**3GPP TSG RAN WG1 Meeting #118 R1-240XXXX**

**Maastricht, Netherlands, August 19th – 23th, 2024**

**Source: Moderator (Lenovo)**

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

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

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

# Introduction

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

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

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| **1. Specify a solution for multi-cell PUSCH/PDSCH scheduling (one PDSCH/PUSCH per cell) with a single DCI [RAN1]*** **Identify the maximum number of cells that can be scheduled simultaneously**
* **Consider both intra-band and inter-band CA operation**
* **Consider both FR1 and FR2**
* ***The single DCI shall be optimized for 3 or more cells for the multi-cell PUSCH/PDSCH scheduling***
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In this contribution, the related issues and proposals are summarized based on the contributions submitted in RAN1#118 under the agenda item 8.1.

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

# Issue 1: HARQ-ACK skipping

## Companies’ inputs

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| Huawei:*Proposal 2:* * *When a PDCCH MO that provides a DCI format 1\_3 is before an active DL BWP change on a cell of co-scheduled cells by the DCI format 1\_3, and the DCI format 1\_3 does not trigger the active DL BWP change for the cell, and the PUCCH indicated by the DCI format 1\_3 is to be transmitted after the active DL BWP change on the cell,*
* *For Type 1 codebook and for Type 2 codebook for generating the first sub-codebook, follow the legacy behavior (the corresponding HARQ-ACK information for that scheduled cell with active DL BWP change is skipped)*
	+ *No spec impacts*
* *For Type 2 codebook for generating the second sub-codebook, the HARQ-ACK information for the DCI format 1\_3 is skipped.*
* *Adopt draft CR in R1-2406990 for TS 38.213.*

ZTE:***Proposal 2:*** *The HARQ-ACK generation with NACK bits for the second sub-codebook is performed per DCI in case of BWP switching on a cell.*NTT DOCOMO:***Proposal 1:*** * *When a PDCCH MO that provides a DCI format 1\_3 is before an active DL BWP change on a cell of co-scheduled cells by the DCI format 1\_3, and the DCI format 1\_3 does not trigger the active DL BWP change for the cell, and the PUCCH indicated by the DCI format 1\_3 is to be transmitted after the active DL BWP change on the cell,*
* *For Type 1 codebook and for Type 2 codebook for generating the first sub-codebook, follow the legacy behaviour (the corresponding HARQ-ACK information for that scheduled cell with active DL BWP change is skipped)*
	+ *No spec impact*
* *For Type 2 codebook for generating the second sub-codebook,*
	+ *the HARQ-ACK information for that scheduled cell with active DL BWP change is generated with NACK bit*
 |

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

[R1-2405931](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2405931.zip) Draft CR on HARQ-ACK codebook generation when BWP switching Spreadtrum Communications

[R1-2406074](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406074.zip) Draft CR on HARQ-ACK skipping for Rel-18 multi-cell scheduling Lenovo

[R1-2406120](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406120.zip) Draft CR on HARQ-ACK generation in case of DL BWP switching ZTE Corporation, Sanechips

[R1-2406153](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406153.zip) Draft CR on HARQ-ACK codebook for DL BWP switching vivo

[R1-2406342](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406342.zip) Draft CR on HARQ-ACK information skipping due to BWP change for second Type-2 HARQ-ACK codebook CATT

[R1-2406619](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406619.zip) Draft CR on HARQ-ACK skipping for DL/UL BWP switching in multi-cell scheduling Samsung

[R1-2406990](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406990.zip) Correction on type 2 HARQ-ACK codebook skipping in case of BWP switching Huawei, HiSilicon

[R1-2407013](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2407013.zip) Correction on Type-2 HARQ-ACK codebook for multi-cell PDSCH scheduling Qualcomm Incorporated

## Moderator summary and proposals

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

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

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

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

For RAN1#118 meeting, companies’ views are summarized as below:

* When a PDCCH MO that provides a DCI format 1\_3 is before an active DL BWP change on a cell of co-scheduled cells by the DCI format 1\_3, and the active DL BWP change for the cell is not triggered in the PDCCH MO, and the PUCCH indicated by the DCI format 1\_3 starts at or after a slot for the active DL BWP change on the cell,
* For Type 2 codebook for generating the second sub-codebook,
	+ Option 1: the HARQ-ACK information is skipped for all co-scheduled cells by the DCI format 1\_3.
		- Supported by Huawei, ZTE, Qualcomm
	+ Option 2: the HARQ-ACK information for that cell with active DL BWP change is generated with NACK bit.
		- Supported by Spreadtrum, NTT DOCOMO, vivo, CATT, Samsung, Lenovo

Based on above analysis, Proposal 1-1 is provided for discussion. If decision is made, then we will discuss the CR in the week.

#### Proposal 1-1:

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

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | At this late stage, we should directly look at the CR rather than agreeing high level proposal. We even do not fully understand the difference between “HARQ-ACK is skipped” and “HARQ-ACK information for.., is generated with NACK bit”.We do not see any benefit/gain of Option 2 compared to Option 1, and see unnecessary complication with Option 2. Therefore, we support Option 1 approach. |
| Samsung | Support the proposal. It is consistent with with CA operation based on SC-DCI scheduling and preferable to the alternative as actual HARQ-ACK bits are not set to NACK for no reason.  |
| Spreadtrum | Support.  |
| vivo | Support.Option1 leads to uncessary retransmissions. |
| ZTE | Firstly, based on the agreement made in RAN1#117, a UE generates a NACK for Type-2 HARQ-ACK codebook when there is an UL BWP change, which also applies for DL BWP change. As a result, the agreement made in RAN1#116 should be revised to align the UE behaviour for UL/DL BWP change.

|  |
| --- |
| **Agreement*** When a PDCCH MO that provides a DCI format 1\_3 is before active UL BWP change on the PUCCH cell, and the PUCCH indicated by the DCI format 1\_3 is to be transmitted after the active UL BWP change on the PUCCH cell, the corresponding HARQ-ACK information for the DCI format 1\_3 is skipped for type 1 codebook generation, and the corresponding HARQ-ACK information for the DCI format 1\_3 is generated with NACK bits for type 2 codebook generation.
* FFS: When a PDCCH MO that provides a DCI format 1\_3 is before an active DL BWP change on a cell of co-scheduled cells by the DCI format X1\_3, and the DCI format 1\_3 does not trigger the active DL BWP change for the cell, and the PUCCH indicated by the DCI format 1\_3 is to be transmitted after the active DL BWP change on the cell,
	+ For type 2 codebook for generating the second sub-codebook, the corresponding HARQ-ACK information for that cell with BWP switching is generated with NACK bit
	+ For type 1 codebook and for type 2 codebook for generating the first sub-codebook, follow the legacy behaviour (the corresponding HARQ-ACK information for that cell with BWP switching is skipped for type 1 codebook generation, and the corresponding HARQ-ACK information for that cell with BWP switching is generated with NACK bit for type 2 codebook generation)
 |

Meanwhile, Option 1/2 should be updated as “The HARQ-ACK information generation with NACK bits for the second sub-codebook is performed per DCI/cell in case of BWP switching on a cell.”Secondly, our first preference is Option 1, which is a simple solution without ambiguity. For Option 2, although the codebook size can be determined without ambiguity, the HARQ timing for determining the start of K1 may be ambiguous. To solve the ambiguity of K1, we suggest the following updates if we go to option 2. * When BWP switching occurs on a cell,
	+ the HARQ-ACK information for that scheduled cell with active DL BWP change is generated with NACK bit, if the last PDSCH is not scheduled on the cell and the cell is not the PUCCH cell;
	+ The HARQ-ACK information for the DCI format 1\_3 (all cells in the cell set) are generated with NACK bits, otherwise.
 |
| CATT | SupportThere is no reason that a BWP change on a carrier has impact on the scheduling on another carrier.  |
| NTT DOCOMO | We support the proposal.It is important to conclude this issue at this meeting, and hence if the majority is ok with Option 1, we can also live with it.  |
| LGE | Share the same view with QC since it seems unnecessary complication/optimization.Thus, we also support the way of Option 1. |
| Moderator | With above proposal agreed during Monday online session, the discussion on this thread is closed. Please provide your comments on below Proposal 1-2 for capturing above proposal in spec. |
| New H3C | Support |
|  |  |

#### (New)Proposal 1-2:

* TP in below CR is agreed.

9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel

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

If a UE is provided by *MC-DCI-SetofCellsToAddModList* a number of sets of serving cells and is provided USS sets to monitor PDCCH for detection of DCI format 1\_3, the UE separately applies the following procedures for determining a corresponding second Type-2 HARQ-ACK sub-codebook for scheduling cells associated with DCI format 1\_3 that

- schedules PDSCH receptions on more than one serving cells from a set of serving cells, and/or

- does not include a SCell dormancy indication field or the SCell dormancy indication field is reserved, indicates SCell dormancy, and schedules PDSCH reception on one or more serving cells from the set of serving cells

- in the following, and for the purpose of providing HARQ-ACK information corresponding to SCell dormancy indication, the UE assumes that the UE receives a PDSCH on the serving cell associated with fields in DCI format 1\_3 used for SCell dormancy indication, as described in Clause 10.3, and that the PDSCH provides one transport block that the UE correctly decodes

from the procedures for determining a first Type-2 HARQ-ACK sub-codebook that is associated with unicast SPS PDSCH receptions or with any unicast DCI format scheduling a PDSCH reception on a single serving cell, or has associated HARQ-ACK information without scheduling a PDSCH reception as described in this clause. The UE appends the second Type-2 HARQ-ACK sub-codebook to the first Type-2 HARQ-ACK sub-codebook.

Denote by $N\_{C−DAI}^{DL}$ the number of bits for the counter DAI field in DCI format 1\_3 and set $T\_{D}=2^{N\_{C−DAI}^{DL}}$. Denote by $V\_{C−DAI,c,m}^{DL}$ the value of the counter DAI in a DCI format 1\_3 scheduling PDSCH receptions on more than one serving cells among the more than one serving cells, in PDCCH monitoring occasion $m$ according to Table 9.1.3-1. Denote by $V\_{T−DAI,m}^{DL}$ the value of the total DAI in DCI format 1\_3 scheduling PDSCH receptions on more than one cells in PDCCH monitoring occasion $m$ according to Table 9.1.3-1. The UE assumes a same value of total DAI in all DCI formats 1\_3 in PDCCH monitoring occasion $m$ that schedule more than one PDSCH receptions on respective more than one serving cells from a set of serving cells.

The UE determines the $\tilde{o}\_{0}^{ACK}, \tilde{o}\_{1}^{ACK},\cdots ,\tilde{o}\_{O\_{ACK}−1}^{ACK}$, for a total number of $O\_{ACK}$ HARQ-ACK information bits in the second Type-2 HARQ-ACK sub-codebook according to the following pseudo-code.

Set $N\_{cells,set}^{DL,max}$ to the maximum number of serving cells in *ScheduledCell-ListDCI-1-3* of a set of serving cells provided by *MC-DCI-SetofCells*, across the number of sets of serving cells, that can be scheduled PDSCH receptions by DCI format 1\_3

Set $N\_{sets}^{TB,max}$ to the maximum total number of TBs in PDSCH receptions that can be scheduled by a DCI format 1\_3 over more than one serving cells in a set of serving cells across the number of sets of serving cells

Set $N\_{sets}^{DL}$ to the number of sets of serving cells *MC-DCI-SetofCells* in a PUCCH group

Set $N\_{cells}^{DL}$ to the number of serving cells, across $N\_{sets}^{DL}$ sets of serving cells in the PUCCH group

Set $c$ to the index of serving cells, $c=0,…, N\_{cells}^{DL}−1$, a lower index corresponds to a lower RRC index of a corresponding serving cell

- if the UE indicates *type2-HARQ-ACK-Codebook* and receives $N\_{PDSCH, c}^{m}>1$ PDSCHs on a serving cell $c$ that are scheduled by $N\_{PDSCH, c}^{m}$ DCI formats 1\_3 in PDCCH receptions at a same PDCCH monitoring occasion $m$, where

- each of the DCI formats 1\_3 schedules more than one PDSCH receptions on respective more than one serving cells,

- $c$ is the smallest cell index among the respective more than one serving cells, and

- $c$ is same across the $N\_{PDSCH, c}^{m}$ DCI formats 1\_3

the serving cell $c$ is counted $N\_{PDSCH, c}^{m}$ times for PDCCH monitoring occasion $m$ in increasing order of the PDSCH reception starting time among the $N\_{PDSCH, c}^{m}$ PDSCH receptions

Set $mc$ to the index of a serving cell, in a set of indexes of serving cells arranged in ascending order, from the set of $N\_{cells,set}^{DL,max}$ serving cells, $mc=0,…, N\_{cells,set}^{DL,max}−1$

Set $m=0$ – PDCCH monitoring occasion index for detection of a DCI format 1\_3 scheduling PDSCH receptions on more than one serving cells from a set of serving cells: lower index corresponds to earlier PDCCH monitoring occasion

Set $j=0$

Set $V\_{temp}=0$

Set $V\_{temp2}=0$

Set $V\_{s}=∅$

Set $M$ to the number of PDCCH monitoring occasions

while $m<M$

$c=0$

if *harq-ACK-SpatialBundlingPUCCH* is not provided,

while $c<N\_{cells}^{DL}$

if PDCCH monitoring occasion $m$ is before an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn*, and the PUCCH transmission with the HARQ-ACK information starts at or after a slot for the active UL BWP change

$c=c+1$;

else

if there is a PDSCH reception on serving cell $c$ that is scheduled by a DCI format scheduling more than one PDSCHs that provide respective more than one transport blocks with enabled HARQ-ACK information on respective more than one serving cells, where the DCI format is associated with a PDCCH reception in PDCCH monitoring occasion $m$ and *c* is the smallest serving cell index among the more than one serving cells

if $V\_{C−DAI,c,m}^{DL}\leq V\_{temp}$

$j=j+1$;

end if

$V\_{temp}=V\_{C−DAI,c,m}^{DL}$;

if $V\_{T-DAI,m}^{DL}=∅$

$V\_{temp,2}=V\_{C−DAI,c,m}^{DL}$;

else

$V\_{temp,2}=V\_{T−DAI,m}^{DL}$;

end if

$cnt=0$;

