3GPP TSG-RAN WG1 Meeting #103-e R1-20xxxxx

Online, October 26th – November 13th, 2020

Agenda Item: 7.2.4

Source: Moderator (Ericsson)

Title: Thread 3 on Maintenance for 5G V2X with NR sidelink – Mode 1

Document for: Discussion, Decision

# 1 List of issues for discussion

[103-e-NR-Rel-16-V2X-03] Email discussion/approval regarding toutstanding agreement from RAN1#102-e on the minimum gap between PSFCH and next SL retransmission.

* Issue M1-1-1: Conditions for applicability
* Issue M1-1-2: Value of delta
* Also include the issue of sl-DCI-ToSL-Trans for DCI 3-0

till 10/29, with a potential CR by 11/4 – Ricardo (Ericsson)

# Discussion

## M1-1 Outstanding agreement from RAN1#102-e

The following agreement was made in RAN1#102-e:

|  |
| --- |
| Agreements:  For Mode 1 when applicable:   * For the same TB, the minimum time between PSFCH reception and next scheduled PSCCH/PSSCH retransmission is Tprep +delta (ms)   + To conclude the value of delta>=0 during the e-Meeting   + A UE is not expected to be scheduled consecutive SL transmisions for the same TB such that the minimum time between PSFCH reception and next PSCCH/PSSCH retransmission can not be guaranteed * FFS the detailed conditions of the applicability |

### M1-1-1 Conditions for applicability

Regarding the conditions for applicability, the following proposal received more support than any other alternative in the contributions:

~~Proposal:~~

* ~~The agreement from RAN1#102 applies when the grant is provided for a pool configured with PSFCH resources~~

FL update 27/10/2020:

* Views are split between 3 options:
  + Opt 1. ”The agreement from RAN1#102applies when the grant is provided for a pool configured with PSFCH resources”.
  + Opt 2. ”The agreement from RAN1#102applies for a TB with HARQ feedback enabled.”
  + Opt 3. ”The agreement from RAN1#102applies when the grant includes PUCCH resources”.
* It does not seem that we are going to converge on any of them. My suggestion would be to take a different approach, consisting of:
  + The above agreement is applicable always that the grant is for a pool with PSFCH resources and that the UE uses it for a TB with HARQ-feedback enabled.
  + The UE is allowed to drop the next scheduled PSCCH/PSSCH retransmission if the minimum time is not guaranteed.

Such proposal provides enough information to the gNB to provide the grant with the appropriate separation between resources, while leaving the possibility of having tighter scheduling for other occasions. Finally, if the condition is not met, it defines a UE behavior to deal with it. There is clearly no impact to RAN2.

Proposal:

* The agreement from RAN1#102 applies when the grant is provided for a pool configured with PSFCH resources and the UE uses it for a TB with SL HARQ-feedback enabled.
* If the minimum time time between PSFCH reception and next scheduled PSCCH/PSSCH retransmission is less than Tprep + delta, the UE is allowed to drop the PSCCH/PSSCH retransmission

Is the proposal acceptable. If not, please state your alternative proposal and clarify any potential impact to RAN2:

|  |  |
| --- | --- |
| **Company** | **View** |
| NTT DOCOMO | Support |
| LG Electronics | Not support.  According the current RAN2 specification, since the mapping between “LCH with HARQ FB enabled/disabled” and “Mode 1 CG” is provided by RRC signaling, Mode 1 UE can clearly know which Mode 1 CG is configured to be used for “MAC PDU with HARQ FB enabled” transmission.  With this understanding, for the pool configured with PSFCH resources, we are not technically convinced why all the Mode 1 CGs should satisfy the minimum time gap between PSFCH reception and next scheduled PSCCH/PSSCH retransmission for the same TB. This restriction rather makes it difficult to support a service with low latency requirement in the pool configured with PSFCH resources. In other words, even for the pool configured with PSFCH resources, it should be allowed for gNB to configure Mode 1 CG not satisfying the minimum time gap mentioned above, and Mode 1 UE can know that such CG is allocated for “MAC PDU with HARQ FB disabled” transmission via receiving RRC signaling providing the mapping between “LCH with HARQ FB enabled/disabled” and “Mode 1 CG”.  Note that the above-mentioned restriction doesn’t exist for Mode 2. We think that it doesn’t need to specify/agree UE’s behavior for the error case. In summary, our suggestion is as below, and it doesn’t have any impact to RAN2.  *For a TB with HARQ feedback enabled, a UE doesn’t expect to receive Mode 1 SL grant such that the minimum time between PSFCH reception and next PSCCH/PSSCH retransmission is not guaranteed for the same TB.*  FL reply 27/10/2020:  I am confused by your emphasis on CG Type-1. The above agreement applies to DG and CG Type-2 as well. We need a solution for all 3 cases.  At least for DG, we need to make an exception because it can happen that the grant is provided such that the time between PSFCH and next PSCCH/PSSCH is too short. |
| vivo | Disagree.  The proposal would incur unnecessary delay as explained by LG.  We think the presence of PUCCH is more suitable application condition as it implies that the gNB expects SL HARQ-ACK reporting.  When gNB does not provide a PUCCH but configures PSFCH, and SL data arrives with a higher priority and HARQ-ACK enabled, the UE just follows the existing behavior, i.e., sending a BSR to request new resource if none of the acquired grants meets the minimum time restriction. ***So using the presence of PUCCH as the pre-condition*** ***does not introduce any LCP modification***.   * The agreement from RAN1#102 applies when the grant is provided with PUCCH ~~for a pool configured with PSFCH resources~~   UE behaviour should be clarified, i.e., UE should transmit a TB with HARQ-ACK disabled on the resources if the resources do not meet the minimum time restriction Tprep +delta (ms)  The proposal could be changed as below:   * ~~If the minimum time between a PSFCH reception and next scheduled PSCCH/PSSCH retransmission is less than Tprep +delta (ms), UE should use the scheduled resources for a TB with HARQ-ACK disabled~~   FL reply 27/10/2020:  Regarding your proposal on the condition, let us consider the following case:   1. The UE has data in the buffer for a LCH that does not use SL feedback. 2. The UE sends BSR to the gNB. 3. New data from a higher priority LCH that uses SL feedback arrives. 4. The gNB provides a grant without PUCCH but for a pool with PSFCH resources. The grant does not meet the minimum time between PSFCH and next PSCCH/PSSCH.   Can you clarify how the UE avoid building a TB for the high priority LCH? It looks to me that RAN2 has to specify that behavior, right?  vivo 28/10/2020:  thanks for your reply. In our understanding, in step3, if data from a higher priority LCH that uses SL feedback arrives but gnb only provided a grant without PUCCH, UE will trigger a second SR/BSR to request addtional resources. Based on that second BSR, gnb can know that which LCG has data to transmit and whether the LCG enables HARQ-ACK as whether a logical channel is with SL HARQ-ACK enabled or HARQ-ACK disabled is configured by gnb, then it can provide resources for the data from higher LCH priority. I’m not sure why this procedure needs to change RAN2 spec as RAN2 already allows UE to trigger BSR in step3.  A SL-BSR shall be triggered if any of the following events occur:  1> if the MAC entity has been configured with Sidelink resource allocation mode 1:  2> SL data, for a logical channel of a Destination, becomes available to the MAC entity; and either  3> this SL data belongs to a logical channel with higher priority than the priorities of the logical channels containing available SL data which belong to any LCG belonging to the same Destination; or  3> none of the logical channels which belong to an LCG belonging to the same Destination contains any available SL data.  Regarding your last paragraph, I am not sure which proposal you want to change. Do you refer to changing the existing agreement? In any case, what you are saying is that depending on the grant (i.e. whether there is enough time between PSFCH and next PSCCH/PSSCH) one or another TB should be transmitted (i.e., data from one or another LCH). I would say that your last bullet has RAN2 impact.  vivo 28/10/2020:  I get your point, thanks for clarification, I add a strikethrough to the last paragraph.  Regarding the second subbullet   * + The UE is allowed to drop the next scheduled PSCCH/PSSCH retransmission if the minimum time is not guaranteed.   In our understanding, UE should drop the resources when it uses the grant for TB with HARQ enabled, while the proposal implies UE is still allowed to utilize the resource for TB with HARQ-ACK enabled if it wants to, it also seems to allow UE to drop the next resource when the resource is used for TB with HARQ disabled. We prefer to clarify this aspect and re-organzie the wording in this way   * The UE is not allowed to use the next scheduled resources for transmission of a same TB with HARQ-ACK enabled if the minimum time is not guaranteed. |
| OPPO | Not support  Even if the RP is configured with PSFCH resource, the TX UE has the flexibility whether SL FB is enabled or not, which depends on which LCH the SL data belongs to. If SL FB is disabled, the minimum time restriction is not applicable.  In mode 1, gNB should have fully control of SL transmission. If the allocated SL resource can fulfil the minimum time limitation, UE can send SL data with or without SL FB. Otherwise, the SL FB should be disabled.  We agree with vivo’s proposal that if the minimum time between PSFCH reception and next scheduled PSCCH/PSSCH is not fulfilled, SL FB should be disabled.  FL reply 27/10/2020:  See my reply to them |
| Sharp | Agree with vivo in general, but think it would be better to say “if the minimum time is less than Tprep + delta, the UE shall not transmit PSCCH/PSSCH with HARQ feedback enabled in SCI”.  FL reply 27/10/2020:  We can discuss the wording when drafting a TP/CR  [Sharp2]  We support the FL proposal (there seems to be a typo “ If the minimum time ~~time~~“). |
| CATT | Not support.  When the minimum time between a PSFCH reception and next scheduled PSCCH/PSSCH retransmission of the same TB is not fulfilled, the following procedures can be considered for the UE:   * Alt 1: SL feedback should be disabled. * Alt 2: Tx UE ignores the corresponding PSFCH occasions and do blind re-transmissions on the scheduled resources. There is no necessary to disable HARQ FB specifically, and the UE can do the (re-)transmissions whenever the time gap between PSFCH and the scheduled re-tx resources cannot fulfil min. requirement. For the rest transmissions in the same CG of the resource pool, HARQ FB is still enabled. * Alt 3: Tx UE does not use the re-tx resource which has the time gap with the previous received PSFCH less than the min. requirement. That is to say, Tx UE skips this re-tx chance and use the following re-tx resource (if there is) for the same TB.   We also share the similar view with vivo and OPPO that Alt 1 is preferred.  FL reply 27/10/2020:  See my reply to them |
| ZTE | We support this proposal. Regarding LG and Vivo’s comment, we admit that this proposal may bring some delay. But one critical issue is that network actually cannot know whether the UE is enable or disable HARQ feedback for each TB, and mode 1 UE should always follow network scheduling. Thus, network should always use the PSFCH enabled case to schedule the UE. |
| Qualcomm | We agree with the proposal from the feature-lead.  ~~We are also ok in principle with the first proposal from vivo to apply the timeline restriction when a PUCCH resource is provided. A clarification is needed that the UE doesn’t expect a PUCCH resource to be provided if the feedback timeline is not followed.~~ [QC2: this could also require a mix of blind and feedback-based retransmission].  Disabling sidelink feedback based on retransmission time gap requires support of mixing blind and feedback-based retransmissions. This topic was discussed in RAN1 and then referred to RAN2, which decided to not support this operation in Rel-16. Although we think this feature is beneficial and supported its inclusion in Rel-16, that discussion and decision has already taken place. We support including this functionality in Rel-17 for reliability and latency enhancement. |
| Apple | Fine with the proposal. Since gNB does not know whether PSFCH is triggered or not by UE, gNB does not know exactly when to ensure the minimum time gap between PSFCH and reTx PSCCH/PSSCH. The only criteria to use is when a resource pool with PSFCH resources. |
| Huawei, HiSilicon | Disagree.  Based on the discussion of companies, the controversial part is whether the timeline restriction is always applied if the PSFCH resources are configured.  Since whether the HARQ-based transmission is used is determined by Tx UE, the blind transmission can also be used although the PSFCH resources are configured in resource pool. If the condition of the minimum gap between PSFCH and the next PSSCH is applied as long as the resource pool are configured PSFCH resources, the stringent latency requirement for some urgent traffic may not be met.  On the contrary, if the PUCCH resources are indicated or configured by gNB, which means the gNB expects to receive the SL HARQ report from UE, UE needs to enable the HARQ feedback, and the minimum time gap between PSFCH and next PSSCH has to be guaranteed when gNB schedules the transmission resources. Otherwise, it means gNB does not expect the SL HARQ information, then it can allow some scheduling flexibility for gNB.  Therefore, the applicable condition should be the configuration of the PUCCH resource is provided by gNB.  FL reply 27/10/2020:  See my reply to vivo |
| Intel | We are fine with either FL proposal or LGE suggestion.  The suggestion from LGE could be realized by gNB by always scheduling the minimum gap whenever PSFCH resources are present in the resource pool, i.e. by using the stronger restriction of FL suggestion. But in the same time it allows smarter implementation which predicts feedback mode at the UE besides the semi-static PSFCH presence.  We don’t agree to restrict the applicability condition to PUCCH resource presence. In our view, forwarding of the feedback to gNB is a separate feature from the feedback on sidelink, and the latter should not be coupled with PUCCH resources.  FL reply 27/10/2020:  See my reply to them |
| Samsung | Not support.  We have similar view as LGE and vivo that SL HARQ enabling/disabling should not only depend on PSFCH configuration of a resource pool. Therefore, the condition proposed by FL seems unnecessary restriction for us.  We are fine in principle with vivo’s proposal to provide more flexibility, but prefer the modification from Sharp.  FL reply 27/10/2020:  See my reply to them |
| MediaTek | We support FL proposal.  Based on the possible values of delta listed in M-1-1-2, the latency incurred by delta doesn’t seem too large.  We can also be fine with LGE’s suggestion, but it’s not clear to us if network can know PSFCH reception time.  We disagree with Vivo’s and Sharp’s suggestions. UE should not be required to disable sidelink feedback depending on whether the retransmission gap is satisfied. We have not made an agreement to support such feedback disabling behaviour. |
| Futurewei | We do not support as this can sometimes create additional, unnecessary delay. The clarification proposed by LGE, although not indispensable, could be useful to add  FL reply 27/10/2020:  See my reply to them |
| Nokia, NSB | Don’t support FL’s proposal, it is too restrictive.  Support LGE’s approach, it seems straightforward.  FL reply 27/10/2020:  See my reply to them |
| Ericsson | Agree with the proposal |

### M1-1-2 Value of delta

A few contributions expressed their position on the value of delta. Unfortunately, there is no clear majority

~~Proposal:~~

* ~~The value of delta in the agreement from RAN1#102 is:~~
  + ~~Option A: 0~~
  + ~~Option B: 7 symbols~~
  + ~~Option C: 0.5 ms~~

FL update 27/10/2020:

* Option C has the largest support but option A is also fine for many.
* Option B has few supporters.
* As a FL I would suggest taking the majority view. However, it seems that many believe that delta=0 is possible. It seems strange to me to accept that delta=0 is possible and at the same time agree on a value of delta that introduces an additional delay.
* As explained by Intel, it is also strange that a fixed value 0.5 ms is taken, irrespective of the SCS. In some cases delta is quite large compared to Tprep.

Proposal:

* The value of delta in the agreement from RAN1#102 is:
  + 0.5 ms

Please share your views:

|  |  |
| --- | --- |
| **Company** | **View** |
| NTT DOCOMO | Either option A or Option C.  It seems unclear whether PSCCH/PSSCH preparation time is larger than PUCCH preparation time. |
| LG Electronics | No strong preference between Option B and Option C. |
| ZTE | Either option A or option C |
| Qualcomm | Option C |
| Apple | Option A is fine to us, considering is larger than for most of subcarrier spacings (i.e., 15/30/60 kHz SCS). We are also fine with Option C. |
| Huawei, HiSilicon | Option C: 0.5 ms  Considering the processing difference between Uu and SL, the time to prepare SL HARQ codebook should be the reference to determine delta. In general, the time consumption to prepare HARQ feedback is smaller than that of PSCCH/PSSCH including retransmission, since there is no encoding in PHY and other procedures in MAC layer. On the other hand, a UE could prepare SL HARQ on PUCCH and PSCCH/PSSCH retransmission in parallel, reporting SL HARQ and then transmitting PSCCH/PSSCH, additional time for retransmission is needed. The time to prepare a retransmission, i.e. a PSSCH, is larger than that of HARQ-ACK codebook preparation. Therefore, a value of delta larger than zero is appropriate from the UE perspective and 0.5ms is a reasonable value. |
| Intel | We are in favour of Option B.  We even think Option A could work since there is no fundamental increase of the processing/preparation complexity comparing to Tprep. In that sense, going with Option C would be quite excessive, resulting in 28 and 56 symbols additional gap for FR2 SCS, that is comparable to Tprep on its own.  Option B is viewed as a compromise between no delta (which may be also OK) and an excessive delta of 0.5 ms. |
| MediaTek | Option C |
| Futurewei | Option C  We would also be fine with Option A if it is viewed as not too aggressive |
| Ericsson | A |
|  |  |
|  |  |
|  |  |

## sl-DCI-ToSL-Trans

The values of sl-DCI-ToSL-Trans have not been agreed so far. There are two contributions proposing different ranges:

~~Proposal:~~

* ~~The configurable values for sl-DCI-ToSL-Trans are:~~
  + ~~Option A: 0-7 slots~~
  + ~~Option B: 0-31 slots~~

FL comment: given the agreed value for Tprep (cf. TS 38.214 Clause 8.6), it seems that configuring the value of 0 is not useful for any of the numerologies.

FL update 27/10/2020:

* 1-32 slots has the largest support.
* As Nokia explained in their reply, the fact that 3 bits are used in DCI does not preclude that the list of possible configurable values includes 32 entries. Just that up to 8 can be configured at the same time.

Proposal:

* The configurable values for sl-DCI-ToSL-Trans are:
  + 1-32 slots

Please share your views on the range and whether it should start at 0 or some other value.

|  |  |
| --- | --- |
| **Company** | **View** |
| NTT DOCOMO | Option B with removal of value 0. (or in addition max is 32 as K2.)  In NR, 0 is used for self-contained operation. SL is slot-based, so 0 would be unnecessary (unavailable). |
| LG Electronics | We are fine with “Option B with removing 0 value”. |
| vivo | Agree with DCM, the candidate values should be 1-32 slot. 0 is not needed as NR SL does not support self-contained scheduling.  BTW, I would like to ask for clarification: is it a common understanding in the group that the sl-DCI-ToSL-Trans represents a number of physical slots in SL SCS?  vivo 28/10/2020:  support FL’s proposal  We appreciate the response from OPPO and ZTE, this aligns with our understanding support. And we share a similar view as ZTE, it can be described more precisely as “1-31 physical slots with SL numerology”. |
| OPPO | Option B by excluding value 0.  To vivo: in my view, it is based on physical slots in SL SCS. If the scheduled SL is not the slot of the TX RP, the first slot within the TX RP should be used. |
| Sharp | Fine with Option B excluding value 0.  [Sharp2]  We support the FL proposal. |
| CATT | Agree that Option B with removing “0”.  Similar view of OPPO to vivo: we also think it should be physical slots in SL SCS. |
| ZTE | Option B  In order to avoid ambiguity, it can be described more clearly as “1-31 physical slots with SL numerology”. |
| Qualcomm | Option A (no strong view on “0”). The spec already defines the Time gap field to be 3 bits.  During RAN1 discussion on this topic, the agreement to have a configurable table was to avoid unnecessarily increasing DCI size. Option B requires 5 bits compared to Option A’s 3. We don’t see the need to increase DCI size by those two bits. |
| Apple | Option B (without 0 slot) seems reasonable. The sl-DCI-ToSL-Trans should be in a comparable range as K2, which is between 0 and 32 slots. Furthermore, the value 0 slot is not needed for sidelink. |
| Huawei, HiSilicon | Option A: 0-7 slots  Considering the overhead of “time gap” field, Option A should be supported.  Since the slot of the first sidelink transmission scheduled by the DCI is the first SL slot of the corresponding resource pool that starts not earlier than , so the 0 should be included in the configurable value. The value of can be 0, but the actual interval between PDCCH and the PSSCH can also be larger than 0. Thus the preparation time in TS 38.214 Clause 8.6 can be ensured. |
| Intel | Option A |
| Samsung | Option B, and we are fine with removing “0” value |
| MediaTek | Option B with removing “0” is better |
| Futurewei | Option A. No strong view on 0 |
| Nokia, NSB | Option B.  I don’t understand the argument about number of bits in the DCI field: What we are discussing here, in my understanding, is not the number of values in the table (which of course is limited by the number of bits in the DCI field), we are discussing the range of the values in that table. So a large range of values as in Option B is possible, it is just not possible to populate the table with all these values at the same time. |
| Ericsson | Option B, without 0 is fine. |

## Other comments

|  |  |
| --- | --- |
| **Company** | **View** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |