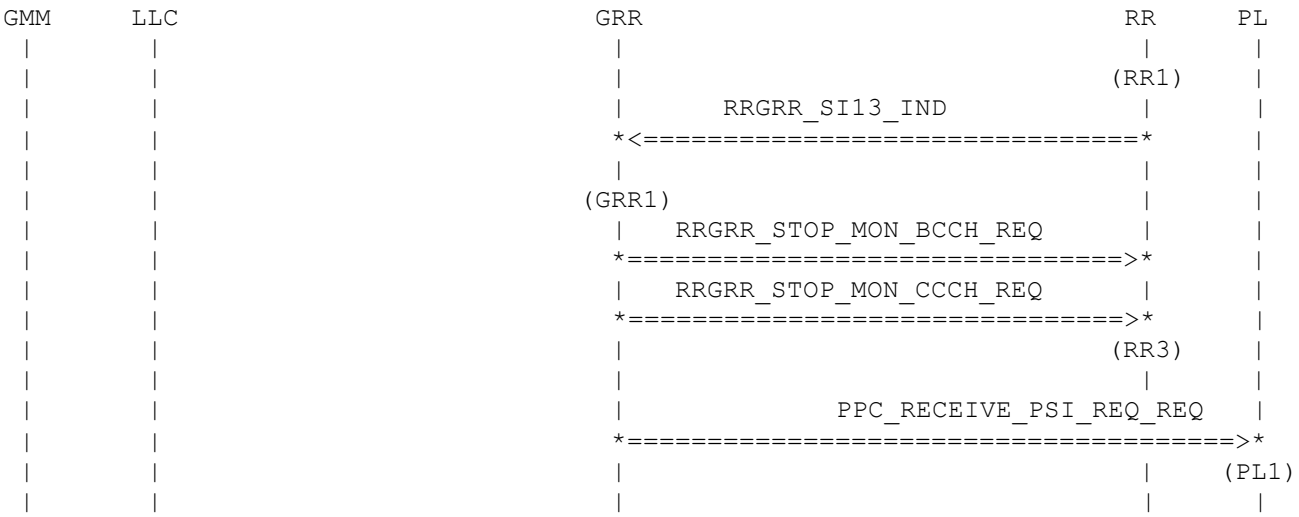
In case of RR does receive a second SI13 with in 60 seconds the GRR resets all internal states. The procedure "Initial SI13 Read Procedure (BCCH case)" starts again.

4.1.8 SI13 reception failure

If the SI13 or PSI13 message has not been received within 60 seconds, perform cell reselection (TBD).

4.2 PBCCH

4.2.1 Initial SI13 Read Procedure (PBCCH case)



(RR1)

RR is reading the EBCCH. As soon as RR detects a SI13, RR forwards this message to GRR.

(GRR2)

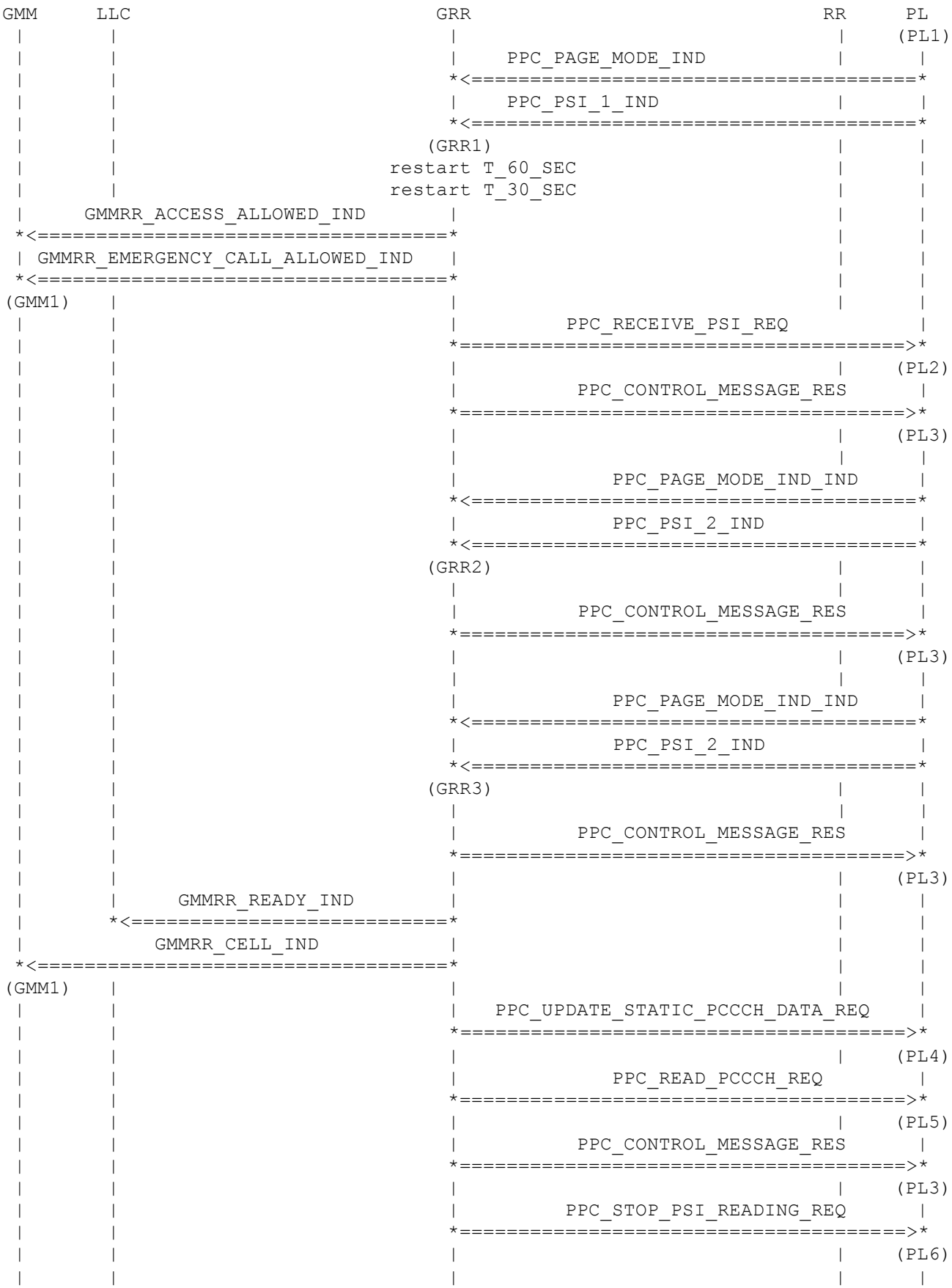
GRR receives a SI13 with a valid PBCCH description. GRR stops reading of BCCH and CCCH and requests from PL reading of PBCCH.

(RR2)

RR stops reading of BCCH as well as CCCH.

(PL1)
PL starts reading of PSI on PBCCH.

4.2.2 System information on PBCCH



(PL1)
PL is reading the PBCCH for PSI.

(GRR1)
GRR receives PSI1 message. GRR starts two timers: 60 second and 30 second timer. These timers are restarted if GRR receives PSI1 or (P)SI13 messages on PACCH or PBCCH. GRR checks the acquisition state whether it should stop the PSI reading procedure or not.

(GMM1)
The primitives initialize GMM procedures, see MSC GMM.

(PL2)
PL reorganizes PSI reading according to the parameter in PPC_RECEIVE_PSI_REQ.

(PL3)
PPC_CONTROL_MESSAGE_RES informs the PL that GRR is ready with analyzing the latest air message (Air-Message-Buffer Management)

(GRR2)
GRR receives PSI2 message. GRR checks the acquisition state whether it should stop the PSI reading procedure or not.

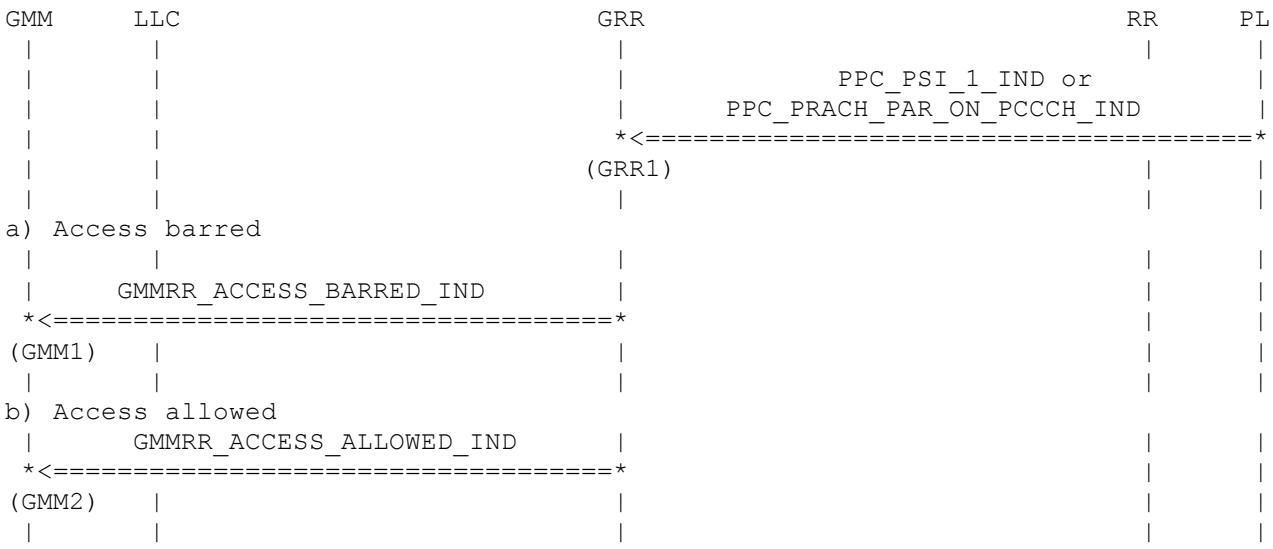
(GRR3)
GRR receives PSI2 message. GRR checks the acquisition state whether it should stop the PSI reading procedure or not. If the acquisition completed, GRR stops the process of reading PSI messages. (There might be more PSI then presented in this MSC.) PPC orders PL also to read the PCCCH in case of completed acquisition of PSI.

(PL4)
GRRPPC_UPDATE_STATIC_PCCCH_DATA_REQ contains the necessary information to read the PCCCH.

(PL5)
PPC_READ_PCCCH_REQ starts the reading process of PCCCH.

(PL6)
PPC_STOP_PSI_READING_REQ stops the reading process of PSI.

4.2.3 Indication of the access control information

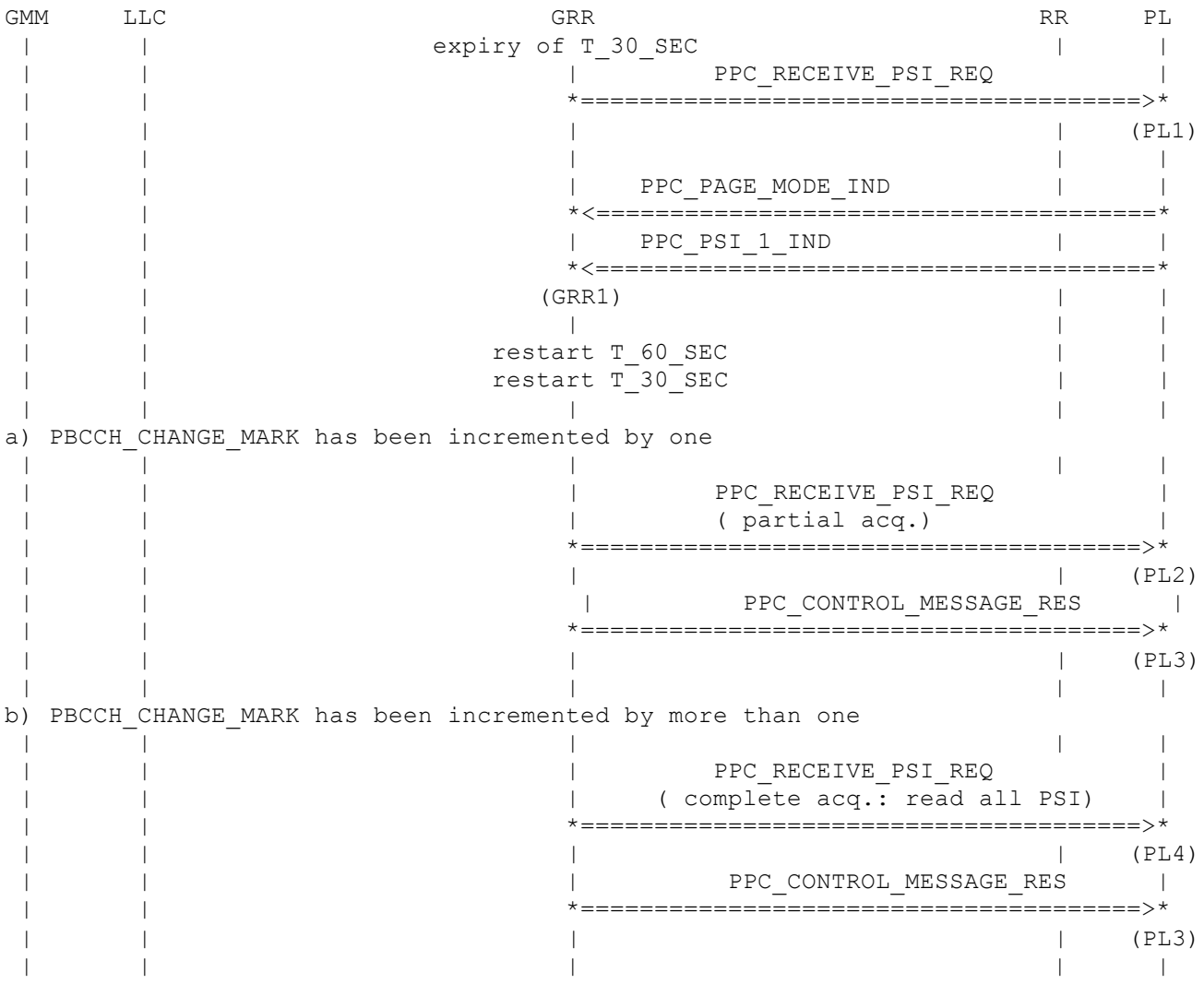


(GRR 1)
GRR receives PSI1 message or Packet Prach Parameters.

(GMM 1)
Access to the network is barred.

(GMM 2)
Access to the network is allowed

4.2.4 Supervision of PBCCH_CHANGE_MARK and update of PBCCH information



(PL1)
GRR informs the PL to read PSI1 message.

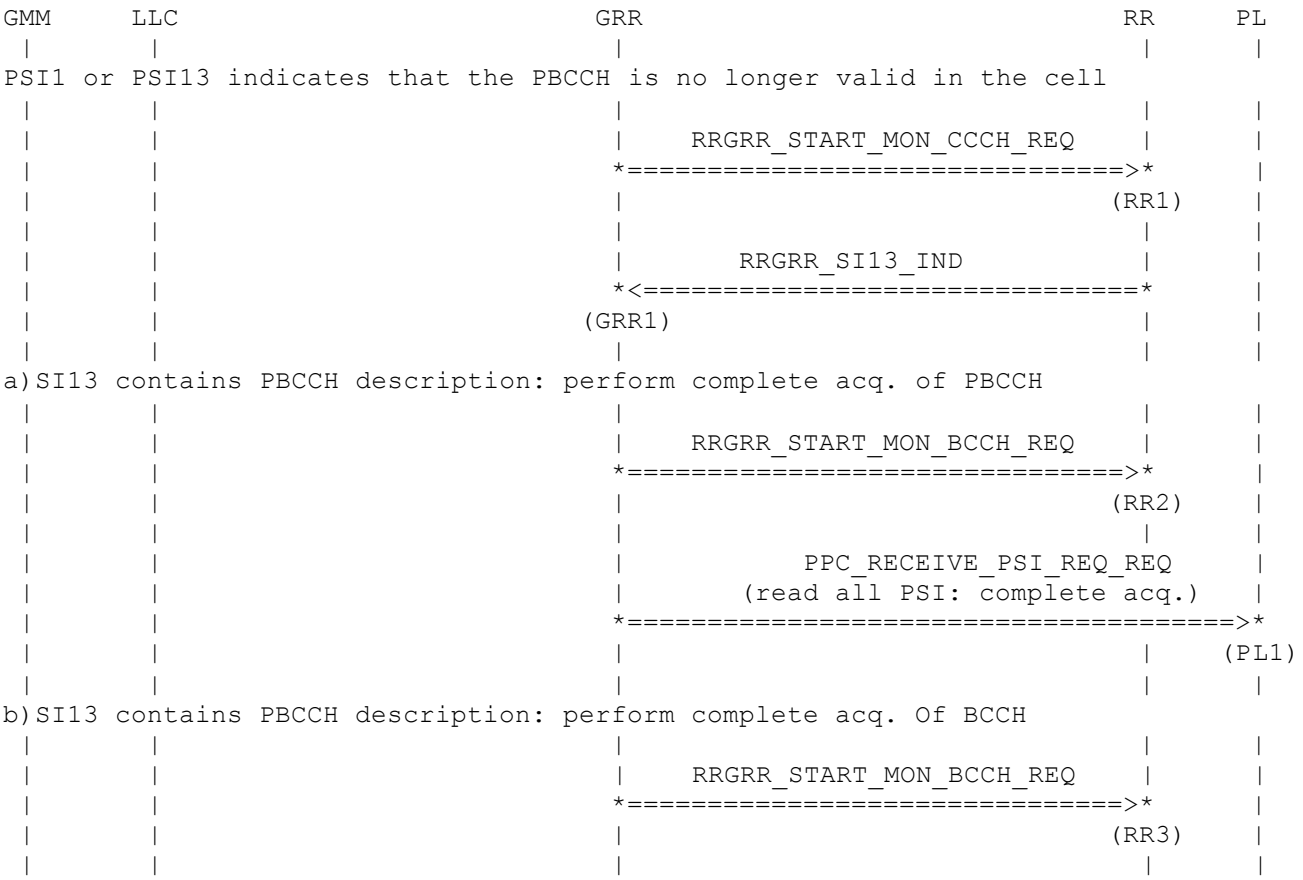
(GRR1)
GRR receives PSI1 message. GRR restarts 60 and 30 second timers. GRR supervises PBCCH_CHANGE_MARK.

(PL2)
GRR informs the PL to read PSI as defined in the change marks.

(PL3)
PPC_CONTROL_MESSAGE_RES informs the PL that GRR is ready with analyzing the latest air message (Air-Message-Buffer Management)

(PL4)
PL should perform complete acquisition of all PSI.

4.2.5 Replacement of PBCCH



(RR1)
After receiving PSI1 or PSI13 GRR knows that the PBCCH has been no longer available. Therefore it starts to receive SI13 message via RR/TIL.

(GRR 1)
SI13 has been received

(PL 1)
SI13 contains a PBCCH description: GRR should perform a complete acq. of PSI messages.

(PL 2)
SI13 contains no PBCCH description: GRR should perform a complete acq. of SI messages on BCCH.

4.2.6 PSI1 reception failure

If the PSI1 message has not been received within 60 seconds, perform cell reselection. To be done (TBD).

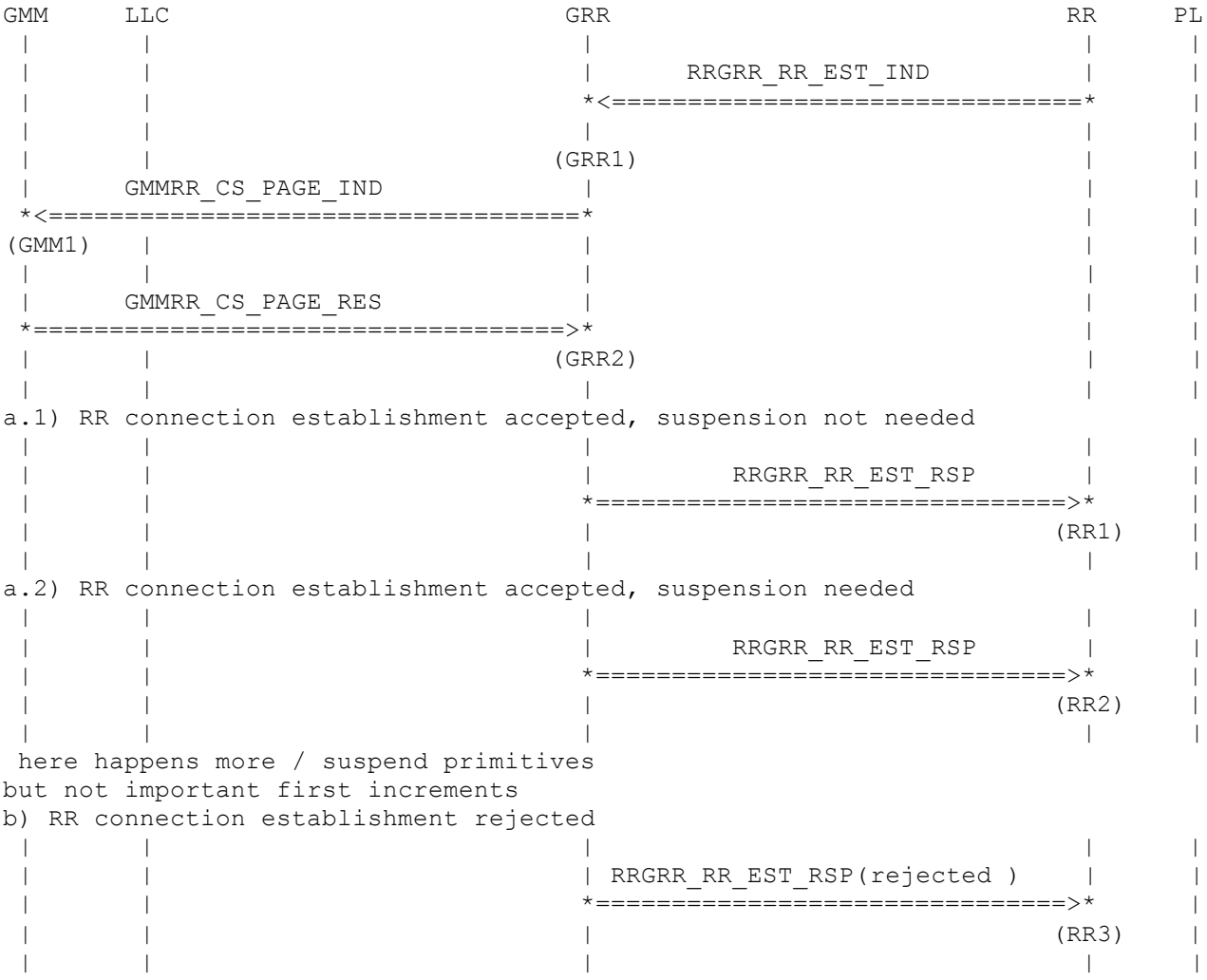
5 Paging

5.1 CCCH

This part describes the paging procedures on CCCH. It can be divided to two parts. One for initiation of RR connection establishment and one for downlink packet transfer.

5.1.1 Paging procedure for RR connection establishment

This procedure has only meaning in the GRR part if the MS class is not CG (for definition of mobile classes see SAP GMMRR.DOC). Because of the fact that CG mobiles can not accept or receive RR establishment request. This type of MS is only GPRS capable.



(GRR 1)
RR/TIL indicates to GRR that a RR connection establishment was received on CCCH channel. GRR has to inform GMM.

(GMM 1)
GMM decide weather to respond on the page request or not.

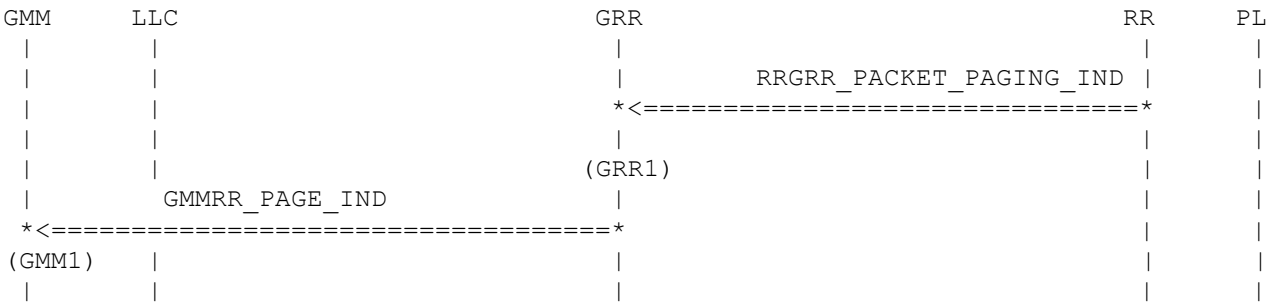
(GRR 2)
GRR receives the answer and forwards the information to RR. Beside that GRR suspends

(RR1)
Establishment request was accepted, no suspension needed: (RR does not send GPRS Suspension Request message)

(RR2)
Establishment request was accepted, suspension needed: (RR has to send GPRS Suspension Request message)

(RR3)
Establishment request was rejected

5.1.2 Paging procedure for packet transfer



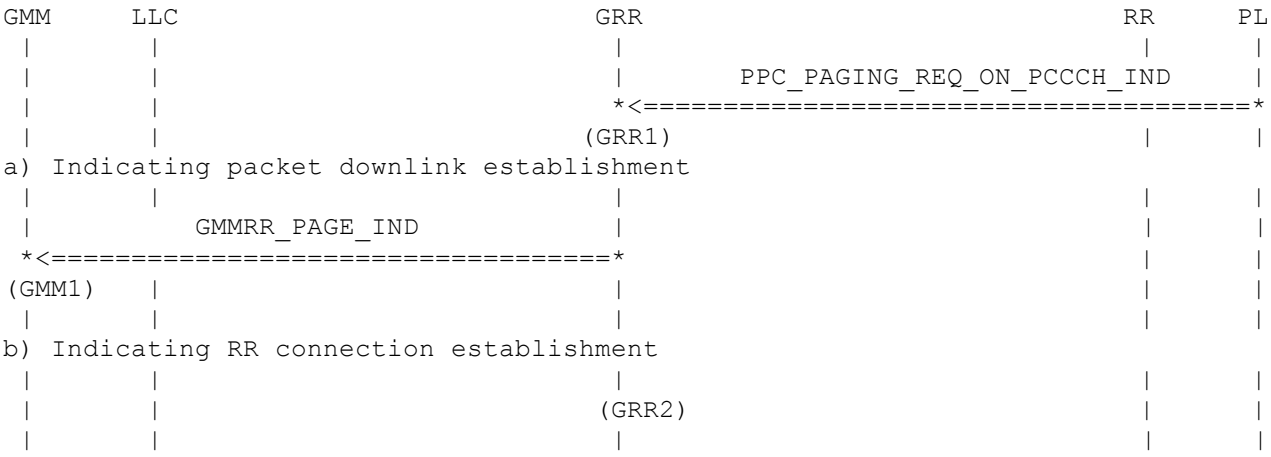
(GRR 1)
RR indicates to the GRR that the packet-paging request was received. This information is in paging request type 1, 2 or 3. This primitive indicates whether the paging type was IMSI or P-TMSI.

(GMM 1)
GRR informs the GMM about the reception of paging request.

5.2 PBCCH

5.2.1 Receiving a PACKET PAGING REQUEST

5.2.1.1 On PCCCH_GROUP

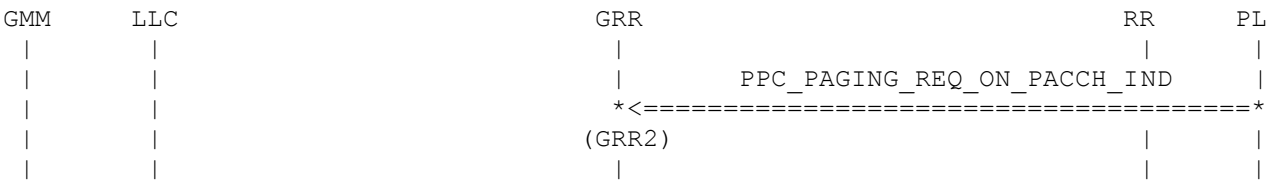


(GRR 1)
The network sends the PACKET PAGING REQUEST to the MS in the PCCCH_GROUP.

(GMM 1)
GRR indicates the paging request to the GMM.

(GRR 2)
GRR indicates the paging request for RR connection establishment to the RR (except MSs in class C).

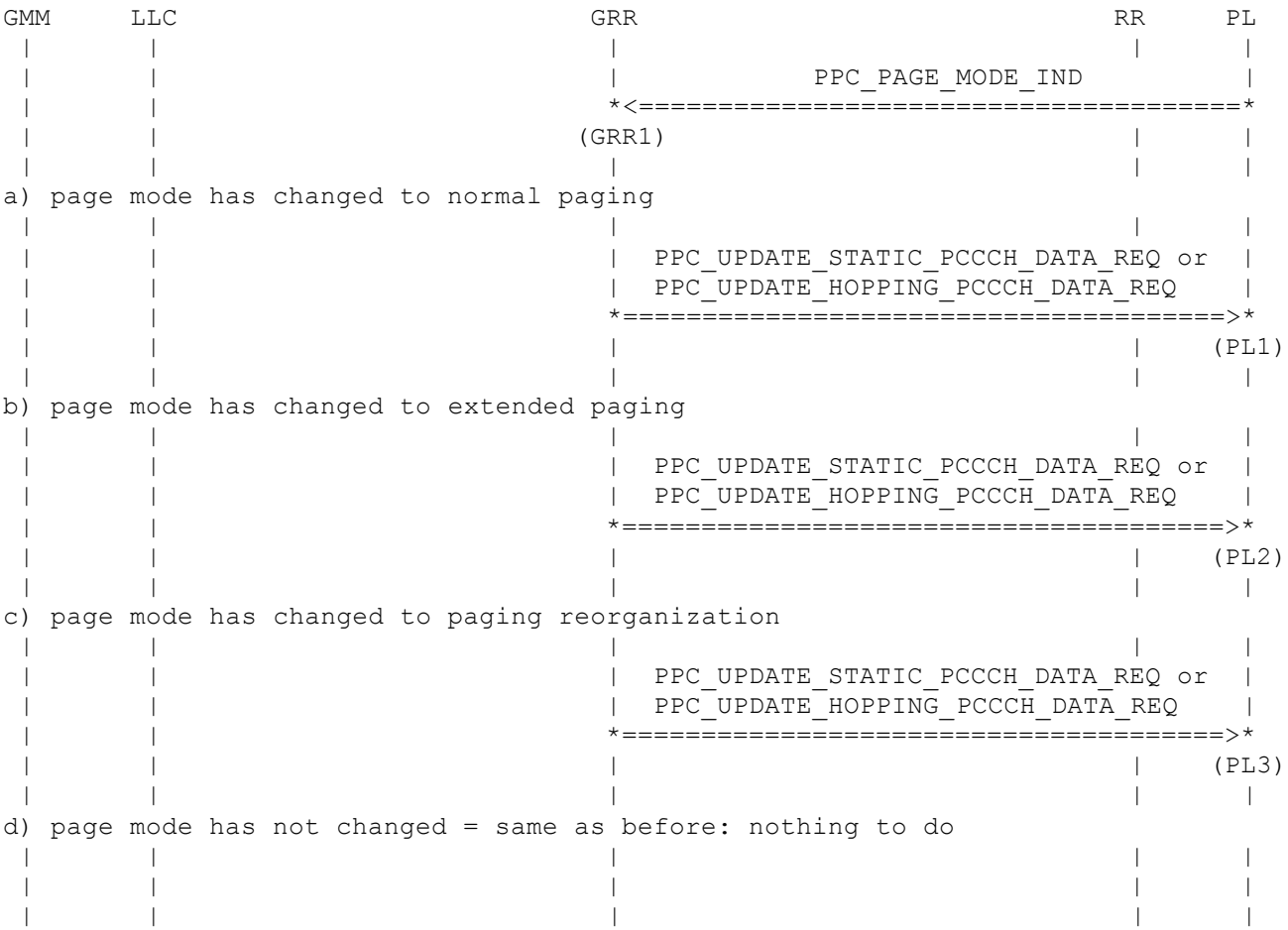
5.2.1.2 On PACCH



(GRR 2)
GRR indicates the paging request for RR connection establishment to the RR (except MS in class B or C).

5.2.2 Page mode procedures on PCCCH

A mobile station in packet transfer mode shall not consider the page mode information received in any message.



(GRR 1)
PL receives any control message in the corresponding paging group. GRR takes the page mode information in this message into account.

(PL 1)
GRR starts paging procedure with normal paging in PL.

(PL 2)
GRR starts paging procedure with extended paging in PL.

(PL 3)
GRR starts paging procedure with paging reorganization PL.

6 TBF Establishment

Depending on which kind of cell the mobile camps, the TBF establishment procedure may be done on packet channels (PCCCH, PRACH, ..) or on classic GSM channels (RACH, BCCH, ..).

6.1 Queuing of Data Requests

A TBF establishment procedure might be started because of

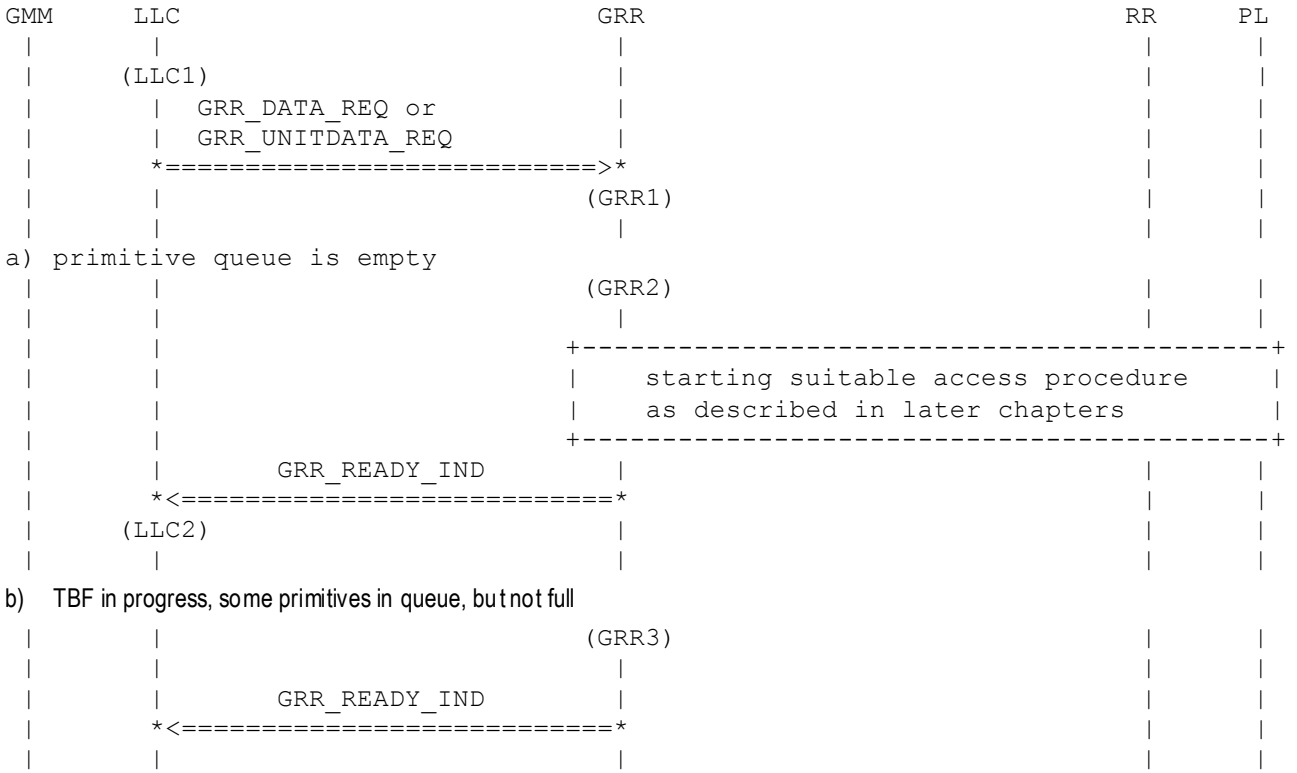
1) GRR internal data transfer reasons like sending of PACKET MEASUREMENT REPORT

2) Data transmission requests from LLC.

