**3GPP TSG RAN WG1 Meeting #117 R1-240XXXX**

**Fukuoka, Japan, May 20th - 24th, 2024**

**Source: Moderator (Lenovo)**

**Title: Feature lead summary #2 on multi-cell scheduling with a single DCI**

**Agenda item:** **8.1**

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

# Introduction

This document summarizes the remaining issues on multi-cell scheduling from contributions submitted under the agenda item of “**8.1** **Maintenance on Multi-Carrier Enhancements for NR**” for Rel-18 WI Multi-carrier enhancements.

The Rel-18 WI Multi-carrier enhancements was agreed during RAN#94-e meeting [1], where one of the objectives is targeted to specify a solution for multi-cell PUSCH/PDSCH scheduling with a single DCI. The detailed objectives in the WID are listed below:

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| **1. Specify a solution for multi-cell PUSCH/PDSCH scheduling (one PDSCH/PUSCH per cell) with a single DCI [RAN1]**   * **Identify the maximum number of cells that can be scheduled simultaneously** * **Consider both intra-band and inter-band CA operation** * **Consider both FR1 and FR2** * ***The single DCI shall be optimized for 3 or more cells for the multi-cell PUSCH/PDSCH scheduling*** |

In this contribution, the related issues and proposals are summarized based on the contributions submitted in RAN1#117 under the agenda item 8.1.

Below issues are selected for discussion in this meeting. 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.

# Issue 1: HARQ-ACK skipping

## Companies’ inputs

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| **Huawei:**  *Proposal 2:*   * *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 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)* * *For Type 2 codebook for generating the second sub-codebook, the HARQ-ACK information is skipped for the DCI format 1\_3.* * *Adopt draft CR in R1-2405309 for TS 38.213.*   **ZTE：**  ***Proposal 2:*** *The HARQ-ACK generation with NACK bits for the second sub-codebook is performed per DCI in case of BWP switching on a cell.*  **NTT DOCOMO:**  Proposal 2:   * 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 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) * 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 ~~if at least one cell of co-scheduled cells has no active DL BWP change or the DCI format 1\_3 has fields reinterpreted for the SCell dormancy indication;~~   + ~~otherwise, the HARQ-ACK information is skipped for the DCI format 1\_3.~~   **Lenovo:**  *Proposal 1: For a DCI format 1\_3 scheduling one or multiple cells with fields reinterpreted for SCell dormancy indication, the corresponding HARQ-ACK information for SCell dormancy indication is not skipped* *no matter which cell scheduled by the DCI format 1\_3 has active DL BWP change.*  *Proposal 2: 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 is not triggered in the PDCCH MO, 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-1 HARQ-ACK codebook and the first sub-codebook of Type-2 HARQ-ACK codebook, follow the legacy behavior, i.e., the corresponding HARQ-ACK information for the cell with active DL BWP change is skipped.* * *For the second sub-codebook of Type-2 HARQ-ACK codebook, the corresponding HARQ-ACK information for the cell with active DL BWP change is generated with NACK bit, then the generated HARQ-ACK information bits for scheduled cells are ordered in ascending order of associated serving cell indices as current specification.* |

Relevant draft CRs are listed below to avoid redundancy and simplify the summary.

[R1-2404089](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404089.zip) Draft CR on HARQ-ACK skipping for DL/UL BWP switching in multi-cell scheduling Samsung

[R1-2404147](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404147.zip) Draft CR on HARQ-ACK codebook for DL BWP switching vivo

[R1-2404234](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404234.zip) Draft CR on HARQ-ACK generation in case of DL BWP switching ZTE

[R1-2404378](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404378.zip) Draft CR on HARQ-ACK information skipping due to BWP change for second Type-2 HARQ-ACK codebook CATT

[R1-2405221](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405221.zip) Draft CR on HARQ-ACK skipping for Rel-18 multi-cell scheduling Lenovo

[R1-2405309](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405309.zip) Correction on type 2 HARQ-ACK codebook skipping in case of BWP switching Huawei, HiSilicon

## Moderator summary and proposals

For legacy Type-1 and Type-2 HARQ-ACK codebook determination, HARQ-ACK information for a DCI format skipping is specified when active DL BWP change on a scheduled cell or active UL BWP change on the PUCCH cell happens after the monitoring occasion that provides the DCI format and before the PUCCH transmission occasions that is scheduled by the DCI format and the DCI format doesn’t trigger the active DL BWP change on the scheduled cell.

Relevant issues have been discussed in RAN1#116 meeting and below agreement is made. There is one FFS issue when DL active BWP change happens on one cell of cells co-scheduled by one DCI format 1\_3.

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| **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) |

For Type-2 HARQ-ACK codebook, for a set of cells which are configured for multi-cell scheduling by one DCI format 1\_3, the performance degradation happens if the HARQ-ACK information is skipped for all co-scheduled cells by one DCI format 1\_3 as long as active DL BWP change happens on at least one cell. Hence, the HARQ-ACK information is skipped only for cell(s) with active DL BWP change and the HARQ-ACK information is reported only for cell(s) without active DL BWP change.

For RAN1#117 meeting, companies’ views are summarized as below:

* For DCI format 1\_3, when active DL BWP change on a scheduled cell happens after the PDCCH monitoring occasion that provides the DCI format 1\_3 and before the PUCCH transmission occasion that is scheduled by the DCI format 1\_3, and the DCI format 1\_3 doesn’t trigger the active DL BWP change on the cell,
* For Type 2 codebook for generating the second sub-codebook,
  + Option 1: the HARQ-ACK information is skipped for all co-scheduled cells by the DCI format 1\_3.
    - Supported by Huawei, ZTE,
  + Option 2: the HARQ-ACK information for that cell with active DL BWP change is generated with NACK bit.
    - Supported by NTT DOCOMO, vivo, CATT, Samsung, Lenovo

Based on above analysis, Proposal 1-1 is provided for discussion.

#### Proposal 1-1:

* 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 is to be transmitted after 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.

Companies are encouraged to provide comments in the table below.

