**3GPP TSG-RAN WG2 Meeting #117-e *R2-2xxxxxx***

**Online, 21 February – 03 March 2022**

**Agenda item: 5.3 User Plane corrections**

**Source: Huawei, HiSilicon**

**Title: Report of [AT117-e][025][NR15] User-plane Corrections**

**Document for: Discussion and decision**

1. Introduction

This document is to report the outcome of the following email discussion at RAN2#117-e Meeting:

* [AT117-e][025][NR15] User-plane Corrections (Huawei)

 Scope: Treat R2-2202109, R2-2203129, R2-2203130, R2-2203241, R2-2203242, R2-2203240, R2-2202552, R2-2202553, R2-2203239, R2-2202194. Ph1 Determine agreeable parts. P2 agree CRs for agreeable parts.

 Intended outcome: Report, Agreed CRs.

 Deadline: Schedule 1

Discussions with Deadline **Schedule 1**:

A **first round** with **Deadline for comments W1 Thur Feb 24th 1200 UTC** to settle scope what is agreeable etc

A Final round with **Final deadline W2 Wed March 2nd 1200 UTC** to settle details / agree CRs etc.

2. Contact Information

|  |  |
| --- | --- |
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3. Phase 1 discussion

## 3.1 Initial state of elements controlled by MAC CE

[1] R2-2202109 Reply LS on initial state of elements controlled by MAC CEs (R1-2112860, Contact: Huawei) LS in Rel-15 To:RAN2 Cc:RAN4

[2] R2-2203129 Clarification on the initial state of elements controlled by MAC CE (based on LS R1-2112860, Contact: Huawei) Huawei, HiSilicon CR Rel-15 38.321 15.12.0 1208 - F NR\_newRAT-Core, TEI16

[3] R2-2203130 Clarification on the initial state of elements controlled by MAC CE (based on LS R1-2112860, Contact: Huawei) Huawei, HiSilicon CR Rel-16 38.321 16.7.0 1209 - F NR\_newRAT-Core, TEI16

[4] R2-2203241 Correction to 38.321 on the term of the handover in handling of MAC CE ZTE Corporation,Sanechips CR Rel-16 38.321 16.7.0 1212 - F NR\_newRAT-Core

[5] R2-2203242 Discussion on Initial State of Elements Controled by MAC CEs ZTE Corporation,Sanechips discussion Rel-15 NR\_newRAT-Core

[6] R2-2203240 Correction to 38.321 on the term of the handover in handling of MAC CE ZTE Corporation,Sanechips CR Rel-15 38.321 15.12.0 1211 - F NR\_newRAT-Core

The issue of initial state of elements controlled by MAC CE was discussed in RAN2#116 and a LS was approved to ask RAN1 views on RAN2 identified questions, and RAN1 has provided their anwers in [1].

[2][3][4][5][6] all discussed this issue and also provided the corresponding R15 and R16 corrections but with different understandings on some particular questions. Therefore, as the rapporteur, we would like to first understand company’s views on these questions, respectively.

**Q1-1**: Do you agree that “the initial deactivation when using handover is applied for both PCell change and PSCell change/addition” based on RAN1 answer to question 1 as follows?

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| 1. Whether the initial deactivation when using handover should be applied for both PCell change and PSCell change/addition of DC?

[RAN1 answer]: Initial state of deactivation is applied for both PCell change and PSCell change/addition in the case of DC. |

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| ZTE | Yes |  |
| Samsung | Yes | - |
| Huawei, HiSilicon | Yes |  |
| OPPO | Yes |  |
| Lenovo/Motorola Mobility | Yes |  |
| vivo | Yes | We share the same understanding of RAN1. |
| Nokia | Yes |  |
| CATT | Yes |  |
| Xiaomi | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |
| LG | Yes |  |
| NEC | Yes |  |
| MediaTek | Yes |  |
| Sequans | Yes |  |
| Ericsson | yes |  |
| Fujitsu | Yes |  |

**Q1-2**: If your answer to Q1-1 is “Yes”, do you agree that handover” should be corrected to “reconfiguration with sync” as in [2][3][4][6]?

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| **Company** | **Agree as is/****Agree with change/****No change needed** | **Comments** |
| Qualcomm | Agree with [2][3] with a minor change | For the spatial relation of PUCCH resource, it seems clearer without “initially”, since the TP includes both initial configuration and reconfiguration.  |
| ZTE | Agree with [5][6] |  |
| Samsung | Agree with [2][3] | We also support the change from Qualcomm above. |
| Huawei, HiSilicon | Agree with [2][3] | We are okay with the proposed changes from QC |
| OPPO | Agree with [2][3] | No strong view on Qualcomm’s improvement. |
| Lenovo/Motorola Mobility | Agree with [2][3] | OK to go with the improvements proposed by Qualcomm |
| vivo | Agree as [2][3] | We are fine with those two CRs. By the way, we think “initially” can be kept as it is also used for the other MAC CEs that involve both initial configuration and RRC reconfiguration. We prefer to align the wording style.  |
| Nokia | Agree with [2][3] | Also fine with Qualcomm’s clarification |
| CATT | Agree with [2][3] |  |
| Xiaomi | Agree with [2][3] |  |
| Apple | Agree with [2][3] | Fine with the change proposed by Qualcomm |
| Intel | Agree with [2][3] | OK with removal of “initially” for all relevant MAC CEs. |
| LG | Agree with [2][3] | We object to remove “initially” from a specific MAC CE. Having different texts for different MAC CEs would cause confusion to readers. Thus, same text should be used for all MAC CEs, i.e. either removing “initially” from all MAC CEs or keeping “initially” for all MAC CEs. |
| NEC | Agree with [2][3] |  |
| MediaTek | Agree with [2][3] |  |
| Sequans | Agree with [2][3] | Agree with LG, we don't understand why "initially" should be removed for one case and not the others. So prefer to keep as is. |
| Ericsson | Agree with [2][3] | Agree with LG |
| Fujitsu | Agree with [2][3] |  |

**Q2-1**: Do you agree that “initial deactivation when using configuration should be applied for both “initial configuration by RRC” and “reconfiguration by RRC” based on RAN1 answer to question 2 as follows?

