



ATIS-0700362

ATIS Standard on -

**WIDEBAND GENERAL PACKET RADIO SERVICE (WGPRS) PACKET-
DATA SERVICE – HIGH SPEED (HS) INDOOR RADIO LINK
CONTROL/MEDIUM ACCESS CONTROL (RLC/MAC)**



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ATIS-0700362, Wideband General Packet Radio Service (WGPRS) Packet – Data Service – High Speed (HS) Indoor Radio Link Control/Medium Access Control (RLC/MAC)

Is an American National Standard developed by the **Radio Access Network (RAN)** Subcommittee under the **ATIS Wireless Technologies and Systems Committee (WTSC)**.

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Wideband General Packet Radio Service (WGPRS) Packet-Data Service – High Speed (HS) Indoor Radio Link Control/Medium Access Control (RLC/MAC)

Alliance for Telecommunications Industry Solutions

Abstract

This standard specifies the Wideband General Packet Radio Service (WGPRS) procedures used at the radio interface for the Radio Link Control/Medium Access Control (RLC/MAC) function, used exclusively as a packet traffic channel (PTCH), on a 1.6 MHz bearer channel (designated as High Speed (HS) Indoor). The HS Indoor PTCH (WPTCH) is launched from a packet control channel (PCCH).

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Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, WTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

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ATIS Standard on –

Wideband General Packet Radio Service (WGPRS) Packet-Data Service – High Speed (HS) Indoor Radio Link Control/Medium Access Control (RLC/MAC)

1 Scope

This standard specifies the Wideband General Packet Radio Service (WGPRS) procedures used at the radio interface for the Radio Link Control/Medium Access Control (RLC/MAC) function, used exclusively as a packet traffic channel (PTCH), on a 1.6 MHz bearer channel (designated as High Speed (HS) Indoor). The HS Indoor PTCH (WPTCH) is launched from a packet control channel (PCCH).

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

- [1] 3GPP TS 23.003: "Numbering, addressing and identification".¹
- [2] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".¹
- [3] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network protocols; Stage 3".¹
- [5] ATIS-0700361: "Wideband General Packet Radio Service (WGPRS) Packet-Data Service- High Speed (HS) Indoor Physical Layer ".²
- [6] 3GPP TS 45.008: "Radio subsystem link control".¹
- [7] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control (RRC) protocol".¹
- [8] ITU-T Recommendation T.4 "Standardization of Group 3 facsimile terminals for document transmission" 2003³
- [9] 3GPP TS 43.013: "Discontinuous Reception (DRX) in the GSM system"¹
- [10] 3GPP TS 45.002: "Multiplexing and multiple access on the radio path"¹
- [11] 3GPP TS 45.005: "Radio transmission and reception"¹
- [12] 3GPP TS 44.060: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol"¹
- [13] 3GPP TS 23.003: "Numbering, addressing and identification"¹
- [14] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2"¹

¹ This document is available from the Third Generation Partnership Project (3GPP) at < <http://www.3gpp.org/specs/specs.htm> >.

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3 Definitions & Abbreviations

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < <http://www.atis.org/glossary> >.

3.1 Definitions

The following terms are used in this Standard:

3.1.1 Block period: Depending on the coding mode, a radio block is one of the following: a sequence of four short bursts, one long burst, or a sequence of four long bursts.

3.1.2 EGPRS: Enhanced General Packet Radio Service, enables higher data rates through usage of 8PSK modulation in addition to Gaussian Minimum Shift Keying (GMSK). EGPRS also enables Incremental Redundancy (IR) operation.

3.1.3 MCS: Modulation and Coding Scheme.

3.1.4 Packet idle mode: In packet idle mode, the mobile station is prepared to transfer Logical Link Control (LLC) Packet Data Units (PDUs) on packet data physical channels (see subclause 5.3). The mobile station is not allocated any radio resource on a packet data physical channel; it listens to the PCCH.

3.1.5 Packet transfer mode: In packet transfer mode, the mobile station is prepared to transfer LLC PDUs on packet data physical channels (see subclause 5.4). The mobile station is allocated radio resource on one or more packet data physical channels for the transfer of LLC PDUs.

3.1.6 PDCH: Packet Data Channel. In this standard, PDCH refers to one short or long timeslot (see ATIS-0700360) on the indoor carrier. It is required that an uplink indoor carrier and the corresponding downlink indoor carrier shall be split into timeslots symmetrically. This means that for each long timeslot on an uplink frame there shall be a long timeslot starting at the same place in the downlink frame. Also for each short slot on an uplink frame there shall be a short slot starting at the same place in the downlink frame. When a mobile is assigned to an uplink PDCH, the corresponding downlink PDCH is the one that starts in the same place in the downlink frame and vice versa.

3.1.7 Radio block: Depending on the coding mode a radio block is one of the following: the sequence of four shortbursts, four long bursts or one long burst carrying one RLC/MAC protocol data unit. (The one exception is a radio block occasionally used on WGPRS Packet Associated Control Channel (WPACCH) consisting of a sequence of four access bursts, each carrying a repetition of one short RLC/MAC block.)

3.1.8 Random values: In a number of places in this Standard, it is mentioned that some value must take a "random" value, in a given range, or more generally with some statistical distribution. For such random values refer to 3GPP TS 24.008.

3.1.9 RLC/MAC block: Radio Link Control and Medium Access Control block. A RLC/MAC block is the protocol data unit exchanged between RLC/MAC entities (see subclause 10).

3.1.10 RLC/MAC control block: A RLC/MAC control block is the part of a RLC/MAC block carrying a control message between RLC/MAC entities (see subclause 10.3).

3.1.11 RLC data block: A RLC data block is the part of a RLC/MAC block carrying user data or upper layers' signalling data (see subclause 10.2).

3.1.12 TBF abort: The term "abort" as applied to Temporary Block Flow (TBF) is used when the TBF is abruptly stopped without using the Release of TBF procedures defined in subclause 9.

3.1.13 TBF release: The term "release" as applied to TBF is used when the TBF is stopped using one of the Release of TBF procedures defined in subclause 9.

3.1.14 Temporary Block Flow (TBF): A TBF is a physical connection used by the two RLC/MAC peer entities to support the unidirectional transfer of LLC PDUs on packet data physical channels (see subclause 5.2.1).

3.1.15 Uplink State Flag (USF): The USF is used on HS Indoor PDCHs to allow multiplexing of uplink Radio blocks from different mobile stations (see subclause 5.2.3 and subclause 10).

3.1.16 WGPRS: Wideband General Packet Radio Service. Enhanced GPRS for 1.6 MHz bearer channel, enables higher data rates through usage of Offset Quadrature Amplitude Modulation (O-QAM) modulation. WGPRS also enables Type II Hybrid Automatic Repeat Request (ARQ).

3.1.17 WGPRS TBF mode: Refers to a TBF utilizing the WGPRS enhancements, e.g., O-QAM modulation and Type II Hybrid ARQ. All bursts within a WGPRS TBF shall be of equal size, either long bursts or short bursts. Burst types shall not be mixed within a WGPRS TBF.

3.2 Acronyms

AC	Address Control
ARFCN	Absolute Radio Frequency Channel Number
ARQ	Automatic Repeat Request
BCCH	Broadcast Control Channel
BEC	Backward Error Correction
BER	Bit Error Ratio
B-O-QAM	Binary Quaternary Offset Quadrature Amplitude Modulation
BOW	Beginning of Window
BSN	Block Sequence Number
BTS	Base Transceiver Station
CCCH	Common Control Channel
COS	Coding Scheme Indicator
CRBB	Compressed Receive Block Bitmap
CSN.1	Concrete Syntax Notation One
CV	Countdown Value
DRX	Discontinuous Reception
EGPRS	Enhanced General Packet Radio Service
EOW	End of Window
ESN	Ending Sequence Number
FBI	Final Block Indicator
FN	Frame Number
FPB	First Partial Bitmap
FRB	Full Received Bitmap
FS	Final Segment
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Service
HS	High Speed
IE	Information Element
IMSI	International Mobile Subscriber Identity
IR	Incremental Redundancy
LLC	Logical Link Control
MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MS	Mobile Station
NPB	Next Partial Bitmap

NTS	Number of Time Slots
O-QAM	Offset Quadrature Amplitude Modulation
PACCH	Packet Associated Control Channel
PBSN	Partial Bitmap Sequence Number
PCCCH	Packet Common Control Channel
PCCH	Packet Control Channel
PDCH	Packet Data Channel
PDU	Packet Data Unit
PS	Puncturing Scheme
PT	Payload Type
PTCH	Packet Traffic Channel
PUS	Puncturing Scheme Indicator
QAM	Quadrature Amplitude Modulation
Q-O-QAM	Quaternary Offset Quadrature Amplitude Modulation
QoS	Quality of Service
RB	Reported Bitmap
RBB	Received Block Bitmap
RBSN	Reduced Block Sequence Number
RLC	Radio Link Control
RR	Radio Resources
RRBP	Relative Reserved Block Period
RTI	Radio Transaction Identifier
S/P	Supplementary/Polling
SI	Stall Indicator
SNS	Sequence Number Space
SSN	Starting Sequence Number
TBC	Total Number of RLC Data Blocks to be transmitted
TBF	Temporary Block Flow
TDMA	Time Division Multiple Access
TFI	Temporary Flow Identity
TI	TLLI Indicator
TLLI	Temporary Logical Link Identity
URBB	Uncompressed Received Block Bitmap
USF	Uplink State Flag
V(A)	Acknowledge State Variable
V(B)	Acknowledge State Array
V(CS)	Control Send State Variable
V(H)	Receive Header State Variable
V(N)	Receive State Array
V(Q)	Receive Window State Variable
V(S)	Send State Variable
WGPRS	Wideband General Packet Radio Service
WMCS	WGPRS Modulation and Coding Scheme

WPACCH	WGPRS Packet Associated Control Channel
WPTCH	WGPRS Packet Traffic Channel
WS	Window Size

4 Layered Overview of Radio Interface

See ATIS-0700360 for an overview of the radio interface.

4.1 Layer Services

The HS Indoor RLC/MAC provides services for the transfer of upper layer PDUs using a shared medium between multiple mobile stations and the network. The HS Indoor RLC/MAC function supports two modes of operation:

- Unacknowledged operation; and
- Acknowledged operation.

The HS Indoor RLC/MAC transfers data and controls channel assignments during packet transfer mode on WPTCH. In packet-idle mode, the mobile station monitors its paging channel on the PCCH.

4.2 Layer Functions

The HS Indoor RLC/MAC includes functions for RLC and MAC.

The RLC function defines the procedures for segmentation and reassembly of LLC PDUs into RLC/MAC blocks and, in RLC acknowledged mode of operation, for the Backward Error Correction (BEC) procedures enabling the selective retransmission of unsuccessfully delivered RLC/MAC blocks. In RLC acknowledged mode of operation, the RLC function preserves the order of higher layer PDUs provided to it. The RLC function provides also link adaptation.

In RLC acknowledged mode of operation, the RLC function may provide IR. The MAC function defines the procedures that enable multiple mobile stations to share a common transmission medium, which may consist of several physical channels. The function may allow a mobile station to use several physical channels in parallel, i.e., use several timeslots within the TDMA frame. Additionally, the HS Indoor RLC/MAC provides radio resource management functions during packet transfer mode on the WPTCH.

4.3 Services Required from Other Layers

The HS Indoor RLC/MAC uses the services provided by the physical link layer as defined in ATIS-0700361.

5 Introduction to the Medium Access Control (MAC) Procedures

5.1 General

The MAC procedures include the functions related to the management of the shared transmission resources, e.g., the packet data physical channels and the radio link connections on packet data physical channels.

The MAC procedures support the provision of TBFs that allow the point-to-point transfer of signalling and user data within a cell between the network and a mobile station.

5.2 Multiplexing Principles

5.2.1 Temporary Block Flow

A TBF is a physical connection used by the two Radio Resources (RR) entities to support the unidirectional transfer of LLC PDUs on packet data physical channels. The TBF is allocated RR on one or more PDCHs and comprises a number of RLC/MAC blocks carrying one or more LLC PDUs. A TBF is temporary and is maintained only for the duration of the data transfer (i.e., until there are no more RLC/MAC blocks to be transmitted and, in RLC acknowledged mode, all of the transmitted RLC/MAC blocks have been successfully acknowledged by the receiving entity).

On a WPTCH, the TBF operates in WGPRS TBF mode. The network sets the TBF mode in the Channel Assignment Type D, PACKET UPLINK ASSIGNMENT, Channel Assignment Type E, or WGPRS PACKET DOWNLINK ASSIGNMENT.

5.2.2 Temporary Flow Identity

Each TBF is assigned a Temporary Flow Identity (TFI) by the network. The mobile station shall assume that the TFI value is unique among concurrent TBFs in each direction (uplink or downlink). The same TFI value may be used concurrently for TBFs in opposite directions.

An RLC/MAC block associated with a certain TBF shall comprise a TFI. The TBF is identified by the TFI together with, in case of a RLC data block, the direction (uplink or downlink) in which the RLC data block is sent; and in case of a RLC/MAC control message, the direction in which the RLC/MAC control message is sent and the message type.

Each TBF may also be identified by a Global_TFI. The Global_TFI unambiguously identifies the mobile station in an uplink or downlink RLC/MAC control message. If present, the Global_TFI addresses the MS using either the uplink TFI or downlink TFI of the MS. Which TFI is used is at the discretion of the sender except where explicitly defined by procedure.

5.2.3 Uplink State Flag

An USF is included in the header of each RLC/MAC block on a downlink PDCH, as specified in subclause 10. It may be used by the network to control the multiplexing of different mobile stations on uplink PDCH.

5.2.4 Medium Access Modes

Three medium access modes are supported:

- Dynamic Allocation characterized by the mobile station detecting an assigned USF value for each assigned PDCH and block, or group of four blocks, that the MS is allowed to transmit on that PDCH. (see subclause 8.1.1.1);
- Extended Dynamic Allocation characterized by the mobile station detecting an assigned USF value for any assigned PDCH allowing the mobile station to transmit on that PDCH and all higher numbered assigned PDCHs in the same block or group of four blocks (see subclause 8.1.1.2); and
- Fixed Allocation characterized by fixed allocation of radio blocks and PDCHs in the assignment message without an assigned USF (see subclause 8.1.1.3).

Either the Dynamic Allocation medium access mode or Fixed Allocation medium access mode shall be supported by all networks that support WGPRS. The support of Extended Dynamic Allocation is optional for the network.

The Dynamic Allocation and Fixed Allocation modes shall be supported in all mobile stations. The support of Extended Dynamic Allocation is optional and shall be indicated in the MS Radio Access Capability.

5.3 Packet Idle Mode

In packet idle mode, upper layers may require the establishment of an RR connection. When the mobile station enters dedicated mode (see 3GPP TS 44.018), it may leave the packet idle mode, if the mobile station limitations make it unable to handle the RR connection and the procedures in packet idle mode simultaneously.

In packet idle mode, no TBF exists (see 3GPP TS 44.060). Upper layers may require the transfer of a LLC PDU, which implicitly triggers the establishment of a TBF.

In packet idle mode, the mobile station monitors the relevant paging subchannels on a PCCH.

5.4 Packet Transfer Mode

In packet transfer mode, the mobile station is allocated RR providing a TBF for a physical point-to-point connection on one or more packet data physical channels for the unidirectional transfer of LLC PDUs between the network and the mobile station. Continuous transfer of one or more LLC PDUs is possible. Concurrent TBFs may be established in opposite directions. The RR sublayer provides the following services:

- Transfer of LLC PDUs in RLC acknowledged mode;
- Transfer of LLC PDUs in RLC unacknowledged mode.

When a transfer of LLC PDUs terminates, in either downlink or uplink direction, the corresponding TBF is released. When all TBFs have been released, in downlink and uplink direction, the mobile station returns to packet idle mode.

In WGPRS TBF mode the transfer of RLC data blocks in RLC acknowledged mode may be controlled by an IR mechanism coupled with the numbering of the RLC data blocks within one TBF.

5.5 General Procedures in Packet Idle & Packet Transfer Modes

5.5.1 Mobile Station Side

The mobile station in packet idle and packet transfer modes shall monitor the system information broadcast in the cell (transmitted on the PCCH).

5.5.1.1 Cell Reselection

Cell reselection in packet idle and packet transfer modes is specified in 3GPP TS 45.008. The RR entity on the mobile station side indicates to the upper layers the availability of a cell and a cell change when decided by the RR sublayer. Upper layers are advised of system information broadcast in the cell when a new cell has been selected, or when a relevant part of this information changes.

5.5.1.2 System Information on PBCCH

System information is broadcast on the PCCH.

5.5.1.3 Suspension of Operation to Receive System Information

During certain conditions, the mobile station in packet transfer mode is allowed to suspend a TBF to receive certain information on PCCH. Such suspension is made without notification to the network. Suspension of a TBF for this purpose is allowed during the time required, for each message and according to the mobile station's multislot class (see ATIS-0700361), to receive the required messages on the PCCH. The allowable suspension of an uplink TBF may be extended with one block period, in case of dynamic or extended dynamic allocation, if the mobile station is unable to receive the corresponding USF due to the suspension of downlink operation.

5.5.1.4 Frequency Parameters

Frequency parameters are included in the assignment messages (i.e., Channel Assignment Type D, Channel Assignment Type E, WGPRS PACKET DOWNLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT, or WGPRS PACKET TIMESLOT RECONFIGURE) and define the radio frequency channels or set of radio frequency channels the mobile station is to use during the assigned TBF. The first assignment message, sent to the mobile station when it enters packet transfer mode, shall include the frequency parameters. Subsequent assignment messages, sent to the mobile station during packet transfer mode, may omit the frequency parameters. If a mobile station receives a subsequent assignment message, during packet transfer mode, without the frequency parameters, the mobile station shall continue to use the previously assigned frequency parameters.

The Frequency Parameters information element is defined in subclause 12.8. The frequency parameters include an ARFCN defining a non-hopping radio frequency channel.

5.5.2 System Information

System information is broadcast on the PCCH.

6 Paging Procedures

The network can initiate the establishment of an RR connection by the paging procedure for RR connection establishment. Such a procedure can only be initiated by the network.

6.1 Paging Initiation by the Network

The network initiates the paging procedure to trigger RR connection establishment by broadcasting a paging request message on the appropriate paging subchannel on Common Control Channel (CCCH) or Packet Common Control Channel (PCCCH), and starts timer T3113 (see 3GPP TS 44.018). The paging subchannels on CCCH and PCCCH are specified in 3GPP TS 45.002 and 3GPP TS 43.013.

The network may also send paging related information on PACCH to a mobile station in packet transfer mode.

6.1.1 Paging Initiation Using Paging Subchannel on CCCH

Paging initiation using the paging subchannel on CCCH is used when sending paging information to a mobile station in idle mode. It is also used when sending paging information to a mobile station in packet idle mode, if PCCCH is not present in the cell.

6.1.2 Paging Initiation Using Paging Subchannel on PCCCH

Paging initiation using a paging subchannel on PCCCH (see 3GPP TS 44.060), applies when sending paging information to a mobile station in packet idle mode and PCCCH is provided in the cell.

The paging initiation procedure and the paging request message used on PCCCH are specified in 3GPP TS 44.060.

6.1.3 Paging Initiation Using PACCH

Paging initiation using PACCH (see 3GPP TS 44.060), applies to a mobile station in packet transfer mode or in broadcast/multicast receive mode if so ordered by the network.

The paging initiation procedure and the message used to carry paging related information on PACCH are specified in 3GPP TS 44.060.

7 MAC Procedures in Packet Idle Mode

7.1 TBF Establishment Initiated by the Mobile Station

The purpose of the packet access procedure is to establish a TBF to support the transfer of upper-layer PDUs in the direction from the mobile station to the network. Packet access shall be done on PCCCH, as defined in 3GPP TS 44.060, if a PCCCH exists. Otherwise, packet access shall be done on CCCH, as defined in 3GPP TS 44.018. The packet access can be done in either one phase or in two phases.

TBF establishment can also be done on PACCH if a TBF for transfer of upper-layer PDUs in the direction from the network to the mobile station is already established. TBF establishment can also be done on PACCH if the mobile station is releasing a TBF for transfer of upper-layer PDUs in the direction from the mobile station to the network and TBF for transfer of upper-layer PDUs in the direction from the network to the mobile station is not established.

7.1.1 Packet Resource Assignment for Uplink Procedure

When the mobile station has received a channel assignment type E message and tuned to the assigned 1.6 MHz bearer it shall respond with a PACKET RESOURCE REQUEST message in the allocated single radio block. At sending of the PACKET RESOURCE REQUEST message, the mobile station shall start timer TW3168.

- The PACKET RESOURCE REQUEST message is sent by the mobile station to the network.

The mobile station shall indicate in the RLC_OCTET_COUNT the number of octets of user data that it has to be transferred in the TBF. Both when the dynamic allocation or extended dynamic allocation medium access method is used and when the fixed allocation medium access method is used, the maximum value of RLC_OCTET_COUNT shall be interpreted as a request for the maximum number of octets, and the value '0' as a request for an open ended TBF.

On receipt of a PACKET RESOURCE REQUEST message, the network shall respond by sending a PACKET UPLINK ASSIGNMENT (RR assignment on one or more PDCHs to be used by the mobile station for the TBF) or a PACKET ACCESS REJECT message to the mobile station on WPACCH on the same PDCH on which the mobile station has sent the PACKET RESOURCE REQUEST message.

On receipt of a PACKET UPLINK ASSIGNMENT message the mobile station shall switch to the assigned PDCHs. After waiting the optional starting time assigned in the PACKET UPLINK ASSIGNMENT the mobile station shall start timer TW3164. At expiration of TW3164 mobile station shall follow procedures defined in subclause 7.1.5.

7.1.2 Contention Resolution

The contention resolution is completed on the network side when the network receives a Temporary Logical Link Identity (TLLI) value identifying the mobile station, as part of the contention resolution procedure on the TBF.

The contention resolution is completed on the mobile station side when the mobile station receives a PACKET UPLINK ASSIGNMENT message with the same TLLI as the mobile station has included in the PACKET RESOURCE REQUEST message. The mobile station shall then stop timer TW3168. It does not include its TLLI in any RLC data block.

The contention resolution has failed on the mobile station side when the mobile station does not receive a PACKET UPLINK ASSIGNMENT message with its TLLI before expiry of timer TW3168. The mobile station shall then reinitiate the packet access procedure unless it has already been repeated 4 times. In that case, TBF failure has occurred.

7.1.3 TBF Establishment Completion

The channel access procedure is completed upon a successful contention resolution. The mobile station has entered the packet transfer mode.

7.1.4 Timing Advance

Timing advance control is not used on the 1.6 MHz channels.

7.1.5 Abnormal Cases

If the channel access procedure fails for any reason, the mobile station shall return to packet idle mode, notify higher layer (TBF establishment failure), transactions in progress shall be aborted and cell reselection continues.

7.2 TBF Establishment Initiated by the Network

The procedure is triggered by a request from upper layers on the network side to transfer an upper layer PDU to a mobile station in packet idle mode. The request from upper layers specifies an optional priority level, a Quality of Service (QoS) profile including the requested RLC mode, optional Discontinuous Reception (DRX) parameters, an optional International Mobile Subscriber Identity (IMSI) and an optional Mobile Station (MS) Radio Access Capability, multislot class and mobile classmark to be associated with the packet transfer.

The request is implicit when receiving an upper layer PDU to a mobile station not already having any assigned RR. Upon such a request, the network shall initiate a packet downlink assignment procedure as defined in sub-clause 7.2.1.

7.2.1 Packet Downlink Assignment Procedure

The network may assign a radio resource on one or more PDCHs to be used for the TBF. The amount of radio resource to be reserved is a network dependent choice. The allocated radio resource is assigned to the mobile station in a *Channel Assignment Type D* message. On receipt of a *Channel Assignment Type D* message, the mobile station shall switch to the assigned PDCHs.

A *Channel Assignment Type D* message may indicate an assignment starting time in the TBF Starting Time parameter. The mobile station shall monitor the assigned 1.6 MHz PDCH until the point in time denoted by the TBF Starting Time. Thereafter it shall switch to the assigned PDCHs. If while monitoring the 1.6 MHz PDCH the mobile station receives more than one WGPRS PACKET DOWNLINK ASSIGNMENT message, it shall act upon the most recently received message and shall ignore the previous message. When receiving the WGPRS PACKET DOWNLINK ASSIGNMENT message and after waiting the TBF Starting Time when applicable, the mobile station starts timer TW3190. The timer is reset when receiving the first valid RLC/MAC block.

On expiry of timer TW3190, the mobile station shall abort the procedure and return to packet idle mode.

7.2.2 Packet Downlink Assignment Procedure Completion

The Packet downlink assignment procedure is completed when the mobile station receives an RLC/MAC block containing its TFI. The mobile station has entered the packet transfer mode.

7.2.3 Abnormal Cases

If a failure occurs on the mobile station side of the new TBF before mobile station has successfully entered the packet transfer mode, the newly reserved resources shall be released; the mobile station shall return to packet idle mode and cell reselection continues.

8 MAC Procedures in Packet Transfer Mode

8.1 Transfer of RLC Data Blocks

The transfer of RLC data blocks is governed by different principles on both uplink and downlink for each of the defined medium access modes: dynamic allocation, extended dynamic allocation, and fixed allocation. The medium access mode the mobile station is to use is signalled in the MAC_MODE parameter of the WGPRS PACKET DOWNLINK ASSIGNMENT message. The medium access mode the mobile station is to use in an uplink transfer depends on whether the Dynamic Allocation IE or the Fixed Allocation IE is included in the PACKET UPLINK ASSIGNMENT and WGPRS PACKET TIMESLOT RECONFIGURE messages.

8.1.1 Uplink RLC data block transfer

Prior to the initiation of RLC data block transfer on the uplink, the network assigns the following parameters to characterize the uplink TBF in the PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message:

- A unique TFI. The mobile station shall set the TFI field of each uplink RLC data block to the TFI value assigned to the mobile station in the PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message.
- A set of PDCHs to be used for the uplink transfer.
- A TBF Starting Time indication (optional in case of a dynamic or extended dynamic allocation).

RLC data blocks that are transmitted for the first time shall be transmitted with the WGPRS Modulation and Coding Scheme (WMCS) commanded. Retransmitted RLC data blocks shall use the same WMCS they were initially transmitted with. Upon receipt of a command from the network to change channel coding scheme, the mobile station shall react in accordance with the time specified in subclause 14.

Upon receipt of any message containing an uplink assignment (PACKET UPLINK ASSIGNMENT message, TIMESLOT RECONFIGURE message and PACKET UPLINK ACK/NACK message), the mobile station shall be ready to transmit in accordance with the requirements given in subclause 14. The mobile station shall transmit RLC/MAC blocks with the following priority:

- RLC/MAC control blocks, except Packet Uplink Dummy Control Blocks.
- RLC data blocks.
- RLC/MAC control blocks containing Packet Uplink Dummy Control Blocks.

During the TBF, if the countdown procedure has not started, the mobile station shall ask for new RR, by sending a PACKET RESOURCE REQUEST message (subclauses 8.1.1.1.2 and 8.1.1.3.2), in the following cases:

- When the mobile station has more blocks to send than negotiated in the last PACKET RESOURCE REQUEST message.
- When the mobile station has data to send with a lower priority than negotiated in the last PACKET RESOURCE REQUEST message.

8.1.1.1 Dynamic Allocation Uplink RLC Data Block Transfer

This subclause specifies mobile station behavior for dynamic allocation uplink RLC data block transfer while in packet transfer mode.

When the mobile station receives a complete uplink assignment that does not contain a TBF starting time, the mobile station shall begin monitoring the assigned PDCHs for the assigned USF value for each assigned PDCH after the reaction time defined in subclause 14. If a TBF starting time information element is present and no uplink TBF is in progress, but a downlink TBF is in progress, the mobile station shall wait until the starting time before beginning to monitor the USFs. While waiting for the starting time, the mobile station shall monitor the

assigned PDCHs. If an uplink TBF is already in progress, the mobile station shall continue to use the assigned parameters of the uplink TBF until the TDMA frame number indicated by the TBF starting time occurs, at which time the mobile station shall immediately begin to use the newly assigned uplink TBF parameters. If while waiting for the frame number indicated by the TBF starting time the mobile station receives another uplink assignment, the mobile station shall act upon the most recently received uplink assignment and shall ignore the previous uplink assignment.

If the PACKET UPLINK ASSIGNMENT or WGPRES PACKET TIMESLOT RECONFIGURE message contains the RLC_DATA_BLOCKS_GRANTED field, the TBF is a close-ended TBF. Otherwise the TBF is open-ended.

During a close-ended TBF the mobile station shall transmit only the number of RLC data blocks indicated in the RLC_DATA_BLOCKS_GRANTED field. RLC/MAC control blocks and retransmissions of RLC data blocks do not count toward the limit. When the mobile station nears the end of the fixed length TBF, it shall count down so that it sends the last RLC data block when Countdown Value (CV) = 0 (see subclause 9.3.1). The mobile station and network shall then follow the appropriate procedure for release of TBF defined in subclause 9.3.2.4 or subclause 9.3.3.3. Upon receipt of a PACKET TBF RELEASE message during a closed-end TBF, the mobile station shall follow the procedure in subclause 8.1.1.4. If the number of RLC data blocks granted is not sufficient to empty the mobile station's send buffer, the mobile station shall attempt to establish a new uplink TBF for the transmission of the outstanding LLC frames following the end of the fixed length TBF.

Whenever the mobile station detects an assigned USF value on an assigned PDCH, the mobile station shall transmit either a single RLC/MAC block or a sequence of four RLC/MAC blocks on the same PDCH. The time relation between an uplink block, which the mobile station shall use for transmission, and the occurrence of the USF value is defined in ATIS-0700361. The number of RLC/MAC blocks to transmit is controlled by the USF_GRANULARITY parameter characterizing the uplink TBF. When the mobile station transmits an RLC/MAC block to the network, it shall start timer TW3180. When the mobile station detects an assigned USF value on an assigned PDCH, the mobile station shall reset timer TW3180. If timer TW3180 expires, the mobile station shall perform the abnormal release with random access procedure (see subclause 8.4.2).

Whenever the network receives a valid RLC/MAC block from the mobile station, it shall reset counter NW3101. The network shall increment counter NW3101 for each radio block, allocated to that mobile station, for which no data is received. If $NW3101 = NW3101_{max}$, the network shall stop the scheduling of RLC/MAC blocks from the mobile station and start timer TW3169. When TW3169 expires, the network may reuse the USF and TFI.

8.1.1.1.1 WPACCH Operation

The mobile station shall attempt to decode every downlink RLC/MAC block on all assigned PDCHs. Whenever the mobile station receives an RLC/MAC block containing an RLC/MAC control block, the mobile station shall attempt to interpret the message contained therein. If the message addresses the mobile station, the mobile station shall act on the message.

Whenever the mobile station detects an assigned USF value on any assigned PDCH, the mobile station may transmit a WPACCH block on the same PDCH in the next block period (ATIS-0700361). The mobile station shall not transmit an RLC data block in any uplink radio block allocated via the polling mechanism (see subclause 10.4.4).

8.1.1.1.2 Resource Reallocation for Uplink

The mobile station and the network are not allowed to change the RLC mode of an already established TBF during resource reallocation. Change of RLC mode shall be achieved through release of on-going TBF and establishment of a new TBF with the newly requested RLC mode. During an uplink packet transfer, upper layers may request to transfer another LLC PDU with a different Radio Priority, a different peak throughput class or a different RLC mode than the one which is in transfer. An LLC PDU containing signalling shall be treated as having the highest Radio Priority, and the acknowledged RLC mode shall be used.

If the mobile station has not started the countdown procedure and the new LLC PDU has the same RLC mode as the current uplink TBF and either a higher radio priority or the same radio priority but a higher peak throughput class, the mobile station shall immediately request a resource reallocation for uplink according to the

new Radio Priority and peak throughput class of the new LLC PDU by sending a PACKET RESOURCE REQUEST message on the WPACCH and starting timer TW3168. Then the mobile station shall complete the transmission of the current LLC PDU.

If the new LLC PDU has the same RLC mode as the current uplink TBF and either a lower Radio Priority or the same radio priority but a lower peak throughput class, the mobile station shall first complete the sending of the LLC PDU in transfer. When the sending of LLC PDUs at the higher Radio Priority or the same radio priority but higher peak throughput class stops, without waiting for the acknowledgement from the network if in RLC acknowledged mode, the mobile station shall then perform the request of a resource reallocation for uplink for any remaining LLC PDU(s) by sending a PACKET RESOURCE REQUEST message on the WPACCH and start timer TW3168.

If the new LLC PDU does not have the same RLC mode as the current uplink TBF but has a higher radio priority, the mobile station shall complete the transmission of the current LLC PDU using the countdown procedure including acknowledgement from the network, if in RLC acknowledged mode. The mobile station shall then release the TBF and establish a new uplink TBF for transmission of the new LLC PDU. When the sending of LLC PDUs with a higher radio priority is completed using the countdown procedure, including acknowledgement from the network if in RLC acknowledged mode, the mobile station shall try to establish an uplink TBF for the transmission of any remaining LLC PDU(s).

On receipt of the PACKET RESOURCE REQUEST the network shall respond by sending a PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE or a PACKET ACCESS REJECT message to the mobile station on the downlink WPACCH.

After the transmission of the PACKET RESOURCE REQUEST message with the reason for changing the priority or peak throughput class of an assigned uplink TBF the mobile station shall continue to use the currently assigned uplink TBF assuming that the requested priority or peak throughput class is already assigned to that TBF.

On receipt of a PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message the mobile station shall stop timer TW3168 and switch to the assigned PDCHs.

The mobile station is then not allowed to send new PACKET RESOURCE REQUEST messages until either a new packet transfer request is received from the upper layers or when sending of LLC PDU(s) at a lower Radio Priority has to be continued.

On expiry of timer TW3168 the mobile station shall retransmit the PACKET RESOURCE REQUEST message unless the PACKET RESOURCE REQUEST has already been transmitted four times in which case the mobile station shall perform an abnormal release with random access.

If no PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message is received before the mobile station has completed its currently assigned TBFs the mobile station shall stop timer TW3168 and return to packet idle mode (listening to its paging channel).

The network may at any time during the uplink TBF initiate a change of resources by sending on the downlink WPACCH monitored by the MS, an unsolicited PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message to the mobile station. During the reallocation TFI is allowed to be changed.

On receipt of a PACKET ACCESS REJECT message, the mobile station shall stop timer TW3168 if running and return to packet idle mode. If the PACKET ACCESS REJECT message contains a WAIT_INDICATION field in a Reject structure addressed to the mobile station, the mobile station shall

- Start timer TW3172 and if the mobile station has additional RLC data blocks to transmit, it shall initiate a new TBF establishment procedure. The mobile station is not allowed to make a new attempt for packet access in the same cell until timer TW3172 expires. It may, however, attempt packet access in another cell after successful cell reselection. A mobile station in MS class B mode of operation may attempt to enter the dedicated mode in the same cell before timer TW3172 has expired.

The value of the WAIT_INDICATION field (i.e., timer TW3172) relates to the cell from which it was received.

8.1.1.1.2.1 Abnormal Cases

The following abnormal cases apply:

- If the mobile station receives a PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release with system information (see subclause 8.4.3).
- If the mobile station receives a PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message specifying frequencies that are not all in one frequency band then the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If the mobile station receives a PACKET UPLINK ASSIGNMENT message containing a Frequency Parameters information element specifying a frequency that is in a frequency band not supported by the mobile station then the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).

NOTE: A PACKET UPLINK ASSIGNMENT or PACKET TIMESLOT RECONFIGURE message received by a multi-band mobile station shall not be considered invalid if it indicates new frequencies that are all in a different frequency band to that of the PDCH(s) on which the assignment was received. The assignment may however be rendered invalid for some other reason.

8.1.1.1.3 Establishment of Downlink TBF

During uplink transfer, the network may initiate a downlink TBF by sending a WGPRS PACKET DOWNLINK ASSIGNMENT message, or a WGPRS PACKET TIMESLOT RECONFIGURE, to the mobile station on the WPACCH. If a WGPRS PACKET TIMESLOT RECONFIGURE message is sent, then the message shall contain the DOWNLINK_TFI_ASSIGNMENT field. The multislot restrictions of the mobile station shall be observed.

A mobile allocation or reference frequency list, received as part of a downlink assignment, replaces the previous parameters and shall be used until a new assignment is received or the MS enters to the packet idle mode. The downlink radio resource is assigned to the mobile station in a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message. On receipt of an assignment message, and after the TBF starting time, if present, the mobile station shall switch to the assigned PDCHs, and start timer TW3190. The operation of the downlink TBF follows the procedures in subclause 8.1.2 with the following additions:

- The mobile station shall prioritize transmission of RLC/MAC control blocks associated with the downlink TBF over RLC/MAC control blocks associated with the uplink TBF;
- If a timer or counter expiry causes the uplink TBF to be aborted in the mobile station, the mobile station shall also abort the downlink TBF and perform an abnormal release with random access (see subclause 8.4.2).
- If uplink and downlink TBFs are already established, then the network may send a WGPRS PACKET TIMESLOT RECONFIGURE message without DOWNLINK_TFI_ASSIGNMENT. The mobile station shall interpret this as a reassignment of the timeslot allocations of the concurrent uplink and downlink TBFs and the downlink TFI is not changed.

8.1.1.1.3.1 Abnormal Cases

If a failure occurs on the mobile station side before the new TBF has been successfully established, the newly reserved resources are released. The subsequent behavior of the mobile station depends on the type of failure and previous actions:

- If the information in the WGPRS PACKET TIMESLOT RECONFIGURE does not properly specify an uplink and downlink PDCH or violates the mobile station's multislot capabilities, the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If uplink and downlink TBFs are not already established and the WGPRS PACKET TIMESLOT RECONFIGURE message does not include a DOWNLINK_TFI_ASSIGNMENT field, then the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).

- If a failure in the WGPRS PACKET TIMESLOT RECONFIGURE is due to any other reason, the mobile station shall abort the procedure and perform an abnormal release with random access (see subclause 8.4.2).
- If a failure in the WGPRS PACKET DOWNLINK ASSIGNMENT is due to any reason, the mobile station shall abort the procedure and continue the normal operation of the uplink TBF.

8.1.1.2 Extended Dynamic Allocation Uplink RLC Data Block Transfer

The Extended Dynamic Allocation medium access method extends the Dynamic Allocation medium access method to allow higher uplink throughput.

This subclause defines the extensions to the Dynamic Allocation medium access method. All procedures defined in subclause 8.1.1.1 apply, except where this subclause defines a new procedure. In cases where this subclause conflicts with subclause 8.1.1.1, this subclause takes precedence.

8.1.1.2.1 Uplink PDCH Allocation

The PACKET UPLINK ASSIGNMENT message allocates to the mobile station a subset of 1 to N PDCHs, where N depends on the MSs multislot class.

The mobile station shall monitor its assigned PDCHs starting with the lowest numbered PDCH, then the next lowest numbered PDCH, etc. Whenever the mobile station detects an assigned USF value on an assigned PDCH, the mobile station shall transmit either a single RLC/MAC block or a sequence of four RLC/MAC blocks on the same PDCH and all higher numbered assigned PDCHs. The time relation between an uplink block, which the mobile station shall use for transmission, and the occurrence of the USF value is defined in ATIS-0700361. The number of RLC/MAC blocks to transmit on each PDCH is controlled by the USF_GRANULARITY parameter characterizing the uplink TBF. The mobile station need not monitor and shall disregard the USF on those higher numbered PDCHs during the block period where the assigned USF value is detected and the block period(s) in which the mobile station obtains permission to transmit.

If the network reduces the number of PDCHs allocated to a mobile station per block period, the network shall not allocate any resources to that mobile station for one block period following the block period with the higher number of PDCHs allocated.

8.1.1.2.2 WPACCH Operation

The mobile station shall attempt to decode every downlink RLC/MAC block on all monitored PDCHs. Whenever the mobile station receives an RLC/MAC block containing an RLC/MAC control block, the mobile station shall attempt to interpret the message contained therein. If the message addresses the mobile station, the mobile station shall act on the message.

The network shall transmit all WPACCH messages on the first PDCH in the allocation. Whenever the mobile station detects an assigned USF value on any assigned PDCH, the mobile station may transmit a WPACCH block on the same PDCH in the next block period (see ATIS-0700361). The mobile station shall not transmit an RLC data block in any uplink radio block allocated via the polling mechanism (see subclause 10.4.).

8.1.1.3 Fixed Allocation Uplink RLC Data Block Transfer

A fixed allocation TBF can be operated as a close-ended TBF or as an open-ended TBF. A close-ended TBF occurs when the MS sends a PACKET RESOURCE REQUEST or PACKET DOWNLINK ACK/NACK message containing an RLC_OCTET_COUNT field that contains a value less than or equal to the maximum, and different from '0'. An open-ended TBF occurs when the RLC_OCTET_COUNT field contains the value '0'.

A close-ended TBF transfers exactly the number of octets specified in the RLC_OCTET_COUNT field in the PACKET RESOURCE REQUEST message. The network will automatically provide sufficient resources for the number of octets requested. The mobile station does not need to send further PACKET RESOURCE REQUEST

messages to the network. If the mobile station sends a subsequent PACKET RESOURCE REQUEST message to the network, the TBF becomes an open-ended TBF. A closed-ended TBF may be ended by the network before the number of requested octets has been transferred. In this case the TBF ends when the network sends a FINAL_ALLOCATION indication in a fixed allocation assignment message or a PACKET ACCESS REJECT message to the mobile station.

An opened-ended TBF transfers an arbitrary number of octets. The mobile station is required to send a PACKET RESOURCE REQUEST message for each fixed allocation. Each time the mobile station receives a fixed allocation, if it wishes to continue the TBF, it shall then send another PACKET RESOURCE REQUEST to the network. The open-ended TBF ends when the network sends a FINAL_ALLOCATION indication in a fixed allocation assignment message or a PACKET ACCESS REJECT message to the mobile station, or when the mobile has exhausted its supply of data to transmit and has executed the countdown procedure.

At initiation of an uplink TBF, the mobile station shall signal the number of RLC data octets to be transferred, plus the number of RLC data block length octets to be transferred, in the RLC_OCTET_COUNT parameter of the PACKET RESOURCE REQUEST or PACKET DOWNLINK ACK/NACK.

8.1.1.3.1 Transfer of RLC/MAC Blocks

The PACKET UPLINK ASSIGNMENT or WGPRES PACKET TIMESLOT RECONFIGURE message contains a Fixed Allocation struct when signalling a fixed allocation.

The Timeslot Allocation shall assign from 1 to 64 PDCHs to the fixed allocation. The multislot restrictions of the mobile station shall be observed. A timeslot allocation in one direction shall consist of only short timeslots or only long timeslots. A mobile cannot have both slot types in its allocation. See ATIS-0700361.

If the BLOCKS_OR_BLOCK_PERIODS field indicates blocks, then the bits in the ALLOCATION_BITMAP correspond to radio blocks. Bits are included in the bitmap only for radio blocks on assigned PDCHs. Each bit in the bitmap indicates whether the corresponding radio block is assigned to the fixed allocation. The mobile station shall transmit an RLC/MAC block in each radio block assigned by the ALLOCATION_BITMAP. If the number of bits in the ALLOCATION_BITMAP is not an integral multiple of the number of timeslots assigned in the Timeslot Allocation field, then the mobile station shall add to the end of the bitmap (bit number indexes < 0, see subclause 12.4) the minimum number of bits needed to form an integral multiple of the number of assigned timeslots, with the value set to '0'. If the BLOCKS_OR_BLOCK_PERIODS field indicates block periods, then the bits in the bitmap indicate which block periods are assigned to the allocation. The mobile station shall transmit an RLC/MAC block on each timeslot assigned in the Timeslot Allocation field in each block period assigned to the allocation. The ALLOCATION_BITMAP_LENGTH field, if present, indicates the length of the ALLOCATION_BITMAP field. If not present, the ALLOCATION_BITMAP continues until the end of the message.

The network shall acknowledge packet transfers by sending PACKET UPLINK ACK/NACK messages on the WPACCH during gaps in the uplink allocation. The network shall maintain a count of the number of erroneous blocks received from the mobile and allocate additional resources for the retransmissions with a PACKET UPLINK ACK/NACK or an unsolicited PACKET UPLINK ASSIGNMENT or WGPRES PACKET TIMESLOT RECONFIGURE message. The mobile station shall not request resources or adjust its RLC_OCTET_COUNT for retransmissions requested in the PACKET UPLINK ACK/NACK (see subclause 8.1.1.3.2). The mobile station may retransmit erroneous blocks in any allocated uplink block. During a close-ended TBF the network automatically sends sufficient fixed allocation resources for the mobile station to transmit the number of octets specified in the RLC_OCTET_COUNT of the initial PACKET RESOURCE REQUEST or PACKET_DOWNLINK ACK/NACK message. The network signals the end of the close-ended TBF to the mobile by setting the FINAL_ALLOCATION bit to '1' in the PACKET UPLINK ASSIGNMENT, the WGPRES PACKET TIMESLOT RECONFIGURE, or the PACKET UPLINK ACK/NACK, or by sending the PACKET ACCESS REJECT message or the PACKET TBF RELEASE message, with a cause value, to the mobile station.

Upon receipt of a complete uplink assignment containing a fixed allocation and with the field FINAL_ALLOCATION set to 1, the mobile station shall execute the countdown procedure such that the countdown ends before the current allocation is exhausted.

Upon receipt of a PACKET ACCESS REJECT message, the mobile station shall release the TBF using the procedures in 9.3.2.4 or 9.3.3.3, such that the countdown ends within the current allocation. Then, if the mobile

station has additional RLC data blocks to transfer, it shall request new RR on the PCCH or via the PACKET DOWNLINK ACK/NACK if during a downlink TBF.

Upon receipt of a PACKET TBF RELEASE message, the mobile station shall follow the procedure in subclause 8.1.1.4.

During a close-ended TBF the mobile station may change the Radio Priority of the TBF or extend the TBF by sending a PACKET RESOURCE REQUEST message or a PACKET DOWNLINK ACK/NACK containing a Channel Request Description IE. The close-ended TBF then becomes an open-ended TBF and the procedures in subclause 8.1.1.3.2 apply.

8.1.1.3.2 Reallocation for Open-Ended TBF

The mobile station and the network are not allowed to change the RLC mode of an already established TBF during resource reallocation. Change of RLC mode shall be achieved through release of on-going TBF and establishment of a new TBF with the newly requested RLC mode.

During an uplink packet transfer, upper layers may request to transfer another LLC PDU with a different Radio Priority, a different peak throughput class or a different RLC mode than the one which is in transfer. An LLC PDU containing signalling shall be treated as having the highest Radio Priority, and the acknowledged RLC mode shall be used.

If the mobile station has not started the countdown procedure and the new LLC PDU has the same RLC mode as the current uplink TBF and either a higher radio priority or the same radio priority but a higher peak throughput class, the mobile station shall immediately request a resource reallocation for uplink according to the new Radio Priority and peak throughput class of the new LLC PDU by sending a PACKET RESOURCE REQUEST message on the WPACCH and starting timer TW3168. Then the mobile station shall complete the transmission of the current LLC PDU. If the new LLC PDU has the same RLC mode as the current uplink TBF and either a lower Radio Priority or the same radio priority but a lower peak throughput class, the mobile station shall first complete the sending of the LLC PDU in transfer. When the sending of LLC PDUs at the higher Radio Priority or the same radio priority but higher peak throughput class stops, without waiting for the acknowledgement from the network if in RLC acknowledged mode, the mobile station shall then perform the request of a resource reallocation for uplink for any remaining LLC PDU(s) by sending a PACKET RESOURCE REQUEST message on the WPACCH and start timer TW3168.

If the new LLC PDU does not have the same RLC mode as the current uplink TBF but has a higher radio priority, the mobile station shall complete the transmission of the current LLC PDU using the countdown procedure including acknowledgement from the network, if in RLC acknowledged mode. The mobile station shall then release the TBF and establish a new uplink TBF for transmission of the new LLC PDU. When the sending of LLC PDUs with a higher radio priority is completed using the countdown procedure, including acknowledgement from the network if in RLC acknowledged mode, the mobile station shall try to establish an uplink TBF for the transmission of any remaining LLC PDU(s).

On receipt of the PACKET RESOURCE REQUEST the network shall respond by sending a PACKET UPLINK ASSIGNMENT or WGPSR PACKET TIMESLOT RECONFIGURE or a PACKET ACCESS REJECT message to the mobile station on the downlink WPACCH.

After the transmission of the PACKET RESOURCE REQUEST message with the reason for changing the priority or peak throughput class of an assigned uplink TBF the mobile station shall continue to use the currently assigned uplink TBF assuming that the requested priority or peak throughput class is already assigned to that TBF.

On receipt of a PACKET UPLINK ASSIGNMENT or WGPSR PACKET TIMESLOT RECONFIGURE message the mobile station shall stop timer TW3168 and switch to the assigned PDCHs.

The mobile station is then not allowed to send new PACKET RESOURCE REQUEST messages until either a new packet transfer request is received from the upper layers or when sending of LLC PDU(s) at a lower Radio Priority has to be continued.

On expiry of timer TW3168, the mobile station shall retransmit the PACKET RESOURCE REQUEST message unless the PACKET RESOURCE REQUEST message has already been transmitted four times in which case the mobile station shall perform an abnormal release with random access.

If no PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message is received before the mobile station has completed its currently assigned TBFs the mobile station shall stop timer TW3168 and return to packet idle mode (listening to its paging channel).

The network may at any time during the uplink TBF initiate a change of resources by sending on the downlink WPACCH monitored by the MS, an unsolicited PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE, or an uplink resource reassignment in a PACKET UPLINK ACK/NACK message to the mobile station.

On receipt of a PACKET ACCESS REJECT message, the mobile station shall stop timer TW3168 if running and return to packet idle mode. If the PACKET ACCESS REJECT message contains a WAIT_INDICATION field in a Reject structure addressed to the mobile station, the mobile station shall

- Start timer TW3172 and if the mobile station has additional RLC data blocks to transmit, it shall initiate a new TBF establishment procedure, but the mobile station is not allowed to make a new attempt for packet access in the same cell until timer TW3172 expires, it may, however, attempt packet access in another cell after successful cell reselection. A mobile station in MS class B mode of operation may attempt to enter the dedicated mode in the same cell before timer TW3172 has expired.
- The value of the WAIT_INDICATION field (i.e., timer TW3172) relates to the cell from which it was received.

8.1.1.3.2.1 At The Beginning of Each Fixed Allocation

At the beginning of each allocation of an open-ended TBF the mobile station shall either request to continue the TBF by transmitting a PACKET RESOURCE REQUEST or a PACKET DOWNLINK ACK/NACK containing a Channel Request Description IE message on the uplink WPACCH, or the mobile station shall begin the countdown procedure so that it ends within the current allocation.

The mobile station shall signal the number of RLC data octets ready to transmit, plus the number of RLC data block length octets ready to transmit, in the RLC_OCTET_COUNT field of the PACKET RESOURCE REQUEST or PACKET DOWNLINK ACK/NACK message. The mobile station shall always indicate the current state of its transmit buffer at the time the message is sent. In RLC acknowledged mode, previously transmitted but currently unacknowledged octets shall not be included in the RLC_OCTET_COUNT.

8.1.1.3.2.2 Upon Receipt of the Reallocation Request

Upon receipt of the PACKET RESOURCE REQUEST or PACKET DOWNLINK ACK/NACK with a Channel Request Description IE, the network shall continue the TBF by sending a PACKET UPLINK ASSIGNMENT or PACKET UPLINK ACK/NACK containing a fixed allocation to the mobile station, or shall end the TBF by sending a PACKET ACCESS REJECT message. Alternatively, the network may end the TBF by sending an uplink assignment containing a fixed allocation with the FINAL_ALLOCATION bit set to 1.

Upon receipt of a complete uplink assignment containing an ALLOCATION_BITMAP, the mobile station shall begin transmitting on the new resources at the indicated TBF Starting Time. If there is a conflict between a previous allocation and the new allocation, the new allocation shall take precedence.

Upon receipt of a PACKET UPLINK ACK/NACK with a REPEAT_ALLOCATION, the mobile station shall start a new allocation when the current allocation ends. This new allocation shall begin immediately after the current allocation ends and shall use the most recently received ALLOCATION_BITMAP. If the mobile station receives multiple PACKET UPLINK ACK/NACK messages with REPEAT_ALLOCATION during an allocation, the mobile station shall repeat the ALLOCATION_BITMAP only once. If the mobile receives a PACKET UPLINK ACK/NACK without the REPEAT_ALLOCATION indication, the mobile station shall transmit to the end of its current allocation without repeating the allocation, regardless of any previous REPEAT_ALLOCATION indications that may have been received.

8.1.1.3.2.3 Upon Exhaustion of the Current Allocation

If the mobile station exhausts its assigned fixed allocation and has more RLC data blocks to transmit, it shall start timer TW3188 and monitor the downlink of all assigned PDCHs. If the mobile station receives a PACKET UPLINK ASSIGNMENT message containing a fixed allocation, the mobile station shall stop timer TW3188 and use the new allocation at the assigned starting time. If the mobile station receives a PACKET UPLINK ACK/NACK with a REPEAT ALLOCATION after its current allocation has been exhausted, it shall stop timer TW3188, wait until the next repeated allocation boundary and then begin transmitting using the repeated ALLOCATION_BITMAP. If timer TW3188 expires, the mobile station shall perform an abnormal release with random access (see 8.4.2).

8.1.1.3.2.4 Ending the TBF

Upon receipt of a PACKET ACCESS REJECT message, the mobile station shall stop timer TW3188, if running, release the TBF using the procedures in 9.3.2.4 or 9.3.3.3, such that the countdown ends within the current allocation. Then, if the mobile station has additional RLC data blocks to transfer, it shall request RR using a PACKET DOWNLINK ACK/NACK if during a downlink TBF.

Upon receipt of a complete uplink assignment containing a fixed allocation and with the field FINAL_ALLOCATION set to 1, the mobile station shall execute the countdown procedure such that the countdown ends before the current allocation is exhausted.

8.1.1.3.2.5 Abnormal Cases

The following abnormal cases apply:

- If the mobile station receives an assignment message containing an allocation other than a fixed allocation, the mobile station shall perform an abnormal release with random access.
- If a mobile station receives a PACKET UPLINK ASSIGNMENT or WGPRES PACKET TIMESLOT RECONFIGURE message and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release with system information (see subclause 8.4.3).

NOTE: A PACKET UPLINK ASSIGNMENT message received by a multi-band mobile station shall not be considered invalid if it indicates new frequencies that are all in a different frequency band to that of the PDCH(s) on which the assignment was received. The assignment may however be rendered invalid for some other reason.

8.1.1.3.3 WPACCH Operation

Mobile station shall monitor a radio block on an assigned PDCH for downlink a WPACCH block, according to its multislot capabilities.

The network shall leave such sets of gaps in the uplink fixed allocation for the purpose of transmission of the downlink WPACCH.

A mobile station shall monitor one PDCH in the allocation for downlink WPACCH. The network shall indicate that PDCH on uplink resource assignment (DOWNLINK_CONTROL_TIMESLOT parameter) according to MS multislot class. In case of simultaneous uplink and downlink TBFs, the PDCH used for the downlink WPACCH of the uplink TBF shall be compatible (according to the MS multislot) with the monitoring of the PDCH of the downlink TBF.

In the case of simultaneous uplink and downlink TBFs, the mobile station shall monitor all assigned downlink PDCHs and any uplink PDCHs it is able to monitor. The mobile station may transmit a WPACCH block on any uplink radio block allocated via the ALLOCATION_BITMAP.

In the case of simultaneous uplink and downlink TBFs, the mobile station shall not transmit an RLC data block in any uplink radio block allocated via the polling mechanism (see subclause 10.4.4).

8.1.1.3.4 Establishment of Downlink TBF

During an uplink fixed allocation TBF, the network may initiate a downlink TBF by sending the WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message on the WPACCH.

The downlink radio resource is assigned to the mobile station in a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message. The assigned timeslot configuration of the simultaneous uplink and downlink TBF must be compliant with the mobile station's multislot class.

On receipt of an assignment message the mobile station shall follow the procedure below. The network may send a WGPRS PACKET TIMESLOT RECONFIGURE message. If a WGPRS PACKET TIMESLOT RECONFIGURE message is sent, then the message shall contain the DOWNLINK_TFI_ASSIGNMENT field.

The mobile station shall, after expiry of the TBF starting time, if present, act upon the complete downlink assignment, and start timer TW3190.

The mobile station shall then act upon the WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message.

8.1.1.3.4.1 Abnormal Cases

If a failure occurs on the mobile station side before the new TBF has been successfully established, the newly reserved resources are released. The subsequent behavior of the mobile station depends on the type of failure and previous actions:

- If the information available in the mobile station, after the reception of a WGPRS PACKET DOWNLINK ASSIGNMENT message does not satisfactorily define a PDCH, the mobile station shall ignore the WGPRS PACKET DOWNLINK ASSIGNMENT message.
- If a failure in the WGPRS PACKET DOWNLINK ASSIGNMENT is due to any other reason, then the mobile station shall ignore the WGPRS PACKET DOWNLINK ASSIGNMENT.
- If the information in the WGPRS PACKET TIMESLOT RECONFIGURE does not properly specify an uplink and downlink PDCH or violates the mobile station's multislot capabilities, the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If the WGPRS PACKET TIMESLOT RECONFIGURE does not include a DOWNLINK_TFI_ASSIGNMENT field, then the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If a failure in the WGPRS PACKET TIMESLOT RECONFIGURE is due to any other reason, then the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If the failure is due to any other reason, the mobile station shall abort the procedure and perform an abnormal release with random access (see subclause 8.4.2).

8.1.1.4 Network Initiated Release of Uplink TBF

The network may initiate release of an uplink TBF by transmitting a PACKET TBF RELEASE message to the mobile station on the WPACCH. A cause value indicates the reason for release.

If the cause value is "Normal release" the mobile station shall continue to the next LLC PDU boundary, starting the countdown procedure (see subclause 9.3.1) at whatever value of CV is appropriate to count down to zero at the LLC PDU boundary, and then release the TBF according to the procedures in subclause 9.3.2.4 or 9.3.3.3.

If the cause value is "Abnormal Release" the mobile station shall immediately stop transmitting and follow the abnormal release with random access procedure (see subclause 8.4.2).

8.1.1.5 Abnormal Cases

The following abnormal cases apply:

- If the mobile station receives a PACKET UPLINK ASSIGNMENT, WGPRS PACKET TIMESLOT RECONFIGURE, PACKET UPLINK ACK/NACK with an ALLOCATION_BITMAP, or a WGPRS PACKET DOWNLINK ASSIGNMENT message with an invalid Frequency Parameters information element, the mobile station shall perform an abnormal release with system information (see subclause 8.4.3).
- If a mobile station receives a PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release with system information (see subclause 8.4.3).
- If the mobile station receives a PACKET UPLINK ASSIGNMENT, WGPRS PACKET TIMESLOT RECONFIGURE, PACKET UPLINK ACK/NACK with an ALLOCATION_BITMAP, or a WGPRS PACKET DOWNLINK ASSIGNMENT message specifying frequencies that are not all in one band then the mobile shall perform an abnormal release with random access (see subclause 8.4.2).
- If the mobile station receives a PACKET UPLINK ASSIGNMENT, WGPRS PACKET TIMESLOT RECONFIGURE, or a PACKET UPLINK ACK/NACK with an ALLOCATION_BITMAP whose TBF starting time has elapsed, the mobile station shall use whatever portion of the fixed allocation remains. If none of the fixed allocation remains, the mobile station shall ignore the message.
- If the mobile station receives a PACKET UPLINK ACK/NACK with missing mandatory fields, the MS shall perform an abnormal release with random access.
- If the mobile station has not started or has not completed the countdown procedure and it receives a Packet Uplink Ack/Nack with the Final Ack Indicator set, it shall perform an abnormal release with random access.

NOTE: A PACKET UPLINK ASSIGNMENT, WGPRS PACKET TIMESLOT RECONFIGURE, PACKET UPLINK ACK/NACK with an ALLOCATION_BITMAP, or a WGPRS PACKET DOWNLINK ASSIGNMENT message sent to a multi-band mobile station shall not be considered invalid if it indicates new frequencies that are all in a different frequency band to that of the ARFCN of the serving cell.

8.1.2 Downlink RLC Data Block Transfer

Prior to the initiation of RLC data block transfer on the downlink, the network assigns the following parameters to the downlink TBF in the *Channel Assignment Type D*, WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message:

- a unique TFI. The TFI applies to all radio blocks transferred in regards to the downlink TBF.
- a set of PDCHs to be used for the downlink transfer; and
- optionally, a TBF starting time indication.

For each TBF, the network shall prioritize RLC/MAC control blocks, not containing a PACKET DOWNLINK DUMMY CONTROL BLOCK message, to be transmitted ahead of RLC data blocks for that TBF. If the network has no other RLC/MAC block to transmit, but wishes to transmit on the downlink, the network shall transmit an RLC/MAC control block containing a PACKET DOWNLINK DUMMY CONTROL BLOCK message.

8.1.2.1 Downlink RLC Data Block Transfer

This subclause specifies mobile station behavior for downlink RLC data block transfer while in packet transfer mode.

Upon reception of a complete downlink assignment that does not contain a TBF starting time the mobile station shall start timer TW3190 and then shall attempt to decode every downlink block on its assigned PDCHs. If the *Channel Assignment Type D*, WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message contains a TBF starting time information element and there is no downlink TBF in

progress, but an uplink TBF is in progress, the mobile station shall remain on the assigned PDCHs until the TDMA frame number indicated by the TBF starting time, at which time the mobile station shall start timer TW3190 and immediately begin decoding the assigned downlink PDCH(s). If the WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message contains a TBF starting time and there is a downlink TBF already in progress, the mobile station shall continue to use the parameters of the downlink TBF in progress until the TDMA frame number indicated in the TBF starting time occurs, at which time the mobile station shall immediately begin to use the new assigned downlink TBF parameters. If while waiting for the frame number indicated by the TBF starting time the mobile station receives another downlink assignment, the mobile station shall act upon the most recently received downlink assignment and shall ignore the previous downlink assignment.

If the mobile station receives a valid RLC data block addressed to itself, the mobile station shall reset and restart timer TW3190. If timer TW3190 expires, the mobile station shall perform an abnormal release with return to packet idle mode (see subclause 8.4.1).

Upon receipt of a PACKET TBF RELEASE referring to the downlink TBF, the mobile station shall follow the procedure in subclause 8.1.2.8.

8.1.2.2 Polling for Packet Downlink Ack/Nack

Whenever the mobile station receives an RLC data block addressed to itself and with a valid Relative Reserved Block Period (RRBP) field in the RLC data block header (i.e., is polled), the mobile station shall transmit a PACKET DOWNLINK ACK/NACK message in the uplink radio block specified by the RRBP field whatever the Block Sequence Number (BSN) value of the received RLC data block, unless another RLC/MAC control message is waiting to be transmitted, in which case the other RLC/MAC control message shall be sent. However, the mobile station shall transmit an RLC/MAC control message other than a PACKET DOWNLINK ACK/NACK message at most every second time it is polled. Furthermore the mobile station shall not transmit an RLC/MAC control message other than a PACKET DOWNLINK ACK/NACK message if the PACKET DOWNLINK ACK/NACK message would contain a Final Ack Indicator or Channel Request Description IE. The mobile station shall not send a PACKET CONTROL ACKNOWLEDGEMENT message unless otherwise specified.

Whenever the network receives a valid RLC/MAC control message from the mobile station, it shall reset counter NW3105. The network shall increment counter NW3105 for each radio block, allocated to that mobile station with the RRBP field, for which no RLC/MAC control message is received. If $NW3105 = NW3105_{max}$, the network shall release the downlink TBF internally and start timer TW3195. When TW3195 expires, the network may reuse the TFI.

The network shall poll the mobile station by respecting the resources allocated to the MS and the MS multislot class. If the polling does not fulfill these requirements, the mobile station shall not respond to the polling.

In the case of simultaneous uplink and downlink TBFs, the transmission of the polling response takes precedence over the transmission of allocated uplink radio blocks. If transmission of the poll response would result in more than the maximum Tx or sum of Rx and Tx timeslots per TDMA frame allowed by the multislot class, transmission of the highest numbered PDCH(s) shall be omitted.

8.1.2.3 Resource Reassignment for Downlink

The network initiates resource reassignment by sending a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message on the downlink WPACCH. This message indicates a change in resources in the same TBF. The Control Ack bit in the message shall be set to '0'. During the reassignment TFI is allowed to be changed. Mobile shall use the TFI indicated in the WGPRS PACKET DOWNLINK ASSIGNMENT when using the resource indicated in the message.

The network is not allowed to change the RLC mode of an already established TBF during resource reallocation. Change of RLC mode shall be achieved through release of on-going TBF and establishment of a new TBF with the newly requested RLC mode using the procedures described in subclause 8.1.2.4.1. On receipt of a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message, and after the

TBF starting time, if present, the mobile station shall switch to the assigned PDCHs. Upon switching to the new PDCHs the mobile station shall restart timer TW3190.

When the mobile station receives an RLC/MAC block addressed to itself on any of the new assigned resources it shall restart timer TW3190. If timer TW3190 expires, the mobile station shall perform an abnormal release with return to packet idle mode (see subclause 8.4.1).

8.1.2.4 Establishment of Downlink TBF after Downlink TBF Release

After the network has initiated the release of a downlink TBF and the mobile station has received all the RLC blocks, the mobile station shall send the PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to '1', start timer TW3192 and continue to monitor all assigned PDCHs.

If the network receives a PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to '1' and has new data to transmit for the mobile station, the network may establish a new downlink TBF for the mobile station by sending the WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message with the Control Ack bit set to '1' on WPACCH.

If the mobile station, after sending the PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to '1', receives a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message with the Control Ack bit set to '1' while timer TW3192 is running, the mobile station shall stop timer TW3192, consider the previous downlink TBF released and act upon the new assignment.

8.1.2.4.1 Abnormal Cases

If a mobile station receives a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release with system information (see subclause 8.4.3).

8.1.2.5 Establishment of Uplink TBF

The mobile station may request establishment of an uplink transfer during a downlink TBF by including a Channel Request Description information element in the PACKET DOWNLINK ACK/NACK message. Initiation is triggered by a request from upper layers to transfer a LLC PDU. The request from upper layers specifies a Radio Priority to be associated with the packet transfer.

The mobile station initiates the packet access procedure by sending the Channel Request Description information element in the PACKET DOWNLINK ACK/NACK message on the WPACCH and starting timer TW3168.

On receipt of a Channel Request Description information element in the PACKET DOWNLINK ACK/NACK message, the network may assign RR to the mobile station on one or more PDCHs by transmitting a PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message on the WPACCH, or may reject the request by sending a PACKET ACCESS REJECT message on the WPACCH. If the WGPRS PACKET TIMESLOT RECONFIGURE message is sent, then the message shall contain the UPLINK_TFI_ASSIGNMENT field.

A mobile allocation or reference frequency list, received as part of an uplink assignment, replaces the previous parameters and shall be used until a new assignment is received or the MS enters to the packet idle mode.

On receipt of a PACKET UPLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message the mobile station shall follow the procedure below. On reception of a complete uplink assignment the mobile station shall stop timer TW3168.

The mobile station shall, after expiry of the TBF starting time, if present, act upon the complete uplink assignment.

The mobile station shall then switch to the assigned uplink PDCHs and begin to send RLC data blocks on the assigned PDCH(s). The TLLI shall not be included in any of the uplink RLC data blocks in that case. On receipt

of a PACKET ACCESS REJECT message containing a WAIT_INDICATION field in a Reject structure addressed to the mobile station, the mobile station shall stop timer TW3168 and start timer TW3172 with the indicated value (Wait Indication). The mobile station is not allowed to make a new attempt for packet access in the same cell until timer TW3172 expires, but may attempt packet access in another cell after successful cell reselection. When timer TW3172 expires, if the downlink TBF is still active the mobile station shall initiate the establishment of an uplink TBF using the procedure in this subclause. If no TBF is active, the mobile station shall initiate the establishment of an uplink TBF.

On receipt of a PACKET ACCESS REJECT message that contains a Reject structure addressed to the mobile station without a WAIT_INDICATION field, the mobile station shall stop timer TW3168 and shall perform an abnormal release with system information (see subclause 8.4.3).

If timer TW3168 expires, the mobile station shall retransmit the Channel Request Description information element in the next PACKET DOWNLINK ACK/NACK message unless it has been transmitted four times in which case the mobile station shall perform an abnormal release with random access. If the downlink TBF is released, including expiry of timer TW3192, before expiry of timer TW3168 the mobile station shall stop timer TW3168 and perform an abnormal release with random access.

8.1.2.5.1 Abnormal Cases

If a failure occurs on the mobile station side before the new TBF has been successfully established, the newly reserved resources are released. The subsequent behavior of the mobile station depends on the type of failure and previous actions.

- If the mobile station has been assigned more PDCHs than it supports according to its mobile station multislot class, the mobile station shall reinitiate the access unless it has already been attempted 4 times, in which case, the mobile station shall perform the abnormal release with random access (see subclause 8.4.2).
- If a failure in the PACKET UPLINK ASSIGNMENT is due to any other reason, the mobile station shall abort the procedure and continue the reception of downlink PDUs.
- If the information in the WGPRS PACKET TIMESLOT RECONFIGURE does not properly specify a set of uplink and downlink PDCH(s) or violates the mobile station's multislot capabilities, the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If the WGPRS PACKET TIMESLOT RECONFIGURE does not include a correct UPLINK_TFI_ASSIGNMENT field, then the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If a failure in the WGPRS PACKET TIMESLOT RECONFIGURE is due to any other reason, the mobile station shall perform an abnormal release with random access (see subclause 8.4.2).
- If the failure is due to any other reason, the mobile station shall abort the procedure and perform an abnormal release with random access (see subclause 8.4.2).

8.1.3 Network Initiated Abnormal Release of Downlink TBF

The network may initiate immediate abnormal release of a downlink TBF by transmitting a PACKET TBF RELEASE message to the mobile station on the WPACCH.

The mobile station shall immediately stop monitoring its assigned downlink PDCHs. If a valid RRBP field is received as part of the Packet TBF Release message, the mobile station shall transmit a PACKET CONTROL ACKNOWLEDGMENT message in the uplink radio block specified. If there is no on-going uplink TBF, the mobile station then shall enter packet idle mode.

8.2 Packet PDCH Release

The network may broadcast the PACKET PDCH RELEASE message on WPACCH to indicate one or more timeslots is no longer available for packet data service.

When a mobile station receives a PACKET PDCH RELEASE message without a TIMESLOTS_AVAILABLE field, it shall immediately stop transmitting and receiving on the PDCH on which the PACKET PDCH RELEASE message was received, and remove that PDCH from its list of assigned PDCHs.

When a mobile station receives a PACKET PDCH RELEASE message containing a TIMESLOTS_AVAILABLE field, it shall immediately stop transmitting and receiving on all assigned PDCHs, which are indicated as not present in the TIMESLOTS_AVAILABLE field, remove those PDCHs from its list of assigned PDCHs.

If an uplink TBF in fixed allocation mode was in progress and if one of timeslots that are being released is its downlink WPACCH timeslot, the mobile station shall temporarily read all downlink blocks that it is able to decode according to its multislot capability, on all of its remaining assigned PDCHs, and act upon any RLC/MAC control message that is addressed to it, until another downlink WPACCH timeslot is assigned. If the mobile station's multislot capability does not allow it to monitor the downlink of any of its assigned PDCHs, it shall perform an abnormal release with random access.

If all of the mobile station's assigned PDCHs are removed from its list of assigned PDCH, and, if an uplink TBF was in progress, the mobile station shall perform an abnormal release with random access (see subclause 8.4.2). If no uplink TBF was in progress, the mobile station shall perform an abnormal release with return to packet idle mode (see subclause 8.4.1).

8.3 Packet Control Acknowledgement

A PACKET CONTROL ACKNOWLEDGEMENT message shall always be sent in the uplink block specified by the corresponding valid RRBP field of a downlink RLC/MAC control block, and not in any other uplink block that may be allocated to the mobile station. However the transmission of the PACKET CONTROL ACKNOWLEDGEMENT takes precedence over the transmission of allocated uplink radio blocks or the reception of PCCH or assigned WPTCH radio blocks. If transmission of the PACKET CONTROL ACKNOWLEDGEMENT would result in more than the maximum Tx timeslots per TDMA frame allowed by the multislot class, transmission of the highest numbered PDCH(s) shall be omitted.

8.4 Abnormal Cases

The following abnormal cases apply:

- If a mobile station receives a WGPRS PACKET DOWNLINK ASSIGNMENT assigning a different MAC mode than the MAC mode of an already operating uplink TBF, the WGPRS PACKET DOWNLINK ASSIGNMENT message shall be ignored.
- If a mobile station receives a PACKET UPLINK ASSIGNMENT assigning a different MAC mode than the MAC mode of an already operating downlink TBF, the PACKET UPLINK ASSIGNMENT message shall be ignored.

8.4.1 Abnormal Release with Return to packet idle mode

The mobile station shall abort all TBFs in progress and return to packet idle mode.

8.4.2 Abnormal Release with Random Access

The mobile station shall abort all TBFs in progress. The mobile station in packet transfer mode shall return to packet idle mode and initiate the establishment of one or more new uplink TBFs, using the procedures on CCCH or PCCCH (see 3GPP TS 44.060).

8.4.3 Abnormal Release with System Information

If the mobile station was performing an uplink TBF when the abnormal release occurred, the mobile station shall abort the TBF and its associated resources and proceed as follows:

- If there are no on-going TBFs it shall immediately return to the Broadcast Control Channel (BCCH) and reread all relevant BCCH and PBCCH information;
- If the mobile station had one ongoing uplink TBF when the abnormal release occurred, the mobile station shall then perform an abnormal release with random access (see 8.4.2);
- If the mobile station had no ongoing uplink TBFs when the abnormal release occurred, it shall perform an abnormal release with return to packet idle mode (see 8.4.1);
- Otherwise, the mobile station shall maintain all its ongoing TBFs that were in progress prior to receiving the assignment message containing invalid frequency parameter information and provide a failure indication to the upper layers associated with the aborted TBFs.

9 RLC Procedures in Packet Transfer Mode

The RLC function is responsible for:

- Interface primitives allowing the transfer of Logical Link Control layer PDUs (LLC PDU) between the LLC layer and the MAC function.
- Segmentation of LLC PDUs into RLC data blocks and reassembly of RLC data blocks into LLC PDU.
- Segmentation of RLC/MAC control messages into RLC/MAC control blocks and reassembly of RLC/MAC control messages from RLC/MAC control blocks.
- BEC procedures enabling the selective retransmission of RLC data blocks.

In this subclause Packet Ack/Nack refers to any of the following messages:

- PACKET DOWNLINK ACK/NACK
- PACKET UPLINK ACK/NACK

Additionally the following definitions apply:

- Sequence Number Space (SNS): 4096
- Window Size (WS): 448 to 2048

9.1 Procedures & Parameters for Peer-to-Peer Operation

A TBF is comprised of two peer entities RLC endpoints. Each RLC endpoint has a receiver that receives RLC/MAC blocks. Each RLC endpoint also has a transmitter that transmits RLC/MAC blocks. Each endpoint's receiver has a receive window of size WS (see subclause 9.1.9). In RLC acknowledged mode, the receive window is defined by the receive state variable $V(Q)$ in the following inequality $[V(Q) \leq BSN < V(Q) + WS]$ modulo SNS. All BSNs which meet that criteria are valid within the receive window. In RLC unacknowledged mode, all values of BSN are within the receive window. Each endpoint's transmitter has a transmit window of size WS. In RLC acknowledged mode, the transmit window is defined by the send state variable $V(S)$ in the following inequality: $[V(A) \leq BSN < V(S)]$ modulo SNS, where $[V(S) - V(A)]$ modulo SNS $\leq WS$. All BSNs which meet that criteria are valid within the transmit window. In RLC unacknowledged mode, all values of BSN are within the transmit window.

9.1.1 Send State Variable V(S)

Each RLC endpoint transmitter shall have an associated send state variable $V(S)$. $V(S)$ denotes the sequence number of the next in-sequence RLC data block to be transmitted. $V(S)$ can take on the value 0 through SNS - 1. $V(S)$ shall be set to the value 0 at the beginning of each TBF in which the RLC endpoint is the transmitter. The

value of $V(S)$ shall be incremented by 1 after transmission of the RLC data block with $BSN = V(S)$. In RLC acknowledged mode, $V(S)$ shall not exceed $V(A)$ modulo SNS by more than the maximum allowed number of outstanding RLC data blocks WS .

9.1.1.1 Control Send State Variable $V(CS)$

The network RLC endpoint transmitter shall have one instance of an associated control send state variable $V(CS)$ for each parallel control transaction identified by the RTI field of the RLC/MAC control block header. $V(CS)$ denotes the sequence number of the next in-sequence RLC/MAC control block to be transmitted for the control transaction. $V(CS)$ can take on the values 0 to 3. $V(CS)$ shall be set to the value 0 prior to the transmission of each RLC/MAC control block that contains the first octet of an RLC/MAC control message of the control transaction and the value of $V(CS)$ shall be incremented after the transmission of each RLC/MAC control block with the same RTI value.

9.1.2 Acknowledge State Variable $V(A)$

In RLC acknowledged mode, each RLC endpoint transmitter shall have an associated acknowledge state variable $V(A)$. $V(A)$ contains the BSN value of the oldest RLC data block that has not been positively acknowledged by its peer. $V(A)$ can take on the values 0 through $SNS - 1$. $V(A)$ shall be set to the value 0 at the beginning of each TBF in which the RLC endpoint is the transmitter. The value of $V(A)$ shall be updated from the values received from its peer in the received block bitmap (RBB) of the Packet Ack/Nack message (see subclause 9.1.8). Furthermore, $[V(S) - V(A)] \text{ modulo } SNS \leq WS$.

9.1.3 Acknowledge State Array $V(B)$

In RLC acknowledged mode, each RLC endpoint transmitter shall have an associated acknowledge state array ($V(B)$). $V(B)$ is an array of SNS elements indicating the acknowledgement status of WS previous RLC data blocks. The array is indexed relative to the acknowledge state variable $V(A)$ modulo SNS or relative to the starting sequence number (SSN). The values of $V(B)$ shall be updated from the values received from its peer in the reported bitmap (RB) of the Packet Ack/Nack message (see subclause 9.1.8). If a compressed reported bitmap is received, decompression shall be first applied according to subclause 9.1.10.

The transmitter shall transmit the oldest RLC data block whose corresponding element in $V(B)$ indexed relative to $V(A)$ has the value NACKED. As each RLC data block is transmitted the corresponding element in $V(B)$ is set to the value PENDING_ACK. If $[V(S) < V(A) + WS] \text{ modulo } SNS$ and no RLC data blocks have a corresponding element in $V(B)$ with the value NACKED, the RLC data block with $BSN = V(S)$ shall be transmitted and the corresponding element in $V(B)$ shall be set to the value PENDING_ACK. If there are no further RLC data blocks available for transmission (i.e., the RLC data block with $BSN = V(S)$ does not exist), the sending side shall transmit the oldest RLC data block whose corresponding element in $V(B)$ has the value PENDING_ACK, then the next oldest block whose corresponding element in $V(B)$ has the value PENDING_ACK, etc. If all RLC data blocks whose corresponding element in $V(B)$ has the value PENDING_ACK have been transmitted once, the process shall be repeated beginning with the oldest RLC data block.

If $V(S) = [V(A) + WS] \text{ modulo } SNS$ (i.e., the transmit window is stalled), the sending side shall transmit the oldest RLC data block whose corresponding element in $V(B)$ has the value PENDING_ACK, then the next oldest RLC data block whose corresponding element in $V(B)$ has the value PENDING_ACK, etc. If all RLC data blocks whose corresponding element in $V(B)$ has the value PENDING_ACK has been transmitted once, the process shall be repeated beginning with the oldest RLC data block. This process of transmitting the oldest RLC data blocks whose value in $V(B)$ has the value PENDING_ACK shall continue indefinitely.

When an element in $V(B)$ falls outside of the active transmit window, i.e., $[V(A) \leq BSN < V(S)] \text{ modulo } SNS$, the element shall be set to the value INVALID.

If the mobile station is the transmitter, it shall set an instance of timer TW3198 for each RLC data block sent. The timer TW3198 shall have the expiry value set to BS_CV_MAX block periods.

9.1.4 Block Sequence Number

9.1.4.1 Block Sequence Number BSN

Each RLC data block contains a BSN field that is 12 bits in length. At the time that an in-sequence RLC data block is designated for transmission, the value of BSN is set equal to the value of the send state variable $V(S)$.

9.1.4.2 Reduced Block Sequence Number RBSN

Each downlink RLC/MAC control block contains a Reduced Block Sequence Number (RBSN) field. At the time that an in-sequence RLC/MAC control block is designated for transmission, the value of RBSN is set equal to the value of the control send state variable $V(CS)$.

9.1.5 Receive State Variable $V(R)$

Each RLC endpoint receiver shall have an associated receive state variable $V(R)$. The receive state variable denotes the BSN of the next in-sequence RLC data block expected to be received. $V(R)$ shall be set to the value '0' at the beginning of each TBF in which the RLC endpoint is the receiver. $V(R)$ can take on the value 0 through $SNS - 1$.

In RLC acknowledged mode, $V(R)$ shall be set to $[BSN' + 1]$ modulo SNS , where BSN' is the BSN of most recently received RLC data block, provided the RLC data block was error free and $[V(R) \leq BSN' < V(Q) + WS]$ modulo SNS .

In RLC unacknowledged mode, $V(R)$ shall be set to $[BSN' + 1]$ modulo SNS , where BSN' is the BSN of most recently received RLC data block.

9.1.5.1 Receive Header State Variable $V(H)$

Each RLC endpoint receiver in TBF mode shall have an associated Receive header state variable $V(H)$. In RLC acknowledged mode, $V(H)$ shall be set to $[BSN' + 1]$ modulo SNS , where BSN' is the BSN of the highest (modulo SNS) received RLC data block, provided the header of the RLC data block was error free and $[V(R) < BSN' < V(Q) + WS]$ modulo SNS . This variable is not used in unacknowledged mode.

9.1.6 Receive Window State Variable $V(Q)$

Each RLC endpoint receiver shall have an associated receive window state variable $V(Q)$. The receive window state variable denotes the BSN of the oldest RLC data block within the receive window that has not been received. $V(Q)$ shall be set to the value 0 at the beginning of each TBF in which the RLC endpoint is the receiver. The receive window state variable can take on the value 0 through $SNS - 1$. In RLC acknowledged mode, the value of $V(Q)$ shall be updated when the RLC receiver receives the RLC data block whose BSN is equal to $V(Q)$. The value of $V(Q)$ shall then be set to the value of the oldest BSN in the receive window that has not been received, or it shall be set to $V(R)$ if all RLC data blocks in the receive window have been received properly.

In RLC unacknowledged mode, if $[V(R) - V(Q)]$ modulo $SNS > WS$ after updating $V(R)$, then $V(Q)$ is set to $[V(R) - WS]$ modulo SNS .

9.1.7 Receive State Array $V(N)$

Each RLC endpoint receiver shall have an associated receive state array $V(N)$. $V(N)$ is an array of SNS elements indicating the receive status of WS previous RLC data blocks. The array is indexed relative to the receive window state variable $V(Q)$ modulo SNS . When an RLC data block is received with BSN within the active window i.e., such that $[V(Q) \leq BSN < V(Q) + WS]$ modulo SNS , the corresponding element in $V(N)$ is set to the value RECEIVED.

Moreover, if BSN is the largest value within the active window, $V(R)$ shall be set to BSN. When an element in $V(N)$ falls outside of the active window (i.e., $[BSN > V(Q) + WS]$ modulo SNS) the element is set to the value INVALID.

9.1.8 Starting Sequence Number (SSN) & Received Block Bitmap (RBB)

The Packet Ack/Nack message contains a SSN and a RB. The Packet Ack/Nack message is sent by the RLC receiver and is received by the RLC transmitter. The SSN and RB are determined as defined in this subclause and transmitted in both RLC acknowledged and RLC unacknowledged mode. The SSN and RB shall be ignored by the RLC receiver in unacknowledged mode.

The BSN values specified in the RBB are interpreted by adding the bit position in the bitmap from the number $SSN \text{ modulo SNS}$. A valid BSN value in the RBB is one that is in the range $[V(A) \leq BSN < V(S)] \text{ modulo SNS}$. These inequalities shall be interpreted in the following way: BSN is valid if, and only if, $[BSN - V(A)] \text{ modulo SNS} < [V(S) - V(A)] \text{ modulo SNS}$.

9.1.8.1 Extended Polling

For uplink TBFs, the network may select any composition of the ACK/NACK message to send to the MS. In downlink TBFs, an additional poll bit is added to the S/P field in every downlink RLC block so that the network can request the following:

- First Partial Bitmap (FPB) segment with $SSN = (V(Q) + 1) \text{ modulo } 4096$ (i.e., at the beginning of the window) where SSN denotes the Starting Sequence Number.
- Next Partial Bitmap (NPB) segment with $SSN = (PBSN + 1) \text{ modulo } 4096$ where PBSN denotes a Partial Bitmap Sequence Number variable stored at the receiver.

SSN is determined by the receiver as a function of S/P, $V(Q)$ and PBSN as described in the next subclause. The FPB and NPB are specific instances of the *WGPRS Ack/Nack Description Information Element* within the Packet Downlink ACK/NACK message. The MS shall respond to S/P field according to the table below.

Table 9.1 – Format of S/P field within each WGPRS RLC block.

S/P	Feedback Request (Poll) Description
00	Nothing (RRBP field invalid)
01	Packet Downlink Ack/Nack message containing FPB (First Partial Bitmap), drop channel quality report
10	Packet Downlink Ack/Nack message containing NPB (Next Partial Bitmap), drop channel quality report
11	Packet Downlink Ack/Nack message containing NPB and Channel Quality Report

9.1.8.2 Determination of SSN

If the receiving side is the network, the network may select any SSN within the receive window. If the receiving side is the MS, SSN shall be determined as follows: Let PBSN represent a Partial Bitmap Sequence Number variable stored at the receiver which helps determine the SSN for the next partial bitmap to be transmitted. Based on PBSN, V(Q) and the S/P field set by the network, SSN and PBSN shall be determined according to the table below.

Table 9.2 – Determination of SSN as a function of S/P, V(Q) and PBSN.

S/P	Determination of SSN
00	-
01	<p>If full bitmap fits in available space</p> <p style="padding-left: 40px;">Set SSN = (V(Q)+1) modulo 4096, PBSN = V(Q).</p> <p>Else{</p> <p style="padding-left: 40px;">SSN = (V(Q)+1) modulo 4096.</p> <p style="padding-left: 40px;">PBSN = last sequence number for which Ack/Nack status can be indicated in available space.</p> <p>}</p>
10, 11	<p>If full bitmap fits in available space,</p> <p style="padding-left: 40px;">Set SSN = (V(Q)+1) modulo 4096, PBSN = V(Q).</p> <p>Else{</p> <p style="padding-left: 40px;">If (PBSN+1) modulo 4096 = V(Q) or (PBSN+1) modulo 4096 lies outside the receiver window</p> <p style="padding-left: 80px;">SSN = (V(Q)+1) modulo 4096.</p> <p style="padding-left: 40px;">Else</p> <p style="padding-left: 80px;">SSN = (PBSN+1) modulo 4096.</p> <p style="padding-left: 40px;">PBSN = last sequence number for which Ack/Nack status can be indicated in available space. Optionally adjust SSN to include more of the bitmap as described below.</p> <p>}</p>

NOTE: If a full bitmap does not fit in the available space and the next partial bitmap segment is being transmitted in response to a poll, it may turn out that $(V(R)-PBSN)$ modulo 4096 is much smaller than the available space. In such cases, a larger amount of feedback can be provided as an implementation option if the receiver backtracks from PBSN and represents as much of the $V(Q)$ to PBSN range as possible, in addition to the PBSN to $V(R)$ range. If backtracking is carried out, the SSN must be properly indicated within the WGPRS Ack/Nack Description in order to allow the transmitter to accurately interpret the feedback.

9.1.8.3 Generation of the Bitmap

First, a Full Received Bitmap (FRB) is built from the receive state array $V(N)$ by extracting the part between $V(Q)$ and $V(H)$ similar to the GPRS case: it is assigned the elements whose indices in the receive state array $V(N)$ at the receiver range from $[V(Q)+ 1]$ modulo SNS to $[V(H)]$ modulo SNS. This global number of elements is less than or equal to WS. For each bit in the bitmap, the bit is assigned the value '1' if the corresponding element in $V(N)$ indexed relative to SSN has the value RECEIVED. The bit is assigned the value '0' if the element in $V(N)$ has the value INVALID.

From the FRB, a RB shall then be generated. Different lengths of RBs exist: 77, 101, 124, and 146 bits. For uplink TBFs, the network may transmit any RB size to the MS. For downlink TBFs, the network may order the MS to transmit a certain RB size through use of the S/P field. The bitmap size may be selected based on e.g., risk of protocol stalling. The RB is generated in one of two ways:

- a) Uncompressed reported bitmap:

The RB is assigned the first N bits of the FRB starting at SSN, where N depends on the reported bitmap size used.

b) Compressed reported bitmap:

Using the compression algorithm, the receiver generates a compressed FRB; the reported bitmap is then generated from compressed FRB similar to the uncompressed reported bitmap case.

The receiver shall send the compressed reported bitmap if and only if it covers more blocks than the uncompressed reported bitmap, otherwise the uncompressed bitmap shall be sent. The Beginning of Window (BOW) bit shall be set if $SSN = V(Q)$, the EOW bit shall be set if $V(H)$ is explicitly included in the bitmap.

For uplink TBFs, the reported bitmap is sent using the PACKET UPLINK ACK/NACK message corresponding to the used RB size. For downlink TBFs, the reported bitmap is sent using the PACKET DOWNLINK ACK/NACK message corresponding to the used RB size. Further, if the reported bitmap is shorter than the requested bitmap size, the MS shall include a channel quality report if there is room enough.

9.1.8.4 Interpretation of the Bitmap

If a compressed reported bitmap is received, the bitmap shall first be decompressed according to subclause 9.1.10. The uncompressed bitmap shall then be treated as follows: Firstly, if the BOW bit is set in the Reported Bitmap, then this bitmap acknowledges all blocks between $V(A)$ and SSN, and the corresponding elements in $V(B)$ shall be set to the value ACKED. Then, for each bit in the uncompressed bitmap whose corresponding BSN value is within the transmit window, if the bit contains the value '1', the corresponding element in $V(B)$ indexed relative to SSN shall be set to the value ACKED. If the bit contains the value '0', the element in $V(B)$ shall be set to the value NACKED. A bit within the uncompressed bitmap whose corresponding BSN is not within the transmit window, shall be ignored. If the RLC transmitter is on the mobile station side, the bit contains the value '0' and the instance of timer TW3198 corresponding to BSN is not expired (i.e., the RLC data block was recently (re)transmitted and thus cannot be validly negatively acknowledged in this particular Packet Ack/Nack message), the element in $V(B)$ shall not be modified.

9.1.9 Window Size

The window size shall be set according to the number of slots assigned in the direction of the TBF (uplink or downlink). The window size may be set independently on uplink and downlink.

Table 9.3 – Window size as a function of number of slots assigned for the TBF.

Number of slots assigned	Window Size
1-8	448
9-16	832
17-24	1216
25-32	1408
33-40	1600
41-48	1792
49-56	1952
57-64	2048

9.1.10 Filler Octets

Filler octets, or spare padding bits as they are also known, use a particular sequence of bits, of fixed position, aligned on an octet boundary, i.e., the value of a bit depends on its position relative to the start of the octet. The filler octet is 00101011, starting on an octet boundary.

9.1.11 Compression

The compression algorithm is as follows. If the window size is less than the number of bits available for the bitmap, then full feedback is provided using an uncompressed bitmap. If the window size is larger than the number of bits available for the bitmap, then one-dimensional run length coding (based on ITU-T Rec T.4) [8] is carried out starting at SSN.

The T.4 procedure for encoding run lengths is as follows. Runs of ones and zeros alternate, and the run lengths are represented by the code words listed in the tables below. The code words for run lengths of zeros and ones are as described in T.4 except for one minor modification: the terminating code words used for indicating run lengths of 1 zero and 3 zeros are interchanged. This modification helps in achieving some throughput improvement if frequency hopping will be defined in future versions of the Indoor standard. The run length code words are of two types: terminating code words and make-up code words. Each run length is represented by either one terminating code word or one make-up code word followed by a terminating code word. Run lengths in the range 0-63 bits are encoded with their appropriate terminating code word. Run lengths greater than 63 bits are encoded first by the make-up code word which is equal to or shorter than that required. This is then followed by the terminating code word representing the difference between the required run length and the run length represented by the make-up code.

No special code words are used either at the beginning of the bitmap or the end of a bitmap. A one bit indicator (i.e., Compressed Bitmap Starting Color Code) is used to indicate whether the compressed bitmap starts with a run length of zeros or a run length of ones. This avoids any ambiguities or loss of code word synchronization at the run length decoder.

The compressed bitmap is assumed to be of length L_c bits. The run length encoder output is used only if a compression gain is realized; otherwise an uncompressed partial bitmap is transmitted. The compressed portion of the bitmap must end on a T.4 code word boundary which may or may not coincide with the number of bits available. In such cases, one possible implementation is to recognize the boundary of the last valid T.4 code word that fits into the available space as the end of the compressed bitmap. The rest of the bitmap is assumed to be uncompressed; the uncompressed portion of the bitmap has length $(L-L_c-22)$ bits. Any bits representing sequence numbers beyond $V(R)$ in either the compressed or uncompressed portion of the bitmap must be set to 0. Implementations may use other schemes to determine the boundary between the compressed and uncompressed portions of the bitmap.

Table 9.4 – Terminating codes (reproduced from ITU-T Rec T.4)

One run length	Code word	Zero run length	Code word
0	00110101	0	0000110111
1	000111	1	10
2	0111	2	11
3	1000	3	010
4	1011	4	011
5	1100	5	0011
6	1110	6	0010
7	1111	7	00011

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8	10011	8	000101
9	10100	9	000100
10	00111	10	0000100
11	01000	11	0000101
12	001000	12	0000111
13	000011	13	00000100
14	110100	14	00000111
15	110101	15	000011000
16	101010	16	0000010111
17	101011	17	0000011000
18	0100111	18	0000001000
19	0001100	19	00001100111
20	0001000	20	00001101000
21	0010111	21	00001101100
22	0000011	22	00000110111
23	0000100	23	00000101000
24	0101000	24	00000010111
25	0101011	25	00000011000
26	0010011	26	000011001010
27	0100100	27	000011001011
28	0011000	28	000011001100
29	00000010	29	000011001101
30	00000011	30	000001101000
31	00011010	31	000001101001
32	00011011	32	000001101010
33	00010010	33	000001101011
34	00010011	34	000011010010
35	00010100	35	000011010011
36	00010101	36	000011010100
37	00010110	37	000011010101
38	00010111	38	000011010110
39	00101000	39	000011010111
40	00101001	40	000001101100

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41	00101010	41	000001101101
42	00101011	42	000011011010
43	00101100	43	000011011011
44	00101101	44	000001010100
45	00000100	45	000001010101
46	00000101	46	000001010110
47	00001010	47	000001010111
48	00001011	48	000001100100
49	01010010	49	000001100101
50	01010011	50	000001010010
51	01010100	51	000001010011
52	01010101	52	000000100100
53	00100100	53	000000110111
54	00100101	54	000000111000
55	01011000	55	000000100111
56	01011001	56	000000101000
57	01011010	57	000001011000
58	01011011	58	000001011001
59	01001010	59	000000101011
60	01001011	60	000000101100
61	00110010	61	000001011010
62	00110011	62	000001100110
63	00110100	63	000001100111

Table 9.5 - Make-up codes (reproduced from ITU-T Rec T.4).

One run length	Code word	Zero run length	Code word
64	11011	64	0000001111
128	10010	128	000011001000
192	010111	192	000011001001
256	0110111	256	000001011011
320	00110110	320	000000110011
384	00110111	384	000000110100
448	01100100	448	000000110101
512	01100101	512	0000001101100
576	01101000	576	0000001101101
640	01100111	640	0000001001010
704	011001100	704	0000001001011
768	011001101	768	0000001001100
832	011010010	832	0000001001101
896	011010011	896	0000001110010
960	011010100	960	0000001110011

9.1.12 Segmentation of LLC PDUs into RLC Data Units

Segmentation of LLC PDUs is supported to allow transport of LLC PDUs larger than the data field of a single RLC data block. If the contents of an LLC PDU do not fill an integer number of RLC data blocks, the beginning of the next LLC PDU shall be placed within the final RLC data block of the first LLC PDU, with no padding or spacing between the end of the first LLC PDU and the beginning of the next. If the final LLC PDU in the TBF does not fill an integer number of RLC data blocks, filler octets shall be used to fill the remainder of the RLC data block.

The received (and segmented) LLC PDUs shall be put into RLC data blocks in the same order as they are received from higher layers. A BSN is included in the header of each RLC data block to number the RLC data block. The RLC data blocks are to be numbered consecutively, modulo SNS, to allow reassembly of the LLC PDUs on the receiving side.

Once an RLC data block has been transmitted over the physical link, should it be necessary to re-transmit the RLC data block, it shall be re-transmitted using the same channel coding scheme, BSN, and CV as it had in the previous transmission.

9.1.13 Reassembly of LLC PDUs from RLC Data Units

RLC data blocks shall be collected at the receiver until all RLC data blocks comprising an LLC PDU have been received. The RLC headers shall be removed from each RLC data block at this time and the RLC data units re-assembled into an LLC PDU and passed to the next higher layer.

During RLC acknowledged mode operation, received LLC PDUs shall be delivered to the higher layer in the order in which they were originally transmitted.

During RLC unacknowledged mode operation, received LLC PDUs shall be delivered to the higher layer in the order in which they are received. Fill bits having the value '0' shall be substituted for RLC data units not received. For erroneous RLC data blocks for which the header is correctly received, the output from decoder shall be delivered to the higher layer (error indication needed). The number of fill bits substituted shall be determined using Table 9.6. In the uplink direction the channel coding scheme shall be the commanded channel coding scheme. In the downlink direction the channel coding scheme shall be the channel coding scheme of the last correctly received RLC data block. If no RLC data blocks have been correctly received by the mobile station, the requested channel coding scheme shall be used. If no requested channel coding scheme has been sent to the network, the mobile station shall use the number of fill bits for WMCS-1. The size of the LLC PDU delivered to the higher layer shall not exceed 1560 octets. The part of the LLC PDU exceeding that size is discarded.

Table 9.6 – RLC unacknowledged mode fill bits

Short Burst Uplink fill bits	
Channel Coding Scheme	Number of fill bits
WMCS-1	208
WMCS-2	432
WMCS-3	488
WMCS-4	1008
Long Burst Uplink fill bits	
Channel Coding Scheme	Number of fill bits
WMCS-1	1328
WMCS-2	568
WMCS-3	2736
WMCS-4	1272
Short Burst Downlink fill bits	
Channel Coding Scheme	Number of fill bits
WMCS-1	208
WMCS-2	432
WMCS-3	488
WMCS-4	1000
Long Burst Downlink fill bits	
Channel Coding Scheme	Number of fill bits (bits)
WMCS-1	1328
WMCS-2	560
WMCS-3	2736
WMCS-4	1256

9.1.14 Segmentation of RLC/MAC Control Messages into RLC/MAC Control Blocks

The network may segment RLC/MAC control messages into one to four RLC/MAC control blocks depending on the length of the RLC/MAC control message. If the contents of a control message do not fit an integer number of control blocks, filler octets shall be used to fill the remainder of the RLC/MAC control block. Only the last

RLC/MAC control block containing elements of the control message shall contain filler octets. The Final Segment (FS) bit of the RLC/MAC control block header shall be set according to whether the RLC/MAC control block contains the final segment of an RLC/MAC control message.

The mobile station shall not segment RLC/MAC control messages.

9.1.15 Reassembly of RLC/MAC Control Messages from RLC/MAC Control Blocks

RLC/MAC control blocks shall be collected at the receiver until all RLC/MAC control blocks comprising an RLC/MAC control message have been received. If the contents of the RLC/MAC control blocks received by the mobile station with RTI value equal to x do not form a complete RLC/MAC control message when an RLC/MAC control block with RTI value described by the inequality $[x+8 < RTI \leq x+15]$ modulo 16 is received, the mobile station shall discard and ignore the RLC/MAC control blocks with RTI value equal to x , irrespective of whether the RLC/MAC control block described by the inequality is addressed to the mobile station or not.

In packet transfer mode, the mobile station shall be capable of receiving two RLC/MAC control messages in parallel on the same PDCH. If the mobile station receives RLC/MAC control blocks containing part of a third RLC/MAC control message while it still has RLC/MAC control blocks for two partially received RLC/MAC control messages, the mobile station shall discard the RLC/MAC control blocks of the oldest partially received message.

The mobile station shall set an instance of timer TW3200 following the receipt of an RLC/MAC control block whose RTI value does not correspond to the RTI value of a partially received RLC/MAC control message.

If the mobile station discards a partially received RLC/MAC control message while the corresponding instance of timer TW3200 is running, the mobile station shall reset the corresponding instance of timer TW3200.

On expiry of an instance of timer TW3200, the mobile station shall discard and ignore all segments of the corresponding partially received RLC/MAC control message.

9.1.16 Priority of LLC PDUs

The mobile station shall not transmit LLC PDUs during a TBF that have a lower Radio Priority than the priority that was used at initial access or the priority sent in the last PACKET RESOURCE REQUEST message. The mobile station may change the Radio Priority of an uplink TBF by sending a PACKET RESOURCE REQUEST message to the network (see subclause 8.1.1.1.2 and subclause 8.1.1.3.2).

9.2 Operation during RLC/MAC Control Message Transfer

RLC/MAC control blocks shall be used to transport RLC/MAC control messages. Segments of only one RLC/MAC control message shall be transported per RLC/MAC control block. RLC/MAC control blocks shall be sent at a higher priority than RLC data blocks. The receiving side shall determine the length of the RLC/MAC control message contents by interpreting the RLC/MAC control block contents.

No general acknowledgement shall be made as part of the transfer of RLC/MAC control blocks or RLC/MAC control messages. The receiver shall not acknowledge an RLC/MAC control block except when a valid RRBP field is present in the MAC header of the RLC/MAC control block. The receiver shall not acknowledge an RLC/MAC control message except when the RLC/MAC procedures explicitly specify an acknowledgement.

Each downlink RLC/MAC control block header, if present, contains a Radio Transaction Identifier (RTI) field that is 4 bits in length and performs in effect a modulo 16 count of the downlink RLC/MAC control messages sent on a PDCH. The RTI field shall be used to group the RLC/MAC control blocks that make up an RLC/MAC control message. The RTI field allows the transmitting and receiving entities to distinguish between up to 16 RLC/MAC control messages in a single transmit direction therefore allowing up to 16 parallel transactions per PDCH.

The network shall not use the same RTI value at the same time on the same PDCH for two separate RLC/MAC control messages. The network may use the same RTI value at the same time on separate PDCHs.

9.3 Operation during RLC Data Block Transfer

The RLC ARQ functions support two modes of operation: RLC acknowledged mode, and RLC unacknowledged mode. RLC acknowledged mode operation uses retransmission of RLC data blocks to achieve high reliability. RLC unacknowledged mode operation does not utilize retransmission of RLC data blocks. A TBF may operate in either RLC acknowledged mode or RLC unacknowledged mode. The mobile station sets the RLC mode of the uplink TBF by setting the RLC_MODE bit to either RLC acknowledged mode or RLC unacknowledged mode in the PACKET RESOURCE REQUEST or the PACKET DOWNLINK ACK/NACK message.

The network sets the RLC mode of the downlink TBF by setting the RLC_MODE bit in the WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message.

9.3.1 Countdown Procedure

The mobile station shall send the CV in each uplink RLC data block to indicate to the network the absolute BSN (BSN') of the last RLC data block that will be sent in the uplink TBF. The CV shall be calculated as follows.

$$\text{Let integer } x = \text{round} \left(\frac{\text{TBC} - \text{BSN}' - 1}{\text{NTS}} \right).$$

$$\text{Then, CV} = \begin{cases} x, & \text{if } x \leq \text{BS_CV_MAX} \\ 15, & \text{otherwise} \end{cases},$$

Where:

TBC = total number of RLC data blocks that will be transmitted in the TBF,

BSN' = absolute block sequence number of the RLC data block, with range from 0 to (TBC - 1),

NTS = number of timeslots assigned to the uplink TBF in the assignment message, with range 1 to 64 (if mobile uses short slots) or 1 to 16 (if the mobile uses long slots),

Function round() rounds upwards to the nearest integer,

BS_CV_MAX is a parameter broadcast in the system information,

The division operation is non-integer and results in zero only for (TBC - BSN' - 1) = 0.

The final RLC data block transmitted in the TBF (i.e., the RLC data block with BSN' = TBC - 1) shall have CV set to the value '0'. No other RLC data blocks transmitted during the TBF shall have the value '0'.

Once the mobile station transmits a value of CV other than 15, the mobile station shall transmit exactly (TBC - BSN' - 1) untransmitted RLC data blocks. If the mobile station receives a change in the Channel Coding Command in a PACKET UPLINK ACK/NACK message during the countdown procedure, the mobile station shall act upon the new Channel Coding Command. The mobile station shall then recalculate the CV values for any untransmitted RLC data blocks using the new RLC data block size. Any data that arrives from the higher layer after the commencement of the countdown process shall be sent within a future TBF.

The mobile station may retransmit during the countdown in response to a Packet Ack/Nack or if stalled. If an RLC data block is retransmitted, the same CV shall be used as during the previous transmission of the RLC data block.

The mobile station may transmit an RLC/MAC control block during the countdown only in response to a poll request.

For fixed allocation, once the MS counts down to zero, at that point the MS forfeits its current uplink allocation and shall not transmit again using that allocation. If the MS receives a new allocation during the countdown, the MS shall use this new allocation to the end of the countdown procedure. The network shall provide unsolicited uplink resources for any retransmissions that may be required.

9.3.2 Acknowledged Mode Operation

The transfer of RLC data blocks in the RLC acknowledged mode uses retransmissions of RLC data blocks. The transmitting side numbers the RLC data blocks via the BSN. The BSN is used for retransmission and for reassembly. The receiving side sends PACKET Ack/Nack messages in order to request retransmission of RLC data blocks.

9.3.2.1 Incremental Redundancy (IR) Support

The transfer of RLC Data Blocks in the acknowledged RLC/MAC mode can be controlled by a selective type I ARQ mechanism, or by type II hybrid ARQ IR mechanism, coupled with the numbering of the RLC Data Blocks within one TBF. According to the link quality, an initial Modulation and Coding Scheme (WMCS) is selected for an RLC block. For the retransmissions, the same WMCS shall be used. The selection of WMCS is controlled by the network.

The RLC data blocks shall first be sent with one of the initial code rates (i.e., the rate 1/3 encoded data is punctured with the Puncturing Scheme (PS) 1 of the selected WMCS). If the RLC Data Block is received in error, additional coded bits (i.e., the output of the rate 1/3 encoded data which is punctured with PS 2 of the prevailing WMCS) shall be sent. If all the codewords (different punctured versions of the encoded data block) have been sent, the procedure shall start over and the first codeword (which is punctured with PS 1) shall be sent followed by PS 2 etc. RLC data blocks which are retransmitted using a new WMCS shall at the first transmission after the WMCS switch be sent with PS 1.

This procedure allows the receiver to operate either in type I or type II hybrid ARQ mode. In the type I ARQ mode, decoding of an RLC Data Block is solely based on the prevailing transmission (i.e., erroneous blocks are not stored). In the type II ARQ case, erroneous blocks are stored by the receiver and a joint decoding with new transmissions is done. If the memory for IR operation run out in the MS, the MS shall indicate this by setting the MS_OUT_OF_MEMORY bit in the PACKET DOWNLINK ACK/NACK message (see note).

Type II hybrid ARQ is mandatory in MS receivers.

The performance requirements for WGPRS are specified in ATIS-0700019 subclause 6.2.

NOTE: The WMCS selection may take the IR capability of the receiver into account.

9.3.2.2 Establishment of Temporary Block Flow

The establishment of a TBF occurs as described in subclause 7.1. RLC functions related to the ARQ function shall not operate until RLC data block transfer has been initiated.

If the last uplink TBF ended with an incompletely transmitted LLC PDU or any unacknowledged LLC PDUs, the mobile station shall begin transmission on the new TBF with the oldest unacknowledged LLC PDU.

9.3.2.3 Operation of Uplink Temporary Block Flow

The mobile station shall transmit an RLC/MAC block in each assigned uplink data block. RLC/MAC control blocks have preference to RLC data blocks, i.e., temporarily replacing the WPTCH with WPACCH. The network shall send PACKET UPLINK ACK/NACK messages when needed.

The mobile station shall indicate a transmit window stall condition when $V(S) = V(A) + WS$. Upon detecting a transmit window stall condition, the mobile station shall set the Stall indicator (SI) bit in all subsequent uplink RLC data block until the stall condition ceases to exist.

Upon detecting the stall condition the mobile station shall also start timer TW3182. Timer TW3182 shall be stopped upon reception of a PACKET UPLINK ACK/NACK message that makes $V(S) < V(A) + WS$. If timer TW3182 expires, the mobile station shall decrement counter NW3102 by WPAN_DEC, and perform an abnormal release with random access (see subclause 9.4.1).

Whenever the mobile station receives a PACKET UPLINK ACK/NACK message that allows the advancement of V(S) or V(A), the mobile station shall increment NW3102 by WPAN_INC, however NW3102 shall never exceed the value WPAN_MAX. Upon cell reselection the mobile station shall set counter NW3102 to the value WPAN_MAX. When $NW3102 \leq 0$ is reached, the mobile station shall perform an abnormal release with cell reselection. If WPAN_DEC, WPAN_INC, or WPAN_MAX are set to the value 0, counter NW3102 shall be disabled.

A mobile station operating with a fixed allocation shall start or restart timer TW3184 upon reception of a PACKET UPLINK ACK/NACK message. If timer TW3184 expires, the mobile station shall perform an abnormal release with cell reselection (see subclause 9.4.2).

9.3.2.4 Release of Uplink Temporary Block Flow

The mobile station initiates release of the uplink TBF by beginning the countdown process (see subclause 9.3.1). When the mobile station has sent the RLC data block with CV = 0 and there are no elements in the V(B) array set to the value Naked, it shall start timer TW3182 and stop timer TW3180, if running. The mobile station shall continue to send RLC data blocks on each assigned uplink data block, according to the algorithm defined in subclause 9.1.3.

If the network has received all RLC data blocks when it detects the end of the TBF (i.e., when CV=0 and V(Q) = V(R)), it shall send the PACKET UPLINK ACK/NACK message with the Final Ack Indicator bit set to '1', include a valid RRBP field in the RLC/MAC control block header and clear counter NW3103. If the network has not received all of the RLC data blocks when it detects the end of the TBF, it shall send a PACKET UPLINK ACK/NACK message to the mobile station and if necessary allocate sufficient uplink resources for the mobile station to retransmit the required RLC data blocks.

Upon reception of a PACKET UPLINK ACK/NACK message the mobile station shall stop timer TW3182. If the PACKET UPLINK ACK/NACK message has the Final Ack Indicator bit set to '1', the mobile station shall transmit the PACKET CONTROL ACKNOWLEDGEMENT message and release the TBF. If there is no ongoing downlink TBF the mobile station shall enter packet idle mode.

If the PACKET UPLINK ACK/NACK message requests retransmission of RLC data blocks, the mobile station shall if necessary wait for allocation of uplink resources and then retransmit the RLC data blocks requested, restarting timer TW3180 after each block is transmitted. The mobile station shall then start timer TW3182 and wait for a PACKET UPLINK ACK/NACK message as above. If the timer TW3180 expires, the mobile station performs an abnormal release with random access.

When the network receives the PACKET CONTROL ACKNOWLEDGEMENT message in the radio block indicated by the RRBP field, it may reuse the TFI and USF resources. If the network does not receive the PACKET CONTROL ACKNOWLEDGEMENT message in the radio block indicated by the RRBP field, it shall increment counter NW3103 and retransmit the PACKET UPLINK ACK/NACK message. If counter NW3103 exceeds its limit, the network shall start timer TW3169. When timer TW3169 expires the network may reuse the TFI and USF resources.

9.3.2.5 Operation of Downlink Temporary Block Flow

The mobile station receives RLC/MAC blocks on the assigned downlink PDCHs. On each assigned PDCH, the mobile station shall in the RLC header identify the TFI and decode the RLC data blocks intended for the mobile station. The operation during the TBF shall be as defined in subclause 9.1.

9.3.2.6 Release of Downlink Temporary Block Flow

The network initiates release of a downlink TBF by sending an RLC data block with the Final Block Indicator (FBI) set to the value '1' and with a valid RRBP field. The RLC data block sent shall have the highest BSN' (see subclause 9.3.1) of the downlink TBF. The network shall start timer TW3191. While timer TW3191 is running the network may retransmit the RLC data block with the FBI bit set to the value '1'. If the mobile station receives an

RLC data block with the FBI bit set the value '1' and with a valid RRBP field, the mobile station shall transmit a PACKET DOWNLINK ACK/NACK message in the specified uplink block. The mobile station shall continue to monitor all assigned PDCHs.

Whenever the mobile station receives an RLC data block with a valid RRBP and the mobile station has received all RLC data blocks of the TBF, the mobile station shall send the PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to "1", stop timer TW3190 and start or restart timer TW3192.

If the network receives a PACKET DOWNLINK ACK/NACK message before timer TW3191 expires, and if retransmissions are required, then the network stops timer TW3191 and retransmits necessary RLC data blocks according to the ARQ protocol before re-initiating the release of the downlink TBF. The FBI is set to '1' only if the RLC data block with the highest BSN' of the TBF is retransmitted. If no retransmission is required, the network shall stop timer TW3191 and start timer TW3193. When TW3193 expires the network shall release the TBF.

If timer TW3191 expires, then the network shall release the TBF. If the network has received the PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to '1' and has new data to transmit for the mobile station, the network may establish a new downlink TBF for the mobile station by sending the WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message with the Control Ack bit set to '1' on WPACCH. In case the network establishes a new downlink TBF for the mobile station, the network shall stop timer TW3193. If the mobile station, after sending the PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to '1', receives a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message with the Control Ack bit set to '1' while timer TW3192 is running, the mobile station shall stop timer TW3192, consider the previous downlink TBF released and act upon the new assignment.

When timer TW3192 expires the mobile station shall stop monitoring its assigned downlink PDCHs. If there is no ongoing uplink TBF, enter packet idle mode.

9.3.3 Unacknowledged Mode Operation

The transfer of RLC data blocks in the RLC unacknowledged mode does not include any retransmissions, except during the release of an uplink TBF where the last transmitted uplink block may be retransmitted (see subclause 9.3.3.3). The BSN in the RLC data block header is used to number the RLC data blocks for reassembly. The receiving side sends Packet Ack/Nack messages in order to convey the necessary other control signalling.

9.3.3.1 Establishment of Temporary Block Flow

If the last uplink TBF ended with an incompletely transmitted LLC PDU, the mobile station shall begin transmission on the new TBF with the last incompletely transmitted LLC PDU.

9.3.3.2 Operation of Uplink Temporary Block Flow

The network shall send PACKET UPLINK ACK/NACK messages when needed. The mobile station shall set the Stall indicator (SI) bit to '0' in all RLC data blocks. If the mobile station transmits WS RLC data blocks without receiving a Packet Ack/Nack message the mobile station shall start timer TW3182. Timer TW3182 shall be stopped upon reception of a PACKET UPLINK ACK/NACK message. If timer TW3182 expires, the mobile station shall decrement counter NW3102 by WPAN_DEC, and perform an abnormal release with random access (see subclause 9.4.1).

Whenever the mobile station receives a PACKET UPLINK ACK/NACK message, the mobile station shall increment NW3102 by WPAN_INC, however NW3102 shall never exceed the value WPAN_MAX. When $NW3102 \leq 0$ is reached, the mobile station shall perform an abnormal release with return to packet idle mode. If WPAN_DEC, WPAN_INC, or WPAN_MAX are set to the value 0, counter NW3102 shall be disabled. A mobile station operating with a fixed allocation shall start or restart timer TW3184 upon reception of a PACKET UPLINK ACK/NACK message. If timer TW3184 expires, the mobile station shall perform an abnormal release with return to packet idle mode (see subclause 9.4.2).

9.3.3.3 Release of Uplink Temporary Block Flow

The mobile station initiates release of the uplink TBF by beginning the countdown process (see subclause 9.3.1). It indicates the end of the TBF by setting the CV value to 0 and starts timer TW3182.

When the network detects the end of the TBF (i.e., when CV=0) it shall send a PACKET UPLINK ACK/NACK message with the Final Ack Indicator bit set to '1', include a valid RRBP field in the RLC/MAC control block header and clear counter NW3103. In case the network receives multiple blocks with CV=0, only the first needs to be acknowledged with PACKET UPLINK ACK/NACK message.

Upon reception of a PACKET UPLINK ACK/NACK message the mobile station shall stop timer TW3182. If the PACKET UPLINK ACK/NACK message has the Final Ack Indicator bit set to '1', the mobile station shall transmit the PACKET CONTROL ACKNOWLEDGEMENT message and release the TBF. If there is no ongoing downlink TBF the mobile station shall enter packet idle mode.

If the PACKET UPLINK ACK/NACK message does not have the Final Ack Indicator bit set to '1', the mobile station shall when possible repeat sending the last block with CV=0 and restart Timer TW3182 until a PACKET UPLINK ACK/NACK message with Final Ack Indicator bit set to '1' is received. The block shall not be retransmitted more than four times. If the medium access mode is dynamic allocation, the repetitions are transmitted when the mobile station is scheduled USFs. If fixed allocation is used, the mobile station shall transmit the repetitions within any remaining allocated uplink blocks. If timer TW3182 expires the mobile station shall release the TBF as if a PACKET UPLINK ACK/NACK message was received.

When the network receives the PACKET CONTROL ACKNOWLEDGEMENT message in the radio block indicated by the RRBP field, it may reuse the TFI and USF resources. If the network does not receive the PACKET CONTROL ACKNOWLEDGEMENT message in the radio block indicated by the RRBP field, it shall increment counter NW3103 and retransmit the PACKET UPLINK ACK/NACK message. If counter NW3103 exceeds its limit, the network shall start timer TW3169. When timer TW3169 expires the network may reuse the TFI and USF resources.

9.3.3.4 Operation of Downlink Temporary Block Flow

The mobile station receives RLC/MAC blocks on the assigned downlink PDCHs. On each assigned PDCH, the mobile station shall in the RLC header identify the TFI and decode the RLC data blocks intended for the mobile station. The operation during the TBF shall be as defined in subclause 9.1.

9.3.3.5 Release of Downlink Temporary Block Flow

The network initiates release of a downlink TBF by sending an RLC data block with the FBI set to the value '1' and with a valid RRBP field. The RLC data block sent shall have the highest BSN' (see subclause 9.3.1) of the downlink TBF. The network shall start timer TW3191. The network may retransmit the last block with FBI set to the value '1' and with a valid RRBP field. For each retransmission the timer TW3191 is restarted.

For each RLC data block with the FBI bit set to '1' and with a valid RRBP field, the mobile station shall transmit the PACKET CONTROL ACKNOWLEDGEMENT message in the uplink block specified by the RRBP field. The mobile station shall continue to read the assigned downlink PDCHs until the block period pointed to by the RRBP. If the mobile station receives more than one RLC data block with the FBI bit set to '1' and with valid RRBP fields that point the same uplink block period, the mobile station shall transmit the PACKET CONTROL ACKNOWLEDGEMENT message only once. The mobile station shall then stop timer TW3190, start timer TW3192 and continue to monitor all assigned downlink PDCHs. If the mobile station then receives a subsequent RLC data block with a valid RRBP and the FBI bit set to '1', the mobile station shall retransmit the PACKET CONTROL ACKNOWLEDGEMENT message and restart timer TW3192. If the mobile station receives more than one RLC data block with the FBI set to '1', it shall accept the data from only the first one of these blocks.

If the network receives the PACKET CONTROL ACKNOWLEDGEMENT message before timer TW3191 expires, the network shall stop timer TW3191 and start timer TW3193. When TW3193 expires the network shall release the TBF.

