3GPP TSG-RAN WG2 Meeting #110e R2-2006224

E-meeting, June 1 – June 12, 2020

Agenda Item: 6.7.4

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.323** | **CR** | **0049** | **rev** | **1** | **Current version:** | **16.0.0** |  |
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| *For* [***HE******LP***](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:*** | NR PDCP corrections for NR IIOT | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | LG Electronics Inc. | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_IIOT-Core | | | | |  | ***Date:*** | | | 2020-06-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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 can be 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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This CR captures the agreement made in RAN2#109bis-e and RAN2#110-e. | | | | | | | | |
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| ***Summary of change:*** | | 1. The definition of split secondary RLC entity is updated to specify the setting of the split secondary RLC entity for the PDCP entity associated with only two RLC entities.  2. The *pdcp-Duplication* is not configured for the PDCP entity associated with more than two RLC entities. In this case, *moreThanTwoRLC* should be used to determine whether the PDCP duplication is configured.  3. It is made clear that the PDCP duplication is deactivated for the DRB when all secondary RLC entities are deactivated.  4. The editor’s note of Rel-15 Duplication MAC CE is removed, because it is decided to be not used for duplication configuration with more than two RLC entities.  5. MAX\_CID\_EHC\_UL is introduced in the clause “5.12.3 Protocol parameters”. The NOTE in A.1 is also updated to include this parameter.  6. It is clarified that the EHC compressed packets include both EHC full header packets and EHC compressed header packets.  7. It is clarified that the “compress” in EHC means removing the fields from the Ethernet header.  8. The editor’s note on CID length and reserved bit are removed, because it is decided that the CID length is 7 or 15 bits, for 1 byte and 2 byte EHC header, respectively. | | | | | | | | |
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| ***Consequences if not approved:*** | | If the CR is not approved, ambiguities still remain on PDCP duplication and EHC. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.1, 5.2.1, 5.6, 5.11.1, 5.11.2, 5.12.3, 5.12.4, A.1, A.2.1.1, A.2.1.2, A.2.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

## 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].

**AM DRB**:a data radio bearer which utilizes RLC AM.

**DAPS bearer**:a bearer whose radio protocols are located in both the source gNB and the target gNB during DAPS handover to use both source gNB and target gNB resources.

**Non-split bearer**: a bearer whose radio protocols are located in either the MgNB or the SgNB to use MgNB or SgNB resource, respectively.

**NR sidelink communication**: AS functionality enabling at least V2X communication as defined in TS 23.287 [13], between two or more nearby UEs, using NR technology but not traversing any network node.

**PDCP data volume**: the amount of data available for transmission in a PDCP entity.

**Split bearer**: in dual connectivity, a bearer whose radio protocols are located in both the MgNB and the SgNB to use both MgNB and SgNB resources.

**Split secondary RLC entity**: in dual connectivity, the RLC entity other than the primary RLC entity which is responsible for split bearer operation. If the PDCP entity is associated with two RLC entities, the split secondary RLC entity is the RLC entity other than the primary RLC entity. If the PDCP entity is associated with more than two RLC entities, the split secondary RLC entity is configured by upper layers.

**UM DRB**:a data radio bearer which utilizes RLC UM.

### 5.2.1 Transmit operation

At reception of a PDCP SDU from upper layers, the transmitting PDCP entity shall:

- start the *discardTimer* associated with this PDCP SDU (if configured).

For a PDCP SDU received from upper layers, the transmitting PDCP entity shall:

- associate the COUNT value corresponding to TX\_NEXT to this PDCP SDU;

NOTE 1: Associating more than half of the PDCP SN space of contiguous PDCP SDUs with PDCP SNs, when e.g., the PDCP SDUs are discarded or transmitted without acknowledgement, may cause HFN desynchronization problem. How to prevent HFN desynchronization problem is left up to UE implementation.

- perform header compression of the PDCP SDU using ROHC as specified in the clause 5.7.4 and/or using EHC as specified in the clause 5.12.4;

- perform integrity protection, and ciphering using the TX\_NEXT as specified in the clause 5.9 and 5.8, respectively;

- set the PDCP SN of the PDCP Data PDU to TX\_NEXT modulo 2[*pdcp-SN-SizeUL*];

- increment TX\_NEXT by one;

- submit the resulting PDCP Data PDU to lower layer as specified below.

