**3GPP TSG-RAN WG2 #113-e *R2-20XXXXX***

**E-meeting, January 2020**

Agenda Item:

Source: OPPO (rapporteur)

Title: Draft summary of email discussion [701][V2X] RAN1 related discussion (OPPO)

Document for: Discussion, Decision

# Introduction

This is to kick off following email discussion:

* [POST112-e][701][V2X] RAN1 related discussion (OPPO)

Discuss the remaining RAN1 related issues and new RAN1 decisions that impact MAC specification (including the issues raised in the contributions listed in the proposal 5 in R2-2010982)

Intended outcome: agreeable CR, Report if needed

Deadline is long email discussion until next RAN2 e-meeting.

# Configured grant

## CG resource allocation

In discussion papers [1][2] sidelink resources are categorized into 3 levels:

Level\_1: physical slots including both uplink and sidelink slots

Level\_2: only sidelink logical slots which contain both SSB and reserved slots

Level\_3: only sidelink logical slots which belong to one specific resource pool excluding SSB and reserved slots and expressed by a bitmap whose length is configured in RRC signaling



Figure 1 [1]

It is obviously that CG resource can’t be defined in Level\_1 physical slots because of mixture between uplink and sidelink slots. The equations for type1 or type2 CG resource allocation in section 5.8.3 of MAC specification are defined based on index of the Level\_2 logical slots as indicated in [Annex](#_5.8.3_Sidelink).

One alternative proposal in [1] is to define CG resource slots based on index of the Level\_3 logical slots. As pointed out in [1] the main problem for current equations is that allocated CG resource slots could be out of resource pool. This is caused by the fact that Level\_2 logical slots contains SSB slots and reserved slots of one specific resource pool. So it is possible that CG resource slot could be overlapped with SSB slot or reserved slot directly e.g. slot#20 in Level\_2 logical slots. Another reason is that periodic CG resource slot is no more periodic any more in the associated resource pool even CG period matches with bitmap length of the resource pool due to the fact that SSB slots and reserved slots are excluded in Level\_3 logical slots and scatter sparsely without periodical pattern. Hence some CG resource slots e.g. #10 in Level\_2 logical slots could be located out of associated resource pool. The sparser the resource pool is, the more serious the problem is. Alternative solution proposed in [1] is to define CG resource slot in Level\_3 logical slots. In this way all the CG resource slots will be located within resource pool. Note in alternative solution periodicity of CG need be further transformed by taking the occupancy ratio of bitmap of associated resource pool into account as indicated in equation (6) in [1].

**Question 2.1-1: The equation to define CG resource slot should be defined based on which level logical slots?**

Option1: Level\_2 logical slots

Option2: Level\_3 logical slots

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| Ericsson | Option 2 | Option 2 is similar as in LTE SPS.  |
| HW | / | We think RAN1 is also having discussion on this issue, please refer to the following email thread [103-e-NR-Rel-16-V2X-07], the related discussion is summarized in R1-2009763 including potential options. As discussed in RAN1, one possible option is to not have the equation in section 8.1.7 of TS 38. 214 at all and consider the nearest logical slot within the resource pool as the CG slot.So if RAN1 finally agrees with this option, then there may be no equation and this question does not make sense any more. Therefore, in order to avoid any misalignment and duplication between different groups, we should wait for RAN1’s conclusion. [Rapporteur]: In RAN1 email discussion 103-e-NR-Rel-16-V2X-07 there are 2 issues:**Issue PP-7: Interpretation of sidelink slot for TRIV and resource reservation period****Issue M2-6: Interpretation of sidelink slot for sensing and resource selection procedure**In a mode 1 resource pool, RX UE doesn’t need to know whether scheduled SL grant is periodic resource or not unless this resource pool is mixed with mode 2 resource pool. Note, the mixture between mode1 and mode2 resource pool is not supported in Rel16. RAN1 has discussed whether resource period parameter is necessary or not in SCI but could not conclude it.If RAN1 conclude that no resource period parameter in SCI is necessary for configured grant, then issue PP-7 is not relevant with this email discussion at all, otherwise it does. |
| Qualcomm | Option 1 | Consistent with RAN1’s decision to use logical slots for the calculation (Level 2 slot) |
| Sharp | Option 1 | Scattering issue was discussed in RAN1#103e with no consensus made. In case when the bitmap does not match well with the CG periodicity and the existence of S-SSB and reserved slots, option 2 also has the scattering issue. Thus, we propose to keep the formula in a form as it is in current MAC specs, which is based on Level 2 logical slots. |
| vivo | Option 1 | Defining the CG resource based on Level\_3 logical slots seems a little bit over-optimized to us. Equation based on level-2, which is also the approach in current MAC specification, can be modified to further consider how to ensure the CG resources are within resource pools. |
| OPPO | Option 2 | RAN1 concluded on issue M2-6 in email discussion 103-e-NR-Rel-16-V2X-07 as following:It means the timing parameter in SCI is interpreted based on TX resource pool.Our view is that no reservation period parameter is necessary in SCI considering no mixture resource pool between mode 1 and mode2. Even it is possible in future, considering the conclusion of RAN1 in issue M2-6, we think it is most likely slot index should be based on level 3 i.e. optioin2.One more point is that for type1 CG, UE at least should know where the 1st valid slot is regardless of RAN1’s conclusion. |
| Samsung | Option1 | We prefer to keep the current approach of MAC specification. |
| CATT | Option2 | Agree with OPPO. |
| Lenovo | Option 2 | Agree with rapporteur analysis that CG resource may not in the resource pool, by current equation for SL CG resource allocation. |
| ZTE | Wait for RAN1 decision | As Huawei mentioned, RAN1 currently is discussing the outcome of period in SCI indication. |
| Apple | Option 2 | We think the CG is configured per Tx pool, so the parameters are based on the logical slots defined for the TX resource pool. If companies want to wait for RAN1 clarification, we are also fine. |
| Intel | Option2 | We share the view with Apple that it makes sense to have define based on logical slots for the resource pool. We are also fine if companies want to wait for RAN1 decision. |

If option1 is chosen, one issue need be resolved is how to deal with invalid CG resource slot which is not located in associated resource pool of CG? Basically there are three options:

Option A: to replace the invalid CG resource slot with a slot of the associated resource pool which is closest to the invalid CG resource slot in Level\_2 time domain

Option B: do nothing i.e. to simply drop the invalid CG resource slot

Option C: up to network implementation to reduce or avoid invalid CG resource slot

**Question 2.1-2: If option1 is chosen, between option A and option B which option do you prefer to treat invalid CG resource slot?**

|  |  |  |
| --- | --- | --- |
| Company | Options | Comments |
| HW | / | See our reply on Question 2.1-1 |
| Qualcomm | Option A |  |
| Sharp | Option C/B | From our perspective, the issue highly depends on the outcome of the discussion in RAN1 future meeting, which is a leftover issue in RAN1#103e as mentioned by HW in Question 2.1-1. For option A, there might be a collision issue to replace with the closest resource. |
| vivo | Option B or C | We think network implementation may solve this as CG and resource pool are both configured by NW. Meanwhile, option B seems also a simple solution as dropping the invalid CG resource will not cause any serious problems. |
| OPPO | Option B or C |  |
| Samsung | Option B/C |  |
| Lenovo | Option B/C |  |
| ZTE | Wait for RAN1 |  |
| Apple | Wait for RAN1 |  |
| Intel | Wait for RAN1 |  |

As pointed out by discussion paper [1][3][4], the key parameter *numberOfSLSlotsPerFrame* is not a valid parameter. When tdd-UL-DL-ConfigurationCommon includes two separate TDD patterns and the periodicity of each TDD pattern is 10ms (i.e. a frame), the number of SL slots within the 10ms of the 1st TDD pattern can be different from the number of SL slots within the next 10ms of the 2nd TDD pattern. Thus, the parameter numberOfSLSlotsPerFrame is not a constant and cannot be used in the CG resource calculation equation. Instead, number of slots in two frames is a constant r egardless of TDD pattern(s) in tdd-UL-DL-ConfigurationCommon which is also used to transfer configured *sl\_periodCG* to be *PeriodicitySL* i.e.the parameter N. If this can be confirmed, then the meaning of the parameter “logical slot number in the frame” should be changed to be “logical slot number in two frames” because the granularity to accumulate logical slots is two radio frames instead of one.

**Question 2.1-3 If option1 is chosen, do you agree to change the accumulation granularity from *numberOfSLSlotsPerFrame* to be parameter N and to replace “logical slot number in the frame” to be “logical slot number in two frames” in the equation?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | Comments |
| HW | / | See our reply on Question 2.1-1 |
| Qualcomm | Yes | Agree the number of SL slots per frame is not constant |
| Sharp | Yes |  |
| vivo | Yes | Agree with rapporteur. |
| OPPO | Yes |  |
| Samsung | Yes |  |
| Lenovo | Yes |  |
| ZTE | Wait for RAN1 |  |

Currently parameter N is specified as “the number of slots that can be used for SL transmsission within 20ms, if configured, of TDD-UL-DL-ConfigCommon, as specified in TS 38.331 [5] and clause 8.1.7 of TS 38.214 [7]”. The pair frames where N is constant value could be either one even frame followed by one odd frame or vice versa. For example they could be [2n-1,2n] or [2n,2n+1]. If even frame is before odd frame, sidelink logical slots up to radio frame SFN can be expressed as floor(SFN/2)\*N. While if odd frame is before even frame, #0 radio frame and #1023 radio frame need be treaded specially since SFN is wrap round between #1023 radio frame and #0 radio frame. In order to simplify the equation, it is proposed to clarify that the 1st frame of two radio frames where N is a constant value should be an even radio frame.

**Question 2.1-4: If option1 is chosen, do you agree to further clarify that the 1st frame of two radio frames where N is a constant value should be an even radio frame?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | Comments |
| HW | / | See our reply on Question 2.1-1 |
| Qualcomm | No strong view | Agree the standard should include text to specify the selection, but no strong view on whether even frame or not.  |
| Sharp | Yes |  |
| vivo | Yes | No strong view on this, the way proposed by rapporteur is OK for us. |
| OPPO | Yes |  |
| Samsung | Yes |  |
| Lenovo | Yes |  |
| ZTE | Wait for RAN1 |  |

If option2 is chosen new equations are introduced to allocated CG resource slots. Discussion paper [1] provides the equations for type1/2 CG as following:

The equation to transfer configured CG period to be a period applied to logical slots of a resource pool:

 (1)

Where:

* K is the total number of slots within the bitmap marked with 1
* L is the bitmap length

The detail equation for CG type1 is as following:

(2)

Where:

* :the total number of logical slots of the associated resource pool within SFN period
* :the slot offset between the first CG resource slot and
* :the period of SL CG resources. Please refer to equation (1)
* :current logical slot in the resource pool whose value range is [0, ]
* S :the index of CG radio resource, S>=0
* : the reference slot which could be either 1st slot within associated resource pool i.e. zero or the slot index equals to

For CG type2, the equation is as following:

(3)

Where:

Parameters *Current\_slot, S, sl\_periodCG\_RP* share the same meaning as those in equation (2). *Slot\_start* refers the slot index of the first PSSCH duration after the configured sidelink grant was (re-)initialised.

