**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 |  |
| Vivo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Sharp | Yes |  |
| OPPO | Yes and No | Generally, agree with Option 1’s wording and we also see QC’s point that resources in the immediate last period may be dropped due to prioritization and congestion control causing the resources in the current period being un-reserved. We suggest to modify the main bullet of Option 1 as:  “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, for resources in non-initial resource re-selection triggered by pre-emption, or for resources in the current period that has not been signalled in the immediate last” |
| Samsung | Yes |  |
| CATT | Yes |  |
| Huawei/HiSilicon | Yes with minor update | Technically, after re-valuation, the UE can still perform re-evaluation, it’s up to UE implementation. But it seems this case is not captured in Option 1. So maybe in Option 1, in the last part of the main bullet, we need to change “pre-emption” to “pre-emption/re-evaluation”? |
| Futurewei | Yes |  |
| Nokia, NSB | Yes |  |

**Based on the comments it seems the description of Option 1 is mostly accurate. For the comments on the skipped immediate previous period and current period, it seems there was no such intention in Option 1. The proposal from Qualcomm and OPPO creates another option.**

**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”?   FL comment:  “Collision checking is skipped for the nearest period” is intended to say that in the current/nearest period corresponding to j = 0, the resources have been already reserved by prior SCI in immediate previous period. Thus, these resources could not be re-evaluated.  “MAC layer resets SL\_RESOURCE\_RESELECTION\_COUNTER following agreed procedures” means that re-selection due to re-evaluation resets the reselection counter since is equal to the change of resources due to full re-selection. |
| 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 |  |
| Vivo | No | To us, it is not necessary to change steps in 214, even we may accept the re-evaluation check to periodic resource. So, the proposal should eliminate RAN1 spec. change.  Our suggestion for progress as following:  1. We do not support cross-period check, which has been discussed multiple rounds without consensus.  2. We prefer a simple solution directly addressing companies’ concern who do not support option 1. To my best understanding, re-evaluation is only applied to resources which is regarded as occupied resource from proximity-UE perspective. Based on 214, the following resource is un-occupied resource from proximity-UE as commented by QC ‘resources that has not been signalled in the immediate last or current SPS period’. We agree that those resources can be re-evaluation.  Based on the discussion, we suggest following proposal (red colored part is changed based on agreement for pre-emption check) for option 2 for further discussion.   * If periodic reservation is in use by a UE, the UE perform re-evaluation check for resources provided by MAC layer to L1, according to specified procedures   + L1 expects that MAC layer provides resources intended for transmission of one TB, which can fit to resource selection window of current TB of the UE, and for which the relevant priority is available   + Re-evaluation check is not applied to the resources that have been signaled in the immediate last or current period   + If a resource is indicated for re-evaluation, a re-selection for the resource is triggered based on the specified step 1 and step 2 procedures,     - with details up to UE implementations, including whether/how to set the reservation period in the re-selected resource |
| ZTE | Partially Yes (See comment) | We agree with most bullets of option 2 except last bullet. From our understanding, once UE triggered resource reslection due to re-evaluation, it is up to UE implementation to select either the next period resource or the set of following periods resources. It is not preferred to add the restriction to say UE can only reselect resource for one period due to re-evaluation. So the last bullet is suggested to be removed. |
| Sharp | No | We share similar view as Qualcomm. |
| OPPO | Same as LGE | In addition to LGE’s questions:  As for “In SCI, which was supposed to reserve the re-evaluated resource with a period, the reservation period is set to 0”, does it mean that UE can re-select a resource in upcoming period when UE performs re-evaluation check in current period? But UE can only select a resource within a selection window and the selection window is defined and covers only the current period.  We may have more questions after. |
| Huawei/HiSilicon | Unclear about Option 2 | In Option 2, we are unclear about the 2nd sub-bullet and 4th sub-bullet, i.e., why we need “j is let to be ‘1 to Cresel-1’ for re-evaluation” and “MAC layer resets SL\_RESOURCE\_RESELECTION\_COUNTER”?  **FL comment:**  **See reply to LGE**  And we think the 1st sub-bullet is against previous agreement (copied below).  According to the cyan part of the following agreements in RAN1#98b, the re-evaluation is performed before transmission of SCI with reservation.  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 |
| Futurewei |  | We do not fully understand what the second bullet wants to capture:   * + 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   Generally speaking, option 2 is more complicated and not as clear as option 1 |
| Nokia, NSB | Not sure | I need to think about this option a bit more. |

**Based on the comments, it seems the intention of modifying j to start from 1 is not clear to everyone. Similar situation is with some other sub-bullets, i.e. the realization of Option 2 is not yet stable.**

**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. |
| vivo |  | Not necessary to down-select in-between, which has been done in previous meeting, however failed. It is suggested to compromise to a simple solution. |
| ZTE | Option 2 + UE implementation | For periodic traffic, if re-evaluation is limited to the first period, then the resource conflict cannot be avoided in the subsequent periods even if some resource collisions are detected. Therefore, we support option 2. In addition, it is up to UE implementation to reselect either the next period or the set of following periods resource(s). |
| Apple | Option 1 + UE implementation |  |
| Sharp | Option 1 | We support to keep the re-evaluation as it was defined “pre-selected resource(s)” in the agreements. |
| OPPO | Option 1 | Option 2 will lead to so much modifications of the spec. And it violates at least the definition of selection window. |
| Samsung | Option 1 |  |
| CATT | Option 1 |  |
| Huawei/HiSilicon | Option 1 | Option 2 leads to too many specification changes, and the benefits are unclear. |
| Futurewei | Option 1 |  |

**Based on the views, it seems Option 1 has majority support. There is also an interesting compromise from vivo which can be checked for support.**

**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.  **FL comment: In my understanding, your example describes Option 2** |
| vivo | As commented above |
| OPPO | Based on the example of Ericsson, we think that, prior to the transmission in resource n+k, UE performs re-evaluation. During the regular Step 1 of re-evaluation, UE will check whether there is a collision on resource n+k+P because j is up to Cresel-1. If the collision exists, UE will re-select a resource from the selection window in the current period to replace resource n+k. The corresponding resources in upcoming periods (n+k+P,n+k+2p…) will be changed due to the re-selection of n+k. Hope both interpretations can make this issue more clearly. |
| Qualcomm 2 | To further clarify, there are 2 types of re-evaluation here.  1/ Re-evaluation for the purpose of using the resource for transmission in the current period: this should be done every period for the resources in this period that has not been reserved by current period or immediately previous period.  2/ Re-evaluation for the purpose of signalling SPS reservation for the next period: this should be done every period for the resources in the next SPS period. We think that Ericsson description of the procedure correctly capture our intention. Once a collision is detected, the UE should not signal SPS reservation period for the next SPS period. It is up to UE to use per packet scheduling for the next period and switch back to the SPS grant for the one after that, or reselect the whole SPS grant from next period. |

## 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 |  |
| vivo | No | What if the pre-empting UE sends SCI in the non-monitored slots. Then the pre-empting UE cannot be detect. The benefit of the change is not easy to be justified. |
| ZTE | Yes | For pre-emption, there is not available priority of the resources excluded in step 5, so here this step is not necessary. |
| Apple | Yes |  |
| Sharp | Yes | We share the view as Ericsson and DCM. |
| OPPO | Yes | Same as QC |
| Samsung | Yes | We share the view as Ericsson |
| CATT | YEs | When performing sensing based resource exclusion operations for periodic service, the selected and reserved resource(s) would be excluded in Step 5) but there is no RSRP measurements and priority value in the hypothetical SCI format 1-A. then in Step 6), the excluded resource(s) would not be checked. Because of the absent of RX priority, the reselection cannot be triggered during the pre-emption check. So we think it should be clarified and resolved. |
| Huawei/HiSilicon | Yes | If a resource is already excluded in step 5, it will not be checked in step 6. So it’s unclear whether this resource is actually pre-empted or not. |
| Futurewe | Yes | Not absolutely critical to fix, but okay to address |
| Nokia, NSB | Yes | OK to fix even though it is doubtful if this is critical/essential. |

**Based on the comments, it seems the issue can be acknowledged.**

**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. |
| ZTE | For both pre-emption and re-evaluation, skip step 5) |
| Apple | Do not include Tx period when executing step 5) |
| Sharp | Swap step 5 and step 6 is preferred. Since current step 5 assumes the worst case of collision, without performing it, the pre-emption check could be not thorough enough. |
| OPPO | Do not include Tx period when executing step 5) |
| Samsung | We propose to remove step 5) in Mode 2 procedure.  In addition to issue M2-7, with step 5), a UE might exclude candidate resources for resource selection unnecessarily and result in performance degradation especially when short reservation periodicity is configured at higher layer. |
| CATT | Skip step 5) during pre-emption check |
| Huawei/HiSilicon | We support solution similar to 2nd sub-bullet, i.e., “Do not include TX period when executing step 5)”.  If resources subject to pre-emption check have already been periodically reserved, the period associated with the reservation is excluded from the periodicity values allowed by the higher layer parameter *sl-ResourceReservePeriodList* when executing step 5). |
| Futurewei | Skip step 5) |
| Nokia, NSB | Skip step 5 |

Skip step 5):

6

Do not include TX period in step 5)

5

Swap 5) and 6)

1

It seems skipping of step 5) has slight majority. Furthermore, excluding only the TX period from step 5) still has similar issues e.g. if other periods are integer multiple of the TX period (i.e. P / n, where n is integer). Having this in mind, skipping of step 5) is proposed for pre-emption.

**Proposal 2**

* **When resource identification procedure is performed to check for pre-emption, step 5) in section 8.1.4 of TS 38.214 is not executed**

2nd round discussion

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

FL observations

* Based on the comments it seems the description of Option 1 is mostly accurate. For the comments on the skipped immediate previous period and current period, it seems there was no such intention in Option 1. The proposal from Qualcomm and OPPO creates another option, which is similar to the suggested by vivo as a compromise.
* Based on the comments, it seems the intention of modifying j to start from 1 is not clear to everyone. Similar situation is with some other sub-bullets, i.e. the realization of Option 2 is not yet stable.
  + j was supposed to start from 1 since the case of 0 is the current period, and in usual case these resources are signalled by the immediate previous period SCI, that is why those could not be re-evaluated.
  + The intention of re-setting SL\_RES\_RESEL\_COUNTER is to capture that re-evaluation in this case terminates the SPS process
* Based on the views, it seems Option 1 has majority support. There is also an interesting compromise from vivo which can be checked for support.

Further, almost unchanged Option 1 (as per explanation above), slightly modified Option 2, and a new Option 3 are presented aiming for another round of technical discussion.

**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/re-evaluation
  + 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~~, i.e. collision checking is performed for the immediate next 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

**Option 3:**

* If periodic reservation is in use by a UE, the UE performs re-evaluation check for resources provided by MAC layer to L1, according to specified procedures
  + L1 expects that MAC layer provides resources intended for transmission of one TB, which can fit to resource selection window of current TB of the UE, and for which the relevant priority is available
  + Re-evaluation check is not applied to the resources that have been signalled in the immediate last or current period
  + If a resource is indicated for re-evaluation, a re-selection for the resource is triggered based on the specified step 1 and step 2 procedures,
    - with details up to UE implementations, including whether/how to set the reservation period in the re-selected resource

**Proposal 1**

* TBD based on further technical discussion

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| --- | --- |
| **Source** | **Comments** |
| QC | We support Option 2 + Option 3 |
| CATT | We support Option1.  For re-evaluating the non-reserved resource(s) in the next period, we think it could be avoided by the sensing check in step 6-c). and at the same time, pre-emption can also be used for avoiding the remaining collisions if it happens.  For the issue of dropped resource(s) caused by pre-emption, congestion control and prioritization, we think it is related to the LS from RAN2, we should first determine which dropped resource will cause an explicit resource re-selection trigger. if there is an explicit resource-reselection trigger, we can follow option 1’s operation and re-evaluate the reselected resource . |
| OPPO | In the updated Option 1, by adding “re-evaluation” at the end of the main bullet, in our understanding this creates some ambiguity in whether the already signalled resource in the next period can be re-evaluated.  Otherwise, we can also accept Option 3, which follows last meeting description for pre-emption, but with a modification, because there is no overbooking issue in re-evaluation. Also, the description for sub-bullet 3 is not entirely correct. We suggest to modify this sub-bullet as:   * + If a resource is indicated for re-evaluation, a re-selection for the resource is performed according to the specified step 2 procedure,   **FL comment: Good suggestion** |
| LG Electronics | We are supportive of Option 1, but just to be clear, is this correct understanding that after the initial resource re-selection trigger, if the part of resource(s) in the first period was indicated by the prior SCI, UE is not allowed to perform the re-evaluation for those resources?  **FL comment: Yes** |
| Samsung | We support Option1.  The situation is not different with the last meeting. Still Option 1 is the majority view. Note that this is maintenance phase and spec impact should be minimized. Other options are further optimization. |
| vivo | Option 3 is a compromise. In NR, we have no RSSI based resource exclusion, a TX UE can only reserve resource in one following period. If resource in previous period is not used by the UE, the UE actually cannot reserve resource to the following period, because proximity UE does not exclude it.  Regarding option 2, we are not clear about the solution, based on FL’s feedback to Ericsson, it seems cross-period check, so we have some concern. 1) if period is long, re-evaluation check for the next period is not accurate considering varying channel condition. 2) if period is short, in candidate resource set derivation step, a UE excludes the periodic resources in selection window based on *q*=1, 2, …, *Q.* if we allow TX UE to change the periodic resource freely, resource waste will occur, since proximity-UE regard original periodic resources are occupied by TX UE. |
| NTT DOCOMO | We support Option 1 without adding re-evaluation, or Option 3. |
| Huawei/HiSilicon | We support Option 1.  Some explanations on adding “/re-evaluation” to the end of the main bullet:  Assume at slot n, UE selects resources in slot n+k, n+k+P, n+k+2\*P, …  Before slot n+K, the UE can perform re-evaluation for resource in slot n+K since it’s not signalled.  And before slot n+K, the UE can perform multiple re-evaluations at different slots (it’s up to UE implementation). So we propose to add “/re-evaluation” to the end of the main bullet to capture this case, i.e., triggered by re-evaluation.  If it is consensus that this case is already captured by Option 1 without adding “/re-evaluation”, that might be ok for us, but we’d like to how it is captured. |
| Apple | We support Option 1, but can accept Option 3 as a compromise. |
| Ericsson | Option 2. For Option 3, which resources is MAC layer providing? We have trouble understanding the proposal.  **FL comment: The proposal from vivo mimics similar proposal on pre-emption with the intention that resources not being recently reserved by TDRA or Period can be re-evaluated. In this case MAC layer provides to PHY the set of resource for re-evaluation for current TB only with the above restriction.** |
| Nokia, NSB | Option 1, Option 3 is also OK if it helps to get closer to consensus |
| Bosch | We support Option 2. However, we can also accept Option 3 as a compromise if we omit or modify Option 3 first sub-bullet, i.e., sl-ResourceReservePeriod is also provided by upper layers!  In general, it should be possible to consider if a UE drops one following period, the UE can re-evaluate its resource(s).  **FL comment: the period is anyway provided by higher layers, is not it?** |
| Sharp | We share the view with Apple and Nokia. |
| Panasonic | Option 1, also ok for option 3. |
| ZTE | Option 2 was supported by us. But as a comprise, we can agree option3 but “immediate last” is not clear to us, we suggest to remove this description and only keep “current period”  **FL comment: if only “current period” is left then this becomes similar to Option 1. The intention of Option 3 is to allow re-evaluation every period if a resource was not reserved by previous period.** |

## 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

FL observations

* Based on the comments, it seems the issue can be acknowledged.
* Regarding the solution, the following “votes” distribution is observed
  + Skip step 5):
    - 6
  + Do not include TX period in step 5) or similar solution
    - 5
  + Swap 5) and 6)
    - 1

It seems skipping of step 5) has slight majority. Furthermore, excluding only the TX period from step 5) still has similar issues e.g. if other periods are integer multiple of the TX period (i.e. P / n, where n is integer). Having this in mind, skipping of step 5) is proposed for pre-emption.

