



**Universal Mobile Telecommunications System (UMTS);  
LTE;  
Measurements of User Equipment (UE)  
radio performances for LTE/UMTS terminals;  
Total Radiated Power (TRP)  
and Total Radiated Sensitivity (TRS) test methodology  
(3GPP TR 37.902 version 12.1.0 Release 12)**



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Reference

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Keywords

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## Foreword

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## Introduction

In this technical report, the needed modifications to measurement parameters for LTE devices will be studied and applicability of the existing measurement procedures, e.g. TRP and TRS will be evaluated for LTE devices with multiple receive antennas TDD-LTE and FDD-LTE terminals (as it is expected that the same issues are applicable independent of RAT). As UMTS devices with multiple receive antennas are still needing test methodology, it is easy to extend to this study item contribution to UMTS terminals with, due to similar situation and technical issue. UMTS TRP and TRS test methods should also be updated in the same way.

## 1 Scope

The present document is a Technical Report of the Study Item for OTA TRP and TRS requirement of LTE terminals, which was approved at TSG RAN #55 [2]. The report provides the measurement procedure of Over The Air TRP and TRS requirements for LTE terminals. It will make a simple extension to the UE OTA TRP and TRS test methods TS34.114[3] for LTE UE with multiple receive antennas, without considering all of the aspects associated with spatial channels. The work should utilise the existing environments in TR25.914[4]. The results of the UE OTA test method with Head and Hand Phantoms study item can be considered later on once finalized. The report also provides some future extensions and work items after LTE TRP and TRS methods mature.

## 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] RP-120412, "New study item proposal: Measurements of radio performances for LTE terminals - conformance testing methodology".
- [3] 3GPP TS 34.114: "User Equipment (UE) / Mobile Station (MS) Over The Air (OTA) antenna performance".
- [4] 3GPP TR 25.914: "Measurements of radio performances for UMTS terminals in speech mode".
- [5] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment (UE) radio transmission and reception".
- [6] 3GPP TS 36.521-1: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: conformance testing".
- [7] RP-120368, "Verification of radiated multi-antenna reception performance of UEs in LTE/UMTS WID".

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

Void

### 3.2 Symbols

For the purposes of the present document, the following symbols apply:

- |          |  |
|----------|--|
| $\theta$ | Zenith angle in the spherical co-ordinate system   |
| $\phi$   | Azimuth angle in the spherical co-ordinate system  |
| $\Omega$ | Solid angle defined at the phase centre of the DUT |

|                          |  |
|--------------------------|--|
| $G\psi(\theta, \phi, f)$ | Antenna gain pattern in the $\psi$ -polarization as function of the spherical co-ordinates and the carrier frequency       |
| F                        | Carrier frequency  |
| Ptr                      | Transmitted power  |
| $Q\psi(\theta, \phi, f)$ | Angular power distribution in the $\psi$ -polarization as function of the spherical co-ordinates and the carrier frequency |
| dB                       | decibel  |
| dBm                      | dB referenced to one milliwatt   |
| m                        | meter  |
| mm                       | millimetre   |
| kbps                     | kilobit per second   |
| ms                       | millisecond  |
| MHz                      | megahertz  |

### 3.3 Abbreviations

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

|         |  |
|---------|--|
| 3G      | 3rd Generation   |
| 3GPP    | 3G Partnership Project   |
| 3-D     | Three Dimensional  |
| 16QAM   | 16 Quadrature Amplitude Modulation                             |
| A-MPR   | Additional Maximum Power Reduction                             |
| BS      | Base Station   |
| CN      | Core Network   |
| DL      | Downlink   |
| DUT     | Device Under Test  |
| ETSI    | European Telecommunications Standards Institute                |
| E-UTRA  | Evolved Universal Terrestrial Radio Access                     |
| LME     | Laptop Mounted Equipment                                       |
| LEE     | Laptop Embedded Equipment                                      |
| LTE     | Long Term Evolution  |
| MPR     | Maximum Power Reduction  |
| MS      | Mobile Station   |
| NB      | Node B   |
| QoS     | Quality of Service   |
| QPSK    | Quadrature Phase Shift Keying (modulation)                     |
| RAB     | Radio Access Bearer  |
| RAN     | Radio Access Network   |
| RB      | Resource Block   |
| RF      | Radio Frequency  |
| Rx      | Receiver   |
| RBstart | RB number where a RB allocation begins within the channel      |
| SAM     | Specific Anthropomorphic Mannequin                             |
| Tx      | Transmitter  |
| TRP     | Total Radiated Power   |
| TRS     | Total Radiated Sensitivity (also: Total Isotropic Sensitivity) |
| UL      | Uplink   |
| UE      | User Equipment   |
| UTRA    | Universal Terrestrial Radio Access                             |

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## 4 General

The present document is a Technical Report of the Study Item for OTA TRP and TRS requirement of LTE terminals, which was approved at TSG RAN #55 [2]. The report provides the measurement procedure of Over The Air TRP and TRS requirements for LTE terminals. It will make a simple extension to the UE OTA TRP and TRS test methods TR 25.914[4] for LTE UE with multiple receive antennas, without considering all of the aspects associated with spatial channels. The work should utilise the existing environments in TR 25.914[4]. The results of the UE OTA test method

with Head and Hand Phantoms study item can be considered later on once finalized. The report also provides some future extensions and work items after LTE TRP and TRS methods mature.

## 4.1 Scope

The measurement procedure explained in this document applies to all LTE devices, which are already satisfied the standard 3GPP LTE RF minimum performance requirements and conformance testing defined in 3GPP TS 36.101: Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception[5] and 3GPP TS 36.521-1: Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: conformance testing[6], respectively.

The testing methodology applies to any 4G LTE handset, USB-dongle and LEE etc, with internal or external antenna. 3GPP TR 25.914[4] has done many meaningful studies for evaluating antenna performance of UMTS and GSM terminals. In this document, the majority work will be focus on the LTE TRP and TRS test. A simple test methodology for LTE devices without channel emulator will be studied.

