**3GPP TSG-RAN WG2 #113bis-e *R2-210xxxx***

**E-meeting, April 2021**

Agenda Item: 6.4.2

Source: OPPO

Title: Summary of  [POST113-e][708][V2X/SL] How to handle DG for retransmissions? (OPPO)

Document for: Discussion, Decision

# Introduction

This is for the following email discussion

* [POST113-e][708][V2X/SL] How to handle DG for retransmissions? (OPPO)

**Scope:** Discuss option 1 (supported by the current spec) and option 2 (change of UE’s buffer flush behaviour).

**Intended outcome:** Discussion summary and CR (if needed)

**Deadline:** Long email discussion

# Discussion

During RAN2#113, based on the following discussion

R2-2100117 Left issue on HARQ feedback for CG OPPO, vivo, Apple, InterDigital, Qualcomm, ZTE Corporation, Sanechips, CATT discussion Rel-16 5G\_V2X\_NRSL-Core

[…]

* From RAN2 point of view, it will be good to send ACK if max number of retransmissions are reached (See further discussion and decision in comeback session).
* LS will be sent to RAN1 to inform what is specified in MAC and what is the consequence with the current ACK/NACK transmission specified in RAN1. Ask RAN1 to take it into account (See further discussion and decision in comeback session).

RAN2 converged on mode 1 TX UE reporting ACK in PUCCH when maximum retransmission number being reached when PSFCH = NACK (i.e., feedback enabled), i.e., by reverting RAN1 agreement.

However, later according to the further offline and online discussion as follows

**Further discussion on [AT113-e][712] in comeback session:**

[…]

* RAN2 confirms sl-CG-MaxTransNumList covers {only CG resources}.

[…]

* No need to send LS to RAN1.

I.e., under the assumption above, it does not matter how many HARQ retransmissions the UE has attempted for the TB in a given CG, since it is anyway bounded by the available CG resources. The Network will be able to conclude that the maximum transmission number being reached already in regardless of the sl-priority of the TB. So the LS on reverting RAN1 agreement is not needed.

However, still there is one left issue for the two options:

How to handle DG for retransmissions needs to be further discussed:

- Option 1: No change of the current specification. gNB can schedule DG resources for retransmissions with the appropriate configuration (e.g. set sl-CG-MaxTransNumList as larger value than 3, or not configure sl-CG-MaxTransNumList).

- Option 2: UE does not flush the buffer when sl-CG-MaxTransNumList is reached.

Before digging into the difference of the two options, it is important to understand the spec impact from the agreement so far.

Firstly, the current RRC/MAC spec needs to be checked based on the latest agreement.

Based on RRC spec, it seems the CG-resource limitation has been reflected in the field description

***sl-CG-MaxTransNumList***

This field indicates the maximum number of times that a TB can be transmitted using the resources provided by the configured grant. *sl-Priority* corresponds to the logical channel priority.

But not in the ASN.1

SL-CG-MaxTransNumList-r16 ::= SEQUENCE (SIZE (1..8)) OF SL-CG-MaxTransNum-r16

SL-CG-MaxTransNum-r16 ::= SEQUENCE {

sl-Priority-r16 INTEGER (1..8),

sl-MaxTransNum-r16 INTEGER (1..32)

}

**Q1-1: Based on the latest agreement “RAN2 confirms *sl-CG-MaxTransNumList* covers {only CG resources}”, any change is needed for the RRC specification?**

**Option-1: No, and UE does not expect a configuration of *sl-MaxTransNum* larger than the number of CG resources;**

**Option-2: No, and UE can be configured with *sl-MaxTransNum* of a value larger than the number of CG resources;**

**Option-3: Yes, e.g., further clarify in the field description that UE does not expect a configuration of *sl-MaxTransNum* larger than the number of CG resources;**

**Option-4: Yes, change the value range from (1..32) to (1..3), e.g., by dummifying the original field**

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| Company | Option | Comment |
| OPPO | Option-3 | Firstly, it is helpful to confirm the UE implementation assumption. Based on our understanding, a configuration of *sl-MaxTransNum* larger than the number of CG resources is not expected.  Then between Option-1 and Option-3, a clarification in field description without changing ASN.1 is the preferred way to handled it as always. |
| Ericsson (Min) | Option 2 | Don’t see any spec change is needed. |
| vivo | Option-3 | We agree that it is not expected for a configuration of *sl-MaxTransNum* larger than the number of CG resources and we are ok to clarify this in field description.  We also would like to point out that we understand a configuration of *sl-MaxTransNum* less than the number of CG resources is meaningless because if the NW would like to control the transmission number in mode-1 it can simply rely on the number of CG resources. |
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Currently, in MAC spec, one related part is as follows

1> if *sl-MaxTransNum* corresponding to the highest priority of the logical channel(s) in the MAC PDU has been configured in *sl-CG-MaxTransNumList* for the sidelink grant by RRC and the number of transmissions of the MAC PDU has been reached to *sl-MaxTransNum*; or

[…]

2> flush the HARQ buffer of the associated Sidelink process.

**Q1-2: Based on the latest agreement “RAN2 confirms *sl-CG-MaxTransNumList* covers {only CG resources}”, any change is needed for the MAC specification?**

**Option-1: No, RRC restriction is sufficient;**

**Option-2: Yes, one needs to clarify that “the number of transmissions of the MAC PDU” is limited to the transmission using CG resources;**

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| Company | Option | Comment |
| OPPO | Option-1 | The root issue is to restrict the configurable value of *sl-MaxTransNum*, so nothing else needed after clarification in RRC spec. |
| Ericsson (Min) | Neither Option 1 nor Option 2 | Don’t see any spec change is needed. |
| vivo | Option-1 | Agree with OPPO. |
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Secondly, another related part in MAC spec is as follows

2> else if HARQ feedback has been disabled for the MAC PDU and next retransmission(s) of the MAC PDU is not required:

3> instruct the physical layer to signal a positive acknowledgement corresponding to the transmission on the PUCCH according to clause 16.5 of TS 38.213 [6].

However, it is not clearly stated that how for the UE to judge the “next retransmission(s) of the MAC PDU is not required**”.**

**Q1-3a: For CG, when *sl-CG-MaxTransNumList* is configured, do you agree UE judges “next retransmission(s) of the MAC PDU is not required” based on whether *sl-CG-MaxTransNum* being reached?**

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| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | It is more than obvious.. |
| Ericsson (Min) | Agree |  |
| vivo | Agree |  |
|  |  |  |

**Q1-3b: For CG, when *sl-CG-MaxTransNumList* is NOT configured, what is your understanding on UE behaviour**

**Option-1: UE behaviour is not defined yet**

**Option-2: UE would judge “next retransmission(s) of the MAC PDU is not required” based on UE implementation**

**Option-3: Others**

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| Company | Option | Comment |
| OPPO | Option-1 | There is no RAN1 or RAN2 agreement UE behaviour when there is no *sl-CG-MaxTransNumList* being configured.  We believe in this case (when sl-CG-MaxTransNumList is NOT configured), UE loses the base to judge when to report A/N, so a reasonable implementation is UE only reports NACK. |
| Ericsson (Min) | Option 2 |  |
| vivo | Option-2 | When *sl-CG-MaxTransNumList* is NOT configured, a simple way is based on UE implementation to judge whether the next retransmission is required by considering e.g. the number of CG resources or other information. |
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Before down-selection between the two options, it would be helpful to align the understanding on option-1 and option-2.

## Option-1

According to the current RAN1 agreement on **FB disabled case**



Plus the RAN2 specification on UE flushing buffer

1> if *sl-MaxTransNum* corresponding to the highest priority of the logical channel(s) in the MAC PDU has been configured in *sl-CG-MaxTransNumList* for the sidelink grant by RRC and the number of transmissions of the MAC PDU has been reached to *sl-MaxTransNum*; or

[…]

2> flush the HARQ buffer of the associated Sidelink process.

It is aligned, i.e., by reporting ACK to network (agreed by RAN1) plus flushing the HARQ buffer (captured by RAN2 spec), network is not supposed to schedule DG-based retransmission after maximum retransmission number being reached, for FB enabled case.

The issue is mainly for **FB enabled case**, i.e., whether DG-based retransmission scheduling is necessary / allowed, where RAN1 allows NACK reporting, but flushing operation has been captured by RAN2 spec



**Q2.1-1a: When *SL-CG-MaxTransNum-r16* is configured with a value equal to or less than the number of CG resource (i.e., at most 3), based on the current specification, do you agree that “DG-based retransmission scheduling” cannot be used since UE has flushed the buffer?**

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| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | It is more than obvious since the UE is anyway of empty buffer.. |
| Ericsson (Min) | disagree | However, the gNB can always just set the maximum number to be larger than 3. |
| vivo | Agree | We understand the question is based on the assumption that the MaxTransNum is equal to or less than 3 so we agree. |
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**Q2.1-1b: When *SL-CG-MaxTransNum-r16* is configured with a value equal to or less than the number of CG resource (at most 3), based on the current specification, do you agree that PUCCH reporting (regardless of whether it is ACK or NACK), would not be useful for network decision on retransmission scheduling?**

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| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | It is more than obvious since the UE is anyway of empty buffer..  Basically, it means the concluded UE behaviour on A/N reporting by RAN1 (as follows) is meaningless, i.e., the result is the same regardless whether PSFCH/PUCCH is configured, and regardless what is reported (A/N) by PSFCH/PUCCH  cid:image003.jpg@01D6F88B.FDDFBF10 |
| Ericsson (Min) | disagree | However, the gNB can just set the maximum number to be larger than 3. |
| vivo | Partially agree | PUCCH reporting would still be useful before *SL-CG-MaxTransNum-r16* is reached. Only the last PUCCH reporting after reaching *SL-CG-MaxTransNum-r16* and when it is NACK, would bring problems as discussed before. |
|  |  |  |

Based on the RAN1 agreement an RAN2 confirmation, ***sl-MaxTransNum*** should be limited to the number of CG resources, yet the proponent of option-1 claimed that can be configured to a value larger than 3, so that the UE would never flush the buffer, rapporteur understand it is the same as not configuring ***sl-MaxTransNum***.

- Option 1: No change of the current specification. gNB can schedule DG resources for retransmissions with the appropriate configuration (e.g. set sl-CG-MaxTransNumList as larger value than 3, or not configure sl-CG-MaxTransNumList).

**Q2.1-2: If you selected option-2 for Q1-1 above, do you agree “set *sl-CG-MaxTransNumList* as larger value than 3” achieves the same result as “not configure *sl-CG-MaxTransNumList*”, i.e., UE would never flush buffer due to reaching *sl-MaxTransNum*?**

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| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| Ericsson (Min) | agree |  |
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One more thing to clarify is since the network

* Cannot differentiate A/N report on PUCCH between FB-enabled case and FB-disabled case;
* Currently the maximum transmission number of Tx-UE is applied commonly for both FB-enabled and FB-disabled case (i.e., flushing is to be done regardless whether FB is enabled or disabled);

1> if *sl-MaxTransNum* corresponding to the highest priority of the logical channel(s) in the MAC PDU has been configured in *sl-CG-MaxTransNumList* for the sidelink grant by RRC and the number of transmissions of the MAC PDU has been reached to *sl-MaxTransNum*; or

[…]

2> flush the HARQ buffer of the associated Sidelink process.

Based on option-1, network cannot achieve differentiated option for FB-enabled and FB-disabled case

- Option 1: No change of the current specification. gNB can schedule DG resources for retransmissions with the appropriate configuration (e.g. set sl-CG-MaxTransNumList as larger value than 3, or not configure sl-CG-MaxTransNumList).

**Q2.1-3: For option-1 above, do you agree that network cannot achieve differentiated control on retransmission number for FB-enabled and FB-disabled case?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | If *SL-CG-MaxTransNum-r16* is configured, there is no differentiation since the usage of the IE is for both cases (i.e., flushing is to be done regardless whether FB is enabled or disabled)  1> if *sl-MaxTransNum* corresponding to the highest priority of the logical channel(s) in the MAC PDU has been configured in *sl-CG-MaxTransNumList* for the sidelink grant by RRC and the number of transmissions of the MAC PDU has been reached to *sl-MaxTransNum*; or  […]  2> flush the HARQ buffer of the associated Sidelink process.  Or if it is not configured, without knowing whether the feedback is enabled or not, network cannot take it into account when providing DG-based retransmission scheduling.  **I.e., the existence of PSFCH/PUCCH report (when FB is enabled) does not help on network decision, and thus does not make any difference.** |
| Ericsson (Min) | disagree | The network doesn’t need to do different control between the two cases. |
| vivo | Not-agree | Firstly we don’t understand the motivation to differentiate control on retransmission number for FB-enabled and FB-disabled case.  Secondly the PUCCH report can still be helpful e.g. if option-1 is adopted, *sl-MaxTransNum* would not be reached but the gNB can still schedule DG resources for retransmissions based on PUCCH report, e.g. only when NACK is received on PUCCH the DG-based retransmission would be scheduled. |
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## Option-2

Based on the offline discussion, rapporteur understand option-2 is to change the buffer flushing operation only for the case of feedback being enabled, i.e., the buffer flushing operation is to be kept as it is for feedback being disabled case.

- Option 2: UE does not flush the buffer when sl-CG-MaxTransNumList is reached.

The reason is to align the buffer flushing operation and PUCCH A/N reporting, i.e.,

* Either to do both flushing and PUCCH = ACK reporting;
* Or to do neither flushing nor PUCH = ACK reporting (i.e., report PUCCH = NACK)

Which based on rapporteur understanding is also the intention of RAN1 based on the following agreement, i.e., for feedback disabled case

While for feedback enabled case



And rapporteur would like to highlight that so far neither RAN1 nor RAN2 has explicit agreement on flushing operation applicability issue.

So before down-selection, it is good to align the understanding of the “option-2” here.

**Q2.2-0: For option-2, do you agree the operation of “UE does not flush the buffer when *sl-CG-MaxTransNumList* is reached” is only applied to FB-enabled case, but not applied to FB-disabled case?**

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| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | The intention of option-2 is to alleviate the gap between RAN1 agreement (allowing TX-UE reporting NACK when reaching max retx number)  cid:image003.jpg@01D6F88B.FDDFBF10  and RAN2 spec (buffer flushing when reaching max retx number) for FB enabled case.  1> if *sl-MaxTransNum* corresponding to the highest priority of the logical channel(s) in the MAC PDU has been configured in *sl-CG-MaxTransNumList* for the sidelink grant by RRC and the number of transmissions of the MAC PDU has been reached to *sl-MaxTransNum*; or  […]  2> flush the HARQ buffer of the associated Sidelink process.  But for FB disabled case, since RAN1 has agreed that UE will always report ACK, there is no collision with UE flushing buffer operation.  cid:image005.jpg@01D6F88B.FDDFBF10 |
| Ericsson (Min) | agree | As specified in the MAC spc,  > else if HARQ feedback has been disabled for the MAC PDU and next retransmission(s) of the MAC PDU is not required:  3> instruct the physical layer to signal a positive acknowledgement corresponding to the transmission on the PUCCH according to clause 16.5 of TS 38.213 [6].  The UE will report ACK to gNB if the maximum CG transmissions/reransmissions are reached in case of no SL HARQ feedback. |
| vivo | Not-agree | From the RAN1 agreement quoted by rapporteur, it seems for FB disabled case, the UE can also report NACK to request resources for blind retransmission, so we wonder why this flushing operation is only applied to FB enabled case. |
|  |  |  |

Then it is good to align the same understanding on UE behaviour in case option-2 is adopted.