If timer TW3191 expires, the network shall release the TBF. If the network has received the PACKET CONTROL ACKNOWLEDGEMENT message and has new data to sending the WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message with the Control Ack bit set to '1' on WPACCH. In case the network establishes a new downlink TBF for the mobile station, the network shall stop timer TW3193.

If the mobile station, after sending the PACKET CONTROL ACKNOWLEDGEMENT message, receives a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE message with the Control Ack bit set to '1' while timer TW3192 is running, the mobile station shall stop timer TW3192, consider the previous downlink TBF released and act upon the new assignment.

When timer TW3192 expires the mobile station shall stop monitoring its assigned downlink PDCHs. If there is no ongoing uplink TBF the mobile station shall enter packet idle mode.

9.4 Abnormal Release Cases

9.4.1 Abnormal Release with Random Access

The mobile station shall abort all TBFs in progress and return to packet idle mode and initiate establishment of an uplink TBF.

9.4.2 Abnormal Release with Return to Packet Idle Mode

The mobile station shall abort all TBFs in progress and return to packet idle mode.

10 RLC/MAC Block Structure

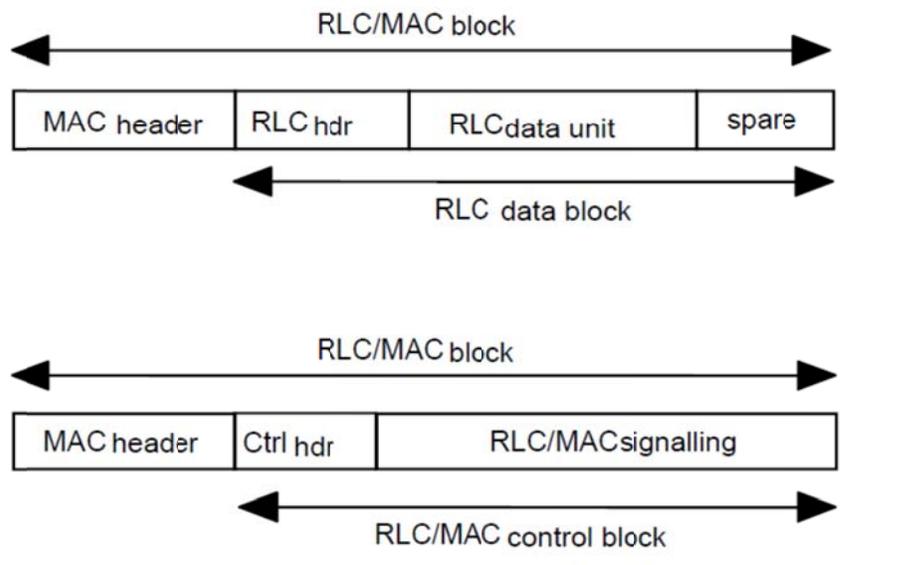


Figure 10.1 – RLC/MAC block structure

10.1 Radio Block Structure

Different Radio Block structures for data transfer and control message transfer purposes are defined.

10.1.1 Radio Block for Data Transfer

Radio Block for data transfer consists of one RLC/MAC header and one RLC Data Block.

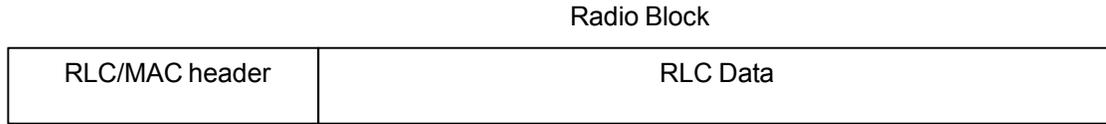


Figure 10.2 – Radio Block structure for data transfer for WGPRS

The RLC data field contains octets from one or more LLC PDUs.

10.1.2 Radio Block for Control Message

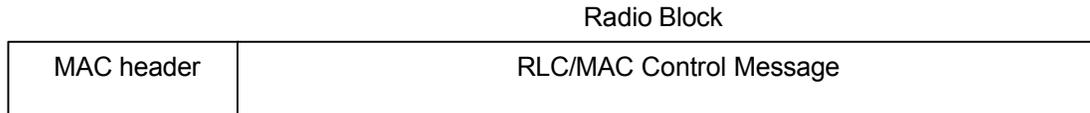


Figure 10.3 – Radio block structure for control message

The RLC/MAC Control message field contains one RLC/MAC control message.

10.2 Spare Bits

Where the description of RLC/MAC blocks in this Standard contains bits defined to be 'spare bits', these bits shall set to the value '0' by the sending side, and their value shall be ignored by the receiving side.

10.3 RLC/MAC Control Blocks

The RLC/MAC control block consists of a control message contents field and in the downlink direction an optional control header. RLC/MAC control messages shall be transported within RLC/MAC control blocks. An RLC/MAC control block shall always be encoded using the coding scheme WMCS-1 (see ATIS-0700361) and transmitted in a Radio Block consisting of 4 short bursts. Bit transmission order of RLC/MAC control blocks is following: The lowest numbered octet is transmitted first, then the next highest numbered octet until the last octet. Each octet is transmitted so that bit 1 (least significant) is transmitted first; bit 2 is transmitted next and so on. Bit 8 (most significant) is transmitted last.

10.3.1 Downlink RLC/MAC Control Block

The Downlink RLC/MAC control block together with its MAC header is formatted as shown in Figure 10.4.

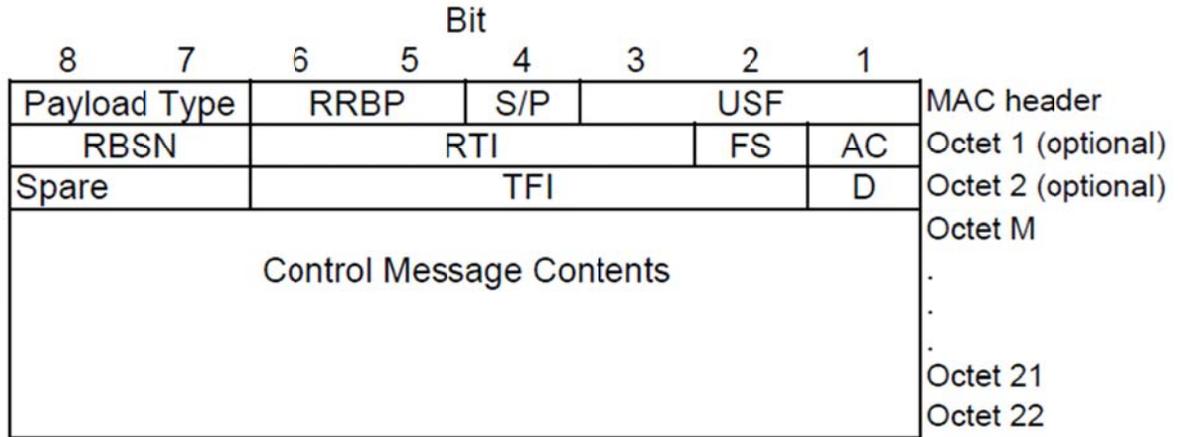


Figure 10.4 – Downlink RLC/MAC control block together with its MAC header

10.3.2 Uplink RLC/MAC Control Block

The Uplink RLC/MAC control block together with its MAC header is formatted as shown in Figure 10.5.

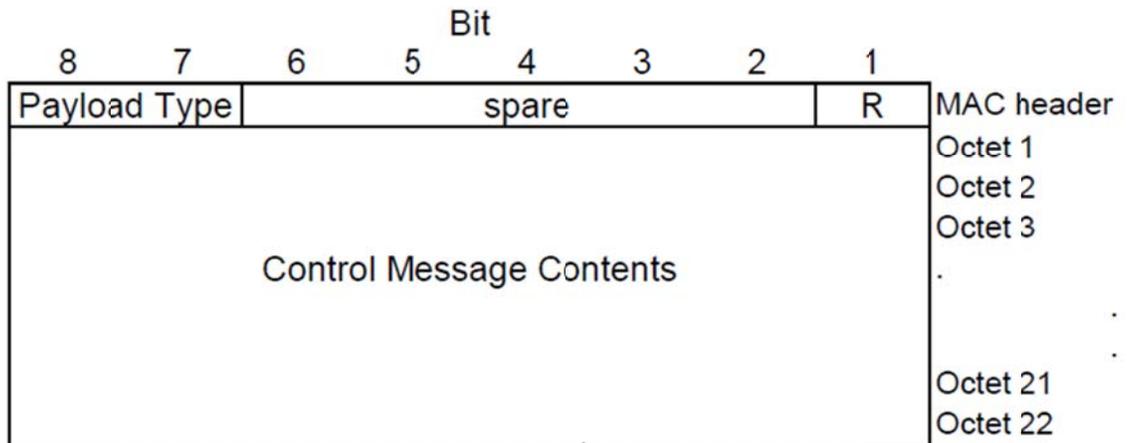


Figure 10.5 – Uplink RLC/MAC control block together with its MAC header

10.4 WGPRS RLC Data Blocks

The downlink RLC data block consists of E field and FBI field in addition to RLC data unit. The uplink RLC data block consists of E field and TI field in addition to RLC data unit. An RLC data block is encoded using any of the available channel coding schemes WMCS-1, WMCS-2, WMCS-3, WMCS-4.



The size of the RLC data block for each of the channel coding schemes is shown in Table 10.1. Bit transmission order of WGPRS RLC data blocks is following: The lowest numbered octet is transmitted first, then the next highest numbered octet until the last octet. Each octet is transmitted so that bit 1 (least significant) is transmitted first; bit 2 is transmitted next and so on. Bit 8 (most significant) is transmitted last.

RLC shall set all spare bits at the end of a block to value 0 in transmission. In reception RLC shall remove the spare bits from the RLC data unit before reassembly of the LLC PDUs.

Table 10.1 – WGPRS-RLC data block size
Short Burst Uplink RLC data block size

Channel Coding Scheme	RLC Data Block [Octets]	RLC data block size with TI+E [bits]	Number of Spare bits	RLC dataBlock size [bits]
WMCS-1	26	210	0	210
WMCS-2	54	434	7	441
WMCS-3	61	490	2	492
WMCS-4	126	1010	7	1017

Long Burst Uplink RLC data block size

Channel Coding Scheme	RLC Data Block [Octets]	RLC data block size with TI+E [bits]	Number of Spare bits	RLC data block size [bits]
WMCS-1	166	1330	4	1334
WMCS-2	71	570	1	571
WMCS-3	342	2738	2	2740
WMCS-4	159	1274	3	1277

Short Burst Downlink RLC data block size

Channel Coding Scheme	RLC Data Block [Octets]	RLC data block size with FBI+E [bits]	Number of Spare bits	RLC data block size [bits]
WMCS-1	26	210	0	210
WMCS-2	54	434	4	438
WMCS-3	61	490	2	492
WMCS-4	125	1002	0	1002

Long Burst Downlink RLC data block size

Channel Coding Scheme	RLC Data Block [Octets]	RLC data block size with FBI+E [bits]	Number of Spare bits	RLC data Block size [bits]
WMCS-1	166	1330	4	1334
WMCS-2	70	562	6	568
WMCS-3	342	2738	2	2740
WMCS-4	157	1258	4	1262

10.4.1 WGPRS Downlink RLC data block

The WGPRS Downlink RLC data block consists of an FBI bit, an E bit, optional length indicators (15 bits each) and a set of data bytes. The E bit (when 0) indicates that the first length indicator is present. The first length indicator indicates the number of octets belonging to the first LLC PDU in the RLC data block. The first length indicator is followed by another E bit. This E bit (when 0) indicates that there is another length indicator and E bit following. And so on. See subclause 10.4.14 for details of length indicator encoding and use. The FBI and E bits are added in front of the RLC data block delivered to physical layer. At the end of the data block RLC adds the required number of spare bits.

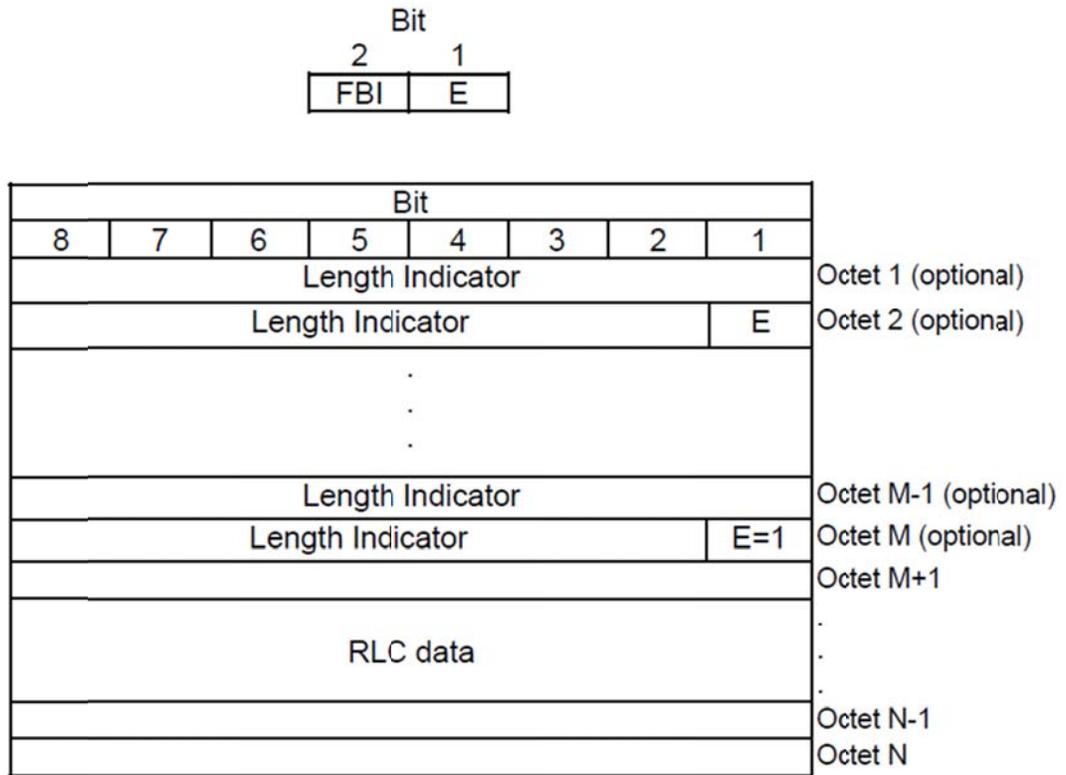


Figure 10.6 – Downlink RLC data block

10.4.2 WGPRS Uplink RLC Data Block

The WGPRS uplink RLC data block has the format shown in the below figure. The WGPRS Uplink RLC data block consists of a TI bit, an E bit, optional length indicators (15 bits each) and a set of data bytes. The E bit (when 0) indicates that the first length indicator is present. The first length indicator indicates the number of octets belonging to the first LLC PDU in the RLC data block. The first length indicator is followed by another E bit. This E bit (when 0) indicates that there is another length indicator and E bit following. And so on. See subclause 10.4.14 for details of length indicator encoding and use. The TI and E bits are added in front of the RLC data block delivered to physical layer. At the end of the data block RLC adds the required number of spare bits.

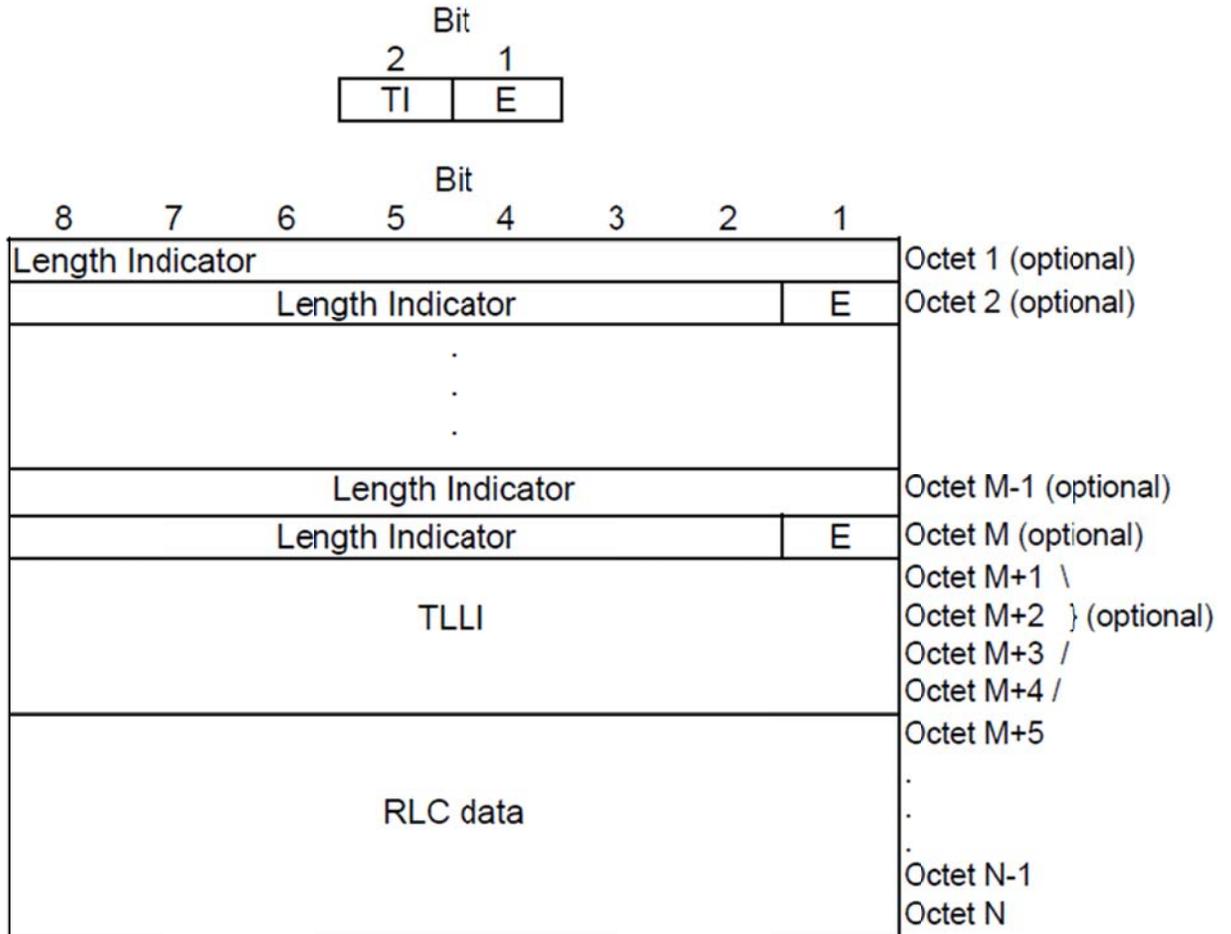


Figure 10.7 – Uplink RLC data block

When an RLC block that previously contains a TLLI field needs to be retransmitted, it shall be retransmitted with the same TLLI field included.

10.4.3 WGPRS Downlink RLC/MAC Deader

This header is 31 bit long.

- < Header content > ::=
- < PT : (bit 2)>
- < USF : bit (3) >
- < RRBP : bit (2) >
- < S/P : bit (2) >
- < TFI: bit (5) >
- < BSN : bit (12) >
- < COS : bit (3) >
- < PUS : bit (2) >;

10.4.4 Uplink RLC/MAC Header

This header is 31 bit long.

- < Header content > ::=
- < **PT** : (bit 2) >
- < **SI** : bit (1) >
- < **Countdown value** : bit (4) >
- < **TFI**: bit (5) >
- < **BSN** : bit (12) >
- < **COS** : bit (4) >
- < **PUS** : bit (2) >
- < **Spare** : bit (1) >

10.5 Header Fields

10.5.1 Uplink State Flag (USF) Field

The USF field is sent in all downlink RLC/MAC blocks and indicates the owner or use of the next uplink Radio block on the same timeslot (see ATIS-0700361). The USF field is three bits in length and eight different USF values can be assigned.

10.5.2 Spare Field

Any fields marked Spare are for future use and the corresponding bits shall be set to value 0.

10.5.3 Stall Indicator (SI) Bit

This is a reserved field.

10.5.4 Supplementary/Polling (S/P) Bits

The S/P bits are used to indicate whether next polling should include channel quality report, extended bit map of type 1 or extended bit map of type 2 in RLC acknowledged mode. In RLC unacknowledged mode, only channel quality report are reported when S/P indicates RRBP is valid (see subclause 9).

Table 10. 2 – Supplementary/Polling (S/P) bits – WGPRS case

Bits	
S/P	
0 0	RRBP field is not valid (no Polling)
0 1	RRBP field is valid – Extended Ack/Nack bit map type 1
1 0	RRBP field is valid – Extended Ack/Nack bit map type 2
1 1	RRBP field is valid- channel quality report

10.5.5 Relative Reserved Block Period (RRBP) Field

The RRBP value specifies a single uplink block in which the mobile station shall transmit either a PACKET CONTROL ACKNOWLEDGEMENT message or a WPACCH block to the network. If the RRBP field is received as part of an RLC/MAC block containing an RLC/MAC control block containing any message except Packet Access Reject, the mobile station shall transmit a PACKET CONTROL ACKNOWLEDGEMENT message in the uplink radio block specified. If the RRBP field is received as part of an RLC/MAC block containing a Packet Access Reject message, the mobile station shall ignore this RRBP field. The mobile station shall only react on RLC/MAC control blocks containing a valid RRBP field if the mobile station is unambiguously addressed either in the downlink RLC/MAC control block header or in the control message itself. If the control message is segmented into more than one downlink RLC/MAC control blocks the mobile station shall react only on RLC/MAC control blocks containing a valid RRBP field if the mobile station is unambiguously addressed in the downlink RLC/MAC control block header. If the mobile station receives two or more RLC/MAC blocks containing an RLC/MAC control message with different RRBP values such that they specify the same uplink block, the mobile station shall transmit one PACKET CONTROL ACKNOWLEDGEMENT message in the specified uplink radio block. If the RRBP field is received as part of a RLC/MAC block containing an RLC data block, the mobile station shall transmit a WPACCH block in the specified uplink radio block. If the mobile station receives two or more RLC/MAC blocks containing an RLC data block with different RRBP values such they specify the same uplink radio block, the mobile station shall transmit one WPACCH block in the specified uplink radio block.

If the mobile station receives an RLC data block and an RLC/MAC control block with different RRBP values such that they specify the same uplink radio block, the mobile station shall transmit an PACKET CONTROL ACKNOWLEDGEMENT message in the specified uplink radio block.

The mobile station shall always transmit the uplink radio block on the same timeslot as the block where the RRBP was received. After receiving an RLC/MAC block containing a valid RRBP field the mobile station need not monitor the USF in the associated downlink RLC/MAC block appearing just before the uplink block it shall transmit.

A polled control message shall always be sent in the uplink block specified by the corresponding valid RRBP field of a downlink RLC/MAC control block, and not in any other uplink block that may be allocated to the mobile station.

Table 10.3 indicates the number of TDMA frames the mobile station shall wait before transmitting the uplink RLC/MAC block. The delay is relative to the first TDMA frame (N) of the downlink block containing the RRBP value.

The RRBP field refers in all cases to an uplink radio block on the same uplink timeslot where the message that contained the RRBP was received. The channel coding used in the uplink block shall always be WMCS-1. The uplink timeslot type to be used is the same as the timeslot type where the RRBP was received.

Table 10.3 – Relative Reserved Block Period (RRBP) field

bit	
<u>6</u>	
<u>5</u>	
0 0	Uplink block with TDMA frame number = N+13
0 1	Uplink block with TDMA frame number = N+17 or N+18
1 0	Uplink block with TDMA frame number = N+21 or N+22
1 1	Uplink block with TDMA frame number = N+26

10.5.6 Countdown Value (CV) Field

The CV field is sent by the mobile station to allow the network to calculate the number of RLC data blocks remaining for the current uplink TBF. The CV value shall be calculated according to the process described in subclause 9.3.1. The CV field is 4 bits in length and is encoded as a binary number with range 0 to 15.

10.5.7 Payload Type (PT) Field

The Payload Type (PT) field shall indicate the type of data contained in remainder of the RLC/MAC block. The encoding of the Payload Type field is shown in Table 10.4.

Table 10.4 – Payload Type field

bit	
<u>8 7</u>	<u>Payload Type</u>
0 0	RLC/MAC block contains an RLC data block
0 1	RLC/MAC block contains an RLC/MAC control block that does not include the optional octets of the RLC/MAC control header
1 0	In the downlink direction, the RLC/MAC block contains an RLC/MAC control block that includes the optional first octet of the RLC/MAC control header. In the uplink direction, this value is reserved.
1 1	Reserved. In this version of the protocol, the mobile station shall ignore all fields of the RLC/MAC block except for the USF field

10.5.8 Final Block Indicator (FBI) Bit

The FBI bit indicates that the downlink RLC data block is the last RLC data block of the downlink TBF.

Table 10.5 – Final block indicator bit

Bit	
<u>2</u>	<u>Final block indicator</u>
0	Current block is not last RLC data block in TBF
1	Current block is last RLC data block in TBF

10.5.9 Coding Scheme Indicator Field (COS)

The Coding Scheme indicator field is used to indicate the kind of channel coding used for data blocks (see ATIS-0700361).

Table 10.6 – Coding Scheme indicator field

Bits	COS
000	WMCS-1, Short Burst
001	WMCS-2, Short Burst
010	WMCS-3, Short Burst
011	WMCS-4, Short Burst
100	WMCS-1, Long Burst
101	WMCS-2, Long Burst
110	WMCS-3, Long Burst
111	WMCS-4, Long Burst
	All the other values are reserved for future use.

10.5.10 Puncturing Scheme Indicator Field (PUS)

The Puncturing Scheme Indicator (PUS) indicates the puncturing used in the data block. There are three possible puncturing schemes for each channel coding. Depending on the puncturing scheme, the P1, P2, or P3 sub block is sent.

Table 10.7 – Puncturing Scheme Indicator Field

bits	
00	Puncturing scheme 1 (P1)
01	Puncturing scheme 2 (P2)
10	Puncturing scheme 3 (P3)
11	Reserved

10.5.11 TLLI Indicator (TI) bit

The TLLI Indicator (TI) bit indicates the presence of an optional TLLI field within the RLC data block.

Table 10.8 – TLLI Indicator (TI) bit

bit	
<u>1</u>	<u>TLLI indicator (TI) bit</u>
0	TLLI field is not present
1	TLLI field is present

10.5.12 Address Control (AC) Bit

The Address Control (AC) bit is used to indicate the presence of the optional TFI/D octet in the header of downlink RLC/MAC control blocks.

Table 10.9 – Address Control (AC) bit

Bit	
<u>1</u>	<u>Address Control (AC) bit</u>
0	TFI/D octet is not present
1	TFI/D octet is present

10.5.13 Final Segment (FS) Bit

The Final Segment (FS) bit indicates that the downlink RLC/MAC control block contains the final segment of an RLC/MAC control message.

Table 10.10 – Final Segment (FS) bit

bit	
<u>2</u>	<u>Final Segment (FS) bit</u>
0	Current block does not contain the final segment of an RLC/MAC control message
1	Current block contains the final segment of an RLC/MAC control message

10.5.14 Radio Transaction Identifier (RTI) Field

The Radio Transaction Identifier (RTI) field is used to group the downlink RLC/MAC control blocks that make up an RLC/MAC control message and identifies the segmented control message sequence with which the downlink RLC/MAC control block is associated. The RTI field is four bits in length with range 0 to 15.

10.5.15 Direction (D) Bit

The Direction (D) bit indicates the direction of the TBF identified by the TFI field in the downlink RLC/MAC control block header.

Table 10.11 – Direction (D) bit

bit	
<u>1</u>	<u>Direction (D) bit</u>
0	TFI field identifies an uplink TBF
1	TFI field identifies a downlink TBF

10.5.16 Temporary Flow Identifier (TFI) Field

In RLC data blocks, the TFI identifies the TBF to which the RLC data block belongs. For the downlink and the uplink TFI the TFI field is 5 bits in length and is encoded as a binary number with range 0 to 31. In downlink RLC/MAC control blocks, the TFI identifies the TBF to which the RLC/MAC control message contained in the downlink RLC/MAC control block relates. If present, this field indicates the mobile station to which the control message is addressed, and all other mobile stations shall ignore the control message. If this field is present and the contents of the control message also contain a TFI addressing the mobile station, the mobile station shall ignore the TFI in the control message contents. If this field is not present all mobile stations shall interpret the contents of the control message.

10.5.17 Extension (E) Bit

The Extension (E) bit is used to indicate the presence of an optional octet in the RLC data block header.

Table 10.12 – Extension (E) bit

bit	
<u>1</u>	E bit
0	Extension octet follows immediately
1	No extension octet follows

10.5.18 Block Sequence Number

10.5.18.1 Block Sequence Number (BSN) Field

The BSN field carries the sequence absolute Block Sequence Number (BSN') modulo Sequence Number Space (SNS) (4096) of each RLC data block within the TBF.

10.5.18.2 Reduced Block Sequence Number (RBSN) Bit

The RBSN field carries the sequence number of the downlink RLC/MAC control blocks. The RBSN field is encoded as a binary number with range 0 to 3.

10.5.19 More (M) bit

The M bit is not used, instead a special combination of the LI field is used to indicate presence of following LLC PDUs.

Table 10.13 – M bit

bit	
<u>M</u>	Reserved

10.5.20 Length Indicator (LI) Field

The Length Indicator is used to delimit LLC PDUs within the RLC data block. The first Length Indicator shall indicate the number of octets of the RLC data field belonging to the first LLC PDU, the second Length Indicator shall indicate the number of octets of the RLC data field belonging to the second LLC PDU, etc. The final RLC data block of a TBF shall have a Length indicator field unless the final LLC PDU fills the RLC data block precisely. The LI field is 15 bits in length and shall be encoded as a binary number with range 1 to 340. The value 0 shall indicate that no LLC PDU boundary exists. In this case the E bit shall be set to '1' on the transmitting side. The value 32767 (1111 1111 111 1111) shall indicate that there is no following LLC PDU.

All other values are reserved, and in this version of the protocol, the mobile station shall ignore all fields of the RLC data block except for the USF field.

