Technical Document – Confidential

GPRS GENERAL PACKET RADIO SERVICES

MESSAGE SEQUENCE CHARTS

MAC

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6. Update according to S2
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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

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1.2 Abbreviations

ACI	Application Control Interface
AGCH	Access Grant Channel
AT	Attention sequence "AT" to indicate valid commands of the ACI
BCCH	Broadcast Control Channel
BS	Base Station
BSIC	Base Station Identification Code
C/R	Command/Response
C1	Path Loss Criterion
C2	Reselection Criterion
CBCH	Cell Broadcast Channel
CBQ	Cell Bar Qualify
CC	Call Control
CCCH	Common Control Channel
CCD	Condat Coder Decoder
CCI	Compression and Ciphering Interface
CHAP	Challenge Handshake Authentication Protocol
CKSN	Ciphering Key Sequence Number
CRC	Cyclic Redundancy Check
DCCH	Dedicated Control Channel
DCOMP	Identifier of the user data compression algorithm used for the N-DPU
DISC	Disconnect Frame
DL	Data Link Layer
DM	Disconnected Mode Frame
DTX	Discontinuous Transmission
E	Extension bit
EA	Extension Bit Address Field
EL	Extension Bit Length Field
EMMI	Electrical Man Machine Interface
F	Final Bit
FACCH	Fast Associated Control Channel
FHO	Forced Handover
GACI	GPRS Application Control Interface
GMM	GPRS Mobility Management
GP	Guard Period
GRR	GPRS RR
GSM	Global System for Mobile Communication
HDLC	High-level Data Link Control
HISR	High level Interrupt Service Routine
HPLMN	Home Public Land Mobile Network
I	Information Frame
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
IPCP	Internet Protocol Control Protocol
ITU	International Telecommunication Union
IWF	Interworking Function
Kc	Ciphering Key
L	Length Indicator
LAI	Location Area Information
LCP	Link Control Protocol
LISR	Low level Interrupt Service Routine

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

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

1.3 Terms

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

2 Overview

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

The protocol stack for 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 :

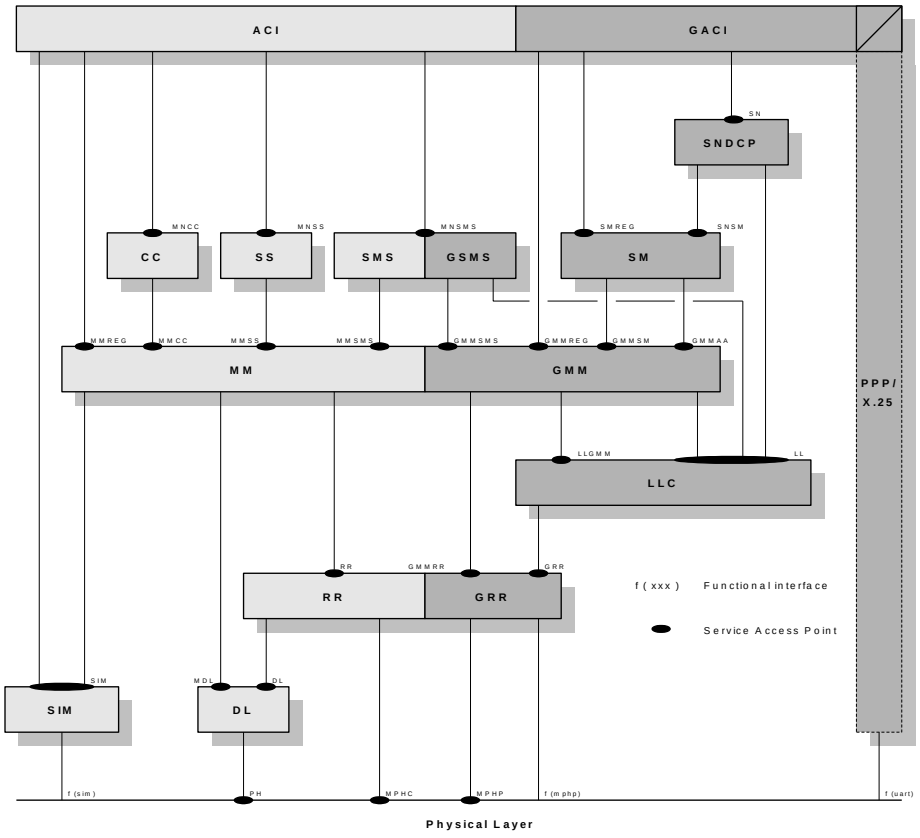


Figure 2-1: Architecture of the GSM/GPRS protocol stack

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

The entities of the GPRS protocol stack are:

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

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

2.2 LLC – Logical Link Control

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

2.3 GMM – GPRS Mobility Management

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

2.4 SM – Session Management

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

2.5 SNDCP - Subnetwork Dependant Convergence Protocol

SNDCP carries out all functions related to transfer of Network layer Protocol Data Units (N-PDUs) over GPRS in a transparent way. SNDCP helps to improve channel efficiency by means of compression techniques. The set of protocol entities above SNDCP consists of commonly used network protocols. They all use the same SNDCP entity, which then performs multiplexing of data coming from different sources to be sent using the service provided by the LLC layer.

2.6 GACI – GPRS Application Control Interface

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

2.7 USART - Universal Synchronous Asynchronous Receiver Transmitter Driver

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

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

2.8 TOM – Tunnelling of Messages

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

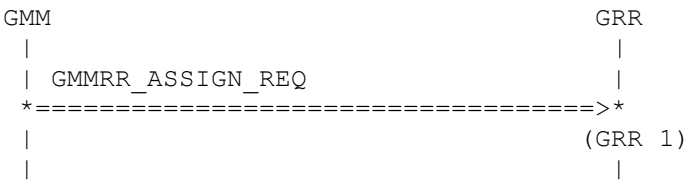
The main function of TOM is to tunnel non-GSM signalling messages between the MS and the SGSN. The only non-GSM signalling which is currently supported by TOM is for the EGPRS-136 system (according to TIA/EIA-136-376). Data transfer

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

3 Protocol

3.1 Configuration

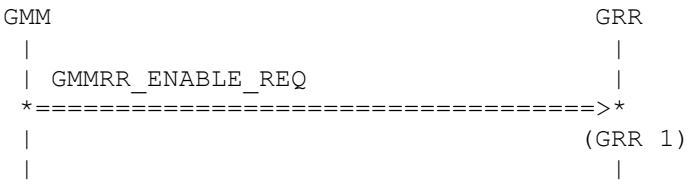
3.1.1 TLLI assign



(GRR 1)
GMM assigns a new TLLI and GRR stores this value.

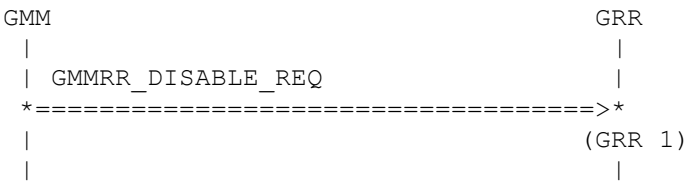
3.1.2 Enable/disable GPRS service

a)GPRS enable



(GRR 1)
GMM enables GPRS service, GRR saves this state.

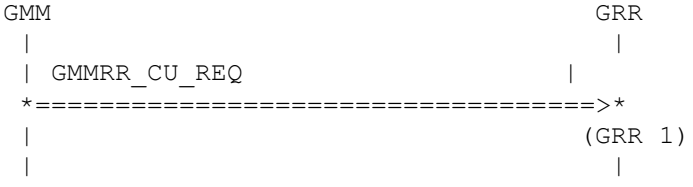
b)GPRS enable



(GRR 1)
GMM disables GPRS service, GRR saves this state.

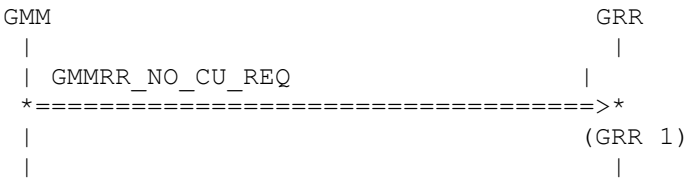
3.1.3 GMM state indication

a)GMM is in READY state



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

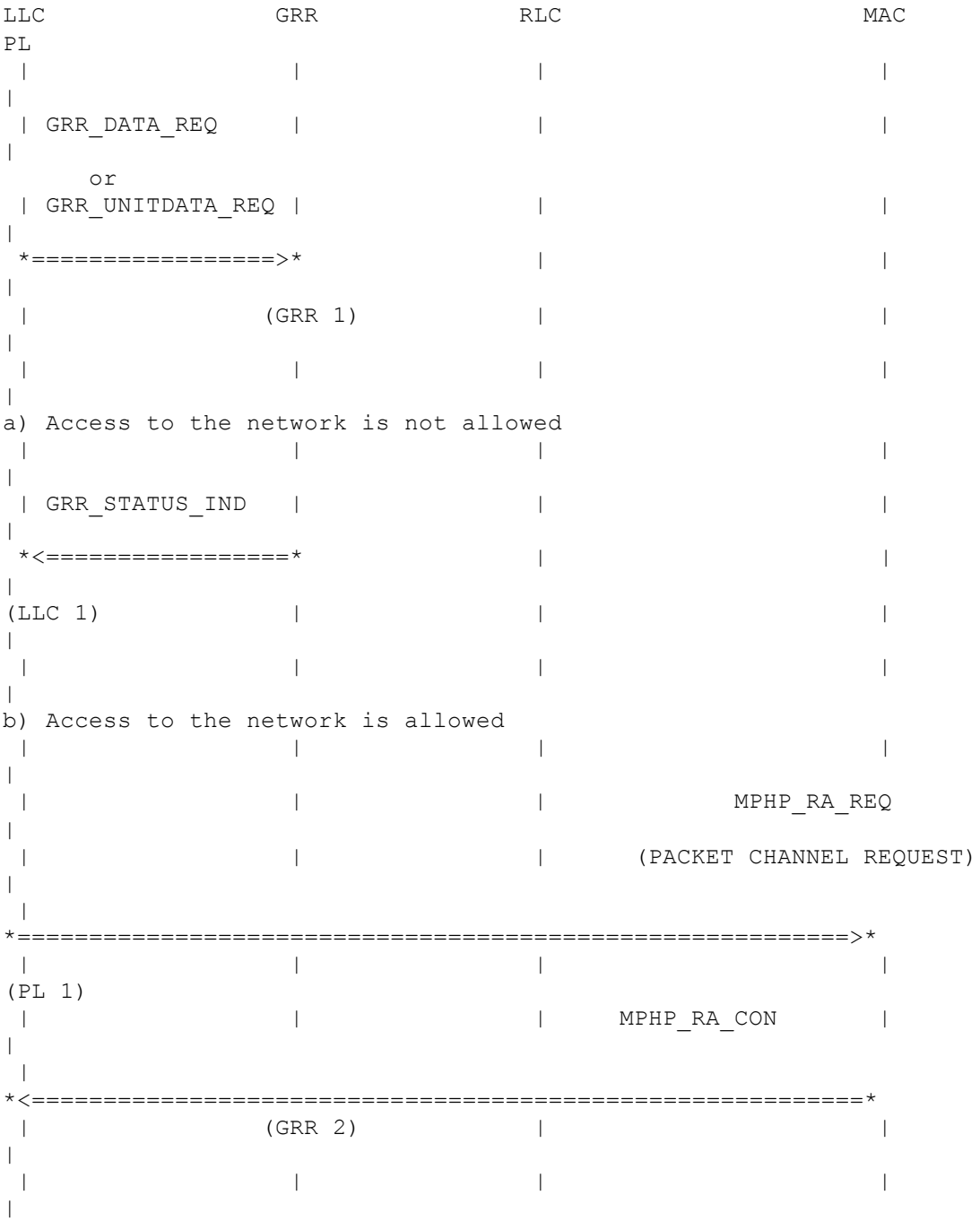
b)GMM enters the STANDBY state



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

3.2 TBF establishment initiated by the MS on PCCCH

3.2.1 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.

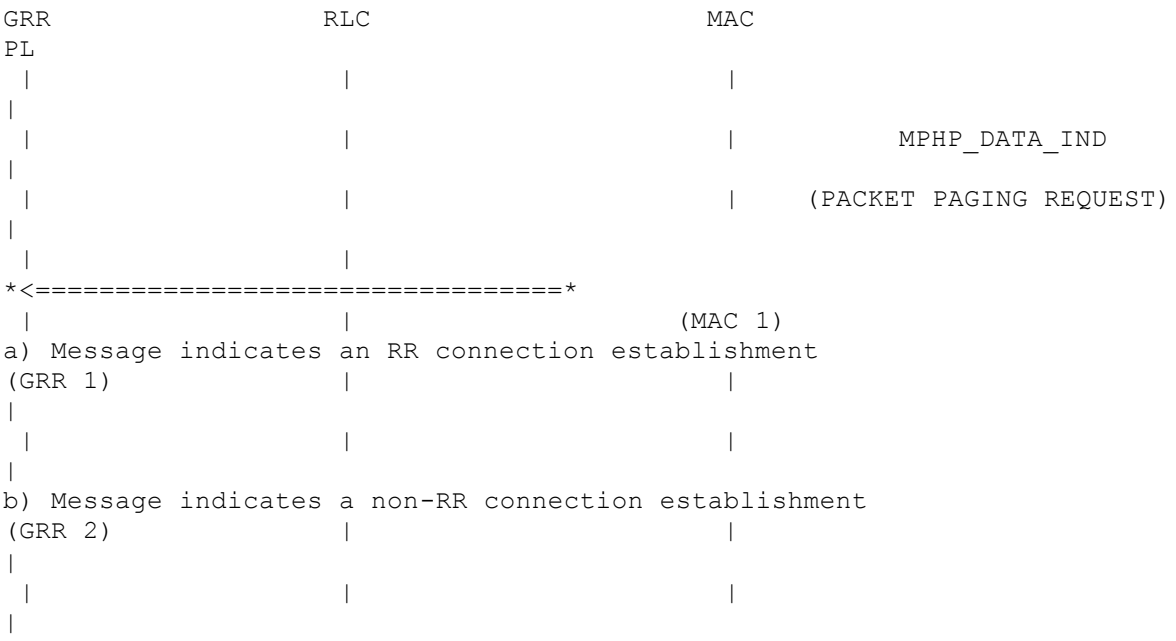
(PL 1)
If the upper layer wants to transmit LLC PDUs, then the GRR composes PACKET CHANNEL REQUEST message and posts it to the PL. The PL sends this message on PRACH corresponding to its PCCCH_GROUP. The GRR can send maximum MAX_RETRANS + 1 times PACKET CHANNEL REQUEST. The GRR set the Retry (R) bit 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).

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

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>

3.2.2 Receiving packet paging request during packet access procedure



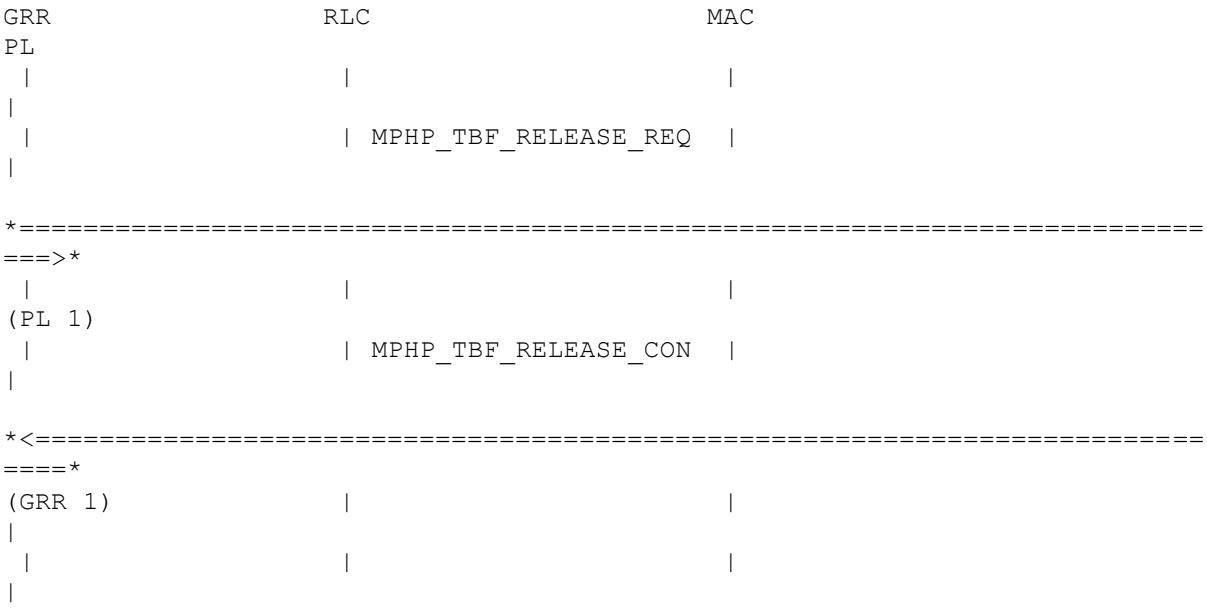
(MAC 1)
The MAC receives a PACKET PAGING REQUEST.

(GRR 1)
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.

(GRR 2)
This message will be ignored by all MS classes.

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

3.2.3 Stop the uplink TBF establishment

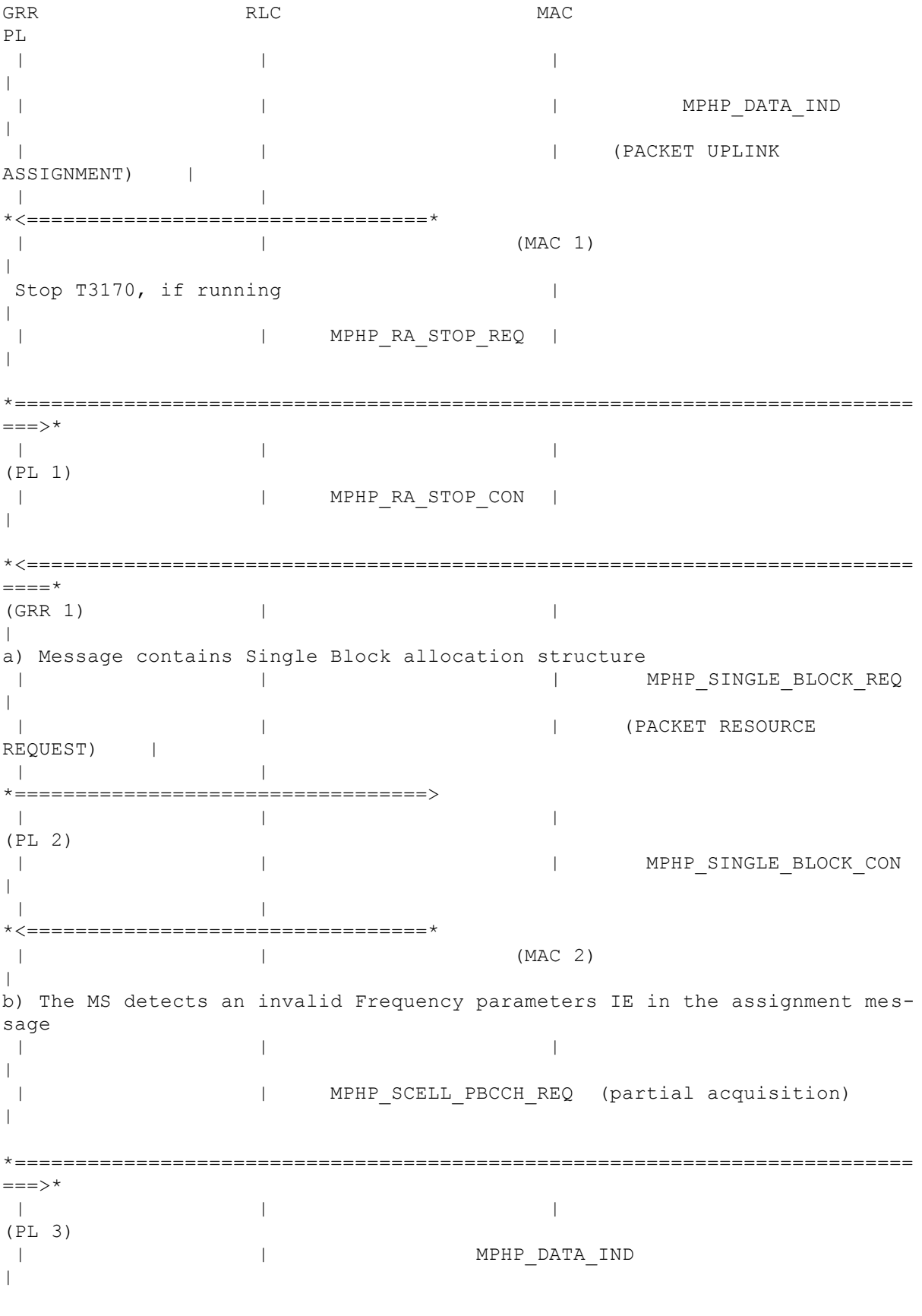


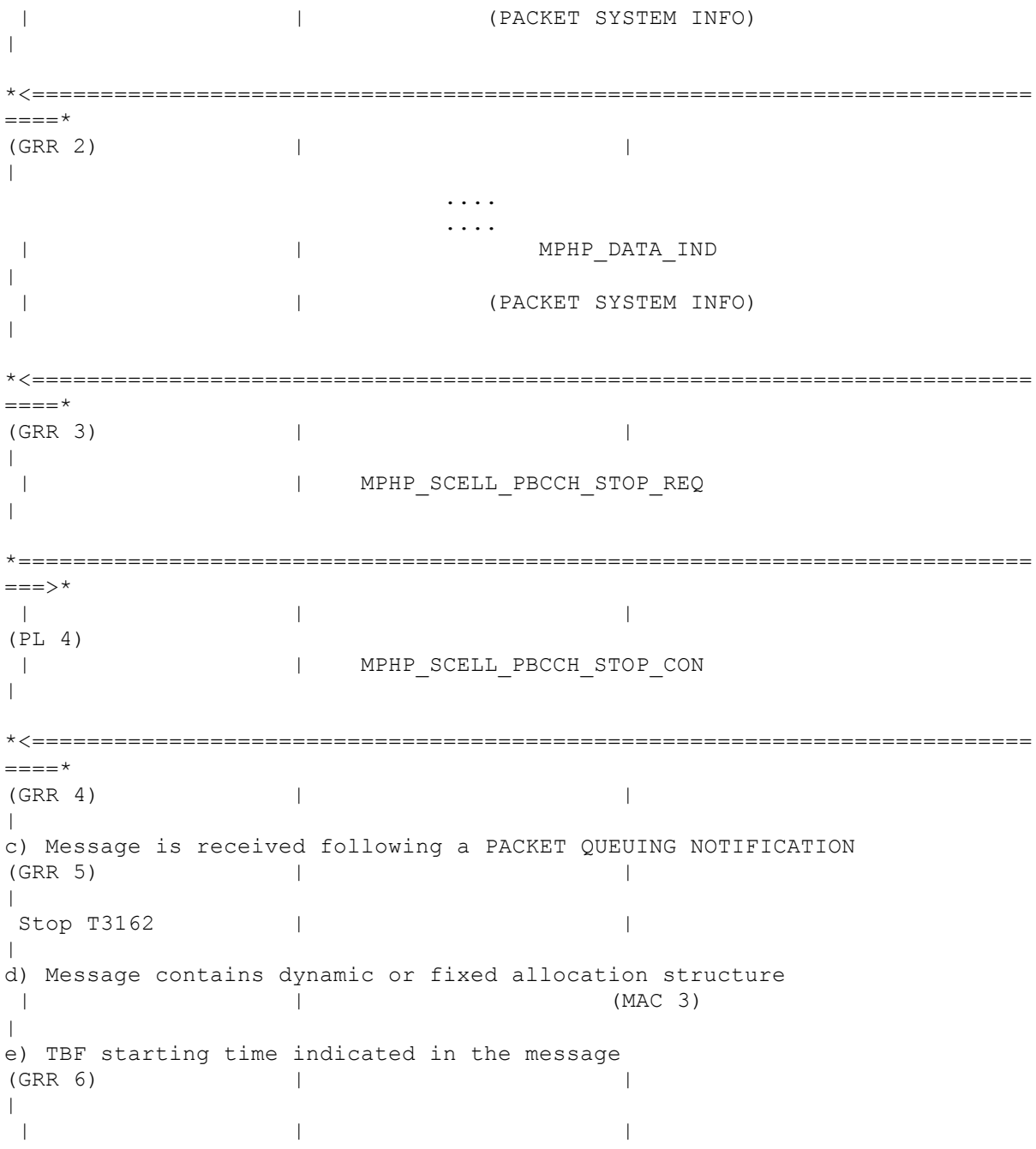
(PL 1)
The GRR stops to send message on PRACH.

(GRR 1)
The PL confirms the received message.

Requirements:
defined in S921

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





(PL 1)
The PL stops to sending channel requests.

(GRR 1)
The PL confirms that the sending of channel requests was stopped.

(MAC 1)
The PL sends the received PACKET UPLINK ASSIGNMENT message to MAC.

(PL 2)
The MAC sends PACKET RESOURCE REQUEST to start the two phase access. This message is sent on the channel which is indicated via Single Block Allocation structure.

(MAC 2)
The PL confirms that the PACKET RESOURCE REQUEST was sent.

(PL 3)
If the MS detects an invalid frequency parameters IE in the assignment message, the MS aborts the procedure, if required initiates a partial acquisition of PBCCH or BCCH and may reinitiate this procedure.

(GRR 2-3)
The PL indicates the read packet system information to the GRR.

(PL 4)
The GRR stops to read the packet system information.

(GRR 4)
The PL confirms the stop request.

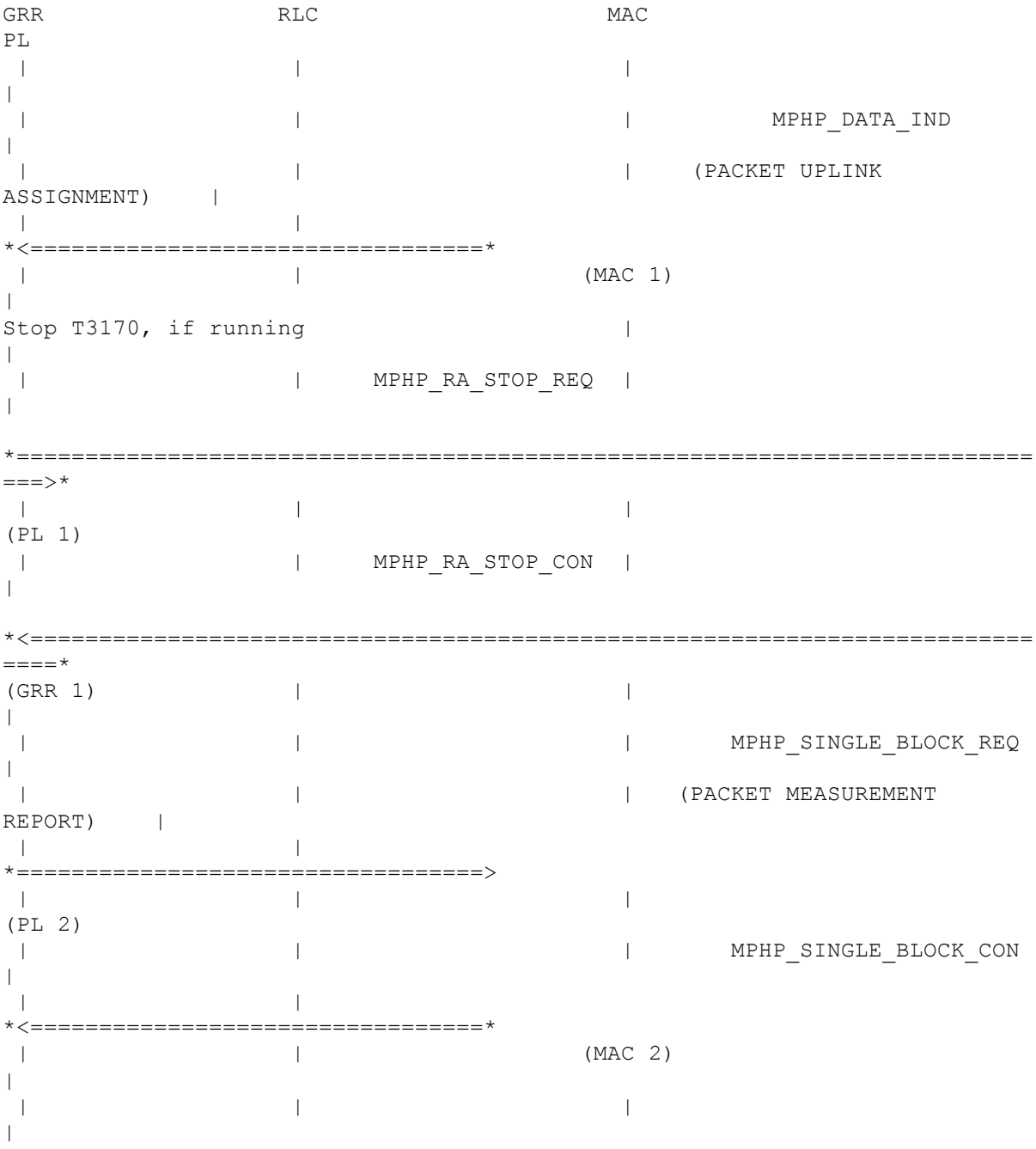
(GRR 5)
The GRR stops timer T3162 and switches to the assigned PDCHs.

(MAC 3)
The MAC 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>

3.2.5 Packet assignment procedure (The MS has indicated a measurement report)



(PL 1)
The PL stops to sending channel requests.

(GRR 1)
The PL confirms that the sending of channel requests was stopped.

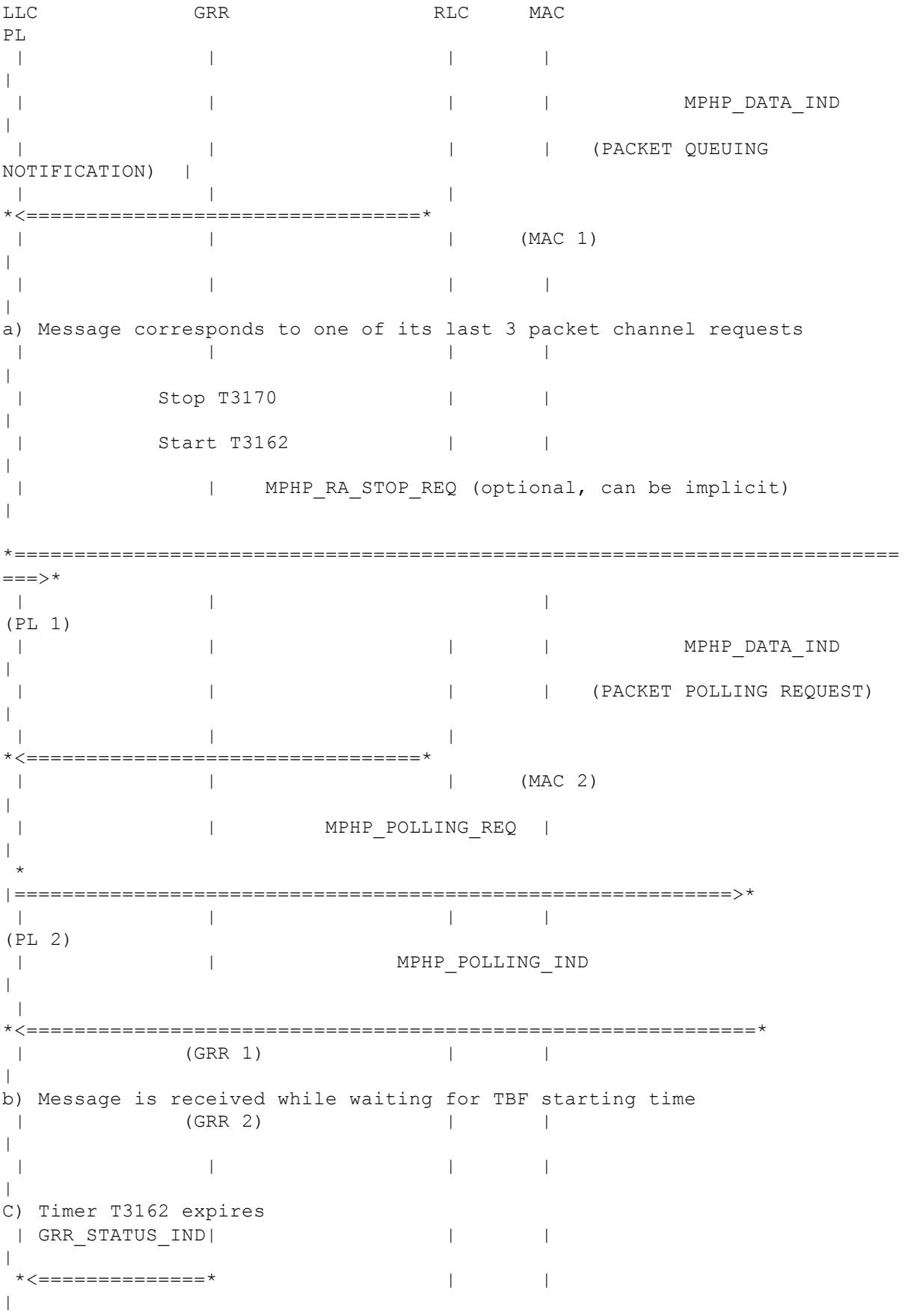
(MAC 1)
The MAC receives the PACKET UPLINK ASSIGNMENT message. This message contains the PDCH on which the measurement report should be send. The GRR stops the timer T3170.

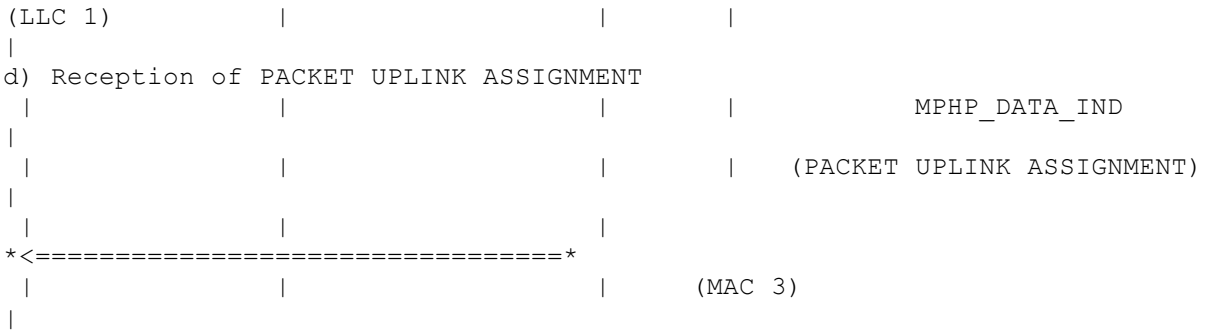
(PL 2)
The MAC composes the PACKET MEASUREMENT REPORT structure and sends it on the assigned PDCH.

(MAC 2)
The PL confirms the sent of the message.

Requirements:
<R.MAC.REC_CHRQ.M.006>, <R.MAC.REC_CHRQ.M.014>

3.2.6 Receipt of packet queuing notification





(MAC 1)
The MAC receives the PACKET QUEUING NOTIFICATION message.

(PL 1)
The GRR stops the timer T3170 if running and starts the timer T3162, and stop 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 LLC 1).

(MAC 2)
The MAC deliver a PACKET CONTROL ACKNOWLEDGEMENT within a MPHP_POLLING_RESPONSE_REQUESTS to PL.

(PL 2)
PL transmits PACKET CONTROL ACKNOWLEDGEMENT.

(GRR 1)
GRR restarts T3162.

(GRR 2)
The GRR ignores this message.

