**3GPP TSG-RAN WG4 Meeting #110R4-2403896**

**Athens, Greece, February 26- March 1 , 2024**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-2** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **18.4.0** |  |
|  | | | | | | | | |
| *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 | **X** | Radio Access Network |  | Core Network |  |

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|  | | | | | | | | | | |
| ***Title:*** | CR for TS 38.101-2 MultiRx PC3 RF requirement applicable frequency range | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_FR2\_multiRx\_DL-Core | | | | |  | ***Date:*** | | | 2024-3-4 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **F** |  | | | | | ***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 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This big CR is the formal version of R4-2403630.  Following aspects are identified as to be modified/improved:   1. It was decided to exclude 47 GHz from the requirement due to unavailability of design data or measurements. 2. Annex J didn’t include all 12 initial DUT orientations for test. 3. The sentence “*which is specified in A.3.x and A.3.y for UEs supporting singleDCI-SDM-scheme-r16 and for UEs supporting multiDCI-MultiTRP-r16 respectively*” is redundant RMC information for PC6. 4. MultiRx is not for CA. 5. Other editorial changes. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Remove n262 from the bands supporting MultiRx and STxMP. 2. Add 12 initial DUT orientations for MultiRx test. 3. Remove the aforementioned redundancy. 4. Make clause 5.5K as void. 5. Editorial changes. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Specification implementation for MultiRx cannot be impeccable. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.3, 5.2K, 5.5K, 7.3K.0, 7.3K.3, 7.3K.6, J.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.521-2 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## **<<Start of Change>>**

## **<<Change #1>>**

## 4.3 Specification suffix information

Unless stated otherwise the following suffixes are used for indicating at 2nd level clause, shown in Table 4.3-1.

Table 4.3-1: Definition of suffixes

|  |  |
| --- | --- |
| Clause suffix | Variant |
| None | Single Carrier |
| A | Carrier Aggregation (CA) |
| B | Dual-Connectivity (DC) |
| C | Supplement Uplink (SUL) |
| D | UL MIMO |
| K | Simultaneous reception or transmission in multiple directions |
| NOTE 1: Suffix D in this specification represents either polarized UL MIMO or spatial UL MIMO. RF requirements are same. If UE supports both kinds of UL MIMO, then RF requirements only need to be verified under either polarized or spatial UL MIMO.  NOTE 2: Suffix K applies to simultaneous reception or transmission with different TCI states and different QCL-TypeD reference signals across the TCI states | |

## **<<Change #2>>**

## 5.2K Operating bands for simultaneous reception or transmission in multiple directions

Simultaneous reception or transmission in multiple directions is enabled for the bands defined in Table 5.2K-1.

Table 5.2K-1: NR bands for simultaneous reception or transmission in multiple directions

|  |
| --- |
| NR bands for simultaneous reception or transmission in multiple directions  (Table 5.2-1) |
| n257 |
| n258 |
| n259 |
| n260 |
| n261 |

## **<<Change #3>>**

## 5.5K Configurations for simultaneous reception or transmission in multiple directions

(reserved)

## **<<Change #4>>**

### 7.3K.0 General

For this release, the requirement applies only to FR2-1 UEs that support the following set of capabilities:

1. simultaneousReceptionDiffTypeD-r16

2. At least one of:

a. singleDCI-SDM-scheme-r16 or

b. multiDCI-MultiTRP-r16 and either of:

i. overlapPDSCHsFullyFreqTime-r16.

ii. overlapPDSCHsInTimePartiallyFreq-r16

The requirement applies for simultaneous reception of rank 2 PDSCH, where each layer uses overlapping RBs in both time and frequency and is associated with a unique TCI state and AoA. The scheduled TCI states for the rank 2 PDSCH shall be configured with different QCL type-D reference signals respectively. The DL power at the center of quiet zone from each AoA equals the EIS spherical coverage requirement from sub-clause 7.3.4.

For UEs supporting *singleDCI-SDM-scheme-r16,* the cumulative throughput in the DL associated with both TCI states shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified A.3.3.2-5 and A.3.3.2-6 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL signal as described in Annex A.5.2.1).

For UEs supporting *multiDCI-MultiTRP-r16*, the throughput in the DL associated with each TCI state shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified A.3.3.2-1 and A.3.3.2-2 (with one sided dynamic OCNG Pattern OP.1 TDD for the DL-signal as described in Annex A.5.2.1).

The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to the downlink transmission bandwidth. The UL is assigned to any one of the two TCI states scheduled for simultaneous DL reception, with reference measurement channel as specified in Annex A.2.3.2. The transmitter shall be set to PUMAX as defined in clause 6.2.4.

Unless otherwise specified, the minimum requirements shall be verified with the network signalling value NS\_200 (Table 6.2.3.1-1) configured.

### 7.3K.1 (Reserved)

### 7.3K.2 (Reserved)

### 7.3K.3 2AoA spherical coverage of power class 3

The requirements apply to the UE when tested in a test system as described in Annex L. The requirement is verified with the test metric of throughput (Link= 2AoA spherical coverage grid, Meas=Link Angle).

The spherical coverage requirement for simultaneous reception from multiple directions is defined in terms of the probability to support simultaneous reception of rank 2 PDSCH defined in sub-clause 7.3K.0. The probability (see Annex L) is defined as the spatial average over the full sphere around the UE of the probability of any one direction to support 2 AoA reception. In the applicable test system (see Annex L), the probability of any one direction of the UE to support 2 AoA reception for any specific AoA separation is the ratio of the number of unique AoA pairs that include that direction and can support 2 AoA reception to the total number of verified unique AoA pairs that include that direction.

The requirement applies only for the UE’s declared orientation in the positioner of the test system. The requirement for each AoA separation condition applies only for the UE’s declared orientation in the positioner of the test system for that AoA separation. The minimum required overall probability to support 2 AoA reception for power class 3 UEs for any channel bandwidth is specified by AoA separation in table 7.3K.3-1. The UE is only required to fulfil the requirement at any one of AoA separations declared from Table 7.3K.3-1.

Table 7.3K.3-1: Requirement for power class 3

|  |  |
| --- | --- |
| AoA separation (degrees) | Probability (%) |
| 30 | 18.5 |
| 60 | 13.5 |
| 90 | 12.5 |
| 120 | 20.5 |
| 150 | 28.5 |

### 7.3K.4 (Reserved)

### 7.3K.5 (Reserved)

### 7.3K.6 2AoA spherical coverage for power class 6

The requirements for a power class 6 UE are applicable with network signalling *highSpeedDeploymentTypeFR2-r17* configured as *bidirectional*. UE spherical coverage evaluation areas are found in Table 6.2.1.6-3a in clause 6.2.1.6, by consisting of Area-1 and Area-2, in the reference coordinate system in Annex L.1. If one AoA is within Area-1 and another AoA is within Area-2, the 2AoA spherical coverage requirements apply with DL power specified in Table 7.3K.6-1 for the PDSCH of each AoA. For any AoA pair selected from Area-1 and Area-2, respectively, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels. The requirement is verified with a 150° angular separation between 2AoAs. The requirement is verified with the test metric of Throughput (Link=2AoA Spherical coverage grid, Meas=Link angle).

Table 7.3K.6-1: DL power for 2AoA spherical coverage requirement for power class 6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Operating band | PDSCH DL power over UE spherical coverage evaluation areas (dBm) / Channel bandwidth | | | |
| 50 MHz | 100 MHz | 200 MHz | 400 MHz |
| n257 | -82.6 | -79.6 | -76.6 | -73.6 |
| n258 | -82.8 | -79.8 | -76.8 | -73.8 |
| n261 | -82.6 | -79.6 | -76.6 | -73.6 |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4  NOTE 2: The 2AoA spherical coverage requirements are verified only under normal thermal conditions as defined in Annex E.2.1.  NOTE 3: The requirements in this table are applicable with the network signalling *highSpeedMeasFlagFR2-r17* configured as *set2*. | | | | |

The requirement shall be met for an uplink transmission using QPSK DFT-s-OFDM waveforms and for uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.1-2.

Unless given by Table 7.3.2.1-3, the minimum requirements for 2AoA spherical coverage shall be verified with the network signalling value NS\_200 (Table 6.2.3.1-1) configured.

## **<<Change #5>>**

# J.2 Test conditions and angle definitions

Tables J.2-1 through J.2-3 below provides the test conditions and angle definitions for three permitted device alignment for the default test condition, DUT orientation 1, and two different options for each permitted device alignment to re-position the device for DUT Orientation 2 as outlined by figures in Tables J.2-1 through J.2-3.

Table J.2-1: Test conditions and angle definitions for Alignment Option 1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test condition** | **DUT orientation** | **Link angle** | **Measurement angle** | **Diagram** |
| Free space DUT Orientation 1 (default) | α = 0º; β = 0º; γ = 0º | θLink; ϕLink  with polarization reference PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment01_trimetric_Matricesv1 |
| Free space  DUT Orientation 2 – Option 1  (based on re-positioning approach) | α = 180º; β = 0º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment01_trimetric_Matricesv1 |
| Free space  DUT Orientation 2 – Option 2  (based on re-positioning approach) | α = 0º; β = 180º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment01_trimetric_Matricesv1 |
| NOTE 1: A polarization reference, as defined in relation to the reference coordinate system in J.1-1, is maintained for each signal angle, link or interferer angle, and measurement angle.  NOTE 2: The combination of rotations is captured by matrix M=*Rz*()•*Ry*()•*Rx*() | | | | |

Table J.2-2: Test conditions and angle definitions for Alignment Option 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test condition** | **DUT orientation** | **Link angle** | **Measurement angle** | **Diagram** |
| Free space  DUT Orientation 1 (default) | α = 0º; β = -90º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment02_trimetric_Matricesv1 |
| Free space  DUT Orientation 2 – Option 1  (based on re-positioning approach) | α = 180º; β = 90º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment02_trimetric_Matricesv1 |
| Free space  DUT Orientation 2 – Option 2  (based on re-positioning approach) | α = 0º; β = 90º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment02_trimetric_Matricesv1 |
| NOTE 1: A polarization reference, as defined in relation to the reference coordinate system in J.1-1, is maintained for each signal angle, link or interferer angle, and measurement angle.  NOTE 2: The combination of rotations is captured by matrix M=*Rz*()•*Ry*()•*Rx*() | | | | |

Table J.2-3: Test conditions and angle definitions for Alignment Option 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test condition | DUT orientation | Link angle | Measurement angle | Diagram |
| Free space  DUT Orientation 1 (default) | α = 90º; β = 0º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment03_trimetric_Matricesv1 |
| Free space  DUT Orientation 2 – Option 1  (based on re-positioning approach) | α = -90º; β = 0º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment03_trimetric_Matricesv1 |
| Free space  DUT Orientation 2 – Option 2  (based on re-positioning approach) | α = 90º; β = 180º; γ = 0º | θLink; ϕLink  with polarization reference  PolLink = θ or ϕ | θMeas; ϕMeas  with polarization reference  PolMeas = θ or ϕ | DUTalignment03_trimetric_Matricesv1 |
| NOTE 1: A polarization reference, as defined in relation to the reference coordinate system in J.1-1, is maintained for each signal angle, link or interferer angle, and measurement angle.  NOTE 2: The combination of rotations is captured by matrix M=*Rz*()•*Ry*()•*Rx*() | | | | |

Table J.2-4 through J.2-6 provides the test conditions and angle definitions for twelve permitted device orientations for the initial test condition for simultaneous reception from multiple directions. The DUT orientation to be tested is chosen from Table J.2-4, Table J.2-5 and Table J.2-6 by UE vendor declaration.

Table J.2-4: Test conditions and angle definitions for Alignment Option 1

|  |  |  |
| --- | --- | --- |
| Test condition | DUT orientation | Diagram |
| Orientation 1  (Option 1) | α = 0º; β = 0º; γ = 0º |  |
| Orientation 1  (Option 2) | α = 0º; β = 0º; γ = 180º |  |
| Orientation 2  (Option 1) | α = 180º; β = 0º; γ = 0º |  |
| Orientation 2  (Option 2) | α = 0º; β = 180º; γ = 0º |  |
| NOTE 1: The combination of rotations is captured by matrix M=*Rz*()•*Ry*()•*Rx*() | | |

Table J.2-5: Test conditions and angle definitions for Alignment Option 2

|  |  |  |
| --- | --- | --- |
| Test condition | DUT orientation | Diagram |
| Orientation 1  (Option 1) | α = 0º; β = -90º; γ = 0º |  |
| Orientation 1  (Option 2) | α = 0º; β = -90º; γ = 180º |  |
| Orientation 2  (Option 1) | α = 180º; β = 90º; γ = 0º |  |
| Orientation 2  (Option 2) | α = 0º; β = 90º; γ = 0º |  |
| NOTE 1: The combination of rotations is captured by matrix M=*Rz*()•*Ry*()•*Rx*() | | |

Table J.2-6: Test conditions and angle definitions for Alignment Option 3

|  |  |  |
| --- | --- | --- |
| Test condition | DUT orientation | Diagram |
| Orientation 1  (Option 1) | α = 90º; β = 0º; γ = 0º |  |
| Orientation 1  (Option 2) | α = 90º; β = 0º; γ = 180º |  |
| Orientation 2  (Option 1) | α = -90º; β = 0º; γ = 0º |  |
| Orientation 2  (Option 2) | α = 90º; β = 180º; γ = 0º |  |
| NOTE 1: The combination of rotations is captured by matrix M=*Rz*()•*Ry*()•*Rx*() | | |

For each UE requirement and test case, each of the parameters in Table J.2-1 through J.2-6 need to be recorded, such that DUT positioning, DUT beam direction, and angles of the signal, link/interferer, and measurement are specified in terms of the fixed coordinate system.

Due to the non-commutative nature of rotations, the order of rotations is important and needs to be defined when multiple DUT orientations are tested.

The rotations around the x, y, and z axes can be defined with the following rotation matrices





and

.

with the respective angles of rotation, ****** and



Additionally, any translation of the DUT can be defined with the translation matrix



with offsets tx, ty, tz in x, y, and z, respectively and with



The combination of rotations and translation is captured by the multiplication of rotation and translation matrices.

For instance, the matrix M

describes an initial rotation of the DUT around the x axis with angle  *α*, a subsequent rotation around the y axis with angle *β*, and a final rotation around the z axis with angle *γ*. After those rotations, the DUT is translated by tx, ty, tz in x, y, and z, respectively.

……

**< unchanged text omitted >**

## **<<End of Change>>**