

TSG RAN Meeting #13
Beijing, China, 18-21 September 2001

RP-010632

Title: CRs (Rel-4) to TS 25.141

Source TSG RAN WG4

Agenda item: 8.4.4

RAN4 Tdoc	Spec	CR	Title	Cat	Phase	Curr Ver	New Ver
R4-011009	25.141	115	RACH message and preamble testcases for static and multipath fading case 3	F	Rel-4	4.1.0	4.2.0

Edinburgh, Great Britain, 3rd - 7th September 2001

CR-Form-v4

CHANGE REQUEST⌘ **25.141 CR 115** ⌘ ev **-** ⌘ Current version: **4.1.0** ⌘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:	⌘ RACH message and preamble testcases for static and multipath fading case 3														
Source:	⌘ RAN WG4														
Work item code:	⌘ TEI4 Date: ⌘ 2001-07-03														
Category:	⌘ F Release: ⌘ Rel-4														
Use <u>one</u> of the following categories:															
<table border="0"> <tr> <td>F (correction)</td> <td>2 (GSM Phase 2)</td> </tr> <tr> <td>A (corresponds to a correction in an earlier release)</td> <td>R96 (Release 1996)</td> </tr> <tr> <td>B (addition of feature),</td> <td>R97 (Release 1997)</td> </tr> <tr> <td>C (functional modification of feature)</td> <td>R98 (Release 1998)</td> </tr> <tr> <td>D (editorial modification)</td> <td>R99 (Release 1999)</td> </tr> <tr> <td></td> <td>REL-4 (Release 4)</td> </tr> <tr> <td></td> <td>REL-5 (Release 5)</td> </tr> </table>		F (correction)	2 (GSM Phase 2)	A (corresponds to a correction in an earlier release)	R96 (Release 1996)	B (addition of feature),	R97 (Release 1997)	C (functional modification of feature)	R98 (Release 1998)	D (editorial modification)	R99 (Release 1999)		REL-4 (Release 4)		REL-5 (Release 5)
F (correction)	2 (GSM Phase 2)														
A (corresponds to a correction in an earlier release)	R96 (Release 1996)														
B (addition of feature),	R97 (Release 1997)														
C (functional modification of feature)	R98 (Release 1998)														
D (editorial modification)	R99 (Release 1999)														
	REL-4 (Release 4)														
	REL-5 (Release 5)														
Detailed explanations of the above categories can be found in 3GPP <u>IR 21.900</u> .															

Reason for change:	⌘ RACH performance requirements are stated in 3GPP 25.104 v.4.1.0. Currently there are no testcases described in 3GPP 25.141 v.4.1.0. There are also missing headings in Annex B.
Summary of change:	⌘ Adding testcases for RACH message and preamble detection for static and multipath fading case 3.
Consequences if not approved:	⌘ RACH testcases are not described and can not be performed.

Clauses affected:	⌘ New clause 8.8 for RACH. New clause A.7 in Annex A. Headings in Annex B (new B.3).
Other specs affected:	⌘ <input checked="" type="checkbox"/> Other core specifications ⌘ 3GPP TS 25.104 V.4.1.0 (2001-06) <input type="checkbox"/> Test specifications <input type="checkbox"/> 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.

8.8 RACH performance

8.8.1 RACH preamble detection in static propagation conditions

8.8.1.1 Definition and applicability

The performance requirement of RACH for preamble detection in static propagation conditions is determined by the two parameters probability of false detection of the preamble (P_{fa}) and the probability of detection of preamble (P_d). The performance is measured by the required E_c/N_0 at probability of detection, P_d of 0.99 and 0.999. P_{fa} is defined as a conditional probability of erroneous detection of the preamble when input is only noise (+interference). P_d is defined as conditional probability of detection of the preamble when the signal is present. P_{fa} shall be 10^{-3} or less. Only one signature is used and it is known by the receiver.

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

8.8.1.2 Conformance requirement

The P_d shall be above or equal to the limits for the E_c/N_0 specified in table 8.16.

Table 8.16: Preamble detection requirements in AWGN channel

	$P_d = 0.99$	$P_d = 0.999$
Required E_c/N_0	-20.5 dB	-20.1 dB

The reference for this requirement is TS 25.104 subclause 8.7.1.

8.8.1.3 Test purpose

The test shall verify the receiver's ability to detect RACH preambles under static propagation conditions.

8.8.1.4 Method of test

8.8.1.4.1 Initial conditions

Test environment: normal; see subclause 4.4.1.