**Question2.1-5: If option2 is chosen, do you agree above 3 equations to define type1/2 CG resource slots?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | Comments |
| Ericsson | Yes |  |
| HW | / | See our reply on Question 2.1-1 |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | No | For equation , in our understanding, this is to covert SL CG period into SL CG periodicity based on resource pool slots. The new equation introduces the new factor K/L, but seems this cannot accurately reflect the RP\_slot based SL CG periodicity, on top of legacy equation. This is because N in the equation refer to the slots for all SL transmissions including S-SSB slots and reserved slots. But K/L does not consider these slots. So the calculated RP\_slot based period will be larger than the N based period, and introduce latency for transmission. |
| ZTE | Wait for RAN1 |  |
| Apple | Yes |  |
| Intel | Yes | In general, we are fine with the equations for type1 and type2 CG |

## CG HARQ process ID

Discussion paper [1] pointed out that the parameter of the equation to calculate HARQ process ID of CG resource should be aligned with parameters to allocate CG resource slot. To be specific the parameter *CURRENT\_slot* should be aligned with current slot in the equation to allocate CG resource slot. If option1 under question 2.1-1 is chosen and answer yes to question 2.1-3, it could be “(× *N*) + logical slot number in the two frames”. Or if option2 under question 2.1-1 is chosen, it could be *Current\_slot* in equation (2) or (3). As for the periodicity of the CG resource, it should be also aligned with transferred period of either of the two options too. Discussion paper [5] also pointed out that configured parameter *sl-PeriodCG* should be transferred to be logical slot at first. So again if option1 under question 2.1-1 is chosen, then should be used. Or if option2 under question 2.1-1 is chosen, then period in equation (1) should be used.

**Question 2.2-1: Do you agree that parameter CURRENT\_slot and period of CG resource in the equation to calculate HARQ process ID for SL CG should be aligned with parameters in equation to calculate CG resource slot regardless which option under question 2.1-1 is chosen?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | Comments |
| Ericsson | Yes |  |
| HW | See comments | If there is an equation to calculate the CG slot, then the definition of CURRENT\_slot and period of CG resource in the equation to calculate HARQ process ID for SL CG should be aligned with that in the CG equation but as we replied in Question 2.1-1, if RAN1 agrees to not have the equation to calculate the CG slot, then this question makes no sense.  |
| Qualcomm | Yes |  |
| Sharp | No | In our understanding, the equation is to align the understanding between gNB and SL UE on the HPN when using SL CG for transmission. Thus, we don’t see strong need to change the equation. |
| vivo | Yes |  |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |

Another issue pointed out by [5] is that the value range of *sl-HARQ-ProcID-offset* is [1,16] while the HARQ process ID in DCI is only 4 bits i.e. its value range is [0~15]. To avoid mismatch between these two value ranges, it is proposed to change it from *sl-HARQ-ProcID-offset* to (*sl-HARQ-ProcID-offset-1*). It is rapporteur’s understanding the value range of parameter *sl-NrOfHARQ-Processes* is [1,16], so in theory the calculated HARQ Process ID could be beyond 15 regardless whether *sl-HARQ-ProcID-offset* is changed or not. On the other hand the meaning of the *sl-HARQ-ProcID-offset* is an offset and hence it could be zero i.e. without any shift e.g. for the 1st CG resource configuration. The value range of similar parameters in uplink “*harq-ProcID-Offset-r16*” and “*harq-ProcID-Offset2-r16*” is also [0~15]. It should be noted that the equation to claculate HARQ process ID, either in R15 or R16, imply that network should configure the parameters properly so that calcluated HARQ process ID is within value range [0,15] and not overlaps with each other.

Option1: without change value range of *sl-HARQ-ProcID-offset*, but change it from *sl-HARQ-ProcID-offset* to (*sl-HARQ-ProcID-offset-1*) as proposed in [5]

Option2: without change the equation, but change the value range from [1,16] to be [0,15]

Option3: do nonthing i.e. up to network’s implemenation to configure proper parameters

Note the 2nd option is a non-backward compatible change.

**Question 2.2-2: Regarding parameter *sl-HARQ-ProcID-offset,* which option do you prefer?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred option | Comments |
| Ericsson | Option 2 | Option 2 gives cleaner solution, aligned with RAN1 spec. |
| HW | Option 1 | As indicated by the Rapp, Option 2 above is a NBC change that potentially touches ASN.1. In the case that there is any alternative way to handle the issue, option 2 shouldn’t be accepted at this stage. |
| Qualcomm | Option 3 |  |
| Sharp | Option 2 | Option 1 is fine for us as well considering the NBC change mentioned by HW. |
| vivo | Option-2 | To align with RAN1 definition. |
| OPPO | Option2 with comment | One compromise way is not change ASN.1 itself but clarify in the field description that UE should interpret *sl-HARQ-ProcID-offset* as *sl-HARQ-ProcID-offset-1*. |
| Samsung | Option1 | Same view as HW |
| CATT | Option 1 |  |
| Lenovo | Option 2 | Prefer to align with RAN1 |
| ZTE | Option 2 |  |
| Apple | Option 1 | We have concern about NBC change in ASN.1 |
| Intel | Option 3 | If NBC is an issue, we think option 3 should be acceptable as a compromise. |

## Others:

RAN1 LS [7] answered following question from RAN2:

|  |
| --- |
| ***Question：***Is it possible to use the retransmission opportunities for initial transmission for a sidelink configured grant in case when the data was not available for the transmission opportunity for initial transmission? |

The RAN1 LS replies RAN2 LS [13] which is triggered by the discussion on contribution [14] . The contribution assumes initial transmission is possible only in 1st transmission opportunity and hence propose to remove one condition for initial transmission in section 5.22.1.3.1 i.e. to remove “if no MAC PDU has been obtained”. Since RAN1 confirmed that it is possible to use the retransmission opportunities for initial transmission for a sidelink configured grant in case when the data was not available for the transmission opportunity for initial transmission, no change is necessary.

