**3GPP TSG-RAN WG1 Meeting #110bis-eR1-22XXXXX**

E-meeting, Oct. 10th – 20th, 2022

**Agenda item: 8.3**

**Source: Moderator (Nokia)**

**Title: Moderator summary #X on Maintenance of HARQ-ACK feedback enhancements for NR Rel-17 URLLC/IIoT**

**Document for: Discussion and Decision**

# Introduction

As per chairman’s guidance, the email discussion is planned according to the following schedule:

[110bis-e-R17-IIoT-URLLC-01] Email discussion to determine maintenance issues to be handled in RAN1#110bis-e by October 12 – Klaus (Nokia)

* Additional email discussions will be set up once the maintenance issues for RAN1#110bis-e are determined

**This document focuses on maintenance of HARQ-ACK enhancements**

# Issue#1: PUCCH repetition with semi-static PUCCH cell switching

* 1. Background & companies’ inputs

This issues was shortly discussed during the 38.213 editor CR post-meeting discussions of RAN1#109-e based on the following RAN1#109-e agreement:

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| **Agreement**  For semi-static PUCCH cell switch and PUCCH repetitions:   * Semi-static PUCCH cell switching is applicable only to PUCCH transmissions without repetitions.   + *Note: UE assumes there is no PUCCH scheduling on multiple slots mapped to PCell and PUCCH-sSCell. i.e., gNB need to schedule carefully so there is no such case where a  PUCCH repetition from PCell would be need to be transmitted in a slot indicated by the pattern for PUCCH transmission on PUCCH-sSCell (as for slot #X+3 in the example figure below)*      * **Conclusion**: PUCCH repetitions are only applicable on Pcell, PScell, and PUCCH Scell. |

During RAN1#110, there had been further discussions with the following discussed way to proceed on this issue, see Sec. 2.3.9 of the final moderator summary in R1-2208102:

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| Therefore, the companies discussed / concluded the following handing / next steps:   * We try to support PUCCH cell switching in a way, that for slots with a PUCCH repetition the PUCCH cell pattern is not applicable (i.e. the UE neglects / does not apply the PUCCH cell switching pattern indication for such slots)   + This operation is sketched in the following figure:   + Moderator Note / explanation: The red crossing out means the pattern is not applicable / neglected and the UE transmits the PUCCH on PCell – so the pattern would again only be applied from Slot X+3 (after the rep bundle)     - For the first repetition, the gNB will still need to guarantee the PUCCH to be on PCell – therefore there is no ‘crossed out’ for slot #X, but starts only in the next slot     - The PUCCH cell pattern to be applicable applies to all the slots until the UE has transmitted the last PUCCH repetition (so also including the time that there would be some potential PUCCH repetition deferral based on 9.2.6 of 38.213). So for the case above, the pattern would only be applicable again from slot X+3     - The pattern not being applicable / neglected by the UE applies also for PUCCH transmissions without repetition when having an ongoing PUCCH repetition bundle and is applicable for scheduled PUCCH (through DCI) as well as for non-scheduled PUCCH.       * This is to prevent that there would be PUCCHs on PCell (through the repetition) and any other PUCCH in overlapping slot on PUCCH-sSCell. * Companies will check if there are any specific issues / showstoppers for this operation till RAN1#110b-e and will check how this would need to be implemented in the specifications (which may require specially also checking the details of the PUCCH repetition operation incl. deferral in Sec. 9.2.6 of 38.213) * It is encouraged that if someone identifies some issues / showstoppers to inform other interested companies offline about the findings to be able to check these issues possibly already before RAN1#110b-e. * At RAN1#110b-e:   + If no showstoppers / major issues are identified, we try to agree the related CRs (if needed, intention is to prevent any ambiguity) to have the intended operation as outline in the first bullet agreed.   + If showstoppers / major issues are identified, we may need to revert the earlier agreement to support the combination of semi-static PUCCH cell switching and PUCCH repetition operation. |

### Overall companies positions

The overall support has been provided:

* **Alt. 2A from RAN1#108-e: CATT** (in [**R1-2208938**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208938.zip), no draft CR / TP), **LG** (in [**R1-2209448**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209448.zip), no draft CR / TP)
  + Arguments:
    - CATT: RAN1#110 intention (i) increases latency, (ii) increases complexity, (iii) may result in different understanding between gNB & UE, (iv) different SCS handling would need to be clarified and (v) SR handling is unclear
    - LG: RAN1#110 intention (i) introduces complicated timeline issues, (ii) increases UE & gNB complexity and (iii) ambiguity between gNB & UE
  + Description of Alt. 2A (from RAN1#108-e):

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| * **For semi-static PUCCH cell switching, a PUCCH repetition transmission on a different target PUCCH cell from the PUCCH cell of the first PUCCH repetition is not supported**    + **A PUCCH slot mapped to different PUCCH cell is considered as invalid for PUCCH repetition and is not counted towards the total number of PUCCH repetitions, i.e., the repetition is postponed as in Rel-16.** * **PUCCH repetitions are only applicable on PCell, PScell, and PUCCH SCell.** |

* **Intention of the RAN#110 discussions (see details above):** **HW / HiSi** (???, [**R1-2208465**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208465.zip), ‘if reverted’, proposals on clarification, no TP/draft CR), **ZTE** ([**R1-2209466**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209466.zip), ‘if proposals 1 to 3 are adopted', no TP/draft CR), **QC** (in [**R1-2209945**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209945.zip), one proposal for clarification, no TP / draft CR), **Ericsson** (draft CR in [**R1-2210142**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210142.zip)), **Nokia/NSB** (discussion with proposals in [**R1-2210146**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210146.zip), draft CR in [**R1-2210147**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210147.zip))
* **‘Original’ RAN1#109 intention:** **ZTE** ([**R1-2209466**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209466.zip), ‘if proposals 1 to 3 not are adopted', no TP/draft CR)
  + Further details:
    - ZTE: only PUCCH repetition on PCell is allowed based on the agreement in RAN1#109

### Additional requirements / proposals / clarifications on the RAN1#110 intention

HW / HiSi in [**R1-2208465**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208465.zip) proposes the following:

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| ***Proposal: If the 109-e agreement is reverted with the 110 meeting solution, consider the following for the joint operation between PUCCH repetition and semi-static PUCCH cell pattern:***   * ***UE expects that PUCCH with repetitions are always indicated to transmit on PCell*** * ***UE does not expect to be indicated by the semi-static PUCCH cell pattern as sSCell on the slot of the 1st PUCCH repetition*** * ***For PUCCH repetition(s) other than the 1st repetition, UE always transmits the PUCCH repetition on PCell regardless of the indication of the semi-static PUCCH cell pattern*** * ***For another scheduled/configured PUCCH without repetition, consider one of the following:***   + ***Opt1: if it occurs within the same PCell slot with the PUCCH repetition(s) other than the 1st repetition, UE transmits the scheduled/configured PUCCH also on the PCell regardless of the indication of the semi-static PUCCH cell pattern, and the multiplexing in clause 9.2.5 and 9.2.6 in 38.213 happens after determining the PCell***   + ***Opt2: UE does not expect the scheduled/configured PUCCH without repetition occurs within the same PCell slot with the PUCCH repetition(s) other than the 1st repetition if the PCell slot is indicated as sSCell by the semi-static PUCCH cell pattern.*** |

ZTE in [**R1-2209466**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209466.zip) proposes the following:

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| ***Proposal 1:*** *RAN1 considers the Alt2 to ignore PUCCH cell switching patterns when PUCCH repetition is triggered.*   * *Alt2: PUCCH cell switching pattern are ignored in the slots determined for PUCCH repetition based on TS 38.213 section 9.2.6.*   ***Proposal 2:*** *For ignoring PUCCH cell switching pattern,*   * *The first PUCCH repetition should be deferred if the first PUCCH repetition collides with DL symbols in the initial slot.* *The deferred first PUCCH repetition should still be guaranteed by gNB or UE to be on PCell based on PUCCH cell switching pattern.* * *UE shall not ignore the PUCCH cell switching pattern in the initial slot if the first PUCCH repetition would be deferred from the initial slot.*   ***Proposal 3:*** *For SR PUCCH repetition and PUCCH cell switching,*   * *If it is supported that for slots with a PUCCH repetition the PUCCH cell pattern is not applicable, the UE is expected to cancel the PUCCH transmission in a SCell slot before the first symbol of the SR PUCCH repetition in a PCell slot when the SCell slot overlaps with the PCell slot.* * *The first repetition of SR PUCCH should not be transmitted by UE in a PCell slot if the PCell slot is not for PUCCH based on PUCCH cell switching pattern.*   ***Proposal 4:*** *If the above proposal1~proposal3 are not supported in the this meeting, it is proposed to support the original proposal with potential limitation that only PUCCH repetition on PCell is allowed based on agreement in RAN1#109 meeting.* |

QC in [**R1-2209945**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209945.zip) proposed the following:

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| Proposal 1: Starting from a slot where a UE transmits the first repetition of a PUCCH until a slot where the UE transmits the last repetition of the PUCCH, the UE ignores the semi-static PUCCH cell switch pattern and transmits PUCCH (including PUCCH with repetitions and PUCCH without repetition) on Pcell. |

Nokia / NSB in [**R1-2210146**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210146.zip) proposes the following:

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| * *Observation 1: To prevent a ‘first’ PUCCH repetition on PUCCH-sSCell, the simplest way would be to defined that the UE does not expect to be configured with any PUCCH resource with*  *on PUCCH-sSCell.* * *Observation 2: Having the UE to neglect / not apply the PUCCH cell pattern for UL slots of the reference SCS configuration with a PUCCH transmission with as determined in Sec. 9.2.6 of TS 38.213 (compared to decision per PCell PUCCH slot) would simplify the specification effort and guarantee the PUCCH cell switching times aligned with the time-domain pattern granularity.* * *Observation 3: To prevent uncertainty on the PUCCH cell switching operation a change to the current specification text is required so that the UE in addition to not transmit PUCCH on the cell not being indicated to also not process PUCCH on the cell not being indicated in the time-domain pattern.* * *Observation 4: The decision to neglect / not apply the PUCCH cell pattern is to be based on the (pending) PUCCH repetitions of both priorities jointly, to guarantee the pattern is equally applied for either PHY priority.* * Proposal: For semi-static PUCCH cell switching with PUCCH repetition:   + The UE does not expect to be configured with any PUCCH resource with on the PUCCH-sSCell.   + *Note: This guarantees that semi-static PUCCH cell switching is not applicable for a first PUCCH repetition of a PUCCH repetition bundle to limit the UE complexity*   + The UE neglects / does not apply the time-domain pattern for UL slots of the reference SCS configurations with PUCCH transmission of either PHY priority with repetitions, starting from a slot where the UE would transmit a first repetition of the PUCCH until a slot where the UE would transmit a last repetition of the PUCCH as described in Clause 9.2.6. |

### TPs / Draft CRs for the RAN1#110 intention

Ericsson providing the following draft CR in [**R1-2210142**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210142.zip):

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| 9.A PUCCH cell switching This clause is applicable when a UE is provided a PUCCH-sSCell by *pucch-sSCell* and the PUCCH-sSCell is activated and does not have a dormant UL/DL active BWP.  A UE can be provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern.* Each bit of the pattern corresponds to a slot for a reference SCS configuration provided by *tdd-UL-DL-ConfigurationCommon* for the PCell with a value of '0' or a value of '1' indicating, respectively, the PCell or the PUCCH-sSCell as the cell for PUCCH transmissions during the slot of the reference SCS configuration. For slots of the reference SCS configuration with PUCCH transmissions of any priority, starting from a slot where the UE would transmit a first repetition of a PUCCH until a slot where the UE would transmit a last repetition of the PUCCH as described in Clause 9.2.6, the UE does not apply the provided pattern and transmits the PUCCHon the PCell. The UE does not transmit a PUCCH in a slot on a cell if the pattern indicates a different cell for PUCCH transmission during the slot. A slot on the active UL BWP of the PUCCH-sSCell does not overlap with more than one slot on the active UL BWP of the PCell. If a slot for the active UL BWP of the PCell overlaps with more than one slot on the active BWP of the PUCCH-sSCell and the UE would transmit a PUCCH on the PUCCH-sSCell, the UE considers the first of the overlapping slots for the PUCCH transmission on the PUCCH-sSCell.  If a UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, a corresponding DCI format associated with generation of HARQ-ACK information by the UE can include a PUCCH cell indicator field [5, TS 38.212] with a value of '0' or a value of '1' indicating, respectively, whether a PUCCH transmission with the HARQ-ACK information by the UE is on the PCell or on the PUCCH-sSCell. When the UE transmits a PUCCH with HARQ-ACK information that is associated only with SPS PDSCH receptions, the UE transmits the PUCCH on the PCell. The UE does not expect the PUCCH cell indicator field to indicate the PUCCH-sSCell for a PUCCH transmission in a slot that overlaps with a slot on the PCell where the UE would transmit another PUCCH of same or different priority index.  **< Unchanged parts are omitted >** |

Nokia / NSB providing the following draft CR in [**R1-2210147**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210147.zip):

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| 9.A PUCCH cell switching This clause is applicable when a UE is provided a PUCCH-sSCell by *pucch-sSCell* and the PUCCH-sSCell is activated and does not have a dormant UL/DL active BWP.  A UE can be provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern.* Each bit of the pattern corresponds to a slot for a reference SCS configuration provided by *tdd-UL-DL-ConfigurationCommon* for the PCell with a value of '0' or a value of '1' indicating, respectively, the PCell or the PUCCH-sSCell as the cell for PUCCH transmissions during the slot of the reference SCS configuration. For slots of the reference SCS configuration with PUCCH transmissions of any PHY priority, starting from a slot where the UE would transmit a first repetition of a PUCCH of a PHY priority until a slot where the UE would transmit the last repetition of the PUCCH as described in Clause 9.2.6, the UE does not apply the provided pattern but determines the PCell as the cell for PUCCH transmission. The UE ~~does not~~neither processes nor transmits a PUCCH in a slot on a cell if the pattern indicates a different cell for PUCCH transmission during the slot. A slot on the active UL BWP of the PUCCH-sSCell does not overlap with more than one slot on the active UL BWP of the PCell. If a slot for the active UL BWP of the PCell overlaps with more than one slot on the active BWP of the PUCCH-sSCell and the UE would transmit a PUCCH on the PUCCH-sSCell, the UE considers the first of the overlapping slots for the PUCCH transmission on the PUCCH-sSCell. The UE does not expect to be configured with any PUCCH resource with on the PUCCH-sSCell.  If a UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, a corresponding DCI format associated with generation of HARQ-ACK information by the UE can include a PUCCH cell indicator field [5, TS 38.212] with a value of '0' or a value of '1' indicating, respectively, whether a PUCCH transmission with the HARQ-ACK information by the UE is on the PCell or on the PUCCH-sSCell. When the UE transmits a PUCCH with HARQ-ACK information that is associated only with SPS PDSCH receptions, the UE transmits the PUCCH on the PCell. The UE does not expect the PUCCH cell indicator field to indicate the PUCCH-sSCell for a PUCCH transmission in a slot that overlaps with a slot on the PCell where the UE would transmit another PUCCH of same or different priority index.  **< Unchanged parts are omitted >** |

* 1. Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110bis-e

**The overall issue is still pending and valid.**

But looking at the overall companies’s positions in Sec. 1.1.1, there now seem to be again three different ways to support the feature proposed. The moderator had the understanding based on the RAN1#110 discussions, that the further discussions should only focus on the RAN1#110 discussed way:

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| Therefore, the companies discussed / concluded the following handing / next steps:   1. We try to support PUCCH cell switching in a way, that for slots with a PUCCH repetition the PUCCH cell pattern is not applicable (i.e. the UE neglects / does not apply the PUCCH cell switching pattern indication for such slots)   ….   1. At RAN1#110b-e:    * If no showstoppers / major issues are identified, we try to agree the related CRs (if needed, intention is to prevent any ambiguity) to have the intended operation as outline in the first bullet agreed.    * If showstoppers / major issues are identified, we may need to revert the earlier agreement to support the combination of semi-static PUCCH cell switching and PUCCH repetition operation. |

Instead, CATT & LG propose to support the operation of Alt. 2A of RAN1#108-e. The moderator would like to note here the following:

* Samsung objected in the 4th round in **RAN1#108-e** (see. Sec. 6.8 of [R1-2202774](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_108-e/Docs/R1-2202774.zip)) here:

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| *Company* | *Comments* |
| Samsung | “Enough” for this proposal was at least one meeting ago.  A proposal to enable the system to be worse than doing nothing (Rel-16), and to discard THE main use case for introducing the PUCCH cell switching feature, is bad enough on its own. However, the moderator apparently strongly believes such proposal needs special treatment compared to other non-agreed proposals with ‘large’ support, and should be repeatedly made, round-after-round and meeting-after-meeting, given the plentiful time available, the ease of e-meetings, and the absence of other issues. Will now be a last time or will it come back again in Round 5 or in RAN1#109-e/…? |

* The method had been further discussed **in RAN1#109-e** (see moderator summary in [R1-2205504](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_109-e/Docs/R1-2205504.zip)):
  + - Sustained objection by Samsung in GTW session. Based on this status – the ‘Alt. 3’ had been develoved during RAN1#109-e (starting from the 3rd round of email discussions – see [R1-2205504](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_109-e/Docs/R1-2205504.zip)), which lead to the agreement taken at RAN1#109-e on the support of what was noted as ‘Alt. 3’ there in the discussions.

***Moderator comment on re-discussing Alt. 2A:***

* *Alt. 2A had not been discussion for the last about 1 ½ RAN1 meetings based on the (sustained) objection from Samsung during RAN1#108-e and RAN1#109-e – but instead alternative solutions were discussed in RAN1#109-e (i.e. ‘Alt.3’) as well as RAN1#110-e (see background in Sec. 1.1.)*
* ***Trying to re-discuss now Alt. 2A from moderator perspective again seems to be not really helping looking at the repeated (sustained) objections from Samsung. Moreover, the RAN1#110 tendency seemed to be to focus only on the RAN1#110 discussed method. Therefore, moderator would suggest to not re-discuss Alt. 2A and focus the discussions the RAN1#110 described operation.***

ZTE proposed to conditionally support the ‘Alt. 3’ (RAN1#109-e ‘intention) that had majority support in RAN1#109-e (looking at input there), but there had been Samsung objection there – which again led to the ‘Way forward’ on how to proceed in RAN1#110 (as noted above). **Also here, the moderator thinks it not to help here to rediscussing the ‘Alt. 3’ and would suggest to follow the discussed further handling in RAN1#110, i.e. to focus /continue the discussions on the RAN1#110-e ‘way forward’.**

**Moderator suggested handling:**

* **The issue to be treated overall RAN1#110bis-e, but**
* **the focus is limited to the RAN1#110-e discussed operation, i.e.:**
  + ***… for slots with a PUCCH repetition the PUCCH cell pattern is not applicable (i.e. the UE neglects / does not apply the PUCCH cell switching pattern indication for such slots)***
  1. Issue to be handled during RAN1#110bis-e?

**Question: Do you support discussing Issue#1 (overall) during RAN1#110bis-e?**

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| Yes - support: | CATT OPPO, LG, Intel, Nokia/NSB, Samsung , New H3C, vivo |
| No - not support: |  |

**Comments on the moderator comments / suggested handling or any other comments on the draft CR:**

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| *Company* | *Comments* |
| CATT | We support discussing the issue in RAN1#110bis-e but we do not agree to only focus on the RAN1#110-e discussed operation.  Yes, Samsung objected to Alt. 2A in RAN1#108-e with the argument that it may increase the latency of PUCCH repetition compared with switching within the PUCCH repetition bundle, which is against the purpose of introducing PUCCH cell switching. But we do not understand how the RAN1#110-e discussed operation resolves the concern. At least, we would like to hear Samsung and other companies’ views. Otherwise, the RAN1#110-e discussed operation is not acceptable to us considering the various issues as discussed in our contribution. |
| LG | We support to discuss the issue itself. |
| vivo | We have sympathy on CATT’s comments. |
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**Proposal: The semi-static PUCCH switching & PUCCH repetition repetitions discussions are limited to the RAN1#110-e discussed operation, i.e.: *… for slots with a PUCCH repetition the PUCCH cell pattern is not applicable (i.e. the UE neglects / does not apply the PUCCH cell switching pattern indication for such slots)***

* **The earlier discussed Alt. 2A from RAN1#108-e and RAN1#109-e is out of scope of RAN1#110bis-e discussions.**
* **The earlier discussed Alt. 3 from RAN1#109-e is out of scope of RAN1#110bis-e discussions.**

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| Support: | Nokia/NSB, Samsung |
| Object: | CATT, LG |

**Comments on the moderator comments / suggested handling or any other comments on the draft CR:**

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| *Company* | *Comments* |
| CATT | See our comment above. |
| LG | Based on Samsung’s comment in RAN1#108-e, the reason to object Alt. 2A seems that Alt. 2A could make the system worse than Rel-16. However, the contributions from CATT and LG have pointed out that the RAN1#110-e discussed operation is worse than Alt. 2A.  At least we think it is not fair to consider those options as out of scopes. |
| Intel | Considering the issues raised by CATT and LG in tdocs, it seems the option discussed in RAN1 #110-e may require some addtional efforts or with degraded performance. Therefore, we’re also open to include Alt 2A in the scope. |
| Nokia/NSB | Without the restriction and the fact that we have only 6 meetings days / 3 rounds available, we think the restriction will be needed – as otherwise, there will be no PUCCH repetition operation in Rel-17 (as this should not continue anymore in Nov / Toulouse). |
| Samsung | We support a simple completion on this topic as its overall importance couldn’t be more marginal and a highly disproportionate time has already been allocated to it.  We would prefer to leave the UE behavior undefined over defining any optimization with additional spec impact and possibility of additional conditions/UE behaviors. |
| vivo | We are also open to include Alt 2A. |

# Issue#2: Correction on RRC parameters for enhanced Type-3 codebook in TS 38.212 & 38.213

* 1. Companies’ inputs

vivo raised the following in their draft CRs in [R1-2208599](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208599.zip) for TS 38.212 and [R1-2208600](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208600.zip) for TS 38.213:

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| Align the following RRC parameter name with the RRC specification in TS38.331:   * Rel-17 enhanced Type-3 HARQ-ACK codebook in Sec. 7.3.1.2.2 & 7.3.1.2.3 of TS 38.212   + *pdsch-HARQ-ACK-EnhType3List*   *pdsch-HARQ-ACK-EnhType3ToAddModList*   + *pdsch-HARQ-ACK-EnhType3SecondaryList*   *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList* * Rel-17 enhanced Type-3 HARQ-ACK codebook in Sec. 9.1.4 of TS 38.213   + *pdsch-HARQ-ACK-EnhType3List*   *pdsch-HARQ-ACK-EnhType3ToAddModList* |

With the following related draft CR to 38.212

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| \*\*\* Unchanged text omitted \*\*\*  7.3.1.2.2 Format 1\_1  \*\*\* Unchanged text omitted \*\*\*  - One-shot HARQ-ACK request – 0 or 1 bit.  - 1 bit if higher layer parameter *pdsch-HARQ-ACK-OneShotFeedback-r16* or *pdsch-HARQ-ACK-EnhType3ToAddModList* is configured;  - 0 bit otherwise.  If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList* for the secondary PUCCH group*.*  - Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits.  - 0 bit if *pdsch-HARQ-ACK-EnhType3DCI-Field* is not configured;  - bits otherwise, where is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-EnhType3ToAddModList.*  If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3DCI-Field* is replaced by *pdsch-HARQ-ACK-EnhType3DCI-FieldSecondaryPUCCHgroup* for the secondary PUCCH group, and *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList* for the secondary PUCCH group*.*  \*\*\* Unchanged text omitted \*\*\*  7.3.1.2.3 Format 1\_2  \*\*\* Unchanged text omitted \*\*\*  - Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits.  - 0 bit if *pdsch-HARQ-ACK-EnhType3DCI-Field-1-2*  is not configured;  - bits otherwise, where is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-EnhType3ToAddModList.*  If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList* for the secondary PUCCH group.  \*\*\* Unchanged text omitted \*\*\* |

and draft CR to 38.213:

|  |
| --- |
| \*\*\* Unchanged text omitted \*\*\*  9.1.4 Type-3 HARQ-ACK codebook determination  If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback*, the UE determines HARQ-ACK information bits, for a total number of HARQ-ACK information bits, of a Type-3 HARQ-ACK codebook according to the following procedure. If the UE is provided *pdsch-HARQ-ACK-EnhType3ToAddModList* and a DCI format scheduling PDSCH reception and triggering the Type-3 HARQ-ACK codebook includes an enhanced Type 3 codebook indicator field that provides a value for *pdsch-HARQ-ACK-EnhType3Index*, the UE determines a size of a set of indicated serving cells and a size of a set of indicated numbers of HARQ processes for each indicated serving cell and each indicated HARQ process number from the entry in *pdsch-HARQ-ACK-EnhType3ToAddModList* corresponding to the *pdsch-HARQ-ACK-EnhType3Index* value. If the DCI format does not include the enhanced Type 3 codebook indicator field, the *pdsch-HARQ-ACK-EnhType3Index* value is zero.  \*\*\* Unchanged text omitted \*\*\*  If  - a UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, and  - the CRC of the DCI is scrambled by a C-RNTI or an MCS-C-RNTI, and  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in the DCI format are equal to 1, or  - *resourceAllocation = dynamicSwitch* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0 or 1  the DCI format provides a request for a Type-3 HARQ-ACK codebook report and does not schedule a PDSCH reception. If the UE is provided *pdsch-HARQ-ACK-EnhType3ToAddModList* and the DCI format includes an enhanced Type 3 codebook indicator field that provides a value for *pdsch-HARQ-ACK-EnhType3Index*, the UE determines a number of indicated serving cells and a number of indicated HARQ processes for each indicated serving cell from the entry in *pdsch-HARQ-ACK-EnhType3ToAddModList* corresponding to the *pdsch-HARQ-ACK-EnhType3Index* value. If the DCI format does not include the enhanced Type 3 codebook indicator field, the *pdsch-HARQ-ACK-EnhType3Index* value is provided by the value of MCS field in the DCI format. The UE is expected to provide HARQ-ACK information in response to the request for the Type-3 HARQ-ACK codebook after symbols from the last symbol of a PDCCH providing the DCI format, where the value of for is provided in clause 10.2 by replacing "SPS PDSCH release" with "DCI format".  If a UE multiplexes HARQ-ACK information in a PUSCH transmission, the UE generates the HARQ-ACK codebook as described in this clause except that *harq-ACK-SpatialBundlingPUCCH* is replaced by *harq-ACK-SpatialBundlingPUSCH*.  \*\*\* Unchanged text omitted \*\*\* |

* 1. Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110bis-e

**The identified RRC parameter corrctions by vivo seem valid and would need to be corrected.**

**Moderator suggested handling:**

* **Treat the issue during RAN1#110bis-e**
* Refer RRC parameter corrections to the editor alignment CRs of 38.212 and 38.213 - as we have done in RAN1#110, and as guided by Mr. chairman to moderators offline: “*Please make sure that* ***only technical*** *corrections are endorsed as individual Cat F CRs. For anything else, let’s use alignment CRs from the editors”*
  1. Issue to be handled during RAN1#110bis-e?

**Question: Do you support discussing Issue #2 during RAN1#110bis-e?**

|  |  |
| --- | --- |
| Yes - support: | CATT OPPO, LG, Intel, Nokia/NSB, Samsung ,New H3C, vivo |
| No - not support: |  |

**Comments on the moderator comments / suggested handling or any other comments:**

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | Can be included in the alignment CRs |
| vivo | Agree with moderator’s suggestion on the handling “to the editor alignment CR” |
|  |  |
|  |  |
|  |  |

# Issue#3: MCS field of the first TB used for enh. Type 3 CB indication and HARQ-ACK re-tx slot offset indication

* 1. Companies inputs

OPPO raised in two draft CRs, that when using the MCS field for indication, it would need to be clarified in 38.213 that for DCI format 1\_1, if the DCI has MCS fields for the transport block 1 & 2, the MCS field of transport block 1 should be used.

The draft CR on the enh. Type 3 CB by OPPO in [**R1-2208864**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208864.zip) reads as:

|  |
| --- |
| 9.1.4 Type-3 HARQ-ACK codebook determination  \*\*\* Unchanged text is omitted \*\*\*  If  - a UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, and  - the CRC of the DCI is scrambled by a C-RNTI or an MCS-C-RNTI, and  - *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0, or  - *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in the DCI format are equal to 1, or  - *resourceAllocation = dynamicSwitch* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0 or 1  the DCI format provides a request for a Type-3 HARQ-ACK codebook report and does not schedule a PDSCH reception. If the UE is provided *pdsch-HARQ-ACK-EnhType3List* and the DCI format includes an enhanced Type 3 codebook indicator field that provides a value for *pdsch-HARQ-ACK-EnhType3Index*, the UE determines a number of indicated serving cells and a number of indicated HARQ processes for each indicated serving cell from the entry in *pdsch-HARQ-ACK-EnhType3List* corresponding to the *pdsch-HARQ-ACK-EnhType3Index* value. If the DCI format does not include the enhanced Type 3 codebook indicator field, the *pdsch-HARQ-ACK-EnhType3Index* value is provided by the value of MCS field in the DCI format. If there are two MCS fields for two transport blocks in the DCI format, the *pdsch-HARQ-ACK-EnhType3Index* value is provided by the value of MCS field for transport block 1 in the DCI format. The UE is expected to provide HARQ-ACK information in response to the request for the Type-3 HARQ-ACK codebook after symbols from the last symbol of a PDCCH providing the DCI format, where the value of for is provided in clause 10.2 by replacing "SPS PDSCH release" with "DCI format".  \*\*\* Unchanged text is omitted \*\*\* |

The draft CR by OPPO on the HARQ-ACK re-transmission in [**R1-2208865**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208865.zip) reads as:

|  |
| --- |
| 9.1.5 HARQ-ACK codebook retransmission  \*\*\* Unchanged text is omitted \*\*\*  If the HARQ-ACK retransmission indicator field value in the DCI format 1\_1 or 1\_2 is '1', the UE determines slot as where is determined by a one-to-one mapping in ascending order among the values of the MCS field for transport block 1 in the DCI format 1\_1 or the MCS field in the DCI format 1\_2 and the values from -7 to 24.  \*\*\* Unchanged text is omitted \*\*\* |

* 1. Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110bis-e

**The identified change by OPPO seem valid and would need to be corrected.**

**Moderator suggested handling:**

* **Treat the issue during RAN1#110**
* Have a joint discussion and a single CR with aligned wording on both, enh. Type 3 CB and HARQ-ACK retransmission.
  1. Issue to be handled during RAN1#110bis-e?

**Question: Do you support discussing Issue #3 during RAN1#110bis-e?**

|  |  |
| --- | --- |
| Yes - support: | CATT OPPO, LG, Intel, Nokia/NSB, Samsung,New H3C, vivo |
| No - not support: |  |

**Comments on the moderator comments / suggested handling or any other comments:**

|  |  |
| --- | --- |
| *Company* | *Comments* |
| Samsung | The proposed TPs are OK. |
|  |  |
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# Issue#4: Clarification on overlapping PUCCH for SPS HARQ-ACK deferral

* 1. Companies’ inputs

Samsung in [**R1-2209699**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209699.zip) discusses has the following arguments for a need for change to the SPS HARQ-ACK deferral description:

|  |
| --- |
| Reason:  The current spec is not clear if the result PUCCH is provided by *sps-PUCCH-AN-List or* *n1PUCCH-AN* and overlaps with semi-static DL symbols in a second slot.  Change:  Clarify that UE defers the SPS HARQ-ACK in a next slot if the result PUCCH is provided by *sps-PUCCH-AN-List or n1PUCCH-AN* and overlaps with semi-static DL symbols in a second slot  If not approved:  Unclear UE behaviour for SPS HARQ-ACK deferral if the result PUCCH is provided by *sps-PUCCH-AN-List or n1PUCCH-AN* and overlaps with semi-static DL symbols in a second slot. |

.. with the following change to TS 38.213 (omitted text by Samsung amended by moderator for easier checking for delegates to have the full picture available):

|  |
| --- |
| 9.2.5.4 UE procedure for deferring HARQ-ACK for SPS PDSCH \*\*\* Unchanged text is omitted \*\*\*  If a UE is provided *sps-HARQ-Deferral* and, after performing the procedures in clauses 9 and 9.2.5 to resolve overlapping among PUCCHs and PUSCHs in a first slot, if any, the UE determines a PUCCH resource for a PUCCH transmission with first HARQ-ACK information bits for SPS PDSCH receptions that the UE would report for a first time, and the PUCCH resource  - is provided by *SPS-PUCCH-AN-List* as described in clause 9.2.1, or by *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided  - is not cancelled by an overlapping PUCCH or PUSCH transmission of larger priority index  - overlaps with a symbol indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigDedicated*, or indicated for a SS/PBCH block by *ssb-PositionsInBurst*, or belonging to a CORESET associated with a Type0-PDCCH CSS set  the UE  - determines an earliest second slot and, after performing the procedures in clauses 9.2.1 and 9.2.3 to determine a PUCCH with HARQ-ACK information bits including second HARQ-ACK information bits and then performing the procedures in clauses 9 and 9.2.5 to resolve overlapping among PUCCHs and PUSCHs, if any, a PUSCH or a PUCCH in the earliest second slot to multiplex HARQ-ACK information bits that include second HARQ-ACK information bits from the first HARQ-ACK information bits , where the second HARQ-ACK information bits correspond to SPS PDSCH configurations with *sps-HARQ-Deferral* values that are larger than or equal to a time difference, with reference to slots for PUCCH transmissions on the primary cell, between the second slot and the slot of the SPS PDSCH reception, if any  - if the UE detects a DCI format in a PDCCH reception that triggers a PUCCH transmission with a Type-3 HARQ-ACK codebook in a slot as described in clause 9.1.4, the UE stops the procedure to determine the earliest second slot in the slot  - if the UE is provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern*, the UE determines the earliest second slot and a corresponding cell based on the periodic cell switching pattern as described in clause 9.A  - if the UE multiplexes the second HARQ-ACK information in a PUSCH, or in a PUCCH using a resource that is not from *SPS-PUCCH-AN-List*, or from *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided, the UE stops the procedure to determine the earliest second slot in the slot  - if the UE multiplexes the second HARQ-ACK information in a first PUCCH using a resource provided by *SPS-PUCCH-AN-List*, or by *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided, of smaller priority index and the UE drops the first PUCCH transmission due to an overlapping with a second PUSCH or PUCCH transmission of larger priority index, the UE stops the procedure to determine the earliest second slot in the slot  - if the UE multiplexes the second HARQ-ACK information in a first PUCCH using a resource provided by *SPS-PUCCH-AN-List*, or by *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided, and the PUCCH transmission is not dropped due to an overlapping with a PUSCH or PUCCH transmission of larger priority ~~and~~   * if the first PUCCH does not have any symbol that overlaps with a symbol indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigDedicated*, or indicated for a SS/PBCH block by *ssb-PositionsInBurst*, or belonging to a CORESET associated with a Type0-PDCCH CSS set, the UE stops the procedure to determine the earliest second slot in the slot * otherwise, the UE defers the first HARQ-ACK information bits to a next slot   - the second HARQ-ACK information bits, generated as described in clause 9.1.2, are appended in a HARQ-ACK codebook the UE generates as described in clauses 9.1.2, 9.1.2.1, 9.1.3.1, or 9.1.5  - if the UE would receive a PDSCH providing a TB for a same HARQ process as a HARQ-ACK information bit from the second HARQ-ACK information bits prior to transmitting the PUCCH or the PUSCH, the UE does not include the HARQ-ACK information bit in the HARQ-ACK information bits.  The UE does not expect to be provided both *sps-HARQ-Deferral* and *nrofSlots* or *pucch-RepetitionNrofSlots* for any PUCCH resource of same priority.  \*\*\* Unchanged text is omitted \*\*\* |

* 1. Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110bis-e

**(Initial) Moderator assessment:**

* The Samsung suggested clarification adds the condition the UE actually continues the deferral to a next earliest 2nd slot – as currently, the 5 ‘if-statements’ only describe when the UE actually stops looking for a earliest 2nd slot.

**Moderator suggested handling:**

* **Treat the issue during RAN1#110bis-e**
  1. Issue to be handled during RAN1#110bis-e?

**Question: Do you support discussing Issue #4 during RAN1#110bis-e?**

|  |  |
| --- | --- |
| Yes - support: | CATT, Samsung, vivo |
| No - not support: | OPPO, LG |

**Comments on the moderator comments / suggested handling or any other comments on the draft CR:**

|  |  |
| --- | --- |
| *Company* | *Comments* |
| CATT | We do not see a strong need for a CR but we are fine to discuss the issue and hear more views. |
| OPPO | Based on current spec., unless the stopping condition(s) are satisfied, it is to be understood UE would continue determining an earlist second slot which needs to satisfiy all the conditions. So the change is common understanding and seems not necessary. |
| LG | Based on the current framework, it seems common understanding that UE keep trying to determine earliest second slot unless UE procedure is stopped or leaching to sps-HARQ-Deferral. Once it is stopped, and if UE multiplexes second HARQ-ACK in a PUCCH as described, and if the PUCCH is not dropped, UE would transmit PUCCH with deferred HARQ-ACK codebook. Otherwise, UE wouldn’t transmit PUCCH since there is no possible case.  We think the spec seems to work and further changes is not necessary. |
| Intel | We share similar view with OPPO an LG that CR is not necessary, but we can be fine for further discussion. |
| Nokia/NSB | We don’t oppose discussing this – but maybe there is no ultimate need for this. |
| Samsung | At the “top level” sub-bullet, there is the statement “the UE determines an earliest second slot …”. However, in the “lower level” sub-bullet, we think it is currently unclear that if the condition for “the UE stops the procedure to determine the earliest second slot in the slot” is not satisfied, the UE continues the deferral.  The intention is to make clearer the UE procedure. If RAN1 thinks it is already clear, we’re fine to not further discuss the proposal. |

# Issue#5: k1 / PDSCH-to-HARQ for semi-static PUCCH cell switching

* 1. Companies’ inputs

Nokia in [**R1-2210145**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210145.zip) provided a draft CR, based on the following reasoning:

|  |  |
| --- | --- |
| **Reason for change:**  The current specifications do not clearly define on how to apply the PDSCH-to-HARQ slot offset for semi-static and dynamic PUCCH cell switching.  For semi-static PUCCH cell switching, the slot offset is to be applied on PCell and not the cell for PUCCH transmission, whereas for dynamic PUCCH cell switching and no PUCCH switching, the slot offset is to be applied on the cell for PUCCH transmission.  The following earlier RAN1 agreements are available:   |  | | --- | | **Agreement from RAN1#106bis-e**  For semi-static PUCCH cell switching, PCell / PSCell / PUCCH-SCell is reference cell:   * The time domain pattern configurations are based on the numerology of the reference cell. * The PDSCH to HARQ-ACK offset k1 is interpreted based on the numerology and PUCCH configuration of a reference cell to be able to apply the time-domain PUCCH cell switching pattern. * Note: There may not be a need to define a ‘reference cell’ in the specification. This terminology is used for further clarifications of the procedure.   **Agreement from RAN1#105-e:**  For PUCCH carrier switching based on dynamic indication in DCI scheduling a PUCCH (i.e. Alt. 1), the PDSCH to HARQ-ACK offset k1 is interpreted based on the numerology of the dynamically indicated target PUCCH cell. |   **Change:**  Correct the applicable PDSCH-to-HARQ slot offset for semi-static PUCCH cell switching.  **If not approved:**  Incorrect timing for HARQ-ACK reporting based on PDSCH-to-HARQ slot offset on PUCCH-sSCell for semi-static PUCCH cell switching. |

The draft CR looks as follows:

|  |
| --- |
| 9.2.3 UE procedure for reporting HARQ-ACK  **< Unchanged parts are omitted >**  If the UE is provided *subslotLengthForPUCCH*, is the last UL slot of the PCell if the UE is provided *pucch-sSCellPattern*, or the last UL slot of the serving cell for PUCCH transmission if the UE is not provided *pucch-sSCellPattern,* that overlaps with a PDSCH reception or with a PDCCH reception providing a DCI format having associated HARQ-ACK information without scheduling a PDSCH reception; otherwise, is the last UL slot of the PCell if the UE is provided *pucch-sSCellPattern*, or the last UL slot of the serving cell for PUCCH transmission if the UE is not provided *pucch-sSCellPattern,* that overlaps with the DL slot for the PDSCH reception or with the DL slot for the PDCCH reception in case of a DCI format that triggers a HARQ-ACK information report and does not schedule a PDSCH reception.  For a SPS PDSCH reception ending in DL slot , the UE transmits the PUCCH in UL slot of the PCell where is provided by the PDSCH-to-HARQ\_feedback timing indicator field, if present, in a DCI format activating the SPS PDSCH reception.  If the UE detects a DCI format that does not include a PDSCH-to-HARQ\_feedback timing indicator field and schedules a PDSCH reception or activates a SPS PDSCH reception ending in DL slot , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within UL slot of the PCell if the UE is provided *pucch-sSCellPattern*, or UL slot of the serving cell for PUCCH transmission if the UE is not provided *pucch-sSCellPattern,* where is provided by *dl-DataToUL-ACK*, or *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17*, or *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDciFormat4\_1*.  If the UE detects a DCI format scheduling a number of PDSCH receptions ending in DL slot  or if the UE detects a DCI format generating a HARQ-ACK information bit and does not schedule a PDSCH reception through a PDCCH reception ending in DL slot , the UE provides corresponding HARQ-ACK information in a PUCCH transmission within UL slot of the PCell if the UE is provided *pucch-sSCellPattern*, or UL slot of the serving cell for PUCCH transmission if the UE is not provided *pucch-sSCellPattern*, where is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17*, or *dl-DataToUL-ACK-DCI-1-2-r17*, or *dl-DataToUL-ACK-MulticastDciFormat4\_1*.  **< Unchanged parts are omitted >** |

* 1. Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110bis

**The identified change by Nokia seem valid and would need to be corrected.**

**Moderator suggested handling:**

* **Treat the issue during RAN1#110bis-e**
  1. Issue to be handled during RAN1#110bis-e?

**Question: Do you support discussing Issue #5 during RAN1#110bis-e?**

|  |  |
| --- | --- |
| Yes - support: | CATT OPPO, LG, Intel, Nokia/NSB, Samsung, New H3C, vivo |
| No - not support: |  |

**Comments on the moderator comments / suggested handling or any other comments:**

|  |  |
| --- | --- |
| *Company* | *Comments* |
| CATT | We do not see a strong need for a CR but we are fine to discuss the issue and hear more views. |
| LG | We are fine to discuss |
|  |  |
|  |  |
|  |  |

# Issue#6: Timeline of determining SPS HARQ-ACK deferral

* 1. Companies’ inputs

Samsung in [**R1-2209700**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209700.zip) discusses the following (no draft CR provided):

|  |
| --- |
| For UCI multiplexing in a PUCCH or PUSCH, the UCI multiplexing timeline is ensured by gNB. For a deferred SPS HARQ-ACK multiplexing in a PUCCH or PUSCH in a target slot, the multiplexing timeline should also be satisfied.  For an activated SPS PDSCH, a PUCCH with the SPS HARQ-ACK only can be determined semi-statically and whether the PUCCH with the SPS HARQ-ACK only collides with semi-static DL symbols can be determined semi-statically as well. If there is no overlapping PUCCH or PUSCH, the timeline for multiplexing the deferred SPS HARQ-ACK in the target slot can always be satisfied. However, when considering the overlapping PUCCH or PUSCH, the timeline becomes an issue.  Consider a simple example in Figure 1, whether the SPS HARQ-ACK is deferred depends on the status of HP SR. For a positive SR, the SPS HARQ-ACK is deferred. However, for a negative SR, the SPS HARQ-ACK is not deferred. If UE determines the SPS HARQ-ACK deferral early, for example, at the start of slot 0, the SPS HARQ-ACK should be deferred since the UL traffic has not arrived yet and the SR is negative. However, if the UE determines the SPS HARQ-ACK deferral late, for example, at the end of slot 0 the SPS HARQ-ACK should not be deferred because the SR becomes positive. For deferred SPS HARQ-ACK, it takes time for a UE to generate the HARQ-ACK codebook and encode the UCI bits when multiplexing the UCI in a PUCCH, for example, Tproc is the processing time as shown in Figure 1. If the determination is performed after T0, there will be no enough time to ensure the multiplexing procedure.    **Figure 1**  The timeline for multiplexing the deferred SPS HARQ-ACK in a PUSCH should also be considered as well. Consider another example in Figure 2, for multiplexing in a PUSCH, a UE should first determine the HARQ-ACK codebook and then determines the PUCCH for carrying the HARQ-ACK and finally the UE determines whether the HARQ-ACK is multiplexed in an overlapping PUSCH.    **Figure 2**  To address the issue, the time when a UE determines the SPS HARQ-ACK deferral should be specified. A simple solution could be that the UE determines the SPS HARQ-ACK deferral *N* symbols before the end of the current PUCCH slot. The value of *N* can reuse the values for PUSCH preparation time *N2* as defined in TS 38.214.  **Proposal: For SPS HARQ-ACK deferral, a UE determines the SPS HARQ-ACK deferral *N2* symbols as defined in TS 38.214 before the end of the slot of the PUCCH with SPS HARQ-ACK.** |

* 1. Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110bis-e

**(Initial) Moderator assessment:**

* The moderator thinks that some correction to argumentation would be needed here, as the yellow parts and the green parts above are not aligned. From moderator perspective, the yellow part should be updated as:

|  |
| --- |
| Consider a simple example in Figure 1, whether the SPS HARQ-ACK is deferred depends on the status of HP SR. For a positive SR, the SPS HARQ-ACK is **NOT** deferred. However, for a negative SR, the SPS HARQ-ACK is **~~not~~** deferred. If UE determines the SPS HARQ-ACK deferral early, for example, at the start of slot 0, the SPS HARQ-ACK should be deferred since the UL traffic has not arrived yet and the SR is negative. However, if the UE determines the SPS HARQ-ACK deferral late, for example, at the end of slot 0 the SPS HARQ-ACK should not be deferred because the SR becomes positive. For deferred SPS HARQ-ACK, it takes time for a UE to generate the HARQ-ACK codebook and encode the UCI bits when multiplexing the UCI in a PUCCH, for example, Tproc is the processing time as shown in Figure 1. |

* Now to the timeline example, it is moderators understanding that for SR there is no multiplexing timeline defined as there is no timing defined for the SR. The UE implementation will just need to guarantee for the case of SR (when delivered by higher layers) that the resulting multiplexing is performed as defined. For all other UCI multiplexing cases within a PHY priority the Rel-15 PHY multiplexing timeline applies as well as for the PHY prioritization the PHY prioritization timeline (if applicable)
  + Therefore, it is moderator’s understanding similarly here, UE implementation will need to guarantee for the case of (HP or LP SR) that it can process according to the specifications.
  + For any other cases than SR, the multiplexing & PHY prioritization timelines are in place already.
* Therefore, the need for defining some timeline (at least for the specific example of pos / neg SR) are a bit unclear to the moderator.

**Moderator suggested handling:**

* **Treat this issues during RAN1#110bis-e (at least to clarify if a timeline is needed or not)**
* But further clarification from Samsung would be appreciated early in RAN1#110, if the timeline is needed for the case of SR only – and / or for other UCI than SR as well.
  1. Issue to be handled during RAN1#110bis-e?

**Question: Do you support discussing Issue#6 during RAN1#110bis-e?**

|  |  |
| --- | --- |
| Yes - support: | CATT, Samsung, |
| No - not support: |  |

**Comments on the moderator comments / suggested handling or on the proposal & draft CR:**

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| --- | --- |
| *Company* | *Comments* |
| CATT | We share the similar understanding with moderator but we are fine to discuss the issue and hear more views. |
| OPPO | To our understanding, the timeline issue only occurs for SR, but does not exist for other UCI(s), e.g. HARQ-ACK. If it is correct understanding, we prefer to leave it to UE implementation. |
| LG | Since both SPS HARQ-ACK and SR are semi-static, we think it would not make scheduling restricsion at gNB side. We share moderator’s view on the necessity of timeline. |
| Intel | We understand the issue, but as explained by FL, the timeline for SR is always handled by UE implementation. We are open to hear more views. |
| Nokia/NSB | Not opposing here, but we don’t see a need for the timeline for SR (leave to UE implementation as OPPO pointed out). So maybe Samsung could clarify a bit more on the need. |
| Samsung | Yes, the main case is for positive HP SR (there are other cases but we think they do not have timeline issues).  To clarify, the issue is not about having the UE implementation handle positive SR – that would be OK. The issue is about specifications being unclear for the case that LP/HP multiplexing/prioritization timelines are not satisfied and then the corresponding procedures are not applicable. Then, the question is whether UE drops HP SR and then also drops the LP HARQ-ACK due to collision with semi-static DL, or whether the UE drops the LP HARQ-ACK first (due to collision with semi-static DL and as the UE knows the cancelation timeline cannot be fulfilled in order to apply multiplexing/prioritization) and then the UE can transmit the HP SR. |
| New H3C | We share the same view with FL and other companies. This issue can leave to UE implementation. |
| vivo | We share moderator’s views. |

# Issue#7: Timing for PUCCH cell pattern applicability

* 1. Companies’ inputs

The issue had been discussed already in RAN1#109-e and RAN1#110.

The related question from RAN1#109-e reads as:

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| **Question 2.7.1: Which of the following points (A…E) from the following CATT proposal do you support:**  ***For semi-static PUCCH carrier switching, UE applies PUCCH cell switching pattern based on the following time point:***   1. ***If UE receives in a PDSCH an activation command for the SCell ending in slot n, UE applies the PUCCH cell switching time-domain pattern from the first PCell slot after SCell is active, where the active timing is determined based on the minimum requirement defined in [10, TS 38.133].*** 2. ***If UE receives in a PDSCH a deactivation command for the SCell ending in slot n, the UE would not apply the PUCCH cell switching time-domain pattern from slot n, where slot is defined in section 4.3 of TS38.213.*** 3. ***If the sCellDeactivationTimer associated with the SCell expires in slot n, the UE would not apply the PUCCH cell switching time-domain pattern from the first PCell slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell.*** 4. ***If UE detects a DCI indicating SCell dormancy, the UE would not apply the PUCCH cell switching time-domain pattern from the first PCell slot after slot , where slot is the slot indicated for PUCCH transmission with HARQ-ACK information corresponding to the DCI and  is the SCS configuration for the PUCCH.*** 5. ***If UE detects a DCI indicating SCell from dormancy to active, the UE apply the PUCCH cell switching time-domain pattern from the first PCell slot after the time duration specified in [10, TS 38.133].*** |

**QC** (in [**R1-2209946**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209946.zip)) suggesting to **support cases A to E, but based on different timelines as discussed in their earlier RAN1#110 contribution (**[R1-2207190](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207190.zip)**) already**

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| **Proposal 1: For semi-static PUCCH cell switch, if a *UE receives in a PDSCH in slot n an activation command for a SCell, the UE can apply the PUCCH cell switching time-domain pattern no earlier than slot n+k, where , and slot n+m is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception*.**  **Proposal 2: For semi-static PUCCH cell switch, if a *UE receives in a PDSCH in slot n a deactivation command for a SCell, the UE stop to apply the PUCCH cell switching time-domain pattern after slot n+k, where and slot n+m is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception*.**  **Proposal 3: For semi-static PUCCH cell switch, if sCellDeactivationTimer expires *in slot n for a SCell, the UE stop to apply the PUCCH cell switching time-domain pattern after slot n+k, where* .**  **Proposal 4: For semi-static PUCCH cell switch, if a *UE receives in a PDCCH in slot n with a DCI to turn an active Scell into dormancy, the UE stop to apply the PUCCH cell switching time-domain pattern after slot n+min(k,TdormantBWPswitchDelay), where and slot n+m is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception*.**  **Proposal 5: For semi-static PUCCH cell switch, if a *UE receives in a PDCCH in slot n with a DCI to turn a darmant Scell into active, the UE apply the PUCCH cell switching time-domain pattern after slot n+TdormantBWPswitchDelay.*** |

* 1. Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110bis-e

**(Initial) Moderator assessment:**

* The issue had been discussed already in RAN1#109-e
* In RAN1#110 we had further discussed (incl. the QC proposed handling above) in Toulouse with the following offline discussion outcome (see RAN1#110 moderator summary in [R1-2208102](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2208102.zip))

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| 2.4.6 Report from ‘offline’ discussion (without GTW) between interested companies on Thu 25th (afternoon coffee break) The following companies participated an offline discussion (without GTW access / locally only): Moderator / Nokia (Klaus), Samsung (Aris), Huawei (Chengyan), Ericsson (Sorour), Qualcomm (Yi), vivo (Lihui), LG (Duckhyun) and Apple (Weidong)  **Discussion summary:**  The situation was discussed again, and companies felt that specifying a time-line may not be absolutely needed (i.e. nothing is broken, can be handled by gNB implementation / gNB to handle the uncertainties).  **Discussion outcome / conclusion:**  The related discussions are to be stopped at this point and there is no intention come back to this issue in Rel-17 URLLC maintenance. |

* The related discussions in RAN1#110 ended with the tendency to not continue the related discussions any further. So from this perspective, moderator suggesting to not re-discuss the issue.
* If nevertheless this is to discussed, we may need to bring back the different options proposed also by other companies to RAN1#110 as well (of Sec. 2.4.1 in RAN1#110 summary of [R1-2208102](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2208102.zip))
  1. Issue to be handled during RAN1#110bis-e?

**Question: Do you support discussing Issue #7 during RAN1#110bis-e?**

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| --- | --- |
| Yes - support: |  |
| No - not support: | Nokia/NSB, Samsung |

**Comments on the moderator comments / suggested handling or any other comments:**

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| --- | --- |
| *Company* | *Comments* |
| CATT | Our understanding of the conclusion in last meeting is to stop discussing the issue. But as one proponent of the issue, we would be ok to discuss the issue in this meeting if we bring back the different options proposed in last meeting as proposed by moderator. |
| Nokia/NSB | Same understanding with CATT on the conclusion. Looking at the situation of the discussions in Toulouse in Aug, there seems to be no real convergence here. |
| Samsung | It is surprising to see that proposal as we concluded to stop discussion. Qualcomm was present.  Again, the issue is similar to PDCCH capability partitioning in case of sSCell activation/deactivation for Rel-17 DSS (was discussed and the conclusion was to leave it to gNB implementation – Qualcomm proposed/agreed). Also, the issue (some timing uncertainty) always exists for any RRC-based activation/deactivation (again, gNB implementation handles timing for any case involving enabling/disabling functionalities by RRC). |
| vivo | Share the understanding with CATT on the conclusion made in last meeting. |
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# Outcome

TBA