# **Agreements regarding multi-cell PUSCH/PDSCH scheduling with a single DCI**

## **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.

## **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.

## **RAN1#110bis-e**

**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.

## **RAN1#111**

**Agreement**

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):

|  |  |  |
| --- | --- | --- |
| **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

## **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.

**Agreement**

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

## **RAN1#112bis-e**

Agreement

[**R1-2304238**](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304238.zip) captures the higher layers parameters for the following Rel-18 work items and TEI that are considered stable from RAN1 perspective:

* NR network-controlled repeaters (NR\_netcon\_repeater-Core)
* Enhancement of NR Dynamic Spectrum Sharing (NR\_DSS\_enh)
* Multi-carrier enhancements for NR (NR\_NC\_enh-Core)
* BandWidth Part operation without restriction in NR (BWP\_wor)
* 1-symbol PRS (TEI18)

Note: The updates in the list as compared to the already communicated higher layer parameters to RAN2/RAN3 are highlighted in blue.

Note: [R1-2304221](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304221.zip)captures all the discussed higher layers parameters including the stable and unstable ones.

[112bis-e-R18-38.211-NR\_MC\_enh] Review of draft CR by April 26 – Stefan (Ericsson)

[**R1-2304278**](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304278.zip) **Introduction of multi-carrier enhancements Ericsson**

**Decision:** As per email decision posted on April 27th, the draft CR in [R1-2304278](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304278.zip) for Rel-18 TS38.211 MC-Enh is endorsed in principle.

[112bis-e-R18-38.212-NR\_MC\_enh] Review of draft CR by April 26 – Chengyan (Huawei)

[**R1-2304265**](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304265.zip) **Summary of email discussion [112bis-e-R18-38.212-NR\_MC\_enh] Moderator (Huawei)**

[**R1-2304263**](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304263.zip) **Introduction of Rel-18 Multi-carrier enhancements Huawei** (rev of [R1-2303803](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2303803.zip))

**Decision:** As per email decision posted on April 27th, the draft CR in [R1-2304263](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304263.zip) for Rel-18 TS38.212 MC-Enh is endorsed in principle.

[112bis-e-R18-38.213-MC\_enh] Review of draft CR by April 26 – Aris (Samsung)

[**R1-2304193**](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304193.zip) **Summary of email discussions [112bis-e-R18-38.213-NR\_MC\_enh] Moderator (Samsung)**

[**R1-2304196**](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304196.zip) **Introduction of multi-carrier enhancements Samsung** (rev of [R1-2303161](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2303161.zip))

**Decision:** As per email decision posted on April 25th, the draft CR in [R1-2304196](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304196.zip) for Rel-18 TS38.213 MC-Enh is endorsed in principle.

[112bis-e-R18-38.214-MC\_Enh-Scheduling] Review of draft CR by April 26 – Mihai (Nokia)

[**R1-2304204**](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304204.zip) **Summary of email discussion on Multi-Cell Scheduling in [112bis-e-R18-38.214-MC\_Enh] Moderator (Nokia)**

**[R1-2304201](file:///C:\\MyMeetings\\TSGR1_112b-e\\Docs\\R1-2304201.zip) Introduction of multi-carrier enhancements Nokia** (rev of [R1-2303012](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2303012.zip))

**Decision:** As per email decision, the draft CR in [R1-2304201](file:///C:\MyMeetings\TSGR1_112b-e\Docs\R1-2304201.zip) for Rel-18 TS38.214 MC-Enh CR including only the scheduling/DCI part is endorsed in principle.

