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Technical Specification

**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**



Reference

DTS/SES-001-GMPRS-1-04060

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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 1.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, 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 04.004";

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 04.007";

Sub part 8: "Mobile Radio Interface Layer 3 Specifications; GMR-1 04.008";

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 GMPRS-1 04.060".

Part 5: "Radio interface physical layer specifications";

Part 6: "Speech coding specifications";

Part 7: "Terminal adaptor specifications".

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 specification is part of the GMR Release 2 specifications. Release 2 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.)

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.

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

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

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

where:

- xx.0yy ($z = 0$) is used for GMR specifications that have a corresponding GSM specification. In this case, the numbers xx and yy correspond to the GSM numbering scheme.
- xx.2yy ($z = 2$) is used for GMR specifications that do not correspond to a GSM specification. In this case, only the number xx corresponds to the GSM 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 specifications as follows:

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

NOTE 1: Any references to GSM 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 specification.

- If a GMR specification does not exist, the corresponding GSM specification may or may not apply. The applicability of the GSM specifications is defined in GMR-1 01.201 [19].

NOTE 2: The present specification is based on the GSM 04.60 specification [21], and the clause numbering has been aligned to the numbering in GSM 04.60 where possible. Some clauses of GSM 04.60 are not applicable to the present document and these unused clauses have been replaced with void clauses in order to preserve the alignment of the clause numbering.

1 Scope

The present document specifies the procedures used at the radio interface (Reference Point Um, see GMR-1 04.002 [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. GMPRS-1 03.064 [5] contains an overview of the GPRS radio interface (Um).

GMR-1 04.003 [7] and GMR-1 04.004 [8] contains the definition of the control channels used in the present document.

GMPRS-1 04.007 [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.

GMPRS-1 04.008 [11] contains the definition of GMPRS RLC/MAC procedures when operating on the Common Control Channel (CCCH).

GSM 04.64 [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 GMR-1 04.003 [7]. They use the functions and services provided by layer 1 defined in GMR-1 04.004 [8]. GMPRS-1 04.007 [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 GMPRS-1 05.002 [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

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

- [1] GMR-1 01.004 (ETSI TS 101 376-1-1): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms; GMR-1 01.004".
- [2] GSM 02.60 (ETSI EN 301 113): "Digital cellular telecommunications system (Phase 2+) (GSM); General Packet Radio Service (GPRS); Service description; Stage 1 (GSM 02.60 version 6.3.1 Release 1997)".
- [3] GMPRS-1 03.003 (ETSI TS 101 376-3-3): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service; Part 3: Network specifications; Sub-part 3: Numbering, Addressing and identification; GMPRS-1 03.003".
- [4] GMR-1 03.013: "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 7: Discontinuous Reception (DRX); GMR-1 03.013".
- [5] GMPRS-1 03.064 (ETSI TS 101 376-3-22): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 3: Network specifications; Sub-part 22: Overall description of the GMPRS radio interface; Stage 2; GMPRS-1 03.064".
- [6] GMR-1 04.002: "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".
- [7] GMR-1 04.003: "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 3: Channel Structures and Access Capabilities; GMR-1 04.003".
- [8] GMR-1 04.004: "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 4: Layer 1 General Requirements; GMR-1 04.004".
- [9] GMR-1 04.005: "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 5: Data Link Layer General Aspects; GMR-1 04.005".
- [10] GMPRS-1 04.007 (ETSI TS 101 376-4-7): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 4: Radio interface protocol specifications; Sub-part 7: Mobile Radio Interface Signalling Layer 3 General Aspects; GMPRS-1 04.007".
- [11] GMPRS-1 04.008 (ETSI TS 101 376-4-8): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications; GMPRS-1 04.008".
- [12] GSM 04.64 (V6.5.1): "Digital cellular telecommunications system; General Packet Radio Service (GPRS); Logical Link Control (LLC)".
- [13] GMPRS-1 05.002 (ETSI TS 101 376-5-2): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description; GMPRS-1 05.002".
- [14] GMPRS-1 05.003 (ETSI TS 101 376-5-3): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 3: Channel Coding; GMPRS 1 05.003".

- [15] GMPRS-1 05.008 (ETSI TS 101 376-5-6): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 5: Radio interface physical layer specifications; Sub-part 6: Radio Subsystem Link Control; GMPRS-1 05.008".
- [16] GMPRS-1 05.010 (ETSI TS 101 376-5-7): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 7: Radio Subsystem Synchronization; GMPRS-1 05.010".
- [17] GMPRS-1 05.005 (ETSI TS 101 376-5-5): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception; GMPRS-1 05.005".
- [18] GSM 03.60 (ETSI TS 101 344): "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Service description; Stage 2 (3GPP TS 03.60 version 6.10.1 Release 1997)".
- [19] GMPRS-1 01.201 (ETSI TS 101 376-1-2): "GEO-Mobile Radio Interface Specifications (Release 2); General Packet Radio Service; Part 1: General specifications; Sub-part 2: Introduction to the GMR-1 family; GMPRS-1 01.201".
- [20] GMR-1 02.011: "GEO-Mobile Radio Interface Specifications; Part 2: Service specifications; Sub-part 1: Service Accessibility; GMR-1 02.011".
- [21] GSM 04.60 (ETSI TS 101 349): "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 04.60 version 6.13.0 Release 1997)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMR-1 01.004 [1] and the following apply:

Frame period: one MAC-slot on a PDCH for all PDCHs allocated to the mobile earth station within the 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 GMPRS-1 05.002 [13].

NOTE 2: The mobile earth station may indicate different multislot classes for circuit mode services and for GMPRS (see GMPRS-1 04.008 [11]). Different multislot class mobile earth stations are capable of supporting different medium access modes (see clause 5.2.4).

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

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

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 GMR-1 04.004 [8])

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

NOTE: For such random values refer to GMPRS-1 04.008 [11].

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

NOTE: See clause 10 and GMR-1 04.004 [8]

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

NOTE: See clause 10.3.

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

NOTE: See clause 10.2.

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

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

Temporary Block Flow (TBF): physical connection used by the two RR peer entities to support the unidirectional transfer of LLC PDUs on packet data physical channels

NOTE: See clause 5.2.1.

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

NOTE: See clause 5.2.3, clause 10 and GMPRS-1 05.002 [13].

GMPRS-1 also uses some GSM definitions and the relevant GSM/GPRS specific definitions can be found in GSM 02.60 [2] and GSM 03.60 [18].

3.2 Abbreviations

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

MAC	Medium Access Control
MCS	Modulation and Coding Scheme.
RLC	Radio Link Control

4 Layered overview of radio interface

The Radio Resource 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 basis. The packet logical channel PBCCH is not supported in GMR-1.

