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

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

Source: vivo

Title: Summary of [103-e-NR-7.1CRs-08] discussions on PUSCH skipping (Rel-16) #1

Agenda Item: 7.1

Document for: Discussion and Decision

# Introduction

The document provides a summary for the email discussion thread [103-e-NR-7.1CRs-08] Discussions on PUSCH skipping (Rel-16). **Note that the deadline for the discussion for the email thread and the corresponding TP is set to be 10/29 and 11/5. Please provide the comments by 10/27 UTC 4:59 pm.**

[103-e-NR-7.1CRs-08] Discussions on PUSCH skipping (Rel-16) – vivo

* Discussion and decision by 10/29, TPs by 11/5

# Discussions on CR for DG PUSCH with skipping

In RAN1 #102-e meeting, following agreements were made for UL skipping of dynamic UL grant.

Agreement

* For UL skipping of dynamic UL grant in non-CA and CA case, when there is PUCCH carrying UCI overlapping with a set of PUSCHs, the PUSCH with UCI multiplexing from the set cannot be skipped. MAC generates MAC PDU for the PUSCH and the UCI is multiplexed on the PUSCH.

Agreement

The following text proposal for TS38.214 is endorsed. Final CR is agreed in R1-2007337 (TS 38.214, Rel-16, CR#0123, Cat F).

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| **6.1 UE procedure for transmitting the physical uplink shared channel**<unchanged part omitted>A UE shall upon detection of a DCI format scheduling a PUSCH transmit the corresponding PUSCH unless the UE does not generate a transport block as described in [10, TS38.321]. Upon detection of a DCI format 0\_1 or 0\_2  with "UL-SCH indicator" set to "0" and with a non-zero "CSI request" where the associated "reportQuantity" in *CSI-ReportConfig* set to "none" for all CSI report(s) triggered by "CSI request" in this DCI format 0\_1 or 0\_2, the UE ignores all fields in this DCI except the "CSI request" and the UE shall not transmit the corresponding PUSCH as indicated by this DCI format 0\_1 or 0\_2. When the UE is scheduled with multiple PUSCHs by a DCI, HARQ process ID indicated by this DCI applies to the first PUSCH, as described in clause 6.1.2.1, HARQ process ID is then incremented by 1 for each subsequent PUSCH(s) in the scheduled order, with modulo 16 operation applied. For any HARQ process ID(s) in a given scheduled cell, the UE is not expected to transmit a PUSCH that overlaps in time with another PUSCH. For any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i*, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i*. The UE is not expected to be scheduled to transmit another PUSCH by DCI format 0\_0, 0\_1 or 0\_2 scrambled by C-RNTI or MCS-C-RNTI for a given HARQ process until after the end of the expected transmission of the last PUSCH for that HARQ process. <unchanged part omitted> |

However, the agreed CR was based on Rel-15 TS 38.214 V15.10.0, instead of Rel-16 TS 38.214 V16.2.0. In RAN1 #103-e, a revision CR of [R1-2007337](file:///E%3A%5CWorkspace%5C3GPP%20related%5C3GPP%20meeting%5C2020%5C2020.Q4%5CRAN1%23103e%5CDocs%5CR1-2007337.zip) is submitted in [4], which has implemented the agreed text proposal into the specification with correct version number.

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| ***Reason for change:*** | This CR is a revision of [R1-2007337](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_102-e/Docs/R1-2007337.zip).Following two cases on dynamic UL skipping were discussed in RAN1 and related conclusions were made below.* Case 1: dynamic PUSCH skipping without overlapping CSI/HARQ-ACK on PUCCH
* Case 2: dynamic PUSCH skipping with overlapping CSI/HARQ-ACK on PUCCH

For Case 1, it was agreed in RAN1#100-e meeting that when a UL grant without UL-SCH field or UL-SCH =1 (if present) is detected by a UE configured with *skipUplinkTxDynamic*, the corresponding PUSCH transmission is skipped by the UE if no transport block for the PUSCH transmission is generated by MAC and there is no CSI/HARQ-ACK on PUCCH overlapping with the PUSCH.For Case 2, RAN1 agreed that in Rel-15, the UE behavior is undefined. Case 2 was further discussed in Rel-16 and RAN1 made the following agreement.**Agreement**For UL skipping of dynamic UL grant in non-CA and CA case, when there is PUCCH carrying UCI overlapping with a set of PUSCHs, the PUSCH with UCI multiplexing from the set cannot be skipped. MAC generates MAC PDU for the PUSCH and the UCI is multiplexed on the PUSCH. |
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| ***Summary of change:*** | To capture the UE behavior for Case 1 in 38.214 section 6.1 that a PUSCH is not transmitted by the UE when the UE does not generate a transport block.  |

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| 6.1 UE procedure for transmitting the physical uplink shared channel<unchanged part omitted>A UE shall upon detection of a PDCCH with a configured DCI format 0\_0, 0\_1 or 0\_2 transmit the corresponding PUSCH as indicated by that DCI unless the UE does not generate a transport block as described in [10, TS38.321]. Upon detection of a DCI format 0\_1 or 0\_2 with "UL-SCH indicator" set to "0" and with a non-zero "CSI request" where the associated "reportQuantity" in *CSI-ReportConfig* set to "none" for all CSI report(s) triggered by "CSI request" in this DCI format 0\_1 or 0\_2, the UE ignores all fields in this DCI except the "CSI request" and the UE shall not transmit the corresponding PUSCH as indicated by this DCI format 0\_1 or 0\_2. When the UE is scheduled with multiple PUSCHs by a DCI, HARQ process ID indicated by this DCI applies to the first PUSCH, as described in clause 6.1.2.1, HARQ process ID is then incremented by 1 for each subsequent PUSCH(s) in the scheduled order, with modulo 16 operation applied. For any HARQ process ID(s) in a given scheduled cell, the UE is not expected to transmit a PUSCH that overlaps in time with another PUSCH. For any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i*, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i*. The UE is not expected to be scheduled to transmit another PUSCH by DCI format 0\_0, 0\_1 or 0\_2 scrambled by C-RNTI or MCS-C-RNTI for a given HARQ process until after the end of the expected transmission of the last PUSCH for that HARQ process. <unchanged part omitted> |

**Proposal 1: Adopt the revision CR on 38.214 for Rel-16 in R1-2008655.**

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| **Company** | **Comment** |
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# Discussions on CG PUSCH overlapping with UCI

In RAN1 #102-e meeting, there were some discussions on CG PUSCH overlapping with PUCCH. Following options were proposed for CG PUSCH when there is PUCCH carrying UCI overlapping with a set of CG PUSCHs for non-CA and CA case. However, there was no conclusion on it.

In this meeting, CG PUSCH overlapping with UCI are discussed in 4 tdocs provided in [1][2][3][5].

**Round #1 discussion:**

Before we discuss whether and how to address the case of CG PUSCH overlapping with UCI for Rel-16, it is better to clarify the understandings on the CG PUSCH overlapping with UCI for Rel-15.

In Rel-15, a UE can indicate whether it supports more than one configured grant configurations (including both Type 1 and Type 2) in a cell group by “*multipleConfiguredGrants*” as in 38.306. For each cell, the UE supports at most one configured grant per BWP and the maximum number of configured grant configurations per cell group is 2.

According to current specification, for configured grant, it is conditionally mandatory feature that a UL configured grant PUSCH will be skipped if no data to transmit. As result, when a CG PUSCH overlapping with a PUCCH carrying UCI, the UCI would be multiplexed on the CG PUSCH if there are data to transmit on the PUSCH. Otherwise, the UCI would be transmitted on the PUCCH and the CG PUSCH would be skipped. In such case, gNB needs to perform blind detection for both CG PUSCH transmission and PUCCH transmission.

Based on the behaviour defined in Rel.15 for CG PUSCH overlapping with UCI, when there is single CG PUSCH overlapping with UCI, the complexity of blind detection for UCI on CG PUSCH or PUCCH may not be an issue for gNB.

When there are more than one CG PUSCH overlapping with UCI with *N*<=2 CG configurations per cell group, e.g. as shown in the following figures, it needs to further clarify by companies whether the complexity of blind detection on which UCI would be multiplexed is acceptable for gNB.



**Figure 1: multiple CG PUSCHs of single CG configuration on single CC overlapping with UCI**



**Figure 2: multiple CG PUSCHs of multiple CG configurations on multiple CCs overlapping with UCI**

**In Rel.15, when a CG PUSCH overlapping with a PUCCH carrying UCI, the UCI would be multiplexed on the CG PUSCH if there are data to transmit on the PUSCH. Otherwise, the UCI would be transmitted on the PUCCH and the CG PUSCH would be skipped.**

* **Q-1: When there are more than one CG PUSCH overlapping with UCI with *N*<=2 CG configurations per cell group, whether the complexity of blind detection on which UCI would be multiplexed is acceptable for gNB for the following cases?**
	+ **Case 1: multiple CG PUSCHs of single CG configuration on single CC overlapping with UCI**
	+ **Case 2: multiple CG PUSCHs of multiple CG configurations on multiple CCs overlapping with UCI**

**Please provide your comments on Q-1.**

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| **Company** | **Comment** |
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# List of contributions

1. R1-2008426 Discussions on PUSCH skipping Apple

1. [R1-2008528](file:///C%3A%5C%5CUsers%5C%5Cwanshic%5C%5COneDrive%20-%20Qualcomm%5C%5CDocuments%5C%5CStandards%5C%5C3GPP%20Standards%5C%5CMeeting%20Documents%5C%5CTSGR1_103%5C%5CDocs%5C%5CR1-2008528.zip) Discussion on CG skipping vs UCI multiplexing on CG PUSCH NTT DOCOMO, INC.

1. [R1-2008654](file:///C%3A%5C%5CUsers%5C%5Cwanshic%5C%5COneDrive%20-%20Qualcomm%5C%5CDocuments%5C%5CStandards%5C%5C3GPP%20Standards%5C%5CMeeting%20Documents%5C%5CTSGR1_103%5C%5CDocs%5C%5CR1-2008654.zip) Disucssion on configured grant PUSCH with overlapping UCI on PUCCH in Rel-16 vivo

1. R1-2008655 Correction on 38.214 for PUSCH with UL skipping in Rel-16 vivo

1. [R1-2008776](file:///C%3A%5C%5CUsers%5C%5Cwanshic%5C%5COneDrive%20-%20Qualcomm%5C%5CDocuments%5C%5CStandards%5C%5C3GPP%20Standards%5C%5CMeeting%20Documents%5C%5CTSGR1_103%5C%5CDocs%5C%5CR1-2008776.zip) Discussion on UL skipping for CG PUSCH Huawei, HiSilicon

# Agreements (RAN1 #102-e)

Agreement

* For UL skipping of dynamic UL grant in non-CA and CA case, when there is PUCCH carrying UCI overlapping with a set of PUSCHs, the PUSCH with UCI multiplexing from the set cannot be skipped. MAC generates MAC PDU for the PUSCH and the UCI is multiplexed on the PUSCH.

Agreement

The following text proposal for TS38.214 is endorsed. Final CR is agreed in [R1-2007337](file:///E%3A%5CWorkspace%5C3GPP%20related%5C3GPP%20meeting%5C2020%5C2020.Q4%5CRAN1%23103e%5CDocs%5CR1-2007337.zip) (TS 38.214, Rel-16, CR#0123, Cat F).

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| **6.1 UE procedure for transmitting the physical uplink shared channel**<unchanged part omitted>A UE shall upon detection of a DCI format scheduling a PUSCH transmit the corresponding PUSCH unless the UE does not generate a transport block as described in [10, TS38.321]. Upon detection of a DCI format 0\_1 or 0\_2  with "UL-SCH indicator" set to "0" and with a non-zero "CSI request" where the associated "reportQuantity" in *CSI-ReportConfig* set to "none" for all CSI report(s) triggered by "CSI request" in this DCI format 0\_1 or 0\_2, the UE ignores all fields in this DCI except the "CSI request" and the UE shall not transmit the corresponding PUSCH as indicated by this DCI format 0\_1 or 0\_2. When the UE is scheduled with multiple PUSCHs by a DCI, HARQ process ID indicated by this DCI applies to the first PUSCH, as described in clause 6.1.2.1, HARQ process ID is then incremented by 1 for each subsequent PUSCH(s) in the scheduled order, with modulo 16 operation applied. For any HARQ process ID(s) in a given scheduled cell, the UE is not expected to transmit a PUSCH that overlaps in time with another PUSCH. For any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i*, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i*. The UE is not expected to be scheduled to transmit another PUSCH by DCI format 0\_0, 0\_1 or 0\_2 scrambled by C-RNTI or MCS-C-RNTI for a given HARQ process until after the end of the expected transmission of the last PUSCH for that HARQ process. <unchanged part omitted> |

Agreement

Send an LS to RAN2 to inform them of the latest RAN1 agreement on uplink skipping.

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| In Rel-15, for dynamic UL skipping, RAN1 discussed the LS [R1-2000015](file:///E%3A%5CWorkspace%5C3GPP%20related%5C3GPP%20meeting%5C2020%5C2020.Q4%5CRAN1%23103e%5CDocs%5CR1-2000015.zip) from RAN2 and provided replies in [R1-2001376](file:///E%3A%5CWorkspace%5C3GPP%20related%5C3GPP%20meeting%5C2020%5C2020.Q4%5CRAN1%23103e%5CDocs%5CR1-2001376.zip) for Case 1 of dynamic PUSCH skipping without overlapping CSI/HARQ-ACK on PUCCH.Case 2 of dynamic PUSCH skipping with overlapping CSI/HARQ-ACK on PUCCH was further discussed in RAN1. In RAN1#101-e meeting, it was concluded that in Rel-15, the UE behavior is undefined for case 2 and case 2 can be addressed for Rel-16. Endorsed CR [R1-2005044](file:///E%3A%5CWorkspace%5C3GPP%20related%5C3GPP%20meeting%5C2020%5C2020.Q4%5CRAN1%23103e%5CDocs%5CR1-2005044.zip) (TS38.214, Rel-15, CR#0105, Cat. F) for Case 1 and Case 2 can be found in the attachment. In Rel-16, RAN1 continued the discussion for Case 2 and made following agreements in RAN1#102-e meeting:

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| AgreementFor UL skipping of dynamic UL grant in non-CA and CA case, when there is PUCCH carrying UCI overlapping with a set of PUSCHs, the PUSCH with UCI multiplexing from the set cannot be skipped. MAC generates MAC PDU for the PUSCH and the UCI is multiplexed on the PUSCH. |

Based on above agreements, RAN1 in principle agreed the corrections for Rel-16 TS 38.214 (R1-200xxxx), assuming that RAN2 will update the Rel-16 sepcification TS 38.321 corresponding to the above agreement so that UE generates the MAC PDU for the PUSCH with UCI multiplexing. In addition, RAN1 noticed that in Rel-15, dynamic UL skipping is an optional feature with capability signaling (*skipUplinkTxDynamic*). It is RAN1’s understanding the dynamic UL skipping cannot be implemented based on the Rel-15 specification. For Rel-16 with the defined UE behavior for dynamic UL skipping, RAN1 has discussed  following two options for the capability signaling handling. However, the final decision on the capability design for Rel-16 dynamic UL skipping should be decided by RAN2. * Option 1: introduce a new UE capability for Rel-16 dynamic UL skipping
* Option 2: Reuse Rel-15 UE capability with the understanding that Rel-15 dynamic UL skipping is not implementable therefore UEs indicating this capability should implement Rel-16 behavior.
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LS is approved in:

[**R1-2007338**](file:///E%3A%5CWorkspace%5C3GPP%20related%5C3GPP%20meeting%5C2020%5C2020.Q4%5CRAN1%23103e%5CDocs%5CR1-2007338.zip) **LS on PUSCH with UL skipping RAN1, vivo**