Agreement

* Introduce separate FGs for the support of monitoring DCI formats 1\_3 and 0\_3 as FGs 49-1 and 49-2
  + Note: Some capabilities can be reported separately for DCI formats 1\_3 and 0\_3, details FFS
  + FFS whether/which capabilities can be commonly applied for DCI formats 1\_3 and 0\_3, FFS how to report

Agreement

* Introduce separate FGs for the support of same and different SCSs between scheduling cell and cells in the set
  + Note: Some capabilities can be reported separately for same and different SCSs, details FFS
  + FFS whether/which capabilities can be commonly applied for same and different SCSs, FFS how to report
  + FFS whether the FG for the support of different SCS is separate or common for DCI format 0\_3 and 1\_3

Agreement

* Following is reported separately for DCI formats 1\_3 and 0\_3 as a component of FGs 49-1/1a/1b and 49-2/2a/2b
  + Max number of co-scheduled cells supported by a DCI format for the UE: Candidate value set of {2, 3, 4}

Agreement:

Introduce following FGs

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 49. NR\_MC\_enh | 49-1 | Multi-cell PDSCH scheduling by DCI format 1\_3 on a scheduling cell with same SCS between scheduling cell and cells in the set | 1) UE supports monitoring DCI format 1\_3 for DL scheduling with same SCS between scheduling cell and cells in the set  [2) Scheduling cell is PCell if set of cells includes PCell, and scheduling cell is PCell or an SCell if set of cells includes only SCells.]  3) Scheduling cell and co-scheduled cells have same SCS/carrier type[: candidate value set {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2}]  4) Max number of co-scheduled cells per set of cells supported by UE is reported with candidate value set of {2, 3, 4}, FFS whether this component is reported per reported value in component 3  5) Max number of sets of cells supported by UE [per PUCCH group]: Candidate value set of {[1, 2, 3, 4]}, FFS whether to separately report for primary and secondary PUCCH cell groups, FFS whether this component is reported per reported value in component 3  [Max total number of cells, across different sets of cells, supported by UE per PUCCH group: Candidate value set of {[2, 3, …, 16]}, FFS whether this component is reported per reported value in component 3]  6) Max number of sets of cells supported by UE for a same scheduling cell: Candidate value set of {[1, 2, 3, 4]}, FFS whether this component is reported per reported value in component 3  [Max total number of cells, across different sets of cells, supported by UE for a same scheduling cell: Candidate value set of {[2, 3, …, 8]}, FFS whether this component is reported per reported value in component 3]  FFS whether to report max number of sets of cells supported by UE across PUCCH groups  7) HARQ feedback based on Type 1 HARQ codebook, FFS Type 2 HARQ codebook  8) Supported co-scheduled cell indication schemes: Candidate value set of {FDRA field based, co-scheduled cell indicator field based, both}  [9) Supported types for ‘Antenna port(s)’ field: Candidate value set of {Type-2, Type 1A and Type-2}]  [Note: When scheduling cell is outside the set of cells, UE is not expected to be configured with another cell to monitor PDCCH candidates for the scheduling cell]  FFS whether this FG is separated for the case when scheduling cell is not included in a set of cells and/or when scheduling cell is not the reference cell for the set, and FFS for the case when same SCS but different carrier types between scheduling cell and set of cells  FFS: Number of unicast DCI(s) to process for a set of cells when monitoring DCI format 0\_3 or 1\_3 is configured  FFS: whether to introduce new FG for Configuration/monitoring of DCI format 0\_3 or 1\_3 for a set of cells and legacy DCI format(s) for cell(s) in the set, or to support it by default |  | Yes |  | UE does not support multi-cell PDSCH scheduling by DCI format 1\_3 on a scheduling cell with same SCS between scheduling cell and cells in the set | [Per BC] | N/A | N/A | N/A |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-1a | Multi-cell PDSCH scheduling by DCI format 1\_3 on a scheduling cell not included in a set of cells with same SCS/carrier type between scheduling cell and cells in the set | 1) UE supports monitoring DCI format 1\_3 for DL scheduling where scheduling cell is not included in a set of cells in same PUCCH group.  2) Scheduling cell is PCell or SCell, and a set of cells includes only SCells.  