**Question 2.3-1: Do you agree that according to reply in LS [7], the change proposed by [14] is not agreeable?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | Comments |
| Ericsson | Yes | RAN1 LS has clearly indicated that no change is needed. |
| HW | Yes but  | The proposed change by [14] is based on the original text which is not correct as we only use “no MAC PDU has been obtained”.For example, UE obtains a dynamic sidelink grant for initial transmission, but no MAC PDU has been obtained. Then UE obtains a dynamic sidelink grant for retransmission. In this case, the condition that no MAC PDU has been obtained is met, and UE will perform new transmission instead of retransmission. But the current spec has already been updated and the RAN1 reply has already been reflected. So no change is needed on the current spec. 1> if the MAC entity determines that the sidelink grant is used for initial transmission as specified in clause 5.22.1.1; or1> if the sidelink grant is a configured sidelink grant and no MAC PDU has been obtained in a sl-PeriodCG of the configured sidelink grant: |
| Qualcomm | Yes | Agree RAN1 agreement implies the clause in [14] should be retained |
| Sharp | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |

# Mode 2 operation

## Timing of re-evaluation and pre-emption

In [8] RAN1 indicated following understanding:

*It is RAN1 understanding, that since MAC layer triggers re-evaluation and pre-emption checking at PHY layer, the MAC specification is expected to capture the timing when a UE performs re-evaluation and pre-emption by calling the procedure in 8.1.4 of TS 38.214*

In MAC specification initial resource selection is specified in section 5.22.1.1. In section 5.22.1.2 MAC layer will reselect resource due to re-evaluation and pre-emption when indicated by physical layer and replace original selected resource or reserved resource with re-selected resource. But there is no place to capture when MAC layer will trigger re-evaluation or re-emption after initially selected resource(s) are indicated to physical layer.

**Question 3.1-1 Can RAN2 confirm that MAC specification should capture the timing for UE to perform re-evaluation or pre-emption?**

|  |  |  |
| --- | --- | --- |
| Company | Position (Yes or not) | Comments |
| Ericsson | Yes | As RAN1 LS indicated, the MAC specification should capture the timing for UE to perform re-evaluation or pre-emption. |
| HW | Yes |  |
| Qualcomm | Yes |  |
| Sharp | Yes |  |
| vivo | Yes | This is cleared mentioned in RAN1 LS so we prefer to capture the timing in MAC specification. |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Intel | Yes | It is clear that MAC needs to capture the UE behaviour in this case. |

The LS [8] also indicates following agreement regarding timing for re-evaluation:

**RAN1#100-e**

Agreements:

* **For re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’, where k ≥ m,**
	+ **Step 1 of the resource (re-)selection procedure is performed at least at the moment ‘m-T3’, and if the pre-selected resource is not in the identified candidate resource set, Step 2 is triggered for reselection of the resource**
		- **Re-evaluations before the moment ‘m-T3’ or after ‘m-T3’ but before ‘m’ are not precluded and are up to UE implementation**
			* FFS whether to mandate a UE to perform Step 1 checking every slot before ‘m-T3’

**RAN1#101-e**

Agreements:

* **For a reserved resource to be signalled in slot ‘m’, the procedure to check whether it is re-selected due to pre-emption, the UE follows the same behavior in terms of the timing of checking as in that of the re-evaluation case.**
	+ Further discussion regarding any potential issue related to pre-emtption application timing

**Conclusion:**

**       For re-evaluation of a pre-selected resource contained in a slot ‘k’ to be first time signaled in a slot ‘m’, where k ≥ m, a UE is not mandated to perform Step 1 checking every slot before ‘m-T3’**

From these RAN1 agreements it is clear that before “m-T3” UE is not mandated to perform re-evaluation and before or after “m-T3” it is up to UE’s implementation to do it. So the timing which need be specified is at moment “m-T3”. For pre-emption, RAN1 also agreed that UE follows the same behaviour in terms of the timing of checking as in that of the re-evaluation case. In addition the reply in RAN1 LS [10] also indicates that pre-emption is applicable for the current generated MAC PDU.

**Question 3.1-2 Do you agree that in MAC specification only the moment “m-T3” need be captured?**

|  |  |  |
| --- | --- | --- |
| Company | Position (yes or no) | Comments |
| Ericsson | Yes with comments | Agree with rapporteur that ”m-T3” needs to be captured in the spec, in addition, it needs to be captured in the spec (e.g., as a note) that it is up to UE implementation to perform re-evaluation on other moments (i.e., before or after “m-T3” before “m”). |
| HW | See comments | We think “m-” is mandatory and should be captured in the normative text and before the moment ‘m-’ or after ‘m-’ but before ‘m’ are up to UE implementation and can be captured in a NOTE.  |
| Qualcomm | No | The spec should explicitly indicate UE implementation |
| Sharp | Yes | The note mentioned by Ericsson and HW seems already captured in subclause 8.1.4 of TS38.214 and is not needed in MAC specs. |
| vivo | Yes with comments | Just to clarify, if we capture m-T3, what ‘m’ means (i.e. for the resource(s) to be signalled first time at the moment ‘m’) should also be explained. |
| OPPO | Yes with comment | We are fine to capture a note to clarify UE’s implementation. |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes | We are fine to capture this as a note |
| ZTE | Yes | As mentioned by other companies, UE implementation shall be captured as well. |
| Apple | Yes with comments | We are fine to capture this as a NOTE |
| Intel | Yes | We agree with Ericsson and HW that at least the “m-T3” needs to be captured in the specification; the UE behavior before or after this moment can be captured as a note. |

