**3GPP TSG-SA5 Meeting #140-e *S5-216133***

**e-meeting, 15 - 24 November 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
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|  | **28.552** | **CR** | **0333** | **rev** | - | **Current version:** | **17.4.0** |  |
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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 |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Add enhanced MIMO PRB Usage for cell |
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| ***Source to WG:*** | China Unicom |
| ***Source to TSG:*** | S5 |
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| ***Work item code:*** | ePM\_KPI\_5G |  | ***Date:*** | 2021-11-05 |
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| ***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. The cell level enhanced MIMO PRB usage is not defined in TS 28.552;
2. In the existing scheme of PRB usage for MIMO in TS 38.314, the statistic granularity is per UE which is not in accordance with the requirement of statistic granularity defined in TS28.552 and the algorithm has some issues;
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| ***Summary of change:*** | Introduce an enhanced new MIMO PRB usage for cell level in TS 28.552，which use the time domain averaged maximum scheduled layer number as space factor to represent the spatial multiplexing capability of a cell.The measurement takes into account the resource occupancy in both frequency domain and space domain which can more accurately reflect the resource utilization of wireless network in MIMO scenarios on cell level. |
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| ***Consequences if not approved:*** |  |
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| ***Clauses affected:*** | 5.1.1.2.x(new), 5.1.1.2.y(new), A.X |
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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 PDSCH PRB Usage per cell for MIMO

a) This measurement provides the total usage (in percentage) of physical resource blocks (PRBs) per cell for MIMO with time domain averaged maximum scheduled layer number as spatial factor in the downlink.

b) SI

c) This measurement is obtained as:

 

Where

 denotes total PDSCH PRB usage per cell which is percentage of PRBs used, averaged during time period 𝑇 with integer value range: 0-100;

 denotes the number of PDSCH PRBs multiplexed by *i* MIMO layers at sampling occasion *j*.

*N(T)* denotes total number of sampling occasions taken during time period T;

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

*LM(T)* denotes the maximum scheduled layer number of PDSCH in time period T defined in TS 28.552;

NOTE: At every sampling occasion the maximum scheduled layer number of all PRBs included in PDSCH is collected as a sampling value and at the end of statistical duration the average of all sampling values is the measuremnt result as defined in TS 28.552.

*T* denotes the time period during which measurement is performed;

*i* is an integer denoting a MIMO layer number that is scheduled in time period T;

*j* denotes sampling occasion (e.g. 1 slot) during time period T.

d) A single integer value from 0 to 100.

e) RRU.PrbTotDlMimo, *which indicates the PDSCH PRB Usage per cell for MIMO*

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for monitoring the load of the radio physical layer under MIMO scenario.

##### 5.1.1.2.y PUSCH PRB Usage per cell for MIMO

a) This measurement provides the total usage (in percentage) of physical resource blocks (PRBs) per cell for MIMO with time domain averaged maximum scheduled layer number as spatial factor in the uplink.

b) SI

c) This measurement is obtained as:

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Where

 denotes total PUSCH PRB usage per cell which is percentage of PRBs used, averaged during time period 𝑇 with integer value range: 0-100;

 denotes the number of PUSCH PRBs multiplexed by *i* MIMO layers at sampling occasion *j*.

*N(T)* denotes total number of sampling occasions taken during time period T;

 denotes total number of PUSCH PRBs available for sampling occasion j on single MIMO layer per cell;

*LM(T)* denotes the maximum scheduled layer number of PUSCH in time period T defined in TS 28.552;

NOTE: At every sampling occasion the maximum scheduled layer number of all PRBs included in PUSCH is collected as a sampling value and at the end of statistical duration the average of all sampling values is the measuremnt result as defined in TS 28.552.

*T* denotes the time period during which measurement is performed;

*i* is an integer denoting a MIMO layer number that is scheduled in time period T;

*j* denotes sampling occasion (e.g. 1 slot) during time period T.

d) A single integer value from 0 to 100.

e) RRU.PrbTotUlMimo, *which indicates the PUSCH PRB Usage per cell for MIMO*

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for monitoring the load of the radio physical layer under MIMO scenario.

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| **2nd Change** |

# A.X 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.

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| **End of Change** |