Table 10.14 – LI field and E bit

<u>LI</u> <u>E</u>	
LI=Current LLC length, E=0 followed by LI=32767, E=1	no LLC data after the current LLC PDU
Current LLC length 0 followed by LI≠32767	a new LLC PDU starts after the current LLC PDU and there is another extension octet, which delimits the new LLC PDU
LI=Current LLC length, E= 1	a new LLC PDU starts after the current LLC PDU (if it did not fill the entire RLC block) and continues until the end of the RLC information field, no more extension octets

10.5.21 TLLI Field

TLLI encoding is specified in subclause 12.11.

10.5.22 RLC Data Field

The RLC data field contains octets from one or more LLC PDUs. The RLC data field may contain parts of one or two LLC PDUs and all of an arbitrary number of LLC PDUs. The E bit and the Length Indicator delimit the RLC data field into LLC PDUs. If the last LLC PDU of the TBF does not fill the entire RLC data field, an extension octet shall be used to indicate the number of valid RLC data octets and the remainder of the RLC data field shall be filled with filler octets with the value '00101011'. Only the last RLC data block of the TBF may contain filler octets.

10.5.23 Control Message Contents Field

The Control message contents field shall contain exactly one segment from one RLC/MAC control message field (i.e., RLC/MAC control block).

11 Message Functional Definitions & Contents

This subclause defines the structure of the RLC/MAC control messages. These are non-standard L3 messages as defined in 3GPP TS 24.007. Each definition given in the present subclause includes:

- A brief description of the message direction and use;
- A CSN.1 description of the message information elements and fields (see 3GPP TS 24.007). Definition of information elements may immediately follow the definition of the message. If the definition of an information element immediately follows the message definition, the information element name ends with 'struct'. Otherwise the information element name ends with 'IE' and the definition of the information element is defined in subclause 12 or in 3GPP TS 24.008. The definition of a 'struct' is valid only within the table in which it is defined. No references shall be made to a 'struct' definition from outside of the table in which it is defined or from outside this standard. The definition of an information element is valid throughout subclause 11 and subclause 12;
- A note specifying, where appropriate, conditions for information elements or fields with presence requirement C or O in the relevant message which together with other conditions specified in this standard define when the information elements shall be included or not, what non-presence of such information elements or fields means, and – for IEs with presence requirement C – the static conditions for presence and/or non-presence of the information elements or fields (see 3GPP TS 24.007);

- A table follows which contains a definition for each field referenced in the message definition or in an information element struct immediately following the message definition.

Bit fields within RLC/MAC messages shall have the highest numbered bit of the bit field in the highest numbered bit of the lowest number octet. The mapping of an 11 bit field is illustrated in Figure 11.1.

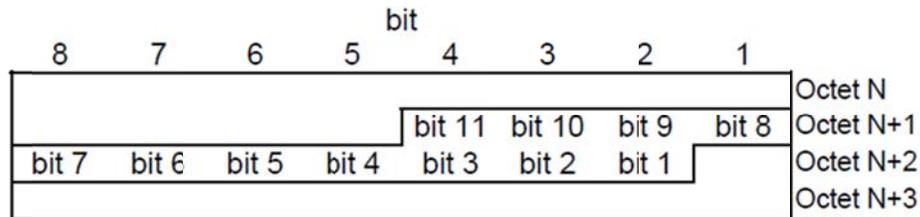


Figure 11.1 – Field mapping within RLC/MAC messages

The length of an RLC/MAC control messages is an integer number of RLC/MAC control blocks. Padding bits are necessary to fill the message up to the desired length. The padding bits may be the 'null' string. Otherwise, the padding bits starts with bit '0', followed by 'spare padding'.

```
< padding bits > ::= { null | 0 < spare padding > ! ignore : 1 bit** = < no string > } ;
```

The padding sequence used for 'spare padding' in this standard, see 3GPP TS 24.007, is a repetition of octet '00101011', starting on an octet boundary.

11.1 Handling of Erroneous Protocol Data

This subclause specifies procedures for the handling of unknown and erroneous protocol data by the receiving entity. These error-handling procedures are mandatory for the mobile station. A message is defined to be syntactically incorrect if it violates rules of clauses 11 and 12, or if it contains at least one value defined as "reserved" in clauses 11 and 12. However, if the rules of subclause 11 and 12 define a specific interpretation for a "reserved" value, the specified interpretation takes precedence and the considered field remains syntactically correct. Decoding a received message based on its CSN.1 description yields the complete acceptance or rejection of the message. Error handling allows a message to be partially accepted even when some parts are erroneous. Error detection mechanisms are introduced to identify which parts of a message to be protected against which kinds of errors.

11.1.1 Message Classification

The PDCH is a shared resource, i.e., all mobile stations assigned resources on a PDCH may receive a message sent by the network. The message type is identified by the MESSAGE_TYPE field contained in each message. The message type is used for classification and determining the message syntax.

Messages sent from the network to the mobile station are classified as either distribution messages or non-distribution messages.

11.1.1.1 Distribution Messages

A distribution message is recognized by the most significant bit of the message type being set to bit '1'. The general format of a distribution message sent from the network to the mobile station is:

```

< Distribution message > ::=
< MESSAGE_TYPE : 1 bit (5) >
< Distribution contents >
< spare padding > ;

```

A distribution message may be received by all mobile stations. Depending on the protocol state of the mobile station, it shall be analyzed as specified in clauses 5, 6, 7, 8, and 9 of this Standard. The specific syntax of the 'Distribution contents' depends on the message type. The 'spare padding' can be reduced to the null string.

11.1.1.2 Non-distribution Messages

A non-distribution message is recognized by the most significant bit of the message type being set to bit '0'. The general format of a message sent from the network to the mobile station is:

```

< Non-distribution message > ::=
< MESSAGE_TYPE : 0 bit (5) >
< Distribution contents >
< Address information > < Non-distribution contents >
< spare padding > ;

```

A non-distribution message may be received by all mobile stations.

The 'Address information' contained in the message shall be analyzed by a mobile station receiving the message. The 'Non-distribution contents' following the address information shall be ignored by any mobile station not identified by the address information. The allowed addressing options and the specific syntax of the 'Non-distribution contents' depend on the message type. The 'spare padding' can be reduced to the null string.

11.1.1.2.1 Format of the Address Information

The general format of the 'Address information' in a non-distribution message is:

```

< Address information > ::=
0      < Global TFI IE > |-- see subclause 12.8
1 0    < TLLI > |
1 1 0  < TQI > |--
1 1 1  < Packet Request Reference IE > ;-- see subclause 12.11

```

The description of a certain message type may specify a restricted set of addressing options being syntactically correct in the message. A message received with a disallowed addressing option shall be regarded as syntactically incorrect.

11.1.2 Error Detection Mechanism

The symbol '!' indicates an error branch. It acts as a separator (similar to the '|' choice symbol) where the choice on the right of the '!' are to be considered as an 'error' branch. The symbol '!' allows partial analysis of data in a received message, with some parts of the message to be ignored due to it being syntactically incorrect.

The description on the left of '!' defines the set of syntactically correct data and shall be recognized correctly. Otherwise, the data associated shall be rejected and the description within the error branch shall be used. The description within the error branch, on the right of '!', shall accept any syntactically incorrect data. Therefore, according to the error label the relevant error handling procedure shall be implemented.

11.1.3 Error Labels

There are different categories of error labels introduced in clauses 11 and 12 of this Standard.

11.1.3.1 Generic Error Labels

Generic error labels are defined for syntactical errors ‘Unknown message type’, ‘Distribution part error’, ‘Address information part error’, and ‘Non-distribution part error’. The general format of a distribution message, including these error labels, is:

```
< Distribution message > ::=
< MESSAGE_TYPE : 1 bit (5) >
{
    < Distribution contents >
    < spare padding >
    ! < Distribution part error : bit (*) = < no string > > }
! < Unknown message type : bit (*) = < no string > > ;
```

The general format of a non-distribution message, including these error labels, is:

```
< Non-distribution message > ::=
< MESSAGE_TYPE : 0 bit (5) >
{
    < Distribution contents >
    {
        < Address information >
        {
            < Non-distribution contents >
            < spare padding >
            ! < Non-distribution part error : bit (*) = < no string > > }
        ! < Address information part error : bit (*) = < no string > > }
    ! < Distribution part error : bit (*) = < no string > > }
! < Unknown message type : bit (*) = < no string > > ;
```

These error labels allow ignoring a part of the message that is syntactically incorrect. Once an error is detected, the error branch is called, followed by a null string that expands to the end of the message. The corresponding data is ignored.

11.1.3.2 “Ignore” Error Label

An ‘Ignore’ error label is used to ignore part of the message. The generic description is:

```
< content > ! < Ignore : bit (*) = < no string > >-- Ignore by indefinite length
```

Or

```
< content of fixed length n > ! < Ignore : bit (n) = < no string > >-- Ignore by definite length
```

An ‘Ignore’ error label shall be applied by the receiver of a downlink RLC/MAC control message when specified in the message description in subclauses 11 and 12 of this Standard. This error label allows ignoring a part of the message that is syntactically incorrect. Once the error is detected, the error branch ‘Ignore’ is called followed by a null string. When this error label is used with an indefinite length (bit (*) = < no string >), the null string expands to the end of the message and the corresponding data is ignored.

NOTE: If this error label is used with the indefinite length within a structure or delimited description (i.e., within { } brackets), any description following the structure or delimited description must allow truncation, in order to be consistent with the CSN.1 description of the message.

When this error label is used with a definite length (bit (n) = < no string >), the null string is a defined number of bits and the corresponding data is ignored.

11.1.3.3 “Message Escape” Error Label

The ‘Message escape’ error label is used to provide an escape for, e.g., a future modification of the message syntax. The generic description is:

0 < Content > ! < Message escape : 1 bit (*) = < no string > >

An ‘Message escape’ error label shall be applied by the receiver of a downlink RLC/MAC control message when specified in the message description in subclauses 11 and 12 of this Standard. The description on the left of the error branch needs to be correctly recognized. Otherwise, the error branch ‘Message escape’ is called and the remaining part of the message is ignored.

NOTE: Any description following a structure or delimited description (i.e., within { } brackets) including this error label must allow truncation. Otherwise, it is not consistent with the CSN.1 description of the message.

11.1.4 Error Detection & Order of Precedence

A mobile station shall detect and process errors in the order in which they are defined in this subclause (11.1.4) of this Standard. (e.g., a message, which is not compatible with the current protocol state AND is syntactically incorrect, shall be treated as if it is not compatible with the current protocol state.) At certain error events defined in this subclause (11.1.4), the PACKET TBF STATUS message shall be sent by the mobile station. In case of multiple error events, and, due to restrictions defined in clauses 5, 6, 7, 8 and 9, the mobile station is not able to send a first status message until the occurrence of a subsequent event generating a second status message, the mobile station shall suppress the sending of the second and additional status messages until the first status message has been sent to the network.

11.1.4.1 Unknown Message Type

If a mobile station receives a message with message type either not defined or not implemented (generic error label: ‘Unknown message type’), the message shall be ignored.

11.1.4.2 Message Not Compatible with Current Protocol State

When a non-distribution message is received, which is not expected by the addressed receiver in its current protocol state, the mobile station shall follow the procedures that are described in clauses 5, 6, 7, 8, and 9 of this Standard.

If no such reaction is specified, the mobile station shall ignore the message. If in packet transfer mode, the mobile station, which is identified by the address information shall return a status message (PACKET MOBILE TBF STATUS message) with TBF_CAUSE #4, “Message not compatible with current protocol state”.

Unexpected distribution messages are ignored.

11.1.4.3 Syntactically Incorrect Message

When a message containing a syntactically incorrect data is received, depending on the error detection mechanisms that may be defined in the CSN.1 description of the message, the message can be rejected or partially accepted.

NOTE: The order, in which the error labels mentioned in this subclause are detected and processed, depends on the nesting of error labels defined by the description of each message type in clauses 11.2 and 12. e.g., a message, which contains syntactically incorrect data in both the addressing information AND the non-distribution contents, is typically received with the error label ‘Address information part error.’

11.1.4.3.1 Messages with Error Label: 'Distribution Part Error'

For syntactically incorrect messages received with generic error label: 'Distribution part error', data corresponding to the description following the error label shall be recognized as erroneous data and be ignored.

11.1.4.3.2 Messages with Error Label: 'Address Information Part Error'

For syntactically incorrect messages received with generic error label: 'Address information part error', data corresponding to the description following the error label shall be recognized as erroneous data and be ignored. The distribution contents preceding the error label may be analyzed and treated as described in subclause 5 of this Standard.

11.1.4.3.3 Messages with Error Label: 'Non-Distribution Part Error'

For syntactically incorrect messages received with generic error label: 'Non-distribution part error', data corresponding to the description following the error label shall be recognized as erroneous data and be ignored.

The address information preceding the error label shall be analyzed. In packet transfer mode, the mobile station identified by the address information shall return a PACKET MOBILE TBF STATUS message with TBF_CAUSE #2 "Syntactically incorrect message, non-distribution part error".

11.1.4.3.4 Messages with Error Label: 'Message Escape'

For syntactically incorrect messages with error label: 'Message escape', data corresponding to the description following the error label shall be recognized as erroneously received mandatory data and be rejected.

The distribution contents preceding the error label may be analyzed and treated as described in subclause 5 of this Standard.

If the address information precedes the error label and it is received correctly, it shall be analyzed. In packet transfer mode, the mobile station identified by the address information shall return a PACKET MOBILE TBF STATUS message with TBF_CAUSE #3 "Syntactically incorrect message, message escape".

11.1.4.3.5 Messages with Error Label: 'Ignore'

For syntactically incorrect messages with error label: 'Ignore', data corresponding to the description following the error label shall be recognized as unnecessary data. If a syntactically incorrect message with the 'Ignore' error label is received, depending on the length of the null string associated with the error label (subclause 11.1.2.1), the corresponding data shall be ignored.

11.1.4.4 Syntactic Error in Truncated Concatenation

Truncated concatenation is sequences of components encapsulated by the { } brackets followed by the symbol '//'. The concatenation is any of the concatenations starting with null and up to any number of components.

{ < a > < b > < c > } //

The above set is equivalent to

```

{ < a > < b > < c > } or
{ < a > < b > } or
{ < a > } or
null

```

Any syntactically incorrect component shall truncate the sequence. The correctly received components are accepted and the truncated components are ignored.

NOTE: If the 'spare padding' at the end of a message is included within the concatenation, truncation requires the resulting concatenation to fit exactly with the received message length. Otherwise, it is a syntactical error, which may cause rejection of the complete message or part thereof.

11.2 RLC/MAC Control Messages

Table 11.1 summarizes the RLC/MAC control messages. For each control message, the message type shall be a fixed number of bits from the beginning of the message.

Table 11.1 – RLC/MAC Control Messages

Uplink TBF establishment messages:	Reference
Packet Access Reject	11.2.2
Packet Resource Request	11.2.10
Packet Uplink Assignment	11.2.13
Downlink TBF establishment messages:	Reference
WGPRS Packet Downlink Assignment	11.2.5
TBF release messages:	Reference
Packet TBF Release	11.2.11
RLC messages:	Reference
Packet Downlink Ack/Nack	11.2.4
Packet Uplink Ack/Nack	11.2.12
Miscellaneous messages:	Reference
Packet Control Acknowledgement	11.2.3
Packet Downlink Dummy Control Block	11.2.6.1
Packet Uplink Dummy Control Block	11.2.6.2
Packet Mobile TBF Status	11.2.7
Packet PDCH Release	11.2.8
Packet Power Control	11.2.9
WGPRS Packet Timeslot Reconfigure	11.2.14

11.2.1 Message Format

All RLC/MAC control messages follow the same non-standard format (see 3GPP TS 24.007).

11.2.1.1 Downlink RLC/MAC Messages

Downlink RLC/MAC control messages are received in RLC/MAC control block format. The different types of messages are distinguished by the MESSAGE_TYPE field.

```
< Downlink RLC/MAC control message > ::=
  < MESSAGE_TYPE : bit (6) == 1 00001 > < Packet Access Reject message content > |
  < MESSAGE_TYPE : bit (6) == 0 00010 > < WGPRS PACKET DOWNLINK ASSIGNMENT
message content > |
  < MESSAGE_TYPE : bit (6) == 1 00011 > < Packet PDCH Release message content > |
```

```
  < MESSAGE_TYPE : bit (6) == 0 00101 > < PACKET POWER CONTROL message
content > |
  < MESSAGE_TYPE : bit (6) == 0 00111 > < WGPRS Packet Timeslot Reconfigure message
content > |
  < MESSAGE_TYPE : bit (6) == 0 01000 > < Packet TBF Release message content > |
  < MESSAGE_TYPE : bit (6) == 0 01001 > < Packet Uplink Ack/Nack message content > |
  < MESSAGE_TYPE : bit (6) == 0 01010 > < Packet Uplink Assignment message content > |
  < MESSAGE_TYPE : bit (6) == 1 00101 > < Packet Downlink Dummy Control Block message
content > |
  ! < Unknown message type : bit (*) = < no string > > ;
```

11.2.1.2 Uplink RLC/MAC Messages

Uplink RLC/MAC control messages are received in the RLC/MAC control block format. The different types of messages are distinguished by the MESSAGE_TYPE field.

```
< Uplink RLC/MAC control message > ::=
  < MESSAGE_TYPE : bit (6) == 000001 > < Packet Control Acknowledgement message
content > |
  < MESSAGE_TYPE : bit (6) == 000010 > < Packet Downlink Ack/Nack message content > |
  < MESSAGE_TYPE : bit (6) == 000011 >
  < Packet Uplink Dummy Control Block message content > |
  < MESSAGE_TYPE : bit (6) == 000101 > < Packet Resource Request message content > |
  < MESSAGE_TYPE : bit (6) == 000110 > < Packet Mobile TBF Status message content > ;
> ;
```

11.2.2 Packet Access Reject

This message is sent on the WPACCH by the network to the mobile station to indicate that the network has rejected the MSs channel request. This message may contain fields addressing more than one mobile station.

Message type: PACKET ACCESS REJECT

Direction: network to mobile station

Classification: distribution message

Table 11.2 – PACKET ACCESS REJECT information elements

```

< Packet Access Reject message content > ::=
< Reject : < Reject struct > >
{ { 1 < Additional Reject: < Reject struct > > } ** 0
< padding bits > } //      -- truncation at end of message allowed, bits '0' assumed
! < Distribution part error : bit (*) = < no string > > ;

< Reject struct > ::=
{ 0   < TLLI : bit (32) >
| 1   < Global TFI : < Global TFI IE > > }
{ 0 | 1 < WAIT_INDICATION : bit (8) >
  < WAIT_INDICATION_SIZE : bit (1) > }
! < Ignore : bit (*) = < no string > > ;

```

Table 11.3 – PACKET ACCESS REJECT information element details**TLLI** (32 bit field)

This information field shall be included if the PACKET ACCESS REJECT message is sent in response to a PACKET RESOURCE REQUEST message or a Channel Request Description IE contained in a PACKET DOWNLINK ACK/NACK message. This information field is defined in subclause 12.11.

Global TFI

This information element contains the TFI of the mobile station's downlink TBF or uplink TBF. This field is defined in subclause 12.8.

WAIT_INDICATION (8 bit field)

The Wait Indication field indicates the time the mobile station shall wait before attempting another channel request. If this field is present the cause value is 'Wait'. If this field is not present, the cause value is 'Read System Information'. This field is coded as the binary representation of the TW3172 timeout value in units of 20 milliseconds or in units of seconds. The units are indicated in the WAIT_INDICATION_SIZE field.

Range 0 to 255.

WAIT_INDICATION_SIZE (1 bit field)

This field indicates the units of the WAIT_INDICATION field.

- 0 the WAIT_INDICATION field is coded in units of seconds
- 1 the WAIT_INDICATION field is coded in units of 20 milliseconds

11.2.3 Packet Control Acknowledgement

This message is sent on the WPACCH from the mobile station to the network. The order of bit transmission is defined in subclause 10. The RLC/MAC control block format is shown in table 11.4 and table 11.5.

Message type: Packet Control Acknowledgement

Direction: mobile station to network

Table 11.4 – PACKET CONTROL ACKNOWLEDGEMENT

```

< Packet Control Acknowledgement message content > ::=      -- RLC/MAC control block format
< TLLI : bit (32) >
< CTRL_ACK : bit (2) >
< padding bits > ;

```

Table 11.5 – PACKET CONTROL ACKNOWLEDGEMENT

TLLI (32 bit field)	
This field contains the TLLI of the mobile station. This field is encoded as defined in subclause 12.11.	
CTRL_ACK (2 bit field)	
This field contains acknowledgement information for the group of RLC/MAC control blocks that make up an RLC/MAC control message. The mobile station shall set the CTRL_ACK field to indicate which segments of an RLC/MAC control message have been received by the time of transmission of the PACKET CONTROL ACKNOWLEDGEMENT message.	
If the PACKET CONTROL ACKNOWLEDGEMENT message is being transmitted in response to a valid RRBP field received as part of an RLC/MAC block with Payload Type equal to '10', the CTRL_ACK field shall be set according to the following table:	
Bit	
<u>2 1</u>	
0 0	reserved - this value shall not be sent. If received it shall be interpreted as bit value '0 1'.
0 1	the MS received an RLC/MAC control block addressed to itself and with FS = 1 and RBSN = N (N=1,2,3), and did not receive all RLC/MAC control blocks with the same RTI value and FS=0 and RBSN= 0, ..., N-1
1 0	the MS received one or more RLC/MAC control blocks addressed to itself and with FS = 0, and did not receive an RLC/MAC control block with the same RTI value and FS = 1.
1 1	the MS received a continuous sequence of RLC/MAC blocks with the same RTI value and RBSN = 0,1...,N (N less or equal to 3) including the block with FS=1 and RBSN=N.
If the PACKET CONTROL ACKNOWLEDGEMENT message is being transmitted in response to a valid RRBP field received as part of an RLC/MAC block with Payload Type not equal to '10', the CTRL_ACK field shall be set to the value '11'.	
If the mobile station receives an RLC/MAC block with Payload Type equal to '10' and RLC/MAC block with Payload Type not equal to '10' with different RRBP values such that they specify the same uplink block, the mobile station shall set the CTRL_ACK field according to the group of RLC/MAC control blocks that the RLC/MAC block with Payload Type equal to '10' belongs.	

11.2.4 Packet Downlink Ack/Nack

This message is sent on the WPACCH from the mobile station to the network to indicate the status of downlink RLC data blocks received and to report the channel quality of the downlink. The mobile station may optionally initiate an uplink TBF or request a temporary suspension of the downlink TBF.

Message type: Packet Downlink Ack/Nack

Direction: mobile station to network

Table 11.6 – PACKET DOWNLINK ACK/NACK information elements

< Packet Downlink Ack/Nack message content > ::=	
	< MESSAGE_TYPE : bit (6) >
	< DOWNLINK_TFI : bit (5) >
	< TBF_RELEASE : bit (1) >
	< MS OUT OF MEMORY : bit(1)>
	{ L H < WGPRS Channel Quality Report : WGPRS Channel Quality Report struct : bit
(47) >}	
	{ L H < Channel Request Description : Channel Request Description IE : bit
	(24) >} spare bits : bit (6)
	< WGPRS Ack/Nack Description : WGPRS Ack/Nack Description IE : bit (L)>
	};

Table 11.7 – WGPRS PACKET DOWNLINK ACK/NACK information element details

<p>DOWNLINK_TFI (5 bit field) This field contains the TFI of the mobile station's downlink TBF. This field is defined in subclause 12.8.</p> <p>WGPRS Ack/Nack Description IE (L bit field) This information element is defined in subclause 12.2. The number of bits (L) available for WGPRS Ack/Nack Description information element depends on the inclusion of channel quality reports and channel requests. L shall be set so that the entire PACKET DOWNLINK ACK/NACK message evenly fits into an RLC/MAC control block. If a lower L covers the entire receive window, that L shall be used.</p> <p>TBF_RELEASE (1 bit field) This field indicates if the mobile station is requesting to release the downlink TBF. 0 Release of TBF is not requested 1 Release of TBF is requested</p> <p>MS_OUT_OF_MEMORY (1 bit field) This field indicates that the MS has not enough memory to perform IR. 0 The MS has enough memory 1 The MS is running out of memory</p> <p>Channel Request Description IE This information element is defined in subclause 12.5.</p> <p>WGPRS Channel Quality Report IE This information element is defined in subclause 12.4.1.</p>

11.2.5 WGPRS Packet Downlink Assignment

This message is sent on the WPACCH by the network to the mobile station to assign downlink resources to the mobile station. A mobile allocation or reference frequency list received as part of this assignment message shall be valid until a new assignment is received or each TBF of the MS are terminated.

Message type: WGPRS Packet Downlink Assignment

Direction: network to mobile station

Table 11.8 – WGPRS_PACKET DOWNLINK ASSIGNMENT information elements

<pre> < WGPRS Packet Downlink Assignment message content > ::= < MESSAGE_TYPE : bit (6) > < Referenced address : Referenced address struct > < MAC_MODE : bit (2) > < RLC_MODE : bit (1) > < CONTROL_ACK : bit (1) > < Timeslot Allocation : Timeslot Allocation IE> < REL_OR_ABS_FN : bit (1) > { { 0 1 < Frequency Parameters : < Frequency Parameters IE > > } } { 0 1 < DOWNLINK_TFI_ASSIGNMENT : bit (5) > } { 0 1 < Power Control Parameters : < Power Control Parameters IE > > } { 0 1 < TBF Starting Time : < Starting Frame Number Description IE > > } < spare padding > } // ; -- truncation of optional elements allowed, 0's assumed </pre> <pre> <Referenced Address struct > ::= { 0 < Global TFI : Global TFI IE > 1 < TLLI : bit (32) > } </pre>
--

Table 11.9 – WGPRES PACKET DOWNLINK ASSIGNMENT information element details

Referenced address struct

This information element contains the address of the mobile station addressed by the message.

Global TFI IE

This information element contains the TFI of the mobile station's downlink TBF or uplink TBF. This field is defined in subclause 12.8.

TLLI (32 bit field)

This field is defined in subclause 12.11.

MAC_MODE (1 bit field)

This information field indicates the medium access method to be used during the TBF.

Bit

2 1

- 0 0 Dynamic Allocation
- 0 1 Extended Dynamic Allocation
- 1 0 Fixed Allocation
- 1 1 Reserved

RLC_MODE (1 bit field)

This field indicates the RLC mode of the requested TBF.

- 0 RLC acknowledged mode
- 1 RLC unacknowledged mode

CONTROL_ACK (1 bit field)

This field shall be set to '1' if the network establishes a new downlink TBF for the mobile station whose timer TW3192 is running. Otherwise this field shall be set to '0'.

Timeslot Allocation

The Timeslot Allocation I is defined in subclause 12.12.

REL_OR_ABS_FN (1 bit field)

This field indicates the type of encoding - Relative or Absolute Frame Number - used for all the Starting Time fields in this message, and in all subsequent RLC/MAC control messages which are sent on the downlink TBF assigned by this message.

- 0 Absolute Frame Number encoding shall be used ;
- 1 Relative Frame Number encoding shall be used ;

Power Control Parameters IE

This information element is defined in subclause 12.7.2.

Frequency Parameters IE

This information element is defined in subclause 12.6.

DOWNLINK_TFI_ASSIGNMENT (5 bit field)

This information element, if present, assigns the TFI to the mobile station to identify to downlink TBF described by this message. TFI is encoded as defined in subclause 12.10.

TBF_STARTING_TIME (13 or 16 bit field)

The TBF Starting Time field contains a starting time that indicates the TDMA framenummer during which the assigned TBF may start. If no downlink TBF is in progress, the mobile station need not monitor the TFI field of downlink RLC data blocks until the indicated TDMA framenummer. After the indicated TDMA framenummer, the mobile station shall operate as during a downlink TBF. If a downlink TBF is already in progress, the mobile station shall continue to use the parameters of the existing TBF until the TDMA framenummer occurs. When the indicated TDMA framenummer occurs, the mobile station shall immediately begin to use the new parameters assigned. This field is encoded the same as the Starting Frame Number Description IE. Depending on the value of the REL_OR_ABS_FN field indicated in this message, the length of this field will be 13 bits (relative FN) or 16 bits (absolute FN).

11.2.6 Packet Dummy Control Block

This message is sent on the WPACCH as a fill message with no content.

11.2.6.1 Packet Downlink Dummy Control Block

This message is sent on the WPACCH by the network to the mobile station as a fill message with no content.

Message type: PACKET DOWNLINK DUMMY CONTROL BLOCK

Direction: network to mobile station

Classification: distribution message

Table 11.10 – PACKET DOWNLINK DUMMY CONTROL BLOCK information elements

< Packet Downlink Dummy Control Block message content > ::=
 < padding bits >
 ! < Distribution part error : bit (*) = < no string > > ;

11.2.6.2 Packet Uplink Dummy Control Block

This message is sent on the WPACCH from the mobile station to the network when the mobile station has no other block to transmit.

Message type: PACKET UPLINK DUMMY CONTROL BLOCK

Direction: mobile station to network

Table 11.11 – PACKET UPLINK DUMMY CONTROL BLOCK information elements

< Packet Uplink Dummy Control Block message content > ::=
 < TLLI : bit (32) >
 < padding bits > ;

Table 11.12 - PACKET UPLINK DUMMY CONTROL BLOCK information element details

TLLI (32 bit field)
 This field contains the TLLI of the mobile station. This field is encoded as defined in subclause 12.11.

11.2.7 Packet Mobile TBF Status

This message is sent from the mobile station to the network on the uplink WPACCH to indicate erroneous messages have been received relating to either a downlink or an uplink TBF.

Message type: PACKET MOBILE TBF STATUS

Direction: mobile station to network

Table 11.13 – Packet MOBILE TBF STATUS information elements

```

< Packet Mobile TBF Status message content > ::=
< GLOBAL_TFI : < Global TFI IE > >
  < TBF_CAUSE : bit (3) >
    { 0 | 1 < STATUS_MESSAGE_TYPE : bit (6) > }
< padding bits > ;
    
```

Table 11.14 – Packet MOBILE TBF STATUS information element details

Global TFI IE

This information element contains the TFI of the mobile station's downlink TBF or uplink TBF. This field is defined in subclause 12.8

TBF_CAUSE (3 bit field)

The TBF_CAUSE field indicates the error cause value of the current TBF. This field is encoded according to the following table:

bit		
3	2 1	
0	0 0	Normal event;
0	0 1	Status, unspecified;
0	1 0	Syntactically incorrect message, non-distribution part error;
0	1 1	Syntactically incorrect message, message escape;
1	0 0	Message not compatible with current protocol state.

All other values are reserved and may be interpreted "Status, unspecified".

STATUS_MESSAGE_TYPE (6 bit field)

The STATUS_MESSAGE_TYPE field, if present, is the binary representation of the message type of the downlink RLC/MAC control message that caused the status condition. Message type values are defined in subclause 11.2.1.1.

11.2.8 Packet PDCH Release

This message is sent on WPACCH by the network to notify all mobile stations listening to that PDCH that one or more PDCHs will be immediately released and become unavailable for packet data traffic.

Message type: PACKET PDCH RELEASE

Direction: network to mobile station

Classification: distribution message

Table 11.15 – PACKET PDCH RELEASE information elements

```

< Packet PDCH Release message content > ::=
{ 0 | 1 < TIMESLOTS_AVAILABLE: <Timeslot Allocation IE>> }
< padding bits >
! < Distribution part error : bit (*) = < no string > > ;
    
```

Table 11.16 – PACKET PDCH RELEASE information element details

TIMESLOTS_AVAILABLE

This information field indicates the timeslots assigned for WGPRS use on the current ARFCN. If this field is not present, the timeslot on which the message was sent is the timeslot being released. The Timeslot Allocation IE has been defined in subclause 12.12.

11.2.9 Packet Power Control

This message is sent on WPACCH by the network to the mobile station in order to update the mobile station power control parameters.

Message type: PACKET POWER CONTROL

Direction: network to mobile station

Classification: non-distribution message

Table 11.17 – PACKET POWER CONTROL information elements

```

< PACKET POWER CONTROL message content > ::=
{
  { 0 < Global TFI : < Global TFI IE > >
    { 0 -- Message escape
      { 0 | 1 < Global Power Control Parameters : < Global Power Control
Parameters IE >> }
      { 0 | 1 < Power Control Parameters: < Power Control Parameters
IE >> }
    }
  }
  < padding bits >
  ! < Non-distribution part error : bit (*) = < no string > > }
  ! < Message escape : 1 bit (*) = <no string> > }
  ! < Address information part error : bit (*) = < no string > > }
  ! < Distribution part error : bit (*) = < no string > > ;

```

Table 11.18 – PACKET POWER CONTROL information element details

Global Power Control Parameters IE

This information field is defined in subclause 12.7.1.

Power Control Parameters IE

This information field is defined in subclause 12.7.2.

Referenced Address struct

This information element indicates the identity of the mobile station to which this message is addressed. All other mobile stations shall ignore this message.

Global TFI IE

This information element contains the TFI of the mobile station's downlink TBF or uplink TBF. This field is defined in subclause 12.8.

11.2.10 Packet Resource Request

This message is sent on the WPACCH by the mobile station to the network to request a change in the uplink resources assigned.

Message type: PACKET RESOURCE REQUEST

Direction: mobile station to network

Table 11.19 – PACKET RESOURCE REQUEST information elements

<pre> < PACKET RESOURCE REQUEST message content > ::= < MESSAGE_TYPE : bit (6) > { 0 1 < ACCESS_TYPE : bit (2) > } { 0 < Global TFI : < Global TFI IE > > 1 < TLLI : < TLLI IE > > } < Channel Request Description : < Channel Request Description IE > > < WGPRS Channel Quality Report : < WGPRS Channel Quality Report IE > > < spare padding > ; </pre>

Table 11.20 - PACKET RESOURCE REQUEST information element details

<p>Global TFI This information element contains the TFI of the mobile station's uplink TBF, if available, or the TFI of the mobile station's downlink TBF. If no TFI is available, this field is omitted. This field is defined in subclause 12.8.</p> <p>ACCESS_TYPE (2 bit field) This field indicates the reason for requesting the access. It shall be included only in response to a single block assignment.</p> <p>bit</p> <table border="0"> <tr> <td><u>2 1</u></td> <td></td> </tr> <tr> <td>0 0</td> <td>Reserved</td> </tr> <tr> <td>0 1</td> <td>User Data</td> </tr> <tr> <td>1 0</td> <td>Reserved</td> </tr> <tr> <td>1 1</td> <td>Reserved</td> </tr> </table> <p>TLLI IE (32 bit field) This information element is defined in subclause 12.11.</p> <p>Channel Request Description This information element is defined in subclause 12.5.</p> <p>WGPRS_Channel_Quality_Report IE This information element is defined in subclause 12.4.1.</p>	<u>2 1</u>		0 0	Reserved	0 1	User Data	1 0	Reserved	1 1	Reserved
<u>2 1</u>										
0 0	Reserved									
0 1	User Data									
1 0	Reserved									
1 1	Reserved									

11.2.11 Packet TBF Release

This message is sent on the WPACCH by the network to the mobile station to initiate release of an uplink or downlink TBF.

Message type: PACKET TBF RELEASE

Direction: network to mobile station

Classification: non-distribution message

Table 11.21 – PACKET TBF RELEASE information elements

```

< Packet TBF Release message content > ::=
{
    00
    < GLOBAL_TFI : Global TFI IE >
    < UPLINK_RELEASE : bit (1) >
    < DOWNLINK_RELEASE : bit (1) >
    {
        < TBF_RELEASE_CAUSE : bit (4) = { 0000 | 0010 } >
        < padding bits >
        ! < Non-distribution part error : bit (*) = < no string > > }
        ! < Address information part error : bit (*) = < no string > > }
        ! < Distribution part error : bit (*) = < no string > > ;
    }

```

Table 11.22 – PACKET TBF RELEASE information element details

Global TFI IE

This information element contains the TFI of the mobile station's which uplink and/or downlink TBF to be released. This field is defined in subclause 12.8.

Uplink_Release (1 bit field)

Downlink_Release (1 bit field)

These fields indicate which TBF shall be release, uplink or downlink. Both directions can be released at the same time.

0 TBF shall not be released

1 TBF shall be released

TBF_RELEASE_CAUSE (8 bit field)

This field indicates the reason for the release of the TBF. This field is encoded according to the following table:

bit	
<u>4 3 2 1</u>	
0 0 0 0	Normal release
0 0 1 0	Abnormal release

All other values are reserved, the same behavior in reception as if 'Abnormal release'.

11.2.12 Packet Uplink Ack/Nack

This message is sent on the WPACCH by the network to the mobile station indicate the status of the received RLC data blocks. This message may also update the power control parameters. A fixed allocation mobile station may also be assigned uplink resources.

Message type: Packet Uplink Ack/Nack

Direction: network to mobile station

Classification: non-distribution message

Table 11.23 – PACKET UPLINK ACK/NACK information elements

```

< WGPRS Packet Uplink Ack/Nack message content > ::=
  < MESSAGE_TYPE : bit (6) >
  < UPLINK_TFI : bit (7) >
  < WGPRS_CHANNEL_CODING_COMMAND : <WGPRS MCS IE >
  <WGPRS Ack/Nack Description : < WGPRS Ack/Nack Description IE > >
  { 0 | 1 < CONTENTION_RESOLUTION_TLLI : bit (32) > }
  { 0 | 1 < Power Control Parameters : < Power Control Parameters IE > > }
  { 0 | 1 < Extension Bits : Extension Bits IE > } -- subclause 12.16
  { 0 | 1 < Fixed Allocation Parameters : < Fixed Allocation struct > > }
  < spare padding > ;

< Fixed Allocation struct > ::=
  < FINAL_ALLOCATION : bit (1) >
  { 0 < REPEAT_ALLOCATION : bit (1) >
  | 1 Timeslot Allocation : Timeslot Allocation IE >
  <Common_Fixed_Allocation : <WGPRS Common Fixed allocation IE> >
  
```

Table 11.24 – PACKET UPLINK ACK/NACK information element details

UPLINK_TFI (7 bit field)
 This field identifies the uplink TBF to which this message applies. This field is coded the same as the TFI field defined in subclause 12.10.

WGPRS_MCS IE
 The WGPRS MCS Information element is defined in subclause 12.9.

WGPRS Ack/Nack Description IE
 This information element is defined in subclause 12.2 The number of bits (L) available for WGPRS Ack/Nack Description information element depends on the inclusion of other information elements. L may be set so that the entire WGPRS PACKET UPLINK ACK/NACK message evenly fits into an RLC/MAC control block. If a lower L covers the entire receive window, that L may be used.

CONTENTION_RESOLUTION_TLLI (32 bit field)
 The CONTENTION_RESOLUTION_TLLI field is present only if the network has decoded one of the uplink RLC data blocks containing the TLLI. The mobile station shall perform the contention resolution function if the TLLI information element is present. This field contains a TLLI, which is defined in subclause 12.11.

Power Control Parameters IE
 This information element, if present, contains power control command for the mobile station. If this information element is not present for certain previously allocated timeslots, the MS shall continue to use the previous power on these timeslots. This information element is defined in subclause 12.7.2.

FINAL_ALLOCATION (1 bit field)
 This field indicates whether this allocation is the last allocation of the TBF.
 0 this allocation is not the last allocation of the TBF
 1 this allocation is the last allocation of the TBF

REPEAT_ALLOCATION (1 bit field)
 This field indicates whether the mobile's current allocation repeats after it ends.
 0 do not repeat the current allocation after it ends
 1 repeat the current allocation when it ends

11.2.13 Packet Uplink Assignment

This message is sent on the WPACCH by the network to the mobile station to assign uplink resources. The mobile station shall be addressed by TFI.

Message type: Packet Uplink Assignment

Direction: network to mobile station

Table 11.25 – PACKET UPLINK ASSIGNMENT information elements

```

< Packet Uplink Assignment message content > ::=
  < MESSAGE_TYPE : bit (6) >
  < Referenced Address : < Referenced Address struct > >
  { 0 ! < Ignore remaining error : 1 bit(*) = <no string> > }
  < WGPRS_CHANNEL_CODING_COMMAND : <WGPRS MCS IE >>
  < TLLI_BLOCK_CHANNEL_CODING : bit (1) >
  < REL_OR_ABS_FN : bit (1) >
  {
    { 0 | 1 < Frequency Parameters : < Frequency Parameters IE > > }
    { 01 < Dynamic Allocation : < Dynamic Allocation struct > >
      | 10 < Single Block Allocation : < Single Block Allocation struct
      | 00 < extension >
      | 11 < Fixed allocation : < Fixed Allocation struct > > }
    < spare padding > } // ; -- truncation of optional elements allowed, 0 's assumed

<extension> ::= -- Future extension should be done by modifying this structure
  < null > ;

<Referenced Address struct > ::=
  { 0 < Global TFI : < Global TFI IE > >
    | 1 < TLLI : < TLLI IE > >
    };

<Dynamic Allocation struct > ::=
  { 0 | 1 < UPLINK_TFI_ASSIGNMENT : bit (7) > }
  < Common Dynamic Allocation : < WGPRS Common Dynamic Allocation IE > > ;

<Single Block Allocation struct > ::=
  < TIMESLOT_NUMBER : bit (8) >
  { 0 | 1 < ALPHA : bit (4) >
  < GAMMA_TN : bit (5) > }
  < TBF Starting Time : < Starting Frame Number Description IE > >

<Fixed Allocation struct > ::=
  < FINAL_ALLOCATION : bit (1) >
  < DOWNLINK_CONTROL_TIMESLOT : bit(8)>
  { 0 | 1 < CONTENTION_RESOLUTION_TLLI : bit (32) > }
  { 0 < Timeslot Allocation : Timeslot Allocation IE >
  | 1 < Power Control Parameters : < Power Control Parameters IE > > }
  <Common Fixed Allocation : < WGPRS Common Fixed Allocation IE > >

```

Table 11.26 – PACKET UPLINK ASSIGNMENT information element details

NOTE: If the ALLOCATION_BITMAP_LENGTH is not present, then the ALLOCATION_BITMAP field is variable length and fills the remainder of the message.

Referenced Address struct

This information element contains the address of the mobile station addressed by the message.

Global TFI IE (6 bit field)

This information element identifies the uplink TFI, if available, or the downlink TFI, to which this message applies. This field is defined in subclause 12.8

TLLI IE (32 bit field)

This information element is described in subclause 12.11. !

Timeslot Allocation

The Timeslot Allocation IE is defined in subclause 12.12. If this field is not present, the timeslot allocation is indicated by the Power Control Parameters IE.

WGPRS_MCS IE

The WGPRS MCS IE is defined in subclause 12.9.

TLLI_BLOCK_CHANNEL_CODING (1 bit field)

This field indicates the channel coding command that the mobile station shall use for any RLC data block containing a TLLI field in the RLC data block header. This field is coded as shown:

0 the MS shall use WMCS-1 for any RLC data block containing a TLLI in the RLC data block header

1 the MS shall use the value commanded in the WGPRS_CHANNEL_CODING_COMMAND for any RLC data block containing a TLLI in the RLC data block header

REL_OR_ABS_FN (1 bit field)

This field indicates the type of encoding – Relative or Absolute Frame Number - used for all the Starting Time fields in this message, and in all subsequent RLC/MAC control messages which are sent on the uplink TBF assigned by this message.

0 Absolute Frame Number encoding shall be used ;

1 Relative Frame Number encoding shall be used ;

UPLINK_TFI_ASSIGNMENT (5 bit field)

This information element, if present, assigns the contained TFI to the mobile station to identify to uplink TBF described by this message. This field is coded the same as the TFI field defined in subclause 12.10.

Frequency Parameters IE

This information element, if present, assigns frequency parameters to the uplink TBF. If this information element is not present the mobile station shall use its previously assigned frequency parameters. This information element is defined in subclause 12.6.

Dynamic Allocation struct

This information element contains parameters necessary to define the RR of a dynamic allocation or an extended dynamic allocation.

Single Block Allocation struct

This information element contains parameters necessary to define the RR of a Single Block allocation

TIMESLOT_NUMBER (8 bit field)

This field indicates the timeslot assigned for transfer of a single RLC/MAC block on the uplink. The encoding of TIMESLOT_NUMBER field has been defined in subclause 12.14.

Fixed Allocation struct

This information element contains parameters necessary to define the RR of a fixed allocation.

FINAL_ALLOCATION (1 bit field)

This field indicates whether this allocation is the last allocation of the TBF.

0 this allocation is not the last allocation of the TBF

1 this allocation is the last allocation of the TBF

DOWNLINK_CONTROL_TIMESLOT (8 bit field)

This information field indicates the downlink timeslot that mobile station operating in fixed allocation mode shall monitor for downlink WPACCH. Encoding of this field is the same as encoding of TIMESLOT_NUMBER field that is defined in subclause 12.14.

11.2.14 WGRS Packet Timeslot Reconfigure

This message is sent on the WPACCH by the network to the mobile station to assign uplink and/or downlink resources.

Message type: WGRS Packet Timeslot Reconfigure

Direction: network to mobile station

Table 11.27 – WGRS PACKET TIMESLOT RECONFIGURE information elements

```

<WGRS Packet Timeslot Reconfigure message content > ::=
  < MESSAGE_TYPE : bit (6) >
  < GLOBAL_TFI : < Global TFI IE > >
  { 0 ! < Ignore remaining error : 1 bit (*) = <no string>> }
  < WGRS_CHANNEL_CODING_COMMAND : < WGRS MCS IE > >
  < DOWNLINK_RLC_MODE : bit(1) >
  < CONTROL_ACK : bit (1) >
  { 0 | 1 < GLOBAL_TFI_ASSIGNMENT : bit (6) >
    < REL_OR_ABS_FN : bit (1) >
    < Downlink Timeslot Allocation : Timeslot Allocation IE >
    {
      { 0 | 1 < Frequency Parameters : < Frequency Parameters IE > > }
      { 0 < Dynamic Allocation : < Dynamic Allocation struct > >
        | 1 < Fixed allocation : < Fixed Allocation struct > > }
      < spare padding > // ; -- truncation of optional elements allowed, 0 's assumed
    }
  }

```

<Dynamic Allocation struct > ::=

<Common Dynamic alloc : WGRS Common Dynamic Allocation IE>>}

<Fixed Allocation struct > ::=

```

{ 0 < Uplink Timeslot Allocation : Timeslot Allocation IE>
  | 1 < Power Control Parameters : < Power Control Parameters IE > > }
< FINAL_ALLOCATION : bit (1) >
< DOWNLINK_CONTROL_TIMESLOT : TIMESLOT_NUMBER (8 bit)>
{<Common Fixed Allocation : <WGRS Common Fixed allocation IE>> }

```

Global TFI IE (6 bit field)

This field identifies the uplink TFI, if available, or the downlink TFI, to which this message applies. This field is defined in subclause 12.8.

WGRS_MCS IE

The WGRS_MCS Information element is defined in subclause 12.9.

DOWNLINK_RLC_MODE (1 bit field)

This field indicates the RLC mode of the requested TBF.

```

0 RLC acknowledged mode
1 RLC unacknowledged mode

```

CONTROL_ACK (1 bit field)

This field shall be set to '1' if the network establishes a new downlink TBF for the mobile station whose timer TW3192 is running. Otherwise this field shall be set to '0'.

GLOBAL_TFI_ASSIGNMENT (6 bit field)

This information element, if present, assigns the contained TFI to the mobile station to identify to an uplink or downlink TBF described by this message. This field is coded the same as the GLOBAL_TFI field defined in subclause 12.8.

REL_OR_ABS_FN (1 bit field)

This field indicates the type of encoding - Relative or Absolute Frame Number - used for all the Starting Time fields in this message, and in all subsequent RLC/MAC control messages which are sent on the uplink or downlink TBF assigned by this message.

```

0 Absolute Frame Number encoding shall be used ;
1 Relative Frame Number encoding shall be used ;

```

Power Control Parameters IE

This information element, if present, contains the power control command and timeslot allocation for the uplink TBF. If this information element is not present, the MS shall continue to use the previous power. This information element is defined in subclause 12.7.2.

Frequency Parameters IE

This information element, if present, assigns frequency parameters to the uplink or downlink TBF. If this information element is not present the mobile station shall use its previously assigned frequency parameters. This information element is defined in subclause 12.6.

Dynamic Allocation struct

This information element contains parameters necessary to define the RR of a dynamic allocation or an extended dynamic allocation.

WGPRS Common Dynamic Allocation IE

The WGPRS Common Dynamic Allocation IE is defined in subclause 12.4.2.

Fixed Allocation struct

This information element contains parameters necessary to define the RR of a fixed allocation.

WGPRS Common Fixed Allocation IE

The WGPRS Common Fixed Allocation IE is defined in subclause 12.4.3.

TIMESLOT_NUMBER (8 bit field)

This information field indicates the downlink timeslot that mobile station operating in fixed allocation mode shall monitor for downlink WPACCH. Coding of this field has been defined in subclause 12.14.

12 Information Element Coding

12.1 Overview

Information elements used within the context of only one RLC/MAC control message are defined in subclause 11. All other information elements are defined within the present subclause.

12.2 WGPRS Ack/Nack Description

The WGPRS Ack/Nack Description information element contains the RLC parameters used to acknowledge or on the inclusion or exclusion of other information elements in the used message.

Table 12.1 – WGPRS Ack/Nack Description information elements

```

< WGPRS Ack/Nack Description IE > ::=
    <FINAL_ACK_INDICATION : bit (1) >
    <BEGINNING_OF_WINDOW (BOW); bit (1) >
    <END_OF_WINDOW (EOW); bit (1) >
    <STARTING_SEQUENCE_NUMBER; bit (11) >
    {1 <UNCOMPRESSED_RECEIVED_BLOCK_BITMAP; bit (Lu) > | 0
     {<COMPRESSED_BITMAP_LENGTH (Lc): bit (7) >
      <COMPRESSED_BITMAP_STARTING_COLOR_CODE: bit (1) >
      <COMPRESSED_RECEIVED_BLOCK_BITMAP : bit (Lc) >
      <UNCOMPRESSED_RECEIVED_BLOCK_BITMAP; bit (Lu) > }
    };

```

Table 12. 2 – WGPRES Ack/Nack Description information element details

<p>FINAL_ACK_INDICATION (1 bit field) This field indicates whether the entire TBF is being acknowledged. If the entire TBF is being acknowledged, the SSN, CRBB and URBB fields contain no information and shall be ignored.</p> <p>0 retransmissions are requested and the TBF is incomplete. 1 no retransmissions are requested and this message indicates acknowledgement of all RLC data in the TBF.</p> <p>BEGINNING_OF_WINDOW (1 bit field) This bit indicates if the Ack/Nack bitmap starts at the beginning of the window.</p> <p>0 SSN not equal to $(V(Q)+1)$ modulo 4096. 1 SSN = $(V(Q)+1)$ modulo 4096</p> <p>END_OF_WINDOW (1 bit field) This bit indicates if the end of the receiver window is included in the bitmap(s).</p> <p>0 End of the receiver window, $V(R)$, is not explicitly included in the bitmap. 1 End of the receiver window, $V(R)$, is explicitly included in the bitmap.</p> <p>STARTING_SEQUENCE_NUMBER (SSN) (11 bit field) Range 0 to 4095 The SSN indicates the Block Sequence Number of the first RLC block for which the Ack/Nack receipt status is indicated within the bitmap. The SSN is determined using S/P, PBSN and $V(Q)$.</p> <p>COMPRESSED_BITMAP_LENGTH (7 bit field) Range 0 to 127 This field represents the length of the compressed bitmap. Compression is carried out using T.4 run length coding.</p> <p>COMPRESSED_BITMAP_STARTING_COLOR_CODE (1 bit field) This bit indicates if the first code word in the compressed bitmap (i.e., CRBB) represents a run length of ones or a run length of zeros.</p> <p>0 First code word in CRBB represents run length of zeros. 1 First code word in CRBB represents run length of ones.</p> <p>COMPRESSED_RECEIVE_BLOCK_BITMAP (CRBB) (L_c bit field) The CRBB is a compressed bitmap. Compression is carried out starting at SSN using T.4 run length coding. The number of bits (L_c) available for WGPRES Ack/Nack Description depends on the inclusion of other information elements in the used message.</p> <p>UNCOMPRESSED_RECEIVE_BLOCK_BITMAP (URBB) (L_u bit field) The URBB is an uncompressed bitmap representing Block Sequence Numbers. The bitmap is indexed relative to SSN as follows: $BSN = (ESN_CRBB + bit_number) \text{ modulo } 4096, \quad \text{for } bit_number = 1 \text{ to } L-L_c-22.$ where ESN_CRBB represents the ending sequence number of the CRBB, if no CRBB is included, $ESN_CRBB = SSN$. The value of each bit is encoded as: 0 Negative acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ modulo } 4096$ 1 Positive acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ modulo } 4096$</p>

12.3 ALLOCATION_BITMAP

The ALLOCATION_BITMAP represents uplink radio blocks, each bit representing one radio block or an entire block period. Each bit indicates whether the mobile station is permitted to transmit during the corresponding uplink radio block or radio block period.

Table 12.3 – ALLOCATION_BITMAP information element details

<p>ALLOCATION_BITMAP (variable length field)</p> <p>The ALLOCATION_BITMAP represents uplink radio blocks or radio block periods, each bit representing one radio block or an entire radio block.</p> <p>If the BLOCKS_OR_BLOCK_PERIODS field indicates blocks, the bitmap describes a two dimensional array of radio blocks. The number of columns in the array is variable and is equal to the number of timeslots allocated in the Timeslot Allocation. The array is indexed as follows:</p> $\text{radio block}[x,y]$ $x = (L - n) / \text{NTS}, \text{ for } n = 0 \text{ to } L,$ $y = (L - n) \text{ modulo } \text{NTS} \text{ for } n = 0 \text{ to } L,$ <p>where:</p> <p>x = block period relative to TBF_STARTING_TIME, range 0 to L / NTS;</p> <p>y = timeslot number of the assigned timeslots in the TIMESLOT_BITMAP, range 0 to NTS-1;</p> <p>L = number of bits in the ALLOCATION_BITMAP - 1;</p> <p>n = bit number index into the ALLOCATION_BITMAP, range 0 to L;</p> <p>TBF_STARTING_TIME indicates the first block period of the assigned allocation;</p> <p>NTS = number of timeslots assigned in the Timeslot Allocation, range 1 to 64;</p> <p>The division operation is integer division;</p> <p>The modulo operation is integer modulo.</p> <p>The value of each bit is encoded as:</p> <p>0 radio block[x,y] is not part of the assigned allocation</p> <p>1 radio block[x,y] is part of the assigned allocation</p> <p>Note the interpretation of ALLOCATION_BITMAP depends on the slot type allocated to a mobile. The timeslot allocation of a mobile consists of only long slots or short slots. Depending on the coding mode, block period refers to either 1 or 4 frames.</p> <p>If the BLOCKS_OR_BLOCK_PERIODS field indicates block periods, the bitmap describes a one dimensional array of block periods. For each block period indicated as part of the allocation in the bitmap, each of the timeslots indicated in the Timeslot Allocation is assigned as part of the allocation. The array is indexed as follows:</p> $\text{block period}[z]$ <p style="text-align: right;">$z = n$ for $n =$</p> <p>0 to L,</p> <p>where:</p> <p>L = number of bits in the ALLOCATION_BITMAP - 1;</p> <p>z = block period relative to TBF_STARTING_TIME;</p> <p>n = bit number index into the ALLOCATION_BITMAP, range 0 to L;</p> <p>TBF_STARTING_TIME indicates the first block period of the assigned allocation;</p> <p>NTS = number of timeslots assigned in the Timeslot Allocation, range 1 to 64.</p> <p>The value of each bit is encoded as:</p> <p>0 block period[n] is not part of the assigned allocation</p> <p>1 block period[n] is part of the assigned allocation</p>
--

12.4 Mobile Allocation Information Elements

12.4.1 WGPRES Channel Quality Report

Table 12.4 – WGPRES Channel Quality Report Information elements

```

< WGPRES Channel Quality Report > ::=
  < Mean_BEP : bit (5) >
  < Std_BEP : bit (4) >
  < C_VALUE : bit (6) >;

```

Table 12.5 – WGPRES Channel Quality Report Information Elements details

Mean_BEP (5 bit field)

This field contains the mean value of the Bit Error Probability of the channel.
Range 0 to 31

Std_BEP (4 bits)

This field contains the Standard Deviation of the Bit error Probability (BEP) of the channel.
Range 0 to 7

C_VALUE (6 bits)

This field contains the value of the C parameter calculated by the mobile station (see 3GPP TS 45.008). This field is encoded as the binary representation of the C value parameter value defined in 3GPP TS 45.008.
Range 0 to 63

12.4.2 WGPRES Common Dynamic Allocation

This IE contains the parameters frequently needed for Dynamic Allocation.

Table 12.6 – WGRS Common Dynamic Allocation Information Elements

```

< Extended Dynamic Allocation: bit(1)>
< USF_GRANULARITY : bit (1) >
{ 0 | 1 < RLC_DATA_BLOCKS_GRANTED : bit (8) > }
{ 0 | 1 < TBF Starting Time : < Starting Frame Number Description IE > > }
{ 0
    -- Timeslot Allocation
    { 0 | 1 <TIMESLOT_TYPE : bit(2)>< USF_TS : bit (3) > } -- 1st timeslot
    { 0 | 1 <TIMESLOT_TYPE : bit(2)>< USF_TS : bit (3) > } -- 2nd timeslot
    ...
    { 0 | 1 <TIMESLOT_TYPE : bit(2)>< USF_TS : bit (3) > } -- last timeslot (max 64)
| 1
    -- Timeslot Allocation with Power Control
Parameters
  < ALPHA : bit (4) >
  { 0 | 1 < TIMESLOT_TYPE : bit(2)>< USF_TS : bit (3) > -- 1st timeslot
    < GAMMA_TS : bit (5) > }
  { 0 | 1 <TIMESLOT_TYPE : bit(2)>< USF_TS : bit (3) > -- 2nd timeslot
    < GAMMA_TS : bit (5) > }
  ...
  { 0 | 1 <TIMESLOT_TYPE : bit(2)>< USF_TS : bit (3) > -- last timeslot (max 64)
    < GAMMA_TS : bit (5) > } };

```

-- The timeslot allocations above are bit maps that start from the beginning of the frame. First bit refers to the first short slot in the frame. The next bit refers to the next short slot in the frame. And so on. If a bit in the bit map has the value one then the timeslot starting at the beginning of the corresponding short slot is included into the timeslot allocation. If a timeslot is included into the timeslot allocation then the two following bits define the type of the timeslot (long or short slot). In case the timeslot type is short slot then the next bit in the bit map refers to the following short slot. In case the timeslot type is long slot then the next bit refers to the first short slot after the end of the allocated long slot.

