3GPP TSG-RAN WG2 #112-e R2-200xxxx

**Electronics, 2– 13 November, 2020**

**Agenda item: 6.4.3**

**Source: LG Electronics Inc. (Rapporteur)**

**Title: [AT112-e][712][V2X] CR update to new RAN1 decisions (LG)**

**Document for: Discussion and decision**

# Introduction

This document is to trigger the following email discussion:

 **[AT112-e][712][V2X] CR update to new RAN1 decisions (LG)**

Discuss only the remaining issues from [R2-2009250](file:///D%3A%5C%ED%91%9C%EC%A4%80%ED%9A%8C%EC%9D%98%5C%5B20201026%5D3GPP%20RAN2%23112-e%5Cdocs%5CR2-2009250.zip) and prepare the agreeable CR in [R2-2010948](file:///D%3A%5C%ED%91%9C%EC%A4%80%ED%9A%8C%EC%9D%98%5C%5B20201026%5D3GPP%20RAN2%23112-e%5Cdocs%5CR2-2010948.zip). CR will be agreed by email. Deadline is 12:00pm 11/12/2020 (UTC).

The following issues in R2-2009250 remained after the first week of RAN2#112-e:

Recommendation A3: RAN2’s understanding is that ‘the last transmission’ in 5.22.1.3.1a of 38.321 includes the last transmission terminated by HARQ feedback. No change to specifications is required to clarify this understanding.

[Apple]: Have different understanding on the meaning of “the last transmission”. Consider HARQ buffer flush is only applied into mode 1. [Huawei]: We still can leave it to UE implementation whether the buffer is flushed or not. [Apple]: But according to the current specification, the UE is mandated to flush the buffer for mode 2.

* Noted. Additional changes in R2-2009519 (first and second changes) will be discussed as part of email discussion [AT112-e][712].

Recommendation B: Add the following NOTE and remove the concerned normative text.

NOTE: If retransmission resource(s) cannot be selected by ensuring that the resource(s) can be indicated by the time resource assignment of a prior SCI, how to select the time and frequency resources for one or more transmission opportunities from the available resources is left for UE implementation by ensuring the minimum time gap between any two selected ‎resources in case that PSFCH is configured for this pool of ‎resources.

* Adding NOTE is agreed, but detailed wording will be discussed in the email discussion [AT112-e][712].

In this document, Rapporteur propose to discuss the above issues only.

# Discussion

#### Issue A: SL\_RESOURCE\_RESELECTION\_COUNTER

SL\_RESOURCE\_RESELECTION\_COUNTER is a UE variable used to reserve a selected sidelink grant for transmissions of multiple MAC PDUs in Sidelink resource allocation mode 2. This NR counter inherited from the LTE counter for the same purpose. Like in LTE, if PSSCH transmission corresponds to the last transmission of a MAC PDU, the Sidelink process decrements *SL\_RESOURCE\_RESELECTION\_COUNTER* by 1 in NR. However, unlike in LTE sidelink resource allocation mode 4, HARQ feedback can be enabled in NR sidelink resource allocation mode 2. Thus, we would need to take into account the case when transmission of a MAC PDU terminates based on HARQ ACK, e.g. as pointed out in R2-2007094.

For NR sidelink, HARQ feedback can be based on either NACK-only or ACK-NACK. Thus, RAN2#112-e agreed to support the following behaviours:

Recommendation A1: The following behaviour is supported.

- If a positive acknowledgement to a transmission of the MAC PDU has been received, the Sidelink process decrements SL\_RESOURCE\_RESELECTION\_COUNTER by 1.

* Agreed.

Recommendation A2: The following behaviour is supported.

- If a negative-only acknowledgement was enabled in the SCI and no negative acknowledgement was received for the most recent (re-)transmission of the MAC PDU, the Sidelink process decrements SL\_RESOURCE\_RESELECTION\_COUNTER by 1.

* Agreed.

