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**Digital cellular telecommunications system (Phase 2+) (GSM);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
User Equipment (UE) and Mobile Station (MS) GSM, UTRA and  
E-UTRA over the air performance requirements  
(3GPP TS 37.144 version 16.2.0 Release 16)**



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# Foreword

This Technical Specification has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

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# 1 Scope

The present document establishes over the air antenna minimum requirements for user equipment (UE) and mobile station (MS).

Handheld UE requirements are defined for roaming bands for the speech position (beside the head and beside the head and hand) and hand phantom browsing mode position. Laptop mounted equipment requirements are defined for roaming bands for the data transfer position (laptop ground plane phantom). Laptop embedded equipment requirements are defined for roaming bands for the data transfer position (free space).

All bands are potential roaming bands, and the requirements for roaming bands shall therefore be fulfilled for all bands supported by a UE/MS.

Requirements for operating bands are dependent on how the network has been built and are thus operator specific and cannot be specified here. Recommended performance values for operating bands (Annex B) are however included in this specification for information. It should be recognised that the ability to meet the recommended performance values depends on the number of frequency bands supported by the UE/MS.

---

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

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- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 25 101: "User Equipment (UE) radio transmission and reception (FDD)".
- [3] 3GPP TS 45.005: "Radio transmission and reception".
- [4] 3GPP TS 34.114: "User Equipment (UE) / Mobile Station (MS) Over The Air (OTA) antenna performance; Conformance testing".
- [5] ETSI ETR 273: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties; Part 1: Uncertainties in the measurement of mobile radio equipment characteristics; Sub-part 2: Examples and annexes".
- [6] 3GPP TR 25.914: "Measurements of radio performances for UMTS terminals in speech mode"
- [7] 3GPP TR 37.977: "Verification of radiated multi-antenna reception performance of User Equipment (UE)"
- [8] 3GPP TR 37.902: "Measurements of User Equipment (UE) radio performances for LTE/UMTS terminals; Total Radiated Power (TRP) and Total Radiated Sensitivity (TRS) test methodology"
- [9] 3GPP TS 36.521-1: "User Equipment (UE) conformance specification Radio transmission and reception; Part 1: Conformance Testing;"
- [10] 3GPP TS 38.161: "NR; User Equipment (UE) TRP (Total Radiated Power) and TRS (Total Radiated Sensitivity) requirements; Range 1 Standalone and Range 1 Interworking operation with other radios".



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## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], TR 37.977 [7] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1] or TR 37.977 [7].

**primary mechanical mode:** the mode that is most often used during a call beside the head. Other mechanical modes are secondary. Every terminal has at least one primary mechanical mode.

**speech position:** UE used close to head phantom (specific anthropomorphic mannequin).

**data transfer position:** UE used away from the user's head, applicable for LME and LEE devices.

**FS:** UE used in a free space configuration.

**LME:** Laptop mounted equipment (such as plug-in devices like USB dongles).

**LEE:** Laptop embedded equipment (such as embedded module card embedded in notebooks).

### 3.2 Symbols

|                 |  |
|-----------------|--|
| $TRP_{average}$ | the average measured total radiated power of low, mid and high channel                   |
| $TRP_{min}$     | the lowest measured total radiated power of each channel within an operating band        |
| $TRS_{average}$ | the average measured total radiated sensitivity of low, mid and high channel             |
| $TRS_{max}$     | the highest measured total radiated sensitivity of each channel within an operating band |

### 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], TR 37.977 [7] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1] or TR 37.977 [7].

|      |  |
|------|--|
| DUT  | Device Under Test                        |
| OTA  | Over The Air                             |
| TRMS | Total Radiated Multi-antenna Sensitivity |
| TRP  | Total Radiated Power                     |
| TRS  | Total Radiated Sensitivity               |

---

## 4 General

### 4.1 Minimum requirements for roaming bands

The minimum requirements for roaming bands apply only to the primary mechanical mode in the environmental conditions specified in Annex A. All bands are potential roaming bands, and a UE/MS shall fulfil the minimum requirements for roaming bands for all bands supported by the UE/MS.

### 4.2 Relationship between minimum requirements for roaming bands and test requirements

The minimum requirements for roaming bands given in this specification make no allowance for measurement uncertainty. The test specification 34.114 [4] Annex F defines test tolerances. These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in this specification to create test requirements.

The measurement results returned by the test system are compared - without any modification - against the test requirements as defined by the shared risk principle.

The shared risk principle is defined in ETR 273 [5] Part 1 sub-part 2 section 6.5.

## 4.3 Terminal classes

### 4.3.1 Mechanical modes

The mechanical modes of a device under test (DUT) are declared by the manufacturer. A DUT shall have at least one mechanical mode. If only one mode is supported, then this is defined as the primary.

## 4.4 UTRA chip rates

The requirements defined in this specification for UTRA are based on a chip rate of 3.84 Mcps (FDD) and 1.28 Mcps (TDD).

NOTE: Other chip rates may be considered in future releases.

---

# 5 Frequency bands

## 5.1 GSM frequency bands

The requirements defined in this specification for GSM apply to the frequency bands defined in Table 5.1-1.

**Table 5.1-1: GSM frequency bands**

| Operating band | UL frequencies<br>MS transmit, BTS receive | DL frequencies<br>MS receive, BTS transmit |
|----------------|--|--|
| GSM 850        | 824 - 849 MHz                              | 869 - 894 MHz                              |
| P-GSM 900      | 890 - 915 MHz                              | 935 - 960 MHz                              |
| E-GSM 900      | 880 - 915 MHz                              | 925 - 960 MHz                              |
| DCS 1800       | 1710 - 1785 MHz                            | 1805 - 1880 MHz                            |
| PCS 1900       | 1850 -1910 MHz                             | 1930 -1990 MHz                             |

## 5.2 UTRA FDD frequency bands

The requirements defined in this specification for UTRA FDD apply to the frequency bands defined in Table 5.2-1.

**Table 5.2-1: UTRA FDD frequency bands**

| Operating Band | UL frequencies<br>UE transmit, Node B receive | DL frequencies<br>UE receive, Node B transmit |
|----------------|---|---|
| I              | 1920 - 1980 MHz                               | 2110 - 2170 MHz                               |
| II             | 1850 - 1910 MHz                               | 1930 - 1990 MHz                               |
| III            | 1710 - 1785 MHz                               | 1805 - 1880 MHz                               |
| IV             | 1710 - 1755 MHz                               | 2110 - 2155 MHz                               |
| V              | 824 - 849 MHz                                 | 869 - 894 MHz                                 |
| VI             | 830 - 840 MHz                                 | 875 - 885 MHz                                 |
| VII            | 2500 - 2570 MHz                               | 2620 - 2690 MHz                               |
| VIII           | 880 - 915 MHz                                 | 925 - 960 MHz                                 |
| IX             | 1749,9 – 1784,9 MHz                           | 1844,9 – 1879,9 MHz                           |
| XIX            | 830 - 845MHz                                  | 875 - 890 MHz                                 |

Deployment in other frequency bands is not precluded

## 5.3 UTRA TDD frequency bands

The requirements defined in this specification for UTRA TDD apply to the frequency bands defined in Table 5.3-1.

**Table 5.3-1: UTRA LCR TDD frequency bands**

| Operating Band | Frequencies                        |
|----------------|------------------------------------|
| a              | 1900 - 1920 MHz<br>2010 - 2025 MHz |
| b*             | 1850 - 1910 MHz<br>1930 - 1990 MHz |
| c*             | 1910 - 1930 MHz                    |
| d**            | 2570 - 2620 MHz                    |
| e              | 2300 - 2400 MHz                    |
| f              | 1880 - 1920 MHz                    |

NOTE: Deployment in other frequency bands is not precluded.

\* Used in ITU Region 2

\*\* Used in ITU Region 1

## 5.4 E-UTRA FDD frequency bands

The requirements defined in this specification for E-UTRA FDD apply to the frequency bands defined in Table 5.4-1.

**Table 5.4-1 E-UTRA FDD operating bands**

| E-UTRA Operating Band | Uplink (UL) operating band<br>BS receive<br>UE transmit | Downlink (DL) operating band<br>BS transmit<br>UE receive | Duplex Mode      |
|-----------------------|---|---|------------------|
|                       | F <sub>UL_low</sub> – F <sub>UL_high</sub>              | F <sub>DL_low</sub> – F <sub>DL_high</sub>                |                  |
| 1                     | 1920 MHz – 1980 MHz                                     | 2110 MHz – 2170 MHz                                       | FDD              |
| 2                     | 1850 MHz – 1910 MHz                                     | 1930 MHz – 1990 MHz                                       | FDD              |
| 3                     | 1710 MHz – 1785 MHz                                     | 1805 MHz – 1880 MHz                                       | FDD              |
| 4                     | 1710 MHz – 1755 MHz                                     | 2110 MHz – 2155 MHz                                       | FDD              |
| 5                     | 824 MHz – 849 MHz                                       | 869 MHz – 894 MHz   | FDD              |
| 7                     | 2500 MHz – 2570 MHz                                     | 2620 MHz – 2690 MHz                                       | FDD              |
| 8                     | 880 MHz – 915 MHz                                       | 925 MHz – 960 MHz   | FDD              |
| 12                    | 699 MHz – 716 MHz                                       | 729 MHz – 746 MHz   | FDD              |
| 13                    | 777 MHz – 787 MHz                                       | 746 MHz – 756 MHz   | FDD              |
| 19                    | 830 MHz – 845 MHz                                       | 875 MHz – 890 MHz   | FDD              |
| 20                    | 832 MHz – 862 MHz                                       | 791 MHz – 821 MHz   | FDD              |
| 21                    | 1447.9 MHz – 1462.9 MHz                                 | 1495.9 MHz – 1510.9 MHz                                   | FDD              |
| 28                    | 703 MHz – 748 MHz                                       | 758 MHz – 803 MHz   | FDD              |
| 32                    | N/A   | 1452 MHz – 1496 MHz                                       | FDD <sup>1</sup> |

NOTE 1: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.

Deployment in other frequency bands is not precluded.

## 5.5 E-UTRA TDD frequency bands

The requirements defined in this specification for E-UTRA TDD apply to the frequency bands defined in Table 5.5-1.

Table 5.5-1 E-UTRA TDD operating bands

| E-UTRA Operating Band   | Uplink (UL) operating band<br>BS receive<br>UE transmit | Downlink (DL) operating band<br>BS transmit<br>UE receive | Duplex Mode        |
|---|---|---|--------------------|
|   | $F_{UL\_low}$ – $F_{UL\_high}$                          | $F_{DL\_low}$ – $F_{DL\_high}$                            |                    |
| 38  | 2570 MHz – 2620 MHz                                     | 2570 MHz – 2620 MHz                                       | TDD                |
| 39  | 1880 MHz – 1920 MHz                                     | 1880 MHz – 1920 MHz                                       | TDD                |
| 40  | 2300 MHz – 2400 MHz                                     | 2300 MHz – 2400 MHz                                       | TDD                |
| 41  | 2496 MHz – 2690 MHz                                     | 2496 MHz – 2690 MHz                                       | TDD                |
| 42  | 3400 MHz – 3600 MHz                                     | 3400 MHz – 3600 MHz                                       | TDD                |
| 46  | 5150 MHz – 5925 MHz                                     | 5150 MHz – 5925 MHz                                       | TDD <sup>1,2</sup> |
| NOTE 1: This band is an unlicensed band restricted to licensed-assisted operation using Frame Structure Type 3          |   |   |                    |
| NOTE 2: In this version of the specification, restricted to E-UTRA DL operation when carrier aggregation is configured. |   |   |                    |

Deployment in other frequency bands is not precluded.

## 6 Transmitter total radiated power

### 6.1 Minimum requirement for roaming bands 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 6.1.1, 6.1.2 and 6.1.3. 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 phantom and 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. Average TRP requirement is shown in the column “Average” on the requirement tables.

$$TRP_{average} = 10 \log \left[ \frac{10^{P_{left\_low}/10} + 10^{P_{left\_mid}/10} + 10^{P_{left\_high}/10} + 10^{P_{right\_low}/10} + 10^{P_{right\_mid}/10} + 10^{P_{right\_high}/10}}{6} \right]$$

In addition the lowest TRP of each measured channel shall be higher than minimum TRP requirement specified in subclauses 6.1.1, 6.1.2 and 6.1.3. Minimum TRP requirement is shown in the column “Min” on the requirement tables.

$$TRP_{min} = 10 \log \left[ \min \left( 10^{P_{left\_low}/10}, 10^{P_{left\_mid}/10}, 10^{P_{left\_high}/10}, 10^{P_{right\_low}/10}, 10^{P_{right\_mid}/10}, 10^{P_{right\_high}/10} \right) \right]$$

#### 6.1.1 Beside the head phantom position

Beside the head phantom test method is defined in TR 25.914 [6] subclauses 5.1.1 and 5.1.2.

### 6.1.1.1 GSM

Handheld MS TRP minimum performance requirements for GMSK in beside the head phantom position and the primary mechanical mode are defined in Table 6.1.1.1-1.

**Table 6.1.1.1-1: Handheld UE TRP minimum performance requirement for GSM roaming bands in beside the head phantom position and the primary mechanical mode**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |      | Power class 5 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|------|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |      | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min  | Average       | Min |
| GSM 850        |               |     |               |     |               |     | 19,5          | 17,5 |               |     |
| GSM 900        |               |     |               |     |               |     | 20,5          | 18,5 |               |     |
| DCS 1800       | 21            | 19  |               |     |               |     |               |      |               |     |
| PCS 1900       | 21            | 19  |               |     |               |     |               |      |               |     |

NOTE: Applicable for dual-mode GSM/UMTS.

### 6.1.1.2 UTRA FDD

Handheld UE TRP minimum performance requirements for UTRA FDD in beside the head phantom position and the primary mechanical mode are defined in Table 6.1.1.2-1.

**Table 6.1.1.2-1: Handheld UE TRP minimum performance requirement for UTRA FDD roaming bands in beside the head phantom position and the primary mechanical mode**

| Operating band | Power class 1 | Power class 2 | Power class 3 |      | Power class 3bis |      | Power class 4 |      |
|----------------|---------------|---------------|---------------|------|------------------|------|---------------|------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   |      | Power (dBm)      |      | Power (dBm)   |      |
|                |               |               | Average       | Min  | Average          | Min  | Average       | Min  |
| I              | -             | -             | +15           | +13  | +15              | +13  | +13           | +11  |
| II             | -             | -             | +15           | +13  | +15              | +13  | +13           | +11  |
| III            | -             | -             | +15           | +13  | +15              | +13  | +13           | +11  |
| IV             | -             | -             | +15           | +13  | +15              | +13  | +13           | +11  |
| V              | -             | -             | +11           | +9   | +11              | +9   | +9            | +7   |
| VI             | -             | -             | +11           | +9   | +11              | +9   | +9            | +7   |
| VII            | -             | -             | +15           | +13  | +15              | +13  | +13           | +11  |
| VIII           | -             | -             | +12           | +10  | +12              | +10  | +10           | +8   |
| IX             | -             | -             | +15           | +13  | +15              | +13  | +13           | +11  |
| XIX            | -             | -             | +11,5         | +9,5 | +11,5            | +9,5 | +9,5          | +7,5 |

NOTE: Applicable for dual-mode GSM/UMTS.

### 6.1.1.3 UTRA LCR TDD

Handheld UE TRP minimum performance requirements for UTRA LCR TDD in beside the head phantom position and the primary mechanical mode are defined in Table 6.1.1.3-1.

**Table 6.1.1.3-1: Handheld UE TRP minimum performance requirement for UTRA LCR TDD roaming bands in beside the head phantom position and the primary mechanical mode**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| a              | -             | -   | +15           | +13 | -             | -   | -             | -   |
| b              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| c              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| d              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| e              | -             | -   | +15           | +13 | -             | -   | -             | -   |
| f              | -             | -   | +15           | +13 | -             | -   | -             | -   |

NOTE: Applicable for dual-mode GSM /UTRA LCR TDD.

### 6.1.2 Beside the head and hand phantom position

Beside the head and hand phantom position is defined in TR 25.914 [6] subclauses 5.1.5 and 5.1.6.

The Wide Grip hand related positioning guideline for talk mode shall be the same as described in TS 38.161 Clause B.3.2.2 [10].

#### 6.1.2.1 UTRA FDD

Handheld UE TRP minimum performance requirements for UTRA FDD in beside the head and hand phantom position and the primary mechanical mode are defined in Table 6.1.2.1-1.

**Table 6.1.2.1-1: Handheld UE TRP minimum performance requirement for FDD roaming bands in beside the head and hand phantom position and the primary mechanical mode**

| Operating band | Power class 1 | Power class 2 | Power class 3 |     | Power class 3bis |     | Power class 4 |     |
|----------------|---------------|---------------|---------------|-----|------------------|-----|---------------|-----|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   |     | Power (dBm)      |     | Power (dBm)   |     |
|                |               |               | Average       | Min | Average          | Min | Average       | Min |
| I              | -             | -             | 13,25         | TBD | TBD              | TBD | TBD           | TBD |
| II             | -             | -             | 13,25         | TBD | TBD              | TBD | TBD           | TBD |
| III            | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| IV             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| V              | -             | -             | 9,40          | TBD | TBD              | TBD | TBD           | TBD |
| VI             | -             | -             | 9,40          | TBD | TBD              | TBD | TBD           | TBD |
| VII            | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| VIII           | -             | -             | 9,40          | TBD | TBD              | TBD | TBD           | TBD |
| IX             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| XIX            | -             | -             | 9,40          | TBD | TBD              | TBD | TBD           | TBD |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for devices narrower than 72mm as defined in TR 25.914.  
NOTE 3: Not applicable for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation).

### 6.1.2.2 UTRA LCR TDD

Handheld UE TRP minimum performance requirements for UTRA LCR TDD in beside the head and hand phantom position and the primary mechanical mode are defined in Table 6.1.2.2-1.

**Table 6.1.2.2-1: Handheld UE TRP minimum performance requirement for UTRA LCR TDD roaming bands beside the head and hand phantom position and the primary mechanical mode**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| a              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| b              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| c              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| d              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| e              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| f              | -             | -   | TBD           | TBD | -             | -   | -             | -   |

NOTE: Applicable for dual-mode GSM /UTRA LCR TDD.

### 6.1.2.3 E-UTRA FDD

### 6.1.2.4 E-UTRA TDD

## 6.1.3 Hand phantom browsing mode position

Hand phantom browsing mode position is defined in TR 25.914 [6] subclauses 5.1.5 and 5.1.7.

The Wide Grip hand related positioning guideline for browsing mode shall be the same as described in TS 38.161 Clause B.3.1.1 [10].

### 6.1.3.1 UTRA FDD

Handheld UE TRP minimum performance requirements for UTRA FDD in hand phantom browsing mode position are defined in Table 6.1.3.1-1.

**Table 6.1.3.1-1: Handheld UE TRP minimum performance requirement for UTRA FDD roaming bands in hand phantom browsing mode position**

| Operating band | Power class 1 | Power class 2 | Power class 3 |     | Power class 3bis |     | Power class 4 |     |
|----------------|---------------|---------------|---------------|-----|------------------|-----|---------------|-----|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   |     | Power (dBm)      |     | Power (dBm)   |     |
|                |               |               | Average       | Min | Average          | Min | Average       | Min |
| I              | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| II             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| III            | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| IV             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| V              | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| VI             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| VII            | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| VIII           | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| IX             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| XIX            |               |               | TBD           | TBD | TBD              | TBD | TBD           | TBD |

NOTE: Applicable for dual-mode GSM/UMTS.

### 6.1.3.2 UTRA LCR TDD

Handheld UE TRP minimum performance requirements for UTRA LCR TDD UE in hand phantom browsing mode position are defined in Table 6.1.3.2-1.

**Table 6.1.3.2-1: Handheld UE TRP minimum performance requirement for UTRA LCR TDD roaming bands in hand phantom browsing mode position**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| a              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| b              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| c              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| d              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| e              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| f              | -             | -   | TBD           | TBD | -             | -   | -             | -   |

NOTE: Applicable for dual-mode GSM /UTRA LCR TDD.

### 6.1.3.3 E-UTRA FDD

### 6.1.3.4 E-UTRA TDD

## 6.2 Minimum requirement for roaming bands for LME

The average measured TRP of low, mid and high channel for laptop mounted equipment shall be higher than the average TRP requirement specified in this subclause. The averaging shall be done in linear scale for the TRP results. Average TRP requirement is shown in the column “Average” on the requirement tables.

$$TRP_{average} = 10 \log \left[ \frac{10^{P_{low}/10} + 10^{P_{mid}/10} + 10^{P_{high}/10}}{3} \right]$$

In addition the lowest TRP of each measured channel shall be higher than minimum TRP requirement specified in this subclause. Minimum TRP requirement is shown in the column “Min” on the requirement tables.

$$TRP_{min} = 10 \log \left[ \min \left( 10^{P_{low}/10}, 10^{P_{mid}/10}, 10^{P_{high}/10} \right) \right]$$

LME requirements in this clause are defined to be measured with laptop ground plane phantom as defined in TR 25.914 [6] subclauses 5.1.3 and 5.1.4.

### 6.2.1 GSM

LME TRP minimum performance requirements for GSM with laptop ground plane phantom in data transfer position are defined in Table 6.2.1-1.



**Table 6.2.1-1: LME TRP minimum performance requirement for GSM in the data transfer position**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     | Power class 5 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| GSM 850        | -             | -   | -             | -   | -             | -   | TBD           | TBD | -             | -   |
| GSM 900        | -             | -   | -             | -   | -             | -   | TBD           | TBD | -             | -   |
| DCS 1800       | TBD           | TBD | -             | -   | -             | -   | -             | -   | -             | -   |
| PCS 1900       | TBD           | TBD | -             | -   | -             | -   | -             | -   | -             | -   |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for USB plug-in devices.

### 6.2.2 UTRA FDD

LME TRP minimum performance requirements for UTRA FDD with laptop ground plane phantom in data transfer position are defined in Table 6.2.2-1.

**Table 6.2.2-1: LME TRP minimum performance requirement for UTRA FDD in the data transfer position**

| Operating band | Power class 1 | Power class 2 | Power class 3 |     | Power class 3bis |     | Power class 4 |     |
|----------------|---------------|---------------|---------------|-----|------------------|-----|---------------|-----|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   |     | Power (dBm)      |     | Power (dBm)   |     |
|                |               |               | Average       | Min | Average          | Min | Average       | Min |
| I              | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| II             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| III            | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| IV             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| V              | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| VI             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| VII            | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| VIII           | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| IX             | -             | -             | TBD           | TBD | TBD              | TBD | TBD           | TBD |
| XIX            |               |               | TBD           | TBD | TBD              | TBD | TBD           | TBD |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for USB plug-in devices.

### 6.2.3 UTRA LCR TDD

LME TRP minimum performance requirements for UTRA LCR TDD with laptop ground plane phantom in data transfer position are defined in Table 6.2.3-1.

**Table 6.2.3-1: LME TRP minimum performance requirement for UTRA LCR TDD in the data transfer position**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| a              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| b              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| c              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| d              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| e              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| f              | -             | -   | TBD           | TBD | -             | -   | -             | -   |

NOTE 1: Applicable for dual-mode GSM /UTRA LCR TDD.  
NOTE 2: Applicable for USB plug-in devices.

## 6.2.4 E-UTRA FDD

## 6.2.5 E-UTRA TDD

# 6.3 Minimum requirement for roaming bands for LEE

The average measured TRP of low, mid and high channel for laptop embedded equipment shall be higher than the average TRP requirement specified in this subclause. The averaging shall be done in linear scale for the TRP results. Average TRP requirement is shown in the column “Average” on the requirement tables.

$$TRP_{average} = 10 \log \left[ \frac{10^{P_{low}/10} + 10^{P_{mid}/10} + 10^{P_{high}/10}}{3} \right]$$

In addition the lowest TRP of each measured channel shall be higher than minimum TRP requirement specified in this subclause. Minimum TRP requirement is shown in the column “Min” on the requirement tables.

$$TRP_{min} = 10 \log \left[ \min \left( 10^{P_{low}/10}, 10^{P_{mid}/10}, 10^{P_{high}/10} \right) \right]$$

LEE requirements in this clause are defined to be measured as defined in TR 25.914 [6]: subclause 5.3.1 applies to notebook devices, and subclause 5.3.2 applies to tablet devices.

## 6.3.1 GSM

LEE TRP minimum performance requirements for GSM are defined in Tables 6.3.1-1 and 6.3.1-2.

**Table 6.3.1-1: Notebook TRP minimum performance requirement for GSM in the data transfer position**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     | Power class 5 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| GSM 850        | -             | -   | -             | -   | -             | -   | TBD           | TBD | -             | -   |
| GSM 900        | -             | -   | -             | -   | -             | -   | TBD           | TBD | -             | -   |
| DCS 1800       | TBD           | TBD | -             | -   | -             | -   | -             | -   | -             | -   |
| PCS 1900       | TBD           | TBD | -             | -   | -             | -   | -             | -   | -             | -   |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for notebook devices.

**Table 6.3.1-2: Tablet TRP minimum performance requirement for GSM in the data transfer position**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     | Power class 5 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| GSM 850        | -             | -   | -             | -   | -             | -   | TBD           | TBD | -             | -   |
| GSM 900        | -             | -   | -             | -   | -             | -   | TBD           | TBD | -             | -   |
| DCS 1800       | TBD           | TBD | -             | -   | -             | -   | -             | -   | -             | -   |
| PCS 1900       | TBD           | TBD | -             | -   | -             | -   | -             | -   | -             | -   |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for tablet devices.

## 6.3.2 UTRA FDD

LEE TRP minimum performance requirements for UTRA FDD are defined in Tables 6.3.2-1 and 6.3.2-2.

**Table 6.3.2-1: Notebook TRP minimum performance requirement for UTRA FDD in the data transfers position**

| Operating band | Power class 1 | Power class 2 | Power class 3 |      | Power class 3bis |     | Power class 4 |     |
|----------------|---------------|---------------|---------------|------|------------------|-----|---------------|-----|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   |      | Power (dBm)      |     | Power (dBm)   |     |
|                |               |               | Average       | Min  | Average          | Min | Average       | Min |
| I              | -             | -             | 19,0          | 17,5 | TBD              | TBD | TBD           | TBD |
| II             | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| III            | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| IV             | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| V              | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| VI             | -             | -             | 18,5          | 16,5 | TBD              | TBD | TBD           | TBD |
| VII            | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| VIII           | -             | -             | 18,5          | 16,5 | TBD              | TBD | TBD           | TBD |
| IX             | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| XIX            |               |               | 18,5          | 16,5 | TBD              | TBD | TBD           | TBD |

NOTE 1: Applicable for multi-mode GSM/UMTS/LTE.  
NOTE 2: Applicable for notebook devices.

NOTE: TRP minimum performance requirements in table 6.3.2-1 apply to HSPA and LTE UEs supporting only single carrier operation. Their applicability to multi-carrier operation is FFS. This is because it has not been verified whether the UEs measured to derive the requirements supported carrier aggregation or not.

**Table 6.3.2-2: Tablet TRP minimum performance requirement for UTRA FDD in the data transfer position**

| Operating band | Power class 1 | Power class 2 | Power class 3 |      | Power class 3bis |     | Power class 4 |     |
|----------------|---------------|---------------|---------------|------|------------------|-----|---------------|-----|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   |      | Power (dBm)      |     | Power (dBm)   |     |
|                |               |               | Average       | Min  | Average          | Min | Average       | Min |
| I              | -             | -             | 19            | 17,5 | TBD              | TBD | TBD           | TBD |
| II             | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| III            | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| IV             | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| V              | -             | -             | 17            | 15,0 | TBD              | TBD | TBD           | TBD |
| VI             | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| VII            | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| VIII           | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| IX             | -             | -             | TBD           | TBD  | TBD              | TBD | TBD           | TBD |
| XIX            |               |               | 17            | 15,0 | TBD              | TBD | TBD           | TBD |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for tablet devices with two antennas.

### 6.3.3 UTRA LCR TDD

LEE TRP minimum performance requirements for UTRA LCR TDD are defined in Tables 6.3.3-1 and 6.3.3-2.

**Table 6.3.3-1: Notebook TRP minimum performance requirement for UTRA LCR TDD in the data transfer position**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| a              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| b              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| c              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| d              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| e              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| f              | -             | -   | TBD           | TBD | -             | -   | -             | -   |

NOTE 1: Applicable for dual-mode GSM /UTRA LCR TDD.  
NOTE 2: Applicable for notebook devices.

**Table 6.3.3-2: Tablet TRP minimum performance requirement for UTRA LCR TDD in the data transfer position**

| Operating band | Power class 1 |     | Power class 2 |     | Power class 3 |     | Power class 4 |     |
|----------------|---------------|-----|---------------|-----|---------------|-----|---------------|-----|
|                | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     | Power (dBm)   |     |
|                | Average       | Min | Average       | Min | Average       | Min | Average       | Min |
| a              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| b              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| c              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| d              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| e              | -             | -   | TBD           | TBD | -             | -   | -             | -   |
| f              | -             | -   | TBD           | TBD | -             | -   | -             | -   |

NOTE 1: Applicable for dual-mode GSM /UTRA LCR TDD.  
NOTE 2: Applicable for tablet devices.

## 6.3.4 E-UTRA FDD

LEE TRP minimum performance requirements for E-UTRA FDD are defined in Table 6.3.4-1 for Tablet devices.

Table 6.3.4-1: Tablet TRP minimum requirements for E-UTRA FDD in the data transfer position

| Operating band | Power Class 1 | Power Class 2 | Power Class 3 |      | Power Class 4 |
|----------------|---------------|---------------|---------------|------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   |      | Power (dBm)   |
|                |               |               | Average       | Min  |               |
| 1              |               |               | 18.5          | 17.0 |               |
| 2              |               |               |               |      |               |
| 3              |               |               | 18.5          | 17.0 |               |
| 4              |               |               |               |      |               |
| 5              |               |               |               |      |               |
| 7              |               |               | 18.0          | 16.5 |               |
| 8              |               |               |               |      |               |
| 12             |               |               |               |      |               |
| 13             |               |               |               |      |               |
| 19             |               |               | 17.5          | 15.5 |               |
| 20             |               |               | 17.5          | 15.5 |               |
| 21             |               |               | 17.5          | 16.0 |               |
| 28             |               |               |               |      |               |

NOTE 1: Applicable for multi-mode GSM/UMTS/LTE.  
NOTE 2: Applicability for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation) is FFS.

## 6.3.5 E-UTRA TDD

# 7 Receiver total radiated sensitivity

## 7.1 Minimum requirement for roaming bands 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 7.1.1, 7.1.2 and 7.1.3. 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 phantom and beside the head and hand phantom positions. For the hand phantom browsing mode position the averaging shall be done in linear scale for the TRS results of both right and left hand phantom measurements. Average TRS requirement is shown in the column “Average” on the requirement tables.

$$TRS_{average} = 10 \log \left[ 6 / \left( \frac{1}{10^{P_{left\_low}/10}} + \frac{1}{10^{P_{left\_mid}/10}} + \frac{1}{10^{P_{left\_high}/10}} + \frac{1}{10^{P_{right\_low}/10}} + \frac{1}{10^{P_{right\_mid}/10}} + \frac{1}{10^{P_{right\_high}/10}} \right) \right]$$

In addition the highest TRS of each measured channel shall be lower than maximum TRS requirement specified in subclauses 7.1.1, 7.1.2 and 7.1.3. Maximum TRS requirement is shown in the column “Max” on the requirement tables.

$$TRS_{max} = 10 \log \left[ \max \left( 10^{P_{left\_low}/10}, 10^{P_{left\_mid}/10}, 10^{P_{left\_high}/10}, 10^{P_{right\_low}/10}, 10^{P_{right\_mid}/10}, 10^{P_{right\_high}/10} \right) \right]$$

### 7.1.1 Beside the head phantom position

Beside the head phantom test method is defined in TR 25.914 [6] subclauses 5.1.1 and 5.1.2.

#### 7.1.1.1 GSM

Handheld MS TRS minimum performance requirements for GMSK in beside the head phantom position and the primary mechanical mode for TCH/FS at 2% class II (RBER) [3] are defined in Table 7.1.1.1-1.

**Table 7.1.1.1-1: Handheld UE TRS minimum requirements for GSM roaming bands in beside the head phantom position and the primary mechanical mode**

| Operating band | Unit | <REF <sub>or</sub> > |       |
|----------------|------|----------------------|-------|
|                |      | Average              | Max   |
| GSM 850        | dBm  | -98                  | -95   |
| GSM 900        | dBm  | -97                  | -94   |
| DCS 1800       | dBm  | -99,5                | -96,5 |
| PCS 1900       | dBm  | -98,5                | -95,5 |

NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power.  
NOTE 2: Applicable for dual-mode GSM/UMTS.

### 7.1.1.2 UTRA FDD

Handheld UE TRS minimum performance requirements for UTRA FDD in beside the head phantom position and the primary mechanical mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.1.1.2-1.

**Table 7.1.1.2-1: Handheld UE TRS minimum requirements for UTRA FDD roaming bands in beside the head phantom position and the primary mechanical mode**

| Operating band | Unit         | <REF <sub>or</sub> > |     |
|----------------|--------------|----------------------|-----|
|                |              | Average              | Max |
| I              | dBm/3,84 MHz | -101                 | -98 |
| II             | dBm/3,84 MHz | -99                  | -96 |
| III            | dBm/3,84 MHz | -98                  | -95 |
| IV             | dBm/3,84 MHz | -101                 | -98 |
| V              | dBm/3,84 MHz | -96                  | -93 |
| VI             | dBm/3,84 MHz | -96                  | -93 |
| VII            | dBm/3,84 MHz | -99                  | -96 |
| VIII           | dBm/3,84 MHz | -96                  | -93 |
| IX             | dBm/3,84 MHz | -100                 | -97 |
| XIX            | dBm/3,84 MHz | -96                  | -93 |

NOTE 1: For Power class 3, 3bis and 4 this shall be achieved at the maximum output power.  
NOTE 2: For the UE which supports both Band III and Band IX operating frequencies, the reference level of TDB dBm TRS <REF<sub>or</sub>> [average and min] shall apply for Band IX.  
NOTE 3: Applicable for dual-mode GSM/UMTS.  
NOTE 4: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -98 dBm/3,84 MHz and max <REF<sub>or</sub>> level of -95 dBm/3,84 MHz shall apply for Band II.  
NOTE 5: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -100 dBm/3,84 MHz and max <REF<sub>or</sub>> level of -97 dBm/3,84 MHz shall apply for Band IV.

### 7.1.1.3 UTRA LCR TDD

Handheld UE TRS minimum performance requirements for UTRA LCR FDD in beside the head phantom position and the primary mechanical mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.1.1.3-1.

**Table 7.1.1.3-1: Handheld UE TRS minimum requirement for UTRA LCR TDD roaming bands in beside the head phantom position and the primary mechanical mode**

| Operating band | Unit         | <REF <sub>or</sub> > |      |
|----------------|--------------|----------------------|------|
|                |              | Average              | Max  |
| a              | dBm/1,28 MHz | -101                 | -100 |
| b              | dBm/1,28 MHz | TBD                  | TBD  |
| c              | dBm/1,28 MHz | TBD                  | TBD  |
| d              | dBm/1,28 MHz | TBD                  | TBD  |
| e              | dBm/1,28 MHz | -101                 | -100 |
| f              | dBm/1,28 MHz | -101                 | -100 |

Note: Applicable for dual-mode GSM/UTRA LCR TDD.

## 7.1.2 Beside the head and hand phantoms position

Beside the head and hand phantom position is defined in TR 25.914 [6] subclauses 5.1.5 and 5.1.6.

The Wide Grip hand related positioning guideline for talk mode shall be the same as described in TS 38.161 Clause B.3.2.2 [10].

### 7.1.2.1 UTRA FDD

Handheld UE TRS minimum performance requirements for UTRA FDD in beside the head and hand phantoms position and the primary mechanical mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.1.2.1-1.

**Table 7.1.2.1-1: Handheld UE TRS minimum requirements for UTRA FDD roaming bands in beside the head and hand phantoms position and the primary mechanical mode**

| Operating band | Unit         | <REF <sub>or</sub> > |     |
|----------------|--------------|----------------------|-----|
|                |              | Average              | Max |
| I              | dBm/3,84 MHz | -101,00              | TBD |
| II             | dBm/3,84 MHz | -99,00               | TBD |
| III            | dBm/3,84 MHz | TBD                  | TBD |
| IV             | dBm/3,84 MHz | TBD                  | TBD |
| V              | dBm/3,84 MHz | -96,75               | TBD |
| VI             | dBm/3,84 MHz | -96,75               | TBD |
| VII            | dBm/3,84 MHz | TBD                  | TBD |
| VIII           | dBm/3,84 MHz | -96,75               | TBD |
| IX             | dBm/3,84 MHz | TBD                  | TBD |
| XIX            | dBm/3,84 MHz | -96,75               | TBD |

NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power.

NOTE 2: For the UE which supports both Band III and Band IX operating frequencies, the reference level of TBD dBm TRS <REF<sub>or</sub>> [average and min] shall apply for Band IX.

NOTE 3: Applicable for dual-mode GSM/UMTS.

NOTE 4: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -98 dBm/3,84 MHz and max <REF<sub>or</sub>> level of -95 dBm/3,84 MHz shall apply for Band II.

NOTE 5: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -100 dBm/3,84 MHz and max <REF<sub>or</sub>> level of -97 dBm/3,84 MHz shall apply for Band IV.

NOTE 6: Applicable for devices narrower than 72mm as defined in TR 25.914.

NOTE 7: Not applicable for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation).

### 7.1.2.2 UTRA LCR TDD

Handheld UE TRS minimum performance requirements for UTRA LCR TDD in beside the head and hand phantoms position and the primary mechanical mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.1.2.2-1.

**Table 7.1.2.2-1: Handheld UE TRS minimum requirement for UTRA LCR TDD roaming bands in beside the head and hand phantoms position and the primary mechanical mode**

| Operating band                                   | Unit         | <REFlor> |     |
|--|--------------|----------|-----|
|  |              | Average  | Max |
| a  | dBm/1,28 MHz | TBD      | TBD |
| b  | dBm/1,28 MHz | TBD      | TBD |
| c  | dBm/1,28 MHz | TBD      | TBD |
| d  | dBm/1,28 MHz | TBD      | TBD |
| e  | dBm/1,28 MHz | TBD      | TBD |
| f  | dBm/1,28 MHz | TBD      | TBD |
| Note: Applicable for dual-mode GSM/UTRA LCR TDD. |              |          |     |

### 7.1.2.3 E-UTRA FDD

### 7.1.2.4 E-UTRA TDD

## 7.1.3 Hand phantom browsing mode position

Hand phantom browsing mode position is defined in TR 25.914 [6] subclauses 5.1.5 and 5.1.7.

The Wide Grip hand related positioning guideline for browsing mode shall be the same as described in TS 38.161 Clause B.3.1.1 [10].

### 7.1.3.1 UTRA FDD

Handheld UE TRS minimum performance requirements for UTRA FDD in hand phantom browsing mode position and the primary mechanical mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.1.3.1-1.



**Table 7.1.3.1-1: Handheld UE TRS minimum requirements for UTRA FDD roaming bands in hand phantom browsing mode position**

| Operating band | Unit         | <REF <sub>or</sub> > |     |
|----------------|--------------|----------------------|-----|
|                |              | Average              | Max |
| I              | dBm/3,84 MHz | TBD                  | TBD |
| II             | dBm/3,84 MHz | TBD                  | TBD |
| III            | dBm/3,84 MHz | TBD                  | TBD |
| IV             | dBm/3,84 MHz | TBD                  | TBD |
| V              | dBm/3,84 MHz | TBD                  | TBD |
| VI             | dBm/3,84 MHz | TBD                  | TBD |
| VII            | dBm/3,84 MHz | TBD                  | TBD |
| VIII           | dBm/3,84 MHz | TBD                  | TBD |
| IX             | dBm/3,84 MHz | TBD                  | TBD |
| XIX            | dBm/3,84 MHz | TBD                  | TBD |

NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power.

NOTE 2: For the UE which supports both Band III and Band IX operating frequencies, the reference level of TDB dBm TRS <REF<sub>or</sub>> [average and min] shall apply for Band IX.

NOTE 3: Applicable for dual-mode GSM/UMTS.

NOTE 4: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -98 dBm/3,84 MHz and max <REF<sub>or</sub>> level of -95 dBm/3,84 MHz shall apply for Band II.

NOTE 5: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -100 dBm/3,84 MHz and max <REF<sub>or</sub>> level of -97 dBm/3,84 MHz shall apply for Band IV.

### 7.1.3.2 UTRA LCR TDD

Handheld UE TRS minimum performance requirements for UTRA LCR TDD in hand phantom browsing mode position and the primary mechanical mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.1.3.2-1.

**Table 7.1.3.2-1: Handheld UE TRS minimum requirement for UTRA LCR TDD roaming bands in hand phantom browsing mode position**

| Operating band | Unit         | <REF <sub>or</sub> > |     |
|----------------|--------------|----------------------|-----|
|                |              | Average              | Max |
| a              | dBm/1,28 MHz | TBD                  | TBD |
| b              | dBm/1,28 MHz | TBD                  | TBD |
| c              | dBm/1,28 MHz | TBD                  | TBD |
| d              | dBm/1,28 MHz | TBD                  | TBD |
| e              | dBm/1,28 MHz | TBD                  | TBD |
| f              | dBm/1,28 MHz | TBD                  | TBD |

Note: Applicable for dual-mode GSM/UTRA LCR TDD.

### 7.1.3.3 E-UTRA FDD

### 7.1.3.4 E-UTRA TDD

## 7.2 Minimum requirement for roaming bands for LME

The average measured TRS of low, mid and high channel for laptop mounted equipment shall be lower than average TRS requirement specified in this subclause. The averaging shall be done in linear scale for the TRS results. Average TRS requirement is shown in the column "Average" on the requirement tables.

$$TRS_{average} = 10 \log \left[ 3 / \left( \frac{1}{10^{P_{low}/10}} + \frac{1}{10^{P_{mid}/10}} + \frac{1}{10^{P_{high}/10}} \right) \right]$$

In addition the highest TRS of each measured channel shall be lower than maximum TRS requirement specified in this subclause. Maximum TRS requirement is shown in the column “Max” on the requirement tables.

$$TRS_{max} = 10 \log \left[ \max \left( 10^{P_{low}/10}, 10^{P_{mid}/10}, 10^{P_{high}/10} \right) \right]$$

## 7.2.1 GSM

LME TRS minimum performance requirements for GPRS PDTCH/CS1 at 10% BLER [3] with laptop ground plane phantom in data transfer position are defined in Table 7.2.1-1.

**Table 7.2.1-1: LME TRS minimum requirements for GSM in data transfer position**

| Operating band | Unit | <REF <sub>or</sub> > |     |
|----------------|------|----------------------|-----|
|                |      | Average              | Max |
| GSM 850        | dBm  | TBD                  | TBD |
| GSM 900        | dBm  | TBD                  | TBD |
| DCS 1800       | dBm  | TBD                  | TBD |
| PCS 1900       | dBm  | TBD                  | TBD |

NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power.  
NOTE 2: Applicable for dual-mode GSM/UMTS.  
NOTE 3: Applicable for USB plug-in devices.

## 7.2.2 UTRA FDD

LME TRS minimum performance requirements for UTRA FDD with laptop ground plane phantom in data transfer position mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.2.2-1. [The values in the tables are  $\hat{I}$  for with no interference.]

**Table 7.2.2-1: LME TRS minimum requirements for UTRA FDD in data transfer position**

| Operating band | Unit         | <REF <sub>or</sub> > |     |
|----------------|--------------|----------------------|-----|
|                |              | Average              | Max |
| I              | dBm/3,84 MHz | TBD                  | TBD |
| II             | dBm/3,84 MHz | TBD                  | TBD |
| III            | dBm/3,84 MHz | TBD                  | TBD |
| IV             | dBm/3,84 MHz | TBD                  | TBD |
| V              | dBm/3,84 MHz | TBD                  | TBD |
| VI             | dBm/3,84 MHz | TBD                  | TBD |
| VII            | dBm/3,84 MHz | TBD                  | TBD |
| VIII           | dBm/3,84 MHz | TBD                  | TBD |
| IX             | dBm/3,84 MHz | TBD                  | TBD |
| XIX            | dBm/3,84 MHz | TBD                  | TBD |

NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power.  
NOTE 2: Applicable for dual-mode GSM/UMTS.  
NOTE 3: Applicable for USB plug-in devices.

## 7.2.3 UTRA LCR TDD

LME TRS minimum performance requirements for UTRA LCR TDD with laptop ground plane phantom in data transfer position mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Table 7.2.3-1. [The values in the tables are  $\hat{I}$  for with no interference.]

**Table 7.2.3-1: LME TRS minimum requirements for UTRA LCR TDD in data transfer position**

| Operating band | Unit         | <REF <sub>lor</sub> > |     |
|----------------|--------------|-----------------------|-----|
|                |              | Average               | Max |
| a              | dBm/1,28 MHz | TBD                   | TBD |
| b              | dBm/1,28 MHz | TBD                   | TBD |
| c              | dBm/1,28 MHz | TBD                   | TBD |
| d              | dBm/1,28 MHz | TBD                   | TBD |
| e              | dBm/1,28 MHz | TBD                   | TBD |
| f              | dBm/1,28 MHz | TBD                   | TBD |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for USB plug-in devices.

## 7.2.4 E-UTRA FDD

## 7.2.5 E-UTRA TDD

## 7.3 Minimum requirement for roaming bands for LEE

The average measured TRS of low, mid and high channel for laptop embedded equipment shall be lower than average TRS requirements specified in this subclause. The averaging shall be done in linear scale for the TRS results. Average TRS requirement is shown in the column “Average” on the requirement tables.

$$TRS_{average} = 10 \log \left[ 3 / \left( \frac{1}{10^{P_{low}/10}} + \frac{1}{10^{P_{mid}/10}} + \frac{1}{10^{P_{high}/10}} \right) \right]$$

In addition the highest TRS of each measured channel shall be lower than maximum TRS requirement specified in this subclause. Maximum TRS requirement is shown in the column “Max” on the requirement tables.

$$TRS_{max} = 10 \log \left[ \max \left( 10^{P_{low}/10}, 10^{P_{mid}/10}, 10^{P_{high}/10} \right) \right]$$

### 7.3.1 GSM

LEE TRS minimum performance requirements for GPRS PDTCH/CS1 at 10% BLER [3] are defined in Tables 7.3.1-1 and 7.3.1-2.

**Table 7.3.1-1: Notebook TRS minimum requirements for GSM in data transfer position**

| Operating band | Unit | <REF <sub>lor</sub> > |     |
|----------------|------|-----------------------|-----|
|                |      | Average               | Max |
| GSM 850        | dBm  | TBD                   | TBD |
| GSM 900        | dBm  | TBD                   | TBD |
| DCS 1800       | dBm  | TBD                   | TBD |
| PCS 1900       | dBm  | TBD                   | TBD |

NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power.  
NOTE 2: Applicable for dual-mode GSM/UMTS.  
NOTE 3: Applicable for notebook devices.

**Table 7.3.1-2: Tablet TRS minimum requirements for GSM in data transfer position**

| Operating band | Unit | <REF <sub>or</sub> > |     |
|----------------|------|----------------------|-----|
|                |      | Average              | Max |
| GSM 850        | dBm  | TBD                  | TBD |
| GSM 900        | dBm  | TBD                  | TBD |
| DCS 1800       | dBm  | TBD                  | TBD |
| PCS 1900       | dBm  | TBD                  | TBD |

NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power.  
NOTE 2: Applicable for dual-mode GSM/UMTS.  
NOTE 3: Applicable for tablet devices.

## 7.3.2 UTRA FDD

LEE TRS minimum performance requirements for UTRA FDD in data transfer position mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Tables 7.3.2-1 and 7.3.3-2. [The values in the tables are for with no interference.]

**Table 7.3.2-1: Notebook TRS minimum requirements for UTRA FDD in data transfer position**

| Operating band | Unit         | <REF <sub>or</sub> > |        |
|----------------|--------------|----------------------|--------|
|                |              | Average              | Max    |
| I              | dBm/3,84 MHz | -103,5               | -102,0 |
| II             | dBm/3,84 MHz | TBD                  | TBD    |
| III            | dBm/3,84 MHz | TBD                  | TBD    |
| IV             | dBm/3,84 MHz | TBD                  | TBD    |
| V              | dBm/3,84 MHz | TBD                  | TBD    |
| VI             | dBm/3,84 MHz | -101,5               | -99,5  |
| VII            | dBm/3,84 MHz | TBD                  | TBD    |
| VIII           | dBm/3,84 MHz | -101,5               | -99,5  |
| IX             | dBm/3,84 MHz | TBD                  | TBD    |
| XIX            | dBm/3,84 MHz | -101,5               | -99,5  |

NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power.  
NOTE 2: Applicable for multi-mode GSM/UMTS/LTE.  
NOTE 3: Applicable for notebook devices.

NOTE: TRS minimum performance requirements in table 7.3.2-1 apply to HSPA and LTE UEs supporting only single carrier operation. Their applicability to multi-carrier operation is FFS. This is because it has not been verified whether the UEs measured to derive the requirements supported carrier aggregation or not.

**Table 7.3.2-2: Tablet TRS minimum requirements for UTRA FDD in data transfer position**

| Operating band | Unit         | <REF <sub>or</sub> > |         |
|----------------|--------------|----------------------|---------|
|                |              | Average              | Max     |
| I              | dBm/3,84 MHz | -105,75              | -104,25 |
| II             | dBm/3,84 MHz | TBD                  | TBD     |
| III            | dBm/3,84 MHz | TBD                  | TBD     |
| IV             | dBm/3,84 MHz | TBD                  | TBD     |
| V              | dBm/3,84 MHz | -103                 | -101,0  |
| VI             | dBm/3,84 MHz | TBD                  | TBD     |
| VII            | dBm/3,84 MHz | TBD                  | TBD     |
| VIII           | dBm/3,84 MHz | TBD                  | TBD     |
| IX             | dBm/3,84 MHz | TBD                  | TBD     |
| XIX            | dBm/3,84 MHz | -103                 | -101,0  |

NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power.  
NOTE 2: Applicable for dual-mode GSM/UMTS.  
NOTE 3: Applicable for tablet devices with two antennas.

### 7.3.3 UTRA LCR TDD

LEE TRS minimum performance requirements for UTRA LCR TDD in data transfer position mode for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] are defined in Tables 7.3.3-1 and 7.3.2-2. [The values in the tables are for with no interference.]

**Table 7.3.3-1: LEE TRS minimum requirements for UTRA LCR TDD in data transfer position**

| Operating band | Unit         | <REFlor> |     |
|----------------|--------------|----------|-----|
|                |              | Average  | Max |
| a              | dBm/1,28 MHz | TBD      | TBD |
| b              | dBm/1,28 MHz | TBD      | TBD |
| c              | dBm/1,28 MHz | TBD      | TBD |
| d              | dBm/1,28 MHz | TBD      | TBD |
| e              | dBm/1,28 MHz | TBD      | TBD |
| f              | dBm/1,28 MHz | TBD      | TBD |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for notebook devices.

**Table 7.3.3-2: Tablet TRS minimum requirements for UTRA LCR TDD in data transfer position**

| Operating band | Unit         | <REFlor> |     |
|----------------|--------------|----------|-----|
|                |              | Average  | Max |
| a              | dBm/1,28 MHz | TBD      | TBD |
| b              | dBm/1,28 MHz | TBD      | TBD |
| c              | dBm/1,28 MHz | TBD      | TBD |
| d              | dBm/1,28 MHz | TBD      | TBD |
| e              | dBm/1,28 MHz | TBD      | TBD |
| f              | dBm/1,28 MHz | TBD      | TBD |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for tablet devices.

### 7.3.4 E-UTRA FDD

LEE TRS minimum performance requirements for E-UTRA FDD in data transfer position mode for throughput  $\geq 95\%$  of the maximum throughput of the reference measurement channels as specified in section 7.3 of TS 36.521-1 [9] and Annex A of TS 36.521-1 [9] are defined in Table 7.3.4-1 for Tablet devices.

Table 7.3.4-1: Tablet TRS minimum requirements for E-UTRA FDD in data transfer position

| Operating band | Channel bandwidth | Sensitivity (dBm) |        |
|----------------|-------------------|-------------------|--------|
|                |                   | Average           | Max    |
| 1              | 10 MHz            | -93.75            | -92.25 |
| 2              | 10 MHz            |                   |        |
| 3              | 10 MHz            | -95.0             | -93.5  |
| 4              | 10 MHz            |                   |        |
| 5              | 10 MHz            |                   |        |
| 7              | 10 MHz            | -93.5             | -92.0  |
| 8              | 10 MHz            |                   |        |
| 12             | 10 MHz            |                   |        |
| 13             | 10 MHz            |                   |        |
| 19             | 10 MHz            | -91.5             | -89.5  |
| 20             | 10 MHz            | -92.5             | -90.5  |
| 21             | 15 MHz            | -90.0             | -88.5  |
| 28             | 10 MHz            |                   |        |
| 32             | 10 MHz            |                   |        |

NOTE 1: Applicable for multi-mode GSM/UMTS/LTE.  
NOTE 2: Applicability for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation) is FFS.

### 7.3.5 E-UTRA TDD

## 8 Receiver total radiated multi-antenna sensitivity

### 8.1 Minimum requirement for roaming bands for handheld UE

#### 8.1.1 Free Space

Requirements in this section are stated for the free space configuration, are applicable to handheld devices, and are not applicable to wrist-worn devices.

For the reference MPAC methodology and the harmonized RTS methodology defined in [7], the average TRMS of free space data mode portrait (FS DMP), free space data mode landscape (FSDML), and free space data mode screen up (FS DMSU), as defined in Annex E of TR 37.977 [7], when measured at the mid channel shall be lower than the average TRMS requirements specified in subclauses 8.1.1.1 and 8.1.1.2. The averaging shall be done in linear scale for the TRMS results at these DUT positions. Two average TRMS quantities are calculated from sensitivity measurements at 70% and 95% throughput, respectively. Average TRMS requirement are shown in the column “Average, 70” and “Average, 95” on the requirement tables.

$$TRMS_{average,70} = 10\log \left[ 3 / \left( \frac{1}{10^{S_{FS\_DMP,70}/10}} + \frac{1}{10^{S_{FS\_DML,70}/10}} + \frac{1}{10^{S_{FS\_DMSU,70}/10}} \right) \right]$$

$$TRMS_{average,95} = 10\log \left[ 3 / \left( \frac{1}{10^{S_{FS\_DMP,95}/10}} + \frac{1}{10^{S_{FS\_DML,95}/10}} + \frac{1}{10^{S_{FS\_DMSU,95}/10}} \right) \right]$$

Where

$$S_{MODE,x} = 10\log \left[ 12 / \left( \frac{1}{10^{P_{MODE,x,0}/10}} + \frac{1}{10^{P_{MODE,x,1}/10}} + \dots + \frac{1}{10^{P_{MODE,x,11}/10}} \right) \right]$$

Such that *MODE* is one of {*FS\_DMP*, *FS\_DML*, *FS\_DMSU*}, *x* is one of {70, 95}, and {*P<sub>MODE,x,0</sub>*, ..., *P<sub>MODE,x,11</sub>*} are the measured sensitivity values at each azimuth position.

For the reference MPAC methodology and the harmonized RTS methodology defined in [7], if 1 azimuth position does not result in a defined measured sensitivity at 70% or 95% throughput,  $S_{MODE,70}$  or  $S_{MODE,95}$  are calculated using the 11 measured sensitivities and the maximum downlink RS-EPRE  $P_{RS-EPRE-MAX}$  (substitution approach) for the one missing result. If 2 azimuth positions do not result in a defined measured sensitivity at 95% throughput,  $S_{MODE,95}$  is calculated using the 10 measured sensitivities and  $P_{RS-EPRE-MAX}$  for the two missing results. If more azimuth positions result in undefined values for measured sensitivity at the 70% and/or 95% throughput, then the TRMS requirement for the corresponding throughput levels has not been met by such a device.  $P_{RS-EPRE-MAX}$  is defined as -80 dBm/15 kHz and is the maximum downlink RS-EPRE supported by the test system.

### 8.1.1.1 E-UTRA FDD

Handheld UE TRMS minimum performance requirements for E-UTRA FDD in free space and the primary mechanical mode for 70% and 95% DL throughput with the reference measurement channel defined in Clause 7 of TR 37.977 [7] are defined in Table 8.1.1.1-1.

**Table 8.1.1.1-1: Handheld UE TRMS minimum requirements for E-UTRA FDD roaming bands in free space and the primary mechanical mode**

| Channel Model as defined in clause 8.2 in [7] |            | Test 1                |             |
|---|------------|-----------------------|-------------|
|   |            | SCME urban micro-cell |             |
| Operating band                                | Unit       | <REF <sub>or</sub> >  |             |
|   |            | Average, 70           | Average, 95 |
| 1   | dBm/15 kHz | -94.75                | -92.75      |
| 2   | dBm/15 kHz | TBD                   | TBD         |
| 3   | dBm/15 kHz | -93.75                | -91.75      |
| 4   | dBm/15 kHz | TBD                   | TBD         |
| 5   | dBm/15 kHz | -91.5                 | -89.5       |
| 7   | dBm/15 kHz | -92.5                 | -90.5       |
| 8   | dBm/15 kHz | TBD                   | TBD         |
| 12  | dBm/15 kHz | TBD                   | TBD         |
| 13  | dBm/15 kHz | TBD                   | TBD         |
| 19  | dBm/15 kHz | -91.5                 | -89.5       |
| 20  | dBm/15 kHz | TBD                   | TBD         |
| 28  | dBm/15 kHz | TBD                   | TBD         |
| 32 (1)  | dBm/15 kHz | TBD                   | TBD         |

NOTE 1: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.

NOTE 2: Applicability for devices supporting 4-receiver architectures is not confirmed.

### 8.1.1.2 E-UTRA TDD

Handheld UE TRMS minimum performance requirements for E-UTRA TDD in free space and the primary mechanical mode for 70% and 95% DL throughput with the reference measurement channel defined in Clause 7 of TR 37.977 [7] are defined in Table 8.1.1.2-1.

**Table 8.1.1.2-1: Handheld UE TRMS minimum requirements for E-UTRA TDD roaming bands in free space and the primary mechanical mode**

|   |            | Test 1                |             |
|---|------------|-----------------------|-------------|
| Channel Model as defined in clause 8.2 in [7]   |            | SCME urban micro-cell |             |
| Operating band  | Unit       | <REF <sub>or</sub> >  |             |
|   |            | Average, 70           | Average, 95 |
| 38  | dBm/15 kHz | -95.5                 | -93.5       |
| 39  | dBm/15 kHz | TBD                   | TBD         |
| 40  | dBm/15 kHz | TBD                   | TBD         |
| 41  | dBm/15 kHz | -95.5                 | -93.5       |
| 42  | dBm/15 kHz | TBD                   | TBD         |
| 46 (1,2)  | dBm/15 kHz | TBD                   | TBD         |
| NOTE 1: This band is an unlicensed band restricted to licensed-assisted operation using Frame Structure Type 3          |            |                       |             |
| NOTE 2: In this version of the specification, restricted to E-UTRA DL operation when carrier aggregation is configured. |            |                       |             |
| NOTE 3: Applicability for devices supporting 4-receiver architectures is not confirmed.                                 |            |                       |             |



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# Annex A (normative): Environmental conditions

## A.1 General

This normative annex specifies the environmental requirements of the UE. Within these limits the requirements of the present documents shall be fulfilled.

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## A.2 Environmental requirements

The requirements in this clause apply to all types of UE(s) and MS(s).

### A.2.2 Temperature

All the OTA requirements are applicable in room temperature e.g. 25°C.

### A.2.3 Voltage

All test cases shall be performed in the normal voltage condition with the DUT operated in stand-alone battery powered mode. No extreme voltage testing is required. It is recommended to start testing with a fully charged battery and conclude and/or pause testing before the battery has completely lost its charge.

## Annex B (informative): Recommended performance

### B.1 General

This annex introduces the concept of recommended OTA performance for operating bands. This requirement is not mandatory but is recommended.

The concept of recommended performance is to ensure that UE/MS OTA performance is maximised in order to improve user experience and network performance. It is recognised that the ability to meet the recommended performance depends on the number of frequency bands supported by the UE/MS.

### B.2 Transmitter total radiated power

The OTA TRP performance for GSM, UTRA and E-UTRA should be greater or equal than the recommended values in this clause.

#### B.2.1 Recommended performance for handheld UE

##### B.2.1.1 Beside the head phantom position

Beside the head phantom test method is defined in TR 25.914 [6] subclauses 5.1.1 and 5.1.2.

##### B.2.1.1.1 GSM

**Table B.2.1.1.1-1: Handheld UE TRP recommended performance for GSM in beside the head phantom position and the primary mechanical mode**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 4 | Power class 5 |
|----------------|---------------|---------------|---------------|---------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   |
|                | Average       | Average       | Average       | Average       | Average       |
| GSM 850        | -             | -             | -             | 24            | -             |
| GSM 900        | -             | -             | -             | 24            | -             |
| DCS 1800       | 24            | -             | -             | -             | -             |
| PCS 1900       | 24            | -             | -             | -             | -             |

NOTE: Applicable for dual-mode GSM/UMTS.

## B.2.1.1.2 UTRA FDD

Table B.2.1.1.2-1: Handheld UE TRP recommended performance for UTRA FDD in beside the head phantom position and the primary mechanical mode

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| I              | -             | -             | +18           | +18              | +16           |
| II             | -             | -             | +18           | +18              | +16           |
| III            | -             | -             | +18           | +18              | +16           |
| IV             | -             | -             | +18           | +18              | +16           |
| V              | -             | -             | +14           | +14              | +12           |
| VI             | -             | -             | +14,5         | +14,5            | +12,5         |
| VII            | -             | -             | +18           | +18              | +16           |
| VIII           | -             | -             | +15           | +15              | +13           |
| IX             | -             | -             | +18           | +18              | +16           |
| XIX            | -             | -             | +14,5         | +14,5            | +12,5         |

NOTE: Applicable for dual-mode GSM/UMTS.

## B.2.1.1.3 UTRA LCR TDD

Table B.2.1.1.3-1: Handheld UE TRP recommended performance for UTRA LCR TDD in beside the head phantom position and the primary mechanical mode

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| a              | -             | +18           | -             | -                | -             |
| b              | -             | TBD           | -             | -                | -             |
| c              | -             | TBD           | -             | -                | -             |
| d              | -             | TBD           | -             | -                | -             |
| e              | -             | +18           | -             | -                | -             |
| f              | -             | +18           | -             | -                | -             |

Note: Applicable for dual-mode GSM/UTRA LCR TDD.

## B.2.1.2 Beside the head and hand phantoms position

### B.2.1.2.1 UTRA FDD

**Table B.2.1.2.1-1: Handheld UE TRP recommended performance for UTRA FDD beside the head and hand phantoms position and the primary mechanical mode**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                |               |               | Average       | Average          | Average       |
| I              | -             | -             | 16,25         | TBD              | TBD           |
| II             | -             | -             | 16,25         | TBD              | TBD           |
| III            | -             | -             | TBD           | TBD              | TBD           |
| IV             | -             | -             | TBD           | TBD              | TBD           |
| V              | -             | -             | 12,40         | TBD              | TBD           |
| VI             | -             | -             | 12,40         | TBD              | TBD           |
| VII            | -             | -             | TBD           | TBD              | TBD           |
| VIII           | -             | -             | 12,40         | TBD              | TBD           |
| IX             | -             | -             | TBD           | TBD              | TBD           |
| XIX            | -             | -             | 12,40         | TBD              | TBD           |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for devices narrower than 72mm as defined in TR 25.914.  
NOTE 3: Not applicable for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation).

### B.2.1.2.2 UTRA LCR TDD

**Table B.2.1.2.2-1: Handheld UE TRP recommended performance for UTRA LCR TDD in beside the head and hand phantoms position and the primary mechanical mode**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                |               | Average       |               |                  |               |
| a              | -             | TBD           | -             | -                | -             |
| b              | -             | TBD           | -             | -                | -             |
| c              | -             | TBD           | -             | -                | -             |
| d              | -             | TBD           | -             | -                | -             |
| e              | -             | TBD           | -             | -                | -             |
| f              | -             | TBD           | -             | -                | -             |

Note: Applicable for dual-mode GSM/UTRA LCR TDD.

## B.2.1.2.3 E-UTRA FDD

## B.2.1.2.4 E-UTRA TDD

## B.2.1.3 Hand phantom browsing mode position

## B.2.1.3.1 UTRA FDD

**Table B.2.1.3.1-1: Handheld UE TRP recommended performance for UTRA FDD in the hand phantom browsing mode position**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                |               |               | Average       | Average          | Average       |
| I              | -             | -             | TBD           | TBD              | TBD           |
| II             | -             | -             | TBD           | TBD              | TBD           |
| III            | -             | -             | TBD           | TBD              | TBD           |
| IV             | -             | -             | TBD           | TBD              | TBD           |
| V              | -             | -             | TBD           | TBD              | TBD           |
| VI             | -             | -             | TBD           | TBD              | TBD           |
| VII            | -             | -             | TBD           | TBD              | TBD           |
| VIII           | -             | -             | TBD           | TBD              | TBD           |
| IX             | -             | -             | TBD           | TBD              | TBD           |
| XIX            | -             | -             | TBD           | TBD              | TBD           |

NOTE: Applicable for dual-mode GSM/UMTS.

## B.2.1.3.2 UTRA LCR TDD

**Table B.2.1.3.2-1: Handheld UE TRP recommended performance for UTRA LCR TDD in the hand phantom browsing mode position**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                |               | Average       |               |                  |               |
| a              | -             | TBD           | -             | -                | -             |
| b              | -             | TBD           | -             | -                | -             |
| c              | -             | TBD           | -             | -                | -             |
| d              | -             | TBD           | -             | -                | -             |
| e              | -             | TBD           | -             | -                | -             |
| f              | -             | TBD           | -             | -                | -             |

Note : Applicable for dual-mode GSM/UTRA LCR TDD.

B.2.1.3.3 E-UTRA FDD

B.2.1.3.4 E-UTRA TDD

B.2.2 Recommended performance for LME

B.2.2.1 GSM

Table B.2.2.1-1: LME TRP recommended performance for GSM in data transfer position

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 4 | Power class 5 |
|----------------|---------------|---------------|---------------|---------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   |
|                | Average       | Average       | Average       | Average       | Average       |
| GSM 850        | -             | -             | -             | TBD           | -             |
| GSM 900        | -             | -             | -             | TBD           | -             |
| DCS 1800       | TBD           | -             | -             | -             | -             |
| PCS 1900       | TBD           | -             | -             | -             | -             |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for USB plug-in devices.

B.2.2.2 UTRA FDD

Table B.2.2.2-1: LME TRP recommended performance for UTRA FDD in data transfer position

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| I              | -             | -             | TBD           | TBD              | TBD           |
| II             | -             | -             | TBD           | TBD              | TBD           |
| III            | -             | -             | TBD           | TBD              | TBD           |
| IV             | -             | -             | TBD           | TBD              | TBD           |
| V              | -             | -             | TBD           | TBD              | TBD           |
| VI             | -             | -             | TBD           | TBD              | TBD           |
| VII            | -             | -             | TBD           | TBD              | TBD           |
| VIII           | -             | -             | TBD           | TBD              | TBD           |
| IX             | -             | -             | TBD           | TBD              | TBD           |
| XIX            | -             | -             | TBD           | TBD              | TBD           |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for USB plug-in devices.

B.2.2.3 UTRA LCR TDD

Table B.2.2.3-1: LME TRP recommended performance for UTRA LCR TDD in data transfer position

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| a              | -             | TBD           | -             | -                | -             |
| b              | -             | TBD           | -             | -                | -             |
| c              | -             | TBD           | -             | -                | -             |
| d              | -             | TBD           | -             | -                | -             |
| e              | -             | TBD           | -             | -                | -             |
| f              | -             | TBD           | -             | -                | -             |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for USB plug-in devices.

### B.2.2.4 E-UTRA FDD

Table B.2.2.4-1: Tablet TRP recommended performance for E-UTRA FDD in the data transfer position

| Operating band | Power Class 1 | Power Class 2 | Power Class 3  | Power Class 4 |
|----------------|---------------|---------------|----------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)    | Power (dBm)   |
|                |               |               | <b>Average</b> |               |
| 1              |               |               | 21.0           |               |
| 2              |               |               |                |               |
| 3              |               |               | 20.5           |               |
| 4              |               |               |                |               |
| 5              |               |               |                |               |
| 7              |               |               | 20.0           |               |
| 8              |               |               |                |               |
| 12             |               |               |                |               |
| 13             |               |               |                |               |
| 19             |               |               | 20.0           |               |
| 20             |               |               | 19.5           |               |
| 21             |               |               | 20.0           |               |
| 28             |               |               |                |               |

NOTE 1: Applicable for multi-mode GSM/UMTS/LTE.  
 NOTE 2: Applicability for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation) is FFS.

### B.2.2.5 E-UTRA TDD

## B.2.3 Recommended performance for LEE

### B.2.3.1 GSM

Table B.2.3.1-1: Notebook TRP recommended performance for GSM in data transfer position

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 4 | Power class 5 |
|----------------|---------------|---------------|---------------|---------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   |
|                | Average       | Average       | Average       | Average       | Average       |
| GSM 850        | -             | -             | -             | TBD           | -             |
| GSM 900        | -             | -             | -             | TBD           | -             |
| DCS 1800       | TBD           | -             | -             | -             | -             |
| PCS 1900       | TBD           | -             | -             | -             | -             |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
 NOTE 2: Applicable for notebook devices.

Table B.2.3.1-2: Tablet TRP recommended performance for GSM in data transfer position

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 4 | Power class 5 |
|----------------|---------------|---------------|---------------|---------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)   |
|                | Average       | Average       | Average       | Average       | Average       |
| GSM 850        | -             | -             | -             | TBD           | -             |
| GSM 900        | -             | -             | -             | TBD           | -             |
| DCS 1800       | TBD           | -             | -             | -             | -             |
| PCS 1900       | TBD           | -             | -             | -             | -             |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
 NOTE 2: Applicable for tablet devices.

## B.2.3.2 UTRA FDD

**Table B.2.3.2-1: Notebook TRP recommended performance for UTRA FDD in data transfer position**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| I              | -             | -             | 21,5          | TBD              | TBD           |
| II             | -             | -             | TBD           | TBD              | TBD           |
| III            | -             | -             | TBD           | TBD              | TBD           |
| IV             | -             | -             | TBD           | TBD              | TBD           |
| V              | -             | -             | TBD           | TBD              | TBD           |
| VI             | -             | -             | 21,0          | TBD              | TBD           |
| VII            | -             | -             | TBD           | TBD              | TBD           |
| VIII           | -             | -             | 21,0          | TBD              | TBD           |
| IX             | -             | -             | TBD           | TBD              | TBD           |
| XIX            | -             | -             | 21,0          | TBD              | TBD           |

NOTE 1: Applicable for multi-mode GSM/UMTS/LTE.  
NOTE 2: Applicable for notebook devices.

NOTE: TRP minimum performance requirements in table B.2.3.2-1 apply to HSPA and LTE UEs supporting only single carrier operation. Their applicability to multi-carrier operation is FFS. This is because it has not been verified whether the UEs measured to derive the requirements supported carrier aggregation or not.

**Table B.2.3.2-2: Tablet TRP recommended performance for UTRA FDD in data transfer position**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| I              | -             | -             | 21,5          | TBD              | TBD           |
| II             | -             | -             | TBD           | TBD              | TBD           |
| III            | -             | -             | TBD           | TBD              | TBD           |
| IV             | -             | -             | TBD           | TBD              | TBD           |
| V              | -             | -             | 19,5          | TBD              | TBD           |
| VI             | -             | -             | TBD           | TBD              | TBD           |
| VII            | -             | -             | TBD           | TBD              | TBD           |
| VIII           | -             | -             | TBD           | TBD              | TBD           |
| IX             | -             | -             | TBD           | TBD              | TBD           |
| XIX            | -             | -             | 19,5          | TBD              | TBD           |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for tablet devices with two antennas.

## B.2.3.3 UTRA LCR TDD

**Table B.2.3.3-1: Notebook TRP recommended performance for UTRA LCR TDD in data transfer position**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| a              | -             | TBD           | -             | -                | -             |
| b              | -             | TBD           | -             | -                | -             |
| c              | -             | TBD           | -             | -                | -             |
| d              | -             | TBD           | -             | -                | -             |
| e              | -             | TBD           | -             | -                | -             |
| f              | -             | TBD           | -             | -                | -             |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for notebook devices.



**Table B.2.3.3-2: Tablet TRP recommended performance for UTRA LCR TDD in data transfer position**

| Operating band | Power class 1 | Power class 2 | Power class 3 | Power class 3bis | Power class 4 |
|----------------|---------------|---------------|---------------|------------------|---------------|
|                | Power (dBm)   | Power (dBm)   | Power (dBm)   | Power (dBm)      | Power (dBm)   |
|                | Average       | Average       | Average       | Average          | Average       |
| a              | -             | TBD           | -             | -                | -             |
| b              | -             | TBD           | -             | -                | -             |
| c              | -             | TBD           | -             | -                | -             |
| d              | -             | TBD           | -             | -                | -             |
| e              | -             | TBD           | -             | -                | -             |
| f              | -             | TBD           | -             | -                | -             |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for tablet devices.

### B.2.3.4 E-UTRA FDD

### B.2.3.5 E-UTRA TDD

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## B.3 Receiver total radiated sensitivity

The OTA TRS performance for GSM, UTRA and E-UTRA should be lower or equal than the recommended values shown in this clause.

### B.3.1 Recommended performance for handheld UE

#### B.3.1.1 Beside the head phantom position

Beside the head phantom test method is defined in TR 25.914 [6] subclauses 5.1.1 and 5.1.2.

##### B.3.1.1.1 GSM

**Table B.3.1.1.1-1: Handheld UE TRS recommended performance for GSM in beside the head phantom position and the primary mechanical mode.**

| Operating band | Unit | <REF <sub>or</sub> ><br>Average |
|----------------|------|---------------------------------|
| GSM 850        | dBm  | -100,5                          |
| GSM 900        | dBm  | -100,5                          |
| DCS 1800       | dBm  | -103,5                          |
| PCS 1900       | dBm  | -103,5                          |

NOTE: Applicable for dual-mode GSM/UMTS.

## B.3.1.1.2 UTRA FDD

**Table B.3.1.1.2-1: Handheld UE TRS recommended performance for FDD in beside the head phantom position for the primary mechanical mode**

| Operating band | Unit         | <REF <sub>or</sub> > |
|----------------|--------------|----------------------|
| I              | dBm/3,84 MHz | -104                 |
| II             | dBm/3,84 MHz | -102                 |
| III            | dBm/3,84 MHz | -101                 |
| IV             | dBm/3,84 MHz | -104                 |
| V              | dBm/3,84 MHz | -99,5                |
| VI             | dBm/3,84 MHz | -101                 |
| VII            | dBm/3,84 MHz | -102                 |
| VIII           | dBm/3,84 MHz | -100                 |
| IX             | dBm/3,84 MHz | -103                 |
| XIX            | dBm/3,84 MHz | -101                 |

NOTE 1: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -101 dBm/3.84 shall apply for Band II.

NOTE 2: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>or</sub>> level of -103 dBm/3.84 MHz shall apply for Band IV.

## B.3.1.1.3 UTRA LCR TDD

**Table B.3.1.1.3-1: Handheld UE TRS recommended performance for UTRA LCR TDD in beside the head phantom position and the primary mechanical mode.**

| Operating band | Unit         | <REF <sub>or</sub> ><br>Average |
|----------------|--------------|---------------------------------|
| a              | dBm/1,28 MHz | -105                            |
| b              | dBm/1,28 MHz | TBD                             |
| c              | dBm/1,28 MHz | TBD                             |
| d              | dBm/1,28 MHz | TBD                             |
| e              | dBm/1,28 MHz | -105                            |
| f              | dBm/1,28 MHz | -105                            |

NOTE: Applicable for dual-mode GSM/UTRA LCR TDD.

### B.3.1.2 Beside the head and hand phantoms position

#### B.3.1.2.1 UTRA FDD

**Table B.3.1.2.1-1: TRS recommended performance for UTRA FDD in the beside the head and hand phantoms position for the primary mechanical mode**

| Operating band  | Unit         | <REF <sub>or</sub> ><br>Average |
|---|--------------|---------------------------------|
| I   | dBm/3,84 MHz | -104,00                         |
| II  | dBm/3,84 MHz | -102,00                         |
| III   | dBm/3,84 MHz | TBD                             |
| IV  | dBm/3,84 MHz | TBD                             |
| V   | dBm/3,84 MHz | -99,75                          |
| VI  | dBm/3,84 MHz | TBD                             |
| VII   | dBm/3,84 MHz | TBD                             |
| VIII  | dBm/3,84 MHz | -99,75                          |
| IX  | dBm/3,84 MHz | TBD                             |
| XIX   | dBm/3,84 MHz | TBD                             |
| NOTE 1: For the UE which supports DB-DC-HSDPA configuration 2, average <REF <sub>or</sub> > level of -101 dBm/3,84 shall apply for Band II.     |              |                                 |
| NOTE 2: For the UE which supports DB-DC-HSDPA configuration 2, average <REF <sub>or</sub> > level of -103 dBm/3,84 MHz shall apply for Band IV. |              |                                 |
| NOTE 3: Applicable for devices narrower than 72mm as defined in TR 25.914   |              |                                 |
| NOTE 4: Not applicable for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation)                    |              |                                 |

#### B.3.1.2.2 UTRA LCR TDD

**Table B.3.1.2.2-1: TRS recommended performance for UTRA LCR TDD in the beside the head and hand phantoms position and the primary mechanical mode**

| Operating band                                   | Unit         | <REF <sub>or</sub> ><br>Average |
|--|--------------|---------------------------------|
| a  | dBm/1,28 MHz | TBD                             |
| b  | dBm/1,28 MHz | TBD                             |
| c  | dBm/1,28 MHz | TBD                             |
| d  | dBm/1,28 MHz | TBD                             |
| e  | dBm/1,28 MHz | TBD                             |
| f  | dBm/1,28 MHz | TBD                             |
| NOTE: Applicable for dual-mode GSM/UTRA LCR TDD. |              |                                 |

## B.3.1.2.3 E-UTRA FDD

## B.3.1.2.4 E-UTRA TDD

## B.3.1.3 Hand phantom browsing mode position

## B.3.1.3.1 UTRA FDD

**Table B.3.1.3.1-1: TRS recommended performance for UTRA FDD in hand phantom browsing mode position**

| Operating band | Unit         | <REF <sub>lor</sub> ><br>Average |
|----------------|--------------|----------------------------------|
| I              | dBm/3,84 MHz | TBD                              |
| II             | dBm/3,84 MHz | TBD                              |
| III            | dBm/3,84 MHz | TBD                              |
| IV             | dBm/3,84 MHz | TBD                              |
| V              | dBm/3,84 MHz | TBD                              |
| VI             | dBm/3,84 MHz | TBD                              |
| VII            | dBm/3,84 MHz | TBD                              |
| VIII           | dBm/3,84 MHz | TBD                              |
| IX             | dBm/3,84 MHz | TBD                              |
| XIX            | dBm/3,84 MHz | TBD                              |

NOTE 1: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>lor</sub>> level of -101 dBm/3,84 shall apply for Band II.  
NOTE 2: For the UE which supports DB-DC-HSDPA configuration 2, average <REF<sub>lor</sub>> level of -103 dBm/3,84 MHz shall apply for Band IV.

## B.3.1.3.2 UTRA LCR TDD

**Table B.3.1.3.2-1: TRS recommended performance for UTRA LCR TDD in hand phantom browsing mode position**

| Operating band | Unit         | <REF <sub>lor</sub> ><br>Average |
|----------------|--------------|----------------------------------|
| a              | dBm/1,28 MHz | TBD                              |
| b              | dBm/1,28 MHz | TBD                              |
| c              | dBm/1,28 MHz | TBD                              |
| d              | dBm/1,28 MHz | TBD                              |
| e              | dBm/1,28 MHz | TBD                              |
| f              | dBm/1,28 MHz | TBD                              |

NOTE: Applicable for dual-mode GSM/UTRA LCR TDD.

## B.3.1.3.3 E-UTRA FDD

## B.3.1.3.4 E-UTRA TDD

## B.3.2 Recommended performance for LME

## B.3.2.1 GSM

Table B.3.2.1-1: LME TRS recommended performance for GSM in the data transfer position

| Operating band | Unit | <REF <sub>or</sub> ><br>Average |
|----------------|------|---------------------------------|
| GSM 850        | dBm  | TBD                             |
| GSM 900        | dBm  | TBD                             |
| DCS 1800       | dBm  | TBD                             |
| PCS 1900       | dBm  | TBD                             |

NOTE 1: Applicable for dual-mode GSM/UMTS.  
NOTE 2: Applicable for USB plug-in devices.

## B.3.2.2 UTRA FDD

Table B.3.2.2-1: LME TRS recommended performance for UTRA FDD in the data transfer position

| Operating band | Unit         | <REF <sub>or</sub> ><br>Average |
|----------------|--------------|---------------------------------|
| I              | dBm/3,84 MHz | TBD                             |
| II             | dBm/3,84 MHz | TBD                             |
| III            | dBm/3,84 MHz | TBD                             |
| IV             | dBm/3,84 MHz | TBD                             |
| V              | dBm/3,84 MHz | TBD                             |
| VI             | dBm/3,84 MHz | TBD                             |
| VII            | dBm/3,84 MHz | TBD                             |
| VIII           | dBm/3,84 MHz | TBD                             |
| IX             | dBm/3,84 MHz | TBD                             |
| XIX            | dBm/3,84 MHz | TBD                             |

NOTE: Applicable for USB plug-in devices.

## B.3.2.3 UTRA LCR TDD

Table B.3.2.3-1: LME TRS recommended performance for UTRA LCR TDD in the data transfer position

| Operating band | Unit         | <REF <sub>or</sub> ><br>Average |
|----------------|--------------|---------------------------------|
| a              | dBm/1,28 MHz | TBD                             |
| b              | dBm/1,28 MHz | TBD                             |
| c              | dBm/1,28 MHz | TBD                             |
| d              | dBm/1,28 MHz | TBD                             |
| e              | dBm/1,28 MHz | TBD                             |
| f              | dBm/1,28 MHz | TBD                             |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for USB plug-in devices.

## B.3.2.4 E-UTRA FDD

## B.3.2.5 E-UTRA TDD

## B.3.3 Recommended performance for LEE

## B.3.3.1 GSM

Table B.3.3.1-1: Notebook TRS recommended performance for GSM in the data transfer position

| Operating band   | Unit | <REF <sub>or</sub> ><br>Average |
|--|------|---------------------------------|
| GSM 850  | dBm  | TBD                             |
| GSM 900  | dBm  | TBD                             |
| DCS 1800   | dBm  | TBD                             |
| PCS 1900   | dBm  | TBD                             |
| NOTE 1: Applicable for dual-mode GSM/UMTS.<br>NOTE 2: Applicable for notebook devices. |      |                                 |

Table B.3.3.1-2: Tablet TRS recommended performance for GSM in the data transfer position

| Operating band   | Unit | <REF <sub>or</sub> ><br>Average |
|--|------|---------------------------------|
| GSM 850  | dBm  | TBD                             |
| GSM 900  | dBm  | TBD                             |
| DCS 1800   | dBm  | TBD                             |
| PCS 1900   | dBm  | TBD                             |
| NOTE 1: Applicable for dual-mode GSM/UMTS.<br>NOTE 2: Applicable for tablet devices. |      |                                 |

## B.3.3.2 UTRA FDD

Table B.3.3.2-1: Notebook TRS recommended performance for UTRA FDD in the data transfer position

| Operating band  | Unit         | <REF <sub>or</sub> ><br>Average |
|---|--------------|---------------------------------|
| I   | dBm/3,84 MHz | -106.5                          |
| II  | dBm/3,84 MHz | TBD                             |
| III   | dBm/3,84 MHz | TBD                             |
| IV  | dBm/3,84 MHz | TBD                             |
| V   | dBm/3,84 MHz | TBD                             |
| VI  | dBm/3,84 MHz | -104.5                          |
| VII   | dBm/3,84 MHz | TBD                             |
| VIII  | dBm/3,84 MHz | -104.5                          |
| IX  | dBm/3,84 MHz | TBD                             |
| XIX   | dBm/3,84 MHz | -104.5                          |
| NOTE 1: Applicable for multi-mode GSM/UMTS/LTE.<br>NOTE 2: Applicable for notebook devices. |              |                                 |

NOTE: TRS minimum performance requirements in table B.3.3.2-1 apply to HSPA and LTE UEs supporting only single carrier operation. Their applicability to multi-carrier operation is FFS. This is because it has not been verified whether the UEs measured to derive the requirements supported carrier aggregation or not.

**Table B.3.3.2-2: Tablet TRS recommended performance for UTRA FDD in the data transfer position**

| Operating band | Unit         | <REF <sub>or</sub> ><br>Average |
|----------------|--------------|---------------------------------|
| I              | dBm/3,84 MHz | -108,75                         |
| II             | dBm/3,84 MHz | TBD                             |
| III            | dBm/3,84 MHz | TBD                             |
| IV             | dBm/3,84 MHz | TBD                             |
| V              | dBm/3,84 MHz | -106,0                          |
| VI             | dBm/3,84 MHz | TBD                             |
| VII            | dBm/3,84 MHz | TBD                             |
| VIII           | dBm/3,84 MHz | TBD                             |
| IX             | dBm/3,84 MHz | TBD                             |
| XIX            | dBm/3,84 MHz | -106,0                          |

NOTE: Applicable for tablet devices with two antennas.

### B.3.3.3 UTRA LCR TDD

**Table B.3.3.3-1: Notebook TRS recommended performance for UTRA LCR TDD in the data transfer position**

| Operating band | Unit         | <REF <sub>or</sub> ><br>Average |
|----------------|--------------|---------------------------------|
| a              | dBm/1,28 MHz | TBD                             |
| b              | dBm/1,28 MHz | TBD                             |
| c              | dBm/1,28 MHz | TBD                             |
| d              | dBm/1,28 MHz | TBD                             |
| e              | dBm/1,28 MHz | TBD                             |
| f              | dBm/1,28 MHz | TBD                             |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for notebook devices.

**Table B.3.3.3-2: Tablet TRS recommended performance for UTRA LCR TDD in the data transfer position**

| Operating band | Unit         | <REF <sub>or</sub> ><br>Average |
|----------------|--------------|---------------------------------|
| a              | dBm/1,28 MHz | TBD                             |
| b              | dBm/1,28 MHz | TBD                             |
| c              | dBm/1,28 MHz | TBD                             |
| d              | dBm/1,28 MHz | TBD                             |
| e              | dBm/1,28 MHz | TBD                             |
| f              | dBm/1,28 MHz | TBD                             |

NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD.  
NOTE 2: Applicable for tablet devices.

### B.3.3.4 E-UTRA FDD

Table B.3.3.4-1: Tablet TRS recommended performance for E-UTRA FDD in data transfer position

| Operating band  | Channel bandwidth | Sensitivity (dBm) |
|---|-------------------|-------------------|
|   |                   | Average           |
| 1   | 10 MHz            | -96.0             |
| 2   | 10 MHz            |                   |
| 3   | 10 MHz            | -97.0             |
| 4   | 10 MHz            |                   |
| 5   | 10 MHz            |                   |
| 7   | 10 MHz            | -95.75            |
| 8   | 10 MHz            |                   |
| 12  | 10 MHz            |                   |
| 13  | 10 MHz            |                   |
| 19  | 10 MHz            | -94.5             |
| 20  | 10 MHz            | -94.5             |
| 21  | 15 MHz            | -93.0             |
| 28  | 10 MHz            |                   |
| 32  | 10 MHz            |                   |
| NOTE 1: Applicable for multi-mode GSM/UMTS/LTE.   |                   |                   |
| NOTE 2: Applicability for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation) is FFS. |                   |                   |

### B.3.3.5 E-UTRA TDD



## Annex C (informative): Change history

| Change history |             |           |      |     |     |  |             |
|----------------|-------------|-----------|------|-----|-----|--|-------------|
| Date           | Meeting     | TDoc      | CR   | Rev | Cat | Subject/Comment  | New version |
| 2014-03        | RAN4#70 bis | R4-141169 |      |     |     | TP to TS37.144 on adding tables of performance requirements for tablet devices   | 0.1.0       |
| 2015-04        | RAN4#74 bis | R4-151168 |      |     |     | TP to TS 37.144 on adding UTRA FDD LEE TRP/TRS requirements for Bands I and VIII   | 0.2.0       |
| 2015-04        | RAN4#74 bis | R4-151215 |      |     |     | TP to TS 37.144 on a skeleton for MIMO OTA requirements  | 0.2.0       |
| 2015-05        | RAN4#75     | R4-152459 |      |     |     | LEE requirement for UMTS Band VI and XIX   | 0.3.0       |
| 2016-02        | RAN4#78     | R4-161467 |      |     |     | TP for TS 37.144 Introduction of new TRP/TRS requirements  | 1.0.0       |
| 2016-04        | RAN4#78 bis | R4-163122 |      |     |     | Addition of missing Tablet requirements  | 1.1.0       |
| 2016-05        | RAN4#79     | R4-164969 |      |     |     | TP to to TS 37.144 UTRA handheld TRP/TRS agreements  | 2.0.0       |
| 2016-06        | RAN#72      | R4-164811 |      |     |     | TP to TS 37.144 on MIMO OTA performance requirement structure  | 2.1.0       |
| 2016-06        | RAN#72      | R4-164812 |      |     |     | TP to TS 37.144 on MIMO OTA test case parameters   | 2.1.0       |
| 2016-06        | RAN#72      |           |      |     |     | TR approved by RAN plenary   | 13.0.0      |
| 2016-08        | RAN#72      |           |      |     |     | Automatic upgrade to Rel-14 (Accidentally approved as Rel-13 at RAN#72, and later promoted with no technical change to Rel-14) | 14.0.0      |
| 2016-09        | RP-73       | RP-161620 | 0001 | 1   | F   | Applicability of UTRA Requirements   | 14.1.0      |
| 2016-12        | RP-74       | RP-162397 | 0003 | -   | F   | Introduction of UTRA BHH TRP and TRS Requirements for Band VI and XIX  | 14.2.0      |
| 2016-12        | RP-74       | RP-162389 | 0004 | -   | F   | Correction of TRMS test case parameters  | 14.2.0      |
| 2017-06        | RP-76       | RP-171271 | 0005 | 1   | B   | Finalization of LTE Tablet TRP/TRS for bands 1, 3, 7, 19, 20, 21   | 14.3.0      |
| 2017-09        | RP-77       | RP-171931 | 0008 | 1   | F   | CR on maximum RS-EPRE level  | 14.4.0      |
| 2017-09        | RP-77       | RP-171931 | 0011 |     | B   | MIMO OTA TRMS requirements for PS1   | 14.4.0      |
| 2017-12        | RAN#78      | RP-172583 | 0013 | 1   | F   | CR to 37.144 on handset TRMS   | 14.5.0      |
| 2018-03        | RAN#79      | RP-180295 | 0014 | 1   | F   | Inclusion of TDD RTS as harmonized method in 37.144  | 14.6.0      |
| 2018-06        | RAN#80      | RP-181115 | 0015 | 1   | F   | Inclusion of FDD RTS as harmonized method in 37.144  | 14.7.0      |
| 2018-06        | SA#80       | -         | -    | -   | -   | Update to Rel-15 version (MCC)   | 15.0.0      |
| 2020-06        | SA#88       | -         | -    | -   | -   | Update to Rel-16 version (MCC)   | 16.0.0      |
| 2024-09        | RAN#105     | RP-242191 | 0022 |     | A   | Clarification of voltage environmental requirement   | 16.1.0      |
| 2024-12        | RAN#106     | RP-243066 | 0027 |     | A   | CR to TS 37.144 on adding test method for UE over 72mm wide [OTA_WideHand]   | 16.2.0      |

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# History

| <b>Document history</b> |              |             |
|-------------------------|--------------|-------------|
| V16.0.0                 | July 2020    | Publication |
| V16.1.0                 | October 2024 | Publication |
| V16.2.0                 | January 2025 | Publication |
|                         |              |             |
|                         |              |             |