**3GPP TSG RAN WG1 Meeting #104-e R1-21xxxxx**

**E-meeting, January 25 – February 5, 2021**

**Agenda Item: 7.2.5**

**Source: Moderator (Huawei)**

**Title: Email discussion on preparation phase for Rel-16 URLLC/IIoT**

**Document for: Discussion and Decision**

# Introduction

The paper summarizes the preparation phase email discussion for contribution submitted to 7.2.5 on Rel-16 URLLC/IIoT.

# Recommendation for the scope of email threads

Per the guidance from Chairman, we will only have 5 email threads for Rel-16 URLLC/I-IoT for RAN1#103-e. Note that one additional email thread will be treated under 7.2.5 on the LS R2-2011124 on overlapped data and SR with equal L1 priority for Rel-16 URLLC per the guidance from Chairman.

## Draft recommendation for the scope of email threads

Based on discussion among feature leads, we made the draft recommendation on the issues to be discussed for this meeting as below. Note that once the issues to be discussed are set, we will further discuss among feature leads to see how to divide the issues to 5 email threads.

**Draft recommended issues to be discussed in RAN1#104-e**

PDCCH enhancements:

* **Issue A-1**: Correction on *dci-FormatsExt* in section 10.1 in TS 38.213
* **Issue A-5**: PDSCH resource mapping with RE symbol level granularity

UCI enhancements:

* **Issue 1**: Timing for secondary cell activation / deactivation
* **Issue 2**: Limitation on the number of PUCCHs carrying HARQ-ACK in a slot/subslot
* **Issue 3**: Conflict between the first PUCCH repetition and semi-static configuration
* **Issue 4**: Sub-slot-based HARQ-ACK and separate HARQ-ACKs with multi-DCI based multi-TRP
* **Issue 5**: Correction for sub-slot based PUCCH

PUSCH enhancements:

* **Issue 1:** New RRC parameter for TDRA indication to support up to 64 entries in a TDRA table for Type 1 configured grant with PUSCH repetition Type B
* **Issue 2:** Part 2 CSI dropping for UCI multiplexing on PUSCH repetition Type B

Scheduling & HARQ:

* **Issue 1:** Correction on intra-UE prioritization timeline by replacing “before the first overlapping symbol” with “no later than the first overlapping symbol” (Simple correction)
* **Issue 2:** Prioritization due to collision with semi-static DL and SSB symbols
* **Issue 4**: Active duration of CSI-RS resources in case of cancellation (Simple correction)
* **Issue 5:** Including the agreement that any HP DCI can cancel a LP transmission (Simple correction)

eCG enhancements:

* **Issue 1**: PHY behavior for collision between CG and DG with same/different PHY-priority index

SPS enhancements:

* **Issue 3**: SPS PDSCH release and SPS receptions with slot aggregation
* **Issue 4:** PUCCH resource for SPS PDSCH HARQ-ACK and SR (Simple correction)

**Companies are encouraged to indicate the priority (high or medium or low) of the remaining issues for this meeting. If the priority is high, please provide your reasons why it has to be discussed in this meeting.**

* Remaining issues for PDCCH enhancements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | Issue A-2 | Issue A-3 | Issue A-4 | Comments |
| Spreadtrum | HighWe are fine to not use PDCCH starting symbol as reference point for SLIV for CCS with different SCS. But it should be in the specification just like K0 and PDSCH mapping type B to avoid further misunderstanding. Considering it is an easy change, we propose to correct it in RAN1 104e. | Medium | Low | Issue A-4 can use similar method as CIF in DCI X\_2 when smaller bits are configured.Support Issue A-2. |
| Samsung | Low – gNB misconfiguration | High – Current spec is not working if PDCCH MO configurations are different in different slots. The SLIV of a PDSCH can be determined by a PDCCH MO in an earlier slot for SPS PDSCH and PDSCH repetition. | Low – gNB implementation |  |
| DOCOMO | High | Medium | Medium | A-2: it would be good to clarify the new SLIV reference is applied only for same SCS case in the spec based on the agreement. This is an easy correction. |
| Qualcomm | Low | Low- Agree with FL that current spec can work.  | Low |  |
| CATT | Not needed since it is already specified in TS38.214 clause 5.1.2.1. | MediumThe intention of the current specification is to consider all the potential starting symbols of PDCCH MOs across all the slots and extend the SLIV based on all the possible starting symbols within a slot. So in the example in R1-2101177, although there is only one MO in slot 1, SLIV2 is also included for slot 1 since there is a MO starting from the middle of the slot in slot 0.If companies have different understandings on the current spec, we are fine to discuss to clarify. | Not needed as the current descriptions in 214 already covers DCI format, i.e. the sub-selection MAC CE can be applied to DCI format 0\_1 and DCI format 0\_2.  |  |
| ZTE | LowIt has already been reflected in TS 38.214.  | MediumFine to discuss for a common understanding.  | LowCurrent spec works.  |  |
| OPPO | Low-Agree with FL’s comment. | Medium | Low |  |
| Nokia, NSB | LowAlready reflected in 38.214 | Low / Mediumwe agree with FL that current specs can work. But could be discussed (if there is space) | LowCurrent specs are operational |  |
| LG | LowIt could be gNB misconfiguration | MediumFine to discuss | LowOptimization |  |
| HW/HiSi | Low Agree with CATT | LowThe current spec does work. It seems like an optimization | MediumWe should discuss it. It is a valid issue, even if it was de-prioritized last meeting.  |  |
| Intel | Low (agree with CATT, others) | Low/Medium (same view as Nokia) | Low (Falls under optimization at this point) |  |
| Apple | Low | Low | low |  |

* Remaining issues for UCI enhancements

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Issue #6 | Issue #7 | Comments |
| Samsung | Low – gNB misconfiguration | Low – gNB misconfiguration |  |
| DOCOMO | HighIssue is valid and can be fixed easily | Medium |  |
| Qualcomm | Low | Low  | Issue 3 from CATT is a Rel-15 problem, it should be discussed as Rel-15 CR, has nothing to do with URLLC. The other related issue on Issue 3 brought up by Huawei (cancellation order for colliding w/ semi-static downlink symbols) is discussed under HARQ& scheduling. As such, Issue 3 can be deleted from the email discussion. |
| CATT | MediumSimple correction to complete the spec | MediumTP to capture previous conclusion | Reply to Qualcomm: We discussed the issue for Rel-15 and the understanding is that gNB would ensure that the first PUCCH slot is available. However, it becomes challenging or even impossible in Rel-16 due to shorter SPS periodicity and multiple SPS configurations. That is why we proposed to discuss for Rel-16. Hope it clarifies. Whether issue #4 is discussed in URLLC or mTRP maintenance session needs to be coordinated |
| ZTE | LowNo need to change specification | LowConclusion is clear, no need to change specification. |  |
| OPPO | Low | Low |  |
| Nokia, NSB | High | Low | Issue #6: Indeed, UE may have just one PUCCH config and that may configure sub-slot PUCCH. Specification is not complete without mentioning this situation. Issue #7: A clarification only. |
| LG | Low | MediumGood to capture |  |
| HW/HiSi | Medium.  | Medium.It is ok to clarify this in the specification. |  |
| Intel | Medium~High (easy fix) | Medium (good to capture) (easy fix) |  |
| Apple | High | High | Issue #6 should be clarified and is a very easy fix.For issue #7, even though there is a conclusion, the specification should capture it as well to make it complete. |
| Company | Issue #10 |  | Comments |
| Samsung | Medium – need to clarify |  |  |
| DOCOMO | HighIssue is valid and can be fixed easily |  |  |
| Qualcomm | Medium- this is an easy fix, can be discussed in this meeting. |  |  |
| CATT | MediumCan be discussed together with Issue #2 |  |  |
| ZTE | Medium Good to be clarified.  |  |  |
| OPPO | Medium – this is an easy correction. |  |  |
| Nokia, NSB | Low |  | Should be clear enough already. If discussed, as mentioned by CATT, then to be paired with e.g. Issue #2 |
| LG | MediumGood to fix |  |  |
| HW/HiSi | MediumGood to have clarified |  |  |
| Intel | Medium (easy fix) |  |  |
| Apple | MediumGood to clarify |  |  |

* Remaining issues for scheduling & HARQ

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Issue #3 | Issue #6 | Comments |
| Samsung | Medium – good to discuss |  |  |
| DOCOMO | Medium |  |  |
| Qualcomm | Low-no need to discuss in this meeting.  |  |  |
| CATT | LowConsidering the work load in this meeting, it can be discussed later. | MediumThe previous agreement was not captured in the spec in case UE misses SFI. |  |
| ZTE | MediumFine to clarify.  | LowCurrent spec covers the case to be added.  |  |
| OPPO | Low for this meeting | Low |  |
| Nokia, NSB | LowOK to clarify but this could be discussed in an upcoming meeting | Low/MediumOK to clarify if time allows |  |
| LG | Low | LowIn our view, “a PUSCH” also covers a PUSCH repetition |  |
| HW/HiSi | LowNo need to discuss it at this meeting | LowAgree with ZTE. |  |
| Intel | Low  | Low |   |
| Apple | LowOk to discuss later |  |  |

