**3GPP TSG-RAN WG1 Meeting #107-e *R1-21xxxxx***

**e-Meeting, November 11–19, 2021**

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| *CR-Form-v12.1* |
| **DRAFT CHANGE REQUEST** |
|  |
|  | **38.212** | **CR** |  | **rev** | **-** | **Current version:** | **16.7.0** |  |
|  |
| *For* [***HE******LP***](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:***  |  |
|  |  |
| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** | R1 |
|  |  |
| ***Work item code:*** | NR\_UE\_pow\_sav\_enh-Core |  | ***Date:*** | 2021-11-29 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-17 |
|  | *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-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | Inclusion of Rel-17 UE power saving enhancements. |
|  |  |
| ***Summary of change:*** | Support of Rel-17 UE power saving enhancements: 1. Update DCI formats to support PDCCH monitoring adaptation indication and TRS availability indication.
2. Add DCI format 2\_7 to support paging early indication and TRS availability indication for one or more UEs.
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| ***Consequences if not approved:*** | UE power saving enhancements in Rel-17 will be incomplete. |
|  |  |
| ***Clauses affected:*** | 7.3.1, 7.3.1.1.2, 7.3.1.1.3, 7.3.1.2.1, 7.3.1.2.2, 7.3.1.2.3, 7.3.1.3.8 (new) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.211, TS 38.213, TS 38.214  |
| ***affected:*** |  | **X** |  Test specifications |  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

7.3.1 DCI formats

The DCI formats defined in table 7.3.1-1 are supported.

**Table 7.3.1-1: DCI formats**

|  |  |
| --- | --- |
| **DCI format** | **Usage** |
| 0\_0 | Scheduling of PUSCH in one cell |
| 0\_1 | Scheduling of one or multiple PUSCH in one cell, or indicating downlink feedback information for configured grant PUSCH (CG-DFI) |
| 0\_2 | Scheduling of PUSCH in one cell |
| 1\_0 | Scheduling of PDSCH in one cell |
| 1\_1 | Scheduling of PDSCH in one cell, and/or triggering one shot HARQ-ACK codebook feedback |
| 1\_2 | Scheduling of PDSCH in one cell |
| 2\_0 | Notifying a group of UEs of the slot format, available RB sets, COT duration and search space set group switching |
| 2\_1 | Notifying a group of UEs of the PRB(s) and OFDM symbol(s) where UE may assume no transmission is intended for the UE |
| 2\_2 | Transmission of TPC commands for PUCCH and PUSCH |
| 2\_3 | Transmission of a group of TPC commands for SRS transmissions by one or more UEs |
| 2\_4 | Notifying a group of UEs of the PRB(s) and OFDM symbol(s) where UE cancels the corresponding UL transmission from the UE |
| 2\_5 | Notifying the availability of soft resources as defined in Clause 9.3.1 of [10, TS 38.473] |
| 2\_6 | Notifying the power saving information outside DRX Active Time for one or more UEs |
| 2\_7 | Notifying paging early indication and TRS availability indication for one or more UEs. |
| 3\_0 | Scheduling of NR sidelink in one cell |
| 3\_1 | Scheduling of LTE sidelink in one cell |

The fields defined in the DCI formats below are mapped to the information bits  to  as follows.

Each field is mapped in the order in which it appears in the description, including the zero-padding bit(s), if any, with the first field mapped to the lowest order information bit  and each successive field mapped to higher order information bits. The most significant bit of each field is mapped to the lowest order information bit for that field, e.g. the most significant bit of the first field is mapped to .

If the number of information bits in a DCI format is less than 12 bits, zeros shall be appended to the DCI format until the payload size equals 12.

The size of each DCI format is determined by the configuration of the corresponding active bandwidth part of the scheduled cell and shall be adjusted as described in clause 7.3.1.0 if necessary.

If a UE is configured with *pdsch-HARQ-ACK-CodebookList-r16*, *pdsch-HARQ-ACK-Codebook* is replaced by the relevant entry in *pdsch-HARQ-ACK-CodebookList-r16* in this clause.