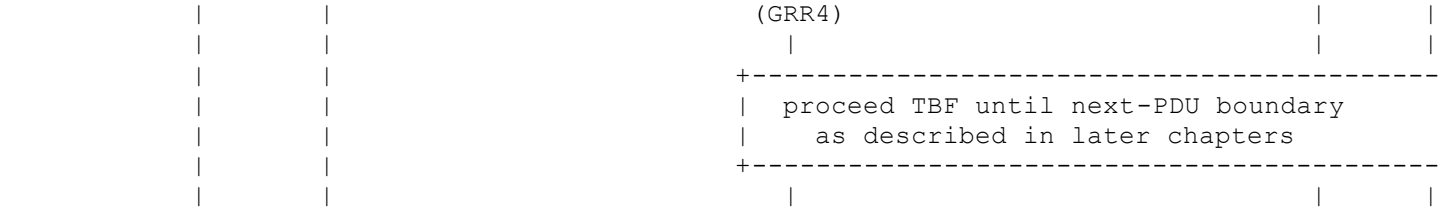
Data transmissions related internal reasons are done with a Single Block TBF or they are included in an existing TBF, but they do not use the primitive queue.

The data requests from LLC are queued in a primitive queue inside of GRR and are sent in a sequence according to the rules in GSM0460, which is not necessarily the request sequence from LLC.

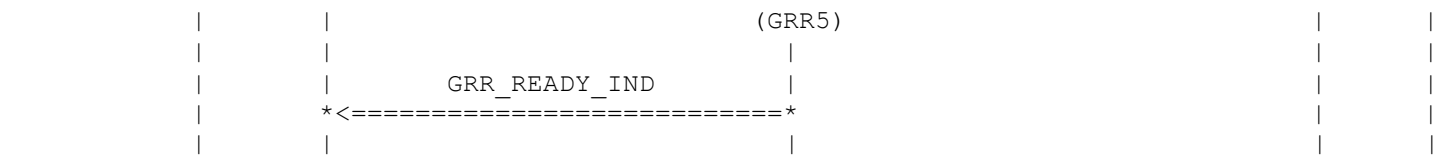
The focus of this chapter is the handling of GRR_DATA_REQ and GRR_UNIT_DATA_REQ related to the primitive queue. It does not show the resulting TBF procedures.



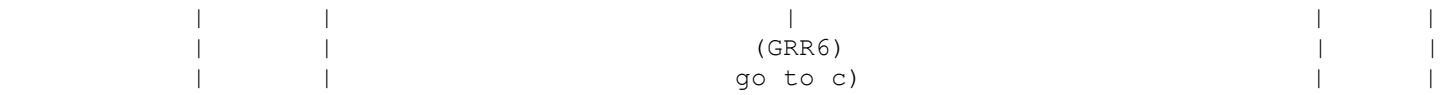
c) TBF in progress, primitive queue contains (including the new one) more data then MAX_GRR_USER_DATA bytes or contains more then PRIM_QUEUE_SIZE primitives.



c1) primitive queue content is lower then MAX_GRR_USER_DATA bytes



c2) primitive queue content still more then MAX_GRR_USER_DATA



(LLC1)
LLC request data transmission with GRR_DATA_REQ or GRR_UNITDATAREQ. LLC is not allowed to sent a new data request until it has received a GRR_READY_IND.

(GRR1)

GRR treats GRR_DATA_REQ and GRR_UNITDATAREQ in the same way in primitive queue related things. GRR put the primitive at the correct position in the primitive queue. The correct position is estimated by considering the priority, trough put, RLC Mode of all primitives in the queue, except primitives (LLC-PDU) which are already in transmission.

(GRR2)
In case the primitive queue is empty, GRR starts a packet access procedure and sends immediately a GRR_READY_IND.

(LLC2)
After reception of GRR_READY_IND, LLC may request the transmission of another LLC-PDU.

(GRR3)

In case of an existing TBF GRR sends immediately a GRR_READY_IND. The queued primitive will be considered in ongoing MAC procedures.

(GRR4)
GRR have an upper limited of user data it stores. If this limit is reached GRR does not allow LLC to sent more transmission requests.

(GRR5)

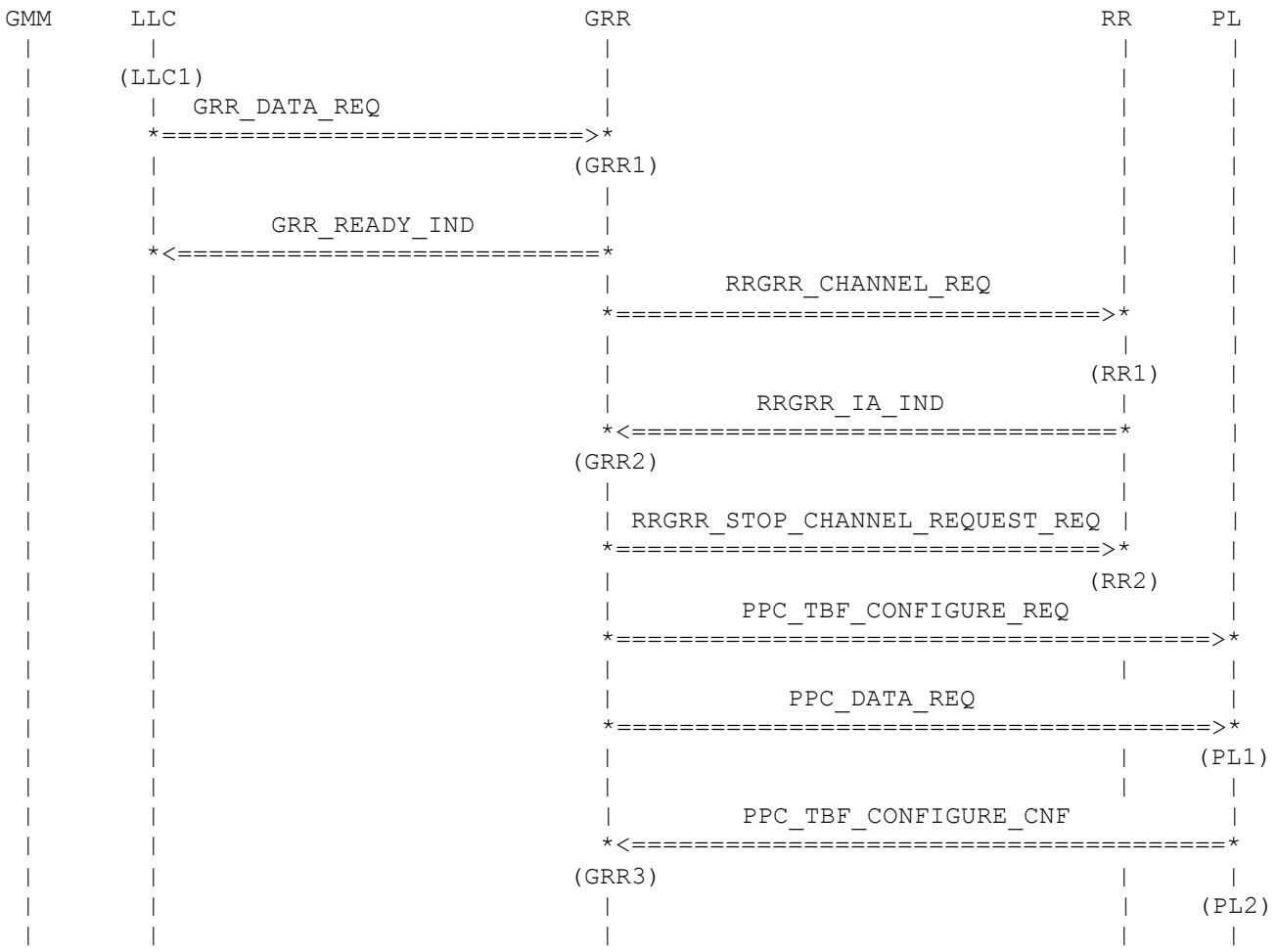
In case c) GRR will check the amount of data stored in GRR after each completely sent LLC-PDU. If the data amount is lower then the limit (c1), GRR allows LLC to request new data transmission by sending GRR_READY_IND.

(GRR6)

There may be the situation that several LLC-PDU have to be sent completely, until the next GRR_READY_IND follow. (In case the completed LLC-PDU are small, and the last queued one was big.)

6.2 TBF establishment on CCCH

6.2.1 Uplink TBF Establishment / One Phase / No TBF Staring Time/ Successful Case



(LLC1)
LLC requests acknowledged data transmission.

(GRR1)
GRR requests a CHANNEL REQUEST procedure from RR.

(RR1)
RR performs a random access procedure on CCCH. RR observes T3146. If the access reference matches, RR forwards incoming IMMEDIATE ASSIGNMENT messages to GRR.

(GRR2)
If GRR gets a suitable IMMEDIATE ASSIGNMENT it stops the access procedure in RR and configures TBF. In case of no starting time GRR sends immediately the first data to PL.

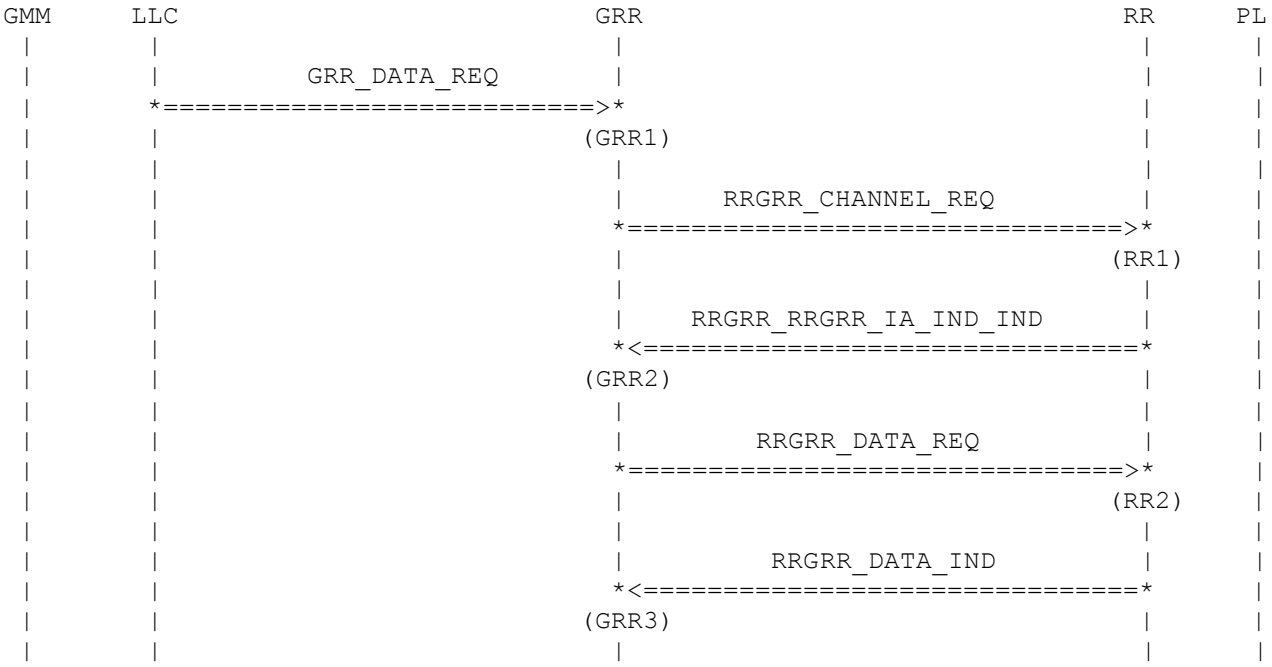
(RR2)
RR stops the access procedure and continues as before the access procedure.

(PL1)
PL prepares a TBF as described in PPC_TBF_CONFIGURE_REQ. PL. Short before PL starts to use the TBF-assignment, PL sends a PPC_TBF_CONFIGURE_CNF (here immediately, because here is no TBF-starting time included).

(GRR3)
GRR is waiting for incoming control messages or a ready indication from PL.

(PL2)
PL is searching for an opportunity to send the first data block.

6.2.2 Uplink TBF Establishment / SDCCH usage / Successful



(GRR1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-PDU.

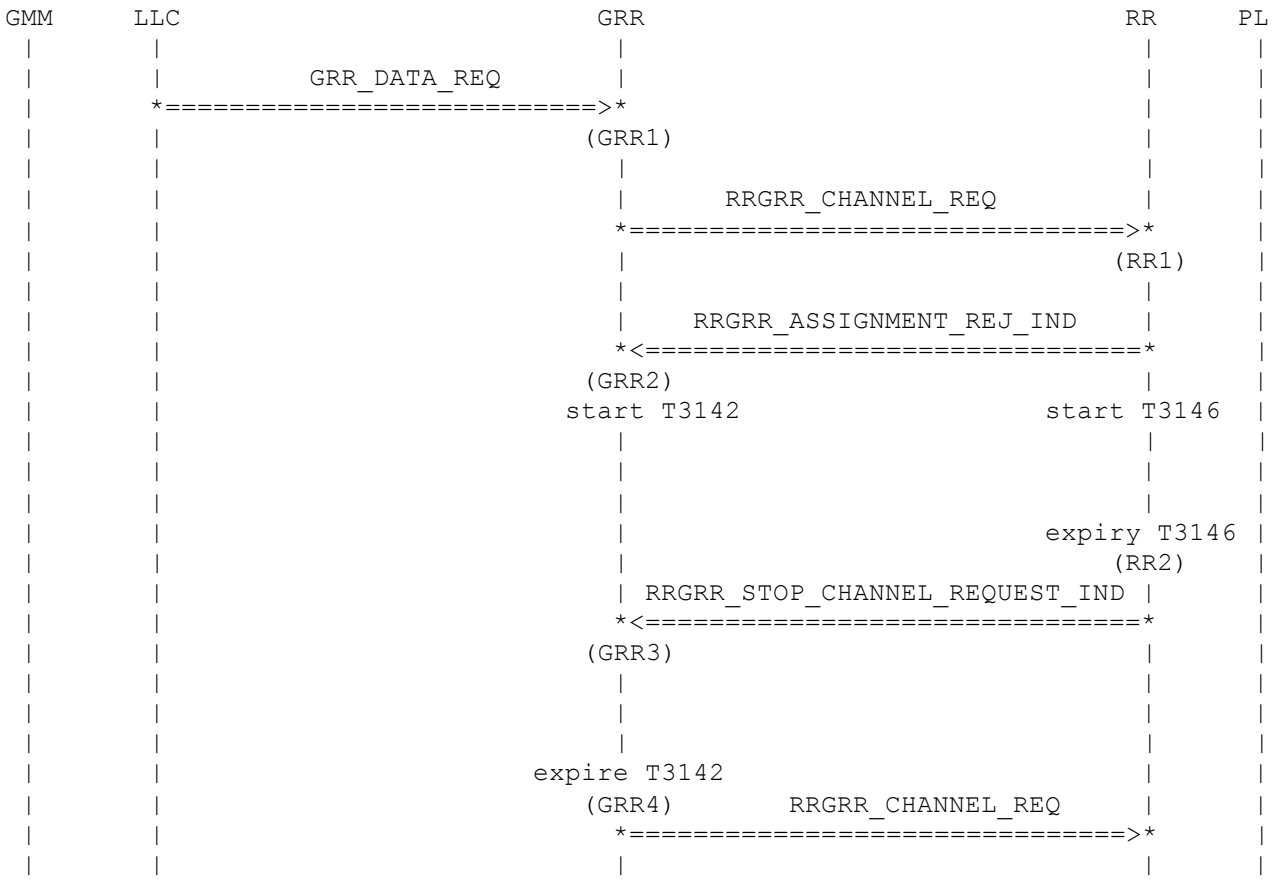
(RR1)
RR performs a channel request procedure on RACH. On reception of an IMMEDIATE ASSIGNMENT with correct access request reference RR passes this to GRR.

(GRR2)
In case the IMMEDIATE ASSIGNMENT include a DCCH request GRR answer with a RRGRR_DATA_REQ primitive including a RR INITIALISATION REQUEST

(RR2)
RR establishes a SDCCH and transmits the RR INITIALISATION REQUEST.

(GRR 3)
RR sends GRR a RRGRR_DATA_IND primitive including a PDCH ASSIGNMENT COMMAND.

6.2.3 Uplink TBF Establishment / Reject Case / No establishment



(GRR1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-PDU.

(RR1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to start an access procedure. In response RR receives a RRGRR_ASSINGMENT_REJ_IND, which RR sends to GRR.

(GRR2)
In case of rejected access procedure T3142 has to be started.

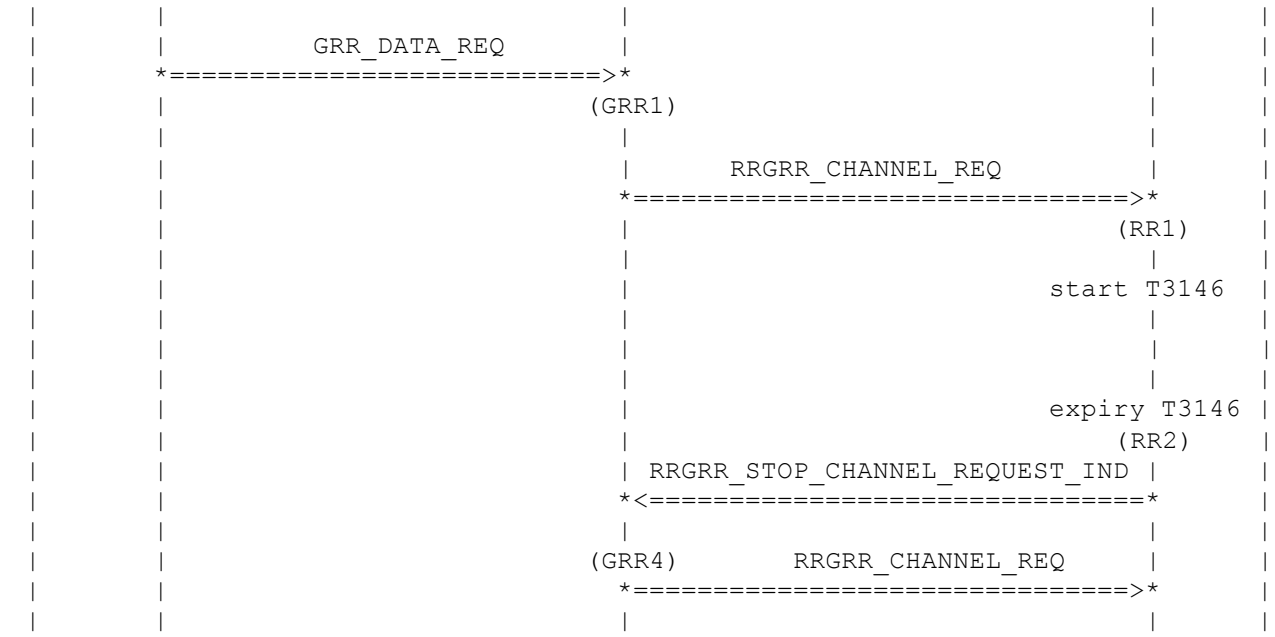
(GRR2)
The RR sends GRR an RRGRR_ASSINGMENT_REJ_IND (assignment rejection indication) primitive. Timer T3142 is started.

(RR2)
When timer T3146 expires, RR sends GRR a RRGRR_STOP_CHANNEL_REQUEST_IND primitive. REORG is stopped.

(GRR3)
After reception of RRGRR_STOP_CHANNEL_REQUEST_IND GRR cancel the running access procedure.

(GRR4)
When timer T3146 expires GRR starts a new access procedure.

6.2.4 Uplink TBF Establishment / No response from network



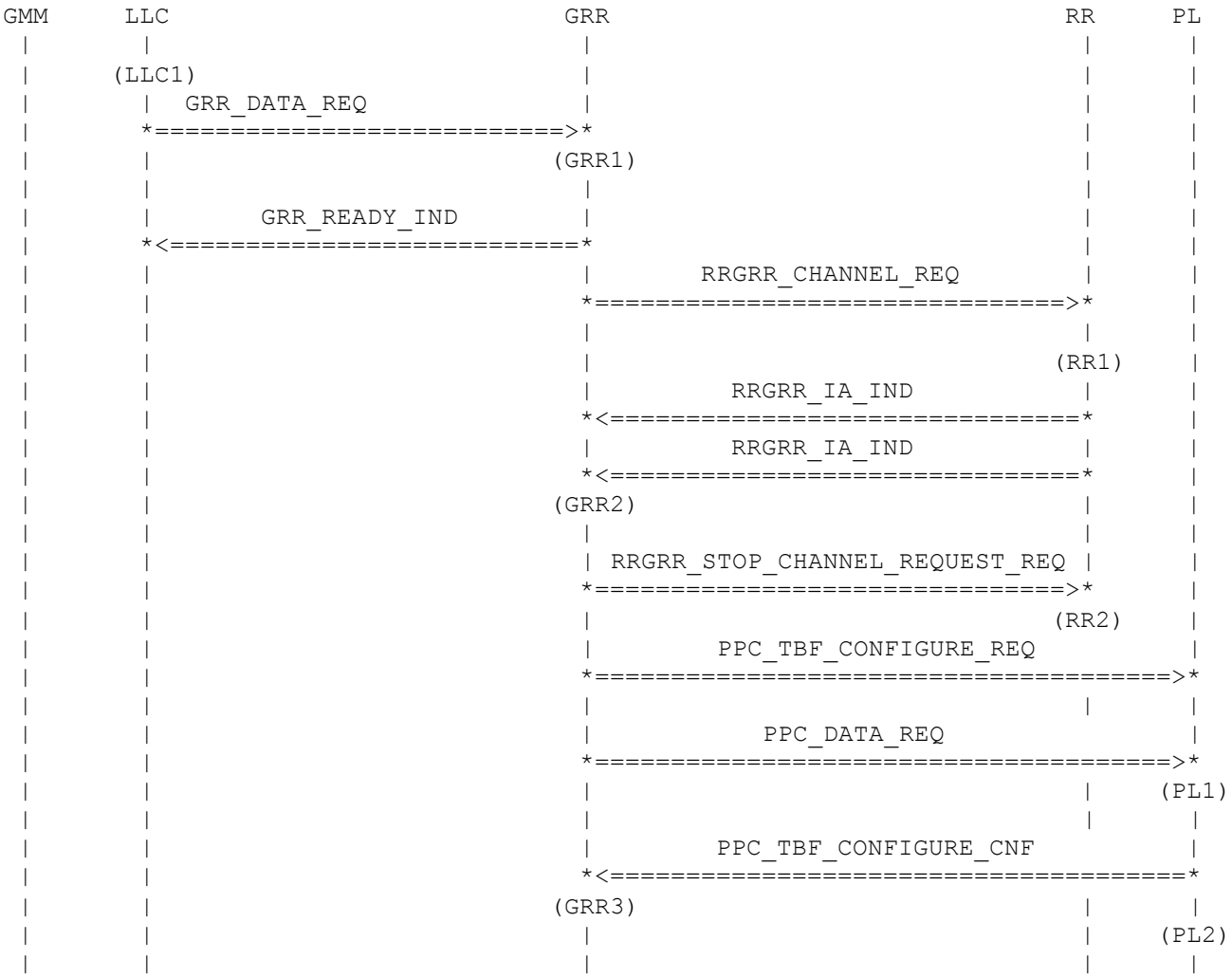
(GRR1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-PDU.

(RR1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to start an access procedure. After sending the last CHANNEL REQUEST RR starts T3146.

(RR2)
When timer T3146 expires, RR sends GRR a RRGRR_STOP_CHANNEL_REQUEST_IND primitive. REORG is stopped.

(GRR3)
After reception of RRGRR_STOP_CHANNEL_REQUEST_IND GRR cancel the running access procedure.
GRR starts a new access procedure (if required).

6.2.5 Uplink TBF Establishment / usage of 2 message IMMEDIATE ASSIGNMENT



(LLC1)
LLC requests acknowledged data transmission.

(GRR1)
GRR requests a CHANNEL REQUEST procedure from RR.

(RR1)
RR performs a random access procedure on CCCH. RR observes T3146. If the access reference matches, RR forwards incoming IMMEDIATE ASSIGNMENT messages to GRR.

(GRR2)
If GRR gets a both parts of the two message IMMEDIATE ASSIGNMENT it stops the access procedure in RR and configures TBF. In case of no starting time GRR sends immediately the first data to PL.

(RR2)
RR stops the access procedure and continues as before the access procedure.

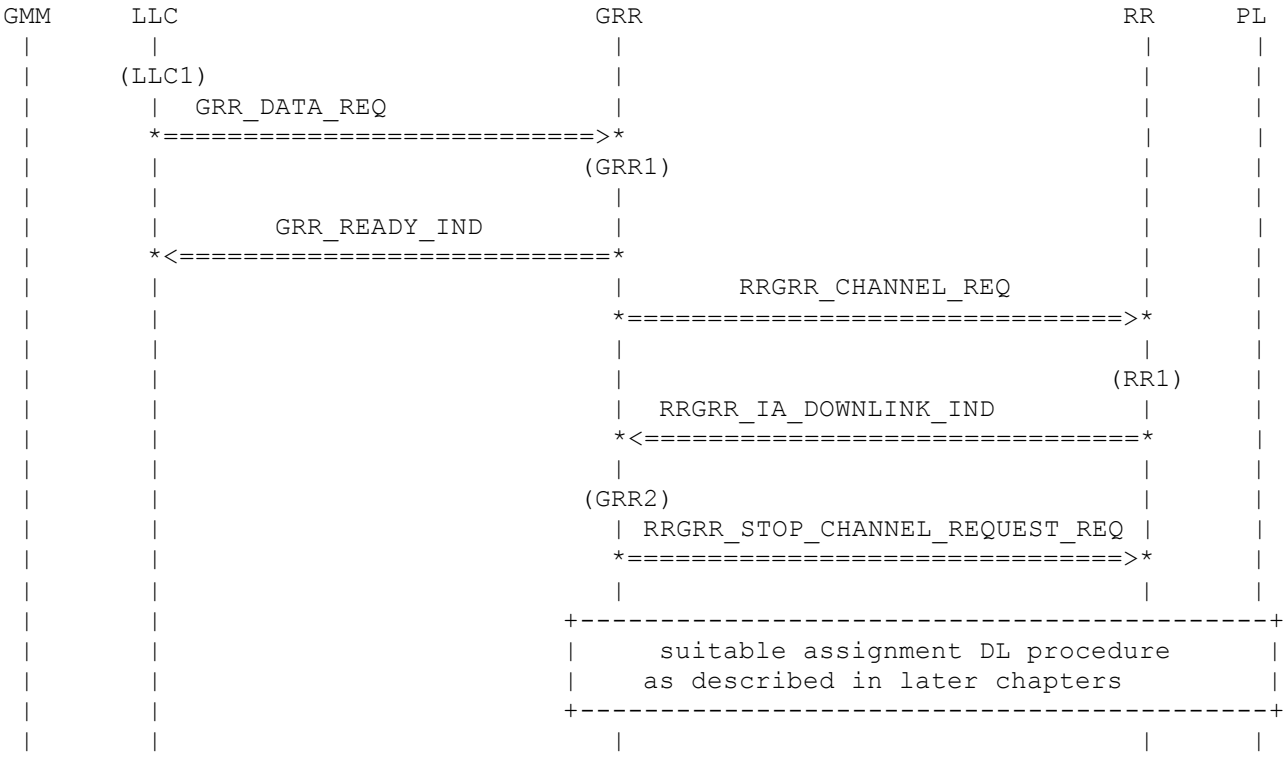
(PL1)
PL prepares a TBF as described in PPC_TBF_CONFIGURE_REQ. PL. Short before PL starts to use the TBF-assignment, PL sends a PPC_TBF_CONFIGURE_CNF (here immediately, because here is no TBF-starting time included).

(GRR3)
GRR is waiting for incoming control messages or a ready indication from PL.

(PL2)

PL is searching for an opportunity to send the first data block.

6.2.6 Uplink TBF Establishment / interrupted by downlink assignment



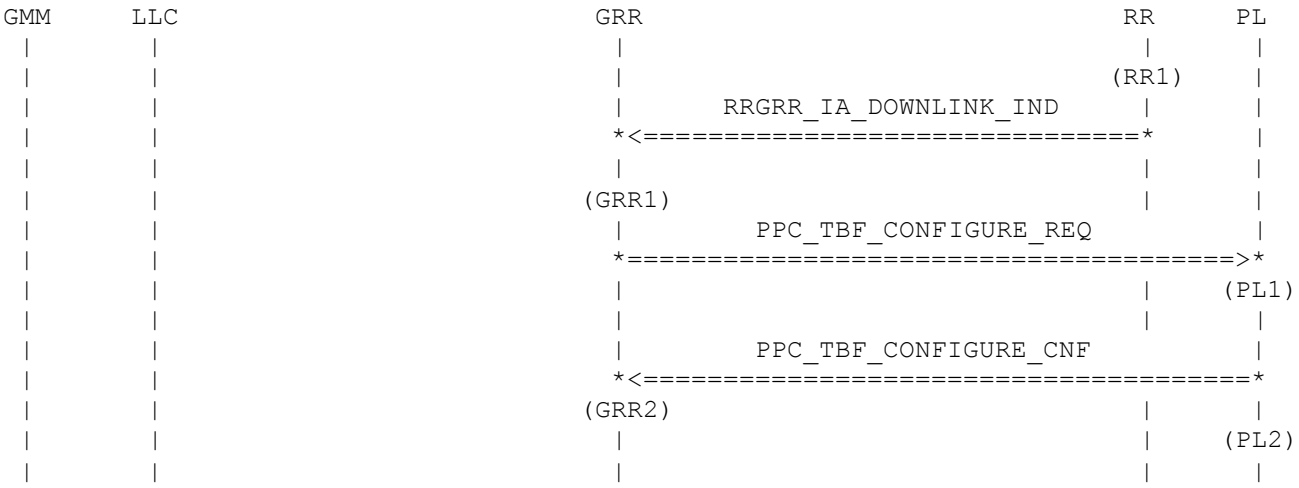
(LLC1)
LLC requests acknowledged data transmission.

(GRR1)
GRR requests a CHANNEL REQUEST procedure from RR.

(RR1)
RR performs a random access procedure on CCCH. RR observes T3146. If the access reference matches, RR forwards incoming IMMEDIATE ASSIGNMENT messages to GRR. In case of IMMEDIATE ASSIGNMENT with purpose of downlink assignment RR uses the primitive RRGRR_IA_DOWNLINK_IND.

(GRR 2)
In case of a downlink assignment RR cancel the ongoing uplink access procedure and react on the downlink assignment..

6.2.7 Downlink TBF/ No TBF Staring Time/ Successful Case



(RR1)
RR is reading CCCH. After receiving an IMMEDIATE ASSIGNMENT for a downlink assignment it passes this messages to GRR.

(GRR1)
If GRR gets a suitable IMMEDIATE ASSIGNMENT, GRR configures TBF.

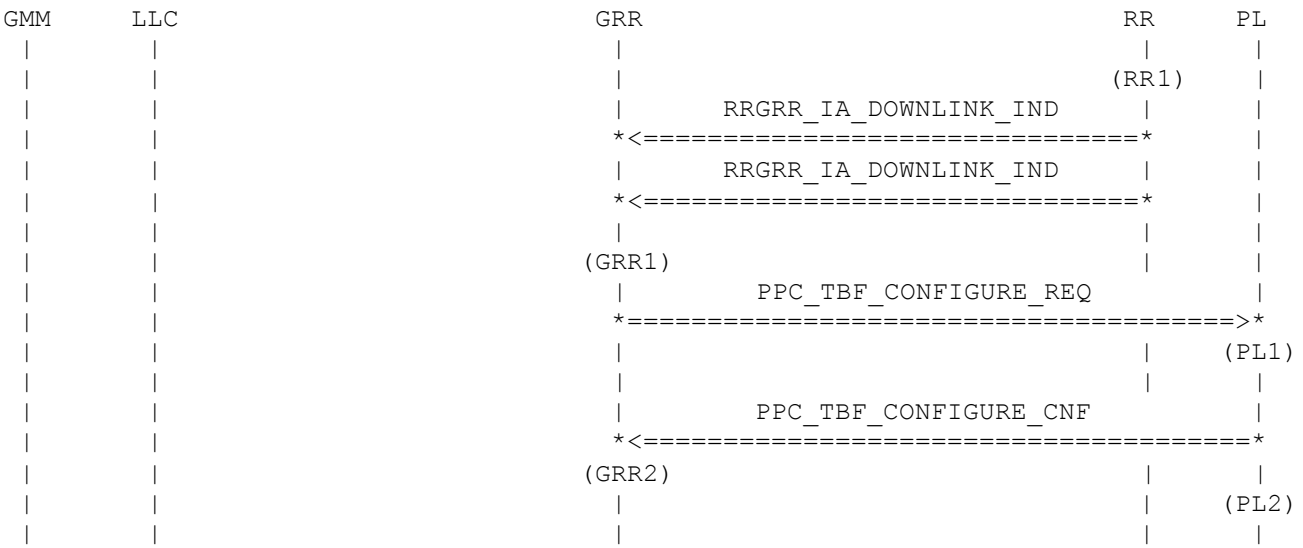
(PL1)
PL prepares a TBF as described in PPC_TBF_CONFIGURE_REQ. Short before PL starts to use the TBF-assignment, PL sends a PPC_TBF_CONFIGURE_CNF (here immediately, because here is no TBF-starting time included).

(GRR2)
GRR is waiting for a incoming data block, control message or ready indication from PL.

(PL2)

PL is searching valid blocks on the assigned resources.

6.2.8 Downlink TBF Establishment / using two message IMMEDTIATE ASSIGNMENT



(RR1)
RR is reading CCCH. After receiving both parts of an IMMEDIATE ASSIGNMENT for a downlink assignment it passes these messages to GRR.

(GRR1)
If GRR gets two suitable IMMEDIATE ASSIGNMENT, GRR configures TBF.

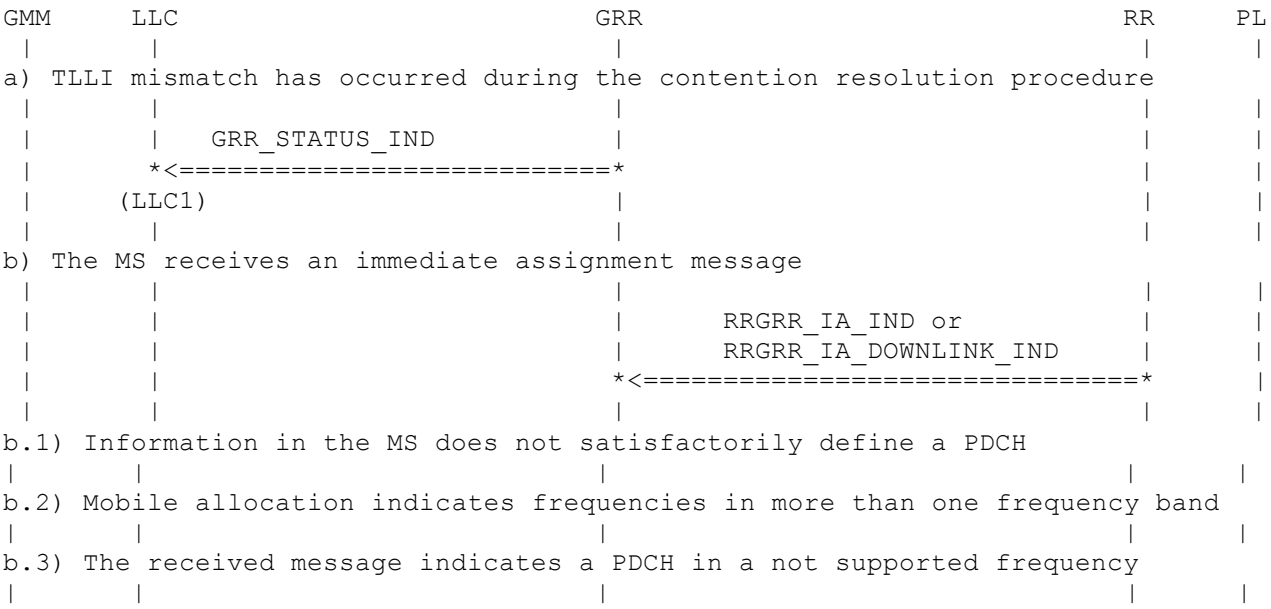
(PL1)
PL prepares a TBF as described in PPC_TBF_CONFIGURE_REQ. Short before PL starts to use the TBF-assignment, PL sends a PPC_TBF_CONFIGURE_CNF (here immediately, because here is no TBF-starting time included).

(GRR2)
GRR is waiting for a incoming data block, control message or ready indication from PL.

(PL2)

PL is searching valid blocks on the assigned resources.

6.2.9 Abnormal cases



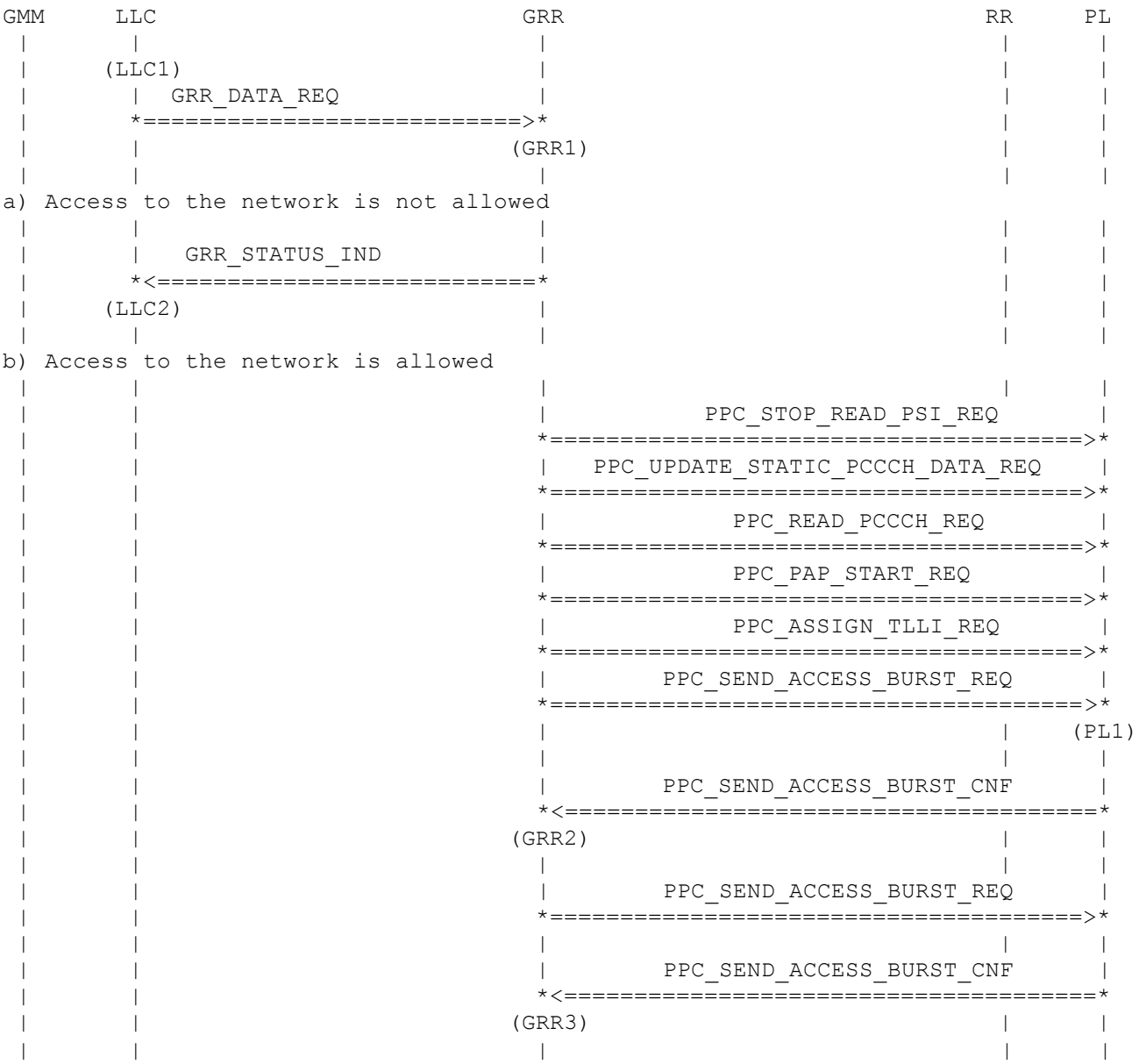
(LLC1)
TLLI mismatch has occurred. GRR informs the LLC via GRR_STATUS_IND. The cause parameter contains TBF establishment failure.

(GRR1)
GRR receives an IMMEDIATE ASSIGNMENT message. If one of the four abnormal cases occurs before the contention resolution procedure is completed, the MS returns to the packet idle mode and notifies upper layers.

Requirements:
<R.MAC.AB_IMMAS.M.00x>

6.3 TBF Establishment PCCCH

6.3.1 Uplink TBF establishment initiated by the MS on PCCCH



(GRR 1)
LLC wants to transmit LLC PDU. GRR checks whether the access to the network is allowed or not.

(LLC 1)
If the access to the network is not allowed, the GRR sends GRR_STATUS_IND, which contains a cause field: Network access not allowed.

(PL 1)
If the upper layer wants to transmit LLC PDUs, then the GRR composes PACKET CHANNEL REQUEST message and posts it to the PL. The PL sends this message on PRACH corresponding to its PCCCH_GROUP. The GRR can send maximum MAX_RETRANS + 1 times PACKET CHANNEL REQUEST. The GRR set the Retry (R) bit into the appropriate value. This bit is used in subsequent MAC headers. The format of the PACKET CHANNEL REQUEST is either 8 bit or 11 bit. It is broadcast on PBCCH. For the next channel

request attempt the GRR shall take PERSISTENCE_LEVEL into account. The purpose of the packet access shall be indicated in the message (Page Response, Cell Update, Mobility Management, Single Block without TBF). As preparation to the access procedure GRR stops PSI reading and changes the PCCCH reading to page mode REORG.

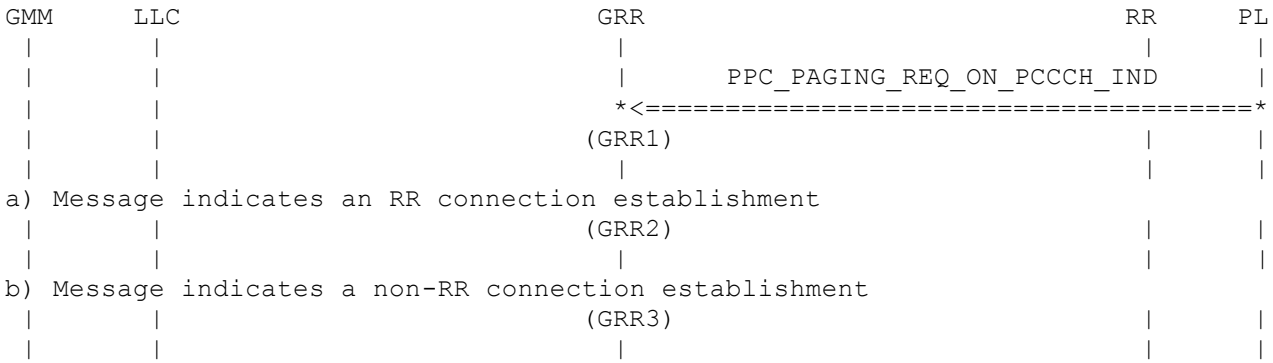
(GRR 2)
The PL sends a confirmation to the GRR to indicate that the PACKET CHANNEL REQUEST message was sent. GRR request transmission of another PACKET CHANNEL REQUEST.

(GRR 3)

There may be multiple PPC_SEND_ACCESS_BURST_REQ and PPC_SEND_ACCESS_BURST_CNF, depending on how many repeats of access bursts are defined in the packet system information (MAX_RETRANS).

Requirements:
<R.MAC.TBFPCCCH.M.00x>, <R.MAC.P_ACCESS.M.001-4, <R.MAC.P_ACCESS.M.009-13>, <R.MAC.ACCS_PER.M.00x>

6.3.2 Receiving packet paging request during packet access procedure



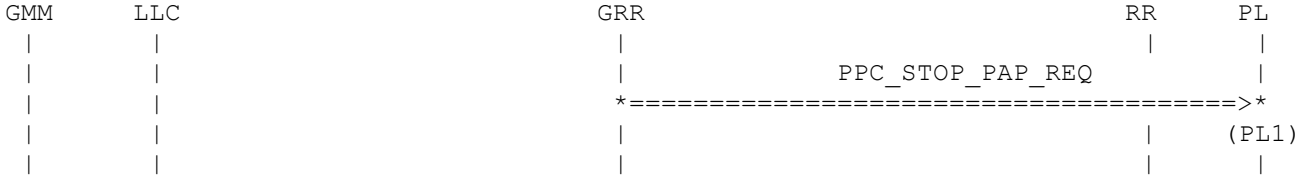
(GRR1)
The MAC receives a PACKET PAGING REQUEST.

(GRR2)
Class C MS ignores this message but decodes the PERSISTENCE_LEVEL, if indicated in the message.. Class A and B MSs shall respond to this message. Class B MS may aborts the packet access procedure and indicates this to RR.

(GRR3)
This message will be ignored by all MS classes.

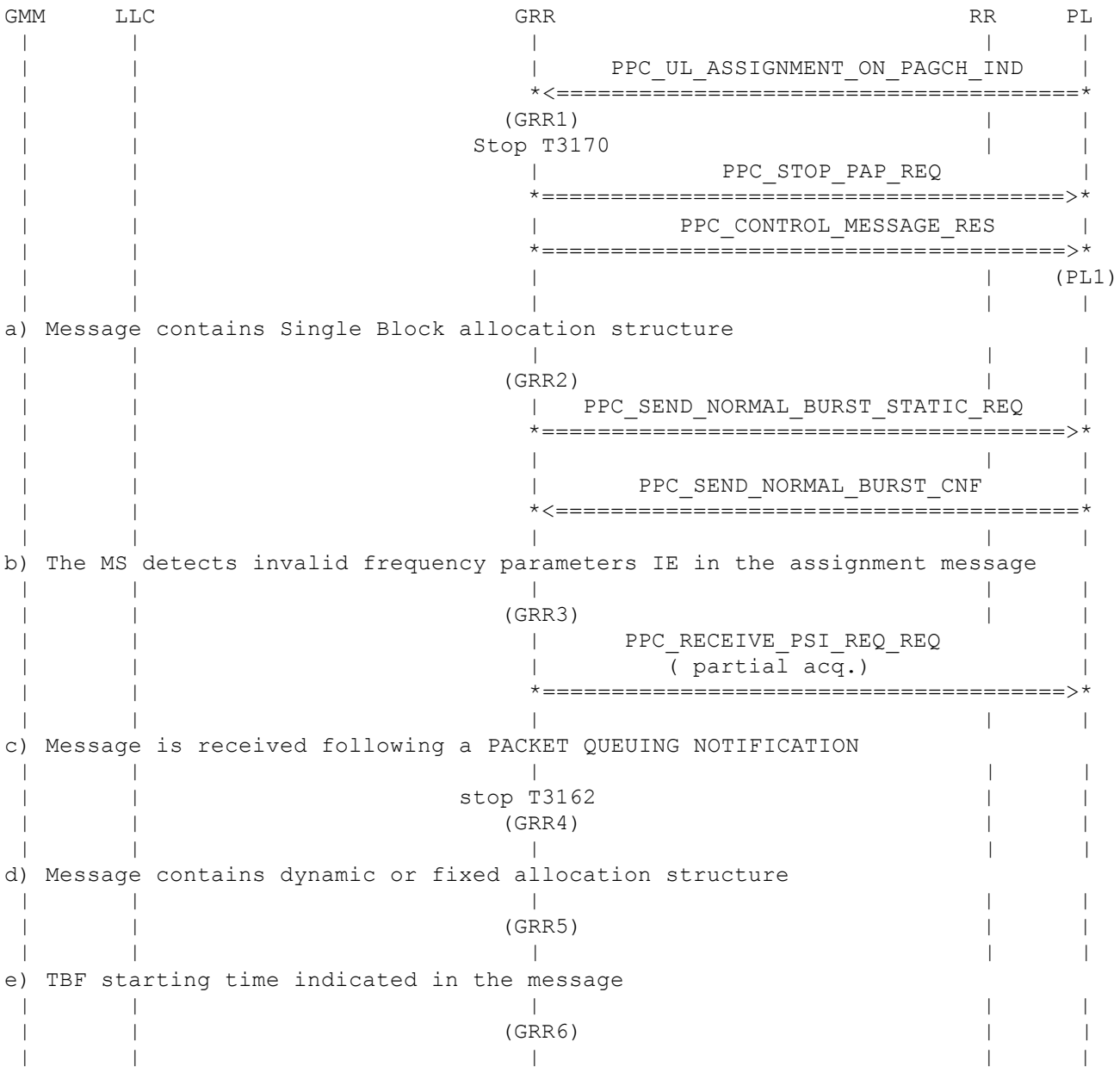
Requirements:
<R.MAC.P_ACCESS.M.005-8>

6.3.3 Stop the uplink TBF establishment



(PL 1)
GRR cancels pending transmissions of PACKET ACCESS REQUEST.

6.3.4 Packet assignment procedure (The MS has not indicated a measurement report)



(GRR1)

GRR stops T3170 and evaluates the PACKET UPLINK ASSIGNMENT.

(PL1)
The PL stops to sending PACKET CHANNEL REQUEST.

(GRR2)
GRR sends PACKET RESOURCE REQUEST to start a two phase access procedure.

(GRR3)
If the MS detects invalid frequency parameters IE in the assignment message, the MS aborts the procedure, if required GRR initiates a partial acquisition of PBCCH or BCCH and may reinitiate this procedure.

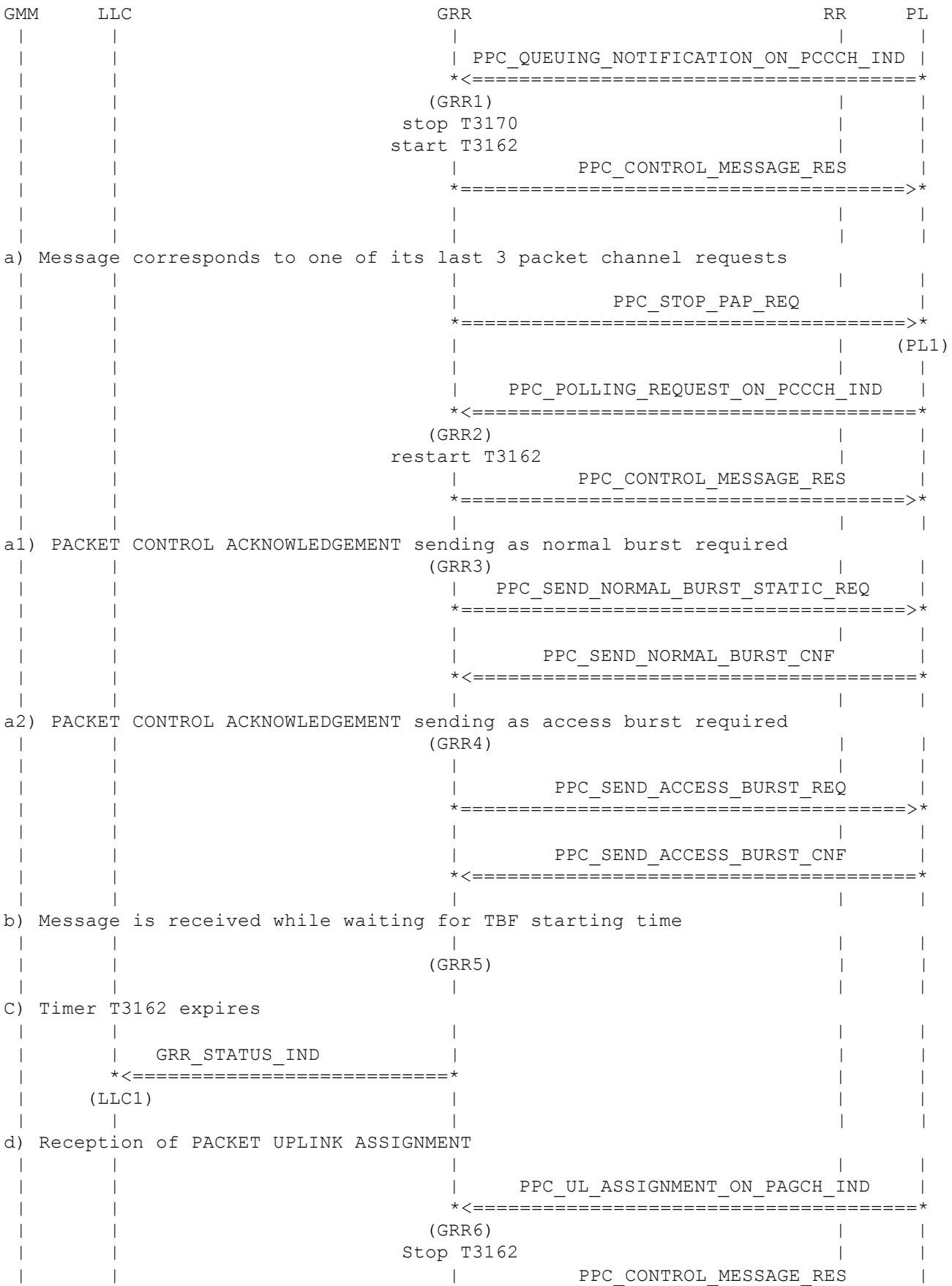
(GRR 4)
GRR stops timer T3162 and switches to the assigned PDCH.

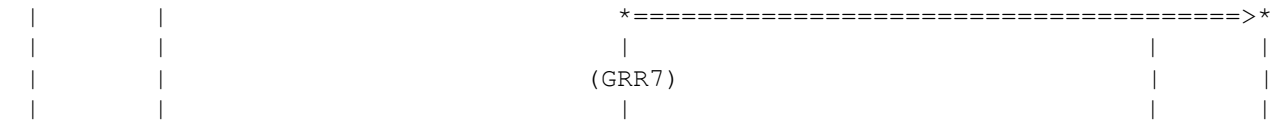
(GRR5)
GRR follows the one phase access procedure.

(GRR 6)
The GRR shall monitor PCCCH until the point in time denoted by the TBF starting time. Thereafter it shall switch to the assigned PDCHs, start timer T3164 and proceed with the contention resolution. While monitoring the PCCCH, if the MAC receives more than one PACKET UPLINK ASIGNMENT message, it shall act on the new one. This point is also valid for the situation on which the GRR has indicated a measurement report in the channel request message.

Requirements:
<R.MAC.REC_CHRQ.M.0xx>, <R.MAC.RC_RS_RQ.M.007>

6.3.5 Receipt of packet queuing notification





(GRR1)

GRR receives the PACKET QUEUING NOTIFICATION message. The GRR stops the timer T3170 if running and starts the timer T3162, and stops sending PACKET CHANNEL REQUEST messages. The GRR shall continue to listen to the PBCCH and PCCCH. If the timer T3162 expires the packet access procedure shall be aborted and a packet access failure is indicated to the upper layer (see LLC1).

(GRR2)

GRR receives a PACKET POLLING RESPONSE REQUEST. GRR has to answer with PACKET CONTROL ACKNOWLEDGEMENT in access or normal burst.

(GRR3)
GRR delivers a PACKET CONTROL ACKNOWLEDGEMENT within a PPC_SEND_NORMAL_BURST_STATIC_REQ to PL.

(GRR4)
GRR delivers a PACKET CONTROL ACKNOWLEDGEMENT within PPC_SEND_ACCESS_BURST_REQ to PL.

(LLC 1)

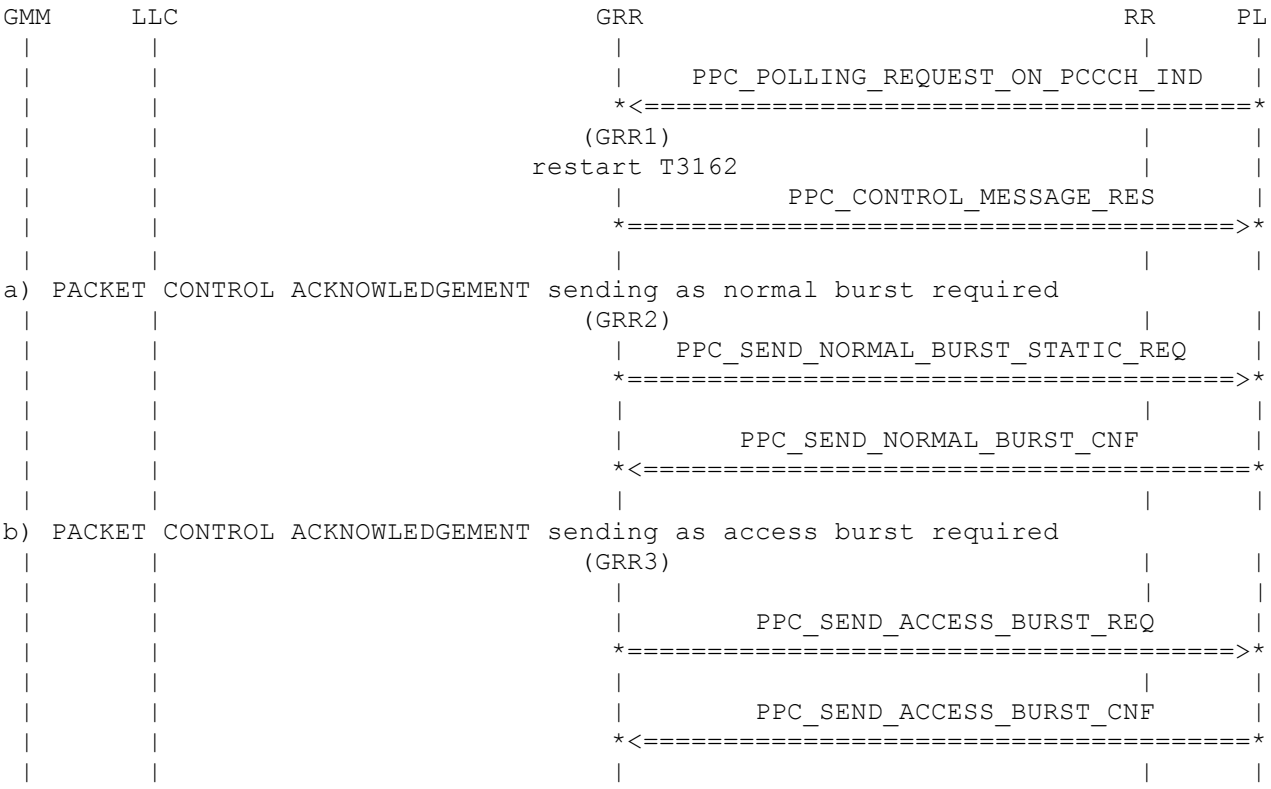
GRR sends to the LLC packet access failure indication via GRR_STATUS_IND. Cause field contains: Failure during packet access procedure, e.g. T3162 expired.

(GRR6)
GRR restarts T3162.

(GRR7)
After reception of a PACKET UPLINK ASSIGNMENT the packet queuing procedure is finished, T3162 shall be stopped, T3164 started and GRR a should continue with a TBF assignment procedure.

Requirements:
<R.MAC.ACCS_QUE.M.00X>

6.3.6 Packet polling procedure



(GRR1)

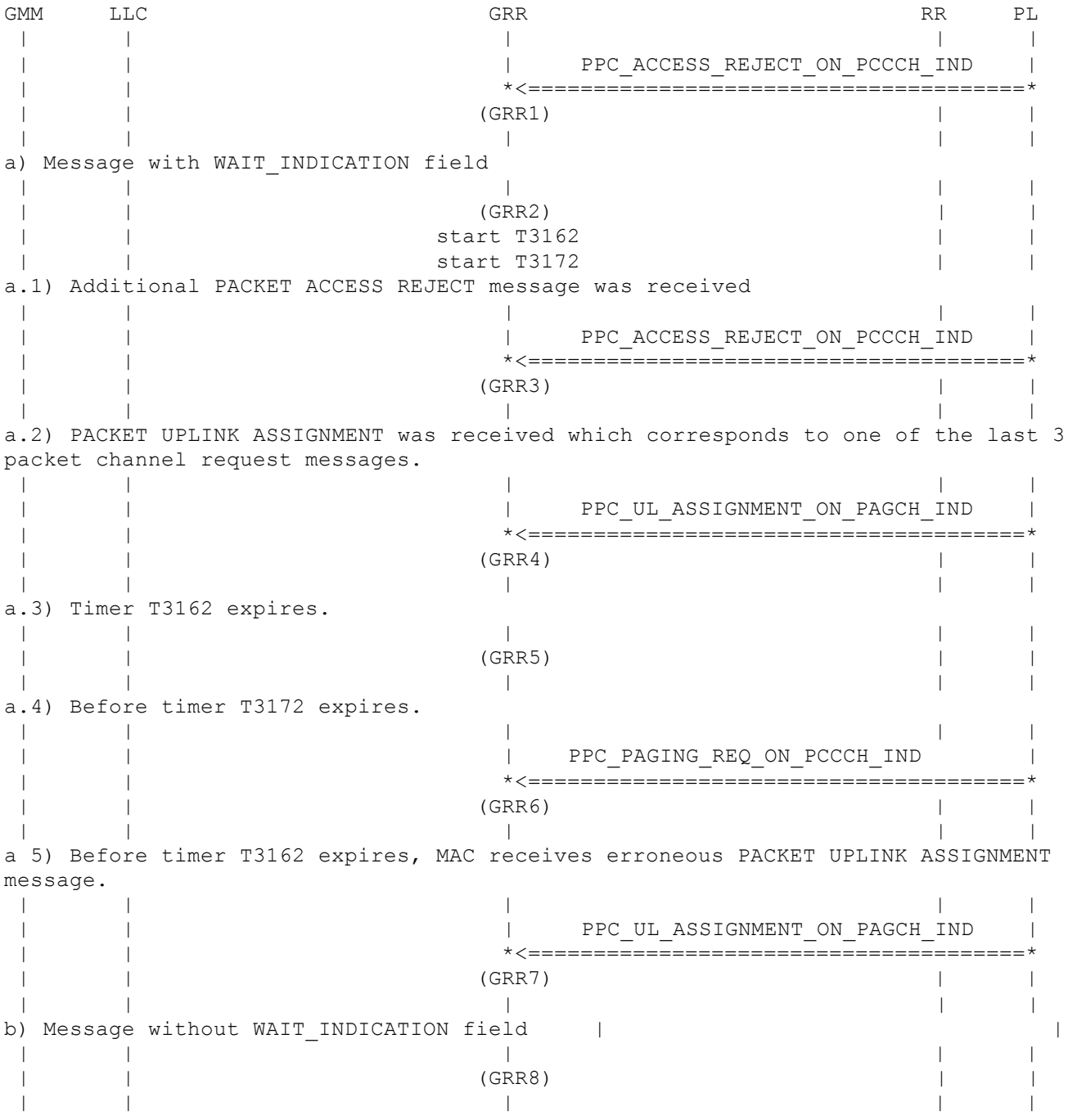
GRR receives a PACKET POLLING RESPONSE REQUEST. GRR has to answer with PACKET CONTROL ACKNOWLEDGEMENT in access or normal burst.

(GRR2)
GRR delivers a PACKET CONTROL ACKNOWLEDGEMENT within a PPC_SEND_NORMAL_BURST_STATIC_REQ to PL.

(GRR3)

GRR delivers a PACKET CONTROL ACKNOWLEDGEMENT within PPC_SEND_ACCESS_BURST_REQ to PL.

6.3.7 Receipt of packet access reject message



(GRR1)
GRR receives the PACKET ACCESS REJECT message.

(GRR2)
PL indicates the PACKET ACCESS REJECT to the GRR. The message contains wait indication field. The GRR starts T3162 if it has not already been started, and starts T3172. The GRR shall listen to the PCCCH until timer T3162 expires. Before timer T3172 expires, it is not allowed to make a new attempt for packet access in the same cell, but may attempt packet access in a different cell after successful cell reselection. MS class A or B may attempt to enter dedicated mode in the same cell before T3172 expires.

(GRR3)
The MAC receives additional PACKET ACCESS REJECT message while waiting. The MAC ignores these messages.

(GRR4)
The timers T3172 and T3162 should be stopped, and the same procedure as for receiving a PACKET UPLINK ASSIGNMENT message following a PACKET QUEUEING NOTIFICATION message should be followed.

(GRR5)
If the timer T3162 expires the MS shall return to packet idle mode.

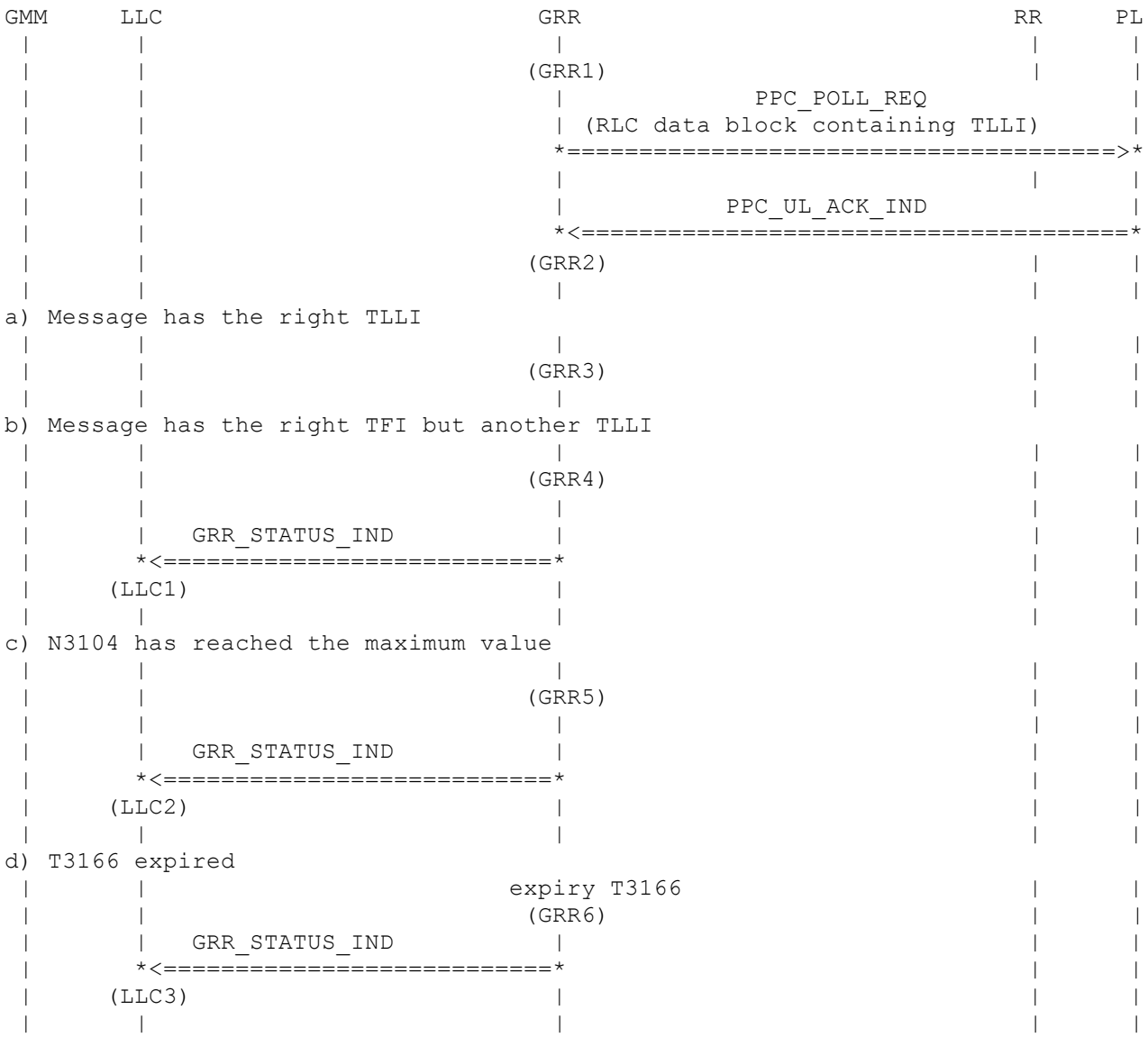
(GRR6)
The MAC shall ignore the received PACKET PAGING REQUEST messages except paging request to trigger RR connection establishment.

(GRR7)
The MAC receives an erroneous PACKET UPLINK ASSIGNMENT message, reinitiate packet access procedure unless it has already been repeated 4 times, the MS shall return to packet idle mode.

(GRR8)
The PL indicates the PACKET ACCESS REJECT to the GRR. The message does not contain wait indication field. Stop T3162, if running and return to packet idle mode. GRR shall decode the PACKET SYSTEM INFORMATION messages, if broadcast, or the SYSTEM INFORMATION messages before re-attempting the uplink TBF establishment.

Requirements:
<R.MAC.ACCS_REJ.M.00x>, <R.MAC.RC_RS_RQ.M.003-5>

6.3.8 Contention resolution completion/failure at one phase access



(GRR1)
GRR sends RLC data blocks. At sending of the first RLC data block T3164 shall be stopped, the counter N3104 shall be set to 1 and the timer T3166 shall be started

(GRR2)
The MS receives a PACKET UPLINK ACK/NACK message.

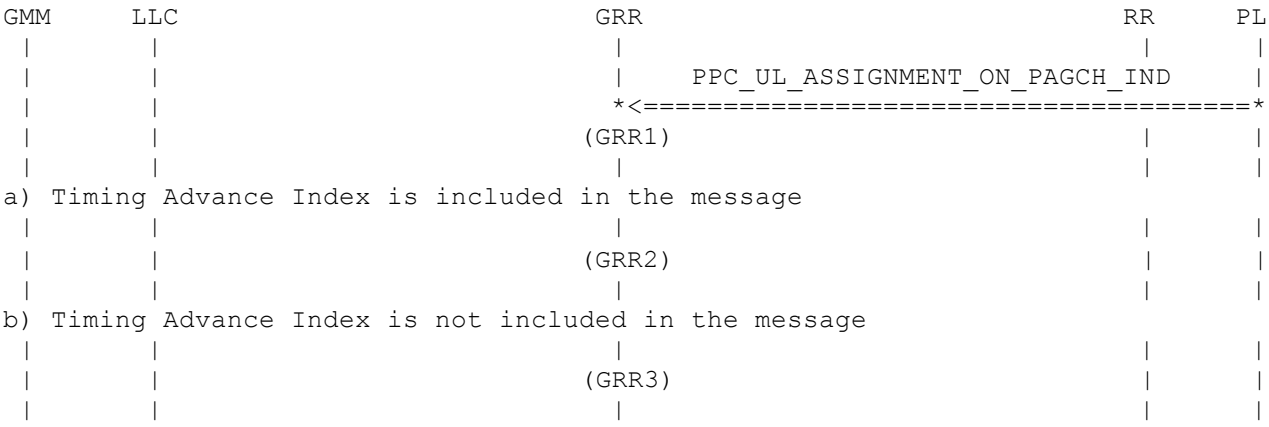
(GRR 3)
Contention resolution completed. Stop T3166 and N3104.