* Remaining issues for Inter-UE multiplexing

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Issue #1 | Issue #2 | Comments |
| Samsung | Low | Low | Already discussed – no need for spec impact |
| DOCOMO | Medium | Low |  |
| Qualcomm | High- We think this issues should be discussed in this meeting. the need for defining a timeline was discussed during the last RAN1 meeting. Without a change, a UE has to compute MPR multiple times, which adds to UE's complexity unnecessarily.  | High. We think this should be discussed in this meeting.  |  |
| CATT | Low | Low | Both issues have been extensively discussed in the last meeting and the common understanding is no specification change is needed. Although it would be good to draw a conclusion based on the common understanding achieved in the last meeting, re-opening it with debating the same thing discussed during previous meetings is not preferred. It should be treated as low priority. |
| ZTE | Low | Low | Not essential issues and had been discussed several meetings without consensus |
| OPPO | Low | Low |  |
| Nokia, NSB | High | High | Would be good to get the same understanding at least on the power scaling issue – as there had been different understanding e.g. if a skipped PUSCH is to be considered in the power scaling or not.  |
| LG | LowNo specification changes are need | Low | Both issue already discussed in last meeting. |
| HW/HiSi | Low | Low | Agree with the comment from CATT |
| Intel | Low | Low | Same view as summarized by CATT. |
| Apple | Medium | Medium | In principle, we are supportive of achieving a conclusion/common understanding for both issues. But after last meeting’s discussion, we think PHR is better to be discussed in RAN2. For power scaling, our understanding is that it is up to UE implementation and we do not need specify anything. |

* Remaining issues for eCG enhancements

|  |  |  |
| --- | --- | --- |
| Company | Issue #2 | Comments |
| Samsung | Low | Already discussed  |
| DOCOMO | Low |  |
| Qualcomm | Low |  |
| CATT | Medium |  |
| ZTE | Medium | Based on current spec, a UE shall report the PHR for the first PUSCH which overlaps the PUSCH carrying PHR. It’s better to clarify the meaning of ‘first PUSCH’ in case of multiple CG configurations.  |
| OPPO | Low |  |
| Nokia, NSB | Low | Valid issue but maybe not highest priority |
| LG | HighIt make uncertainty on UE behavior and easy to fix. | This issue is different from PHR timeline issue (issue#1) in inter UE multiplexing. This issue haven’t discussed yet. |
| HW/HiSi | Medium | Could be clarified |
| Intel | Low | Agree with Nokia. |
| Apple | medium |  |

* Remaining issues for others (e.g. SPS enhancements and others)

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Issue #1 | Issue #2 | Comments |
| Samsung | Low – gNB implementation | Medium – good to discuss |  |
| DOCOMO | Low | Low |  |
| Qualcomm | Low | Low |  |
| CATT | LowIt is not an essential issue. | MediumIt is a remaining issue which would impact the URLLC SPS HARQ-ACK feedback. |  |
| ZTE | Low | Low |  |
| OPPO | MediumIt leads misunderstanding on SPS PDSCH overlapping and corresponding HARQ-ACK codebook between gNB and UE . | Low |  |
| Nokia, NSB | Low – not essential | Low. Feature & issue coming from eMIMO WI – so should be discussed in eMIMO WI (and not in URLLC) We do not think the that it is the duty of URLLC maintenance to address this problem.  |  |
| HW/HiSi | Low | Low |  |
| Intel | Low | Low |  |
| Apple | low | low |  |
| Company | Issue #5 | Issue #6 | Comments |
| Samsung | Medium – need to clarify. We haven’t come to any conclusion to align companies’ views. | Medium – need to clarify the error case. It can happen with multiple SPS PDSCH receptions. |  |
| DOCOMO | Low | Low |  |
| Qualcomm | Low | Low |  |
| CATT | MediumIt seems to be clear from Rel-17 discussion that SPS overriding is on a per repetition basis. If companies think that it is not clear, we are fine to discuss. | No need to repeat the discussion. |  |
| ZTE | Low | LowAlready discussed.  |  |
| OPPO | Low | Low |  |
| Nokia, NSB | Low  | Low |  |
| LG | Low | Low |  |
| HW/HiSI | Low | Low |  |
| Intel | Low | Low |  |
| Apple | Medium | low |  |

#  Summary of detailed issues

A brief summary of the issues are given in the following tables. Details can be found in the feature lead summaries uploaded to the draft folder.

**Table 1 Summary of issues for PDCCH enhancements**

|  |  |  |  |
| --- | --- | --- | --- |
| **Issue #** | **Description** | **Source** | **Recommended handling**  |
| A-1 | Inconsistence between TS 38.213 and TS 38.331 in terms of the *dci-FormatsExt* | Sharp (R1-2101535) | Included in the scope for email discussion **Reason:***Critical correction, otherwise the spec is not correct* |
| A-2 | Restriction on SCS between PDCCH and PDSCH with the starting symbol of the PDCCH monitoring occasion as the reference of SLIV | Spreadtrum (R1-200792) | No discussion in RAN1#104-e **Reason:***It was agreed not to use new SLIV reference for cross-carrier scheduling with different numerologies.* |
| A-3 | Whether the new SLIV reference (i.e. the starting symbol of the PDCCH monitoring occasion as the reference of SLIV) can be applied to Type 1 HARQ-ACK codebook | Samsung (R1-2101177) | More inputs from companies on whether to include or not.  **Reason:***It seems the current specification can work. However, if time permit can be discussed to achieve common understanding.* |
| A-4 | Ambiguity of subselection indication for DCI format 0\_1 and DCI format 0\_2 | Huawei/HiSilicon (R1-2101262) | More inputs from companies on whether to include or not. **Reason:***It seems the current specification can work. However, if time permit can be discussed to achieve common understanding.* |
| A-5 | PDSCH resource mapping with RE symbol level granularity | Sharp (R1-2101536) | Included in the scope for email discussion **Reason:***Critical correction, otherwise the spec is not complete* |

**Table 2 Summary of issues for UCI enhancements**

|  |  |  |
| --- | --- | --- |
| **Issue#1** | Timing for secondary cell activation / deactivation  | ZTE, E///, CATT, vivo, Fujitsu, Nokia, HW |
| **Issue#2** | Limitation on the number of PUCCHs carrying HARQ-ACK in a slot/subslot | Nokia, Xiaomi, DCM |
| **Issue#3** | Conflict between the first PUCCH repetition and semi-static configuration | CATT |
| **Issue#4** | Sub-slot-based HARQ-ACK and separate HARQ-ACKs with multi-DCI based multi-TRP | Nokia, Apple |
| **Issue#5** | Correction for sub-slot based PUCCH  | CATT, vivo |
| **Issue#6** | PUCCH resource for CSI and SR If one  *PUCCH-Config* with *subslotLengthForPUCCH-r16* is provided  | CATT, DCM |
| **Issue#7** | TPs reflecting the agreement not supporting Type-1 for sub-slot based HARQ-ACK in R16 | CATT |
| **~~Issue#8~~** | ~~Type-1 HARQ-ACK codebook for SPS PDSCH with PDSCH aggregation~~  | ~~CATT~~ |
| **~~Issue#9~~** | ~~Clarification of the configuration for one~~ *~~PUCCH-Config~~* ~~with~~ *~~subslotLengthForPUCCH-r16~~* | ~~DCM~~ |
| **Issue#10** | Clarification of the maximum number of PUCCH resource sets | DCM |

**Table 3 Summary of issues for PUSCH enhancements**

|  |  |
| --- | --- |
| **Issue #1:** New RRC parameter for TDRA indication to support up to 64 entries in a TDRA table for Type 1 configured grant with PUSCH repetition Type B | ZTE (R1-2100090) |
| **Issue #2:** Part 2 CSI dropping for UCI multiplexing on PUSCH repetition Type B | Apple (R1-2101347) |

**Table 4 Summary of issues for scheduling & HARQ**

|  |  |
| --- | --- |
| **Topic** | **Companies supporting the discussion in RAN1 #104e** |
| **Issue #1**: Correction on intra-UE prioritization timeline by replacing “before the first overlapping symbol” with “no later than the first overlapping symbol” | OPPO (R1-2100178) |
| **Issue #2**: Prioritization due to collision with semi-static DL and SSB symbols  | OPPO (R1-2100179), Ericsson (R1-2100267), CATT (R1-2100338), vivo (R1-2100414), Nokia/NSB (R1-2100826), Qualcomm (R1-2101439), NTT DOCOMO (R1-2101585), Huawei/HiSilicon (R1-2101263 section 2.2) |
| **Issue #3**: PDSCH SCS for defining prioritization timeline | CATT (R1-2100338) |
| **Issue #4**: Active duration of CSI-RS resources in case of cancellation  | Qualcomm (R1-2101439) |
| **Issue #5**: Including the agreement that any HP DCI can cancel a LP transmission | Qualcomm (R1-2101439) |
| **Issue #6:** Including the agreement that intra-UE prioritization/multiplexing is not affected by cancellation due to SFI in case UE misses the SFI | CATT (R1-2100338) |

**Table 5 Summary of issues for Inter-UE multiplexing**

|  |  |
| --- | --- |
| **Issue #1:** Impact to PHR calculation due to UL CI and skipping in UL CA | Nokia (R1-2100826) section 3, issue 1-1 and issue 1-2Qualcomm (R1- 2101439) section 4 |
| **Issue #2:** Impact to UE power scaling due to UL CI and skipping in UL CA | Nokia (R1-2100826) section 3, issue 2-1 and issue 2-2Qualcomm (R1- 2101439) section 5 |

**Table 6 Summary of issues for eCG**

|  |  |
| --- | --- |
| **Issues**  | **Source** |
| **Issue#1:** PHY behavior for collision between CG and DG with same/different PHY-priority index*(Note: RAN1 continue the discussion on the expected PHY layer behavior for the collision scenario between CG and DG with same/different PHY-priority index when the MAC entity is configured with lch-basedPrioritization, and when there is collision between PUCCH and the CG with the same priority and/or there is collision between PUCCH and the DG with the same priority.)* | R1-2100091, ZTER1-2100265, EricssonR1-2100336, CATTR1-2100415, vivoR1-2100632, Intel CorporationR1-2100756, Nokia, Nokia Shanghai BellR1-2100793, Spreadtrum CommunicationsR1-2100829, InterDigital, Inc.R1-2101264, Huawei, BUPT, China Southern Power Grid, HiSiliconR1-2101348, AppleR1-2101440, Qualcomm IncorporatedR1-2101586, NTT DOCOMO, INC. |
| **Issue#2:** discuss which CG should be used for PH calculation if multiple CG PUSCHs with same starting symbol in one cell overlap with a PUSCH carrying the PHR in the other cell. | LG ([R1-2100898](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_104-e/Docs/R1-2100898.zip)) |

**Table 7 Summary of issues for others**

|  |  |  |
| --- | --- | --- |
| **Topic** | **Companies supporting the discussion in RAN1 #104e** | **FL recommendation** |
| **Issue #1** Processing timeline for overlapping update due to SPS release | OPPO (R1-2100180) | No specification changes are needed |
| **Issue #2** Type-1 HARQ-ACK codebook for SPS PDSCH with PDSCH aggregation | CATT (R1-2100337)          | No specification changes are needed |
| **Issue #3** SPS PDSCH release and SPS receptions with slot aggregation | LG(R1-2100899), Samsung(R1-2101179) | Discuss the above case with R1-210089 |
| **Issue #4** PUCCH resource for SPS PDSCH HARQ-ACK and SR | Samsung (R1-2101178) | Take TP from R1-2101178 as alignment CR. |
| **Issue #5** Dynamic grant PDSCH overriding SPS PDSCH repetition | Samsung (R1-2101178) | No specification changes are necessary. |
| **Issue #6** PUCCH power control for HARQ-ACK codebook of multiple SPS PDSCH receptions | Samsung (R1-2101178) | Based on the previous discussion, no specification changes are necessary. |

# References

1. R1-21xxxxx Feature lead summary on PDCCH enhancements Huawei, HiSilicon
2. R1-21xxxxx Summary of eURLLC PUSCH enh 7.2.5 Apple
3. R1-21xxxxx Feature lead summary on URLLC HARQ and Scheduling Qualcomm
4. R1-21xxxxx Summary of Remaining issues on inter-UE prioritization Vivo
5. R1-21xxxxx Feature lead summary on eCG for eURLLC Vivo
6. R1-21xxxxx Summary on Others for URLLC and IIOT LG
7. R1-21xxxxx Summary#1 on UCI enhancements for R16 URLLC OPPO