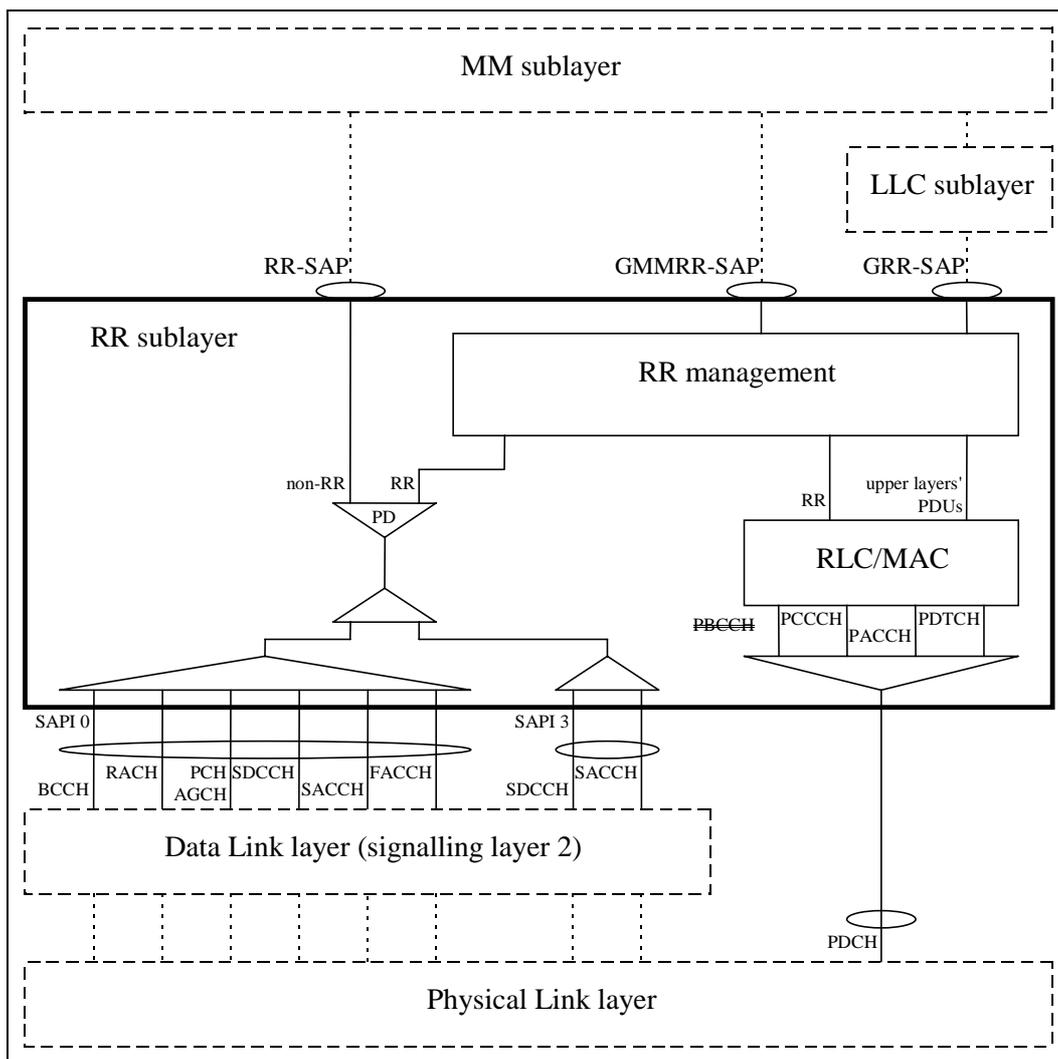


Figure 4.1: Protocol architecture of Radio Resource (RR) sublayer and RLC/MAC function

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 provides also link adaptation.

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 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 GMPRS-1 04.007 [10].

4.4 Services required from lower layers

The RLC/MAC function uses the services provided by the physical link layer as defined in GMR-1 04.004 [8].

The RR sublayer may use the services provided by the data link layer as defined in GMR-1 04.005 [9]. Moreover, the RR sublayer directly uses services provided by the physical layer such as BCCH searching, as defined in GMR-1 04.004 [8].

5 Introduction to the Medium Access Control (MAC) procedures

5.1 General

The Medium Access Control 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 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. Moreover, the Medium Access Control 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 GMPRS-1 05.008 [15]).

5.2 Multiplexing principles

5.2.1 Temporary block flow

A Temporary Block Flow (TBF) is a physical connection used by the two RR entities to support the unidirectional transfer of LLC 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 LLC PDUs. A TBF is temporary and is maintained only for the duration of the data transfer (i.e. until there are no more RLC/MAC blocks to be transmitted and, in RLC acknowledged mode, all of the transmitted RLC/MAC blocks have been successfully acknowledged by the receiving entity). The network sets the TBF mode in the PACKET UPLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT, or IMMEDIATE ASSIGNMENT message.

5.2.2 Temporary flow identity

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 identification includes 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 direction in which the RLC/MAC control message is sent and the message type are 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. 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. 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 GMPRS-1 05.002 [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.

Currently only one multislot class type of mobile earth station is defined, refer to GMPRS-1 05.002 [13]. It shall be capable of full duplex operation over all 8 MAC-slots.

The network shall ensure that the medium access mode and the resource allocation used for a mobile earth station is compatible with the multislot class of the mobile earth station (the mobile earth station MES multislot class is defined in GMPRS-1 05.002 [13]).

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 mobile, the network must code the PUI using the defined mechanism and format and the USF must point to the next uplink Mac-slot.

The dynamic allocation using USF granularity requires that a GMPRS MES can read the USF in a block intended for any future MES. Any future air interface will leave the PUI coding and modulation format intact, including the position of the USF and the MCS. This permits a standard GMPRS MES to detect the USF in blocks transmitted to future MESs supporting an enhanced air interface.

For MES synchronization, the first part of every downlink burst contains a unique word sequence modulated using $\Pi/4$ CQPSK; refer to GMPRS-1 05.002 [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 a LLC 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 LLC PDUs between the network and the mobile earth station. Continuous transfer of one or more LLC PDUs is possible. Concurrent TBFs may be established in opposite and/or same directions. The RR sublayer provides the following services:

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

When a transfer of LLC PDUs terminates, in either 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.

5.5 General procedures in packet idle and packet transfer modes

5.5.1 Mobile earth station side

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 clauses 5.5.1.3. The determination of the paging group for the mobile earth station is defined in GMPRS-1 05.002 [13].

5.5.1.1 Cell reselection

Spotbeam reselection procedure shall be as defined in GMPRS-1 05.008 [15].

5.5.1.2 System information on PBCCH

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

5.5.1.3 System information on BCCH

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 BCCH_Global_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 GMPRS-1 04.008 [11].

5.5.1.3.2 GPRS SI reception failure

Failure to receive GPRS SI is described in GMPRS-1 05.008 [15].

5.5.1.4 Acquisition of system information on the broadcast channel

System information shall be acquired on BCCH when the mobile earth station is in packet idle mode only and shall be as specified in GMPRS-1 04.008 [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 GMPRS-1 05.002 [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.

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 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 clause 12.8. The frequency parameters shall consist of an ARFCN and a bandwidth information for the downlink, and an indication of the uplink ARFCN as a differential encoding of the downlink ARFCN and bandwidth information for the uplink. Also refer to GMPRS-1 05.005 [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 segment 2 and 3 messages are regularly broadcast by the network on the BCCH to support GPRS. 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 GMPRS-1 04.008 [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 GMPRS-1 04.008 [11].

5.5.2.2 Paging

Paging using PCCCH is not supported in GMR-1.

5.6 Measurement reports

Measurement reports are not supported in GMR-1.

6 Paging procedures

For a mobile earth station in packet idle mode, the network can set up a downlink packet transfer by the paging procedures. The paging procedure 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 GMPRS-1 04.008 [11].

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

6.1 Paging procedure for RR connection establishment

Paging for the purpose of RR connection establishment is only supported by transmitting a page message on CCCH. Refer to GMPRS-1 04.008 [11] for details.

6.2 Paging procedure for downlink packet transfer

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 GMPRS-1 05.002 [13] and GMR-1 03.013 [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 GMPRS-1 04.008 [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 GMPRS-1 05.010 [16].

NOTE: The mobile earth station initiates an implicit packet paging response by sending an LLC PDU to the network as defined in GSM 04.64 [12] and GMPRS-1 04.008 [11].

7 Medium Access Control (MAC) procedures on PCCCH

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 GMPRS-1 04.008 [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 GMPRS-1 05.002 [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.

On detecting the assignment of new a TLLI or if specifically instructed by the LLC, 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 GMPRS-1 04.008 [11].

7.1 TBF establishment initiated by the mobile earth station on PCCCH

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 GMPRS-1 04.008 [11]. The packet access on PCCCH shall be done using one phase (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 ACC_CONTR_CLASS 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 GMR-1 02.011 [20].

The network also broadcasts on BCCH a CELL_BAR_ACCESS bit and a CELL_BAR_ACCESS_EXTENDED bit. If the value of these two bits do not match, 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

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 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 GMPRS-1 04.008 [11].

For each PRACH attempt, 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 *r* for PACKET CHANNEL REQUEST 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 attempt.

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 messages are sent on PRACH and contain an indication of the type of access, the TLLI to identify the MES, and parameters indicating the mobile earth station demand for radio resource.

The PACKET CHANNEL REQUEST message contains 64 bits of information. The mobile earth station shall 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 1/2 rate coding for a PDCH(4,3) in the uplink direction. If the demand is greater than 63 RLC blocks, a value of 63 shall be used. 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.