(GRR 4, 5, 6)
Contention resolution fails. Reset of N3104, stop 3166, stopping of transmitting on this TBF.

(LLC 1,2,3)
GRR sends TBF failure to the LLC via GRR_STATUS_IND.

Requirements:
<R.MAC.CON_RES1.M.00x>, <R.MAC.ACC_COMP.A.001>

6.3.9 Timing Advance



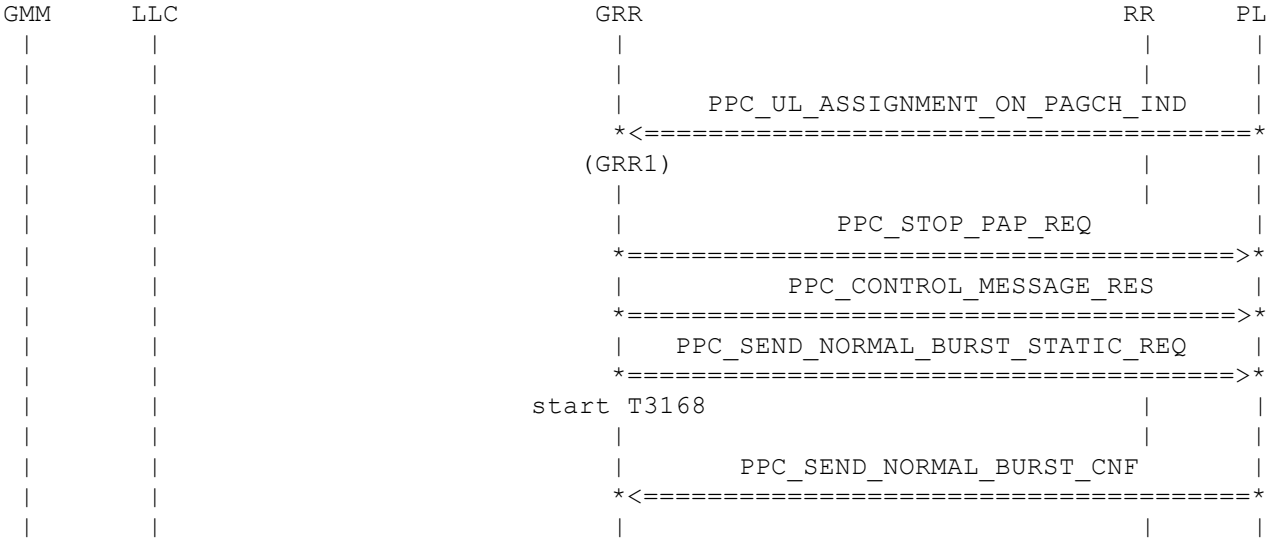
(GRR1)
GRR receives a PACKET UPLINK ASSIGNMENT message.

(GRR2)
In this case the continuous update timing advance mechanism should be used.(Under construction!!!)

(GRR3)
The continuous update timing advance mechanism shall not be used. The MS is not allowed to send normal bursts on the uplink until it receives a valid timing advance either through continuous timing advance procedure or packet power control/ timing advance message.

Requirements:
<R.MAC.TA.M.003-4>, <R.MAC.TA_2PH.M.00x>

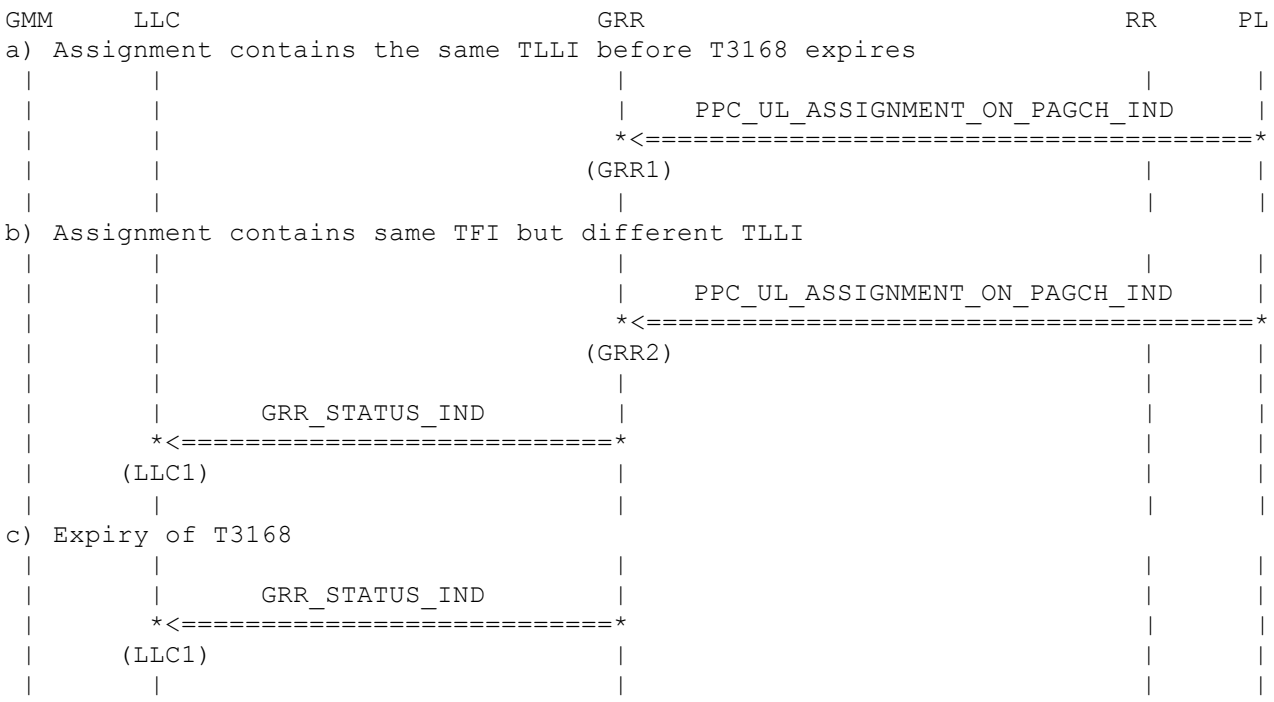
6.3.10 TBF establishment using two phase access



(GRR1)
GRR receives PACKET UPLINK ASSIGMENT message, which contains single block allocation structure. GRR composes a PACKET RESOURCE REQUEST message and sends it to the PL and starts timer T3168. The MS shall indicate in the RLC_OCTET_COUNT the number of octets of user data that it has to be transferred in the TBF.

Requirements:
<R.MAC.TBF_2PH.M.001>, <R.MAC.RES_REQ.M.00x>, <R.MAC.RC_RS_RQ.M.002>

6.3.11 Contention resolution at two phase access



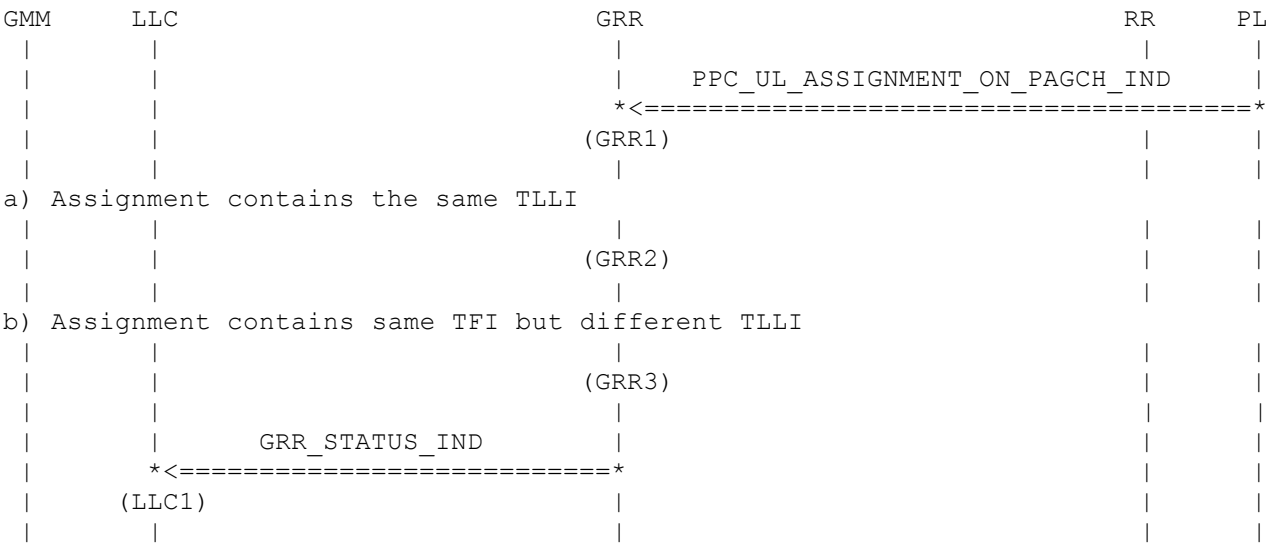
(GRR1)
GRR has received PACKET UPLINK ASSIGMENT message, which contains the same TLLI as GRR has included in the PACKET RESOURCE REQUEST message. GRR stops T3168. GRR continues with two phase access procedure.

(GRR2)
Contention resolution fails. Stop timer T3168, reinitiate packet access procedure unless it has already been repeated 4 times. In that case, TBF failure has occurred.

(LLC1)
GRR indicates to the LLC via GRR_STATUS_IND that a TBF failure has occurred.

Requirements:
<R.MAC.CON_RES2.M.00x>, <R.MAC.AB_PCCCH.M.001>

6.3.12 Abnormal cases (not ready yet)



(GRR1)
GRR receives PACKET UPLINK ASSIGNMENT message, which contains a single block allocation structure.

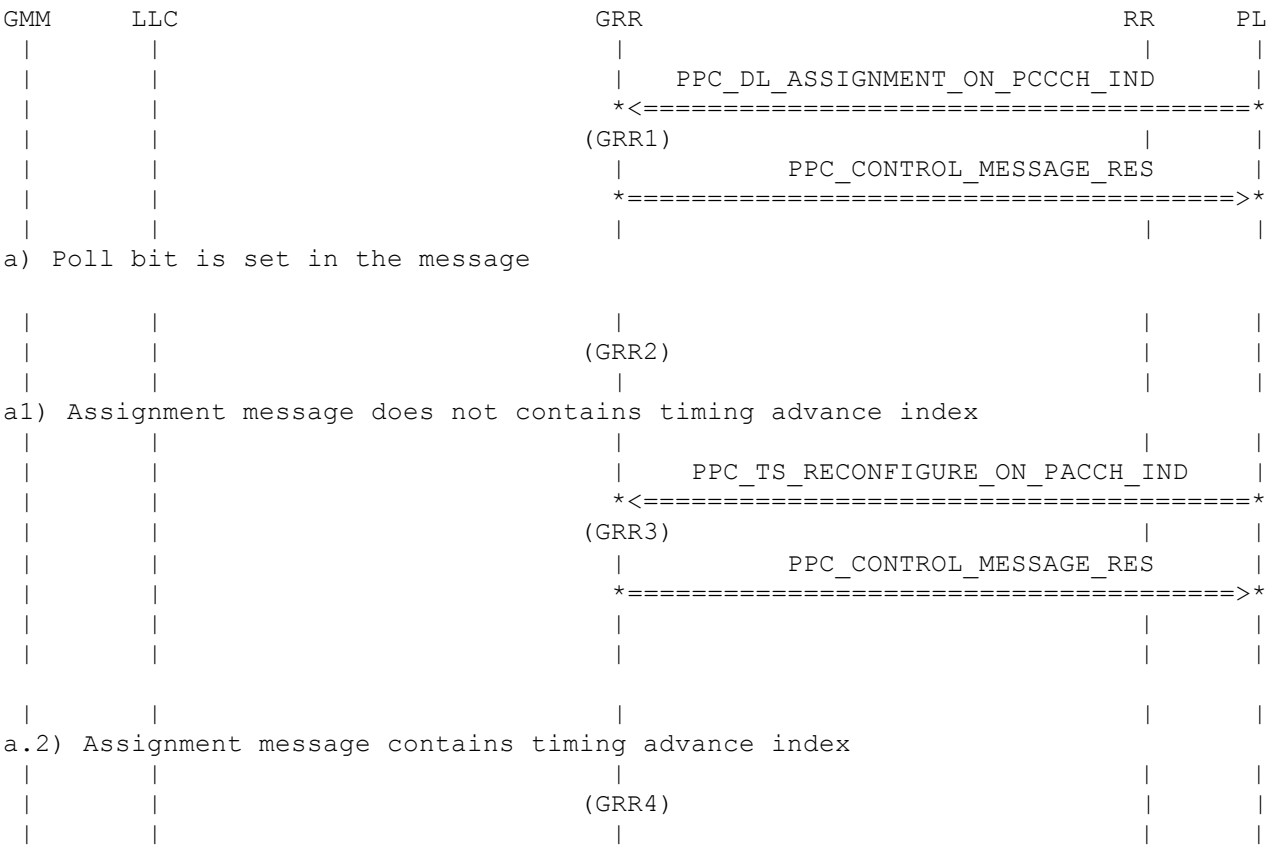
(GRR2)
GRR has received PACKET UPLINK ASSIGMENT message, which contains the same TLLI as GRR has included in the PACKET RESOURCE REQUEST message. GRR stops T3168.

(GRR3)
Contention resolution fails. Stop timer T3168, reinitiate packet access procedure unless it has already been repeated 4 times. In that case, TBF failure has occurred.

(LLC1)
GRR indicates to the LLC via GRR_STATUS_IND that a TBF failure has occurred.

Requirements:
<R.MAC.AB_PCCCH.M.00x>

6.3.13 Packet downlink assignment



(GRR1)
GRR receives a PACKET DOWNLINK ASSIGNMENT message. If this message contains a TBF starting time, the GRR shall monitor PCCCH until the starting time occurs. The timer T3190 shall be started. The timer is reset when receiving the first valid RLC/MAC block. On expiry of T3190, the MS aborts the procedure and returns to packet idle mode.

(GRR2)
The same procedure as described in 6.3.6

(GRR3)
GRR receives message to update the timing advance. The update of timing advance can be also done by continuous timing advance procedure, if timing advance index is included in the message.

(GRR4)
The timing advance in the MS shall be updated via continuous timing advance procedure.

6.3.14 Packet polling procedure after receiving a packet downlink assignment

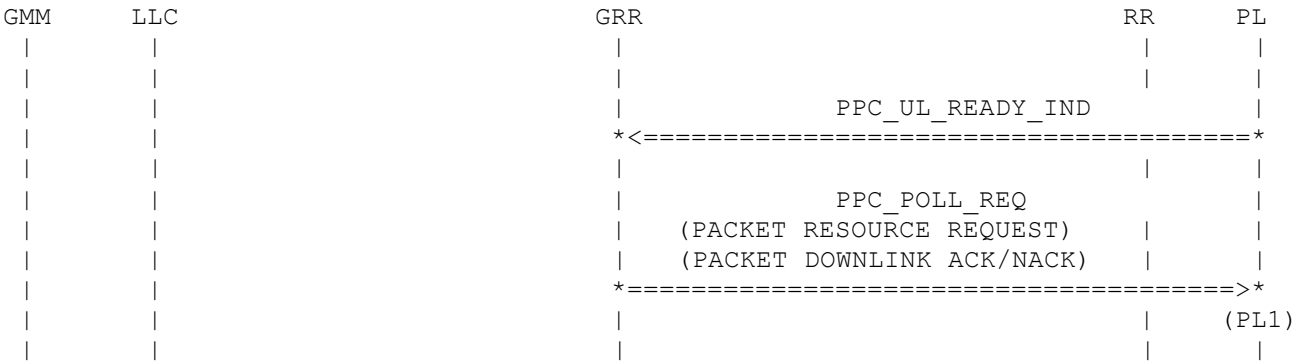
This procedure is described in 6.3.6.

Requirements:
<R.MAC.I_P_POLL.M.00x>

7 MAC Procedures on TBF

7.1 MAC procedures in uplink packet transfer mode

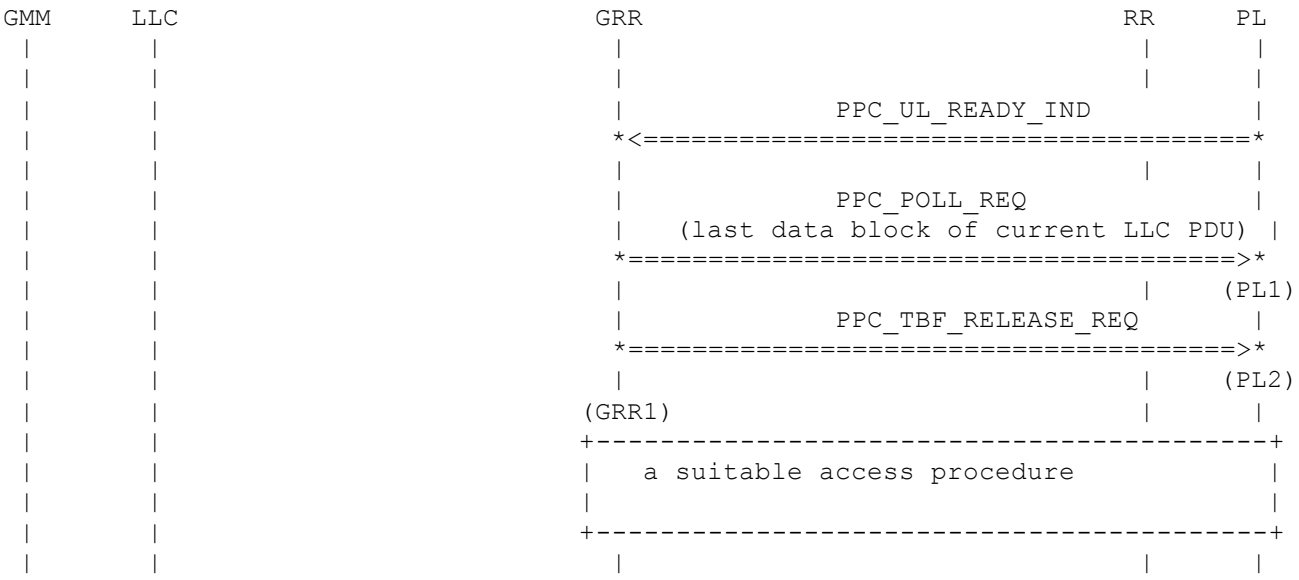
7.1.1 Resource Reallocation (Uplink)



(PL 1)
The MS requests new resources.

Requirements:
<R.MAC.UPL_RLCD.M.006-11>, <R.MAC.RR_UPL.M.001-4>, <R.MAC.RR_UPL.M.009>, <R.MAC.RR_UPL.M.0015>, <R.MAC.R_OE_TBF.M.001-2>, <R.MAC.BEGIN_FX.M.001-2>, <R.MAC.NC_PWR.M.001-3>

7.1.2 Resource Reallocation for new LLC PDUs with different RLC mode and higher priority (Uplink)



(PL 1)
The MS completes the transmission of the current LLC PDU.

(PL 2)

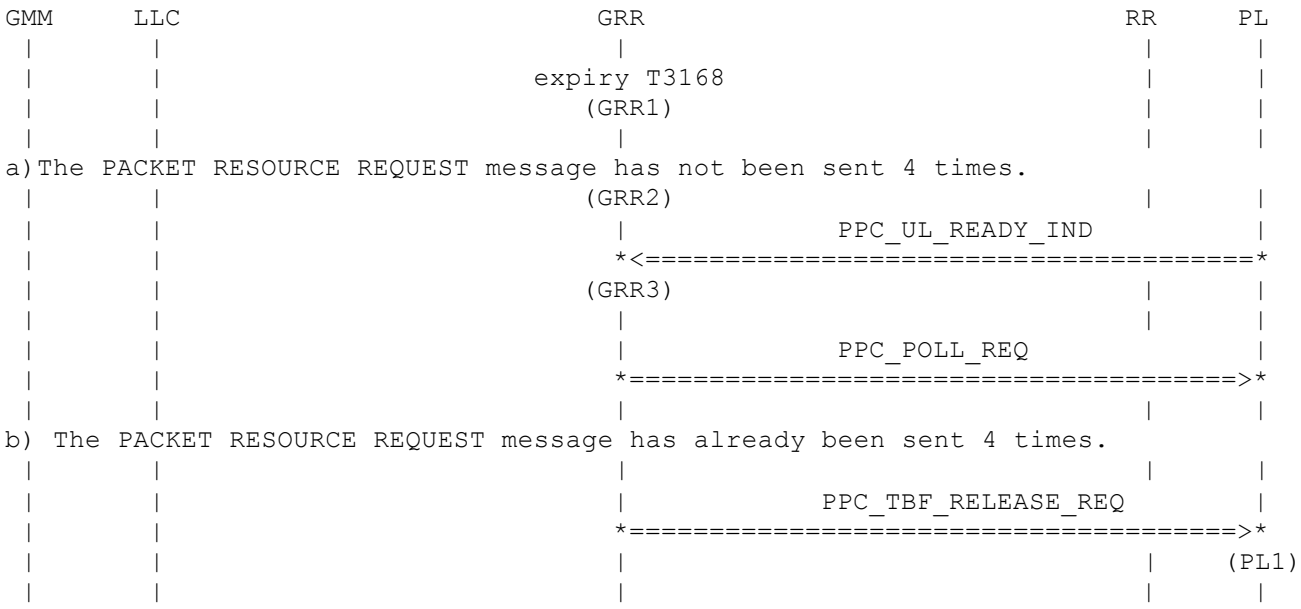
The MS releases the current TBF.

(GRR 1)

GRR starts a suitable access procedure for the new LLC PDU.

Requirements:
<R.MAC.RR_UPL.M.005-7>

7.1.3 On expiry if Timer T3168



(GRR1)
Timer T3168 expires.

(GRR2)
GRR composes a PACKET RESOUCES REQUEST and waits for PACCH occurrence.

(GRR3)

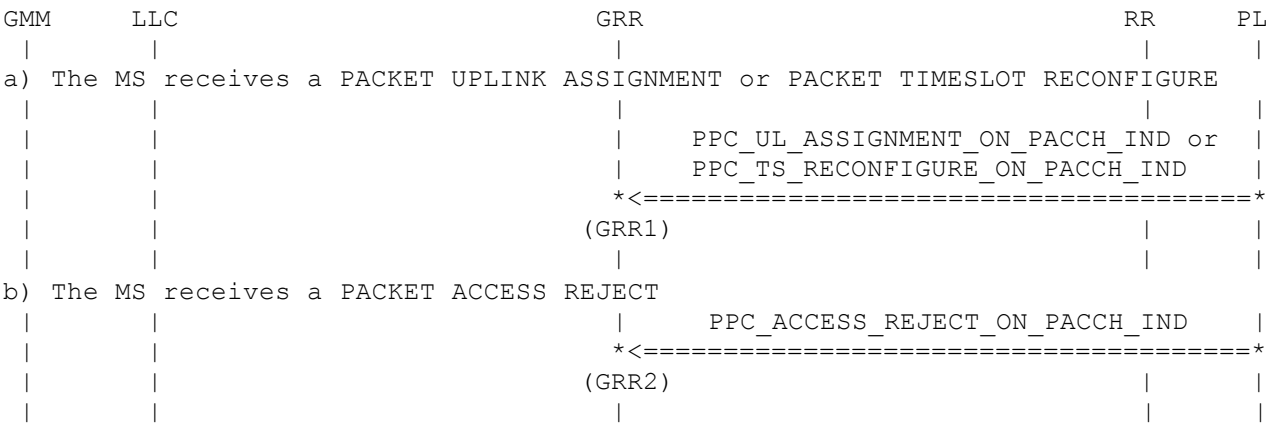
On every PPC_UL_READY_IND GRR checks weather this block is PACCH or not. GRR passes a PACKET RESOUCE REQUEST to PL.

(GRR 1)

PL deletes the TBF.

Requirements:
<R.MAC.RR_UPL.M.010>, <R.MAC.R_OE_TBF.M.003

7.1.4 Reaction of the network to the resource reallocation request

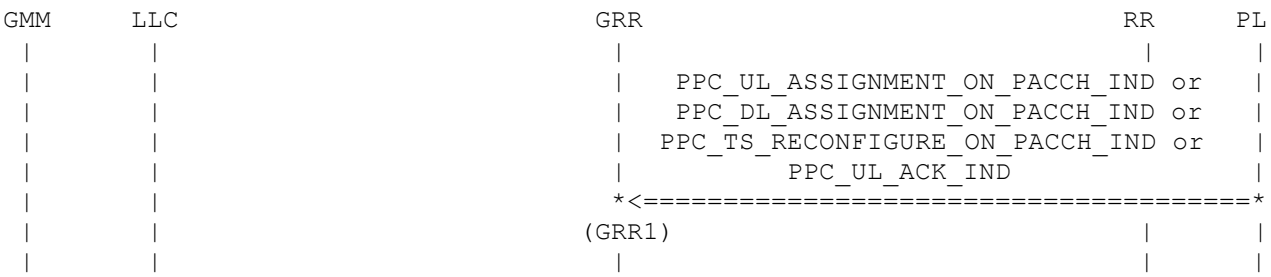


(GRR2)
GRR receives new resources. It resumes as described in the PACKET UPLINK ASSIGNMENT procedure.

(GRR2)
GRR receives a PACKET ACCESS REJECT message. It continues as described as in the packet access reject procedure.

Requirements:
<R.MAC.RR_UPL.M.009>, <R.MAC.RR_UPL.M.011-14>, <R.MAC.END_TBF.M.001>, <R.MAC.A_FX_UPL.M.003>

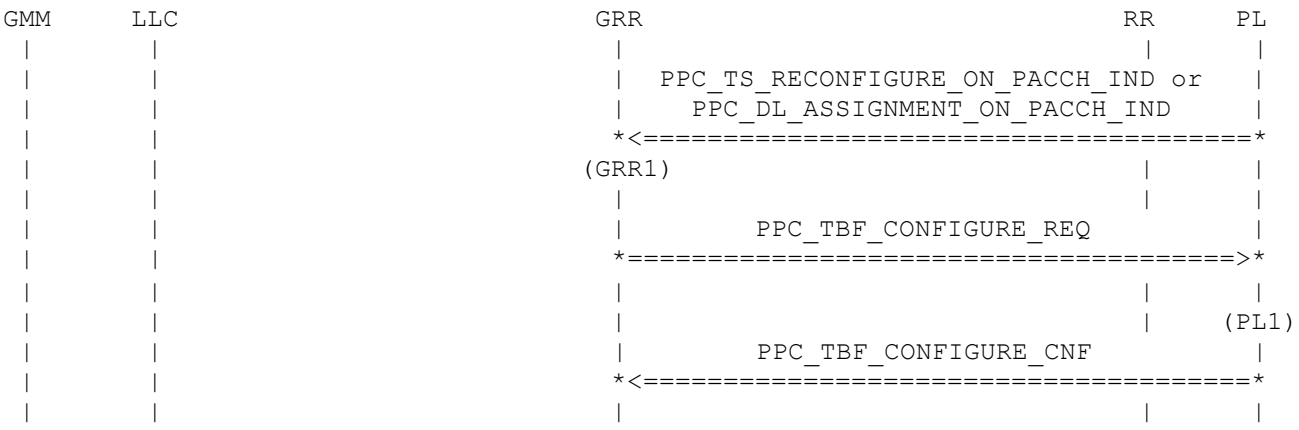
7.1.5 Abnormal Cases



(GRR1)
GRR receives control messages, which contains parameter errors. The MS performs an abnormal release and resumes with either system information reading or random access.

Requirements:
<R.MAC.AB_PACCH.M.001-3>, <R.MAC.A_FX_UPL.M.001>, <R.MAC.A_FX_UPL.M.003-5>

7.1.6 Establishment of Downlink TBF

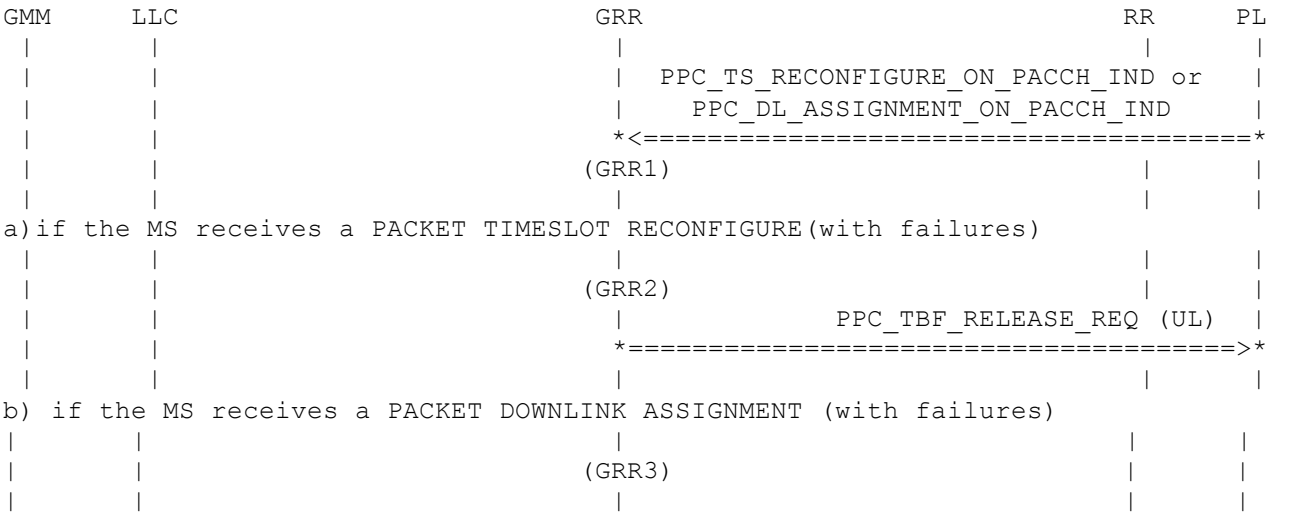


(GRR1)
GRR receives during an uplink TBF a PACKET DOWNLINK ASSIGNMENT or a PACKET TIMESLOT RECONFIGURE. The downlink allocation is indicated to layer 1.

(GRR 1)
The downlink allocation is confirmed by layer 1.

Requirements:
<R.MAC.DWL_TBF.M.001>, <R.MAC.DWL_TBF.A.004-5>, <R.MAC.FX_DL_T.M.00x>, <R.MAC.A_FX_UPL.M.003>, <R.MAC.C_TBF_HD.M.00x>, <R.MAC.F2_R_DWL.M.001>, <R.MAC.Q_R_DWL.M.001>

7.1.7 Abnormal cases during downlink assignment



(GRR1)
GRR receives during the uplink TBF a PACKET DOWNLINK ASSIGNMENT or a PACKET TIMESLOT RECONFIGURE.

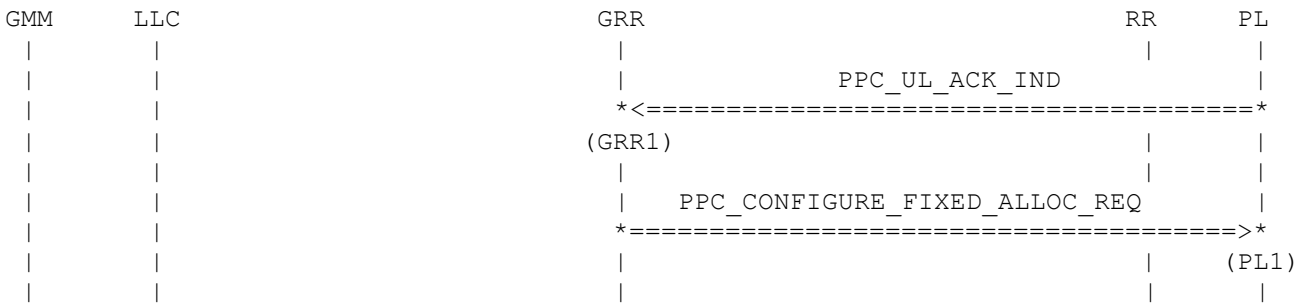
(GRR2)
In case a) due to failures (see requirements) the uplink TBF is released. A new random access is performed. In case b) GRR ignores the downlink assignment procedure and continues with uplink assignment.

(GRR3)

In case b) GRR ignores the downlink assignment procedure and continues with uplink assignment.

Requirements:
<R.MAC.AB_DWLTF.M.001-5>, <R.MAC.END_TBF.M.002>, <R.MAC.AB_TBF.M.00x>, <R.MAC.AB_FX_DL.M.00x> <R.MAC.AB.M.001>

7.1.8 Reallocation of the fixed Allocation

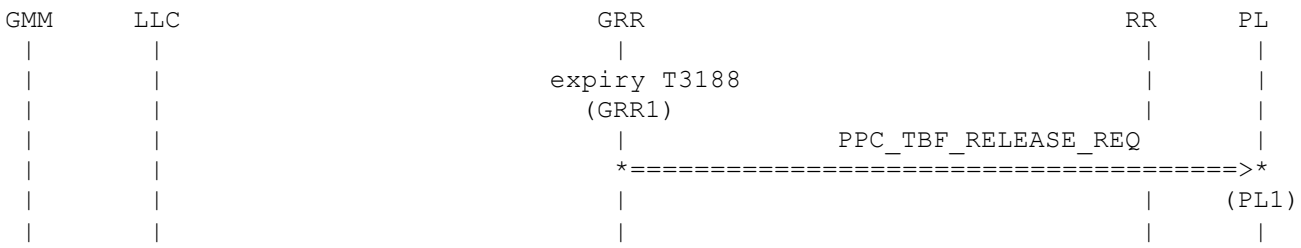


(GRR1)
GRR receives during the uplink TBF with fixed mode an PACKET UPLINK ACK/NACK message indicating a repeat allocation.

(PL 1)
The reallocation is indicated to layer 1.

Requirements:
<R.MAC.R_REA_RQ.M.004-6>, <R.MAC.EXH_ALOC.M.001-2>, <R.MAC.A_FX_UPL.M.003>

7.1.9 On expiry if Timer T3188

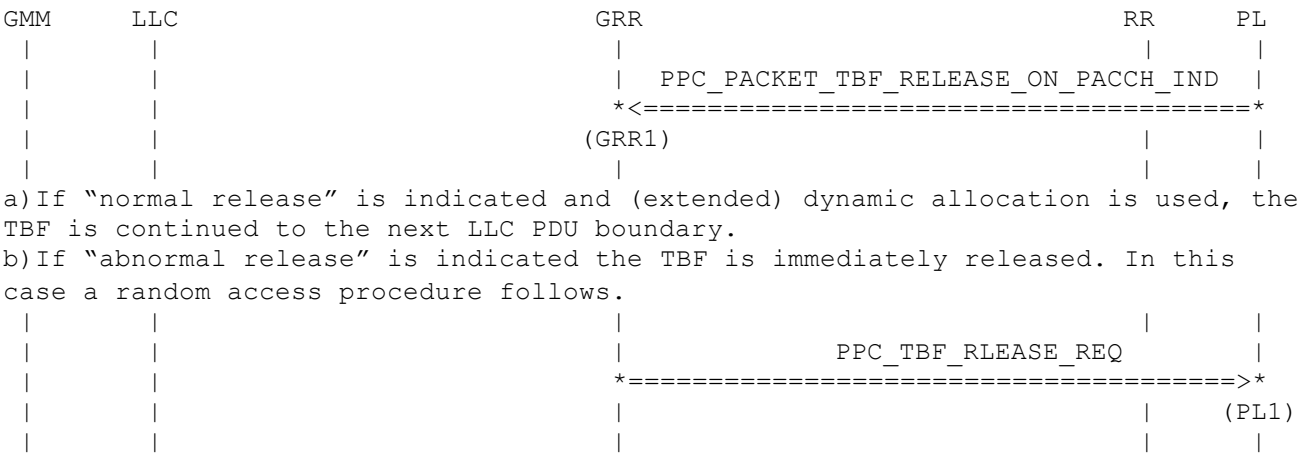


(GRR1)
Timer T3188 expires.

