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Universal Mobile Telecommunications System (UMTS);
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User Equipment (UE) and Mobile Station (MS)
GSM, UTRA and E-UTRA over
the air performance requirements
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Contents

Foreword

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1 Scope

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

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

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

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

2 References

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

- 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] 3GPP TS 25 101: "User Equipment (UE) radio transmission and reception (FDD)".

[3] 3GPP TS 45.005: "Radio transmission and reception".

[4] 3GPP TS 34.114: "User Equipment (UE) / Mobile Station (MS) Over The Air (OTA) antenna performance; Conformance testing".

[5] ETSI ETR 273: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement of radiated methods of measurement (using test sites) and evaluation of the corresponding measurement uncertainties; Part 1: Uncertainties in the measurement of mobile radio equipment characteristics; Sub-part 2: Examples and annexes".

[6] 3GPP TR 25.914: ”Measurements of radio performances for UMTS terminals in speech mode”

[7] 3GPP TR 37.977: “Verification of radiated multi-antenna reception performance of User Equipment (UE)”

[8] 3GPP TR 37.902: “Measurements of User Equipment (UE) radio performances for LTE/UMTS terminals; Total Radiated Power (TRP) and Total Radiated Sensitivity (TRS) test methodology”

[9] 3GPP TS 36.521-1: “User Equipment (UE) conformance specification Radio transmission and reception; Part 1: Conformance Testing;”

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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

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

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

FS: UE used in a free space configuration.

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

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

3.2 Symbols

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

3.3 Abbreviations

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

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

4 General

4.1 Minimum requirements for roaming bands

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

4.2 Relationship between minimum requirements for roaming bands and test requirements

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

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

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

4.3 Terminal classes

4.3.1 Mechanical modes

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

4.4 UTRA chip rates

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

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

5 Frequency bands

5.1 GSM frequency bands

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

Table 5.1-1: GSM frequency bands

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

5.2 UTRA FDD frequency bands

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

Table 5.2-1: UTRA FDD frequency bands

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

Deployment in other frequency bands is not precluded

5.3 UTRA TDD frequency bands

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

Table 5.3-1: UTRA LCR TDD frequency bands

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

NOTE: Deployment in other frequency bands is not precluded.
* Used in ITU Region 2
** Used in ITU Region 1

5.4 E-UTRA FDD frequency bands

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

Table 5.4-1 E-UTRA FDD operating bands

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

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

Deployment in other frequency bands is not precluded.

5.5 E-UTRA TDD frequency bands

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

Table 5.5-1 E-UTRA TDD operating bands

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

Deployment in other frequency bands is not precluded.

6 Transmitter total radiated power

6.1 Minimum requirement for roaming bands for handheld UE

The average measured total radiated power (TRP) of low, mid and high channel for handheld UE shall be higher than the average TRP requirement specified in subclauses 6.1.1, 6.1.2 and 6.1.3. The averaging shall be done in linear scale for the TRP results of both right and left side of the phantom head in case of beside the head phantom and beside the head and hand phantom positions. For the hand phantom browsing mode position the averaging shall be done in linear scale for the TRP results of both right and left hand phantom measurements. Average TRP requirement is shown in the column "Average" on the requirement tables.

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

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

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

6.1.1 Beside the head phantom position

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

6.1.1.1 GSM

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4		Power class 5	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min	Average	Min
GSM 850							19,5	17,5		
GSM 900							20,5	18,5		
DCS 1800	21	19								
PCS 1900	21	19								
NOTE: Applicable for dual-mode GSM/UMTS.										

6.1.1.2 UTRA FDD

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

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

Operating band	Power class 1	Power class 2	Power class 3		Power class 3bis		Power class 4	
	Power (dBm)	Power (dBm)	Power (dBm)		Power (dBm)		Power (dBm)	
			Average	Min	Average	Min	Average	Min
I	-	-	+15	+13	+15	+13	+13	+11
II	-	-	+15	+13	+15	+13	+13	+11
III	-	-	+15	+13	+15	+13	+13	+11
IV	-	-	+15	+13	+15	+13	+13	+11
V	-	-	+11	+9	+11	+9	+9	+7
VI	-	-	+11	+9	+11	+9	+9	+7
VII	-	-	+15	+13	+15	+13	+13	+11
VIII	-	-	+12	+10	+12	+10	+10	+8
IX	-	-	+15	+13	+15	+13	+13	+11
XIX	-	-	+11,5	+9,5	+11,5	+9,5	+9,5	+7,5
NOTE: Applicable for dual-mode GSM/UMTS.								

6.1.1.3 UTRA LCR TDD

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min
a	-	-	+15	+13	-	-	-	-
b	-	-	TBD	TBD	-	-	-	-
c	-	-	TBD	TBD	-	-	-	-
d	-	-	TBD	TBD	-	-	-	-
e	-	-	+15	+13	-	-	-	-
f	-	-	+15	+13	-	-	-	-
NOTE: Applicable for dual-mode GSM /UTRA LCR TDD.								

