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Technical Report

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Measurements of User Equipment (UE) radio performances for LTE/UMTS terminals; Total Radiated Power (TRP) and Total Radiated Sensitivity (TRS) test methodology (Release 11)

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Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

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  - 1 presented to TSG for information;
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

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:

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
RB	Radio Bearer
RAN	Radio Access Network
RF	Radio Frequency
Rx	Receiver
RB	Resource Block
RBstart	RB number where a RB allocation begins within the channel
SAM	Specific Anthropomorphic Mannequin
TRS	Total Radiated Sensitivity (also: Total Isotropic Sensitivity)
Tx	Transmitter
TRP	Total Radiated Power
TRS	Total Radiated 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 5.3.2.3) for voice or data application when the handset is held close to the user.

Laptop Embedded Equipment : laptop embedded equipment including the wireless devices embedded into the laptop,e.g. notebook and tablet .That correspond to predefined positions (see Chapter 5.3.2.1) for "data mode" application.

Laptop Mounted Equipment : the plug-in type device that host on the laptop, e.g. USB-dongle, that correspond to predefined positions (see Chapter 5.3.2.2) 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	0*	0*	12	0
300	18300	10	2140	1950	0*	0*	12	20
550	18550	10	2165	1975	0*	0*	12	38
Band 2								
650	18650	10	1935	1855	0*	0*	12	0
900	18900	10	1960	1880	0*	0*	12	20
1150	19150	10	1985	1905	0*	0*	12	38
Band 3								
1250	19250	10	1810	1715	0*	0*	12	0
1575	19575	10	1842,5	1747,5	0*	0*	12	20
1900	19900	10	1875	1780	0*	0*	12	38
Band 4								
2000	20000	10	2115	1715	0*	0*	12	0
2175	20175	10	2132,5	1732,5	0*	0*	12	20
2350	20350	10	2150	1750	0*	0*	12	38
Band 5								
2450	20450	10	874	829	0*	0*	12	0
2525	20525	10	881,5	836,5	0*	0*	12	20
2600	20600	10	889	844	0*	0*	12	38
Band 7								
2800	20800	10	2625	2505	0*	0*	12	0
3100	21100	10	2655	2535	0*	0*	12	20
3400	21400	10	2685	2565	0*	0*	12	38
Band 8								
3500	21500	10	930	885	0*	0*	12	0
3625	21625	10	942,5	897,5	0*	0*	12	20
3750	21750	10	955	910	0*	0*	12	38
Band 12								
5060	23060	10	734	704	0*	0*	12	0
5095	23095	10	737,5	707,5	0*	0*	12	20
5130	23130	10	741	711	0*	0*	12	38
Band 13								
5230	23230	10	751	782	0*	0*	12	0
5230	23230	10	751	782	0*	0*	12	20
5230	23230	10	751	782	0*	0*	12	38
Band 14								
5330	23330	10	763	793	0*	0*	12	0
5330	23330	10	763	793	0*	0*	12	20
5330	23330	10	763	793	0*	0*	12	38
Band 17								
5780	23780	10	739	709	0*	0*	12	0
5790	23790	10	740	710	0*	0*	12	20
5800	23800	10	741	711	0*	0*	12	38
Band 19								
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 20								
6200	24200	10	796	837	0*	0*	12	0
6300	24300	10	806	847	0*	0*	12	20
6400	24400	10	816	857	0*	0*	12	38
Band 21								
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 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	0*	0*	8	0
8365	26365	5	1962.5	1882.5	0*	0*	8	8
8665	26665	5	1992.5	1912.5	0*	0*	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								
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
Note *: As per 3GPP TS 36.521-1 [6], Section 6.2 (UE Maximum Output Power)								

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	0*	0*	18	40
Band 34								
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Band 35								
36450	36450	20	1860	1860	0*	0*	18	0
36650	36650	20	1880	1880	0*	0*	18	40
36850	36850	20	1900	1900	0*	0*	18	82
Band 36								
37050	37050	20	1940	1940	0*	0*	18	0
37250	37250	20	1960	1960	0*	0*	18	40
37450	37450	20	1980	1980	0*	0*	18	82
Band 37								
37650	37650	20	1920	1920	0*	0*	18	40
Band 38								
37850	37850	20	2580	2580	0*	0*	18	0
38000	38000	20	2595	2595	0*	0*	18	40
38150	38150	20	2610	2610	0*	0*	18	82
Band 39								
38350	38350	20	1890	1890	0*	0*	18	0
38450	38450	20	1900	1900	0*	0*	18	40
38550	38550	20	1910	1910	0*	0*	18	82
Band 40								
38750	38750	20	2310	2310	0*	0*	18	0
39150	39150	20	2350	2350	0*	0*	18	40
39550	39550	20	2390	2390	0*	0*	18	82
Band 41								
39750	39750	20	2506	2506	0*	0*	18	0
40620	40620	20	2593	2593	0*	0*	18	40
41490	41490	20	2680	2680	0*	0*	18	82
Band 42								
41690	41690	20	3410	3410	0*	0*	18	0
42590	42590	20	3500	3500	0*	0*	18	40
43490	43490	20	3590	3590	0*	0*	18	82
Band 43								
43690	43690	20	3610	3610	0*	0*	18	0
44590	44590	20	3700	3700	0*	0*	18	40
45490	45490	20	3790	3790	0*	0*	18	82
Band 44								
TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Note *: As per 3GPP TS 36.521-1 [6], Section 6.2 (UE Maximum Output Power)								

Table 6.4-3: TRS allocations (FDD)

Refer to TS36.101 [5], Table 7.3.1-2.

Table 6.4-4: TRS allocations (TDD)

Refer to TS36.101 [5], Table 7.3.1-2.

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 free space environment. Detailed positioning and specification refer to section 5.3.

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 Annex A, 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 and laptop embedded equipment DUT, laptop ground plane phantom and free space test is used respectively.

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 free space environment. Detailed positioning and specification refer to section 5.3.

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 or spectrum analyser 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 Annex A, 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 and laptop embedded equipment DUT, laptop ground plane phantom and free space test is used respectively.

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