**3GPP TSG-RAN WG1 Meeting #100bis-e R1-200XXXX**

**E-Meeting, April 20 – April 30, 2020**

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| *CR-Form-v12.0* |
| **[DRAFT] CHANGE REQUEST** |
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|  | **38.214** | **CR** | **-** | **rev** | **-** | **Current version:** | **15.9.0** |  |
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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:***  | Clarification on rate-matching for PDSCH in TS38.214 |
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| ***Source to WG:*** | Huawei, HiSilicon, [Qualcomm] |
| ***Source to TSG:*** | R1 |
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| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2020-04-20 |
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| ***Category:*** | **F** |  | ***Release:*** | Rel-15 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | In section 5.1.4, there is a general description for PDSCH resource mapping* When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Subclauses 5.1.4.1, 5.1.4.2 are not available for PDSCH.

However, it is not clear how the “configured or dynamically indicated resources” are determined and when these resources are not available for PDSCH. Hence some more details are provided in section 5.1.4.1 and section 5.1.4.2.In section 5.1.4.1, there are some detailed description for PDSCH resource mapping for the following cases1. PDSCH resource mapping with respect to the REs corresponding to the configured resources that are include in the higher layer configured parameter *rateMatchPatternGroup1* or *rateMatchPatternGroup2* for
	* PDSCH scheduled by DCI format 1\_1
	* PDSCH scheduled by DCI format 1\_0
	* PDSCHs with SPS activated by DCI format 1\_0
2. PDSCH resource mapping with respect to the REs corresponding to the configured resources that are not include in the higher layer configured parameter *rateMatchPatternGroup1* or *rateMatchPatternGroup2* for
	* PDSCH scheduled by DCI format 1\_1

Hence, some clarification are needed for the following cases1. PDSCH resource mapping with respect to the REs corresponding to the configured resources that are include in the higher layer configured parameter *rateMatchPatternGroup1* or *rateMatchPatternGroup2* for
	* PDSCHs with SPS activated by DCI format 1\_1
2. PDSCH resource mapping with respect to the REs corresponding to the configured resources that are not include in the higher layer configured parameter *rateMatchPatternGroup1* or *rateMatchPatternGroup2* for
	* PDSCH scheduled by DCI format 1\_0
	* PDSCHs with SPS activated by DCI format 1\_0
	* PDSCHs with SPS activated by DCI format 1\_0

In addition, * The spec uses the terminology “RB and symbol level resource sets”. However, this is not accurate and would have a risk of misinterpretation, since “the resource sets configured by *rateMatchPattern(s)*” is formed by the set(s) of three bit-maps, including *periodicityAndPattern*. It should be clarified that the resource sets are the unions of resource sets configured by *rateMatchPattern(s)*.
* For a given PDSCH, the rate match indicator field value should be applicable only to the scheduled PDSCH. For example, suppose there are two PDSCHs in one slot scheduled by two different DCI format 1\_1, and they overlap with part of the union of REs configured by *rateMatchPattern(s)* in the slot that belong to a *rateMatchPatternGroup1*. Then, for each PDSCH, whether to perform rate-match based on the resource sets in *rateMatchPatternGroup1* depends on the own scheduling DCI. This should be clear in the spec.
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| ***Summary of change:*** | 1. Clarify that the configured RB-symbol level resource-sets that are not included in either *rateMatchPatternGroup1* or *rateMatchPatternGroup2* are not available for PDSCH scheduled by DCI format 1\_0, PDSCHs with SPS activated by DCI format 1\_0, or PDSCHs with SPS activated by DCI format 1\_1.
2. Clarify that the configured RB-symbol level resource-sets that are in either *rateMatchPatternGroup1* or *rateMatchPatternGroup2* are not available for the PDSCHs with SPS activated by DCI format 1\_1 if a corresponding bit of the rate matching indicator field in DCI format 1\_1 scheduling the PDSCH is equal to 1.
3. Clarify that the rate-matching is perfomed according to the *rateMatchPattern(s)*, with each including three bit-maps (including *periodictyAndPattern*).
4. Clarify that for a given PDSCH, the rate match indicator field value is valid only for the scheduled PDSCH
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| ***Consequences if not approved:*** | There may be different understanding between UE and gNB on PDSCH resource mapping, resulting in PDSCH decoding failure. |
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| ***Clauses affected:*** |  5.1.4.1 |
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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:*** | **Isolated impact analysis:**This CR has isolated impact. This CR impacts the rate matching of the configured RB-level resources for PDSCH. If the UE is implemented in accordance to this CR and the gNB is not, or the gNB is implemented in accordance to this CR and the UE is not, there will be different understanding between UE and gNB on PDSCH resource mapping and PDSCH detection failure occurs. It is expected both the gNB and UE have been implemented in accordance to the CR due to agreement in RAN1#96bis. |

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| ***This CR's revision history:*** |  |

#### 5.1.4.1 PDSCH resource mapping with RB symbol level granularity

A UE may be configured with any of the following higher layer parameters indicating REs declared as not available for PDSCH:

- *rateMatchPatternToAddModList* given by *PDSCH-Config,* by *ServingCellConfig* or by *ServingCellConfigCommon* and configuring up to 4 *RateMatchPattern(s)* per BWP and up to 4 *RateMatchPattern(s)* per serving-cell. A *RateMatchPattern* may contain:

- within a BWP, when provided by *PDSCH-Config* or within a serving cell when provided by *ServingCellConfig* or *ServingCellConfigCommon*, a pair of reserved resources with numerology provided by higher layer parameter *subcarrierSpacing* given by *RateMatchPattern* when configured per serving cellor by numerology of associated BWP when configured per BWP.The pair of reserved resources are respectively indicated by an RB level bitmap (higher layer parameter *resourceBlocks* given by *RateMatchPattern* ) with 1RB granularity and a symbol level bitmap spanning one or two slots (higher layer parameters *symbolsInResourceBlock* given by *RateMatchPattern* ) for which the reserved RBs apply. A bit value equal to 1 in the RB and symbol level bitmaps indicates that the corresponding resource is not available for PDSCH. For each pair of RB and symbol level bitmaps, a UE may be configured with a time-domain pattern (higher layer parameter *periodicityAndPattern* given by *RateMatchPattern* ), where each bit of *periodicityAndPattern* corresponds to a unit equal to a duration of the symbol level bitmap, and a bit value equal to 1 indicates that the pair is present in the unit. The *periodicityAndPattern* can be {1, 2, 4, 5, 8, 10, 20 or 40} units long, but maximum of 40ms. The first symbol of *periodicityAndPattern* every 40ms/P periods is a first symbol in frame $n\_{f}$ mod 4 = 0, where P is the duration of *periodicityAndPattern* in units of ms. When *periodicityAndPattern* is not configured for a pair, for a symbol level bitmap spanning two slots, the bits of the first and second slots correspond respectively to even and odd slots of a radio frame, and for a symbol level bitmap spanning one slot, the bits of the slot correspond to every slot of a radio frame. The pair can be included in one or two groups of resource sets (higher layer parameters *rateMatchPatternGroup1*and *rateMatchPatternGroup2*). The *rateMatchPatternToAddModList* given by *ServingCellConfig* or *ServingCellConfigCommon* configuration in numerology *µ* applies only to PDSCH of the same numerology *µ*.

- within a BWP, a frequency domain resource of a CORESET configured by *ControlResourceSet* with *controlResourceSetId* or *ControlResourceSetZero* and time domain resource determined by the higher layer parameters *monitoringSlotPeriodicityAndOffset,* *duration* and *monitoringSymbolsWithinSlot* of all search-space-sets configured by *SearchSpace* and time domain resource of search-space-set zero configured by *searchSpaceZero* associated with the CORESET as well as CORESET duration configured by *ControlResourceSet* with *controlResourceSetId* or *ControlResourceSetZero.* This resource not available for PDSCH can be included in one or two groups of resource sets (higher layer parameters *rateMatchPatternGroup1* and *rateMatchPatternGroup2*).

A configured group *rateMatchPatternGroup1* or *rateMatchPatternGroup2* contains alist of indices of of *rateMatchPattern(s)* forming a union of resource-sets not available for a PDSCH dynamically if a corresponding bit of the Rate matching indicator field of the DCI format 1\_1 scheduling the PDSCH is equal to 1. The REs corresponding to the union of configured RB-symbol level resource-sets that are not included in either of the two groups are not available for PDSCH scheduled by DCI format 1\_0, PDSCH scheduled by DCI format 1\_1 or PDSCHs with SPS. When receiving PDSCH scheduled by a DCI format 1\_0 or PDSCHs with SPS activated by a DCI format 1\_0, the REs corresponding to configured resources in *rateMatchPatternGroup1* or *rateMatchPatternGroup2* are not available for the scheduled PDSCH or PDSCHs with SPS. When receiving PDSCH with SPS activated by a DCI format 1\_1, the REs corresponding to configured resources in rateMatchPatternGroup1 or rateMatchPatternGroup2 are not available for the PDSCHs with SPS if a corresponding bit of the rate matching indicator field in the DCI format 1\_1 activating the PDSCH with SPS is equal to 1.

For a bitmap pair included in one or two groups of resource sets, the dynamic indication of availability for PDSCH applies to a set of slot(s) where the *rateMatchPatternToAddModList* is present among the slots of scheduled PDSCH.

If a UE monitors PDCCH candidates of aggregation levels 8 and 16 with the same starting CCE index in non-interleaved CORESET spanning one OFDM symbol and if a detected PDCCH scheduling the PDSCH has aggregation level 8, the resources corresponding to the aggregation level 16 PDCCH candidate are not available for the PDSCH.

If a PDSCH scheduled by a PDCCH would overlap with resources in the CORESET containing the PDCCH, the resources corresponding to a union of the detected PDCCH that scheduled the PDSCH and associated PDCCH DM-RS are not available for the PDSCH. When *precoderGranularity* configured in a CORESET where the PDCCH was detected is equal to *allContiguousRBs*, the associated PDCCH DM-RS are DM-RS in all REGs of the CORESET. Otherwise, the associated DM-RS are the DM-RS in REGs of the PDCCH.

#### < Unchanged parts are omitted >