6.1.2 Beside the head and hand phantom position

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

6.1.2.1 UTRA FDD

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

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

Operating band	Power class 1	Power class 2	Power class 3		Power class 3bis		Power class 4	
	Power (dBm)	Power (dBm)	Power (dBm)		Power (dBm)		Power (dBm)	
			Average	Min	Average	Min	Average	Min
I	-	-	13,25	TBD	TBD	TBD	TBD	TBD
II	-	-	13,25	TBD	TBD	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD	TBD	TBD	TBD
V	-	-	9,40	TBD	TBD	TBD	TBD	TBD
VI	-	-	9,40	TBD	TBD	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VIII	-	-	9,40	TBD	TBD	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD	TBD	TBD	TBD
XIX			9,40	TBD	TBD	TBD	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for devices narrower than 72mm as defined in TR 25.914. NOTE 3: Not applicable for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation).								

6.1.2.2 UTRA LCR TDD

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min
a	-	-	TBD	TBD	-	-	-	-
b	-	-	TBD	TBD	-	-	-	-
c	-	-	TBD	TBD	-	-	-	-
d	-	-	TBD	TBD	-	-	-	-
e	-	-	TBD	TBD	-	-	-	-
f	-	-	TBD	TBD	-	-	-	-
NOTE: Applicable for dual-mode GSM /UTRA LCR TDD.								

6.1.2.3 E-UTRA FDD

6.1.2.4 E-UTRA TDD

6.1.3 Hand phantom browsing mode position

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

6.1.3.1 UTRA FDD

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

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

Operating band	Power class 1	Power class 2	Power class 3		Power class 3bis		Power class 4	
	Power (dBm)	Power (dBm)	Power (dBm)		Power (dBm)		Power (dBm)	
			Average	Min	Average	Min	Average	Min
I	-	-	TBD	TBD	TBD	TBD	TBD	TBD
II	-	-	TBD	TBD	TBD	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD	TBD	TBD	TBD
V	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VI	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VIII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD	TBD	TBD	TBD
XIX			TBD	TBD	TBD	TBD	TBD	TBD
NOTE: Applicable for dual-mode GSM/UMTS.								

6.1.3.2 UTRA LCR TDD

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min
a	-	-	TBD	TBD	-	-	-	-
b	-	-	TBD	TBD	-	-	-	-
c	-	-	TBD	TBD	-	-	-	-
d	-	-	TBD	TBD	-	-	-	-
e	-	-	TBD	TBD	-	-	-	-
f	-	-	TBD	TBD	-	-	-	-
NOTE: Applicable for dual-mode GSM /UTRA LCR TDD.								

6.1.3.3 E-UTRA FDD

6.1.3.4 E-UTRA TDD

6.2 Minimum requirement for roaming bands for LME

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

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

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

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

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

6.2.1 GSM

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4		Power class 5	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min	Average	Min
GSM 850	-	-	-	-	-	-	TBD	TBD	-	-
GSM 900	-	-	-	-	-	-	TBD	TBD	-	-
DCS 1800	TBD	TBD	-	-	-	-	-	-	-	-
PCS 1900	TBD	TBD	-	-	-	-	-	-	-	-
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for USB plug-in devices.										

6.2.2 UTRA FDD

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

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

Operating band	Power class 1	Power class 2	Power class 3		Power class 3bis		Power class 4	
	Power (dBm)	Power (dBm)	Power (dBm)		Power (dBm)		Power (dBm)	
			Average	Min	Average	Min	Average	Min
I	-	-	TBD	TBD	TBD	TBD	TBD	TBD
II	-	-	TBD	TBD	TBD	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD	TBD	TBD	TBD
V	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VI	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VIII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD	TBD	TBD	TBD
XIX			TBD	TBD	TBD	TBD	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for USB plug-in devices.								

6.2.3 UTRA LCR TDD

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min
a	-	-	TBD	TBD	-	-	-	-
b	-	-	TBD	TBD	-	-	-	-
c	-	-	TBD	TBD	-	-	-	-
d	-	-	TBD	TBD	-	-	-	-
e	-	-	TBD	TBD	-	-	-	-
f	-	-	TBD	TBD	-	-	-	-
NOTE 1: Applicable for dual-mode GSM /UTRA LCR TDD. NOTE 2: Applicable for USB plug-in devices.								

6.2.4 E-UTRA FDD

6.2.5 E-UTRA TDD

6.3 Minimum requirement for roaming bands for LEE

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

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

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

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

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

6.3.1 GSM

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4		Power class 5	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min	Average	Min
GSM 850	-	-	-	-	-	-	TBD	TBD	-	-
GSM 900	-	-	-	-	-	-	TBD	TBD	-	-
DCS 1800	TBD	TBD	-	-	-	-	-	-	-	-
PCS 1900	TBD	TBD	-	-	-	-	-	-	-	-
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for notebook devices.										

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4		Power class 5	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min	Average	Min
GSM 850	-	-	-	-	-	-	TBD	TBD	-	-
GSM 900	-	-	-	-	-	-	TBD	TBD	-	-
DCS 1800	TBD	TBD	-	-	-	-	-	-	-	-
PCS 1900	TBD	TBD	-	-	-	-	-	-	-	-
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for tablet devices.										

