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Technical Specification

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

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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:

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- 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 14 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications (Release 3) Third Generation Satellite Packet Radio Service, as identified below:

Part 1:   "General specifications";

Part 2:   "Service specifications";

Part 3:   "Network specifications";

Part 4:   "Radio interface protocol specifications":

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

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

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

   Sub-part 4:   "Layer 1 General Requirements";

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

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

   Sub-part 7:   "Mobile Radio Interface Signalling Layer 3 General Aspects";

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

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

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

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

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

Sub-part 13: "Radio Resource Control (RRC) protocol; Iu Mode";

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

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

- Release 1 specifications have a GMR 1 prefix in the title and a version number starting with "1" (V1.x.x).

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

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

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

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

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

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

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

- Release 1: GMR n xx.zyy.

- Release 2: GMPRS n xx.zyy.

- Release 3: GMR-1 3G xx.zyy

where:

xx.0yy (z = 0) is used for GMR specifications that have a corresponding GSM or 3GPP specification. In this case, the numbers xx and yy correspond to the GSM or 3GPP numbering scheme.

xx.2yy (z = 2) is used for GMR specifications that do not correspond to a GSM or 3GPP specification. In this case, only the number xx corresponds to the GSM or 3GPP numbering scheme and the number yy is allocated by GMR.

n denotes the first (n = 1) or second (n = 2) family of GMR specifications.

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

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

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

- If a GMR specification does not exist, the corresponding GSM or 3GPP specification may or may not apply. The applicability of the GSM or 3GPP specifications is defined in GMR-1 3G 41.201 [2].

1   Scope

1.1   General

The present document specifies procedures for the following layers of the radio interface (*Um* reference point), the interface between the GSM/EDGE Radio Access Network (GERAN) and the Mobile Station (MS) in GERAN *Iu mode*:

-        Radio Link Control (RLC).

-        Medium Access Control (MAC), including Physical Link Control functions.

1.2   Related documents

The following documents provide information related to the present document:

-        GMR-1 3G 43.051 [9] is an overall description of the GSM/EDGE Radio Access Network (GERAN) in *Iu mode*.

-        GMR-1 04.004 [3] specifies services offered by the physical layer of the *Um* reference point. It also specifies control channels. RLC and MAC use these services and control channels.

-        GMPRS-1 04.007 [13] specifies, in general terms, this protocol's structured functions, its procedures and its relationship with other layers and entities. It also specifies the basic message format and error handling applied by layer 3 protocols.

-        GMR-1 3G 44.118 [4] specifies the RRC procedures when operating in *Iu mode*.

-        GMR-1 3G 44.060 [10] specifies RLC/MAC procedures specific to *A/Gb mode* as well as the procedures that are common to both *A/Gb mode* and *Iu mode*. It also specifies the messages and Information Elements for both modes.

1.3   Use of logical control channels

GMR-1 3G 45.002 [5] defines the following logical control channels:

-        Broadcast Control Channel (BCCH): downlink only, used to broadcast Cell specific information.

-        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 random access bursts to allow estimation of the timing advance for one MS in transfer state.

-        Packet Timing advance control channel downlink (PTCCH/D): used to transmit timing advance updates for several MS. One PTCCH/D is paired with several PTCCH/Us.

1.4   Use of logical traffic channels

GMR-1 3G 45.002 [5] defines the following logical traffic channels used by RLC and MAC:

-        Dedicated Traffic Channel (DTCH): bidirectional, carries encoded speech on a dedicated channel (DCH).

-        Packet Data Traffic Channel (PDTCH): downlink or uplink, carries user data.

1.4a   Use of transport channels

FLO is not supported in GMR-1 3G.

1.5   Conventions

Unless explicitly stated otherwise, the following conventions apply:

-       The notations "further study", "FS" or "FFS" indicate the annotated text is not normative.

2   References

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.

- •   Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:

    -       if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;

    -       for informative references.

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

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

2.1   Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1]   3GPP TR 21.905 (ETSI TR 121 905): "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications".

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

[3]   GMR-1 04.004: (ETSI TS 101 376-4-4): "GEO-Mobile Radio Interface Specifications; Part 4: Radio interface protocol specifications; Sub-part 4: Layer 1 General Requirements".

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

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

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

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

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

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

[9]   GMR-1 3G 43.051 (ETSI TS 101 376-3-23): "GEO-Mobile Radio Interface Specifications
            (Release 3); Third Generation Satellite Packet Radio Service; Part 3: Network specifications;
            Sub-part 23: Radio Access Network; Overall description - Stage 2".

[10]   GMR-1 3G 44.060 (ETSI TS 101 376-4-12): "GEO-Mobile Radio Interface Specifications
            (Release 3); Third Generation Satellite 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".

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

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

[13]   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".

NOTE: This is a reference to a GMR-1 Release 2 specification. See the introduction for more details.

[14]   GMPRS-1 01.004 (ETSI TS 101 376-1-1): "GEO-Mobile Radio Interface Specifications
            (Release 2); General Packet Radio Service; Part 1: General specifications; Sub-part 1:
            Abbreviations and acronyms".

NOTE: This is a reference to a GMR-1 Release 2 specification. See the introduction for more details.

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

[16]   3GPP TS 25.331 (ETSI TS 125 331): "3rd Generation Partnership Project; Technical Specification
            Group Radio Access Network; Radio Resource Control (RRC); Protocol Specification".

[17]   3GPP TS 35.201 (ETSI TS 135 201): "3rd Generation Partnership Project; Technical Specification
            Group Services and System Aspects; 3G Security; Specification of the 3GPP Confidentiality and
            Integrity Algorithms; Document 1: f8 and f9 Specification".

2.2   Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with
regard to a particular subject area. For non-specific references, the latest version of the referenced document (including
any amendments) applies.

Not applicable.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMR-1 3G 44.060 [10] and the following apply:

DACCH: refers to the logical channel that is mapped to DCH for transporting non-speech information (signalling or user data)

NOTE: DACCH is functionally equivalent to FACCH.

DCCH TBF mode: refers to a TBF mapped onto a DACCH

RLC non-transparent mode: refers to either RLC acknowledged mode or RLC unacknowledged mode

TCH TBF mode: refers to a TBF mapped onto a DTCH

3.2 Symbols

For the purposes of the present document, the following symbols apply:

A	Interface between a BSS and a 2G MSC
Gb	Interface between a BSS and a 2G SGSN
Iu	Interface between a BSS or an RNC and a 3G MSC or a 3G SGSN
Iu-cs	Interface between a BSS or an RNC and a 3G MSC
Iu-ps	Interface between a BSS or an RNC and a 3G SGSN
Um	Interface between an MES and the GERAN

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in GMPRS-1 01.004 [14], 3GPP TR 21.905 [1] and the following apply:

ADCH	Associated DCH
ARQ	Automatic Repeat reQuest
BCCH	Broadcast Control CHannel
BSS	Base Station Subsystem
CDCH	Control-plane DCH
CN	Core Network
DCH	Dedicated CHannel
EDGE	Enhanced Data rates for Global Evolution
FACCH	Fast Associated Control CHannel
FLO	Flexible Layer One
GERAN	GSM/EDGE Radio Access Network
GPRS	General Packet Radio Service
GRA	GERAN Registration Area
G-RNTI	GERAN Radio Network Temporary Identity
GSM	Global System for Mobile communications
HFN	Hyper Frame Number
IMSI	International Mobile Subscriber Identity
MAC	Medium Access Control
MCS	Modulation and Coding Scheme
MS	Mobile Station
MSC	Mobile Switching Centre
NT-RLC	RLC non-transparent mode
PBCCH	Packet BCCH
PDCH	Packet Data physical CHannel
PDCP	Packet Data Convergence Protocol

PDTCH	Packet Data TCH
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network
PTCCH	Packet Timing-advance Control CHannel
P-TMSI	Packet TMSI
RB	Radio Bearer
RBid	Radio Bearer identity
RLC	Radio Link Control
RNC	Radio Network Controller
RRBid	Reduced RBid
RRC	Radio Resource Control
SACCH	Slow Associated Control CHannel
SAPI	Service Access Point Identifier
SDCCH	Stand-alone Dedicated Control CHannel
SDU	Service Data Unit
SGSN	Serving GPRS Support Node
SRB	Signalling Radio Bearer
TBF	Temporary Block Flow
TCH	Traffic CHannel
TMSI	Temporary Mobile Subscriber Identity
T-RLC	RLC transparent mode
UDCH	User-plane DCH
UMTS	Universal Mobile Telecommunication System
URB	User Radio Bearer
USF	Uplink State Flag

4 Layered overview of radio interface

4.0 Protocol architecture

The protocol architecture for the radio interface is shown in figure 4.1.

The RLC/MAC function provides a service to PDCP for User plane data, to RRC for Control plane data and to the application layer of the CS User plane.
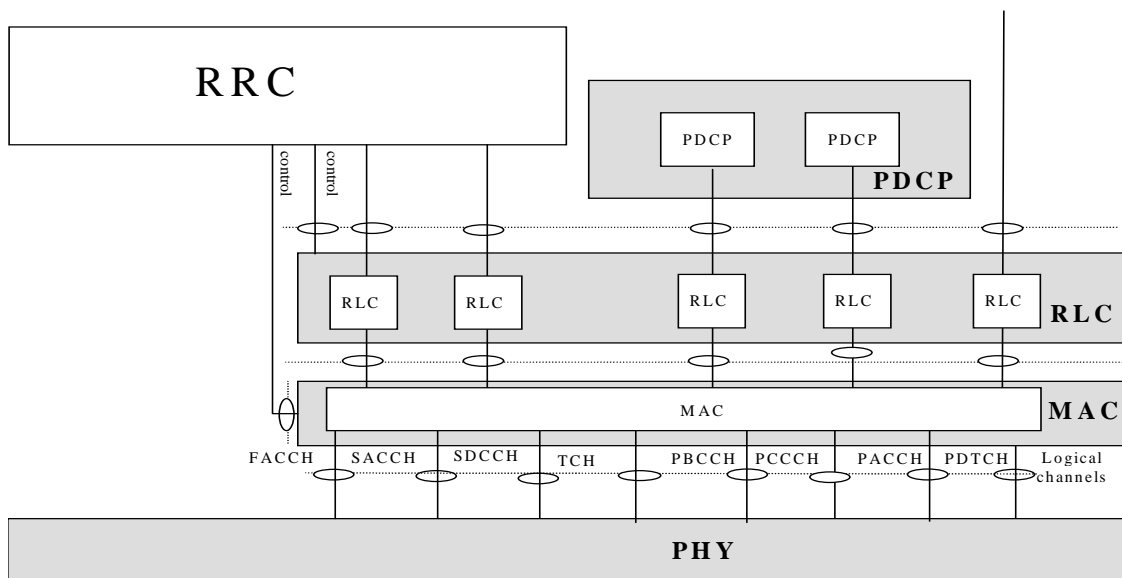
Figure 4.1: Radio Interface Protocol architecture

Figure 4.2: Void

4.1 Layer services

The RLC/MAC sublayer provides services for the transfer over the physical layer between the network and mobile earth station of upper layer PDUs for one mobile earth station when operating on a dedicated basic physical subchannel, or for one or more mobile stations when operating on a shared basic physical subchannel.

The RLC function provides the following services to the upper layers:

- **Transparent data transfer:** This service transmits higher layer PDUs without adding any protocol information.

- **Acknowledged data transfer:** This service transmits higher layer PDUs and guarantees delivery to the peer entity.

- **Unacknowledged data transfer:** This service transmits higher layer PDUs without guaranteeing delivery to the peer entity.

- **Notification of unrecoverable errors:** RLC notifies the upper layer of errors that cannot be resolved by RLC itself by normal exception handling procedures.

- **Notification of discard:** RLC notifies the upper layer of the higher layer PDUs (RLC SDUs) it discards.

- **Suspend:** The RLC entity does not transmit any new RLC PDUs to the lower layer.

- **Resume:** The RLC entity resumes data transmission.

- **Stop:** The RLC entity does not transmit any RLC PDUs to the lower layer and does not receive any PDUs from the lower layer.

- **Continue:** The RLC entity resumes data transmission and reception.

- **Re-establishment:** The RLC entity is re-established.

The MAC function provides the following service to the upper layer:

- **Data transfer.**

4.2 Layer functions

4.2.1 RLC function

The functions provided by the RLC are given in table 4.2.1.1. Transparent RLC mode provides no functionality.

Table 4.2.1.1: RLC Functions

	Acknowledged mode RLC	Unacknowledged mode RLC	Transparent mode RLC
Segmentation of upper layer PDUs into RLC data blocks	X	X	
Concatenation of upper layer PDUs into RLC data blocks	X	X	
Padding to fill out RLC data block	X	X	
Backward Error Correction (BEC) procedure enabling the selective retransmission of RLC data blocks	X		
Discard of RLC SDUs not yet segmented into RLC PDUs, according to the delay requirements of the associated Radio Bearers	X		
Reassembly of RLC data blocks into upper layer PDUs	X	X	

	Acknowledged mode RLC	Unacknowledged mode RLC	Transparent mode RLC
In-sequence delivery of upper layer PDUs	X	X	
Link Adaptation	X	X	
Ciphering	X	X	
Sequence number check to detect lost RLC blocks	X	X	

4.2.2   MAC layer function

The functions of the MAC layer include:

- **Configuring the mapping between logical channels and basic physical channels:** The MAC layer is responsible for configuring the mapping of logical channel(s) onto the appropriate basic physical channel(s).

- **Selecting logical channels to be used for each signalling radio bearer service:** The MAC layer is responsible for mapping SRBs onto logical channels. There are a set of rules defined for this mapping (see clause 5.6) which shall be used in the uplink and should be used in the downlink. The mapping is dependent on the SRB to be sent, the MAC state, and the logical channels available. The SFACCH may be selected in preference to the PDTCH if a TBF is not already established for the SRB.

- **Selecting logical channels to be used for each user radio bearer service:** The logical channels used by the MAC for user radio bearers are set up by configuration from RRC.

- **Assignment, reconfiguration and release of shared radio resources for a TBF:** The MAC layer may handle the assignment of radio resources needed for a TBF including needs from both the control and user plane. The MAC layer may reconfigure radio resources of a TBF.

- **MES measurement reporting and control of the reporting:** The MAC layer is responsible for sending information that control the MS measurement reporting when using BCCH or PACCH channels. The MAC layer also performs the reporting of the measurements from the MS to the network using PACCH.

- **Broadcasting/listening of/to BCCH and CCCH:** The MAC layer broadcasts/listens (to) the BCCH of the serving cell for the sending/decoding of packet system information messages. The MAC layer also sends paging information on the CCCH or and monitors the paging occasions according to the DRX cycle. Within the Mobile Station, the MAC layer notifies the RRC layer when receiving a paging message; within the network, it is responsible for aggregating and sending paging messages addressed to one or more Mobile Stations when received from the RRC layer.

- **Timing advance control:** The MAC layer controls the operation of timing advance on shared basic physical subchannels.

- **Ciphering and deciphering** (only in combination with transparent RLC mode).

When the MAC layer is providing services to a non-transparent RLC mode entity, the MAC layer supports the following additional functions:

- **Ciphering.**

- **Identification of different traffic flows of one or more MSs on the basic physical channels:** Inband identification is needed to address a flow to an MS in the downlink or identify a flow from an MS in the uplink.

- **Multiplexing/demultiplexing of higher layer PDUs:** This may include priority handling between data flows of one or more mobile stations, e.g. by attributes of Radio Bearer services.

- **Multiplexing/demultiplexing multiple TBFs on the same shared channel:** The MAC layer is responsible for multiplexing/demultiplexing RLC data blocks belonging to different TBFs carried on the same PDTCH.

- **Multiplexing/demultiplexing user and control plane data to/from the physical layer for PDTCHs:** The MAC layer is responsible for multiplexing/demultiplexing RLC data blocks carried on PDTCH and RLC/MAC control blocks carried on PACCH.

- **Scheduling of RLC/MAC data and control PDUs delivered to the physical layer on shared physical channels:** This includes USF and UUG field monitoring for uplink transfer and sharing radio resources on the downlink.

- **Splitting/recombining:** This includes splitting/recombining of the RLC/MAC PDU flow belonging to one or more TBF(s) onto/from several shared logical channels. This function does not apply for RLC/MAC control blocks.

4.3 Service primitives

4.3.1 MAC to Physical Layer Primitives

These are defined in GMR-1 04.004 [3].

4.3.2 PDCP to RLC Primitives

4.3.2.1 Primitives

The primitives between PDCP and RLC are shown in table 4.3.2.1.1.

Table 4.3.2.1.1: Primitives between RLC and upper layers

Generic Name	Parameters			
	Req.	Ind.	Resp.	Conf.
RLC-AM-DATA	Data, CNF, MUI	Data	Not Defined	Status, MUI
RLC-UM-DATA	Data	Data	Not Defined	Not Defined
RLC-TM-DATA	Data	Data, Error_Indicator	Not Defined	Not Defined

Each Primitive is defined as follows:

RLC-AM-DATA-Req/Ind/Conf

- RLC-AM-DATA-Req is used by upper layers to request transmission of an RLC SDU in acknowledged mode.

- RLC-AM-DATA-Ind is used by the AM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in acknowledged mode.

- RLC-AM-DATA-Conf is used by the AM RLC entity to confirm to upper layers the reception of an RLC SDU by the peer-RLC AM entity or to inform the upper layers of a discarded RLC SDU.

RLC-UM-DATA-Req/Ind/Conf

- RLC-UM-DATA-Req is used by upper layers to request transmission of an RLC SDU in unacknowledged mode.

- RLC-UM-DATA-Ind is used by the UM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in unacknowledged mode.