If a PACKET DOWNLINK ASSIGNMENT is received by the mobile during the packet access procedure, the terminal 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 message; in case of a PACKET CHANNEL REQUEST 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 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 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 GMPRS-1 04.008 [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 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 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 mobile 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 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 REQUESTs, stop timer T3170 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 message

On receipt of a PACKET CHANNEL REQUEST 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 PDTCH 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 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, 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 is identical to the previous one (except in terms of number of blocks required) but has not started receiving data from the mobile 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 mobile corresponding to allocations made for that PACKET UPLINK ASSIGNMENT or if the new PACKET CHANNEL REQUEST 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 messages, the mobile earth station shall stop timer T3170 or T3186 if running, stop sending PACKET CHANNEL REQUEST 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. The MES shall then continue with the one phase packet access procedure described in clause 7.1.2.3.

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 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 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 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 messages.

If an erroneous PACKET UPLINK ASSIGNMENT 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 an other spotbeam after successful spotbeam reselection.

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

7.1.2.3 One phase packet access completion

The one phase packet access procedure is completed upon the reception of PACKET UPLINK ASSIGNMENT message with the same TLLI 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 preconception prior to transmission of channel request as specified in GMPRS-1 05.010 [16] and GMPRS-1 04.008 [11] and the initial timing and frequency correction may be provided in the PACKET UPLINK ASSIGNMENT in the PACKET LINK SYNCHRONIZATION field.

Thereafter the timing and frequency advance is updated by PACKET LINK SYNCHRONIZATION 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 GMPRS-1 05.010 [16]).

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 terminal shall perform an abnormal release with random access on the RACH channel.

7.1.3 Void

7.1.4 Initiation of TBF Establishment on CCCH

Initiation of access for TBF establishment on CCCH is as specified in GMPRS-1 04.008 [11].

On reception of IMMEDIATE ASSIGNMENT TYPE 2 on the AGCH, the MES shall switch to assigned PDCH as specified in GMPRS-1 04.008 [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, the MES is time synchronized with the network. So re-initiation of access procedures are 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 in a mode or 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.

7.2 TBF establishment initiated by the network on CCCH

7.2.1 Entering the packet transfer mode

The procedure is triggered by a request from upper layers on the network side to transfer a LLC 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 classmark to be associated with the packet transfer. The request is implicit when receiving a LLC 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 mobile station 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 GMPRS-1 05.002 [13] and GMPRS-1 04.008 [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 mobile station in packet idle mode (see GMPRS-1 05.002 [13]). The multislot capabilities of the mobile station must 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 terminal 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 GMPRS-1 05.010 [16] and GMPRS-1 03.064 [5]).

When receiving the IMMEDIATE ASSIGNMENT TYPE 3 message the mobile station 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 mobile station shall abort the procedure and return to packet idle mode. If the terminal had transmitted a RACH message prior to receiving the IMMEDIATE ASSIGNMENT 3 message, it shall proceed as defined in GMPRS-1 04.008 [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 mobile station side of the new TBF before mobile station has successfully entered the packet transfer mode, the newly reserved resources are released; the subsequent behaviour of the mobile station 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 MS 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 terminal receives the initial assignment or it expires while the terminal is waiting for its first assigned correction MAC-slot OR the first TAI MAC-slot, the terminal 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

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 GMPRS-1 04.008 [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 message as described in clause 8.1.1.1.3.

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

8.1 Transfer of RLC data blocks

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

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

- 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 in the PACKET UPLINK ASSIGNMENT message;
- a set of PDCHs to be used for the uplink transfer.

In case of retransmission of RLC data blocks, the MES shall use the same MCS that was used in the initial transmission.

Upon receipt of a PACKET UPLINK ASSIGNMENT message, the mobile earth station shall be ready to transmit in accordance with the requirements given in GMPRS-1 05.010 [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).

8.1.1.1 Dynamic allocation uplink RLC data block transfer

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, 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 GMPRS-1 05.010 [16]. Whenever the mobile earth station detects an assigned USF value on an assigned PDCH, the mobile earth station shall transmit a single RLC/MAC block on the same PDCH. The time relation between an uplink Mac-slot, which the mobile earth station shall use for transmission, and the occurrence of the USF value is defined in GMPRS-1 05.010 [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 transmits an RLC/MAC block to the network, it shall start timer T3180. When the mobile earth station detects an assigned USF value on an assigned PDCH, 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, it shall reset counter N3101. The network shall increment counter N3101 for each Mac-slot allocated to that mobile earth station, for which no data is received. If $N3101 = N3101_{max}$, the network shall stop the scheduling of Mac-slots from the mobile earth station and start timer T3169. When T3169 expires, the network may reuse the USF and TFI.

8.1.1.1.1 PACCH operation

The mobile earth station shall attempt to decode every received downlink RLC/MAC block on all 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 an Mac-slot assigned to it on any assigned PDCH, the mobile earth station may transmit PACCH blocks starting the same PDCH in the next MAC-slot. The network shall set the USF value to reserved in downlink MAC slot which has UUG (in RLC/MAC header) setting indicating a MAC slot allocations. The terminal shall always send the polled control information on the allocated MAC-slots.

8.1.1.1.2 Resource reallocation for uplink TBF

During an uplink packet transfer, upper layers may request the transfer of an LLC PDU with different Radio Priority, peak throughput class, or RLC mode than the current uplink TBF. The UT may transfer the LLC PDU over the existing uplink TBF. Alternatively, the UT 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 LLC PDU.

8.1.1.1.3 Establishment of downlink TBF

During uplink transfer, the network may initiate a downlink TBF by sending a PACKET DOWNLINK ASSIGNMENT message to the mobile earth station on the PACCH. The multislot restrictions of the mobile earth station shall be observed.

The downlink radio resource is assigned to the mobile earth station in a PACKET DOWNLINK ASSIGNMENT message. On receipt of an assignment message, the mobile earth station shall switch to the assigned PDCHs, and start timer T3190. The operation of the downlink TBF follows the procedures in clause 8.1.2 with the following additions:

- the mobile earth station shall prioritize transmission of RLC/MAC control blocks associated with the downlink TBF over RLC/MAC control blocks associated with the uplink TBF;
- if a timer or counter expiry causes the uplink TBF to be aborted in the mobile 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).

8.1.1.1.3.1 Abnormal cases

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 mobile earth station shall abort the procedure and continue the normal operation of the uplink TBF, if present.

8.1.1.2 Void

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 and follow the abnormal release with random access procedure (see clause 8.7.2).

8.1.1.5 Abnormal cases

The following abnormal cases apply:

- If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT 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 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 or a PACKET DOWNLINK ASSIGNMENT message specifying frequencies that are not all in one band then the mobile shall perform an abnormal release with random access (see 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.

8.1.2 Downlink RLC data block transfer

Prior to the initiation of RLC data block transfer on the downlink, the network assigns the following parameters to the downlink TBF in the PACKET DOWNLINK ASSIGNMENT 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.

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

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

Upon reception of a complete downlink assignment, the mobile earth station shall start timer T3190 and then shall attempt to decode every downlink radio block received on every Mac-slot on its assigned PDCHs. If the mobile earth station receives a valid RLC/MAC block carrying the TFI of the downlink TBF in the RLC/MAC header, the mobile earth station shall restart timer T3190. If timer T3190 expires, the mobile earth station shall perform an abnormal release with return to CCCH

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

8.1.2.2 Polling for packet downlink ACK/NACK

Whenever the mobile earth station receives an RLC/MAC block addressed to itself by a downlink TFI for an 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 GMPRS-1 05.005 [17] for definition of "next") uplink 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.

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. The network shall increment counter N3105 for each Mac-slot allocated to that mobile earth station using 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. 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 GMPRS-1 05.002 [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.

8.1.2.3 Void

8.1.2.4 Resource reassignment for downlink

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 message containing the desired RLC mode, a set of PDCHs. The mobile station shall start monitoring the new set of PDCHs assigned to the downlink TBF.

8.1.2.4a Establishment of downlink TBF after downlink TBF release

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 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 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.. The mobile earth station shall perform time/frequency synchronization using the TAI assigned by the previously received assignment message.

8.1.2.4a.1 Abnormal cases

If a mobile earth station receives a PACKET DOWNLINK ASSIGNMENT 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 the mobile earth station has an existing downlink TBF, and T3192 is not running, and receives a PACKET DOWNLINK ASSIGNMENT requesting the establishment of a new 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 requesting the establishment of a new 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.

8.1.2.5 Establishment of uplink TBF

The mobile earth station may request establishment of an uplink transfer during a downlink TBF by initiating PRACH access as specified in clause 7.1.2. 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 a LLC 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, 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 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 an other 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.

8.1.2.5.1 Abnormal cases

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 8.7.1).
- 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.

8.1.2.6 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 specified.

If there is no on-going uplink TBF, the mobile earth station 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.

8.1.3 Void

8.1.4 Multiplexing of control and data messages

An RLC/MAC block in both acknowledged and unacknowledged mode may constitute multiplexed control blocks and a RLC data block. Each RLC/MAC block shall be capable of multiplexing at most two control blocks of 18 octets each along with a single RLC block. The multiplexed RLC block shall occupy variable number of octets depending on the MCS and the number of control blocks multiplexed.

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 Downlink Ack 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 must 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, an Uplink Ack message always takes precedence of pending RLC blocks for retransmissions.

8.2 Packet PDCH release

This function is not supported by GMR-1.

8.3 Procedure for measurement report sending in Packet Transfer mode

This function is not supported by GMR-1.

8.4 Cell change procedures in packet transfer mode

This function is not supported in GMR-1.

8.5 Measurement order procedures in packet transfer mode

This function is not supported in GMR-1.

8.6 Packet control acknowledgement

A PACKET CONTROL ACKNOWLEDGEMENT message shall always be sent in the uplink Mac-slot specified by the corresponding valid UUG field of a downlink RLC/MAC control block, and not in any other uplink 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.

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 mobile 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

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 is scheduled to it (refer GMPRS-1 05.010 [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.

9 Radio link control (RLC) procedures in packet transfer mode

The RLC function is responsible for:

- interface primitives allowing the transfer of Logical Link Control layer PDUs (LLC PDU) between the LLC layer and the MAC function;
- segmentation of LLC PDUs into RLC data blocks and re-assembly of RLC data blocks into LLC PDU;
- 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.

9.1 Procedures and parameters for peer-to-peer operation

A TBF is comprised of two peer entities RLC endpoints. Each RLC endpoint has a receiver that receives RLC/MAC blocks. Each RLC endpoint also has a transmitter that transmits RLC/MAC blocks.

Each endpoint's receiver has a receive window of size WS (see 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, $[V(S) - V(A)]$ modulo SNS $\leq WS$.

9.1.3 Acknowledge state array $V(B)$

9.1.3.1 Acknowledge state array $V(B)$ for GPRS TBF Mode

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. As each RLC data block is transmitted the corresponding element in $V(B)$ is set to the value PENDING_ACK.

If $[V(S) < V(A) + WS]$ 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 $V(S) = V(A) + WS$ 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. $[V(A) > BSN$ or $BSN \geq V(S)]$ 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(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 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. $[V(Q) \leq \text{BSN} < V(Q) + \text{WS}]$ 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

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 $[V(A) < \text{BSN} < V(S)]$ modulo SNS.

These inequalities shall be interpreted in the following way:

- BSN is valid if, and only if, $[\text{BSN} - V(A)]$ 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 $[(Q) + 1]$ modulo SNS to $[V(R) - 1]$ modulo SNS. This global number of elements is less than or equal to WS. For each bit in the bitmap, the bit is assigned the value "1" if the corresponding element in $V(N)$ indexed relative to SSN has the value RECEIVED. The bit is assigned the value "0" if the element in $V(N)$ has the value INVALID.

From the FRB, a 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.

9.1.8.1.2 Interpretation of the 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 mobile station 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 can not 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 GMPRS-1, 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 Void

9.1.11 Segmentation of LLC PDUs into RLC data units

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

If a LLC 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 LLC 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 LLC PDU fragment in the RLC data block. The LastPartSize field in the header is set to zero if a new LLC PDU starts at the beginning of the RLC data block. If the RLC data block begins with the last fragment of the previous LLC 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 LLC PDU, the LastPartSize is set to the value 0xFF. The received (and segmented) LLC PDUs shall be put into RLC data blocks in the same order as they are received from higher layers. A 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 LLC PDUs on the receiving side.

In GMPRS 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 LLC PDUs from RLC data units

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

If the received LastPartSize is zero, a new LLC 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 LLC PDU.

The 0xFF value of LastPartSize indicates that the RLC data block contains a LLC 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 a LLC PDU.

If the Last Part Size is neither 0x00 nor 0xff, then the 2 octets immediately following the end of the current LLC PDU shall be considered to be the length of the next LLC PDU. If the most significant byte of the LLC 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 LLC PDUs shall be delivered to the higher layer in the order in which they were originally transmitted.

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

The size of the LLC PDU delivered to the higher layer shall not exceed 1560 octets. If the contents of the LLC PDU length octets indicates a size greater than 1560 octets, the receiver shall perform abnormal release of the TBF. If the contents of the LastPartSize field does not correspond to the expected length, as read from the two octets of the LLC PDU length field, the receiver shall perform abnormal release of the TBF.

9.1.12a Void

9.1.12b Void

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

The RLC ARQ functions support two modes of operation: RLC acknowledged mode, and RLC unacknowledged mode. RLC acknowledged mode operation uses retransmission of RLC data blocks to achieve high reliability. RLC unacknowledged mode operation does not utilize retransmission of RLC data blocks. A TBF may operate in either RLC acknowledged mode or RLC unacknowledged mode.

The mobile 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.

9.3.1 Void

9.3.2 Acknowledged mode operation

The transfer of RLC data blocks in the RLC acknowledged mode uses retransmissions of RLC data blocks. The transmitting side numbers the RLC data blocks via the 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 terminal of the coding scheme to be used for the current assignment; refer to GMPRS-1 03.064 [5]. The signal quality report generated as specified in GMPRS-1 05.008 [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 Void

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. RLC/MAC control blocks have preference over RLC data blocks, i.e. temporarily replacing the PDTCH with PACCH.

The network shall send PACKET UPLINK ACK/NACK messages when needed.

The timer T3180 shall be started by the mobile earth station on every transmission 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 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 terminal sends a block with a non-zero UD value to the network. 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 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 LLC PDU boundary. This is triggered, for example, when a new TLLI is assigned by upper layers to the RLC/MAC entity.

When the network detects the ITR bit set, it should respond immediately with a PACKET UPLINK ACK/NACK 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 with the Final Ack Indicator set. Once the mobile earth station gets a PACKET UPLINK ACK/NACK 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 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 terminal 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 uplink TBF exists without 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 releases the TBF by transmitting a PACKET UPLINK ACK/NACK 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 message. When the network receives acknowledgement message in the 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 indicated by the UUG field in the PACKET UPLINK ACK/NACK message with the FAI bit set, it shall increment counter N3103 and retransmit the PACKET UPLINK ACK/NACK 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 in an RLC/MAC block.

As long as T3182 is running the mobile earth station may receive additional uplink 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 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 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 LLC 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 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 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 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 block with the Final Block Indicator (FBI) set to the value "1" and with a valid UUG field. If the RLC/MAC block contains an RLC block, it must 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.

If the mobile earth station receives an RLC/MAC block, which may or may not contain an RLC block with a valid UUG field indicating a poll for a control packet, the mobile earth station shall transmit a PACKET DOWNLINK ACK/NACK message in the specified uplink 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 all data blocks have been received, the mobile earth station shall send the 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 network receives a 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 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 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 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 mobile shall apply DRX mode procedures as specified in clause 5.5.1.4.

9.3.3 Unacknowledged mode operation

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 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 mobile 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 terminal 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 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 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 mobile 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 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 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 must 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 specified by the UUG field. The mobile earth station shall continue to read the assigned downlink PDCHs until the frame period pointed to 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 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 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 mobile shall apply DRX mode procedures as specified in clause 5.5.1.4.

9.4 Abnormal release cases

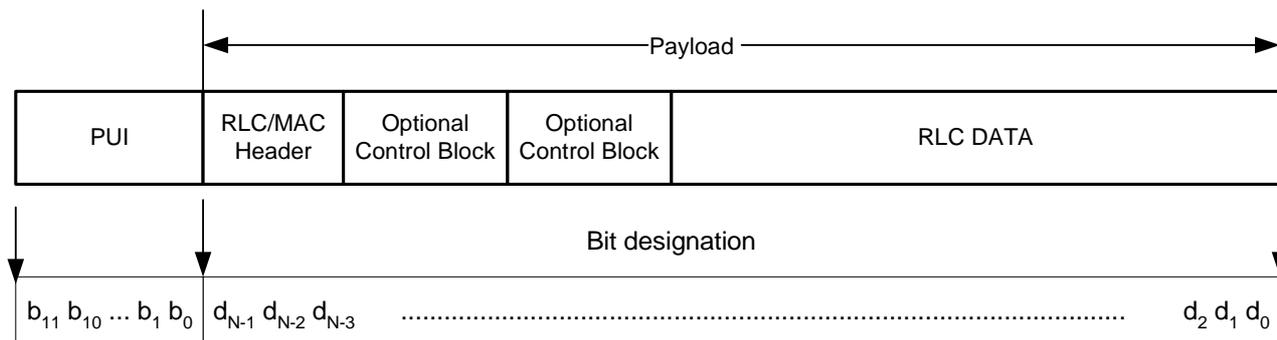
9.4.1 Abnormal release with random access

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.