The radio tests considered here are:

1. The measurement of the radiated output power (TRP)
2. The measurement of the radiated sensitivity (TRS)

The test procedure described in this document measures the performance of the transmitter and the receiver, including the antenna and also the effects of the user.

The purpose of this document is to serve as a standard test procedure for radio performance testing of 4G LTE mobile terminals. It is the intention that this procedure is going to be used by test houses, network operators, mobile terminal and antenna manufacturers, research institutes etc. The motivation for the development of this document is the lack of standards in this area in 3GPP.

During RAN4 #62bis following proposal were agreed.

**Proposal 1:** LTE TRP test method is the same for all LTE UEs independent of release, including e.g. LTE CA, UL TX Div or UL MIMO capable UEs

**Proposal 2:** LTE TRS test method is the same for all LTE UEs independent of release, including e.g. LTE CA, UL TX Div or UL MIMO capable UEs

**Proposal 3:** In the first phase re-use test environments including phantoms available already in TS34.114 for LTE TPR and TRS purposes as well. Once new methods like hand phantom based test environments are defined for UTRA TRP and TRS, then also LTE TRP and TRS testing should be extended to these additional environments.

During RAN4 #63 following proposal were agreed.

**WF 1:** Select one channel bandwidth per band for TRP and TRS tests for LTE FDD and TDD. Default channel bandwidth is 10 MHz but another bandwidth can be considered on case by case basis.

**WF2:** For TRS select the reference measurement channel configuration for LTE FDD and TDD as defined for the conducted REFSENS minimum requirements and adopt UL allocation per band as defined in 36.101 Table 7.3.1-2 [5]. TRS is measured on low, mid and high channel.

**WF3:** For TRP select the UL reference measurement channel configuration as in conductive maximum output power test and the UL allocation for LTE FDD and TDD per band as shown in a table 1 below. Bands that are not covered in Table 1 will be addressed as well.

**WF4:** Select combined LTE TRS measurement in order to make the test method available for all LTE devices starting from Release 8. (Note: further enhancements for radiated UE receiver verifications are developed under the MIMO OTA WI in RP-120368 [7] and therefore combined LTE TRS test method may eventually be revisited.)

**WF5:** Given that existing TRP and TRS measurement procedures for UMTS terminals in speech mode specify two alternate testing methodologies (i.e. anechoic and reverb) [4], the standardization of two TRP/TRS testing

methodologies for LTE UEs may be one eventual outcome, and RAN4 shall take the view to avoid differences in the absolute test results.

## 4.2 Device Under Test definition

Handset: the UE/MS used under the "Speech mode" or 'Browsing mode' conditions that correspond to predefined positions (see Chapter 5.1.6 in [4] for 'Speech mode' and Chapter 5.1.7 in [4] for 'Browsing mode') for voice or data application when the handset is held close to the user.

Laptop Embedded Equipment : the equipment with a wireless device embedded inside, e.g. notebook and tablet .The corresponding predefined positions for 'data mode' application are defined in Chapter 5.3.1 in [4] for notebooks and Chapter 5.3.2 in [4] for tablets.

Laptop Mounted Equipment : the plug-in type device that host on the laptop, e.g. USB-dongle, that correspond to predefined positions (see Chapter 5.1.4 in [4]) for 'data mode' application.

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# 5 Measurement environment condition

## 5.1 Chamber environment constraints

Chamber environment constraints shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

## 5.2 Positioning Requirements and Coordinate system

Positioning Requirements and Coordinate system shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

## 5.3 DUT Test Positions and Phantom Specifications

### 5.3.1 Phantom Specifications

Phantom Specifications shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

### 5.3.2 DUT Test Positions

DUT Test Positions shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

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# 6 Measurement parameters

Measurement parameters shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

## 6.1 Definition of the Total Radiated Power

This definition will be used to calculate the TRP value of LTE DUT. See section 6.1 and E.2.1 in TR25.914[4].

## 6.2 Definition of Total Radiated Sensitivity

### 6.2.1 Total Radiated Sensitivity

This definition will be used to calculate the TRS value of LTE DUT. See section 6.5 and E.2.2 in TR25.914[4].

### 6.2.2 Alternate measurement parameter

## 6.3 Sampling grid and independent samples

For the anechoic chamber based measurement procedures the measurement of TRP is basically based on the measurement of the spherical radiation pattern of the Device Under Test . The power radiated by the DUT is sampled in far field in a group of points located on a spherical surface enclosing the DUT. The samples of TRP are taken using a constant sample step of 15° both in theta ( $\theta$ ) and phi ( $\phi$ ) directions.

The measurement of TRS is basically based on the measurement of the spherical sensitivity pattern of the Device Under Test. The sensitivity values of the DUT at a predefined BLER level are sampled in far field in a group of points located on a spherical surface enclosing the DUT. The samples of TRS are taken using a constant sample step of 30° both in theta ( $\theta$ ) and phi ( $\phi$ ) directions.

All the samples are taken with two orthogonal linear polarizations,  $\theta$ - and  $\varphi$ -polarisations. It is also possible to measure some other polarisation components, if it is possible to recover  $\theta$ - and  $\varphi$ -polarisations from the measured data by some technique.

For the reverberation chamber based measurement procedures the measurement of TRP is basically based on sampling the radiated power of the Device-Under-Test for a discrete number of field combinations in the chamber. The average value of these statistically distributed samples is proportional to the Total Radiated Power, and by calibrating the average power transfer function in the chamber, an absolute value of the TRP can be obtained. The samples of TRP are taken so that a minimum of 100 independent Rayleigh faded samples are measured, as per section 5.1.3 in TS34.114[3].

The measurement of TRS is basically based on searching for the lowest power received by the Device Under Test for a discrete number of field combinations in the chamber. The power received by the DUT at each discrete field combination that provides a BLER which is better than the specified target BLER level shall be averaged with other such measurements using different field combinations. By calibrating the average power transfer function, an absolute value of the TRS can be obtained when the linear values of all downlink power levels described above have been averaged. The samples of TRS are taken so that a minimum of 100 independent Rayleigh faded samples are measured, as per section 6.1.3 in TS34.114[3].