RLC-TM-DATA-Req/Ind/Conf

- RLC-TM-DATA-Req is used by upper layers to request transmission of an RLC SDU in transparent mode.

- RLC-TM-DATA-Ind is used by the TM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in transparent mode.

4.3.2.2 Primitive parameters

The following parameters are used in the primitives:

1) The parameter Data is the RLC SDU that is mapped onto the Data field in RLC PDUs.

2) The parameter Confirmation Request (CNF) indicates whether the transmitting side of the AM RLC entity needs to confirm the reception of the RLC SDU by the peer-RLC AM entity. If required, once all AMD PDUs that make up the RLC SDU are positively acknowledged by the receiving AM RLC entity, the transmitting AM RLC entity notifies upper layers.

3) The parameter Message Unit Identifier (MUI) is an identity of the RLC SDU, which is used to indicate which RLC SDU that is confirmed with the RLC-AM-DATA-Conf. Primitive.

4) The Error_Indicator parameter indicates that the RLC SDU is erroneous.

5) The parameter Status is only applicable for AM operation. This parameter indicates whether a RLC SDU is successfully transmitted or discarded.

4.3.3 RRC to RLC Primitives

4.3.3.1 Primitives

The primitives between RRC and RLC are shown in table 4.3.3.1.

Table 4.3.3.1: Primitives between RRC and RLC

Generic Name	Parameters			
	Req.	Ind.	Resp.	Conf.
RLC-AM-DATA	Data, CNF, MUI, DiscardReq	Data	Not Defined	Status, MUI
RLC-UM-DATA	Data	Data	Not Defined	Not Defined
CRLC-CONFIG	E/R, Stop (UM/AM only), Continue (UM/AM only), Ciphering Elements (UM/AM only), TM_parameters (TM only), UM_parameters (UM only-SDU discard, window size), AM_parameters (AM only –SDU discard, resegment bit, window size)	Not Defined	Not Defined	Not Defined
CRLC-SUSPEND (UM/AM only)	N	Not Defined	Not Defined	V(S) (AM/UM only)
CRLC-RESUME (UM/AM only)	No Parameter	Not Defined	Not Defined	Not Defined

Each Primitive is defined as follows:

RLC-AM-DATA-Req/Ind/Conf

- RLC-AM-DATA-Req is used by upper layers to request transmission of an RLC SDU in acknowledged mode.

- RLC-AM-DATA-Ind is used by the AM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in acknowledged mode.

- RLC-AM-DATA-Conf is used by the AM RLC entity to confirm to upper layers the reception of an RLC SDU by the peer-RLC AM entity.

RLC-UM-DATA-Req/Ind/Conf

- RLC-UM-DATA-Req is used by upper layers to request transmission of an RLC SDU in unacknowledged mode.

- RLC-UM-DATA-Ind is used by the UM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in unacknowledged mode.

CRLC-CONFIG-Req

This primitive is used by upper layers to establish, re-establish, release, stop, continue or modify the RLC. Ciphering elements are included for UM and AM operation.

CRLC-SUSPEND-Req/Conf

- CRLC-SUSPEND-Req is used by upper layers to suspend the UM or AM RLC entity.

- CRLC-SUSPEND-Conf is used by the UM or AM RLC entity to confirm that the entity is suspended.

CRLC-RESUME-Req

This primitive is used by upper layers to resume the UM or AM RLC entity after the UM or AM RLC entity has been suspended.

4.3.3.2   Primitive parameters

Following parameters are used in the primitives:

1) The parameter Data is the RLC SDU that is mapped onto the Data field in RLC PDUs.

2) The parameter Confirmation Request (CNF) indicates whether the transmitting side of the AM RLC entity needs to confirm the reception of the RLC SDU by the peer-RLC AM entity. If required, once all AMD PDUs that make up the RLC SDU are positively acknowledged by the receiving AM RLC entity, the transmitting AM RLC entity notifies upper layers.

3) The parameter Message Unit Identifier (MUI) is an identity of the RLC SDU, which is used to indicate which RLC SDU that is confirmed with the RLC-AM-DATA-Conf. Primitive.

4) The parameter E/R indicates establishment, re-establishment, release or modification of an RLC entity, where re-establishment is applicable to AM and UM RLC entities only.

5) The parameter Ciphering Elements are only applicable for UM and AM operations. These parameters are Ciphering Key, Activation Time (Sequence Number (BSN) to activate a new ciphering configuration) and HFN (Hyper Frame Number).

6) The AM_parameters are only applicable for AM operation.

7) The Stop parameter is applicable to AM and UM RLC entities only and indicates to the RLC entity to not transmit nor receive any RLC PDUs.

8) The Continue parameter is applicable to AM and UM RLC entities only and indicates to the RLC entity to continue transmission and reception of RLC PDUs.

9) The UM_parameters are only applicable for UM operation.

10) The TM_parameters are only applicable for TM operation.

11) The N parameter indicates that an RLC entity will not send a PDU with "Sequence Number"$\geq V(S) + N$ for UM/AM RLC entities where N is a non-negative integer.

12) The $V(S)$ parameter indicates the value of the Send State Variable for the case of the AM/UM RLC entities.

13) The parameter Status is only applicable for AM operation. This parameter indicates whether a RLC SDU is successfully transmitted or discarded.

14) The parameter DiscardReq indicates whether the transmitting RLC entity needs to inform the upper layers of the discarded RLC SDU. If required, the transmitting RLC entity notifies upper layers when the RLC SDU is discarded.

4.3.4 RRC to MAC Primitives

4.3.4.1 Primitives

The primitives between MAC and RRC are shown in table 4.3.4.1.

Table 4.3.4.1: Primitives between RRC sub-layer and MAC

Generic Name	Parameter			
	Request	Indication	Response	Confirm
CMAC-CONFIG	MS information elements, RB information elements, Ciphering elements,			
CMAC-SYS-INFO	System Information Elements			
PAGING	MS Identity, CN Domain Identity, Paging Cause, Paging Record Type Identifier	MS Identity, CN Domain Identity, Paging Cause, Paging Record Type Identifier	NA	NA
HANDOVER	Handover Reference Value	Handover Reference Value	NA	NA
PHYSICAL-INFO	Timing Advance Value	Timing and Frequency Correction	NA	NA

CMAC-CONFIG-Req

- CMAC-CONFIG-Req is used to request for setup, release and configuration of a logical channel, G-RNTI allocation, mapping between radio bearer and logical channel.

CMAC-SYS-INFO-Req

- CMAC-SYS-INFO-Req is used to pass information elements needed for the generation of system information messages within the MAC entity.

PAGING-Req/Ind

- PAGING-Req is used by RRC to page a MS.

- PAGING-Ind is used by the MS to inform the RRC of the reception of a PACKET PAGING REQUEST message.

HANDOVER-Req/Ind

- HANDOVER-Req is used by the mobile station's RRC to trigger the transmission of the HANDOVER ACCESS message to the network.

- HANDOVER-Ind is used by the network to inform the RRC of the reception of a HANDOVER ACCESS message.

PHYSICAL-INFO-Req/Ind

- PHYSICAL-INFO-Req is used by the network's RRC to trigger the transmission of the PHYSICAL INFORMATION message to the mobile station.

- PHYSICAL-INFO-Ind is used by the mobile earth station to inform the RRC of the reception of the PHYSICAL INFORMATION message.

4.3.4.2 Primitive Parameters

The MAC configuration primitives use the following parameters. See GMR-1 3G 44.118 [4] for a detailed description of the MS, and RB information elements:

1) MS information elements
   G-RNTI
   SRNC identity
   Activation time

2)   RB information elements
     RB multiplexing info (Logical channel identity, radio priority, mapping of reduced radio bearer id to radio
     bearer id, transport channel identity)

3)   Ciphering elements
     Ciphering key
     Activation Time (TDMA Frame Number)   HFN

The system information primitives use the following parameter:

1)   System Information elements
     See GMR-1 3G 44.008 [11]

The paging primitives use the following parameters:

1)   The *MS Identity* parameter is the IMSI, TMSI, PTMSI, or G-RNTI.

2)   The *CN Domain Identity* parameter indicates whether a CN-initiated page is from the packet domain or circuit
     domain.

3)   The *Paging Cause* parameter indicates the reason for the page.

4)   The *Paging Record Type Identifier* parameter indicates the type of MS identity used by the CN in a
     CN-initiated page, e.g. IMSI (GSM), IMSI (DS-41), TMSI/PTMSI (GSM).

The handover primitives use the following parameter:

1)   The *Handover Reference Value* parameter indicates the handover reference value used for access identification
     in the HANDOVER ACCESS message.

The physical info primitives use the following parameter:

1)   The *Timing Advance Value* parameter indicates the timing advance value in the PHYSICAL INFORMATION
     message to be applied by the mobile station.

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 [3].

The following services are required of the physical layer:

-   **Access capabilities:** The physical layer offers logical channels and the transmission services associated to
    higher layers. Logical channels are multiplexed either in a fixed predefined manner (multiframe structure) or
    dynamically by the MAC layer on basic physical subchannels. Basic physical subchannels are the units
    scheduled on the radio medium. Some are reserved by the network for common use (e.g. for use by a
    combination of CCCH and BCCH), others are assigned to dedicated connections with MESs (dedicated basic
    physical subchannels), or are assigned to a shared usage between MSs (shared basic physical subchannels).

-   **Error detection:** The physical layer offers an error protected transmission service, it includes error detection
    functions and to a lower level, error correction functions. Erroneous received frames may be notified to upper
    layers and, depending on the need of the upper layer, offered to it. The probability of one or more errors in a
    physical block transferred by the physical layer is defined in GMR-1 3G 45.005 [12]. Due to non-specified
    methods of quality detection, the probability of residual errors in transferred blocks may vary between
    implementations.

-   **Measurement of the signal strength of neighbouring base stations:** Measurements are transferred to RRC.

-   **Measurement of the signal quality of the physical channel used:** Measurements are transferred to the MAC
    layer for reporting to the base station.

-   **Cell/PLMN selection in MAC-Idle state:** In MAC-Idle state the physical layer selects the best cell with its
    BCCH in close co-operation with layer 3, meeting requirements for PLMN selection specified in GMR-1
    3G 43.022 [15].

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) and dedicated transmission resources (e.g. the multiplexing of logical channels onto DCHs).

The Medium Access Control procedures support the provision of Temporary Block Flows that allow the point-to-point transfer of signalling and user data within a cell between the network and a mobile station.

Moreover, the Medium Access Control procedures include the procedures for reception of BCCH and CCCH, which permits autonomous cell reselection performed by the mobile earth station (see GMR-1 3G 45.008 [7]).

5.2   Multiplexing principles

5.2.1   Temporary Block Flow

A TBF is a logical connection used by two MAC entities to support the unidirectional transfer of upper-layer PDUs on physical channels. A mobile earth station shall support eight TBFs in each direction (uplink and downlink). The network shall not assign more than eight TBFs to a mobile station. The total amount of TBFs assigned to a mobile earth station in a given direction shall always be lower than or equal to eight.

The TBF is allocated radio resources on one or more physical channels of the same type (i.e. either PDCH(s) or DCH(s)) and may only be mapped on one logical channel type at a time. The TBF comprises a number of RLC/MAC blocks carrying one or more upper-layer PDUs.

A TBF mapped on PDTCH(s) operates implicitly in normal TBF mode.

A TBF mapped on DACCH operates implicitly in DCCH TBF mode.

A TBF mapped on DTCH operates implicitly in TCH TBF mode.

A TBF associated with a URB may operate in either normal TBF mode, DCCH TBF mode or TCH TBF mode.

A TBF associated with a SRB may operate in either normal TBF mode or DCCH TBF mode.

5.2.2   Temporary Flow Identity

5.2.2.1   Temporary Flow Identity for PDCH

See GMR-1 3G 44.060 [10], clause 5.2.2.

5.2.2.2   Temporary Flow Identity for DCH

A TBF mapped on DCH(s) may operate in either DCCH or TCH TBF mode. A TBF mapped on DACCH shall operate in DCCH TBF mode.

A TBF in TCH TBF mode is not assigned a TFI. This TBF is in its direction the only user of the TCH on which it is mapped, as described in clause 9.2.2.

A TBF in DCCH TBF mode is implicitly assigned a Reduced Radio Bearer identity (RRBid) that provides a one-to-one mapping with the RBid of the radio bearer it carries. In case this radio bearer is a User-plane Radio Bearer (URB), the mapping between RRBid and RBid is given at radio bearer set-up of this URB by means of primitive exchange between RRC and MAC (CMAC-CONFIG). An RLC/MAC block associated with a DCCH TBF mode shall contain an RRBid. The TBF to which a RLC data block belongs is identified by the RRBid and the direction (uplink or downlink) in which this RLC data block is sent. The TBF to which a RLC/MAC control message belongs is identified by the RBid, the direction in which this RLC/MAC control message is sent and the message type.

5.2.3 Uplink State Flag

See GMR-1 3G 44.060 [10], clause 5.2.3.

5.2.4 Medium Access modes

5.2.4.1 Medium Access modes for PDCH

See GMR-1 3G 44.060 [10], clause 5.2.4.

5.2.4.2 Medium Access modes for DCH

The dedicated allocation is applicable exclusively on a dedicated channel (i.e. mapped onto a DCH). No other MAC mode may apply on DCH. If the mobile earth station is assigned a DCH (e.g. PACKET DCH ASSIGNMENT), dedicated allocation shall be used in uplink direction on this DCH. Downlink direction may be assigned either DCH or PDCH.

5.2.5 Multiplexing of GMPRS and future mobile earth stations

See GMR-1 3G 44.060 [10], clause 5.2.4a.

5.3 MAC States

5.3.1 MAC-Idle state

5.3.1.1 General

In MAC-Idle state no TBF exists and the mobile earth station monitors relevant paging subchannels on the CCCH. The mobile earth station may use DRX for monitoring the CCCH. While in MAC-Idle state the MES shall perform idle mode functions as specified in GMR-1 3G 43.022 [15]. The MES shall also perform GPS position determination and reporting as specified in GMR-1 3G 44.008 [11].

5.3.1.2 Establishment of a PDCH

In MAC-Idle state, upper layers may require the transfer of an upper-layer PDU, which may trigger the establishment of a TBF on PDCH(s) and the transition to MAC-Shared state.

5.3.1.3 Establishment of a DCH

In MAC-Idle state upper layers may require the transfer of an upper-layer PDU, which may trigger the establishment of a TBF on DCH(s) either through RRC procedures (see GMR-1 3G 44.118 [4]) or RLC/MAC procedures, in which case the mobile earth station leaves MAC-Idle state and enters the MAC-Dedicated state immediately after assignment of the DCH(s).

5.3.2 MAC-Shared state

5.3.2.1 General

In MAC-Shared state, the mobile earth station is allocated radio resources providing a TBF for a point-to-point connection on one or more PDCHs. The TBF is used for the unidirectional transfer of upper-layer PDUs between the network and the mobile station. In MAC-Shared state the following services are offered:

- transfer of upper-layer PDUs in RLC acknowledged mode;

- transfer of upper-layer PDUs in RLC unacknowledged mode.

5.3.2.2 Release of all PDCHs

In MAC-Shared state, when all TBFs have been released in the downlink and uplink direction, the mobile earth station returns to MAC-Idle state.

5.3.2.3 Establishment of a DCH

In MAC-Shared state upper layers may require the transfer of an upper-layer PDU, which may trigger the establishment of a TBF on a DCH through RRC procedures (see GMR-1 3G 44.118 [4]), in which case the mobile earth station leaves MAC-Shared state and enters the MAC-DTM state.

5.3.2.4 Radio bearer reconfiguration

Upon reconfiguration of all Radio Bearers from PDCH(s) to DCH(s), the mobile earth station shall leave the MAC-Shared state and enter the MAC-Dedicated state after release of all TBFs on PDCH(s) and set-up of the first DCH. See GMR-1 3G 44.118 [4].

5.3.3 MAC-DTM state

5.3.3.1 General

In MAC-DTM state a mobile earth station has been allocated radio resources providing one or more DCHs and one or more PDCHs. The allocation of radio resources is co-ordinated by the network, in agreement with the capabilities of the mobile station.

The transfer of upper-layer PDUs in RLC acknowledged, RLC unacknowledged mode or RLC transparent mode is provided.

5.3.3.2 Release of all PDCHs

In MAC-DTM state, when all TBFs on PDCHs have been released, in downlink and uplink directions, the mobile earth station enters MAC-Dedicated state.

5.3.3.3 Release of all DCHs

In MAC-DTM state, upon release of all DCHs, the mobile earth station enters the MAC-Shared state.

5.3.3.4 Release of all PDCHs and DCHs

In MAC-DTM state, upon release of all PDCHs and DCHs, the mobile earth station enters the MAC-Idle state.

5.3.4   MAC-Dedicated state

5.3.4.1   General

In MAC-Dedicated state a mobile earth station has been allocated radio resources providing one or more DCHs. The allocation of radio resources is co-ordinated by the network, in agreement with the capabilities of the mobile station.

The transfer of upper-layer PDUs in RLC acknowledged, RLC unacknowledged mode or RLC transparent mode is provided.

5.3.4.2   Release of all DCHs

In MAC-Dedicated state, upon release of all DCHs, the mobile earth station shall enter the MAC-Idle state.

5.3.4.3   Radio bearer reconfiguration

Upon reconfiguration of all Radio Bearers from DCH(s) to PDCH(s), the mobile earth station shall leave the MAC-Dedicated state and enter the MAC-Shared state after release of all DCH(s) and set-up of the first TBF on PDCH(s) (see GMR-1 3G 44.118 [4]).