(PL1)
The MS performs an abnormal release with random access.

Requirements:
<R.MAC.EXH_ALOC.003>

7.1.10 Network initiated release of uplink TBF

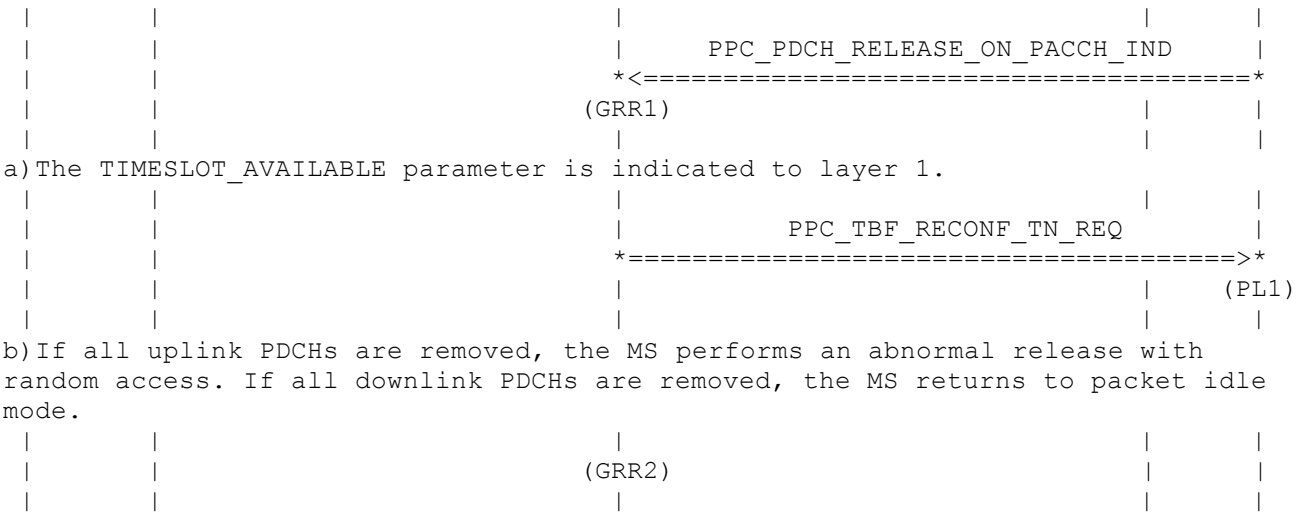


(GRR1)
The MS receives a PACKET TBF RELEASE message.

(PL 1)
The MS performs a TBF release.

Requirements:
<R.MAC.NREL_TBF.I.001-4>

7.1.11 Packet PDCH Release



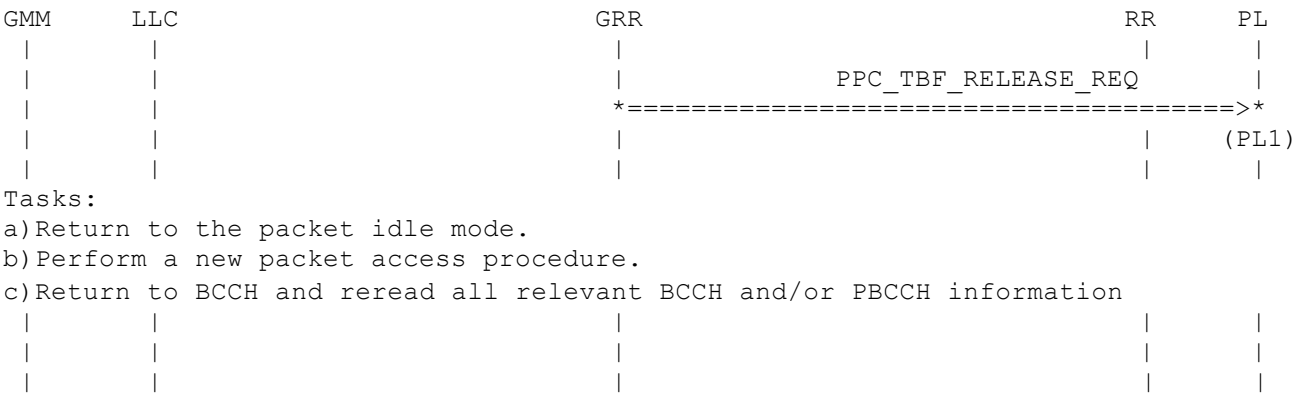
(GRR1)
The MS receives a PACKET PDCH RELEASE message.

(PL1)
PL removes the released slots from the TBF configuration.

(GRR2)
If all uplink PDCHs are removed, the MS performs an abnormal release with random access. If all downlink PDCHs are removed, the MS returns to packet idle mode.

Requirements:
<R.MAC.PDCH_REL.M.00x>

7.1.12 Abnormal Release

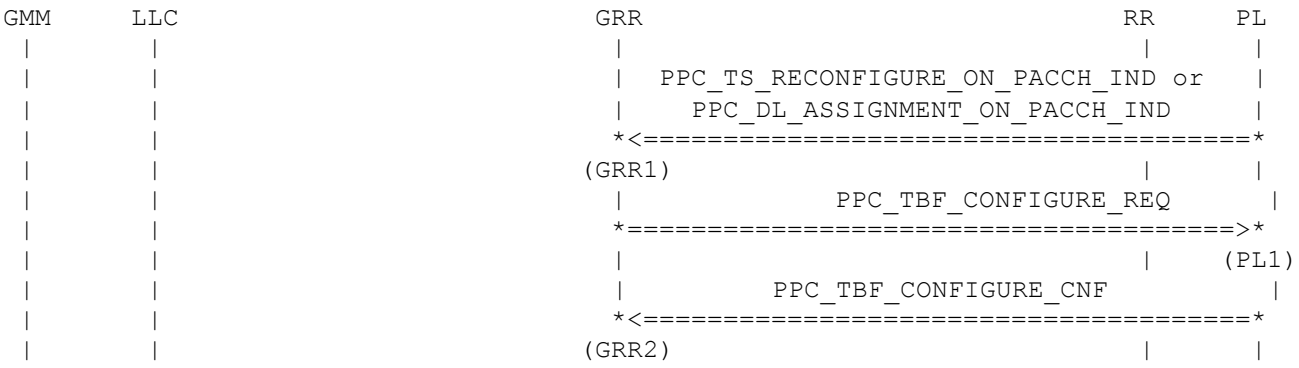


(PL 1)
The MS releases the downlink and/or uplink TBF, if it was in progress.

Requirements:
<R.MAC.AB.M.00x>, <R.MAC.AB_R_CCH.M.00x>, <R.MAC.AB_R_RAC.M.001>, <R.MAC.AB_R_SYS.M.00x>

7.2 MAC procedures in downlink packet transfer mode

7.2.1 Downlink assignment



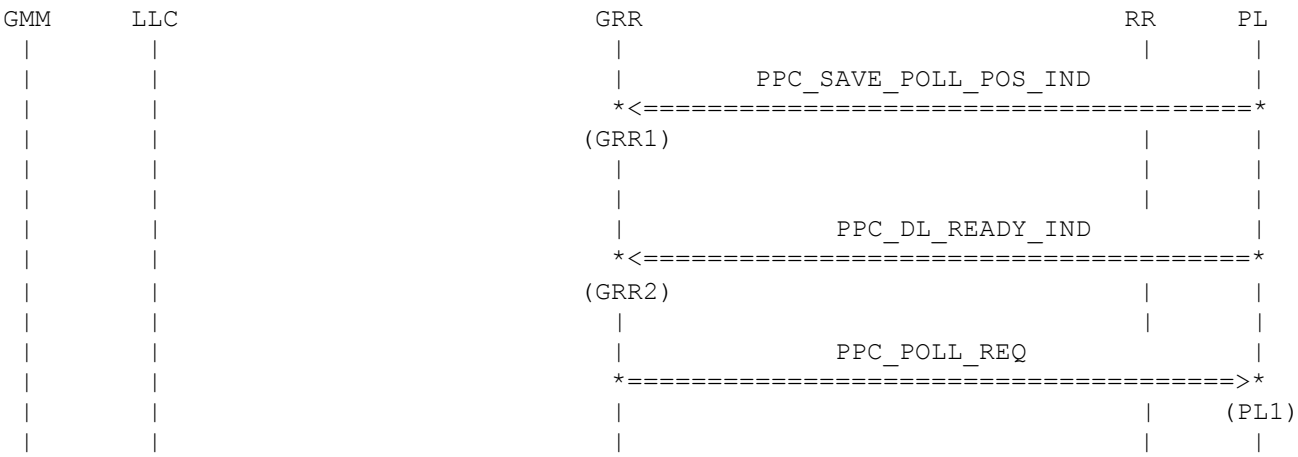
(GRR1)
The MS receives new downlink resources.

(PL1)
The downlink allocation is indicated to layer 1.

(GRR2)
The downlink allocation is confirmed by layer 1.

Requirements:
<R.MAC.DWL_BLK.M.001-4>

7.2.2 Polling for Downlink ACK/NACK



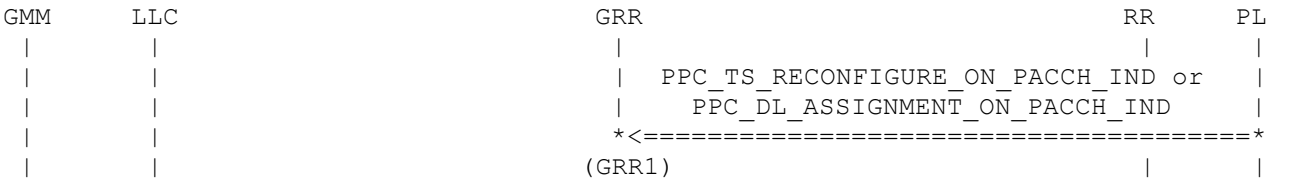
(GRR1)
GRR receives a RLC data block including a valid RRBP field (indicates the MS a single block for transmitting a PACKET DOWNLINK ACK/NACK message to the network).

(GRR2)
GRR checks on every incoming PPC_DL_READY_IND if there is PACCH. If so it follows a PPC_POLL_REQ including the PACKET DOWNLINK ACK/NACK.

(PL1)
PL transmits the block.

Requirements:
<R.MAC.PL_PNACK.M.001>, <R.MAC.PL_PNACK.M.003-6>, <R.MAC.PL_PNACK.A.008-9>

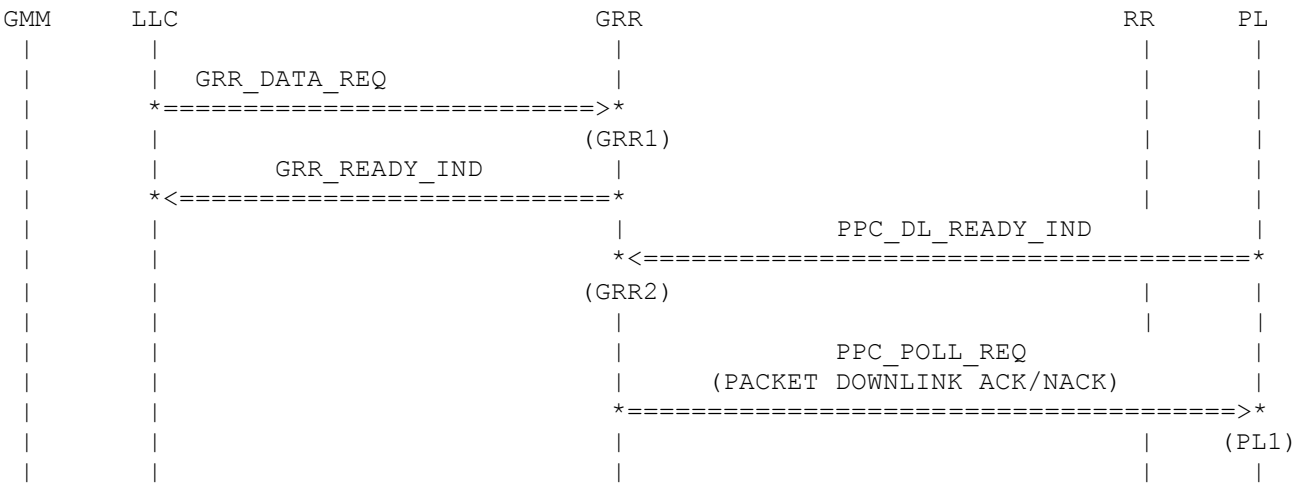
7.2.3 Resource Reassignment for Downlink TBF



(GRR1)
The MS receives a change in resources in the current TBF.

Requirements:
<R.MAC.RR_DWL.M.001-3>

7.2.4 Establishment of uplink TBF



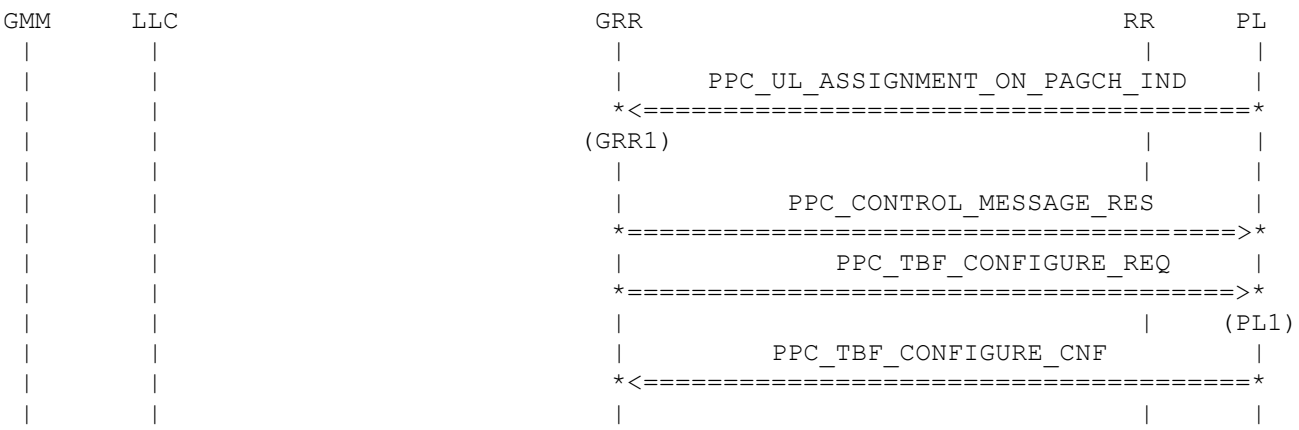
(GRR1)
GRR starts a uplink TBF establishment procedure on downlink TBF

(GRR2)
GRR checks on every incoming PPC_DL_READY_IND if there is PACCH. If so it follows a PPC_POLL_REQ including the PACKET DOWNLINK ACK/NACK, which requests the uplink TBF.

(PL1)
PL transmits the block.

Requirements:
<R.MAC.DWL_UPL.M.001-5>, <R.MAC.DWL_UPL.M.015>, <R.MAC.C_TBF_HD.M.00x>, <R.MAC.F2_UPL.M.001>, <R.MAC.F2_R_UPL.M.003>, <R.MAC.RR_DL_DL.M.00x>

7.2.5 Receiving of uplink resources

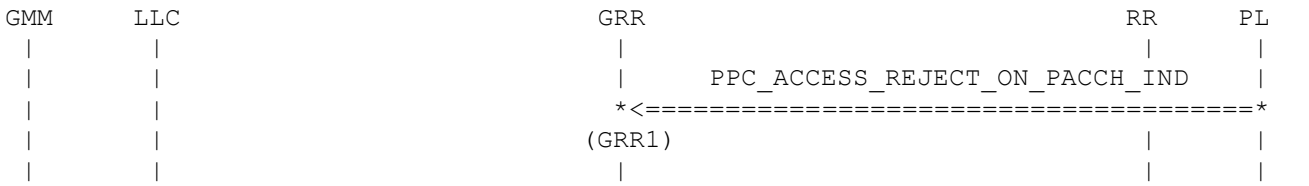


(GRR1)
The MS receives uplink resources.

(PL 1)
The uplink allocation is indicated to layer 1.

Requirements:
<R.MAC.DWL_UPL.M.007-8>, <R.MAC.DWL_UPL.M.011-12>, <R.MAC.DWL_UPL.M.0016>, <R.MAC.Q_R_UPL.M.002>

7.2.6 Receiving of packet access reject

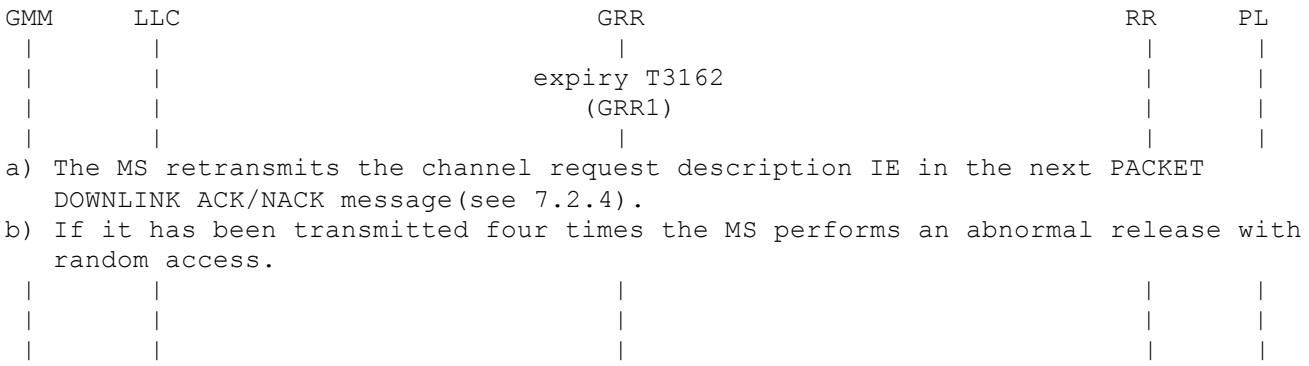


a) including a WAIT_INDICATION: wait for uplink assignment until expiry of T3172(WAIT_INDICATION value). On expiry of T3172 the continues with establishment of uplink assignment(either 7.2.4 or packet access procedure).
b) not including a WAIT_INDICATION: the MS performs a abnormal release with system information reading.

(GRR1)
The MS receives PACKET ACCESS REJECT message.

Requirements:
<R.MAC.DWL_UPL.M.013-14>

7.2.7 On expiry if Timer T3168

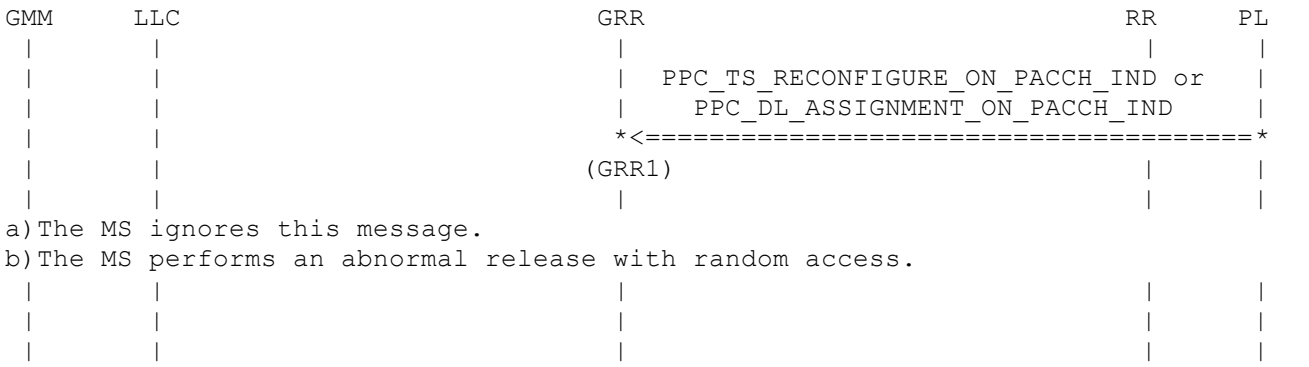


a) The MS retransmits the channel request description IE in the next PACKET DOWNLINK ACK/NACK message(see 7.2.4).
b) If it has been transmitted four times the MS performs an abnormal release with random access.

(GRR1)
Timer T3168expires.

Requirements:
<R.MAC.DWL_UPL.M.015>

7.2.8 Abnormal cases

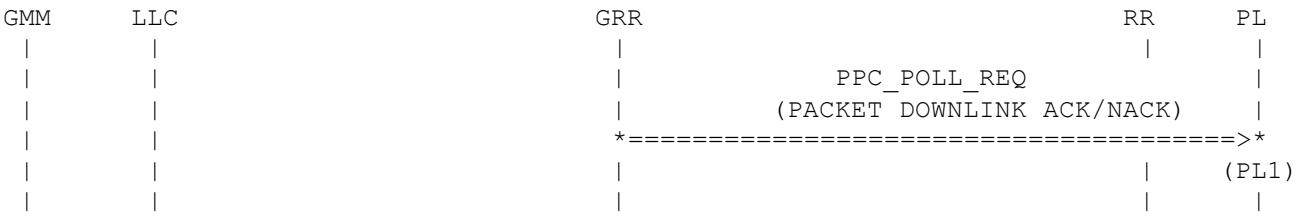


a) The MS ignores this message.
b) The MS performs an abnormal release with random access.

(GRR1)
The MS receives uplink resources. A failure occurs.

Requirements:
<R.MAC.A_DWLUPL.M.00x>, <R.MAC.AB.M.002>, <R.MAC.RR_DL_AB.M.00x>

7.2.9 Network initiated downlink TBF release



(PL1)
The MS initiates the release of the downlink TBF by setting the TBF_RELEASE bit in the PACKET DOWNLINK ACK/NACK message.

Requirements:
<R.MAC.NT_DWL_R.M.001>

8 Data Procedures

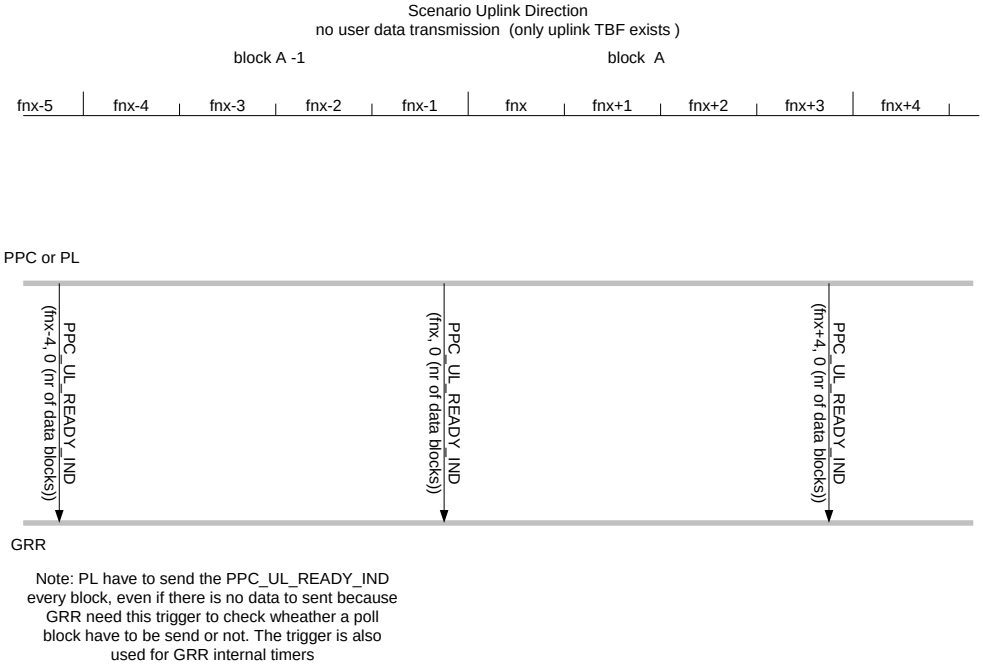
8.1 General Principle

This chapter shows the general aspects of the data path, to highlight the timing aspects a different MSC style is chosen.

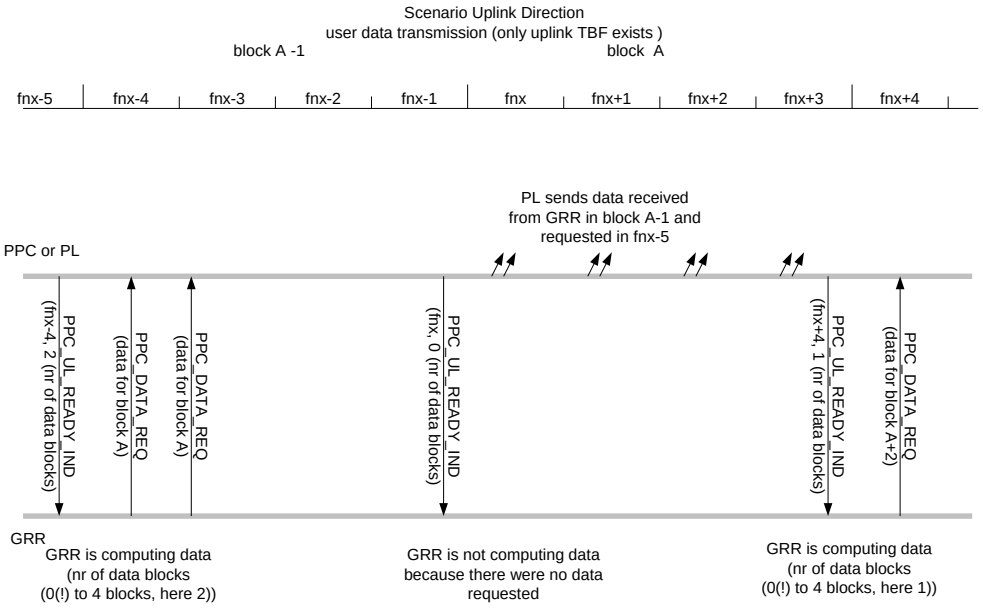
In the following chapters “uplink direction” means primitive traffic due to transmitting data; “downlink direction” means primitive traffic due to receiving data. Both types of primitive traffic may occur in downlink TBF and uplink TBF.

Idle frames are not considered. In general if primitives are expected to occur short before a block, they occur there even if there is an idle frame.

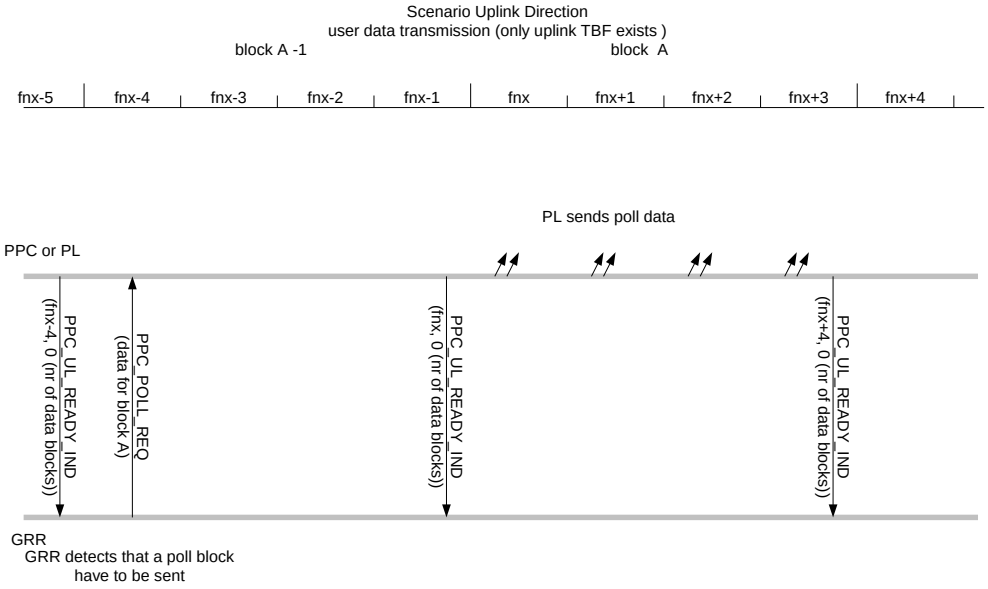
8.1.1 Uplink Direction: Uplink TBF/ no data transmission



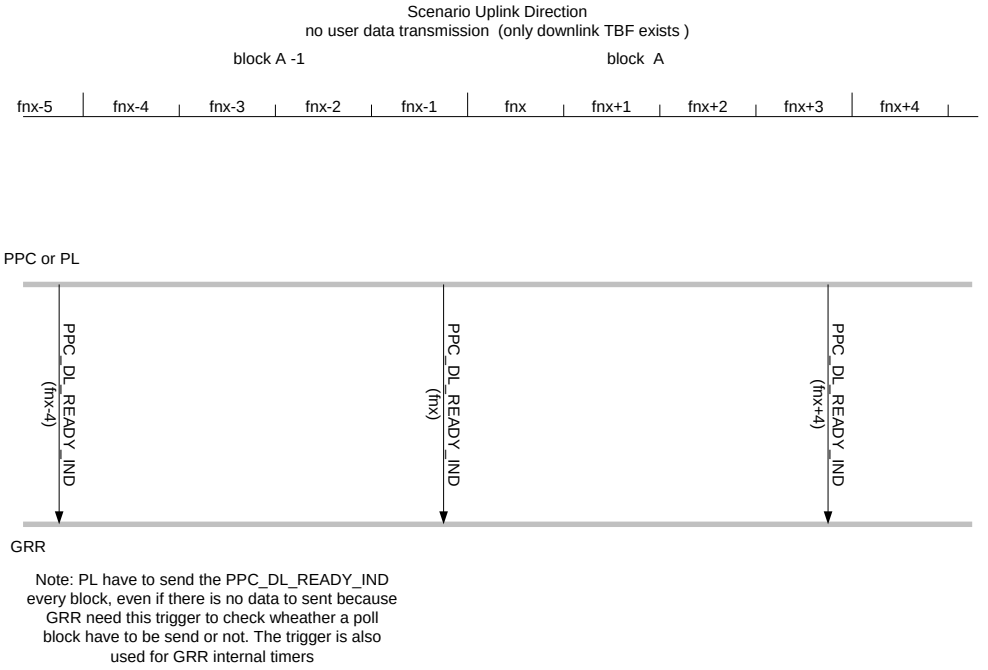
8.1.2 Uplink Direction: Uplink TBF/ data transmission



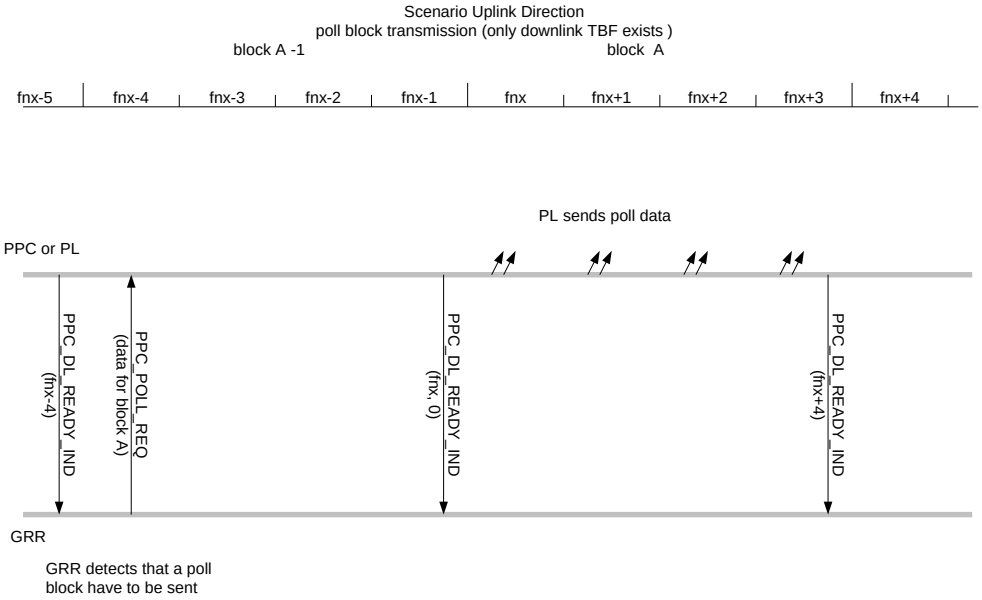
8.1.3 Uplink Direction: Uplink TBF/ poll transmission



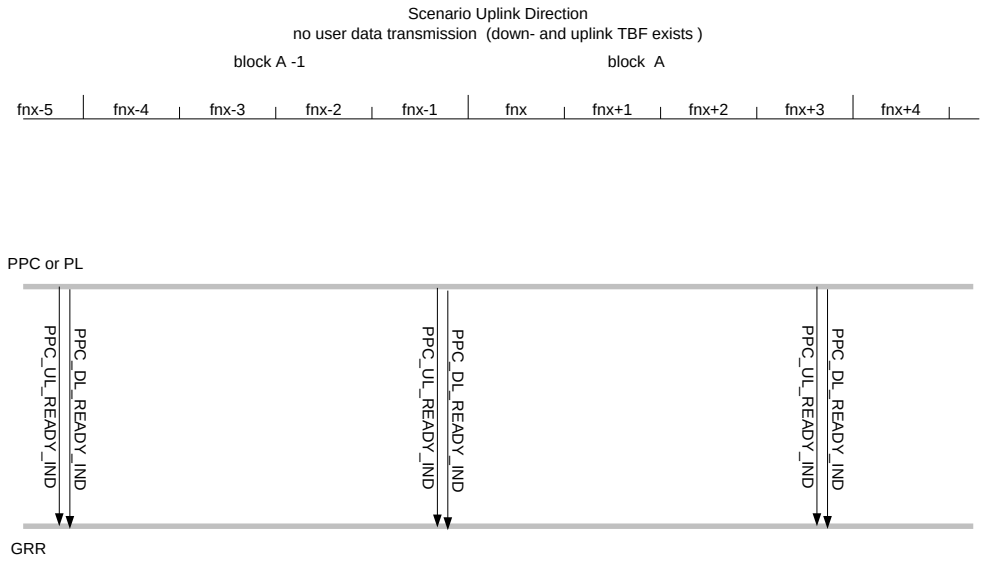
8.1.4 Uplink Direction: Downlink TBF/ no transmission



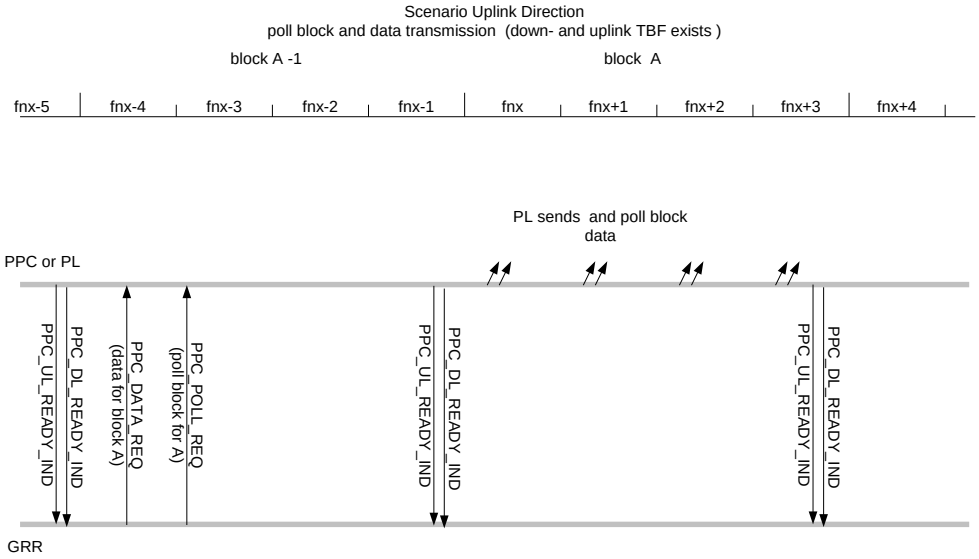
8.1.5 Uplink Direction: Downlink TBF/ poll transmission