6.3.2 UTRA FDD

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

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

Operating band	Power class 1	Power class 2	Power class 3		Power class 3bis		Power class 4	
	Power (dBm)	Power (dBm)	Power (dBm)		Power (dBm)		Power (dBm)	
			Average	Min	Average	Min	Average	Min
I	-	-	19,0	17,5	TBD	TBD	TBD	TBD
II	-	-	TBD	TBD	TBD	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD	TBD	TBD	TBD
V	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VI	-	-	18,5	16,5	TBD	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VIII	-	-	18,5	16,5	TBD	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD	TBD	TBD	TBD
XIX			18,5	16,5	TBD	TBD	TBD	TBD
NOTE 1: Applicable for multi-mode GSM/UMTS/LTE. NOTE 2: Applicable for notebook devices.								

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

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

Operating band	Power class 1	Power class 2	Power class 3		Power class 3bis		Power class 4	
	Power (dBm)	Power (dBm)	Power (dBm)		Power (dBm)		Power (dBm)	
			Average	Min	Average	Min	Average	Min
I	-	-	19	17,5	TBD	TBD	TBD	TBD
II	-	-	TBD	TBD	TBD	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD	TBD	TBD	TBD
V	-	-	17	15,0	TBD	TBD	TBD	TBD
VI	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
VIII	-	-	TBD	TBD	TBD	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD	TBD	TBD	TBD
XIX			17	15,0	TBD	TBD	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for tablet devices with two antennas.								

6.3.3 UTRA LCR TDD

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

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min
a	-	-	TBD	TBD	-	-	-	-
b	-	-	TBD	TBD	-	-	-	-
c	-	-	TBD	TBD	-	-	-	-
d	-	-	TBD	TBD	-	-	-	-
e	-	-	TBD	TBD	-	-	-	-
f	-	-	TBD	TBD	-	-	-	-
NOTE 1: Applicable for dual-mode GSM /UTRA LCR TDD. NOTE 2: Applicable for notebook devices.								

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

Operating band	Power class 1		Power class 2		Power class 3		Power class 4	
	Power (dBm)		Power (dBm)		Power (dBm)		Power (dBm)	
	Average	Min	Average	Min	Average	Min	Average	Min
a	-	-	TBD	TBD	-	-	-	-
b	-	-	TBD	TBD	-	-	-	-
c	-	-	TBD	TBD	-	-	-	-
d	-	-	TBD	TBD	-	-	-	-
e	-	-	TBD	TBD	-	-	-	-
f	-	-	TBD	TBD	-	-	-	-
NOTE 1: Applicable for dual-mode GSM /UTRA LCR TDD. NOTE 2: Applicable for tablet devices.								

6.3.4 E-UTRA FDD

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

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

Operating band	Power Class 1	Power Class 2	Power Class 3		Power Class 4
	Power (dBm)	Power (dBm)	Power (dBm)		Power (dBm)
			Average	Min	
1			18.5	17.0	
2					
3			18.5	17.0	
4					
5					
7			18.0	16.5	
8					
12					
13					
19			17.5	15.5	
20			17.5	15.5	
21			17.5	16.0	
28					
NOTE 1: Applicable for multi-mode GSM/UMTS/LTE. NOTE 2: Applicability for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation) is FFS.					

6.3.5 E-UTRA TDD

7 Receiver total radiated sensitivity

7.1 Minimum requirement for roaming bands for handheld UE

The average measured total radiated sensitivity (TRS) of low, mid and high channel for handheld UE shall be lower than the average TRS requirement specified in subclauses 7.1.1, 7.1.2 and 7.1.3. The averaging shall be done in linear scale for the TRS results of both right and left side of the phantom head in case of beside the head phantom and beside the head and hand phantom positions. For the hand phantom browsing mode position the averaging shall be done in linear scale for the TRS results of both right and left hand phantom measurements. Average TRS requirement is shown in the column "Average" on the requirement tables.

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

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

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

7.1.1 Beside the head phantom position

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

7.1.1.1 GSM

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
GSM 850	dBm	-98	-95
GSM 900	dBm	-97	-94
DCS 1800	dBm	-99,5	-96,5
PCS 1900	dBm	-98,5	-95,5
NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power. NOTE 2: Applicable for dual-mode GSM/UMTS.			

7.1.1.2 UTRA FDD

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
I	dBm/3,84 MHz	-101	-98
II	dBm/3,84 MHz	-99	-96
III	dBm/3,84 MHz	-98	-95
IV	dBm/3,84 MHz	-101	-98
V	dBm/3,84 MHz	-96	-93
VI	dBm/3,84 MHz	-96	-93
VII	dBm/3,84 MHz	-99	-96
VIII	dBm/3,84 MHz	-96	-93
IX	dBm/3,84 MHz	-100	-97
XIX	dBm/3,84 MHz	-96	-93
NOTE 1: For Power class 3, 3bis and 4 this shall be achieved at the maximum output power. NOTE 2: For the UE which supports both Band III and Band IX operating frequencies, the reference level of TDB dBm TRS <REFÎor> [average and min] shall apply for Band IX. NOTE 3: Applicable for dual-mode GSM/UMTS. NOTE 4: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -98 dBm/3,84 MHz and max <REFÎor> level of -95 dBm/3,84 MHz shall apply for Band II. NOTE 5: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -100 dBm/3,84 MHz and max <REFÎor> level of -97 dBm/3,84 MHz shall apply for Band IV.			

