**3GPP TSG RAN WG1 #117** **R1-240xxxx**

**Fukuoka City, Fukuoka, Japan, May 20th – 24th, 2024**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **38.213** | **CR** |  | **rev** |  | **Current version:** | **18.2.0** |  |
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| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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| ***Title:***  |  Correction on Type-2 HARQ-ACK codebook and DL BWP change |
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| ***Source to WG:*** | Samsung |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core, TEI18 |  | ***Date:*** | 2024-05-22 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | Existing specifications for HARQ-ACK skipping in case of DL/UL BWP change for Type-2 HARQ-ACK codebook do not properly capture the agreements from RAN1#91, RAN1#92, and RAN1#92bis regarding the PUCCH transmission being after a DL/UL BWP change. Also, the existing text on the trigger condition refers to “an active DL BWP change” which can be ambigious and may be interpreted to imply a different DL BWP change on the same or different serving cell. Detailed discussion can be found at R1-2404070. |
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| ***Summary of change:*** | Capture the agreements from RAN1#91 and RAN1#92bis to clarify HARQ-ACK report in case of DL/UL BWP change for Type-2 HARQ-ACK codebook * Add the condition that PUCCH transmission starts at or after a slot of a DL/UL BWP change
* Clarify that the trigger condition is for the same DL BWP change
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| ***Consequences if not approved:*** | Incorrect/ambiguous specifications for Type-2 HARQ-ACK codebook construction in case of DL/UL BWP change. |
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| ***Clauses affected:*** | 9.1.3.1 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | This CR does not prevent earlier implementation by a pre-Rel-17 UE/gNB of the functionality introduced by this CR. |
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| ***This CR's revision history:*** |  |

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

If a UE is configured to monitor PDCCH for multicast DCI formats with CRC scrambled by one or more G-RNTIs for multicast or G-CS-RNTIs that the UE generates a Type-2 HARQ-ACK codebook, the UE separately applies the procedures in this clause per G-RNTI for multicast or per G-CS-RNTI using *maxNrofCodeWordsScheduledByDCI* in *pdsch-ConfigMulticast* except the procedures for SPS PDSCHs and applies the procedures in this clause using *maxNrofCodeWordsScheduledByDCI* provided in *pdsch-Config* for unicast DCI formats excluding the unicast DCI format activating SPS PDSCH receptions, and determines the Type-2 HARQ-ACK codebook by concatenating the Type-2 HARQ-ACK codebook for unicast DCI formats excluding the unicast DCI format activating SPS PDSCH receptions, followed by the HARQ-ACK codebooks for the multicast DCI formats in ascending order of the corresponding G-RNTI values, followed by the HARQ-ACK codebooks for the multicast DCI formats in ascending order of the corresponding G-CS-RNTI values excluding the multicast DCI format activating SPS PDSCH receptions, followed by the HARQ-ACK codebooks for unicast and multicast SPS PDSCH receptions.

A UE determines monitoring occasions for PDCCH with DCI format scheduling PDSCH receptions, or having associated HARQ-ACK information without scheduling PDSCH reception, on an active DL BWP of a serving cell $c$, as described in clause 10.1, and for which the UE transmits HARQ-ACK information in a same PUCCH in slot $n$ based on

- PDSCH-to-HARQ\_feedback timing indicator field values, or a *dl-DataToUL-ACK*, *dl-DataToUL-ACK-r16* or *dl-DataToUL-ACK-DCI-1-2* or *dl-DataToUL-ACK-r17* or *dl-DataToUL-ACK-v1700* or *dl-DataToUL-ACK-DCI-1-2-r17* value if the PDSCH-to-HARQ\_feedback timing indicator field is not present in a DCI format, for PUCCH transmission with HARQ-ACK information in slot $n$, as described in clause 9.2.3, in response to PDSCH receptions, or in response to a DCI format having associated HARQ-ACK information without scheduling PDSCH reception

- slot offsets $K\_{0}$ [6, TS 38.214] provided by time domain resource assignment field in a DCI format scheduling PDSCH receptions and by *pdsch-AggregationFactor*, or *pdsch-AggregationFactor-r16*, or *repetitionNumber*, when provided.

The set of PDCCH monitoring occasions for DCI formats scheduling PDSCH receptions, or having associated HARQ-ACK information without scheduling PDSCH reception, is defined as the union of PDCCH monitoring occasions across active DL BWPs of configured serving cells. PDCCH monitoring occasions are indexed in an ascending order of their start times. The cardinality of the set of PDCCH monitoring occasions defines a total number $M$ of PDCCH monitoring occasions. PDCCH monitoring occasions are separately counted for a DCI format scheduling a PDSCH reception on a single serving cell and for a DCI format scheduling PDSCH receptions on more than one serving cells and corresponding values of $M$ can be different.

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 $0\leq m<M$.

If, for an active DL BWP of a serving cell, the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode* = *joint*, the value of the counter DAI is in the order of the first CORESETs and then the second CORESETs for a same serving cell index and a same PDCCH monitoring occasion index.

The value of the total DAI, when present [5, TS 38.212], in a DCI format denotes the total number of {serving cell, PDCCH monitoring occasion}-pair(s) in which PDSCH reception(s) that provide transport blocks with enabled HARQ-ACK information report, or HARQ-ACK information that does not correspond to PDSCH receptions, associated with DCI formats, excluding the SPS activation DCI, is present, up to the current PDCCH monitoring occasion $m$ and is updated from PDCCH monitoring occasion to PDCCH monitoring occasion. If, for an active DL BWP of a serving cell, the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode* = *joint*, the total DAI value counts the {serving cell, PDCCH monitoring occasion}-pair(s) for both the first CORESETs and the second CORESETs.

Denote by $N\_{C-DAI}^{DL}$ the number of bits for the counter DAI 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 scheduling PDSCH reception, or having associated HARQ-ACK information without scheduling PDSCH reception, on serving cell $c$ in PDCCH monitoring occasion $m$ according to Table 9.1.3-1 or Table 9.1.3-1A. Denote by $V\_{T-DAI,m}^{DL}$ the value of the total DAI in a DCI format 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 that include a total DAI field in PDCCH monitoring occasion $m$. A UE does not expect to multiplex, in a same Type-2 HARQ-ACK codebook, HARQ-ACK information that is in response to detection of DCI formats with different number of bits for the counter DAI field.

If the UE transmits HARQ-ACK information in a PUCCH in slot $n$ and for any PUCCH format, 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, according to the following pseudo-code:

Set $m=0$ – PDCCH, with DCI format scheduling PDSCH reception, or having associated HARQ-ACK information without scheduling a PDSCH reception, monitoring occasion index: lower index corresponds to earlier PDCCH monitoring occasion

Set $j=0$

Set $V\_{temp}=0$

Set $V\_{temp2}=0$

Set $V\_{s}=∅$

Set $N\_{cells}^{DL}$ to the number of serving cells configured by higher layers for the UE

- if, for an active DL BWP of a serving cell, the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for one or more first CORESETs and is provided *coresetPoolIndex* with value 1 for one or more second CORESETs, and is provided *ackNackFeedbackMode = joint,* the serving cell is counted two times where the first time corresponds to the first CORESETs and the second time corresponds to the second CORESETs

- 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 DCI formats in PDCCH receptions at a same PDCCH monitoring occasion *m*, 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

Set $M$ to the number of PDCCH monitoring occasion(s)

while $m<M$

Set $c=0$ – serving cell index: lower indexes correspond to lower RRC indexes of corresponding cell

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

if PDCCH monitoring occasion $m$ is before an active DL BWP change on serving cell $c$ or an active UL BWP change on the serving cell of PUCCH transmission if the UE is provided *pucch-sSCellDyn* or *pucch-sSCellDynDCI-1-2*, or an active UL BWP change on the PCell if the UE is not provided *pucch-sSCellDyn* and *pucch-sSCellDynDCI-1-2,* and the active DL BWP change is not triggered in PDCCH monitoring occasion $m$, and the PUCCH transmission starts at or after a slot for the active DL BWP change or the active UL BWP change

$c=c+1$;

else

if there is a PDSCH providing a transport block for a HARQ process with enabled HARQ-ACK information on serving cell $c$ associated with PDCCH in PDCCH monitoring occasion $m$, or there is a PDCCH providing a DCI format associated with HARQ-ACK information without scheduling PDSCH reception on serving cell $c$

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