3GPP TSG-RAN WG2 Meeting #118-e R2-22xxxxx

Online, May 09 – May 20, 2022

**Agenda item: 6.5.3**

**Source: Samsung**

**Title: Summary of Offline 506: IIOT UP Open Issues**

**Document for: Discussion & Decision**

# Introduction

This document is a summary of the following offline discussion:

* [AT118-e][506][IIoT] UP open issues and CR 38.321 (Samsung)

 UP open issues and CR capturing agreed corrections

Deadline: To be set by rapporteur aiming to have company inputs and proposals by Friday

The discussion covers the following tdocs:

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-CoreR2-2205020 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.

**Q1. Which option do companies support?**

* **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).**

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| **Company** | **Option** | **Comment** |
| CATT | Option 2 | In 38.300, it states “When activating duplication for a DRB, NG-RAN should ensure that at least one serving cell is activated for each logical channel associated with an activated RLC entity of the DRB; and when the deactivation of SCells leaves no serving cells activated for a logical channel of the DRB, NG-RAN should ensure that duplication is also deactivated for the RLC entity associated with the logical channel.”When survival time state is supported, at least one cell should be activated for corresponding RLC. So option 1 is not needed and option 2 (no specification change) is preferred. |
| Ericsson | Okay to Option 2 | We acknowledge that it would be good to let NW decide which serving cell it wants to keep activated. On the other hand, this survival time mechanism is for a very demanding situation. When triggered, it seems that all RLC entities are needed to be activated. Not sure though the requirement that the cell must be kept active, since the referred text by CATT is from stage 2 with a wording “should”, not “shall”.  |
| Apple | Option 1 | Option 1 sounds reasonable to us. This is a good example why the network should first configure a subset of RLC entities that the UE should activate upon survival time state entry. To force the network to always keep at least one serving cell activated for each of the RLC entities of this DRB limits scheduling flexibility and unnecessarily consumes UE power. Thus, we don’t think it makes sense for the network to always keep at least one serving cell active for every RLC entity of a DRB, simply because survival time state could be triggered spontaneously. It results in unnecessary power wastage in both gNB and UE sides. Whether to have at least one active serving cell for one RLC entity is also a network implementation issue, it is strange if we enforce how the gNB should manage the radio resource by specification. The TS 38.300 text referred by CATT is for “activating duplication for a DRB”, this is not equivalent to “survival time state entry”. Note that duplication for a DRB could be already activated even before survival time state is triggered. Also, TS 38.300 also states that: “when the deactivation of SCells leaves no serving cells activated for a logical channel of the DRB, NG-RAN should ensure that **duplication is also deactivated for the RLC entity** associated with the logical channel.”So, if all serving cells for a RLC entity are already deactivated, we should make sure duplication on this RLC entity is also deactivated – this means the UE should not activate this RLC entity even if the DRB enters the survival time state.  |
| Qualcomm | 2 | The issue seems to be fixing a misconfiguration whereby the network configures RLC with no serving cell. However, it should be on the NW to ensure that this case is resolved so we do not see the rationale for a standards restriction. Also, a UE implementation can just not forward PDCP PDUs to those RLC channels, otherwise they would just be buffered and not much will change.  |
| OPPO | Option 2 | The survival time mechanism is to match the specific requirement. As discussed in RAN2 before, if it is triggered, all RLC entities need to be activated. Option 1 somehow contradicts RAN2 intention.On the text mentioned by CATT, our understanding is that the cell must be kept active, but maybe something I missed here. |
| Samsung | 2 | If an RLC has no active cell, duplicate will not be transmitted via the RLC and will be discarded by PDCP discard timer. Thus, there’s no actual difference between Option 1 and Option 2.  |
| Futurewei | 2 | When ST is triggered, all configured RLC entities should be activated. And the NW should ensure proper configurations for the RLC entities to be activated when ST is triggered. |
| Nokia | 1 | We disagree with the comment that a leg can be activated even if there is no active cell since the data will stuck there and keeps filling up the Tx buffer in vain which will impact later operation. That was why we had the requirement in legacy that NW needs to ensure there is at least one cell activated for a duplication leg. But the point is in legacy it is up to NW control which cells to activate and which legs to activate. Since SCell activation/deactivation could be based on radio quality as well, keeping it activated and transmitting duplication there would not help but increase UE power consumption. SCell deactivation should be kept rather independent.  |
| LGE | 1 | We have different understanding with CATT. The text in TS38.300 does not mean that at least one serving cell is activated for all RLC entities configured for duplication. It means that ‘if RLC entity is activated for duplication, it has to be associated with at least one activated serving cell’. It naturally implies that if there is no activated serving cell for an RLC entity, it shouldn’t be activated for duplication while it is up to networks responsibility to keep at least one cell active for the intended RLC entities. PDCP is not aware of whether the associated serving cell is activated or not. So, the option1 makes the packet is not delivered to the RLC entity associated with no activated serving cell while the option2 delivers the packet to the RLC entity associated with no activated serving cell uselessly.  |
| Intel | Option 2 | Agree with CATT. |
| Sequans | Option 2 | Same view as CATT.In Rel-15 and Rel-16 duplication "It was agreed the situation of having duplication of a DRB activated while there is no SCell activated that can be mapped to for the duplication leg of the DRB should be avoided by network implementation" because "If duplication of a DRB is activated while no SCell that the duplication leg of the DRB can be mapped to is activated, data accumulated for the duplication leg might cause HFN de-sync issue." (R2-1808829). The only difference Rel-15 and Rel-16 duplication is that with ST, activation is done on all configured legs and not with a bitmap (like in MAC CE), which is less flexible for NW, but that was a conscious decision.Also agree with QC that even if NW does not ensure this, UE would not just duplicate/send packet to RLC entities with no active cells. |
| III | 2 | We are fine with no change and assume NW can configure RLC entities properly. |
| Huawei, HiSilicon | 2 | We think this specification change is not needed of a perhaps corner case of bad network configuration. Network implementation should guarantee there are activated serving cell for to-be-activated legs. For the demanding IIOT scenario, Network shall be prepared in such way, also not to waste NT/UE resource in a bad radio condition cell.  |
| Xiaomi | Option 2 | We think that a proper network implementation should provide the correct configuration to the UE. |
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< Summary >

- Option 1: 3 companies (Apple, Nokia, LGE)

- Option 2: 12 companies (CATT, Ericsson, Qualcomm, OPPO, Samsung, Futurewei, Intel, Sequans, III, Huawei/HiSilicon, Xiaomi)

A number of companies agreed that NW should ensure at least one serving cell is activated for each logical channel, and agreed Option 2 is ok. Ericsson/Nokia/LGE mentioned it is not always guaranteed. But considering majority view and cell activation status can be controlled by NW, Option 2 is proposed.

**Proposal 1 (12/15). Upon survival time state entry, 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.** |

**Q2. Which option do companies support?**

**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)**
* **Option 3: Switch the HARQ process to pending upon deprioritization of the autonomous retransmission**

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| **Company** | **Option** | **Comment** |
| CATT | 3 | We agree with the intention to fix the issue. But another option is to switch the HARQ process to pending upon de-prioritization as it will enforce the autonomous retransmission, as in an LBT case (which in our view is cleaner). |
| Ericsson | 2 | Given the complexity to resolve the issue and the diverging opinions, we are fine to leave the spec unchanged since this is a corner case in an unlikely configuration of both *cg-RetransmissionTimer* and *autonomousTx* |
| Apple | 1 | This case is not super-critical (it should not happen frequently), however, we support it for the sake of a reliable transmission, which is important for URLLC. In Rel-16, we stop the *configuredGrantTimer* upon de-prioritization is because we do not want *autonomousTx* to be blocked by the running timer in the subsequent CG. On the other hand, according to TS 38.321, autonomous transmission only kicks in if the MAC PDU has not been completely transmitted:3> else if this uplink grant is a configured grant configured with *autonomousTx*; and3> if the previous configured uplink grant, in the BWP, for this HARQ process was not prioritized; and3> if a MAC PDU had already been obtained for this HARQ process; and3> if the uplink grant size matches with size of the obtained MAC PDU; and3> if none of PUSCH transmission(s) of the obtained MAC PDU has been completely performed:4> consider the MAC PDU has been obtained.In the concerned case of Q2, the PUSCH of this MAC PDU has been completely performed at t0 in the figure, which means the *autonomousTx* mechanism will not kick in. Therefore, we think Option 1 makes some sense. |
| Qualcomm | 2 | Deprioritization without CGRT configured mandates that CGT is stopped. We do not prefer creating new branches of behaviour that creates new dependencies between deprioritization and CGRT regarding whether to stop CGT or not. The benefits are minimal and not worth making the feature more cumbersome. |
| OPPO | 1(Proponent) | Since we need to support URLLC traffic which has a high-reliability requirement, it is better to resolve this issue. Otherwise, the MAC PDU associated with the URLLC traffic is not decoded correctly at the gNB side but is finally lost. |
| Samsung | 2 | Agree with Ericsson and QualcommThe case does not frequently happen. Rel-17 IIoT assumes UCE where LBT failure is not frequent. Thus, the proposed enhancement may not be so useful. |
| Nokia | 1/2 | It has been discussed before and we supported option 1, but since it was concluded to go with option 2, we are fine to leave it as it is. |
| LGE | 2 | Agree with Ericsson. |
| Intel | 2 | We don’t think further optimization is needed, and therefore prefer to keep the current specification without change. |
| Sequans | 2 | Same view as Ericsson. |
| Huawei, HiSilicon | 1 | We think this issue can be solved now and the introduced changes are not many.  |
| Xiaomi | 2 | Agree with Ericsson and Qualcomm. |
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- Option 1: 4 companies (Apple, OPPO, Nokia, Huawei/HiSilicon)

- Option 2: 8 companies (Ericsson, Qualcomm, Samsung, Nokia, LGE, Intel, Sequans, Xiaomi)

- Option 3: 1 company (CATT)

5 companies supporting Option1 and Option 3 think the change is needed for high-reliability service and required changes are not many. However, 8 companies think it is for a corner case which does not frequently happen, and no change is ok.

**Proposal 2 (8/12). When both *cg-RetransmissionTimer* and *autonomousTx* are configured and HP is not pending, CGT for de-prioritized CG used for autonomous retransmission is stopped. (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-CoreR2-2205681 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.

**Q3. Do companies support the following?**

**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)**

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| **Company** | **Yes/No** | **Comment** |
| CATT | Yes | Same as Rel-16. |
| Ericsson | Yes | Unless indicated by RAN1, RAN2 follows Rel-16 |
| Apple | Yes | The cancellation and replacement feature is for time-critical use cases with very low latency requirements. In these cases, both lch-basedPrioritization and PHY-prioritization are beneficial (and expected) to be enabled. Since the current specification does support generation of two MAC PDUs if both LCH and PHY prioritization are enabled, there is no need to overcomplicate the spec by introducing yet another behavior variant for the intra-UE prioritization. |
| Qualcomm | Yes |  |
| OPPO | Yes | Fine to follow Rel-16 |
| Samsung | Yes | Seems that all companies have a common understanding. |
| Futurewei | Yes |  |
| Nokia | Yes |  |
| LGE | Yes | Same as Rel-16. |
| Intel | Yes | This is same as Rel-16. |
| Sequans | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Xiaomi | Yes |  |
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All companies confirmed.

**Proposal 3 (13/13). 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.** |

**Q4. Which option do companies support?**

**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)**

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| **Company** | **Option** | **Comment** |
| CATT | Option 2 | In our understanding such CG de-prioritization is already covered in MAC, no need for an explicit tagging. |
| Ericsson | Option 2 | Share similar views as CATT |
| Apple | Option 1 | As shown in R2-2205680 the PHY layer, per the behavior in 38.213, can cancel a PUSCH by a higher priority PUCCH (Rel-16/17) or a higher priority PUSCH transmission (Rel-17). A similar case for high-PHY priority PUCCH was discussed in R2-2007131/ R2-2008651 and added to the specification in Rel-16. These changes apply when PHY cancels the CG-PUSCH after UL grant processing has already happened or when a CG is de-prioritized due to reception of a higher priority DG during uplink grant processing in MAC. The exact sequence of events depends on PHY and MAC timing. We think this scenario is not yet covered by the current text.  |
| Qualcomm | 2 | Prefer not to mix PHY and MAC prioritization nor to change any behaviour last meeting unless it solves a critical problem which does not seem to be the case. Also, a TB deprioritized or cancelled by PHY may not correspond to the same MAC PDU so unclear if we can return the PDU to MAC for a deprioritization recovery procedure.  |
| OPPO | See comment | We understand the intention and slightly prefer Option1.  |
| Samsung | 2 | A common understanding during Rel-16 IIoT is that it is very likely to configure both PHY prioritization and LCH-based Prioritization. Thus, if a CG is cancelled by DG PUSCH, it means that DG has high LCH prioritization. It is already coverd by Rel-16 behaviour. Thus there’s no need for this change. |
| Futurewei | 2 | Agree with CATT. |
| Nokia | 2 |  |
| LGE | 2 | Share the view from Samsung. |
| Intel | 1 | We tend to think the change is aligned with Rel-16 behavior that PUSCH cancelled by PHY is considered deprioritized. |
| Sequans | 1 | It seems not clear given some companies comment it's already handled while other comment depriorization recovery may not be applicable in that case. |
| Huawei, HiSilicon | 2 | PHY layer prioritization results shall not be used back to influence MAC layer prioritization.  |
| Xiaomi | 2 |  |
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- Option 1: 4 companies (Apple, OPPO, Intel, Sequans)

- Option 2: 9 companies (CATT, Ericsson, Qualcomm, Samsung, Futurewei, Nokia, LGE, Huawei/HiSilicon, Xiaomi)

4 companies think the case of cancelled CG is not covered by the current MAC spec. However, 9 companies think Rel-16 IIOT text already covers all possible cases, i.e. if DG has higher LCH priority, MAC delivers two MAC PDU to PHY and the CG can be cancelled.

**Proposal 4 (9/13). When a CG-PUSCH transmission is cancelled due to cancellation and replacement in Rel-17, de-prioritization relies on existing Rel-16 LCH-based Prioritization (no specification change).**

### *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. |

**Q5. Which option do companies support?**

**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)**

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| **Company** | **Option** | **Comment** |
| CATT | Option 1 | This indeed provides flexibility to NW to schedule a retransmission beyond the maximum allowed deferral time. |
| Ericsson | Option 1 | The intention to introduce SPS HARQ-ACK deferral is to eventually transmit HARQ-ACK feedback and reduce HARQ-ACK feedback delay in URLLC TDD. If the maximum value is reached, it seems counter-intuitive to fall-back to the legacy Rel-15 behaviours in which the timer is not started and forbids network to schedule re tx, i.e., introducing a larger delay which is not good for URLLC service. The proposal seems reasonable with small changes.  |
| Apple | See comment | The drx-retransmissionTimer does not need to be started by default at the maximum value as a target deferral budget can be associated with a SPS configuration by the network. No strong view though.In fact a simple note may be sufficient. For example: “NOTE X: When the HARQ feedback is subject to SPS HARQ-ACK deferral as specified in TS 38.213 [6], the corresponding transmission carrying the DL HARQ feedback occurs in a PUCCH resource with a PUCCH transmission at the next available resource.” |
| Qualcomm | 2 (see comment) | Waiting for SPS HARQ deferral to reach its maximum delay and then start listening for a retransmission does not make a lot of sense for URLLC.If the UE does not manage to transmit the collided SPS HARQ, the network either retransmits the same DL SPS – if of high importance- or not. No need to complicate the UE behaviour.For an alternative proposal we can support that upon SPS HARQ deferral, drx-rtt-HARQ timer and all the associated timers with retransmissions are deactivated. |
| OPPO | See comment | The proposed change seems not to benefit URLLC much. If it is URLLC traffic and the gNB wants potential retransmissions (e.g. by gNB implementation), the gNB can retransmit it before the maximum number of slots or sub-slots the transmission of DL SPS HARQ-ACK deferral is reached. Thus, we slightly prefer no spec change. |
| Samsung | 2 | Usually a sufficiently large value is configured for the maximum duration. This change might not be needed. |
| Nokia | 1 | We should still allow in time retransmission scheduling after the HARQ feedback is dropped since the NW does not know whether the TB is successfully decoded. |
| LGE | 2 | The maximum allowed deferral time is just to prohibit further delaying the HARQ feedback and there is no intention to start retransmission from that point in time. If retransmission is required, it only makes sense for URLLC to start the RTT Timer from the original occasion of the HARQ feedback.  |
| Intel | 2 | Our understanding is that gNB implementation can have other tools to enable UE to monitor the potential HARQ retransmission when maximum delay is reached, and there is no need to complicate the UE behavior. |
| Huawei, HiSilicon | 1 | We understand either way doesn’t make much difference for gNB scheduling, still prefer Option 1 for added flexibility.  |
| Xiaomi | 1 | We think that this may provide more flexibility for retransmission. |
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- Option 1: 5 companies (CATT, Ericsson, Nokia, Huawei/HiSilicon, Xiaomi)

> It provides flexibility

> NW has a chance to schedule retransmission after HARQ FB dropping

- Option 2: 6 companies (Apple, Qualcomm, OPPO, Samsung, LGE, Intel)

> Not suitable for URLLC, considering long delay

> gNB can schedule retransmission before the maximum time.

Split view.

**Proposal 5 (5/11). RAN2 to discuss:** **when the maximum allowed deferral time of HARQ feedback is reached, *drx-RetransmissionTimerDL* is started.**

## 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-CoreR2-2204759 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; and2> 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); |
| R2-2204759 (OPPO, Samsung)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; and2> 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); |

**Q6. Do companies support the following?**

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

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| CATT | Yes (proponent) |  |
| Apple | Yes | The proposal from OPPO/Samsung in R2-2204759 is preferred in our view. |
| Qualcomm | Yes | Fine with proposed change |
| OPPO | Yes (proponent) | For the difference between R2-2204666 and R2-2204759, we understand it depends on the outcome of Q7? |
| Samsung | Yes (proponent) |  |
| Futurewei | Yes |  |
| Nokia | Yes | Prefer TP in R2-2204666 with reference to PHY as it also aligns with change discussed in next question. |
| LGE | Yes |  |
| Intel | Yes |  |
| Sequans | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Xiaomi | Yes |  |
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< Summary >

All companies agreed the current text is not correct

**Proposal 6 (all). 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; orNote that there are four similar required changes in the CR |

**Q7. Do companies agree the following?**

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

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| **Company** | **Yes/No** | **Comment** |
| CATT | Yes (proponent) |  |
| Apple | No | The existing specification text makes it clear what is the parameter and functionality concerned, whereas the proposal in R2-2204666 is quite generic. We think it is better to explicitly mention which RRC parameter is concerned, it would be much easier for the developers to understand the specifications. |
| Qualcomm | No strong opinion |  |
| OPPO | See comment | If the proposed change applies, in our understanding, it seems that the two cases below are supported here, 1) The simultaneous PUCCH-PUSCH transmission in one PUCCH group according to *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup*; and,2) The simultaneous PUCCH-PUSCH transmission in different PUCCH groups, i.e. if PUCCH and PUSCH are associated with different PUCCH groups, PUSCH and PUCCH can be transmitted simultaneously.If companies agree with the above two cases, we are fine with the proposed change, otherwise, we tend to think the current spec points to what is intended. |
| Samsung | Yes | It is clear that the current text is not correct.We may have two options on the table:1. Remove the configuration parameter as CATT proposed.2. Add simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup Either way is fine for us. |
| Futurewei | - | Same view as Samsung. Either way to fix it is fine. |
| Nokia | Yes |  |
| LGE | No strong view | The second suggestion from Samsung is also fine to us to address the concerned case more clearly. |
| Intel | Yes |  |
| Sequans | Yes |  |
| Huawei, HiSilicon | Yes | Prefer option 1 by Samsung (and CATT).  |
| Xiaomi | Yes |  |
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< Summary >

All companies (including Apple) agreed to correct it. But 3 companies (Apple, LGE, Huawei/HiSilicon) preferred to add exact RRC configurations, i.e. by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup*. The rapporteur would like to suggest to add the concerned configuration, rather than removing the configuration.

**Proposal 7. (compromise) “by configuration of *simultaneousPUCCH-PUSCH*” is replaced by “by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup”***

### 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. |

**Q8. Which option do companies support?**

* **Option 1. The stage-2 description is updated according to R2-2204665.**
* **Option 2. No change**

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| **Company** | **Option** | **Comment** |
| CATT | Yes (proponent) |  |
| Apple | See comment | The existing stage-2 text may benefit from the addition that simultaneous transmission of PUCCH and PUSCH associated with different priorities on cells of different bands is supported for a PUCCH group. We are not sure though the TP in R2-2204665 is clear enough as a whole. In the last part, PUSCH may need to be replaced by PUCCH? We are ok to check a bit more if time allows.  |
| Qualcomm | 2 | It is not critical to capture this in stage 2 since it is already clear in PHY spec. |
| OPPO | See comment | We tend to think that it may benefit to have the 1st change. But the change for the text starting from “where” looks strange to us, especially for the “if” part. Hope the proponent can clarify more. |
| Samsung | 1 | Ok for clarity |
| Nokia | 1 |  |
| LGE | 1 |  |
| Intel | Option 1 |  |
| Sequans | 1 |  |
| Huawei, HiSilicon | See comment | We agree with the intention however prefer to check further to make sure no ambiguity.  |
| Xiaomi | 1 |  |
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< Summary >

- Option 1: 7 companies (CATT, Samsung, Nokia, LGE, Intel, Sequans, Xiaomi)

- Agee the intention but need further check: 3 companies (Apple, OPPO, Huawei)

- Option 2: 1 company (Qualcomm)

**Proposal 8 (10/11). TP of R2-2204665 is agreed as a baseline. RAN2 will further refine the final wording during the CR review.**

### 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. |

**Q9. Which option do companies support?**

* **Option 1. capture a NOTE on SPS HARQ feedback deferral according to R2-2206028.**
* **Option 2. No change**

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| **Company** | **Option** | **Comment** |
| CATT | Option 2 | There is no room for misunderstanding. |
| Apple | Option 1 | We are supportive to capture the intended UE behaviour in a note. |
| Qualcomm | 1 | Fine with proposed change |
| OPPO | Option 2 | RAN1 spec already captures the thing and there is no room for misunderstanding. |
| Samsung | 1 | MAC spec has a similar NOTE on inapplicable k1. Thus, for consistency, it would be good to have. |
| Nokia | 2 | Already clear. |
| LGE | Option 2 | See no problem without the NOTE because it seems already clear that MAC starts the timer based on the real feedback transmission.  |
| Intel | Option 2 | Although technically OK, such note does not belong to DRX section, and should be part of RAN1 spec (if not already specified). |
| Sequans | Option 2 | The start of the timer is clear |
| Huawei, HiSilicon | 2 | Understand the intention however this NOTE seems do not bring further clarity.  |
| Xiaomi | 1 | Proponent. As we have already got a NOTE for inapplicable k1, this may cause misunderstanding that deferring th HARQ RTT timer is only applicable for inapplicable k1. |
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< Summary >

- Option 1: 4 companies (Apple, Qualcomm, Samsung, Xiaomi)

- Option 2: 8 companies (CATT, OPPO, Nokia, LGE, Intel, Sequans, Huawei/HiSilicon)

**Proposal 9 (8/12). NOTE on SPS HARQ feedback deferral proposed by R2-2206028 is not pursued.**

### 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. |

**Q10. Which option do companies support?**

* **Option 1. clarify the text on PDCP duplication with *surivialTimeStateSupport* according to R2-2205510.**
* **Option 2. No change**

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| **Company** | **Option** | **Comment** |
| CATT | Option 2 | We think it is clear from clause 5.4.1. so there is no room for misinterpretation. |
| Apple | See comment | We are ok with option 2 but this depends on the outcome of Q1. |
| Qualcomm | 1 | Fine with clarification |
| OPPO | 1 | Fine to clarify |
| Samsung | 1 | Fine to clarify |
| Futurewei | 1 | Fine with clarification |
| Nokia | 2 | Agree with CATT. Already clear in 5.4.1 for which case it is applicable. |
| LGE | Option 2 | Agree that the detailed operation is already clear. In the meanwhile, Q10 may be related to Q1 because Option1 of Q1 means that subset of RLC entities are activated by CS-RNTI with NDI=1. |
| Intel | Option 1 |  |
| Sequans | Option 2 | Agree with CATT. |
| III |  | No strong view. |
| Huawei, HiSilicon | No strong view | Can wait for result of Q1.  |
| Xiaomi | 1 |  |
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< Summary >

- Option 1: 6 companies (Qualcomm, OPPO, Samsung, Futurewei, Intel, Xiaomi)

- Option 2: 5 companies (CATT, Apple, Nokia, LGE, Sequans)

- No strong view: 2 companies (III, Huawei/HiSilicon)

5 companies think there is no room for misinterpretation and text in 5.4.1 is already clear. 6 companies are fine with the clarification. Since it’s about editorial correction and the TP specifies the behaviour precisely, the rapporteur would like to suggest to agree the TP for clarification.

**Proposal 10. (6/11), TP of R2-2205510 is agreed as a baseline. Further refinement may be needed according to Proposal 1.**

### “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. |

**Q11. Which option do companies support?**

* **Option 1. use only “data that are multiplexed” according to R2-2205710.**
* **Option 2. No change**

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| **Company** | **Option** | **Comment** |
| CATT | Option 1 | It is OK to use a single unified expression. |
| Apple | Option 2 | There is no possibility for misinterpretation. But okay to follow majority view especially for the first change in section 5.4.1. For the 2nd and 3rd change we think the existing specification text is cleaner. |
| Qualcomm | No strong opinion | Fine with change or no change. |
| OPPO | See comment | We are fine with the 1st change in this CR. For the 2nd and 3rd, we have no strong view and can follow the majority. |
| Samsung | 1 | Ok for consistency. |
| Futurewei | 1 | Fine with change. |
| Nokia | 1 |  |
| LGE | 1 |  |
| Intel | No strong view |  |
| Sequans | No strong view | Fine to polish text if it's majority view. |
| III |  | No strong view. |
| Huawei, HiSilicon | See comments | Firs change not needed, usually we don’t see data for a logical channel and the channel are different. Can follow majority for second/third changes.  |
| Xiaomi | No strong view |  |
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< Summary >

- Option 1: 5 companies (CATT, Samsung, Futurewei, Nokia, LGE)

- Ok with 1st change: 2 companies (Apple, OPPO)

- Ok with 2nd & 3rd changes: 1 company (Huawei/HiSilicon)

- Option 2: 1 company (Apple)

- No strong view: 3 companies (Qualcomm, Sequans, III, Xiaomi)

Companies have no consensus on the wording improvement and think the current text is ok, although 5 companies are ok for consistency and polishing text. The rapporteur would like to suggest to leave the current text as it is.

**Proposal 11. (diverged view) TP of R2-2205710 is not pursued.**

# Conclusion

**Proposal 1 (12/15). Upon survival time state entry, all RLC entities configured for the DRB are activated for duplication (no specification change).**

**Proposal 2 (8/12). When both *cg-RetransmissionTimer* and *autonomousTx* are configured and HP is not pending, CGT for de-prioritized CG used for autonomous retransmission is stopped. (no specification change)**

**Proposal 3 (13/13). 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 (9/13). When a CG-PUSCH transmission is cancelled due to cancellation and replacement in Rel-17, de-prioritization relies on existing Rel-16 LCH-based Prioritization (no specification change).**

**Proposal 5 (5/11). RAN2 to discuss:** **when the maximum allowed deferral time of HARQ feedback is reached, *drx-RetransmissionTimerDL* is started.**

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

**Proposal 7. (compromise) “by configuration of *simultaneousPUCCH-PUSCH*” is replaced by “by configuration of *simultaneousPUCCH-PUSCH* or *simultaneousPUCCH-PUSCH-SecondaryPUCCHgroup”***

**Proposal 8 (10/11). TP of R2-2204665 is agreed as a baseline. RAN2 will further refine the final wording during the CR review.**

**Proposal 9 (8/12). NOTE on SPS HARQ feedback deferral proposed by R2-2206028 is not pursued.**

**Proposal 10. (6/11), TP of R2-2205510 is agreed as a baseline. Further refinement may be needed according to Proposal 1.**

**Proposal 11. (diverged view) TP of R2-2205710 is not pursued.**