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| 1. Whether the initial deactivation when using configuration should be applied for both “initial configuration by RRC” and “reconfiguration by RRC”?

[RAN1 answer]: Initial state of deactivation is applied for “initial configuration by RRC”, and is applied for “reconfiguration by RRC” with PCell change and PSCell change/addition in the case of DC or when the corresponding elements are newly added or modified by the reconfiguration message (unimpacted elements should maintain their previous state). |

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes with comment | We think RAN1’s reply indicates both 1. RRC initial configuration and RRC reconfiguration (or simply RRC configuration);
2. 2 RRC reconfiguration with sync
 |
| ZTE | Yes |  |
| Samsung | Yes | - |
| Huawei, HiSilicon | Yes |  |
| OPPO | Yes |  |
| Lenovo/Motorola Mobility | Yes |  |
| vivo | Yes | We share the same understanding of RAN1. |
| Nokia | Yes |  |
| CATT | Yes |  |
| Xiaomi | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |
| LG | Yes |  |
| NEC | Yes |  |
| MediaTek | Yes |  |
| Sequans | Yes |  |
| Ericsson | yes |  |
| Fujitsu | Yes |  |

**Q2-2**: If your answer to Q2-1 is “Yes”, do you agree that “upon configuration” should be corrected to “upon RRC (re-)configuration” as in [2][3]?

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| **Company** | **Agree as is/****Agree with change/****No change needed** | **Comments** |
| Qualcomm | Agree as is in [2][3] |  |
| ZTE | No change needed | No need to correct, we think ‘configuration’ indicate both initial configuration and re-configuration, and RAN1 LS does not give a clear mind about the wording issue, how to capture the wording is up to RAN2. In addition, in LTE (36.321), we also have the similar wording as below:----------- From 36.321 --------------------------------------**5.19 Activation/Deactivation of CSI-RS resources**The network may activate and deactivate the configured CSI-RS resources of a serving cell by sending the Activation/Deactivation of CSI-RS resources MAC control element described in clause 6.1.3.14. The configured CSI-RS resources are initially deactivated upon **configuration** and after a handover.----------- From 36.321 --------------------------------------So we do not think this is an essential issue to be corrected, if not, maybe we should consider correct LTE SPEC as well. |
| Samsung | Agree as is in [2][3] | Since we are improving the text now, the changes in [2][3] look good to us. |
| Huawei, HiSilicon | Agree as is in [2][3] | Note that it indeed caused some confusions in RAN2#116 and that is the reason why we asked RAN1 for clarification. Thus we think it is okay to improve the MAC text for clarity. |
| OPPO | Agree as is in [2][3] |  |
| Lenovo/Motorola Mobilty | Agree [2][3] |  |
| vivo | Agree as [2][3] |  |
| Nokia | Not exactly. | We usually use “(re-)configuration by upper layers”, not “RRC (re-)configuration” |
| CATT | Agree | Also OK with Nokia’s wording. |
| Xiaomi | Agree as [2][3] |  |
| Apple | Agree as is in [2][3] |  |
| Intel | Agree as in [2][3] |  |
| LG | Agree as is in [2][3] |  |
| NEC | Agree but  | wording suggested by Nokia should be used instead |
| MediaTek | Agree but | Prefer Nokia’s suggestion |
| Sequans | Agree as in [2][3] | " RRC (re-)configuration" wording is already used in MAC spec so not sure where is the problem. |
| Ericsson | Agree as in [2][3] |  |
| Fujitsu | Agree as is in [2][3] |  |

**Q3-1**: Do you agree that “UE behavior relevant to (Enhanced) PUCCH spatial relation Activation/Deactivation MAC CE should be aligned with the other MAC CEs” based on RAN1 answer to question 3 as follows?

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| 1. Whether the UE behavior relevant to (Enhanced) PUCCH spatial relation Activation/Deactivation MAC CE should be aligned with the other MAC Ces?

[RAN1 answer]: RAN1 assumed the UE ehaviour relevant to (Enhanced) PUCCH spatial relation Activation/Deactivation MAC CE is aligned with other MAC Ces, i.e., initial state of deactivation is applied for configured candidate spatial relations. So, nothing is to be aligned from RAN1 perspective. Whether or not to reflect this in the specification for (Enhanced) PUCCH spatial relation Activation/Deactivation MAC CE is up to RAN2. From RAN1 perspective, either is OK. |

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| ZTE | Yes, but | According to RAN1 reply, they have confirmed that the same rule have been applied in RAN1, so that’s why:So, nothing is to be aligned from RAN1 perspective. Whether or not to reflect this in the specification for (Enhanced) PUCCH spatial relation Activation/Deactivation MAC CE is up to RAN2. From RAN1 perspective, either is OKAnd also confirm , it is not a critical issue if nothing is captured in RAN2 specification. Consider this correction is involving the R15 UE , we suggest not to touch the part which is not essential |
| Samsung | Yes | - |
| Huawei, HiSilicon | Yes |  |
| OPPO | Yes |  |
| Lenovo/Motorola Mobility | Yes |  |
| vivo | Yes |  |
| Nokia | Yes |  |
| CATT | Yes |  |
| Xiaomi | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |
| LG | Yes |  |
| NEC | Yes |  |
| MediaTek | Yes |  |
| Sequans | Yes |  |
| Ericsson | yes |  |
| Fujitsu | Yes |  |

**Q3-2**: If your answer to Q3-1 is “Yes”, do you agree that “the UE behavior relevant to (Enhanced) PUCCH spatial relation Activation/Deactivation MAC CE should be corrected in order to align with other MAC CEs” as in [2][3]?