Meanwhile, RAN2 decided to discuss additional changes in R2-2009519 (first and second changes) as part of email discussion [AT112-e][712]. The first two changes are written in R2-2009519 as follows:

1. Added new “if-else” seapraiton to limit “flush HARQ buffer” operation to mode 1 UE and “*SL\_RESOURCE\_RESELECTION\_COUNTER* change” behavior to mode 2 UE, respectively.

2. Added a NOTE explaining that the last transmisison of MAC PDU can be determined by mode 2 UE by a couple of different scenarios, incluiding HARQ feedback, congestion control, preemption, etc.

According to proponents in R2-2009519, the normative requirements for TX UE to flush HARQ TX buffer when receiving an affirmative HARQ feedback shall be only limited to mode 1 UE, Mode 2 UE does not need to flush HARQ TX buffer because UE implementation can simply use the newly arrived TB to replace the old data in the same buffer.

Alternatively, we would not need to differentiate SL mode 1 and 2. So, no change is needed to limit “flush HARQ buffer” operation to SL mode 1.

Companies are requested to provide their views on the first change:

Question A1: Do we need to limit “flush HARQ buffer” operation to SL mode 1 only?

**Option A1-1: Yes. “flush HARQ buffer” operation in 5.22.1.3.1a is limited to SL mode 1. So, if-else” separation in R2-2009519 is needed.**

**Option A1-2: No. “flush HARQ buffer” operation in 5.22.1.3.1a can be applicable to both SL mode 1 and 2. So, no change to “flush HARQ buffer” operation in 5.22.1.3.1a is needed.**

**Option A1-3: Apply the “flush HARQ buffer” to all cases of mode 2 “last transmisison”, not only to HARQ feedback cases.**

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| Company | Preferred option | Comment |
| LG | A1-2 | Nothing is broken in the current specification. No change is needed. |
| Apple | A1-1orA1-3 | The current procedure read as follows:1. For mode 2 UE, if this is last retrnamsision of a TB (for whatever reason), decrement COUNTER
2. Then, for mode 1 UE receiving CG from RRC or mode1/2 UE receiving HARQ FB case, flush HARQ buffer.

This create a confusion that why mode 2 UE only need to flush buffer for the HARQ FB case, but not for any other case of “last transmission”. This definitely creates extra normative requirements for mode 2 UE implementation, in which UE need to single out those cases to implement this extra step.However, there is no reasonable justification for such a differentiation for mode-2 UE to do this in one case, but not the other. To write a good specification, we do not need to create any unnecessary requirements for UE. So, if companies agree that mode 2 UE only need to decrement COUNTER when it reaches its “last transmission”, then the flush HARQ buffer operation needs to be limited to only mode 1 UE.Alternatively, if LG (rapporteur) think the flush HARQ buffer also apply to all other “last tranmission” cases for mode 2 (e.g., including blind HARQ reTX case and HARQ FB cases), then the spec still needs to be changed because this is not what the current text suggests. |
| HW | **Option A1-2** | For mode 2, flush HARQ buffer is also needed. For the selected sidelink grant which is reserved for retransmission, if previous transmission has been ACKed but the buffer is not flushed, based on current procedure, UE will still perform retransmission which is unnecessary. |
| OPPO | A1-1 | For mode-2, since the grant is generated by the UE itself, after ACK / no-NACK is received, it would not further utilize SL grant for transmission of the same TB. As stated above by the rapporteur, “UE implementation can simply use the newly arrived TB to replace the old data in the same buffer”.While for mode-1, NW may further provide re-transmission grant even if the UE receiving ACK / no-NACK, where “flushing” operation is helpful to avoid redundant re-transmission.We prefer to make the spec more rigorous. |
| CATT | **Option A1-2** | We think flush HARQ buffer for both mode1 and mode 2 is a safer way for (re-)transmission. Thus, the current spec is nothing broken. |
| vivo | A1-2 | We also understand that TX UE handling to flush HARQ TX buffer can be applicable to both SL mode 1 and 2. We don’t see the necessity to differentiate handling for mode 1 and 2.For A1-3 to add ‘flush HARQ buffer’ to other cases in the specification, we are not sure if this is really needed as this may be left to UE implementation. |
| Ericsson (Min) | A1-2 |  |
| Intel | A1-2 | Regardless of which way we go, we should first clarify UE behavior, i.e. whether the HARQ buffer flush is applicable for both mode1 and mode2. In our view, there is no real reason to restrict this to mode1. |
| Qualcomm | A1-2 | Agree with LG |
| InterDigital | A1-1 |  |