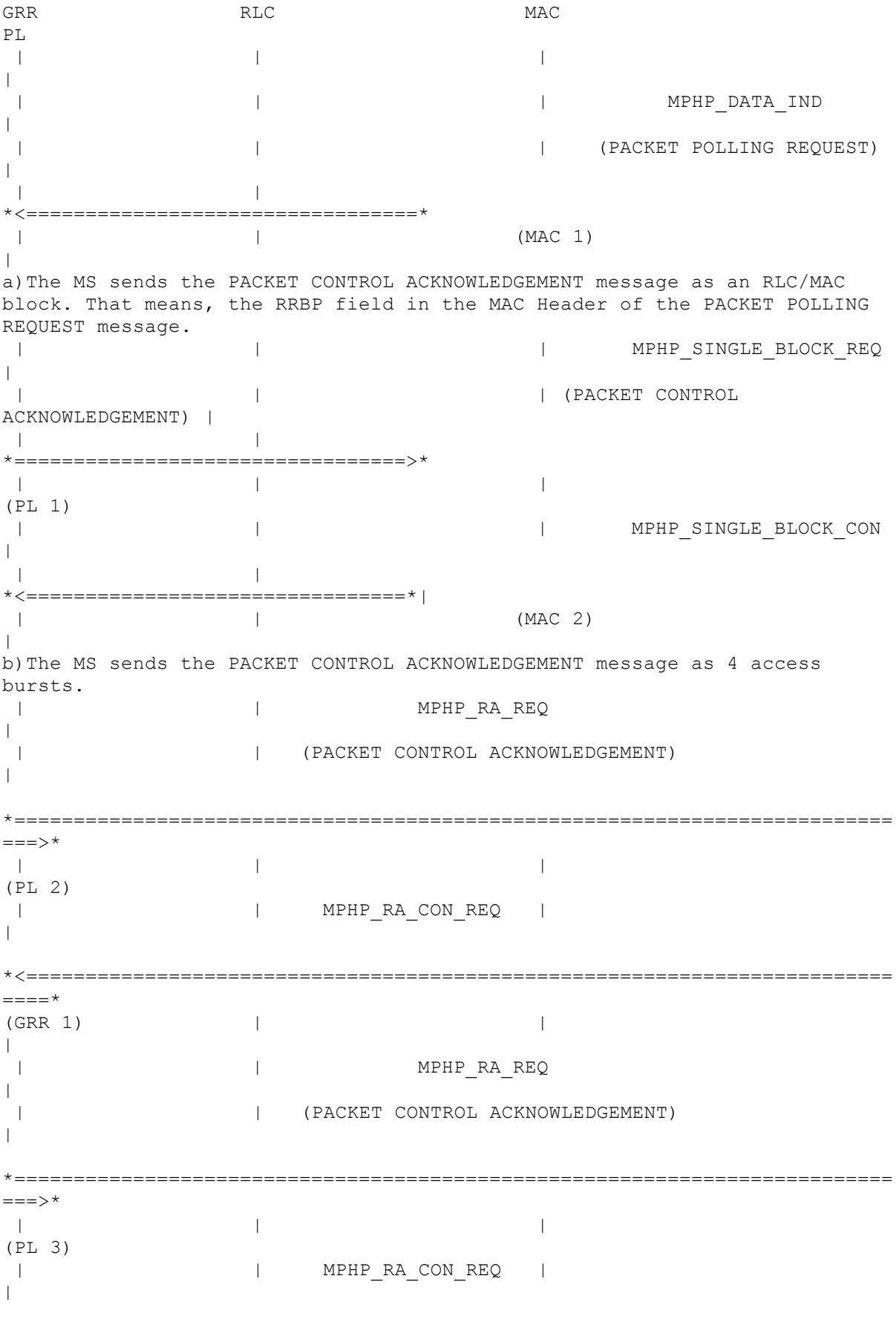
(MAC 2)
The PL indicates a PACKET POLLING REQUEST message. The timer T3162 should be restarted.

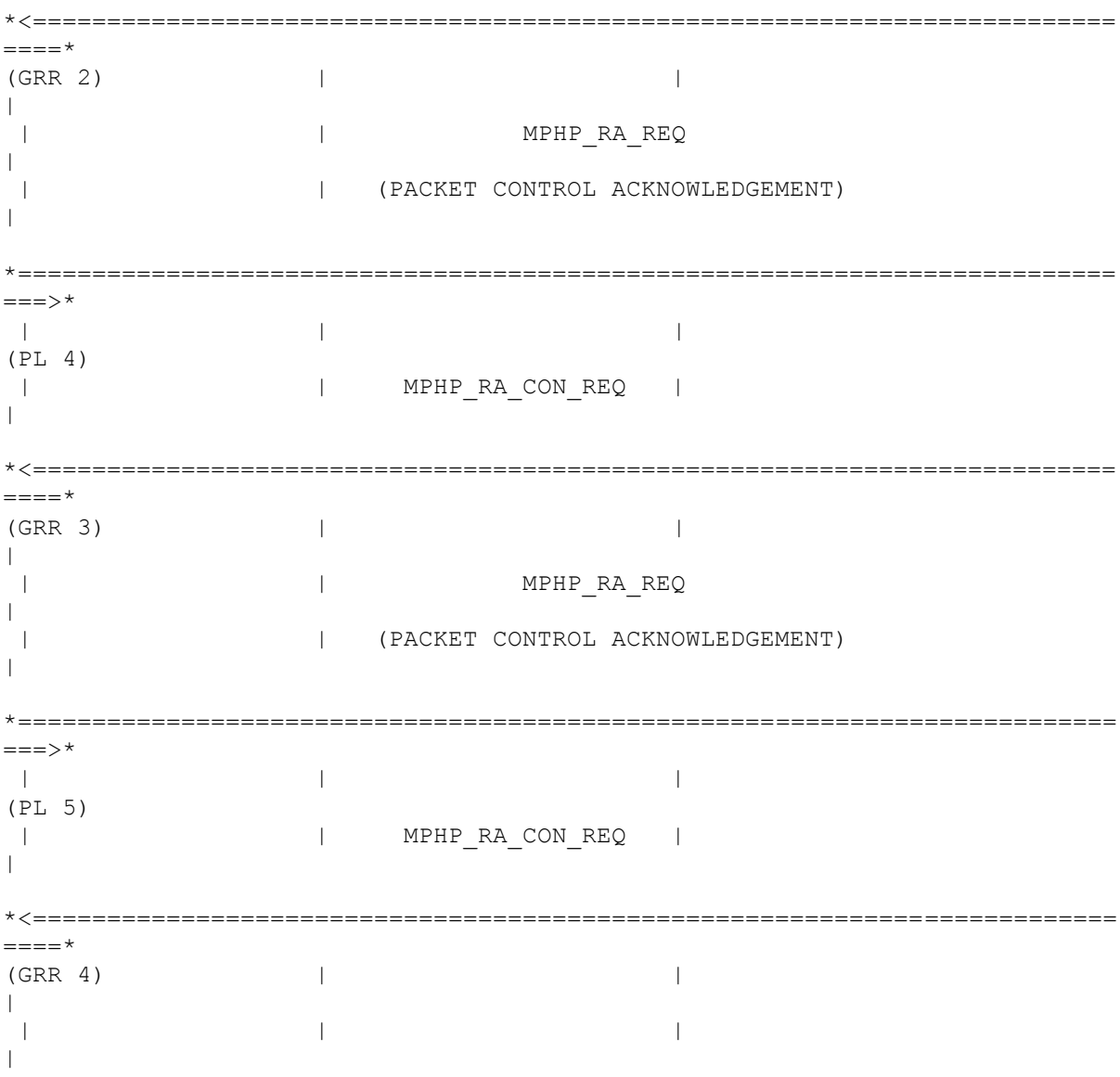
(LLC 1)
GRR sends to the LLC packet access failure indication via GRR_STATUS_IND. Cause field contains: Failure during packet access procedure, e.g. T3162 expired.

(MAC 3)
After reception of a PACKET UPLINK ASSIGNMENT the packet queueing procedure is finished, T3162 shall be stopped, T3164 started and GRR a should continue with TBF assignement procedure.

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

3.2.7 Packet polling procedure





(MAC 1)
The PL indicates the PACKET POLLING REQUEST to the MAC. The timer T3162 should be restarted.

(PL 1)
If the CONTROL_ACK_TYPE (broadcast in PSI1 or (P)SI 13) indicates RLC/MAC control block, then the PACKET CONTROL ACKNOWLEDGEMENT message is sent within a RLC/MAC block. The MPHP_SINGLE_BLOCK_REQ is used to transfer the block.

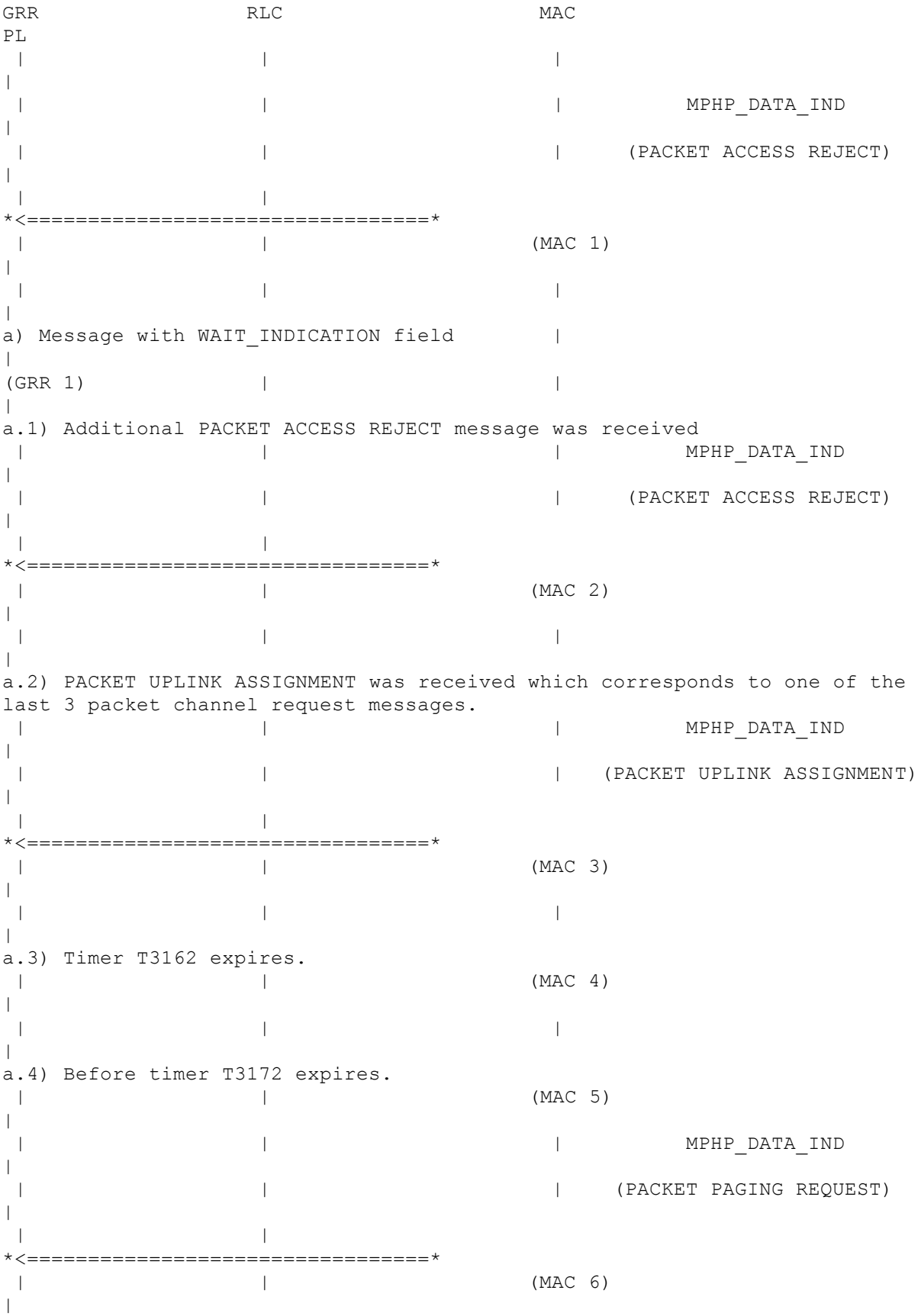
(MAC 2)
The PL confirms that the single block.

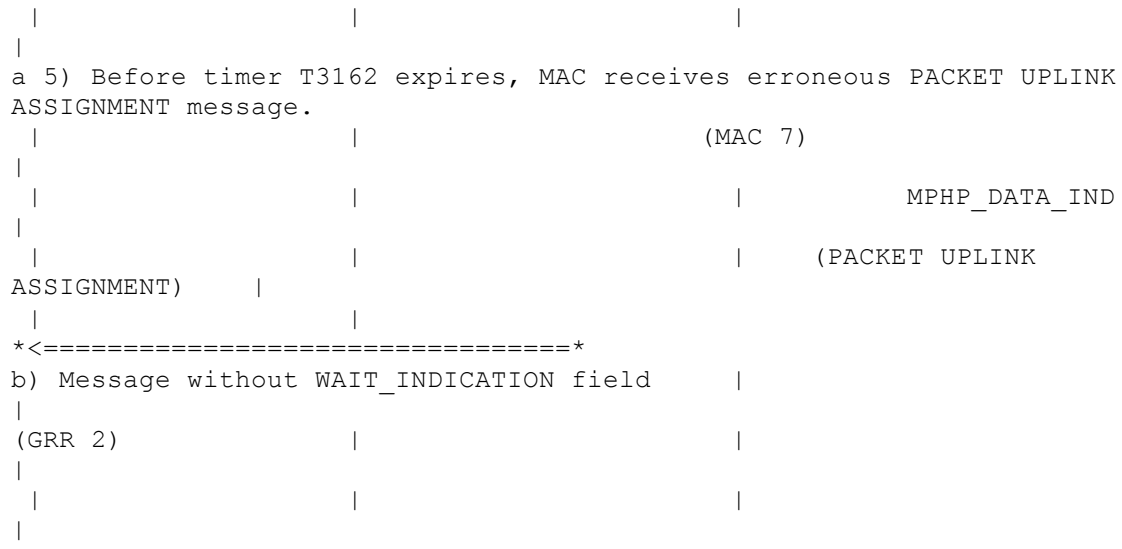
(PL 2-5)
If the CONTROL_ACK_TYPE indicates 4 access bursts, the PACKET CONTROL ACKNOWLEDGEMENT message is sent as random access burst.

(GRR 1-4)
The PL confirms the random access request.

Requirements:
<R.MAC.P_POLL.M.003>

3.2.8 Receipt of packet access reject message





(MAC 1)
The MAC receives the PACKET ACCESS REJECT message.

(GRR 1)
The 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

(MAC 2)
The MAC receives additional PACKET ACCESS REJECT message while waiting. The MAC ignores these messages.

(MAC 3)
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.

(MAC 4)
If the timer T3162 expires the MS shall return to packet idle mode.

(MAC 5)
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.

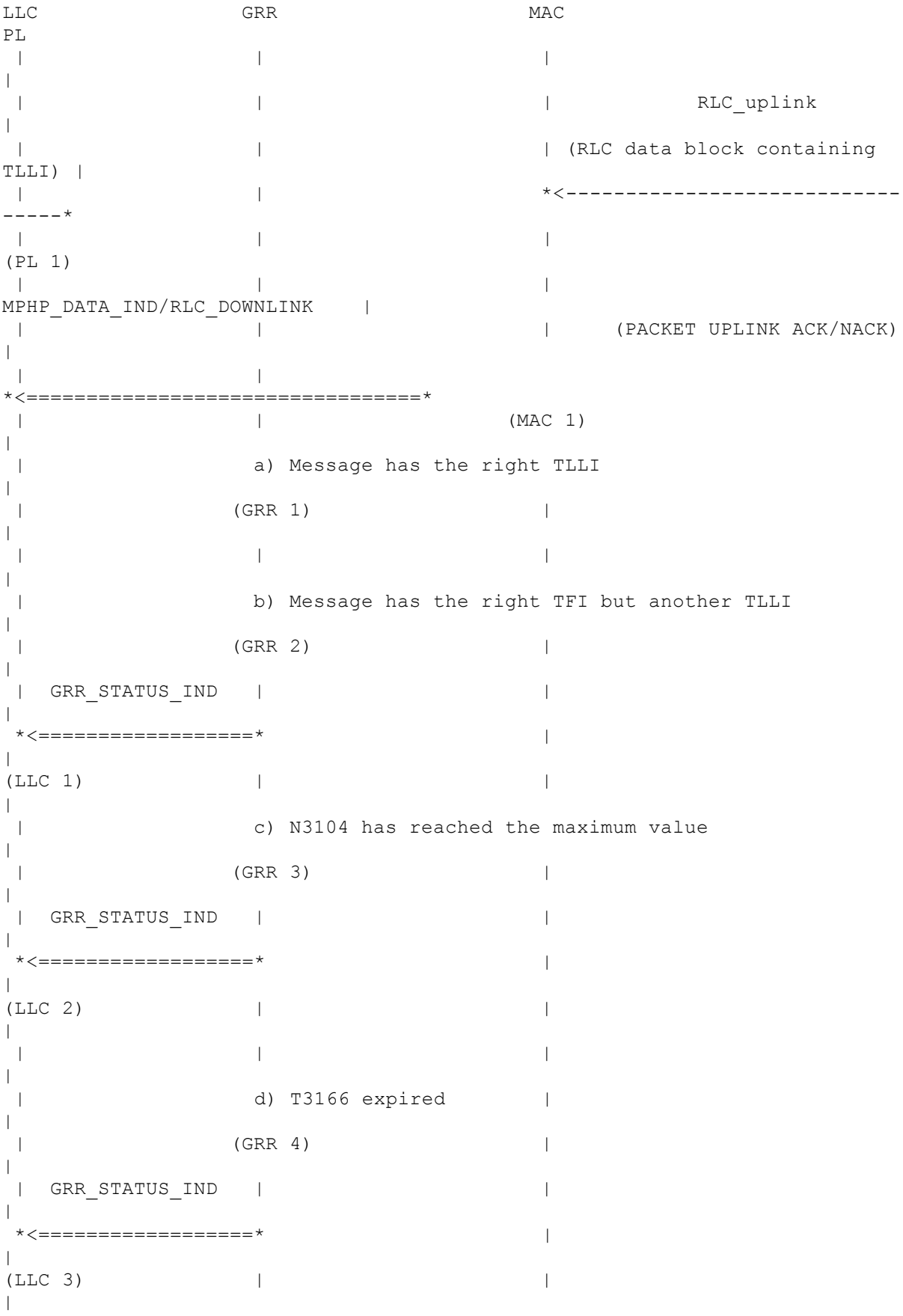
(MAC 6)
The MAC shall ignore the received PACKET PAGING REQUEST messages except paging request to trigger RR connection establishment.

(MAC 7)
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.

(GRR 2)
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>

3.2.9 Contention resolution completion/failure at one phase access



(PL 1)
The MAC 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

(MAC 1)
The MS receives a PACKET UPLINK ACK/NACK message.

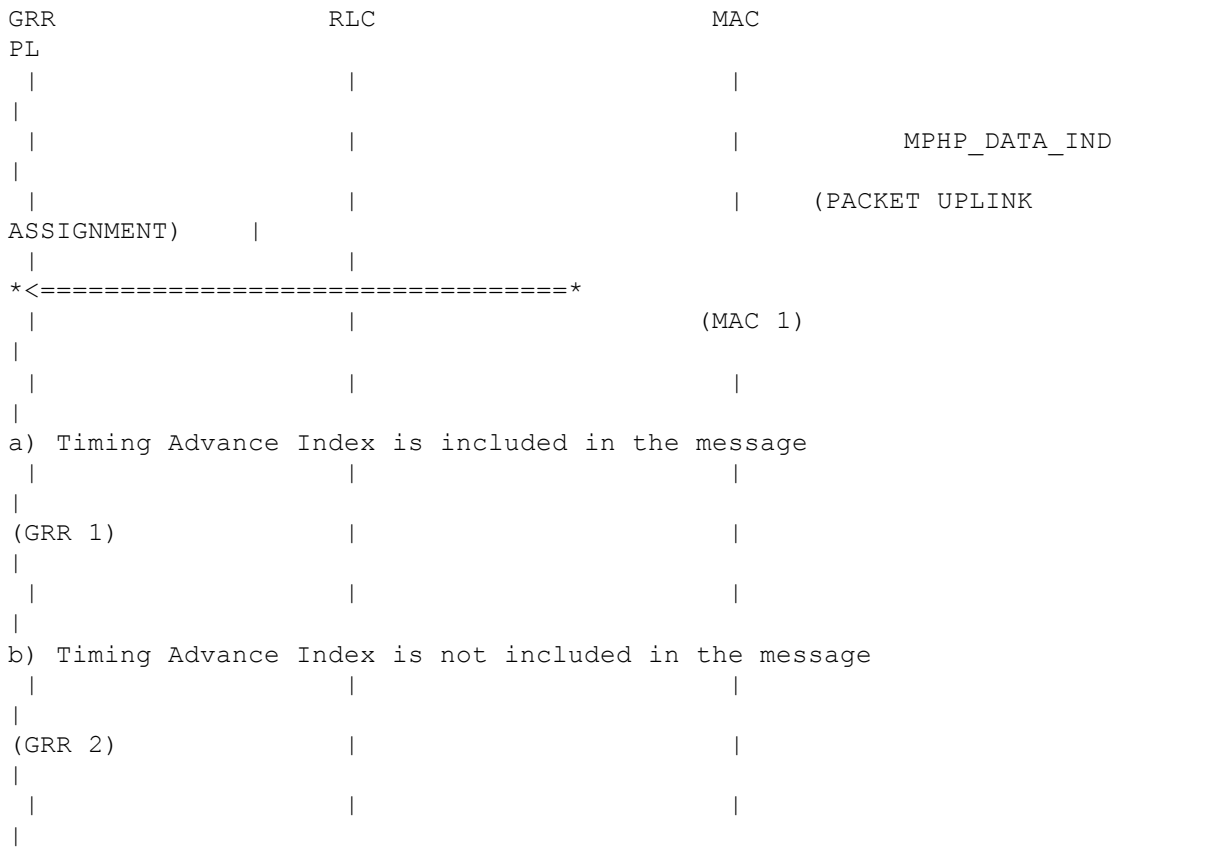
(GRR 1)
Contention resolution completed. Stop T3166 and N3104.

(GRR 2, 3, 4)
Contention resolution fails. Reset of N3104, stop 3166, stop 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>

3.2.10 Timing Advance



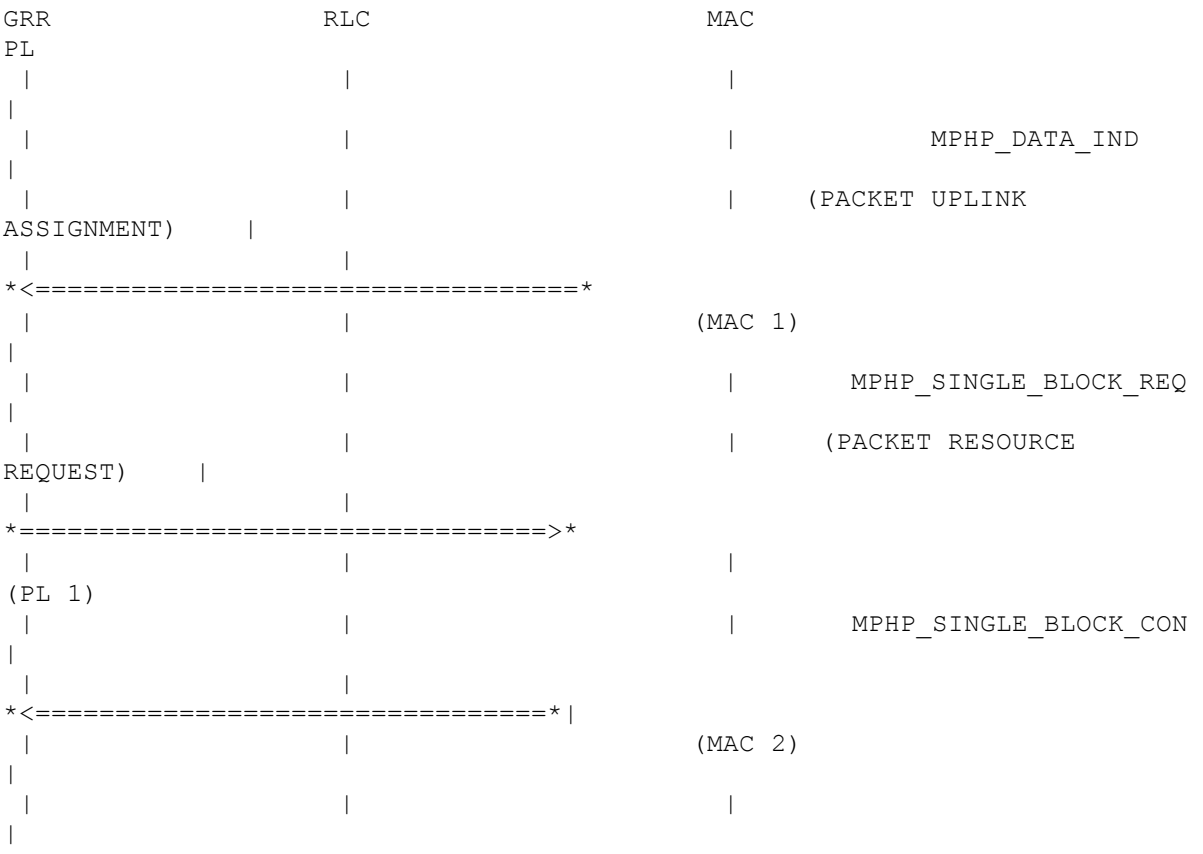
(MAC 1)
The MAC receives a PACKET UPLINK ASSIGNMENT message.

(GRR 1)
In this case the continuous update timing advance mechanism should be used.(Under construction!!!)

(GRR 2)
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>

3.2.11 TBF establishment using two phase access



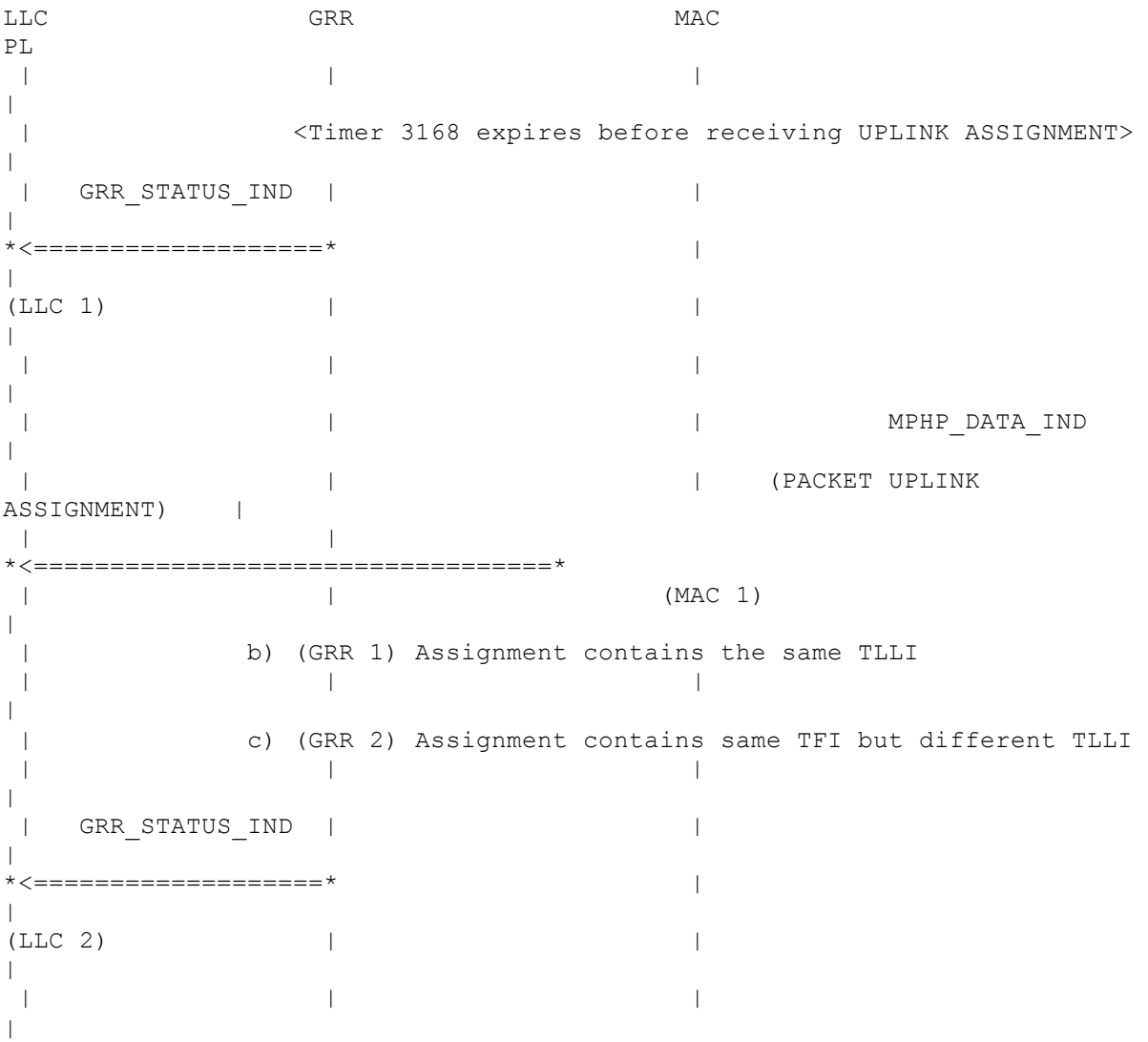
(MAC 1)
MAC receives PACKET UPLINK ASSIGMENT message which contains single block allocation structure.

(PL 1)
MAC composes a PACKET RESOURCE REQUEST message and sends it to the PL. Start 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.

(MAC 2)
The PL confirms that the requested message was sent.

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

3.2.12 Contention resolution at two phase access



(LLC 1)
GRR indicates to the LLC via GRR_STATUS_IND that a RLC/MAC error has occurred (T3168 expired).

(MAC 1)
MAC receives PACKET UPLINK ASSIGMENT message which contains single block allocation structure.

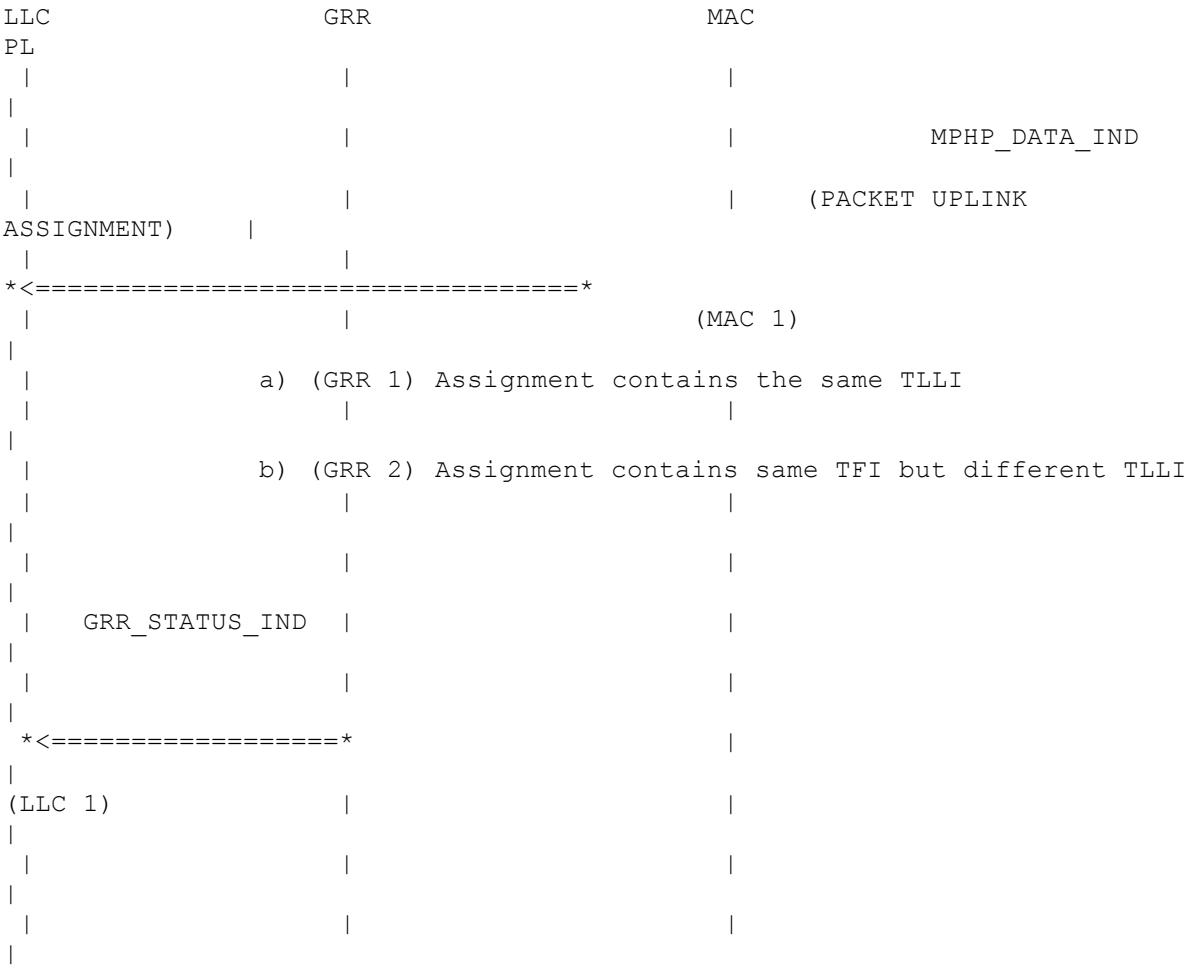
(GRR 1)
MAC receives PACKET UPLINK ASSIGMENT message which contains the same TLLI as the MAC has included in the PACKET RESOURCE REQUEST message. The GRR stops T3168.

(GRR 2)
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.

(LLC 2)
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>

3.2.13 Abnormal cases (muss noch gemacht werden)



(MAC 1)
MAC receives PACKET UPLINK ASSIGMENT message which contains single block allocation structure.

(GRR 1)
MAC receives PACKET UPLINK ASSIGMENT message which contains the same TLLI as the MAC has included in the PACKET RESOURCE REQUEST message. The GRR stops T3168.

(GRR 2)
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.

(LLC 1)
GRR indicates to the LLC via GRR_STATUS_IND that a TBF failure has occurred.

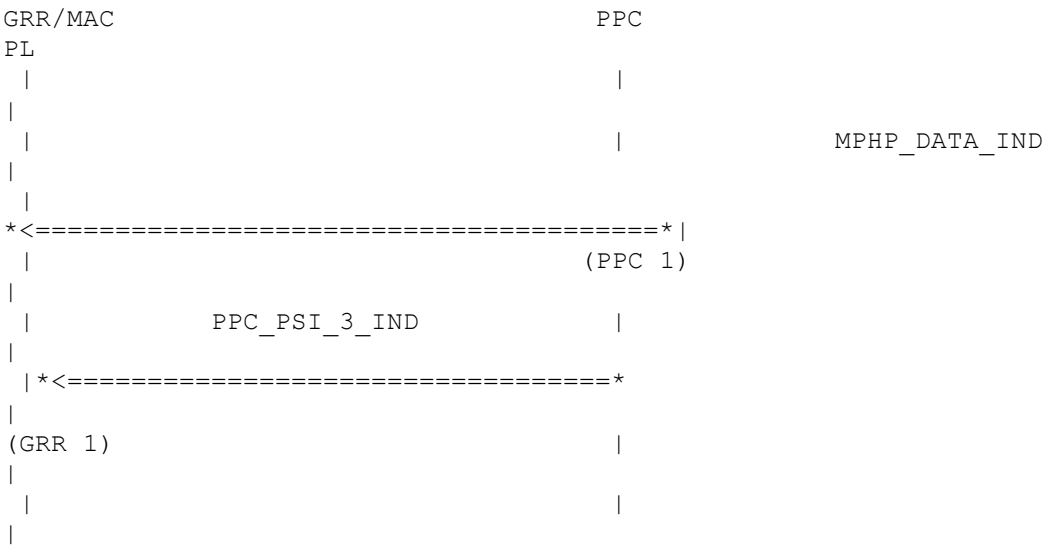
Requirements:
<R.MAC.AB_PCCCH.M.00x>

3.3 Neighbour Cell Syncronisation

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

- Defintion of BCCH allocation(BA_GPRS)
- Synchronisation to neighbourcells
- Fieldstrength measurements

3.3.1 Defintion of BCCH allocation (BA_GPRS)



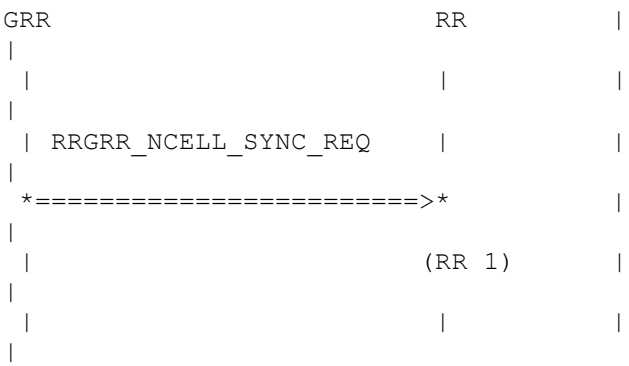
(PPC 1)

PPC receives an MPHP_DATA_IND including a psi 3 message.

(GRR 1)

GRR receives a psi 3 meassge, which includes the BCCH allocation (BA list for GPRS). These ncells are stored. If needed GRR starts synchronisation and/or measurements to ncells.