When submitting a PDCP PDU to lower layer, the transmitting PDCP entity shall:

- if the transmitting PDCP entity is associated with one RLC entity:

- submit the PDCP PDU to the associated RLC entity;

- else, if the transmitting PDCP entity is associated with at least two RLC entities:

- if the PDCP duplication is activated for the RB:

- if the PDCP PDU is a PDCP Data PDU:

- duplicate the PDCP Data PDU and submit the PDCP Data PDU to the associated RLC entities activated for PDCP duplication;

- else:

- submit the PDCP Control PDU to the primary RLC entity;

- else (i.e. the PDCP duplication is deactivated for the RB):

- if the split secondary RLC entity is configured; and

- if the transmitting PDCP entity is not associated with a DAPS bearer; and

- if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 38.322 [5]) in the primary RLC entity and the split secondary RLC entity is equal to or larger than *ul-DataSplitThreshold*:

- submit the PDCP PDU to either the primary RLC entity or the split secondary RLC entity;

- else, if the transmitting PDCP entity is associated with the DAPS bearer:

- if the uplink data switching has not been requested:

- submit the PDCP PDU to the RLC entity associated with the source cell;

- else:

- if the PDCP PDU is a PDCP Data PDU:

- submit the PDCP Data PDU to the RLC entity associated with the target cell;

- else:

- if the PDCP Control PDU is associated with source cell:

- submit the PDCP Control PDU to the RLC entity associated with the source cell;

- else:

- submit the PDCP Control PDU to the RLC entity associated with the target cell;

- else:

- submit the PDCP PDU to the primary RLC entity.

NOTE 2: If the transmitting PDCP entity is associated with two RLC entities, the UE should minimize the amount of PDCP PDUs submitted to lower layers before receiving request from lower layers and minimize the PDCP SN gap between PDCP PDUs submitted to two associated RLC entities to minimize PDCP reordering delay in the receiving PDCP entity.

## 5.6 Data volume calculation

For the purpose of MAC buffer status reporting, the transmitting PDCP entity shall consider the following as PDCP data volume:

- the PDCP SDUs for which no PDCP Data PDUs have been constructed;

- the PDCP Data PDUs that have not been submitted to lower layers;

- the PDCP Control PDUs;

- for AM DRBs, the PDCP SDUs to be retransmitted according to clause 5.1.2;

- for AM DRBs, the PDCP Data PDUs to be retransmitted according to clause 5.5.

If the transmitting PDCP entity is associated with at least two RLC entities, when indicating the PDCP data volume to a MAC entity for BSR triggering and Buffer Size calculation (as specified in TS 38.321 [4] and TS 36.321 [12]), the transmitting PDCP entity shall:

- if the PDCP duplication is activated for the RB:

- indicate the PDCP data volume to the MAC entity associated with the primary RLC entity;

- indicate the PDCP data volume excluding the PDCP Control PDU to the MAC entity associated with the RLC entity other than the primary RLC entity activated for PDCP duplication;

- indicate the PDCP data volume as 0 to the MAC entity associated with RLC entity deactivated for PDCP duplication;

- else (i.e. the PDCP duplication is deactivated for the RB):

- if the split secondary RLC entity is configured; and

- if the transmitting PDCP entity is not associated with a DAPS bearer; and

- if the total amount of PDCP data volume and RLC data volume pending for initial transmission (as specified in TS 38.322 [5]) in the primary RLC entity and the split secondary RLC entity is equal to or larger than *ul-DataSplitThreshold*:

- indicate the PDCP data volume to both the MAC entity associated with the primary RLC entity and the MAC entity associated with the split secondary RLC entity;

- indicate the PDCP data volume as 0 to the MAC entity associated with RLC entity other than the primary RLC entity and the split secondary RLC entity;

- else, if the transmitting PDCP entity is associated with the DAPS bearer:

- if the uplink data switching has not been requested:

- indicate the PDCP data volume to the MAC entity associated with the source cell;

- else:

- indicate the PDCP data volume excluding the PDCP Control PDU for interspersed ROHC feedback associated with the source cell to the MAC entity associated with the target cell;

- indicate the PDCP data volume of PDCP Control PDU for interspersed ROHC feedback associated with the source cell to the MAC entity associated with the source cell;

- else:

- indicate the PDCP data volume to the MAC entity associated with the primary RLC entity;

- indicate the PDCP data volume as 0 to the MAC entity associated with the RLC entity other than the primary RLC entity.

### 5.11.1 Activation/Deactivation of PDCP duplication

For the PDCP entity configured with *pdcp-Duplication*, the transmitting PDCP entity shall:

- for SRBs:

- activate the PDCP duplication;

- for DRBs:

- if the activation of PDCP duplication is indicated for the DRB:

- activate the PDCP duplication for the DRB;

- if the activation of PDCP duplication is indicated for at least one associated RLC entities:

- activate the PDCP duplication for the indicated associated RLC entities;

- activate the PDCP duplication for the DRB;

- if the deactivation of PDCP duplication is indicated for the DRB:

- deactivate the PDCP duplication for the DRB;

- if the deactivation of PDCP duplication is indicated for at least one associated RLC entities:

- deactivate the PDCP duplication for the indicated associated RLC entities;

- if all associated RLC entities other than the primary RLC entity are deactivated for PDCP duplication:

- deactivate the PDCP duplication for the DRB.

