**3GPP TSG-RAN WG2 #118-e *R2-220XXXX***

**Online, May 09 - 20, 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.322** | **CR** | **0048** | **rev** | **1** | **Current version:** | **17.0.0** |  |
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| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Correction on RLC for SL relay |
|  |  |
| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** |  |  | ***Date:*** | 9 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | The RLC operation for relay discovery can be applied to non-relay discovery i.e., direct discovery. So this CR is to generalize the handling of discovery message for both relay case and non-relay case. |
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| ***Summary of change:*** | Section 3.1- Replaced ‘Relay discovery’ with ‘Sidelink discovery’ and modified the definition to incorporate non-relay discovery.- Added ProSe communication of TS 23.304 in the description of NR sidelink communication.Section 4.2.1- Replaced ‘Relay discovery’ with ‘Sidelink discovery’.Section 4.2.1.2.1- Added ‘Sidelink discovery’ for UM mode only. Section 7.1 - Replaced ‘Relay discovery’ with ‘Sidelink discovery’ in the description of RX\_Next\_Reassembly and RX\_Next\_Highest. |
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| ***Consequences if not approved:*** | For non-relay discovery unclear operation is remained. |
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| ***Clauses affected:*** | 3.1, 4.2.1, 4.2.1.2.1, 7.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

START OF CHANGES

# 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].

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

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [6] and ProSe communication (including ProSe Relay) as defined in TS 23.304 [8], between two or more nearby UEs, using NR technology but not traversing any network node.

**Sidelink discovery**: AS functionality enabling 5G ProSe UE-to-Network Relay Discovery or 5G ProSe Direct Discovery as defined in TS 23.304 [8], using NR technology but not traversing any network node.

**RLC data volume:** The amount of data available for transmission in an RLC entity.

**RLC SDU segment:** A segment of an RLC SDU.

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## 4.2 RLC architecture

### 4.2.1 RLC entities

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

RRC is generally in control of the RLC configuration.

Functions of the RLC sub layer are performed by RLC entities. For an RLC entity configured at the gNB, there is a peer RLC entity configured at the UE and vice versa. In NR sidelink communication, in Sidelink discovery, for an RLC entity configured at the transmitting UE, there is a peer RLC entity configured at each receiving UE.

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 an RLC data PDU or an RLC control PDU. If an RLC entity receives RLC SDUs from upper layer, it receives them through a single RLC channel between RLC and upper layer, and after forming RLC data PDUs from the received RLC SDUs, the RLC entity submits 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 RLC channel between RLC and upper layer. If an RLC entity submits/receives RLC control PDUs to/from lower layer, it submits/receives them through the same logical channel it submits/receives the RLC data PDUs through.

NOTE 1: In case the upper layer is BAP as defined in TS 38.340 [7], an RLC channel refers to a Backhaul RLC channel.

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

RLC SDUs of variable sizes which are byte aligned (i.e. multiple of 8 bits) are supported for all RLC entity types (i.e. TM, UM and AM RLC entity).

Each RLC SDU is used to construct an RLC PDU without waiting for notification from the lower layer (i.e., by MAC) of a transmission opportunity. In the case of UM and AM RLC entities, an RLC SDU may be segmented and transported using two or more RLC PDUs based on the notification(s) from the lower layer.

RLC PDUs are submitted to lower layer only when a transmission opportunity has been notified by lower layer (i.e. by MAC).

NOTE 2: The UE should aim to prevent excessive non-consecutive RLC PDUs in a MAC PDU when the UE is requested to generate more than one MAC PDU.

Description of different RLC entity types are provided below.

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#### 4.2.1.2 UM RLC entity

##### 4.2.1.2.1 General

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

- DL/UL DTCH, SCCH, STCH, MCCH, and MTCH.



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

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

- UMD PDU.

An UMD PDU contains either one complete RLC SDU or one RLC SDU segment.

NOTE: For groupcast and broadcast of NR sidelink communication or for Sidelink discovery only uni-directional UM mode is supported.

##### 4.2.1.2.2 Transmitting UM RLC entity

The transmitting UM RLC entity generates UMD PDU(s) for each RLC SDU. It shall include relevant RLC headers in the UMD PDU. When notified of a transmission opportunity by the lower layer, the transmitting UM RLC entity shall segment the RLC SDUs, if needed, so that the corresponding UMD PDUs, with RLC headers updated as needed, fit within the total size of RLC PDU(s) indicated by lower layer.

##### 4.2.1.2.3 Receiving UM RLC entity

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

- detect the loss of RLC SDU segments at lower layers;

- reassemble RLC SDUs from the received UMD PDUs and deliver the RLC SDUs to upper layer as soon as they are available;

- discard received UMD PDUs that cannot be re-assembled into an RLC SDU due to loss at lower layers of an UMD PDU which belonged to the particular RLC SDU.

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# 7 Variables, constants and timers

## 7.1 State variables

This clause describes the state variables used in AM and UM entities in order to specify the RLC protocol. The state variables defined in this clause are normative.

All state variables and all counters are non-negative integers.

All state variables related to AM data transfer can take values from 0 to 4095 for 12 bit SN or from 0 to 262143 for 18 bit SN. All arithmetic operations contained in the present document on state variables related to AM data transfer are affected by the AM modulus (i.e. final value = [value from arithmetic operation] modulo 4096 for 12 bit SN and 262144 for 18 bit SN).

All state variables related to UM data transfer can take values from 0 to 63 for 6 bit SN or from 0 to 4095 for 12 bit SN. All arithmetic operations contained in the present document on state variables related to UM data transfer are affected by the UM modulus (i.e. final value = [value from arithmetic operation] modulo 64 for 6 bit SN and 4096 for 12 bit SN).