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| **Company** | **Agree as is/****Agree with change/****No change needed** | **Comments** |
| Qualcomm | Agree as is in [2][3] |  |
| ZTE | No change needed |  |
| Samsung | Agree as is in [2][3] | Since we are improving the text now, the changes in [2][3] look good to us. |
| Huawei, HiSilicon | Agree as is in [2][3] | No reason to overlook this MAC CE from the spec point |
| OPPO | Agree as is in [2][3] |  |
| Lenovo/Motorola Mobility | Agree [2][3] |  |
| vivo | Agree as [2][3] |  |
| Nokia | Agree as is in [2][3] |  |
| CATT | Agree as is in [2][3] |  |
| Xiaomi | Agree as is in [2][3] |  |
| Apple | Agree as is in [2][3] |  |
| Intel | Agree as in [2][3] |  |
| LG | Agree as is in [2][3] |  |
| NEC | Agree as is in [2][3] |  |
| MediaTek | Agree as in [2][3] |  |
| Sequans | Agree as is in [2][3] |  |
| Ericsson | Agree as is in [2][3] |  |
| Fujitsu | Agree as is in [2][3] |  |

**Summary:**

For “handover” term, all the companies agree “the initial deactivation when using handover is applied for both PCell change and PSCell change/addition”. There is one wording suggestion to remove “initially” but is objected by several companies since this term is applied to all the relevant MAC CEs. The rapporteur think this argument to keep it is valid so the orginial text proposal in [2][3] can be agreeable.

For “configuration” term, all the companies agree “initial deactivation when using configuration should be applied for both “initial configuration by RRC” and “reconfiguration by RRC” and there is clear majority to improve the text for clarity. And there are some comments to use “upon (re-)configuration by upper layers” for alignment. The rapporteur think either term is fine and the proposed term seems also fine and aligned with most aspects in MAC, and thus this wording suggestion can be included in the updated CRs.

For “PUCCH spatial relation Activation/Deactivation MAC CE”, all the companies agree that “UE behavior relevant to (Enhanced) PUCCH spatial relation Activation/Deactivation MAC CE should be aligned with the other MAC CEs” and almost all the companies agree to capture this as in [2] [3]. Given that it is RAN2 common understandings and it is important to remain the MAC spec complete, the rapporteur think we can go with the clear majority.

**Proposal 1: CR in R2-2203129 and R2-2203130 are agreed (by merging** **R2-2203240 and R2-2203241) with the following change: change “RRC (re-)configuration” to “(re-)configuration by upper layers”.**

## 3.2 DRX RTT timer with UL skipping

[7] R2-2202552 Clarification on the DRX RTT Timer operation with UL skipping configuration Apple CR Rel-15 38.321 15.12.0 1195 - F NR\_newRAT-Core

[8] R2-2202553 Clarification on the DRX RTT Timer operation with UL skipping configuration Apple CR Rel-16 38.321 16.7.0 1196 - A NR\_newRAT-Core

[7][8] think the following MAC text is ambiguous whether the UE should start the UL HARQ RTT timer if the UL transmission is skipped,

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| *2> if the PDCCH indicates a UL transmission:**3> start the drx-HARQ-RTT-TimerUL for the corresponding HARQ process in the first symbol after the end of the first transmission (within a bundle) of the corresponding PUSCH transmission;* |

and propose to further enhance the current MAC text by adding “actual” before “corresponding PUSCH transmission” to clearly indicate that the UE should not start the UL HARQ RTT timer if the UL transmission is skipped.

**Q4-1**. Companies are asked to provide your views on above issue:

* Option A: the UE shall not start the UL HARQ RTT timer when UL transmission is skipped
* Option B: the UE shall start the UL HARQ RTT timer when UL transmission is skipped
* Option C: the UE behaviour is not specified (i.e. up to UE implementation)

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| **Company** | **Option A/B/C** | **Comments** |
| Qualcomm | See comment | We support the intention of the CR. But in practice the proposed change probably would not make much difference if DRX inactivity timer is still re-/started by a new UL grant even if it is skipped, because DRX inactivity timer usually is much longer than a typical HARQ process.  |
| ZTE | See comments | We think neither Option A nor Option B can make the RAN interface misalignment between NW and UE, in other word, nothing is missing, so we do not think this is an issue shall be resolved in maintenance period. |
| Samsung | Option A but | We think the current text already says Option A from the phrase ‘*after the end of the first transmission*’. However, even if others have different opinion, we do not see the need of specification change at this phase, as Qualcomm and ZTE said above. |
| Huawei, HiSilicon | Option A but | Agree with above |
| OPPO | Option A but | According to the current text, we understand the timer is started only after the PUSCH transmission, Thus, the UL HARQ RTT timer will not start when UL transmission is skipped. On the other hand, we also do not expect any spec change, as mentioned by the above companies.  |
| Lenovo/Motorola  | Comment | Our interpretation of the current spec is basically Option A. Therefore we don’t see a need to enhance the spec text.  |
| Vivo | Comments | From MAC perspective, transmission can only be triggered only if a MAC PDU to transmit has been obtained. In this sense, the existing terminology PUSCH transmission means that the MAC entity has already generated a MAC PDU. Otherwise, the transmission will not be triggered when UL skipping is done based on 5.4.2.2 and the DRX RTT timer would not be started. In this sense, we think everything works well and fail to figure out the motivation of this CR (i.e. no change is required). |
| Nokia | Option A but | Agree with Samsung. |
| CATT | Option A | As currently captured |
| Xiaomi | Option A | No change needed |
| Apple | Option A | UE operation on the DRX timer should be clear to avoid the misalignment between NW and UE. If companies think the current spec is clear, we are fine to capture the common understanding (i.e. Option A) in chairman notes.  |
| Intel | Option A | Agree with the intention. Given that this is Rel-15/16 CR, whether to have the clarification depends on whether it is aligned with existing implementations. It will be good to capture the change if there is common understanding.Regarding Qualcomm’s comment, even if inactivity timer can be larger than HARQ RTT, there can be multiple slots of offset between PDCCH and PUSCH transmission, therefore inactivity timer might not cover the UL retransmission timer.  |
| LG | Option A but | Agree with Samsung. It is clear that “*corresponding PUSCH transmission*” means actual PUSCH transmission. Thus, specification change is not needed. |
| NEC | Option A but  | No need to change. Agree with Samsung  |
| MediaTek | Comment | Agree with Samsung and others that no change is needed |
| Sequans | Option A | Will go with majority on whether clarification is required. |
| Ericsson | A |  |
| Fujitsu | Option A but | Agree with the intention. But specification change would not be necessary. |