As for the detail text proposal here is one example from rapporteur:

*A resource(s) of the selected sidelink grant for current MAC PDU is re-evaluated at T3 before the slot where it will be signalled at first time as specified in section 8.1.4 of TS 38.214.*

*A resource(s) of the selected sidelink grant which has been indicated by a prior SCI for current MAC PDU could be checked for pre-emption at T3 before the slot where corresponding PSSCH duration is located as specified in section 8.1.4 of TS 38.214.*

**Question 3.1-3: What comments do you have for the proposed text capture the timing for re-evaluation and pre-emption?**

|  |  |  |
| --- | --- | --- |
| Company |  | Comments on text proposal |
| Ericsson | no | The proposed texts are ok to us. |
| HW |  | Firstly, we think it is not necessary to mention “for current MAC PDU” as it implies the MAC PDU needs to be already generated when re-evaluation or pre-emption is performed. Secondly, according to RAN1 agreement, we think “m-” should be at least guaranteed but before the moment ‘m-’ or after ‘m-’ but before ‘m’ is also allowed and up to UE implementation. So this needs to be reflected and we think a NOTE is also needed. *A resource(s) of the selected sidelink grant is re-evaluated at least at before the slot where it is signalled at first time as specified in section 8.1.4 of TS 38.214.**A resource(s) of the selected sidelink grant which has been indicated by a prior SCI is checked for pre-emption at least at before the slot of the corresponding PSSCH, as specified in section 8.1.4 of TS 38.214.*NOTE: it is up to UE implementation to re-evaluate or pre-empt before the moment ‘m-’ or after ‘m-’ but before ‘m’. For re-evaluation, m is the slot where it is signalled at first time as specified in section 8.1.4 of TS 38.214. For pre-emption, m is the slot of the corresponding PSSCH, as specified in section 8.1.4 of TS 38.214. |
| Sharp |  | We share similar view as HW that “for current MAC PDU” is not needed. |
| vivo | See comment | The agreement describes two aspect. 1. The timing for trigger the re-evaluation and pre-emption. 2. The resource to be check.For the pre-emption part, the timing for the check is correct, however, the mandatory resource to be checked is not aligned w/ agreement. The following change is suggested.*“A resource(s) of the selected sidelink grant which has been indicated by a prior SCI for current MAC PDU is ~~could be~~ checked for pre-emption at T3 before the slot where corresponding PSSCH duration is to be signalled by SCI corresponding to current MAC PDU ~~located~~ as specified in section 8.1.4 of TS 38.214”*[Rapporteur]: not sure about the difference, can you clarify by an example? |
| OPPO | Yes with comment | The wording “current MAC PDU” is to address the wording “current TB” in RAN1’s LS[10] since this is RAN2 language. But if people think this causes some misunderstanding, we are fine to replace it with “current TB”. |
| Samsung |  | We are fine with the proposed texts.  |
| CATT | Yes with comments | We share the same view with OPPO. |
| Lenovo |  | Fine with the proposed texts |
| ZTE |  | We share the same view with Huawei |
| Intel | Yes with comments | We are fine with the proposed text in general. We also support the inclusion of additional text proposed by HW and the reference to RAN1 specification for further clarification, i.e,: NOTE: it is up to UE implementation to re-evaluate or pre-empt before the moment ‘m-’ or after ‘m-’ but before ‘m’. For re-evaluation, m is the slot where it is signalled at first time as specified in section 8.1.4 of TS 38.214. For pre-emption, m is the slot of the corresponding PSSCH, as specified in section 8.1.4 of TS 38.214. |

## Re-evaluation issues

The LS [10] provides more RAN1 agreements regarding re-evaluation of periodic reservation as following:

**RAN1#103-e**

Agreements:

* 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 current period or previous periods as per agreements, except that it is up to UE implementation whether to apply re-evaluation check to the resource in non-initial reservation period that have ~~not~~ been signalled neither in the immediate last nor in the 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
* NOTE: re-evaluation for the purpose of SPS period signalling in non-initial reservation period is neither supported nor precluded by this agreement

The text in 1st sub-bullet means re-evaluation is applicable for current period when one generated MAC PDU is to be transmitted initially or retransmitted. From triggering timing point of view, it has nothing special i.e. it is covered already in issues discussed under question 3.1-1 and 3.1-2. But 2nd sub-bullet pointed out that it is up to UE implementation whether to apply re-evaluation check to the resource in non-initial reservation period that have been signalled neither in the immediate last nor in the current period. During RAN1’s discussion the ambiguity comes from the argument whether the concerned resource is reserved or not when its predecessor resource is dropped due to congestion control or prioritization. If RAN2 confirms that MAC should capture timing for re-evaluation or pre-emption, this case is an exceptional case and should be captured also. Considering it is up to UE implementation, it seems more appropriate to capture this using a NOTE instead of normative text.

