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Contents

Foreword

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1 Scope

The present document specifies the E-UTRA Radio Link Control (RLC) protocol for the UE – E-UTRAN radio interface.

The specification describes:

- E-UTRA RLC sublayer architecture;
- E-UTRA RLC entities;
- services expected from lower layers by E-UTRA RLC;
- services provided to upper layers by E-UTRA RLC;
- E-UTRA RLC functions;
- elements for peer-to-peer E-UTRA RLC communication including protocol data units, formats and parameters;
- handling of unknown, unforeseen and erroneous protocol data at E-UTRA RLC.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.300: "E-UTRA and E-UTRAN Overall Description; Stage 2".

[3] 3GPP TS 36.321: "E-UTRA MAC protocol specification".

[4] 3GPP TS 36.323: "E-UTRA PDCP specification".

[5] 3GPP TS 36.331: "E-UTRA RRC Protocol specification".

[6] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[7] 3GPP TS 23.303: "Technical Specification Group Services and System Aspects; Proximity-based services (ProSe)".

[8] 3GPP TS 38.323: "NR; Packet Data Convergence Protocol (PDCP) specification".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

byte segment: A byte of the Data field of an AMD PDU. Specifically, byte segment number 0 corresponds to the first byte of the Data field of an AMD PDU.

Data field element: An RLC SDU or an RLC SDU segment that is mapped to the Data field.

NB-IoT: NB-IoT allows access to network services via E-UTRA with a channel bandwidth limited to 200 kHz.

NB-IoT UE: A UE that uses NB-IoT.

RLC SDU segment: A segment of an RLC SDU.

Sidelink communication: AS functionality enabling ProSe Direct Communication as defined in TS 23.303 [7], between two or more nearby UEs, using E-UTRA technology but not traversing any network node. In this version, the terminology "sidelink communication" without "V2X" prefix only concerns PS unless specifically stated otherwise.

3.2 Abbreviations

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

AM	Acknowledged Mode
AMD	AM Data
ARQ	Automatic Repeat reQuest
BCCH	Broadcast Control CHannel
BCH	Broadcast CHannel
BR-BCCH	Bandwidth Reduced Broadcast Control CHannel
CCCH	Common Control CHannel
DCCH	Dedicated Control CHannel
DL	DownLink
DL-SCH	DL-Shared CHannel
DTCH	Dedicated Traffic CHannel
E	Extension bit
eNB	E-UTRAN Node B
E-UTRA	Evolved UMTS Terrestrial Radio Access
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
FI	Framing Info
HARQ	Hybrid ARQ
LI	Length Indicator
LSF	Last Segment Flag
MAC	Medium Access Control
MCCH	Multicast Control Channel
MTCH	Multicast Traffic Channel
NB-IoT	NarrowBand Internet of Things
PCCH	Paging Control CHannel
PDU	Protocol Data Unit
PS	Public Safety
RLC	Radio Link Control
RRC	Radio Resource Control
SAP	Service Access Point
SBCCH	Sidelink Broadcast Control Channel
SC-MCCH	Single Cell Multicast Control Channel
SC-MTCH	Single Cell Multicast Transport Channel
SDU	Service Data Unit
SN	Sequence Number
SO	Segment Offset
STCH	Sidelink Traffic Channel
TB	Transport Block
TM	Transparent Mode
TMD	TM Data
UE	User Equipment
UL	UpLink
UM	Unacknowledged Mode
UMD	UM Data

V2X Vehicle-to-Everything

4 General

4.1 Introduction

The objective is to describe the RLC architecture and the RLC entities from a functional point of view.

4.2 RLC architecture

4.2.1 RLC entities

The description in this sub clause is a model and does not specify or restrict implementations.

RRC is generally in control of the RLC configuration. For NB-IoT, RRC configurable parameters are specified in *RLC-Config-NB* [5].

Functions of the RLC sub layer are performed by RLC entities. For a RLC entity configured at the eNB, there is a peer RLC entity configured at the UE and vice versa. For an RLC entity configured at the transmitting UE for STCH or SBCCH there is a peer RLC entity configured at each receiving UE for STCH or SBCCH.

