**3GPP TSG-RAN WG1 Meeting #117 *R1-24xxxxx***

**Fukuoka, Japan, May 20 – 24, 2024**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.213** | **CR** |  | **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:*** | Clarification on not multiplexing UCI on MSG3 PUSCH | | | | | | | | | |
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| ***Source to WG:*** | Nokia | | | | | | | | | |
| ***Source to TSG:*** | R1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Core, TEI18 | | | | |  | ***Date:*** | | | 2024-05-22 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***Release:*** | | | 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 can be 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:*** | | The current specification can be understood so that if a UE in RRC connected mode initiates a RACH procedure and the Msg3 PUSCH would overlap with a PUCCH, the UE should multiplex the UCI on Msg3 PUSCH as if the Msg3 PUSCH were a regular PUSCH. However, the gNB would not be able to identify the UE trasmitting the Msg3 PUSCH and thus would not know that the same UE is to transmit UCI. So if the UCI is multiplexed on the Msg3 PUSCH the gNB would not be able to decode the PUSCH nor the UCI and the RACH procedure would fail.  If the UE multiplexes UCI on Msg3 PUSCH, this may cause e.g. the beam failure recovery and the scheduling request failure procedures fail. The UCI collision with Msg3 can appear with a high probability in TDD cells when the HARQ-ACKs and CSI reports are concentrated in time, increasing the likelihood that UE has UCI to transmit on top of beam failure recovery or scheduling request recovery Msg3 PUSCH.  A corresponding UCI dropping when colliding with Msg3 PUSCH has been specified for LTE (10.1 of 36.213). | | | | | | | | |
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| ***Summary of change:*** | | Clarifying that UCI should not be multiplexed on Msg3 PUSCH. | | | | | | | | |
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| ***Consequences if not approved:*** | | If the UE multiplexes UCI on Msg3 PUSCH, as the gNB is not aware of which UE is transmitting the Msg3 PUSCH, the gNB cannot know if/what UCI is being multiplexed, leading to the loss of both the UCI and the PUSCH, and to a failure of the random access procedure. This leads to beam failure recovery and scheduling request failure procedures to fail with high probability especially on TDD cells. | | | | | | | | |
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| ***Clauses affected:*** | | 9 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **x** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | |  | | |
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| ***Other comments:*** | | **RAN1#117 agreed to reflect the following conclusion in the CR cover page:**   * If a Msg3 PUSCH scheduled by a RAR UL grant or a DCI with CRC scrambled by TC-RNTI overlaps with a PUCCH, it is up to the UE to transmit either the Msg3 PUSCH or the PUCCH   **Isolated impact analysis: The CR impact is isolated to Msg3 PUSCH transmission that is overlapped with a PUCCH transmission**   * The gNB cannot assume UCI on PUSCH, and thus is by definition always implemented according to the CR * If the UE is implemented according to the CR the random access attempt succeeds. * If the UE is not implemented according to the CR and it multiplexes UCI on Msg3 both the UCI and the Msg3 PUSCH will fail and the random access procedure will fail. | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

# 9 UE procedure for reporting control information

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* UNCHANGED PARTS OMITTED \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

If a UE multiplexes aperiodic CSI in a PUSCH and the UE would multiplex UCI that includes HARQ-ACK information in a PUCCH that overlaps with the PUSCH and the timing conditions for overlapping PUCCHs and PUSCHs in clause 9.2.5 are fulfilled, the UE multiplexes only the HARQ-ACK information in the PUSCH and does not transmit the PUCCH.

When a UE transmits multiple PUSCHs on respective serving cells in a slot with reference to slots for PUCCH transmissions and the multiple PUSCHs overlap with a PUCCH carrying UCI in the slot, the UE selects all the PUSCHs overlapping with the PUCCH as the candidate PUSCHs for UCI multiplexing within the slot.

If a UE would transmit a single PUSCH scheduled by a DCI format that includes a DAI field on a serving cell in a slot with reference to slots for PUCCH transmissions without any other PUSCH that would be transmitted on any serving cell in the slot and the UE does not determine any PUCCH carrying HARQ-ACK information in the slot, or if the UE indicates the corresponding capability *mux-HARQ-ACK-withoutPUCCH-onPUSCH* and the UE transmits multiple PUSCHs on respective serving cells in a slot with reference to slots for PUCCH transmissions and the UE does not determine any PUCCH carrying HARQ-ACK information in the slot and at least one of the multiple PUSCHs is scheduled by a DCI format that includes a DAI field, the UE selects the single PUSCH or all the multiple PUSCHs in the slot as the candidate PUSCHs for HARQ-ACK multiplexing within the slot except for any PUSCH among the multiple PUSCHs that is scheduled by a DCI format that includes a DAI field that is equal to 4 in case the UE is configured with *pdsch-HARQ-ACK-Codebook = dynamic* or with *pdsch-HARQ-ACK-Codebook-r16*, or is equal to 0 in case the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*.

If a Msg3 PUSCH scheduled by a RAR UL grant or a DCI with CRC scrambled by TC-RNTI overlaps with a PUCCH, the UE does not multiplex UCI on the Msg3 PUSCH.

The UE determines the PUSCH for UCI multiplexing by applying the following procedure on the candidate PUSCHs as described in this clause:

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* UNCHANGED PARTS OMITTED \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***