**3GPP TSG-WG4 Meeting #94 *R4-20xxxxx***

**Athens, Greece, February 24th-28th 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-1** | **CR** | **<CR#>** | **rev** | **<Rev#>** | **Current version:** | **16.2.0** |  |
|  | | | | | | | | |
| *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 |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | : UL MIMO for NR-V2X | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | 5G\_V2X\_NRSL-Core | | | | |  | ***Date:*** | | | 2020-2-3 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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:*** | | Introduce UL MIMO requirements for NR-V2X in TS 38.101-1. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Specify the UL MIMO requirements for NR V2X. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | UL MIMO feature will not be supported by NR V2X. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2E, 6.2E.1, 6.2E.2, 6.2E.3, 6.2E.4, 6.3E.1, 6.3E.2, 6.3E.3, 6.3E.4, 6.4E.1, 6.4E.2, 6.5E.1, 6.5E.2, 6.5E.3, 6.5E.4, | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.521-1 | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## **<Start of Changes>**

## 6.2E Transmitter power for V2X

### 6.2E.1 UE maximum output power for V2X

For power class 2 NR V2X UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 6.2E.1-1. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2. For NR V2X UE supporting UL MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1 ms).

Table 6.2E.1-1: NR V2X UE Power Class for UL-MIMO in closed loop spatial multiplexing scheme

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NR band | Class 1 (dBm) | Tolerance (dB) | Class 2 (dBm) | Tolerance (dB) | Class 3 (dBm) | Tolerance (dB) | Class 4 (dBm) | Tolerance (dB) |
| n38 |  |  | 26 | +2/-3 | 23 | +2/-3 |  |  |
| n47 |  |  | 26 | +2/-3 | 23 | +2/-3 |  |  |

## **<Next Change>**

### 6.2E.2 UE maximum output power reduction for V2X

For NR V2X UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the allowed Maximum Power Reduction (MPR) values specified in Table [TBD] shall apply to the maximum output power specified in Table 6.2E.1-1. The requirements shall be met with UL MIMO configurations defined in Table 6.2D.1-2. For UE supporting UL MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector.

For the UE maximum output power modified by MPR, the power limits specified in clause 6.2E.4 apply.

## **<Next Change>**

### 6.2E.3 UE additional maximum output power reduction for V2X

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the A-MPR values specified in clause 6.2.3 shall apply to the maximum output power specified in Table 6.2E.1-1. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2. For UE supporting UL MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For the UE maximum output power modified by A-MPR, the power limits specified in clause 6.2E.4 apply.

## **<Next Change>**

### 6.2E.4 Configured output power for V2X

For NR V2X UE supporting UL MIMO, the transmitted power is configured per each UE.

For NR V2X UE with two transmit antenna connectors in closed-loop spatial amultiplexing scheme, the tolerance is specified in Table 6.2E.4-1. The requirements shall be met with UL MIMO configurations specified in Table 6.2D.1-2.

Table 6.2E.4-1: PCMAX,*c* tolerance in closed-loop spatial multiplexing scheme

|  |  |  |
| --- | --- | --- |
| PCMAX,*c*(dBm) | Tolerance TLOW(PCMAX\_L,*c*) (dB) | Tolerance THIGH(PCMAX\_H,*c*) (dB) |
| PCMAX,*c* = 26 | 3.0 | 2.0 |
| 23 ≤ PCMAX,*c* < 26 | 3.0 | 2.0 |
| 22 ≤ PCMAX,*c* < 23 | 5.0 | 2.0 |
| 21 ≤ PCMAX,*c* < 22 | 5.0 | 3.0 |
| 20 ≤ PCMAX,*c* < 21 | 6.0 | 4.0 |
| 16 ≤ PCMAX,*c* < 20 | 5.0 | |
| 11 ≤ PCMAX,*c* < 16 | 6.0 | |
| -40 ≤ PCMAX,*c* < 11 | 7.0 | |

## **<Next Change>**

### 6.3E.1 Minimum output power for V2X

For NR V2X UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power at each transmit connector in one sub-frame (1 ms). The minimum output power shall not exceed the values specified for single carrier.

**<Next Change>**

### 6.3E.2 Transmit OFF power for V2X

The transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1 ms) excluding any transient periods.

The transmit OFF power at each transmit antenna connector shall not exceed the values specified for single carrier.

## **<Next Change>**

### 6.3E.3 Transmit ON/OFF time mask for V2X

For NR V2X UE supporting UL MIMO, the ON/OFF time mask requirements apply at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in clause 6.3E.3 apply to each transmit antenna connector. The requirements shall be met with the UL MIMO configurations described in clause 6.2D.1.

## **<Next Change>**

### 6.3E.4 Power control for V2X

#### 6.3E.4.1 in licensed band Power control for V2X con-current operation

For NR V2X UE supporting UL MIMO, the power control tolerance for single carrier shall apply to the sum of output power at each transmit antenna connector.

## **<Next Change>**

## 6.4E Transmit signal quality for V2X

### 6.4E.1 Frequency error for V2X

For NR V2X UE supporting UL MIMO, the UE modulated carrier frequency at each transmit antenna connector shall be accurate to within ±0.1 PPM observed over a period of 0.5 ms in case of using GNSS synchronization source. The same requirements applied over a period of 0.5 ms compared to the relative frequency in case of using the NR gNode B or V2X UE sidelink synchronization signals.

### 6.4E.2 Transmit modulation quality for V2X

For NR V2X UE supporting UL MIMO, the transmit modulation quality requirements for single carrier shall apply to each transmit antenna connector.

## **<Next Change>**

## 6.5E Output RF spectrum emissions for V2X

### 6.5E.1 Occupied bandwidth for V2X

For NR V2X UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the occupied bandwidth at each transmitter antenna shall be less than the channel bandwidth specified in table 6.5.1-1. The requirements shall be met with UL MIMO configurations described in clause 6.2D.1.

### 6.5E.2 Out of band emission for V2X

For NR V2X UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements specified for single carrier shall apply to each transmit antenna connector. The requirements shall be met with UL MIMO configurations described in clause 6.2D.1.

## **<Next Change>**

### 6.5E.3 Spurious emission for V2X

For NR V2X UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements specified for single carrier shall apply to each transmit antenna connector. The requirements shall be met with the UL MIMO configurations described in clause 6.2D.1.

## **<Next Change>**

### 6.5E.4 Transmit intermodulation for V2X

For NR V2X UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements specified for single carrier shall apply to each transmit antenna connector. The requirements shall be met with the UL MIMO configurations described in clause 6.2D.1.

## **<End of Changes>**