Regarding the second change, RAN2 recently agreed:

***If a positive acknowledgement to a transmission of the MAC PDU has been received, the Sidelink process decrements SL\_RESOURCE\_RESELECTION\_COUNTER by 1.***

* ***If a negative-only acknowledgement was enabled in the SCI and no negative acknowledgement was received for the most recent (re-)transmission of the MAC PDU, the Sidelink process decrements SL\_RESOURCE\_RESELECTION\_COUNTER by 1.***

During [Post111-e][707][V2X], some companies assumed that ‘the last transmission’ can cover the above agreement without any clarification. However, according to proponents in R2-2009519, the meaning of “last transmission” will be interpreted to a much wider scope and cover many different scenarios. Therefore, it is suggested to add a NOTE to clarify this.

Question A2: Do we need to specify the above agreements related to a HARQ feedback in 38.321?

**Option A2-1: New texts can be added to capture the above two agreements in 5.22.1.3.1a.**

**Option A2-2: No additional texts are needed in 5.22.1.3.1a because ‘the last transmission’ already cover the agreements.**

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| Company | Preferred option | Comment |
| LG | Option A2-1 |  |
| Apple | Yes | We believe the above agreements, if not somehow captured in the spec , will cause confusion for UE implementation. |
| HW | **Option A2-2** | We think the last transmission has already covered the above cases. The UE is clear which transmission is the last transmission as UE will flush the HARQ buffer under the following cases:1. Reaching the maximum transmission number
2. Receives ACK
3. Receives no NACK for groupcast.

For mode 1 UEs, if any of the above 3 cases happens, then UE knows the transmission before flushing the HARQ buffer is the last transmission.For mode 2 Ues, if any of 2 or 3 happens, then UE knows the transmission before flushing the HARQ buffer is the last transmission. Or if neither 2 or 3 happens, then in this case UE knows the last reserved retransmission resource for this MAC PDU is the last transmission. Even if during the transmission/retransmission procedure, pre-emption or congestion control happens, UE is able to perform resource reselection and continues retransmission. Since all reserved/reselected resources are determined by the UE, it of course knows about which resource is the last retransmission resource. But if the majority would like to add some clarification, we are fine with a note which can clarify last transmission means receiving ACK or receiving no NACK for groupcast or last reserved retransmission resource.  |
| OPPO | Option A2-2 | There are multiple cases for the counter decrement:* Receiving ACK/no-ACK;
* Maximum re-transmission number reached before receiving ACK/no-ACK;
* Even though no ACK/no-NACK being received, and maximum re-transmission number not being received, UE cannot perform additional transmission due to congestion control, pre-emption, resource dropping, PDB requirement, or the transmission of next TB has begun;

Considering all these cases can be reflected by “last transmission”, there is no need to highlight only one case separately. |
| CATT | **Option A2-2** | We think the last transmission in the current spec is already clear enough to cover all the potential cases. How to determine the last transmission can be left to UE implementation. If we add some clarifications, it will limit the cases when UE determine the last transmission. |
| Vivo | A2-1 | We are fine to add a NOTE to clarify this issue and make the specification clearer. |
| Ericsson (Min) | **Option A2-2** | We share the same view as OPPO and CATT. |
| Intel | A2-2 | We share the view with OPPO |
| Qualcomm  | Option A2-2 | We agree with the comments that the “last transmission” currently in the spec addresses this.  |
| InterDigital | Option 2-1 | Last transmission, as inherited by LTE, was associated with blind retransmission. The meaning of last transmission for NR should be clarified. Otherwise, the cases for decrementing the counter are not correctly identified in NR. |

Question A3: (If Yes in A2) How do you want to specify the above agreements related to a HARQ feedback in 38.321?