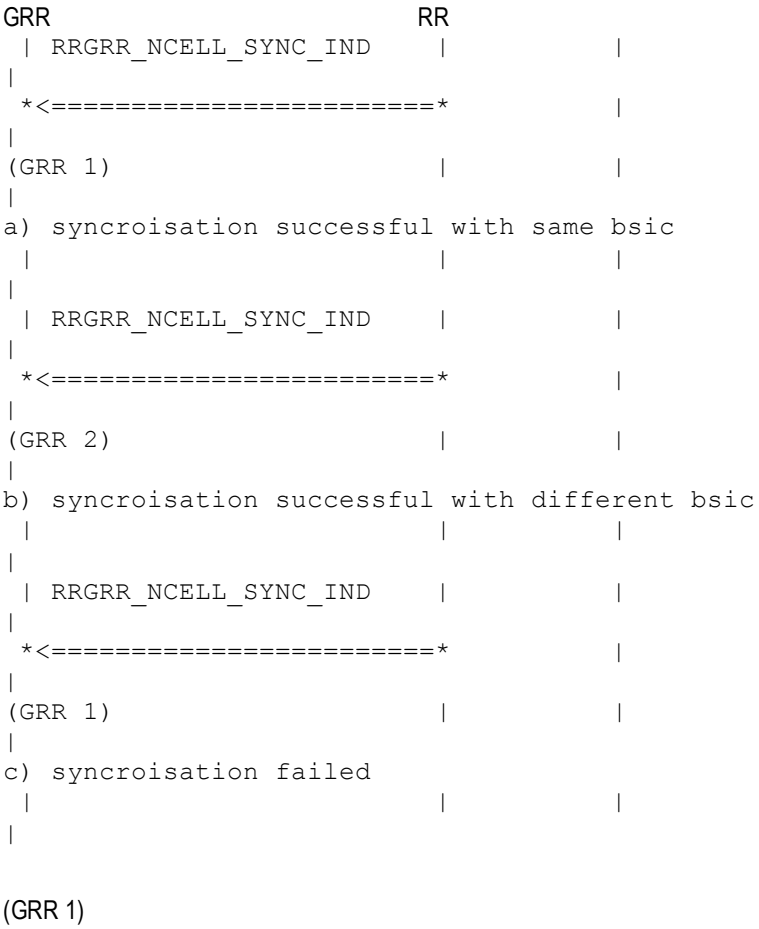
3.3.2 Synchronisation Request of ncells



(RR 1)

GRR requests the synchronisation to ncells. RR starts its own procedures to synchronize the neighbour cells (see MSC document of TI++ chapter 5).

3.3.3 Conformation of Synchronisation to ncells



(GRR 1)
RR indicates a successful syncronisation to ncells with the same bsic.

(GRR 2)
RR indicates a successful syncronisation to ncells with the different bsic. The carrier is treated as a new carrier.

(GRR 3)

RR indicates a failed syncronisation to ncell(s).

3.4 Performing measurements

This part describes the measurement procedures performed via MPHP –on PCCCH- and MPHC –on CCCH- in GPRS mode. This part contains an interface named **P**acket **P**hysical layer **C**onvergence (PPC). This interface allows different physical layer software to use Condat layer 2&3 and vice versa.

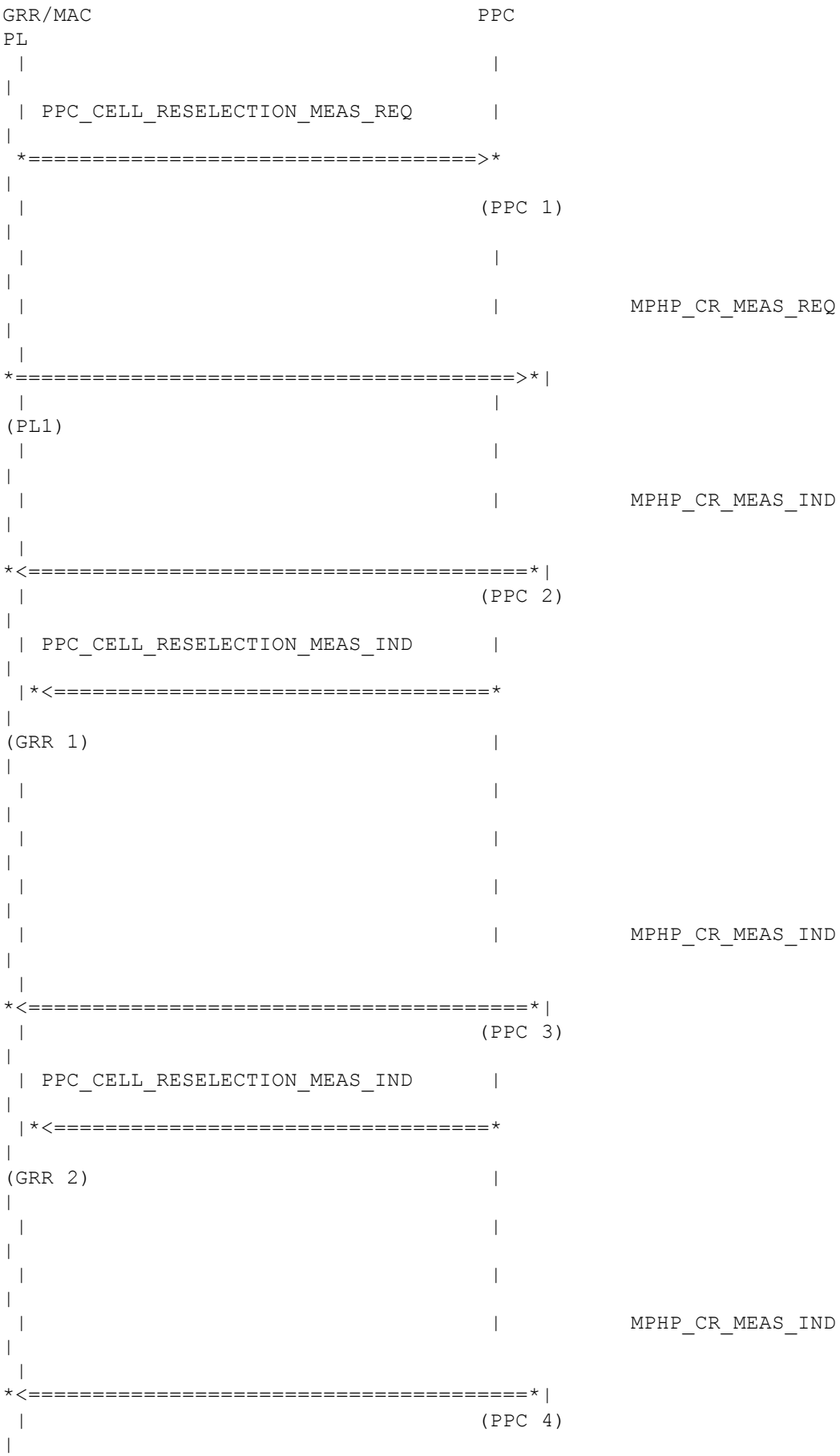
3.4.1 Measurements on PCCCH

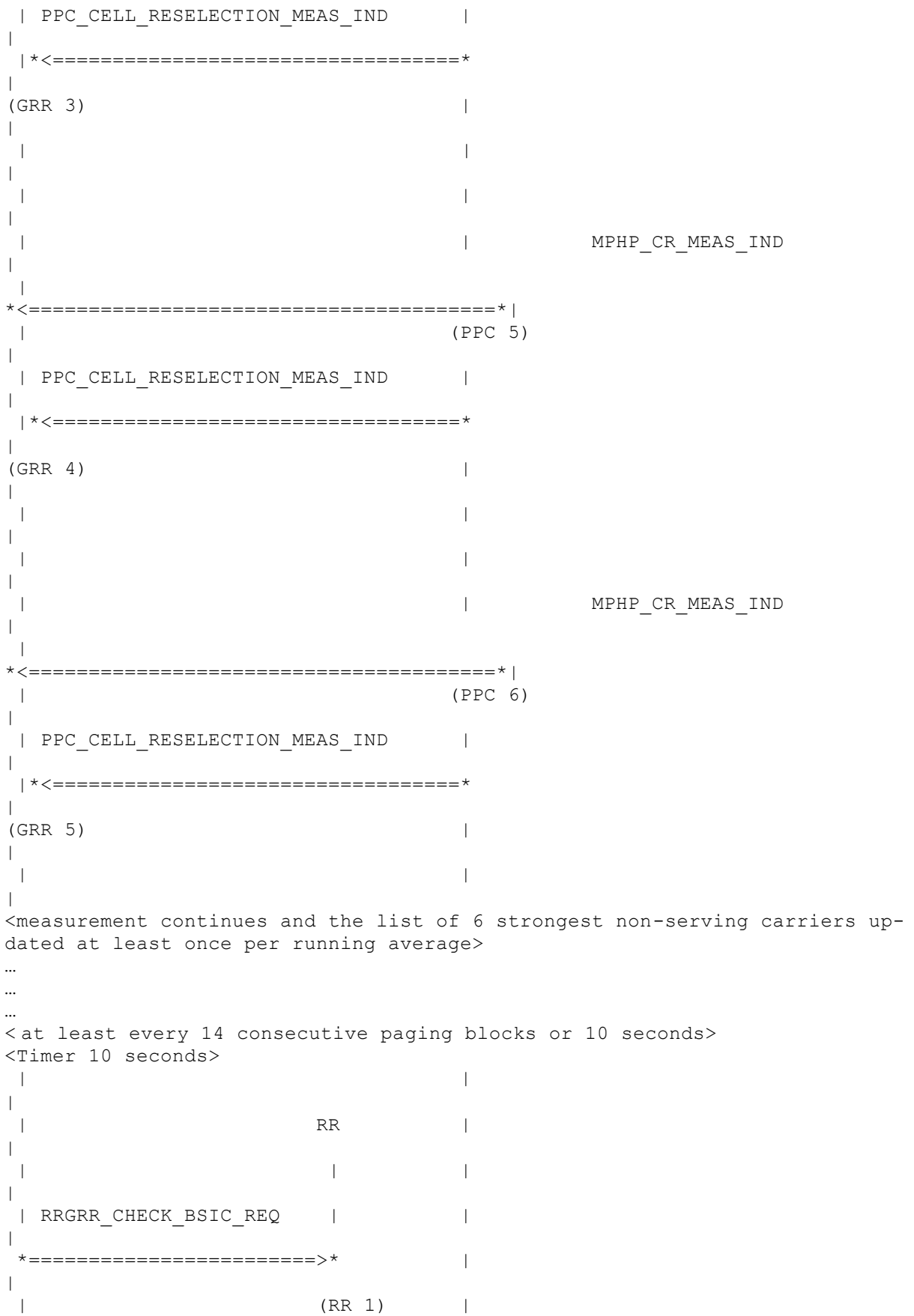
The MS shall not use the discontinuous reception (DRX) mode of operation (i.e. powering itself down when it is not expecting paging messages from the network) while performing the cell selection algorithm defined in GSM 03.22.

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 sub-clause 10.1.1.

3.4.1.1 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.


GRR/MAC
PPC
PL
PPC_CELL_RESELECTION_MEAS_REQ
(PPC 1)
MPHP_CR_MEAS_REQ
(PL1)
MPHP_CR_MEAS_IND
(PPC 2)
PPC_CELL_RESELECTION_MEAS_IND
(GRR 1)
MPHP_CR_MEAS_IND
(PPC 3)
PPC_CELL_RESELECTION_MEAS_IND
(GRR 2)
MPHP_CR_MEAS_IND
(PPC 4)


PPC_CELL_RESELECTION_MEAS_IND
(GRR 3)
MPHP_CR_MEAS_IND
(PPC 5)
PPC_CELL_RESELECTION_MEAS_IND
(GRR 4)
MPHP_CR_MEAS_IND
(PPC 6)
PPC_CELL_RESELECTION_MEAS_IND
(GRR 5)
<measurement continues and the list of 6 strongest non-serving carriers up-dated at least once per running average>
…
…
…
< at least every 14 consecutive paging blocks or 10 seconds>
<Timer 10 seconds>
RR
RRGRR_CHECK_BSIC_REQ
(RR 1)

(PPC 1)

PPC receives a request for performing measurements for a list of BCCH carriers for surrounding cells as indicated in BA (GPRS), e.g. send in PSI3/PSI3bis, and serving cell BCCH frequency that are used for cell reselection and optionally the NC_FREQUENCY_LIST. This list adds or deletes some frequencies from the BA (GPRS) list.

(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]

(PPC 2)

PL sends received signal level measurement samples to PPC. 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)

PPC 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.

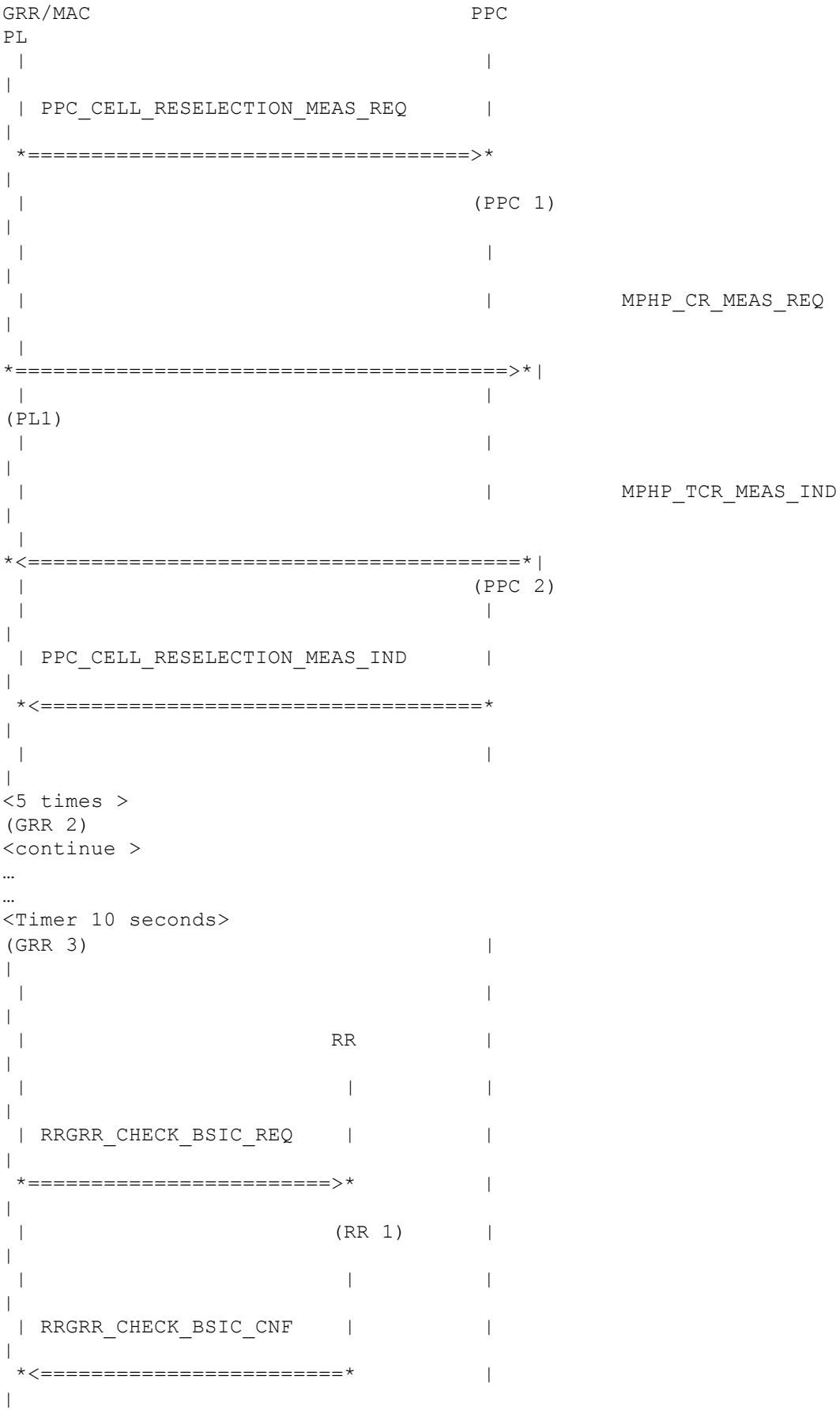
(GRR 2,3,4,5 and PPC 3,4,5,6)
See comments in GRR1 and PPC 2.
In addition the MS shall verify the BSIC of the BCCH carriers. Only cells with allowed BSIC shall be considered for reselection. The allowed BSIC is either the BSIC broadcast for that carrier in the BA (GPRS) list or, for cells in BA (BCCH) where no BSIC is broadcast, a BSIC with allowed NCC part.

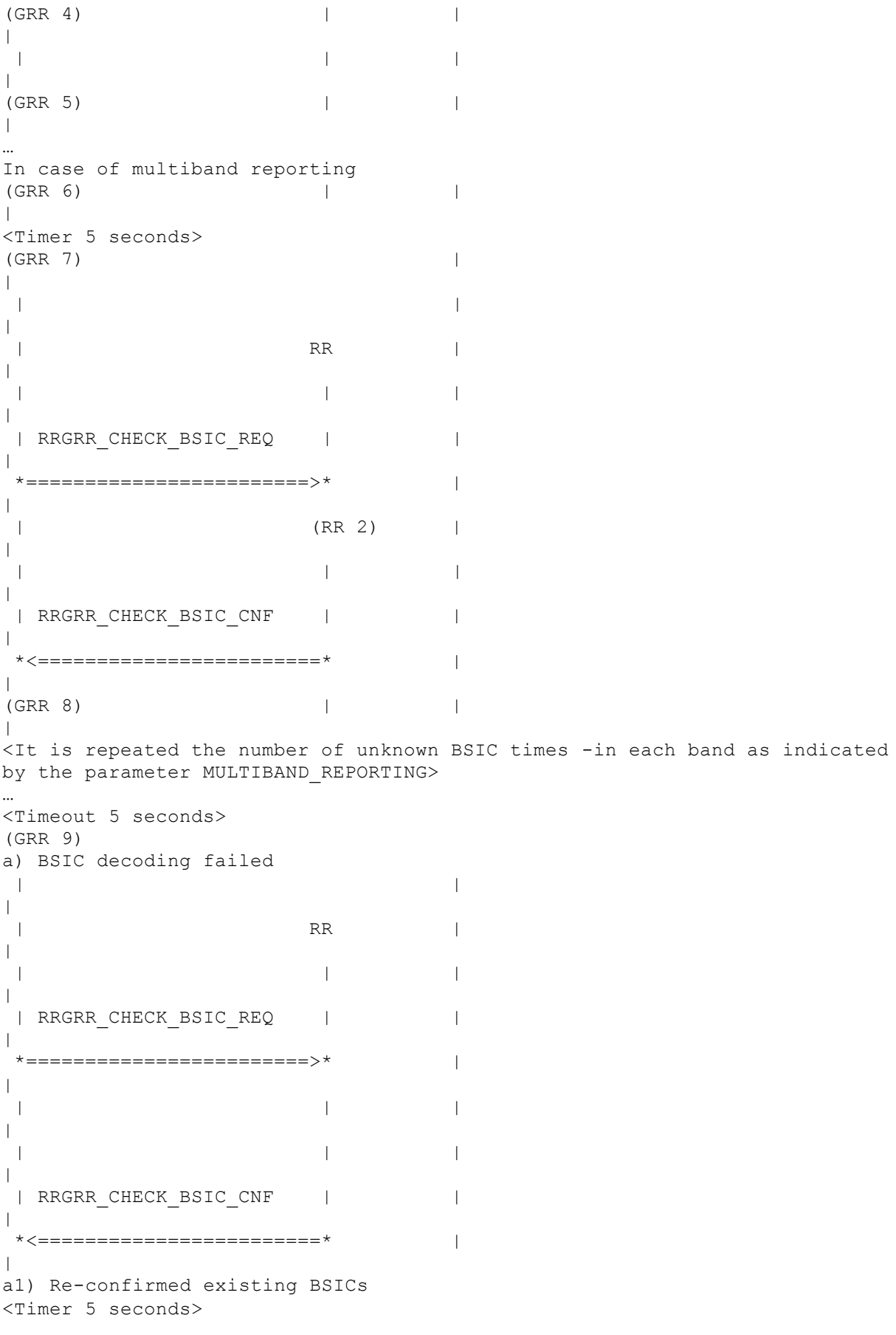
(RR 1)
GRR sends the BSIC of the 6 strongest non-serving cell BCCH carriers to check.

(GRR 7)
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.

3.4.1.2 Packet transfer mode


GRR/MAC
PPC
PL
PPC_CELL_RESELECTION_MEAS_REQ
(PPC 1)
MPHP_CR_MEAS_REQ
(PL1)
MPHP_TCR_MEAS_IND
(PPC 2)
PPC_CELL_RESELECTION_MEAS_IND
<5 times >
(GRR 2)
<continue >
…
…
<Timer 10 seconds>
(GRR 3)
RR
RRGRR_CHECK_BSIC_REQ
(RR 1)
RRGRR_CHECK_BSIC_CNF


(GRR 4)
(GRR 5)
…
In case of multiband reporting
(GRR 6)
<Timer 5 seconds>
(GRR 7)
RR
RRGRR_CHECK_BSIC_REQ
(RR 2)
RRGRR_CHECK_BSIC_CNF
(GRR 8)
<It is repeated the number of unknown BSIC times -in each band as indicated by the parameter MULTIBAND_REPORTING>
…
<Timeout 5 seconds>
(GRR 9)
a) BSIC decoding failed
RR
RRGRR_CHECK_BSIC_REQ
RRGRR_CHECK_BSIC_CNF
a1) Re-confirmed existing BSICs
<Timer 5 seconds>

```
  |                                          |
|
  |                            RR            |
|
  |                             |            |
|

see notes following a1)
```

(PPC 1, PL 1)
After entering the packet transfer mode, GRR starts via PPC received signal level measurements.

(PPC 2, GRR 1)
PPC 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:

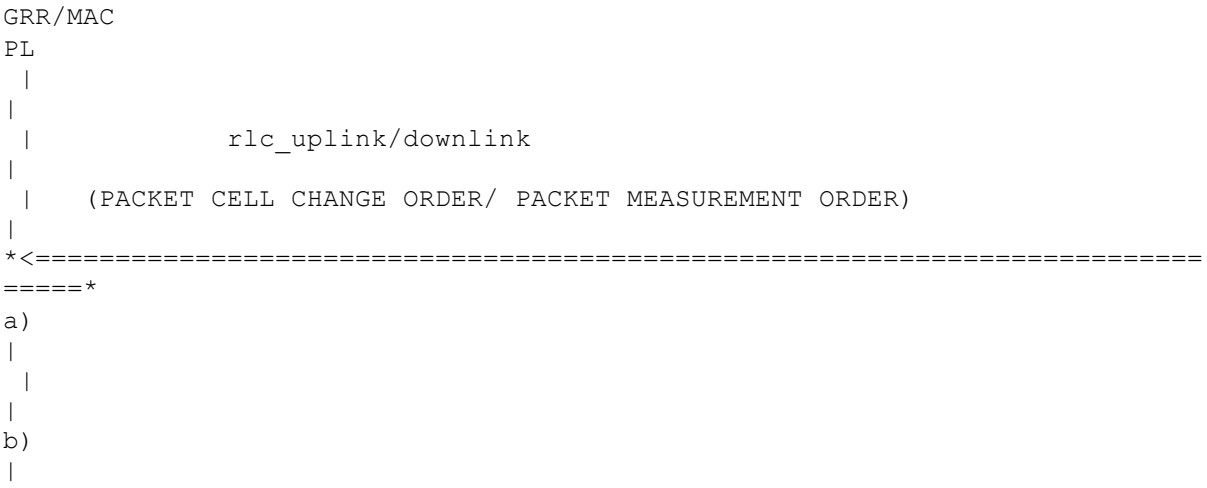
- If either no BSIC can be decoded on a surrounding cell BCCH carrier, or the BSIC is not allowed, then the received signal level measurements on that channel shall be discarded and the MS shall continue to monitor that channel.

- 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.

3.4.2 Measurements on CCCH

There are no PBCCH present in the cell.



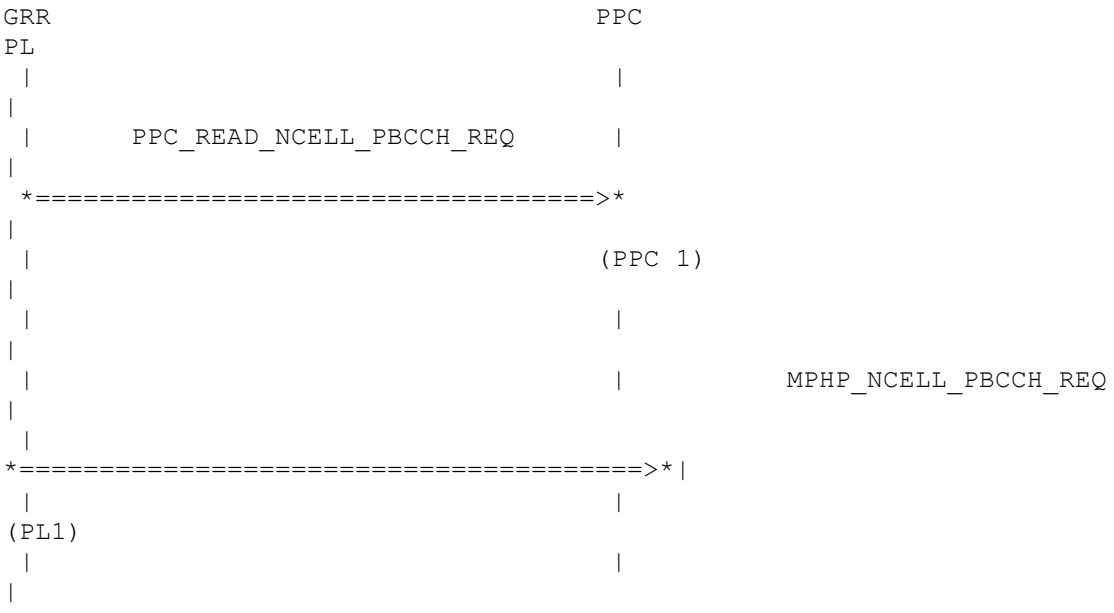
a)
GRR receives cell re-selection parameters in a Packet Cell Change Order or Packet Measurement Order message on PACCH, e.g. during transfer mode. GRR takes the cell selection and measurement procedures for GPRS into account

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.

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

GRR deceides to change the cell in packet idle mode. The decision depends on the fieldstrength measurements of the lower layer.

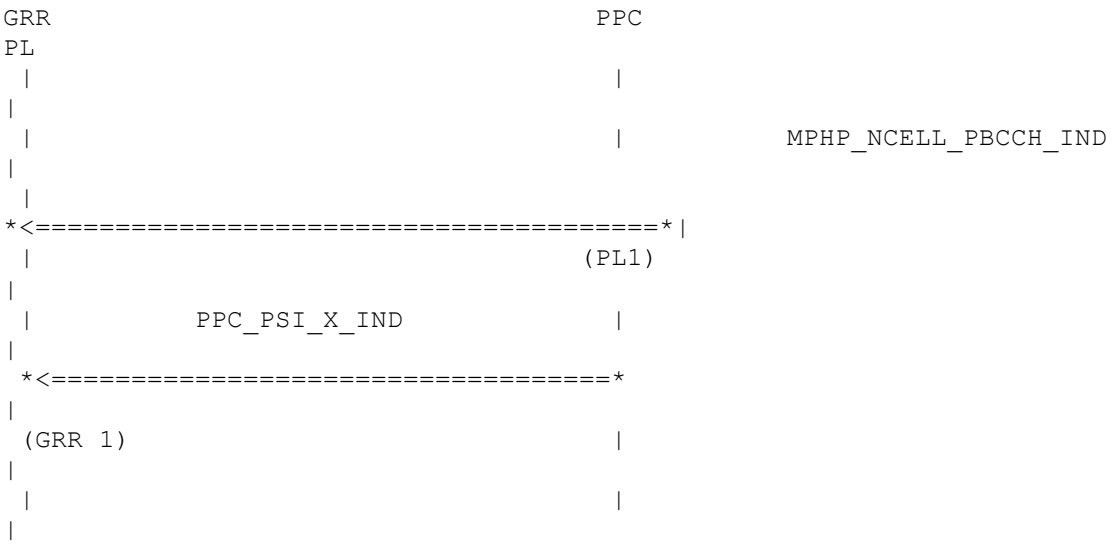
3.5.1 Read the pbcch of the new cell



(PPC 1)
GRR requests the reading of the potenally new cell.

(PL 1)
PPC indicate the to L1 to read the indacted neighbourcell.

3.5.2 Receiving of PSIs in the new cell

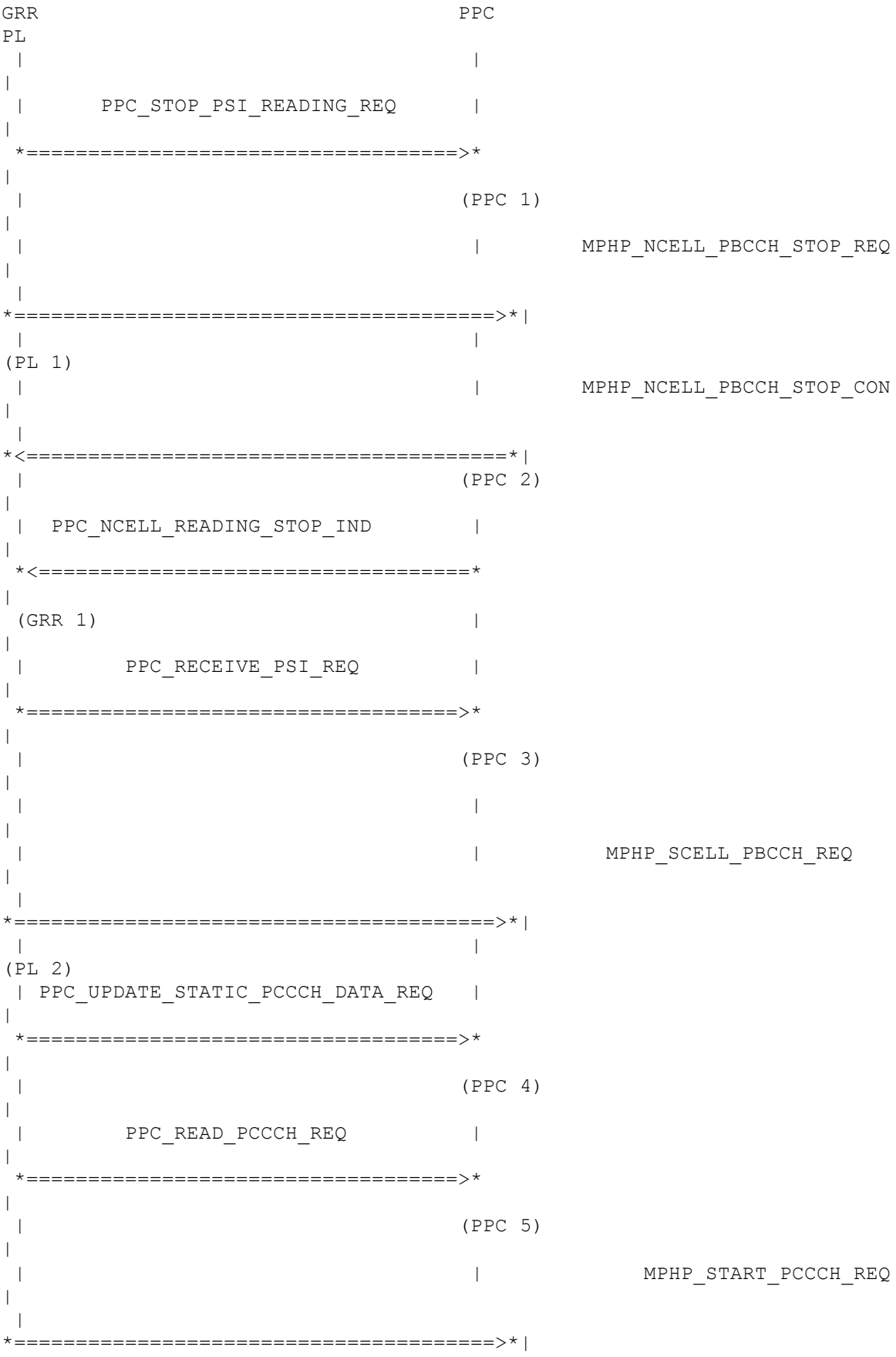


(PL 1)
L1 indicates the receiving of packet system information in the new cell.

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

This procedure is possible foe different packet system information.

3.5.3 Reselect new cell in packet idle mode



(PPC 1)
GRR requests the stop of reading of the new cell.

(PL 1)
PPC forwards the request to L1.

(PPC 2)
L1 confirms that the reading of the neighbour cell is stopped.

(GRR 1)
PPC forwards the confirm to GRR.

(PPC 2)
GRR starts to assign the new cell to ppc.

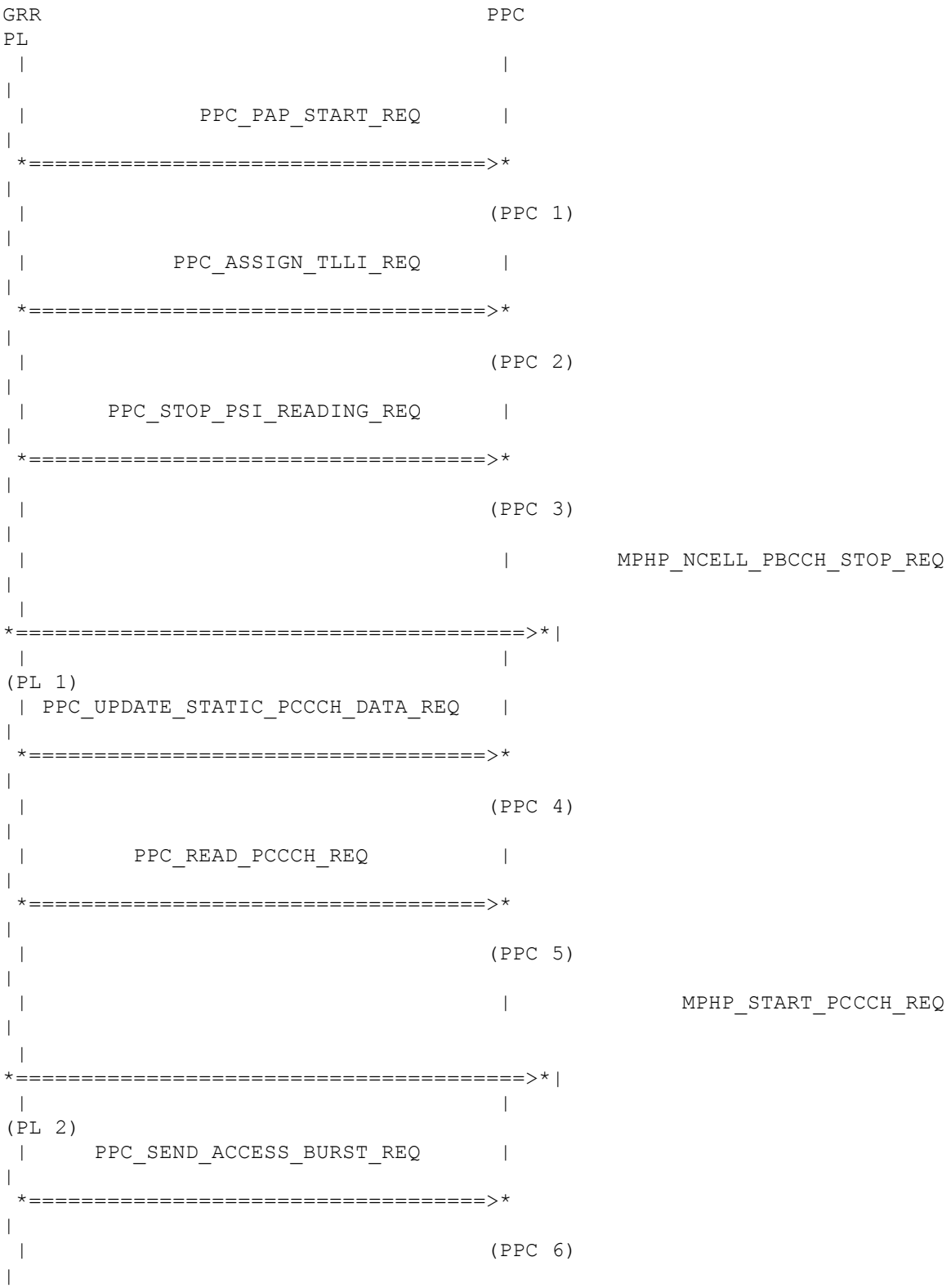
(PL 2)
PPC forwards the request to L1 .

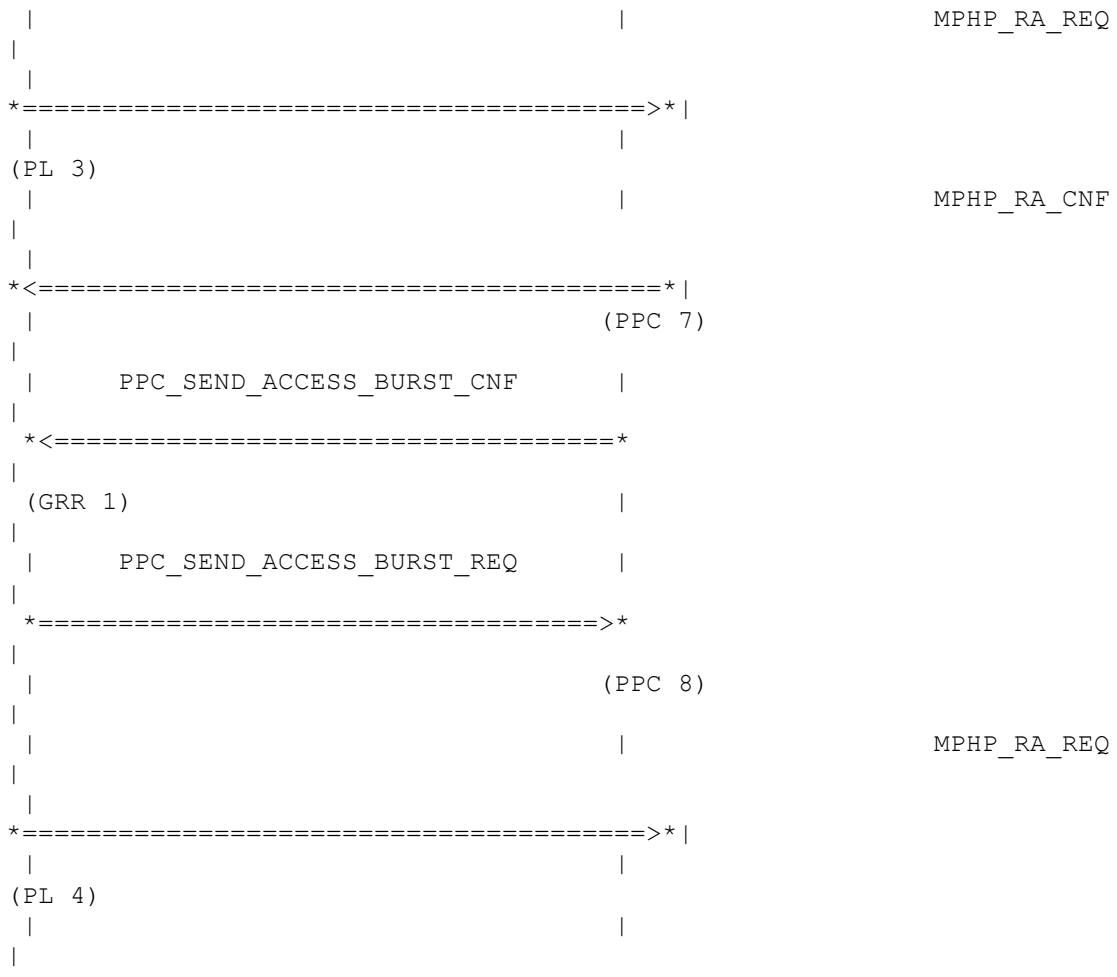
(PPC 4)
GRR updates the PCCCH parameters.

(PPC 5)
GRR requests to assign the PCCCH parameters to L1.

(PL 3)
PPC forwards the request to L1 .

3.5.4 Packet Access in the new Cell(must be modified only in packet transfer mode)





(PPC 1)
GRR indicates the start of the packet access procedure.

(PPC 2)
GRR assigns the TLLI to PPC.

(PPC 3)
GRR requests the stop of reading psis in the new cell.

(PL 1)
PPC forwards the request to L1.

(PPC 4)
GRR updates PCCCH parameters.

(PPC 5)
GRR requests to reorg the PCCCH of the new cell.

(PL 2)
PPC forwards the request to L1.

(PPC 6)
GRR builds a random access burst with cause "cell update" and sends it to PPC.

(PL 3)
PPC forwards the request to L1.

(PPC 7)
L1 confirms that the random access burst was sent.

(GRR 1)

PPC forwards the confirm to GRR.

(PPC 8)

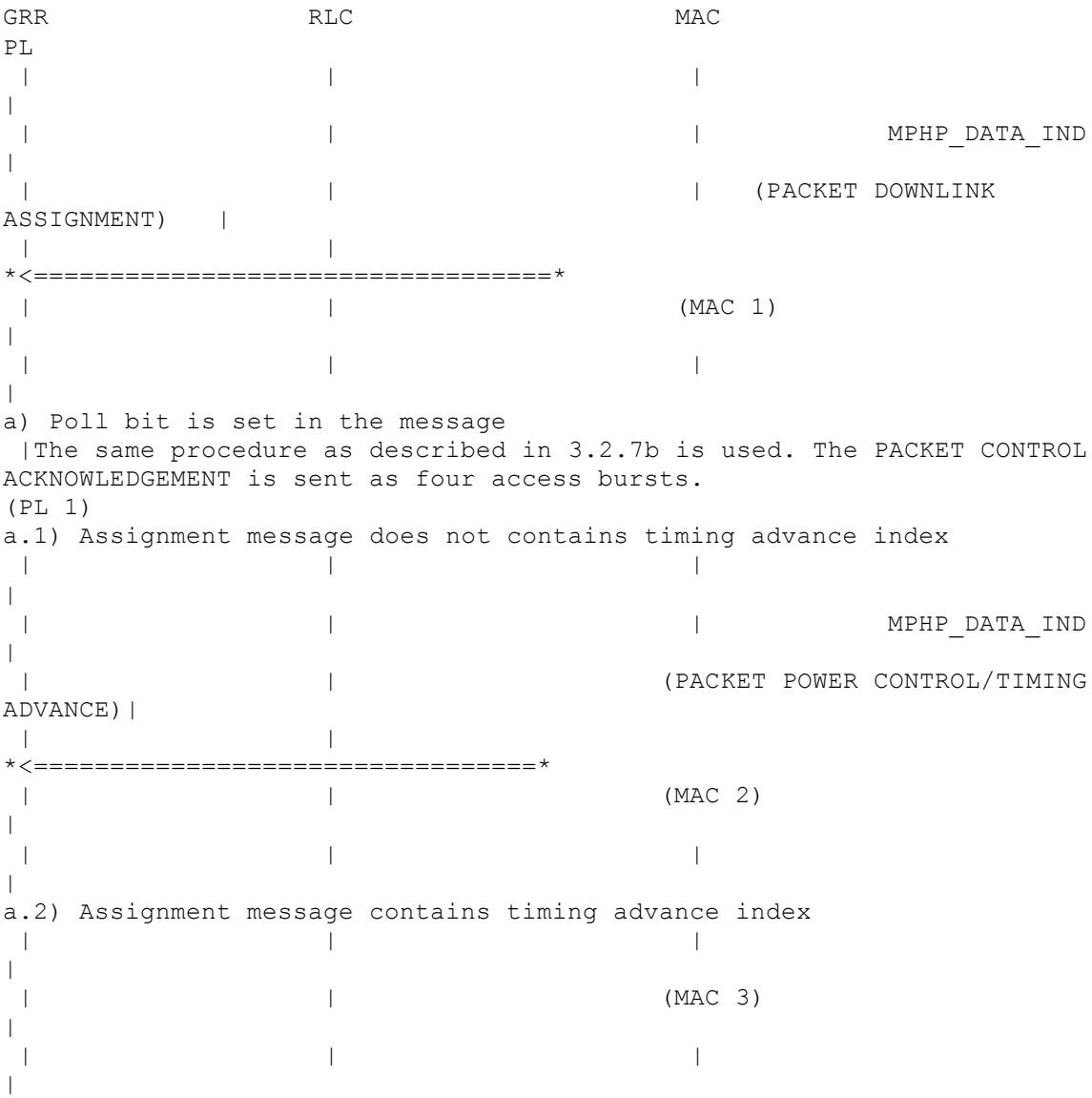
GRR builds again a random access burst with cause "cell update" and sends it to PPC.

(PL 4)

PPC forwards the request to L1.

3.6 TBF establishment initiated by the network on PCCCH

3.6.1 Packet downlink assignment



(MAC 1)

MAC 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.

(PL 1)
MAC sends the PACKET CONTROL ACKNOWLEDGEMENT message as four access bursts in the reserved uplink radio block specified by the RRBP field. The reserved block is considered as a one block PACCH allocation. The PACKET CONTROL ACKNOWLEDGEMENT, message is used to derive the timing advance.

(MAC 2)
MAC 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.

(MAC 3)
The timing advance in the MS shall be updated via continuous timing advance procedure.

Requirements:
<R.MAC.P_DWN_AS.M.00x>, <R.MAC.AI_PCCCH.M.00x>

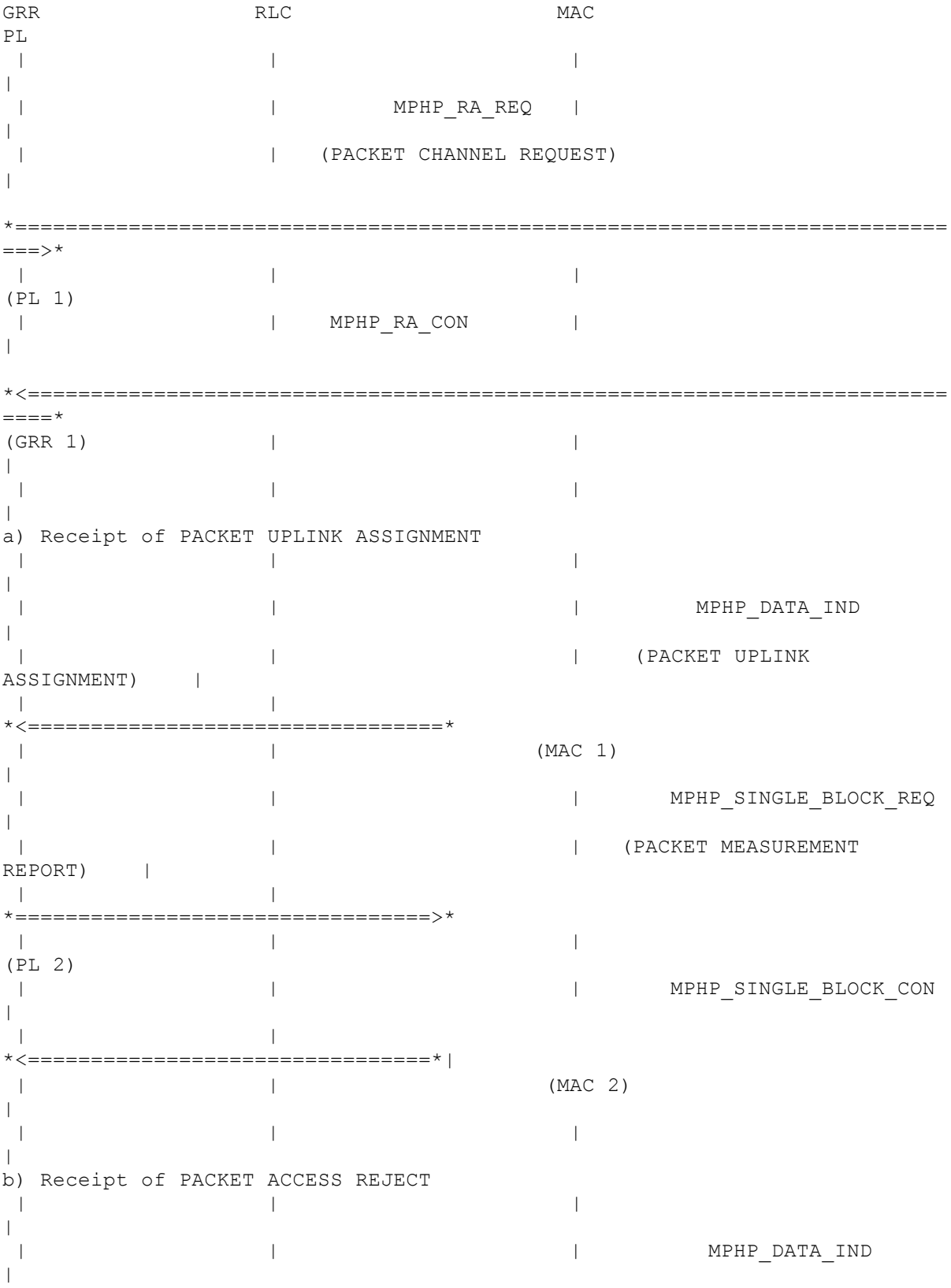
3.6.2 Packet polling procedure after receiving a packet downlink assignment

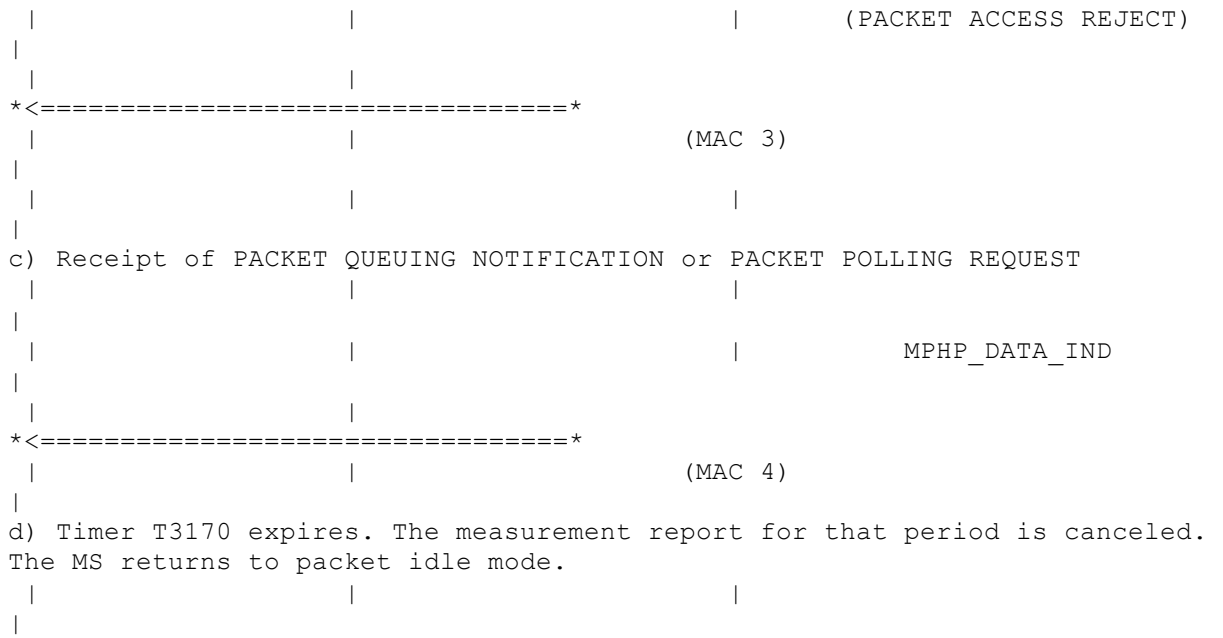
This procedure is described in 3.2.7.

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

3.7 Procedures for sending measurement reports in packet idle mode

3.7.1 Measurement report sending initiated on PCCCH





(PL 1)
GRR composes a PACKET CHANNEL REQUEST message containing as cause “Single block without TBF establishment” and sends it on PRACH.

(GRR 1)
The PL confirms that the message was sent.

(MAC 1)
The PL indicates to the MAC that the PACKET UPLINK ASSIGNMENT was received. No TBF will be started. T3170 was not expired at the time on which the PACKET UPLINK ASSIGNMENT message was received. If T3170 expires, packet access procedure is cancelled and the transmission of the measurement report is cancelled for that measurement report period.

(PL 2)
The MAC composes PACKET MEASUREMENT REPORT either containing NC measurement report or EXT measurement report structure and sends it on the allocated single block.

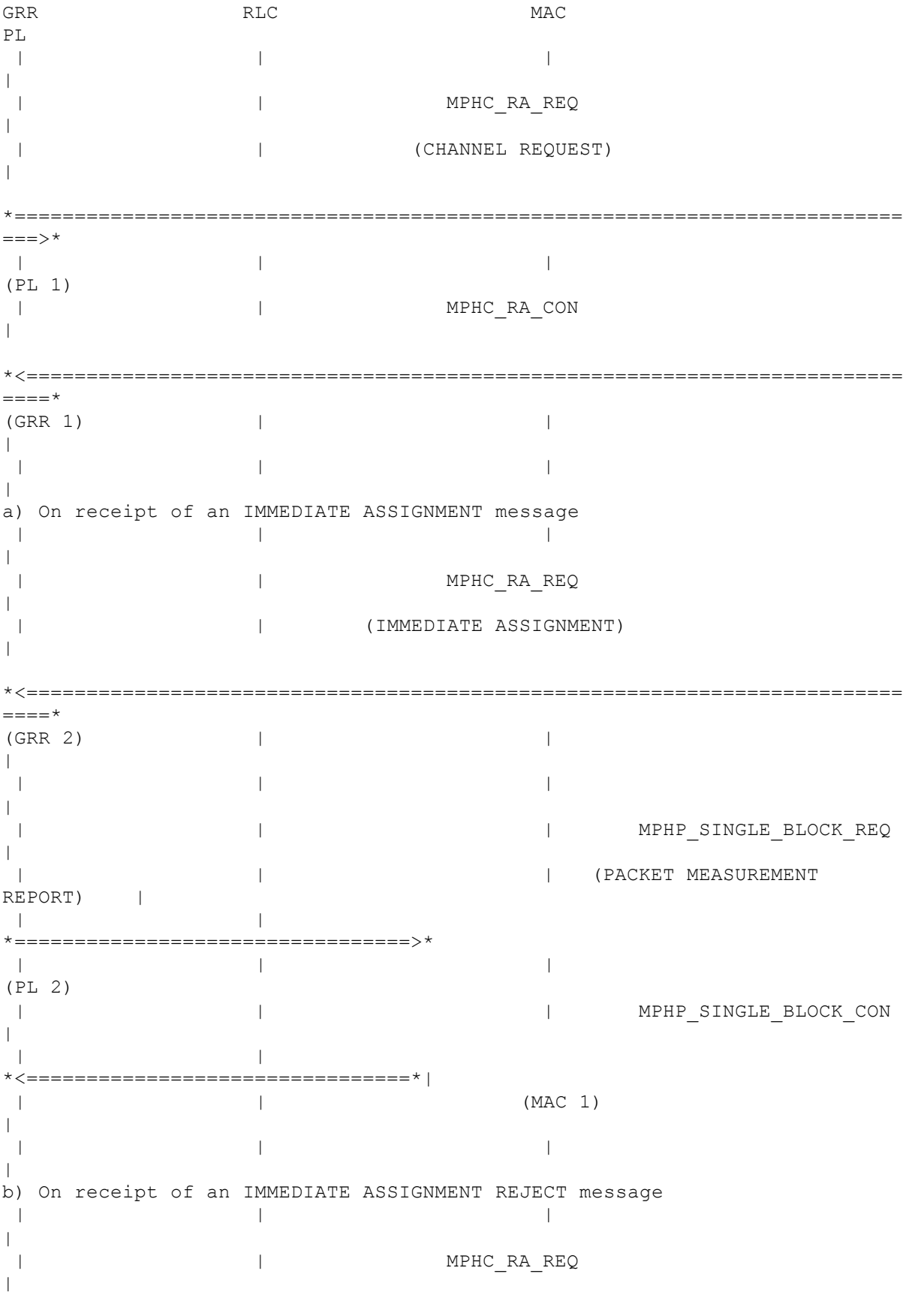
(MAC 2)
The PL confirms that the PACKET MEASUREMENT message was sent.

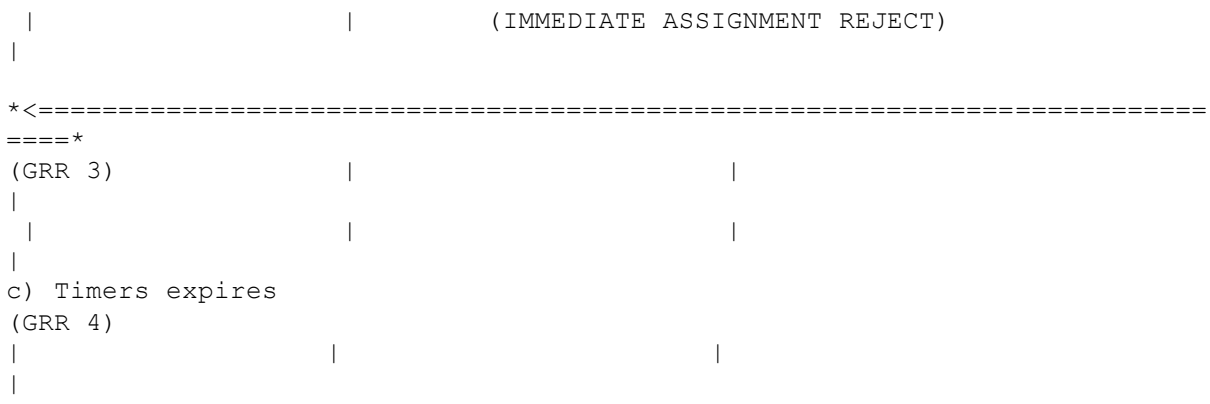
(MAC 3)
The MAC receives the PACKET ACCESS REJECT message. The procedures in packet access reject message are done in this situation. If any of the measurement report interval timers T3158 or T3178 expires before any of the timers T3172 or T3162 expires. In this case no new measurement report shall be initiated but T3158 or T3178 shall be restarted.

(MAC 4)
The MAC receives either PACKET QUEUING NOTIFICATION or PACKET POLLING REQUEST and aborts the procedure.

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>

3.7.2 Measurement report sending initiated on CCCH





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

(GRR 1)
The PL confirms the send of the message.

(GRR 2)
GRR receives an IMMEDIATE ASSIGNMENT message.

(PL 2)
The MAC composes a packet MEASUREMENT REPORT message and sends it on the assigned single block.

(MAC 3)
The PL confirms the send of the message.

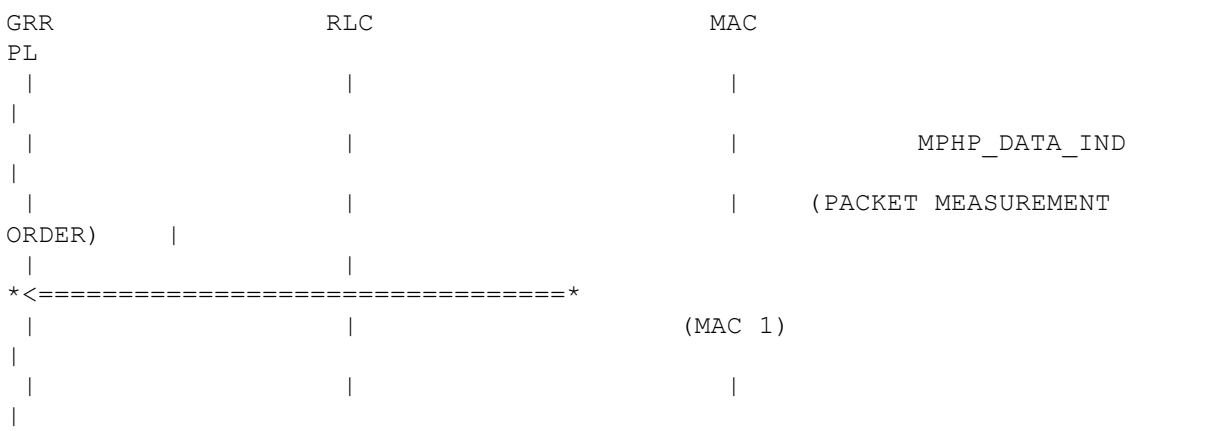
(GRR 3)
The GRR receives an IMMEDIATE ASSIGNMENT REJECT message. The measurement procedure shall be aborted.

(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>

3.8 Measurement order procedures in packet idle mode

3.8.1 Measurement order procedures initiated on PCCCH



(MAC 1)
The MAC receives a PACKET MEASUREMENT ORDER message. Storing the measurement order parameters and immediately return to PCCCH.

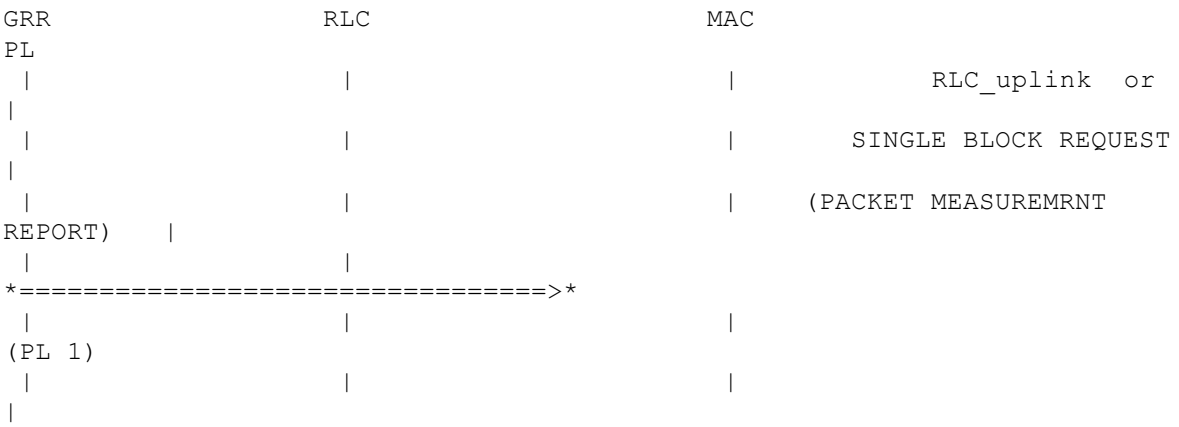
Requirements:
<R.MAC.MORD_PCC.M.00x>

3.8.2 Measurement order procedures initiated on CCCH

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

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

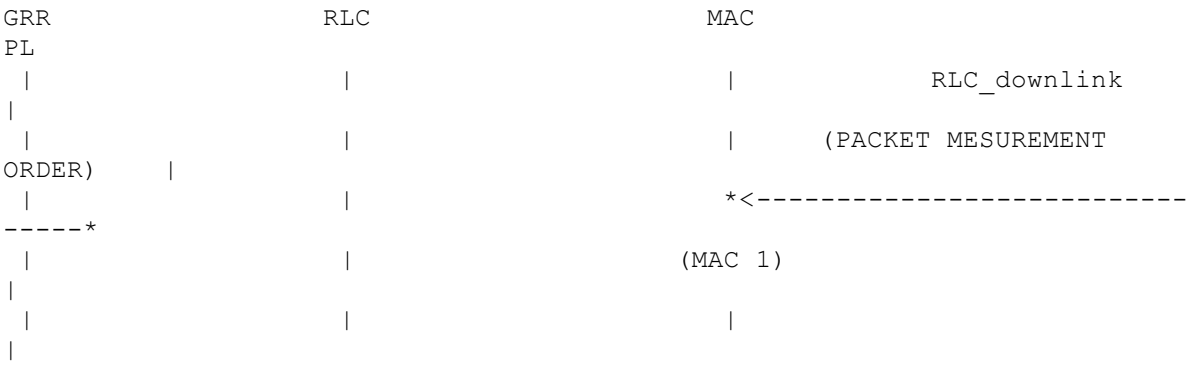
3.9 Measurement report in packet transfer mode



(PL 1)
The MS sends the PACKET MEASUREMENT REPORT to the network in either the RLC_uplink or SINGLE BLOCK REQUEST.

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

3.10 Measurement Order procedures in packet transfer mode

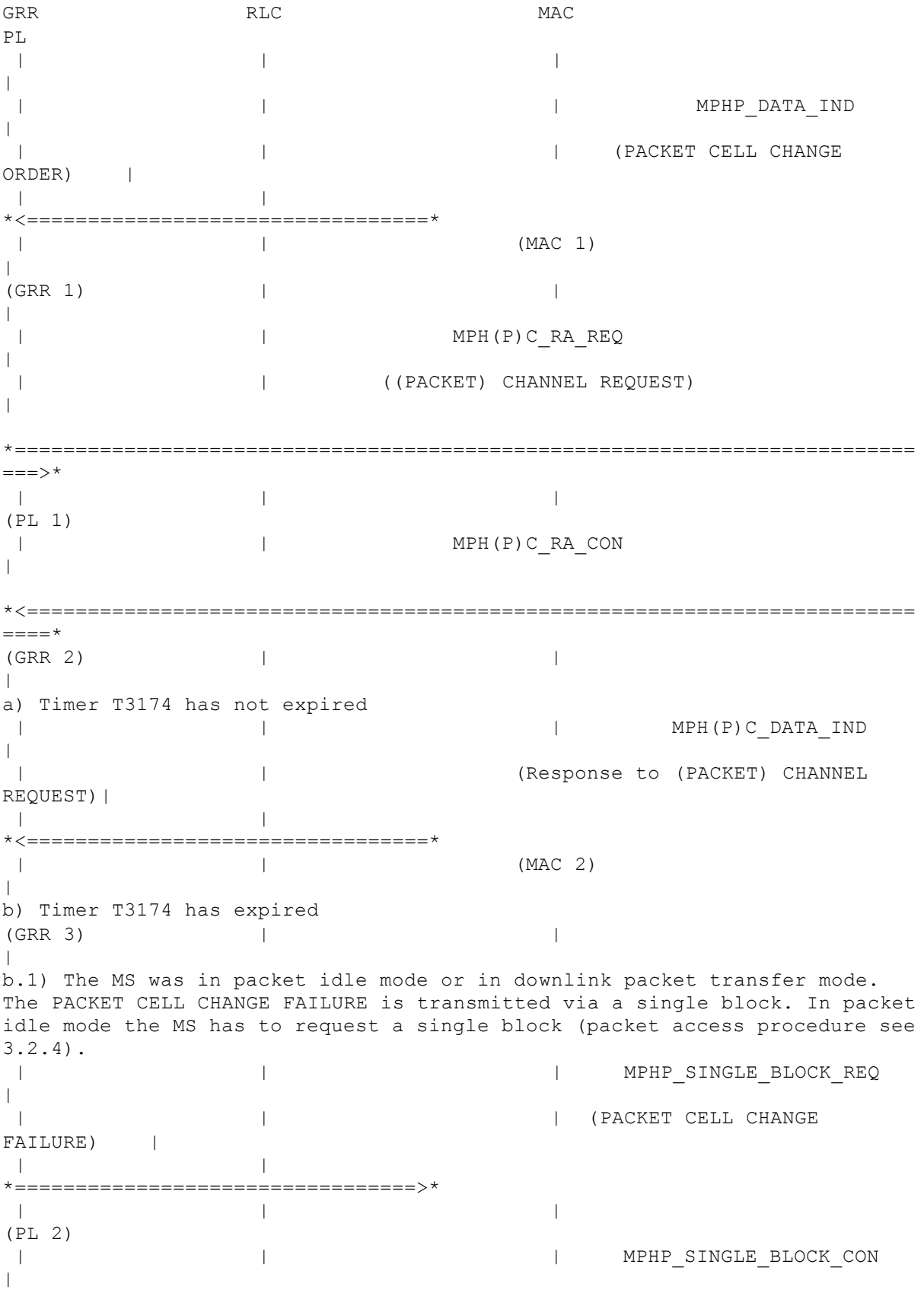


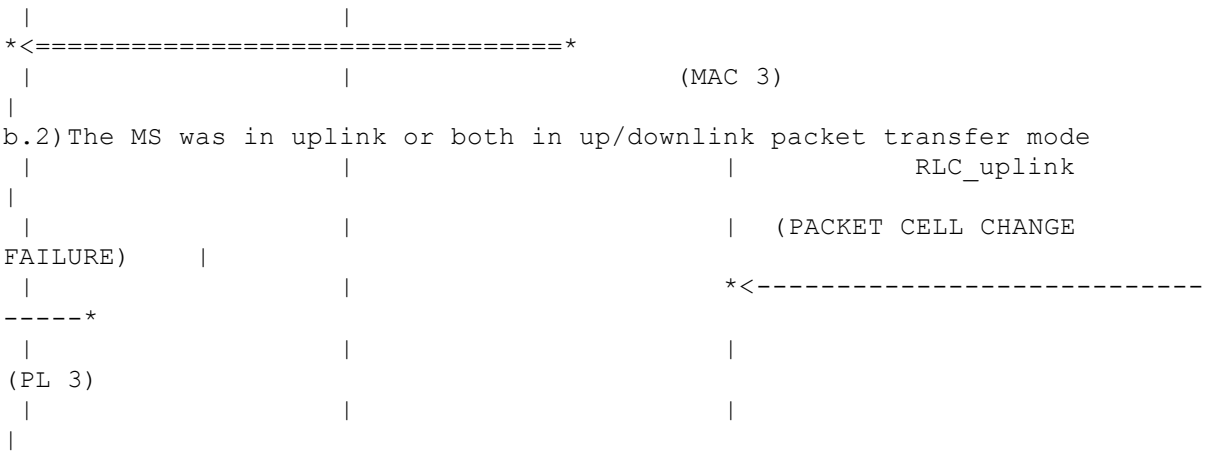
(MAC 1)
The network sends the PACKET MESUREMENT ORDER to the MS in the RLC_uplink.

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

3.11 Cell change order procedure in packet idle mode

3.11.1 Cell change order procedure initiated on PCCCH





(MAC 1)
The MAC receives PACKET CELL CHANGE ORDER message on the PCCCH blocks. The MAC stops all RLC/MAC timers and start timer T3174.

(GRR 1)
The MAC 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.

(PL 1)
The GRR sends PACKET CHANNEL REQUEST or CHANNEL REQUEST in the new cell and waits for an answer.

(GRR 2)
The PL confirms that the message was sent.

(MAC 2)
The MAC receives a response to PACKET CHANNEL REQUEST in the new cell. Stop timer T3174.

(GRR 3)
Timer T3174 has expired before a response to PACKET CHANNEL REQUEST. Start timer T3176 and return to the old cell.

(PL 2)
The 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. Stop T3176. If T3176 expires before sending PACKET CELL CHANGE FAILURE, abnormal release with return to CCCH or PCCCH.

(MAC 3)
The PL confirms the single block request.

(PL 3)
The GRR initiates a new TBF and sends a PACKET CELL CHANGE FAILURE to the network. Stop T3176. If T3176 expires before sending PACKET CELL CHANGE FAILURE, abnormal release with random access shall be done.

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

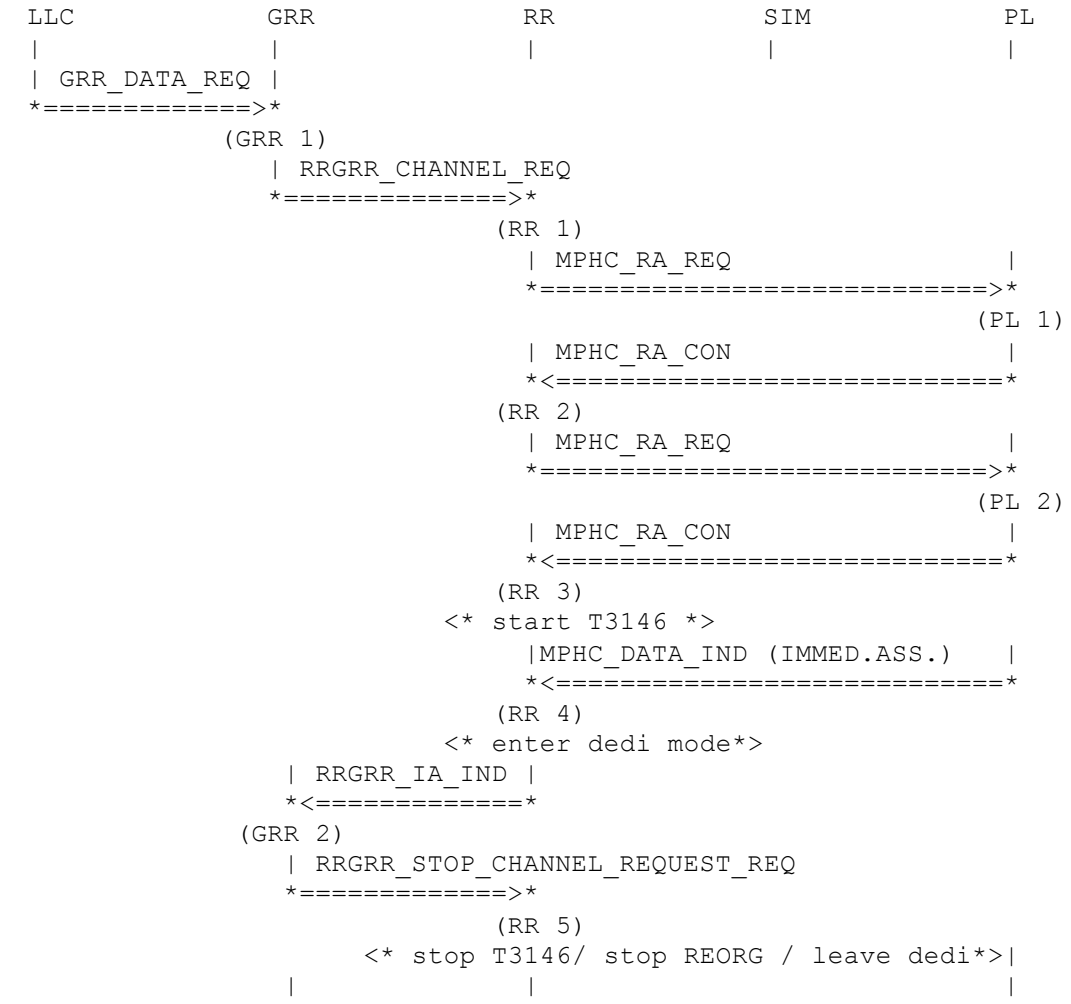
3.11.2 Cell change order procedure initiated on CCCH

The procedure is the same procedure as in the cell change order initiated on PCCCH. The main difference is that the PACKET CELL CHANGE ORDER message is sent on the PDCH which was assigned by IMMEDIATE ASSIGNMENT message.