$mc=0$;

while $mc<N\_{cells,set}^{DL,max}$

if the UE is scheduled PDSCH reception on serving cell$mc$, if any, from the more than one serving cells

if PDCCH monitoring occasion $$ is before an active DL BWP change on serving cell $$, and the active DL BWP change is not triggered in PDCCH monitoring occasion $$, and the PUCCH is to be transmitted starts at or after a slot for the active DL BWP change,

if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell$$,

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}$ = NACK;

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}$ = NACK;

$$;

else

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}$ = NACK;

$$;

end if

elseif *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell$mc$, if any, from the more than one serving cells

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the first transport block of this cell

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+1+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the second transport block of this cell

$cnt=cnt+2$;

else

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the transport block of this cell

$cnt=cnt+1$;

end if

end ifend if

$mc=mc+1$;

end while

while $cnt< N\_{sets}^{TB,max}$

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅V\_{C−DAI,c,m}^{DL}−1+cnt}^{ACK}$= NACK;

$cnt=cnt+1$;

end while

$V\_{s}=V\_{s}∪\left\{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), …, N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{sets}^{TB,max}−1\right\}$;

end if

$c=c+1$;

end if

end while

else

while $c<N\_{cells}^{DL}$

if PDCCH monitoring occasion $m$ is before an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn*, and the PUCCH transmission with the HARQ-ACK information starts at or after a slot for the active UL BWP change

$c=c+1$;

else

if there is a PDSCH reception on serving cell $c$ that is scheduled by a DCI format scheduling more than one PDSCHs that provide respective more than one transport blocks with enabled HARQ-ACK information on respective more than one serving cells, where the DCI format is associated with a PDCCH reception in PDCCH monitoring occasion $m$ and *c* is the smallest serving cell index among the more than one serving cells

if $V\_{C−DAI,c,m}^{DL}\leq V\_{temp}$

$j=j+1$;

end if

$V\_{temp}=V\_{C−DAI,c,m}^{DL}$;

if $V\_{T-DAI,m}^{DL}=∅$

$V\_{temp,2}=V\_{C−DAI,c,m}^{DL}$;

else

$V\_{temp,2}=V\_{T−DAI,m}^{DL}$;

end if

$cnt=0$;

$mc=0$;

while $mc<N\_{cells,set}^{DL,max}$

if the UE is scheduled PDSCH reception for transport blocks with enabled HARQ-ACK information on serving cell $mc$, if any, from the more than one serving cells

if PDCCH monitoring occasion $$ is before an active DL BWP change on serving cell $$, and the active DL BWP change is not triggered in PDCCH monitoring occasion $$, and the PUCCH is to be transmitted starts at or after a slot for the active DL BWP change,

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\_{}^{}}^{}$ = NACK;

else

if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell $mc$

if the PDSCH reception provides two transport blocks

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1+cnt}^{ACK}$ = binary AND operation of the HARQ-ACK information bits corresponding to the first and second transport blocks of this cell

else

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the first transport block of this cell

end if

else

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1+cnt}^{ACK}$= HARQ-ACK information bit of this cell

end if

$cnt=cnt+1$;

end if

end if

$mc=mc+1$;

end while

while $cnt< N\_{cells,set}^{DL,max}$

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1+cnt}^{ACK}$= NACK;

$cnt=cnt+1$;

end while

$V\_{s}=V\_{s}∪\left\{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+1…, N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{cells,set}^{DL,max}−1\right\}$;

end if

$c=c+1$;

end if

end while

end if

$m=m+1$;

end while

$V\_{temp}=\left(j mod\left(\frac{4}{T\_{D}}\right)\right)×\left(\frac{4}{T\_{D}}\right)+V\_{temp}$;

if UE does not set $V\_{temp2}=V\_{T−DAI}^{UL}$ and $T\_{D}=2$

$V\_{temp2}=V\_{temp}$;

end if

$j=\left⌊\frac{j×T\_{D}}{4}\right⌋$;

if $V\_{temp2}<V\_{temp}$

$j=j+1$;

end if

if *harq-ACK-SpatialBundlingPUCCH* is not provided,

$O^{ACK}=N\_{sets}^{TB,max}⋅\left(4⋅j+V\_{temp2}\right)$

else

$O^{ACK}=N\_{cells,set}^{DL,max}⋅\left(4⋅j+V\_{temp2}\right)$

end if

$\tilde{o}\_{i}^{ACK}=NACK$ for any $i\in \left\{0,1,\cdots ,O^{ACK}−1\right\}\V\_{s}$ .

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

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| New H3C | Support |
| NTT DOCOMO | Support |
| Huawei, HiSilicom | “the PUCCH is to be transmitted starts” does not read. Suggest to use ‘starting’ instead of ‘starts’. |
| Samsung | The TP for the DL BWP change is unnecessarily complicated, and is different from that for UL BWP change and also from the legacy text for HARQ-ACK skipping that use the general formulation of {cell index = cell index + 1}. The green-highlighted lines already capture the NACK generation, so no need to duplicate the text.Also, agree with the observation from HW, and can say “the PUCCH transmission with the HARQ-ACK information”. Therefore, we suggest a simple update as follows (same can be applied with and without spatial bundling):while $mc<N\_{cells,set}^{DL,max}$if PDCCH monitoring occasion $$ is before an active DL BWP change on serving cell $$, and the active DL BWP change is not triggered in PDCCH monitoring occasion $$, and the PUCCH ~~is to be~~ transmission~~tted~~ with the HARQ-ACK information starts at or after a slot for the active DL BWP change,$mc= mc+1$ elseif the UE is scheduled PDSCH reception on serving cell$mc$, if any, from the more than one serving cellsif *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell$mc$, if any, from the more than one serving cells$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the first transport block of this cell$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+1+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the second transport block of this cell$cnt=cnt+2$;else$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the transport block of this cell$cnt=cnt+1$;end ifend if$mc=mc+1$;end ifend whilewhile $cnt< N\_{sets}^{TB,max}$ $\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅V\_{C−DAI,c,m}^{DL}−1+cnt}^{ACK}$= NACK;$cnt=cnt+1$;end while$$V\_{s}=V\_{s}∪\left\{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+1…, N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{cells,set}^{DL,max}−1\right\}$$ |
| Moderator | @All:According to below agreement, it clearly states that, the HARQ-ACK information for that scheduled cell with active DL BWP change is generated with NACK bit, instead of skipping HARQ-ACK feedback generation for the cell.Hence, I provided the above CR to exactly capture the agreement into spec.Agreement* When a PDCCH MO that provides a DCI format 1\_3 is before an active DL BWP change on a cell of co-scheduled cells by the DCI format 1\_3, and the active DL BWP change for the cell is not triggered in the PDCCH MO, and the PUCCH indicated by the DCI format 1\_3 starts at or after a slot for the active DL BWP change on the cell,
* For Type 1 codebook and for Type 2 codebook for generating the first sub-codebook, follow the legacy behaviour (the corresponding HARQ-ACK information for that scheduled cell with active DL BWP change is skipped)
	+ No spec impact
* For Type 2 codebook for generating the second sub-codebook,
	+ the HARQ-ACK information for that scheduled cell with active DL BWP change is generated with NACK bit.
 |
| Samsung2 | Regarding the FL comment, need to clarify that there is no such thing as "*skipping HARQ-ACK feedback generation for the cell*", even in legacy operation – HARQ-ACK bit is always generated for any scheduling DCI to avoid confusion on the CB size. In case of BWP change, the UE "skips" the PDSCH decoding result, and directly generates a NACK, same as for missed DCIs formats: $\tilde{o}\_{i}^{ACK}=NACK$ for any $i\in \left\{0,1,\cdots ,O^{ACK}−1\right\}\V\_{s}$.The is the same as in the new RAN1 agreement for MC-DCI. The simple TP we suggested above uses the clean legacy formulation {cell index = cell index + 1}, and for NACK generation, the SC-DCI pseudo code and the additional lines (green highlight in our comment above) in the MC-DCI pseudo-code remain applicable – no need for all the new text. |
| New H3C | Support FL ‘s revised proposal 1-2 |
|  |  |
|  |  |
|  |  |

# Issue 2: TCI update

## Companies’ inputs

[R1-2406118](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406118.zip) Draft CR on application of indicated unified TCI state by DCI format 1\_3 ZTE Corporation, Sanechips

|  |  |  |
| --- | --- | --- |
| ***Reason for change:*** | In RAN1#117, unified TCI state indication for multi-cell scheduling was agreed in R1-2405734. Meanwhile, the application of the indicated unified TCI states depends on the reception of positive HARQ-ACK corresponding to the PDSCH scheduled by the DCI carrying the TCI state indication based on current spec.

|  |
| --- |
| <TS 38.214 section 5.1.5>When a UE configured with *dl-OrJointTCI-StateList* would transmit a PUCCH with positive HARQ-ACK or a PUSCH with positive HARQ-ACK corresponding to the DCI carrying the TCI State indication and without DL assignment, or corresponding to the PDSCH scheduled by the DCI carrying the TCI State indication, and if the indicated TCI State(s) is/are different from the previously indicated one(s), the indicatedTCI-State(s) and/or *TCI-UL-State*(s)should be applied starting from the first slot that is at least *beamAppTime* symbols after the last symbol of the PUCCH or the PUSCH, and if the UE receives more than one indicated TCI state for a CC/BWP to be applied starting from the first slot that is at least *beamAppTime* symbols after the last symbol of the PUCCH or the PUSCH, the indicated TCI state carried in the latest DCI in time corresponding to positive HARQ-ACK value is applied. |

However, when multiple PDSCHs are scheduled by a DCI format 1\_3, how/whether to apply the unified TCI state is not clear when the HARQ-ACK feedback includes both ACK and NACK. As illustrated in Figure 1, the cells {0,1,2,3} comprised in a cell set for multi-cell scheduling are also in the same CC list 1 for unified TCI update. Cell 0, 1 and 2 are scheduled by a DCI format 1\_3 with {ACK, NACK, NACK} feedback. It is not clear how/whether to apply the indicated unified TCI state for the CC list 1 based on current spec. More specifically, the updated TCI state should be applied for the cells in the CC list from the cell 0 perspective since 'ACK' has been received while the updated TCI state should not be applied unitl the ‘ACK’ is feedback from cell 1 and cell 2 perspective. Figure 1 Multi-cell schedulingTo solve this issue, it is better to apply the unified TCI state in the case of at least one ACK feedback of the scheduled multiple PDSCHs.  |
|  |  |
| ***Summary of change:*** | The application of indicated unified TCI state by DCI format 1\_3 is determined by at least one positive HARQ-ACK feedback for the multiple PDSCHs scheduled by DCI format 1\_3.  |
|  |  |
| ***Consequences if not approved:*** | The application of the indicated unified TCI state is not clear when multiple PDSCHs are scheduled by a DCI format 1\_3 carrying the TCI state indication. |

5.1.5 Antenna ports quasi co-location

<text omitted>

**<Unchanged parts are omitted>**

When a UE configured with *dl-OrJointTCI-StateList* would transmit a PUCCH with positive HARQ-ACK or a PUSCH with positive HARQ-ACK corresponding to the DCI format 1\_1/1\_2 carrying the TCI State indication and without DL assignment, or corresponding to the PDSCH scheduled by the DCI format 1\_1/1\_2 carrying the TCI State indication, or corresponding to at least one of the PDSCH(s) scheduled by the DCI format 1\_3 carrying the TCI State indication, and if the indicated TCI State(s) is/are different from the previously indicated one(s), the indicated *TCI-State(s)* and/or *TCI-UL-State(s)* should be applied starting from the first slot that is at least $ beamAppTime$ symbols after the last symbol of the PUCCH or the PUSCH, and if the UE receives more than one indicated TCI state for a CC/BWP to be applied starting from the first slot that is at least $ beamAppTime$ symbols after the last symbol of the PUCCH or the PUSCH, the indicated TCI state carried in the latest DCI, for the corresponding *coresetPoolIndex* value when applicable, in time corresponding to positive HARQ-ACK value is applied. The first slot and the $ beamAppTime$ symbols are both determined on the active BWP with the smallest SCS among the BWP(s) from the CCs applying the indicated *TCI-State(s)* or *TCI-UL-State(s)* that are active at the end of the PUCCH or the PUSCH carrying the positive HARQ-ACK.

**<Unchanged parts are omitted>**

## Moderator summary and proposals

Unified TCI framework is introduced in Rel-17. According to current spec, the application of the indicated unified TCI states depends on the reception of positive HARQ-ACK corresponding to the PDSCH scheduled by the DCI carrying the TCI state indication or corresponding to the DCI carrying TCI state indication and without DL assignment.

For Rel-18 multi-cell scheduling, when multiple PDSCHs are scheduled by a DCI format 1\_3, how/whether to apply the unified TCI state is not clear in case the HARQ-ACK feedback includes both ACK and NACK. To solve this issue, the indicated TCI state is applied in case at least one ACK is generated corresponding to the scheduled multiple PDSCHs.

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

**Question 1:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We think the spec is already clear, but we are fine with the CR. |
| Samsung | The specification is clear as is. No need for the CR. |
| Spreadtrum | CR is not needed.For the example given by the CR, TCI of Cell 1/2/3 are all update, due to they are in a TCI list and there is a positive HARQ-ACK, which is covered by the following spec. So even though there is one PDSCH with positive HARQ-ACK, TCI states of Cell1/2/3 will be updated.

|  |
| --- |
| When *tci-PresentInDCI* is set as 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET, a UE configured with *dl-OrJointTCI-StateList* with activated *TCI-State* or *ul-TCI-StateList* with activated *TCI-UL-State* receives DCI format 1\_1/1\_2/1\_3 providing indicated *TCI-State(s)* and/or *TCI-UL-State(s)* for a CC or all CCs in the same CC list configured by *simultaneousU-TCI-UpdateList1-r17, simultaneousU-TCI-UpdateList2-r17, simultaneousU-TCI-UpdateList3-r17, simultaneousU-TCI-UpdateList4-r17*. |

 |
| vivo | Same view as Spreadturm |
| Nokia | Agree with other companies that the specs seems to be clear already. Still on other proposed TCI changes – i.e. the ZTE contribution in **[R1-2406117](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_118/Docs/R1-2406117.zip)** – what to do with that one?  |
| ZTE | Support this CR.@Spreadtrum, the spec you copy is only related to how to apply updated TCI. I agree with you that the TCI state for cell 1/2/3 are also updated. But the issue is when. When does the UE apply the updated TCI. They are totally two different issues.In the current spec, the UE will apply the updated TCI state after the UE transmits the ACK feedback and there is a defined timeline. Based on this, from the cell 0 persepctive, the UE should update the TCI state for the cells in the cell list after the PUCCH is transmitted due to the ACK feedback. However, from the other cell perspective, the UE should not update the TCI state for the cells in the cell list after the PUCCH is transmitted due to the ‘NACK’ feedback. Therefore, the conflict UE behavior is obtained in this case. The UE behavior is not clear after PUCCH is transmission. Our CR is to resolve this issue so that the UE can apply the updated TCI state after the PUCCH transmisison since ‘ACK’ means that the UE has received the DCI and the updated TCI state.

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

@Nokia, **[R1-2406117](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_118/Docs/R1-2406117.zip)** is to disucss another issue. TCI state(s) (with ‘s’) is only applied to M-TRP, which is not allowed in MC scheduling.  |
|  |
| CATT | Agree with Spreadtrum. |
| NTT DOCOMO | We are OK with the CR. |
| LGE | Same view as Spreadtrum. |
| ZTE | After discussion with companies offline, the draft CR is updated as below for simplicity.

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

 |
| New H3C | Share similar view with Spreadtrum |
| Moderator | With agreement reached on Wednesday online session, this thread is closed. |

# Issue 3: SRS resource

## Companies’ inputs

[R1-2405930](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2405930.zip) Draft CR on miscellaneous corrections of DCI format 0\_3 in 38.214 Spreadtrum Communications

|  |  |  |
| --- | --- | --- |
| ***Reason for change:*** | 1. Unclear mapping of PUSCH scheduled by DCI format 0\_3 and antenna ports as the SRS port(s) indicated by SRI for non-codebook based UL transmission.2. m-TRP and multi-cell scheduled cannot be configured simultaneously, so there is up to one SRS resource set.3. It was agreed DMRS bundling is supported for PUSCH scheduled by DCI format 0\_3 and the TP of adding DCI format 0\_3 for DMRS bundling was agreed according to the following agreement in RAN1#116. However, one place is missing for DCI format 0\_3.

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

 |
|  |  |
| ***Summary of change:*** | 1. PUSCH scheduled by DCI format 0\_3 use the same antenna ports as the SRS ports(s) indicated by SRI in the DCI for non-codebook based UL transmission.2. Remove the case of two SRS resource sets are configured when a PUSCH is scheduled by DCI format 0\_3.3. Adding back PUSCH repetition type A scheduled by DCI format 0\_3 to DMRS bundling |
|  |  |
| ***Consequences if not approved:*** | 1. It is unclear how to mapping PUSCH and SRS port(s)2. It is against the previous conclusion of m-TRP and multi-cell scheduled cannot be configured simultaneously.2. Previous agreement was not correctly captured. |

6.1.1.2 Non-Codebook based UL transmission

<text omitted>

The UE shall perform one-to-one mapping from the indicated SRI(s) to the indicated DM-RS ports(s) and their corresponding PUSCH layers {0 … ν-1} given by DCI format 0\_1, 0\_2 or 0\_3 or by *configuredGrantConfig* according to clause 6.1.2.3 in increasing order.

The UE shall transmit PUSCH using the same antenna ports as the SRS port(s) in the SRS resource(s) indicated by SRI(s) given by DCI format 0\_1, 0\_2 or 0\_3 or by *configuredGrantConfig* according to clause 6.1.2.3, where the SRS port in (*i*+1)-th SRS resource in the SRS resource set is indexed as .

The DM-RS antenna ports  in Clause 6.4.1.1.3 of [4, TS 38.211] are determined according to the ordering of DM-RS port(s) given by Tables 7.3.1.1.2-6 to 7.3.1.1.2-23 in Clause 7.3.1.1.2 of [5, TS 38.212].

For non-codebook based transmission, the UE does not expect to be configured with both *spatialRelationInfo* for SRS resource and *associatedCSI-RS* in *SRS-ResourceSet* for SRS resource set.

For non-codebook based transmission, the UE can be scheduled with DCI format 0\_1, 0\_2 or 0\_3 when at least one SRS resource is configured in *SRS-ResourceSet* with *usage* set to 'nonCodebook'.

<text omitted>

6.1.2.1 Resource allocation in time domain

<text omitted>

When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' or 'noncodebook', for PUSCH repetition Type A, in case *K>1,* the same symbol allocation is applied across the *K* consecutive slots and the PUSCH is limited to a single transmission layer. The UE shall repeat the TB across the *K* consecutive slots applying the same symbol allocation in each slot, and the association of the first and second SRS resource set in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* toeach slot is determined as follows:

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "00" for the *SRS resource set indicator*, the first SRS resource set is associated with all K consecutive slots,

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "01" for the *SRS resource set indicator*, the second SRS resource set is associated with all K consecutive slots,

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "10" for the *SRS resource set indicator*, the first and second SRS resource set association to K consecutive slots is determined as follows:

- When K = 2, the first and second SRS resource sets are applied to the first and second slot of 2 consecutive slots, respectively.

- When K > 2 and *cyclicMapping* in *PUSCH-Config* is enabled, the first and second SRS resource sets are applied to the first and second slot of K consecutive slots, respectively, and the same SRS resource set mapping pattern continues to the remaining slots of K consecutive slots.

- When K > 2 and *sequentialMapping* in *PUSCH-Config* is enabled, first SRS resource set is applied to the first and second slots of K consecutive slots, and the second SRS resource set is applied to the third and fourth slot of K consecutive slots, and the same SRS resource set mapping pattern continues to the remaining slots of K consecutive slots.

- Otherwise, a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "11" for the *SRS resource set indicator*, and the first and second SRS resource set association to K consecutive slots is determined as follows,

- When K = 2, the second and first SRS resource set are applied to the first and second slot of 2 consecutive slots, respectively.

- When K > 2 and *cyclicMapping* in *PUSCH-Config* is enabled, the second and first SRS resource sets are applied to the first and second slot of K consecutive slots, respectively, and the same SRS resource set mapping pattern continues to the remaining slots of the K consecutive slots.

- When K > 2 and *sequentialMapping* in *PUSCH-Config* is enabled, the second SRS resource set is applied to the first and second slot of K consecutive slots, and the first SRS resource set is applied to the third and fourth slot of K consecutive slots, and the same SRS resource set mapping pattern continues to the remaining slots of the K consecutive slots.

<text omitted>

6.1.7 UE procedure for determining time domain windows for bundling DM-RS

<text omitted>

For PUSCH transmissions of PUSCH repetition Type A scheduled by DCI format 0\_1, 0\_2 or 0\_3, PUSCH repetition Type A with a configured grant, PUSCH repetition Type B and TB processing over multiple slots, when *pusch-DMRS-Bundling* is enabled, and for PUCCH transmissions of PUCCH repetition, when *PUCCH-DMRS-Bundling* is enabled, the UE determines one or multiple nominal TDWs, as follows:

- For PUSCH transmissions of repetition Type A, PUSCH repetition Type B and TB processing over multiple slots, the duration of each nominal TDW except the last nominal TDW, in number of consecutive slots, is:

- Given by *pusch-TimeDomainWindowLength*, if configured.

- Computed as min (*maxDurationDMRS-Bundling*, M), if *pusch-TimeDomainWindowLength* is not configured, where *maxDurationDMRS-Bundling* is maximum duration for a nominal TDW subject to UE capability [13, TS 38.306], M is the time duration in consecutive slots of $N∙K$ PUSCH transmissions, and where:

* For PUSCH transmissions of PUSCH repetition Type A, N=1 and K is the number of repetitions, as defined in Clause 6.1.2.1 or in Clause 6.1.2.3.
* For PUSCH transmissions of PUSCH repetition Type B, N=1 and K is the number of nominal repetitions, as defined in Clause 6.1.2.1 or in Clause 6.1.2.3.
* For PUSCH transmissions of TB processing over multiple slots, N is the number of slots used for TBS determination and K is the number of repetitions of the number of slots N used for TBS determination, as defined in Clause 6.1.2.1 or in Clause 6.1.2.3.

- For PUCCH transmissions of PUCCH repetition, the duration of each nominal TDW except the last nominal TDW, in number of consecutive slots, is:

<text omitted>

## Moderator summary and proposals

**Question 2:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the CR |
| Samsung | OK with the CR. |
| Spreadtrum | support |
| vivo | ok |
| Nokia | Ok / support |
| ZTE | Support. |
| CATT | OK |
| NTT DOCOMO | We are OK with the CR. |
| LGE | OK. |
| Moderator | With agreement reached during Monday online meeting, the discussion on this thread is closed. |
| New H3C | OK |

# Issue 4: determination of *UCI-onPUSCH*

## Companies’ inputs

[R1-2406796](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406796.zip) Draft CR on correction of UCI-onPUSCH for PUSCH scheduled by DCI format 0\_3 Nokia

|  |  |
| --- | --- |
| ***Reason for change:*** | The RRC parameter *UCI-OnPUSCH-DCI-0-3* is not existing and UCI on PUSCH scheduled by DCI format 0\_3 is determined by *UCI-onPUSCH* |
|  |  |
| ***Summary of change:*** | Correct and clarify, that *UCI-onPUSCH* determines the UCI multiplexing for PUSCH scheduled by DCI format 0\_3. |
|  |  |
| ***Consequences if not approved:*** | The specification is unclear. |

9.3 UCI reporting in physical uplink shared channel

< Unchanged parts are omitted >

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

< Unchanged parts are omitted >

## Moderator summary and proposals

As shown in TS38.331-i20, there is no RRC parameter *UCI-OnPUSCH-DCI-0-3* defined for DCI format 0\_3. From moderator’s point of view, the above CR is needed to make spec clear.

Hence, one question is provided to collect companies’ views first.

**Question 3:**

* Do you support above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the CR |
| Samsung | OK with the CR. |
| Spreadtrum | support |
| vivo | support |
| Nokia | OK / support |
| ZTE | Support. |
| CATT | OK |
| NTT DOCOMO | We are OK with the CR. |
| LGE | OK. |
| Moderator | With agreement reached during Monday online meeting, the discussion on this thread is closed. |
| New H3C | OK |
|  |  |

# Issue 5: PDCCH overbooking

## Companies’ inputs

[R1-2406991](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406991.zip) Correction on PDCCH overbooking in TS 38.213 Huawei, HiSilicon

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

10.1 UE procedure for determining physical downlink control channel assignment

< Unchanged parts are omitted >

For all search space sets that a UE monitors PDCCH on the primary cell within a slot $n$, or within a group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or within a span in slot $n$, denote by $S\_{css}$ a set of CSS sets, except for CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI, with cardinality of $I\_{css}$ and

* by $S\_{uss}$ a set of USS sets if neither DCI format 0\_3 nor 1\_3 is configured, and CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI with cardinality of $J\_{uss}$ for scheduling on the primary cell, or
* by $\_{}$ a set of USS sets if one or both of DCI format 0\_3 and 1\_3 is configured when primary cell is the serving cell for counting the PDCCH candidates and corresponding number of non-overlapping CCEs, and CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI with cardinality of $\_{}$.

The location of search space sets $s\_{j}$, $0\leq j<J\_{uss}$, in $S\_{uss}$ is according to an ascending order of the search space set index.

< Unchanged parts are omitted >

## Moderator summary and proposals

**Question 4:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | Agree with the proposal and the CR is necessary. |
| Samsung | A CR can be discussed. The fix can be much simpler than what is proposed in x6991. It can simply be clarified that the current text in 38.213 is for USS sets where the PDCCH candidates/non-overlapping CCEs are on the PCell. For example, adding the following would be enough.“by $S\_{uss}$ a set of USS sets with PDCCH candidates and non-overlapping CCEs counted on the primary cell and CSS sets …” |
| Spreadtrum | Fine with the intention. We are OK with the CR or Samsung’s changes.  |
| vivo | It is agreed that MBS and mc-scheduling cannot be configured for the same PUCCH group. Therefore, there is no case where Pcell is configured as the reference cell for mc-scheduling and configured with SS for MBS, the second half of the 2nd change is not correct**Agreement**Simultaneous configuration of both multicast reception and multi-cell scheduling in the same PUCCH group is not supported in Rel-18.In addition, we have submitted a draft CR in R1-2406154 to capture the above agreement. If this agreement is not included in the spec, it would compel the UE to support HARQ-ACK concatenation between MC-scheduling and MBS. However, this draft CR is not currently included in the FLS. We would like to ask FL if this draft CR can be treated in this meeting. |
| Nokia | Agree with the intention – but:* as vivo noted if we would ‘double’ the description we would not need to include MTCH there for MC-DCI
* the new paragraph would be conditional ‘when’ the PCell is the cell for counting. But this may only be true for the MC-DCI but not the legacy DCIs for the PCell. So when adopting the proposed structure here, if an SCell is the cell for the counting for MC-DCI, the USS sets for PCell SC-DCI scheduling would not be captured anymore to our reading.

The proposed change by Samsung (i) simplifies this a bit and (ii) would not have the issue mentioned in the second bullet above, as the wording would still capture the SC-DCI scheduling (& counting) on PCell and MC-DCI scheduling counted on Scell correctly (in terms of overbooking). So we prefer the simpler (and more correct) Samsung version.  |
| ZTE | Seems reasonable but we prefer the following updates with minimum spec impact. For the issue rasied by vivo, we think ‘if any’ can be added.

|  |
| --- |
| 10.1 UE procedure for determining physical downlink control channel assignment< Unchanged parts are omitted >For all search space sets that a UE monitors PDCCH counted on the primary cell within a slot $n$, or within a group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or within a span in slot $n$, denote by $S\_{css}$ a set of CSS sets, except for, if any, CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI, with cardinality of $I\_{css}$ and by $S\_{uss}$ a set of USS sets and CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI with cardinality of $J\_{uss}$ for scheduling on the primary cell. The location of search space sets $s\_{j}$, $0\leq j<J\_{uss}$, in $S\_{uss}$ is according to an ascending order of the search space set index.< Unchanged parts are omitted > |

 |
| CATT | Some clarifications are needed. In our understanding, for the case that ‘If the primary cell is included in a set of cells, but the reference cell is a cell in the set of cells other than primary cell’, it’s similar to the case of cross-carrier scheduling where the scheduling cell is PCell and the scheduled cell is a SCell. If the current spec can be applied to cross carrier scheduling, why we need to change for the case of DCI format 0-3/1-3? The motivation of this CR is not clear for us. Also, there are following cases for the search spaces monitor on the Pcell:* Case 1: Only legacy DCI format is configured for the PCell
* Case 2: DCI format 0-3/1-3 is monitor on the Pcell and Pcell is the reference cell of DCI format 0-3/1-3
* Case 3: DCI format 0-3/1-3 is monitor on the Pcell and Pcell is the reference cell of DCI format 0-3/1-3, and legacy DCI format is configured for the PCell.
* Case 4: DCI format 0-3/1-3 is monitor on the Pcell and Pcell isn’t the reference cell of DCI format 0-3/1-3, and legacy DCI format is configured for the PCell.

The proposed CR only reflects case 1 and case 2, both case 3 and case 4 are missed. |
| NTT DOCOMO | We are OK with the CR. |
| LGE | Similar view as other companies.Simplified/minimum change is preferred as suggested by Samsung/ZTE. |
| Moderator | According to above comments, please kindly check below update based on Samsung’s suggestion.TS38.21310.1 UE procedure for determining physical downlink control channel assignment < Unchanged parts are omitted >For all search space sets that a UE monitors PDCCH on the primary cell within a slot $n$, or within a group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or within a span in slot $n$, denote by $S\_{css}$ a set of CSS sets, except for CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI, with cardinality of $I\_{css}$ and by $S\_{uss}$ a set of USS sets with PDCCH candidates and non-overlapping CCEs counted on the primary cell and CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI with cardinality of $J\_{uss}$ for scheduling on the primary cell. The location of search space sets $s\_{j}$, $0\leq j<J\_{uss}$, in $S\_{uss}$ is according to an ascending order of the search space set index.< Unchanged parts are omitted > |
| New H3C | OK |
| NTT DOCOMO | Support |
| Huawei, HiSilicon | Based on our reading, the change suggested by Samsung is a nice simplification, however, still has a resticiton by keeping “or scheduling on the primary cell”, which is not necessary for MC scheduling since the PCell could be counted by not being scheduled.We agree with @vivo on that MBS does not need to be included, thus the texts of second change in our TP can be simplied as well.Another simplification could be as below since for legacy, the yellow part and blue part is the same so legacy operation is kept while for MC-DCI, the addition by blue address the issue.TS38.21310.1 UE procedure for determining physical downlink control channel assignment < Unchanged parts are omitted >For all search space sets that a UE monitors PDCCH on the primary cell within a slot $n$, or within a group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or within a span in slot $n$, denote by $S\_{css}$ a set of CSS sets, except for CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI, with cardinality of $I\_{css}$ and by $S\_{uss}$ a set of USS sets and CSS sets provided by *searchSpaceMCCH*, *searchSpaceMTCH* or by *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI or G-CS-RNTI with cardinality of $J\_{uss}$ ~~for scheduling on the primary cell~~ with PDCCH candidates and non-overlapping CCEs counted on the primary cell. The location of search space sets $s\_{j}$, $0\leq j<J\_{uss}$, in $S\_{uss}$ is according to an ascending order of the search space set index.< Unchanged parts are omitted > |
| Moderator | With agreement reached on Wednesday online session, this thread is closed. |

# Issue 6: PDCCH search space

## Companies’ inputs

[R1-2406119](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406119.zip) Draft CR on search space of DCI format 0\_3 and DCI format 1\_3 ZTE Corporation, Sanechips

|  |  |  |
| --- | --- | --- |
| ***Reason for change:*** | The DCI size and BD/CCE of DCI format 0\_3/1\_3 is counted on the reference cell and there are two cases to determine the reference cell according to the agreement in RAN1#111.

|  |
| --- |
| 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
	+ [Case 1]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;
	+ [Case2 ]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.
 |

For Case 2, the reference cell is one cell of the set of cells. The search space of DCI format 0\_3/1\_3 is configured on the reference cell. It is associated with the search space of the scheduling cell with the same search space ID. However, how to derive the $M\_{s,n\_{CI}}^{\left(L\right)}$ of DCI format 0\_3/1\_3 based on the *nCI-Value* for the set of cells should be clarified, because the USS with same search space ID are configured on both the scheduling cell and scheduled cell. Note, in this case, the BD/CCE of the candidates in the USS with DCI format 0\_3/1\_3 configured on scheduling cell should not be counted on the scheduling cell, because the scheduling cell is out of the set of cells. |
|  |  |
| ***Summary of change:*** | In case the reference cell is one cell of the set of cells which search space of DCI format 0\_3/1\_3 is configured on both the reference cell and the scheduling cell with the same search space ID, use the nCI-Value for the set of cells to derive the CCE resources of the candidates of the same aggregation level in the USS with same ID configured in the reference cell, and the UE is not required to monitor the candidates of the USS with same ID configured in the scheduling cell. |
|  |  |
| ***Consequences if not approved:*** | $M\_{s,n\_{CI}}^{\left(L\right)}$ is not clear if the number of PDCCH candidates in both the USS with same ID of DCI format 0\_3/1\_3 are configured on the scheduling cell which is out of the set of cells, and the reference cell in the set of cells. |

10.1 UE procedure for determining physical downlink control channel assignment

**<Unchanged parts are omitted>**

For a search space set $s$ associated with CORESET $p$, the CCE indexes for aggregation level $L$ corresponding to PDCCH candidate $m\_{s,n\_{CI}}^{(L)} $ of the search space set in slot $n\_{s,f}^{μ}$ for an active DL BWP of a serving cell corresponding to carrier indicator field value $n\_{CI}$, or corresponding to value $n\_{CI}$ of *nCI-Value* associated with a set of serving cells *MC-DCI-SetofCells*, are given by

$$L⋅\left\{\left(Y\_{p,n\_{s,f}^{μ}}+\left⌊\frac{m\_{s,n\_{CI}}^{(L)}⋅N\_{CCE,p}}{L⋅M\_{s,max}^{\left(L\right)}}\right⌋+n\_{CI}\right)mod\left⌊{N\_{CCE,p}}/{L}\right⌋\right\}+i$$

where

for any CSS, $Y\_{p,n\_{s,f}^{μ}}=0$;

for a USS, $Y\_{p,n\_{s,f}^{μ}}=\left(A\_{p}⋅Y\_{p,n\_{s,f}^{μ}−1}\right)modD$, $Y\_{p,−1}=n\_{RNTI}\ne 0$, $A\_{p}=39827$ for $pmod3=0$, $A\_{p}=39829$ for $pmod3=1$, $A\_{p}=39839$ for $pmod3=2$, and $D=65537$;

$i=0,\cdots ,L−1$;

$N\_{CCE,p}$ is the number of CCEs, numbered from 0 to $N\_{CCE,p}−1$, in CORESET $p$ and, if any, per RB set

- forCORESET 0, the CCEs are obtained prior to puncturing, if any, of corresponding RBs [4, TS 38.211];

$n\_{CI}$ is

- the carrier indicator field value, if provided by *cif-InSchedulingCell* in *CrossCarrierSchedulingConfig* for the serving cell on which PDCCH is monitored, except for scheduling of the serving cell from the same serving cell in which case $n\_{CI}=0$;

- the *nCI-Value* provided for the set of serving cells *MC-DCI-SetofCells*, if *MC-DCI-SetofCells* is provided;

- otherwise, including for any CSS, $n\_{CI}=0$

$m\_{s,n\_{CI}}^{(L)}=0,\cdots ,M\_{s,n\_{CI}}^{\left(L\right)}−1$, where $M\_{s,n\_{CI}}^{\left(L\right)}$ is

- the number of PDCCH candidates the UE is configured to monitor for aggregation level $L$ of a search space set $s$ for a serving cell corresponding to $n\_{CI}$;

- the number of PDCCH candidates the UE is configured in the scheduling cell to monitor for aggregation level $$ of a search space set $$ for a set of serving cells corresponding to $\_{}$ if the scheduling cell is included in the set of serving cells and the UE is provided search space sets for one or both of DCI format 0\_3 and DCI format 1\_3 for the PDCCH candidates only on the scheduling cell;

- the number of PDCCH candidates the UE is configured in the scheduled cell to monitor for aggregation level $$ of a search space set $$ for a set of serving cells corresponding to $\_{}$ if search space sets $$ for one or both of DCI format 0\_3 and DCI format 1\_3, respectively, are provided on the scheduled cell and on the scheduling cell. The UE is not required to monitor the number of PDCCH candidates configured in the scheduling cell for aggregation level $$ of the search space set $$ for the set of serving cells.

for any CSS, $M\_{s,max}^{\left(L\right)}=M\_{s,0}^{\left(L\right)}$;

for a USS, $M\_{s,max}^{\left(L\right)}$ is the maximum of $M\_{s,n\_{CI}}^{\left(L\right)}$ over all configured $n\_{CI}$ values for a CCE aggregation level $L$ of search space set $s$ ;

the RNTI value used for $n\_{RNTI}$ is the C-RNTI.

**<Unchanged parts are omitted>**

[R1-2407108](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2407108.zip) Correction on PDCCH Search Space for Rel-18 Multi-Carrier Enhancements Langbo

|  |  |
| --- | --- |
| ***Reason for change:*** | There is an ambiguity for determining the number of PDCCH candidates $M\_{s,n\_{CI}}^{\left(L\right)}$ for multi-cell scheduling when two search space sets with same searchSpaceId for multi-cell scheduling, respectively, are provided on a serving cell and on the scheduling cell in a set of cells *MC-DCI-SetofCells*. |
|  |  |
| ***Summary of change:*** | $M\_{s,n\_{CI}}^{\left(L\right)}$ is the number of PDCCH candidates the UE is configured to monitor for aggregation level $L$ of a search space set $s$ on the serving cell for counting the PDCCH candidates corresponding to $n\_{CI}$ in Section 10.1 in TS 38.213. |
|  |  |
| ***Consequences if not approved:*** | The set of CCEs for a PDCCH candidate may be incorrectly determined. |

< Unchanged parts are omitted >

For a search space set $s$ associated with CORESET $p$, the CCE indexes for aggregation level $L$ corresponding to PDCCH candidate $m\_{s,n\_{CI}}^{(L)} $ of the search space set in slot $n\_{s,f}^{μ}$ for an active DL BWP of a serving cell corresponding to carrier indicator field value $n\_{CI}$, or corresponding to value $n\_{CI}$ of *nCI-Value* associated with a set of serving cells *MC-DCI-SetofCells*, are given by

$$L⋅\left\{\left(Y\_{p,n\_{s,f}^{μ}}+\left⌊\frac{m\_{s,n\_{CI}}^{(L)}⋅N\_{CCE,p}}{L⋅M\_{s,max}^{\left(L\right)}}\right⌋+n\_{CI}\right)mod\left⌊{N\_{CCE,p}}/{L}\right⌋\right\}+i$$

where

for any CSS, $Y\_{p,n\_{s,f}^{μ}}=0$;

for a USS, $Y\_{p,n\_{s,f}^{μ}}=\left(A\_{p}⋅Y\_{p,n\_{s,f}^{μ}−1}\right)modD$, $Y\_{p,−1}=n\_{RNTI}\ne 0$, $A\_{p}=39827$ for $pmod3=0$, $A\_{p}=39829$ for $pmod3=1$, $A\_{p}=39839$ for $pmod3=2$, and $D=65537$;

$i=0,\cdots ,L−1$;

$N\_{CCE,p}$ is the number of CCEs, numbered from 0 to $N\_{CCE,p}−1$, in CORESET $p$ and, if any, per RB set

- forCORESET 0, the CCEs are obtained prior to puncturing, if any, of corresponding RBs [4, TS 38.211];

$n\_{CI}$ is

- the carrier indicator field value, if provided by *cif-InSchedulingCell* in *CrossCarrierSchedulingConfig* for the serving cell on which PDCCH is monitored, except for scheduling of the serving cell from the same serving cell in which case $n\_{CI}=0$;

- the *nCI-Value* provided for the set of serving cells *MC-DCI-SetofCells*, if *MC-DCI-SetofCells* is provided;

- otherwise, including for any CSS, $n\_{CI}=0$

$m\_{s,n\_{CI}}^{(L)}=0,\cdots ,M\_{s,n\_{CI}}^{\left(L\right)}−1$, where $M\_{s,n\_{CI}}^{\left(L\right)}$ is the number of PDCCH candidates the UE is configured to monitor for aggregation level $L$ of a search space set $s$ for a serving cell for counting the PDCCH candidates corresponding to $n\_{CI}$;

for any CSS, $M\_{s,max}^{\left(L\right)}=M\_{s,0}^{\left(L\right)}$;

for a USS, $M\_{s,max}^{\left(L\right)}$ is the maximum of $M\_{s,n\_{CI}}^{\left(L\right)}$ over all configured $n\_{CI}$ values for a CCE aggregation level $L$ of search space set $s$ ;

the RNTI value used for $n\_{RNTI}$ is the C-RNTI.