10 RLC/MAC block structure



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

Figure 10.1: RLC/MAC block structure

10.1 Radio block structure

The radio block structure is same for transfer of control and data messages. Also, GMPRS and future enhancements shall have the same structure. Refer to figure 10.1.

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 GMPRS-1 05.003 [14] for details.

The coding of MCS bits with payload capacity for different bandwidth channel is given below:

MCS value	Modulation	Coding Rate	Bandwidth	Payload octets	N
0000	$\pi/4$ - CQPSK	Rate = $\sim R1/2$	4	47	376
			5	60	480
0001	$\pi/4$ - CQPSK	Rate = $\sim R5/8$	4	59	472
			5	76	608
0010	$\pi/4$ - CQPSK	Rate = $\sim R3/4$	4	71	568
			5	91	728
1111	NA	NA			

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

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. The control block shall be 18 octets with maximum of up to 2 control blocks per burst. The rest of the octets shall be occupied by an RLC data block which can contain octets from one or more LLC PDUs.

10.2 Public information bits

The PUI consists of 12 bits. These are used as given in the table below for the downlink and uplink respectively (the MSB is on the left hand side):

Table 10.1: Downlink and uplink PUI field coding

MCS bits ($b_{11} - b_8$)	USF bits ($b_7 - b_2$)	Spare ($b_1 - b_0$)
MCS bits ($b_{11} - b_8$)	Uplink PAN field ($b_7 - b_2$)	Spare ($b_1 - b_0$)

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 UT power control.

The 12 bit PUI header is subsequently Golay coded using a (24,12) Golay code. Refer to GMPRS-1 05.003 [14] for details.

10.3 RLC/MAC header

10.3.1 Downlink RLC/MAC header

	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, PC (5 - 0)					
Octet 5	TFI (6 - 0)							E

10.3.2 Uplink RLC/MAC header

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type		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

10.4 Header fields

10.4.1 Uplink state flag (USF) field

The USF field is sent in all downlink RLC/MAC blocks and indicates the owner or use of the next uplink MAC-slot on the same PDCH (see GMPRS-1 05.002 [13]). 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.

10.4.2 Void

10.4.3 Stall indicator (SI) bit

The Stall indicator (SI) bit indicates whether the mobile's RLC transmit window can advance (i.e. is not stalled) or can not advance (i.e. is stalled). The mobile earth station shall set the SI bit in all uplink RLC data blocks.

Table 10.2: 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.

Table 10.3: 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

This field is used by the network to allocate a Mac-slots starting the next uplink frame to the mobile earth station.

Table 10.5: 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 Poll
1	0 1	Single 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. 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.

10.4.6 Void

10.4.7 Payload type field

The Payload Type field shall indicate the type of data contained in remainder of the RLC/MAC block. The encoding of the Payload Type field is shown in table 10.6.

Table 10.6: Payload type field

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

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 Void

10.4.9 Void

10.4.9a Void

10.4.9b Void

10.4.9c Void

10.4.9d Direction (D) bit

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

Table 10.9: Direction (D) bit

bit	Direction (D) bit
1	
0	TFI field identifies an uplink TBF
1	TFI field identifies a downlink TBF

10.4.10 Temporary flow identifier (TFI) field

10.4.10.1 Downlink header TFI

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 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.

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

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

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.

10.4.10.2 Uplink header TFI

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 7 bits long and is encoded as a binary number with range 0 to 127.

There are three uplink RLC/MAC block payload types: data-only, control-only, and data+control. The addressing for each of these payload types is described below.

10.4.10.2.1 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

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

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) field

Power Control field shall be used in the downlink to indicate the PAR values as defined in GMPRS-1 05.008 [15].

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
1	
0	Extension octet follows immediately
1	No extension octet follows

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 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. This field shall be interpreted as decimal equivalent of binary value i.e. 0 to 255.

The value 0 shall be used to indicate new LLC PDU starts in the RLC data block, i.e. no part of the previous LLC PDU is in the RLC data block.

The value 0xff (255) 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.

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 terminal. 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. The valid range of this field is from 127-0. If the number of blocks to be indicated is greater than 127, then the value of 127 is reported.

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

This clause defines the structure of the RLC/MAC control messages. These are non-standard L3 messages as defined in GMPRS-1 04.007 [10]. The formats for the messages are valid only for the PDCH. The format for RLC/MAC control messages for use on the CCCH are defined in GMPRS-1 04.008 [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 GMPRS-1 04.007 [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 GMPRS-1 04.008 [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 clause 11 and clause 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 GMPRS-1 04.007 [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 this EN, see GMPRS-1 04.007 [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

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 clause 11 and 12 define a specific interpretation for a "reserved" value, the specified interpretation takes precedence and the considered field remains syntactically correct.

Decoding a received message based on its CSN.1 description yields the complete acceptance or rejection of the message. Error handling allows a message to be partially accepted even when some parts are erroneous.

Error detection mechanisms are introduced to identify which parts of a message to be protected against which kinds of errors.

11.1.1 Message classification

The 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, 6, 7, 8 and 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

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

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 > > -- Ignore by indefinite length
```

Or

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

An "Ignore" error label shall be applied by the receiver of a downlink RLC/MAC control message when specified in the message description in 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.

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

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

11.1.3.3 "Message escape" error label

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

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

An "Message escape" error label shall be applied by the receiver of a downlink RLC/MAC control message when specified in the message description in 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.

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

11.1.4 Error detection and order of precedence

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 11.1.4, 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, 6, 7, 8 and 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, 6, 7, 8 and 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

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 of the present document.

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 of the present document.

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

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 Uplink Assignment	11.2.22
Downlink TBF establishment messages:	Reference
Packet Downlink Assignment	11.2.7
TBF release messages:	Reference
Packet TBF Release	11.2.19
Paging messages:	Reference
These messages are not supported	
RLC messages:	Reference
Packet Downlink Ack/Nack	11.2.6
Packet Uplink Ack/Nack	11.2.21
System information messages:	Reference
These messages are not supported	
Miscellaneous messages:	Reference
Packet Control Acknowledgement	11.2.2
Packet Downlink Dummy Control Block	11.2.8
Packet Uplink Dummy Control Block	11.2.8a
Packet Mobile TBF Status	11.2.9
Packet Link Control	11.2.13
Packet Link Quality Report	11.2.25

11.2.0 Message format

All RLC/MAC control messages, with the exception of the PACKET CHANNEL REQUEST message, follow the same non-standard format (see GMPRS-1 04.007 [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 00010 >	< Packet Downlink Assignment message content >
< MESSAGE_TYPE : bit (6) == 1 01010 >	< Packet Link Control message content >
< MESSAGE_TYPE : bit (6) == 0 01000 >	< Packet TBF Release message content >
< MESSAGE_TYPE : bit (6) == 0 01001 >	< Packet Uplink Ack/Nack message content >
< MESSAGE_TYPE : bit (6) == 0 01010 >	< Packet Uplink Assignment message content >
< MESSAGE_TYPE : bit (6) == 1 00101 >	< Packet Downlink Dummy Control Block message content >
! < Unknown message type : bit (*) = < no string >	
< CBF: bit(1);	< If set to 1, indicates that there is another
control block immediately following this one> >;	

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) == 000001 >      < Packet Control Acknowledgement message content > |
  < MESSAGE_TYPE : bit (6) == 000010 >      < Packet Downlink Ack/Nack message content > |
  < MESSAGE_TYPE : bit (6) == 000011 >      < Packet Uplink Dummy Control Block message
  content > |
  < MESSAGE_TYPE : bit (6) == 000100 >      < Packet Link Quality Report message content > |

  < MESSAGE_TYPE : bit (6) == 000110 >      < Packet Mobile TBF Status message content > |;

  < CBF: bit(1)
  immediately following this one > >;      < If set to 1, indicates that there is another control block

