3GPP TS 25.143 V1.0.0 (2000-12)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group RAN; UTRA Repeater; Conformance Testing; (Release 4)

Keywords
<[keyword, keyword]>

3GPP

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Contents

Foreword

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

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1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for UTRA Repeaters. These have been derived from, and are consistent with the UTRA Repeater specifications defined in TS 25.106.

This document establishes the minimum RF characteristics of the UTRA Repeater.

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.

[1] 3GPP TS 25.104: "UTRA(BS) FDD; Radio transmission and Reception".

[2] 3GPP TS 25.942: "RF system scenarios".

[3] 3GPP TS 25.113: "Base station EMC".

[4] ITU-R recommendation SM.329-7: "Spurious emissions".

[5] ITU-T recommendation O.153: "Basic parameters for the measurement of error performance at bit rates below the primary rate".

[6] IEC 60721-3-3 (1994): "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 (1990): "Environmental testing - Part 2: Tests. Tests A: Cold".

[9] IEC 60068-2-2 (1974): "Environmental testing - Part 2: Tests. Tests B: Dry heat".

[10] IEC 60068-2-6 (1995): "Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)".

[11] 3GPP TS 25.141 Base station conformance testing (FDD).

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Down-link	Signal path where base station transmits and mobile receives.
Operating band	The Repeater can have one or several operating bands. The operating band is the frequency range that the Repeater operates in with operational configuration. This

	frequency range that the Repeater operates in with operational configuration. This frequency range can correspond to one or several consecutive nominal 5 MHz channels. If they are not consecutive each subset of channels shall be considered as an individual operating band.
Repeater	A device that receives, amplifies and transmits the radiated or conducted RF carrier both in the down-link direction (from the base station to the mobile area) and in the up-link direction (from the mobile to the base station).
Up-link	Signal path where mobile transmits and base station receives.

3.2 Symbols

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

<symbol> <Explanation>

3.3 Abbreviations

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

EVM Error Vector Magnitude
FDD Frequency Division Duplex
FFS For Further Study
IMT2000 International Mobile Telecommunication-2000
ITU International Telecommunication Union
RF Radio Frequency
UARFCN UTRA Absolute Radio Frequency Channel Number
UMTS Universal Mobile Telecommunication System
UTRA Universal Terrestrial Radio Access
WCDMA Wide band Code Division Multiple Access

4 Frequency bands and channel arrangement

4.1 Frequency bands

A UTRA/FDD Repeater is designed to operate in one or several operating bands within either of the following paired frequency bands;

(a) 1920 – 1980 MHz: Up-link (Mobile transmit, base receive)
2110 – 2170 MHz: Down-link (Base transmit, mobile receive)

(b) 1850 – 1910 MHz: Up-link (Mobile transmit, base receive)
1930 – 1990 MHz: Down-link (Base transmit, mobile receive)
(Note 1)

NOTE 1: Used in Region 2. Additional allocations in ITU region 2 are FFS.

NOTE 2: Deployment in other frequency bands is not precluded.

4.2 Up-link to down-link frequency separation

(a) The minimum up-link to down-link frequency separation is 134,8 MHz and the maximum value is 245,2 MHz and all UTRA/FDD Repeaters shall support a up-link to down-link frequency separation of 190 MHz when operating in the paired frequency band defined in sub-clause 4.1(a).

(b) A UTRA/FDD Repeater can support both fixed and variable up-link to down-link frequency separation.

(c) When operating in the paired frequency band defined in sub-clause 4.1 (b), all UTRA/FDD Repeaters shall support an up-link to down-link frequency separation of 80 MHz.

(d) The use of other up-link to down-link frequency separations in existing or other frequency bands shall not be precluded.

4.3 Channel arrangement

4.3.1 Channel spacing

The nominal channel spacing is 5 MHz, but this can be adjusted to optimise performance in a particular deployment scenario.

4.3.2 Channel raster

The channel raster is 200 kHz, which means that the centre frequency must be an integer multiple of 200 kHz.

4.3.3 Channel number

The carrier frequency is designated by the UTRA Absolute Radio Frequency Channel Number (UARFCN). The value of the UARFCN in the IMT2000 band is defined as follows:

Table 4.1: UTRA Absolute Radio Frequency Channel Number

Up-link	$N_u = 5 * F_{uplink}$	0,0 MHz $\leq F_{uplink} \leq$ 3276,6 MHz where F_{uplink} is the up-link frequency in MHz
Down-link	$N_d = 5 * F_{downlink}$	0,0 MHz $\leq F_{downlink} \leq$ 3276,6 MHz where $F_{downlink}$ is the down-link frequency in MHz

5 General test conditions and declarations

The requirements of this clause apply to all tests in the present document, when applicable.

