**3GPP TSG-RAN4 Meeting #113 *R4-241xxxx***

**Orlando, US, 18 – 22 November, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** | - | **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:*** | draftCR on performance requirements for RedCap positioning | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh2-Perf | | | | |  | ***Date:*** | | | 2024-11-05 |
|  |  | | | |  | |  | | |  |
| ***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 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:*** | | 1. The RSRP accuracy for 1RX RedCap UE are not aligned with simulation results as copied below from R4-2416903.   C:\Users\z00471532\AppData\Roaming\WeLink_Desktop\appdata\IM\z00471532\ReceiveFiles\ScreenShot\EB29DB2D-61CE-48DA-9E65-E632A52347C1.png   1. The simulation results for RSRP for 1RX RedCap UE are for 90%-tile error, while the relative accuracy is derived based on 95%-5% -tile error according to R16 agreement in R4-2108040. The current simulation results do not support defining relative RSRP accuracy for 1RX RedCap UE. 2. The RSRPP accuracy for 1RX RedCap UE are not aligned with simulation results as copied below from R4-2416903. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Update RSRP accuracy for 1RX RedCap UE based on simulation results from R4-2416903. 2. Remove relative RSRP accuracy for 1RX RedCap UE. 3. Update RSRPP accuracy for 1RX RedCap UE based on simulation results from R4-2416903. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Accuracy requirements for RedCap UE are incorrect. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 10.1A.17.2, 10.1A.19.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | The CR is based on revised version of big draftCR R4-2416892 from RAN4 reflector after RAN4#112-bis | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<Start of Change 1>

10.1A.17.2 Measurement Accuracy Requirements

10.1A.17.2.1 Absolute PRS RSRP Accuracy Requirement

Accuracy requirement, corresponding to the PRS bandwidth supported by the RedCap UE for measurement without RX FH, defined in clause 10.1.24.2.1 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE without RX FH.

Accuracy requirement in clause 10.1.24.2.1 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE with RX FH, where the PRS bandwidth in clause 10.1.24.2.1 correspond to the PRS bandwidth measured by the RedCap UE per hop.

Accuracy requirement in table 10.1A.17.2.1-1 applies to the 4-sample PRS-RSRP measurement performed by 1Rx RedCap UE without RX FH.

Accuracy requirement in table 10.1A.17.2.1-2 applies to reduced sample PRS-RSRP measurement performed by 1Rx RedCap UE without RX FH

Accuracy requirement in table 10.1A.17.2.1-1 and table 10.1A.17.2.1-2 apply to the PRS-RSRP measurement performed by 1Rx RedCap UE with RX FH, where the PRS bandwidth in table 10.1A.17.2.1-1 and table 10.1A.17.2.1-2 correspond to the PRS bandwidth measured by the RedCap UE per hop.

**Table 10.1A.17.2.1-1: PRS-RSRP absolute accuracy for 1Rx RedCap UE in FR1 (without RX FH)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | | | | |
| **Normal condition** | **Extreme condition** | **PRS Ês/Iot** | **PRS BWNote 2** | **Repetition factor**  **(** | **Io Note 5 range** | | | | |
| **NR operating band groups Note 6** | **Minimum Io Note 1**  **dBm / SCSPRS** | | | **Maximum Io** |
| **dB** | **dB** | **dB** | **PRB** |  |  | **dBm / SCSPRS** | | | **dBm/BWChannel** |
| **dBm/15kHz Note 4** | **dBm/30kHz Note 4** | **dBm/60kHz Note 4** |
| ±7 | ±11.5 | ≥-3dB | ≥24 | All | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A, NR\_SDL\_FR1\_A | -127 | -124 | -121 | -50 |
| NR\_FDD\_FR1\_B | -126.5 | -123.5 | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -126 | -123 | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -122.5 | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -122 | -119 | -50 |
| NR\_FDD\_FR1\_F | -124.5 | -121.5 | -118.5 | -50 |
| NR\_FDD\_FR1\_G, NR\_TDD\_FR1\_G | -124 | -121 | -118 | -50 |
| NR\_FDD\_FR1\_H | -123.5 | -120.5 | -117.5 | -50 |
| NR\_FDD\_FR1\_N | -120.5 | -117.5 | -114.5 | -50 |
| ±7.5] | ±12 | ≥-10dB | 24 ≤ BW ≤ 52 | All | Note 3 | | | | |
| ±6] | ±10.5 | 52< BW≤ 104 | All | Note 3 | | | | |
| ±5.5] | ±9.5 | BW >104 | All | Note 3 | | | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: PRS bandwidth is as indicated in *dl-PRS-ResourceBandwidth* in the DL-TDOA or DL-AoD or multi-RTT assistance data defined in [34].  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 5: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 6: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | |

**Table 10.1A.17.2.1-2: PRS-RSRP absolute accuracy for 1Rx RedCap UE in FR1 with reduced sample number (without RX FH)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | | | | | |
| **Normal condition** | **Extreme condition** | **PRS Ês/Iot** | **PRS BWNote 2** | **Repetition factor**  **(** | **Io Note 6 range** | | | | | |
| **NR operating band groups Note 5** | **Minimum Io Note 1**  **dBm / SCSPRS** | | | | **Maximum Io** |
| **dB** | **dB** | **dB** | **PRB** |  |  | **dBm / SCSPRS** | | | | **dBm/BWChannel** |
| **dBm/15kHz Note 4** | | **dBm/30kHz Note 4** | **dBm/60kHz Note 4** |
| ±3.5 | ±8 | ≥0 | ≥48 | All | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A, NR\_SDL\_FR1\_A | -127 | -124 | | -121 | -50 |
| NR\_FDD\_FR1\_B | -126.5 | -123.5 | | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -126 | -123 | | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -122.5 | | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -122 | | -119 | -50 |
| NR\_FDD\_FR1\_F | -124.5 | -121.5 | | -118.5 | -50 |
| NR\_FDD\_FR1\_G, NR\_TDD\_FR1\_G | -124 | -121 | | -118 | -50 |
| NR\_FDD\_FR1\_H | -123.5 | -120.5 | | -117.5 | -50 |
|  |  |  |  |  | NR\_FDD\_FR1\_N | -120.5 | -117.5 | | -114.5 | -50 |
| ±4 | ±8.5 | ≥-6 | 48 ≤ BW ≤ 52 | All | Note 3 | | | | | |
| ±4 | ±8.5 | 52< BW≤ 104 | All | Note 3 | | | | | |
| ±3.5 | ±8 | BW >104 | All | Note 3 | | | | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: PRS bandwidth is as indicated in *dl-PRS-ResourceBandwidth* in the DL-TDOA or DL-AoD or multi-RTT assistance data defined in [34].  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.  NOTE 4: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 5: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | | |

10.1A.17.2.2 Relative PRS RSRP Accuracy Requirement

Relative accuracy requirement, corresponding to the PRS bandwidth supported by the RedCap UE for measurement without RX FH, defined in clause 10.1.24.2.2 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE without RX FH.

Relative accuracy requirement in clause 10.1.24.2.2 apply to the PRS-RSRP measurement performed by 2Rx RedCap UE with RX FH, where the PRS bandwidth in clause 10.1.24.2.2 correspond to the PRS bandwidth measured by the RedCap UE per hop.







<End of Change 1>

<Start of Change 2>

10.1A.19.2 Measurement Accuracy Requirements

10.1A.19.2.1 Absolute PRS RSRPP accuracy

The absolute accuracy requirements for PRS-RSRPP measurements for 1Rx RedCap UE for FR1 defined in table 10.1A.19.2.1-1 and table 10.1A.19.2.1-2 are valid under the following conditions:

- Conditions defined in 38.101-1 clause 7.3 for reference sensitivity are fulfilled.

- PRP 1,2|dBm according to annex B.2.14 for a corresponding Band.

The absolute accuracy requirements for PRS-RSRPP measurements defined in clause 10.1.38.2.1 are reused for 2Rx RedCap UE.

The absolute accuracy requirements for PRS-RSRPP measurement defined in table 10.1A.19.2.1-1 apply for the RedCap UE not supporting *supportedDL-PRS-ProcessingSamples* [34] or LMF does not indicate RedCap UE to perform positioning measurements with reduced number of samples.

The absolute accuracy requirements for PRS-RSRPP measurement defined in table 10.1A.19.2.1-2 apply for the RedCap UE supporting *supportedDL-PRS-ProcessingSamples* [34].

The absolute accuracy requirements for PRS-RSRPP measurement defined in this clause apply to the measurements with and without frequency hopping. For the measurements with frequency hopping, the accuracy requirements apply for the corresponding PRS bandwidth per hop.

Note: The requriements in this clause are derived based on two-tap channel defined in 38.101-4 annex B.2.4 (a = 1, τd=0.45 µs and fD=5 Hz).

Note: The requirements in this clause are derived based on the difference between the estimated PRS-RSRPP compared to the ideal PRS-RSRPP defined as

Where:

is the effective channel frequency response (over REs occupied by PRS) measured without receiver noise.

is the exact delay of the p-th path in the channel model.

**Table 10.1A.19.2.1-1: PRS-RSRPP absolute accuracy for 1Rx RedCap UE for FR1**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | | | | |
| **Normal condition** | **Extreme condition** | **PRS Ês/Iot** | **PRS BW** | **Repetition factor**  **(** | **Io Note 6 range** | | | | |
| **NR operating band groups Note 7** | **Minimum Io Note 1**  **dBm / SCSPRS** | | | **Maximum Io** |
| **dB** | **dB** | **dB** | **PRB** | **-** |  | **dBm / SCSPRS** | | | **dBm/BWChannel** |
| **dBm/15kHz Note 5** | **dBm/30kHz Note 5** | **dBm/60kHz Note 5** |
| ±3.5 | ±8 | ≥-3 | ≥24 | All | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A, NR\_SDL\_FR1\_A | -127 | -124 | -121 | -50 |
| NR\_FDD\_FR1\_B | -126.5 | -123.5 | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -126 | -123 | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -122.5 | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -122 | -119 | -50 |
| NR\_FDD\_FR1\_F | -124.5 | -121.5 | -118.5 | -50 |
| NR\_FDD\_FR1\_G | -124 | -121 | -118 | -50 |
| NR\_FDD\_FR1\_H | -123.5 | -120.5 | -117.5 | -50 |
| NR\_FDD\_FR1\_N | -120.5 | -117.5 | -114.5 | -50 |
| Note 3 | | | | |
| Note 3 | | | | |
| ±4.5 | ±9 | ≥-10 | 24 ≤ BW ≤ 52 | All | Note 3 | | | | |
| ±4 | ±8.5 | BW > 52 | All | Note 3 | | | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in [34].  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 24 PRB.  NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | |

**Table 10.1A.19.2.1-2: PRS-RSRPP absolute accuracy for 1Rx RedCap UE for FR1 for reduced number of samples**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Accuracy** | | **Conditions** | | | | | | | |
| **Normal condition** | **Extreme condition** | **PRS Ês/Iot** | **PRS BW** | **Repetition factor**  **(** | **Io Note 6 range** | | | | |
| **NR operating band groups Note 7** | **Minimum Io Note 1**  **dBm / SCSPRS** | | | **Maximum Io** |
| **dB** | **dB** | **dB** | **PRB** | **-** |  | **dBm / SCSPRS** | | | **dBm/BWChannel** |
| **dBm/15kHz Note 5** | **dBm/30kHz Note 5** | **dBm/60kHz Note 5** |
| ±3.5 | ±8 | ≥0 | ≥48 | All | NR\_FDD\_FR1\_A, NR\_TDD\_FR1\_A, NR\_SDL\_FR1\_A | -127 | -124 | -121 | -50 |
| NR\_FDD\_FR1\_B | -126.5 | -123.5 | -120.5 | -50 |
| NR\_TDD\_FR1\_C | -126 | -123 | -120 | -50 |
| NR\_FDD\_FR1\_D, NR\_TDD\_FR1\_D | -125.5 | -122.5 | -119.5 | -50 |
| NR\_FDD\_FR1\_E, NR\_TDD\_FR1\_E | -125 | -122 | -119 | -50 |
| NR\_FDD\_FR1\_F | -124.5 | -121.5 | -118.5 | -50 |
| NR\_FDD\_FR1\_G | -124 | -121 | -118 | -50 |
| NR\_FDD\_FR1\_H | -123.5 | -120.5 | -117.5 | -50 |
| NR\_FDD\_FR1\_N | -120.5 | -117.5 | -114.5 | -50 |
| Note 3 | | | | |
| Note 3 | | | | |
| ±4 | ±8.5 | ≥-6 | 48 ≤ BW ≤ 52 | All | Note 3 | | | | |
| ±3.5 | ±7.5 | BW >52 | All | Note 3 | | | | |
| NOTE 1: This minimum Io condition is expressed as the average Io per RE over all REs in an OFDM symbol.  NOTE 2: PRS bandwidth is as indicated in *prs-Bandwidth* in the DL-TDOA or DL-AoD assistance data defined in [34].  NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding requirement with the PRS bandwidth ≥ 48 PRB.  NOTE 4: The serving cell, the reference cell, and the measured neighbour cell i are on the same carrier frequency.  NOTE 5: The condition level is increased by ∆>0, when applicable, as described in Sections B.3.2 and B.3.3.  NOTE 6: The Io is defined in PRS positioning subframes. The same Io range applies to PRS and non-PRS symbols. Io levels are different in PRS and non-PRS symbols within the same subframe.  NOTE 7: NR operating band groups are as defined in Section 3.5.2. | | | | | | | | | |

<End of Change 2>