**3GPP TSG RAN WG1 #105-e R1-210xxxx**

**e-Meeting, May 10th – 27th, 2021**

**Source: Moderator (Intel Corporation)**

**Title: Discussion [105-e-NR-5G\_V2X-05]**

**Agenda item: 7.2.4**

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

Introduction

This document provides discussion on the following approved email thread as part of RAN1#105-e Release 16 NR V2X maintenance discussion:

[105-e-NR-5G\_V2X-05] Email discussion/approval regarding

* Issue M2-1: TP to implement the agreement from [104b-e-NR-5G\_V2X-03]

till 5/24 – Sergey (Intel)

Outcome

Discussion on Draft CR

## Round 1

In RAN1#104bis-e the following agreement was made:

Agreement

* Update the specification of identification of candidate resources for Mode-2 resource allocation in section 8.1.4 of TS 38.214 to handle the case when X·M\_total number of identified resources could not be reached after any number of loop iterations
	+ If the number of the excluded resources in step 5 is larger than (1-X)·M\_total, a UE skips step 5

There was no sufficient time to implement the above agreement as a CR. In this meeting, the discussion on CR is initiated separately.

From the review of contributions [1]-[7], the following two different interpretations have been identified:

**Interpretation 1 [1][2][3][5][6][7]**

* The step 5 is performed, and after its completion the condition on (1-X)·M\_total is checked. If the excluded number of resources is greater, then the result of step 5 is ignored, i.e. S\_A is re-initialized as in step 4.

**Interpretation 2 [4]**

* The step 5 is interpreted as a loop over periodicities and/or non-monitored slots. In this assumption, once a UE excludes a slot / period leading to the number of excluded resources greater than (1-X)·M\_total, it breaks the loop of step 5 and continues with step 6; S\_A is not re-initialized.

Note, in [1] it is proposed to further introduce additional functionality beyond the agreement proposed in P2 and P3, therefore these considerations are not taken into account – only P1 is assumed relevant.

It should be noted that Interpretation 1 was also FL understanding in RAN1#104bis-e, and this could be tracked from the beginning of the discussion in [104b-e-NR-5G\_V2X-03]. Nevertheless, the first question would be to confirm this interpretation (or interpretation 2), and then go to the detailed implementation discussion.

**Q1: Which of the interpretations 1 and 2 above or any other interpretation/combination is correct in your view and should be further pursued as a CR?**

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| **Source** | **Answer** | **Comment** |
| OPPO | Interpretation 1 | In our view, interpretation 2 was never intended and discussed as a solution from the beginning. It has several technical issues and these are discussed in [2]. |
| vivo | Comment | Firstly, we would like to confirm that the question is on interpretation on the agreement, but not a specific solution preferred by companies.If yes, our understanding is that the agreement does not preclude either of the interpretations. Secondly, we are not sure whether this question is really relevant to the CR. The CR should follow RAN1’s agreement, not for a specific interpretation. Different interpretations are allowed for implementation as long as there is no interoperation issue. In this specific case, regardless of which interpretation is implemented, there is no interoperation issue between TX and RX UEs. Thus, the interoperation can be up to UE implementation. |
| ZTESane | Interpretation 1 |  |
| Ericsson | Interpretation 1 | Regarding vivo’s comment, we do not think that interpretation 2 is compatible with the agreement. The agreement states that “a UE skips step 5”, not that “a UE skips part of step 5” or “a UE stops executing step 5”. |
| Futurewei | Comment | Not sure the interpretation is as important as having good CR text, but ok to provide our view: the key aspect of the agreement was that under that condition step 5 is skipped, but what to set for SA (outside of Step 5 in 5-1) was not explicit in the agreement. The draft CR from last time is one way to do this, where SA was initialized to the value the same as in Step 4. Our Proposal 2 is another (better) way to initialize in step 5-1 (see example below). (Our proposal 3 is even better, but does change the threshold for skipping step 5 so we agree it is a further enhancement.) We feel Proposal 2 is in scope under the agreement but not covered by interpretation 1 or 2. 5-1)  If the number of candidate single-slot resources excluded from the set  is larger than (1- X)⋅  , select the resources from those excluded in step 5) according to the order of time first, frequency 2nd, from low to high index on each domain and add them to set  until the number of the candidate single-slot resources remaining in the set  is not smaller than (X+X)⋅  , with X =5%.  |
| QC | Interpretation 1 | We agree with Ericsson.  |
| LG Electronics | Interpretation 1 | We shared the same view with Ericsson. |
| NTT DOCOMO | Comment | We do not have preference, but our feeling is following.Once see vivo’s proposal, the TP seems not a loop over periodicities and/or non-monitored slots but just adding one condition to apply step 5. Outcomes of interpretation 1/2 would be completely same. In this case, we should take just majority one, i.e. interpretation 1. Why we need to select minority one? |
| CATT, GOHIGH | Interpretation 1 | We agree with Ericsson. |
| Sharp | Interpretation 1 | In our view, the proposed text from vivo seems to have an issue. The overall description of step 5) is to determine whether to exclude one $R\_{x,y}$, while based on vivo’s proposal, the exclusion depends on whether the remaining S\_A after exclusion of every $R\_{x,y}$ satisfies the inequality, which is not clear enough. Moreover, we also share the view from Ericsson that the agreement does not lead to interpretation 2. |
| Apple | Interpretation 1 | We think the agreement mentions “skip Step 5”, which means the whole Step 5 is not executed.  |
| Samsung | Interpretation 1 | We agree with Ericsson. |
| Spreadtrum | Interpretation 1 | The agreement in RAN1#104bis-e clearly states that if the number of the excluded resources in step 5 is larger than (1-X)·M\_total, a UE skips step 5. We think that a UE skips step 5 means the result of step 5 is ignored. |
| NEC | Interpretation |  |
| Huawei, HiSilicon | Interpretation 1, with comment | The agreement is straightforward that step 5 is skipped entirely, not partially.However, the agreement does not preclude that something else needs to be done once step 5 is skipped, before step 6 is executed. Returning a certain amount of the resources excluded by step 5 can help to avoid a high RSRP threshold after step 6, so this could be considered. |
| Nokia, NSB | Interpretation 1 | Interpretation 1 is what the dictionary meaning of “skip” requires. Moreover, there are technical issues with Interpretation 2, as mentioned in our tdoc. |

