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Technical Specification

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Base station conformance testing (TDD)

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Contents

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Foreword

This Technical Specification has been produced by the 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 this TS, 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;

2 presented to TSG for approval;

3 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 specification.

1 Scope

The present document specifies the Radio Frequency (RF) test methods and conformance requirements for UTRA Base Transceiver Stations (BTS) operating in the TDD mode. These have been derived from, and are consistent with, the UTRA base station (BS) specifications defined in 3G TS 25.105 [1].

In this TS, the reference point for RF connections (except for the measurement of mean transmitted RF carrier power) is the antenna connector, as defined by the manufacturer. This TS does not apply to repeaters or RF devices which may be connected to an antenna connector of a BTS.

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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] 3G TS 25.105: "BTS Radio Transmission and reception (TDD)".

[2] ETR 027: "Methods of measurement for mobile radio equipment".

[3] IEC 721: "Classification of environmental conditions"

[4] IEC 68-2: "Basic environmental testing procedures; Part 2: Tests"

[5] ETR 028: "Uncertainties in the measurement of mobile radio equipment characteristics"

[6] Recommendation ITU-R SM.329-7: "Spurious emissions"

3 Definitions, symbols, and abbreviations

3.1 Definitions

For the purposes of the present document, the [following] terms and definitions [given in ... and the following] apply.

<defined term>: <definition>.

example: text used to clarify abstract rules by applying them literally.

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:

<ACRONYM> <Explanation>

4 Frequency bands and channel arrangement

4.1 General

The information presented in this section is based on a chip rate of 3,84 Mcps.

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

4.2 Frequency bands

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

1900 – 1920 MHz: Uplink and downlink transmission

2010 – 2025 MHz Uplink and downlink transmission

Deployment of TDD in the 1920-1980 MHz band is an open item.

Deployment in other frequency bands is not precluded.

4.3 TX–RX frequency separation

No TX-RX frequency separation is required as Time Division Duplex (TDD) is employed. Each TDMA frame consists of 15 timeslots where each timeslot can be allocated to either transmit or receive.

4.4 Channel arrangement

4.4.1 Channel spacing

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

4.4.2 Channel raster

The channel raster is 200 kHz, which means that the carrier frequency must be a multiple of 200 kHz.

4.4.3 Channel number

The carrier frequency is designated by the UTRA absolute radio frequency channel number (UARFCN).

5 General test conditions and declarations

The requirements of this clause apply to all tests in this TS, when applicable.

The general conditions during the tests should be according to the relevant parts of ETR 027 [2] (methods of measurement for mobile radio equipment) with the exceptions and additions defined in the individual tests.

Many of the tests in this TS 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.

Certain functions of a BTS are optional in the UTRA specifications.

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

5.1 Base station classes

The requirements in this specification apply to base stations intended for general-purpose applications in co-ordinated network operation.

In future, further classes of base stations may be defined; the requirements for these may be different than for general-purpose applications.

5.2 Output power and determination of power class

The manufacturer shall declare the maximum output power of the base station which is defined as the mean power level per carrier at the antenna connector; see subclause 6.2.

5.3 Specified frequency range

The manufacturer shall declare:

- which of the frequency bands defined in sub-clause 4.2 is supported by the BSS.
- the frequency range within the above frequency band(s) supported by the BSS. As TDD is employed, the same frequency range is used for transmit and receive operation.

Many tests in this TS are performed with appropriate frequencies in the bottom, middle and top of the operating frequency band of the BTS. These are denoted as RF channels B (bottom), M (middle) and T (top).

When a test is performed by a test laboratory, the UARFCNs to be used for RF channels B, M and T 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 UARFCNs to be used for RF channels B, M and T may be specified by an operator.

5.4 Test environments

For each test in this TS, the environmental conditions under which the BSS 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 under any combination of conditions between the minimum and maximum limits stated in table 5.4.1.1.

Table 5.4.1.1: 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:

a) The equipment class for the equipment under test, as defined in ETS 300 019-1-3, (Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-3: Classification of environmental conditions, Stationary use at weather protected locations).

b) The equipment class for the equipment under test, as defined in ETS 300 019-1-4, (Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-4: Classification of environmental conditions, Stationary use at non-weather protected locations).

c) For equipment that does not comply to an ETS 300 019-1 [11] class, the relevant classes from IEC 721 [3] 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 this TS. 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 environmental test equipment and methods of inducing the required environmental phenomena into the equipment, conforming to the test procedure of IEC 68-2-1 [4], Environmental Testing, Part 2: Tests - Tests A: Cold. The equipment shall be maintained at the stabilized condition for the duration of the test sequence.

Maximum temperature:

The test shall be performed with the environmental test equipment and methods of inducing the required environmental phenomena in to the equipment, conforming to the test procedure of IEC 68-2-2 [4] (Environmental Testing, Part 2: Tests - Tests Bd Dry heat). The equipment shall be maintained at the stabilized condition for the duration of the test sequence.

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 manufacturers 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 68-2-6 [4], Environmental Testing, Part 2: Tests - Test Fc and guidance: Vibration (Sinusoidal). Other environmental conditions shall be within the ranges specified in subclause 5.4.1, Normal test environment.

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 the 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 a steady state minimum and maximum limit declared by the manufacturer for the equipment, to the methods described in IEC 68-2-1 [4] Test Ab/Ad: Cold and IEC 68-2-2 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 a steady state minimum and maximum limit declared by the manufacturer for the equipment, to the methods described in IEC 68-2-1 [4] Test Ab/Ad: Cold and IEC 68-2-2 [4] Test Bb/Bd: Dry Heat.

5.4.5 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, unless otherwise stated.

Subclause 5.4, Test environments:

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 controlled and the specification for the control of the test environment specifies the uncertainty for the parameter.

Transmitter

Subclause 6.2, Base station maximum output power:

Conformance requirement:

RF power, for static power step 0 ± 1,0 dB

Subclause 6.3, Base station output power:

Conformance requirement:

RF power ± 1,0 dB

Subclause 6.4, Frequency stability:

Conformance requirement:

Frequency ± 10 Hz

Subclause 6.5, Output power dynamics

Conformance requirement:

RF power, for static power steps (minimum and maximum Tx power) ± 1,0 dB

Relative RF Power ± 0,7 dB

Subclause 6.6, Transmit ON/OFF ratio:

Conformance requirement:

RF power difference

Power difference < 50 dB ± 0,7 dB

Power difference ≥ 50 dB ± 1,5 dB

Subclause 6.7, Output RF spectrum emissions

Conformance requirement:

RF power difference

Power difference < 50 dB ± 0,7 dB

Power difference ≥ 50 dB ± 1,5 dB

Relative RF power:

Table 5.4.5.1: Acceptable uncertainty of relative RF power measurements

Offset from carrier, MHz	Power difference, dB	Uncertainty of relative power, dB

Spurious emissions

RF power

- inside the BTS transmit band ± 1.5 dB

- outside the BTS transmit band:

f ≤ 2 GHz ± 1.5 dB

2 GHz < f ≤ 4 GHz ± 2.0 dB

f > 4 GHz ± 4.0 dB

Subclause 6.8, Transmit intermodulation:

Test case:

Relative RF power (of injected signal); ± 1.5 dB

Conformance requirement (outside RX band):

RF power; absolute limit values ± 1.5 dB

RF power, relative measurements ± 2.0 dB

Conformance requirement (inside RX band):

RF power; absolute limit values +4 dB -3 dB

NOTE: The positive limit for uncertainty is greater than the negative limit because the measurement result can be increased (but not decreased) due to intermodulation products within the measurement apparatus.

Receiver

Where a measurement uncertainty of +5 dB -0 dB is specified for an input signal, the measured value of the input signal should be increased by an amount equal to the uncertainty with which it can be measured. This will ensure that the true value of the input signal is not below the specified nominal.

Subclause 7.2, Reference sensitivity level

Test case:

RF power ± 1.0 dB

Subclause 7.3, Dynamic range:

Test case:

RF power ± 1.5 dB

Relative RF power ± 3.0 dB

Subclause 7.4, Adjacent Channel Selectivity (ACS):

Test case:

RF power ± 1.5 dB

Relative RF power ± 3.0 dB

Subclause 7.5, Blocking characteristics:

Test case:

RF power, wanted signal ± 1.0 dB

RF power, interfering signal;

f ≤ 2 GHz ± 0.7 dB

2 GHz < f ≤ 4 GHz ± 1.5 dB

f > 4 GHz ± 3.0 dB

Subclause 7.6, Spurious response:

Test case:

RF power, wanted signal ± 1.0 dB

RF power, interfering signal;

f ≤ 2 GHz ± 0.7 dB

2 GHz < f ≤ 4 GHz ± 1.5 dB

f > 4 GHz ± 3.0 dB

Subclause 7.7, Intermodulation characteristics:

Test case:

RF power, wanted signal ± 1.0 dB

RF power, interfering signals ± 0.7 dB

Subclause 7.8, Spurious emissions:

Conformance requirement:

RF power;

f ≤ 2 GHz ± 1.5 dB

2 GHz < f ≤ 4 GHz ± 2.0 dB

f > 4 GHz	± 4.0 dB

5.5 Interpretation of measurement results

The requirements given in these specifications are absolute. Compliance with the requirement is determined by comparing the measured value with the specified limit, without making allowance for measurement uncertainty.

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

The recorded value for the measurement uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in subclause 5.4 of this TS.

NOTE: This procedure is recommended in ETR 028 [5].

If the measurement apparatus for a test is known to have a measurement uncertainty greater than that specified in subclause 5.4, it is still permitted to use this apparatus provided that an adjustment is made to the measured value as follows:

The adjustment is made by subtracting the modulus of the specified measurement uncertainty in subclause 4.7 from the measurement uncertainty of the apparatus. The measured value is then increased or decreased by the result of the subtraction, whichever is most unfavourable in relation to the limit.

5.6 Selection of configurations for testing

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

- Not all TRXs in the configuration may be specified to be tested.
- 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.

5.7 BTS Configurations

This TS has been written to specify tests for the standard configurations of BTS which have been assumed in UTRA requirements specifications, in particular TS 25.105 "BTS Radio transmission and reception" [1]. However, there are other configurations of BTS which comply with these specifications, but for which the application of these specifications is not fully defined. For some such configurations there may be alternate ways to apply the requirements of this specification to testing of the configuration, or some variation in the test method may be necessary. It may therefore be necessary for the parties to the testing to reach agreement over the method of testing in advance.

If the BSS is supplied in a number of different environmental enclosures or configurations, it may not be necessary to test RF parameters for each environmental configuration, provided that it can be demonstrated that the equipment has been tested at the worst internal environmental conditions.

Where alternative interpretations of this specification are possible for a BSS configuration under test, the interpretation which has been adopted in performing the test shall be recorded with the test results.

Where variation in the test method within this TS has been necessary to enable a BSS configuration to be tested, the variation in the test method which has been made in performing the test shall be recorded with the test results. Where possible, agreement should be reached in advance about the nature of such a variation with any party who will later receive the test results.

Possible interpretations of this TS for some common configurations are given in the following subclauses.

5.7.1 Receiver diversity

i) For the tests in clause 7 of this TS, the specified test signals may be applied to one receiver antenna connector, with the remaining receiver antenna connectors being terminated with 50 ohms.

or

ii) For the tests in clause 7 of this TS, the specified test signals may be simultaneously applied to each of the receiver antenna connectors.

5.7.2 Duplexers

Due to TDD operation, there is no need to use a duplexer in the BSS.

5.7.3 Power supply options

If the BSS 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.

This applies particularly if a BSS contains a DC rail which can be supplied either externally or from an internal mains power supply. In this case, the conditions of extreme power supply for the mains power supply options can be tested by testing only the external DC supply option. The range of DC input voltages for the test should be sufficient to verify the performance with any of the power supplies, over its range of operating conditions within the BTS, including variation of mains input voltage, temperature and output current.

5.7.4 Ancillary RF amplifiers

Ancillary RF amplifier: a piece of equipment, which when connected by RF coaxial cables to the BTS, has the primary function to provide amplification between the transmit and/or receive antenna connector of a BTS and an antenna without requiring any control signal to fulfil its amplifying function.

The requirements of this TS shall be met with the ancillary RF amplifier fitted. At tests according to clause 6 and 7 for TX and RX respectively, the ancillary amplifier is connected to the BTS by a connecting network (including any cable(s), attenuator(s), etc.) with applicable loss to make sure the appropriate operating conditions of the ancillary amplifier and the BTS. The applicable connecting network loss range is declared by the manufacturer. Other characteristics and the temperature dependence of the attenuation of the connecting network are neglected. The actual attenuation value of the connecting network is chosen for each test as one of the applicable extreme values. The lowest value is used unless otherwise stated.

Sufficient tests should be repeated with the ancillary amplifier fitted and, if it is optional, without the ancillary RF amplifier to verify that the BSS meets the requirements of this TS in both cases.

5.7.5 BSS using antenna arrays

A BSS may be configured with a multiple antenna port connection for some or all of its TRXs or with an antenna array related to one cell (not one array per TRX). This subclause applies to a BSS which meets at least one of the following conditions:

- The transmitter output signals from one or more TRX appear at more than one antenna port, or
- there is more than one receiver antenna port for a TRX or per cell and an input signal is required at more than one port for the correct operation of the receiver (NOTE: diversity reception does not meet this requirement) thus the outputs from the transmitters as well as the inputs to the receivers are directly connected to several antennas (known as "aircombining"), or

- transmitters and receivers are connected via duplexers to more than one antenna

If a BSS is used, in normal operation, in conjunction with an antenna system which contains filters or active elements which are necessary to meet the UTRA requirements, the tests of conformance may be performed on a system comprising the BSS together with these elements, supplied separately for the purposes of testing. In this case, it must be demonstrated that the performance of the configuration under test is representative of the system in normal operation, and the conformance assessment is only applicable when the BSS is used with the antenna system.

For testing of conformance of such a BSS, the following procedure may be used:

Receiver tests

For each test, the test signals applied to the receiver antenna connectors shall be such that the sum of the powers of the signals applied equals the power of the test signal(s) specified in the test.

An example of a suitable test configuration is shown in figure 5.7.5.1.

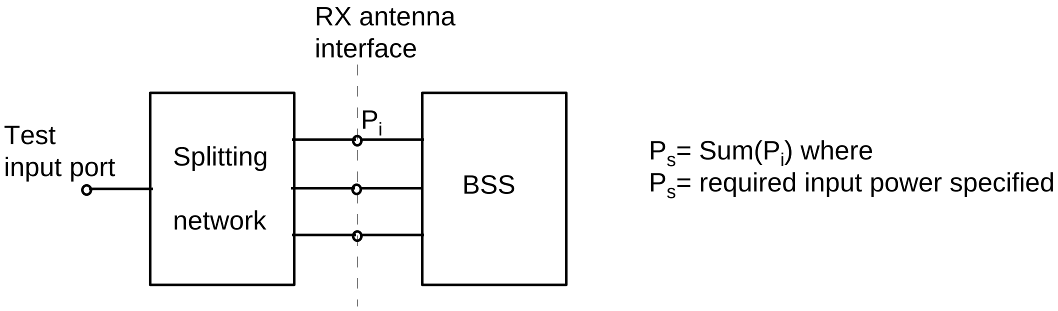

Figure 5.7.5.1: Receiver test setup

For spurious emissions from the receiver antenna connector, the test may be performed separately for each receiver antenna connector.

Transmitter tests

For each test, the conformance requirement shall be met by the sum of the signals emitted by each transmitter antenna connector. This may be assessed by separately measuring the signals emitted by each antenna connector and summing the results, or by combining the signals and performing a single measurement. The characteristics (e.g. amplitude and phase) of the combining network should be such that the power of the combined signal is maximised.

An example of a suitable test configuration is shown in figure 5.7.5.2.

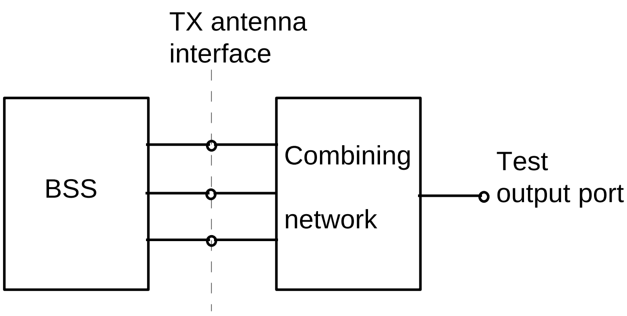

Figure 5.7.5.2: Transmitter test setup

For Intermodulation attenuation, the test may be performed separately for each transmitter antenna connector.

5.8 Overview of the conformance test requirements

Tables 5.8.2, 5.8.3 and 5.8.4 give an overview of the conformance test requirements for the transmitter, the receiver and system performance, respectively.

Table 5.8.2: Overview of the conformance tests requirements for the transmitter

Requirement specified in reference TS [1]		**Sub-clause of Conformance Test TS**
Name	Sub-clause of [1]	
Base station output power	6.2	
Frequency stability	6.3	
Output power dynamics	6.4	
Closed loop power control	6.4.1	
Power control steps	6.4.2	
Power control dynamic range	6.4.3	
Minimum transmit power	6.4.4	
Total power dynamic range	6.4.5	
Power control cycles per second	6.4.6.	
Perch channel power	6.4.7.	
Transmit ON/OFF ratio	6.5	
Output RF spectrum emissions	6.6	
Occupied bandwidth	6.6.1	
Out-of-band emission	6.6.2	
Spectrum emission mask	6.6.2.1	
Adjacent Channel Leakage power Ratio (ACLR)	6.6.2.2	
Spurious emissions	6.6.3	
Mandatory requirements	6.6.3.1	
Co-existence with GSM 900	6.6.3.2	
Co-existence with DCS 1800	6.6.3.3	
Transmit intermodulation	6.7	
Modulation accuracy	6.8	

Table 5.8.3: Overview of the conformance tests requirements for the receiver

Requirement specified in reference TS [1]		**Sub-clause of Conformance Test TS**
Name	Sub-clause of [1]	
Reference sensitivity level	7.2	
BS reference sensitivity level	7.2.1	
Maximum frequency deviation for receicer performance	7.2.2	
Dynamic range	7.3	
Adjacent Channel Selectivity (ACS)	7.4	
Blocking characteristics	7.5	
Spurious response	7.6	
Intermodulation characteristics	7.7	
Spurious emissions	7.8	

Table 5.8.4: Overview of the conformance test requirements for system performance

Requirement specified in reference TS [1]		**Sub-clause of Conformance Test TS**
Name	Sub-clause of [1]	
Dynamic reference sensitivity performance	8.2	
Performance in AWGN channel	8.2.1	
Single link performance	8.2.1.1	
Multi link performance	8.2.1.2	
Performance in multipath fading channels	8.2.2	
Single link performance	8.2.2.1	
Performance without TPC	8.2.2.1.1	
Performance with TPC	8.2.2.1.2	
Multi link performance	8.2.2.2	

5.9 Format and interpretation of tests

Each test in the following clauses has a standard format:

X Title

X.1 Test purpose

This subclause defines the purpose of the test.

X.2 Test case

This subclause describes the steps necessary to perform the test. The general test conditions described in clause 5 also apply.

X.3 Conformance requirements

This subclause describes the conformance requirements necessary to ensure compatibility and to verify the important aspects of the transmission quality of the system. This subclause is divided into two parts:

Test environment

This subclause describes the test environment or environments under which the test shall be performed. Where more than one test environment is specified, the extent of testing is specified for each environment.

Conformance requirement

This subclause describes the requirement which shall be met for the specified tests.

6 Transmitter characteristics

6.1 General

Unless otherwise stated, all measurements shall be made at the BTS antenna connector.

6.2 Maximum output power

6.2.1 Definition and applicability

Output power, Pout, of the base station is the power of one carrier delivered to a load with resistance equal to the nominal load impedance, when averaged (in the sense of thermal power) over the useful part of the burst (time slot).

Maximum output power, Pmax, of the base station is the output power that the manufacturer has declared to be available at the antenna connector.

The requirements in this subclause shall apply to base stations intended for general-purpose applications.

6.2.2 Conformance requirements

In normal conditions, the base station maximum output power shall remain within +2 dB and –2 dB of the available power declared by the manufacturer.

In extreme conditions, the base station maximum output power shall remain within +2,5 dB and –2,5 dB of the available power declared by the manufacturer.

The reference for this requirement is TS 25.105 subclause 6.2.1.1.

6.2.3 Test purpose

The test purpose is to verify the accuracy of the maximum output power across the frequency range and under normal and extreme conditions for all transmitters in the BS.

6.2.4 Method of test

6.2.4.1 Initial conditions

(1) The transmitter under test and all other transmitters of the base station (if any) are switched on.

(2) The power of the transmitters not under test (if any) are controlled down.

(3) Connect the power measuring equipment to the BS antenna connector.

(4) Set the parameters of the transmitted signal according to table 6.2.4.1.1.

Table 6.2.4.1.1 Parameters of the transmitted signal for maximum output power test

Parameter	Value/description
TDD Duty Cycle	TS i; i = 1,2, ..., 15: on, if i is odd; off, if i is even.
Number of DPCH in each active TS	TBD
Base station power	maximum, according to manufacturer's declaration
Data content of DPCH	real life (sufficient irregular)

6.2.4.2 Procedure

(1) Measure thermal power over the useful part of the burst,

with the useful part starting TBD chips after the data symbol start and ending TBD chips before the guard period starts, and with a measurement bandwidth of at least 5 MHz.

(2) Average over TBD time slots.

(3) Run steps (1) and (2) for RF channels Low / Mid / High.

6.2.5 Test requirements

The value of the measured output power, derived according to subclause 6.2.4.2, shall be within the tolerance defined in subclause 6.2.2.

6.3 Frequency stability

6.3.1 Definition and applicability

Frequency stability is the ability of the BS to transmit at the assigned carrier frequency.

The requirements in this subclause shall apply to base stations intended for general-purpose applications.

6.3.2 Conformance requirements

The BS frequency stability shall be within $\pm$ 0,05 ppm.

The reference for this requirement is TS 25.105 subclause 6.3.1.

6.3.3 Test purpose

The test purpose is to verify the accuracy of the carrier frequency across the frequency range and under normal and extreme conditions.

6.3.4 Method of test

6.3.4.1 Initial conditions

(1) The transmitter under test and all other transmitters of the base station (if any) are switched on.

(2) The power of the transmitters not under test (if any) are controlled down.

(3) Connect the tester to the BS antenna connector.

(4) Set the parameters of the transmitted signal according to table 6.3.4.1.1.

Table 6.3.4.1.1 Parameters of the transmitted signal for frequency stability test

Parameter	Value/description
TDD Duty Cycle	TS i; i = 1,2, ..., 15: on, if i is odd; off, if i is even.
Number of DPCH in each active TS	[1]
Base station power	maximum, according to manufacturer's declaration
Data content of DPCH	real life (sufficient irregular)

6.3.4.2 Procedure

(1) Measure the frequency error delta f across one burst (time slot), by applying the global in-channel Tx test method described in Annex A

(2) Repeat step (1) for 200 bursts (time slots)

(3) Run steps (1) and (2) for RF channels Low / Mid / High.

6.3.5 Test requirements

For all measured bursts (time slots), the frequency error, derived according to subclause 6.3.4.2, shall not exceed 0,5 x 10E-7.

6.4 Output power dynamics

6.4.1 Closed loop power control

Closed loop power control is the ability of the BS transmitter to adjust its output power in response to the UL received signal.

For closed loop correction on the Downlink Channel (with respect to the open loop estimate), the base station adjust its mean output power level in response to each valid power control bit received from the UE on the Uplink Channel.

6.4.2 Power control steps

6.4.2.1 Definition and applicability

The power control step is the step change in the DL transmitter output power in response to a TPC message from the UE.

The requirements in this subclause shall apply to base stations intended for general-purpose applications.

6.4.2.2 Conformance requirements

The power control step sizes in the DL shall be 1 dB, 2 dB and 3 dB.

The tolerance of the transmitter output power and the greatest average rate of change in mean power due to the power control step shall be within the range shown in Table 6.4.2.2.1.

Table 6.4.2.2.1: Power control step size tolerance

Step size	tolerance	Range of average rate of change in mean power per 10 steps	
		minimum	maximum
1dB	+/-0.5dB	+/-8dB	+/-12dB
2dB	[+/-0.75dB]	[+/-16dB]	[+/-24dB]
3dB	[+/-1dB]	[+/-24dB]	[+/-36dB]

The reference for this requirement is TS 25.105 subclause 6.4.2.1.

6.4.2.3 Test purpose

The DL power control is applied to adjust the BS output power to a value that is sufficiently high to generate a SIR at the UE receiver equal to the target SIR, while limiting the intercell interference.

The test purpose is to verify the ability of the BS to interpret received TPC commands in a correct way and to adjust its output power according to these commands with the specified accuracy.

6.4.2.4 Method of test

6.4.2.4.1 Initial conditions

(1) Connect the BS tester to the antenna connector of the BS under test.

(2) Disable closed loop power control in the BS under test.

(3) Set the initial parameters of the BS transmitted signal according to table 6.4.2.4.1.1.

(4) Set up a call between the BS under test and the BS tester according to the generic call setup procedure.

NOTE: The BS tester used for this test must have the ability

- to analyze the output signal of the BS under test with respect to code domain power, by applying the global in-channel Tx test method described in Annex A;

- to simulate an UE with respect to the generation of TPC commands embedded in a valid UE signal.

Table 6.4.2.4.1.1 Initial parameters of the BS transmitted signal for power control steps test

Parameter	Value/description
TDD Duty Cycle	TS i; i = 1,2, ..., 15: transmit, if i is odd; receive, if i is even.
Number of DPCH in each active TS	[1]
DPCH power	minimum
Data content of DPCH	real life (sufficient irregular)

6.4.2.4.2 Procedure

(1) Configure the BS transmitter to enable power control steps of size 1 dB.

(2) Set the BS tester to produce a sequence of TPC commands related to the active DPCH. This sequence shall be transmitted to the BS within the even time slots TS i (receive time slots of the BS) and shall consist of a series of TPC commands with content "Increase Tx power", followed by a series of TPC commands with content "Decrease Tx power". Each of these series should be sufficiently long so that the transmit output power of the active DPCH is controlled to reach its maximum and its minimum, respectively.

(3) Measure the power of the active DPCH over the useful part of each odd time slot TS i (transmit time slots of the BS), with the useful part starting TBD chips after the data symbol start and ending TBD chips before the guard period starts, and with a measurement filter that has a RRC filter response with a roll off $\alpha = 0,22$ and a bandwidth equal to the chip rate.

(4) Based on the measurement made in step (3), calculate the power control step sizes and the average rate of change per 10 steps.

(5) Configure the BS transmitter to enable power control steps of 2 dB and of 3 dB, respectively, and repeat steps (2) to (4).

NOTE: In case of power control step size 3 dB, the number of power control steps feasible within the power control dynamic range of the BS under test may be lower than 10. In this case, the evaluation of the average rate of change in mean power may be based on less than 10 power control steps.

6.4.2.5 Test requirements

For all measurements, the tolerance of the power control step sizes and the average rate of change per 10 steps shall be within the limits given in Table 6.4.2.2.1.

6.4.3 Power control dynamic range

6.4.3.1 Definition and applicability

The power control dynamic range is the difference between the maximum and the minimum transmit output power for a specified reference condition.

The requirements in this subclause shall apply to base stations intended for general-purpose applications.

6.4.3.2 Conformance requirements

The DL power control dynamic range shall be greater than or equal to 30 dB.

The reference for this requirement is TS 25.105 subclause 6.4.3.1.

6.4.3.3 Test purpose

The test purpose is to verify the ability of the BS to control the power of a single code signal over the specified dynamic range.

6.4.3.4 Method of test

6.4.3.4.1 Initial conditions

(1) Connect the BS tester to the antenna connector of the BS under test.

(2) Set the parameters of the BS transmitted signal according to table 6.4.3.4.1.1.

(3) Set up a call between the BS under test and the BS tester according to the generic call setup procedure.

NOTE: The BS tester used for this test must have the ability

- to analyze the output signal of the BS under test with respect to code domain power, by applying the global in-channel Tx test method described in Annex A;

- to simulate an UE with respect to the generation of TPC commands embedded in a valid UE signal.

Table 6.4.3.4.1.1 Parameters of the BS transmitted signal for power control steps test

Parameter	Value/description
TDD Duty Cycle	TS i; i = 1,2, ..., 15: transmit, if i is odd; receive, if i is even.
Number of DPCH in each active TS	[1]
Data content of DPCH	real life (sufficient irregular)

6.4.3.4.2 Procedure

(1) Configure the BS transmitter to enable power control steps of size 1 dB.

(2) Set the BS tester to produce a sequence of TPC commands related to the active DPCH, with content "Increase Tx power". This sequence shall be sufficiently long so that the transmit output power of the active DPCH is controlled to reach its maximum, and shall be transmitted to the BS within the even time slots TS i (receive time slots of the BS).

(3) Measure the power of the active DPCH over the useful part of each odd time slot TS i (transmit time slots of the BS), with the useful part starting TBD chips after the data symbol start and ending TBD chips before the guard period starts, and with a measurement filter that has a RRC filter response with a roll off $\alpha = 0,22$ and a bandwidth equal to the chip rate.

(4) Average over TBD time slots.

(5) Set the BS tester to produce a sequence of TPC commands related to the active DPCH, with content "Decrease Tx power". This sequence shall be sufficiently long so that the transmit output power of the active DPCH is controlled to reach its minimum, and shall be transmitted to the BS within the even time slots TS i (receive time slots of the BS).

(6) Measure thermal power of the active DPCH over the useful part of each odd time slot TS i (transmit time slots of the BS), with the useful part starting TBD chips after the data symbol start and ending TBD chips before the guard period starts, and with a measurement bandwidth of at least 5 MHz.

(7) Average over TBD time slots.

(8) Calculated the power control dynamic range difference between the maximum transmit output power measured in steps (3) and (4) and the minimum transmit output power measured in steps (6) and (7).

(9) Configure the BS transmitter to enable power control steps of 2 dB and of 3 dB, respectively, and repeat steps (2) to (8).

6.4.3.5 Test requirements

The power control dynamic range derived according to 6.4.3.4.2 shall be in compliance with the requirements in 6.4.3.2.

6.4.4 Minimum transmit power

6.4.4.1 Definition and applicability

The minimum controlled output power of the BS is when the power control setting is set to a minimum value. This is when the power control indicates a minimum transmit output power is required.

The requirements in this subclause shall apply to base stations intended for general-purpose applications.

6.4.4.2 Conformance requirements

The DL minimum transmit power shall be lower than or equal to

Maximum output power – 30 dB.

The reference for this requirement is TS 25.105 subclause 6.4.4.1.

6.4.4.3 Test purpose

The test purpose is to verify the ability of the BS to reduce its output power to a specified value.

6.4.4.4 Method of test

6.4.4.4.1 Initial conditions

(1) Connect the BS tester to the antenna connector of the BS under test.

(2) Set the parameters of the BS transmitted signal according to table 6.4.4.4.1.1.

(3) Set up a call between the BS under test and the BS tester according to the generic call setup procedure.

NOTE: The BS tester used for this test must have the ability

- to analyze the output signal of the BS under test with respect to thermal power;

- to simulate an UE with respect to the generation of TPC commands embedded in a valid UE signal.

Table 6.4.4.4.1.1 Parameters of the BS transmitted signal for minimum transmit power test

Parameter	Value/description
TDD Duty Cycle	TS i; i = 1,2, ..., 15: transmit, if i is odd; receive, if i is even.
Number of DPCH in each active TS	TBD (shall be equal to the number in BS maximum output power test; see 6.2)
Data content of DPCH	real life (sufficient irregular)

6.4.4.4.2 Procedure

(1) Configure the BS transmitter to enable power control steps of size 1 dB.

(2) Set the BS tester to produce a sequence of TPC commands related to all active DPCH, with content "Decrease Tx power". This sequence shall be sufficiently long so that the transmit output power of all active DPCH is controlled to reach its minimum, and shall be transmitted to the BS within the even time slots TS i (receive time slots of the BS).

(3) Measure thermal power of the BS output signal over the useful part of each odd time slot TS i (transmit time slots of the BS), with the useful part starting TBD chips after the data symbol start and ending TBD chips before the guard period starts, and with a measurement bandwidth of at least 5 MHz.

(4) Average over TBD time slots.

(5) Configure the BS transmitter to enable power control steps of 2 dB and of 3 dB, respectively, and repeat steps (2) to (4).

6.4.4.5 Test requirements

For all measurements, the minimum transmit power derived in step (4) of 6.4.4.4.2 shall be at least 30 dB below the maximum output power as declared by the manufacturer; see 6.2.

6.4.5 Total power dynamic range

The power control dynamic range is the difference between the maximum and the minimum transmit output power for a specified reference condition.

6.4.5.1 Test purpose

6.4.5.2 Test case

6.4.5.3 Conformance requirements

6.4.6 Power control cycles per second

6.4.6.1 Test purpose

The test purpose is to verify the ability of the BS to follow power control commands at the specified rate (cycles per second).

or

The test purpose is to verify the ability of the BS to generate power control commands in the DL, with the aim to adjust the UE transmitted power.

6.4.6.2 Test case

6.4.6.3 Conformance requirements

6.4.7 Perch channel power

< Editor's note: The name and the use of the common control channel may need to be adapted, subject to WG1 definition. >

6.4.7.1 Test purpose

6.4.7.2 Test case

6.4.7.3 Conformance requirements

6.5 Transmit OFF power

6.5.1 Definition and applicability

The transmit OFF power is the maximum residual output power within the channel bandwidth when the BS does not transmit.

6.5.2 Conformance requirements

The transmit OFF power shall be less than –33 dBm measured with a filter that has a Root-Raised Cosine (RRC) filter response with a roll-off $\alpha = 0{,}22$ and a bandwidth equal to the chip rate.

The reference for this requirement is TS 25.105 subclause 6.5.1.

6.5.3 Test purpose

This test verifies the ability of the BS to reduce its transmit OFF power to a value below the specified limit. This ability is needed to minimize the interference for other users receiving on the same frequency.

6.5.4 Method of test

6.5.4.1 Initial conditions

(1) Connect the power measuring equipment to the BS antenna connector.

(2) Set the parameters of the transmitted signal according to table 6.5.4.1.1.

Table 6.5.4.1.1 Parameters of the transmitted signal for transmit OFF power test

Parameter	Value/description
TDD Duty Cycle	TS i; i = 1,2, ..., 15: on, if i is odd; off, if i is even.
Number of DPCH in each active TS	TBD; shall be equal to the number in BS maximum output power test, see 6.2
Base station power	maximum, according to manufacturer's declaration
Data content of DPCH	real life (sufficient irregular)

6.5.4.2 Procedure

(1) Measure thermal power over the useful part of the even time slots TS i (receive time slots of the BS), with the useful part starting TBD chips after the guard period of the preceding time slot ends and ending TBD chips before the first data symbol of the following time slot starts, and with a measurement filter that has a RRC filter response with a roll off $\alpha = 0,22$ and a bandwidth equal to the chip rate.

(2) Average over TBD time slots.

(3) Run steps (1) and (2) for RF channels Low / Mid / High.

6.5.5 Test requirements

The value of the transmit OFF power derived according to subclause 6.5.4.2, shall be below the limit defined in subclause 6.5.2.

6.6 Output RF spectrum emissions

6.6.1 Occupied bandwidth

6.6.1.1 Test purpose

Occupied bandwidth is a measure of the bandwidth containing 99% of the total integrated power for transmitted spectrum and is centered on the assigned channel frequency. The occupied channel bandwidth is less than 5 MHz based on a chip rate of 3,84 Mcps.

< Editor's note: Needs to be reviewed for the conformance specification. >

6.6.1.2 Test case

6.6.1.3 Conformance requirements

6.6.2 Out of band emission

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 can be specified in terms of a spectrum emission mask and adjacent channel power ratio for the transmitter.

6.6.2.1 Spectrum emission mask

< Editor's note: The emission mask of the base station is an item for further study. >

6.6.2.1.1 Test purpose

6.6.2.1.2 Test case

6.6.2.1.3 Conformance requirements

6.6.2.2 Adjacent Channel Leakage power Ratio (ACLR)

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the transmitted power to the power measured after a receive filter in the adjacent channel(s). Both the transmitted and the received power are measured through a matched filter (root raised cosine and roll-off 0,22) with a noise power bandwidth equal to the chip rate.

6.6.2.2.1 Test purpose

6.6.2.2.2 Test case

< Editor's note: This section is tentatively based on text in TS 25.141 V0.1.0, which, in turn, is taken from Section 6.1.1.3 of ARIB Vol. 5. Additional amendments as proposed in R4-99195 >

1. Connect a spectrum analyzer or other suitable test equipment to the base station RF output port, using an attenuator or directional coupler if necessary.

2. The spectrum analyzer (Digital storage type) is set as shown below.

Median frequency : carrier frequency and each of the adjacent channel frequencies

Sweep spectrum range : 0 Hz

Resolution bandwidth : root-raised cosine 3,84 MHz

Averaging : 1000 power averages (for 0,2 dB error at 95% confidence)

Sweep mode : zero span

Sweep trigger : to be defined

Detection mode : peak of true power

3. Set the base station to transmit an appropriate signal. Total power at the RF output port shall be the nominal power as specified by the manufacturer.

< Editor's note: Further work needed to define the composition of the transmitted signal. >

4. Measure the power level at the carrier frequency and at each of the adjacent channel frequencies.

6.6.2.2.3 Conformance requirements

Table 6.6.2.2.3.1: BS ACLR limits

BS adjacent channel offset	ACLR limit
± 5 MHz	[45] dB
± 10 MHz	[55] dB

6.6.2.3 Protection outside a licensee's frequency block

6.6.2.3.1 Test purpose

This requirement is applicable if protection is required outside a licensee's defined frequency block.

6.6.2.3.2 Test case

This requirement applies for frequencies outside the licensee’s frequency block, up to an offset of [12.5MHz] from a carrier frequency.

Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier centre frequency and one above the carrier centre frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power.

When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee’s frequency block edges, both upper and lower, as the design permits.

The measurements of emission power shall be mean power.

6.6.2.3.3 Conformance requirements

The power of any emission shall be attenuated below the transmit power (P) by at least 43 + 10 log (P) dB.

6.6.3 Spurious emissions

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 base station RF output port.

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

6.6.3.1 Mandatory Requirements

6.6.3.1.1 Test purpose

6.6.3.1.2 Test case

< Editor's note: This section is tentatively based on text in TS 25.141 V0.1.0, which, in turn, is taken from Section 6.1.1.4 of ARIB Vol. 5. >

1. Connect a spectrum analyzer or other suitable test equipment to the base station RF output port, using an attenuator or directional coupler if necessary.

2. The spectrum analyzer (Digital storage type) is set as shown below.

Median frequency	: spurious frequency
Sweep spectrum range	: see tables below in subclause on conformance requirements
Resolution bandwidth	: see tables below in subclause on conformance requirements
Video bandwidth	: Equivalent of resolution bandwidth
Y-axis scale	: 10dB/div
Sweep mode	: Single mode
Sweep trigger	: Freerun or video trigger. Generally + voltage, but adjustment is necessary.
Sweep time	: [**]msec
Detection mode	: Sample mode

3. Set the base station to transmit an appropriate signal. Total power at the RF Output port shall be the nominal power as specified by the manufacturer.

< Editor's note: Further work needed to define the composition of the transmitted signal. >

4. Measure the power level at the carrier frequency.

5. Sweep the spectrum analyzer over a frequency range from a low radio frequency (about 25 MHz) to three times the carrier frequency at least.

6.6.3.1.3 Conformance requirements

The requirements of either subclause 6.6.3.1.3.1 or subclause 6.6.3.1.3.2 shall apply.

Either requirement applies at frequencies within the specified frequency ranges which are more than [12.5MHz] from a [carrier frequency].

6.6.3.1.3.1 Spurious emissions (Category A)

The following requirements shall be met in cases where Category A limits for spurious emissions, as defined in ITU-R Recommendation SM.329-7 [6], are applied.

The power of any spurious emission shall not exceed:

Table 6.6.3.1.3.1.1: BS mandatory spurious emissions limits, Category A

Band	Minimum requirement	Measurement Bandwidth	Note
9 kHz – 150 kHz	43 + 10logP (dBc)	1 kHz	Bandwidth as in ITU SM.329-7, s4.1
150 kHz – 30 MHz		10 kHz	Bandwidth as in ITU SM.329-7, s4.1
30 MHz – 1 GHz		100 kHz	Bandwidth as in ITU SM.329-7, s4.1
1 GHz – 12,75 GHz		1 MHz	Upper frequency as in ITU SM.329-7, s2.6

P = Mean power (W) where P < 500W

6.6.3.1.3.2 Spurious emissions (Category B)

The following requirements shall be met in cases where Category B limits for spurious emissions, as defined in ITU-R Recommendation SM.329-7 [6], are applied.

The power of any spurious emission shall not exceed:

Table 6.6.3.1.3.2.1: BS mandatory spurious emissions limits, Category B

Band	Maximum Level	Measurement Bandwidth	Note
9 kHz – 150 kHz	- 36 dBm	1 kHz	Bandwidth as in ITU SM.329-7, s4.1
150 kHz – 30 MHz	- 36 dBm	10 kHz	Bandwidth as in ITU SM.329-7, s4.1
30 MHz – 1 GHz	- 36 dBm	100 kHz	Bandwidth as in ITU SM.329-7, s4.1
1 GHz – 12,75 GHz	- 30 dBm	1 MHz	Upper frequency as in ITU SM.329-7, s2.6

6.6.3.2 Co-existence with GSM 900

6.6.3.2.1 Operation in the same geographic area

6.6.3.2.1.1 Test purpose

This requirement may be applied for the protection of GSM 900 MS in geographic areas in which both GSM 900 and UTRA are deployed.

[This requirement assumes the scenario described in 25.942.] For different scenarios, the manufacturer may declare a different requirement.

6.6.3.2.1.2 Test case

see subclause 6.6.3.1.2

6.6.3.2.1.3. Conformance

The power of any spurious emission shall not exceed:

Table 6.6.3.2.1.3.1: BS Spurious emissions limits for BS in geographic coverage area of GSM 900

Band	Maximum Level	Measurement Bandwidth	Note
921 – 960 MHz	-47 dBm	100 kHz	

6.6.3.2.2. Co-located base stations

6.6.3.2.2.1. Test purpose

This requirement may be applied for the protection of GSM 900 BTS receivers when GSM 900 BTS and UTRA BS are co-located.

[This requirement assumes the scenario described in 25.942.] For different scenarios, the manufacturer may declare a different requirement.

6.6.3.2.2.2 Test case

see subclause 6.6.3.1.2

6.6.3.2.2.3 Conformance requirements

The power of any spurious emission shall not exceed:

Table 6.6.3.2.2.3.1: BS spurious emissions limits for protection of the BS receiver

Band	Maximum Level	Measurement Bandwidth	Note
876 – 915 MHz	–[98]dBm	100 kHz	

6.6.3.3 Co-existence with DCS 1800

6.6.3.3.1 Operation in the same geographic area

6.6.3.3.1.1 Test purpose

This requirement may be applied for the protection of DCS 1800 MS in geographic areas in which both DCS 1800 and UTRA are deployed.

[This requirement assumes the scenario described in 25.942.] For different scenarios, the manufacturer may declare a different requirement.

6.6.3.3.1.2 Test case

see subclause 6.6.3.1.2

6.6.3.3.1.3 Conformance

The power of any spurious emission shall not exceed:

Table 6.6.3.3.1.3.1: BS spurious emissions limits for BS in geographic coverage area of DCS 1800

Band	Maximum Level	Measurement Bandwidth	Note
1805 – 1880 MHz	-57 dBm	100 kHz	

6.6.3.3.2 Co-located base stations

6.6.3.3.2.1 Test purpose

This requirement may be applied for the protection of DCS 1800 BTS receivers when DCS 1800 BTS and UTRA BS are co-located.

[This requirement assumes the scenario described in 25.942.] For different scenarios, the manufacturer may declare a different requirement.

6.6.3.3.2.2 Test case

see subclause 6.6.3.1.2

6.6.3.3.2.3 Conformance requirements

The power of any spurious emission shall not exceed:

Table 6.6.3.3.2.3.1: BS spurious emissions limits for BS co-located with DCS 1800 BTS

Band	Maximum Level	Measurement Bandwidth	Note
1710 – 1785 MHz	-[98]dBm	100 kHz	

6.7 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

The transmit intermodulation level is the power of the intermodulation products when a CDMA modulated interference signal is injected into the antenna connector at a level of 30 dB lower than that of the subject signal. The frequency of the interference signal shall be ±5 MHz, ±10 MHz and ±15 MHz offset from the subject signal.

6.7.1 Test purpose

To verify that the RF transmit equipment is able to restrict the generation of signals in its non-linear elements caused by the presence of the RF output from the transmitter and an interfering signal reaching the transmitter via its antenna to below specified levels.

6.7.2 Test case

< Editor's note: This section is tentatively based on text in TS 25.141 V0.1.0, which, in turn, is taken from Section 6.1.1.4 of ARIB Vol. 5. >

1. Configure the base station according to the test model described in figure 6.7.2.1.

2. Conditions for measuring instrument is set as follows:

(1) The transmitting wave must have enough directivity so that no leak nor measurement error occurs in the standard signal generator.

(2) Setting of standard signal generator:

Median frequency: Transmission average frequency [**]MHz

(3) The spectrum analyzer (Digital storage type) is set as shown below.

Median frequency : Intermodulation spurious frequency

Sweep spectrum range : [**]Hz

Resolution bandwidth : [**]Hz

Video bandwidth : Equivalent of resolution bandwidth

Y-axis scale : 10dB/div

Sweep mode : Single mode

Sweep trigger : Freerun or video trigger. Generally + voltage, but adjustment is necessary.

Sweep time : [**]msec

Detection mode : Sample mode

3. Set the base station to transmit an appropriate signal.

< Editor's note: Further work needed to define the composition of the transmitted signal. >

4. Set the median Frequency of the standard signal generator at the carrier +[**]MHz (or –[**]MHz) and set the output level of standard signal generator so that a maximum transmission output of –[**]dB is in terms of the unit under test antenna output end calculation.

5. Set the switching selector on the unit under test side and obtain power of transmission intermodulated wave by the spectrum analyzer.

6. The ratio of the maximum transmission output and the maximum value of power obtained in 2 corresponds to the transmission intermodulation.

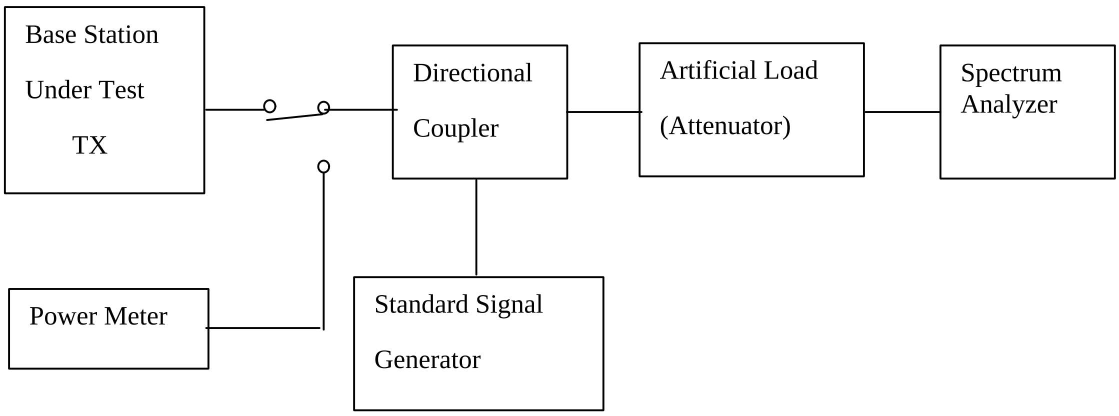

Figure 6.7.2.1: Functional setup for Base Station intermodulation spurious response tests

6.7.3 Conformance requirements

The Transmit intermodulation level shall not exceed the out of band or the spurious emission requirements of section 6.6.2 and 6.6.3.

6.8 Transmit Modulation

6.8.1 Transmit pulse shape filter

6.8.2 Modulation accuracy

The modulation accuracy is a measure of the difference between the measured waveform and the theoretical modulated waveform (the error vector). It is the square root of the ratio of the mean error vector power to the mean reference signal power expressed as %. The measurement interval is one timeslot.

6.8.2.1 Test purpose

6.8.2.2 Test case

6.8.2.3 Conformance requirements

The modulation accuracy shall not be worse than 12,5 %.

6.8.3 Peak Code Domain Error

The code domain error is computed by projecting the error vector power onto the code domain at the maximum spreading factor. The error power for each code is defined as the ratio to the mean power of the reference waveform expressed in dB. And the Peak Code Domain Error is defined as the maximum value for Code Domain Error. The measurement interval is one timeslot.

6.8.3.1 Test purpose

6.8.3.2 Test case

6.8.3.3 Conformance requirements

The peak code domain error shall not exceed -28 dB.

7 Receiver characteristics

7.1 General

All tests unless otherwise stated in this subclause shall be conducted on Base Station Systems fitted with a full complement of Transceivers for the configuration. The manufacturer shall provide appropriate logical or physical test access to perform all tests in this subclause. Measurements shall include any RX multicoupler.

The tests in this subclause assume that the receiver is not equipped with diversity. For receivers with diversity, the tests may be performed by applying the specified signals to one of the receiver inputs, and terminating or disabling the other(s). The tests and requirements are otherwise unchanged.

For receivers with diversity, testing of conformance shall be performed by applying the specified signals to one of the receiver inputs, and terminating or disabling the other(s).

In all the relevant subclauses in this clause all Bit Error Ratio (BER), Residual BER (RBER) and Frame Erasure Ratio (FER) measurements shall be carried out according to the general rules for statistical testing.

Unless detailed the receiver characteristic are specified at each antenna connector of the BS.

7.2 Reference sensitivity level

The reference sensitivity is the minimum receiver input power measured at the antenna connector at which the FER/BER does not exceed the specific value indicated in section 7.2.1.3. The signal power is equally applied to each antenna connector for diversity.

7.2.1 Minimum requirement

7.2.1.1 Test purpose

7.2.1.2 Test case

7.2.1.3 Conformance requirements

For the different services with corresponding data rates, the reference sensitivity level of the BS shall be specified in table 7.2.1.3 below.

Table 7.2.1.3: BS reference sensitivity levels

Data rate (kb/s)	BS reference sensitivity level (dBm)	[FER/BER]
12,2	-110	BER shall not exceed 0,001

7.2.2 Maximum frequency deviation for receiver performance

7.2.2.1 Test purpose

7.2.2.2 Test case

7.2.2.3 Conformance requirements

7.3 Dynamic range

The receiver dynamic range is the input power range at each BS antenna connector over which the [FER/BER] does not exceed a specific rate.

7.3.1 Test purpose

7.3.2 Test case

7.3.3 Conformance requirements

7.4 Adjacent Channel Selectivity (ACS)

7.4.1 Test purpose

Adjacent channel selectivity (ACS) is a measure of the receiver ability to receive a wanted signal at is assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the center frequency of the assigned channel. ACS is the ratio of the receiver filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

7.4.2 Test case

7.4.3 Conformance Requirements

The BER shall not exceed 0,001 for the parameters specified in table 7.4.3.1.

Table 7.4.3.1: Adjacent channel selectivity

Parameter	Level	Unit
Data rate	12,2	kbit/s
Wanted signal	[ ]	dBm
Interfering signal	[ ]	dBm
Fuw (Modulated)	5	MHz

7.5 Blocking characteristics

7.5.1 Test purpose

The blocking characteristics is a measure of the receiver ability to receive a wanted signal at is assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the adjacent channels. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

7.5.2 Test case

7.5.3 Conformance requirements

The static reference performance as specified in subclause 7.2 should be met with a wanted and an interfering signal coupled to the BS antenna input using the parameters given in Table 7.5.3.1.

Table 7.5.3.1: Wanted and the interfering signal parameters for the blocking characteristics test

Center Frequency of Interfering Signal	Interfering Signal Level	Wanted Signal Level	Minimum Offset of Interfering Signal	Type of Interfering Signal
1900 – 1920 MHz, 2010 – 2025 MHz	-40 dBm	<REFSENS> + 6 dB	10 MHz	WCDMA signal with one code
1880 – 1900 MHz, 1990 – 2010 MHz, 2025 – 2045 MHz	-40 dBm	<REFSENS> + 6 dB	10 MHz	WCDMA signal with one code
1920 – 1980 MHz	-40 dBm	<REFSENS> + 6 dB	10 MHz	WCDMA signal with one code
<1880, 1980 – 1990 MHz, > 2045 MHz	-15 dBm	<REFSENS> + 6 dB	—	CW carrier

7.6 Intermodulation characteristics

7.6.1 Test purpose

Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

7.6.2 Test case

< Editor's note: This section is tentatively based on text in TS 25.141 V0.1.0, which, in turn, is taken from Section 6.1.2.5 of ARIB Vol. 5. >

(a) Measuring system diagram

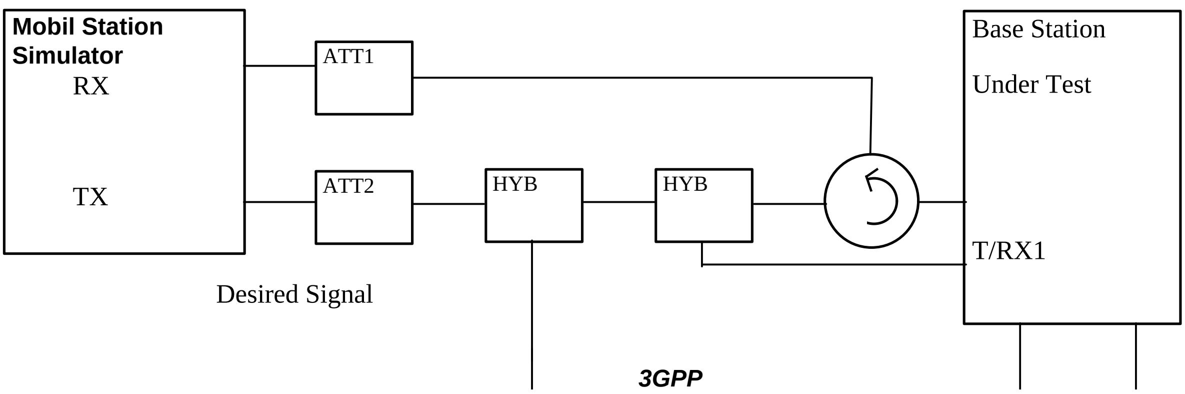

Figure 7.7.2.1: Measuring system setup for reception intermodulation sensitivity

(b) Measurement method

1. Connect the BTS to a mobile station simulator and a Signal generator.
2. Transmitter power control (TPC) is disabled.*
3. Transmit a PN signal from the MS simulator with a level 3dB higher than the minimum required sensitivity level. (refer to 6.1.2.2)
4. Adjust the Signal generators to frequency offsets of [+10**] MHz and [+20.1**] MHz from the assigned WCDMA channel.
5. Adjust the power of the Signal generators to the absolute value specified for the base station type.
6. Measure the performance (FER/BER) of the base station.
7. Repeat the measurement for frequency offsets [-10**] MHz and [-20.1**] MHz.

* Necessity and method of closed loop measurement is for future study.

** These values are working assumption for the 5MHz carrier spacing.

7.6.3 Conformance requirements

The static reference performance as specified in clause 7.2 should be met when the following signals are coupled to the BS antenna input:

- a wanted signal at the assigned channel frequency, 6 dB above the static reference level;
- two interfering signals with the parameters given in Table 7.6.3.1.

Table 7.6.3.1: Parameters of the interfering signals

Interfering Signal Level	Offset	Type of Interfering Signal
- 48 dBm	10 MHz	CW signal
- 48 dBm	20 MHz	WCDMA signal with one code

7.7 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the BS receiver antenna connector.

7.7.1 Test purpose

7.7.2 Test case

7.7.3 Conformance requirements

The spurious emission shall be:

a) Less than [-78] dBm/3.84 MHz at the BS receiver antenna connector, for frequencies within the BS receive band.

b) Less than [-57] dBm/100 kHz at the BS receiver antenna connector, for frequencies bands from 9kHz to 1GHz.

c) Less than [-47] dBm/100 kHz at the BS receiver antenna connector, for frequencies bands from 1GHz to 12.75GHz.

7.8 Timing advance (TA) requirements

7.8.1 Test purpose

7.8.2 Test case

7.8.3 Conformance requirements

The conditions under which the requirements must be met shall be 3dB below reference sensitivity level in section 7.2.

On request the BS shall measure the delay of the received signal relative to the expected signal from an UE at zero distance under static channel conditions. This delay, called the timing advance, shall be rounded to the nearest value corresponding to 4 chips period. The delay shall be assessed in such a way that the measurement error (due to noise and interference) is less than 2 chips periods for stationary UE.

8 Performance requirements

8.1 General

Performance requirements are specified for a number of test environments and multi-path channel classes.

8.2 Dynamic reference sensitivity performance

The minimum required dynamic reference sensitivity performance is specified according to the traffic rate and the propagation conditions.

8.2.1 Performance in AWGN channel

The performance requirement in AWGN channel is determined by the Eb/I0 required for BER=10-3, 10-6. The BER is calculated for each of the possible data services.

8.2.1.1 Single link performance

8.2.1.1.1 Test purpose

8.2.1.1.2 Test case

8.2.1.1.3 Conformance requirements

8.2.1.2 Multi link performance

8.2.1.2.1 Test purpose

8.2.1.2.2 Test case

8.2.1.2.3 Conformance requirements

8.2.2 Performance in multipath fading channels

The performance requirement of reverse link with/without TPC in multipath fading channels is determined by the Eb/I0 required for BER=10-3, 10-6. The BER is calculated for each of the possible data services.

8.2.2.1 Single link performance

8.2.2.1.1 Performance without TPC

8.2.2.1.1.1 Test purpose

8.2.2.1.1.2 Test case

8.2.2.1.1.3 Conformance requirements

8.2.2.1.2 Performance with TPC

8.2.2.1.2.1 Test purpose

8.2.2.1.2.2 Test case

8.2.2.1.2.3 Conformance requirements

8.2.2.2 Multi link performance

8.2.2.2.1 Test purpose

8.2.2.2.2 Test case

8.2.2.2.3 Conformance requirements

8.3 BS synchronisation performance

8.3.1 Test purpose

8.3.2 Test case

8.3.3 Conformance requirements

The timing error of BSs synchronised to each other shall be less than [5] µs.

Annex A (normative): Global in-channel Tx test

A.1 General

The global in-channel Tx test enables the measurement of all relevant parameters that describe the in-channel quality of the output signal of the Tx under test in a single measurement process.

A.2 Definition of the process

A.2.1 Basic principle

The process is based on the comparison of the actual **output signal of the Tx under test**, received by an ideal receiver, with a **reference signal**, that is generated by the measuring equipment and represents an ideal error free received signal. All signals are represented as equivalent (generally complex) baseband signals.

A.2.2 Output signal of the Tx under test

The output signal of the Tx under test is recorded through a matched filter (RRC 0.22, correct in shape and in position on the frequency axis) at one sample per chip.

Depending on the parameter to be evaluated, it is appropriate to represent the recorded signal in one of the following two different forms:

Form1 (representing the physical signal in the entire measurement interval):

one vector **Z**, containing N = n x m complex samples;

with

n: number of symbols in the measurement interval;

m: number of chips per symbol.

Form 2 (derived from form 1 by separating the samples into symbol intervals):

n time sequential vectors **z** with m complex samples, where each vector comprises a symbol interval.

A.2.3 Reference signal

The reference signal is constructed by the measuring equipment according to the relevant Tx specifications, filtered by a matched filter and sampled at the Inter-Symbol-Interference-free instants.

Depending of the parameter to be evaluated, it is appropriate to represent the reference set of samples in one of the following three different forms:

Form1 (representing the physical signal in the entire measurement interval):

one vector **R**, containing N = n x m complex samples;

with

n: number of symbols in the measurement interval;

m: number of chips per symbol.

Form 2 (derived from form 1 by separating the samples into symbol intervals):

n time-sequential vectors **r** with m complex samples, where each vector comprises a symbol interval.

(Note: Clarification is needed in case of a multi-code with multi-rate signal)

Form 3 (derived from form 2 by separating the samples into code signals):

n sequential expressions $\sum_{i=1}^{k} \mathbf{rc}_i$,

with

k: number of codes;

a single summand $\mathbf{rc}_i$ representing the vector of one code i, containing m complex samples of the symbol interval

A.2.4 Provisions in case of multi code signals

In case of multi code signals, the code multiplex shall contain only orthogonal codes. (Otherwise non-orthogonal codes must be eliminated (e.g. by time-windowing the measurement interval or switch off).

A.2.5 Classification of measurement results

The measurement results achieved by the global in-channel Tx test can be classified into two types:

Results of type 1, where the error-free parameter has a non-zero magnitude. These parameters are:

RF Frequency

(Chip Frequency)

Power

Code Domain Power (in case of multi code)

Timing (only for MS)

Results of type 2, where the error-free parameter has value zero. These parameters are:

Error Vector Magnitude

Peak Code Domain Power Error

A.2.6 Process definition to achieve results of type 1

The reference signal is varied with respect to the parameters mentioned in subclause A.2.5 under "results of type 1" in order to achieve best fit with the recorded signal under test (output signal of the Tx under test, filtered and sampled according to subclause A.2.2). Best fit is achieved when the RMS difference value between the signal under test and the varied reference signal is an absolute minimum. The varied reference signal in this best fit case will be called **R'.**

The varied parameters leading to **R'** represent directly the wanted results of type 1. These measurement parameters are expressed as deviation from the reference value with dimensions same as the reference value.

In case of multi code, the type-1-parameters (frequency, (chip frequency) and timing) are varied commonly for all codes such that the process returns one frequency-error, (one chip-frequency error), one timing error.

(These parameters are not varied on the individual codes signals such that the process returns k frequency errors... . (k: number of codes)).

Only the type-1-parameters (code powers) are varied individually such that the process returns k code powers (k: number of codes)

A.2.7 Process definition to achieve results of type 2

The difference between the signal under test (**Z**; see subclause A.2.2) and the reference signal after the minimum process (**R'**; see subclause A.2.6) is the error vector **E** versus time:

$$\mathbf{E} = \mathbf{Z} - \mathbf{R'}.$$

Depending on the parameter to be evaluated, it is appropriate to represent **E** in one of the following two different forms:

Form1 (representing the physical error signal in the entire measurement interval):

One vector **E**, containing N = n x m complex samples;

with

n: number of symbols in the measurement interval

m: number of chips per symbol

Form 2 (derived from form 1 by separating the samples into symbol intervals):

n time-sequential vectors **e** with m complex samples comprising one symbol interval

E gives results of type 2 applying the two algorithms defined in subclauses A.2.7.1 and A.2.7.2.

A.2.7.1 Error Vector Magnitude

The Error Vector Magnitude EVM is calculated according to the following steps:

(1) Take the error vector **E** defined in subclause A.2.7 (form 1) and calculate the RMS value of **E** chip-wise over the entire measurement interval; the result will be called RMS(**E**).

(2) Take the reference vector **R** defined in subclause A.2.3 (form 1) and calculate the RMS value of **R** chip-wise over the entire measurement interval; the result will be called RMS(**R**)

(3) Calculate EVM according to

$$\mathrm{EVM} = \frac{\mathrm{RMS}(\mathbf{E})}{\mathrm{RMS}(\mathbf{R})} \times 100\%$$

(here, EVM is relative and expressed in %)

A.2.7.2 Peak Code Domain Power Error

The Peak Code Domain Power Error is calculated according to the following steps:

(1) Take the error vectors **e** defined in subclause A.2.7 (form 2) and the reference vectors $\mathbf{rc}_i$ defined in subclause A.2.3 (form 3) and calculate the inner product of **e** and $\mathbf{rc}_i$ chip-wise over the symbol duration for all symbols of the measurement interval and for all permitted codes of the code space.

This gives a matrix of format k x n, each value representing an error voltage connected with a specific symbol and a specific code, which can be exploited in a large variety.

k: number of codes

n: number of symbols in the measurement interval

(2) Calculate k RMS values, each RMS value unifying n symbols within one code.

(This values can be called "absolute Code-EVMs" [Volt].)

(3) Find the peak value among the k "absolute Code-EVMs".

(This value can be called "absolute Peak-Code-EVM" [Volt].)

(4) Calculate the following term:

$$10\lg \frac{(\text{absolute Peak - Code} - \text{EVM})^2}{(\text{RMS}(\mathbf{R}))^2} \text{ dB}.$$

This term is called Peak Code Domain Power Error (a relative value in dB).

(5) If the values RMS(**r**) are not constant during the measurement interval, Peak Code Domain Power Error should be expressed absolutely instead by the term:

$$\frac{(\text{absolute Peak} - \text{Code} - \text{EVM})^2}{50\,\text{Ohm}}$$

This term is called Absolute Peak Code Domain Power Error [Watt or dBm]

A.3 Applications

This process is applicable to the following paragraphs:

6.3 Frequency Stability

6.4 Output Power Dynamics

6.5 Transmit OFF Power

6.9 Modulation Accuracy

[Chip Frequency]

History

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