**3GPP TSG-RAN WG1 Meeting #108-e *R1-22xxxxx***

**e-Meeting, February 21 – March 3, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **38.212** | **CR** |  | **rev** | **-** | **Current version:** | **17.0.0** |  |
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| *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:*** | Corrections on NR Multicast and Broadcast Services in 38.212 | | | | | | | | | |
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| ***Source to WG:*** | Huawei | | | | | | | | | |
| ***Source to TSG:*** | R1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MBS | | | | |  | ***Date:*** | | | 2022-03-08 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***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 can be 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)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Capture endorsed TPs and agreements from RAN1#107bis-e and RAN1#108-e. | | | | | | | | |
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| ***Summary of change:*** | | 1. Incorporate the TPs agreed in RAN1#107bis-e meeting, including the TP for Table 5.4.2.1-1 and the TP for clause 7.3.1.5.1. 2. Reflect the agreements achieved in RAN1#107bis-e meeting, including adding fields of MCS/NDI/RV for transport block 2, adding the field of “ZP CSI-RS trigger” in Clasue 7.3.1.5.3, and adding the description that the size of DCI format 4\_2 is configurable. 3. Incorporate the TPs agreed in RAN1#108-e meeting, including the TP for clause 7.3.1.5.2 and the TP for clause 7.3.1.5.3. 4. Reflect the agreements achieved in RAN1#108-e meeting, including deleting the case of 4 bits for DAI field in DCI format 4\_2 and deleting the case of UE configured with a PUCCH-SCell in DCI format 4\_2 since only one cell is configured for multicast. | | | | | | | | |
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| ***Consequences if not approved:*** | | The specification for NR Multicast and Broadcast Services is incomplete. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.4.2.1, 7.3.1.5.1, 7.3.1.5.2, 7.3.1.5.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS 38.213, TS 38.214 | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

#### 5.4.2.1 Bit selection

The bit sequence after encoding  from Clause 5.3.2 is written into a circular buffer of length  for the -th coded block, where  is defined in Clause 5.3.2.

For the -th code block, let  if  and  otherwise, where, ,  is determined according to Clause 6.1.4.2 in [6, TS 38.214] for UL-SCH and Clause 5.1.3.2 in [6, TS 38.214] for DL-SCH/PCH, assuming the following:

For one TB for DL-SCH with PDSCH scheduled by DCI format 4\_0/4\_1/4\_2,

- if the PDSCH is scheduled by DCI format 4\_1/4\_2,

- maximum number of layers is given by X, where

- if the higher layer parameter *maxMIMO-Layers-Multicast* of *PDSCH-Config-Multicast* is configured*,* X is given by that parameter;

- otherwise, X equals to 1;

- if the higher layer parameter *mcs-Table* given bya *PDSCH-Config-Multicast* for at least one common frequency resource (CFR) is set to 'qam256', maximum modulation orderis assumed for DL-SCH; otherwise a maximum modulation orderis assumed for DL-SCH;

- if the PDSCH is scheduled by DCI format 4\_0,

- maximum number of layers is 1;

- if the higher layer parameter *mcs-Table* given by a *PDSCH-Config-MCCH* is set to 'qam256', maximum modulation order is assumed for DL-SCH; otherwise a maximum modulation order is assumed for DL-SCH;

- if the higher layer parameter *mcs-Table* given by a *PDSCH-Config-MTCH* is set to 'qam256', maximum modulation orderis assumed for DL-SCH; otherwise a maximum modulation order is assumed for DL-SCH;

- is given by Table 5.4.2.1-1, where the value of for DL-SCH is determined according to the size of the CFR if only one CFR is configured to the UE;

- maximum coding rate of 948/1024;

- ;

- is the number of code blocks of the transport block determined according to Clause 5.2.2.

For one TB for UL-SCH, or for one TB for DL-SCH/PCH except for DL-SCH with PDSCH scheduled by DCI format 4\_0/4\_1/4\_2,

- maximum number of layers for one TB for UL-SCH is given by X, where

- if the higher layer parameter *maxMIMO-Layers* of *PUSCH-ServingCellConfig* of the serving cell is configured, X is given by that parameter

- elseif the higher layer parameter *maxRank* of *pusch-Config* of the serving cell is configured, X is given by the maximum value of *maxRank* across all BWPs of the serving cell

- otherwise, X is given by the maximum number of layers for PUSCH supported by the UE for the serving cell

- maximum number of layers for one TB for DL-SCH/PCH is given by the minimum of X and 4, where

- if the higher layer parameter *maxMIMO-Layers* of *PDSCH-ServingCellConfig* of the serving cell is configured, X is given by that parameter

- otherwise, X is given by the maximum number of layers for PDSCH supported by the UE for the serving cell

- if the higher layer parameter *mcs-Table-r17* or *mcs-TableDCI-1-2-r17* given by a *pdsch-Config* for at least one DL BWP of the serving cell is set to 'qam1024', maximum modulation order is assumed for DL-SCH, else if the higher layer parameter *mcs-Table* or *mcs-TableDCI-1-2* given by a *pdsch-Config* for at least one DL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for DL-SCH; otherwise a maximum modulation order  is assumed for DL-SCH;

- if the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* or *mcs-TableDCI-0-2* or *mcs-TableTransformPrecoderDCI-0-2* given by a *pusch-Config* or the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* given by *configuredGrantConfig* for at least one UL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for UL-SCH; otherwise a maximum modulation order  is assumed for UL-SCH

- maximum coding rate of 948/1024;

-  is given by Table 5.4.2.1-1, where the value of  for DL-SCH is determined according to the initial downlink bandwidth part if there is no other downlink bandwidth part configured to the UE;

- ;

-  is the number of code blocks of the transport block determined according to Clause 5.2.2.

Table 5.4.2.1-1: Value of 

|  |  |
| --- | --- |
| Maximum number of PRBs across all configured DL BWPs and UL BWPs of a carrier for DL-SCH and UL-SCH, respectively,  or  Maximum number of PRBs across all CFRs of a carrier for DL-SCH with PDSCH scheduled by DCI format 4\_0/4\_1/4\_2 |  |
| Less than 33 | 32 |
| 33 to 66 | 66 |
| 67 to 107 | 107 |
| 108 to 135 | 135 |
| 136 to 162 | 162 |
| 163 to 217 | 217 |
| Larger than 217 | 273 |

< Unchanged parts are omitted >

##### 7.3.1.5.1 Format 4\_0

DCI format 4\_0 is used for the scheduling of PDSCH for broadcast in DL cell.

The following information is transmitted by means of the DCI format 4\_0 with CRC scrambled by MCCH-RNTI or G-RNTI for MTCH configured by *MBS-SessionInfo*:

- Frequency domain resource assignment – bits where equals to

* the size of CORESET 0 if CORESET 0 is configured for the cell; and
* the size of initial DL bandwidth part if CORESTE 0 is not configured for the cell.

- Time domain resource assignment – 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]

- VRB-to-PRB mapping – 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme – 5 bits as defined in Clause 5.1.3 of [6, TS38.214]

- Redundancy version – 2 bits as defined in Table 7.3.1.1.1-2

- MCCH change notification – 2 bits as defined in Clause x.x.x of [8, TS38.321] if the CRC of the DCI format 4\_0 is scrambled by MCCH-RNTI. Otherwise, this bit field is reserved.

- Padding bits, if required

Zeros shall be appended to DCI format 4\_0 until the payload size equals that of DCI format 1\_0 monitored in common search space in the same serving cell.

7.3.1.5.2 Format 4\_1

DCI format 4\_1 is used for the scheduling of PDSCH for multicast in DL cell.

The following information is transmitted by means of the DCI format 4\_1 with CRC scrambled by G-RNTI configured by *G-RNTI-Config* or G-CS-RNTI:

- Frequency domain resource assignment – bits where equals to as given by clause 7.3.1.0

- Time domain resource assignment – 4 bits as defined in Clause 5.1.2.1 of [6, TS38.214]

- VRB-to-PRB mapping – 1 bit according to Table 7.3.1.2.2-5

- Modulation and coding scheme – 5 bits as defined in Clause 5.1.3 of [6, TS38.214]

- New data indicator – 1 bit

- Redundancy version – 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number – 4 bits

- Downlink assignment index – 2 bits as defined in Clause 9.1.3 of [5, TS 38.213], as counter DAI

- PUCCH resource indicator – 3 bits as defined in Clause 9.2.3 of [5, TS38.213]

- PDSCH-to-HARQ\_feedback timing indicator – 3 bits as defined in Clause 9.2.3 of [5, TS38.213]

- Reserved bits – 3 bits

##### 7.3.1.5.3 Format 4\_2

DCI format 4\_2 is used for the scheduling of PDSCH in DL cell.

The following information is transmitted by means of the DCI format 4\_2 with CRC scrambled by G-RNTI configured by *G-RNTI-Config* or G-CS-RNTI:

- Frequency domain resource assignment – number of bits determined by the following, where is the size of the common frequency resource as configured by higher layer parameter *locationAndBandwidth-Multicast*:

- bits if only resource allocation type 0 is configured, where is defined in Clause 5.1.2.2.1 of [6, TS38.214],

- bits if only resource allocation type 1 is configured, or

- bits if *resourceAllocation* in *PDSCH-Config-Multicast* is configured as '*dynamicSwitch'*.

- If *resourceAllocation* in *PDSCH-Config-Multicast* is configured as '*dynamicSwitch'*, the MSB bit is used to indicate resource allocation type 0 or resource allocation type 1, where the bit value of 0 indicates resource allocation type 0 and the bit value of 1 indicates resource allocation type 1.

- For resource allocation type 0, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.1 of [6, TS 38.214].

- For resource allocation type 1, the LSBs provide the resource allocation as defined in Clause 5.1.2.2.2 of [6, TS 38.214]

- Time domain resource assignment – 0, 1, 2, 3, or 4 bits as defined in Clause 5.1.2.1 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *pdsch-TimeDomainAllocationList* if the higher layer parameter is configured; otherwise *I* is the number of entries in the default table.

- VRB-to-PRB mapping – 0 or 1 bit:

- 0 bit if only resource allocation type 0 is configured or if *vrb-ToPRB-Interleaver* in *PDSCH-Config-Multicast* is not configured;

- 1 bit according to Table 7.3.1.2.2-5 otherwise, only applicable to resource allocation type 1, as defined in Clause 7.3.1.6 of [4, TS 38.211].

- PRB bundling size indicator – 0 bit if the higher layer parameter *prb-BundlingType* is not configured in *PDSCH-Config-Multicast* or is set to 'staticBundling', or 1 bit if the higher layer parameter *prb-BundlingType* in *PDSCH-Config-Multicast* is set to 'dynamicBundling' according to Clause 5.1.2.3 of [6, TS 38.214].

- Rate matching indicator – 0, 1, or 2 bits according to higher layer parameters *rateMatchPatternGroup1* and *rateMatchPatternGroup2* in *PDSCH-Config-Multicast*, where the MSB is used to indicate *rateMatchPatternGroup1* and the LSB is used to indicate *rateMatchPatternGroup2* when there are two groups.

- ZP CSI-RS trigger – 0, 1, or 2 bits as defined in Clause 5.1.4.2 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where is the number of aperiodic ZP CSI-RS resource sets configured in *PDSCH-Config-Multicast*.

For transport block 1:

- Modulation and coding scheme – 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]

- New data indicator – 1 bit

- Redundancy version – 2 bits as defined in Table 7.3.1.1.1-2

For transport block 2 (only present if *maxNrofCodeWordsScheduledByDCI* equals 2):

- Modulation and coding scheme – 5 bits as defined in Clause 5.1.3.1 of [6, TS 38.214]

- New data indicator – 1 bit

- Redundancy version – 2 bits as defined in Table 7.3.1.1.1-2

- HARQ process number – 4 bits

- Downlink assignment index – number of bits as defined in the following

- 2 bits if the higher layer parameter *pdsch-HARQ-ACK-Codebook-Multicast=dynamic*, where the 2 bits are the counter DAI;

- 0 bits otherwise.

If higher layer parameter *priorityIndicatorDCI-4-2* is configured in *PDSCH-Config-Multicast*, if the bit width of the Downlink assignment index in DCI format 4\_2 for one HARQ-ACK codebook is not equal to that of the Downlink assignment index in DCI format 4\_2 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller Downlink assignment index until the bit width of the Downlink assignment index in DCI format 4\_2 for the two HARQ-ACK codebooks are the same.

- PUCCH resource indicator – 3 bits as defined in Clause 9.2.3 of [5, TS 38.213]

- PDSCH-to-HARQ\_feedback timing indicator – 0, 1, 2, or 3 bits as defined in Clause 9.2.3 of [5, TS 38.213]. The bitwidth for this field is determined as bits, where *I* is the number of entries in the higher layer parameter *dl-DataToUL-ACK* in *PUCCH-Config-Multicast1* if configured or *PUCCH-Config-Multicast2* if configured; otherwise, *I* is the number of entries in the higher layer parameter *dl-DataToUL-ACK* in *PUCCH-Config.*

If higher layer parameter *priorityIndicatorDCI-4-2* is configured in *PDSCH-Config-Multicast*, if the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 4\_2 for one HARQ-ACK codebook is not equal to that of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 4\_2 for the other HARQ-ACK codebook, a number of most significant bits with value set to '0' are inserted to smaller PDSCH-to-HARQ\_feedback timing indicator until the bit width of the PDSCH-to-HARQ\_feedback timing indicator in DCI format 4\_2 for the two HARQ-ACK codebooks are the same.

- Antenna port(s) – 4, 5, or 6 bits as defined by Tables 7.3.1.2.2-1/2/3/4, where the number of CDM groups without data of values 1, 2, and 3 refers to CDM groups {0}, {0,1}, and {0, 1,2} respectively. The antenna ports shall be determined according to the ordering of DMRS port(s) given by Tables 7.3.1.2.2-1/2/3/4.

If a UE is configured with both *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB*, the bitwidth of this field equals , where is the "Antenna ports" bitwidth derived according to *dmrs-DownlinkForPDSCH-MappingTypeA* and is the "Antenna ports" bitwidthderived according to *dmrs-DownlinkForPDSCH-MappingTypeB*. A number of zeros are padded in the MSB of this field, if the mapping type of the PDSCH corresponds to the smaller value of and .

- Transmission configuration indication – 0 bit if higher layer parameter *tci-PresentInDCI* in *PDCCH-Config-Multicast* is not enabled; otherwise 3 bits as defined in Clause 5.1.5 of [6, TS38.214].

- DMRS sequence initialization – 1 bit.

- Priority indicator – 0 bit if higher layer parameter *priorityIndicatorDCI-4-2* is not configured in *PDSCH-Config-Multicast*; otherwise 1 bit as defined in Clause 9 in [5, TS 38.213].

- Enabling/disabling HARQ-ACK feedback indication –1 bit if higher layer parameter *harq-FeedbackEnabler-Multicast* indicates *dci-enabler*; 0 bit, otherwise.

The size of DCI format 4\_2 is configurable by higher layer parameter *sizeDCI-4-2* from 20 bits and up to 140 bits.

< Unchanged parts are omitted >