**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.  |
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**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.  |
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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.  |
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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.  |
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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.  |
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**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 |
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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**

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| --- | --- | --- |
| Company | Yes/No | Comment |
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# 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” ($N\_{slot,MCSt}$) 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 |  |
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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). |
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**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**

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| 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.  |
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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

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| [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**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| OPPO | Yes | 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. |
| Xiaomi | See 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.  |
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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**

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| [**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 |

**Q2-2: In order to support MCSt, whether the legacy PDB indication from MAC to PHY upon resource (re)selection needs to be changed?**

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

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| Company | Yes/No | Comment |
| OPPO | No | The legacy specificationaccording 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.  |
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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.

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| **Agreement**In Mode 2 resource allocation,* The higher layer can indicate a “number of consecutive slots for MCSt” ($N\_{slot,MCSt}$) 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 $S\_{A}$ 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 $S\_{A}$, 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 ($prio\_{TX}$, remaining PDB, $L\_{subCH}$ and $P\_{rsvp\\_TX}$) - 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 ($prio\_{TX}$, remaining PDB, $L\_{subCH}$ and $P\_{rsvp\\_TX}$) + “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 ($prio\_{TX}$, remaining PDB, $L\_{subCH}$ and $P\_{rsvp\\_TX}$) + “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