3GPP TSG-RAN WG2 Meeting #118-e R2-22xxxxx

Online, May 09 – May 20, 2022

**Agenda item: 5.1.3**

**Source: Samsung**

**Title: Offline 014: Rel-15/16 User Plane**

**Document for: Discussion & Decision**

# Introduction

This document is a summary of the following offline discussion:

* [AT118-e][014][NR1516] User Plane (Samsung)

Scope: Treat R2-2204755, R2-2204756, R2-2204757, R2-2205682, R2-2205717, R2-2205718, R2-2205715, R2-2205716,  
Ph1 Determine agreeable parts, Ph2 for agreeable parts agree CRs (offline agreement, CB online only if necessary).

Intended outcome: Report, Agreed CRs

Deadline: Schedule 1

The following contributions are discussed:

* 5.1.3.1 MAC

R2-2204755 Clarification on SR and PUSCH collision OPPO, Samsung CR Rel-15 38.321 15.13.0 1231 - F NR\_newRAT-Core

R2-2204756 Clarification on SR and PUSCH collision OPPO, Samsung CR Rel-16 38.321 16.8.0 1232 - F NR\_newRAT-Core, NR\_IIOT-Core

R2-2204757 Clarification on SR and PUSCH collision OPPO, Samsung CR Rel-17 38.321 17.0.0 1233 - A NR\_newRAT-Core, NR\_IIOT-Core

R2-2205682 CR for procedure level alignment of UL skipping Apple CR Rel-16 38.321 16.8.0 1192 1 D NR\_IIOT-Core R2-2202524

R2-2205717 Clarification on Duplication MAC CE Samsung CR Rel-16 38.321 16.8.0 1282 - F NR\_IIOT-Core

R2-2205718 Clarification on Duplication MAC CE Samsung CR Rel-17 38.321 17.0.0 1283 - A NR\_IIOT-Core

* 5.1.3.2 RLC PDCP SDAP BAP

R2-2205715 CR for EHC decompression Samsung CR Rel-16 36.323 16.5.0 0300 - F NR\_IIOT-Core

R2-2205716 CR for EHC decompression Samsung CR Rel-17 36.323 17.0.0 0301 - A NR\_IIOT-Core

# Contact Information

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# Discussion

## SR vs PUSCH Resource Overlap

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| R2-2204755 Clarification on SR and PUSCH collision OPPO, Samsung CR Rel-15 38.321 15.13.0 1231 - F NR\_newRAT-Core  R2-2204756 Clarification on SR and PUSCH collision OPPO, Samsung CR Rel-16 38.321 16.8.0 1232 - F NR\_newRAT-Core, NR\_IIOT-Core  R2-2204757 Clarification on SR and PUSCH collision OPPO, Samsung CR Rel-17 38.321 17.0.0 1233 - A NR\_newRAT-Core, NR\_IIOT-Core |

When the MAC determines if there is SR vs. data collision, the MAC entity checks SR vs. data collision in the MAC entity (cell group) and data is selected for transmission in Rel-15. However, when two PUCCH groups for one MAC entity is configured, simultaneous transmissions associated with different PUCCH groups are allowed from the RAN1 perspective. It is not captured in the MAC specification at all. R2-2204755 proposed a simple clarification to add “as specified in TS 38.213”

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| 1> else, for the SR configuration corresponding to the pending SR:  2> when the MAC entity has an SR transmission occasion on the valid PUCCH resource for SR configured; and  2> if *sr-ProhibitTimer* is not running at the time of the SR transmission occasion; and  2> if the PUCCH resource for the SR transmission occasion does not overlap with a measurement gap; and  2> if the PUCCH resource for the SR transmission occasion does not overlap with a UL-SCH resource as specified in TS 38.213 [6]:  3> if *SR\_COUNTER* < *sr-TransMax*:  4> increment *SR\_COUNTER* by 1;  4> instruct the physical layer to signal the SR on one valid PUCCH resource for SR;  4> start the *sr-ProhibitTimer*. |

**Q1. Do companies support the proposed change of R2-2204755 (Rel-15 NR) and 4766 (further updates on Rel-16 IIOT)?**

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| **Company** | **Yes/No** | **Comment** |
| vivo | No | In our understanding, whether there is an overlapping between the PUCCH and PUSCH is anyway estimated by PHY (i.e. only the PHY can interpret the FDRA/TDRA info of PUSCH) per PUCCH group level (the MAC may ask PHY to check whether there is overlapping and the PHY subsequently report the result to MAC). In this sense, the current spec is clear. We fail to see the motivation to capture anything in the MAC spec about parallel transmission on two PUCCH groups.  [OPPO] Thanks for the comments. From our perspective, if so, why not we add “as specified in TS 38.213 [6]”, which is the way we used before (could be as a kind of interaction between MAC and PHY)? It does not hurt anything but can clarify how the overlapping is judged. |
| Qualcomm | No | Our understanding is that simultaneous Tx of SR and PUSCH is not supported in MAC is not because simultanous PUCCH+PUSCH transmission is not supported (at least in paper, cross-PUCCH group simultaneous transmission has been supported before R17), but because it is not necessary to send SR when PUSCH is sent.  [OPPO] Thanks for the comments. We understand that there are still some cases that SR is necessary to transmit, i.e. SR is triggered after MAC PDU associated with PUSCH is generated and delivered to PHY. In this case, we think it is reasonable to allow SR transmission since the SR related information is not included in the PUSCH(especially when SR has a high priority for the R16/R17 case).  [Ericsson] First, gNB may schedule retransmissions, thus the UL-SCH transmission may not help as there is no BSR possible that cancel the SR. This can significantly delay the gNB becoming aware of new data arrival in the UE.  Second, it is very clear from the MAC spec that SR can be triggerd, even when there is a PUSCH transmission, see the NOTE at the end of 5.4.5:  NOTE: MAC PDU assembly can happen at any point in time between uplink grant reception and actual transmission of the corresponding MAC PDU. BSR and SR can be triggered after the assembly of a MAC PDU which contains a BSR MAC CE, but before the transmission of this MAC PDU. In addition, BSR and SR can be triggered during MAC PDU assembly. |
| Huawei, HiSilicon | No | Share view as QC. In R15, SR and PUSCH overlapping was discussed in both RAN1 and RAN2, and the conclusion was it is up to RAN2 that SR is not needed when PUSCH is available, so we think the current MAC spec is clear. |
| MediaTek | No |  |
| ZTE | No | Same view with above |
| Nokia | No | Agree with others for Rel-15 the check of overlapping PUCCH and PUSCH in MAC is per MAC entity, not per PUCCH group.  [OPPO] Thanks for the comments. If this overlapping is checked per MAC entity, it results in the misalignment between RAN1 and RAN2. Accordingly, the UE can not support the simultaneous transmission of SR and PUSCH which is actually supported by RAN1. Especially, it will hurt the NR prioritization feature(R16/R17 IIoT feature). |
| LG | No | Same view as QC. SR is not needed when PUSCH is available. |
| OPPO | Yes  (Proponent) | According to 38.213, the overlapping behaviour in clause 9 (including SR related, e.g. SR overlaps PUSCH) is performed per PUCCH group. Thus, from the RAN1 point of view, it is clear that the cross-PUCCH group simultaneous transmission is supported from R15.  The issue here is the cross-PUCCH group simultaneous transmission is not allowed in MAC spec, since MAC spec is for the MAC entity operation considering multiple cells in CA. It results in the misalignment between RAN1 and RAN2. Accordingly, the UE can not support the simultaneous transmission of SR and PUSCH which is actually supported by RAN1.  Regarding the necessity of SR transmission, we understand the answer shall be yes.  According to the latest R15/R16/R17 MAC spec, there are some texts related to this issue.  *NOTE: MAC PDU assembly can happen at any point in time between uplink grant reception and actual transmission of the corresponding MAC PDU. BSR and SR can be triggered after the assembly of a MAC PDU which contains a BSR MAC CE, but before the transmission of this MAC PDU. In addition, BSR and SR can be triggered during MAC PDU assembly.*  *When an SR is triggered, it shall be considered as pending until it is cancelled. All pending SR(s) triggered prior to the MAC PDU assembly shall be cancelled and each respective sr-ProhibitTimer shall be stopped when the MAC PDU is transmitted and this PDU includes a Long or Short BSR MAC CE which contains buffer status up to (and including) the last event that triggered a BSR (see clause 5.4.5) prior to the MAC PDU assembly. All pending SR(s) shall be cancelled and each respective sr-ProhibitTimer shall be stopped when the UL grant(s) can accommodate all pending data available for transmission.*  Our understanding of this NOTE is that SR can be triggered before or after MAC PDU assembly. And, If we remembered correctly, both cases are discussed at least in the IIoT session. Thus, there can be two scenarios for the overlapping of SR and PUSCH.  1) SR is triggered before MAC PDU associated with PUSCH is generated and delivered to PHY. In this case, there may be no need to send SR, since SR related information(e.g. BSR MAC CE) is already reflected in the PUSCH(unless the grant size is less than e.g. BSR MAC CE+ the related MAC subheader).  2) SR is triggered after MAC PDU associated with PUSCH is generated and delivered to PHY. In this case, we do not see any reason to disallow the SR transmission if the SR and PUSCH are associated with different PUCCH groups and this SR related information is not reflected in the overlapped PUSCH. Especially in R16/R17 IIoT, the SR may have a higher priority than PUSCH, we understand it is not reasonable to disallow this simultaneous transmission of SR and PUSCH.    Thus, we see the reason to resolve this issue and clarify in MAC that the cross-PUCCH group simultaneous transmission is supported.  But, if companies have a strong concern for R15 CR, we understand we can try this clarification at least for R16/R17, since it will much benefit the IIoT feature. |
| Samsung | Yes (proponent) | The current status is that MAC does not indicate SR transmission in different PUCCH group although PHY spec support the simultanesous SR transmission. As OPPO mentioned, there is a case that an SR is pending, SR transmission is not indicated to PHY, but PHY is able to transmit it. |
| Ericsson | Agree with intent | We think MAC and L1 specification specifies different behaviour.  The PUSCH transmission can be a retransmission and , thus possibility to send an SR overlapping with UL-SCH can significantly decrease the delay.  However, we think its better to add the main point of the change directly in the TP “in the same PUCCH group as specified in TS 38.213 [6]”. |
| Apple | See comment | We have some sympathy with this CR. Our understanding is that only PUCCH resources on a BWP which is active at the time of SR transmission occasion are considered valid. Moreover, the simultaneous transmission of PUCCH and PUSCH in Rel-017 is for the same PUCCH group. It is already specified in MAC that the physical layer needs to be able to “signal the SR on one valid PUCCH resource for SR”, which implies some interaction between PHY and MAC.  Based on this understanding we think the intended behavior can be interpreted as already supported in the current specification. We are not totally against a clarification though. But we think “as specified in TS 38.213” is a bit generic, we are ok with the enhancement suggested by Ericsson. |
| CATT | See comment | We agree with the proponents’ analysis, and acknowledge that it can happen that SR is triggered after PUSCH was assembled, since R15. However we are not sure if the proposed change solves anything. Indeed, the question is do we need to capture something specific in R15 MAC to clarify that, from PHY perspective, SR “overlapping” with PUSCH may lead to concurrent transmission or collision, depending on whether they are from the same or different PUCCH groups. So, for it to be clean, we think it should be captured similarly as what is being discussed in offline [506] based on R2-2204666:  2>   if the PUCCH resource for the SR transmission occasion does not overlap with a UL-SCH resource ~~as specified in TS 38.213 [6]~~ or the simultaneous transmission of the SR and the uplink grant is allowed according to clause 9 of TS 38.213 [6]:  3>  if *SR\_COUNTER* < *sr-TransMax*:  That being said, our view is that this has been there since R15 without raising any issue, so we would be also OK with no change in R15. |

## Rel-16 PDCP Duplication MAC CE

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| R2-2205717 Clarification on Duplication MAC CE Samsung CR Rel-16 38.321 16.8.0 1282 - F NR\_IIOT-Core  R2-2205718 Clarification on Duplication MAC CE Samsung CR Rel-17 38.321 17.0.0 1283 - A NR\_IIOT-Core |

MAC specification captures a restriction that Rel-15 Duplication Activation/Deactivation MAC CE is not used if a DRB is configured with more than two RLC entities. However, the NOTE may be misleading, for example, the network cannot use Rel-15 Duplication MAC CE when a DRB is configured with 4 UM RLC entities (2 for each direction). In this case, Rel-15 MAC CE can be used. R2-2205717 proposed to clarify to cover bi-directional UM bearer as follows:

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| NOTE: The Duplication Activation/Deactivation MAC CE is not used if a DRB is configured with N UM RLC entities (for same direction), 2 × N UM RLC entities (N for each direction), or N AM RLC entities, where 2 < N <= 4. |

**Q2. Do companies support the proposed change of R2-2205717?**

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| **Company** | **Yes/No** | **Comment** |
| vivo | Yes with comments | We assume “N” should be written in italic, isn’t it? |
| Qualcomm | Yes | We think the change is necessary and correct. |
| Huawei, HiSilicon | No | This note has been discussed over several times. We would like to note that “more than two RLC entities” is configured by RRC where the details of moreThanTwoRLC-DRB-r16 is clearly specified in RRC. So we don't see much room of misunderstanding on the term. Otherwise, it implies the term of moreThanTwoRLC-DRB-r16 is also misleading, which we don't agree with.  [Samsung] In my understanding, “discussed over several times” would mean about PDCP text. Due to this bi-directional/uni-directional problem, PDCP spec now has several sentences for each case. MAC spec didn’t touch this aspect at all. We think it’s not aligned but contradictory.  Regarding RRC, we think RRC field description may be unclear too. For RRC, it would be better to clarify about the direction in the future. |
| MediaTek | No | Agree with Huawei. |
| ZTE | No | Agree with HW. |
| Nokia | No | Agree with Huawei. |
| LG | No | “more than two RLC entities” always means for each direction. If clarification is really needed, we can simply change as:  The Duplication Activation/Deactivation MAC CE is not used if a DRB is configured with more than two RLC entities (for each direction).  [Samsung] The intention of “more than two RLC entities” in MAC spec is for each direction. But there’s nowhere it means for each direction.  “RLC entities (for each direction)” is not correct. As you already know, AM RLC is always bi-directional. Thus “(for each direction)” is not correct. That’s why the current PDCP spec has a separate sentence on the number of RLC entities for AM bearer. |
| OPPO | Tend to No | We share a similar view as Huawei. There could not be much room for misunderstanding if we also refer to the RRC text and other text of MAC. |
| Samsung | Yes | The problem is that the current text is not correct.  The source of confusion is a DRB can be configured with two RLC entities for UL and two RLC entities for DL (i.e. four RLC entities are configured). In this case, Rel-15 MAC CE can be used. It contradicts to the current text.  We also fine with a simple change. But considering RLC modelling, it may not be easy to have a simple and correct sentence. Any suggestion is welcomed but we think it’s the best way.. |
| Ericsson | Preferably no but can accept if majority wants. | We acknowledge that the note in the MAC spec is not precise. See the below text from PDCP on the exact counting when an RB is configured with PDCP duplication.  - For RBs configured with PDCP duplication, each PDCP entity is associated with N UM RLC entities (for same direction), 2 × N UM RLC entities (N for each direction), or N AM RLC entities, where 2 <= N <= 4;  **However,** theproblem exists already at least in the Rel-15 RRC spec. For example, the below Rel-15 field is ambiguous  *moreThanOneRLC*  This field configures UL data transmission when more than one RLC entity is associated with the PDCP entity. This field is not present if the bearer is configured as DAPS bearer.  If we agree on this CR, then there is a need to do a proper clean-up of RRC specs.  Lastly, the duplication MAC CE is used for **UL** duplication and perhaps the UE shall understand it as more than two RLC entities that can be used for UL transmission. If this understanding is shared, then there is no need for the change. |
| Apple | See comment | The Rel-15 Duplication MAC CE (which can be used in Rel-16) is for the DRB. If a DRB is configured with 4 UM RLC entities (2 for each direction) then this can only be a bi-directional DRB. So the change seems correct, however, we the way it is formulated may not be very fortunate. If the sentence in the PDCP spec gets changed then this would also need updating in MAC.  Our understanding is that the network would not use this MAC CE for PDCP duplication in the DL direction. In DL, the NW can just enable duplication any time, there are no special conditions (based on NW implementation). The UE in this case just relies on the normal duplicate detection function to discard packets. In other words the PDCP duplication procedures in the MAC/PDCP spec only apply to the uplink.  Then maybe we can change it in a simple way:  “NOTE: The Duplication Activation/Deactivation MAC CE is not used if a DRB is configured with more than two RLC entities in uplink direction.” |
| CATT | Yes but | … maybe we can just refer to the RRC parameter (for which we don’t think there is much ambiguity): “The Duplication Activation/Deactivation MAC CE is not used if a DRB is configured with *moreThanTwoRLC-DRB-r16* ” |

## EHC in LTE PDCP

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| R2-2205715 CR for EHC decompression Samsung CR Rel-16 36.323 16.5.0 0300 - F NR\_IIOT-Core  R2-2205716 CR for EHC decompression Samsung CR Rel-17 36.323 17.0.0 0301 - A NR\_IIOT-Core |

At PDCP re-establishment of an LTE PDCP entity configured with EHC and associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*, Ethernet header (EH) decompression should be performed before the delivery to the upper layer. However, it is missing in the PDCP spec. R2-2205715 proposed to add the procedure of EH decompression.

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| When upper layers request a PDCP re-establishment when the reordering function is used, the UE shall:  - process the PDCP Data PDUs that are received from lower layers due to the re-establishment of the lower layers, as specified in the clause 5.1.2.1.4;  - stop and reset *t-Reordering*, if running;  - if the PDCP entity is associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*:  - deliver all stored PDCP SDUs, if any, to upper layers in ascending order of associated COUNT values after performing header decompression (if configured) using EHC as specified in the clause 5.14.5;  - reset the EHC protocol for downlink (if configured) if *drb-ContinueEHC-DL* is not configured, see TS 36.331 [3];  - else;  deliver all stored PDCP SDUs, if any, to upper layers in ascending order of associated COUNT values.- set Next\_PDCP\_RX\_SN, and RX\_HFN to 0 and Last\_submitted\_PDCP\_RX\_SN to Maximum\_PDCP\_SN;  - apply the ciphering algorithm and key provided by upper layers during the re-establishment procedure. |

**Q3. Do companies support the proposed change of R2-2205715?**

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| **Company** | **Yes/No** | **Comment** |
| vivo | Yes with comments | We agree with the intention. And we slightly prefer the NR wording style.Specifically, we propose the following revision  When upper layers request a PDCP re-establishment when the reordering function is used, the UE shall:  - process the PDCP Data PDUs that are received from lower layers due to the re-establishment of the lower layers, as specified in the clause 5.1.2.1.4;  - stop and reset *t-Reordering*, if running;  - deliver all stored PDCP SDUs, if any, to upper layers in ascending order of associated COUNT values after performing header decompression (if configured) using EHC as specified in the clause 5.14.5;  - if the PDCP entity is associated with at least one RLC entity configured with *rlc-OutOfOrderDelivery*:  - reset the EHC protocol for downlink (if configured) if *drb-ContinueEHC-DL* is not configured, see TS 36.331 [3];  - set Next\_PDCP\_RX\_SN, and RX\_HFN to 0 and Last\_submitted\_PDCP\_RX\_SN to Maximum\_PDCP\_SN;  - apply the ciphering algorithm and key provided by upper layers during the re-establishment procedure. |
| Qualcomm | Yes | A very minor editorial comment: It seems better to move “if configured” after "using EHC”, i.e.   * deliver all stored PDCP SDUs, if any, to upper layers in ascending order of associated COUNT values after performing header decompression using EHC (if configured) as specified in the clause 5.14.5; |
| Huawei, HiSilicon | Yes with comments | Prefer the wording from vivo |
| MediaTek | Yes | Agree with vivo |
| ZTE | Yes | Vivo’s wording is simpler |
| Nokia | Yes with comments | Agree with the improvements from both vivo and Qualcomm. |
| LG | Yes with comments | Agree with the intention, but vivo change seems good together with QC suggestion.  - deliver all stored PDCP SDUs, if any, to upper layers in ascending order of associated COUNT values after performing header decompression using EHC (if configured) as specified in the clause 5.14.5; |
| OPPO | Yes | Also, we are fine with the editorial comment from Qualcomm. |
| Samsung | Yes |  |
| Ericsson | Yes | Agree with Vivo + QC |
| Apple | Yes |  |
| CATT | Yes | Agree with Qualcomm’s comment. |

## Level Alignment of UL Skipping

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| R2-2205682 CR for procedure level alignment of UL skipping Apple CR Rel-16 38.321 16.8.0 1192 1 D NR\_IIOT-Core R2-2202524 |

In RAN2#117-e, the proposed change was postponed because it’s a purely editorial category D CR which can be merged to other Rel-16 CR. R2-2205682 was resubmitted. The rapporteur assumes this CR will be merged by other 38.321 Rel-16 CR if there is an agreed category F CR.

**Q4. If you have any concern on R2-2205682, please share. (It is assumed that this CR does not need any technical discussion in this meeting.)**

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| **Company** | **Comment in case that you have any concern** |
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# Conclusion