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

3.12 TBF establishment initiated by the MS on CCCH

3.12.1 Mobile originated packet access –B



(GRR 1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-pdu.

(RR 1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to send RANDOM ACCESS REQUEST primitives to PL.

(PL 1)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH.

(RR 2)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH.

(PL 2)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH. The RR will send RANDOM ACCESS REQUESTs until an IMMEDIATE ASSIGNMENT message arrives or max_retrans CHANNEL REQUEST are sent or timer T3146 expires

(RR 3)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH. Timer T3146 is started.

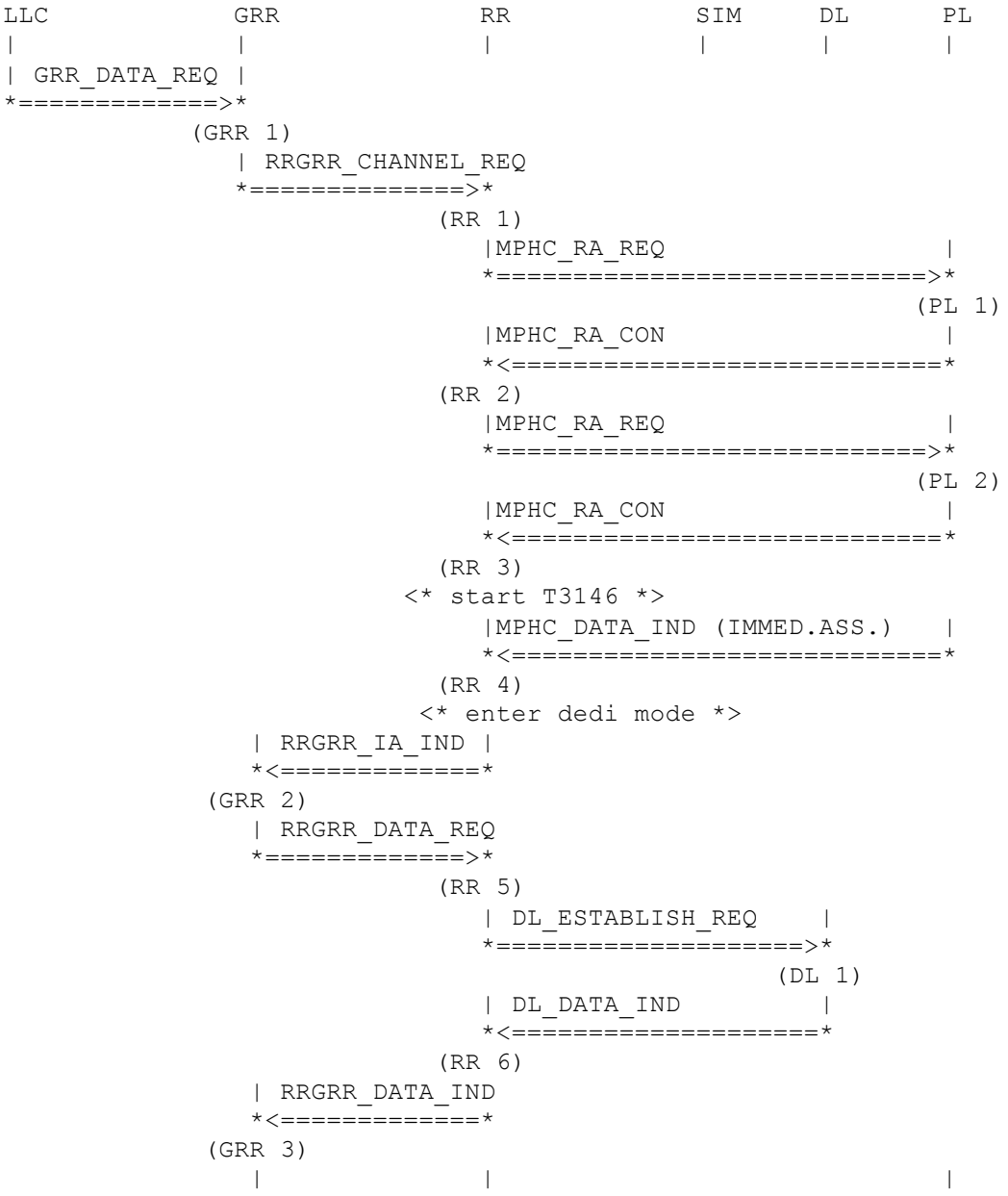
(RR 4)
The PL sends RR an MPHC_DATA_IND primitive, including an IMMEDIATE ASSIGNMENT message. Dedicated mode is entered.

(GRR 2)
The RR sends GRR an RRGRR_IA_IND (immediate assignment) primitive.

(RR 5)
The GRR sends RR a RRGRR_STOP_CHANNEL_REQUEST_REQ primitive. Timer T3146 and REORG is stopped, dedicated mode is left.

Requirements:

3.12.2 Mobile originated packet access –B



(GRR 1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-pdu.

(RR 1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to send RANDOM ACCESS REQUEST primitives to PL.

(PL 1)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH.

(RR 2)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH.

(PL 2)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH. The RR will send RANDOM ACCESS REQUESTs until an IMMEDIATE ASSIGNMENT message arrives arrives or max_retrans CHANNEL REQUEST are sent or timer T3146 expires.

(RR 3)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH. Timer T3146 is started.

(RR 4)
The PL sends RR an MPHC_DATA_IND primitive, including an IMMEDIATE ASSIGNMENT message. Dedicated mode is entered.

(GRR 2)
The RR sends GRR an RRGRR_IA_IND primitive.

(RR 5)
The GRR sends RR a RRGRR_DATA_REQ primitive including a RR INITIALISATION REQUEST

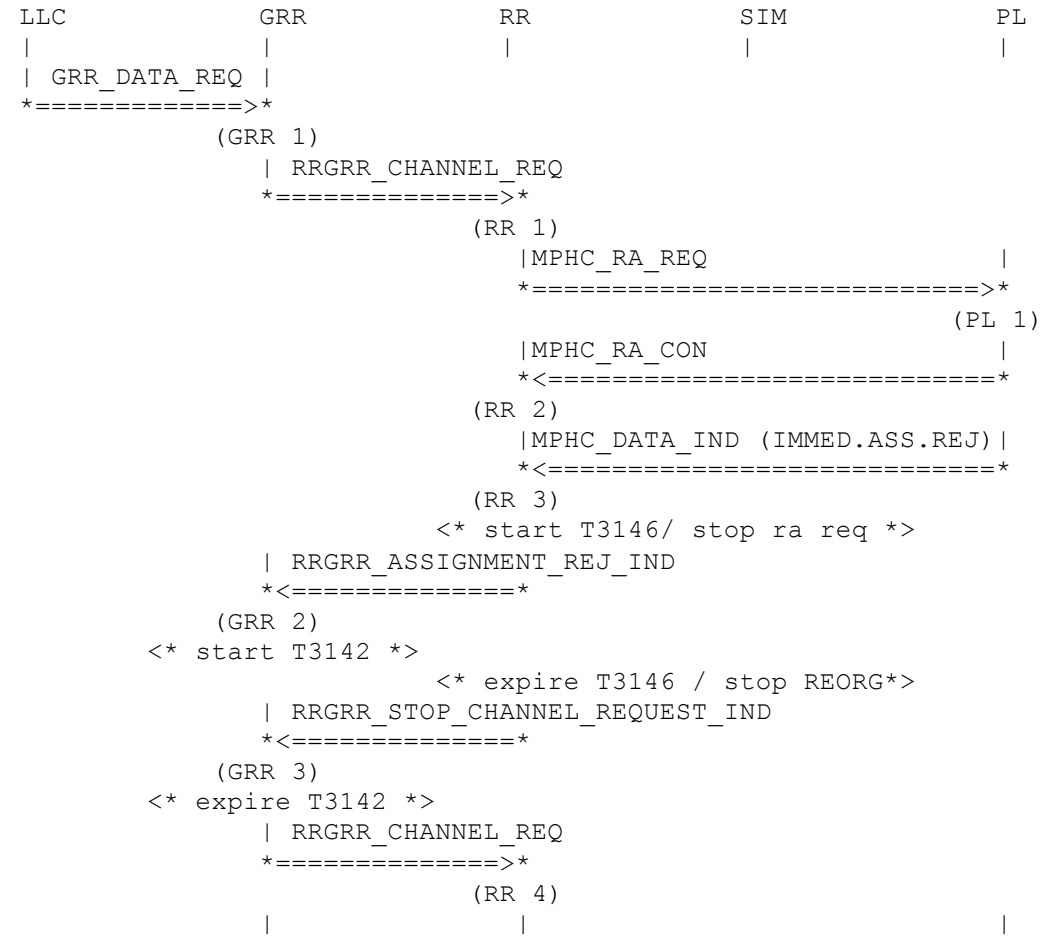
(DL 1)
RR establishes the dedicaded mode

(RR 6)
RR receives the PDCH ASSIGNMENT COMMAND

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

Requirements:

3.12.3 Mobile originated packet access –B



(GRR 1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-pdu.

(RR 1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to send RANDOM ACCESS REQUEST primitives.

(PL 1)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH.

(RR 2)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH.

(RR 3)
The PL sends RR an MPHC_DATA_IND primitive, including an IMMEDIATE ASSIGNMENT REJECTION message. Timer T3146 is started random access request is stopped.

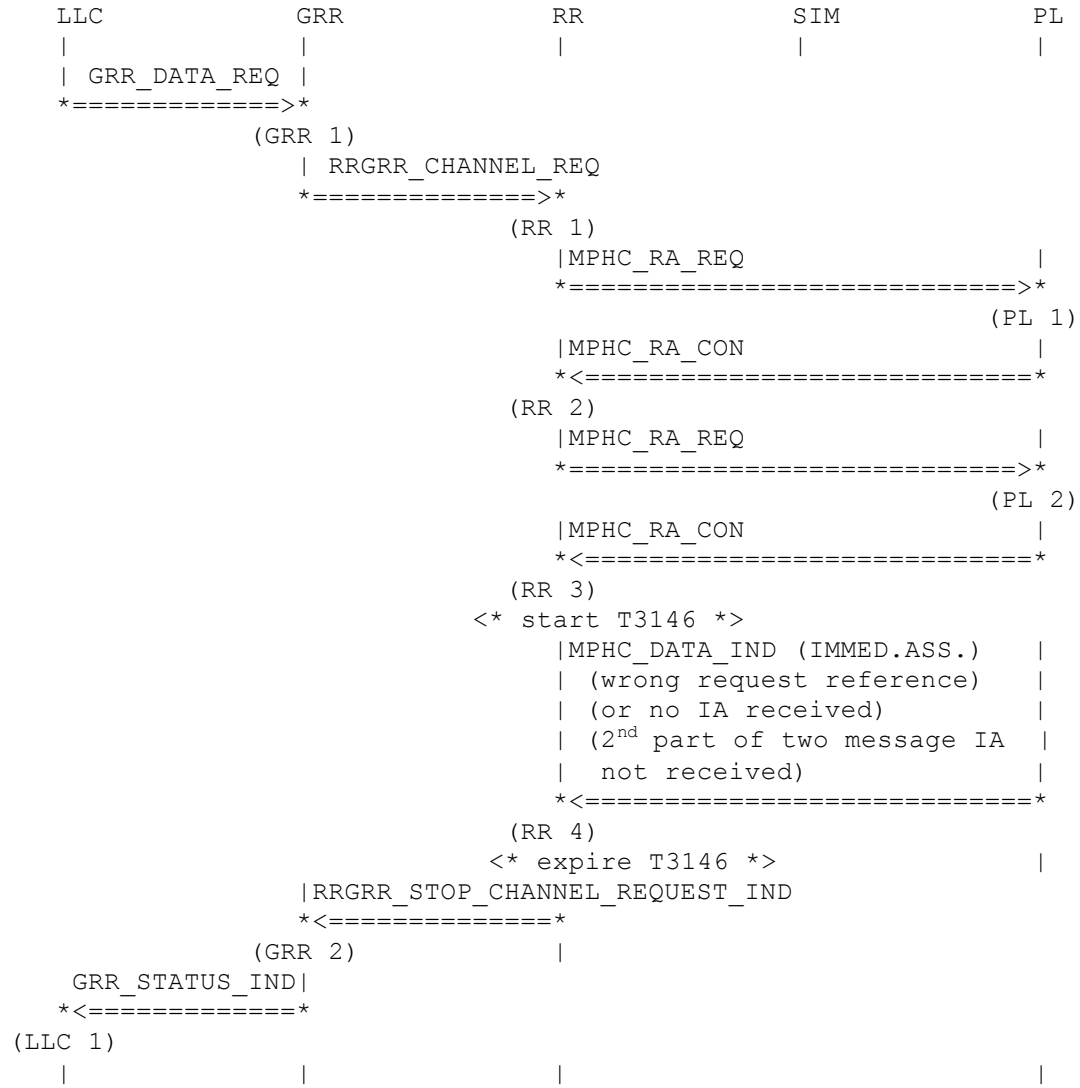
(GRR 2)
The RR sends GRR an RRGRR_ASSINGMENT_REJ_IND (assignment rejection indication) primitive. Timer T3142 is started.

(GRR 3)
When timer T3146 expires, RR sends GRR a RRGRR_STOP_CHANNEL_REQUEST_IND primitive. REORG is stopped.

(RR 4)
When timer T3142 expires, GRR sends RR a new RRGRR_CHANNEL_REQ primitive.

Requirements:

3.12.4 Mobile originated packet access –B



(GRR 1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-pdu.

(RR 1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to send RANDOM ACCESS REQUEST primitives.

(PL 1)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH.

(RR 2)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH.

(PL 2)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH. The RR will send RANDOM ACCESS REQUESTs until an IMMEDIATE ASSIGNMENT message arrives.

(RR 3)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH. Timer T3146 is started.

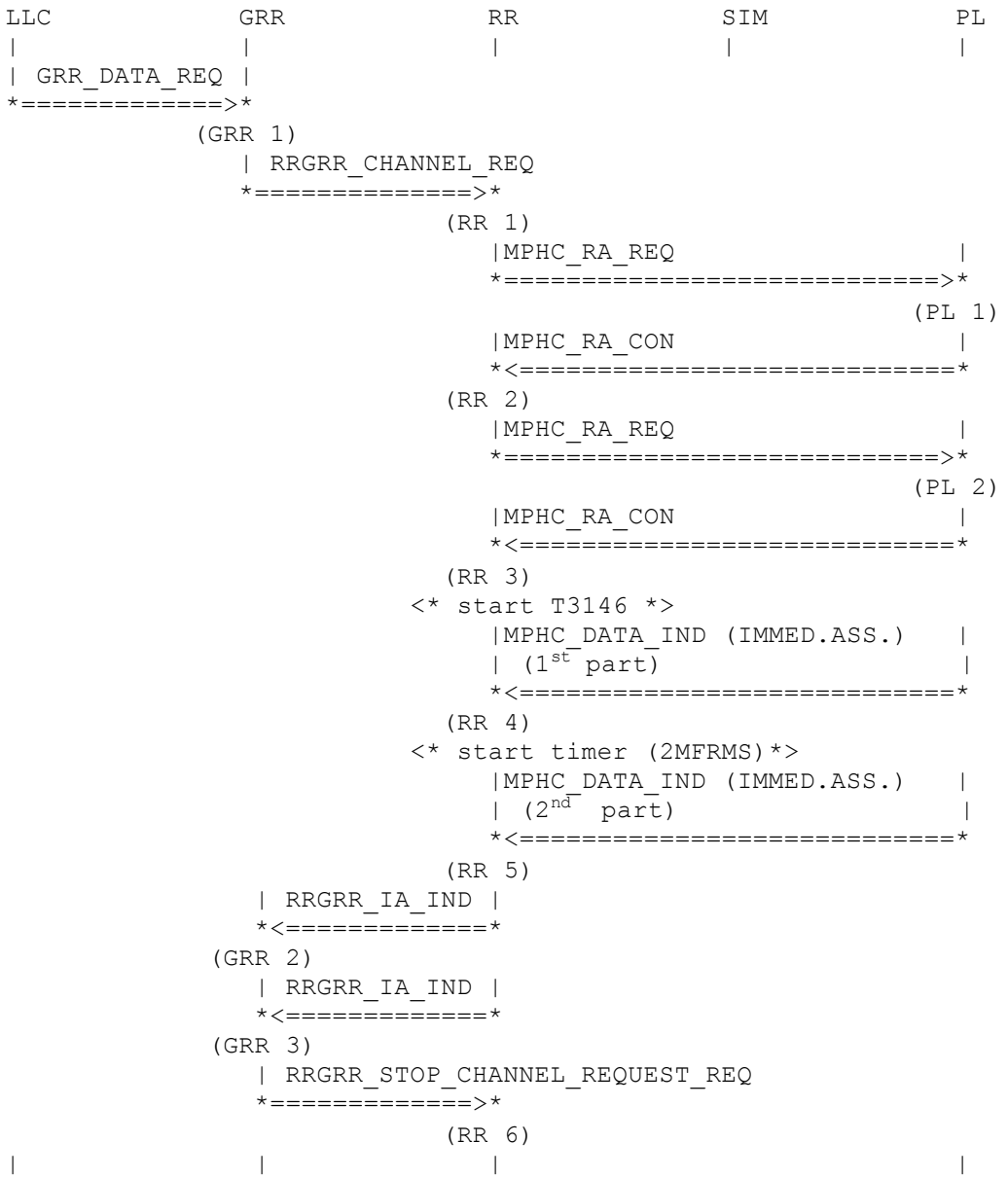
(RR 4)
The PL sends RR an MPHC_DATA_IND primitive, including an IMMEDIATE ASSIGNMENT message, but there was a wrong request reference or the second part of the message was not received.

(GRR 2)
When timer T3146 expires, RR sends GRR a RRGRR_STOP_CHANNEL_REQUEST_IND primitive.

(LLC 1)
The GRR sends LLC a GRR_STATUS_IND primitive which indicates an access failure

Requirements:

3.12.5 Mobile originated packet access –B



(GRR 1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-pdu.

(RR 1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to send RANDOM ACCESS REQUEST primitives.

(PL 1)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH.

(RR 2)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH.

(PL 2)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH. The RR will send RANDOM ACCESS REQUESTs until an IMMEDIATE ASSIGNMENT message arrives.

(RR 3)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH. Timer T3146 is started.

(RR 4)
The PL sends RR an MPHC_DATA_IND primitive, including the first part of an IMMEDIATE ASSIGNMENT message. Timer 2MFRMS is started.

(RR 5)
The PL sends RR a UNITDATA INDICATION primitive, including the second part of an IMMEDIATE ASSIGNMENT message.

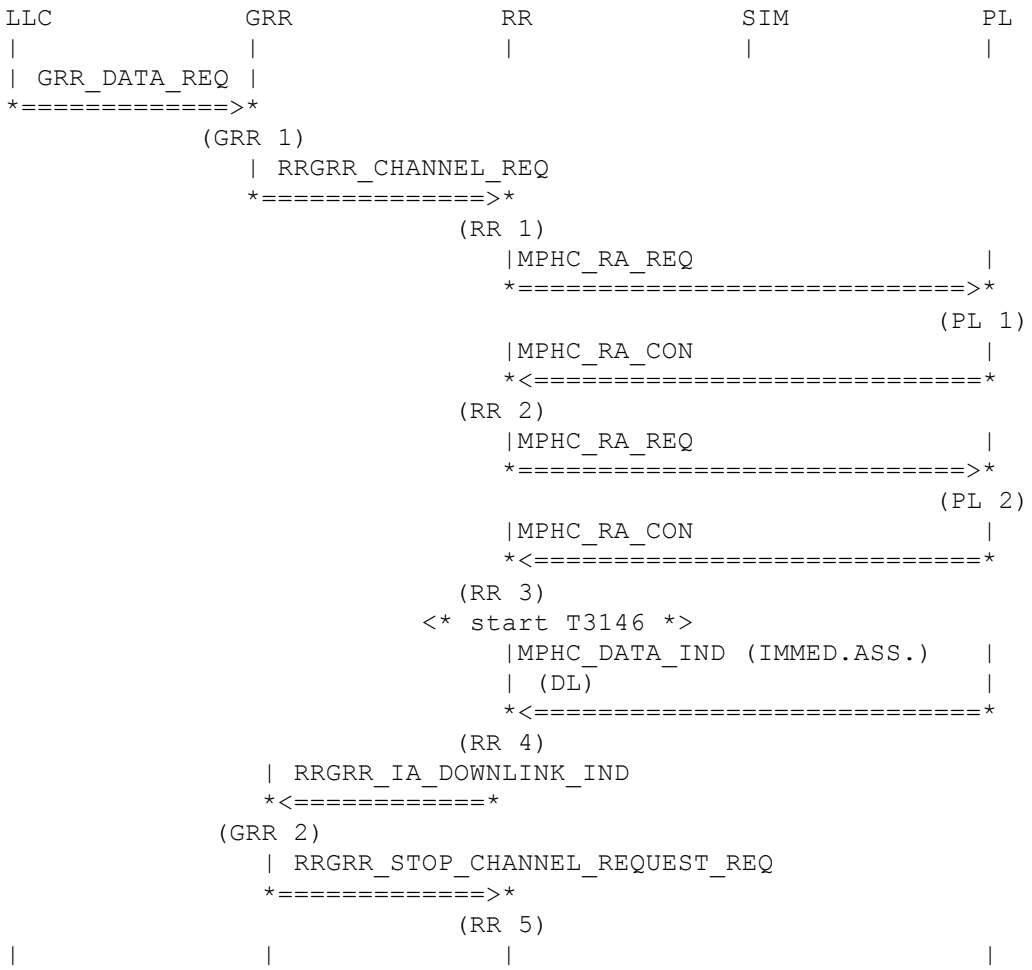
(GRR 2)
The RR sends GRR an RRGRR_IA_IND (immediate assignment indication 1 part) primitive.

(GRR 3)
The RR sends GRR an RRGRR_IA_IND (immediate assignment indication 2 part) primitive.

(RR 6)
The GRR sends RR an RRGRR_STOP_CHANNEL_REQUEST_REQ primitive.

Requirements:

3.12.6 Mobile originated packet access –B



(GRR 1)
The LLC sends GRR a GRR_DATA_REQ primitive including LLC-pdu.

(RR 1)
With an RRGRR_CHANNEL_REQ primitive GRR orders RR to send RANDOM ACCESS REQUEST primitives.

(PL 1)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH.

(RR 2)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH.

(PL 2)
The RR sends PL an MPHC_RA_REQ primitive. PL sends a CHANNEL REQUEST message on RACH. The RR will send RANDOM ACCESS REQUESTs until an IMMEDIATE ASSIGNMENT message arrives.

(RR 3)
The PL sends RR an MPHC_RA_CON primitive, indicating that a CHANNEL REQUEST message has been sent out on RACH. Timer T3146 is started.

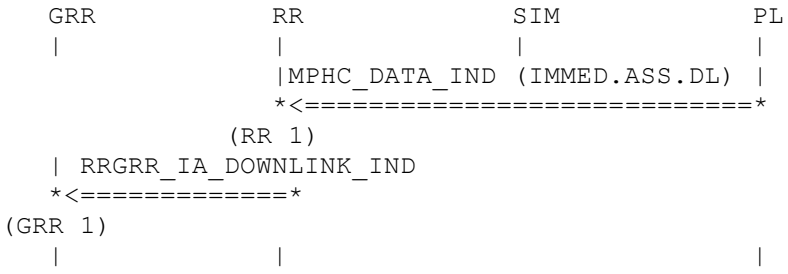
(RR 4)
The PL sends RR an MPHC_DATA_IND primitive, including an IMMEDIATE ASSIGNMENT (downlink) message.

(GRR 2)
The RR sends GRR an RRGRR_IA_DOWNLINK_IND (downlink immediate assignment) primitive.

(RR 5)
The GRR sends RR an RRGRR_STOP_CHANNEL_REQUEST_REQ primitive. . The uplink TBF will be established on the downlink TBF

Requirements:

3.12.7 Mobile terminated downlink assignment –B

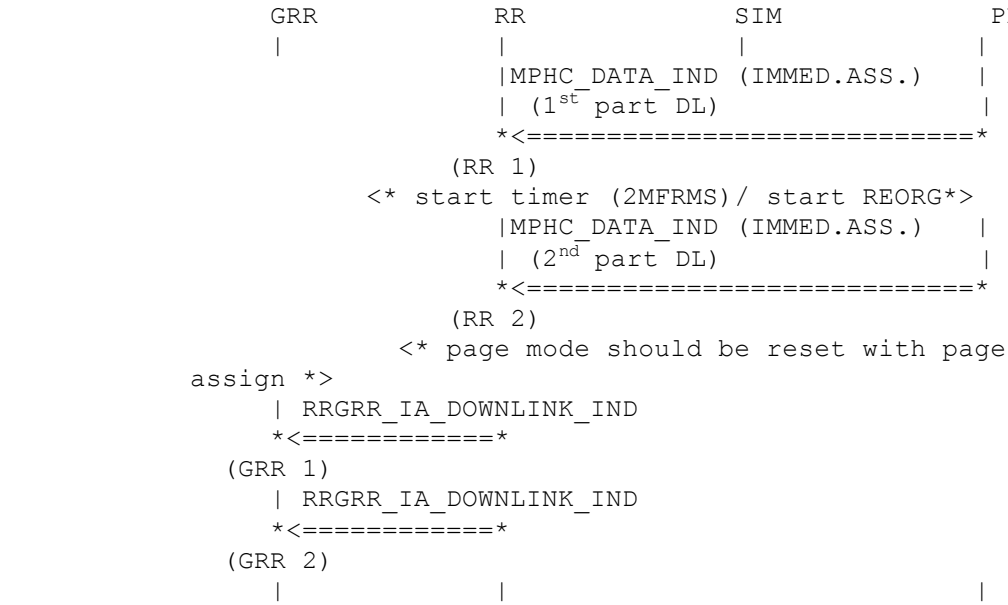


(RR 1)
The PL sends RR an MPHC_DATA_IND primitive including an IMMEDIATE ASSINGMENT (downlink) message.

(GRR 1)
The RR sends GRR an RRGRR_IA_DOWNLINK_IND (downlink immediate assignment) primitive.

Requirements:

3.12.8 Mobile terminated downlink assignment –B



(RR 1)
The PL sends RR an MPHC_DATA_IND primitive including first part of a two part IMMEDIATE ASSINGMENT (downlink) message.

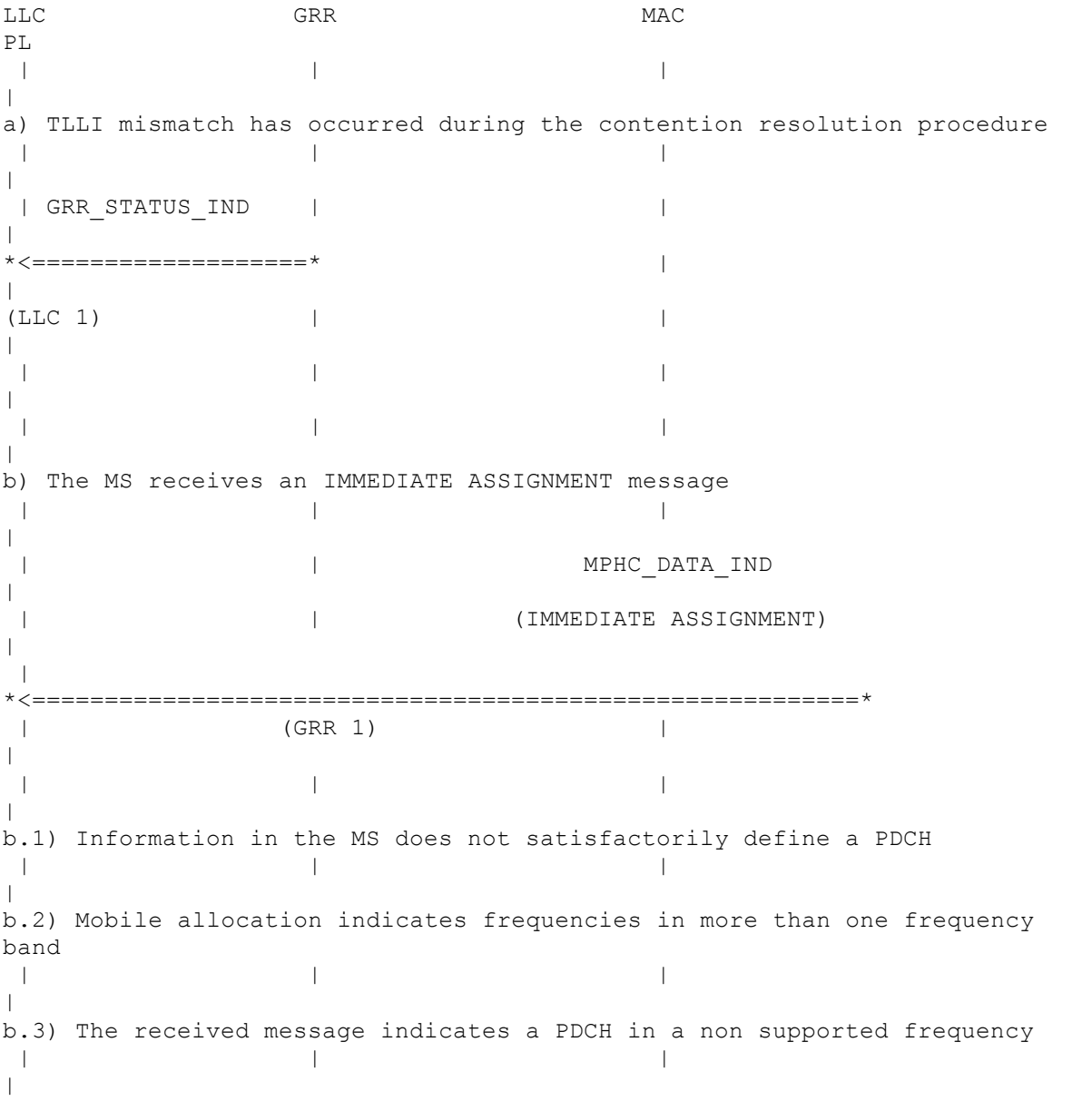
(RR 2)
The PL sends RR an MPHC_DATA_IND primitive including second part of a two part IMMEDIATE ASSINGMENT (downlink) message.

(GRR 1)
The RR sends GRR an RRGRR_IA_DOWNLINK_IND (downlink immediate assignment 1 part) primitive.

(GRR 2)
The RR sends GRR an RRGRR_IA_DOWNLINK_IND (downlink immediate assignment 2 part) primitive.

Requirements:

3.12.9 Abnormal cases

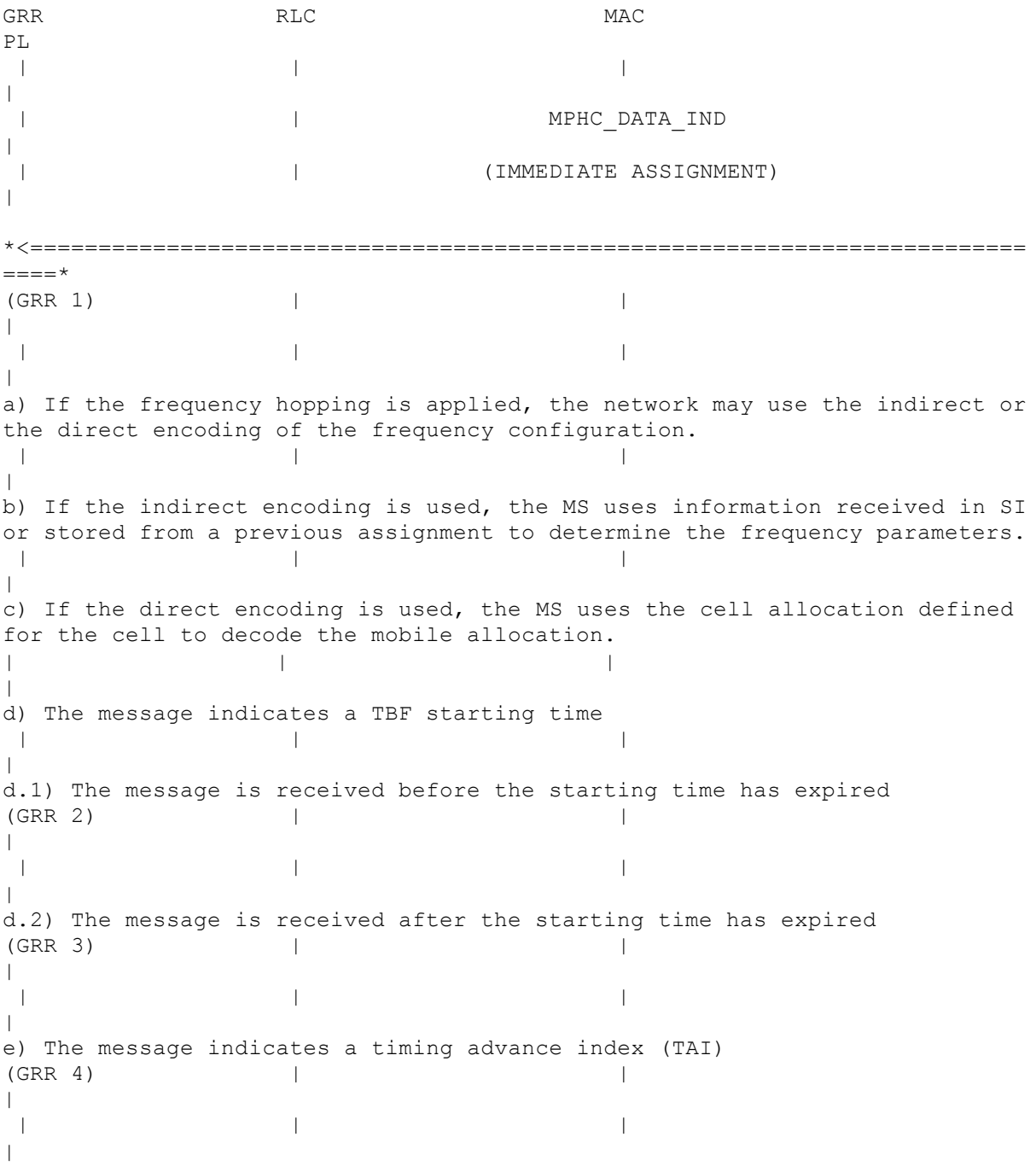


(LLC 1)
TLLI mismatch has occurred. GRR informs the LLC via GRR_STATUS_IND. The cause parameter contains TBF establishment failure.

(GRR 1)
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>

3.13 Packet downlink assignment procedure on CCCH



(GRR 1)
The GRR receives an IMMEDIATE ASSIGNMENT message which indicates a downlink TBF. If the MS applies DRX mode, the message will be received on CCCH block corresponding to a paging group, otherwise on the CCCH timeslot corresponding to CCCH group the MS belongs to. The MS stops monitoring downlink CCCH and switches to the assigned PDCH and starts listening for downlink RLC/MAC blocks identified by the TFI; it starts the timer T3190.

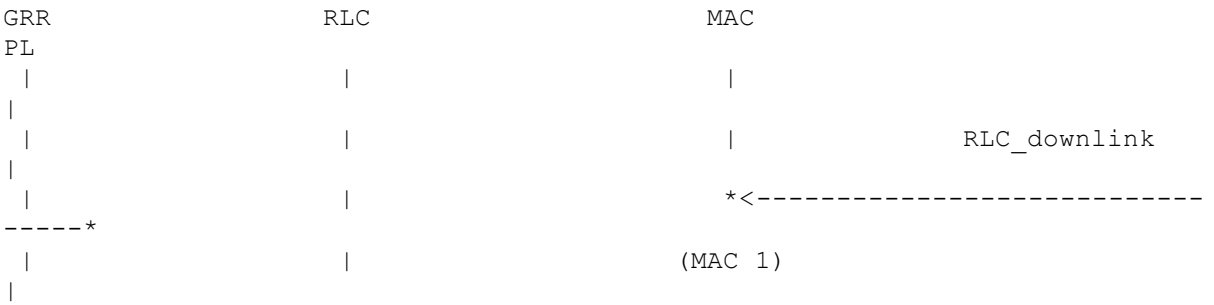
(GRR 2)
The GRR waits until the frame number indicated by the TBF starting time, starts timer T3190 and switches to the assigned PDCH.

(GRR 3)
The GRR ignores the starting time and starts timer T3190 and switches to the assigned PDCH.

(GRR 4)
If there is a TAI indicated in the IMMEDIATE ASSIGNMENT message, the GRR uses the continuous update timing advance procedure, using PTCCH in the same timeslot as the assigned PDCH. Otherwise, the GRR does not use the continuous update timing advance procedure.

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

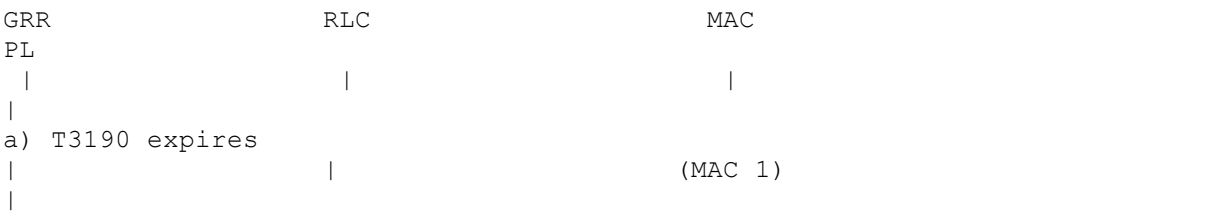
3.13.1 Packet downlink assignment completion



(MAC 1)
The packet downlink assignment procedure is completed when the MAC receives an RLC/MAC block identified by the assigned TFI. The GRR stops timer T3190.

Requirements:
<R.MAC.DWL_BLK.M.005>, <R.MAC.DWL_BLK.M.006>, <R.MAC.RR_DWL.M.004>

3.13.2 Packet downlink assignment abnormal cases



(MAC 1)
The timer T3190 expires before receiving a valid RLC/MAC block. The MS returns to the packet idle mode, TBF is released. Other abnormal cases are the same cases which are listed for the process packet uplink assignment on CCCH.

Requirements:
<R.MAC.AB_DWL.M.00x>, <R.MAC.DWL_COMP.M.002>, <R.MAC.DWL_BLK.M.007>, <R.MAC.RR_DWL.M.005>

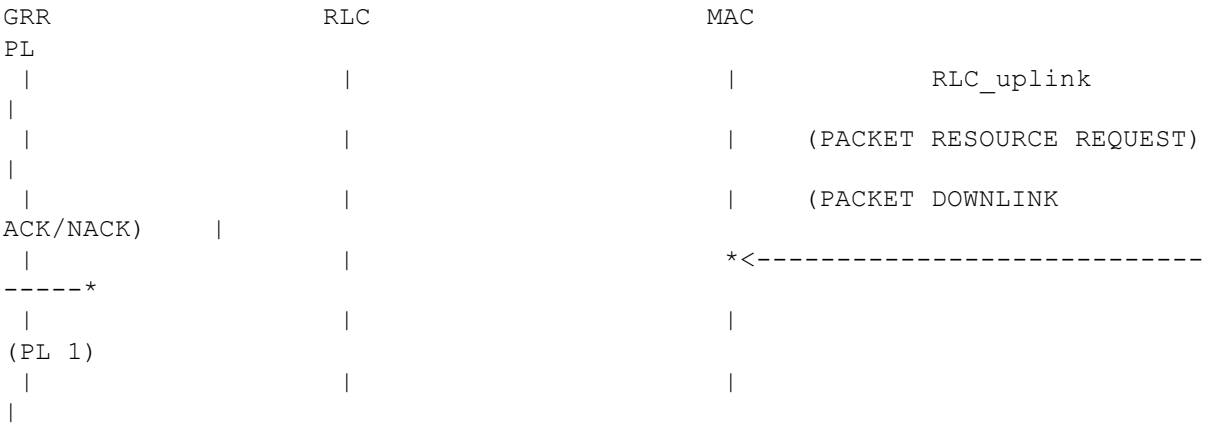
3.13.3 Sending an RLC/MAC control message: single block packet downlink assignment procedure

(GRR 1)
Assumption: The GRR has received an IMMEDIATE ASSIGNMENT message which contains a single block allocation structure. The GRR switches to the assigned PDCH and attempt to decode an RLC/MAC control message in the assigned downlink block. The actions done by having a TBF starting time are the same actions done in different procedures.

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

3.14 MAC procedures in uplink packet transfer mode

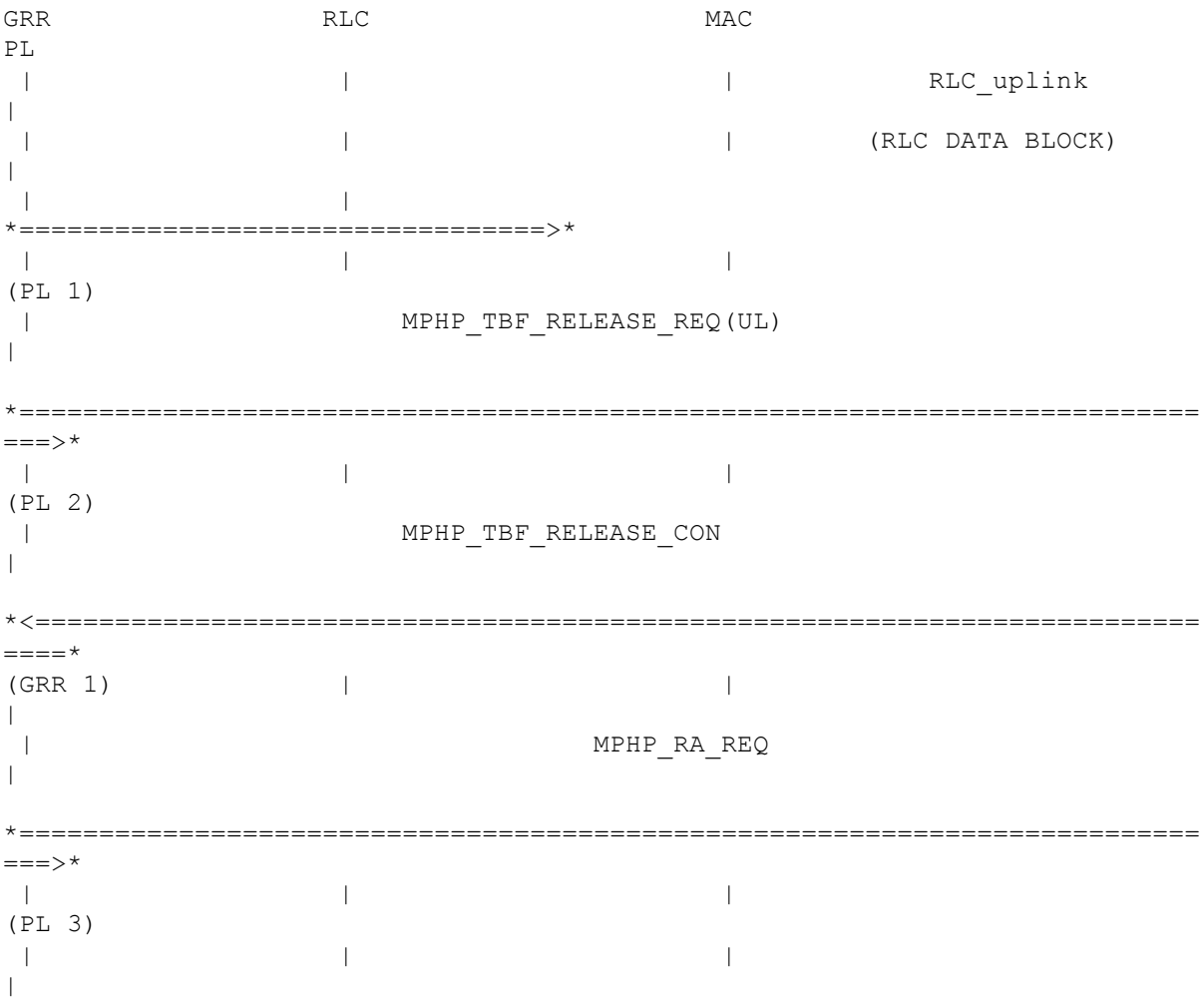
3.14.1 Resource Reallocation (Uplink)



(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>

3.14.2 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)

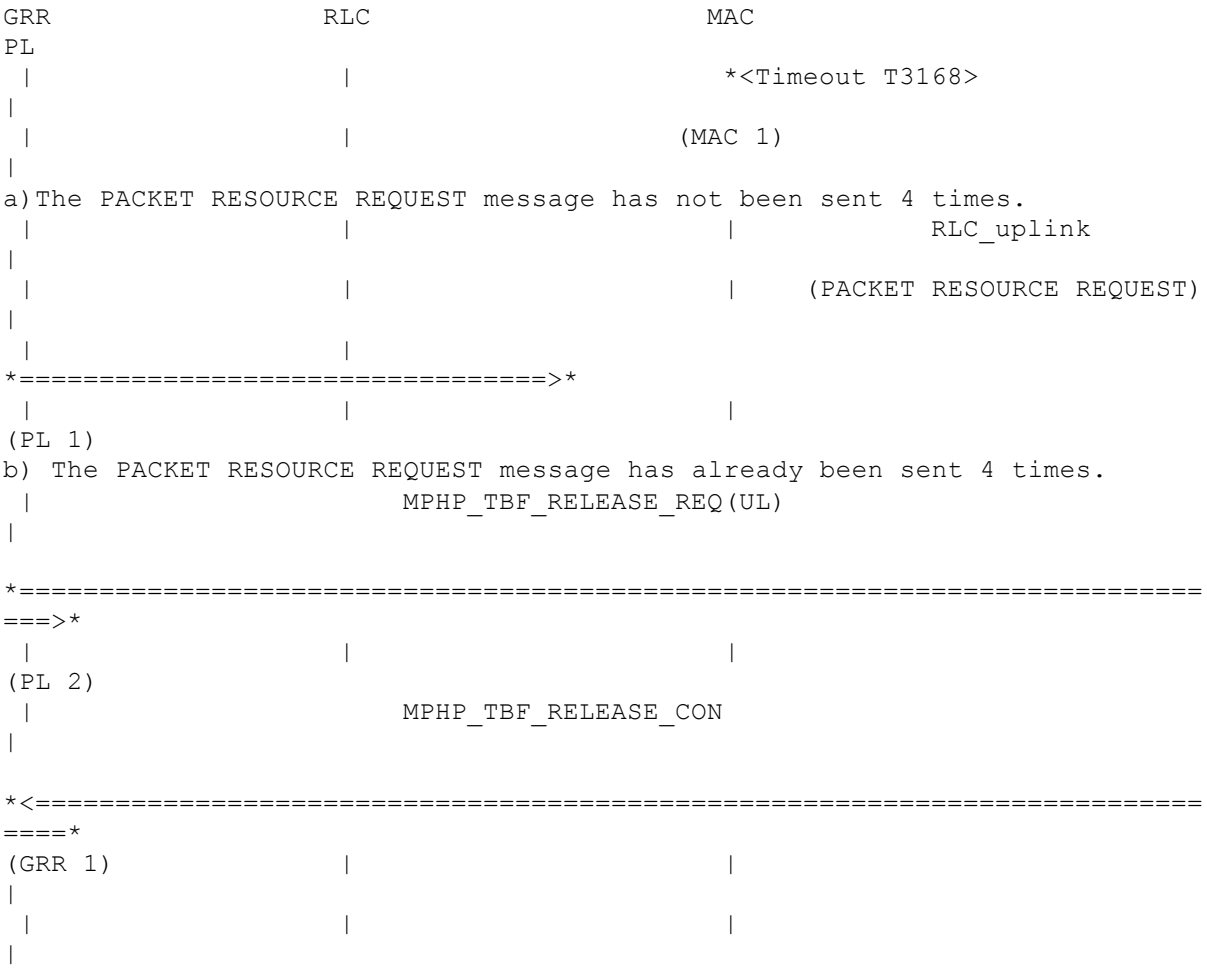
The MS confirms the release of the TBF.

(PL 3)

The MS starts a new TBF for the new LLC PDUs. When the sending of LLC PDUs with higher priority is complete the MS shall establish an uplink TBF for the remaining LLC PDUs.

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

3.14.3 On expiry if Timer T3168



(MAC 1)
Timer T3168 expires.

(PL 1)

The MS retransmits the PACKET RESOURCE REQUEST message.

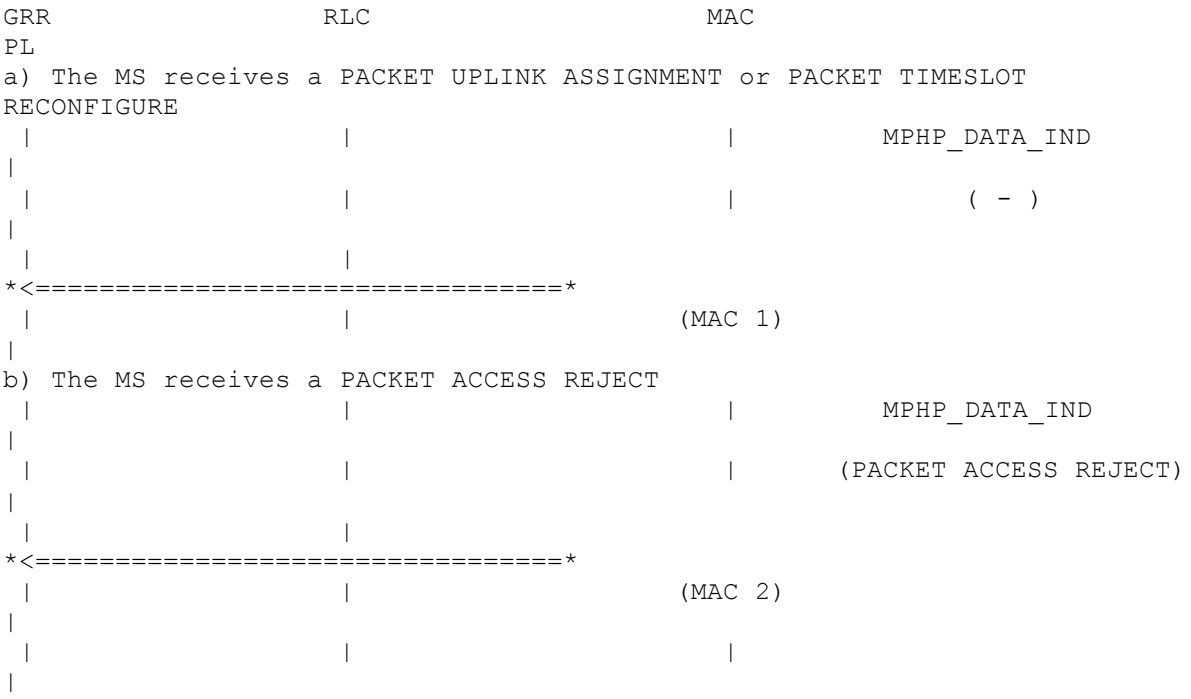
(PL 2)
The MS performs an abnormal release with random access.

(GRR 1)

The MS confirms the release of the TBF.

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

3.14.4 Reaction of the network to the resource reallocation request

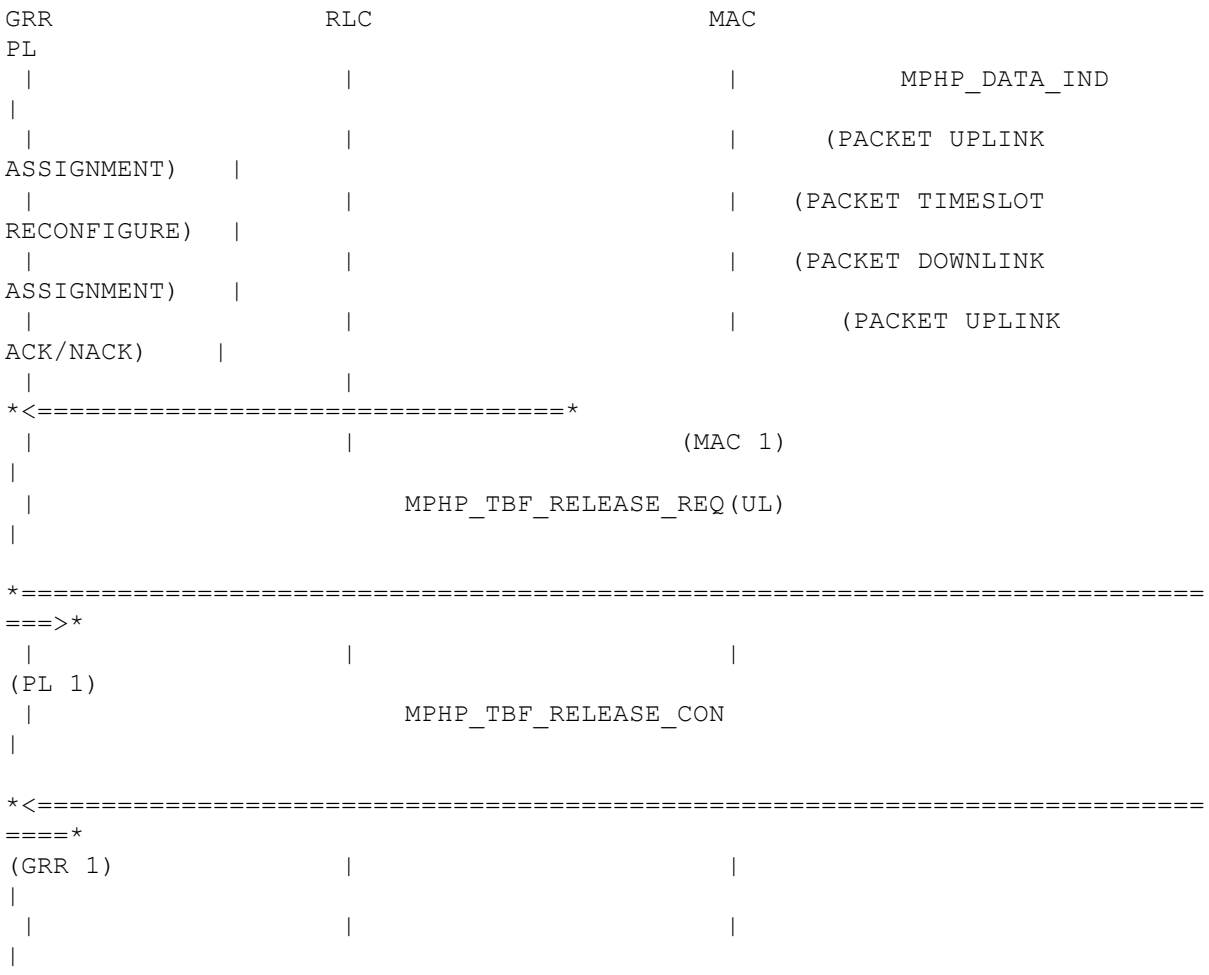


(MAC 1)
MAC receives new resources. It resumes as described in the PACKET UPLINK ASSIGNMENT procedure.

(MAC 2)
MAC 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>

3.14.5 Abnormal Cases



(MAC 1)
MAC receives new resources. Parameter error occurs.

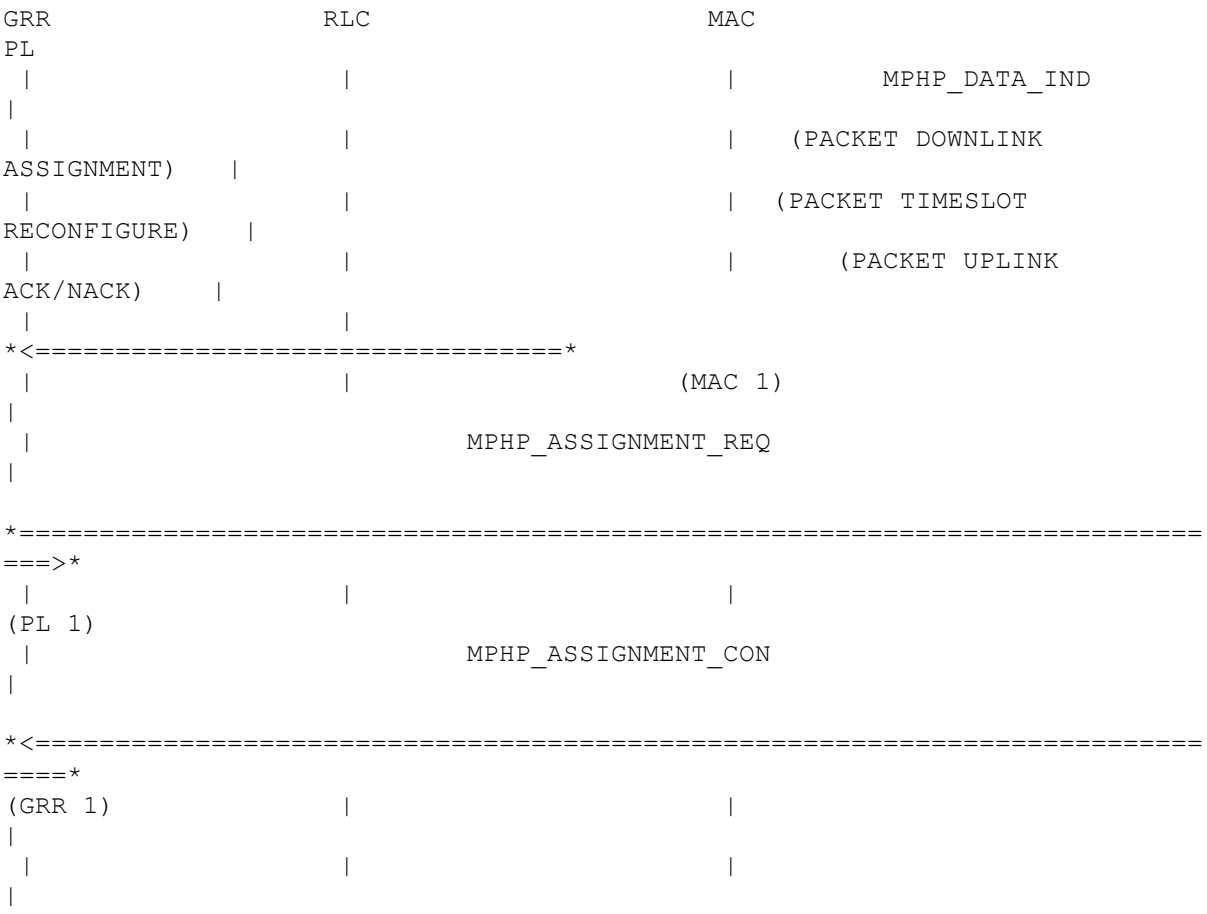
(PL 1)
The MS performs an abnormal release and resumes with either system information reading or random access.

(GRR 1)

The MS confirms the release of the TBF.

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

3.14.6 Establishment of Downlink TBF



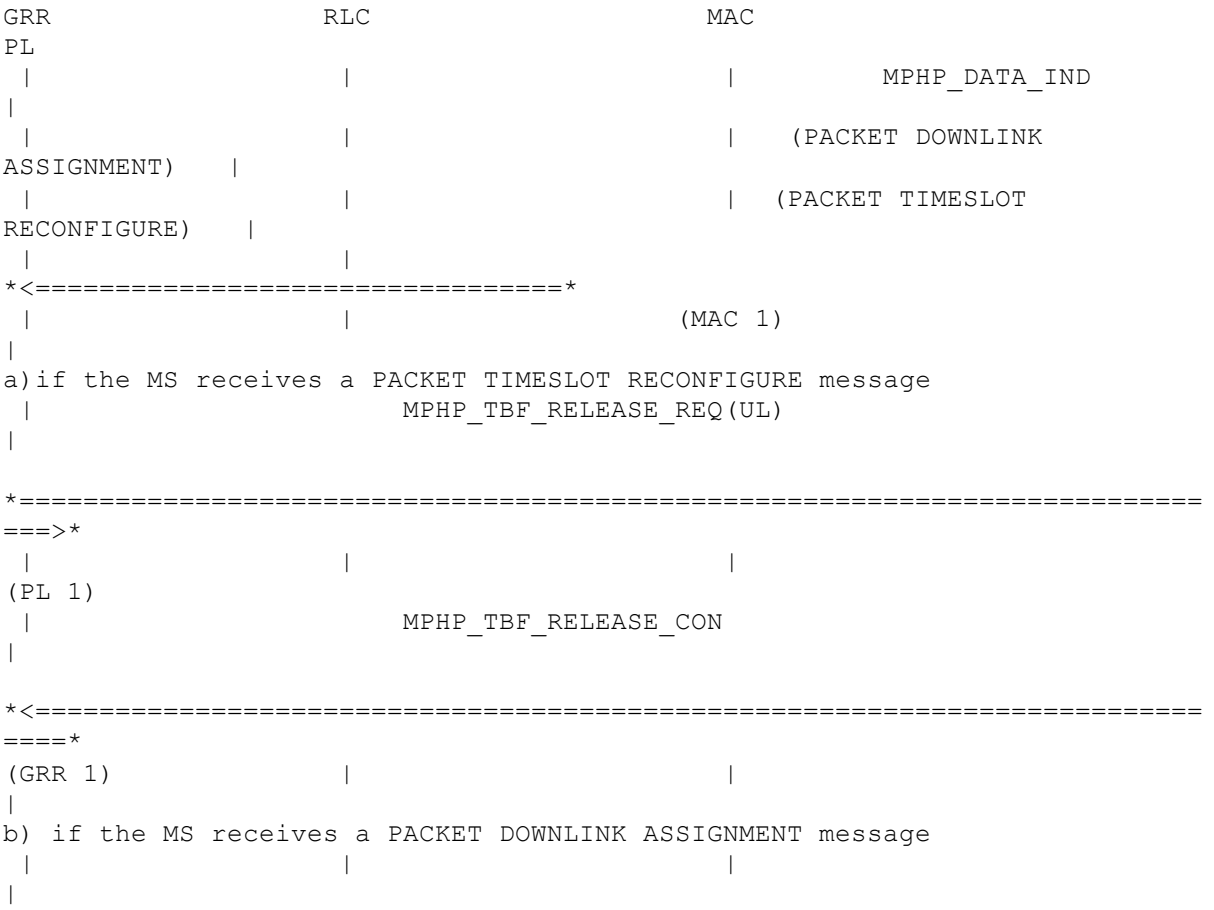
(MAC 1)
MAC receives during the uplink a PACKET DOWNLINK ASSIGNMENT or a PACKET TIMESLOT RECONFIGURE.

(PL 1)
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>

3.14.7 Abnormal cases during downlink assignment



(MAC 1)
MAC receives during the uplink TBF a PACKET DOWNLINK ASSIGNMENT or a PACKET TIMESLOT RECONFIGURE.

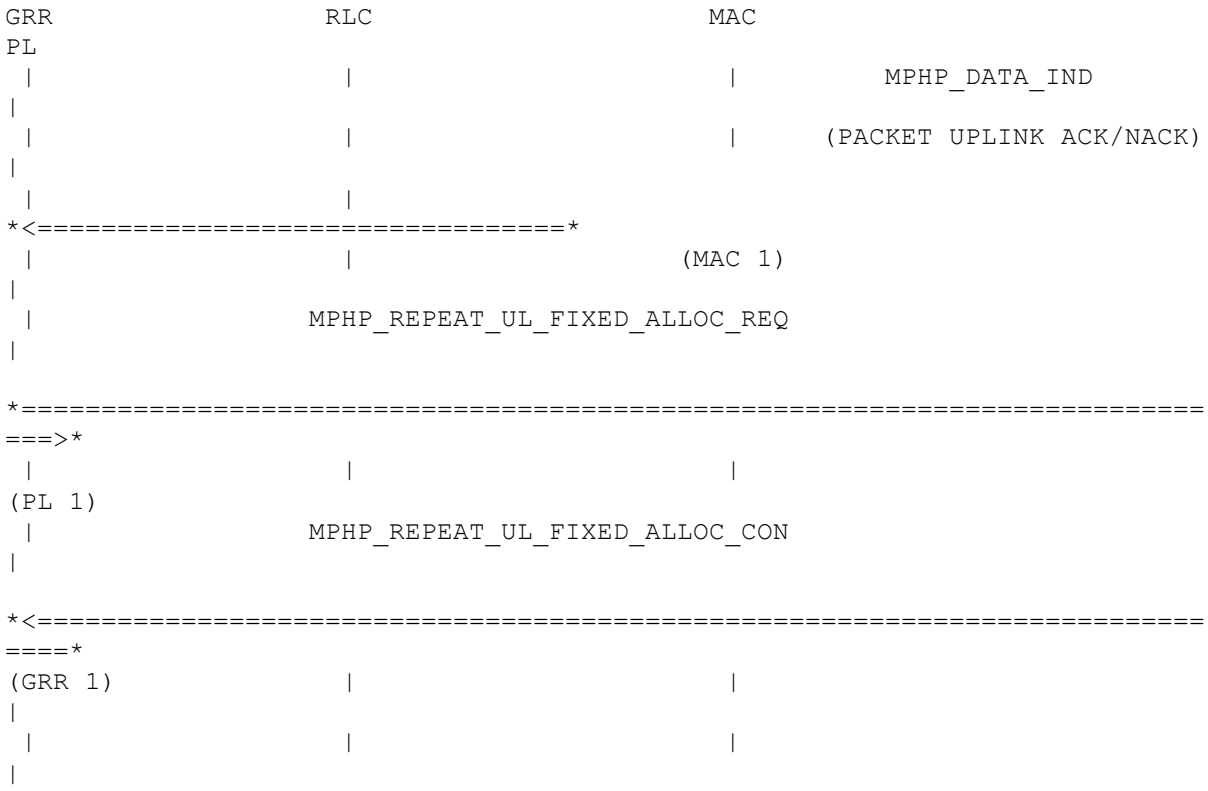
(PL 1)
In case a) due to failures (see requirements) the uplink is released. A new random access is performed. In case b) the aborts or ignores the downlink assignment procedure and continues with uplink assignment.

(GRR 1)

The MS confirms the release of the TBF.

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>

3.14.8 Reallocation of the fixed Allocation



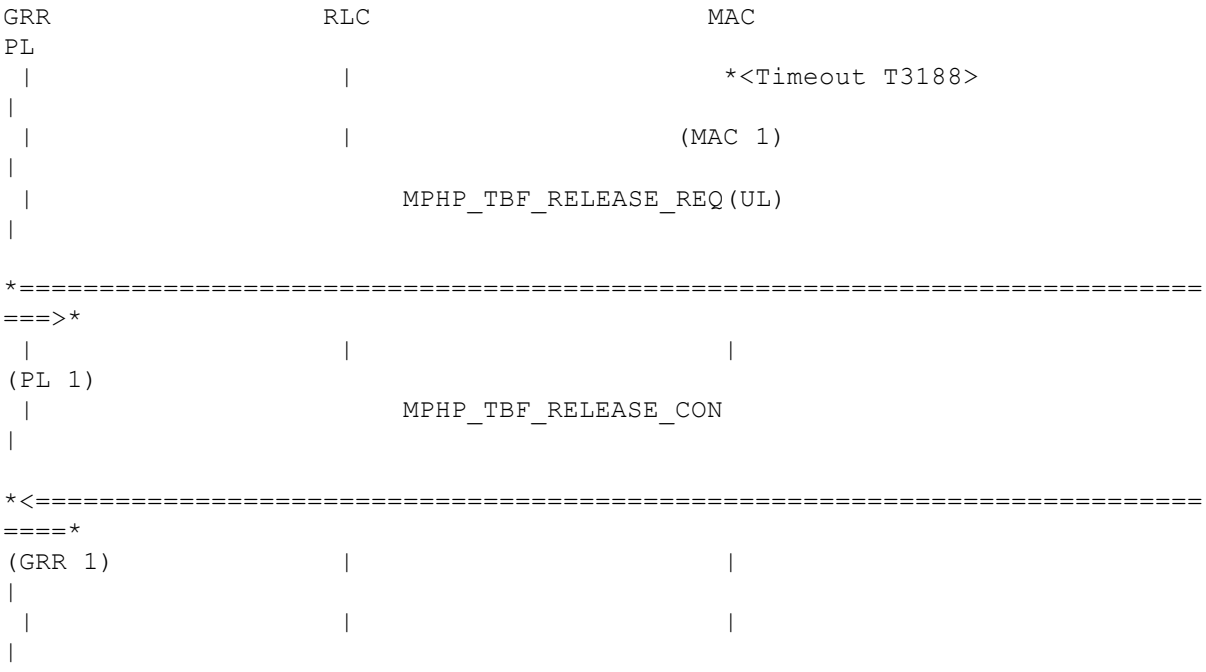
(MAC 1)
MAC receives during the uplink TBF with fixed mode an PACKET UPLINK ACK/NACK message indicating a repeat allocation.

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

(GRR 1)
The reallocation is confirmed by 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>

3.14.9 On expiry if Timer T3188



(MAC 1)
Timer T3188 expires.

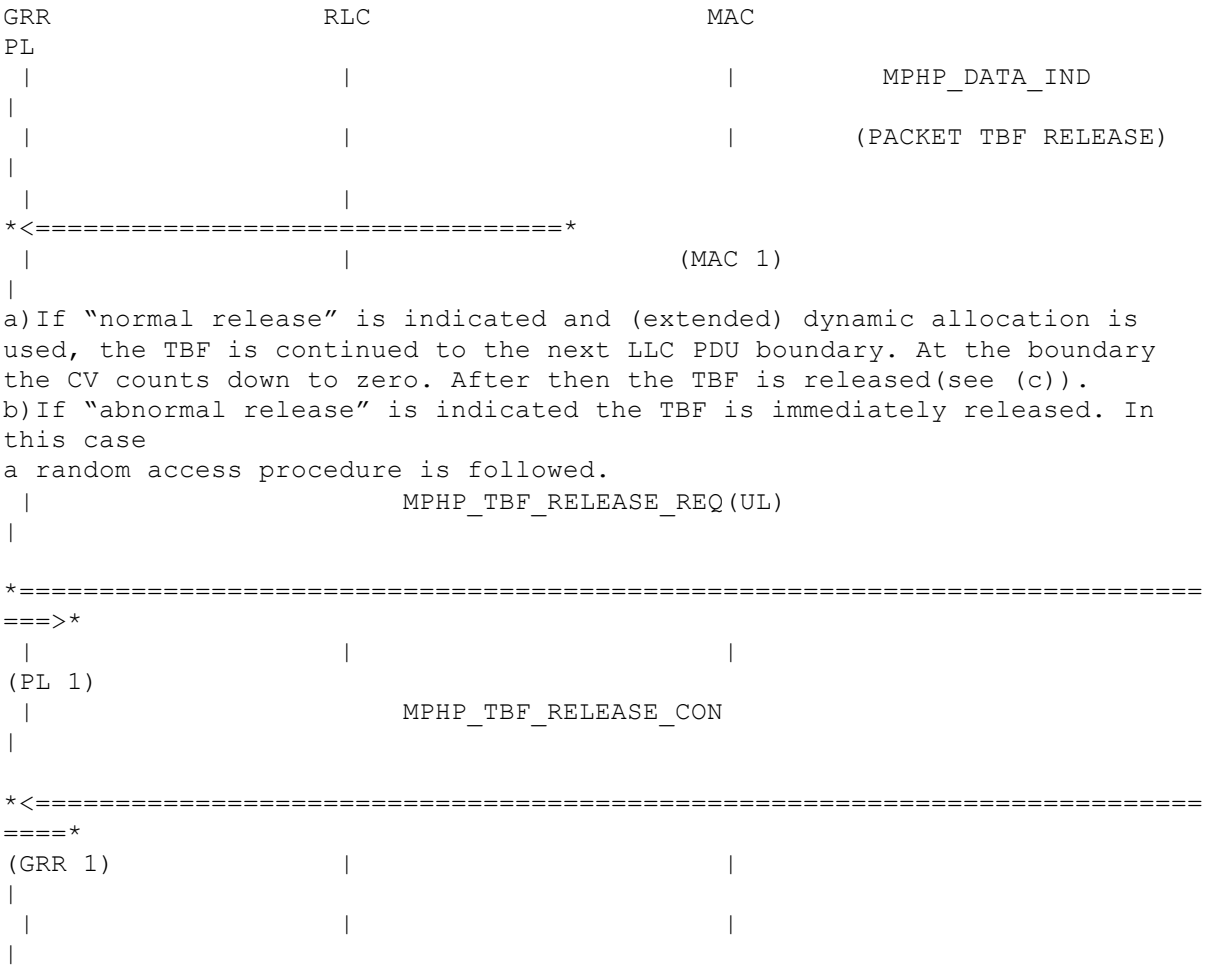
(PL 1)
The MS performs an abnormal release with random access.

(GRR 1)

The MS confirms the release of the TBF.

Requirements:
<R.MAC.EXH_ALOC.003>

3.14.10 Network initiated release of uplink TBF



(MAC 1)
The MS receives a PACKET TBF RELEASE message.

(PL 1)
The MS performs an abnormal release with random access.

(GRR 1)

The MS confirms the release of the TBF.

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

3.15 MAC procedures in downlink packet transfer mode

3.15.1 Downlink assignment

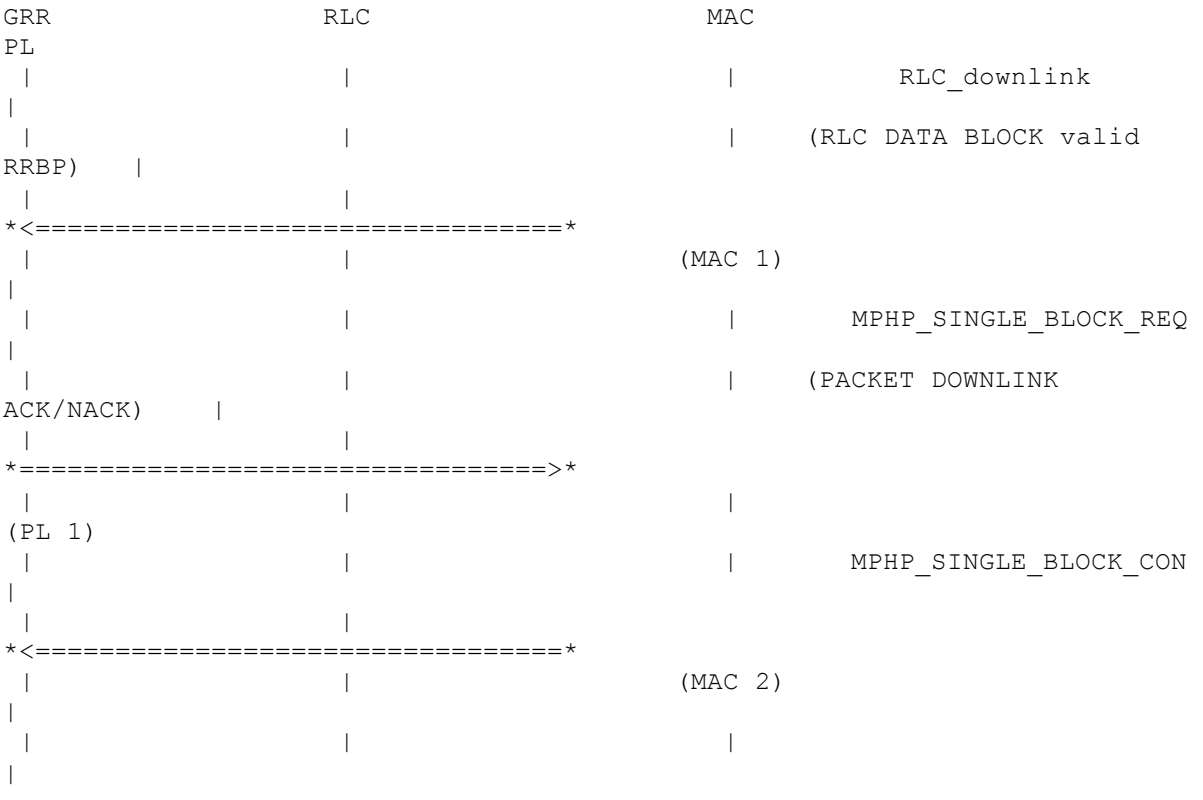
(PL 1)
The MS receives new downlink resources.

(PL 2)
The downlink allocation is indicated to layer 1.

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

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

3.15.2 Polling for Downlink ACK/NACK



(MAC 1)
MAC 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).

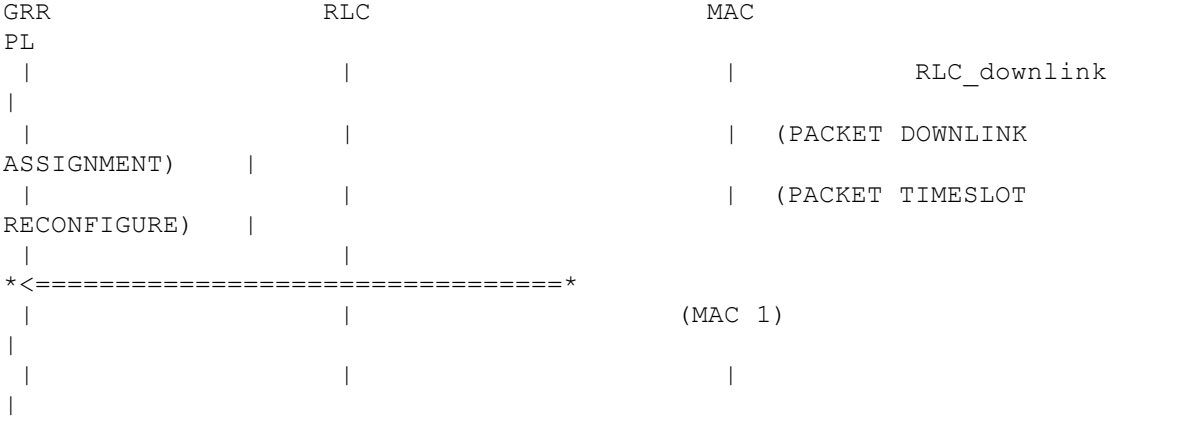
(PL 1)
The PACKET DOWNLINK ACK/NACK message is sent by a single block request.

(MAC 2)
The single block transmission is confirmed by layer 1.

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

3.15.3 Suspending the Downlink TBF !!! REMOVED !!!

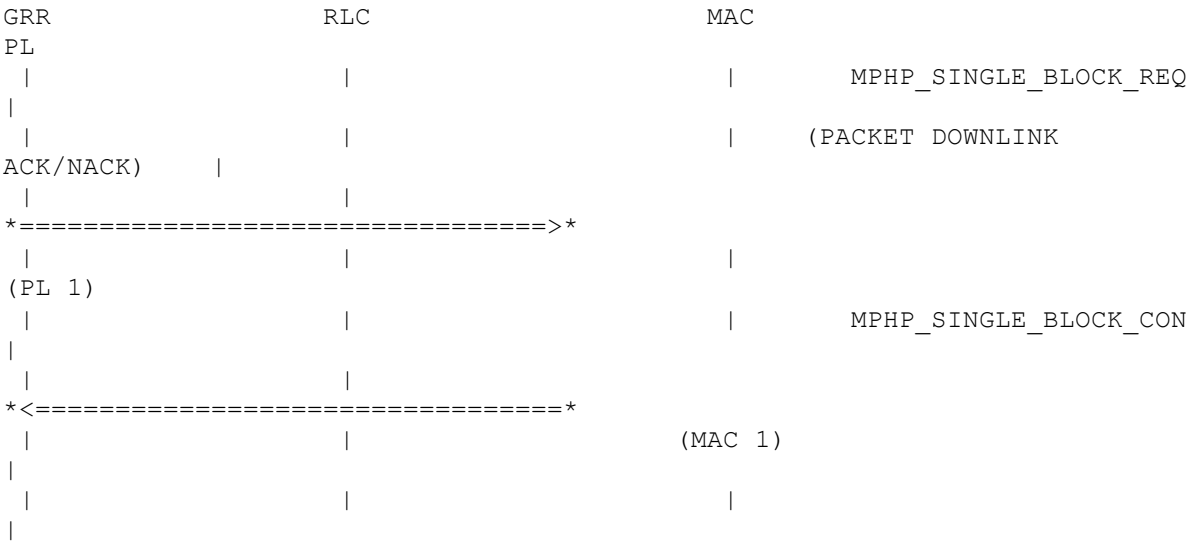
3.15.4 Resource Reassignment for Downlink TBF



(MAC 1)
The MS receives a change in resources in the current TBF.

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

3.15.5 Establishment of uplink TBF

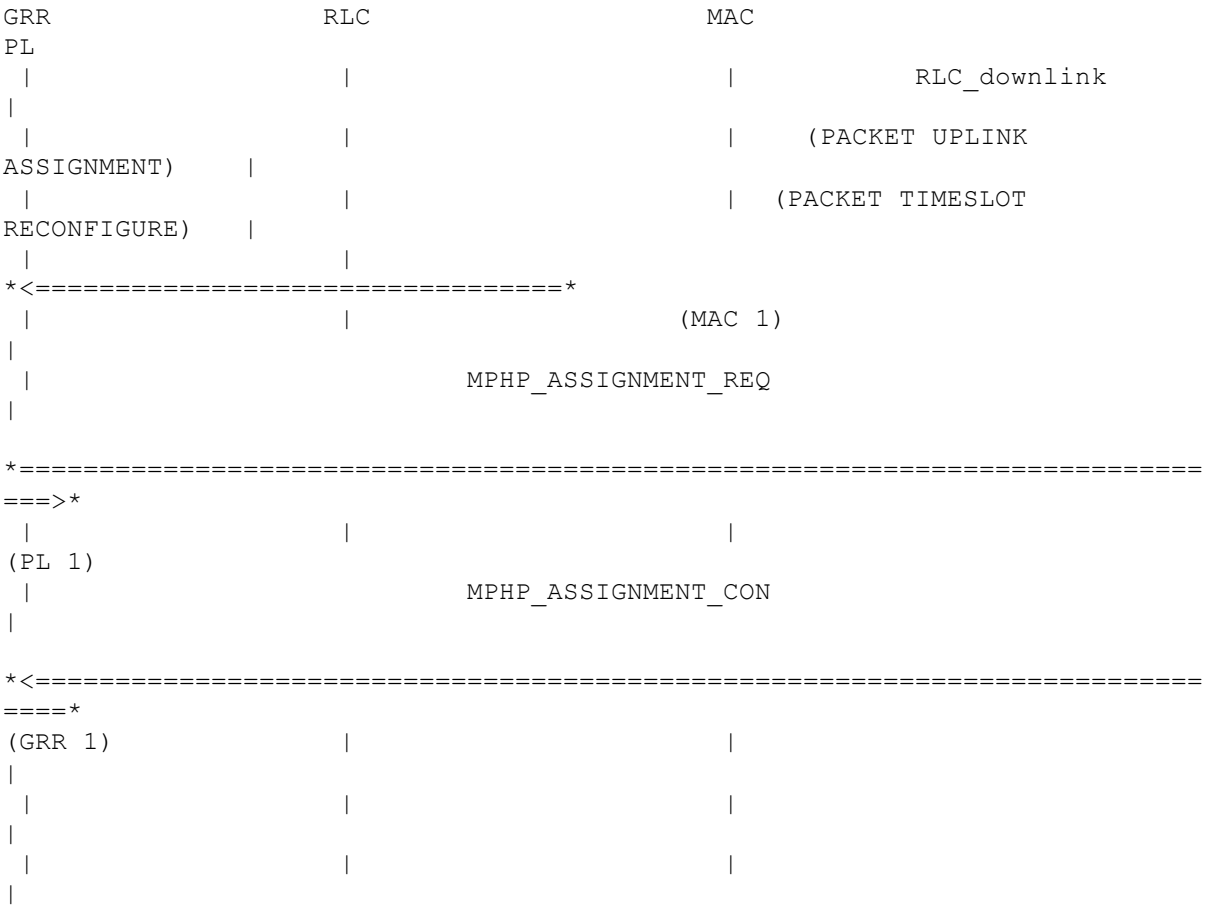


(PL 1)
The MS requests a uplink TBF in the PACKET DOWNLINK ACK/NACK.

(MAC 1)
The single block transmission is confirmed by layer 1.

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>

3.15.6 Receiving of uplink resources



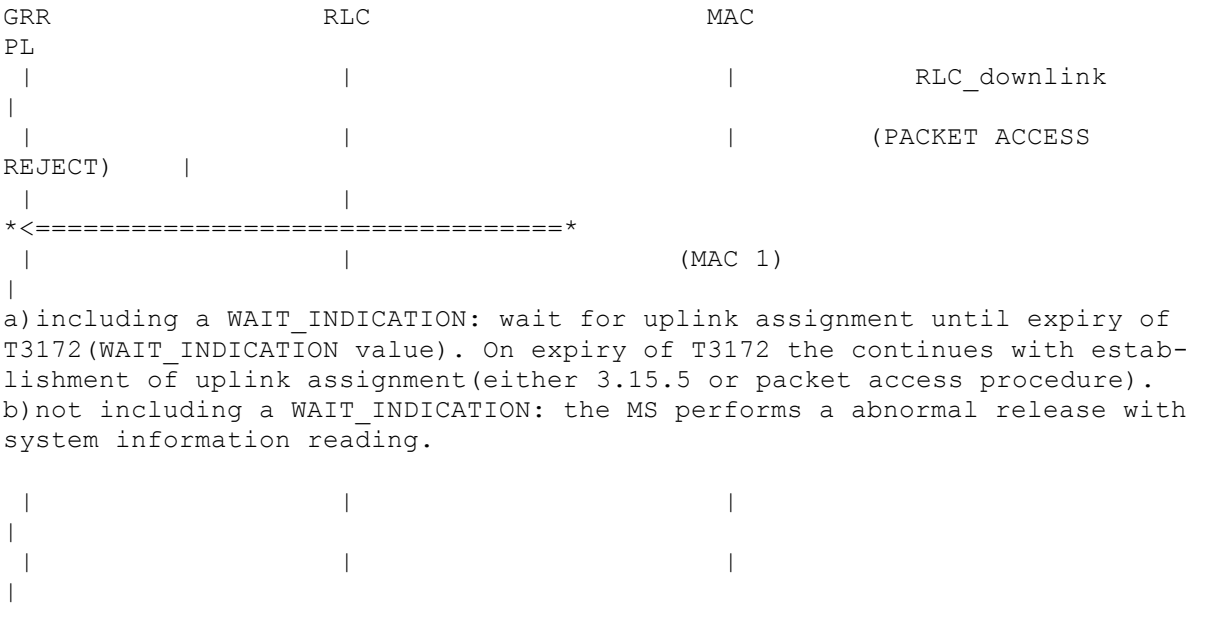
(MAC 1)
The MS receives uplink resources.

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

(GRR 1)
The uplink allocation is confirmed by 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>

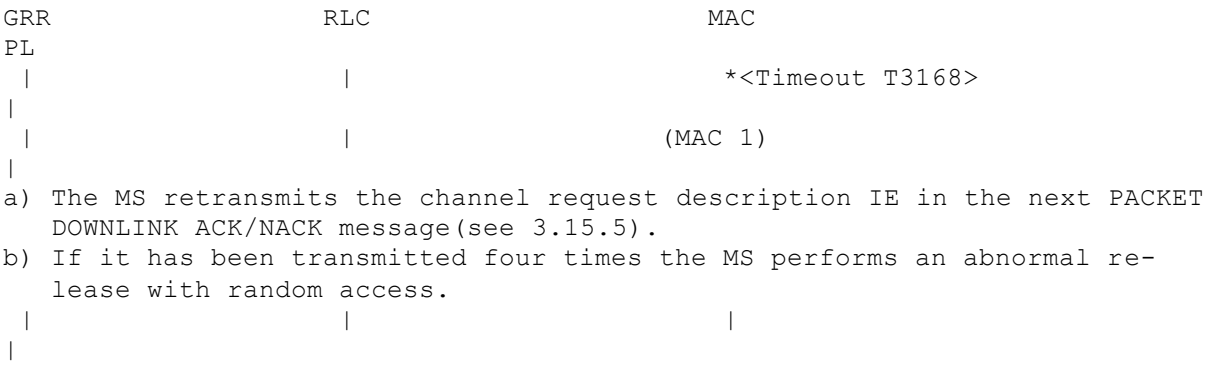
3.15.7 Receiving of packet access reject



(MAC 1)
The MS receives PACKET ACCESS REJECT message.

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

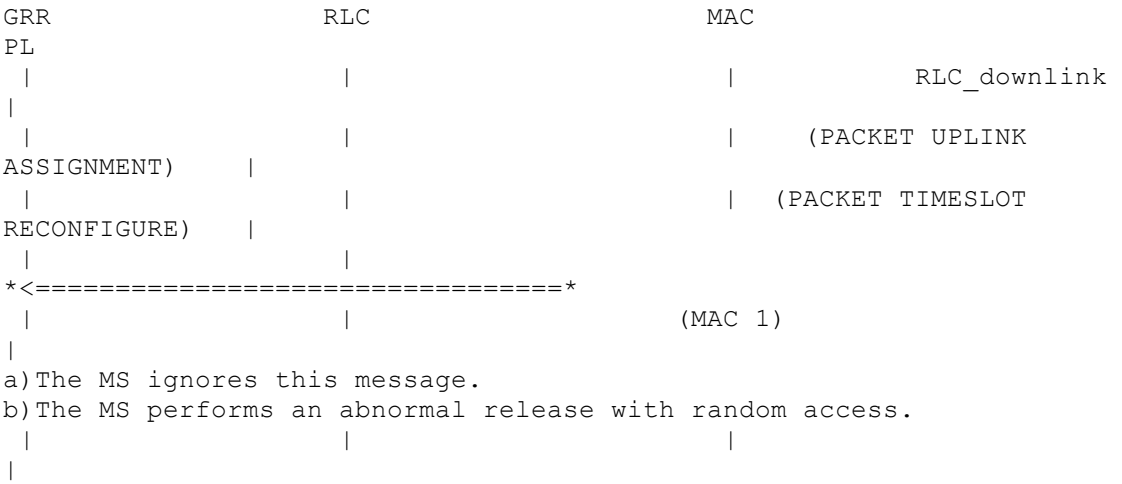
3.15.8 On expiry if Timer T3168



(MAC 1)
Timer T3168expires.

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

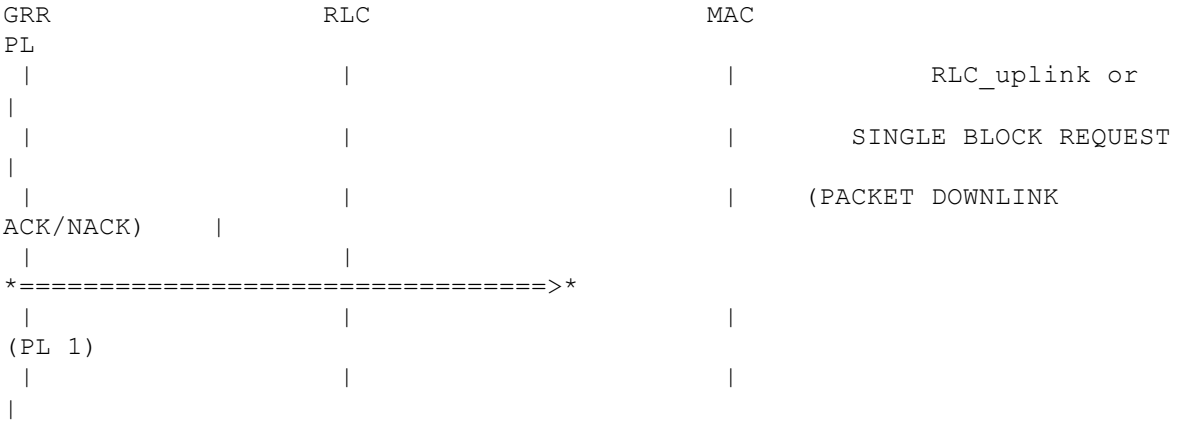
3.15.9 Abnormal cases



(MAC 1)
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>

3.15.10 Network initiated downlink TBF release

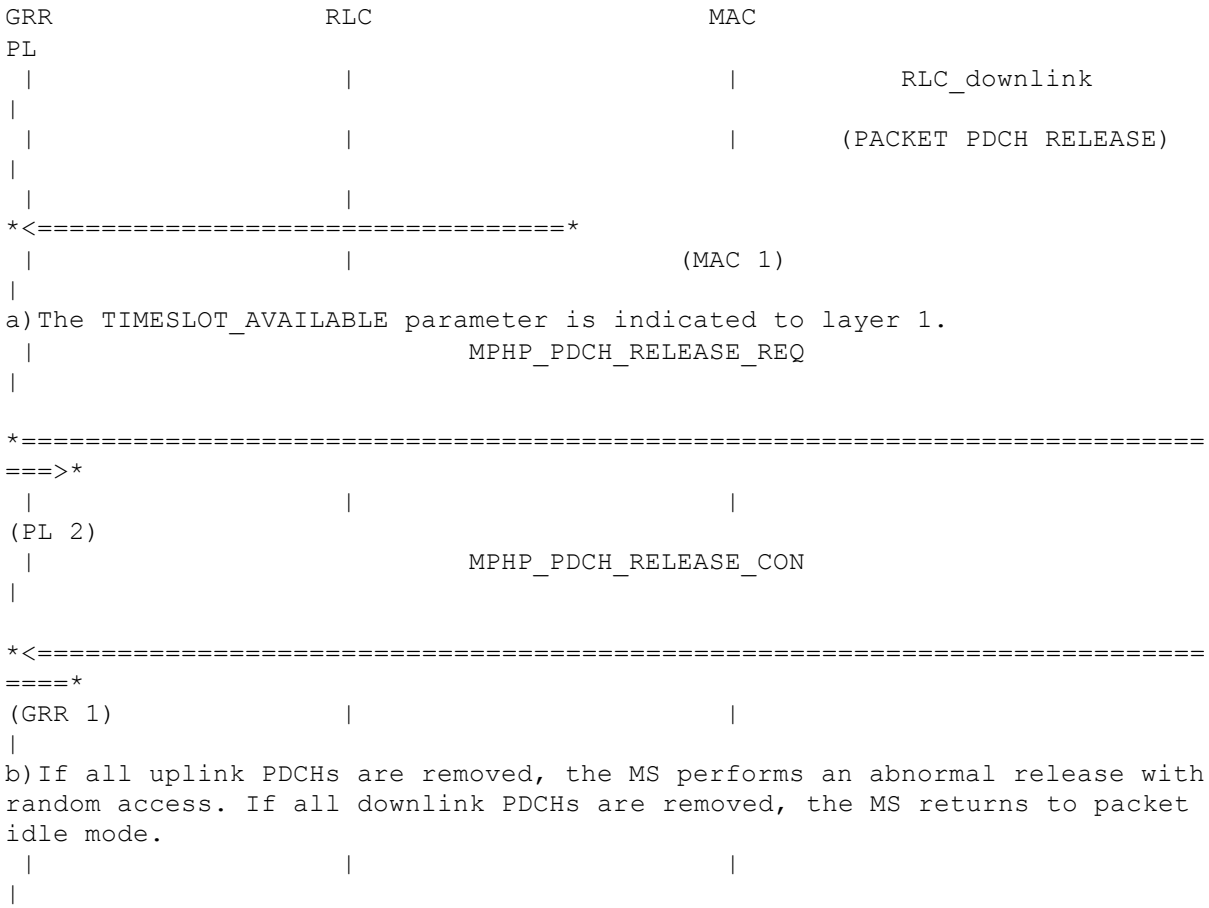


(MAC 1)
The MS initiates the release of the downlink TBF by setting the TBF_RELEASE bit in the PACKET DOWNLINK ACK/NACK message.

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

3.16 Packet PDCH Release

3.16.1 On reception of PACKET PDCH RELEASE



(PL 1)
The MS receives a PACKET PDCH RELEASE message.

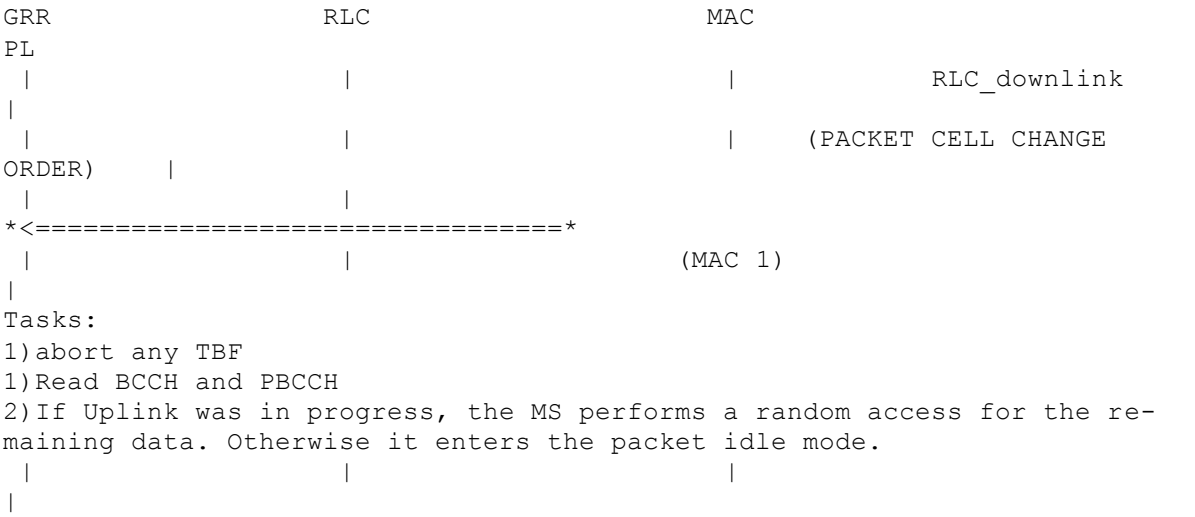
(PL 2)
The TIMESLOT_AVAILABLE is indicated to layer 1.

(GRR 1)
The TIMESLOT_AVAILABLE is confirmed by layer 1.

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

3.17 Cell change procedure in packet transfer mode

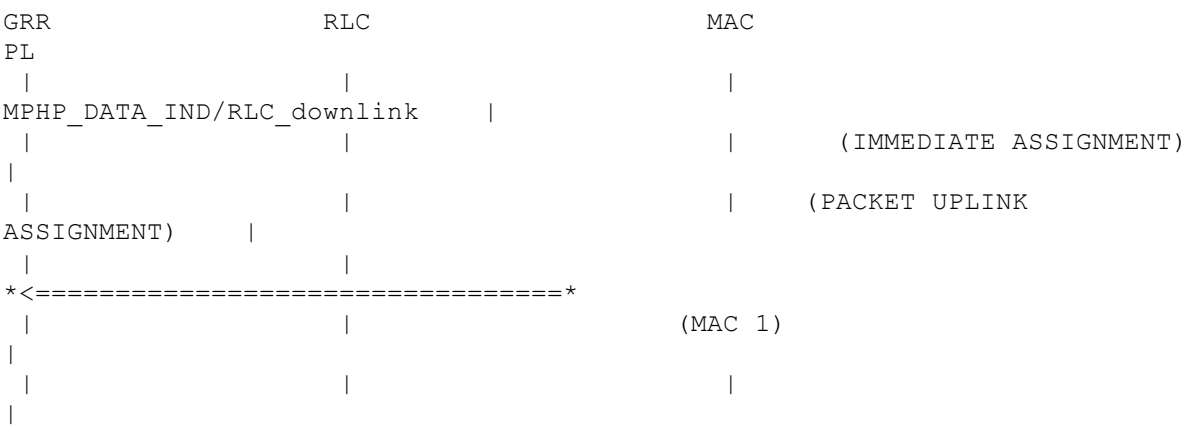
3.17.1 On reception of PACKET CELL CHANGE ORDER



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

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

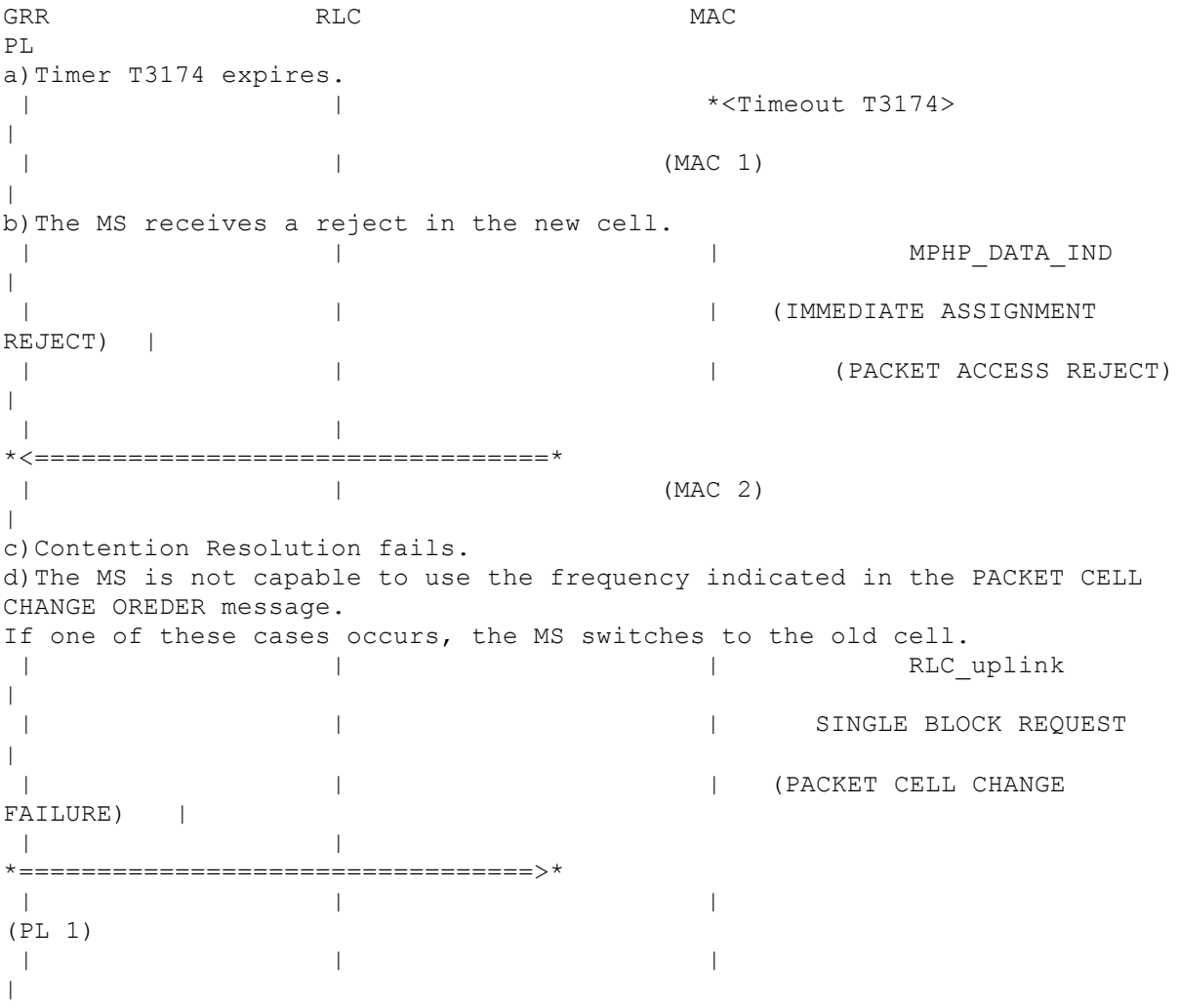
3.17.2 Network controlled cell reselection completion



(MAC 1)
The MS receives a response to its channel request or packet channel request.

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

3.17.3 Failure on the new cell or Timeout of T3174



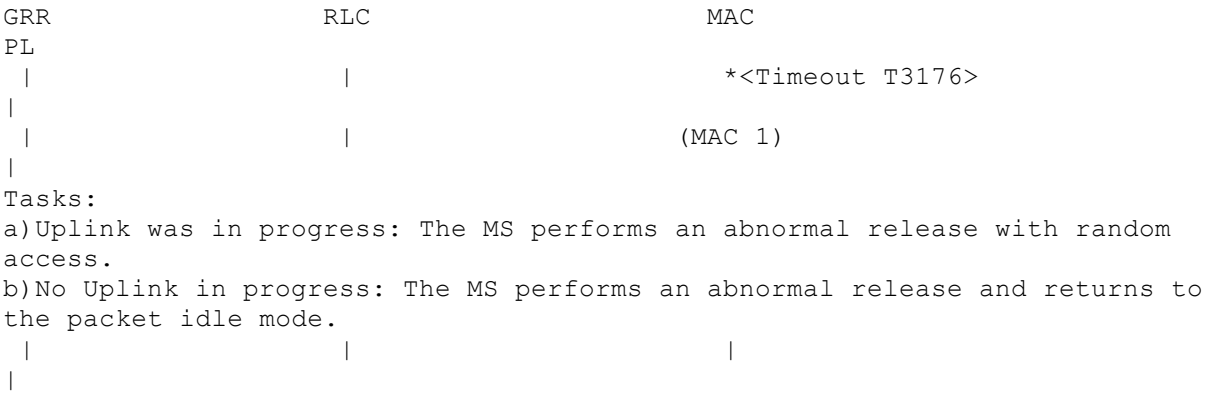
(MAC 1)
Timer T3174 expires.

(MAC 2)
The MS receives a negative response to its channel request or packet channel request.

(PL 1)
The MS transmits the PACKET CELL CHANGE FAILURE message to the network. If uplink was in progress, the message is transmitted in the RLC_uplink message. Other wise the MS starts random access procedure and request single block. On reception of single block assignment, the transmits the PACKET CELL CHANGE FAILURE message. Timer T3716 is started.

Requirements:
<R.MAC.NC_CRES.M.003-5>, <R.MAC.ABCC_TRF.M.001>

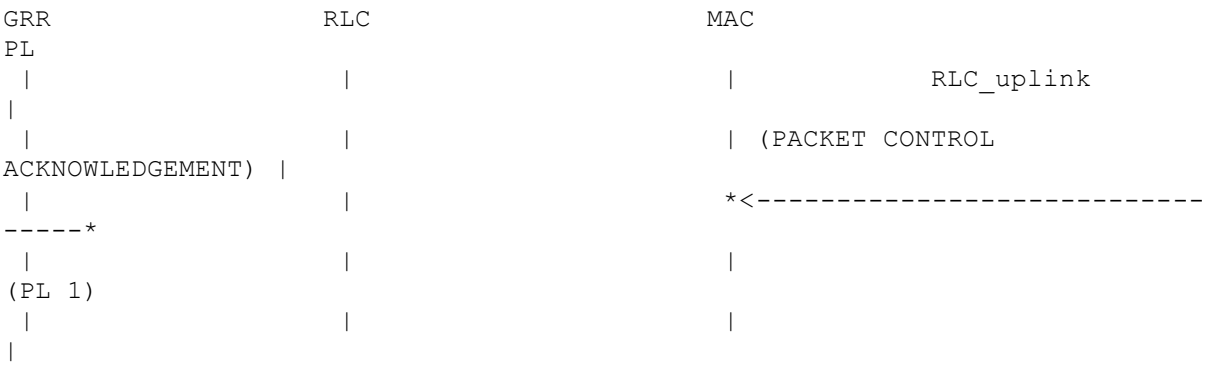
3.17.4 Timeout of Timer T3176



(MAC 1)
Timer T3176 expires.

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

3.18 Packet Control Acknowledgement

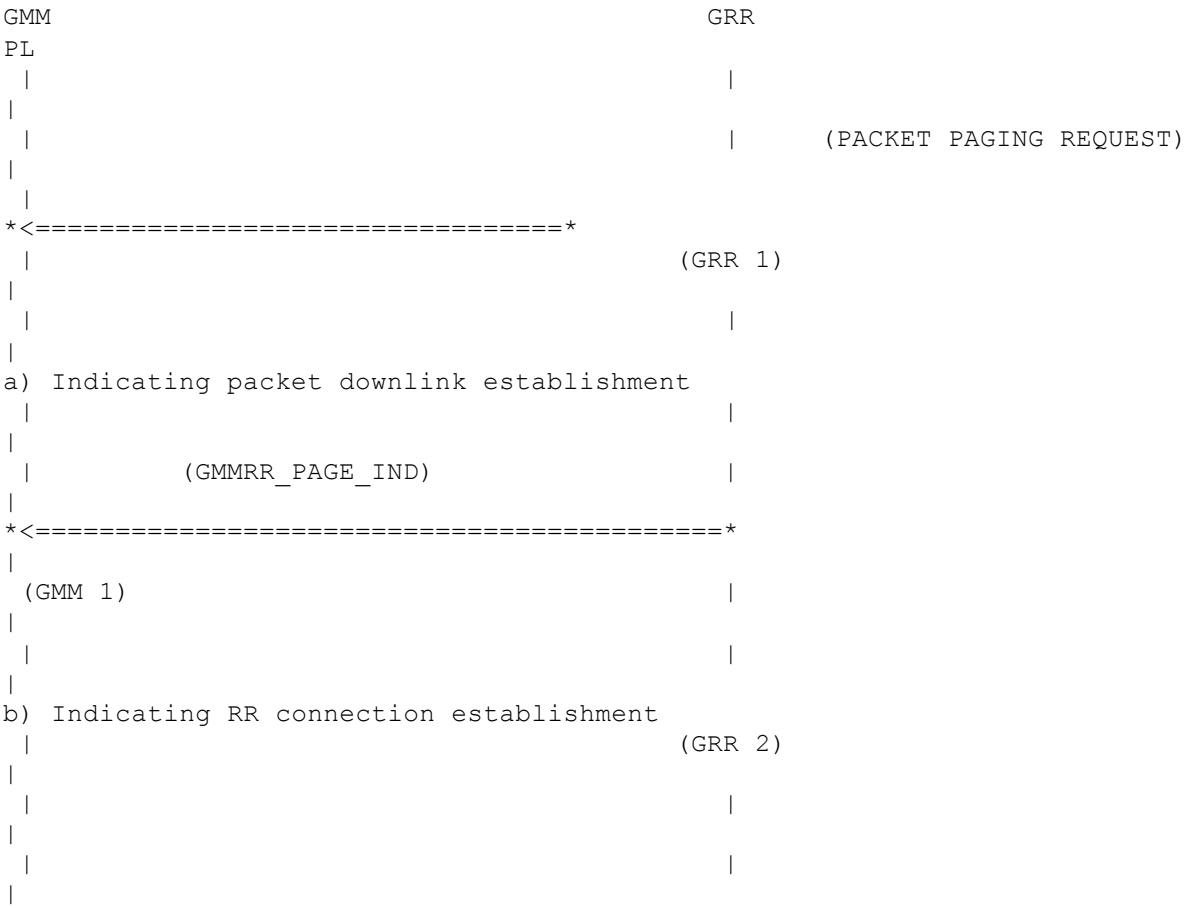


(PL 1)
The network sends the PACKET CONTROL ACKNOWLEDGEMENT message.

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

3.19 Receiving a PACKET PAGING REQUEST

3.19.1 On PCCCH_GROUP

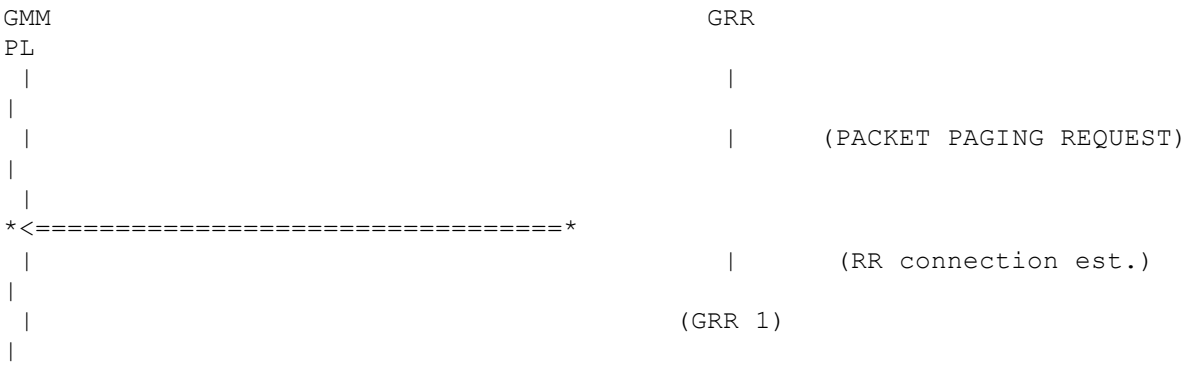


(GRR 1)
The network sends the PACKET PAGING REQUEST to the MS in the PCCCH_GROUP.

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

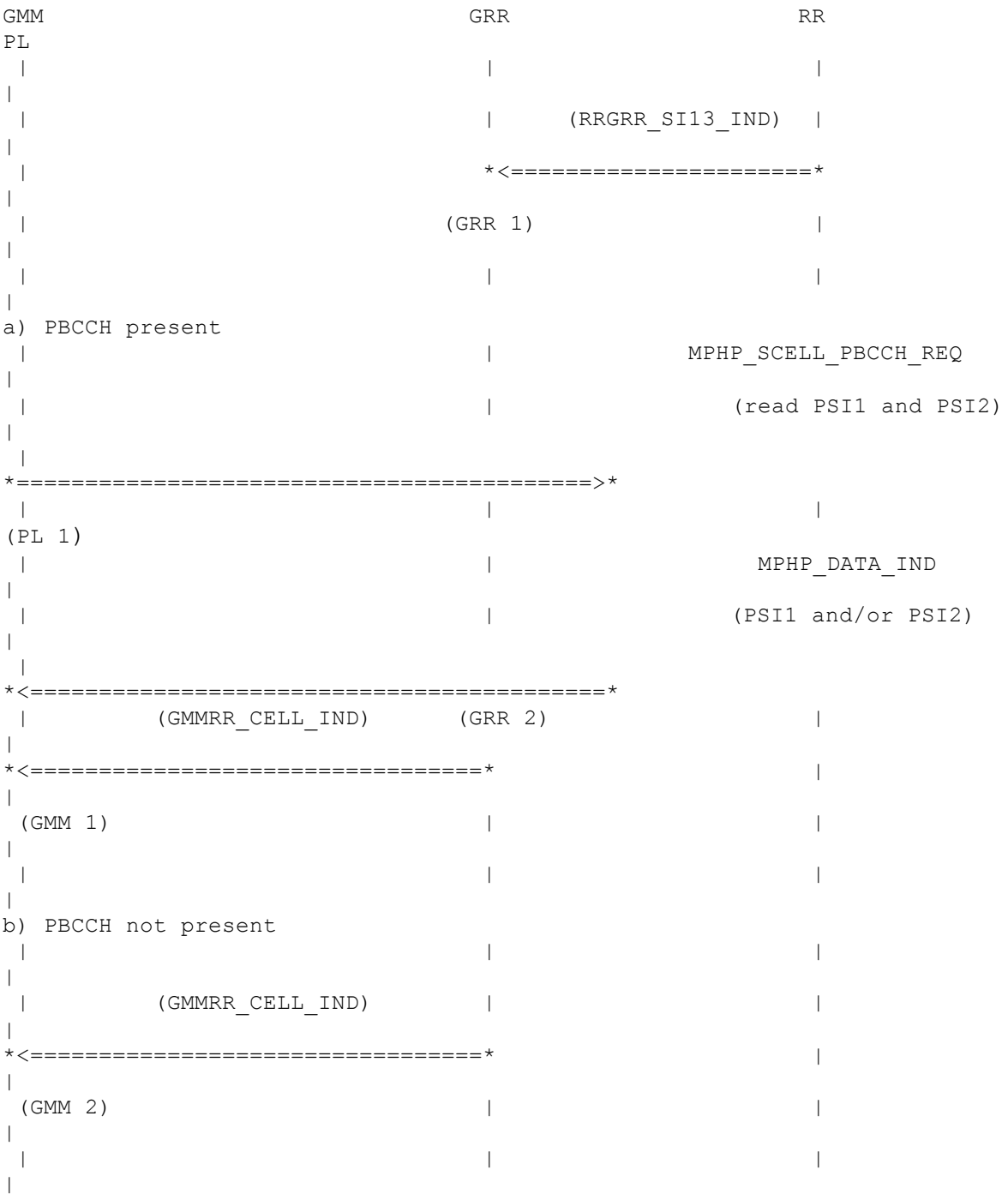
(GRR 2)
The GRR indicates the paging request for RR connection establishment to the RR (except MSs in class C).

3.19.2 On PACCH



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

3.20 Cell indication



(GRR 1)
GRR receives RRGRR_SI13_IND from the RR.

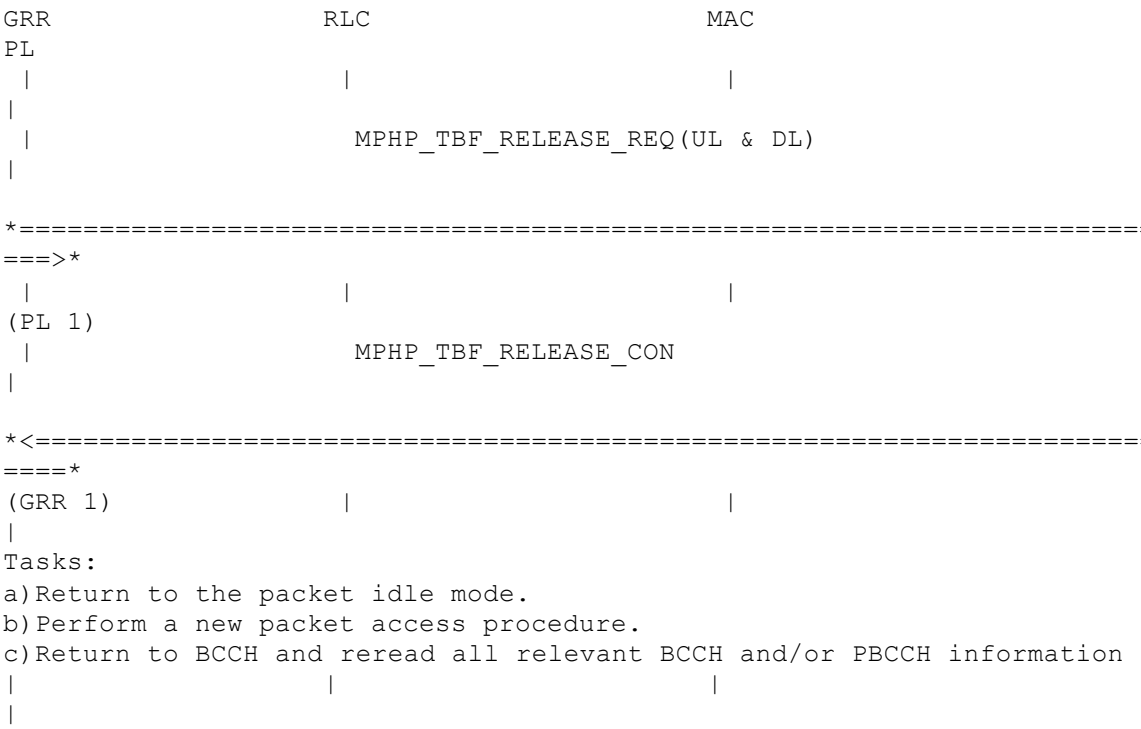
(PL 1)
PL reads PSI1 and PSI2

(GRR 2)
GRR receives PSI1 and/or PSI2.

(GMM 1)
GRR indicates the cell information to the GMM. Note: If the Routing Area Code changes, GRR shall also send a GMMRR_CELL_IND to the GMM.

(GMM 2)
There is no PBCCH present, GRR sends GMMRR_CELL_IND to the GMM.

3.21 Abnormal Release

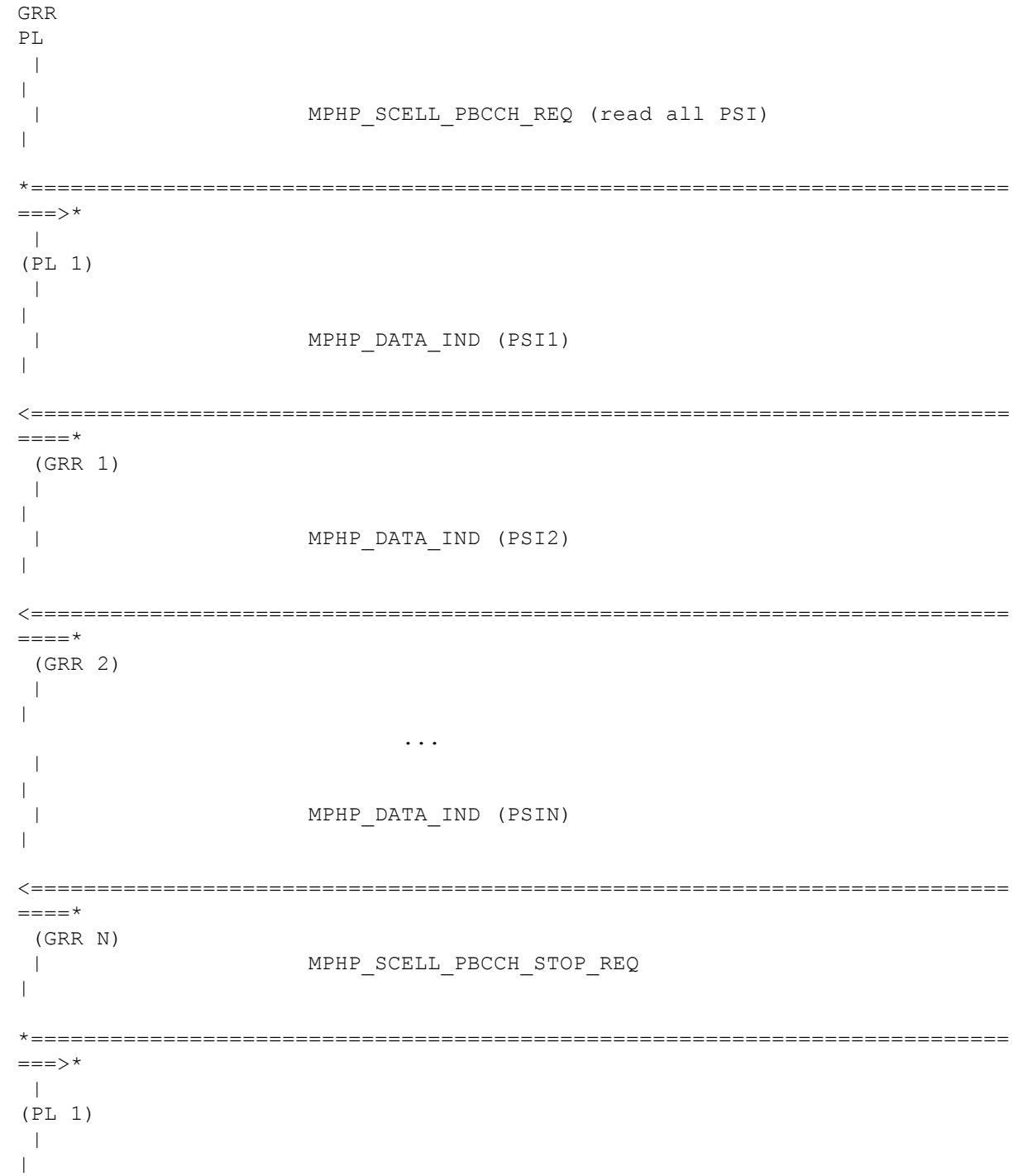


(PL 1)
The MS releases the downlink and/or uplink TBF, if it was in progress.

(GRR 1)
Layer 1 confirms the release of the uplink and/or downlink TBF .

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>

3.22 System information on PBCCH



(PL 1)
GRR informs the PL to read all PSI messages (complete acquisition).

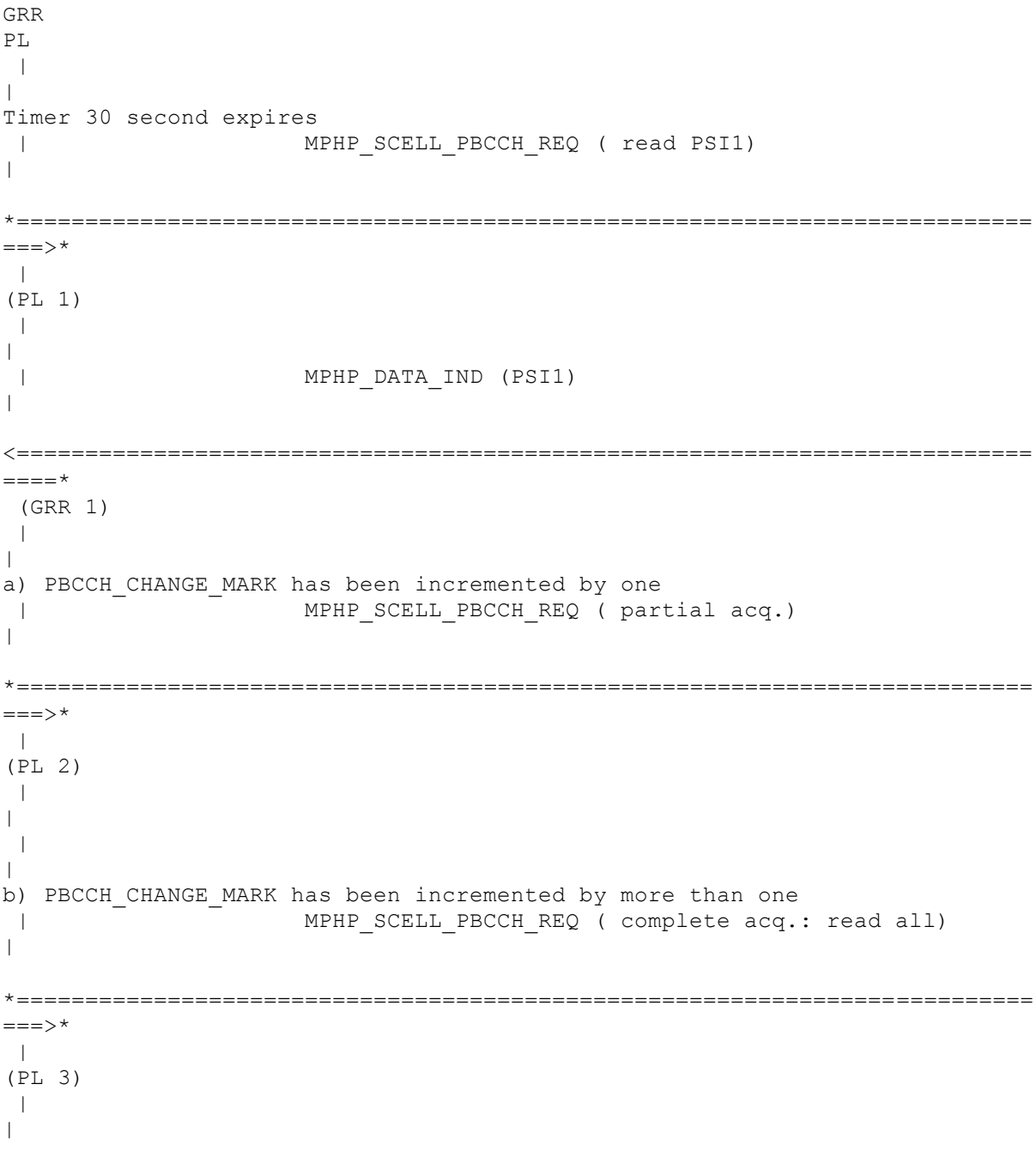
(GRR 1)
GRR receives PSI1 message. GRR starts two timers: 60 second and 30 second timer. These timers are restarted everytime if the GRR receives PSI1 or (P)SI13 messages on PACCH or PBCCH. GRR checks the acquisition state whether it should stop the PSI reading procedure or not.

(GRR 2)
GRR receives PSI2 message. GRR checks the acquisition state whether it should stop the PSI reading procedure or not.

(GRR N)
GRR receives PSIN message. GRR checks the acquisition state whether it should stop the PSI reading procedure or not. If the acquisition completed, then the GRR stops the process of reading PSI messages.

(PL 2)
PL stops reading PSI messages.

3.22.1 Supervision of PBCCH_CHANGE_MARK and update of PBCCH information



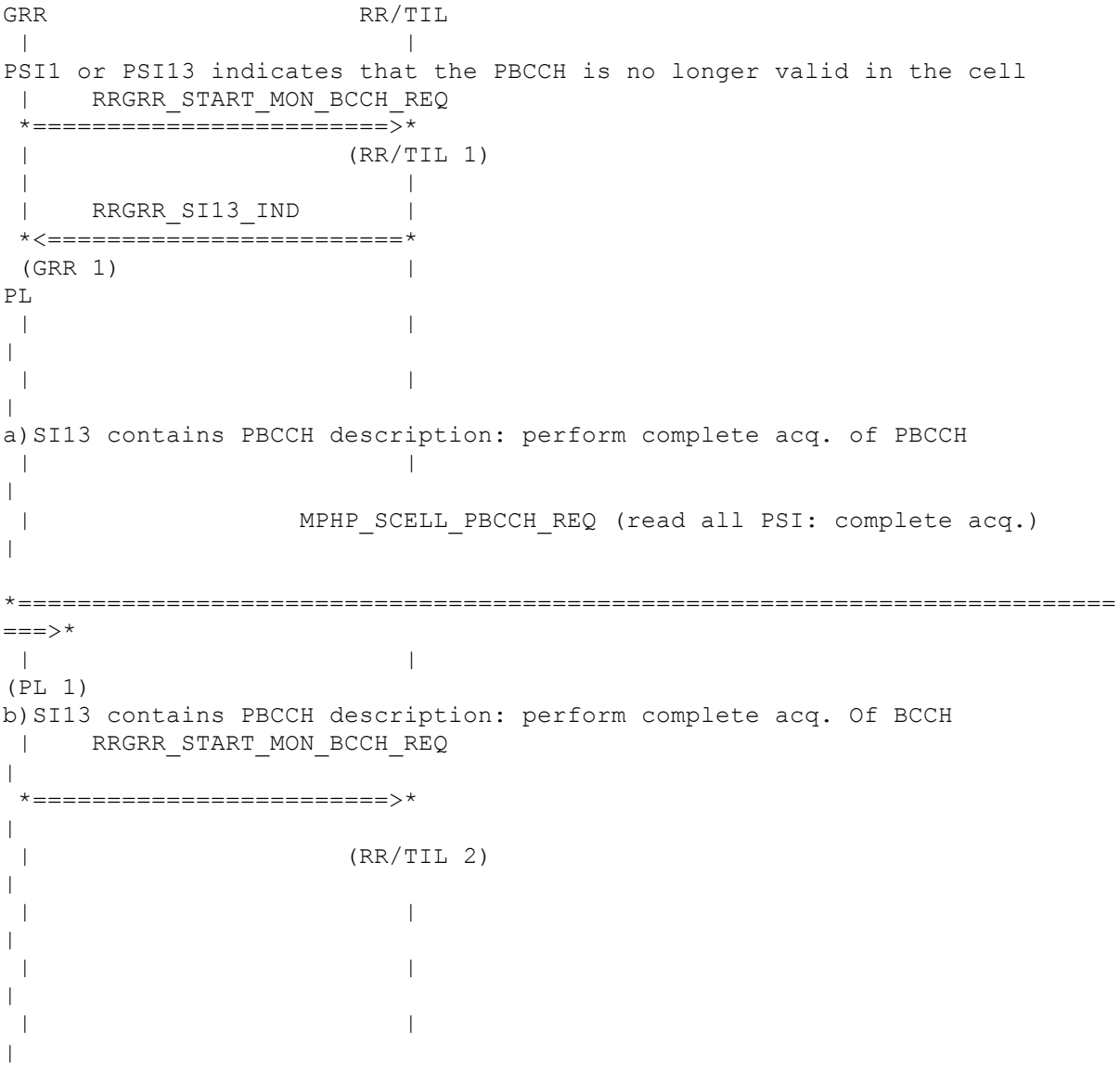
(PL 1)
GRR informs the PL to read PSI1 message.

(GRR 1)
GRR receives PSI1 message. GRR restarts 60 and 30 second timers. GRR supervises PBCCH_CHANGE_MARK.

(PL 2)
PL should perform partial acquisition. The PSI to acquire has been computed in GRR and passed to PL.

(PL 3)
PL should perform complete acquisition.

3.22.2 Replacement of PBCCH



(RR/TIL 1)
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

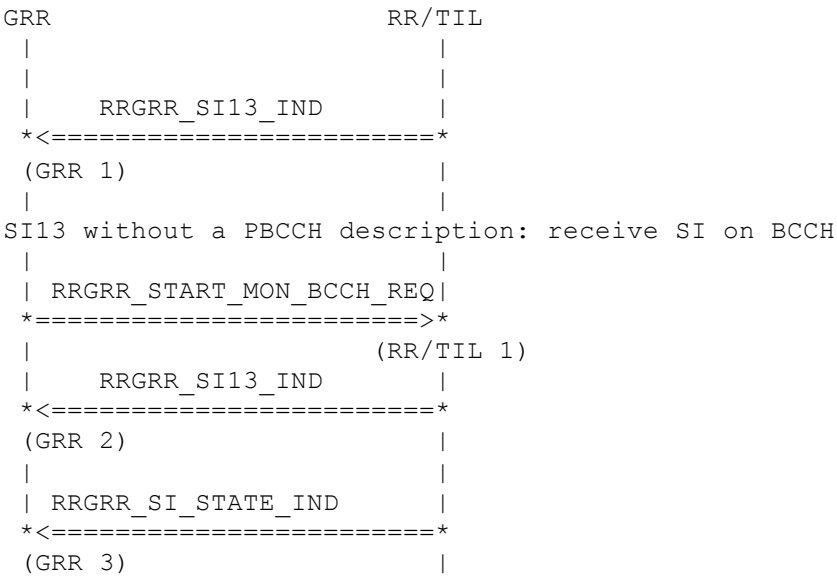
(PL 1)
SI13 contains a PBCCH description: GRR should perform a complete acq. of PSI messages.

(PL 1)
SI13 contains no PBCCH description: GRR should perform a complete acq. of SI messages on BCCH.

3.22.3 PSI1 reception failure

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

3.23 System information on BCCH



(GRR 1)
GRR receives SI13 which contains no PBCCH description. GRR should perform complete acq. of SI messages on BCCH.

(RR/TIL 1)
TIL has to perform complete acq. of SI messages.

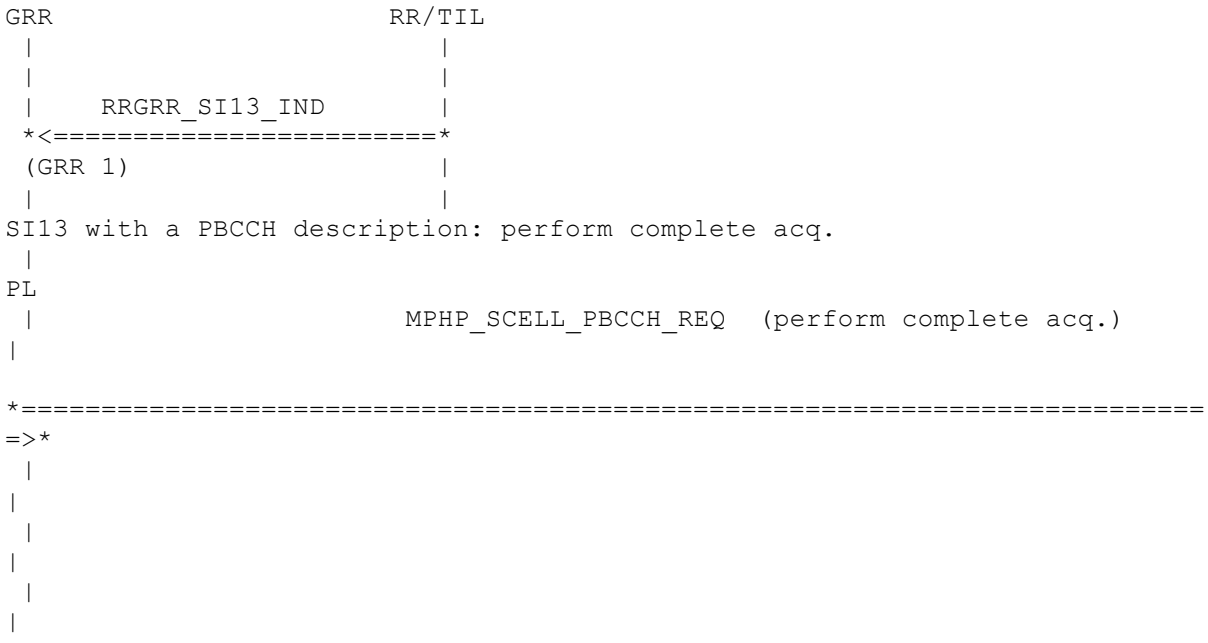
(GRR 2)
RR/TIL may send SI13 to GRR..

(GRR 3)
GRR gets the information about SI acq. state (to allow packet access).

3.23.1 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.

3.23.2 Establishment of PBCCH



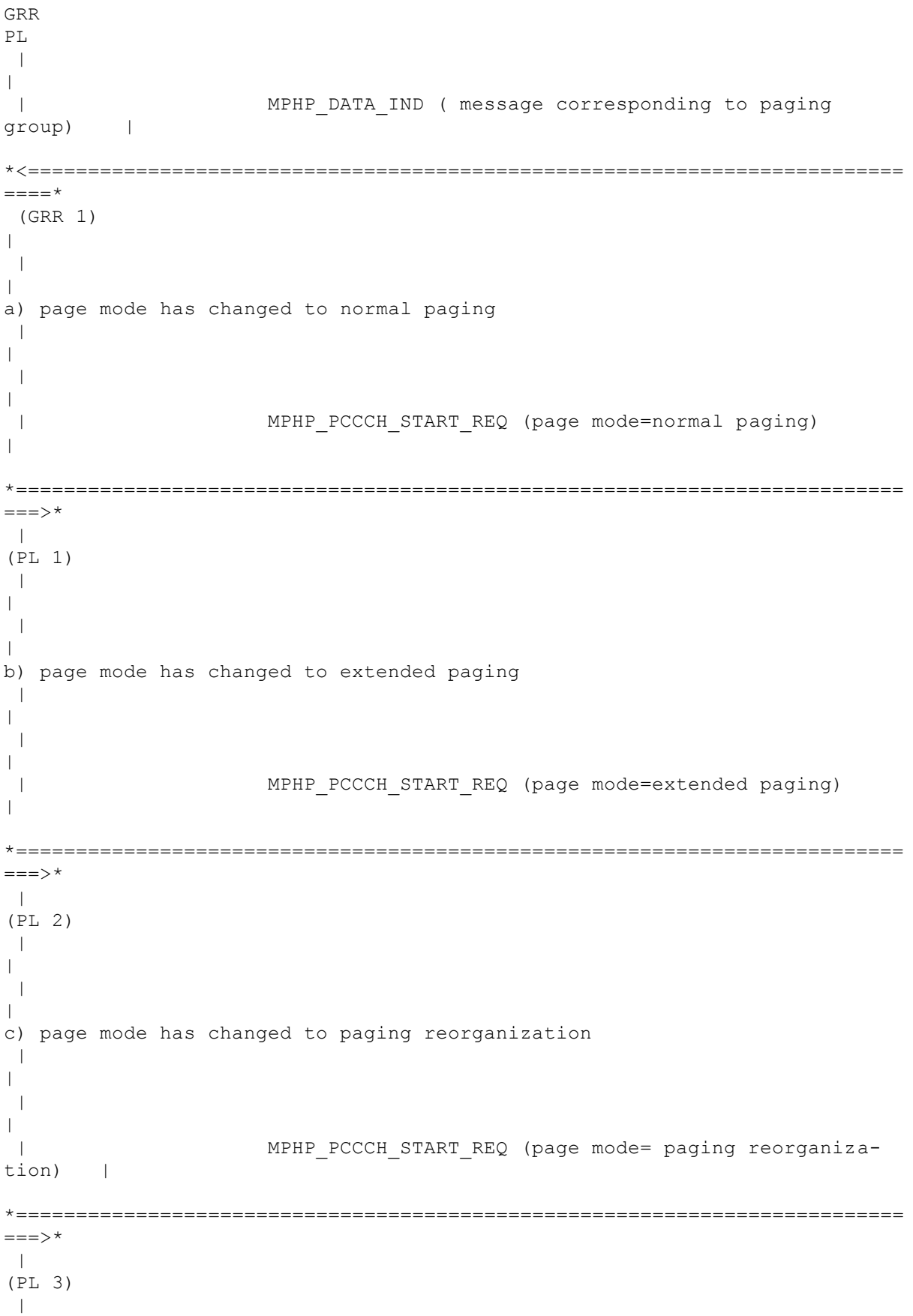
(GRR 1)
GRR receives SI13 which contains no PBCCH description. GRR should perform complete acq. of SI messages on BCCH.

3.23.3 SI13 reception failure

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

3.24 Page mode procedures on PCCCH

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


GRR
PL
MPHP_DATA_IND (message corresponding to paging group)
(GRR 1)
a) page mode has changed to normal paging
MPHP_PCCCH_START_REQ (page mode=normal paging)
(PL 1)
b) page mode has changed to extended paging
MPHP_PCCCH_START_REQ (page mode=extended paging)
(PL 2)
c) page mode has changed to paging reorganization
MPHP_PCCCH_START_REQ (page mode= paging reorganiza-tion)
(PL 3)

```
  |
|
d) page mode has not changed = same as before: nothing to do
  |
|
```

(GRR 1)
GRR receives any control message in the corresonding 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.

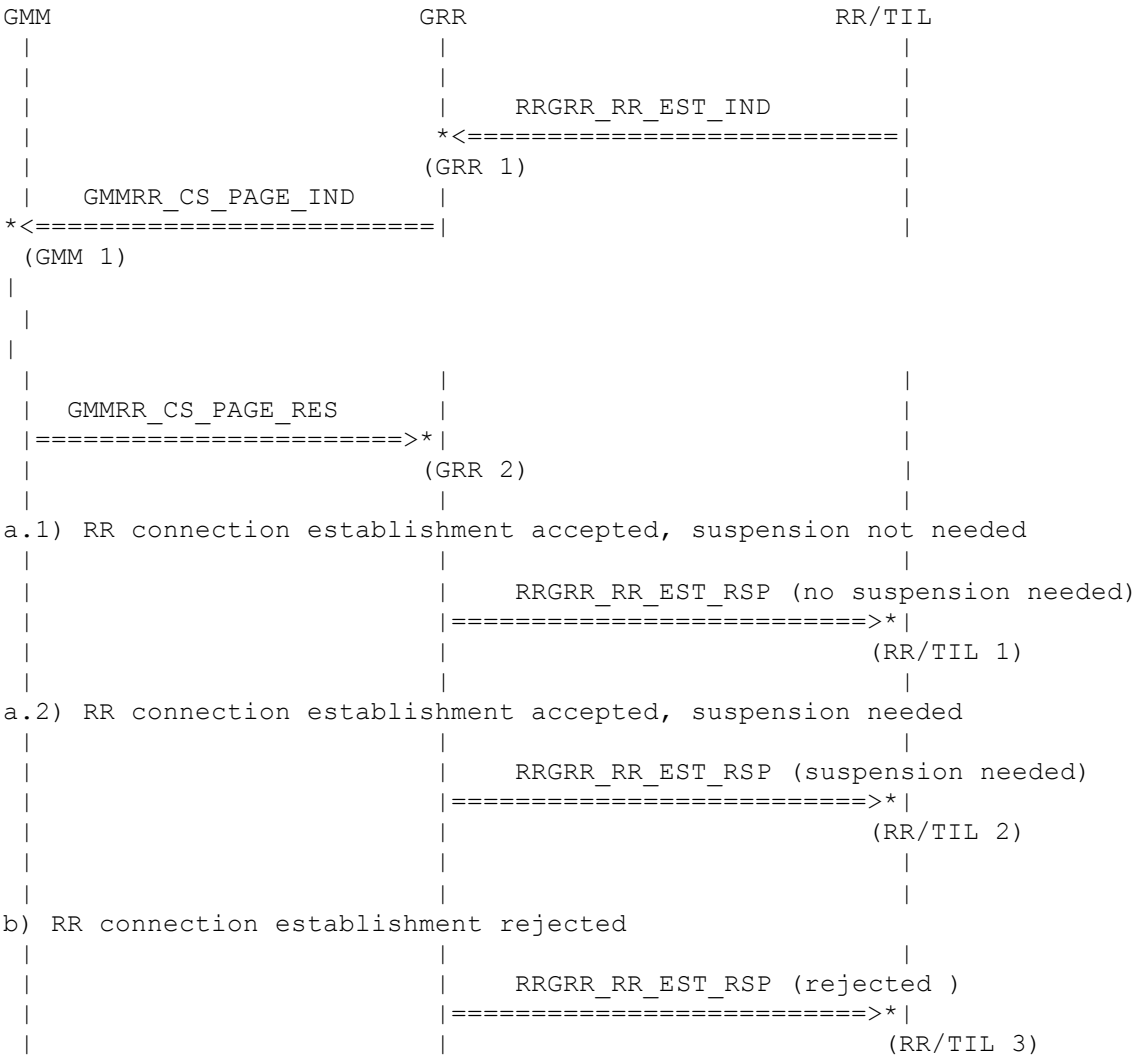
(PL 3)
GRR starts paging procedure with paging reorganization PL.

3.25 Page mode procedures on 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.

3.25.1 Paging procedure for RR connection establishment

This procedure has only meaning in the GRR part if the MS class is not CG. Because CG mobiles can not accept or receive RR establishment request. This type of MSs are only GPRS capable MSs



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

(GMM 1)
GRR informs the GMM about the receiption of RR connection establishment.

(GRR 2)
GRR receives the answer to the former indication

(RR/TIL 1)
Establishment request was accepted, no suspension needed: (RR does not send GPRS Suspension Request message)

(RR/TIL 2)
Establishment request was accepted, suspension needed: (RR has to send GPRS Suspension Request message)

(RR/TIL 3)
Establishment request was rejected

3.25.2 Paging procedure for downlink packet transfer

(GRR 1)
RR/TIL 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 (GPRS TMSI). (GMM 1)

(GMM 1)
GRR informs the GMM about the receiption of paging request for downlink transfer.

Appendices

A. Acronyms

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

B. Glossary

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