An RLC entity receives/delivers RLC SDUs from/to upper layer and sends/receives RLC PDUs to/from its peer RLC entity via lower layers. An RLC PDU can either be a RLC data PDU (see sub clause 6.1.1) or a RLC control PDU (see sub clause 6.1.2). If an RLC entity receives RLC SDUs from upper layer, it receives them through a single SAP between RLC and upper layer, and after forming RLC data PDUs from the received RLC SDUs, the RLC entity delivers the RLC data PDUs to lower layer through a single logical channel. If an RLC entity receives RLC data PDUs from lower layer, it receives them through a single logical channel, and after forming RLC SDUs from the received RLC data PDUs, the RLC entity delivers the RLC SDUs to upper layer through a single SAP between RLC and upper layer. If an RLC entity delivers/receives RLC control PDUs to/from lower layer, it delivers/receives them through the same logical channel it delivers/receives the RLC data PDUs through.

An RLC entity can be configured to perform data transfer in one of the following three modes: Transparent Mode (TM), Unacknowledged Mode (UM) or Acknowledged Mode (AM). Consequently, an RLC entity is categorized as a TM RLC entity, an UM RLC entity or an AM RLC entity depending on the mode of data transfer that the RLC entity is configured to provide.

A TM RLC entity is configured either as a transmitting TM RLC entity or a receiving TM RLC entity. The transmitting TM RLC entity receives RLC SDUs from upper layer and sends RLC PDUs to its peer receiving TM RLC entity via lower layers. The receiving TM RLC entity delivers RLC SDUs to upper layer and receives RLC PDUs from its peer transmitting TM RLC entity via lower layers.

An UM RLC entity is configured either as a transmitting UM RLC entity or a receiving UM RLC entity. The transmitting UM RLC entity receives RLC SDUs from upper layer and sends RLC PDUs to its peer receiving UM RLC entity via lower layers. The receiving UM RLC entity delivers RLC SDUs to upper layer and receives RLC PDUs from its peer transmitting UM RLC entity via lower layers.

An AM RLC entity consists of a transmitting side and a receiving side. The transmitting side of an AM RLC entity receives RLC SDUs from upper layer and sends RLC PDUs to its peer AM RLC entity via lower layers. The receiving side of an AM RLC entity delivers RLC SDUs to upper layer and receives RLC PDUs from its peer AM RLC entity via lower layers.

Figure 4.2.1-1 illustrates the overview model of the RLC sub layer.

