**3GPP TSG-RAN WG4 Meeting #112 R4-241xxxx**

**Maastricht, Netherlands, 19th – 23rd August, 2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.161** | **CR** | **0014** | **rev** | **3** | **Current version:** | **18.1.0** |  |
|  | | | | | | | | |
| *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 to TS 38.161 on Rel-18 FR1 TRP TRS requirements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | vivo, Samsung, OPPO, Apple, Xiaomi, Huawei, Vodafone, NTT DoCoMo, Telecom Italia, Orange | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_FR1\_TRP\_TRS\_enh-Perf | | | | |  | ***Date:*** | | | 2024-08-08 |
|  |  | | | |  | |  | | |  |
| ***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:*** | | The specified Rel-18 FR1 TRP TRS requirements should be added in TS. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Adding the Rel-18 FR1 TRP TRS requirements concluded this meeting. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The spec is incomplete. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.3, 6, 7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R4-2413593 | | | | | | | | |

<Start of Changes>

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AC Anechoic Chamber

BHH Beside Head and Hand

BHHL Beside Head and Hand Left Side (Head and Hand Phantom)

BHHR Beside Head and Hand Right Side (Head and Hand Phantom)

CA Carrier Aggregation

DUT Device Under Test

E-UTRA Evolved UTRA

EIRP Effective Isotropic Radiated Power

EUT Equipment Under Test

FR1 Frequency Range 1

FS Free Space

HL Hand Left (Hand Phantom Only)

HR Hand Right (Hand Phantom Only)

MPR Allowed maximum power reduction

NR New Radio

NSA Non-Standalone, a mode of operation where operation of an other radio is assisted with an other radio

OTA Over The Air

QZ Quiet Zone

RedCap Reduced Capability

SA Standalone

SS System Simulator

TAA Time-Averaging Algorithm

TAS Tx Antenna Switching

TRP Total Radiated Power

TRS Total Radiated Sensitivity

TxD Tx Diversity

UE User Equipment

UL MIMO Uplink Multiple Antenna transmission

<End of changes>

<Start of changes>

# 6 FR1 TRP requirements

## 6.1 General

The TRP requirements specified in Clause 6 apply to handheld UE with TAS off and power back-off functions disabled.

The TRP requirements defined in Clause 6.2 should be verified based on the detailed test parameters in

Table 5.3-1.

Note: The TRP minimum performance requirements specified in this specification are for global bands with full bandwidth specified by 3GPP. Adoption of other values, e.g., improved values, by regional standardization bodies is not precluded.

## 6.2 Minimum requirement

### 6.2.1 Minimum requirement for handheld UE

The average measured total radiated power (TRP) of low, mid and high channel for handheld UE shall be higher than the average TRP requirement specified in subclauses 6.2.1.1 and 6.2.1.2. The averaging shall be done in linear scale for the TRP results of both right and left side of the phantom head in case of beside the head and hand phantom positions. For the hand phantom browsing mode position the averaging shall be done in linear scale for the TRP results of both right and left hand phantom measurements.

For UEs which do not support NR FR1 in stand-alone mode, EN-DC mode requirements apply. SA and EN-DC test case applicability is defined in Clause 4.3, and test case applicability based on power class capability is defined in Clause 4.4. The relevant test methodology is defined in Annexes A and B of this specification.

#### 6.2.1.1 Hand phantom browsing mode

Hand phantom browsing mode positions are defined in Clause B.3.1.

##### 6.2.1.1.1 NR FR1

Handheld UE TRP minimum performance requirement for NR FR1 bands in the hand phantom browsing position and the primary mechanical mode are defined in Tables 6.2.1.1.1-1 and 6.2.1.1.1-2.

Table 6.2.1.1.1-1: Handheld PC3 UE TRP minimum performance requirement for NR FR1 bands in the hand phantom browsing position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | HL and HR |  | 11.6 |
| n28 | 20 | HL and HR |  | 101 |
| n41 | 100 | HL and HR |  | 9.5 |
| n78 | 100 | HL and HR |  | 10 |
| n79 | 100 | HL and HR |  |  |
| NOTE 1: 0.5dB higher value will be adopted in March 2026 (RAN#111). | | | | |

Table 6.2.1.1-2: Handheld PC2 UE TRP minimum performance requirement for NR FR1 bands in the hand phantom browsing position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 2 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | HL and HR |  |  |
| n28 | 20 | HL and HR |  |  |
| n41 | 100 | HL and HR |  | 12.5 |
| n78 | 100 | HL and HR |  | 13 |
| n79 | 100 | HL and HR |  |  |

##### 6.2.1.1.2 NR FR1 in EN-DC mode

Handheld UE TRP minimum performance requirement for NR FR1 bands (in EN-DC mode) in the hand phantom browsing position and the primary mechanical mode are defined in Tables 6.2.1.1.2-1 and 6.2.1.1.2-2.

Table 6.2.1.1.2-1: Handheld PC3 UE TRP minimum performance requirement for NR FR1 bands (in EN-DC mode) in the hand phantom browsing position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | HL and HR |  |  |
| n28 | 20 | HL and HR |  |  |
| n41 | 100 | HL and HR |  |  |
| n78 | 100 | HL and HR |  |  |
| n79 | 100 | HL and HR |  |  |

Table 6.2.1.1.2-2: Handheld PC2 UE TRP minimum performance requirement for NR FR1 bands (in EN-DC mode) in the hand phantom browsing position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 2 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | HL and HR |  |  |
| n28 | 20 | HL and HR |  |  |
| n41 | 100 | HL and HR |  |  |
| n78 | 100 | HL and HR |  |  |
| n79 | 100 | HL and HR |  |  |

#### 6.2.1.2 Beside the head and hand phantom talk mode

Beside the head and hand phantom mode positions are defined in Clause B.3.2 of this specification.

##### 6.2.1.2.1 NR FR1

Handheld UE TRP minimum performance requirement for NR FR1 bands in the beside head and hand phantom talk position and the primary mechanical mode are defined in Tables 6.2.1.2.1-1 and 6.2.1.2.1-2.

Table 6.2.1.2.1-1: Handheld PC3 UE TRP minimum performance requirement for NR FR1 bands in the beside head and hand phantom talk position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | BHHL and BHHR |  | 10.6 |
| n28 | 20 | BHHL and BHHR |  | 7.21 |
| n41 | 100 | BHHL and BHHR |  |  |
| n78 | 100 | BHHL and BHHR |  |  |
| n79 | 100 | BHHL and BHHR |  |  |
| NOTE 1: 0.4dB higher value will be adopted in March 2026 (RAN#111). | | | | |

Table 6.2.1.2.1-2: Handheld PC2 UE TRP minimum performance requirement for NR FR1 bands in the beside head and hand phantom talk position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 2 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | BHHL and BHHR |  |  |
| n28 | 20 | BHHL and BHHR |  |  |
| n41 | 100 | BHHL and BHHR |  | 10 |
| n78 | 100 | BHHL and BHHR |  | 11.51 |
| n79 | 100 | BHHL and BHHR |  |  |
| NOTE 1: 0.5dB higher value will be adopted in March 2026 (RAN#111). | | | | |

##### 6.2.1.2.2 NR FR1 in EN-DC mode

Handheld UE TRP minimum performance requirement for NR FR1 bands (in EN-DC mode) in the beside head and hand phantom talk position and the primary mechanical mode are defined in Tables 6.2.1.2.2-1 and 6.2.1.2.2-2.

Table 6.2.1.2.2-1: Handheld PC3 UE TRP minimum performance requirement for NR FR1 bands (in EN-DC mode) in the beside head and hand phantom talk position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | BHHL and BHHR |  |  |
| n28 | 20 | BHHL and BHHR |  |  |
| n41 | 100 | BHHL and BHHR |  |  |
| n78 | 100 | BHHL and BHHR |  |  |
| n79 | 100 | BHHL and BHHR |  |  |

Table 6.2.1.2.2-2: Handheld PC2 UE TRP minimum performance requirement for NR FR1 bands (in EN-DC mode) in the beside head and hand phantom talk position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 2 | |
| Average TRP (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | BHHL and BHHR |  |  |
| n28 | 20 | BHHL and BHHR |  |  |
| n41 | 100 | BHHL and BHHR |  |  |
| n78 | 100 | BHHL and BHHR |  |  |
| n79 | 100 | BHHL and BHHR |  |  |

# 7 FR1 TRS requirements

## 7.1 General

The TRS requirements specified in Clause 7 apply to handheld UE configured with maximum number of Rx antennas supported for each band, which is specified in TS 38.101-1 Clause 7.3 [3].

The TRS requirements defined in Clause 7.2 should be verified based on the detailed test parameters in Table 5.3-2.

Note: The TRS minimum performance requirements specified in this specification are for global bands with full bandwidth specified by 3GPP. Adoption of other values, e.g., improved values, by regional standardization bodies is not precluded.

## 7.2 Minimum requirement

### 7.2.1 Minimum requirement for handheld UE

The average measured total radiated sensitivity (TRS) of low, mid and high channel for handheld UE shall be lower than the average TRS requirement specified in subclauses 7.2.1.1 and 7.2.1.2. The averaging shall be done in linear scale for the TRS results of both right and left side of the phantom head in case of beside the head and hand phantom positions. For the hand phantom browsing mode position the averaging shall be done in linear scale for the TRP results of both right and left hand phantom measurements.

For UEs which do not support NR FR1 in stand-alone mode, EN-DC mode requirements apply. SA and EN-DC test case applicability is defined in Clause 4.3, and test case applicability based on power class capability is defined in Clause 4.4. The relevant test methodology is defined in Annexes A and B of this specification.

#### 7.2.1.1 Hand phantom browsing mode

Hand phantom browsing mode positions are defined in Clause B.3.1.

##### 7.2.1.1.1 NR FR1

Handheld UE TRS minimum performance requirement for NR FR1 bands in the hand phantom browsing position and the primary mechanical mode are defined in Tables 7.2.1.1.1-1 and 7.2.1.1.1-2.

Table 7.2.1.1.1-1: Handheld PC3 and PC2 UE TRS minimum performance requirement for NR FR1 bands in the hand phantom browsing position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 and Power Class 2 | |
| Average TRS (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | HL and HR |  | -88.5 |
| n28 | 20 | HL and HR |  | -83.5 |
| n41 | 100 | HL and HR |  | -80 |
| n78 | 100 | HL and HR |  | -81.2 |
| n79 | 100 | HL and HR |  |  |

##### 7.2.1.1.2 NR FR1 in EN-DC mode

Handheld UE TRS minimum performance requirement for NR FR1 bands (in EN-DC mode) in the hand phantom browsing position and the primary mechanical mode are defined in Tables 6.2.1.1.2-1 and 6.2.1.1.2-2.

Table 7.2.1.1.2-1: Handheld PC3 and PC2 UE TRS minimum performance requirement for NR FR1 bands (in EN-DC mode) in the hand phantom browsing position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 and Power Class 2 | |
| Average TRS (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | HL and HR |  |  |
| n28 | 20 | HL and HR |  |  |
| n41 | 100 | HL and HR |  |  |
| n78 | 100 | HL and HR |  |  |
| n79 | 100 | HL and HR |  |  |

#### 7.2.1.2 Beside the head and hand phantom position

Beside the head and hand phantom mode positions are defined in Clause B.3.2.

##### 7.2.1.2.1 NR FR1

Handheld UE TRP minimum performance requirement for NR FR1 bands in the beside head and hand phantom position and the primary mechanical mode are defined in Tables 7.2.1.2.1-1 and 7.2.1.2.1-2.

Table 7.2.1.2.1-1: Handheld PC3 and PC2 UE TRS minimum performance requirement for NR FR1 bands in the beside head and hand phantom position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 and Power Class 2 | |
| Average TRS (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | BHHL and BHHR |  | -87 |
| n28 | 20 | BHHL and BHHR |  | -80 |
| n41 | 100 | BHHL and BHHR |  | -79 |
| n78 | 100 | BHHL and BHHR |  | -80 |
| n79 | 100 | BHHL and BHHR |  |  |

##### 7.2.1.2.2 NR FR1 in EN-DC mode

Handheld UE TRS minimum performance requirement for NR FR1 bands (in EN-DC mode) in the beside head and hand phantom position and the primary mechanical mode are defined in Tables 6.2.1.2.2-1 and 6.2.1.2.2-2.

Table 7.2.1.2.2-1: Handheld PC3 and PC2 UE TRS minimum performance requirement for NR FR1 bands (in EN-DC mode) in the beside head and hand phantom position and the primary mechanical mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NR Band | Bandwidth (MHz) | Usage Scenario | Power Class 3 and Power Class 2 | |
| Average TRS (dBm) | |
| UE width ≤ 72mm | UE width > 72mm |
| n1 | 15 | BHHL and BHHR |  |  |
| n28 | 20 | BHHL and BHHR |  |  |
| n41 | 100 | BHHL and BHHR |  |  |
| n78 | 100 | BHHL and BHHR |  |  |
| n79 | 100 | BHHL and BHHR |  |  |

<End of changes>