**3GPP TSG RAN WG1 Meeting #103-E R1-** **200xxxx**

**e-Meeting, October 26th – November 13th, 2020**

**Source: Moderator (Intel Corporation)**

**Title: Discussion on [103-e-NR-Rel-16-V2X-04]**

**Agenda item: 7.2.4**

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

Introduction

This contribution provides discussion on critical issues for the thread [103-e-NR-Rel-16-V2X-04].

[103-e-NR-Rel-16-V2X-04] Email discussion/approval regarding e-evaluation procedure for periodic resource reservations

* Issue M2-1: Fix undefined UE behaviour for the case of re-evaluation performed during periodic reservation process
* Issue M2-7: Fix the issue of unreachable pre-emption event condition due to prior exclusion of slots related to non-monitored slots in the sensing window

till 10/30, with a potential CR by 11/4 – Sergey (Intel)

Outcome summary

Text proposal

1st round discussion

## Issue M2-1: Fix undefined UE behaviour for the case of re-evaluation performed during periodic reservation process

It is currently uncertain in specification whether a UE should perform re-evaluation procedure only before SCIs of the first period after the re-selection, or before ant SCI regardless of the periodic occasion.

In the last meeting the issue was discussed but no final decision was made. The following was one of the latest proposals:

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| **Updated Proposal**   * If periodic reservation is in use by a UE selecting resources, the UE performs re-evaluation procedure at least for resource(s) in the first period after the initial resource re-selection trigger or for resources in non-initial resource re-selection triggered by pre-emption   + Allow discussion in the next meeting whether re-evaluation in other than the first period is feasible and can be allowed for the UE implementation   + Note, this is intended to be captured in MAC specification   + Note, the initial resource re-selection trigger refers to the initial (re-)selection triggered according to clause 5.22.1.2 of TS 38.321, except resource re-selection triggered by re-evaluation and pre-emption |

This option was not supported by a few sources since it precludes re-evaluation every period. However, it was argued that if ‘sl-ReselectAfter’ is configured to 0 or a smaller value, then it may be already possible to do re-evaluation/re-selection when there is no packet transmission in a period.

Another issue found with re-evaluation every period is self-blocking due to step 5) execution. Similar to Issue M2-7, the resource being re-evaluated overlaps with the slot which should be excluded in step 5). In this case, after execution of steps 1)-7), the resource will not be in S\_A, even if there was no collision.

In order to facilitate decision in this meeting, the following set of questions is presented, based on the following two options:

**Option 1:**

* If periodic reservation is in use by a UE selecting resources, the UE performs re-evaluation procedure only for resource(s) in the first period after the initial resource re-selection trigger or for resources in non-initial resource re-selection triggered by pre-emption
  + Note, this is intended to be captured in MAC specification as a restriction when and which resource for re-evaluation can be passed to PHY
  + Note, the initial resource re-selection trigger refers to the initial (re-)selection triggered according to clause 5.22.1.2 of TS 38.321, except resource re-selection triggered by re-evaluation and pre-emption

**Option 2:**

* If periodic reservation is in use by a UE selecting resources, the UE performs re-evaluation procedure for resource(s) in every period by the following procedure
  + During re-evaluation check for resources indicated by a prior SCI with a period, step 5) in 8.1.4 of 38.214 is omitted during re-evaluation check
  + During re-evaluation check for resources indicated by a prior SCI with a period, in step 6)-c) in 8.1.4 of 38.214, j is let to be ‘1 to Cresel-1’ for re-evaluation, i.e. collision checking is skipped for the nearest period
  + If the resource is not in the identified resource set, then re-evaluation is indicated to MAC layer
  + MAC layer resets SL\_RESOURCE\_RESELECTION\_COUNTER following agreed procedures
  + In SCI, which was supposed to reserve the re-evaluated resource with a period, the reservation period is set to 0

**Q1-1: Does the above description of Option 1 capture the intention of performing re-evaluation only for resource in the first period? Please answer even if you don’t support Option 1.**

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| **Source** | **Short answer** | **Comments** |
| LG Electronics | Yes |  |
| Qualcomm | No | If periodic reservation is in use by a UE selecting resources, the UE performs re-evaluation procedure only for resource(s) in the first period after the initial resource re-selection trigger or for resources that has not been signalled in the immediate last or current SPS period.  The resource may not be reserved by the immediate last SPS period due to transmission drop (congestion control, prioritization, etc.), feedback not triggered, or pre-emption in the immediate last SPS. |
| NTT DOCOMO | Yes |  |
| Panasonic | Yes |  |