7.1.1.3 UTRA LCR TDD

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
a	dBm/1,28 MHz	-101	-100
b	dBm/1,28 MHz	TBD	TBD
c	dBm/1,28 MHz	TBD	TBD
d	dBm/1,28 MHz	TBD	TBD
e	dBm/1,28 MHz	-101	-100
f	dBm/1,28 MHz	-101	-100
Note: Applicable for dual-mode GSM/UTRA LCR TDD.			

7.1.2 Beside the head and hand phantoms position

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

7.1.2.1 UTRA FDD

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

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

Operating band	Unit	<REFÎ$_{or}$>	
		Average	Max
I	dBm/3,84 MHz	-101,00	TBD
II	dBm/3,84 MHz	-99,00	TBD
III	dBm/3,84 MHz	TBD	TBD
IV	dBm/3,84 MHz	TBD	TBD
V	dBm/3,84 MHz	-96,75	TBD
VI	dBm/3,84 MHz	-96,75	TBD
VII	dBm/3,84 MHz	TBD	TBD
VIII	dBm/3,84 MHz	-96,75	TBD
IX	dBm/3,84 MHz	TBD	TBD
XIX	dBm/3,84 MHz	-96,75	TBD
NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power.			
NOTE 2: For the UE which supports both Band III and Band IX operating frequencies, the reference level of TDB dBm TRS <REFÎ$_{or}$> [average and min] shall apply for Band IX.			
NOTE 3: Applicable for dual-mode GSM/UMTS.			
NOTE 4: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -98 dBm/3,84 MHz and max <REFÎor> level of -95 dBm/3,84 MHz shall apply for Band II.			
NOTE 5: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -100 dBm/3,84 MHz and max <REFÎor> level of -97 dBm/3,84 MHz shall apply for Band IV.			
NOTE 6: Applicable for devices narrower than 72mm as defined in TR 25.914.			
NOTE 7: Not applicable for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation).			

7.1.2.2 UTRA LCR TDD

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

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

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

7.1.2.3 E-UTRA FDD

7.1.2.4 E-UTRA TDD

7.1.3 Hand phantom browsing mode position

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

7.1.3.1 UTRA FDD

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

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

Operating band	Unit	<REFÎ$_{or}$>	
		Average	Max
I	dBm/3,84 MHz	TBD	TBD
II	dBm/3,84 MHz	TBD	TBD
III	dBm/3,84 MHz	TBD	TBD
IV	dBm/3,84 MHz	TBD	TBD
V	dBm/3,84 MHz	TBD	TBD
VI	dBm/3,84 MHz	TBD	TBD
VII	dBm/3,84 MHz	TBD	TBD
VIII	dBm/3,84 MHz	TBD	TBD
IX	dBm/3,84 MHz	TBD	TBD
XIX	dBm/3,84 MHz	TBD	TBD
NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power. NOTE 2: For the UE which supports both Band III and Band IX operating frequencies, the reference level of TDB dBm TRS <REFÎ$_{or}$> [average and min] shall apply for Band IX. NOTE 3: Applicable for dual-mode GSM/UMTS. NOTE 4: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -98 dBm/3,84 MHz and max <REFÎor> level of -95 dBm/3,84 MHz shall apply for Band II. NOTE 5: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -100 dBm/3,84 MHz and max <REFÎor> level of -97 dBm/3,84 MHz shall apply for Band IV.			

7.1.3.2 UTRA LCR TDD

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

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

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

7.1.3.3 E-UTRA FDD

7.1.3.4 E-UTRA TDD

7.2 Minimum requirement for roaming bands for LME

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

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

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

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

7.2.1 GSM

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
GSM 850	dBm	TBD	TBD
GSM 900	dBm	TBD	TBD
DCS 1800	dBm	TBD	TBD
PCS 1900	dBm	TBD	TBD
NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power. NOTE 2: Applicable for dual-mode GSM/UMTS. NOTE 3: Applicable for USB plug-in devices.			

7.2.2 UTRA FDD

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
I	dBm/3,84 MHz	TBD	TBD
II	dBm/3,84 MHz	TBD	TBD
III	dBm/3,84 MHz	TBD	TBD
IV	dBm/3,84 MHz	TBD	TBD
V	dBm/3,84 MHz	TBD	TBD
VI	dBm/3,84 MHz	TBD	TBD
VII	dBm/3,84 MHz	TBD	TBD
VIII	dBm/3,84 MHz	TBD	TBD
IX	dBm/3,84 MHz	TBD	TBD
XIX	dBm/3,84 MHz	TBD	TBD
NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power. NOTE 2: Applicable for dual-mode GSM/UMTS. NOTE 3: Applicable for USB plug-in devices.			

7.2.3 UTRA LCR TDD

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
a	dBm/1,28 MHz	TBD	TBD
b	dBm/1,28 MHz	TBD	TBD
c	dBm/1,28 MHz	TBD	TBD
d	dBm/1,28 MHz	TBD	TBD
e	dBm/1,28 MHz	TBD	TBD
f	dBm/1,28 MHz	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for USB plug-in devices.			