**Q4-2**. If you answer to Q4-1 is “Option A”, do you agree the text proposal in [7][8] to the current MAC spec?

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| **Company** | **Agree as is/****Agree with change/****No change needed** | **Comments** |
| Samsung | No change needed | As commented in Q4-1 above. |
| Huawei, HiSilicon | No change needed |  |
| OPPO | No change needed | See comments above in Q4-1. |
| Nokia | No change needed | Current spec is clear in our opinion. |
| CATT | No change needed | Current text is clear. |
| Apple | Agree with change  | We are also fine to capture the option A in the chairman notes as the RAN2 common understanding.  |
| Intel | Agree with change | See comments in Q4-1. |
| LG | No change needed |  |
| NEC | No change needed |  |
| MediaTek | No change needed |  |
| Ericsson | No change needed | “if the PDCCH indicating a UL transmission” is received also for when a transmission is skipped, but in section 5.4.2.1 it is clear that the line “5> instruct the identified HARQ process to trigger a new transmission;” will never be reached, thus there is no “corresponding PUSCH transmission” and thus the timer shall not be started. |
| Fujitsu | No change needed |  |

**Summary:** It seems company’s views are aligned on Option A that “the UE shall not start the UL HARQ RTT timer when UL transmission is skipped” and majority including the proponent company believe the current spec is clear enough and no change to the spec is needed. Thus the rapporteur think the common understanding can be captured in the chairman notes instead.

**Proposal 2: Capture the following RAN2 common understandings in the Chair’s notes:**

**RAN2 confirms that the UE shall not start the *drx-HARQ-RTT-TimerUL* for the corresponding HARQ process if the corresponding PUSCH transmission is skipped.**

## 3.3 Abnormal handling of UL retransmission

[9] R2-2203239 Discussion on An Abnormal Case for Retransmission ZTE Corporation,OPPO, Sanechips discussion Rel-15 NR\_newRAT-Core

[9] discusses the case that the UE receives a UL grant for retransmission with a different TBS from the previous transmission, i.e. the TBS doesn’t match the size of MAC PDU stored in the HARQ buffer, and proposes to discuss the UE behaviour in this case.

**Q5**: Companies are asked to provide your views on the above issue:

* Option A: the UE shall ignore the UL grant
* Option B: the UE shall consider the UL grant for a new transmission, and then generate a MAC PDU for it
* Option C: the UE behaviour is not specified (i.e. up to UE implementation between option A or Option B)

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| **Company** | **Option A/B/C** | **Comments** |
| Qualcomm | Option C | We think it is an error case and hence its handling should be up to UE implementation. |
| ZTE | Proponent | We want companies to confirm whether UE may go to either A or B , and maybe ‘up to UE implementation between A and B’. Which means UE won’t re-transmit the MAC PDU saved in the buffer using the UL grant indicating an ill-suited size.  |
| Samsung | Option C | We share the view with Qualcomm.  |
| Huawei, HiSilicon | Agree with the intention, but | We share the sympathy on this issue. But we also understand this “old” issue is too late to fix in NR spec, so we can rely on sensible UE implementation to avoid any unexpected errors at the NW receiving side. |
| OPPO | See comment | As clarified by ZTE above, C intends to say whether to perform A or B depends on the UE implementation, and the UE does not retransmit the stored MAC PDU in this case. We have no strong view on the solutions and would like to have a common understanding of how to handle this issue. If Option A or B is agreed, we expect the corresponding spec change, while if Option C is the majority view, it means that it depends on the UE implementation to choose A or B(no spec change). |
| Lenovo/Motorola Mobility | Comments | We think that such error cases have been already discussed in the past. In the past we always left such cases to UE implementation since they should occur only rarely. |
| vivo | Comments | We would like to point out that a similar question had been discussed in the Rel-15 RAN1 LDPC coding session. Specifically, there is no bug in such a case. Alternatively (it might be a common understanding from the RAN1 perspective), the UE can still perform the retransmission based on the scheduling info (rate matching framework can handle any misalignment, e.g. TBS 100 bit and code-rate 1/2 (assuming RV0) for initial transmission, then 200 bit (i.e. 100-bit system bit and 100-bit check bits) will be transmitted in the initial transmission. Assuming retransmission is set to 50 bit and code-rate with 1/2 and RV0, then 100 bit (i.e. all 100-bit system bit without check bit) will be transmitted. Soft combination can still be done as the BG pattern and all de-coding parameters will not be changed during retransmission). In conclusion, the current spec works well. What’s worse, the proposed change would bring the NBC issue. It is not preferable at all.Fei: Basically, we are not willing to correct anything, we just want to confirm the UE behavior when receiving the abnormal UL grant with none-taggled NDI. If the UE is still to send the obsolete data to NW,as you mentioned, the AM RLC re-transmission window will be pushed into a abnormal range, if status report is triggered, UE will receive a status report where the SN values those are not received will be indicated in the status report. In such case, UE behavior is not defined, and RRC re-establishment would be illegally triggered. By the way, it happened frequently when in the full rate test. |
| Nokia | - | Since there is currently no behaviour specified to take such a grant into account, it will be ignored. Option B corresponds to a new behaviour. Thus, we believe Option A is the one already specified and nothing additional is required. We also feel this has been discussed a few times in the past already. |
| CATT | Option C | It has been discussed since LTE where it was decided to leave it up to UE implementation as in current specification. |
| Xiaomi | Option C | Very old issue since LTE, left to UE implementation, no issue found. |
| Apple | Option C | Same understanding as CATT and Xiaomi, this issue was discussed before and the conclusion is up to UE implementation.  |
| Intel | Option C | Agree that this issue was discussed before and can be left to UE implementation. |
| LG | Option C | This issue has been discussed from LTE, and each time this issue was brought up, RAN2 decided to left it up to UE implementatin. To prevent same discussion again in a future, we are open to add a NOTE similar to DL case.NOTE 2: If the MAC entity receives a retransmission with a TB size different from the last valid TB size signalled for this TB, the UE behavior is left up to UE implementation. |
| NEC | Option C | We assume this is not normal case and UE implementation can handle, so Option C is probably enough. |
| MediaTek | Option C | Agree with Qualcomm |
| Sequans | Option C | Agree with previous comments |
| Ericsson (Robert)  | Option C | This is avoidable by NW implementation. Normally, a retransmission grant does not contain the TBS, Imcs only indicate a modulation. If the NW do not detect the PUSCH transmission after a grant with toggled NDI is sent, NW can use a DCI format for retransmission that includes the TBS (for example the same as the initial grant). If the NW did not receive any PUSCH at all for a certain TB, and the NW deciding to not send more retransmission grants for that HARQ process, then if NW want to schedule the same HARQ process with a new TBS, it can do so by sending a new grant with new TBS without toggling the NDI. In the unlikely event that the UE do receive a retransmission grant with a different TBS indicated (as described in [9] which is an unlikely error case), it can be left to UE implementation. RAN1 did discuss similar question for DL, and here is the conclusion at RAN1#92bis:

