3GPP TSG-RAN WG2 Meeting #118-e Draft of R2-2206222

Online, May 09 – May 20, 2022

**Agenda item: 6.5.3**

**Source: Samsung**

**Title: Summary of IIOT/URLLC User Plane**

**Document for: Discussion & Decision**

# Introduction

This document is a summary of tdocs on user plane issues in IIOT/URLLC WI. The following documents are summarized:

R2-2204665 Correction on Simultaneous PUCCH/PUSCH Transmission CATT discussion Rel-17 NR\_IIOT\_URLLC\_enh-Core

R2-2204666 Corrections on the description of simultaneous PUCCH/PUSCH transmission CATT CR Rel-17 38.321 17.0.0 1226 - F NR\_IIOT\_URLLC\_enh-Core

R2-2204759 Correction on the simultaneous PUCCH PUSCH transmission OPPO, Samsung draftCR Rel-17 38.321 17.0.0 F NR\_IIOT\_URLLC\_enh-Core

R2-2204760 Open issues on the termination of the CGT OPPO discussion Rel-17 NR\_IIOT\_URLLC\_enh-Core

R2-2205019 Correction on duplication activation for survival time state entry Nokia, Nokia Shanghai Bell CR Rel-17 38.300 17.0.0 0450 - F NR\_IIOT\_URLLC\_enh-Core

R2-2205020 Correction on duplication activation with UL retransmission grant reception Nokia, Nokia Shanghai Bell CR Rel-17 38.321 17.0.0 1246 - F NR\_IIOT\_URLLC\_enh-Core

R2-2205021 Corrections on HARQ feedback deferral Nokia, Nokia Shanghai Bell CR Rel-17 38.321 17.0.0 1247 - F NR\_IIOT\_URLLC\_enh-Core

R2-2205510 correction for PDCP duplication with survivalTimeSupport Ericsson, Samsung draftCR Rel-17 38.321 17.0.0 NR\_IIOT\_URLLC\_enh-Core

R2-2205680 Impact of Rel-17 PHY prioritization on MAC Apple discussion Rel-17 NR\_IIOT\_URLLC\_enh-Core

R2-2205681 Draft CR for impact of Rel-17 PHY prioritization on MAC Apple draftCR Rel-17 38.321 17.0.0 F NR\_IIOT\_URLLC\_enh-Core

R2-2206028 Clarification on the SPS HARQ deferral Xiaomi Communications, Samsung draftCR Rel-17 38.321 17.0.0 F NR\_IIOT\_URLLC\_enh-Core R2-2205460

R2-2205710 Correction for Enhanced NR IIoT and URLLC in 38.321 Samsung CR Rel-17 38.321 17.0.0 1281 - F NR\_IIOT\_URLLC\_enh-Core

# Discussion

## Corrections on MAC Procedures

In this section, we discuss the tdocs which propose to change the current procedures.

### PDCP Duplication for RLC Entity without Activated Cell at Survival Time State Entry

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| R2-2205019 Correction on duplication activation for survival time state entry Nokia, Nokia Shanghai Bell CR Rel-17 38.300 17.0.0 0450 - F NR\_IIOT\_URLLC\_enh-Core  R2-2205020 Correction on duplication activation with UL retransmission grant reception Nokia, Nokia Shanghai Bell CR Rel-17 38.321 17.0.0 1246 - F NR\_IIOT\_URLLC\_enh-Core |

Currently, upon survival time state entry all RLC entities configured for the DRB are activated for duplication. A problematic scenario is the case that some RLC entities have no activated serving cell to transmit the duplicated data. R2-2205019/5020 proposed to activate RLC entities with at least one activated servicing cell upon survival time state entry. A main reason is that the NW should be able decide which serving cells it wants to keep activated for the UE depending on the cell load and radio quality other etc., other than being enforced to keep the serving cells activated for all the duplication legs.

