**3GPP TSG-RAN WG4 Meeting #111  *R4-2409929***

**Fukuoka, Japan, 20th – 24th May, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.761** | **CR** |  | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *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 to 38.761 on FR1 CDL-C UMa channel model validation results | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CAICT, SAICT | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MIMO\_OTA\_enh | | | | |  | ***Date:*** | | | 30 |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To add CDL-C UMa channel model validation results for band n1 from volunteer labs into 38.761. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Add CDL-C UMa channel model validation results for band n1 submitted by volunteer labs in R4-2400032 (CAICT), R4-2405313 (CMCC&BUPT), and R4-2407062 (Apple). | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The CDL-C UMa channel model validation for band n1 would be missing in 38.761. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  |  | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  |  | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  |  | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | This is a revision of R4-2407656. | | | | | | | | |

< start of change 1 >

6.2.2.1 Power Delay Profile (PDP)

The PDP should be validated in a Beam-Specific manner. It is assumed that the beams are mapped to the inputs of the channel emulator as follows:

- Beam 1: Input 1 and Input 2

- Beam 2: Input 3 and Input 4 (CDL-C UMa only)

The PDP measurement results of UMa CDL-C for bands n41, n78, and n1 are presented in Figures 6.2.2.1-1~5.

****

**(a) Band n41**

****

**(b) Band n78**

 

**(c) Band n1**

**Figure 6.2.2.1-1: Lab 1: PDP measurement results for** **CDL-C UMa, (a) Band n41, beam 1 and beam 2; (b) Band n78, beam 1 and beam 2; (c) Band n1, beam 1 and beam 2. CE bandwidth: 100MHz**

****

**(a) Band n41**

****

**(b) Band n78**

**** 

**(c) Band n1**

**Figure 6.2.2.1-2: Lab 2: PDP measurement results for CDL-C UMa, (a) Band n41, beam 1 and beam 2; (b) Band n78, beam 1 and beam 2; (c) Band n1, beam 1 and beam 2.**

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< start of change 2 >

Chart, diagram, histogram

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(a) Band n41

Chart, diagram, histogram

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(b) Band n78

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**(c) Band n1**

Figure 6.2.2.1-6: Lab 6: PDP measurement results for CDL-C UMa, (a) Band n41, beam 1 and beam 2; (b) Band n78, beam 1 and beam 2; (c) Band n1, beam 1.

< end of change 2 >

< start of change 3 >

6.2.2.2 Doppler/Temporal correlation

The Doppler should be validated in a Beam-Specific manner. It is assumed that the beams are mapped to the inputs of the channel emulator as follows:

- Beam 1: Input 1 and Input 2

- Beam 2: Input 3 and Input 4 (CDL-C UMa only)

The Doppler measurement results of UMa CDL-C for bands n41, n78, and n1 are presented in Figures 6.2.2.2-1~6.

****

**(a-1) Beam 1, H11 (a-2) Beam 2, H11**

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**(a-3) Beam 1, H12 (a-4) Beam 2, H12**

** **

**(a-5) Beam 1, H12 (a-6) Beam 2, H12**

** **

**(a-7) Beam 1, X2V (a-8) Beam 2, X2V**

**(a) Band n41**

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**(b-1) Beam 1, H11 (b-2) Beam 2, H11**

 

**(b-3) Beam 1, X2V (b-4) Beam 2, X2V**

**(b) Band n78**



**(c-1) Beam 1, X2V (c-1) Beam 2, X2V**

**(c) Band n1**

**Figure 6.2.2.2-1: Lab 1: Doppler measurement results for CDL-C UMa, (a) Band n41 with different beams and different polarizations; (b) Band n78 with different beams and different polarizations; (c) Band n1 with different beams**

****

**(a) Band n41**

****

**(b) Band n78**

****

**(c) Band n1**

**Figure 6.2.2.2-2: Lab 2: Doppler measurement results for CDL-C UMa, (a) Band n41, beam 1 and beam 2; (b) Band n78, beam 1 and beam 2; (c) Band n1, beam 1 and beam 2**

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(a) Band n41

Chart, line chart

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(b) Band n78

A comparison of a graph

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**(c) Band n1**Figure 6.2.2.2-6: Lab 6: Doppler measurement results for CDL-C UMa, (a) Band n41, beam 1 and beam 2; (b) Band n78, beam 1 and beam 2; (c) Band n1, beam 1 and beam 2

< end of change 4 >

< start of change 5 >

6.2.2.3 Spatial correlation

The Spatial correlation should be validated in a Beam-Combined manner. It is assumed that the beams are mapped to the inputs of the channel emulator as follows:

- Beam 1: Input 1 and Input 2

- Beam 2: Input 3 and Input 4 (CDL-C UMa only)

- Combined beam for CDL-C UMa: Input 1 + Input 2 + Input 3 + Input 4

- Combined beam for CDL-C UMi: Input 1 + Input 2

The Spatial correlation measurement results of UMa CDL-C for bands n41, n78, and n1 are presented in Figures 6.2.2.3-1~6.

** **

****

**(a) Band n41**

****

**(b) Band n78**



**(c) Band n1**

**Figure 6.2.2.3-1: Lab 1: Spatial correlation measurement results for CDL-C UMa, (a) Band n41, beam 1, beam 2, and combined beams; (b) Band n78, combined beams; (c) Band n78, combined beams**

****

**(a) Band n41 (b) Band n78**



**(c) Band n1**

**Figure 6.2.2.3-2: Lab 2: Spatial correlation measurement results for CDL-C UMa, (a) Band n41 with combined beams; (b) Band n78 with combined beams; (c) Band n1 with combined beams**

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< start of change 6 >

Chart, line chart

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(a) Band n41

Chart, line chart

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(b) Band n78

A graph of different colored lines

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**(c) Band n1**

Figure 6.2.2.3-6: Lab 6: Spatial correlation measurement results for CDL-C UMa, (a) Band n41, combined beams; (b) Band n78, combined beams; (c) Band n1 with combined beams

< end of change 6 >

< start of change 7 >

6.2.2.4 Cross-polarization

The Cross-polarization should be validated in a Beam-Specific manner. It is assumed that the beams are mapped to the inputs of the channel emulator as follows:

- Beam 1: Input 1 and Input 2

- Beam 2: Input 3 and Input 4 (CDL-C UMa only)

The Cross-polarization measurement results of UMa CDL-C for bands n41, n78, and n1 are presented in Table 6.2.2.4-1~6.

**Table 6.2.2.4-1: Lab 1: Cross-polarization verification results for CDL-C UMa, bands n41, n78, and n1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Beam** | **Reference** | **Measurement result** | **Pass/fail limit** |
| fc = 2450 MHz (n41) | Beam 1 | Input 1+2:  V/H = 0 dB | 0.44 dB | ±1 dB |
| Beam 2 | Input 3+4:  V/H = 0 dB | 0.55 dB |
| fc = 3600 MHz (n78) | Beam 1 | Input 1+2:  V/H = 0 dB | 0.49 dB |
| Beam 2 | Input 3+4:  V/H = 0 dB | 0.58 dB |
| fc = 2132.5 MHz (n1) | Beam 1 | Input 1+2:  V/H = 0 dB | 0.59 dB |
| Beam 2 | Input 3+4:  V/H = 0 dB | -0.14 dB |

**Table 6.2.2.4-2: Lab 2: Cross-polarization verification results for CDL-C UMa, bands n41, n78, and n1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Beam** | **Reference** | **Measurement result** | **Pass/fail limit** |
| fc = 2450 MHz (n41) | Beam 1 | Input 1:  V/H = -0.5 dB  Input 2:  V/H = 0.6 dB | Input 1:  V/H = -0.96 dB  Input 2:  V/H = 0.94 dB | ±1 dB |
| Beam 2 | Input 3:  V/H = -0.6 dB  Input 4:  V/H = 0.7 dB | Input 3:  V/H = -0.11 dB  Input 4:  V/H = 0.71 dB |
| fc = 3600 MHz (n78) | Beam 1 | Input 1:  V/H = -0.6 dB  Input 2:  V/H = 0.7 dB | Input 1:  V/H = -0.51 dB  Input 2:  V/H = 1.19 dB |
| Beam 2 | Input 3:  V/H = -0.7 dB  Input 4:  V/H = 0.8 dB | Input 3:  V/H = -0.41 dB  Input 4:  V/H = 0.47 dB |
| fc = 2132.5 MHz (n1) | Beam 1 | Input 1+2:  V/H = 0 dB | Input 1+2:  V/H = 0.31 dB |
| Beam 2 | Input 3+4:  V/H = 0 dB | Input 3+4:  V/H = -0.25 dB |

**Table 6.2.2.4-3: Lab 3: Cross-polarization verification results for CDL-C UMa, bands n41 and n78**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Beam** | **Reference** | **Measurement result** | **Pass/fail limit** |
| fc = 2450 MHz (n41) | Beam 1 | Input 1:  V/H = -0.5 dB  Input 2:  V/H = 0.6 dB  Input 1+ 2:  V/H = 0 dB | Input 1:  V/H = -0.98 dB  Input 2:  V/H = 0.63 dB  Input 1+ 2:  V/H = -0.21 dB | ±1 dB |
| Beam 2 | Input 3:  V/H = -0.6 dB  Input 4:  V/H = 0.7 dB  Input 3+4:  V/H = 0 dB | Input 3:  V/H = -1.1dB  Input 4:  V/H = -0.07 dB  Input 3+4:  V/H = -0.60 dB |
| fc = 3600 MHz (n78) | Beam 1 | Input 1:  V/H = -0.6 dB  Input 2:  V/H = 0.7 dB  Input 1+ 2:  V/H = 0 dB | Input 1:  V/H = -0.45  Input 2:  V/H = 1.32 dB  Input 1+ 2:  V/H = 0.39 dB |
| Beam 2 | Input 3:  V/H = -0.7 dB  Input 4:  V/H = 0.8 dB  Input 3+4:  V/H = 0 dB | Input 3:  V/H = 0.25  Input 4:  V/H = 1.61  Input 3+4:  V/H = 0.91 dB |

**Table 6.2.2.4-4: Lab 4: Cross-polarization verification results for CDL-C UMa, bands n41 and n78**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Beam** | **Reference** | **Measurement result** | **Pass/fail limit** |
| fc = 2450 MHz (n41) | Beam 1 | Input 1:  V/H = -0.5 dB  Input 2:  V/H = 0.6 dB  Input 1+ 2:  V/H = 0 dB | Input 1:  V/H = -0.48 dB  Input 2:  V/H = 0.57 dB  Input 1+ 2:  V/H = 0.36 dB | ±1 dB |
|  | Beam 2 | Input 3:  V/H = -0.6 dB  Input 4:  V/H = 0.7 dB  Input 3+4:  V/H = 0 dB | Input 3:  V/H = -0.69 dB  Input 4:  V/H = 0.71 dB  Input 3+4:  V/H = 0.52 dB |
| fc = 3600 MHz (n78) | Beam 1 | Input 1:  V/H = -0.6 dB  Input 2:  V/H = 0.7 dB  Input 1+ 2:  V/H = 0 dB | Input 1:  V/H = -0.48  Input 2:  V/H = 0.99 dB  Input 1+ 2:  V/H = 0.47 dB |
|  | Beam 2 | Input 3:  V/H = -0.7 dB  Input 4:  V/H = 0.8 dB  Input 3+4:  V/H = 0 dB | Input 3:  V/H = -0.34  Input 4:  V/H = 1.13  Input 3+4:  V/H = 0.66 dB |

**Table 6.2.2.4-5: Lab 5: Cross-polarization verification results for CDL-C UMa, band n41 and n78**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Beam** | **Reference** | **Measurement result** | **Pass/fail limit** |
| fc = 2450 MHz (n41) | Beam 1 | Input 1+2:  V/H = 0 dB | 0.38 dB | ±1 dB |
|  | Beam 2 | Input 3+4:  V/H = 0 dB | 0.12 dB |
| fc = 3600 MHz (n78) | Beam 1 | Input 1+2:  V/H = 0 dB | -0.25dB |
|  | Beam 2 | Input 3+4:  V/H = 0 dB | 0.34dB |

**Table 6.2.2.4-6: Lab 6: Cross-polarization verification results for CDL-C UMa, bands n41, n78, and n1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Beam** | **Reference** | **Measurement result** | **Pass/fail limit** |
| fc = 2450 MHz (n41) | Beam 1 | Input 1+2:  V/H = 0 dB | -0.6555 dB | ±1 dB |
| Beam 2 | Input 3+4:  V/H = 0 dB | -0.0676 dB |
| fc = 3600 MHz (n78) | Beam 1 | Input 1+2:  V/H = 0 dB | 0.5064 dB |
| Beam 2 | Input 3+4:  V/H = 0 dB | 0.6414 dB |
| fc = 2132.5 MHz (n1) | Beam 1 | Input 1+2:  V/H = 0 dB | -0.75 dB |
| Beam 2 | Input 3+4:  V/H = 0 dB | -0.05 dB |

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< start of change 8 >

#### 6.2.2.5 Power validation

The Power validation results of UMa CDL-C for bands n41, n78, and n1 are presented in Table 6.2.2.5-1~5.

Table 6.2.2.5-1: Lab 1: Power validation results for CDL-C UMa, bands n41, n78, and n1 (Unit: dBm/30kHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Frequency | Measured V power | Measured H power | Measured total power | Target power | Delta | Pass/fail limit |
| 2592.99 MHz | -79.6244 | -79.5959 | -76.5999 | -77 | 0.4001 | ±1.5 dB |
| 3549.99 MHz | -79.9988 | -79.6618 | -76.8168 | -77 | 0.1832 |
| 2140 MHz | -83.7348 | -82.9744 | -80.3277 | -80 | -0.32768 |

Table 6.2.2.5-2: Lab 2: Power validation results for CDL-C UMa, band n1 (Unit: dBm/30kHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Frequency | Measured V power | Measured H power | Measured total power | Target power | Delta | Pass/fail limit |
| 2140 MHz | -83.42 | -84.87 | -81.0745 | -82 | -0.926 | ±1.5 dB |

**Table 6.2.2.5-3: Lab 4: Power validation results for CDL-C UMa, bands n41 and n78 (Unit: dBm/30kHz)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Measured power** | **Target power** | **Delta** | **Pass/fail limit** |
| CDL-C UMa, n41  2592.99 MHz | -80.8630082 | -80.6 | -0.26 | ±1.5 dB |
| CDL-C UMa, n78  3549.99 MHz | -80.9320026 | -80.6 | -0.33 |

**Table 6.2.2.5-4: Lab 5: Power validation results for CDL-C UMa, bands n41 and n78 (Unit: dBm/20MHz)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency** | **Measured power** | **Target power** | **Delta** | **Pass/fail limit** |
| fc = 2593 MHz | -51.17 | -50.22 | -0.94dB | ±1.5dB |
| fc = 3550 MHz | -51.76 | -51.69 | -0.07 dB | ±1.5dB |

**Table 6.2.2.5-5 (a): Lab 6: Power validation results for CDL-C UMa, band n41 (Unit: dBm/20MHz)**

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**Table 6.2.2.5-5 (b): Lab 6: Power validation results for CDL-C UMa, band n78 (Unit: dBm/20MHz)**

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**Table 6.2.2.5-5 (c): Lab 6: Power validation results for CDL-C UMa, band n1 (Unit: dBm/20MHz)**

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Table 6.2.2.5-5: Lab 2: Power validation results for CDL-C UMi, Bands n28, n5, n1 (Unit: dBm/15kHz)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Frequency | Measured Power V component | Measured Power H component | Measured Power | Target power | Delta | Pass/fail limit |
| 780.5MHz | -83.432 | -83.036 | -80.219 | -80 | 0.219 | ±1.5dB |
| 881.5MHz | -85.812 | -84.695 | -82.207 | -82 | 0.207 |
| 2140MHz | -84.32 | -86.6 | -82.302 | -82 | 0.302 |

< end of change 9 >