**Question 3.2-1 Do you agree to capture exceptional case in above sub-bullet 2 in MAC specification using a NOTE?**

|  |  |  |
| --- | --- | --- |
| Company | Position (yes or no) | Comments |
| Ericsson | Yes | It is sufficient to capture sub-bullet 2 in a NOTE. |
| HW | Yes |  |
| Qualcomm | Yes | Agree that a note indicating UE implementation is appropriate |
| Sharp | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |

Here is an example to capture this exceptional case:

*NOTE: It is up to UE implementation whether to apply re-evaluation check to the resource in non-initial reservation period that have been signalled neither in the immediate last nor in the current period.*

**Question 3.2-2 what’s comment to the proposed text? Please also indicate whether it is normative text or just a Note.**

|  |  |  |
| --- | --- | --- |
| Company | Normative text or Note? | Comments on proposed text |
| Ericsson | Note | It is enough to add a note. |
| HW | Note | We think “Re-evaluation check is not applied to the resources that have been signalled in current period or previous periods” should also be reflected in the note and we think it is better to add the condition “If periodic reservation is in use by a UE” to be aligned with the RAN1 agreement. NOTE: *If periodic reservation is in use by a UE, re-evaluation check is not applied to the resources that have been signalled in current period or previous periods, except that it is up to UE implementation whether to apply re-evaluation check to the resource in non-initial reservation period that have been signalled neither in the immediate last nor in the current period.* |
| Sharp | Note |  |
| vivo | Either | Either in a note or normal spec. text is acceptable for us.If common behaviour is to be specified regardless whether the resource is in initial or non-initial period, it is fine to have a NOTE |
| OPPO | Note | To clarify this Note is for periodic reservation is fine for us. |
| Samsung | Note |  |
| CATT | Note |  |
| Lenovo | Note | Note is enough for UE implementation case |
| ZTE | Note |  |
| Apple | Note |  |
| Intel | Note | We are fine with the proposed note |

The agreement in 3rd sub-bullet means if a resource is re-selected due to re-evaluation in current period then all successors in future periods should be changed to the same resource as well i.e. original pre-selected resource in future periods are replaced by the re-selected resource also. In current MAC specification pre-selected resources are removed at first when resource reselection (step 2) is triggered by physical layer procedure due to re-evaluation and then reselected resource will replace removed resources eventually.

#### 5.22.1.2 TX resource (re-)selection check

…(deleted text)

1> if retransmission of a MAC PDU on the selected sidelink grant has been dropped by either sidelink congestion control as specified in section 8.1.6 of TS 38.214 or de-prioritization as specified in section 16.2.4 of TS 38.213 [6], section 5.4.2.2 of TS 36.321 [22] and section 5.4.2.2:

2> remove the resource(s) from the selected sidelink grant associated to the Sidelink process, if the resource(s) of the selected sidelink grant is indicated for re-evaluation or pre-emption by the physical layer;

2> randomly select the time and frequency resource from the resources indicated by the physical layer as specified in section 8.1.4 of TS 38.214 [7] for either the removed resource or the dropped resource, according to the amount of selected frequency resources, the selected number of HARQ retransmissions and the remaining PDB of either SL data available in the logical channel(s) by ensuring the minimum time gap between any two selected resources of the selected sidelink grant in case that PSFCH is configured for this pool of resources, and that a resource can be indicated by the time resource assignment of a SCI for a retransmission according to section 8.3.1.1 of TS 38.212 [9];

sectionNOTE y: If retransmission resource(s) cannot be selected by ensuring that the resource(s) can be indicated by the time resource assignment of a prior SCI, how to select the time and frequency resources for one or more transmission opportunities from the available resources is left for UE implementation by ensuring the minimum time gap between any two selected ‎resources in case that PSFCH is configured for this pool of ‎resources.

2> replace the removed or dropped resource(s) by the selected resource(s) for the selected sidelink grant.

**Observation1: Agreement in sub-bullet 3 has already been captured in current MAC specification.**

**Question 3.2-3 Do you agree with observation1? If you disagree, please provide your proposal.**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | Your proposal to capture agreement in sub-bullet 3 |
| Ericsson | Yes | Agree with Rapporteur |
| HW | Yes with comments | We do not agree that the 3rd bullet means if a resource is re-selected due to re-evaluation in current period then all successors in future periods should be changed to the same resource as well i.e. original pre-selected resource in future periods are replaced by the re-selected resource also. We think according to RAN1 agreement, for pre-selected but not reserved resource, it is up to UE implementation to reselect or not during the reselection procedure and in last meeting, RAN2 agreed to add a note to reflect this agreement, see issue 10B and 10C of offline [713]. So we agree the current MAC spec including the above procedure as well as the added note together reflect the bullet 3.  |
| Qualcomm | Yes |  |
| Sharp | Yes |  |
| vivo | Partially yes. However, the periodic reservation is missing somehow. | The above explanation of 3rd bullet seems incorrect. Step 2 only refer to the selection of resource for one resource period, which has nothing to do with successors in future periods.Per the current agreement, it is still not clear how to drop/set periodic reservation(s). In our opinion, spec. can either describe the dropping of original periodic resource as described above, or add a note to say the dropping and periodic reservation of re-selected resource is up to implementation (This aligns the behaviour for pre-emption and re-evaluation procedure) |
| OPPO | Yes with comment | Our understanding is there maybe overbooking issue for cell reselection due to pre-emption but not re-evaluation. |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes with comment | We share the view with Huawei and Vivo that the replacement of resources in future periods is not indicated in RAN1 agreement, and this has to be left to UE implementation. |
| Intel | Yes |  |

## Pre-emption issues:

The concerned RAN1 agreement in replied RAN1 LS [10] is as following:

* *If periodic reservation is in use by a UE, and if pre-emption is enabled in a resource pool, the UE checks pre-emption 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*
	+ *If a resource is pre-empted, a re-selection for the pre-empted 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*
	+ *FFS in TP phase how/where to capture this in specification*
		- *During the pre-emption checking, j is up to Cresel-1*

The yellow part agreement means reselected resource due to pre-emption could be one-shot resource or periodic resources in future periods. This is different from reselection resource due to re-evaluation which is always periodic resources including current period and future periods. However as discussed under question 3.2-3 there is no such difference in current MAC specification.

**Question 3.3-1: Do you agree to capture such UE implementation in MAC layer for resource reselection due to preemption i.e. to clarify it in a Note as “it is up to UE implementation how to set the reservation period in the re-selected resource to replace pre-empted resource”?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | comments |
| Ericsson | Yes |  |
| HW | Yes |  |
| Qualcomm | Yes | We suggest modifying the note as follows:“it is up to UE implementation how to set the reservation period in the re-selected resource to replace pre-empted resource, including a zero value” |
| Sharp | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |

## Resource reselection due to prioritization and congestion control

In RAN1 LS [9] RAN1 answers following question from RAN2:

**Q1: RAN2 would like to ask RAN1 whether resource reselection is needed for dropped retransmission caused by prioritization, pre-emption and congestion control.**

**RAN1 reply to Q1:**

* As per existing RAN1 agreements, pre-emption always triggers re-selection of the resource(s) identified to be pre-empted.
* For congestion control, RAN1 did not previously discuss whether it can trigger resource re-selection. It is RAN1 understanding, that there is no need to specify an additional re-selection trigger condition for congestion control related dropping.
* For prioritization caused resource dropping cases, RAN1 did not previously discuss whether it can trigger resource re-selection. There is no consensus in RAN1 whether to specify a separate resource reselection trigger due to dropping caused by prioritization, and it is left up to UE implementation.

It means no resource reselection need be specified for dropped resource due to congestion control. However it is captured in current MAC specification as following:

#### 5.22.1.2 TX resource (re-)selection check

…(deleted text)

1> if a resource(s) of the selected sidelink grant is indicated for re-evaluation or pre-emption by the physical layer as specified in clause 8.1.4 of TS 38.214 [7]; or

1> if retransmission of a MAC PDU on the selected sidelink grant has been dropped by either sidelink congestion control as specified in clause 8.1.6 of TS 38.214 or de-prioritization as specified in clause 16.2.4 of TS 38.213 [6], clause 5.4.2.2 of TS 36.321 [22] and clause 5.4.2.2:

**Question 3.4-1 Do you agree to remove the resource reselection for dropped resource due to congestion control?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | comments |
| Ericsson | Yes | Per RAN1 agreement, there is no need to trigger resource reselection for dropped resource due to congestion control. |
| HW | Yes |  |
| Qualcomm | Yes |  |
| Sharp | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes |  |
| ZTE | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |

Regarding dropped resource due to de-prioritization there is no consensus in RAN1 and it is up to UE’s implementation. One clean way is not to specify it either in MAC.

**Question 3.4-2 Do you agree to remove the resource reselection for dropped resource due to prioritization, and add a NOTE to leave it to UE implementation?**

|  |  |  |
| --- | --- | --- |
| Company | Position(yes or no) | comments |
| Ericsson | Yes | It is sufficient to add a note. |
| HW | Yes |  |
| Qualcomm | Yes | Agree with note indicating this is left to UE implementation |
| Sharp | Yes |  |
| vivo | Yes |  |
| OPPO | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| Lenovo | Yes with comments | We agree the principle that to align with RAN1 that it is up to UE’s implementation. But we are wondering, if dropping case because of congestion control and de-prioritization are all removed, Question 3.2-3 will have different answer, since Question 3.2-3 is based on observation 1 that reselection caused by these cases are already specified in MAC layer |
| ZTE | Yes |  |
| Apple | Yes |  |
| Intel | Yes |  |

# Conclusion

# Reference

[1] R2-2008800 Discussion on resource and HARQ process id of configured grant OPPO

[2] R2-2009044 Discussion on CG resource calculation ZTE Corporation, Sanechips

[3] R2-2009045 CR for TS 38.321 on calculation of CG type1 and type 2 ZTE Corporation, Sanechips

[4] R2-2009318 Discussion on resource determination of SL configured grant SHARP Corporation

[5] R2-2010310 Correction on HARQ process ID calculation for SL CG Huawei, Hisilicon

[6] R2-2009253 Correction to pre-emption check for Sidelink resource allocation mode 2 LG Electronics France

[7]R1-2009460 LS reply on SL CG handling

[8]R1-2009474 LS on R16 V2X Mode-2 agreements to capture in MAC specification

[9]R1-2009475 LS reply on RAN2 agreements and RAN1 related issues

[10]R1-2009661 LS reply on RAN1 agreement on pre-emption

[11]R2-2010948 Corrections to 5G V2X with NR Sidelink LG Electronics Inc.

[12]R2-2010949 Corrections to 5G V2X with NR Sidelink LG Electronics Inc.

[13] R2-2008586 LS to RAN1 on sidelink configured grant handling

[14] R2-2007918 Discussion on sidelink grant handling

[15] LS on RAN1 agreement on pre-emption

# Annex

### 5.8.3 Sidelink

There are two types of transmission without dynamic grant:

- configured grant Type 1 where an sidelink grant is provided by RRC, and stored as configured sidelink grant;

- configured grant Type 2 where an sidelink grant is provided by PDCCH, and stored or cleared as configured sidelink grant based on L1 signalling indicating configured sidelink grant activation or deactivation.

Type 1 and/or Type 2 are configured with a single BWP. Multiple configurations of up to 8 configured grants (including both Type 1 and Type 2, if configured) can be active simultaneously on the BWP.

RRC configures the following parameters when the configured grant Type 1 is configured, as specified in TS 38.331 [5] or TS 36.331 [21]:

- *sl-ConfigIndexCG*: the identifier of a configured grant for sidelink;

- *sl-CS-RNTI*: SLCS-RNTI for retransmission;

- *sl-NrOfHARQ-Processes*: the number of HARQ processes for configured grant;

- *sl-PeriodCG*: periodicity of the configured grant Type 1;

- *sl-TimeOffsetCG-Type1*: Offset of a resource with respect to SFN = *sl-TimeReferenceSFN-Type1* in time domain, referring to the number of logical slots that can be used for SL transmission;

- *sl-TimeResourceCG-Type1*: time resource location of the configured grant Type 1;

- *sl-CG-MaxTransNumList*: the maximum number of times that a TB can be transmitted using the configured grant;

*- sl-HARQ-ProcID-offset*: offset of HARQ process for configured grant Type 1;

- *sl-TimeReferenceSFN-Type1*: SFN used for determination of the offset of a resource in time domain. The UE uses the closest SFN with the indicated number preceding the reception of the sidelink configured grant configuration Type 1.

RRC configures the following parameters when the configured grant Type 2 is configured, as specified in TS 38.331 [5]:

- *sl-ConfigIndexCG*: the identifier of a configured grant for sidelink;

- *sl-CS-RNTI*: SLCS-RNTI for activation, deactivation, and retransmission;

- *sl-NrOfHARQ-Processes*: the number of HARQ processes for configured grant;

- *sl-PeriodCG*: periodicity of the configured grant Type 2;

- *sl-CG-MaxTransNumList*: the maximum number of times that a TB can be transmitted using the configured grant;

*- sl-HARQ-ProcID-offset*: offset of HARQ process for configured grant Type 2.

Upon configuration of a configured grant Type 1, the MAC entity shall for each configured sidelink grant:

1> store the sidelink grant provided by RRC as a configured sidelink grant;

1> initialise or re-initialise the configured sidelink grant to determine PSCCH duration(s) and PSSCH duration(s) according to *sl-TimeOffsetCG-Type1* and *sl-TimeResourceCG-Type1*, and to reoccur with *sl-periodCG* for transmissions of multiple MAC PDUs according to clause 8.1.2 of TS 38.214 [7].

NOTE 1: If the MAC entity is configured with multiple configured sidelink grants, collision among the configured sidelink grants may occur. How to handle the collision is left to UE implementation.

After a sidelink grant is configured for a configured grant Type 1, the MAC entity shall consider sequentially that the first slot of the Sth sidelink grant occurs in the logical slot for which:

[(SFN × *numberOfSLSlotsPerFrame*) + logical slot number in the frame] =
 (*sl-TimeReferenceSFN-Type1* × *numberOfSLSlotsPerFrame* *+* *sl-TimeOffsetCGType1*+ S × *PeriodicitySL*) modulo (1024 × *numberOfSLSlotsPerFrame*).

where , *numberOfSLSlotsPerFrame* refers to the number of logical slots that can be used for SL transmsission in the frame and *N* refer to the number of slots that can be used for SL transmsission within 20ms, if configured, of *TDD-UL-DL-ConfigCommon*, as specified in TS 38.331 [5] and clause 8.1.7 of TS 38.214 [7].

After a sidelink grant is configured for a configured grant Type 2, the MAC entity shall consider sequentially that the first slot of Sth sidelink grant occurs in the logical slot for which:

[(SFN × *numberOfSLSlotsPerFrame*) + logical slot number in the frame] =
[(SFNstart time × *numberOfSLSlotsPerFrame* + slotstart time) + S × *PeriodicitySL*] modulo (1024 × *numberOfSLSlotsPerFrame*).

where SFNstart time and slotstart time are the SFN and logical slot, respectively, of the first transmission opportunity of PSSCH where the configured sidelink grant was (re-)initialised.

When a configured sidelink grant is released by RRC, all the corresponding configurations shall be released and all corresponding sidelink grants shall be cleared.

The MAC entity shall:

1> if the configured sidelink grant confirmation has been triggered and not cancelled; and

1> if the MAC entity has UL resources allocated for new transmission:

2> instruct the Multiplexing and Assembly procedure to generate a Sidelink Configured Grant Confirmation MAC CE as defined in clause 6.1.3.34;

2> cancel the triggered configured sidelink grant confirmation.

For a configured grant Type 2, the MAC entity shall clear the corresponding configured sidelink grant immediately after first transmission of Sidelink Configured Grant Confirmation MAC CE triggered by the configured sidelink grant deactivation.

#### 5.22.1.1 SL Grant reception and SCI transmission

…(deleted part)

For configured sidelink grants, the HARQ Process ID associated with the first slot of a SL transmission is derived from the following equation:

HARQ Process ID = [floor(CURRENT\_slot / *sl-PeriodCG*)] modulo *sl-NrOfHARQ-Processes* + *sl-HARQ-ProcID-offset*

where CURRENT\_slot = (SFN × *numberOfSlotsPerFrame* + slot number in the frame), and *numberOfSlotsPerFrame* refer to the number of consecutive slots per frame as specified in TS 38.211 [8].