**3GPP TSG-RAN WG2 #124 *R2-230xxxx***

**Xiamen, China, October 2023**

Agenda Item: 7.15.3

Source: OPPO

Title: Summary of [POST123][511][V2X/SL] Additional conditions to trigger resource (re)selection (OPPO)

Document for: Discussion, Decision

# Introduction

This is for the following email discussion.

* [POST123][511][V2X/SL] Additional conditions to trigger resource (re)selection (OPPO)

**Scope:** Discuss and check companies’ views on other conditions to trigger resource (re)selection and resource (re)selection rules, based on RAN2#123 contributions.

**Intended outcome:** Discussion summary

**Deadline:** Long email discussion

# Discussion on impact to resource (re)selection due to COT

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| [**R2-2307479**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307479.zip) | In case of having received COT resources from other UE, UE gives preference to select the time and frequency resources within the intersection of the received COT resources and the resources indicated by the physical layer during resource selection. | ZTE Corporation, Sanechips |
| [**R2-2307724**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307724.zip) | Proposal 8: When the UE is the responding UE and operates in mode 2, the UE firstly selects resources from resources indicated by the physical layer and within the shared COT upon resource (re-)selection. | Xiaomi |
| [**R2-2308377**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2308377.zip) | Proposal 3: RAN2 determines which of the following factors are used to determine whether/how to prioritize selection of resources within a shared COT: 1) QoS of the data to be transmitted, 2) Measured CBR, 3) Remaining COT duration. | InterDigital |
| [**R2-2308377**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2308377.zip) | Proposal 1: A UE can prioritize resource selection within the COT if it has data for transmission that meets the COT sharing requirements associated with that COT. | InterDigital |
| [**R2-2307817**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307817.zip) | Proposal 6: Introduce below resource selection enhancement for COT sharing: MAC layer uses the remaining COT duration to further filter S\_A reported from PHY layer.  If the number of resources in this filtered subset is larger than a threshold, then MAC layer randomly selects resources within this subset.  If the number of resources in this filtered subset is smaller than a threshold, then MAC layer performs legacy resource selection (i.e., ignore COT sharing and randomly select resources within S\_A). | Apple |

**Q1-1a: Should R2 pursue the UE behavior of prioritizing the resources within a shared COT during resource selection step?**

**1) Yes**

**2) No**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | No | Our R1 colleagues told me that R1 has discussed this, yet did not take this due to the concern on increased resource collision, i.e., the collision is because multiple responding UEs all prioritize the resource within a COT. This collision should have been solved by the legacy randomized resource selection scheme. |
| Xiaomi | Yes | We think this mechanism is similar as “preferred resource” in IUC scheme. And we can have similar solutions, i.e., first select within the interaction of shared COT and resource delivered from PHY, if there is no sufficient resource within the interaction, then select within the resource delivered from PHY. As the concern raised by OPPO, the responding UE is very limited not multiple since only one additional ID can be indicated, the collision is not an issue. |
| NEC | No | Firstly RAN1 has the similar discussion but with no consensus to have this enhancement. Secondly, if to adopt this enhancement, which will be beneficial to mode 2 UE only, which will cause the unfairness to mode 1 UE. (mode 2 UE will have a high possibility to use type 2 LBT to use the COT) |
| Vivo | Yes | RAN1 does not spend much time on this issue because they are over loaded by other topics. To address OPPO’s concern, if the COT is only shared to a given unicast responding UE, there would be no collision issue between multiple responding UEs.  The benefit of the solution is to increase the channel access probability. Which is worth to support. |
| LG | Yes | Same view with Xiaomi and vivo. Collision would be not a critical issue such as commented by Xiaomi and vivo.  It is beneficial (e.g., increasing the channel access probability & reducing the type 1 LBT overhead) for the UE to be able to perform Type 2 LBT on Shared COT. |
| Apple | Yes | 1. Same view as Xiaomi, vivo and LG. Collision is not a critical issue because the number of the responding UE is expected to be limited since only one additional ID can be indicated.  2. On the comments about unfairness to mode 1 UE, isn't an issue of whole mechanism of COT sharing ? (not only for resource selection of COT sharing). And RAN2 has discussed this issue and made below agreement:  2: No change compared to enhanced LCP in mode2 is needed for the case when the COT responding UE receives mode 1 resource and shared COT from COT initiating UE.  3. On the comments about RAN1 no consensus yet, we are not sure why it is an issues. First, we are discussing about resource (re)selection in MAC layer which is led by RAN2 and should be determined by RAN2 as usual. Secondly, as far as we know, RAN1 does not spend much time on this issue. |
| Huawei, HiSilicon | Yes | If all UE select the resource randomly, there is a risk that the COT may be lost, because no UE may choose the shared COT resources. As for the collision issue mentioned by OPPO, different CPE lengths used within shared COT can be used to alleviate this issue, which had been agreed in RAN1. |
| CATT | No | We think this can be left to UE implementation which can have good balance between the benefit of using type-2 LBT on the shared COT and avoiding potential collision during resource reselection.  Also, it is seen from companies’ input in later questions that such a prioritization operation will lead to impact on resource reselection window setting, thus potentially leading to impacts to RAN1 Spec. Although people say that similar thing was done before to IUC, we still believe this is not a good way to follow, as this challenges the basic framework for resource reselection procedure in L1. |
| TCL | No | RAN1 has similar discussion and RAN2 can wait for RAN1 decision for further action if necessary. |
| Qualcomm | No | Based on our RAN1 delegate’s feedback, RAN1 did not pursue a detailed design for this because:   1. Timeline to gain benefit of sharing the COT is too slim (considering the processing time and the earliest resource in , the likelihood for that to fall within the COT remainder is very small) 2. The amount of discussions for detailed design would be large (COT-SI needs to be mapped to logical IDs, then at the time of selection of resources in LCP & MUX has not happened yet and data with higher priority and different IDs can be selected to form the TBs, etc, which complicates the criteria to “filter” )   Instead RAN1 introduced relaxations of random selection in MAC layer to allow performance improvement in different directions. For example, “it is not restricted to select resources at random” and “can select consecutive resources” (from the agreement on Mode 2 selection and MCSt), and can select prioritizing slots before reserved slots, or avoid N slots before and M after reserved slots (as in the Inter-UE blocking avoidance agreement).  In summary it is already possible that MAC prioritizes selection of desired resources according to UE’s internal determination or UE implementation, and if prioritization of resources within a shared COT is to be pursued, it should be addressed in this approach.  There can be a compromise for a simple solution resulting in minimal spec changes like “MAC layer can prioritize selection of resources in a shared COT according to UE implementation” but we object working towards complicate designs at this very late stage of Release 18. |
| Ericsson | No | Share the same view as OPPO, and Qualcomm, at the late stage, any solution agreed shall aim for minimized spec change and aim for RAN2 to complete the work in time. meanwhile, as OPPO pointed out, there may be a risk of increased collision probability in case of multiple responding UE. For Huawei comment, it is not correct. CPE extension serves the purpose of avoid inter-UE blocking not for avoiding collision of resource selection. |
| ZTE | Yes | Without such restriction, UE can not be benefit from COT sharing and corresponding COT will be lost. For the collision concern from other company, we think UE does not select COT sharing resource directly, resource is selected still based on it’s own sensing result. |
| Lenovo | Yes | We think prioritize resource selection within the shared COT is benefit for reducing the LBT duration and thus increase the transmission efficiency. And agree with Xiaomi, vivo, LG, Apple, Huawei, ZTE that collision is not a severe problem. |
| ASUSTeK | No | There would be not enough processing time (e.g., decoding COT sharing information, resource selection based on sensing result and LCP) for responding UE to select resources in shared COT right after receiving the COT sharing information from initiating UE. For example, when receiving a COT sharing information at slot n indicating a shared COT [n+1, n+K], it’d be difficult for the responding UE to prioritize selecting the resource at slot (n+1) to maintain the continuity of the COT. |
| Sharp | No | As the referred solution from IUC in Rel-17 was discussed/agreed in RAN1, and the issue was once discussed in RAN1 for SL-U and no consensus made, we tend to think the optimization for resource selection is not needed. For a selected resource, if it is within the shared COT, it can be transmitted with type 2 LBT; otherwise, type 1 is used. |
| Nokia | No | We agree with Qualcomm and OPPO and believe that this may be up to UE implementation similar to it being up to UE implementation whether to use LBT type 2 or 1 in the first place. |

**Q1-1b: If Yes to Q1-1a, under which condition the prioritization is to be done**

1. **Condition-1: the UE has the data meeting the COT requirement**
2. **Condition-2: the number of resources in the filtered resource subset (within the remaining COT duration) is larger than a threshold**
3. **Condition-3: based on QoS of the buffered data (if this option is selected, please clarify the specific rule)**
4. **Condition-4: CBR (if this option is selected, please clarify the specific rule)**
5. **Other conditions (if this option is selected, please clarify the specific rule)**

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| --- | --- | --- |
| Company | Condition(s) | Comment |
| Xiaomi | None | We think there is no need to define any condition on when to prioritize the resource within the shared COT. Actually in IUC scheme, there is no defined condition based on, e.g., CBR, QoS, number of resource etc., to determine when to prioritize the preferred resource set. Regarding condition 1, we think “UE has data meeting the COT requirement” is a prerequisite to perform type 2 LBT and to use the shared COT, which already agreed as UE implementation, therefore, we don’t need to reflect this during resource (re)selection. |
| Vivo | Condition 1 | If the responding is able to share the COT, it can use this mechanism. |
| LG | Condition 1 | If UE has data meeting the COT requirement (i.e., DST restriction and CAPC restriction), it can use this mechanism. |
| Apple | See comments  (whether/what detailed conditions should be discussed after we make conclusion whether to prioritize resource within COT duration) | 1. Not sure why to discuss detailed conditions before we make conclusion whether to prioritize resource within COT duration. We suggest to first align understanding and decide whether benefit to prioritize resource within COT duration. The decision doesn't depend on whether we define condition or not, but depend on whether the prioritization has benefits.  2. What is "condition" is confusing. For example, we are proponent of condition-2, but our intention is to first select resource within COT duration if there is sufficient resource. Otherwise (i.e. if there is no sufficient resource within the COT duration), then select within the resource set S\_A. We don't think it is a condition. |
| Huawei, HiSilicon | **Condition-1** | Only the data need to be transmitted meet the IDs matching and CAPC requirement, the responding UE can use the COT, which had been agreed in RAN1, thus Condition-1 is necessary. |
| Qualcomm | Condition 5 | We don’t support any further specifications (e.g., conditions 1 ~ 4), due to the reasons described for Q1-1a. However, it may be Condition 5 with “up to UE’s implementation” as a compromised solution if it’s agreed by majority companies to support the prioritization. |
| ZTE | **None or Condition-1** | Condition1 is ok but agree with xiaomi, we also think that LCP is performed after resource selection, UE does not konw whether the final MAC PDU can meet the COT requirement, we can leave the decision of condition-1 during LCP.  For other conditions, do not see the necessary. |
| Lenovo | **Condition-1** | We also think if prioritize resource selection within shared COT, condition-1 is a must condition, otherwise it is not necessary and useless to select resource within shared COT |

Considering in RAN1 conclusion on resource (re)selection due to inter-UE blocking (as in Annex-1), the UE is just optional to do it, so rapporteur would like to understand the proponent view, w.r.t. whether the UE should be mandated to do it.

**Q1-1c: If Yes to Q1-1a, should the UE be mandated to do the prioritization?**

1. **Yes, the UE shall do it**
2. **No, the UE may do it**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| Xiaomi | 1 or 2 | We think either 1 or 2 can be accepted. |
| Vivo | No | The UE may do it. The UE has multiple implementation choice, e.g., selecting MCSt resource, selecting the in-COT resource, we should give sufficient flexibility for the UE implementation. |
| LG | 1 | Similar with E-LCP. Just as RAN2 has agreed that if the UE uses a shared COT with type 2 LBT, the UE uses E-LCP. |
| Apple | 1 or 2 | Same view as Xiaomi |
| Huawei, HiSilicon | Yes | It is beneficial for the whole COT sharing mechanism. |
| Qualcomm | 2 | We don’t support any mandated optimization, due to the reasons described for Q1-1a. However, it may be up to UE’s implementation as a compromised solution if it’s agreed by majority companies to support the prioritization. |
| ZTE | 2 | May do is enough |
| Lenovo | 1 | If condition-1 in Q1-1b is fulfilled, it is beneficial for UE to do the prioritization |

Besides, one misc issue related to the COT-resource prioritization

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| [**R2-2308377**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2308377.zip) | Proposal 2: When prioritizing resource selection within a COT, the MAC layer provides the legacy resource selection window (i.e., based on PDB) to the PHY, and performs the prioritization from the set of available resources provided by the PHY. | InterDigital |
| [**R2-2307817**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307817.zip) | Proposal 5: If the initiating UE is selected as the destination, MAC layer of the responding UE needs to further restrict the resource selection window within remaining COT duration besides PDB of the pending SL data available in the LCH(s). | Apple |

**Q1-1d: If yes to Q1-1a, how should the resource selection window be set?**

1. **Option-1: Set as in legacy based on PDB only**
2. **Option-2: Set based on both PDB and remaining COT duration**

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| --- | --- | --- |
| Company | Option(s) | Comment |
| Xiaomi | Option 1 | Not sure if proposal 5 works since DST selection is performed after resource (re)selection. |
| Vivo | Option 1 | Option 1 can simplify the specification impact |
| LG | Option 1 | Legacy principle can be reused. |
| Apple | Option 2 | We are proponent. It seems there is some misunderstanding. We would like to clarify:  1. UE using E-LCP (i.e. UE will use COT sharing) is prerequisite of the proposal. So, to response Xiaomi's comment, in E-LCP, our understanding is that DST selection is before resource (re)selection.  2. After UE decides to use E-LCP, it means the UE will use COT sharing. Then, it doesn't make sense for the UE to select resource outside of remaining COT duration. If the UE have concern, it should not use E-LCP.  3. The spec impacts is quite simple. In Clause 5.22.1.1 of TS 38.321:  ....  3> if transmission based on random selection is configured by upper layers:  4> randomly select the time and frequency resources for one transmission opportunity from the resources pool, according to the amount of selected frequency resources and intersection between the remaining PDB of SL data available in the logical channel(s) allowed on the carrier and remaining COT duration.  3> else:  4> randomly select the time and frequency resources for one transmission opportunity from the resources indicated by the physical layer as specified in clause 8.1.4 of TS 38.214 [7], according to the amount of selected frequency resources and intersection between the remaining PDB of SL data available in the logical channel(s) allowed on the carrier and remaining COT duration.  .... |
| Huawei, HiSilicon | Option 1 |  |
| Qualcomm | Option 1 | We don’t support any further optimization, due to the reasons described for Q1-1a. However, it may be based on legacy PDB approach as a compromised solution if it’s agreed by majority companies to support the prioritization. |
| ZTE | none | We admit that the resource selection window is based on option-1. However, MAC layer does not touch the resource selection windows determination. MAC layer only only pass the remaining PDB to PHY layer, the detailed window is determied by PHY. So, why do RAN2 discuss this issue? |
| Lenovo | Option 1 | Option 1 is simpler |

And also there seems an intention to trigger resource reselection upon reception of a usable shared COT.

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| [**R2-2307978**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307978.zip) | Proposal 3: RAN2 to discuss whether a mode-2 UE can trigger resource reselection to select a resource within a usable shared COT for a selected grant not containing any resources belonging to the shared COT. | vivo |
| [**R2-2307992**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307992.zip) | Proposal 5: UE triggers a resource (re)selection when receiving a shared COT indication for cases that UE is eligible to use the shared COT | Lenovo |

**Q1-2a: Should R2 pursue the UE behavior of triggering a resource reselection upon reception of a usable shared COT?**

1. **Yes**
2. **No**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | No | Same reason as Q1-1a.  Besides, upon triggering of resource reselection, still the resource has to be selected within the set-A reported by PHY, there is no guarantee that the COT-resource would be selected. I.e., it has to come together with the enhancement in Q1-1a, otherwise, the triggering is not beneficial. |
| Xiaomi | See comment | Agree with OPPO, it depends on the outcome of Q1-1a. |
| NEC | No | Agree with OPPO. Besides, if the selected resource is still available, there is no need to trigger the resource reselection to increase complexity. |
| Vivo | Yes | It is also preferred to have an optional behavior for the reselection trigger, i.e., UE may reselect |
| LG | Yes | We understand that usable shared COT means shared COT which meets COT requirements. So, we think that Q1-2a is similar as Q1-1b. If option 1 (i.e., the UE has the data meeting the COT requirement) of Q1-1b is accepted, the answer to this question can also be easily accepted (i.e., “Yes”). |
| Apple | Yes | To fully utilize the shared resource and avoid type 1 CCA, we think it is benefit to allow UE trigger resource reselection based on COT sharing info. |
| Huawei,HiSilicon | NO |  |
| CATT | No | Same view as OPPO. No guarantee that the resource reselection triggered leads to intended effect. |
| TCL | no | See our comment in Q1-1a, can’t ensure the resource collision caused by COT selection by multiple UEs |
| Qualcomm | No | Similar reasons to Q1\_1a. No clear benefits giving the very tight timeline and many different scenarios. |
| Ericsson | No |  |
| ZTE | Yes | Same view with Apple, without this enhancement, the received COT is lost. |
| Lenovo | Yes | Trigger resource reselection based on received shared COT could fully exploit the benefit of shared COT |
| ASUSTeK | No | Similar reason in comment to Q1-1a. |
| Sharp | No |  |

**Q1-2b: If Yes to Q1-2a, under which condition the resource reselection should be triggered**

1. **Condition-1: the UE has the data meeting the COT requirement**
2. **Other conditions (if this option is selected, please clarify the specific rule)**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| Vivo | Condition 1 |  |
| LG | Condition 1 |  |
| Apple | No need to define any condition | We understand RAN2 has agreed whether to use COT sharing and whether to use E-LCP is up to UE implementation. So, defining any other condition related to COT sharing is meaningless. |
| ZTE | **None or Condition-1** | See Q1-1b. |
| Lenovo | Condition 1 |  |

Considering in RAN1 conclusion on resource (re)selection due to inter-UE blocking (as in Annex-1), the UE is just optionally to do it, so rapporteur would like to understand the proponent view, w.r.t. whether the UE should be mandated to do it.

**Q1-2c: If Yes to Q1-2a, should the UE be mandated to do the prioritization?**

1. **Yes, the UE shall do it**
2. **No, the UE may do it**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Vivo | No, UE may do it |  |
| LG | No, UE may do it |  |
| Apple | No | Up to UE implementation |
| Qualcomm | No | There was a controversial discussion in RAN1, after which companies agreed to this behavior only as:  - fully optional for the UE ("may")  - is based on an optional UE capability  - can be fully disabled by the gNB (even if the UE is capable and want to use it, gNB can stop it)  So discussions on mandating this behavior are strongly rejected since they will revert RAN1 decisions. |
| ZTE | No, UE may do it |  |
| Lenovo | No, UE may do it |  |

# Discussion on impact to resource (re)selection due to MCSt

As stated in R1 LSout (Annex-2), one left issue for R2 to conclude on the details of following issue

In Mode 2 resource allocation,

* The higher layer can indicate a “number of consecutive slots for MCSt” () larger than 1 for L1 reporting multi-slots candidates to the higher layer. The candidate multi-slots resource definition is applied.
  + Otherwise, the candidate single-slot resource definition is applied (same as R16/17).

I.e., how for high layer to select on indicate “number of consecutive slots for MCSt” larger than 1, and if so, how to decide on the concrete value of “number of consecutive slots for MCSt”.

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| [**R2-2307724**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307724.zip) | Proposal 5: MAC derives the parameter “number of slots” based on the lowest CAPC priority of LCHs to be multiplexed in the TB for MCSt based on approach 2. | Xiaomi |
| [R2-2308377](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2308377.zip) | Proposal 5: When selecting resources intended for COT initiation, the UE determines whether to select multiple consecutive resources based on the priority of pending data. FFS if any conditions are needed on the maximum length of the consecutive resources for this case. | InterDigital |
| [R2-2308377](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2308377.zip) | Proposal 7: When selecting multiple consecutive resources intended for COT sharing, the UE determines whether to select such a resource based on the priority of pending data, the amount of data available that can be transmitted, and the CBR. | InterDigital |

Firstly, for the issue-1, i.e., how for high layer to select on indicate “number of consecutive slots for MCSt” larger than 1, rapporteur understand it is essentially about how for UE to select between approach-1 and approach-2 (see Annex-3).

**Q2-1a, how for MAC layer to decide whether to indicate a “number of consecutive slots for MCSt” larger than 1?**

1. **Option-1: Up to UE implementation**
2. **Other options (if this option is selected, please clarify the concrete rule)**

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| --- | --- | --- |
| Company | Option | Comment |
| OPPO | 1 | We do not see the need to specify a rule for the selection between approach-1 and approach-2, considering that the attempt has failed in R1. |
| Xiaomi | 1 |  |
| NEC | 1 |  |
| Vivo | 1 |  |
| LG | 1 |  |
| Apple | 1 | Want to clarify whether the discussion is for single TB case only or include Multi-TB as well. We think it is single TB only, but Rapporteur may clarify. |
| Huawei,HiSilicon | 1 |  |
| CATT | 1 |  |
| TCL | 1 |  |
| Qualcomm | 1 | It should be UE’s implementation |
| Ericsson | 1 |  |
| ZTE | 1 |  |
| Lenovo | 1 |  |
| ASUSTeK | 1 |  |
| Sharp | 1 |  |
| Nokia | 1 |  |

Secondly, for the issue-2, i.e., how to decide on the oncrete value of “number of consecutive slots for MCSt”.

**Q2-1b-1, In case MAC layer decides to indicate a “number of consecutive slots for MCSt” larger than 1, how to decide on the concrete value of the “number of consecutive slots for MCSt”?**

1. **Option-1: Rely on a specified rule for UE to decide on the “number of consecutive slots for MCSt” larger than 1**
2. **Option-2” Rely on UE implementation to decide on the “number of consecutive slots for MCSt” larger than 1**

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| --- | --- | --- |
| Company | Option | Comment |
| OPPO | 2 | We do not see the need to specify a rule for the decision of N, considering a higher N value gives a longer MCSt transmission (so reduce the LBT effort/overhead) but also may lead to worse quality of identified resource candidates reported by PHY in set-A, i.e., it is always a trade-off related to channel quality environment. Therefore, UE needs to have the flexibility to set a N value. |
| Xiaomi | 1 | According to the LS from RAN1, it should be based on CAPC of the MAC PDU(s). |
| NEC | 2 |  |
| Vivo | 2 |  |
| LG | 2 |  |
| Apple | 2 | Want to clarify whether the discussion is for single TB case only or include Multi-TB as well. We think it is single TB only, but Rapporteur may clarify. |
| Huawei,HiSilicon | 2 |  |
| CATT | 1 | We think the “number of consecutive slots for MCSt, ” for single TB transmissions (as clarified by the Rapp), should be subject to two factors:   1. the allowed TX number decided by the CBR and priority, based on the “CBR-priority” look-up table. 2. the specified in TS 37.213 running CR which acts as the maximum transmission duration for the transmission of a given CAPC.   Reason for bullet 1 above is that determines the Retx number of a TB. For non-MCSt case, CBR-priority parameter adaptation has already been inherited so that resource reselection still follows the allowed TX number per “CBR-priority”, as currently specified in MAC running CR. So there is no reason why in MCSt case, this restriction w.r.t. “CBR-priority” look-up table is not followed anymore, especially considering that leaving it to UE implementation allows the UE to overbook resources, deteriorating the channel congestion situation.  Bullet 2 corresponds to the requirement in TS 37.213 running CR “A UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds where the channel access procedure is performed based on the channel access priority class associated with the UE transmissions, as given in Table 4.5-1”. |
| TCL | 2 |  |
| Ericsson | 2 |  |
| ZTE | 2? |  |
| Lenovo | 2 |  |
| ASUSTeK | 1 | As RAN1 LS suggested, we can discuss more how to set the number of slots for MCSt (e.g., CAPC, CBR, or allowed number of retransmission for the TB). |
| Sharp | 1 | We share similar view with CATT for the 1st bullet, i.e. should be at least based on the allowed TX number. Specifically, for the case of a single TB/MAC PDU, since L1 reports the candidate multi-slot resource and the number of slots is equal to , the selected TX number for the TB should be divided by . |
| Nokia | 1 |  |

**Q2-1b-2, If one selected option-1 for Q2-1b-1, how to decide on the concrete value of the “number of consecutive slots for MCSt”?**

1. **Condition-1: Based on maximum COT duration of the lowest CAPC of data in buffer**
2. **Condition-2: Based on priority of data in buffer**
3. **Condition-3: Based on the amount of data in buffer**
4. **Condition-4: Based on CBR**
5. **Other conditions**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| Xiaomi | 1 | At least the number of slots should not extend the maximum duration of the lowest CAPC of data in the buffer. |
| CATT | 1 and 4 | Same view as Xiaomi for Condition-1.  For Condition-4, it should be based on CBR and priority, decided by the allowed TX number (e.g. *sl-MaxTxTransNumPSSCH)* in the CBR-priority look-up table. |
| ASUSTeK | At least 1 and 4 | Agree with Xiaomi and CATT. Other factors can also be considered with further discussion (e.g., CAPC, CBR, or allowed number of retransmission for the TB). |
| Sharp | 4 |  |
| Nokia | At least 1 |  |

Some other left issues:

* Send an LS to RAN2 informing that it is up to RAN2 to decide in regards to the HARQ RTT timing (minimum time gap)

whether a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource

Firstly, upon the usable of MCSt, how to handle the minimum gap requirement (a + b) for data requiring HARQ feedback

6> randomly select the time and frequency resources for one or more transmission opportunities from the available resources which occur within the SL DRX Active time if configured as specified in clause 5.28.2 of the destination UE selected for indicating to the physical layer the SL DRX Active time above, according to the amount of selected frequency resources, the selected number of HARQ retransmissions and the remaining PDB of SL data available in the logical channel(s) allowed on the carrier, and/or the latency requirement of the triggered SL-CSI by ensuring the minimum time gap between any two selected resources in case that PSFCH is configured for this pool of resources, and that a retransmission resource can be indicated by the time resource assignment of a prior SCI according to clause 8.3.1.1 of TS 38.212 [9];

For which, the view from contribution ias follows

|  |  |  |
| --- | --- | --- |
| [R2-2307145](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307145.zip) | Proposal-9: Blind Retransmission of the same TB is allowed for MCSt based transmission. | NEC |

**Q2-2: In order to support MCSt, do you agree to support “a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource”?**

1. **Yes**
2. **No**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Neutral | We understand it has no impact to the SCI format, i.e., it can still indicate HARQ-feedback-required, although no gap is needed for the MCSt case.  [OPPO2] update our answer here. Even if we go with it, as clarified above, we do not think it should lead to a behavior that the HARQ-feedback attributive in SCI being overridden. Or we are open to not pursue this, for which the consequence is as Xiaomi indicated, which seems also fine. |
| Xiaomi | No with comment | Based on the existing specification, if PSFCH is configured, the minimum time gap should be ensured for any two selected resources. Then the multiple consecutive transmission for a single TB cannot be supported unless this requirement reverted or some other rules defined to solve this issue. In our understanding, considering the time gap requirement, if RP is configured with PSFCH, then only MSCt based on approach 1 can be supported and MCSt is limited to slots carrying different TB, if RP is not configured with PSFCH, MCSt based on approach 1 and approach 2 can be both supported. |
| NEC | Yes | Firstly, we agree with OPPO that there will be no impact to SCI format, secondly how to perform HARQ feedback for MCSt can be further discussed. |
| Vivo | Yes | Even with PSFCH transmission, SL transmission burst can be formulated based on RAN1 spec., so it is preferred to support the proposal. |
| LG | No | Same view with Xiaomi. It has a big impact on MAC spec, if a single TB transmitted over consecutive slots is supported. |
| Apple | Yes, but see comment | The question itself seems to be a RAN1 issue. But what RAN1 asked is how to decide minimum RTT time.  We actually think the intention is to say this is like blind retransmissions where minimum RTT time is equal to 0. We can agree it (i.e. minimum RTT time is equal to 0). Whether **“**a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource” should be decided by RAN1. |
| Huawei,HiSilicon | Up to RAN1 to decide | Although we think it is technically feasible, we think it is better to be decided by RAN1 |
| CATT | Yes | There is no reason why non-MCSt transmission can enjoy HARQ feedback enabled transmission, but MCSt transmission cannot. |
| TCL | Yes |  |
| Qualcomm | Yes with comment | 1. HARQ based retransmissions have to be transmitted in the resource pool with PSFCH allocated but blind retransmissions have not been specified so far if can be transmitted ONLY in the resource pool without PSFCH allocation (*e.g.,3> else, 4> select any pool of resources among the pools of resources except the pool(s) in sl-BWP-DiscPoolConfig or sl-BWP-DiscPoolConfigCommon, if configured.*). 2. It’s stated in RAN1’s agreement that “*It is RAN1 intention that, once the higher layer selects a multi-slots candidate from the set, it will* ***use all the single-slot resources of the selected multi-slots candidate for transmission****. This RAN1 agreement has no intention on potential RAN2 discussion about how SL resource selection processes are defined in MCSt.*” Therefore, the remaining slots of a selected multi-slot resource needs to be filled with some transmissions for retaining the MCSt.   We are open to i) details to be addressed by RAN1 or ii) details to be addressed by RAN2. |
| Ericsson | No | Have the same view as xiaomi. For resource pool with PSFCH resource, the UE shall follow the minimum HARQ RTT requirement which cannot be zero. |
| ZTE | No | Same view with Xiaomi. With this, the benefitial of PSFCH and HARQ feedback is not present. |
| Lenovo | Can follow majority | We understand with current minimum time gap requirement, single TB MCSt transmission is prevented in resource pool configured with PSFCH. Although we think this is an unnecessary restriction for single TB MCSt transmission, we are also fine to not do further optimization, i.e. single TB MCSt transmission is not allowed in RP with PSFCH, because of limited time. |
| ASUSTeK | Yes | No technical justification to have a restriction for MCSt. Besides, RAN1 also discussed how to maintain COT continuity across PSFCH occasions, so it would imply that MCSt could be supported on resource pools with PSFCH resources.  **Agreement (RAN1#113)**  When neither COT initiating UE nor responding UE intends to transmit PSFCH on some PSFCH occasion(s) within a COT, to avoid COT interruption, select one or more of the followings:   * Option 1: COT initiating UE or responding UE transmits PSSCH on such PSFCH occasion(s)   + FFS details, e.g., how PSSCH Rx UE knows such transmission, etc. * Option 2: COT initiating UE or responding UE transmits a PSFCH-like signal on such PSFCH occasion(s)   + FFS details, e.g., signaling design, etc.   Option 3: no optimization for this case |
| Sharp | Yes | Approach 2 (“guarantee MCSt for single TB and best effort for multiple TBs”) has been clarified as supporting MCSt for single TB and the minimum gap requirement still applies for the last resource of a candidate multi-slot resource and the first resource of a latter selected candidate multi-slot resource in time domain. |
| Nokia | Yes | We believe that HARQ is an important feature, and how to support is can be up for further discussion |

Secondly, how to indicate the PDB for the MCSt transmission

**In case MAC layer decides to indicate a “number of consecutive slots for MCSt” larger than 1, how for MAC to indicate the PDB**

|  |  |  |
| --- | --- | --- |
| [**R2-2307145**](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_123/Docs/R2-2307145.zip) | Proposal-5: The PDB of the parameter set for MCSt resource (re)selection is based on the lowest PDB of the SL-LCHs. | NEC |

**Q2-3: In order to support MCSt, whether the legacy remaining PDB indication from MAC to PHY upon resource (re)selection needs to be changed?**

1. **Yes**
2. **No**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | No | The legacy specification  according to the amount of selected frequency resources and **the remaining PDB of SL data available in the logical channel(s) allowed on the carrier**.  Is sufficient |
| Xiaomi | No | Same view as rapporteur. |
| NEC | See comment | Based on current spec:  NOTE 3C: How the MAC entity determines the remaining PDB of SL data is left to UE implementation.  It is not clear on how MAC entity drive the remaining PDB, where we would like to further clarify on this part. Due to currently MAC may select MCSt for multiple retransmission, where the PDB may not satisfy the lowest PDB value of the corresponding LCH if it is still purely on UE implementation. |
| Vivo | No |  |
| LG | No |  |
| Apple | No | Current spec is sufficient. |
| Huawei,HiSilicon | ?? | The question is wrong, there is, only remaining PDB indication from MAC to PHY, so not clear about the problem, it is about PDB or remaining PDB? |
| CATT | No | Fail to find necessity to make the change. |
| TCL | No |  |
| Qualcomm | No | Don’t see the benefit of it, especially at such late stage of Release 18. |
| Ericsson | No |  |
| ZTE | No | Same with rapporteur. |
| Lenovo | No | Current spec is sufficient |
| Sharp | No |  |
| Nokia | No |  |

1. Xxx.

# Conclusion

We have the following proposals:

[Proposal 1 Xxx.](#_Toc144133462)

# Annex-1: Inter-UE Blocking WA from R1#113

**Working assumption**

For Type 1 LBT block issue (inter-UE case), the following option 2 and option 1 are supported separately based on UE capability

* Option 2: If transmission in slot(s) before a reserved resource is able to share its initiated COT to the reservation [with high L1 SL priority], UE may prioritize/select resource(s) in the slot(s) for transmission.
  + FFS: details of applying this prioritization, which layer to perform above prioritization behaviour, and if the reserved resource belongs to a MCSt, the COT initiating UE should be able to share the COT to cover the whole MCSt
  + (pre)configuring enabling/disabling option 2 is supported
* Option 1:
  + UE may avoid selection of N consecutive resource(s) before a reserved resource with high L1 SL priority.
    - The value of N can be selected from {0, 1, 2}
    - The selection of the value of N is up to UE implementation
      * FFS: unless (pre-)configured or indicated by UE reserved resource in SCI
  + UE may avoid selection of M consecutive resource(s) after a reserved resource when the transmitting symbols of the reserved resource overlap with LBT of the selected resource.
    - M is determined based on UE implementation (at least including 0)
  + FFS: Which layer to perform above behaviour
  + FFS: any restriction of M
  + (pre)configuring enabling/disabling option 1 is supported
* FFS: Whether the above high priority is determined according to a (pre)configured threshold
* Note: both option1 and option2 are optional UE features

# Annex-2: R1 LSout in R1-2308664

**3GPP TSG RAN WG1 Meeting #114 R1-** **2308664**

**Toulouse, France, Aug 21st – Aug 25th, 2023**

**Title: LS on resource selection for MCSt**

**Response to: -**

**Release: Rel-18**

**Work Item: NR\_SL\_enh2-Core**

**Source: RAN1**

**To: RAN2**

**Cc: -**

**Contact person: Kevin Lin**

**Kevin.Lin@oppo.com**

**Send any reply LS to: 3GPP Liaisons Coordinator,** <mailto:3GPPLiaison@etsi.org>

**Attachments:** -

Overall description

RAN1 has discussed design details for MCSt and reached the following agreement.

|  |
| --- |
| **Agreement**  In Mode 2 resource allocation,   * The higher layer can indicate a “number of consecutive slots for MCSt” () larger than 1 for L1 reporting multi-slots candidates to the higher layer. The candidate multi-slots resource definition is applied.   + Otherwise, the candidate single-slot resource definition is applied (same as R16/17). * The higher layer selects resources from the reported according to one of the following based on UE implementation:   + Random selection as per R16/17   + Higher layer is not restricted to select resources at random, and can select in consecutive slots     - It is up to RAN2 to define detailed behaviour as needed   + It is RAN1 intention that, once the higher layer selects a multi-slots candidate from the set , it will use all the single-slot resources of the selected multi-slots candidate for transmission. This RAN1 agreement has no intention on potential RAN2 discussion about how SL resource selection processes are defined in MCSt. * Note, the above is intended to support Approach 1 and 2 only. * Send an LS to RAN2 informing that it is up to RAN2 to decide in regards to the HARQ RTT timing (minimum time gap)   + whether a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource |

As indicated in the RAN1 agreement, we would like to inform RAN2 that it is up to RAN2 to decide whether a single TB transmitted over consecutive slots is supported in a resource pool configured with PSFCH resource.

Actions:

**To RAN2:**

RAN1 respectfully requests RAN2 to take the above agreement into account in the future work.

Date of Next TSG-RAN1 Meetings:

RAN1#114bis 09th -13th Oct 2023 Xiamen, CN

RAN1#115 13th -17th Nov 2023 Chicago, US

# Annex-3: 3 Approaches for MCSt resource selection

RAN1 has discussed the following approaches to implement/achieve MCSt for SL-U communication. RAN1 would like to seek RAN2’s opinion on the following questions.

Approach 1: “best effort for multiple TBs”

* Step 1: Higher layer triggers L1 resource selection for one TB with one set of parameters (, remaining PDB, and ) - R16/17 behavior.
* Step 2: L1 report a set of candidate single-slot resource (*SA*) according to existing L1 resource allocation procedure - R16/17 behavior.
* Step 3: Higher layer selects a set of resources either randomly (R16/17 behavior) or according to a consecutive-slots criterion (new behavior) to achieve MCSt.
* Step 4: Repeat Step 1-3 for different TB if required.

Approach 2: “guarantee MCSt for single TB and best effort for multiple TBs”

* Step 1: Higher layer triggers L1 resource selection for one TB with one set of parameters (, remaining PDB, and ) + “number of slots for MCSt” which could be derived based on CAPC of the logical channel/TB or other means.
* Step 2: L1 report a set of candidate multi-slot resource (*SA*) according to most of the existing L1 resource allocation procedure (FFS: RSRP calculation / threshold may need to change)
* Step 3: Higher layer selects a candidate multi-slot resource either randomly (R16/17 behavior) or according to a consecutive-slots criterion (new behavior).
* Step 4: Repeat Step 1-3 for different TB if required.

Approach 3: “guarantee MCSt for multiple TBs”

* Step 1: Higher layer triggers L1 resource (re-)selection one time for one or multiple TBs with one set of parameters (, remaining PDB, and ) + “number of slots for MCSt” which could be derived based on CAPC of the multiple TBs.
* Step 2: L1 report a set of candidate multi-slot resource (*SA*) according to most of the existing L1 resource allocation procedure (FFS: RSRP calculation / threshold may need to change)
* Step 3: Higher layer selects transmission resource for the one or multiple TB(s) from the reported set of candidate multi-slot resource (*SA*).

# Reference

1. R2-2307090 Discussion on Resource (Re)selection and LCP Enhancement OPPO discussion Rel-18 NR\_SL\_enh2
2. R2-2307131 Consideration on SL resource selection and LCP enhancement Huawei, HiSilicon discussion Rel-18 NR\_SL\_enh2
3. R2-2307145 Consideration on MCSt impact NEC discussion NR\_SL\_enh2
4. R2-2307215 Discussion on SL resource (re)selection and LCP impact LG Electronics Inc. discussion NR\_SL\_enh2
5. R2-2307479 Discussion on resource (re)selection and LCP for SL-U ZTE Corporation, Sanechips discussion Rel-18 NR\_SL\_enh2
6. R2-2307556 Discussion on Sidelink Resource Reselection CATT discussion Rel-18 NR\_SL\_enh2
7. R2-2307724 Discussion on resource allocation and enhanced LCP for SL-U Xiaomi discussion
8. R2-2307817 Remaining issues on LCP and resource (re)selection in SL-U Apple discussion NR\_SL\_enh2
9. R2-2307903 LCP enhancement for COT sharing Ericsson, Xiaomi, Nokia, Nokia Shanghai Bell, vivo discussion Rel-18 NR\_SL\_enh2
10. R2-2307904 Resource selection and reselection for SL-U Ericsson discussion Rel-18 NR\_SL\_enh2
11. R2-2307978 Remaining issues on resource (re)selection and LCP vivo discussion Rel-18
12. R2-2307992 Discussion on resource (re)selection for NR SL-U Lenovo discussion Rel-18
13. R2-2308084 On resource reselection and enhanced LCP Intel Corporation discussion Rel-18 NR\_SL\_enh2
14. R2-2308118 Discussion on resource (re)selection and SL LCP in SL-U Spreadtrum Communications discussion Rel-18
15. R2-2308376 Implementing LCP for SL Unlicensed InterDigital discussion Rel-18 NR\_SL\_enh2
16. R2-2308377 Mode 2 Resource Selection Considering LBT Impacts InterDigital discussion Rel-18 NR\_SL\_enh2
17. R2-2308463 SL resource (re)selection with intra-UE LBT impact Samsung discussion Rel-18 NR\_SL\_enh2
18. R2-2308516 Open issues on resource (re)selection and LCP restrictions Nokia, Nokia Shanghai Bell discussion NR\_SL\_enh2
19. R2-2308590 Discussion on SL resource selection and LCP Qualcomm India Pvt Ltd discussion
20. R2-2308725 Discussion on resource (re)selection for MCSt ASUSTeK discussion Rel-18 NR\_SL\_enh2