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Contents

Foreword

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1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for E-UTRA FDD Repeater. These have been derived from, and are consistent with the E-UTRA FDD repeater specifications defined in [2].

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 36.106: “Evolved Universal Terrestrial Radio Access (E-UTRA); FDD repeater radio transmission and reception”.

[3] ITU-R Recommendation M.1545: “Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000”.

[4] ITU-R recommendation SM.329: “Unwanted emissions in the spurious domain”.

[5] 3GPP TR 25.942: “Radio Frequency (RF) system scenarios”.

[6] IEC 60721-3-3 (2002): “Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weather protected locations”.

[7] IEC 60721-3-4 (1995): “Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 4: Stationary use at non-weather protected locations”.

[8] IEC 60068-2-1 (2007): “Environmental testing – Part 2: Tests. Tests A: Cold”.

[9] IEC 60068-2-2 (2007): “Environmental testing – Part 2: Tests. Tests B: Dry heat”.

[10] IEC 60068-2-6 (2007): “Environmental testing – Part 2: Tests – Test Fc: Vibration (sinusoidal)”.

[11] 3GPP TS 36.141: “Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing”.

[12] 3GPP TS 36.521-1: “Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing”.

[13] 3GPP TS.36.104: "E-UTRA Base Station (BS) radio transmission and reception".

[14] CEPT ECC Decision (13)03, "The harmonised use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL) ".

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].

Carrier: The modulated waveform conveying the E-UTRA or UTRA physical channels

Channel bandwidth: The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

Channel edge: The lowest and highest frequency of the E-UTRA carrier, separated by the channel bandwidth.

Donor coupling loss: is the coupling loss between the repeater and the donor base station.

Downlink: Signal path where base station transmits and mobile receives.

Downlink operating band: The part of the operating band designated for downlink.

Maximum output power, Pmax: This is the mean power level per carrier measured at the antenna connector of the Repeater in specified reference condition.

Operating band: A frequency range in which E-UTRA operates (paired or unpaired), that is defined with a specific set of technical requirements.

NOTE1: The operating band(s) for an E-UTRA Repeater is declared by the manufacturer according to the designations in clause 5.5 table 5.5-1.

NOTE2: Unless specified, operating band refers to the uplink operating band and downlink operating band.

Output power, Pout: This is the mean power of one carrier at maximum repeater gain delivered to a load with resistance equal to the nominal load impedance of the transmitter.

Pass band: The frequency range in which the repeater operates in with operational configuration. This frequency range can correspond to one or several consecutive nominal channels. If they are not consecutive each subset of channels shall be considered as an individual pass band. A repeater can have one or several pass bands

Rated output power: Rated output power of the repeater is the mean power level per carrier that the manufacturer has declared to be available at the antenna connector.

Repeater: A device that receives, amplifies and transmits the radiated or conducted RF carrier both in the downlink direction (from the base station to the mobile area) and in the uplink direction (from the mobile to the base station). ~~In operating bands with one exclusive link direction, only the dedicated link direction is repeated.~~ In operating bands specified with only down-link or up-link, only the up-link or down-link as specified for the operating band is repeated.

Transmission bandwidth: Bandwidth of an instantaneous transmission from a UE or BS, measured in Resource Block units.

Transmission bandwidth configuration: The highest transmission bandwidth allowed for uplink or downlink in a given channel bandwidth, measured in Resource Block units.

Uplink: Signal path where mobile transmits and base station receives.

Uplink operating band: The part of the operating band designated for uplink.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

$BW_{Channel}$ Channel bandwidth

BW_{Config}	Transmission bandwidth configuration, expressed in MHz, where $BW_{Config} = N_{RB}$ x 180 kHz in the uplink and BW_{Config} = 15 kHz + N_{RB} x 180 kHz in the downlink.
BW_{Meas}	Measurement bandwidth
BW_{Signal}	Bandwidth of the repeater input signal filling the repeater pass band
F_{DL_low}	The lowest frequency of the downlink operating band
F_{DL_high}	The highest frequency of the downlink operating band
F_{filter}	Filter centre frequency
F_{UL_low}	The lowest frequency of the uplink operating band
F_{UL_high}	The highest frequency of the uplink operating band
f_offset_PB	Distance from the channel edge frequency of the first or last channel in the pass band
N_{DL}	Downlink EARFCN
$N_{Offs-DL}$	Offset used for calculating downlink EARFCN
$N_{Offs-UL}$	Offset used for calculating uplink EARFCN
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks
N_{UL}	Uplink EARFCN
$P_{EM,B32,ind}$	Declared emission level in Band 32, ind=a, b, c, d, e
$P_{EM,N}$	Declared emission level for channel N
Pmax	Maximum output power
Pout	Output power

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].

ACRR	Adjacent Channel Rejection Ratio
BS	Base Station
BW	Bandwidth
DTT	Digital Terrestrial Television
DUT	Device Under Test
E-TM	E-UTRA Test Model
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
EIRP	Effective Isotropic Radiated Power
EVM	Error Vector Magnitude
FFS	For Further Study
IDFT	Inverse Discrete Fourier Transform
PB	Pass Band
GSM-R	GSM for Railways
RRC	Root Raised Cosine
RRS	Root Sum of the Squares
TBD	To be defined
TT	Test Tolerance

4 General test conditions and declarations

Many of the tests in this specification measure a parameter relative to a value that is not fully specified in the E-UTRA specifications. For these tests, the Minimum Requirement is determined relative to a nominal value specified by the manufacturer.

Some requirements for the Repeater may be regional as listed in subclause 4.2.

When specified in a test, the manufacturer shall declare the nominal value of a parameter, or whether an option is supported.

4.1 Measurement uncertainties and test requirements

4.1.1 General

The requirements of this clause apply to all applicable tests in this specification.

The Minimum requirements are given in 36.106 [2] and test requirements are given in this specification. Test Tolerances are defined in Annex B of this specification. Test Tolerances are individually calculated for each test. The Test Tolerances are used to relax the Minimum requirements in 36.106 [2] to create Test Requirements.

4.1.2 Acceptable uncertainty of test system

The maximum acceptable uncertainty of the Test System is specified below for each test, where appropriate. The Test System shall enable the stimulus signals in the test case to be adjusted to within the specified tolerance and the equipment under test to be measured with an uncertainty not exceeding the specified values. All tolerances and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95% is the measurement uncertainty tolerance interval for a specific measurement that contains 95% of the performance of a population of test equipment.

For RF tests, it should be noted that the uncertainties in subclause 4.1.2 apply to the Test System operating into a nominal 50 ohm load and do not include system effects due to mismatch between the DUT and the Test System.

4.1.2.1 Measurement of Repeater

Table 4.1.2-1: Maximum test system uncertainty

Subclause	Maximum Test System Uncertainty and Range over which Test System Uncertainty applies	Derivation of Test System Uncertainty
6 Output power	±0,7 dB, f ≤ 3.0 GHz ±1,0 dB, 3.0 GHz < f ≤ 4.2 GHz	
7 Frequency stability	±12 Hz Measurement results of ± 500 Hz	
8 Out of band gain	±0,5 dB, f ≤ 3.0 GHz ±0,8 dB, 3.0 GHz < f ≤ 4.2 GHz Calibration of test set-up shall be made without DUT in order to achieve the accuracy	
9.1 Operating band unwanted emission (except 9.1.5.4)	±1,5 dB, f ≤ 3.0 GHz ±1,8 dB, 3.0 GHz < f ≤ 4.2 GHz The interference from the signal generator ACLR shall be minimum 10 dB below that of a Base Station according toTS36.141 [11]	
9.1.5.4 Protection of the BS receiver in the operating band	for results > -60 dBm ±2,0 dB for results < -60 dBm ±3,0 dB	
9.2 Spurious emissions	In E-UTRA and coexistence receive bands: for results > -60 dBm ±2,0 dB for results < -60 dBm ±3,0 dB Outside above range: emission power 9kHz < f ≤ 4 GHz ±2,0 dB; 4GHz < f ≤ 19 GHz ±4,0 dB. The interference from the signal generator ACLR shall be minimum 10 dB below that of a Base Station according to TS36.141 [11]	
10 Error vector magnitude	1% signal analyser, 2% stimulus signal	Requirement limit shifted by RSS requirement and stimulus signal EVM. Analyser error added to requirement limit.
11 Input intermodulation	±1,2 dB	Formula: RSS CW1 level error, 2 x CW2 level error, and measurement error (using all errors = ±0,5 dB)
12 Output intermodulation	±2,1 dB operating band unwanted emission The interference from the signal generator ACLR shall be minimum 10 dB below that of a Base Station For spurious emission: In UTRA and coexistence receive bands: for results > -60 dBm ±2,0 dB for results < -60 dBm ±3,0 dB Outside above range: emission power; 9 kHz < f ≤ 4 GHz ±2,0 dB; 4GHz < f ≤ 19 GHz ±4,0 dB. The interference signal must have a spurious emission level at least 10 dB below the spurious levels required in 9.2.	Formula: RSS 2x Interference signal level error and operating band unwanted emission measurement level error. (1 dB interference signal level error is assumed.)
13 Adjacent channel rejection ratio	±0,7 dB	

4.1.2.2 Interpretation of measurement results

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 ITU-R M.1545 [3].

The actual measurement uncertainty of the Test System for the measurement of each parameter shall be included in the test report.

The recorded value for the Test System uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in subclause 4.1.2 of this specification.

If the Test System for a test is known to have a measurement uncertainty greater than that specified in subclause 4.1.2, it is still permitted to use this apparatus provided that an adjustment is made as follows.

Any additional uncertainty in the Test System over and above that specified in subclause 4.1.2 shall be used to tighten the Test Requirement, making the test harder to pass. (For some tests e.g. receiver tests, this may require modification of stimulus signals). This procedure (defined in Annex B) will ensure that a Test System not compliant with subclause 4.1.2 does not increase the chance of passing a device under test where that device would otherwise have failed the test if a Test System compliant with subclause 4.1.2 had been used.

4.2 Regional requirements

Some requirements in the present document may only apply in certain regions either as optional requirements or set by local and regional regulation as mandatory requirements. It is normally not stated in the 3GPP specifications under what exact circumstances that the requirements apply, since this is defined by local or regional regulation.

Table 4.2-1 lists all requirements that may be applied differently in different regions.

Table 4.2-1: List of regional requirements

Clause number	Requirement	Comments
5.5	Operating bands	Some bands may be applied regionally.
5.6	Channel bandwidth	Some channel bandwidths may be applied regionally.
5.7	Channel arrangement	The requirement is applied according to what operating bands in clause 5.5 that are supported by the Repeater.
6	Output power	In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the range of conditions defined as normal.
9.1.5.1	Operating band unwanted emissions (Category A)	This requirement is mandatory for regions where Category A limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [5] apply.
9.1.5.2	Operating band unwanted emissions (Category B)	This requirement is mandatory for regions where Category B limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [5], apply.
9.1.5.3	Operating band unwanted emissions : Additional requirements	These requirements may be applied regionally for some operating bands.
9.2.5.1	Spurious emissions (Category A)	This requirement is mandatory for regions where Category A limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [5] apply.
9.2.5.2	Spurious emissions (Category B)	This requirement is mandatory for regions where Category B limits for spurious emissions, as defined in ITU-R Recommendation SM.329 [5], apply.
9.2.5.3	Co-existence with other systems in the same geographical area	These requirements may apply in geographic areas in which both E-UTRA –FDD repeater and a system operating in another frequency band are deployed.
9.2.5.4	Co-location with base stations	These requirements may be applied for the protection of other BS receivers when a BS operating in another frequency band is co-located with an E-UTRA-FDD repeater.
11.5.2	Input Intermodulation: Co-location with other systems	These requirements may be applied for the protection of FDD Repeater input when GSM900, DCS1800, PCS1900, GSM850, UTRA FDD, UTRA TDD and/or E-UTRA BS are co-located with an E-UTRA FDD Repeater.
11.5.3	Input Intermodulation: Co-existence with other systems	These requirements may be applied when GSM900, DCS1800, PCS1900, GSM850, UTRA FDD, UTRA TDD and/or E-UTRA BS operating in another frequency band co-exist with an E-UTRA FDD Repeater

4.3 Selection of configurations for testing

Most tests in the present document are only performed for a subset of the possible combinations of test conditions. For instance:

- Only one RF channel may be specified to be tested;
- Not all channel bandwidths may be specified to be tested.