**Option A3-1: Specify the agreements in normative texts in 5.22.1.3.1a.**

**Option A3-2: Specify the agreements in a new NOTE in 5.22.1.3.1a to clarify the meaning of the last transmission.**

***NOTE: If a positive acknowledgement to a transmission of the MAC PDU has been received, or if a negative-only acknowledgement was enabled in the SCI and no negative acknowledgement was received for the most recent (re-)transmission of the MAC PDU, the MAC entity may determine this transmission corresponds to the last transmission of the MAC PDU.***

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| Company | Preferred option | Comment |
| LG | Option A3-1 |  |
| Apple | A3-2 | We think the NOTE is sufficient to explain that decrementing the COUNTER operation are not limited to the blind HARQ ReTx case used in LTE-V2X with identical text in TS 36.321. But if companies prefer the normative text, we are also fine. |
| OPPO | Option A3-2 | As replied to A2 above, we prefer No to A2.Or if RAN2 agrees to do this finally, A3-2 is preferred to avoid impact on normative text. |
| vivo | A3-2 | A3-2 is fine to us. |
| Ericsson (Min) | A3-2 |  |
| InterDigital | A3-2 | A note is sufficient. |

According to proponents in R2-2009519, the last transmisison of MAC PDU in SL mode 2 can be determined by a couple of different scenarios, including the maximum number of retransmissions, congestion control, preemption, etc. as well as HARQ feedback.

Companies are requested to provide their view on the maximum number of retransmissions, i.e. *sl-MaxTransNum.*

Question A4: Can UE use *sl-MaxTransNum* to determine the last transmission in 5.22.1.3.1a?

**Option A4-1: *sl-MaxTransNum* is used to determine the last transmsision in 5.22.1.3.1a that decrements SL\_RESOURCE\_RESELECTION\_COUNTER by 1.**

**Option A4-2: A new NOTE in 5.22.1.3.1a says that the MAC entity may consider the last transmission determined by *sl-MaxTransNum* as ‘the last transmission of the MAC PDU’.**

**Option A4-3: A new NOTE in 5.22.1.3.1a says that whether to consider *sl-MaxTransNum* in 5.22.1.3.1a is up to UE implementation.**

**Option A4-4: Nothing needs to be specified in 5.22.1.3.1a because the last transmission already covers *sl-MaxTransNum.***

**Option A4-5: Nothing needs to be specified in 5.22.1.3.1a because *sl-MaxTransNum* only applies to mode 1*.***

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| Company | Preferred option | Comment |
| LG | Option A4-1 |  |
| Apple | A4-2 | Not sure about the question, because “sl-MaxTransNum” used in the procedure text is only for mode 1 UE case,but Apple prefer a note for mode 2 case. |
| HW | A4-5 | Agree with Apple. sl-MaxTransNum only applies to mode 1. |
| OPPO | Option A4-4 | As replied to A2-2, the “last transmission” can already cover all different cases, so no need to specify each individual case explicitly. |
| CATT | A4-4 | As comments to A2-2, nothing needs to be specified. |
| vivo | A4-5 | Agree with Huawei. |
| Ericsson (Min) | A4-4 | No need to specify anything since “last transmission” is already clear. |
| Intel | A4-4 |  |
| Qualcomm | Option A4-1 | The ***sl-MaxTransNum*** should be applied to both Mode 1 and Mode 2. The ***sl-MaxTransNum*** can be used to determine the last transmission if no ACK or NACK was received.  |
| InterDigital | A4-2 | Agree with Apple. The note should cover mode 2, but sl-MaxTransNum is for mode 1. So the note covers a different aspect. |

Companies are requested to provide their view on pre-emption.

Question A5: Can UE consider the transmission dropped by pre-emption to determine the last transmission in 5.22.1.3.1a?