3) Scheduling cell and co-scheduled cells have same SCS/carrier type (licensed or unlicensed, FR1 or FR2-1 or FR2-2).  4) Max number of co-scheduled cells supported by UE is reported with candidate value set of {[2, 3, 4]}  5) UE can be configured with at least one set of cells. Maximum number of sets for a UE in total and maximum number of sets for a same scheduling cell are reported in FG49-4  6) HARQ feedback based on Type 1 HARQ codebook  7) FDRA field based co-scheduled cell indication | 6-10 (CCS with same SCS) | Yes |  | UE does not support multi-cell PDSCH scheduling by DCI format 1\_3 on a scheduling cell which is not included in a set of cells with same SCS/carrier type scheduling cell and cells in the set | [Per BC] | N/A | N/A | N/A |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-1b | Multi-cell PDSCH scheduling by DCI format 1\_3 on a scheduling cell not included in a set of cells with different SCS/carrier type between scheduling cell and cells in the set | 1) UE supports monitoring DCI format 1\_3 for DL scheduling where scheduling cell is not included in a set of cells in same PUCCH group.  2) Scheduling cell is PCell or SCell, and a set of cells includes only SCells.  3a) Scheduling cell and co-scheduled cells have different SCS. The set of co-scheduled cells share the same SCS and carrier type  Candidate value set for component 3a:   * {Scheduling cell of lower SCS and scheduled cells of higher SCS, Scheduling cell of higher SCS and scheduled cells of lower SCS, both}   3b) Scheduling cell and co-scheduled cells have same or different carrier type (FR1 licensed FDD or FR1 licensed TDD or FR1 unlicensed TDD or FR2-1 or FR2-2).  Candidate value set for component 3b:   * [Bitmap] indication of support/not support for each of applicable combinations of scheduling cell from {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2} and scheduled cells from {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2} from the band combinations   FFS: relation between 3a and 3b  FFS: whether/how to indicate support of scheduling on unlicensed band(s)  4) Max number of co-scheduled cells per set of cells supported by UE is reported with candidate value set of {2, 3, 4}. FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b  5) Max number of sets of cells supported by UE [per PUCCH group]: Candidate value set of {[1, 2, 3, 4]}, FFS whether to separately report for primary and secondary PUCCH cell groups, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b  [Max total number of cells, across different sets of cells, supported by UE per PUCCH group: Candidate value set of {[2, 3, …, 16]}, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b]  6) Max number of sets of cells supported by UE for a same scheduling cell: Candidate value set of {[1, 2, 3, 4]}, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b  [Max total number of cells, across different sets of cells, supported by UE for a same scheduling cell: Candidate value set of {[2, 3, …, 8]}, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b]  7) HARQ feedback based on Type 1 HARQ codebook, FFS Type 2 HARQ codebook  8) Supported co-scheduled cell indication schemes: Candidate value set of {FDRA field based, co-scheduled cell indicator field based, both}  [9) Supported types for ‘Antenna port(s)’ field: Candidate value set of {Type-2, Type 1A and Type-2}]  FFS: Number of unicast DCI(s) to process for a set of cells when monitoring DCI format 0\_3 or 1\_3 is configured  FFS: whether to introduce new FG for Configuration/monitoring of DCI format 0\_3 or 1\_3 for a set of cells and legacy DCI format(s) for cell(s) in the set, or to support it by default |  | Yes |  | UE does not support multi-cell PDSCH scheduling by DCI format 1\_3 on a scheduling cell which is not included in a set of cells with different SCS/carrier type scheduling cell and cells in the set | [Per BC] | N/A | N/A | N/A |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-2 | Multi-cell PUSCH scheduling by DCI format 0\_3 on a scheduling cell with same SCS between scheduling cell and cells in the set | 1) UE supports monitoring DCI format 0\_3 for UL scheduling with same SCS between scheduling cell and cells in the set  [2) Scheduling cell is PCell if set of cells includes PCell, and scheduling cell is PCell or an SCell if set of cells includes only SCells.]  3) Scheduling cell and co-scheduled cells have same SCS/carrier type[: candidate value set {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2}.]  4) Max number of co-scheduled cells per set of cells supported by UE is reported with candidate value set of {2, 3, 4}, FFS whether this component is reported per reported value in component 3  5) Max number of sets of cells supported by UE [per PUCCH group]: Candidate value set of {[1, 2, 3, 4]}, FFS whether to separately report for primary and secondary PUCCH cell groups, FFS whether this component is reported per reported value in component 3  [Max total number of cells, across different sets of cells, supported by UE per PUCCH group: Candidate value set of {[2, 3, …, 16]}, FFS whether this component is reported per reported value in component 3]  6) Max number of sets of cells supported by UE for a same scheduling cell: Candidate value set of {[1, 2, 3, 4]}, FFS whether this component is reported per reported value in component 3  [Max total number of cells, across different sets of cells, supported by UE for a same scheduling cell: Candidate value set of {[2, 3, …, 8]}, FFS whether this component is reported per reported value in component 3]  7) Supported co-scheduled cell indication schemes: Candidate value set of {FDRA field based, co-scheduled cell indicator field based, both}  [8) Supported types for ‘Antenna port(s)’, ‘Precoding information and number of layers’ and ‘SRS resource indicator’ fields: Candidate value set of {Type-2, Type 1A and Type-2}]  [Note: When scheduling cell is outside the set of cells, UE is not expected to be configured with another cell to monitor PDCCH candidates for the scheduling cell]  FFS whether this FG is separated for the case when scheduling cell is not included in a set of cells and/or when scheduling cell is not the reference cell for the set, and FFS for the case when same SCS but different carrier types between scheduling cell and set of cells  FFS: Number of unicast DCI(s) to process for a set of cells when monitoring DCI format 0\_3 or 1\_3 is configured  FFS: whether to introduce new FG for Configuration/monitoring of DCI format 0\_3 or 1\_3 for a set of cells and legacy DCI format(s) for cell(s) in the set, or to support it by default |  | Yes |  | UE does not support multi-cell PUSCH scheduling by DCI format 0\_3 on a scheduling cell with same SCS between scheduling cell and cells in the set | [Per BC] | N/A | N/A | N/A |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-2a | Multi-cell PUSCH scheduling by DCI format 0\_3 on a scheduling cell not included in a set of cells with same SCS/carrier type between scheduling cell and cells in the set | 1) UE supports monitoring DCI format 0\_3 for UL scheduling where scheduling cell is not included in a set of cells in same PUCCH group.  2) Scheduling cell is PCell or SCell, and a set of cells includes only SCells.  3) Scheduling cell and co-scheduled cells have same SCS/carrier type (licensed or unlicensed, FR1 or FR2-1 or FR2-2).  4) Max number of co-scheduled cells supported by UE is reported with candidate value set of {[2, 3, 4]}  5) UE can be configured with at least one set of cells. Maximum number of sets for a UE in total and maximum number of sets for a same scheduling cell are reported in FG49-4  6) FDRA field based co-scheduled cell indication | 6-10 (CCS with same SCS) | Yes |  | UE does not support multi-cell PUSCH scheduling by DCI format 0\_3 on a scheduling cell which is not included in a set of cells with same SCS/carrier type scheduling cell and cells in the set | [Per BC] | N/A | N/A | N/A |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-2b | Multi-cell PUSCH scheduling by DCI format 0\_3 on a scheduling cell not included in a set of cells with different SCS/carrier type between scheduling cell and cells in the set | 1) UE supports monitoring DCI format 0\_3 for UL scheduling where scheduling cell is not included in a set of cells in same PUCCH group.  2) Scheduling cell is PCell or SCell, and a set of cells includes only SCells.  3a) Scheduling cell and co-scheduled cells have different SCS. The set of co-scheduled cells share the same SCS and carrier type  Candidate value set for component 3a:   * {Scheduling cell of lower SCS and scheduled cells of higher SCS, Scheduling cell of higher SCS and scheduled cells of lower SCS, both}   3b) Scheduling cell and co-scheduled cells have same or different carrier type (FR1 licensed FDD or FR1 licensed TDD or FR1 unlicensed TDD or FR2-1 or FR2-2).  Candidate value set for component 3b:   * [Bitmap] indication of support/not support for each of applicable combinations of scheduling cell from {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2} and scheduled cells from {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2} from the band combinations   FFS: relation between 3a and 3b  FFS: whether/how to indicate support of scheduling on unlicensed band(s)  4) Max number of co-scheduled cells per set of cells supported by UE is reported with candidate value set of {2, 3, 4}, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b  5) Max number of sets of cells supported by UE [per PUCCH group]: Candidate value set of {[1, 2, 3, 4]}, FFS whether to separately report for primary and secondary PUCCH cell groups, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b  [Max total number of cells, across different sets of cells, supported by UE per PUCCH group: Candidate value set of {[2, 3, …, 16]}, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b]  6) Max number of sets of cells supported by UE for a same scheduling cell: Candidate value set of {[1, 2, 3, 4]}, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b  [Max total number of cells, across different sets of cells, supported by UE for a same scheduling cell: Candidate value set of {[2, 3, …, 8]}, FFS whether to report separately for the reported combinations between scheduling and scheduled cells in components 3a/3b]  7) Supported co-scheduled cell indication schemes: Candidate value set of {FDRA field based, co-scheduled cell indicator field based, both}  [8) Supported types for ‘Antenna port(s)’, ‘Precoding information and number of layers’ and ‘SRS resource indicator’ fields: Candidate value set of {Type-2, Type 1A and Type-2}]  FFS: Number of unicast DCI(s) to process for a set of cells when monitoring DCI format 0\_3 or 1\_3 is configured  FFS: whether to introduce new FG for Configuration/monitoring of DCI format 0\_3 or 1\_3 for a set of cells and legacy DCI format(s) for cell(s) in the set, or to support it by default |  | Yes |  | UE does not support multi-cell PUSCH scheduling by DCI format 0\_3 on a scheduling cell which is not included in a set of cells with different SCS/carrier type scheduling cell and cells in the set | [Per BC] | N/A | N/A | N/A |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-3 | Monitoring both legacy DCI format(s) (0\_0/1\_0, 0\_1/1\_1 and/or 0\_2/1\_2) and DCI format 0\_3/1\_3 on the same scheduling cell | Monitoring both legacy DCI format(s) (0\_0/1\_0, 0\_1/1\_1 and/or 0\_2/1\_2) and DCI format 0\_3/1\_3 on the same scheduling cell | At least one of {49-1, 49-1a, 49-1b, 49-2, 49-2a, 49-2b} | Yes |  | UE does not support monitoring both legacy DCI format(s) (0\_1/1\_1 and/or 0\_2/1\_2) and DCI format 0\_3/1\_3 on the same scheduling cell | [Per UE] | No | No | No |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-4a | Nominal RBG size of Configuration 3 for FDRA type 0 | 1) Support of nominal RBG size of Configuration 3 for FDRA type 0 | [At least one of {49-1, 49-1b, 49-2, 49-2b}] | Yes |  |  | FFS | FFS | FFS | FFS |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-4b | FDRA Type 1 granularity of 2, 4, 8, or 16 consecutive RBs based RIV for DCI format 1\_3/0\_3 | 1) Support of FDRA Type 1 granularity of 2, 4, 8, or 16 consecutive RBs based RIV for DCI format 1\_3/0\_3 | [At least one of {49-1, 49-1b, 49-2, 49-2b}] | Yes |  |  | FFS | FFS | FFS | FFS |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-5 | Type 2 HARQ CB support for DCI format 1\_3 | HARQ feedback based on Type 2 HARQ codebook for PDSCHs scheduled by DCI format 1\_3 | At least one of {49-1, 49-1a, 49-1b} | Yes |  | UE does not support HARQ feedback based on Type 2 HARQ codebook for PDSCHs scheduled by DCI format 1\_3 | [Per UE] | No | No | No |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-5a | Trigger Type 3 HARQ CB based feedback using DCI format 1\_3 | Trigger Type 3 HARQ CB based feedback using DCI format 1\_3 | 10-16 (Type 3 HARQ CB), At least one of {49-1, 49-1a, 49-1b} | Yes |  | UE does not support HARQ feedback based on Type 3 HARQ codebook triggered by DCI format 1\_3 | [Per band] | N/A | N/A | N/A |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-5b | Trigger enhanced Type 3 HARQ CB based feedback using DCI format 1\_3 | Trigger enhanced Type 3 HARQ CB based feedback using DCI format 1\_3 | 25-6 (Enhanced Type 3 HARQ CB), At least one of {49-1, 49-1a, 49-1b} | Yes |  | UE does not support HARQ feedback based on enhanced Type 3 HARQ codebook triggered by DCI format 1\_3 | [Per band] | N/A | N/A | N/A |  | Optional with capability signaling |

## **RAN1#113**

**Agreement**

* Component 2 in FG 49-1/49-2 is confirmed as: Scheduling cell is PCell if set of cells includes PCell, and scheduling cell is PCell or an SCell if set of cells includes only SCells.

**Agreement**

* Candidate value set for component 3 in FG 49-1/49-2 is confirmed as: {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2}

**Agreement**

* Component 3 is revised as: Scheduling cell and co-scheduled cells have same SCS/carrier type: value set: {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2}, UE reports one or multiple of values from the value set

**Agreement**

* Reporting type of FG 49-1/49-1b/49-2/49-2b is per BC

**Agreement**

* Component 9 in FG 49-1/49-1b is confirmed as: Support~~ed types~~ Type-2 for ‘Antenna port(s)’ field~~: Candidate value set of {Type-2, Type 1A and Type-2}~~
* Component 8 in FG 49-2/49-2b is confirmed as: Support~~ed types~~ Type-2 for ‘Antenna port(s)’, ‘Precoding information and number of layers’ and ‘SRS resource indicator’ fields~~: Candidate value set of {Type-2, Type 1A and Type-2}~~
* Introduce following FG

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 49. NR\_MC\_enh | 49-4c | Configurable Type-1A fields for DCI format 0\_3/1\_3 | 1) Support Type-1A for ‘Antenna port(s)’ field for DCI format 1\_3  2) Support Type-1A for ‘Antenna port(s)’, ‘Precoding information and number of layers’ and ‘SRS resource indicator’ fields for DCI format 0\_3 | At least one of {49-1, 49-1b, 49-2, 49-2b} | Yes |  |  | Per UE | No | No | No |  | Optional with capability signaling |

**Agreement**

* Following component is introduced in FG 49-1
  + The number of unicast DL DCI to process [for a set of cells] configured for multi-cell PDSCH scheduling by a DCI format 1\_3
    - One unicast DCI per slot of scheduling cell [for the set of cells] for FDD/TDD scheduling cell
  + FFS whether to count DCI format 1\_3 only or both legacy DCI formats and DCI format 1\_3
* Introduce advanced UE capability for larger number of unicast DL DCI, details FFS
* Following component is introduced in FG 49-2
  + The number of unicast UL DCI to process [for a set of cells] configured for multi-cell PUSCH scheduling by a DCI format 0\_3
    - One unicast DCI per slot of scheduling cell [for the set of cells] for FDD scheduling cell
    - Two unicast DCI per slot of scheduling cell [for the set of cells] for TDD scheduling cell
  + FFS whether to count DCI format 0\_3 only or both legacy DCI formats and DCI format 0\_3
* Introduce advanced UE capability for larger number of unicast UL DCI, details FFS

**Agreement**

* Candidate value set for component 3b in FG 49-1b/49-2b is updated as: ~~[Bitmap]~~ Indication of support/not support for each of applicable combinations of scheduling cell from {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2} and scheduled cells from {FR1 licensed FDD, FR1 licensed TDD, FR1 unlicensed TDD, FR2-1, FR2-2} from the band combinations
* “FFS: relation between 3a and 3b” is removed from component 3a/3b in FG 49-1b/49-2b
* “FFS: whether/how to indicate support of scheduling on unlicensed band(s)” is removed from component 3a/3b in FG 49-1b/49-2b

**Agreement**

* Introduce following FG

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 49. NR\_MC\_enh | 49-4a | Nominal RBG size of Configuration 3 for FDRA type 0 for DCI format 1\_3 | 1) Support of nominal RBG size of Configuration 3 for FDRA type 0 for DCI format 1\_3 | At least one of {49-1, 49-1b} | Yes |  |  | Per UE | No | No | No |  | Optional with capability signaling |
| 49. NR\_MC\_enh | 49-4b | Nominal RBG size of Configuration 3 for FDRA type 0 for DCI format 0\_3 | 1) Support of nominal RBG size of Configuration 3 for FDRA type 0 for DCI format 0\_3 | At least one of {49-2, 49-2b} | Yes |  |  | Per UE | No | No | No |  | Optional with capability signaling |

**Agreement**

* Introduce following FG

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 49. NR\_MC\_enh | 49-4d | FDRA Type 1 granularity of 2, 4, 8, or 16 consecutive RBs based RIV for DCI format 1\_3/0\_3 | 1) Support of FDRA Type 1 granularity of 2, 4, 8, or 16 consecutive RBs based RIV for DCI format 0\_3  2) Support of FDRA Type 1 granularity of 2, 4, 8, or 16 consecutive RBs based RIV for DCI format 1\_3 | At least one of {49-1, 49-1b, 49-2, 49-2b} | Yes |  |  | Per UE | No | No | No |  | Optional with capability signaling |

**Proposal 3.1 (MCE)**

With respect to higher layer parameters for MCE, the value range of nCI-Value is “INTEGER(0…7)”.

* Note: An n\_CI value configured for a set of cells can be re-used as a carrier indicator field n\_CI for single-cell scheduling of a cell associated with the same scheduling cell

**Proposal 3.2 (MCE)**

With respect to higher layer parameters for MCE:

* Two FFSs for ScheduledCell-ListDCI-1-3 and ScheduledCell-ListDCI-0-3 are removed.
* Add following notes for ScheduledCell-ListDCI-1-3 and ScheduledCell-ListDCI-0-3
  + When a cell is included in either or both of *ScheduledCell-ListDCI-1-3* or *ScheduledCell-ListDCI-0-3* for one set of cells *MC-DCI-SetofCells*, the cell cannot be included in any of *ScheduledCell-ListDCI-1-3* or *ScheduledCell-ListDCI-0-3* for any other set of cells.

**Proposal 3.3a (MCE)**

With respect to higher layer parameters for MCE, the minimum size of ScheduledCellCombo-ListDCI-1-3 and ScheduledCellCombo-ListDCI-0-3 is 1, and the FFS for ScheduledCellCombo-ListDCI-1-3 and ScheduledCellCombo-ListDCI-0-3 is removed.

**Proposal 3.6 (MCE)**

With respect to higher layer parameters for MCE, the minimum size of joint configuration table entries for type-1B fields is 2.

**Proposal 3.7-1 (MCE)**

With respect to higher layer parameters for MCE, the value range of TDRA-FieldIndexDCI-1-3 is “INTEGER(0…maxNrofDL-Allocations – 1)”.

**Proposal 3.7-2 (MCE)**

With respect to higher layer parameters for MCE, the value range of TDRA-FieldIndexDCI-0-3 is “INTEGER(0…maxNrofUL-Allocations-r16 – 1)”.

**Proposal 3.7-4a (MCE)**

With respect to higher layer parameters for MCE, the value range of TCI-DCI-1-3 is “[INTEGER(0…7)]”.

**Proposal 3.8 (MCE)**

With respect to higher layer parameters for MCE, the value range of numberOfBitsForRV-DCI-1-3 and numberOfBitsForRV-DCI-0-3 is “INTEGER(0…2)”.

**Proposal 3.10 (MCE)**

With respect to higher layer parameters for MCE, the typo for BandPriority is corrected as “**p~~e~~riority**”

**Proposal 3.10-1 (MCE)**

With respect to higher layer parameters for MCE, Column E is moved to column M according to the guidance in R1-2305769.

## **RAN#97-e**

**Updated proposal 4.1:**

− **Deprioritize any optimization for unlicensed spectrum operation for designing the multi-cell**

**PUSCH/PDSCH scheduling in Rel-18.**

**Updated proposal 4.2:**

− **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**

**Updated proposal 4.3:**

− **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.**

**Updated proposal 4.5:**

− **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**