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Third Generation Satellite Packet Radio Service;
Part 4: Radio interface protocol specifications;
Sub-part 12: Mobile Earth Station (MES) -
Base Station System (BSS) interface;
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Access Control (RLC/MAC) protocol;
GMR-1 3G 44.060**

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The contents of the present document are subject to continuing work within TC-SES and may change following formal TC-SES approval. Should TC-SES modify the contents of the present document it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 3.m.n

where:

- the third digit (n) is incremented when editorial only changes have been incorporated in the specification;
- the second digit (m) is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

The present document is part 4, sub-part 12 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications (Release 3) Third Generation Satellite Packet Radio Service, as identified below:

Part 1: "General specifications";

Part 2: "Service specifications";

Part 3: "Network specifications";

Part 4: "Radio interface protocol specifications":

Sub-part 1: "Mobile Earth Station-Gateway Station System (MES-GSS) Interface; GMR-1 04.001";

Sub-part 2: "GMR-1 Satellite Network Access Reference Configuration; GMR-1 04.002";

Sub-part 3: "Channel Structures and Access Capabilities; GMR-1 04.003";

Sub-part 4: "Layer 1 General Requirements; GMR-1 3G 44.004";

Sub-part 5: "Data Link Layer General Aspects; GMR-1 04.005";

Sub-part 6: "Mobile earth Station-Gateway Station Interface Data Link Layer Specifications; GMR-1 04.006";

Sub-part 7: "Mobile Radio Interface Signalling Layer 3 General Aspects; GMR-1 3G 24.007";

Sub-part 8: "Mobile Radio Interface Layer 3 Specifications; GMR-1 3G 44.008";

Sub-part 9: "Performance Requirements on the Mobile Radio Interface; GMR-1 04.013";

Sub-part 10: "Rate Adaptation on the Access Terminal-Gateway Station Subsystem (MES-GSS) Interface; GMR-1 04.021";

Sub-part 11: "Radio Link Protocol (RLP) for Data Services; GMR-1 04.022";

Sub-part 12: "Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; GMR-1 3G 44.060";

Sub-part 13: "Radio Resource Control (RRC) protocol; Iu Mode; GMR-1 3G 44.118";

Sub-part 14: "Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; Iu Mode; GMR-1 3G 44.160";

Sub-part 15: "Packet Data Convergence Protocol (PDCP) specification; GMR-1 3G 25.323";

Part 5: "Radio interface physical layer specifications";

Part 6: "Speech coding specifications";

Part 7: "Terminal adaptor specifications".

Modal verbs terminology

In the present document "shall", "shall not", "should", "should not", "may", "need not", "will", "will not", "can" and "cannot" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"must" and "must not" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for Mobile Satellite Services (MSS) utilizing geostationary satellite(s). GMR is derived from the terrestrial digital cellular standard GSM and supports access to GSM core networks.

The present document is part of the GMR Release 3 specifications. Release 3 specifications are identified in the title and can also be identified by the version number:

- Release 1 specifications have a GMR 1 prefix in the title and a version number starting with "1" (V1.x.x).
- Release 2 specifications have a GMPRS 1 prefix in the title and a version number starting with "2" (V2.x.x).
- Release 3 specifications have a GMR-1 3G prefix in the title and a version number starting with "3" (V3.x.x).

The GMR release 1 specifications introduce the GEO-Mobile Radio interface specifications for circuit mode Mobile Satellite Services (MSS) utilizing geostationary satellite(s). GMR release 1 is derived from the terrestrial digital cellular standard GSM (phase 2) and it supports access to GSM core networks.

The GMR release 2 specifications add packet mode services to GMR release 1. The GMR release 2 specifications introduce the GEO-Mobile Packet Radio Service (GMPRS). GMPRS is derived from the terrestrial digital cellular standard GPRS (included in GSM Phase 2+) and it supports access to GSM/GPRS core networks.

The GMR release 3 specifications evolve packet mode services of GMR release 2 to 3rd generation UMTS compatible services. The GMR release 3 specifications introduce the GEO-Mobile Radio Third Generation (GMR-1 3G) service. Where applicable, GMR-1 3G is derived from the terrestrial digital cellular standard 3GPP and it supports access to 3GPP core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM or 3GPP standard are necessary. Some GSM and 3GPP specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM and 3GPP specifications do not apply, while some GMR specifications have no corresponding GSM or 3GPP specification.

Since GMR is derived from GSM and 3GPP, the organization of the GMR specifications closely follows that of GSM or 3GPP as appropriate. The GMR numbers have been designed to correspond to the GSM and 3GPP numbering system. All GMR specifications are allocated a unique GMR number. This GMR number has a different prefix for Release 2 and Release 3 specifications as follows:

- Release 1: GMR n xx.zyy
- Release 2: GMPRS n xx.zyy
- Release 3: GMR-1 3G xx.zyy

where:

- xx.0yy ($z = 0$) is used for GMR specifications that have a corresponding GSM or 3GPP specification. In this case, the numbers xx and yy correspond to the GSM or 3GPP numbering scheme.
- xx.2yy ($z = 2$) is used for GMR specifications that do not correspond to a GSM or 3GPP specification. In this case, only the number xx corresponds to the GSM or 3GPP numbering scheme and the number yy is allocated by GMR.
- n denotes the first ($n = 1$) or second ($n = 2$) family of GMR specifications.

A GMR system is defined by the combination of a family of GMR specifications and GSM and 3GPP specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM or 3GPP specification (if any). This precedence rule applies to any references in the corresponding GSM or 3GPP specifications.

NOTE: Any references to GSM or 3GPP specifications within the GMR specifications are not subject to this precedence rule. For example, a GMR specification may contain specific references to the corresponding GSM or 3GPP specification.

- If a GMR specification does not exist, the corresponding GSM or 3GPP specification may or may not apply. The applicability of the GSM or 3GPP specifications is defined in ETSI TS 101 376-1-2 [19].

The clause numbering and the table numbering and figure numbering in the present document are aligned to the corresponding numbering of ETSI TS 101 376-4-12 (Release 2) [25] as far as possible. In several places, this means that the table numbering and figure numbering is non-continuous in the present document in order to maintain this alignment, the following rules apply:

- A table that uses the same table number replaces the corresponding table in ETSI TS 101 376-4-12 (Release 2) [25].
- A table that uses a different table number is a new additional table.

1 Scope

The present document specifies the procedures used at the radio interface (Reference Point Um, see ETSI TS 101 376-4-2 [6]) for the GMR-1 General Packet Radio Service (GMPRS-1) Medium Access Control/Radio Link Control (MAC/RLC) layer.

The present document is applicable to the following GPRS Um functional layers:

- Radio Link Control functions;
- Medium Access Control functions; and
- Physical Link Control functions.

The procedures described in the present document are for the RLC/MAC functions of the GMPRS radio interface (Um) when operating on a Packet Data Channel (PDCH).

The present document provides the overall description for RLC/MAC layer functions of the general Packet Radio Service (GMPRS) radio interface Um. ETSI TS 101 376-3-22 [5] contains an overview of the GPRS radio interface (Um).

ETSI TS 101 376-4-3 [7] and ETSI TS 101 376-4-4 [8] contain the definition of the control channels used in the present document.

ETSI TS 101 376-4-7 [10] contains a description in general terms of the structured functions and procedures of this protocol and the relationship of this protocol with other layers and entities.

ETSI TS 101 376-4-8 [11] contains the definition of GMR-1 3G RLC/MAC procedures when operating on the Common Control Channel (CCCH).

ETSI TS 101 351 [12] contains functional procedures for the Logical Link Control (LLC) layer.

Application to interface structure

The RLC/MAC procedures apply to the interface structures defined in ETSI TS 101 376-4-3 [7]. They use the functions and services provided by layer 1 defined in ETSI TS 101 376-4-4 [8]. ETSI TS 101 376-4-7 [10] gives the general description of layer 3 including procedures, messages format and error handling.

Use of logical control channels

The logical control channels are defined in ETSI TS 101 376-5-2 [13]. Two similar sets of logical channels are defined. The first set consists of the logical channels:

- Broadcast Control Channel (BCCH): downlink only, used to broadcast Cell specific information;
- Paging Channel (PCH): downlink only, used to send page requests to Mobile Earth Stations (MESs);
- Random Access Channel (RACH): uplink only, used to request GPRS resources or a Dedicated Control Channel;
- Access Grant Channel (AGCH): downlink only, used to allocate GPRS resources or a Dedicated Control Channel.

The second set consists of the logical channels:

- Packet Random Access Channel (PRACH): uplink only, used to request GPRS resources;
- Packet Access Grant Channel (PAGCH): downlink only, used to allocate GPRS resources;
- Packet Associated Control Channel (PACCH): bi-directional, associated with a Temporary Block Flow (TBF);
- Packet Timing advance Control Channel Uplink (PTCCH/U): used to transmit Packet Normal bursts to allow estimation of the timing advance for one MES in transfer state;

- Packet Timing advance Control Channel Downlink (PTCCH/D): used to transmit timing advance updates for several MES. One PTCCH/D is paired with several PTCCH/Us.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in Release 7 or to the latest version of that document in the latest release less than 7.

In the case of a reference to a GMR-1 3G document, a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

- [1] ETSI TS 101 376-1-1: "GEO-Mobile Radio Interface Specifications (Release 2) General Packet Radio Service; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms; GMPRS-1 01.004".
- [2] ETSI EN 301 113: "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Service description; Stage 1 (GSM 02.60 Release 1997)".
- [3] ETSI TS 101 376-3-3: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 3: Network specifications; Sub-part 3: Numbering, addressing and identification; GMR-1 3G 23.003".
- [4] ETSI TS 101 376-3-7: "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 7: Discontinuous Reception (DRX); GMR-1 03.013".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- [5] ETSI TS 101 376-3-22: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 3: Network specifications; Sub-part 22: Overall description of the GMPRS radio interface; Stage 2; GMR-1 3G 43.064".
- [6] ETSI TS 101 376-4-2: "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 2: GMR-1 Satellite Network Access Reference Configuration; GMR-1 04.002".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- [7] ETSI TS 101 376-4-3: "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 3: Channel Structures and Access Capabilities; GMR-1 04.003".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- [8] ETSI TS 101 376-4-4: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 4: Layer 1 General Requirements; GMR-1 3G 44.004".

- [9] ETSI TS 101 376-4-5: "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 5: Data Link Layer General Aspects; GMR-1 04.005".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- [10] ETSI TS 101 376-4-7: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 7: Mobile Radio Interface Signalling Layer 3 General Aspects; GMR-1 3G 24.007".

- [11] ETSI TS 101 376-4-8: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications; GMR-1 3G 44.008".

- [12] ETSI TS 101 351: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification (3GPP TS 04.64 Release 1997)".

- [13] ETSI TS 101 376-5-2: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description; GMR-1 3G 45.002".

- [14] ETSI TS 101 376-5-3: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 3: Channel Coding; GMR-1 3G 45.003".

- [15] ETSI TS 101 376-5-6: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control; GMR-1 3G 45.008".

- [16] ETSI TS 101 376-5-7: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 7: Radio Subsystem Synchronization; GMR-1 3G 45.010".

- [17] ETSI TS 101 376-5-5: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception; GMR-1 3G 45.005".

- [18] ETSI TS 101 344: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS) Service description; Stage 2 (3GPP TS 03.60 Release 1997)".

- [19] ETSI TS 101 376-1-2: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 1: General specifications; Sub-part 2: Introduction to the GMR-1 family; GMR-1 3G 41.201".

- [20] ETSI TS 101 376-2-1: "GEO-Mobile Radio Interface Specifications; Part 2: Service specifications; Sub-part 1: Service Accessibility; GMR-1 02.011".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

- [21] ETSI TS 101 376-3-10: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 3: Network specifications; Sub-part 10: Functions related to Mobile Earth Station (MES) in idle mode; GMR-1 3G 43.022".

- [22] ETSI TS 144 060: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol (3GPP TS 44.060 Release 7)".

- [23] ETSI TS 101 376-4-13: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 13: Radio Resource Control (RRC) protocol; Iu Mode; GMR-1 3G 44.118".

- [24] ETSI TS 101 376-4-14: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 14: Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; Iu Mode; GMR-1 3G 44.160".

- [25] ETSI TS 101 376-4-12: "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 12: Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; GMPRS-1 04.060".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TS 124 008: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Mobile radio interface Layer 3 specification; Core network protocols; Stage 3 (3GPP TS 24.008)".
- [i.2] ETSI TS 125 331: "Universal Mobile Telecommunications System (UMTS); Radio Resource Control (RRC); Protocol specification (3GPP TS 25.331)".
- [i.3] ETSI TS 125 133: "Universal Mobile Telecommunications System (UMTS); Requirements for support of radio resource management (FDD) (3GPP TS 25.133)".
- [i.4] ETSI TS 125 123: "Universal Mobile Telecommunications System (UMTS); Requirements for support of radio resource management (TDD) (3GPP TS 25.123)".
- [i.5] Recommendation ITU-T T.4: "Standardization of Group 3 facsimile terminals for document transmission".
- [i.6] ETSI TS 125 101: "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (FDD) (3GPP TS 25.101)".
- [i.7] ETSI TS 125 102: "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (TDD) (3GPP TS 25.102)".
- [i.8] ETSI TS 125 224: "Universal Mobile Telecommunications System (UMTS); Physical layer procedures (TDD) (3GPP TS 25.224)".
- [i.9] ETSI TS 125 223: "Universal Mobile Telecommunications System (UMTS); Spreading and modulation (TDD) (3GPP TS 25.223)".
- [i.10] ETSI TS 145 008: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control (3GPP TS 45.008)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMR-1 3G 41.201 [19], ETSI EN 301 113 [2], ETSI TS 101 344 [18] and the following apply:

4-MAC-Slot: contiguous sequence of 12 timeslots of total duration 20 ms

NOTE: There are two 4-MAC-Slots corresponding to a 40 ms TDMA frame.

A/Gb mode: mode of operation of the MES when connected to the Core Network via GERAN and the A and/or Gb interfaces

D-MAC-Slot: contiguous sequence of six timeslots of total duration 10 ms

NOTE: There are 4 D-MAC-Slots corresponding to a 40 ms TDMA frame.

GMPRS multislot class: refers to the different mobile earth station capabilities to transmit and receive on different combinations of multiple PDCHs

NOTE 1: The multislot classes are defined in ETSI TS 101 376-5-2 [13].

NOTE 2: The mobile earth station may indicate different multislot classes for circuit mode services and for GMPRS (see ETSI TS 101 376-4-8 [11]). Different multislot class mobile earth stations are capable of supporting different medium access modes (see clause 5.2.4 of the present document).

Iu mode: mode of operation of the MES when connected to the Core Network via GERAN or UTRAN and the Iu interface

MAC-dedicated state: MAC-control-entity state where a Dedicated Channel (DCH) is assigned and no PDCH is assigned

NOTE: This state only applies in *Iu mode*.

MAC-DTM state: MAC-control-entity state where at least one DCH and one PDCH are assigned

NOTE: This state only applies in *Iu mode*.

MAC-idle state: MAC-control-entity state where no physical channels are assigned

NOTE: This state only applies in *Iu mode*. This state is equivalent to Packet Idle state of A/Gb mode.

MAC-shared state: MAC-control-entity state where at least one PDCH is assigned

NOTE: This state only applies in *Iu mode*.

MAC-Slot: contiguous sequence of three timeslots of length 5 ms

NOTE: There are 8 MAC-Slots corresponding to a 40 ms TDMA frame.

multiple TBF procedures: mobile earth station that supports multiple TBF procedures can support one or more concurrent TBFs in either direction while in packet transfer mode (A/Gb mode)

NOTE: A network that supports multiple TBF procedures can support one or more concurrent TBFs in either direction for a mobile earth station that supports multiple TBF procedures in packet transfer mode (A/Gb mode).

packet idle mode: in packet idle mode, the mobile earth station is prepared to transfer LLC PDUs on packet data physical channels (see clause 5.3)

NOTE: The mobile earth station is not allocated any radio resource on a packet data physical channel; it listens to the BCCH and the CCCH.

packet transfer mode: in packet transfer mode, the mobile earth station is prepared to transfer LLC PDUs on packet data physical channels (see clause 5.4)

NOTE: The mobile earth station is allocated radio resource on one or more packet data physical channels for the transfer of LLC PDUs.

PDCH carrier: RF frequency, defined by the ARFCN and the frequency plan identifier, and the bandwidth of a PDCH

NOTE: The definition of a PDCH includes both a PDCH carrier and a MAC_Slot allocation.

radio block: one normal burst carrying one RLC/MAC protocol data unit (see ETSI TS 101 376-4-4 [8])

random values: in a number of places in the present document, it is mentioned that some values take a "random" value, in a given range, or more generally with some statistical distribution

NOTE: For such random values refer to ETSI TS 101 376-4-8 [11].

RLC data block: part of a RLC/MAC block carrying user data or upper layers' signalling data

NOTE: See clause 10.2.

RLC/MAC block: protocol data unit exchanged between RLC/MAC entities

NOTE: See clause 10 of the present document and ETSI TS 101 376-4-4 [8].

RLC/MAC control block: part of a RLC/MAC block carrying a control message between RLC/MAC entities

NOTE: See clause 10.3.

RR connection: physical connection established between a mobile earth station and the network to support the upper layers' exchange of information flows

NOTE: An RR connection is maintained and released by the two peer entities.

TBF abort: when TBF is abruptly stopped without using the Release of TBF procedures defined in clause 9 of the present document

TBF release: when the TBF is stopped using one of the Release of TBF procedures defined in clause 9 of the present document

Temporary Block Flow (TBF): in *A/Gb mode*, a TBF is a physical connection used by the two RR peer entities to support the unidirectional transfer of LLC PDUs on packet data physical channels and in *Iu mode*, a TBF is a logical connection offered by two MAC entities to support the unidirectional transfer of RLC PDUs on physical channels

NOTE: See clause 5.2.1 for a more detailed definition of TBF.

Uplink State Flag (USF): used on PDCH channel(s) to allow multiplexing of uplink Radio blocks from different mobile earth stations

NOTE: See clauses 5.2.3 and 10 of the present document and ETSI TS 101 376-5-2 [13].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in GMPRS-1 01.004 [1] and the following apply:

LDPC	Low Density Parity Check
MCS	Modulation and Coding Scheme
PoC	Push-to-talk over Cellular

4 Layered overview of radio interface

4.0 General

The Radio Resource (RR) sublayer provides the functions necessary for:

- Radio Resource (RR) management of packet data physical channels (PDCHs), and
- Radio Link Control and Medium Access Control (RLC/MAC) on packet data physical channels.

As shown in figure 4.1, the RR sublayer provides services to the MM and LLC sublayers. The RR sublayer utilizes the services of the Data Link layer (signalling layer 2) and the Physical Link layer. The packet logical PCCCH, (including PRACH and PAGCH), PACCH and PDTCH, are multiplexed onto the packet data physical channels on a per Mac-slot or D-MAC-slot basis. The packet logical channel PBCCH is not supported in GMR-1.

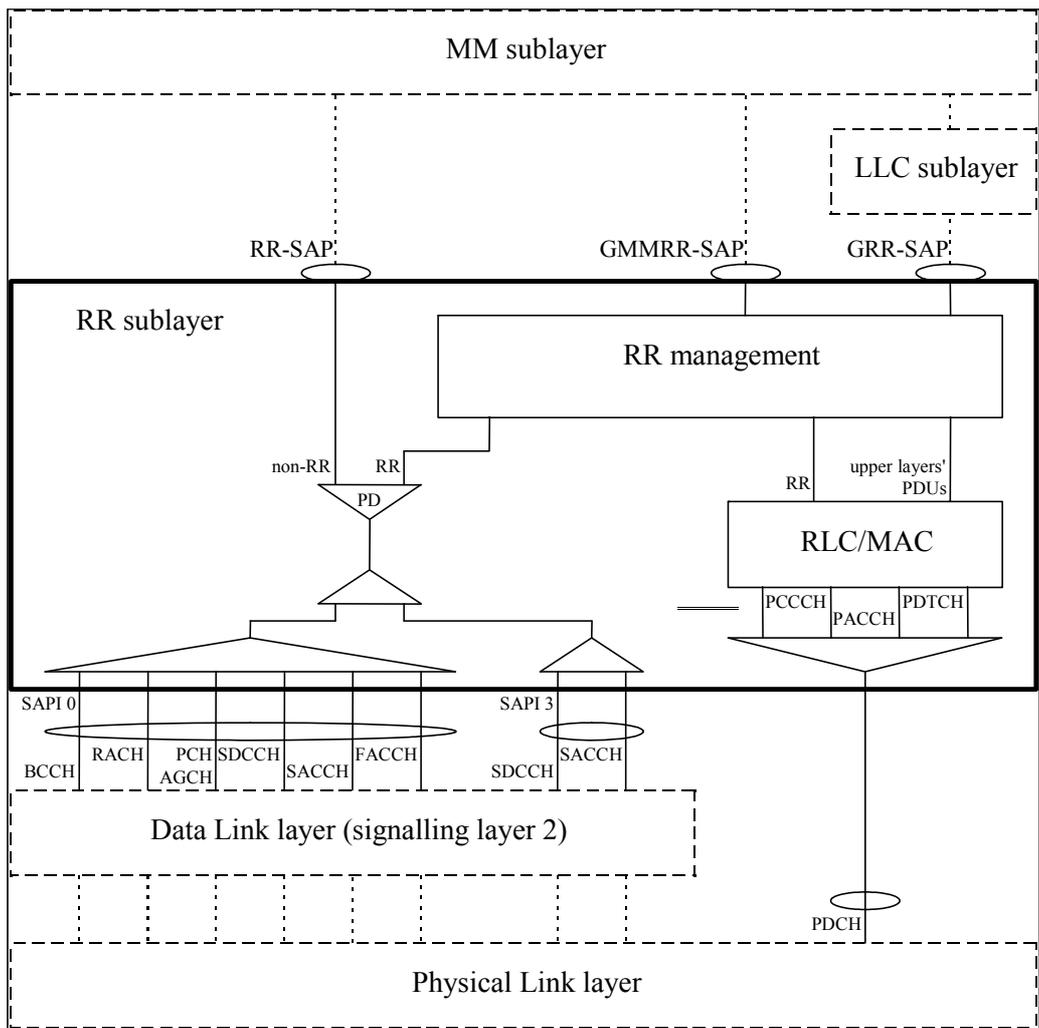


Figure 4.1: Protocol architecture of Radio Resource (RR) sublayer and RLC/MAC function

4.1 Layer services

The RR sublayer provides services for the transfer of upper layer PDUs using a shared medium between multiple mobile earth stations and the network. Direct communication is only possible between the network and one or more mobile earth stations. The RLC/MAC function supports two modes of operation:

- unacknowledged operation, and
- acknowledged operation.

The RR sublayer further provides services for the paging of mobile earth stations and position reporting.

4.2 Layer functions

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

The RLC function also provides procedures for link adaptation and resuming GMPRS services.

The MAC function defines the procedures that enable multiple mobile earth stations to share a common transmission medium, which may consist of several physical channels. The function may allow a mobile earth station to use several physical channels in parallel, i.e. use several MAC-slots or D-MAC slots within the TDMA frame.

For the mobile earth station originating access, the MAC function provides the procedures for the arbitration between multiple mobile earth stations simultaneously attempting to access the shared transmission medium.

For the mobile earth station terminating access, the MAC function provides the procedures for queuing and scheduling of access attempts.

4.3 Service primitives

Information flow between layers is performed by the use of Service Primitives. Service Access Points (SAP) and their corresponding Service Primitives for the RR sublayer are defined in ETSI TS 101 376-4-7 [10].

4.4 Services required from lower layers

The RLC/MAC function uses the services provided by the physical link layer as defined in ETSI TS 101 376-4-4 [8].

The RR sublayer may use the services provided by the data link layer as defined in ETSI TS 101 376-4-5 [9]. Moreover, the RR sublayer directly uses services provided by the physical layer such as BCCH searching, as defined in ETSI TS 101 376-4-4 [8].

5 Introduction to the Medium Access Control (MAC) procedures

5.1 General

The Medium Access Control (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 Medium Access Control (MAC) procedures support the provision of Temporary Block Flows (TBFs) that allow the point-to-point transfer of signalling and user data within a spot beam between the network and a mobile earth station. The MAC procedures also support the provision of MBMS radio bearers that allow the point-to-multipoint transfer of signalling and user data within a cell between the network and one (or more) mobile earth station(s).

Moreover, the Medium Access Control (MAC) procedures include the procedures for reception of BCCH and CCCH, which permits autonomous GPS position based spotbeam reselection performed by the mobile earth station (see ETSI TS 101 376-5-6 [15]).

5.2 Multiplexing principles

5.2.1 Temporary Block Flow (TBF)

A Temporary Block Flow (TBF) is a physical connection used by the two RR entities to support the unidirectional transfer of higher layer PDUs on packet data physical channels.

The TBF is allocated radio resource on one or more PDCHs and comprises a number of RLC/MAC blocks carrying one or more higher layer 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).

The radio resource allocation schemes used on the network side shall take into account the traffic profile (specified in ETSI TS 101 344 [18]). For example, when TBF is meant for carrying traffic with a guaranteed bit rate, the network shall ensure that sufficient radio resources are reserved or prioritized in such a way to meet the MES bit rate requirements.

In A/Gb mode, guaranteed bit rate service requested by MES shall specify the following parameters at the initiation of TBF establishment on CCCH:

- Uplink peak throughput;
- Downlink peak throughput.

If the Uplink peak throughput is non-zero, it indicates the uplink stream service, otherwise it is uplink best effort. If the Downlink peak throughput is non-zero, it indicates the downlink stream service, otherwise it is downlink best effort.

In Iu-mode, for the case where a mobile earth station supports multiple TBF procedures the maximum number of TBFs it can support concurrently is not specified. Mobile station implementations are expected to ensure that the mobile earth station can support a sufficient number of TBFs to operate all the PDP contexts it has activated. As such, a mobile earth station may choose to release, modify or activate one or more PDP contexts when prioritizing the services it wants to operate concurrently. The network is not required to consider any potential complexity limitations regarding the number of concurrent TBFs when establishing an uplink or downlink TBF for a mobile earth station that supports multiple TBF procedures.

The following messages are used only if both the MES and network support multiple TBF procedures:

- MULTIPLE TBF UPLINK ASSIGNMENT.
- MULTIPLE TBF DOWNLINK ASSIGNMENT.
- MULTIPLE TBF TIMESLOT RECONFIGURE.

5.2.2 Temporary Flow Identity (TFI)

Each TBF is assigned a Temporary Flow Identity (TFI) by the network. The mobile earth 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 and in case of an RLC data block, the direction (uplink or downlink) in which the RLC data block is sent. In a case where there is an RLC/MAC control message, the TBF is identified by the direction in which the RLC/MAC control message is sent and the message type is identified.

Global_TFI is used to unambiguously identify the mobile earth station during packet transfer mode in an uplink or downlink RLC/MAC control message. However, if the TFI belongs to an RB for which the MES initiated RAB Binding Request to add Multicast Binding (see ETSI TS 101 376-4-13 [23]), it shall not be used as a Global TFI to identify the mobile earth station neither in downlink nor uplink RLC/MAC control messages. If present, the Global TFI addresses the MES using either the uplink TFI or downlink TFI of the MES. Which TFI is used is at the discretion of the sender except where explicitly defined by procedure.

5.2.3 Uplink state flag

An Uplink State Flag (USF) is included in the PUI of each radio block on a downlink PDCH, as specified in clause 10. Multiple USF values may also be included in ULMAP to allocate multiple uplink transmission spanning in frequency and time as specified in clause 10. It may be used by the network to control the multiplexing of different mobile earth stations on uplink PDCH. The use of USF is further specified in ETSI TS 101 376-5-2 [13].

5.2.4 Medium access modes

The dynamic allocation medium access mode is supported for uplink TBFs. The mobile earth station monitors its assigned downlink PDCHs for an assigned USF value indicating that it is allowed to transmit on the corresponding uplink PDCH (see clause 8.1.1.1). The dynamic allocation mode shall be supported in all mobile earth stations.

The network shall ensure that the medium access mode and the resource allocation used for a MES are compatible with the multislot class of the MES multislot class is defined in ETSI TS 101 376-5-2 [13]). When dynamic allocation medium access mode is used for half duplex MESs, the network shall ensure the following:

- USF allocation or downlink RLC/MAC blocks meant for the MES are not sent when the MES is transmitting (see below);
- MES is not allocated a transmission opportunity that coincides with the MES's PTCCH/D reception time interval.

The network may transmit a USF to a half-duplex MES in the downlink if it determines that the MES's scheduled transmission in the uplink is at least RX/TX switching time after the MES receives the downlink burst header as specified in ETSI TS 101 376-5-2 [13]. Consequently, the MES shall be capable of decoding the burst header to determine if its USF is present in the PUI portion of the burst header or in the ULMAP when present.

An uplink PDCH with fixed allocation may also be assigned to the MES, which is given during flow establishment using Packet TBF Assignment message or through RRC procedure. The assignment indicates the PDCH channel type, the MAC slot, and the carrier to be used by the MES. The assignment is valid every frame for the assigned flow until the release of the TBF.

5.2.4a Multiplexing of GMPRS and future MESs

The GMPRS and future MESs can be multiplexed dynamically on the same PDCH by utilizing the USF and MCS bits in PUI. When uplink resources are allocated to a GMPRS MES, the network shall code the PUI using the defined mechanism and format and the USF shall point to the next uplink Mac-slot, D-MAC-slot or 4-MAC-slot. (see ETSI TS 101 376-5-7 [16]).

For MES synchronization, the first part of every downlink burst contains a unique word sequence modulated using $\Pi/4$ CQPSK; refer to ETSI TS 101 376-5-2 [13].

5.3 Packet idle mode

In packet idle mode, no temporary block flow exists.

The mobile earth station monitors the relevant paging subchannels on CCCH. The upper layer may require the transfer of an upper layer PDU, which implicitly triggers the establishment of a TBF and the transition to packet transfer mode.

5.4 Packet transfer mode

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

- Transfer of upper layer PDUs in RLC acknowledged mode.
- Transfer of upper layer PDUs in RLC unacknowledged mode.

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

A GMPRS class-B MES may leave both the packet idle mode and packet transfer mode before entering dedicated mode.

5.5 General procedures in packet idle and packet transfer modes

5.5.1 Mobile earth station side

5.5.1.0 General

The mobile earth station in packet idle mode shall monitor the system information broadcast in the spotbeam. The mobile earth station shall monitor the transmission on CCCH, as defined in clause 5.5.1.3. The determination of the paging group for the mobile earth station is defined in ETSI TS 101 376-5-2 [13].

5.5.1.1 Cell reselection

Spotbeam reselection procedure shall be as defined in ETSI TS 101 376-5-6 [15].

5.5.1.1a Network Assisted Cell Change

5.5.1.1a.0 General

The mobile earth station shall support the Network Assisted Cell Change procedures. The Network Assisted Cell Change consists of procedures that can assist a mobile earth station in packet transfer mode or MAC-Shared state with neighbour cell system information for a neighbouring cell required for initial packet access after a cell change.

5.5.1.1a.1 Neighbour Cell System Information Distribution

The network may send neighbour cell system information to a mobile earth station in packet transfer mode or MAC-Shared state. A mobile earth station, which receives this information, shall store the information for 30 seconds and during that period the information can be used for initial access in the neighbour cell (see clause 8.8.1).

5.5.1.1a.2 CCN Mode

CCN Mode is not supported in this version of GMR-1 3G 44.060.

5.5.1.2 System Information (SI) on PBCCH

System information on PBCCH is not supported in GMR-1.

5.5.1.3 System Information (SI) on BCCH

5.5.1.3.0 General

The mobile earth station shall receive the System Information (SI) messages broadcast on BCCH.

The mobile earth station shall perform a *complete acquisition* of BCCH messages (see clause 5.5.1.4). The mobile earth station shall not perform packet access in the selected spotbeam, or enter the packet transfer mode, until it has:

- acquired the Packet Control Channel Definition IE and Packet Spotbeam Specific Parameters IE in the Segment 3;
- acquired the RACH/PRACH control parameters in Segment 2 from the System Information.

5.5.1.3.1 Supervision of BCCH_CHANGE_MARK and update of BCCH information

The mobile earth station shall follow the change information rules specified in ETSI TS 101 376-4-8 [11].

5.5.1.3.2 GPRS SI reception failure

Failure to receive GPRS SI is described in ETSI TS 101 376-5-6 [15].

5.5.1.4 Acquisition of system information on the broadcast channel

5.5.1.4.0 General

System information shall be acquired on BCCH when the mobile earth station is in packet idle mode only and shall be as specified in ETSI TS 101 376-4-8 [11].

5.5.1.4.1 Suspension of operation to receive system information

This clause is not applicable for GMR-1.

5.5.1.4.2 Request for acquisition of system information

This clause is not applicable for GMR-1.

5.5.1.5 Discontinuous reception (DRX)

A mobile earth station in packet idle mode shall listen to the transmission on CCCH as defined in ETSI TS 101 376-5-2 [13].

The mobile earth station shall treat the value of the NON_DRX_TIMER field as zero. It shall immediately enter the DRX mode period when it has entered the packet idle mode and may start using DRX on CCCH.

The mobile earth station shall enter a non-DRX mode period under the following cases:

- When initiating the MM procedures for *GPRS attach* and *routing area update* defined in ETSI TS 124 008 [i.1], the mobile earth station shall enter the MM non-DRX mode period. This period ends when either of the messages GPRS ATTACH ACCEPT, GPRS ATTACH REJECT, ROUTING AREA UPDATE ACCEPT or ROUTING AREA UPDATE REJECT is received by the mobile earth station. This period also ends after timeout when waiting for any of these messages.

5.5.1.6 Page mode procedures on PCCCH

This clause is not used.

5.5.1.7 Frequency parameters

Frequency parameters are included in the assignment messages (i.e. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, PACKET UPLINK ASSIGNMENT) and define the radio frequency channels the mobile earth station is to use during the assigned TBF. The first assignment message sent to the mobile earth station when it enters packet transfer mode shall include the frequency parameters. Subsequent assignment messages, sent to the mobile earth station during packet transfer mode, may omit the frequency parameters. If a mobile earth station receives a subsequent assignment message during packet transfer mode without the frequency parameters, the mobile earth station shall continue to use the previously assigned frequency parameters.

The Frequency Parameters information element is defined in clauses 12.8 and 12.8a. The frequency parameters shall consist of an ARFCN and a bandwidth information for the downlink, bandwidth information for the uplink and an indication of the uplink ARFCN as a differential encoding of the downlink ARFCN. Also refer to ETSI TS 101 376-5-5 [17]. The frequency information that the mobile earth station has stored while camping on a spotbeam shall be deleted when the mobile earth station selects a new spotbeam.

5.5.2 Network side

5.5.2.1 System Information broadcasting

5.5.2.1.1 System information on PBCCH

System information on PBCCH is not supported in GMR-1.

5.5.2.1.2 System information on BCCH

The GMPRS system information messages are regularly broadcast by the network on the BCCH to support packet services. Based on this information, the GMPRS mobile earth station is able to decide whether and how it gains access to the system via the current spotbeam (see ETSI TS 101 376-4-8 [11]).

5.5.2.1.3 System information on PACCH (and other logical channels)

System information on PACCH (and other logical channels) is not supported in GMR-1.

5.5.2.1.4 Consistent sets of system information messages

Refer ETSI TS 101 376-4-8 [11].

5.5.2.2 Paging

Paging using PCCCH is not supported in GMR-1.

5.6 Measurement reports

5.6.0 General

The network may request measurement reports from the MS. The measurement reporting principles are specified in ETSI TS 101 376-5-6 [15]. The measurement reports consist of:

- Network Control (NC) measurement reports sent when the MES is in *A/Gb mode* and GMM Ready state (see ETSI TS 124 008 [i.1]) or the MES is in *Iu mode* and in RRC-Cell_Shared state; this may be performed with the PACKET MEASUREMENT REPORT message.

5.6.1 Network Control (NC) measurement reporting

Network Control (NC) measurement reporting is applicable only when the mobile earth station is in packet transfer mode (*A/Gb mode*) or MAC-Shared state (*Iu Mode*). Measurement reporting may require determination of MES's GPS position or measurement of 3G neighbouring cells.

The network shall request for measurements from the MES by transmitting a PACKET MEASUREMENT ORDER message and start timer $T_{MAC-M-ORD}$. The PACKET MEASUREMENT ORDER message shall include *Request Reference IE* and an indication if measurement of GPS position or measurement of 3G neighbour cell is required.

On receipt of a valid PACKET MEASUREMENT ORDER, the MES shall use the *Request Reference IE* in PACKET MEASUREMENT ORDER to determine if this is a new measurement order or retransmission of previous measurement order.

If PACKET MEASUREMENT ORDER is a new measurement order (i.e. there is no stored measurements or the *Request Reference IE* does not match the stored value) then the MES shall start timer $T_{MAC-M-REP}$ and start the measurement procedure. On successful completion of measurements the MES shall stop timer $T_{MAC-M-REP}$, store the current measurements along with the current *Request Reference IE*, overwriting any previous measurements and previous *Request Reference IE*, and then transmit PACKET MEASUREMENT REPORT message with new measurement results.

If PACKET MEASUREMENT ORDER is a retransmission of a previous measurement order (i.e. *Request Reference IE* matches stored measurements), then the MES shall immediately transmit a PACKET MEASUREMENT REPORT with stored measurement results.

If PACKET MEASUREMENT ORDER received from the network is invalid or if any error conditions prevent the MES from starting the measurement process, the MES shall ignore the PACKET MEASUREMENT ORDER message.

On receipt of PACKET MEASUREMENT REPORT with a matching *Request Reference IE*, the network shall stop the timer $T_{MAC-M-ORD}$ and process the measurement results. The network shall ignore PACKET MEASUREMENT REPORT with *Request Reference IE* that does not match an outstanding measurement order.

If the timer $T_{MAC-M-ORD}$ expires on the network side, the network may retransmit the PACKET MEASUREMENT ORDER with the same Request Id IE. The number of retransmission attempt is network implementation dependent.

If the timer $T_{MAC-M-REP}$ expires on the MES side, the MES shall abandon measurement procedure.

5.6.2 Void

5.6.3 Additional measurement and reporting parameters

5.6.3.0 General

Some parameters from the PACKET MEASUREMENT ORDER, PACKET CELL CHANGE ORDER messages allow to build GPRS 3G Measurement Parameters and neighbour cell lists which are used for Network Control (NC) measurement reporting.

5.6.3.1 Deriving the 3G Neighbour Cell list from the 3G Neighbour Cell description

The 3G Neighbour cell list may be supplied by a PACKET CELL CHANGE ORDER message or by one or more instances of the PACKET MEASUREMENT ORDER message.

The 3G Neighbour Cell list may contain up to 96 3G Neighbour Cells and/or UTRAN frequencies for RSSI reporting.

Each *3G Neighbour Cell Description* received is added to the 3G Neighbour Cell list, starting with the index equal to the parameter *Index_Start_3G*. If this parameter is not present then the value 0 shall be used.

For each 3G Neighbour Cell Description received, the cells/UTRAN frequencies are indexed in the following order:

- 1) UTRAN FDD cells/UTRAN FDD frequencies: FDD UARFCNs are indexed in the order of occurrence in the 3G Neighbour Cell description. For each FDD UARFCN indicating UTRAN FDD cells, the cells are indexed in the order of increasing values of the decoded FDD_CELL_INFORMATION parameters.
- 2) UTRAN TDD cells/UTRAN TDD frequencies: TDD UARFCNs are indexed in the order of occurrence in the 3G Neighbour Cell description. For each TDD UARFCN indicating UTRAN TDD cells, the cells are indexed in the order of increasing values of the decoded TDD_CELL_INFORMATION parameters.

If more than one cell/UTRAN frequency with the same index in the 3G Neighbour Cell list are provided by different instances of 3G Neighbour Cell descriptions, the cell/UTRAN frequency from the message instance with the highest index shall be used. In case the same 3G Cell/UTRAN frequency occurs more than once in the resulting 3G Neighbour Cell list, each occurrence shall be assigned an index but only the cell/UTRAN frequency with the highest index in the 3G Neighbour Cell list shall be referred to in measurement reports.

The *3G Neighbour Cell Description* may contain information on 3G Neighbour Cells/UTRAN frequencies to be removed (*REMOVED_3GCELL_Description*). The cells/UTRAN frequencies to be removed are identified by their indices in the 3G Neighbour Cell list. Removed cells/UTRAN frequencies shall keep their indices but no measurement shall be performed. If the index is higher than 95 or points to a 3G cell/UTRAN frequency that does not exist, this shall not be considered as an error.

If a 3G Neighbour Cell Description includes non-supported frequencies or Radio Access Technologies or if the same cell/UTRAN frequency occurs more than once, this shall not be considered as an error; indices in the 3G neighbour Cell list shall be incremented accordingly. If a cell/UTRAN frequency is provided for an index higher than 95 in the 3G Neighbour Cell list, this shall not be considered as an error; the cell/UTRAN frequency shall not be included in the 3G Neighbour Cell list.

The MES behaviour is not specified if the number of 3G frequencies or cells exceeds the MES monitoring capabilities as defined in ETSI TS 101 376-5-6 [15].

5.6.3.2 Deriving BA(GPRS) and the GSM Neighbour Cell list

Not used in GMR-1 3G.

5.6.3.3 Deriving the Neighbour Cell list from the GSM Neighbour Cell list and the 3G Neighbour Cell list

Not used in GMR-1 3G.

5.6.3.4 GPRS Real Time Differences

Not used in GMR-1 3G.

5.6.3.5 GPRS Report Priority Descriptions

Not used in GMR-1 3G.

5.6.3.6 GPRS Measurement Parameters and GPRS 3G Measurement Parameters

Not used in GMR-1 3G.

5.6.3.7 The GPRS 3G Cell Reselection list

Not used in GMR-1 3G.

6 Paging procedures (A/Gb mode only)

6.0 General

For a mobile earth station in packet idle mode, the network may initiate the establishment of RR connection on a downlink packet transfer by the paging procedures. The paging procedure for MESs in packet idle mode can only be initiated by the network on a paging subchannel on CCCH. A number of mobile earth stations can be paged for downlink packet transfer by packing several paging information elements in a single Paging Message. Refer to ETSI TS 101 376-4-8 [11].

Paging procedures for downlink packet transfer are described in clause 6.2.

6.1 Paging procedure for RR connection establishment

6.1.0 General

The network may initiate the establishment of an RR connection by the paging procedure for RR connection establishment.

For mobile earth stations in packet idle mode, the network initiates the paging procedure to trigger an RR connection establishment by broadcasting a paging request message on the appropriate paging subchannel on CCCH. The paging subchannels on CCCH are specified in ETSI TS 101 376-5-2 [13].

The network may also send paging related information on PACCH to a mobile earth station in GMPRS class B mode of operation when such mobile earth station is in packet transfer mode.

If the mobile earth station in GMPRS class B mode of operation is in packet transfer mode then the MES is not required to decode the CS paging subchannels on CCCH.

6.1.1 Paging initiation using paging subchannel on CCCH

The paging initiation procedure and the paging request messages used on CCCH are specified in ETSI TS 101 376-4-8 [11].

6.1.2 Paging initiation using paging subchannel on PCCCH

Paging using paging subchannel on PCCCH is not supported in GMR-1.

6.1.3 Paging initiation using PACCH

Paging initiation using PACCH shall apply to a mobile earth station in class B mode of operation when such mobile earth station is in packet transfer mode and when the network operates according to mode I (see ETSI TS 101 376-4-8 [11]). Paging initiation using PACCH may also apply in network mode of operation II or III (see ETSI TS 101 376-4-8 [11]). In all these cases, the network shall send the PACKET PAGING REQUEST message to the mobile earth station on the appropriate PACCH. The message includes the mobile earth station identification and the channel needed field which defines how MESs of different capabilities shall code the establishment cause field in the CHANNEL REQUEST TYPE 2 message as specified in ETSI TS 101 376-4-8 [11].

6.1.4 Paging response

Upon receipt of a Paging Request or Packet Paging Request message, the purpose of which is to trigger the establishment of an RR connection, a mobile earth station operating in class B mode of operation and in packet transfer mode shall either ignore or answer the paging message according to ETSI EN 301 113 [2].

When responding to a paging message the purpose of which is to trigger the establishment of an RR connection, the mobile earth station, whatever its MES class mode of operation, shall follow the paging response procedures as specified in ETSI TS 101 376-4-8 [11]. Additionally, a mobile earth station operating in class B mode of operation shall abort the current GMPRS data transfer(s) if it was in packet transfer mode and suspend any GMPRS activity until returning to idle mode (see ETSI TS 101 376-4-8 [11]).

6.2 Paging procedure for downlink packet transfer

6.2.0 General

The network may initiate the packet paging procedure in order to obtain the mobile earth station spotbeam location required for downlink packet transfer. The packet paging procedure can only be initiated by the network. The procedure is initiated by broadcasting PAGING REQUEST message on the appropriate paging subchannel on CCCH. The paging subchannels on CCCH are specified in ETSI TS 101 376-5-2 [13] and ETSI TS 101 376-3-7 [4].

Packet paging using the paging subchannel on CCCH applies to a mobile earth station that is not in packet transfer mode.

6.2.1 Paging procedure using paging subchannel on CCCH

The packet paging procedure and the paging request messages used on CCCH are specified in ETSI TS 101 376-4-8 [11].

6.2.2 Paging using paging subchannel on PCCCH

Paging using paging subchannel on PCCCH is not supported in GMR-1.

6.2.3 Paging response to a page on CCCH

Whenever the MM sublayer in the mobile earth station indicates an LLC PDU in response to a PAGE REQUEST, the mobile earth station shall initiate the uplink TBF using a CHANNEL REQUEST on RACH or PACKET CHANNEL REQUEST on PRACH. The decision to use a RACH or PRACH depends on the timing synchronization of the mobile earth station in packet idle mode. Refer to ETSI TS 101 376-5-7 [16].

NOTE: The mobile earth station initiates an implicit packet paging response by sending an upper layer PDU to the network as defined in ETSI TS 101 351 [12] and ETSI TS 101 376-4-8 [11].

7 Medium Access Control (MAC) procedures on PCCCH

7.0 General

The establishment of a Temporary Block Flow (TBF) can be initiated by either the mobile earth station or the network.

A mobile earth station-initiated TBF establishment shall begin with a normal random access burst on CCCH as described in ETSI TS 101 376-4-8 [11] or use of a packet access burst (PAB) on the PCCCH. The mobile earth station shall attempt packet access burst on PCCCH as specified in this clause if it meets the timing synchronization requirements as specified in ETSI TS 101 376-5-2 [13] since the last timing correction received from the network. Under all other conditions the MES shall use a normal random access burst on the CCCH.

The network shall maintain a traffic profile for a guaranteed bit rate service for the TLLI sent by the MES. The traffic profile shall be created (or updated) only when the MES requests for TBF establishment using random access procedure on CCCH. Subsequent TBF establishment on PCCCH or downlink TBF establishment shall use the information in the traffic profile for allocation resources to the TBF.

On detecting the assignment of a new TLLI or if specifically instructed by the upper layers, the MES shall immediately terminate the existing uplink TBF, if present, using the ITR bit as defined in clauses 9.3.3.3 or 9.3.2.4. The MES shall then transfer the uplink PDU only after a new uplink TBF is established using the CCCH as described in clause 7.1.4.

Network initiated TBF establishment shall begin with a paging request or an IMMEDIATE ASSIGNMENT TYPE 3 on CCCH to the MES as specified in clause 6 and ETSI TS 101 376-4-8 [11].

7.0a Support of multiple TBF procedures

If both the network and the mobile earth station support multiple TBF procedures, and if more than one request is received from upper layers to transfer upper layer PDUs for more than one PFC before the packet access procedure can be initiated by the mobile earth station, then the mobile earth station may initiate a packet access procedure requesting multiple TBFs.

During multiple TBF procedures in clause 7:

- The mobile earth station may send the PACKET RESOURCE REQUEST message on an existing TBF to request multiple uplink TBFs.
- The network shall support the PACKET UPLINK ASSIGNMENT message to assign a single uplink TBF.
- The network may send the MULTIPLE TBF UPLINK ASSIGNMENT message to assign one or more uplink TBFs to a mobile earth station that requested multiple TBFs in the PACKET RESOURCE REQUEST message. In this clause this message shall only be sent in response to a multiple uplink resource request.

7.1 TBF establishment initiated by the mobile earth station on PCCCH

7.1.0 General

The purpose of the packet access procedure is to establish a TBF to support the transfer of LLC PDUs in the direction from the mobile earth station to the network. Packet access shall be done on PCCCH using PAB, as defined in this clause, if a PCCCH exists, i.e. if the PRACH is available and are specified in the BCCH. Otherwise, packet access shall be done on CCCH, as defined in ETSI TS 101 376-4-8 [11]. The packet access on PCCCH shall be done using one phase access (see clause 7.1.2).

The packet access procedure is initiated by the mobile earth station. Initiation is triggered by a request from upper layers to transfer a LLC PDU. The request from upper layers specifies throughput, RLC mode and a Radio Priority to be associated with the packet transfer or indicates that the packet to be transferred contains signalling.

Upon such a request:

- if access to the network is allowed (see clause 7.1.1), the mobile earth station shall initiate the packet access procedure as defined in clause 7.1.2.1;
- otherwise, the RR sublayer in the mobile earth station shall reject the request.

If the request from upper layers indicates signalling, the highest Radio Priority shall be used at determination if access to the network is allowed, and the acknowledged RLC mode shall be used.

7.1.1 Permission to access the network

The network broadcasts on BCCH, the list of authorized access classes and authorized special access classes in the Access Classes parameter. Access to the network is allowed if the mobile earth station is a member of at least one authorized access class or special access class as defined in ETSI TS 101 376-2-1 [20].

The network also broadcasts on BCCH a CELL_BAR_ACCESS bit, a CELL_BAR_ACCESS_EXTENTION bit and a CELL_BAR_ACCESS_EXTENTION2 bit as defined in ETSI TS 101 376-4-8 [11]. If the value of these three bits are not specified per ETSI TS 101 376-3-10 [21] and annex C of ETSI TS 101 376-5-2 [13], the mobile earth station is not allowed to transmit a PRACH/RACH on that network for the purpose of initiating a packet session of any kind.

7.1.2 Initiation of a TBF establishment

7.1.2.1 Initiation of the packet access procedure

7.1.2.1.0 General

If the mobile earth station is in packet idle mode, the mobile earth station shall initiate the packet access procedure by scheduling the sending of PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages on the PRACH and simultaneously leaving the packet idle mode. If there are multiple PDCH-Carriers within the spotbeam carrying PRACH, the mobile earth station shall select the last PDCH-Carrier it used successfully to complete a TBF, if it is still available. If that particular PDCH-Carrier is not available or does not carry PCCCH any more, the mobile earth station shall perform TBF establishment using CCCH as described in clause 7.1.4. If the mobile earth station is in packet transfer mode, the mobile earth station shall use the PDCH-Carrier associated with the downlink TBF for PRACH transmission. The PDCH-Carriers which carry PCCCH i.e. PRACH and PAGCH are transmitted on the system information. If the PRACH_OVERLAY variable in the BCCH system information is set to a value greater than 0, this means that multiple overlaid PRACH Channels are supported by the network. PRACH overlay is defined in ETSI TS 101 376-4-8 [11].

For a PDCH(4,3), PDCH(5,3) or a PDCH(5,12) (see ETSI TS 101 376-5-2 [13]), the mobile earth station shall monitor all downlink MAC slots for PRACH MAC slots (i.e. USF = FREE). The mobile earth station shall select a PRACH MAC slot within a frame for PRACH access. When multiple PRACH MAC slots appear within a frame, each PRACH MAC slot shall have equal probability of selection. The mobile earth station shall then select one of the overlaid PRACH channels available in the selected PRACH MAC slot for PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 transmission. The mobile earth station shall monitor all downlink MAC slots for a response from the network. When the mobile earth station receives the PERSISTENCE_LEVEL parameter, the value of the PERSISTENCE_LEVEL parameter shall be taken into account at the next following PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 attempt.

For a PDCH(2,6) (see ETSI TS 101 376-5-2 [13]) the mobile earth station can transmit on the PRACH channel in two ways which are as follows:

- a) The MES monitors the downlink for USF = FREE on D-MAC slots 0, 1, 2, 3 and then transmits by selecting randomly one of the two MAC slots on the corresponding uplink.
- b) It transmits on the assigned ARFCN and MAC slots which are communicated to the MES through the BCCH as defined in ETSI TS 101 376-4-8 [11].

For PDCH3, when multiple PRACH MAC slots are signalled in PUI and/or the ULMAP, each PRACH MAC slot shall have equal probability of selection.

