**3GPP TSG-RAN WG2 Meeting #120 *R2-2213113***

**Toulouse, France, 14 – 18 November 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.323** | **CR** | **0112** | **rev** | **-** | **Current version:** | **17.2.0** |  |
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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:***  | PDCP Initialisation of MRB |
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| ***Source to WG:*** | Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | R2 |
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| ***Work item code:*** | NR\_MBS-Core |  | ***Date:*** | 2022-11 |
|  |  |  |  |  |
| ***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:*** | When a gNB wants to set up MRB(s) for a UE, current specifications require that *initialRX-DELIV* is provided to the UE even if the gNB does not know which value to give. As a result, a gNB must wait until it receives the first MBS packets before configuring MRB(s) to the UE and if multiple UEs have joined a deactivated MBS session, the activation of the MBS session will trigger RRC reconfiguration to all UEs to setup the MRB(s) at the same time. |
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| ***Summary of change:*** | The initialisation of PDCP receiver state variables is made optional and configurable for MRBs (UM and AM) during re-establishment.**Impact analysis**Impacted functionality: MRB (re)configuration.Inter-operability: 1. If the network is implemented according to the CR and the UE is not, an MRB reconfiguration might fail.
2. If the UE is implemented according to the CR and the network is not, no inter-operability issue is foreseen.
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| ***Consequences if not approved:*** | Initialisation of RX\_NEXT and RX\_DELIV can only be performed during MRB establishment. |
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| ***Clauses affected:*** | 5.1.2, 7.1 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** | **x** |  |  Other core specifications  | TS 38.331 CR 3500 |
| ***affected:*** |  | **x** |  Test specifications |  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications |  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*First Modified Subclause*

### 5.1.2 PDCP entity re-establishment

When upper layers request a PDCP entity re-establishment, the UE shall additionally perform once the procedures described in this clause for Uu or PC5 interface. After performing the procedures in this clause, the UE shall follow the procedures in clause 5.2.

When upper layers request a PDCP entity re-establishment, the transmitting PDCP entity shall:

- for UM DRBs and AM DRBs, reset the ROHC protocol for uplink and start with an IR state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs and AM DRBs, reset the EHC protocol for uplink if *drb-ContinueEHC-UL* is not configured in TS 38.331 [3];

- for AM DRBs, reset the UDC compression buffer to all zeros and prefill the dictionary if *drb-ContinueUDC* is not configured in TS 38.331 [3];

- for SRBs and UM DRBs, set TX\_NEXT to the initial value;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- for UM DRBs, for each PDCP SDU already associated with a PDCP SN but for which a corresponding PDU has not previously been submitted to lower layers, and;

- for AM DRBs for Uu interface whose PDCP entities were suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, for each PDCP SDU already associated with a PDCP SN:

- consider the PDCP SDUs as received from upper layer;

- perform transmission of the PDCP SDUs in ascending order of the COUNT value associated to the PDCP SDU prior to the PDCP re-establishment without restarting the *discardTimer*, as specified in clause 5.2.1;

- for AM DRBs whose PDCP entities were not suspended, from the first PDCP SDU for which the successful delivery of the corresponding PDCP Data PDU has not been confirmed by lower layers, perform retransmission or transmission of all the PDCP SDUs already associated with PDCP SNs in ascending order of the COUNT values associated to the PDCP SDU prior to the PDCP entity re-establishment as specified below:

- 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;

- If *drb-ContinueUDC* is configured and if the PDCP SDU has been compressed before:

- submit the PDCP SDU previously compressed to integrity protection and ciphering function;

- else:

- perform uplink data compression of the PDCP SDU as specified in clause 5.14.4, and submit the PDCP SDU to integrity protection and ciphering function;

- perform integrity protection and ciphering of the PDCP SDU using the COUNT value associated with this PDCP SDU as specified in the clause 5.9 and 5.8;

- submit the resulting PDCP Data PDU to lower layer, as specified in clause 5.2.1.

When upper layers request a PDCP entity re-establishment, the receiving PDCP entity shall:

- process the PDCP Data PDUs that are received from lower layers due to the re-establishment of the lower layers, as specified in the clause 5.2.2.1;

- for SRBs, discard all stored PDCP SDUs and PDCP PDUs;

- for SRBs, UM DRBs and UM MRBs, if *t-Reordering* is running:

- stop and reset *t-Reordering*;

- for UM DRBs and UM MRBs, deliver all stored PDCP SDUs to the upper layers in ascending order of associated COUNT values after performing header decompression;

- for AM DRBs and AM MRBs for Uu interface, perform header decompression using ROHC for all stored PDCP SDUs if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for AM DRBs for PC5 interface, perform header decompression using ROHC for all stored PDCP IP SDUs;

