**3GPP TSG RAN WG1 #102e R1-** **20xxxxx**

**August 17th – 28th, 2020**

**Agenda item:** 7.2.5.4

**Source:** Moderator (Qualcomm)

**Title:** Summary #2 of [102-e-NR-L1enh-URLLC-Scheduling and HARQ-01]

**Document for:** Discussion and Decision

# 1 Introduction

This document summarizes the companies’ views and captures the agreements related to the following email discussion:

**[102-e-NR-L1enh-URLLC-Scheduling and HARQ-01] Prioritization order involving semi-static DL symbols, SSB and dynamic SFI – Kianoush (Qualcomm)**

* Processing order between semi-static TDD configuration and intra-UE prioritization
  + Order of intra-UE prioritization and cancellation due to collision with configured DL symbols and SSB
  + Clarification on the 3-step UE behavior and UE behavior in case there is collision after step 3.
* Processing order between dynamic SFI and intra-UE prioritization
  + Proposed agreement:
    - *UE behavior of handling intra-UE prioritization/multiplexing for overlapping UL transmissions on semi-static flexible symbols is not affected by UL cancellation due to dynamic SFI or DL grant.*
    - Note that the proposed agreement is to start the discussions.
* **Discussions/Agreements by 8/21, TPs by 8/28**

A summary of the companies’ proposals is captured in [1]. Companies are encouraged to share their views by Wednesday August 19th.

# 2 Issue#1: Processing order between semi-static TDD configuration and intra-UE prioritization

The following agreement was made during RAN1 #101e:

**Agreement#1:**

*After the UE determines the overlapping PUCCH or PUSCH for multiplexing/prioritization, the UE cancels the PUCCH or PUSCH that has overlapping with semi-static configured DL symbols or SSB symbols, and then the multiplexing/prioritization is performed among the non-cancelled overlapping transmissions*

### 2.1 Issue #1-1

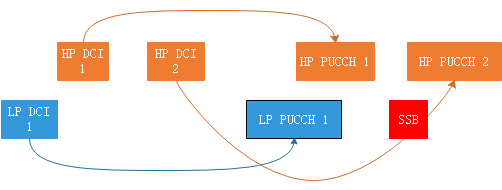
Huawei/HiSi in [2] considers the abovementioned agreement as well as the following agreement also made in RAN1#101e:

***Agreement #2:***

*If a UE is expected to cancel a scheduled low priority PUCCH/PUSCH due to a first DCI scheduling an overlapping high priority channel, the UE is not expected to transmit the scheduled low priority PUCCH/PUSCH due to a second DCI scheduling UCCH/PUSCH that is received after the first DCI.*

* *Note: The collision between HP PUSCH and LP PUSCH is not covered by this agreement.*

For scenarios such as the one illustrated in the figure below, [2] argues the following:



*“Considering the example above, according to Agreement #1, the collision handling is done based on the final DCI. This would mean that the overlap is determined among LP PUCCH 1, HP PUCCH 2 and SSB. It means when the UE receives the intermediate HP DCI 1 (i.e. it has not received HP DCI 2 yet), the UE will not resolve the collisions between HP PUCCH 1 and LP PUCCH1. Instead the UE will wait to receive the final DCI for the HP PUCCH, i.e. until the DCI scheduling the HP PUCCH 2, and then it will resolve any the collision based on HP PUCCH 2. Thus LP PUCCH 1 will be transmitted. On the other hand, following agreement #2, the UE will resolve the collision between the HP PUCCH 1 and LP PUCCH 1 when it receives HP DCI 1. It means the UE will not wait for any final DCI. Thus LP PUCCH 1 will be canceled.”*

**Comment from the FL: The two operations should be done separately. According to the current specification, one HP PUCCH1 is scheduled, LP PUCCH1 is dropped. Later, HP PUCCH1 may be overridden by a new DCI which requests a transmission on HP PUCCH2. At that time, the collision between HP PUCCH2 and SSB is resolved.**

**Question #1-1: Considering the example and the explanations above, is there any clarification needed for the UE’s operations based on Agreement#1 and Agreement#2? Please share your views in the table below.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| vivo | Above agrerement#1 is to define the processing order between intra-UE multiplexing/prioritization, and cancellation **due to semi-static TDD configuration and SSB**, UE will have 3-step processing for it:  • Step 1: UE follows Rel-15 behaviours for any intermediate procedure to determine the overlapping PUCCH or PUSCH for multiplexing/prioritization  • Step 2: UE cancels the ones that collides with semi-static DL symbols,  • Step 3: UE performs multiplexing/prioritization among the non-cancelled overlapping channels.  Therefore, for the example/figure in [2], if gNB really schedules/indicates the HP PUCCH 2, knowing that there will be collision with SSB, then LP PUCCH 1 will be canceled. But we think reasonable gNB should not indicates the resource for HP PUCCH 2 colliding with the SSB.  For agreement#2, this is highly related to the [102-e-NR-L1enh-URLLC-Scheduling and HARQ-02]. Our understanding for the determined PUCCH which cancels other low priority channel(s) or to be cancelled by other high priority channels should be the ‘final’ PUCCH based on the PUCCH resource updating timeline i.e., *N3*, not the ‘intermediate’ PUCCH. This is different from Agreement#1 that the resource collision with semi-static configured DL symbols or SSB symbols should be avoided by proper gNB scheduling. |
| ZTE | The contradiction between the two agreements is valid according to the example showed. Maybe only one of the two agreements could survive. From our perspective, the agreement1 could be revised to:  *~~After the UE determines the overlapping PUCCH or PUSCH for multiplexing/prioritization, t~~The UE cancels the PUCCH or PUSCH that has overlapping with semi-static configured DL symbols or SSB symbols, and then the multiplexing/prioritization is performed among the non-cancelled overlapping transmissions* |
| DOCOMO | We don’t see the contradiction between the two agreements. In our understanding, the agreement 1 does not rely on the last DCI but on any DCI for triggering the three steps in vivo’s comment above. Or, even if the agreement 1 would rely on the last DCI, the LP PUCCH 1 needed to be cancelled by HP PUCCH 1 to comply with the following agreement. However, it would be difficult for UE to cancel the LP PUCCH 1 after triggering by HP DCI 2 scheduling HP PUCCH 2 as the timeline Tproc,2+d1 may not be met. Therefore, it would be better to clarify the agreement 1 is triggered by any DCI.  **Agreement**  In case of collision between a high priority channel and low priority channels, adopt one of the following options:   * A UE is expected to cancel the overlapping low priority channel by the first overlapping symbol at the latest. Further, a UE expects that the first [overlapping] symbol of the high priority channel is not earlier than Tproc,2+d1 after the last symbol of the PDCCH with the DCI format scheduling the high priority channel. |
| HW/HiSi | We see a possible conflict between agreement #1 and #2 above for the case when PUCCH does overlap with DL symbols or SSB.  I copied the figure from above for convenience:    In this figure, we have the HP PUCCH 2 colliding with SSB. Therefore in accordance with agreement #1 the 3 step procedure below should be followed:   * ***Step 1:*** *A UE follows Rel-15 behaviors for any intermediate procedure to determine the overlapping PUCCH or PUSCH for multiplexing/prioritization* * ***Step 2:*** *UE cancels the ones that collides with semi-static DL symbols,* * ***Step 3:*** *UE performs multiplexing/prioritization among the non-cancelled overlapping channels.*   In step #1, it is said that the UE follows Rel-15 behavior, thus the final DCI has to be considered and HP PUCCH 1 is overridden. Step 1 is for channels of the same priority. In step #2, HP PUCCH 2 is removed due to collision with SSB. Step 3 includes channels with different priority and multiplexing/prioritization among the non-cancelled channels is performed. Since there is no HP PUCCH anymore, LP PUCCH 1 is transmitted.  The agreement #2, on the other hand, is what we discussed in the Scheduling & HARQ session last meeting. It means that the LP PUCCH 1 is cancelled as soon as HP DCI 1 has been received and should not recover.  So according to Agreement #1, if there is a collision of a channel with SSB/DL symbols, this collision is resolved firstly and it is based on the final DCI and only in the last step HP/LP prioritization is done and LP PUCCH 1 would be transmitted. But according to agreement #2, cancellation is based on the intermediate DCI and LP PUCCH 1 should be canceled.  We think that even for the case that one channel overlaps with SSB, the potential resource overlap between HP/LP transmissions should still be based on any DCI, not on the final DCI. Thus, for the example above, LP PUCCH 1 should be cancelled.  We agree with the FL that both agreements should be applied in parallel. Agreement #2 is already captured in the spec, when agreement #1 is going to be captured, we should ensure that HP/LP overlap still is based on any DCI. |
| Spreadtrum | We do not see any contradiction between the two agreements. The collisions of LP PUCCH1 and HP PUCCH1 are resolved according to Agreement #2. And the collisions of HP PUCCH2 and SSB are solved according to Agreement #1, which belongs to HP collision handling. According to the vivo’s comments, Agreement #1 is the step 2, and agreement #1 is used in step 3.  So there is no need to clarify the UE’s operations.  Furthermore, we prefer the HP PUCCH2 in the example is not a typical scheduling. Because it is a PDCCH scheduled UL transmission but it overlaps with a SSB. In Rel-15, dynamic PUCCH cannot overwrite DL symbols (SSB is treated as DL symbols). In our understanding, it is not reasonable to schedule a HP PUCCH to overlap with SSB. |
| OPPO | Agree with FL’s comments. Contradiction between the two agreements is not clear for us. |
| Qualcomm | The misalignment between the agreements is not clear. The LP PUCCH1 gets dropped by the UE after detecting the first HP grant based on Agreement #2 (unless the behavior will be modified based on the discussions in the other HARQ and Scheduling email discussion.) |
| Ericsson | In our view two agreements complement each other resolving different scenarios. The main problem in scenario/figure from [2] is in determining a point in time when UE prepares LP PUCCH for transmission and check whether HP PUCCH 1 is overridden or not. It seems impossible to know when HP DCI 2 is decoded and how far in advance UE starts preparation of LP PUCCH => such details are up to UE implementation. Thus, Agreement #2 is a simple and non-contradicting solution. In the scenario [2] nothing is transmitted by UE because gNB has done bad job scheduling HP PUCCH 2. Here we agree with feature lead: two actions are done separately. |
| Samsung | We also have same understanding with FL’s comment on the example. That is, two agreements can be done separately, no need to do more clarification.  We also understand that in the above figure, HP PUCCH 2 does not include same HARQ-ACK codebook as in HP PUCCH 1 (e.g. HP PUCCH 2 is not a final PUCCH resource determined based on a last DCI reception by the UE; otherwise, PUCCH 1 does not exist) – instead PUCCH 2 is in a different sub-slot and includes different HARQ-ACK information. |
| Intel | We do not see any inconsistency here. We agree with the FL that these two agreements need to be applied separately, according to the respective conditions.  Certainly, the outcome would likely be different (e.g., LP PUCCH may not be dropped) if Agreement #2 is changed in the other thread. |
| CATT | We share the same understanding with FL. |
| Apple | Agree with FL’s comments. Basically Agreement #2 allows the UE to cancel LP PUCCH1 after receiving HP DCI1 (with the need to waiting for any future DCIs). Then agreement #1 applies to the collision resolution between HP PUCCH1/2 and SSB.  However, we wonder for agreement #2, when we say “*the UE is not expected to transmit..*”, does it mean the UE can choose to either transmit or not transmit depending on its own implementation? Or does it mean that the UE will not transmit? |
| Nokia, NSB | Agree with the FL comment.  There is no contradiction between these two agreements since they can be operated in the event-triggered way independently. |

**RAN1 agreed that no further clarification is needed.**

### 2.1 Issue #1-2

Qualcomm [3] refers to the following three steps:

* ***Step 1:*** *A UE follows Rel-15 behaviors for any intermediate procedure to determine the overlapping PUCCH or PUSCH for multiplexing/prioritization*
* ***Step 2:*** *UE cancels the ones that collides with semi-static DL symbols,*
* ***Step 3:*** *UE performs multiplexing/prioritization among the non-cancelled overlapping channels.*

And points out a remaining ambiguity in the UE behavior. As an example, after performing step 3, the final PUCCH resource to be used could be overlapping with the DL symbols. Hence, the UE has to perform a step 4 for final checking as well. If such an event happens, then one UE behavior could be to drop the final transmission completely. This might not be the best approach; instead, if the UE is allowed to remove all overlapping configured PUCCH/PUSCH resources colliding with the DL symbols or SSBs from the beginning, this issue will not happen.

**Question #2-1: For handling collisions between PUCCH/PUSCH and semi-static DL symbols/SSBs:**

1. **Should the UE remove all the configured PUCCH/PUSCH resources overlapping with semi-static DL symbols/SSBs?**
2. **If not, and after performing step #3, the final PUCCH/PUSCH overlaps with the semi-static DL symbols/SSBs, what is the expected UE’s behavior?**

**Please share your comments in the table below.**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| vivo | Based on agreement#1, yes, UE should remove all the configured PUCCH/PUSCH resources overlapping with semi-static DL symbols/SSBs. |
| ZTE | After step3, if UE multiplexes among the non-cancelled overlapping channels and need new resources for multiplexing, there may be a collision with the DL symbols or SSB. However, gNB knows everything about the possible collision after step3, and then gNB could indicate the non-overlapping resources for multiplexing. It means UE doesn’t expect the collision with DL symbols or SSB after step3. |
| DOCOMO | Agree with vivo. Approach 1 should be better to avoid more complexity at UE behavior. However, as ZTE mentioned, the discussed step, i.e. step 4, could be avoided by gNB scheduling.  Besides, we would like to ask the group to take CA case into account for making agreement because these steps are applicable to CA cases. One example is given in the figure below. Here carrier aggregation with CC#1 and CC#2 is assumed. On CC#1, configured PUCCH is scheduled but it is collided with semi-static DL symbols in this slot, which would lead to cancellation due to semi-static DL symbols. On CC#2, there is no collision on itself but intra-UE UL multiplexing/prioritization is possible between PUCCH on CC#1 and PUSCH on CC#2. In this case, the same processing order issue arises. We think the discussed steps can be straightforwardly applied since the agreement #1 above is captured in section 9 in 213, which is applicable to the same cell group or PUCCH group. Therefore, we think it would be better to make clear agreement/conclusion/note for CA case as well in order to avoid future misinterpretation. |
| HW/HiSi | @Kianoush: I am wondering if I understand correctly and need a clarification:  Do you mean that after step 3 there could still be an overlap with DL symbols? I am wondering if this could become the case? In Step 1, all multiplexing/overriding is performed according to Rel-15 behavior, thus it is dealt with the channels of the same priority. Then in step 2, everything that exists after step 1 but overlaps with SSB/DL symbols is cancelled.  In step 3 multiplexing/prioritization is done for the remaining channels, none of them is overlapping with SSBs/DL symbols. Could you give an example for my understanding in which situation would result into resources that overlap again with SSB/DL symbols? I think in the last step there would be only HP/LP prioritizations left to do, which should not lead to new resources that could overlap with SSB? |
| Spreadtrum | If configured PUCCH/PUSCH resources means all the involved PUCCH/PUSCH resources are configured by higher layer signaling, not by PDCCH, we agree that UE should remove all the configured PUCCH/PUSCH resources overlapping with semi-static DL symbols/SSBs. However, one special configured PUCCH resource is multi-CSI PUCCH Resource. It is used when multiple CSI reports on PUCCHs overlaps. In the current specification, the one with larger capacity of multi-CSI PUCCH resource compared with UCI size is chosen. But this procedure is in the step 3. We would like to understand whether this multi-CSI PUCCH resources are in the scope of configured PUCCH/PUSCH resources.  When there is at least one dynamic PUCCH/PUSCH, neither an intermediate PUCCH resource nor the final PUCCH/PUSCH resource is expected to overlap with semi-static DL symbols which is the same as Rel-15 overwriting rules. Regarding to SSBs, we also prefer the same operations as semi-static DL symbols. |
| OPPO | Approach 1 is not clear for us. What is “**all the configured PUCCH/PUSCH resources**”? Are they all configured PUCCH resources in *PUCCH-Config* and PUSCH?  In addition, if all the configured PUCCH/PUSCH resources overlapped with semi-static DL symbols/SSB are cancelled, there may be a result that no PUCCH is available for PUCCH multiplexing. As shown in the following figure, after PUCCH for HARQ-ACK and PUCCH for CSI is multiplexed, no PUCCH resource with large payload, e.g. PUCCH resource i can be used due to all PUCCH resource with large payload are dropped in 1st step. What should UE do? We do not expect any additional spec work but we are not sure there is no additional spec work if approach 1 is supported. Approach 1 is too creative at current stage.    At current stage, we focus on essential issue only. Optimization is not considered. Therefore, approach 1 is not considered.  As ZTE mentioned, the discussed step, i.e. step 4, could be avoided by gNB scheduling. We do not need any solution in spec. |
| Qualcomm | We think that all the overlapping PUCCH resources and all the configured PUSCH resources should be removed first. Otherwise, after the last step, there could still be a collision with the DL symbols/SSBs.   * @Thorsten: Let’s assume that PUCCH resources overlapping with the DL symbols are not removed before hand. PUCCH overriding or multiplexing at the last step may move the PUCCH resource to be overlapping with the DL symbols. If we clarify the behavior as explained by vivo above, then there should not be any issue. Hope this clarifies.   We also agree with Spreadtrum that the dynamically granted transmissions should not overlap with semi-static DL symbols and SSBs at any point (neither intermediated steps nor the final step.)  @OPPO: Not sure which part is creative; the goal is to clarify the agreement. In your example, what happens if the UE multiplexes all UCIs, finds a resource to transmit it, but that resource is overlapping with DL symbols? Again, the UE has no resource for transmission. |
| Ericsson | Our understanding is the same as vivo: after step 2 there will be no transmissions overlapping with DL/SSB. We don’t think that multiplexing/prioritization between HP/LP in step 3 can lead to PUCCH format change. |
| Samsung | We understand what it matters in the process of PUCCH resource selection. Although removing all configured PUCCH resources overlapping with DL symbols might be better to ensure final PUCCH transmission, we think that it should be up to gNB implementation since gNB handles all configuration and scheduling. So, if final PUCCH resource would be overlapped with semi-static configured DL symbols, UE just drops.  Basically, no change is required in the current specifications – the UE resolves the overlapping (9.2.5), that is the PUCCH the UE determines to actually transmit, and that is the PUCCH considered in 11.1 and 11.1.1 for collision with DL symbols for dropping. |
| Intel | We understand the motivation of updating the behavior as suggested in approach #1 as it would save the final UCI in some cases involving multiplexing into a new PUCCH resource in Step 3 (for pure LP-HP prioritizations, the issue does not seem to exist). However, we also need to be careful regarding how this correlates with Rel-15 behavior. Fundamentally, what we are discussing should apply to Rel-15 as well – only the LP/HP prioritization is missing.  Let’s assume there is no LP/HP prioritizations. Our understanding is that the PUCCH overriding/multiplexing and resource determination defined in Section 9.2.5 of 213 is about determining the PUCCH resources, and the final transmission is subject to the constraints/link direction conflicts defined in Section 11.1 of 213 (Section 11.1 deals with actual transmissions and not candidate PUSCH/PUCCH resources, etc.). Thus, to the question from the FL for Approach #2, the UE would indeed drop the transmission of the final resource if it overlaps with DL symbols.  We could accept Approach #1, but only if this is also consistent with Rel-15 behavior, which we are not sure is the case. Thus, in summary we have similar view as Samsung (which seems aligned with Approach #2). |
| CATT | If seems that companies have different understandings on the proposal. Our understanding of the proposal is to remove all the PUCCH resources configured in PUCCH-Config which collide with DL/SSB symbols to avoid selecting a final PUCCH resource colliding with DL/SSB symbols.  With this understanding, we share the similar view with Intel that it is the same as in Rel-15. Our preference is to have the same handling as in Rel-15, i.e. UE drops the final transmission if colliding with DL/SSB symbols. |
| Apple | Similar as some other companies, we are not sure what “all the configured PUCCH/PUSCH resources” means exactly. If e.g. for PUCCH resource, it really means all the resources configured by RRC signaling, it could lead to a situation where the multiplexing cannot find a resource and the procedure basically becomes broken or undefined.  Regarding step 4 mentioned by QC, we agree that it should not conflict with semi-static DL (because dynamically indicated UL transmission should not conflict with semi-static DL) but could potentially conflict with SSB with the current specs. We do not agree that we can simply say this can be avoided by gNB scheduling. For UE implementation, if it is not defined as an error case in the specs, the UE would need to handle it.  So we agree with the observation from QC, but the proposal is not clear to us.  Before we move on to discuss the solution, maybe one thing to clarify first: in step 1, exactly which procedures are included in “any intermediate procedure”? Is it correct to say that it includes HARQ-ACK PUCCH resource overriding (the resulting PUCCH would be the PUCCH resource indicated by PRI assuming HARQ-ACK payload only) and multi-CSI PUCCH resource determination? We would like to have the common understanding on this before moving on to the next-step discussion. |
| Nokia, NSB | Agree with the comments of Samsung, Intel, CATT – this should not change the operation within a single priority (which is defined by Rel-15 operation).  maybe more clarification is needed what ‘all PUCCH configurations’ here means as pointed out by CATT if to be agreed |

# 3 Issue#2: Processing order between Dynamic SFI and intra-UE prioritization

**Proposed agreement:**

* *UE behavior of handling intra-UE prioritization/multiplexing for overlapping UL transmissions on semi-static flexible symbols is not affected by UL cancellation due to dynamic SFI ~~or DL grant~~.*

|  |  |
| --- | --- |
| **Company** | **Comment** |
| vivo | We support the proposal for dynamic SFI case since this is the same handling as for UL CI case as agreed in RAN1#100bis-e  Agreements: (RAN1#100bis-e)  *UE behavior of handling intra-UE prioritization/multiplexing for overlapping UL transmissions is not affected by UL CI.*  But, we would like to understand above what the “DL grant” in above proposal intends for. |
| ZTE | How to understand the “*not affected by*”, there could at least two possible understanding. The first understanding is ‘*intra-UE prioritization/multiplexing*’ should be done first even though the DCI for intra-UE processing is after the dynamic SFI or DL grant for UL cancellation, this means UE should wait for all the possible DCI related to intra-UE processing. The second understanding is that UE behavior is following the DCI order, no need to wait, when the intra-UE prioritization/multiplexing is processing, no latter DCI could interrupt the procedure.  From our perspective, we prefer the second understanding, and we propose:  *If the ending symbol of PDCCH carrying the DL/UL grant scheduling the overlapping UL transmission is earlier than the ending symbol of PDCCH carrying the dynamic SFI or DL grant or UL CI indicating the cancellation, UE performs intra-UE multiplexing/prioritization first. Otherwise, UE performs UL cancellation due to dynamic SFI or DL grant or UL CI first.* |
| DOCOMO | We support the proposal in principle. However, the wording “not affected by” is vague and misleading as ZTE also points out. Based on the common understanding for the agreement UL CI case, intra-UE multiplexing/prioritization is performed first and then UL CI is performed. This UE behavior is captured in the spec as follows:  *A UE that detects a DCI format 2\_4 for a serving cell cancels a PUSCH transmission or an actual repetition of a PUSCH transmission [6, TS 38.214] if the PUSCH transmission is with repetitions, as determined in Clauses 9 and 9.2.5 or in Clause 6.1 of [6, TS 38.214],*  As it would be simpler to adopt the same behavior for dynamic SFI case, we prefer to do intra-UE multiplexing/prioritization first and then cancellation due to dynamic SFI or PDSCH scheduled by DL grant on semi-static flexible symbols.  In response to vivo’s comment “*But, we would like to understand above what the “DL grant” in above proposal intends for*,” we think the “DL grant” means the PDSCH scheduled by DL grant on semi-static flexible symbols. Please see the following example figure excerpted from our contribution. |
| HW/HiSi | Agree with the proposal |
| Spreadtrum | We support the proposal. |
| OPPO | We support the proposal in principle and the second understanding proposed by ZTE is our preferred. |
| Qualcomm | Support the proposal with the following interpretation: The UE first performs multiplexing/prioritization; once this is done, dynamic SFI applies to the final channels. |
| Ericsson | We also support the proposal. |
| Samsung | Agree with proposal. This can provide same principle with what UL does for UL CI.  This is also consistent with our comment on Issue #1-2. |
| Intel | Support the proposal (and agree with Samsung’s comment in relation to Issue #1-2). |
| CATT | We support the proposal with the understanding that multiplexing/prioritization is performed before dynamic cancellation. |
| Apple | We also think the current wording of the proposal is vague and could result in different understandings. We would like to have the intention of the proposal clarified first.  Also we would like to point out that the agreement for UL CI has a similar issue and it seems that different companies have different understanding. |
| Nokia, NSB | We support the proposal. |

**Based on the discussions, the following working assumption was agreed:**

**Working Assumption:**

  UE behavior of handling intra-UE prioritization/multiplexing for overlapping UL transmissions on semi-static flexible symbols is not affected by UL cancellation due to dynamic SFI or [DL grant]

  Note: The UE performs prioritization/multiplexing first and once done applies dynamic SFI

There are two remaining issues:

* Should DL grant be included in the working assumption above?
* Since dynamic transmissions cannot be cancelled by dynamic SFI or a DL grant, some clarity on whether a transmission is considered as dynamically scheduled or a configured one is needed:
  + SPS HARQ-ACK multiplexed on DG PUSCH - should be considered as dynamic tx
  + Dynamic HARQ-ACK multiplexed on CG PUSCH - this should be considered as configured tx
  + Multiplexing of dynamic HARQ-ACK with P-CSI with PUCCH resource determined based on PRI - dynamic tx
  + Multiplexing of dynamic HARQ-ACK and SR
    - Using HARQ-ACK resource - dynamic tx
    - Using SR resource – configured tx

**Question #3-1: Should “DL grant” be included in the above working assumption?**

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| --- | --- |
| **Company** | **Comment** |
| **LG** | **Yes. In the perspective of configured grant transmission of PUSCH or PUCCH, there is no difference between DL reception by DL grant and DL symbol indicated by DCI format 2\_0. We think DL grant needs to be included.** |
| **DOCOMO** | **Yes. Following case can be considered as an example for “DL grant.” As we commented in our previous input above, “DL grant” means the PDSCH scheduled by DL grant on semi-static flexible symbols. The same UE behavior on the processing order should be applied for the following case as well as dynamic SFI case. Consequently, PDSCH#B and HARQ-ACK multiplexed on PUSCH are transmitted since UE multiplexes the HARQ-ACK into the PUSCH first, and then there is no more collision between PDSCH #B and the HARQ-ACK on PUCCH on the semi-static flexible symbols.** |
| HW/HiSI | Yes, we don’t see reason why not to include “DL grant”, considering that “DL grant” is similar with dynamic SFI, i.e. it can also cancel the semi-static UL transmissions on semi-static flexible symbols. |
| CATT | Yes, we think the same approach should be applied to SFI and DL grant. |
| Nokia, NSB | Yes. Similar view as DOCOMO and others above |
| Apple | Yes, DL grant should be included. |
| Intel | Yes |
| Samsung | Yes |
| ZTE | Yes |
| vivo | Yes |
| Spreadtrum | Yes |

**Question #3-2: Do you agree with the following categorization? If not, please state which cases?**

* **Case 1: SPS HARQ-ACK multiplexed on DG PUSCH – should be considered as dynamic tx**
* **Case 2: Dynamic HARQ-ACK multiplexed on CG PUSCH – this should be considered as configured tx**
* **Case 3: Multiplexing of dynamic HARQ-ACK with P-CSI with PUCCH resource determined based on PRI – dynamic tx**
* **Case 4: Multiplexing of dynamic HARQ-ACK and SR**
  + **Case 4-1: Using HARQ-ACK resource – dynamic tx**
  + **Case 4-2: Using SR resource – configured tx**

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| --- | --- | --- |
| **Company** | **Cases with disagreement** | **Comments** |
| **LG** |  | **All cases and categorization are agreeable to us.** |
| **DOCOMO** |  | **Agree with the categorization.** |
| HW/HiSi |  | Agree.  Just some thought (bought we agree regardless): Maybe we could apply a simple principle for all cases, i.e. after intra-UE prioritization/multiplexing, the UE would transmit PUSCH or PUCCH.   * If the PUSCH or PUCCH is scheduled by DCI, then it belongs to “dynamic UL transmission” and cannot be cancelled. * If the PUSCH or PUCCH is not scheduled by DCI, then it belongs to “semi-static UL transmission”. Then it can be cancelled by dynamic SFI or DL grant. |
| CATT |  | We agree in principle. We think HW/HiSi’s categorization may be simpler. Otherwise if we want to stick to the original proposal, we would like to propose the following additions in red.   * + SPS HARQ-ACK and/or P/SP-CSI multiplexed on DG PUSCH - should be considered as dynamic tx   + Dynamic HARQ-ACK multiplexed on CG PUSCH - this should be considered as configured tx   + Multiplexing of dynamic HARQ-ACK with P/SP-CSI/SR with PUCCH resource determined based on PRI - dynamic tx   + Multiplexing of dynamic HARQ-ACK and SR     - Using HARQ-ACK resource - dynamic tx     - Using SR resource – configured tx |
| Nokia, NSB |  | We agree with the categorization for the different cases |
| Apple |  | We agree with the categorization. The rule is exactly as what Huawei/HiSi stated, but it may be more accurate to say it depends on the “resource” used for the transmission is a configured resource or a resource determined based on DCI. When a PUCCH/PUSCH carries both dynamic and semi-static information, it is a bit unclear to say if the channel itself is dynamic or configured. The reason that we listed at least these cases is to provide some examples, especially the most tricky one in our view is multiplexing of dynamic HARQ-ACK and SR transmitted using SR resource.  If this principle is agreeable, we propose to add a generic sentence in TS 38.213 s11.1.1 to clarify so that we don’t leave any ambiguity. |
| Intel |  | We have same understanding as described above. Attributing configured/dynamic characteristic based on “**resource used for transmission**” is consistent with descriptions in Sections 11.1/1A of 213 that talk about “***PUxCH*** ***transmissions***” in relation to UE behavior w.r.t. TDD and dynamic SFI configurations (or for any cancelation in general). In the context of cancelations and slot formats, what should matter is the channel and corresponding resource used for transmission. So, we are not sure if any thing needs to be said more in the specs. |
| Samsung |  | Agree in principle. Agree with Intel’s view. It is not clear what specification impact is needed more. |
| ZTE |  | Agree and a conclusion is enough for confirming the understanding. |
| vivo |  | We agree with the categorization for all the cases and Intel’s formulation. |
| Spreadtrum |  | We agree with the categorization, and also agree with HW/HiSi’s categorization which is the same as the description in specification. So a conclusion is enough for this issue. |

**Proposal Agreement: Confirm the following working assumption and remove the brackets as follows:**

***Working Assumption:***

* *A UE behavior of handling intra-UE prioritization/multiplexing for overlapping UL transmissions on semi-static flexible symbols is not affected by UL cancellation due to dynamic SFI or DL grant*
* *Note: The UE performs prioritization/multiplexing first and once done applies dynamic SFI*

**Proposed Conclusion:**

* If the PUSCH or PUCCH is scheduled by DCI, then it belongs to “dynamic UL transmission” and cannot be cancelled by either a dynamic SFI or a DL grant.
* If the PUSCH or PUCCH is not scheduled by DCI, then it belongs to “semi-static UL transmission”. Then, it can be cancelled by dynamic SFI or DL grant.

# 4 References

**[1] R1-2007033, “*Summary of the remaining issues on HARQ and scheduling enhancements for URLLC: preparation phase*,” Moderator (Qualcomm)**

**[2] R1-2006389, “*Corrections on operation of HARQ*,” Huawei, HiSi**

**[3] R1-2006777, *“Remaining issues on HARQ and scheduling for URLLC,”* Qualcomm**