A mobile earth station in class B mode of operation shall respond to a PACKET PAGING REQUEST message indicating an RR connection establishment. A MES in class B mode of operation may abort the packet access procedure at the receipt of a PACKET PAGING REQUEST message indicating an establishment of an RR connection. PACKET PAGING REQUEST messages indicating a non-RR connection shall be ignored.

Mobile earth stations in class C mode of operation shall ignore any type of PACKET PAGING REQUEST message.

For the first PRACH attempt, the Rid field shall be set to zero. It shall subsequently be incremented for each PRACH attempt, modulo 4.

The PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages are sent on PRACH and contain an indication of the type of access, the TLLI or S-RNTI to identify the MES, and parameters indicating the mobile earth station demand for radio resource.

In the PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message the mobile earth station shall optionally declare the current number of RLC blocks required to be transmitted in the access request. The number of RLC blocks shall be calculated assuming the most conservative coding and modulation for the shortest PDCH duration burst type in the uplink direction (refer to table 7.1.2.1.0.1). The mobile earth station shall also declare the radio-priority and throughput class in the Packet Channel Request. If the purpose of the packet access procedure is for a Mobility Management procedure, the mobile earth station shall indicate this in the PACKET CHANNEL REQUEST message.

Table 7.1.2.1.0.1: MCS value and burst type used to calculate initial RLC blocks

Terminal type	MCS for PDCH (binary)	PDCH burst type
A	0000	PDCH(4,3)/PDCH(5,3)
C	000	PDCH(1,6)
D	0011	PDCH(5,3)
E and above	0000	PDCH3(m,3)
E and above	000	PDCH3(m,6)

If a PACKET DOWNLINK ASSIGNMENT or PACKET DOWNLINK ASSIGNMENT TYPE 2 is received by the MES during the packet access procedure, the MES shall act upon it immediately while continuing the packet access procedure as described in clause 7.2.1.1.

7.1.2.1.1 Access persistence control on PRACH

The mobile earth station shall make maximally $M + 1$ attempts to send a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message; in case of a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 with cause code "Initial Correction", only one attempt shall be made. If the access cause is "one phase access request", then during each re-transmission attempt of the PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message, the mobile earth station may optionally update one or more of the following fields - number of blocks, radio priority, peak throughput class, RLC mode and LLC Type. If the radio priority changes, then PRACH control parameters applicable for this radio priority shall be applicable. However the Rid field shall be modified as specified in clause 7.1.2.1. After sending each PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message, the mobile earth station shall listen to all PCCCHs on the corresponding downlink carrier (i.e. carried by the same PDCH).

The PRACH Control Parameters IE contains the access persistence control parameters and shall be broadcast on BCCH. The parameters included in the PRACH Control Parameters IE are:

- MAX_RETRANS, for each radio priority I (I = 1, 2, 3, 4);
- PERSISTENCE_LEVEL, which consists of the PERSISTENCE_LEVEL P(I) for each radio priority I (I = 1, 2, 3, 4); where $P(I) \in \{0, 1, \dots, 14, 16\}$. If the PRACH Control Parameters IE does not contain the PERSISTENCE_LEVEL parameter or they contain the Reduced Persistence Level parameters, this shall be interpreted as if $P(I) = 0$ for all radio priorities;
- S;
- TX_INT.

The mobile earth station shall monitor for the USF flags on all PDCHs of any PCCCH identified in the BCCH for possible PRACH usage if set to FREE.

The mobile earth station shall start timer T3186 at the beginning of the Packet Access Procedure. Afterwards, when the mobile earth station detects an USF set to FREE on the PDCHs identified in the BCCH, it shall restart timer T3186. At expiry of timer T3186, the packet access procedure shall be aborted and the mobile earth station shall attempt channel request on the RACH of CCCH as specified in ETSI TS 101 376-4-8 [11] if no downlink TBF is active. If a downlink TBF is active, the mobile earth station shall discard the pending uplink LLC PDU(s) and report an error to the higher layer. T3186 is switched off at the end of the access procedure, either in success or failure.

The first attempt to send a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message, may be initiated at the first possible opportunity. For each subsequent attempt to transmit a PACKET CHANNEL REQUEST, the mobile earth station shall draw a random value R with uniform probability distribution in the set $\{0, 1, \dots, 15\}$. The mobile earth station is allowed to transmit a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message if $P(I)$, where I is the radio priority of the TBF being established, is less or equal to R. This is only required if Persistence parameters are transmitted in the system information.

The S and T parameters are used to determine the minimum gap to the next MAC-slot after which the MES may make a successive attempt. The minimum number of MAC-slot between two successive attempts to send a PACKET CHANNEL REQUEST message is a random value drawn for each transmission with uniform probability distribution in the set $\{S, S + 1, \dots, S + T - 1\}$. S and T are both measured in MAC-slots.

Here:

- M is the value of the parameter MAX_RETRANS, belonging to the Radio Priority of the access;
- T is the value of the parameter TX_INT for the first retry and is doubled for every subsequent retry;
- S is the value of the parameter S.

Having made maximal attempts to send a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message, the mobile earth station shall stop timer T3186 and start timer T3170. At expiry of timer T3170, the mobile earth station declares a failure to the upper layer. If there is no downlink TBF active currently, the next access shall be on CCCH. If there is a downlink TBF active then the next access may be on the PCCCH.

7.1.2.1.2 Handling of T3202 expiry

The MES shall let the timer T3202 run during the access procedure. If T3202 expires during the procedure, the MES shall immediately stop transmitting PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages, stop timer T3186 or T3170 if running and shall immediately perform a random access on the RACH channel.

7.1.2.2 Packet assignment procedure

7.1.2.2.1 On receipt of a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message

On receipt of a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message, the network may assign a radio resource on one or more PDCHs to be used by the mobile earth station for the TBF.

The allocated PDCH and PACCH resource is assigned to the mobile earth station in a PACKET UPLINK ASSIGNMENT message, sent on any PAGCH block on any PCCCH on the same PDCH-Carrier on which the network has received the PACKET CHANNEL REQUEST message. The TLLI/G-RNTI information element shall be used to address the mobile earth station and frequency parameters shall be included. The network shall include the USF values allocated for PDCHs in the PACKET UPLINK ASSIGNMENT message.

If the network receives a PACKET CHANNEL REQUEST with the same TLLI as a previous PACKET CHANNEL REQUEST or if the network receives a PACKET CHANNEL REQUEST TYPE 2 with the same S-RNTI as a previous PACKET CHANNEL REQUEST TYPE 2, the network will act as follows:

- If it has not already sent a PACKET UPLINK ASSIGNMENT or it has sent a PACKET UPLINK ASSIGNMENT and the new PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 is identical to the previous one (except in terms of number of blocks required) but has not started receiving data from the MES corresponding to allocations made for that PACKET UPLINK ASSIGNMENT, it shall send (resend) the PACKET UPLINK ASSIGNMENT.
- If it has already sent a PACKET UPLINK ASSIGNMENT and has started receiving data from the MES corresponding to allocations made for that PACKET UPLINK ASSIGNMENT or if the new PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 requests a different priority level or RLC mode than the previous one, it shall do a local release of the existing TBF and send a new PACKET UPLINK ASSIGNMENT.

On receipt of a PACKET UPLINK ASSIGNMENT message corresponding to one of its last 3 PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages, the mobile earth station shall stop timer T3170 or T3186 if running, stop sending PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages, start timer T3164 and switch to the assigned PDCHs. The timer T3202 shall be restarted upon applying the timing and frequency correction information in the PACKET UPLINK ASSIGNMENT.

If while monitoring the PCCCH the mobile earth station receives more than one PACKET UPLINK ASSIGNMENT message, it shall act upon the most recently received message and shall ignore the previous message. The MES shall monitor the downlink transmission for its allocated USF as indicated. When it transmits the first RLC/MAC block, the MES shall switch off timer T3164.

7.1.2.2.2 Void

7.1.2.2.3 Void

7.1.2.2.4 Packet access reject procedure

The network may send to the mobile earth station a PACKET ACCESS REJECT message on any PAGCH block on any PCCCH in the same PDCH-Carrier on which the channel request message was received. This message contains the TLLI, the Rid (Request Identifier) and a WAIT_INDICATION field in the Reject structure of the PACKET ACCESS REJECT message.

On receipt of a PACKET ACCESS REJECT message, where the Rid in the Reject structure corresponds to one of its 3 last PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages, the mobile earth station shall stop sending PACKET CHANNEL REQUEST messages, stop timer T3170, if running, start timer T3172 with the value indicated in the WAIT_INDICATION field, start timer T3162 and listen to the downlink PCCCH until timer T3162 expires. During this time, the mobile earth station shall ignore additional PACKET ACCESS REJECT messages, but on reception of any PACKET UPLINK ASSIGNMENT message corresponding to any other of its 3 last PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages the mobile earth station shall stop timers T3162 and T3172, start timer T3164, and switch to the assigned PDCHs, as further defined in clause 7.1.3.2.1.

If no PACKET UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 message is received before expiration or stoppage of timer T3162, the mobile earth station shall interpret the current access attempt as having failed. If further retries are permissible (number of attempts is less than the maximum permitted), the mobile earth station may retry as soon as T3172 has expired, if T3172 is running currently. If not, it shall declare the access procedure as failed to the upper layers and return to packet idle mode (listening to its paging channel). As an option the mobile earth station may stop timer T3162 and return to packet idle mode as soon as it has received responses from the network on all, or in case more than 3 were sent, the last 3 of its PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages.

If an erroneous PACKET UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 message addressed to the mobile earth station is received before expiration of timer T3162, the mobile earth station shall act as stated in clause 7.1.4.

The mobile earth station is not allowed to make a new attempt for packet access in the same spotbeam until timer T3172 expires, but may attempt packet access in another spotbeam after successful spotbeam reselection. A mobile earth station in class B mode of operation may attempt to enter the dedicated mode in the same cell before timer T3172 has expired. During the time T3172 is running, the MES shall ignore all received PACKET PAGING REQUEST messages except paging request to trigger RR connection establishment.

The value of the WAIT_INDICATION field (i.e. timer T3172) relates to the spotbeam from which it was received.

If the cause value is "Resource not available" the mobile earth station shall immediately stop transmitting and locally release all TBFs in progress. Any partially transmitted PDU or fully transmitted but not fully acknowledged PDU (in RLC acknowledge mode) shall be treated as not having been sent. The mobile earth station shall perform a TBF establishment using CCCH as described in clause 7.1.4. Note that the PACKET ACCESS REJECT message with the release cause "Resource not available" shall not be accompanied by a poll.

If the cause value is "Retry on CCCH" the mobile earth station shall immediately stop transmitting Packet Channel Requests. The mobile earth station shall then retry TBF establishment on CCCH as described in clause 7.1.4.

7.1.2.3 One phase packet access completion

The one phase packet access procedure is completed upon the reception of PACKET UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 message with the same TLLI/G-RNTI as the mobile earth station included in the PACKET CHANNEL REQUEST message. The mobile earth station has entered the packet transfer mode.

7.1.2.4 Timing and frequency correction

The MES shall make timing precorrection prior to transmission of channel request as specified in ETSI TS 101 376-5-7 [16] and ETSI TS 101 376-4-8 [11] and the initial timing and frequency correction may be provided in the PACKET UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 in the PACKET LINK SYNCHRONIZATION field.

Thereafter the timing and frequency advance is updated by PACKET LINK CONTROL message at periodic intervals. Timing Advance Index (TAI), when included in an IMMEDIATE ASSIGNMENT or PACKET UPLINK ASSIGNMENT message, shall be considered as an assignment. The mobile earth station shall use the TAI for periodic timing and frequency correction using its allocation on PTCCH (see ETSI TS 101 376-5-7 [16]). If no TAI is assigned, the MES shall receive the PACKET LINK CONTROL on the PACCH or the DACCH.

The assigned TAI shall be used by the MES to identify the appropriate Packet Link Synchronization parameters received in Packet Link Control message on PTCCH/D or PACCH.

The timer T3202 shall be restarted every time a timing correction is received successfully from the network. If it expires, the MES shall perform an abnormal release with random access on the RACH channel.

The MES shall populate "Start Receive Frame N to Start Transmit Frame N+7" field in PACKET CONTROL ACKNOWLEDGEMENT message if it receives PACKET LINK CONTROL message with UUG bit set in RLC/MAC control header.

7.1.3 Packet Resource Request Procedure (lu mode only)

7.1.3.0 General

The mobile earth station shall use packet resource request procedure to request multiple uplink TBFs. Packet resource request procedure shall be initiated on an already established uplink or downlink TBF. If uplink or downlink TBF does not exist, the mobile earth station shall first establish uplink TBF as specified in clause 7.1.2. On successful establishment of uplink TBF, the mobile earth station shall proceed with packet resource request procedure.

7.1.3.1 Initiation of the Packet resource request procedure

If one or more uplink TBF exists, then the mobile earth station shall initiate packet resource request procedure by sending a PACKET RESOURCE REQUEST message on an existing uplink TBF.

At the time of initiating packet resource request procedure if only downlink TBF(s) in RLC ACK mode exists, the mobile earth station may initiate packet resource request procedure by including *Iu Mode Channel Request* IE in the next PACKET DOWNLINK ACK/NACK message. If only downlink TBF(s) in RLC UNACK mode exists, the mobile earth station may initiate packet resource request procedure by including *Iu Mode Channel Request* IE in the next PACKET CONTROL ACKNOWLEDGEMENT message or by transmitting PACKET RESOURCE REQUEST message in the next uplink opportunity signalled through UUG bit.

When a MES gets an uplink demand with only a downlink TBF it shall start timer T3194. On receipt of an uplink transmission opportunity, the MES shall stop timer T3194. On the expiry of timer T3194 the MES shall initiate the packet access procedure by scheduling the sending of PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 messages on the PRACH to establish an uplink TBF.

At sending of the PACKET RESOURCE REQUEST message, PACKET CONTROL ACKNOWLEDGEMENT, or PACKET DOWNLINK ACK/NACK with *Iu Mode Channel Request* IE, requesting multiple TBFs, the mobile earth station shall start one instance of T3168 for each of the resource requests for the transfer of upper layer PDUs.

7.1.3.2 On receipt of a PACKET RESOURCE REQUEST message

On receipt of a PACKET RESOURCE REQUEST message requesting multiple uplink TBFs, the network shall respond by sending either a MULTIPLE TBF UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2 message or a PACKET ACCESS REJECT message to the mobile earth station on PACCH on the same PDCH on which the mobile earth station has sent the PACKET RESOURCE REQUEST message. These messages shall address (assign or reject) some or all of the resource requests in the PACKET RESOURCE REQUEST message. For the resource requests that have not been addressed by the first assignment or reject message, additional MULTIPLE TBF UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2 or PACKET ACCESS REJECT messages may be sent to the mobile earth station on the PACCH to which the mobile earth station has been assigned.

7.1.3.3 Completion of Packet resource request procedure

On receipt of a MULTIPLE TBF UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 message identifying the mobile earth station with TLLI/G-RNTI, the mobile earth station shall switch to the assigned PDCHs, stop T3168 for each resource request that is assigned a TBF in the MULTIPLE TBF UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 message, and start timer T3164 for each allocated TBF. For all those resource requests that were not allocated a TBF, the corresponding timer T3168 instance shall continue to run.

At sending of the first RLC data block on a TBF, the mobile earth station shall stop timer T3164 for that TBF.

If the mobile earth station detects an invalid Frequency Parameters information element in the assignment message, it shall abort the procedure, and may then re-initiate the access on the CCCH.

On receipt of a PACKET ACCESS REJECT message that contains a Reject structure addressed to the mobile earth station, the mobile earth station shall stop timer T3168 and indicate a packet access failure to upper layer for each resource request which is rejected in the Reject structure.

If the PACKET ACCESS REJECT message contains a WAIT_INDICATION field in a Reject structure addressed to the mobile earth station, the mobile earth station shall start timer T3172 with the indicated value (Wait Indication). The mobile earth station is not allowed to make a new attempt for packet access in the same cell until timer T3172 expires, but may attempt packet access in another cell after successful cell reselection.

If an instance of timer T3168 expires after receipt of MULTIPLE TBF UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 (which assigned TBF to some of the resource requests), the TBF establishment for the corresponding upper layer PDU has failed. The mobile earth station shall reinitiate a resource request for that upper layer PDU using the procedures described in clauses 8.1.1.1.2a and 8.1.1.1.2b.

The Packet resource request has failed on the mobile earth station side when the mobile earth station does not receive a MULTIPLE TBF UPLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT TYPE 2 message with its TLLI/G-RNTI assigning at least one TBF for which resources were requested before expiry of timer T3168. The mobile earth station shall then reinitiate the packet resource request procedure or packet access procedure unless the procedure has already been attempted three times. In that case, TBF failure has occurred and an RLC/MAC error should be reported to the higher layer for each of the TBFs for which resources were requested.

7.1.4 Initiation of TBF Establishment on CCCH

Initiation of access for TBF establishment on CCCH is as specified in ETSI TS 101 376-4-8 [11].

The number of RLC blocks reported at the time of TBF establishment on CCCH shall be based on the most conservative coding and modulation for the shortest PDCH duration burst type in the uplink direction (refer to table 7.1.4).

Table 7.1.4: MCS value and burst type used to calculate initial RLC blocks

Terminal type	MCS for PDCH (binary)	PDCH burst type
A	0000	PDCH(4,3)/PDCH(5,3)
C	000	PDCH(1,6)
D	0011	PDCH(5,3)
E and above	0000	PDCH3(m,3)
E and above	000	PDCH3(m,6)

On reception of IMMEDIATE ASSIGNMENT TYPE 2 or IMMEDIATE ASSIGNMENT TYPE 4 on the AGCH, the MES shall switch to assigned PDCH as specified in ETSI TS 101 376-4-8 [11] and shall start timer T3164. On transmission of the first RLC/MAC block, the MES shall stop timer T3164.

If timer T3164 expires, then the MES shall re-initiate access procedure on the PCCCH using PRACH unless it has already been re-initiated 3 times in which case the MES shall abort the access procedure and shall notify the upper layer about the TBF establishment failure and shall return to idle mode.

NOTE: On receipt of IMMEDIATE ASSIGNMENT TYPE 2 or IMMEDIATE ASSIGNMENT TYPE 4, the MES is time synchronized with the network. So re-initiation of access procedures is performed on the PRACH.

7.1.5 Abnormal cases

If a failure occurs on the mobile earth station side of the new TBF before mobile earth station has successfully entered the packet transfer mode, the newly reserved resources are released; the subsequent behaviour of the mobile earth station depends on the type of failure and previous actions.

- If the mobile earth station has been assigned a TBF with a MCS that the MES does not support, the MES shall return to packet idle mode and notify higher layers (TBF establishment failure).

- On expiry of timer T3164, the mobile earth station shall reinitiate the packet access procedure unless it has already been reinitiated 3 times, in which case the mobile earth station shall return to packet idle mode and notify higher layers (TBF establishment failure).
- On expiry of timer T3172, the mobile earth station shall stop T3162 if running and reinitiate the packet access procedure unless it has already been reinitiated 4 times, in which case the mobile earth station shall return to packet idle mode and notify higher layers (TBF establishment failure).
- If the failure is due to any other reason, the mobile earth station shall return to packet idle mode, notify higher layer (TBF establishment failure), transactions in progress shall be aborted and spotbeam reselection continues.
- If the information in the MULTIPLE TBF UPLINK ASSIGNMENT message does not properly specify an uplink PDCH or violates the mobile earth station's multislot capabilities, the mobile earth station shall reinitiate the packet access procedure for each of the TBFs for which there is an error unless the procedure has already been attempted 3 times for the TBF. In that case, TBF failure has occurred.
- If the MULTIPLE TBF UPLINK ASSIGNMENT message contains assignments including RB Id values for which no TBF was requested, the mobile earth station shall not act upon these assignments. The mobile earth station shall act upon the valid assignments contained in the received message.
- If the MULTIPLE TBF UPLINK ASSIGNMENT message contains assignments such that more than one RB Id value has been assigned to the same TFI, then TBF failure has occurred for the requests containing each of those RB Id values.
- If the PACKET ACCESS REJECT message incorrectly specifies a *Reject structure* and *Iu mode Reject structure* for this mobile earth station, or contains one or more RB Ids in the *Iu mode Reject structure* for which no TBF was requested, the mobile earth station shall ignore this message.

7.2 TBF establishment initiated by the network on CCCH (A/Gb mode only)

7.2.1 Entering the packet transfer mode

7.2.1.0 General

The procedure is triggered by a request from upper layers on the network side to transfer an upper layer PDU to a mobile earth station in packet idle mode. The request from upper layers specifies an optional priority level, a QoS profile including the requested RLC mode, optional DRX parameters, an optional IMSI and an optional MS Radio Access Capability, multislot class and mobile earth station classmark to be associated with the packet transfer. The request is implicit when receiving an upper layer PDU to a mobile earth station not already having any assigned radio resources. Upon such a request, the network shall initiate a packet downlink assignment procedure as defined in clause 7.2.1.1.

7.2.1.1 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 MES in an IMMEDIATE ASSIGNMENT TYPE 3 message. The IMMEDIATE ASSIGNMENT TYPE 3 message is transmitted on the CCCH corresponding to the paging group the mobile earth station belongs to. The appropriate paging group is calculated from the IMSI, see ETSI TS 101 376-5-2 [13] and ETSI TS 101 376-4-8 [11]. The behaviour of the network when the IMSI is not provided by the upper layers is implementation dependent for the calculation of the paging group where the IMMEDIATE ASSIGNMENT TYPE 3 message has to be sent. This message shall be sent in one or more CCCH corresponding to a paging group determined for the MES in packet idle mode (see ETSI TS 101 376-5-2 [13]). The multislot capabilities of the MES shall be considered.

On reception of IMMEDIATE ASSIGNMENT TYPE 3 message, the MES shall respond with a PACKET CHANNEL REQUEST message on a PRACH channel with a cause code "Initial Correction" if timer T3202 has not expired. If timer T3202 has expired, the MES shall ignore the IMMEDIATE ASSIGNMENT TYPE 3 message. If the MES does respond with a PACKET CHANNEL REQUEST, it shall start timer T3208 and start monitoring the corresponding downlink channel. On reception of PRACH, the network shall provide the time and frequency correction on the assigned downlink channel using a PACCH. The MES shall stop timer T3208 on reception of the first timing and frequency synchronization parameters. If the timer T3208 expires, the MES shall ignore the received downlink assignment and shall revert to packet idle mode behaviour specified in clauses 6 and 7.

When timer T3208 is active, the MES shall not initiate uplink access procedure on RACH or PRACH to establish an uplink TBF.

The MES shall not transmit any uplink PNB bursts (including timing correction bursts if scheduled) until it has received timing and frequency correction value at least once from the network since the last IMMEDIATE ASSIGNMENT TYPE 3 message was received on the PCH channel. However, the MES shall be capable of receiving downlink data prior to receiving the timing and frequency correction values. Once the correction is received from the network, the MES switches off T3208 and is able to transmit on the uplink. Thereafter the mobile earth station shall use the continuous update timing advance mechanism, using the Timing Advance Index sent to it on the Assignment message to compute its allocation on PTCCH (see ETSI TS 101 376-5-7 [16] and ETSI TS 101 376-3-22 [5]).

When receiving the IMMEDIATE ASSIGNMENT TYPE 3 message the MES starts timer T3190. The timer is restarted when the mobile earth station receives a downlink RLC/MAC block carrying the TFI of the downlink TBF in the RLC/MAC header.

On expiry of timer T3190, the MES shall abort the procedure and return to packet idle mode. If the MES had transmitted a RACH message prior to receiving the IMMEDIATE ASSIGNMENT 3 message, it shall proceed as defined in ETSI TS 101 376-4-8 [11].

7.2.1.2 Packet downlink assignment procedure completion

The Packet downlink assignment procedure is completed when the mobile earth station receives a valid RLC/MAC block. The mobile earth station has entered the packet transfer mode.

7.2.1.3 Void

7.2.2 Abnormal cases

If a failure occurs on the MES side of the new TBF before MES has successfully entered the packet transfer mode, the newly reserved resources are released; the subsequent behaviour of the MES depends on the type of failure and previous actions.

- If the mobile earth station has been assigned a TBF with an MCS indicated that the MES does not support, the MES shall return to packet idle mode and notify higher layers (TBF establishment failure).
- On expiry of timer T3190, the mobile earth station shall return to packet idle mode.
- If T3208 has expired when the MES receives the initial assignment or it expires while the MES is waiting for its first assigned correction D-MAC-slot/MAC-slot OR the first TAI D-MAC-slot/MAC-slot, the MES shall execute abnormal release with random access using the RACH channel.
- If the failure is due to any other reason, the mobile earth station shall return to packet idle mode.

7.3 Procedure for measurement report sending in packet idle mode

This function is not supported in GMR-1.

7.4 Cell change order procedures in packet idle mode

7.4.0 General

For an individual mobile earth station in packet idle mode, the network may initiate the cell change order procedure on CCCH.

7.4.1 Cell change order procedure initiated on PCCCH

This function is not supported in GMR-1.

7.4.2 Cell change order procedure initiated on CCCH

Cell Change procedure on CCCH shall be as specified in ETSI TS 101 376-4-8 [11].

7.5 Measurement order procedures in packet idle mode

This function is not supported in GMR-1.

7.6 Void

7.7 Void

7.8 TBF establishment on PACCH by network

A downlink TBF can be established by the network on PACCH if an uplink TBF already exists. The network initiates establishment of a downlink TBF by sending a Packet Downlink Assignment or Packet Downlink Assignment Type 2 message as described in clause 8.1.1.1.3.

7.9 GMPRS Resume procedure on PCCCH (A/Gb mode only)

7.9.0 General

GMPRS resume procedure is triggered by a request from MM sub-layer on the mobile earth station side to resume a previously suspended GMPRS service (see ETSI TS 101 376-4-8 [11]).

7.9.1 Initiation of GMPRS resume procedure

The MES shall initiate GMPRS resume procedure by scheduling the transmission of PACKET CHANNEL REQUEST message on the PRACH as specified in clause 7.1.2.1 if timer T3202 has not expired. If T3202 has expired or if a suitable PCCCH is not available (if the last used PDCH carrier is not available), then MES shall initiate GMPRS resume procedure on CCCH as specified in ETSI TS 101 376-4-8 [11].

The MES shall set the type of access to indicate "GMPRS resume procedure" and include its TLLI in PACKET CHANNEL REQUEST. Access persistence control specified in clause 7.1.2.1.1 for "one phase access request" is applicable when the access type "GMPRS resume procedure". After transmitting a PACKET CHANNEL REQUEST indicating "GMPRS resume procedure", the mobile earth station shall start timer T3196 and monitor all downlink D-MAC slots for a response from the network.

The MES shall ignore PACKET DOWNLINK ASSIGNMENT or PACKET UPLINK ASSIGNMENT messages during GMPRS resume procedure.

7.9.2 Completion of GMPRS resume procedure

On receipt of a PACKET CHANNEL REQUEST message requesting resumption of GMPRS services, the network shall attempt to resume GMPRS services only if a GMPRS suspend procedure (see ETSI TS 101 376-4-8 [11]) was successful for the same MES. If GMPRS suspend procedure was unsuccessful or if sufficient information is not available at the network, then the network shall respond with a PACKET GMPRS RESUME RESPONSE message on PAGCH with a result indicating that GMPRS service resumption was unsuccessful. If GMPRS suspend procedure for the MES was successful, then the network shall attempt to resume the GMPRS services. On successful completion of GMPRS service resumption, network shall transmit a PACKET GMPRS RESUME RESPONSE message on PAGCH with a result indicating that GMPRS service was successfully resumed.

The TLLI information shall be used to address the mobile earth station in PACKET GMPRS RESUME RESPONSE message. The MES shall compare its TLLI with the TLLI present in PACKET GMPRS RESUME RESPONSE message. If the two TLLIs do not match, the MES shall ignore the PACKET GMPRS RESUME RESPONSE.

On receipt of a PACKET GMPRS RESUME RESPONSE message matching its TLLI, the mobile earth station shall stop timer T3196 and stop sending PACKET CHANNEL REQUEST messages. The MES shall then notify MM sub-layer on the result (success or failure) of the GMPRS resume procedure.

7.9.3 Abnormal cases

On expiry of timer T3196, the MES shall reinitiate the GMPRS resume procedure unless it has already been reinitiated three times in which case the MES shall return packet idle mode and indicate a failure to resume GMPRS services to the MM sub-layer. All further access to the network shall be made on CCCH.

If the network is unable to resume GMPRS services it shall respond to the MES with a PACKET GMPRS RESUME RESPONSE message on the PAGCH with a result indicating that GMPRS service resumption was unsuccessful.

7.10 Talk Burst Request Transmission on PCCCH

7.10.0 General

If the mobile earth station is in packet idle mode, the mobile earth station may use application specific Talk Burst Request indication in Packet Channel Request Type 2, in which case it shall specify the RB Id and the Request Priority based on upper layer PDU. Upon transmission of Packet Channel Request Type, the MES shall leave the packet idle mode. If there are multiple PDCH-Carriers within the spotbeam carrying PRACH, the mobile earth station shall select the last PDCH-Carrier it used successfully to complete a TBF, if it is still available. If that particular PDCH-Carrier is not available or does not carry PCCCH any more, the mobile earth station shall perform TBF establishment using CCCH as described in clause 7.1.4.

If the mobile earth station is in packet transfer mode, the mobile earth station shall use the PDCH-Carrier associated with the downlink TBF for PRACH transmission. The mobile earth station may use PRACH for Talk Burst Request even when it has uplink TBF active. It may either send PRACH with Talk Burst Request indication or PACKET UPLINK TALK BURST CONTROL message depending on whether the MES gets uplink resources or PRACH opportunities first.

When multiple PRACH MAC slots are signalled in PUI and/or the ULMAP, each PRACH MAC slot shall have equal probability of selection.

For the first transmission of TALK BURST REQUEST, the Reference ID field shall be set to zero and be incremented subsequently for any new request. In case of a retransmission associated with the same PACKET UPLINK TALK BURST CONTROL, the Retransmission bit gets set, and the Reference ID remains the same.

7.10.1 Access persistence control on PRACH

Same as clause 7.1.2.1.1.

7.10.2 On receipt of a PACKET CHANNEL REQ TYPE 2 message with Talk Burst Request Indication

On receipt of a PACKET CHANNEL REQUEST TYPE 2 message, the network shall acknowledge receipt by transmitting PACKET UPLINK TALK BURST CONTROL RESPONSE message with the same RB Id and Reference ID set as in PACKET CHANNEL REQUEST TYPE 2.

On receipt of a PACKET UPLINK TALK BURST CONTROL RESPONSE message corresponding to one of its last 3 PACKET CHANNEL REQUEST TYPE 2 messages, the mobile earth station shall stop timer T3170 or T3186 if running and stop sending PACKET CHANNEL REQUEST TYPE 2 messages. If there are no other ongoing active flows, the MES shall move back to packet idle mode (listening to its paging channel) upon receiving PACKET UPLINK TALK BURST CONTROL RESPONSE; otherwise the MES shall stay in packet transfer mode.

7.10.3 Absence of PACKET UPLINK TALK BURST CONTROL RESPONSE

If no PACKET UPLINK TALK BURST CONTROL RESPONSE message is received before the next eligible attempt to send a PACKET CHANNEL REQUEST TYPE 2 based on parameter S and T, the mobile earth station shall interpret the current access attempt as having failed. If further retries are permissible (number of attempts is less than the maximum permitted), the mobile earth station may retry. If not, it shall declare the transmission as failed to the upper layers.

Having made maximal attempts to send a PACKET CHANNEL REQUEST TYPE 2 message, the mobile earth station shall stop timer T3186 and start timer T3170. At expiry of timer T3170, the mobile earth station declares a failure to the upper layer. If there is no downlink TBF active currently, the next access shall be on CCCH. If there is a downlink TBF active then the next access may be on the PCCCH.

7.11 Uplink Talk Burst Control Transmission on Established TBF

7.11.0 General

The mobile earth station may send application specific PACKET UPLINK TALK BURST CONTROL message on established TBF using PACCH, PDCH, or DACCH. The mobile earth station shall start one instance of T3302 when sending PACKET UPLINK TALK BURST CONTROL message.

7.11.1 On receipt of a PACKET UPLINK TALK BURST CONTROL message

On receipt of a PACKET UPLINK TALK BURST CONTROL message, the network shall acknowledge receipt of the message by transmitting PACKET UPLINK TALK BURST CONTROL RESPONSE message with the same RB Id and Reference ID set in the received message.

On receipt of a PACKET UPLINK TALK BURST CONTROL RESPONSE message identifying the mobile earth station, the mobile earth station shall stop T3302.

The PACKET UPLINK TALK BURST CONTROL transmission has failed on the mobile earth station side when the mobile earth station does not receive a PACKET UPLINK TALK BURST CONTROL RESPONSE message with its RB Id and Reference ID before expiry of timer T3302. The mobile earth station shall then reinitiate the transmission of PACKET UPLINK TALK BURST CONTROL unless it has already been attempted three times. In that case, TBF failure has occurred and an RLC/MAC error should be reported to the higher layer.

8 Medium access control (MAC) procedures in packet transfer mode

8.1 Transfer of RLC data blocks

8.1.0 General

The transfer of RLC data blocks associated with a TBF in the downlink direction is performed using a dynamic medium access method. The transfer of RLC data blocks associated with a TBF in the uplink direction also uses a dynamic access method.

8.1.1 Uplink RLC data block transfer

8.1.1.0 General

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 uplink assignment (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE) messages:

- unique Temporary Flow Identity (TFI). The mobile earth station shall set the TFI field of each uplink RLC data block to the TFI value assigned to the mobile earth station for that uplink TBF;
- a set of PDCHs to be used for the uplink transfer;
- the RB Id associated with each allocated TBF if the network and the mobile earth station both support multiple TBF procedures.

In case of retransmission of RLC data blocks on the same burst type, the MES shall use the same MCS that was used in the initial transmission if the RLC data block does not fit in the allocated burst with the assigned MCS. If the assigned MCS is less robust than the initially used MCS, the MES shall retransmit using either the initially used MCS or the assigned MCS. Prepending with RLC control header or dummy control block may be required as specified in clause 8.1.5.

If the allocated burst type differs from the burst type initially used to transmit an RLC data block, the MES shall transmit on the allocated burst type using the assigned MCS. If the RLC data block does not fit in the allocated burst with the assigned MCS, it shall attempt to transmit the burst with a less robust MCS that corresponds to a payload size large enough to hold the data block being retransmitted. Prepending with RLC control header or dummy control block may be required as specified in clause 8.1.5.

In case of a retransmission of RLC data block with counter N3306 equal to N3306max, the MES shall not transmit; instead it shall release the uplink TBF and shall discard all outstanding Upper Layer PDUs which are partially transmitted or partially or fully unacknowledged (see clause 9.3.2.4). Subsequently the mobile earth station shall re-establish the uplink TBF using Packet Resource Request message if there is another uplink or downlink TBF established (see clause 7.1.3); otherwise the MES shall use PACKET CHANNEL REQUEST message (see clause 7.1.2). The MES shall re-establish the uplink TBF regardless of whether there are any pending upper layer PDUs.

Upon receipt of a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message, the mobile earth station shall be ready to transmit in accordance with the requirements given in ETSI TS 101 376-5-7 [16].

The mobile earth 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.

The RLC/MAC control block or blocks shall be in the beginning of the payload. The presence of a RLC/MAC control block is indicated by the payload type field in the MAC/RLC header (see clause 10.3).

In *Iu mode*, a mobile earth station that supports multiple TBF procedures shall send a PACKET RESOURCE REQUEST message to a network supporting multiple TBF procedures (see clause 8.1.1.1.2), if it has data to send for one or more RBs (*Iu mode*) for which no uplink TBFs are established.

8.1.1.1 Dynamic allocation uplink RLC data block transfer

8.1.1.1.0 General

This clause specifies mobile earth station behaviour for dynamic allocation uplink RLC data block transfer while in packet transfer mode.

When the mobile earth station receives a complete uplink assignment (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE), the mobile earth station shall begin monitoring the assigned PDCHs for the assigned USF value for each assigned PDCH within the response time defined in ETSI TS 101 376-5-7 [16]. The mobile earth station shall continue to use the newly assigned parameters of each uplink TBF until the TBF is either released or reconfigured.

If a mobile earth station has requested multiple uplink TBFs in a PACKET RESOURCE REQUEST message the network may allocate resources for these TBFs by sending one or more uplink assignment messages in response (see clause 8.1.1.1.2). The mobile earth station shall act upon each successive uplink assignment message as it is received.

Whenever the mobile earth station detects an assigned USF value on an assigned PDCH for any TBF belong to the same mobile earth station, the mobile earth station shall transmit one or more RLC/MAC blocks on the same PDCH for that TBF, depending on the type of PDCH (see clause 10.2). The time relation between an uplink Mac-slot, D-MAC-slot or 4-MAC-slot which the mobile earth station shall use for transmission, and the occurrence of the USF value is defined in ETSI TS 101 376-5-7 [16]. The UD field in the RLC data block shall be set to indicate the total pending demand in the mobile earth station for this TBF, including packets that have not yet been segmented, and taking into account RLC overhead. This includes packets for retransmission.

When the mobile earth station starts transmitting RLC/MAC blocks with $UD > 0$ to the network, it shall start timer T3180 for the uplink TBF on which the block was sent. When the mobile earth station detects an assigned USF value on an assigned PDCH for that TBF, the mobile earth station shall reset timer T3180. If timer T3180 expires, the mobile earth station shall perform the abnormal release with random access procedure (see clause 8.7.2).

Whenever the network receives a valid RLC/MAC block from the mobile earth station in an assigned MAC-slot, D-MAC-slot or 4-MAC-slot it shall reset counter N3101 for that TBF. The network shall increment counter N3101 for each Mac-slot D-MAC-slot or 4-MAC-slot, allocated to that TBF, for which no data is received. If $N3101 = N3101_{max}$, the network shall stop the scheduling of Mac-slots/D-MAC-slots/4-MAC-slots for that TBF, and start timer T3169. When T3169 expires, the network may reuse the USF and TFI allocated to that TBF.

If the MES receives an indication that it shall use PNB3(1,6) 2,6 kbps Data in the uplink assignment message, it shall operate exactly as above according to USF allocation, except that when it transmits data for the associated TBF, it shall use Header type 2 (see clause 10.3.2c).

If a terminal type that has a duty cycle of one transmission per frame gets an uplink dedicated allocation for one of its RB (i.e. PACKET TBF ASSIGNMENT, RADIO BEARER SETUP, RADIO BEARER RECONFIGURATION,...), it shall move all of its active flows using PNB3(1,6) 2,6 kbps Data in the uplink in shared mode, if any, into the same channel as in the assignment message. All other TBFs assigned an uplink PDCH channel and their corresponding downlink TBFs, if any, shall be suspended until the release of all the uplink dedicated TBF. The MES shall temporarily use the assigned channel and ceases to listen to the uplink allocation using the flow USFs, until TBF or RB Release of the newly activated RB. The MES flow selection and transmission follows that in clause (see clause 9.2.2 and ETSI TS 101 376-4-14 [24]). The MES shall also stop using Header type 2 and start using DACCH header, except for retransmission of RLC blocks that were initially sent using Header type 2. Any response with PACKET CONTROL ACK or PACKET DOWNLINK ACK/NACK to a request from the network shall be sent using uplink shared allocation and before switching to the dedicated assignment.

Upon a TBF release of the RB that triggered the move to a new channel, the MES shall fall back to its initial mode of operation and transmit according to the USF allocation of the flows using Header type 2. Again, any retransmission of an RLC block, the MES shall use the header definition of the initial transmission. Note, the difference between DACCH data header (see clause 12.7.3 of ETSI TS 101 376-4-14 [24]) and Header type 2 is one byte in payload and the unsatisfied demand field. When switching between RLC/MAC blocks using Header type 2 and DACCH, no sequence shall be reset or reinitialized. Any response with a PACKET CONTROL ACK or a PACKET DOWNLINK ACK/NACK to a request from the network shall be sent using the assigned dedicated allocation and before switching back to shared uplink allocation mode.

In the event a shared uplink TBF is established and assigned PNB3(1,6) 2,6 kbps data burst while the mobile earth station has a dedicated allocation and has a duty cycle of one transmission per frame, the TBF flow shall be mapped directly onto the existing dedicated allocation. Upon a TBF or RB release of the RB(s) with the dedicated allocation, the MES shall fall back to the shared mode of operation and transmit according to its USF using Header type 2. Again, any retransmission of an RLC block, the MES shall use the header definition of the initial transmission. If the MES with an assigned uplink dedicated channel requests the establishment of an uplink TBF using Packet Resource Request and the network assigns an uplink PDCH channel for the TBF, the MES shall immediately move the TBF to suspended state. When the DCH channel is released, the terminal starts listening to uplink allocation using the assigned USF and TBF resumes normal data transfer on the uplink PDCH channel.

8.1.1.1.1 PACCH operation (A/Gb mode only)

The mobile earth station shall attempt to decode every received downlink RLC/MAC block on all Mac-slots/D-MAC-slots/4-MAC-slots on every assigned PDCHs. Whenever the mobile earth station receives an RLC/MAC block containing an RLC/MAC control block, the mobile earth station shall attempt to interpret the message contained therein. If the message addresses the mobile earth station, the mobile earth station shall act on the message.

Whenever the mobile earth station detects a Mac-slot/D-MAC-slot/4-MAC-slot assigned to it on any assigned PDCH, the mobile earth station may transmit PACCH blocks using the same PDCH in the next MAC-slot/D-MAC-slot/4-MAC-slot. The network shall set the USF value to reserved in downlink MAC slot or D-MAC-slot which has UUG (in RLC/MAC header) setting indicating a MAC slot, D-MAC-slot or 4-MAC-slot allocation. The MES shall always send the polled control information on the allocated MAC-slots.

8.1.1.1.1a PDCH3 PACCH operation (lu mode only)

The network shall set the USF to USF_ACK1=11111100 or USF_ACK2=11111011 in the PUI or ULMAP of current or next downlink burst respectively to indicate the uplink allocation corresponding to the polled control message. The MES shall always send the polled control information with assigned burst on the assigned carrier frequency and time as described in clauses 10.2.1 and 10.4.5.3.

8.1.1.1.2 Resource reallocation for uplink TBF

During an uplink packet transfer, upper layers may request the transfer of an upper layer PDU with a different RB Id, a different Radio Priority, peak throughput class, or RLC mode than the current uplink TBF. The MES may transfer the Upper Layer PDU over the existing uplink TBF. An upper layer PDU containing signalling shall be treated as having the highest Radio Priority, and the acknowledged RLC mode shall be requested. Alternatively, the MES may set the ITR bit in uplink RLC/MAC blocks as described in clauses 9.3.3.3 or 9.3.2.4 in order to quickly terminate the current TBF, and then establish a new uplink TBF with the QoS requested by the pending Upper Layer PDU.

If both the mobile earth station and the network support multiple TBF procedures the following procedures apply:

- The mobile earth station shall initiate a request for one or more new uplink TBFs when it has upper layer PDUs associated with one or more RBIDs for which there are no ongoing uplink TBFs. In this case it sends a PACKET RESOURCE REQUEST message on the PACCH and starts an instance of timer T3168 for each uplink TBF requested.
- All ongoing uplink TBFs shall continue to operate using their currently allocated resources.

On receipt of the PACKET RESOURCE REQUEST message the network shall respond by sending either an uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE) or a PACKET ACCESS REJECT message to the mobile earth station on the downlink PACCH.

If both the mobile earth station and the network support multiple TBF procedures, then after transmission of a PACKET RESOURCE REQUEST message the mobile earth station shall maintain its ongoing uplink TBFs using their currently allocated TBF parameters.

On receipt of an uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) sent in response to a PACKET RESOURCE REQUEST message the mobile earth station shall stop timer T3168 for each uplink TBF assigned in the assignment message and switch to the assigned PDCHs. A mobile earth station that supports multiple TBF procedures shall act on the uplink assignment message as defined in clause 8.1.2.5.

If both the mobile earth station and the network support multiple TBF procedures, then upon expiry of all instances of timer T3168 the mobile earth station shall retransmit the PACKET RESOURCE REQUEST message to request resources for those uplink TBFs that did not receive an uplink assignment or reject unless the PACKET RESOURCE REQUEST message has already been transmitted three times without receiving any uplink assignment in response. In this case the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).

If no assignment message (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) addressing any requested uplink TBF is received before the mobile earth station has completed its currently assigned TBFs the mobile earth station shall stop all instances of timer T3168.

The network may at any time during uplink packet transfer initiate a change of resources by sending on the downlink PACCH monitored by the MES, an unsolicited uplink assignment message (e.g. PACKET TBF ASSIGNMENT or PACKET DCH ASSIGNMENT message) to the mobile earth station. During the reallocation, the network may change the following resources:

- The uplink dedicated resources (e.g. MAC slot allocation, burst duration, or frequency) for TM or NTM mode TBFs.
- The uplink fixed allocation (e.g. MAC slot allocation, frequency offset or PDCH Channel Info).
- The uplink channel type for TM mode TBF from PDCH to DCH or from DCH to PDCH.
- Uplink PDCH Resources (e.g. MAC Slots, USF or TFI).

A non-TM mode TBF may be assigned different resources but the network shall not change the channel type using this MAC procedure. If PACKET TBF ASSIGNMENT message is used with the assignment type indicating reconfiguration, the RLC associated with the TBF shall not be reset and shall continue on the newly assigned resources. If PACKET DCH ASSIGNMENT message is used the TBF shall get re-established and RLC shall be reset.

A mobile earth station that supports multiple TBF procedures shall act on the uplink assignment message as defined in clause 8.1.2.5.

On receipt of a PACKET ACCESS REJECT message, the mobile earth station shall stop timer T3168, if running, for the TBFs rejected in the PACKET ACCESS REJECT message, abort the uplink TBFs and indicate a packet access failure to the upper layer associated with each rejected TBF. If no more uplink or downlink TBFs exist, the mobile earth station in packet transfer mode shall return to packet idle mode; the mobile earth station in dual transfer mode shall return to dedicated mode. The DRX mode procedures shall be applied, as specified in clause 5.5.1.5.

If the PACKET ACCESS REJECT message contains a WAIT_INDICATION field in a Reject structure addressed to the mobile earth station, the mobile earth station shall:

- If both the mobile earth station and the network support multiple TBF procedures the mobile earth station shall start one instance of timer T3172 for each uplink TBF that was rejected. All TBFs in progress that are not rejected shall be maintained. The mobile earth station is not allowed to attempt re-establishment of a rejected uplink TBF in the same cell until its associated instance of timer T3172 expires. It may, however, attempt re-establishment of a rejected uplink TBF in another cell after successful cell reselection. The mobile earth station may attempt to enter the dedicated mode in the same cell before all instances of timer T3172 have expired. During the time one or more instances of T3172 are running, the mobile earth station shall ignore all received PACKET PAGING REQUEST messages except paging request to trigger RR connection establishment.

The value of the WAIT_INDICATION field (i.e. timer T3172) 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 earth station receives an uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) and detects an invalid Frequency Parameters information element in the message, the mobile earth station shall perform an abnormal release with system information (see clause 8.7.3).
- If the mobile earth station receives an uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) specifying frequencies that are not all in one frequency band then the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).
- If the information in the PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, or the MULTIPLE TBF UPLINK ASSIGNMENT message does not properly specify an uplink PDCH or violates the mobile earth station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).
- If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message does not properly specify an uplink and downlink PDCH or violates the mobile earth station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).
- If the mobile earth station receives a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, or a MULTIPLE TBF UPLINK ASSIGNMENT message containing a Frequency Parameters information element specifying a frequency that is in a frequency band not supported by the mobile earth station then the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).
- If a mobile earth station in dual transfer mode receives a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message including the Frequency Parameters information element, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).
- If a failure in the uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF TIMESLOT RECONFIGURE or PACKET CS RELEASE INDICATION message) is due to any other reason, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).
- If both the mobile earth station and the network support multiple TBF procedures and if any given uplink assignment message provides an uplink TBF allocation for a PFI not indicated in the PACKET RESOURCE REQUEST message and not associated with any ongoing uplink TBF, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2).
- If the mobile earth station receives an Absolute Frame Number in the Packet Link Synchronization IE that does not match its internally maintained frame number, the MES shall perform an abnormal release with system information (see clause 8.7.3).

An uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) received by a multi-band mobile earth 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 the establishment of one or more downlink TBFs by sending a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE) to the mobile earth station on the PACCH. If a PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF TIMESLOT RECONFIGURE or a MULTIPLE TBF DOWNLINK ASSIGNMENT message is sent, then the message shall contain the DOWNLINK_TFI_ASSIGNMENT field for each downlink TBF being established. If multiple TBF procedures are supported by the mobile earth station and the network, the network shall indicate the RB Id associated with each TBF it allocates or reallocates in the downlink assignment message. The network shall not attempt to establish multiple downlink TBFs for a mobile earth station with only one uplink TBF unless the mobile earth station's radio access capabilities are known. The multislot restrictions of the mobile earth station shall be observed.

A mobile earth station that supports multiple TBF procedures shall act on the downlink assignment message as follows:

- Upon reception of a MULTIPLE TBF DOWNLINK ASSIGNMENT or PACKET DOWNLINK ASSIGNMENT TYPE 2 message the mobile earth station shall maintain all ongoing TBFs not addressed by this message using its currently allocated TBF parameters and shall act on the message.
- Upon reception of a MULTIPLE TBF TIMESLOT RECONFIGURE or PACKET TIMESLOT RECONFIGURE message the mobile earth station shall release all ongoing uplink and downlink TBFs not addressed by this message and shall act on the message.

On receipt of an assignment message, the mobile earth station shall switch to the assigned PDCHs, and start timer T3190 for each of its assigned TBFs. The operation of the downlink TBF follows the procedures in clause 8.1.2 with the following additions:

- a) the mobile earth station shall prioritize transmission of RLC/MAC control blocks associated with a downlink TBF over RLC/MAC control blocks associated with an uplink TBF;
- b) if a timer or counter expiry causes the uplink TBF to be aborted in the mobile earth station, the mobile earth station shall also abort the downlink TBF and perform an abnormal release with random access (see clause 8.7.2).

If one uplink and one downlink TBF are already established, then the network may send a PACKET TIMESLOT RECONFIGURE message without DOWNLINK_TFI_ASSIGNMENT. The mobile earth 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 earth station side in A/Gb mode before the new TBF has been successfully established, the newly reserved resources are released. The mobile earth station shall abort the procedure and continue the normal operation of the uplink TBF, if present.

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

- If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message does not properly specify an uplink and downlink PDCH or violates the mobile earth station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If one uplink and one downlink TBF are not already established and the PACKET TIMESLOT RECONFIGURE message does not include a DOWNLINK_TFI_ASSIGNMENT field, then the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

- If a mobile earth station in MAC-DTM state receives a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) including the Frequency Parameters information element, that is not the same as the current allocation, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If a failure in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If both the mobile earth station and the network support multiple TBF procedures and if any given downlink assignment message provides an uplink TBF allocation for a RB Id not associated with any ongoing uplink TBF, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If a failure in the PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, or MULTIPLE TBF DOWNLINK ASSIGNMENT message is due to any other reason, the mobile earth station shall abort the procedure and continue the normal operation of the ongoing uplink TBFs and ongoing downlink TBFs.

8.1.1.2 Uplink PDCH(5,3) and PDCH(5,12) multiplexing

MES supporting uplink PDCH(5,3) and PDCH(5,12) shall support:

- start of a PDCH(5,12) burst in any Mac-slot in a frame;
- PDCH(5,12) bursts straddling two frames;
- transmission of a PDCH(5,12) or four PDCH(5,3) bursts in a 4-MAC-slot USF allocation.

8.1.1.3 Void

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 earth station on the PACCH. A cause value indicates the reason for release.

If the cause value is "Normal release" the mobile earth station shall immediately stop transmitting and locally release the TBF. If the PACKET TBF RELEASE message is accompanied by a poll, the mobile earth station shall transmit an acknowledgement message as described in clause 10.4.5. Any partially transmitted PDU or fully transmitted but not fully acknowledged PDU (in RLC acknowledged mode) shall be treated as not having been sent.

If the cause value is "PDCH-carrier being deassigned" the mobile earth station shall immediately stop transmitting and locally release all TBFs in progress. The PACKET TBF RELEASE message with release cause "PDCH-carrier being deassigned" will not be accompanied by a poll. Any partially transmitted PDU or fully transmitted but not fully acknowledged PDU (in RLC acknowledge mode) shall be treated as not having been sent. Next time the mobile earth station shall perform TBF establishment using CCCH as described in clause 7.1.4.

If the cause value is "Abnormal Release" the mobile earth station shall immediately stop transmitting, locally release all downlink and uplink TBFs in progress, and follow the abnormal release with random access procedure (see clause 8.7.2).

If the cause value is "Resource not available", the mobile earth station of GMPRS terminal type D (Refer to ETSI TS 101 376-5-2 [13] for terminal type definition) shall immediately stop transmitting and locally release all TBFs in progress. Note that the PACKET TBF RELEASE message with the release cause "Resource not available" shall not be accompanied by a poll. Any partially transmitted PDU or fully transmitted but not fully acknowledged PDU (in RLC acknowledge mode) shall be treated as not having been sent. The mobile earth station shall perform a TBF establishment using CCCH as described in clause 7.1.4. This cause value shall be ignored by the MES of GMPRS terminal type A and C.

8.1.1.5 Abnormal cases

The following abnormal cases apply:

- If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE, message with an invalid Frequency Parameters information element, the mobile earth station shall perform an abnormal release with system information (see clause 8.7.3).
- If a mobile earth station receives a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release with system information (see clause 8.7.3).
- If the mobile earth station receives a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or a MULTIPLE TBF TIMESLOT RECONFIGURE message specifying frequencies that are not all in one band then the mobile earth station shall perform an abnormal release with random access (see clause 8.7.2).
- If the mobile earth station receives a PACKET UPLINK ACK/NACK with missing mandatory fields, the MES shall perform an abnormal release with random access.
- In A/Gb mode, if the mobile earth station detects radio link failure (see ETSI TS 101 376-5-6 [15]), the MES shall perform an abnormal release and return to CCCH or PCCCH.
- In Iu mode, if the mobile earth station detects radio link failure (see ETSI TS 101 376-5-6 [15]), the MES shall notify RRC layer (see ETSI TS 101 376-4-13 [23]).

8.1.1.6 Network initiated establishment of uplink TBF

In Iu mode, the network may initiate the establishment of a new uplink TBF for the mobile station by sending an uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT TYPE 2, PACKET MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TBF ASSIGNMENT, PACKET DCH ASSIGNMENT,...). The mobile earth station shall then create a new TBF as specified in the assignment message then switch to the assigned uplink channel and begin to send any new RLC data blocks on the assigned channel.

8.1.1.7 Fixed allocation uplink RLC data block transfer

An uplink PDCH with fixed allocation may also be assigned to the MES, which is given during flow establishment using Packet TBF Assignment message or through RRC procedure. The assignment indicates the PDCH channel type, the MAC slot, and the carrier to be used by the MES. The assignment is valid every frame for the assigned flow until the release of the TBF. When assigning a fixed uplink PDCH allocation, the network shall follow the following rules:

- Allocate at most one non-Transparent mode TBF flow on the fixed PDCH burst.
- When allocating Transparent mode TBFs on the same PDCH burst, all the RLC data blocks shall fit in one PDCH burst.

In every uplink allocation, at most one RLC block from each flow is sent on the uplink allocation. Multiple RLC/MAC blocks belonging to different flows may be present in one uplink physical burst. The MES shall also carry other data flows suitable on the assigned channel if the assigned allocation can still carry additional data. At most one non-Transparent mode RLC data block can be present in the uplink burst as indicated in clause 8.1.5. When selecting a flow to use in the remaining payload, Radio Bearers associated with the same RAB as the RBs operating on the fixed PDCH slot have highest priority.

For a Transparent mode TBF, the MES shall transmit only one RLC/MAC data block per 25 frames during silence period. If the MES has no data to send for any flow suitable on the assigned channel, the MES shall transmit an uplink dummy control block every 25 frames.

For a non-Transparent mode TBF, if the MES has no data to send for any flow suitable on the assigned channel, the MES shall transmit an uplink dummy data block every 25 frames.

8.1.2 Downlink RLC data block transfer

8.1.2.0 General

Prior to the initiation of RLC data block transfer on the downlink, the network assigns the following parameters in a downlink assignment (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE) message:

- A unique Temporary Flow Identity (TFI). The TFI applies to all radio blocks transferred as part of the downlink Temporary Block Flow (TBF).
- A set of PDCHs to be used for the downlink transfer.
- A RB Id associated with each allocated TBF if the network and the mobile earth station both support multiple TBF procedures.

For each TBF, the network shall prioritize RLC/MAC control blocks (except those containing a PACKET DOWNLINK DUMMY CONTROL BLOCK message) over 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

8.1.2.1.0 General

This clause specifies mobile earth station behaviour for downlink RLC data block transfer while in packet transfer mode.

A network may send an unsolicited downlink assignment message to a mobile earth station. A mobile earth station that supports multiple TBF procedures shall act on the downlink assignment message as defined in clause 8.1.1.1.3.

Upon reception of a complete downlink assignment, the mobile earth station shall start timer T3190 for each downlink TBF assigned in the downlink assignment message and then it shall attempt to decode every downlink radio block received on every Mac-slot/D-MAC-slot/4-MAC-slot on its assigned PDCHs.

If the mobile earth station receives a valid RLC/MAC block addressed to one of its TBFs, the mobile earth station shall restart timer T3190 for that TBF. At the time of receipt of a valid RLC/MAC block, if a downlink TBF is active for Signalling Radio Bearer (SRB) with RB Id = 2, then the MES shall also restart timer T3190 for that TBF.

If any given timer T3190 expires, the mobile earth station shall perform an abnormal release of all downlink and uplink TBFs with return to CCCH.

Upon receipt of a PACKET TBF RELEASE referring to a downlink TBF, the mobile earth station shall follow the procedure in clause 8.1.2.9.

8.1.2.1.1 Abnormal cases

If a failure occurs on the mobile earth station side before one or more new TBFs have been successfully established, the newly reserved resources are released. The subsequent behaviour of the mobile earth station depends on the type of failure and previous actions:

- If a mobile earth station receives a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release with system information (see clause 8.7.3).
- If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message does not properly specify an uplink and downlink PDCH or violates the mobile earth station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

- If the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message does not include a DOWNLINK_TFI_ASSIGNMENT field, then the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If a failure in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If the information available in the mobile earth station, after the reception of a PACKET DOWNLINK ASSIGNMENT PACKET DOWNLINK ASSIGNMENT TYPE 2, or MULTIPLE TBF DOWNLINK ASSIGNMENT message does not satisfactorily define a PDCH, the mobile earth station shall ignore the PACKET DOWNLINK ASSIGNMENT/PACKET DOWNLINK ASSIGNMENT TYPE 2 /MULTIPLE TBF DOWNLINK ASSIGNMENT message.
- If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2 or MULTIPLE TBF DOWNLINK ASSIGNMENT message containing different frequency parameters than are currently in effect for the uplink TBF, the mobile earth station shall ignore the PACKET DOWNLINK ASSIGNMENT/PACKET DOWNLINK ASSIGNMENT TYPE 2/MULTIPLE TBF DOWNLINK ASSIGNMENT message and continue normal operation of the uplink TBF.
- If a failure in the PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, or MULTIPLE TBF DOWNLINK ASSIGNMENT message is due to any other reason, the mobile earth station shall abort the establishment of the downlink TBFs indicated in the downlink assignment message. If one or more ongoing uplink or downlink TBFs exist, the mobile earth station shall continue the normal operation of all the ongoing uplink TBFs. If no ongoing uplink or downlink TBFs exist, the mobile earth station shall perform an abnormal release without retry (see clause 8.7.1).
- If both the mobile earth station and the network support multiple TBF procedures and if any given downlink assignment message provides an uplink TBF allocation for a RB Id not associated with any ongoing uplink TBF, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

8.1.2.2 Polling for packet downlink ACK/NACK

Whenever the mobile earth station receives an RLC/MAC block addressed to one of its TBFs in RLC acknowledged mode TBF and carrying a valid UUG field in the RLC data block header (i.e. is polled), the mobile earth station shall transmit a Packet Downlink ACK/NACK message in the "next" (refer ETSI TS 101 376-5-5 [17] for definition of "next") uplink Mac-slot/D-MAC-slot. In all other cases, a mobile earth station addressed via the RLC/MAC header or control message and polled for a response via the UUG field shall send a PACKET CONTROL ACK as described in clause 10.4.5.

For PDCH3, the mobile earth station shall respond to the UUG polling according to USF_ACK allocation as described in clause 10.4.5.3.

Whenever the network receives a valid RLC/MAC control message from the mobile earth station as a response to a poll, it shall reset counter N3105 for that TBF. The network shall increment counter N3105 for each Mac-slot/D-MAC-slot allocated to that TBF with the UUG field for which no RLC/MAC control message is received. If $N3105 = N3105_{max}$, the network shall release the downlink TBF internally and start timer T3195 for that TBF. When T3195 expires, the network may reuse the TFI.

The network shall poll the mobile earth station by respecting the resources allocated to the MES and the MES multislot class (see ETSI TS 101 376-5-2 [13]). If the polling does not fulfil these requirements, the mobile earth 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 RLC blocks on allocated uplink Mac-slots/D-MAC-slots.

8.1.2.3 Downlink PDCH(5,3) and PDCH(5,12) multiplexing

MES supporting downlink PDCH(5,3) and PDCH(5,12) shall support:

- start of a PDCH(5,12) burst in any Mac-slot in a frame;

- PDCH(5,12) bursts straddling two frames.

If the MES does not support PDCH(5,12) reception in the downlink, it shall skip the Mac-slot boundary PUI reception until the transmission of the PDCH(5,12) burst is completed.

8.1.2.4 Resource reassignment for downlink

The network initiates resource reassignment by sending a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) on the downlink PACCH. These messages indicate a change in resources in the same TBF. If multiple TBF procedures are supported by the mobile earth station and the network, the network shall indicate the RB Id associated with each TBF it allocates or reallocates in the downlink assignment message. During the reassignment of any given TBF its associated TFI shall be changed; otherwise MES would ignore it and interpret it as a control message retransmission. Mobile shall use the TFI indicated in the PACKET DOWNLINK ASSIGNMENT/PACKET DOWNLINK ASSIGNMENT TYPE 2/MULTIPLE TBF DOWNLINK ASSIGNMENT when using the resource indicated in the message.

The network may also initiate downlink resource reassignment (e.g. MAC slot allocation, burst duration, or frequency) for a TBF (non-TM mode or TM mode). If a PACKET TBF ASSIGNMENT message is used with the assignment type indicating reconfiguration, the RLC associated with the TBF shall not be reset and continue on the newly assigned resources. If PACKET DCH ASSIGNMENT message is used, the TBF shall get re-established and RLC shall be reset.

The network is not allowed to change the RLC mode of an already established TBF during resource reallocation. The network may terminate an existing TBF and start a new TBF in the appropriate RLC mode, using the release procedure as defined. The network may send a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message containing the desired RLC mode, a set of PDCHs. The MES shall start monitoring the new set of PDCHs assigned to the downlink TBF.

On receipt of a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) the mobile earth station shall switch to the assigned PDCHs. Upon switching to the new PDCHs the mobile earth station shall restart timer T3190 for each newly assigned downlink TBF. A mobile earth station that supports multiple TBF procedures shall act on the uplink assignment message as defined in clause 8.1.1.1.3.

When the mobile earth station receives an RLC/MAC block addressed to (one of) its downlink TBF(s) on any of the new assigned resources it shall restart timer T3190 for that TBF. If any given timer T3190 expires, and if one or more uplink TBF is in progress, the mobile earth station shall perform an abnormal release of all downlink and uplink TBFs with return to CCCH.

8.1.2.4a Establishment of downlink TBF after downlink TBF release

8.1.2.4a.0 General

After the network has initiated the release of a downlink TBF and the mobile earth station has received all the RLC blocks, the mobile earth station shall send the PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to "1" start timer T3192 and continue to monitor all assigned PDCHs. The mobile earth station shall continue to perform time/frequency synchronization using the TAI assigned by the previously received assignment message.

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 earth station, the network may establish a new downlink TBF for the mobile earth station by sending the PACKET DOWNLINK ASSIGNMENT or PACKET DOWNLINK ASSIGNMENT TYPE 2 message on PACCH.

If the mobile earth station, after sending the PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to "1", receives a PACKET DOWNLINK ASSIGNMENT or PACKET DOWNLINK ASSIGNMENT TYPE 2 message while timer T3192 is running, the mobile earth station shall stop timer T3192, and release the previous downlink TBF. The mobile earth station shall then create a new TBF as specified by the PACKET DOWNLINK ASSIGNMENT or PACKET DOWNLINK ASSIGNMENT TYPE 2. The mobile earth station shall perform time/frequency synchronization using the TAI, if assigned, by the previously received assignment message.

8.1.2.4a.1 Abnormal cases

If a mobile earth station receives a downlink assignment (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF TIMESLOT RECONFIGURE) message and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release. If PCCCH is present in the spotbeam the mobile earth station shall perform an abnormal release with system information (see clause 8.7.3). If PCCCH is not present, the mobile earth station shall perform an abnormal release with random access (see clause 8.7.2).

If a mobile earth station in MAC-DTM state receives PACKET DOWNLINK ASSIGNMENT TYPE 2, a MULTIPLE TBF DOWNLINK ASSIGNMENT, a PACKET TIMESLOT RECONFIGURE or a MULTIPLE TBF TIMESLOT RECONFIGURE message including the Frequency Parameters information element, the mobile earth station shall perform an abnormal release with access retry if there is at least one ongoing uplink TBF (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]), otherwise it shall perform an abnormal release without retry (see clause 8.7.1 and ETSI TS 101 376-4-14 [24]).

If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT message does not properly specify an uplink and downlink PDCH or violates the mobile earth station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

If a failure in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

If the information available in the mobile earth station, after the reception of a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2 or MULTIPLE TBF DOWNLINK ASSIGNMENT message does not satisfactorily define a PDCH, the mobile earth station shall ignore the PACKET DOWNLINK ASSIGNMENT/MULTIPLE TBF DOWNLINK ASSIGNMENT message and maintain its ongoing TBFs.

If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2 or MULTIPLE TBF DOWNLINK ASSIGNMENT message containing different frequency parameters than are currently in effect for its ongoing TBFs, the mobile earth station shall ignore the PACKET DOWNLINK ASSIGNMENT message and continue normal operation of its ongoing TBFs.

If a failure in the PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2 or MULTIPLE TBF DOWNLINK ASSIGNMENT message is due to any other reason, the mobile earth station shall abort the establishment of the downlink TBFs indicated in the downlink assignment message. If one or more ongoing uplink or downlink TBFs exist, the mobile earth station shall continue the normal operation of all ongoing uplink TBFs. If no ongoing uplink or downlink TBFs exist, the mobile earth station shall perform an abnormal release without retry (see clause 8.7.1).

If both the mobile earth station and the network support multiple TBF procedures and if any given downlink assignment message provides an uplink TBF allocation for a RB Id not associated with any ongoing uplink TBF, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

If the mobile earth station has an existing downlink TBF, and T3192 is not running, and receives a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2 or PACKET TBF ASSIGNMENT requesting the establishment of a new downlink TBF with the same TFI as the existing TBF, the mobile earth station shall maintain the existing downlink TBF. The mobile earth station shall respond with an acknowledgment message if requested as described in clause 10.4.5.

If the mobile earth station has an existing downlink TBF, and T3192 is not running, and receives a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2 or PACKET TBF ASSIGNMENT requesting the establishment of a new downlink TBF with a different TFI, the mobile earth station shall immediately release the existing downlink TBF. The mobile earth station shall then act upon the new downlink assignment as described in clause 8.1.1.1.3.

In A/Gb mode, if the mobile earth station detects radio link failure (see ETSI TS 101 376-5-6 [15]), the MES shall perform an abnormal release and return to CCCH or PCCCH.

In Iu mode, if the mobile earth station detects radio link failure (see ETSI TS 101 376-5-6 [15]), the MES shall notify RRC layer (see ETSI TS 101 376-4-13 [23]).

8.1.2.5 Establishment of uplink TBF

8.1.2.5.0 General

The mobile earth station may request establishment of one or more uplink TBFs when there are one or more ongoing downlink TBFs. When multiple TBF are requested, the mobile earth station shall start one instance of timer T3168 for each uplink TBF it requests. Each requested uplink TBF is associated with a different RB Id. A mobile earth station shall continue to use its ongoing downlink TBFs unless re-allocated or released as a result of the uplink assignment message(s) sent in response by the network.

The Multislot class-1 (full duplex) mobile earth station may request establishment of one or more uplink TBFs by initiating PRACH access as specified in clause 7.1.2.

A half duplex MES in the RLC acknowledged mode shall use the GMPRS PACKET DOWNLINK ACK/NACK message with the packet channel request information or PACKET DOWNLINK ACK/NACK message with Iu Mode Channel Request information, embedded in it (see clause 11.2.6/11.2.6a) to establish an uplink TBF. When a half duplex MES gets an uplink demand with only a downlink TBF in RLC acknowledged mode it shall start timer T3194. On receipt of a GMPRS PACKET DOWNLINK ACK/NACK or PACKET DOWNLINK ACK/NACK transmission opportunity, the MES shall stop timer T3194.

On the expiry of timer T3194 the MES shall initiate PRACH to establish an uplink TBF. The MES shall start timer T3168 after transmission of the packet channel request information in the GMPRS PACKET DOWNLINK ACK/NACK or PACKET DOWNLINK ACK/NACK. Upon receipt of a Packet Uplink Assignment or Packet Uplink Assignment Type 2 it will stop timer T3168.

A half duplex MES in the RLC unacknowledged mode will always initiate PRACH to establish one or more uplink TBFs. The use of PRACH in either RLC unacknowledged and acknowledged mode may result in the half duplex MES missing downlink packets. Note that the PRACH access may only take place on the same PDCH-carrier on which the existing TBF is established, if it carries PCCCH. This procedure is triggered by a request from upper layers to transfer an upper layer PDU. The request from upper layers specifies a Radio Priority to be associated with the packet transfer.

On receipt of a Packet Channel Request message in A/Gb mode, or a GMPRS PACKET DOWNLINK ACK/NACK message with the packet channel request embedded, the network may assign radio resources to the mobile earth station on one or more PDCHs by transmitting a PACKET UPLINK ASSIGNMENT message on the PACCH, or may reject the request by sending a PACKET ACCESS REJECT message on the PACCH. On receipt of a PACKET UPLINK ASSIGNMENT message the mobile earth station shall switch to the assigned uplink PDCHs and begin to send RLC data blocks on the assigned PDCH(s).

On receipt of a PACKET ACCESS REJECT message, in A/Gb mode containing a Reject structure addressed to the mobile earth station, the mobile earth station shall start timer T3172 with the indicated value (Wait Indication). The mobile earth station is not allowed to make a new attempt for packet access in the same spotbeam until timer T3172 expires, but may attempt packet access in another spotbeam after successful spotbeam reselection. When timer T3172 expires, if the downlink TBF is still active the mobile earth station shall initiate the establishment of an uplink TBF using the procedure in this clause. If no TBF is active, the mobile earth station shall initiate the establishment of an uplink TBF on CCCH or PCCCH.

In Iu mode, on receipt of a Packet Channel Request Type 2 message or a PACKET DOWNLINK ACK/NACK message with the packet channel request or Iu Mode Channel Request embedded, the network may assign radio resources to the mobile earth station on one or more PDCHs by transmitting an uplink assignment (PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE) message on the PACCH, or may reject the request by sending a PACKET ACCESS REJECT message on the PACCH.

If the PACKET TIMESLOT RECONFIGURE message is sent, then the message shall contain the UPLINK_TFI_ASSIGNMENT field.

If multiple TBF procedures are supported by the mobile earth station and the network, the network shall indicate the RB Id associated with each TBF it allocates or reallocates in the uplink assignment message.

In Iu mode, on receipt of an uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT TYPE 2, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message) the mobile earth station shall proceed as follows:

- On reception of an uplink assignment message the mobile earth station shall stop the instance of timer T3168 associated with the TBF receiving a resource allocation.
- The mobile earth station shall then switch to the assigned uplink PDCHs and begin to send RLC data blocks on the assigned PDCH(s).

A mobile earth station that supports multiple TBF procedures shall act on the uplink assignment message as follows:

- Upon reception of a PACKET UPLINK ASSIGNMENT TYPE 2 message the mobile earth station shall release all ongoing uplink TBFs not addressed by this message and shall act on the message. If multiple uplink TBFs were requested then the mobile earth station shall consider those not addressed by this message as rejected and shall stop the corresponding T3168 timer instances. All ongoing downlink TBFs shall be maintained.
- Upon reception of a PACKET TIMESLOT RECONFIGURE message the mobile earth station shall release all ongoing uplink and downlink TBFs not addressed by this message and shall act on the message. If multiple uplink TBFs were requested then the mobile earth station shall consider those not addressed by this message as rejected and shall stop the corresponding T3168 timer instances.
- Upon reception of a MULTIPLE TBF UPLINK ASSIGNMENT message the mobile earth station shall maintain all ongoing TBFs not addressed by this message using its currently allocated TBF parameters and shall act on the message. If a requested uplink TBF is not addressed by this message and the associated timer T3168 is still running the mobile earth station shall wait for another instance of this message.
- Upon reception of a MULTIPLE TBF TIMESLOT RECONFIGURE message the mobile earth station shall release all ongoing uplink and downlink TBFs not addressed by this message and shall act on the message. If multiple uplink TBFs were requested then the mobile earth station shall consider those not addressed by this message as rejected and shall stop the corresponding T3168 timer instances.

In Iu mode, on receipt of a PACKET ACCESS REJECT message that contains a Reject structure addressed to the mobile earth station, the mobile earth station shall stop the instance of timer T3168 associated with each uplink TBF being rejected and indicate a packet access failure to the corresponding upper layers.

If the PACKET ACCESS REJECT message contains a WAIT_INDICATION field in a Reject structure addressed to the mobile earth station, it shall proceed as follows:

- If multiple TBF procedures are not supported the mobile earth station shall start timer T3172 with the indicated value (Wait Indication). The mobile earth station is not allowed to make a new attempt for uplink TBF establishment in the same cell until timer T3172 expires, but it may attempt uplink TBF establishment in another cell after successful cell reselection.
- If both the mobile earth station and the network support multiple TBF procedures the mobile earth station shall start one instance of timer T3172 for each uplink TBF that was rejected. All ongoing TBFs shall be maintained. The mobile earth station is not allowed to attempt re-establishment of a rejected uplink TBF in the same cell until its associated instance of timer T3172 expires.

If all instances of timer T3168 have expired, the mobile earth station shall retransmit the Packet Channel Request or Packet Channel Request Description IE in the next PACKET DOWNLINK ACK/NACK message unless the message has already been transmitted three times in which case the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]). If all the ongoing downlink TBFs are released, including expiry of timer T3192, before expiry of all instances of timer T3168 and no uplink TBFs are either ongoing or have received an uplink assignment, the mobile earth station shall stop all remaining instances of timer T3168 and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

8.1.2.5.1 Abnormal cases (A/Gb mode)

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

- If the mobile earth station receives a PACKET UPLINK ASSIGNMENT message containing different frequency parameters than are currently in effect for the downlink TBF, the mobile earth station shall ignore the PACKET UPLINK ASSIGNMENT message, continue normal operation of the downlink TBF, and reinitiate the access unless it has already been attempted 4 times, in which case, the mobile earth station shall perform the abnormal release with random access (see clause 8.7.2).
- If a failure in the PACKET UPLINK ASSIGNMENT is due to any other reason, the mobile earth station shall abort the procedure, inform the upper layer of the uplink TBF establishment failure, and continue the reception of downlink PDUs.

8.1.2.5.1a Abnormal cases (lu mode)

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

- If the information in the PACKET UPLINK ASSIGNMENT TYPE 2 or MULTIPLE TBF UPLINK ASSIGNMENT message violates the mobile earth station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If the mobile earth station receives a PACKET UPLINK ASSIGNMENT TYPE 2 or a MULTIPLE TBF UPLINK ASSIGNMENT message containing different frequency parameters than are currently in effect for the downlink TBF(s), the mobile earth station shall ignore the PACKET UPLINK ASSIGNMENT TYPE2/MULTIPLE TBF UPLINK ASSIGNMENT message, continue normal operation of the ongoing downlink TBF(s), and reinitiate the establishment of the uplink TBF(s) unless the establishment of the uplink TBF(s) has already been attempted four times, in which case, the mobile earth station shall perform the abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If a mobile earth station in MAC-DTM state receives a PACKET UPLINK ASSIGNMENT TYPE 2 or a MULTIPLE TBF UPLINK ASSIGNMENT message including the Frequency Parameters information element, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If a failure in the PACKET UPLINK ASSIGNMENT TYPE 2 or in the MULTIPLE TBF UPLINK ASSIGNMENT message is due to any other reason, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2).
- If the information in the PACKET TIMESLOT RECONFIGURE or in the MULTIPLE TBF TIMESLOT RECONFIGURE message does not properly specify a set of uplink and downlink PDCH(s) or violates the mobile earth station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If the PACKET TIMESLOT RECONFIGURE or the MULTIPLE TBF TIMESLOT RECONFIGURE message does not include a correct UPLINK_TFI_ASSIGNMENT field, then the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If a mobile earth station in dual transfer mode receives a PACKET TIMESLOT RECONFIGURE or a MULTIPLE TBF TIMESLOT RECONFIGURE message including the Frequency Parameters information element, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If a failure in the PACKET TIMESLOT RECONFIGURE or in the MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).
- If the failure is due to any other reason, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

- If both the mobile earth station and the network support multiple TBF procedures and if any given uplink assignment message provides an uplink TBF allocation for a RB Id not indicated in the request for uplink TBF sent by the mobile earth station, the mobile earth station shall abort the procedure and perform an abnormal release with access retry (see clause 8.7.2 and ETSI TS 101 376-4-14 [24]).

8.1.2.6 Void

8.1.2.7 Void

8.1.2.8 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 earth station on the PACCH.

The mobile earth station shall immediately stop monitoring its assigned downlink PDCHs. If a valid UUG field is received as part of the Packet TBF Release message, the mobile earth station shall transmit an acknowledgement message as described in clause 10.4.5 in the uplink Mac-slot/D-MAC-slot specified.

The mobile earth station shall locally release all downlink and uplink TBFs in progress then shall enter packet idle mode. Upon entering packet idle mode, the mobile earth station shall apply DRX mode procedures as specified in clause 5.5.1.4.

8.1.2.9 Network initiated release of downlink TBF

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

If the cause value is "Normal release" the mobile earth station shall immediately stop monitoring its assigned downlink PDCHs and locally release the TBF. If the PACKET TBF RELEASE message is accompanied by a poll, the mobile earth station shall transmit an acknowledgement message as described in clause 10.4.5. Any partially received PDU or fully received but not fully acknowledged PDU (in RLC acknowledged mode) shall be treated as not having been received.

If the cause value is "PDCH-carrier being deassigned" the mobile earth station shall immediately stop monitoring its assigned downlink PDCHs and locally release all TBFs in progress. The PACKET TBF RELEASE message with release cause "PDCH-carrier being deassigned" will not be accompanied by a poll. Any partially received PDU or fully received but not fully acknowledged PDU (in RLC acknowledge mode) shall be treated as not having been received. Next time the mobile earth station shall perform TBF establishment using CCCH as described in clause 7.1.4.

If the cause value is "Abnormal Release" the mobile earth station shall follow the TBF release procedure defined in clause 8.1.2.8.

If the cause value is "Resource not available", the mobile earth station of GMPRS terminal type D shall immediately stop monitoring its assigned downlink PDCHs and locally release all TBFs in progress. Note that the PACKET TBF RELEASE message with the release cause "Resource not available" shall not be accompanied by a poll. Any partially received PDU or fully received but not fully acknowledged PDU (in RLC acknowledged mode) shall be treated as not having been received. The mobile earth station shall perform a TBF establishment using CCCH as described in clause 7.1.4. This cause value shall be ignored by the MES of GMPRS terminal type A and C.

8.1.2.10 Network initiated Establishment of Uplink TBF

In Iu mode, the network may initiate the establishment of a new uplink TBF for the mobile station by sending an uplink assignment message (e.g. PACKET UPLINK ASSIGNMENT TYPE 2, PACKET MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TBF ASSIGNMENT, PACKET DCH ASSIGNMENT...). The mobile earth station shall then create a new TBF as specified in the assignment message then switch to the assigned uplink channel and begin to send any new RLC data blocks on the assigned channel.

8.1.3 Void

8.1.4 Multiplexing of control and data messages (A/Gb mode only)

An RLC/MAC block in both acknowledged and unacknowledged mode may constitute multiplexed control blocks and a RLC data block. In A/Gb mode, each RLC/MAC block shall be capable of multiplexing at most two control blocks of 18 octets each along with a single RLC block.

Refer clause 10 for radio block structure definition and payload octets per modulation and coding scheme (MCS).

When an uplink TBF is active, the MES may multiplex control blocks and a RLC data block in any RLC/MAC block. The size of the RLC data block shall be adjusted to make space for the control information. In case the RLC/MAC block has to be retransmitted, the same number of control blocks shall be inserted as in the original RLC/MAC block; in the absence of any other pending control blocks, a dummy control block may be inserted. The MES may also transmit a control block with no data - for this it shall set the payload type field and other header variables appropriately. The MES should not transmit a control block standalone if there is new data pending, but may be required to do this when the only pending data is blocks for retransmission which are too big to fit into the payload along with the control message. In these cases, a control message always takes precedence over RLC blocks waiting for retransmissions.

When a downlink TBF is active, the network may multiplex control blocks and a RLC data block in any MAC/RLC block. The size of the RLC block shall be adjusted to make space for the control blocks. In case the MAC/RLC block has to be retransmitted, the same number of control blocks shall be inserted as in the original MAC/RLC block; in the absence of any other pending control blocks, one or more dummy control blocks may be inserted. The network may also transmit a control block with no data - for this it shall set the payload type field and other header variables appropriately. The network should not transmit a control block standalone if there is new data pending, but may be required to do this when the only pending data is RLC blocks for retransmission which are too large to be multiplexed with a control block. In these cases, a control message always takes precedence of pending RLC blocks for retransmissions.

8.1.5 Multiplexing multiple TBFs on the same burst (lu mode only)

On the downlink, multiple MAC/RLC blocks belonging to different TBFs may be multiplexed on the same burst. The TBFs may belong to the same or different MES. When multiplexing multiple TBFs each RLC block has a TFI and a PDU length field in the RLC/MAC header. The presence of the PDU length field is indicated through the LI bit. The PDU length field does not include the RLC/MAC header size. The absence of the PDU length field in the header (i.e. When LI is set to "0") indicates that the RLC/MAC continues until the end of the burst and is determined as described in clauses 9.1.11 and 9.1.12. Transparent mode RLC block length is indicated through the Payload Subtype field. A MES in transfer mode is able to parse through the payload for TBF or RLC/MAC control packet destined to it using the RLC/MAC header and the PDU length field. If the RLC/MAC PDUs do not exactly occupy a full burst, multiplexing ends when:

- the payload left is less than 2 bytes; or
- the occurrence of a downlink control header with PDU length set to zero using 2 octets (equivalently a bit sequence of value 0x4001).

At most two control blocks may be multiplexed in a downlink burst with length as specified in the header. The multiplexed RLC data blocks may occupy variable number of octets depending on the MCS and the number of control blocks multiplexed.

On uplink, the radio block may be used for control only, data only or multiplexed control and data. When control and data information are multiplexed, the data block shall always occur after the control block. At most two control blocks may exist in the burst, each carrying its own MAC header indicating the length of the control block. When a control block is present in the burst, it may be followed by either another control block indicated with the payload type ("01"), or by a Non-Transparent Mode RLC block indicated by a the payload type ("00").

When there is an active uplink TBF, The MES should not transmit a control block standalone if there is new data pending, but may be required to do this when the only pending data is blocks for retransmission which are too big to fit into the payload along with the control message. In these cases, a control message shall always take precedence over RLC blocks waiting for retransmissions. When selecting a flow to multiplex with the RLC control block, uplink TBF associated with the same Radio Bearer as that of the RLC control block has highest priority.

No more blocks are present if:

- the remaining payload left is less than 2 bytes; or
- the occurrence of an uplink control header with PDU length set to zero using 2 octets (equivalently a bit sequence of value 0x4001).

Note that the occurrence of an uplink control header of size 1 byte with PDU length set to zero (equivalently a bit sequence of value 0x41) does not indicate that there are no more blocks.

At most one Non-Transparent mode RLC block may be present in the burst.

When present, the RLC/MAC data block shall fill the remaining of the payload. If the RLC block cannot fill the remaining of a payload, for example due to retransmission, it shall be prepended with an uplink dummy control block of appropriate length. In order to prepend with only 1 byte, an uplink control header of size 1 octet with PDU length set to zero (equivalently a bit sequence of value 0x41) shall be used. In all other cases, an uplink control header followed by an uplink dummy control block of appropriate length shall be used.

On uplink, terminal capability permitting, the radio block may be used to carry multiple Transparent mode RLC blocks for different flows, followed by at most 2 control blocks and/or at most one other Non-Transparent mode RLC block. Note that the payload subtype indicates the length of transparent mode RLC blocks.

8.2 Packet PDCH release (lu mode only)

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

When a mobile station receives a PACKET PDCH RELEASE message, 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 all of the mobile station's assigned PDCHs are removed from its list of assigned PDCH, and, if at least one uplink TBF was in progress, the mobile station shall perform an abnormal release with random access (see clause 8.7.2). If no uplink TBFs were in progress, the mobile station shall perform an abnormal release with return to CCCH or PCCCH. (see clause 8.7.1).

8.3 Procedure for measurement report sending in Packet Transfer mode (lu mode only)

The MES shall transmit measurement report (PACKET MEASUREMENT REPORT) only when explicitly requested by the network in a PACKET MEASUREMENT ORDER message. See clause 5.6.3.1.

8.4 Network controlled cell reselection procedure (lu mode only)

8.4.0 General

In GMR-1 3G, cell reselection when the mobile earth station is in packet transfer mode, is controlled by the network.

When a cell reselection is initiated by the network for an individual mobile earth station, the cell change order procedure is started by sending a PACKET CELL CHANGE ORDER message to the mobile earth station on the PCCCH or PACCH.

The PACKET CELL CHANGE ORDER message contains:

- The characteristics of the new cell that are necessary to identify it (i.e. BCCH frequency).
- The IMMEDIATE_REL parameter.

For a multi-RAT mobile earth station, the PACKET CELL CHANGE ORDER message may contain information on a 3G target cell, together with the IMMEDIATE_REL parameter; in the case of UTRAN establishment of UTRAN channel(s) and subsequent measurement reporting are defined in ETSI TS 125 331 [i.2].

Upon receipt of the PACKET CELL CHANGE ORDER message the mobile earth station shall start timer T3174 and apply the cell reselection procedure defined in ETSI TS 101 376-4-14 [24], with the additional rule that an immediate abort of operation in the old cell may be required by the network through the IMMEDIATE_REL field, except for the acknowledgement, by means of a PACKET CONTROL ACKNOWLEDGEMENT message, of a valid UUG field possibly included in the PACKET CELL CHANGE ORDER message. A UTRAN capable mobile earth station ordered to a UTRAN cell shall obey the PACKET CELL CHANGE ORDER message irrespective of whether the target cell is known or not known (see ETSI TS 125 133 [i.3] and ETSI TS 125 123 [i.4]).

If the timers related to measurement reporting expire while the reselection procedure has not yet been completed, these timers shall be restarted so that the mobile earth station resumes the measurement reporting procedures once camped on the new cell.

8.4.1 Network controlled cell reselection completion

The mobile earth station shall regard the network controlled cell reselection procedure as successfully completed when it has performed access and successfully completed TBF establishment in the new cell, or the GMM READY timer (see ETSI TS 124 008 [i.1]) stops running during the execution of the procedure. The mobile earth station shall then stop timer T3174.

NOTE: Access may be performed for the establishment of a dedicated connection or an uplink TBF.

If the GMM READY timer stops running, the mobile earth station shall abort all data transfers and apply the idle mode cell re-selection procedures.

8.4.2 Abnormal cases

In the following cases, the mobile earth station shall determine that the network controlled cell reselection procedure has failed:

- The PACKET CELL CHANGE ORDER message commands the mobile earth station to a frequency in a frequency band not supported by the mobile earth station. *Cause*: "frequency not implemented".
- Access is denied in the new cell (i.e. the mobile earth station receives an IMMEDIATE ASSIGNMENT REJECT, a PACKET ASSIGNMENT REJECT or, in a UTRAN cell, an RRC CONNECTION REJECT message). *Cause*: "Immediate Assign Reject or Packet Access Reject on target cell".
- The mobile earth station is unable to synchronize to the new cell (see ETSI TS 101 376-5-6 [15]) or the timer T3174 expires before a successful completion of the network controlled cell reselection procedure. *Cause*: "No response on target cell".
- Due to any other reason (e.g. unknown or unsupported target cell information). In this case the MS shall set the ARFCN to the value zero and set the cause to value "frequency not implemented".

If the mobile earth station determines that the network controlled cell reselection procedure has failed, the mobile earth station shall stop timer T3174 (if it is still running) and start timer T3176. The mobile earth station shall return to the old cell, where it may trigger a cell update or other GMM specific procedure. In case the mobile earth station synchronized and attempted to access the new cell before returning to the old cell, the mobile earth station shall trigger a cell update or other GMM specific procedure, as appropriate according to the GMM requirements (see ETSI TS 124 008 [i.1]).

The mobile earth station shall send a PACKET CELL CHANGE FAILURE message with the appropriate cause value to the network in the old cell and stop timer T3176. The PACKET CELL CHANGE FAILURE message may be sent on PACCH when the mobile earth station is in packet transfer mode or MAC-Shared state. Alternatively, the mobile earth station may initiate uplink TBF establishment and send the PACKET CELL CHANGE FAILURE message using the assigned TBF.

A mobile earth station shall ignore a PACKET CELL CHANGE ORDER message received while in MAC-DTM state (refer to ETSI TS 101 376-4-14 [24]).

If a MES which is UTRAN capable is commanded to a 3G-target cell whose description is in contradiction to the UTRAN capabilities of the mobile earth station, it shall include the UTRAN FDD target cell or UTRAN TDD Target cell IE in the PACKET CELL CHANGE FAILURE message.

In case the network controlled cell reselection procedure fails and the MES returns to the old cell, the MS shall delete any stored NC measurement parameters and stop timer T3158.

If the mobile earth station is unable to synchronize to the old cell (see ETSI TS 101 376-5-6 [15]), or if timer T3176 expires, the mobile earth station shall cancel the sending of the PACKET CELL CHANGE FAILURE message and perform an autonomous cell re-selection.

8.5 Measurement order procedures in packet transfer mode (lu mode only)

The network may initiate the measurement order procedure by sending a PACKET MEASUREMENT ORDER message on the PACCH to a mobile earth station in packet transfer mode or in MAC-Shared state.

Upon receipt of the PACKET MEASUREMENT ORDER message, the mobile earth station shall store the received parameters and perform measurements as specified in ETSI TS 101 376-5-6 [15] and in clause 5.6.

8.6 Packet control acknowledgement

A PACKET CONTROL ACKNOWLEDGEMENT message shall always be sent in the uplink Mac-slot/D-MAC-slot specified by the corresponding valid UUG field of a downlink RLC/MAC control block, and not in any other uplink Mac-slot/D-MAC-slot that may be allocated to the mobile earth station. The transmission of the PACKET CONTROL ACKNOWLEDGEMENT takes precedence over the transmission of RLC data blocks.

The Global TFI or G-RNTI in PACKET CONTROL ACKNOWLEDGEMENT message shall be set as follows:

- If the PACKET CONTROL ACKNOWLEDGEMENT is sent in response to a downlink control message with UUG=1 and if this downlink control message contains a Global TFI, then the MES shall use the Global TFI as is.
- If the PACKET CONTROL ACKNOWLEDGEMENT is sent in response to a downlink control message with UUG=1 and if this downlink control message contains a single TFI (e.g. Packet Downlink Assignment or Packet Downlink Assignment Type 2, Packet Uplink Assignment, Packet Uplink Assignment Type 2), then the MES shall use the Global TFI. TFI field in Global TFI IE shall be set to the TFI from the downlink control message and the direction field shall be set to the direction for which the TFI is applicable.
- If the PACKET CONTROL ACKNOWLEDGEMENT is sent in response to a downlink control message with UUG=1 and if this downlink control message contains more than one TFI (Multiple Downlink TBF Assignment, Multiple Uplink TBF Assignment, or multiple control messages in a single RLC/MAC block), then the MES shall use G-RNTI.
- If the PACKET CONTROL ACKNOWLEDGEMENT is sent in response to a downlink control message with UUG=1 and if this downlink control message does not contain any TFI, then the MES shall use G-RNTI.

8.7 Abnormal cases

8.7.1 Abnormal release with return to CCCH or PCCCH

When performing an abnormal release with return to CCCH or PCCH, the mobile earth station shall abort all TBFs in progress and return to packet idle mode. Upon entering packet idle mode, the MES shall apply DRX mode procedures as specified in clause 5.5.1.5.

8.7.2 Abnormal release with random access

When performing an abnormal release with random access, the mobile earth station shall abort all TBFs in progress and its associated resources, return to the CCCH or PCCCH and initiate establishment of a new uplink TBF as defined in clause 7.1.

8.7.3 Abnormal release with system information

When performing an abnormal release with system information, the mobile earth station shall abort the TBF and its associated resources, immediately return to the BCCH and reread all relevant BCCH information. If the mobile earth station was performing an uplink TBF when the abnormal release occurred, the mobile earth station shall then perform an abnormal release with random access (see clause 8.7.2). Otherwise the mobile earth station shall perform an abnormal release with return to CCCH or PCCCH (see clause 8.7.1).

8.8 Packet link quality reporting in packet transfer mode (A/Gb mode only)

The MES shall send a link quality report, i.e. PACKET LINK QUALITY REPORT message on the first transmission opportunity in any uplink or downlink TBF. The SIN field in this PACKET LINK QUALITY REPORT message shall be set to 1. Thereafter when in packet transfer mode, the MES shall send PACKET LINK QUALITY REPORT message every time an uplink PTCCH Mac-slot/D-MAC-slot is scheduled to it (refer ETSI TS 101 376-5-7 [16]). The MES shall increment the SIN value every time it sends the PACKET LINK QUALITY REPORT message and this value shall be limited to a maximum value of 15.

8.8a Packet link quality reporting in packet transfer mode (lu mode only)

The MES shall send a link quality report using PACKET LINK QUALITY REPORT Type 2 message, PACKET DOWNLINK ACK/NACK message or PACKET CONTROL ACK message on the first transmission opportunity using uplink TBF, PACCH, or DACCH after a measurement update as described ETSI TS 101 376-5-6 [15].

8.9 Coding rate change procedure in packet transfer mode

8.9.0 General

The network shall monitor the link quality for both uplink channel and downlink channel for each MES. During packet transfer session, network may instruct MES to change either downlink TBF or uplink TBF coding rate while TBF is in packet transfer mode.

8.9.1 Downlink TBF coding rate change procedure

The network may change the coding rate dynamically while the downlink TBF is active by changing the MCS field in the PUI.

8.9.2 Uplink TBF coding rate change procedure

When MES receives a Packet Uplink ACK/NACK, Packet Uplink ACK/NACK type 2, or Packet Link Adaptation Control message with a different CHANNEL_MCS_COMMAND field, MES shall apply the new coding rate immediately to the uplink TBF indicated in the message. Retransmission of RLC blocks shall use the same MCS applied to the lost RLC block. If the lost RLC block included a control message, the retransmitted RLC block shall replace the lost control message with a Packet Uplink Dummy Control Block. Packet Uplink ACK/NACK type 2 may also be used to change the MCS of an uplink TBF in RLC UNACK mode, in which case the GMPRS Ack/Nack Description field shall be ignored.

9 Radio Link Control (RLC) procedures in packet transfer mode

9.0 General

The RLC function is responsible for:

- Interface primitives allowing the transfer of upper layer PDUs between the upper layer and the MAC function.
- Segmentation of upper layer PDUs into RLC data blocks and re-assembly of RLC data blocks into upper layer PDU.
- Segmentation of RLC/MAC control messages into RLC/MAC control blocks and re-assembly of RLC/MAC control messages from RLC/MAC control blocks.
- Backward Error Correction (BEC) procedures enabling the selective retransmission of RLC data blocks.

In this clause 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): 1 024;
- Window Size (WS): 512.

A mobile earth station that supports multiple TBF procedures can operate multiple RLC entities simultaneously each one with its own set of RLC parameters (e.g. sequence number; receive and transmit windows, etc.).

9.1 Procedures and parameters for peer-to-peer operation

9.1.0 General

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 clause 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.

Peer RLC endpoints have the same RLC mode and radio priority.

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.

9.1.1a Control send state variable V(CS)

This function is not supported in GMR-1.

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 clause 9.1.8).

Furthermore, $[V(S) - V(A)] \text{ modulo SNS} \leq WS$.

9.1.3 Acknowledge state array V(B)

9.1.3.1 Acknowledge state array V(B) for GMPRS

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 Received Block Bitmap (RBB) of the Packet Ack/Nack message (see clause 9.1.8).

The transmitter shall transmit the oldest RLC data block whose corresponding element in V(B) indexed relative to V(A) has the value NACKED. When the transmitter is the mobile earth station and the RLC data block sent has a corresponding element in V(B) set to NACKED, the mobile shall increment N3306 counter. There is a N3306 counter per RLC block. 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 a new data block is acknowledged whose BSN falls outside of the active transmit window, i.e. $[V(A) > BSN \text{ or } BSN \geq V(S)] \text{ modulo SNS}$, the corresponding element in V(B) shall remain in the INVALID state.

If the mobile earth station is the transmitter, it shall set an instance of timer T3198 for each RLC block sent. The value of timer T3198 is computed from the SI parameter BS_CV_MAX as given in clause 13.1.

9.1.3.2 Void

9.1.4 Block Sequence Number BSN

9.1.4.1 Block Sequence Number BSN for GPRS TBF

Each RLC data block contains a Block Sequence Number (BSN) field that is 10 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 Void

9.1.4a Void

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 the received RLC data block with the highest BSN within the current window.

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

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 shall be set to $V(R)$ if all RLC data blocks in the receive window have been received properly.

In RLC unacknowledged mode $V(Q)$ is not used.

9.1.7 Receive state array $V(N)$

9.1.7.1 Receive state array $V(N)$ in GMPRS TBF

Each RLC endpoint receiver in acknowledged mode 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 state variable $V(Q)$ modulo SNS . When an RLC data block is received with BSN within the receive window (i.e. $[V(Q) \leq BSN < V(Q) + WS]$ modulo SNS), the corresponding element in $V(N)$ is set to the value RECEIVED.

When a new block is received with a BSN outside of the receive window the corresponding element in $V(N)$ shall remain in the INVALID state and the new block shall be discarded.

9.1.7.2 Void

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

9.1.8.1 Starting Sequence Number (SSN) and Received Block Bitmap (RBB) in GMPRS TBF

9.1.8.1.0 General

The Packet Ack/Nack message contains a Starting Sequence Number (SSN) and a Received Block Bitmap (RBB). The Packet Ack/Nack message is sent by the RLC receiver and is received by the RLC transmitter. The SSN and RBB are determined as defined in this clause and transmitted in both RLC acknowledged and RLC unacknowledged mode. The SSN and RBB may be ignored by the RLC transmitter in unacknowledged mode.

The BSN values specified in the RBB are found by adding the bit position in the bitmap to the Starting Sequence Number (SSN) modulo SNS, where the bit positions in the bitmap are numbered beginning with 1.

A valid BSN value in the RBB is one that is in the range $[V(A) < BSN < V(S)]$ modulo SNS.

These inequalities shall be interpreted in the following way:

- BSN is valid if, and only if, $[BSN - V(A)]$ modulo SNS $< [V(S) - V(A)]$ modulo SNS.

The Starting Sequence Number (SSN) is assigned the value of the receive state variable $V(Q)$.

9.1.8.1.1 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 $V(R)$: 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 $[V(R) - 1]$ modulo SNS. This global number of elements is less than or equal to $WS-1$. 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 reported bitmap (RB) shall then be generated. The size of the reported bitmap shall be adjusted to fit into the control message that is going to carry it. The RB is assigned the N bits of the FRB relative to the SSN, where N depends on the reported bitmap size used.

If compression is supported, using the compression algorithm, the receiver generates RB of length N bits starting at SSN, where N is the reported bitmap size used.

If the compressed reported bitmap covers more blocks than the uncompressed reported bitmap, the receiver shall send the compressed reported bitmap, otherwise the receiver shall send the uncompressed reported bitmap. As an exception, if the FRB length or the range of indices from SSN to the end of FRB is less than or equal to N bits, the receiver may send the uncompressed reported bitmap without attempting compression.

9.1.8.1.2 Interpretation of the bitmap

If a compressed reported bitmap is received, the bitmap shall first be decompressed according to clause 9.1.10. The uncompressed bitmap shall then be treated as follows: Firstly, the bitmap acknowledges all blocks between $V(A)$ and $(SSN - 2)$ (modulo SNS), and the corresponding elements in $V(B)$ shall be set to the value ACKED. Also a bitmap value of "0" is assumed at the bit position corresponding to $(SSN-1)$ modulo SNS which corresponds to $V(Q)$.

If an uncompressed bitmap is received or after decompression of a received compressed bitmap, for each bit in the 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 bitmap whose corresponding BSN is not within the transmit window shall be ignored. If the RLC transmitter is on the MES side, the bit contains the value "0", the instance of timer T3198 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.

If the RLC transmitter receives a partial RBB array (indicated by an RBB length less than the maximum permissible length), the RLC transmitter shall create a full-size RBB array by appending "0" values to the end of the partial RBB array received. The RLC transmitter shall then interpret the full-size RBB array as described in the previous paragraph.

9.1.8.2 Void

9.1.9 Window size

For GMR-1 3G, the window size (WS) shall be 512.

9.1.9a 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.

9.1.10 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 Recommendation ITU-T T.4 [i.5]) 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. 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 to 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.

The compressed bitmap is assumed to be of length L_c (see clause 12) 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 shall 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 variable length (see clause 12). Any bits representing sequence numbers $V(R)$ or beyond in either the compressed or uncompressed portion of the bitmap shall be set to 0. Implementations may use other schemes to determine the boundary between the compressed and uncompressed portions of the bitmap.

Table 9.1.10.1: Terminating codes (reproduced from Recommendation ITU-T T.4 [i.5]); T.4 code words used for representing run lengths of 1 zero and 3 zeros are interchanged

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
8	10011	8	000101
9	10100	9	000100
10	00111	10	0000100

One run length	Code word	Zero run length	Code word
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
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 9.1.10.2: Make-up codes
(reproduced from Recommendation ITU-T T.4 [i.5])

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

9.1.11 Segmentation of upper layer PDUs into RLC data units

Segmentation of upper layer PDUs is supported to allow transport of upper layer PDUs larger than the data field of a single RLC data block. Prior to segmentation, each PDU is prepended with a two octet field indicating its length. The upper layer PDU length value does not include the two octets occupied by the prepended length field. The upper layer PDU length octets are ordered as most significant octet, least significant octet. If the contents of an upper layer PDU do not fill an integer number of RLC data blocks, the beginning of the next upper layer PDU shall be placed within the final RLC data block of the first upper layer PDU, with no padding or spacing between the end of the first upper layer PDU and two octet length field indicating the length of the second PDU. If the final upper layer 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.

If an upper layer PDU ends within a RLC block and another does not begin within the block, then the most significant byte of the length field for the following upper layer PDU field shall be set to 0xFF (255). All subsequent bytes within the RLC block, if any, shall be set to the fill value.

The LastPartSize field is used to indicate the length of the upper layer PDU fragment in the RLC data block. The LastPartSize field in the header is set to zero if a new upper layer PDU starts at the beginning of the RLC data block. If the RLC data block begins with the last fragment of the previous upper layer PDU, then the LastPartSize is set to indicate the length of the last fragment. However, if the entire RLC data block contains the middle segment of an upper layer PDU, the LastPartSize is set to the value 0xff if the MES terminal type is A or C, for all other terminal types the LastPartSize is set to the value of 0x7ff. The received (and segmented) upper layer PDUs shall be put into RLC data blocks in the same order as they are received from higher layers. A Block Sequence Number (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 re-assembly of the upper layer PDUs on the receiving side.

In Normal TBF mode, 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 and BSN as it had in the previous transmission.

9.1.12 Re-assembly of upper layer PDUs from RLC data units

RLC data blocks shall be collected at the receiver until all RLC data blocks comprising an upper layer 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 upper layer PDU and passed to the next higher layer. During re-assembly, the LastPartSize field in the RLC/MAC header will be used to determine whether the RLC data block contains the last fragment of a previous upper layer PDU.

If the received LastPartSize is zero, a new upper layer PDU starts in the RLC data block and the first two bytes of the RLC data block are interpreted as the length of the new upper layer PDU.

The 0xFF or 0x7FF value of LastPartSize indicates that the RLC data block contains an upper layer PDU which started in one of the previous RLC data blocks and continues into at least the next RLC data block. All other values of LastPartSize are used for identifying the length of the last fragment of an upper layer PDU.

If the Last Part Size is neither 0x00 nor 0xFF when the MES terminal type is A or C or if the Last Part Size is neither 0x000 nor 0x7FF for other terminal types, then the 2 octets immediately following the end of the current upper layer PDU shall be considered to be the length of the next upper layer PDU. If the most significant byte of the upper layer PDU length field found within an RLC block has the value 0xFF (255), then the rest of the bytes within the block are fill bytes and shall be ignored by the receiver.

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

During RLC unacknowledged mode operation, received upper layer PDUs shall be delivered to the higher layer in the order in which they are received. If an RLC block is lost, the partially reassembled upper layer PDU is discarded. The RLC receiver shall monitor the LPS field in subsequent RLC blocks for the beginning of the next upper layer PDU. Reassembly shall then commence with the next upper layer PDU.

The size of the data plane upper layer PDU delivered to the higher layer shall not exceed 1 560 octets when operating in A/Gb mode. If the contents of the upper layer PDU length octets indicate a size greater than 1 560 octets, the receiver shall perform abnormal release of the TBF.

If the contents of the LastPartSize field do not correspond to the expected length, as read from the two octets of the upper layer PDU length field, the receiver shall perform abnormal release of the TBF.

9.1.12a Void

9.1.12b Void

9.1.12c Dummy Data Block (lu mode only)

A dummy data block contains only an RLC/MAC Data header. Its LastPartSize is set to 0x7FE for PDCH3. Its Reduced LastPartSize is set to 0x1E. Except for the BSN, which should not be interpreted, all the fields in the MAC header should be set appropriately. Dummy data blocks can be sent in downlink and uplink direction and are referred to as downlink dummy data block and uplink dummy data block respectively. Dummy data blocks can be sent on PDCH3 and DACCH. The corresponding RLC/MAC data header shall be used according to channel type and direction of transmission.

9.1.13 Void

9.2 Operation during RLC/MAC control message transfer

RLC/MAC control blocks or blocks containing control information shall be sent at a higher priority than RLC data blocks.

The receiver shall not acknowledge an RLC/MAC control block except when a valid UUG 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.

9.3 Operation during RLC data block transfer

9.3.0 General

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.

In A/Gb mode, the mobile earth station requests the RLC mode of the uplink TBF by setting the RLC_MODE bit to either RLC acknowledged mode or RLC unacknowledged mode in PACKET CHANNEL REQUEST message. The network sets the RLC mode of an uplink TBF by setting the RLC_MODE bit in the PACKET UPLINK ASSIGNMENT. The network sets the RLC mode of a downlink TBF by setting the RLC_MODE bit in the PACKET DOWNLINK ASSIGNMENT message.

In Iu mode, RLC mode is set based on radio bearer information in RRC messages specified in ETSI TS 101 376-4-13 [23].

9.3.1 Void

9.3.2 Acknowledged mode operation

9.3.2.0 General

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 Block Sequence Number (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.

The network shall inform the MES of the coding scheme to be used for the current assignment; refer to ETSI TS 101 376-3-22 [5]. The signal quality report generated as specified in ETSI TS 101 376-5-6 [15] shall be used to make a decision on the type of coding scheme to be used for any subsequent assignment. Retransmission of RLC data blocks shall take place with the same coding scheme used initially.

9.3.2.1 Additional functionality in acknowledged mode on PDCH3 (Iu mode only)

According to the link quality, an initial Modulation and Coding Scheme (MCS) is selected for RLC block. For retransmissions, the same or another MCS may be selected. If the retransmission occur on a more robust MCS scheme, different parts of RLC data block need to be sent in different radio blocks as the initially transmitted RLC block no longer fits in the radio block with the new MCS. In this case, the Split Block Number (SPBN) and the Final Split Block (FSB) bit shall be set to indicate that the RLC block is split and whether it is the final split block belonging to the RLC with BSN in the MAC header. When the split block does not fully occupy the radio block, the PDU length field should be used to indicate the exact size of the split block when sent on the downlink. On the return link, it shall be prepended with an uplink dummy control block of appropriate length.

9.3.2.2 Establishment of temporary block flow

The establishment of a TBF occurs as described in clause 7. RLC functions related to the ARQ function shall not operate until RLC data block transfer has been initiated.

9.3.2.3 Operation of uplink temporary block flow

The mobile earth station shall transmit an RLC/MAC block in each assigned uplink Mac-slot/D-MAC-slot. RLC/MAC control blocks have preference over RLC data blocks, i.e. temporarily replacing the PDCH with PACCH.

The network shall send PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 messages when needed. The network shall send link synchronization parameters as and when needed in PACKET UPLINK ACK/NACK, PACKET UPLINK ACK/NACK TYPE 2 or PACKET LINK CONTROL message.

The timer T3180 shall be started by the mobile earth station on every transmission with UD > 0 and shall be stopped on every USF grant from the network. If T3180 expires, the MES shall perform an abnormal release with random access.

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

Upon detecting the stall condition the mobile earth station shall also start timer T3182. Timer T3182 shall be stopped upon reception of a PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 message that makes $V(S) < V(A) + WS$. If timer T3182 expires, the mobile earth station shall perform an abnormal release with random access (see clause 8.7.2).

9.3.2.4 Release of uplink temporary block flow

The mobile earth station indicates that it has no immediate demand for link resources by setting UD field in the RLC/MAC header to 0. At this point, it shall stop T3180 if running and start timer T3182. T3180 shall be restarted and T3182 stopped the next time the MES sends a block with a non-zero UD value to the network. If the mobile earth station gets an uplink demand after it has set the UD field to 0 it shall wait for the network to allocate an unsolicited USF and not use PRACH to indicate uplink demand. If the network has not received all of the RLC data blocks when it decides to release an uplink TBF, it shall send a PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 message to the mobile earth station and if necessary allocate sufficient uplink resources for the mobile earth station to retransmit the required RLC data blocks. The mobile earth station may also request an immediate termination of the current TBF by sending a RLC/MAC block with the ITR bit set to "1" and starting timer T3182. The mobile earth station should ensure that it does so only on an Upper Layer PDU boundary. This is triggered, for example, when a new TLLI/G-RNTI is assigned by upper layers to the RLC/MAC entity.

The ITR based release procedure shall be used only when executing the TLLI change procedure (refer to ETSI TS 101 376-4-8 [11]). In all other cases, Uplink TBF release shall be initiated by the network.

When the network detects the ITR bit set, it should respond immediately with a PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 and allocate enough resources for the mobile earth station to retransmit the missing RLC blocks, if any. If there are no missing RLC blocks, it sends PACKET UPLINK ACK/NACK with Final Ack Indicator set. Once the mobile earth station has sent a block with ITR bit set to "1" it may use any allocations that it gets before receiving the PACKET UPLINK ACK/NACK by retransmitting previous packets declared missing as described in clause 9.1.3.1. In all cases, it shall keep the ITR bit set. Once the network receives all missing RLC blocks, it shall send the PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 with the Final Ack Indicator set. Once the mobile earth station gets a PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 with Final Ack Indicator set and there are no further packets to transmit, it may transmit an acknowledgement message as described in clause 10.4.5 and release the TBF. T3182 shall be stopped when the final PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 is received. The abnormal conditions are handled as given above. If there was a downlink TBF existing along with the uplink TBF and it is still not released when the uplink TBF is cleared, the MES shall execute a local-end release of the downlink TBF and return to CCCH.

The network shall start timer T3201 to set the time during which an MES does not have demand for link resources. Before timer T3201 expires, it shall give the MES an opportunity to transmit at least once. Timer T3201 is stopped if the network receives indication that there is data to be transmitted by the MES by receiving a RLC/MAC block with UD set to a non-zero value. T3201 is restarted if the network receives a RLC/MAC block carrying an RLC block that advances $V(R)$ and $UD=0$. If the network receives a non-zero UD value, it shall allocate resources to the mobile earth station and continue the TBF. If the network polls the MES using a USF and there is no response, the network shall increment counter N3101. If counter N3101 exceeds its limits, the network shall transmit a PACKET TBF RELEASE message, stop timer T3201 and start timer T3169. When timer T3169 expires the network may reuse the TFI and USF resources.

On expiry of timer T3201, the network may release the TBF by transmitting a PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 with Final Ack Indicator set to "1" and asking for an acknowledgement by using the UUG field. The network should ensure that all outstanding data-packets are acknowledged before it sends the PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 message. When the network receives acknowledgement message in the Mac-slot/D-MAC-slot indicated by the UUG field, it may reuse the TFI and USF resources.

If the network does not receive an acknowledgement message in the Mac-slot/D-MAC-slot indicated by the UUG field in the PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 message with the FAI bit set, it shall increment counter N3103 and retransmit the PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 message. If counter N3103 exceeds its limit, the network shall start timer T3169. When timer T3169 expires the network may reuse the TFI and USF resources.

If timer T3182 is already active, it shall be restarted every time the MES transmits a UD value of zero in the next RLC/MAC block for any uplink TBF within the same mobile earth station.

As long as T3182 is running the mobile earth station may receive additional uplink MAC-slot/D-MAC-slot allocations. If there are unacknowledged or negatively acknowledged RLC blocks in the transmit window (i.e. $V(A)$ does not equal $V(S)$), the mobile earth station shall transmit or retransmit the RLC blocks as described in clause 9.1.3.1. If there are no RLC blocks within the transmit window (i.e. $V(A)$ equals $V(S)$), the mobile earth station shall transmit a Packet Uplink Dummy Control Block in the allocated MAC or D-MAC slots. For PDCH3, the mobile earth station shall transmit an uplink dummy data block in the allocated MAC or D-MAC slots. For both these cases, the UD field shall be set as described in clause 10.4.18. If a UD value of zero is reported, the mobile earth station shall restart timer T3182. Otherwise it shall proceed as described in clause 9.3.2.3. This shall continue until a PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 message with Final Ack Indicator bit set to "1" or a PACKET TBF RELEASE message is received.

If the network does not receive a response to a poll using the UUG field, it shall increment counter N3105. If counter N3105 exceeds its limits, the network shall transmit a PACKET TBF RELEASE message, stop timer T3201 and start timer T3169. When timer T3169 expires the network may reuse the TFI and USF resources.

Subsequently, if the MES receives a Packet TBF Release message or timer T3182 expires, the mobile earth station shall release the current TBF. If there is no ongoing downlink or uplink TBF the mobile earth station shall respond to the PACKET TBF RELEASE if any with a PACKET CONTROL ACKNOWLEDGEMENT and, if there is no other ongoing uplink or downlink TBF, enter packet idle mode. Upon entering packet idle mode, the mobile earth station shall apply DRX mode procedures as specified in clause 5.5.1.4. If the MES gets a downlink assignment or uplink assignment message, it shall act on that message.

If the MES has any outstanding Upper Layer PDUs which are partially transmitted or partially or fully unacknowledged and the MES executes a local release or receives a control message from the network requiring it to release the TBF (i.e. PACKET TBF RELEASE or PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 with FAI bit set), it shall discard all such PDUs.

While timer T3182 is running, if new data arrives at the MES which does not match the mode, radio-priority or throughput class of the existing TBF, the MES shall send the new data over the existing uplink TBF. If the PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 message requests retransmission of RLC data blocks, the mobile earth station shall if necessary wait for allocation of uplink resources and then retransmit the RLC data blocks requested, restarting timer T3180 after each RLC block is transmitted. If there is further new data pending at the mobile earth station of the same mode, radio-priority and peak-throughput class, the mobile earth station shall update the UD field appropriately. After transmitting all outstanding data and declaring UD=0, the mobile earth station shall then start timer T3182 and wait for a PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 or a PACKET TBF RELEASE message as above. If the timer T3182 expires, the mobile earth station performs an abnormal release with random access.

9.3.2.5 Operation of downlink temporary block flow

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

9.3.2.6 Release of downlink temporary block flow

The network initiates release of a downlink TBF by sending an RLC/MAC block which may or may not contain an RLC data (downlink dummy control block) with the Final Block Indicator (FBI) set to the value "1" and with a valid UUG field. For PDCH3, the network initiate release using a downlink dummy data block when no RLC data is sent. If the RLC/MAC block contains an RLC block, it shall have the highest BSN of the downlink TBF. The network shall start timer T3191. While timer T3191 is running the network may retransmit the RLC/MAC block with the FBI bit set to the value "1"; upon retransmitting the RLC/MAC block with FBI bit set, the timer T3191 shall be restarted. The network shall insure that no RLC/MAC requires any retransmission when sending a dummy data block.

If the mobile earth station receives an RLC/MAC block, which may or may not contain an RLC data block with a valid UUG field indicating a poll for a control packet, the mobile earth station shall transmit a GMPRS PACKET DOWNLINK ACK/NACK or PACKET DOWNLINK ACK/NACK message in the specified uplink Mac-slot/D-MAC-slot. The mobile earth station shall continue to monitor all assigned PDCHs. If the FBI bit is set, the mobile earth station shall conclude that the TBF is going to terminate. In this case, if the FBI is set in RLC/MAC data block and if all data blocks have been received, the mobile earth station shall send the GMPRS PACKET DOWNLINK ACK/NACK or PACKET DOWNLINK ACK/NACK message with the Final Ack Indicator bit set to "1", stop timer T3190 and start or restart timer T3192. If the FBI is set in dummy data block, the mobile earth station shall assume all packets have been received for the flow.

If the network receives a GMPRS PACKET DOWNLINK ACK/NACK or PACKET DOWNLINK ACK/NACK message before timer T3191 expires, and if retransmissions are required i.e. the TBF is in acknowledged mode, then the network stops timer T3191 and retransmits necessary RLC data blocks according to the ARQ protocol before re-initiating the release of the downlink TBF. The FBI bit is set and timer T3191 started for the last data block that is retransmitted in response to the GMPRS PACKET DOWNLINK ACK/NACK or PACKET DOWNLINK ACK/NACK. If no retransmission is required, the network shall stop timer T3191 and start timer T3193. When T3193 expires the network shall release the TBF.

If timer T3191 expires, then the network shall release the TBF.

If the network has new data to transmit for the mobile earth station and timer T3193 is not expired, the network may establish a new downlink TBF for the mobile earth station by sending the PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message on PACCH. In case the network establishes a new downlink TBF for the mobile earth station, the network shall stop timer T3193.

If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message while timer T3192 is running, the mobile earth station shall follow the procedure in clause 8.1.2.4a to establish a new downlink TBF.

When timer T3192 expires the mobile earth station shall stop monitoring its assigned downlink PDCHs. If there is no uplink TBF establishment in progress or existing uplink TBF, the MES shall enter packet idle mode. Upon entering packet idle mode, the MES shall apply DRX mode procedures as specified in clause 5.5.1.4.

9.3.3 Unacknowledged mode operation

9.3.3.0 General

The transfer of RLC data blocks in the RLC unacknowledged mode does not include any retransmissions. The Block Sequence Number (BSN) in the RLC data block header is used to number the RLC data blocks for reassembly. For downlink transfers, the receiving side sends Packet Control Ack messages in order to convey the necessary control signalling, such as channel quality information. For uplink transfers, the receiving side sends a timing advance correction to the MES in a PACKET LINK CONTROL message.

9.3.3.1 Establishment of temporary block flow

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

9.3.3.2 Operation of uplink temporary block flow

The network shall send PACKET LINK CONTROL messages when needed.

The mobile earth station shall set the Stall indicator (SI) bit to "0" in all RLC/MAC data blocks.

The mobile earth station shall start timer T3180 whenever it transmits an uplink RLC/MAC block with $UD > 0$. The mobile earth station shall stop timer T3180 when it receives an uplink Mac-slot/D-MAC-slot allocation. If timer T3180 expires, the mobile earth station shall perform an abnormal release with random access (see clause 8.7.2).

9.3.3.3 Release of uplink temporary block flow

The mobile earth station indicates that it has no further data to transmit by setting the UD value to zero in the last transmitted RLC/MAC block and starting timer T3182. If timer T3182 is already active, it shall be restarted every time the MES transmits a UD value of zero in an RLC/MAC block.

The MES may be polled for control or pending data messages even after it has declared UD=0 to the network using either the UUG method or USF. If there is internal data pending at the MES that can be transmitted on the current TBF as per the rules in clause 8, it shall send a response with the UD field set appropriately. If there is no data to be transmitted, the MES shall transmit any other control block and if no control block exists, then PACKET UPLINK DUMMY CONTROL block is transmitted. Whenever the MES transmits a data-block to the network in response to an allocation and sets the UD > 0, it shall stop T3182, start T3180 and proceed as defined in clause 9.3.3.2.

The mobile earth station may request an immediate termination of the current TBF by setting the ITR bit set to "1" and starting timer T3182. This is triggered, for example, when a new TLLI is assigned by the upper layers to the RLC/MAC entity. The mobile earth station should ensure that it does so only on an LLC PDU boundary. When the network detects the ITR bit set to "1", it should respond immediately with a PACKET TBF RELEASE message with a UUG allocation. The TBF release procedure then continues as described below. Note that once the MES has set the ITR bit in an RLC/MAC block, it is not allowed to transmit new information on any subsequent allocation. Instead, it should transmit a pending control message or an UPLINK DUMMY CONTROL MESSAGE with the ITR bit set on any subsequent allocation till it gets a PACKET TBF RELEASE message. If there was a downlink TBF existing along with the uplink TBF and it is still not released when the uplink TBF is cleared, the MES shall execute a local-end release of the downlink TBF and return to CCCH.

The ITR based release procedure shall be used only when executing the TLLI change procedure (refer to ETSI TS 101 376-4-8 [11]). In all other cases, Uplink TBF release shall be initiated by the network.

The network shall start timer T3201 to set the time during which an uplink TBF exists without demand for link resources. Before timer T3201 expires, it shall poll the MES at least once. Timer T3201 is stopped if the network receives indication that there is data to be transmitted by the MES by receiving an RLC/MAC block with UD set to a non-zero value. T3201 is also stopped if the ITR bit is set in any RLC/MAC block received by the network. T3201 is restarted if the network receives a RLC/MAC block carrying an RLC block that advances V(R) and UD=0. If the network receives a non-zero UD value, it shall allocate resources to the mobile earth station and continue the TBF. If the network polls the MES using the USF and there is no response, the network shall increment counter N3101. If counter N3101 exceeds its limits, the network shall transmit a PACKET TBF RELEASE message, stop timer T3201 and start timer T3169. When timer T3169 expires, the network may reuse the TFI and USF resources.

On expiry of timer T3201, the network releases the TBF by transmitting a PACKET TBF RELEASE and asking for an acknowledgement by using the UUG field. When the network receives the acknowledgement message in the Mac-slot/D-MAC-slot indicated by the UUG field, it may reuse the TFI and USF resources.

Upon reception of a PACKET TBF RELEASE message the mobile earth station shall stop timer T3182 and release the TBF. If the PACKET TBF RELEASE message contains an allocation via the UUG field, the mobile earth station shall transmit an acknowledgement message as described in clause 10.4.5. If there is no ongoing downlink TBF the mobile earth station shall enter packet idle mode. Upon entering packet idle mode, the MES shall apply DRX mode procedures as specified in clause 5.5.1.4.

If T3182 expires, and there is pending data at the MES, the MES shall perform an abnormal release with random access. If there is no pending data, the MES shall perform a normal release and return to idle mode if there is no other TBF.

When the MES releases the downlink TBF any partially transmitted LLC PDUs shall be discarded.

When the network receives an acknowledgement message in the Mac-slot/D-MAC-slot indicated by the UUG field in the last poll, it may reuse the TFI and USF resources.

If the network does not receive an acknowledgement message in the Mac-slot/D-MAC-slot indicated by the UUG field, it shall increment counter N3103 and retransmit the PACKET TBF RELEASE message. If counter N3103 exceeds its limit, the network shall start timer T3169. When timer T3169 expires the network may reuse the TFI and USF resources.

If the mobile earth station receives a downlink assignment at any time during the process, it shall act upon it immediately without affecting any of the procedures defined above.

9.3.3.4 Operation of downlink temporary block flow

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

9.3.3.5 Release of downlink temporary block flow

The network initiates release of a downlink TBF by sending an RLC/MAC block which may or may not contain an RLC block with the Final Block Indicator (FBI) set to the value "1" and with a valid UUG field indicating a poll for a control block. If the RLC/MAC block contains an RLC block, it shall have the highest BSN (see clause 9.3.1) of the downlink TBF. The network shall start timer T3191. The network may repeat the downlink TBF release request by sending another RLC/MAC block, with FBI set to the value "1", no RLC block and with a valid UUG field. For each retransmission the timer T3191 is restarted.

For each RLC data block with the FBI bit set to "1" and with a valid UUG field indicating a poll for a control message, the mobile earth station shall transmit the PACKET CONTROL ACKNOWLEDGEMENT message in the Mac-slot/D-MAC-slot specified by the UUG field. The mobile earth station shall continue to read the assigned downlink PDCHs until the next uplink slot (see ETSI TS 101 376-5-7 [16]) for transmission provided by the UUG. The mobile earth station shall then stop timer T3190, start timer T3192 and continue to monitor all assigned downlink PDCHs. If the mobile earth station then receives a subsequent RLC data block with a valid UUG and the FBI bit set to "1", the mobile earth station shall retransmit the PACKET CONTROL ACKNOWLEDGEMENT message and restart timer T3192.

If the mobile earth 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 T3191 expires, the network shall stop timer T3191 and start timer T3193. When T3193 expires the network shall release the TBF.

If timer T3191 expires, the network shall release the TBF.

If the network has received the PACKET CONTROL ACKNOWLEDGEMENT message and has new data to transmit for the mobile earth station, the network may establish a new downlink TBF for the mobile earth station by sending the PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message on PACCH as long as timer T3193 has not expired. In case the network establishes a new downlink TBF for the mobile earth station, the network shall stop timer T3193.

If the mobile earth station, after sending the PACKET CONTROL ACKNOWLEDGEMENT message, receives a PACKET DOWNLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT TYPE 2, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message while timer T3192 is running, the mobile earth station shall follow the procedure in clause 8.1.2.4a to establish a new downlink TBF.

When timer T3192 expires, the mobile earth station shall stop monitoring its assigned downlink PDCHs. If there is no uplink TBF establishment in progress or existing uplink TBF, the mobile earth station shall enter packet idle mode. Upon entering packet idle mode, the MES shall apply DRX mode procedures as specified in clause 5.5.1.4.

9.4 Abnormal release cases

9.4.1 Abnormal release with random access

The mobile earth station shall abort all TBFs in progress and return to the CCCH and initiate establishment of an uplink TBF as defined in clause 7.1.

9.4.2 Abnormal release with spotbeam reselection

This function is not supported in GMR-1.

9.5 Radio Link Control (RLC) procedures in packet transfer mode when using PNB3(1,6) Data in shared mode

See ETSI TS 101 376-4-14 [24], clause 11.

10 RLC/MAC block structure

10.0a PNB(m,n) bursts - A/Gb mode

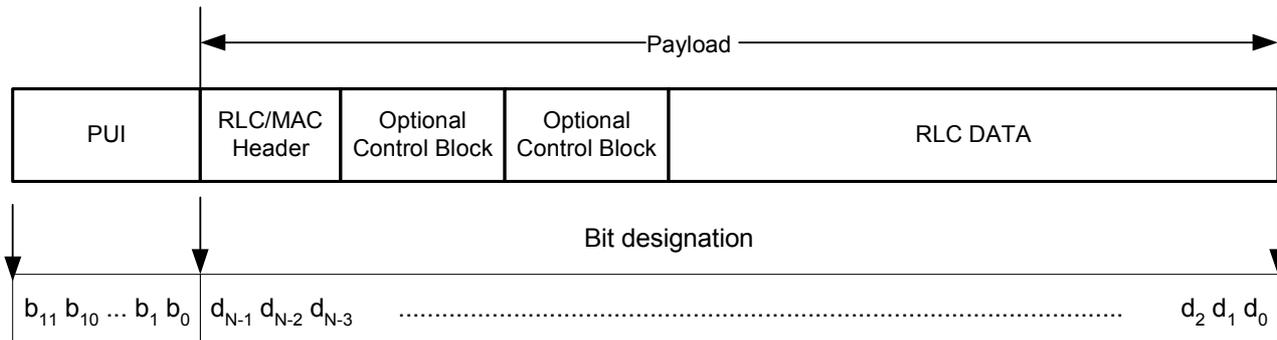


Figure 10.0a.1: PNB(m,n) RLC/MAC block structure

10.0b PNB2(m,n) bursts - A/Gb mode

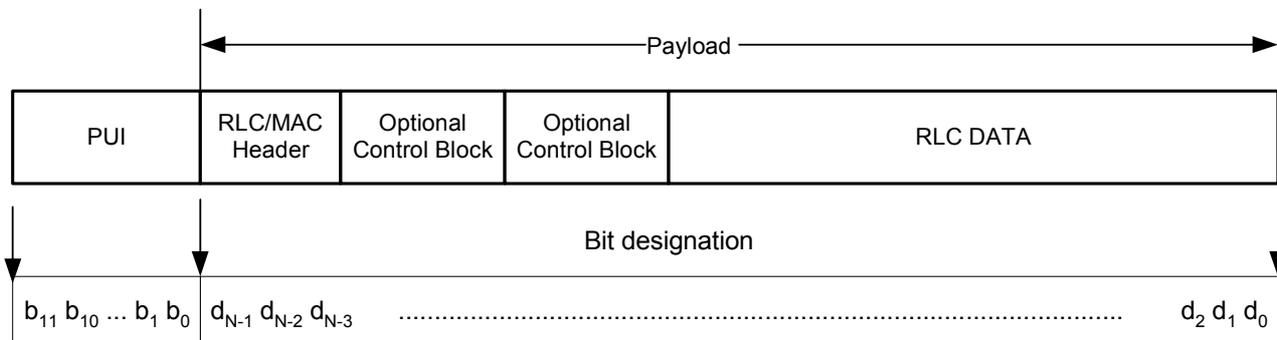


Figure 10.0b.1: PNB2(5,3) RLC/MAC block structure

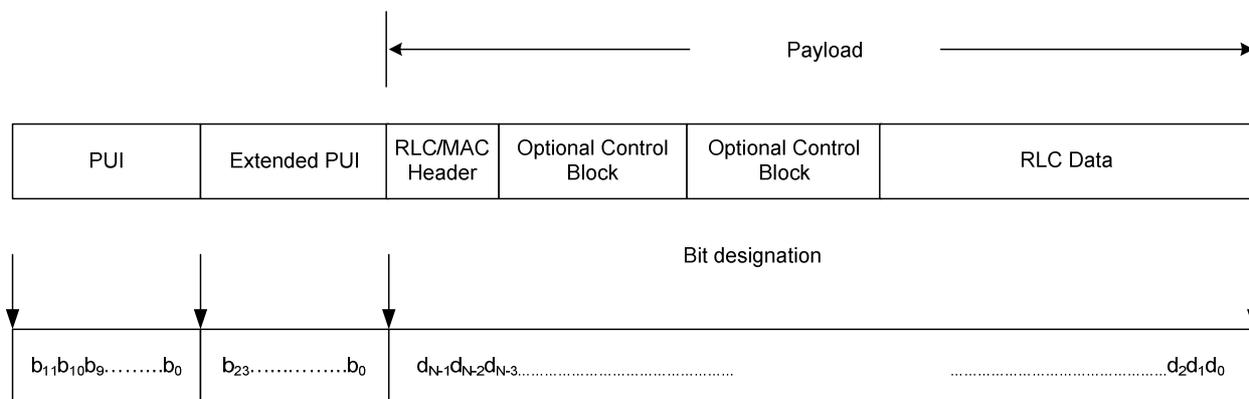


Figure 10.0b.2: Downlink PNB2(5,12) RLC/MAC block structure

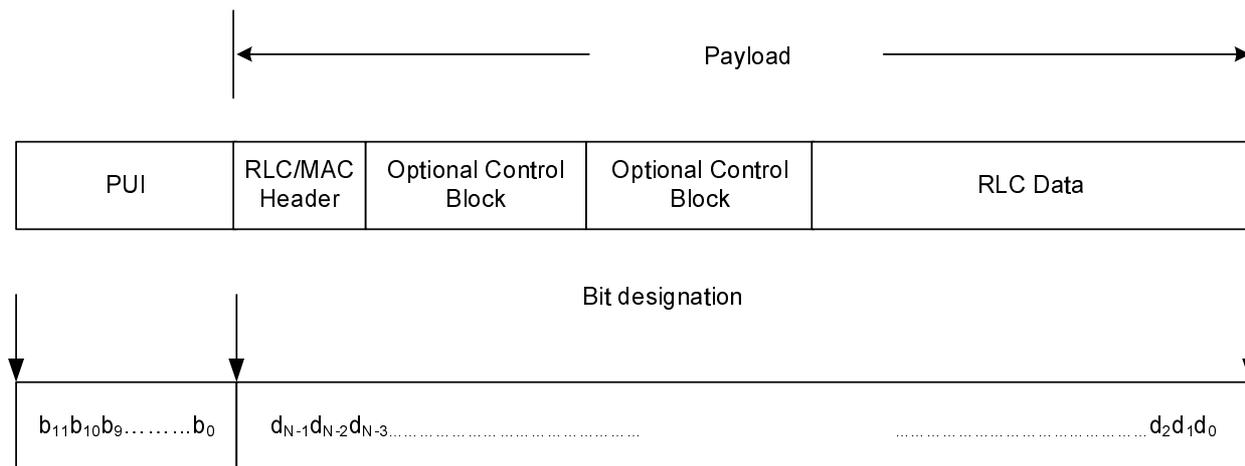


Figure 10.0b.3: Uplink PNB2(5,12) RLC/MAC block structure

Table 10.0b.1: RLC/MAC block fields on PNB(m,n) and PNB2(m,n) bursts

Block part	Size (in octets)
RLC/MAC Header(fixed)	5
Control Block	18
Data	Variable

10.0c PDCH - lu mode

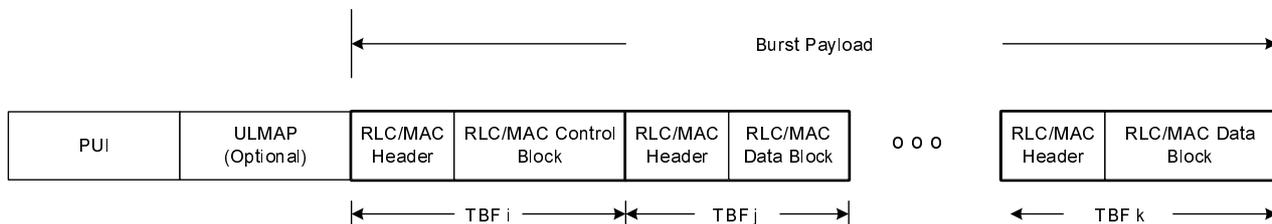


Figure 10.0c.1: Exemplary Downlink PNB(1,6), PNB3(2,6), PNB3(5,3), PNB3(5,12) and PNB3(10,3) RLC/MAC block structure

NOTE: There is no ULMAP for PNB(1,6) and PNB3(2,6) bursts.

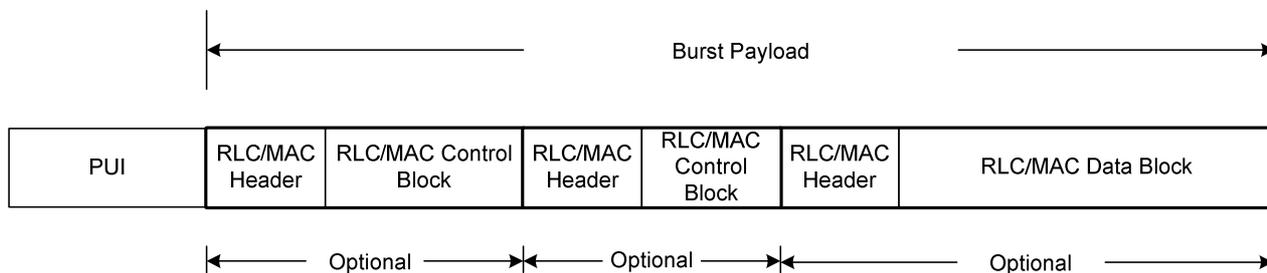


Figure 10.0c.2: Exemplary Uplink PNB(1,6), PNB3(2,6), PNB3(5,3), and PNB3(5,12) RLC/MAC block structure

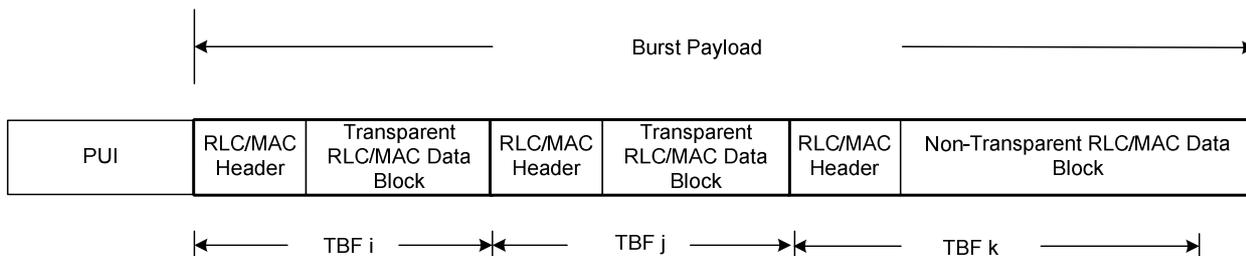


Figure 10.0c.3: Exemplary Uplink PNB(1,6), PNB3(2,6), PNB3(5,3) and PNB3(5,12) RLC/MAC block structure carrying Transparent and non-Transparent mode RLC blocks

Table 10.0c.1: RLC/MAC block fields on PNB3(m,n) bursts

Block part	Size (in octets)
RLC/MAC Header	Variable
Control Block	Variable
Data	Variable

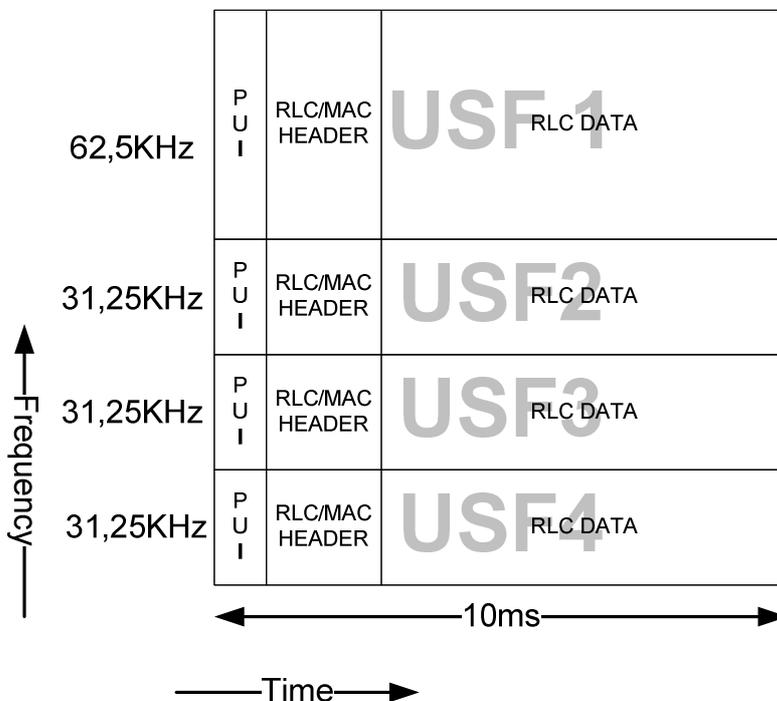


Figure 10.0c.4: Simultaneous transmissions on uplink

On PDCH3, a dummy data block has a RLC/MAC data header only without any RLC Data and that is indicated through LastPartSize.

10.1 Radio block structure

The radio block structures for PNB2(m,n) are defined in clause 10.0b. The radio block contains the PUI and payload. Note that the downlink PNB2(5,12) burst has an additional Extended PUI field.

The radio block structures for PNB3(m,n) are defined in clause 10.0c. The radio block in the downlink contains the PUI, an optional ULMAP and the payload. The radio block in the uplink contains the PUI and the payload.

PNB3(m,n) bursts in the downlink have the capability to multiplex RLC/MAC blocks meant for one or more MESS in the same burst.

Multiple simultaneous transmissions from different MES may occur, as shown in figure 10.0c.4, on the return link on different frequency channels using different burst types. Simultaneous transmissions on uplink are indicated in the ULMAP present in the corresponding downlink burst.

For a given terminal type, the RLC/MAC header formats are common across the different coding schemes that are used. The header size shall be fixed for the operating MCS. The payload bits d_{N-1} through d_0 are subsequently appended with 16-bit CRC (or BCS). The CRC appended payload bits are encoded according to the coding rate designated by the MCS value. Refer to ETSI TS 101 376-5-3 [14] for details. The coding of MCS bits with payload capacity, for the PDCH(4,3) and PDCH(5,n) is given in table 10.1a.

Table 10.1a: MCS field values for PDCH(4,3) and PDCH(5,n)

MCS value	Modulation	Coding Scheme	Coding rate	Burst Duration	Direction	Bandwidth	Payload octets	Payload bits (N)	Supported terminal types
0000	$\pi/4$ - CQPSK	Convolutional	$\sim R1/2$	5 ms	Uplink, Downlink	4	47	376	A
					Uplink, Downlink	5	60	480	A
0001	$\pi/4$ - CQPSK	Convolutional	$\sim R5/8$	5 ms	Uplink, Downlink	4	59	472	A
					Uplink, Downlink	5	76	608	A
0010	$\pi/4$ - CQPSK	Convolutional	$\sim R3/4$	5 ms	Uplink, Downlink	4	71	568	A
					Uplink, Downlink	5	91	728	A
0011	$\pi/4$ - QPSK	LDPC	$\sim R1/2$	20 ms	Downlink	5	275	2 200	D
					Uplink	5	275	2 200	D
				5 ms	Downlink	5	60	480	D
					Uplink	5	60	480	D
0100	$\pi/4$ - QPSK	LDPC	$\sim R2/3$	20 ms	Downlink	5	369	2 952	D
					Uplink	5	369	2 952	D
				5 ms	Downlink	5	78	624	D
					Uplink	5	78	624	D
0101	$\pi/4$ - QPSK	LDPC	$\sim R4/5$	20 ms	Downlink	5	443	3 544	D
					Uplink	5	443	3 544	D
				5 ms	Downlink	5	94	752	D
					Uplink	5	94	752	D
0110	$\pi/4$ - QPSK	LDPC	$\sim R9/10$	20 ms	Downlink	5	498	3 984	D
					Uplink	5	498	3 984	D
				5 ms	Downlink	5	106	848	D
					Uplink	5	106	848	D
0111	16 APSK	LDPC	$\sim R2/3$	20 ms	Downlink	5	739	5 912	D
					Uplink	5	739	5 912	D
				5 ms	Downlink	5	158	1 264	D
					Uplink	5	158	1 264	D
1000	16 APSK	LDPC	$\sim R4/5$	20 ms	Downlink	5	887	7 096	D
					Uplink	5	887	7 096	D
				5 ms	Downlink	5	190	1 520	D
					Uplink	5	190	1 520	D
1001	16 APSK	LDPC	$\sim R9/10$	20 ms	Uplink	5	998	7 984	D
				5 ms	Uplink	5	214	1 712	D
1010	32 APSK	LDPC	$\sim R3/4$	20 ms	Downlink	5	1 038	8 304	D
				5 ms	Downlink	5	223	1 784	D
1011	32 APSK	LDPC	$\sim R4/5$	20 ms	Downlink	5	1 109	8 872	D
				5 ms	Downlink	5	238	1 904	D
1111	NA		NA						

The coding "1111" is used to indicate that the burst does not include the payload.

The coding of MCS bits with payload capacity for the PDCH(1,6) and PDCH(2,6) is given in table 10.1b.

Table 10.1b: MCS field values PDCH(1,6) and PDCH(2,6)

MCS value	Modulation	Coding Rate	Direction	Bandwidth	Payload octets (including 16 bits of CRC)	Payload bits N (including 16 bits of CRC)
000	$\pi/4$ - CQPSK	~R3/5	Uplink, Downlink	1	26	208
			Downlink	2	59	472
001	$\pi/4$ - CQPSK	~R7/10	Uplink, Downlink	1	31	248
			Downlink	2	70	560
010	$\pi/4$ - CQPSK	~R4/5	Uplink, Downlink	1	36	288
			Downlink	2	80	640
111	NA	NA				

The coding "111" is used to indicate that the burst does not include the payload. The coding of MCS bits with payload capacity, for the PDCH3(m,n) is given in tables 10.1c and 10.1d. A MCS value of "1111" is used to indicate that the burst does not include the payload.

Table 10.1c: MCS field values for PDCH3(m,n) without ULMAP

MCS value	Modulation	Coding Scheme	Coding rate	Burst Duration	Direction	Bandwidth	Payload octets (including 16 bits CRC)	Payload bits (N) (including 16 bits CRC)
0000	$\pi/4$ - QPSK	Turbo	~R1/2	5 ms	Uplink, Downlink	5	60	480
					Downlink	10	130	1 040
				20 ms	Uplink, Downlink	5	278	2 224
0001	$\pi/4$ - QPSK	Turbo	~R5/8	5 ms	Uplink, Downlink	5	75	600
					Downlink	10	163	1 304
				20 ms	Uplink, Downlink	5	348	2 784
0010	$\pi/4$ - QPSK	Turbo	~R3/4	5 ms	Uplink, Downlink	5	90	720
					Downlink	10	196	1 568
				20 ms	Uplink, Downlink	5	416	3 328
0011	$\pi/4$ - QPSK	Turbo	~R5/6	5 ms	Uplink, Downlink	5	100	800
					Downlink	10	217	1 736
				20 ms	Uplink, Downlink	5	465	3 720
0100	16 APSK	Turbo	~R2/3	5 ms	Downlink	5	160	1 280
					Downlink	10	369	2 952
				20 ms	Downlink	5	2 x 370 (see note)	2 x 2 960 (see note)
0101	16 APSK	Turbo	~R1/2	20 ms	Uplink, Downlink	5	2 x 278 (see note)	2 x 2224 (see note)
0110	16 APSK	Turbo	~R4/7	20 ms	Uplink, Downlink	5	2 x 324 (see note)	2 x 2592 (see note)
1111	N/A	N/A						

NOTE: The Payload includes two 16 bit CRCs.

Table 10.1d: MCS field values for PDCH3(m,n) with ULMAP

MCS value	Modulation	Coding Scheme	Coding rate	Burst Duration	Direction	Bandwidth	Payload octets (including 16 bits CRC)	Payload bits (N) (including 16 bits CRC)
0000	$\pi/4$ - QPSK	Turbo	~R1/2	5 ms	Downlink	5	51	408
			~R1/2	5 ms	Downlink	10	113	904
			~R1/2	20 ms	Downlink	5	255	2 040
0001	$\pi/4$ - QPSK	Turbo	~R5/8	5 ms	Downlink	5	64	512
			~R5/8	5 ms	Downlink	10	142	1 136
			~R5/8	20 ms	Downlink	5	320	2 560
0010	$\pi/4$ - QPSK	Turbo	~R3/4	5 ms	Downlink	5	74	592
			~R3/4	5 ms	Downlink	10	171	1 368
			~R3/4	20 ms	Downlink	5	383	3 064
0011	$\pi/4$ - QPSK	Turbo	~R5/6	5 ms	Downlink	5	84	672
			~R5/6	5 ms	Downlink	10	189	1 512
			~R5/6	20 ms	Downlink	5	427	3 416
0100	16 APSK	Turbo	~R2/3	5 ms	Downlink	5	134	1 072
			~R2/3	5 ms	Downlink	10	320	2 560
			~R2/3	20 ms	Downlink	5	2 x 342 (see note)	2 x 2 736 (see note)
0101	16 APSK	Turbo	~R1/2	20 ms	Downlink	5	2 x 258 (see note)	2 x 2064 (see note)
0110	16 APSK	Turbo	~R4/7	20 ms	Downlink	5	2 x 298 (see note)	2 x 2384 (see note)

NOTE: The Payload includes two 16 bit CRCs

The coding of MCS bits with payload capacity, for the PDCH3(2,6) is given in table 10.1e. A MCS value of "1111" is used to indicate that the burst does not include the payload.

Table 10.1e: MCS field values for PDCH3(2,6)

MCS value	Modulation	Coding Scheme	Coding Rate	Direction	Payload octets (including 16 bits CRC)	Payload bits (N) (including 16 bits CRC)
000	$\pi/4$ - QPSK	Turbo	~R3/5	Uplink, Downlink	59	472
001	$\pi/4$ - QPSK	Turbo	~R7/10	Uplink, Downlink	70	560
010	$\pi/4$ - QPSK	Turbo	~R4/5	Uplink, Downlink	80	640

The Radio block may be used for control only, data only or multiplexed control and data. When control and data information are multiplexed, the control block shall occupy the octets immediately following the RLC/MAC header. On PDCH(m,n) and PDCH2(m,n) the control block shall be 18 octets with maximum of up to 2 control blocks per burst. On PDCH3(m,n) the control block shall be variable in length. The rest of the octets shall be occupied by an RLC data block which can contain octets from one or more upper layer PDUs.

10.2 Public information bits

10.2.0 General

The PUI fields used in different burst types are listed in table 10.2a.

Table 10.2a: PUI definitions for different burst types

Burst/Channel Type	Direction	PUI	Extended PUI
PKAB3(1,6)	Downlink	Table 10.2h	N/A
PDCH3(1,6)	Downlink	Table 10.2h	N/A
PKAB(2,6)	Downlink	Table 10.2h	N/A
PDCH(2,6)	Downlink	Table 10.2h	N/A
PKAB3(2,6)	Downlink	Table 10.2m	N/A
PDCH3(2,6)	Downlink	Table 10.2m	N/A
PKAB(4,3)	Downlink	Table 10.2c	N/A
PDCH(4,3)	Downlink	Table 10.2d	N/A
PKAB(5,3)	Downlink	Table 10.2c	N/A
PDCH(5,3)	Downlink	Table 10.2d	N/A
PDCH2(5,3)	Downlink	Table 10.2d	N/A
PKAB3(5,3) with 1 USF	Downlink	Table 10.2o	N/A
PKAB3(5,3) with 2 USFs	Downlink	Table 10.2p	N/A
PDCH3(5,3)	Downlink	Table 10.2j Table 10.2k	N/A
PDCH2(5,12)	Downlink	Table 10.2b	Tables 10.2e and 10.2f
PDCH3(5,12)	Downlink	Table 10.2l	N/A
PKAB3(10,3)	Downlink	Table 10.2n	N/A
PDCH3(10,3)	Downlink	Table 10.2n	N/A
PDCH(1,6)	Uplink	Table 10.2i	N/A
PDCH3(1,6)	Uplink	Table 10.2i	N/A
PDCH3(2,6)	Uplink	Table 10.2i	N/A
PDCH(4,3)	Uplink	Table 10.2g	N/A
PDCH(5,3)	Uplink	Table 10.2g	N/A
PDCH2(5,3)	Uplink	Table 10.2g	N/A
PDCH3(5,3)	Uplink	Table 10.2g	N/A
PDCH2(5,12)	Uplink	Table 10.2g	N/A
PDCH3(5,12)	Uplink	Table 10.2g	N/A

Table 10.2b: Downlink PUI field coding for PDCH2(5,12)

MCS ($b_{11} - b_8$)	USF ₁ ($b_7 - b_2$)	Downlink Burst Duration (b_1)	Spare (b_0)
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Table 10.2c: Downlink PUI field coding for PKAB (4,3) and PKAB(5,3)

MCS ($b_{11} - b_8$) = (1111) _{binary}	USF ₁ ($b_7 - b_2$)	Spare (1)	USF Allocation Duration (b_0)
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Table 10.2d: Downlink PUI field coding for PDCH(4,3), PDCH(5,3) and PDCH2(5,3)

MCS ($b_{11} - b_8$)	USF ₁ ($b_7 - b_2$)	Downlink Burst Duration (b_1)	USF Allocation Duration (b_0)
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Table 10.2e: Downlink Extended PUI (3 additional USF format) field coding for PDCH2(5,12)

PUI Type ($b_{29} - b_{28}$)	USF ₂ ($b_{27} - b_{22}$)	USF ₃ ($b_{21} - b_{16}$)	USF ₄ ($b_{15} - b_{10}$)	Spare ($b_9 - b_8$)	CRC ($b_7 - b_0$)
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Table 10.2f: Downlink Extended PUI (2 additional USF format) field coding for PDCH2(5,12)

PUI Type ($b_{29} - b_{28}$)	PUI Subtype ($b_{27} - b_{25}$)	Reserved ($b_{24} - b_{22}$)	USF ₂ ($b_{21} - b_{16}$)	USF ₃ ($b_{15} - b_{10}$)	Spare ($b_9 - b_8$)	CRC ($b_7 - b_0$)
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Table 10.2g: Uplink PUI field coding for PDCH(4,n), PDCH2(5,n) and PDCH3(5,n)

MCS bits (b ₁₁ - b ₈)	Uplink PAN field (b ₇ - b ₂)	Uplink Burst Duration (b ₁)	Spare (b ₀)
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Table 10.2h: Downlink PUI field coding for PKAB(2,6), PDCH(2,6), PKAB3(1,6) and PDCH3(1,6)

MCS bits (b ₁₁ - b ₉)	USF bits (b ₈ - b ₄)	EXT bits (b ₃ - b ₁)	Spare (b ₀)
NOTE: MCS will be set to 111 for PKAB(2,6) and PKAB3(1,6).			

Table 10.2i: Uplink PUI field coding for PDCH(1,6), PDCH3(1,6) and PDCH3(2,6)

MCS bits (b ₁₁ - b ₉)	Uplink PAN field (b ₈ - b ₃)	Spare (b ₂ - b ₀)
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Table 10.2j: Downlink PUI field coding for PDCH3(5,3) with 1 USF in PUI

E=0 (b22)	MCS (b21-b18)	DL Burst Duration (b17)	UAT (b16-b14)	USF (b13-b6)	Spare (b5-b3)	CRC (b2-b0)
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Table 10.2k: Downlink PUI field coding for PDCH3(5,3) with 2 USFs in PUI

E=0 (b22)	MCS (b21-b18)	DL Burst Duration (b17)	UAT (b16-b14)	USF1 (b13-b9)	USF2 (b8-b4)	Spare (b3)	CRC (b2-b0)
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Table 10.2l: Downlink PUI field coding for PDCH3(5,12)

E=0 (b22)	MCS (b21-b18)	DL Burst Duration (b17)	UAT (b16-b13)	USF (b12-b5)	Spare (b4-b3)	CRC (b2-b0)
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Table 10.2m: Downlink PUI field coding for PKAB3(2,6), PDCH3(2,6)

E=0 (b20)	MCS (b19-b17)	USF1 (b16-b12)	EXT1 (b11-b10)	USF2 (b9-b5)	EXT2 (b4-b3)	CRC (b2-b0)
NOTE: MCS will be set to 111 for PKAB3(2,6).						

Table 10.2n: Downlink PUI field coding for PKAB3(10,3) and PDCH3(10,3)

E=0 (b29)	MCS (b28-b25)	UAT (b24-b21)	USF1 (b20-b13)	USF2 (b12-b5)	Spare (b4-b3)	CRC (b2-b0)
NOTE: MCS will be set to 1111 for PKAB3(10,3).						

Table 10.2o: Downlink PUI field coding for PKAB3(5,3) with 1 USF in PUI

E=0 (b22)	MCS="1111"b (b21-b18)	Spare (b17)	UAT (b16-b14)	USF (b13-b6)	Spare (b5-b3)	CRC (b2-b0)
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Table 10.2p: Downlink PUI field coding for PKAB3(5,3) with 2 USFs in PUI

E=0 (b22)	MCS="1111"b (b21-b18)	Spare (b17)	UAT (b16-b14)	USF1 (b13-b9)	USF2 (b8-b4)	Spare (b3)	CRC (b2-b0)
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The "Downlink Burst Duration" fields in the downlink PUI for PDCH(5,12) (table 10.2b), PDCH(4,3)/PDCH(5,3) (table 10.2d), PDCH3(5,3) and PDCH3(5,12) specify the duration of the downlink burst following the PUI. The fields are encoded as:

0: 5 ms burst;

1: 20 ms burst.

E bit in PUI is the "Critical Extension" escape bit. The Critical Extension bit shall always be set to 0. The MES shall ignore downlink bursts with Critical Extension bit set to 1. The corresponding downlink burst duration shall be assumed to be as indicated in table 10.2q.

Table 10.2q: Assumed Downlink Burst Duration with E bit set to 1

Downlink Bandwidth	Burst Duration
62,5 kHz	10 ms
156,25 kHz	According to DL Burst Duration field in PUI
312,5 kHz	5 ms

The MCS bits indicate the modulation and coding scheme used. On the downlink, the MCS value "1111" is used to indicate no payload (PRI) for PDCH(4,3), PDCH(5,3), PDCH(5,12), PDCH3(5,3), PDCH3(5,12) and PDCH3(10,3). The MCS value "111" is used to indicate no payload for PDCH(2,6), PDCH3(1,6) and PDCH3(2,6), refer to clause 10.1.

If the MCS is not supported by the MES, the payload (PRI) shall be ignored, but the field in the PUI and the ULMAP, when present, shall still be interpreted.

If the UAT is reserved, CRC shall be evaluated against just the PUI bits. In this case, only the downlink burst duration bit, when applicable, shall be interpreted and corresponding PRI shall not be further processed.

Spare bits in the PUI shall be ignored.

If PUI in CRC fails, the MES shall ignore the downlink burst for a duration of 5 ms for downlink bandwidth of 156,25 kHz and 312,5 kHz and for a duration of 10 ms for downlink bandwidth of 31,25 kHz and 62,5 kHz.

10.2.1 Downlink PUI for PDCH (4,n) and PDCH (5,n) and PDCH2(5,3)

The 12 bit PUI header is subsequently Golay coded using a (24,12) Golay code. Refer to ETSI TS 101 376-5-3 [14] for details.

The MCS bits indicate the modulation and coding scheme used. The MCS value "1111" is used to indicate no payload, refer to clause 10.1.

The USF bits are used for uplink resource allocation.

The "USF Allocation Duration" field in the downlink PUI for PKAB bursts (table 10.2c) specifies the duration of the USF₁ allocation. The definition is given below:

Table 10.2.1a: USF Allocation Duration Encoding - Downlink PUI for PKAB(4,3)/PKAB(5,3)

USF Allocation Duration field	Allocated Uplink Slot Duration
0	5 ms
1	20 ms

The "USF Allocation Duration" field in the downlink PUI for PDCH(4,3)/PDCH(5,3) (table 10.2d) specifies the duration of the USF₁ allocation. The definition is given below.

Table 10.2.1b: USF Allocation Duration Encoding - Downlink PUI for PDCH(4,3)/PDCH(5,3) and PDCH2(5,3)

USF Allocation Duration field	Allocated Uplink Slot Duration
0	5 ms
1	20 ms

10.2.1a Downlink PUI for PDCH3(5,3)

UAT bits are used to indicate uplink allocation type.

PUI field interpretation depends on the UAT value. For return bandwidth of 31,25 kHz and 62,5 kHz, UAT is set to "010" and the PUI fields are defined in table 10.2k. For return bandwidth of 93,75 kHz, 125 kHz and 156,25 kHz the PUI fields are defined in table 10.2j and UAT set according to table 10.2.1c. The return bandwidth refers to the total bandwidth in the return direction and need not be contiguous.

For a return bandwidth of 31,25 kHz or 62,5 kHz the uplink resource allocation may be done solely through USF1 and USF2. USF1 is used for the low carrier frequency and USF2 is used for the high carrier frequency when available. The USF bits are used for uplink resource allocation using PNB(1,6) with one exception:

- When the return bandwidth is a contiguous 62,5 kHz and USF1 is the same as USF2 and do not correspond to PRACH, the MES associated with the USF shall use PNB(2,6) on the return PDCH for its transmission.

For a return bandwidth of 93,75 kHz, 125 kHz or 156,25 kHz, the resource allocation is done through USF in PUI, Uplink Allocation Type (UAT) and ULMAP when present. Uplink Allocation Type interpretation is shown in table 10.2.1c for PDCH(5,3).

Table 10.2.1c: PDCH3(5,3) Uplink Allocation Type (UAT)

UAT	Description	Downlink PUI format
000	No ULMAP, PNB3(5,3) allocation through USF in PUI	Table 10.2j
001	No ULMAP, PNB3(5,12) allocation through USF in PUI	Table 10.2j
010	No ULMAP, allocation through USF1 and USF2 in PUI. This is used when return bandwidth is 31,25 kHz or 62,5 kHz	Table 10.2k
011	ULMAP present for PNB3(1,6) and PNB3(2,6) allocations	Table 10.2j

The uplink allocations on PDCH3(5,3) through ULMAP are for PNB3(1,6) and PNB3(2,6) allocations.

The ULMAP size is 4 bytes and contains four USFs. The USF in PUI and ULMAP consists of a list of 5 USFs for 5 PNB3(1,6) allocations. The PNB3(1,6) allocations start at the lowest frequency carrier. Two PNB3(1,6) allocations with the same USF on contiguous frequency carriers translates to one PNB(2,6) allocation, unless the USF value correspond to PRACH (see clause 10.4.1).

The USF response time T_{RESP-1} is described in ETSI TS 101 376-5-7 [16].

When the MCS is set to "1111" (PKAB3), the ULMAP shall be interpreted if and only if UAT indicates ULMAP.

10.2.1b Downlink PUI for PDCH3(5,12)

The PUI field is defined in table 10.2l. The resource allocation is done through USF in PUI, Uplink Allocation Type (UAT) and ULMAP when present. The type of allocation is determined by the UAT. Uplink Allocation Type interpretation is shown in table 10.2.1d.

Table 10.2.1d: PDCH3(5,12) Uplink Allocation Type (UAT)

UAT	ULMAP	Allocations
0000	Not present	5 ms
0001	Not present	20 ms
0010	Present	(5 ms, 20 ms)
0011	Present	(5 ms, 5 ms, 20 ms)
0100	Present	(5 ms, 5 ms, 5 ms, 20 ms)
0101	Present	(5 ms, 5 ms, 5 ms, 5 ms)
0110	Present	(10 ms, 10 ms)
0111	Present	(5 ms, 5 ms, 10 ms)
1000	Present	(5 ms, 10 ms, 5 ms)
1001	Present	(10 ms, 5 ms, 5 ms)
1010	Present	(5 ms, 10 ms, 10 ms)
1011	Present	(10 ms, 20 ms)
1100	Present	(5 ms, 10 ms, 20 ms)
1101	Present	(10 ms, 5 ms, 20 ms)
1110	Present	(5 ms, 5 ms, 5 ms, 10 ms)
1111	Reserved	

5 ms refers to one USF for a PNB3(5,3) allocation. 20 ms refers to one USF for a PNB3(5,12) allocation. 10 ms refers to 5 USFs for 5 PNB3(1,6) allocations. The PNB3(1,6) allocations start at the lowest frequency carrier. Two PNB3(1,6) allocations with the same USF on contiguous frequency carriers translates to one PNB(2,6) allocation, unless the USF value corresponds to PRACH (see clause 10.4.1).

When the ULMAP is used, the first USF is in the PUI followed by a list of the USF in the ULMAP. The ULMAP size is 10 bytes and contains up to 10 USFs.

The USF response time T_{RESP-1} for USF₁ is described in ETSI TS 101 376-5-7 [16]. The response time T_{RESP-1} for the rest of USFs takes into account the duration of the prior transmission allocated in the same downlink burst.

10.2.1c Downlink PUI for PDCH3(10,3)

The PUI field is defined in table 10.2n. The return frequency is divided to two sets, with each set having a maximum total bandwidth of 156,25 kHz. The carrier frequencies need not be contiguous neither between the two sets nor within each set. The MES is assigned to either the first or second set of frequencies. The assignment is indicated in the Immediate Assignment type 4 message. USF1 in PUI is associated with the first set of frequencies and USF2 in PUI is associated with the second set of frequencies.

The UAT field indicates the uplink allocation type. The UAT description is shown in table 10.2.1e.

Table 10.2.1e: PDCH3(10,3) Uplink Allocation Type (UAT)

UAT	ULMAP	Description
0000	Not Present	PNB3(5,3) for USF1 and PNB3(5,3) for USF2
0001	Not Present	PNB3(5,3) for USF1 and PNB3(5,12) for USF2
0010	Not Present	PNB3(5,12) for USF1 and PNB3(5,3) for USF2
0011	Not Present	PNB3(5,12) for USF1 and PNB3(5,12) for USF2
0100	Present	PNB(5,3) for USF1 and ULMAP for second set of frequencies
0101	Present	PNB(5,12) for USF1 and ULMAP for second set of frequencies
0110	Present	ULMAP for first set frequencies and PNB(5,3) for USF2
0111	Present	ULMAP for first set frequencies and PNB(5,12) for USF2
1000	Present	ULMAP for first set of frequencies and second set of frequencies
1001-1111		Reserved

The ULMAP size is 8 bytes and may have up to 8 USFs depending on the UAT field. When ULMAP is used for a set of frequencies, the USF in PUI and ULMAP consists of a list of 5 USFs for 5 PNB3(1,6) allocations. The PNB3(1,6) allocations start at the lowest frequency carrier for the corresponding set. Two PNB3(1,6) allocations with the same USF on contiguous frequency carriers translates to one PNB(2,6) allocation, unless the USF value correspond to PRACH(see clause 10.4.1).

The USF response time T_{RESP-1} is described in ETSI TS 101 376-5-7 [16].

When the MCS is set to "1111" (PKAB3), the ULMAP shall be interpreted if and only if UAT indicates ULMAP is present.

10.2.2 Downlink Extended PUI for PDCH2(5,12)

The 30 bit secondary PUI header is convolution coded at rate 1/4. Refer to ETSI TS 101 376-5-3 [14] for details.

Downlink Extended PUI only exists for PDCH (5,12). There are two types of Downlink Extended PUI. They are defined as:

- Downlink Extended PUI (3 additional USFs) (table 10.2e); and
- Downlink Extended PUI (2 additional USFs) (table 10.2f).

The "PUI Type" is used to indicate the format used. The definition is given in table 10.2.2a.

Table 10.2.2a: Secondary Extended PUI Format Table

PUI type	Secondary Downlink PUI format
00	Downlink Extended PUI (3 additional USFs) (table 10.2e)
01	Downlink Extended PUI (3 additional USFs) (table 10.2e)
11	Downlink Extended PUI (2 additional USFs) (table 10.2f)

The PUI Type bits and PUI Subtype bits together are used to indicate if the uplink allocation is for a 5 ms or 20 ms burst, the definition is given below:

Table 10.2.2b: USF allocation Table

PUI Type	PUI Sub-type	Downlink Extended PUI format	USF ₁	USF ₂	USF ₃	USF ₄
00	N/A	3 additional USF format (table 10.2e)	5 ms	5 ms	5 ms	5 ms
01	N/A	3 additional USF format (table 10.2e)	5 ms	5 ms	5 ms	20 ms
11	000	2 additional USF format (table 10.2f)	5 ms	5 ms	20 ms	N/A
11	010	1 additional USF format (table 10.2f)	5 ms	20 ms	N/A	N/A
11	100	No additional USF format (table 10.2f)	20 ms	N/A	N/A	N/A

The MCS bits indicate the modulation and coding scheme used.

The USF bits are used for uplink resource allocation. For a PNB(5,12) burst, the Downlink Extended PUI field shall be used to signal additional USFs. If a USF field in the PUI maps to a previously allocated 20 ms USF allocation, the USF field would be set to RESERVED.

The USF response time T_{RESP-1} for USF₁ is described in ETSI TS 101 376-5-7 [16]. The response time T_{RESP-1} for USF₂ to USF₄ is calculated as follows:

$$(T_{RESP-1} \text{ for USF}_n) = (T_{RESP-1} \text{ for USF}_1) + \sum_{i=1}^{n-1} \text{BurstDurationForUSFi}$$

Here $n = 2..4$

The "Burst Duration for USF_i" is either 5 ms or 20 ms.

The CRC bit in the Extended PUI covers all the bits in the PUI as well as Extended PUI. The CRC polynomial is defined in ETSI TS 101 376-5-3 [14].

10.2.3 Uplink PUI for PDCH (4,3), PDCH (5,n), PDCH2(5,n) and PDCH3(5,n)

The 12 bit PUI header is subsequently Golay coded using a (24,12) Golay code. Refer to ETSI TS 101 376-5-3 [14] for details.

The MCS bits indicate the modulation and coding scheme used.

The PAN fields are used for MES power control.

The "Uplink Burst Duration" field in the uplink PUI is one bit, the definition is given below:

- 0: 5 ms burst;
- 1: 20 ms burst.

10.2.4 Downlink PUI for PDCH (2,6)

The 12 bit PUI header is subsequently Golay coded using a (24,12) Golay code. Refer to ETSI TS 101 376-5-3 [14] for details.

The MCS bits indicate the modulation and coding scheme used.

The USF bits are used for uplink resource allocation.

The PAN fields are used for MES power control.

The EXT (Extended Transmission) bits are to be interpreted by the MES when its USF is present in the PUI. When the MES detects an assigned USF on an assigned PDCH it shall transmit on "N" consecutive uplink D-MAC slots where N is defined as given below.

b_3	b_2	b_1	N
0	0	0	1
0	0	1	2
0	1	0	4
0	1	1	8
1	0	0	16
1	0	1	32
1	1	0	Reserved
1	1	1	Reserved

The time relationship between the occurrence of the USF in the downlink and the first out of "N" consecutive uplink D-MAC-slots which the mobile earth station shall use for transmission, is defined in ETSI TS 101 376-5-7 [16].

10.2.4a Downlink PUI for PDCH3(2,6)

USF1 is used for the low carrier frequency and USF2 is used for the high carrier frequency when available. The USF bits are used for uplink resource allocation using PNB(1,6) with one exception:

- When the return bandwidth is a contiguous 62,5 kHz and USF1 is the same as USF2 and do not correspond to PRACH, the MES associated with the USF shall use PNB(2,6) on the return PDCH for its transmission.

EXT (Extended Transmission) bits are to be interpreted by the MES when its USF is present in the PUI. When the MES detects an assigned USF on an assigned PDCH it shall transmit on "N" consecutive uplink D-MAC slots where N is defined as given below. EXT1 is associated with USF1 allocation and EXT2 is associated with USF2 allocation. EXT bits are encoded as follows:

b₂ b₁ N
 0 0 1
 0 1 2
 1 0 4
 1 1 8

10.2.5 Uplink PUI for PDCH (1,n), PDCH3(1,n) and PDCH3(2,6)

The 12 bit PUI header is subsequently Golay coded using a (24,12) Golay code. Refer to ETSI TS 101 376-5-3 [14] for details.

The MCS bits indicate the modulation and coding scheme used.

The PAN fields are used for MES power control.

10.3 RLC/MAC header

10.3.1 Downlink RLC/MAC header for PNB(m,n) and PNB2(m,n) bursts

The RLC/MAC header uses one of two formats specified below:

- Table 10.3a specifies the Downlink RLC/MAC header used for MESs with terminal type A and C.
- Table 10.3b specifies the Downlink RLC/MAC header used for MESs with terminal type D.

Table 10.3a: Downlink RLC/MAC header (MES terminal type A and C) - A/Gb mode only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type (1 - 0)		UUG		S/P	FBI	BSN (9 - 8)	
Octet 2	Block Sequence Number, BSN (7 - 0)							
Octet 3	Last Part Size, LPS (7 - 0)							
Octet 4	D	Spare	Power Control Parameters, PC (5 - 0)					
Octet 5	TFI (6 - 0)							E

Table 10.3b: Downlink RLC/MAC header (MES terminal type D) - A/Gb mode only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type (1 - 0)		UUG	Block Sequence Number, BSN (9 - 5)				
Octet 2	Block Sequence Number, BSN (4 - 0)				Last Part Size, LPS (10 - 8)			
Octet 3	Last Part Size, LPS (7 - 0)							
Octet 4	D	FBI	Power Control Parameters, PC (5 - 0)					
Octet 5	TFI (6 - 0)							E

10.3.1a Downlink RLC/MAC Data header for PNB3(m,n) bursts - lu mode only

Table 10.3.1a: Downlink RLC/MAC Data header for PNB3(m,n) bursts

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Octet 1	Payload Type (1 - 0)		UUG	Block Sequence Number, BSN (9 - 5)					
Octet 2	Block Sequence Number, BSN (4 - 0)				LPS (10 - 8)				
Octet 3	Last Part Size, LPS (7 - 0)								
Octet 4	LI	FBI	Power Control Parameters (5 - 0)						
Octet 5	TFI(6-0)							E	
Octet 6	SRB(1-0)		SPBN (2-0)		FSPB	TFI(7)	E	optional	
Octet 7	PDU Length(5-0)					TFI(7)	E	optional	
Octet 8	PDU Length(10-6)				Spare		E	optional	

NOTE: SRB field is not used in this version of GMR-1 3G 44.060. The network shall always set SRB to "00" when Octet 6 is present.

10.3.1b Downlink RLC/MAC Control header for PNB3(m,n) bursts - lu mode only

Table 10.3.1b: Downlink RLC/MAC Control header for PNB3(m,n) bursts

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type=01		UUG	Power Control Parameters, PC (5 - 1)				
Octet 2	PC (0)		PDU Length (5-0)					E

10.3.2 Uplink RLC/MAC header for PNB(m,n) and PNB2(m,n) bursts - A/Gb mode only

Table 10.3c: Uplink RLC/MAC header (MES terminal type A and C)

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type=00		Spare			ITR	BSN (9 - 8)	
Octet 2	Block Sequence Number, BSN (7 - 0)							
Octet 3	Last Part Size, LPS (7 - 0)							
Octet 4	Unsatisfied Demand, UD(6-0)							Stall Ind
Octet 5	TFI(6-0)							E

Table 10.3d: Uplink RLC/MAC header (MES terminal type D) - A/Gb mode only

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type		ITR	BSN (9 - 5)				
Octet 2	Block Sequence Number, BSN (4 - 0)				Last Part Size, LPS (10 - 8)			
Octet 3	Last Part Size, LPS (7 - 0)							
Octet 4	Unsatisfied Demand, UD(6-0)							Stall Ind
Octet 5	TFI (6-0)							E

10.3.2a Uplink RLC/MAC Data header for PNB3(m,n) bursts - lu mode only

Table 10.3.2a: Uplink RLC/MAC header for PNB3(m,n)

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type (1-0)		ITR	BSN (9 - 5)				
Octet 2	Block Sequence Number, BSN (4 - 0)				Last Part Size, LPS (10 - 8)			
Octet 3	Last Part Size, LPS (7 - 0)							
Octet 4	Unsatisfied Demand, UD(6-0)							Stall Ind
Octet 5	TFI (6-0)							
Octet 6	SRB(1-0)		SPBN (2-0)		FSPB	TFI(7)		E
NOTE:	SRB field is not used in this version of GMR-1 3G 44.060. The MES shall always set SRB to "00" when Octet 6 is present.							

10.3.2b Uplink RLC/MAC Control header for PNB3(m,n) bursts - lu mode only

10.3.2b: Uplink RLC/MAC Control Header for PNB3(m,n)

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type=01		PDU Length (4-0)					E
Octet 2	PDU Length (10-5)						Spare	E

10.3.2c Header type 2: Uplink RLC/MAC Data header for PNB3(1,6) Data in dynamic allocation mode - lu mode only

Table 10.3.2c: Uplink RLC/MAC header for PNB3(1,6) Data in dynamic allocation mode

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type = 10		ITR	Reduced Block Sequence Number, RBSN (6-2)				
Octet 2	RBSN(1-0)		Reduced Last Part Size (4 - 0)				RRBId(2)	
Octet 3	RRBId (1-0)		Stall Ind	Unsatisfied Demand, UD(6-2)				
Octet 4	UD(1-0)		E	RLC Data (Bytes)				
...								
...								

10.4 Header fields

10.4.1 Uplink state flag (USF) field

10.4.1.1 PDCH(4,3), PDCH(5,3) PDCH2(5,3) and PDCH2(5,12) - A/Gb mode only

The USF field is sent in all downlink RLC/MAC blocks and indicates the owner or use of the next uplink MAC-slot (see ETSI TS 101 376-5-7 [16]) on the same PDCH (see ETSI TS 101 376-5-2 [13]) for PDCH(4,3), PDCH(5,3) and PDCH(5,12). The USF field is six bits in length and sixty-four different USF values can be assigned, except on PCCCH, where the value "111111" (USF=FREE) indicates that the corresponding uplink MAC-slot contains PRACH. The value "000000" (USF=RESERVED) indicates that the corresponding uplink MAC-slot is reserved.

10.4.1.1a PDCH3(5,3),PDCH3(5,12) and PDCH3(10,3) - lu mode only

The USF field is eight bits in length and 255 different USF values can be assigned. The USF field present in the downlink PUI and in the optional ULMAP indicates the owner and use of the allocation. When 8 bit USF is used:

- A value "11111111" (USF=FREE) associated with uplink PNB(1,6) indicates the corresponding D-MAC slot contain 2 successive PRACHs.

- A value of "1111110" associated with uplink PNB(1,6) indicates only one PRACH in the first MAC slot of the D-MAC slot allocation and the second MAC slot is reserved.
- A value of "1111101" indicates only one PRACH in the second MAC slot of the D-MAC slot allocation and the first MAC slot is reserved.
- A value of "1111111" (USF=FREE) associated with uplink PNB3(5,3) correspond to 5 overlaid PRACHs on each uplink frequency.
- USF_ACK1=1111100 and USF_ACK2=1111011 are two reserved USF values used with UUG as described in clause 10.4.5.3.
- A value of "0000000" (USF=RESERVED) is used when the associated uplink is a dedicated channel (DCH).
- Remaining values are allocated for TBFs.

For PDCH3(5,3) using a 5 bit USF:

- A value of "11111" (USF=FREE) associated with uplink PNB(1,6) indicates the corresponding D-MAC slot contain 2 successive PRACHs.
- A value of "11110" associated with uplink PNB(1,6) indicates only one PRACH in the first MAC slot of the D-MAC slot allocation and the second MAC slot is reserved.
- A value of "11101" associated with uplink PNB(1,6) indicates only one PRACH in the second MAC slot of the D-MAC slot allocation and the first MAC slot is reserved.
- USF_ACK1=11100 and UAF_ACK2=11011 are two reserved USF values used with UUG as described in clause 10.4.5.3.
- A value of "0000000" (USF=RESERVED) is used when the associated uplink is a dedicated channel (DCH).
- Remaining values are allocated for TBFs.

10.4.1.2 PDCH(2,6) - A/Gb mode only

The USF field is sent in all downlink RLC/MAC blocks and indicates the owner or use of the next uplink D-MAC-slot (see ETSI TS 101 376-5-7 [16]) on the same PDCH (see ETSI TS 101 376-5-2 [13]) for PDCH(1,6). The USF field is five bits in length and thirty-two different USF values can be assigned, except on PCCCH, where the value "11111" (USF=FREE) indicates that the corresponding uplink D-MAC-slot contains PRACH. The value "00000" (USF=RESERVED) indicates that the corresponding uplink D-MAC-slot is reserved.

10.4.1.2a PDCH3(2,6) and PDCH3(1,6) - lu mode only

The USF field is sent in all downlink RLC/MAC blocks and indicates the owner or use of the next uplink D-MAC-slot (see ETSI TS 101 376-5-7 [16]) on the same PDCH. The USF field is five bits in length and thirty-two different USF values can be assigned.

- A value "11111" (USF=FREE) associated with uplink PNB(1,6) indicates the corresponding D-MAC slot contain 2 successive PRACHs.
- A value of "11110" associated with uplink PNB(1,6) indicates only one PRACH in the first MAC slot of the D-MAC slot allocation and the second MAC slot is reserved.
- A value of "11101" associated with uplink PNB(1,6) indicates only one PRACH in the second MAC slot of the D-MAC slot allocation and the first MAC slot is reserved.
- USF_ACK1=11100 is reserved USF value used with UUG as described in clause 10.4.5.3.
- A value of "00000" (USF=RESERVED) is used when the associated uplink is a dedicated channel (DCH).
- Remaining values are allocated for TBFs.

10.4.2 Void

10.4.3 Stall indicator (SI) bit

The Stall indicator (SI) bit indicates whether the MES's RLC transmit window can advance (i.e. is not stalled) or cannot advance (i.e. is stalled). The mobile earth station shall set the SI bit in all uplink RLC data blocks.

Table 10.4: Stall indicator bit

bit 2	Stall indicator
0	MES RLC transmit window is not stalled
1	MES RLC transmit window is stalled

10.4.4 Supplementary/polling (S/P) bit

The S/P bit in the RLC/MAC header in the downlink is used to indicate the usage of Unsolicited Uplink Grant (UUG) field for the MES terminal type A and C.

Table 10.5: Supplementary/polling (S/P) bit

bit 4	S/P
0	Reserved
1	UUG field indicates uplink allocations by network

10.4.5 Unsolicited uplink grant (UUG) field

10.4.5.0 General

The UUG field has two formats. One format is applicable to terminal type A and C. The other format is used for terminal type D.

10.4.5.1 UUG field for terminal type A and C - A/Gb mode only

For terminal type A and C, UUG is a two bit field. It is used by the network to allocate a MAC-slot or D-MAC-slot starting the next uplink slot (see ETSI TS 101 376-5-7 [16]) to the mobile earth station with the terminal type A and C.

Table 10.6a: Unsolicited uplink grant bits

S/P bit 3	UUG bits 5 4	
0	0 0	Reserved
0	0 1	Reserved
0	1 0	Reserved
0	1 1	Reserved
1	0 0	No Mac-slot/D-MAC-slot Poll
1	0 1	Single Mac-slot/D-MAC-slot Poll
1	1 0	Reserved
1	1 1	Reserved

If the S/P bit is 1 and UUG is 01, then a single MES shall respond to the UUG request. A MES shall respond in two situations. In the first situation, the MES may be addressed with a global TFI in the downlink MAC/RLC header. Alternatively, the MES may be addressed with a broadcast TFI in the downlink MAC/RLC header and a TLLI, TAI, or global TFI carried in a control message.

An MES shall respond to a UUG with a Packet Downlink ACK/NACK message if the TFI field in the downlink MAC/RLC header field corresponds to a downlink TBF in RLC ACK mode. If the UUG is received as part of an RLC/MAC block containing an RLC/MAC control block containing a Packet Paging Request, the mobile earth station shall ignore UUG field. In all other cases, the MES shall send a PACKET CONTROL ACKNOWLEDGEMENT message. The MES shall respond only if it is unambiguously and uniquely addressed in the RLC/MAC header or the control message.

10.4.5.2 UUG field for terminal type D - A/Gb mode only

For terminal type D, UUG is a one bit field. It is used by the network to allocate a Mac-slot or D-MAC-slot starting the next uplink slot (see ETSI TS 101 376-5-7 [16]) to the mobile earth station with the terminal type D.

Table 10.6b: Unsolicited uplink grant bits

UUG bit	
5	
0	No Mac-slot Poll
1	Single Mac-slot Poll

If the UUG bit is 1, then a single MES shall respond to the UUG request. A MES shall respond in two situations. In the first situation, the MES may be addressed with a global TFI in the downlink MAC/RLC header. Alternatively, the MES may be addressed with a broadcast TFI in the downlink MAC/RLC header and a TLLI, TAI, or global TFI carried in a control message.

An MES shall respond to a UUG with a Packet Downlink ACK/NACK message if the TFI field in the downlink MAC/RLC header field corresponds to a downlink TBF in RLC ACK mode. If the UUG is received as part of an RLC/MAC block containing an RLC/MAC control block containing a Packet Paging Request, the mobile earth station shall ignore UUG field. In all other cases, the MES shall send a PACKET CONTROL ACKNOWLEDGEMENT message. The MES shall respond only if it is unambiguously and uniquely addressed in the RLC/MAC header or the control message.

10.4.5.3 PDCH3 UUG field - lu mode only

10.4.5.3.0 General

UUG is a one bit field. It is used by the network to indicate to the terminal that the next uplink allocation received by the terminal is either for Packet Downlink ACK/NACK message or PACKET CONTROL ACKNOWLEDGMENT.

If the UUG bit is 1, then a single MES shall respond to the UUG request. A MES shall respond in two situations. In the first situation, the MES may be addressed with a downlink TFI in the downlink MAC/RLC header. Alternatively, the MES may be addressed with a TLLI/G-RNTI or global TFI carried in a control message.

An MES shall respond to a UUG with a Packet Downlink ACK/NACK message if the TFI field in the downlink MAC/RLC header field corresponds to a downlink TBF in RLC ACK mode. In all other cases, the MES shall send a PACKET CONTROL ACKNOWLEDGEMENT message. The MES shall respond only if it is unambiguously and uniquely addressed in the RLC/MAC header or the control message. If the TFI in the downlink MAC/RLC data block corresponds to a downlink TBF in RLC UNACK mode, the MES may also respond using a Packet Uplink Dummy Control Block.

The uplink allocation is indicated through one of two reserved USF values (USF_ACK1=1111100 or USF_ACK2=11111011). USF_ACK1 and USF_ACK2 are used to indicate where the uplink allocation is occurring after the indication of polling through UUG bit. The uplink allocation for Packet Downlink ACK/NACK message or PACKET CONTROL ACKNOWLEDGMENT is same as in clause 10.2.1.

The MES shall use a PNB3(1,6) 2,6 kbps data burst in the uplink if it is the only burst type supported by MES in the uplink direction (see GMR-1 3G 45.002 [13]) and the uplink allocation is for a PNB(1,6).

10.4.5.3.1 PDCH3(10,3) and PDCH3(5,3) - lu mode only

When present in the same downlink burst (in the PUI or ULMAP) as the packet carrying the UUG bit set, USF_ACK1 is associated with the Packet Downlink ACK/NACK or PACKET CONTROL ACKNOWLEDGEMENT and indicates the uplink allocation. When USF_ACK1 is not present in the same downlink burst (neither in the PUI nor ULMAP), the uplink allocation is indicated in the next downlink burst through USF_ACK2. When PNB(n,6) bursts are allocated on the return link, a 10 ms period on the uplink is associated with 2 downlink bursts. If the UUG bit is set in the first downlink burst, the uplink allocation is signalled through ULMAP present in the same burst using USF_ACK1. However, when the second downlink burst has the UUG bit set, the allocation can no longer occur in the same 10 ms uplink period. Thus the allocation is signalled in the following burst using USF_ACK2 for the next set of uplink allocations. When both USF_ACK1 and USF_ACK2 are present in the ULMAP, USF_ACK1 is for the MES receiving the current downlink transmission containing the UUG=1 and the ULMAP. USF_ACK2 is for the MES that received the preceding downlink burst which also had the UUG bit set.

USF_ACK1 and USF_ACK2 correspond to a MES only for the first and second uplink allocation periods respectively. When used, USF_ACK2 may be present in a PNB(5,3) or PNB(5,12).

10.4.5.3.2 PDCH3(5,12) and PDCH3(2,6) - lu mode only

USF_ACK1 is associated with the Packet Downlink ACK/NACK or PACKET CONTROL ACKNOWLEDGEMENT for the MES and provides the indication for uplink allocation. For PDCH3, in the case when multiple TBFs are multiplexed in the downlink, only one TBF can have a UUG bit set to "1". For PDCH3(2,6) USF_ACK1=11100, as USF is 5 bit field.

When polling on PDCH3, if no uplink allocation is signalled using USF_ACK1 or USF_ACK2 and the MES has an active DCH on the uplink, it shall respond to the polling using DACCH. The uplink transmission shall occur on the first opportunity starting and including slot m of frame (N + USF DELAY) if the downlink transmission containing the UUG bit is sent on slot m of frame N.

10.4.5.3.3 DACCH - lu mode only

When polling using DACCH, the MES shall respond to the polling using DACCH on the first opportunity starting and including slot m of frame (N + USF DELAY) if the downlink transmission containing the UUG bit is sent on slot m of frame N.

10.4.6 Void

10.4.7 Payload type field

The Payload Type field shall indicate the format of the rest of the MAC/RLC header and the type of data contained in remainder of the RLC/MAC block. The encoding of the Payload Type field is shown in table 10.7.

Table 10.7: Payload type field in PNB(m,n) and PNB2(m,n)

bit 8 7	Payload Type
0 0	RLC/MAC block contains an RLC data block only
0 1	RLC/MAC block contains an RLC/MAC control block only
1 0	RLC/MAC block contains both control and RLC data blocks
1 1	Reserved

Table 10.7b: Payload type field in PDCH - lu mode

bit 8 7	Payload Type
0 0	RLC/MAC block contains an RLC data block only
0 1	RLC/MAC block contains an RLC/MAC control block only
1 0	Reserved
1 1	RLC/MAC block contains a transparent mode RLC data block

Table 10.7c: Payload type field on DACCH or PNB3(1,6) 2,6kbps data in shared mode

bit 8 7	Payload Type
0 0	RLC/MAC block contains an RLC data block as defined in clause 12.7 of ETSI TS 101 376-4-14 [24].
0 1	RLC/MAC block contains an RLC/MAC control block
1 0	RLC/MAC block contains an RLC data block using header type 2 as defined in clause 10.3.2c. Applies only the uplink direction.
1 1	Reserved

In the uplink direction, the RLC/MAC data block as defined in 10.3.2c shall be sent on DACCH only in case of a retransmission of data block that was initially transmitted using PNB3(1,6) 2,6kbps data in shared mode. Similarly, the RLC/MAC data block as defined in clause 12.7 of ETSI TS 101 376-4-14 [24] shall be sent using PNB3(1,6) 2,6kbps data in shared mode only in case of a retransmission of a data block that was initially transmitted using DACCH.

10.4.7a Void

10.4.8 Final Block Indicator (FBI) bit

The Final Block Indicator (FBI) bit indicates that the downlink RLC data block is the last RLC data block of the downlink TBF.

Table 10.8: Final block indicator bit

bit 1	Final block indicator
0	Current block is not last RLC data block in TBF
1	Current block is last RLC data block in TBF

10.4.8a Void

10.4.8b.1 Split Block Number (SPBN) - lu mode only

The split block number field is present in the optional octet 6 and is used when retransmission occurs on more robust MCS scheme and/or burst type has smaller payload and needs to be split to fit into the new burst payload. Using BSN, SPBN and FSB, the receiver is capable of reconstructing the initially transmitted RLC block associated with BSN indicated in the header. When Octet 6 is present and the RLC block is not split, SPBN shall be set to "000" and FSPB shall be set to "1".

10.4.8b.2 Final Split Block (FSB) - lu mode only

When set, the payload is the final split block of the initially transmitted RLC Block. When Octet 6 is present and the RLC block is not split, FSB shall be set to "1" and SPBN shall be set to "000".

10.4.9 Void

10.4.9a Void

10.4.9b Void

10.4.9c Void

10.4.9d Direction (D) bit (A/Gb mode only)

The Direction (D) bit indicates the direction of the TBF identified by the TFI field in the downlink RLC/MAC control block header. The direction of the TBF can also be deduced from the control message type.

Table 10.9: Direction (D) bit

bit	Direction (D) bit
1	
0	TFI field identifies an uplink TBF
1	TFI field identifies a downlink TBF

10.4.9e SRB field (Iu mode only)

The Signalling Radio Bearer Identity (SRB) field is used to identify the SRB to which the RLC data block belongs. It is encoded as shown in table 10.4.9e.

Table 10.4.9e: Signalling Radio Bearer Identity (SRB Id) field

Bit	SRB Id: Signalling Radio Bearer Identity
2 1	
0 0	No Resource Stealing.
0 1	SRB2
1 0	SRB3
1 1	SRB4

These bits are only used in Iu mode of operation. The SRB Id bits are present when octet6 of MAC/RLC header is present. Octet 6 is present when E bit of Octet 5 is set to "1".

10.4.10 Temporary flow identifier (TFI) field

10.4.10.1 Downlink header TFI

10.4.10.1.0 General

When operating in A/Gb mode, the TFI is 7 bits in length. When operating in Iu mode, the TFI may be 7 or 8 bits in length. The TFI field in the MAC/RLC header of a downlink RLC/MAC block (the "downlink header TFI") uniquely addresses a particular MES by specifying a downlink Temporary Block Flow (TBF) terminated by the MES or an uplink TBF originating at the MES. Alternatively, the downlink header TFI can carry the broadcast TFI value 0x7F, which indicates that all MESs monitoring the Mac-slot/D-MAC-slot are addressed by the RLC/MAC block. When the broadcast TFI is sent, the direction bit within the MAC/RLC header is set to "1" and is ignored by the MES. The downlink header TFI field is 7 bits long and is encoded as a binary number with range 0 to 127. A MES shall determine whether a particular RLC/MAC block is addressed to it solely by inspecting the downlink header TFI address. If a control block carried within an RLC/MAC block carries a separate TFI (the "control TFI"), the control TFI and downlink header TFI shall always address the same MES.

The same TFI may be assigned to multiple MES if they joined a multicast session. In that case, the TBF associated to the TFI is common among all the terminals and is in unacknowledged mode.

There are three downlink RLC/MAC block payload types: data-only, control-only, and data+control. The addressing for each of these payload types is described below.

10.4.10.1.1 Data-only downlink RLC/MAC block

For a data-only downlink RLC/MAC block, the header TFI specifies the downlink TBF associated with the RLC block carried within the RLC/MAC block.

10.4.10.1.2 Control-only downlink RLC/MAC block (A/Gb mode only)

For a control-only downlink RLC/MAC block, the header TFI may carry either the broadcast TFI or the TFI of a downlink or uplink TBF handled by the MES.

10.4.10.1.3 Control+data downlink RLC/MAC block (A/Gb mode only)

For a control+data downlink RLC/MAC block, the header TFI specifies the downlink TBF associated with the RLC block carried within the RLC/MAC block.

10.4.10.1a Downlink header TFI (bit7)

This is used in Iu mode of operation. TFI bit 7 is present when octet 6 or octet 7 of MAC/RLC header are present. Octet 6 and/or octet 7 presence is indicated through E bit of Octet 5 and LI bit. With bit 7, the downlink header TFI field is 8 bits long and is encoded as a binary number with range 0 to 255. TFI value 0x7F is the broadcast TFI even when the TFI field is 8 bits.

When both octet 6 and 7 of the RLC/MAC header are present, TFI bit 7 will be present in both octet 6 and 7 and shall be set to the same value.

10.4.10.2 Uplink header TFI

10.4.10.2.0 General

When operating in A/Gb mode, the TFI is 7 bits in length. When operating in Iu mode, the TFI is 8 bits in length.

The TFI field in the MAC/RLC header of an uplink RLC/MAC block (the "uplink header TFI") specifies the uplink TBF associated with an RLC block included within the RLC/MAC block, when an RLC block is present. The uplink header TFI field is 8 bits long and is encoded as a binary number with range 0 to 256.

There are three uplink RLC/MAC block payload types: data-only, control-only, and data+control. In A/Gb mode, the addressing for each of these payload types is described below. In Iu mode control and data blocks have independent headers containing addressing information.

10.4.10.2.1 Data-only uplink RLC/MAC block

For a data-only uplink RLC/MAC block, the uplink header TFI specifies the uplink TBF associated with the RLC block carried within the RLC/MAC block.

10.4.10.2.2 Control-only uplink RLC/MAC block (A/Gb mode only)

For a control-only uplink RLC/MAC block, the uplink header TFI is set to the TFI of the uplink TBF originating at the MES, when present. When no uplink TBF is available, the uplink header TFI is set to the broadcast TFI.

10.4.10.2.3 Control+data uplink RLC/MAC block (A/Gb mode only)

For a control+data uplink RLC/MAC block, the uplink header TFI specifies the uplink TBF associated with the RLC block carried within the RLC/MAC block.

10.4.10a Power control (PC) Parameters field

Power Control field shall be used in the downlink to indicate the PAR values as defined in ETSI TS 101 376-5-6 [15].

The PAR values received by the MES shall be applied as follows:

The PC field shall be ignored if the downlink TBF is a multicast TBF (a TBF associated with an RB for which the MES initiated a RAB Binding Request to add Multicast Binding).

- If the PC is sent with a TM TBF corresponding to an uplink flow assigned a dedicated channel, then the PC command applies to the uplink dedicated slot of the TM flow. All DACCH and DTCH on that uplink slot shall apply the PC command. The same applies if the PC is sent with Packet Link Adaptation Control with an RB Id of one of the flows on the uplink dedicated channel.
- Otherwise, if the PC is sent with a NTM TBF, or with a TM TBF for which the corresponding TM uplink flow is not assigned to a dedicated channel, the PC command applies to both uplink PDCH and any dedicated slot carrying DACCH only (not DTCH).

10.4.11 Extension (E) bit

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

Table 10.10: Extension (E) bit

bit	Extension (E) bit
0	Extension octet follows immediately
1	No extension octet follows

For downlink PDCH3(m,n), the optional fields and MAC header size depend on Extension bits in the different octets and the LI bit. The table below summarizes when the option fields are set as a function of the extension bits and the LI bit.

Table 10.4.10a

LI bit	E bit, Octet 5	E bit, Octet 6	E bit, Octet 7	E bit, Octet 8	MAC header Size	Optional fields set
0	1	N/A	N/A	N/A	5 bytes	
1	1	N/A	1	N/A	6 bytes	PDU length (5-0), TFI(7)
1	1	N/A	0	1	7 bytes	PDU length (5-0), TFI(7), PDU length(10-6)
0	0	1	N/A	N/A	6 bytes	SRB(1-0), SPBN(1-0), FSPB(1), TFI(7)
1	0	1	1	N/A	7 bytes	SRB(1-0), SPBN(1-0), FSPB(1), TFI(7), PDU length(5-0)
1	0	1	0	1	8 bytes	SRB(1-0), SPBN(1-0), FSPB(1), TFI(7), PDU length(5-0), PDU length(10-6)

10.4.12 Block Sequence Number (BSN) field

The Block Sequence Number (BSN) field carries the sequence absolute Block Sequence Number (BSN) modulo Sequence Number Space (SNS) (1 024) of each RLC data block within the TBF.

The BSN is 10 bits in length and is encoded as a binary number with range 0 to 1 023.

10.4.12a Void

10.4.13 Void

10.4.14 Void

10.4.14a Void

10.4.15 Last Part Size (LPS) field

This is an 8 bit or 11 bit information field. This field is used to indicate the length of the last part of a segmented LLC PDU present in the RLC data block.

- When the MES terminal type is A or C, the LPS is an 8 bit field.
- For all other terminal types, the LPS is an 11 bit field.

The value 0 shall be used to indicate new upper layer PDU starts in the RLC data block, i.e. no part of the previous LLC PDU is in the RLC data block.

The value 0x7ff (2047) for 11 bit LPS field or 0xff (255) for 8 bit LPS indicates that a middle segment (i.e. not the first or the last segment) of the LLC PDU completely occupies the RLC data block and the LLC PDU continues into the next radio block.

The value 0x7FE (2046) on PDCH3 indicates a dummy data block as described in clause 9.1.12c.

10.4.15a PDU Length

For RLC/MAC data header in the downlink, the PDU Length field is present when the length indicator bit is set to "1". The PDU Length field is either 6 or 11 bits. It is 11 bits when E bit in octet 7 is set to "0". It indicates the size of PDU in bytes. The size does not include the RLC/MAC header.

For RLC/MAC control header in uplink and downlink, the PDU length field is 5 bits. The PDU length does not include the MAC header.

10.4.15b Length Indicator (LI)

When the length indicator bit is set to 1, the Downlink MAC header contains octet 7 containing (5-0) bit of the PDU length field.

10.4.16 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. If the last LLC PDU of the TBF does not fill the entire RLC data field 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.

10.4.17 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).

10.4.18 Unsatisfied Demand (UD)

This field indicates the number of RLC blocks awaiting transmission from the MES. If there is no uplink TBF, UD shall be set to zero. UD is defined as the number of pending RLC blocks not yet sent plus the number of RLC blocks awaiting retransmission. UD does not include the number of RLC blocks already sent and awaiting acknowledgement.

For MES terminal type A and C, the valid range of this field is from 0-127 RLC blocks. If the number of RLC blocks to be indicated is greater than 127, then the value of 127 is reported.

For MES terminal type D, the UD field encoding is specified in table 10.11.

Table 10.11: UD field encoding (MES terminal type D)

UD Value (# RLC blocks)	Encoded Value
0-120	0-120
121-124	121
125-128	122
129-132	123
133-136	124
137-140	125
141-144	126
> 144	127

NOTE: When a range of UD values map to a single encoding, the network should assume the upper limit of the range as the UD value.

The RLC block for the shortest duration burst length at the currently assigned coding rate shall be used for UD calculation. For example, an MES belonging to terminal Type D shall define the UD field based on the RLC Block for the PNB2(5,3) burst at the currently assigned coding rate. The network shall establish the equivalence between the UD value and the allocated resources when it allocates a mix of PNB2(5,3) and PNB2(5,12) bursts in the uplink direction.

On PDCH3, the number of RLC blocks for UD calculation shall be based on the return channel bandwidth and terminal capability as show in table 10.12 as well as the assigned MCS.

Table 10.12: Burst type used for UD calculation on PDCH3

Return Link Terminal Capability	Maximum Contiguous Return Bandwidth				
	31,25 kHz	62,50 kHz	93,75 kHz	125 kHz	156,25 kHz
31,25 kHz capable terminal	PNB(1,6)	PNB(1,6)	PNB(1,6)	PNB(1,6)	PNB(1,6)
62,50 kHz capable terminal	PNB(1,6)	PNB3(2,6)	PNB3(2,6)	PNB3(2,6)	PNB3(2,6)
156,25 kHz capable terminal	PNB(1,6)	PNB3(2,6)	PNB3(2,6)	PNB3(2,6)	PNB3(5,3)

10.4.19 Immediate Termination Request (ITR)

This bit is present in the uplink header. When set, it indicates that the mobile earth station wishes to terminate this TBF immediately, without going through the "waiting" period governed by T3201.

11 Message functional definitions and contents

11.0 General

This clause defines the structure of the RLC/MAC control messages. These are non-standard L3 messages as defined in ETSI TS 101 376-4-7 [10]. The formats for the messages are valid only for the PDCH and DCH. The format for RLC/MAC control messages for use on the CCCH are defined in ETSI TS 101 376-4-8 [11].

Each definition given in the present clause includes:

- a brief description of the message direction and use;

- a CSN.1 description of the message information elements and fields (see ETSI TS 101 376-4-7 [10]). 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 clause 12 or in ETSI TS 101 376-4-8 [11]. 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 the present document. The definition of an information element is valid throughout clauses 11 and 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 the present document 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 ETSI TS 101 376-4-7 [10]);
- 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.

Bit								
8	7	6	5	4	3	2	1	
								Octet N
				bit 11	bit 10	bit 9	bit 8	Octet N+1
bit 7	bit 6	Bit 5	bit 4	bit 3	bit 2	bit 1		Octet N+2
								Octet N+3

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 the present document, see ETSI TS 101 376-4-7 [10], is a repetition of octet "00101011", starting on an octet boundary.

All reserved fields sent within a message by the mobile earth station or network shall be set to zero.

11.1 Handling of erroneous protocol data

11.1.0 General

This clause specifies procedures for the handling of unknown and erroneous protocol data by the receiving entity.

These error-handling procedures are mandatory for the mobile earth 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 clauses 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

11.1.1.0 General

The packet data channel (PDCH) is a shared resource, i.e. all mobile earth 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 earth 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 earth station is.

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

A distribution message may be received by all mobile earth stations. Depending on the protocol state of the mobile earth station, it shall be analysed as specified in clauses 5 to 9.

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

11.1.1.2.0 General

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 earth 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 earth stations.

The "Distribution contents" of a non-distribution message currently contains no information.

The "Address information" contained in the message shall be analysed by a mobile earth station receiving the message. The "Non-distribution contents" following the address information shall be ignored by any mobile earth 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 clause 12.10
1 0 < TLLI >

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

11.1.3.0 General

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

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 > > -- <i>Ignore by indefinite length</i>

Or

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

An "Ignore" error label shall be applied by the receiver of a downlink RLC/MAC control message when specified in the message description in clauses 11 and 12 of the present document. 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.

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 shall 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 clauses 11 and 12 of the present document. 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.

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

11.1.4 Error detection and order of precedence

11.1.4.0 General

A mobile earth station shall detect and process errors in the order in which they are defined in this clause 11.1.4 of the present document. (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 clause, the PACKET TBF STATUS message shall be sent by the mobile earth station. In case of multiple error events, and, due to restrictions defined in clauses 5 to 9, the mobile earth station is not able to send a first status message until the occurrence of a subsequent event generating a second status message, the mobile earth 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 earth 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 earth station shall follow the procedures that are described in clauses 5 to 9.

If no such reaction is specified, the mobile earth station shall ignore the message. If in packet transfer mode, the mobile earth 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

11.1.4.3.0 General

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.

Exceptions to the rules in this clause are given in clause 11.1.4.5.

NOTE: The order, in which the error labels mentioned in this clause 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 analysed and treated as described in clause 5.

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 distribution contents preceding the error label may be analysed and treated as described in clause 5.

The address information preceding the error label shall be analysed. In packet transfer mode, the mobile earth 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 analysed and treated as described in clause 5.

If the address information proceeds the error label and it is received correctly, it shall be analysed. In packet transfer mode, the mobile earth 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 (see clause 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.

11.1.4.5 Void

11.2 RLC/MAC control messages

11.2.0 Message format

11.2.0.0 General

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	11.2.1
Packet Channel Request	11.2.5
Packet Resource Request	11.2.16
Packet Uplink Assignment	11.2.22
Packet Uplink Assignment type 2	11.2.22a
Multiple TBF Uplink Assignment	11.2.22b
Packet TBF Assignment	11.2.7c
Downlink TBF establishment messages:	Reference
Packet DCH Assignment	11.2.5b
Packet Downlink Assignment	11.2.7
Packet Downlink Assignment type 2	11.2.7a
Multiple TBF Downlink Assignment	11.2.7b
Packet TBF Assignment	11.2.7c
TBF release messages:	Reference
Packet TBF Release	11.2.19
Packet TBF Release type 2	11.2.19a
Paging messages:	Reference
Packet Paging Request	11.2.10

RLC messages:	Reference
Packet Downlink Ack/Nack	11.2.6
Packet DCH Downlink Ack/NAck	11.2.6b
Packet Uplink Ack/Nack	11.2.21
Packet Uplink Ack/Nack type 2	11.2.21a
Packet DCH Uplink Ack/Nack	11.2.21b
System information messages:	Reference
These messages are not supported	
Miscellaneous messages:	Reference
Packet Control Acknowledgement	11.2.2
Packet Cell Change Failure	11.2.3
Packet Cell Change Order	11.2.4
Packet Downlink Dummy Control Block	11.2.8
Packet Uplink Dummy Control Block	11.2.8a
Packet Measurement Report	11.2.9a
Packet Measurement Order	11.2.9b
Packet Mobile TBF Status	11.2.9
Packet Link Control	11.2.13
Packet Link Quality Report	11.2.25
Packet Link Quality Report type 2	11.2.25a
Packet GMPRS Resume Response	11.2.26
Packet Timeslot Reconfigure	11.2.27
Multiple TBF Timeslot Reconfigure	11.2.27a
Physical Information	11.2.28
Packet Uplink Talk Burst Control	11.2.31
Packet Uplink Talk Burst Control Response	11.2.32
Packet Link Adaptation Control	11.2.33

All RLC/MAC control messages, with the exception of the PACKET CHANNEL REQUEST message, follow the same non-standard format (see ETSI TS 101 376-4-7 [10]).

11.2.0.1 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 00001 >	< Packet Cell Change Order message content >
< MESSAGE_TYPE : bit (6) == 0 00010 >	< Packet Downlink Assignment message content >
< MESSAGE_TYPE : bit (6) == 1 11100 >	< Packet Downlink Assignment type 2 message content >
< MESSAGE_TYPE : bit (6) == 0 00011 >	< Packet Measurement Order message content >
< MESSAGE_TYPE : bit (6) == 1 00010 >	< Packet Paging Request message content >
< MESSAGE_TYPE : bit (6) == 1 00011 >	< Packet PDCH Release message content >
< MESSAGE_TYPE : bit (6) == 0 00101 >	< Packet Link Control message content >
< MESSAGE_TYPE : bit (6) == 0 00110 >	< Packet Link Adaptation Control message content >
< MESSAGE_TYPE : bit (6) == 0 00111 >	< Packet Timeslot Reconfigure message content >
< MESSAGE_TYPE : bit (6) == 0 01000 >	< Packet TBF Release message content >
< MESSAGE_TYPE : bit (6) == 1 01000 >	< Packet TBF Release type 2 message content >
< MESSAGE_TYPE : bit (6) == 0 01001 >	< Packet Uplink Ack/Nack message content >
< MESSAGE_TYPE : bit (6) == 1 01001 >	< Packet Uplink Ack/Nack type 2 message content >
< MESSAGE_TYPE : bit (6) == 0 01010 >	< Packet Uplink Assignment message content >
< MESSAGE_TYPE : bit (6) == 1 01010 >	< Packet Uplink Assignment type 2 message content >
< MESSAGE_TYPE : bit (6) == 0 01110 >	< Packet DCH Assignment message content >
< MESSAGE_TYPE : bit (6) == 0 01111 >	< Multiple TBF Downlink Assignment message content >
< MESSAGE_TYPE : bit (6) == 0 10000 >	< Multiple TBF Uplink Assignment message content >
< MESSAGE_TYPE : bit (6) == 0 10001 >	< Multiple TBF Timeslot Reconfigure message content >
< MESSAGE_TYPE : bit (6) == 0 10010 >	< Physical Information message content >
< MESSAGE_TYPE : bit (6) == 0 10011 >	< Packet TBF Assignment message content >
< MESSAGE_TYPE : bit (6) == 1 00101 >	< Packet Downlink Dummy Control Block message content >
< MESSAGE_TYPE : bit (6) == 1 00110 >	< Packet Uplink Talk Burst Control Response >
< MESSAGE_TYPE : bit (6) == 0 11101 >	< PDCH Organization message content >
< MESSAGE_TYPE : bit (6) == 0 11110 >	< Packet GMPRS Resume Response message content >
< MESSAGE_TYPE : bit (6) == 0 11111 >	< Packet DCH Uplink Ack/Nack message content >
! < Unknown message type : bit (*) = < no string >	

11.2.0.2 Uplink RLC/MAC messages

Uplink RLC/MAC control messages other than the Packet Channel Request 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) == 000000 >	< Packet Cell Change Order Failure message content >
< MESSAGE_TYPE : bit (6) == 000001 >	< Packet Control Acknowledgement message content >
< MESSAGE_TYPE : bit (6) == 000010 >	< GMPRS Packet Downlink Ack/Nack message content >
< MESSAGE_TYPE : bit (6) == 001011 >	< Packet Downlink Ack/Nack message content >
< MESSAGE_TYPE : bit (6) == 000011 >	< Packet Uplink Dummy Control Block message content >
< MESSAGE_TYPE : bit (6) == 000100 >	< Packet Link Quality Report message content >
< MESSAGE_TYPE : bit (6) == 000101 >	< Packet Resource Request message content >
< MESSAGE_TYPE : bit (6) == 000111 >	< Packet Uplink Talk Burst Control >
< MESSAGE_TYPE : bit (6) == 001010 >	< Packet Measurement Report message content >
< MESSAGE_TYPE : bit (6) == 000110 >	< Packet Mobile TBF Status message content >
< MESSAGE_TYPE : bit (6) == 011111 >	< Packet DCH Downlink Ack/Nack message content >
< MESSAGE_TYPE : bit (6) == 001000 >	< Packet Link Quality Report Type2 message content > ;

Messages using the access burst formats (64-bit formats) are defined in clauses 11.2.2 and 11.2.5.

11.2.1 Packet access reject

This message is sent on the PCCCH or PACCH by the network to the mobile earth station to indicate that the network has rejected the MESS access request. This message may contain fields addressing more than one mobile earth station.

Message type: PACKET ACCESS REJECT;

Direction: network to mobile earth station;

Classification: distribution message.

Table 11.2a: Packet ACCESS REJECT information elements (MES terminal type A and C)

< Packet Access Reject message content > ::=
< Reject : < Reject struct > >
{{ 0 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 0 < Global TFI : <Global TFI IE > > }
<Rid: bit (2)>
< reserved : bit (1) >
< WAIT_INDICATION : bit (8) >
< WAIT_INDICATION_SIZE : bit (1) >
! < Ignore : bit (*) = <no string> > ;

Table 11.2b: Packet ACCESS REJECT information elements (MES terminal type D)

< Packet Access Reject message content > ::=
< Reject : < Reject struct > >
{{ 0 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 0 < Global TFI : <Global TFI IE > > }
<Rid: bit (2)>
< reserved : bit (1) >
< WAIT_INDICATION : bit (8) >
< WAIT_INDICATION_SIZE : bit (1) >
< REJECT_CAUSE : bit (2) >
! < Ignore : bit (*) = <no string> > ;

Table 11.2c: Packet ACCESS REJECT information elements (lu mode)

< Packet Access Reject message content > ::=
< Reject : < Reject struct > >
{{ 0 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 or G-RNTI : bit (32) >
1 0 < Global TFI : <Global TFI IE > > }
<Rid: bit (2)>
< reserved : bit (1) >
< WAIT_INDICATION : bit (8) >
< WAIT_INDICATION_SIZE : bit (1) >
< REJECT_CAUSE : bit (2) >
{0 1 < RB Id : bit (5) > }
! < 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 CHANNEL REQUEST or a Channel Request Description IE contained in a PACKET DOWNLINK ACK/NACK message. This information field is defined in clause 12.16.
G-RNTI (32 bit field) This field is defined in clause 12.16a. This information field shall be included if the PACKET ACCESS REJECT message is sent in response to a PACKET CHANNEL REQUEST TYPE 2 or if lu Mode Channel Request Description IE was included in a PACKET DOWNLINK ACK/NACK or PACKET RESOURCE REQUEST message.
Global TFI This information element contains the TFI of the mobile earth station's downlink TBF or uplink TBF. This field is defined in clause 12.10.
Rid (2 bit field) The Rid is extracted from the corresponding field in the Packet Channel Request to which the Reject corresponds to.
WAIT_INDICATION (8 bit field) The Wait Indication field indicates the time the mobile earth station shall wait before attempting another channel request. 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 40 milliseconds
REJECT_CAUSE (2 bit field) This field indicates the reason for the rejection. This field is encoded according to the following table:
Bit 2 1 0 0 Reserved 0 1 Resource not available 1 0 Retry on CCCH All other values are reserved.
RB Id (5 bit field) This field indicates the Radio Bearer for which the reject information is applicable.

11.2.2 Packet control acknowledgement

This message is sent on the PACCH from the mobile earth station to the network. The message is formatted as an RLC/MAC control block. The order of bit transmission is defined in ETSI TS 101 376-4-4 [8].

The RLC/MAC control block format is shown in tables 11.4 and 11.5.

Message type: Packet Control Acknowledgement

Direction: mobile earth station to network

Table 11.4: Packet control acknowledgement

< Packet Control Acknowledgement message content > ::= -- RLC/MAC control block format
{ 0 < TLLI/G-RNTI : bit (32) > 10 < Global TFI: <Global TFI IE >> }
< CTRL_ACK : bit (2) >
{ 0 1 < SQIR : bit (6) > } { 0 1 < SQI Standard Deviation : bit (6) > } { 0 1 < RB Id : bit(5) > { 0 1 < Forward Quality Indicator : bit (6) > } } { 0 1 < lu Mode Channel Request Description: <lu mode Channel Request Description IE>> } { 0 1 < Start Receive Frame N to Start Transmit Frame N+7: < Receive to Transmit Frame Offset struct >> } -- this field shall be present if the mobile earth station receives a Packet Link Control message and control header UUG field is set to 1. < padding bits > ;
< Receive to Transmit Frame Offset struct > ::=
< Time Slot Offset : bit (5) >
< Symbol Offset : bit (12) >
;

Table 11.5: Packet control acknowledgement

<p>Global TFI This information element contains the TFI of the mobile earth station's downlink TBF or uplink TBF. This field is defined in clause 12.10. The MES shall include Global TFI under conditions specified in clause 8.6.</p> <p>CTRL_ACK (2 bit field) This field contains acknowledgement information for the number of RLC/MAC control blocks that have been received in the control message in response to which the PACKET CONTROL ACKNOWLEDGEMENT message is being sent. The CTRL_ACK field shall be set according to the following table:</p>
<p>Bit 2 1 0 0 reserved - this value shall not be sent. If received it shall be interpreted as bit value "0 1". 0 1 the MES received an RLC/MAC block with one embedded control block addressed to itself or RLC/MAC data block for a TBF in RLC unacknowledged mode. 1 0 the MES received an RLC/MAC block with two embedded control blocks addressed to itself 1 1 the MES is responding to IMMEDIATE ASSIGNMENT TYPE 2 (refer to ETSI TS 101 376-4-8 [11]) when polling bit was set</p> <p>SQIR (6 bits) This field gives the signal quality as received by the MES. Refer ETSI TS 101 376-5-6 [15] for details.</p> <p>SQI Standard Deviation (6 bits) This field gives the standard deviation of the signal quality measured by the MES. Refer to ETSI TS 101 376-5-6 [15] for details.</p>
<p>RB Id (5 bit field) This field indicates the radio bearer identity for which this message is applicable. Range: 0 to 31.</p>
<p>Forward Quality Indicator (6bits) This field gives the receiver perceived channel frame error rate. Refer to ETSI TS 101 376-5-6 [15] for encoding details.</p>
<p>TLLI/G-RNTI This information element contains the TLLI or the G-RNTI assigned to the mobile earth station. TLLI is defined in clause 12.16. G-RNTI is defined in clause 12.16a. The MES shall include TLLI/G-RNTI under conditions specified in clause 8.6.</p> <p>Iu mode Channel Request Description IE This IE is valid only when operating in Iu Mode. This IE defined in clause 12.7a.</p>
<p>Start Receive Frame N to Start Transmit Frame N+7 This field indicates the time between the forward link timeslot 0 in FN = N and the return link timeslot 0 in FN = N + 7.</p> <p>Receive to Transmit Frame Offset struct This structure provides the offset between a receive frame and transmit frame in Ts/40 resolution unit, where Ts is a symbol period for a reference symbol rate of 23,4 Ksps (i.e. (2 × 5/234) ms). (Refer to note below)</p> <p>Timing Offset = Time Slot Offset * 39 * 40 + Symbol Offset</p> <p>The timing offset is the result of the initial timing correction at the time of RACH plus all timing corrections made and still pending as instructed by the network.</p>
<p>Time Slot Offset (5bit) Slot offset unit is time slots. There are 39 symbols in a time slot. Range 0 to 31.</p>
<p>SYMBOL_OFFSET (12bit) The timing correction information is a 12-bit signed value. The time offset is specified in a 2's complement form coded in binary. The correction value is specified in Ts/40 resolution unit, where Ts is a symbol period for a reference symbol rate of 23,4 Ksps (i.e. (2 × 5/234) ms). (Refer to note below). Range -1 280 to 1 240.</p> <p>NOTE: Symbol period Ts used here does not refer to the symbol period on the PDCH carrier. The Ts value is derived from a reference symbol rate of 23,4 Ksps.</p>

11.2.3 Packet cell change failure (Iu mode only)

This message is sent on the PACCH from the mobile earth station to the network to indicate that a commanded cell change order has failed. For a (3G) multi-RAT mobile earth station this may be a 3G Cell.

Message type: PACKET CELL CHANGE FAILURE

Direction: mobile earth station to network

Table 11.5a: PACKET CELL CHANGE FAILURE message content

```

< Packet Cell Change Failure message content > ::=
  < G-RNTI : bit (32) >
  < ARFCN : bit (11) >
  < Spotbeam Id : bit (10) >
  < CAUSE : bit (4) >
  {
    0
  | 1 { 0 | 1 < UTRAN FDD Target cell: < UTRAN FDD Target cell IE > }
      { 0 | 1 < UTRAN TDD Target cell: < UTRAN TDD Target cell IE > }
      < padding bits > } ;

```

Table 11.5b: PACKET CELL CHANGE FAILURE information element details

G-RNTI (32 bit field)
This field is defined in clause 12.16.

ARFCN (11 bit field)
This field contains the BCCH frequency of the new cell on which the failure occurred. This field is encoded as the ARFCN defined in ETSI TS 101 376-5-5 [17].
Range 0 to 2 048
If a 3G Cell is indicated, this field shall be sent with the value 0.

Spotbeam Id (10 bit field)
This field contains the binary representation Satellite Spotbeam Id of the new cell on which the failure occurred.
Range 1 to 1 023
If a 3G Cell is indicated, this field shall be sent with the value 0.

CAUSE (4 bit field)
This field indicates the cause of the cell change order failure on the target cell.

bit
4 3 2 1
0 0 0 0 Frequency not implemented
0 0 0 1 No response on target cell
0 0 1 0 Immediate Assign Reject or Packet Access Reject on target cell
0 1 0 1 MES in GMM Standby state
0 1 1 0 Forced to the Standby state
All others Reserved for future use

UTRAN FDD Target cell
This information element contains the description of the UTRAN FDD Target cell. This information element is defined in clause 12.31.

UTRAN TDD Target cell
This information element contains the description of the UTRAN TDD Target cell. This field is defined in clause 12.32.

11.2.4 Packet cell change order (lu mode only)

This message is sent on the PCCCH or PACCH by the network to the mobile earth station to command the mobile earth station to leave the current cell and change to a new cell. For a (3G) multi-RAT mobile earth station the new cell may be a 3G Cell.

Message type: PACKET CELL CHANGE ORDER

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.5c: PACKET CELL CHANGE ORDER message content

```

< Packet Cell Change Order message content > ::=
{
  { 0 < Global TFI : < Global TFI IE > >
  | 10 < G-RNTI : bit (32) > }
  { 0
  | < IMMEDIATE_REL : bit >
    < Target Cell: < GMR target cell struct >> }
  | 1
    { 00 -- Message escape
    { < IMMEDIATE_REL : bit >
      { 0 | 1 < UTRAN FDD Target cell: < UTRAN FDD Target cell IE > }
      { 0 | 1 < UTRAN TDD Target cell: < UTRAN TDD Target cell IE > }
      < padding bits > } }
      ! < Non-distribution part error : bit (*) = < no string > > }
      ! < Message escape : { 01 | 10 | 11} bit (*) = < no string > > } }
      ! < Address information part error : bit (*) = < no string > > }
      ! < Distribution part error : bit (*) = < no string > > ;

< GMR target cell struct > ::=
  < ARFCN : bit (11) >
  < BCCH_TN: bit(5)
  < Spotbeam Id : bit (10) >;

< 3G Neighbour Cell Description struct > ::=
  { 0 | 1 < Index_Start_3G : bit (7) > }
  { 0 | 1 < Absolute_Index_Start_EMR : bit (7) > }
  { 0 | 1 < UTRAN FDD Description : < UTRAN FDD Description struct >> }
  { 0 | 1 < UTRAN TDD Description : < UTRAN TDD Description struct >> }
  { 0 | 1 < REMOVED_3GCELL_Description : < REMOVED_3GCELL_Description struct >> } ;

< REMOVED_3GCELL_Description struct > ::=
  < N1 : bit (2) >
  { < N2 : bit (5) >
    { < REMOVED_3GCELL_INDEX : bit (7) >
      < 3G_CELL_DIFF_LENGTH : bit (3) >
      < 3GCELL_DIFF : bit (val(3G_CELL_DIFF_LENGTH)) >
    } * (1+val(N2))
  } * (1+val(N1));

< UTRAN FDD Description struct > ::=
  { 0 | 1 < Bandwidth_FDD : bit (3) > }
  { 1 < Repeated UTRAN FDD Neighbour Cells : < Repeated UTRAN FDD Neighbour Cells struct >> } ** 0 ;

< Repeated UTRAN FDD Neighbour Cells struct > ::=
  0 < FDD-ARFCN : bit (14) > -- The value "1" was used in an earlier
                             -- version of the protocol and shall not be used.

  < FDD_Indic0 : bit >
  < NR_OF_FDD_CELLS : bit (5) >
  < FDD_CELL_INFORMATION Field : bit(p(NR_OF_FDD_CELLS)) > ;
                             -- p(x) defined in table 11.2.9b.2.a/ETSI TS 144 060 [22]

< UTRAN TDD Description struct > ::=
  { 0 | 1 < Bandwidth_TDD : bit (3) > }
  { 1 < Repeated UTRAN TDD Neighbour Cells : < Repeated UTRAN TDD Neighbour Cells struct >> } ** 0 ;

< Repeated UTRAN TDD Neighbour Cells struct > ::=
  0 < TDD-ARFCN : bit (14) > -- The value "1" was used in an earlier
                             -- version of the protocol and shall not be used.

  < TDD_Indic0 : bit >
  < NR_OF_TDD_CELLS : bit (5) >
  < TDD_CELL_INFORMATION Field : bit(q(NR_OF_TDD_CELLS)) > ;
                             -- q(x) defined in table 11.2.9b.2.b/ETSI TS 144 060 [22].

```

Table 11.5d: PACKET CELL CHANGE ORDER information element details

<p>Global TFI This information element contains the TFI of the mobile earth station's downlink TBF or uplink TBF. This field is defined in clause 12.10.</p> <p>TLLI/G-RNTI (32 bit field) This field is defined in clause 12.16.</p> <p>IMMEDIATE_REL (bit) This field indicates whether the MS shall immediately abort any operation in the old cell and move to the target cell (see clause 8.4), or it shall not immediately abort operation in the old cell and follow the cell reselection procedure defined in clause 5.5.1.1. This field is coded according to the following table: 0 No immediate abort of operation in the old cell is required. 1 Immediate abort of operation in the old cell is required.</p> <p>ARFCN (11 bit field) This field contains the BCCH frequency of the new cell. This field is encoded as the ARFCN defined in ETSI TS 101 376-5-5 [17]. Range 0 to 1 047.</p> <p>BCCH_TN (5 bit field) This field contains the starting time slot of BCCH. Range 0 to 23.</p> <p>SpotbeamId (10 bit field) This field contains the binary representation Satellite Spotbeam Id of the new cell. Range 1 to 1 023.</p> <p>UTRAN FDD Target cell This information element contains the description of the UTRAN FDD Target cell. This information element is defined in clause 12.31.</p> <p>UTRAN TDD Target cell This information element contains the description of the UTRAN TDD Target cell. This information element is defined in clause 12.32.</p>

11.2.5 Packet channel request (A/Gb Mode only)

This message is sent in random mode on the PRACH. It does not follow the basic format. The order of bit transmission is defined in ETSI TS 101 376-4-4 [8].

Message format and description of PACKET CHANNEL REQUEST transmitted over PAB is shown in tables 11.6 and 11.7.

Table 11.6: PACKET CHANNEL REQUEST 64 bit message content

< Packet channel request 64 bit message content > ::=
{0 < One Phase Access Request :
< TLLI : bit (32) >
< Rid: bit (2) >
< No of Blocks : bit (6) >
< Peak Throughput Class : bit (4) >
< Radio Priority: bit (2) >
< RLC Mode : bit (1) >
< LLC PDU TYPE : bit (1) >
< GMPRS Terminal Type Identifier Bits 6-1: bit (6) >
< SQIR : bit (6) >
< GMPRS Terminal Type Identifier Bit 7: bit (1) >
< Spare : bit (2) > >
10101 < GMPRS Resume Procedure:
< TLLI: bit (32) >
< Spare: bit (27) > >
10110 <MM Procedure:
< TLLI: bit (32) >
< Rid: bit (2) >
< SQIR: bit (6) >
< Spare: bit (19) >>
10111 <Initial Correction:
<TFI: bit (7)>
< Rid: bit (2) >
< SQIR: bit (6)>
< Spare: bit (44)>>
}

Table 11.7: PACKET CHANNEL REQUEST 64 bit message details

TLLI (32 bit field) The TLLI field is encoded as a binary number. Range 0 to 4 294 967 295
Rid (2 bit field) The Rid is a cyclic identifier. It is incremented on every PRACH attempt by the MES, modulo 4.
No Of Blocks (6 bit field) This field is defined in clause 12.31.
Peak Throughput Class (4 bit field) Reserved. The contents of this field are ignored by the network.
Priority (2 bit field) This information field indicates the requested Radio Priority. This field is coded as shown in the following table. The 8 bit format has a default Radio Priority of 4 bit
Bit 2 1 0 0 Radio Priority 1 (Highest priority) 0 1 Radio Priority 2 1 0 Radio Priority 3 1 1 Radio Priority 4 (Lower priority)
RLC_MODE (1 bit field) This field contains 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
GMPRS Terminal Type Identifier GMPRS terminal type identifier is defined in ETSI TS 101 376-5-2 [13]. The following two fields within the Packet Channel Request message are used to encode 7 bits of GMPRS terminal type identifier. Note that these two fields are not contiguous. Both fields shall be processed before interpreting the terminal type identifier. GMPRS Terminal Type Identifier Bits 6-1 (6 bit field) This field encodes bits b6-b1 of GMPRS Terminal type identifier. GMPRS Terminal Type Identifier Bit 7 (1 bit field) This field encodes bit b7 of GMPRS Terminal type identifier.
SQIR (6 bit field) Contains the SQIR based on the BCCH RSSI measurements. See ETSI TS 101 376-5-6 [15] for details.
TFI (7 bit field) This field contains the downlink TFI received by the MES in the Packet Immediate Assignment Type 3 message (see ETSI TS 101 376-4-8 [11]).

11.2.5a Packet Channel Request Type 2 (lu mode only)

This message is sent in random mode on the PRACH3. It does not follow the basic format. The order of bit transmission is defined in ETSI TS 101 376-4-4 [8].

Message format and description of PACKET CHANNEL REQUEST TYPE 2 transmitted over PAB3 is shown in tables 11.6a and 11.7a. PACKET CHANNEL REQUEST TYPE 2 is 40 bits in length.

Table 11.7a: PACKET CHANNEL REQUEST TYPE 2

<pre> <Packet Channel Request Type 2 Message Content> ::= { 0 -- RRC Cell Update { < Rid: bit (2) > < S-RNTI : bit (20) > < Cell Update Cause: bit(3) > < RB Info: <RB Request Struct IE>> < Spare: bit(3) > }} 1000 -- Handover Access { < Rid: bit (2) > < Handover Reference : bit (8)> < RB Info: <RB Request Struct IE>> < Spare: bit (15)>}} 1001 -- Periodic GRA Update Procedure { < Rid: bit (2) > < S-RNTI: bit (20) > < Spare: bit (14) >}} 1010 -- Initial Correction { < Rid: bit (2) > < S-RNTI : bit (20)> < TFI: bit(8)> < Spare: bit (6)>}} 1011 -- Uplink Resource Request { < Rid: bit (2) > < S-RNTI : bit (20)> < RB Info: <RB Request Struct IE>> < Spare: bit (3)>}} 1100 -- User Data Transfer - Application Type 1 { < Rid: bit (2) > < S-RNTI : bit (20) > < RB Id: bit (5)> < User Data: bit (8) > < Spare Bits: bit(1)>}} 1101 - Talk Burst Request { < Reference ID: bit (2) > <RETRANSMISSION: bit(1)> < S-RNTI : bit (20) > < RB Id: bit (5)> { 0 1<Request Priority: bit (2) >} < Spare Bits: bit(6)>}} ! < Content part error : bit (*) = < no string > > } }; </pre>
<pre> <RB Request Struct IE> ::= < RB Id: bit(5)> < RLC_BLOCK_COUNT:bit(6)>; </pre>

Table 11.7b: PACKET CHANNEL REQUEST TYPE 2 message details

S-RNTI (20 bit field) The S-RNTI field is defined in clause 12.16a.
Rid (2 bit field) The Rid is a cyclic identifier. It is incremented on every PRACH attempt by the MES, modulo 4.
Cell Update Cause (3 bit field) The Cell Update Cause field is defined in ETSI TS 101 376-4-13 [23].
RB Id (5 bit field) This field contains the identity of the Radio Bearer for which data transfer (signalling or user traffic) is pending. If user traffic transfer is pending, then the MES shall include RB Id of the corresponding User Radio Bearer (URB). When multiple User Radio Bearers have data to be transmitted, the MES shall select one user RB Id based an implementation choice. See ETSI TS 101 376-4-13 [23] for the definition of RB Id, If only upper layer signalling transfer is pending, then the MES shall include RB Id corresponding to the signalling radio bearer (SRB). See ETSI TS 101 376-4-13 [23] for details on signalling radio bearer. If Cell Update Cause is RLC unrecoverable error, the RB Id contains the identity of the RLC entity on which the error occurred.
RLC_BLOCK_COUNT (6 bit field) This field is defined in clause 12.31.
Handover Reference (8 bit field) This field is coded as the handover reference value field defined in ETSI TS 101 376-4-13 [23].
User Data (8 bit field) This field is for FFS.
Request Priority (2 bit field) Talk Burst Request Priority.

11.2.5b Packet DCH Assignment (Iu mode only)

This message is sent on the PACCH or DACCH from the network to the mobile earth station in *Iu mode* to assign one or more DCH to the mobile earth station.

Message type: PACKET DCH ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.7c: PACKET DCH ASSIGNMENT information elements

```

< Packet DCH Assignment message content > ::=
{
  {00 | 01 < Global TFI : < Global TFI IE > > | 10 < G-RNTI : bit(32) >}
  { 0
    -- Message escape
    < Rid: bit (2) >
    { 0 | 1 < Frequency Allocation: < Frequency Allocation IE >> }
    { 0 | 1 < Packet Link Synchronization IE > }
    < TBF Assignment: < TBF Assignment Struct >>
    < padding bits >
    -- truncation at end of message allowed, bits "0" assumed
    ! < 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 > > ;
  }

< TBF Assignment Struct > ::=
{
  0 < Uplink DCH TBF Allocation: < DCH TBF Allocation IE >> -- UL is DCH and DL is PDCH
  10 < Uplink and Downlink DCH TBF Allocation: < DCH TBF Allocation IE >> -- UL and DL are both DCH
  { null | 0 bit** = < no string > } };

< DCH TBF Allocation IE > ::=
{ < Channel Info: < Channel Info IE >> -- Applies to both the uplink and downlink DCH, used for symmetric allocation
  < Power Control Synch Offset: < Power Control Synch Offset IE > > -- Applies only to uplink DCH
  < DCH Channel MCS Info: < DCH MCS IE >> -- Applies only to uplink DCH
  { 0 < Downlink MAC Slot Allocation: bit(8) > | 1 < Downlink Slot Allocation: < Slot Allocation IE >> }
  { 0 < Uplink MAC Slot Allocation: bit(8) > | 1 < Uplink Slot Allocation: < Slot Allocation IE >> }
  < RB Id: bit (5) > };

```

Table 11.7d: PACKET DCH ASSIGNMENT information elements details

Global TFI
This information element contains one of the mobile earth station's downlink or uplink TFIs.
This field is defined in clause 12.10.

G-RNTI (32 bit field)
This field is defined in clause 12.16a.

Rid (2 bit field)
The Rid is a cycle identifier. It is incremented on every PRACH attempt by the MES, modulo 4. The MES shall use this field to determine which one of its PACKET CHANNEL REQUEST TYPE 2 message is being acknowledged by the network.

Frequency Allocation IE
This IE is defined in clause 12.8a. The network may omit this field if all the active RBs are already allocated the same ARFCN and 31,25 kHz bandwidth. The MES shall use the same frequency and bandwidth as the existing RBs for the new assignment if the Frequency Allocation is not included.

Channel Info IE
This IE is defined in clause 12.36.

Packet Link Synchronization
This IE is defined in clause 12.29.

DCH MCS IE
This IE is defined in clause 12.35a.

Channel Info IE (3 bit field)
This IE is defined in clause 12.36.

Power Control Synch Offset IE
This IE is defined in clause 12.38.

Downlink MAC Slot Allocation
This IE is defined in clause 12.18.

Uplink MAC Slot Allocation
This IE is defined in clause 12.18.

Slot Allocation IE
This IE is defined in clause 12.18a.

RB Id (5 bit field)
This field indicates the radio bearer identity. Range: 0 to 31.

11.2.6 GMPRS packet downlink Ack/Nack (A/Gb mode only)

This message is sent on the PACCH on an uplink PDCH from the mobile earth 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 earth station may optionally initiate an uplink TBF or request a temporary suspension of the downlink TBF.

Message type: GMPRS Packet Downlink Ack/Nack

Direction: mobile earth station to network

Table 11.8: GMPRS Packet downlink Ack/Nack information elements

<pre> < Packet Downlink Ack/Nack message content > ::= < DOWNLINK_TFI : bit (7) > < reserved : bit (1) > {0 1 <SQI Standard Deviation: bit (6) > {0 <reserved: bit (17) > 1 <Channel Request Description : channel request description IE :bit (17)} } {0 1 < SQIR: bit (6) >} < GMPRS Ack/Nack Description : GMPRS Ack/Nack Description IE : > ; </pre>

Table 11.9: GMPRS Packet downlink Ack/Nack information element details

<p>DOWNLINK_TFI (7 bit field) This field contains the TFI of the mobile earth station's downlink TBF. This field is defined in clause 12.15.</p> <p>GMPRS Ack/Nack Description IE (L bit field) This information element is defined in clause 12.3a. The number of bits (L) available for Ack/Nack Description information element depends on the inclusion of an optional channel request. L shall be set so that the entire GMPRS 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>SQIR (6 bits) This field gives the signal quality as received by the MES. Refer ETSI TS 101 376-5-6 [15] for details.</p> <p>SQI Standard Deviation (6 bits) This field gives the standard deviation of the signal quality measured by the MES. Refer to ETSI TS 101 376-5-6 [15] for details.</p> <p>Channel Request Description IE (17 bits) This information element is valid only for multislot class 2 MES. This IE is defined in clause 12.7.</p>

11.2.6a Packet downlink Ack/Nack (lu mode only)

This message is sent on the PACCH or DACCH from the mobile earth 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 earth station may optionally initiate an uplink TBF or request a temporary suspension of the downlink TBF.

Message type: Packet Downlink Ack/Nack

Direction: mobile earth station to network

Table 11.9a: Packet downlink Ack/Nack information elements

```

< Packet Downlink Ack/Nack message content > ::=
  < DOWNLINK_TFI : bit (8) >
  < reserved : bit (1) >
  {0 | 1 <SQI Standard Deviation: bit (6) >}
  {0 | 1 <Channel Request Description : channel request description IE :bit (17)>}
  {0 | 1 < SQIR: bit (6) >}
  {0 | 1 <lu Mode Channel Request Description: <lu mode Channel Request Description IE>>}
  {0 | 1 < Forward Quality Indicator : bit (6) >}
  < GMPRS Ack/Nack Description : GMPRS Ack/Nack Description IE : > ;

```

Table 11.9b: GMPRS Packet downlink Ack/Nack information element details

DOWNLINK_TFI (8 bit field)
This field contains the TFI of the mobile earth station's downlink TBF. This field is defined in clause 12.15.

GMPRS Ack/Nack Description IE (L bit field)
This information element is defined in clause 12.3. The number of bits (L) available for Ack/Nack Description information element depends on the inclusion of an optional channel request. L shall be set so that the entire GMPRS 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.

SQIR (6 bits)
This field gives the signal quality as received by the MES. Refer ETSI TS 101 376-5-6 [15] for details.

SQI Standard Deviation (6 bits)
This field gives the standard deviation of the signal quality measured by the MES. Refer to ETSI TS 101 376-5-6 [15] for details.

Channel Request Description IE (17 bits)
This information element is valid only for multislot class 2 MES. This IE is defined in clause 12.7.

lu mode Channel Request Description IE
This IE is valid only when operating in lu Mode. This IE defined in clause 12.7a.

Forward Quality Indicator (6 bits)
This field gives the receiver perceived channel frame error rate. Refer to ETSI TS 101 376-5-6 [15] for encoding details.

11.2.6b Packet DCH Downlink Ack/Nack (lu mode only)

This message is sent on PACCH or DACCH from the mobile earth station to the network to indicate the status of downlink RLC data blocks received.

Message type: PACKET DCH DOWNLINK ACK/NACK

Direction: mobile earth station to network

Table 11.9c: PACKET DCH DOWNLINK ACK/NACK information elements

```

< Packet DCH Downlink Ack/Nack message > ::=
  < RB Id : bit (5) >
  { 1 -- DCCH TBF mode
  < DCCH Ack/Nack Description : < DCCH Ack/Nack Description IE > > }
  < padding bits > ;

```

Table 11.9d: PACKET DCH DOWNLINK ACK/NACK information element details

RB Id (5 bit field)
This field contains the radio bearer identity of the mobile earth station's radio bearer for which the downlink data transfer is acknowledged. This field is encoded as a binary number with range 0 to 31.

DCCH Ack/Nack Description IE
This IE is defined in clause 12.3a.

11.2.7 Packet downlink assignment (A/Gb mode only)

This message is sent on the PACCH by the network to the mobile earth station to assign downlink resources to the mobile earth station.

Message type: PACKET DOWNLINK ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.10: Packet downlink assignment information elements

<pre> < Packet Downlink Assignment message content > ::= { { 0 < TLLI : bit (32) > 10 < Global TFI : < Global TFI IE > > } { 0 -- Message escape { < RLC_MODE : bit (1) > < reserved : bit (1) > < MAC Slot Allocation : bit (8) > < reserved: bit (31) > < DOWNLINK_TFI_ASSIGNMENT : bit (7) > { { 0 1 < Frequency Parameters : < Frequency Parameters IE > > } { 0 1 < reserved: bit (6) > } { 0 1 < reserved: bit (4) : > } < padding bits > } // -- truncation at end of message allowed, bits "0" assumed ! < 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 > > ; </pre>

Table 11.11: PACKET Downlink ASSIGNMENT information element details

Global TFI
This information element contains the TFI of an already existing TBF in this mobile earth station in the uplink or downlink direction. This field is defined in clause 12.10.
TLLI (32 bit field)
This field is defined in clause 12.16.
RLC_MODE (1 bit field)
This field is defined in clause 12.32.
MAC Slot Allocation (8 bit field)
This field is defined in clause 12.18.
Frequency Parameters
This information element is defined in clause 12.8.
DOWNLINK_TFI_ASSIGNMENT (7 bit field)
This information element assigns the TFI to the mobile earth station to identify to downlink TBF described by this message. TFI is encoded as defined in clause 12.15.

11.2.7a Packet downlink assignment type 2 (lu mode only)

This message is sent on the PACCH or DACCH by the network to the mobile earth station to assign downlink resources to the mobile earth station. This message may also include uplink resources, when the uplink physical channel paired with the downlink PDCH is of type DCH.

Message type: PACKET DOWNLINK ASSIGNMENT TYPE 2

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.11a: Packet downlink assignment type 2 information elements

```

< Packet Downlink Assignment type 2 message content > ::=
{
  { 0 < TLLI/G-RNTI: bit (32) >
    | 10 < Global TFI : < Global TFI IE > >
    | 110 < S-RNTI: bit(20) > }
  { 0 -- Message escape
    { < RLC_MODE : bit (1) >
      < RB Id: bit(5)>
        < MAC Slot Allocation : bit (8) > -- Applicable for Downlink TBF
        < DOWNLINK_TFI_ASSIGNMENT : bit (8) >
      { 0 | 1 < HFN_LSB : bit (1) >
        { 0 | 1 < Frequency Allocation : < Frequency Allocation IE > > }
        { 0 | 1 < PDCH Uplink Organization: <PDCH Uplink Organization IE>> }
        { 0 | 1 < Uplink DCH TBF Allocation: < DCH TBF Allocation Struct>> }
          < padding bits > } // -- truncation at end of message allowed, bits "0" assumed
        ! < 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 > > ;

<DCH TBF Allocation Struct>::=
{
  <Channel Info: <Channel Info IE>>
  <Power Control Sync Offset: <Power Control Sync Offset IE>> -- Applies only for uplink DCH
  <DCH Channel MCS Info: <DCH MCS IE>>
  {0<Downlink MAC Slot Allocation: bit(8)> | 1 <Downlink Slot Allocation: <Slot Allocation IE>>}
  {0<Uplink MAC Slot Allocation: bit(8)> | 1 <Uplink Slot Allocation: <Slot Allocation IE>>}
  <RB Id: bit(5)>;
}

```

Table 11.11b: PACKET Downlink ASSIGNMENT TYPE 2 information element details

Global TFI
This information element contains the TFI of an already existing TBF in this mobile earth station in the uplink or downlink direction. This field is defined in clause 12.10.
TLLI/G-RNTI (32 bit field)
This field is defined in clause 12.16. G-RNTI is defined in clause 12.16a.
S-RNTI (20 bit field)
This field is defined in clause 12.16a.
RLC_MODE (1 bit field)
This field contains the RLC mode to be used for the assigned TBF. 0 RLC acknowledged mode. 1 RLC unacknowledged mode.
MAC Slot Allocation (8 bit field)
This field is defined in clause 12.18.
Frequency Allocation
This information element is defined in clause 12.8a.
DOWNLINK_TFI_ASSIGNMENT (7 bit field)
This information element assigns the TFI to the mobile earth station to identify to downlink TBF described by this message. TFI is encoded as defined in clause 12.15.
HFN_LSB (1 bit field) (<i>lu mode</i> only)
This field contains the least significant bit of the downlink HFN of the radio bearer for which the TBF is assigned.
PDCH Uplink Organization
This IE is included only if Frequency Allocation IE does not include uplink frequency. This IE is defined in clause 12.37.
Channel Info
This IE is defined in clause 12.36.
Power Control Sync Offset
This IE is defined in clause 12.38.
DCH Channel MCS Info
This IE is defined in clause 12.35a.
Downlink MAC Slot Allocation
This IE is defined in clause 12.18.
Downlink Slot Allocation
This IE is defined in clause 12.18a.
Uplink MAC Slot Allocation
This IE is defined in clause 12.18.
Uplink Slot Allocation
This IE is defined in clause 12.18a.
RB Id
This field indicates the radio bearer identity for which this TBF is allocated. Range 0 to 31.

11.2.7b Multiple TBF Downlink Assignment (*lu mode* only)

This message is sent on the PACCH by the network to the mobile earth station to assign multiple downlink resources to the mobile earth station.

Message type: MULTIPLE TBF DOWNLINK ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.11c: MULTIPLE TBF DOWNLINK ASSIGNMENT information elements

```

< Multiple TBF Downlink Assignment message content > ::=
{
  { 0 < Global TFI : < Global TFI IE > >
    | 10 < G-RNTI : bit(32) >
    | 110 < S-RNTI: bit(20)> }
  { 0 -- Message escape
    { 0 | 1 < Frequency Allocation : < Frequency Allocation IE > > }
    { 0 | 1 < PDCH Uplink Organization: <PDCH Uplink Organization IE>> }
    { 1 < Multiple Downlink TBF Assignment : < Multiple Downlink TBF Assignment struct > > } ** 0
    < padding bits > } // -- truncation at end of message allowed, bits "0" assumed
    ! < 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 > > ;

< Multiple Downlink TBF Assignment struct > ::=
< MAC Slot Allocation : bit (8) >
{ 1 < Downlink TBF assignment : < Downlink TBF assignment struct > > } ** 0 ;

< Downlink TBF assignment struct > ::=
{ < RLC_MODE: bit(1)>
< RB Id : bit (5) >
< DOWNLINK_TFI_ASSIGNMENT : bit (8) >
{ 0 | 1 < HFN_LSB : bit (1) > } }; -- HFN_LSB field used in lu mode only

```

Table 11.11d: MULTIPLE TBF DOWNLINK ASSIGNMENT information element details

Global TFI
This information element identifies one of the mobile earth station's downlink or uplink TFIs.
This field is defined in clause 12.10.

G-RNTI (32 bit field)
G-RNTI is defined in clause 12.16a.

S-RNTI (20 bit field)
This field is defined in clause 12.16a.

MAC Slot Allocation (8 bit field)
This field is defined in clause 12.18.

Frequency Allocation
This information element is defined in clause 12.8a.

DOWNLINK_TFI_ASSIGNMENT (9 bit field)
This information element assigns one TFI(s) to each TBF assigned to the mobile earth station in this message. This field is repeated for each TBF that is assigned in this message. TFI is encoded as defined in clause 12.15.

RB Id (5 bit field)
This field contains the radio bearer identifier for the radio bearer using the assigned TBF. This provides the mapping of TFI to RB Id which is necessary to uniquely identify lu-mode data flows.

HFN_LSB (1 bit field) (*lu mode* only)
This field contains the least significant bit of the downlink HFN of the radio bearer for which the TBF is assigned.

PDCH Uplink Organization
This IE is included only if Frequency Allocation IE did not include uplink frequency. This IE is defined in clause 12.37.

RLC_MODE (1 bit field)
This field contains the RLC mode to be used for the assigned TBF.

0 RLC acknowledged mode.
1 RLC unacknowledged mode.

11.2.7c Packet TBF Assignment (*lu mode* only)

This message is sent on the PACCH, PDCH or DACCH from the network to the mobile earth station in *lu mode* to assign one or more channels to the mobile earth station.

Message type: PACKET TBF ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.11e: Packet TBF assignment

```

< Packet TBF Assignment type 2 message content > ::=
{ 00
|01 < Global TFI : < Global TFI IE > >
|10 < G-RNTI: bit(32) >
|110 < S-RNTI: bit(20) > }
{ 0 -- Message escape
< RB List Size: bit (2) >
{ < RB Id: bit(5)>
{ 0 | 1 < RB Priority : bit (2) > }
{ 0 | 1 < RRBid: RRB Identity IE > }
< RLC_MODE : bit (2) >
< Assignment Type: bit (1) >
< Physical Information : < Physical Channel Configuration IE > > }*(1+val(RB List Size))
< padding bits > } // -- truncation at end of message allowed, bits "0" assumed
! < 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 11.11f: Packet TBF ASSIGNMENT information element details

Global TFI

This information element identifies one of the mobile earth station's downlink or uplink TFIs.

This field is defined in clause 12.10.

G-RNTI (32 bit field)

G-RNTI is defined in clause 12.16a.

S-RNTI (20 bit field)

This field is defined in clause 12.16a.

RB Id (5 bit field)

This field contains the radio bearer identifier for the radio bearer using the assigned TBF. This provides the mapping of TFI to RB Id which is necessary to uniquely identify lu-mode data flows.

RRBid

This field is used to identify the Reduced Radio Bearer identity. This IE is defined in clause 9.3.80a. The RRB identity/RB identity association holds only on the MAC slots assigned in the message.

RB Priority (2 bit field)

This field identifies the Radio Bearer priority as determined by the network.

bit

2 1

0 0 Priority 0 (Highest)

0 1 Priority 1

1 0 Priority 2

1 1 Priority 3 (Lowest)

RLC_MODE (2 bit field)

This field contains the RLC mode to be used for the assigned TBF.

00 RLC acknowledged mode.

01 RLC unacknowledged mode.

11 RLC Transparent mode.

Assignment Type (1 bit field)

This field indicates whether it is an initial assignment or reconfiguration of an existing TBF.

0 indicates that this message is an initial Packet TBF Assignment. If uplink TBF is already established, UT shall re-establish and reset the corresponding RLC entity. If downlink TBF is already established, it shall re-establish and reset the corresponding RLC entity, unless the downlink TBF being established is in shared mode and TFI value in the assignment is the same as the already established TBF (this occurs when the initial assignment is retransmitted due to loss of Ack Message).

1 indicates that this message is a reconfiguration of an existing TBF not requiring an RLC Reset neither in downlink or uplink direction. This option can be used to reconfigure slot, frequency and/or burst duration of a dedicated uplink assignment. The uplink channel type of TM mode may also be changed i.e. from fixed PDCH to DCH or vice versa.

Uplink and/or downlink TBFs is indicated in Physical Information IE.

Physical Information IE

The *Physical Channel Configuration* IE is defined in is defined in ETSI TS 101 376-4-13 [23].

11.2.8 Packet downlink dummy control block

This message is sent on the PCCCH or PACCH or DACCH by the network to the mobile earth station as a fill message with the optional persistence level parameters.

Message type: PACKET DOWNLINK DUMMY CONTROL BLOCK

Direction: network to mobile earth station

Classification: distribution message

Table 11.12: Packet DOWNLINK DUMMY CONTROL BLOCK information elements

< Packet Downlink Dummy Control Block message content > ::=
{ 0 1 <PERSISTENCE_LEVEL : bit (4) >*4 }
< padding bits >
! < Distribution part error : bit (*) = < no string > > ;

Table 11.13: Packet DOWNLINK DUMMY CONTROL BLOCK information element details

PERSISTENCE_LEVEL (4 bit field for each Radio Priority 1...4) This field is defined in clause 12.14, PRACH Control Parameters.

11.2.8a Packet uplink dummy control block

This message is sent on the PACCH or DACCH from the mobile earth station to the network when the mobile earth station has no other block to transmit or cannot transmit on the allocated resource. This message can also be sent when the MES receives a downlink MAC/RLC data block carrying a downlink TBF in RLC unacknowledged mode with UUG bit set. This message is also used to convey link quality information to the network. Link quality information for one or more radio bearers shall be included by the MES.

Message type: PACKET UPLINK DUMMY CONTROL BLOCK

Direction: mobile earth station to network

Table 11.14: Packet uplink dummy control block information elements

< Packet Uplink Dummy Control Block message content > ::= { 0 < TLLI-G-RNTI : bit (32) > <Link Quality:<Link Quality Struct>> 10 < Global TFI: <Global TFI IE >> <Link Quality:<Link Quality Struct>> 11 } < padding bits >; <Link Quality Struct> ::= < SQIR : bit (6)> { 0 1 <SQI Standard Deviation : bit (6) >} { 0 1 <FQI: <FQI Struct>>} <FQI Struct> ::= { 1 <RB Id: bit(5)><Forward Quality Indicator: bit(6)>} **0;

Table 11.15: Packet uplink dummy control block information element details

Global TFI This information element contains the TFI of the mobile earth station's downlink TBF or uplink TBF. This field is defined in clause 12.10.
SQI Report (6 bit field) This field gives the signal quality as received by the MES. Refer to ETSI TS 101 376-5-6 [15] for details.
SQI Standard Deviation (6 bits) This field gives the standard deviation of the signal quality measured by the MES. Refer to ETSI TS 101 376-5-6 [15] for details.
RB Id (5 bit field) This field indicates the radio bearer identity. Range: 0 to 31.
Forward Quality Indicator (6bits) This field gives the receiver perceived channel frame error rate for the Radio Bearer identified by RB Id. Refer to ETSI TS 101 376-5-6 [15] for encoding details.
TLLI/G-RNTI This information element contains the TLLI or the G-RNTI assigned to the mobile earth station. TLLI is defined in clause 12.16. G-RNTI is defined in clause 12.16a. When operating in Iu mode the MES shall include TLLI/G-RNTI instead of Global TFI, only if there are no active TBF(s) assigned for SRB2.

11.2.9 Packet mobile TBF status

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

Message type: PACKET MOBILE TBF STATUS

Direction: mobile earth station to network

Table 11.16: Packet MOBILE TBF STATUS information elements

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

Table 11.17: Packet MOBILE TBF STATUS information element details

Global TFI IE This information element contains the TFI of the mobile earth station's downlink TBF or uplink TBF. This field is defined in clause 12.10. The TFI in this IE shall be set to correspond to the TBF on which erroneous message was received.														
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:														
<table border="0"> <tr> <td>Bit</td> <td></td> </tr> <tr> <td>3 2 1</td> <td></td> </tr> <tr> <td>0 0 0</td> <td>Normal event;</td> </tr> <tr> <td>0 0 1</td> <td>Status, unspecified;</td> </tr> <tr> <td>0 1 0</td> <td>Syntactically incorrect message, non-distribution part error;</td> </tr> <tr> <td>0 1 1</td> <td>Syntactically incorrect message, message escape;</td> </tr> <tr> <td>1 0 0</td> <td>Message not compatible with current protocol state.</td> </tr> </table> <p>All other values are reserved and may be interpreted "Status, unspecified".</p>	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.
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.													
SQIR (6 bit field) This field gives the signal quality as received by the MES. Refer ETSI TS 101 376-5-6 [15] for details.														
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 clause 11.2.0.1.														

11.2.9a Packet Measurement Report (lu mode only)

This message is sent on the PACCH from the mobile earth station to the network to report measurement results. The message contains measurement results from the Network Control measurements. For a (3G) multi-RAT mobile earth station, report on 3G cells may be included.

Message type: PACKET MEASUREMENT REPORT

Direction: mobile earth station to network

Table 11.17a: PACKET MEASUREMENT REPORT message content

```

< Packet Measurement Report message content > ::=
  < G-RNTI : bit (32) >
  < Request Reference: bit (8) >
  { 0 < Position Measurement Report : < Position Measurement Report struct > > |
    10 < GMR 3G Measurement Report : < 3G Measurement Report struct > > }
  < padding bits > ;

< Position Measurement Report struct > ::=
  { 0 < MES GPS Position : < GPS Position IE >> |
    10 < Distance Information : < Distance IE >> };

< GMR 3G Measurement Report struct > ::=
  0 | 1 < GMR Measurement Report : < NC Measurement Report struct >>
  0 | 1 < 3G Measurement Report : < 3G Measurement Report struct >>

< GMR Measurement Report struct > ::=
  < RXLEV_SERVING_CELL : bit (6) >
  < NUMBER_OF_MEASUREMENTS : bit (3) >
  { < GMR_CELL_LIST_INDEX : bit (5) >
    < RXLEV : bit (6) > } * (val(NUMBER_OF_MEASUREMENTS));

< 3G Measurement Report struct > ::=
  < N_3G : bit (3) >
  { < 3G_CELL_LIST_INDEX : bit (7) >
    < REPORTING_QUANTITY : bit (6) > } * (val(N_3G + 1));
  
```

Table 11.17b: PACKET MEASUREMENT REPORT information element details

<p>G-RNTI (32 bit field) This field is encoded as defined in clause 12.16.</p> <p>Request Reference (8 bit field) The MES shall set this to the same value present in PACKET MEASUREMENT ORDER for which this report is being sent to the network.</p> <p>MES GPS Position This IE contains the value part of GPS Position IE defined in ETSI TS 101 376-4-8 [11].</p> <p>Distance Information Use of this IE is FFS.</p> <p>3G Measurement Report Measurement reporting for 3G Cells is defined in ETSI TS 145 008 [i.10].</p> <p>3G_CELL_LIST_INDEX (7 bit field) This is the index of the i'th reported 3G neighbour cell in the 3G Neighbour Cell List. See clause 5.6.3.1.</p> <p>REPORTING_QUANTITY (6 bit field) This is the reporting quantity for the i'th reported 3G cell. The quantities are defined in ETSI TS 145 008 [i.10] for the respective Radio Access Technology.</p> <p>RXLEV_SERVING_CELL (6 bit field) This field contains the value of the RXLEV parameter for the serving spot beam calculated by the mobile earth station (see ETSI TS 101 376-5-6 [15]). This field is encoded as the binary representation of the RXLEV parameter value defined in ETSI TS 101 376-5-6 [15]. Range 0 to 63</p> <p>GMR_CELL_LIST_INDEX (8 bit field) This field contains the index of i'th reported spotbeam. The index is with reference to the order in which the spot beams were listed in PACKET MEASUREMENT ORDER message.</p> <p>RXLEV (6 bit field) This field indicates the measured RXLEV for neighbour spot beams (see ETSI TS 101 376-5-6 [15]). Range 0 to 63.</p>

11.2.9b Packet Measurement Order (lu mode only)

This message is sent on the PACCH or DACCH by the network to a mobile earth station giving information for position measurement or measurement of GMR-1 3G neighbouring cells.

Message type: PACKET MEASUREMENT ORDER

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.17c: Packet Measurement Order information elements

```

< Packet Measurement Order message content > ::=
{
  { 0 < Global TFI : < Global TFI IE > >
  | 10 < G-RNTI : bit (32) > }
  {
    < Measurement Request Reference : bit(8)>
    { 0 < Position Measurement : < Position Measurement struct > > |
      10 < GMR 3G Neighbour Cell : < GMR 3G Neighbour Cell Description struct > > }
    ! < Non-distribution part error : bit (*) = < no string > > }
    ! < Address information part error : bit (*) = < no string > > }
    ! < Distribution part error : bit (*) = < no string > > ;
}

<Position Measurement struct> ::=
{ <Position Report Type : bit(2)>
  { 0 | 1 < Serving Spot Beam Coordinates: <Spot Beam Coordinates IE>}
  { 0 | 1 < GPS Assist Information: GPS Assist IE > > } };

< GMR 3G Neighbour Cell Description struct > ::=
  0 | 1 < NC Measurement Parameters : < NC Measurement Parameters struct > >
  0 | 1 < GMR Neighbour Cell Description : < GMR Neighbour Cell Description struct > >
  0 | 1 < 3G Neighbour Cell Description : <3G Neighbour Cell Description struct> >

< NC Measurement Parameters struct > ::=
  { < NC_REPORTING_PERIOD_T : bit (3) > };

< GMR Neighbour Cell Description struct > ::=
  { 1 < GMR Cell: < GMR Frequency list struct > > } ** 0;

< GMR Frequency list struct > ::=
  < ARFCN : bit (11) >
  < Satellite Id: bit(2)>
  < SpotBeam Id : bit (10) >
  < BCCH_TN : bit (5) >;

< 3G Neighbour Cell Description struct> ::=
  { 0 | 1 < UTRAN FDD Description : < UTRAN FDD Description struct > > }
  { 0 | 1 < UTRAN TDD Description : < UTRAN TDD Description struct > > };

```

Table 11.17d: Packet Measurement Order information element details

Global TFI

If present, this information element indicates the mobile earth station to which this message is addressed.
This field is defined in clause 12.10.

G-RNTI (32 bit field)

If present, this field indicates the mobile earth station to which this message is addressed.
This field is defined in clause 12.16a.

Measurement Request Reference (8 bit field)

This field is used to match measurement order with the response from the MES.
The MES shall include this field in the response to the network.

Position Report Type (2 bit field)

This field indicates the type information that shall be included in the POSITION MEASUREMENT REPORT by MES.
Bit

2 1

0 0 Report entire GPS position.
All remaining values are reserved.

Spot Beam Coordinates

Use of this IE is FFS.

GPS Assist IE

Use of this IE is FFS.

3G Neighbour Cell Description

The building of the 3G Neighbour Cell list and the ordering of indices within each Radio Access Technology is described in clause 5.6.3.1.

ARFCN

This field contains the Absolute Radio Frequency Number of BCCH. See ETSI TS 101 376-5-5 [17].

Satellite Id

This field contains the Satellite Identifier. This field is defined in ETSI TS 101 376-4-8 [11].

Spotbeam Id

This IE is defined in ETSI TS 101 376-4-8 [11]. See definition of LAI in ETSI TS 101 376-4-8 [11].

BCCH TN

This IE is defined in ETSI TS 101 376-4-8 [11].

NC_REPORTING_PERIOD_T

Use of this IE is FFS.

11.2.10 Packet Paging Request (A/Gb mode only)

This message is on PACCH to a MES in packet transfer mode to indicate page request for RR connection establishment. The MES is identified by either IMSI or TMSI.

Message type: PACKET PAGING REQUEST MESSAGE

Direction: network to mobile earth station

Classification: distribution message

Table 11.18: PACKET PAGING REQUEST message content

<pre> < Packet Paging Request message content > ::= < reserved : bit (2) > { 0 1 < reserved : bit (4) >* 4} { 0 1 < reserved : bit (2) > } { { 1 < Repeated Page info : < Repeated Page info struct > > } ** 0 < padding bits > } // -- truncation at end of message allowed, bits "0" assumed ! < Distribution part error : bit (*) = < no string > > ; </pre>
<pre> < Repeated Page info struct > ::= { 0 -- Page request for TBF establishment (reserved) { 0 < reserved : bit (32) > 1 < Length of reserved field: bit (4) > < reserved : octet (val (Length of reserved field contents)) > } 1 -- Page request for RR conn. establishment { 0 < TMSI : bit (32) > 1 < Length of Mobile Identity contents : bit (4) > < Mobile Identity : octet (val (Length of Mobile Identity contents)) > } < CHANNEL_NEEDED : bit (2) > { 0 1 < reserved : bit (3) > } } { 0 1 < MSC ID: bit (6) > } } ! < Ignore : bit (*) = <no string> > ; </pre>

Table 11.19: PACKET PAGING REQUEST information elements

<p>Repeated Page info struct</p> <p>The Repeated Page info struct is repeated as many times as required to fulfil the number of wanted paged MESs. If the Paging Request Message is used with only TMSIs, the field can be repeated up to four times within one message. If the Paging Request Message is used with only IMSIs, the field can be repeated up to two times within one message. The first bit in the Repeated Page info field indicates if this is a page request for TBF connection establishment or for RR connection establishment. The MES shall ignore this IE if the first bit indicates TBF connection establishment. A page request for RR connection establishment contains Channel Needed IE and can either be addressed with TMSI or IMSI.</p>
<p>Mobile Identity (variable length octet string)</p> <p>This octet string is the representation of the <i>Mobile Identity</i>. It shall provide the International Mobile Subscriber Identity (IMSI). The encoding of this octet string is the <i>value part</i> (starting with octet 3) of the type 4 information element <i>Mobile Identity</i> defined in ETSI TS 101 376-4-8 [11]. Any value other than IMSI for the type of identity in this octet string is spare. Such mobile identity shall be disregarded by the receiver but any further occurrence of the Repeated Page Info struct in the message shall be analysed.</p>
<p>TMSI (32 bit field)</p> <p>TMSI is a unique Temporary Mobile Subscriber Identity. TMSI is associated with the mobile subscriber and defined in ETSI TS 101 376-3-3 [3]. This field is coded as a binary number. Range 0 to 4 294 967 295.</p>
<p>CHANNEL_NEEDED (2 bit field)</p> <p>The channel needed field indicates which type of channel is needed for the mobile earth station for the transaction linked to the paging procedure. See ETSI TS 101 376-4-8 [11].</p>
<p>MSC ID (6 bit field)</p> <p>The MSC ID indicates the MSC associated with the paging message. The MES shall include the MSC ID information when responding to the page request. See ETSI TS 101 376-4-8 [11].</p>

11.2.11 Packet PDCH release (lu mode only)

This message is sent on PACCH by the network to notify all mobile earth 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 earth station

Classification: distribution message

Table 11.19a: PACKET PDCH RELEASE information elements

<pre> < Packet PDCH Release message content > ::= { 1 < MACSLOTS_AVAILABLE : bit (8) > } < padding bits > ! < Distribution part error : bit (*) = < no string > > ; </pre>

Table 11.19b: PACKET PDCH RELEASE information element details

<p>MACSLOTS_AVAILABLE (8 bit field) This information field indicates the MAC slots assigned for GMR-1 3G use on ARFCN. Bit 8 indicates the status of MAC slot 0, bit 7 indicates the status of MAC slot 1, etc. 0 MAC slot is not assigned 1 MAC slot is assigned</p>

11.2.12 Packet polling request

This message is not used in GMR-1.

11.2.13 Packet link control

This message is sent on PACCH, on DACCH, or on the PTCCH/D by the network to the mobile earth stations. Transmissions on the PTCCH/D are made to mobile earth stations that had transmitted in the allotted Mac-slots/D-MAC-slots for timing/frequency correction eight frames previously. This message is sent in order to update the mobile earth station timing advance and frequency control parameters. This message can contain information for up to four mobile earth stations when sent on PTCCH/D/. Packet Link synchronization IE contains the Frame number in Iu-mode (see clause 12.29).

- Message type: PACKET LINK CONTROL
- Direction: network to mobile earth station
- Classification: distribution message

Table 11.20: Packet link control information elements

<pre> < Packet Link Control message content > ::= {0 {00 01< Global TFI : < Global TFI IE > > 10 < G-RNTI : bit(32) >} < Packet Link Synchronization : < Packet Link Synchronization IE > > }1 { 0 1 < Packet Link Synchronization : < Packet Link Synchronization IE > > }*4} < padding bits > ! < Distribution part error : bit (*) = < no string > > ; </pre>

Table 11.21: Packet link control information element details

<p>Packet Link Synchronization IE This information field is defined in clause 12.29.</p>

11.2.14 Packet PRACH parameters

This message is not used in GMR-1.

11.2.15 Packet queuing notification

This message is not used in GMR-1.

11.2.16 Packet resource request (lu mode only)

This message is sent on the DACCH or PACCH by the mobile earth station to the network to request a change in the uplink resources assigned.

Message type: PACKET RESOURCE REQUEST

Direction: mobile earth station to network

Table 11.21a: PACKET RESOURCE REQUEST information elements

```
< Packet Resource Request message content > ::=
  { 0 < Global TFI : < Global TFI IE > >
  10 <G-RNTI: bit(32)> }
  <RETRANSMISSION OF PRR: bit(1)>
  < lu mode Channel Request Description : < lu mode Channel Request Description IE > >
  { 0 | 1 < HFN_LSB : bit (1) > }
  < padding bits > ;
```

Table 11.21b: PACKET RESOURCE REQUEST information element details

Global TFI
This information element contains (one of) the TFI of the mobile earth station's uplink TBF, if available, or (one of) the TFI of the mobile earth station's downlink TBF. If no TFI is available, this field is omitted. This field is defined in clause 12.10.

G-RNTI (32 bit field)
G-RNTI is defined in clause 12.16a.

lu Mode Channel Request Description
This information element is defined in clause 12.7a. This IE contains a request for one or more additional uplink TBFs and shall only be included if the mobile earth station and the network support multiple TBF procedures.

RETRANSMISSION OF PRR (1 bit field)
This field indicates whether the corresponding Packet Resource Request message is a retransmission. In case the PRR message is a retransmission, the message content (except this field and the address information) shall be identical to the one of the PRR which was sent immediately after the uplink TBF was established (and preceding any eventual request for resource reassignment).
0 indicates that this message is an initial Packet Resource Request.
1 indicates that this message is a retransmitted Packet Resource Request: in this case the corresponding PRR message shall not be interpreted as a request for resource reassignment.

HFN_LSB (1 bit field)
This field contains the least significant bit of the uplink HFN of the radio bearer for which the TBF is requested.

11.2.16a Void

11.2.17 Packet PSI status

This message is not used in GMR-1.

11.2.18 Packet system information type 1

This message is not used in GMR-1.

11.2.19 Packet TBF release (A/Gb mode only)

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

Message type: PACKET TBF RELEASE

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.22: 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) >
< padding bits >
! < Non-distribution part error : bit (*) = < no string > >
! < Address information part error : bit (*) = < no string > > }
! < Distribution part error : bit (*) = < no string > > ;

Table 11.23: Packet TBF RELEASE information element details

Global TFI IE This information element contains the TFI of the mobile earth station which uplink and/or downlink TBF to be released. This field is defined in clause 12.10.
Uplink_Release (1 bit field) Downlink_Release (1 bit field) These fields indicate which TBF shall be released, 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 (4 bit field) This field indicates the reason for the release of the TBF. This field is encoded according to the following table: bit 4 3 2 1 0 0 0 0 Normal release 0 0 0 1 PDCH-carrier being deassigned 0 0 1 0 Abnormal release 0 0 1 1 Beam being darkened 0 1 0 0 Resource not available All other values are reserved.

11.2.19a Packet TBF release type 2 (lu mode only)

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

Message type: PACKET TBF RELEASE type 2

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.23a: Packet TBF RELEASE type 2 information elements

< Packet TBF Release message content > ::=
{ 0
{ 0 < GLOBAL_TFI : Global TFI IE >
10 <G-RNTI: bit(32)><RB Id:bit(5)>}
< UPLINK_RELEASE : bit (1) >
< DOWNLINK_RELEASE : bit (1) >
< TBF_RELEASE_CAUSE : bit (4) >
< padding bits >
! < Non-distribution part error : bit (*) = < no string > >
! < Address information part error : bit (*) = < no string > > }
! < Distribution part error : bit (*) = < no string > > ;

Table 11.23b: Packet TBF RELEASE type 2 information element details

Global TFI IE
This information element contains an uplink TFI or a downlink TFI of the mobile earth station. When present, the TFI is associated with the RB for the uplink and/or downlink TBF to be released. This field is defined in clause 12.10.
G-RNTI
This IE is defined in clause 12.16a.
RB Id (5 bit field)
This IE identifies the Radio Bearer for which the TBF release message is applicable.
Uplink_Release (1 bit field) Downlink_Release (1 bit field)
These fields indicate which TBF shall be released, 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 (4 bit field)
This field indicates the reason for the release of the TBF. This field is encoded according to the following table:
bit
4 3 2 1
0 0 0 0 Normal release
0 0 0 1 PDCH-carrier being deassigned
0 0 1 0 Abnormal release
0 0 1 1 Beam being darkened
0 1 0 0 Resource not available
All other values are reserved.

11.2.20 Void

11.2.21 Packet uplink Ack/Nack (A/Gb mode only)

This message is sent on the PACCH by the network to the mobile earth station indicate the status of the received RLC data blocks. This message may also update the timing advance and the uplink coding rate.

Message type: PACKET UPLINK ACK/NACK

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.24: PACKET UPLINK ACK/NACK information elements

<pre> < Packet Uplink Ack/Nack message content > ::= { 00 < UPLINK_TFI : bit (7) > { 0 -- Message escape { < CHANNEL_MCS_COMMAND : bit (4) > { 0 1 < Packet Link Synch : < Packet Link Synchronization IE > > } { 0 1 < CHANNEL_MCS_COMMAND_PNB_5_12 : bit (4) > } < GMPRS Ack/Nack Description : < GMPRS Ack/Nack Description 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 > > ; </pre>

Table 11.25: Packet uplink ACK/NACK information element details

<p>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 clause 12.15.</p> <p>CHANNEL_MCS_COMMAND (4 bit field) The Channel Coding Indicator field for PNB(4,3)/PNB(5,3)/PNB(1,6). This field indicates the channel coding scheme for PNB(4,3)/PNB(5,3)/PNB(1,6) that the mobile earth station shall use when transmitting on the uplink. The coding for this field is defined in clause 10.1.</p> <p>CHANNEL_MCS_COMMAND_PNB_5_12 (4 bit field) The channel coding indicator bit field for PNB2(5,12). This field indicates the channel coding scheme that the mobile earth station shall use when transmitting on the uplink. If the value in this field is 1111, it means the mobile earth station shall not transmit any PNB2(5,12) burst except for retransmission. The coding for this field is defined in clause 10.1.</p> <p>Ack/Nack Description This information element is defined in clause 12.3.</p> <p>Packet Link Synchronization message This information element is defined in clause 12.29.</p>

11.2.21a Packet uplink Ack/Nack type 2 (lu mode only)

This message is sent on the PACCH by the network to the mobile earth station indicate the status of the received RLC data blocks. This message may also update the timing advance and the uplink coding rate.

Message type: PACKET UPLINK ACK/NACK type 2

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.25a: PACKET UPLINK ACK/NACK type 2 information elements

<pre> < Packet Uplink Ack/Nack message content > ::= { 00 < UPLINK_TFI : bit (8) > { 0 -- Message escape { <Channel MCS Info: <MCS Info IE>> { 0 1 < Packet Link Synch : < Packet Link Synchronization IE > > } { 0 1 < CHANNEL_MCS_COMMAND_PNB_5_12 : bit (4) > } < GMPRS Ack/Nack Description : < GMPRS Ack/Nack Description 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 > > ; </pre>

Table 11.25b: Packet uplink ACK/NACK type 2 information element details

<p>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 clause 12.15.</p> <p>MCS Info IE This IE contains the MCS that MES shall use when transmitting on the uplink. This IE is defined in clause 12.35.</p> <p>CHANNEL_MCS_COMMAND_PNB_5_12 (4 bit field) The channel coding indicator bit field for PNB2(5,12). This field indicates the channel coding scheme that the mobile earth station shall use when transmitting on the uplink. If the value in this field is 1111, it means the mobile earth station shall not transmit any PNB2(5,12) burst except for retransmission. The coding for this field is defined in clause 10.1.</p> <p>GMPRS Ack/Nack Description This information element is defined in clause 12.3.</p> <p>Packet Link Synchronization IE This information element is defined in clause 12.29.</p>

11.2.21b Packet DCH Uplink Ack/Nack (lu mode only)

This message is sent on PACCH or DACCH from the network to the mobile earth station to indicate the status of uplink RLC data blocks received. This message is also used by the network to provide time and frequency correction to the MES.

Message type: PACKET DCH UPLINK ACK/NACK

Direction: network to mobile earth station

Classification: DCH message

Table 11.25c: PACKET DCH UPLINK ACK/NACK information elements

<pre> < Packet DCH Uplink Ack/Nack message content > ::= { < RB Id : bit (5) > {0 1 <G-RNTI : bit(32) >} {0 1 <T and F Correction: <Time and Frequency Correction IE>>} {0 1 <DCH Channel MCS Info: <DCH MCS IE>>} -- applies to all flows operating on DACCH {1 -- DCCH TBF mode < DCCH Ack/Nack Description: <DCCH Ack/Nack Description IE >>} <padding bits > ! < DCH message part error : bit (*) = < no string > > } ; </pre>

Table 11.25d: PACKET DCH UPLINK ACK/NACK information element details

RB Id (5 bit field) This field contains the radio bearer identity of the mobile earth station's radio bearer for which the uplink data transfer is acknowledged. This field is encoded as a binary number with range 0 to 31.
G-RNTI (32 bit field) G-RNTI is defined in clause 12.16a.
Time and Frequency Correction IE This IE is defined in clause 12.29a.
DCH MCS IE This IE is defined in clause 12.35a.
DCCH Ack/Nack Description IE This IE is defined in clause 12.3a.

11.2.22 Packet uplink assignment (A/Gb mode only)

This message is sent on the PCCCH or PACCH by the network to the mobile earth station to assign uplink resources. The mobile earth station may be addressed by TFI, TQI, or TLLI depending upon the procedure used.

Message type: PACKET UPLINK ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.26: Packet uplink assignment information elements

```

< Packet Uplink Assignment message content > ::=
  {
    { 0 < TLLI : bit(32) >
      | 10 < Global TFI : <Global TFI IE> >
      | 110 < reserved: bit (16) >
    }
  }
  <Rid: bit(2)>
  { 0 -- Message escape
    {
      < CHANNEL_MCS_COMMAND : bit (4) >
      < Packet Link Synchronization : < Packet Link Synchronization. IE > >
      < Frequency Parameters : < Frequency Parameters IE > > }
    { 0 <Dynamic Allocation : < Dynamic Allocation struct > >
      | 10 < reserved>
      | 110 <reserved>
      | 1110<extension> }
    < 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 > > ;
  }

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

<Dynamic Allocation struct > ::=
  < reserved : bit (1) >
  < reserved : bit (1) >
  < UPLINK_TFI_ASSIGNMENT : bit (7) >
  < reserved: bit (1) >
  < reserved: bit (5) >
  < CHANNEL_MCS_COMMAND_PNB_5_12: bit (4) >
  < MAC Slot Allocation: bit (8) > -- Timeslot Allocation
  < reserved: bit(3)>
  < USF : bit (6) >

```

Table 11.27: PACKET UPLINK ASSIGNMENT information element details

Global TFI
This information element identifies the uplink TFI, if available, or the downlink TFI, to which this message applies. This field is defined in clause 12.10.

Rid (2 bit field)
The Rid is a cyclic identifier. It is incremented on every PRACH attempt by the MES, modulo 4.

MAC Slot Allocation (8 bit field)
This field is defined in clause 12.18.

CHANNEL_MCS_COMMAND (4 bit field)
The Channel Coding Indicator field PNB(4,3)/PNB(5,3)/PNB(1,6). This field indicates the channel coding scheme for PNB(4,3)/PNB(5,3)/PNB(1,6) that the mobile earth station shall use when transmitting data on the uplink. The coding for this field is defined in clause 10.1.

CHANNEL_MCS_COMMAND_PNB_5_12 (4 bit field)
The channel coding indicator bit field for PNB2(5,12). This field indicates the channel coding scheme that the mobile earth station shall use when transmitting on the uplink. If the value in this field is 1111, it means the mobile earth station shall not transmit any PNB2(5,12) burst except for retransmission. The coding for this field is defined in clause 10.1.

UPLINK_TFI_ASSIGNMENT (7 bit field)
This information element, if present, assigns the contained TFI to the mobile earth station to identify to uplink TBF described by this message. This field is coded the same as the TFI field defined in clause 12.15.

Packet Link Synchronization
This information element is defined in clause 12.29.

Dynamic Allocation struct
This information element contains parameters necessary to define the radio resources of a dynamic allocation.

USF (6 bit field)
USF value for all allocated Mac-slots/D-MAC-slots/4-MAC-slots.
These fields indicate the USF value assigned to the MES for all allocated MAC-slots (range 0 to 7), 4-MAC-slots (starting slot 0-7 or D-MAC-slots (range 0 to 3)). These fields are encoded as a binary presentation of the USF value as defined in clause 10.4.1.

11.2.22a Packet uplink assignment type 2 (lu mode only)

This message is sent on the PCCCH, PACCH or DACCH by the network to the mobile earth station to assign uplink resources. The mobile earth station may be addressed by TFI, or TLLI or G-RNTI depending upon the procedure used.

Message type: PACKET UPLINK ASSIGNMENT type 2

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.27a: Packet uplink assignment type 2 information elements

<pre> <Packet Uplink Assignment type 2 Message Content> ::= { { 0 <TLLI/G-RNTI: bit(32> 10 <Global TFI: <Global TFI IE>> } <Rid: bit(2)> { 0 -- Message Escape { {0 1<PDCH Channel MCS Info: <PDCH MCS IE>>} <Packet Link Synchronization: <Packet Link Synchronization IE>> <Frequency Allocation: <Frequency Allocation IE>> { 0 1 <PDCH Uplink Organization: <PDCH Uplink Organization IE>>} { 0 <Dynamic Allocation: <Dynamic Allocation struct>> 10 <Uplink DCH Allocation: <DCH Allocation Struct>> 110 <Uplink and Downlink DCH Allocation: <DCH Allocation Struct>> ! < 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 > > ; } } </pre>
<pre> <Dynamic Allocation struct> ::= { <Downlink MAC Slot Allocation: bit(8)> <Uplink TFI: bit(8)> {0 1 <Uplink Status Flag: bit(8)>} <RB Id: bit(5)> <Return Frequency Set: bit(1)>}; </pre>
<pre> -- DCH allocation struct is used for both uplink and downlink TBF of a DCH. For uplink TBF the Downlink MAC -- slot indication specifies the downlink slots that MES should monitor for PACCH/DACCH associated with the -- uplink TBF <DCH Allocation Struct> ::= { <Channel Info: <Channel Info IE>> < Power Control Synch Offset: <Power Control Synch Offset IE>> -- Applies only to uplink DCH <DCH Channel MCS Info: <DCH MCS IE>> {0<Downlink MAC Slot Allocation: bit(8)> 1<Downlink Slot Allocation: <Slot Allocation IE>>} {0<Uplink MAC Slot Allocation: bit(8)> 1 <Uplink Slot Allocation: <Slot Allocation IE>>} <RB Id: bit(5)>}; </pre>

Table 11.27b: PACKET UPLINK ASSIGNMENT type 2 information element details

<p>Global TFI This information element identifies the uplink TFI, if available, or the downlink TFI, to which this message applies. This field is defined in clause 12.10.</p> <p>TLLI/G-RNTI TLLI is defined in clause 12.16 and G-RNTI is defined in clause 12.16a.</p> <p>Rid (2 bit field) The Rid is a cyclic identifier. It is incremented on every PRACH attempt by the MES, modulo 4. The MES shall use this field to determine which one of its PACKET CHANNEL REQUEST TYPE 1 or TYPE 2 message is being acknowledged by the network.</p> <p>DOWNLINK MAC Slot Allocation (8 bit field) This field is defined in clause 12.18.</p> <p>Downlink Slot Allocation This IE is defined in clause 12.18a.</p> <p>Uplink Slot Allocation This IE is defined in clause 12.18a.</p> <p>PDCH Channel MCS Info PDCH MCS IE is defined in clause 12.35.</p> <p>DCH Channel MCS Info DCH MCS IE is defined in clause 12.35a.</p> <p>UPLINK TFI (8 bit field) This information element, if present, assigns the contained TFI to the mobile earth station to identify to uplink TBF described by this message. This field is coded the same as the TFI field defined in clause 12.15.</p> <p>Packet Link Synchronization This information element is defined in clause 12.29.</p> <p>Uplink Status Flag (USF) (8 bit field) Uplink Status Flag value for all allocated Mac-slots/D-MAC-slots/4-MAC-slots This field indicates the USF value assigned to the MES for all allocated MAC-slots (range 0 to 7), 4-MAC-slots (starting slot 0-7 or D-MAC-slots (range 0 to 3)). These fields are encoded as a binary presentation of the USF value as defined in clause 10.4.1. If USF field is not included, then the value of USF is same as the uplink TFI.</p> <p>RB Id (5 bit field) This field indicates the radio bearer identity for which this TBF is allocated. Range 0 to 31.</p> <p>Frequency Allocation This IE is defined in clause 12.8a.</p> <p>PDCH Uplink Organization This IE is included only if the frequency Allocation IE does not include the uplink frequency. This IE is defined in clause 12.37.</p> <p>Channel Info This IE is defined in clause 12.36.</p> <p>Power Control Synch Offset This IE is defined in clause 12.38.</p> <p>Return Frequency Set (1 bit field) This field indicates the uplink frequency set on which the uplink resources are allocated. 0: First Set. 1: Second Set. The Return Frequency Set field shall be ignored if PDCH Uplink Organization field is present. PDCH Uplink Organization IE includes the return frequency set.</p>

11.2.22b Multiple TBF Uplink Assignment (lu mode only)

This message is sent on the PACCH by the network to the mobile earth station to assign uplink resources. The mobile earth station may be addressed by the G-RNTI or the TFI depending upon the procedure used.

Message type: MULTIPLE TBF UPLINK ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.27c: MULTIPLE TBF UPLINK ASSIGNMENT information elements

```

< Multiple TBF Uplink Assignment message content > ::=
{
  { 0 < Global TFI : < Global TFI IE > >
  | 10 < G-RNTI : bit(32) > }
  { 0 -- Message escape bit
    { { 0 | 1 < PDCH Frequency Allocation: <Frequency Allocation IE> } -- For normal mode TBFs only
      { 0 | 1 < Packet Link Synchronization: <Packet Link Synchronization IE> }
      { 0 | 1 < PDCH Uplink Organization: <PDCH Uplink Organization IE>> }
      <Downlink MAC Slot Allocation: bit(8)>
      { 0 | 1 < Uplink TBF Assignment : < Uplink Assignment struct > > }
      < padding bits > } }
    ! < Non-distribution part error : bit (*) = < no string > > }
    ! < Address information part error : bit (*) = < no string > > }
    ! < Distribution part error : bit (*) = < no string > > ;
  < Uplink Assignment struct > ::=
  { 1 < Uplink TBF Assignment : < Uplink TBF Assignment struct > > } ** 0 ;
  < Uplink TBF Assignment struct > ::=
  { 0 < PDCH Allocation: <PDCH Allocation struct>>
    10 <Uplink DCH Allocation: <UL DCH Allocation Struct>> };
  <PDCH Allocation struct> ::=
  {
    { 0 | 1 < Channel MCS Info : <PDCH MCS IE>> }
    <Uplink TFI: bit(8)>
    { 0 | 1 <Uplink Status Flag: bit(8)> }
    <RB Id: bit(5)>
    <Return Frequency Set: bit(1)> };
  <UL DCH Allocation Struct> ::=
  { <Channel Info: <Channel Info IE>>
    <DCH Channel MCS Info: <DCH MCS IE>>
    { 0 <Uplink MAC Slot Allocation: bit(8)> | 1 <Uplink Slot Allocation: <Slot Allocation IE>> }
    <RB Id: bit(5)>
    <DCH Frequency Allocation: <Frequency Allocation IE>> }; -- For TCH/DCCH mode TBFs only
}

```

Table 11.27d: MULTIPLE TBF UPLINK ASSIGNMENT information element details

<p>G-RNTI G-RNTI is defined in clause 12.16a.</p> <p>Global TFI This information element identifies one of the mobile earth station's downlink or uplink TFIs. This field is defined in clause 12.10.</p> <p>PDCH Channel MCS Info PDCH MCS IE is defined in clause 12.35.</p> <p>DCH Channel MCS Info DCH MCS IE is defined in clause 12.35a.</p> <p>Uplink TFI (8 bit field) This field is defined in clause 12.15.</p> <p>RB Id (5 bit field) This field contains the radio bearer identifier for the radio bearer using the assigned TBF. This provides the mapping of TFI to RB Id which is necessary to uniquely identify lu-mode data flows.</p> <p>Packet Link Synchronization This information element is defined in clause 12.29.</p> <p>Downlink MAC Slot Allocation This field is defined in clause 12.18.</p> <p>Uplink MAC Slot Allocation This field is defined in clause 12.18.</p> <p>Uplink Slot Allocation This IE is defined in clause 12.18a.</p> <p>Frequency Allocation This IE is defined in clause 12.8a.</p> <p>Uplink Status Flag (8 bit field) This field is defined in clause 10.4.1.</p> <p>Channel Info This IE is defined in clause 12.36.</p> <p>PDCH Uplink Organization This IE is defined in clause 12.37. This IE is included only when the Frequency allocation IE meant for PDCH resources does not contain uplink frequency information.</p> <p>Return Frequency Set (1 bit) This field indicates the uplink frequency set on which the uplink resources are allocated. 0: First Set. 1: Second Set. The Return Frequency Set field shall be ignored if PDCH Uplink Organization field is present. PDCH Uplink Organization IE includes the return frequency set.</p>

11.2.23 Void

11.2.24 Void

11.2.25 Packet link quality report (A/Gb mode only)

This message is sent on the PACCH, DACCH or PTCCH/U by the mobile earth station to the network to report the link quality.

Message type: PACKET LINK QUALITY REPORT

Direction: mobile earth station to network

Table 11.28: PACKET LINK QUALITY REPORT information elements

<pre> < Packet Link Quality Report message content > ::= <Link Quality : <Link Quality Report IE > > {0 1 <G-RNTI: bit(32)> < padding bits > ; </pre>

Table 11.29: PACKET LINK QUALITY REPORT information element details

<p>Link Quality Report This information element is defined in clause 12.30.</p> <p>G-RNTI (32 bit field) This field is included only when Packet Link Quality Report is sent on PACCH or DACCH. G-RNTI identifies the MES sending this report. G-RNTI is defined in clause 12.16a.</p>

11.2.25a Packet link quality report type 2 (lu mode)

This message is sent on PDCH, PACCH, or DACCH by the mobile earth station to the network to report the link quality.

Message type: PACKET LINK QUALITY REPORT Type 2

Direction: mobile earth station to network

Table 11.28a: PACKET LINK QUALITY REPORT TYPE2 information elements

<pre>< Packet Link Quality Report message content > ::= { { 0 < Global TFI : < Global TFI IE > > 10 < S-RNTI: bit(20) > } < SQIR : bit (6)> { 0 1 <SQI Standard Deviation : bit (6) >} { 0 1 <FQI: <FQI Struct>>} } < padding bits > ;</pre>
<pre><FQI Struct> ::= { 1 <RB Id: bit(5)><Forward Quality Indicator: bit(6)>} **0;</pre>

Table 11.29a: PACKET LINK QUALITY REPORT TYPE2 information element details

<p>Global TFI This information element identifies one of the mobile earth station's downlink or uplink TFIs. This field is defined in clause 12.10.</p> <p>S-RNTI (20 bit field) This field is defined in clause 12.16a.</p> <p>SQI Report (6 bit field) This field gives the signal quality as received by the MES. Refer to ETSI TS 101 376-5-6 [15] for details.</p> <p>SQI Standard Deviation (6 bits) This field gives the standard deviation of the signal quality measured by the MES. Refer to ETSI TS 101 376-5-6 [15] for details.</p> <p>RB Id (5 bit field) This field indicates the radio bearer identity. Range: 0 to 31.</p> <p>Forward Quality Indicator (6bits) This field gives the receiver perceived channel frame error rate for the Radio Bearer identified by RB Id. Refer to ETSI TS 101 376-5-6 [15] for encoding details.</p>

11.2.26 Packet GMPRS Resume Response (A/Gb mode only)

This message is sent on the PAGCH by the network to inform the mobile earth station of the result of GMPRS service resumption. The mobile earth station shall be addressed by TLLI.

Message type: PACKET GMPRS RESUME RESPONSE

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.30: PACKET GMPRS RESUME RESPONSE information elements

```

< Packet GMPRS Resume Response message content > ::=
{ 0 < TLLI : bit(32) > }
{ 0 -- Message escape
  < Result : bit (1) >
  < padding bits > } // -- truncation at end of message allowed, bits "0" assumed
! < 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 11.31: PACKET GMPRS RESUME RESPONSE information element details

TLLI (32 bit field) This field is defined in clause 12.16.
Result (1 bit field) 0: GMPRS services not successfully resumed 1: GMPRS services successfully resumed

11.2.27 Packet Timeslot Reconfigure (lu mode only)

This message is sent on the PACCH by the network to the mobile earth station to assign uplink and downlink resources.

Message type: PACKET TIMESLOT RECONFIGURE

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.32: PACKET TIMESLOT RECONFIGURE information elements

```

< Packet Timeslot Reconfigure message content > ::=
{ 0 < GLOBAL_TFI : < Global TFI IE > >
  { 0 -- Message escape
    { { 0 | 1 < PDCH Channel MCS Info : <PDCH MCS IE >> }
      { 0 | 1 < Packet Link Synchronization : < Packet Link Synchronization Parameters IE > > }
      { 0 | 1 < Frequency Allocation : < Frequency Allocation IE > > }
    }
  { 0 | 1 < Return Frequency Set : bit(1)> }
  { 0 | 1 < PDCH Uplink Organization : <PDCH Uplink Organization IE>> }
  < DOWNLINK_RLC_MODE : bit (1) >
  { 0 | 1 < DOWNLINK_TFI_ASSIGNMENT : bit (8) > }
  { 0 | 1 < UPLINK_TFI_ASSIGNMENT : bit (8) > }
  { 0 | 1 < USF : bit(8)> } -- 0 indicates USF value is the same as uplink TFI
  < MAC Slot Allocation : bit (8) >
  { 0 | 1 < RB Id : bit (5) > }
  < padding bits > } }
! < Non-distribution part error : bit (*) = < no string > > }
! < Message escape : bit (*) = <no string> > } -Extended for future changes
! < Address information part error : bit (*) = < no string > > }
! < Distribution part error : bit (*) = < no string > > ;

```

Table 11.33: PACKET TIMESLOT RECONFIGURE information element details

<p>Global TFI This field identifies (one of) the uplink TFI, if available, or (one of) the downlink TFI, to which this message applies. This field is defined in clause 12.10.</p> <p>PDCH Channel MCS Info PDCH MCS IE is defined in clause 12.35.</p> <p>DOWNLINK_RLC_MODE (1 bit field) This field indicates the RLC mode of the requested TBF. 0 RLC acknowledged mode 1 RLC unacknowledged mode.</p> <p>DOWNLINK_TFI_ASSIGNMENT (5 bit field) This information element, if present, assigns the contained TFI to the mobile earth station to identify a downlink TBF described by this message. This field is coded the same as the TFI field defined in clause 12.15.</p> <p>UPLINK_TFI_ASSIGNMENT (5 bit field) This information element, if present, assigns the contained TFI to the mobile earth station to identify an uplink TBF described by this message. This field is coded the same as the TFI field defined in clause 12.15.</p> <p>MAC Slot Allocation (8 bit field) This field is defined in clause 12.18.</p> <p>Frequency Allocation This information element is defined in clause 12.8a.</p> <p>Packet Link Synchronization This IE is defined in clause 12.29.</p> <p>RB Id (5 bit field) This field is included when this message is used to reconfigure TBFs in lu mode. This field contain the radio bearer identifier for the radio bearer using the assigned TBF.</p> <p>PDCH Uplink Organization The PDCH Uplink Organization IE is included only if the frequency allocation IE does not specify uplink frequency. This IE is defined in clause 12.37.</p> <p>Return Frequency Set (1 bit) This field indicates the uplink frequency set on which the uplink resources are allocated. 0: First Set. 1: Second Set. The Return Frequency Set field shall be ignored if PDCH Uplink Organization field is present. PDCH Uplink Organization IE includes the return frequency set.</p>

11.2.28 Multiple TBF Timeslot Reconfigure (lu mode only)

This message is sent on the PACCH by the network to the mobile earth station to assign uplink and downlink resources.

Message type: MULTIPLE TBF TIMESLOT RECONFIGURE

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.34: MULTIPLE TBF TIMESLOT RECONFIGURE information elements

```

< Multiple TBF Timeslot Reconfigure message content > ::=
{
  0 < GLOBAL_TFI : < Global TFI IE > >
  { 0 -- Message escape for GPRS mode TBFs
    {
      { 0 | 1 < Packet Link Synchronization : < Packet Link Synchronization IE > > }
      { 0 | 1 < Frequency Allocation : < Frequency Allocation IE > > }
    }
  { 0 | 1 < PDCH Uplink Organization: <PDCH Uplink Organization IE>> }
  < Multiple Downlink Assignment : < Multiple Downlink Assignment struct > >
  < Multiple Uplink Assignment : < Multiple Uplink Assignment struct > >
  < padding bits > }
  ! < Non-distribution part error : bit (*) = < no string > > }
  ! < Message escape : { 01| 10 | 11} bit (*) = < no string > > } -Extended for future changes
  ! < Address information part error : bit (*) = < no string > > }
  ! < Distribution part error : bit (*) = < no string > > ;
< Multiple Downlink Assignment struct > ::=
< MAC Slot Allocation : bit (8) >
{ 1 < Downlink TBF assignment : < Downlink TBF assignment struct > > } ** 0 ;
< Downlink TBF assignment struct > ::=
{ < RB Id : bit (5) > }
  < TFI Assignment : bit (8) >;
< Multiple Uplink Assignment struct > ::=
{ 1 < Uplink TBF Assignment : < Uplink TBF Assignment struct > > } ** 0 ;
< Uplink TBF Assignment struct > ::=
{ { 0 | 1 < PDCH Channel MCS Info: <PDCH MCS IE>> }
  <Uplink TFI: bit(8)>
  { 0 | 1 <Uplink Status Flag: bit(8)> }
  <RB Id: bit(5)>
  <Return Frequency set: bit(1)>; }

```

Table 11.35: MULTIPLE TBF TIMESLOT RECONFIGURE information element details

<p>Global TFI This information element identifies one of the mobile earth station's downlink or uplink TFIs. This field is defined in clause 12.10.</p> <p>PDCH Channel MCS Info PDCH MCS IE is defined in clause 12.35.</p> <p>Packet Link Synchronization This information element is defined in clause 12.29.</p> <p>TFI Assignment (8 bit field) This information element assigns one TFI(s) to each TBF assigned to the mobile earth station in this message. This field is repeated for each TBF that is assigned in this message. TFI values are encoded as defined in clause 12.15.</p> <p>RB Id (5 bit field) This field contains the radio bearer identifier for the radio bearer using the assigned TBF. This provides the mapping of TFI to RB Id which is necessary to uniquely identify lu-mode data flows.</p> <p>MAC Slot Allocation (8 bit field) This field is defined in clause 12.18.</p> <p>Frequency Allocation This information element is defined in clause 12.8a.</p> <p>Uplink Status Flag (8 bit field) This field indicates the USF value assigned to the MS. This field is encoded as a binary presentation of the USF value as defined in clause 10.4.1.</p> <p>Return Frequency Set (1 bit) This field indicates the uplink frequency set on which the uplink resources are allocated. 0: First Set. 1: Second Set. The Return Frequency Set field shall be ignored if PDCH Uplink Organization field is present. PDCH Uplink Organization IE includes the return frequency set.</p> <p>Channel Info This information element is defined in clause 12.36.</p> <p>PDCH Uplink Organization The PDCH Uplink Organization IE is included only if the frequency allocation IE does not specify uplink frequency. This IE is defined in clause 12.37.</p>

11.2.29 Physical Information (lu mode only)

This message is sent on DACCH or PACCH by the network to the mobile earth station during a handover procedure as specified in ETSI TS 101 376-4-14 [24] and ETSI TS 101 376-4-13 [23] to indicate a valid timing and frequency corrections to the mobile earth station.

Message type: PHYSICAL INFORMATION

Direction: network to mobile station

Classification: DCH message

Table 11.36: PHYSICAL INFORMATION elements

< Physical information message content > ::=	-- RLC/MAC control block format
<G-RNTI : bit(32) >	
<T and F Correction : <Time and Frequency Correction IE >>	
< padding bits >;	-- truncation at end of message allowed, bits "0" assumed

Table 11.37: PHYSICAL INFORMATION element details

G-RNTI This field is defined in clause 12.16a.
T and F Correction Timing and Frequency Correction IE is defined in clause 12.29a.

11.2.30 PDCH Organization (lu mode only)

This message is sent on PACCH by the network to the mobile earth station to specify the frequency information for the PDCH.

Message type: PDCH ORGANIZATION

Direction: network to mobile station

Classification: Non-distribution message

Table 11.38: PDCH Organization information elements

< PDCH Organization message content > ::=	-- RLC/MAC control block format
{0 <G-RNTI : bit(32) >	
10 <S-RNTI: bit(20)> }	
< PDCH Uplink Organization : Packet Uplink Organization IE >>	
< padding bits >;	-- truncation at end of message allowed, bits "0" assumed

Table 11.39: PDCH Organization information element details

G-RNTI This field is defined in clause 12.16a.
S-RNTI This field is defined in clause 12.16a.
PDCH Uplink Organization This IE is defined in clause 12.37.

11.2.31 Packet Uplink Talk Burst Control

This message is sent on the DACCH, PDCH or PACCH by the mobile earth station to the network to send application specific messages

Message type: PACKET UPLINK TALK BURST CONTROL

Direction: mobile earth station to network

Table 11.40: Packet Uplink Talk Burst Control information elements

<pre> < Packet Uplink Talk Burst Control message content > ::= { 0 < Global TFI : < Global TFI IE > > 10 < S-RNTI: bit(20) >> 110<G-RNTI: bit(32) > } < RB Id: bit (5)> <Reference ID: bit(2)> <RETRANSMISSION: bit(1)> {00 {0 1<Request Priority: bit(2)>} -- Talk Burst Request 01 -- Talk Burst Release 10 <Subtype: bit(5)> <Reason Code: bit(3)> -- Talk Burst Acknowledgement 11 --Reserved } } < padding bits > ; </pre>

Table 11.41: Packet Uplink Talk Burst Control information element details

<p>Global TFI This information element contains (one of) the TFI of the mobile earth station's uplink TBF, if available, or (one of) the TFI of the mobile earth station's downlink TBF. If no TFI is available, this field is omitted. This field is defined in clause 12.10.</p> <p>S-RNTI (20 bit field) This field is defined in clause 12.16a.</p> <p>G-RNTI (32 bit field) G-RNTI is defined in clause 12.16a.</p> <p>RB Id (5 bit field) This field contains the radio bearer identifier for the radio bearer using the assigned TBF. This provides the mapping of TFI to RB Id which is necessary to uniquely identify lu-mode data flows.</p> <p>RETRANSMISSION(1 bit field) This field indicates whether the message is a retransmission. In case it is a retransmission, the message content (except this field and the address information) shall be identical to the initial transmission. 0 indicates that this is the initial transmission of the message 1 indicates that this message is a retransmitted</p> <p>Reference ID: bit(2)> Reference ID is a cyclic identifier. It is incremented on every new Talk Burst Request/Release message sent by the MES, modulo 4. It does not get incremented if the retransmission bit is set.</p> <p>Subtype: bit(5) Subtype is the value found in the message being acknowledged. Reason Code: bit(3) 000 PoC Client has accepted the incoming PoC session 001 PoC Client has not accepted the incoming PoC session, because it is busy 010 PoC Client has not accepted the incoming PoC session 011 Reserved ... 111 Reserved</p>

11.2.32 Packet Uplink Talk Burst Control Response

This message is sent on the DACCH, PDCH or PACCH by the network to the MES to acknowledge receipt of Packet Channel Request Type 2 with indication of Packet Talk Burst Request or the receipt of Packet Uplink Talk Burst Control message.

Message type: PACKET UPLINK TALK BURST CONTROL RESPONSE

Direction: network to mobile earth station

Table 11.42: Packet Uplink Talk Burst Control Response information elements

```

< Packet Uplink Talk Burst Control Response message content > ::=
  { 0 < Global TFI : < Global TFI IE > >
  | 10 < S-RNTI: bit(20) >>
  | 110 < G-RNTI: bit(32) >
  < RB Id: bit (5)>
  < Reference ID: bit (2) >
  }
  < padding bits > ;

```

Table 11.43: Packet Uplink Talk Burst Control Response information element details**Global TFI**

This information element contains (one of) the TFI of the mobile earth station's uplink TBF, if available, or (one of) the TFI of the mobile earth station's downlink TBF. If no TFI is available, this field is omitted. This field is defined in clause 12.10.

S-RNTI (20 bit field)

This field is defined in clause 12.16a.

G-RNTI (32 bit field)

G-RNTI is defined in clause 12.16a.

RB Id (5 bit field)

This field contains the radio bearer identifier for the radio bearer using the assigned TBF. This provides the mapping of TFI to RB Id which is necessary to uniquely identify lu-mode data flows.

Reference ID: bit(2)

Reference ID contains the Reference ID field set in Packet Uplink Talk Burst Control message sent by the MES that is being acknowledged.

11.2.33 Packet Link Adaptation Control

This message is sent on PACCH, on DACCH by the network to the mobile earth station.

Message type: PACKET LINK ADAPTATION CONTROL

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.44: Packet Link Adaptation Control information elements

```

< Packet Link Adaptation Control message content > ::=
  { 00 < UPLINK_TFI : bit (8) > | 01 < G-RNTI: bit(32) | 10 < S-RNTI: bit(20) >> }
  { 0 -- Message Escape
    < RB Id: bit(5)>
    { 0 | 1 < Channel MCS Info: < PDCH MCS IE >> } -- This applies to uplink TBF associated with the RB Id
    { 0 | 1 < DCH Channel MCS Info: < DCH MCS IE >> } - This applies to all flows operating on DACCH, except the
    VoIP flow as its MCS is based on its payload size
    < 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 11.45: Packet link adaptation control information element details

<p>UPLINK TFI (8 bit field) This information element, if present, assigns the contained TFI to the mobile earth station to identify to uplink TBF described by this message. This field is coded the same as the TFI field defined in clause 12.15.</p> <p>G-RNTI (32 bit field) This field is defined in clause 12.16a.</p> <p>S-RNTI (20 bit field) This field is defined in clause 12.16a.</p> <p>RB Id (5 bit field) This field is included when this message is used to reconfigure TBFs in lu mode. This field contain the radio bearer identifier for the radio bearer using the assigned TBF.</p> <p>PDCH Channel MCS Info PDCH MCS IE is defined in clause 12.35.</p> <p>DCH MCS IE This IE is defined in clause 12.35a.</p>

12 Information element coding

12.1 Overview

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

12.2 Void

12.3 GMPRS Ack/Nack description

The Ack/Nack Description information element contains the RLC parameters used to acknowledge or negatively acknowledge a group of RLC data blocks. The number of bits available for the bitmap depends on the inclusion or exclusion of other information elements in the used message.

Table 12.1: GMPRS Ack/Nack Description information elements

```

< GMPRS Ack/Nack Description IE > ::=
  <FINAL_ACK_INDICATION : bit (1) >
  <reserved: bit (1) >
  { 0 | 1 < Length: bit (9) >}
  <STARTING_SEQUENCE_NUMBER; bit (10) >
  {1 <UNCOMPRESSED_RECEIVED_BLOCK_BITMAP: bit (Val(Lu)) > |
  0 <COMPRESSED_BITMAP_STARTING_COLOR_CODE: BIT(1)>
  <COMPRESSED_RECEIVED_BLOCK_BITMAP: bit(Val(Lc))>}
  };

```

Table 12.2: 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 TBF is incomplete. Retransmissions are requested if URBB or CRBB is present (length > 11).</p> <p>1 no retransmissions are requested and this message indicates acknowledgement of all RLC data in the TBF.</p> <p>LENGTH (9 bit field) This field gives the length of the rest of the IE which includes the Starting Sequence Number and the bitmap. If not present, it should be taken to mean that the IE covers the rest of the control block. Valid values range from 11 to 452 for Packet Downlink Ack/Nack and 11 to 442 for Packet Uplink Ack/Nack.</p> <p>STARTING_SEQUENCE_NUMBER (SSN) (10 bit field) Range 0 to 1 023 The SSN is set to V(Q), the sequence number of the oldest RLC block within the receive window that has not been received.</p> <p>UNCOMPRESSED_RECEIVE_BLOCK_BITMAP (URBB) (Lu bit field) The URBB is an uncompressed bitmap representing Block Sequence Numbers. The bitmap is indexed relative to SSN as follows: $BSN = (SSN + bit_number) \text{ modulo } 1\ 024$, for bit_number = 1 to Lu. Lu is the length of URBB: $Lu = \text{Val}(\text{Length}) - \text{Length}(\text{SSN}) - 1$ The value of each bit is encoded as: 0 Negative acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ mod } 1\ 024$ 1 Positive acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ mod } 1\ 024$.</p> <p>NOTE: The URBB bits are packed into a bit field using the bit mapping defined in clause 11.</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. 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) (Lc bit field) The CRBB is a compressed bitmap. Compression is carried out starting at SSN using modified T.4 run length coding. Lc is the length of CRBB: $Lc = \text{Val}(\text{Length}) - \text{Length}(\text{SSN}) - 2$ The packing order of the CRBB shall be such that the codeword (or pair of make up/terminating codewords) corresponding to the run including the SSN starts at the most significant bit of the CRBB, and codewords (or pairs of make-up/terminating codewords) corresponding to runs including higher and successively increasing sequence numbers are placed in bits of successively decreasing significance.</p>

12.3a DCCH Ack/Nack description

The DCCH Ack/Nack Description information element contains the RLC parameters used to acknowledge or negatively acknowledge a group of RLC data blocks. The number of bits available for the bitmap depends on the inclusion or exclusion of other information elements in the used message.

Table 12.1a: DCCH Ack/Nack Description information elements

<pre> < DCCH Ack/Nack Description IE > ::= <FINAL_ACK_INDICATION : bit (1) > <reserved: bit (1) > { 0 1 < Length: bit (6) > } <STARTING_SEQUENCE_NUMBER; bit (7) > { 1 <UNCOMPRESSED_RECEIVED_BLOCK_BITMAP: bit (Val(Lu)) > }; </pre>

Table 12.2a: DCCH Ack/Nack Description information element details

<p>FINAL_ACK_INDICATION (1 bit field) This field indicates whether the entire TBF is being acknowledged, in which case only the SSN will be present without the RBB. 0 TBF is incomplete. Retransmissions are requested if URBB or CRBB is present (length > 8). Retransmission are not requested when length = 8, all blocks until SSN-1 are positively acknowledged. 1 no retransmissions are requested and this message indicates acknowledgement of all RLC data in the TBF up to SSN-1.</p> <p>LENGTH (6 bit field) This field gives the length of the rest of the IE, in bits, which includes the Starting Sequence Number and the bitmap. If not present, it should be taken to mean that the IE covers the rest of the control block. Valid values range start from 8.</p> <p>STARTING_SEQUENCE_NUMBER (SSN) (7 bit field) Range 0 to 127 The SSN is set to V(Q), the sequence number of the oldest RLC block within the receive window that has not been received.</p> <p>UNCOMPRESSED_RECEIVE_BLOCK_BITMAP (URBB) (Lu bit field) The URBB is an uncompressed bitmap representing Block Sequence Numbers. The bitmap is indexed relative to SSN as follows: $BSN = (SSN + bit_number) \text{ modulo } 128$, for bit_number = 1 to Lu. Lu is the length of URBB: $Lu = \text{Val}(\text{Length}) - \text{Length}(\text{SSN}) - 1$ The value of each bit is encoded as: 0 Negative acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ mod } 128$ 1 Positive acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ mod } 128$.</p> <p>NOTE: The URBB bits are packed into a bit field using the bit mapping defined in clause 11.</p>

12.4 Void

12.5 Void

12.6 Void

12.7 Channel Request Description

The Channel Request Description information element is sent by the MES to the network to request uplink resources in the Packet Downlink Ack/Nack message. For a description of these fields refer to table 11.7.

Table 12.3: Channel Request Description information element details

< channel request description IE > ::=
< Rid: bit(2)>
< No of Blocks : bit (6) >
< Peak Throughput Class : bit (4) >
<Radio Priority: bit (2) >
< RLC Mode : bit (1) >
< LLC PDU TYPE : bit (1) >
< Spare : bit (1) >;

12.7a Iu mode Channel Request Description

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

Table 12.3a: Iu mode Channel Request Description information elements

```
< Iu mode Channel Request Description IE > ::=
  < RB Id : bit (5) >
  < RADIO_PRIORITY : bit (2) >
  < RLC_BLOCK_COUNT : bit (6) >
  { 0 | 1 < Iu mode Channel Request Description IE > } ; -- IE to be repeated only when
  -- in a Multiple TBF request message
```

Table 12.3b: Iu mode Channel Request Description information element details

RB Id (5 bit field)
This field indicates the radio bearer identity of the upper layer PDU that caused the Iu mode Channel Request Description IE to be transmitted.
Range: 0 to 31

RADIO_PRIORITY (2 bit field)
This field indicates the Radio Priority of the requested TBF.

Bit
2 1

0 0	Radio Priority 1 (Highest priority)
0 1	Radio Priority 2
1 0	Radio Priority 3
1 1	Radio Priority 4 (Lower priority)

RLC_BLOCK_COUNT (6 bit field)
This field is defined in clause 12.31.

12.8 Frequency parameters

The Frequency Parameters information element defines frequency parameters, which are allocated to a mobile earth station to define its channel configuration. All Mac-slots/4-MAC-slots/D-MAC-slots in the channel configuration of the mobile earth station shall use the same frequency parameters.

The frequency parameters shall consist of an ARFCN for both the downlink and the uplink, a downlink frequency plan identifier, bandwidth information for the downlink, an uplink frequency offset and the bandwidth information for the uplink.

Table 12.4: Frequency parameters information elements

```
< Frequency Parameters IE > ::=
  < Downlink BW: bit (3) >
  < Downlink ARFCN : bit (11) >
  < Reserved: bit(1) >
  < Uplink BW: bit (3) >
  < Uplink ARFCN : bit (11) >
  < Reserved: bit(1) >;
```

Table 12.5: Frequency parameters information element details

<p>Downlink BW (3 bit field) This field represents the bandwidth to be used for the downlink PDCH-Carrier in multiples of 31,25 kHz, see ETSI TS 101 376-5-5 [17]. Range: 1 to 7.</p> <p>Downlink ARFCN (11 bit field) This field is the binary representation of the absolute radio frequency channel number (ARFCN) for the downlink PDCH as defined in ETSI TS 101 376-5-5 [17]. Range 0 to 2 048.</p> <p>Uplink BW (3 bit field) This field represents the bandwidth to be used for the uplink PDCH-Carrier in multiples of 31,25 kHz, see ETSI TS 101 376-5-5 [17]. Range: 1 to 7.</p> <p>Uplink ARFCN (11 bit field) This field is the binary representation of the absolute radio frequency channel number (ARFCN) for uplink PDCH as defined in ETSI TS 101 376-5-5 [17]. Range 0 to 2 048.</p>

12.8a Frequency Allocation

The Frequency Allocation IE defines the uplink and downlink frequency parameters independently.

Table 12.5a: Frequency allocation information elements

<pre> < Frequency Allocation IE > ::= { Downlink Frequency: <Frequency Struct> {0 1 <Uplink Frequency: <Frequency Struct>> <Frequency Struct> { < Bandwidth: bit(3)> <ARFCN: bit(11)> <Reserved: bit(1)>}; </pre>

Table 12.5b: Frequency allocation information elements details

<p>Bandwidth (3 bit field) This field represents the bandwidth to be used for the downlink PDCH-Carrier in multiples of 31,25 kHz, see ETSI TS 101 376-5-5 [17]. Range: 1 to 7.</p> <p>ARFCN (11 bit field) This field is the binary representation of the absolute radio frequency channel number (ARFCN) for the downlink PDCH as defined in ETSI TS 101 376-5-5 [17]. Range 0 to 2 048.</p>

12.9 Void

12.10 Global TFI

The Global Temporary Flow Identifier (TFI) information element contains either an uplink TFI or a downlink TFI. The uplink or downlink TFI identifies a single Temporary Block Flow. If the TFI belongs to an RB for which the MES initiated RAB Binding Request to add Multicast Binding (see ETSI TS 101 376-4-13 [23]), it shall not be used as a Global TFI to identify the mobile earth station neither in downlink nor uplink RLC/MAC control messages.

Table 12.6: Global TFI information elements

<pre> < Global TFI IE > ::= { 0 < UPLINK_TFI : bit (8) > 1 < DOWNLINK_TFI : bit (8) > } ; </pre>

Table 12.7: Global TFI information element details

<p>UPLINK_TFI (8 bit field) This field identifies an uplink TBF. This field is coded the same as the TFI field defined in clause 12.15.</p> <p>DOWNLINK_TFI (8 bit field) This field identifies a downlink TBF. This field is coded the same as the TFI field defined in clause 12.15.</p>

Table 12.8: Void

12.10a Void

12.10b Void

12.10c Void

12.10d Void

12.10e Void

12.11 Void

12.12 Void

12.12a Void

12.13 Void

12.14 PRACH control parameters

The purpose of the PRACH Control Parameters information element is to provide parameters used to control the PRACH utilization. When this IE is used in the system information, the reduced persistence level field is used.

Table 12.9: PRACH Control parameters information elements

<p>< PRACH Control Parameters IE > ::=</p> <p>< MAX_RETRANS : bit (3) ></p> <p>< S : bit (2) ></p> <p>< TX_INT : bit (2) ></p> <p>{ 0 <Reduced persistence level : bit(3)></p> <p> 1 < PERSISTENCE_LEVEL : bit (4) > * 4 } ;</p>

Table 12.10: PRACH Control parameters information element details Part 1

TX_INT (2 bit field)	
Number of Mac-slots to spread transmission of the random access. The field is coded according to the following table: bit	
2 1	
0 0	10 Mac-slots used to spread transmission
0 1	15 Mac-slots used to spread transmission
1 0	20 Mac-slots used to spread transmission
1 1	25 Mac-slots used to spread transmission
S (2 bit field)	
S is a parameter used for calculation of the minimum number of Mac-slots between two successive Channel request messages. The field is coded according to the following table:	
bit	
2 1	
0 0	S = 96
0 1	S = 112
1 0	S = 128
1 1	S = 144

All other values reserved.

Table 12.11: PRACH Control parameters information element details Part 2

MAX_RETRANS (1 bit field for each Radio Priority 1..4)	
Indicates for each Radio Priority level 1 to 4 the maximum number of retransmissions allowed. Radio Priority 1 represents the highest priority. The field is coded as shown below:	
bit	
3 2 1	
0 0 0	No retransmission allowed for any radio priority level
0 0 1	1 retransmission allowed for priorities 1 and 2, no retransmission for priorities 3 and 4
0 1 0	1 retransmission allowed for priorities 1, 2 and 3, no retransmission for priority 4
0 1 1	2 retransmissions allowed for priorities 1, 2 and 3, no retransmission for priority 4
1 0 0	3 retransmissions allowed for all priority 1, 1 retransmission for priorities 2, 3 and 4
1 0 1	3 retransmissions allowed for all priorities 1-2, 1 retransmission for priorities 3 and 4
1 1 0	3 retransmissions allowed for all priorities 1-3, 1 retransmission for priority 4
1 1 1	3 retransmissions allowed for all radio priority levels
Reduced Persistence Level: bit(3)	
The field is reserved for future use.	
PERSISTENCE_LEVEL (4 bit field for each Radio Priority 1..4)	
The PERSISTENCE_LEVEL field indicates the values of the access persistence level P(l) for each Radio Priority l (l = 1..4) where Radio Priority 1 represents the highest Radio Priority of an LLC PDU to be transmitted.	
Bits	
4 3 2 1	
0 0 0 0	persistence level 0
0 0 0 1	persistence level 1
0 0 1 0	persistence level 2
0 0 1 1	persistence level 3
0 1 0 0	persistence level 4
...	
1 1 1 0	persistence level 14
1 1 1 1	persistence level 16

12.15 Temporary Flow Identifier (TFI)

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

Table 12.12: UPLINK_TFI information element details

UPLINK_TFI (8 bit field)	
The Temporary Flow Identifier field identifies an uplink Temporary Block Flow (TBF). This field is encoded as a binary number.	
Range 0 to 255	

Table 12.13: DOWNLINK_TFI information element details**DOWNLINK_TFI** (8 bit field)

The Temporary Flow Identifier field identifies a downlink Temporary Block Flow (TBF). This field is encoded as a binary number.

Range 0 to 255

12.16 Temporary logical link identity (TLLI)

The Temporary Logical Link Identity (TLLI) is associated with the GPRS subscriber. TLLI is defined in ETSI TS 101 376-3-3 [3].

Table 12.14: TLLI information element details**TLLI** (32 bit field)

The TLLI field is encoded as a binary number.

Range 0 to 4 294 967 295

12.16a GERAN Radio Network Temporary Identity (G-RNTI)

The G-RNTI (GERAN Radio Network Temporary Identity) is allocated to an MES at the RRC layer having a RRC connection and identifies the MES within GERAN. It is used by the RLC/MAC layer to identify an MES.

NOTE: The RRC layer uses the G-RNTI defined in ETSI TS 101 376-4-13 [23].

Table 12.14a: G-RNTI information element

< G-RNTI IE > ::=

< **Serving BSC Identity** : bit (12) >

< **S-RNTI** : bit (20) >;

Table 12.14b: G-RNTI information element details**Serving BSC identity** (12 bit field)

This field identifies the mobile earth station's serving BSC in GERAN.

S-RNTI (20 bit field)

This field identifies the mobile earth station within the serving BSC.

12.17 Void

12.18 MAC Slot Allocation

The MAC Slot Allocation field indicates the Mac-slots for use during a TBF or the Mac-slots carrying a PCCCH.

Table 12.15: MAC Slot Allocation information element details

<p>MAC Slot Allocation (8 bit field)</p> <p>This information field indicates the Mac-slots assigned for use during the TBF or the Mac-slots carrying a PCCCH. Bit 8 indicates the status of Mac-slot 0, bit 7 indicates the status of Mac-slot 1, etc. At least one Mac-slot shall be assigned.</p> <p>0 Mac-slot is not assigned 1 Mac-slot is assigned.</p> <p>The MAC Slot Allocation bits shall be set or cleared in pairs for PDCH(2,6) and PDCH(1,6) based carriers. The starting Mac-slot number on PDCH(2,6) or PDCH(1,6) shall always be an even number.</p> <p>When a Downlink TBF is operating in dynamic mode, the MES shall not monitor downlink bursts in Mac-slots that have not been assigned by the network. If the duration field in PUI indicates that downlink burst extend beyond the Mac-slots assigned for use during the TBF, then the PRI shall be ignored and the burst payload length shall be assumed to be zero. For example, if PDCH3(5,12) starts at an assigned Mac-slot, but extend beyond all the assigned Mac slots, only the PUI and optional ULMAP shall be decoded.</p> <p>When an Uplink TBF is operating in dynamic mode, the MES shall not monitor the USF in Mac-slots that have not been assigned by the network.</p> <p>The MAC Slot Allocation bits shall be set or cleared in pairs for DCH(1,6). The starting Mac-slot number on DCH(1,6) shall always be an even number.</p> <p>When this information field is set to all zeros in Radio Bearer Setup, Radio Bearer Reconfigure, or Cell Update Confirm messages, it indicates that that Radio Bearer is setup; however, the corresponding TBF is not established (i.e. no resources are allocated).</p>

12.18a Slot Allocation

The Slot Allocation IE defines the time slots for use on a DCH.

Table 12.15a: Slot Allocation information element details

<p><Slot Allocation IE> ::=</p> <p>{ <Starting MAC Slot>: bit(3) <Offset within MAC Slot>: bit(2)};</p> <p>Starting MAC Slot (3 bit field)</p> <p>This field identifies the starting MAC slot number.</p> <p>Offset within MAC slot (2 bit field)</p> <p>2 1</p> <p>0 0 - Physical Layer burst offset by 0 Time Slots from the start of MAC slot -- No offset 0 1 - Physical Layer burst offset by 1 Time Slots from the start of MAC slot 1 0 - Physical Layer burst offset by 2 Time Slots from the start of MAC slot 1 1 - Reserved</p> <p>See ETSI TS 101 376-5-2 [13] for definition of Time Slot.</p>

12.19 Void

12.20 Void

12.21 Void

12.22 Void

12.23 Void

12.24 Void

12.25 Void

12.26 Void

12.27 Void

12.28 Void

12.29 Packet link synchronization parameter

The link synchronization parameter consists of timing parameters necessary to maintain the radio link between the MES and the network.

Table 12.21: Link synchronization parameters

```
<Packet Link Synchronization Parameters IE > ::=
  < Timing correction : bit (10) >
  < Timing correction flag : bit(1)>
  < Frequency correction : bit (12) >
  <Frequency correction flag : bit(1)>
  < Timing Advance Index : bit (7) >
  { 0 | 1 < Frame Number : bit(19) >};
```

Table 12.22: Packet link synchronization information element details

TIMING CORRECTION (10 bit field)

The timing correction information is a 10-bit signed value. The timing correction is specified in a 2's complement form coded in binary. The valid range for the timing correction values is from -375 to +375. The correction value is specified in $T_s/40$ resolution unit, where T_s is a symbol period for a reference symbol rate of 23,4 Ksps (i.e. $(2 \times 5/234)$ ms). (Refer to note below). The use of this parameter is described in ETSI TS 101 376-5-7 [16].

TIMING CORRECTION FLAG

This flag indicates whether the timing correction is to replace all existing corrections (1) or to be applied in adjunct to any existing correction (0).

FREQUENCY CORRECTION (12 bit field)

The Frequency Correction information is a 12-bit signed value. The Frequency Correction is specified in a 2's complement form coded in binary. The valid range for the frequency correction values is from -2 048 to +2 047. The correction value is specified in 1 Hz resolution unit. The use of this parameter is described in ETSI TS 101 376-5-7 [16].

FREQUENCY CORRECTION FLAG

This flag indicates whether the frequency correction is to replace all existing corrections (1) or to be applied in adjunct to any existing ongoing correction (0).

TIMING_ADVANCE_INDEX (7 bit field)

Range 0 to 127. The MES shall ignore this field if a TAI was not allocated by the network.

FRAME NUMBER (19 bit field)

Range 0 to 313 343. The MES shall ignore Frame Number if TAI is allocated by the network. If TAI was not allocated, then the MES shall use this frame number to check frame number synchronization. If the frame number indicated does not match FN maintained by the MES, the MES shall abort all TBFs with return to system information.

NOTE: Symbol period T_s used here does not refer to the symbol period on the PDCH carrier. The T_s value is derived from a reference symbol rate of 23,4 Ksps.

12.29a Time and Frequency Correction

The Time and Frequency Correct IE contains timing and frequency corrections parameters necessary to maintain the radio link between the MES and the network.

Table 12.22a: Time and Frequency Correction information element

```

<Time and Frequency Correction IE > ::=
  < Timing correction : bit (10) >
  < Timing correction flag : bit(1)>
  < Frequency correction : bit (12) >
  < Frequency correction flag : bit(1)>;

```

Table 12.22b: Time and Frequency Correction information element details**TIMING CORRECTION (10 bit field)**

The timing correction information is a 10-bit signed value. The timing correction is specified in a 2's complement form coded in binary. The valid range for the timing correction values is from -375 to +375. The correction value is specified in $T_s/40$ resolution unit, where T_s is a symbol period for a reference symbol rate of 23,4 Ksps (i.e. $(2 \times 5/234)$ ms).

(Refer to note below). The use of this parameter is described in ETSI TS 101 376-5-7 [16].

TIMING CORRECTION FLAG

This flag indicates whether the timing correction is to replace all existing corrections (1) or to be applied in adjunct to any existing correction (0).

FREQUENCY CORRECTION (12 bit field)

The Frequency Correction information is a 12-bit signed value. The Frequency Correction is specified in a 2's complement form coded in binary. The valid range for the frequency correction values is from -2 048 to +2 047.

The correction value is specified in 1 Hz resolution unit. The use of this parameter is described in ETSI TS 101 376-5-7 [16].

FREQUENCY CORRECTION FLAG

This flag indicates whether the frequency correction is to replace all existing corrections (1) or to be applied in adjunct to any existing ongoing correction (0).

NOTE: Symbol period T_s used here does not refer to the symbol period on the PDCH carrier. The T_s value is derived from a reference symbol rate of 23,4 Ksps.

12.30 Link quality report

This information element is the quality of the downlink PDCH as seen by the mobile earth station.

Table 12.23: Link Quality Report

```

< Link Quality Report IE > ::=
  < SQIR : bit (6) >
  <GMPRS Terminal Type Identifier: bit(7)>
  < SIN : bit (4) >
  < PAN : bit (6) >
  {0 | 1 < IMEI : bit (64) > }
  {0 | 1 < GPS Position : bit (40) >}

```

Table 12.24: Packet Link Synchronization information element details

<p>SQIR: Contains the SQI Report based on the PDCH RSSI measurements. See ETSI TS 101 376-5-6 [15] for details.</p> <p>GMPRS Terminal Type Id (7 bit field) This field identifies the GMR-1 capabilities of the MES. GMPRS Terminal Type Identifier is encoded as a binary number. Range 0 to 127. See ETSI TS 101 376-5-2 [13].</p> <p>SIN: (4 bit field) This field indicates the start of a TBF and thereafter the number of link quality reports transmitted since the transition from packet idle mode to packet transfer mode.</p> <p>Bit</p> <p>0 0 0 0 - reserved</p> <p>0 0 0 1 - 1st link quality report</p> <p>0 0 1 0 - 2nd link quality report</p> <p>---</p> <p>---</p> <p>1 1 1 1 - 15th or later quality report</p> <p>PAN: (6 bit field) This is the MES transmission power level, i.e. Power attenuation notification value. The PAN field value contained in this information element may match any PAN value the MES used or may have used (Given a transmit opportunity) in the 120 ms. Interval prior to transmission of the radio block containing this information element. See ETSI TS 101 376-5-6 [15] for details.</p> <p>IMEI: (64 bit field) This is the mobile equipment identity, see ETSI TS 101 376-3-3 [3] for details.</p> <p>GPS Position: (40 bit field) This provides the position information of the MES, see ETSI TS 101 376-4-8 [11] for coding details.</p>

12.31 Number of Blocks

This information field indicates the number of blocks computed using the basic coding scheme for the given channel requested for a mobile originated Temporary Block Flow. The field is coded as an unsigned binary value. The information field is 6 bits long when used within the Packet Channel Request message (PRACH) and 10 bits long when used within the Channel Request Type 1 message (RACH).

12.32 UTRAN Target cell

12.32a UTRAN FDD Target cell

The *UTRAN FDD Target cell* information element contains the description of a UTRAN FDD Target cell.

Table 12.31.1: UTRAN FDD Target cell information element

<pre> < UTRAN FDD Target cell IE > ::= < FDD-ARFCN : bit (14) > < Diversity : bit > { 0 1 < Bandwidth_FDD : bit (3) > } < SCRAMBLING_CODE : bit (9) > ; </pre>

Table 12.31.2: UTRAN FDD Target cell information element details**FDD_ARFCN** (14 bit field)

This information element is defined as the UARFCN in ETSI TS 125 101 [i.6]. Any non-supported frequency shall not be considered as an error; indices of the 3G Neighbour Cell list shall be incremented accordingly.

Diversity (1 bit field)

This parameter indicates if diversity is applied for the cell:

Bit

0 Diversity is not applied for this cell

1 Diversity is applied for this cell.

Bandwidth_FDD (3 bit field)

This information element will be used for future releases. It shall not be sent in this version of the protocol.

When missing, this indicates the present FDD bandwidth. When present, this shall not be considered as an error; indices of the 3G Neighbour Cell list shall be incremented accordingly.

Scrambling Codes (9 bit field)

This parameter indicates the Primary Scrambling Code as defined in ETSI TS 125 331 [i.2].

12.32b UTRAN TDD Target cell

The *UTRAN TDD Target cell* information element contains the description of a UTRAN TDD Target cell.

Table 12.32.1: UTRAN TDD Target cell information element

```
< UTRAN TDD Target cell IE > ::=
  < TDD-ARFCN : bit (14) >
  < Diversity TDD : bit >
  { 0 | 1 < Bandwidth_TDD : bit (3) > }
  < Cell Parameter : bit (7) >
  < Sync Case TSTD : bit >;
```

Table 12.32.2: UTRAN TDD Target cell information element details**TDD_ARFCN** (14 bit field)

This information element is defined as the UARFCN in ETSI TS 125 102 [i.7]. Any non supported frequency shall not be considered as an error; indices of the 3G Neighbour Cell list shall be incremented accordingly.

Bandwidth_TDD (3bit field)

This information element refers to ETSI TS 125 331 [i.2].

Bit

321

000 3,84 Mcps

001 1,28 Mcps

All other values shall not be sent. All other values shall not be interpreted as an error; indices of the 3G Neighbour Cell list shall be incremented accordingly (but no reporting can be performed). When missing, this indicates 3,84 Mcps.

Diversity TDD (1 bit field)

This parameter indicates if SCTD (see ETSI TS 125 224 [i.8]) is applied for the cell:

Bit

0 SCTD is not applied for this cell

1 SCTD is applied for this cell.

Cell Parameter (7 bit field)

This parameter is defined in ETSI TS 125 223 [i.9].

Sync Case TSTD (1 bit field)

For 3,84 Mcps TDD, this parameter is defined in ETSI TS 125 223 [i.9].

Bit

0 Sync Case 1

1 Sync Case 2

For 1,28 Mcps TDD, this parameter indicates if TSTD (see ETSI TS 125 224 [i.8]) is applied for the cell:

Bit

0 TSTD is not applied for this cell

1 TSTD is applied for this cell.

12.33 Void

12.34 Void

12.35 PDCH MCS

The PDCH MCS information element defines the modulation and coding scheme to be used on uplink PDCH bursts.

Table 12.35: PDCH MCS information element

```
<PDCH MCS IE> ::=
{ < CHANNEL_MCS_COMMAND: bit(4)>
  < CHANNEL_MCS_COMMAND_PNB_1_6: bit(3)>
  < CHANNEL_MCS_COMMAND_PNB_2_6: bit(3)>
  { 0 | 1 < CHANNEL_MCS_COMMAND_PNB_5_12: bit(4)> } };
```

Table 12.35b: PDCH MCS information element details

CHANNEL_MCS_COMMAND (4 bit field)
The Channel Coding Indicator field PNB(4,3)/PNB(5,3)/PNB2(5,3)/PNB3(5,3). This field indicates the channel coding scheme for PNB(4,3)/PNB(5,3) that the mobile earth station shall use when transmitting data on the uplink. The coding for this field is defined in clause 10.1. A value of "1111" indicates that PNB(4,3)/PNB(5,3)/PNB2(5,3)/PNB3(5,3) shall not be transmitted.

CHANNEL_MCS_COMMAND_PNB_5_12 (4 bit field)
The channel coding indicator bit field for PNB2(5,12)/PNB3(5,12). This field indicates the channel coding scheme that the mobile earth station shall use when transmitting on the uplink. If the value in this field is 1111, it means the mobile earth station shall not transmit any PNB(5,12) burst except for retransmission. The coding for this field is defined in clause 10.1.

CHANNEL_MCS_COMMAND_PNB_2_6 (3 bit field)
The Channel Coding Indicator field for PNB(2,6)/PNB3(2,6). This field indicates the channel coding scheme for PNB(2,6) that the mobile earth station shall use when transmitting data on the uplink. The coding for this field is defined in clause 10.1. A value of "111" indicates that PNB(2,6)/PNB3(2,6) shall not be transmitted.

CHANNEL_MCS_COMMAND_PNB_1_6 (3 bit field)
The Channel Coding Indicator field for PNB(1,6). This field indicates the channel coding scheme for PNB(1,6) that the mobile earth station shall use when transmitting data on the uplink. The coding for this field is defined in clause 10.1. A value of "110" indicates that PNB3(1,6) 2,6 kbps Data shall be used along with Header type 2. The coding of PNB3(1,6) 2,6 kbps is specified in 12.1b.2 of ETSI TS 101 376-4-14 [24]. A value of "111" indicates that PNB(1,6) shall not be transmitted.

12.35a DCH MCS

The DCH MCS information element defines the modulation and coding scheme to be used for uplink dedicated channel (DCH) bursts.

Table 12.35a.1: DCH MCS information element

```
<DCH MCS IE> ::=
{ < CHANNEL_MCS_COMMAND_DCH_PNB_n_m: bit(3)> }; -- Used in conjunction with the uplink dedicated channel
allocation given by the Channel Info IE in clause 12.36.
NOTE: For speech mode dedicated channel RB assignments the MCS specified indicates the modulation and coding
that will be applicable for both the perceptually important and unimportant bits as given in ETSI
TS 101 376-4-14 [24].
```

Table 12.35a.2: DCH MCS information element Details**CHANNEL MCS COMMAND_DCH_PNB_n_m** (3 bit field)

This field indicates the channel coding scheme for DCH that the mobile earth station shall use when transmitting data on the uplink. The coding for this field is defined in ETSI TS 101 376-4-14 [24].

NOTE: For speech mode dedicated channel RB assignments the MCS specified indicates the modulation and coding that will be applicable for both the perceptually important and unimportant bits as given in ETSI TS 101 376-4-14 [24].

12.36 Channel Info

The Channel Info information element defines the mode, channel type and channel rate information for Dedicated Channels (DCH).

Table 12.36a: Channel Info information element

```
<Channel Info IE>
{ <Channel Mode: bit(1)>
  <Channel Type: bit(3)> };
```

Table 12.36b: Channel Info information element details**Channel Mode** (1 bit field)

0 Non-speech (Signalling/Data)

1 Speech

Channel Type (3 bit field)

3 2 1

0 0 0 DCH(1,3)

0 0 1 DCH(1,6)

0 1 0 DCH(1,8)

All other values are reserved.

12.36a PDCH Channel Info

The PDCH Channel Info determines the channel type and its MCS

Table 12.36c: PDCH Channel Info information element

```
<PDCH Channel Info IE>
{ <Channel Type: bit(3)>
  <Channel MCS: bit(4)> };
```

Table 12.36d: PDCH Channel Info information element details**Channel Type** (3 bit field)

3 2 1

0 0 0 PDCH3(1,6)

0 0 1 PDCH3(2,6)

0 1 0 PDCH3(5,3)

0 1 1 PDCH3(5,12)

All other values are reserved.

Channel MCS (4 bit field)

This field indicates the MCS of the PDCH channel

12.37 PDCH Uplink Organization

The PDCH Uplink Organization information element defines the organization of uplink frequencies associated within a PDCH.

Table 12.37a: PDCH Uplink Organization information element

```

<PDCH Uplink Organization IE> ::=
  <Number of Uplinks: bit(4)>
  {<Uplink ARFCN Ordered List: <Uplink ARFCN Struct>> ** val(Number of Uplinks)};
<Uplink ARFCN Struct> ::=
  <Return Frequency Set: bit(1)>
  <Uplink Bandwidth: bit(3)>
  <Uplink ARFCN: bit (11)>
  <UL Frequency Plan ID: bit (1) >;

```

Table 12.37b: PDCH Uplink Organization information element details

Number of Uplinks (4 bits)
This field defines the number of uplink carriers present within this PDCH.

Return Frequency Set (1 bit)
This field defines the frequency set in which the uplink carrier is included. See clause 10.2.1c.
0: First set
1: Second set.
NOTE: Only downlink PDCH(10,3) supports two sets of uplink frequencies. For PDCH(1,6), PDCH3(2,m), PDCH3(5,m) this field will be always be set to 0.
Only the uplink carriers of the frequency set assigned to the UT are specified.

Uplink ARFCN (11 bit field)
This field is the binary representation of the absolute radio frequency channel number (ARFCN) defined in ETSI TS 101 376-5-5 [17]. Range 0 to 2 048.

UL Frequency Plan ID (1 bit field)
This field indicates the frequency plan to be used. When set, it indicates that the absolute frequency should be shifted by 15,625 kHz, as defined in ETSI TS 101 376-5-5 [17].

Uplink Bandwidth (3 bit field)
This field represents the bandwidth to be used for the PDCH-Carrier in multiples of 31,25 kHz, see ETSI TS 101 376-5-5 [17]. Range: 1 to 5.

12.38 Power Control Synch Offset

The Power Control Synch Offset field provides the K value used to determine the start frame of the control group for uplink power control synchronization as specified in ETSI TS 101 376-5-7 [16]. This field applies only to an uplink Dedicated Channel (DCH).

Table 12.38a: Power Control Synch Offset

```

Power Control Synch Offset (2 bit field)
bit
2 1
0 0 K=6
0 1 K=7
1 0 K=8
1 1 K=9

```

13 Timers and counters

13.0 General

The tables in clauses 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 GMPRS 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 earth station side

Table 13.1: Specification of timers used in GMPRS on the mobile earth station side

Timer	Started	Stopped	Action at expiry	Value
T3162 (per TBF)	On receipt of a PACKET ACCESS REJECT message indicating WAIT.	On receipt of a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2 or T3172 expiry.	Wait for T3172 expiry, then try again if number of retries is less than maximum allowed, or else declare failure to the upper layers.	15 s
T3164 (per TBF)	On receipt of a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2 or transitioning to packet transfer mode due to reception of IMMEDIATE ASSIGNMENT TYPE 2 or IMMEDIATE ASSIGNMENT TYPE 4.	At sending of the first RLC/MAC block.	The MES shall re-initiate packet access procedure on the PCCCH using PRACH.	10 s
T3168 (per TBF)	On transmission of GMPRS PACKET DOWNLINK ACK/NACK containing the packet channel request or PACKET DOWNLINK ACK/NACK TYPE 2 lu mode channel request.	Upon receipt of a Packet Uplink Assignment or Packet Uplink Assignment Type 2.	Reinitiate the Packet Resource Request procedure unless it has been initiated three times without receiving any uplink assignment in response. In this case the mobile earth station shall perform an abnormal release with access retry.	Assigned in system information
T3170 (per MES)	After having made M + 1 attempts to send a PACKET CHANNEL REQUEST or PACKET CHANNEL REQUEST TYPE 2 message.	On receipt of a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2 message.	Abort Packet access procedure; indicate an access failure to upper layer. The next access will take place on the CCCH unless there is a downlink TBF currently active.	10 s
T3172 (per TBF)	On receipt of a PACKET ACCESS REJECT message with WAIT INDICATION.	On receipt of a PACKET UPLINK ASSIGNMENT, PACKET UPLINK ASSIGNMENT TYPE 2 message.	Packet Access in the spotbeam no longer prohibited.	Assigned in message
T3180 (per TBF)	When transmitting an RLC/MAC block to the network and UD > 0.	When detecting an assigned USF value on assigned PDCH.	Perform Abnormal release with random access procedure.	15 s

Timer	Started	Stopped	Action at expiry	Value
T3182 (per TBF)	After sending the potentially last data block (with UD=0), or upon detecting a transmit window stall condition.	When operating in Ack mode, on receipt of the PACKET UPLINK ACK/NACK message if the transmission window moves from stalled to not stalled state or on receipt of PACKET UPLINK ACK/NACK message with final ack indicator bit set to "1". Restarted when an uplink RLC/MAC block is sent with UD=0.	Abnormal release with random access if there is unacknowledged data or data waiting to be transmitted. Normal release otherwise.	30 s
T3184	This timer is not used.			
T3186 (per MES)	When packet access procedure is started.	Restarted when detecting an USF = FREE value on the downlink PCCCH carrying PRACH. Stopped after last access attempt on the PRACH channel or on receiving a response from the network.	Switch to access procedure on RACH channel or report an error to the higher layer, as described in clause 7.1.2.1.1.	10 s
T3188	This timer is not used.			
T3190 (per TBF)	At reception of a downlink assignment message. Upon reactivation of TBF from a suspended state (see clause 8.1.1.1).	Restarted on receipt of a downlink RLC/MAC block carrying the TFI of the downlink TBF in the RLC/MAC header. Stopped when downlink TBF becomes suspended as described in clause 8.1.1.1. T3190 corresponding to the TBF allocated for SRB with RB Id = 2 shall also be restarted on receipt of valid RLC/MAC block for any active downlink TBFs with RB Id > 2.	Abnormal release with return to CCCH or PCCCH.	60 s (A/Gb mode) 140 s (lu mode)
T3192 (per TBF)	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 PACKET DOWNLINK ASSIGNMENT or PACKET DOWNLINK ASSIGNMENT TYPE 2.	Release the resources, stop monitoring the downlink PDCHs, and return to packet idle mode if no uplink TBF establishment is in progress or uplink TBF exists.	Assigned in system information
T3202 (per MES)	When the MES receives a correction from the network on AGCH, PAGCH or PTCCH/D.	None	For next channel request, the RACH channel will have to be used.	In system information
T3208 (per MES)	When a PRACH is transmitted on reception of IMMEDIATE ASSIGNMENT TYPE 3.	When a timing and frequency correction is received.	Goes to packet idle mode.	5 s

Timer	Started	Stopped	Action at expiry	Value
T3194 (per MES)	On receipt of an uplink demand when only a downlink TBF is present.	On receipt of a GMPRS PACKET DOWNLINK ACK/NACK transmission opportunity, or Packet Control Acknowledgement transmission opportunity, or a transmission of a Packet Resource Request message transmission on uplink opportunity signalled through UUG bit.	Initiate a PRACH access to establish an uplink TBF.	1 s
T3196 (per MES)	When PRACH or RACH is transmitted for GMPRS resume procedure.	On receipt of a valid PACKET GMPRS RESUME RESPONSE or GMPRS RESUME RESPONSE.	Retransmit PRACH (or RACH) and restart T3196 if maximum number of retries has not been achieved else abort GMPRS resume procedure and return to packet idle mode.	20 s
T3198 (per TBF)	When transmitting RLC data block.	Receive a positive acknowledgement of the RLC data block.	Accept negative acknowledgement for RLC data block.	Calculated based on BS_CV_MAX present in system information
T3298 (per TBF)	Applies only to TBF using uplink DCH channel. When T3198 expires uplink.	Received Uplink Ack/Nack for corresponding to the TBF.	Mark the RLC block negatively acknowledged.	1 s
T _{MAC-M-REP} (per MES)	When measurements are started on receipt of PACKET MEASUREMENT ORDER message.	On completion of measurement procedure.	Abandon measurement procedure.	<TBC>
T3300 (per TBS)	Receipt of Packet DCH Uplink Ack/Nack with FAI bit set.	Receipt of Packet DCH Assignment message.	Release uplink and downlink TBF associated with the RB specified in Packet DCH Uplink Ack/Nack.	4 s
T3302	Transmission of Packet Talk Burst Request/Release message	Receipt of Packet Talk Burst Acknowledgement.	Retransmit Talk Burst Request/Release if maximum number of retries have not been achieved else abort indicate TBF failure to upper layers.	S × 0,005 s S is in PRACH Control parameters IE.

T3162: Wait for Packet Uplink Assignment after reception of Packet Reject with WAIT INDICATION
This timer is used on the MES side after receiving Packet Access Reject with WAIT INDICATION to define when to stop waiting for a Packet Uplink Assignment and repeat the access procedure.

T3164: Wait for Uplink State Flag After Assignment.
This timer is used on the MES side to define when to stop waiting for the USF determining the assigned portion of the uplink channel and repeat the procedure for random access. 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.

T3168: This timer is started on the MES side after the MES transmits a packet channel request in a GMPRS PACKET DOWNLINK ACK/NACK message. At expiry of timer T3168 the MES shall reinitiate Packet Resource Request Procedure to establish an uplink TBF unless it has been initiated three times. The timer is stopped on receipt of a Packet Uplink Assignment from the network.

T3170: Wait for Packet Uplink Assignment after having done (M+1) Packet Channel Requests.
This timer is used on the MES side when having made M + 1 attempts to send a Packet Channel Request. At expiry of timer T3170, the Packet Uplink Assignment procedure is aborted; an access failure is indicated to the upper layer. The next access will take place on the CCCH if there is no downlink TBF currently active.

- T3172:** Wait for Packet Uplink Assignment after Packet Access Reject message with WAIT INDICATION has been received. On expiry of this timer, the mobile earth station can continue the access procedure by sending a further Packet Channel Request message, if number of retries is not exceeded.
After T3172 expiry packet Access is no longer prohibited in the cell but no Channel Request message shall be sent as a response to a page until a Paging Request message for the MES is received.
- T3180:** Wait for Uplink State Flag After Data Block.
This timer is used on the MES side to define when to stop waiting for the USF determining the assigned portion of the uplink channel after the previous RLC/MAC block is sent. If a UD value of zero is transmitted to the network, the scheduling of USFs is significantly reduced, thus this timer is to be stopped if UD=0 is sent to the network. In multislot operation, it is enough that the assigned USF is noted on one of the uplink PDCHs. If expired, the MES repeats the procedure for random access. This timer does not apply to fixed allocation transfers.
- T3182:** Wait for Response.
This timer is used on the MES 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 i.e. the stalling condition has been achieved or the MES has declared UD=0. If expired, the MES does an abnormal release with random access if there were packets pending transmission or acknowledgement in RLC acknowledged mode. It does a normal release if there were no packets pending transmission and no packets that were awaiting acknowledgement in RLC acknowledged mode.
Once the MES has transmitted UD=0, it uses the T3182 timer to define when to stop waiting for the next poll from the network. It is restarted whenever an RLC/MAC block is transmitted with UD=0. When the TBF RELEASE message is received it is stopped.
- T3186:** Wait for Uplink State Flag during dynamic PRACH Access using USF=FREE.
This timer is used on the MES side to define when to stop waiting for the USF determining the assigned portion of the uplink channel. At expiry of timer T3186, the Packet Uplink establishment procedure on PRACH is stopped as described in clause 7.1.2.1.1. This timer only applies to MESs monitoring the USF= FREE in order to gain access to the PRACH logical channel.
- T3190:** Wait for Valid Downlink Data Received from the Network.
This timer is used on the MES side to stop waiting for the valid data from the network side either following the initial Packet Downlink Assignment or after some previous downlink RLC/MAC block. The MES shall restart T3190 corresponding to the TBF allocated for SRB with RB Id = 2 when it receives a valid RLC/MAC block for any other active downlink TBFs with RB Id > 2.
- T3192:** Wait for release of the TBF after reception of the final block.
This timer is used on the MES side when the MES has received all of the RLC data blocks. When timer T3192 expires the MES shall release the resources associated with the downlink TBF (e.g. TFI).
- T3194:** This timer is started on receipt of an uplink demand in the presence of a downlink TBF only. When timer T3194 expires the MES shall initiate a PRACH to establish an uplink TBF. The timer is stopped on receipt of a GMPRS PACKET DOWNLINK ACK/NACK or PACKET DOWNLINK ACK/NACK transmission opportunity. Packet Control Acknowledgement transmission, or transmission of Packet Resource Request message on uplink opportunity signalled through UUG bit.
- T3196:** This timer is started on transmission of PRACH or RACH for GMPRS resume procedure. When timer T3196 expires the mobile earth station shall retransmit another PRACH (or RACH) only if maximum number of attempts have not yet been reached. This timer is stopped on receipt of PACKET GMPRS RESUME RESPONSE or GMPRS RESUME RESPONSE with a TLLI that matches the one on the mobile earth station. Upper layer is informed if no response is received after having made maximal attempts.
- T3198:** RLC timer.
T3198 is an array of timers used by the MES to control when it will accept a negative acknowledgement for an RLC data block. There is one timer for every transmitted RLC block. It is computed based on the SI parameter BS_CV_MAX using the following equation:

$$500 \text{ ms} + \text{BS_CV_MAX} \times 5 \text{ ms.}$$

- T3202:** PT2 timer.
T3202 is used by the MES to determine whether its synchronization is good enough for it to use the PRACH channels.
- T3208:** This timer is started on transmission of PRACH in response to an IMMEDIATE ASSIGNMENT TYPE 3 message on the PCH. Expiry of this timer means failure in obtaining timing and frequency correction necessary for the MES to operate in packet transfer mode.
- T_{MAC-M_REP}:** This timer is started on initiating measurement procedures following receipt of PACKET MEASUREMENT ORDER. Expiry of this timer means failure to complete the measurement in time.
- T3298:** RLC timer.
These timers are only used for DCH uplink flows. T3298 is an array of timers used by the MES to mark an RLC data as negatively acknowledged if it does not receive any DCH Uplink Ack/Nack message for the associated flow after 1 sec from T3198 expiry of the RLC Block.
- T3300:** This timer is started on receiving Packet DCH Uplink Ack/Nack with FAI bit set for release of the TBF. On expiry of this timer, the MES shall release uplink and downlink TBF associated with the RB indicated in Packet DCH Uplink Ack/Nack.

13.2 Timers on the network side

Table 13.2: Specification of timers used in GMPRS on the network side

Timer	Started	Stopped	Action at expiry	Typical value
T3169 (per TBF)	If counter N3101 = N3101_MAX, or if counter N3103 = N3103_MAX.	None.	The network releases USF and TFI resources.	15 s
T3191 (per TBF)	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 s
T3193 (per TBF)	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.	network defined
T3195 (per TBF)	If counter N3105 = N3105_MAX.	None.	The network releases TFI resources.	5 s
T3201 (per TBF)	When the network receives a RLC/MAC block from the MES with UD=0. Restarted upon receipt of RLC/MAC block carrying an RLC block that advances V(R) and UD=0.	When the network receives a RLC/MAC block from the MES with UD greater than zero or on TBF release or on getting a request for new TBF.	The network transmits a PACKET TBF RELEASE or PACKET TBF RELEASE TYPE 2 message and clears the TBF.	Operator defined, less than T3182
T _{MAC-M-ORD} (per MES)	When PACKET MEASUREMENT ORDER message is sent.	When PACKET MEASUREMENT REPORT with matching <i>Request Reference IE</i> is received.	The network may retransmit PACKET MEASUREMENT ORDER.	network defined
T3301 (per TBF)	Receipt of Packet Control Acknowledgment for Packet Uplink Ack/Nack with FAI bit set or Packet TBF Release or Packet TBF Release Type 2 message.	Packet Control Acknowledgment for a Packet DCH Assignment message that was sent to reactivate the TBF.	Release uplink and downlink TBF associated with the same RB.	3 s
T3305 (per TBF)	When N3303 exceeds its limits.	None.	Release uplink and downlink TBF associated with the same RB.	4 s

- T3169:** Wait for reuse of USF and TFI after the MES uplink assignment is invalid. This timer is used on the network side to define when the current uplink assignment is surely invalid on the MES 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 T3169 is > T3180. Its value is network dependent.
- T3191:** 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 MES side so that the TFI can be reused. Its value is network dependent.
- T3193:** Wait for reuse of TFI after reception of the final Packet Downlink Ack/Nack from the MES. This timer is used on the network side to define when timer T3192 on the MES side has surely expired so that the TFI can be reused. Its value is network dependent. The network shall set it to take into account the fact that the matching timer T3192 in the mobile earth station has started running half a round trip time before the start of this timer.

- T3195:** Wait for reuse of TFI when there is no response from the MES (radio failure or cell change). This timer is used on the network side to define when the current assignment is surely invalid on the MES side so that the TFI can be reused. Its value is network dependent.
- T3201:** Defines duration for which the network can keep an uplink TBF open after the MES has declared that it has no further data to transmit.
- T_{MAC-M_ORD}:** This timer is started transmission of PACKET MEASUREMENT ORDER. Expiry of this timer indicates that a report from MES was not received.
- T3301:** This timer is used to supervise the release of DCCH mode TBF, following the receipt of an acknowledgement from the MES for a Packet DCH Uplink Ack/Nack with FAI bit set or in response to Packet TBF Release Type 2 message.
- T3305:** Wait for release of a DCCH mode TBF when there is no response from the MES during release procedure. This timer is started at the network side once the counter N3303 exceeds its maximum value.

13.3 Counters on the mobile earth station side

- N3306:** When the MES retransmits and RLC block whose corresponding element in V(B) has the value NACKED, it increments N3306. The MES shall release the uplink TBF if the RLC block counter value N3306 reaches N3306max when trying to retransmit the same RLC block. N3306max is equal to 5.

13.4 Counters on the network side

- N3101:** When the network after setting USF, receives a valid data RLC/MAC block from the mobile earth station, it will reset counter N3101. The network will increment counter N3101 for each USF for which no RLC/MAC is received. N3101max shall be greater than 8.
- N3103:** N3103 is reset when transmitting the final PACKET UPLINK ACK/NACK or PACKET UPLINK ACK/NACK TYPE 2 or PACKET TBF RELEASE or PACKET TBF RELEASE TYPE 2 message within a TBF (final ack indicator set to 1). If the network does not receive the acknowledgement message in the accompanying UUG allocation, it shall increment counter N3103 and retransmit the previous message. If counter N3103 exceeds N3103max, the network shall start timer T3169.
- N3105:** When the network after sending a poll for control information in the downlink RLC/MAC data block, receives a valid RLC/MAC control message from the mobile earth station, it will reset counter N3105. The network will increment counter N3105 for each allocated Mac-slot/D-MAC-slot for which no RLC/MAC control message is received. The value of N3105max is network dependent.
- N3303:** N3303 is reset when transmitting the final PACKET DCH UPLINK ACK/NACK or PACKET TBF RELEASE TYPE 2 message within a DCCH mode TBF (with final ack indicator set to 1). If the network does not receive the acknowledgement message in the accompanying UUG allocation, it shall increment counter N3303 and retransmit the previous message. If counter N3303 exceeds N3303max, the network shall start timer T3305. The value of N3303max is network dependent.

Annex A (normative): Uplink Map (ULMAP)

A.1 When downlink carrier is mapped to one UL 5x carrier

In case of a single contiguous 5x carrier allocated in the uplink, PDCH Uplink Organization list is not required. The Immediate Assignment 4 message (see ETSI TS 101 376-4-8 [11]) contains a bit field that indicates that Uplink ARFCN can be used for PDCH. The MES shall derive the individual channel information when the contiguous 5x carrier is segmented into multiple sub-carriers for uplink allocation. The MES shall divide a given uplink 5x carrier into individual sub-carriers based on USFs in the ULMAP assigned by the network.

A.2 When downlink carrier is mapped to multiple uplink carriers

For cases where the UL carrier group contains multiple carriers, it is mandatory for the network to send the PDCH Uplink Organization IE or PDCH ORGANIZATION message. The MES shall treat this as an error if the PDCH Uplink organization IE lists ARFCNs that are not in increasing order.

For example, in the 5x/1x, 1x, 1x, 1x, 1x case, the PDCH uplink organization list will have five entries with each entry specified with BW = 1 and corresponding ARFCNs. In the 5x/2x, 2x, 1x case the PDCH uplink organization list will have three entries and corresponding ARFCNs. Two entries will list BW=2 and one with BW=1.

The use of the 2x uplink carrier as two 1x carriers or contiguous 2x carriers is specified in the ULMAP. The use of PDCH3(2,6) is specified using two identical USF values.

Annex B (informative): RLC data block encoding

This annex is not used in GMR-1.

Annex C (informative): Message sequence diagrams

This annex is not used in GMR-1.

Annex D (informative): Examples of fixed allocation timeslot assignment

This annex is not used in GMR-1.

Annex E (informative): Repeated fixed allocations

This annex is not used in GMR-1.

Annex F (informative): Examples of countdown procedure operation

This annex is not used in GMR-1.

Annex G (informative): Handling of erroneous protocol data, examples

G.0 General

Procedures for the handling of erroneous protocol data are defined in clause 11.1. These procedures define error labels for the treatment of syntactical errors in a received message.

G.1 Application of error labels

An RLC/MAC control message description could have an error label included, as shown in the examples below.

```
< Packet XXX message content > ::=
  < FIELD_1 : bit (3) >
  < FIELD_2 : bit (16) >
  ...
  < spare padding >
  ! < Ignore : bit (*) = < no string > > ;
```

In the case of a complete message, the contents of the received syntactically incorrect message can be ignored.

Or

```
< PRECEDING_FIELD : bit (3) >
...
{ 00 < FIELD_1 : bit (10) >
  | 01 < FIELD_2 : bit (10) >
  ! < Ignore : bit (2+10) = < no string > > }
...
< FOLLOWING_FIELD : bit (8) >
```

The syntactically incorrect description within the { } brackets can be ignored, the correctly received descriptions preceding and following the { } brackets are accepted.

Or

```
< Structure 1 struct > ::=
  < FIELD_1 : bit (3) >
  { 1 < FIELD_2 : bit (8) > } ** 0
  ...
  ! < Ignore : bit (*) = < no string > > ;
```

The above description indicates that the syntactically incorrect structure can be ignored.

NOTE: When this structure is included in the description of a message, any description following the structure allows truncation.

G.2 Application of the "message escape" error label

The "Message escape" branch protects the comprehension of the description following bit "0", as shown in the example below.

```
< Packet YYY message content > ::= -- Protocol version 1
  < FIELD_1 : bit (3) >
  { 0 < FIELD_2 : bit (16) >
    ...
    < spare padding >
  ! <Message escape : 1 bit (*) = <no string> > } ;
```

The comprehension of "FIELD_2" is required. If the receiver detects bit "1", the "Message escape" branch is called and the remaining part of the message can be ignored.

The "Message escape" branch may be used to introduce a new alternative coding of the message in a later version of the protocol.

```
< Packet YYY message content > ::= -- Protocol version 2
  < FIELD_1 : bit (3) >
  { 0 < FIELD_2 : bit (16) >
    ...
    < spare padding >
  | 1 -- New code option, replacing old "Message escape":
    { 00 < FIELD_3 : bit (12) >
      ...
      < spare padding >
    ! <Message escape : { 01 | 10 | 11 } bit (*) = <no string> > } } ;
```

An alternative coding, including "FIELD_3", is introduced following "bit 1" in the former "Message escape" branch. A new "Message escape" is defined, this time using to control bits to allow future modification.

A receiver implemented according to the original syntax will not accept the new coding. The original "Message escape" branch will be called and the remaining part of the message, including "FIELD_3" is ignored. The content of "FIELD_1" (e.g. information to identify the receiver) is accepted and can be used to determine appropriate condition handling.

G.3 Application of truncated concatenation including "spare padding"

The truncated concatenation may include "spare padding" at the end of a message. In that case, the resulting concatenation fits exactly with the received message length, otherwise the message is syntactically incorrect.

The construction is useful, e.g. when a message ends with a sequence of optional components, where the transmitter may need to truncate trailing bits "0", indicating optional components not included in the message.

```
< Packet ZZZ message content > ::=
  ...
  { { 0 | 1 < Optional component 1 > }
    { 0 | 1 < Optional component 2 > }
    ...
    { 0 | 1 < Optional component N > }
  < spare padding > } // ;
```

If the optional components from k to N are not needed in the message, the transmitter may use the full message length for the components up to optional component k - 1. The receiver accepts this message and assumes that the choice bits for optional components from k to N are all set to zero (i.e. these components are not present).

However, if the receiver detects a syntactical error within one optional component which is indicated as present in the message, that results in a truncated concatenation which does not fit with the received message length. In this case, the receiver does not accept the message as being syntactically correct.

An error label may be provided within a truncated concatenation to allow the receiver to accept part of a concatenation in case of a syntactical error within it. This is useful for recurring components at the end of a message.

```
< Packet TTT message content > ::=
...
{ { 1 { < Recurring component > ! Ignore : bit (*) = < no string > } } ** 0
  < spare padding > } // ;
```

If one of the recurring components is syntactically incorrect, the error branch is called. The error branch expands to the end of the message. The tail bit "0", terminating the recursion, and the "spare padding" are truncated. The receiver accepts any syntactically correct instance of the recurring component preceding the syntactically incorrect one in the message.

G.4 Message extension using "padding bits"

The bit "0" in the first bit position of the "padding bits", see clause 11, may be altered into a bit "1" in future versions of the present document, in order to indicate an extension of the message content. When a message is received with bit "1" in this position, a receiver implemented according to the current version of the present document ignores the remaining part of the message.

The example show how a message can be extended, relying on the fact that the "padding bits" are defined with bit "0" in the first bit position.

```
< Packet UUU message content > ::= -- Current version of the present document
  < contents defined in current version >
  < padding bits > ;
```

The presence of the extension of the message content is indicated by bit "1". The transmitter sends a bit "1" in this position if any content is defined for the remaining part of the message. If a bit "0" is received in this position by a receiver in the new version, it ignores the remaining part of the message.

```
< Packet UUU message content > ::= -- Future version of the present document
  < contents defined in current version >
  { null | 0 bit** = < no string >           -- Receiver backward compatible with earlier version
    | 1                                     -- Bit "1" sent by transmitter in new version
    < contents defined in a future version >
    < padding bits > } ;
                                     -- New "padding bits" allows further extension
```

Annex H (informative): Bibliography

ETSI TS 101 349: "3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/ Medium Access Control (RLC/MAC) protocol (3GPP TS 04.60)".

Recommendation ITU-T I.130: "Method for the Characterization of Telecommunication Services Supported by an ISDN".

Recommendation ITU-T Q.65: "Stage 2 of the Method for Characterization of the Services Supported by an ISDN".

DIS 8886: "OSI Data Link Service Definition".

DIS 10022: "OSI Physical Service Definition".

ISO 10039: "Medium Access Control Service Definition".

ISO 4335: "HDLC Procedures".

ISO 7478: "Multilink Procedures".

ISO 7498: "OSI Basic Reference Model and Layer Service Conventions".

ETSI TS 101 376-3-21: "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 21: Position Reporting services; Stage 2 Service description; GMR-1 03.299".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

Annex I (informative): MES FER Calculation

For non-Transparent RLC mode in shared channel, the MES may calculate the FER based on the received and skipped block sequence numbers. The MES increments by one the number of successfully received RLC blocks when it receives an RLC block with sequence number SN that results in updating V(R). The MES increments number of lost packets based on skipped sequence numbers, that is when V(R) is updated to $V'(R) \neq [V(R)+1] \text{ modulo SNS}$. The MES calculates the FER as follows and encodes FQI as specified in ETSI TS 101 376-5-6 [15]:

- number of skipped sequence numbers / (number of received RLC blocks + number of skipped sequence numbers).

After reporting the FQI, the MES sets the number of received RLC blocks and number of skipped sequence numbers to zero.

For Transparent RLC mode in shared channel, the MES uses the flow TFI and the last MCS carrying the Transparent mode TBF to determine whether to include the downlink burst in calculating the FER according to the following rules:

- If the received burst MCS on the assigned downlink MAC slot is same as the last MCS carrying the Transparent mode TBF, then the MES updates the number of CRC errors or number of CRC successes regardless of the TFIs in the RLC Blocks.
- If the received burst MCS on the assigned downlink MAC slot is less robust than the last MCS carrying the Transparent mode TBF, then the MES does not update the number of CRC errors nor number of CRC successes, unless the burst is successfully received and contains the MES Transparent mode flow, in which case the number of CRC successes should be updated.
- If the received burst MCS on the assigned downlink MAC slot is more robust than the last MCS carrying the Transparent mode TBF, then the MES updates only the number of CRC errors if there is a CRC error.

The MES calculates the FER as follows and encodes FQI as specified in ETSI TS 101 376-5-6 [15]:

- number of CRC errors / (number of CRC errors + number of CRC successes).

After reporting the FQI, the MES resets number of CRC errors and number of CRC successes.

History

Document history		
V2.1.1	March 2003	Publication
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V2.3.1	July 2008	Publication
V3.1.1	July 2009	Publication
V3.2.1	February 2011	Publication
V3.3.1	December 2012	Publication
V3.4.1	October 2015	Publication
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