5.3.5   MAC state machine

Figure 5.3.5.1 represents the state machine of the MAC sublayer.
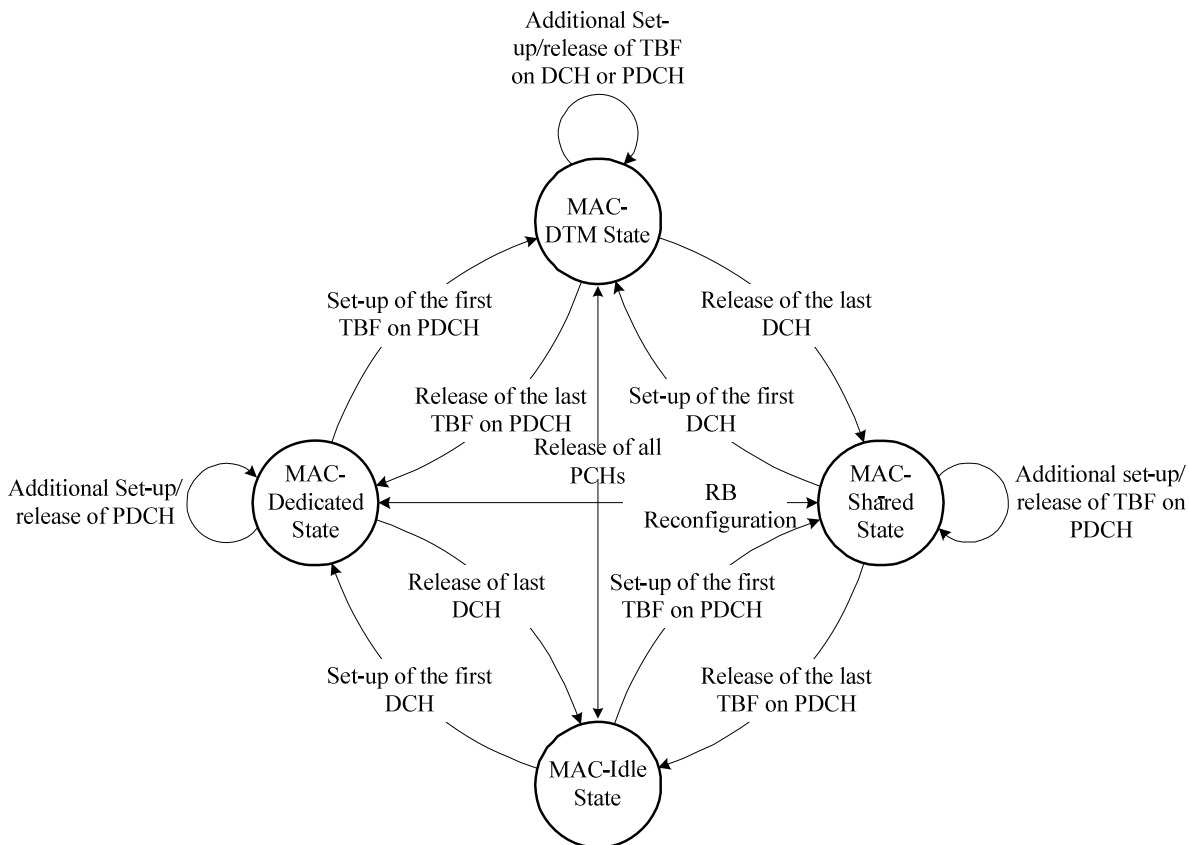
Figure 5.3.5.1: MAC state machine

5.4 General MAC procedures in MAC-Idle state and MAC-Shared state

5.4.1 Mobile station side

5.4.1.1 General

A mobile earth station in MAC-Idle state shall monitor the system information broadcast in the cell.

In MAC-Idle state, the mobile earth station shall monitor the radio blocks on CCCH as defined in clauses 5.4.1.8 and 5.4.1.9. The determination of the paging group for the mobile earth station is defined in GMR-1 3G 45.002 [5].

5.4.1.2 Cell (Spotbeam) reselection

Cell reselection in MAC-Idle state is specified in GMR-1 3G 45.008 [7]. The MAC entity on the mobile earth station side indicates to the RRC layer the availability of a cell and a cell change when decided by the MAC sublayer. RRC is advised of system information broadcast in the cell when a new cell has been selected or when a relevant part of this information changes.

If the new cell supports *Iu mode* the mobile earth station shall operate in *Iu mode* unless ordered to operate in *A/Gb mode* by the network. If the new cell does not support *Iu mode*, a mobile earth station which supports *A/Gb mode* shall operate in *A/Gb mode* as described in GMR-1 3G 44.060 [10]. If operating in *Iu mode*, the mobile earth station shall perform packet access in *Iu mode* otherwise the mobile earth station shall perform packet access in *A/Gb mode*.

When a cell reselection is determined by the mobile earth station or ordered by the network, the mobile earth station may continue its operation in MAC-Idle state in the old serving cell, while acquiring certain system information for the target cell. When the cell reselection has been determined, the MES follow the procedures for Network Assisted Cell Change as specified in GMR-1 3G 44.060 [10], clauses 5.5.1.1a.2 and 8.8.2.

5.4.1.3 Network Assisted Cell Change

See GMR-1 3G 44.060 [10], clause 5.5.1.1a.

5.4.1.4 Release of DCHs

5.4.1.4.1 General

The mobile earth station shall acquire system information broadcast in the serving cell when in MAC-Idle state, after the release of all DCHs if the mobile earth station had been unable to monitor the system information broadcast on BCCH while one or more DCHs were allocated:

- The acquisition of system information shall be performed according to the requirements in clause 5.4.1.6.

- The mobile earth station shall not attempt a packet access or accept a packet downlink assignment before these requirements are fulfilled.

The following exceptions, stated in clauses 5.4.1.4.2 and 5.4.1.4.3, may apply.

5.4.1.4.2 Continuation of PBCCH information

This clause is not applicable to GMR-1.

5.4.1.4.3 Receipt of PSI14 message in MAC-DTM state

This clause is not applicable to GMR-1.

5.4.1.5 System information on PBCCH

See GMR-1 3G 44.060 [10], clause 5.5.1.2.

5.4.1.6 System information on BCCH

5.4.1.6.1 General

The support of *Iu mode* shall be indicated in SI messages sent on BCCH (see GMR-1 3G 44.008 [11]).

See GMR-1 3G 44.060 [10], clause 5.5.1.3.

5.4.1.6.2 Establishment of PBCCH

This clause is not applicable to GMR-1.

5.4.1.6.3 (void)

5.4.1.7 (void)

5.4.1.8 Discontinuous reception (DRX)

A mobile earth station in MAC-Idle state may use Discontinuous Reception (DRX) to reduce its power consumption.

In DRX mode, the MAC layer receives the paging group relevant for the mobile earth station from the RRC layer via the CMAC-CONFIG primitive. The computation of the paging group is defined in GMR-1 3G 45.002 [5]. The mobile earth station shall only monitor the blocks corresponding to its paging group. The GERAN shall initiate paging procedures for this mobile earth station on the blocks corresponding to its paging group.

In non-DRX mode, the mobile earth station shall monitor all paging blocks on the monitored CCCH (see GMR-1 3G 45.002 [5]).

When initiating the MM procedures for GPRS attach and routeing area update defined in GMR-1 3G 44.008 [11], the mobile earth station shall enter the MM non-DRX mode period. This period ends when either of the messages GPRS ATTACH ACCEPT, GPRS ATTACH REJECT, ROUTING AREA UPDATE ACCEPT or ROUTING AREA UPDATE REJECT is received by the mobile station. This period also ends after timeout when waiting for any of these messages.

5.4.1.9 Page mode procedures on PCCCH

See GMR-1 3G 44.060 [10], clause 5.5.1.6.

5.4.1.10 Frequency Parameters

See GMR-1 3G 44.060 [10], clause 5.5.1.7.

5.4.1.11 G-RNTI Management

G-RNTI is used to identify a mobile earth station during contention resolution and is allocated by RRC in the GERAN. If a mobile earth station does not possess a GERAN allocated G-RNTI when making a contention access it shall use a Random G-RNTI. Upon receiving a G-RNTI allocation from the GERAN a mobile earth station shall use it for subsequent contention accesses for as long as it remains valid.

5.4.2 Network side

5.4.2.1 System Information broadcasting

5.4.2.1.1 System information on PBCCH

See GMR-1 3G 44.060 [10], clause 5.5.2.1.1.

5.4.2.1.2 System information on BCCH

See GMR-1 3G 44.008 [11].

5.4.2.1.3 System information on PACCH (and other logical channels)

See GMR-1 3G 44.060 [10], clause 5.5.2.1.3.

5.4.2.1.4 Consistent sets of system information messages

See GMR-1 3G 44.060 [10], clause 5.5.2.1.4.

5.4.2.2 Paging

See GMR-1 3G 44.060 [10], clause 5.5.2.2.

5.4.2.3 Network Assisted Cell Change

See GMR-1 3G 44.060 [10], clause 5.5.2.3.

5.5 Measurement reports

5.5.1 General

See GMR-1 3G 44.060 [10], clause 5.6.0.

5.5.2 Network Control (NC) measurement reporting

Network Control (NC) measurement reporting is applicable only when the mobile earth station is in MAC-Shared state.

See GMR-1 3G 44.060 [10], clause 5.6.

5.5.3 (void)

5.5.4 Additional measurement and reporting parameters

See GMR-1 3G 44.060 [10], clause 5.6.4.

5.6 Mapping of Signalling Radio Bearers (SRB) onto logical channels

5.6.1 Downlink

In downlink direction, the mapping of SRBs onto logical channels is left up to network implementation. The rules defined in clause 5.6.2 should be used. The MES shall be able to receive SRB data on any of the following logical channels if available: DACCH or PDTCH.

5.6.2 Uplink

5.6.2.1 MAC-Dedicated State

Table 5.6.2.1.1 represents the alternatives for mapping a given SRB onto a given logical channel. The MES shall obey the rules given in this table. Only the logical channels available for SRBs are listed.

**Table 5.6.2.1.1: Mapping of SRBs onto logical channels or transport channels
in MAC-Dedicated State**

	MAC-Dedicated State	
	DACCH	**PDTCH**
SRB1	N/A	N/A
SRB2	DACCH	N/A
SRB3	DACCH	N/A
SRB4	DACCH	N/A
NOTE: Use of SRB3 and SRB4 is optional. If SRB3 and SRB4 are not used, the services provided by SRB3 and SRB4 shall be provided by SRB2.		

5.6.2.2   MAC-Shared State

Table 5.6.2.2.1 represents the alternatives for mapping a given SRB onto a given logical channel when the MES is in MAC-Shared state. The MES shall obey the rules given in this table. Only the logical channels available for SRBs are listed.

Table 5.6.2.2.1: Mapping of SRBs onto logical channels in MAC-Shared State

	MAC-Shared State
	PDTCH
SRB1	N/A
SRB2	PDTCH
SRB3	PDTCH
SRB4	PDTCH
NOTE: Use of SRB3 and SRB4 is optional. If SRB3 and SRB4 are not used, the services provided by SRB3 and SRB4 shall be provided by SRB2.	

5.6.2.3   MAC-DTM State

Table 5.6.2.3.1 represents the alternatives for mapping a given SRB onto a given logical channel when the MS is in MAC-DTM state. The MES shall obey the rules given in this table. Only the logical channels available for SRBs are listed.

**Table 5.6.2.3.1: Mapping of SRBs onto logical channels or transport channels
in MAC-DTM State**

	MAC-DTM State
	(DACCH) + (PDTCH + SFACCH)
SRB1	N/A
SRB2	DACCH or PDTCH
SRB3	DACCH or PDTCH
SRB4	DACCH or PDTCH
NOTE: Use of SRB3 and SRB4 is optional. If SRB3 and SRB4 are not used, the services provided by SRB3 and SRB4 shall be provided by SRB2.	

5.7   Multiplexing principles with Flexible Layer One

5.7.1   General

FLO is not supported in GMR-1 3G.

5.7.2   Multiplexing between user-plane and control-plane

FLO is not supported in GMR-1 3G.

6   Paging procedures

6.1   General

The Packet Paging procedure is always initiated upon request by RRC. RRC shall provide all the necessary information to construct a PAGING REQUEST message. The MAC layer shall include in the PAGING REQUEST message all information received from the RRC layer. A number of mobile earth stations can be paged in the same paging message.

On receipt of a PAGING REQUEST message, the MAC shall forward all received information for this mobile earth station to RRC.

6.2   Paging initiation in MAC-Idle state

In MAC-Idle state and upon request from RRC, the MAC layer initiates the Packet Paging procedure by transmitting a PAGING REQUEST message on an appropriate paging subchannel on the CCCH, taking into account the DRX parameters valid for each targeted mobile earth station (see clause 5.4.1.8).

The following IEs shall be included in the in the PAGING REQUEST message. RRC determines the values of the IEs (see GMR-1 3G 44.008 [11]).

-       MS Identity (IMSI, P-TMSI or G-RNTI).

The following IEs may be included in the in the PAGING REQUEST message. RRC determines which IEs to include and their values (see GMR-1 3G 44.008 [11]).

-       CN domain identity.

-       Paging cause.

-       Paging Record Type Identifier.

6.3   Paging initiation in MAC-Shared state

Paging in MAC-Shared state is not supported in GMR-1 3G.

6.4   Reception of PACKET PAGING REQUEST by an MS

Upon reception of a PAGING REQUEST message, the MAC shall forward all received information for this mobile earth station to RRC.

7   Medium Access Control (MAC) procedures on PCCCH

7.1   General

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

A mobile earth station-initiated TBF establishment shall begin with a normal random access burst on CCCH as described in GMR-1 3G 44.008 [11] or use of a packet access burst (PAB) on the PCCCH. MES shall initiate TBF establishment on CCCH if indicated to do so by RRC or if the synchronization state requires use of CCCH.

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 GMR-1 3G 45.010 [8]. Under all other conditions the MES shall use a normal random access burst on the CCCH.

The request for establishment of a TBF using the PCCCH is described in this clause.

7.2 TBF establishment initiated by the mobile earth station on PCCCH

7.2.1 General

The purpose of the packet access procedure is to establish a TBF to support the transfer of upper-layer PDUs in the direction from the mobile earth station to the network. Packet access shall be done on PCCCH using PAB, as defined in this clause if a PCCCH exists. Availability of PCCCH is specified in the SI message transmitted on BCCH. If PCCCH does not exist (based on the last carrier used successfully to complete a TBF, see GMR-1 3G 44.060 [10]), packet access shall be done on CCCH, as defined in GMR-1 3G 44.008 [11]. The packet access on PCCCH shall be done using one phase access (see clause 7.2.3).

TBF establishment can also be done on PACCH if a TBF for transfer of upper-layer PDUs in the direction from the network to the mobile earth station is already established (see clause 8.2.2.1.3).

The packet access procedure is initiated by the mobile station. Initiation is triggered by a request from upper layers to transfer an upper-layer PDU using the primitives that are defined in clause 4.3.

Upon such a request:

- if access to the network is allowed (clause 7.2.2), the mobile earth station shall initiate the packet access procedure as defined in clause 7.2.3.1.1;

- otherwise, the MAC sublayer in the mobile earth station shall reject the request.

7.2.2 Permission to access the network

See GMR-1 3G 44.060 [10], clause 7.1.1.

7.2.3 Initiation of a TBF establishment

7.2.3.1 Initiation of the packet access procedure

7.2.3.1.1 General

The mobile earth station shall initiate the packet access procedure by scheduling the sending of a PACKET CHANNEL REQUEST TYPE 2 message on the PRACH. If there are multiple PDCH-Carriers within the cell 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 no longer carries PRACH, the mobile earth station shall perform TBF establishment using CCCH as described in clause 7.1.4 of GMR-1 3G 44.060 [10].

If the mobile earth station is in MAC-Shared state, the mobile earth station shall use the PDCH-Carrier associated with the downlink TBF for PRACH transmission. The PDCH-Carriers that carry PCCCH, i.e. PRACH and PAGCH, are transmitted on the system information.

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 PACKET CHANNEL REQUEST TYPE 2 messages are sent on PRACH3 and contain an indication of the type of access, the S-RNTI to identify the MES, and parameters indicating the mobile earth station demand for radio resource.

The cause value to be used in the PACKET CHANNEL REQUEST TYPE 2 message depends on the purpose of the packet access procedure as follows:

- If the mobile earth station is in RRC-GRA_PCH state (see GMR-1 3G 44.118 [4]) and intends to use the TBF to send user data or upper layer signalling, it shall indicate the cause as "RRC Cell Update".

- If the mobile earth station is in RRC-GRA_PCH state and intends to use the TBF periodic GRA update (see GMR-1 3G 44.118 [4]), it shall indicate the cause as "Periodic GRAUpdate".

- If the mobile earth station is in RRC-Cell Shared state without an uplink TBF and requires uplink resources for transferring user or upper layer signalling, it shall indicate the cause as "Uplink Resource Request".

- If the mobile earth station is accessing the GERAN as part of handover procedure (see 3GPP 25.331 [16]), then it shall indicate the cause as "handover access".

If a PACKET DOWNLINK ASSIGNMENT is received by the MES during the packet access procedure, the MES shall act upon it immediately while continuing the packet access procedure as described in clause 7.2.1.1 of GMR-1 3G 44.060 [10].

7.2.3.1.2 Access persistence control on PRACH

See GMR-1 3G 44.060 [10], clause 7.1.2.1.1.

7.2.3.2 Packet assignment procedure

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

7.2.3.2.1.1 General

On receipt of a PACKET CHANNEL REQUEST TYPE 2 message, the network may assign to the mobile earth station a radio resource on either one or more PDCHs and/or on one or more DCHs, based on the cause field in the received message.

7.2.3.2.1.2 Allocation of resource on PDCH(s)

See GMR-1 3G 44.060 [10], clause 7.1.2.2.1.

7.2.3.2.1.3 Allocation of resource on DCH(s)

When the mobile earth station has been allocated a resource on one or more DCHs, the allocated dedicated resource is assigned to the mobile earth station in a PACKET DCH ASSIGNMENT message, sent on any PAGCH block on the same PCCCH on which the network has received the PACKET CHANNEL REQUEST TYPE 2 message. The G-RNTI information element shall be used to address the mobile earth station and frequency parameters shall be included.

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

On receipt of a PACKET DCH ASSIGNMENT message corresponding to one of its 3 last PACKET CHANNEL REQUEST TYPE 2 messages the mobile earth station shall stop timers T3186 and T3170 if running and stop sending PACKET CHANNEL REQUEST TYPE 2 messages. The mobile earth station shall then switch to the assigned DCH(s) and enter the MAC-Dedicated state. If PDCH(s) is assigned on the downlink, the mobile earth station shall switch to the assigned PDCH(s) and enter MAC-DTM state.

When the mobile earth station switches to the assigned DCH(s), it shall take into account the power control parameters received in downlink, perform signal strength measurements and apply output power control procedures as they are defined for MAC-Dedicated state (see GMR-1 3G 45.008 [7]).

7.2.3.2.1.4 Packet access queuing notification procedure

See GMR-1 3G 44.060 [10], clause 7.1.2.2.2.

7.2.3.2.1.5 Packet polling procedure

See GMR-1 3G 44.060 [10], clause 7.1.2.2.3.

7.2.3.2.1.6   Packet access reject procedure

The network may, as response to a PACKET CHANNEL REQUEST TYPE 2 message, send to the mobile earth station a PACKET ACCESS REJECT message on any PAGCH block on the same PCCCH on which the channel-request message was received. This message contains the G-RNTI and optionally a WAIT_INDICATION field in the *Reject structure* of the PACKET ACCESS REJECT message.

On receipt of a PACKET ACCESS REJECT message addressed to the mobile station corresponding to one of the mobile earth station's last 3 PACKET CHANNEL REQUEST TYPE 2 messages:

- The mobile earth station shall stop T3186, stop sending PACKET CHANNEL REQUEST TYPE 2 messages, start T3172 with the value indicated in the WAIT_INDICATION field, start T3170 if it has not already been started, and listen to the downlink PCCCH until T3170 expires. During this time, the mobile earth station shall ignore additional PACKET ACCESS REJECT messages, but on reception of any PACKET UPLINK ASSIGNMENT or PACKET DCH ASSIGNMENT message corresponding to any other of its last 3 PACKET CHANNEL REQUEST TYPE 2 messages, the mobile earth station shall stop T3170, stop T3172, and follow the procedure defined in clause 7.2.3.2.1.

- If no PACKET UPLINK ASSIGNMENT or PACKET DCH ASSIGNMENT message is received before expiration of T3170, the mobile earth station shall indicate a packet access failure to upper layer and return to *MAC-Idle state.* As an option, the mobile earth station may stop T3170, indicate a packet access failure to upper layer and return to *MAC-Idle state* 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 TYPE 2 messages.

- If an erroneous PACKET UPLINK ASSIGNMENT or PACKET DCH ASSIGNMENT message (*e.g.* the mobile earth station has been assigned more PDCHs than it supports according to its multislot class) addressed to the mobile earth station is received before expiration of T3170, the mobile earth station shall stop T3170 and act as stated in clause 7.2.5.

- If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT message, it shall stop T3170 and respond to the message (see clause 7.3.2).

- If the mobile earth station receives a PACKET DCH ASSIGNMENT message, it shall stop T3170 and respond to the message (see clause 7.3.3).

- The mobile earth station shall not make a new attempt for packet access in the same cell until T3172 expires, but may attempt packet access in another cell after successful cell reselection for radio-conditions reasons (see GMR-1 3G 45.008 [7]).

- The value of the WAIT_INDICATION field (*i.e.* T3172) relates to the cell from which it was received.

7.2.3.3   Contention resolution at one phase access

Contention resolution is not required in GMR-1 3G.

7.2.3.4   RLC/MAC procedures during contention resolution

7.2.3.4.1   RLC/MAC procedures during contention resolution on PDCHs

Contention resolution is not required in GMR-1 3G.

7.2.3.4.2   RLC/MAC procedures during contention resolution on DCHs

Contention resolution is not required in GMR-1 3G.

7.2.3.5   One phase packet access completion

7.2.3.5.1   One phase packet access completion on PDCHs

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

The network may include G-RNTI in response messages even if S-RNTI was used by MES. In such cases, the MES shall use only S-RNTI field of the included G-RNTI to determine if the response was addressed to itself or not.

7.2.3.5.2   One phase packet access completion on DCHs

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

The network may include G-RNTI in response messages even if S-RNTI was used by MES. In such cases, the MES shall use only S-RNTI field of the included G-RNTI to determine if the response was addressed to itself or not.

7.2.3.6   Timing Advance

7.2.3.6.1   Timing advance on PDCHs

See GMR-1 3G 44.060 [10], clause 7.1.2.4.

7.2.3.6.2   Timing advance on DCHs

Initial timing advance may be provided in the PACKET DCH ASSIGNMENT message in the Packet Link Synchronization IE.

7.2.4   TBF establishment using two phase access

Two phase access is not required in GMR-1 3G.

7.2.5   Abnormal cases

If a failure occurs on the mobile earth station side of the new TBF before the mobile earth station has successfully completed contention resolution, 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 failure is due to the expiry of timers T3166 or T316, the mobile earth station shall return to MAC-Idle state, notify higher layer (TBF establishment failure), transactions in progress shall be aborted and cell reselection may take place, unless the failure takes place during a Packet Cell Change Order procedure, in which case the mobile behaviour shall be as described in the Abnormal cases of the Network controlled cell reselection procedure in GMR-1 3G 44.060 [10], clause 8.4.2.

- If the mobile earth station has been assigned more PDCHs than it supports according to its MS multislot class, the mobile earth station shall reinitiate the packet access procedure unless the packet access procedure has already been attempted four times. In that case, TBF failure has occurred.

- If the information in the PACKET UPLINK ASSIGNMENT message does not properly specify an uplink PDCH or violates the mobile station's multislot capabilities, the mobile earth station shall reinitiate the packet access procedure unless the packet access procedure has already been attempted four times. In that case, TBF failure has occurred.

- If the information in the PACKET DCH ASSIGNMENT message does not properly specify a DCH or violates the mobile station's multislot capabilities, the mobile earth station shall reinitiate the packet access procedure unless the packet access procedure has already been attempted four times. In that case, TBF failure has occurred.

- If the mobile earth station has been assigned a TCH that it does not support, the mobile earth station shall return to MAC-Idle state and notify higher layers (TBF establishment failure).

- If the information in the MULTIPLE TBF UPLINK ASSIGNMENT message does not properly specify an uplink PDCH or violates the mobile station's multislot capabilities, the mobile earth station shall reinitiate the packet access procedure for each of the TBFs for which there is an error unless the procedure has already been attempted 4 times for the TBF. In that case, TBF failure has occurred.

- If the MULTIPLE TBF UPLINK ASSIGNMENT message contains assignments for radio bearers for which a TBF was not requested, the mobile earth station shall not act upon these assignments. The mobile earth station shall act upon the valid assignments.

- If the MULTIPLE TBF UPLINK ASSIGNMENT message contains assignments such that more than one RB is mapped onto one TBF, then TBF failure has occurred for each of the RBs that are mapped onto the same TBF.

- If the mobile earth station has been assigned an MCS that the MS does not support, the MS shall return to MAC-Idle state and notify higher layers (TBF establishment failure).

- On expiry of timer T3164, the mobile earth station shall reinitiate the packet access procedure for the related RB unless the packet access procedure has already been attempted four times for this RB, in which case the mobile earth station shall notify higher layers of TBF establishment failure. If the mobile earth station has no remaining TBFs it shall return to MAC-Idle state.

- If the failure is due to any other reason, the mobile earth station shall return to MAC-Idle state, notify higher layer (TBF establishment failure), transactions in progress shall be aborted and cell reselection continues.

7.3 TBF establishment initiated by the network on CCCH

The purpose of network initiated TBF establishment is to establish a TBF to support the transfer of upper layer PDUs in the direction from the network to the mobile station. TBF establishment on CCCH is supported only in MAC-Idle state.

The RRC layer on the network shall initiate paging procedures specified in clause 6.0 prior to establishment of TBF.

7.4 Procedure for measurement report sending in MAC-Idle state

Measurement reporting in MAC-Idle state is not supported in GMR-1 3G.

7.5 Cell Change Order procedures in MAC-Idle state

Cell Change Order procedures in MAC-idle state are not supported in GMR-1 3G.

8 Medium Access Control (MAC) procedures on PDCH

8.1 General

The MAC procedures defined in this clause are applicable in MAC-Shared state and MAC-DTM state.

The full set of downlink assignment messages comprises the PACKET DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF DOWNLINK ASSIGNMENT, MULTIPLE TBF TIMESLOT RECONFIGURE and optionally PACKET DCH ASSIGNMENT messages.

The full set of uplink assignment messages comprises the PACKET UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF UPLINK ASSIGNMENT and MULTIPLE TBF TIMESLOT RECONFIGURE messages.

The network may choose to send either single assignment messages (PACKET UPLINK ASSIGNMENT, PACKET DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE) or multiple TBF assignment messages (MULTIPLE TBF DOWNLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, MULTIPLE TBF TIMESLOT RECONFIGURE) on the PACCH. The network shall only use the multiple TBF assignment messages when assigning or reallocating the mobile earth station with more than one uplink TBF and/or more than one downlink TBF.

The network may multiplex RLC/MAC blocks from multiple MESs in a single downlink PDCH burst. The RLC/MAC header in these blocks will indicate if the transparent or non-transparent RLC mode is used. The burst format on downlink PDCH for non-transparent mode RLC is specified in clause 10.0 of GMR-1 3G 44.060 [10]. The burst format for transparent mode RLC is specified in clause 12.4.1a.

8.1a Resource stealing (SFACCH)

Use of SFACCH in GMR-1 3G is FFS.

8.2 Transfer of RLC data blocks

8.2.1 Medium access mode

The transfer of RLC data blocks on PDCH is governed by different principles on both uplink and downlink for each of the defined medium access modes.

8.2.2 Uplink RLC data block transfer

8.2.2.0 General

8.2.2.0.1 General

See GMR-1 3G 44.060 [10], clause 8.1.1.

8.2.2.0.2 Establishment of additional uplink TBF(s)

When the mobile earth station has data to send that does not have the same radio bearer identity as (any of) the uplink TBF(s) or TBF request(s) in progress, the mobile earth station shall request uplink resources through one of the following procedures:

- If the data belongs to a signalling radio bearer:

    - Establish an additional TBF (clause 8.2.2.1.2).

    - If the mobile earth station cannot support the establishment of an additional TBF, then the network may release an on-going TBF in order to establish a new TBF (clause 8.2.2.1.2).

- If the data belongs to a user radio bearer:

    - Establish an additional TBF (clause 8.2.2.1.2).

    - If the mobile earth station cannot support the establishment of an additional TBF, then the network may release an on-going TBF in order to establish a new TBF (clause 8.2.2.1.2).

8.2.2.0.3 Uplink resource reallocation/reconfiguration

Neither the mobile earth station nor the network are allowed to modify the RLC mode, TBF mode or radio bearer identity of an already established TBF. If the mobile earth station has data to send that requires a modification of existing uplink resources, an uplink resource request shall be sent, see clause 8.2.2.0.2.

If no modifications to the uplink resources are required, the network may reallocate existing resources through one of the following procedures:

- The network may send a PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message to the mobile earth station on the PACCH to reallocate uplink (and also downlink) resources, see clause 8.2.2.1.2.2.

- The network may send a PACKET UPLINK ASSIGNMENT or MULTIPLE TBF UPLINK ASSIGNMENT message to the mobile earth station on the PACCH to reallocate uplink resources, see clause 8.2.2.1.2.2.

8.2.2.0.4 Establishment of downlink TBF(s)

During uplink data transfer, the network may initiate downlink data transfer for one or more TBFs by sending a downlink assignment message to the mobile earth station on the downlink PACCH.

The network initiates assignment of a single downlink TBF by sending a PACKET DOWNLINK ASSIGNMENT or a PACKET TIMESLOT RECONFIGURE message. The network initiates assignment of more than one downlink TBF by sending a MULTIPLE TBF DOWNLINK ASSIGNMENT or a MULTIPLE TBF TIMESLOT RECONFIGURE message.

The procedure to be followed is described in clause 8.2.2.1.3.

8.2.2.1 Dynamic Allocation uplink RLC data block transfer

See GMR-1 3G 44.060 [10], clause 8.1.1.1.

8.2.2.1.1 PACCH operation

See GMR-1 3G 44.060 [10], clause 8.1.1.1.1.

8.2.2.1.2 Resource Allocation/Reallocation for Uplink

8.2.2.1.2.1 General

The mobile earth station shall initiate the uplink resource (re)allocation procedure by sending a PACKET RESOURCE REQUEST message on the PACCH and starting timer T3168 for each TBF request included in the Iu mode Channel Request Description IE.

8.2.2.1.2.2 On receipt of the PACKET RESOURCE REQUEST

On receipt of the PACKET RESOURCE REQUEST message the network shall respond by sending one or more uplink assignment messages (e.g. PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, MULTIPLE TBF TIMESLOT RECONFIGURE or PACKET TIMESLOT RECONFIGURE) and/or a PACKET ACCESS REJECT message and/or a PACKET TBF RELEASE message to the mobile earth station on the downlink PACCH.

When the mobile earth station has already been allocated the maximum number of TBFs in the uplink direction that it can support, the network shall respond with either a PACKET ACCESS REJECT message, or a PACKET TBF RELEASE message followed by an uplink assignment message.

On receipt of an uplink assignment message the mobile earth station shall stop timer T3168 for each uplink TBF assigned in the assignment message and switch to the assigned PDCHs. A new assignment shall not terminate the previous assignment unless the uplink assignment message explicitly contains a reassignment for an on-going TBF.

On expiry of timer T3168 the mobile earth station shall retransmit the PACKET RESOURCE REQUEST message for the TBF(s) for which T3168 has expired unless the PACKET RESOURCE REQUEST message has already been transmitted four times for this TBF in which case the mobile earth station shall indicate a packet access failure to upper layer and perform an abnormal release without retry (see clause 8.7.1).

If no uplink assignment message is received for a TBF for which timer T3168 is running before the mobile earth station has completed its currently assigned TBF(s), the mobile earth station shall stop timer T3168 for that TBF, return to MAC-Idle state and start the packet access procedure on the PCCCH.

The network may at any time during an uplink TBF initiate a change of resources or allocation of new resources by sending on the downlink PACCH monitored by the MS, an unsolicited uplink assignment message to the mobile station.

On receipt of a PACKET ACCESS REJECT message, the mobile earth station shall stop timer T3168, if running, for each TBF request rejected in the PACKET ACCESS REJECT message and indicate a packet access failure to the upper layer. If no other uplink or downlink TBFs exist, the mobile earth station in MAC-Shared state shall return to MAC-Idle state; the mobile earth station in MAC-DTM state shall return to MAC-Dedicated state. The DRX mode procedures shall be applied, as specified in clause 5.5.1.5.

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

-    start timer T3172 for each TBF request rejected in the message (listed by radio bearer identity). The mobile earth station is not allowed to make a new attempt for an uplink TBF establishment for this radio bearer in the same cell until this instance of timer T3172 expires. It may attempt a TBF establishment for another radio bearer while T3172 is running. It may attempt an uplink TBF establishment in another cell after successful cell reselection. While T3172 is running, the mobile earth station shall ignore all received PACKET PAGING REQUEST messages.

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

8.2.2.1.2.3   Abnormal cases

The following abnormal cases apply:

-    If the mobile earth station receives a PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message and detects an invalid Frequency Parameters information element in the message, the mobile earth station shall perform an abnormal release with system information (see clause 8.8.4).

-    If the information in the PACKET UPLINK ASSIGNMENT or MULTIPLE TBF UPLINK ASSIGNMENT message incorrectly specifies one or more uplink PDCHs, the mobile earth station shall perform an abnormal release with access retry of the uplink TBF(s) with erroneous assignments (see clause 8.8.5). The mobile earth station shall act upon the valid assignments.

-    If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message incorrectly specifies one or more uplink and/or downlink PDCHs, the mobile earth station shall perform an abnormal release with access retry of the uplink TBF(s) with erroneous assignments (see clause 8.8.5). The mobile earth station shall act upon the valid assignments.

-    If the information in the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message violates the mobile station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

-    If the mobile earth station receives a PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message specifying frequencies that are not all in one frequency band then the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

-    If the mobile earth station receives a PACKET UPLINK ASSIGNMENT or MULTIPLE TBF UPLINK ASSIGNMENT message containing a Frequency Parameters information element specifying a frequency that is in a frequency band not supported by the mobile earth station then the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

-    If the mobile earth station receives a PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message containing assignments such that more than one radio bearer is mapped onto one TBF, then the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

-    If the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, or MULTIPLE TBF TIMESLOT RECONFIGURE message assigns the same USF to more than one TBF on the same timeslot, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

-    If the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message specifies a RBid that is not assigned to the mobile station, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If a mobile earth station in MAC-DTM state receives a PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message including the Frequency Parameters information element, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If the MULTIPLE TBF UPLINK ASSIGNMENT or MULTIPLE TBF TIMESLOT RECONFIGURE message does not specify a Channel Coding scheme for one or more of the uplink TBFs that it is assigning, then the mobile earth station shall perform an abnormal release with access retry of the uplink TBFs with erroneous assignments (see clause 8.8.5). The mobile earth station shall act upon the valid assignments.