**Proposal 2**

* When resource identification procedure is performed to check for pre-emption, step 5) in section 8.1.4 of TS 38.214 is not executed

|  |  |
| --- | --- |
| **Source** | **Comments** |
| QC | Skipping step 5 for pre-emption. |
| CATT | Skip step 5) for pre-emption. |
| OPPO | Assuming a resource was initially selected with performing step 5) and after RSRP threshold incremented several times to reach X% of total candidate resources, then if during pre-emption check step 5) is skipped, this likely means X% can be reached without RSRP threshold increment. Then the initially selected resource is likely assumed to be pre-empted. In a way, this is not a fair pre-emption checking. Furthermore, if step 5) is skipped and pre-emption is indicated to the higher layer, then the higher layer will re-select a resource from a newly reported candidate set which includes resources that should have been excluded by step 5) due to non-monitored slots. This would increase collision probability.  Therefore, it is safer to not include TX period in step 5). |
| LG Electronics | First of all, it should be clarified that the options listed above are used only to decide the pre-empted resources (i.e., not for generating the set of idle resources to be used for the pre-empted resource re-selection at higher layer). If this understanding is not correct, please let us know about it.  Assuming that this understanding is correct, we are not technically convinced that it is desirable to simply ignore a possibility that the transmission with high priority value (satisfying the pre-emption threshold) exists in the non-monitored slot and its reserved resource is overlapped with that of pre-emption checking UE.  In this sense, we think that the followings can be considered as an alternative solution.   * In case when a UE has a packet to be transmitted with a priority value lower than the pre-emption threshold (i.e., priopre in TS 38.214), * the UE doesn’t include its own reservation periodicity in Step 5) for the pre-emption checking. * Otherwise (i.e., a UE has a packet to be transmitted with a priority value equal to or larger than the pre-emption threshold), * the UE assumes that the excluded reserved resource in Step 5) due to the non-monitored slot are pre-empted. |
| Samsung | We support remove step 5) in general Mode 2 procedure. We do not want to skipping step 5) only for pre-emption. We think that including step 5) does not provide much benefit. As we commented before, with step 5), a UE might exclude candidate resources for resource selection unnecessarily and result in performance degradation especially when short reservation periodicity is configured at higher layer. |
| Vivo | I am a little confused based on the 1st round discussion, I am not sure whether I get the point or not, our opinion is given as below.  The issue did not exist at RAN1#98 when we decided to support pre-emption mechanism, we did not use the wording ‘candidate resource set’, instead, we used wording ‘associated RSRP threshold’. However, we somehow made an editorial mistake in later meetings. We just fixed it based on existing agreement, new agreement is not necessary at all  98b Agreements**:**   * Support a resource pre-emption mechanism for Mode-2   + A UE triggers reselection of already signaled resource(s) as a resource reservation in case of overlap with resource(s) of a higher priority reservation from a different UE and, SL-RSRP measurement associated with the resource reserved by that different UE is larger than an associated SL-RSRP threshold     - Only the overlapped resource(s) is/are reselected     - FFS       * the timeline for reselection       * other details     - FFS whether or not to support other potential UE behaviour (e.g, power boosting/reduction)   + This mechanism can be enabled or disabled, per resource pool     - FFS details   As agreed, the intention to derive the candidate resource set in re-evaluation/pre-emption is to determine the associated RSRP threshold. We just change the re-evaluation/pre-emption check in 38.214 to original wording,  “If a resource from the set is not a member of …”🡺  “If measured RSRP on a resource from the set is larger than associated RSRP threshold, …”. … the associated RSRP threshold is derived based on …. of … |
| NTT DOCOMO | We share OPPO’s comment above and still support not to include TX period in step 5). Just to skip step 5) would make identified resource sets unfair between initial identification with step 5) and another identification due to pre-emption without step 5), and all the resources initially excluded at step 5) could be highly likely to be included in the identified resource set. |
| Huawei/HiSilicon | We share similar view with OPPO and NTT DOCOMO, and support not to include TX period in step 5).  Skipping step 5) would lead to inaccurate resource exclusion for determining the remaining candidate resource set S\_A, and also causes unfairness between initial selection and pre-emption check. |
| Apple | We share the views from OPPO and other companies. The exclusion of TX period from step 5) makes accurate resource exclusion and keeps fairness between initial selection and pre-emption check. |
| Ericsson | We are OK with the proposal. |
| Nokia, NSB | Support FL proposal |
| Bosch | We agree to skip step 5) for pre-emption. |
| Sharp | We agree FL proposal. |
| Panasonic | We share similar view with OPPO and NTT DOCOMO, and support not to include TX period in step 5). |
| ZTE | We agree to skip step 5) for pre-emption |

3rd round discussion

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

FL observations

* For Option 1
  + 4 sources for Option 1 only
  + 5 sources for Option 1 or Option 3 as a compromise
* For Option 2 only
  + 1 source for Option 2 only
  + 3 sources for Option 2 or Option 3
* For Option 3
  + 1 source for Option 3 only
  + 8 sources for Option 3 as a compromise to other option

From the support analysis, it seems Option 3 may become a good compromise, with necessary updates suggested by companies.

**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/re-evaluation
  + 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’ for re-evaluation, i.e. collision checking is performed for the immediate next period
  + If the resource is not in the identified resource set, then re-evaluation is indicated to MAC layer
  + In SCI, which was supposed to reserve the re-evaluated resource with a period, the reservation period is set to 0

**Option 3:**

* If periodic reservation is in use by a UE, the UE performs re-evaluation check for resources provided by MAC layer to L1, according to specified procedures
  + L1 expects that MAC layer provides resources intended for transmission of one TB, which can fit to resource selection window of current TB of the UE, and for which the relevant priority is available
  + Re-evaluation check is not applied to the resources that have been signalled in the immediate last or current period
  + If a resource is indicated for re-evaluation, a re-selection for the resource is performed according to the specified step 2 procedure,

**Proposal 1**

* Support Option 3 above

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| --- | --- |
| **Source** | **Comments** |
| vivo | Fine with FL proposal |
| NTT DOCOMO | We support FL Proposal 1. |

## 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

FL comments:

* There is majority in support of skipping step 5)
* It seems the arguments from OPPO are valid and skipping of step 5) can introduce misalignment between initial selection and pre-emption resource sets.
* On the LGE question, the intention of the procedure in 8.1.4 is that after its execution, both pre-emption event and the candidate set for reselection can be obtained simultaneously
* There could be different solutions in two different cases
  + **Understanding 1**: When pre-emption is checked by procedure in 8.1.4, the candidate set S\_A for re-selection is simultaneously obtained
  + **Understanding 2**: When pre-emption is checked by procedure in 8.1.4, the candidate set S\_A for re-selection can be obtained by another execution of 8.1.4 with potentially different outcome S\_A between the two attempts
* If Understanding 1 is common, then the solution to the issue should strive for the same outcome of 8.1.4 for initial selection and pre-emption/re-evaluation check
* If Understanding 2 is common, then outcome of 8.1.4 could be different between initial selection and pre-emption/re-evaluation check

Based on Understanding 1, it seems there the following are suitable options:

* Do not include TX period in step 5) during pre-emption check
  + It does not solve the cases of integer multiple periods
* In step 5) do not exclude slots containing resources for pre-emption check
  + This should minimize the difference between initial selection and re-evaluation

It seems the new option can work well in all cases. For consideration, the previous proposal and the alternative proposal are suggested for further discussion:

**Proposal 2**

* When resource identification procedure is performed to check for pre-emption, step 5) in section 8.1.4 of TS 38.214 is not executed

**Proposal 2’**

* When resource identification procedure is performed to check for pre-emption, in step 5) in section 8.1.4 of TS 38.214 the slots containing resources subject to pre-emption check are not excluded

|  |  |
| --- | --- |
| **Source** | **Comments** |
| vivo | Neither is preferred. Actually, the issue is raised, because we do not follow the preemption check procedure agreed at RAN1#98 bis. We do not need to discuss new technical solution to address editorial mistake. So, we propose a conclusion to re-interpret the agreement, then the issue can be resolved automatically.  Proposed conclusion   * The procedure of pre-emption check agreed at the RAN1#100bis is interpreted as following to align with pre-emption check procedure agreed at the RAN1#98bis   + A regular Step 1 (as in 8.1.4 in 38.214) of the resource (re-)selection procedure is performed   + If SL-RSRP measurement associated with the reserved resource is larger than the associated SL-RSRP threshold which is used to derive the identified candidate resource set after the Step 1 execution, then Step 2 for reselection of the reserved resource(s) is not triggered   + If SL-RSRP measurement associated with the reserved resource is not larger than the associated SL-RSRP threshold which is used to derive 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   I cite the agreement as following, if I make a mistake, please point it out.  98b Agreements**:**   * Support a resource pre-emption mechanism for Mode-2   + A UE triggers reselection of already signaled resource(s) as a resource reservation in case of overlap with resource(s) of a higher priority reservation from a different UE and, SL-RSRP measurement associated with the resource reserved by that different UE is larger than an associated SL-RSRP threshold     - Only the overlapped resource(s) is/are reselected     - FFS       * the timeline for reselection       * other details     - FFS whether or not to support other potential UE behaviour (e.g, power boosting/reduction)   + This mechanism can be enabled or disabled, per resource pool     - FFS details   100b Agreements:   * The procedure to check whether a reserved resource to be signaled in slot ‘m’ should be re-selected due to pre-emption, is performed at the moment ‘m-T3’ as follows:   + 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 |
| NTT DOCOMO | We support Proposal 2’. Proposal 2 could lead to not only misalignment between the initial S\_A and the S\_A identified by pre-emption check, but also the situation where the resources with high collision probability could be included in the S\_A identified by pre-emption check. Since whether the resource(s) associated with the unmonitored slots are really reserved or not is invisible from pre-emption checking UE anyway, it should avoid including such resources in S\_A as much as possible.  Our understanding is that, with performing step 5) as it currently is, pre-emption would not be performed at all. We don’t think a regular step 5) could resolve this issue. |

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**Other Rel.16 NR V2X contributions**

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28. [R1-2008232](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008232.zip) Text proposal of physical layer procedure for NR sidelink OPPO
29. [R1-2008237](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008237.zip) Corrections for FDM-based semi-static power split for in-device coexistence OPPO
30. [R1-2008334](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008334.zip) Correction on sidelink timing definition Huawei, HiSilicon
31. [R1-2008381](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008381.zip) Remaining issue on physical layer structure and procedure for sidelink in NR V2X Panasonic Corporation
32. [R1-2008387](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008387.zip) Remaining issues on physical layer structure for NR sidelink Sharp
33. [R1-2008388](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008388.zip) Remaining issues on resource allocation mode 1 for NR sidelink Sharp
34. [R1-2008390](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008390.zip) Remaining issues on synchronization mechanism for NR sidelink Sharp
35. [R1-2008391](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008391.zip) Remaining issues on physical layer procedures for NR sidelink Sharp
36. [R1-2008428](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008428.zip) Remaining Issues of Physical Layer Procedures Apple
37. [R1-2008429](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008429.zip) Remaining Issue of Sidelink Physical Layer Structure Apple
38. [R1-2008430](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008430.zip) Remaining Issues of Mode 1 Resource Allocation Apple
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
54. [R1-2008753](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2008753.zip) Draft\_CR\_TS38.213 Ericsson

1. [R1-2008754](file:///C:\\Users\\wanshic\\OneDrive%20-%20Qualcomm\\Documents\\Standards\\3GPP%20Standards\\Meeting%20Documents\\TSGR1_103\\Docs\\R1-2008754.zip) Draft\_CR\_TS38.214 Ericsson