**3GPP TSG-RAN WG2 Meeting #110-e R2-200xxxx**

**E-meeting, June 1 – June 12, 2020**

**Agenda item:**6.7.4.1 (NR\_IIOT-Core)

**Source:** LG Electronics Inc.

**Title:** [AT110e][045][IIOT] PDCP Duplication and PDCP CRs

**Document for:** Information

# 1. Introduction

This document is to report the result of the following email discussion in RAN2#109bis-e Meeting, based on R2-2005723.

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| * [AT110e][045][IIOT] PDCP Duplication and PDCP CRs (LG)

Scope: Treat R2-2005723, determine agreeable parts and and make agreements. Implement meeting agreements in updated CRs. Part 1: Agreements (rapporteur sets the deadline) Part 2: Agreed CRs 38323 36323 Deadline: June 11 0700 UTC |

It is suggested to progress the discussion with the following schedule.

- Part 1 discussion: June 4 0700 UTC (identify easy agreements and controversial issues)

- Part 2 discussion: June 10 0700 UTC (resolving controversial issues)

- Agreeable CRs on 38.323 and 36.323: June 11 0700 UTC (rapporteur will provide the CRs)

FYI, the issues are summarized from documents submitted in this meeting, as follows.

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| # | Tdoc | Title | Source |
| 1 | R2-2004740 | Clarification on the RRC-based activation of PDCP duplication | vivo |
| 2 | R2-2004958 | [E225] On simplification for PDCP-duplication | Ericsson |
| 3 | R2-2005506 | Indication of PDCP duplication configuration | LG Electronics Inc. |
| 4 | R2-2005649 | Radio Bearer with More than Two RLC Entities for Downlink Duplication or Split [E225] | Samsung |
| 5 | R2-2004887 | Configuration of PDCP duplication (discuss issues raised in E225) | SHARP |
| 6 | R2-2004589 | Control of Duplication by Rel-16 Duplication MAC CE | CATT |
| 7 | R2-2004924 | Issues with Network Coordination for PDCP Duplication | Nokia, Nokia Shanghai Bell |
| 8 | R2-2004590 | [C601] PDCP Duplication Configuration in MR-DC | CATT |
| 9 | R2-2004892 | MAC update on R15 MAC CE not used for moreThanTwoRLC | Fujitsu |
| 10 | R2-2005068 | Clarification of DC+CA duplication definition | Huawei, HiSilicon |
| 11 | R2-2005650 | Clarification on Initial State of PDCP Duplication in IIOT | Samsung |
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# 2. Issue summaries

## 2.1 Indication of PDCP duplication configuration

The Tdocs [1]~[5] address this issue.

In PDCP specification, it is required to indicate whether the PDCP entity is configured with PDCP duplication. In Rel-15, the *pdcp-Duplication* plays that role. However, in Rel-16, the *pdcp-Duplication* is absent when *moreThanTwoRLC* is configured, and it cannot be used to indicate that the PDCP entity is configured with PDCP duplication when more than two RLC entities are associated. Instead of *pdcp-Duplication*, the *moreThanTwoRLC* is used to indicate the PDCP duplication configuration when more than two RLC entities are associated. The configuration according to current RRC running CR is summarized below.

- For DRBs with two RLCs entities and SRBs

- the presence of *pdcp-Duplication* indicates the PDCP duplication configuration

- the value of *pdcp-Duplication* indicates the state of the PDCP duplication

- for SRBs, the value of *pdcp-Duplication* is always set to TRUE

- For DRBs with more than two RLC entities

- the presence of *moreThanTwoRLC* indicates the PDCP duplication configuration

- the value of *duplicationState* indicates the state of each RLC entities

- the *pdcp-Duplication* is absent

To remove the above discrepancies, [1]~[4] suggest that the *pdcp-Duplication* is also used to indicate PDCP duplication configuration for DRBs with more than two RLC entities. However, [5] suggest to stick to the current RRC running CR because there is no technical issue.

**Question 1. Which option should be used to indicate the PDCP duplication configuration for DRBs with more than two RLC entities.**

**- Option 1. The presence of *pdcp-Duplication* indicates the PDCP duplication configuration (i.e. *pdcp-Duplication* is always used to indicate the PDCP duplication configuration for both DRBs and SRBs)**

**- Option 2. The presence of *moreThanTwoRLC* indicates the PDCP duplication configuration (i.e. keep the current running CR)**

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| **Company** | **Preferred option** | **Comment** |
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## 2.2 Control of PDCP duplication status of DRB in other node by Rel-16 MAC CE

The Tdoc [6] address this issue.

The Rel-16 Duplication RLC Activation/Deactivation MAC CE includes a DRB ID field, which indicates the identity of DRB configured for the UE. Thus, theoretically, one node can control the PDCP duplication status of DRBs belonging to other node.

However, [6] suggest that one node does not control the PDCP duplication status of DRBs belonging to other node with following reasons:

- No new reason triggers gNB to control CA duplication in the other node.

- It is impossible to control CA duplication in LTE side by the Rel-16 duplication MAC CE in gNB side in EN-DC.

- RAN2 decision about control of duplication by Rel-16 duplication MAC CE has essential impact on RAN3 discussion.

**Question 2. Do you think one node is allowed to control the PDCP duplication status of DRBs belonging to other node?**

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| **Company** | **Yes/No** | **Comment** |
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## 2.3 Handling of RLCi field belonging to other node in Rel-16 MAC CE

The Tdoc [7] address this issue.

It is argued in [7] that if network coordination for Rel-16 UL PDCP duplication in DC+CA architecture is not specified or not feasible, it would be ambiguous for the UE to know whether the MAC CE should be applicable to all legs associating to the targeted DRB, or only applicable to the leg subset hosted by the issuing node. To resolve this ambiguity, it might be needed for the UE to know whether the received MAC CE is also applicable to RLC entities corresponding to the node other than the node issuing this MAC CE.

Therefore, [7] proposed two options as follows:

- Option 1. Adding an indication in Rel-16 MAC CE to indicate whether the MAC CE is applicable to all RLCs or only a subset of RLCs of a DRB

- Option 2. The UE shall ignore indication relating to RLC(s) in another node in Rel-16 MAC CE.

**Question 3. How the RLCi field belonging to other node in Rel-16 MAC CE is handled if network coordination is not supported?**

**- Option 1. Adding an indication in Rel-16 MAC CE to indicate whether the MAC CE is applicable to all RLCs or only a subset of RLCs of a DRB**

**- Option 2. The UE shall ignore indication relating to RLC(s) in another node in Rel-16 MAC CE.**

**- Option 3. The UE shall follow the indication in Rel-16 MAC CE.**

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| **Company** | **Preferred option** | **Comment** |
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## 2.4 PDCP Duplication Configuration in MR-DC

The Tdoc [8] address this issue.

As the RAN2 decided at the last meeting that Rel-15 Duplication MAC CE is not used for Rel-16 Duplication configuration (with more than two RLC entities configured), [6] suggest that DC duplication with more than two RLC entities are not configured for MR-DC including EN-DC, NGEN-DC, and NE-DC. The reason is that Rel-16 MAC CE is not supported by the LTE MAC.

Therefore, [8] suggest to explicitly specify in 37.340 and 38.331 that DC duplication with more than two RLC entities is not supported for MR-DC.

**Question 4. Do you think the DC duplication with more than two RLC entities should be supported for MR-DC?**

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| **Company** | **Yes/No** | **Comment** |
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## 2.5 MAC update on R15 MAC CE not used for *moreThanTwoRLC*

The Tdoc [9] address this issue.

[9] argues that the text “The PDCP duplication for all or a subset of associated RLC entities for the configured DRB(s)” may be misleading that Rel-15 MAC CE can be used for Rel-16 PDCP duplication configuration, and propose to make a correction on MAC specification as follows

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| 5.10 Activation/Deactivation of PDCP duplicationIf one or more DRBs are configured with PDCP duplication, the network may activate and deactivate the PDCP duplication for all or a subset of associated RLC entities for the configured DRB(s).If the MAC entity is configured with *moreThanTwoRLC*, the PDCP duplication for the configured DRB(s) is activated and deactivated by:- receiving the Duplication Activation/Deactivation MAC CE described in clause 6.1.3.11;- receiving the Duplication RLC Activation/Deactivation MAC CE described in clause 6.1.3.32;- indication by RRC.If the MAC entity is configured with *pdcp-Duplication*, the PDCP duplication for all or a subset of associated RLC entities for the configured DRB(s) is activated and deactivated by:- receiving the Duplication RLC Activation/Deactivation MAC CE described in clause 6.1.3.32;- indication by RRC. |

**Question 5. Do you think the text “the PDCP duplication for all or a subset of associated RLC entities” needs further clarification, as provided above?**

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| **Company** | **Yes/No** | **Comment** |
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## 2.6 Clarification of DC+CA duplication definition

The Tdoc [10] address this issue.

[10] argues that the definition of DC+CA duplication is not clear, and propose to clarify in 38.300 that the DC+CA duplication is one kind of DC duplication, and the duplication within each cell group is seen as CA duplication. The Text proposal in [10] is captured below.

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| 16.1.3 Packet DuplicationWhen duplication is activated, the original PDCP PDU and the corresponding duplicate(s) shall not be transmitted on the same carrier. The logical channels associated with a same radio bearer can either belong to the same MAC entity (referred to as CA duplication) or to different ones (referred to as DC duplication). CA duplication can be configured together with DC duplication when duplication over more than two RLC entities is configured in the UE, which is called DC+CA duplication. DC+CA duplication is also DC duplication, and in DC+CA duplication, the duplication within each cell group (if configured) is CA duplication. In CA duplication, logical channel mapping restrictions are used in MAC to ensure that different logical channels are not sent on the same carrier. When CA duplication is configured for an SRB, one of the logical channels associated to the SRB is mapped to SpCell.When CA duplication in a MAC entity is deactivated for a DRB, the logical channel mapping restrictions of the logical channels associated with the MAC entity are lifted for as long as the CA duplication remains deactivated. |

**Question 6. Do you agree to clarify in 38.300 that the DC+CA duplication is one kind of DC duplication, and the duplication within each cell group is seen as CA duplication, as provided above?**

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| **Company** | **Yes/No** | **Comment** |
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## 2.7 Clarification on Initial State of PDCP Duplication

The Tdoc [11] address this issue.

During RAN2#109bis-e meeting, for Rel-15 RRC corrections, RAN2 agreed not to use “initial state” for description of duplication state indicated by RRC. Instead, it is agreed to use “the state of PDCP duplication at the time of (re-)configuration” for *pdcp-Duplication*. In Rel-16 IIOT, RAN2 introduced another state indication by RRC, i.e. *duplicationState*, but whose descriptions in both RRC and stage-2 specifications still use expression “initial”.

Therefore, [11] proposed to remove “initial” from the description of *duplicationState*, and use the similar description as we agreed for *pdcp-Duplication*.

The rapporteur think this could be easily agreed, because the proposal is aligned with the agreement made in RAN2#109bis-e meeting.

**Question 7. Do you agree to remove “initial” from the description of *duplicationState*, and use “at the time of receiving this IE” similar to description agreed for *pdcp-Duplication*?**

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| **Company** | **Yes/No** | **Comment** |
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# 3.Proposals

To be filled later