7.2.4 E-UTRA FDD

7.2.5 E-UTRA TDD

7.3 Minimum requirement for roaming bands for LEE

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

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

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

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

7.3.1 GSM

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
GSM 850	dBm	TBD	TBD
GSM 900	dBm	TBD	TBD
DCS 1800	dBm	TBD	TBD
PCS 1900	dBm	TBD	TBD
NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power. NOTE 2: Applicable for dual-mode GSM/UMTS. NOTE 3: Applicable for notebook devices.			

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

Operating band	Unit	<REFÎor>	
		Average	Max
GSM 850	dBm	TBD	TBD
GSM 900	dBm	TBD	TBD
DCS 1800	dBm	TBD	TBD
PCS 1900	dBm	TBD	TBD
NOTE 1: For power class 1 and 4 this shall be achieved at the maximum output power. NOTE 2: Applicable for dual-mode GSM/UMTS. NOTE 3: Applicable for tablet devices.			

7.3.2 UTRA FDD

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
I	dBm/3,84 MHz	-103,5	-102,0
II	dBm/3,84 MHz	TBD	TBD
III	dBm/3,84 MHz	TBD	TBD
IV	dBm/3,84 MHz	TBD	TBD
V	dBm/3,84 MHz	TBD	TBD
VI	dBm/3,84 MHz	-101,5	-99,5
VII	dBm/3,84 MHz	TBD	TBD
VIII	dBm/3,84 MHz	-101,5	-99,5
IX	dBm/3,84 MHz	TBD	TBD
XIX	dBm/3,84 MHz	-101,5	-99,5
NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power. NOTE 2: Applicable for multi-mode GSM/UMTS/LTE. NOTE 3: Applicable for notebook devices.			

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
I	dBm/3,84 MHz	-105,75	-104,25
II	dBm/3,84 MHz	TBD	TBD
III	dBm/3,84 MHz	TBD	TBD
IV	dBm/3,84 MHz	TBD	TBD
V	dBm/3,84 MHz	-103	-101,0
VI	dBm/3,84 MHz	TBD	TBD
VII	dBm/3,84 MHz	TBD	TBD
VIII	dBm/3,84 MHz	TBD	TBD
IX	dBm/3,84 MHz	TBD	TBD
XIX	dBm/3,84 MHz	-103	-101,0
NOTE 1: For power class 3, 3bis and 4 this shall be achieved at the maximum output power. NOTE 2: Applicable for dual-mode GSM/UMTS. NOTE 3: Applicable for tablet devices with two antennas.			

7.3.3 UTRA LCR TDD

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

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

Operating band	Unit	<REFÎor>	
		Average	Max
a	dBm/1,28 MHz	TBD	TBD
b	dBm/1,28 MHz	TBD	TBD
c	dBm/1,28 MHz	TBD	TBD
d	dBm/1,28 MHz	TBD	TBD
e	dBm/1,28 MHz	TBD	TBD
f	dBm/1,28 MHz	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for notebook devices.			

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

Operating band	Unit	<REFÎor>	
		Average	Max
a	dBm/1,28 MHz	TBD	TBD
b	dBm/1,28 MHz	TBD	TBD
c	dBm/1,28 MHz	TBD	TBD
d	dBm/1,28 MHz	TBD	TBD
e	dBm/1,28 MHz	TBD	TBD
f	dBm/1,28 MHz	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for tablet devices.			

7.3.4 E-UTRA FDD

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

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

Operating band	Channel bandwidth	Sensitivity (dBm)	
		Average	Max
1	10 MHz	-93.75	-92.25
2	10 MHz		
3	10 MHz	-95.0	-93.5
4	10 MHz		
5	10 MHz		
7	10 MHz	-93.5	-92.0
8	10 MHz		
12	10 MHz		
13	10 MHz		
19	10 MHz	-91.5	-89.5
20	10 MHz	-92.5	-90.5
21	15 MHz	-90.0	-88.5
28	10 MHz		
32	10 MHz		
NOTE 1: Applicable for multi-mode GSM/UMTS/LTE. NOTE 2: Applicability for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation) is FFS.			

7.3.5 E-UTRA TDD

8 Receiver total radiated multi-antenna sensitivity

8.1 Minimum requirement for roaming bands for handheld UE

8.1.1 Free Space

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

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

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

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

Where

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

Such that *MODE* is one of {*FS_DMP, FS_DML, FS_DMSU*}, *x* is one of {*70, 95*}, and {$P_{MODE,x,0}$, …, $P_{MODE,x,11}$} are the measured sensitivity values at each azimuth position.

For the reference MPAC methodology and the harmonized RTS methodology defined in [7], if 1 azimuth position does not result in a defined measured sensitivity at 70% or 95% throughput, $S_{MODE,70}$ or $S_{MODE,95}$ are calculated using the 11 measured sensitivities and the maximum downlink RS-EPRE $P_{RS\text{-}EPRE\text{-}MAX}$ (substitution approach) for the one missing

result. If 2 azimuth positions do not result in a defined measured sensitivity at 95% throughput, $S_{MODE,95}$ is calculated using the 10 measured sensitivities and $P_{RS\text{-}EPRE\text{-}MAX}$ for the two missing results. If more azimuth positions result in undefined values for measured sensitivity at the 70% and/or 95% throughput, then the TRMS requirement for the corresponding throughput levels has not been met by such a device. $P_{RS\text{-}EPRE\text{-}MAX}$ is defined as -80 dBm/15 kHz and is the maximum downlink RS-EPRE supported by the test system.

8.1.1.1 E-UTRA FDD

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

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

		Test 1	
Channel Model as defined in clause 8.2 in [7]		SCME urban micro-cell	
Operating band	Unit	<REFÎ$_{or}$>	
		Average, 70	Average, 95
1	dBm/15 kHz	-94.75	-92.75
2	dBm/15 kHz	TBD	TBD
3	dBm/15 kHz	-93.75	-91.75
4	dBm/15 kHz	TBD	TBD
5	dBm/15 kHz	-91.5	-89.5
7	dBm/15 kHz	-92.5	-90.5
8	dBm/15 kHz	TBD	TBD
12	dBm/15 kHz	TBD	TBD
13	dBm/15 kHz	TBD	TBD
19	dBm/15 kHz	-91.5	-89.5
20	dBm/15 kHz	TBD	TBD
28	dBm/15 kHz	TBD	TBD
32 (1)	dBm/15 kHz	TBD	TBD
NOTE 1: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the carrier aggregation configuration that is supporting the configured Pcell.			
NOTE 2: Applicability for devices supporting 4-receiver architectures is not confirmed.			

8.1.1.2 E-UTRA TDD

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

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

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

Annex A (normative): Environmental conditions

A.1 General

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

A.2 Environmental requirements

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

A.2.2 Temperature

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

A.2.3 Voltage

The UE or MS shall be equipped with a real battery that is fully charged (in the beginning of the Test).

Annex B (informative): Recommended performance

B.1 General

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

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

B.2 Transmitter total radiated power

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

B.2.1 Recommended performance for handheld UE

B.2.1.1 Beside the head phantom position

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

B.2.1.1.1 GSM

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 4	Power class 5
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
GSM 850	-	-	-	24	-
GSM 900	-	-	-	24	-
DCS 1800	24	-	-	-	-
PCS 1900	24	-	-	-	-
NOTE: Applicable for dual-mode GSM/UMTS.					

B.2.1.1.2 UTRA FDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
I	-	-	+18	+18	+16
II	-	-	+18	+18	+16
III	-	-	+18	+18	+16
IV	-	-	+18	+18	+16
V	-	-	+14	+14	+12
VI	-	-	+14,5	+14,5	+12,5
VII	-	-	+18	+18	+16
VIII	-	-	+15	+15	+13
IX	-	-	+18	+18	+16
XIX	-	-	+14,5	+14,5	+12,5
NOTE: Applicable for dual-mode GSM/UMTS.					

B.2.1.1.3 UTRA LCR TDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
a	-	+18	-	-	-
b	-	TBD	-	-	-
c	-	TBD	-	-	-
d	-	TBD	-	-	-
e	-	+18	-	-	-
f	-	+18	-	-	-
Note: Applicable for dual-mode GSM/UTRA LCR TDD.					

B.2.1.2 Beside the head and hand phantoms position

B.2.1.2.1 UTRA FDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
			Average	Average	Average
I	-	-	16,25	TBD	TBD
II	-	-	16,25	TBD	TBD
III	-	-	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD
V	-	-	12,40	TBD	TBD
VI	-	-	12,40	TBD	TBD
VII	-	-	TBD	TBD	TBD
VIII	-	-	12,40	TBD	TBD
IX	-	-	TBD	TBD	TBD
XIX	-	-	12,40	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for devices narrower than 72mm as defined in TR 25.914. NOTE 3: Not applicable for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation).					

B.2.1.2.2 UTRA LCR TDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
		Average			
a	-	TBD	-	-	-
b	-	TBD	-	-	-
c	-	TBD	-	-	-
d	-	TBD	-	-	-
e	-	TBD	-	-	-
f	-	TBD	-	-	-
Note: Applicable for dual-mode GSM/UTRA LCR TDD.					

B.2.1.2.3 E-UTRA FDD

B.2.1.2.4 E-UTRA TDD

B.2.1.3 Hand phantom browsing mode position

B.2.1.3.1 UTRA FDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
			Average	Average	Average
I	-	-	TBD	TBD	TBD
II	-	-	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD
V	-	-	TBD	TBD	TBD
VI	-	-	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD
VIII	-	-	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD
XIX	-	-	TBD	TBD	TBD
NOTE: Applicable for dual-mode GSM/UMTS.					

B.2.1.3.2 UTRA LCR TDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
		Average			
a	-	TBD	-	-	-
b	-	TBD	-	-	-
c	-	TBD	-	-	-
d	-	TBD	-	-	-
e	-	TBD	-	-	-
f	-	TBD	-	-	-
Note : Applicable for dual-mode GSM/UTRA LCR TDD.					

B.2.1.3.3 E-UTRA FDD

B.2.1.3.4 E-UTRA TDD

B.2.2 Recommended performance for LME

B.2.2.1 GSM

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 4	Power class 5
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
GSM 850	-	-	-	TBD	-
GSM 900	-	-	-	TBD	-
DCS 1800	TBD	-	-	-	-
PCS 1900	TBD	-	-	-	-
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for USB plug-in devices.					

B.2.2.2 UTRA FDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
I	-	-	TBD	TBD	TBD
II	-	-	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD
V	-	-	TBD	TBD	TBD
VI	-	-	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD
VIII	-	-	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD
XIX	-	-	TBD	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for USB plug-in devices.					

B.2.2.3 UTRA LCR TDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
a	-	TBD	-	-	-
b	-	TBD	-	-	-
c	-	TBD	-	-	-
d	-	TBD	-	-	-
e	-	TBD	-	-	-
f	-	TBD	-	-	-
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for USB plug-in devices.					

B.2.2.4 E-UTRA FDD

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

Operating band	Power Class 1	Power Class 2	Power Class 3	Power Class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
			Average	
1			21.0	
2				
3			20.5	
4				
5				
7			20.0	
8				
12				
13				
19			20.0	
20			19.5	
21			20.0	
28				
NOTE 1: Applicable for multi-mode GSM/UMTS/LTE. NOTE 2: Applicability for devices supporting CDMA or aggregated carriers (e.g. multi-carrier HSPA, LTE Carrier Aggregation) is FFS.				

B.2.2.5 E-UTRA TDD

B.2.3 Recommended performance for LEE

B.2.3.1 GSM

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 4	Power class 5
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
GSM 850	-	-	-	TBD	-
GSM 900	-	-	-	TBD	-
DCS 1800	TBD	-	-	-	-
PCS 1900	TBD	-	-	-	-
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for notebook devices.					

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 4	Power class 5
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
GSM 850	-	-	-	TBD	-
GSM 900	-	-	-	TBD	-
DCS 1800	TBD	-	-	-	-
PCS 1900	TBD	-	-	-	-
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for tablet devices.					

B.2.3.2 UTRA FDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
I	-	-	21,5	TBD	TBD
II	-	-	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD
V	-	-	TBD	TBD	TBD
VI	-	-	21,0	TBD	TBD
VII	-	-	TBD	TBD	TBD
VIII	-	-	21.0	TBD	TBD
IX	-	-	TBD	TBD	TBD
XIX	-	-	21,0	TBD	TBD
NOTE 1: Applicable for multi-mode GSM/UMTS/LTE. NOTE 2: Applicable for notebook devices.					

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

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
I	-	-	21,5	TBD	TBD
II	-	-	TBD	TBD	TBD
III	-	-	TBD	TBD	TBD
IV	-	-	TBD	TBD	TBD
V	-	-	19,5	TBD	TBD
VI	-	-	TBD	TBD	TBD
VII	-	-	TBD	TBD	TBD
VIII	-	-	TBD	TBD	TBD
IX	-	-	TBD	TBD	TBD
XIX	-	-	19,5	TBD	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for tablet devices with two antennas.					

B.2.3.3 UTRA LCR TDD

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
a	-	TBD	-	-	-
b	-	TBD	-	-	-
c	-	TBD	-	-	-
d	-	TBD	-	-	-
e	-	TBD	-	-	-
f	-	TBD	-	-	-
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for notebook devices.					

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

Operating band	Power class 1	Power class 2	Power class 3	Power class 3bis	Power class 4
	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)	Power (dBm)
	Average	Average	Average	Average	Average
a	-	TBD	-	-	-
b	-	TBD	-	-	-
c	-	TBD	-	-	-
d	-	TBD	-	-	-
e	-	TBD	-	-	-
f	-	TBD	-	-	-
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for tablet devices.					

B.2.3.4 E-UTRA FDD

B.2.3.5 E-UTRA TDD

B.3 Receiver total radiated sensitivity

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

B.3.1 Recommended performance for handheld UE

B.3.1.1 Beside the head phantom position

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

B.3.1.1.1 GSM

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

Operating band	Unit	<REFÎ$_{or}$> Average
GSM 850	dBm	-100,5
GSM 900	dBm	-100,5
DCS 1800	dBm	-103,5
PCS 1900	dBm	-103,5
NOTE: Applicable for dual-mode GSM/UMTS.		

B.3.1.1.2 UTRA FDD

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

Operating band	Unit	<REFÎor>
I	dBm/3,84 MHz	-104
II	dBm/3,84 MHz	-102
III	dBm/3,84 MHz	-101
IV	dBm/3,84 MHz	-104
V	dBm/3,84 MHz	-99,5
VI	dBm/3,84 MHz	-101
VII	dBm/3,84 MHz	-102
VIII	dBm/3,84 MHz	-100
IX	dBm/3,84 MHz	-103
XIX	dBm/3,84 MHz	-101
NOTE 1: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -101 dBm/3.84 shall apply for Band II. NOTE 2: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -103 dBm/3.84 MHz shall apply for Band IV.		

B.3.1.1.3 UTRA LCR TDD

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

Operating band	Unit	<REFÎor> Average
a	dBm/1,28 MHz	-105
b	dBm/1,28 MHz	TBD
c	dBm/1,28 MHz	TBD
d	dBm/1,28 MHz	TBD
e	dBm/1,28 MHz	-105
f	dBm/1,28 MHz	-105
NOTE: Applicable for dual-mode GSM/UTRA LCR TDD.		

B.3.1.2 Beside the head and hand phantoms position

B.3.1.2.1 UTRA FDD

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

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

B.3.1.2.2 UTRA LCR TDD

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

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

B.3.1.2.3 E-UTRA FDD

B.3.1.2.4 E-UTRA TDD

B.3.1.3 Hand phantom browsing mode position

B.3.1.3.1 UTRA FDD

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

Operating band	Unit	<REFÎ$_{or}$> Average
I	dBm/3,84 MHz	TBD
II	dBm/3,84 MHz	TBD
III	dBm/3,84 MHz	TBD
IV	dBm/3,84 MHz	TBD
V	dBm/3,84 MHz	TBD
VI	dBm/3,84 MHz	TBD
VII	dBm/3,84 MHz	TBD
VIII	dBm/3,84 MHz	TBD
IX	dBm/3,84 MHz	TBD
XIX	dBm/3,84 MHz	TBD
NOTE 1: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -101 dBm/3,84 shall apply for Band II. NOTE 2: For the UE which supports DB-DC-HSDPA configuration 2, average <REFÎor> level of -103 dBm/3,84 MHz shall apply for Band IV.		

B.3.1.3.2 UTRA LCR TDD

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

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

B.3.1.3.3 E-UTRA FDD

B.3.1.3.4 E-UTRA TDD

B.3.2 Recommended performance for LME

B.3.2.1 GSM

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

Operating band	Unit	<REFÎ$_{or}$> Average
GSM 850	dBm	TBD
GSM 900	dBm	TBD
DCS 1800	dBm	TBD
PCS 1900	dBm	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for USB plug-in devices.		

B.3.2.2 UTRA FDD

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

Operating band	Unit	<REFÎ$_{or}$> Average
I	dBm/3,84 MHz	TBD
II	dBm/3,84 MHz	TBD
III	dBm/3,84 MHz	TBD
IV	dBm/3,84 MHz	TBD
V	dBm/3,84 MHz	TBD
VI	dBm/3,84 MHz	TBD
VII	dBm/3,84 MHz	TBD
VIII	dBm/3,84 MHz	TBD
IX	dBm/3,84 MHz	TBD
XIX	dBm/3,84 MHz	TBD
NOTE: Applicable for USB plug-in devices.		

B.3.2.3 UTRA LCR TDD

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

Operating band	Unit	<REFÎor> Average
a	dBm/1,28 MHz	TBD
b	dBm/1,28 MHz	TBD
c	dBm/1,28 MHz	TBD
d	dBm/1,28 MHz	TBD
e	dBm/1,28 MHz	TBD
f	dBm/1,28 MHz	TBD
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for USB plug-in devices.		

B.3.2.4 E-UTRA FDD

B.3.2.5 E-UTRA TDD

B.3.3 Recommended performance for LEE

B.3.3.1 GSM

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

Operating band	Unit	<$\hat{I}_{or}$> Average
GSM 850	dBm	TBD
GSM 900	dBm	TBD
DCS 1800	dBm	TBD
PCS 1900	dBm	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for notebook devices.		

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

Operating band	Unit	<$\hat{I}_{or}$> Average
GSM 850	dBm	TBD
GSM 900	dBm	TBD
DCS 1800	dBm	TBD
PCS 1900	dBm	TBD
NOTE 1: Applicable for dual-mode GSM/UMTS. NOTE 2: Applicable for tablet devices.		

B.3.3.2 UTRA FDD

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

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

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

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

Operating band	Unit	<REFÎ$_{or}$> Average
I	dBm/3,84 MHz	-108,75
II	dBm/3,84 MHz	TBD
III	dBm/3,84 MHz	TBD
IV	dBm/3,84 MHz	TBD
V	dBm/3,84 MHz	-106,0
VI	dBm/3,84 MHz	TBD
VII	dBm/3,84 MHz	TBD
VIII	dBm/3,84 MHz	TBD
IX	dBm/3,84 MHz	TBD
XIX	dBm/3,84 MHz	-106,0
NOTE: Applicable for tablet devices with two antennas.		

B.3.3.3 UTRA LCR TDD

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

Operating band	Unit	<REFÎor> Average
a	dBm/1,28 MHz	TBD
b	dBm/1,28 MHz	TBD
c	dBm/1,28 MHz	TBD
d	dBm/1,28 MHz	TBD
e	dBm/1,28 MHz	TBD
f	dBm/1,28 MHz	TBD
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for notebook devices.		

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

Operating band	Unit	<REFÎor> Average
a	dBm/1,28 MHz	TBD
b	dBm/1,28 MHz	TBD
c	dBm/1,28 MHz	TBD
d	dBm/1,28 MHz	TBD
e	dBm/1,28 MHz	TBD
f	dBm/1,28 MHz	TBD
NOTE 1: Applicable for dual-mode GSM/UTRA LCR TDD. NOTE 2: Applicable for tablet devices.		

B.3.3.4 E-UTRA FDD

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

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

B.3.3.5 E-UTRA TDD

Annex C (informative): Change history

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

History

Document history		
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