TSG-RAN Meeting #12 *RP-010367*
Stockholm, Sweden, 12 - 15 June 2001

Title: **Agreed CR (Release 4) to TS 25.143**

Source: **TSG-RAN WG4**

Agenda item: **8.4.4**

WG4 doc	Status WG4	Spec	CR	Phase	Title	Cat	V old	V new
R4-010726	agreed	25.143	1	Rel-4	Measurement uncertainty corrections	F	4.0.0	4.1.0

3GPP TSG RAN WG4 Meeting #17 **R4-010726**

Gothenburg, Sweden 21st - 25th May 2001

CR-Form-v4

CHANGE REQUEST

⌘ **25.143 CR 1** ⌘ ev **-** ⌘ Current version: 4.0.0 ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☒ Core Network ☐

Title:	⌘	Correction to Measurement Uncertainties and Test requirements
Source:	⌘	RAN WG4
Work item code:	⌘	RInImp-REP
Date:	⌘	22 May 2001
Category:	⌘	**F**
Release:	⌘	REL-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Test requirements are not finalised in current version. Some measurement set-ups need to be clarified. Editorial corrections required.
Summary of change:	⌘	Update of Measurement system uncertainty and Test tolerance tables and introduction of explicit test requirements. Editorial corrections. Test system Set-ups and Derivation of test requirements are updated.
Consequences if not approved:	⌘	Correct conformance tests cannot be performed.

Clauses affected:	⌘	5.1, 5.2, 6.1.3, 6.1.5, 7.5, 8.5, 9.1.5, 10.1.5, 10.2.5, 11.4.1, 11.5.1, 11.5.2, Annex A - A.1, A.2, A.3, A..4, A.5, A.6, A.7, Annex B.
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5 General test conditions and declarations

This specification applies only to UTRA/FDD Repeater.

The requirements of this clause apply to all applicable tests in this specification. Many of the tests in this specification measure a parameter relative to a value, that is not fully specified in the UTRA specifications. For these tests, the Minimum Requirement is determined relative to a nominal value specified by the manufacturer.

Some requirements for the Repeater may be regional as listed in subclause **Error! Reference source not found.**.

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

Schematic drawings for the individual measurement set-up can be found in the Annex.

5.1 Acceptable uncertainty of Test System

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

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

For RF test it should be noted that the uncertainties in subclause 0 apply to the Test System operating into a nominal 50 ohm load and do not include system effects due to mismatch between the DUT and the Test System.

5.1.1 Measurements of test environments

The measurement accuracy of the Repeater test environments defined in Subclause **Error! Reference source not found.**, 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 Measurements of Repeater

Table 0.1: Maximum Test System Uncertainty

Subclause	Maximun Test System Uncertainty	Range over which Test System Uncertainty Appies
0 6.1 Maximum output power	±[0,7] dB	
0 Frequency error	±[12] Hz	Measurement results of ± 500 Hz
0 8 Out of band gain	±[1,10,5] dB Calibration of test set-up must be made without D.U.T. in order to achieve the accuracy	
0 9.1 Spectrum emission mask	±[1,5] dB Due to carrier leakage for measurements specified in a 1MHz bandwidth close to the carrier (4 MHz to 8 MHz), integration of the measurement using several narrower bandwidth measurements may be necessary in order to achieve the above accuracy. The interference from the signal generator ACLR must be minimum 10 dB below that of a Base Station according toTS25.141	
9.2 Spurious emissions	In UTRA and coexistence receive bands: for results > -60 dBm ±[2,0] dB for results < -60 dBm ±[3,0] dB Outside above range: emission power f ≤ 2,2 GHz ±[1,5] dB; 2,2 GHz < f ≤ 4 GHz ±[2,0] dB; f > 4 GHz ±[4,0] dB. The interference from the signal generator ACLR must be minimum 10 dB below that of a Base Station according toTS25.141	
0 10.1 Error vector magnitude	± [2,5] % (single code applied) (±2,5 % measurement error for single code). [5,0] % EVM in the stimulus signal (single code) will shift the EVM maximum value 0,7% to 18,2%. (RSS repeater EVM and Stimulus EVM.)	Measurement results from 12,5% to 22,5% at signal power = P_max – 3dB to P_max – 18 dB
0 10.2 Peak code domain error	± [1,1]dB [1,0]dB Formula: RSS measurement error and impedance mismatch error (using ±1,0 dB measurement error and ±0,5 dB impedance mismatch error (stimulus side) assuming 14 dB return loss)	Measurement results from – 36 dB to – 30 dB, at signal power = P_max – 3 dB to P_max – 18 dB
0 Input intermodulation Characteristics	±[1,2] dB±[0,6] dB Formula: RSS CW1 level error, 2 x CW2 level error, and measurement error (using all errrors = ±[0,5] dB)	

5.2 Repeater test tolerances (informative)

The Test Tolerances defined in this subclause have been used to relax the Minimum Requirements in this specification to derive the Test Requirements.

The Test Tolerances are derived from Test System uncertainties, regulatory requirements and criticality to system performance. As a result, the Test Tolerances may sometimes be set to zero.

The test tolerances should not be modified for any reason e.g. to take account of commonly known test system errors (such as mismatch, cable loss, etc.)

Table 0.2: Test Tolerance

Subclause	Test Tolerance	Notes
0 6.1 Maximum output power	[0,7] dB	
0 Frequency error	[12] Hz	
0 8 Out of band gain	[0,5]dB[1,1]dB	
0 9.1 Spectrum emission mask	[1,5] dB	
9.2 Spurious emissions	In UTRA and coexistence receive bands: for results > -60 dBm [2,0] dB for results < -60 dBm [3,0] dB Outside above range: emission power f ≤ 2,2 GHz [1,5] dB; 2,2 GHz < f ≤ 4 GHz [2,0] dB; f > 4 GHz [4,0] dB. [0] dB	
0 10.1 Error vector magnitude	[0] %[2,5] %	Target value is shifted due to stimulus EVM
0 10.2 Peak code domain error	[1,1] dB[1,0] dB	
0 Input intermodulation Characteristics	[1,2]dB[0,6]dB	

5.3 Interpretation of measurement results

The measurement results returned by the Test System are compared – without any modification – against the Test Requirements as defined by the share risk principle.

The share risk principle is defined in ETR 273 Part 1 sub-part 2 section 6.5.

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

The recorded value for the Test System uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in subclause 0 of this specification.

If the Test System for a test is known to have a measurement uncertainty greater than that specified in subclause 0, it is still permitted to use this apparatus provided that an adjustment is made as follows.

Any additional uncertainty in the Test System over and above that specified in subclause 0 shall be used to tighten the Test Requirement-making the test harder to pass. (For some tests e.g. receiver test, this may require modification of stimulus signals). This procedure will ensure that a Test System not compliant with subclause 0does not increase the chance of passing a device under test where that device would otherwise have failed the test if a Test System compliant with subclause 0 had been used.

…...

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 Minimum Requirements

In normal conditions as specified in section **Error! Reference source not found.**, the Repeater maximum output power shall remain within limits specified in Table 0.1 relative to the manufacturer's rated output power.

Table 0.1: 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	+2 dB and -2 dB
P < 31 dBm	+3 dB and -3 dB

In extreme conditions as specified in section **Error! Reference source not found.**, the Repeater maximum output power shall remain within limits specified in Table 0.2 relative to the manufacturer's rated output power.

Table 0.2: 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	+2,5 dB and -2,5 dB
P < 31 dBm	+4 dB and -4 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 **Error! Reference source not found.**.

6.1.3 Test purpose

To verify that the ~~Frequency Error~~Repeater maximum output power is within the limit specified in 0.

6.1.4 Method of test

6.1.4.1 Initial conditions

1. Set-up the equipment as shown in annex A.
2. Connect the signal generator equipment to the Repeater input port.
3. Connect the power measuring equipment to the Repeater output port.

6.1.4.2 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.
4. Increase the power with 10 dB compare to the level obtained in step 2.
5. Measure the mean power at the RF output port over a certain slot.

6.1.5 Test Requirements

In normal conditions as specified in section **Error! Reference source not found.**, the Repeater maximum output power shall remain within limits specified in Table 0.1 relative to the manufacturer's rated output power.

Table 0.3: Repeater output power; normal conditions

Rated output power	Limit
P ≥ 43 dBm	+2,7 dB and –2,7 dB ~~+2 dB and –2 dB~~
39 ≤ P < 43 dBm	+2,7 dB and –2,7 dB ~~+2 dB and –2 dB~~
31 ≤ P < 39 dBm	+2,7 dB and –2,7 dB ~~+2 dB and –2 dB~~
P < 31 dBm	+3,7 dB and –3,7 dB ~~+3 dB and –3 dB~~

In extreme conditions as specified in section **Error! Reference source not found.**, the Repeater maximum output power shall remain within limits specified in Table 0.2 relative to the manufacturer's rated output power.

Table 0.4: Repeater output power; extreme conditions

Rated output power	Limit
P ≥ 43 dBm	+3,2 dB and –3,2 dB ~~+2,5 dB and –2,5 dB~~
39 ≤ P < 43 dBm	+3,2 dB and –3,2 dB ~~+2,5 dB and –2,5 dB~~
31 ≤ P < 39 dBm	+3,2 dB and –3,2 dB ~~+2,5 dB and –2,5 dB~~
P < 31 dBm	+4,7 dB and –4,7 dB ~~+4 dB and –4 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 **Error! Reference source not found.**.

NOTE: If the above Test Requirement differs from the Minimum Requirement then the Test Tolerance applied for this test is non zero. The Test Tolerance for this test is defined in subclause 0 and the explanation of how the Minimum Requirement has been relaxed by the Test Tolerance is given in Annex 0.

7 Frequency stability

Frequency error is the measure of the difference between the frequency of the received signal and the frequency of the re-transmitted signal.

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. The test shall address the uplink and the downlink path of the Repeater.

7.2 Minimum Requirement

In normal conditions as specified in section **Error! Reference source not found.** the frequency deviation shall be within ± 0,01 ppm.

7.3 Test purpose

To verify that the Frequency Error is within the limit specified in 0.

7.4 Method of test

7.4.1 Initial conditions

1. Set-up the equipment as shown in annex A.
2. Connect the cw signal generator equipment to the Repeater input port.
3. Connect the frequency counter to the Repeater output port. Both the signal generator and the frequency counter shall use the same reference frequency.
4. Adjust the input power to the Repeater to create the maximum nominal Repeater output power as declared by the manufacturer at maximum gain.

7.4.2 Procedure

Measure the frequency error for both paths Uplink and Downlink of the Repeater.

7.5 Test requirements

The measurement result of 0 shall not exceed:

$$| f_{IN} - f_{out} | \leq (f_{out} * 0{,}01 \text{ ppm}) + 12 \text{ Hz}$$

8 Out of band gain

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 both paths Uplink and Downlink of the Repeater.

8.2 Minimum Requirements

The requirement shall be met by a Repeater operating at maximum gain. In normal conditions as specified in section **Error! Reference source not found.** the gain outside the operating band shall not exceed the maximum level specified in Table 0.1, where:

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

Table 0.1: 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	35 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

Set-up the equipment as shown in annex A.

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

Table 0.2: Out of band gain limits

Frequency offset from the carrier frequency, f_offset	Maximum level
2,7 ≤ f_offset < 3,5 MHz	60,5 dB
3,5 ≤ f < 7,5 MHz	45,5 dB
7,5 ≤ f_offset < 12,5 MHz	45,5 dB
12,5 MHz ≤ f_offset	35,5 dB

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

9 Unwanted emission

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 0.1, Table 0.2, Table 0.3, and Table 0.4 below may be mandatory in certain regions. In other regions this mask may not be applied.

9.1.2 Minimum 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. In normal conditions as specified in section **Error! Reference source not found.** emissions shall not exceed the maximum level specified in Table 0.1, Table 0.2, Table 0.3, and Table 0.4 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 0.1: 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 0.2: 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 0.3: 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 0.4: 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. Set-up the equipment as shown in annex A.
2. 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.
3. Measurements with an offset from the carrier centre frequency between 2,515 MHz and 4,0 MHz shall use a 30 kHz measurement bandwidth.
4. 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.
5. 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.
4. Increase the power with 10 dB compare to the level obtained in step 2.
5. Measure the emission at the specified frequencies with specified measurement bandwidth and note that the measured value does not exceed the specified value.
6. Repeat the test for the opposite path of the Repeater.

9.1.5 Test requirements

The measurement result of step 3 and 5 of 0 shall not exceed the maximum level specified in tables 9.5 to 9.8 for the appropriate Repeater maximum output power.

Table 0.5: 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	-12,5 dBm~~-14 dBm~~	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	-12,5 – 15·(~~-14 – 15·~~(f_offset- 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	-24,5 dBm~~-26 dBm~~	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	-11,5 dBm~~-13 dBm~~	1 MHz
7,5 ≤ Δf MHz	8,0 MHz ≤ f_offset < f_offset$_{max}$	-11,5 dBm~~-13 dBm~~	1 MHz

Table 0.6: 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	-12,5 dBm~~-14 dBm~~	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	-12,5 – 15·(~~-14 – 15·~~(f_offset – 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	-24,5 dBm~~-26 dBm~~	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	-11,5 dBm~~-13 dBm~~	1 MHz
7,5 ≤ Δf MHz	8,0MHz ≤ f_offset < f_offset$_{max}$	P – 54,5 dBm~~P – 56 dBm~~	1 MHz

Table 0.7: 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 – 51,5 dBm~~53 dBm~~	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	P – 51,5 ~~– 53 –~~ 15·(f_offset – 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	P – 63,5 dBm~~65 dBm~~	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	P – 50,5 dBm~~52 dBm~~	1 MHz
7,5 ≤ Δf MHz	8,0MHz ≤ f_offset < f_offset$_{max}$	P – 54,5 dBm~~56 dBm~~	1 MHz

Table 0.8: 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	-20,5 dBm~~-22 dBm~~	30 kHz
2,7 ≤ Δf < 3,5 MHz	2,715MHz ≤ f_offset < 3,515MHz	-20,5 ~~-22 –~~ 15·(f_offset - 2,715) dBm	30 kHz
	3,515MHz ≤ f_offset < 4,0MHz	-32,5 dBm~~-34 dBm~~	30 kHz
3,5 ≤ Δf < 7,5 MHz	4,0 MHz ≤ f_offset < 8,0MHz	-19,5 dBm~~-21 dBm~~	1 MHz
7,5 ≤ Δf MHz	8,0MHz ≤ f_offset < f_offset$_{max}$	-23,5 dBm~~-25 dBm~~	1 MHz

NOTE: If the above Test Requirement differs from the Minimum Requirement then the Test Tolerance applied for this test is non-zero. The Test Tolerance for this test is defined in subclause 0 and the explanation of how the Minimum Requirement has been relaxed by the Test Tolerance is given in Annex 0.

9.2 Spurious emissions

….

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 Error Vector Magnitude is a measure of the difference between the theoretical waveform and a modified version of the measured waveform. The modification is done according to annex E of TS25.141. This difference is called the error vector. The EVM result is defined as the square root of the ratio of the mean error vector power to the modified mean reference signal power expressed as a %. The measurement interval is one power control group (timeslot).

10.1.2 Minimum Requirements

In normal conditions as specified in section **Error! Reference source not found.** 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 0 after the signal passed through the Repeater..

10.1.4 Method of test

10.1.4.1 Initial conditions

Set-up the equipment as shown in annex A.

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 is used to measure the EVM value.

