**3GPP TSG-SA5 Meeting #154 *S5-242200d1***

**Changsha, China, 15 - 19 April 2024**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **28.552** | **CR** | **0556** | **rev** | **1** | **Current version:** | **18.6.0** |  |
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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 PDCCH CCE Usage related measurement |
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| ***Source to WG:*** | CMCC, China Unicom, Huawei, ZTE, CATT, Ericsson, AT&T |
| ***Source to TSG:*** | S5 |
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| ***Work item code:*** | TEI18 |  | ***Date:*** | 2024-04-07 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18  |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | 1. TS28.552 has defined the evaluation of PRB Usage (see subclause 5.1.1.2), but not the usage of PDCCH. Recently, the CR to TS38.314 “Introduction of PDCCH CCE Usage for gNB Layer 2 measurement [L2M\_PDCCH\_Usage]” has been adopted at TSG-RAN WG2 Meeting #125, and it is necessary to introduce this measurement to TS 28.552 as an important scheme to evaluate the CCE usage for operators.
2. In real-life deployment, it is observed that the number of users is large while PDSCH/PUSCH PRB usage is relatively low. In such case, the PDCCH is the bottleneck channel. Introducing the usage of PDCCH is essential for both OAM performance observability and inter-cell load balancing.
3. Similar to PDSCH/PUSCH usage metric, multiple MIMO layers of PDCCH can be scheduled to the UE. Therefore, the introduction of PDCCH CCE Usage need to take the space division multiplexing into consideration to reflect the usage of resources of PDCCH precisely.
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| ***Summary of change:*** | Add a new measurement "PDCCH CCE Usage" to evaluate the usage of resources of PDCCH. |
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| ***Consequences if not approved:*** | Lack of measurement of the usage of PDCCH. |
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| ***Clauses affected:*** | 5.1.1.2.x (new) |
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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:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| **1st Change** |

##### 5.1.1.2.x PDCCH CCE Usage

###### 5.1.1.2.x.1 PDCCH CCE Usage per cell

a) This measurement provides the total usage (in percentage) of PDCCH control-channel elements (CCEs) per cell. The objective of the measurement is to measure usage of time, frequency and space resources.

b) SI

c) This measurement is defined:

$\left(\right)\left⌊\frac{\sum\_{}^{}\sum\_{}^{}\_{}\_{}}{\sum\_{}^{}\_{}}\right⌋$**,**

where $$ denotes total PDCCH CCE usage per cell which is percentage of CCEs used for MIMO and non-MIMO, averaged during time period $$ with integer value range: 0-100.

$\_{}\left(\right)$ denotes a count of PDCCH CCEs used for control information transmission for UE $$ on each MIMO layer per cell at sampling occasion $$ for MIMO scenario, or a count of PDCCH CCEs used for control information transmission for UE $$ per cell at sampling occasion $$ for non-MIMO scenario.

$\_{}$ denotes the number of MIMO layers scheduled for UE $$ at sampling occasion $$ for MIMO scenario or equals 1 for non-MIMO scenario.

$$denotes a UE $$ that is scheduled during time period 𝑇.

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

$\_{}\left(\right)$ denotes total number of PDCCH CCEs available for sampling occasion $$ on each MIMO layer per cell for MIMO scenario, or total number of PDCCH CCEs available for sampling occasion $$ per cell for non-MIMO scenario.

$$ denotes the time period during which the measurement is performed to calculate $\left(\right)$, e.g., 15min, 1 hour, etc.

$$ is a constant value of available MIMO layers configured by OAM during time period 𝑇 with float value 1.00-100.00 for MIMO scenario, or a constant value configured by OAM during time period 𝑇 with float value 1.00 for non-MIMO scenario. With this parameter, $$ should not be larger than 100.

d) A single integer value from 0 to 100.

e) RRU.CceTot, which indicates the PDCCH CCE Usage per cell.

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for monitoring the PDCCH Usage in a cell.

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| **2st Change** |

# A.A Use case of measurement for PDCCH CCE Usage

The PDCCH CCE Usage measurement could provide operators the load information on PDCCH of radio network. Under the circumstance in which the usage of PDCCH is high and the performance of the whole cell is affected, this measurement can help operators identify problems and perform network maintenance to improve user experience and cell performance.

The PDCCH CCE Usage also considers the space division multiplexing and MIMO layer. Therefore, this measurement is suitable to evaluate the usage of cell capacity with or without MIMO deployment and needs to be monitored.

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| **End of Change** |