< Unchanged parts are omitted >

[R1-2406620](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406620.zip) Draft CR on Search Space for DCI formats 0\_3/1\_3 Samsung

|  |  |
| --- | --- |
| ***Reason for change:*** | RAN2 (in TS38.331 v18.2.0) moved the configuration of DCI formats 0\_3/1\_3 from *SearchSpace* to *SearchSpaceExt*-v1800 (in order to avoid a network having to also provide *dci-Formats*, and the UE ignoring *dci-Formats*, when the network provides *dci-FormatsMC*). TS38.213 needs to be accordingly updated to reflect the RRC configuration providing *dci-FormatsMC*. |
|  |  |
| ***Summary of change:*** | Include *SearchSpaceExt*-v1800 in the search spaces providing USS sets. |
|  |  |
| ***Consequences if not approved:*** | Incomplete specifications for monitoring PDCCH providing DCI formats 0\_3/1\_3. |

10.1 UE procedure for determining physical downlink control channel assignment

A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets

- a Type0-PDCCH CSS set on the primary cell of the MCG configured by

- *pdcch-ConfigSIB1* in MIB or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI, or

- *searchSpaceZero* by providing *searchSpaceID*=0 for *searchSpaceMCCH* or *searchSpaceMTCH* for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI for broadcast, or

- *searchSpaceZero* by providing *searchSpaceID*=0 for *searchspaceMulticastMCCH* for a DCI format 4\_0 with CRC scrambled by a Multicast MCCH-RNTI, or by *searchSpaceMulticastMTCH* for a DCI format 4\_1 with CRC scrambled by a G-RNTI for multicast in RRC\_INACTIVE state

- a Type0A-PDCCH CSS set configured by *searchSpaceOtherSystemInformation* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI on the primary cell of the MCG

- a Type0B-PDCCH CSS set configured by

- *searchSpaceMCCH* and *searchSpaceMTCH* for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI for broadcast, on the primary cell of the MCG

- *searchspaceMulticastMCC*H for a DCI format 4\_0 with CRC scrambled by a Multicast MCCH-RNTI, or by *searchSpaceMulticastMTCH* for a DCI format 4\_1 with CRC scrambled by a G-RNTI for PDCCH receptions in RRC\_INACTIVE state

- a Type1-PDCCH CSS set configured by *ra-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a RA-RNTI, a MsgB-RNTI, or a TC-RNTI on the primary cell

- a Type1A-PDCCH CSS set configured by *sdt-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a C-RNTI or a CS-RNTI on the primary cell

- a Type2-PDCCH CSS set configured by *pagingSearchSpace* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a P-RNTI on the primary cell of the MCG

- a Type2A-PDCCH CSS set configured by *pei-SearchSpace* in *pei-ConfigBWP* for a DCI format 2\_7 with CRC scrambled by a PEI-RNTI on the primary cell of the MCG

- a Type3-PDCCH CSS set configured by

- *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by INT-RNTI, SFI-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, TPC-SRS-RNTI, CI-RNTI, or cellDTRX-RNTI and, only for the primary cell, C-RNTI, MCS-C-RNTI, CS-RNTI(s), or PS-RNTI, or

- *SearchSpace* in *pdcch-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI, or

- *searchSpaceMCCH* and *searchSpaceMTCH* on a secondary cell for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI for broadcast, and

- a USS set configured by

- *SearchSpace* or by *SearchSpaceExt-v1800* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), SL-RNTI, SL-CS-RNTI, SL Semi-Persistent Scheduling V-RNTI, or NCR-RNTI

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

## Moderator summary and proposals

As mentioned in above two CRs, i.e., R1-2406119 and R1-2407108, there is an ambiguity for determining the number of PDCCH candidates $M\_{s,n\_{CI}}^{\left(L\right)}$ for multi-cell scheduling when two search space sets with same *searchSpaceId* for multi-cell scheduling are provided on a serving cell within the set of cells configured by *MC-DCI-SetofCells* and on the scheduling cell, respectively.

From moderator’s point of view, as stated in spec, $M\_{s,n\_{CI}}^{\left(L\right)}$ is the number of PDCCH candidates the UE is configured to monitor for aggregation level $L$ of a search space set $s$ for a serving cell corresponding to $n\_{CI}$, here, “the serving cell” means the reference cell. With addition of “for counting the PDCCH candidates” for the serving cell, the spec can be clearer.

In addition, as mentioned in R1-2406620, TS38.331 v18.2.0 moved the configuration of DCI formats 0\_3/1\_3 from *SearchSpace* to *SearchSpaceExt*-v1800. Hence, TS38.213 needs to be accordingly updated to reflect the RRC configuration providing *dci-FormatsMC*.

**Question 5:**

* Do you support draft CR in R1-2407108 for TS38.213 on clarifying PDCCH Search Space?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are not ok with the CR.The search space ID linkage between scheduling cell and the scheduled cell is from legacy R15 cross-carrier scheduling. We don’t think a change is necessary. |
| Samsung | Do not support the CR. The proposed change does not relate to counting PDCCH candidates, the associated specification text is for the search space. |
| Spreadtrum | Agree with Qualcomm. Search space linkage is same as Rel-15, no ambiguity here.  |
| Nokia | Agree with QC.  |
| ZTE | Our CR is preferred. Besides the addition of “for counting the PDCCH candidates” for the serving cell, **the UE is not required to monitor the number of PDCCH candidates configured in the scheduling cell for aggregation level** $L$ **of the search space set** $s$ **for the set of serving cells**, when two search space sets with same *searchSpaceId* for multi-cell scheduling are provided on a serving cell within the set of cells configured by *MC-DCI-SetofCells* and on the scheduling cell, respectively. This is not same as legacy R15 cross-carrier scheduling, wherein the USS with same ID configured on scheduling cell will be also monitored and counted on the scheduling cell. In the MC scheduling, the search space with DCI format 1\_3/0\_3 configured in the scheduling cell may only be used for MC scheduling for the set not including the scheduling cell and only counted on the scheduled cell. |
| NTT DOCOMO | We agree with Qualcomm’s comment. |
| LGE | Same view as other companies. |
| New H3C | CR isn't required |
| Moderator | Based on online discussion, this CR is not necessary and not pursued. |
|  |  |
|  |  |

**Question 6:**

* Do you support draft CR in R1-2406620 for TS38.213 on correcting search space for DCI format 0\_3/1\_3?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the CR |
| Samsung | OK with the CR. |
| Spreadtrum | Support |
| Nokia | OK / supportjust thinking if we could combine this with other minor changes to a ‘213 editor’ CR.  |
| ZTE | OK |
| CATT | OK |
| NTT DOCOMO | We are OK with the CR. |
| LGE | OK. |
| Moderator | With agreement reached during Monday online meeting, the discussion on this thread is closed. |
| New H3C | OK |
|  |  |
|  |  |

# Issue 7: Correction on table caption for DCI format 0\_3/1\_3 in TS 38.212

## Companies’ inputs

[R1-2407164](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2407164.zip) Correction on table caption for DCI format 0\_3/1\_3 in TS 38.212 Huawei, HiSilicon

|  |  |
| --- | --- |
| ***Reason for change:*** | ChannelAccess-CPext-CAPC field in DCI format 0\_3 indicates one or more entries from Table 7.3.1.1.2-35 or Table 7.3.1.1.2-35A. Both tables are configued by the higher layer parameter *ul-AccessConfigListDCI-0-1*.However, DCI format 0\_3 is missing in the caption of Table 7.3.1.1.2-35 and Table 7.3.1.1.2-35A, and it should be added to the caption.Similarly, ChannelAccess-CPext field in DCI format 1\_3 indicates one or more entries fromTable 7.3.1.2.2-6 or Table 7.3.1.2.2-6A. Both tables are configued by the higher layer parameter *ul-AccessConfigListDCI-1-1*. However, DCI format 1\_3 is missing in the caption of Table 7.3.1.2.2-6 and Table 7.3.1.2.2-6A, and should be added. |
|  |  |
| ***Summary of change:*** | Add DCI format 0\_3 to the caption of Table 7.3.1.1.2-35, Table 7.3.1.1.2-35A. Add DCI format 1\_3 to the caption of Table 7.3.1.2.2-6 and Table 7.3.1.2.2-6A.Provide additional descriptions in captions to explain that one or more entries in Table 7.3.1.1.2-35 or Table 7.3.1.2.2-6 are configured by *ul-AccessConfigListDCI-0-1* and *ul-AccessConfigListDCI-1-1*, respectively. |
|  |  |
| ***Consequences if not approved:*** | The specification is incomplete. |

7.3.1.1.2 Format 0\_1

< Unchanged parts are omitted >

**Table 7.3.1.1.2-35: Allowed entries for DCI format 0\_1/0\_3 and DCI format 0\_2, configured by
higher layer parameter *ul-AccessConfigListDCI-0-1* and *ul-AccessConfigListDCI-0-2*, respectively,
in frequency range 1.**

| **Entry index** | **Channel Access Type**  | **The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, 38.211]** | **CAPC** |
| --- | --- | --- | --- |
| 0 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 | 1 |
| 1 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 | 2 |
| 2 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 | 3 |
| 3 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 | 4 |
| 4 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 1 |
| 5 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 2 |
| 6 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 3 |
| 7 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 | 4 |
| 8 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 1 |
| 9 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 2 |
| 10 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 3 |
| 11 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 | 4 |
| 12 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 1 |
| 13 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 2 |
| 14 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 3 |
| 15 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 | 4 |
| 16 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 1 |
| 17 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 2 |
| 18 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 3 |
| 19 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 | 4 |
| 20 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 1 |
| 21 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 2 |
| 22 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 3 |
| 23 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 | 4 |
| 24 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 1 |
| 25 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 2 |
| 26 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 3 |
| 27 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 | 4 |
| 28 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 1 |
| 29 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 2 |
| 30 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 3 |
| 31 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 | 4 |
| 32 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 1 |
| 33 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 2 |
| 34 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 3 |
| 35 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 | 4 |
| 36 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 1 |
| 37 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 2 |
| 38 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 3 |
| 39 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 | 4 |
| 40 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 1 |
| 41 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 2 |
| 42 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 3 |
| 43 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 | 4 |

**Table 7.3.1.1.2-35A: Allowed entries for DCI format 0\_1, DCI format 0\_2 and DCI format 0\_3, configured by higher layer parameter *ul-AccessConfigListDCI-0-1* in frequency range 2-2**

|  |  |
| --- | --- |
| **Entry index** | **Channel Access Type**  |
| 0 | Type 1 channel access defined in clause 4.4.1 of TS 37.213 [14] |
| 1 | Type 2 channel access defined in clause 4.4.2 of TS 37.213 [14] |
| 2 | Type 3 channel access defined in clause 4.4.3 of TS 37.213 [14] |

< Unchanged parts are omitted >

7.3.1.2.2 Format 1\_1

< Unchanged parts are omitted >

**Table 7.3.1.2.2-6: Allowed entries for DCI format 1\_1/1\_3 and DCI format 1\_2, configured by higher layer parameter *ul-AccessConfigListDCI-1-1* and *ul-AccessConfigListDCI-1-2*, respectively, in frequency range 1.**

|  |  |  |
| --- | --- | --- |
| **Entry index** | **Channel Access Type**  | **The CP extension Text index defined in Clause 5.3.1 of [4,TS 38.211]**  |
| 0 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 0 |
| 1 | Type2C-ULChannelAccess defined in clause 4.2.1.2.3 in TS 37.213 [14] | 2 |
| 2 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 0 |
| 3 | Type2B-ULChannelAccess defined in clause 4.2.1.2.2 in TS 37.213 [14] | 2 |
| 4 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 0 |
| 5 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 1 |
| 6 | Type2A-ULChannelAccess defined in clause 4.2.1.2.1 in TS 37.213 [14] | 3 |
| 7 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 0 |
| 8 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 1 |
| 9 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 2 |
| 10 | Type1-ULChannelAccess defined in clause 4.2.1.1 in TS 37.213 [14] | 3 |

**Table 7.3.1.2.2-6A: Allowed entries for DCI format 1\_1, DCI format 1\_2 and DCI format 1\_3, configured by higher layer parameter *ul-AccessConfigListDCI-1-1* in frequency range 2-2**

|  |  |
| --- | --- |
| **Entry index** | **Channel Access Type**  |
| 0 | Type 1 channel access defined in clause 4.4.1 of TS 37.213 [14] |
| 1 | Type 2 channel access defined in clause 4.4.2 of TS 37.213 [14] |
| 2 | Type 3 channel access defined in clause 4.4.3 of TS 37.213 [14] |

< Unchanged parts are omitted >

## Moderator summary and proposals

**Question 7:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the CR |
| Samsung | OK with the CR. |
| Spreadtrum | Support |
| Nokia | OK / support (could also be be considered for editor / alignment CR) |
| ZTE | OK. |
| CATT | OK |
| NTT DOCOMO | We are OK with the CR. |
| LGE | OK. |
| Moderator | With agreement reached during Monday online meeting, the discussion on this thread is closed. |
| New H3C | OK |
|  |  |
|  |  |
|  |  |

# Issue 8: HARQ-ACK codebook retransmission

## Companies’ inputs

[R1-2406340](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406340.zip) Draft CR on HARQ-ACK codebook retransmission triggered by DCI 1\_3 CATT

|  |  |  |
| --- | --- | --- |
| ***Reason for change:*** | In RAN1#114b, it was agreed that a DCI format 1\_3 can indicate HARQ-ACK coodbook retransmission using one cell with invalid FDRA field, and schedule PDSCH reception on the other cells with valid FDRA fields. However, above case was not captured in the TS 38.213. The agreement is as follows:

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

 |
|  |  |
| ***Summary of change:*** | Capture the missing case of DCI format 1\_3 for HARQ-ACK codebook retransmission |
|  |  |
| ***Consequences if not approved:*** | DCI formant 1\_3 cann’t trigger HARQ-ACK retransmission on one cell and schedule PDSCH reception on other cells. |

9.1.5 HARQ-ACK codebook retransmission

With reference to slots of PUCCH transmissions on the primary cell and for Type-1 or Type-2 HARQ-ACK codebooks, a UE that transmitted or would transmit a PUCCH or a PUSCH with a first HARQ-ACK codebook in slot $m$ can be indicated by a DCI format with CRC scrambled by a C-RNTI or a MCS-C-RNTI that does not schedule a PDSCH reception [4, TS 38.212] or a DCI format 1\_3 that indicates HARQ-ACK codebook retransmission and schedules PDSCH reception on one or more serving cells from the set of serving cells and is received in a PDCCH ending in slot $n$, to transmit a PUCCH with the first HARQ-ACK codebook in slot $n+k$, where slot $n+k$ is after slot $m$. The UE determines $k$ and a resource for the PUCCH transmission as described in clauses 9.2.3 and 9.2.5. If the UE is provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern*, the UE further determines a corresponding cell based on the periodic cell switching pattern as described in clause 9.A.

If the HARQ-ACK retransmission indicator field value in a DCI format is '1', the UE determines slot $m$ as $m=n−l$ where $l$ is determined by a one-to-one mapping in ascending order among the values from -7 to 24 and the values of

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

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

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

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

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

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

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

< Unchanged parts are omitted >

## Moderator summary and proposals

**Question 8:**

* Do you support the above CR?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the CR |
| Samsung | The CR is not needed.The existing text “DCI format with CRC scrambled by a C-RNTI or a MCS-C-RNTI that does not schedule a PDSCH reception” is OK as is.  |
| Spreadtrum | We are fine with the intention, but prefer similar words can be reused as Type-3 HARQ-ACK codebook, which is also simpler, as the red part in below.With reference to slots of PUCCH transmissions on the primary cell and for Type-1 or Type-2 HARQ-ACK codebooks, a UE that transmitted or would transmit a PUCCH or a PUSCH with a first HARQ-ACK codebook in slot $m$ can be indicated by a DCI format with CRC scrambled by a C-RNTI or a MCS-C-RNTI that does not schedule a PDSCH reception [4, TS 38.212] on one or more serving cells and is received in a PDCCH ending in slot $n$, to transmit a PUCCH with the first HARQ-ACK codebook in slot $n+k$, where slot $n+k$ is after slot $m$. The UE determines $k$ and a resource for the PUCCH transmission as described in clauses 9.2.3 and 9.2.5. If the UE is provided a periodic cell switching pattern for PUCCH transmissions by *pucch-sSCellPattern*, the UE further determines a corresponding cell based on the periodic cell switching pattern as described in clause 9.A. |
| vivo | The CR also precludes the case where NW indicates PUCCH retransmission by a mc-DCI without schedule any PDSCH, is this correct understanding? If yes, we are fine with this change. |
| Nokia | We agree with the intention, but think the proposed way to fix this by Spreadrum above to be simpler (and aligned with Type 3 HARQ specs text).  |
| ZTE | We are fine with the CR and also the change from Spreadrum. |
| CATT | We support this CR.For the case that a DCI 1-3 without any PDSCH scheduling can indicate HARQ-ACK codebook retransmission, it has be reflected by ‘a DCI format with CRC scrambled by a C-RNTI or a MCS-C-RNTI that does not schedule a PDSCH reception’ in current spec.But for the case that a DCI 1-3 with more than one PDSCH scheduling can indicate HARQ-ACK codebook retransmission, it didn’t capture in the current spec. As a result, a CR is needed to capture the latter case.   |
| NTT DOCOMO | We are OK with the intention of the CR and prefer Spreadtrum’s wording. |
| LGE | OK with the CR. |
| New H3C | OK with spreadtrum ‘s modification |
| Moderator | Please provide your views on Spreadtrum’s wording with intention to align same wording for Type-3 HARQ-ACK codebook.  |
| Moderator | With agreement reached on Wednesday online session, this thread is closed. |
|  |  |

# Issue 9: Type-2 HARQ-ACK codebook determination

## Companies’ inputs

[R1-2406339](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406339.zip) Draft CR on Type-2 HARQ-ACK codebook determination for PDSCHs scheduled by DCI format 1\_3 CATT

|  |  |
| --- | --- |
| ***Reason for change:*** | For generation Type-2 HARQ-ACK codebook for multi-cells PDSCHs scheduled by DCI format 1\_3. $N\_{sets}^{TB,max}/N\_{cells,set}^{DL,max}$ is set as maximum bits number of HARQ-ACK for a DCI format 1\_3 signalling, the $\tilde{o}^{ACK}$ shall be counted as $N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)$ or $ N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)$. But in current specitfication, some formals are described as $N\_{sets}^{TB,max}⋅V\_{C−DAI,c,m}^{DL}−1$ or $N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1$, it is not correct. |
|  |  |
| ***Summary of change:*** | 1: Modify $N\_{sets}^{TB,max}⋅V\_{C−DAI,c,m}^{DL}−1 to $ $N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)$2: Modify $N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1$ to $ N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)$ |
|  |  |
| ***Consequences if not approved:*** | The bit number of $ \tilde{o}^{ACK}$ is counted incorrectly. |

9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel

< Unchanged parts are omitted >

The UE determines the $\tilde{o}\_{0}^{ACK}, \tilde{o}\_{1}^{ACK},\cdots ,\tilde{o}\_{O\_{ACK}−1}^{ACK}$, for a total number of $O\_{ACK}$ HARQ-ACK information bits in the second Type-2 HARQ-ACK sub-codebook according to the following pseudo-code.

Set $N\_{cells,set}^{DL,max}$ to the maximum number of serving cells in *ScheduledCell-ListDCI-1-3* of a set of serving cells provided by *MC-DCI-SetofCells*, across the number of sets of serving cells, that can be scheduled PDSCH receptions by DCI format 1\_3

Set $N\_{sets}^{TB,max}$ to the maximum total number of TBs in PDSCH receptions that can be scheduled by a DCI format 1\_3 over more than one serving cells in a set of serving cells across the number of sets of serving cells

Set $N\_{sets}^{DL}$ to the number of sets of serving cells *MC-DCI-SetofCells* in a PUCCH group

Set $N\_{cells}^{DL}$ to the number of serving cells, across $N\_{sets}^{DL}$ sets of serving cells in the PUCCH group

Set $c$ to the index of serving cells, $c=0,…, N\_{cells}^{DL}−1$, a lower index corresponds to a lower RRC index of a corresponding serving cell

- if the UE indicates *type2-HARQ-ACK-Codebook* and receives $N\_{PDSCH, c}^{m}>1$ PDSCHs on a serving cell $c$ that are scheduled by $N\_{PDSCH, c}^{m}$ DCI formats 1\_3 in PDCCH receptions at a same PDCCH monitoring occasion $m$, where

- each of the DCI formats 1\_3 schedules more than one PDSCH receptions on respective more than one serving cells,

- $c$ is the smallest cell index among the respective more than one serving cells, and

- $c$ is same across the $N\_{PDSCH, c}^{m}$ DCI formats 1\_3

the serving cell $c$ is counted $N\_{PDSCH, c}^{m}$ times for PDCCH monitoring occasion $m$ in increasing order of the PDSCH reception starting time among the $N\_{PDSCH, c}^{m}$ PDSCH receptions

Set $mc$ to the index of a serving cell, in a set of indexes of serving cells arranged in ascending order, from the set of $N\_{cells,set}^{DL,max}$ serving cells, $mc=0,…, N\_{cells,set}^{DL,max}−1$

Set $m=0$ – PDCCH monitoring occasion index for detection of a DCI format 1\_3 scheduling PDSCH receptions on more than one serving cells from a set of serving cells: lower index corresponds to earlier PDCCH monitoring occasion

Set $j=0$

Set $V\_{temp}=0$

Set $V\_{temp2}=0$

Set $V\_{s}=∅$

Set $M$ to the number of PDCCH monitoring occasions

while $m<M$

$c=0$

if *harq-ACK-SpatialBundlingPUCCH* is not provided,

while $c<N\_{cells}^{DL}$

if PDCCH monitoring occasion $m$ is before an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn*

$c=c+1$;

else

if there is a PDSCH reception on serving cell $c$ that is scheduled by a DCI format scheduling more than one PDSCHs that provide respective more than one transport blocks with enabled HARQ-ACK information on respective more than one serving cells, where the DCI format is associated with a PDCCH reception in PDCCH monitoring occasion $m$ and *c* is the smallest serving cell index among the more than one serving cells

if $V\_{C−DAI,c,m}^{DL}\leq V\_{temp}$

$j=j+1$;

end if

$V\_{temp}=V\_{C−DAI,c,m}^{DL}$;

if $V\_{T-DAI,m}^{DL}=∅$

$V\_{temp,2}=V\_{C−DAI,c,m}^{DL}$;

else

$V\_{temp,2}=V\_{T−DAI,m}^{DL}$;

end if

$cnt=0$;

$mc=0$;

while $mc<N\_{cells,set}^{DL,max}$

if the UE is scheduled PDSCH reception on serving cell$mc$, if any, from the more than one serving cells

if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell$mc$, if any, from the more than one serving cells

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the first transport block of this cell

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+1+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the second transport block of this cell

$cnt=cnt+2$;

else

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the transport block of this cell

$cnt=cnt+1$;

end if

end if

$mc=mc+1$;

end while

while $cnt< N\_{sets}^{TB,max}$

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+\_{}^{}\left(\_{}^{}\right)\_{}^{}\_{}^{}+cnt}^{ACK}$= NACK;

$cnt=cnt+1$;

end while

$V\_{s}=V\_{s}∪\left\{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), …, N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{sets}^{TB,max}−1\right\}$;

end if

$c=c+1$;

end if

end while

else

while $c<N\_{cells}^{DL}$

if PDCCH monitoring occasion $m$ is before an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn*

$c=c+1$;

else

if there is a PDSCH reception on serving cell $c$ that is scheduled by a DCI format scheduling more than one PDSCHs that provide respective more than one transport blocks with enabled HARQ-ACK information on respective more than one serving cells, where the DCI format is associated with a PDCCH reception in PDCCH monitoring occasion $m$ and *c* is the smallest serving cell index among the more than one serving cells

if $V\_{C−DAI,c,m}^{DL}\leq V\_{temp}$

$j=j+1$;

end if

$V\_{temp}=V\_{C−DAI,c,m}^{DL}$;

if $V\_{T-DAI,m}^{DL}=∅$

$V\_{temp,2}=V\_{C−DAI,c,m}^{DL}$;

else

$V\_{temp,2}=V\_{T−DAI,m}^{DL}$;

end if

$cnt=0$;

$mc=0$;

while $mc<N\_{cells,set}^{DL,max}$

if the UE is scheduled PDSCH reception for transport blocks with enabled HARQ-ACK information on serving cell $mc$, if any, from the more than one serving cells

if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell $mc$

if the PDSCH reception provides two transport blocks

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+\_{}^{}\left(\_{}^{}\right)\_{}^{}\_{}^{}+cnt}^{ACK}$ = binary AND operation of the HARQ-ACK information bits corresponding to the first and second transport blocks of this cell

else

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+\_{}^{}\left(\_{}^{}\right)\_{}^{}\_{}^{}+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the first transport block of this cell

end if

else

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+\_{}^{}\left(\_{}^{}\right)\_{}^{}\_{}^{}+cnt}^{ACK}$= HARQ-ACK information bit of this cell

end if

$cnt=cnt+1$;

end if

$mc=mc+1$;

end while

while $cnt< N\_{cells,set}^{DL,max}$

$\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+\_{}^{}\left(\_{}^{}\right)\_{}^{}\_{}^{}+cnt}^{ACK}$= NACK;

$cnt=cnt+1$;

end while

$V\_{s}=V\_{s}∪\left\{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+1…, N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{cells,set}^{DL,max}−1\right\}$;

end if

$c=c+1$;

end if

end while

end if

$m=m+1$;

end while

$V\_{temp}=\left(j mod\left(\frac{4}{T\_{D}}\right)\right)×\left(\frac{4}{T\_{D}}\right)+V\_{temp}$;

if UE does not set $V\_{temp2}=V\_{T−DAI}^{UL}$ and $T\_{D}=2$

$V\_{temp2}=V\_{temp}$;

end if

$j=\left⌊\frac{j×T\_{D}}{4}\right⌋$;

if $V\_{temp2}<V\_{temp}$

$j=j+1$;

end if

if *harq-ACK-SpatialBundlingPUCCH* is not provided,

$O^{ACK}=N\_{sets}^{TB,max}⋅\left(4⋅j+V\_{temp2}\right)$

else

$O^{ACK}=N\_{cells,set}^{DL,max}⋅\left(4⋅j+V\_{temp2}\right)$

end if

$\tilde{o}\_{i}^{ACK}=NACK$ for any $i\in \left\{0,1,\cdots ,O^{ACK}−1\right\}\V\_{s}$

< Unchanged parts are omitted >

[R1-2406992](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406992.zip) Corrections on Type2-HARQ-ACK codebook for DCI format 1\_3 in TS 38.213 Huawei, HiSilicon

|  |  |
| --- | --- |
| ***Reason for change:*** | In section 9.1.3.1 of TS38.213, regarding the pseudo-code for generating HARQ-ACK information for multi-cell scheduling, the subscript of $\tilde{o}^{ACK}$ in the context is inconsistent, which leads to errors in the bit positions of the HARQ-ACK information. This may result in mismatch of the HARQ-ACK codebook interpretation between the UE and gNB in some cases. The detailed analysis can be referred to R1-2405846. |
|  |  |
| ***Summary of change:*** | Change $\tilde{o}\_{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1+cnt}^{ACK}$ to $\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$. |
|  |  |
| ***Consequences if not approved:*** | The bit position of HARQ-ACK information in Type-2 HARQ-ACK codebook is incorrect. |

9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel

< Unchanged parts are omitted >

The UE determines the $\tilde{o}\_{0}^{ACK}, \tilde{o}\_{1}^{ACK},\cdots ,\tilde{o}\_{O\_{ACK}−1}^{ACK}$, for a total number of $O\_{ACK}$ HARQ-ACK information bits in the second Type-2 HARQ-ACK sub-codebook according to the following pseudo-code.

Set $N\_{cells,set}^{DL,max}$ to the maximum number of serving cells in *ScheduledCell-ListDCI-1-3* of a set of serving cells provided by *MC-DCI-SetofCells*, across the number of sets of serving cells, that can be scheduled PDSCH receptions by DCI format 1\_3

Set $N\_{sets}^{TB,max}$ to the maximum total number of TBs in PDSCH receptions that can be scheduled by a DCI format 1\_3 over more than one serving cells in a set of serving cells across the number of sets of serving cells

Set $N\_{sets}^{DL}$ to the number of sets of serving cells *MC-DCI-SetofCells* in a PUCCH group

Set $N\_{cells}^{DL}$ to the number of serving cells, across $N\_{sets}^{DL}$ sets of serving cells in the PUCCH group

Set $c$ to the index of serving cells, $c=0,…, N\_{cells}^{DL}−1$, a lower index corresponds to a lower RRC index of a corresponding serving cell

- if the UE indicates *type2-HARQ-ACK-Codebook* and receives $N\_{PDSCH, c}^{m}>1$ PDSCHs on a serving cell $c$ that are scheduled by $N\_{PDSCH, c}^{m}$ DCI formats 1\_3 in PDCCH receptions at a same PDCCH monitoring occasion $m$, where

- each of the DCI formats 1\_3 schedules more than one PDSCH receptions on respective more than one serving cells,

- $c$ is the smallest cell index among the respective more than one serving cells, and

- $c$ is same across the $N\_{PDSCH, c}^{m}$ DCI formats 1\_3

the serving cell $c$ is counted $N\_{PDSCH, c}^{m}$ times for PDCCH monitoring occasion $m$ in increasing order of the PDSCH reception starting time among the $N\_{PDSCH, c}^{m}$ PDSCH receptions

Set $mc$ to the index of a serving cell, in a set of indexes of serving cells arranged in ascending order, from the set of $N\_{cells,set}^{DL,max}$ serving cells, $mc=0,…, N\_{cells,set}^{DL,max}−1$

Set $m=0$ – PDCCH monitoring occasion index for detection of a DCI format 1\_3 scheduling PDSCH receptions on more than one serving cells from a set of serving cells: lower index corresponds to earlier PDCCH monitoring occasion

Set $j=0$

Set $V\_{temp}=0$

Set $V\_{temp2}=0$

Set $V\_{s}=∅$

Set $M$ to the number of PDCCH monitoring occasions

while $m<M$

$c=0$

if *harq-ACK-SpatialBundlingPUCCH* is not provided,

while $c<N\_{cells}^{DL}$

if PDCCH monitoring occasion $m$ is before an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn*

$c=c+1$;

else

if there is a PDSCH reception on serving cell $c$ that is scheduled by a DCI format scheduling more than one PDSCHs that provide respective more than one transport blocks with enabled HARQ-ACK information on respective more than one serving cells, where the DCI format is associated with a PDCCH reception in PDCCH monitoring occasion $m$ and *c* is the smallest serving cell index among the more than one serving cells

if $V\_{C−DAI,c,m}^{DL}\leq V\_{temp}$

$j=j+1$;

end if

$V\_{temp}=V\_{C−DAI,c,m}^{DL}$;

if $V\_{T-DAI,m}^{DL}=∅$

$V\_{temp,2}=V\_{C−DAI,c,m}^{DL}$;

else

$V\_{temp,2}=V\_{T−DAI,m}^{DL}$;

end if

$cnt=0$;

$mc=0$;

while $mc<N\_{cells,set}^{DL,max}$

if the UE is scheduled PDSCH reception on serving cell$mc$, if any, from the more than one serving cells

if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell$mc$, if any, from the more than one serving cells

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the first transport block of this cell

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+1+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the second transport block of this cell

$cnt=cnt+2$;

else

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the transport block of this cell

$cnt=cnt+1$;

end if

end if

$mc=mc+1$;

end while

while $cnt< N\_{sets}^{TB,max}$

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}\tilde{}\_{\_{}^{}\_{}\_{}^{}\_{}^{}}^{}$= NACK;

$cnt=cnt+1$;

end while

$V\_{s}=V\_{s}∪\left\{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), …, N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{sets}^{TB,max}−1\right\}$;

end if

$c=c+1$;

end if

end while

else

while $c<N\_{cells}^{DL}$

if PDCCH monitoring occasion $m$ is before an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn*

$c=c+1$;

else

if there is a PDSCH reception on serving cell $c$ that is scheduled by a DCI format scheduling more than one PDSCHs that provide respective more than one transport blocks with enabled HARQ-ACK information on respective more than one serving cells, where the DCI format is associated with a PDCCH reception in PDCCH monitoring occasion $m$ and *c* is the smallest serving cell index among the more than one serving cells

if $V\_{C−DAI,c,m}^{DL}\leq V\_{temp}$

$j=j+1$;

end if

$V\_{temp}=V\_{C−DAI,c,m}^{DL}$;

if $V\_{T-DAI,m}^{DL}=∅$

$V\_{temp,2}=V\_{C−DAI,c,m}^{DL}$;

else

$V\_{temp,2}=V\_{T−DAI,m}^{DL}$;

end if

$cnt=0$;

$mc=0$;

while $mc<N\_{cells,set}^{DL,max}$

if the UE is scheduled PDSCH reception for transport blocks with enabled HARQ-ACK information on serving cell $mc$, if any, from the more than one serving cells

if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell $mc$

if the PDSCH reception provides two transport blocks

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}\tilde{}\_{\_{}^{}\_{}\_{}^{}\_{}^{}}^{}$ = binary AND operation of the HARQ-ACK information bits corresponding to the first and second transport blocks of this cell

else

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}\tilde{}\_{\_{}^{}\_{}\_{}^{}\_{}^{}}^{}$ = HARQ-ACK information bit corresponding to the first transport block of this cell

end if

else

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}\tilde{}\_{\_{}^{}\_{}\_{}^{}\_{}^{}}^{}$= HARQ-ACK information bit of this cell

end if

$cnt=cnt+1$;

end if

$mc=mc+1$;

end while

while $cnt< N\_{cells,set}^{DL,max}$

$\tilde{}\_{\_{}^{}\_{}\_{}^{}\left(\_{}^{}\right)}^{}\tilde{}\_{\_{}^{}\_{}\_{}^{}\_{}^{}}^{}$= NACK;

$cnt=cnt+1$;

end while

$V\_{s}=V\_{s}∪\left\{N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+1…, N\_{cells,set}^{DL,max}⋅T\_{D}⋅j+N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{cells,set}^{DL,max}−1\right\}$;

end if

$c=c+1$;

end if

end while

end if

$m=m+1$;

end while

$V\_{temp}=\left(j mod\left(\frac{4}{T\_{D}}\right)\right)×\left(\frac{4}{T\_{D}}\right)+V\_{temp}$;

if UE does not set $V\_{temp2}=V\_{T−DAI}^{UL}$ and $T\_{D}=2$

$V\_{temp2}=V\_{temp}$;

end if

$j=\left⌊\frac{j×T\_{D}}{4}\right⌋$;

if $V\_{temp2}<V\_{temp}$

$j=j+1$;

end if

if *harq-ACK-SpatialBundlingPUCCH* is not provided,

$O^{ACK}=N\_{sets}^{TB,max}⋅\left(4⋅j+V\_{temp2}\right)$

else

$O^{ACK}=N\_{cells,set}^{DL,max}⋅\left(4⋅j+V\_{temp2}\right)$

end if

$\tilde{o}\_{i}^{ACK}=NACK$ for any $i\in \left\{0,1,\cdots ,O^{ACK}−1\right\}\V\_{s}$ .

< Unchanged parts are omitted >

[R1-2406341](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406341.zip) Draft CR on maxNrofCodeWordsScheduledByDCI for second Type-2 HARQ-ACK codebook CATT

|  |  |
| --- | --- |
| ***Reason for change:*** | In current specification, for the second type-2 HARQ-ACK codebook, if a UE is configured by maxNrofCodeWordsScheduledByDCI with 2, the HARQ-ACK information bit corresponding to a cell is defined as following:“if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell$mc$, if any, from the more than one serving cells”There are two understandings on the highlighted part in blue: * Understanding 1: if at least one cell of a set of cells scheduled by DCI format 1\_3 is configured with *maxNrofCodeWordsScheduledByDCI* =2, the number of HARQ-ACK information bit for the cell *mc* is 2; Otherwise, it is 1.
* Understanding 2: if the cell *mc* is configure with *maxNrofCodeWordsScheduledByDCI* =2, the number of HARQ-ACK information bit for the cell *mc* is 2. Otherwise, it is 1.

According to the achieved agreement in RAN1#110b, understanding 2 is correct. However, this is not clear reflected in current specification in TS 38.213. |
|  |  |
| ***Summary of change:*** | Remove ‘if any, from the more than one serving cells’ |
|  |  |
| ***Consequences if not approved:*** | Unclear UE behaviour for the second Type-2 HARQ-ACK codebook. |

9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel

while $m<M$

$c=0$

if *harq-ACK-SpatialBundlingPUCCH* is not provided,

while $c<N\_{cells}^{DL}$

if PDCCH monitoring occasion $m$ is before an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn*

$c=c+1$;

else

if there is a PDSCH reception on serving cell $c$ that is scheduled by a DCI format scheduling more than one PDSCHs that provide respective more than one transport blocks with enabled HARQ-ACK information on respective more than one serving cells, where the DCI format is associated with a PDCCH reception in PDCCH monitoring occasion $m$ and *c* is the smallest serving cell index among the more than one serving cells

if $V\_{C−DAI,c,m}^{DL}\leq V\_{temp}$

$j=j+1$;

end if

$V\_{temp}=V\_{C−DAI,c,m}^{DL}$;

if $V\_{T-DAI,m}^{DL}=∅$

$V\_{temp,2}=V\_{C−DAI,c,m}^{DL}$;

else

$V\_{temp,2}=V\_{T−DAI,m}^{DL}$;

end if

$cnt=0$;

$mc=0$;

while $mc<N\_{cells,set}^{DL,max}$

if the UE is scheduled PDSCH reception on serving cell$mc$, if any, from the more than one serving cells

if *maxNrofCodeWordsScheduledByDCI* is 2 for serving cell$mc$,

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the first transport block of this cell

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+1+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the second transport block of this cell

$cnt=cnt+2$;

else

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)+cnt}^{ACK}$ = HARQ-ACK information bit corresponding to the transport block of this cell

$cnt=cnt+1$;

end if

end if

$mc=mc+1$;

end while

while $cnt< N\_{sets}^{TB,max}$

$\tilde{o}\_{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅V\_{C−DAI,c,m}^{DL}−1+cnt}^{ACK}$= NACK;

$cnt=cnt+1$;

end while

$V\_{s}=V\_{s}∪\left\{N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right), …, N\_{sets}^{TB,max}⋅T\_{D}⋅j+N\_{sets}^{TB,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)+N\_{sets}^{TB,max}−1\right\}$;

end if

$c=c+1$;

end if

end while

< Unchanged parts are omitted >

## Moderator summary and proposals

As mentioned in the two contributions, i.e., [R1-2406339](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406339.zip) and [R1-2406992](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406992.zip), when generating Type-2 HARQ-ACK codebook for PDSCHs scheduled by DCI format 1\_3, there are some errors on the pseudo-code, the index of $\tilde{o}^{ACK}$ shall be counted as $N\_{sets}^{TB,max}⋅\left(V\_{C−DAI,c,m}^{DL}−1\right)$ or $ N\_{cells,set}^{DL,max}⋅\left(V\_{C-DAI,c,m}^{DL}−1\right)$ instead of $N\_{sets}^{TB,max}⋅V\_{C−DAI,c,m}^{DL}−1$ or $N\_{cells,set}^{DL,max}⋅V\_{C-DAI,c,m}^{DL}−1$.

From moderator’s perspective, a CR is needed to correct these errors and CR in [R1-2406339](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406339.zip) is provided for discussion as it reuses the index of $N\_{cells,set}^{DL,max}⋅T\_{D}⋅j$ for determining the index of $\tilde{o}^{ACK}$.

In addition, as mentioned in R1-2406341, “Draft CR on maxNrofCodeWordsScheduledByDCI for second Type-2 HARQ-ACK codebook”, it proposes to remove the unclear part of “if any, from the more than one serving cells” from the psedu-code when generating the Type-2 HARQ-ACK codebook for multi-cell scheduling. From moderator’s perspective, such description is not necessary.

**Question 9:**

* Do you support the draft CR in [R1-2406339](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406339.zip)?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | We are OK with the CR |
| Samsung | OK. The typo for the missing ( ) can be captured in the Rel-18 alignment CR. |
| vivo | agree |
| Nokia | Agree with the intention, and think as Samsung that some smaller issues could be in a 38.213 editor / alignment CR (e.g. also together with RRC parameters in 6620 of Question 6).  |
| ZTE | OK |
| CATT | OK with the CR |
| NTT DOCOMO | We are OK with the CR. |
| LGE | OK. |
| Moderator | With agreement reached during Monday online meeting, the discussion on this thread is closed. |
| New H3C | OK |
|  |  |
|  |  |

**Question 10:**

* Do you support the draft CR in [R1-2406341](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406339.zip)?

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
| Qualcomm | Not sure if just removal of the text is sufficient. We may need to add some clarifications to reflect the agreement in the spec. |
| Samsung | OK with the CR. |
| Nokia | OK / support (could potentially also go in a potential 38.213 editor /alignment CR) |
| ZTE | OK |
| CATT | OK with the CR |
| NTT DOCOMO | We are OK with the CR. |
| LGE | OK. |
| Moderator | With agreement reached during Monday online meeting, the discussion on this thread is closed. |
| New H3C | OK |
|  |  |
|  |  |
|  |  |