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| Conclusion:It is RAN1’s understanding that a UE is not expected to receive a retransmission with a TB size that is different from the last valid TB size signalled for this TB. Note: This does not have any RAN1 specification impact. A note similar to the one in TS36.321, Subclause 5.3.2.2 can be added to 38.321. |

See 38.321 section 5.3.2.2:

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| NOTE: If the MAC entity receives a retransmission with a TB size different from the last TB size signalled for this TB, the UE behavior is left up to UE implementation. |

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| Fujitsu | Option C | We understand the abnormal case explained in [9] could happen. We think it is up to implementation to select either Option A or Option B. |

**Summary:** (14 out of 18) companies tend to think it is up to UE implementation to handle the abnormal case and quite a few companies pointed out that this issue has been discussed in the past and the decision is up to UE implementation. The rapporteur think the situation seems no change compared from the past so no change to the specifications is needed.

**Proposal 3: Capture the following RAN2 common understandings in the Chair’s notes:**

**No change to the specification is needed for the issue in R2-2203239.**

## 3.4 Handling of discardOnPDCP

[10] R2-2202194 Discussion on handling of discardOnPDCP OPPO discussion Rel-15 NR\_newRAT-Core

[10] proposes an interesting issue of SRB discard at UE receiving side when upper layers request a PDCP SDU discard (e.g. PDCP data recovery for intra-CU inter-DU handover), and thinks the PDCP receiving window at the UE side may get stuck if there is any stored PDCP PDU for SRB but discarded and the value of t-Reordering is set to “infinity”.

**Q6-1**: Companies are asked to provide your views on the above issue:

* Option A: There are no stored PDCP PDUs at UE RX buffer at the time of receiving *discardOnPDCP* (i.e. interpretation-1 in [10]), and no change to the specification
* Option B: There might be stored PDUs at UE RX buffer at the time of receiving *discardOnPDCP* (i.e. interpretation-2 in [10]), and to discuss in Phase 2 the UE behaviour in this case
* Option C: Others (please indicate the details if any)

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| **Company** | **Option A/B/C** | **Comments** |
| Qualcomm | Option B |  |
| Samsung | See comment | We do not see the need of consideration on the RX side. SRB is associated with AM RLC entity and thus no data loss would be foreseen. The network will ensure that there is no data loss and no out-of-order PDCP PDU by retransmission, i.e. there would be no issue in the current specification.[OPPO] can I understand it means that network implementation would ensure there would be NO case for RX\_DELIV < RX\_NEXT, i.e., option-A ? If yes, we need to make it clear UE does not have to handle such case. If no, what is the gap? |
| ZTE | See comments | We think the *discardOnPDCP* is only applied to the TX buffer which have been explained in [10], in other word, the data PDU is still stored in the RX buffer,With option B, we think the received PDCP can send the PDU to upper layer as long as all PDCP SDUs within the re-order window are received[OPPO] for it, the question is what if not all PDCP SDUs within the reordering window is received, deliver it to upper layer or not? If deliver, whether to update variable or not?ZTE: My understanding is that, first of all, we think NW will guarantee there is no data in the RX buffer before sending the *discardOnPDCP.* Secondly, if something worth happen,we think RX buffer will be kept as it is if there is any data is still stored when receiving the *discardOnPDCP*. And TX PDCP at NW side can automatically re-transmit the PDCP PDU those are not confirmed by the lower layer. |
| Huawei, HiSilicon | See comment | DL RRC messages are assumed to be lossless, so no matter we go with Option A or Option B, we don't see there is an issue and it is up to NW to avoid PDCP SN gap in the UE receiving side for SRB. Thus we think no change to the specification is needed.[OPPO] can I understand it means that network implementation would ensure there would be NO case for RX\_DELIV < RX\_NEXT, i.e., option-A? If yes, we need to make it clear UE does not have to handle such case. If no, what is the gap?[HW] when to trigger SRB discard/PDCP data recovery procedure is NW implementation, so we see it is very likely that NW could ensure there is no out-of-order PDCP PDU stored in the UE RX buffer (i.e. all PDCP PDUs for SRB have been received before and in-order delivered), we understand this operation corresponds to Option A. But we also think Option B may have no issue since NW could still perform PDCP retransmission after this procedure in order to ensure DL RRC messages lossless if there is a need (e.g. NAS message inside), which can be seen as also NW implementation. Thus we understand regardless of Option A or B, there is no issue at the UE RX side and no change to the specification is needed.[OPPO] difficult for me to follow the part above, in case of option-B, i.e., reordering timer is running, and there is stored PDU in Rx buffer, and if UE clear the Rx buffer, i.e., the received PDU are discarded. So when you say “NW could still perform PDCP retransmission after this procedure”, do you mean 1. Either the Rx buffer has to be cleared, by assuming that the network would not only retransmit the PDU that did not received by the UE, **but also the ones already received by the UE (which has been discarded)**, in order for the Rx window to move forward? Otherwise, the Rx window still get stuck
2. Or the UE does not have to clear the Rx buffer in this case (i.e., where there is stored PDU in Rx buffer)?

**Which one is the correct understanding? Which is the key Q for us as UE vendor to understand**[HW] We understand whether to perform discard for UE receiving PDCP is not essential for Option B, as long as NW could perform retransmission from the first missing PDU if NW detects there is a need, but we agree with others that Option A can be the right one to assume. |
| OPPO (Qianxi) | See comment  | Either *discardOnPDCP* does not apply to Rx BufferOr we do not see another option besides option-A/B. If the view is leave to NW to handle it, i.e., option-A, we need to make it clear using R2 agreement. Otherwise, we need to clarify the left issue in option-B. |
| vivo | Option B with comments | We think the current behavior at the receiving side is quite clear, as per the highlighted text in TS 38.323 (i.e. discard the PDCH SDU). There is no essential issue found. 5.3 SDU discardFor SRBs, when upper layers request a PDCP SDU discard, the PDCP entity shall discard all stored PDCP SDUs and PDCP PDUs.NOTE: Discarding a PDCP SDU already associated with a PDCP SN causes a SN gap in the transmitted PDCP Data PDUs, which increases PDCP reordering delay in the receiving PDCP entity. It is up to UE implementation how to minimize SN gap after SDU discard.[OPPO] The second highlighted one is for Tx entity, while the Q here is for Rx entity.. |
| Nokia | See comment | Since this is a network-triggered operation, the first interpretation seems like the right one to assume and thus and there's nothing to fix. |
| CATT | Option A | Our understanding is that Network makes sure there are no stored PDCP PDUs at UE RX buffer at the time of receiving *discardOnPDCP*. No strong view on whether anything needs to be captured for clarifying this. |
| Xiaomi | See comment | The discard operation is only applicable to Tx PDCP. |
| Apple | Option B | It is not clear to us how network can always ensure that there are no stored PDCP PDUs/SDUs in the receiver side when inter-DU handover occurs. We think the current spec refer does not specifally apply to Tx side only. While it may be too late to change the spec, it will be good to at least capture RAN2 understanding of what the UE is supposed to do when there is a gap in the reordering window prior to handover. |
| Intel | Option A | Our understanding is that *discardOnPDCP* does not apply to Rx buffer.Even for the Rx side mentioned in the document, it should be noted that SRB is operated in lossless manner and is delivered from PDCP to RRC in sequence. When UE is handling the RRC message carrying *discardOnPDCP*, UE has already received all previous PDCP SDUs and processed them by RRC. Since the main usage scenario of *discardOnPDCP* is for PCell change under same CU (therefore PDCP re-establishment is not used), *discardOnPDCP* should be the last RRC message sent by source PCell. Therefore when UE RRC processes RRC message carrying *discardOnPDCP*, there are no PDCP SDUs in Rx buffer corresponding to RRC messages generated by source PCell. |
| LG | Option B with comments | When the discardOnPDCP was first introduced, companies focused on Tx side and didn’t think much of Rx side. Though the original intention is to discard PDCP SDUs and PDUs in the Tx side, it is true that the current specification mandates to discard PDCP SDUs and PDUs for both Tx and Rx sides.And, as pointed out by Oppo, if there are stored PDCP PDUs in the Rx side and if they are discarded by the discardOnPDCP, stuck situation will happen because RX\_DELIV != RX\_NEXT and t-Reordering is set to infinity for SRBs.But it is difficult to change the UE behavior in frozen releases. Thus, we propose followings.- For R15/16, network ensures that there are no stored PDCP PDUs in the UE’s Rx side when sending discardOnPDCP.- For R17, change the PDCP specification such that discardOnPDCP applies to Tx side only. |
| NEC | See comment | The intention of discardOnPDCP is to ensure that the UE does not send old SRB contents after the HO without key change. So, it is basically for Tx side only.On the other hand, the current specification does not restrict it only on the Tx side and thus some companies could understand it is also applied to Rx side. If we assume this is the case, our view is that the network can ensure not to discard the stored PDCP PDUs for SRB, as normally the network will send the discardOnPDCP after confirming ongoing RRC signaling sent earlier. There might be a corner case, where some PDCP PDUs in stored in Rx side, but we do not see a strong need to fix it for Rel-15 at least. |
| MediaTek | Comments | It is our understanding that *discardOnPDCP* is only applicable to the TX side. |
| Sequans | Option B | Our understanding is that *discardOnPDCP* is only applicable to the TX side.In general there might be gaps (stored SDU/PDUs). Intel statement is correct but for SRB1, there can still be gaps for e.g. SRB2. |
| Ericsson | Option B | If higher layers. Initiated by NW, have indicated discard of SRB data in order to not still have SDUs/PDUs of obsolete e.g. RRC/NAS messages that cause problems, it seems logical to have an implementation according to the current specification to actually discard that data. Since we are using RLC AM and reorder in PDCP, the case of having SN gaps seems very small, but as there seem to be views that *discardOnPDCP* does not apply in this case RAN2 should discuss a bit more if this actually renders a problem that needs to be clarified. I.e if implementations where neither discard nor adequate SN gap handling is performed results in issues. |
| Fujitsu | See comment | We wonder if it is realistic that PCDP SDU/PDU (RRC message) could be stacked in the SRB Rx buffer when *discardOnPDCP* is triggered. This means DL RRC message was lost and NW could implement proparily to manage the loss before triggering *discardOnPDCP*. |

**Summary:** Company’s views can be summaried as

1. *Whether discardOnPDCP is applied to RX side*: 4 companies explicitly indicate that it is only applicable to TX side and thus not to RX side while 3 companies tend to believe the current spec doesn't restrict it to TX side.

2. *Whether Option B can be ruled out*: 8 out 17 companies tend to believe Option A can be assumed, i.e. NW ensures that there are no stored PDCP PDUs in the UE’s Rx side when sending discardOnPDCP. However, 4 companies indicate that Option B may need to be considered following the current spec. Several companies further explains that even in case of Option B, proper NW implementation is sufficient to ensure DL RRC lossless. Given the situation, the rapporteur thinks it is important to keep the R15 spec stable and it seems difficult to change the UE behaviour at this stage considering the issue is not critical and corner case.

However, several companies have expressed different views on how to conclude from different angles. Thus the rapporteur think we can further consolidate our views in Phase 2 discussions.