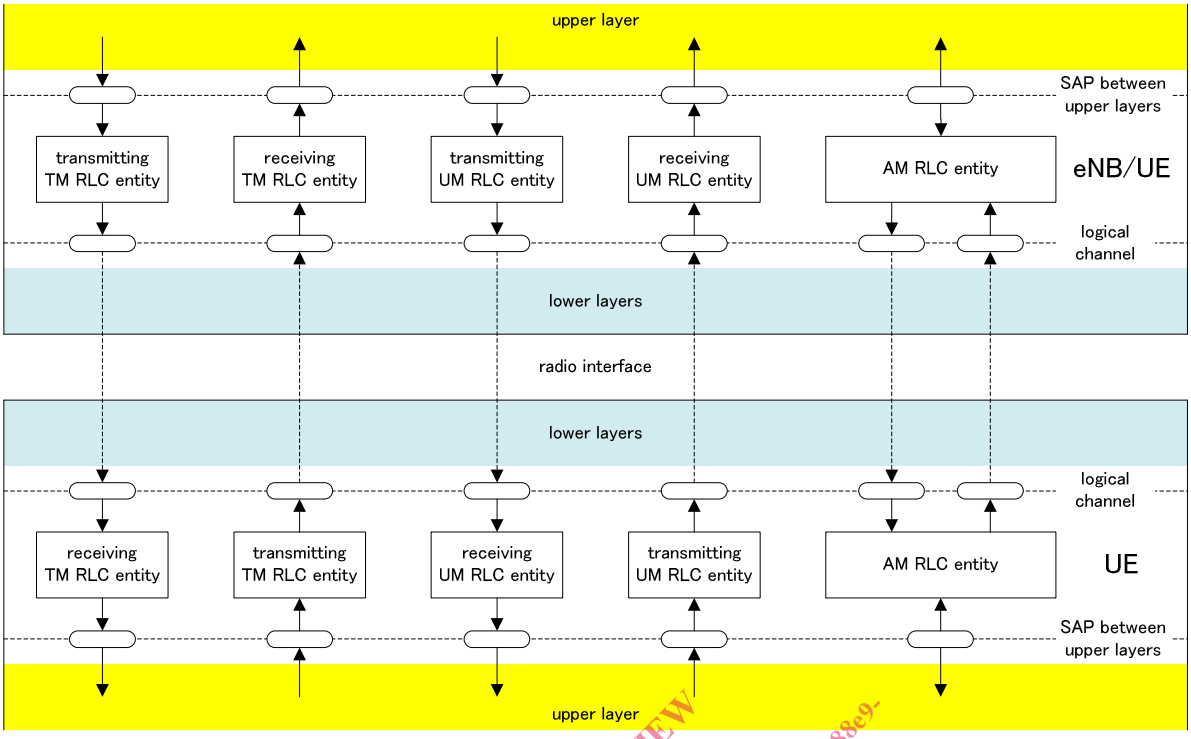

Figure 4.2.1-1: Overview model of the RLC sub layer

The following applies to all RLC entity types (i.e. TM, UM and AM RLC entity):

- RLC SDUs of variable sizes which are byte aligned (i.e. multiple of 8 bits) are supported;
- RLC PDUs are formed only when a transmission opportunity has been notified by lower layer (i.e. by MAC) and are then delivered to lower layer.

Description of different RLC entity types are provided below.

4.2.1.1 TM RLC entity

4.2.1.1.1 General

A TM RLC entity can be configured to deliver/receive RLC PDUs through the following logical channels:

- BCCH, BR-BCCH, DL/UL CCCH, PCCH and SBCCH.

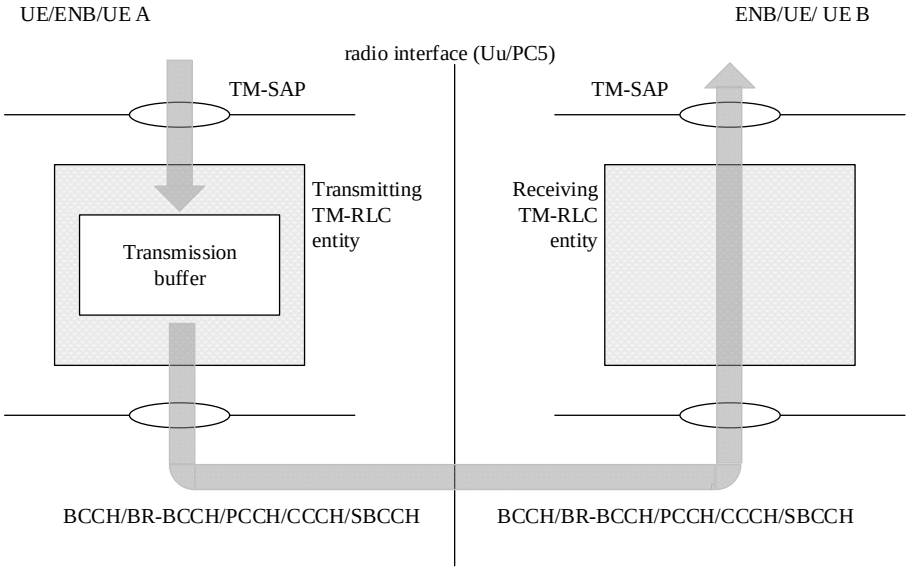

Figure 4.2.1.1.1-1: Model of two transparent mode peer entities

A TM RLC entity delivers/receives the following RLC data PDU:

- TMD PDU.

4.2.1.1.2 Transmitting TM RLC entity

When a transmitting TM RLC entity forms TMD PDUs from RLC SDUs, it shall:

- not segment nor concatenate the RLC SDUs;
- not include any RLC headers in the TMD PDUs.

4.2.1.1.3 Receiving TM RLC entity

When a receiving TM RLC entity receives TMD PDUs, it shall:

- deliver the TMD PDUs (which are just RLC SDUs) to upper layer.