Table 12.7 – WGPRES Common Dynamic Allocation Information Element details

Extended Dynamic Allocation (1 bit field)	
This information field indicates the medium access mode to be used during the TBF.	
0	Dynamic Allocation
1	Extended Dynamic Allocation
Power Control Parameters IE	
This information element, if present, contains power control command and timeslot allocation for the mobile station. If this information element is not present, the MS shall continue to use the previous power. This information element is defined in subclause 12.7.2.	
RLC_DATA_BLOCKS_GRANTED (8 bit field)	
The RLC/MAC blocks Granted field assigns a fixed number of RLC data blocks that the mobile station shall transmit during the uplink TBF. If the RLC_DATA_BLOCKS_GRANTED field is present the mobile station shall transmit only the assigned number of RLC data blocks. Otherwise the duration of the uplink TBF is undefined. Retransmissions of negatively acknowledged RLC data blocks do not apply toward the maximum number. This field is encoded as a binary number as shown:	
bit	
<u>8 7 6 5 4 3 2 1</u>	
0 0 0 0 0 0 0 0	9 RLC data blocks
0 0 0 0 0 0 0 1	10 RLC data blocks
...	
1 1 1 1 1 1 0 0	26 RLC data blocks
All others Reserved	
TBF_STARTING_TIME (13 or 16 bit field)	
The TBF Starting Time field contains a starting time that indicates the frame number during which the assigned TBF may start.	
In case of dynamic allocation, if no uplink TBF is in progress, the MS need not monitor the USF field until the TDMA frame number occurs. When the indicated TDMA frame number occurs, the mobile station shall immediately begin to monitor the USF field and use the new assigned uplink TBF parameters when its USF has occurred. If an uplink TBF is already in progress, the MS shall continue to use the parameters of the existing TBF until the TDMA frame number occurs. When the indicated TDMA frame number occurs, the mobile station shall immediately begin to monitor the USF field and use the new assigned uplink TBF parameters when its USF has occurred.	
In case of single block allocation, the mobile station shall use the assigned timeslot during the RLC/MAC block whose first TDMA burst occurs in the indicated TDMA frame number.	
In case of fixed allocation, if no uplink TBF is in progress, the MS shall wait until the TDMA frame number occurs, and then shall use the assigned uplink resources from the indicated TDMA frame number forward, according to the parameters in the fixed allocation struct. If an uplink TBF is in progress, the MS shall continue to use the parameters of the existing TBF until the TDMA frame number occurs. When the TDMA frame number occurs, the MS shall then use the assigned uplink resources from the indicated TDMA frame number forward, according to the parameters in the fixed allocation struct. This field is encoded as the Starting Frame Number Description IE. Depending on the value of the REL_OR_ABS_FN field indicated in this message, the length of this field will be 13 bits (relative FN) or 16 bits (absolute FN).	
USF_TS for Timeslot Number 0 (TN0) (3 bit field)	
This field indicate the USF value assigned to the MS for allocated timeslots (range 0 to 63). These fields are encoded as a binary presentation of the USF value as defined in subclause 10.5.1.	
USF_GRANULARITY (1 bit field)	
This information field indicates the USF granularity to be applied by the mobile station when it is assigned a TBF using Dynamic Allocation.	
0	the mobile station shall transmit one RLC/MAC block.
1	the mobile station shall transmit four consecutive RLC/MAC blocks.
ALPHA (4 bit field)	
The ALPHA Power control parameter field is coded according to the following table:	
bits	
<u>4 3 2 1</u>	
0 0 0 0	$\alpha = 0.0$
0 0 0 1	$\alpha = 0.1$
...	
1 0 0 1	$\alpha = 0.9$
1 0 1 0	$\alpha = 1.0$
All other values are reserved.	
GAMMA_TS (5 bit field)	

The GAMMA_TN field is the binary representation of the parameter ΓCH for MS output power control in units of 2 dB, see 3GPP TS 45.008.

12.4.3 WGPRS Common Fixed Allocation

This IE contains the parameters used for a fixed allocation.

Table 12.8 – Common Fixed Allocation Information Elements

```

< WGPRS Common Fixed Allocation IE > ::=
< TBF Starting Time : < Starting Frame Number Description IE > >
{ 0 ! < Ignore remaining error : 1 bit (*) = <no string>> }
{ 0      -- with length of Allocation Bitmap
  < BLOCKS_OR_BLOCK_PERIODS : bit (1) >
  < ALLOCATION_BITMAP_LENGTH : bit (10) >
  < ALLOCATION_BITMAP : bit (val(ALLOCATION_BITMAP_LENGTH))
|1      -- without length of Allocation Bitmap (fills remainder of the message)
  < ALLOCATION_BITMAP : bit ** > } ;
    
```

Table 12.9 – Common fixed allocation Information Elements Details

TBF_STARTING_TIME (13 or 16 bit field)
 The TBF Starting Time field contains a starting time that indicates the frame number during which the assigned TBF may start.

Power Control Parameters IE
 This information element, if present, contains power control command and timeslot allocation for the mobile station. If this information element is not present, the MS shall continue to use the previous power. This information element is defined in subclause 12.7.2.

BLOCKS_OR_BLOCK_PERIODS (1 bit field)
 This indicates if the ALLOCATION_BITMAP is to be interpreted as blocks or block periods.
 0 the ALLOCATION_BITMAP is to be interpreted as blocks
 1 the ALLOCATION_BITMAP is to be interpreted as block periods

ALLOCATION_BITMAP_LENGTH (10 bit field)
 This specifies the number of bits in the ALLOCATION_BITMAP.
 Range 0 to 1023.

ALLOCATION_BITMAP (variable length field)
 If The ALLOCATION_BITMAP field is variable length. If the ALLOCATION_BITMAP_LENGTH field is not present, the ALLOCATION_BITMAP fills the remainder of the message. If the BLOCKS_OR_BLOCK_PERIODS field is not present, then the ALLOCATION_BITMAP should be interpreted as blocks. This field is defined in subclause 12.3.

12.5 Channel Request Description

The Channel Request Description information element is sent by the mobile station to the network to request uplink resources.

Table 12.10 – Channel Request Description information elements

```

< Channel Request Description IE > ::=
< PEAK_THROUGHPUT_CLASS : bit (4) >
< RADIO_PRIORITY : bit (2) >
< RLC_MODE : bit (1) >
< LLC_PDU_TYPE : bit (1) >
< RLC_OCTET_COUNT : bit (16) > ;

```

Table 12.11 – Channel Request Description information element details**PEAK_THROUGHPUT_CLASS** (4 bit field)

This field indicates the peak throughput class for the PDP context of the LLC PDU that caused the Channel Request Description IE to be transmitted. The field is coded as the binary representation of the Peak Throughput Class specified in 3GPP TS 23.060.

Range: 1 to 9.

RADIO_PRIORITY (2 bit field)

This field indicates the Radio Priority of the requested TBF. The field is encoded as the Radio Priority field of the Packet Channel Request (see 3GPP TS 44.060).

RLC_MODE (1 bit field)

This field indicates the RLC mode of the requested TBF.

- 0 RLC acknowledged mode
- 1 RLC unacknowledged mode

LLC_PDU_TYPE (1 bit field)

This field indicates the type of the first LLC PDU to be transmitted over the requested uplink TBF.

- 0 LLC PDU is SACK or ACK
- 1 LLC PDU is not SACK or ACK

RLC_OCTET_COUNT (16 bit field)

The RLC_OCTET_COUNT field indicates the number of LLC data octets, plus the number of RLC data block length octets, that the mobile station wishes to transfer. The value '0' shall be interpreted as a request for an open ended TBF by the mobile station. All other values shall be interpreted as a request for a close ended TBF. Range 0 to 65535

12.6 Frequency Parameters

The Frequency Parameters information element defines frequency parameters and a training sequence code (TSC), which may be allocated to a mobile station to define its channel configuration. All timeslots in the channel configuration of the mobile station shall use the same frequency parameters and training sequence code. The frequency parameters consist of an ARFCN, defining a non-hopping radio frequency channel.

Channel spacing shall be 1.6 MHz. The channel number assignments are the same as for the 200 kHz Bearer Channel (see 3GPP TS 45.005) with the additional requirement that the channels are spaced 1.6 MHz apart. Therefore for a given 1.6 MHz bearer located at channel N, the next 1.6 MHz bearer channels shall be located at channel numbers N+8 M, where M is an integer. Additionally, a guard band is required between 1.6 MHz bearer channels and uncoordinated spectrum. The amount of guard band is implementation dependent, and ranges from 200 kHz to a maximum 1.6 MHz. This channel allocation provides the maximum flexibility in the use of radio spectrum.

As an example, a deployment of a 1.6 MHz bearer channel in the 1900 MHz A band could utilize channel 523 (1852.400 Mobile Station Transmitter, 1932.400 Base Station Transmitter) as the first channel. The reasoning is as follows: assuming a 1.6 MHz guard band is required from 1850.000 MHz & 1930.000 MHz, plus an additional .800 MHz (1/2 the channel width). Because the channel spacing is required to be 1.6 MHz, the second bearer would be located at channel 531. Additional channels would be allocated

throughout the remainder of the frequency block. Similarly, an implementation could choose to use channel 522 as the first 1.6 MHz bearer channel, and channel 530 as the second 1.6 MHz bearer channel, and so on.

Table 12.12 – Frequency Parameters information elements

```
< Frequency Parameters IE > ::=
< TSC : bit (5) >
{ 00 < ARFCN : bit (10) >
};
```

Table 12.13 – Frequency Parameters information element details

TSC (5 bit field)
This field is the binary representation of the training sequence code, see ATIS-0700361. Range: 0 to 21.

ARFCN (10 bit field)
This field is the binary representation of the absolute radio frequency channel number (ARFCN) defined in 3GPP TS 45.005. Range 0 to 1023.

12.7 Power Control Parameters

The Power Control Parameters are used to determine its TX power level.

12.7.1 Global Power Control Parameters

The Global Power Control Parameters information element contains parameters the mobile station shall use to determine its TX power level.

Table 12.14 – Global Power Control Parameters information elements

```
< Global Power Control Parameters IE > ::=
< ALPHA : bit (4) >
< T_AVG_W : bit (5) >
< T_AVG_T : bit (5) >
    < N_AVG_I : bit (4) > ;
```

Table 12.15 – Global Power Control Parameters information element details

ALPHA (4 bit field)	
The ALPHA power control parameter field is coded according to the following table:	
bit	
<u>4 3 2 1</u>	
0 0 0 0	$\alpha = 0.0$
0 0 0 1	$\alpha = 0.1$
0 0 1 0	$\alpha = 0.2$
::::	
1 0 0 1	$\alpha = 0.9$
1 0 1 0	$\alpha = 1.0$
All other values are reserved.	
T_AVG_W (5 bit field)	
The T_AVG_W parameter is a signal strength filter period for power control in packet idle mode. $2^{(k/2)} / 6$ multiframes, $k = 0, 1, 2, \dots, 25$. All other values are reserved.	
T_AVG_T (5 bit field)	
The T_AVG_T parameter is a signal strength filter period for power control in packet transfer mode. $2^{(k/2)} / 6$ multiframes, $k = 0, 1, 2, \dots, 25$; All other values are reserved.	
N_AVG_I (4 bit field)	
The N_AVG_I parameter is an interfering signal strength filter constant for power control $2^{(k/2)}$, $k=0, 1, \dots, 15$.	

12.7.2 Power Control Parameters

The Power Control parameters information element contains parameters the mobile station shall use to determine its TX power level.

Table 12.16 – Power Control Parameters information elements

< Power Control Parameters IE > ::=
< ALPHA : bit (4) >
{ 0 1 <TIMESLOT_TYPE : bit (2) >< GAMMA_TS : bit (5) > } – 1 st timeslot
{ 0 1 <TIMESLOT_TYPE : bit (2) >< GAMMA_TS : bit (5) > } – 2 nd timeslot
...
{ 0 1 <TIMESLOT_TYPE : bit (2) >< GAMMA_TS : bit (5) > }; -- last timeslot (max 64)

Table 12.17 – Power Control Parameters information element details

ALPHA (4 bit field)	
The ALPHA Power control parameter field is coded according to the following table: bit	
<u>4 3 2 1</u>	
0 0 0 0	$\alpha = 0.0$
0 0 0 1	$\alpha = 0.1$
: : :	
1 0 0 1	$\alpha = 0.9$
1 0 1 0	$\alpha = 1.0$
All other values are reserved.	
GAMMA_TS (5 bit field)	
The GAMMA_TS field is the binary representation of the parameter Γ_{CH} for MS output power control in units of 2 dB, see 3GPP TS 45.008. GAMMA_TS contains the gamma value for that timeslot to which the field is associated in the Power Control Parameters IE. The GAMMA_TS field is coded according to the following table:	
bit	
<u>5 4 3 2 1</u>	
0 0 0 0 0	$\Gamma_{CH} = 0$ dB
0 0 0 0 1	$\Gamma_{CH} = 2$ dB
: : : :	
1 1 1 1 0	$\Gamma_{CH} = 60$ dB
1 1 1 1 1	$\Gamma_{CH} = 62$ dB

12.8 Global TFI

The Global TFI (Temporary Flow Identifier) information element contains either an uplink TFI or a downlink TFI. The uplink or downlink TFI identifies a single TBF.

Table 12.18 – Global TFI information elements

<p>< Global TFI IE > ::=</p> <p>{ 0 < UPLINK_TFI : bit (5) ></p> <p> 1 < DOWNLINK_TFI : bit (5) > };</p>

Table 12.19 – Global TFI information element details

<p>UPLINK_TFI (5 bit field)</p> <p>This field identifies an uplink TBF. This field is coded the same as the TFI field defined in subclause 12.10.</p> <p>DOWNLINK_TFI (5 bit field)</p> <p>This field identifies a downlink TBF. This field is coded the same as the TFI field defined in subclause 12.10.</p>
--

12.9 WGPRS_MCS Description

This information element defines the modulation and coding scheme to be used.

Table 12.20 – WGPRS_MCS Description information element details

<u>WGPRS_MCS Description IE Bits</u>	<u>value</u>
4 3 2 1	
0 0 0 0	WMCS-1 short
0 0 0 1	WMCS-2 short
0 0 1 0	WMCS-3 short
0 0 1 1	WMCS-4 short
0 1 0 0	WMCS-1 long
0 1 0 1	WMCS-2 long
0 1 1 0	WMCS-3 long
0 1 1 1	WMCS-4 long

12.10 Temporary Flow Identifier (TFI)

The Temporary Flow Identifier (TFI) uniquely identifies either a single uplink TBF or a single downlink TBF.

Table 12.21 – UPLINK_TFI information element details

<p>UPLINK_TFI (5 bit field) The Temporary Flow Identifier field identifies an uplink TBF. This field is encoded as a binary number. Range 0 to 31</p>
--

Table 12.22 – DOWNLINK_TFI information element details

<p>DOWNLINK_TFI (5 bit field) The Temporary Flow Identifier field identifies a downlink TBF. This field is encoded as a binary number. Range 0 to 31</p>

12.11 Temporary Logical Link Identity (TLLI)

The Temporary Logical Link Identity (TLLI) is associated with the GPRS subscriber. TLLI is defined in 3GPP TS 23.003.

Table 12.23 – TLLI information element details

<p>TLLI (32 bit field) The TLLI field is encoded as a binary number. Range 0 to 4294967295</p>

12.12 Timeslot Allocation IE

The Timeslot Allocation IE field indicates the timeslots for use during a TBF.

Table 12.24 – Timeslot Allocation Information Element details

<p>Timeslot Allocation IE This information field indicates the timeslots assigned for use during the TBF. At least one timeslot must be assigned. Timeslot Allocation IE ::=</p> <pre> { 0 1 <TIMESLOT_TYPE : bit(2)> } – 1st slot { 0 1 <TIMESLOT_TYPE : bit(2)> } – 2nd slot ... { 0 1 <TIMESLOT_TYPE : bit(2)> } -- last slot (max 64 slots) </pre> <p>TIMESLOT_TYPE ::= { 00 -- short slot 01 -- long slot 10 -- reserved 11 -- reserved }</p> <p>The timeslot allocation is a bit map that starts from the beginning of the frame. The first bit refers to the first short slot in the frame. The next bit refers to the next short slot in the frame. And so on. If a bit in the bit map has the value one then the timeslot starting at the beginning of the corresponding short slot is included into the timeslot allocation. If a timeslot is included into the timeslot allocation then the two following bits define the type of the timeslot (long or short slot). In case the timeslot type is short slot then the next bit in the bit map refers to the following short slot. In case the timeslot type is long slot then the next bit refers to the first short slot after the end of the allocated long slot. All timeslots in a timeslot allocation must have same timeslot type. A TBF can consist only either of long slots or of short slots.</p>
--

12.13 Starting Frame Number Description

There are two types of encoding for this IE: Relative Frame Number or Absolute Frame Number.

Table 12.25 – Starting Frame Number Description information element

<pre> < Starting Frame Number Description IE > ::= { 0 < Absolute Frame Number Encoding > 1 < Relative Frame Number Encoding > } ; </pre>

12.13.1 Absolute Frame Number Encoding

In this case, the field is encoded as the 16-bit Starting Time IE defined in 3GPP TS 24.008, and the value of the Starting FN is obtained directly.

12.13.2 Relative Frame Number Encoding

In this case, the field indicates the delay, relative to the first TDMA frame (N) of the RLC/MAC block containing the Starting Time field, before the assigned or requested resource becomes valid. The value of this field is the 13-bit binary representation of the integer k, from which the offset to be applied to

N can be derived.

The value of the Starting Frame Number is:

$$N + 4 + 4k + (k \text{ div} 3), N + 5 + 4k + (k \text{ div} 3) \text{ (note 1) for } (k \text{ modulo } 3) = 0,$$

$$\text{and } (k \text{ modulo } 3) = 1$$

$$0 \leq k \leq 8191$$

$$N + 5 + 4k + (k \text{ div} 3) \text{ for } (k \text{ modulo } 3) = 2$$

Example :

Starting Frame Number Description (13-bit field)		
k = 1	0000000000001	block with first TDMA framenumber = N+8 or N+9
k = 2	0000000000010	block with first TDMA framenumber = N+13
k = 3	0000000000011	block with first TDMA framenumber = N+17 or N+18

NOTE 1: In these cases, only one of the frame numbers $N+4+4k+k\text{div}3$ or $N+5+4k+k\text{div}3$ is valid, because the other corresponds to an idle frame, depending on the position of the block in the multi-frame.

NOTE 2: The value of $(k+1)$ gives the number of relative blocks. The maximum number of relative blocks is therefore 8192; this value was chosen according to the interval of time encoded by the Starting Time IE in 3GPP TS 44.008 (32024 frames).

NOTE 3: The value $(k=0)$ should not be used, so as to leave time for the MS to analyze the message and get ready to receive or transmit.

12.14 TIMESLOT_NUMBER

The TIMESLOT_NUMBER is an 8 bit field that defines a WGPRS uplink or downlink timeslot. The context of the information element in the message determines is the slot for uplink or downlink.

Table 12.26 – TIMESLOT_NUMBER field details.

<p>TIMESLOT_NUMBER ::= <TIMESLOT_TYPE : (2 bit)> <TIMESLOT_START_TIME : (6 bit)></p> <p>TIMESLOT_TYPE (2 bit field that defines the type of the timeslot): This field is encoded as follows:</p> <p>Bit</p> <p><u>2</u> <u>1</u></p> <p>00 Short slot 01 Long slot 10 Reserved 11 Reserved</p> <p>TIMESLOT_START_TIME : A 6 bit field defining the position of the timeslot in the WGPRS frame. This field is encoded as a binary number in the range of 0..63. It defines the starting time of the timeslot in the 4.615 ms frame. For the purpose of timeslot definition the 4.615 ms frame is imagined to be divided into 64 short slots (short slots) numbered 0, 1, ..., 63 starting from the beginning of the frame. Value 0 in this field means that the defined timeslot starts at the beginning of the short slot numbered 0. Value 1 means that it starts at the beginning of the short slot numbered 1. And so on. Value 63 means the timeslot starts from the beginning of the short slot numbered 63. If TIMESLOT_TYPE field indicates a long slot then the slot occupies the length of 4 successive short slots in the frame. For instance value 8 in TIMESLOT_START_TIME field and value 01 in TIMESLOT_TYPE field define a long slot that occupies the imaginary short slots positions numbered 8, 9, 10 and 11 in the frame. See ATIS-0700361 for details of the allowed ways to split a frame into timeslots.</p>

12.15 Extension Bits IE

The *Extension Bits* information element is used to provide a generalized means for possible future extension within a message. This information element is variable length and contains the length indicator and spare bits.

Table 12.27 – Extension Bits Information Element

```

< Extension Bits IE > ::=
< extension length : bit (6) >
< spare bit (val(extension length)+1) > ;

```

13 Timers & Counters

The tables in subclause 13.1 and 13.2 specifies the timers used in RLC/MAC protocol signalling. The denotation of columns is defined as follows:

timer ::= name of the timer;
 started ::= under which conditions the timer is started;
 stopped ::= under which conditions the timer is stopped;
 action at expiry ::= which actions the GPRS entity shall perform at expiry;
 value ::= the duration between setting the timer and expiry of the timer (“s” denotes “second(s)”, “xx - yy” means that any value between xx and yy is permitted).

13.1 Timers on the Mobile Station Side

Table 13.1 – Specification of timers used in GPRS on the Mobile Station side

timer	started	stopped	action at expiry	value
TW3164	On receipt of a PACKET UPLINK ASSIGNMENT	At sending of the first RLC/MAC Block.	See subclause 7.1.5	5 sec
TW3168	At sending the PACKET RESOURCE REQUEST message or Channel Request Description IE in PACKET DOWNLINK ACK/NACK	On receipt of a PACKET UPLINK ASSIGNMENT message	Reinitiate the packet access procedure or retransmit the PACKET RESOURCE REQUEST or PACKET DOWNLINK ACK/NACK	5 sec
TW3170	After having made M + 1 attempts to send a PACKET CHANNEL REQUEST message	On receipt of a PACKET UPLINK ASSIGNMENT	Abort Packet access procedure; the mobile station shall perform an abnormal release with cell reselection (see subclause 9.4.2).	5 sec
TW3172	On receipt of a PACKET ACCESS REJECT message	On receipt of a PACKET UPLINK ASSIGNMENT message	Packet Access in the cell no longer prohibited	5 sec
TW3180	When transmitting an RLC/MAC block to the network	When detecting an assigned USF value on assigned PDCH	Perform Abnormal release with random access procedure	5 sec

timer	started	stopped	action at expiry	value
TW3182	After sending the last data block (with CV = 0), or Upon detecting a transmit window stall condition	On receipt of the PACKET UPLINK ACK/NACK message	Abnormal release with random access	5 sec
TW3184	On receipt of a PACKET UPLINK ACK/NACK message	On receipt of PACKET UPLINK ACK/NACK message (TW3184 is also reset)	Abnormal release with random access	5 sec
TW3188	If a new fixed allocation has been requested, when all data has been sent on the assigned allocation	On receipt of PACKET UPLINK ASSIGNMENT, PACKET UPLINK ACK/NACK message containing a fixed allocation, or PACKET ACCESS REJECT	Resend the last allocation request if it needs more data to complete the TBF	5 sec
TW3190	At reception of a downlink assignment message	Restarted on receipt of data on the resources	Abnormal release with return to PCCH	5 sec
TW3192	At sending the PACKET DOWNLINK ACK/NACK with the Final Ack Indicator=1, or at sending the PACKET CONTROL ACK as a response to final RLC data block in unacknowledged mode.	Restarted at sending the PACKET DOWNLINK ACK/NACK with the Final Ack Indicator=1, or at sending the PACKET CONTROL ACK as a response to final RLC data block in unacknowledged mode. Stopped at the reception of a WGPRS PACKET DOWNLINK ASSIGNMENT or WGPRS PACKET TIMESLOT RECONFIGURE.	Release the resources, stop monitoring the PDCHs, and begin to monitor the paging channel	2.5 sec
TW3198	When transmitting RLC data block	none	Accept negative acknowledgement for RLC data block	see subclause 9.1.3
TW3200	On receipt of an RLC/MAC control block containing a segment of an RLC/MAC control message	On receipt of an RLC/MAC control block containing a segment of an RLC/MAC control message such that the mobile station now has the complete control message	Discard and ignore all segments of the partially received RLC/MAC control message	see subclause 9.1.15

TW3164: Wait for Uplink State Flag After Assignment

This timer is used on the mobile station side to define when to stop waiting for the USF determining the assigned portion of the uplink channel. In multislot operation, it is enough that the assigned USF is noted on one of the uplink PDCHs. This timer is not used when fixed allocations are assigned.

TW3170: Wait for Packet Uplink Assignment after having done (M+1) Packet Channel Requests.

This timer is used on the mobile station side when having made M + 1 attempts to send a Packet Channel Request. At expiry of timer TW3170, the Packet Uplink Assignment procedure is aborted; the mobile station shall perform an abnormal release with cell reselection (see subclause 9.4.2).

- TW3172:** Wait for Packet Uplink Assignment after Packet Access Reject message has been received.
This timer is used on the mobile station side on receipt of a Packet Access Reject message corresponding to one of the mobile station's 3 last Packet Channel Request messages. If TW3172 expires before receiving an assignment message, the mobile station returns to packet idle mode.
After TW3172 expiry packet Access is no longer prohibited in the cell.
- TW3180:** Wait for Uplink State Flag After Data Block
This timer is used on the mobile station side to define when to stop waiting for the USF determining the assigned portion of the uplink channel after the pervious RLC/MAC block is sent. In multislot operation, it is enough that the assigned USF is noted on one of the uplink PDCHs. If expired, the mobile station repeats the procedure for random access. This timer does not apply to fixed allocation transfers.
- TW3182:** Wait for Acknowledgement
This timer is used on the mobile station side to define when to stop waiting for temporary Packet Uplink Ack/Nack after the last RLC data block has been sent for the current send window or for the entire TBF.
- TW3184:** No Ack/Nack Received
This timer is used on the mobile station side to decide when to stop waiting for a Packet Uplink Ack/Nack. (This timer does not apply to mobiles performing a dynamic allocation transfer).
- TW3188:** Allocation Exhausted
This timer is used on the mobile station side to decide when to stop waiting to receive additional resources from the network. (This timer does not apply to a mobile performing a dynamic allocation transfer).
- TW3190:** Wait for Valid Downlink Data Received from the Network
This timer is used on the mobile station side to stop waiting for the valid data from the network side either following the initial WGPRES PACKET DOWNLINK ASSIGNMENT or after some previous downlink RLC/MAC block.
- TW3192:** Wait for release of the TBF after reception of the final block
This timer is used on the mobile station side when the mobile station has received all of the RLC data blocks. When timer TW3192 expires the mobile station shall release the resources associated with the TBF (e.g., TFI) and begin to monitor its paging channel.
- TW3198:** RLC timer
TW3198 is an array of 64 timers used by the mobile station to control when it will accept a negative acknowledgement for an RLC data block.
- TW3200** RLC/MAC control message reassembly guard
TW3200 is used by the mobile station to control when it will discard segments of a partially received RLC/MAC control message. The mobile station shall have one instance of timer TW3200 for each segmented RLC/MAC control message that the mobile station is capable of receiving in parallel.

13.2 Timers on the Network Side

Table 13.2 – Specification of timers used in GPRS on the Network side

timer	started	stopped	action at expiry	typical value
TW3169	If counter NW3101 = NW3101_MAX, or if counter NW3103 = NW3103_MAX	none	The network releases USF and TFI resources.	5 sec
TW3191	When the last RLC data block is sent with the FBI bit set to '1'	When the final PACKET DOWNLINK ACK/NACK or PACKET CONTROL ACKNOWLEDGEMENT is received Restarted at the transmission of an RLC data block with the FBI bit set to '1'.	The network releases TFI resource.	5 sec
TW3193	When the final PACKET DOWNLINK ACK/NACK or PACKET CONTROL ACKNOWLEDGEMENT is received	When the network establishes a new downlink TBF.	The network releases TFI resource	greater than TW3192
TW3195	If counter NW3105 = NW3105_MAX	None	The network releases TFI resources.	5 sec

TW3169: Wait for Reuse of USF and TFI after the mobile station uplink assignment is invalid.

This timer is used on the network side to define when the current uplink assignment is surely invalid on the mobile station side so that the assigned USF(s) and TFI can be reused on the uplink. During that period the corresponding USF(s) is not broadcast. The value for TW3169 is > TW3180. Its value is network dependent.

TW3191: Wait for reuse of TFI after sending of the last RLC Data Block.

This timer is used on the network side to define when the current assignment is surely invalid on the mobile station side so that the TFI can be reused. Its value is network dependent.

TW3193: Wait for reuse of TFI after reception of the final Packet Downlink Ack/Nack from the mobile station.

This timer is used on the network side to define when timer TW3192 on the mobile station side has surely expired so that the TFI can be reused. Its value is network dependent.

TW3195: Wait for reuse of TFI when there is no response from the MS (radio failure or cell change).

This timer is used on the network side to define when the current assignment is surely invalid on the mobile station side so that the TFI can be reused. Its value is network dependent.

13.3 Counters on the Mobile Station Side

NW3102: At each cell reselection the mobile station shall set the counter NW3102 to the value defined by the optional broadcast parameter WPAN_MAX. Whenever the mobile station receives a Packet Ack/Nack that allows the advancement of V(S), the mobile station shall increment NW3102 by

the broadcast value WPAN_INC, however NW3102 shall never exceed the value WPAN_MAX. Each time TW3182 expires the mobile station shall decrement NW3102 by the broadcast value WPAN_DEC. When $NW3102 \leq 0$ is reached, the mobile station shall perform an abnormal release with cell reselection.

NW3104: When the mobile station sends the first RLC/MAC block the counter NW3104 shall be initialized to 1. For each new RLC/MAC block the mobile station sends it shall increment NW3104 by 1 until the first correct PACKET UPLINK ACK/NACK message is received. Then NW3104 shall not be further incremented. If the NW3104 counter is greater than NW3104_MAX and no correct PACKET UPLINK ACK/NACK message has been received, the contention resolution fails and the mobile station behaves as specified in subclause 7.1.2. NW3104_MAX shall have the value: $NW3104_MAX = 3 * BS_CV_MAX * \text{number of uplink timeslots assigned}$.

13.4 Counters on the Network Side

NW3101: When the network after setting USF, receives a valid data block from the mobile station, it will reset counter NW3101. The network will increment counter NW3101 for each USF for which no data is received. NW3101max shall be greater than 8.

NW3103: NW3103 is reset when transmitting the final PACKET UPLINK ACK/NACK message within a TBF (final ack indicator set to 1). If the network does not receive the PACKET CONTROL ACKNOWLEDGEMENT message in the scheduled block, it shall increment counter NW3103 and retransmit the PACKET UPLINK ACK/NACK message. If counter NW3103 exceeds its limit, the network shall start timer TW3169.

NW3105: When the network after sending a RRBP field in the downlink RLC data block, receives a valid RLC/MAC control message from the mobile station, it will reset counter NW3105. The network will increment counter NW3105 for each allocated data block for which no RLC/MAC control message is received. The value of NW3105max is network dependent.

14 Reaction Time Definitions

14.1 Uplink & Downlink Assignment Reaction Times

An MS shall be ready to transmit and receive using a new assignment received on WPACCH no later than the next occurrence of block $B((x+3) \text{ modulo } 12)$ where block $B(x)$ is the last radio block containing the uplink assignment. This applies also for the reception of the first USF for dynamic uplink assignment. If the MS is required to transmit a PACKET CONTROL ACKNOWLEDGEMENT subsequent to a PACKET DOWNLINK ASSIGNMENT, the MS shall be ready to receive on the new assignment no later than the next occurrence of block $B((x+2) \text{ modulo } 12)$ where block $B(x)$ is radio block containing the PACKET CONTROL ACKNOWLEDGEMENT.

14.2 Change in Channel Coding Scheme Commanded By Network

Upon receipt of a command from the network to change the channel coding scheme, the MS shall begin to transmit blocks using the new channel coding scheme no later than the next occurrence of block $B((x+3) \text{ mod } 12)$ where block $B(x)$ is the radio block containing the command.