## 6.4 Measurement frequencies

This section defines the LTE-FDD and LTE-TDD TRP and TRS measurement frequencies allocations.

Table 6.4-1: TRP allocations (FDD)

| DL<br>EARFCN   | UL<br>EARFCN | Channel<br>BW | DL Carrier<br>Frequency | UL Carrier<br>frequency | DL C <sub>LRB</sub> | DL RB <sub>Start</sub> | UL C <sub>LRB</sub> | UL<br>RB <sub>Start</sub> |
|----------------|--------------|---------------|-------------------------|-------------------------|---------------------|------------------------|---------------------|---------------------------|
| <b>Band 1</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 50             | 18050        | 10            | 2115                    | 1925                    | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 300            | 18300        | 10            | 2140                    | 1950                    | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 550            | 18550        | 10            | 2165                    | 1975                    | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 2</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 650            | 18650        | 10            | 1935                    | 1855                    | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 900            | 18900        | 10            | 1960                    | 1880                    | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 1150           | 19150        | 10            | 1985                    | 1905                    | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 3</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 1250           | 19250        | 10            | 1810                    | 1715                    | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 1575           | 19575        | 10            | 1842,5                  | 1747,5                  | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 1900           | 19900        | 10            | 1875                    | 1780                    | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 4</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 2000           | 20000        | 10            | 2115                    | 1715                    | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 2175           | 20175        | 10            | 2132,5                  | 1732,5                  | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 2350           | 20350        | 10            | 2150                    | 1750                    | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 5</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 2450           | 20450        | 10            | 874                     | 829                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 2525           | 20525        | 10            | 881,5                   | 836,5                   | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 2600           | 20600        | 10            | 889                     | 844                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 7</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 2800           | 20800        | 10            | 2625                    | 2505                    | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 3100           | 21100        | 10            | 2655                    | 2535                    | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 3400           | 21400        | 10            | 2685                    | 2565                    | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 8</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 3500           | 21500        | 10            | 930                     | 885                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 3625           | 21625        | 10            | 942,5                   | 897,5                   | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 3750           | 21750        | 10            | 955                     | 910                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 12</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5060           | 23060        | 10            | 734                     | 704                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 5095           | 23095        | 10            | 737,5                   | 707,5                   | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 5130           | 23130        | 10            | 741                     | 711                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 13</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5230           | 23230        | 10            | 751                     | 782                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 5230           | 23230        | 10            | 751                     | 782                     | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 5230           | 23230        | 10            | 751                     | 782                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 14</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5330           | 23330        | 10            | 763                     | 793                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 5330           | 23330        | 10            | 763                     | 793                     | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 5330           | 23330        | 10            | 763                     | 793                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 17</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5780           | 23780        | 10            | 739                     | 709                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 5790           | 23790        | 10            | 740                     | 710                     | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 5800           | 23800        | 10            | 741                     | 711                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 19</b> |              |               |                         |                         |                     |                        |                     |                           |
| 6050           | 24050        | 10            | 880                     | 835                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 6075           | 24075        | 10            | 882,5                   | 837,5                   | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 6100           | 24100        | 10            | 885                     | 840                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 20</b> |              |               |                         |                         |                     |                        |                     |                           |
| 6200           | 24200        | 10            | 796                     | 837                     | NOTE 1              | NOTE 1                 | 12                  | 0                         |
| 6300           | 24300        | 10            | 806                     | 847                     | NOTE 1              | NOTE 1                 | 12                  | 19                        |
| 6400           | 24400        | 10            | 816                     | 857                     | NOTE 1              | NOTE 1                 | 12                  | 38                        |
| <b>Band 21</b> |              |               |                         |                         |                     |                        |                     |                           |
| 6525           | 24525        | 15            | 1503,4                  | 1455,4                  | NOTE 1              | NOTE 1                 | 16                  | 0                         |
| 6525           | 24525        | 15            | 1503,4                  | 1455,4                  | NOTE 1              | NOTE 1                 | 16                  | 29                        |
| 6525           | 24525        | 15            | 1503,4                  | 1455,4                  | NOTE 1              | NOTE 1                 | 16                  | 59                        |
| <b>Band 22</b> |              |               |                         |                         |                     |                        |                     |                           |
| TBD            | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| TBD            | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| TBD            | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |

|                |       |    |        |        |        |        |     |     |
|----------------|-------|----|--------|--------|--------|--------|-----|-----|
| <b>Band 23</b> |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| <b>Band 24</b> |       |    |        |        |        |        |     |     |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| <b>Band 25</b> |       |    |        |        |        |        |     |     |
| 8065           | 26065 | 5  | 1932.5 | 1852.5 | NOTE 1 | NOTE 1 | 8   | 0   |
| 8365           | 26365 | 5  | 1962.5 | 1882.5 | NOTE 1 | NOTE 1 | 8   | 8   |
| 8665           | 26665 | 5  | 1992.5 | 1912.5 | NOTE 1 | NOTE 1 | 8   | 17  |
| <b>Band 26</b> |       |    |        |        |        |        |     |     |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| <b>Band 27</b> |       |    |        |        |        |        |     |     |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| TBD            |       |    | TBD    | TBD    | TBD    | TBD    | TBD | TBD |
| <b>Band 28</b> |       |    |        |        |        |        |     |     |
| 9260           | 27260 | 10 | 763    | 708    | NOTE 1 | NOTE 1 | 12  | 0   |
| 9410           | 27410 | 10 | 778    | 723    | NOTE 1 | NOTE 1 | 12  | 19  |
| 9610           | 27610 | 10 | 798    | 743    | NOTE 1 | NOTE 1 | 12  | 38  |

NOTE 1: As per 3GPP TS 36.521-1 [6], Section 6.2 (UE Maximum Output Power), and Section A.3.2.A (Downlink Reference measurement channel for TX characteristics)