```

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 11.2: Packet ACCESS REJECT information elements

```

< Packet Access Reject message content > ::=

< Reject : < Reject struct > >
{ { 0 | 1 < Additional Reject: < Reject struct > > } ** 0
{ 0 | 1 < Additional Reject: < Reject struct > > }
< 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 11.3: Packet ACCESS REJECT information element details

<p>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 PACKET RESOURCE REQUEST message or a Channel Request Description IE contained in a PACKET DOWNLINK ACK/NACK message. This information field is defined in clause 12.16.</p> <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>Rid (2 bit field) The Rid is a extracted from the corresponding field in the Packet Channel Request to which the Reject corresponds to.</p> <p>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.</p> <p>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</p>
--

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 GMR-1 04.004 [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

<pre> < Packet Control Acknowledgement message content > ::= -- RLC/MAC control block format { 0 < reserved : bit (32) > 10 < Global TFI: Global TFI IE >> } < CTRL_ACK : bit (2) > {0 1 < SQIR : bit (6) >} < padding bits > ; </pre>

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.</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</p> <p><u>2 1</u></p> <p>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 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 GMPRS-1 04.008 [11]) when polling bit was set</p> <p>SQIR (6 bits) This field gives the signal quality as received by the MES. Refer GMPRS-1 05.008 [15] for details.</p>

11.2.3 Packet cell change failure

This message is not used in GMR-1.

11.2.4 Packet cell change order

This message is not used in GMR-1.

11.2.5 Packet channel request

This message is sent in random mode on the PRACH. It does not follow the basic format. The possible formats are presented directly below, without reference to information fields. The order of bit transmission is defined in GMR-1 04.004 [8].

The message is 64 bits long, and is coded as 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) >
   < Multislot Capability : bit (3) >
   < RF Power Capability Bits 1-3 : bit (3) >
   < SQIR : bit (6) >
< RF Power Capability Bit 4: bit (1) >
   < Spare : bit (2) > >
| 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 details

TLLI (32 bit field) The TLLI field is encoded as a binary number. Range 0 to 4294967295
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) This field indicates the peak throughput class for the PDP context of the LLC PDU that caused the Channel Request Description IE to be transmitted. The field is coded as the binary representation of the Peak Throughput Class specified in GSM 03.60 [18]. Range: 1 to 9
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 <u>2 1</u> 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 is defined in clause 12.32.
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
Multislot Class (3 bit field) This information field indicates the multislot class of the ME. The coding is defined in the following table. The semantics of this field is defined in GMPRS-1 05.002 [13], Annex B.
bit <u>3 2 1</u> 0 0 0 multislot class 1 other reserved values
RF Power Capability (4 bit field) This information field indicates the output radio power capability of the MES as defined in GMPRS-1 05.005 [17]
SQIR (6 bit field) Contains the SQIR based on the BCCH RSSI measurements. See GMPRS-1 05.008 [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 GMPRS-1 04.008 [11]).

11.2.6 GMPRS packet downlink Ack/Nack

This message is sent on the PACCH 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 < reserved : bit (24) >} {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 GMPRS-1 05.008 [15] for details.</p>
--

11.2.7 Packet downlink assignment

This message is sent on the PACCH by the network to the mobile earth station to assign downlink resources to the mobile earth station.

A mobile allocation or reference frequency list received as part of this assignment message shall be valid until a new assignment is received or each TBF of the MES are terminated.

Message type: PACKET DOWNLINK ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.10: Packet downlink assignment information elements

```

< 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 > > ;
    
```

Table 11.11: PACKET Downlink ASSIGNMENT information element details

<p>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.</p> <p>TLLI (32 bit field) This field is defined in clause 12.16.</p> <p>RLC_MODE (1 bit field) This field is defined in clause 12.32..</p> <p>MAC-SLOT_ALLOCATION (8 bit field) This field is defined in clause 12.18.</p> <p>Frequency Parameters This information element is defined in clause 12.8.</p> <p>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.</p>

11.2.8 Packet downlink dummy control block

This message is sent on the PCCCH or PACCH 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

<p>PERSISTENCE_LEVEL (4 bit field for each Radio Priority 1...4) This field is defined in clause 12.14, PRACH Control Parameters.</p>

11.2.8a Packet uplink dummy control block

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

Message type: PACKET UPLINK DUMMY CONTROL BLOCK

Direction: mobile earth station to network

Table 11.14: Packet uplink dummy control block information elements

<pre> < Packet Uplink Dummy Control Block message content > ::= { 0 < reserved : bit (32) > 10 < Global TFI: Global TFI IE >> } < SQIR : bit (6)> < padding bits > </pre>
--

Table 11.15: Packet uplink dummy control block 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>SQI Report (6 bit field) This field gives the signal quality as received by the MES. Refer to GMPRS-1 05.008 [15] for details.</p>
--

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

<pre> < 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 > ; </pre>

Table 11.17: Packet MOBILE TBF STATUS information element details

<p>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.</p> <p>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:</p> <table border="0"> <tr> <td>bit</td> <td></td> </tr> <tr> <td><u>3</u> <u>2</u> <u>1</u></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> <p>SQIR (6 bit field) This field gives the signal quality as received by the MES. Refer GMPRS-1 05.008 [15] for details.</p> <p>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.</p>	bit		<u>3</u> <u>2</u> <u>1</u>		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														
<u>3</u> <u>2</u> <u>1</u>														
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.													

11.2.10 Void

11.2.11 Packet PDCH release

This message is not used in GMR-1.

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 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 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.

Message type: **PACKET LINK CONTROL**
 Direction: network to mobile earth station
 Classification: distribution message

Table 11.21: Packet link control information elements

<pre>< Packet Link Control message content > ::= { 0 1 < Packet Link Synchronization : < Packet Link Synchronization IE > > } *4 < padding bits > ! < Distribution part error : bit (*) = < no string > > ;</pre>
--

Table 11.22: Packet power 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

This message is not used in GMR-1.

11.2.16.a 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

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 11.30: 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 11.31: 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

All other values are reserved.

11.2.20 Void

11.2.21 Packet uplink Ack/Nack

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.

Message type: PACKET UPLINK ACK/NACK

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.32: 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 Synch. IE > > } { 0 1 < Extension Bits : Extension Bits IE > } -- clause 12.26 < Ack/Nack Description : < 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 11.33: 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 indicates the channel coding scheme that the mobile earth station shall use when transmitting on the uplink. These are defined in 03.064.</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> <p>Extension Bits This information element, if present, shall be skipped over. Any information content shall be ignored by the mobile earth station. This information element is defined in clause 12.26.</p>

11.2.22 Packet uplink assignment

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. A mobile allocation or reference frequency list received as part of this assignment message shall be valid until new assignment is received or each TBF of the MES are terminated.

Message type: PACKET UPLINK ASSIGNMENT

Direction: network to mobile earth station

Classification: non-distribution message

Table 11.34: 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 Synch. : < Packet Link Synch. 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) >
  < reserved: bit (4) >
  < MAC-SLOT_ALLOCATION: bit (8) > -- Timeslot Allocation
  < reserved: bit(3)>
  < USF : bit (6) >
  
```

Table 11.35: 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 indicates the channel coding scheme that the mobile earth station shall use when transmitting data on the uplink. The coding of this field is defined in GMPRS-1 03.064.

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. This information element is encoded as the Starting Frame Number Description IE. See clause 12.21.

USF (6 bit field)
USF value for all allocated MAC-slots
These fields indicate the USF value assigned to the MES for all allocated MAC-slots (range 0 to 7). These fields are encoded as a binary presentation of the USF value as defined in clause 10.4.1.