- If the PACKET ACCESS REJECT message does not specify a G-RNTI field in the Reject structure for each G-RNTI included in the TLLI/G-RNTI field in the Reject structure, then the mobile earth station shall ignore the message.

- If the PACKET ACCESS REJECT message includes one or more RBid fields in the Iu mode Reject structure which were not included by the mobile earth station in the Iu mode Channel Request Description structure, then the mobile earth station shall perform abnormal release with access retry (see clause 8.8.3).

- If a failure in the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

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

8.2.2.1.3 Establishment of downlink TBF

8.2.2.1.3.1 General

During uplink transfer, the network may initiate one or more downlink TBFs by sending a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF DOWNLINK ASSIGNMENT, MULTIPLE TBF TIMESLOT RECONFIGURE) to the mobile earth station on the PACCH.

If a PACKET TIMESLOT RECONFIGURE message is sent, then the message shall contain the DOWNLINK_TFI_ASSIGNMENT field. The multislot restrictions of the mobile earth station shall be observed.

A mobile allocation or reference frequency list, received as part of a downlink assignment, replaces the previous parameters and shall be used until a new assignment is received or the mobile earth station has released all TBFs.

On receipt of a downlink assignment message, and after the TBF starting time, if present, the mobile earth station shall switch to the assigned PDCHs, and start timer T3190 for each TBF. The operation of the downlink TBF follows the procedures in clause 8.2.3 and GMR-1 3G 44.060 [10], 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 triggering an abnormal release with access retry on PCCCH (see clause 8.8.3), the mobile earth station shall also abort all downlink TBF(s). The mobile earth station shall not abort the downlink TBF(s) in case an abnormal release with access retry on PACCH is triggered;

- if both uplink and downlink TBFs are already established and if more than one TBF is already established in either/both direction(s), then the network may send a MULTIPLE TBF TIMESLOT RECONFIGURE message. If this message contains a change in frequency in the frequency parameters and does not contain a reassignment for one or more of the mobile station's TBFs, these TBFs are to be released upon moving to the new frequency. If no change in frequency parameters is included, the TBFs not explicitly reconfigured shall continue according to their original assignment.

8.2.2.1.3.2 Abnormal cases

In the following abnormal cases it is assumed that at least one uplink TBF exists. The subsequent behaviour of the mobile earth station depends on the type of failure and previous actions:

- If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message incorrectly specifies an uplink and/or downlink PDCH, the mobile earth station shall perform an abnormal release of the downlink TBF(s) with erroneous assignments (see clause 8.8.6). The mobile earth station shall act upon the valid assignments.

- If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message violates the mobile station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If a downlink TBF is not already established and the PACKET TIMESLOT RECONFIGURE message does not include a DOWNLINK_TFI_ASSIGNMENT field, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If a downlink TBF is not already established and the MULTIPLE TBF TIMESLOT RECONFIGURE message does not assign any downlink TBFs, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message containing assignments such that more than one radio bearer is mapped onto a TBF, then the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If the PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message specifies a RBid not assigned to the mobile station, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If a mobile earth station in MAC-DTM state receives a PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message including the Frequency Parameters information element, the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If a failure in the PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall abort the procedure. If other uplink TBFs exist, the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3). If only downlink TBFs exist, the mobile earth station shall continue the normal operation of these TBFs. If no other TBFs exist, the mobile earth station shall perform an abnormal release without retry (see clause 8.8.2).

8.2.2.2 Extended Dynamic Allocation uplink RLC data block transfer

Extended Dynamic Allocation medium access method is not supported in GMR-1.

8.2.2.3 Exclusive Allocation uplink RLC data block transfer

Exclusive Allocation is not supported in GMR-1.

8.2.2.4 Network initiated release of uplink TBF

See GMR-1 3G 44.060 [10], clause 8.1.1.4.

8.2.2.5 Abnormal cases

The following additional abnormal cases are applicable to an uplink transfer:

- if the mobile earth station receives a PACKET UPLINK ACK/NACK message with missing mandatory fields, the mobile earth station shall perform an abnormal release with access retry of the uplink TBF (clause 8.8.5) associated with this message;

-       if the mobile earth station receives a PACKET UPLINK ACK/NACK message that contains a RBid that is not assigned to the mobile earth station or that is assigned to the mobile earth station but without any corresponding uplink TBF, the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

8.2.3   Downlink RLC data block transfer

8.2.3.1   General

8.2.3.1.0   General

The network initiates assignment of a single downlink TBF by sending a PACKET DOWNLINK ASSIGNMENT or a PACKET TIMESLOT RECONFIGURE message on the downlink PACCH. The network initiates assignment of more than one downlink TBF by sending a MULTIPLE TBF DOWNLINK ASSIGNMENT or a MULTIPLE TBF TIMESLOT RECONFIGURE message on the downlink PACCH. Prior to the initiation of RLC data block transfer on the downlink, the network assigns the following parameters to the downlink TBF in the downlink assignment message:

-       a Temporary Flow Identity (TFI). The TFI applies to all radio blocks transferred in regards to the downlink Temporary Block Flow (TBF);

-       a Radio Bearer identity (RBid). There is a one-to-one mapping between the TFI and the RBid of the radio bearer for which the downlink TBF is established;

-       a set of PDCHs to be used for the downlink transfer;

-       optionally, a TBF starting time indication.

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

8.2.3.1.1   Downlink resource reallocation

Neither the mobile earth station nor the network are allowed to modify the RLC mode, TBF mode or radio bearer identity of an already established TBF.

If no modifications to the downlink resources are required, the network may reallocate existing resources through one of the following procedures:

-       The network may send a PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message to the mobile earth station on the PACCH to reallocate downlink (and also uplink) resources, see clause 8.2.3.2.

-       The network may send a PACKET DOWNLINK ASSIGNMENT or MULTIPLE TBF DOWNLINK ASSIGNMENT message to the mobile earth station on the PACCH to reallocate downlink resources, see clause 8.2.3.2.

The network may multiplex RLC/MAC blocks from multiple MESs on the same downlink PDCH. This shall include RLC/MAC blocks from TBFs supporting non-transparent mode RLC as well as transparent mode RLC. The RLC/MAC header shall indicate if the RLC/MAC data is meant for transparent mode or non-transparent mode RLC entity on the MES. Other than multiplexing, no other RLC procedures are applicable for transparent mode RLC/MAC blocks.

Allocation of resources on the downlink PDCH for supporting transparent mode RLC shall be indicated to the MES through RRC layer procedures. See GMR-1 3G 44.118 [4].

8.2.3.1.2 (void)

8.2.3.2 Downlink RLC data block transfer procedure

8.2.3.2.0 General

Upon reception of a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF DOWNLINK ASSIGNMENT, MULTIPLE TBF TIMESLOT RECONFIGURE) that does not contain a TBF starting time the mobile earth station shall start timer T3190 for each downlink TBF assigned in the downlink assignment message and, within the reaction time defined in GMR-1 3G 45.010 [8], it shall attempt to decode every downlink block on its assigned PDCH(s). If the downlink assignment message contains a TBF starting time information element and there are no downlink TBFs in progress, but one or more uplink TBFs are in progress, the mobile earth station shall remain on the assigned PDCHs until the TDMA frame number indicated by the TBF starting time, at which time the mobile earth station shall start timer T3190 for each downlink TBF assigned in the downlink assignment message and immediately begin decoding the assigned downlink PDCH(s).

If the downlink assignment message contains a TBF starting time and there are one or more downlink TBFs already in progress, the mobile earth station shall continue to use the parameters of the downlink TBFs in progress until the TDMA frame number indicated in the TBF starting time occurs, at which time the mobile earth station shall immediately begin to use the new assigned downlink TBF parameters. If, while waiting for the frame number indicated by the TBF starting time, the mobile earth station receives another downlink assignment for the same TBF, the mobile earth station shall act upon the most recently received downlink assignment and shall ignore the previous downlink assignment. Procedures on receipt of a downlink assignment message (e.g. PACKET DOWNLINK ASSIGNMENT message) while no TBF is in progress are specified in clause 7.3.2.1 and GMR-1 3G 44.060 [10], clause 7.2.1.1.

If the mobile earth station receives a valid RLC data block addressed to (one of) its TBF(s), the mobile earth station shall restart timer T3190 for that TBF. If timer T3190 expires for a TBF and if one or more uplink TBFs are in progress, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3 and GMR-1 3G 44.060 [10], clause 8.7.2). If no other TBFs are in progress, the mobile earth station shall perform an abnormal release without retry (see clause 8.7.1).

Upon receipt of a PACKET TBF RELEASE message referring to the downlink TBF, the mobile earth station shall follow the procedure in clause 8.2.3.6.

8.2.3.2.1 Abnormal cases

The following abnormal cases apply:

- If a mobile earth station receives a PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF TIMESLOT RECONFIGURE, PACKET DOWNLINK ASSIGNMENT or MULTIPLE TBF DOWNLINK ASSIGNMENT PACKET DOWNLINK ASSIGNMENT or PACKET TIMESLOT RECONFIGURE message and detects an invalid Frequency Parameters information element in the message, it shall perform an abnormal release with system information (see clause 8.8.4), performing a partial acquisition of system information messages containing frequency information.

- If the information in the PACKET DOWNLINK ASSIGNMENT or MULTIPLE TBF DOWNLINK ASSIGNMENT message incorrectly specifies one or more downlink PDCHs, the mobile earth station shall perform an abnormal release of the downlink TBF(s) with erroneous assignments (see clause 8.8.6). The mobile earth station shall act upon the valid assignments.

- If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message incorrectly specifies one or more uplink and/or downlink PDCHs, the mobile earth station shall perform an abnormal release of the downlink TBF(s) with erroneous assignments (see clause 8.8.6). The mobile earth station shall act upon the valid assignments.

- If the information in the PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message violates the mobile station's multislot capabilities, the mobile earth station shall perform an abnormal release without retry (see clause 8.8.2).

- If a mobile earth station in MAC-DTM state receives a PACKET DOWNLINK ASSIGNMENT or MULTIPLE TBF DOWNLINK ASSIGNMENT message including the Frequency Parameters information element, the mobile earth station shall abort the procedure. If another TBF exists on a PDCH, the mobile earth station shall continue the normal operation of these TBFs. If no other TBF exists, the mobile earth station shall perform an abnormal release without retry (see clause 8.8.2).

- If a mobile earth station in MAC-DTM state receives a PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message including the Frequency Parameters information element, specifying different values from the current allocation, the mobile earth station shall perform an abnormal release without retry (see clause 8.8.2).

- If one or more uplink TBFs are already established and the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT or MULTIPLE TBF DOWNLINK ASSIGNMENT message containing different frequency parameters than are currently in effect for the uplink TBF(s), the mobile earth station shall ignore the received message and continue normal operation of the existing TBFs.

- If a downlink TBF is not already established and the PACKET TIMESLOT RECONFIGURE message does not include a DOWNLINK_TFI_ASSIGNMENT field, then the mobile earth station shall perform an abnormal release without retry (clause 8.8.2).

- If a downlink TBF is not already established and the MULTIPLE TBF TIMESLOT RECONFIGURE message does not assign any downlink TBFs, then the mobile earth station shall perform an abnormal release without retry (clause 8.8.2).

- If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message containing assignments such that more than one radio bearer is mapped onto a TBF, then the mobile earth station shall perform an abnormal release without retry (see clause 8.8.2).

- If the PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message specifies an RBid that is not assigned to the mobile station, then the mobile earth station shall perform an abnormal release without retry (clause 8.8.2).

- If the mobile earth station receives a PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT message so that the total amount of downlink TBFs assigned to the mobile earth station (i.e. new and existing TBFs) is larger than the maximum number of downlink TBFs the mobile earth station supports, the mobile earth station shall ignore the message and continue normal operation of the existing TBFs.

- If the mobile earth station receives a PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message so that the total amount of TBFs assigned to the mobile earth station (i.e. new and existing TBFs) in any direction is larger than the maximum number of TBFs the mobile earth station supports in any direction, the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If a failure in the PACKET DOWNLINK ASSIGNMENT, MULTIPLE TBF DOWNLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall abort the procedure. If other uplink TBFs exist, the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3). If only downlink TBFs exist, the mobile earth station shall continue the normal operation of these TBFs. If no other TBFs exist, the mobile earth station shall perform an abnormal release without retry (see clause 8.8.2).

8.2.3.3   Polling for Packet Downlink Ack/Nack

See GMR-1 3G 44.060 [10], clause 8.1.2.2.

8.2.3.4   Resource Reassignment for downlink

See GMR-1 3G 44.060 [10], clause 8.1.2.4.

8.2.3.5   Establishment of uplink TBF

8.2.3.5.0   General

See GMR-1 3G 44.060 [10], clause 8.1.2.5.

8.2.3.5.1   Abnormal cases

In the following abnormal cases it is assumed that at least one downlink TBF exists. The subsequent behaviour of the mobile earth station depends on the type of failure and previous actions.

- If the information in the PACKET UPLINK ASSIGNMENT or MULTIPLE TBF UPLINK ASSIGNMENT message incorrectly specifies one or more uplink PDCHs, the mobile earth station shall perform an abnormal release with access retry of the uplink TBF(s) with erroneous assignments (see clause 8.8.5). The mobile earth station shall act upon the valid assignments.

- If the information in the PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message incorrectly specifies one or more uplink and/or downlink PDCHs, the mobile earth station shall perform an abnormal release with access retry of the uplink TBF(s) with erroneous assignments (see clause 8.8.5). The mobile earth station shall act upon the valid assignments.

- If the information in the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message violates the mobile station's multislot capabilities, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If the mobile earth station receives a PACKET UPLINK ASSIGNMENT or MULTIPLE TBF UPLINK ASSIGNMENT message containing different frequency parameters than are currently in effect for its existing TBFs, the mobile earth station shall ignore the PACKET UPLINK ASSIGNMENT or MULTIPLE TBF UPLINK ASSIGNMENT message, continue normal operation of the existing TBFs, and reinitiate the establishment of the new uplink TBFs unless the establishment of any of these TBFs has already been attempted four times, in which case, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If a mobile earth station in MAC-DTM state receives a PACKET UPLINK ASSIGNMENT or MULTIPLE TBF UPLINK ASSIGNMENT message including the Frequency Parameters information element that is not the same as the one currently allocated, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If an uplink TBF is not already established and the PACKET TIMESLOT RECONFIGURE message does not include a UPLINK_TFI_ASSIGNMENT field, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If an uplink TBF is not already established and the MULTIPLE TBF TIMESLOT RECONFIGURE message does not assign any uplink TBFs, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If the mobile earth station receives a PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message contains assignments such that more than one radio bearer is mapped onto a TBF, then the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If the MULTIPLE TBF UPLINK ASSIGNMENT or MULTIPLE TBF TIMESLOT RECONFIGURE message does not specify a Channel Coding scheme for all of the uplink TBFs that it is assigning, then the mobile earth station shall perform an abnormal release with access retry of the uplink TBFs with erroneous assignments (see clause 8.8.5). The mobile earth station shall act upon the valid assignments.

- If the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, MULTIPLE TBF TIMESLOT RECONFIGURE message assigns the same USF to more than one TBF on the same timeslot, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE, MULTIPLE TBF TIMESLOT RECONFIGURE message specifies a RBid that is not assigned to the mobile station, then the mobile earth station shall perform an abnormal release with access retry (clause 8.8.3).

- If the PACKET ACCESS REJECT message does not specify a G-RNTI in the Reject structure for each G-RNTI included in the TLLI/G-RNTI field in the Reject structure, then the mobile earth station shall ignore the message.

- If the PACKET ACCESS REJECT message includes one or more RBid fields in the Reject structure which were not included by the mobile earth station in the Iu mode Channel Request Description structure, then the mobile earth station shall perform abnormal release with access retry (see clause 8.8.3).

- If a mobile earth station in MAC-DTM state receives a PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message including the Frequency Parameters information element that is not the same as the one currently allocated, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

- If a failure in the PACKET UPLINK ASSIGNMENT, MULTIPLE TBF UPLINK ASSIGNMENT, PACKET TIMESLOT RECONFIGURE or MULTIPLE TBF TIMESLOT RECONFIGURE message is due to any other reason, the mobile earth station shall perform an abnormal release with access retry (see clause 8.8.3).

8.2.3.6 Network initiated abnormal release of downlink TBF

See GMR-1 3G 44.060 [10], clause 8.1.2.8.

8.3 Packet PDCH Release

See GMR-1 3G 44.060 [10], clause 8.2.

8.4 Procedure for measurement report sending in MAC-Shared state

See GMR-1 3G 44.060 [10], clause 8.3.

8.5 Network Controlled cell reselection procedures in MAC-Shared state

See GMR-1 3G 44.060 [10], clause 8.4.

8.6 Measurement Order procedures in MAC-Shared state

See GMR-1 3G 44.060 [10], clause 8.5.

8.7 PACKET CONTROL ACKNOWLEDGEMENT

See GMR-1 3G 44.060 [10], clause 8.6.

8.8 Abnormal cases

8.8.1 General

See GMR-1 3G 44.060 [10], clause 8.7.0.

8.8.2 Abnormal release without retry

See GMR-1 3G 44.060 [10], clause 8.7.1.

8.8.3 Abnormal release with access retry

The mobile earth station shall abort all TBFs in progress. The mobile earth station in MAC-Shared state shall return to MAC-Idle state and initiate the establishment of a new uplink TBF on PDCH(s), using the procedures on PCCCH, as defined in clause 7.2.

In case the mobile earth station fails to establish a new uplink TBF on PDCH(s), the mobile earth station shall report an RLC/MAC failure to upper layers. The DRX mode procedures shall be applied, as specified in clause 5.4.1.8.

8.8.4 Abnormal release with system information

See GMR-1 3G 44.060 [10], clause 8.7.3.

