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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 15.0.0 Release 15)

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Contents

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.
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- 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:

θ	Zenith angle in the spherical co-ordinate system
ϕ	Azimuth angle in the spherical co-ordinate system
Ω	Solid angle defined at the phase centre of the DUT
$G\psi(\theta,\phi,f)$	Antenna gain pattern in the ψ-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 ψ-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

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.

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].

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 (θ) and phi (ϕ) 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 (θ) and phi (ϕ) directions.

All the samples are taken with two orthogonal linear polarizations, θ- and φ-polarisations. It is also possible to measure some other polarisation components, if it is possible to recover θ- and φ-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 EARFCN	UL EARFCN	Channel BW	DL Carrier Frequency	UL Carrier frequency	DL C_{LRB}	DL RB_{Start}	UL C_{LRB}	UL RB_{Start}
Band 1								
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
Band 2								
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
Band 3								
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
Band 4								
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
Band 5								
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
Band 7								
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
Band 8								
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
Band 12								
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
Band 13								
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
Band 14								
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
Band 17								
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
Band 19								
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
Band 20								
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
Band 21								
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
Band 22								
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
Band 23								

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
Band 24								
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
Band 25								
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
Band 26								
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
Band 27								
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
Band 28								
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 EARFCN	UL EARFCN	Channel BW	DL Carrier Frequency	UL Carrier frequency	DL C_{LRB}	DL RB_{Start}	UL C_{LRB}	UL RB_{Start}
Band 33								
36100	36100	20	1910	1910	NOTE 1	NOTE 1	18	41
Band 34								
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Band 35								
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
Band 36								
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
Band 37								
37650	37650	20	1920	1920	NOTE 1	NOTE 1	18	41
Band 38								
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
Band 39								
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
Band 40								
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
Band 41								
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
Band 42								
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
Band 43								
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
Band 44								
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 EARFCN	UL EARFCN	Channel BW	DL Carrier Frequency	UL Carrier frequency	DL C_{LRB}	DL RB_{Start}	UL C_{LRB}	UL RB_{Start}
Band 1								
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
Band 2								
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
Band 3								
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
Band 4								
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
Band 5								
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
Band 7								
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
Band 8								
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
Band 12								
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
Band 13								
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
Band 14								
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
Band 17								
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
Band 19								
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
Band 20								
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
Band 21								
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
Band 22								
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
Band 23								

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
Band 24								
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
Band 25								
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
Band 26								
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
Band 27								
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
Band 28								
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 EARFCN	UL EARFCN	Channel BW	DL Carrier Frequency	UL Carrier frequency	DL C_{LRB}	DL RB_{Start}	UL C_{LRB}	UL RB_{Start}
Band 33								
36100	36100	20	1910	1910	100	0	100	0
Band 34								
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Band 35								
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
Band 36								
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
Band 37								
37650	37650	20	1920	1920	100	0	100	0
Band 38								
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
Band 39								
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
Band 40								
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
Band 41								
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
Band 42								
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
Band 43								
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
Band 44								
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].

Annex A:
System Parameters

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 as way to be as close as possible to the free space conditions.

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.

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[1]	25[1]		FDD
19			25	25[1]	25[1]		FDD
20			25	20[1]	20[3]	20[3]	FDD
21			25	25[1]	25[1]		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[1]			FDD
28		15	25	25[1]	25[1]	25[1]	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: [1] 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: [3] refers to Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 16

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].

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].

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].

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 signaling 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
2016-01	SP-70	-	-	-	Update to Rel-13 version (MCC)	12.1.0	13.0.0
2017-03	RP-75	-	-	-	Update to Rel-14 version (MCC)	13.0.0	14.0.0

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2018-06	SA#80	-	-	-	-	Update to Rel-15 version (MCC)	15.0.0

History

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