**Option A5-1: A new NOTE in 5.22.1.3.1a says that the MAC entity may consider the transmission dropped by pre-emption to determine ‘the last transmission of the MAC PDU’.**

**Option A5-2: A new NOTE in 5.22.1.3.1a says that whether to consider pre-emption to determine ‘the last transmission of the MAC PDU’ is up to UE implementation.**

**Option A5-3: Nothing related to pre-emption needs to be specified in 5.22.1.3.1a.**

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| Company | Preferred option | Comment |
| LG | A5-3 | The transmission dropped by pre-emption will be replaced by a new reserved resource according to 5.22.1.2. |
| Apple | A5-1 | The pre-empted resource may or may not be replaced, so this is one scenario where the UE may determine the “last transmission”. |
| HW | A5-3 | Firstly we would like to clarify “the transmission dropped by pre-emption” may not be the last transmission this is because resource reselection may be triggered and UE can continue retransmission on the reselected resources. In addition, as we commented in QA-2, if neither ACK nor no NACK (for groupcast) received, then in this case UE knows the last reserved retransmission resource for this MAC PDU is the last transmission. Even if during the transmission/retransmission procedure, pre-emption or congestion control happens, UE is able to perform resource reselection and continues retransmission. Since all reserved/reselected resources are determined by the UE, it of course knows about which resource is the last retransmission resource. |
| OPPO | Option A5-3 | As replied to A2-2, UE can consider the transmission dropped by pre-emption to determine the last transmission, but nothing needs to be additional specified since “the last transmission” already covers this scenario. |
| CATT | A5-3 | As comments to A2-2, nothing needs to be specified. |
| Vivo | A5-3 | Agree with Huawei. The last transmission may be deduced by pre-emption or congestion control however there is no inevitable relationship. We believe capturing the cases for Receiving ACK or No-ACK is enough.  |
| Ericsson (Min) | A5-3 |  |
| Intel | A5-3 | Agree with OPPO that the last transmission in the spec should include the case of pre-emption as well.  |
| Qualcomm | A5-3 | Agree with LG |
| InterDigital | A5-1 | There are cases where pre-emption causes the last transmission. So we think the note, with “may” in the wording is the correct way to capture these cases, rather than ignoring them altogether. |

Companies are requested to provide their view on congestion control.

Question A6: Can UE consider the transmission dropped by congestion control to determine the last transmission in 5.22.1.3.1a?

**Option A6-1: A new NOTE in 5.22.1.3.1a says that the MAC entity may consider the transmission dropped by congestion control to determine ‘the last transmission of the MAC PDU’.**

**Option A6-2: A new NOTE in 5.22.1.3.1a says that whether to consider congestion control to determine ‘the last transmission of the MAC PDU’ is up to UE implementation.**

**Option A6-3: Nothing related to congestion control needs to be specified in 5.22.1.3.1a.**

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| Company | Preferred option | Comment |
| LG | A6-3 | The transmission dropped by congestion control will be replaced by a new reserved resource according to 5.22.1.2. |
| Apple  | A6-2 | Congestion control may reduce the CR to be used by a TX UE, so that the TX UE has to give up the retry to avoid violating CBR rules. For this reason, this is also a scenario where the UE may determine the “last transmission”. |
| HW | A6-3 | See comment above. |
| OPPO | Option A6-3 | Similar with the comments to question A5  |
| CATT | A6-3 | See comment above. |
| Vivo | A6-3 | See comments in Question A5. |
| Ericsson (Min) | A6-3 |  |
| Intel | A6-3 | Same comment as above |
| Qualcomm | A6-3 |  |
| InterDigital | A6-1 or A6-2 | There are cases where congestion control causes the last transmission. So we think the note, with “may” in the wording is the correct way to capture these cases, rather than ignoring them altogether. |

#### Issue B: Selection of retransmission resource(s)

It has been specified in 38.321 how to select resources in case retransmission resource(s) cannot be selected up to the selected number of HARQ retransmissions by ensuring that the resource(s) can be indicated by the time resource assignment of a prior SCI, how to select the time and frequency resources for one or more transmission opportunities from the available resources.