- for AM DRBs and AM MRBs for Uu interface, perform header decompression using EHC for all stored PDCP SDUs if *drb-ContinueEHC-DL* is not configured in TS 38.331 [3];

- for UM DRBs, AM DRBs, UM MRBs and AM MRBs, reset the ROHC protocol for downlink and start with NC state in U-mode (as defined in RFC 3095 [8] and RFC 4815 [9]) if *drb-ContinueROHC* is not configured in TS 38.331 [3];

- for UM DRBs, AM DRBs, UM MRBs and AM MRBs, reset the EHC protocol for downlink if *drb-ContinueEHC-DL* is not configured in TS 38.331 [3];

- for SRBs and UM DRBs, set RX\_NEXT and RX\_DELIV to the initial value;

- for UM MRBs and AM MRBs, set RX\_NEXT and RX\_DELIV to the initial value if *initialRX-DELIV* is configured in TS 38.331 [3];

- apply the ciphering algorithm and key provided by upper layers during the PDCP entity re-establishment procedure;

- apply the integrity protection algorithm and key provided by upper layers during the PDCP entity re-establishment procedure.

NOTE: After PDCP re-establishment on a sidelink ‎SRB/DRB, UE determines when to transmit and receive with the new key and discard the old key as specified in TS ‎‎33.536 [14].‎

*Next Modified Subclause*

## 7.1 State variables

This clause describes the state variables used in PDCP entities in order to specify the PDCP protocol. The state variables defined in this clause are normative.

All state variables are non-negative integers, and take values from 0 to [232 – 1].

PDCP Data PDUs are numbered integer sequence numbers (SN) cycling through the field: 0 to [2[*pdcp-SN-SizeUL*] – 1] or 0 to [2[*pdcp-SN-SizeDL*] – 1] or 0 to [2[*sl-PDCP-SN-Size*] – 1].

The transmitting PDCP entity shall maintain the following state variables:

a) TX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU to be transmitted. The initial value is 0, except for SRBs configured with state variables continuation. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

The receiving PDCP entity shall maintain the following state variables:

a) RX\_NEXT

This state variable indicates the COUNT value of the next PDCP SDU expected to be received. The initial value is 0, except for sidelink broadcast and groupcast, for SRBs configured with state variables continuation, and for broadcast MRBs. For NR sidelink communication for broadcast and groupcast or sidelink SRB4 for broadcast and groupcast based sidelink discovery, the initial value of the SN part of RX\_NEXT is (x +1) modulo (2[*sl-PDCP-SN-Size*]), where x is the SN of the first received PDCP Data PDU. For broadcast MRBs, the initial value of the SN part of RX\_NEXT is (x +1) modulo (2[*PDCP-SN-SizeDL*]), where x is the SN of the first received PDCP Data PDU. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

NOTE 1: For NR sidelink communication for broadcast and groupcast or sidelink SRB4 for broadcast and groupcast based sidelink discovery, it is up to UE implementation to select the HFN part for RX\_NEXT such that initial value of RX\_DELIV should be a positive value.

NOTE 2: For broadcast MRBs, the initial value of the HFN part of RX\_NEXT is set by UE implementation.

b) RX\_DELIV

This state variable indicates the COUNT value of the first PDCP SDU not delivered to the upper layers, but still waited for. The initial value is 0, except for sidelink broadcast and groupcast, for SRBs configured with state variables continuation, and for MRBs. For NR sidelink communication for broadcast and groupcast or sidelink SRB4 for broadcast and groupcast based sidelink discovery, the initial value of the SN part of RX\_DELIV is (x – 0.5 × 2[*sl-PDCP-SN-Size*–1]) modulo (2[*sl-PDCP-SN-Size*]), where x is the SN of the first received PDCP Data PDU. For broadcast MRBs, the initial value of the SN part of RX\_DELIV is set to (x – 0.5 × 2[*PDCP-SN-SizeDL*–1]) modulo (2[*PDCP-SN-SizeDL*]), where x is the SN of the first received PDCP Data PDU. For multicast MRBs, the initial value of RX\_DELIV is set, if provided, by *initialRXDELIV* in TS 38.331 [3]. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

NOTE 3: For broadcast MRBs, the initial value of the HFN part of RX\_DELIV is set by UE implementation.

c) RX\_REORD

This state variable indicates the COUNT value following the COUNT value associated with the PDCP Data PDU which triggered *t-Reordering*. For target SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding source SRB. For source SRB configured with state variables continuation, the initial value is the value stored in PDCP entity for the corresponding target SRB.

*End of Changes*