## Round 2

From the collected views in Round 1, it is clear that Interpretation 1 is a way forward.

Based on this, the following draft TP is suggested based on versions:

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| << UNCHANGED PARTS OMITTED >>4) The set $S\_{A}$ is initialized to the set of all the candidate single-slot resources. 5) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:- the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.5-1) If the number of candidate single-slot resources $\_{}$ excluded from the set $S\_{A}$ in step 5 is greater than $\_{}$, the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources as in Step 4.6) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:<< UNCHANGED PARTS OMITTED >> |

**Q2: Please provide your views on the above draft TP.**

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| **Source** | **Comment** |
| **Ericsson** | Agree with FL’s TP. |
| Nokia, NSB | The TP is correct. But in our view it would be more readable to reuse the same wording for the condition as in step 7, that is “If the number of candidate single-slot resources remaining in the set $S\_{A}$ is smaller than $X⋅M\_{total}$, then”.  |
| vivo | We **object** this TP.We understand most companies prefer interpretation 1, but as stated before this is not relevant to how to capture the agreement. The agreement is to resolve the infinite loop issue, and either interpretation can serve this purpose. Introducing a new step of “re-initialization” is an unnecessary enhancement that beyond the RAN1 agreement. The key point we object this TP is not about which interpretation is better. The problem is the proposed TP introduces something not agreed (at least in our view), including at least:1. we did not agree to have an additional step 5-1)
2. we did not agree to do the re-initialization

On the other hand, some companies think the TP we provided cannot lead to interpretation 1. Then I try to provide a new TP as compromise:==========5)  The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:-     the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.-     for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.If the number of candidate single-slot resources $R\_{x,y}$ excluded from the set $S\_{A}$ in step 5 is greater than $(1-X)⋅M\_{total}$, step 5 is skipped.=========The above TP exactly aligns with the agreement, which should be acceptable to all. |
| OPPO | We are fine with either FL’s TP or the suggestion from Nokia using “…is smaller than $X⋅M\_{total}$ …”. |
| Futurewei | Our preference is still to do proposal 2 in our contribution which is a better solution. It is in the scope of the agreement, as 'skip' could mean cannot add anything into step 5 and ok to add step 5-1 and discuss the initialization. But as last time we can accept the majority as it is important to fix the problem. |
| Sharp | We are fine with FL’s TP. Regarding TP from vivo, since “step 5 is skipped” is performed after the exclusion procedure of step 5 itself, actually it also means SA goes back to the original set. We don’t think it change the coding implementation of the whole procedures. |
| QC | Agree with the TP |
| Samsung | O.K with the TP but we prefer the wording suggested by Nokia. |
| NTT DOCOMO | OK with either the TP or updated one by Nokia. |
| CATT, GOHIGH | Both FL's TP and Nokia's TP are OK. Nokia's wording is preferable. |
| Huawei, HiSilicon | We are generally fine with the TP and prefer Nokia’s version.We also think the agreement allows returning a certain amount of the resources excluded by step 5 in step 5-1). This could also be considered. |
| ZTE, Sanechips | Agree with Nokia's update. |

## Round 3

From the responses, it seems we now have two versions: the TP from Round 2 and the proposal from vivo, since they object the original TP.

Although it is an unfortunate situation that the intended understanding is objected, I **suggest considering vivo’s direction of implementing the agreement to remove the objections.**

In that sense, in this round it is asked whether the following version of the TP is not “objectable” accepting a bit less accurate description than possible.

Note, the comments from Futurewei and Huawei/HiSilicon on enhancing the re-initialization of S\_A are considering out of scope of the task of implementing the previous agreement.

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| << UNCHANGED PARTS OMITTED >>4) The set $S\_{A}$ is initialized to the set of all the candidate single-slot resources. 5) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:- the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.If the number of candidate single-slot resources $R\_{x,y}$ remaining in the set $S\_{A}$ is smaller than $X⋅M\_{total}$, step 5 is skipped.6) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:<< UNCHANGED PARTS OMITTED >> |

**Q3: Please indicate whether the above version merged from Nokia and vivo comments is acceptable.**

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| **Source** | **Comment** |
| vivo | The change is acceptable to us. Regarding Sharp’s comment of “step 5 is skipped” is performed after the exclusion procedure of step 5 itself, not sure I correctly understand this comment, but please note that the TP is not an additional step after step 5, it is part of the description of step 5. Thus, I think it should be OK to derive interpretation 1 if you want. |
| Sharp | We support the current version. @vivo, thank you for the response. Our former comment is to say the text from vivo in Round 2 seems equivalent to FL’s text, sorry for confusion. |
| OPPO | The latest proposed TP is NOT acceptable to us as it is unclear the meaning of “skipped” in the specification. Based on the current version, Step 5 has already been performed when UE determines the remaining resources in candidate set are smaller than X\*Mtotal and decides to skip Step 5. How does the UE skip Step 5 under the condition that Step 5 is already performed? Furthermore, the behaviour described in the specification needs to be concise without ambiguity. By saying only “skipped”, it is unclear what should be UE do with the candidate resource set *SA*. Therefore, our preference is still the TP in round 2 or the TP in round 2 with the modification from Nokia. |
| CATT, GOHIGH | The current TP is not acceptable. The description of "step5 is skipped" will lead to ambiguity. In specification, accurate description is necessary. We support the FL's TP in Round 2 or Nokia's updated TP in Round 2.  |
| ZTE, Sanechips | Similar confusion as OPPO, we prefer Nokia's proposed update in the previous round.5-1) If the number of candidate single-slot resources remaining in the set $S\_{A}$ is smaller than $X⋅M\_{total}$, the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources as in Step 4. |

References

1. **R1-2104194 TP to address infinite loop due to excessive resource exclusion for Rel. 16 V2X FUTUREWEI**

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| -------------------------------- Start of Text Proposal for 38.214 (Based on Proposal 1) -----------------------------------<Unchanged parts omitted>8.1.4 UE procedure for determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink resource allocation mode 2<Unchanged parts omitted>5) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:- the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.5-1) If the number of candidate single-slot resources $R\_{x,y}$ excluded from the set $S\_{A}$in step 5 is greater than (1-$ $X)⋅$ M\_{total}$, the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources as in step 4).<Unchanged parts omitted>-------------------------------- End of Text Proposal for 38.214 (Based on Proposal 1) ----------------------------------- |

1. **R1-2104751 Discussion on TPs for skipping step 5 in mode 2 RA OPPO**

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| 4)  The set $S\_{A}$ is initialized to the set of all the candidate single-slot resources. 5)  The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:-     the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.-     for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.5-1) If the number of candidate single-slot resources excluded from the set $S\_{A}$ in step 5 is greater than $(1-X)⋅M\_{total}$, the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources.6)  The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions: |

1. **R1-2104887 Correction to sidelink resource identification procedure to prevent infinite loop issue – implementation of the agreement from [104b-e-NR-5G\_V2X-03] Intel Corporation**

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| << UNCHANGED PARTS OMITTED >>4) The set $S\_{A}$ is initialized to the set of all the candidate single-slot resources. 5) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:- the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.If the number of candidate single-slot resources $\_{}$ excluded from the set $S\_{A}$ in step 5 is greater than $\_{}$, the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources.6) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:<< UNCHANGED PARTS OMITTED >> |

1. **R1-2105463 Maintenance on NR sidelink mode-2 resource allocation mechanism vivo**

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| ------------------------------------------------ Start of Draft TP of TS 38.214 --------------------------------------------8.1.4 UE procedure for determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink resource allocation mode 2<Unchanged parts omitted>4) The set $S\_{A}$ is initialized to the set of all the candidate single-slot resources. 5)  The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:-     the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.-     for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.-     the number of candidate single-slot resources excluded from the set $S\_{A}$ is not greater than $(1-X)⋅M\_{total}$---------------------------------------------------------- End of Draft TP ---------------------------------------------------- |

1. **R1-2105612 Remaining issues on mode 2 ZTE, Sanechips**

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| 8.1.4 UE procedure for determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink resource allocation mode 2<Unchanged parts omitted>4) The set $S\_{A}$ is initialized to the set of all the candidate single-slot resources. 5) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:- the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.5-1) If the number of candidate single-slot resources remaining in the set $S\_{A}$ is smaller than $X⋅M\_{total}$, the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources.6) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:a) the UE receives an SCI format 1-A in slot $t'\_{m}^{SL}$, and '*Resource reservation period'* field, if present, and '*Priority*' field in the received SCI format 1-A indicate the values $P\_{rsvp\\_RX}$ and $prio\_{RX}$, respectively according to Clause 16.4 in [6, TS 38.213];b) the RSRP measurement performed, according to clause 8.4.2.1 for the received SCI format 1-A, is higher than $Th\left(prio\_{RX},prio\_{TX}\right);$c) the SCI format received in slot $t'\_{m}^{SL} $or the same SCI format which, if and only if the '*Resource reservation period*' field is present in the received SCI format 1-A, is assumed to be received in slot(s) $t'\_{m+q×P\_{rsvp\\_RX}^{'}}^{SL}$ determines according to clause 8.1.5 the set of resource blocks and slots which overlaps with $R\_{x,y+j×P\_{rsvp\\_TX}^{'}}$ for *q*=1, 2, …, *Q* and *j=*0, 1, …, $C\_{resel}-1$. Here, $P\_{rsvp\\_RX}^{'}$ is $P\_{rsvp\\_RX}$ converted to units of logical slots according to clause 8.1.7, $Q=\left⌈\frac{T\_{scal}}{P\_{rsvp\\_RX}}\right⌉ $ if $P\_{rsvp\\_RX}< T\_{scal}$ and $ n^{'}-m\leq P\_{rsvp\\_RX}^{'}$, where $t'\_{n^{'}}^{SL} = n$ if slot *n* belongs to the set $\left(t'\_{0}^{SL},t'\_{1}^{SL},...,t'\_{T'\_{max}-1}^{SL}\right)$, otherwise slot $t'\_{n^{'}}^{SL}$ is the first slot after slot *n* belonging to the set $\left(t'\_{0}^{SL},t'\_{1}^{SL},...,t'\_{T'\_{max}-1}^{SL}\right)$; otherwise $Q=1$. $T\_{scal}$ is set to selection window size *T2* converted to units of msec.7) If the number of candidate single-slot resources remaining in the set $S\_{A}$ is smaller than $X⋅M\_{total}$, then $Th(p\_{i},p\_{j})$ is increased by 3 dB for each priority value $Th(p\_{i},p\_{j})$ and the procedure continues with step 4.<Unchanged parts omitted> |

1. **R1-2105897 Condition to stop the infinite loop for Mode 2 RA Ericsson**

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| 8.1.4 UE procedure for determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink resource allocation mode 2<Unchanged parts omitted>4) The set $S\_{A}$ is initialized to the set of all the candidate single-slot resources. 5) The UE shall exclude any candidate single-slot resource $R\_{x,y}$ from the set $S\_{A}$ if it meets all the following conditions:- the UE has not monitored slot $t'\_{m}^{SL}$ in Step 2.- for any periodicity value allowed by the higher layer parameter *sl-ResourceReservePeriodList* and a hypothetical SCI format 1-A received in slot $t'\_{m}^{SL}$ with '*Resource reservation period*' field set to that periodicity value and indicating all subchannels of the resource pool in this slot, condition c in step 6 would be met.5-1) If the number of candidate single-slot resources $R\_{x,y} $excluded from the set $S\_{A}$ in step 5 is greater than $(1-X)⋅M\_{total}$, the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources as indicated in Step 4. |

1. **R1-2105944 Maintenance for Resource allocation for sidelink - Mode 2 Nokia, Nokia Shanghai Bell**

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| -------------------------- Start of Text Proposal for TS 38.214 --------------------------8.1.4 UE procedure for determining the subset of resources to be reported to higher layers in PSSCH resource selection in sidelink resource allocation mode 2------------------- < Unchanged parts are omitted > --------------------------5a) If the number of candidate single-slot resources remaining in the set $S\_{A}$ is smaller than $X⋅M\_{total}$, then the set $S\_{A}$ is initialized to the set of all the candidate single-slot resources.-------------------------- End of Text Proposal for TS 38.214 -------------------------- |