**3GPP TSG-RAN WG1 Meeting #110R1-22XXXXX**

Toulouse, France, Aug. 22nd – 26th, 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:

[110-R17-IIoT\_URLLC] To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc – Klaus (Nokia)

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

# Discussions per topic

* 1. Issue#1: DCI field size definition for secondary PUCCH group (potential RRC impact)

### 2.1.1 Companies inputs

Nokia in their draft CR in [R1-2206150](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206150.zip) idenfied three needed changes to 38.212 for the DCI formats 1\_1 and 1\_2:

* For DCI format 1\_1, the definition for the secondary PUCCH group for the One-shot HARQ-ACK request is currently missing.
* For the Enhanced Type 3 codebook indicator field in DCI format 1\_2, the DCI field presence is not separately configurable for the primary and secondary PUCCH group (i.e. no related RRC parameter existing), but is directly configured per DL serving cell (in pdsch-config).
* For the HARQ-ACK retransmission indicator field in DCI format 1\_2, the DCI field presence is not separately configurable for the primary and secondary PUCCH group (i.e. no related RRC parameter existing), but is directly configured per DL serving cell (in pdsch-config).

and the related change / draft CR reads as:

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| 7.3.1.2.2 Format 1\_1DCI format 1\_1 is used for the scheduling of one or multiple PDSCH in one cell. **< Unchanged parts are 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-enhType3List* is configured;- 0 bit otherwise.If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3List* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryList* for the secondary PUCCH group*.*- Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits.- 0 bit if *pdsch-HARQ-ACK-enhType3DCIfield* is not configured;- $\left⌈log\_{2}(n\_{CB})\right⌉$ bits otherwise, where$n\_{CB}$ is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-enhType3List.* If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-enhType3DCIfield* is replaced by *pdsch-HARQ-ACK-enhType3DCIfield-secondaryPUCCHgroup* for the secondary PUCCH group, and *pdsch-HARQ-ACK-enhType3List* is replaced by *pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup* for the secondary PUCCH group*.***< Unchanged parts are omitted >**7.3.1.2.3 Format 1\_2DCI format 1\_2 is used for the scheduling of PDSCH in one cell. **< Unchanged parts are omitted >**- Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits. - 0 bit if *pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-2* is not configured; - $\left⌈log\_{2}(n\_{CB})\right⌉$ bits otherwise, where$n\_{CB}$ is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-enhType3List.* If the UE is configured with a PUCCH-SCell, pdsch-HARQ-ACK-enhType3List is replaced by pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup for the secondary PUCCH group.- HARQ-ACK retransmission indicator – 0 or 1 bit.- 1 bit if higher layer parameter *pdsch-HARQ-ACK-retxDCI-1-2* is configured.- 0 bit otherwise.**< Unchanged parts are omitted >** |

Huawei / HiSi in contast is proposing to add the RRC parameters for the secondary PUCCH cell group for HARQ re-tx triggering and enh. Type 3 CB in [R1-2207662](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207662.zip)

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| **Proposal: Send LS to RAN2 to add the following RRC parameters.**

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| **WI code** | **Sub-feature group** | **RAN1 specification** | **Section** | **RAN2 Parent IE** | **RAN2 ASN.1 name** | **Parameter name in the spec** | **New or existing?** | **Parameter name in the text** | **Description** | **Value range** | **Default value aspect** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| NR\_IIOT\_URLLC\_enh | Triggering of HARQ-ACK re-transmission on a PUCCH resource  | 38.212, 38.213 | Section 7.3.1.2.3 for 38.212Section 9.1.5 in 38.213 |  | 　 | pdsch-HARQ-ACK-retxDCI-1-2-secondaryPUCCHgroup | New | pdsch-HARQ-ACK-retxDCI-1-2-secondaryPUCCHgroup | When configured, the DCI format 1\_2 can request the UE to perform a HARQ-ACK re-transmission on a PUCCH resource as described in Clause 9.1.5 in TS38.213Note: Can only be configured if the UE is configured with twoPUCCHgroup (i.e., conditional) | Enabled | NA | in pdsch-config | UE specific | 38.331 | AgreementThe one-shot HARQ re-transmission on PUCCH is configured per PUCCH cell group (i.e., separately configurable for primary and secondary PUCCH cell group). |
| NR\_IIOT\_URLLC\_enh | enhanced Type 3 HARQ-ACK codebook | 38.212, 38.213 | Section 7.3.1.2.3 for 38.212Section 9.1.4 in 38.213 | 　 | 　 | pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-2-secondaryPUCCHgroup | New | pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-2-secondaryPUCCHgroup | Enables the enhanced Type 3 CB through a new DCI field to indicate the enhanced Type 3 HARQ-ACK codebook in DCI format 1\_2 if the more than one enhanced Type HARQ-ACK codebook is configured for the secondary PUCCH cell group.  | Enabled  | NA | in pdsch-config | UE specific | 38.331 | AgreementThe list enhanced Type 3 HARQ-ACK codebooks is configured per PUCCH cell group (i.e., separately configurable for primary and secondary PUCCH cell group). |

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… and HW/HiSi is the proposing a related RRC parameter change for the same occurrences in 38.212 in their draft CR in [R1-2207659](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207659.zip):

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| 7.3.1.2.3 Format 1\_2< Unchanged parts are omitted >- Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits. - 0 bit if *pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-2* is not configured; - $\left⌈log\_{2}(n\_{CB})\right⌉$ bits otherwise, where$n\_{CB}$ is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-enhType3List.* If the UE is configured with a PUCCH-SCell, pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-2 is replaced by pdsch-HARQ-ACK-enhType3DCIfieldDCI-1-2-secondaryPUCCHgroup for the secondary PUCCH group, and pdsch-HARQ-ACK-enhType3List is replaced by pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup for the secondary PUCCH group. |

### 2.1.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**Initial Moderator assessment:**

* On the HW proposal about additional RRC parameters and LS: The RRC parameters for DCI format 1\_2 have not been added, as the RRC parameters for HARQ-reTX and Enh. Type 3 DCI field presence for DCI format 1\_2 are configured in pdsch-config already, which is not just PUCCH group but also ‘DL serving cell’ specific already

🡪 no need for these additional RRC parameters as the functionality is given by the current RRC parameters already.

* Note: Huawei offline also confirmed that these RRC parameters are no required
* Therefore, the Nokia CR seems to be the correct in this respect.

**Moderator suggested handling:**

* **The issue to be treated during RAN1#110 early (as having potential RRC impact)**
* **Discuss if new RRC parameters would be needed – moderator thinks they are not needed & HW confirmed offline as well as seems to be no need for new RRC parameters**
* If not, try to agree based on the Nokia draft CR in [R1-2206150](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206150.zip) – change the sourcing companies to Moderator (Nokia), Nokia Shanghai Bell

### 2.1.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

|  |  |
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| Yes - support:  | Vivo, Huawei/Hisi, DOCOMO, ASUSTeK, Samsung, ZTE, CATT, Spreadtrum, NEC,OPPO, Intel, QC, LG |
| No - not support:  |  |

**Question: Do you see a need to introduce these new RRC parameters?**

|  |  |
| --- | --- |
| Yes - support:  |  |
| No - not support:  | Vivo, DOCOMO, ASUSTeK, Samsung, ZTE, CATT, Spreadtrum, NEC,OPPO, Intel, LG |

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

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| *Company* | *Comments*  |
| vivo | Agree with moderator’s assessment that no need of additional RRC parameter given the DCI field presence is is already configured per DL serving cell in pdsch-config.  |
| Huawei/Hisi | After seeing Moderator’s assessment, we now agree that there is no need to add new RRC parameters.For the 212 CR part of *pdsch-HARQ-ACK-EnhType3SecondaryList* in Clause 7.3.1.2.2 (Format 1\_1), however, we think there is redundancy to repeat this IE under both “One-shot HARQ-ACK request” field and “Enhanced Type 3 codebook indicator” field. For other IEs related with “secondary PUCCH group” and appear under more than one DCI fields, e.g., *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16*, and *pucch-sSCellDyn-secondaryPUCCHgroup*, the description for the replacement of secondary PUCCH group only appears at its first occurance. To keep consistency with other IEs, it is then suggested to remove the replacement description under the “Enhanced Type 3 codebook indicator” field as in below.

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| - One-shot HARQ-ACK request – 0 or 1 bit.- 1 bit if higher layer parameter *pdsch-HARQ-ACK-OneShotFeedback-r16* or *pdsch-HARQ-ACK-enhType3List* is configured;- 0 bit otherwise.If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-EnhType3List* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryList* for the secondary PUCCH group*.*- Enhanced Type 3 codebook indicator - 0, 1, 2, or 3 bits.- 0 bit if *pdsch-HARQ-ACK-enhType3DCIfield* is not configured;- $\left⌈log\_{2}(n\_{CB})\right⌉$ bits otherwise, where$n\_{CB}$ is the number of entries in the higher layer parameter *pdsch-HARQ-ACK-enhType3List.* If the UE is configured with a PUCCH-SCell, *pdsch-HARQ-ACK-enhType3DCIfield* is replaced by *pdsch-HARQ-ACK-enhType3DCIfield-secondaryPUCCHgroup* for the secondary PUCCH group~~, and~~ *~~pdsch-HARQ-ACK-enhType3List~~* ~~is replaced by~~ *~~pdsch-HARQ-ACK-enhType3List-secondaryPUCCHgroup~~* ~~for the secondary PUCCH group~~*.* |

 |
| DOCOMO | We agree with the moderator’s assessment.Regarding Huawei’s comment on redundancy of *pdsch-HARQ-ACK-EnhType3SecondaryList* IE under both “One-shot HARQ-ACK request” field and “Enhanced Type 3 codebook indicator” field, we think it is fine to not remove because the *pdsch-HARQ-ACK-enhType3List* is related with both fields. |
| ASUSTeK | Agree with moderator’s assessment.  |
|  |  |

### 2.1.4 Scheduled offline session, Mon 22nd

The input received hints that this should be treated and no new RRC parameters will be needed.

The idenfied changes by Nokia seem to be correct, HW just raised the issue if when introducing the missing part, if it should be then removed for the next DCI field again (which DCM thought this should not be removed).

**Offline outcome: There has been no need for new, additional RRC parameters identified.**

Offline outcome:

**The identified required changes by Nokia / NSB in** [R1-2206150](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206150.zip) **are to be reflected in the 38.212 editor alignment CR.**

**Things to clarify:**

* Should then the part identified by Huawei / HiSi be removed or not?
* Editor alignment CR or do we need a separate CR?
	1. Issue#2: Correction to HARQ-ACK re-transmission trigger

### 2.2.1 Companies inputs

Two companies (Nokia & Asustek) identified the same needed change to the HARQ-ACK re-transmission triggering in 38.213 Sec. 9.1.5, namely to apply the DCI field name (which is common for DCI format 1\_1 and 1\_2) instead of the RRC parameters configuring the DCI field presence.

Nokia in the draft CR in [R1-2206151](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206151.zip) reads as:

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| 9.1.5 HARQ-ACK codebook retransmission With reference to slots of PUCCH transmissions on the primary cell and for Type-1 or Type-2 HARQ-ACK codebooks, a UE that transmitted or would transmit a PUCCH or a PUSCH with a first HARQ-ACK codebook in slot $m$ can be indicated by a DCI format with CRC scrambled by a C-RNTI or a MCS-C-RNTI that does not schedule a PDSCH reception [4, TS 38.212] and is received in a PDCCH ending in slot $n$, to transmit a PUCCH with the first HARQ-ACK codebook in slot $n+k$, where slot $n+k$ is after slot $m$. The UE determines $k$ and a resource for the PUCCH transmission as described in clauses 9.2.3 and 9.2.5. If the UE is provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern*, the UE further determines a corresponding cell based on the periodic cell switching pattern as described in clause 9.A.If the HARQ-ACK retransmission indicator field value in the DCI format 1\_1 or 1\_2 is '1', the UE determines slot $m$ as $m=n-l$ where $l$ is determined by a one-to-one mapping in ascending order among the values of the MCS field in the DCI format 1\_1 or 1\_2 and the values from -7 to 24. |

The ASUSTeK draft CR in [R1-2207501](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207501.zip) reads as:

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| 9.1.5 HARQ-ACK codebook retransmission With reference to slots of PUCCH transmissions on the primary cell and for Type-1 or Type-2 HARQ-ACK codebooks, a UE that transmitted or would transmit a PUCCH or a PUSCH with a first HARQ-ACK codebook in slot $m$ can be indicated by a DCI format with CRC scrambled by a C-RNTI or a MCS-C-RNTI that does not schedule a PDSCH reception [4, TS 38.212] and is received in a PDCCH ending in slot $n$, to transmit a PUCCH with the first HARQ-ACK codebook in slot $n+k$, where slot $n+k$ is after slot $m$. The UE determines $k$ and a resource for the PUCCH transmission as described in clauses 9.2.3 and 9.2.5. If the UE is provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern*, the UE further determines a corresponding cell based on the periodic cell switching pattern as described in clause 9.A.If the HARQ-ACK retransmission indicator field value in the DCI format 1\_1 or 1\_2, respectively, is '1', the UE determines slot $m$ as $m=n-l$ where $l$ is determined by a one-to-one mapping in ascending order among the values of the MCS field in the DCI format 1\_1 or 1\_2 and the values from -7 to 24. |

### 2.2.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**The identified change by Nokia & ASUSTEK is valid and would need to be corrected.**

**Moderator suggested handling:**

* **Treat the issue during RAN1#110**
* The two draft CRs are identical in terms of the DCI field name change (in yellow above) – but Nokia in addition (in blue) suggests to also remove the ‘respectively’ as there is now only a single (common) DCI field name (and not two RRC parameters, for which the ‘respectively’ had been used to distinguish)
🡪 use the Nokia formulation (and also remove the blue ‘respectively’, fine for ASUSTek based on offline comment)
* Use the Nokia draft CR in [R1-2206147](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206147.zip) – change the sourcing companies to Moderator (Nokia), Nokia Shanghai Bell, ASUSTeK
	+ Note: ASUSTek offline are fine with moderator proposed handling & their co-sourcing

### 2.2.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

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| Yes - support:  | vivo, Huawei/Hisi, DOCOMO, ASUSTeK, Samsung, ZTE, CATT, Spreadtrum, NEC, Intel, QC, LG |
| No - not support:  |  |

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

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| *Company* | *Comments*  |
| Samsung | Alignment of parameter names is to be handled in general Rel-17 alignment CRs. Should be possible to confirm via email with a quick online endorsement. |
| OPPO | Editorial correction and it can be handled in general Rel-17 alignment CRs |
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### .2.4 Scheduled offline session, Mon 22nd

The issue to be treated and companies think this should be handled in the alignment CR.

Offline outcome:

**The identified required changes by Nokia / NSB and ASUSTeK in** [R1-2206147](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206147.zip) **are to be reflected in the 38.213 editor alignment CR.**

* 1. Issue#3: PUCCH repetition with semi-static PUCCH cell switching

### 2.3.1 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.
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The only thing missing here is the actual draft CR, where several companies provided their input on how this is to be captured in Sec. 9.A of 38.213.

Huawei/HiSi in [**R1-2205791**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205791.zip):

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| 9.A PUCCH Cell SwitchingThis 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. 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. The UE does not expect to be indicated with the PUCCH-sSCell as the cell for PUCCH transmissions during a slot of the reference SCS configuration that would overlap with a slot on the active UL BWP of the PCell where the UE would transmit a PUCCH repetition. |

ZTE in [**R1-2205949**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205949.zip):

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| 9.A PUCCH cell switchingThis 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. 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. For slots with PUCCH transmission(s) on PCell with repetition of >1 according to clause 9.2.6, the UE does not except to be indicated with a value of ‘1’ by the *pucch-sSCellPattern*. |

Nokia/NSB in [**R1-2206152**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206152.zip):

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| 9.A PUCCH cell switchingThis 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. 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. The UE does not expect to be indicated with the PUCCH-sSCell as the cell for PUCCH transmissions during a slot of the reference SCS configuration that would overlap with a slot on the active UL BWP of the PCell where the UE would transmit a PUCCH repetition. |

NEC in [R1-2206474](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206474.zip)

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| 9.A PUCCH cell switchingThis 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. The UE does not transmit a PUCCH repetition in a slot on a cell if the pattern indicates a different cell from the Pcell 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. |

vivo in [R1-2206739](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206739.zip):

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| --- |
| 9.A PUCCH cell switchingThis 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. 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. For slots with PUCCH transmission on the PCell corresponding to a PUCCH with repetition of >1 according to clause 9.2.6, the UE does not except to be indicated with a value of ‘1’ by the *pucch-sSCellPattern* in any of the slots. |

CATT in [R1-2206941](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206941.zip):

|  |
| --- |
| 9.A PUCCH cell switchingThis 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. 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. The UE does not expect to be indicated a slot for PUCCH repetition on the PUCCH-sSCell by the periodic cell switching pattern for PUCCH transmissions. |

LG in [R1-2207032](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207032.zip):

|  |
| --- |
| 9.A PUCCH cell switchingThis 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. 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. The UE does not expect to be indicated with the PUCCH-sSCell as the cell for PUCCH transmissions during a slot of the reference SCS configuration that would overlap with a slot on the active UL BWP of the PCell where the UE would transmit a PUCCH repetition. |

QC in [R1-2207188](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207188.zip):

|  |
| --- |
| 9.A PUCCH cell switchingThis 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. 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. Semi-static PUCCH cell switching is applicable only to PUCCH transmissions without repetitions. PUCCH repetitions are only applicable on Pcell, PScell, and PUCCH Scell. A UE does not expect to transmit a repetition of a PUCCH on PUCCH-sSCell. |

Ericsson in [R1-2207627](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207627.zip):

|  |
| --- |
| 9.A PUCCH cell switchingThis 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. 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. The UE does not expect to be indicated to transmit PUCCH repetitions on the PUCCH-sSCell. If a UE would transmit a PUCCH repetition, the UE does not expect the slots from the first slot to the last slot with the PUCCH repetition to overlap with the slots of the reference SCS configuration that correspond to the pattern with a bit value of ‘1’. |

### 2.3.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**Initial Moderator assessment:**

* The issue is valid and was discussed during RAN1#109-e already
* **All companies except seem to have the understanding of not expecting to be indicated with ‘1’ or PUCCH-sSCell transmission for a PUCCH transmission for a PUCCH repetition** (HW/HiSi, ZTE, Nokia/NSB, NEC, CATT, vivo, LG, QC, Ericsson)
	+ Huawei/HiSi, Nokia/NSB & LG have the same text proposed using the wording of ‘PUCCH repetition’ and ‘reference SCS configuration’
		- Ericsson is also using the terminology of the reference SCS configuration, but slightly different wording there.
	+ ZTE & vivo have similar TPs / draft CRs using ‘N\_PUCCH>1’ and ‘in a slot’
		- CATT proposing a more concise version
	+ The change by NEC would reflect the intention, but remove the initial intention of the sentence the change is proposed to: i.e. the current sentence is independent of having a PUCCH transmission or not, i.e. the UE does not transmit PUCCH on the cell which is not indicated. So maybe this change is not sufficient.
	+ QC using ‘UE does not expect to transmit’ instead of ‘expect to be indicated’ (compared to HW/HiSi, Nokia/NSB, LG, ZTE, vivo, CATT)

**Moderator suggested handling:**

* **The issue to be treated during RAN1#110 (high priority)**
* Some more offline discussions (incl. ‘offline offline’) may be needed to converge on the final text of the draft CR.

### 2.3.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

|  |  |
| --- | --- |
| Yes - support:  | Vivo, Huawei/Hisi, DOCOMO, QC, ASUSTeK, Samsung, ZTE, CATT, Spreadtrum, NEC,OPPO, Intel, LG |
| No - not support:  |  |

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

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| Samsung | OK to discuss whether or not a CR is needed and, if so, the CR itself. |
| OPPO | Fine with text proposal provided by Huawei/HiSi, Nokia/NSB and LG |
| LG | Fine to have a discussion for final text.  |
|  |  |
|  |  |

### 2.3.4 Scheduled offline session, Mon 22nd

Offline outcome:

* The issues is to be treated during RAN1#110
* More offline discussions will be needed
	1. Issue#4: Timing for PUCCH cell pattern applicability

### 2.4.1 Companies inputs

The issue had been discussed already in RAN1#109-e without concluding this issue. Based on the initial proposal by CATT input to RAN1#109-e, the following cases had been discussed:

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

|  |
| --- |
| **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***$+k$***, where slot*** $n+k$ ***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*** $n+3N\_{slot}^{subframe,µ}$***, where slot*** $n$ ***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].***
 |

During RAN1#109-e, vivo brought up the issue that only cases A & E could be supported without impacting the UE freedom to active / release a carrier earlier.

The following input provided to this meeting by different companies:

* **LGE** (in [R1-2207032](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207032.zip)) suggesting to **‘de-prioritize’** the discussions
* **Huawei /HiSi** (in [R1-2205790](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2205790.zip)) suggesting to **leave the handling during the ambiguity period up to UE implementation**
	+ but at least after the minimum requirement for cases A & E
	+ Up to UE implementation to stop applying the pattern after the minimum requirement for cases B, C & D
* **Nokia/NSB** (R1-2206153, draft CR in [R1-2206154](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206154.zip)) suggest to support only **cases A & E**, based on the timelines discussed in RAN1#109-e (see the RAN1#109-e question above)
* **CATT** (draft CR in [R1-2206939](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206939.zip)) suggesting to **support all 5 cases (A to E)**, based on the timelines discussed in RAN1#109-e (see the RAN1#109-e question above)
* **QC** (in [R1-2207190](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207190.zip)) suggesting to **support cases A to E, but based on different timelines as discussed in RAN1#109-e**
	+ *For case A, the UE can apply the PUCCH cell switching time-domain pattern no earlier than slot n+k, where* $k=m+3 N\_{slot}^{subframe,μ}+1$ *, and slot n+m is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception*

* + *For case B, the UE stop to apply the PUCCH cell switching time-domain pattern after slot n+k, where* $k=m+3 N\_{slot}^{subframe,μ}+1$ *and slot n+m is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception*

* + *For case C, the UE stop to apply the PUCCH cell switching time-domain pattern after slot n+k, where* $k=m+3 N\_{slot}^{subframe,μ}+1$ *and slot n+m is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception*

* + *For case D, the UE stop to apply the PUCCH cell switching time-domain pattern after slot* ***n+min(k,TdormantBWPswitchDelay)****, where* $k=m+3 N\_{slot}^{subframe,μ}+1$ *and slot n+m is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception*.

* + *For case E, the UE apply the PUCCH cell switching time-domain pattern after slot* ***n+TdormantBWPswitchDelay.***

### 2.4.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**(Initial) Moderator assessment:**

* **Looking at the company inputs, the views are rather diverse**
* 2 (LG & HW) out of 5 inputs basically suggesting to not define exact timelines when the UE stops / starts applying the PUCCH cell pattern
* 3 companies suggesting (at least for some of the cases) to define some exact timing of applying / stop applying the pattern – but also there the communalities are a bit limited
	+ Nokia for case A & E and CATT all 5 cases using the earlier discussed timelines
	+ QC for all 5 cases using a different timeline

**Moderator suggested handling:**

* **Check in the first official offline session if some companies would object defining a timeline, otherwise treat this issues during RAN1#110 with lower priority**
* If so, use unofficial offline to try to converge to some common solution by more than one company before spending excessive official offline & online time first.

### 2.4.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

|  |  |
| --- | --- |
| Yes - support:  | QC, Samsung, ZTE, CATT, Spreadtrum |
| No - not support:  | Vivo Huawei/Hisi |

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

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| vivo | The ambiguity cannot be solved entirely for all cases e.g., for case B, C and D and all the ambiguity caused by SCell activation/deactivation/dormancy is not a new issue. So, we do not think it is essential or necessary to handle it.  |
| Huawei/Hisi | The ambiguity time in legacy is left for UE implementation (e.g., SRS transmission/PDCCH monitor for SCell, etc.), so there seems to be no need in R17 to force a UE to perform with a hard timeline for the PUCCH cell switching pattern. The gNB can reserve the resources to both PCell and PUCCH-sCell and perform the blind detection, or does not receive any PUCCH until the minimum requirement. |
| DOCOMO | We share same view as Huawei. |
| QC | @Huawe, DCM: we disagree that in current spec, everything is left to UE implementation, regarding this issue to Scell activation/deactivation/dormancy switch. At least, for Scell activation, CSI report timeline is precisely defined. Please see the following highlighted. We think if UE can handle CSI, UE should be able to handle HARQ-ACK feedback, as HARQ-ACK feedback is more important than CSI. 4.3 Timing for secondary cell activation / deactivationWith reference to slots for PUCCH transmissions, when a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell ending in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] **no later than** the minimum requirement defined in [10, TS 38.133] and **no earlier than** slot , except for the following:- the actions related to CSI reporting on a serving cell that is active in slot - the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot - the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.The value of  is $m+3 N\_{slot}^{subframe,μ}+1$ where slot *n*+*m* is a slot indicated for PUCCH transmission with HARQ-ACK information for the PDSCH reception as described in clause 9.2.3 and  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission as defined in [4, TS 38.211]. |
| Samsung | Do not think that defining timelines for the suggested cases is needed, handling can be by gNB implementation as for other similar cases in R16/R17, but OK to discuss. |
| ZTE | We are open to discuss whether the exact timeline definition can solve the ambiguity issue. |
| CATT | We agree with QC that the timing is not all up to UE implementation and suggest to discuss the issue. |
| Intel  | Open for the discussion, though we think it can be handled by gNB implementation.  |
| LG | We are also fine to discuss, though we think the issue can be avoided by gNB scheduling, and the drawback is limited.  |

### 2.4.4 Scheduled offline session, Mon 22nd

Offline outcome:

* Discuss with low priority (if time available)
	1. Issue#5: SPS deferral rule when overlapping with semi-static DL symbols

### 2.5.1 Companies inputs

Samsung in [**R1-2206795**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206795.zip)discusses the following (no draft CR available):

|  |  |
| --- | --- |
| In RAN#107-e meeting, the interaction between intra-UE prioritization and SPS HARQ-ACK deferral was discussed and we made the following conclusion.

|  |
| --- |
| **Conclusion**For SPS HARQ-ACK deferral, if a UE is not configured with Rel-17 intra-UE multiplexing but configured with Rel-16 PHY prioritization, the UE first performs Rel-16 UCI multiplexing and PHY prioritization in both initial slot and target slot and if a LP SPS HARQ-ACK PUCCH is deprioritized, the LP SPS HARQ-ACK is not deferred.* Note: If the SPS HARQ-ACK is deprioritized in any slot, no further deferral.
 |

There is a similar case which is not discussed yet. For example, if a PUCCH with SPS HARQ-ACK only overlaps with both a PDSCH scheduled by a PDCCH on a same cell and semi-static DL symbols, UE behaviour is not clear. There can be two candidate UE behaviours.Behaviour 1: UE first resolves the overlapping for the PUCCH with SPS HARQ-ACK only and a PDSCH scheduled by a PDCCH. UE cancels the PUCCH with SPS HARQ-ACK only without deferral.Behaviour 2: UE first resolves the overlapping for the PUCCH with SPS HARQ-ACK only and semi-static DL symbols. UE defers the SPS HARQ-ACK to the next available slot.**Proposal 1: If a PUCCH with SPS HARQ-ACK only overlaps with both a PDSCH scheduled by a PDCCH on a same cell and semi-static DL symbols, UE first resolves the overlapping for the PUCCH with SPS HARQ-ACK only and semi-static DL symbols. UE defers the SPS HARQ-ACK to the next available slot.** |

### 2.5.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**(Initial) Moderator assessment:**

* According to the moderator understanding, for the case mentioned here there is no need to define respective UE handling. The specs clearly specify that if the PUCCH cannot be transmitted as overlapping with semi-static DL symbols, the SPS HARQ-ACK is to be deferred.

This should be independent if the PUCCH cannot be transmitted in addition due to other conditions.

* So in this respect, based on the moderator reading of the existing agreement and the current specifications, Behaviour 2 is already specified (and no further clarifications seem to be needed)

**Moderator suggested handling:**

* **Discuss /decide in the first offline session (based on the initial company inputs) if to be treated or not**
* If to be discussed, some more detailed offline discussions may be needed as there had not been a related draft CR been provided.

### 2.5.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

|  |  |
| --- | --- |
| Yes - support:  |  |
| No - not support:  | vivo, Sony, Huawei/Hisi, DOCOMO, Samsung, ZTE, CATT, Spreadtrum, NEC,OPPO, QC |

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

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| vivo | We have the same understanding with the moderator on the agreements. No clarification in spec is needed. |
| Huawei/Hisi | Overlapping with a PDSCH will not impact the procedure of R16 UCI multiplexing/prioritization |
| DOCOMO | We think the SPS deferral determination should not be impacted by PDSCH. Otherwise, ambiguity may occur if UE misses scheduling DCI for PDSCH. |
| Samsung | There is no correction to be made. |
| CATT | We share the same understanding as moderator. |
| OPPO | Share with moderator’s assessment. |
| Inyrl  | We share same understanding with moderator.  |
| LG | We share same view with moderator.  |

### 2.5.4 Scheduled offline session, Mon 22nd

Offline consensus:

* The issues is not further discussed during RAN1#110
	1. Issue#6: Last DCI format determination for HARQ-ACK re-transmission

### 2.6.1 Companies inputs

Samsung in [**R1-2206795**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206795.zip)discusses the following:

|  |
| --- |
| One remaining issue on HARQ-ACK retransmission is the issue of last DCI determination. For example, a UE receives two DCI formats carried by PDCCHs in a same MO with HARQ-ACK in a same slot. One DCI format triggers HARQ-ACK retransmission and the other DCI format schedules a PDSCH. Which DCI format is the last DCI format is not clear. It is proposed to have the scheduling DCI format as the last DCI format.**Proposal 2: For last DCI format determination, a DCI format triggering HARQ-ACK codebook retransmission is indexed prior to DCI formats scheduling PDSCHs when the DCI formats are from PDCCH receptions in a same PDCCH monitoring occasion. Adopt Draft CR for last DCI format determination for HARQ-ACK retransmission.** |

And provides in the same document the related draft CR as:

|  |
| --- |
| **9.2.3 UE procedure for reporting HARQ-ACK**\*\*\* Unchanged text is omitted \*\*\*For a PUCCH transmission with HARQ-ACK information, a UE determines a PUCCH resource on the cell of the PUCCH transmission, as described in clause 9.A, after determining a set of PUCCH resources for $O\_{UCI}$ HARQ-ACK information bits, as described in clause 9.2.1. The PUCCH resource determination is based on a PUCCH resource indicator field [5, TS 38.212], if present, in a last DCI format, excluding the SPS activation DCI, among the DCI formats that have a value of a PDSCH-to-HARQ\_feedback timing indicator field, if present, or a value of *dl-DataToUL-ACK*, or *dl-DataToUL-ACK-r16*, or *dl-DataToUL-ACK-DCI-1-2*, or *dl-DataToUL-ACK-r17,* or *dl-DataToUL-ACK-MulticastDciFormat4\_1*, indicating a same slot for the PUCCH transmission, that the UE detects and for which the UE transmits corresponding HARQ-ACK information in the PUCCH. For PUCCH resource determination, detected DCI formats are first indexed in an ascending order across serving cells indexes for a same PDCCH monitoring occasion and are then indexed in an ascending order across PDCCH monitoring occasion indexes. For indexing DCI formats within a serving cell for a same PDCCH monitoring occasion, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs on an active DL BWP of a serving cell, and with *ackNackFeedbackMode* = *joint* for the active UL BWP, detected DCI formats from PDCCH receptions in the first CORESETs are indexed prior to detected DCI formats from PDCCH receptions in the second CORESETs. For indexing DCI formats for a same PDCCH monitoring occasion, a DCI format triggering HARQ-ACK codebook retransmission is indexed prior to DCI formats scheduling PDSCHs.\*\*\* Unchanged text is omitted \*\*\* |

### 2.6.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**(Initial) Moderator assessment:**

* Issue is valid, some handling would be needed, as there could be more than one DCI issued for a serving cell here.
* On the details of the proposal, some more discussion may be needed (i.e.. prior across all serving cells, or only prior across the DCIs of the same serving cell index)

**Moderator suggested handling:**

* **Treat this issues during RAN1#110**
* Some more detailed offline discussions may be needed

### 2.6.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

|  |  |
| --- | --- |
| Yes – support:  | vivo, Sony, DOCOMO, Samsung, Spreadtrum, NEC, QC, LG |
| No – not support:  | [ZTE], [CATT] |

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

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| vivo | We are fine to discuss it during the meeting. But there are other cases that there is HARQ-ACK for DCI without scheduling PDSCH. They should be solved in a unified way. |
| DOCOMO | Agree with vivo that there are many other cases for DCI not scheduling PDSCH in the same monitoring occasion. And we understand it may also be related with Rel-16 CR, since there are also such cases for Rel-16, e.g. SPS release DCI or Scell dormancy indication DCI without scheduling PDSCH. |
| ZTE | The intention should be clairified first. In prior release discussion, the issue of last DCI in the same MO is left to implementation. Is there any difference for DCI format not scheduling PDSCH? Also, if the order of DCI in the same MO should be clairified, does it mean the DAI fields in DCIs also have the order issue although the DAI is not used in DCI triggering HARQ-ACK codebook retransmission? |
| CATT | We made the following agreement in RAN1#109-e. With this agreement, we are not clear what ambiguity would be for last DCI determination and would like proponent to clarify.**Agreement**In Rel-16, a UE is not expected to detect two or more DCI formats in PDCCHs without scheduling PDSCH received in a same PDCCH MO on a same cell and indicating a same slot for corresponding HARQ-ACK transmission.In Rel-16, a UE is not expected to detect one or more DCI formats in PDCCH(s) in a PDCCH MO on a cell scheduling PDSCH(s) for self-carrier scheduling, and another DCI format in PDCCH in the same PDCCH MO on the same cell that does not schedule PDSCH other than a DCI format triggering Type-3 HARQ-ACK codebook and indicating a same slot for corresponding HARQ-ACK transmission.* FFS whether CR is needed
 |
| Spreadtrum | Agree with vivo that all types of DCI without DL grant can be discussed together. For CATT’s comments, we are not sure which cell does the “DCI format triggering HARQ-ACK codebook retransmission” belong to, since the agreement made in RAN1#109e only involves the DCIs “in a same PDCCH MO on a same cell”, and SPS PSDCH release always counted on Pcell even if it releases a SPS PDSCH on a Scell. So it is not clear whether it can cover this issue. |
| OPPO | The motivation is not clear.In our understanding, it is reasonable to configure the same PRI value for DCI formats in the same slot indicating the same PUCCH slot. So it is not necessary to define DCI format order for a given serving cell in the same slot. |
| Intel  | We also want to understand, if we don’t differentiate which one is last DCI among DCIs within a PDCCH MO, what ambiguilty woud happen? As commented by other companies, in previous release, the spec does not capture how to determine last DCI within a PDCCH MO for many other cases, e.g., for Rel-16 DC-CA with multiple PDCCHs in a PDCCH MO scheduling PDSCHs for same serving cell, for multiple PDCCHs with or without PDSCH in a PDCCH MO.  |
| LG | We are open to discuss and prefer to make it as an error case like in Rel-16. |

### 2.6.4 Scheduled offline session, Mon 22nd

Several companies noted, that there are also other cases for DCI without PDSCH, where the ‘last DCI’ is currently not defined in detail which goes partially back to Rel-16 as well.

Offline outcome:

* Treat with low priority
* At least the following cases to be considered: Scell dormancy indication, TCI state indication and HARQ-ACK re-tx trigger, Type 3 triggering without PDSCH scheduled
	1. Issue#7: HARQ-ACK CB with PUCCH cell switching and UL BWP switching

### 2.7.1 Companies inputs

QC in [R1-2207189](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207189.zip) provided a draft CR, based on the following reasoning:

* In RAN1#109e, it was agreed that the HARQ-ACK info associated with PDSCH received prior to an active UL BWP change on the serving cell where the UE transmits the PUCCH is excluded from the Type-1 and Type-2 HARQ-ACK codebook. This rule is aimed to address the potential mis-alignment between UE and gNB for HARQ-ACK construction during the UL BWP change.
* However, this rule does not solve the problem for the case of semi-static PUCCH cell switching. This is because, for semi-static PUCCH cell switch, the HARQ-ACK codebook construction depends on the PUCCH configurations on the PCell, but not on the Scell. In particular, the set of K1 values and the unit of K1, which are used by the UE to generate the HARQ-ACK codebook (for both Type 1 and Type 2) HARQ-ACK codebook are all based on the configurations on the PCell. On the one hand, if there is an active UL BWP change on the PCell, there will be mis-alignment between the UE and gNB for the HARQ-ACK codebook construction, regardless of in which cell the PUCCH is transmitted. On the other hand, the HARQ-ACK codebook construction doesn’t depend on PUCCH configuration on the Scell. Therefore, there is no need for the UE to exclude the HARQ-ACK information if an active UL BWP change occurs on the SCell.
* The UE shall exclude the HARQ-ACK information associated with PDSCH received prior to an active UL BWP change on
* the serving cell where the UE transmits PUCCH in case the UE is configured with dynamic PUCCH cell switching, or
* the PCell, otherwise (i.e., either the UE is configured with semi-static PUCCH cell switching, or the UE is not configured with PUCCH cell switching)

 which reads as:

|  |
| --- |
| 9.1.2.1 Type-1 HARQ-ACK codebook in physical uplink control channel<unchanged text omitted>If a UE is not provided *ca-SlotOffset* for any serving cell of PDSCH receptions and for the serving cell of corresponding PUCCH transmission with HARQ-ACK informationwhile $k<C\left(K\_{1}\right)$ <unchanged text omittedif slot $n\_{U}$ starts at a same time as or after a slot for an active DL BWP change on serving cell $c$, or an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn* and *pucch-sSCellDynDCI-1-2,* and slot $n\_{0,k}+n\_{D}$ is before the slot for the active DL BWP change on serving cell $c$ or the active UL BWP change on the serving cell of PUCCH transmission, or *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook and slot $n\_{0,k}+n\_{D}$ overlaps with UL slot $n\_{U}-K\_{1,k-1}$, $k>0$, where $n\_{0,k}$ is a DL slot with a smallest index among DL slots overlapping with UL slot $n\_{U}-K\_{1,k}$, $n\_{D}=n\_{D}+1$; else <unchanged text omitted>else while $k<C\left(K\_{1}\right)$ <unchanged text omitted>if slot $n\_{U}$ starts at a same time as or after a slot for an active DL BWP change on serving cell $c$, or an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn* and *pucch-sSCellDynDCI-1-2,* and slot $n\_{0,k}+n\_{D}$ is before the slot for the active DL BWP change on serving cell $c$ or the active UL BWP change on the serving cell of PUCCH transmission where $n\_{0,k}$ is a DL slot with a smallest index among DL slots overlapping with UL slot $n\_{U}-K\_{1,k}$, or *subslotLengthForPUCCH* is provided for the HARQ-ACK codebook and slot $n\_{0,k}+n\_{D}$ overlaps with UL slot $n\_{U}-K\_{1,k-1}$, $k>0$,$n\_{D}=n\_{D}+1$; <unchanged text omitted>9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel<unchanged text omitted>while $m<M$Set $c=0$ – serving cell index: lower indexes correspond to lower RRC indexes of corresponding cellwhile $c<N\_{cells}^{DL}$if PDCCH monitoring occasion $m$ is before an active DL BWP change on serving cell $c$, or an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn* and *pucch-sSCellDynDCI-1-2,* and an active DL BWP change is not triggered in PDCCH monitoring occasion $m$ $c=c+1$;<unchanged text omitted> |

### 2.7.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**Moderator assessment:**

* The issues seems valid, as for the semi-static PUCCH cell switching the UL BWP change on PUCCH-sSCell should not affect on the HARQ-CB construction (but only an UL BWP change on PCell, which is used to defined the HARQ-ACK CB).
* The draft CR seems to be technically correct.

**Moderator suggested handling:**

* **Treat this issues during RAN1#110**
* Try to agree the QC draft CR in [R1-2206149](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206149.zip) by changing the sourcing companies to Moderator (Nokia), Qualcomm

### 2.7.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

|  |  |
| --- | --- |
| Yes - support:  | Vivo, DOCOMO, QC, ASUSTeK, Samsung, ZTE, CATT, Spreadtrum, NEC,OPPO, Intel, LG |
| No – not support:  |  |

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

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| vivo | We support to discuss the identified issue during the meeting. |
| ASUSTeK | Agree with Moderator’s assessment. |
| Samsung | OK to discuss although the proposal is an optimization targeting a rare event that is also under the Gnb control and does not impact system throughput. |
| OPPO | The issue is valid. However, TP provided by QC is not accurate, especially for the condition “ if the UE is not provided *pucch-sSCellDyn* and *pucch-sSCellDynDCI-1-2*”, which is too board and covers any scenario not supporting dynamic PUCCH cell switch. |
|  |  |

### 2.7.4 Scheduled offline session, Mon 22nd

offline outcome:

* The issues is to be treated during RAN1#110
* Continue discussion during the week
	+ Potential outcome: individual CR
	1. Issue#8: Second HARQ-ACK information for SPS deferral

### 2.8.1 Companies inputs

CATT a draft CR in [R1-2206942](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206942.zip):

* Reason: For SPS HARQ-ACK deferral defined in section 9.2.5.4 of 38.214,
	+ The definition of the second HARQ-ACK information should be provided earlier when the the second HARQ-ACK information is used;
	+ The description for the second HARQ-ACK information bits appending in a HARQ-ACK codebook should be a sub-bullet of descriptions for UE determines an earliest second slot.
* Change:
	+ Move the definition of the second SPS HARQ-ACK to the main bullet;
	+ Change the description for the second HARQ-ACK information bits appending in a HARQ-ACK codebook as a sub-bullet of descriptions for UE determines an earliest second slot.

The related change in 38.213 reads as:

|  |
| --- |
| 9.2.5.4 UE procedure for deferring HARQ-ACK for SPS PDSCH If a UE is provided *spsHARQdeferral* 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 *spsHARQdeferral* 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~~- the second HARQ-ACK information bits correspond to SPS PDSCH configurations with~~ *~~spsHARQdeferral~~* ~~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 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 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- 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 *spsHARQdeferral* and *nrofSlots* or *PUCCH-nrofSlots* for any PUCCH resource of same priority. |

### 2.8.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**(Initial) Moderator assessment:**

* If the change is absolutely required (‘essential’) may be a matter of taste, as the current specification seems to be not broken

**Moderator suggested handling:**

* **Discuss / decide during the first offline session if this is to be treated during RAN1#110 (based on the initial companies’ inputs)**
* Some more detailed offline discussions may be needed

### 2.8.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

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

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

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| vivo | We think the correct is improvement of spec description for better readability. But it is not essential. |
| DOCOMO | Seems not essential. |
| Samsung | OK to discuss – may be included in a general editorial CR (it is not Cat-F). |
| ZTE | Not essential, but be better for wording of specification.  |
| CATT | We are fine to include in a combined editorial CR. |
| OPPO | Share with moderator’s assessment |
| InTEL  | We think it is not essential |
| LG | We think it is not essential.  |

### 2.8.4 Scheduled offline session, Mon 22nd

Correction seems to be not essential but may improve specs readability.

offline consensus:

**The identified required changes by CATT in** [**R1-2206942**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206942.zip) **are to be reflected in the 38.213 editor alignment CR.**

* 1. Issue #9: PUCCH-sSCell changes for secondary PUCCH group in 38.213

### 2.9.1 Companies inputs

Huawei / HiSi provided a draft CR in [R1-2207660](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2207660.zip), which reads as:

|  |
| --- |
| 9 UE procedure for reporting control informationIf a UE is configured with a SCG, the UE shall apply the procedures described in this clause for both MCG and SCG.- When the procedures are applied for MCG, the terms 'secondary cell', 'secondary cells' , 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell, serving cells belonging to the MCG respectively.- When the procedures are applied for SCG, the terms 'secondary cell', 'secondary cells', 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells (not including PSCell), serving cell, serving cells belonging to the SCG respectively. The term 'primary cell' in this clause refers to the PSCell of the SCG.If a UE is configured with a PUCCH-SCell, the UE shall apply the procedures described in this clause for both primary PUCCH group and secondary PUCCH group- When the procedures are applied for the primary PUCCH group, the terms 'secondary cell', 'secondary cells' , 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell, serving cells belonging to the primary PUCCH group respectively.- When the procedures are applied for secondary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells (not including the PUCCH-SCell), serving cell, serving cells belonging to the secondary PUCCH group respectively. The term 'primary cell' in this clause refers to the PUCCH-SCell of the secondary PUCCH group. If *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16* is provided, *pdsch-HARQ-ACK-Codebook* is replaced by *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16*. If *harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup* is provided, *harq-ACK-SpatialBundlingPUCCH* is replaced by *harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup*. If *harq-ACK-SpatialBundlingPUSCH-secondaryPUCCHgroup* is provided, *harq-ACK-SpatialBundlingPUSCH* is replaced by *harq-ACK-SpatialBundlingPUSCH-secondaryPUCCHgroup*. If *UCI-MuxWithDifferentPriority-secondaryPUCCHgroup* is provided, *UCI-MuxWithDifferentPriority* is replaced by *UCI-MuxWithDifferentPriority-secondaryPUCCHgroup*. If *simultaneousPUCCH-PUSCH-secondaryPUCCHgroup* is provided, *simultaneousPUCCH-PUSCH* is replaced by *simultaneousPUCCH-PUSCH-secondaryPUCCHgroup*. If *pucch-sSCellSecondaryPUCCHgroup* is provided, *pucch-sSCell* is replaced by *pucch-sSCellSecondaryPUCCHgroup*. If *pucch-sSCellPatternSecondaryPUCCHgroup* is provided, *pucch-sSCellPattern* is replaced by *pucch-sSCellPatternSecondaryPUCCHgroup*. If *pucch-sSCellDynSecondaryPUCCHgroup* is provided, *pucch-sSCellDyn* is replaced by *pucch-sSCellDynSecondaryPUCCHgroup*. If *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList* is provided, *pdsch-HARQ-ACK-EnhType3ToAddModList* is replaced by *pdsch-HARQ-ACK-EnhType3SecondaryToAddModList*. If *pdsch-HARQ-ACK-RetxSecondaryPUCCHgroup* is provided, *pdsch-HARQ-ACK-Retx* is replaced by *pdsch-HARQ-ACK-RetxSecondaryPUCCHgroup*.< Unchanged parts are omitted > |

### 2.9.2 Initial (pre-meeting) moderator assessment & suggested handling during RAN1#110

**Moderator assessment:**

* The issues is valid (i.e. the parts suggested by HW/HiSi are missing) and the draft CR seems to be technically correct

**Moderator suggested handling:**

* **Treat this issues during RAN1#110**
* Try to agree the HW draft CR in [R1-2206149](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206149.zip) by changing the sourcing companies to Moderator (Nokia), Huawei, HiSilicon

### 2.9.3 Initial input by companies till Mon, 15.00 CET

**Question: Do you support discussing the above during RAN1#110?**

|  |  |
| --- | --- |
| Yes - support:  | Vivo, Huawei/Hisi, DOCOMO, ASUSTeK, Samsung, CATT, Spreadtrum, NEC,OPPO, Intel, LG |
| No - not support:  |  |

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

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| vivo | We are fine to dicuss it during the meeting.  |
| ZTE | If 38.331 has captured these RRC parameters, should we repeat in 38.213 again? |
|  |  |
|  |  |
|  |  |

### 2.9.4 Scheduled offline session, Mon 22nd

Seems to be, that most companies think this should be discussed. Maybe we could try to refer this to the editor CR as well.

offline outcome:

**The identified required changes by Huawei / HiSilicon in** [**R1-2206149**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110/Docs/R1-2206149.zip) **are to be included in the 38.213 editor alignment CR.**

# 3 Outcome

TBA