**3GPP TSG RAN WG1 Meeting #122 R1-250XXXX**

**Bengaluru, India, Aug 25th – 29th, 2025**

**Source: Moderator (Xiaomi)**

**Title: Feature lead summary #1 on multi-cell scheduling with a single DCI**

**Agenda item:** **8.12.1**

**Document for:** **Discussion and Decision**

# Introduction

This document summarizes the open issues on multi-cell scheduling from contributions submitted under the agenda item of “**8.12.1 Multi-Carrier Enhancements for NR Phase 3**” for Rel-19 WI Multi-carrier enhancements.

The Rel-19 WI Multi-carrier enhancements was approved during RAN#105 meeting in RP-242408, where the objective is targeted to specify the support of multi-cell PUSCH/PDSCH scheduling with a single DCI including scheduling of different SCS/carrier types and one or multiple PUSCHs/PDSCHs per scheduled cell. The detailed objectives of the WID are further updated in RP-242904 during RAN#106 meeting and listed below:

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| ***1. Specify the support of the following for multi-cell PUSCH/PDSCH scheduling with a single DCI [RAN1]***   * ***Different SCS/carrier type among co-scheduled cells by the single DCI.*** * ***One or multiple PUSCHs/PDSCHs per scheduled cell by the single DCI.***   + ***The maximum number of PUSCHs/PDSCHs for a scheduled cell is 8.***   + ***Note: Type-1 HARQ-ACK codebook is not enhanced for Rel-19 multi-cell scheduling.***   + ***Note: The maximum number of sub-codebooks for Type-2 HARQ-ACK codebook is not increased for Rel-19 multi-cell scheduling.***   + ***Note: UE does not expect to be configured with both single-cell multi-PUSCH/PDSCH scheduling and multi-cell multi-PUSCH/PDSCH scheduling on the same or different cells within a same PUCCH group.*** * ***Note: No new DCI format is introduced.*** |

In this contribution, the related issues and proposals are summarized based on the contributions submitted in RAN1#122 under the agenda item 8.12.1 [1]-[7]. The whole feature lead summary is structured as follows:

For this meeting, moderator tries to resolve any valid issues and selects below for discussion at the first step. Companies are highly encouraged to provide views as soon as possible. Moderator will try to update the proposals based on companies’ inputs at least on daily basis.

# Restriction of simultaneous configuration of single-cell multi-PUSCH scheduling and multi-cell multi-PUSCH scheduling

## Companies’ inputs

[R1-2505440](file:///D:\RAN1\RAN1%23122\tdocs\R1-2505440.zip) Text proposals for Rel-19 Multi-carrier enhancements Xiaomi

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| Reason for change: The restriction of simultaneous configuration of single-cell multi-PUSCH scheduling and multi-cell multi-PUSCH scheduling within a same PUCCH group has not been captured in TS38.214-j00.  Summary of change: Mimic same wording on restriction of PDSCH scheduling in Section 5.1.2.1 to Section 6.1.2.1 for restriction of PUSCH scheduling, i.e., add the sentence of “*If a UE is configured with pusch-TimeDomainAllocationListForMultiPUSCH in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell within a PUCCH group, the UE does not expect to be configured with higher layer parameter ScheduledCell-ListDCI-0-3 on any serving cell within the PUCCH group.*”  Consequences if not approved: The note in the WID of Rel-19 Multi-carrier enhancements hasn’t be captured in TS38.214. |

6.1.2 Resource allocation

6.1.2.1 Resource allocation in time domain

When the UE is scheduled to transmit a transport block and no CSI report by a DCI or by a RAR UL grant or fallbackRAR UL grant, or the UE is scheduled to transmit a transport block and a CSI report(s) on PUSCH by a DCI, the '*Time domain resource assignment'* field value *m* for the scheduled PUSCH on the serving cell of the DCI or the *PUSCH time resource allocation* field value *m* of the RAR UL grant or of the fallbackRAR UL grant provides a row index *m* + 1to a resource allocation table. The determination of the used resource allocation table is defined in Clause 6.1.2.1.1. The indexed row defines the slot offset *K2*, the start and length indicator *SLIV*, or directly the start symbol *S* and the allocation length *L*, the PUSCH mapping type, the number of slots used for TBS determination (if *numberOfSlotsTBoMS* is present in the resource allocation table), and the number of repetitions (if *numberOfRepetitions* is present in the resource allocation table) to be applied in the PUSCH transmission, and the OCC length *Locc* (if configured) to apply in case OCC is used on top of PUSCH repetitions.

When the UE is scheduled to transmit a PUSCH with no transport block and with a CSI report(s) by a '*CSI request'* field on a DCI, the '*Time domain resource assignment'* field value *m* of the DCI provides a row index *m* + 1to the allocated table as defined in Clause 6.1.2.1.1. The indexed row defines the start and length indicator SLIV, or directly the start symbol *S* and the allocation length *L*, and the PUSCH mapping type to be applied in the PUSCH transmission and the *K2* value is determined as , where  are the corresponding list entries of the higher layer parameter

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For *pusch-TimeDomainAllocationListForMultiPUSCH* and *pusch-TimeDomainAllocationListForMultiPUSCH***-***DCI-0-3* in *pusch-Config*, if a row indicates resource allocation for two to eight contiguous PUSCHs and *extendedK2* is not configured, *K2* given by *k2-r16* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH* signalled in DCI format 0\_1 or in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* signalled in DCI format 0\_3.

For *pusch-TimeDomainAllocationListForMultiPUSCH* and *pusch-TimeDomainAllocationListForMultiPUSCH***-***DCI-0-3* in *pusch-Config,* if a row indicates resource allocation of more than one PUSCH and *extendedK2* is configured, each PUSCH has a separate SLIV, mapping type and *K2* given by *extendedK2*. If a row indicates resource allocation of a single PUSCH, the PUSCH has a single SLIV, mapping type, and *K2*, where *K2* is given by *extendedK2*, if configured, otherwise *K2* is given by *k2-r16*. The number of scheduled PUSCHs is signalled by the number of indicated SLIVs in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH* signalled in DCI format 0\_1 or in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* signalled in DCI format 0\_3.

If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple *SLIV*s for PUSCH on a UL BWP of a serving cell, and the UE is indicated re-transmission of PUSCH by DCI format 0\_1, where the PUSCH is correspond to a configured grant Type 1 or Type 2, the UE does not expect that the number of indicated *SLIV*s in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH* by the DCI is more than one.

If a UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* or *pusch-TimeDomainAllocationListForMultiPUSCH***-***DCI-0-3* in which one or more rows contain multiple *SLIV*s for PUSCH on a UL BWP of a serving cell, the UE does not expect to be scheduled with one or multiple PUSCH transmissions by a single DCI format 0\_1 or 0\_3, where each PUSCH transmission overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*.

If a UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell within a PUCCH group, the UE does not expect to be configured with higher layer parameter *ScheduledCell-ListDCI-0-3* on any serving cell within the PUCCH group.When the UE is configured with *minimumSchedulingOffsetK2* in an active UL BWP it applies a minimum scheduling offset restriction indicated by the '*Minimum applicable scheduling offset indicator*' field in DCI format 0\_1, 0\_3, 1\_1 or 1\_3 if the same field is available. When the UE is configured with *minimumSchedulingOffsetK2* in an active UL BWP and it has not received '*Minimum applicable scheduling offset indicator*' field in DCI format 0\_1, 0\_3, 1\_1 or 1\_3, the UE shall apply a minimum scheduling offset restriction indicated based on '*Minimum applicable scheduling offset indicator*' value '0'. When the minimum scheduling offset restriction is applied the UE is not expected to be scheduled with a DCI in slot *n* to transmit a PUSCH scheduled with C-RNTI, CS-RNTI, MCS-C-RNTI or SP-CSI-RNTI with *K*2 smaller than, where *K*2min and are the applied minimum scheduling offset restriction and the numerology of the active UL BWP of the scheduled cell when receiving the DCI in slot *n*, respectively, and is the numerology of the new active UL BWP in case of active UL BWP change in the scheduled cell and is equal to , otherwise. The minimum scheduling offset restriction is not applied when PUSCH transmission is scheduled by RAR UL grant or fallbackRAR UL grant for RACH procedure, or when PUSCH is scheduled with TC-RNTI. The application delay of the change of the minimum scheduling offset restriction is determined in Clause 5.3.1.

[R1-2505724](file:///D:\RAN1\RAN1%23122\tdocs\R1-2505724.zip) Maintenance on multi-cell scheduling with a single DCI OPPO

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| 6.1.2.1 Resource allocation in time domain  **<Unchanged parts are omitted>**  If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell, the UE does not apply *pusch-AggregationFactor*, if configured, to DCI format 0\_1 on the UL BWP of the serving cell and the UE does not expect to be configured with *numberOfRepetitions* in *pusch-TimeDomainAllocationListForMultiPUSCH.* If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell, the UE does not apply *pusch-AggregationFactor*, if configured, to DCI format 0\_3 on the UL BWP of the serving cell and the UE does not expect to be configured with *numberOfRepetitions* in *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3*.  If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH* or *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell, when any two UL DCIs end in the same symbol and at least one of the DCIs scheduling multiple PUSCHs, the UE does not expect that the any scheduled multiple PUSCHs have overlapping spans, where the span associated with a DCI is defined from the beginning of the first scheduled PUSCH till the end of the last scheduled PUSCH.  If a UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell within a PUCCH group, the UE does not expect to be configured with higher layer parameter *ScheduledCellListDCI-0-3* including any serving cell configured with *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* on any serving cell within the PUCCH group.  **<Unchanged parts are omitted>** |

## Moderator summary and proposals based on contributions

As stated in the WID of Rel-19 Multi-carrier enhancements, there is one note to restrict the simultaneous configuration of single-cell multi-PUSCH/PDSCH scheduling and multi-cell multi-PUSCH/PDSCH scheduling within a same PUCCH group. The note is shown in below:

* Note: UE does not expect to be configured with both single-cell multi-PUSCH/PDSCH scheduling and multi-cell multi-PUSCH/PDSCH scheduling on the same or different cells within a same PUCCH group.

According to the latest TS38.214-j00, such restriction has been captured in section 5.1.2.1 for PDSCH scheduling, which is highlighted in cyan as “ If a UE is configured with *pdsch-TimeDomainAllocationListForMultiPDSCH* in which one or more rows contain multiple SLIVs for PDSCH on a DL BWP of a serving cell within a PUCCH group, the UE does not expect to be configured with higher layer parameter *ScheduledCell-ListDCI-1-3* on any serving cell within the PUCCH group.”.

However, in the latest TS38.214-j00, such restriction has not been captured in section 6.1.2.1 for PUSCH scheduling. Hence, below TP1 is provided to add this restriction to PUSCH scheduling.

Hence, Proposal 1-1 is provided for discussion.

## 1st round of discussions

#### Proposal 1-1:

* Below TP is agreed for TS38.214 on adding the restriction of simultaneous configuration of single-cell multi-PUSCH scheduling and multi-cell multi-PUSCH scheduling within a same PUCCH group.

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| Reason for change: The restriction of simultaneous configuration of single-cell multi-PUSCH scheduling and multi-cell multi-PUSCH scheduling within a same PUCCH group has not been captured in TS38.214-j00.  Summary of change: Mimic same wording on restriction of PDSCH scheduling in Section 5.1.2.1 to Section 6.1.2.1 for restriction of PUSCH scheduling, i.e., add the sentence of “*If a UE is configured with pusch-TimeDomainAllocationListForMultiPUSCH in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell within a PUCCH group, the UE does not expect to be configured with higher layer parameter ScheduledCell-ListDCI-0-3 on any serving cell within the PUCCH group.*”  Consequences if not approved: The note in the WID of Rel-19 Multi-carrier enhancements hasn’t be captured in TS38.214. |

6.1.2 Resource allocation

6.1.2.1 Resource allocation in time domain

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*<Unchanged parts are omitted>\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

For *pusch-TimeDomainAllocationListForMultiPUSCH* and *pusch-TimeDomainAllocationListForMultiPUSCH***-***DCI-0-3* in *pusch-Config*, if a row indicates resource allocation for two to eight contiguous PUSCHs and *extendedK2* is not configured, *K2* given by *k2-r16* indicates the slot where UE shall transmit the first PUSCH of the multiple PUSCHs. Each PUSCH has a separate SLIV and mapping type. The number of scheduled PUSCHs is signalled by the number of indicated valid SLIVs in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH* signalled in DCI format 0\_1 or in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* signalled in DCI format 0\_3.

For *pusch-TimeDomainAllocationListForMultiPUSCH* and *pusch-TimeDomainAllocationListForMultiPUSCH***-***DCI-0-3* in *pusch-Config,* if a row indicates resource allocation of more than one PUSCH and *extendedK2* is configured, each PUSCH has a separate SLIV, mapping type and *K2* given by *extendedK2*. If a row indicates resource allocation of a single PUSCH, the PUSCH has a single SLIV, mapping type, and *K2*, where *K2* is given by *extendedK2*, if configured, otherwise *K2* is given by *k2-r16*. The number of scheduled PUSCHs is signalled by the number of indicated SLIVs in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH* signalled in DCI format 0\_1 or in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* signalled in DCI format 0\_3.

If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple *SLIV*s for PUSCH on a UL BWP of a serving cell, and the UE is indicated re-transmission of PUSCH by DCI format 0\_1, where the PUSCH is correspond to a configured grant Type 1 or Type 2, the UE does not expect that the number of indicated *SLIV*s in the row of the *pusch-TimeDomainAllocationListForMultiPUSCH* by the DCI is more than one.

If a UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* or *pusch-TimeDomainAllocationListForMultiPUSCH***-***DCI-0-3* in which one or more rows contain multiple *SLIV*s for PUSCH on a UL BWP of a serving cell, the UE does not expect to be scheduled with one or multiple PUSCH transmissions by a single DCI format 0\_1 or 0\_3, where each PUSCH transmission overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*.

If a UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell within a PUCCH group, the UE does not expect to be configured with higher layer parameter *ScheduledCell-ListDCI-0-3* on any serving cell within the PUCCH group.

When the UE is configured with *minimumSchedulingOffsetK2* in an active UL BWP it applies a minimum scheduling offset restriction indicated by the '*Minimum applicable scheduling offset indicator*' field in DCI format 0\_1, 0\_3, 1\_1 or 1\_3 if the same field is available. When the UE is configured with *minimumSchedulingOffsetK2* in an active UL BWP and it has not received '*Minimum applicable scheduling offset indicator*' field in DCI format 0\_1, 0\_3, 1\_1 or 1\_3, the UE shall apply a minimum scheduling offset restriction indicated based on '*Minimum applicable scheduling offset indicator*' value '0'. When the minimum scheduling offset restriction is applied the UE is not expected to be scheduled with a DCI in slot *n* to transmit a PUSCH scheduled with C-RNTI, CS-RNTI, MCS-C-RNTI or SP-CSI-RNTI with *K*2 smaller than, where *K*2min and are the applied minimum scheduling offset restriction and the numerology of the active UL BWP of the scheduled cell when receiving the DCI in slot *n*, respectively, and is the numerology of the new active UL BWP in case of active UL BWP change in the scheduled cell and is equal to , otherwise. The minimum scheduling offset restriction is not applied when PUSCH transmission is scheduled by RAR UL grant or fallbackRAR UL grant for RACH procedure, or when PUSCH is scheduled with TC-RNTI. The application delay of the change of the minimum scheduling offset restriction is determined in Clause 5.3.1.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*<Unchanged parts are omitted>\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Companies are encouraged to provide comments in the table below.

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| **Company** | **Comment** |
| Samsung | OK |
| ZTE | Fine with the TP |
| Spreadtrum | The restriction of simultaneous configuration of single-cell multi-PDSCH scheduling and multi-cell multi-PDSCH scheduling within a same PUCCH group is captured in Rel-18. And this is valid for Rel-19. So actually PUSCH part should be Rel-18 CR. |
| Ericsson | OK |
| NTT DOCOMO | Fine with the TP to follow the WID. |
| Nokia | Could somebody please tell me where we got an agreement to not have DCI format 0\_1 multi-PUSCH scheduling together with DCI format 0\_3 operation in first place?  For PDSCH this restriction was clear, as this is coming from the HARQ-ACK CB construction (only two Type 2 sub-codebooks).   And we agree with Spreadtrum here, if such restriction would be needed it should have been there in R18 already.  Please note, the configuration of the multi PUSCH table for 0\_1 and 0\_3 is captured in 38.331. |
| vivo | We already capture this agreement in the LS sent to RAN2. So it is expected to be captured in the RRC description. We don’t need to capture it in RAN1. |
| OPPO | According to the WID, it says “*UE does not expect to be configured with both single-cell multi-PUSCH/PDSCH scheduling and multi-cell multi-PUSCH/PDSCH scheduling on the same or different cells within a same PUCCH group*”, so it is a restriction between “single cell multi-PUSCH/PDSCH” and “multi-cell multi-PUSCH/PDSCH”, instead of a restriction between “single-cell multi-PUSCH/PDSCH” and “multi-cell”. Based on that, we think the TP provided in our contribution is more aligned with the WID (copied below for convenience):   |  | | --- | | 6.1.2.1 Resource allocation in time domain  **<Unchanged parts are omitted>**  If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell, the UE does not apply *pusch-AggregationFactor*, if configured, to DCI format 0\_1 on the UL BWP of the serving cell and the UE does not expect to be configured with *numberOfRepetitions* in *pusch-TimeDomainAllocationListForMultiPUSCH.* If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell, the UE does not apply *pusch-AggregationFactor*, if configured, to DCI format 0\_3 on the UL BWP of the serving cell and the UE does not expect to be configured with *numberOfRepetitions* in *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3*.  If a UE is configured with *extendedK2* in *pusch-TimeDomainAllocationListForMultiPUSCH* or *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell, when any two UL DCIs end in the same symbol and at least one of the DCIs scheduling multiple PUSCHs, the UE does not expect that the any scheduled multiple PUSCHs have overlapping spans, where the span associated with a DCI is defined from the beginning of the first scheduled PUSCH till the end of the last scheduled PUSCH.  If a UE is configured with *pusch-TimeDomainAllocationListForMultiPUSCH* in which one or more rows contain multiple SLIVs for PUSCH on a UL BWP of a serving cell within a PUCCH group, the UE does not expect to be configured with higher layer parameter *ScheduledCellListDCI-0-3* including any serving cell configured with *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* on any serving cell within the PUCCH group.  **<Unchanged parts are omitted>** | |
| LGE | OK |
| Moderator | @Spreadtrum @Nokia:  In Rel-18, we don’t have agreement to exclude the simultaneous configuration of both single-cell multi-PUSCH scheduling and multi-cell single-PUSCH scheduling in one PUCCH group. This is the reason why Rel-18 TS38.214 has not captured such restriction.  In Rel-19, due to quite limited TU for Rel-19 MCE, the restriction of “*UE does not expect to be configured with both single-cell multi-PUSCH/PDSCH scheduling and multi-cell multi-PUSCH/PDSCH scheduling on the same or different cells within a same PUCCH group*” is added as one note in the Rel-19 WID in order to avoid any complicated design to delay the progress. The motivation of the TP is to capture this restriction in spec.  @vivo:  In the LS to RAN2, we add the note of the restriction in the excel sheet. However, I am not quite sure whether RAN2 will add this restriction in TS38.331. If they do it, then RAN1 will not need to repeat the restriction.  @OPPO:  I think the first step is to capture this restriction to Rel-19 spec. Whether to add or avoid this restriction to Rel-18 can be next step work. In addition, your proposed wording is a bit redundant to me. |

# Determination on maximum number of schedulable PUSCHs/PDSCHs for a cell

## Companies’ inputs

[R1-2505557](file:///D:\RAN1\RAN1%23122\tdocs\R1-2505557.zip) Remaining issues on multi-carrier enhancements. Samsung

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| **Proposal 2: For the number of bits of NDI/RV fields in DCI format 0\_3/1\_3 with multi-PUSCH/PDSCH scheduling:**   * **the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell is determined by TDRA table for *the active BWP of* the cell.** |

## Moderator summary and proposals based on contributions

As agreed in RAN1#120 meeting, we have below agreements on NDI/RV determination in DCI format 0\_3/1\_3:

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| Agreement   * For NDI indication in DCI format 0\_3/1\_3 for a TB,   + Option 1 is adopted.   Agreement   * For RV indication in DCI format 0\_3/1\_3 for a TB,   + Option 1 is adopted. |

Definition of Option 1 for NDI/RV is given below in RAN1#119 meeting:

* For NDI indication in DCI format 0\_3/1\_3 for TB1, further study
  + Option 1: For each block of NDI field, the number of bits is equal to the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3.
    - Maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell is determined by TDRA table for the cell.
* For RV indication in DCI format 0\_3/1\_3 for TB1, further study
  + Option 1: For each block of RV field, the number of bits is equal to the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3 and number of bits for RV configured for the cell.
    - Maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell is determined by TDRA table for the cell.

As shown in above, the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell is determined by TDRA table for the cell. Correspondingly, it is captured in TS38.212-v19.0.0 as “If *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* is configured for a cell, the number of bits for the corresponding block is equal to the maximum number of schedulable PDSCHs among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* for the cell”, and shown in below:

TS38.212-v19.0.0:

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| - New data indicator - number of bits determined by the following:  - block number 1, block number 2,…, block number  Each block corresponds to the new data indicator for a cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the new data indicator for the cell with the smallest serving cell index. If *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* is configured for a cell, the number of bits for the corresponding block is equal to the maximum number of schedulable PDSCHs among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* for the cell, where each bit corresponds to one scheduled PDSCH as defined in clause 6.1.4 in [6, TS 38.214]; otherwise, the corresponding block is 1 bit.  - Redundancy version - number of bits determined by the following:  - block number 1, block number 2,…, block number  Each block corresponds to the redundancy version for a cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the redundancy version for the cell with the smallest serving cell index. The number of bits for each block is determined by following:  - if *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* is configured for a cell, the number of bits for the corresponding block is determined by , where is the maximum number of schedulable PDSCHs among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* for the cell, is 0, 1 or 2 bits determined by higher layer parameter *numberOfBitsForRV-DCI-1-3* for the cell, and each bit(s) corresponds to one scheduled PDSCH as defined in clause 6.1.4 in [6, TS 38.214], |

Considering *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* is configured per BWP per cell, one thing not clear is “the maximum number of schedulable PDSCHs among all entries in the higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH-DCI-1-3* for the cell” is the maximum number of schedulable PDSCHs among all entries of all TDRA tables of the cell, OR the maximum number of schedulable PDSCHs among all entries of the TDRA table for the active BWP of the cell.

As proposed by Samsung, the reasonable way is to follow the legacy behavior specified in Rel-17 as below:

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| **Conclusion (RAN1#114bis)**   * It is clarified that the maximum DCI field sizes of NDI/RV for PDSCH and NDI/RV for PUSCH are determined based on the maximum number of schedulable PUSCH or PDSCH among all entries in TDRA table configured for the active BWP.   If a bandwidth part indicator field … [*Not fully reproduced for brevity*] |

Hence, Proposal 2-1 is provided for discussion.

## 1st round of discussions

#### Proposal 2-1:

In NDI/RV fields of DCI format 0\_3/1\_3, for determining the number of bits in a block for a cell,

* the maximum number of schedulable PUSCHs/PDSCHs for the cell is determined by the TDRA table for the active BWP of the cell.

Companies are encouraged to provide comments in the table below.

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| --- | --- |
| **Company** | **Comment** |
| Samsung | Agree |
| ZTE | Support the proposal as a conclusion. |
| Spreadtrum | We don’t think it is necessary, TDRA table is configured per BWP. It already means the TDRA table of active BWP. |
| Ericsson | OK |
| NTT DOCOMO | Support. |
| Nokia | Our understanding is that the current specification captures the maximum of the cell, i.e. the maximum across all BWPs of the DL serving cell.   We are open to define this as active BWP, but then we think a conclusion would not be sufficient but it would be better to capture this in the specifications directly to prevent any miss-understanding. |
| OPPO | Support the proposal as a conclusion and there is no spec impact. |
| LGE | OK with a conclusion as commented by companies. |
|  |  |
|  |  |

# Editorial changes

## Companies’ inputs

[R1-2505440](file:///D:\RAN1\RAN1%23122\tdocs\R1-2505440.zip) Text proposals for Rel-19 Multi-carrier enhancements Xiaomi

|  |
| --- |
| Reason for change: The current purposes of DCI format 0\_3/1\_3 in both section 7.3.1.1.4 and 7.3.1.2.4 do not capture the feature of Rel-19 Multi-carrier enhancements, i.e., DCI format 0\_3/1\_3 can schedule one or multiple cells with one or multiple PUSCHs/PDSCHs on each scheduled cell.  Summary of change: Change the purposes of DCI format 0\_3/1\_3 in both section 7.3.1.1.4 and 7.3.1.2.4 to capture the feature of Rel-19 Multi-carrier enhancements, i.e., DCI format 0\_3/1\_3 can schedule one or multiple cells with one or multiple PUSCHs/PDSCHs on each scheduled cell.  Consequences if not approved: The feature of Rel-19 Multi-carrier enhancements can’t be captured in TS38.212.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  7.3.1.1.4 Format 0\_3  DCI format 0\_3 is used for the scheduling of one or multiple PUSCHs in one cell, or multiple PUSCHs in multiple cells with one or multiple PUSCHs per cell.  The following information is transmitted by means of the DCI format 0\_3 with CRC scrambled by C-RNTI or MCS-C-RNTI:  - Identifier for DCI formats - 1 bit  - The value of this bit field is always set to 0, indicating an UL DCI format  - Scheduled cell set indicator - bits, where is the number of cell sets which are configured by higher layer parameter *mc-DCI-SetofCellsToAddModList* to be respectively scheduled by DCI format 0\_3/1\_3 from the cell on which this format is carried by PDCCH. If present, this field is used to indicate the scheduled cell set according to Table 7.3.1.1.4-1; otherwise, the scheduled cell set is the cell set configured to be scheduled by DCI format 0\_3/1\_3 from the cell by higher layer parameter *mc-DCI-SetofCellsToAddModList*.  ….  7.3.1.2.4 Format 1\_3  DCI format 1\_3 is used for the scheduling of one or multiple PDSCHs in one cell, or multiple PDSCHs in multiple cells with one or multiple PDSCHs per cell.  The following information is transmitted by means of the DCI format 1\_3 with CRC scrambled by C-RNTI or MCS-C-RNTI:  - Identifier for DCI formats - 1 bits  - The value of this bit field is always set to 1, indicating a DL DCI format  - Scheduled cell set indicator - bits, where is the number of cell sets which are configured by higher layer parameter *mc-DCI-SetofCellsToAddModList* to be respectively scheduled by DCI format 0\_3/1\_3 from the cell on which this format is carried by PDCCH. If present, this field is used to indicate the scheduled cell set according to Table 7.3.1.1.4-1; otherwise, the scheduled cell set is the cell set configured to be scheduled by DCI format 0\_3/1\_3 from the cell by higher layer parameter *mc-DCI-SetofCellsToAddModList*.  … |

## Moderator summary and proposals based on contributions

As stated in the WID, the objective of the Rel-19 WI Multi-carrier enhancements is targeted to specify the support of multi-cell PUSCH/PDSCH scheduling by a single DCI with one or multiple PUSCHs/PDSCHs per scheduled cell. Hence, the definition of DCI format 0\_3/1\_3 should be updated as shown in Table 7.3.1-1, TS38.212.

TS38.212-j00:

7.3.1 DCI formats

The DCI formats defined in table 7.3.1-1 are supported.

**Table 7.3.1-1: DCI formats**

| **DCI format** | **Usage** |
| --- | --- |
| 0\_0 | Scheduling of PUSCH in one cell |
| 0\_1 | Scheduling of one or multiple PUSCH in one cell, or indicating downlink feedback information for configured grant PUSCH (CG-DFI) |
| 0\_2 | Scheduling of PUSCH in one cell |
| 0\_3 | Scheduling of one or multiple PUSCHs in one cell, or multiple PUSCHs in multiple cells with one or multiple PUSCHs per cell |
| 1\_0 | Scheduling of PDSCH in one cell |
| 1\_1 | Scheduling of one or multiple PDSCH in one cell, and/or triggering one shot HARQ-ACK codebook feedback |
| 1\_2 | Scheduling of PDSCH in one cell |
| 1\_3 | Scheduling of one or multiple PDSCHs in one cell, or multiple PDSCHs in multiple cells with one or multiple PDSCHs per cell |
| … | … |

Hence, Proposal 3-1 is provided for discussion.

## 1st round of discussions

#### Proposal 3-1:

* Below TP is agreed for TS38.212 on updating purposes of DCI format 0\_3/1\_3 in section 7.3.1.1.4 and 7.3.1.2.4.

|  |
| --- |
| Reason for change: The current purposes of DCI format 0\_3/1\_3 in both section 7.3.1.1.4 and 7.3.1.2.4 do not capture the feature of Rel-19 Multi-carrier enhancements, i.e., DCI format 0\_3/1\_3 can schedule one or multiple cells with one or multiple PUSCHs/PDSCHs on each scheduled cell.  Summary of change: Change the purposes of DCI format 0\_3/1\_3 in both section 7.3.1.1.4 and 7.3.1.2.4 to capture the feature of Rel-19 Multi-carrier enhancements, i.e., DCI format 0\_3/1\_3 can schedule one or multiple cells with one or multiple PUSCHs/PDSCHs on each scheduled cell.  Consequences if not approved: The feature of Rel-19 Multi-carrier enhancements can’t be captured in TS38.212.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  7.3.1.1.4 Format 0\_3  DCI format 0\_3 is used for the scheduling of one or multiple PUSCHs in one cell, or multiple PUSCHs in multiple cells with one or multiple PUSCHs per cell.  The following information is transmitted by means of the DCI format 0\_3 with CRC scrambled by C-RNTI or MCS-C-RNTI:  - Identifier for DCI formats - 1 bit  - The value of this bit field is always set to 0, indicating an UL DCI format  - Scheduled cell set indicator - bits, where is the number of cell sets which are configured by higher layer parameter *mc-DCI-SetofCellsToAddModList* to be respectively scheduled by DCI format 0\_3/1\_3 from the cell on which this format is carried by PDCCH. If present, this field is used to indicate the scheduled cell set according to Table 7.3.1.1.4-1; otherwise, the scheduled cell set is the cell set configured to be scheduled by DCI format 0\_3/1\_3 from the cell by higher layer parameter *mc-DCI-SetofCellsToAddModList*.  ….  7.3.1.2.4 Format 1\_3  DCI format 1\_3 is used for the scheduling of one or multiple PDSCHs in one cell, or multiple PDSCHs in multiple cells with one or multiple PDSCHs per cell.  The following information is transmitted by means of the DCI format 1\_3 with CRC scrambled by C-RNTI or MCS-C-RNTI:  - Identifier for DCI formats - 1 bits  - The value of this bit field is always set to 1, indicating a DL DCI format  - Scheduled cell set indicator - bits, where is the number of cell sets which are configured by higher layer parameter *mc-DCI-SetofCellsToAddModList* to be respectively scheduled by DCI format 0\_3/1\_3 from the cell on which this format is carried by PDCCH. If present, this field is used to indicate the scheduled cell set according to Table 7.3.1.1.4-1; otherwise, the scheduled cell set is the cell set configured to be scheduled by DCI format 0\_3/1\_3 from the cell by higher layer parameter *mc-DCI-SetofCellsToAddModList*.  … |

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Samsung | OK |
| ZTE | OK |
| Spreadtrum | OK |
| Ericsson | OK |
| NTT DOCOMO | OK |
| Nokia | OK |
| LGE | OK |
|  |  |
|  |  |
|  |  |

# Proposals for online/offline discussion

# References

1. R1-2505229 Maintenance of Rel-19 Multi-carrier enhancements Huawei, HiSilicon
2. R1-2505392 Maintenance on enhancement of multi-cell PUSCH and PDSCH scheduling with a single DCI vivo
3. R1-2505440 Text proposals for Rel-19 Multi-carrier enhancements Xiaomi
4. R1-2505557 Remaining issues on multi-carrier enhancements. Samsung
5. R1-2505724 Maintenance on multi-cell scheduling with a single DCI OPPO
6. R1-2506026 Multi-carrier enhancements for NR Phase 3 MediaTek Inc.
7. R1-2506126 Maintenance on Multi-carrier enhancements for NR phase 3 ZTE Corporation, Sanechips

# List of agreements

## Agreements made in RAN1#109-e

**Agreement**

Agree the following terminologies ONLY for convenience of discussion:

* DCI format 0\_X is used for scheduling multiple PUSCHs on multiple cells with one PUSCH per cell
* DCI format 1\_X is used for scheduling multiple PDSCHs on multiple cells with one PDSCH per cell.

The above does not imply introducing new DCI format(s) at this point.

**Agreement**

* Different TBs are scheduled on different cells by DCI format 0\_X.
* Different TBs are scheduled on different cells by DCI format 1\_X.

**Agreement**

* Fallback DCI (i.e., DCI formats 0\_0 and 1\_0) does not support multi-cell scheduling.

**Agreement**

* The DCI for multi-cell scheduling is monitored only in USS set.

**Agreement**

* PDSCH cannot be scheduled by DCI format 0\_X.
* PUSCH cannot be scheduled by DCI format 1\_X.

**Agreement**

* All the co-scheduled cells by a DCI format 1\_X and the scheduling cell are included in the same PUCCH group.
* FFS: All the co-scheduled cells by a DCI format 0\_X and the scheduling cell are included in the same [cell or PUCCH group].

**Agreement**

* DCI format 0-X/1-X on a scheduling cell can be used to schedule PUSCHs/PDSCHs on multiple cells including the scheduling cell.
* DCI format 0-X/1-X on a scheduling cell can be used to schedule PUSCHs/PDSCHs on multiple cells not including the scheduling cell.

**Agreement**

* For a UE, the maximum number of cells scheduled by a DCI format 0\_X can be same or different to the maximum number of cells scheduled by a DCI format 1\_X.

**Working Assumption**

* All HARQ-ACK codebook types (Type-1/2/3) are applicable when multi-carrier PDSCH scheduling is configured.

**Agreement**

* One value for the maximum number of co-scheduled cells by a DCI format 0\_X in Rel-18 is selected from {3, 4, 8}.
* For a UE, the maximum number of co-scheduled cells by a DCI format 0\_X can be smaller than or equal to the maximum number supported in Rel-18.

**Agreement**

* One value for the maximum number of co-scheduled cells by a DCI format 1\_X in Rel-18 is selected from {3, 4, 8}.
* For a UE, the maximum number of co-scheduled cells by a DCI format 1\_X can be smaller than or equal to the maximum number supported in Rel-18.

**Agreement**

* **(Working assumption)** DCI format 0\_X/1\_X is a new DCI format for multi-cell scheduling
* DCI format 0\_X can be used for single cell PUSCH scheduling.
* DCI format 1\_X can be used for single cell PDSCH scheduling.
* FFS: UE monitors one of or both multi-cell scheduling DCI and legacy single cell scheduling DCI for a scheduled cell.

**Agreement**

* DCI format 0-X/1-X can be transmitted on PCell.
* DCI format 0-X/1-X can be transmitted on a SCell at least when the DCI format 0-X/1-X does not schedule PUSCH/PDSCH on PCell.
* FFS whether a DCI format 0-X/1-X can be transmitted on an SCell if the DCI format 0-X/1-X schedules PUSCH/PDSCH on PCell.

**Agreement**

Further study DCI size budget including below options for multi-cell scheduling DCI:

* Option 1: Existing DCI size budget is maintained per scheduled cell.
  + Alt 1-1: DCI size budget is maintained via DCI size alignment and DCI size budget of DCI format 0\_X/1\_X is counted for each of the co-scheduled cells.
  + Alt 1-2: DCI size budget is maintained via configured size for multi-cell scheduling DCI and DCI size budget of DCI format 0\_X/1\_X is counted for each of the co-scheduled cells.
  + Alt 1-3: DCI size budget is maintained via DCI size alignment and DCI size budget of multi-cell scheduling DCI is counted only in one scheduled cell.
* Option 2: Existing DCI size budget is not necessarily maintained per scheduled cell.
  + Alt 2-1: DCI size budget of multi-cell scheduling DCI is counted only in one scheduled cell.
  + Alt 2-2: DCI size budget of multi-cell scheduling DCI is not counted per serving cell and not considered in the related serving cell specific DCI size alignment procedure, e.g., for K co-scheduled cells, gNB guarantee the total budget of 3\*K DCI sizes is not exceeded.
  + Alt 2-3: voiding the “3+1” limit for multi-cell scheduling
  + Alt 2-4: the DCI size budget for DCI size alignment can be separately configured for each cell
  + Alt 2-5: DCI size budget of the scheduling cell can be increased to account for the DCI format for multi-cell scheduling. Accordingly, the DCI size budget of a scheduled cell can be reduced.
* Other options/alternatives could be considered.

**Agreement**

Further study BD/CCE counting for multi-cell scheduling DCI based on below options:

* Alt 1: counted on each co-scheduled cell
* Alt 2: counted only in one scheduled cell
* Alt 3: scaled down to each of co-scheduled cell according to the number of co-scheduled cells
* Alt 4: counted as part of the scheduling cell instead of each scheduled cell
* Alt 5: scaled down to each of scheduled cells excluding scheduling cell
* Alt 6: counted on each co-scheduled cell excluding scheduling cell
* Other alternatives could be considered.

**Agreement**

For multi-cell scheduling, the co-scheduled cells are indicated by DCI format 0\_X/1\_X. At least the following options are considered:

* Option 1: An indicator in the DCI points to one row of a table defining combinations of scheduled cells.
  + The table is configured by RRC signaling.
  + FFS: Separate tables can be configured for multi-cell PDSCH scheduling and multi-cell PUSCH scheduling.
* Option 2: An indicator in the DCI is a bitmap corresponding to a set of configured cells that can be scheduled by the DCI 0\_X/1\_X
  + FFS: Separate sets of configured cells for multi-cell PDSCH scheduling and multi-cell PUSCH scheduling.
* Option 3: using existing field (e.g., CIF, FDRA) to indicate whether one or more cells are scheduled or not
* Other options are not precluded.
* Note: It does not preclude other DCI information fields (e.g., BWP) to be jointly indicated by the indicator of the co-scheduled cells.

**Agreement**

For design of multi-cell scheduling DCI, companies are encouraged to consider following types of DCI fields:

* Type-1 field: A single field indicating common information to all the co-scheduled cells or separate information to each of co-scheduled cells via joint indication or an information to only one of co-scheduled cells
* Type-2 field: Separate field for each of the co-scheduled cells, or each sub-group comprising one or more co-scheduled cells where a single field is commonly applied to the co-scheduled cells belonging to a same sub-group
* Type-3 field: Common or separate to each of the co-scheduled cells or to each sub-group.
  + FFS: whether it is dependent on explicit configuration or implicit condition (e.g., intra or inter band CA, FR1 or FR2).
* Other types are not precluded.

## Agreements made in RAN1#110

**Agreement**

All the co-scheduled cells by a DCI format 0\_X and the scheduling cell are included in the same PUCCH group.

**Agreement**

Confirm below working assumption reached in RAN1#109e meeting.

* **(Working assumption)** DCI format 0\_X/1\_X is a new DCI format for multi-cell scheduling

**Working Assumption**

For a cell within a set of cells which can be co-scheduled by a DCI format 0\_X/1\_X, support monitoring the DCI format 0\_X/1\_X and legacy single cell scheduling DCI format(s) from a same scheduling cell.

* The DCI format 0\_X/1\_X and the legacy DCI format(s) can be monitored simultaneously.
  + FFS: whether monitoring of the DCI format 0\_X/1\_X and the legacy DCI format(s) is supported for one, a subset, or all cells within the set of cells.
* FFS: number of different DCI sizes for 0\_X/1\_X and for legacy DCI formats
* FFS: whether to support a subset or all legacy DCI format(s) to be monitored with DCI 0\_X/1\_X

**Working Assumption**

* The maximum number of co-scheduled cells by a DCI format 1\_X in Rel-18 is 4.
* The maximum number of co-scheduled cells by a DCI format 0\_X in Rel-18 is 4.
* FFS: The maximum number of configurable cells for co-scheduling

**Agreement**

For discussing field design of DCI format 0\_X/1\_X which schedules more than one cell, reformulate the types of DCI fields as below:

* Type-1 field:
  + Type-1A field: A single field indicating common information to all the co-scheduled cells
  + Type-1B field: A single field indicating separate information to each of co-scheduled cells via joint indication
  + Type-1C field: A single field indicating an information to only one of co-scheduled cells
* Type-2 field: Separate field for each of the co-scheduled cells
* Type-3 field: Common or separate to each of the co-scheduled cells, or separate to each sub-group, dependent on explicit configuration.
  + Note: One sub-group comprises a subset of co-scheduled cells where a single field is commonly applied to the co-scheduled cell(s) belonging to a same sub-group.
* Note: Handling of any parameters applicable to multi-cell scheduling where corresponding fields are not included in DCI format 0\_X/1\_X (if any) will be separately discussed.

**Agreement**

* For DCI format 1\_X/0\_X which can schedule more than one cell,
* Type-1 fields at least include below:
  + Type-1A:
    - Identifier for DCI formats
    - Downlink assignment index
    - TPC for scheduled PUCCH
    - PUCCH resource indicator
    - PDSCH-to-HARQ timing indicator
    - One-shot HARQ-ACK request
* Type-2 fields at least include below:
  + New data indicator per TB
  + Redundancy version per TB
* FFS: Other fields to be included in DCI format 1\_X/0\_X and which type of the fields belongs to.
* FFS: size for each field

**Agreement**

* When UE detects a DCI format 1\_X scheduling a set of PDSCHs, the UE provides corresponding HARQ-ACK information in a PUCCH transmission within UL slot , where is a number of slots and is indicated by the PDSCH-to-HARQ\_feedback timing indicator field in the DCI format and is the last UL slot overlapping with the DL slot for the reference PDSCH reception for slot-based PUCCH or an UL slot overlapping with the end of the reference PDSCH reception in DL slot for sub-slot based PUCCH.



* FFS details of reference PDSCH

**Agreement**

* For Type-2 HARQ-ACK codebook, two sub-codebooks are generated with a first sub-codebook comprising HARQ-ACK information bits for PDSCH(s) scheduled by DCI(s) with each scheduling a single cell and a second sub-codebook comprising HARQ-ACK information bits for PDSCH(s) scheduled by DCI(s) with each scheduling more than one cell.
* Separate DAI counting for DCI(s) with each scheduling a single cell and DCI(s) with each scheduling more than one cell.
* FFS whether a DCI scheduling more than one cell is associated with the first sub-codebook or the second sub-codebook when the number of cells with actual PDSCH reception due to collision with semi-static TDD DL/UL configuration is one.
* Type-2 HARQ-ACK codebook is generated by concatenating the first sub-codebook and the second sub-codebook.
* If at least one cell of the set of cells which can be co-scheduled by a DCI format 1\_X is configured with maximum 2 codewords per PDSCH without spatial bundling,
  + FFS: the number of HARQ-ACK information bits for each DCI format 1\_X that schedules more than one cell;
* Otherwise, the number of HARQ-ACK information bits for each DCI format 1\_X that schedules more than one cell is equal to N, where N is the maximum number of cells which can be co-scheduled by a DCI format 1\_X in the PUCCH group for the UE.
* HARQ-ACK information bits for co-scheduled PDSCHs by a DCI format 1\_X is ordered based on serving cell indices associated with co-scheduled PDSCHs.
* HARQ-ACK bundling across co-scheduled cells is not supported for multi-cell scheduling.

**Agreement**

* UE does not expect to be configured both CBG-based PDSCH/PUSCH transmission and the multi-cell PDSCH/PUSCH scheduling on the same or different cells within a same PUCCH group.

**Agreement**

* At least cases 1-1 and 1-2 on SCS are supported:
* Case 1-1: A DCI format 0-X/1-X on a scheduling cell can schedule multiple cells including the scheduling cell and same SCS is used among all the co-scheduled cells including the scheduling cell.
* Case 1-2: A DCI format 0-X/1-X on a scheduling cell can schedule multiple cells not including the scheduling cell and same SCS is used among all the co-scheduled cells which may be same or different to the SCS of the scheduling cell.
* Case 1-3: A DCI format 0-X/1-X on a scheduling cell can schedule multiple cells including the scheduling cell and different SCS is used among the co-scheduled cells including the scheduling cell.
* Case 1-4: A DCI format 0-X/1-X on a scheduling cell can schedule multiple cells not including the scheduling cell and different SCS is used among the co-scheduled cells.
* FFS: Whether Case 1-3 or 1-4 is additionally supported.

## Agreements made in RAN#97

**Conclusion:**

* Deprioritize any optimization for unlicensed spectrum operation for designing the multi-cell PUSCH/PDSCH scheduling in Rel-18.
* Enhanced Type-2 HARQ-ACK codebook is not supported for the multi-cell PUSCH/PDSCH scheduling in Rel-18.
* Type-1 HARQ-ACK codebook is supported only for the case where co-scheduled cells by a DCI format 1\_X have same SCS/carrier type/duplex mode in Rel-18.
* Additional restriction(s) can be discussed in RAN1
* Configuring more than one scheduling cell for DCI format 0\_X/1\_X for each scheduled cell is not supported for the multi-cell PUSCH/PDSCH scheduling in Rel-18.

**Conclusion:**

* Followings are excluded from multi-cell PDSCH/PUSCH scheduling in Rel-18.
* SCell schedules multiple cells including P(S)Cell
* Different SCS among co-scheduled cells
* Different carrier type (licensed or unlicensed, FR1 or FR2-1 or FR2-2) among co-scheduled cells
* Configuration of both multi-cell PDSCH/PUSCH scheduling and multi-TRP for a scheduled cell
* Support for any sidelink scheduling

**Conclusion:**

* Following is excluded from multi-cell PDSCH/PUSCH scheduling in Rel-18.
* PCell schedules multiple cells by DCI format 0\_X/1\_X when a sSCell is configured to schedule PCell

## Agreements made in RAN1#110bis

**Agreement**

Confirm the following working assumption reached in RAN1#110 meeting.

**Working Assumption**

* The maximum number of co-scheduled cells by a DCI format 1\_X in Rel-18 is 4.
* The maximum number of co-scheduled cells by a DCI format 0\_X in Rel-18 is 4.
* FFS: The maximum number of configurable cells for co-scheduling

**Agreement**

At least the following fields are excluded from DCI format 1\_X/0\_X:

* CBGTI
* CBGFI
* PDSCH group index
* New feedback indicator
* Number of requested PDSCH group(s)
* Sidelink assignment index
* Second TPC command for scheduled PUSCH
* Second SRS resource indicator
* Second Precoding information
* Second PTRS-DMRS association
* Second TPC command for scheduled PUCCH

**Agreement**

For DCI format 1\_X/0\_X, Type-1 fields at least include the following:

* Priority indicator
* Indicator of co-scheduled cells
* beta offset indicator
* CSI request
* UL-SCH indicator
* FFS: ChannelAccess-CPext

**Agreement**

Confirm below working assumption reached in RAN1#110 meeting with revision.

**Working Assumption**

* For any cell within a set of cells which can be co-scheduled by a DCI format 0\_X/1\_X, RAN1 specification supports monitoring the DCI format 0\_X/1\_X and DCI format 0\_0/1\_0, 0\_1/1\_1, and/or 0\_2/1\_2 (if supported by the UE), if configured from a same scheduling cell.
* The DCI format 0\_X/1\_X and the DCI format 0\_0/1\_0/0\_1/1\_1/0\_2/1\_2 can be monitored simultaneously.
* Note: This does not mean a UE is required to support number of BDs/CCEs beyond the Rel-17 limits (i.e., and ) for PDCCH candidates for each scheduled cell.

**Agreement**

For a set of cells co-scheduled by a DCI format 0\_X/1\_X, time domain resource allocations for the set of cells are ~~jointly~~ indicated by a single TDRA field in the DCI format 0\_X/1\_X.

* Separate {SLIV, mapping type, scheduling offset K0 (or K2)} is indicated for each of co-scheduled PDSCHs/PUSCHs.
* FFS details of the TDRA table design

**Agreement**

Confirm below working assumption:

**Working Assumption**

HARQ-ACK codebook types (Type-1, Rel-15 Type-2, Rel-16 Type-3, Rel-17 Type-3) are applicable when multi-cell PDSCH scheduling is configured.

**Working Assumption**

For a set of cells which is configured for multi-cell scheduling,

* Existing DCI size budget is maintained on each cell of the set of cells.
* DCI size of DCI format 0\_X/1\_X is counted on one cell among the set of cells.
  + FFS which cell DCI size of the DCI format 0\_X/1\_X is counted on.
* BD/CCE of DCI format 0\_X/1\_X is counted on one cell among the set of cells.
  + FFS which cell BD/CCE of the DCI format 0\_X/1\_X is counted on.
* Search space of DCI format 0\_X/1\_X is configured on one cell of the set of cells and associated with the search space of the scheduling cell with the same search space ID.
  + FFS which cell the SS of the DCI format 0\_X/1\_X is configured on.
* FFS: How to address Rel-17 BD/CCE limit for any given cell (operating the feature under Rel-17 BD/CCE limit)
* Note: This does not mean a UE is required to support number of BDs/CCEs beyond the Rel-17 limits (i.e., and ) for PDCCH candidates for each scheduled cell.

**Agreement**

* UE does not expect to be configured both multi-PDSCH scheduling and multi-cell PDSCH scheduling on the same or different cells within a same PUCCH group.

**Agreement**

* For Type-2 HARQ-ACK codebook, if at least one cell of a set of cells which can be co-scheduled by DCI format 1\_X is configured with maximum 2 codewords per PDSCH without spatial bundling, the number of HARQ-ACK information bits for each DCI format 1\_X that schedules more than one cell of the set of cells is equal to M, where M is the maximum number of TBs which can be co-scheduled by a DCI format 1\_X in the PUCCH group for the UE.

**Agreement**

* For Type-2 HARQ-ACK codebook, a DCI format 1\_X scheduling more than one cell is associated with the second sub-codebook when the number of cells with actual PDSCH reception due to collision with semi-static TDD DL/UL configuration is one.
* If a UE is scheduled by a DCI format 1\_X to receive PDSCH over multiple cells, and if tdd-UL-DL-ConfigurationCommon, or tdd-UL-DL-ConfigurationDedicated, indicates that, for a cell from the multiple cells, at least one symbol from a set of symbols where the UE is scheduled PDSCH reception in the cell is an uplink symbol, the UE does not receive the PDSCH in the cell.
* If a UE is scheduled by a DCI format 0\_X to transmit PUSCH over multiple cells, and if tdd-UL-DL-ConfigurationCommon, or tdd-UL-DL-ConfigurationDedicated, indicates that, for a cell from the multiple cells, at least one symbol from a set of symbols where the UE is scheduled PUSCH transmission in the cell is a downlink symbol, the UE does not transmit the PUSCH in the cell.

## Agreements made in RAN1#111

**Proposal 2-1 rev3:**

Confirm the RAN1#110bis-e working assumption with the following changes:

**Working Assumption**

For a set of cells which is configured for multi-cell scheduling,

* Existing DCI size budget is maintained on each cell of the set of cells.
* DCI size of DCI format 0\_X/1\_X is counted on one cell among the set of cells.
  + DCI size of the DCI format 0\_X/1\_X is counted on the reference cell.
* BD/CCE of DCI format 0\_X/1\_X is counted on one cell among the set of cells.
  + BD/CCE of the DCI format 0\_X/1\_X is counted on the reference cell.
* Same reference cell is used for both DCI format 0\_X and DCI format 1\_X.
* The reference cell is
  + the scheduling cell if the scheduling cell is included in the set of cells and search space of the DCI format 0\_X/1\_X is configured only on the scheduling cell;
  + one cell of the set of cells which search space of DCI format 0\_X/1\_X is configured on and associated with the search space of the scheduling cell with the same search space ID if search space of the DCI format 0\_X/1\_X is configured on the cell in addition to the scheduling cell.
    - It is up to gNB on which cell the SS of the DCI format 0\_X/1\_X is configured on.
* To address Rel-17 BD/CCE limit for any given cell (operating the feature under Rel-17 BD/CCE limit)
  + For the reference cell, a total number of configured BD/CCEs for both DCI formats 0\_X/1\_X and legacy DCI formats (if configured) does not exceed the Rel-17 limits.
  + For other cells in the sets of cells, Rel-17 limits for PDCCH/DCI monitoring and BD/CCE counting rules for legacy DCI formats (not including DCI formats 0\_X/1\_X) apply
* ~~Note: This does not mean a UE is required to support number of BDs/CCEs beyond the Rel-17 limits (i.e., and ) for PDCCH candidates for each scheduled cell.~~

**Agreement**

For a set of cells which is configured for multi-cell scheduling, up to 4 cells within the set of cells are supported.

* A DCI format 0\_X/1\_X can schedule PUSCH(s)/PDSCH(s) on a combination of co-scheduled cells among the same set of cells.

**Agreement**

For DCI format 1\_X/0\_X,

* Type-1 fields at least include below:
  + ChannelAccess-Cpext
  + TDRA
* Below fields are agreed to be supported for DCI format 0\_X/1\_X. FFS: Whether the fields are type1, type2, type configurable, or omitted. FFS: details on the fields (e.g. length, which legacy configurations are applicable), other fields.
  + HARQ process number
  + MCS (FFS: potential compression scheme)
  + Bandwidth part indicator
  + Frequency domain resource assignment (FFS: potential compression scheme)
  + VRB-to-PRB mapping
  + PRB bundling size indicator
  + Rate matching indicator
  + ZP CSI-RS trigger
  + Antenna port(s)
  + Transmission configuration indication
  + DMRS sequence initialization
  + Frequency hopping flag
  + TPC command for scheduled PUSCH
  + Precoding information and number of layers
  + PTRS-DMRS association
  + SRS request
  + SRS resource indicator
  + SRS offset indicator
  + PTRS-DMRS association
  + Open-loop power control parameter set indication
  + UL/SUL indicator

Note: RAN1 strives to minimize the number of fields which are type configurable.

**Agreement**

For monitoring PDCCH candidates for a set of cells which is configured for multi-cell scheduling, the n\_CI in the search space equation is determined by a value configured for the set of cells by RRC signaling.

Agreement

The types for below fields in DCI format 1\_X are listed ([R1-2212924](file:///D:/RAN1/RAN1%23112/tdocs/FL%20summary/R1-2212924.zip)):

|  |  |  |
| --- | --- | --- |
| **Field** | **Type** | **Details (for information only)** |
| HARQ process number | Type 2 | Details in Section 7.1.1 |
| MCS | Alt 1: Type 2 (without compression) | Details in Section 7.1.2 |
| BWP indicator | Type 1A | Details in Section 7.1.3 |
| FDRA | Type 2   * Further consider larger RBG granularity than existing maximum specified or configured value for RA type 0 * Use large RBG-based RIV for RA type 1 based on R16 configurable granularities for DCI format 1\_2 | Details in Section 7.1.4 |
| VRB-to-PRB mapping | Type 1A | Details in Section 7.1.5 |
| PRB bundling size indicator | Type 1A | Details in Section 7.1.6 |
| Rate matching indicator | Type 1B (up to 4 bits) | Details in Section 7.1.7 |
| ZP CSI-RS trigger | Type 1B (up to 3 bits) | Details in Section 7.1.8 |
| Antenna port(s) | Configurable between Type 1A and Type 2 | Details in Section 7.1.9 |
| TCI | Type 1B (up to 4 bits) | Details in Section 7.1.10 |
| DMRS sequence initialization | Type 1A | Details in Section 7.1.11 |
| SRS request | Type 1B (up to 4 bits) | Details in Section 7.1.12 |
| SRS offset indicator | Type 1B (up to 3 bits) | Details in Section 7.1.13 |

This does not imply that payload of DCI can be larger than what is supported for polar code in Rel-17.

FFS: Details

**Agreement**

* The types for below fields in DCI format 0\_X are listed:

|  |  |  |
| --- | --- | --- |
| Field | Type | **Details (for information only)** |
| HARQ process number | Type 2 | Details in Section 7.2.1 |
| MCS | Alt 1: Type 2 (without compression) | Details in Section 7.2.2 |
| BWP indicator | Type 1A | Details in Section 7.2.3 |
| FDRA | Type 2   * Further consider larger RBG granularity than existing maximum specified or configured value for RA type 0 * Use large RBG-based RIV for RA type 1 based on R16 configurable granularities for DCI format 1\_2 | Details in Section 7.2.4 |
| Frequency hopping flag | Type 1A | Details in Section 7.2.5 |
| TPC command for scheduled PUSCH | Type 2 | Details in Section 7.2.6 |
| Open-loop power control parameter set indication | Type 1A | Details in Section 7.2.7 |
| Antenna port(s) | Configurable between Type 1A and Type-2 | Details in Section 7.2.8 |
| Precoding information and number of layers | Configurable between Type 1A and Type-2 | Details in Section 7.2.9 |
| PTRS-DMRS association | Type 2 | Details in Section 7.2.10 |
| DMRS sequence initialization | Type 1A | Details in Section 7.2.11 |
| SRS request | Type 1B (up to 4 bits) | Details in Section 7.2.12 |
| SRS resource indicator | Configurable between Type 1A and Type-2 | Details in Section 7.2.13 |
| SRS offset indicator | Type 1B (up to 3 bits) | Details in Section 7.2.14 |
| UL/SUL indicator | FFS | Details in Section 7.2.15 |

This does not imply that payload of DCI can be larger than what is supported for polar code in Rel-17.

FFS: Details

## Agreements made in RAN1#112

**Agreement**

For Type-2 HARQ-ACK codebook, for a set of cells which is co-scheduled by a DCI format 1\_X, the reference PDSCH to determine DAI counting is the PDSCH with smallest serving cell index among the set of co-scheduled cells.

**Agreement**

* For a set of cells which is co-scheduled by a DCI format 1\_X, the PDSCH with the smallest serving cell index among the set of co-scheduled cells is used to determine last DCI format for PUCCH determination among DCI formats within a same PDCCH MO.
* It is up to gNB implementation to resolve the last DCI format issue when both DCI format 1\_X and other DCI format 1\_0/1\_1/1\_2/1\_X are received in a same PDCCH monitoring occasion on a same scheduling cell for scheduling PDSCHs on same scheduled cell.

**Agreement**

For determining the timing of a PUCCH carrying HARQ-ACK information corresponding to a set of co-scheduled PDSCHs by a DCI format 1\_X, the reference PDSCH is the PDSCH ending last as indicated in the DCI format 1\_X among the set of co-scheduled PDSCHs.

**Conclusion**

Type-1 HARQ-ACK codebook is supported for multi-cell scheduling without K1 extension.

* UE expects HARQ-ACK information for all co-scheduled PDSCHs by DCI format 1\_X can be mapped in the Type-1 HARQ-ACK codebook.
* Type-1 HARQ-ACK codebook is not enhanced for Rel-18 multi-cell scheduling.

**Agreement**

For a set of cells which is configured for multi-cell scheduling using DCI format 0\_X/1\_X, a joint TDRA table is configured by RRC signaling for the set of cells with each row in the table containing TDRA indexes for all cells within the set of cells.

* TDRA field in the DCI format 0\_X/1\_X belongs to Type-1B field.
* TDRA field in the DCI format 0\_X/1\_X indicates a row from the joint TDRA table.
* TDRA index for a cell points to a corresponding TDRA in the TDRA table applicable for DCI format 0-1/1-1.

**Agreement**

CSI request in DCI format 0\_X belongs to Type-1C field.

* This field is applied to the cell with smallest serving cell index among the co-scheduled cells.

**Agreement**

UL-SCH indicator in DCI format 0\_X belongs to Type-1C field.

* This field is applied to the cell with smallest serving cell index among the co-scheduled cells.

**Agreement**

Enhanced Type-3 codebook indicator in DCI format 1\_X belongs to Type-1A field.

**Agreement**

HARQ-ACK retransmission indicator in DCI format 1\_X belongs to Type-1A field.

**Agreementl**

PUCCH Cell indicator in DCI format 1\_X belongs to Type-1A field.

**Agreement**

For a set of cells configured for multi-cell scheduling using DCI format 0\_X/1\_X,

* the size of a Type-1A field in the DCI format 0\_X/1\_X is determined as maximum field size of active BWP among all cells within the set of cells.
* the size of a Type-1B field in the DCI format 0\_X/1\_X is equal to ceiling(log2(N)), where N is the number of rows in RRC-configured table with each row containing multiple indexes for all cells within the set of cells.
  + The Type-1B field indicates one row of the configured table
  + The Type-1B index for a cell points to a corresponding index in a RRC configured table applicable for DCI format 0\_1/1\_1 or MAC CE activated values.
* the size of a per cell Type-2 field in the DCI format 0\_X/1\_X is determined based on active BWP for each cell.

**Agreement**

For a set of cells which is configured for multi-cell scheduling using DCI format 0\_X and DCI format 1\_X, support the following:

* If table defining combinations of co-scheduled cells for the set of cells is configured,
  + an indicator in the DCI is included and points to one row of the table.
  + The table is configured by RRC signaling for the set of cells.
    - Separate tables are configured for downlink scheduling and uplink scheduling
  + The size of the indicator is equal to ceil(log2(N)), where N is the number of rows in the table.
  + The max number of rows in the table is 16
  + The size of the per-cell Type 2 fields for each co-scheduled cell does not change according to the indicated co-scheduled cell combination
  + The payload size of DCI format 1\_X is derived by UE based on RRC configuration of the active BWP(s) of co-scheduled cell combinations within the set of cells.
    - The payload size of DCI format 1\_X is the same for the active BWP(s) of all the co-scheduled cell combinations and equal to the largest payload size among the active BWP(s) of all the co-scheduled cell combinations determined by the co-scheduled cell combination table.
  + The payload size of DCI format 0\_X is derived by UE based on RRC configuration of the active BWP(s) of co-scheduled cell combinations within the set of cells.
    - The payload size of DCI format 0\_X is the same for the active BWP(s) of all the co-scheduled cell combinations and equal to the largest payload size among the active BWP(s) of all the co-scheduled cell combinations determined by the co-scheduled cell combination table.
* Otherwise,
  + The UE determines the actually scheduled cell(s) based on the FDRA field of each cell of the set of cells.
    - For Type 0 FDRA, all 0s indicates the cell is not scheduled.
    - For Type 1 FDRA, all 1s indicates the cell is not scheduled.
  + The size of the Type 2 fields for each cell does not change according to actually co-scheduled cells.
  + The payload size of DCI format 0\_X is derived by UE based on RRC configuration of the active BWP(s) of all cells within the set of cells.
  + The payload size of DCI format 1\_X is derived by UE based on RRC configuration of the active BWP(s) of all cells within the set of cells.

**Agreement**

Following is supported in Rel-18 multi-cell scheduling

* A UE can be configured one or multiple sets of cells with each set configured for multi-cell scheduling using DCI format 0\_X/1\_X.
* Up to 4 sets of cells can be configured per PUCCH group.
* When multiple sets of cells are configured,
  + a cell in one set of cells can’t be included in another set of cells.
  + n\_CI value is independently configured for each set of cells.
  + reference cell for counting DCI size and BD/CCE of DCI format 0\_X/1\_X is independently determined for each set of cells.
  + search space configuration of DCI format 0\_X/1\_X is independently configured for each set of cells.
  + DCI size of DCI format 0\_X is independently determined for each set of cells.
  + DCI size of DCI format 1\_X is independently determined for each set of cells.
* The multiple sets of cells can be scheduled by DCI format 0\_X/1\_X from different scheduling cells.
* Up to N sets of cells can be configured and respectively scheduled by DCI format 0\_X/1\_X from a same scheduling cell.
  + The value of N is reported as UE capability.
  + An indicator is included in the DCI to indicate the scheduled set of cells,
    - The size of the indicator is equal to ceil(log2(N)), where N is the number of sets of cells.
  + Unique n\_CI value is configured for each set of cells.

**Agreement**

* A new RBG size configuration “Configuration 3” is added with the following values and only used for DCI format 0\_X/1\_X for RA type 0.
* RBG size is configured per BWP per cell.
* Independent RA type configuration is applied per BWP per cell for multi-cell scheduling DCI.

**Table 5.1.2.2.1-1 / Table 6.1.2.2.1-1: Nominal RBG size *P***

|  |  |  |  |
| --- | --- | --- | --- |
| **Bandwidth Part Size** | **Configuration 1** | **Configuration 2** | **Configuration 3** |
| 1 – 36 | *2* | 4 | 8 |
| 37 – 72 | 4 | 8 | 16 |
| 73 – 144 | 8 | 16 | 32 |
| 145 – 275 | 16 | 16 | 32 |

**Agreement**

DCI format 0\_X / 1\_X with CRC scrambled by C-RNTI and MCS-C-RNTI is supported.

**Agreement**

For a set of cells which is configured for multi-cell scheduling using DCI format 0\_X/1\_X, if DCI size budget on the reference cell can’t be maintained after performing Rel-17 DCI size alignment procedures for legacy DCI formats (after step 4C), UE applies zero padding to whichever of DCI formats 0\_X or 1\_X that has a smaller size to have equal size.

**Agreement**

* Separate search space sets for DCI format 0\_X/1\_X and legacy DCI formats are independently configured
* Separate search space sets for DCI format 0\_X and 1\_X can be independently configured

**Agreement**

If the UE is configured with two SRS resource sets with ‘codebook’ or ‘non-codebook’, a PUSCH scheduled by DCI format 0\_X is always associated with the first SRS resource set with ‘codebook’ or ‘non-codebook’.

**Conclusion**

PUSCH repetition Type B operation is not supported with DCI format 0\_X (i.e. UE cannot be configured with PUSCH repetition Type B applicable for DCI format 0\_1)

**Agreement**

New RRC parameter of RBG granularity for RA type 1 can be configured per BWP per cell for DCI format 0\_X/1\_X with same value range applicable for DCI 0\_2/1\_2.

**Agreement**

Size of RV field can be configured per BWP per cell for DCI format 0\_X/1\_X.

**Agreement**

Size of HPN field can be configured per BWP per cell for DCI format 0\_X/1\_X.

**Agreement**

Priority indicator in DCI format 0\_X belongs to Type-1A field.

* The indicated priority is applied to all the co-scheduled PUSCH(s)

Priority indicator in DCI format 1\_X belongs to Type-1A field.

* The indicated priority indicator is applied to the PUCCH.

RRC parameters is introduced to configure the presence of priority indicator in DCI format 0\_X/1\_X

* This parameter is per set of cells

**Agreement**

ChannelAccess-Cpext in DCI format 1\_X belongs to Type-1A field.

* The indicated channel access information is applied to the PUCCH and/or SRS (whichever is first).

ChannelAccess-Cpext-CAPC in DCI format 0\_X belongs to Type-1A field.

* The indicated code point is applied to all the co-scheduled PUSCHs and/or SRS (whichever is first) by DCI format 0\_X.

**Agreement**

Beta\_offset indicator in DCI format 0\_X belongs to Type-1A field.

* This field is applied to the scheduled PUSCH(s) where the UCI is multiplexed.

**Agreement**

Inclusion of SCell dormancy indication in DCI format 0\_X/1\_X is configurable

**Agreement**

Inclusion of PDCCH monitoring adaptation indication in DCI format 0\_X/1\_X is configurable

**Agreement**

Inclusion of minimum applicable scheduling offset indicator in DCI format 0\_X/1\_X is configurable

## Agreements made in RAN1#114bis

**Agreement**

For a serving cell included in *MC-DCI-SetofCells*, a UE does not expect to be configured to monitor PDCCH candidates on more than one scheduling cell for detection of DCI formats scheduling the serving cell.

**Agreement**

DCI format level padding is adopted for DCI format 0\_3 or DCI format 1\_3.

**Agreement**

For DCI format 0\_3, when *ScheduledCellCombo-ListDCI-0-3* is not configured, all '0's for FDRA Type 2 with μ=1 or all ‘1’s for FDRA Type 2 with μ=0 indicates the corresponding cell is not scheduled.

**Agreement**

Below TP on TS38.213-i00 is adopted.

* Reason for change: PDCCH monitoring adaptation indication is applicable for PDCCH monitoring on a serving cell and captured in DCI format 0\_3/1\_3 in 38.212-i00. However, TS38.213-i00 does not reflect it.
* Summary of change: Add DCI format 0\_3 and DCI format 1\_3 in Section 10 on PDCCH skipping and SSSG switching.
* Consequence if not approved: Inconsistency between TS38.212 and TS38.213.

|  |
| --- |
| **10.4 Search space set group switching and skipping of PDCCH monitoring**  <Omit unchanged text>  A UE can be provided a set of durations by *pdcch-SkippingDurationList* for PDCCH monitoring on an active DL BWP of a serving cell and, if the UE is not provided *searchSpaceGroupIdList-r17* on the active DL BWP of the serving cell, a DCI format 0\_1,~~and~~ a DCI format 0\_2 and a DCI format 0\_3 that schedule PUSCH transmission, and a DCI format 1\_1,~~and~~ a DCI format 1\_2 and a DCI format 1\_3 that schedule PDSCH receptions can include a PDCCH monitoring adaptation field of 1 bit or of 2 bits.  <Omit unchanged text>  A UE can be provided group indexes for a Type3-PDCCH CSS set or USS set by *searchSpaceGroupIdList-r17* for PDCCH monitoring on an active DL BWP of a serving cell and, if the UE is not provided *pdcch-SkippingDurationList* for the active DL BWP of the serving cell, a DCI format 0\_1,~~and~~ a DCI format 0\_2 and a DCI format 0\_3 that schedule PUSCH transmissions and a DCI format 1\_1,~~and~~ a DCI format 1\_2 and a DCI format 1\_3 that schedule PDSCH receptions can include a PDCCH monitoring adaptation field of 1 bit or of 2 bits for the serving cell.  <Omit unchanged text>  A UE can be provided a set of durations by *pdcch-SkippingDurationList* and group indexes for a Type3-PDCCH CSS set or USS set by *searchSpaceGroupIdList-r17* for PDCCH monitoring on an active DL BWP of a serving cell and, a DCI format 0\_1,~~and~~ a DCI format 0\_2 and a DCI format 0\_3 that schedule PUSCH transmissions, and a DCI format 1\_1,~~and~~ a DCI format 1\_2 and a DCI format 1\_3 that schedule PDSCH receptions can include a PDCCH monitoring adaptation field of 2 bits.  <Omit unchanged text> |

**Agreement**

* The Minimum applicable scheduling offset indicator, if configured to be present in DCI format 0\_3/1\_3, is of Type-1A field with 1 bit.
* Below TP on TS38.212-i00 is adopted.
* Reason for change: RAN1 has agreed that inclusion of minimum applicable scheduling offset indicator is supported in DCI format 0\_3/1\_3 and this field is already captured in 38.212-i00. However, the bit size is not defined.
* Summary of change: Add the clarification to this field when the bit size is equal to 1.
* Consequence if not approved: Bit size of this field is not defined in TS38.212.

|  |
| --- |
| **7.3.1.1.4 Format 0\_3**  < Unchanged parts are omitted >  - Minimum applicable scheduling offset indicator – 0 or 1 bit  - 0 bit if higher layer parameter *minimumSchedulingOffsetK0DCI-0-3* is not configured;  - ~~x~~ 1 bit~~s~~ otherwise. The 1 bit indication is used to determine the minimum applicable K2 for the active UL BWP and the minimum applicable K0 value for the active DL BWP, if configured respectively, according to Table 7.3.1.1.2-33. If the minimum applicable K0 is indicated, the minimum applicable value of the aperiodic CSI-RS triggering offset for an active DL BWP for each scheduled cell shall be the same as the minimum applicable K0 value.  < Unchanged parts are omitted >  **7.3.1.2.4 Format 1\_3**  < Unchanged parts are omitted >  - Minimum applicable scheduling offset indicator – 0 or 1 bit  - 0 bit if higher layer parameter *minimumSchedulingOffsetK0DCI-1-3* is not configured;  - ~~x~~ 1 bit~~s~~ otherwise. The 1 bit indication is used to determine the minimum applicable K0 for the active DL BWP and the minimum applicable K2 value for the active UL BWP, if configured respectively, according to Table 7.3.1.1.2-33. If the minimum applicable K0 is indicated, the minimum applicable value of the aperiodic CSI-RS triggering offset for an active DL BWP for each scheduled cell shall be the same as the minimum applicable K0 value.  < Unchanged parts are omitted > |

**Agreement**

Simultaneous configuration of both multicast reception and multi-cell scheduling in the same PUCCH group is not supported in Rel-18.

**Agreement**

For an enhanced Type-3 HARQ-ACK codebook triggered by a DCI format 1\_3, if the enhanced Type-3 HARQ-ACK codebook indicator is not configured, the MCS field of TB1 corresponding to a cell with smallest serving cell index ~~among the co-scheduled cells~~ with invalid FDRA field values is used to indicate the index of the enhanced Type-3 HARQ-ACK codebook.

* Note: Cells with valid FDRA fields are scheduled

**Agreement**

For HARQ-ACK retransmission triggered by a DCI format 1\_3, the MCS field of TB1 corresponding to a cell with smallest serving cell index ~~among the co-scheduled cells~~ with invalid FDRA field values is used to indicate the value of slot level offset *l*.

* Note: Cells with valid FDRA fields are scheduled

**Agreement**

The value range of *SRS-RequestCombo* is BIT STRING (2..3).

**Agreement**

* Single joint table is configured per set of cells for each of Type-1B fields other than TDRA (i.e., rateMatchListDCI-1-3, zp-CSI-RSListDCI-1-3, tci-ListDCI-1-3, srs-RequestListDCI-1-3, srs-OffsetListDCI-1-3, srs-RequestListDCI-0-3, srs-OffsetListDCI-0-3).
  + Entries for each CC are interpreted based on the new/target BWPs per cell that is indicated by the BWP indicator field of DCI 0\_3/1\_3.
* Single joint table is configured per set of cells for TDRA (i.e., TDRA-FieldIndexListDCI-1-3, TDRA-FieldIndexListDCI-0-3).
  + Entries of the joint table for TDRA (i.e., TDRA-FieldIndexDCI-1-3) are configured for each BWP of each CC.
  + Columns of the indicated entry corresponding to the new/target BWPs per cell that is indicated by the BWP indicator field of DCI 0\_3/1\_3 are applied.
* The maximum size of TDRA-FieldIndexListDCI-1-3 is 32.
* The maximum size of TDRA-FieldIndexListDCI-0-3 is 64.

**Agreement**

Below TP on TS38.212-i00 is adopted.

* Reason for change: RAN1 has agreed that inclusion of SCell dormancy indication is supported in DCI format 0\_3/1\_3 and this field is already captured in 38.212-i00. However, the bit size is not defined.
* Summary of change: Add the clarification on the bit size of this field in Section 7.3.1.14 in TS38.212.
* Consequence if not approved: Bit size of this field is not defined in TS38.212.

|  |
| --- |
| **7.3.1.1.4 Format 0\_3**  <omitted text>  - SCell dormancy indication – 0 bit if higher layer parameter *dormancyDCI-0-3* or *dormancyGroupWithinActiveTime* is not configured; otherwise ~~x bits~~ 1, 2, 3, 4, or 5 bits bitmap determined according to the number of different *DormancyGroupID(s)* provided by higher layer parameter *dormancyGroupWithinActiveTime,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *dormancyGroupWithinActiveTime,* with MSB to LSB of the bitmap corresponding to the first to last configured SCell group in ascending order of *DormancyGroupID*. The field is only present when this format is carried by PDCCH on the primary cell within DRX Active Time and the UE is configured with at least two DL BWPs for an SCell.  <omitted text>  **7.3.1.2.4 Format 1\_3**  <omitted text>  - SCell dormancy indication – 0 bit if higher layer parameter *~~SCell-dormancy-indication-Present~~* *dormancyDCI-1-3* or *dormancyGroupWithinActiveTime* is not configured; otherwise ~~x bits.~~ 1, 2, 3, 4, or 5 bits bitmap determined according to the number of different *DormancyGroupID(s)* provided by higher layer parameter *dormancyGroupWithinActiveTime,* where each bit corresponds to one of the SCell group(s) configured by higher layers parameter *dormancyGroupWithinActiveTime,* with MSB to LSB of the bitmap corresponding to the first to the last configured SCell group in ascending order of *DormancyGroupID*. The field is only present when this format is carried by PDCCH on the primary cell within DRX Active Time and the UE is configured with at least two DL BWPs for an SCell.  <omitted text> |

**Agreement**

For MC-DCI, SCell dormancy indication Case 1 (for both DCI format 0-3 and 1-3) and Case 2 (only for DCI format 1-3) are supported.

**Agreement**

For a UE configured with a set of cells by *MC-DCI-SetofCells*,

* If the scheduling cell is active while the reference cell is indicated dormant or deactivated, the UE does not monitor DCI format 0\_3/1\_3 on the scheduling cell for the set of cells.

## Agreements made in RAN1#115

**Conclusion**

There is no consensus to support TPI field for DCI format 0\_3 in Rel-18

**Agreement**

For a UE configured with a set of cells by *MC-DCI-SetofCells*,

* If an SCell within the set of cells is deactivated and its *firstActiveDownlinkBWP-Id* is not set to dormant BWP, the UE determines the sizes of fields in DCI format 1\_3 according to the DL BWP provided by *firstActiveDownlinkBWP-Id*.
* If an SCell within the set of cells is dormant, or if an SCell within the set of cells is deactivated and its *firstActiveDownlinkBWP-Id* is set to dormant BWP,
  + the UE determines the sizes of fields in DCI format 1\_3 according to the DL BWP provided by *firstWithinActiveTimeBWP-Id* for the SCell if provided;
  + otherwise, according to the DL BWP provided by *firstOutsideActiveTimeBWP-Id* for the SCell.
* If an SCell within the set of cells is deactivated, the UE determines the sizes of fields in DCI format 0\_3 according to the UL BWP provided by *firstActiveUplinkBWP-Id*.

**Agreement**

Adopt the following TP to 38.214 for the support of FDRA Type 2 for PUSCH scheduled by DCI format 0\_3:

**Agreement**

* When Antenna port(s) field in DCI format 1\_3 is configured as type1a, UE expects to be configured with a common table from Tables 7.3.1.2.2-1/2/3/4 in TS38.212 is used for all cells in set of cells.
  + The DMRS mapping type should be the same across the cells in set of cells
* When Antenna port(s) field in DCI format 0\_3 is configured as type1a, UE expects to be configured with a common table from Tables 7.3.1.1.2-6, 7.3.1.1.2-6A, 7.3.1.1.2-7, 7.3.1.1.2-7A, 7.3.1.1.2-8, 7.3.1.1.2-9, 7.3.1.1.2-10, 7.3.1.1.2-11, 7.3.1.1.2-12, 7.3.1.1.2-13, 7.3.1.1.2-14, 7.3.1.1.2-15, 7.3.1.1.2-16, 7.3.1.1.2-17, 7.3.1.1.2-18, 7.3.1.1.2-19, 7.3.1.1.2-20, 7.3.1.1.2-21, 7.3.1.1.2-22, 7.3.1.1.2-23, 7.3.1.1.2-24, and 7.3.1.1.2-25 in TS38.212 is used for all cells in set of cells.
  + The DMRS mapping type should be the same across the cells in set of cells
* When TPMI field in DCI format 0\_3 is configured as type1a, UE expects to be configured with a common table from Tables 7.3.1.1.2-2, 7.3.1.1.2-2A, 7.3.1.1.2-B, 7.3.1.1.2-3, 7.3.1.1.2-3A, 7.3.1.1.2-4, 7.3.1.1.2-4A, 7.3.1.1.2-5, and 7.3.1.1.2-5A in TS38.212 is used for all cells in set of cells.
* When SRI field in DCI format 0\_3 is configured as type1a, UE expects to be configured with a common table from Tables 7.3.1.1.2-28, 7.3.1.1.2-29, 7.3.1.1.2-30, 7.3.1.1.2-31, 7.3.1.1.2-32, 7.3.1.1.2-32A, and 7.3.1.1.2-32B in TS38.212 is used for all cells in set of cells.

**Agreement**

For a UE configured with DCI format 1\_3, the number of HARQ-ACK bits used for PUCCH power control is derived based on a summation of the corresponding numbers of HARQ-ACK bits in the two HARQ-ACK sub-codebooks.

**Agreement**

* Alt 2: For a DCI format 1\_3 transmitted on PCell, if one-shot HARQ-ACK request is not present or set to '0', and if HARQ-ACK retransmission indicator is not present or set to ‘0’, SCell dormancy indication is provided by repurposing below fields corresponding to one ~~or more~~ serving cell with the smallest cell index with invalid FDRA values ~~in ascending order of serving cell index~~:
  + Modulation and coding scheme of transport block 1
  + NDI of transport block 1
  + Redundancy version of transport block 1
  + HARQ process number
  + Antenna port(s) if *AntennaPortsDCI1-3* is configured as ‘*type2*’
* Note: Cells with valid FDRA fields are scheduled.

**Agreement**

Rel-18 specifications support a DCI format 1\_3 is transmitted without scheduling any PDSCH for SCell dormancy indication.

* For Type-2 HARQ-ACK codebook, the corresponding HARQ-ACK information for the DCI format 1\_3 is included in the first Type-2 sub-codebook.

**Agreement**

For a cell provided in *MC-DCI-SetofCells*, when no search space set is configured for the cell, the cell is not counted as a scheduled cell for M\_total\_μ/C\_total\_μ calculation.

**Agreement**

* BWP indicator in a DCI format 0\_3/1\_3 applies only to the scheduled cell(s) with valid FDRA value(s).
* For a cell scheduled by DCI format 0\_3/1\_3 with valid FDRA value, if the BWP indicator indicates a code point that does not correspond to a configured BWP for the cell, the UE does not perform dynamic BWP switching based on the BWP indicator and transmits/receives data on the current active BWP of the cell.

**Agreement**

In case of BWP switching, for a Type-2 field in a DCI format 0\_3/1\_3, the existing procedure for DCI field parsing (via truncation or zero-padding) is applied per “block” of the Type-2 field in the DCI format 0\_3/1\_3.

**Agreement**

* For Type-2 HARQ-ACK codebook, if a DCI format 1\_3 is transmitted with fields repurposed for SCell dormancy indication and schedules one or more PDSCHs,
  + the corresponding HARQ-ACK information for the one or more PDSCHs is included in the second Type-2 HARQ-ACK sub-codebook.
  + HARQ-ACK information for the SCell dormancy indication is mapped to HARQ-ACK bit position for the serving cell with the smallest cell index with invalid FDRA and included in the second Type-2 HARQ-ACK sub-codebook.

## Agreements made in RAN1#116

**Agreement**

Adopt following TP for TS38.213.

* **Change reason:** Unicast DCI formats do not include DCI format 1\_3 and 0\_3.
* **Change summary:** Add DCI format 1\_3 and 0\_3 in unicast DCI format list.
* **Consequence if not approved:** Incomplete unicast DCI format list.

|  |
| --- |
| 9 UE procedure for reporting control information  <text omitted>  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 multicast-MCCH-RNTI, G-RNTI for multicast or G-CS-RNTI are also referred to as multicast DCI formats. Corresponding unicast DCI formats are DCI formats 0\_0/0\_1/0\_2/0\_3/1\_0/1\_1/1\_2/1\_3 and multicast DCI formats are DCI formats 4\_0/4\_1/4\_2 [4, TS 38.212]. PDSCH receptions scheduled by unicast or multicast DCI formats are referred as unicast or multicast PDSCH receptions. HARQ-ACK information associated with unicast or multicast DCI formats for PDCCH receptions in RRC\_CONNECTED state are also respectively referred as unicast or multicast HARQ-ACK information.  <text omitted> |

**Agreement**

Adopt the following TP for sub-clause 9.1.2.1 in TS38.213.

|  |
| --- |
| **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\_2/1\_3 for serving cell , or the active DL BWP for serving cell is dormant BWP, 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\_1/1\_3 and is not configured to monitor PDCCH for DCI format 1\_2 for serving cell , is provided by *dl-DataToUL-ACK* or *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-r17*  - If the UE is configured to monitor PDCCH for DCI format 1\_2 and is not configured to monitor PDCCH for DCI format 1\_1/1\_3 for serving cell , is provided by *dl-DataToUL-ACK-DCI-1-2* or *dl-DataToUL-ACK-DCI-1-2-r17*  - If the UE is configured to monitor PDCCH for DCI format 1\_1/1\_3 and DCI format 1\_2 for serving cell , is provided by the union of *dl-DataToUL-ACK* or *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-r17* and *dl-DataToUL-ACK-DCI-1-2* or *dl-DataToUL-ACK-DCI-1-2-r17*  - If an inapplicable value in dl-DataToUL-ACK-r16 or dl-DataToUL-ACK-r17 is provided, the value is excluded from |

**Agreement**

A UE does not expect a DCI format 0\_3/1\_3 schedules an SCell with valid FDRA value and indicates the SCell to switch to dormant BWP.

**Conclusion**

For a cell scheduled by DCI format 0\_3 with valid FDRA value, UE does not expect that OLPC/CAPC/TPMI/SRI in the DCI format indicates a code point that does not correspond to a configuration for the cell.

* No spec impact

**Conclusion**

FDRA validity for a cell is determined based on the indicated BWP of the cell.

* No spec impact

**Agreement**

Adopt the following TP to 38.212 for DMRS sequence initialization in DCI format 0\_3:

|  |
| --- |
| **7.3.1.1.4 Format 0\_3**  <omitted text>  DMRS sequence initialization –1 bit if transform precoder is disabled at least for one cell configured by higher layer parameter ScheduledCell-ListDCI-0-3 in the scheduled cell set ~~is configured with disabled transform precoder~~; otherwise, 0 bit.  This field is applied to all the scheduled cells with transform precoder disabled and indicated by Scheduled cells indicator field or Frequency domain resource assignment field independently.  <omitted text> |

**Agreement**

TP1 in section 8 of [R1-2401589](https://lenovobeijing-my.sharepoint.com/personal/leihp1_lenovo_com/Documents/R1-2401589.zip) is agreed for TS38.214.

**Agreement**

Adopt the following TP covering multi-cell scheduling in TS38.300.

**10.X Multi-cell scheduling by a single DCI**

Multi-cell scheduling by a single DCI allows the PDCCH of a serving cell to schedule PDSCH(s)/PUSCH(s) on one or more serving cells with the single DCI but with the following restrictions:

* When a serving cell is configured with a PDCCH which schedules PDSCH(s)/PUSCH(s) on a cell set, the PUSCH/PDSCH on serving cells in the cell set is always scheduled by a PDCCH on the serving cell;
* When PCell is configured with a PDCCH which schedules PDSCH(s)/PUSCH(s) on serving cells in a cell set, that PCell’s PDSCH and PUSCH cannot be scheduled by a PDCCH on an SCell;
* When an SCell is configured with a PDCCH which schedules PDSCH(s)/PUSCH(s) on serving cells in a cell set, PCell is not included in the cell set;
* The scheduling PDCCH and the scheduled PDSCH(s)/PUSCH(s) can use the same or different numerologies;
* The co-scheduled PDSCH(s) with a PDCCH use the same numerology.
* The co-scheduled PUSCH(s) with a PDCCH use the same numerology.

Send an LS to RAN2 to convey the above TP. Final LS is in [R1-2401716](https://lenovobeijing-my.sharepoint.com/personal/leihp1_lenovo_com/Documents/R1-2401716.zip).

**Agreement**

TP2 in Section 8 for TS38.213 is agreed in principle. TS38.213 editor to provide final TP.

**Agreement**

* When a PDCCH MO that provides a DCI format 1\_3 is before active UL BWP change on the PUCCH cell, and the PUCCH indicated by the DCI format 1\_3 is to be transmitted after the active UL BWP change on the PUCCH cell, the corresponding HARQ-ACK information for the DCI format 1\_3 is skipped.
* FFS: When a PDCCH MO that provides a DCI format 1\_3 is before an active DL BWP change on a cell of co-scheduled cells by the DCI format 1\_3, and the DCI format 1\_3 does not trigger the active DL BWP change for the cell, and the PUCCH indicated by the DCI format 1\_3 is to be transmitted after the active DL BWP change on the cell,
  + For type 2 codebook for generating the second sub-codebook, the corresponding HARQ-ACK information for that cell with BWP switching is generated with NACK bit
  + For type 1 codebook and for type 2 codebook for generating the first sub-codebook, follow the legacy behaviour (the corresponding HARQ-ACK information for that cell with BWP switching is skipped)

## Agreements made in RAN1#116bis

**Agreement**

* Adopt following TP for TS38.214.

|  |
| --- |
| ***5.5 UE PDSCH reception preparation time ~~with cross carrier scheduling~~ with different subcarrier spacings for PDCCH and PDSCH in different cells***  This clause applies only if the PDCCH carrying the scheduling DCI is received on one carrier with one OFDM subcarrier spacing (µPDCCH), and the PDSCH scheduled to be received by the DCI is on another carrier with another OFDM subcarrier spacing (µPDSCH).  If the µPDCCH < µPDSCH, the UE is expected to receive the scheduled PDSCH, if the first symbol in the PDSCH allocation, including the DM-RS, as defined by the slot offset *K0* and the start and length indicator *SLIV* of the scheduling DCI starts no earlier than the first symbol of the slot of the PDSCH reception starting at least *Npdsch* PDCCH symbols after the end of the PDCCH scheduling the PDSCH, not taking into account the effect of receive timing difference between the scheduling cell and the scheduled cell.  If the µPDCCH > µPDSCH, the UE is expected to receive the scheduled PDSCH, if the first symbol in the PDSCH allocation, including the DM-RS, as defined by the slot offset *K0* and the start and length indicator *SLIV* of the scheduling DCI starts no earlier than *Npdsch* PDCCH symbols after the end of the PDCCH scheduling the PDSCH, not taking into account the effect of receive timing difference between the scheduling cell and the scheduled cell.  When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining *Npdsch*, the PDCCH candidate that ends later in time is used.  <omitted text> |

**Agreement**

The following TP is agreed in principle. Final TP to be decided by the editor.

TP2 on TS38.213:

|  |
| --- |
| **[TS 38.213 V18.2.0]**  9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel  < unchanged part omitted >  A value of the counter downlink assignment indicator (DAI) field in DCI formats, each scheduling PDSCH receptions on respective single serving cells with associated HARQ-ACK information, or having associated HARQ-ACK information without scheduling a PDSCH reception, in a same HARQ-ACK codebook denotes the accumulative number of {serving cell, PDCCH monitoring occasion}-pairs in which PDSCH receptions that provide transport blocks with enabled HARQ-ACK information report, or HARQ-ACK information bits that are not in response for PDSCH receptions, associated with the DCI formats, excluding the SPS activation DCI, is present up to the current serving cell and current PDCCH monitoring occasion,  - first, if the UE indicates by *type2-HARQ-ACK-Codebook* support for more than one PDSCH reception on a serving cell that are scheduled from a same PDCCH monitoring occasion, in increasing order of the PDSCH reception starting time for the same {serving cell, PDCCH monitoring occasion} pair,  - second in ascending order of serving cell index, and  - third in ascending order of PDCCH monitoring occasion index , where .  A value of the counter DAI field in DCI formats, each scheduling PDSCH receptions on respective more than one serving cells with associated HARQ-ACK information in a same HARQ-ACK codebook, denotes the accumulative number of {serving cell with smallest index from the more than one serving cells, PDCCH monitoring occasion}-pairs in which PDSCH receptions are present up to the current more than one serving cells and current PDCCH monitoring occasion,  - first, if the UE indicates by *type2-HARQ-ACK-Codebook* support for more than one PDSCH receptions on a serving cell that are scheduled from a same PDCCH monitoring occasion, in increasing order of the PDSCH reception starting time for the same {serving cell with smallest index from the more than one serving cells, PDCCH monitoring occasion} pair,  - second in ascending order of the smallest serving cell index from the more than one serving cells, and  - third in ascending order of PDCCH monitoring occasion index , where .  < unchanged part omitted >  The UE determines the , for a total number of HARQ-ACK information bits in the second Type-2 HARQ-ACK sub-codebook according to the following pseudo-code.  Set to the maximum number of serving cells in *ScheduledCell-ListDCI-1-3* of a set of serving cells provided by *MC-DCI-SetofCells*, across the number of sets of serving cells, that can be scheduled PDSCH receptions by DCI format 1\_3  Set to the maximum total number of TBs in PDSCH receptions that can be scheduled by a DCI format 1\_3 over more than one serving cells in a set of serving cells across the number of sets of serving cells  Set to the number of sets of serving cells *MC-DCI-SetofCells* in a PUCCH group  Set to the number of serving cells, across sets of serving cells in the PUCCH group  Set to the index of serving cells, , a lower index corresponds to a lower RRC index of a corresponding serving cell   * if the UE indicates *type2-HARQ-ACK-Codebook,* and receives a number of PDSCHs on a serving cell *c* that are scheduled by [] DCI formats 1\_3 in PDCCH receptions at a same PDCCH monitoring occasion *m*, wherein each of the DCI formats 1\_3 schedule more than one PDSCH receptions on respective more than one serving cells, and *c* is the same smallest cell index among the respective more than one serving cells across the [] DCI formats 1\_3, the serving cell *c* is counted times for PDCCH monitoring occasion *m* in increasing order of the PDSCH reception starting time among the PDSCHs * if the UE indicates *type2-HARQ-ACK-Codebook,* and receives a number of PDSCHs on a serving cell *c* that are scheduled by [] DCI formats 1\_3 in PDCCH receptions at a same PDCCH monitoring occasion *m*, wherein each of the DCI formats 1\_3 schedule more than one PDSCH receptions on respective more than one serving cells, and *c* is the smallest cell index among the respective more than one serving cells which is the same across the [] DCI formats 1\_3, the serving cell *c* is counted times for PDCCH monitoring occasion *m* in increasing order of the PDSCH reception starting time among the PDSCHs   Set to the index of a serving cell, in a set of indexes of serving cells arranged in ascending order, from the set of serving cells,  Set – PDCCH monitoring occasion index for detection of a DCI format 1\_3 scheduling PDSCH receptions on more than one serving cells from a set of serving cells: lower index corresponds to earlier PDCCH monitoring occasion  Set  Set  Set  Set  Set to the number of PDCCH monitoring occasions  < unchanged part omitted > |

**Agreement**

For a UE configured with a set of cells by *MC-DCI-SetofCells*, when a cell in the set of cells is dormant or deactivated and the cell is neither the scheduling cell nor the reference cell for the set of cells, the UE can receive a DCI format 1\_3/0\_3 that schedules serving cells including the cell;

* The UE does not expect a PDSCH or a PUSCH scheduled on the cell.
* The fields of DCI format 1\_3 corresponding to the cell can be reinterpreted for indicating SCell dormancy indication, the index of the enhanced Type-3 HARQ-ACK codebook or the value of slot level offset *l.*
  + The UE checks the field value of the cell in the DCI format 1\_3.
* Note: FDRA field of the cell in the DCI format 1\_3/0\_3 is set to invalid.

**Conclusion**

There is no consensus to support search space sharing for DCI format 0\_3/1\_3.

**Agreement**

The following TP is agreed for Rel-18 38.214.

-----------------------------Begin TP1 for 38.214, subclause 6.2.1.3-----------------------------

6.2.1.3 UE sounding procedure between component carriers

**<Unchanged parts are omitted>**

For an aperiodic SRS triggered in DCI format 1\_1 or 1\_2, if the UE is configured by *SRS-CarrierSwitching*, it transmits SRS on one serving cell not configured for PUSCH/PUCCH transmission scheduled by the DCI and the UE in the serving cell transmits the configured one or two SRS resource set(s) with higher layer parameter ~~usage~~ *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* in *SRS-ResourceSet* set to 'aperiodic'.

For an aperiodic SRS triggered in DCI format 1\_3, if the UE is configured by *SRS-CarrierSwitching*,

for an SRS transmission in a scheduled cell not configured for PUSCH/PUCCH transmission, the UE transmits the configured one or two SRS resource set(s) with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* in *SRS-ResourceSet* set to 'aperiodic'.

**<Unchanged parts are omitted>**

-----------------------------End TP1 for 38.214, subclause 6.2.1.3-----------------------------

**Agreement**

* Keep the wording of TS38.212-i20 unchanged in regards to the usage of invalid FDRA for determination of scheduled / non-schedueld cells.
* RAN1 confirms that repurposed-based indication of {SCell dormancy, enhanced Type-3 HARQ-ACK CB, HARQ retransmission} is supported regardless of whether *ScheduledCellCombo-ListDCI-1-3* is configured or not.
* No RAN1 spec impact

**Agreement**

Adopt TP3 in Section 8 of [**R1-2403479**](file:///D:/RAN1/RAN1%23117/tdocs/FL%20summary/R1-2403479.zip) for TS38.214.

**Conclusion**

For a cell scheduled by DCI format 0\_3/1\_3 with valid FDRA value, UE does not expect that a Type-1B field in the DCI format indicates a code point that does not correspond to a configuration for the cell.

* No RAN1 spec impact

## Agreements made in RAN1#117

**Agreement**

The TP in draft CR R1-2404235 for TS38.212 on correcting precoding information and number of layers in DCI format 0\_3 is agreed for **alignment CR. Editor to submit CR.**

**Agreement**

The TP in draft CR R1-2404856 for TS38.212 on correcting number of MCS/NDI/RV blocks for TB-2 in DCI 1\_3 is agreed for **alignment CR**. **Editor to submit CR.**

**Agreement**

Following TP is agreed for TS38.214. Final in CR in R1-2405734.

5.1.5 Antenna ports quasi co-location

<text omitted>

When *tci-PresentInDCI* is set as 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET, a UE configured with *dl-OrJointTCI-StateList* with activated *TCI-State* or *ul-TCI-StateList* with activated *TCI-UL-State* receives DCI format 1\_1/1\_2/1\_3 providing indicated *TCI-State(s)* and/or *TCI-UL-State(s)* for a CC or all CCs in the same CC list configured by *simultaneousU-TCI-UpdateList1-r17, simultaneousU-TCI-UpdateList2-r17, simultaneousU-TCI-UpdateList3-r17, simultaneousU-TCI-UpdateList4-r17*. The DCI format 1\_3 provides indicated *TCI state(s)* and/or*TCI-UL-State(s)* for the CC(s) in a *scheduledCellListDCI-1-3* if the UE is scheduled by the DCI format 1\_3 to receive PDSCH at least on one serving cell in the *scheduledCellListDCI-1-3*. The DCI format 1\_1/1\_2 can be with or without, if applicable, DL assignment. If the DCI format 1\_1/1\_2 is without DL assignment, the UE can assume the following:

- CS-RNTI is used to scramble the CRC for the DCI

- The values of the following DCI fields are set as follows:

- RV = all '1's

- MCS = all '1's

- NDI = 0

- Set to all '0's for FDRA Type 0, or all '1's for FDRA Type 1, or all '0's for dynamicSwitch (same as in Table 10.2-4 of [6, TS 38.213]).

After a UE receives an initial higher layer configuration of *dl-OrJointTCI-StateList* with more than one *TCI-State* and before application of an indicated TCI state from the configured TCI states:

- The UE assumes that DM-RS of PDSCH and DM-RS of PDCCH and the CSI-RS applying the indicated TCI state are quasi co-located with the SS/PBCH block the UE identified during the initial access procedure

\*\*\* Unchanged parts are omitted \*\*\*

**Agreement**

The TP in R1-2404855 for TS38.212 on correcting Type-2 field blocks in DCI 1\_3/0\_3 is agreed but without the addition of “counted towards ”, “counted towards ”. The TP is agreed for **alignment CR.**

## Agreements made in RAN1#118

**Agreement**

* When a PDCCH MO that provides a DCI format 1\_3 is before an active DL BWP change on a cell of co-scheduled cells by the DCI format 1\_3, and the active DL BWP change for the cell is not triggered in the PDCCH MO, and the PUCCH indicated by the DCI format 1\_3 starts at or after a slot for the active DL BWP change on the cell,
* For Type 1 codebook and for Type 2 codebook for generating the first sub-codebook, follow the legacy behaviour (the corresponding HARQ-ACK information for that scheduled cell with active DL BWP change is skipped)
  + No spec impact
* For Type 2 codebook for generating the second sub-codebook,
  + the HARQ-ACK information for that scheduled cell with active DL BWP change is generated with NACK bit.

**Agreement**

* The TP in draft CR [R1-2405930](file:///D:/RAN1/RAN1%23118/tdocs/R1-2405930.zip) for TS38.214 on corrections of DCI format 0\_3 is agreed as alignment CR.

**Agreement**

* The TP in draft CR [R1-2406796](file:///D:/RAN1/RAN1%23118/tdocs/R1-2406796.zip) for TS38.213 on corrections of UCI-onPUSCH for DCI format 0\_3 is agreed as alignment CR.

**Agreement**

* The TP in draft CR R1-2406620 for TS38.213 on correcting search space for DCI format 0\_3/1\_3 is agreed as alignment CR.

**Agreement**

* The TP in draft CR [R1-2407164](file:///D:/RAN1/RAN1%23118/tdocs/R1-2407164.zip) for TS38.212 on correcting table caption for DCI format 0\_3/1\_3 is agreed as alignment CR.

**Agreement**

* The TP in draft CR [R1-2406339](file:///D:/RAN1/RAN1%23118/tdocs/R1-2406339.zip) for TS38.213 on correcting Type-2 HARQ-ACK codebook determination is agreed as alignment CR.

**Agreement**

* The TP in draft CR [R1-2406341](file:///D:/RAN1/RAN1%23118/tdocs/R1-2406339.zip) for TS38.213 on correcting Type-2 HARQ-ACK codebook determination is agreed as alignment CR.

**Agreement**

* Adopt the following TP for Section 10.1, TS38.213 on PDCCH overbooking is agreed in principle for alignment.

10.1 UE procedure for determining physical downlink control channel assignment

< Unchanged parts are omitted >

For all search space sets that a UE monitors PDCCH on the primary cell within a slot , or within a group of slots for a corresponding combination , or within a span in slot , denote by a set of CSS sets, except for CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI, with cardinality of and by a set of USS sets and CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI with cardinality of ~~for scheduling on the primary cell~~ with PDCCH candidates and non-overlapping CCEs counted on the primary cell. The location of search space sets , , in is according to an ascending order of the search space set index.

< Unchanged parts are omitted >

**Agreement**

Adopt the following TP for Section 9.1.5, TS38.213 is agreed in principle for alignment.

< Unchanged parts are 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] on one or more serving cells 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 HARQ-ACK retransmission indicator field value in a DCI format is '1', the UE determines slot as where is determined by a one-to-one mapping in ascending order among the values from -7 to 24 and the values of

- the MCS field for transport block 1 if the DCI format is DCI format 1\_1

- the MCS field if the DCI format is DCI format 1\_2

- the MCS field for transport block 1 for a serving cell if the DCI format is DCI format 1\_3, where the serving cell is the one with smallest index that has

- *resourceAllocation* = *resourceAllocationType0* and all bits of the corresponding block of the frequency domain resource assignment field equal to 0, or

- *resourceAllocation* = *resourceAllocationType1* and all bits of the corresponding block of the frequency domain resource assignment field equal to 1, or

- *resourceAllocation = dynamicSwitch* and all bits of the corresponding block of the frequency domain resource assignment field equal to 0 or 1

If the DCI format 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.

< Unchanged parts are omitted >

**Agreement**

* Adopt the following TP for Section 5.1.5, Rel-18 TS38.214 is agreed in principle for alignment.

5.1.5 Antenna ports quasi co-location

**<Unchanged parts are omitted>**

When a UE configured with *dl-OrJointTCI-StateList* would transmit a PUCCH with positive HARQ-ACK or a PUSCH with positive HARQ-ACK corresponding to the DCI carrying the TCI State indication and without DL assignment, or corresponding to ~~the~~ one or more PDSCHs scheduled by the DCI carrying the TCI State indication, and if the indicated TCI State(s) is/are different from the previously indicated one*(s)*, the indicated *TCI-State(s)* and/or *TCI-UL-State(s)* should be applied starting from the first slot that is at least symbols after the last symbol of the PUCCH or the PUSCH, and if the UE receives more than one indicated TCI state for a CC/BWP to be applied starting from the first slot that is at least symbols after the last symbol of the PUCCH or the PUSCH, the indicated TCI state carried in the latest DCI, for the corresponding *coresetPoolIndex* value when applicable, in time corresponding to positive HARQ-ACK value is applied. The first slot and the symbols are both determined on the active BWP with the smallest SCS among the BWP(s) from the CCs applying the indicated *TCI-State(s)* or *TCI-UL-State(s)* that are active at the end of the PUCCH or the PUSCH carrying the positive HARQ-ACK.

**<Unchanged parts are omitted>**

**Agreement**

Draft CR in Section 11 of R1-2407227 is endorsed in principle.

**Agreement**

Final CR R1-247545 is endorsed.

## Agreements made in RAN1#118bis

For Rel-18 CR

Agreement

* Adopt the following TP for Section 6.1.2.2, TS38.214 in principle for alignment CR.

6.1.2.2 Resource allocation in frequency domain

-------------------------------------Begin of TP----------------------------------------------

The UE shall determine the resource block assignment in frequency domain using the resource allocation field in the detected PDCCH DCI except for a PUSCH transmission scheduled by a RAR UL grant or fallbackRAR UL grant, in which case the frequency domain resource allocation is determined according to clause 8.3 of [6, 38.213] or a MsgA PUSCH transmission with frequency domain resource allocation determined according to clause 8.1A of [6, 38.213]. Three uplink resource allocation schemes type 0, type 1 and type 2 are supported. Uplink resource allocation scheme type 0 is supported for PUSCH only when transform precoding is disabled. Uplink resource allocation scheme type 1 and type 2 are supported for PUSCH for both cases when transform precoding is enabled or disabled.

If the scheduling DCI is configured to indicate the uplink resource allocation type as part of the '*Frequency domain resource'* assignment field by setting a higher layer parameter r*esourceAllocation* in *pusch-Config* to 'dynamicSwitch', for DCI format 0\_1 or setting a higher layer parameter *resourceAllocationDCI-0-2* in *pusch-Config* to 'dynamicSwitch' for DCI format 0\_2 or setting a higher layer parameter *resourceAllocationDCI-0-3* in *pusch-ConfigDCI-0-3* to 'dynamicSwitch' for DCI format 0\_3, the UE shall use uplink resource allocation type 0 or type 1 as defined by this DCI field. Otherwise the UE shall use the uplink frequency resource allocation type as defined by the higher layer parameter *resourceAllocation* for DCI format 0\_1 or the higher layer parameter *resourceAllocationDCI-0-2* for DCI format 0\_2 or by the higher layer parameter *resourceAllocationDCI-0-3* for DCI format 0\_3. The UE shall assume that when the scheduling PDCCH is received with DCI format 0\_1/0\_3 and *useInterlacePUCCH-PUSCH* in *BWP-UplinkDedicated* is configured, uplink type 2 resource allocation is used.

-------------------------------------End of TP----------------------------------------------

Agreement

* Adopt the TP in R1-2408629 for Section 7.3.1.1.4, TS38.212 in principle for alignment CR with additional change of the changed text “mapped” to “associated”.

Agreement

Adopt the following TP for Section 12, TS38.213 in principle for alignment CR.

12 Bandwidth part operation

< Unchanged parts are omitted >

The UE does not expect to be scheduled by a DCI format 0\_3/1\_3 to transmit/receive a PUSCH/PDSCH on an activated SCell, if:

- the DCI format 0\_3/1\_3 indicates an active DL BWP provided by *dormantBWP-Id* for the activated SCell, and

- *resourceAllocation* = *resourceAllocationType0* and not all bits of a block of the frequency domain resource assignment field associated with the activated SCell in the DCI format 0\_3/1\_3 are equal to 0, or

- *resourceAllocation* = *resourceAllocationType1* and not all bits of a block of the frequency domain resource assignment field associated with the activated SCell in the DCI format 0\_3/1\_3 are equal to 1, or

- *resourceAllocation = dynamicSwitch* and not all bits of a block of the frequency domain resource assignment field associated with the activated SCell in the DCI format 0\_3/1\_3 are equal to either 0 or 1, or

- *useInterlacePUCCH-PUSCH* is provided and not all bits of a block of the frequency domain resource assignment field associated with the serving cell in the DCI format 0\_3 are equal to 1 for or not all bits of the block are equal to 0 for .

< Unchanged parts are omitted >

Agreement

Draft CR R1-2408973 to TS38.214 is endorsed in principle for alignment CR.

Agreement

Adopt the following TP for Section 5.1.5, TS38.214 in principle for alignment CR.

5.1.5 Antenna ports quasi co-location

< Unchanged parts are omitted >

When a UE supports two TCI states in a codepoint of the DCI field '*Transmission Configuration Indication'* the UE may receive an activation command, as described in clause 6.1.3.24 of [10, TS 38.321], the activation command is used to map up to 8 combinations of one or two TCI states to the codepoints of the DCI field *'Transmission Configuration Indication'*. The UE is not expected to receive more than 8 TCI states in the activation command.

If the UE is provided a set of serving cells by *mc-DCI-SetOfCellsToAddModList-r18*, the UE does not expect to receive an activation command mapping two *TCI-States* and/or two *TCI-UL-States* to only one TCI codepoint, or to be provided *PDCCH-Config* that is associated with two different values of *coresetPoolIndex* for scheduling on a serving cell from the set of serving cells.

When the DCI field *'Transmission Configuration Indication'* is present in DCI format 1\_2 and when the number of codepoints S in the DCI field *'Transmission Configuration Indication'* of DCI format 1\_2 is smaller than the number of TCI codepoints that are activated by the activation command, as described in clause 6.1.3.14, 6.1.3.24 and 6.1.3.47 of [10, TS38.321], only the first S activated codepoints are applied for DCI format 1\_2.

< Unchanged parts are omitted >

For Rel-19 MCE:

Agreement

* For multiple PUSCHs/PDSCHs scheduled on a cell by a DCI format 0\_3/1\_3,
* Common FDRA is applied to the PUSCHs/PDSCHs on the cell as Rel-16/17 multi-PUSCH/PDSCH scheduling.
* Common MCS is applied to the PUSCHs/PDSCHs on the cell as Rel-16/17 multi-PUSCH/PDSCH scheduling.
* HARQ process number indicated for the cell is applied to the first scheduled PUSCH/PDSCH and then incremented by 1 for subsequent PUSCHs/PDSCHs on the cell (with modulo operation if needed) as Rel-16/17 multi-PUSCH/PDSCH scheduling.

Agreement

* In DCI format 0\_3/1\_3, for each block of NDI field, consider the following options:
  + Option 1: the number of bits is equal to the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3.
  + Option 2: the number of bits is equal to the actual number of scheduled PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3.
  + Option 3: if the number of scheduled PUSCH/PDSCH is 1, then one bit NDI is applied; otherwise, option 1 is applied.

Agreement

* In DCI format 0\_3/1\_3, for each block of RV field, consider the following options:
  + Option 1: the number of bits is determined based on the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3 and number of bits for RV configured for the corresponding cell.
  + Option 2: the number of bits is determined based on the actual number of scheduled PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3 and number of bits for RV configured for the corresponding cell.
  + Option 3: if the number of scheduled PUSCH/PDSCH is 1, then option 2 is applied; otherwise, option 1 is applied.

Agreement

* A single TDRA field in DCI format 0\_3/1\_3 indicates one row from a joint TDRA table.
* Each row in the table contains only one TDRA index for each BWP of each cell within the set of cells. Each TDRA index points to one or multiple time domain resource allocations in the TDRA table applicable for multi-PUSCH/PDSCH scheduling by DCI format 0\_3/1\_3 for the corresponding cell.

Agreement

* Time domain HARQ-ACK bundling is supported.

Agreement

* Consider at least the case that up to two different SCS can be scheduled by a DCI format 0\_3/1\_3 in Rel-19.
* Consider at least the following cases for scheduled cells in Rel-19:
* Case 1: A DCI format 0\_3/1\_3 scheduling PUSCHs/PDSCHs on FR1 licensed FDD cell(s) with SCS1 and FR1 licensed TDD cell(s) with SCS2.
  + SCS1 can be same or different to SCS2.
* Case 2: A DCI format 0\_3/1\_3 scheduling PUSCHs/PDSCHs on FR1 licensed FDD cell(s) with SCS1 and FR2-1 cell(s) with SCS2.
  + SCS1 can be same or different to SCS2.
* Case 3: A DCI format 0\_3/1\_3 scheduling PUSCHs/PDSCHs on FR1 licensed TDD cell(s) with SCS1 and FR2-1 cell(s) with SCS2.
  + SCS1 can be same or different to SCS2.
* Case 4: A DCI format 0\_3/1\_3 scheduling PUSCHs/PDSCHs on FR1 licensed FDD cell(s) with different SCS.
* Case 5: A DCI format 0\_3/1\_3 scheduling PUSCHs/PDSCHs on FR1 licensed TDD cell(s) with different SCS.
* Case 6: A DCI format 0\_3/1\_3 scheduling PUSCHs/PDSCHs on FR2-1 cell(s) with different SCS.

## Agreements made in RAN1#119

For Rel-18 CR:

Agreement

Draft CR R1-2410190 to TS 38.213 is endorsed in principle as alignment CR.

Agreement

Draft CR R1-2410598 to TS 38.212 is endorsed in principle as alignment CR.

Agreement

Draft CR R1-2409665 to TS 38.213 is endorsed in principle as alignment CR.

Agreement

Draft CR R1-2410897 to TS 38.213 is endorsed in principle as alignment CR.

For Rel-19 MCE:

Agreement

* Time-domain HARQ-ACK bundling is configured per cell as Rel-17.

Agreement

* Specification supports the maximum number of PUSCHs/PDSCHs for a scheduled cell by a DCI format 0\_3/1\_3 is 8.
* Payload size of a DCI format 0\_3/1\_3 exceeding 140 is not supported in Rel-19.

Agreement

* Type-2 HARQ-ACK codebook is generated by concatenating a first sub-codebook and a second sub-codebook.
* The first sub-codebook comprises HARQ-ACK information bits for PDSCH(s) scheduled by DCI(s) with each scheduling a single PDSCH, or each scheduling a single cell with multiple PDSCHs on it and *nrofHARQ-BundlingGroups* configured as 1, and HARQ-ACK information bit(s) for DCI(s) having associated HARQ-ACK information without scheduling PDSCH reception.
* The second sub-codebook comprises HARQ-ACK information bits for PDSCHs scheduled by DCI(s) with each scheduling more than one cell, or each scheduling a single cell with multiple PDSCHs on it without *nrofHARQ-BundlingGroups* or *nrofHARQ-BundlingGroups* configured larger than 1.
* Separate DAI counting is applied for DCI(s) associated with the first sub-codebook and DCI(s) associated with the second sub-codebook as Rel-18.
* Note: For providing HARQ-ACK information corresponding to SCell dormancy indication, the UE assumes that the UE receives a PDSCH on the serving cell associated with fields in DCI format 1\_3 used for SCell dormancy indication as Rel-18.

Agreement

* For the second sub-codebook, the number of HARQ-ACK information bits for each DCI format 1\_3 is equal to M, to select one of the following options.
  + Option 1: M is the maximum number of HARQ-ACK information bits which can be generated for a DCI format 1\_3 across all the configured cell set(s) in the PUCCH group for the UE. M is implicitly derived based on RRC configuration.
  + Option 2: M is explicitly configured by RRC parameter for the PUCCH group.
  + Other options are not precluded.

Agreement

* For NDI indication in DCI format 0\_3/1\_3 for TB1, further study
  + Option 1: For each block of NDI field, the number of bits is equal to the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3.
    - Maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell is determined by TDRA table for the cell.
  + Option 2a: Total number of bits of the NDI field is equal to the maximum number of schedulable PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 across all the co-schedulable cells.
    - The number of bits of a block of NDI field corresponding to a scheduled cell is equal to the actual number of the scheduled PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 on the cell.
    - Some reserved bits are needed when the actual number of the scheduled PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 is smaller than the maximum number of schedulable PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 across all the co-schedulable cells.
* Other options are not precluded.
* Note: For Option 1 and 2a, DCI format 0\_3/1\_3 has blocks of NDI field for TB1, same as in Rel-18.

Agreement

* For RV indication in DCI format 0\_3/1\_3 for TB1, further study
  + Option 1: For each block of RV field, the number of bits is equal to the maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell by the DCI format 0\_3/1\_3 and number of bits for RV configured for the cell.
    - Maximum number of schedulable PUSCHs/PDSCHs on the corresponding cell is determined by TDRA table for the cell.
  + Option 2a: Total number of bits of the RV field is determined based on the maximum number of schedulable PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 across all the co-schedulable cells.
    - The number of bits of a block of RV field corresponding to a scheduled cell is determined based on the actual number of the scheduled PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 on the cell and number of bits for RV configured for the cell.
    - Some reserved bits are needed when the actual number of the scheduled PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 is smaller than the maximum number of schedulable PUSCHs/PDSCHs by the DCI format 0\_3/1\_3 across all the co-schedulable cells.
* Other options are not precluded.
* Note: For Option 1 and 2a, DCI format 0\_3/1\_3 has blocks of RV field for TB1, same as in Rel-18.

## Agreements made in RAN1#120

Agreement

* For determining the timing of a PUCCH carrying HARQ-ACK information corresponding to a set of co-scheduled PDSCHs by a DCI format 1\_3, follow Rel-18 operation.
* If the UE is not provided *subslotLengthForPUCCH*, the DL slot 𝑛𝐷 is the DL slot ending last, amongst the DL slots where the more than one PDSCH are scheduled by the DCI format 1\_3.
  + FFS: RAN1 spec impact till RAN1#120-bis
* If the UE is provided *subslotLengthForPUCCH*, no spec change is necessary.
* Note: Specification of this feature shall not impact the existing UE processing PDSCH timeline requirement for any individual PDSCH, as specified in 5.3.1 of TS38.214.

Agreement

* For the second sub-codebook, the number of HARQ-ACK information bits for each DCI format 1\_3 is equal to M.
* M is the maximum number of HARQ-ACK information bits which can be generated for a DCI format 1\_3 across all the configured cell set(s) in the PUCCH group for the UE. M is implicitly derived based on RRC configuration.

Agreement

* For NDI indication in DCI format 0\_3/1\_3 for a TB,
  + Option 1 is adopted.

Agreement

* For RV indication in DCI format 0\_3/1\_3 for a TB,
  + Option 1 is adopted.

Agreement

* For multi-PUSCH/PDSCH scheduling using a DCI format 0\_3/1\_3, 1 bit RV indication is determined according to Table 7.3.1.2.3-1 of TS 38.212.
  + Note: This is aligned with Rel-18 DCI format 0\_3/1\_3 for cells configured with 1 bit RV by *numberOfBitsForRV-DCI-0-3/1-3*.

Agreement

* For the second sub-codebook, the HARQ-ACK information bits for a DCI format 1\_3 are ordered firstly according to same ordering as in Rel-17 multi-PDSCHs scheduling for PDSCH receptions on a same serving cell, then according to ascending order of associated serving cell indexes.

Agreement

* For Type-1C fields in DCI format 0\_3, when the TDRA field indicates more than one scheduled PUSCHs on the scheduled cell with the smallest cell index:
  + The CSI request field applies to the PUSCH determined based on Rel-17 multi-PUSCH scheduling on same serving cell.
  + Note for background: When the TDRA field of DCI format 0\_3 indicates only one scheduled PUSCH on the scheduled cell with the smallest cell index, DCI interpretation and UE procedure is same as in Rel-18.

Working Assumption

For a DCI format 1\_3 with fields repurposed for SCell dormancy indication and scheduling one or more PDSCHs, if TDRA field indicates multiple SLIVs for the serving cell with smallest serving cell index with invalid FDRA, the HARQ-ACK information bit for SCell dormancy indication is ACK for the first SLIV and followed by NACK bits for the remaining SLIVs.

Agreement

* Regarding presence of UL-SCH field,
  + 1 bit UL-SCH field is always present in DCI format 0\_3.
* UL-SCH field and CSI request field in a DCI format 0\_3 are applied to the same PUSCH.

Agreement

* For NDI/RV indication in DCI format 0\_3/1\_3 for a TB,
  + Within each block of NDI field, the NDI bits are placed in the LSBs based on the SLIV position in the indicated TDRA row. Padding bits, if any, are placed in the MSBs within the block.
  + Within each block of RV field, the RV bits are placed in the LSBs based on the SLIV position in the indicated TDRA row. Padding bits, if any, are placed in the MSBs within the block.

## Agreements made in RAN1#120bis

Conclusion

* All bits in the NDI of TB1 and RV of TB1 corresponding to the cell with smallest serving cell index with invalid FDRA are used for SCell dormancy indication.

Conclusion

* For a DCI format 1\_3 with fields repurposed for SCell dormancy indication and without scheduling any PDSCH, one bit of ACK is generated for SCell dormancy indication and included in the first sub-codebook regardless of the number of SLIVs indicated by the DCI format 1\_3 for the cell with fields repurposed for SCell dormancy indication.

Agreement

* For a DCI format 1\_3 with fields repurposed for SCell dormancy indication and scheduling one or more PDSCHs, if TDRA field indicates multiple SLIVs for the serving cell with smallest serving cell index with invalid FDRA and *nrofHARQ-BundlingGroups* is not provided for the serving cell, the HARQ-ACK information bit for SCell dormancy indication is ACK for the first SLIV and followed by NACK bits for the remaining SLIVs.
* For a DCI format 1\_3 with fields repurposed for SCell dormancy indication and scheduling one or more PDSCHs, if TDRA field indicates multiple SLIVs for the serving cell with smallest serving cell index with invalid FDRA and *nrofHARQ-BundlingGroups* is provided for the serving cell, the HARQ-ACK information bit for SCell dormancy indication is ACK for the first TBG, and followed by NACK bits for the remaining TBGs, if any.
* Note: Related working assumption made in RAN1#120 meeting does not need to be confirmed.

Agreement

For determining the number M of HARQ-ACK information bits for each DCI format 1\_3 corresponding to the second HARQ-ACK sub-codebook in a PUCCH transmission:

* *M* is a maximum number over all the configured cell set(s) *S* in a PUCCH group of the sum of (if *nrofHARQ-BundlingGroups* is not provided for a serving cell *c*) or (if *nrofHARQ-BundlingGroups* is provided for the serving cell *c*) across serving cells of a respective cell set *S* that can be co-scheduled by a DCI format 1\_3;
  + is the maximum number of SLIVs amongst all rows of the multi-PDSCH TDRA table configured on the active BWP of the serving cell *c*;
  + is the maximum number of transport block groups (TBGs) for first TBs (and for second TBs, if configured) for the serving cell *c* if *harq-ACKSpatialBundlingPUCCH* is not provided, or the maximum number of PDSCH reception groups on the serving cell *c* if *harq-ACKSpatialBundlingPUCCH* is provided, and is provided by RRC parameter *nrofHARQ-BundlingGroups*;
  + is the value of *maxNrofCodeWordsScheduledByDCI* for serving cell *c* when *harq-ACKSpatialBundlingPUCCH* is not provided; otherwise .

## Agreements made in RAN1#121

Agreement

* Below TP for TS38.300 is adopted for Rel-19 MCE.

|  |
| --- |
| 10.11 Multi-cell scheduling by a single DCI  Multi-cell scheduling by a single DCI allows the PDCCH of a serving cell to schedule PDSCH(s)/PUSCH(s) on one or more serving cells with the single DCI but with the following restrictions:  - When a serving cell is configured with a PDCCH which schedules PDSCH(s)/PUSCH(s) on a cell set, the PUSCH/PDSCH on serving cells in the cell set is always scheduled by a PDCCH on the serving cell;  - When SpCell is configured with a PDCCH which schedules PDSCH(s)/PUSCH(s) on serving cells in a cell set, that SpCell's PDSCH and PUSCH cannot be scheduled by a PDCCH on an SCell;  - When an SCell is configured with a PDCCH which schedules PDSCH(s)/PUSCH(s) on serving cells in a cell set, SpCell is not included in the cell set;  - The scheduling PDCCH and the scheduled PDSCH(s)/PUSCH(s) can use the same or different numerologies;  - The co-scheduled PDSCH(s) with a PDCCH can use the same or different numerologies;  - The co-scheduled PUSCH(s) with a PDCCH can use the same or different numerologies. |

* Send an LS to RAN2 to convey the above TP.

Agreement

* For a cell within a cell set configured to be schedulable by a DCI format 0\_3, the network does not configure *pusch-TimeDomainAllocationListForMultiPUSCH-DCI-0-3* simultaneously with the *numberOfSlotsTBoMS-r17* and/or *pusch-AggregationFactor*.
* Add above to RRC parameter list.

Agreement



Agreement

* For Type-2 HARQ-ACK codebook, adopt TP1 in Section 8 of R1-2504761 to Section 9.1.3.1, TS38.213.

Agreement

For PUCCH power control, adopt TP2A in Section 8 of R1-2504761 to Section 9.1.3.1, TS38.213.

Agreement

* Support maximum 64 rows for *TDRA-FieldIndexListDCI-1-3-r19*.
* Support maximum 128 rows for *TDRA-FieldIndexListDCI-0-3-r19*.

Agreement

Draft LS R1-2504764 is endorsed in principle.

Agreement

Final LS R1-2504861 is endorsed.