< Unchanged parts are omitted >

7.3.1.1.2 Format 0\_1

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

< Unchanged parts are omitted >

- SCell dormancy indication – 0 bit if higher layer parameter *dormancyGroupWithinActiveTime* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to 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. 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.

- Sidelink assignment index – 0, 1 or 2 bits:

- 1 bit if the UE is configured with *pdsch-HARQ-ACK-Codebook* = *semi-static* and, in addition, the UE is configured with a SL configured grant type 1 or to monitor DCI format 3\_0 with CRC scrambled by SL-RNTI or SL-CS-RNTI;

- 2 bits if the UE is configured with *pdsch-HARQ-ACK-Codebook* = *dynamic* and, in addition, the UE is configured with a SL configured grant type 1 or to monitor DCI format 3\_0 with CRC scrambled by SL-RNTI or SL-CS-RNTI;

- 0 bit otherwise.

- PDCCH monitoring adaptation indication – 0, 1 or 2 bits

- 1 or 2 bits, if *searchSpaceGroupIdList-r17* is not configured and if *PDCCHSkippingDurationList* is configured

- 1 bit if the UE is configured with only one duration by *PDCCHSkippingDurationList;*

- 2 bits if the UE is configured with more than one duration by *PDCCHSkippingDurationList*.

- 1 or 2 bits, if *PDCCHSkippingDurationList* is not configured and if *searchSpaceGroupIdList-r17* is configured

- 2 bits, if *PDCCHSkippingDurationList* is configured and if *searchSpaceGroupIdList-r17* is configured

- 0 bit, otherwise

A UE does not expect that the bit width of a field in DCI format 0\_1 with CRC scrambled by CS-RNTI is larger than corresponding bit width of same field in DCI format 0\_1 with CRC scrambled by C-RNTI for the same serving cell. If the bit width of a field in the DCI format 0\_1 with CRC scrambled by CS-RNTI is not equal to that of the corresponding field in the DCI format 0\_1 with CRC scrambled by C-RNTI for the same serving cell, a number of most significant bits with value set to '0' are inserted to the field in DCI format 0\_1 with CRC scrambled by CS-RNTI until the bit width equals that of the corresponding field in the DCI format 0\_1 with CRC scrambled by C-RNTI for the same serving cell.

If the number of information bits in DCI format 0\_1 scheduling a single PUSCH prior to padding is not equal to the number of information bits in DCI format 0\_1 scheduling multiple PUSCHs for the same serving cell, zeros shall be appended to the DCI format 0\_1 with smaller size until the payload size is the same for scheduling a single PUSCH and multiple PUSCHs.

< Unchanged parts are omitted >

7.3.1.1.3 Format 0\_2

DCI format 0\_2 is used for the scheduling of PUSCH in one cell.

< Unchanged parts are omitted >

- Open-loop power control parameter set indication – 0 or 1 or 2 bits.

- 0 bit if the higher layer parameter *p0-PUSCH-SetList* is not configured;

- 1 or 2 bits otherwise,

- 1 bit if SRS resource indicator is present in the DCI format 0\_2;

- 1 or 2 bits as determined by higher layer parameter *olpc-ParameterSetDCI-0-2* if SRS resource indicator is not present in the DCI format 0\_2;

- Priority indicator – 0 bit if higher layer parameter *priorityIndicatorDCI-0-2* is not configured; otherwise 1 bit as defined in Clause 9 in [5, TS 38.213].

- Invalid symbol pattern indicator – 0 bit if higher layer parameter *invalidSymbolPatternIndicatorDCI-0-2* is not configured; otherwise 1 bit as defined in Clause 6.1.2.1 in [6, TS 38.214].

- PDCCH monitoring adaptation indication – 0, 1 or 2 bits

- 1 or 2 bits, if *searchSpaceGroupIdList-r17* is not configured and if *PDCCHSkippingDurationList* is configured

- 1 bit if the UE is configured with only one duration by *PDCCHSkippingDurationList;*

- 2 bits if the UE is configured with more than one duration by *PDCCHSkippingDurationList*.

- 1 or 2 bits, if *PDCCHSkippingDurationList* is not configured and if *searchSpaceGroupIdList-r17* is configured

- 2 bits, if *PDCCHSkippingDurationList* is configured and if *searchSpaceGroupIdList-r17* is configured

- 0 bit, otherwise

A UE does not expect that the bit width of a field in DCI format 0\_2 with CRC scrambled by CS-RNTI is larger than corresponding bit width of same field in DCI format 0\_2 with CRC scrambled by C-RNTI for the same serving cell. If the bit width of a field in the DCI format 0\_2 with CRC scrambled by CS-RNTI is not equal to that of the corresponding field in the DCI format 0\_2 with CRC scrambled by C-RNTI for the same serving cell, a number of most significant bits with value set to '0' are inserted to the field in DCI format 0\_2 with CRC scrambled by CS-RNTI until the bit width equals that of the corresponding field in the DCI format 0\_2 with CRC scrambled by C-RNTI for the same serving cell.

< Unchanged parts are omitted >

7.3.1.2 DCI formats for scheduling of PDSCH

7.3.1.2.1 Format 1\_0

DCI format 1\_0 is used for the scheduling of PDSCH in one DL cell.

< Unchanged parts are omitted >

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by P-RNTI:

- Short Messages Indicator – 2 bits according to Table 7.3.1.2.1-1.

- Short Messages – 8 bits, according to Clause 6.5 of [9, TS38.331]. If only the scheduling information for Paging is carried, this bit field is reserved.

- Frequency domain resource assignment – bits. If only the short message is carried, this bit field is reserved.

-  is the size of CORESET 0

- Time domain resource assignment – 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]. If only the short message is carried, this bit field is reserved.

- VRB-to-PRB mapping – 1 bit according to Table 7.3.1.2.2-5. If only the short message is carried, this bit field is reserved.

- Modulation and coding scheme – 5 bits as defined in Clause 5.1.3 of [6, TS38.214], using Table 5.1.3.1-1. If only the short message is carried, this bit field is reserved.

- TB scaling – 2 bits as defined in Clause 5.1.3.2 of [6, TS38.214]. If only the short message is carried, this bit field is reserved.

- TRS availability indication – 1, 2, 3, 4, 5, or 6 bits if *TRS-ResourceSetConfig* is configured; 0 bits otherwise.

- Reserved bits – (8 – *M*) bits for operation in a cell with shared spectrum channel access, (6 – *M*) bits for operation in a cell without shared spectrum channel access, where the value of *M* is the number of bits for the field of 'TRS availability indication' as defined above.

< Unchanged parts are omitted >

7.3.1.2.2 Format 1\_1

DCI format 1\_1 is used for the scheduling of PDSCH in one cell.

< Unchanged parts are omitted >

- SCell dormancy indication – 0 bit if higher layer parameter *dormancyGroupWithinActiveTime* is not configured; otherwise 1, 2, 3, 4 or 5 bits bitmap determined according to 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. 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.

If one-shot HARQ-ACK request is not present or set to '0', and all bits of frequency domain resource assignment are set to 0 for resource allocation type 0 or set to 1 for resource allocation type 1 or set to 0 or 1 for dynamic switch resource allocation type, this field is reserved and the following fields among the fields above are used for SCell dormancy indication, where each bit corresponds to one of the configured SCell(s), with MSB to LSB of the following fields concatenated in the order below corresponding to the SCell with lowest to highest SCell index

- Modulation and coding scheme of transport block 1

- New data indicator of transport block 1

- Redundancy version of transport block 1

- HARQ process number

- Antenna port(s)

- DMRS sequence initialization

- PDCCH monitoring adaptation indication – 0, 1 or 2 bits

- 1 or 2 bits, if *searchSpaceGroupIdList-r17* is not configured and if *PDCCHSkippingDurationList* is configured

- 1 bit if the UE is configured with only one duration by *PDCCHSkippingDurationList;*

- 2 bits if the UE is configured with more than one duration by *PDCCHSkippingDurationList*.

- 1 or 2 bits, if *PDCCHSkippingDurationList* is not configured and if *searchSpaceGroupIdList-r17* is configured

- 2 bits, if *PDCCHSkippingDurationList* is configured and if *searchSpaceGroupIdList-r17* is configured

- 0 bit, otherwise

If DCI formats 1\_1 are monitored in multiple search spaces associated with multiple CORESETs in a BWP for scheduling the same serving cell, zeros shall be appended until the payload size of the DCI formats 1\_1 monitored in the multiple search spaces equal to the maximum payload size of the DCI format 1\_1 monitored in the multiple search spaces.

< Unchanged parts are omitted >

7.3.1.2.3 Format 1\_2

DCI format 1\_2 is used for the scheduling of PDSCH in one cell.

< Unchanged parts are omitted >

- DMRS sequence initialization – 0 or 1 bit

- 0 bit if the higher layer parameter *dmrs-SequenceInitializationDCI-1-2* is not configured;

- 1 bit otherwise.

- Priority indicator – 0 bit if higher layer parameter *priorityIndicatorDCI-1-2* is not configured; otherwise 1 bit as defined in Clause 9 in [5, TS 38.213].

- PDCCH monitoring adaptation indication – 0, 1 or 2 bits

- 1 or 2 bits, if *searchSpaceGroupIdList-r17* is not configured and if *PDCCHSkippingDurationList* is configured

- 1 bit if the UE is configured with only one duration by *PDCCHSkippingDurationList;*

- 2 bits if the UE is configured with more than one duration by *PDCCHSkippingDurationList*.

- 1 or 2 bits, if *PDCCHSkippingDurationList* is not configured and if *searchSpaceGroupIdList-r17* is configured

- 2 bits, if *PDCCHSkippingDurationList* is configured and if *searchSpaceGroupIdList-r17* is configured

- 0 bit, otherwise

If DCI formats 1\_2 are monitored in multiple search spaces associated with multiple CORESETs in a BWP for scheduling the same serving cell, zeros shall be appended until the payload size of the DCI formats 1\_2 monitored in the multiple search spaces equal to the maximum payload size of the DCI format 1\_2 monitored in the multiple search spaces.

**Table 7.3.1.2.3-1: Redundancy version**

|  |  |
| --- | --- |
| Value of the Redundancy version field | Value of  to be applied |
| 0 | 0 |
| 1 | 3 |

#### 7.3.1.3 DCI formats for other purposes

< Unchanged parts are omitted >

##### 7.3.1.3.8 Format 2\_7

DCI format 2\_7 is used for notifying the paging early indication and TRS availability indication for one or more UEs.

The following information is transmitted by means of the DCI format 2\_7 with CRC scrambled by PEI-RNTI:

- Paging indication field – $N\_{PO}^{PEI}N\_{SG}^{PO}$ bit(s), where

- $N\_{PO}^{PEI}$ is the number of paging occasions configured by higher layer parameter *PONumPerPEI* as defined in Clause 10.4A in [5, TS 38.213];

- $N\_{SG}^{PO}$is the number of sub-groups of a paging occasion configured by higher layer parameter *subgroupsNumPerPO*, if *subgroupsNumPerPO* is configured and not set to 0; otherwise $N\_{SG}^{PO}$ is set to 1.

Each bit in the field indicates one UE subgroup of a paging occasion if subgroupsNumPerPO is configured and not set to 0; otherwise each bit in the field indicates the UE group of a paging occasion.

- TRS availability indication – 1, 2, 3, 4, 5, or 6 bits if *TRS-ResourceSetConfig* is configured; 0 bits otherwise.

The size of DCI format 2\_7 is indicated by the higher layer parameter *payloadSizeDCI\_format2\_7*, according to Clause 10.4A of [5, TS 38.213]. If the number of information bits in format 2\_7 is less than the size of format 2\_7, the remaining bits are reserved.