**3GPP TSG-RAN WG1 Meeting #117 *R1-2405531***

**Fukuoka, Japan, May 20th – 24th, 2024**

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| *CR-Form-v12.2* |
|  **Draft CHANGE REQUEST** |
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|  | **38.213** | **CR** | **XXX** | **rev** | **-** | **Current version:** | **18.2.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Correction on HARQ-ACK multiplexing on a PUSCH repetition [HARQ-ACK MUX on PUSCH] |
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| ***Source to WG:*** | Moderator (Huawei), HiSilicon, Samsung, Ericsson, ZTE |
| ***Source to TSG:*** | R1 |
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| ***Work item code:*** | TEI-18 |  | ***Date:*** | 2024-05-23 |
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| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | A RAN2 CR R2-2401977 is agreed for capturing the RRC signallings for Rel-18 TEI [HARQ-ACK MUX on PUSCH] and the latest version of TS38.331 (v18.1.0) already captured them after RAN #103. However, RAN1 spec has not been updated accordingly and related RRC signallings is ambiguious.When UE is not provided for either “*enableDiffPUCCH-Resource*” or “*enableDiffCB-Size*”, it requires same PUCCH resource in time domain or same codebook size repectively. However, the reference to determine “same time domain” or “same codebook size” is not clear in the spec. On the other hand, RAN1 clarified the supported cases for Rel-18 TEI in RAN1 #116 in following conclusion, but the case 2 in R1-2400675 is not captured explicitly in the spec.

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| **Conclusion*** The Case 1 and Case 2 in [R1-2400675](file:///C%3A%5C3gpp%5CMeetings%5CTSGR1%5CTSGR1_116%5CDocs%5CR1-2400675.zip) are supported by existing TEI agreements made in RAN1#115.
* Case 2 in [R1-2400675](file:///C%3A%5C3gpp%5CMeetings%5CTSGR1%5CTSGR1_116%5CDocs%5CR1-2400675.zip) is supported with UE capability FG 55-4e.
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| ***Summary of change:*** | Update RRC signallings for R18 TEI in RAN1 spec based on the lastest version of TS38.331.Calrify the reference to determine “same time domain” or “same codebook size”, and add the missing Case 2 agreed in RAN1 #116. |
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| ***Consequences if not approved:*** | Both gNB and UE cannot find correct RRC singallings to generate HARQ codebook corresponding to the PDSCHs scheduled after UL grant.UE does not know which PUCCH resource or codebook is used for comaparing when it cannot support using a new PUCCH resource in different time domain or codebook size should be kept unchanged. On the other hand, the case 2 in R1-2400675 cannot be supported by UE.  |
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| ***Clauses affected:*** | 9 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | **Isolated Impact Analysis:**The CR has isolated impact on HARQ codebook generation to include HARQ information corresponding to PDSCH(s) scheduled after a non-initial PUSCH repetition and multiplexed on the PUSCH repetition. |
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| ***This CR's revision history:*** | Initial version |

# 9 UE procedure for reporting control information

\*\*\* Unchanged parts are omitted \*\*\*

A UE does not expect to detect a first DCI format having associated HARQ-ACK information without scheduling a PDSCH reception, and indicating a resource for a PUCCH transmission with a HARQ-ACK codebook that would include the HARQ-ACK information in a slot if the UE

- detects a second DCI format in a PDCCH monitoring occasion, that starts before a PDCCH monitoring occasion for the first DCI format, that schedules a PUSCH transmission in the slot, and

- multiplexes the HARQ-ACK codebook in the PUSCH transmission in the slot.

If a UE

- is not provided any of *enableType1HARQ-ACK-MuxForDL-AssignmentAfterUL-Grant*, or *enableType2HARQ-ACK-MuxForDL-AssignmentAfterUL-Grant*, or *enableType3HARQ-ACK-MuxForDL-AssignmentAfterUL-Grant*, or

- is provided *uci-MuxWithDiffPrio*, or

- transmits a PUSCH without repetitions or transmits a first repetition of a PUSCH transmission,

the UE does not expect to detect a first DCI format scheduling a PDSCH reception and indicating a resource for a PUCCH transmission with corresponding HARQ-ACK information that would be included in a HARQ-ACK codebook in a slot if the UE

- previously detects a second DCI format scheduling the PUSCH transmission in the slot, and

- multiplexes the HARQ-ACK codebook in the PUSCH transmission in the slot.

If a UE

- is provided *enableType1HARQ-ACK-MuxForDL-AssignmentAfterUL-Grant*, or *enableType2HARQ-ACK-MuxForDL-AssignmentAfterUL-Grant*, or *enableType3HARQ-ACK-MuxForDL-AssignmentAfterUL-Grant*, and

- is not provided *uci-MuxWithDiffPrio*, and

- transmits a repetition of a PUSCH transmission in a slot other than a first repetition,

the UE includes, in a HARQ-ACK codebook, HARQ-ACK information associated with a PDSCH reception scheduled by a first DCI format, in a first PDCCH monitoring occasion, indicating a first resource for a first PUCCH transmission in the slot, when

- the first resource overlaps with the repetition of the PUSCH transmission

- the PUSCH transmission is scheduled by a second DCI format in a second PDCCH monitoring occasion, and

- the UE multiplexes the HARQ-ACK codebook in the PUSCH transmission in the slot, and

- the timeline conditions in clause 9.2.3 for PUCCH resource determination and the timeline conditions of $T\_{proc,1}^{mux}$ and $T\_{proc,2}^{mux}$ for multiplexing the HARQ-ACK information in the PUSCH, as described in clause 9.2.5, are satisfied,

where

- the first PUCCH resource is same in the time domain as a second PUCCH resource that the UE determines for the PUCCH transmission with the HARQ-ACK information in the slot if the UE is not provided *enableDiffPUCCH-Resource* and the first PDCCH monitoring occasion starts after the second PDCCH monitoring occasion, and

- the second PUCCH resource

- is indicated by the last DL DCI format in a third PDCCH monitoring occasion that starts no later than the second PDCCH monitoring occasion, or

- is for the PUCCH transmission with the HARQ-ACK information associated only with SPS PDSCHs activated by DCI formats in PDCCH monitoring occasions that start no later than the second PDCCH monitoring occasion

- UE expects that the size of the HARQ-ACK codebook based on a DAI value of the second DCI format remains the same if the UE is not provided*enableDiffCB-Size*.

\*\*\* Unchanged parts are omitted \*\*\*