**Proposal 1. RAN2 to decide upon survival time state entry:**

* **Option 1: all RLC entities configured for the DRB with at least one serving cell activated are activated for duplication (TPs of R2-2205019 and R2-2205020 are baselines).**
* **Option 2: all RLC entities configured for the DRB are activated for duplication (no specification change).**

### Potential Packet Loss of De-prioritized CG

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| R2-2204760 Open issues on the termination of the CGT OPPO discussion Rel-17 NR\_IIOT\_URLLC\_enh-Core |

R2-2204760 is about the following postponed open issue discussed in RAN2#116bis-e:

2. Put the follow issue on hold and discuss whether and how to handle it during maintenance phase after WI competition: When autonomousTx and cg-retransmissionTimer are configured, if an autonomous retransmission of a PDU is deprioritized with the HARQ not pending, the network will stop the configuredGrantTimer assocated with the deprioritized PDU. A new MAC PDU will be generated and flush the original packet stored in the HARQ buffer, which may lead to packet loss.

A problematic scenario is in the following figure:

* Both *autonomousTx* and *cg-retransmissionTimer* are configured.



* At t0, CG has been transmitted without LBT failure, so the corresponding HP is not pending.
* At t1, CGT is running and *cg-retransmissionTimer* is not running. The CG selected for autonomous retransmission is de-prioritized. CGT is stopped.
* At t2, both CGT and CGRT are not running and HP is not pending 🡪 the stored MAC PDU is deleted by a new MAC PDU.

To resolve the problem, R2-2204760 proposed to add a condition not to stop the CGT as follows:

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| **Proposal 1. If RAN2 agrees to resolve the packet loss issue, in the case that both *cg-RetransmissionTimer* and *autonomousTx* are configured, RAN2 considers not to stop the running CGT associated with the deprioritized CG used for autonomous retransmission.** |

**Proposal 2. RAN2 to decide when both *cg-RetransmissionTimer* and *autonomousTx* are configured and HP is not pending**

* **Option 1: allow not to stop CGT for de-prioritized CG used for autonomous retransmission. (TP of R2-2204760 is a baseline)**
* **Option 2: stop CGT for de-prioritized CG used for autonomous retransmission. (no specification change)**

### MAC Impact of Rel-17 PHY Prioritization

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| R2-2205680 Impact of Rel-17 PHY prioritization on MAC Apple discussion Rel-17 NR\_IIOT\_URLLC\_enh-Core  R2-2205681 Draft CR for impact of Rel-17 PHY prioritization on MAC Apple draftCR Rel-17 38.321 17.0.0 F NR\_IIOT\_URLLC\_enh-Core |

< PHY prioritization when *lch-basedPrioritization* is not configured >

In the current MAC specification, when *lch-basedPrioritization* is not configured and a configured grant (CG) overlaps with a dynamic grant (DG), the DG is chosen to transmit. This means that without *lch-basedPrioritization* MAC does not deliver a MAC PDU for the high PHY-priority CG (i.e. Rel-15 behaviour). R2-2205680 proposed to confirm the current behaviour.

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| **Proposal 1: RAN2 confirms that when PHY prioritization is enabled for overlapping DG/CG in Rel-17 and *lch-basedPrioritization* is not configured, MAC procedures fall back to Rel-15 behaviour.** |

R2-2205680 provided a TP if we make PHY prioritization work without *lch-basedPrioritization*, but the tdoc seems not to support the change. Thus, it is proposed to confirm the current behaviour and agree no specification change.

**Proposal 3. RAN2 confirms that when PHY prioritization is enabled for overlapping DG/CG in Rel-17 and *lch-basedPrioritization* is not configured, MAC procedures fall back to Rel-15 behaviour, i.e. DG is always chosen. (no specification change)**

< De-prioritization of CG by high PHY-priority DG >

Rel-17 PHY prioritization introduced cancellation of ongoing CG transmission with low PHY-priority when overlapping DG has high PHY-priority and MAC delivers two MAC PDUs. R2-2205680/5681 proposed to consider the cancelled low PHY-priority CG as a de-prioritized uplink grant in case that the MAC entity is configured with *lch-basedPrioritization*.

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| **Proposal 2: When a CG-PUSCH transmission is cancelled due to cancellation and replacement in Rel-17, the uplink grant associated with the cancelled CG is considered as a de-prioritized grant.**  **Proposal 3: RAN2 adopts the MAC specification to address Proposal 2. R2-2205681 is used as a baseline.** |

**Proposal 4. RAN2 to discuss: when a CG-PUSCH transmission is cancelled due to cancellation and replacement in Rel-17,**

* **Option 1: the uplink grant associated with the cancelled CG is considered as a de-prioritized grant.**
* **Option 2: No specification change (leaving up to existing LCH-based Prioritization)**

### *drx-RetransmissionTimerDL* at Expiry of SPS HARQ-ACK Deferral

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| R2-2205021 Corrections on HARQ feedback deferral Nokia, Nokia Shanghai Bell CR Rel-17 38.321 17.0.0 1247 - F NR\_IIOT\_URLLC\_enh-Core |

The issue of HARQ feedback dropping due to maximum allowed deferral time was discussed (R2-2203734) in RAN2#117-e with the conclusion that *drx-HARQ-RTT-TimerDL* is not started since according to current specification the timer is only started when the HARQ feedback is sent. However, R2-2205021 proposed to start *drx-RetransmissionTimerDL* timer when the maximum allowed deferral time is reached. The main reason is that it is problematic for the NW as the NW should still be able to schedule potential retransmissions without knowing if the TB is correctly decoded or not.

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| 1> if maximum number of slots or subslots the transmission of DL SPS HARQ-ACK deferral is reached without transmitting the DL SPS HARQ-ACK the as specified in TS 38.213 [6]:  2> start the *drx-RetransmissionTimerDL* for the corresponding HARQ process. |

**Proposal 5. RAN2 to discuss when the maximum allowed deferral time of HARQ feedback is reached:**

* **Option 1. *drx-RetransmissionTimerDL* is started.**
* **Option 2. *drx-RetransmissionTimerDL* is not started. (no specification change)**

## Editorial Corrections/Clarifications/Wording Improvements

Issues in this section are about editorial corrections, clarification or wording improvements. It is assumed that discussion on procedure is not required.

### Simultaneous PUCCH-PUSCH Transmission for SR-PUSCH Overlap

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| R2-2204666 Corrections on the description of simultaneous PUCCH/PUSCH transmission CATT CR Rel-17 38.321 17.0.0 1226 - F NR\_IIOT\_URLLC\_enh-Core  R2-2204759 Correction on the simultaneous PUCCH PUSCH transmission OPPO, Samsung draftCR Rel-17 38.321 17.0.0 F NR\_IIOT\_URLLC\_enh-Core |

Both R2-2204666 and R2-2204759 pointed out that simultaneous transmission of SR and UL-SCH is considered in the sentence of DG/CG collision. It is clear that the MAC specification does not correctly capture the agreement. Two contributions proposed the same, i.e. relocate the condition to SR vs UL-SCH collision.

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| R2-2204666 (CATT)  1> else if this uplink grant is addressed to CS-RNTI with NDI = 1 or C-RNTI:  2> if there is no overlapping PUSCH duration of a configured uplink grant which was not already de-prioritized, in the same BWP whose priority is higher than the priority of the uplink grant; and  2> if there is no overlapping PUCCH resource with an SR transmission which was not already de-prioritized and the simultaneous transmission of the SR and the uplink grant is not allowed according to clause 9 of TS 38.213 [6], and the priority of the logical channel that triggered the SR is higher than the priority of the uplink grant:  3> consider this uplink grant as a prioritized uplink grant;  3> consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s);  3> consider the other overlapping SR transmission(s), if any, as a de-prioritized SR transmission(s); |
| 1> else if this uplink grant is addressed to CS-RNTI with NDI = 1 or C-RNTI:  2> if there is no overlapping PUSCH duration of a configured uplink grant which was not already de-prioritized, in the same BWP, whose priority is higher than the priority of the uplink grant; and  2> if there is no overlapping PUCCH resource with an SR transmission which was not already de-prioritized and the simultaneous transmission of the SR and the uplink grant is not allowed by configuration of *simultaneousPUCCH-PUSCH* and the priority of the logical channel that triggered the SR is higher than the priority of the uplink grant:  3> consider this uplink grant as a prioritized uplink grant;  3> consider the other overlapping uplink grant(s), if any, as a de-prioritized uplink grant(s);  3> consider the other overlapping SR transmission(s), if any, as a de-prioritized SR transmission(s); |

**Proposal 6. Condition of simultaneous transmission in CG vs DG collision is relocated to SR vs UL-SCH collision.**

### Removal of Configuration *simultaneousPUCCH-PUSCH*

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| R2-2204666 Corrections on the description of simultaneous PUCCH/PUSCH transmission CATT CR Rel-17 38.321 17.0.0 1226 - F NR\_IIOT\_URLLC\_enh-Core |

In RRC specification, there are two parameters for simultaneous PUCCH-PUSCH transmissions, namely, 1) *simultaneousPUCCH-PUSCH* and 2) *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup*. However, the current wording in MAC is “not allowed by configuration of *simultaneousPUCCH-PUSCH*” which is incomplete. R2-2204666 proposed not to specify the configuration name but to revise to “according to clause 9 of TS 38.213 [6]”.

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| 3> if the PUCCH resource for the SR transmission occasion overlaps with neither a UL-SCH resource whose simultaneous transmission with the SR is not allowed according to clause 9 of TS 38.213 [6] nor an SL-SCH resource; or  Note that there are four similar required changes in the CR |

**Proposal 7. “by configuration of *simultaneousPUCCH-PUSCH*” is replaced by according to “clause 9 of TS 38.213 [6]”.**

### Stage-2 Correction on Simultaneous PUCCH-PUSCH Transmission

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| R2-2204665 Correction on Simultaneous PUCCH/PUSCH Transmission CATT discussion Rel-17 NR\_IIOT\_URLLC\_enh-Core |

R2-2204665 proposed a TP to clarify two things:

* Rel-17 PUCCH-PUSCH simultaneous transmission is within a PUCCH group.
* When simultaneous PUSCH/PUCCH transmission is configured, UCI cannot be multiplexed in PUSCH with different priority. The current stage-2 specification may be misunderstood.

The corresponding TP is as follows:

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| Simultaneous transmission of PUCCH and PUSCH associated with different priorities on cells of different bands in a PUCCH group is supported, where UCI multiplexing in the PUCCH associated with a priority in combination of UCI multiplexing in a PUSCH associated with a different priority is supported if the UCI multiplexed on PUSCH is of same priority as the PUSCH. |

**Proposal 8. RAN2 to discuss whether the stage-2 description is updated according to R2-2204665.**

### NOTE on HARQ Feedback Deferral

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| R2-2206028 Clarification on the SPS HARQ deferral Xiaomi Communications, Samsung draftCR Rel-17 38.321 17.0.0 F NR\_IIOT\_URLLC\_enh-Core R2-2205460 |

R2-2206028 is about the following FFS of RAN2#117-e:

RAN2 to confirm that the current MAC specification already captures the behaviour upon SPS HARQ-ACK deferral. FFS whether to capture a NOTE for clarification, similar to non-numerical k1.

R2-2206028 proposed to have a NOTE, since it is not clear from the specification whether the UE delays the starting of the drx-HARQ-RTT-TimerDL for the SPS HARQ-ACK up-to the maximum deferral time. The proposed text is aligned with an existing NOTE on inapplicable k1 (non-numerical k1).

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| NOTE x: When SPS HARQ feedback is postponed by the transmission collision, as specified in TS 38.213 [6], the corresponding transmission opportunity to send the DL HARQ feedback is deferred to the next available resource. |

**Proposal 9. RAN2 to discuss whether to capture a NOTE on SPS HARQ feedback deferral according to R2-2206028.**

### Clarification on Activation of PDCP Duplication

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| R2-2205510 correction for PDCP duplication with survivalTimeSupport Ericsson, Samsung draftCR Rel-17 38.321 17.0.0 NR\_IIOT\_URLLC\_enh-Core |

R2-2205510 proposed a TP to clarify two things:

* The existing text may mislead that a subset of associated RLC entities is activated by CS-RNTI with NDI=1. 🡪 All RLC entities are activated.
* The existing text may mislead that all cases of CS-RNTI with NDI=1 trigger the PDCP duplication. 🡪 Only CS-RNTI with NDI=1 for a logical channel associated with the DRB configured with *survivalTimeStateSupport* activates the duplication.

It is proposed to have a separate paragraph for the case as follows:

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| 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.  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.  The PDCP duplication for all associated RLC entities for the configured DRB(s) is activated by:  - receiving an uplink grant addressed to CS-RNTI with NDI=1 for a logical channel associated with the DRB configured with *survivalTimeStateSupport*, described in clause 5.4.1. |

**Proposal 10. RAN2 to discuss whether to clarify the text on PDCP duplication with *surivialTimeStateSupport* according to R2-2205510.**

### “data for logical channels is multiplexed” and “logical channel is multiplexed”

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| R2-2205710 Correction for Enhanced NR IIoT and URLLC in 38.321 Samsung CR Rel-17 38.321 17.0.0 1281 - F NR\_IIOT\_URLLC\_enh-Core |

In descriptions of IIoT/URLLC features, *lch-basedPrioritization*, s*urvivalTimeStateSupport*, and *intraCG-Prioritization*, both “data for logical channels is multiplexed” and “logical channel is multiplexed” are used. They have the same meaning. It is proposed to have a single unified expression.

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| 3> if data for a logical channel associated with a DRB configured with *survivalTimeStateSupport* is multiplexed in the MAC PDU stored in the HARQ buffer for the corresponding HARQ process:  4> trigger activation of PDCP duplication for all configured RLC entities of the DRB. |
| If the MAC entity is configured with *intraCG-Prioritization*, for HARQ Process ID selection, the UE shall prioritize the HARQ Process ID with the highest priority, where the priority of HARQ process is determined by the highest priority among priorities of the logical channels having data that are multiplexed (i.e. the MAC PDU to transmit is already stored in the HARQ buffer) or having data available that can be multiplexed (i.e. the MAC PDU to transmit is not stored in the HARQ buffer) in the MAC PDU, according to the mapping restrictions as described in clause 5.4.3.1. |
| For the MAC entity configured with *lch-basedPrioritization*, priority of an uplink grant is determined by the highest priority among priorities of the logical channels having data that are multiplexed (i.e. the MAC PDU to transmit is already stored in the HARQ buffer) or having data available that can be multiplexed (i.e. the MAC PDU to transmit is not stored in the HARQ buffer) in the MAC PDU, according to the mapping restrictions as described in clause 5.4.3.1.2. |

**Proposal 11. RAN2 to discuss whether to use only “data that are multiplexed” according to R2-2205710.**

# Conclusion

**Proposal 1. RAN2 to decide upon survival time state entry:**

* **Option 1: all RLC entities configured for the DRB with at least one serving cell activated are activated for duplication (TPs of R2-2205019 and R2-2205020 are baselines).**
* **Option 2: all RLC entities configured for the DRB are activated for duplication (no specification change).**

**Proposal 2. RAN2 to decide when both *cg-RetransmissionTimer* and *autonomousTx* are configured and HP is not pending**

* **Option 1: allow not to stop CGT for de-prioritized CG used for autonomous retransmission. (TP of R2-2204760 is a baseline)**
* **Option 2: stop CGT for de-prioritized CG used for autonomous retransmission. (no specification change)**

**Proposal 3. RAN2 confirms that when PHY prioritization is enabled for overlapping DG/CG in Rel-17 and *lch-basedPrioritization* is not configured, MAC procedures fall back to Rel-15 behaviour, i.e. DG is always chosen. (no specification change)**

**Proposal 4. RAN2 to discuss: when a CG-PUSCH transmission is cancelled due to cancellation and replacement in Rel-17,**

* **Option 1: the uplink grant associated with the cancelled CG is considered as a de-prioritized grant.**
* **Option 2: No specification change (leaving up to existing LCH-based Prioritization)**

**Proposal 5. RAN2 to discuss when the maximum allowed deferral time of HARQ feedback is reached:**

* **Option 1. *drx-RetransmissionTimerDL* is started.**
* **Option 2. *drx-RetransmissionTimerDL* is not started. (no specification change)**

**Proposal 6. Condition of simultaneous transmission in CG vs DG collision is relocated to SR vs UL-SCH collision.**

**Proposal 7. “by configuration of *simultaneousPUCCH-PUSCH*” is replaced by according to “clause 9 of TS 38.213 [6]”.**

**Proposal 8. RAN2 to discuss whether the stage-2 description is updated according to R2-2204665.**

**Proposal 9. RAN2 to discuss whether to capture a NOTE on SPS HARQ feedback deferral according to R2-2206028.**

**Proposal 10. RAN2 to discuss whether to clarify the text on PDCP duplication with *surivialTimeStateSupport* according to R2-2205510.**

**Proposal 11. RAN2 to discuss whether to use only “data that are multiplexed” according to R2-2205710.**