8.8.5 Abnormal release of an Uplink TBF with access retry

The mobile earth station shall abort the uplink TBF.

If there are no remaining TBFs on PDCHs and the mobile earth station was in MAC-Shared state or MAC-DTM state, then it shall return to MAC-Idle state and reinitiate the establishment of the uplink TBF on PDCH(s) using the procedures on PCCCH, as defined in clause 7.2. In the case that this TBF was not the last remaining TBF on PDCHs, the mobile earth station shall reinitiate the establishment of the TBF on PDCHs, using the procedures defined on PACCH, as defined in clauses 8.2.3 and 8.3.3.

In case the mobile earth station fails to establish the new uplink TBF on PDCH(s), the mobile earth station shall report an RLC/MAC failure to upper layers. The DRX mode procedures shall be applied, as specified in clause 5.4.1.8.

8.8.6 Abnormal release of a Downlink TBF

The mobile earth station shall abort the downlink TBF.

If there are no remaining TBFs on PDCHs and the mobile earth station was in MAC-Shared state, then it shall return to MAC-Idle state.

If there are no remaining TBFs on PDCHs and the mobile earth station in MAC-DTM state, then it shall abort all uplink TBFs and return to MAC-Idle state.

If there is a TBF remaining on PDCHs, then the mobile earth station shall remain in its current state.

The DRX mode procedures shall be applied as specified in clause 5.4.1.8.

8.9 Network Assisted Cell Change procedures in MAC-Shared state

See GMR-1 3G 44.060 [10], clause 8.4.

8.10 Packet Link Quality Reporting

The MES shall report link quality information to the network in RLC/MAC Control messages or as part of status bits in the physical layer bursts. When in MAC-Shared state, the MES shall include SQIR and/or SQISDR information in RLC/MAC control messages (See GMR-1 3G 44.060 [10] for applicable messages). When in MAC-Dedicated or MAC-DTM state the MES shall include SQIR information in the status bits of the PNB3 burst (See GMR-1 3G 45.003 [6]).

While in MAC-Shared state, after computing the link quality information (as specified in GMR-1 3G 45.008 [7]), the MES shall include this information in the earliest RLC/MAC Control message corresponding to any uplink or downlink TBF. While in MAC-Dedicated or MAC-DTM state, if the MES is allocated more than one uplink DCHs, the MES shall transmit the same link quality information on all uplink DCHs.

8.11 Initiation of Packet access procedure following handover

As part of a shared channel handover the MES shall transmit a PACKET CHANNEL REQUEST TYPE 2 message with establishment cause set to "Handover Access" on the PRACH3 associated with the MES shared channel assignment.

In response to the receipt of the PACKET CHANNEL REQUEST TYPE 2 message with establishment cause set to "Handover Access" from the MES, the network shall transmit a PHYSICAL INFORMATION message on the MES assigned downlink channel. The PHYSICAL INFORMATION message includes time and frequency correction information that provides fine timing adjustment for the subsequent MES transmission (see clause 11.2.28). The network shall use the received PAB3 transmission to derive the link synchronization and frequency and timing correction specified to the MES for subsequent transmissions when a TBF assignment is made.

Once the MES initial frequency and timing have been corrected, the MES can initiate the packet access procedure to obtain a temporary block flow (TBF) assignment. This can be done by sending a PACKET CHANNEL REQUEST TYPE 2 with establishment cause set to "Cell Update" on the PRACH3 channel.

The PACKET CHANNEL REQUEST TYPE 2 message with establishment cause set to "Handover Access" can also be used by the MES to directly indicate a request for uplink TBF channel resources in conjunction with the handover. When the MES indicates that it has data to send for the handed over radio bearer, the network shall initiate a TBF assignment following transmission of the PHYSICAL INFORMATION message.

9 Medium Access Control (MAC) procedures on DCH

9.1 General

The MAC procedures defined in this clause are applicable in MAC-Dedicated state and in MAC-DTM state on DCH only. When a radio bearer is set-up on DCH(s) (see GMR-1 3G 44.118 [4]) the corresponding TBF is implicitly established, on this DCH(s), on the logical channel on which this TBF is mapped. This TBF shall use the TBF mode as specified in clause 5.2.2.2 and according to the radio bearer attributes as may be indicated in the CMAC-CONFIG primitive received from RRC.

9.2 Transfer of RLC/MAC blocks

9.2.0 General

Table 9.2.0.3 summarizes the RLC/MAC control messages that may be sent on a DCH.

Table 9.2.0.1: Void

Table 9.2.0.2: Void

Table 9.2.0.3: RLC/MAC control messages on DACCH

RLC messages:	Reference
Packet DCH Downlink Ack/Nack	GMR-1 3G 44.060 [10], clause 11.2.6b
Packet DCH Uplink Ack/Nack	GMR-1 3G 44.060 [10], clause 11.2.28a
Miscellaneous messages:	**Reference**
Packet Control Acknowledgement	GMR-1 3G 44.060 [10], clause 11.2.2

9.2.1   Dedicated allocation

9.2.1.1   General

On DCH, the transfer of RLC/MAC blocks is governed by the principles of the dedicated allocation.

A mobile earth station in dedicated allocation shall monitor the assigned DCH(s). The mobile earth station shall attempt to decode every downlink RLC/MAC block on the assigned DCH(s). 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 and act upon it.

Except for TCH TBF mode in T-RLC mode, PACKET UPLINK DUMMY CONTROL block(s) (respectively PACKET DOWNLINK DUMMY CONTROL block(s)) shall be sent in periods when no RLC/MAC block is scheduled for transmission in uplink direction (respectively downlink direction), following the scheduling requirements defined in GMR-1 3G 45.008 [7] clause 9.2).

For TCH TBF mode in T-RLC mode, DTX may apply. See GMR-1 3G 45.008 [7], clause 9.2.

9.2.1.2   Performance requirements for TCH and DCCH TBF modes

FFS.

9.2.1.3   Performance requirements for UDCH and CDCH TBF modes

FLO is not used in GMR-1 3G.

9.2.2   Transfer of RLC/MAC blocks on DTCH

One, and only one, TBF in TCH TBF mode may be mapped onto a DTCH. However, a physical channel carrying a DTCH may also be configured to carry a DACCH. The network shall specify the MCS to be used on DACCH and DTCH independently. The network may change the MCS used on DACCH and DTCH independently using RRC procedures.

If DACCH is not mapped to the same physical channel as the DTCH, then the transmission of RLC/MAC blocks shall be prioritized as follows (highest priority first):

-      HANDOVER ACCESS message. This message shall be sent as PAB3 burst.

-      TCH TBF mode URB RLC/MAC data.

    NOTE: There are no RLC/MAC headers in TCH TBF mode.

If a DACCH is mapped on to the same physical channel as the DTCH, then, the DTCH shall be pre-empted (in the order specified below) to transport DCCH TBF mode RLC/MAC blocks, if any is awaiting transmission. The DCCH TBF mode RLC/MAC blocks shall be prioritized as follows (highest priority first):

-      HANDOVER ACCESS (from MES) or PHYSICAL INFORMATION (from network) message. HANDOVER ACCESS message shall be sent by the MES as PAB3 burst.

-      SRB RLC/MAC Control blocks other than Uplink/Downlink Dummy Control blocks.

-      SRB RLC/MAC Data Blocks.

-      DCCH TBF mode URB RLC/MAC Control blocks with higher radio priority than the TCH mode TBF, other than Uplink/Downlink Dummy Control blocks.

-      DCCH TBF mode URB RLC Data blocks with higher radio priority than the TCH mode TBF.

If the scheduling requirements specified in GMR-1 3G 45.008 [7], clause 9.2 are met, then DTCH shall not be pre-empted to send Uplink or Downlink dummy control blocks irrespective of the radio priority of TBF associated with the dummy control blocks.

When DACCH preempts the DTCH, the MCS used on the DACCH shall be the most recent value specified by the network. This MCS is independent of the MCS used on DTCH.

DACCH RLC/MAC Control or Data blocks with lower radio priority than the TCH mode TBF, shall not pre-empt the DTCH.

9.2.3 Transfer of RLC/MAC blocks on DACCH

A TBF associated with a URB may operate in DCCH TBF mode.

All RLC data blocks belonging to a TBF in DCCH TBF mode shall be encoded using the MCS specified by the network.

The mobile earth station shall attempt to decode every downlink RLC/MAC block on DACCH. 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 and shall act on it only if the G-RNTI or Global TFI included in the RLC/MAC control message matches the G-RNTI or TFI allocated to the UT.

Each RLC data block sent on DACCH shall contain a Reduced Radio Bearer identity (RRBid) field corresponding to the radio bearer to which the RLC data block belongs.

RLC/MAC blocks shall be transmitted with the following priority (highest priority first):

- RLC/MAC control block carrying a PHYSICAL INFORMATION message;

- SRB RLC/MAC Control blocks other than Uplink/Downlink Dummy Control blocks;

- SRB RLC/MAC Data Blocks;

- URB RLC/MAC Control blocks other than Uplink/Downlink Dummy Control blocks;

- URB RLC Data blocks;

- RLC/MAC control blocks containing Packet Uplink/Downlink Dummy Control Blocks.

9.2.4 Transfer of RLC/MAC blocks on PDTCH and PACCH

Not supported in GMR-1 3G.

9.2.5 Transfer of RLC/MAC blocks on UDCH, CDCH and ADCH

FLO is not supported in GMR-1 3G.

9.3 PACKET CONTROL ACKNOWLEDGEMENT

See GMR-1 3G 44.060 [10].

9.3a Handover Access and Physical Information

9.3a.1 Handover Access

During a handover, upon trigger from RRC through the HANDOVER-Req primitive, the mobile earth station shall send a HANDOVER ACCESS message containing the necessary handover reference value (see clause 4.3.4) to the network as PAB3 burst on DCH that is allocated to the mobile station.

Upon reception of a HANDOVER ACCESS message by the network, the RRC shall be notified through the HANDOVER-Ind primitive (see clause 4.3.4) and the network shall then proceed as specified in GMR-1 3G 44.118 [4].

No other RLC/MAC blocks except PAB3 burst containing HANDOVER ACCESS message shall be sent by the mobile earth station while the PHYSICAL INFORMATION message has not been received by this mobile station.

9.3a.2   Physical Information

During a handover, upon trigger from RRC layer through the PHYSICAL-INFO-Req primitive, the network shall send a PHYSICAL INFORMATION message containing the necessary timing and frequency correction to the mobile earth station, on DACCH or PACCH.

Upon reception of a PHYSICAL INFORMATION message, the RRC shall be notified through the PHYSICAL-INFO-Ind primitive and the mobile earth station shall then proceed as specified in GMR-1 3G 44.118 [4].

9.4   Abnormal cases

-    If the mobile earth station receives an RLC/MAC control message on a logical channel where this RLC/MAC control message is not allowed (see clause 9.2.0), the mobile earth station shall ignore the message.

-    If the mobile earth station receives an acknowledgement message (PACKET UPLINK ACK/NACK, PACKET DCH UPLINK ACK/NACK) with missing mandatory fields, the mobile earth station shall notify the RRC layer, which shall in turn re-establish all RLC entities for the radio bearers currently established on the DCH(s) and release the DCH(s), as specified in GMR-1 3G 44.118 [4].

-    If the mobile earth station receives an acknowledgement message (PACKET UPLINK ACK/NACK, PACKET DCH UPLINK ACK/NACK) for a radio bearer that is either not established on the DCH(s) or for which no data has been sent in the direction of the acknowledgement on the DCH(s), the mobile earth station shall notify the RRC layer, which shall in turn re-establish all RLC entities for the radio bearers currently established on the DCH(s) and release the DCH(s), as specified in GMR-1 3G 44.118 [4].

10   Radio Link Control (RLC) procedures on PDTCH and PACCH

10.1   General

See GMR-1 3G 44.060 [10], clause 9.0.

10.2   Procedures and parameters for peer-to-peer operation

10.2.1   Send state variable V(S)

See GMR-1 3G 44.060 [10], clause 9.1.1.

10.2.2   Control send state variable V(CS)

See GMR-1 3G 44.060 [10], clause 9.1.1a.

10.2.3   Acknowledge state variable V(A)

See GMR-1 3G 44.060 [10], clause 9.1.2.

10.2.4   Acknowledge state array V(B)

See GMR-1 3G 44.060 [10], clause 9.1.3.

10.2.5   Block sequence number BSN

See GMR-1 3G 44.060 [10], clause 9.1.4.

10.2.6 Receive state variable V(R)

See GMR-1 3G 44.060 [10], clause 9.1.5.

10.2.7 Receive window state variable V(Q)

See GMR-1 3G 44.060 [10], clause 9.1.6.

10.2.8 Receive state array V(N)

See GMR-1 3G 44.060 [10], clause 9.1.7.

10.2.9 Starting sequence number (SSN) and received block bitmap (RBB)

See GMR-1 3G 44.060 [10], clause 9.1.8.

10.2.10 Window Size

See GMR-1 3G 44.060 [10], clause 9.1.9.

10.2.10a RLC buffer

See GMR-1 3G 44.060 [10], clause 9.1.9.3.

10.2.11 Compression

See GMR-1 3G 44.060 [10] clause 9.1.10.

10.2.12 Segmentation of upper layer PDUs into RLC data units

See GMR-1 3G 44.060 [10], clause 9.1.11.

If so ordered by RRC for a given signalling radio bearer using RLC acknowledged mode, in order to assure duplication avoidance at higher layer, RLC shall guarantee that no more than three upper layer PDUs shall be outstanding in the transmit window at any given time: there may be at most three upper layer PDUs that are being transmitted i.e. that have been segmented and for which the RLC PDUs are being transferred to the receiving end.

If so ordered by RRC (CRLC-CONFIG-Req primitive), the RLC transmitter may discard:

- in RLC acknowledged mode, RLC SDU(s) not yet segmented into RLC PDUs. The RLC transmitter shall notify the higher layer of all discarded RLC SDUs, if indicated (RLC-AM-DATA-DiscardReq primitive);

- in RLC unacknowledged mode, RLC SDU(s).

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

See GMR-1 3G 44.060 [10], clause 9.1.12.

10.2.14 Segmentation of RLC/MAC control messages into RLC/MAC control blocks

Segmentation of RLC/MAC control messages on PDCTH/PACCH is not supported in GMR-1 3G.

10.2.15 Re-assembly of RLC/MAC control messages from RLC/MAC control blocks

Segmentation of RLC/MAC control messages on PDCTH/PACCH is not supported in GMR-1 3G.

10.3   Operation during RLC/MAC control message transfer

See GMR-1 3G 44.060 [10], clause 9.2.

10.4   Operation during RLC data block transfer

10.4.1   General

See GMR-1 3G 44.060 [10], clause 9.3.0.

10.4.2   Countdown procedure

See GMR-1 3G 44.060 [10], clause 9.3.1.

10.4.3   Delayed release of downlink Temporary Block Flow

Delayed release is not supported in GMR-1 3G.

10.4.4   Extended uplink TBF mode

Extended uplink TBF mode is not supported in GMR-1 3G.

10.4.5   Acknowledged mode operation

10.4.5.1   General

See GMR-1 3G 44.060 [10], clause 9.3.2.

10.4.5.2   Void

10.4.5.3   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.

If for a given radio bearer, the uplink TBF ended with an incompletely transmitted upper layer PDU or any unacknowledged upper layer PDUs, the mobile earth station shall begin transmission on the new TBF corresponding to this radio bearer with the oldest unacknowledged upper layer PDU.

10.4.5.4   Operation of uplink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.2.3.

10.4.5.5   Release of uplink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.2.4.

10.4.5.6   Operation of downlink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.2.5.

10.4.5.7   Release of downlink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.2.6.

10.4.6 Unacknowledged mode operation

10.4.6.1 General

See GMR-1 3G 44.060 [10], clause 9.3.3.

10.4.6.2 Establishment of Temporary Block Flow

If for a given radio bearer, the uplink TBF ended with an incompletely transmitted upper layer PDU, the mobile earth station shall begin transmission on the new TBF corresponding to this radio bearer with the last incompletely transmitted upper layer PDU.

10.4.6.3 Operation of uplink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.3.2.

10.4.6.4 Release of uplink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.3.3.

10.4.6.5 Operation of downlink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.3.4.

10.4.6.6 Release of downlink Temporary Block Flow

See GMR-1 3G 44.060 [10], clause 9.3.3.5.

10.5 Abnormal release cases

10.5.1 Abnormal release with access retry

Abnormal release with access retry is described in clause 8.8.3. It is applicable in MAC-Shared state and in MAC-DTM state, on PDCH only.

10.5.2 Abnormal release with cell reselection

Abnormal release with cell reselection is applicable in MAC-Shared state only.

See GMR-1 3G 44.060 [10], clause 9.4.2.

10.6 Uplink TBF release in extended uplink TBF mode

Extended uplink TBF mode is not supported in GMR-1 3G.

11 Radio Link Control (RLC) procedures on DTCH and DACCH

11.1 General

This clause describes the RLC procedures in TCH TBF mode and DCCH TBF mode applicable in MAC-Dedicated state and MAC-DTM state. Unless explicitly stated otherwise, the procedures and parameters in this clause are not applicable in T-RLC mode.

TCH TBF mode shall support T-RLC mode only.

In DCCH TBF mode the following definitions apply:

- Sequence Number Space (SNS): 128.

- Window Size (WS): 16.

11.2 Procedures and parameters for peer-to-peer operation

11.2.1 Send state variable V(S)

See GMR-1 3G 44.060 [10], clause 9.1.1.

11.2.2 Control send state variable V(CS)

See GMR-1 3G 44.060 [10], clause 9.1.1a.

11.2.3 Acknowledge state variable V(A)

See GMR-1 3G 44.060 [10], clause 9.1.2.

11.2.4 Acknowledge state array V(B)

See GMR-1 3G 44.060 [10], clause 9.1.3.

11.2.5 Block sequence number BSN

11.2.5.1 Block sequence number for TCH TBF mode

In GMR-1 3G, only T-RLC mode is supported on TCH TBF mode.

11.2.5.2 Block sequence number for DCCH TBF mode

Each RLC data block contains a block sequence number (BSN) field that is 7 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).

11.2.6 Reduced block sequence number RBSN

RBSN is not supported in GMR-1.

11.2.7 Receive state variable V(R)

See GMR-1 3G 44.060 [10], clause 9.1.5.

11.2.8 Receive window state variable V(Q)

See GMR-1 3G 44.060 [10], clause 9.1.6.

11.2.9 Receive state array V(N)

See GMR-1 3G 44.060 [10], clause 9.1.7.1.

11.2.10   Starting sequence number (SSN) and received block bitmap (RBB)

See GMR-1 3G 44.060 [10], clause 9.1.8.

11.2.11 Window Size

11.2.11.1   DTCH

In GMR-1 3G, only T-RLC mode is supported on TCH TBF mode.

11.2.11.2   DACCH

For DCCH TBF mode the window size (WS) shall be 16.

11.2.11a RLC buffer

See GMR-1 3G 44.060 [10], clause 9.1.9.3.

11.2.12   Segmentation of upper layer PDUs into RLC data units

Same as GMR-1 3G 44.060 [10], clause 9.1.11, except that the "Reduced Last Part Size" field is used in place of "Last Part Size" field as follows:

The "Reduced Last Part Size" field is used to indicate the length of the upper layer PDU fragment in the RLC data block. The "Reduced Last Part Size" field in the header is set to zero if a new upper layer PDU starts at the beginning of the RLC data block. If the RLC data block begins with the last fragment of the previous upper layer PDU, then the "Reduced Last Part Size" field is set to indicate the length of the last fragment. However, if the entire RLC data block contains the middle segment of an upper layer PDU, the "Reduced Last Part Size" field is set to the value of 0x1f.

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.

If so ordered by RRC for a given signalling radio bearer using RLC acknowledged mode, in order to assure duplication avoidance at higher layer, RLC shall guarantee that no more than three upper layer PDUs shall be outstanding in the transmit window at any given time: there may be at most three upper layer PDUs that are being transmitted i.e. that have been segmented and for which the RLC PDUs are being transferred to the receiving end.

If so ordered by RRC (CRLC-CONFIG-Req primitive), the RLC transmitter may discard:

-    in RLC acknowledged mode, RLC SDU(s) not yet segmented into RLC PDUs. The RLC transmitter shall notify the higher layer of all discarded RLC SDUs, if indicated (RLC-AM-DATA-DiscardReq primitive);

-    in RLC unacknowledged mode, RLC SDU(s).

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

Same GMR-1 3G 44.060 [10], clause 9.1.12, except that that the "Reduced Last Part Size" field is used in place of "Last Part Size" field as follows:

A value of 0x1F in "Reduced Last Part Size" field indicates that the RLC data block contains an upper layer PDU that started in one of the previous RLC data blocks and continues into at least the next RLC data block. All other values of "Reduced Last Part Size" field are used for identifying the length of the last fragment of an upper layer PDU.

If the "Reduced Last Part Size" field is neither 0x00 nor 0x1F, then the two octets immediately following the end of the current upper layer PDU shall be considered to be the length of the next upper layer PDU. If the most significant byte of the upper layer PDU length field found within an RLC block has the value 0xFF (255), then the rest of the bytes within the block are fill bytes and shall be ignored by the receiver.

11.2.14 Segmentation of RLC/MAC control messages into RLC/MAC control blocks

See GMR-1 3G 44.060 [10], clause 9.1.11a.

11.2.15 Re-assembly of RLC/MAC control messages from RLC/MAC control blocks

See GMR-1 3G 44.060 [10], clause 9.1.12a.

11.3 Operation during RLC/MAC control message transfer

RLC/MAC control blocks shall be used to transport RLC/MAC control messages. Segments of only one RLC/MAC control message shall be transported per RLC/MAC control block.

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

The receiving side shall determine the length of the RLC/MAC control message contents by interpreting the RLC/MAC control block contents.

11.4 Operation during RLC data block transfer

11.4.1 General

The RLC ARQ functions are applicable in NT-RLC mode only and 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. No ARQ function shall apply in T-RLC mode.

A TBF may operate in either RLC acknowledged mode, RLC unacknowledged mode or RLC transparent mode.

For a URB, the RLC mode of the corresponding TBF is set to either RLC acknowledged mode, RLC unacknowledged mode or RLC transparent mode at set-up of this particular URB by means of primitive exchange between RRC and RLC (CRLC-CONFIG) (see GMR-1 3G 44.118 [4]).

For a SRB, the RLC mode of the corresponding TBF is set implicitly to the proper RLC mode, according to the identity of this particular SRB as follows:

-       SRB2, SRB3, SRB4: RLC acknowledged mode.

11.4.2 Acknowledged mode operation

11.4.2.1   General

The transfer of RLC data blocks in 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 acknowledgement in order to request retransmission of RLC data blocks. The operation in RLC acknowledged mode shall be as described in clause 11.2.

11.4.2.2   On DTCH

11.4.2.2.1   General

GMR-1 3G does not support acknowledged mode of operation in TCH TBF mode.

11.4.2.2.2   Uplink

GMR-1 3G does not support acknowledged mode of operation in TCH TBF mode.

11.4.2.2.3   Downlink

GMR-1 3G does not support acknowledged mode of operation in TCH TBF mode.

11.4.2.3   On DACCH

11.4.2.3.1   General

In DCCH TBF mode the transfer of RLC Data Blocks in RLC acknowledged mode is controlled by ARQ mechanism with the numbering of the RLC data blocks.

11.4.2.3.2   Uplink

The mobile earth station shall transmit an RLC/MAC block in each assigned uplink radio block following the rules described in clause 9.2.3. The network shall send acknowledgement when needed.

Upon reception by the mobile earth station of an acknowledgement for this RLC entity, the mobile earth station shall reset counter N3106. If the mobile earth station does not receive any acknowledgement for this RLC entity before the response time specified in clause 9.2.1.2, the mobile earth station shall increment counter N3106. If N3106=N3106max, the mobile earth station shall indicate a link failure to the RRC layer which in turn shall stop the corresponding RLC entity (see clause 14.3 and GMR-1 3G 44.118 [4]).

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 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 DCH UPLINK ACK/NACK message that makes $V(S) < V(A) + WS$. If timer T3182 expires, the mobile earth station shall notify a link failure to the RRC layer which in turn shall stop the corresponding RLC entity (see clause 14.3 and GMR-1 3G 44.118 [4]).

11.4.2.3.3   Downlink

The mobile earth station shall be able to receive RLC/MAC blocks in RLC acknowledged mode on DACCH. The mobile earth station shall, in the RLC/MAC header, identify the RRBid and decode the RLC data blocks belonging to the corresponding radio bearer.

The network may poll the mobile earth station for sending an acknowledgement by setting the UUG bit in a downlink RLC data block. Upon reception by the mobile earth station of a polling request, the mobile earth station shall send an acknowledgement (PACKET DCH DOWNLINK ACK/NACK message) for the corresponding RLC entity to the network as specified in GMR-1 3G 44.060 [10].

Upon reception by the network of an acknowledgement for this RLC entity, the network shall reset counter N3107. If the network does not receive any acknowledgement for this RLC entity before the response time specified in GMR-1 3G 44.060 [10], the network shall increment counter N3107. If counter N3107=N3107max, the network shall indicate a link failure to the RRC layer which shall in turn stop the corresponding RLC entity (see clause 14.3 and GMR-1 3G 44.118 [4]).

11.4.2.3.4　　TBF Release

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 DCH Uplink Ack/Nack message to the mobile earth station and if necessary wait for the mobile earth station to retransmit the required RLC data blocks. Once the network receives all missing RLC blocks, it shall send the Packet DCH Uplink Ack/Nack with Final Ack Indicator set to release the TBF and request an acknowledgment using the UUG field. Any RLC blocks received after the transmission of Packet DCH Uplink Ack/Nack with FAI set. shall be dropped by the network. The network shall also drop all RLC blocks belonging to partially received upper layer PDU. The MES shall consider all RLC blocks sent with sequence number equal or greater than STARTING SEQUENCE NUMBER present in Packet DCH Uplink Ack/Nack with FAI set to be lost. The MES shall also consider RLC blocks belonging to partially transmitted upper layer PDU to be lost.

Upon receiving Packet DCH Uplink Ack/Nack with FAI set, the MES shall respond with an acknowledgement message as specified in GMR-1 3G 44.060 [10] and start timer T3300. When the network receives acknowledgement message, it shall start timer T3301.

If the network does not receive an acknowledgement message in the MAC-slot/D-MAC-slot indicated by the UUG field in the Packet DCH Uplink Ack/Nack message with FAI set (see GMR-1 3G 44.060 [10]), it shall increment counter N3303 and retransmit the Packet DCH Uplink Ack/Nack message. If counter N3303 exceeds its limit, the network shall start timer T3305. When timer T3305 expires the network may consider both uplink and downlink TBF associated with the same RB to be released.

When timer T3300 expires the MES shall locally release both uplink TBF and the downlink TBF associated with the same RB.

When timer T3301 expires the network shall locally release both uplink TBF and the downlink TBF associated with the same RB.

The network may reactivate the TBFs by sending a Packet DCH Assignment if timer T3301 is still running. This could be triggered, for example, by upper layer PDU arrival during TBF release procedure.

If a Packet DCH Assignment message is received by the MES while timer T3300 is running, the MES shall stop timer T3300 and act on the message as indicated in clause 7.2.3.2.1.3 and shall respond with an acknowledgment. If the network does not receive an acknowledgement message in the MAC-slot/D-MAC-slot indicated by the UUG field in the Packet DCH Assignment message (see GMR-1 3G 44.060 [10]), it shall retransmit the Packet DCH Assignment message again. If on the second attempt the network does not receive and acknowledgement, it shall consider the TBF reactivation unsuccessful.

The network shall use the same mechanism to release downlink TBF. Before the network starts the release procedure, it shall ensure that all RLC blocks are received and acknowledged.

11.4.3　　Unacknowledged mode operation

11.4.3.1　　General

The transfer of RLC data blocks in 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. The operation in RLC unacknowledged mode shall be as described in clause 11.2.

11.4.3.2　　On DTCH

11.4.3.2.1　　Uplink

GMR-1 3G does not support unacknowledged mode of operation in TCH TBF mode.

11.4.3.2.2　　(void)

11.4.3.3 On DACCH

11.4.3.3.1 Uplink

The network shall send acknowledgements when needed.

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

11.4.3.3.2 Downlink

The mobile earth station shall be able to receive RLC/MAC blocks in RLC unacknowledged mode on DACCH. The mobile earth station shall, in the RLC/MAC header, identify the RRBid and decode the RLC data blocks belonging to the corresponding radio bearer.

11.4.3.3.3 TBF Release

When the network decides to release an uplink TBF, it shall send a Packet TBF Release message to the mobile earth station and request an acknowledgment using the UUG field. Any RLC blocks received after the transmission of Packet TBF Release shall be dropped by the network. The network shall also drop all RLC blocks belonging to partially received upper layer PDU.

Upon receiving Packet TBF Release message. The MES shall respond with an acknowledgement message according to clause 10.4.5 of GMR-1 3G 44.060 [10] and start timer T3300. When the network receives acknowledgement message, it shall start timer T3301.

If the network does not receive an acknowledgement message in the MAC-slot/D-MAC-slot indicated by the UUG field in the Packet TBF Release message according to clause 10.4.5 of GMR-1 3G 44.060 [10], it shall increment counter N3303 and retransmit the Packet TBF Release message. If counter N3303 exceeds its limit, the network shall start timer T3305. When timer T3305 expires the network may consider both uplink and downlink TBF associated with the same RB to be released.

When timer T3300 expires the MES shall release both uplink TBF and the downlink TBF associated with the same RB.

When timer T3301 expires the network shall release both uplink TBF and the downlink TBF associated with the same RB.

The network may reactivate the TBFs by sending a Packet DCH Assignment if timer T3301 is still running. This could be triggered, for example, by upper layer PDU arrival during TBF release procedure.

If a Packet DCH Assignment message is received by the MES while timer T3300 is running, the MES shall stop timer T3300 and act on the message as indicated in clause 7.2.3.2.1.3 and shall respond with an acknowledgment. If the network does not receive an acknowledgement message in the Mac-slot/D-MAC-slot indicated by the UUG field in the Packet DCH Assignment message and according to clause 10.4.5 of GMR-1 3G 44.060 [10], it shall retransmit the Packet DCH Assignment message again. If on the second attempt the network does not receive and acknowledgement, it shall consider the TBF reactivation unsuccessful.

The network shall use the same mechanism to release downlink TBF.

11.4.4 Transparent mode operation (TCH TBF mode only)

When operating in transparent mode, the RLC protocol has no functionality. The incoming RLC SDUs are transferred to the MAC layer without being altered. No upper layer protocol information is removed. No RLC protocol information is added.

11a Radio Link Control (RLC) procedures for FLO on UDCH, ADCH

FLO is not supported in GMR-1 3G.

12   RLC/MAC block structure

12.1a   RLC/MAC block structure on PDCH

RLC/MAC block structure on PDCH is defined inGMR-1 3G 44.060 [10], clause 10.0.

12.1b   RLC/MAC block structure on DACCH

RLC/MAC block structure on DACCH is show in figure 12.1b.1.

RLC/MAC Header	RLC/MAC Control Message or RLC Data Block

Figure 12.1b.1: RLC/MAC Block Structure on DACCH

Multiplexing of control and data RLC/MAC blocks within a single burst shall not be supported on DACCH.

NOTE 1: The RLC/MAC block on DACCH does not contain PUI.

NOTE 2: On DACCH, a dummy data block has a RLC/MAC data header only without any RLC Data and that is indicated through LastPartSize.

The coding of MCS bits with payload capacity for DACCH is shown in table 12.1b.1 through table 12.1b.3.

Table 12.1b.1: MCS and Payload Capacity for Data over PNB3(1,3) DCH (DACCH)

MCS	Burst Type	Modulation	Coding Scheme	Coding Rate	Data Rate (kbps)	Direction	Payload bits (N) (including 16 bits CRC)
000	PNB3(1,3)	$\pi/2$ - QPSK	Tail Biting Convolution	~R7/13	2,6	Uplink, Downlink	99
001	PNB3(1,3)	$\pi/4$ - QPSK	Tail Biting Convolution	~R4/5	4,0	Uplink, Downlink	155
111	N/A	N/A	N/A				

Table 12.1b.2: MCS and Payload Capacity for Data over PNB3(1,6) DCH (DACCH)

MCS	Burst Type	Modulation	Coding Scheme	Coding Rate	Data Rate (kbps)	Direction	Payload bits (N) (including 16 bits CRC)
000	PNB3(1,6)	$\pi/2$ - BPSK	Tail Biting Convolution	~R10/19	2,6	Uplink, Downlink	99
001	PNB3(1,6)	$\pi/4$ - QPSK	Tail Biting Convolution	~R2/5	4,0	Uplink, Downlink	155
111	N/A	N/A	N/A				

Table 12.1b.3: MCS and Payload Capacity for Data over PNB3(1,8) DCH (DACCH)

MCS	Burst Type	Modulation	Coding Scheme	Coding Rate	Data Rate (kbps)	Direction	Payload bits (N) (including 16 bits CRC)
000	PNB3(1,8)	$\pi/2$ - BPSK	Tail Biting Convolution	~R4/7	4,0	Uplink, Downlink	155
111	N/A	N/A	N/A				

12.2   RLC/MAC block format conventions

See GMR-1 3G 44.060 [10], clause 10.3.

12.3   Spare Bits

See clause 10.3 of GMR-1 3G 44.060 [10].

12.4   RLC/MAC Header formats on PDCH

12.4.1   Downlink RLC/MAC Header

See GMR-1 3G 44.060 [10], clause 10.3.

12.4.1a   Transparent Mode Downlink RLC/MAC Block on PDCH

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type = 11		Payload Sub type		Power Control (5-2)			
Octet 2	Power Control (1-0)		TFI (7-2)					
Octet 3	TFI (1-0)		Payload (98 bits)					
Octet 4								
…								
Octet 15								

Figure 12.4.1a.1: 2,45 Kbps

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type = 11		Payload Sub type		Power Control (5-2)			
Octet 2	Power Control (1-0)		TFI (7-2)					
Octet 3	TFI (1-0)		Payload (160 bits)					
Octet 4								
…								
Octet 23								

Figure 12.4.1a.2: 4Kbps

Transparent mode in dedicated channels does not contain a RLC/MAC header.

12.4.2   Uplink RLC/MAC Header

See clause 10.3 of GMR-1 3G 44.060 [10].

12.5   RLC/MAC control blocks (PACCH)

See clause 10.3 of GMR-1 3G 44.060 [10].

12.6   Void

12.7 RLC/MAC Header formats on DACCH

12.7.1 Downlink RLC/MAC Data Header

The Downlink RLC/MAC header of a RLC/MAC block carrying RLC data is formatted as shown in figure 12.7.1.1.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type = 00		UUG	Reduced Block Sequence Number, RBSN (6-2)				
Octet 2	RBSN(1-0)		Reduced Last Part Size (4-0)					RRBId(2)
Octet 3	RRBId (1-0)		FBI					
Octet 4	RLC Data (Bytes)							
…								
…								

Figure 12.7.1.1: Downlink RLC/MAC Data Header on DACCH

NOTE 1: The RLC/MAC header size is 19 bits. The RLC data always contains an integer number of bytes.

NOTE 2: Bursts on DACCH occupy non-integer number of octets. The least significant bits (Bit 1 and Bit 0) of last octet of RLC data are mapped to Bit 1 and Bit 0 of the last octet in the DACCH block.

12.7.2 Downlink RLC/MAC Control Header

The Downlink RLC/MAC header of a RLC/MAC block carrying RLC/MAC control message is formatted as shown in figure 12.7.2.1.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type = 01		UUG	PDU Length(5-1)				
Octet 2	PDU Length(0)	Spare	E					
…	Control Message (Bytes)							
…								
…								

Figure 12.7.2.1: Downlink RLC/MAC Control Header on DACCH

NOTE 1: The RLC/MAC Control header size is 11 bits. The RLC control message always contains an integer number of bytes.

NOTE 2: Bursts on DACCH occupy non-integer number of octets. The least significant three bits (Bit 2, Bit 1 and Bit 0) of last octet of Control message are mapped to Bit 2, Bit 1 and Bit 0 of the last octet in the DACCH block.

12.7.3 Uplink RLC/MAC Data Header

The Uplink RLC/MAC header of a RLC/MAC block carrying RLC data is formatted as shown in figure 12.7.3.1.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Octet 1	Payload Type = 00		ITR	Reduced Block Sequence Number, RBSN (6-2)				
Octet 2	RBSN(1-0)		Reduced Last Part Size (4-0)					RRBId(2)
Octet 3	RRBId (1-0)		Stall Ind					
Octet 4	RLC Data (Bytes)							
…								
…								

Figure 12.7.3.1: Uplink RLC/MAC Data Header in DACCH

NOTE 1: The RLC/MAC header size is 19 bits. The RLC data always contains an integer number of bytes.

NOTE 2: Bursts on DACCH occupy non-integer number of octets. The least significant three bits (Bit 2, Bit 1 and Bit 0) of last octet of RLC data are mapped to Bit 2, Bit 1 and Bit 0 of the last octet in the DACCH block.

12.7.4 Uplink RLC/MAC Control Header

The Uplink RLC/MAC header of a RLC/MAC block carrying RLC/MAC control message is formatted as shown in figure 12.7.4.1.

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

Figure 12.7.4.1: Uplink RLC/MAC Control Header on DACCH

NOTE 1: The RLC/MAC Control header size is 11 bits. The RLC control message always contains an integer number of bytes.

NOTE 2: Bursts on DACCH occupy non-integer number of octets. The least significant three bits (Bit 2, Bit 1 and Bit 0) of last octet of Control message are mapped to Bit 2, Bit 1 and Bit 0 of the last octet in the DACCH block.

12.8 RLC/MAC block format on TCH (NT-RLC)

Not supported in GMR-1 3G.

12.9 Header fields

12.9.1 General

The header fields described in this clause are applicable only for the blocks described in the present document.

12.9.2 Reduced Radio Bearer identity (RRBid) field

The reduced radio bearer identity field provides a one-to-one mapping with the RBid of the RB to which either the RLC data block belongs, or the RLC/MAC control block relates. It is encoded as shown in table 12.9.2.1.

Table 12.9.2.1: Reduced Radio Bearer identity (RRBid) field

Bit 3 2 1	RRBid: Reduced Radio Bearer identity
0 0 0	Signalling Radio Bearer 1 (Not used)
0 0 1	Signalling Radio Bearer 2
0 1 0	Signalling Radio Bearer 3
0 1 1	Signalling Radio Bearer 4
1 x x	User-plane Radio Bearer The correspondence between Reduced RBid and the RBid in this case is provided at RB setup.

12.9.3 Extension (E) bit

This bit is used in the same way as is described in GMR-1 3G 44.060 [10], clause 10.4.11.

12.9.4 Stall Indicator (SI) bit

The Stall Indicator bit is used as is described in GMR-1 3G 44.060 [10], clause 10.4.3.

12.9.5 Reduced Block Sequence Number (RBSN) field

The Reduced Block Sequence Number (BSN) field carries the sequence absolute Block Sequence Number (RBSN) modulo Sequence Number Space (SNS) (128 in DCCH TBF mode of each RLC data block within the TBF.

In DCCH TBF (DACCH) mode the BSN is 7 bits in length and is encoded as a binary number with range 0 to 127.

12.9.6 Radio Bearer Identity (RBid) field

The RBid uniquely identifies a Radio Bearer. This field is encoded as a binary number with range 0-31.

12.9.7 Payload Type field

See GMR-1 3G 44.060 [10], clause 10.4.7.

Payload Type field equal to "11" is used for transparent mode in downlink with RLC/MAC headers indicated in clause 12.4.1.

12.9.8 Payload Subtype field

The payload subtype field indicates the transparent mode type and length of the payload in bits.

Table 12.9.8.1: Payload subtype field

Payload Subtype	Channel Rate	Length (bits)
00	2,45 kbps	98
01	4 kbps	160
10	Reserved	Reserved
11	Reserved	Reserved

12.9.9 Reduced Last Part Size

This is a 5 bit information field used to indicate the length of the last part of a segmented upper layer PDU present in the RLC data block.

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

The value 0x1f (31 decimal) indicates that a middle segment (i.e. not the first or the last segment) of the upper layer PDU completely occupies the RLC data block, and the upper layer PDU continues into the next radio block.

The value 0x1e(30 decimal) indicates a dummy data block as described in GMR-1 3G 44.060 [10], clause 9.1.12c.

All other values indicate the size of the size of the last fragment of upper layer PDU.

12.9.10 Unsolicited uplink grant (UUG) field

See GMR-1 3G 44.060 [10], clause 10.4.5.

12.9.11 Final Block Indicator (FBI) field

See GMR-1 3G 44.060 [10], clause 10.4.8.

13 Ciphering

13.1 General

The ciphering function is performed either in the RLC sublayer or in the MAC sublayer according to the following rules:

- The RLC sublayer is responsible for ciphering/deciphering RLC data blocks in case of non-transparent RLC mode (unacknowledged or acknowledged).

- The MAC sublayer is responsible for ciphering/deciphering user data in case of transparent RLC mode. It is also responsible for ciphering/deciphering some RLC/MAC control messages.

The ciphering function shall use the ciphering algorithm f8 specified in 3GPP TS 35.201 [17]. Four input parameters are necessary to configure the ciphering algorithm:

- *Ciphering key*: the 128-bit *ciphering key* is received from RRC by means of interlayer primitive.

- *Bearer*: the 5-bit *bearer* indicates, when available, the radio bearer identity of the radio bearer to cipher. It is received from RRC by means of interlayer primitive.

- *Direction*: the 1-bit *direction* indicates the direction of transmission, uplink or downlink, of the flow to cipher.

- *Count*: the 32-bit *count* is used to ensure that the blocks of a same flow are all ciphered differently.

A fifth parameter, *Length*, is used to indicate the length in bits of the plain data to cipher. Plain, ciphered and deciphered data are of the same length. Length is not input to the ciphering algorithm.

13.2 Applicability of ciphering

Ciphering may apply only between the mobile earth station and the serving BSS when contention resolution is successfully completed, i.e. uplink data (respectively downlink data) between the mobile earth station and the serving BSS may be ciphered after contention is successfully completed on mobile earth station side (respectively serving BSS side).

13.3 Ciphering at RLC sublayer

13.3.1 General

The RLC sublayer is responsible for ciphering/deciphering RLC data blocks in case of non-transparent RLC mode (unacknowledged or acknowledged).

For a given radio bearer, ciphering/deciphering is ordered by RRC by means of the CRLC-CONFIG-Req primitive containing the necessary ciphering elements (see clause 4.3.3). Upon receipt of the CRLC-CONFIG-Req primitive containing the ciphering elements, ciphering shall be performed at RLC sublayer according to these ciphering elements for the corresponding radio bearer. Ciphering shall not be performed at RLC sublayer otherwise.

13.3.2 Parameter settings

13.3.2.1 Input parameters to the ciphering algorithm

Table 13.3.2.1.1 defines how to set the input parameters to the ciphering algorithm.

Table 13.3.2.1.1: Input parameters to the ciphering algorithm

Input parameters	Size in bits		Settings		
			TBF mode (see note 1)	DCCH	Normal
Count	32	MSB	HFN (see note 2)	24 bits *0…16777215*	21 bits *0…2097151*
			RBid indicator	1 bit *1* (RBid available)	
		LSB	BSN	7 bits *0…127*	10 bits *0…1023*
Direction	1		Direction	1 bit *0* (uplink) *1* (downlink)	
Bearer	5		RBid	5 bits *0…31*	
Length	16		Length in bits of the plain data to cipher	16 bits *0…8872*	
NOTE 1: Two cases are distinguished as per the format of the BSN used in the RLC data block to cipher, according to the TBF mode: DCCH TBF mode and normal TBF mode. NOTE 2: The handling of the HFN is described in clause 13.3.2.2. NOTE 3: The values in italic represent the range for a given parameter.					

13.3.2.2   Handling of the HFN

The HFN is radio bearer specific.

In RLC acknowledged mode, the HFN used at retransmission of an RLC data block shall be the same as the one used at original transmission of this RLC data block.

The HFN shall be increased by one at every cycle of the BSN, when the BSN reaches 0.

Further handling of the HFN is described in GMR-1 3G 44.118 [4].

13.3.3   Ciphering of RLC PDUs in non-transparent RLC mode

Ciphering may only apply on the payload of the RLC PDUs.

13.4   Ciphering at MAC sublayer

13.4.1   General

The MAC sublayer is responsible for ciphering/deciphering user data in case of transparent RLC mode. It is also responsible for ciphering some RLC/MAC control messages.

For a given radio bearer, ciphering/deciphering is ordered by RRC by means of the CMAC-CONFIG-Req primitive containing the necessary ciphering elements (see clause 4.3.4). Upon receipt of the CMAC-CONFIG-Req primitive containing the ciphering elements, ciphering/deciphering shall be performed at MAC sublayer according to these ciphering elements for the corresponding radio bearer. Ciphering shall not be performed at MAC sublayer otherwise.

13.4.2   Parameter settings

13.4.2.1   Input parameters to the ciphering algorithm

Table 13.4.2.1.1 defines how to set the input parameters to the ciphering algorithm in case of transparent RLC mode.

**Table 13.4.2.1.1: Input parameters to the ciphering algorithm
for layer 2 data in transparent RLC mode**

Input parameters	Size in bits		Settings	
Count	32	MSB	HFN (see note 1)	11 bits *0…2047*
			TDMA Frame Number (see note 2)	17 bits
			RBid indicator	1 bit *1* (RBid available)
		LSB	Timeslot number (see note 5)	3 bits *0…7*
Direction	1		Direction	1 bit *0* (uplink) *1* (downlink)
Bearer	5		RBid	5 bits *0…31*
Length	N		Length in bits of the plain data to cipher	Size of the RLC PDU (see note 3)
NOTE 1: The handling of the HFN is described in clause 13.4.2.2.1.				
NOTE 2: The 17-bit TDMA Frame Number is described below.				
NOTE 3: In transparent RLC mode, the size of an RLC PDU equals that of the RLC SDU it carries.				
NOTE 4: The values in *italic* represent the range for a given parameter.				
NOTE 5: The timeslot number is the MAC-slot number. For bursts that span more than one MAC-slot, the time slot number shall be the starting MAC-slot.				

The 17-bit TDMA Frame Number is constructed as follows:

	Bit																	
	17	16	15	14	13	12	11	10	9	8	7	6	5'4	3	2	1	
	T1'						T2					T3					
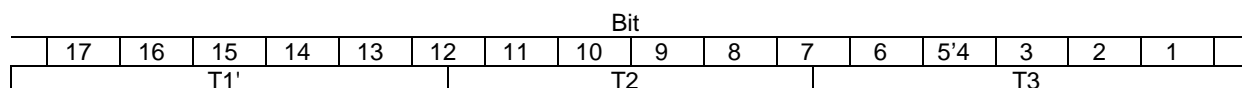
Figure 13.4.2.1.1: 17-bit TDMA Frame Number

T1' (6 bits)   range 0 to 63   = T1 mod 64.

T2 (5 bits)   range 0 to 25   = FN mod 26 as defined in GMR-1 3G 45.002 [5].

T3 (6 bits)   range 0 to 50   = FN mod 51 as defined in GMR-1 3G 45.002 [5].

Where:

T1 = FN div (26 x 51) as defined in GMR-1 3G 45.002 [5].

and

FN = TDMA frame number as defined in GMR-1 3G 45.002 [5].

13.4.2.2   Handling of the HFN

13.4.2.2.1   Ciphering in transparent RLC mode

The HFN is radio bearer specific. It shall obey the following rules for the lifetime of the corresponding radio bearer:

-    It shall be incremented by 1 every time the TDMA Frame Number is smaller than the previous one.

-    It shall also be incremented by 1 at every cell change.

Further handling of the HFN is described in GMR-1 3G 44.118 [4].

13.4.2.2.2   Ciphering of RLC/MAC control messages

Not supported in GMR-1 3G.

13.4.3 Ciphering of RLC/MAC control messages

Not supported in GMR-1 3G.

13.4.4 Ciphering of RLC PDUs in transparent RLC mode

Ciphering applies on the complete RLC PDUs.

14 RLC suspension, stop and re-establishment procedures

14.1 General

This clause describes the following RLC procedures: suspend/resume, stop/continue and re-establishment. These procedures are requested by RRC (see GMR-1 3G 44.118 [4]), and are applicable in NT-RLC only. Suspend/resume is used when e.g. ciphering parameters are changed. Stop/continue and re-establishment are used during e.g. RB reconfiguration.

14.2 Local suspend/resume function (NT-RLC)

The upper layers may suspend/resume a RLC entity. Suspension of a RLC entity is ordered through the CRLC-SUSPEND-Req primitive (see clause 4.3.3). Resumption is ordered through the CRLC-RESUME-Req primitive (see clause 4.3.3).

When a RLC entity operating in unacknowledged mode is suspended by upper layers with the parameter N, the RLC entity shall:

- acknowledge the suspend request through the CRLC-SUSPEND-Conf primitive containing the current value of the send-state variable V(S);

- not send any RLC data block with a "Block Sequence Number" BSN≥(V(S) + N) modulo SNS;

- send Packet Uplink/Downlink Dummy control blocks on allocated radio resources if there is no other RLC/MAC control message to be sent.

When a RLC entity operating in acknowledged mode is suspended by upper layers with the parameter N, the RLC entity shall:

- acknowledge the suspend request through the CRLC-SUSPEND-Conf primitive containing the current value of the send-state variable V(S);

- not send any RLC data block with "Block Sequence Number" BSN ≥ (V(S) + N) modulo SNS;

- proceed with retransmission procedures for RLC data blocks with BSN < (V(S) + N) modulo SNS as defined in clauses 10.4.5 and 11.4.2;

- on PDCH, send Packet Uplink/Downlink Dummy control blocks on allocated radio resources if there is no other RLC/MAC control message or RLC data block to be sent. On DCH, send Packet Uplink/Downlink Dummy control blocks at least once per 25 frames as specified in GMR-1 3G 45.008 [7].

When a RLC entity operating in unacknowledged mode is resumed by upper layers, the RLC entity shall:

- resume data transfer procedure.

When a RLC entity operating in acknowledged mode is resumed by upper layers, the RLC entity shall:

- resume data transfer procedure.

14.3   Stop/continue function (NT-RLC)

The RLC stop/continue procedure is applicable on DCHs only.

The upper layer may stop/continue a RLC entity. Stop of a RLC entity is ordered through the CRLC-CONFIG-Req primitive (see clause 4.3.3). Continuation of a RLC entity is ordered through the CRLC-CONFIG-Req primitive (see clause 4.3.3).

When an uplink RLC entity is stopped, the mobile earth station shall pause the timers T3180 and T3182 if running. When a downlink RLC entity is stopped, the mobile earth station shall pause timer T3190 if running.

When an uplink RLC entity is continued, the mobile earth station shall continue the timers T3180 and T3182 if paused. When a downlink RLC entity is continued, the mobile earth station shall start timer T3190 if paused.

When a RLC entity is stopped by upper layers, the RLC entity shall:

-    not submit any RLC data blocks to lower layer or accept any RLC data blocks;

-    not submit any RLC/MAC control message to lower layer or accept any RLC/MAC control message;

-    save all state variables.

When a RLC entity is continued by upper layers, the RLC entity shall:

-    if the RLC entity is stopped:

    -    continue the data transmission and reception from the stored state variables;

-    otherwise, if the RLC is not stopped:

    -    take no action.

14.4   RLC re-establishment function (NT-RLC)

The RLC re-establishment function is applicable in NT-RLC only, on DCHs only.

The upper layers may re-establish a RLC entity. Re-establishment of a RLC entity is ordered through the RLC-CONFIG-Req primitive (see clause 4.3.3).

When a RLC entity is re-established by upper layers, the RLC entity shall:

-    reset the state variables to their initial value;

-    set the configurable parameters (e.g. RLC window size) to their configured value;

-    set the hyper frame number (HFN) in UL and DL to the value configured by upper layers;

-    if the RLC entity is operating in unacknowledged mode:

    -    if it is a receiving RLC entity:

        -    discard all RLC data blocks (PDUs);

    -    if it is a transmitting RLC entity:

        -    discard the RLC SDUs for which one or more segments have been submitted to the MAC layer;

-    otherwise if the RLC entity is operating in acknowledged mode:

    -    discard all RLC data blocks (PDUs) and RLC/MAC control messages for this RLC entity.

Annex A (informative):
Bibliography

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3GPP TR 45.902 (ETSI TR 145 902): "3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Flexible Layer One (FLO)".

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History

Document history		
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