### 5.11.2 Duplicate PDU discard

For the PDCP entity configured with *pdcp-Duplication*, the transmitting PDCP entity shall:

- if the successful delivery of a PDCP Data PDU is confirmed by one of the associated AM RLC entities:

- indicate to the other AM RLC entities to discard the duplicated PDCP Data PDU;

- if the deactivation of PDCP duplication is indicated for the DRB:

- indicate to the RLC entities other than the primary RLC entity to discard all duplicated PDCP Data PDUs;

- if the deactivation of PDCP duplication is indicated for at least one associated RLC entities:

- indicate to the RLC entities deactivated for PDCP duplication to discard all duplicated PDCP Data PDUs.

### 5.12.3 Protocol parameters

The usage and definition of the parameters shall be as specified below.

- MAX\_CID\_EHC\_UL: This is the maximum CID value that can be used for uplink. One CID value shall always be reserved for uncompressed flows. The parameter MAX\_CID\_EHC\_UL is configured by upper layers (*maxCID-EHC-UL* in TS 38.331 [3]);

### 5.12.4 Header compression using EHC

If EHC is configured, the EHC protocol generates two types of output packets:

- EHC compressed packets (i.e. EHC full header packets and EHC compressed header packets), each associated with one PDCP SDU;

- standalone packets not associated with a PDCP SDU, i.e. EHC feedback.

An EHC compressed packet is associated with the same PDCP SN and COUNT value as the related PDCP SDU. The header compression is not applicable to the SDAP header and the SDAP Control PDU if included in the PDCP SDU.

EHC feedback are not associated with a PDCP SDU. They are not associated with a PDCP SN and are not ciphered.

## A.1 EHC principle

The Ethernet header compression (EHC) protocol compresses Ethernet header as shown in Figure A.1-1 [15]. The fields that are compressed (i.e. removed from the Ethernet header) by the EHC protocol are: DESTINATION ADDRESS, SOURCE ADDRESS, 802.1Q TAG, and LENGTH/TYPE. The fields PREAMBLE, SFD, and FCS are not transmitted in 3GPP system, and thus not considered in EHC protocol. There may be more than one 802.1Q TAG fields in the Ethernet header, and all are compressed by the EHC protocol. The padding (PAD) is not compressed by the EHC protocol.



Figure A.1-1: Ethernet packet format [15]

The EHC compressor and the EHC decompressor store original header field information as a "EHC context". Each EHC context is identified by a unique identifier, called Context ID (CID). The EHC context must be synchronized between the EHC compressor and the EHC decompressor; otherwise, the EHC decompressor erroneously decompresses the "Compressed Header (CH)" packets.

For an Ethernet packet stream, the EHC compressor establishes the EHC context and associates it with the CID. Then, the EHC compressor transmits the "Full Header (FH)" packet to the EHC decompressor including the associated CID. The EHC compressor keeps transmitting the FH packets until the EHC feedback is received from the EHC decompressor.

NOTE: If the maximum number of EHC contexts are already established for the compressed flows and a new Ethernet flow does not match any established EHC context, the compressor should associate the new Ethernet flow with one of the EHC CIDs allocated for the existing compressed flows or send PDCP SDUs belonging to the Ethernet flow as uncompressed packet.

When the EHC decompressor receives the FH packet, the EHC decompressor establishes the EHC context identified by the CID, and transmits the EHC feedback to the EHC compressor to indicate that the EHC context associated with the CID is successfully established in the EHC decompressor.

After receiving the EHC feedback, the EHC compressor starts to transmit the CH packets to the EHC decompressor including the associated CID. The CH packet includes only the header fields not stored in the EHC context.

When the EHC decompressor receives the CH packet, the EHC decompressor restores original header fields based on the stored EHC context identified by the associated CID.

Figure A.1-2 represents a conceptual view of EHC operation.



Figure A.1-2: EHC operation

#### A.2.1.1 EHC Full Header packet and EHC Compressed Header packet

Figure A.2.1.1-1 and Figure A.2.1.1-2 show the formats of EHC FH packet and EHC CH packet, respectively.



Figure A.2.1.1-1: EHC Full Header packet format



Figure A.2.1.1-2: EHC Compressed Header packet format

#### A.2.1.2 EHC feedback packet

Figure A.2.1.2-1 shows the format of the EHC feedback packet.



Figure A.2.1.2-1: EHC feedback packet format

#### A.2.2.2 CID

Length: 7, or 15 bits. The length of the CID is configured by upper layers (*ehc-CID-Length* in TS 38.331 [3]).

The CID = "all zeros" indicates that the corresponding Ethernet header is "uncompressed". The EHC decompressor does not establish the EHC context identified by the CID = "all zeros".