**3GPP TSG RAN WG1 Meeting #100bis-E R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Source: Moderator (Intel Corporation)**

**Title: Email Discussion #1 [100b-e-NR-5G\_V2X\_NRSL-Mode-2-01]**

**Agenda item: 7.2.4.2.2**

**Document for:** **Discussion and Decision**

Introduction

This document provides discussion on issues in the first email discussion on V2X Mode-2 during RAN1#100bis-e.

[100b-e-NR-5G\_V2X\_NRSL-Mode-2-01] Email discussion/approval w.r.t. re-evaluation including aspects:

* Whether/how to ensure the timing restrictions in re-evaluation, including potential change of pre-selected resources
* Whether to mandate every slot re-evaluation

till 4/27, with potential TPs till 4/30 (Intel, Sergey)

|  |
| --- |
| Agreements:* Resource (re-)selection procedure supports re-evaluation of Step 1 and Step 2 before transmission of SCI with reservation
	+ The re-evaluation of the (re-)selection procedure for a resource reservation signalled in a moment ‘m’ is not required to be triggered at moment > ‘m – T3’ (i.e. resource reselection processing time needs to be ensured)
	+ FFS condition to change resource(s) from previous iteration to resource(s) from current iteration
	+ FFS relationship of T1 and T3, if any
	+ FFS whether to handle it differently for blind and feedback-based retransmission resources

Agreements:* For re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’, where k ≥ m,
	+ Step 1 of the resource (re-)selection procedure is performed at least at the moment ‘m-T3’, and if the pre-selected resource is not in the identified candidate resource set, Step 2 is triggered for reselection of the resource
		- Re-evaluations before the moment ‘m-T3’ or after ‘m-T3’ but before ‘m’ are not precluded and are up to UE implementation
			* FFS whether to mandate a UE to perform Step 1 checking every slot before ‘m-T3’
		- FFS whether evaluation of Step 2 has to ensure any introduced timing restrictions between pre-selected and re-selected resources when re-evaluation is triggered, and whether it is allowed to change the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions
* FFS whether for the case of enabled periodic reservation, already reserved resources in upcoming periods can be re-evaluated
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Discussion

The first aspect relates to the issue of ensuring the timing restrictions between selected but not reserved resources during re-evaluation. Since the re-evaluation can trigger resource reselection of the resource which is not in the candidate set after Step 1, there could be situations of violation of the timing restrictions between selected resources. The following timing restrictions are considered:

* HARQ RTT minimum gap Z = a + b
* If introduced, a maximum gap between two consecutive resources in order to reserve resources for HARQ retransmissions

These timing restrictions are integral parts of sensing and resource selection and better to be ensured. If those need to be ensured, there are several options to do that:

* Allow change of other pre-selected resources. Companies argue that there is no issue to do that since these resources are not yet reserved and are part of the internal UE procedures.
* Do not change the re-evaluated resource if no candidate found that fulfils the timing restrictions together with the pre-selected resources. This option can lead to RSRP larger than a threshold, but such events are anyway considered to be rare.
* Do not change the pre-selected resources but drop the re-evaluated resource.

Based on above context, the following options considered:

**Q1: Which of the following options is preferred?**

* Option 1
	+ A UE shall ensure timing restrictions between pre-selected and re-selected resources when re-evaluation is triggered
		- Option 1a: it is allowed to change the pre-selected but not reserved resources which are still in the candidate resource set in order to ensure the timing restrictions
		- Option 1b: the re-evaluated resource is left unchanged if the change can violate the timing restrictions
		- Option 1c: the re-evaluated resource is dropped if the change can violate the timing restrictions
* Option 2
	+ A UE is not required to ensure the timing restrictions during reselection of a resource which is not in the candidate set after Step 1 during re-evaluation

Please provide the supported option and technical justification:

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Option | Comment |  |
| Ericsson | 1a | Pre-selected but not reserved resources are only known by the UE itself.  |  |
| Intel | Option 1a is preferred | Ensuring timing restrictions is important for stable system performance and better KPIs.  |  |
| ZTE, Sanechips | Option 1a | When HARQ feedback is expected, HARQ RTT should be guaranteed between two selected resources of a TB. Therefore, we support Option 1.Due to its flexibility, we prefer Option 1a. |  |
| Futurewei | Option 1 | We agree that something (option 1 or option 2) needs to be specified in order to make sure that UEs have the same behavior when sensing/selection resources. While option 1a appears to be the best option, it is unclear to us how to test for the suboptions of option 1. Thus, we are not sure we need to specify more than option 1.  |  |
| NTT DOCOMO | 1a | Agree with ZTE |  |
| Qualcomm | Option 1a | The pre-selected, but not-reserved resources are only known internally to the UE. Changing them does not impact other UEs in the system and provides the simplest method to ensure timing restrictions are met.We would like to clarify that Option 1a does not imply that the UE would first have to search for resources that can be selected without violating timing restriction, but instead can go ahead and reselect all unreserved resources during reevaluation, as long as timing restrictions are ensured in the end. |  |
| Panasonic | Option 1a | As it is not reserved, to change the pre-selected but not reserved resources should be allowed |  |
| Apple | Option 1a | The change of pre-selected but not reserved resources does not affect other UEs in the system.  |  |
| Lenovo&MM | Option 1a | To ensure the time restriction for same behavior as resource selection is acceptable to us. |  |
| vivo | Option 1a | Option 1a is UE internal processing, should be allowed |  |
| MediaTek | Option 1 | We support specifying Option-1 as ensuring timing restrictions is necessary. However, we don’t see a need to specify any of the sub-bullets under Option-1. At least, Option-1a and Option-1c should both be possible and left to UE implementation as neither Option-1a nor Option-1c impact other UEs. |  |
| OPPO | Option 1 | We are in favor of ensuring timing restrictions between pre-selected and re-selected resources. But we have concern with each of the sub-option.For option 1a (seems to be the most popular one), when pre-selected resources are allowed to change, it means the first pre-selected resource may be changed to a later slot to comply the timing restrictions. In this case, it will need to be re-evaluated again at a new ‘m-T3’. If resource reselection is triggered again, then the whole selection window is shifted. Then there could be a situation where this selection window is kept on shifting and the pre-selected and re-selected resources are further delayed. Furthermore, by allowing to change pre-selected resources does not guarantee the timing restrictions (HARQ RTT and 32-slot time gap) can always be satisfied.For option 1b, as FL pointed out this will force to increase the RSRP threshold. But if this is a rare event, it may not be so bad. But still not our preference.For option 1c, needless to say this will break the chain.Overall, we are not sure if we need to mandate/specify certain UE behavior. This can be largely leave it to UE implementation / best effort by not allowing to change the pre-selected but not reserved resources which are still in the candidate resource set. |  |
| Samsung | Option 1 | Share the same view with Futurewei, MediaTeK, and OPPO. |  |
| Xiaomi | Option1 | Option 1 is enough. There is no need to further discuss how UE guarantee the timeline. |  |
| NEC | Option 1 | We agree with option 1 to introduce timing restriction. However, we don't think current option 1a and 1b/1c are contradictory. Assume we allow change (option 1a), but if the change violate the timing restrictions, then we can still adopt option 1b/option 1c. So, do you mean, * Option 1a: it is allowed to change the pre-selected but not reserved resources which are still in the candidate resource set if no resource could be selected to satisfy the timing restriction
* Option 1b: the re-evaluated resource is left unchanged if no resource could be selected to satisfy the timing restriction
* Option 1c: the re-evaluated resource is dropped if no resource could be selected to satisfy the timing restriction

Or I misunderstood it? |  |
| Bosch | Option 1 | Option 1 should be enough without specifying the details how a UE preserves the timeline. |  |
| TCL | Option 1  | Option 1 is enough as such. If need for refinement, 1a  |  |
| Fraunhofer | Option 1a or 1c | Pre-selected resources are not known to other UEs, and only to the UE carrying out resource selection. Hence, changes in pre-selected resources do not affect other UEs. | Fraunhofer |

The second aspect is related to the FFS whether to mandate a UE to perform Step 1 checking every slot before ‘m-T3’. Based on companies’ contributions, there are several pros and cons views:

* No need to trigger every slot, the UE complexity may be high, while the performance gain may be uncertain
* Every slot re-evaluation enhances latency, as shown in [13] evaluation results
* Every slot re-evaluation enhances PRR, as shown in [27] evaluation results

**Q2: Whether the FFS to mandate a UE to perform Step 1 checking every slot before ‘m-T3’ can be positively confirmed or not?**

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Support or not | Comment |  |
| Ericsson | Do not support | We do not see in point in evaluating multiple times it the last evaluation overwrites all previous evaluations. Leaving it up to UE implementation (as per current agreements) is enough. |  |
| Intel | Support | With proper step-2 implementation, it is beneficial to reduce latency, improve reliability, and overall system performance in case of pre-emption  |  |
| ZTE, Sanechips | Do not support by spec | It can be up to UE implementation. Mandating step-1 checking in every slot before m-T3 requires higher implementation complexity. |  |
| Futurewei | Do not support | No need. The current agreement (without the FFS) leaves it up to the UE implementation. That is enough |  |
| NTT DOCOMO | Do not support | No need to mandate. Although Step 1 checking every slot before ‘m-T3’ is beneficial to reduce latency, not all UEs require such low latency. Leaving it up to UE implementation is sufficient. |  |
| Qualcomm | Support | We observed significant system performance gain when re-evaluation is performed every slot by all UEs. The operation of checking if a resource is still in the candidate set can also be shared/reused with the pre-emption mechanism to limit complexity.  |  |
| Panasonic | Do not support | Up to UE implementation is enough |  |
| Apple | Do not support | The evaluation at every slot will increase UE implementation complexity.  |  |
| Lenovo&MM | Do not support | Multiple re-evaluations introduce much more complexity for UE operation. On the other hand, one shot re-evaluation at the moment ‘m-T3’ has same effect as re-evaluating all before moments. Therefore, we do not support to mandate every slot re-evaluation. |  |
| vivo | Do not support | Agree with ZTE |  |
| MediaTek | Do not support | Should be left to UE implementation |  |
| OPPO | Do not support | Same view as Ericsson and ZTE |  |
| Samsung | Do not support | Every slot Step 1 checking before ‘m-T3’ should not be mandated for re-evaluation procedure since this requires increased UE processing burden. |  |
| Xiaomi | Do not support | It can be up to UE implementation.  |  |
| NEC | Do not support | Agree with Ericsson's comment.  |  |
| Bosch | Support | For the sake of system performance enhancement, we agree with the FFS. We also agree with Qualcomm that part of the complexity can easily be shared with the pre-emption. |  |
| TCL | Do not support | This is a good feature for UEs but no need to be mandatory. |  |

Summary of proposals on the relevant issues

Finalization of re-evaluation and pre-emption requires closure of the following items, where some issues have contribution sources listed:

1. Ensure the timing restrictions or not
	* Supported: [5][7][13][16]
	* Not supported: [11][18]

Change of pre-selected resources

* + Supported: [1][5][6][7][13][17][19][24]
	+ Not supported: [3][18]
1. Every slot re-evaluation
	* Up to UE implementation: [3][4][8][9][11][16][17][18][19][21][24]
	* Mandatory: [1][5][13][15][27]
		+ [13] and [27] show results in support if it

References

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