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

**January 25th – February 5th, 2021**

**Agenda item:** 7.2.5

**Source:** Moderator (Qualcomm)

**Title:** Summary of [104-e-NR-L1enh-URLLC-04]: Email discussion/approval on remaining issues on Scheduling & HARQ enhancements

**Document for:** Discussion and Decision

# 1 Introduction

Based on the discussions during the preparation phase, it is agreed to discuss the following topics during the RAN1 #104e:

[104-e-NR-L1enh-URLLC-04] Email discussion/approval on remaining issues on Scheduling & HARQ enhancements – Kianoush (Qualcomm) by Feb 3

* Issue 1: Correction on intra-UE prioritization timeline by replacing “before the first overlapping symbol” with “no later than the first overlapping symbol”
* 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
* Issue 5: Including the agreement that any HP DCI can cancel a LP transmission

# 2 Issue #1

The following TP is proposed in [1]:

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| ------------------------------------ Start of TP 38.213V16.3.0 section 9---------------------------------<unchanged text omitted>When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5. Then, - if a transmission of a first PUCCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time with a transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the transmission of the second PUSCH or the second PUCCH ~~before~~ no later than the first symbol that would overlap with the first PUCCH transmission- if a transmission of a first PUSCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time with a transmission of a second PUCCH of smaller priority index, the UE cancels the transmission of the second PUCCH ~~before~~ no later than the first symbol that would overlap with the first PUSCH transmissionwhere - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before $T\_{proc,2}+d\_{1}$ after a last symbol of the corresponding PDCCH reception- $T\_{proc,2} $is the PUSCH preparation time for a corresponding UE processing capability assuming $d\_{2,1}=0$ [6, TS 38.214], based on $μ$ and $N\_{2}$ as subsequently defined in this Clause, and $d\_{1}$ is determined by a reported UE capabilityIf a UE is scheduled by a DCI format in a first PDCCH reception to transmit a first PUCCH or a first PUSCH of larger priority index that overlaps with a second PUCCH or a second PUSCH transmission of smaller priority index that, if any, is scheduled by a DCI format in a second PDCCH- $T\_{proc,2}$ is based on a value of $μ$ corresponding to the smallest SCS configuration of the first PDCCH, the second PDCCHs, the first PUCCH or the first PUSCH, and the second PUCCHs or the second PUSCHs - if the overlapping group includes the first PUCCH- if *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for the serving cell where the UE receives the first PDCCH and for all serving cells where the UE receives the PDSCHs corresponding to the second PUCCHs, and if *processingType2Enabled* of *PUSCH-ServingCellConfig* is set to *enable* for the serving cells with the second PUSCHs, *N2* is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$ - else, *N2* is 10 for $μ$=0*,* 12 for $μ=1$, 23 for $μ=2$, and 36 for $μ=3$;- if the overlapping group includes the first PUSCH - if *processingType2Enabled* of *PUSCH-ServingCellConfig* is set to *enable* for the serving cells with the first PUSCH and the second PUSCHs and if *processingType2Enabled* of *PDSCH-ServingCellConfig* is set to *enable* for all serving cells where the UE receives the PDSCHs corresponding to the second PUCCHs, *N2* is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$- else, *N2* is 10 for $μ$=0*,* 12 for $μ=1$, 23 for $μ=2$, and 36 for $μ=3$;If a UE would transmit the following channels that would overlap in time- a first PUCCH of larger priority index with SR and a second PUCCH or PUSCH of smaller priority index, or - a configured grant PUSCH of larger priority index and a PUCCH of smaller priority index, or- a first PUCCH of larger priority index with HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH and a second PUCCH of smaller priority index with SR and/or CSI, or a configured grant PUSCH with smaller priority index, or a PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH, or - a PUSCH of larger priority index with SP-CSI reports(s) without a corresponding PDCCH and a PUCCH of smaller priority index with SR, or CSI, or HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH, or- a configured grant PUSCH of larger priority index and a configured PUSCH of lower priority index on a same serving cellthe UE is expected to cancel the PUCCH/PUSCH transmissions of smaller priority index ~~before~~ no later than the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index.<unchanged text omitted>------------------------------------ End of TP 38.213V16.3.0 section 9--------------------------------- |

**Please share your views on the proposed TP in the table below.**

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| **Company** | **Comment** |
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# 3 Issue #2

For the order of multiplexing and cancellation due to collision with semi-static DL/SSB symbols, please provide your comments on the following proposal [3]:

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| For the purpose of collision resolution of PUCCH/PUSCH resources with semi-static DL and/or SSBs or with other PUCCH/PUSCH resources in a slot, the following steps are applied:* 1. When PUCCH/PUSCH resources in a slot are determined, apply the following steps:
	2. Step 1: Any PUCCH/PUSCH resource that overlaps with semi-static DL symbols or SSB in the slot is cancelled
	3. Step 2: Any overlapping among PUCCH/PUSCH resources is resolved as the following:
		+ Step 2.1: Overlapping among LP PUCCH/PUSCH channels, if any, is resolved similar to Rel-15 as if HP channels do not exist.
		+ Step 2.2: Any LP PUCCH/PUSCH that overlaps with a HP PUCCH/PUSCH channel is cancelled.
		+ Step 2.3: Overlapping among HP PUCCH/PUSCH channels, if any, is resolved similar to Rel-15 as if LP channels do not exist.
		+ Step 2.4: Any LP PUCCH/PUSCH that overlaps with a HP PUCCH/PUSCH channel is cancelled.
	4. Step 3: Any PUCCH/PUSCH resource that overlaps with semi-static DL symbols or SSB is cancelled.
	+ Note: In steps 2.1 or 2.3, for a scheduled LP or HP PUCCH resource carrying HARQ-ACK, respectively, the corresponding overriding procedure if applicable, is performed prior to any multiplexing procedures involving the PUCCH resource.
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**Please share your views in the table below.**

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| **Company** | **Comment** |
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# 4 Issue #4

In RAN1 #101e, the following conclusion was made:

**Conclusion: In Rel. 15, if a PUCCH/PUSCH carrying a CSI report is cancelled, the occupied CPUs are remained occupied until the last symbol of “configured/scheduled” PUCCH/PUSCH.**

In [7], it is proposed to define the active time duration of aperiodic CSI-RS in the same manner.From Section 5.2.1.6 of TS 38.214, we have:

*“In any slot, the UE is not expected to have more active CSI-RS ports or active CSI-RS resources in active BWPs than reported as capability. NZP CSI-RS resource is active in a duration of time defined as follows. For aperiodic CSI-RS, starting from the end of the PDCCH containing the request and ending at the end of the PUSCH containing the report associated with this aperiodic CSI-RS. For semi-persistent CSI-RS, starting from the end of when the activation command is applied, and ending at the end of when the deactivation command is applied. For periodic CSI-RS, starting when the periodic CSI-RS is configured by higher layer signalling, and ending when the periodic CSI-RS configuration is released. If a CSI-RS resource is referred N times by one or more CSI Reporting Settings, the CSI-RS resource and the CSI-RS ports within the CSI-RS resource are counted N times.”*

**Proposal: If the transmission of the PUSCH containing the report associated with the aperiodic CSI-RS is cancelled, the NZP CSI-RS resource is active from the end of the PDCCH containing the request and ending at the end of the “scheduled” PUSCH containing the report.**

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

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| **Company** | **Comment** |
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# 5 Issue #5

Previously, the following clause was included in Section 9 TS 38.213 and was removed by the Editor later:

*“If a UE detects a first DCI format scheduling a PUCCH or PUSCH transmission of larger priority index that would overlap with a PUCCH or PUSCH transmission of smaller priority index, the UE does not expect to transmit the PUCCHs or PUSCHs of the smaller priority index due to a detection of a second DCI format after the detection of the first DCI format.”*

In the last meeting, it was discussed that for more clarity and to avoid any ambiguity, this clause should be added back.

The following TP captures the proposed changes [7]:

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|  **Modified clause (Section 9 of TS 38.213)**When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5. Then, - if a transmission of a first PUCCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time with a transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the transmission of the second PUSCH or the second PUCCH before the first symbol that would overlap with the first PUCCH transmission- if a transmission of a first PUSCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time with a transmission of a second PUCCH of smaller priority index, the UE cancels the transmission of the second PUCCH before the first symbol that would overlap with the first PUSCH transmissionwhere - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before $T\_{proc,2}+d\_{1}$ after a last symbol of the corresponding PDCCH reception- $T\_{proc,2} $is the PUSCH preparation time for a corresponding UE processing capability assuming $d\_{2,1}=0$ [6, TS 38.214], based on $μ$ and $N\_{2}$ as subsequently defined in this Clause, and $d\_{1}$ is determined by a reported UE capabilityIf a UE detects a first DCI format scheduling a PUCCH or PUSCH transmission of larger priority index that would overlap with a PUCCH or PUSCH transmission of smaller priority index, the UE does not expect to transmit the PUCCHs or PUSCHs of the smaller priority index due to a detection of a second DCI format after the detection of the first DCI format. **End** |

**Please share your views on the TP in the table below.**

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| **Company** | **Comment** |
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# 6 References

**[1] R1-2100178, “*Text proposal for intra UE prioritization timeline*,” OPPO**

**[2] R1-2100179, “*Remaining issues on scheduling and HARQ,*” OPPO**

**[3] R1-2100267, “*Maintenance of scheduling/HARQ for NR URLLC,*” Ericsson**

**[4] R1-2100338, “Remaining issues on intra-UE prioritization,” CATT**

**[5] R1-2100414, “Maintenance on scheduling/HARQ,” vivo**

**[6] R1-2100826, “Maintenance of Rel. 16 URLLC Intra-UE and inter-UE prioritization/multiplexing enhancements,” Nokia, NSB**

**[7] R1-2101439, “Remaining issues on HARQ and scheduling for URLLC,” Qualcomm**

**[8] R1-2101585, “Corrections on scheduling/HARQ for Rel. 16 URLLC,” NTT DOCOMO**

**[9] R1-2101263, “Remaining issues on UCI enhancements,” Huawei/HiSi**