4. Phase 2 discussion

**Q7**: Companies are asked to provide your views between Option A, B and C with possible wording suggestions on how to conclude 3.4 Handling of discardOnPDCP for Rel-15:

* **Option A**: Observation 1 and 2 are used to reflect the situation of offline discussions (Obv1 for UE behaviour, Obv2 for NW behavior), and then to conclude it is possible for NW to address the concerns from [10] by taking Obv1 and Obv2 into account, but not mandate either UE or NW to do so (i.e. can be)
	+ Observation 1: There seems different understandings on whether *discardOnPDCP* is applied to UE RX side for Rel-15.
	+ Observation 2: There is significant support that there are no stored PDCP PDUs in the UE’s RX PDCP buffer for SRBs when receiving *discardOnPDCP* indication for Rel-15.
	+ RAN2 understands that it can be up to NW implementation to avoid SN gap in the UE’s RX PDCP buffer for SRBs when sending discardOnPDCP indication.
		- NOTE: there is comment to Obv1 from PDCP rapporteur that it is necessary to indicate “**PDCP specification mandates that discardOnPDCP is applied to both UE RX side and Tx side.**”
* **Option B**: To get a clear view on how to handle *discardOnPDCP* for guidance to UE implementation, and that is the root to cause different understandings from the current spec
	+ RAN2 confirms that the UE does not have to handle the Rx buffer discarding when *discardOnPDCP* is indicated.
* **Option C**: Others, please indicate clearly your views on how to conclude in case you don't agree Option A and B

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| **Company** | **Option A/B/C (with possible wording suggestions)** | **Comments** |
| OPPO | Option-B with comment, or the revised option-A in HW reply below (but not the original option-A) | We see two way-out from UE implementation perspective:1.UE does not have to handle Rx buffer discarding upon discardOnPDCP (this includes both the view that “discardOnPDCP” is not applicable to Rx and the view that “up to NW implementation to avoid SN gap in the UE’s RX PDCP buffer for SRBs when sending discardOnPDCP indication”)2.UE has to perform the Rx buffer discarding upon discardOnPDCP if there is stored PDU (we assume nothing else to be done, i.e., NW implementation, although I do no know whether/how, will handle the Rx window issue)Either one is OK but not both.If we go with option-A above, we also hope the message is clear at least since R17.[OPPO] Otherwise, we add a Q to original option-A to ask for clarification on how option-A imply UE implementation.[OPPO] After seeing the reply from Huawei below, we are fine with the revised version, which clarified that UE would not be mandated to “handle SN gap”, i.e., we take it as both “no Rx buffer discarding” and “Rx buffer discarding” operation exist yet at least UE does not have to handle the SN-gap issue for Rx-buffer (anyway from UE/specification perspective, we do not have how can UE handle it without a clear sync/coordination with NW side). |
| LGE | Option A with modification on Observation 1 | From the PDCP specification point of view, it is clear that SDU discard is applied to both Tx and Rx sides.

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| 5.3 SDU discardWhen the discardTimer expires for a PDCP SDU, or the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU. If the corresponding PDCP Data PDU has already been submitted to lower layers, the discard is indicated to lower layers.For SRBs, when upper layers request a PDCP SDU discard, the PDCP entity shall discard all stored PDCP SDUs and PDCP PDUs. |

Thus, we propose to modify the observation 1 as shown below.* Observation 1: Rel-15 PDCP specification mandates that discardOnPDCP is applied to both UE RX side and Tx side, but there seems different understandings on whether discardOnPDCP is applied to UE RX side for Rel-15.
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| Huawei, HiSilicon | Option A with changes by combining Option B | It seems RAN2 now start to converge views that it is normal case for having no no stored PDCP PDU, which can be handled NW implementation. But in case there is stored PDCP PDU, we see a need to align both UE and NW understandings from the current spec, but we also understand it is too late to change the spec for clarity given that there might be different UE implementations. Neverthless, it is good to see some possible implementations to resolve the issue from the Phase 1 discussions,1. The UE will not perform discarding, this has been already acknowledged by several companies.2. The UE will perform discarding following the current spec, then the SN gap are deemed to be resolved (in case reordering window is set to infinity) but note that it doesn’t mandate the UE to do so from the current spec, this has been also already acknowledged by several companies. Therefore, we think this “corner case” can be handled by implementations, and thus propose the following conclusions for a clear summary of this discussion.* Observation 1: Rel-15 PDCP specification mandates that discardOnPDCP is applied to both UE RX side and Tx side, but there seems different understandings on whether discardOnPDCP is applied to UE RX side for Rel-15.
* Observation 2: There is significant support that there are no stored PDCP PDUs in the UE RX PDCP buffer for SRBs when receiving discardOnPDCP indication for Rel-15.
* RAN2 understands that in case there is stored PDCP PDUs in the UE RX PDCP buffer for SRBs when receiving discardOnPDCP indication, it can be up to implementation to avoid UE RX window to get stuck but doesn' mandate the UE to handle SN gap from the specification. No change to specification is needed for NR Rel-15 and 16.
* The issue can be revisited in NR Rel-17.
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| Apple | Option B | In our view, PDCP SDUs/PDUs in the Rx buffer for SRBs should be discarded, if we accept the logic for discarding PDCP SDUs/PDUs in the Tx side. Then, it is not clear to us how the network can always ensure that the Rx buffer is empty during inter-DU handover (other than re-establishing PDCP which we want to avoid in this scenario). Even if it is too late to change R15 spec, we should at least capture as RAN2 understanding that the UE should update PDCP state variables to ensure there is no stalling of the PDCP Rx window. [HW] Thank you for the comments, and please share your view to the updated proposal as shown above. As I summaried above, there can be implementation approaches that doesn’t mandate the UE handle SN gap, e.g. NW to reconfigure t-Reordering, PDCP retransmission. I think it is difficult now to mandate the UE to handle SN gap in this case given there might be already different UE implementations including “not discard” acknowledged by several companies in Phase 1 discussion. Therefore I understand the updated proposal as shown above is the best compromise we can do for now. |
| Samsung | Option A | Agree to PDCP rapporteur’s comments.[HW] Thank you for the comments, and please share your view to the updated proposal as shown above.  |
| Xiaomi | Option A with modification | In our understanding, it will never happen that there is still PDCP PDU in PDCP buffer when the receiving PDCP entity receives discardOnPDCP indication from RRC since PDCP will only send PDCP SDU to RRC in sequence. Thus, there is nothing requiring network to ensure. We suggest to modify the sentence:“RAN2 understands that it can be up to NW implementation to avoid SN gap in the UE’s RX PDCP buffer for SRBs when sending discardOnPDCP indication.” to the below wording:“ Since it will never happen that there are stored PDCP PDUs in the UE’s RX PDCP buffer for SRBs when receiving discardOnPDCP indication, it doesn’t matter how UE behaves when receiving discardOnPDCP indication.” |
| vivo | Option A with comments | We are fine with Observations 1 and 2 in Option A. But we suggest removing the 3rd bullet as there is no need to emphasize the NW implementation (it seem a bit redundant as we always rely on NW implementation for all cases). Instead, we would like RAN2 to confirm that PDCP specification mandates that discardOnPDCP is applied to both UE RX side and Tx side (as suggested by the PDCP rapporteur). Thus, * + Observation 1: There seems different understandings on whether *discardOnPDCP* is applied to UE RX side for Rel-15.
	+ Observation 2: There is significant support that there are no stored PDCP PDUs in the UE’s RX PDCP buffer for SRBs when receiving *discardOnPDCP* indication for Rel-15.
	+ ~~RAN2 understands that it can be up to NW implementation to avoid SN gap in the UE’s RX PDCP buffer for SRBs when sending discardOnPDCP indication~~ RAN2 confirms PDCP specification mandates that discardOnPDCP is applied to both UE RX side and Tx side (i.e. no spec change is required).
 |
| Appe (Version 2) |  | We thank the email rapporteur for the feedback for our previous response. We agree that it is too late to change the R15 spec. now. Also, I think we only need to capture RAN2 understanding in the minutes, and not observations. Our proposal would be something as follows: RAN2 understands that discardOnPDCP applies to both Rx and Tx side. UE implementation will ensure that PDCP window is not stalled. |
| Intel | Option A | We’re also OK with the revision from Huawei except that we don’t see the need to revisit the issue in NR Rel-17. It might be helpful to understand the key differences between *discardOnPDCP* and PDCP re-establishment for SRBs.* PDCP re-establishment:
	+ Discard SDUs and PDUs at both Tx and Rx side
	+ Reset the PDCP state variables at Tx and Rx side, therefore no SN gap issue.
* *discardOnPDCP:*
	+ Discard SDUs and PDUs at both Tx and Rx side (according to PDCP rapporteur)
	+ No reset of the PDCP state variables at Tx and Rx side, therefore potential SN gap issue if *t-Reordering* is set to *infinity*.