Many of the tests in the present document measure a parameter relative to a value which is not fully specified in the UTRA specifications. For these tests, the conformance requirement is determined relative to a nominal value specified by the manufacturer.

Some requirements for the Repeater may be regional as listed in subclause 5.6.

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

5.1 Acceptable uncertainty of measurement equipment

The maximum acceptable uncertainty of measurement equipment is specified separately for each test, where appropriate. The measurement equipment shall enable the stimulus signals in the test case to be adjusted to within the specified tolerance, and the conformance requirement 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.

It should be noted that the stated uncertainties in subclause 5.1 apply to the test equipment only and do not include system effects due to mismatch between the DUT and the test equipment.

5.1.1 Measurements of test environments

The measurement accuracy of the Repeater test environments defined in Subclause 5.4, Test environments shall be.

- Pressure ± 5 kPa.
- Temperature ± 2 degrees.
- Relative Humidity ± 5 %.
- DC Voltage ± 1,0 %.
- AC Voltage ± 1,5 %.
- Vibration 10 %.
- Vibration frequency 0,1 Hz.

The above values shall apply unless the test environment is otherwise controlled and the specification for the control of the test environment specifies the uncertainty for the parameter.

5.1.2 Repeater measurements

Subclause 6, Output power:

- Repeater maximum output power ±[0,5] dB.

Subclause 7, Frequency stability:

- signal generator frequency ±[TBD] Hz.
- carrier frequency ±[10] Hz.

Subclause8, Out of band gain:

- gain ±[TDB] dB.

Subclause 9.1, Spectrum emission mask:

- emission power:

Table 5.1: Uncertainty for Spectrum emission mask measurement

Frequency offset Δf		Uncertainty
2,5 ≤ Δf < 2,7 MHz		±[1,5] dB
2,7 ≤ Δf < 3,5 MHz		±[1,5] dB
3,5 ≤ Δf < 7,5 MHz		±[1,5] dB
7,5 ≤ Δf ≤ Δf_{max} MHz		±[1,5] dB

Subclause 9.2, Spurious emissions:

- conformance requirement in UTRA and coexistence receive bands:
  - emission power ±[2,0] dB.
- conformance requirements outside UTRA and coexistence receive bands:
  - emission power:

    f ≤ 2.2 GHz ±1,5 dB;

    2.2 GHz < f ≤ 4 GHz ±2,0 dB;

    f > 4 GHz ±4,0 dB.

Subclause10.1, Error Vector Magnitude:

- modulation accuracy (EVM) ±[2,5] % RMS.

Subclause10.2; Peak Code Domain Error:

- peak code domain error ±[] dB.

Subclause 9.1, Spectrum emission mask

- emission power ±[TDB] dB.

5.2 Repeater test tolerances

The following values may be increased only on a test by test basis. The test tolerances should not be increased to take account of commonly known test system errors (such as mismatch, cable loss, etc.)

Subclause 6, Output power:

- Repeater maximum output power ±[0,5] dB.

Subclause 7, Frequency stability:

- carrier frequency ±[10] Hz.

Subclause 8, Out of band gain:

- gain ±[TDB] dB.

Subclause 9.1, Spectrum emission mask:

- emission power:

Table 5.2: Uncertainty for Spectrum emission mask measurement

Frequency offset Δf		Uncertainty
2,5 ≤ Δf < 2,7 MHz		±[1,5] dB
2,7 ≤ Δf < 3,5 MHz		±[1,5] dB
3,5 ≤ Δf < 7,5 MHz		±[1,5] dB
7,5 ≤ Δf ≤ Δf_{max} MHz		±[1,5] dB

Subclause 9.2, Spurious emissions

- conformance requirement in UTRA and coexistence receive bands:
  - emission power ±[0] dB.
- conformance requirements outside UTRA and coexistence receive bands:
  - emission power:

    f ≤ 2.2 GHz ±[0] dB;

    2.2 GHz < f ≤ 4 GHz ±[0] dB;

    f > 4 GHz ±[0] dB.

Subclause 10.1, Error Vector Magnitude:

- modulation accuracy (EVM) ±[2,5] % RMS.

Subclause 10.2, Peak Code Domain Error:

- peak code domain error ±[TBD] dB.

Subclause 11, Input intermodulation:

- emission power ±[TDB] dB.

5.3 Interpretation of measurement results

Compliance with the requirement is determined by comparing the measured value (or derived value from the measured one) with the test limit. The test limit shall be calculated by adding the specified limit in the core requirement using the test tolerance as specified in subclause 5.2. The actual measurement uncertainty of the test equipment for the measurement of each parameter shall be included in the test report.

The recorded value for the test equipment uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in subclause 5.1 of the present document.

If the test equipment for a test is known to have a measurement uncertainty greater than that specified in subclause 5.1, it is still permitted to use this apparatus provided that an adjustment is made to the measured value as follows.

The initial test limit is derived as above. Any additional uncertainty in the test equipment over and above that specified in subclause 5.1 shall be used to tighten the test limit. This procedure will ensure that test equipment not compliant with subclause 5.1does not increase the chance of passing a device under test where that device would otherwise have failed the test if test equipment compliant with subclause 5.1 had been used.

5.4 Test Environment

For each test in the present document, the environmental conditions under which the Repeater is to be tested are defined.

5.4.1 Normal test environment

When a normal test environment is specified for a test, the test should be performed within the minimum and maximum limits of the conditions stated in Table 5.3.

Table 5.3: Limits of conditions for Normal Test Environment

Condition	Minimum	Maximum
Barometric pressure	86 kPa	106 kPa
Temperature	15°C	30°C
Relative Humidity	20 %	85 %
Power supply	Nominal, as declared by the manufacturer	
Vibration	Negligible	

The ranges of barometric pressure, temperature and humidity represent the maximum variation expected in the uncontrolled environment of a test laboratory. If it is not possible to maintain these parameters within the specified limits, the actual values shall be recorded in the test report.

NOTE: This may, for instance, be the case for measurements of radiated emissions performed on an open field test site.

5.4.2 Extreme test environment

The manufacturer shall declare one of the following:

1) the equipment class for the equipment under test, as defined in the IEC 60 721-3-3 [6];

2) the equipment class for the equipment under test, as defined in the IEC 60 721-3-4 [7];

3) the equipment that does not comply to the mentioned classes, the relevant classes from IEC 60 721 [6], [7] documentation for Temperature, Humidity and Vibration shall be declared.

NOTE: Reduced functionality for conditions that fall out side of the standard operational conditions are not tested in the present document. These may be stated and tested separately.

5.4.2.1 Extreme temperature

When an extreme temperature test environment is specified for a test, the test shall be performed at the standard minimum and maximum operating temperatures defined by the manufacturer's declaration for the equipment under test.

Minimum temperature:

The test shall be performed with the environment test equipment and methods including the required environmental phenomena into the equipment, conforming to the test procedure of IEC 60 068-2-1 [8].

Maximum temperature:

The test shall be performed with the environmental test equipment and methods including the required environmental phenomena into the equipment, conforming to the test procedure of IEC 60 068-2-2 [9].

NOTE: It is recommended that the equipment is made fully operational prior to the equipment being taken to its lower operating temperature.

5.4.3 Vibration

When vibration conditions are specified for a test, the test shall be performed while the equipment is subjected to a vibration sequence as defined by the manufacturer's declaration for the equipment under test. This shall use the environmental test equipment and methods of inducing the required environmental phenomena in to the equipment, conforming to the test procedure of IEC 60 068-2-6 [10]. Other environmental conditions shall be within the ranges specified in subclause 5.4.1.

NOTE: The higher levels of vibration may induce undue physical stress in to equipment after a prolonged series of tests. The testing body should only vibrate the equipment during the RF measurement process.

5.4.4 Power supply

When extreme power supply conditions are specified for a test, the test shall be performed at the standard upper and lower limits of operating voltage defined by manufacturer's declaration for the equipment under test.

Upper voltage limit:

The equipment shall be supplied with a voltage equal to the upper limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, to the methods described in IEC 60 068-2-1 [8] Test Ab/Ad and IEC 60 068-2-2 [9] Test Bb/Bd: Dry Heat.

Lower voltage limit:

The equipment shall be supplied with a voltage equal to the lower limit declared by the manufacturer (as measured at the input terminals to the equipment). The tests shall be carried out at the steady state minimum and maximum temperature limits declared by the manufacturer for the equipment, to the methods described in IEC 60 068-2-1 [8] Test Ab/Ad and IEC 60 068-2-2 [9] Test Bb/Bd: Dry Heat.

5.5 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;
- only one timeslot may be specified to be tested.

When a test is performed by a test laboratory, the choice of which combinations are to be tested shall be specified by the laboratory. The laboratory may consult with operators, the manufacturer or other bodies.

When a test is performed by a manufacturer, the choice of which combinations are to be tested may be specified by an operator.

5.5.1 Power supply options

If the Repeater is supplied with a number of different power supply configurations, it may not be necessary to test RF parameters for each of the power supply options, provided that it can be demonstrated that the range of conditions over which the equipment is tested is at least as great as the range of conditions due to any of the power supply configurations.

5.6 Regional requirements

Some requirements in TS 25.143 may only apply in certain regions. Table 5.4 lists all requirements that may be applied differently in different regions.

Table 5.4: List of regional requirements

Sub-clause number	Requirement	Comments
4.1	Frequency bands	Some bands may be applied regionally.

5.7 Test Models

The set-up of physical channels for the Repeater tests shall be according to one of the test models described in TS 25.141 [11]. A reference to the applicable test model in TS 25.141 is made for each test in Table 5.5 by referring to the test model number as it appears in TS 25.141.

These test models shall be used in the tests of both the up-link and the down-link directions of the Repeater unless otherwise stated.

Table 5.5: List of the applicable test models

Test model number in TS 25.141	Requirement	Comments
Test Model 1	Repeater output power	
Test Model 1	Out of band emission	
Test Model 1	Spurious emission	
Test Model 4	Error vector magnitude	
Test Model 3	Peak code domain error	

5.8 Format and interpretation of tests

Each test in the following clauses has a standard format:

X Title

All tests are applicable to all equipment within the scope of the present document, unless otherwise stated.

X.1 Definition and applicability

This subclause gives the general definition of the parameter under consideration and specifies whether the test is applicable to all equipment or only to a certain subset.

X.2 Conformance requirements

This subclause describes the requirement under test has to fulfil to ensure compliance with the relevant specification.

In addition, this subclause contains the reference to the subclause to the 3GPP reference (or core) specification from which the conformance requirements are derived.

X.3 Test purpose

This subclause defines the purpose of the test.

X.4 Method of test

X.4.1 Initial conditions

This subclause defines the initial conditions for each test, including the basic measurement set-up.

X.4.2 Procedure

This subclause describes the steps necessary to perform the test and provides further details of the test definition like point of access (e.g. antenna port), domain (e.g. frequency-span), range, weighting (e.g. bandwidth), and algorithms (e.g. averaging).

X.5 Test requirements

This subclause defines the pass/fail criteria for the equipment under test.

6 Output power

Maximum output power, Pmax, of the Repeater is the mean power level per carrier at maximum Repeater gain that the manufacturer has declared to be available at the antenna connector.

6.1 Maximum output power

6.1.1 Definition and applicability

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

6.1.2 Conformance requirement

In normal conditions, the Repeater maximum output power shall remain within limits specified in Table 6.1 relative to the manufacturer's rated output power.

Table 6.1: Repeater output power; normal conditions

Rated output power	Limit
P ≥ 43 dBm	+[2] dB and -[2] dB
39 ≤ P < 43 dBm	+[2] dB and -[2] dB
31 ≤ P < 39 dBm	+[3] dB and -[3] dB
P < 31 dBm	+[4] dB and -[4] dB

In extreme conditions, the Repeater maximum output power shall remain within limits specified in Table 6.2 relative to the manufacturer's rated output power.

Table 6.2: Repeater output power; extreme conditions

Rated output power	Limit
P ≥ 43 dBm	+[2,5] dB and -[2,5] dB
39 ≤ P < 43 dBm	+[2,5] dB and -[2,5] dB
31 ≤ P < 39 dBm	+[3,5] dB and -[3,5] dB
P < 31 dBm	+[4,5] dB and -[4,5] dB

In certain regions, the minimum requirement for normal conditions may apply also for some conditions outside the ranges defined for the Normal test environment in subclause 5.4.1.

6.1.3 Method of test

6.1.3.1 Initial conditions

1. Connect the signal generator equipment to the Repeater input port.
2. Connect the power measuring equipment to the Repeater output port.

6.1.3.2 Procedure

1. Set the signal generator to transmit a signal modulated with a combination of PCCPCH, SCCPCH and Dedicated Physical Channels specified as test model 1 in TS 25.141.
2. Adjust the input power to the Repeater to create the maximum nominal Repeater output power at maximum gain.
3. Measure the mean power at the RF output port over a certain slot.

6.1.4 Test requirements

Maximum output power requirement shall be met as specified in subclause 6.1.2.

7 Frequency stability

The test shall address the uplink and the downlink path of the Repeater. The test shall be performed with a CW-signal generator connected to the input and a frequency counter connected to the output.

7.1 Definition and applicability

The frequency stability is a measure of the frequency deviation of the output signal with respect to the input signal.

7.2 Conformance Requirement

The Frequency deviation shall be within ± 0,05 PPM.

7.3 Test Purpose

To verify that the Frequency Error is within the limit specified in 7.2.

7.4 Method of test

The Frequency Stability is measured with a CW-signal generator feeding a signal into the Repeater and a frequency counter connected to the output. The Repeater is set to operate at full gain. The signal level is adjusted to the equivalent level to obtain the nominal output power as declared by the manufacturer. Both paths have to be tested.

7.5 Test Requirement

The Frequency Error shall meet the limit specified in 7.2.

8 Out of band gain

This section applies only to UTRA/FDD repeaters.

8.1 Definitions and applicability

Out of band gain refers to the gain of the Repeater immediately outside the operating band.

The measurements shall apply to all antenna ports of the Repeater.

8.2 Conformance requirements

The requirement shall be met by a Repeater operating at maximum gain. The gain outside the operating band shall not exceed the maximum level specified in Table 8.1, where:

- f_offset is the distance from the centre frequency of the first or last 5 MHz channel within the operating band.

Table 8.1: Out of band gain limits

Frequency offset from the carrier frequency, f_offset	Maximum level
2,7 ≤ f_offset < 3,5 MHz	60 dB
3,5 ≤ f < 7,5 MHz	45 dB
7,5 ≤ f_offset < 12,5 MHz	45 dB
12,5 MHz ≤ f_offset	[TBD] dB

8.3 Test purpose

The purpose of this test is to verify that the Repeater meets the out of band gain requirements as specified in TS 25.106.

8.4 Method of test

8.4.1 Initial conditions

The test shall be performed with an offset between CW-signal and the first or last 5 MHz channel within the operating band of 2.7 MHz, 3 MHz, 3.5 MHz, 5 MHz, 7.5 MHz, 10 MHz, 12.5 MHz, 15 MHz and 20 MHz, excluding other operating bands. In addition the test shall also be performed for all harmonic frequencies of the repeaters operating band up to 12.75 GHz.

8.4.2 Procedure

1) Set the Repeater to maximum gain.

2) Set the signal generator to generate a CW-signal, applied to the input port of the repeater. The power level of the RF input signal shall be at least 5 dB below the power level which, when applied within the operating band, would produce the maximum rated output power, as declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.

3) The average output power in each case shall be measured using a spectrum analyser connected to the output port of the repeater and the net gain shall be recorded.

8.5 Test requirements

In all measurements, the requirements according to subclause 8.2 shall be fulfilled.

9 Unwanted emission

This section applies only to UTRA/FDD repeaters.

9.1 Spectrum emission mask

Out of band emissions are unwanted emissions immediately outside the channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask for the transmitter.

NOTE: This subclause may be mandatory in certain regions. In other regions this mask may not be applied.

9.1.1 Definitions and applicability

The masks defined in Table 9.1, Table 9.2, Table 9.3, and Table 9.4 below may be mandatory in certain regions. In other regions this mask may not be applied.

9.1.2 Conformance requirements

For regions where this clause applies, the requirement shall be met by a repeater's RF-signal output at maximum gain with WCDMA signals in the operating band of the Repeater, at levels that produce the maximum rated output power per channel. Emissions shall not exceed the maximum level specified in Tables 6.x to 6.x for the appropriate Repeater maximum output power, in the frequency range from Δf = 2.5 MHz to f_offset_{max} from the 5 MHz channel, where:

- Δf is the separation between the centre frequency of first or last 5 MHz channel used in the operating band and the nominal –3 dB point of the measuring filter closest to the carrier frequency.
- f_offset is the separation between the centre frequency of first or last 5 MHz channel in the operating band and the centre of the measuring filter.
- f_offset_{max} is either 12.5 MHz or the offset to the UTRA band edge at both up- and down-link as defined in section 5.1, whichever is the greater.

If the operating band corresponds to three or more consecutive nominal 5 MHz channels, the requirement shall be met with any combination of two WCDMA modulated signals in the repeaters operating band.

Table 9.1: Spectrum emission mask values, maximum output power P ≥ 43 dBm

Frequency offset of measurement filter – 3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Maximum level	Measurement bandwidth
2,5 ≤ Δf < 2,7 MHz	2,515MHz ≤ f_offset < 2,715MHz	-14 dBm	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	- 14 – 15·(f_offset- 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	-26 dBm	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	-13 dBm	1 MHz
7,5 ≤ Δf MHz	8,0 MHz ≤ f_offset < f_offset_{max}	-13 dBm	1 MHz

Table 9.2: Spectrum emission mask values, maximum output power 39 ≤ P < 43 dBm

Frequency offset of measurement filter – 3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Maximum level	Measurement bandwidth
2,5 ≤ Δf < 2,7 MHz	2,515MHz ≤ f_offset < 2,715MHz	-14 dBm	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	-14 – 15·(f_offset - 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	-26 dBm	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	-13 dBm	1 MHz
7,5 ≤ Δf MHz	8,0MHz ≤ f_offset < f_offset_{max}	P - 56 dBm	1 MHz

Table 9.3: Spectrum emission mask values, maximum output power 31 ≤ P < 39 dBm

Frequency offset of measurement filter – 3dB point,Δf	Frequency offset of measurement filter centre frequency, f_offset	Maximum level	Measurement bandwidth
2,5 ≤ Δf < 2,7 MHz	2,515MHz ≤ f_offset < 2,715MHz	P - 53 dBm	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	P – 53 – 15·(f_offset – 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	P - 65 dBm	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	P - 52 dBm	1 MHz
7,5 ≤ Δf MHz	8,0MHz ≤ f_offset < f_offset_{max}	P - 56 dBm	1 MHz

Table 9.4: Spectrum emission mask values, maximum output power P < 31 dBm

Frequency offset of measurement filter – 3dB point, Δf	Frequency offset of measurement filter centre frequency, f_offset	Maximum level	Measurement bandwidth
2,5 ≤ Δf < 2,7 MHz	2,515MHz ≤ f_offset < 2,715MHz	-22 dBm	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	-22 – 15·(f_offset - 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	-34 dBm	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	-21 dBm	1 MHz
7,5 ≤ Δf MHz	8,0MHz ≤ f_offset < f_offset_{max}	-25 dBm	1 MHz

9.1.3 Test purpose

The purpose of this test is to verify that the Repeater meet the spectrum emission requirements as specified in TS 25.106.

9.1.4 Method of test

9.1.4.1 Initial conditions

1) Connect a signal generator to the input port of the Repeater for tests of repeaters with an operating band corresponding to one 5 MHz channel. If the operating band corresponds to two or more 5 MHz carriers, two signal generators with a combining circuit or one signal generator with the ability to generate several WCDMA carriers is connected to the input.

2) Measurements with an offset from the carrier centre frequency between 2,515 MHz and 4.0 MHz shall use a 30 kHz measurement bandwidth.

3) Measurements with an offset from the carrier centre frequency between 4.0 MHz and (Δfmax – 500 kHz).shall use a 1 MHz measurement bandwidth. The 1MHz measurement bandwidth may be calculated by integrating multiple 50 kHz or narrower filter measurements

4) Detection mode: True RMS.

9.1.4.2 Procedures

1) Set the Repeater to maximum gain.

2) Set the signal generator(s) to generate signal(s) in accordance to test model 1, TS 25.141 subclause 6.2.1.1.1, at level(s) which produce the manufacturer specified maximum output power at maximum gain.

3) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value.

9.1.5 Test requirements

In all measurements, the requirements according to subclause 9.1.2 shall be fulfilled.

9.2 Spurious emissions

9.2.1 Definition and applicability

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emission, intermodulation products and frequency conversion products, but exclude out of band emissions. This is measured at the Repeater output port.

The requirements of either subclause 9.2.2.1 or subclause 9.2.2.2 shall apply whatever the type of Repeater considered (one or several operating bands). It applies for all configurations foreseen by the manufacturer's specification.

Either requirement applies at frequencies within the specified frequency ranges that are more than 12.5 MHz below the centre frequency of the first 5 MHz channel or more than 12.5 MHz above the centre frequency of the last 5 MHz channel in the operating band.

Unless otherwise stated, all requirements are measured as mean power (RMS).

9.2.2 Conformance Requirements

9.2.2.1 Spurious emission (Category A)

The following requirements shall be met in cases where Category A limits for spurious emissions, as defined in ITU-R Recommendation SM.329-8 [4], are applied.

At maximum Repeater gain, with WCDMA signals in the operating band of the Repeater, at levels that produce the maximum rated output power per channel, the power of any spurious emission shall not exceed the limits specified in Table 9.5.

When the power in all channels is increased by 10 dB the requirements shall still be met.

The measurements shall apply both with or without an input signal applied.

NOTE 1: If the operating band corresponds to three or more consecutive nominal 5 MHz channels, the requirement shall be met with any combination of two WCDMA modulated signals in the repeaters operating band.

Table 9.5: Up-link and down-link: Mandatory spurious emissions limits, Category A

Band	Maximum level	Measurement Bandwidth	Note
9kHz – 150kHz	-13 dBm	1 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
150kHz – 30MHz		10 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
30MHz – 1GHz		100 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
1GHz – 12,75 GHz		1 MHz	Upper frequency as in ITU-R SM.329-8, s2.6

9.2.2.2 Minimum Requirement (Category B)

The following requirements shall be met in cases where Category B limits for spurious emissions, as defined in ITU-R Recommendation SM.329-8 [4], are applied.

At maximum Repeater gain, with WCDMA signals in the operating band of the Repeater, at levels that produce the maximum rated power output per channel, the power of any spurious emission shall not exceed the limits specified in Table 9.6 and Table 9.7 for the down- and up-link, respectively.

When the power in all channels is increased by 10 dB the requirements shall still be met.

The measurements shall apply both with or without an input signal applied.

NOTE 1: If the operating band corresponds to three or more consecutive nominal 5 MHz channels, the requirement shall be met with any combination of two WCDMA modulated signals in the repeaters operating band.

Table 9.6: Down-link: Mandatory spurious emissions limits, Category B

Band	Maximum Level	Measurement Bandwidth	Note
9kHz ↔ 150kHz	-36 dBm	1 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
150kHz ↔ 30MHz	- 36 dBm	10 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
30MHz ↔ 1GHz	-36 dBm	100 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
1GHz ↔ Fc1 - 60 MHz or 2100 MHz *whichever is the higher*	-30 dBm	1 MHz	Bandwidth as in ITU-R SM.329-8, s4.1
Fc1 – 60 MHz or 2100 MHz *whichever is the higher* ↔ Fc1 – 50 MHz or 2100 MHz *whichever is the higher*	-25 dBm	1 MHz	Specification in accordance with ITU-R SM.329-8, s4.1
Fc1 – 50 MHz or 2100 MHz *whichever is the higher* ↔ Fc2 + 50 MHz or 2180 MHz *whichever is the lower*	-15 dBm	1 MHz	Specification in accordance with ITU-R SM.329-8, s4.1
Fc2 + 50 MHz or 2180 MHz *whichever is the lower* ↔ Fc2 + 60 MHz or 2180 MHz *whichever is the lower*	-25 dBm	1 MHz	Specification in accordance with ITU-R SM.329-8, s4.1
Fc2 + 60 MHz or 2180 MHz *whichever is the lower* ↔ 12,75 GHz	-30 dBm	1 MHz	Bandwidth as in ITU-R SM.329-8, s4.1. Upper frequency as in ITU-R SM.329-8, s2.6

Table 9.7: Up-link: Mandatory spurious emissions limits, Category B

Band	Maximum Level	Measurement Bandwidth	Note
9kHz ↔ 150kHz	-36 dBm	1 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
150kHz ↔ 30MHz	- 36 dBm	10 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
30MHz ↔ 1GHz	-36 dBm	100 kHz	Bandwidth as in ITU-R SM.329-8, s4.1
1GHz ↔ Fc1 - 60 MHz or 1910 MHz *whichever is the higher*	-30 dBm	1 MHz	Bandwidth as in ITU-R SM.329-8, s4.1
Fc1 – 60 MHz or 1910 MHz *whichever is the higher* ↔ Fc1 – 50 MHz or 1910 MHz *whichever is the higher*	-25 dBm	1 MHz	Specification in accordance with ITU-R SM.329-8, s4.1
Fc1 – 50 MHz or 1910 MHz *whichever is the higher* ↔ Fc2 + 50 MHz or 1990 MHz *whichever is the lower*	-15 dBm	1 MHz	Specification in accordance with ITU-R SM.329-8, s4.1
Fc2 + 50 MHz or 1990 MHz *whichever is the lower* ↔ Fc2 + 60 MHz or 1990 MHz *whichever is the lower*	-25 dBm	1 MHz	Specification in accordance with ITU-R SM.329-8, s4.1
Fc2 + 60 MHz or 1990 MHz *whichever is the lower* ↔ 12,75 GHz	-30 dBm	1 MHz	Bandwidth as in ITU-R SM.329-8, s4.1. Upper frequency as in ITU-R SM.329-8, s2.6

Fc1: Centre frequency of emission of the first 5 MHz channel in an operating band.

Fc2: Centre frequency of emission of the last 5 MHz channel in an operating band.

9.2.3 Test purpose

This test measure conducted spurious emission from the Repeater transmitter antenna connector, while the Repeater is in operation.

9.2.4 Method of test

9.2.4.1 Initial conditions

1) Connect a signal generator to the input port of the Repeater for tests of repeaters with an operating band corresponding to one 5 MHz channel. If the operating band corresponds to two or more 5 MHz carriers, two signal generators with a combining circuit or one signal generator with the ability to generate several WCDMA carriers is connected to the input.

2) Measurements with an offset from the carrier centre frequency between 2,515 MHz and 4.0 MHz shall use a 30 kHz measurement bandwidth.

3) Measurements with an offset from the carrier centre frequency between 4.0 MHz and (Δfmax – 500 kHz).shall use a 1 MHz measurement bandwidth. The 1MHz measurement bandwidth may be calculated by integrating multiple 50 kHz or narrower filter measurements

4) Detection mode: True RMS.

9.2.4.2 Procedures

1) Set the Repeater to maximum gain.

2) Set the signal generator(s) to generate signal(s) in accordance to test model 1, TS 25.141 subclause 6.2.1.1.1, at level(s) which produce the manufacturer specified maximum output power at maximum gain.

3) Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value.

4) The detecting device shall be configured with a measurement bandwidth as stated in the tables.

9.2.5 Test requirements

In all measurements, the requirements according to subclause 9.2.2 shall be fulfilled.

10 Modulation Accuracy

In this section the procedure for testing the modulation accuracy of Repeaters is defined. This test includes EVM and peak code domain error.

10.1 Error Vector Magnitude

In this section the procedure for testing the Error Vector Magnitude (EVM) of Repeaters is defined.

10.1.1 Definition and applicability

The purpose of the test is to verify that the Error Vector Magnitude is still within the core specification after the signal passed through the Repeater.

10.1.2 Conformance requirements

The Error Vector Magnitude shall not be worse than 17,5 % as defined in TS25.106.

10.1.3 Test purpose

To verify that the EVM is within the limit specified in 10.1.2.

10.1.4 Method of test

The test has to be performed in the uplink and the downlink path of the Repeater. The test is based upon the test for the base station. Test model 4 as described in TS25.141 is used for the definition of the signal to test on. A signal generator providing the required signals is connected to the input of the Repeater. The Repeater is set to operate at full gain. The signal level is adjusted to the equivalent level to obtain the nominal output power as declared by the manufacturer. A signal analyser connected to the output measures the EVM value.

10.1.5 Test requirements

The EVM shall meet the limit specified in 10.1.2.

10.2 Peak Code Domain Error

In this section the procedure for testing the Peak Code Domain Error of Repeaters is defined.

10.2.1 Definition and applicability

The purpose of the test is to verify that the Peak Code Domain Error is still within the core specification after the signal passed through the Repeater.

10.2.2 Conformance requirements

The peak code domain error shall not exceed –35 dBc at spreading factor 256 as defined in TS25.106.

10.2.3 Test purpose

To verify that the Peak Code Domain Error is within the limit specified in 10.2.2.

10.2.4 Method of test

The test has to be performed in the uplink and the downlink path of the Repeater. The test is based upon the test for the base station. Test model 3 as described in TS25.141 is used for the definition of the signal to test on. A signal generator providing the required signals is connected to the input of the Repeater. The spreading factor of the signal generator is set to 256. The Repeater is set to operate at full gain. The signal level is adjusted to the equivalent level to obtain the nominal output power as declared by the manufacturer. A signal analyser connected to the output measures the Peak Code Domain Error value.

10.2.5 Test requirements

The Peak Code Domain Error shall meet the limit specified in 10.2.2.

11 Input intermodulation

<Description of the input intermodulation>

11.1 Definition and applicability

11.2 Conformance requirements

11.3 Test purpose

11.4 Method of test

11.4.1 Initial conditions

11.4.2 Procedure

11.5 Test requirements

12 Blocking characteristics

<Description of the blocking characteristics>

12.1 Definition and applicability

12.2 Conformance requirements

12.3 Test purpose

12.4 Method of test

12.4.1 Initial conditions

12.4.2 Procedure

12.5 Test requirements

13 History

Document history		
V0.0.1	2000-05-25	Document R4-000357 “UTRA Repeater; Conformance Testing” with a text suggestion implemented in R4-000503 approved at RAN WG4 #12
V0.0.2	2000-09-16	Editorial Change: The editor has changed.
V1.0.0	2000-11-30	Inclusion of the text proposals approved by RAN WG4 #14 as well as some editorial changes.

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