As discussed in R2-2009250, a majority of companies support removal of the concerned normative text and adding a new NOTE. In R2-2009250, the rapporteur originally proposed to add the following NOTE in 5.22.1.1 of 38.321:

**The original NOTE proposed by the rapporteur:**

***NOTE B1: If retransmission resource(s) cannot be selected up to the selected number of HARQ retransmissions by ensuring that the resource(s) can be indicated by the time resource assignment of a prior SCI, how to select the time and frequency resources for one or more transmission opportunities from the available resources is left for UE implementation.***

However, after email discussion, the NOTE was modified based on comments from some companies. Thus, the recommendation B was finally proposed in R2-2009250 as follows:

**Recommendation B: Add the following NOTE and remove the concerned normative text.**

***NOTE B2: If retransmission resource(s) cannot be selected by ensuring that the resource(s) can be indicated by the time resource assignment of a prior SCI, how to select the time and frequency resources for one or more transmission opportunities from the available resources is left for UE implementation by ensuring the minimum time gap between any two selected ‎resources in case that PSFCH is configured for this pool of ‎resources.***

Question B: Do you support removal of the following normative text from 38.321 and addition of a new NOTE?



**Option B1: Yes. Add the above NOTE B1 and remove the normative text (possibly with minor revision).**

**Option B2: Yes. Add the above NOTE B2 and remove the normative text (possibly with minor revision).**

**Option B3: Yes. Add my own NOTE and remove the normative text.**

**Option B4: No. Do not remove the normative text (i.e. any NOTE is not added).**

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| Company | Preferred option | Comment |
| LG | B4 | Adding NOTE is also fine. But, if there is no consensus on NOTE at this meeting, we propose not to remove the current text. |
| Apple  | B2 | We agree with the modified NOTE. |
| HW | B2 | We are OK with the modified note.  |
| OPPO | B3 | B4 is not preferred since the two level-5 bullets are contradictory to each other, i.e., since it is possible that the “prior-SCI announcing” may not be always feasible, there is no reason to restrict that in the first level-5 bullet.According to our last e-mail discussion, “the minimum time gap” condition was missing in the normative text, which need to be modified. We think adding a NOTE is fine, we update the NOTE B2 with small word modification as follows:***NOTE: If retransmission resource(s) cannot be selected by ensuring that the resource(s) can be indicated by the time resource assignment of a prior SCI, how to select the time and frequency resources for one or more transmission opportunities from the available resources and ensure the minimum time gap between any two selected ‎resources in case that PSFCH is configured for this pool of resources is left for UE implementation.*** |
| CATT | B2 | The modified NOTE was proposed by us during the email discussion. If the PSFCH is configured for this pool of ‎resources‎, the resource for PSFCH transmission is already determined. Thus, when UE performs resource (re)selection, the minimum time gap between any two selected ‎resources should be guaranteed.We also fine with OPPO’s suggestion. |
| Vivo | B2 or B3 | We think B2 is already fine to a number of companies during last email discussion, with some more clarification on ensuring the minimum time gap.The re-wording suggestion by OPPO is also fine to us. |
| Ericsson (Min) | B2 | The modified note is fine. |
| Intel | B2 | We are fine with the modified note as proposed in the summary of the email discussion. |
| Qualcomm  | B2 with comment | We suggest the following clarification to Note B2***NOTE B2: If retransmission resource(s) cannot be selected by ensuring that the resource(s) can be indicated by the time resource assignment of a prior SCI, how to select the time and frequency resources for one or more transmission opportunities from the available resources is left for UE implementation, subject to the constraint the UE implementation ensuring the minimum time gap between any two selected ‎resources in case that PSFCH is configured for this pool of ‎resources.*** |
| InterDigital | B2 | We are ok with the modified note. |

# Conclusion and recommendation

In conclusion, Rapporteur proposes the following recommendations as the outcome of this email discussion: