**3GPP TSG-RAN WG2 #116-e R2-211**

**Electronic meeting, 1 – 12 November 2021**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **38.314** | **CR** | **draft** | **rev** | **-** | **Current version:** | **16.4.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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:*** | 38.314 CR to PRB Usage for MIMO | | | | | | | | | |
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| ***Source to WG:*** | CMCC | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ENDC\_SON\_MDT\_enh-Core | | | | |  | ***Date:*** | | | 2021-11-4 |
|  |  | | | |  | |  | | |  |
| ***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 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-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | PRB usage for MIMO was specified in Rel-16 for actually reflect the PRB usage at the case of MU-MIMO and multiple MIMO layers. Alpha in the matrix was constant integer value. But in the real network, the integer value may not be suitable for some cases. Operator sometime need to configure Alpha with float value.  It is also proposed to correct the error in the legacy matrix for PRB usage for MIMO. Since for each sampling occasion (i.e., OFDM symbol), the available PRB is not always the same, due to occupied by reference signalling, SSB, PDCCH etc. So using a constant value N(T) as the number of available PRB is not accurate. Therefore, the number of available PRB should be corrected as the sum of available PRB for each sampling occasion.  In addition, configuring the same constant value Alpha for all the cells is not suitable, especially for cells in bad radio condition. And it is also difficult to manually configure Alpha for each cell, considering the large number of NR base stations. Therefore, from deployment and maintenance point of view, it is valuable to introduce a new PRB usage matrix with Alpha autonomously adjusted, e.g., based on statistical data of MIMO layer, the variable value can be named, e.g., β.  RAN2#116-e meeting, the agreements are as follows:  1 Alpha in PRB Usage for MIMO is changed to float value 1.00~100.00  2 Introduce a new PRB usage matrix with Alpha autonomously adjusted based on statistical data of MIMO layer, the variable value can be called β.  This CR is to implement the agreements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The following are added or corrected to support PRB usage for MIMO   * Correct the matrix for PRB usage for MIMO * Correct the granularity for Alpha * Add the new matrix for PDSCH PRB Usage based on statistical MIMO layer in the DL per cell * Add the new matrix for PUSCH PRB Usage based on statistical MIMO layer in the UL per cell * Add the new matrix for Enhanced PDSCH PRB Usage for MIMO in the DL per cell * Add the new matrix for Enhanced PUSCH PRB Usage for MIMO in the UL per cell | | | | | | | | |
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| ***Consequences if not approved:*** | | It is not possible to support PRB usage for MIMO based on autonomous MIMO layer value. | | | | | | | | |
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| ***Clauses affected:*** | | 4.2.1.7.1, 4.2.1.7.2, 4.2.1.7.a (new), 4.2.1.7.b (new), 4.2.1.7.c (new), 4.2.1.7.d (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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 ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |

## << Start of changes >>

4 Layer 2 measurements

4.2.1 Measurements valid for all gNB deployment scenarios

## << Partially omitted >>

4.2.1.7 PRB Usage for MIMO

4.2.1.7.1 PDSCH PRB Usage for MIMO in the DL per cell

This measurement provides the total usage (in percentage) of PDSCH physical resource blocks (PRBs) for MIMO in the downlink per cell. The objective of the measurement is to measure usage of time and frequency resources. A use-case is OAM performance observability.

Protocol Layer: MAC, PHY

Table 4.2.1.7.1-1: Definition for PDSCH PRB Usage for MIMO in the DL per cell

|  |  |
| --- | --- |
| Definition | PDSCH PRB Usage for MIMO in the DL per cell is calculated in the time-frequency domain.  Detailed Definition:  where  explanations can be found in the table 4.2.1.7.1-2 below. |

Table 4.2.1.7.1-2: Parameter description for PDSCH PRB Usage for MIMO in the DL per cell

|  |  |
| --- | --- |
|  | Total PDSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value range: 0-100 |
|  | 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-carrier) |
|  | The number of MIMO layers scheduled for UE at sampling occasion . |
|  | A UE that is scheduled during time period 𝑇. |
|  | Sampling occasion during time period T. A sampling occasion is 1 symbol. |
|  | Total number of PDSCH PRBs available for sampling occasion j on single MIMO layer per cell. |
|  | Time Period during which the measurement is performed. |
|  | Constant value configured by OAM with float value range: 1.00-100.00. With this parameter, should not be larger than 100. |

4.2.1.7.2 PUSCH PRB Usage for MIMO in the UL per cell

This measurement provides the total usage (in percentage) of PUSCH physical resource blocks (PRBs) for MIMO in the uplink per cell. The objective of the measurement is to measure usage of time and frequency resources. A use-case is OAM performance observability.