8.1.6 Uplink Direction: Down- and Uplink TBF/ no transmission

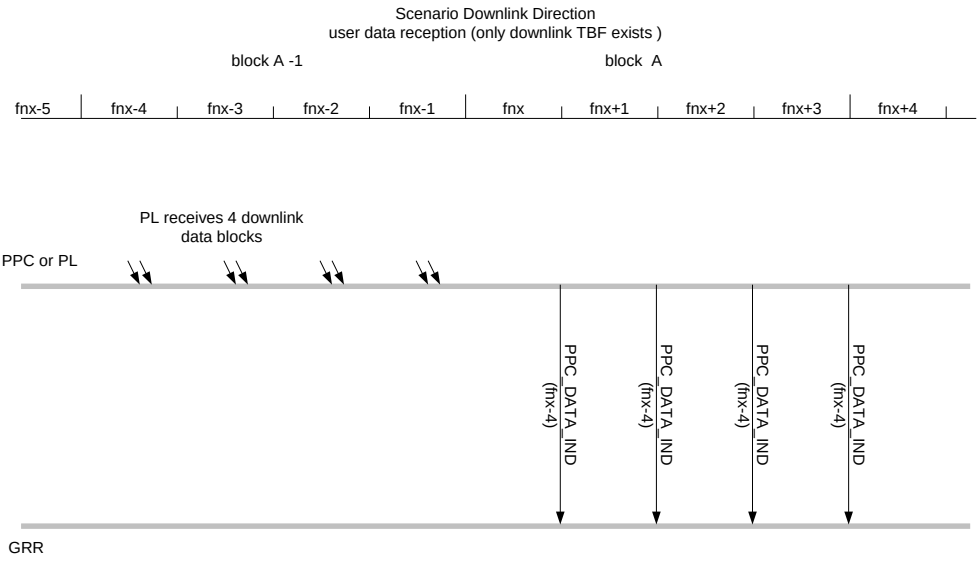


8.1.7 Uplink Direction: Down- and Uplink TBF/ poll+data transmission



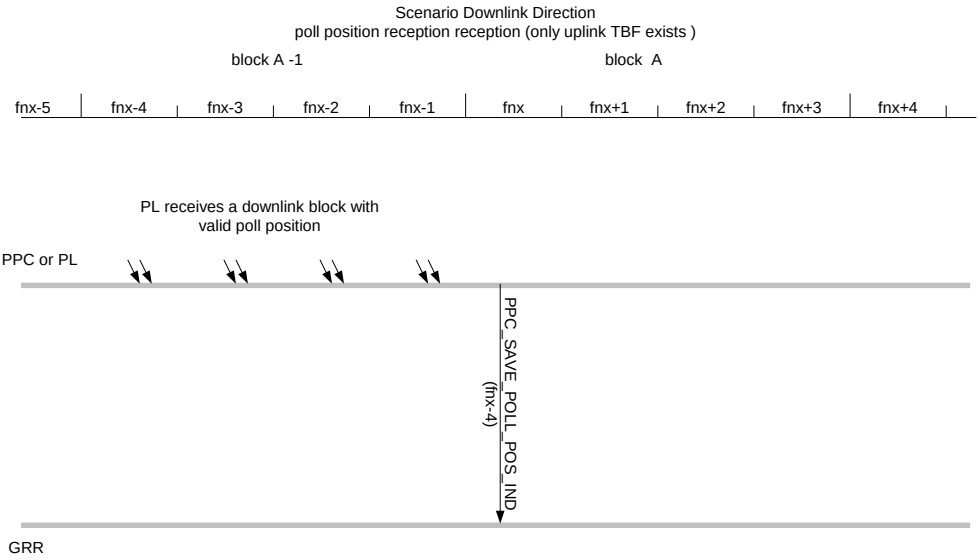
Note: Frame numbers as in previous scenarios

8.1.8 Downlink Scenario: Downlink TBF/ data reception

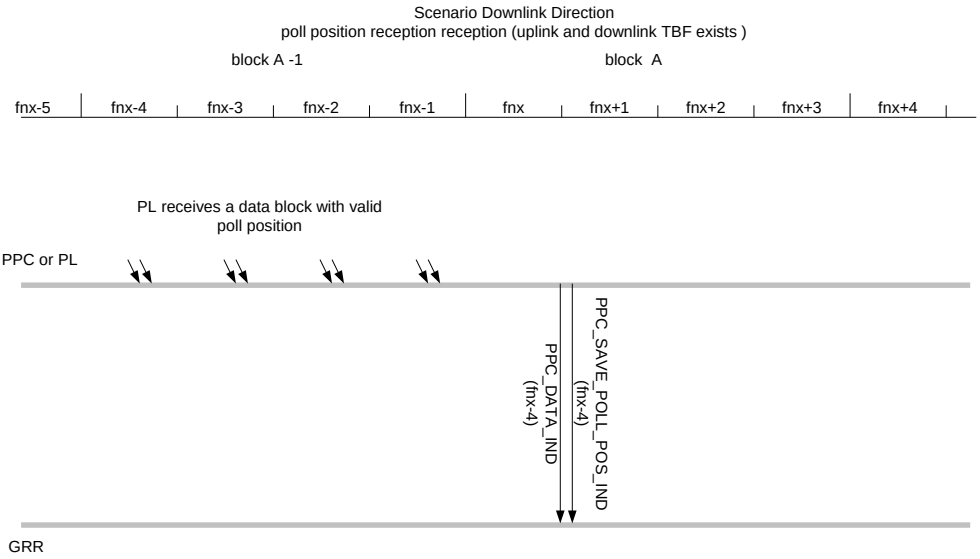


Note: The PPC_DATA_IND includes information for poll possitions

8.1.9 Downlink Scenario: Uplink TBF/ poll position reception

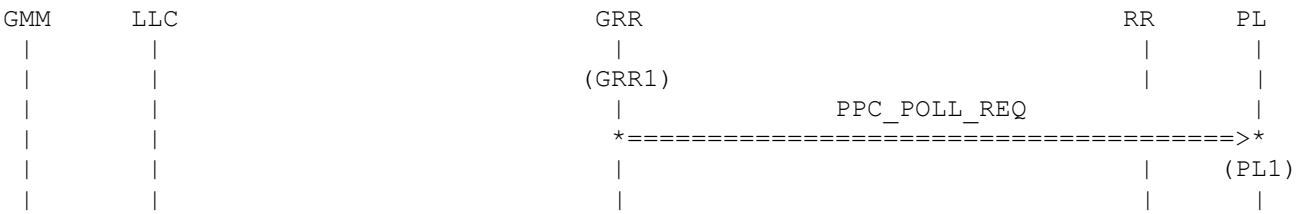


8.1.10 Downlink Scenario: Down- and Uplink TBF/ poll position reception



8.2 RLC Protocol

8.2.1 Transmission of an uplink RLC Data block.

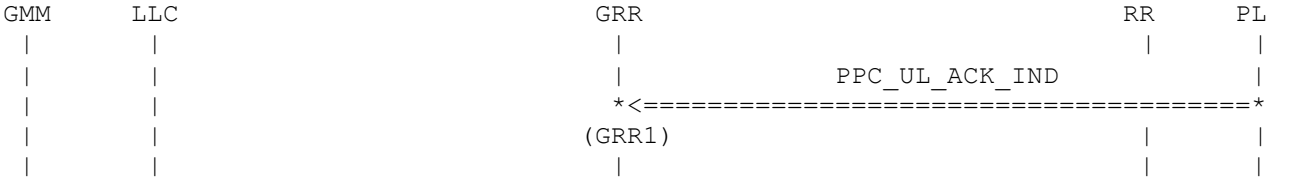


(GRR1)
RLC sends a RLC data block to MAC.

(PL1)
MAC forwards the RLC data block to the network side.

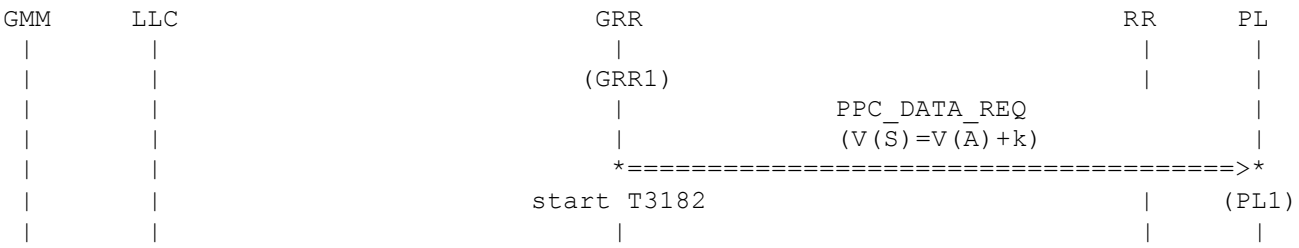
Requirements:
<R.RLC.V_SEND.A.00x>, <R.RLC.V_ACK.A.00x>, <R.RLC.V_B.A.00x>, <R.RLC.BSN.A.001>, <R.RLC.WS_K.A.001>, <R.RLC.FILL_OCT.A.001>, <R.RLC.SEG_DATA.A.00x>, <R.RLC.LLC_PRIO.M.001>, <R.RLC.TRA_CTRL.A.00x>, <R.RLC.CNTDOWN.M.00x>, <R.RLC.ACK_MODE.A.001>, <R.RLC.E_UL_TBF.M.001>, <R.RLC.R_UL_TBF.M.001-2>, <R.RLC.UA_MODE.A.001>, <R.RLC.U_UL_TBF.M.001>, <R.RLC.U_UL_TBF.M.011>

8.2.2 Receiving of an Ack\Nack Description for a transmitted uplink RLC Data block.



Requirements:
<R.RLC.SSN_RBB.A.00x>, <R.RLC.R-A_CTRL.M.00x>, <R.RLC.TRA_CTRL.A.00x>, <R.RLC.ACK_MODE.A.001>, <R.RLC.O_UL_TBF.I.002>, <R.RLC.O_UL_TBF.M.005>, <R.RLC.O_UL_TBF.M.007>, <R.RLC.O_UL_TBF.M.010-11>, <R.RLC.R_UL_TBF.M.007>, <R.RLC.U_UL_TBF.I.002>, <R.RLC.U_UL_TBF.M.006>, <R.RLC.U_UL_TBF.M.008-9>

8.2.3 RLC transmit window(k) stall condition is detected



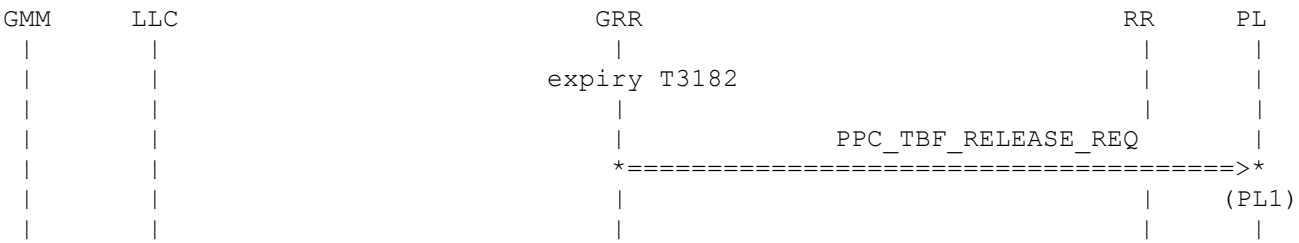
(GRR1)
RLC sends an RLC data block to MAC. The MS detects a transmit window stall indication(only acknowledged mode). In unacknowledged mode there is no stall condition. In this case there is no restriction for uplink transmission.
Timer T3182 is started in both modes.

(PL1)

MAC forwards the RLC data block to the network side.

Requirements:
<R.RLC.WS_K.A.001>, <R.RLC.O_UL_TBF.M.003-5>, <R.RLC.U_UL_TBF.M.003-4

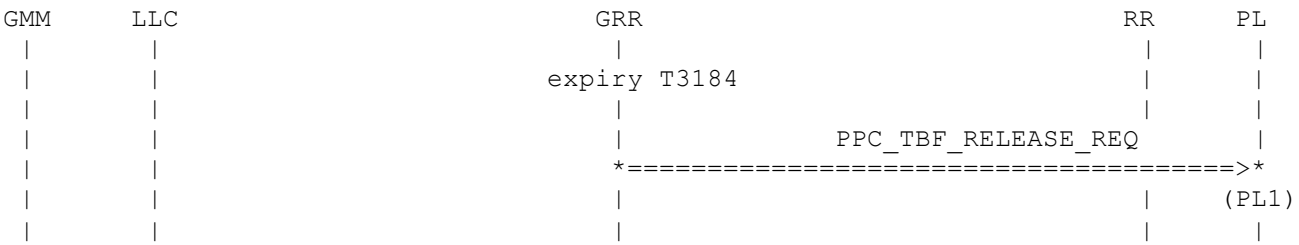
8.2.4 Stall condition timeout of timer T3182



(PL1)
PL aborts the UL-TBF procedure

Requirements:
<R.RLC.O_UL_TBF.M.004>, <R.RLC.O_UL_TBF.M.006>, <R.RLC.O_UL_TBF.M.008-9>, <R.RLC.R_UL_TBF.M.008>, <R.RLC.U_UL_TBF.M.005, <R.RLC.U_UL_TBF.M.017>, <R.RLC.AB_CASES.M.00x>

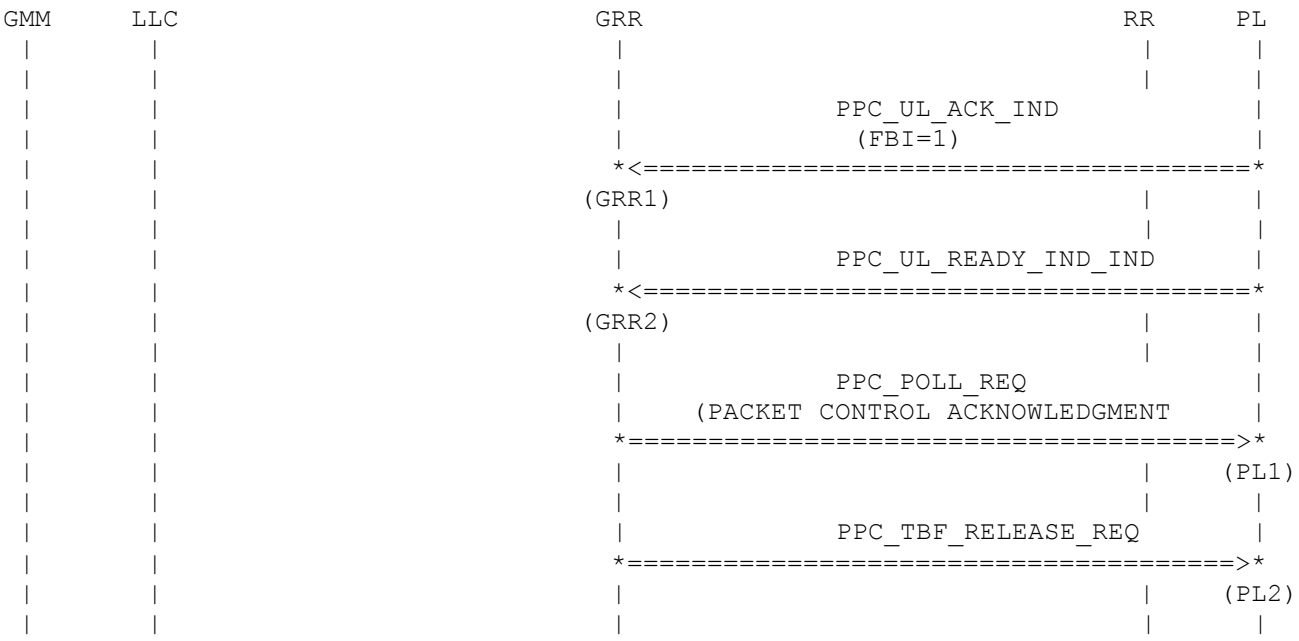
8.2.5 Timeout of timer T3184



(PL1)
PL aborts the UL-TBF procedure

Requirements:
<R.RLC.O_UL_TBF.M.012>, <R.RLC.U_UL_TBF.M.010>, <R.RLC.AB_CASES.M.001>

8.2.6 Release of uplink TBF



(GRR1)
GRR receives PACKET UPLINK ACK\NACK message from the network. The final bit indicator is set. This indicates a release of the uplink TBF. All sent RLC data blocks have been received successfully.

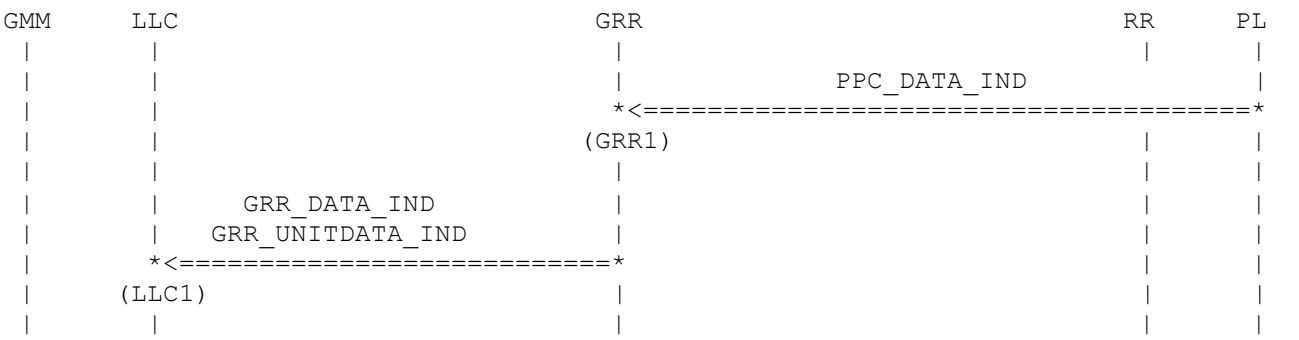
(GRR)
On next occurrence of PACCH, GRR orders PL to send a PACKET CONTROL ACKNOWLEDGMENT.

(PL 1)
The MS sends the PACKET CONTROL ACKNOWLEDGMENT message to the network .

(PL 2)
MAC releases the TBF.

Requirements:
<R.RLC.R_UL_TBF.I.003-6>, <R.RLC.U_UL_TBF.I.013-16>

8.2.7 Receiving of a downlink RLC Data block.



(MAC 1)
MAC receives an RLC data block.

(RLC 1)
GRR checks weather the current LLC-PDU is complete or not and forwards the data to LLC in case of a complete LLC PDU.

(LLC 1)
GRR indicates to LLC that a LLC_PDU was received.

Requirements:
<R.RLC.R-A_DATA.A.00x>, <R.RLC.O_DL_TBF.M.001>, <R.RLC.U_DL_TBF.M.001>, <R.RLC.V_REC.A.00x>, <R.RLC.V_Q.A.00x>, <R.RLC.V_N.A.00x>

8.2.8 Sending of an Ack\Nack Description for an received downlink RLC Data block.

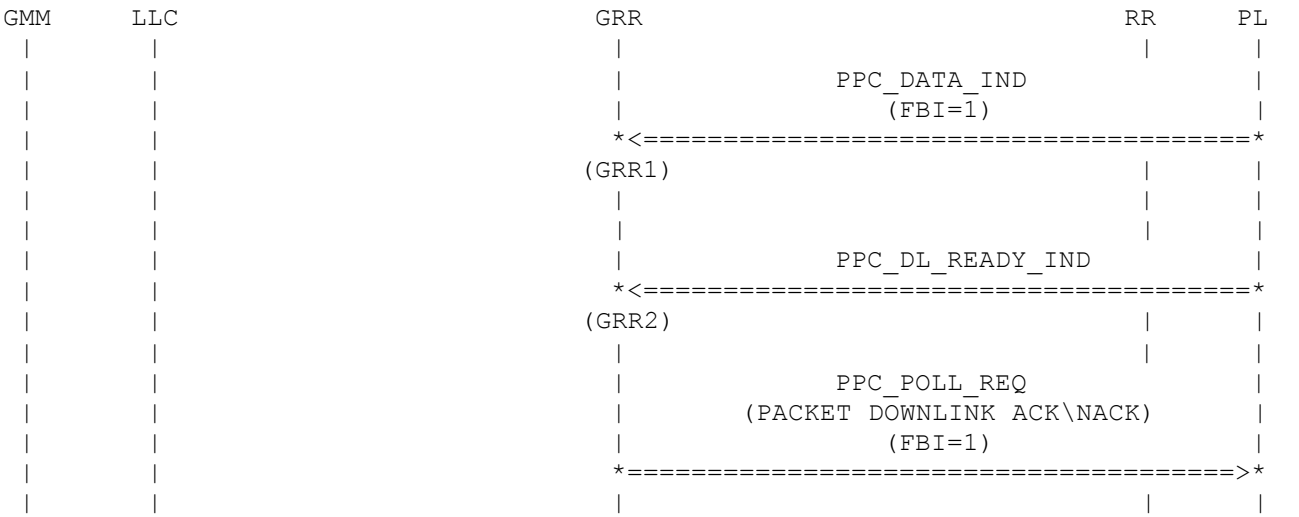
(GRR1)
GRR has to send an ACK\NACK DESCRIPTION and waits for PACCH.

(GRR2)
On reception of every PL_DL_READY_IND GRR checks weather this is a PACCH or not.

(PL 1)
PL sends the PACKET DOWNLINK ACK\NACK message to the network side.

Requirements:
<R.RLC.SSN_RBB.A.002-4>, <R.RLC.SSN_RBB.A.009>, <R.RLC.FILL_OCT.A.001>, <R.RLC.SEG_CTRL.M.004>, <R.RLC.TRA_CTRL.A.00x>, <R.RLC.ACK_MODE.A.001>, <R.RLC.R_DL_TBF.M.002>

8.2.9 Release of downlink TBF

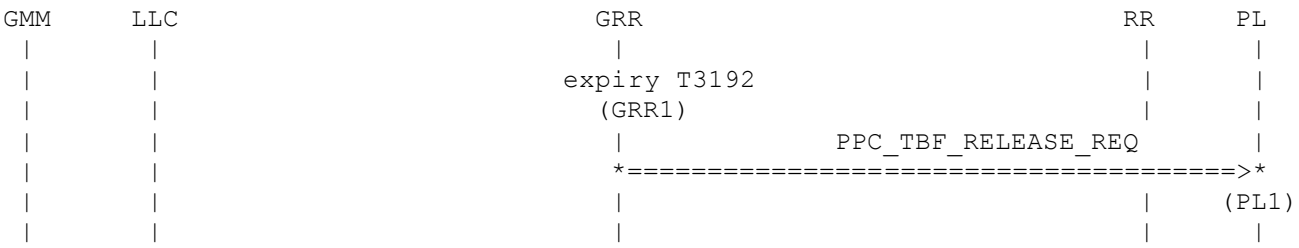


(GRR1)
MAC receives an RLC DATA BLOCK from the network.

(GRR2)
The MS sends the PACKET CONTROL ACKNOWLEDGMENT message to the network and releases the TBF. This message is sent by a poll block request.

Requirements:
<R.RLC.R_DL_TBF.I.001-5>, <R.RLC.U_DL_TBF.I.002-6>

8.2.10 Timeout of timer T3192



(GRR1)
Timer T3192 expires.

(PL 1)
Downlink TBF is released. PL stops monitoring its assigned PDCHs.

Requirements:
<R.RLC.R_DL_TBF.M.010>, <R.RLC.R_DL_TBF.M.012-13>, <R.RLC.U_DL_TBF.M.009>, <R.RLC.U_DL_TBF.M.011-12>

9 Measurement

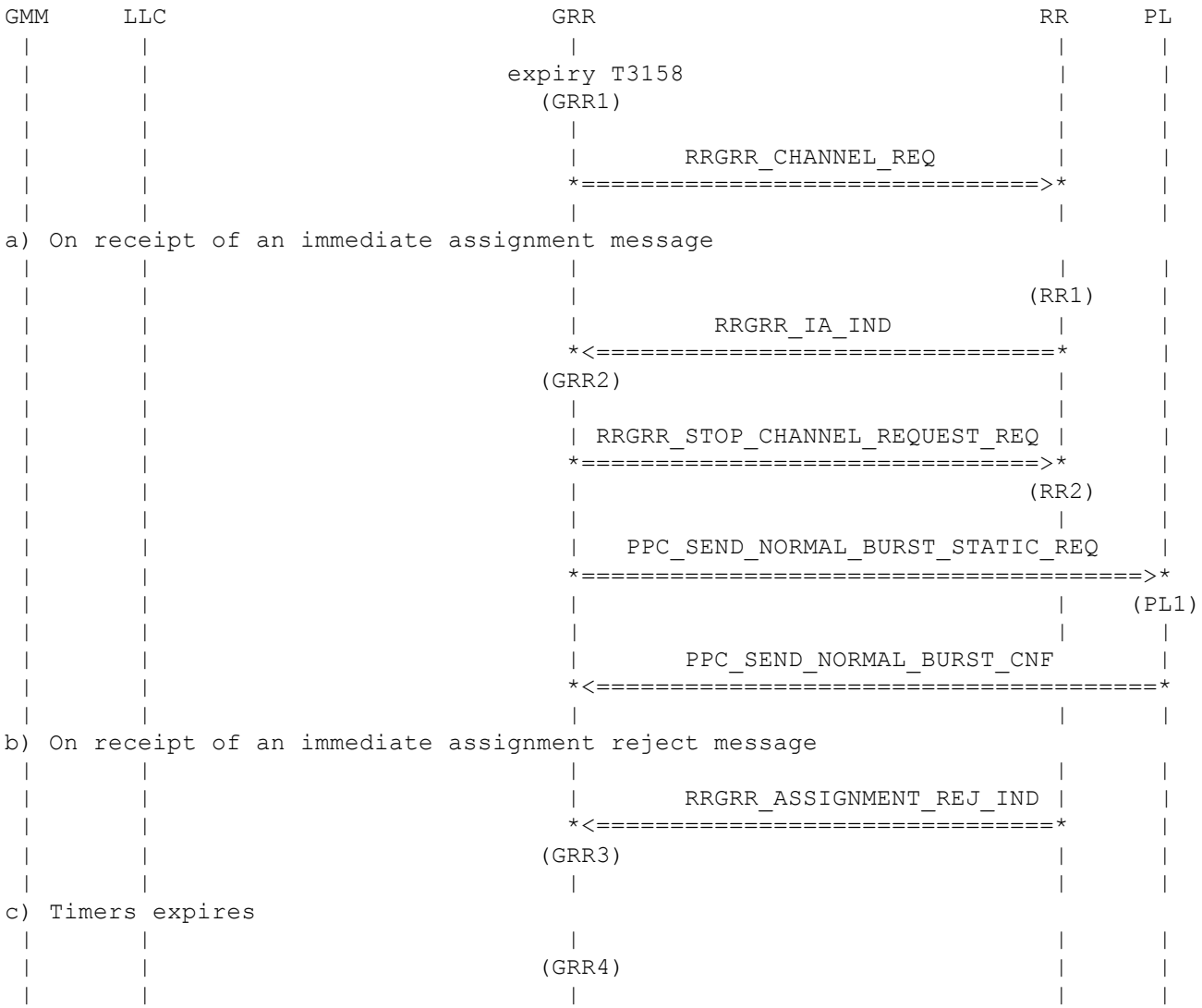
9.1 Measurement Packet Idle Mode CCCH

9.1.1 Measurement order procedures initiated on CCCH

The procedure is the same as the procedure measurement order initiated on PCCCH. The main difference is that the PACKET MEASUREMENT ORDER message is sent on the PDCH, which has been assigned by an IMMEDIATE ASSIGNMENT message.

Requirements:
<R.MAC.MORD_CCC.M.00x>

9.1.2 Measurement report sending initiated on CCCH



(PL 1)
GRR sends a CHANNEL REQUEST message on RACH. This message indicates a “Single block packet access”.

(GRR 1)
GRR forces RR to send CHANNEL REQUEST messages on RACH. This messages indicate “Single block packet access”.

(RR 1)
RR receives an IMMEDIATE ASSIGNMENT message and forwards it to GRR.

(GRR2)
If GRR gets a suitable IMMEDIATE ASSIGNMENT it stops the access procedure in RR and configures a single block TBF.

(RR2)
RR stops the access procedure and continues as before the access procedure.

(PL1)
PL sends PACKET MEASUREMENT REPORT and confirms the sending of the message.

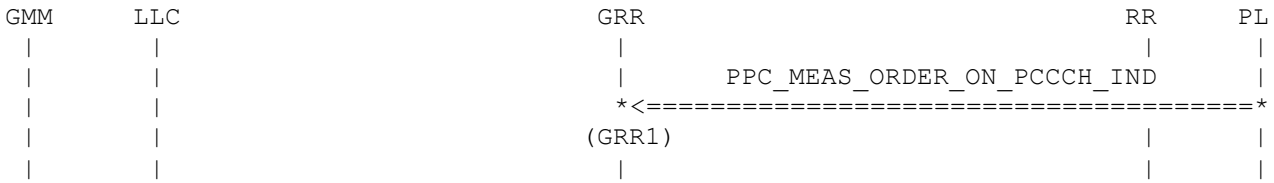
(GRR 3)
GRR receives an IMMEDIATE ASSIGNMENT REJECT message. The measurement procedure shall be aborted.

(GRR 4)
If any of the measurement report interval timers T3158 or T3178 expires before any of the timers T3142 or T3146 expires. In this case no new measurement report shall be initiated but T3158 or T3178 shall be restarted.

Requirements:
<R.MAC.MRP_CCCH.M.00x>

9.2 Measurement Packet Idle Mode PCCCH

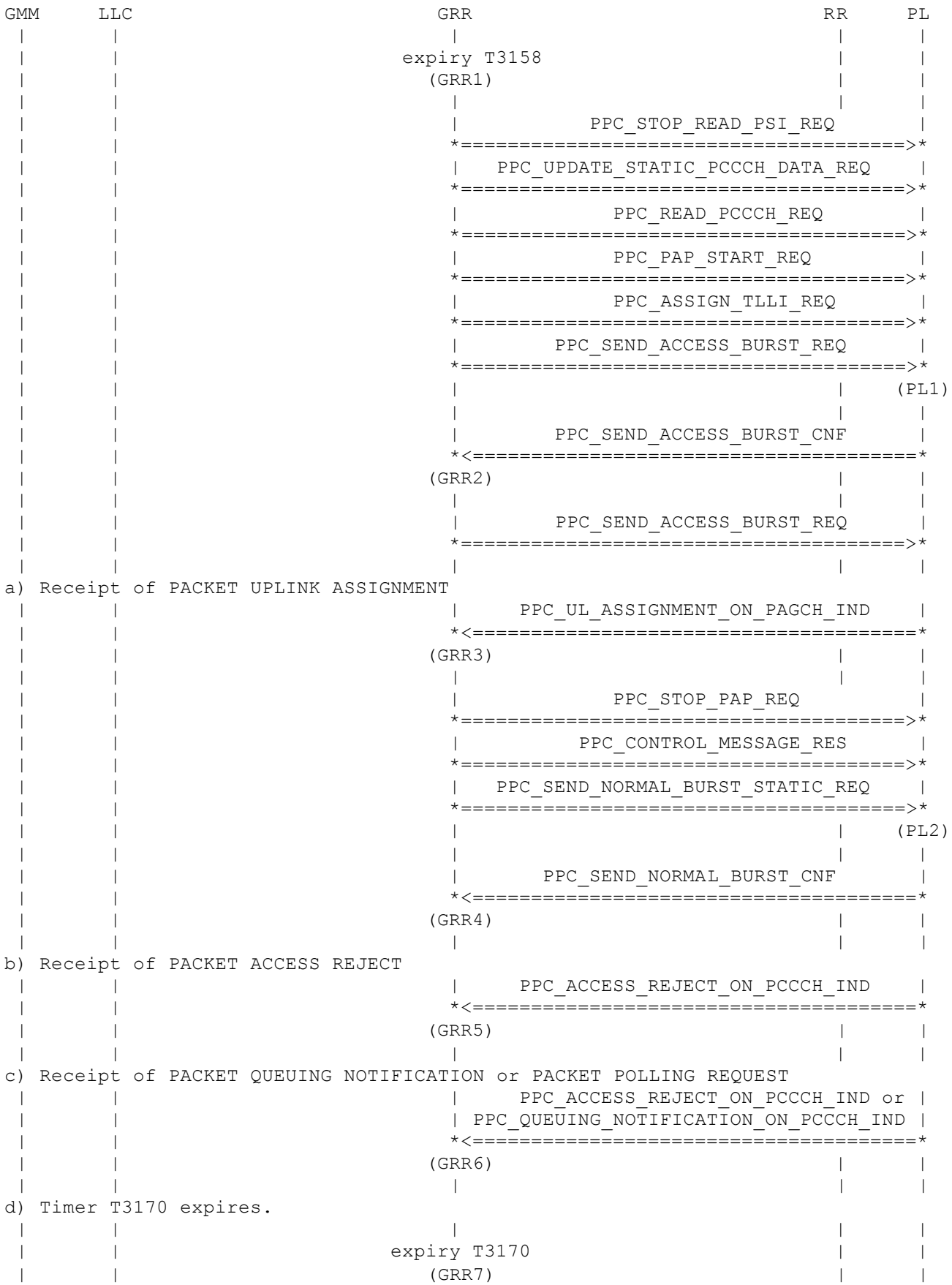
9.2.1 Measurement order procedures initiated on PCCCH



(GRR1)
GRR receives a PACKET MEASUREMENT ORDER message. GRR stores the parameter of this message and immediately returns to PCCCH.

Requirements:
<R.MAC.MORD_PCC.M.00x>

9.2.2 Measurement report sending initiated on PCCCH



(GRR1)
At every expiry of T3158 the MS has to initiate new measurements and has to send a PACKET MEASUREMENT REPORT. This air message shall be transmitted with a single block.

(PL1)
PL stops reading PSI, changes the PCCCH mode to REORG and prepares for sending access bursts. As soon as PL is ready for transmitting access burst PL sends the first PACKET ACCESS REQUEST PL has received with PPC_SEND_ACCESS_BURST_REQ.

(GRR2)
PL sends PPC_SEND_ACCESS_BURST_CNF. GRR requests a new access burst transmission.

(GRR3)
GRR stops the packet access procedure. GRR orders PL to send a PACKET MEASUREMENT REPORT with a PPC_SEND_NORMAL_BURST_STATIC_REQ.

(PL2)
PL sends a single block on the specified resources.

(GRR4)
With reception of a PPC_SEND_NORMAL_BURST_CNF the "measurement report sending" procedure is successfully finished.

(GRR5)
GRR receives the PACKET ACCESS REJECT message. The procedures in packet access reject message are done in this situation. If any of the measurement report interval timers T3158 or T3178 expires before any of the timers T3172 or T3162 expires. In this case no new measurement report shall be initiated but T3158 or T3178 shall be restarted.

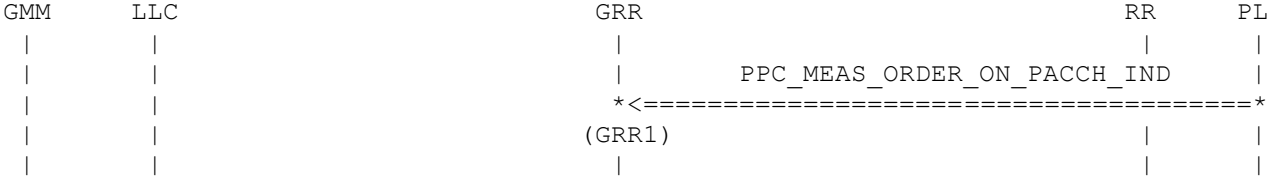
(GRR6)
The MAC receives either PACKET QUEUING NOTIFICATION or PACKET POLLING REQUEST and aborts the procedure.