We don’t see the need to have standardized way in Rel-17 to handle potential SN gap issue for *discardOnPDCP*. If there are really issues (e.g. network cannot guarantee that there are no stored PDCP SDUs/PDUs at UE Rx side when receiving *discardOnPDCP*), then why shouldn’t network use PDCP re-establishment instead? There are no performance differences between PDCP re-establishment and *discardOnPDCP* for SRBs. |
| Nokia | Option A | Supports the clarification from the PDCP rapporteur and fine with the possible addition on optional UE behaviour suggested by Huawei (not essential though in our opinion). Agree with Intel that there is no need to revisit the issue unless IoT issues occur. |
| Fujitsu | Option A with modification | We partially agree with Huawei’s updated proposal. But we think specification change would not be necessary for any release (even after R17).Our understanding is the NW can normally handle so that there is no stored PDCP PDU/SDU in SRB Rx buffer when it triggers discardOnPDCP. However, on the other hand, there might be abnormal case. We think it should be left to UE implementation to handle the abnormal case for all releases.  |
| ZTE | Option A with comments | We are fine with the revised option A suggested by Huawei. From NW vendor point of view, NW implementation is able to guarantee to avoid the SN gap no matter the PDCP SDU is discarded or not. No need to do something in R15/Rel16. Whether to revisit it in Rel-17, it is up to majorities’ view/ |
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**Summary:** It seems company’s views start to converge to a good extent and now the issue becomes much clearer after Phase 2 discussions. Here is the brief summary of the key points from the rapporteur:

**1. Whether discardOnPDCP is applied to UE Rx side**

Most companies are fine with observation1, one company think it is not needed to capture this in the minutes, but the rapporteur think it will be helpful to understand the existing possible UE behaviors given that the orginal intention was to discuss UE Tx side and RX side behaviour is overlooked. So the rapporteur think we can keep this in the conclusions.

**2. Potential scenarios of UE Rx buffer when receiving discardOnPDCP**

There is clear majority view that in normal cases, NW can handle this so that there is no stored PDCP PDUs for SRBs in UE Rx buffer, and only one company believes “any stored PDCP PDU for SRB” doesn't exist at all. Note that according to the Phase 1 discussions, quite a few companies tend to think we cannot rule out this at least for SRB2. It seems situation doesn’t change in Phase 2, thus the rapporteur believe it can be included in the conclusions, and it implies that it doesn't matter whether the UE will perform discarding for SRB.

**3. How to handle the SN gap in case there are any stored PDCP PDUs in the UE’s RX PDCP buffer for SRB**

It seems all companies don't see a need to change the current specification for this “abnormal case”, some companies believe it should be up to UE implementation while some companies think sensible NW implementation is responsible to take care of this. Given the situation, although the current doesn't mandate the UE to handle the SN gap, the rapporteur think we can conclude that it is up to implementation to address this issue and no change to the specification is needed, which also doesn't restrict existing implementations.

**4. Whether this issue can be revisited in NR Rel-17.**

3 companies explicitly object to revist this issue in R17 and think the current spec with proper implementation is sufficient to handle this “abnormal” case. Based on the situation, the rapporteur think this offline is mainly to address R15 and R16 issues, so it is okey to remove this bullet from the conclusions. For sure, the proponent company who may think differently is encouraged to bring this issue to R17

**Proposal 4: Capture the following observations and RAN2 common understandings in the Chair’s notes:**

**Observation 1: NR Rel-15 PDCP specification mandates that *discardOnPDCP* is applied to both UE RX side and Tx side, but there seems different understandings on whether *discardOnPDCP* is applied to UE RX side for Rel-15.**

**Observation 2: There is significant support that there are no stored PDCP PDUs in the UE’s RX PDCP buffer for SRBs when receiving *discardOnPDCP* indication for NR Rel-15.**

**RAN2 understands that in case there is stored PDCP PDUs in the UE RX PDCP buffer for SRBs when receiving *discardOnPDCP* indication, no change to specification is needed for NR Rel-15 and 16. The UE is not mandated to handle the SN gap from the specification but it can be up to implementation to avoid UE RX window to get stuck.**

1. Conclusion

**TBD**