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Universal Mobile Telecommunications System (UMTS);
LTE;
User Equipment (UE) and Mobile Station (MS) GSM, UTRA and E-UTRA over the air performance requirements
(3GPP TS 37.144 version 13.0.0 Release 13)

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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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[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)'

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 receiver total radiated multi-antenna sensitivity apply to the frequency bands defined in Table 5.4-1.

Table 5.4-1 E-UTRA FDD operating bands for receiver total radiated multi-antenna sensitivity requirements

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
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 receiver total radiated multi-antenna sensitivity apply to the frequency bands defined in Table 5.5-1.

Table 5.5-1 E-UTRA TDD operating bands for receiver total radiated multi-antenna sensitivity requirements

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.