# Proposals for online/offline discussion

# References

1. [R1-2405846](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2405846.zip) Maintenance of Rel-18 Multicarrier Enhancements Huawei, HiSilicon
2. [R1-2405930](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2405930.zip) Draft CR on miscellaneous corrections of DCI format 0\_3 in 38.214 Spreadtrum Communications
3. [R1-2405931](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2405931.zip) Draft CR on HARQ-ACK codebook generation when BWP switching Spreadtrum Communications
4. [R1-2406074](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406074.zip) Draft CR on HARQ-ACK skipping for Rel-18 multi-cell scheduling Lenovo
5. [R1-2406117](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406117.zip) Draft CR on indicated unified TCI state for multi-cell scheduling ZTE Corporation, Sanechips
6. [R1-2406118](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406118.zip) Draft CR on application of indicated unified TCI state by DCI format 1\_3 ZTE Corporation, Sanechips
7. [R1-2406119](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406119.zip) Draft CR on search space of DCI format 0\_3 and DCI format 1\_3 ZTE Corporation, Sanechips
8. [R1-2406120](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406120.zip) Draft CR on HARQ-ACK generation in case of DL BWP switching ZTE Corporation, Sanechips
9. [R1-2406121](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406121.zip) Discussion on HARQ-ACK generation in case of DL BWP switching ZTE Corporation, Sanechips
10. [R1-2406153](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406153.zip) Draft CR on HARQ-ACK codebook for DL BWP switching vivo
11. [R1-2406154](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406154.zip) Draft CR on MBS and multi-carrier scheduling vivo
12. [R1-2406339](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406339.zip) Draft CR on Type-2 HARQ-ACK codebook determination for PDSCHs scheduled by DCI format 1\_3 CATT
13. [R1-2406340](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406340.zip) Draft CR on HARQ-ACK codebook retransmission triggered by DCI 1\_3 CATT
14. [R1-2406341](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406341.zip) Draft CR on maxNrofCodeWordsScheduledByDCI for second Type-2 HARQ-ACK codebook CATT
15. [R1-2406342](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406342.zip) Draft CR on HARQ-ACK information skipping due to BWP change for second Type-2 HARQ-ACK codebook CATT
16. [R1-2406348](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406348.zip) Draft CR on transition time of BWP change triggered by DCI format 1\_3/0\_3 CATT
17. [R1-2406619](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406619.zip) Draft CR on HARQ-ACK skipping for DL/UL BWP switching in multi-cell scheduling Samsung
18. [R1-2406620](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406620.zip) Draft CR on Search Space for DCI formats 0\_3/1\_3 Samsung
19. [R1-2406796](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406796.zip) Draft CR on correction of UCI-onPUSCH for PUSCH scheduled by DCI format 0\_3 Nokia
20. [R1-2406909](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406909.zip) Remaining issues for multi-carrier scheduling with single DCI NTT DOCOMO, INC.
21. [R1-2406989](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406989.zip) Correction on SCell dormancy indication case 2 in case of BWP switching Huawei, HiSilicon
22. [R1-2406990](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406990.zip) Correction on type 2 HARQ-ACK codebook skipping in case of BWP switching Huawei, HiSilicon
23. [R1-2406991](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406991.zip) Correction on PDCCH overbooking in TS 38.213 Huawei, HiSilicon
24. [R1-2406992](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2406992.zip) Corrections on Type2-HARQ-ACK codebook for DCI format 1\_3 in TS 38.213 Huawei, HiSilicon
25. [R1-2407013](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2407013.zip) Correction on Type-2 HARQ-ACK codebook for multi-cell PDSCH scheduling Qualcomm Incorporated
26. [R1-2407108](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2407108.zip) Correction on PDCCH Search Space for Rel-18 Multi-Carrier Enhancements Langbo
27. [R1-2407110](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2407110.zip) Correction on Minimum Scheduling Offset for Rel-18 Multi-Carrier Enhancements Langbo
28. [R1-2407164](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23118%5C%5Ctdocs%5C%5CR1-2407164.zip) Correction on table caption for DCI format 0\_3/1\_3 in TS 38.212 Huawei, HiSilicon

# List of agreements

## Agreements made in RAN1#109-e

**Agreement**

Agree the following terminologies ONLY for convenience of discussion:

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

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Working Assumption**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

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

**Agreement**

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

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

**Agreement**

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

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

**Agreement**

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

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

## Agreements made in RAN1#110

**Agreement**

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

**Agreement**

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

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

**Working Assumption**

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

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

**Working Assumption**

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

**Agreement**

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

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

**Agreement**

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

**Agreement**

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

* FFS details of reference PDSCH

**Agreement**

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

**Agreement**

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

**Agreement**

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

## Agreements made in RAN#97

**Conclusion:**

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

**Conclusion:**

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

**Conclusion:**

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

## Agreements made in RAN1#110bis

**Agreement**

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

**Working Assumption**

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

**Agreement**

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

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

**Agreement**

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

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

**Agreement**

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

**Working Assumption**

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

**Agreement**

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

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

**Agreement**

Confirm below working assumption:

**Working Assumption**

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

**Working Assumption**

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

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

## Agreements made in RAN1#111

**Proposal 2-1 rev3:**

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

**Working Assumption**

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

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

**Agreement**

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

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

**Agreement**

For DCI format 1\_X/0\_X,

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

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

**Agreement**

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

Agreement

The types for below fields in DCI format 1\_X are listed ([R1-2212924](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23112%5C%5Ctdocs%5C%5CFL%20summary%5C%5CR1-2212924.zip)):

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

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

FFS: Details

**Agreement**

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

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

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

FFS: Details

## Agreements made in RAN1#112

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Conclusion**

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

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

**Agreement**

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

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

**Agreement**

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

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

**Agreement**

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

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

**Agreement**

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

**Agreement**

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

**Agreementl**

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

**Agreement**

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

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

**Agreement**

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

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

**Agreement**

Following is supported in Rel-18 multi-cell scheduling

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

**Agreement**

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

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

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Conclusion**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

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

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

* The indicated priority indicator is applied to the PUCCH.

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

* This parameter is per set of cells

**Agreement**

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

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

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

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

**Agreement**

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

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

## Agreements made in RAN1#114bis

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

Below TP on TS38.213-i00 is adopted.

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

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

**Agreement**

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

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

**Agreement**

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

**Agreement**

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

* Note: Cells with valid FDRA fields are scheduled

**Agreement**

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

* Note: Cells with valid FDRA fields are scheduled

**Agreement**

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

**Agreement**

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

**Agreement**

Below TP on TS38.212-i00 is adopted.

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

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

**Agreement**

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

**Agreement**

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

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

## Agreements made in RAN1#115

**Conclusion**

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

**Agreement**

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

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

**Agreement**

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

## Agreements made in RAN1#116

**Agreement**

Adopt following TP for TS38.213.

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

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

**Agreement**

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

|  |
| --- |
| **9.1.2.1 Type-1 HARQ-ACK codebook in physical uplink control channel**For a serving cell $c$, an active DL BWP, and an active UL BWP, as described in clause 12, the UE determines a set of $M\_{A,c}$ occasions for candidate PDSCH receptions for which the UE can transmit corresponding HARQ-ACK information in a PUCCH in slot $n\_{U}$. If serving cell $c$ is deactivated, the UE uses as the active DL BWP for determining the set of $M\_{A,c}$ occasions for candidate PDSCH receptions a DL BWP provided by *firstActiveDownlinkBWP-Id*. The determination is based:a) on a set of slot timing values $K\_{1}$ associated with the active UL BWP on the primary cell or, if the PUCCH transmission is indicated by a DCI format to be on the PUCCH-sSCell as described in clause 9A, on a set of slot timing values $K\_{1}$ associated with the active UL BWP on the PUCCH-sSCell- If the UE is configured to monitor PDCCH for DCI format 1\_0 and is not configured to monitor PDCCH for ~~either~~ DCI format 1\_1/ ~~or DCI format~~ 1\_2/1\_3 for serving cell $c$, or the active DL BWP for serving cell $c$ is dormant BWP, $K\_{1}$ is provided by the slot timing values {1, 2, 3, 4, 5, 6, 7, 8} for SCS configuration of PUCCH transmission $μ\leq 3$, {7, 8, 12, 16, 20, 24, 28, 32} for $μ=5$, and {13, 16, 24, 32, 40, 48, 56, 64} for $μ=6$- If the UE is configured to monitor PDCCH for DCI format 1\_1/1\_3 and is not configured to monitor PDCCH for DCI format 1\_2 for serving cell $c$, $K\_{1}$ is provided by *dl-DataToUL-ACK* or *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-r17*- If the UE is configured to monitor PDCCH for DCI format 1\_2 and is not configured to monitor PDCCH for DCI format 1\_1/1\_3 for serving cell $c$, $K\_{1}$ is provided by *dl-DataToUL-ACK-DCI-1-2* or *dl-DataToUL-ACK-DCI-1-2-r17*- If the UE is configured to monitor PDCCH for DCI format 1\_1/1\_3 and DCI format 1\_2 for serving cell $c$, $K\_{1}$ is provided by the union of *dl-DataToUL-ACK* or *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-r17* and *dl-DataToUL-ACK-DCI-1-2* or *dl-DataToUL-ACK-DCI-1-2-r17* - If an inapplicable value in dl-DataToUL-ACK-r16 or dl-DataToUL-ACK-r17 is provided, the value is excluded from $K\_{1}$ |

**Agreement**

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

**Conclusion**

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

* No spec impact

**Conclusion**

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

* No spec impact

**Agreement**

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

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

**Agreement**

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

**Agreement**

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

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

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

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

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

**Agreement**

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

**Agreement**

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

## Agreements made in RAN1#116bis

**Agreement**

* Adopt following TP for TS38.214.

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

**Agreement**

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

TP2 on TS38.213:

|  |
| --- |
| **[TS 38.213 V18.2.0]**9.1.3.1 Type-2 HARQ-ACK codebook in physical uplink control channel< unchanged part omitted >A value of the counter downlink assignment indicator (DAI) field in DCI formats, each scheduling PDSCH receptions on respective single serving cells with associated HARQ-ACK information, or having associated HARQ-ACK information without scheduling a PDSCH reception, in a same HARQ-ACK codebook denotes the accumulative number of {serving cell, PDCCH monitoring occasion}-pairs in which PDSCH receptions that provide transport blocks with enabled HARQ-ACK information report, or HARQ-ACK information bits that are not in response for PDSCH receptions, associated with the DCI formats, excluding the SPS activation DCI, is present up to the current serving cell and current PDCCH monitoring occasion, - first, if the UE indicates by *type2-HARQ-ACK-Codebook* support for more than one PDSCH reception on a serving cell that are scheduled from a same PDCCH monitoring occasion, in increasing order of the PDSCH reception starting time for the same {serving cell, PDCCH monitoring occasion} pair, - second in ascending order of serving cell index, and - third in ascending order of PDCCH monitoring occasion index $m$, where $0\leq m<M$. A value of the counter DAI field in DCI formats, each scheduling PDSCH receptions on respective more than one serving cells with associated HARQ-ACK information in a same HARQ-ACK codebook, denotes the accumulative number of {serving cell with smallest index from the more than one serving cells, PDCCH monitoring occasion}-pairs in which PDSCH receptions are present up to the current more than one serving cells and current PDCCH monitoring occasion,- first, if the UE indicates by *type2-HARQ-ACK-Codebook* support for more than one PDSCH receptions on a serving cell that are scheduled from a same PDCCH monitoring occasion, in increasing order of the PDSCH reception starting time for the same {serving cell with smallest index from the more than one serving cells, PDCCH monitoring occasion} pair,- second in ascending order of the smallest serving cell index from the more than one serving cells, and - third in ascending order of PDCCH monitoring occasion index $m$, where $0\leq m<M$.< unchanged part omitted >The UE determines the $\tilde{o}\_{0}^{ACK}, \tilde{o}\_{1}^{ACK},\cdots ,\tilde{o}\_{O\_{ACK}−1}^{ACK}$, for a total number of $O\_{ACK}$ HARQ-ACK information bits in the second Type-2 HARQ-ACK sub-codebook according to the following pseudo-code. Set $N\_{cells,set}^{DL,max}$ to the maximum number of serving cells in *ScheduledCell-ListDCI-1-3* of a set of serving cells provided by *MC-DCI-SetofCells*, across the number of sets of serving cells, that can be scheduled PDSCH receptions by DCI format 1\_3Set $N\_{sets}^{TB,max}$ to the maximum total number of TBs in PDSCH receptions that can be scheduled by a DCI format 1\_3 over more than one serving cells in a set of serving cells across the number of sets of serving cellsSet $N\_{sets}^{DL}$ to the number of sets of serving cells *MC-DCI-SetofCells* in a PUCCH groupSet $N\_{cells}^{DL}$ to the number of serving cells, across $N\_{sets}^{DL}$ sets of serving cells in the PUCCH groupSet $c$ to the index of serving cells, $c=0,…, N\_{cells}^{DL}−1$, a lower index corresponds to a lower RRC index of a corresponding serving cell* if the UE indicates *type2-HARQ-ACK-Codebook,* and receives a number $N\_{PDSCH, c}^{m}>1$ of PDSCHs on a serving cell *c* that are scheduled by [$N\_{PDSCH, c}^{m}$] DCI formats 1\_3 in PDCCH receptions at a same PDCCH monitoring occasion *m*, wherein each of the DCI formats 1\_3 schedule more than one PDSCH receptions on respective more than one serving cells, and *c* is the same smallest cell index among the respective more than one serving cells across the [$N\_{PDSCH, c}^{m}$] DCI formats 1\_3, the serving cell *c* is counted $N\_{PDSCH, c}^{m}$ times for PDCCH monitoring occasion *m* in increasing order of the PDSCH reception starting time among the $N\_{PDSCH, c}^{m}$ PDSCHs
* if the UE indicates *type2-HARQ-ACK-Codebook,* and receives a number $N\_{PDSCH, c}^{m}>1$ of PDSCHs on a serving cell *c* that are scheduled by [$N\_{PDSCH, c}^{m}$] DCI formats 1\_3 in PDCCH receptions at a same PDCCH monitoring occasion *m*, wherein each of the DCI formats 1\_3 schedule more than one PDSCH receptions on respective more than one serving cells, and *c* is the smallest cell index among the respective more than one serving cells which is the same across the [$N\_{PDSCH, c}^{m}$] DCI formats 1\_3, the serving cell *c* is counted $N\_{PDSCH, c}^{m}$ times for PDCCH monitoring occasion *m* in increasing order of the PDSCH reception starting time among the $N\_{PDSCH, c}^{m}$ PDSCHs

Set $mc$ to the index of a serving cell, in a set of indexes of serving cells arranged in ascending order, from the set of $N\_{cells,set}^{DL,max}$ serving cells, $mc=0,…, N\_{cells,set}^{DL,max}−1$Set $m=0$ – PDCCH monitoring occasion index for detection of a DCI format 1\_3 scheduling PDSCH receptions on more than one serving cells from a set of serving cells: lower index corresponds to earlier PDCCH monitoring occasionSet $j=0$Set $V\_{temp}=0$Set $V\_{temp2}=0$Set $V\_{s}=∅$Set $M$ to the number of PDCCH monitoring occasions< unchanged part omitted > |

**Agreement**

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

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

**Conclusion**

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

**Agreement**

The following TP is agreed for Rel-18 38.214.

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

6.2.1.3 UE sounding procedure between component carriers

**<Unchanged parts are omitted>**

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

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

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

**<Unchanged parts are omitted>**

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

**Agreement**

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

**Agreement**

Adopt TP3 in Section 8 of **[R1-2403479](file:///D%3A%5C%5CRAN1%5C%5CRAN1%23117%5C%5Ctdocs%5C%5CFL%20summary%5C%5CR1-2403479.zip)** for TS38.214.

**Conclusion**

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

* No RAN1 spec impact

## Agreements made in RAN1#117

**Agreement**

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

**Agreement**

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

**Agreement**

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

5.1.5 Antenna ports quasi co-location

<text omitted>

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

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

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

- RV = all '1's

- MCS = all '1's

- NDI = 0

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

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

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

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

**Agreement**

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