3GPP TSG RAN WG1 #103-e R1-20xxxxx

**e-Meeting, October 26th – November 13th, 2020**

**Title: LS on PUSCH skipping with UCI in Rel-16**

**Release: Rel-16**

**Work Item: NR\_newRAT-Core, TEI16**

**Source:** RAN1

**To:** RAN2

**Cc:**

**Attachments:**  R1-2009687

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**1. Overall Description:**

In RAN1 #103-e meeting, RAN1 discussed the PUSCH skipping with UCI for dynamic grant and configured grant. On the case of dynamic grant, RAN1 agreed a new CR (R1-2009687) with correct spec version, which is a revision of the CR (R1-2007337) endorsed in RAN1 #102-e meeting. RAN1 expects RAN2 to agree the corresponding RAN2 CR so that both the RAN1 and RAN2 CRs can be submitted to RAN plenary together for final approval.

The discussions on PUSCH skipping with UCI in RAN1, including the agreements made for DG PUSCH in RAN1#102-e, were based on the assumptions where LCH based prioritization is not configured and there is a single PHY priority for UL transmission.

RAN1 discussed the following cases considering both PUSCH skipping with UCI for dynamic grant and configured grant. The examples are provided in the figures for each case in case of a single carrier.

* Case 1-2: only one or more CG PUSCHs overlapping with PUCCH
* Case 1-3: DG PUSCH and CG PUSCH are overlapping and both DG/CG PUSCH are overlapping with PUCCH
* Case 1-4: DG PUSCH and CG PUSCH are overlapping and DG PUSCH is overlapping with PUCCH, and CG PUSCH is non-overlapping with the PUCCH
* Case 1-5: DG PUSCH and CG PUSCH are non-overlapping and both DG/CG PUSCH are overlapping with PUCCH
* Case 1-6: DG PUSCH and CG PUSCH are overlapping and CG PUSCH is overlapping with PUCCH, and DG PUSCH is non-overlapping with the PUCCH

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| **Case 1-2** | **Case 1-3** |
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| **Case 1-4** | **Case 1-5** |
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| **Case 1-6** |

For Case 1-2 of only one or more CG PUSCHs overlapping with PUCCH, RAN1 discussed the behavior of PUSCH skipping with UCI for configured grant in Rel-16 and made the following agreement.

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| **Possible agreement**For the case (Case 1-2) where only one or more CG PUSCHs overlapping with PUCCH* In Rel.16, for CA and non-CA case, when Rel-16 LCH based prioritization is not configured and there is a single PHY priority for  UL transmissions, and when PUSCH repetition is not applied, in case of one or more CG PUSCHs overlapping with UCI and there is no DG PUSCH overlapping with the UCI and there is no DG PUSCH overlapping with the one or more CG PUSCHs, the CG PUSCH with UCI multiplexing from the one or more CG PUSCHs cannot be skipped.  MAC generates MAC PDU for the CG PUSCH and delivers the MAC PDU to PHY and the UCI is multiplexed on the CG PUSCH.
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For Case 1-3/1-4/1-5, RAN1 has common understading and following conclusion is drawn in RAN1

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| **Possible conclusion**For the following cases, for CA and non-CA, when DG PUSCH skipping is configured and Rel-16 LCH based prioritization is not configured and there is a single PHY priority for UL transmissions, MAC generates MAC PDU for the DG PUSCH and the UCI is multiplexed on the DG PUSCH. For Case 1-3 and Case 1-4, MAC does not generate a TB for the CG PUSCH(s) overlapping with the DG PUSCH on the same serving cell.  The GG PUSCH(s) is discarded and does not participate in subsequent physical layer procedure.* (Case 1-3) DG PUSCH and CG PUSCH are overlapping and both DG/CG PUSCH are overlapping with PUCCH
* (Case 1-4) DG PUSCH and CG PUSCH are overlapping and DG PUSCH is overlapping with PUCCH, and CG PUSCH is non-overlapping with the PUCCH
* (Case 1-5) DG PUSCH and CG PUSCH are non-overlapping and both DG/CG PUSCH are overlapping with PUCCH
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For Case 1-6, RAN1 discussed the following options of expected behavior from RAN1 understanding and made the following working assumptions, for which there is difference on UCI multiplexing behavior in PHY [R1-20xxxxx]. RAN1 will continue discussing the expected behavior for Case 1-6 based on these options.

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| **Possible Working Assumption:**For the case (Case 1-6) when DG PUSCH and CG PUSCH are overlapping on a serving cell and CG PUSCH is overlapping with PUCCH, and DG PUSCH is non-overlapping with the PUCCH* In Rel.16, for non-CA case, When DG PUSCH skipping is configured and Rel-16 LCH based prioritization is not configured and there is a single PHY priority for UL transmissions, and when PUSCH repetition is not applied, in case of one or more CG PUSCHs overlapping with UCI and there is DG PUSCH overlapping with the CG PUSCHs on a serving cell and not overlapping with the UCI
	+ Opt-3:
		- * If there is data for DG, MAC generates PDU for DG PUSCH
				+ UCI is transmitted on PUCCH.
			* If there is no data for DG, MAC does not generate PDU for DG or CG PUSCH
				+ UCI is transmitted on PUCCH.
	+ Opt-4:
		- If there is data for DG, MAC generates PDU for DG PUSCH
			* UCI is dropped together with CG PUSCH.
		- If there is no data for DG, MAC does not generate PDU for DG or CG PUSCH.
			* UCI is dropped together with CG PUSCH.

  Note: In RAN1#104-e, it aims to resolve case 1-6 using above options as a starting point, other options are not precluded. |

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In addition, RAN1 noticed that in legacy Rel-15 and Rel-16, for configured grant, skipping UL configured grant if no data to transmit is conditionally mandatory feature. It is RAN1’s understanding that the agreement in RAN1 for case 1-2 will change the UE behavior for CG PUSCH. RAN1 considers it may be necessary to introduce a new capability/signalling to differentiate the new UE behaviour and the legacy UE behaviour. RAN1 will further discuss the capability for case 1-3, 1-4, 1-5, 1-6 where the uplink skipping involving both DG PUSCH and CG PUSCH after the behaviors for these cases are determined.

**2. Actions:**

RAN1 respectfully asks RAN2 to

* Take into account the above agreements and update Rel-16 TS 38.321 to support Rel-16 PUSCH skipping
* Resolve the capabability signaling issue for Rel-16 CG PUSCH skipping

**3. Date of Next RAN1 Meetings:**

TSG-RAN WG1 Meeting #104-e 25th January – 5th February 2021 E-meeting.

TSG-RAN WG1 Meeting #104bis-e 12th April – 20th April 2021 E-meeting.