(GRR7)
The measurement report for that period is cancelled. The MS returns to packet idle mode.

Requirements:
<R.MAC.MREP_IDL.M.00x>, <R.MAC.MREP_SND.M.001>, <R.MAC.RC_PUPL.M.00x>, <R.MAC.RC_AC_RJ.M.00x>, <R.MAC.AB_MREP.M.00x>

9.3 Measurement Packet Transfer Mode

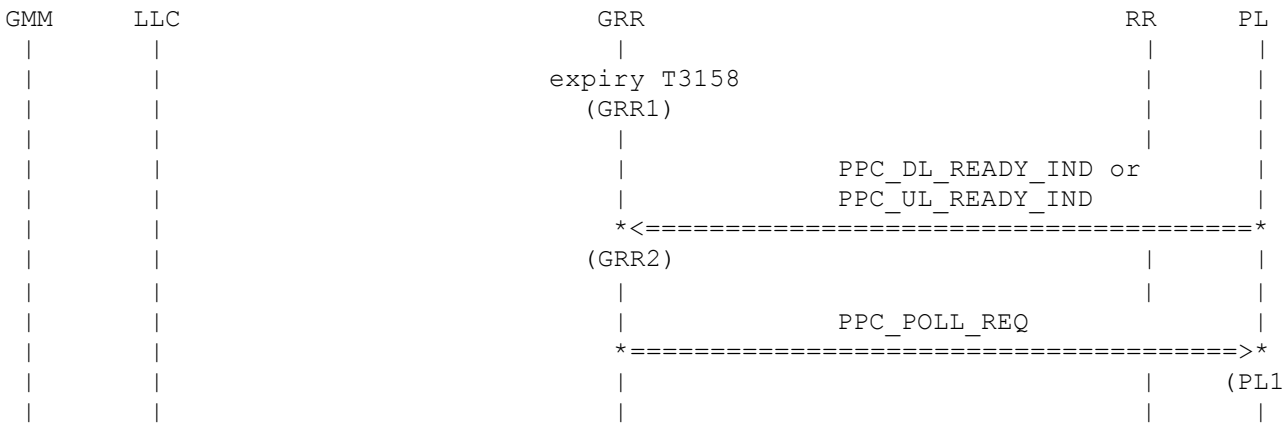
9.3.1 Measurement Order procedures in packet transfer mode



(GRR1)
The network sends the PACKET MESUREMENT ORDER to the MS in the RLC_uplink.

Requirements:
<R.MAC.MORD_TRF.M.001>, <R.MAC.AB.M.004>

9.3.2 Measurement report in packet transfer mode



(GRR1)
At every expiry of T3158 the MS has to initiate new measurements and has to send a PACKET MEASUREMENT REPORT. This air message shall be transmitted with a single block. GRR is waiting for a PACCH.

(GRR2)
GRR checks on every incoming PPC_DL/UL_READY_IND if there is PACCH. If so it follows a PPC_POLL_REQ including the PACKET MEASUREMENT REPORT.

(PL1)
PL transmits the block.

Requirements:
<R.MAC.MREP_TRF.M.00x>

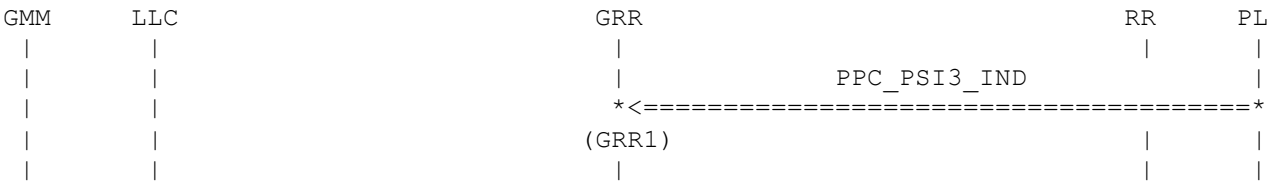
10 Cell Change Procedures

10.1 Neighbour Cell Syncronisation

After a cell indication the MS is in packet idle mode. For neigbour cell synchronisation the following services are requested.

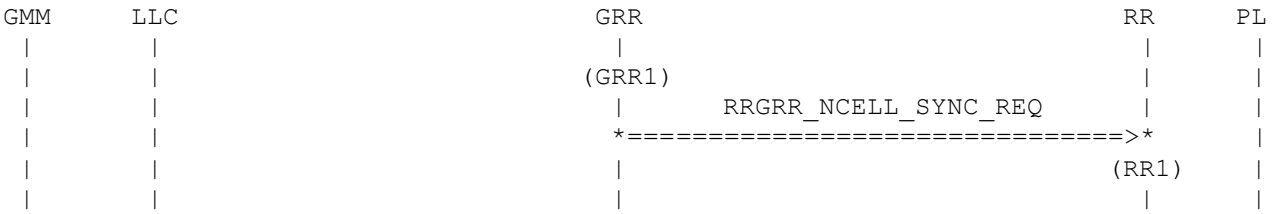
- Definition of BCCH allocation (BA_GPRS)
- Synchronisation to neighbour cells (NCELL)
- Fieldstrength measurements

10.1.1 Definition of BCCH allocation (BA_GPRS)



(GRR 1)
GRR receives a PACKET SYSTEM INFORMATION 3 (PSI3) message, which includes the BCCH allocation (BA list for GPRS). These NCELL are stored. If necessary, GRR starts synchronization and/or measurements to NCELL.

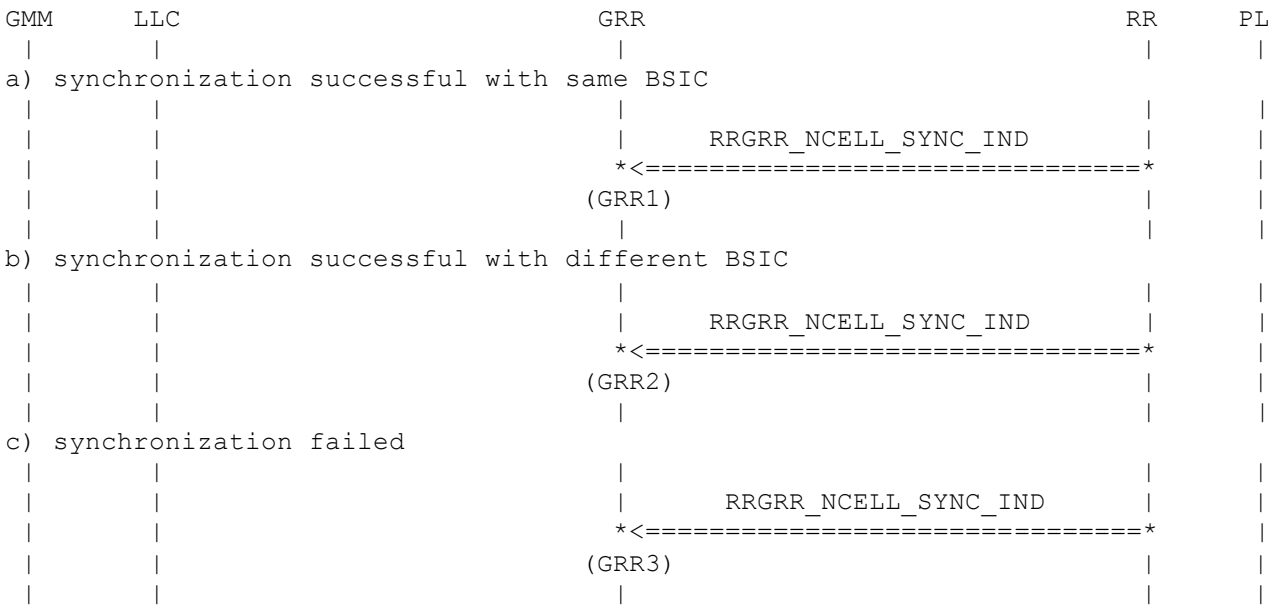
10.1.2 Synchronization Request of NCELL



(GRR1)
GRR needs to trigger a NCELL synchronization (see 10.1.1).

(RR 1)
GRR requests the synchronization to NCELL. RR starts its own procedures to synchronize to neighbor cells (see MSC document of TI++ chapter 5).

10.1.3 Confirmation of Synchronization to NCELL



(GRR 1)
RR indicates a successful synchronization to NCELL with the same BSIC.

(GRR 2)
RR indicates a successful synchronization to NCELL with the different BSIC. The carrier is treated as a new carrier.

(GRR 3)

RR indicates a failed synchronization to NCELL(s).

10.2 Performing measurements

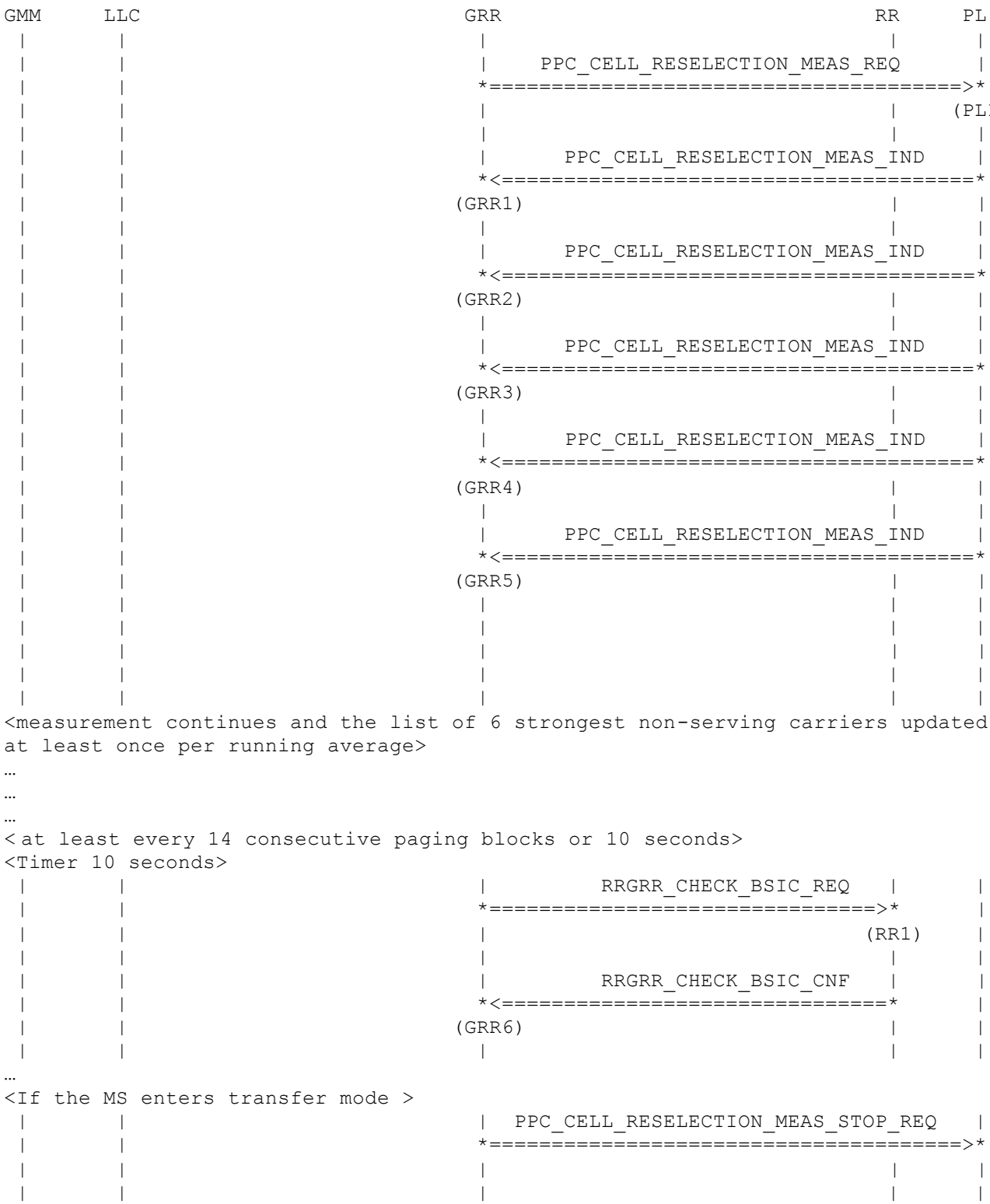
10.2.1 Measurements on PCCCH

The MS shall not use the discontinuous reception (DRX) mode of operation (i.e. powering itself down when it is not expecting paging messages from the network) while performing the cell selection algorithm defined in GSM 03.22.

If PBCCH does not exist, the criteria and algorithms defined in subclauses 10.1.2 and 10.1.3 in [05.08v6.8.0] shall also apply to cells for which the GPRS cell re-selection parameters are provided to the MS in a Packet Cell Change Order or Packet Measurement Order message. In this case, the MS may convert the idle mode cell re-selection parameters, received for the other cells according to clause 6, to GPRS cell re-selection parameters according to table 4 and use the same procedures, except that the MS may measure received signal strength in packet idle mode according to either subclause 6.6.1 or subclause 10.1.1.

10.2.1.1 Packet idle mode

The MS shall measure the received RF signal level on the BCCH carriers of the serving cell and the surrounding cells as indicated in the BA (GPRS) list and optionally the NC_FREQUENCY_LIST, and calculate the received level average (RLA_P) for each carrier.



(PL 1)

PL receives the frequency list to perform measurements for cell reselection and network controlled cell reselection. PL performs measurements according to the rules/restrictions defined in [05.08v680]

PL sends received signal level measurement samples to GRR. PL takes the following constraints into account:

At least one received signal level measurement sample on each BCCH carrier shall be taken for each paging block monitored by the MS according to its current DRX mode and its paging group. As the minimum MS shall take one measurement for each BCCH carrier for every 4 second. As the maximum, the MS is however not required to take more than 1 sample per second for each BCCH carrier. Samples collected over a period of 5 s to Max {5s, five consecutive paging blocks of that MS}, and shall be maintained for each BCCH carrier. The same number of measurement samples shall be taken for all BCCH carriers, and the samples allocated to each carrier shall as far as possible be uniformly distributed over the evaluation period.

(GRR 1)

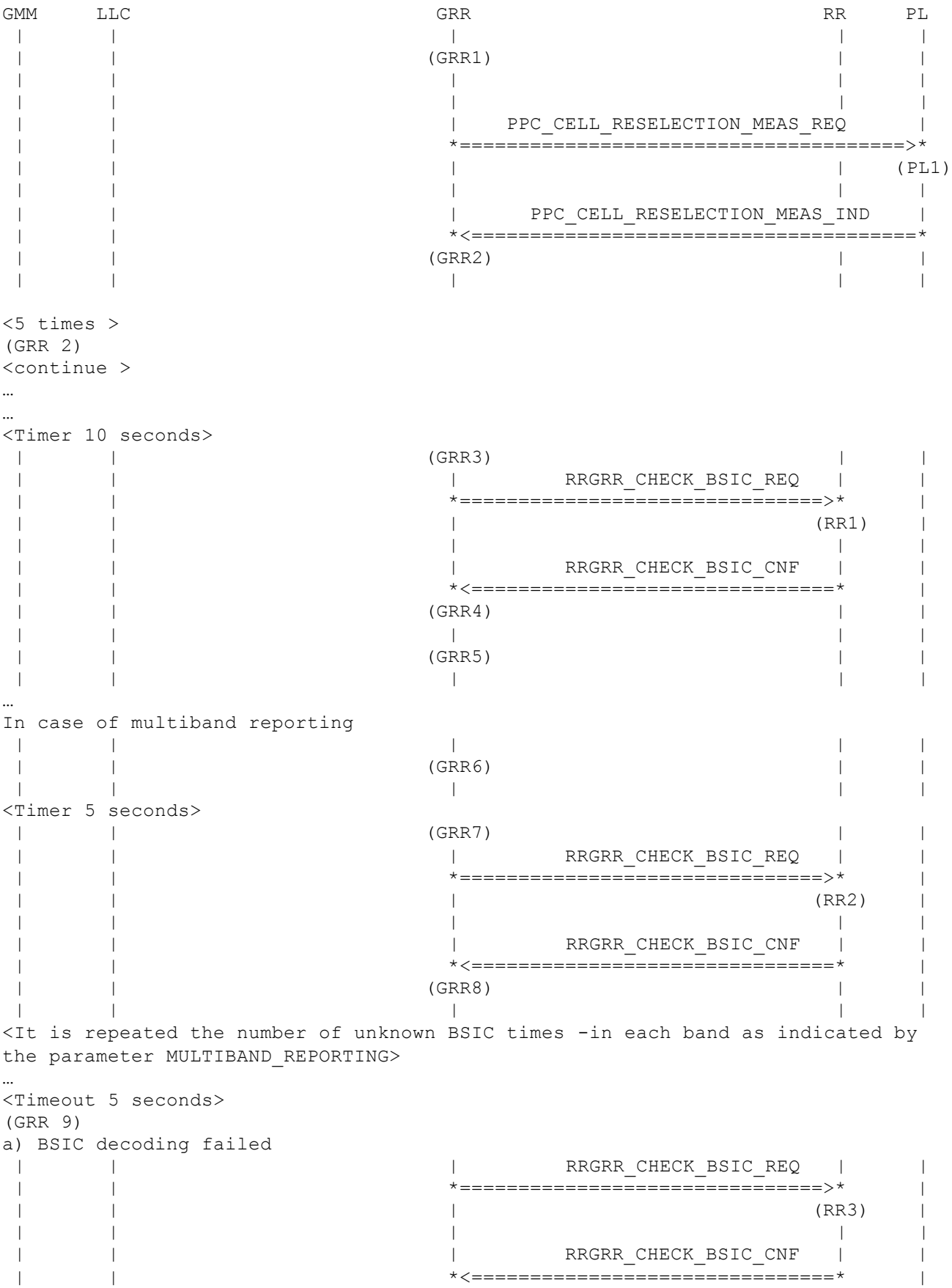
PL sends the received signal level measurements (RX_LEV) to GRR and GRR saves the received last 5 RX_LEV to build a received level running average (RLA_P) value.

(GRR 2,3,4,5 and PPC 3,4,5)
See comments in GRR1 and P1.
In addition the MS shall verify the BSIC of the BCCH carriers. Only cells with allowed BSIC shall be considered for re-selection. The allowed BSIC is either the BSIC broadcast for that carrier in the BA (GPRS) list or, for cells in BA (BCCH) where no BSIC is broadcast, a BSIC with allowed NCC part.

(RR 1)
GRR sends the BSIC of the 6 strongest non-serving cell BCCH carriers to check.

(GRR6)
RR sends the result to GRR. If a change of BSIC is detected then the carrier shall be treated as a new carrier.
In the case of a multiband MS, the MS shall attempt to decode the BSIC, if any BCCH carrier with unknown BSIC is detected among the number of strongest BCCH carriers in each band as indicated by the parameter MULTIBAND_REPORTING, broadcast on PBCCH, or if PBCCH does not exist, on BCCH.

10.2.1.2 Packet transfer mode



```
 |        |                              (GRR9a)                                  |        |
 |        |                                |                                      |        |
a1) Re-confirmed existing BSICs
<Timer 5 seconds>
 |        |                                |                                      |        |
 |        |                              (GRR9a1)                                 |        |
 |        |                                |                                      |        |

see notes following a1)
```

(GRR1)
After entering the packet transfer mode, GRR starts a received signal level measurement.

(PL1)
PL gets the measurement results and passes to GRR. The PL takes into account that samples collected over a period of 5 s, and shall be maintained for each BCCH carrier. The same number of measurement samples shall be taken for all BCCH carriers except, if the parameter PC_MEAS_CHAN indicates that the power control measurements shall be made on BCCH, for the serving cell where at least 6 measurement samples shall be taken per 52-multiframe. The samples allocated to each carrier shall as far as possible be uniformly distributed over the evaluation period.

(GRR 2)
At least 5 received signal level measurement samples are required for a valid RLA_P value, therefore GRR collects at least 5 results.

(GRR 3)
The MS shall attempt to check the BSIC for each of the 6 strongest non-serving cell BCCH carriers as often as possible, and at least every 10 seconds.

(RR 1)
GRR sends the BSIC of the 6 strongest non-serving cell BCCH carriers to check.

(GRR 4)
RR sends the result to GRR. If a change of BSIC is detected then the carrier shall be treated as a new carrier. A list containing BSIC and timing information for these strongest carriers at the accuracy required for accessing a cell including the absolute times derived from the parameters T1, T2, T3 shall be kept by the MS. This information may be used to schedule the decoding of BSIC and shall be used when re-selecting a new cell in order to keep the switching time at a minimum. When a BCCH carrier is found to be no longer among the 6 strongest, BSIC and timing information shall be retained for 10 seconds. (This is in case a cell re-selection command to this cell is received just after the MS has stopped reporting that cell).

(GRR 5)
Here an extract from GSM 05.08: "*If an MS, performing a multislot uplink transfer with fixed allocation, is not able to perform BSIC decoding within the search frames according to its multislot class, the MS shall perform the BSIC decoding between allocations. The MS shall determine the necessary periods by not requiring uplink resources.*
If an MS, performing a multislot downlink transfer with fixed allocation, is not able to perform BSIC decoding within the search frames according to its multislot class, the MS shall perform the BSIC decoding during inactivity periods. The MS shall request these inactivity periods from the network to allow for the required BSIC decoding (see GSM 04.60)." This situation should be taken into account on both Condat and layer 1 side. It is not clear enough!

(GRR 6)
In the case of a multiband MS, the MS shall attempt to decode the BSIC, if any BCCH carrier with unknown BSIC is detected among the number of strongest BCCH carriers in each band as indicated by the parameter MULTIBAND_REPORTING, broadcast on PBCCH, or if PBCCH does not exist, on BCCH.

(GRR 7,8 and RR 2)
Thus an MS shall, for a period of up to 5 seconds, devote all search frames to attempting to decode the BSICs for MULTIBAND_REPORTING.

(GRR 9a)
If decoding of BSIC for MULTIBAND_REPORTING fails then the MS shall return to confirming existing BSICs.

(GRR 9a1)
Having re-confirmed existing BSICs, if there are still BCCH carriers, among the six strongest, with unknown BSICs, then the decoding of these shall again be given priority for a further period of up to 5 seconds.

Notes:

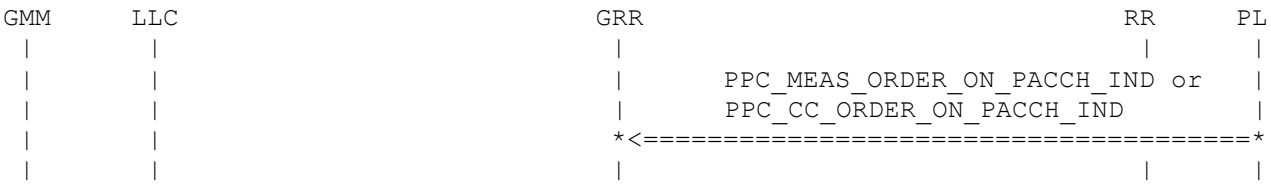
- If either no BSIC can be decoded on a surrounding cell BCCH carrier, or the BSIC is not allowed, then the received signal level measurements on that channel shall be discarded and the MS shall continue to monitor that channel.

- If a change of BSIC is detected on a carrier, then any existing received signal level measurement shall be discarded and the carrier shall be treated as a new carrier.

- If the BSIC cannot be decoded at the next available opportunities re-attempts shall be made to decode this BSIC. If the BSIC is not decoded for more than three successive attempts it will be considered lost and any existing received signal level measurement shall be discarded and the MS shall continue to monitor that carrier.

10.2.2 Measurements on CCCH

There is no PBCCH present in the cell.



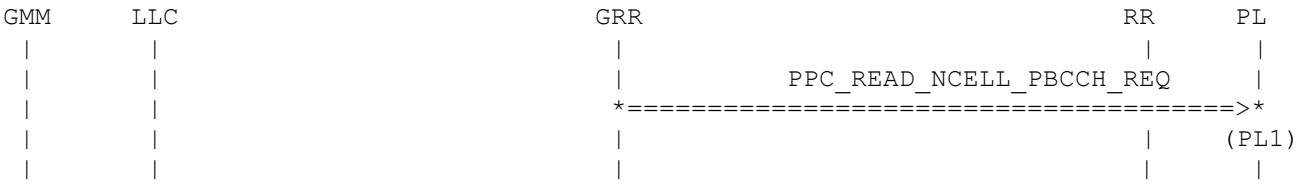
a)
GRR receives cell re-selection parameters in a Packet Cell Change Order or Packet Measurement Order message on PACCH, e.g. during transfer mode. GRR takes the cell selection and measurement procedures for GPRS into account

b)
GRR receives no GPRS relevant measurement or cell change messages. Perform cell reselection according the former procedures for GSM. Except, that the MS shall perform monitoring of full SI on BCCH, if indicated by change mark on BCCH or PACCH.

10.3 Cell Re-selection procedure in packet idle mode (PBCCH exists)

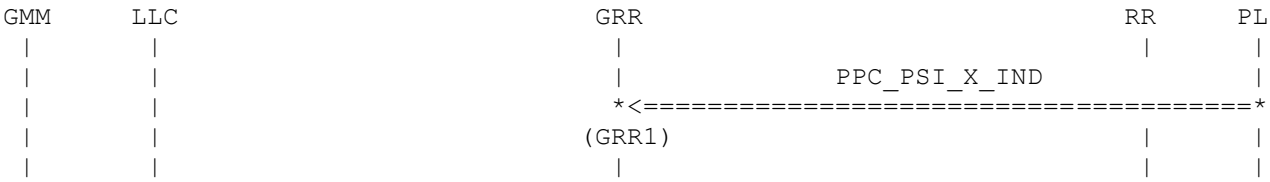
GRR decides to change to the cell in packet idle mode. The decision depends on the field strength measurements of the lower layer.

10.3.1 Read the PBCCH of the new cell



(PL1)
GRR requests the reading of the possible new cell.

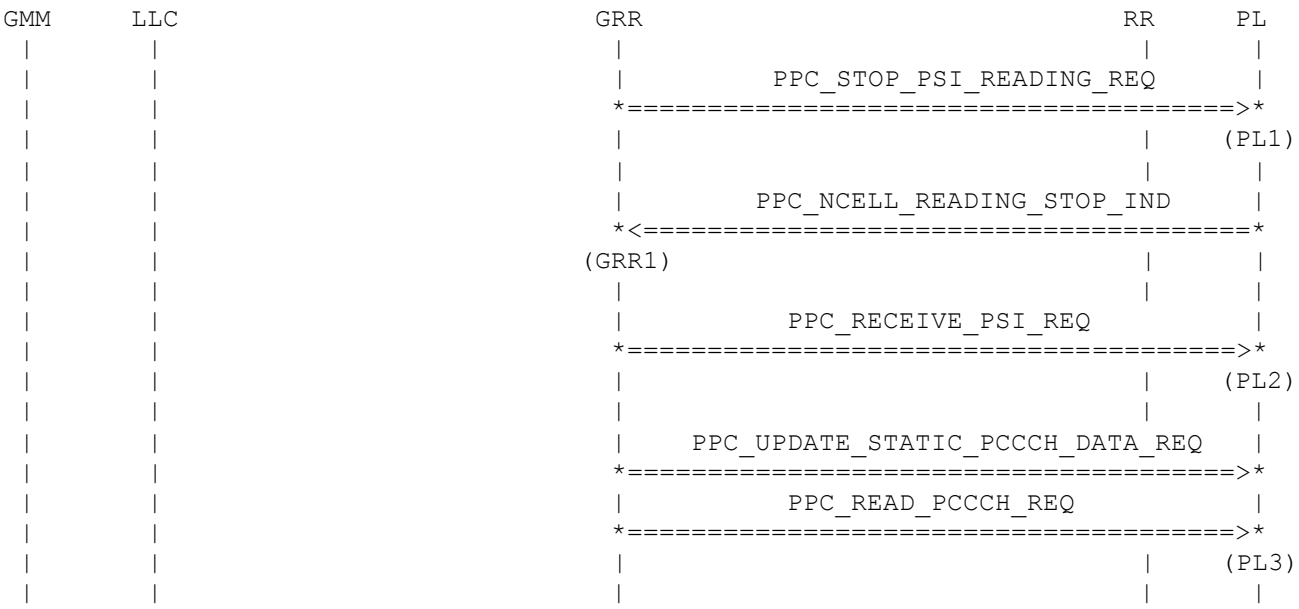
10.3.2 Receiving of PSIs in the new cell



(GRR 1)
PPC indicates to GRR the received PSI.

This procedure is possible foe different packet system information.

10.3.3 Reselect new cell in packet idle mode



(PL1)
GRR requests the stop of reading of the new cell.

(GRR1)
PPC forwards the confirmation to GRR.

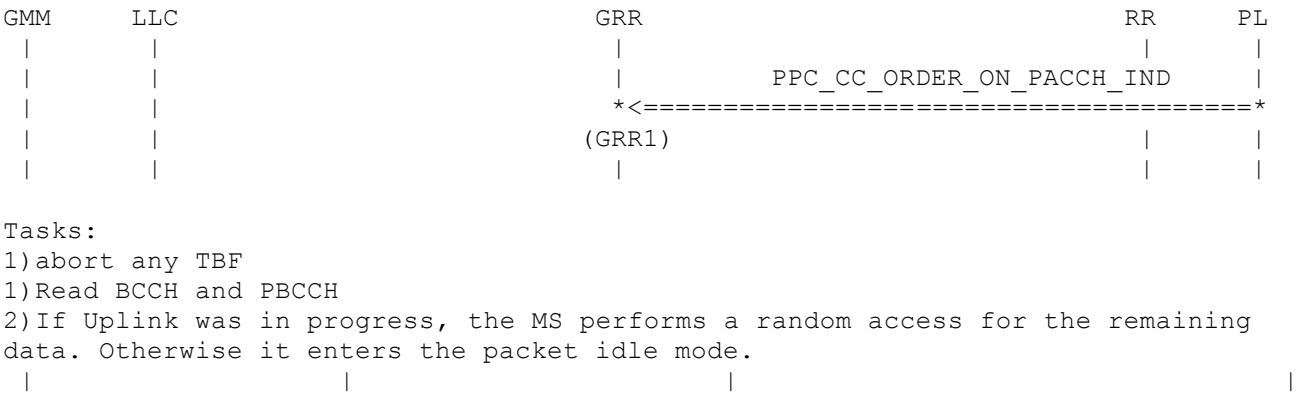
(PL1)
GRR starts to assign the new cell to PL.

(PL2)
GRR updates the PCCCH parameters.

(PL3)
GRR requests to use the PCCCH parameters.

10.4 Cell change procedure in packet transfer mode

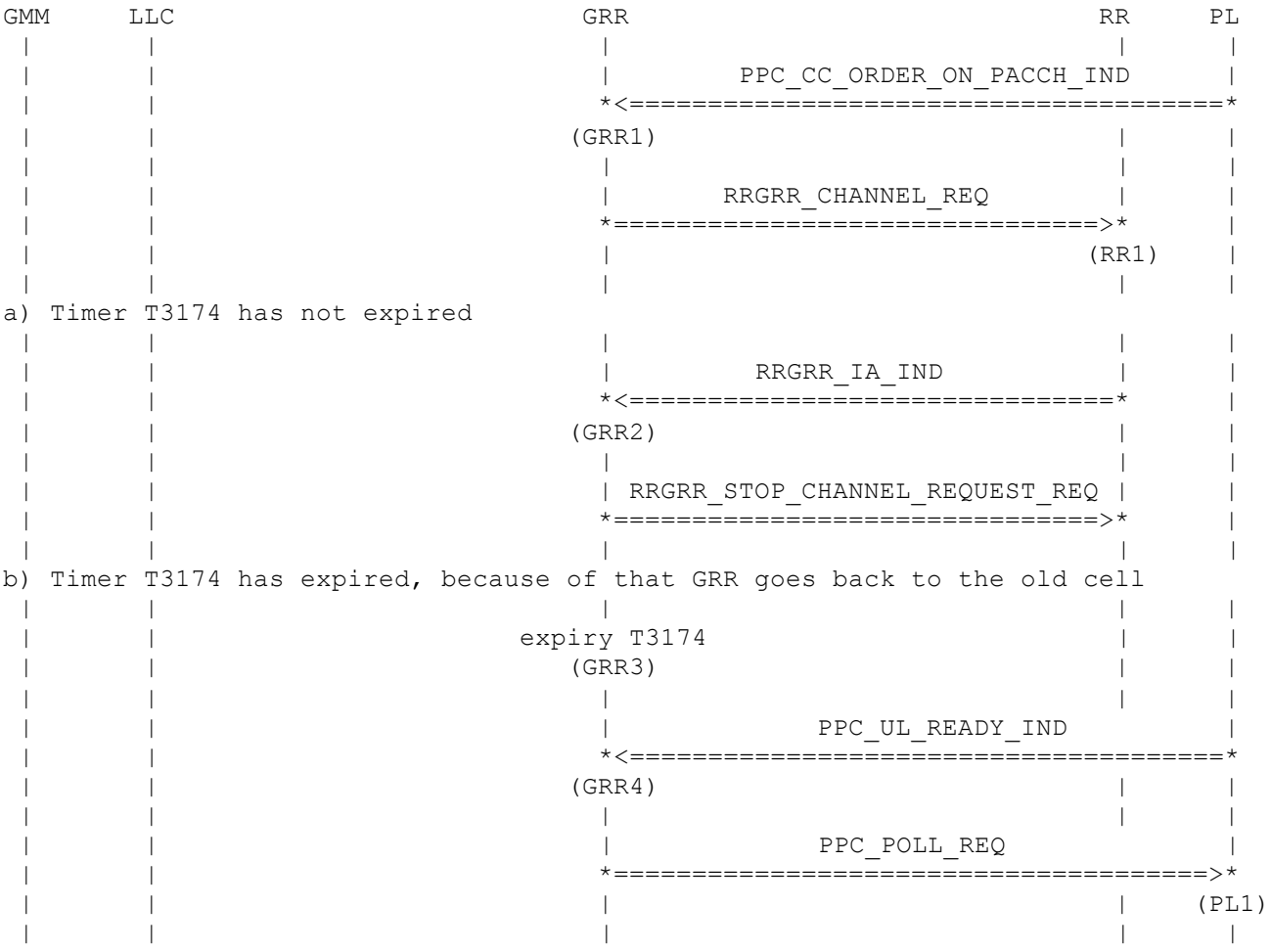
10.4.1 On reception of PACKET CELL CHANGE ORDER



(GRR 1)
The MS receives the PACKET CELL CHANGE ORDER message.

Requirements:
<R.MAC.CC_TRF.M.00x>

10.4.2 Cell change order procedure initiated on PCCCH / complementation on CCCH



(GRR1)

GRR stops all RLC/MAC timers and start timer T3174. The MS shall switch to the specified new cell and obey the RLC/MAC relevant procedures on this new cell.

(RR1)

RR performs an access procedure.

(GRR2)

GRR receives a correct IMMEDIATE ASSIGNMENT.

