3GPP TSG RAN WG1 #103-e R1-2009412

e-Meeting, October 26th – November 13th, 2020

Source: Moderator (OPPO)

Title: Summary#1 of email thread [103-e-NR-L1enh\_URLLC-UCI\_Enh-03]

Agenda Item: 7.2.5

Document for: Discussion and Decision

# Introduction

This paper summarizes the following email discussion in RAN1#103-e meeting:

[103-e-NR-L1enh-URLLC-03] Email discussion/approval on remaining issues on UCI enhancements – Jia (OPPO)

* Issue 2: Intra-UE prioritization for PUCCH repetition
* Issue 3: Type-1 codebook for sub-slot based HARQ-ACK
* issue 4: Timing for secondary cell activation / deactivation
* Discussion and decision by 10/29, TPs by 11/5

# Issue #2: Intra-UE prioritization for PUCCH repetition

## Companies’ proposals

In TS 38.213 v16.3.0, the UE behavior for handling overlapping PUCCH/PUSCH transmissions with repetitions and with different priorities are missing. The following TPs were proposed to specify the UE behavior to resolve overlapping PUCCH/PUSCH transmissions with repetitions and with different priorities.

*CATT proposal:*

***Proposal 4: Adopt the following TP for section 9 of TS38.213.***

-------------------------------------------------- Start of text proposal ------------------------------------------------------

**9 UE procedure for reporting control information**

\*\*\* Unchanged text is 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 over slots of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in a slot 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, where is the provided by respective *nrofSlots* if provided, otherwise



- if a transmission of a first PUSCH over slots of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in a slot 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 transmission, where is the provided by *pusch-AggregationFactor* or *numberofrepetitions-r16* if provided, otherwise



where

- 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 after a last symbol of the corresponding PDCCH reception



- is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability



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

- is based on a value of 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 , 5.5 for  and 11 for



- else, *N2* is 10 for =0*,* 12 for , 23 for , and 36 for ;



- 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 , 5.5 for  and 11 for



- else, *N2* is 10 for =0*,* 12 for , 23 for , and 36 for ;



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 cell

the UE is expected to cancel the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index.

A UE does not expect to be scheduled to transmit a PUCCH or a PUSCH with smaller priority index that would overlap in time with a PUCCH of larger priority index with HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH. A UE does not expect to be scheduled to transmit a PUCCH of smaller priority index that would overlap in time with a PUSCH of larger priority index with SP-CSI report(s) without a corresponding PDCCH.

In the remaining of this Clause, a UE multiplexes UCIs with same priority index in a PUCCH or a PUSCH. A PUCCH or a PUSCH is assumed to have a same priority index as a priority index of UCIs a UE multiplexes in the PUCCH or the PUSCH.

In the remaining of this Clause, the multiplexing or prioritization for overlapping channels are for overlapping channels with same priority index.

In the remaining of this Clause, if a UE is provided *subslotLengthForPUCCH-r16*, a slot for an associated PUCCH transmission includes a number of symbols indicated by *subslotLengthForPUCCH-r16*.

----------------------------------------------------- End of text proposal ------------------------------------------------------

*Nokia proposal:*

**Proposal 1: Adopt the following draft CR to clarify the PUCCH repetition operation with PHY priorities (changes in green, to be shown as track changes in the final CR)**

**9 UE procedure for reporting control information**

<omitted text>

A PUSCH or a PUCCH transmission, including repetitions if any, can be of priority index 0 or of priority index 1. For a configured grant PUSCH transmission, a UE determines a priority index from *priority*, if provided. For a PUCCH transmission with HARQ-ACK information corresponding to a SPS PDSCH reception or a SPS PDSCH release, a UE determines a priority index from *harq-CodebookID*, if provided. For a PUCCH transmission with SR, a UE determines the corresponding priority as described in Clause 9.2.4. For a PUSCH transmission with semi-persistent CSI report, a UE determines a priority index from a priority indicator field, if provided, in a DCI format 0\_1 or DCI format 0\_2 that activates the semi-persistent CSI report. If a priority index is not provided to a UE for a PUSCH or a PUCCH transmission, the priority index is 0.

If a UE is provided two *PUCCH-Config*

- if the UE is provided *subslotLengthForPUCCH-r16* in the first *PUCCH-Config*, the PUCCH resource for any SR configuration with priority index 0 or any CSI report configuration in any *PUCCH-Config* is within the *subslotLengthForPUCCH-r16* symbols in the first *PUCCH-Config*

- if the UE is provided *subslotLengthForPUCCH-r16* in the second *PUCCH-Config*, the PUCCH resource for any SR configuration with priority index 1 in any *PUCCH-Config* is within the *subslotLengthForPUCCH-r16* symbols in the second *PUCCH-Config*

If in an active DL BWP a UE monitors PDCCH either for detection of DCI format 0\_1 and DCI format 1\_1 or for detection of DCI format 0\_2 and DCI format 1\_2, a priority index can be provided by a priority indicator field. If a UE indicates a capability to monitor, in an active DL BWP, PDCCH for detection of DCI format 0\_1 and DCI format 1\_1 and for detection of DCI format 0\_2 and DCI format 1\_2, a DCI format 0\_1 or a DCI format 0\_2 can schedule a PUSCH transmission of any priority and a DCI format 1\_1 or a DCI format 1\_2 can schedule a PDSCH reception and trigger a PUCCH transmission with corresponding HARQ-ACK information of any priority.

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 Clauses 9.2.5 and 9.2.6. 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 in each slot where the overlap would happen the transmission of the second PUSCH or the second PUCCH before the first symbol that would overlap with the first PUCCH transmission in the slot

- 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 in each slot where the overlap would happen before the first symbol that would overlap with the first PUSCH transmission

where

- the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clauses 9.2.5 and 9.2.6

- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception



- is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability



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

- is based on a value of 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 , 5.5 for  and 11 for



- else, *N2* is 10 for =0*,* 12 for , 23 for , and 36 for ;



- 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 , 5.5 for  and 11 for



- else, *N2* is 10 for =0*,* 12 for , 23 for , and 36 for ;



If a UE would transmit the following channels that would overlap in time in one or more slots

- 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 cell

the UE is expected to cancel in each slot where overlap would happen the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index.

A UE does not expect to be scheduled to transmit a PUCCH or a PUSCH with smaller priority index that would overlap in time with a PUCCH of larger priority index with HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH. A UE does not expect to be scheduled to transmit a PUCCH of smaller priority index that would overlap in time with a PUSCH of larger priority index with SP-CSI report(s) without a corresponding PDCCH.

<omitted text>

*QC proposal:*

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| ***Reason for change:*** | In TS 38.213 v16.3.0, the UE behavior for handling overlapping PUCCH/PUSCH transmissions with repetitions and with different priorities are missing. The TP in this section specifies the UE behavior to resolve overlapping PUCCH/PUSCH transmissions with repetitions and with different priorities. |
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| ***Summary of change:*** | The current UE behavior to cancel low priority channel due to collision with high priority channel are extended to cover the case of at least one of the overlapping channels are scheduled with repetitions. |
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| ***Consequences if not approved:*** | PUCCH repetition is broken whenever the UE is configured with two priorities at the physical layer. |

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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, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 in a slot 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 in the slot

- if a transmission of a first PUSCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time in a slot 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 transmission in the slot

where

- the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6

- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception



- is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability



------------------------------------ Omitted parts --------------

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

- 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 cell

the UE is expected to cancel the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index in the overlapping slot(s).

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| **End** |

## Discussion status

## First round proposal and discussions

Considering the TP proposed by QC, companies are encouraged to express your views:

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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, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 in a slot 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 in the slot

- if a transmission of a first PUSCH of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time in a slot 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 transmission in the slot

where

- the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6

- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception



- is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability



------------------------------------ Omitted parts --------------

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

- 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 cell

the UE is expected to cancel the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index in the overlapping slot(s).

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| **End** |

First round comments from companies:

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| Company | Comments |
| Apple | We would like to understand which one of the following is the intention of the TP:  (1) All the overlapping is handled on a per-repetition basis;  (2) The overlapping is handled on a per-slot basis.  We think the intention is (1), but the wording is more like (2).  The issue with the current TP (if the intention is (1)) is that we could have e.g. one PUCCH overlapping with two PUSCH repetitions in a slot, or one PUSCH overlapping with two PUCCH repetitions in a slot. The TP suggests that if one repetition overlaps with another transmission, all the repetitions starting from the first overlapping repetition are cancelled, even if the later ones do not overlap with another transmission. (Also the definition of “a slot” is not exactly clear in case of mixed numerologies.)  Would be good to confirm the intention first. |
| CATT | We would like to clarify the intended UE behavior first as well. We share the same understanding with Apple that prioritization is handled on a per-repetition basis. The repetition(s) of the LP channel overlapping with the HP channel is cancelled/dropped.  Following is an attempt to capture the intended UE behavior based on QC’s TP. We do not have a good wording for the second part and we are open to discuss.   |  | | --- | | When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. Then,  - if a transmission of a first PUCCH of larger priority index in a slot scheduled by a DCI format in a PDCCH reception would overlap in time ~~in a slot~~ with a transmission of a second PUSCH or a second PUCCH of smaller priority index in one or more slots, the UE cancels the transmission of the second PUSCH or the second PUCCH overlapping in time with the first PUCCH in the one or more slots before the first symbol that would overlap with the first PUCCH transmission ~~in the slot~~  - if a transmission of a first PUSCH of larger priority index in a slot scheduled by a DCI format in a PDCCH reception would overlap in time ~~in a slot~~ with a transmission of a second PUCCH of smaller priority index in one or more slots, the UE cancels the transmission of the second PUCCH overlapping in time with the first PUCCH in the one or more slots before the first symbol that would overlap with the first PUSCH transmission ~~in the slot~~  where  - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6  - the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception  - is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability | |
| ZTE | The question from Apple is valid and should be clarified first. From my understanding, for intention 1, i.e., per-repetition basis. It means any cancellation of a repetition would not affect other transmission. For the case which Apple said, I prefer the later channel does not overlap with others would be kept transmission. I think it match the intention 1.  One more question, if the later channel is cancelled, how about the previous channel which is not overlapped? From the principle of specification, the cancellation location is up to UE implementation, so anywhere it can decide to cancel, can we assume the previous channel is also cancelled or kept?  For intention 2, for me, all the repetition in one slot would be affected together, which means any of repetition is cancelled, other repetitions in the same slot would be cancelled.  From my perspective, I prefer intention 1, if it means any cancellation of a repetition would not affect other transmissions in the same slot. |
| Nokia, NSB | We do agree with Apple, that based on previous agreements for other cases the cancelation should be per repetition bases.  At the same time, for the specific case of Rel-15 PUCCH repetition, there would be only one PUCCH repetition per slot (i.e. slot-based PUCCH repetition, we don’t support sub-slot PUCCH repetition).  The problem with the formulation in the TP based on QC input basically is, that in the main clause we define the PUCCH including all the repetitions (….‘,including repetitions if any, …), we would then need to be more specific that each PUSCH/PUCCH ‘repetition occasions’ is treated separately. The wording ‘in a slot’ (if placed appropriately) can only cover the case of PUCCH repetition (as slot based), but as Apple pointed out might lead to miss-understanding e.g. for PUSCH repetition Type B operation here. I guess the proposed edits from CATT do not resolve this issue and may make it even worse, as there we talk about one or more slots for the cancelation (which could be even more ambiguous, if all PUCCH repetitions are canceled if a single overlap is detected in one of the slots).  Not sure, it the wording ‘PUSCH / PUCCH occasion’ could be used in here (to cover the case of potential PUSCH &/ PUCCH repetition)? Just as an example for one of the places where this is happening:  *if a transmission of a first PUCCH occasion of larger priority index scheduled by a DCI format in a PDCCH reception would overlap in time with a transmission of a second PUSCH occasion or a second PUCCH occasion of smaller priority index, the UE cancels the transmission of the second PUSCH occasion or the second PUCCH occasion before the first symbol that would overlap with the first PUCCH transmission occasion.* |
| Spreadtrum | Agree with CATT and ZTE that overlapping and dropping should be per-repetition basis. But the selected intention between per-slot-basis and per-repetition bases cannot be clearly seen from current TP. More discussion on the wording of TP should be considered, for example, by updating CATT’s version as:  *When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. Then,*  *- if a transmission of a first PUCCH of larger priority index in a slot scheduled by a DCI format in a PDCCH reception would overlap in timewith a transmission of a second PUSCH or a second PUCCH of smaller priority index in one or more slots, the UE cancels one or more transmission occasions of the second PUSCH or the second PUCCH overlapping in time with the first PUCCH in the one or more slots before the first symbol that would overlap with the first PUCCH transmission.* |
| Sony | As per CATT & ZTE’s comments, we agree that this should be per repetition basis, i.e. point 1) in Apple’s comment. |
| Vivo | We also agree that the overlapping should be handled on a per-repetition basis. Regarding the TP, maybe we can consider to use similar description as that in section 11.2 in TS 38.213 for PUSCH repetition type B, e.g. (repetition of the) PUSCH/PUCCH transmission. For example,  When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, including repetitions if any, the UE first resolves the overlapping for (repetition of the) PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. Then,  - if a transmission of a first PUCCH of larger priority index in one or more slots scheduled by a DCI format in a PDCCH reception would overlap in time with a transmission (with repetition) of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the (repetition of the) transmission of the second PUSCH or the second PUCCH before the first symbol that would overlap with the (repetition of the) first PUCCH transmission  - if a transmission of a first PUSCH of larger priority index in one or more slots scheduled by a DCI format in a PDCCH reception would overlap in time with a transmission (with repetition) of a second PUCCH of smaller priority index, the UE cancels the (repetition of the) transmission of the second PUCCH before the first symbol that would overlap with the (repetition of the) first PUSCH transmission  where  - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6  - the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception  - is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability |
| HW/HiSi | We share the understanding from Apple, CATT and ZTE that prioritization is handled on a per-repetition basis. |
| OPPO | We do agree with Apple, cancelation should be per repetition bases.  In our understanding, if there is no special illustration, e.g. a PUCCH transmission in the consecutive slots, a PUSCH with repetition Type A, and a PUSCH with repetition Type B , ‘a first PUCCH’, ’a second PUCCH’ is a PUCCH transmission or a PUCCH transmission in each of the slots. ‘a second PUSCH’ is a PUSCH transmission or a PUSCH transmission of PUSCH repetitions.  Most procedure in spec is defined for each repetition, if any. So we think our understanding could avoid large amount of similar modification. If we want to highlight repetition, we could add illustration to identify.  So we prefer to TP proposed by QC. |
| Panasonic | We agree with the companies above that prioritization is handled on a per-repetition basis. |
| Samsung | Overlapping is checked per repetition.  OK with TP from QC but without any of the text that mentions ‘slot’ (not needed and may create other issues). |
| Qualcomm | We share the same understanding as the companies above that overlapping shall be handled per repetition, and we think it is OK to remove the term “in a slot” in the CR if it creates confusion. We are also OK with VIVO’s suggestion to make it explicit that only the (repetition of the) PUCCH/PUSCH that overlap with the HP transmission is cancelled. |
| DOCOMO | We agree with Apple and other companies that the prioritization is handled on a per-slot basis. |
| Ericsson | Overlapping resolution is per repetition, similarly to Rel-15.  (Second attempt after crash .. short comments then 😊 )  CATT TP: The approach based on Repetition factor, etc, is not preferable by us. However, this TP has a text that we think it is important to include in the final TP:  In the remaining of this Clause, the multiplexing or prioritization for overlapping channels are for overlapping channels with same priority index.  On QC and Nokia’s TP both are fine. We don’t see issue with adding “a slot” and “the slot” in QC TP. It is in fact important to include otherwise since PUCCH could be with repetition, it is not clear on which slot cancelation happens. We don’t see the need the updates by vivo.  In QC TP, “in the overlapping slot(s)” should change to “in the slot(s) with overlapping ..”  Nokia TP is also fine. Maybe “in each slot where overlap would happen” can be rephrased to “in each slot with overlapping”. |

## Second round proposal and discussions

Based on the first round discussions, companies seem to have the common understanding that prioritization is handled on a per-repetition basis. Then the “slot” can be replaced by a clearer wording as Nokia and Ericsson suggested.

The following updated TP can be considered.

Potential proposal:

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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, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 in each slot with overlapping

- 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 transmission in each slot with overlapping

where

- the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6

- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception

- is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability



------------------------------------ Omitted parts --------------

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

- 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 cell

the UE is expected to cancel the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index in each slot with overlapping.

A UE does not expect to be scheduled to transmit a PUCCH or a PUSCH with smaller priority index that would overlap in time with a PUCCH of larger priority index with HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH. A UE does not expect to be scheduled to transmit a PUCCH of smaller priority index that would overlap in time with a PUSCH of larger priority index with SP-CSI report(s) without a corresponding PDCCH.

In the remaining of this Clause, a UE multiplexes UCIs with same priority index in a PUCCH or a PUSCH. A PUCCH or a PUSCH is assumed to have a same priority index as a priority index of UCIs a UE multiplexes in the PUCCH or the PUSCH.

In the remaining of this Clause, the multiplexing or prioritization for overlapping channels are for overlapping channels with same priority index.

In the remaining of this Clause, if a UE is provided *subslotLengthForPUCCH-r16*, a slot for an associated PUCCH transmission includes a number of symbols indicated by *subslotLengthForPUCCH-r16*.

|  |
| --- |
| **End** |

Companies are encouraged to check it and provide your further comments:

Second round comments from companies:

|  |  |
| --- | --- |
| Company | Comments |
| CATT | The updated proposal is not clear to us. It is not clear whether the slot is defined with respect to the numerology of the HP channel or the LP channel. It is also not clear whether “with overlapping” means that all the repetitions of the second channel within the slot should be cancelled as long as one of them overlaps with the HP channel or only the overlapping repetitions are cancelled. |
| Apple | We also think the updated TP is not clear. The question here is that whether PUCCH or PUSCH refers to a particular repetition or all the repetitions. If it means all the repetitions, we would still have a problem. |
| Qualcomm | In order to reflect the “per-repetition” cancellation aspect, how about the following:  When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 (repetition of the) transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the (repetition of 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 (repetition of the) transmission of a second PUCCH of smaller priority index, the UE cancels the (repetition of the) transmission of the second PUCCH before the first symbol that would overlap with the first PUSCH transmission  where  - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6  - the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception  - is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability |
| Ericsson | As we mentioned in the email, the following approach can address the concern by using initial or repeated transmission.  When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 an initial or repeated 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 an initial or repeated 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 transmission  where  - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6  - the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception  - is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability |
| Ericsson 2 | On the proposed CR by FL, that is:  -     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 repetition of the transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the repetition of the transmission of the second PUSCH or the second PUCCH before the first symbol that would overlap with the first PUCCH transmission  Th issue is that now it covers only the case with repetition and excludes the case without repetition. To ensure that both are supported, the following approach can address the concern by using initial or repeated transmission.  When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 an initial or repeated 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 an initial or repeated 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 transmission  where  - the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6  - the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception  - is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability |
| vivo | From our understanding, the number of PUCCH repetition  can be 1. The formulation of “a repetition of the transmission of a PUCCCH/PUSCH” can cover the case with or without repetition. The proposed CR by FL in the email is fine to us. |
| Nokia, NSB | We would be fine with the ‘Ericsson 2’ suggested version – i.e. using “with an initial or repeated transmission” |
| Samsung | Fine with the proposed CR by FL (BTW, no such thing as “initial of repeated transmission”) |

## Third round proposal and discussions

To clearly express the per-repetition cancellation, the following TP is proposed. It should be understood that he “repetition” includes the initial transmission (i.e. repetition No.1)

Potential proposal:

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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, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 repetition of the transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the repetition of 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 repetition of the transmission of a second PUCCH of smaller priority index, the UE cancels the repetition of the transmission of the second PUCCH before the first symbol that would overlap with the first PUSCH transmission

where

- the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6

- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception

- is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability



------------------------------------ Omitted parts --------------

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

- 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 cell

the UE is expected to cancel the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index.

A UE does not expect to be scheduled to transmit a PUCCH or a PUSCH with smaller priority index that would overlap in time with a PUCCH of larger priority index with HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH. A UE does not expect to be scheduled to transmit a PUCCH of smaller priority index that would overlap in time with a PUSCH of larger priority index with SP-CSI report(s) without a corresponding PDCCH.

In the remaining of this Clause, a UE multiplexes UCIs with same priority index in a PUCCH or a PUSCH. A PUCCH or a PUSCH is assumed to have a same priority index as a priority index of UCIs a UE multiplexes in the PUCCH or the PUSCH.

In the remaining of this Clause, the multiplexing or prioritization for overlapping channels are for overlapping channels with same priority index.

In the remaining of this Clause, if a UE is provided *subslotLengthForPUCCH-r16*, a slot for an associated PUCCH transmission includes a number of symbols indicated by *subslotLengthForPUCCH-r16*.

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| --- |
| **End** |

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| Company | Comments |
| CATT | We agree with the TP in principle except that for the case of LP channel overlapping with HP channel without DCI, the current TP is not clear whether LP channel is cancelled on a per-repetition basis or cancelled altogether. |
| Nokia, NSB | Agree here with CATT.  From the second part of the TP (without a DCI / configured) there it is not clear that the dropping is done on per repetition bases. |
| Qualcomm | Agree with CATT/Nokia. Perhaps we can add the following:  “ …  the UE is expected to cancel the (repetition of) PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index.” |
| ZTE | Agree with CATT/Nokia/Qualcomm. The case of LP channel overlapping with HP channel without DCI should be discussed. The per-repetition base is preferred for this case. |

## Fourth round proposal and discussions

As companies pointed out, the change for the case of LP channel overlapping with HP channel without DCI was added. Please check the updated TP.

Potential proposal:

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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, including repetitions if any, the UE first resolves the overlapping for PUCCH and/or PUSCH transmissions of smaller priority index as described in Clause 9.2.5 and 9.2.6. 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 repetition of the transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the repetition of 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 repetition of the transmission of a second PUCCH of smaller priority index, the UE cancels the repetition of the transmission of the second PUCCH before the first symbol that would overlap with the first PUSCH transmission

where

- the overlapping is applicable before or after resolving overlapping among channels of larger priority index, if any, as described in Clause 9.2.5 and 9.2.6

- the UE expects that the transmission of the first PUCCH or the first PUSCH, respectively, would not start before after a last symbol of the corresponding PDCCH reception

- is the PUSCH preparation time for a corresponding UE processing capability assuming [6, TS 38.214], based on and as subsequently defined in this Clause, and is determined by a reported UE capability



------------------------------------ Omitted parts --------------

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

- 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 cell

the UE is expected to cancel the repetition of the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index.

A UE does not expect to be scheduled to transmit a PUCCH or a PUSCH with smaller priority index that would overlap in time with a PUCCH of larger priority index with HARQ-ACK information only in response to a PDSCH reception without a corresponding PDCCH. A UE does not expect to be scheduled to transmit a PUCCH of smaller priority index that would overlap in time with a PUSCH of larger priority index with SP-CSI report(s) without a corresponding PDCCH.

In the remaining of this Clause, a UE multiplexes UCIs with same priority index in a PUCCH or a PUSCH. A PUCCH or a PUSCH is assumed to have a same priority index as a priority index of UCIs a UE multiplexes in the PUCCH or the PUSCH.

In the remaining of this Clause, the multiplexing or prioritization for overlapping channels are for overlapping channels with same priority index.

In the remaining of this Clause, if a UE is provided *subslotLengthForPUCCH-r16*, a slot for an associated PUCCH transmission includes a number of symbols indicated by *subslotLengthForPUCCH-r16*.

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| **End** |

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| Company | Comments |
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## Proposal from discussion

# Issue #3: Type 1 HARQ-ACK codebook for sub-slot based operation

## Companies’ proposals

* Option 1: Type-1 HARQ-ACK codebook is not supported for sub-slot based HARQ-ACK feedback in Rel-16.
* Option 2: Change the Type-1 HARQ-ACK codebook algorithm to support sub-slot and cross numerologies as belows:
  + Step 1: Determine the HARQ-ACK multiplexing window based on the HARQ-ACK timing set and sub-slot length.
  + Step 2: If a UL sub-slot in the HARQ-ACK window spans multiple DL slots, create a new TDRA table which is the union of the configured TDRA table and the configured TDRA table offset by 14 symbols.
  + Step 3: Split the TDRA table into N sub-tables based on the sub-slot length and PDSCH-to UL sub-slot association. N is the number of sub-slots within a slot.
  + Step 4: Do pruning based on TDD configuration and sub-table per sub-slot similar as Rel-15.

*CATT proposal:*

***Proposal 6: Type-1 HARQ-ACK codebook is not supported for sub-slot based HARQ-ACK feedback in Rel-16.***

A text proposal is provided below for UL transmissions overlapping in 38.213 section 9.1.2.

-------------------------------------------------- Start of text proposal ------------------------------------------------------

9.1.2 Type-1 HARQ-ACK codebook determination

This clause applies if the UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static*.

A UE does not expect to be configured with *pdsch-HARQ-ACK-Codebook = semi-static* for a codebook if a UE is provided *subslotLength-ForPUCCH* for the codebook*.*

A UE reports HARQ-ACK information for a corresponding PDSCH reception or SPS PDSCH release only in a HARQ-ACK codebook that the UE transmits in a slot indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format. The UE reports NACK value(s) for HARQ-ACK information bit(s) in a HARQ-ACK codebook that the UE transmits in a slot not indicated by a value of a PDSCH-to-HARQ\_feedback timing indicator field in a corresponding DCI format.

----------------------------------------------------- End of text proposal ------------------------------------------------------

*Nokia proposal:*

*Proposal 1: Change the Type-1 HARQ-ACK codebook algorithm to support sub-slot and cross numerologies by enhancing the proposal from NEC to four steps:*

* *Step 1: Determine the HARQ-ACK multiplexing window based on the HARQ-ACK timing set and sub-slot length.*
* *Step 2: If a UL sub-slot in the HARQ-ACK window spans multiple DL slots, create a new TDRA table which is the union of the configured TDRA table and the configured TDRA table offset by 14 symbols.*
* *Step 3: Split the TDRA table into N sub-tables based on the sub-slot length and PDSCH-to UL sub-slot association. N is the number of sub-slots within a slot.*
* *Step 4: Do pruning based on TDD configuration and sub-table per sub-slot similar as Rel-15.*

*Proposal 2: Endorse the following draft CR to TS 38.213 Sec. 9.1.2.1 (green text to be shown as track changes in the final CR)*

<omitted text>

**9.1.2.1 Type-1 HARQ-ACK codebook in physical uplink control channel**

For a serving cell , an active DL BWP, and an active UL BWP, as described in Clause 12, the UE determines a set of occasions for candidate PDSCH receptions for which the UE can transmit corresponding HARQ-ACK information in a PUCCH in slot . If serving cell is deactivated, the UE uses as the active DL BWP for determining the set of occasions for candidate PDSCH receptions a DL BWP provided by *firstActiveDownlinkBWP-Id*. The determination is based:



a) on a set of slot timing values associated with the active UL BWP



a) If the UE is configured to monitor PDCCH for DCI format 1\_0 and is not configured to monitor PDCCH for either DCI format 1\_1 or DCI format 1\_2 on serving cell , is provided by the slot timing values {1, 2, 3, 4, 5, 6, 7, 8}



b) If the UE is configured to monitor PDCCH for DCI format 1\_1 and is not configured to monitor PDCCH for DCI format 1\_2 for serving cell , is provided by *dl-DataToUL-ACK*



c) If the UE is configured to monitor PDCCH for DCI format 1\_2 and is not configured to monitor PDCCH for DCI format 1\_1 for serving cell ,  is provided by *dl-DataToUL-ACK-ForDCIFormat1\_2*



d) If the UE is configured to monitor PDCCH for DCI format 1\_1 and DCI format 1\_2 for serving cell ,  is provided by the union of *dl-DataToUL-ACK* and *dl-DataToUL-ACK-ForDCIFormat1\_2*



b) on a set of row indexes of a table that is associated with the active DL BWP and defining respective sets of slot offsets , start and length indicators *SLIV*, and PDSCH mapping types for PDSCH reception as described in [6, TS 38.214], where the row indexes of the table are provided by the union of row indexes of time domain resource allocation tables for DCI formats the UE is configured to monitor PDCCH for serving cell



a) if the UE is provided *ReferenceofSLIV-ForDCIFormat1\_2*, for each row index with slot offset and PDSCH mapping Type B in a set of row indexes of a table for DCI format 1\_2 [6, TS 38.214], for each PDCCH monitoring occasion in a set of PDCCH monitoring occasions with different starting symbols within a slot where the UE monitors PDCCH for DCI format 1\_2 and with starting symbol , if for normal cyclic prefix and for extended cyclic prefix, add a new row index in the set of row indexes of the table by replacing the starting symbol of the row index by



c) on the ratio between the downlink SCS configuration and the uplink SCS configuration provided by *subcarrierSpacing* in *BWP-Downlink* and *BWP-Uplink* for the active DL BWP and the active UL BWP, respectively



d) if provided, on *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* as described in Clause 11.1

e) if *ca-SlotOffset* is provided, on and provided by ca-SlotOffsetfor serving cell , or on and provided by ca-SlotOffsetfor the primary cell, as described in [4, TS 38.211].



*f)*  indicated by *subslotLength-ForPUCCH* in symbols, if provided, otherwise set to 14, resulting into PUCCH slots in a UL slot.



If a UE

- is not provided *CORESETPoolIndex* or is provided *CORESETPoolIndex* with a value of 0 for first CORESETs on active DL BWPs of serving cells, and

- is provided *CORESETPoolIndex* with a value of 1 for second CORESETs on active DL BWPs of the serving cells, and

- is provided *ackNACKFeedbackMode-r16* = *joint*

where

- a serving cell is placed in a first set of serving cells if the serving cell includes a first CORESET, and



- a serving cell is placed in a second set of serving cells if the serving cell includes a second CORESET, and



- serving cells are placed in a set according to an ascending order of a serving cell index

the UE generates a Type-1 HARQ-ACK codebook for the set and the set of serving cells separately by setting and in the following pseudo-code. The UE concatenates the HARQ-ACK codebook generated for the set followed by the HARQ-ACK codebook generated for the set to obtain a total number of  HARQ-ACK information bits.



For the set of slot timing values, the UE determines a set of  occasions for candidate PDSCH receptions or SPS PDSCH releases according to the following pseudo-code. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to a single SPS PDSCH release is same as for a corresponding SPS PDSCH reception. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to multiple SPS PDSCH releases by a single DCI format is same as for a corresponding SPS PDSCH reception with the lowest SPS configuration index among the multiple SPS PDSCH releases.

Set  - index of occasion for candidate PDSCH reception or SPS PDSCH release

Set 

Set 

Set  to the cardinality of set 

Set *k* =0 – index of slot timing values , in descending order of the slot timing values, in set  for serving cell 

– set of TDRA entries associated with a PUCCH slot.



Set – index of a DL slot within an UL slot



If a UE is not provided *ca-SlotOffset* for any serving cell of PDSCH receptions and for the serving cell of corresponding PUCCH transmission with HARQ-ACK information

while



For each row on , for which the PDSCH end symbol *S+L-1* overlaps with the PUCCH slot , modify start OFDM symbol index to to obtain



Set



end while

while



r=0

while



=



Set *S* and *L* to be the start and length of the *r*-th entry in set



if



end

end

end

while 

~~if ~~

~~Set  – index of a DL slot within an UL slot~~

~~while ~~

Set to the set of rows, where



Set  to the cardinality of 

Set  – index of row in set 

if slot  starts at a same time as or after a slot for an active DL BWP change on serving cell  or an active UL BWP change on the PCell and the corresponding DL slot to PUCCH slot ~~slot~~  is before the slot for the active DL BWP change on serving cell  or the active UL BWP change on the PCell



~~;~~



;



else

while 

if the UE is provided *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, ~~for each slot from slot to slot ,~~ at least one symbol of the PDSCH time resource derived by row  in each of the corresponding DL slot and the preceding DL slots is configured as ULwhere  is the *k*-th slot timing value in set ,



;

else

;

end if

end while

if the UE does not indicate a capability to receive more than one unicast PDSCH per slot and ,

;

;

else

Set  to the cardinality of 

Set  to the smallest last OFDM symbol index, as determined by the *SLIV*, among all rows of 

while 

Set 

while 

if  for start OFDM symbol index  for row 

; - index of occasion for candidate PDSCH reception or SPS PDSCH release associated with row 



;

;



;



else

;

end if

end while



;

Set  to the smallest last OFDM symbol index among all rows of ;

end while

end if

~~;~~



;



end if

~~end while~~

~~end if~~

~~;~~



end while

else

while



For each row on , for which the PDSCH end symbol *S+L-1* overlaps with the PUCCH slot modify start OFDM symbol index to to obtain



Set



end while

while



r=0

while



=



Set *S* and *L* to be the start and length of the *r*-th entry in set



if



end

end

end

while 

~~if~~



~~Set – index of a DL slot within an UL slot~~



~~while~~



Set to the set of rows, where



Set  to the cardinality of 

Set  – index of row in set 

if slot  starts at a same time as or after a slot for an active DL BWP change on serving cell  or an active UL BWP change on the PCell and the corresponding DL slot to PUCCH slot



is before the slot for the active DL BWP change on serving cell  or the active UL BWP change on the PCell

;



else

while 

if the UE is provided *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, ~~for each slot from slot to slot ,~~ at least one symbol of the PDSCH time resource derived by row  in each of the corresponding DL slot and the preceding DL slots is configured as ULwhere  is the *k*-th slot timing value in set ,



;

else

;

end if

end while

if the UE does not indicate a capability to receive more than one unicast PDSCH per slot and ,

;

;

else

Set  to the cardinality of 

Set  to the smallest last OFDM symbol index, as determined by the *SLIV*, among all rows of 

while 

Set 

while 

if  for start OFDM symbol index  for row 

; - index of occasion for candidate PDSCH reception or SPS PDSCH release associated with row 



;

;



;



else

;

end if

end while



;

Set  to the smallest last OFDM symbol index among all rows of ;

end while

end if

~~;~~



;



end if

~~end while~~

~~end if~~

~~;~~



end while

end if

If the UE indicates a capability to receive more than one PDSCH per slot, for occasions of candidate PDSCH receptions corresponding to rows of associated with a same value of , where , the UE does not expect to receive more than one PDSCH in a same DL slot.



<omitted text>

*QC proposal:*

|  |  |
| --- | --- |
| ***Reason for change:*** | 1. In TS 38.213 v16.3.0, the Type-1 HARQ-ACK codebook design as provided in Section 9.1.2.1 is broken for TDD and when the UE is provided by *subslotLength-ForPUCCH.*  2. The Type-1 HARQ-ACK codebook design as provided in Section 9.1.2.1 results in a large redundancy in the codebook size, when the UE is provided by *subslotLength-ForPUCCH.* |
|  |  |
| ***Summary of change:*** | The pesudo code in Section 9.1.2.1 was modified to account for   1. The slot denotes subslot instead of slot  1. To determine the PDSCH occasions for the Type 1 HARQ-ACK CB, SLIV entries that does not end in the subslot is removed from counting. |
|  |  |
| ***Consequences if not approved:*** | The Type 1 HARQ-ACK codebook as provided in Section 9.1.2.1 is broken for TDD and when the UE is provided by subslotLength-ForPUCCH. |

|  |
| --- |
| **Modified clause (Section 9 of 38.212)** |

For the set of slot timing values, the UE determines a set of  occasions for candidate PDSCH receptions or SPS PDSCH releases according to the following pseudo-code. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to a single SPS PDSCH release is same as for a corresponding SPS PDSCH reception. A location in the Type-1 HARQ-ACK codebook for HARQ-ACK information corresponding to multiple SPS PDSCH releases by a single DCI format is same as for a corresponding SPS PDSCH reception with the lowest SPS configuration index among the multiple SPS PDSCH releases.

Set  - index of occasion for candidate PDSCH reception or SPS PDSCH release

Set 

Set 

Set  to the cardinality of set 

Set *k* =0 – index of slot timing values , in descending order of the slot timing values, in set  for serving cell 

If the UE is provided *subslotLength-ForPUCCH*

Set to be the number of subslots contained in an uplink slot on the PUCCH cell



else

Set



end if

If a UE is not provided *ca-SlotOffset* for any serving cell of PDSCH receptions and for the serving cell of corresponding PUCCH transmission with HARQ-ACK information

while 

if mod𝑛𝑈 −𝐾1,𝑘𝑁slotsubslot+1,max2𝜇𝑈𝐿−𝜇𝐷𝐿,1=0 or if the UE is provided *subslotLength-ForPUCCH*



Set  – index of a DL slot within an UL slot

while



Set  to the set of rows

Set  to the cardinality of 

Set  – index of row in set 

if slot  starts at a same time as or after a slot for an active DL BWP change on serving cell  or an active UL BWP change on the PCell and slot is before the slot for the active DL BWP change on serving cell  or the active UL BWP change on the PCell



;



else

while 

if the UE is provided *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, for each slot from slot to slot , at least one symbol of the PDSCH time resource derived by row  is configured as ULwhere  is the *k*-th slot timing value in set ,



;

else if the UE is provided *subslotLength-ForPUCCH* and the end of the PDSCH time resource derived by row r in slot does not overlap with the PUCCH slot



;

else

;

end if

end while

if the UE does not indicate a capability to receive more than one unicast PDSCH per slot and ,

;

;

else

Set  to the cardinality of 

Set  to the smallest last OFDM symbol index, as determined by the *SLIV*, among all rows of 

while 

Set 

while 

if  for start OFDM symbol index  for row 

; - index of occasion for candidate PDSCH reception or SPS PDSCH release associated with row 

;

;

else

;

end if

end while



;

Set  to the smallest last OFDM symbol index among all rows of ;

end while

end if

;



end if

end while

end if

;

end while

else

while 

if or if the UE is provided *subslotLength-ForPUCCH*



Set  – index of a DL slot within an UL slot

while 

Set  to the set of rows

Set  to the cardinality of 

Set  – index of row in set 

if slot  starts at a same time as or after a slot for an active DL BWP change on serving cell  or an active UL BWP change on the PCell and slot



is before the slot for the active DL BWP change on serving cell  or the active UL BWP change on the PCell

;



else

while 

if the UE is provided *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated* and, for each slot from slot to slot , at least one symbol of the PDSCH time resource derived by row  is configured as ULwhere  is the *k*-th slot timing value in set ,



;

else if the UE is provided *subslotLength-ForPUCCH* and the end of the PDSCH time resource derived by row r in slot does not overlap with the slot



;

else

;

end if

end while

if the UE does not indicate a capability to receive more than one unicast PDSCH per slot and ,

;

;

else

Set  to the cardinality of 

Set  to the smallest last OFDM symbol index, as determined by the *SLIV*, among all rows of 

while 

Set 

while 

if  for start OFDM symbol index  for row 

; - index of occasion for candidate PDSCH reception or SPS PDSCH release associated with row 

;

;

else

;

end if

end while



;

Set  to the smallest last OFDM symbol index among all rows of ;

end while

end if

;



end if

end while

end if

;

end while

end if

|  |
| --- |
| **End** |

## Discussion status

## First round proposal and discussions

* Option 1: Type-1 HARQ-ACK codebook is not supported for sub-slot based HARQ-ACK feedback in Rel-16.
  + Apple, CATT, ZTE, Spreadtrum, Sony, vivo, Huawei/HiSilicon, OPPO, Panasonic, Samsung, DOCOMO
  + Arguments:
    - This issue has been intensively discussed in the previous meetings. No need to introduce the support at the very late stage of Rel-16 maintenance.
    - This topic is also included as part of Rel-17 study.
* Option 2: Change the Type-1 HARQ-ACK codebook algorithm to support sub-slot and cross numerologies as belows:
  + Step 1: Determine the HARQ-ACK multiplexing window based on the HARQ-ACK timing set and sub-slot length.
  + Step 2: If a UL sub-slot in the HARQ-ACK window spans multiple DL slots, create a new TDRA table which is the union of the configured TDRA table and the configured TDRA table offset by 14 symbols.
  + Step 3: Split the TDRA table into N sub-tables based on the sub-slot length and PDSCH-to UL sub-slot association. N is the number of sub-slots within a slot.
  + Step 4: Do pruning based on TDD configuration and sub-table per sub-slot similar as Rel-15.
  + Nokia, Qualcomm (modification to Step 3), Ericsson
  + Arguments:
    - Given that we have introduced sub-slots PUCCH in Rel-16, it seems obvious to resolve the identified issues when sub-slots PUCCH is configured with Type-1 HARQ-ACK codebook within Rel-16. It will be incomplete if sub-slot based Type 1 HARQ-ACK codebook is not supported in Rel-16.
    - Type-1 for sub-slot can be supported without optimization of payload size in Rel-16 and do further enhancement in Rel-17.
    - If not supporting all the steps of Option 2 (which are needed to really have the Type 1-CB for subslot PUCCH as small as possible), then we would prefer to not support it in Rel-16. Especially for 2OS sub-slot PUCCH, having the Type 1 CB larger than needed would result in extreme inefficiencies (as 2OS sub-slot PUCCH due to DM-RS overhead is very inefficient for larger payload sizes already).

|  |  |
| --- | --- |
| Company | Comments |
| Apple | Option 1.  We are in a very late stage of Rel-16 maintenance already, and this topic is also included as part of Rel-17 study. We do not see a need to introduce the support at this stage. |
| CATT | Option 1 as indicated in our contribution. |
| ZTE | Option 1. The specification work for Type-1 HARQ-ACK codebook with sub-slot based HARQ-ACK could leave to Rel-17. |
| Nokia, NSB | Option 2  Given that we have introduced sub-slots PUCCH in Rel-16, it seems obvious to resolve the identified issues when sub-slots PUCCH is configured with Type-1 HARQ-ACK codebook within Rel-16.  If not supporting all the steps of Option 2 (which are needed to really have the Type 1-CB for subslot PUCCH as small as possible), then we would prefer to not support it in Rel-16. Especially for 2OS sub-slot PUCCH, having the Type 1 CB larger than needed would result in extreme inefficiencies (as 2OS sub-slot PUCCH due to DM-RS overhead is very inefficient for larger payload sizes already). |
| Spreadtrum | Option1. |
| Sony | Option 1. |
| vivo | Option 1.  This issue has been intensively discussed in the previous meetings. We have never agreed to support sub-slot based type 1 HARQ-ACK, at this time stage, option 2 is not acceptable to us and we can leave it to Rel-17 study. |
| HW/HiSi | We slightly support option1. It is better to go with a clear conclusion that it is not supported in R16 and then discuss how to support this feature in R17. |
| OPPO | Option 1  At the late stage of Rel-16 maintenance, we prefer leave it to Rel-17 |
| Panasonic | Option 1 |
| Samsung | Option 1 (topic should not have even been brought up for discussion) |
| Qualcomm | Agree with Option 2 in principle. Essentially the only aspect missing from the current spec is Step 3, which is revised below to reflect the PDSCH to UL sub-slot association rule. Also slightly edited the QC proposal, since it was not displayed correctly.  Option 2: Change the Type-1 HARQ-ACK codebook algorithm to support sub-slot and cross numerologies as belows:   * + Step 1: Determine the HARQ-ACK multiplexing window based on the HARQ-ACK timing set and sub-slot length.   + Step 2: If a UL sub-slot in the HARQ-ACK window spans multiple DL slots, create a new TDRA table which is the union of the configured TDRA table and the configured TDRA table offset by 14 symbols.   + Step 3: Split the TDRA table into N sub-tables based on the sub-slot length and PDSCH-to UL sub-slot association. A PDSCH TDRA is associated with a UL sub-slot if the end of the PDSCH overlaps with the UL sub-slot. N is the number of sub-slots within a slot.   + Step 4: Do pruning based on TDD configuration and sub-table per sub-slot similar as Rel-15.   We have introduced sub-slot based HARQ-ACK feedback in Rel-16 as a major feature to reduce latency for URLLC. It will be incomplete if sub-slot based Type 1 HARQ-ACK codebook is not supported in Rel-16.  Would companies that support Option 1 express their motivation to support the feature in Rel-17 but not in Rel-16? If there’re other proposals on how to support sub-slot based Type 1 HARQ-ACK, we are open to discuss them. |
| DOCOMO | Option 1  Although we think this feature should be supported for robust HARQ-ACK feedback, considering the situation that it is a very late stage of Rel.16 maintenance, we are OK to discuss further in Rel.17 |
| Ericsson | We are supportive of Option 2.  Our view has been that type-1 HARQ-ACK codebook due to its reliability, it very important for URLLC. We would have been fine to support Type-1 for sub-slot without optimization of payload size in Rel-16 and do further enhancement in Rel-17.  It seems the proponents of Type-1, would like to minimize size in Rel-16 which seems not to be agreeable to opponent of Type-1.  If it is not supported in Rel-16, from our point of view, we should definitely support it in Rel-17. |

## Second round proposal and discussions

Potential proposal:

Type-1 HARQ-ACK codebook is not supported for sub-slot based HARQ-ACK feedback in Rel-16.

Companies are encouraged to check it and provide your further comments:

|  |  |
| --- | --- |
| Company | Comments |
| CATT | We support the proposal. |
| Apple | Support |
| Qualcomm | We do not support the proposal. It seems that most companies that supported Option 1 still think that the feature is useful, but is concerned about “introducing the feature at the late stage”. In our view, the feature is already supported in the spec in Rel-16, we are not introducing a new feature. There’re some issues with the existing spec, but it is not hard to fix. Both Qualcomm and Nokia have proposed TP to fix the issues, and both can work. There are no technical concerns raised by any other companies.  As such, we do not see why we should abandon the feature and leave it to Rel-17. |
| Ericsson | Our preference is still to support Type-1 for sub-slot. |
| vivo | Support |
| Nokia, NSB | As QC & E///, also our preference would be to still support this in Rel-17 (as Qualcomm & Ericsson above).  But we acknowledge the rather strong majority of companies here preferring to not do this in Rel-16, and we would need all companies agreements to a CR to do this still in Rel-16… (which unfortunately seems to be rather unlikely at this point) |
| Samsung | Support the proposal |

## Proposal from discussion

**Possible Conclusion (for Issue#3)**

Type-1 HARQ-ACK codebook is not supported for sub-slot based HARQ-ACK feedback in Rel-16.

(Note from Younsun: On the above conclusion, given we have discussed this issue for multiple meetings, we will not treat this issue again in RAN1#104-e even if we cannot take the above conclusion.)

# Issue #4: Timing for secondary cell activation / deactivation

## Companies’ proposals

The activation time of MAC-CE for sub-slot based HARQ-ACK report was discussed in last meeting. For SCell activation and deactivation, slot is used to determine the activation time, where  is , when sub-slot based PUCCH transmission is configured, the unit of *k*1 is sub-slot, but the unit of  is slot. Therefore, the ambiguity occurs in the specification.

*CATT proposal:*

***Proposal 3: Adopt the following TP for section 4.3 of TS38.213.***

-------------------------------------------------- Start of text proposal ------------------------------------------------------

**4.3 Timing for secondary cell activation / deactivation**

When a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot, except for the following:

- the actions related to CSI reporting on a serving cell that is active in slot 

- the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot

- the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.

The value of  is where  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission.



If a UE receives a deactivation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot *.*



If the *sCellDeactivationTimer* associated with the secondary cell expires in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell.

----------------------------------------------------- End of text proposal ------------------------------------------------------

*Nokia proposal:*

**Proposal 2: Adopt the following draft CR to clarify the SCell activation / deactivation timing with sub-slot PUCCH configuration (changes in green, to be shown as track changes in the final CR)**

<omitted text>

**4.3 Timing for secondary cell activation / deactivation**

With reference to slots for PUCCH transmissions, when a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell ending in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot , except for the following:

- the actions related to CSI reporting on a serving cell that is active in slot 

- the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot 

- the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.

The value of is defined as , where *m* is the slot where UE transmits PUCCH with HARQ-ACK for the PDSCH carrying the activation command  ~~is where, is a number of slots for a PUCCH transmission with HARQ-ACK information for the PDSCH reception and is indicated by the PDSCH-to-HARQfeedback timing indicator field in the DCI format scheduling the PDSCH reception~~ as described in Clause 9.2.3 and  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission.



<omitted text>

*vivo proposal:*

Proposal : Slot should be used when defining the effective time of MAC-CE when a UE is provided *subslotLength-ForPUCCH.*

Proposal : Adopt the following text proposal for timing for SCell activation/deactivation in 38.213.

-------------------------------------------------- Start of text proposal ------------------------------------------------------

4.3 Timing for secondary cell activation / deactivation

With reference to slots for PUCCH transmissions, when a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell and transmits corresponding HARQ-ACK in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot , except for the following:

- the actions related to CSI reporting on a serving cell that is active in slot 

- the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot 

- the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.

The value of  is where  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission.



With reference to slots for PUCCH transmissions, if a UE receives a deactivation command [11, TS 38.321] for a secondary cell and transmits corresponding HARQ-ACK in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot *.*

If the *sCellDeactivationTimer* associated with the secondary cell expires in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell.

\*\*\* Unchanged text is omitted \*\*\*

----------------------------------------------------- End of text proposal ------------------------------------------------------

Text proposal for correction for timing of applying spatial setting for a PUCCH transmission is provided in the following section 2.2.

*ZTE proposal:*

***Proposal 3:*** *The UE applies SCell activation or deactivation command no early than the 3+ 1 slots after the PUCCH with HARQ-ACK corresponding to the PDSCH carrying the activation command. Adopt following text change for clause 4.3 in TS 38.213.*

**--------------------------------------------Text Proposal 3 for Section 4.3 in TS38.213 [1]-----------------------------------**

|  |
| --- |
| 4.3 Timing for secondary cell activation / deactivation <---------------------------Other parts are omitted ------------------------------->  With reference to slots for PUCCH transmissions, when a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell and the PUCCH transmission with HARQ-ACK information for the PDSCH reception ends in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot , except for the following:  - the actions related to CSI reporting on a serving cell that is active in slot  - the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot  - the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.  The value of  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission.  <---------------------------Other parts are omitted ------------------------------->  **Reasons for change**  Remedy the unexpected long latency for SCell activation or deactivation when the sub-slot based PUCCH transmissions are configured  **Summary of changes**  redefine that UE applying the SCell activation or deactivation command always refers to the PUCCH transmission but not the PDSCH carrying the activation command  **Specs/Sections impacted**  TS 38.213, Section 4.3  **Consequences if not approved:**  unexpected latency for SCell activation or deactivation when the sub-slot based PUCCH transmissions are configured |

## Discussion status

## First round proposal and discussions

Considering the TP proposed by CATT, companies are encouraged to express your views:

-------------------------------------------------- Start of text proposal ------------------------------------------------------

**4.3 Timing for secondary cell activation / deactivation**

When a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot, except for the following:

- the actions related to CSI reporting on a serving cell that is active in slot 

- the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot

- the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.

The value of  is where  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission.



If a UE receives a deactivation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot *.*



If the *sCellDeactivationTimer* associated with the secondary cell expires in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell.

----------------------------------------------------- End of text proposal ------------------------------------------------------

|  |  |
| --- | --- |
| Company | Comments |
| Apple | We are fine with the TP. |
| CATT | Support the TP. |
| ZTE | Support FL’s proposal. The four companies TPs are almost the same solution with some wording difference. |
| Nokia, NSB | Support the TP |
| Spreadtrum | Support the TP. |
| vivo | We are fine with the TP. |
| HW/HiSi | Agree with the FL proposal |
| OPPO | Support the TP |
| Panasonic | We are fine with the TP. |
| Samsung | Do not support the TP - understand the intention but the change is unnecessarily extensive and would introduce incompatible text with respect to Rel-15 specifications. A same statement as in Clause 9 can be added.  If a UE is provided *subslotLengthForPUCCH-r16*, a slot for an associated PUCCH transmission includes a number of symbols indicated by *subslotLengthForPUCCH-r16*. |
| Qualcomm | We are fine with the TP. |
| DOCOMO | Support the TP |
| Ericsson | We don’t support the TP.  Not clear why K1 is removed. As Samsung mentioned, we also believe it creates NBC issues and it is not clear, why because of sub-slot configuration, we change the behavior for slot-based and remove K1.  It seems the issue can be resolved by having sub-slot granularity for determining the slot/sub-slot for PUCCH. It means 1+3N or N should be scaled by number of sub-slots per slot.  Therefore, such a change perhaps can perhaps solve the issue where notations by Nokia for Issue#3 is used:  k1+3N+1 -> k1 +Ns(1+3N) ….  N+3N ->3\*Ns\*N  indicated by *subslotLength-ForPUCCH* in symbols, if provided, otherwise set to 14, resulting into PUCCH slots in a UL slot. |
| Fujitsu | We have no problem with the intension of the TP.  **In the proposed TP, the parameter of *k*1 is removed and the meaning of the parameter *n* is completely changed compared with the Rel-15 specification.** Considering that the UE behavior is actually kept unchanged, the obvious text change made in the proposed TP may lead unnecessary misunderstanding of implementation engineers.  We more prefer to keep the Rel-15 specification as much as possible and add an additional sentence or paragraph to solve the Rel-16 issue. This would help to maintain the consistency of specification.   |  | | --- | | 4.3 Timing for secondary cell activation / deactivation With reference to slots for PUCCH transmissions, when a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell ending in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot , except for the following:  - the actions related to CSI reporting on a serving cell that is active in slot  - the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot  - the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.  The value of  is  where  is a number of slots for a PUCCH transmission with HARQ-ACK information for the PDSCH reception and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format scheduling the PDSCH reception as described in Clause 9.2.3 and  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission. In the case that the PUCCH transmission is according to *subslotLength-ForPUCCH*, is a slot offset between the PUCCH transmission and the corresponding PDSCH reception.  With reference to slots for PUCCH transmissions, if a UE receives a deactivation command [11, TS 38.321] for a secondary cell ending in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot *.*  If the *sCellDeactivationTimer* associated with the secondary cell expires in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell.  < Unchanged parts are omitted > | |

## Second round proposal and discussions

Potential proposal:

Add the following sentence in Section 4.3 of TS 38.213:

* If a UE is provided *subslotLengthForPUCCH-r16*, a slot for an associated PUCCH transmission includes a number of symbols indicated by *subslotLengthForPUCCH-r16*.

Companies are encouraged to check it and provide your further comments:

|  |  |
| --- | --- |
| Company | Comments |
| CATT | We disagree with the proposal which would determine a different MAC CE activation time compared with Rel-15 as shown in the figure below assuming 15kHz SCS.    We would like to clarify that our proposal does not change Rel-15 behavior as also commented by other companies because we changed the definition of slot n from the slot of PDSCH to PUCCH carrying HARQ-ACK. |
| Apple | We do not think the added sentence actually addresses the issue. |
| Qualcomm | We share the same view with CATT and Apple. The proposal doesn’t solve the problem. |
| Ericsson | We share the same view as QC, CATT and Apple.  We think for the TP, it is important to consider following:   * The slot duration is 14 symbols, * Not to change the definition of slot n, as in CATT TP. The reason is due to the requirements in [10, TS 38.133]. * As CATT illustrated, when PUCCH is transmitted in a sub-slot, still the slot that include PUCCH is considered as the Reference (as shown by CATT). |
| Ericsson 2 | Our understanding for the need of CR is that when k=k1+1+3Nsubframe, in case of sub-slot, k1 and Nsubframe have different granularity. For example, in case of 15 kHz, and sub-slot of 7 symbols, if k1 in DCI is indicated as 3, slot n+k in our understanding should be as shown below.  That is we have to take into account that “slot” that PUCCH is transmitted, that is slot n+2, and add “1+3N=4” slots to that to obtain slot “n+k=n+6”    With that understanding, we think the TP can simply be the following where we don’t say k1 is obtained from DCI, but we are saying that k1 is number of slots form n. In 9.2.3, it is clearly specified how to determine the slot with PUCCH transmission in case of slot or sub-slot.   |  | | --- | | Timing for secondary cell activation / deactivation With reference to slots for PUCCH transmissions, when a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell ending in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot cid:image019.png@01D6B08C.7D775190, except for the following:  -    the actions related to CSI reporting on a serving cell that is active in slot cid:image019.png@01D6B08C.7D775190  -    the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot cid:image019.png@01D6B08C.7D775190  -    the actions related to CSI reporting on a serving cell which is not active in slot cid:image019.png@01D6B08C.7D775190that the UE applies in the earliest slot after cid:image019.png@01D6B08C.7D775190 in which the serving cell is active.  The value of cid:image020.png@01D6B08C.7D775190 is cid:image021.png@01D6B08C.7D775190 where cid:image018.png@01D6B08C.7D775190 is a number of slots from slot *n* for a PUCCH transmission with HARQ-ACK information for the PDSCH reception ~~and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format scheduling the PDSCH reception~~ as described in Clause 9.2.3 and cid:image022.png@01D6B08C.7D775190 is a number of slots per subframe for the SCS configuration cid:image023.png@01D6B08C.7D775190 of the PUCCH transmission.  With reference to slots for PUCCH transmissions, if a UE receives a deactivation command [11, TS 38.321] for a secondary cell ending in slot cid:image024.png@01D6B08C.7D775190, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot cid:image019.png@01D6B08C.7D775190*.*  If the *sCellDeactivationTimer* associated with the secondary cell expires in slot cid:image024.png@01D6B08C.7D775190, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot cid:image025.png@01D6B08C.7D775190 where cid:image026.png@01D6B08C.7D775190 is the SCS configuration for PDSCH reception on the secondary cell. | |
| vivo | We share the same view with CATT and Apple. |
| Nokia, NSB | Agree with other companies above, that the FL proposal is not solving the issue at hand.  On the proposed change by ‘Ericsson 2’ above, if we refer here to slot, it may be ambiguous if this is really the slot (.. and not the sub-slot?) as we have not been distinguishing between slot and sub-slot but are referring to slot (and this is to be replaced by sub-slot if configured). |
| Samsung | We view the suggested text by the FL as a clarification that, although OK, is not essential.  No change is needed to the current text in 38.213 – k1 is the HARQ-ACK timing – that has nothing to do with whether k1 is in slots, subslots, symbols, or frames. |

## Third round proposal and discussions

Potential proposal:

Down-select from the two options:

* Option 1: No change to spec
  + Samsung
* Option 2: Adopt the following TP:
  + CATT, Apple, ZTE, Nokia/NSB, vivo, HW/HiSi, Spreadtrum, OPPO, Qualcomm, DOCOMO
  + Ericsson, Fujitsu think the TP introduce a NBC change

-------------------------------------------------- Start of text proposal ------------------------------------------------------

**4.3 Timing for secondary cell activation / deactivation**

When a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot, except for the following:

- the actions related to CSI reporting on a serving cell that is active in slot 

- the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot

- the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.

The value of  is where  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission.



If a UE receives a deactivation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot *.*



If the *sCellDeactivationTimer* associated with the secondary cell expires in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell.

----------------------------------------------------- End of text proposal ------------------------------------------------------

Companies are encouraged to check it and provide your further comments:

|  |  |
| --- | --- |
| Company | Comments |
| CATT | We support the TP and do not agree with the comment that the TP is NBC. |
| HW/HiSi | Same view as CATT. We agree with the TP and it is not NBC in our view. |
| Fujitsu | We do not support this TP.  In our understanding, if the definition of slot n is changed from the PDSCH slot to the PUCCH slot, another CR to 38.133 clause 8.3 will be required.  For reference, the relevant description in 38.133 is listed below. It is noticed that the definition of THARQ is the timing between DL data transmission and acknowledgement. More details of THARQ is as specified in 38.213. If we change the definition of slot n from the PDSCH slot to the PUCCH slot, the description in 38.213 related to THARQ will be lost. In this way, another CR to 133 could be needed.  We more prefer the TP proposed by Ericsson. At least Sorour’s TP could be the baseline for further discussion.   |  | | --- | | “ TS38.133 section 8.3.2 8.3.2 SCell Activation Delay Requirement for Deactivated SCell …  Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot , where:  THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]  …” | |
| Nokia, NSB | We support the TP and agree with the comments by CATT & HW/HiSi: there is no NBC issue here. |
| Qualcomm | We do support the intention of the TP. However, the issue pointed out by Fujitsu is also valid. And we also prefer the TP provided Ericsson, which has the same meaning technically as CATT TP, but do not change the definition of the slot n. |
| ZTE | We agree the TP, a corresponding CR could be proposed in 38.133 as mentioned by Fujitsu. We also think there is no NBC issue. |

## Fourth round proposal and discussions

Potential proposal:

Down-select from the two options:

* Option 1: Adopt the TP 1 (changing the definition of the slot n) below
  + Corresponding CR for changing the definition of the slot n is needed for TS 38.133 to change
  + CATT (not NBC), Apple, ZTE (not NBC), Nokia/NSB (not NBC), vivo, HW/HiSi (not NBC), Spreadtrum, OPPO, DOCOMO
  + Ericsson, Fujitsu think the TP introduces a NBC change
* Option 2: Adopt the TP 2 (not changing the definition of the slot n) below
  + E///, Qualcomm

**TP1 (from CATT)**

-------------------------------------------------- Start of text proposal ------------------------------------------------------

**4.3 Timing for secondary cell activation / deactivation**

When a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot, except for the following:

- the actions related to CSI reporting on a serving cell that is active in slot 

- the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot

- the actions related to CSI reporting on a serving cell which is not active in slot that the UE applies in the earliest slot after  in which the serving cell is active.

The value of  is where  is a number of slots per subframe for the SCS configuration  of the PUCCH transmission.



If a UE receives a deactivation command [11, TS 38.321] for a secondary cell and would transmit a PUCCH with corresponding HARQ-ACK in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot *.*



If the *sCellDeactivationTimer* associated with the secondary cell expires in slot , the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot  where  is the SCS configuration for PDSCH reception on the secondary cell.

----------------------------------------------------- End of text proposal ------------------------------------------------------

**TP2 (from Ericsson)**

|  |
| --- |
| Timing for secondary cell activation / deactivation With reference to slots for PUCCH transmissions, when a UE receives in a PDSCH an activation command [11, TS 38.321] for a secondary cell ending in slot *n*, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133] and no earlier than slot cid:image019.png@01D6B08C.7D775190, except for the following:  -    the actions related to CSI reporting on a serving cell that is active in slot cid:image019.png@01D6B08C.7D775190  -    the actions related to the *sCellDeactivationTimer* associated with the secondary cell [11, TS 38.321] that the UE applies in slot cid:image019.png@01D6B08C.7D775190  -    the actions related to CSI reporting on a serving cell which is not active in slot cid:image019.png@01D6B08C.7D775190that the UE applies in the earliest slot after cid:image019.png@01D6B08C.7D775190 in which the serving cell is active.  The value of cid:image020.png@01D6B08C.7D775190 is cid:image021.png@01D6B08C.7D775190 where cid:image018.png@01D6B08C.7D775190 is a number of slots from slot *n* for a PUCCH transmission with HARQ-ACK information for the PDSCH reception ~~and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format scheduling the PDSCH reception~~ as described in Clause 9.2.3 and cid:image022.png@01D6B08C.7D775190 is a number of slots per subframe for the SCS configuration cid:image023.png@01D6B08C.7D775190 of the PUCCH transmission.  With reference to slots for PUCCH transmissions, if a UE receives a deactivation command [11, TS 38.321] for a secondary cell ending in slot cid:image024.png@01D6B08C.7D775190, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in slot cid:image019.png@01D6B08C.7D775190*.*  If the *sCellDeactivationTimer* associated with the secondary cell expires in slot cid:image024.png@01D6B08C.7D775190, the UE applies the corresponding actions in [11, TS 38.321] no later than the minimum requirement defined in [10, TS 38.133], except for the actions related to CSI reporting on an activated serving cell which the UE applies in the first slot that is after slot cid:image025.png@01D6B08C.7D775190 where cid:image026.png@01D6B08C.7D775190 is the SCS configuration for PDSCH reception on the secondary cell. |

Companies are encouraged to check it and provide your further comments:

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## Proposal from discussion

# Conclusions

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