**3GPP TSG-SA5 Meeting #141-e *S5-221058***

**e-meeting, 17 - 26 January 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **28.552** | **CR** | **0341** | **rev** | **1** | **Current version:** | **17.5.0** |  |
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| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)*** *on using this form: comprehensive instructions can be found at <http://www.3gpp.org/Change-Requests>.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Add Space Division Multiplexing PRB Usage for MIMO cell |
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| ***Source to WG:*** | CMCC, Huawei, ZTE  |
| ***Source to TSG:*** | SA5 |
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| ***Work item code:*** | ePM\_KPI\_5G |  | ***Date:*** | 2022-01-06 |
|  |  |  |  |  |
| ***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)* |
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| ***Reason for change:*** | 1. Due to MIMO technology (strong Space Division Multiplexing ability), the capacity of 5G MIMO cell has been improved obviously. Accordingly, the PRB usage (i.e. capacity usage) should take this improvement into consideration.
2. In RAN2 116-e meeting (November, 2021), a refined computing scheme (PRB Usage based on statistical MIMO layer) had been agreed for 5G cell in MIMO scenario. It is necessary to introduce this scheme to TS 28.552, as an important KPI to support operators to run NG-RAN.
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| ***Summary of change:*** | Introduce the computing scheme for PRB usage in MIMO scenario, which had been agreed in RAN2 meeting recently. |
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| ***Consequences if not approved:*** | Lack of choices to compute PRB usage in 5G MIMO scenario. |
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| ***Clauses affected:*** | 5.1.1.2.x(new), 5.1.1.2.y(new), A.96 |
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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)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| **1st Change** |

##### 5.1.1.2.x SDM PDSCH PRB Usage

a) Due to MIMO technology (strong Space Division Multiplexing ability), the cell capacity has been improved obviously. This measurement provides the total usage (in percentage) of PDSCH physical resource blocks (PRBs), based on statistical MIMO layers. The objective is to measure the usage of cell DL capacity in MIMO scenario. A use-case is wireless network workload observation.

b) SI

c) This measurement is defined according to "PDSCH PRB Usage based on statistical MIMO layer in the DL per cell " in TS 38.314 [29] as:

Where

 denotes total PDSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value.

 denotes a count of PDSCH PRBs used for traffic transmission for UE on single MIMO layer per cell at sampling occasion . Counting unit for PRB is 1 Resource Block x 1 symbol. (1 Resource Block = 12 sub-carriers).

 denotes the number of MIMO layers scheduled for UE at sampling occasion .

denotes a UE that is scheduled during time period .

 denotes sampling occasion during time period . A sampling occasion is 1 symbol.

 denotes total number of PDSCH PRBs available for sampling occasion *j* on single MIMO layer per cell.

 denotes the time period during which the measurement is performed to calculate , e.g. 15min, 1 hour, etc.

 is a variable factor for MIMO layers assigned with the maximum during time period 2 with float value 1.00-100.00. For this measurement, the same β value is used for the entire duration of T1.

 is the "Average value of scheduled MIMO layers per PRB on the DL", during time period with float value 1.00-100.00, as defined in 5.1.1.30.

 denotes time period during which the measurement is performed to calculate , as defined in 5.1.1.30.

 is the time period during which the measurement is performed to calculate , e.g.1 week, etc.

d) A single integer value from 0 to 100.

e) RRU.PrbTotSdmDl, which indicates the DL SDM PRB Usage in a Cell supporting MIMO.

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for monitoring the DL Radio Resource Utilization in a cell supporting MIMO.

##### 5.1.1.2.y SDM PUSCH PRB Usage

a) Due to MIMO technology (strong Space Division Multiplexing ability), the cell capacity has been improved obviously. This measurement provides the total usage (in percentage) of PUSCH physical resource blocks (PRBs), based on statistical MIMO layers. The objective is to measure the usage of cell UL capacity in MIMO scenario. A use-case is wireless network workload observation.

b) SI

c) This measurement is defined according to "PUSCH PRB Usage based on statistical MIMO layer in the UL per cell " in TS 38.314 [29] as:

Where

 denotes total PUSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value.

 denotes a count of PUSCH PRBs used for traffic transmission for UE on single MIMO layer per cell at sampling occasion . Counting unit for PRB is 1 Resource Block x 1 symbol. (1 Resource Block = 12 sub-carriers).

 denotes the number of MIMO layers scheduled for UE at sampling occasion.

 denotes a UE that is scheduled during time period .

 denotes sampling occasion during time period . A sampling occasion is 1 symbol.

 denotes total number of PUSCH PRB available for sampling occasion *j* on single MIMO layer per cell.

 denotes the time period during which the measurement is performed to calculate , e.g. 15min, 1 hour, etc.

 is a variable factor for MIMO layers assigned with the maximum during time period 2 with float value 1.00-100.00. For this measurement, the same β value is used for the entire duration of T1.

 is the "Average value of scheduled MIMO layers per PRB on the UL", during time period with float value 1.00-100.00, as defined in 5.1.1.30.

 denotes time period during which the measurement is performed to calculate , as defined in 5.1.1.30.

 is the time period during which the measurement is performed to calculate , e.g.1 week, etc.

d) A single integer value from 0 to 100.

e) RRU.PrbTotSdmUl, which indicates the UL SDM PRB Usage in a Cell supporting MIMO.

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for monitoring the UL Radio Resource Utilization in a cell supporting MIMO.

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| **2nd Change** |

# A.96    Monitoring of PRB Usage for MIMO in NG-RAN

The PRB Usage for MIMO with dynamic factor measurement could provide operators the load information of radio network in MIMO scenario taking spatial resource into consideration. In the early stage of network development, the measurements with a dynamic spatial factor can reflect the actual frequency and space resource utilization of a cell after MU-MIMO is activated. In the late stage of network development, the measurements can help operators be aware of whether a cell has experienced high load.

The SDM PDSCH/PUSCH PRB Usage considers all subscribers’ MIMO layers in a cell. Correspondingly, it is based on the average value of all scheduled MIMO layers. When subscribers in a cell spread over (e.g. distribute randomly), operators can use SDM PDSCH/PUSCH PRB Usage to evaluate the usage of cell capacity in this scenario.

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| **End of Change** |