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| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are not OK with any discussion on this issue for now. There is an on-going discussion in pre-R18 maintenance (agenda 7.1). We need to defer the discussion until that maintenance discussion is settled.  By the way, RAN1 had following conclusions in RAN1#98bis and RAN1#99. We believe these conclusions are still effective, and are applicable to HARQ-ACK codebook construction with DCI format 1\_3 as well.  [**R1-1910312**](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_98b\R1-1910312.zip) Discussion on HARQ-ACK codebook determination with BWP switch CATT  Discuss further offline in combination with draft CR1 in x1413  **Conclusion**:   * For type-2 HARQ-ACK codebook, for the issue raised in R1-1910312, the UE behaviour is not defined   + No CR is necessary   For type-1 HARQ codebook issue – **R1-1911624**  **Conclusion:**   * For Type-1 HARQ-ACK codebook, if the HARQ-ACK codebook size is changed due to BWP switching, the UE behaviour for the HARQ-ACK transmission is not defined.   Check till RAN1#99 whether or not to have a CR  [**R1-1912142**](file:///C:\Users\ktakeda\AppData\Local\Docs\R1-1912142.zip) Correction on HARQ-ACK codebook determination with BWP switch CATT  **Conclusion:**   * For Type-1 HARQ-ACK codebook, if the HARQ-ACK information bit(s) and/or the PUCCH resource for the HARQ-ACK feedback is impacted due to BWP switching, the UE behavior for the HARQ-ACK transmission is not defined. |
| Nokia | Agree with QC, maybe better to wait the outcome of the pre-Rel 18 discussions. |
| Spreadtrum | Agree with QC. |
| NTT DOCOMO | Finr to defer the discussion. |
| LGE | Similar view as QC.  Undefined or, if necessary to be defined, Option 1 is preferred for simplification. |
| CATT | OK to defer the discussion. |
| Samsung | We support the proposal.  We don’t see a relevance of the pre-Rel-18 draft CR under discussion to the proposal. That draft CR is for clarifying the specifications for SC-DCI based on per-Rel-18 agreements. RAN1 can readily decide on the MC-DCI case. Following the SC-DCI operation, “Option 2” is preferred – i.e. if a scheduled cell is not affected by BWP change, the HARQ-ACK report is as usual; otherwise, NACK is reported (as for non-scheduled cells). |
| Huawei, HiSilicon | We don’t think it is worthwhile to adopt such kind of optimization at this late stage, especially it will increase much additional UE complexity. We prefer to just simply skipping the HARQ information, i.e. option 1. |
| Xiaomi | Similar view as QC to defer the discussion. |
| ZTE | Firstly, as analyzed in R1-2404233, the agreement made in RAN1#116 should be revised as below.Secondly, our preference is option 1, which is the simplest way to resolve this issue. In addition, we agree with other companies that we can wait for the conclusion of the same issue discussed in maintanenace.   |  | | --- | | **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 for type 1 codebook generation, and the corresponding HARQ-ACK information for the DCI format 1\_3 is generated with NACK bits for type 2 codebook generation. * 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 for type 1 codebook generation, and the corresponding HARQ-ACK information for that cell with BWP switching is generated with NACK bit for type 2 codebook generation) | |
| Huawei, HiSilicon | There is no strong relevance to defer the discussion since for DCI format 1\_3 the design can and should be simpler. |

# Issue 2: TCI update

## Companies’ inputs

**Spreadtrum:**

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| ***Reason for change:*** | It was agreed TCI field in DCI format 1\_3 is Type-1B field, and entries for each CC are interpreted based on the new/target BWPs per cell. When Rel-17 unified TCI framework is configured, DCI format 1\_3 can also update unified TCI state, which is captured in clause 5.1.5, 38.214.   |  | | --- | | <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*. |   However, how to interpret TCI field in DCI format 1\_3 is not clear if Rel-17 unified TCI is configured, e.g. TCI states only apply to scheduled cells with valid FDRA, or scheduled cells with/without valid FDRA, or all cells in the set. |
|  |  |
| ***Summary of change:*** | Clarify if unified TCI state is configured, transmission configuration indication in a DCI format 1\_3 applies only to the scheduled cell(s) with valid FDRA value(s) |
|  |  |
| ***Consequences if not approved:*** | It is not clear which cells that transmission configuration indication in a DCI format 1\_3 can be applies to. |

5.1.5 Antenna ports quasi co-location

<text 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 PDSCH 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 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.

When a UE configured with *dl-OrJointTCI-StateList*, if a transmission configuration indication field is provided by a DCI format 1\_3,

- the UE applies the indicated TCI state(s) for a serving cell, if

- the UE is scheduled by the DCI format 1\_3 to receive PDSCH, respectively, on the serving cell, and

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

- otherwise, the UE keep the previously indicated TCI state(s) for the serving cell.

When a UE is configured with *dl-OrJointTCI-StateList*, and if the UE is configured with *unifiedTCI-StateType* is set as ‘separate’, and if the UE receives a TCI codepoint mapped with either of {*TCI-State*, *TCI-UL-State}*, the UE shall update the one indicated {*TCI-State*, *TCI-UL-State}* and maintain the other {*TCI-State*, *TCI-UL-State}* that is not updated by the received TCI codepoint.

**Samsung:**

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| --- | --- |
| ***Reason for change:*** | The TCI codepoint of a DCI format 1\_3 provides TCI indexes for all cells in a set of cells for multi-cell scheduling *scheduledCellListDCI-1-3-r18*, regardless of whether or not the cells are scheduled. TS 38.214 v18.2.0 specifies respective unified TCI (uTCI) states to be applied to cells with scheduled PDSCHs. However, it is unclear whether/how the UE applies the TCI states corresponding to cells without scheduled PDSCHs.  For single-cell scheduling, indication of a uTCI state for a non-scheduled cell is supported under the Rel-17 unified TCI framework, using a DCI format 1\_1 or 1\_2 with CRC scrambled by CS-RNTI and with repurposed fields and without DL assignment (DLA). The reason Rel-17 uTCI uses CS-RNTI is that ‘no DLA’ indication using invalid FDRA is not supported for DCI formats 1\_1/1\_2 with C-RNTI, except with auxiliary validation field (e.g., one-shot HARQ, or HARQ reTx field), that are not present for uTCI indication.  The UE behaviour for DCI format 1\_3 can follow from the UE behaviour for DCI formats 1\_1/1\_2. In addition, such indication of uTCI states for non-scheduled cells can be provided by DCI format 1\_3 without the need for CS-RNTI. That is possible because ‘no DLA’ indication using invalid FDRA is specified for C-RNTI / MCS-C-RNTI without the need for any auxiliary field, or any repurposing of DCI fields, and with or without the Scheduled cells indicator field or the RRC parameter *ScheduledCellCombo-ListDCI-1-3*.  Per UE features agreements in RAN1#115, UEs capable of supporting DCI format 1\_3 (FG 49-1/1b) may not support legacy DCI formats 1\_1/1\_2 (FG 6-10), except for self-scheduling of the scheduling cell, and it is therefore not feasible to rely only on legacy DCI formats 1\_1/1\_2. |
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| ***Summary of change:*** | Capture that, when a UE is configured unified TCI states, the TCI indexes provided by a TCI codepoint in a DCI format 1\_3, with or without PDSCH scheduling, provide “indicated” TCI states for both scheduled and non-scheduled cells within the corresponding set of cells *scheduledCellListDCI-1-3-r18*. |
|  |  |
| ***Consequences if not approved:*** | Incomplete specifications for unified TCI state indication with DCI format 1\_3. |

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\_1/1\_2/1\_3 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]).

If the DCI format 1\_3 is without DL assignment for one or more cells from a scheduled cell set *scheduledCellListDCI-1-3-r18*, the UE can assume the following:

- C-RNTI or MCS-C-RNTI is used to scramble the CRC for the DCI, and

- FDRA blocks corresponding to the one or more cells are set to all '0's for FDRA Type 0, or all '1's for FDRA Type 1, or all '0's or all '1's for dynamicSwitch, or

- the one or more cells are not included in scheduled cells *ScheduledCellCombo-ListDCI-1-3*, when configured.

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 \*\*\*

**NTT DOCOMO:**

Proposal 1:

When a UE is configured unified TCI states, the TCI indexes provided by a TCI codepoint in a DCI format 1\_3 with or without PDSCH scheduling provide “indicated” TCI states for both scheduled and non-scheduled cells ~~within the corresponding set of cells~~.

* The above applies regardless of whether or not ScheduledCellCombo-ListDCI-1-3 is configured
* New FG for unified TCI update with DCI format 1\_3 is introduced

## Moderator summary and proposals

Unified TCI framework is introduced in Rel-17. When a DCI format 1\_3 indicates an entry *TCI-DCI-1-3-r18* of the joint multi-cell TCI table *tci-ListDCI-1-3-r18* that includes values for all cells in the set of cells, it needs to clarify whether the TCI states can provide “indicated” TCI states for the non-scheduled cells.

During RAN1#116-bis meeting, the following proposal was discussed and only several companies made inputs.

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| Proposal 3-4:When a UE is configured unified TCI states, the TCI indexes provided by a TCI codepoint in a DCI format 1\_3 with or without PDSCH scheduling provide “indicated” TCI states for both scheduled and non-scheduled cells within the corresponding set of cells.  * The above applies regardless of whether or not *ScheduledCellCombo-ListDCI-1-3* is configured |

For RAN1#117 meeting, this issue was raised by three companies [Spreadtrum, Samsung, NTT DOCOMO] and companies’ views are summarized as below:

When a UE is configured unified TCI states,

* Alt 1: the TCI indexes provided by a TCI codepoint in a DCI format 1\_3 with or without PDSCH scheduling provide “indicated” TCI states for both scheduled and non-scheduled cells
  + Yes: Samsung, NTT DOCOMO
* Alt 2: the TCI indexes provided by a TCI codepoint in a DCI format 1\_3 with or without PDSCH scheduling provide “indicated” TCI states only for scheduled cells
  + Yes: Spreadtrum,

From moderator’s point of view, the above proposal can be further discussed in this meeting.

**Proposal 2-1:**

* When a UE is configured unified TCI states, the TCI indexes provided by a TCI codepoint in a DCI format 1\_3 with or without PDSCH scheduling provide “indicated” TCI states for both scheduled and non-scheduled cells within the corresponding set of cells.
  + The above applies regardless of whether or not *ScheduledCellCombo-ListDCI-1-3* is configured

Companies are encouraged to provide comments in the table below.

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| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are not OK with the proposal.  We think Alt.2 is reasonable. TCI indication for non-scheduled cell is a property of CS-RNTI, which is not supported for DCI format 1\_3. TCI indication for non-scheduled cell by DCI format 1\_3 based on CS-RNTI can be considered in future release if justified as necessary. |
| Nokia | We support the intention.  On the detailed proposal wording: It would be simpler to talk about the cells of the set of cells – i.e. there is no need to distinguish about scheduled & not scheduled cells and any relation to the cell combo.  I.e. simply say   * When a UE is configured unified TCI states, the TCI indexes provided by a TCI codepoint in a DCI format 1\_3 ~~with or without PDSCH scheduling~~ provide “indicated” TCI states for the ~~both scheduled and non-scheduled~~ cells within the corresponding set of cells provide by *scheduledCellListDCI-1-3-r18*.   + ~~The above applies regardless of whether or not~~ *~~ScheduledCellCombo-ListDCI-1-3~~* ~~is configured~~   Similarly, in case we go with Alt. 1, also in the specs text we think it would be simpler to just talk about (all) the cells of the set of cells – so no need to define what a non-scheduled etc. cell is in this part of the specification. |
| Spreadtrum | We support Alt 2.  First, DCI format 1\_3 without PDSCH is a function by CS-RNTI. However, DCI format 1\_3 cannot be scrambled by CS-RNTI.  Second, othe Type-1B fields in DCI 1\_3 are only applied to scheduled cell with valid FDRA. i.e. BWP, rate matching indicator, ZP CSI-RS trigger, SRS request, and SRS offset indicator, so TCI should follow it, too. |
| NTT DOCOMO | We support Alt.1. In Rel-17, unified TCI indication for CA case is supported by DCI scrambled by C-RNTI. More specifically, TCI state indicated by TCI state filed in legacy DCI format is applied to CCs which is configured by *simultaneousU-TCI-UpdateListX-r17*. For example, CC#1/2/3 is configured in *simultaneousU-TCI-UpdateListX-r17*and unified TCI state is indicated by DCI format 1\_1/1\_2 which schedules CC#1, the indicated unified TCI codepoint is applied to CC#2/3 as well. In our view, similar principle should be applied for the unified TCI indication by DCI forma 1\_3, and hence we support Alt.1. In addition, we believe *simultaneousU-TCI-UpdateListX-r17* and *scheduledCellListDCI-1-3-r18* can be configured independently. In that sense, we prefer to remove “within the corresponding set of cells” from the proposal.  Unified TCI indication without scheduling PDSCH by DCI scrambled by CS-RNTI can be discussed separately. |
| LGE | OK with the intention.  And we are fine with the updated proposal provided by Nokia as well as the removal of “within the corresponding set of cells” suggested by DOCOMO. |
| CATT | It depends on whether Rel-17 unified TCI is configured/ supported for a UE. If a UE is conifigured with unified TCI framework, then Alt2 is reasonable. Otherwise, Alt 1 is applied.  And we don’t see the necessity to support TCI indication without scheduling PDSCH by DCI scrambled by CS-RNTI for DCI 1\_3. |
| Samsung | Support the proposal.  Also, OK with the simplified text from Nokia.  For QC’s comment on CS-RNTI, the reason Rel-17 uTCI uses CS-RNTI is that ‘no DLA’ indication using invalid FDRA is not supported for DCI formats 1\_1/1\_2 with C-RNTI, except with auxiliary validation field (e.g., one-shot HARQ, or HARQ reTx field), that are not present for uTCI indication… indication of uTCI states for non-scheduled cells can be provided by DCI format 1\_3 without the need for CS-RNTI. That is possible because ‘no DLA’ indication using invalid FDRA is specified for C-RNTI / MCS-C-RNTI without the need for any auxiliary field, or any repurposing of DCI fields, and with or without the Scheduled cells indicator field or the RRC parameter *ScheduledCellCombo-ListDCI-1-3*. |
| Huawei, HiSilicon | We also think that we should discuss the case with PDSCH scheduling and without PDSCH scheduling separately.  For the case with PDSCH scheduling, agree with DCM that the indidcated TCI can be applied to cells outside of the set of cells.  For the case without PDSCH scheduling, since CS-RNTI is not applied to DCI format 1\_3, additional new procedure is needed for the support of DCI format 1\_3 without PDSCH for unified TCI indication. At such late stage, we prefer not to support it. |
| ZTE | We think the HARQ should be clarified first.  If the DCI 1\_3 schedules PDSCH for one cell and indicates TCI state for the another cell, how to generate the HARQ information bits? Our understanding is that the UE should generate 2 bits, i.e., one bit for PDSCH and the other bit for TCI indication.  If the DCI 1\_3 does not schedule any PDSCH but indicates TCI state for one cell, whether the UE generates the HARQ information bit? Our understanding is that HARQ information bit should be generated. |
| Moderator | A new draft CR is prepared for further discussion. Please input your views in the below table. |

## Updated proposals

**New draft CR for discussion:**

|  |  |  |
| --- | --- | --- |
| ***Reason for change:*** | It was agreed TCI field in DCI format 1\_3 is Type-1B field, and entries for each CC are interpreted based on the new/target BWPs per cell. When Rel-17 unified TCI framework is configured, DCI format 1\_3 can also update unified TCI state, which is captured in clause 5.1.5, 38.214.   |  | | --- | | <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*. |   However, how to interpret TCI field in DCI format 1\_3 is not clear if Rel-17 unified TCI is configured. |
|  |  |
| ***Summary of change:*** | Clarify UE behaviors when the UE is provided *dl-OrJointTCI-StateList* and a transmission configuration indication field is provided by a DCI format 1\_3. |
|  |  |
| ***Consequences if not approved:*** | It is not clear how to interpret TCI field in DCI format 1\_3. |

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*. When the UE is provided *dl-OrJointTCI-StateList* and a transmission configuration indication field is provided by a DCI format 1\_3, the UE assumes the indicated TCI state(s) is valid if the UE is scheduled by the DCI format 1\_3 to receive PDSCH at least on one serving cell with the indicated TCI state(s). The DCI format 1\_1/1\_2/1\_3 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 \*\*\*

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Spreadtrum | We support the CR.  The change part clarifies if a cell is not scheduled with a PDSCH and it is not in a *simultaneousU-TCI-UpdateList* with at least one scheduled cell by this DCI format 1\_3, its TCI would not update.  For a cell is not scheduled with PDSCH but it is in a *simultaneousU-TCI-UpdateList* with a scheduled cell, its TCI will update too and this part has been covered by the previous sentence. So no change for this type of cell. |
| LGE | We also support the CR with same understanding as Spreadtrum.  In summary,   * TCI is updated for a non-scheduled cell if the cell is in a *simultaneousU-TCI-UpdateList* in which at least one scheduled cell by DCI 1\_3 is included. * TCI is NOT updated for a non-scheduled cell if the cell is NOT in a *simultaneousU-TCI-UpdateList* in which at least one scheduled cell by DCI 1\_3 is included. |
| Nokia | Agree with the intention, but we think the change could be even slightly more compact.   * The first sentence already clarifies if a TCI field is there, namely if ‘*tci-PresentInDCI’* is configured. So it should be clear already that a TCI field is provided. So we think this can be shortened. * The only thing we could need to capture in addition to the current specs text is the second side sentence – namely the restriction that at least on cell in *simultaneousU-TCI-UpdateList* is scheduled so that the TCI is applicable. Suggestion here to use the formulation ‘applicable / or apply’ instead of ‘valid’ as otherwise we may later on say, what if this is invalid. * In the latter part, it would be good to remove 1\_3 from the next sentences (yellow marking) as clearly there needs to be one PDSCH scheduled that we apply the TCI update.   i.e. something like that (in green):   |  | | --- | | 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*. ~~When the UE is provided~~ *~~dl-OrJointTCI-StateList~~* ~~and a transmission configuration indication field is provided by a DCI format 1\_3, t~~The UE only applies ~~assumes~~ the indicated TCI state(s) ~~is valid~~ provided in a DCI format 1\_3 if the UE is scheduled by the DCI format 1\_3 to receive PDSCH at least on one serving cell with the indicated TCI state(s). The DCI format 1\_1/1\_2~~/1\_3~~ 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 \*\*\* | |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
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|  |  |

# Issue 3: TB disabling

## Companies’ inputs

Samsung:

|  |  |
| --- | --- |
| ***Reason for change:*** | In RAN1#112, it was agreed that the bit size of a redundancy version (RV) field in DCI format 1\_3 is configurable. According to TS 38.212, if the RV field size is configured to 0 bits, *rvid* = 0 is applied, and if the RV field size is configured to 1 bit, either *rvid* = 0 or *rvid* = 3 is applied. However, in the case of 2 TB configuration for a cell, TS 38.214 v18.2.0 allows disabling one TB only if {*IMCS* = 26, *rvid* = 1}. Therefore, if the RV field size is 0 or 1 bits, gNB cannot disable one of the TBs, as the value *rvid* = 1 is not addressable by the RV field. To resolve the issue, another combination of {*IMCS*, *rvid*} can be used that is commonly applicable to all RV field sizes, for example, {*IMCS =* 26, *rvid* = 0}. |
|  |  |
| ***Summary of change:*** | Correct the condition for RV field value for TB disabling in case of 2 TB configuration for PDSCH reception on a cell when the RV field in DCI format 1\_3 is configured to be of size 0 or 1 bit. |
|  |  |
| ***Consequences if not approved:*** | Incorrect/ambiguous specifications for TB disabling with DCI format 1\_3. |

5.1.3.2 Transport block size determination

In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *PDSCH-config* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 1\_1 if *IMCS* = 26 and if *rvid* = 1 or by DCI format 1\_3 if *IMCS* = 26 and if *rvid* = 0 for the corresponding transport block. In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *pdsch-ConfigMulticast* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 4\_2 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. When the UE is configured with higher layer parameter *pdsch-TimeDomainAllocationListForMultiPDSCH*, either the first or the second transport block of all scheduled PDSCHs is disabled by the DCI format 1\_1 if *IMCS* = 26 and if *rvid* = 2 for the corresponding transport block of all scheduled PDSCHs. If both transport blocks are enabled, transport block 1 and 2 are mapped to codeword 0 and 1 respectively. If only one transport block is enabled, then the enabled transport block is always mapped to the first codeword.

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

## Moderator summary and proposals

According to current spec, the bit size of RV field in DCI format 1\_3 is configurable. If the RV field is configured to 0 bit, rvid = 0 is applied, and if the RV field is configured to 1 bit, either rvid = 0 or rvid = 3 is applied.

However, in the case of 2 TB configuration for a cell, TS 38.214 v18.2.0 allows disabling one TB only if IMCS = 26 and rvid = 1. Therefore, if the RV field size is 0 or 1 bits, gNB cannot disable one of the TBs, as the value rvid = 1 is not addressable by the RV field.

To resolve the issue, {IMCS = 26, rvid = 0} is proposed by Samsung to disable the TB.

**Question 1:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We do not think this is essential. gNB can configure RV field for a cell with 2 bits if it wants to indicate disabled TB. With the flexibility of the configuration, the issue is not critical. |
| Nokia | We agree with QC. Especially as the proposal would not allow using MCS 26 for initial TB scheduling even if 1 or 2 bit RV actually is included. |
| vivo | Same view as Qualcomm |
| NTT DOCOMO | We tend to agree with companies. We don’t see the strong need for the CR especially for DCI format 1\_3. |
| LGE | Simila view as QC/Nokia.  It is reasonable for gNB to avoid such case by configuring non-zero RV field size. |
| CATT | Ok with the CR |
| Samsung | Support the CR.  With 2-TB configuration, DCI format 1\_3 will become large due to additional fields for the 2nd TB, so a reduced size of HPN and RV fields would be desirable.  Also, would like to remind that the issue is not only for the case of 0-bit RV case – it also exists for 1-bit RV.  As for allowing MCS 26 for 2-bit RV, we are open to discuss. We think it would make the spec lengthier. It would also be preferable to have a unified treatment for all RV sizes. |
| Huawei, HiSilicon | Not that essential to do the further optimization here. |
| ZTE | We share the same view with QC. It can be solved by gNB configuration. |
|  |  |

# Issue 4: determination of *UCI-onPUSCH*

## Companies’ inputs

Nokia: R1-2404482, Correction of UCI-onPUSCH for PUSCH scheduled by DCI format 0\_1 and 0\_3

|  |  |
| --- | --- |
| ***Reason for change:*** | Unclear determination of *UCI-onPUSCH* for PUSCH scheduled by DCI format 0\_1 and 0\_3. |
|  |  |
| ***Summary of change:*** | Clarify, that *UCI-onPUSCH* for PUSCH scheduled by DCI format 0\_1 is determined by the configuration of *uci-OnPUSCH* or *uci-OnPUSCH-ListDCI-0-1-r16* and for PUSCH scheduled by DCI format 0\_3 by *uci-OnPUSCH-ListDCI-0-3-r18*. |
|  |  |
| ***Consequences if not approved:*** | The specification is unclear. |

9.1 HARQ-ACK codebook determination

If a UE is provided *pdsch-HARQ-ACK-CodebookList*, the UE can be indicated by *pdsch-HARQ-ACK-CodebookList* to generate one or two HARQ-ACK codebooks. If the UE is indicated to generate one HARQ-ACK codebook, the HARQ-ACK codebook is associated with a PUCCH of priority index 0. If a UE is provided *pdsch-HARQ-ACK-CodebookList*, the UE multiplexes in a same HARQ-ACK codebook only HARQ-ACK information associated with a same priority index. If the UE is indicated to generate two HARQ-ACK codebooks

- a first HARQ-ACK codebook is associated with a PUCCH of priority index 0 and a second HARQ-ACK codebook is associated with a PUCCH of priority index 1

- the UE is provided first and second for each of {*PUCCH-Config*, *UCI-OnPUSCH*, *PDSCH*-*codeBlockGroupTransmission*} by {*PUCCH-ConfigurationList*, *uci-OnPUSCH-ListDCI-0-1*, *PDSCH-CodeBlockGroupTransmissionList*}, {*PUCCH-ConfigurationList*, *uci-OnPUSCH-ListDCI-0-2*, *PDSCH-CodeBlockGroupTransmissionList*} or {*PUCCH-ConfigurationList*, *uci-OnPUSCH-ListDCI-0-3*, *PDSCH-CodeBlockGroupTransmissionList*}, respectively, for use with the first and second HARQ-ACK codebooks, respectively

< Unchanged parts are omitted >

9.3 UCI reporting in physical uplink shared channel

In the remaining of this clause, the applicable parameters in *UCI-OnPUSCH* for PUSCH scheduled by DCI format 0\_0 or 0\_1 are provided by either by *uci-OnPUSCH* or *uci-OnPUSCH-ListDCI-0-1-r16* and for PUSCH scheduled by DCI format 0\_3 by *uci-OnPUSCH-ListDCI-0-3-r18*, respectively.

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

< Unchanged parts are omitted >

If a DCI format that includes a beta\_offset indicator field with one bit or two bits, as configured by *UCI-OnPUSCH* for DCI format 0\_1/0\_3 or *UCI-OnPUSCH-DCI-0-2* for DCI format 0\_2, schedules the PUSCH transmission from the UE, the UE is provided by each of {*betaOffsetACK-Index1*, *betaOffsetACK-Index2*, *betaOffsetACK-Index3*}, the {first, second, third} values provided by *betaOffsetsCrossPri0*, or *betaOffsetsCrossPri0DCI-0-2,* and the {first, second, third} values provided by *betaOffsetsCrossPri1*, or *betaOffsetsCrossPri1DCI-0-2*, a set of two or four indexes from Table 9.3-1 for multiplexing HARQ-ACK information in the PUSCH transmission and by each of {*betaOffsetCSI-Part1-Index1*, *betaOffsetCSI-Part1-Index2*} a set of two or four indexes, and by each of {*betaOffsetCSI-Part2-Index1*, *betaOffsetCSI-Part2-Index2*} a set of two or four indexes from Table 9.3-2, respectively, for multiplexing Part 1 CSI reports and Part 2 CSI reports, respectively, in the PUSCH transmission. The beta\_offset indicator field indicates a value and/or a value, and/or a value, a value and a value from the respective sets of values, with the mapping defined in Table 9.3-3 and in Table 9.3-3A. If the PUSCH transmission has priority 0 or priority 1, and the UE is provided *uci-MuxWithDiffPrio*, and the UE multiplexes HARQ-ACK information of priority 1 or priority 0 in the PUSCH, the UE applies the {first, second, third} values provided by *betaOffsetsCrossPri1* *= 'dynamic'* for DCI format 0\_1/0\_3, *betaOffsetsCrossPri1DCI-0-2= 'dynamic'* for DCI format 0\_2, or applies the {first, second, third} values provided by *betaOffsetsCrossPri0 = 'dynamic'* for DCI format 0\_1/0\_3, *betaOffsetsCrossPri0DCI-0-2= 'dynamic'* for DCI format 0\_2.

< Unchanged parts are omitted >

## Moderator summary and proposals

**Question 2:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the TPs. |
| Nokia | Support the TP / draft CR |
| Spreadtrum | Support |
| vivo | 1st change: not necessary  The high-layer parameter name clearly captures the corresponding applicable DCI format, and the field description also specifies the formats.  uci-OnPUSCH-ListDCI-0-2-r16 SetupRelease { UCI-OnPUSCH-ListDCI-0-2-r16} OPTIONAL, -- Need M  uci-OnPUSCH-ListDCI-0-1-r16 SetupRelease { UCI-OnPUSCH-ListDCI-0-1-r16 } OPTIONAL, -- Need M uci-OnPUSCH-ListDCI-0-1-r16 SetupRelease { UCI-OnPUSCH-ListDCI-0-1-r16 } OPTIONAL, -- Need M  uci-OnPUSCH-ListDCI-0-3-r18 SetupRelease { UCI-OnPUSCH-ListDCI-0-1-r16 } OPTIONAL -- Need M  ***uci-OnPUSCH-ListDCI-0-1, uci-OnPUSCH-ListDCI-0-2***  Configuration for up to 2 HARQ-ACK codebooks specific to DCI format 0\_1/0\_2. The field uci-OnPUSCH-ListDCI-0-1 applies to DCI format 0\_1 and the field uci-OnPUSCH-ListDCI-0-2 applies to DCI format 0\_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13] clause 9.3).  ***uci-OnPUSCH-ListDCI-0-3***  Selection between and configuration of dynamic and semi-static beta-offset for DCI format 0\_3.  Moreover, according to 38.212, it is clear that beta\_offset for DCI format 0-3 is based on *uci-OnPUSCH-ListDCI-0-3*. Thus, even without the TP, the spec is clear that the applicable parameters in UCI-OnPUSCH for PUSCH scheduled by DCI format 0\_0 or 0\_1 are provided by either by uci-OnPUSCH or uci-OnPUSCH-ListDCI-0-1-r16 and for PUSCH scheduled by DCI format 0\_3 by uci-OnPUSCH-ListDCI-0-3-r18, respectively.  - beta\_offset indicator - 0 or 2 bits  - 0 bit if *betaOffsets = semiStatic* is configured in *uci-OnPUSCH-ListDCI-0-3* for all the cells configured by higher layer parameter *scheduledCellListDCI-0-3* in the scheduled cell set;  - otherwise 2 bits as defined by Table 9.3-3 in [5, TS 38.213].  2nd change : we are fine with this change |
| NTT DOCOMO | We are fine with the TPs while we don’t see the strong need for second TP. |
| LGE | OK with the TP. |
| CATT | OK with the TP |
| Samsung | Does not seem necessary; if any need, can be part of the Rel-18 alignment CR. |
| Huawei, HiSilicon | Not that essential as explained by vivo, but fine with the TP as alignment CR to make it clearer if companies think it may result in misunderstanding. . |
| ZTE | We are fine with this TP. |
| Moderator | As commented by Samsung, the CR can be treated as alignment CR. |

# Issue 5: On bitwidth determination of beta\_offset indicator field of DCI format 0\_1

## Companies’ inputs

Nokia, R1-2404481, Correction of bitwidth determination of beta\_offset indicator field of DCI format 0\_1

|  |  |
| --- | --- |
| ***Reason for change:*** | Unclear definition of the *beta\_offset indicator* bitwidth for DCI format 0\_1. |
|  |  |
| ***Summary of change:*** | Clarify, that the determination of the DCI field size of the *beta\_offset indicator* is based on the configuration of *betaOffsets* in *uci-OnPUSCH* or *uci-OnPUSCH-ListDCI-0-1-r16,* to distinguish from the configurations of *uci-OnPUSCH-ListDCI-0-2-r16*  for DCI format 0\_2 and especially *uci-OnPUSCH-ListDCI-0-3-r18* for DCI format 0\_3. |
|  |  |
| ***Consequences if not approved:*** | The specification is unclear. |

7.3.1.1.2 Format 0\_1

DCI format 0\_1 is used for the scheduling of one or multiple PUSCH in one cell, or indicating CG downlink feedback information (CG-DFI) to a UE.

The following information is transmitted by means of the DCI format 0\_1 with CRC scrambled by C-RNTI or CS-RNTI or SP-CSI-RNTI or MCS-C-RNTI:

< Unchanged parts are omitted >

- beta\_offset indicator - 0 if the higher layer parameter *betaOffsets = semiStatic* in *uci-OnPUSCH* or *uci-OnPUSCH-ListDCI-0-1-r16*; otherwise 2 bits as defined by Table 9.3-3 in [5, TS 38.213].

When two HARQ-ACK codebooks are configured by *pdsch-HARQ-ACK-CodebookList* or by *pdsch-HARQ-ACK-CodebookListMulticast* for the same serving cell and if higher layer parameter *priorityIndicatorDCI-0-1* is configured, if the bit width of the beta\_offset indicator in DCI format 0\_1 for one HARQ-ACK codebook is not equal to that of the beta\_offset indicator in DCI format 0\_1 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller beta\_offset indicator until the bit width of the beta\_offset indicator in DCI format 0\_1 for the two HARQ-ACK codebooks are the same.

< Unchanged parts are omitted >

## Moderator summary and proposals

**Question 3:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the TP. |
| Nokia | Support the TP / draft CR |
| Spreadtrum | Support |
| vivo | Not necessary.  Similar comments as that of Question2. 331 clearly states the applicable formats for the higher layer parameters used to determine beta offset. |
| NTT DOCOMO | We don’t see the need of this TP. |
| LGE | OK with the TP. |
| CATT | OK with the TP |
| Samsung | Not necessary |
| Huawei, HiSilicon | Not that essential as explained by vivo, but fine with the TP as alignment CR to make it clearer if companies think it may result in misunderstanding. Note that we don’t need to include the suffix *-r16* |
| Xiaomi | Not necessary. |
| ZTE | The same view with vivo. |
| Moderator | As stated in 331, the CR is not necessary and not pursued in this meeting. |

# Issue 6: TPMI in DCI format 0\_3

## Companies’ inputs

ZTE, R1-2404235, Draft CR on Precoding information and number of layers in DCI format 0\_3

|  |  |  |
| --- | --- | --- |
| ***Reason for change:*** | Multi-TRP operation and multi-cell scheduling cannot be configured simultaneously, and a TP to reflect the RAN#97e agreements was agreed in RAN1#116bis.   |  | | --- | | **Agreement**  Adopt TP3 in Section 8 of **R1-2403479** for TS38.214. |   Meanwhile, two SRS resource sets are not supported for DCI format 0\_3, and the description on Precoding information and number of layers in DCI format 0\_3 should be updated. |
|  |  |
| ***Summary of change:*** | The description on Precoding information and number of layers in DCI format 0\_3 is updated to exclude two SRS resource sets. |
|  |  |
| ***Consequences if not approved:*** | Two SRS resource sets can be configured with DCI format 0\_3 simultaneously. |

7.3.1.1.4 Format 0\_3

**<Unchanged parts are omitted>**

- Precoding information and number of layers - number of bits determined by the following:

- If *tpmi-DCI0-3= type1a* is configured by higher layer,

- bits applying to the scheduled cells with independently, where is mapped to the cells according to an ascending order of a serving cell index with corresponding to the cell with the smallest serving cell index, and is defined below.

- If *tpmi-DCI0-3= type2* is configured by higher layer,

- block number 1, block number 2,…, block number

Each block corresponds to the precoding information and number of layers for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the precoding information and number of layers for the cell with the smallest serving cell index. Each block is defined below.

above for the case of *tpmi-DCI0-3= type1a* or each block above for the case of *tpmi-DCI0-3= type2* is defined by the following:

- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;

- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;

- 4, 5, or 6 bits according to Table 7.3.1.1.2-2 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRank*, and *codebookSubset*;

- 4 or 5 bits according to Table 7.3.1.1.2-2A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1, maxRank=2,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubset*;

- 4 or 6 bits according to Table 7.3.1.1.2-2B for 4 antenna ports, if *txConfig = codebook, ul-FullPowerTransmission =fullpowerMode1,* *maxRank=3 or 4,* transform precoder is disabled, and according to the value of higher layer parameter *codebookSubset*;

- 2, 4, or 5 bits according to Table 7.3.1.1.2-3 for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank* and *codebookSubset*;

- 3 or 4 bits according to Table 7.3.1.1.2-3A for 4 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubset*;

- 2 or 4 bits according to Table7.3.1.1.2-4 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* transform precoder is disabled, and according to the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-4A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, transform precoder is disabled, *maxRank=2*, and *codebookSubset=nonCoherent*;

- 1 or 3 bits according to Table7.3.1.1.2-5 for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission* is not configured or configured to *fullpowerMode2* or configured to *fullpower,* and according to whether transform precoder is enabled or disabled, and the values of higher layer parameters *maxRank* and *codebookSubset*;

- 2 bits according to Table 7.3.1.1.2-5A for 2 antenna ports, if *txConfig = codebook,* *ul-FullPowerTransmission =fullpowerMode1*, *maxRank=1*, and according to whether transform precoder is enabled or disabled, and the value of higher layer parameter *codebookSubset*.

For the higher layer parameter *txConfig=codebook*, if *ul-FullPowerTransmission* is configured to *fullpowerMode2*, *maxRank* is configured to be larger than 2, and at least one SRS resource with 4 antenna ports is configured in an SRS resource set with usage set to 'codebook', and an SRS resource with 2 antenna ports is indicated via SRI in the same SRS resource set, then Table 7.3.1.1.2-4 is used.

For the higher layer parameter *txConfig = codebook*, if different SRS resources with different number of antenna ports are configured, the bitwidth is determined according to the maximum number of ports in an SRS resource among the configured SRS resources in an SRS resource set with usage set to 'codebook'. If the number of ports for a configured SRS resource in the set is less than the maximum number of ports in an SRS resource among the configured SRS resources, a number of most significant bits with value set to '0' are inserted to the field.

**<Unchanged parts are omitted>**

## Moderator summary and proposals

**Question 4:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the TP. |
| Nokia | Support the TP / draft CR |
| Spreadtrum | Support |
| vivo | Agree with the intention |
| NTT DOCOMO | Suport. |
| LGE | OK with the TP. |
| CATT | OK with the TP |
| Samsung | OK |
| Huawei, HiSilicon | Fine with it as alignment CR. |
| Xiaomi | Support the draft CR. |
| ZTE | Support. |

# Issue 7: PDCCH overbooking

## Companies’ inputs

Huawei, R1-2405310, Correction on PDCCH overbooking in TS 38.213

|  |  |
| --- | --- |
| ***Reason for change:*** | In the current specification, PDCCH overbooking can be applied to the USS which is used for scheduling on the primary cell. Accordingly, the BD/CCE of the USS sets is counted on the primary cell. However, for multi-cell scheduling with DCI format 0\_3/1\_3, when primary cell is included in a set of cells, the BD/CCE of the USS for monitoring DCI format 0\_3/1\_3 is counted on the primary cell only if the primary cell is the reference cell for the set of cells. If the primary cell is included in a set of cells, but the reference cell is a cell in the set of cells other than primary cell, the BD/CCE of the USS for the set of cells is counted on the cell rather than primary cell. In this case, PDCCH overbooking shall not be applied to the USS. The current specification texts need modifications to clarify the PDCCH overbooking restriction. |
|  |  |
| ***Summary of change:*** | Distinguish between legacy and multi-cell scheduling in case of PDCCH overbooking.  For multi-cell scheduling, the USS for DCI format 0\_3/1\_3 scheduling on the primary cell can be overbooked when the primary cell is the serving cell for counting BD/CCE of the USS. |
|  |  |
| ***Consequences if not approved:*** | The specification regarding PDCCH overbooking in case of multi-cell scheduling is incorrect. |

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 if neither DCI format 0\_3 nor 1\_3 is configured, or a set of USS sets for one or both of DCI format 0\_3 and 1\_3 when primary cell is the serving cell for counting the PDCCH candidates and corresponding number of non-overlapping CCEs, 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. The location of search space sets , , in is according to an ascending order of the search space set index.

< Unchanged parts are omitted >

## Moderator summary and proposals

**Question 5:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We agree with the intention of the proposal. We think the TP is reasonable. |
| Nokia | Agree with the intention. TP text seems reasonable. |
| vivo | Agree with the intention |
| NTT DOCOMO | Agree with the intention. |
| LGE | OK with the intention. |
| Langbo | Support the TP. |
| CATT | Not support. Since ‘For all search space sets that a UE monitors PDCCH on the primary cell’ has reflected the case that the primary cell is the serving cell for counting BD/CCE of the USS of DCI format 1\_3. Another reason if this is added, the USS of DCI 1\_1 in Rel-17 DSS also should be considered. |
| Samsung | Fine to discuss. If agreed, a possible TP can be simplified – a clarification to the existing text is sufficient – e.g. “when primary cell is the serving cell for counting the PDCCH candidates and corresponding number of non-overlapping CCEs”. Can be part of the Rel-18 alignment CR. |
| Huawei, HiSilicon | Support the proposal. Fine to further disucss any simplied text if any. |
| ZTE | Seems reasonable but we prefer the following updates with minimum spec impact.   |  | | --- | | 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 counted 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. The location of search space sets , , in is according to an ascending order of the search space set index.  < Unchanged parts are omitted > | |
| Moderator | As commented by CATT, this CR is not quite necessary. |
| Huawei, HiSilicon | @CATT  We consider clairifcation is needed as majority replied. The cell that is monitored is not the same meaning as the cell that is counted for PDCCH candidate.  For R17 DSS clarification, that could be separately discussed – R17 DSS with SCell scheduling PCell has already being out of scope of R18 mc scheduling, therefore we feel it is rather irrelevant. But we are open to discuss that separately. |

# Issue 8: MCS/NDI/RV blocks for TB-2 in DCI 1\_3

## Companies’ inputs

OPPO, R1-2404856, Draft CR on number of MCS/NDI/RV blocks for TB-2 in DCI 1\_3

|  |  |
| --- | --- |
| ***Reason for change:*** | The number of blocks for MCS/NDI/RIV for TB-2 in DCI 1\_3, denoted as , is determined in current Rel-18 CR of 38.212 as following:   * If *ScheduledCellCombo-ListDCI-1-3* for the scheduled cell set is configured, is the number of scheduled cells indicated by Scheduled cells indicator field and configured with *maxNrofCodeWordsScheduledByDCI = 2*; * otherwise, is the number of cells configured by higher layer parameter *ScheduledCell-ListDCI-1-3* in the scheduled cell set and configured with *maxNrofCodeWordsScheduledByDCI = 2*.   The “if” condition in the first bullet above can be split into two cases: the configured *ScheduledCellCombo-ListDCI-1-3* has (a) more than one table entry and (b) only one table entry. However, the behavior defined in the first bullet can only be true for case (a) but not for case (b), because for case (b) the bit size of “Scheduled cells indicator field”, specified as , is zero due to . The DCI field does not exist and then cannot indicate anything. Therefore, correction is needed for the case (b) where *ScheduledCellCombo-ListDCI-1-3* has only one table entry*.* |
|  |  |
| ***Summary of change:*** | Modify the determination of number of blocks of MCS/NDI/RV for TB-2 in DCI 1\_3 when *ScheduledCellCombo-ListDCI-1-3* is configured; clarify behaviors in two separate cases for *ScheduledCellCombo-ListDCI-1-3* with more than one entry and with only one entry. |
|  |  |
| ***Consequences if not approved:*** | The specification may specify an error case, where the UE is specified to look for a DCI field (Scheduled cells indicator) to determine the number of blocks for TB-2 reception but the DCI field does not exist in the DCI. |

7.3.1.2.4 Format 1\_3

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

For transport block 2:

- Modulation and coding scheme - number of bits determined by the following:

- block number 1, block number 2,…, block number

If *ScheduledCellCombo-ListDCI-1-3* for the scheduled cell set is configured with more than one entry, is the number of scheduled cells indicated by Scheduled cells indicator field and configured with *maxNrofCodeWordsScheduledByDCI = 2*; if *ScheduledCellCombo-ListDCI-1-3* for the scheduled cell set is configured with only one entry, is the number of cells configured by higher layer parameter *ScheduledCellCombo-ListDCI-1-3* and configured with *maxNrofCodeWordsScheduledByDCI = 2*;otherwise, is the number of cells configured by higher layer parameter *ScheduledCell-ListDCI-1-3* in the scheduled cell set and configured with *maxNrofCodeWordsScheduledByDCI = 2*. Each block corresponds to the modulation and coding scheme for a scheduled cell, and the blocks are placed according to an ascending order of a serving cell index, with block number 1 corresponding to the modulation and coding scheme for the cell with the smallest serving cell index. Each block is 5 bits as defined in Clause 6.1.4.1 of [6, TS 38.214].

- 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 scheduled 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. Each 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 scheduled 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. Each block is 0, 1 or 2 bits determined by higher layer parameter *numberOfBitsForRV-DCI-1-3* configured for the cell corresponding to the block,

- If 0 bit is configured, *rvid* to be applied is 0;

- 1 bit according to Table 7.3.1.2.3-1;

- 2 bits according to Table 7.3.1.1.1-2.

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

## Moderator summary and proposals

**Question 6:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the TP. |
| Nokia | Support the TP / draft CR |
| Spreadtrum | Support |
| vivo | Support |
| NTT DOCOMO | Support. |
| LGE | OK with the TP. |
| Langbo | Support |
| Samsung | Not essential - configuring only a single cell combo for a set of cells is not practically relevant. If a TP is agreed, it can be part of the alignment CR. |
| Huawei, HiSilicon | Fine with alignment CR. |
| Xiaomi | Support |
| ZTE | We are fine with this TP. |

# Proposals for online/offline discussion

# References

1. [R1-2403958](file:///D:\RAN1\RAN1%23117\tdocs\R1-2403958.zip) Maintenance of Rel-18 Multicarrier Enhancements Huawei, HiSilicon
2. [R1-2404013](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404013.zip) Corrections for Unified TCI update by DCI format 1\_3 Spreadtrum Communications
3. [R1-2404087](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404087.zip) Correction of TB disabling for multi-cell scheduling Samsung
4. [R1-2404088](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404088.zip) Correction of indicated unified TCI states for non-scheduled cells in multi-cell scheduling Samsung
5. [R1-2404089](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404089.zip) Draft CR on HARQ-ACK skipping for DL/UL BWP switching in multi-cell scheduling Samsung
6. [R1-2404147](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404147.zip) Draft CR on HARQ-ACK codebook for DL BWP switching vivo
7. [R1-2404232](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404232.zip) Draft CR on search space of DCI format 0\_3 and DCI format 1\_3 ZTE
8. [R1-2404233](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404233.zip) Discussion on HARQ-ACK generation in case of DL BWP switching ZTE
9. [R1-2404234](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404234.zip) Draft CR on HARQ-ACK generation in case of DL BWP switching ZTE
10. [R1-2404235](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404235.zip) Draft CR on Precoding information and number of layers in DCI format 0\_3 ZTE
11. [R1-2404376](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404376.zip) Maintenance on Multi-Carrier Enhancements for NR CATT
12. [R1-2404377](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404377.zip) Draft CR on maxNrofCodeWordsScheduledByDCI for second Type-2 HARQ-ACK codebook CATT
13. [R1-2404378](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404378.zip) Draft CR on HARQ-ACK information skipping due to BWP change for second Type-2 HARQ-ACK codebook CATT
14. [R1-2404379](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404379.zip) Draft CR on information field determination for DCI 0\_3/1\_3 in case of BWP change CATT
15. [R1-2404481](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404481.zip) Correction of bitwidth determination of beta\_offset indicator field of DCI format 0\_1 Nokia
16. [R1-2404482](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404482.zip) Correction of UCI-onPUSCH for PUSCH scheduled by DCI format 0\_1 and 0\_3 Nokia
17. [R1-2404730](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404730.zip) Correction on PDCCH Search Space for Rel-18 Multi-Carrier Enhancements Langbo
18. [R1-2404731](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404731.zip) Correction on Minimum Scheduling Offset for Rel-18 Multi-Carrier Enhancements Langbo
19. [R1-2404855](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404855.zip) Draft CR on Type-2 field blocks in DCI 1\_3/0\_3 OPPO
20. [R1-2404856](file:///D:\RAN1\RAN1%23117\tdocs\R1-2404856.zip) Draft CR on number of MCS/NDI/RV blocks for TB-2 in DCI 1\_3 OPPO
21. [R1-2405020](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405020.zip) Maintenance on Multi-Carrier Enhancements for NR NTT DOCOMO, INC.
22. [R1-2405220](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405220.zip) Discussion on HARQ-ACK skipping for Rel-18 multi-cell scheduling Lenovo
23. [R1-2405221](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405221.zip) Draft CR on HARQ-ACK skipping for Rel-18 multi-cell scheduling Lenovo
24. [R1-2405308](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405308.zip) Correction on SCell dormancy indication case 2 in case of BWP switching Huawei, HiSilicon
25. [R1-2405309](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405309.zip) Correction on type 2 HARQ-ACK codebook skipping in case of BWP switching Huawei, HiSilicon
26. [R1-2405310](file:///D:\RAN1\RAN1%23117\tdocs\R1-2405310.zip) Correction on PDCCH overbooking in TS 38.213 Huawei, HiSilicon

# 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.

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| **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.

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| **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.

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| 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.

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| **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:

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| **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)
  + 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#116bis

**Agreement**

* Adopt following TP for TS38.214.

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| ***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:

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| **[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