Protocol Layer: MAC, PHY

Table 4.2.1.7.2-1: Definition for PUSCH PRB Usage for MIMO in the UL per cell

|  |  |
| --- | --- |
| Definition | PUSCH PRB Usage for MIMO in the UL per cell is calculated in the time-frequency domain.  Detailed Definition:  where  explanations can be found in the table 4.2.1.7.2-2 below. |

Table 4.2.1.7.2-2: Parameter description for PUSCH PRB Usage for MIMO in the UL per cell

|  |  |
| --- | --- |
|  | Total PUSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value range: 0-100 |
|  | A count of PUSCH PRBs scheduled 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-carrier) |
|  | The number of MIMO layers scheduled for UE at sampling occasion . |
|  | A UE that is scheduled during time period 𝑇. |
|  | Sampling occasion during time period T. A sampling occasion is 1 symbol. |
|  | Total number of PUSCH PRBs available for sampling occasion j on single MIMO layer per cell. |
|  | Time Period during which the measurement is performed. |
|  | Constant value configured by OAM with float value range: 1.00-100.00. With this parameter, should not be larger than 100. |

4.2.1.7.a PDSCH PRB Usage based on statistical MIMO layer in the DL per cell

This measurement provides the total usage (in percentage) of PDSCH physical resource blocks (PRBs) for statistical MIMO layer in the downlink per cell. The objective of the measurement is to measure usage of time and frequency resources. A use-case is OAM performance observability.

Protocol Layer: MAC, PHY**Table 4.2.1.7.a-1: Definition for PDSCH PRB Usage based on statistical MIMO layer in the DL per cell**

|  |  |
| --- | --- |
| Definition | PDSCH PRB Usage for MIMO in the DL per cell is calculated in the time-frequency domain.  Detailed Definition:  explanations can be found in the table 4.2.1.7.a-2 below. |

**Table 4.2.1.7.a-2: Parameter description for PDSCH PRB Usage based on statistical MIMO layer in the DL per cell**

|  |  |
| --- | --- |
|  | Total PDSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value. |
|  | 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-carrier) |
|  | The number of MIMO layers scheduled for UE at sampling occasion . |
|  | A UE that is scheduled during time period 𝑇1. |
|  | Sampling occasion during time period T1. A sampling occasion is 1 symbol. |
|  | Total number of PDSCH PRBs available for sampling occasion j on single MIMO layer per cell. |
|  | Time Period during which the measurement is performed to calculate , e.g., 15min, 1 hour, etc. |
|  | A variable factor for MIMO layer assigned with the maximum during time period T2 with float value 0.01-100.00. |
|  | Average value of scheduled MIMO layers per PRB on the DL defined in TS 28.552 [2]. |
|  | Time Period during which the measurement is performed to calculate β, e.g., 1 week, etc. |

NOTE: For this measurement, T2 can be larger than T1. Measurement during T2 can be performed earlier than the measurement during T1.

4.2.1.7.b PUSCH PRB Usage based on statistical MIMO layer in the UL per cell

This measurement provides the total usage (in percentage) of PUSCH physical resource blocks (PRBs) for statistical MIMO layer in the uplink per cell. The objective of the measurement is to measure usage of time and frequency resources. A use-case is OAM performance observability.