When performing arithmetic comparisons of state variables or SN values, a modulus base shall be used.

TX\_Next\_Ack and RX\_Next shall be assumed as the modulus base at the transmitting side and receiving side of an AM RLC entity, respectively. This modulus base is subtracted from all the values involved, and then an absolute comparison is performed (e.g. RX\_Next <= SN < RX\_Next + AM\_Window\_Size is evaluated as [RX\_Next – RX\_Next] modulo 2[*sn-FieldLength*] <= [SN – RX\_Next] modulo 2[*sn-FieldLength*] < [RX\_Next + AM\_Window\_Size – RX\_Next] modulo 2[*sn-FieldLength*]), where *sn-FieldLength* is 12 or 18 for 12 bit SN and 18 bit SN, respectively.

RX\_Next\_Highest– UM\_Window\_Size shall be assumed as the modulus base at the receiving UM RLC entity. This modulus base is subtracted from all the values involved, and then an absolute comparison is performed (e.g. (RX\_Next\_Highest– UM\_Window\_Size) <= SN < RX\_Next\_Highest is evaluated as [(RX\_Next\_Highest– UM\_Window\_Size) – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] <= [SN – (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*] < [RX\_Next\_Highest– (RX\_Next\_Highest– UM\_Window\_Size)] modulo 2[*sn-FieldLength*]), where *sn-FieldLength* is 6 or 12 for 6 bit SN and 12 bit SN, respectively.

The transmitting side of each AM RLC entity shall maintain the following state variables:

a) TX\_Next\_Ack – Acknowledgement state variable

This state variable holds the value of the SN of the next RLC SDU for which a positive acknowledgment is to be received in-sequence, and it serves as the lower edge of the transmitting window. It is initially set to 0, and is updated whenever the AM RLC entity receives a positive acknowledgment for an RLC SDU with SN = TX\_Next\_Ack.

b) TX\_Next – Send state variable

This state variable holds the value of the SN to be assigned for the next newly generated AMD PDU. It is initially set to 0, and is updated whenever the AM RLC entity constructs an AMD PDU with SN = TX\_Next and contains an RLC SDU or the last segment of a RLC SDU.

c) POLL\_SN – Poll send state variable

This state variable holds the value of the highest SN of the AMD PDU among the AMD PDUs submitted to lower layer when POLL\_SN is set according to clause 5.3.3.2. It is initially set to 0.

The transmitting side of each AM RLC entity shall maintain the following counters:

a) PDU\_WITHOUT\_POLL – Counter

This counter is initially set to 0. It counts the number of AMD PDUs sent since the most recent poll bit was transmitted.

b) BYTE\_WITHOUT\_POLL – Counter

This counter is initially set to 0. It counts the number of data bytes sent since the most recent poll bit was transmitted.

c) RETX\_COUNT – Counter

This counter counts the number of retransmissions of an RLC SDU or RLC SDU segment (see clause 5.3.2). There is one RETX\_COUNT counter maintained per RLC SDU.

The receiving side of each AM RLC entity shall maintain the following state variables:

a) RX\_Next – Receive state variable

This state variable holds the value of the SN following the last in-sequence completely received RLC SDU, and it serves as the lower edge of the receiving window. It is initially set to 0, and is updated whenever the AM RLC entity receives an RLC SDU with SN = RX\_Next.

b) RX\_Next\_Status\_Trigger – *t-Reassembly* state variable

This state variable holds the value of the SN following the SN of the RLC SDU which triggered *t-Reassembly*.

c) RX\_Highest\_Status – Maximum STATUS transmit state variable

This state variable holds the highest possible value of the SN which can be indicated by "ACK\_SN" when a STATUS PDU needs to be constructed. It is initially set to 0.

d) RX\_Next\_Highest – Highest received state variable

This state variable holds the value of the SN following the SN of the RLC SDU with the highest SN among received RLC SDUs. It is initially set to 0.

Each transmitting UM RLC entity shall maintain the following state variables:

a) TX\_Next – UM send state variable

This state variable holds the value of the SN to be assigned for the next newly generated UMD PDU with segment. It is initially set to 0, and is updated after the UM RLC entity submits a UMD PDU including the last segment of an RLC SDU to lower layers.

Each receiving UM RLC entity shall maintain the following state variables:

a) RX\_Next\_Reassembly – UM receive state variable

This state variable holds the value of the earliest SN that is still considered for reassembly. It is initially set to 0. For groupcast and broadcast of NR sidelink communication or for SL-SRB4 for broadcast and groupcast based Sidelink discovery, it is initially set to the SN of the first received UMD PDU containing an SN. For the receiving UM RLC entity configured for MCCH or MTCH, it is up to UE implementation to set the initial value of RX\_Next\_Reassembly to a value before RX\_Next\_Highest.

b) RX\_Timer\_Trigger – UM *t-Reassembly* state variable

This state variable holds the value of the SN following the SN which triggered *t-Reassembly*.

c) RX\_Next\_Highest– UM receive state variable

This state variable holds the value of the SN following the SN of the UMD PDU with the highest SN among received UMD PDUs. It serves as the higher edge of the reassembly window. It is initially set to 0. For groupcast and broadcast of NR sidelink communication or for SL-SRB4 for broadcast and groupcast based Sidelink discovery, it is initially set to the SN of the first received UMD PDU containing an SN. For the receiving UM RLC entity configured for MCCH or MTCH, it is initially set to the SN of the first received UMD PDU containing an SN.

END OF CHANGES