(GRR3)

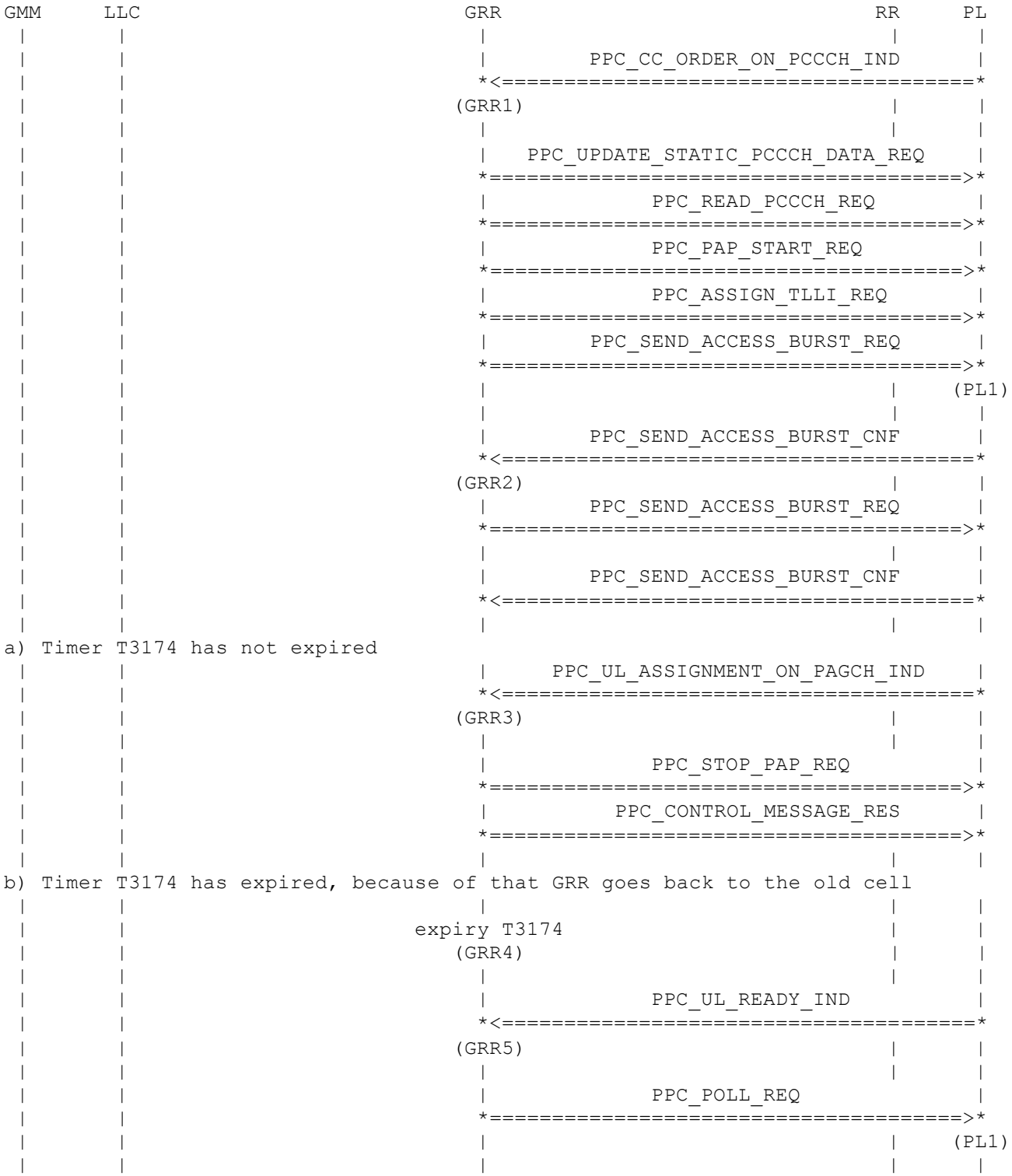
Timer T3174 has expired before a response to packet channel request. Start timer T3176 and return to the old cell. GRR initiates a random access in the old cell with Single block without TBF establishment and sends a packet cell change failure to the network. GRR is waiting for a PACCH.

(GRR4)
GRR checks on every incoming PPC_DL/UL_READY_IND if there is PACCH. If so it follows a PPC_POLL_REQ including the PACKET CELL CHANGE FAILURE.

(PL1)
PL transmits the block.

Requirements:
<R.MAC.CC_PCCCH.M.00x>

10.4.3 Cell change order procedure initiated on PCCCH / complementation on PCCCH



(GRR1)

GRR stops all RLC/MAC timers and start timer T3174. The MS shall switch to the specified new cell and obey the RLC/MAC relevant procedures on this new cell.

(GRR2)

There may be multiple PPC_SEND_ACCESS_BURST_REQ and PPC_SEND_ACCESS_BURST_CNF, depending on how many repeats of access bursts are defined in the packet system information.

(GRR3)

GRR receives a correct IMMEDIATE ASSIGNMENT.

(GRR4)

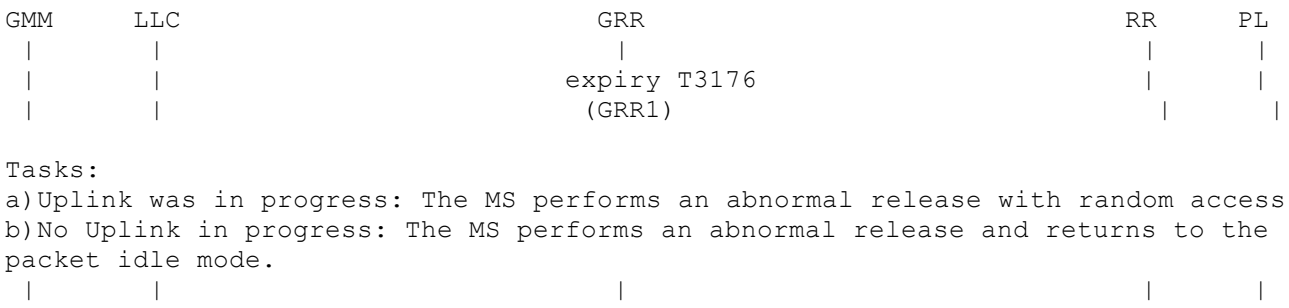
Timer T3174 has expired before a response to packet channel request. Start timer T3176 and return to the old cell. GRR initiates a random access in the old cell with Single block without TBF establishment and sends a packet cell change failure to the network. GRR is waiting for a PACCH.

(GRR5)
GRR checks on every incoming PPC_DL/UL_READY_IND if there is PACCH. If so it follows a PPC_POLL_REQ including the PACKET CELL CHANGE FAILURE.

(PL1)
PL transmits the block.

Requirements:
<R.MAC.CC_PCCCH.M.00x>

10.4.4 Timeout of Timer T3176

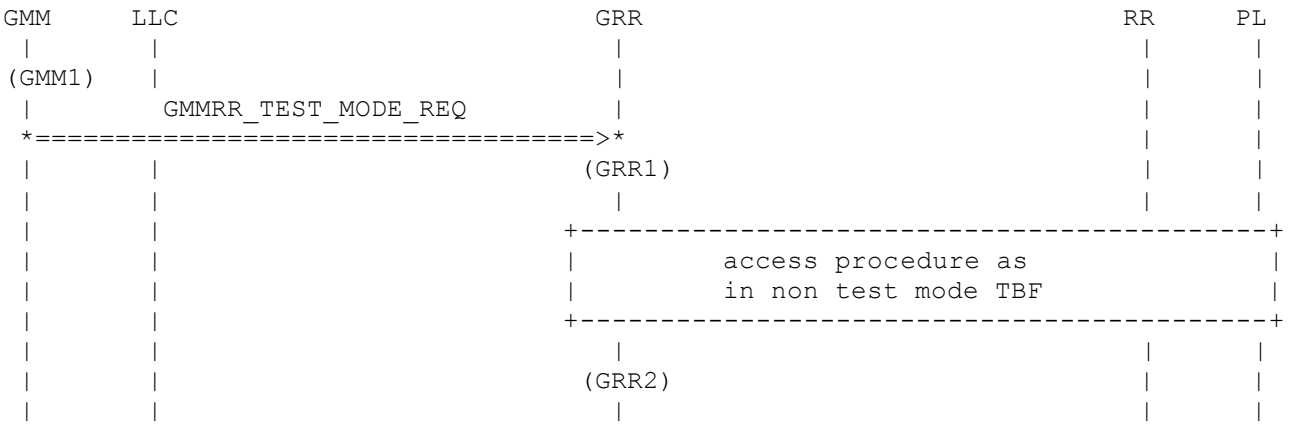


(GRR1)
Timer T3176 expires.

Requirements:
<R.MAC.NC_CRES.M.006> *

11 GPRS Test Mode Procedures

11.1 Activation



(GMM1)
If GMM receives a GPRS_TEST_MODE_CMD command and a test SIM is inserted, GMM sends the primitive GMMRR_TEST_MODE_REQ to GRR. This primitive includes the parameter of the GPRS_TEST_MODE_CMD command.

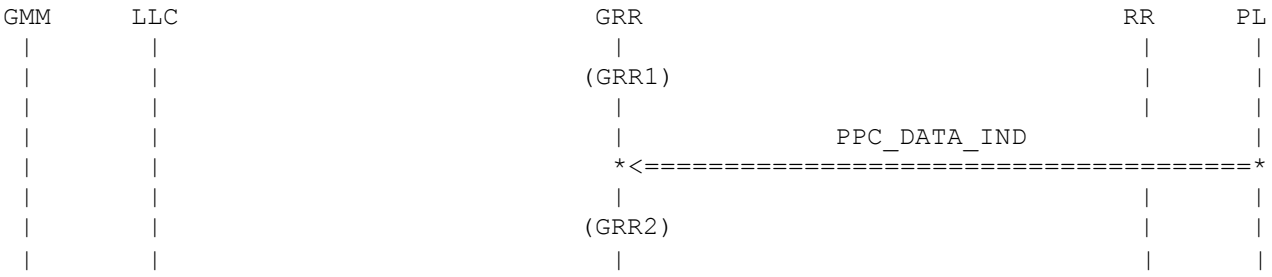
(GRR1)
On reception of this primitive GRR starts an access procedure as for a regular TBF. However there are some exceptions during this access procedure: GRR shall clear the primitive queue if there are primitives queued. GRR shall not send GRR_READY_IND.

(GRR2)
Here follows packet transfer mode as described below. During packet transfer mode new

11.2 Packet Transfer Mode in Test Mode A

In test mode A) the MS is cable to sent a pseudo random bit sequence.

11.2.1 Data Reception



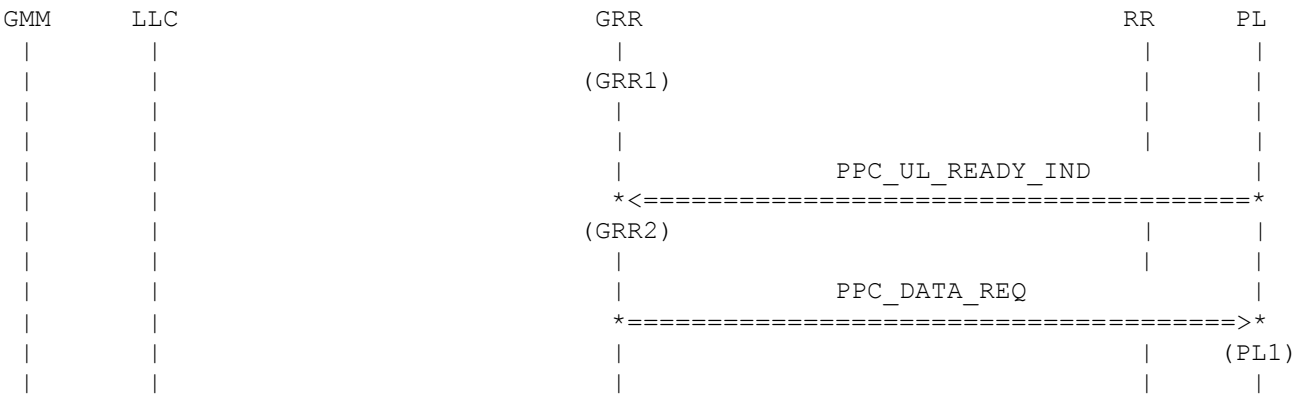
(GRR1)

GRR is in packet transfer mode

(GRR2)

All incoming RLC blocks shall be ignored.

11.2.2 Data Transmission / Single Slot



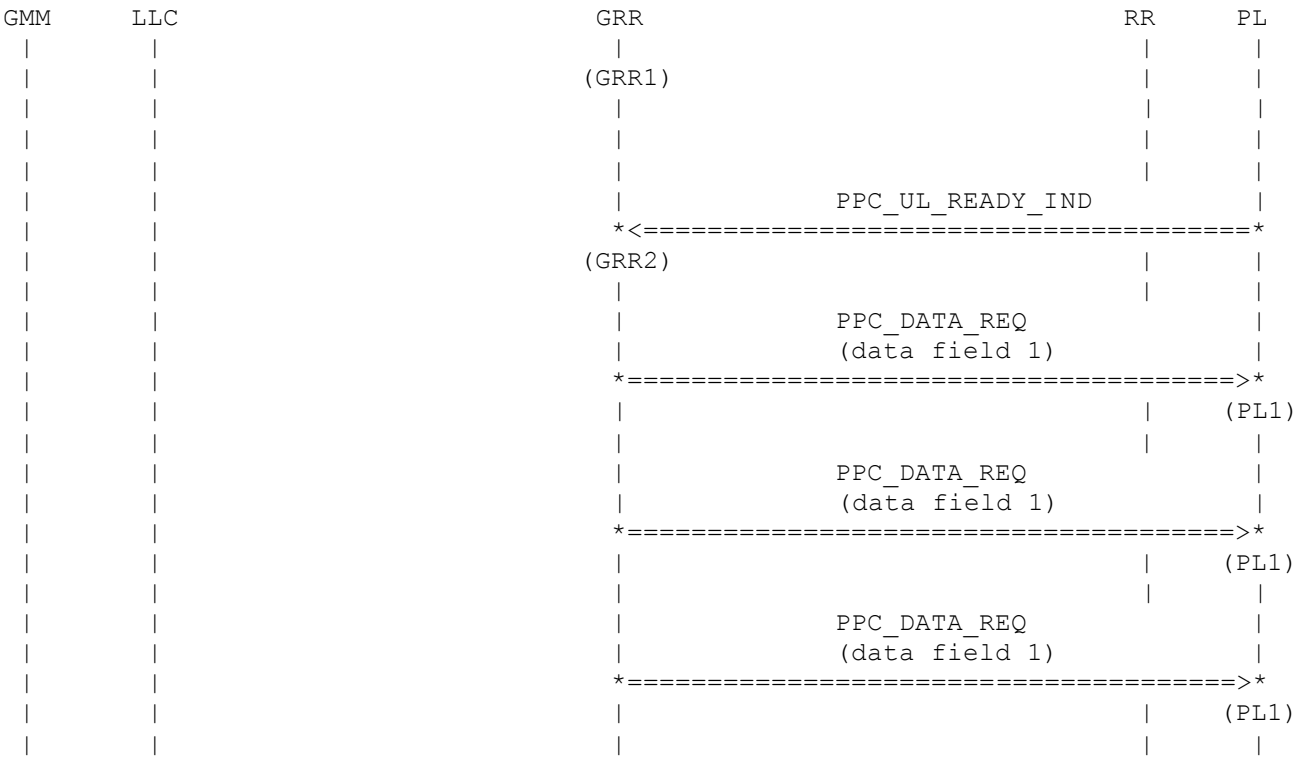
(GRR1)

GRR is in packet transfer mode

(GRR2)
The difference to regular data transmission is that GRR gets the data from a pseudo random bit sequence generator and not from the primitive queue. The RLC/MAC header is constructed as regular.

(PL1)
PL transmits the block.

11.2.3 Data Transmission / Multi Slot



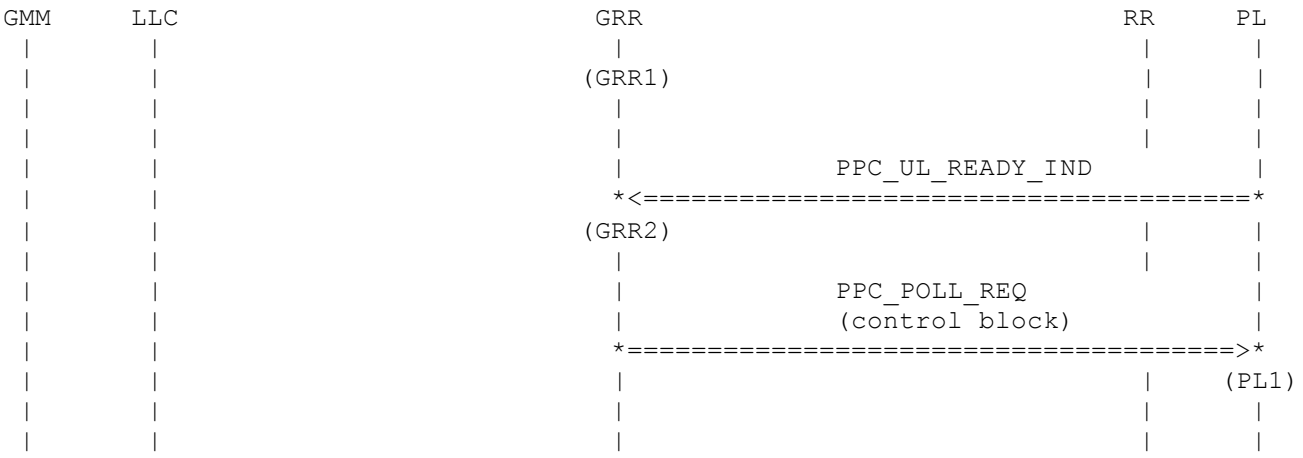
(GRR1)

GRR is in packet transfer mode

(GRR2)
The difference to regular data transmission is that GRR gets the data from the module GPRS_TEST and not from the primitive queue. The data are from a pseudo random bit sequence. The RLC/MAC header is constructed as regular. The data fields in each PPC_DATA_REQ are equal.

(PL1)
PL transmits the block.

11.2.4 Control Blocks / Single Slot



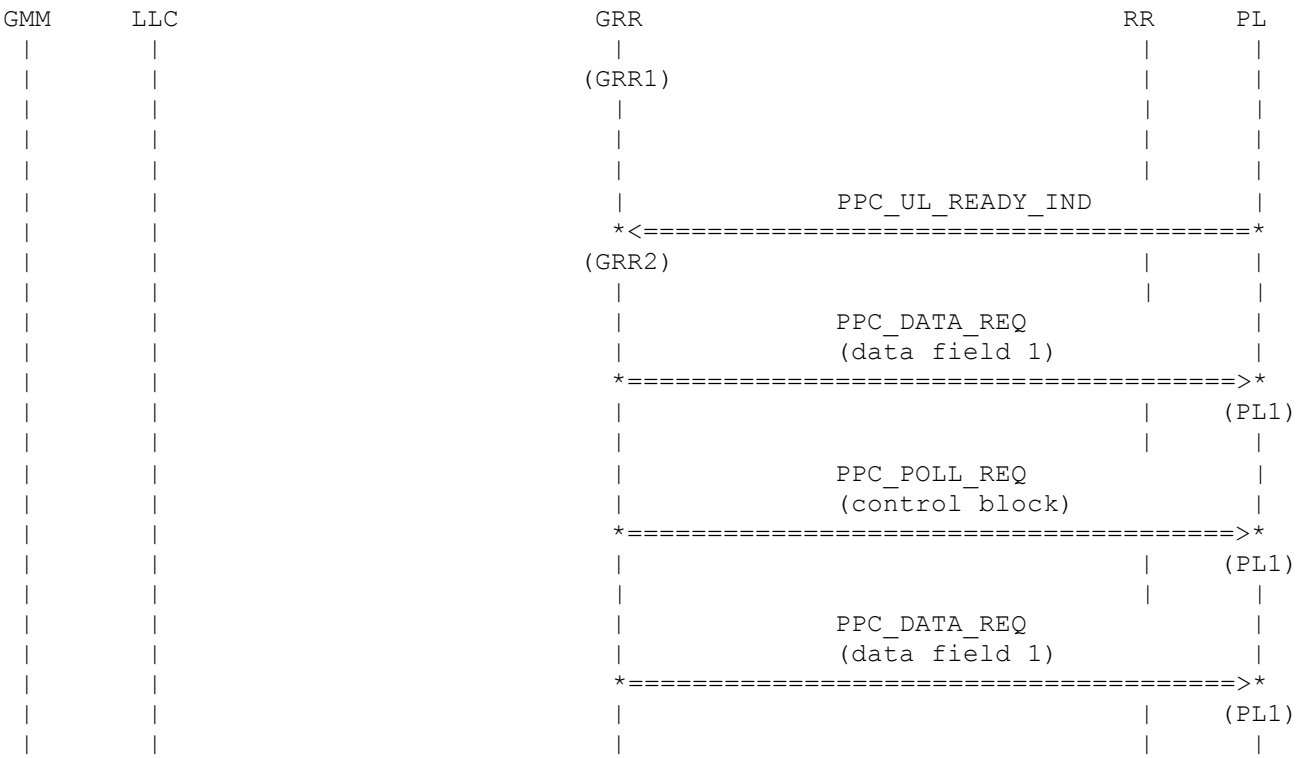
(GRR1)

GRR is in packet transfer mode

(GRR2)
GRR request control block transmission in case of PAGCH. The data pseudo random data sequence is interrupted and will be continued later without a gap.

(PL1)
PL transmits the block.

11.2.5 Control Block Transmission / Data Transmission Multi Slot



(GRR1)

GRR is in packet transfer mode

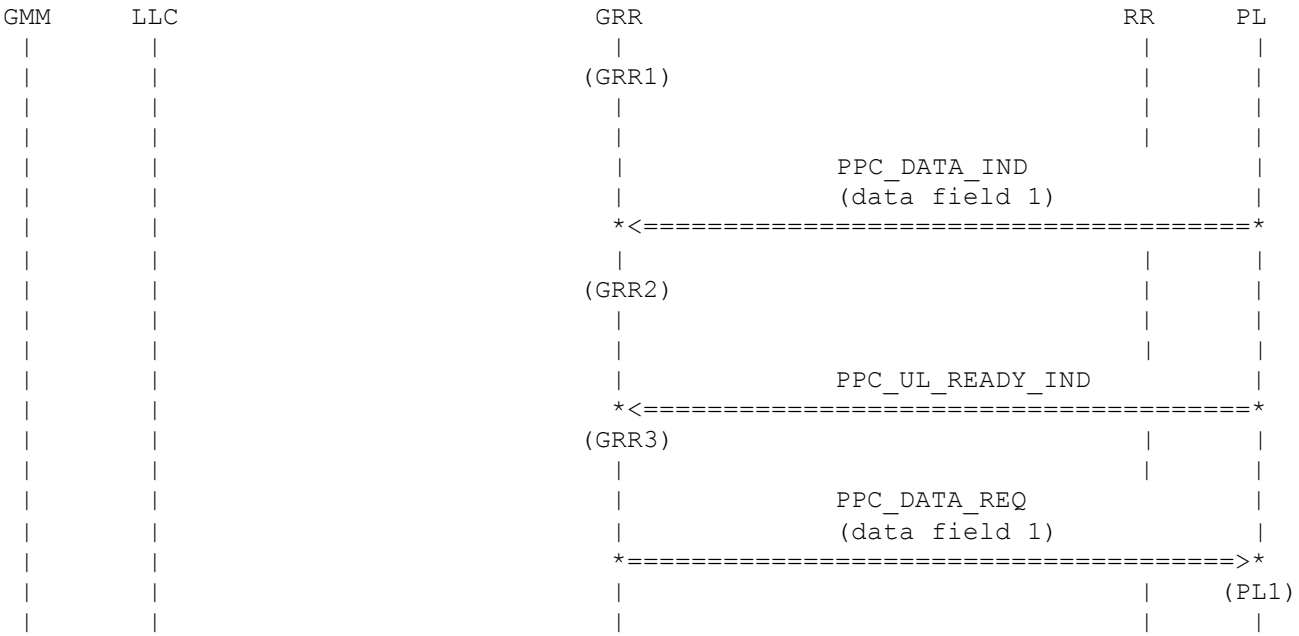
(GRR2)
The difference to regular data transmission is that GRR gets the data from the module GPRS_TEST and not from the primitive queue. The data are from a pseudo random bit sequence. The RLC/MAC header is constructed as regular. The data fields in each PPC_DATA_REQ are equal. The data field, which is replaced by the control block, is skipped and will no be sent later.

(PL1)
PL transmits the block.

11.3 Packet Transfer Mode in Test Mode B

Mode B is not yet required. However, mode B is considered during design of mode A, so that a later implementation is possible.

11.3.1 Data Reception & Transmission / Single Slot



(GRR1)

GRR is in packet transfer mode

(GRR2)

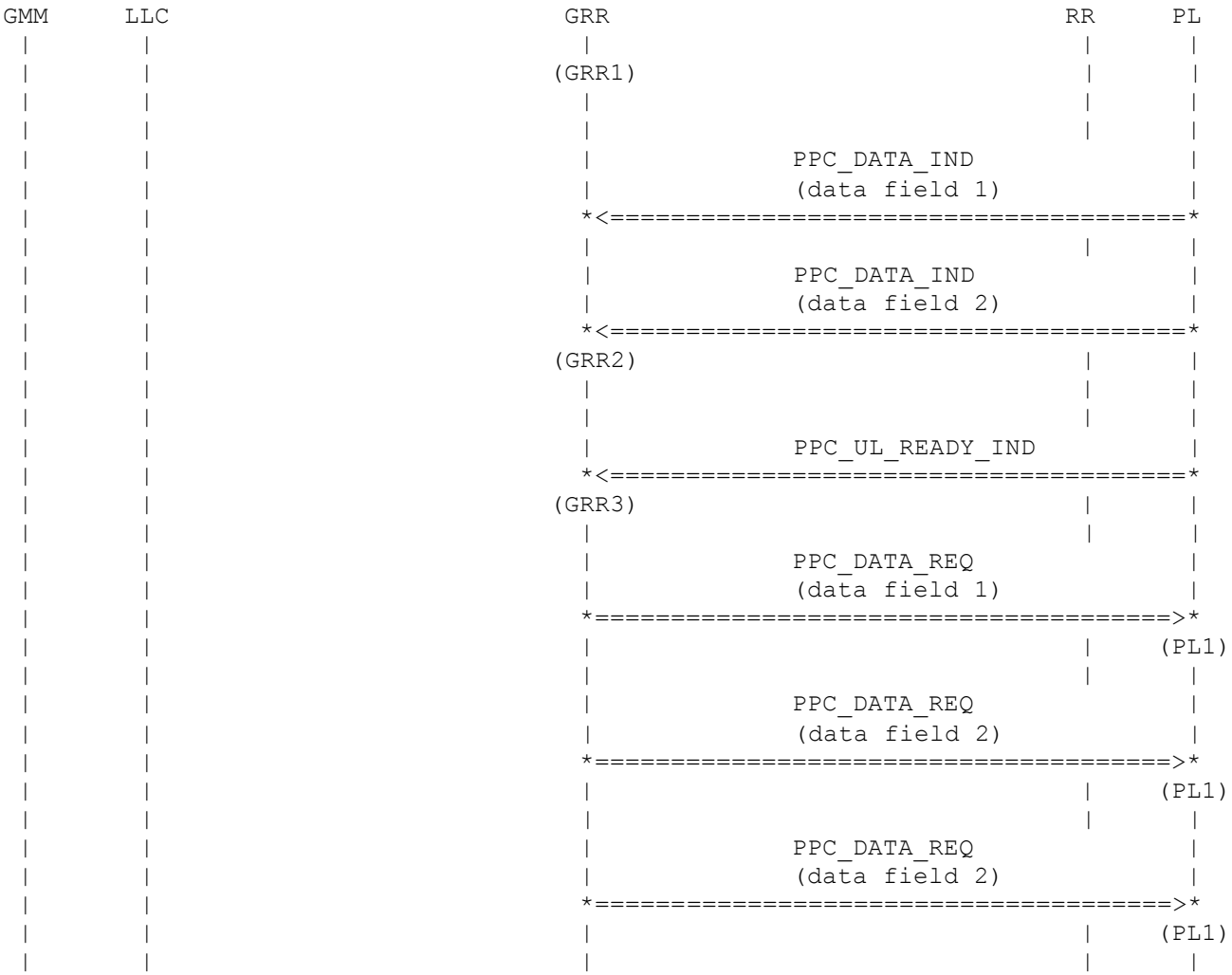
All incoming RLC blocks shall be sent to the GPRS_TEST module. This module is responsible to provide the correct sending data in the correct sequence (downlink offset.).

(GRR3)
The difference to regular data transmission is that GRR gets the data from the module GPRS_TEST and not from the primitive queue. The RLC/MAC header is constructed as regular.

(PL1)
PL transmits the block.

11.3.2 Data Reception & Transmission / Multi Slot / No Downlink TN Offset

Here an example for 2 downlink slots and 3 uplink slots.



(GRR1)

GRR is in packet transfer mode

(GRR2)

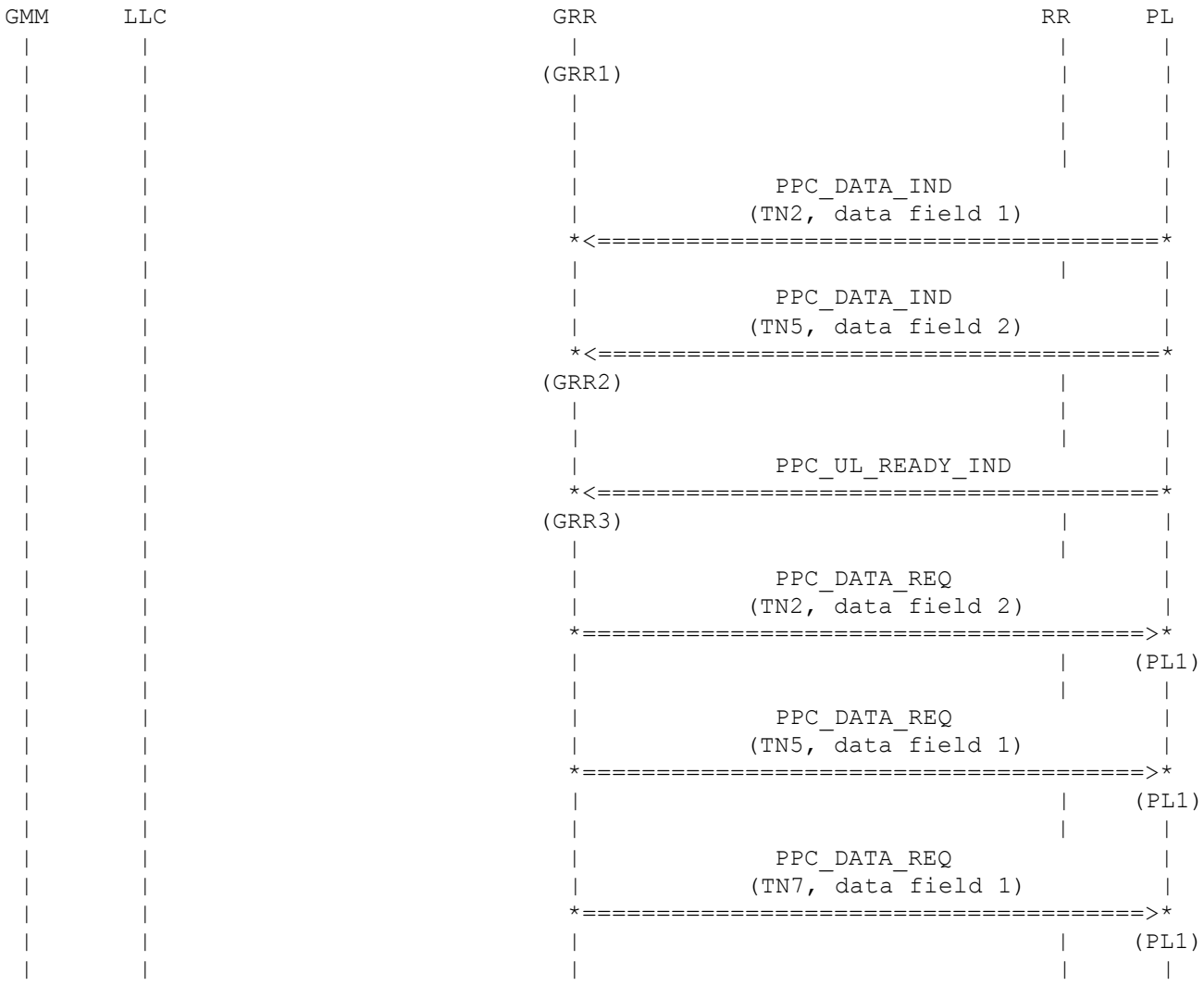
All incoming RLC blocks shall be sent to the GPRS_TEST module. This module is responsible to provide the correct sending data in the correct sequence (downlink offset.).

(GRR3)
The difference to regular data transmission is that GRR gets the data from the module GPRS_TEST and not from the primitive queue. The RLC/MAC header is constructed as regular. Every downlink slots carries the data as in the corresponding downlink slot. If there is no corresponding downlink slot the data from the last downlink slot shall be used.

(PL1)
PL transmits the block.

11.3.3 Data Reception & Transmission / Multi Slot / Downlink TN Offset

Here an example with 2 downlink slots (TN2 and TN5) and 3 uplink slots (TN2, TN5 and TN7). The downlink TN offset is TN4; This means that downlink slot TN5's data shall be transmitted in uplink slot TN2.



(GRR1)

GRR is in packet transfer mode

(GRR2)

All incoming RLC blocks shall be sent to the GPRS_TEST module. This module is responsible to provide the correct sending data in the correct sequence (downlink offset.).

(GRR3)
The difference to regular data transmission is that GRR gets the data from the module GPRS_TEST and not from the primitive queue. The RLC/MAC header is constructed as regular. Every downlink slots carries the data as in the corresponding downlink slot. If there is no corresponding downlink slot the data from the last downlink slot shall be used.

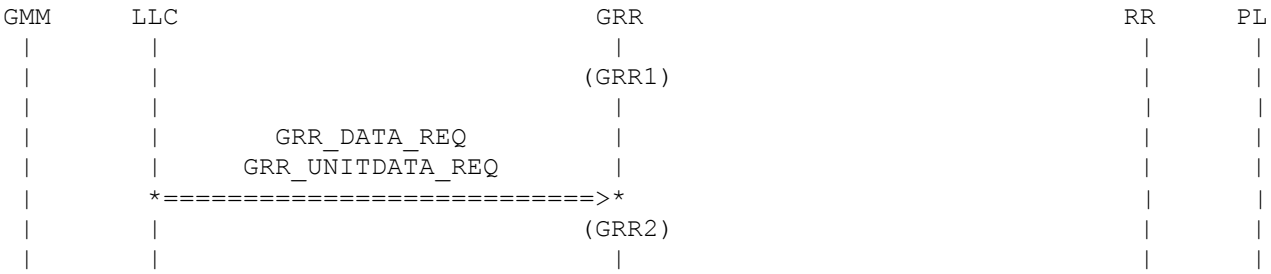
(PL1)
PL transmits the block.

GRR is in packet transfer mode

11.4 Deactivation

11.5 Failure Cases

11.5.1 LLC PDU request from LLC during Test Mode



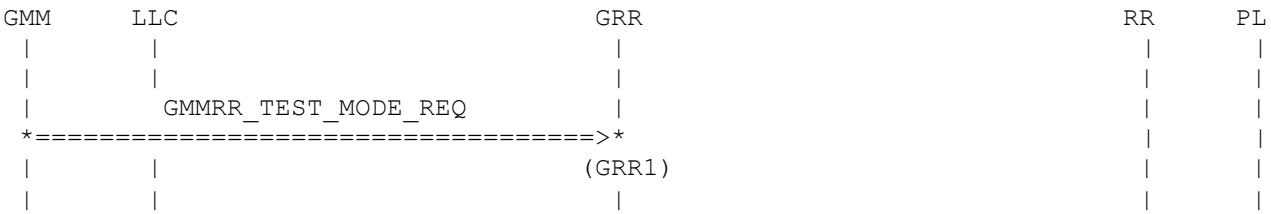
(GRR1)

GRR is in packet transfer mode

(GRR2)

GRR shall ignore all data request during test mode. GRR shall delete any request and shall not answer to LLC.

11.5.2 Another GMMRR_TEST_MODE_REQ during test mode



(GRR1)
GRR ignores all GMMRR_TEST_MODE_REQ if the GPRS test mode runs already, because the system simulator should not sent one (see GSM0414v620 chapter 5.4.1.2).