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**Universal Mobile Telecommunications System (UMTS);
User Equipment (UE) and Mobile Station (MS)
over the air performance requirements
(3GPP TS 25.144 version 10.1.0 Release 10)**

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Foreword

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Contents

Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
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  - 3 or greater indicates TSG approved document under change control.
- 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.

1 Scope

The present document establishes Over the Air antenna minimum requirements for User Equipment (UE) and Mobile Station (MS).

Requirements are defined for roaming bands for the speech position (beside the head). 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 can not be specified here. Recommended performance values for operating bands (Annex <Y>) 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.
- 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] 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".

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] 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].

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).

3.2 Symbols

None

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].

OTA	Over the Air
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 terminal are declared by the manufacturer. A terminal shall have at least one mechanical mode. If only one mode is supported, then this is defined as the primary.

5 Frequency bands

The requirements defined in this specification apply to the frequency bands defined below.

5.1 General

The information presented in this subclause is based on a chip rate of 3.84 Mcps and 1.28 Mcps (TDD).

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

5.2 FDD Frequency bands

a) UTRA/FDD is designed to operate in the following paired bands:

Table 5.1: 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

b) Deployment in other frequency bands is not precluded

5.3 TDD Frequency bands

UTRA/TDD is designed to operate in the following bands;

a) 1900 - 1920 MHz: Uplink and downlink transmission
   2010 - 2025 MHz Uplink and downlink transmission

b)* 1850 - 1910 MHz: Uplink and downlink transmission
   1930 - 1990 MHz: Uplink and downlink transmission

c)* 1910 - 1930 MHz: Uplink and downlink transmission

d)** 2570 - 2620 MHz: Uplink and downlink transmission

e) 2300 - 2400 MHz: Uplink and downlink transmission

f) 1880 - 1920 MHz: Uplink and downlink transmission

* Used in ITU Region 2

**Used in ITU Region 1

5.4 GSM Frequency Bands

Table 5.2: 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

6 Transmitter Performance

6.1 Total Radiated Power

The average TRP of low, mid and high channel in beside head position shall be higher than minimum performance requirements for roaming bands shown in Table 5.2. The averaging shall be done in linear scale for the TRP results of both right and left side of the phantom head.

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

Figure 6.1: Average TRP

In addition the minimum TRP of each measured channel in beside head position shall be higher than minimum performance requirements shown in the columns "Min".

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

Figure 6.2: Minimum TRP

6.1.1 Minimum requirement for roaming bands

6.1.1.1 FDD

Minimum performance requirements for FDD roaming bands are shown in Table 6.1.

Table 6.1: TRP minimum performance requirement for FDD roaming bands in the speech 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.								

6.1.1.2 GSM

For GMSK in the speech position and the primary mechanical mode.

Table 6.2: TRP minimum performance requirement for GSM roaming bands in the speech 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.										

6.1.1.3 UTRA LCR TDD

For URTA LCR TDD UE in the speech position and the primary mechanical mode, the TRP minimum performance requirements are listed in Table 6.3.

Table 6.3: TRP minimum performance requirement for UTRA LCR TDD roaming bands in the speech 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.								

7 Receiver Performance

7.1 Total Radiated Sensitivity

The average TRS of low, mid and high channel in beside head position for 1% BER with 12.2kbps DL reference channel as defined in Annex C.3 of [2] shall be lower than minimum performance requirements for roaming bands shown in Table Y. The averaging shall be done in linear scale for the TRS results of both right and left side of the phantom head.

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

Figure 7.1: Average TRS

In addition the minimum TRS of each measured channel in beside head position shall be better than minimum performance requirements for roaming bands shown in the columns "Min".

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

Figure 7.2: Minimum TRS

7.2 Minimum requirement for roaming bands

7.2.1 FDD

Minimum performance requirements for FDD roaming bands are shown in Table 7.1. [The values in the tables are Îor with no interference.]

Table 7.1: TRS minimum requirements for FDD roaming bands in the speech position for the primary mechanical mode

Operating Band	Unit	<REFÎ$_{or}$>	
		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 <REFÎ$_{or}$> [average and min] shall apply for Band IX. NOTE3 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.			

7.2.2 GSM

Transmitted radiated sensitivity in the primary mechanical mode for TCH/FS at 2% class II (RBER) [3].

Table 7.2: TRS minimum requirements for FDD roaming bands in the speech position for the primary mechanical mode

Operating Band	Unit	<REFÎ$_{or}$>	
		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. NOTE2: Applicable for dual-mode GSM/UMTS.			

Annexes are only to be used where appropriate.

7.2.3 UTRA LCR TDD

For URTA LCR TDD UE in the speech position and the primary mechanical mode, the TRS minimum performance requirements are listed in Table 7.3.

Table 7.3: TRS minimum requirement for UTRA LCR TDD roaming bands in the speech position for 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.			

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 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 Total Radiated Power

The OTA performance for FDD, GSM and UTRA LCR TDD should be greater or equal than the recommended values shown in Tables B.1, B.2 and B.3, respectively.

Table B.1: TRP recommended performance for FDD in the speech 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	-	-	+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.					

Table B.2: TRP recommended performance for GSM in the speech 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.					

Table B.3: TRP recommended performance for UTRA LCR TDD in the speech 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.3 Total Radiated Sensitivity

The OTA performance for FDD, GSM and UTRA LCR TDD should be lesser or equal than the recommended values shown in Tables B.4, B.5 and B.6, respectively.

Table B.4: TRS recommended performance for FDD in the speech position for the primary mechanical mode

Operating Band	Unit	<REFÎ$_{or}$>
		Average
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.		

Table B.5: TRS recommended performance for GSM in the speech 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.		

Table B.6: TRS recommended performance for UTRA LCR TDD in the speech 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..		

Annex C (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2007-06	RP-35				First published version following approval at TSG RAN #35		7.0.0
	SP-42				Upgraded unchanged from Rel-7		8.0.0
2009-03	RP-43	RP-090193	3		TRP and TRS OTA requirements for UTRA bands below 1 GHz (FDD)	8.0.0	8.1.0
2009-03	RP-43	RP-090193	5		TRP requirements for power classes 3bis and 4	8.0.0	8.1.0
2009-03	RP-43	RP-090306	4	3	UTRA TDD OTA performance requirements	8.1.0	9.0.0
2009-05	RP-44	RP-090558	7	1	UTRA LCR TDD OTA performance requirements	9.0.0	9.1.0
2010-03	RP-47	RP-100274	9		DB-DC-HSDPA Configuration 2 REFSENS relaxation to OTA requirements	9.1.0	9.2.0
2010-12	RP-50	RP-101348	010	3	TRP and TRS requirements for GSM 850, GSM 900, DCS 1800 and PCS 1900	9.2.0	9.3.0
	SP-51				Upgraded unchanged from Rel-9	9.3.0	10.0.0
2012-03	SP-55	RP-120304	030		TRP and TRS requirements for UMTS band XIX	10.0.0	10.1.0

History

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