**3GPP TSG-RAN4 Meeting #108bis *R4-2317734***

**Xiamen, China, 09 - 13 October, 2023**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-1** | **CR** |  | **rev** | **-** | **Current version:** | **18.3.0** |  |
|  | | | | | | | | |
| *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:*** | Draft CR to 38.101-1: Introduction of eRedCap | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Inc. | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_redcap\_enh-Core | | | | |  | ***Date:*** | | | 2023-08-11 |
|  |  | | | |  | |  | | |  |
| ***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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | This draft CR introduces eRedCap feature to TS 38.101-1 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Clause 5.3I captures the RB restriction for UE type with both reduced peak rate and reduced baseband bandwidth.  Clause 7.1I captures the RB placement to be middle of the RF channel in both Tx and Rx (when applicable) for UE type with both reduced peak rate and reduced baseband bandwidth and UL configuration is the same as defined for reference sensitivity.  Clause 7.3I.3, a new clause to capture rules how reference sensitivity is re-used from Rel-17 RedCap | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | eRedCap is missing from UE RF requirement specification | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 5.3I, 7.1I, 7.3I.3 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.521-1 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | The changes are on top of TS version 18.2.0. | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### 

<Start of changes>

## 5.3I Channel bandwidth for RedCap

The requirements in this specification apply to the combination of channel bandwidths, SCS and operating bands shown in Table 5.3.5-1 with maximum channel bandwidth of 20MHz. The transmission bandwidth configuration in Table 5.3.2-1 shall be supported for each of the specified channel bandwidths up to 20 MHz. When UE indicates support for [eRedCap BW3/PR3 + PR1 UE] the requirements in this specification apply with maximum contiguous transmission bandwidth of 25RB for 15 kHz SCS and 12 RB for 30 kHz SCS. The channel bandwidths are specified for both the TX and RX path.

## 5.4 Channel arrangemen

<Unchanged sections omitted>

## 7.1I General

For a Redcap UE the requirements in Section 7 shall be verified with the channel bandwidth up to 20MHz and REFSENS specified in clause 7.3I.

When UE indicates support for [eRedCap BW3/PR3 + PR1 UE], the Rx requirements in clauses 7.4 to 7.9 for 10, 15 and 20 MHz channel bandwidth shall be verified only with Tx and Rx RBs, when applicable, allocated within [RBlow = round(NRB/2 - ceil(NRB\_PR3/2)) and RBhigh = RBlow + NRB\_PR3)], where RBlow and RBhigh are the lowest and highest RB used position and NRB\_PR3 is 25 for 15 kHz SCS and 12 for 30 kHz SCS. For 15 kHz SCS the UL configuration shall be the same as defined for reference sensitivity in clause 7.3I.3 for 5 MHz channel bandwidth. For 30 kHz SCS the UL configuration shall be the minimum between the configuration in 7.3I.3 for 10 MHz channel bandwidth and 12 RB.

## 7.2 Diversity characteristics

<Unchanged sections omitted>

## 7.3I Reference sensitivity for RedCap

### 7.3I.1 General

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

### 7.3I.2 Reference sensitivity power level

For a RedCap UE equipped with 2 Rx antenna ports, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2, A3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.2-1a and Table 7.3.2-1b for the applicable operating bands. The reference sensitivity (REFSENS) requirement specified for a RedCap UE equipped with 2 Rx antenna ports shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2-3 and, for FDD bands, with the Tx-Rx separation as defined in clause 5.4.4 for the applicable band and UE channel bandwidth.

For a RedCap UE equipped with 1 Rx antenna ports, reference sensitivity for 2Rx antenna ports in Table 7.3.2-1a and in Table 7.3.2-1b shall be modified by the amount given in ΔR1R in Table 7.3I.2-1 for the applicable operating bands. The reference sensitivity (REFSENS) requirement specified for a RedCap UE equipped with 1 Rx antenna ports shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2-3 and, for FDD bands, with the Tx-Rx separation as defined in clause 5.4.4 for the applicable band and UE channel bandwidth.

Table 7.3I.2-1: Single antenna port reference sensitivity allowance ΔR1R

|  |  |  |
| --- | --- | --- |
| Operating band | Channel bandwidth (MHz) | ΔR1R (dB) |
| TDD band | 5, 10, 15, 20 | 2.5 |
| FDD band | 5 | 2.5 |
| FDD band | 10, 15, 20 | 3.0 |

For a RedCap UE equipped with 2 Rx antenna ports operating in HD-FDD mode, reference sensitivity for 2Rx antenna ports in Table 7.3I.2-2 shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3I.2-4.

**Table 7.3I.2-2: HD-FDD RedCap UE with 2 Rx antenna port reference sensitivity**

| Operating band / SCS / Channel bandwidth | | | | | |
| --- | --- | --- | --- | --- | --- |
| Operating Band | SCS kHz | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) |
| n1 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |
| 30 |  | -97.2 | -95.2 | -93.9 |
| 60 |  | -97.5 | -95.4 | -94.2 |
| n2 | 15 | -98.8 | -95.6 | -93.8 | -92.5 |
| 30 |  | -96.0 | -94.0 | -92.7 |
| 60 |  | -96.3 | -94.2 | -93.0 |
| n3 | 15 | -97.8 | -94.6 | -92.8 | -91.5 |
| 30 |  | -95.0 | -93.0 | -91.7 |
| 60 |  | -95.3 | -93.2 | -92.0 |
| n5 | 15 | -98.8 | -95.6 | -93.8 | -92.5 |
| 30 |  | -96.0 | -94.0 | -92.7 |
| n7 | 15 | -98.8 | -95.6 | -93.8 | -92.5 |
| 30 |  | -96.0 | -94.0 | -92.7 |
| 60 |  | -96.3 | -94.2 | -93.0 |
| n8 | 15 | -97.8 | -94.6 | -92.8 | -91.5 |
| 30 |  | -95.0 | -93.0 | -91.7 |
| n12 | 15 | -97.8 | -94.6 | -92.8 |  |
| 30 |  | -95.0 | -93.0 |  |
| n13 | 15 | -97.8 | -94.6 |  |  |
| 30 |  | -95.0 |  |  |
| n14 | 15 | -97.8 | -94.6 |  |  |
| 30 |  | -95.0 |  |  |
| n18 | 15 | -100.0 | -96.8 | -95.0 |  |
| 30 |  | -97.2 | -95.2 |  |
| n20 | 15 | -97.8 | -94.6 | -92.8 | -91.5 |
| 30 |  | -95.0 | -93.0 | -91.7 |
| n24 | 15 | -100.0 | -96.8 |  |  |
| 30 |  | -97.2 |  |  |
| 60 |  | -97.5 |  |  |
| n25 | 15 | -97.3 | -94.1 | -92.3 | -91.0 |
| 30 |  | -94.5 | -92.5 | -91.2 |
| 60 |  | -94.8 | -92.7 | -91.5 |
| n26 | 15 | -98.3 | -95.1 | -93.3 | -92.0 |
| 30 |  | -95.5 | -93.5 | -92.2 |
| n28 | 15 | -99.3 | -96.1 | -94.3 | -93.0 |
| 30 |  | -96.5 | -94.5 | -93.2 |
| n30 | 15 | -99.5 | -96.3 |  |  |
| 30 |  | -96.7 |  |  |
| n65 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |
| 30 |  | -97.2 | -95.2 | -93.9 |
| 60 |  | -97.5 | -95.4 | -94.2 |
| n66 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |
| 30 |  | -97.2 | -95.2 | -93.9 |
| 60 |  | -97.5 | -95.4 | -94.2 |
| n70 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |
| 30 |  | -97.2 | -95.2 | -93.9 |
| 60 |  | -97.5 | -95.4 | -94.2 |
| n71 | 15 | -98.0 | -94.8 | -93.0 | -91.7 |
| 30 |  | -95.2 | -93.2 | -91.9 |
| n74 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |
| 30 |  | -97.2 | -95.2 | -93.9 |
| 60 |  | -97.5 | -95.4 | -94.2 |
| n85 | 15 | -97.8 | -94.6 | -92.8 |  |
| 30 |  | -95.0 | -93.0 |  |
| n91 | 15 | -100.0 |  |  |  |
| n92 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |
| 30 |  | -97.2 | -95.2 | -93.9 |
| n93 | 15 | -100.0 |  |  |  |
| n94 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |
| 30 |  | -97.2 | -95.2 | -93.9 |

For a RedCap UE equipped with 1 Rx antenna ports and operating in HD-FDD mode, reference sensitivity for 1Rx antenna ports in Table 7.3I.2-3 shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3I.2-4.

Table 7.3I.2-3: HD-FDD RedCap UE with 1 Rx antenna port reference sensitivity

| Operating band / SCS / Channel bandwidth | | | | | |
| --- | --- | --- | --- | --- | --- |
| Operating Band | SCS kHz | 5 MHz (dBm) | 10 MHz (dBm) | 15 MHz (dBm) | 20 MHz (dBm) |
| n1 | 15 | -97.5 | -94.3 | -92.5 | -91.2 |
| 30 |  | -94.7 | -92.7 | -91.4 |
| 60 |  | -95.0 | -92.9 | -91.7 |
| n2 | 15 | -96.3 | -93.1 | -91.3 | -90.0 |
| 30 |  | -93.5 | -91.5 | -90.2 |
| 60 |  | -93.8 | -91.7 | -90.5 |
| n3 | 15 | -95.3 | -92.1 | -90.3 | -89.0 |
| 30 |  | -92.5 | -90.5 | -89.2 |
| 60 |  | -92.8 | -90.7 | -89.5 |
| n5 | 15 | -96.3 | -93.1 | -91.3 | -90.0 |
| 30 |  | -93.5 | -91.5 | -90.2 |
| n7 | 15 | -96.3 | -93.1 | -91.3 | -90.0 |
| 30 |  | -93.5 | -91.5 | -90.2 |
| 60 |  | -93.8 | -91.7 | -90.5 |
| n8 | 15 | -95.3 | -92.1 | -90.3 | -89.0 |
| 30 |  | -92.5 | -90.5 | -89.2 |
| n12 | 15 | -95.3 | -92.1 | -90.3 |  |
| 30 |  | -92.5 | -90.5 |  |
| n13 | 15 | -95.3 | -92.1 |  |  |
| 30 |  | -92.5 |  |  |
| n14 | 15 | -95.3 | -92.1 |  |  |
| 30 |  | -92.5 |  |  |
| n18 | 15 | -97.5 | -94.3 | -92.5 |  |
| 30 |  | -94.7 | -92.7 |  |
| n20 | 15 | -95.3 | -92.1 | -90.3 | -89.0 |
| 30 |  | -92.5 | -90.5 | -89.2 |
| n24 | 15 | -97.5 | -94.3 |  |  |
| 30 |  | -94.7 |  |  |
| 60 |  | -95.0 |  |  |
| n25 | 15 | -94.8 | -91.6 | -89.8 | -88.5 |
| 30 |  | -92.0 | -90.0 | -88.7 |
| 60 |  | -92.3 | -90.2 | -89.0 |
| n26 | 15 | -95.8 | -92.6 | -90.8 | -89.5 |
| 30 |  | -93.0 | -91.0 | -89.7 |
| n28 | 15 | -96.8 | -93.6 | -91.8 | -90.5 |
| 30 |  | -94.0 | -92.0 | -90.7 |
| n30 | 15 | -97.0 | -93.8 |  |  |
| 30 |  | -94.2 |  |  |
| n65 | 15 | -97.5 | -94.3 | -92.5 | -91.2 |
| 30 |  | -94.7 | -92.7 | -91.4 |
| 60 |  | -95.0 | -92.9 | -91.7 |
| n66 | 15 | -97.5 | -94.3 | -92.5 | -91.2 |
| 30 |  | -94.7 | -92.7 | -91.4 |
| 60 |  | -95.0 | -92.9 | -91.7 |
| n70 | 15 | -97.5 | -94.3 | -92.5 | -91.2 |
| 30 |  | -94.7 | -92.7 | -91.4 |
| 60 |  | -95.0 | -92.9 | -91.7 |
| n71 | 15 | -95.5 | -92.3 | -90.5 | -89.2 |
| 30 |  | -92.7 | -90.7 | -89.4 |
| n74 | 15 | -97.5 | -94.3 | -92.5 | -91.2 |
| 30 |  | -94.7 | -92.7 | -91.4 |
| 60 |  | -95.0 | -92.9 | -91.7 |
| n85 | 15 | -95.3 | -92.1 | -90.3 |  |
| 30 |  | -92.5 | -90.5 |  |
| n91 | 15 | -97.5 |  |  |  |
| n92 | 15 | -97.5 | -94.3 | -92.5 | -91.2 |
| 30 |  | -94.7 | -92.7 | -91.4 |
| n93 | 15 | -97.5 |  |  |  |
| n94 | 15 | -97.5 | -94.3 | -92.5 | -91.2 |
| 30 |  | -94.7 | -92.7 | -91.4 |

Table 7.3I.2-4: Uplink configuration for HD-FDD reference sensitivity

| Operating band / SCS / Channel bandwidth | | | | | |
| --- | --- | --- | --- | --- | --- |
| Operating Band | SCS kHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz |
| n1 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n2 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n3 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n5 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| n7 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n8 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| n12 | 15 | 25 | 50 | 75 |  |
| 30 |  | 24 | 36 |  |
| n13 | 15 | 25 | 50 |  |  |
| 30 |  | 24 |  |  |
| n14 | 15 | 25 | 50 |  |  |
| 30 |  | 24 |  |  |
| n18 | 15 | 25 | 50 | 75 |  |
| 30 |  | 24 | 36 |  |
| n20 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| n24 | 15 | 25 | 50 |  |  |
| 30 |  | 24 |  |  |
| 60 |  | 10 |  |  |
| n25 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n26 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| n28 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| n30 | 15 | 25 | 50 |  |  |
| 30 |  | 24 |  |  |
| n65 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n66 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n70 | 15 | 25 | 50 | 75 | NOTE 1 |
| 30 |  | 24 | 36 | NOTE 1 |
| 60 |  | 10 | 18 | NOTE 1 |
| n71 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| n74 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| 60 |  | 10 | 18 | 24 |
| n85 | 15 | 25 | 50 | 75 |  |
| 30 |  | 24 | 36 |  |
| n91 | 15 | 25 |  |  |  |
| n92 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| n93 | 15 | 25 |  |  |  |
| n94 | 15 | 25 | 50 | 75 | 100 |
| 30 |  | 24 | 36 | 50 |
| NOTE 1: For DL channel bandwidths that do not have symmetric UL channel bandwidth, highest valid UL configuration with lowest TX-RX separation (Table 5.4.4-1) shall be used unless otherwise specified. | | | | | |

### 7.3I.3 Reference sensitivity power level for eRedCap

For UE indicating support for [eRedCap 20MHz + PR1 UE], the REFSENS requirements for RedCap UE in clause 7.3I.2 are applicable.

For UE indicating support for [eRedCap BW3/PR3 + PR1 UE], the reference sensitivity level for 5 MHz channel bandwidth defined in clause 7.3I.2 applies. The same requirement applies also for 10, 15 and 20 MHz channel bandwidth with 15kHz SCS and both Tx and Rx RBs, when applicable, allocated within [RBlow = round(NRB/2 - ceil(NRB\_PR3/2)) and RBhigh = RBlow + NRB\_PR3)], where RBlow and RBhigh are the lowest and highest RB used position and NRB\_PR3 is 25 for 15 kHz SCS and 12 for 30 kHz SCS.

For UE indicating support for [eRedCap BW3/PR3 + PR1 UE], for 30 kHz SCS, the reference sensitivity level defined for 10 MHz channel bandwidth in clause 7.3I.2 applies with 3 dB reduced level and and both Tx and Rx RBs allocated within [RBlow = round(NRB/2 - ceil(NRB\_PR3/2)) and RBhigh = RBlow + NRB\_PR3)], where RBlow and RBhigh are the lowest and highest RB used position and NRB\_PR3 12 for 30 kHz SCS.

NOTE: It is sufficient to verify requirements only with 5 MHz channel bandwidth for 15 kHz SCS and 10 MHz channel bandwidth with 30 kHz SCS.

## 7.4 Maximum input level

<End of changes>