**Q1-2: Does the above description of Option 2 capture the intention of performing re-evaluation in every period? Please answer even if you don’t support Option 2.**

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| **Source** | **Short answer** | **Comments** |
| LG Electronics | Difficult to understand the exact behaviour of Option 2 with the current description. | At least the following comments should be clarified:   * What does the sentence of “collision checking is skipped for the nearest period” mean? Is this correct understanding that even though the re-evaluation check for the resources within the current period is performed assuming these resource are periodically reserved “Cresel-1” times, but the resource re-selection can be triggered by this check is limited to the resources within the current period? * What’s the target behaviour/technical motivation with the sentence of “MAC layer resets SL\_RESOURCE\_RESELECTION\_COUNTER following agreed procedures”? |
| Qualcomm | No | During re-evaluation check for resources indicated by a prior SCI with a period, in step 6)-c) in 8.1.4 of 38.214, j is let to be ‘1’ for re-evaluation, i.e. collision checking is performed for the immediate next period  The second last is not needed. It’s up to UE to do a full resource selection, or just transmit next period using per packet scheduling and then switch back to current resource in the next-next period. |
| NTT DOCOMO | Yes |  |
| Panasonic | Yes |  |

**Q1-3: Based on essentiality, spec impact, and backward compatibility which option (or any other alternative) should be implemented?**

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| **Source** | **Short answer** | **Comments** |
| LG Electronics | Option 1 |  |
| Qualcomm | Option 1 + Option 2 | The options as described is not exclusive. Re-evaluation for each period is needed anyway for reason explained in Q1-1. |
| NTT DOCOMO | Option 1 | Once periodic resources are reserved is signalled by TX UE, RX UE and surrounding UE(s) would exclude them at their own step 6. So from resource utilization perspective, it is important that a TX UE utilizes their reserved resources as much as possible. |
| Panasonic | Option 1+ UE implementation | We think it’s necessary to perform re-evaluation for the 1st period but not every period. It may up to implementation whether a UE needs to drop the entire periodic reservations when meet certain numbers of failures.  Therefore, the “at least for resource(s) in the first period …” with the current proposal is ok to us. |

**Q1-4: Any other compromise proposals / comments helping to resolve the outstanding issue?**

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| **Source** | **Comments** |
| Ericsson | We are not sure that everyone is discussing the same thing.  In our view, it is at least necessary to be able to re-evaluate/re-select for the upcoming period. Consider a UE using Mode2 with a reservation period:   * At time n, it selects resources n+k, n+k+P, n+k+2P, n+k+3P, … * At time n+k+j\*P, it reserves resource n+k+(j+1)\*P for j = {0,1,2,…}   Being able to to reselect resources for the coming period consist of:   * Prior to the transmission in resource n+k, the UE should re-evaluate the selected but-not-yet-reserved resource n+k+P.   + If resource n+k+P is available, go ahead and reserve it.   + If not, reselect. * Prior to the transmission in resource n+k+(j+1)\*P, the UE should re-evaluate the selected but-not-yet-reserved resource n+k+(j+2)\*P.   + If resource n+k+(j+2)\*P is available, go ahead and reserve it.   + If not, reselect. * In general (for j={0,1,2,…}), prior to the transmission in resource n+k+j\*P, the UE should re-evaluate the selected but-not-yet-reserved resource n+k+(j+1)\*P.   + If resource n+k+(j+1)\*P is available, go ahead and reserve it.   + If not, reselect.   We would also be fine with UEs being able to make changes further ahead in time, but the preceding behaviour is the minimum that we think is necessary. |
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## Issue M2-7: Fix the issue of unreachable pre-emption event condition due to prior exclusion of slots related to non-monitored slots in the sensing window

In NR SL Mode-2, when pre-emption enabled a UE performs pre-emption checking with both aperiodic and periodic traffic. In case of periodic reservation is enabled in the pool, a UE checks for pre-emption event by comparing RSRP and priority. However, the procedure of resource identification performed by the UE also includes step 5) which excludes slots in the selection window related to slots not monitored in the sensing window, with the set of periodicities configured in the resource pool.

Even if only one period is configured, a UE can face the issue that pre-emption condition is never reached even if there are collisions. This is illustrated in Figure 1 from [1].



Figure 1. Reserved resource with period P during pre-emption

In order to avoid the issue, step 5) may need to be modified for the case when executed during pre-emption checking it does not exclude the reserved resource subject to pre-emption.

**Q2-1: Do you agree that the issue is valid and need to be resolved?**

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| **Source** | **Short answer** | **Comments** |
| LG Electronics | Not critical (i.e., further agreement is not necessary) | Even in Figure 1, according to the current specification, there could be a case that a UE performing the pre-emption checking triggers the resource re-selection of periodically reserved resource if such resource is overlapped with other UE’s resource (e.g., aperiodic resource selection) with a priority satisfying the pre-emption condition, which is identified in a slot different from the location of its periodically reserved resource. |
| Ericsson | OK to correct or clarify | The following agreement is ambiguous:  Agreements:   * The procedure to check whether a reserved resource to be signaled in slot ‘m’ should be re-selected due to pre-emption:   + A regular Step 1 (as in 8.1.4 in 38.214) of the resource (re-)selection procedure is performed   + If the reserved resource is still in the identified candidate resource set after the Step 1 execution, then Step 2 for reselection of the reserved resource(s) is not triggered   + If the reserved resource is NOT in the identified candidate resource set after the Step 1 execution     - If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which can trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is triggered     - If the resource is excluded by comparison with the RSRP measurement for an SCI associated with a priority which cannot trigger pre-emption, then Step 2 for reselection of the reserved resource(s) is not triggered   In our understanding, the case discussed here does not fit into any of the two highlighted sub-bullets. In fact if a resource is excluded in Step 5, then it will not be checked in Step 6.  We do not think that a procedure that forces a UE to reselect resources always is reasonable or supported by agreements. |
| Qualcomm | Yes | This is an issue for both pre-emption and re-evaluation. |
| NTT DOCOMO | Yes | We agree with Ericsson’s points that “In fact if a resource is excluded in Step 5, then it will not be checked in Step 6.  We do not think that a procedure that forces a UE to reselect resources always is reasonable or supported by agreements”. |
| Panasonic | Yes |  |

**Q2-2: If you think the issue is valid, what solution can be applied?**

* **Examples:**
  + **Skip step 5) during pre-emption check**
  + **Do not include TX period when executing step 5)**
  + **Swap step 5) and step 6)**
  + **Etc.**

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| **Source** | **Comments** |
| Qualcomm | Skip step 5) for pre-emption and re-evaluation. |
| NTT DOCOMO | Do not include TX period when executing step 5. Resources not corresponding to the periodic resource (i.e. resources being checked pre-emption) should be excluded at step 5 as it currently is. |
| Panasonic | Do not include TX period when executing step 5. |
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References

**Contributions identified by FL to contain Mode-2 related issues:**

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**Other Rel.16 NR V2X contributions**

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39. [R1-2008496](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008496.zip) Maintenance for PSFCH and PSCCH symbol on NR sidelink ASUSTeK
40. [R1-2008497](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008497.zip) Remaining issues on sidelink power control ASUSTeK
41. [R1-2008498](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008498.zip) Miscellaneous issues of SL HARQ-ACK reporting on PUCCH ASUSTeK
42. [R1-2008529](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008529.zip) Maintenance for sidelink physical layer structure NTT DOCOMO, INC.
43. [R1-2008530](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008530.zip) Maintenance for resource allocation mechanism mode 1 NTT DOCOMO, INC.
44. [R1-2008532](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008532.zip) Maintenance for sidelink physical layer procedure NTT DOCOMO, INC.
45. [R1-2008533](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008533.zip) Maintenance for sidelink-related collision NTT DOCOMO, INC.
46. [R1-2008604](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008604.zip) Remaining Issues in Physical Layer Structure Qualcomm Incorporated
47. [R1-2008605](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008605.zip) Remaining Issues in Mode 1 Resource Allocation Qualcomm Incorporated
48. [R1-2008665](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008665.zip) Remaining issues on physical layer structure for NR sidelink vivo
49. [R1-2008666](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008666.zip) Remaining issues on mode 1 resource allocation mechanism vivo
50. [R1-2008668](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008668.zip) Remaining issues on sidelink synchronization mechanism vivo
51. [R1-2008669](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008669.zip) Remaining issues on physical layer procedure for NR sidelink vivo
52. [R1-2008721](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008721.zip) Remaining issues on physical layer procedures for sidelink KT Corp.
53. [R1-2008751](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008751.zip) Draft\_CR\_TS38.211 Ericsson
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