4.2.1.2 UM RLC entity

4.2.1.2.1 General

An UM RLC entity can be configured to deliver/receive RLC PDUs through the following logical channels:

- DL/UL DTCH, MCCH, MTCH, SC-MCCH, SC-MTCH or STCH.

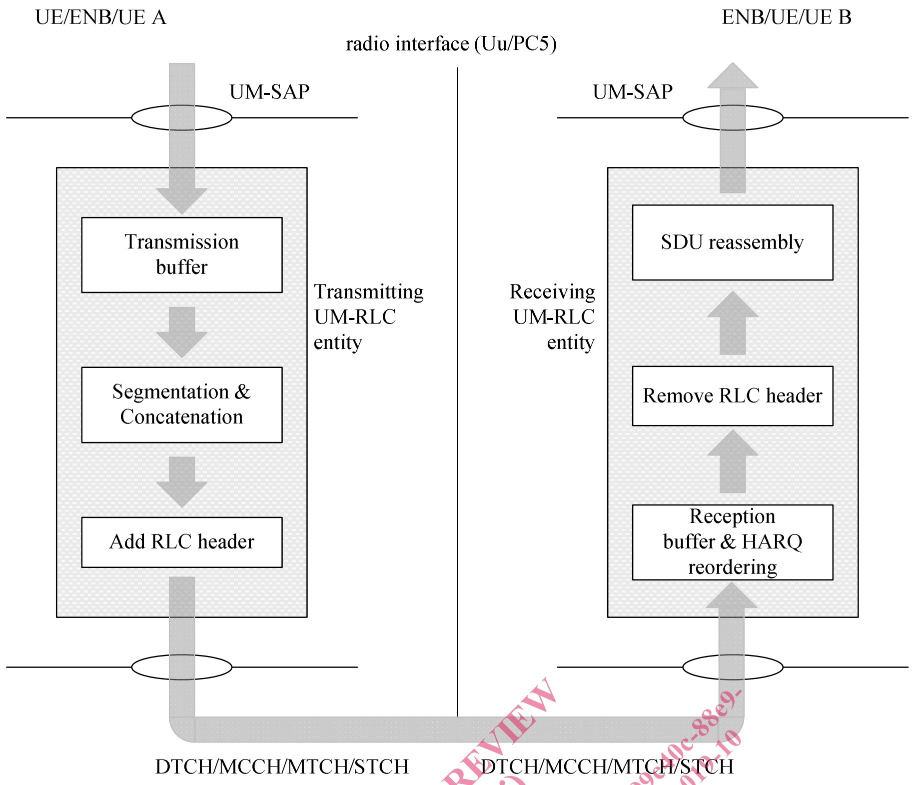

Figure 4.2.1.2.1-1: Model of two unacknowledged mode peer entities

An UM RLC entity delivers/receives the following RLC data PDU:

- UMD PDU.

NOTE: HARQ reordering is not applicable for MCCH, MTCH, SC-MCCH, SC-MTCH or STCH reception for sidelink communication.

4.2.1.2.2 Transmitting UM RLC entity

When a transmitting UM RLC entity forms UMD PDUs from RLC SDUs, it shall:

- segment and/or concatenate the RLC SDUs so that the UMD PDUs fit within the total size of RLC PDU(s) indicated by lower layer at the particular transmission opportunity notified by lower layer;
- include relevant RLC headers in the UMD PDU.

4.2.1.2.3 Receiving UM RLC entity

When a receiving UM RLC entity receives UMD PDUs, it shall:

- detect whether or not the UMD PDUs have been received in duplication, and discard duplicated UMD PDUs;
- reorder the UMD PDUs if they are received out of sequence, if *rlc-OutOfOrderDelivery* is not configured;
- detect the loss of UMD PDUs at lower layers and avoid excessive reordering delays;
- reassemble RLC SDUs from the reordered UMD PDUs (not accounting for RLC PDUs for which losses have been detected) and deliver the RLC SDUs to upper layer in ascending order of the RLC SN;
- discard received UMD PDUs that cannot be re-assembled into a RLC SDU due to loss at lower layers of an UMD PDU which belonged to the particular RLC SDU.

At the time of RLC re-establishment, the receiving UM RLC entity shall: