**3GPP TSG RAN WG1 #108-e** **R1-220xxxx**

**e-Meeting, February 21st – March 3rd, 2022**

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| *CR-Form-v12.2* |
| **DRAFT CHANGE REQUEST** |
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|  | **38.213** | **CR** |  | **rev** |  | **Current version:** | **17.0.0** |  |
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| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network |  | Core Network |  |

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| ***Title:***  | Corrections on IIoT/URLLC enhancements in NR |
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| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** | R1 |
|  |  |
| ***Work item code:*** | NR\_IIOT\_URLLC\_enh-Core |  | ***Date:*** | 2022-03-11 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Corrections on IIoT/URLLC enhancements in NR. |
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| ***Summary of change:*** | 1. Capture agreements from RAN1#107bis-e and RAN1#108-e on intra-UE multiplexing in clause 9.
2. Update k1 set for Type-1 HARQ-ACK codebook in case of PUCCH cell switching in clause 9.1.2.1.
3. Capture use of the MCS field and the slot range for indication of a slot with HARQ-ACK information that is to be retransmitted in clause 9.1.5.
4. Capture support for inclusion of HARQ-ACK information for SPS PDSCHs in a triggered report of HARQ-ACK information in clause 9.1.5.
5. Capture that when a UE drops in a slot a first PUCCH with first HARQ-ACK due to collision with a transmitted second PUCCH with second HARQ-ACK and is indicated the slot for a triggered HARQ-ACK report, the UE reports the second HARQ-ACK in clause 9.1.5.
6. Capture that HARQ-ACK CB retransmission is by DL DCI with CRC scrambled by C-RNTI/MCS-C-RNTI in clause 9.1.5.
7. Update pseudo-code in clause 9.2.5 to include the case of UCI with different priority and multiplexing in HP PUCCH.
8. Capture (a) multiplexing of HP HARQ-ACK and LP HARQ-ACK of one bit each using PUCCH format 0/1 and (b) inclusion of HP SR and use of PUCCH format 2 for multiplexing LP HARQ-ACK with HP HARQ-ACK in clause 9.2.5.3.
9. Capture that a (a) UE does not expect to configured for SPS HARQ-ACK deferral and PUCCH repetitions for a same priority and (b) a clarification from an agreed TP in clause 9.2.5.4.
10. Include beta\_offset values for LP HARQ-ACK multiplexing in HP PUSCH in clasue 9.3.
11. Capture mapping of PUCCH Cell indicator bit value to the PCell or the PUCCH-sSCell.
12. Other miscellaneous corrections/alignments.
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| ***Consequences if not approved:*** | Incomplete support for IIoT/URLLC enhancements in NR. |
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| ***Clauses affected:*** | 9, 9A, 9.1.2.1, 9.1.5, 9.2.5, 9.2.5.3, 9.2.5.4, 9.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS 38.211, TS 38.212, TS 38.214 |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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

# 9 UE procedure for reporting control information

If a UE is configured with a SCG, the UE shall apply the procedures described in this clause for both MCG and SCG.

- When the procedures are applied for MCG, the terms 'secondary cell', 'secondary cells' , 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell, serving cells belonging to the MCG respectively.

- When the procedures are applied for SCG, the terms 'secondary cell', 'secondary cells', 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells (not including PSCell), serving cell, serving cells belonging to the SCG respectively. The term 'primary cell' in this clause refers to the PSCell of the SCG.

If a UE is configured with a PUCCH-SCell, the UE shall apply the procedures described in this clause for both primary PUCCH group and secondary PUCCH group

- When the procedures are applied for the primary PUCCH group, the terms 'secondary cell', 'secondary cells' , 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells, serving cell, serving cells belonging to the primary PUCCH group respectively.

- When the procedures are applied for secondary PUCCH group, the terms 'secondary cell', 'secondary cells', 'serving cell', 'serving cells' in this clause refer to secondary cell, secondary cells (not including the PUCCH-SCell), serving cell, serving cells belonging to the secondary PUCCH group respectively. The term 'primary cell' in this clause refers to the PUCCH-SCell of the secondary PUCCH group. If *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16* is provided, *pdsch-HARQ-ACK-Codebook* is replaced by *pdsch-HARQ-ACK-Codebook-secondaryPUCCHgroup-r16*. If *harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup* is provided, *harq-ACK-SpatialBundlingPUCCH* is replaced by *harq-ACK-SpatialBundlingPUCCH-secondaryPUCCHgroup*. If *harq-ACK-SpatialBundlingPUSCH-secondaryPUCCHgroup* is provided, *harq-ACK-SpatialBundlingPUSCH* is replaced by *harq-ACK-SpatialBundlingPUSCH-secondaryPUCCHgroup*. If *UCI-MuxWithDifferentPriority-secondaryPUCCHgroup* is provided, *UCI-MuxWithDifferentPriority* is replaced by *UCI-MuxWithDifferentPriority-secondaryPUCCHgroup*. If *simultaneousPUCCH-PUSCH-secondaryPUCCHgroup* is provided, *simultaneousPUCCH-PUSCH* is replaced by *simultaneousPUCCH-PUSCH-secondaryPUCCHgroup*.

For unpaired spectrum operation, if a UE is provided a PUCCH-sSCell as described in clause 9.A, the UE shall apply the procedures described in this clause for both the primary cell and the PUCCH-sSCell.

If a UE is provided *pdsch-HARQ-ACK-CodebookList-r16*, *pdsch-HARQ-ACK-Codebook* is replaced by the relevant entry in *pdsch-HARQ-ACK-CodebookList-r16*.

In the remaining of this clause, when a PDCCH reception by a UE includes two PDCCH candidates from corresponding search space sets, as described in clause 10.1

- a PDCCH monitoring occasion is the union of the PDCCH monitoring occasions for the two PDCCH candidates

- the start of the PDCCH reception is the start of the earlier PDCCH candidate

- the end of the PDCCH reception is the end of the PDCCH candidate that ends later

The PDCCH reception includes the two PDCCH candidates also when the UE is not required to monitor one of the two PDCCH candidates as described in clauses 10, 11.1, and 11.1.1.

In the remaining of this clause, a last DCI format is the DCI format that a UE detects in a last PDCCH monitoring occasion from the PDCCH monitoring occasions for which the UE would provide HARQ-ACK information in a PUCCH in a same 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* = *separate*

the UE shall separately apply the procedures described in clauses 9.1 and 9.2.3 for reporting HARQ-ACK information associated with the first CORESETs on active DL BWP of the serving cells and for reporting HARQ-ACK information associated with the second CORESETs on active DL BWP of the serving cells, and the UE does not expect to be provided with *subslotLengthForPUCCH* or to be indicated by *pdsch-HARQ-ACK-CodebookList* to generate two HARQ-ACK codebooks on active DL BWP of the serving cells. HARQ-ACK information reporting is associated with a CORESET through a reception of a PDCCH with a DCI format triggering the reporting of the HARQ-ACK information by the UE.

For NR-DC when both the MCG and the SCG operate either in FR1 or in FR2 and for a power headroom report transmitted on the MCG or the SCG, the UE computes *PH* assuming that the UE does not transmit PUSCH/PUCCH on any serving cell of the SCG or the MCG, respectively.

If a UE is configured for NR-DC operation, the UE does not expect to be configured with a PUCCH-SCell.

A PUSCH or a PUCCH transmission other than PUCCH transmissions with SL HARQ-ACK reports, 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 *phy-PriorityIndex*, 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 that activates the semi-persistent CSI report. If a priority index is not provided to a UE for a PUSCH or a PUCCH transmission other than PUCCH transmissions with SL HARQ-ACK reports, the priority index is 0.

If a UE is provided one *PUCCH-Config*

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

If a UE is provided two *PUCCH-Config*

- if the UE is provided *subslotLengthForPUCCH* 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* symbols in the first *PUCCH-Config*

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

If a UE is provided *subslotLengthForPUCCH* in a *PUCCH-Config* of a given priority index, in a slot of symbols [4, TS 38.211] with HARQ-ACK, the UE does not expect that HARQ-ACK information in response to SPS PDSCH reception(s) only (if any) or SR (if any) of the given priority index in a slot of *subslotLengthForPUCCH* symbols is moved to a different slot of *subslotLengthForPUCCH* symbols after multiplexing overlapping PUCCHs.

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

A DCI format indicating a SPS PDSCH release, or SCell dormancy without scheduling a PDSCH reception, or indicating a TCI state update without scheduling PDSCH reception, is referred to as a DCI format having associated HARQ-ACK information without scheduling a PDSCH reception.

When a UE determines overlapping for PUCCH transmissions with SL HARQ-ACK reports and PUCCH of larger and/or smaller priority index, the UE resolves the overlapping for PUCCH transmissions with SL HARQ-ACK reports and PUCCH of each priority index as described in clause 9.2.5 and 9.2.6 before resolving the overlapping for PUCCH transmissions without SL HARQ-ACK or the overlapping for PUCCH transmissions and PUSCH transmissions.

If a UE

- is provided *simultaneousPUCCH-PUSCH* and would transmit a PUCCH with a first priority index and PUSCHs with a second priority index that is different than the first priority index, where the PUCCH and the PUSCHs overlap in time

- can simultaneously transmit the PUCCH and the PUSCHs [16, TS 38.306],

the UE excludes the PUSCHs for resolving the time overlapping between the PUCCH and PUSCHs, where the timeline conditions are not required for the excluded PUSCHs.

When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes other than PUCCH transmissions with SL HARQ-ACK reports before considering limitations for UE transmission as described in clause 11.1 and clause 11.1.1, including repetitions if any, if the UE is provided *UCI-MuxWithDifferentPriority* and the timeline conditions in clause 9.2.5 for multiplexing UCI in a PUCCH or a PUSCH are satisfied

- first, the UE resolves overlapping for PUCCH and/or PUSCH transmissions of a same priority index as described in clauses 9.2.5 and 9.2.6

- second, the UE resolves the overlapping for PUCCH transmissions of different priority indexes, and

- if the UE is provided *subslotLengthForPUCCH* in the second *PUCCH-Config*, a PUCCH transmission of smaller priority index is associated with the first overlapping slot with *subslotLengthForPUCCH* symbols of larger priority index; otherwise, the PUCCH transmission of smaller priority index is associated with the overlapping slot with symbols [4, TS 38.211] of larger priority index.

- the UE first resolves the overlapping for PUCCH transmissions, where at least one of the PUCCH transmissions is with repetitions, within a slot of larger priority index as is subsequently described in this clause, if any, and then the UE resolves the overlapping for PUCCH transmissions without repetitions within the slot using the pseudo-code in clause 9.2.5

- if the UE determines that a first PUCCH transmission of the smaller priority index is not dropped and the UCI of the first PUCCH transmission is not multiplexed in a second PUCCH transmission of larger priority index in an overlapping slot with *subslotLengthForPUCCH* symbols, the first PUCCH transmission is associated with the next overlapping slot with *subslotLengthForPUCCH* symbols for PUCCH transmissions with the larger priority index

- the UE does not expect a PUCCH transmission that includes UCI of different priority indexes to overlap with a PUCCH transmission with repetitions after resolving the overlapping for PUCCH transmissions without repetitions within a slot

- the UE does not expect a PUCCH transmission with UCI of first and second priority indexes to overlap with a PUCCH transmission with HARQ-ACK information of the first priority index, or with a PUCCH transmission or with a PUSCH transmission of the second priority index when the second priority index is larger than the first priority index

- the UE does not expect a PUCCH transmission with HARQ-ACK information of larger priority index to overlap with more than one PUCCH transmissions with HARQ-ACK information of smaller priority index

- third, the UE resolves the overlapping for PUCCH and PUSCH transmissions of different priority indexes- the UE drops PUSCH transmissions of smaller priority index that overlap with a PUCCH transmission with positive SR of larger priority index prior to multiplexing UCI in a PUSCH transmission of smaller priority index, if any

- the UE drops PUSCH transmissions of smaller priority index that overlap with a PUCCH transmission with repetitions of larger priority index prior to multiplexing UCI in a PUSCH transmission of smaller priority index, if any

- the UE multiplexes HARQ-ACK information in a PUSCH transmission, as is subsequently described in this clause for multiplexing HARQ-ACK information from a PUCCH transmission in a PUSCH transmission of a same priority index, if a PUCCH transmission with HARQ-ACK information of a first priority index overlaps with one or more PUSCH transmissions of a second priority index that is different than the first priority index

- if // this is for cases the UE supports multiplexing information of different priorities in a PUCCH/PUSCH transmission

- a PUCCH transmission with HARQ-ACK information, without repetitions, with smaller priority index overlaps with a PUCCH transmission only with HARQ-ACK information, without repetitions, with larger priority index, or

- a PUCCH transmission without repetitions that includes HARQ-ACK information of smaller priority index overlaps with a PUCCH transmission without repetitions using a PUCCH resource with PUCCH format 2/3/4 with HARQ-ACK information and SR of larger priority index, or

- a PUCCH transmission with HARQ-ACK information, without repetitions, with smaller or larger priority index overlaps, respectively, with a PUSCH transmission with larger or smaller priority index

the UE

- multiplexes HARQ-ACK information of different priority indexes and SR information of larger priority index, if any, in a same PUCCH transmission of larger priority index, or multiplexes HARQ-ACK information the UE would provide in a PUCCH transmission of smaller or larger priority index in a PUSCH transmission of larger or smaller priority index, respectively, and applies the procedures in clause 9.2.5.3 or 9.3, respectively, and

- drops CSI and/or SR carried in the PUCCH of smaller priority index, if any

- drops HARQ-ACK information of smaller priority index if the UE would multiplex the HARQ-ACK information of smaller priority index in a PUSCH where the UE multiplexes Part 1 CSI reports and Part 2 CSI reports of larger priority index

- drops Part 2 CSI reports of smaller priority index if the UE would multiplex the HARQ-ACK information of smaller and larger priority indexes in a PUSCH where the UE multiplexes Part 1 CSI reports and Part 2 CSI reports of smaller priority index

- else

- if the UE would transmit the following channels that would overlap in time where, if a channel transmission is with repetitions, the following are applicable per repetition

- a first PUCCH transmission of larger priority index and a second PUCCH transmission of smaller priority index

- a first PUCCH transmission of larger priority index and a second PUSCH transmission of smaller priority index when the UE cannot simultaneously transmit the first PUCCH and second PUSCH

- a first PUCCH transmission of smaller priority index and a second PUSCH transmission of larger priority index when the UE cannot simultaneously transmit the first PUCCH and second PUSCH

the UE

- transmits the PUCCH or the PUSCH of the larger priority index, and

- does not transmit a PUCCH or a PUSCH of smaller priority index

When a UE determines overlapping for PUCCH and/or PUSCH transmissions of different priority indexes, other than PUCCH transmissions with SL HARQ-ACK reports, before considering limitations for transmissions including with repetitions, if any, as described in clauses 11.1 and 11.1.1, if the UE is not provided *UCI-MuxWithDifferentPriority*, the UE first resolves 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 repetition of a transmission of a second PUSCH or a second PUCCH of smaller priority index, the UE cancels the repetition of a 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 clauses 9.2.5 and 9.2.6

- any remaining PUCCH and/or PUSCH transmission after overlapping resolution is subjected to the limitations for UE transmission as described in clause 11.1 and clause 11.1.1

- 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, is 5 for , 5.5 for  and 11 for

- else, is 10 for *,* 12 for , 23 for , 36 for , 144 for , and 288 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, is 5 for , 5.5 for  and 11 for

- else, is 10 for *,* 12 for , 23 for , 36 for , 144 for , and 288 for ;

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 PDSCH(s) reception without corresponding PDCCH(s) and a second PUCCH of smaller priority index with HARQ-ACK information only in response to PDSCH(s) reception without corresponding PDCCH(s), or 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 PDSCH(s) reception without corresponding PDCCH(s), or

- a configured grant PUSCH of larger priority index and a configured grant PUSCH of smaller priority index on a same serving cell

- a PUSCH of smaller priority index scheduled by a DCI format and a configured grant PUSCH of larger priority index on a same serving cell if the UE is provided *prioritizationBetweenLP-DG-PUSCHandHP-CG-PUSCH*

the UE is expected to cancel a repetition of the PUCCH/PUSCH transmissions of smaller priority index before the first symbol overlapping with the PUCCH/PUSCH transmission of larger priority index if the repetition of the PUCCH/PUSCH transmissions of smaller priority index overlaps in time with the PUCCH/PUSCH transmissions of larger priority index. In case of a PUSCH of larger priority index scheduled by a DCI format in a PDCCH reception and a configured grant PUSCH of smaller priority index on a same serving cell and the UE is provided *prioritizationBetweenHP-DG-PUSCHandLP-CG-PUSCH*

- the UE expects that the transmission of the PUSCH of larger priority index 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 and are determined by a reported UE capability

When a UE determines overlapping for PUCCH transmissions with SL HARQ-ACK reports and PUSCH of smaller priority index, including repetitions if any, after resolving the overlapping PUCCH other than PUCCH transmissions with SL HARQ-ACK reports and/or PUSCH transmissions, if the PUSCH includes no UCI, the UE resolves the overlapping for PUCCH transmissions with SL HARQ-ACK reports and PUSCH of smaller priority index as described in clauses 9.2.5 and 9.2.6.

When a UE determines overlapping for PUCCH transmissions with SL HARQ-ACK reports and PUSCH of larger priority index only, including repetitions if any, after resolving the overlapping PUCCH other than PUCCH transmissions with SL HARQ-ACK reports and/or PUSCH transmissions, the UE does not transmit the PUCCH with SL HARQ-ACK reports

where

- the UE expects that the transmission of the PUSCH 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.

The UE expects the PUCCH and PUSCH transmissions to fulfill the conditions in clause 9 and clause 9.2.5 for UCI multiplexing replacing the reference time of “end of PDSCH” with “end of the last symbol of a last PSFCH reception occasion” as described in 16.5 and *Tproc,*1 with *Tprep*.

A UE does not expect that a PUCCH carrying SL HARQ-ACK reports overlaps with PUSCH with aperiodic or semi-persistent CSI reports.

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 unless the UE is provided *UCI-MuxWithDifferentPriority*. 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 unless the UE is provided *UCI-MuxWithDifferentPriority*.

In the remaining of this clause, a UE multiplexes UCIs with same priority index in a PUCCH or a PUSCH before considering limitations for UE transmission as described in clause 11.1 and clause 11.1.1. 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 or for overlapping channels with a PUCCH carrying SL HARQ-ACK information.

In the remaining of this clause, if a UE is provided *subslotLengthForPUCCH*, a slot for an associated PUCCH resource of a PUCCH transmission with HARQ-ACK information includes a number of symbols indicated by *subslotLengthForPUCCH*, unless stated otherwise.

If a UE would transmit on a serving cell a PUSCH without UL-SCH that overlaps with a PUCCH transmission on a serving cell that includes positive SR information, the UE does not transmit the PUSCH.

If a UE would transmit CSI reports on overlapping physical channels, the UE applies the priority rules described in [6, TS 38.214] for the multiplexing of CSI reports.

If a UE has overlapping resources for PUCCH transmissions in a slot and at least one of the PUCCH transmissions is with repetitions over multiple slots, the UE first follows the procedures described in clause 9.2.6 for resolving the overlapping among the resources for the PUCCH transmissions.

If a UE

- would multiplex UCI in a PUCCH transmission that overlaps with a PUSCH transmission, and

- the PUSCH and PUCCH transmissions fulfill the conditions in clause 9.2.5 for UCI multiplexing,

the UE

- multiplexes only HARQ-ACK information, if any, from the UCI in the PUSCH transmission and does not transmit the PUCCH if the UE multiplexes aperiodic or semi-persistent CSI reports in the PUSCH;

- multiplexes only HARQ-ACK information and CSI reports, if any, from the UCI in the PUSCH transmission and does not transmit the PUCCH if the UE does not multiplex aperiodic or semi-persistent CSI reports in the PUSCH.

A UE does not expect to multiplex in a PUSCH transmission in one slot with SCS configuration UCI of same type that the UE would transmit in PUCCHs in different slots with SCS configuration if .

A UE does not expect to multiplex in a PUSCH transmission or in a PUCCH transmission HARQ-ACK information that the UE would transmit in different PUCCHs of a same priority index.

A UE does not expect a PUCCH resource that results from multiplexing overlapped PUCCH resources, if applicable, to overlap with more than one PUSCHs if each of the more than one PUSCHs includes aperiodic CSI reports.

A UE does not expect to detect a DCI format scheduling a PDSCH reception or having associated HARQ-ACK information report without scheduling a PDSCH reception, and indicating a resource for a PUCCH transmission with corresponding HARQ-ACK information in a slot if the UE previously detects a DCI format scheduling a PUSCH transmission in the slot and if the UE multiplexes HARQ-ACK information in the PUSCH transmission.

If a UE multiplexes aperiodic CSI in a PUSCH and the UE would multiplex UCI that includes HARQ-ACK information in a PUCCH that overlaps with the PUSCH and the timing conditions for overlapping PUCCHs and PUSCHs in clause 9.2.5 are fulfilled, the UE multiplexes only the HARQ-ACK information in the PUSCH and does not transmit the PUCCH.

If a UE transmits multiple PUSCHs in a slot on respective serving cells that include first PUSCHs that are scheduled by DCI formats and second PUSCHs configured by respective *ConfiguredGrantConfig* or *semiPersistentOnPUSCH*, and the UE would multiplex UCI in one of the multiple PUSCHs, and the multiple PUSCHs fulfil the conditions in clause 9.2.5 for UCI multiplexing, the UE multiplexes the UCI in a PUSCH from the first PUSCHs.

If a UE transmits multiple PUSCHs in a slot on respective serving cells and the UE would multiplex UCI in one of the multiple PUSCHs and the UE does not multiplex aperiodic CSI in any of the multiple PUSCHs, the UE multiplexes the UCI in a PUSCH of the serving cell with the smallest *ServCellIndex* subject to the conditions in clause 9.2.5 for UCI multiplexing being fulfilled. If the UE transmits more than one PUSCHs in the slot on the serving cell with the smallest *ServCellIndex* that fulfil the conditions in clause 9.2.5 for UCI multiplexing, the UE multiplexes the UCI in the earliest PUSCH that the UE transmits in the slot.

If a UE transmits a PUSCH over multiple slots and the UE would transmit a PUCCH with HARQ-ACK and/or CSI information over a single slot that overlaps with the PUSCH transmission in one or more slots of the multiple slots, and the PUSCH transmission in the one or more slots fulfills the conditions in clause 9.2.5 for multiplexing the HARQ-ACK and/or CSI information, the UE multiplexes the HARQ-ACK and/or CSI information in the PUSCH transmission in the one or more slots. The UE does not multiplex HARQ-ACK and/or CSI information in the PUSCH transmission in a slot from the multiple slots if the UE would not transmit a single-slot PUCCH with HARQ-ACK and/or CSI information in the slot in case the PUSCH transmission was absent.

If a UE transmits a PUSCH with repetition Type B and the UE would transmit a PUCCH with HARQ-ACK and/or CSI information over a single slot that overlaps with the PUSCH transmission in one or more slots, the UE expects all actual repetitions of the PUSCH transmission [6, TS 38.214] that would overlap with the PUCCH transmission to fulfill the conditions in clause 9.2.5 for multiplexing the HARQ-ACK and/or CSI information, and the UE multiplexes the HARQ-ACK and/or CSI information in the earliest actual PUSCH repetition of the PUSCH transmission that would overlap with the PUCCH transmission and includes more than one symbol. The UE does not expect that all actual repetitions that would overlap with the PUCCH transmission do not include more than one symbol.

If the PUSCH transmission over the multiple slots is scheduled by a DCI format that includes a DAI field, the value of the DAI field is applicable for multiplexing HARQ-ACK information in the PUSCH transmission in any slot from the multiple slots where the UE multiplexes HARQ-ACK information.

When a UE would multiplex HARQ-ACK information in a PUSCH transmission that is configured by a *ConfiguredGrantConfig*, and includes CG-UCI [5, TS 38.212], the UE multiplexes the HARQ-ACK information in the PUSCH transmission if the UE is provided *cg-UCI-Multiplexing*; otherwise, if the HARQ-ACK information and the PUSCH have same priority index, the UE does not transmit the PUSCH and multiplexes the HARQ-ACK information in a PUCCH transmission or in another PUSCH transmission; if the HARQ-ACK information and the PUSCH have different priority indexes, the UE does not transmit the channel with the smaller priority index.

In the following, DCI formats with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI are also referred to as unicast DCI formats and DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI are also referred to as multicast DCI formats. Corresponding unicast DCI formats are DCI formats 0\_0/0\_1/0\_2/1\_0/1\_1/1\_2 and multicast DCI formats are DCI formats 4\_1/4\_2 [4, TS 38.212]. PDSCH receptions scheduled by unicast or multicast DCI formats or HARQ-ACK information associated with unicast or multicast DCI formats are also respectively referred as unicast or multicast PDSCH receptions or unicast or multicast HARQ-ACK information.

For the remaining of this clause, if a UE is provided by *Koffset* in *ServingCellConfigCommon* or by a MAC CE command, reference to a slot for a PUCCH transmission or PUSCH transmission corresponds to a slot for the PUSCH or the PUCCH transmission, where is the SCS configuration for the PUCCH transmission or PUSCH transmission. If *Koffset* or if the MAC CE command is not provided, or , respectively. If the PUCCH transmission or the PUSCH transmission is scheduled by a DCI format with CRC scrambled by TC-RNTI, . If the UE is provided a value by a MAC CE command, the UE applies the MAC command in the first slot that is after slot where is the slot where the UE would transmit a PUCCH with HARQ-ACK information for the PDSCH providing the MAC CE command, is the SCS configuration for the PUCCH transmission that is determined in the slot when the MAC CE command is applied, and is a number of slots for SCS configuration provided by *K-Mac* or if *K-Mac* is not provided.

## 9.A PUCCH cell switching

This clause is applicable when a UE is provided a PUCCH-sSCell by *pucch-sSCell* and the PUCCH-sSCell is activated and does not have a dormant UL/DL active BWP.

A UE can be provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern.* Each bit of the pattern corresponds to a slot for a reference SCS configuration provided by *tdd-UL-DL-ConfigurationCommon* for the PCell with a value of '0' or a value of '1' indicating, respectively, the PCell or the PUCCH-sSCell as the cell for PUCCH transmissions during the slot of the reference SCS configuration. A slot on the active UL BWP of the PUCCH-sSCell does not overlap with more than one slot on the active UL BWP of the PCell. If a slot for the active UL BWP of the PCell overlaps with more than one slot on the active BWP of the PUCCH-sSCell and the UE would transmit a PUCCH on the PUCCH-sSCell, the UE considers the first of the overlapping slots for the PUCCH transmission on the PUCCH-sSCell.

If a UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, a corresponding DCI format associated with generation of HARQ-ACK information by the UE can include a PUCCH cell indicator field [5, TS 38.212] with a value of '0' or a value of '1' indicating, respectively, whether a PUCCH transmission with the HARQ-ACK information by the UE is on the PCell or on the PUCCH-sSCell.

A UE transmits a PUCCH on a PUCCH-sSCell with a power that the UE determines as described in clause 7.2.1, where the UE applies

- a *p0-PUCCH-Value* from *pucch-PowerControl* in *PUCCH-Config* for the PUCCH-sSCell for the determination of

- a *pucch-PathlossReferenceRS-Id* from *pucch-PowerControl* in *PUCCH-Config* for the PUCCH-sSCell for the determination of

- a PUCCH power control adjustment state for active UL BWP of the UL carrier of PUCCH-sSCell and PUCCH transmission occasion where is a TPC command value included in a DCI format associated with generation of HARQ-ACK information for multiplexing in a PUCCH transmission on the PUCCH-sSCell as indicated either by a *pucch-sSCellPattern* or by a PUCCH cell indicator field in the DCI format, or provided by DCI format 2\_2 with CRC scrambled by TPC-PUCCH-RNTI for the PUCCH-sSCell as described in clause 11.3

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

#### 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 on the primary cell or, if the PUCCH transmission is indicated by a DCI format to be on the PUCCH-sSCell as described in clause 9A, on a set of slot timing values associated with the active UL BWP on the PUCCH-sSCell

- 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 for serving cell , is provided by the slot timing values {1, 2, 3, 4, 5, 6, 7, 8} for SCS configuration of PUCCH transmission , {7, 8, 12, 16, 20, 24, 28, 32} for , and {13, 16, 24, 32, 40, 48, 56, 64} for

- 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*

- 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-DCI-1-2*

- 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-DCI-1-2*

- If the UE is configured to monitor PDCCH for multicast DCI formats for serving cell

- if the UE is not provided *type1-Codebook-Generation-Mode =* ‘mode1’, is additionally provided by the union of *dl-DataToUL-ACK-ForDCI Format4\_1*

- if the UE is not provided *dl-DataToUL-ACK-ForDCI Format4\_1*, is provided by the slot timing values {1, 2, 3, 4, 5, 6, 7, 8}

- if the UE is provided *type1-Codebook-Generation-Mode =* ‘mode1’, the UE

- determines a first set as , where is a set of slot timing values for the multicast DCI formats, a second set as , and a third set as

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 if the UE is not configured to monitor PDCCH for multicast DCI formats for serving cell , or is not provided *type1-Codebook-Generation-Mode =* ‘mode1’, or, if any, for the first set

- the union of row indexes of time domain resource allocation tables for DCI format 1\_0 and/or DCI format 1\_1 and/or DCI format 1\_2 for serving cell for the second set, if any

- the union of row indexes of time domain resource allocation tables for multicast DCI formats the UE is configured to monitor PDCCH for serving cell for the third set, if any

- if the UE is provided *referenceOfSLIVDCI-1-2*, 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 any PDCCH monitoring occasion in any 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].

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

### 9.1.5 HARQ-ACK codebook retransmission

With reference to slots of PUCCH transmissions on the primary cell and for Type-1 or Type-2 HARQ-ACK codebooks, a UE that transmitted or would transmit a PUCCH or a PUSCH with a first HARQ-ACK codebook in slot can be indicated by a DCI format with CRC scrambled by a C-RNTI or a MCS-C-RNTI that does not schedule a PDSCH reception [4, TS 38.212] and is received in a PDCCH ending in slot , to transmit a PUCCH with the first HARQ-ACK codebook in slot , where slot is after slot . The UE determines and a resource for the PUCCH transmission as described in clauses 9.2.3 and 9.2.5. If the UE is provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern*, the UE further determines a corresponding cell based on the periodic cell switching pattern as described in clause 9.A.

If the *pdsch-HARQ-ACK-retx* or *pdsch-HARQ-ACK-retxDCI-1-2* field value in the DCI format 1\_1 or 1\_2, respectively, is ‘1’, the UE determines slot as where is determined by a one-to-one mapping in ascending order among the values of the MCS field in the DCI format 1\_1 or 1\_2 and the values from -7 to 24.

If the DCI format 1\_1 or 1\_2 includes a priority indicator field having a value, a priority value of first HARQ-ACK information in the first HARQ-ACK codebook is same as the value of the priority indicator field; otherwise, the priority value of the first HARQ-ACK information is zero.

If the UE would also multiplex in the PUCCH transmission in slot a second HARQ-ACK codebook with second HARQ-ACK information of same priority value as for the first HARQ-ACK information in the first HARQ-ACK codebook, the UE appends the first HARQ-ACK codebook to the second HARQ-ACK codebook. The UE determines to multiplex the second HARQ-ACK information in the PUCCH transmission in slot as described in clause 9.2.3.

If in slot the UE performs a procedure for deferring first HARQ-ACK information for SPS PDSCH receptions, as described in clause 9.2.5.4, and the first HARQ-ACK information has same priority value as a priority value indicated by the DCI format triggering the PUCCH transmission in slot , the UE multiplexes in the PUCCH transmission in slot second HARQ-ACK information with the priority value that results in slot according to the procedure in this clause, by appending the first HARQ-ACK information to the second HARQ-ACK information. If the UE would also multiplex in the PUCCH transmission in slot third HARQ-ACK information with the priority value, the UE appends the second HARQ-ACK information followed by the first HARQ-ACK information to the third HARQ-ACK information. The UE determines to multiplex the third HARQ-ACK information in the PUCCH transmission in slot as described in clause 9.2.3.

If in slot the UE would transmit a first PUCCH with first HARQ-ACK information over more than one slot and a second PUCCH with second HARQ-ACK information over one or more slots, where the first and second HARQ-ACK information have same priority value, the UE multiplexes in the PUCCH transmission in slot one of

- the first HARQ-ACK information if the first PUCCH starts at an earlier slot than the second PUCCH, or

- the second HARQ-ACK information if the second PUCCH starts at an earlier slot than the first PUCCH

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

### 9.2.5 UE procedure for reporting multiple UCI types

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

If a UE would transmit multiple PUCCHs in a slot that include HARQ-ACK information, and/or SR, and/or CSI reports and any PUCCH with HARQ-ACK information in the slot satisfies the above timing conditions and does not overlap with any other PUCCH or PUSCH in the slot that does not satisfy the above timing conditions, the UE multiplexes the HARQ-ACK information, and/or SR, and/or CSI reports and determines corresponding PUCCH(s) for transmission in the slot according to the following pseudo-code. If the multiple PUCCHs do not include HARQ-ACK information and do not overlap with any PUSCH transmission by the UE in response to a DCI format detection by the UE, the timing conditions do not apply.

If

- a UE is not provided *multi-CSI-PUCCH-ResourceList*, and

- a resource for a PUCCH transmission with HARQ-ACK information in response to SPS PDSCH reception and/or a resource for a PUCCH associated with a SR occasion overlap in time with two resources for respective PUCCH transmissions with two CSI reports, and

- there is no resource for a PUCCH transmission with HARQ-ACK information in response to a DCI format detection that overlaps in time with any of the previous resources, and

- the following pseudo code results to the UE attempting to determine a single PUCCH resource from the HARQ-ACK and/or the SR resource and the two PUCCH resources with CSI reports

the UE

- multiplexes the HARQ-ACK information and/or the SR in the resource for the PUCCH transmission with the CSI report having the higher priority, and

- does not transmit the PUCCH with the CSI report having the lower priority

Set to the set of resources for transmission of corresponding PUCCHs in a single slot without repetitions where

- a resource with earlier first symbol is placed before a resource with later first symbol

- for two resources with same first symbol, the resource with longer duration is placed before the resource with shorter duration

- for two resources with same first symbol and same duration, the placement is arbitrary

- the above three steps for the set are according to a subsequent pseudo-code for a function

- a resource for negative SR transmission that does not overlap with a resource for HARQ-ACK or CSI transmission is excluded from set

- if the UE is not provided *simultaneousHARQ-ACK-CSI* and resources for transmission of HARQ-ACK information include PUCCH format 0 or PUCCH format 2, resources that include PUCCH format 2, or PUCCH format 3, or PUCCH format 4 for transmission of CSI reports are excluded from the set if they overlap with any resource from the resources for transmission of HARQ-ACK information

- if the UE is not provided *simultaneousHARQ-ACK-CSI* and at least one of the resources for transmission of HARQ-ACK information includes PUCCH format 1, PUCCH format 3, or PUCCH format 4

- resources that include PUCCH format 3 or PUCCH format 4 for transmission of CSI reports are excluded from the set

- resources that include PUCCH format 2 for transmission of CSI reports are excluded from the set if they overlap with any resource from the resources for transmission of HARQ-ACK information

Set to the cardinality of

Set to be the first symbol of resource in the slot

Set to be the number of symbols of resource in the slot

Set - index of first resource in set

Set - counter of overlapped resources

while

if

 and resource overlaps with resource and the resources in set are of same priority index, or

 and resource overlaps with resource , , the resources in set are of different priority indexes, and the UE is provided *UCI-MuxWithDifferentPriority*

then

;

;

else

if

determine a single resource for multiplexing UCI associated with resources as described in clauses 9, 9.2.5.0, 9.2.5.1, 9.2.5.2, and 9.2.5.3

set the index of the single resource to

 % start from the beginning after reordering unmerged resources at next step

;

 % function that re-orders resources in current set

Set to the cardinality of

else

;

end if

end if

end while

The function performs the following pseudo-code

{

;

while % the next two while loops are to re-order the unmerged resources

;

while

if OR

 ;

;

;

end if

;

end while

;

end while

}

For each PUCCH resource in the set that satisfies the aforementioned timing conditions, when applicable,

- the UE transmits a PUCCH using the PUCCH resource if the PUCCH resource does not overlap in time with a PUSCH transmission after multiplexing UCI following the procedures described in clauses 9.2.5.1 and 9.2.5.2

- the UE multiplexes HARQ-ACK information and/or CSI reports in a PUSCH if the PUCCH resource overlaps in time with a PUSCH transmission, as described in clause 9.3, and does not transmit SR. In case the PUCCH resource overlaps in time with multiple PUSCH transmissions, the PUSCH for multiplexing HARQ-ACK information and/or CSI is selected as described in clause 9. If the PUSCH transmission by the UE is not in response to a DCI format detection and the UE multiplexes only CSI reports, the timing conditions are not applicable

- the UE does not expect the resource to overlap with a second resource of a PUCCH transmission over multiple slots if the resource is obtained from a group of resources that do not overlap with the second resource.

Clauses 9.2.5.0, 9.2.5.1 and 9.2.5.2 assume the following

- resources for transmissions of UCI types, prior to multiplexing or dropping, overlap in a slot

- multiplexing conditions of corresponding UCI types in a single PUCCH are satisfied, and

- the UE does not transmit any PUSCH time-overlapping with PUCCH in the slot.

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

#### 9.2.5.3 UE procedure for reporting UCI of different priorities

If a UE

- is provided *PUCCH-ConfigurationList* for PUCCH transmissions with priority 0 and 1,

- is provided *UCI-MuxWithDifferentPriority*, and

- would transmit overlapping PUCCHs that include a first PUCCH with HARQ-ACK information bits of priority 0 and a second PUCCH with HARQ-ACK information bits of priority 1

- if the PUCCH resource for the second PUCCH includes PUCCH format 2, 3, or 4 and additionally includes SR bits of priority 1, is replaced by where is determined according to clause 9.2.5.1

the UE

- determines

- a PUCCH resource set from the second *PUCCH-Config* using as described in clause 9.2.1, and a PUCCH resource from the PUCCH resource set as described in clause 9.2.3 where a DCI format, if any, triggers PUCCH transmission of priority 1, or

- a PUCCH resource from the second *sps-PUCCH-AN-List* using as described in clause 9.2.1, and

- multiplexes the and HARQ-ACK information bits in a same PUCCH using the PUCCH resource.

If the PUCCH resource includes PUCCH format 2 or PUCCH format 3 and PRBs, the UE determines a number of PRBs for the PUCCH transmission to be the minimum number of PRBs that starts from the first PRB from the PRBs and results to

where or is a number of CRC bits, if any, for encoding the or the HARQ-ACK information bits, respectively, is provided by *maxCodeRateLP*, and the remaining parameters are as defined in clause 9.2.5.2 with . For PUCCH format 3, if is not equal to [4, TS 38.211], is increased to a nearest value that is equal to and does not exceed *nrofPRBs*.

If , the UE transmits the PUCCH over the PRBs. If a UE transmits a PUCCH that includes HARQ-ACK information bits of priority 0 and 1 using PUCCH format 1, the UE determines a power for the PUCCH transmission, as described in clause 7.2.1, assuming that all HARQ-ACK information bits have priority 1.

If a UE transmits a PUCCH that includes one HARQ-ACK information bit of priority 0 and one HARQ-ACK information bit of priority 1

- if the PUCCH transmission uses a resource that includes PUCCH format 0, the HARQ-ACK information bits of priority 1 and priority 0 are set as the first and second bits in Table 9.2.3-4, respectively, to derive the of the PUCCH transmission

- if the PUCCH transmission uses a resource that includes PUCCH format 1, the HARQ-ACK information bits of priority 1 and priority 0 are the first and second bits of the QPSK modulated symbol, respectively, for the PUCCH transmission

If a UE transmits a PUCCH that includes HARQ-ACK information bits of priority 0 and 1 using a PUCCH resource that includes PUCCH format 2, 3, or 4, the UE determines a power for the PUCCH transmission, as described in clause 7.2.1, assuming that the PUCCH includes only UCI bits of priority 1, where .

#### 9.2.5.4 UE procedure for deferring HARQ-ACK for SPS PDSCH

If a UE is provided *spsHARQdeferral* and, after performing the procedures in clauses 9 and 9.2.5 to resolve overlapping among PUCCHs and PUSCHs in a first slot, if any, the UE determines a PUCCH resource for a PUCCH transmission with first HARQ-ACK information bits for SPS PDSCH receptions that the UE would report for a first time, and the PUCCH resource

- is provided by *SPS-PUCCH-AN-List* as described in clause 9.2.1, or by *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided

- is not cancelled by an overlapping PUCCH or PUSCH transmission of larger priority index

- overlaps with a symbol indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigDedicated*, or indicated for a SS/PBCH block by *ssb-PositionsInBurst*, or belonging to a CORESET associated with a Type0-PDCCH CSS set

the UE

- determines an earliest second slot and, after performing the procedures in clauses 9 and 9.2.5 to resolve overlapping among PUCCHs and PUSCHs, if any, a PUSCH or a PUCCH in the earliest second slot to multiplex HARQ-ACK information bits that include second HARQ-ACK information bits from the first HARQ-ACK information bits

- if the UE detects a DCI format in a PDCCH reception that triggers a PUCCH transmission with a Type-3 HARQ-ACK codebook in a slot as described in clause 9.1.4, the UE stops the procedure to determine the earliest second slot in the slot

- if the UE is provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern*, the UE determines the earliest second slot and a corresponding cell based on the periodic cell switching pattern as described in clause 9.A

- if the UE multiplexes the second HARQ-ACK information in a PUSCH, or in a PUCCH using a resource that is not from *SPS-PUCCH-AN-List*, or from *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided, the UE stops the procedure to determine the earliest second slot in the slot

- if the UE multiplexes the second HARQ-ACK information in a first PUCCH using a resource provided by *SPS-PUCCH-AN-List*, or by *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided, of smaller priority index and the UE drops the first PUCCH transmission due to an overlapping with a second PUSCH or PUCCH transmission of larger priority index, the UE stops the procedure to determine the earliest second slot in the slot

- if a PUCCH transmission with the first HARQ-ACK information bits is dropped in a slot, the UE stops the procedure to determine the earliest second slot in the slot

- the second HARQ-ACK information bits correspond to SPS PDSCH configurations with *spsHARQdeferral* values that are larger than or equal to a time difference, with reference to slots for PUCCH transmissions on the primary cell, between the second slot and the slot of the SPS PDSCH reception, if any

- if the UE multiplexes the second HARQ-ACK information in a first PUCCH using a resource provided by *SPS-PUCCH-AN-List*, or by *n1PUCCH-AN* if *SPS-PUCCH-AN-List* is not provided, and the PUCCH transmission is not dropped due to an overlapping with a PUSCH or PUCCH transmission of larger priority and does not have any symbol that overlaps with a symbol indicated as downlink by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigDedicated*, or indicated for a SS/PBCH block by *ssb-PositionsInBurst*, or belonging to a CORESET associated with a Type0-PDCCH CSS set, the UE stops the procedure to determine the earliest second slot in the slot

- the second HARQ-ACK information bits, generated as described in clause 9.1.2, are appended in a HARQ-ACK codebook the UE generates as described in clauses 9.1.2, 9.1.2.1, 9.1.3.1, or 9.1.5

- if the UE would receive a PDSCH providing a TB for a same HARQ process as a HARQ-ACK information bit from the second HARQ-ACK information bits prior to transmitting the PUCCH or the PUSCH, the UE does not include the HARQ-ACK information bit in the HARQ-ACK information bits.

The UE does not expect to be provided both *spsHARQdeferral* and *nrofSlots* or *PUCCH-nrofSlots* for any PUCCH resource of same priority.

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

## 9.3 UCI reporting in physical uplink shared channel

Offset values are defined for a UE to determine a number of resources for multiplexing HARQ-ACK information and for multiplexing CSI reports in a PUSCH. Offset values are also defined for multiplexing CG-UCI [5, TS 38.212] in a CG-PUSCH. The offset values are signalled to a UE either by a DCI format scheduling the PUSCH transmission or by higher layers.

If a DCI format that does not include a beta\_offset indicator field schedules the PUSCH transmission from the UE and the UE is provided *betaOffsets = 'semiStatic'*, the UE applies the , , and values that are provided by *betaOffsets = 'semiStatic'* for the corresponding HARQ-ACK information, Part 1 CSI reports and Part 2 CSI reports. If the PUSCH transmission has priority 0 or priority 1 and the UE is configured by *UCI-MuxWithDifferentPriority* to multiplex HARQ-ACK information of priority 1 or priority 0, respectively, and if the UE multiplexes HARQ-ACK information of priority 1 or priority 0, the UE applies corresponding or provided by *betaOffset-CrossPri1* *= 'semiStatic'* for DCI formats 0\_0/0\_1 and by *betaOffsetsCrossPri1DCI-0-2= 'semiStatic'* for DCI format 0\_2, or by *betaOffset-CrossPri0 = 'semiStatic'* for DCI format 0-1 and by *betaOffsetsCrossPri0DCI-0-2= 'semiStatic'* for DCI format 0\_2, respectively.

If the PUSCH transmission is with a configured grant and the UE is provided *CG-UCI-OnPUSCH= 'semiStatic'*, the UE applies the , , and values that are provided by *CG-UCI-OnPUSCH = 'semiStatic'* for the corresponding HARQ-ACK information, Part 1 CSI reports and Part 2 CSI reports. If the PUSCH transmission has priority 0 or priority 1 and the UE is configured by *UCI-MuxWithDifferentPriority* to multiplex HARQ-ACK information of priority 1 or priority 0, respectively, and if the UE multiplexes HARQ-ACK information of priority 1 or priority 0, the UE applies corresponding or provided by *CG-betaOffsetsCrossPri1* *= 'semiStatic'* or *CG-betaOffsetsCrossPri0 = 'semiStatic'*, respectively.

If the PUSCH transmission is scheduled by DCI format 0\_0 and the UE is provided *betaOffsets = 'dynamic'*, the UE applies the , , and values that are determined from the first value of *betaOffsets = 'dynamic'*. If the UE is configured by *UCI-MuxWithDifferentPriority* to multiplex HARQ-ACK information of priority 1, the UE applies corresponding provided by the first value of *betaOffset-CrossPri1* *= 'dynamic'*.

If the PUSCH transmission is a configured grant Type 2 PUSCH and the UE is provided *CG-UCI-OnPUSCH* =*'dynamic'*, the UE applies the , , and values that are determined from the first value of *CG-UCI-OnPUSCH = 'dynamic'*. If the PUSCH transmission has priority 0 or priority 1 and the UE is configured by *UCI-MuxWithDifferentPriority* to multiplex HARQ-ACK information of priority 1 or priority 0, respectively, and if the UE multiplexes HARQ-ACK information of priority 1 or priority 0, the UE applies corresponding or provided by the first value of *CG-betaOffsetsCrossPri1* *= 'dynamic'* or *CG-betaOffsetsCrossPri0* *= 'dynamic'*, respectively.

HARQ-ACK information offsets are configured to values according to Table 9.3-1. The *betaOffsetACK-Index1*, *betaOffsetACK-Index2*, and *betaOffsetACK-Index3* respectively provide indexes , , and for the UE to use if the UE multiplexes up to 2 HARQ-ACK information bits, more than 2 and up to 11 HARQ-ACK information bits, and more than 11 bits in the PUSCH, respectively.

Offsets for multiplexing HARQ-ACK information with priority 0 in a PUSCH transmission with priority 1 are configured to values according to Table 9.3-1. The *betaOffsetACKPri0-Index1*, *betaOffsetACKPri0-Index2*, and *betaOffsetACKPri0-Index3* respectively provide indexes , , and for the UE to use if the UE multiplexes up to 2 bits, more than 2 and up to 11 bits, and more than 11 bits of HARQ-ACK information with priority 0 in the PUSCH transmission with priority 1, respectively.

Offsets for multiplexing HARQ-ACK information with priority 1 in a PUSCH transmission with priority 0 are configured to values according to Table 9.3-1. The *betaOffsetACKPri1-Index1*, *betaOffsetACKPri1-Index2*, and *betaOffsetACKPri1-Index3* respectively provide indexes , , and for the UE to use if the UE multiplexes up to 2 bits, more than 2 and up to 11 bits, and more than 11 bits of HARQ-ACK information with priority 1 in the PUSCH transmission with priority 0, respectively.

Part 1 CSI report and Part 2 CSI report offsets and , respectively, are configured to values according to Table 9.3-2. The *betaOffsetCSI-Part1-Index1* and *betaOffsetCSI-Part2-Index1* respectively provide indexes and for the UE to use if the UE multiplexes up to 11 bits for Part 1 CSI reports or Part 2 CSI reports in the PUSCH. The *betaOffsetCSI-Part1-Index2* and *betaOffsetCSI-Part2-Index2* respectively provide indexes or for the UE to use if the UE multiplexes more than 11 bits for Part 1 CSI reports or Part 2 CSI reports in the PUSCH.

If a DCI format that includes a beta\_offset indicator field with one bit or two bits, as configured by *uci-OnPUSCH* or *UCI-OnPUSCH-DCI-0-2*, schedules the PUSCH transmission from the UE, the UE is provided by each of {*betaOffsetACK-Index1*, *betaOffsetACK-Index2*, *betaOffsetACK-Index3*}, {*betaOffsetACKPri0-Index1*, *betaOffsetACKPri0-Index2*, *betaOffsetACKPri0-Index3*}, and {*betaOffsetACKPri1-Index1*, *betaOffsetACKPri1-Index2*, *betaOffsetACKPri1-Index3*} a set of two or four indexes from Table 9.3-1for multiplexing HARQ-ACK information in the PUSCH transmission and by each of {*betaOffsetCSI-Part1-Index1*, *betaOffsetCSI-Part1-Index2*} a set of two or four indexes, and by each of {*betaOffsetCSI-Part2-Index1*, *betaOffsetCSI-Part2-Index2*} a set of two or four indexes from Table 9.3-2, respectively, for multiplexing Part 1 CSI reports and Part 2 CSI reports, respectively, in the PUSCH transmission. The beta\_offset indicator field indicates a value and/or a value, and/or a value, a value and a value from the respective sets of values, with the mapping defined in Table 9.3-3 and in Table 9.3-3A. If the PUSCH transmission has priority 0 or priority 1, and the UE is provided *UCI-MuxWithDifferentPriority*, and the UE multiplexes HARQ-ACK information of priority 1 or priority 0 in the PUSCH, the UE applies {*betaOffsetACKPri1-Index1*, *betaOffsetACKPri1-Index2*, *betaOffsetACKPri1-Index3*}, or {*betaOffsetACKPri0-Index1*, *betaOffsetACKPri0-Index2*, *betaOffsetACKPri0-Index3*} provided by *betaOffset-CrossPri1* *= 'dynamic'* for DCI format 0\_1, *betaOffsetsCrossPri1DCI-0-2= 'dynamic'* for DCI format 0\_2, or *betaOffset-CrossPri0 = 'dynamic'* for DCI format 0\_1, *betaOffsetsCrossPri0DCI-0-2= 'dynamic'* for DCI format 0\_2, respectively.

For a PUSCH transmission that is configured by a *ConfiguredGrantConfig* and includes CG-UCI, the UE multiplexes CG-UCI in the PUSCH transmission if the UE is provided by *betaOffsetCG-UCI* a value, from a set of values, with the mapping defined in Table 9.3-1. If the UE is provided *cg-UCI-Multiplexing* and multiplexes HARQ-ACK information in the PUSCH transmission, as described in clauses 9 and 9.2.5, the UE jointly encodes the HARQ-ACK information and the CG-UCI [5, TS 38.212] and determines a number of resources for multiplexing the combined information in a PUSCH using which provides indexes and for the UE to use if the UE multiplexes up to 11, and more than 11 combined information bits, respectively.

Table 9.3-1: Mapping of beta\_offset values for HARQ-ACK information and/or for CG-UCI and the index signalled by higher layers

|  |  |
| --- | --- |
|  or or or or or or or or or  |  or or or  |
| 0 | 1.000 |
| 1 | 2.000 |
| 2 | 2.500 |
| 3 | 3.125 |
| 4 | 4.000 |
| 5 | 5.000 |
| 6 | 6.250 |
| 7 | 8.000 |
| 8 | 10.000 |
| 9 | 12.625 |
| 10 | 15.875 |
| 11 | 20.000 |
| 12 | 31.000 |
| 13 | 50.000 |
| 14 | 80.000 |
| 15 | 126.000 |
| 16 | 0.6 |
| 17 | 0.4 |
| 18 | 0.2 |
| 19 | 0.1 |
| 20 | 0.05 |
| 21 | Reserved |
| 22 | Reserved |
| 23 | Reserved |
| 24 | Reserved |
| 25 | Reserved |
| 26 | Reserved |
| 27 | Reserved |
| 28 | Reserved |
| 29 | Reserved |
| 30 | Reserved |
| 31 | Reserved |

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