10.1.4.2 Procedure

The test has to be performed in the uplink and the downlink path of the Repeater. The EVM has to be measured according to Annex E of TS25.141

10.1.4.2 Stimulus EVM effect

The stimulus signal generator EVM will RSS with the tested repeater EVM. The target for the recorded value is adjusted accordingly in the test requirements.

10.1.5 Test requirements

In normal conditions as specified in section **Error! Reference source not found.**, the Error Vector Magnitude, as defined in TS25.106, shall not exceed 18,2%.

~~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 Peak Code Domain Error is computed by projecting the error vector onto the code domain at a specific spreading factor. The Code Domain Error for every code in the domain is defined as the ratio of the mean power of the projection onto that code, to the mean power of the composite reference waveform. This ratio is expressed in dB. The Peak Code Domain Error is defined as the maximum value for the Code Domain Error for all codes. The measurement interval is one power control group (timeslot).

10.2.2 Minimum Requirements

In normal conditions as specified in section **Error! Reference source not found.** the peak code domain error shall not exceed –35 dB 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 0 after the signal passed through the Repeater.

10.2.4 Method of test

10.2.4.1 Initial conditions

Set-up the equipment as shown in annex A.

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 is used to measure the peak code domain error value.

10.2.4.2 Procedure

The test has to be performed in the uplink and the downlink path of the Repeater. The peak code domain error as described in TS25.141 Annex E has to be measured.

10.2.5 Test requirements

In normal conditions as specified in section **Error! Reference source not found.** the peak code domain error shall not exceed –33,9 dB at spreading factor 256 as defined in TS25.106.

~~The peak code domain error shall meet the limit specified in 10.2.2.~~

11 Input intermodulation

The input intermodulation is a measure of the capability of the Repeater to inhibit the generation of interference in the operating band, in the presence of interfering signals on frequencies other than the operating band.

11.1 Definition and applicability

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 Repeater to maintain the wanted frequency free of internally created interference.

This test applies to Uplink and Downlink path of the Repeater.

11.2 Minimum Requirements

11.2.1 Mandatory requirement

In normal conditions as specified in section **Error! Reference source not found.** the intermodulation performance should be met when the following signals are applied to the Repeater:

Table 11.1 : Input intermodulation requirement

f_offset	Interfering Signal Levels	Type of signals	Measurement bandwidth
3,5 MHz	-40 dBm	2 CW carriers	1 MHz

For the parameters specified in table 11.1, the power in the operating band shall not increase by more than 10 dB at the output of the Repeater as measured in the centre of the operating band, compared to the level obtained without interfering signals applied.

11.2.2 Co-location with GSM900 and/or DCS1800

In normal conditions as specified in section **Error! Reference source not found.** the intermodulation performance should be met when the following signals are applied to the Repeater:

Table 11.2 : Input intermodulation requirements for interfering signals in the GSM900 and DCS1800 bands

Frequency of interfering signals	Interfering Signal Levels	Type of signals	Measurement bandwidth
876 - 915 MHz	20 dBm	2 CW carriers	1 MHz
921 - 960 MHz	20 dBm	2 CW carriers	1 MHz
1710 - 1785 MHz	20 dBm	2 CW carriers	1 MHz
1805 - 1880 MHz	20 dBm	2 CW carriers	1 MHz

For the parameters specified in table 11.2, the power in the operating band shall not increase with more than 10 dB at the output of the repeater as measured in the centre of the operating band, compared to the level obtained without interfering signals applied.

11.3 Test purpose

The purpose of this test is to verify that the Repeater meets the intermodulation characteristics requirements as specified in TS 25.106, subclause 11.1.

11.4 Method of test

11.4.1 Initial conditions

1. Set the Repeater to maximum gain.
2. Connect two signal generators with a combining circuit or one signal generator with the ability to generate several cw carriers to the input.
3. Connect a spectrum analyser to the output of the Repeater. Set the resolution bandwidth to 1 MHz in the centre of the operating band. Set averaging to 1 second or more.

11.4.2 Procedure

1. Adjust the frequency of the input signals so that the lowest order intermodulation product is positioned in the centre of the operating band, according to section 0.
2. Take the measurement of the rise of the output signal.
3. Repeat the measurement for the opposite path of the Repeater.

11.5 Test requirements

11.5.1 Mandatory requirement

In normal conditions as specified in section **Error! Reference source not found.** the intermodulation performance should be met when the following signals are applied to the Repeater:

Table 11.1 : Input intermodulation requirement

f_offset	Interfering Signal Levels	Type of signals	Measurement bandwidth
3,5 MHz	-40 dBm	2 CW carriers	1 MHz

For the parameters specified in table 11.1, the power in the operating band shall not increase by more than 11,2 dB at the output of the Repeater as measured in the centre of the operating band, compared to the level obtained without interfering signals applied.

11.5.2 Co-location with GSM900 and/or DCS1800

In normal conditions as specified in section **Error! Reference source not found.** the intermodulation performance should be met when the following signals are applied to the Repeater:

Table 11.2 : Input intermodulation requirements for interfering signals in the GSM900 and DCS1800 bands

Frequency of interfering signals	Interfering Signal Levels	Type of signals	Measurement bandwidth
876 - 915 MHz	20 dBm	2 CW carriers	1 MHz
921 - 960 MHz	20 dBm	2 CW carriers	1 MHz
1710 - 1785 MHz	20 dBm	2 CW carriers	1 MHz
1805 - 1880 MHz	20 dBm	2 CW carriers	1 MHz

For the parameters specified in table 11.2, the power in the operating band shall not increase with more than 11,2 dB at the output of the repeater as measured in the centre of the operating band, compared to the level obtained without interfering signals applied.

~~The input intermodulation shall not exceed the value specified in section 11.2.~~

Annex A (informative): Repeater measurement system set-up

Example of measurement system set-ups are attached below as an informative annex.

A.1 Maximum output power

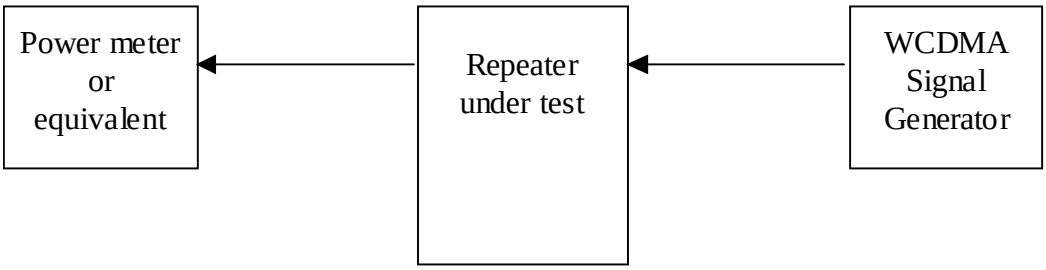

Figure A.1: Measuring system set-up for maximum output power.

Note that a repeater is a bi-directional device. The signal generator may need protection.

A.2 Frequency stability

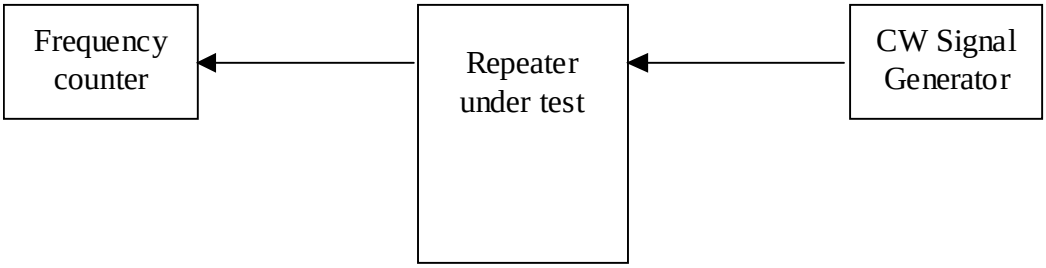

Figure A.2: Measurement system set-up for RF frequency stability.

Note that a repeater is a bi-directional device. The signal generator may need protection.

A.3 Out of band gain

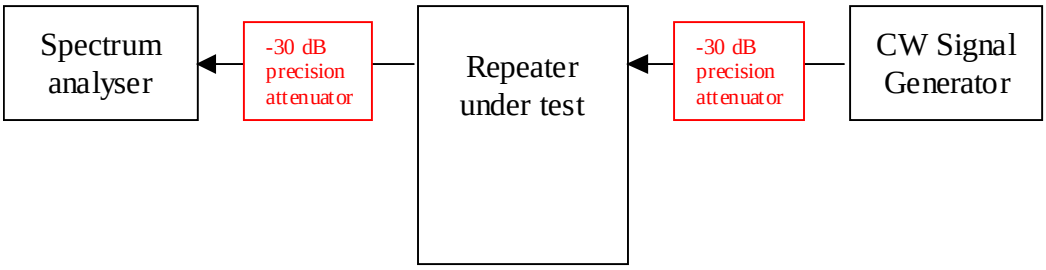

Figure A.3: Measuring system set-up for out of band gain.

A.4 Unwanted emission: Spectrum emission mask

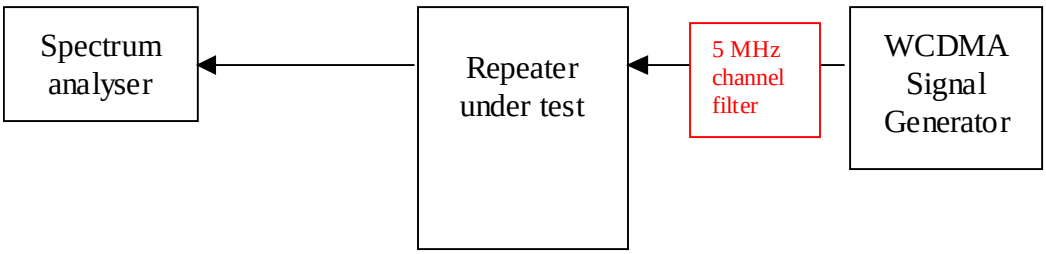

Figure A.4: Measuring system Set-up for unwanted emission: spectrum emission mask.

Note that a repeater is a bi-directional device. The signal generator may need protection.

A.5 Unwanted emission: Spurious emission

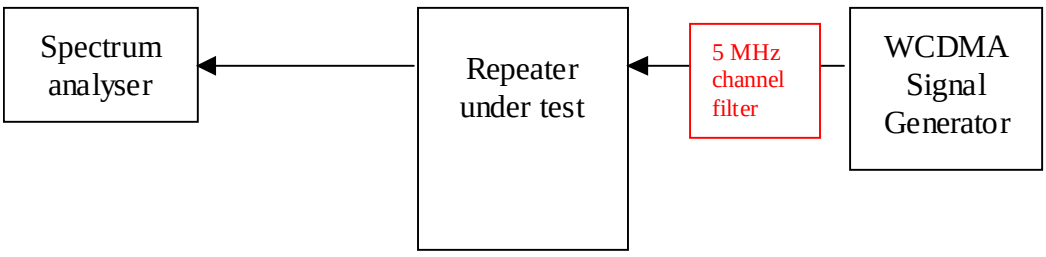

Figure A.5: Measuring system set-up for unwanted emission: spurious emission.

Note that a repeater is a bi-directional device. The signal generator may need protection.

A.6 Modulation Accuracy: Error Vector Magnitude

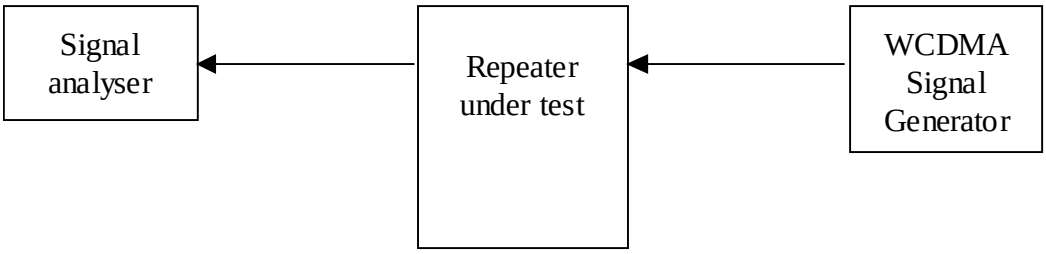

Figure A.6: Measuring system set-up for modulation accuracy: error vector magnitude.

Note that a repeater is a bi-directional device. The signal generator may need protection.

A.7 Modulation Accuracy: Peak Code Domain Error

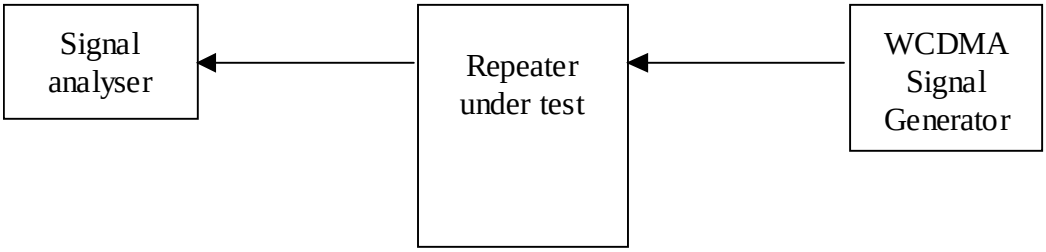

Figure A.7: Measuring system set-up for modulation accuracy: peak code domain error.

Note that a repeater is a bi-directional device. The signal generator may need protection.

Annex B (informative): Derivation of Test Requirements

The Test Requirements in this specification have been calculated by relaxing the Minimum Requirements of the core specification using the Test Tolerances defined in subclause 5.2. When the Test Tolerance is zero, the Test Requirement will be the same as the Minimum Requirement. When the Test Tolerance is non-zero, the Test Requirements will differ from the Minimum Requirements, and the formula used for this relaxation is given in table B.1.

Table 0.1: Derivation of Test Requierments

Clause number	Title	Minimum Requirement in TS 25.106~~TS 25.104~~	Test Tolerance (TT)	Test Requirement in TS 25.143~~TS 25.141~~
0	6.1 Maximum output power	In normal conditions Table 6.1	0,7 dB	Formula: Upper limit + TT Lower limit - TT In normal conditions refer to Table 6.3
		In extreme conditions Tabel 6.2		In extreme conditions refer to Table 6.4
0	9.1 Spectrum emission mask	Tables 9.1, 9.2, 9.3 and 9.4: "Maximum level" = X dB	[1,5] dB	Formula: Maximum level + TT Refer to tables 9.5, 9.6, 9.7 and 9.8 ~~:Tables 9.1, 9.2, 9.3 and 9.4: "Maximum level" = X+1,5 dB~~
7	Frequency stability	7.1 minimum requirement	12 Hz	Formula: Relative error + TT Refer to 7.5 Test requirements
8	Out of Band Gain	Table 8.1: Out of band gain limits	[0,5] dB	Formula: Maximum level + TT Refer to table 8.2
9.2	Spurious emissions	Tables 9.5, to 9.15	[0 dB]	
10.1	Error Vector Magnitude	10.1.1 Minimum requirement	[0] %	Formula: RSS Simulus EVM and Repeater EVM to get target EVM Refer to 10.1.5 Test requirements
10.2	Peak code domain error	10.2.1 Minimum requirement	[1,1 dB]	Formula: Maximum error + TT Refer to 10.2.5 Test requirements
11	Input intermodulation	11.5 Test requirements, and Tables 11.1 and 11.2	[1,2 dB]	Maximum in-band power increase + TT Refer to 11.5 Test requirements.