3GPP TSG RAN WG1 Meeting #102-e R1-200xxxx

eMeeting, August 17 – 28, 2020

Agenda Item: 7.2.4.2.1

Source: Moderator (Ericsson)

Title: Resource allocation for NR sidelink Mode 1 – Thread 2

Document for: Discussion, Decision

# 1 List of issues for discussion

[102-e-NR-5G\_V2X\_NRSL-Mode-1-02] Email discussion/approval covering:

* HARQ reporting to gNB
	+ Details in the WA from RAN#100-e for the case of reaching the maximum number of HARQ re-transmissions for a TB.
	+ Whether there are other exceptional reports to the gNB (e.g., nothing to transmit for DG, etc.) and, if so, how to address them.
	+ Editorial corrections and clarifications for HARQ reporting to gNB (if any).
* Processing times
	+ Processing time for SL CG type-2.
	+ Whether the gNB needs to be aware of SL HARQ RTT (Z = a + b) or alternative assumptions or behaviour, if necessary.
	+ Editorial corrections and clarifications for processing times (if any).

By 8/20, followed by potential TPs by 8/25 – Ricardo (Ericsson)

# Discussion

## 1.3 HARQ reporting to gNB

### Issue 1.3-1 Details in the WA from RAN#100-e for the case of reaching the maximum number of HARQ re-transmissions for a TB.

**Regarding the following working assumption made in RAN#100-e:**

1. **When the maximum number of HARQ retransmissions for a TB is reached, the UE reports ACK/NACK based on the contents of PSFCH (i.e., the same behaviour as if the maximum number of retransmissions had not been reached).**
2. **When the maximum number of HARQ retransmissions for a TB is reached, the UE reports ACK.**

 **(For other answers, please explain)**

**FL summary (19/8/2020):**

* There is a majority of companies supporting option A.
* Some further companies propose not having any additional specification. My understanding is that this is aligned with option A too.

**FL reply (20/8/2020):**

* There is a comment by Nokia on whther there is some misalignment in the RAN2 specs.

**Proposal:**

* When the maximum number of HARQ retransmissions for a TB is reached, the UE reports ACK/NACK based on the contents of PSFCH (i.e., the same behaviour as if the maximum number of retransmissions had not been reached).
* No spec impact is expected.

**During the GTW session on 20/8/20, the following was agreed:**

Agreements:

* For CG, when the maximum number of HARQ retransmissions for a TB is reached, the UE reports ACK/NACK based on the contents of PSFCH (i.e., the same behaviour as if the maximum number of retransmissions had not been reached).

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| **Company** | **View** |
| NTT DOCOMO | Option A.[DCM2] Support the proposal. |
| Intel | Option A[Intel2] Support |
| vivo | We have no particular preference for either option. But we have some questions about option A. I understand that setting the maximum retransmission for a TB to some extent is to limit the resources used for a single TB. Since gnb is not aware of where the initial transmission takes place on a CG, it cannot differentiate the HARQ-ACK reporting with/without satisfying the maximum transmission times restriction. So if we go with option A, gnb may assign more resources for retransmission due to the reported NACK, then what is the purpose of setting the maximum retransmission times in this case? It sees this limit has virtually no impact on the number of resources used by a TB. Could the proponents of option A elaborate a bit more of the intention of setting such restriction if option A is adopted?FL reply (19/8/2020):My understanding is that the existing restriction limits the number of transmissions a UE can perform in the resources provided by a CG. That is not incompatible with the gNB providing further resources.[vivo-2020/08/20]Understand. I was just trying to remember the original intention of introducing a maximum number of transmissions for CG….. it seems that such restriction is totally useless if we follow option A… |
| OPPO | The WA made in RAN1#100-e is as follows:Working assumption (Q5):In case of reaching the maximum number of HARQ re-transmissions for a TB, the UE sends one bit on the UL resources for SL HARQ-ACK reporting. The specification will specify the UE behavior (what the behavior is: FFS), and specify the contents of the report (what the content is: FFS).This WA was partially agreed in RAN1#100bis-e for configured grant: Agreements:* The working assumption (as in proposal 3 in the summary) from RAN1#100-e is confirmed.

Proposal 3 (for a working assumption):* The working assumption from RAN1#100-e is confirmed.
	+ In case of reaching the maximum number of HARQ re-transmissions for a TB using resources provided by a configured grant, the UE reports ACK to the gNB.
		- ~~FFS whether the specification supports that the gNB configures the UE with a maximum number of transmission per TB.~~

While for dynamic grant, there is no agreement till now. @ FL, can you clarify that this issue is only for DG? On the other hand, one remaining issue regarding the WA is how the UE knows whether/when the maximal number of transmissions is reached. We have the following agreement in RAN1#99. For DG, the number of re-transmissions is up to gNB. Based on that agreement, how the UE knows when/whether the number of re-transmission is reached. That should be clarified, and some specification is needed. Otherwise, it cannot work.Agreements:* For dynamic grant, the number of retransmissions of a TB is up to the gNB.
* For configured grant, the maximum number of times that a TB can be retransmitted using the resources provided by the configured grant is configured per priority per configured grant.

FL reply (19/8/2020):My understanding is that this can only apply to CG. For DG the maximum number is up to the gNB, as shown in the last agreement you copy.The working assumption was confirmed in RAN1#100bis-e. I am not sure why you are copying Proposal 3 above. That was never agreed. Only the working assumption (as copied at the beginning of your reply) was agreed.[OPPO2] For the CG case, we have made agreement (Please find Spreadtrum’s comment in the table, I copied the wrong proposal 3, sorry for the confusing).For DG case, we still prefer option B. gNB allocates resource to UE for transmission. While UE may not be able to use the allocated reousrce actually if some transmission occasions are dropped because of prioritization. Then the number of transmissions between gNB and UE are misalignment. gNB assume it has allocated maximal number of transmission resources to UE, while UE cannot use all of them if some transmission occasions are dropped. If UE report NACK to gNB based on received PSFCH, gNB will not allocate more transmission resource for the TB if it has allocated maximal number of resources. While UE needs more resource for re-transmission since the actual number of transmission does not reach the maximal number. If UE reports ACK to gNB in case the maximal number of transmission is reached, gNB will not allocate more resources. Compared to option A, there is no misalignment between gNB and UE. FL reply (20/8/2020):For DG, my understanding is that the above confirmed WA does not apply. |
| LG Electronics | First of all, the network can’t exactly know (a) which CG resource (within a period) is used for the initial TX of TB or (b) how many re-TXs of TB have been performed. In other words, only UE can know such information. With Option B, it is possible for the network to avoid allocating unnecessary re-TX resources for the TB that has been already reached to the maximum number of re-TXs. As a result, we are supportive of **Option B**. Furthermore, **when the maximum number of re-TXs for a TB is configured per priority per CG, it can be defined that this value is shared between re-TXs using CG/DG resources for the same TB**. [LG2] When adopting FL’s proposal, it should be clarified why the parameter of configuring the maximum number of HARQ re-TXs for a TB in CG is necessary? FL reply (20/8/20):See my reply to QC. |
| ZTE, Sanechips | Option A.  |
| Sharp | Option A |
| Qualcomm | We prefer Option BReporting ACK provides information to the gNB to stop giving grants for this TB. In the case where the UE is not (or cannot be) aware of the maximum number of retransmission, the UE will proceed as normal for any retransmission and provide feedback based on received PSFCH.[QC2]: It isn’t clear how the proposal would still utilize the parameter for the maximum number of configured grant retransmissions (sl-CG-MaxTransNum).FL reply:If the number is reached, do not transmit further on resources granted provided by te configured grant. It is unrelated to reporting. |
| CMCC | We share similar view with OPPO that this issue is only for DG and UE cannot be aware of whether the number of re-transmission is reached. So the same behaviour regardless of whether the maximum number of retransmissions has been reached or not is preferred. And from our perspective, UE does not need to know when/whether the number of re-transmission is reached, so no specification is needed.FL reply (19/8/2020):My understanding is that option A entails no further specification |
| Fujitsu | Option A |
| CATT | First of all, how to define the maximum number of the HARQ re-tx for a TB. The maximum number is a number X that should be configured to UE, and $0\leq X\leq 32$. If the maximum number of transmission for a TB is 10, it means this TB can be transmitted and retransmitted no more than 10.* For **CG type-1 and Type-2**, the maximum number is configured exactly to the UE.
	+ For CG type-1, the configured grant can configured and indicate the first set of resource for initial transmission and re-transmission, e.g. N\_max=3, then the rest 7 re-transmission will be scheduled by DG. For DG schedule re-transmission, each time DCI can dynamically scheduled N\_max=1/2/3, and at the end of each set of scheduled resources, there will be a PUCCH resource for ACK/NACK reporting.
	+ For CG type-2, DCI is used to active the first transmission(s), e.g. N\_max=3 indicated in DCI. For each TB, the initial transmission and 2 re-transmissions (3 resources), the resources are indicated by DCI and configured CG period, and the rest 7 re-transmissions are scheduled by other DG if needed.

Therefore, **for CG Type-1, both gNB and UE knows the maximum number that a TB can be transmitted**. gNB should not schedule extra resources for transmission that is exceeds the maximum number (e.g. gNB will not schedule 11-th transmission resources for the TB).**Q1: How many TX resources are configured for each TB? 10 or only 3?****Q2: Can the DG scheduled re-transmissions use CG resources?****Q3: Can a TB use resources located in more than one CG period?*** For **DG**, there is no such a parameter that is configured to UE to indicate the maximum number of transmission. DCI is used for each set of resources for DG transmission. The first set of transmissions indicated by DCI, e.g. N\_max=3, and the rest 7 re-transmissions are scheduled by other DG if needed. **gNB knows the maximum number that a TB can be transmitted but UE does not know**. UE only perform the (re-)transmissions by using the resources scheduled by gNB and indicated.

**With the analysis above, there is no necessary for a UE to act the HARQ-ACK report in case of reaching the maximum Tx number of a TB.**[CATT2]Before down selecting from the two options, the unclear part in this mechanism should be clarified. I think other companies also mentioned about it.* This reporting mechanism in the proposal is intented for CG, but not DG.
* Even for CG, the re-transmissions are scheduled by DG. Both gNB and UE knows the maximum re-tx number of a TB, there is no reason that gNB allocate re-tx resources exceeds the maximum allowance configured by itself.

FL reply (20/8/20):For DG, there is no maximum number. So the agreement cannot apply.For CG, the agreement we states the following:Agreements:* For dynamic grant, the number of retransmissions of a TB is up to the gNB.
* For configured grant, the maximum number of times that a TB can be retransmitted using the resources provided by the configured grant is configured per priority per configured grant.

I think the part in yellow is self-explanatory. It does not include resources granted by the gNB using. |
| Huawei, HiSilicon | We do not have strong preference here, but it should be clarified how the UE know the maximum (re-)transmissions are reached. According to the agreements in RAN1#99, the number of retransmissions of a TB for dynamic grant is up to the gNB, thus maximum number of HARQ retransmissions has not been specified for dynamic grant so far. To provide more flexibility to dynamic grant, it is also no need to define such maximum number of HARQ retransmissions, thus it seems reasonable to report ACK/NACK based on the contents of PSFCH as the general way. |
| Samsung | We prefer Option B.In our understanding this issue is for CG, since the retx number of DG is up to gNB. For CG, if Option A is adopted, gNB has no information of how many times one TB is transmitted, thus gNB may schedule resource for retx even if the maximum retx number is reached. Therefore the scheduled resource is wasted. Option B can better reflect the situation of SL transmission.In addition, since CG could schedule only up to 3 resources per period, we prefer to clarify the number of retx per priority per CG includes both CG-based resource and DG-based resource for retx of CG.[Samsung2] We also think Option A cannot utilize the parameter *sl-CG-MaxTransNum* and may introduce misalignment between UE and gNB, e.g. gNB schedules resource for retx when UE already release the buffer.FL reply (20/8/20):See my reply to QC and Nokia |
| Fraunhofer | Option B.* In our understanding, the maximum number of HARQ retransmissions in question is **relevant only to CGs**. The maximum number of retransmissions for a TB using resources of the grant is configured per priority per configured grant using the parameter *sl-CG-MaxTransNumList*.
* Hence TX UEs are aware of this restriction, and can manage and maintain the number of retransmissions for a given TB. However, as LG stated, the **gNB cannot keep track of the number of retransmissions** a TX UE carries out for a single TB using the resources provided in a given CG.
* In the case of option B, if the gNB receives an ACK after the maximum number of retransmissions was reached, it will carry out the same action as when it receives an ACK for a successful transmission. Hence the gNB’s response does not vary between the two events.
* In the case of option A, it is important for the gNB to differentiate between a NACK when the maximum number of retransmissions has been reached and when it has not been reached.
	+ If NACK was sent before the maximum number of retransmissions was reached, the gNB has the option to schedule further resources for retransmission using DG.
	+ If NACK was sent after reaching the maximum number of retransmissions, the gNB should NOT provide further grants for retransmission. The UE has already attempted to transmit the maximum number of times, given the existing conditions, and has failed to do so successfully. Providing further resources would only result in inefficient resource utilization.
* Agree with OPPO that option A would raise the **question of the functionality and purpose of the restriction on maximum number of retransmissions**.

If the value is set to the maximum, the **behaviour of the UE intended by option A can be covered by option B**, where the gNB can continue providing more resources for retransmission, but bound by the maximum upper limit.[Fraunhofer2] Based on the proposal from the FL, we have the following questions:* Q1. Can a UE continue retransmissions of a TB in the following CG period? RAN1 has an agreement that only one new TB can be transmitted in a period of a CG, but details regarding retransmissions were left FFS.
	+ Q2. If the answer to Q1 is yes, and if the UE does not inform the gNB about reaching the maximum limit, and since the gNB does not keep track of the number of times a TB was already retransmitted, how does the gNB possibly limit the number of times the TB is retransmitted?
	+ Q3. If the answer to Q1 is no, the maximum number of retransmissions for a TB is always set to N\_max. In which case, what is the point of setting the maximum limit per priority?
* Q4. If the UE is not to take any action, and if the gNB is unaware, when the maximum number of retransmissions for a TB in a CG is reached, what is the point of this parameter?
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| Ericsson | Option A |
| Futurewei | Option A |
| Nokia, NSB | It seems to us that the fundamental problem is the meaning of “maximum number of HARQ retransmissions for a TB is reached”along with the definition of sl-CG-MaxTransNumList, which reads “maximum number of times that a TB can be transmitted using the **resources provided by the configured grant**” (emphasis added). If we take the parameter definition as it currently stands then there does not seem to be any reason why this limit on the number of TX **using resources provided by the configured grant** should restrict the number of additional ReTX **using resources provided by dynamic grant**. Hence option A is the obvious answer.On the other hand one could consider changing the definition of the parameter to e.g. “maximum number of times that a TB whose initial TX uses resources provided by the configured grant can be transmitted in total”. If such a change is made then option B makes sense. FL reply (19/8/2020):My understanding is that we are taking definitions as they currently are.[NOK2]Fine with the principle, but there may be an inconstancy with 38.321: If sl-CG-MaxTransNum is reached then the HARQ buffer is flushed. If the UE then reports NAK to the gNB and is assigned resources for ReTX using dynamic grant there would be nothing to retransmit.FL reply (20/8/2020):That is an interesting point that would need a fix in RAN2. |
| InterDigital | Option BWhen the maximum number of HARQ retransmission of a TB is reached, reporting ACK will help the UE stop providing grants for the TB.For a configured grant, it was agreed that the maximum number of HARQ retransmission can be configured per priority. For the dynamic grant, the maximum number of HARQ retransmission can be configured per priority as well. |
| Apple | For dynamic grant, the number of retransmissions of a TB is up to the gNB. Hence, Option B does not work for dynamic grant as UE does not know the maximum number of retransmissions. For configured grant, we think both gNB and UE know how many transmissions for a TB based on the configured number of resources in a configured grant. Hence, gNB will not assign additional resources for retransmissions if the maximum number of retransmissions is reached.  |
| Spreadtrum | No further specification is necessary.Firstly, this issue has been solved for CG in RAN1 100bis as shown below. So, it should be clarified that this issue is only for DG.Proposal 3:* In case of reaching the maximum number of HARQ re-transmissions for a TB using resources provided by a configured grant:
	+ ~~Alt 1. The UE reports ACK to the gNB.~~
	+ ~~Alt 2.~~ The UE reports ACK/NACK based on the corresponding PSFCH reception(s) or absence(s) thereof.

Agreements:* The working assumption (as in proposal 3 in the summary) from RAN1#100-e is confirmed.

Secondly, for DG, according to the following agreements, UE doesn’t know whether the maximum number of re-transmissions is reached.Agreements:* For dynamic grant, the number of retransmissions of a TB is up to the gNB.
* For configured grant, the maximum number of times that a TB can be retransmitted using the resources provided by the configured grant is configured per priority per configured grant.
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### Issue 1.3-2 Other exceptional reports to the gNB

**Are there are other exceptional reports to the gNB (e.g., nothing to transmit for DG, etc.)?**

1. **Yes (please provide details).**
2. **No further specification is necessary.**

**(For other answers, please explain)**

**FL summary (19/8/2020):**

* A majority of companies is supportive of not having any further specification.
* The issues described by the companies supportive of specifying further exceptional cases, do not result in a complete breakdown of the system. If they happen, they only result in some inefficient operation. Some of the supporters have even stated that these are optimizations.
* Given these two observations and that we are quite advanced in the maintenance phase, the proposal is not to specify anything.

**FL summary (20/8/2020)**

* Not many comments on this. The proposal remains the same.

**Proposed conclusion:**

* No additional expceptional reports to the gNB are specified at this point.

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| **Company** | **View** |
| NTT DOCOMO | YesWhen a dynamic grant is provided to a UE, but if the UE skips the corresponding SL transmission, the UE should report ACK to gNB.According to RAN2 spec., SL , is possible; hence, we think this exceptional report is needed. For example, a UE sends SR/BSR to gNB and gNB schedules SL grant based on the reported information. BSR includes destination ID/LCG ID/Buffer size. gNB predicts how many grants are necessary. However, SL grant does not include MCS indication/MIMO/DM-RS/CSI-RS/etc. They are determined by the UE itself and actual transmitted TBS is dependent on the parameters (i.e. channel condition/UE capability/etc.). The provided SL grants may be insufficient to transmit the reported buffer or may be sufficient. If sufficient, the UE could not have any transmitted data on one or more of the provided grants. This is feasible case in our understanding. gNB does not know details of actual SL communication.[DCM2] We do not support the proposal since solving this issue would be essential. Please see the following points:a. In our understaning, the skip mechanism is captured in 38.321. In section 5.22.1.3.1.3, there is the following description, which comes from Uu description in 5.4.3.1.3. Therefore, the skip situation can occur. Meanwhile, we cannot find RAN2 agreement for this...

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| The MAC entity shall not generate a MAC PDU for the HARQ entity if the following conditions are satisfied: - there is no Sidelink CSI Reporting MAC CE generated for this PSSCH transmission as specified in clause 5.22.1.7; and - the MAC PDU includes zero MAC SDUs. |

b. if this situation occurs, i.e. UE skips SL TX on resource provided by DG, of course UE follows current 213. In 16.5 of 213, UE generates HARQ-ACK bit based on the cast-type or feedback option. But when UE does not transmit any on the SL resource, HARQ-ACK bit generation is unclear; especialy whether generated or not. This issue leads to UCI payload size misalignment.c. Note that we had same discussion for CG case and already specified as ACK generation. The motivation would be the same between CG and DG. Therefore, to follow CG case for DG is so reasonable outcome in our understanding.

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| The UE generates an ACK if the UE does not transmit a PSCCH with a SCI format 1-A scheduling a PSSCH in any of the resources provided by a configured grant in a single period and for which the UE is provided a PUCCH resource to report HARQ-ACK information. The priority value of the ACK is same as the largest priority value among the possible priority values for the configured grant. |

(if our understanding of the above ‘a’ is incorrect, i.e. SL TX skip is not supported in RAN2, the proposal is fine for us.) |
| Intel | We are not sure if the case mentioned by NTT DOCOMO needs additional handling. For example, it can be similar to the case when a configured grant is not used. If it is not handled by specification, we are supportive that a UE sends ACK in this case. |
| vivo | Option B. No.In the case of UL, the ability to skip on CG is a mandatory capability, but skipping on DG is an optional capability. Whether the UE can skip on a UL DG depends on the presence of skipUplinkTxDynamic. Specifically, if skipUplinkTxDynamic is configured, the UE can skip on UL grants, if not, the UE cannot skip the grant and should send a MAC PDU with padding.The gnb may provide a sidelink grant, but the UE has no data available. In this case, if SL grant skipping is allowed, then we may need to discuss whether this behavior is an optional or mandatory capability. Since skipping UL DG is an optional capability, skipping SL DG should also be optional. However, defining such a new capability may introduce new RRC parameters, which should be avoided during this maintenance phase. Another possibility is that the UE can send a MAC PDU with padding on a predetermined resource, the UE can then report HARQ-ACK based on the PSFCH reception associated with the DG. In this case, the process for determining the HARQ information is the same as if there is SL data to be sent. Therefore, no special reports need to be defined. |
| OPPO | Yes.In case of dynamic grant, the SL transmission resource is allocated by gNB. While if the allocated resource beyond the PDB of the packet, UE will not use the resource for SL transmission. In that case, UE should report ACK to gNB to terminate gNB’s allocation for re-transmission.  |
| LG Electronics | At this moment, it is not clear that the current MAC specification supports the mechanism that a UE skips SL TX on the resources of Mode 1 DG. So, it would not be desirable for RAN1 to discuss/conclude the relevant behaviour of HARQ reporting before RAN2 makes the explicit agreement on whether to support such mechanism in Rel-16 NR V2X. So, our preference is **Option B**. |
| ZTE, Sanechips | Option B.  |
| Sharp | Option A. We are supportive of specifying the case mentioned by NTT DOCOMO. |
| CMCC | We are open to this optimization so option A is slightly preferred.  |
| Fujitsu | YesWe think it is a feasible case where UE has nothing to transmit on the resources allocated by dynamic grant. For example, this case can occur when PUCCH carrying sidelink ACK is dropped due to prioritization. Since PUCCH is not transmitted, gNB will not receive any ACK/NACK and thus may treat it as DTX. For safety, gNB may continue to schedule retransmission by using dynamic grant. However, UE has nothing to transmit since it has been ACKed before. In this case, letting UE report ACK can prevent gNB from keeping scheduling retransmission. Actually, the principle is similar with what has been defined when UE has nothing to transmit on the configured grant resources. |
| CATT | Option B.Currently, there is not exceptional cases that needs ACK/NACK reported to gNB. in terms of the case mentioned by NTT, the skiping mechanism is not supported now (also mentioned by LGE). UE will perform the transmission and use the resources scheduled by gNB. |
| Huawei, HiSilicon | Option B.UE acquires the resource based on gNB scheduling, so gNB is aware of the SL transmission requirement, such as the latency, so the gNB could schedule a resource within the PDB. For the SL transmission which scheduled by gNB but skipped by the UE, it is due to the misunderstanding about the buffer status between UE and gNB, but this is similar with NR Uu scenario, which UL grant is skipped as well when no UL data is going to be transmitted. Therefore, we think no special issue in SL needs to be addressed. |
| Samsung | Option B.Regarding SL skipping, we share similar view with vivo and LGE that RAN1 should not trigger this feature and introduce high layer impact. For the other issues, we consider it can be solved by current mechanism. Therefore, so further specification impact is needed. |
| Fraunhofer | Option A.We agree with the issue being raised by NTT Docomo. If the UE does not transmit on a resource indicated by a DG, it can respond with an ACK in order to avoid further scheduling of resources by the gNB. This issue is already covered in 38.213 for CG, it can be extended for DG as well. |
| Ericsson | BAt this point, we are not convinced there are other exceptional cases. |
| Futurewei | BWhile there could be exceptional cases that could potentially be investigated, we do not see any critical one needed in Rel-16 |
| Nokia, NSB | B |
| Apple | Option B. We do not see the needs to specify the exceptional case in Rel-16.  |
| Spreadtrum | Slightly prefer Option A. The cases mentioned by NTT and FUJITSU may need specification. |

## 1.4 Processing times

### Issue 1.4-1 Processing time for SL CG type-2

**The current specification only captures the PSSCH processing time for sidelink dynamic grant (TS 38.214 Clause 8.6) corresponding to the following agreement from RAN1#101-e:**

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| Agreements:* For dynamic grant in Mode 1, a UE does not expect to be scheduled to perform a SL transmission earlier than $T\_{proc}$ after the end of the scheduling PDCCH.
	+ $T\_{proc}=(N\_{2}+d\_{2,1})(2048+144)⋅κ2^{-μ}⋅T\_{C}$
		- $N\_{2}$ is 10, 12, 23, and 36 for $μ$ equal to 0, 1, 2, and 3, respectively.
			* FFS other values of $N\_{2}$ based on the discussion on capabilities (Q5).
		- *µ* corresponds to the one of (*µDL*, *µSL*) resulting in the largest *Tproc.*
		- $d\_{2,1}$ = 1
		- $κ=^{T\_{s}}/\_{T\_{c}}$ (parameters as defined in 38.211)
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**R1-2005339 proposes using the existing preparation time for SL CG type-2 activation. Is the following proposal agreeable?**

**Proposal:**

* For SL configured grant type-2 activation, the UE processing time is equal to Tproc (agreed in RAN1#101-e).

**FL summary (19/8/2020):**

* The proposal is agreeable to everyone.

**FL summary (20/8/2020)**

* No update

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|  **Company** | **View** |
| NTT DOCOMO | Agree |
| Intel | Agree. There seems no essential difference. |
| vivo | Agree |
| OPPO | Agree  |
| LG Electronics | We are fine with FL’s proposal. |
| ZTE, Sanechips | Agree |
| Sharp | Agree. |
| Qualcomm | Agree |
| CMCC | Agree |
| Fujitsu | Agee |
| CATT | Agree. |
| Huawei, HiSilicon | Agree. The processing time for CG type 2 should be the same as dynamic grant. |
| Samsung | Agree. |
| Ericsson | Agree |
| Futurewei | Agree |
| Nokia, NSB | Agree |
| Apple | Agree |
| Spreadtrum | Agree |

### Issue 1.4-2 Whether the gNB needs to be aware of SL HARQ RTT (Z = a + b) or alternative assumptions or behaviour, if necessary

**A few contributions (e.g., R1-2005741, R1-2005847) discuss whether it is necessary for the gNB to know the SL HARQ RTT (i.e., Z = a + b in the agreements) for being able to schedule the SL Mode 1 transmissions and to schedule the PUCCH transmissions with SL HARQ reports.**

1. **It is necessary to agree on an assumption on the HARQ RTT.**
2. **It is not necessary to agree on an assumption on the HARQ RTT. In that case,**
	* **How should the UE proceed if the time between two SL transmissions (for the same TB) is shorter than the HARQ RTT?**
	* **How should the UE proceed if the time between the last PSFCH reception and the SL HARQ report to the gNB is smaller than the processing time at the UE?**

**(For other answers, please explain)**

**FL summary (19/8/2020)**

* There is a very clear majority of companies that think that an upper bound on ’b’ should be defined, while leaving the actual value up to UE implementation, as agreed. We can discuss the value but the agreed value for Tproc seems a reasonable starting point.
* For the case that ”the time between the last PSFCH reception and the SL HARQ report to the gNB is smaller than the processing time at the UE”, two companies have expressed the position that this should be left up to UE/NW implementation, while one company proposes to specify some behavior.
* Based on this, my proposal is the following:

**FL summary (20/8/2020)**

* Multiple companies have expressed a preference for using Tprep isntead of Tproc.
* Based on this, I have updated the proposal as follows:

**Proposal:**

* The time between PSFCH reception and next PSCCH/PSSCH retransmission (i.e., ’b’) does not exceed Tprep.
* No additional specification is introduced for the case that the time between the last PSFCH reception and the SL HARQ report to the gNB is smaller than the processing time at the UE.

**During the GTW session on 20/8/20, the following was agreed:**

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

**Regarding applicability:**

The following two options were discussed during the meeting:

* Option A. The gNB provides a grant for transmission in a pool with PSFCH resources.
* Option B. SL HARQ feedback is used (my understanding is that this is the same as TB with HARQ-enabled is transmitted)

My understanding is that the gNB cannot know whether the condition in option B is met or not. The gNB provides resources but the UE is in charge of assembling the TB. Situations like the following may happen:

1. The UE sends a BSR which indicates that it has data belonging to LCH for which SL HARQ FB is not enabled.
2. After the BSR is sent but before the grant is received, a new packet with high priority arrives at the TX buffer.
3. Although the pool contains PSFCH resources, the gNB provides a grant (based on the BSR) with PSFCH-to-PSCCH/PSSCH time smaller than Tprep + delta.
4. The UE finds itself in a situation that it has a packet that requires HARQ feedback but the grant cannot work. This would require that RAN2 introduces new LCP rules, which is highly undesirable at this stage.

For this reason, my proposal would be to go with the first option

**Proposal:**

* Change the first line in the above agreement so that it reads: ”For Mode 1 ~~when applicable~~ when using a pool with PSFCH resources:”

Regarding delta, I would appreciate if companies would share views. So far, we have only seen two values: 0 and 0.5 ms

Please share your views for the proposal and the value for delta using the new table (the old table can be found in the appendix, for reference).

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| **Company** | **View** |
| ZTE, Sanechips | We agree FL’s proposal on “For Mode 1 ~~when applicable~~ when using a pool with PSFCH resources:”Regarding to value of delta, we would like to firstly ask for a clarification of the main bullet in the agreement made in the most recent conference call, i.e. “For the same TB, the minimum time between PSFCH reception and next scheduled PSCCH/PSSCH retransmission is Tprep +delta (ms)”. To our understanding on the original intention of this topic, once the gNB gives the grant (either CG of DG), the UE can do nothing with any modification of the time interval between one PSFCH and the next PSCCH/PSSCH. This is why ZTE commented in the conference call that this main bullet indeed says a gNB behaviour. If this main bullet is considered as UE behavior, the meaning of the whole agreement would be changed in such a way that “In general UE does not expect gNB would give grants that cannot guarantee the minimum time interval, but if gNB indeed does, Tx UE may modify the transmission patterns, such as disabling the PSFCH for a transmission, to guarantee the minimum time interval is not violated”. So here people can have two different understanding:* If the main bullet in agreement is a restriction to gNB behaviour, delta should be a value knowable to gNB.
* If the main bullet in agreement is a UE behaviour, there seems no strong requirement for gNB to know delta, although having the knowledge in gNB is beneficial.

Further, whether the main bullet intends to describe the gNB behavior or UE behavior also impacts how to capture the agreement in TP. It is not our intention to re-open the agreement. Just need a clarification. FL reply (21/8/20)My understanding is that this agreement* Implies that any UE does the required processing (i.e., process PSFCH, prepare a new PSCCH/PSSCH transmission, etc.) in a time that will not be larger than Tprep + delta (but the UE could do faster than that).
* Implies that the UE will not expect the gNB to be scheduled consecutive transmissions of the same TB that are spaced by less than Tprep + delta.
* (The conditions when these applies and the exact value of delta are being discussed in this thread and will be part of the spec text.)

I don’t think this is conceptually any different from the following agreement made in RAN1#100bis-eAgreements:* A UE does not expect to be scheduled to transmit the UL report corresponding to a PSFCH reception earlier than Tprep after the end of the PSFCH.
	+ This includes the effect of time advance.
	+ Tprep = (N+X) ∙ (2048+144) ∙ k ∙ 2 –μ ∙ T\_c where:
		- Working assumption: N is 14, 18, 28 and 32 corresponds to the SCS configuration μ of 0, 1, 2 and 3, μ = min(μ\_SL, μ\_UL)
		- k = T\_s / T\_c (parameters as defined in 38.211)
		- FFS X (including the possibility of value 0)

(Of course we are talking about a SL PSCCH/PSSCH transmission instead of PUCCH in UL, but conceptually the situation is the same). |
| Ericsson | The proposal looks fine.Regarding the value of delta, we believe that delta = 0 is sufficient. This corresponds to Tprep, which is the minimum PSFCH to UL PUCCH report. According to QC, Tprep > Tproc, which is PDCCH to PSCCH/PSCCH time. In our view, the time of assembling a PUCCH report cannot be larger than the time of assembling a PSCCH/PSCCH transmission. Consequently, delta=0 must be sufficient. |
| Qualcomm | In my understanding of the agreement, the value (Tprep + delta) is a processing timeline, which is defined as a minimum scheduling restriction.Tprep (PSFCH to PUCCH) = 18 symbols and Tproc (PDCCH to PSCCH/PSSCH) = 12 symbols with 30 kHz SCS. For this proposal, we’re discussing PSFCH to PSCCH/PSSCH, which is more closely related to Tprep because both have the same starting point. I agree with Ericsson that the time to prepare PSCCH/PSSCH is greater than the time to prepare PUCCH and that’s why I think delta should be greater than 0 and proposed 0.5 ms during the call.I agree with the feature-lead’s assessment that the gNB cannot know when the UE will request feedback.  |
| NTT DOCOMO | My understanding is a bit different.I agree that gNB cannot know whether the condition in option B is met or not. But it does not mean that gNB shall guarantee the time restriction. It is too restrictive that gNB always guarantee the minimum time for any grant, e.g. blind retransmissions of a TB with HARQ feedback disabled. It leads to larger latency of such stransmissions with HARQ feedback disabled.My suggestion is the following:* When SL grant provided by gNB does not guarantee the minimum time, UE can transmit data which does not require HARQ feedback on SL (e.g. broadcast), if any; otherwise, UE skips the transmission.
* When SL grant provided by gNB guarantee the minimum time, UE can transmit data which either requires or does not require HARQ feedback on SL.

Note that RAN2 agreed the following in RAN2#109-bis:

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| Agreements on MAC: ...9: For mode1, if UE only has SL data on LCHs with FB enabled for a SL grant configured without PSFCH, the SL grant is skipped and so not used for transmission. |

FL reply (21/8/20)The RAN2 agreement that you have copied refers to a “SL grant configured without PSFCH” (i.e., a SL grant for a pool without PSFCH resources). The problem here would be that the pool itself would have PSFCH resources but the very specific grant would not allow the UE to process PSFCH and prepare PSCCH/PSSCH. Certainly RAN2 could add an additional rule like the one above for the case we are discussing, but this is exactly what I think we should avoid so deep in the maintenance phase.My view is that, unless it is essential, we should avoid any impact to RAN2 spec.[DCM2] Thank you for kind clarification. OK, you assume that ‘SL grant configured without PSFCH’ means grant for resource pool without PSFCH. I thought the quoted sentence includes our discussing case, i.es. insufficient gap between PSFCH and the next PSSCH. But I checked 321 again and it seems your assumption is valid. We also think that further RAN2 work is not preferable. In that sense, now we are fine with your update above. Thank you. |
| Huawei, HiSilicon | We are generally fine with the FL’s update, but we are curious about the applicability of this proposal.In our understanding, the prospsal is used to limit the time beteween PSFCH and next PSCCH/PSSCH transmission in order to UE could have enough time to prepare a retransmission in case that it receives NACK on the PSFCH resources. However, this the mechanism is based on HARQ feedback. If the HARQ feedback is disabled, UE does not have the HARQ information and will transmit the TB anyway. For this point, gNB does not need to gurantee the time. Which is unfortunately, the HARQ function enabled/disabled is up to TX UE, gNB is not aware of the function is truned on or off, so it cannot predict whether the timeline should be met or not. But for another point, if gNB configures the PUCCH resource which implies the gNB would like to receive the SL HARQ information and UE needs to enable the HARQ function, so the time condition should be satisfied definitly. Otherwise, if the PUCCH reosurces are not configured which means gNB is not willing to receive SL HARQ information, and the timing may be not gurannteed. To the UE, if the time is enough, the UE could apply retransmission based on HARQ feedback, if not, blind transmission could be selected. Note, in RAN2 it has agreed that PUCCH resource cannot be configured without PSFCH resource. So we think in addition the change update by FL, another condition for applicability can be added for the subbullet:* + *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 at least the PUCCH resources are configured.*

As the delta value, we do not have strong views on this point, but think the Tprep seems fine due to it is already larger than Tproc. |
| vivo | Agree with FL that gnb has no idea of whether option B is satisfied. From the perspective of gnb, when a PUCCH is provided by a DG or CG, it means gnb may expect UE to provide some valid SL HARQ-ACK information to help its scheduling. In this case, gnb should gurantee that the resources scheduled by the DG or CG meet the minimum time requirememnt so that UE can transmit a MAC PDU with HARQ feedback on the scheduled resources and then provides an efficetive HARQ-ACK reporting based on the PSFCH reception. (Of course UE still can choose transmit a PDU which does not require HARQ feedback on the granted resources. But since it is the gnb who wants to get some SL information, it is natural for gnb to ensure the minimum gap if it provides PUCCH. Otherwise UE has to do blind retransmission, which is against the intention of providing a PUCCH.If PUCCH is not provided and resources in a pool with PSFCH are scheduled by the CG or DG, it can be to UE to decide whether to map MAC PDU which requires HARQ feedback on the granted resources. There can be two cases:1. When resources provided by gNB does not guarantee the minimum time, UE can transmit MAC PDU which does not require HARQ feedback
2. When resources provided by gnb is no less the minimum time, UE can transmit MAC PDU requiring HARQ feedback or not requiring HARQ feedback.

If we follow option A, as DOCOMO said, the latency of blind transmission in a pool with PSFCH would unnecessarily increase. So the condition could be changed in a way that ‘when PUCCH is provided with a grant’ |
| Intel | Regarding the applicability, it is a bit unfortunate that gNB could not exactly know whether the scheduled grant is for feedback-based or blind transmission. In current situation, we accept having the most robust assumption on PSFCH presence. Note, that in Mode-2, RAN2 implemented the HARQ RTT gap in similar way, although there are still debates about consistency with the RAN1 agreement and associated efficiency of blind retransmissions.If the applicability is not confirmed, then RAN1 & RAN2 need to work out the conditions when a UE can enable or disable feedback even if the LCH is feedback-based.We are not sure if adding PUCCH resource condition is appropriate. In our assessment, SL HARQ feedback reporting to gNB may not be always enabled since may not bring much benefits.Regarding the delta, we are fine either way:* 0 ms
* 0.5 ms
* 0.5 / 2µ, where µ = 0,1,2,3 for 15,30,60,120 kHz – 7 symbols regardless of numerology

Note, that PSCCH/PSSCH preparation could be done before finishing PSFCH detection, and if ‘NACK’ is confirmed, then the transmission is performend, if ‘ACK’ is confirmed, then the transmission is not performed, since Mode-1 does not allow a UE to start a new TB in these resources due to NDI and HARQ ID control procedures. In that sense, the processing time could not be larger than PUCCH preparation time, where the PUCCH payload/sequence is a function of the PSFCH detection outcome. |
| Apple | In general, we are fine with FL’s proposal on “when using a pool with PSFCH resources”. 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. As per the value of delta, we do not have strong position. Considering T\_prep (PSFCH to PUCCH gap) is already larger than T\_proc (PDCCH to PSCCH/PSSCH gap), we think it is probably fine to set delta = 0 for simplicity.  |
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## Other comments

NOTE: I will prepare TPs or list of TPs for editorial aspects. I will share it in a later iteration.

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# Appendix: Previous dicussions

### Issue 1.4-2

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| **Company** | **View** |
| NTT DOCOMO | Option A[DCM2] support the proposal. |
| Intel | Option A.To us it seems easier to define sidelink HARQ RTT at gNB. In this case it should be the same as in Mode-2 with the only update that ‘b’ component needs to be bounded by specification, otherwise still not possible at gNB to always respect this restriction. In our view, ‘b’ is similar to Tprep, and additional small margin could be added if necessary.If this restriction is not introduced, then another specification effort is required to introduce a mix of blind and feedback-based retransmissions on SL depending on the size of the gap between granted resources. Or, it can lead to unnecessary resource wastage.[Intel2] Agree with the direction. However, we think the processing time value needs better reference. In our understanding, Tproc refer to DCI-to-SL-tx time, while a more suitable value is actually Tprep which is the PSFCH-to-PUCCH time. Currently it does not have a name in spec, but can be found in 38.213, section 16.5.In this case, PSFCH processing is accounted already in Tprep. The only difference is in preparation of PSCCH+PSSCH vs PUCCH. This difference may be ignored, or accounted as additional margin.Further, besides the definition of ‘b’, the specification needs to state that UE does not expect a schedule from gNB violating a+b. |
| vivo | Option A.We share the same view as intel that a mix of blind and feedback-based retransmissions should be avoided in mode-1. If the time gap between two adjacent resources provided by a DG/CG is less than ‘a+b’, UE shall map non-HARQ-feedback based MAC PDU on the resources. In this case, UE shall set the ‘SL HARQ enable/disable’ indication in SCI on these resources to ‘disable’, and UE is not expected to be provided with a PUCCH by the DG/CG as there is no associated PSFCH reception.[vivo-2] Regarding the question: **How should the UE proceed if the time between the last PSFCH reception and the SL HARQ report to the gNB is smaller than the processing time at the UE**, I think this issue can be avoided by NW proper scheduling. For example, even for the async case where NW has no SL timing, NW can provide a conservative K1 so that the gap between PSFCH and PUCCH is always equal or larger than the minimum requirement. We don’t think additional rules are needed for UE side.[vivo-2020/08/20]Same view as intel that it is more appropriate to use Tprep as the upper limit of b. RAN1 also needs to specify that UE is not expected to be provided a grant violating a+b if the grant is accompanied with a PUCCH. In other words, if the gap between two adjacent resources provided by a CG/DG is smaller than a+b then PUCCH should not be configured/provided. |
| OPPO | Option BFor the definition of a and b, there is the following agreement. The time of b is based on UE implementation. Different UE may have different UE capability of the processing time. It is not good idea to reopen the discussion of UE capability for PSFCH processing and PSCCH/PSSCH preparing time. For mode 1, how to promise the time between 2 allocated SL resources is larger than Z is left to implementation. The parameter a is determined by resource pool parameter, which is known by gNB. gNB can allocate SL resources with conservative assumption of b. in case the time gap between 2 resources is less than Z, UE cannot use the 2nd resource for transmission. How to report HARQ-ACK can re-use the mechanism as dropping transmission because of prioritization. gNB can allocate the resource of PUCCH which has enough timing gap between the last PSFCH and PUCCH. Agreements:* In Step 2, a UE ensures a minimum time gap Z = a + b between any two selected resources of a TB where a HARQ feedback for the first of these resources is expected
	+ ‘a’ is a time gap between the end of the last symbol of the PSSCH transmission of the first resource and the start of the first symbol of the corresponding PSFCH reception determined by resource pool configuration and higher layer parameters of *MinTimeGapPSFCH* and *periodPSFCHresource*
	+ ‘b’ is a time required for PSFCH reception and processing plus sidelink retransmission preparation including multiplexing of necessary physical channels and any TX-RX/RX-TX switching time and is determined by UE implementation

FL reply (19/8/2020):This is not about changing the agreement but just having an upper bound that the NW can use to know when to schedule the next transmission.[OPPO2] Agree with Intel’s proposal. It is more reasonable to resue the minimal timing gap between PSFCH and PUCCH resource descripted in 16.5 here. No necessary to define upper bound of b.  |
| LG Electronics | Just to be clear, we reformulated the issues to be discussed/resolved.Issue 1) How to avoid the case that the time gap between “PSFCH RX resource” and “re-TX resource” is smaller than UE’s capability (i.e., b)?* Considering an impact on RAN2 specification, it would not be desirable to define new UE capability signalling on “b”. **We think that this issue can be resolved by defining the maximum value of “b” that can be supported by all the UEs**.

Issue 2) How to handle the case when multiple SL HARQ bits are multiplexed in the same PUCCH resource and some of the bits are related to PSFCHs not satisfying the minimum PSFCH-to-PUCCH processing time (i.e., Tprep)?* This problematic case can occur due to a timing misalignment between gNB and UE’s sync source. In the example of figure below, a UE doesn’t have sufficient processing time to generate SL HARQ bit for the green PSFCH when compared with the red PSFCH. **From our perspective, it can be defined that the UE sets the SL HARQ bit with insufficient UE processing time as NACK state** (i.e., for the green PSFCH).

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| ZTE, Sanechips | Option A, in light of a simple solution with a specified upper-bound of “b” (even the value of b is an UE implementation issue). From gNB implementation point of view, it is better not to force gNB to do a best-effort guess of b’s upper-bound on a per-UE basis, given the UE implementation does seem to allow a time-varying value of “b”.  |
| Sharp | Option A |
| Qualcomm | Is the proposal to convey the exact value of ‘b’ to the gNB or to place an upper limit on ‘b’?We are supportive of defining an upper bound on ‘b’, but this was discussed in Mode 2 preparation phase for this meeting, but was not prioritized. Our view is that an upper bound on ‘b’ is useful even in Mode 2 and such an upper bound should be applicable there as well.On the other hand, the exact value of ‘b’ is already agreed to be left up to UE implementation and we don’t see the need to change the agreement.**How should the UE proceed if the time between the last PSFCH reception and the SL HARQ report to the gNB is smaller than the processing time at the UE?** The behvaior should be left up to UE implementation as is done when minimum PDSCH-to-PUCCH time (N1) is violated per subclause 5.3 in 38.214, where a valid HARQ-ACK is only required when processing timeline is satisfied. This is a general problem though and not specific to the value of ‘b’[QC2]: We disagree with the proposal. The maximum value of ‘b’ has significant impact on Mode 2 operation and should be discussed there. For Mode 1 purposes, we can agree that a bound on ‘b’ exists, which is what matters to the gNB, then discuss the bound value in the Mode 2 AI.Even considering Mode 1 only, I don’t think it is correct to use Tproc. During the time ‘b’, the UE needs to decode all PSFCHs, make a decision on the feedback value, then prepare a transmission based on the feedback result. On the other hand, Tproc is the time to decode a DCI and prepare a sidelink transmission. The operations involved are different in the two scenarios and the former requires more time on the UE side.FL reply (20/8/20):I do not think it makes a difference under which AI we make the decision. Could you clarify what the difference would be?What is your proposal for the time? |
| CMCC | Option A. We share the similar view with intel and vivo that a mix of blind and feedback-based retransmissions should be avoided in mode-1. The time of b is based on UE implementation in mode-2, for simplicity, a definition of upper-bound of “b” can be specified for mode-1 scheduling. |
| Fujitsu | Option A |
| CATT | Option A.Similar view with Intel and vivo. With knowing the HARQ RTT, mixture transmission of blind and HARQ based will be avoided. Furthermore, resources will not be wasted. |
| Huawei, HiSilicon | Option BAs the previous agreement in mode-2, “b” is implemented by the UE and this value could be varied by different UEs, so we do not see the necessity that the gNB should know the values. For the feedback scheduling of SL to UL that does not satisfy the processing timeline, we think it would be an error case that up to UE implementation. This is also the NR Uu rule. The aim to specify the processing timeline is providing a reference for gNB scheduling, the gNB could guarantee the scheduling to meet the requirement, and the UE behaviour is unnecessary to specify if the timeline is not met.FL reply (19/8/2020):The gNB would need to know something about b to schedule the transmissions. For example, an upper bound on ‘b’. The actual value would still be up to UE implementation.[HWHiSi\_2]Thanks for reply. Indeed, we still do not see the necessity to have this upper bound. UEs will have different capabilities and a gNB is aware of the capabilities by UE’s capability reporting, so the gNB could schedule the transmission based on the information it receives to satisfy a UE specific “Z”. This is all gNB implementation. As the value of upper bound, I am not sure it is proper to use Tprep. As explained by Intel, it is the processing time to decode PSFCH and preparing PUCCH which may be not comparable for PSFCH preparing PSCCH+PSSCH, because no serious calculation we had before. Hence, I think we do not need to introduce such a bound at late CR phase, especially we do not have enough eavulation about it. |
| Samsung | Option A |
| Fraunhofer  | Option AThe gNB needs to be aware of the processing timeline of the UE, in order to schedule the PUCCH accordingly. Otherwise, it is possible that the feedback might not be ready at the UE at the scheduled PUCCH instance, and the behaviour of the UE would be unclear. |
| Ericsson | Option A. We are fine with a clarification. With such clarification, the gNB can avoid problematic cases. |
| Nokia, NSB | Option A – OK to specify an upper bound on b[NOK2] Fine with the principle, but as others have pointed out T\_proc may not be the appropriate upper bound |
| Apple | Option A. An upper bound on b could be used by gNB for its scheduling.  |
| Spreadtrum  | Option A. In mode 2, it has been agreed that‘b’ is determined by UE implementation. So, upper-bound of “b” should be defined to ensure that the SL resource allocated by gNB can satisfy the HARQ RTT. |