**3GPP TSG RAN WG1 Meeting #110bis-e R1-22xxxxx**

**Toulouse, France, November 14th-18th, 2022**

**Agenda Item: 7.2**

**Source: Moderator (Huawei, HiSilicon)**

**Title: Summary on [111-R16-NR] – Priority rules for CSI reports**

**Document for: Discussion and Decision**

# Introduction

This summary is dedicated to discuss the intra-UE prioritization related to SP-CSI as indicated in the Chairman’s notes for this meeting:

**Priority rules for CSI reports (continuation of [110bis-e-NR-R16-01])**

**For Round 1 discussion, please provide feedback as early as possible, since you already opened the paper, there is no reason wait☺, (but otherwise please not later than Monday 14th Nov 16:00 UTC)**

2 companies (HW/HiSi, Nokia/Nokia Shanghai Bell) provided 3 joint papers to the meeting (1 discussion paper and 2 CRs, one for TS 38.213 and one for TS 38.214, ([1], [2], [3])).

**Background**

This thread is a continuation of [110bis-e-NR-R16-01] on PUSCH overlap related to SP-CSI with the aim to resolve the concern raised by 1 company at the end of the previous meeting.

According to majority of companies’ views given in last meeting [4], it was generally found that the current specification describes the intra-UE prioritization related to PUSCH overlap in a far too complicated manner that easily can lead to misinterpretation and faulty implementation of the intended behaviour:

* Some cases related to PUSCH overlap with SP-CSI are specified in 38.214 (section 5.2.5) whereas most other cases are specified in 38.213 (Section 9)
* To understand and implement the correct behaviour, one also needs to rely on a conclusion, which existence is not straight forward to be aware of

To overcome the above mentioned problem, two TPs are suggested, one for each respective specification. In [3] it is proposed for 38.213 to specify in Section 9 the agreed remaining Case #1 for HP/LP PUSCH overlap with data and SP-CSI:

|  |
| --- |
| **Agreement**For Case 1 – overlap between HP PUSCH with DCI and LP PUSCH with SP-CSI without DCI, The entire LP channel is cancelled. The time-line requirement is the same as in Rel-15 defined in TS 38.214 Clause 5.2.5 for DG PUSCH overriding ~~LP~~ PUSCH with SP-CSI.FFS: RAN1 specification impact |

And in [1] is proposed for 38.214, Section 5.2.5, to clarify that this section only applies for the overlap between SP-CSI and data carried by two PUSCHs of the same physical layer priority.

As a result of these two suggested CRs, all cases of intra-UE prioritization related to PUSCH overlap where SP-CSI is involved would then be specified in 38.213, and all legacy overlap (i.e. for same PHY priority) related to PUSCH with SP-CSI would be handled in 38.214. This would then be a clean division between the specifications and additionally, to correctly interpret the spec there would not anymore be a need to rely on a conclusion for the overlap between LP PUSCH with and data HP PUSCH with SP-CSI.

These two TPs from last meeting could in the end could not be agreed due to a concern raised by one company. The reason for the concern was that if a clarification for TS 38.214 would be introduced in Section 5.2.5, then this should also be done for potential other cases of PUSCH overlap that appear in other sections, not only for the overlap with SP-CSI that is addressed in Section 5.2.5.

Last meeting, there was not enough time available and the other cases could not be assessed. In [2], therefore, these other cases of PUSCH overlap that can be found in TS 38.214 are evaluated. It is found that they all naturally apply to any PHY priority and no clarification should be given for them. The only situation where resolving PUSCH overlap should be confined to the same PHY priority is for SP-CSI vs data, which enhances the need for a clarifying correction in TS 38.214.

# Discussion

## Input papers to the meeting

The following proposals have been submitted to the meeting:

|  |  |  |
| --- | --- | --- |
| **Tdoc** | **Source** | **Proposals** |
| [1] R1-2210860 | HW/HiSi. Nokia/NSB | TP for 38.214: 5.2.5 Priority rules for CSI reportsFor two overlapping PUSCHs, the priority rules in this clause are applied for physical channels with same priority index according to clause 9 in [6, TS 38.213].CSI reports are associated with a priority value $Pri\_{iCSI}\left(y,k,c,s\right)=2∙N\_{cells}∙M\_{s}∙y+N\_{cells}∙M\_{s}∙k+M\_{s}∙c+s$ where-  for aperiodic CSI reports to be carried on PUSCH  for semi-persistent CSI reports to be carried on PUSCH,  for semi-persistent CSI reports to be carried on PUCCH and  for periodic CSI reports to be carried on PUCCH;-  for CSI reports carrying L1-RSRP or L1-SINR and  for CSI reports not carrying L1-RSRP or L1-SINR;- *c* is the serving cell index and $N\_{cells}$ is the value of the higher layer parameter *maxNrofServingCells*;- *s* is the *reportConfigID* andis the value of the higher layer parameter *maxNrofCSI-ReportConfigurations.*A first CSI report is said to have priority over second CSI report if the associated  value is lower for the first report than for the second report.< Unchanged parts are omitted > |
| [2] R1-2210919 | HW/HiSi. Nokia/NSB | ***Observation: The only case for PUSCH overlap that is specified in TS 38.214 and that only should apply to the same PHY priority, is the one in Section 5.2.5 for the overlap handling between PUSCHs where one is carrying data and the other is carrying SP-CSI. All other cases apply to any priority and no further clarification should be given. Not clarifying section 5.2.5, on the other hand, would cause more confusion, since based on the generic applicability of the other cases, one could wrongly assume that even this situation is for the overlap of any PHY priority.*** ***Proposal 1: Add the clarification in section 5.2.5 in TS 38.214 to clarify that the priority rules for SP-CSI in 38.214 are applied for UL channels with same priority. Adopt following TP for TS 38.214 which is given in the draft CR [4] :***

|  |
| --- |
| **5.2.5 Priority rules for CSI reports**For two overlapping PUSCHs, the priority rules in this clause are applied for physical channels with same priority index according to clause 9 in [6, TS 38.213].CSI reports are associated with a priority value $Pri\_{iCSI}\left(y,k,c,s\right)=2∙N\_{cells}∙M\_{s}∙y+N\_{cells}∙M\_{s}∙k+M\_{s}∙c+s$ where< Unchanged parts are omitted > |

***Proposal 2: Capture the agreement for Case 1 in TS 38.213 with the following TP for Section 9 which is given in the draft CR [4]:***

|  |
| --- |
| **Agreement**For Case 1 – overlap between HP PUSCH with DCI and LP PUSCH with SP-CSI without DCI, The entire LP channel is cancelled. The time-line requirement is the same as in Rel-15 defined in TS 38.214 Clause 5.2.5 for DG PUSCH overriding ~~LP~~ PUSCH with SP-CSI.* FFS: RAN1 specification impact
 |

|  |
| --- |
| 9 UE procedure for reporting control information < Unchanged parts are omitted >- 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, $N\_{2} $is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$- else, $N\_{2} $is 10 for $μ$=0*,* 12 for $μ=1$, 23 for $μ=2$, and 36 for $μ=3$;If a PUSCH of larger priority index scheduled by a DCI format overlaps in time with a PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH in one or more symbols on the same carrier, and if the earliest symbol of these PUSCH channels starts no earlier than N2+d2,1 symbols after the last symbol of the DCI scheduling the PUSCH of larger priority index where d2,1 is the maximum of the d2,1 associated with PUSCH of larger priority index scheduled by a DCI format and the PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH, the PUSCH of smaller priority index with SP-CSI report(s) shall not be transmitted by the UE. Otherwise, if the timeline requirement is not satisfied this is an error case.If a UE would transmit the following channels, including repetitions if any, 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 < Unchanged parts are omitted > |

 |
| [3] R1-2210920 | HW/HiSi. Nokia/NSB | TP for 38.213: 9 UE procedure for reporting control information< Unchanged parts are omitted >If 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, $N\_{2} $is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$ - else, $N\_{2} $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, $N\_{2} $is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$- else, $N\_{2} $is 10 for $μ$=0*,* 12 for $μ=1$, 23 for $μ=2$, and 36 for $μ=3$;If a PUSCH of larger priority index scheduled by a DCI format overlaps in time with a PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH in one or more symbols on the same carrier, and if the earliest symbol of these PUSCH channels starts no earlier than N2+d2,1 symbols after the last symbol of the DCI scheduling the PUSCH of larger priority index where d2,1 is the maximum of the d2,1 associated with PUSCH of larger priority index scheduled by a DCI format and the PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH, the PUSCH of smaller priority index with SP-CSI report(s) shall not be transmitted by the UE. Otherwise, if the timeline requirement is not satisfied this is an error case.If a UE would transmit the following channels, including repetitions if any, that would overlap in time |

## Round 1

In the last meeting, it was found that the two TPs for Case 1 in 38.213 and for the clarification of Section 5.2.5 in 38.214 only can be agreed together or not at all.

Samsung raised a concern and commented on the TP for 38.214, that if this clarification in Section 5.2.5 would be agreed, i.e. that the PUSCH overlap related to SP-CSI only is for the same PHY priority, then also other cases of PUSCH overlap (not related to SP-CSI) should be clarified in 38.214. As stated in the introduction, therefore, in [2] these other cases are listed and discussed. According to proponents all other cases are valid for two PHY priorities and no clarification should be given.

**Other cases in TS 38.214 related to PUSCH overlap:**

The following cases of PUSCH overlap are identified in [2] and discussed whether they apply to the same or different priorities:

|  |  |  |  |
| --- | --- | --- | --- |
| **Other case** | **Section** | **Spec text** | **Analysis** |
| #1 | 6 | *“A UE is not expected to be scheduled by a PDCCH ending in symbol* $i$ *to transmit a PUSCH on a given serving cell overlapping in time with a transmission occasion, where the UE is allowed to transmit a PUSCH with configured grant according to [10, TS38.321], starting in a symbol* $j$ *on the same serving cell if the end of symbol* $i$ *is not at least* $N\_{2}$ *symbols before the beginning of symbol* $j$*. The value* $N\_{2}$ *in symbols is determined according to the UE processing capability defined in Clause 6.4, and* $N\_{2} $*and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH with configured grant and the subcarrier spacing of the PDCCH scheduling the PUSCH.”* | This paragraph describes the case that the DG PUSCH overlaps with the CG PUSCH. But prioritization between DG PUSCH and CG PUSCH with different priorities is not supported in Rel-16, a DG PUSCH can always override a CG PUSCH, regardless their PHY layer priorities. Therefore, as opposed to the handling of SP-CSI, this case applies to both HP and LP channels and no further clarification should be given.  |
| #2 | 6 | *“A UE is not expected to be scheduled by a PDCCH ending in symbol* $i$ *to transmit a PUSCH on a given serving cell for a given HARQ process, if there is a transmission occasion where the UE is allowed to transmit a PUSCH with configured grant according to [10, TS38.321] with the same HARQ process on the same serving cell starting in a symbol* $j$ *after symbol* $i$*, and if the gap between the end of PDCCH and the beginning of symbol* $j$ *is less than* $N\_{2}$ *symbols. The value* $N\_{2}$ *in symbols is determined according to the UE processing capability defined in Clause 6.4, and* $N\_{2} $*and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH with configured grant and the subcarrier spacing of the PDCCH scheduling the PUSCH.”* | This paragraph describes the timeline restriction for the case that the DG PUSCH has the same HARQ process ID as the CG PUSCH regardless if they are overlapping or non-overlapping. According to 38.321, upon reception of the dynamic grant, the UE will restart the *ConfiguredGrantTimer* for the corresponding HARQ process, and the running *ConfiguredGrantTimer* will suspend the CG transmission with the same HARQ process. In order to leave enough time for the UE to suspend the CG transmission, the DCI for the DG PUSCH is required to obey the above timeline. This case applies to both the same and different priority and no further clarification is needed.  |
| #3 | 6.3.1 and 6.3.2 | *“For any RV sequence, the repetitions shall be terminated after transmitting K repetitions, or at the last transmission occasion among the K repetitions within the period P, or from the starting symbol of the repetition that overlaps with a PUSCH with the same HARQ process scheduled by DCI format 0\_0, 0\_1 or 0\_2, whichever is reached first. In addition, the UE shall terminate the repetition of a transport block in a PUSCH transmission if the UE receives a DCI format 0\_1 with DFI flag provided and set to '1', and if in this DCI the UE detects ACK for the HARQ process corresponding to that transport block.”**“For any RV sequence, the repetitions shall be terminated after transmitting K nominal repetitions, or at the last transmission occasion among the K nominal repetitions within the period P, or from the starting symbol of an actual repetition that overlaps with a PUSCH with the same HARQ process scheduled by DCI format 0\_0, 0\_1 or 0\_2, whichever is reached first. The UE is not expected to be configured with the time duration for the transmission of K nominal repetitions larger than the time duration derived by the periodicity P.”* | These paragraphs describe the termination condition for CG PUSCH. The third condition (“*or from the starting symbol of the repetition that overlaps with a PUSCH with the same HARQ process scheduled by DCI format 0\_0, 0\_1 or 0\_2*”) is for DG PUSCH overriding CG PUSCH with the same HARQ process. The DG PUSCH can be scheduled with any priority, therefore the two PUSCHs can be either of the same priority or different priorities. Thus, also the third identified case applies to any PHY layer priority and no clarification is needed. |

**Outcome of analysis:**

Based on the above analysis, all other cases for prioritization related to PUSCH overlap which can be found in TS 38.214 are not restricted to PUSCHs with same priorities. They apply naturally also to different PHY priorities. Therefore, no clarification should be given for them. The only identified case that needs the clarification that it only applies for the same priority, is the one for overlap between SP-CSI and data, for which the TP is proposed in [1].

The fact that it is now found that all other cases apply to any priority make the need for a clarification in section 5.2.5 for the same PHY priority even more urgent than identified last meeting. Otherwise, one could wrongly assume that even the specified overlap handling between SP-CSI and data applies to any priority and one would wrongly let the LP PUSCH with data cancel the HP PUSCH with SP-SCI, which has to be avoided.

In [2], the following observation is therefore made:

***Observation: The only case for PUSCH overlap that is specified in TS 38.214 and that only should apply to the same PHY priority, is the one in Section 5.2.5 for the overlap handling between PUSCHs where one is carrying data and the other is carrying SP-CSI. All other cases apply to any priority and no further clarification should be given. Not clarifying section 5.2.5, on the other hand, would cause more confusion, since based on the generic applicability of the other cases, one could wrongly assume that even this situation is for the overlap of any PHY priority.***

***Q1: Companies are encouraged to share their view: do you agree with the above analysis that the other cases #1, #2, #3 apply to the same and different PHY priorities?***

|  |  |
| --- | --- |
| Companies | View |
|  |  |

***Q2: Based on last meetings discussion and the analysis related to Question 1, do you have a strong concern with Proposal 1 below to adopt the TPs for 38.213 and for 38.214, to specify the agreed Case #1 in 38.213 and to clarify in 38.214, Section 5.2.5, that for two overlapping PUSCHs it is valid for the same PHY priority index?***

|  |  |
| --- | --- |
| Companies | Concern |
|  |  |

***Proposal 1: Adopt the following TPs for 38.213 and for 38.214:***

**TP for 38.213, Section 9:**

|  |
| --- |
| 9 UE procedure for reporting control information < Unchanged parts are omitted >- 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, $N\_{2} $is 5 for $μ=0$, 5.5 for $μ=1$ and 11 for $μ=2$- else, $N\_{2} $is 10 for $μ$=0*,* 12 for $μ=1$, 23 for $μ=2$, and 36 for $μ=3$;If a PUSCH of larger priority index scheduled by a DCI format overlaps in time with a PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH in one or more symbols on the same carrier, and if the earliest symbol of these PUSCH channels starts no earlier than N2+d2,1 symbols after the last symbol of the DCI scheduling the PUSCH of larger priority index where d2,1 is the maximum of the d2,1 associated with PUSCH of larger priority index scheduled by a DCI format and the PUSCH of smaller priority index with SP-CSI report(s) without a corresponding PDCCH, the PUSCH of smaller priority index with SP-CSI report(s) shall not be transmitted by the UE. Otherwise, if the timeline requirement is not satisfied this is an error case.If a UE would transmit the following channels, including repetitions if any, that would overlap in time< Unchanged parts are omitted > |

**TP for 38.214, Section 5.2.5**

|  |
| --- |
| **5.2.5 Priority rules for CSI reports**For two overlapping PUSCHs, the priority rules in this clause are applied for physical channels with same priority index according to clause 9 in [6, TS 38.213].CSI reports are associated with a priority value $Pri\_{iCSI}\left(y,k,c,s\right)=2∙N\_{cells}∙M\_{s}∙y+N\_{cells}∙M\_{s}∙k+M\_{s}∙c+s$ where< Unchanged parts are omitted > |

# Outcome

TBD:

# References

[1] R1-2210860, “Correction on Priority rules for CSI reports in TS 38.214" , Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, RAN1#111, Toulouse, France, Nov 14-18, 2022

[2] R1-2210919, “Discussion on cases for prioritization related to PUSCH in TS 38.213 and TS 38.214" , Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, RAN1#111, Toulouse, France, Nov 14-18, 2022

[3] R1-2210920, “Correction on UL prioritization cases related to SP-CSI in TS 38.213 " , Huawei, HiSilicon, Nokia, Nokia Shanghai Bell, RAN1#111, Toulouse, France, Nov 14-18, 2022

[2] R1-2210712, “Summary on 110bis-e-NR-R16-01 - Intra-UE prioritization related to SP-CSI” Huawei, HiSilicon, RAN1#110bis-e, e-Meeting, October 10-19, 2022