NOTE 2: Network signalling value NS\_01 shall be used in TRP tests

**Table 6.4-2: TRP allocations (TDD)**

| DL<br>EARFCN  | UL<br>EARFCN | Channel<br>BW | DL Carrier<br>Frequency | UL Carrier<br>frequency | DL C <sub>LRB</sub> | DL RB <sub>Start</sub> | UL C <sub>LRB</sub> | UL<br>RB <sub>Start</sub> |
|---|--------------|---------------|-------------------------|-------------------------|---------------------|------------------------|---------------------|---------------------------|
| <b>Band 33</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 36100   | 36100        | 20            | 1910                    | 1910                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| <b>Band 34</b>  |              |               |                         |                         |                     |                        |                     |                           |
| TBD   | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| <b>Band 35</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 36450   | 36450        | 20            | 1860                    | 1860                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 36650   | 36650        | 20            | 1880                    | 1880                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 36850   | 36850        | 20            | 1900                    | 1900                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 36</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 37050   | 37050        | 20            | 1940                    | 1940                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 37250   | 37250        | 20            | 1960                    | 1960                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 37450   | 37450        | 20            | 1980                    | 1980                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 37</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 37650   | 37650        | 20            | 1920                    | 1920                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| <b>Band 38</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 37850   | 37850        | 20            | 2580                    | 2580                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 38000   | 38000        | 20            | 2595                    | 2595                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 38150   | 38150        | 20            | 2610                    | 2610                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 39</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 38350   | 38350        | 20            | 1890                    | 1890                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 38450   | 38450        | 20            | 1900                    | 1900                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 38550   | 38550        | 20            | 1910                    | 1910                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 40</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 38750   | 38750        | 20            | 2310                    | 2310                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 39150   | 39150        | 20            | 2350                    | 2350                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 39550   | 39550        | 20            | 2390                    | 2390                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 41</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 39750   | 39750        | 20            | 2506                    | 2506                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 40620   | 40620        | 20            | 2593                    | 2593                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 41490   | 41490        | 20            | 2680                    | 2680                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 42</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 41690   | 41690        | 20            | 3410                    | 3410                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 42590   | 42590        | 20            | 3500                    | 3500                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 43490   | 43490        | 20            | 3590                    | 3590                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 43</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 43690   | 43690        | 20            | 3610                    | 3610                    | NOTE 1              | NOTE 1                 | 18                  | 0                         |
| 44590   | 44590        | 20            | 3700                    | 3700                    | NOTE 1              | NOTE 1                 | 18                  | 41                        |
| 45490   | 45490        | 20            | 3790                    | 3790                    | NOTE 1              | NOTE 1                 | 18                  | 82                        |
| <b>Band 44</b>  |              |               |                         |                         |                     |                        |                     |                           |
| TBD   | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| NOTE 1: As per 3GPP TS 36.521-1 [6], Section 6.2 (UE Maximum Output Power), and Section A.3.2.A (Downlink Reference measurement channel for TX characteristics) |              |               |                         |                         |                     |                        |                     |                           |
| NOTE 2: Network signalling value NS_01 shall be used in TRP tests   |              |               |                         |                         |                     |                        |                     |                           |

**Table 6.4-3: TRS allocations (FDD)**

| DL<br>EARFCN   | UL<br>EARFCN | Channel<br>BW | DL Carrier<br>Frequency | UL Carrier<br>frequency | DL C <sub>LRB</sub> | DL RB <sub>Start</sub> | UL C <sub>LRB</sub> | UL<br>RB <sub>Start</sub> |
|----------------|--------------|---------------|-------------------------|-------------------------|---------------------|------------------------|---------------------|---------------------------|
| <b>Band 1</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 50             | 18050        | 10            | 2115                    | 1925                    | 50                  | 0                      | 50                  | 0                         |
| 300            | 18300        | 10            | 2140                    | 1950                    | 50                  | 0                      | 50                  | 0                         |
| 550            | 18550        | 10            | 2165                    | 1975                    | 50                  | 0                      | 50                  | 0                         |
| <b>Band 2</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 650            | 18650        | 10            | 1935                    | 1855                    | 50                  | 0                      | 50                  | 0                         |
| 900            | 18900        | 10            | 1960                    | 1880                    | 50                  | 0                      | 50                  | 0                         |
| 1150           | 19150        | 10            | 1985                    | 1905                    | 50                  | 0                      | 50                  | 0                         |
| <b>Band 3</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 1250           | 19250        | 10            | 1810                    | 1715                    | 50                  | 0                      | 50                  | 0                         |
| 1575           | 19575        | 10            | 1842,5                  | 1747,5                  | 50                  | 0                      | 50                  | 0                         |
| 1900           | 19900        | 10            | 1875                    | 1780                    | 50                  | 0                      | 50                  | 0                         |
| <b>Band 4</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 2000           | 20000        | 10            | 2115                    | 1715                    | 50                  | 0                      | 50                  | 0                         |
| 2175           | 20175        | 10            | 2132,5                  | 1732,5                  | 50                  | 0                      | 50                  | 0                         |
| 2350           | 20350        | 10            | 2150                    | 1750                    | 50                  | 0                      | 50                  | 0                         |
| <b>Band 5</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 2450           | 20450        | 10            | 874                     | 829                     | 50                  | 0                      | 25                  | 25                        |
| 2525           | 20525        | 10            | 881,5                   | 836,5                   | 50                  | 0                      | 25                  | 25                        |
| 2600           | 20600        | 10            | 889                     | 844                     | 50                  | 0                      | 25                  | 25                        |
| <b>Band 7</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 2800           | 20800        | 10            | 2625                    | 2505                    | 50                  | 0                      | 50                  | 0                         |
| 3100           | 21100        | 10            | 2655                    | 2535                    | 50                  | 0                      | 50                  | 0                         |
| 3400           | 21400        | 10            | 2685                    | 2565                    | 50                  | 0                      | 50                  | 0                         |
| <b>Band 8</b>  |              |               |                         |                         |                     |                        |                     |                           |
| 3500           | 21500        | 10            | 930                     | 885                     | 50                  | 0                      | 25                  | 25                        |
| 3625           | 21625        | 10            | 942,5                   | 897,5                   | 50                  | 0                      | 25                  | 25                        |
| 3750           | 21750        | 10            | 955                     | 910                     | 50                  | 0                      | 25                  | 25                        |
| <b>Band 12</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5060           | 23060        | 10            | 734                     | 704                     | 50                  | 0                      | 20                  | 30                        |
| 5095           | 23095        | 10            | 737,5                   | 707,5                   | 50                  | 0                      | 20                  | 30                        |
| 5130           | 23130        | 10            | 741                     | 711                     | 50                  | 0                      | 20                  | 30                        |
| <b>Band 13</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5230           | 23230        | 10            | 751                     | 782                     | 50                  | 0                      | 15                  | 0                         |
| 5230           | 23230        | 10            | 751                     | 782                     | 50                  | 0                      | 15                  | 0                         |
| 5230           | 23230        | 10            | 751                     | 782                     | 50                  | 0                      | 15                  | 0                         |
| <b>Band 14</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5330           | 23330        | 10            | 763                     | 793                     | 50                  | 0                      | 20                  | 0                         |
| 5330           | 23330        | 10            | 763                     | 793                     | 50                  | 0                      | 20                  | 0                         |
| 5330           | 23330        | 10            | 763                     | 793                     | 50                  | 0                      | 20                  | 0                         |
| <b>Band 17</b> |              |               |                         |                         |                     |                        |                     |                           |
| 5780           | 23780        | 10            | 739                     | 709                     | 50                  | 0                      | 20                  | 30                        |
| 5790           | 23790        | 10            | 740                     | 710                     | 50                  | 0                      | 20                  | 30                        |
| 5800           | 23800        | 10            | 741                     | 711                     | 50                  | 0                      | 20                  | 30                        |
| <b>Band 19</b> |              |               |                         |                         |                     |                        |                     |                           |
| 6050           | 24050        | 10            | 880                     | 835                     | 50                  | 0                      | 25                  | 0                         |
| 6075           | 24075        | 10            | 882,5                   | 837,5                   | 50                  | 0                      | 25                  | 0                         |
| 6100           | 24100        | 10            | 885                     | 840                     | 50                  | 0                      | 25                  | 0                         |
| <b>Band 20</b> |              |               |                         |                         |                     |                        |                     |                           |
| 6200           | 24200        | 10            | 796                     | 837                     | 50                  | 0                      | 20                  | 30                        |
| 6300           | 24300        | 10            | 806                     | 847                     | 50                  | 0                      | 20                  | 30                        |
| 6400           | 24400        | 10            | 816                     | 857                     | 50                  | 0                      | 20                  | 30                        |
| <b>Band 21</b> |              |               |                         |                         |                     |                        |                     |                           |
| 6525           | 24525        | 15            | 1503,4                  | 1455,4                  | 75                  | 0                      | 25                  | 0                         |
| 6525           | 24525        | 15            | 1503,4                  | 1455,4                  | 75                  | 0                      | 25                  | 0                         |
| 6525           | 24525        | 15            | 1503,4                  | TBD1455,4               | 75                  | 0                      | 25                  | 0                         |
| <b>Band 22</b> |              |               |                         |                         |                     |                        |                     |                           |
| TBD            | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| TBD            | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| TBD            | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| <b>Band 23</b> |              |               |                         |                         |                     |                        |                     |                           |

|  |       |     |        |        |     |     |     |     |
|--|-------|-----|--------|--------|-----|-----|-----|-----|
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| <b>Band 24</b>   |       |     |        |        |     |     |     |     |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| <b>Band 25</b>   |       |     |        |        |     |     |     |     |
| 8065   | 26065 | 5   | 1932.5 | 1852.5 | 25  | 0   | 25  | 0   |
| 8365   | 26365 | 5   | 1962.5 | 1882.5 | 25  | 0   | 25  | 0   |
| 8665   | 26665 | 5   | 1992.5 | 1912.5 | 25  | 0   | 25  | 0   |
| <b>Band 26</b>   |       |     |        |        |     |     |     |     |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| <b>Band 27</b>   |       |     |        |        |     |     |     |     |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| TBD  | TBD   | TBD | TBD    | TBD    | TBD | TBD | TBD | TBD |
| <b>Band 28</b>   |       |     |        |        |     |     |     |     |
| 9260   | 27260 | 10  | 763    | 708    | 50  | 0   | 25  | 0   |
| 9410   | 27410 | 10  | 778    | 723    | 50  | 0   | 25  | 0   |
| 9610   | 27610 | 10  | 798    | 743    | 50  | 0   | 25  | 0   |
| NOTE 1: Refer to TS 36.521 [6], Table A.3.2-1 (Fixed Reference Channel for Receiver Requirements (FDD)), 10MHz configuration |       |     |        |        |     |     |     |     |
| NOTE 2: Network signalling value NS_01 shall be used in TRS tests unless explicitly specified                                |       |     |        |        |     |     |     |     |
| NOTE 3: Network signalling value NS_03 shall be used for Bands 2, 4, and 23  |       |     |        |        |     |     |     |     |
| NOTE 4: Network signalling value NS_06 shall be used for Bands 12, 13, 14, and 17  |       |     |        |        |     |     |     |     |
| NOTE 5: Network signalling value NS_08 shall be used for Band 19   |       |     |        |        |     |     |     |     |
| NOTE 6: Network signalling value NS_09 shall be used for Band 21   |       |     |        |        |     |     |     |     |

**Table 6.4-4: TRS allocations (TDD)**

| DL<br>EARFCN   | UL<br>EARFCN | Channel<br>BW | DL Carrier<br>Frequency | UL Carrier<br>frequency | DL C <sub>LRB</sub> | DL RB <sub>Start</sub> | UL C <sub>LRB</sub> | UL<br>RB <sub>Start</sub> |
|--|--------------|---------------|-------------------------|-------------------------|---------------------|------------------------|---------------------|---------------------------|
| <b>Band 33</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 36100  | 36100        | 20            | 1910                    | 1910                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 34</b>   |              |               |                         |                         |                     |                        |                     |                           |
| TBD  | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| <b>Band 35</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 36450  | 36450        | 20            | 1860                    | 1860                    | 100                 | 0                      | 100                 | 0                         |
| 36650  | 36650        | 20            | 1880                    | 1880                    | 100                 | 0                      | 100                 | 0                         |
| 36850  | 36850        | 20            | 1900                    | 1900                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 36</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 37050  | 37050        | 20            | 1940                    | 1940                    | 100                 | 0                      | 100                 | 0                         |
| 37250  | 37250        | 20            | 1960                    | 1960                    | 100                 | 0                      | 100                 | 0                         |
| 37450  | 37450        | 20            | 1980                    | 1980                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 37</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 37650  | 37650        | 20            | 1920                    | 1920                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 38</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 37850  | 37850        | 20            | 2580                    | 2580                    | 100                 | 0                      | 100                 | 0                         |
| 38000  | 38000        | 20            | 2595                    | 2595                    | 100                 | 0                      | 100                 | 0                         |
| 38150  | 38150        | 20            | 2610                    | 2610                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 39</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 38350  | 38350        | 20            | 1890                    | 1890                    | 100                 | 0                      | 100                 | 0                         |
| 38450  | 38450        | 20            | 1900                    | 1900                    | 100                 | 0                      | 100                 | 0                         |
| 38550  | 38550        | 20            | 1910                    | 1910                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 40</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 38750  | 38750        | 20            | 2310                    | 2310                    | 100                 | 0                      | 100                 | 0                         |
| 39150  | 39150        | 20            | 2350                    | 2350                    | 100                 | 0                      | 100                 | 0                         |
| 39550  | 39550        | 20            | 2390                    | 2390                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 41</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 39750  | 39750        | 20            | 2506                    | 2506                    | 100                 | 0                      | 100                 | 0                         |
| 40620  | 40620        | 20            | 2593                    | 2593                    | 100                 | 0                      | 100                 | 0                         |
| 41490  | 41490        | 20            | 2680                    | 2680                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 42</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 41690  | 41690        | 20            | 3410                    | 3410                    | 100                 | 0                      | 100                 | 0                         |
| 42590  | 42590        | 20            | 3500                    | 3500                    | 100                 | 0                      | 100                 | 0                         |
| 43490  | 43490        | 20            | 3590                    | 3590                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 43</b>   |              |               |                         |                         |                     |                        |                     |                           |
| 43690  | 43690        | 20            | 3610                    | 3610                    | 100                 | 0                      | 100                 | 0                         |
| 44590  | 44590        | 20            | 3700                    | 3700                    | 100                 | 0                      | 100                 | 0                         |
| 45490  | 45490        | 20            | 3790                    | 3790                    | 100                 | 0                      | 100                 | 0                         |
| <b>Band 44</b>   |              |               |                         |                         |                     |                        |                     |                           |
| TBD  | TBD          | TBD           | TBD                     | TBD                     | TBD                 | TBD                    | TBD                 | TBD                       |
| NOTE 1: Refer to TS 36.521 [6], Table A.3.2-2 (Fixed Reference Channel for Receiver Requirements (TDD)), 20MHz configuration |              |               |                         |                         |                     |                        |                     |                           |
| NOTE 2: Network signalling value NS_01 shall be used in TRS tests  |              |               |                         |                         |                     |                        |                     |                           |

## 7 Measurement procedure – transmitter performance

This section describes the specifics of the radiated power measurement procedure.

Measurement procedure – transmitter performance shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

## 7.1 General measurement arrangements

A radio communications tester or a corresponding device is used as a NB/BS simulator to setup calls to the DUT. The NB/BS simulator may also measure the radiated power samples. Alternatively, a measurement receiver or spectrum analyzer may be used for that purpose.

As section 4.2 definition, the measurements are performed for Handset, Laptop Embedded Equipment and Laptop Mounted Equipment.

- 1) The DUT of Handset should be placed against a head phantom. The measurement of the DUT is performed both on the left and right ears of the head phantom. And the scenario of placed against a head phantom and hold by the hand phantom is suggested to test. The measurement of the DUT is performed both on the left and right ears of the head phantom. Meanwhile, Hand phantom only is also suggested to test. The measurement of the DUT is performed both on the left and right hand phantom. The characteristics of the phantoms are specified in section 5.3.
- 2) The DUT of laptop embedded equipment should be placed in the following environment: free space for notebook devices (detailed positioning and specification refer to section 5.3.1 in [4]) and free space for tablet devices (detailed positioning and specification refer to section 5.3.2 in [4]).
- 3) The DUT of laptop mounted equipment should be using laptop ground plane phantom for testing scenario. Detailed phantom positioning and specification refer to section 5.3.

The measurements will be performed for the different antenna configurations of the DUT. For example in the case of a retractable antenna, for both antenna extended and antenna retracted configurations. In future, more specific test configurations for each major type of terminals may be added in this part.

More detail description of the BS simulator or spectrum analyser sees section 7.2 below and Annex A System Parameters.

## 7.2 Procedure for radiated power measurement

1. Set the initial conditions as per section 6.2.2 of 3GPP TS 36.521-1, with the following exception: configure the system simulator and the DUT as per section 5, and set the carrier frequency, channel bandwidth, RB length and RB location as per Table 6.4-1 and Table 6.4-2 respectively for FDD and TDD modes.
2. Follow steps 1 and 2 in section 6.2.2.4.2 of 3GPP TS 36.521-1 and ensure that the DUT transmits with its maximum power.
3. For the anechoic chamber based methodologies, measure the spherical effective isotropic radiated power (EIRP) pattern. And following the sampling grid specified in section 6.3 is suggested. For TDD slots with transient periods are not under test. The uplink downlink configuration and the special subframe configuration in TDD is set as per Table 8.2.2-1 of 3GPP TS 36.521-1. Calculate the TRP using the EIRP pattern data as per section 6.1.

For the reverberation chamber based measurement methodologies, sample the radiated power of the Device Under Test (DUT) for a discrete number of field combinations in the chamber. Follow the guidelines about independent samples in section 6.3. For TDD slots with transient periods are not under test. The uplink downlink configuration and the special subframe configuration in TDD is set as per Table 8.2.2-1 of 3GPP TS 36.521-1. Calculate the TRP using the power samples as per section 6.1.

4. In the case of handset DUT, repeat steps 1 through 3 using the head phantom only, head and hand phantom, and hand phantom only. The head phantom only, head and hand phantom, hand phantom only testing are as per section 5.3. For laptop mounted equipment DUT, the laptop ground plane phantom is used. For laptop embedded equipment notebook DUT, free space test is used For laptop embedded equipment tablet DUT, free space test is used; the test configuration may be enhanced once definitions of new testing conditions related to the tablet device categories become available (see Chapter 5.3.2 in [4]).

## 7.3 Calibration measurement

Calibration measurement shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

# 8 Measurement procedure – receiver performance

This section describes the specifics of the radiated sensitivity measurement procedure.

Measurement procedure – transmitter performance shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

## 8.1 General measurement arrangements

A radio communications tester or a corresponding device is used as a NB/BS simulator to setup calls to the DUT. The NB/BS simulator is also used to send test signals to the UE and measure the BLER levels of the radio link and the information on the dedicated channel needed to extract the DUT receiver performances.

As section 4.2 definition, the measurements are performed for Handset, Laptop Embedded Equipment and Laptop Mounted Equipment.

- 1) The DUT of Handset should be placed against a head phantom. The measurement of the DUT is performed both on the left and right ears of the head phantom. And the scenario of placed against a head phantom and hold by the hand phantom is suggested to test. The measurement of the DUT is performed both on the left and right ears of the head phantom. Meanwhile, Hand phantom only is also suggested to test. The measurement of the DUT is performed both on the left and right hand phantom. The characteristics of the phantoms are specified in section 5.3.
- 2) The DUT of laptop embedded equipment should be placed in the following environment: free space for notebook deivces (detailed positioning and specification refer to section 5.3.1 in [4]) and free space for tablet devices (detailed positioning and specification refer to section 5.3.2 in [4]).
- 3)The DUT of laptop mounted equipment should be using laptop ground plane phantom for testing scenario.  
Detailed phantom positioning and specification refer to section 5.3.

The measurements will be performed for the different antenna configurations of the DUT. For example in the case of a retractable antenna, for both antenna extended and retracted configurations. In future, more specific test configurations for each major type of terminals may be added in this part.

More detail description of the BS simulator see section 8.2 below and Annex A System Parameters.

## 8.2 Procedure for radiated sensitivity measurement

1. Set the initial conditions as per section 7.3 of 3GPP TS 36.521-1, with the following exception: configure the system simulator and the DUT as per section 5, and set the carrier frequency, channel bandwidth, RB length and RB location as per Table 6.4-3 and Table 6.4-4 respectively for FDD and TDD modes. For DUTs with more than one receiver port, all the tests should be performed using both (all) antenna ports simultaneously.
2. Follow steps 1 through 4 in sections of 7.3.4.2 of 3GPP TS 36.521-1, with the following exception: measure the receiver sensitivity by adjusting the downlink signal level to 95 % throughput of the maximum throughput of the reference channel (maximum throughput is per Appendix A of 3GPP TS 36.521-1).
3. For the anechoic chamber based methodologies, repeat step 2 with 3-D sampling grid specified in section 6.3. The minimum RF power level resulting a data throughput greater than or equal to 95 % throughput of the maximum throughput for each test shall be recorded for integration pursuant to section 6.2 to calculate TRS.

For the reverberation chamber based methodologies, repeat step 2 for a number of independent samples as specified in section 6.3. The minimum RF power level resulting in a data throughput greater than or equal to 95 % throughput of the maximum throughput for each test shall be recorded for averaging pursuant to section 6.2 to calculate TRS.

4. In the case of handset DUT, repeat steps 1 through 3 using the head phantom only, head and hand phantom, and hand phantom only. The head phantom only, head and hand phantom, hand phantom only testing are as per section 5.3. For laptop mounted equipment, the laptop ground plane phantom is used. For laptop embedded equipment notebook DUT, free space test is used For laptop embedded equipment tablet DUT, free space test is used; the test configuration may be enhanced once definitions of new testing conditions related to the tablet device categories become available (see Chapter 5.3.2 in [4]).

### 8.3 Calibration measurement

Calibration measurement shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

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## Annex A: System Parameters

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### A.1 Definition and applicability

This test is aimed at measuring the output power radiated and receiver sensitivity by a LTE DUT in max transmit power.

Radio measurements are performed in the so-called open area mode in such a way to be as close as possible to the free space conditions.

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### A.2 Establishing the connection

In order to be as close as possible to the real conditions of use, it is necessary to establish the connection between the UE/MS under test and the eNodeB simulator. It makes thus possible to set up the communication parameters to simulate a data link.

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### A.3 Uplink RB allocation for reference sensitivity

This section is just providing the uplink RB allocation table for information, and Table A.3-1 is same as Table 7.3.1-2 in TS36.101.[5]

**Table A.3-1 (for information): Uplink configuration for reference sensitivity**

| E-UTRA Band / Channel bandwidth / NRB / Duplex mode |         |       |       |                 |                 |                 |             |
|---|---------|-------|-------|-----------------|-----------------|-----------------|-------------|
| E-UTRA Band   | 1.4 MHz | 3 MHz | 5 MHz | 10 MHz          | 15 MHz          | 20 MHz          | Duplex Mode |
| 1   |         |       | 25    | 50              | 75              | 100             | FDD         |
| 2   | 6       | 15    | 25    | 50              | 501             | 501             | FDD         |
| 3   | 6       | 15    | 25    | 50              | 501             | 501             | FDD         |
| 4   | 6       | 15    | 25    | 50              | 75              | 100             | FDD         |
| 5   | 6       | 15    | 25    | 251             |                 |                 | FDD         |
| 6   |         |       | 25    | 251             |                 |                 | FDD         |
| 7   |         |       | 25    | 50              | 751             | 751             | FDD         |
| 8   | 6       | 15    | 25    | 251             |                 |                 | FDD         |
| 9   |         |       | 25    | 50              | 501             | 501             | FDD         |
| 10  |         |       | 25    | 50              | 75              | 100             | FDD         |
| 11  |         |       | 25    | 251             |                 |                 | FDD         |
| 12  | 6       | 15    | 201   | 201             |                 |                 | FDD         |
| 13  |         |       | 201   | 201             |                 |                 | FDD         |
| 14  |         |       | 151   | 151             |                 |                 | FDD         |
| ...   |         |       |       |                 |                 |                 |             |
| 17  |         |       | 201   | 201             |                 |                 | FDD         |
| 18  |         |       | 25    | 25 <sup>1</sup> | 25 <sup>1</sup> |                 | FDD         |
| 19  |         |       | 25    | 25 <sup>1</sup> | 25 <sup>1</sup> |                 | FDD         |
| 20  |         |       | 25    | 20 <sup>1</sup> | 20 <sup>3</sup> | 20 <sup>3</sup> | FDD         |
| 21  |         |       | 25    | 25 <sup>1</sup> | 25 <sup>1</sup> |                 | FDD         |
| 22  |         |       | 25    | 50              | 501             | 501             | FDD         |
| 23  | 6       | 15    | 25    | 50              |                 |                 | FDD         |
| 24  |         |       | 25    | 50              |                 |                 | FDD         |
| 25  | 6       | 15    | 25    | 50              | 501             | 501             | FDD         |
| 26  | 6       | 15    | 25    | 251             | 251             |                 | FDD         |
| 27  | 6       | 15    | 25    | 25 <sup>1</sup> |                 |                 | FDD         |
| 28  |         | 15    | 25    | 25 <sup>1</sup> | 25 <sup>1</sup> | 25 <sup>1</sup> | FDD         |
| ...   |         |       |       |                 |                 |                 |             |
| 33  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 34  |         |       | 25    | 50              | 75              |                 | TDD         |
| 35  | 6       | 15    | 25    | 50              | 75              | 100             | TDD         |
| 36  | 6       | 15    | 25    | 50              | 75              | 100             | TDD         |
| 37  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 38  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 39  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 40  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 41  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 42  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 43  |         |       | 25    | 50              | 75              | 100             | TDD         |
| 44  |         | 15    | 25    | 50              | 75              | 100             | TDD         |

NOTE 1: <sup>1</sup> refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2: For the UE which supports both Band 11 and Band 21 the uplink configuration for reference sensitivity is FFS.

NOTE 3: <sup>3</sup> refers to Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB<sub>start</sub> 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB<sub>start</sub> 16

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## Annex B: Measurement Uncertainty

Measurement Uncertainty shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

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## Annex C: Anechoic chamber specifications and validation method

Anechoic chamber specifications and validation method shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

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## Annex D: Reverberation chamber specifications and validation method

Reverberation chamber specifications and validation method shall be the same as described in TR25.914[4] unless otherwise defined in this TR. This TR only defines differences compared to TR25.914[4].

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## Annex E:

### Change history

| Change history |            |           |      |     |   |        |        |
|----------------|------------|-----------|------|-----|---|--------|--------|
| Date           | TSG #      | TSG Doc.  | CR   | Rev | Subject/Comment   | Old    | New    |
| 2012-03        | RAN4#62bis | R4-122129 |      |     | Skeleton for LTE TRP TRS study item   | N/A    | 0.0.1  |
| 2012-05        | RAN4#63    | R4-122506 |      |     | TP of small correction for TRab.cde (LTE TRP TRS)   | 0.0.1  | 1.0.0  |
| 2012-05        | RAN4#63    | R4-122774 |      |     | LTE TRP and TRS test method development   | 0.0.1  | 1.0.0  |
| 2012-05        | RAN4#63    | R4-123581 |      |     | TP for TRab.cde (LTE TRP TRS) General updating from existing standards                        | 0.0.1  | 1.0.0  |
| 2012-05        | RAN4#63    | R4-123629 |      |     | Way forward proposal for LTE TRP and TRS test method development                              | 0.0.1  | 1.0.0  |
| 2012-08        | RAN4#64    | R4-124952 |      |     | TP to TR 37.902: LTE TRP and TRS measurement frequency allocation                             | 1.0.0  | 1.1.0  |
| 2012-08        | RAN4#64    | R4-124953 |      |     | TP to TR 37.902: Measurement method and measurement procedure                                 | 1.0.0  | 1.1.0  |
| 2012-08        | RAN#64     | R4-125002 |      |     | LTE TRP/TRS TR 37.902 v 1.1.0   | 1.1.0  | 2.0.0  |
| 2012-09        | RAN#57     | RP-121163 |      |     | TR 37.902 Presented to RAN for Approval   | 2.0.0  | -      |
| 2012-09        | RAN-57     |           |      |     | TR Approved by RAN-57   | 2.0.0  | 11.0.0 |
| 2012-12        |            |           |      |     | Correction of typo on cover page  | 11.0.0 | 11.0.1 |
| 2013-12        | RAN-62     | RP-131968 | 0001 | -   | CR on correction of TRP and TRS measurement procedure for TR37.902                            | 11.0.1 | 11.1.0 |
| 2013-12        | RAN-62     | RP-131931 | 0002 | -   | Network signalling values in LTE TRP and TRS tests  | 11.0.1 | 11.1.0 |
| 09-2014        | RP-65      | RP-141544 | 0005 |     | CR to TR37.902 on improving tablets definition  | 11.1.0 | 12.0.0 |
| 09-2014        | RP-65      | RP-141544 | 0006 |     | CR to TR37.902 on explicitly listing TRS allocations  | 11.1.0 | 12.0.0 |
| 12-2014        | RP-66      | RP-142171 | 007  | 1   | CR to TR 37.902 on TRP and TRS allocations for bands 19, 21, and 28 and editorial corrections | 12.0.0 | 12.1.0 |

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## History

| <b>Document history</b> |               |             |
|-------------------------|---------------|-------------|
| V12.0.0                 | October 2014  | Publication |
| V12.1.0                 | February 2015 | Publication |
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