Protocol Layer: MAC, PHY

**Table 4.2.1.7.b-1: Definition for PUSCH PRB Usage based on statistical MIMO layer in the UL per cell**

|  |  |
| --- | --- |
| Definition | PUSCH PRB Usage for MIMO in the UL per cell is calculated in the time-frequency domain.  Detailed Definition:  explanations can be found in the table 4.2.1.7.b-2 below. |

**Table 4.2.1.7.b-2: Parameter description for PUSCH PRB Usage based on statistical MIMO layer in the UL per cell**

|  |  |
| --- | --- |
|  | Total PUSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value. |
|  | 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-carrier) |
|  | The number of MIMO layers scheduled for UE at sampling occasion . |
|  | A UE that is scheduled during time period 𝑇1. |
|  | Sampling occasion during time period T1. A sampling occasion is 1 symbol. |
|  | Total number of PUSCH PRBs available for sampling occasion j on single MIMO layer per cell. |
|  | Time Period during which the measurement is performed to calculate M(T1), e.g., 15min, 1 hour, etc. |
|  | A variable factor for MIMO layer assigned with the maximum during time period T2 with float value 0.01-100.00. |
|  | Average value of scheduled MIMO layers per PRB on the UL defined in TS 28.552 [2]. |
|  | Time Period during which the measurement is performed to calculate β, e.g., 1 week, etc. |

NOTE: For this measurement, T2 can be larger than T1. Measurement during T2 can be performed earlier than the measurement during T1.

4.2.1.7.c Enhanced PDSCH PRB Usage for MIMO in the DL per cell

This measurement provides the total usage (in percentage) of PDSCH physical resource blocks (PRBs) for MIMO in the downlink per cell. The objective of the measurement is to measure usage of time, frequency and spatial resources. A use-case is OAM performance observability.

Protocol Layer: MAC, PHY

Table 4.2.1.7.c-1: Definition for enhanced PDSCH PRB Usage for MIMO in the DL per cell

|  |  |
| --- | --- |
| Definition | PDSCH PRB Usage for MIMO in the DL per cell is calculated in the time-frequency and spatial domain.  Detailed Definition:  where  explanations can be found in the table 4.2.1.7.c-2 below. |

Table 4.2.1.7.c-2: Parameter description for enhanced PDSCH PRB Usage for MIMO in the DL per cell

|  |  |
| --- | --- |
|  | Total PDSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value range: 0-100 |
|  | 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-carrier) |
|  | The number of MIMO layers scheduled for UE at sampling occasion . |
|  | A UE that is scheduled during time period 𝑇. |
|  | Sampling occasion during time period T. A sampling occasion is 1 symbol. |
|  | Total number of sampling occasions taken during time period T. |
|  | Total number of PDSCH PRBs available for 1 sampling occasion on single MIMO layer per cell. |
|  | Time Period during which the measurement is performed. |
|  | The number of time-domain average maximum scheduling layer of PDSCH during time period T.    Detailed Definition:  where denotes the maximum number of scheduling layer of PDSCH at sampling occasion *j*; *K(T)* denotes the number of sampling occasions at which is not 0. |

4.2.1.7.d Enhanced PUSCH PRB Usage for MIMO in the UL per cell

This measurement provides the total usage (in percentage) of PUSCH physical resource blocks (PRBs) for MIMO in the uplink per cell. The objective of the measurement is to measure usage of time, frequency and spatial resources. A use-case is OAM performance observability.

Protocol Layer: MAC, PHY

Table 4.2.1.7.d-1: Definition for enhanced PUSCH PRB Usage for MIMO in the UL per cell

|  |  |
| --- | --- |
| Definition | PUSCH PRB Usage for MIMO in the UL per cell is calculated in the time-frequency and spatial domain.  Detailed Definition:  where  explanations can be found in the table 4.2.1.7.d-2 below. |

Table 4.2.1.7.d-2: Parameter description for enhanced PUSCH PRB Usage for MIMO in the UL per cell

|  |  |
| --- | --- |
|  | Total PUSCH PRB usage per cell which is percentage of PRBs used, averaged during time period with integer value range: 0-100 |
|  | A count of PUSCH PRBs scheduled 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-carrier) |
|  | The number of MIMO layers scheduled for UE at sampling occasion . |
|  | A UE that is scheduled during time period 𝑇. |
|  | Sampling occasion during time period T. A sampling occasion is 1 symbol. |
|  | Total number of sampling occasions taken during time period T. |
|  | Total number of PUSCH PRBs available for 1 sampling occasion on single MIMO layer per cell. |
|  | Time Period during which the measurement is performed. |
|  | The number of time-domain average maximum scheduling layer of PDSCH during time period T.    Detailed Definition:  where denotes the maximum number of scheduling layer of PDSCH at sampling occasion *j*; *K(T)* denotes the number of sampling occasions at which is not 0. |

<< End of change >>