# **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%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304238.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%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304221.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%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304278.zip) **Introduction of multi-carrier enhancements Ericsson**

**Decision:** As per email decision posted on April 27th, the draft CR in [R1-2304278](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304278.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%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304265.zip) **Summary of email discussion [112bis-e-R18-38.212-NR\_MC\_enh] Moderator (Huawei)**

[**R1-2304263**](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304263.zip) **Introduction of Rel-18 Multi-carrier enhancements Huawei** (rev of [R1-2303803](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2303803.zip))

**Decision:** As per email decision posted on April 27th, the draft CR in [R1-2304263](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304263.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%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304193.zip) **Summary of email discussions [112bis-e-R18-38.213-NR\_MC\_enh] Moderator (Samsung)**

[**R1-2304196**](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304196.zip) **Introduction of multi-carrier enhancements Samsung** (rev of [R1-2303161](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2303161.zip))

**Decision:** As per email decision posted on April 25th, the draft CR in [R1-2304196](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304196.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%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304204.zip) **Summary of email discussion on Multi-Cell Scheduling in [112bis-e-R18-38.214-MC\_Enh] Moderator (Nokia)**

**[R1-2304201](file:///C%3A%5C%5CMyMeetings%5C%5CTSGR1_112b-e%5C%5CDocs%5C%5CR1-2304201.zip) Introduction of multi-carrier enhancements Nokia** (rev of [R1-2303012](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2303012.zip))

**Decision:** As per email decision, the draft CR in [R1-2304201](file:///C%3A%5CMyMeetings%5CTSGR1_112b-e%5CDocs%5CR1-2304201.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 35) 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 groups7) HARQ feedback based on Type 1 HARQ codebook, FFS Type 2 HARQ codebook8) 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 cellsFFS: Number of unicast DCI(s) to process for a set of cells when monitoring DCI format 0\_3 or 1\_3 is configuredFFS: 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 FG49-46) HARQ feedback based on Type 1 HARQ codebook7) 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 typeCandidate 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 3bFFS: 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/3b5) 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 codebook8) 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 configuredFFS: 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 35) 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 cellsFFS: Number of unicast DCI(s) to process for a set of cells when monitoring DCI format 0\_3 or 1\_3 is configuredFFS: 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 FG49-46) 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 typeCandidate 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 3bFFS: 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/3b5) 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 configuredFFS: 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\_32) 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\_32) 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**