**Q2.2-1a: If option-2 is adopted, when *SL-CG-MaxTransNum-r16* is configured with a value equal to or less than the number of CG resource (at most 3), do you agree that “DG-based retransmission scheduling” can be used, when feedback is enabled by Tx-UE?**

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| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | It is more than obvious that if the buffer flushing operation is removed, with a non-empty buffer at UE, it will be fully up to network whether/how to provide DG-based retransmission grant. |
| Ericsson (Min) | agree | However, the same benefits are achievable even with Option 1. |
| vivo | Partially agree | **Also for FB disabled case**. When *SL-CG-MaxTransNum*is reached, the UE can report NACK to request resources for blind retransmission in FB disabled case. |
|  |  |  |

**Q2.2-1b: If option-2 is adopted, when *SL-CG-MaxTransNum-r16* is configured with a value equal to or less than the number of CG resource (at most 3), do you agree that PUCCH reporting is useful for network decision on retransmission?**

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| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | It is more than obvious that if the buffer flushing operation is removed for FB enabled case, by receiving an NACK via PUCCH, it will allow / be fully up to network whether to provide DG-based retransmission grant, regardless whether max retx number is reached. So PUCCH is necessary input for network decision. |
| Ericsson (Min) | agree | However, the same benefits are achievable even with Option 1. |
| vivo | Agree | Same view as OPPO. |
|  |  |  |

**Q2.2-2: If option-2 is adopted, when *SL-CG-MaxTransNum-r16* is configured with a value equal to or less than the number of CG resource (at most 3), do you agree that network can achieve differentiated control on retransmission number for FB-enabled and FB-disabled case?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Not-agree | Comment |
| OPPO | Agree | For FB disabled case, the network can control the max retx number via the *SL-CG-MaxTransNum-r16*.  For FB enabled case, it is instead controlled by network via dynamic scheduling, i.e., whether / how many DG-based retransmission grant is provided, under the help of PSFCH/PUCCH report.  **I.e., the existence of PSFCH/PUCCH report (when FB is enabled) does make a difference, i.e., allow the network to implement a more dynamic / flexible control on retransmission grant provisioning.** |
| Ericsson (Min) | agree | However, the same benefits are achievable even with Option 1. |
| vivo | Not-agree | The UE can also report NACK to request resources for blind retransmission in FB disabled case |
|  |  |  |

## Option-1 vs. Option-2

**Q2.3: If yes to Q2.2-1 (i.e., by assuming the option-2 above is only for FB enabled case), do you agree with option-1 or option-2?**

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| --- | --- | --- |
| Company | Option-1/2 | Comment |
| OPPO | 2 | It is to remove the gap between RAN1 agreement and RAN2 spec, and to allow a more reasonable implementation which can make full usage of the feedback via PSFCH/PUCCH.  Please note that although it has been captured in the spec, there is **NO** existing RAN2 agreement for such flushing operation at all! |
| Ericsson (Min) | Option 1 | Option 1 is simple, that means no spec changes are needed. Or in other sentences, there are nothing broken in the current spec. |
| vivo | Option-2 | We agree with OPPO observation that there was no RAN2 agreement on flushing operation. Legacy the UE should only flush buffer when NDI is toggled.  Therefore, we prefer option-2, which is simple with least specification impact. |
|  |  |  |

1. xxx.

# Conclusion

We have the following proposals

[Proposal 1 xxx.](#_Toc63679441)

# Annex: RAN2#113 minutes

R2-2100117 Left issue on HARQ feedback for CG OPPO, vivo, Apple, InterDigital, Qualcomm, ZTE Corporation, Sanechips, CATT discussion Rel-16 5G\_V2X\_NRSL-Core

Observation 1 Based on the current RAN2 spec, when HARQ FB being enabled and max re-transmission being reached yet NACK being received from Rx-UE, it is obviously a contradiction that Tx-UE auto-flushing but did not tell network via ACK in PUCCH.

Observation 2 Network cannot know whether sl-CG-MaxTransNumList has been reached or not because it has not information of the priority of the MAC PDU.

Observation 3 Based on RAN1 agreement, UE behaviour should not differ before and after maximum re-transmission being reached for CG, at least in case A/N being enabled and PUCCH being configured.

Proposal 1 Send LS to RAN1 to ask for clarification on UE behaviour if HARQ FB is enabled and max re-transmission is reached, yet NACK received from Rx-UE.

[OPPO]: Last meeting, some companies assumed max retransmission numbers is known in the gNB. However, it is defined per priority, so the gNB cannot be aware of it. It is new compared to last meeting discussion. [LG]: It was discussed last meeting, so we do not need to consider it. [Intel]: Agree with the problem. And it will be desirable if it can be solved in RAN2 instead of impacting RAN1 at this phase. [Huawei]: UE will ignore further grants for retransmission from the gNB if max number of retransmission is reached, which is already clear in MAC spec. Impact seems not so significant. [OPPO]: From UE point of view, it may be ok, however the resources for retransmissions provided by the gNB will be just wasted. Also it will be good to align this issue between RAN1 and RAN2. [Lenovo]: It will be clearer if the UE sends ACK if max retransmission is reached. [LG]: If RAN1 changes RAN1 specification, MAC will be also impacted. [Apple, Nokia, InterDigital, ZTE]: Good to send LS to RAN1 with the information what is specified in MAC and what is the consequence if we follow the existing RAN1 decision. Then it is up to RAN1 whether to change RAN1 specification or not. [Huawei]: disagree with that we send LS to RAN1. [LG]: It will be good to ask more clearly RAN1 to send ACK if max number of retransmissions are reached.

* From RAN2 point of view, it will be good to send ACK if max number of retransmissions are reached (See further discussion and decision in comeback session).
* LS will be sent to RAN1 to inform what is specified in MAC and what is the consequence with the current ACK/NACK transmission specified in RAN1. Ask RAN1 to take it into account (See further discussion and decision in comeback session).
* [AT113-e][712][V2X/SL] LS to RAN1 (OPPO)

**Scope:** Discuss and prepare the approvable LS (including the discussion on detailed wordings).

**Intended outcome:** Approvable LS in R2-2102191. LS will be approved by email.

**Deadline:** Feb 04 0430 (UTC)

**Further discussion on [AT113-e][712] in comeback session:**

[OPPO]: First we need to discuss whether sl-CG-MaxTransNumList covers {only CG resources} or {CG resources + DG resources for retransmissions} [LG, Huawei, Samsung]: According to RAN1 decision, it is clear to cover {only CG resources}.

* RAN2 confirms sl-CG-MaxTransNumList covers {only CG resources}.

[OPPO]: With the confirmation above, motivation to send LS disappears. [Session chair]: Can gNB schedule DG resources for retransmission or not? [LG]: Yes, gNB can still do that with the appropriate configuration (e.g. set sl-CG-MaxTransNumList as larger value than 3, or not configure sl-CG-MaxTransNumList). In this case, the UE will not flush the buffer and we do not need to change the current specification. [Session chair]: Do we still need to send LS? Seems not.

* No need to send LS to RAN1.

How to handle DG for retransmissions needs to be further discussed:

* Option 1: No change of the current specification. gNB can schedule DG resources for retransmissions with the appropriate configuration (e.g. set sl-CG-MaxTransNumList as larger value than 3, or not configure sl-CG-MaxTransNumList).
* Option 2: UE does not flush the buffer when sl-CG-MaxTransNumList is reached.

[Session chair]: Since option 1 is already supported in the current specification, so option 2 needs good reason to change the spec. If not, we can rely on option 1.

* [POST113-e][708][V2X/SL] How to handle DG for retransmissions? (OPPO)

**Scope:** Discuss option 1 (supported by the current spec) and option 2 (change of UE’s buffer flush behaviour).

**Intended outcome:** Discussion summary and CR (if needed)

**Deadline:** Long email discussion

[…]

R2-2100120 Left issue with RAN1 impact OPPO discussion Rel-16 5G\_V2X\_NRSL-Core

[Huawei, LG]: How to send ACK/NACK are RAN1 discussions, so it will be good to directly submit the related contribution in RAN1. [OPPO]: It is to make sure what is missed in MAC specification.

* Noted.