11.2.23 Void

11.2.24 Void

11.2.25 Packet link quality report

This message is sent on the PACCH 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 11.36: PACKET LINK QUALITY REPORT information elements

<pre> < Packet Link Quality Report message content > ::= <{ Link Quality : <Link Quality Report IE > > < padding bits > ; </pre>
--

Table 11.37: PACKET LINK QUALITY REPORT information element details

<pre> Link Quality Report This information element is defined in clause 12.30. </pre>

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

<pre> < Ack/Nack Description IE > ::= <FINAL_ACK_INDICATION : bit (1) > <reserved; bit (1) > { 0 1 < Length: bit (7) > } <STARTING_SEQUENCE_NUMBER; bit (10) > {1 <UNCOMPRESSED_RECEIVED_BLOCK_BITMAP; bit (Lu) > 0 {<reserved > } }; </pre>
--

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. 0 retransmissions are requested and the TBF is incomplete. 1 no retransmissions are requested and this message indicates acknowledgement of all RLC data in the TBF.</p> <p>LENGTH (7 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 106 for Packet Downlink Ack/Nack and 11 to 100 for Packet Uplink Ack/Nack.</p> <p>STARTING_SEQUENCE_NUMBER (SSN) (10 bit field) Range 0 to 1023 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: $BSN = (SSN + bit_number) \text{ modulo } 1024$, for bit_number = 1 to Lu. The value of each bit is encoded as: 0 Negative acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ mod } 1024$ 1 Positive acknowledgement of the RLC data block with $BSN = (SSN + bit_number) \text{ mod } 1024$</p>

12.4 Void

12.5 Void

12.6 Void

12.7 Void

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 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 12.10: Frequency parameters information elements

<p>< Frequency Parameters IE > ::=</p> <ul style="list-style-type: none"> < Downlink BW: bit (3) > < Downlink ARFCN : bit (11) > < Downlink Frequency Plan Identifier: bit(1) > < Uplink BW: bit (3) > < Uplink Frequency Distance: bit (5) > <reserved: bit(3)>>

Table 12.11: Frequency parameters information element details

<p>Downlink BW (3 bit field) This field represents the bandwidth to be used for the PDCH-Carrier in multiples of 31.25 kHz, see GMPRS-1 05.005 [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) defined in GMPRS-1 05.005 [17]. Range 0 to 2048.</p> <p>Downlink Frequency Plan Identifier (1 bit) 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 GMPRS-1 05.005 [17].</p> <p>Uplink Frequency Distance (5 bit field) This field is the signed integer representation of the difference between the frequency derived from the ARFCN in the uplink spectrum (see GMPRS-1 05.005 [17]) and the actual uplink frequency in units of 15.625 kHz. Range +12 to -12. A positive value means that the uplink frequency has a greater absolute magnitude when translated to kHz.</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 GMPRS-1 05.005 [17]. Range: 1 to 7.</p>

12.9 Void

12.10 Global TFI

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

Table 12.13: Global TFI information elements

<pre>< Global TFI IE > ::= { 0 < UPLINK_TFI : bit (7) > 1 < DOWNLINK_TFI : bit (7) > } ;</pre>
--

Table 12.14: Global TFI information element details

<p>UPLINK_TFI (7 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 (7 bit field) This field identifies a downlink TBF. This field is coded the same as the TFI field defined in clause 12.15.</p>
--

12.10a Void

12.10b Void

12.10c Void

12.10d GMPRS modulation and coding scheme description

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

Table 12.15: GMPRS MCS information element details

Modulation and coding scheme	MCS value
MCS-1	0000
MCS-2	0001
MCS-3	0010
DTX	1111

All other values are reserved.

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 12.16: PRACH Control parameters information elements

```

< PRACH Control Parameters IE > ::=
  < MAX_RETRANS : bit (3) >
  < S : bit (2) >
  < TX_INT : bit (2) >
  { 0 <Reduced persistence level : bit(3)>
  | 1 < PERSISTENCE_LEVEL : bit (4) > * 4 } ;

```

Table 12.17: PRACH Control parameters information element details

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	
<u>2 1</u>	
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	
<u>2 1</u>	
0 0	S = 96
0 1	S = 112
1 0	S = 128
1 1	S = 144

All other values reserved.

Table 12.18: PRACH Control parameters information element details

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	
<u>3 2 1</u>	
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	
<u>4 3 2 1</u>	
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 12.19: UPLINK_TFI information element details

UPLINK_TFI (7 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 127	

Table 12.20: DOWNLINK_TFI information element details

<p>DOWNLINK_TFI (7 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 127</p>

12.16 Temporary logical link identity (TLLI)

The Temporary Logical Link Identity (TLLI) is associated with the GPRS subscriber. TLLI is defined in GMPRS 1 03.003 [3].

Table 12.21: TLLI information element details

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

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 12.23: MAC-SLOT_ALLOCATION information element details

<p>MAC-SLOT_ALLOCATION (8 bit field) 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 must be assigned. 0 Mac-slot is not assigned 1 Mac-slot is assigned</p>

12.19 Void

12.20 Void

12.21 Void

12.22 Void

12.23 Spotbeam identification

The Spotbeam Identification information element is used to uniquely identify the cell.

Table 12.27: Cell identification information element

<p>< Cell Identification IE > ::=</p> <table> <tr> <td>< Location Area Identification IE : octet (5) ></td> <td>-- GMPRS-1 04.008 [11]</td> </tr> <tr> <td>< RAC : bit (8) ></td> <td></td> </tr> <tr> <td>< Spotbeam Identity IE : octet (2) > ;</td> <td>-- GMPRS-1 04.008 [11]</td> </tr> </table>	< Location Area Identification IE : octet (5) >	-- GMPRS-1 04.008 [11]	< RAC : bit (8) >		< Spotbeam Identity IE : octet (2) > ;	-- GMPRS-1 04.008 [11]
< Location Area Identification IE : octet (5) >	-- GMPRS-1 04.008 [11]					
< RAC : bit (8) >						
< Spotbeam Identity IE : octet (2) > ;	-- GMPRS-1 04.008 [11]					

Table 12.28: Cell identification information element details

<p>Location Area Identity IE (5 octet field) This field is coded using the V format of the type 3 information element <i>Location Area Identification</i> defined in GMPRS-1 04.008 [11].</p> <p>RAC (8 bit field) This field is the binary representation of the Routing Area Code, see GMPRS-1 03.003 [3].</p> <p>Cell Identity IE (2 octet field) This field is coded using the V format of the type 3 information element <i>Cell Identity</i> defined in GMPRS-1 04.008 [11].</p>

12.24 Void

12.25 PCCCH organization parameters

The PCCCH Organization Parameters information element is used to control the organization of PCCCHs present in the cell. This information element contains general PCCCH organization parameters.

Table 12.31: PCCCH organization parameters information element

<pre>< PCCCH Organization Parameters IE > ::= < BS_PCCCH_PRESENT : bit (8) > < BS_PCC_REL : bit > < BS_PAG_BLK_RES : bit (4) > < BS_PRACH_BLK : bit (4) >;</pre>
--

Table 12.32: PCCCH organization parameters information element details

<p>BS_PCCCH_PRESENT (8 bit field) The field indicates the PDCHs in the current ARFCN that are actually carrying PCCCH i.e. PRACH and PAGCH. A bit set to 1 indicates that the PDCH on the corresponding Mac-slot carries PCCCH.</p> <p>BS_PCC_REL (1 bit field) The BS_PCC_REL field indicates if set = 1 that the last PDCH carrying PCCCH and PBCCH will be released shortly. All mobile earth stations on PCCCH shall then as soon as this information has been received return to CCCH and there obey the information sent on BCCH as specified in GMPRS-1 04.008 [11]. If the field is set = 0, no channel release is pending.</p> <p>BS_PAG_BLK_RES (4 bit field) The BS_PAG_BLK_RES field indicates the number of Mac-slots on each PDCH carrying the PCCCH per multiframe. This number corresponds therefore to the number of Mac-slots reserved for PAGCH (See GMPRS-1 05.002 [13]). If set to zero it shall be interpreted as the default value of 0 Mac-slots reserved for PAGCH, in which case the MES has to. If included, the field is coded as the binary representation of BS_PAG_BLK_RES as defined in GMPRS-1 05.002 [13]. Range: 0-12. All other values are reserved and shall be interpreted as the default value 0.</p> <p>BS_PRACH_BLK (4 bit field) The BS_PRACH_BLK field indicates the number of Mac-slots reserved in a fixed way to the PRACH channel on any PDCH carrying PCCCH (see GMPRS-1 05.002 [13]). The field is optional and if not included it shall be interpreted as no Mac-slot reserved for PRACH. If included, the field is coded as the binary representation of BS_PRACH_BLK as defined in GMPRS-1 05.002 [13]. Range: 0-12. All other values are reserved and shall be interpreted as no Mac-slot reserved for PRACH.</p>
--

12.26 Extension bits IE

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

Table 12.33: Extension bits information element

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

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 12.34: Link synchronization parameters

```
< Link Synchronization Parameters IE > ::=
{
  < Timing correction : bit (10) >
    < Timing correction fla : bit(1)>
    < Frequency correction : bit (12) >
    < Frequency correction fla : bit(1)>
    < Timing Advance Index : bit (7) >
}
```

Table 12.35: 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 -280 to +280. The correction value is specified in Ts/40 resolution unit, where Ts is a symbol period (i.e. $(2 \times 5/234)$ ms)

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.

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)

If the TIMING_ADVANCE_INDEX field are used by the mobile station to execute the Continuous link synchronization procedure.

Range 0 to 127.

12.30 Link quality report

This information element is the quality of the downlink PDCH as seen by the mobile earth station

Table 12.36: Link Quality Report

```
< Link Quality Report IE > ::=
{
  < SQIR : bit (6) >
  < Multislot class : bit (3) >
  < Power class : bit (4) >
  < SIN : bit (4) >
  < PAN : bit (6) >
  < IMEI : bit (64) >
  < GPS Position : bit (40) >
}
```

Table 12.37: Packet Link Synchronization information element details

<p>SQIR: Contains the SQI Report based on the PDCH RSSI measurements. See GMPRS-1 05.008 [15] for details</p> <p>Multislot class: (3 bit field) This information field indicates the multislot class of the MES. The semantics of this field is defined in GMPRS-1 05.002 [13].</p> <p>Power class: (4 bit field) Refer to GMPRS-1 05.005 [17] for definition of power class of terminals.</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 0 0 0 0 - reserved 0 0 0 1 - 1st link quality report 0 0 1 0 - 2nd link quality report - - - - - - 1 1 1 1 - 15th or later quality report</p> <p>PAN: (6 bit field) This is the UT transmission power level, i.e. Power attenuation notification value. . The PAN field value contained in this information element may match any PAN value the UT 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 GMPRS-1 05.008 [15] for details</p> <p>IMEI: (64 bit field) This is the mobile equipment identity, see GMPRS-1 03.003 [3] for details.</p> <p>GPS Position: (40 bit field) This provides the position information of the MES, see GMPRS-1 04.008 [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 RLC Mode

Table 12.38: RLC Mode

<p>RLC_MODE (1 bit field) This field indicates the RLC mode of the requested TBF.</p> <p>0 RLC acknowledged mode 1 RLC unacknowledged mode</p>

13 Timers and counters

The tables in clause 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 station side

Table 13.1: Specification of timers used in GMPRS on the mobile station side

Timer	Started	Stopped	Action at expiry	Value
T3158	This timer is not used.			
T3162	On receipt of a PACKET ACCESS REJECT message indicating WAIT.	On receipt of a PACKET UPLINK ASSIGNMENT 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	On receipt of a PACKET UPLINK ASSIGNMENT or transitioning to packet transfer mode due to reception of IMMEDIATE ASSIGNMENT TYPE 2.	At sending of the first RLC/MAC block	See clauses 7.1.4 and 7.1.5.	10 s
T3166	This timer is not used			
T3168	This timer is not used			
T3170	After having made M + 1 attempts to send a PACKET CHANNEL REQUEST message	On receipt of a PACKET UPLINK ASSIGNMENT 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	On receipt of a PACKET ACCESS REJECT message with WAIT INDICATION	On receipt of a PACKET UPLINK ASSIGNMENT message	Packet Access in the spotbeam no longer prohibited	assigned in message
T3174	This timer is not used			
T3176	This timer is not used			
T3178	This timer is not used			
T3180	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
T3182	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	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	At reception of a downlink assignment message	Restarted on receipt of a downlink RLC/MAC block carrying the TFI of the downlink TBF in the RLC/MAC header.	Abnormal release with return to CCCH or PCCCH	60 s

Timer	Started	Stopped	Action at expiry	Value
T3192	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.	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
T3198	When transmitting RLC data block	none	Accept negative acknowledgement for RLC data block	In system information
T3200	This timer is not used			
T3202	When the terminal 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
T3204	This timer is not used.			
T3208	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 seconds

T3158: This timer is not used.

T3162: Wait for Packet Uplink Assignment after reception of Packet Reject with WAIT INDICATION
This timer is used on the mobile station 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 mobile station 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.

T3166: This timer is not used.

T3168: This timer is not used.

T3170: Wait for Packet Uplink Assignment after having done (M+1) Packet Channel Requests.
This timer is used on the mobile station side when having made M + 1 attempts to send a Packet Channel Request. At expiry of timer 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 Reject, 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 mobile station is received.

T3174: This timer is not used.

T3176: This timer is not used.

T3178: This timer is not used.

T3180: Wait for Uplink State Flag After Data Block.
This timer is used on the mobile station side to define when to stop waiting for the USF determining the assigned portion of the uplink channel after the 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 mobile station 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 mobile station side to define when to stop waiting for temporary Packet Uplink Ack/Nack after the last RLC data block has been sent for the current send window i.e. the stalling condition has been achieved or the terminal has declared UD=0. If expired, the mobile station 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 terminal 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.
- T3184:** This timer is not used.
- T3186:** Wait for Uplink State Flag during dynamic PRACH Access using USF=FREE.
This timer is used on the mobile station side to define when to stop waiting for the USF determining the assigned portion of the uplink channel. 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 mobile stations monitoring the USF=FREE in order to gain access to the PRACH logical channel.
- T3188:** This timer is not used.
- T3190:** Wait for Valid Downlink Data Received from the Network.
This timer is used on the mobile station side to stop waiting for the valid data from the network side either following the initial Packet Downlink Assignment or after some previous downlink RLC/MAC block.
- T3192:** Wait for release of the TBF after reception of the final block.
This timer is used on the mobile station side when the mobile station has received all of the RLC data blocks. When timer T3192 expires the mobile station shall release the resources associated with the downlink TBF (e.g. TFI).
- T3198:** RLC timer.
T3198 is an array of timers used by the mobile station 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:
$$500 \text{ ms} + \text{BS_CV_MAX} \times 5 \text{ ms}$$
- T3200:** This timer is not used.
- T3202:** PT2 timer.
T3202 is used by the mobile station to determine whether its synchronization is good enough for it to use the PRACH channels.
- T3204:** This timer is not used.
- 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.

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	If counter N3101 = N3101_MAX, or if counter N3103 = N3103_MAX	none	The network releases USF and TFI resources.	15 s
T3191	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	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	If counter N3105 = N3105_MAX	None	The network releases TFI resources.	5 s
T3201	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 message and clears the TBF	Operator defined, less than T3182

- T3169:** Wait for Reuse of USF and TFI after the mobile station uplink assignment is invalid. This timer is used on the network side to define when the current uplink assignment is surely invalid on the mobile station side so that the assigned USF(s) and TFI can be reused on the uplink. During that period the corresponding USF(s) is not broadcast. The value for 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 mobile station 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 mobile station. This timer is used on the network side to define when timer T3192 on the mobile station 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 mobile station 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 terminal has declared that it has no further data to transmit.

13.3 Counters on the mobile earth station side

- N3104:** This counter is not used.

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. N3101 shall not be incremented when the network makes an unsolicited uplink grant which is not used by the MES.
- N3103:** N3103 is reset when transmitting the final PACKET UPLINK ACK/NACK or PACKET TBF RELEASE 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 for which no RLC/MAC control message is received. The value of N3105max is network dependent.

Annex A:
Void

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

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 shall be 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 must allow 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 shall fit 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 tailing 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 shall 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 shall ignore 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 this EN
  < contents defined in current version >
  < padding bits > ;
```

The presence of the extension of the message content is indicated by bit "1". The transmitter shall send 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 shall ignore the remaining part of the message.

```
< Packet UUU message content > ::= -- Future version of this EN
  < 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

ITU-T Recommendation I.130: "Method for the Characterization of Telecommunication Services Supported by an ISDN".

ITU-T Recommendation 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".

GMR-1 03.299: "GEO-Mobile Radio Interface Specifications; Part 3: Network specifications; Sub-part 21: Position Reporting services; Stage 2 Service description; GMR-1 03.299".

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History

Document history		
V2.1.1	March 2003	Publication