RF channels to be tested: B, M and T; see subclause 4.8

- 1) Connect the BS tester generating the wanted signal and AWGN generators to both BS antenna connectors for diversity reception via a combining network as shown in annex B.

8.8.1.4.2 Procedure

- 1) Adjust the AWGN generator to -84 dBm/3.84 MHz at the BS input.
- 2) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A.
- 3) Adjust the equipment so that required E_c/N_0 specified in table 8.16 is achieved. To achieve the specified E_c/N_0 , the wanted signal level (of the preamble part) at the BS input should be adjusted to: $-84 + E_c/N_0$ [dBm]. The wanted signal levels during transmission (of the preamble part) at the BS input for the specified E_c/N_0 levels in table 8.16 is found in table 8.17.

Table 8.17: Wanted signal levels (of the preamble part) during transmission in AWGN channel

	$P_d = 0.99$	$P_d = 0.999$
Wanted signal level during transmission	-104.5 dBm.	-104.1 dBm

- 4) The test signal generator sends a preamble and the receiver tries to detect the preamble. This pattern is repeated. Preamble detection should be made only on those access slots a preamble has been sent in.



Figure 8.2: RACH test signal pattern

8.8.1.5 Test requirements

The P_d shall be above or equal to the limits for the E_c/N_0 specified in table 8.16.

8.8.2 RACH preamble detection in multipath fading case 3

8.8.2.1 Definition and applicability

The performance requirement of RACH for preamble detection in in multipath fading case 3 is determined by the two parameters probability of false detection of the preamble (Pfa) and the probability of detection of preamble (Pd). The performance is measured by the required E_c/N_0 at probability of detection, Pd of 0.99 and 0.999. Pfa is defined as a conditional probability of erroneous detection of the preamble when input is only noise (+interference). Pd is defined as conditional probability of detection of the preamble when the signal is present. Pfa shall be 10^{-3} or less. Only one signature is used and it is known by the receiver.

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

8.8.2.2 Conformance requirement

The P_d shall be above or equal to the limits for the E_c/N_0 specified in table 8.18.

Table 8.18: Preamble detection requirements in fading case 3 channel

	Pd = 0.99	Pd = 0.999
Required E_c/N_0	-15.5 dB	-13.4 dB

The reference for this requirement is TS 25.104 subclause 8.7.1.

8.8.2.3 Test purpose

The test shall verify the receiver's ability to detect RACH preambles under multipath fading case 3 propagation conditions.

8.8.2.4 Method of test

8.8.2.4.1 Initial conditions

Test environment: normal; see subclause 4.4.1.

RF channels to be tested: B, M and T; see subclause 4.8

- 1) Connect the BS tester generating the wanted signal and AWGN generators to both BS antenna connectors for diversity reception via a combining network as shown in annex B.

8.8.2.4.2 Procedure

- 1) Adjust the AWGN generator to -84 dBm/3.84 MHz at the BS input.

- 2) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A.
- 3) Adjust the equipment so that required E_c/N_0 specified in table 8.18 is achieved. To achieve the specified E_c/N_0 , the wanted signal level (of the preamble part) at the BS input should be adjusted to: $-84+E_c/N_0$ [dBm]. The wanted signal levels during transmission (of the preamble part) at the BS input for the specified E_c/N_0 levels in table 8.18 is found in table 8.19.

Table 8.19: Wanted signal levels (of the preamble part) during transmission in fading case 3 channels

	$P_d = 0.99$	$P_d = 0.999$
Wanted signal level during transmission	-99.5 dBm	-97.4 dBm

- 4) The test signal generator sends a preamble and the receiver tries to detect the preamble. This pattern is repeated. Preamble detection should be made only on those access slots a preamble has been sent in.



Figure 8.3: RACH test signal pattern

8.8.2.5 Test requirements

The P_d shall be above or equal to the limits for the E_c/N_0 specified in table 8.18.

8.8.3 Demodulation of RACH message in static propagation conditions

8.8.3.1 Definition and applicability

The performance requirement of RACH in static propagation conditions is determined by the maximum Block Error Ratio (BLER) allowed when the receiver input signal is at a specified E_b/N_0 limit. The BLER is calculated for each of the measurement channels supported by the base station.

The power on the preamble is set to meet or exceed the requirements on P_{fa} and P_d in subclauses 8.8.1 and 8.8.2. Only one signature is used and it is known by the receiver.

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

8.8.3.2 Conformance requirement

The BLER shall not exceed the limit for the E_b/N_0 specified in table 8.20.

Table 8.20: Performance requirements in AWGN channel

Transport Block size TB and TTI in frames	E_b/N_0 for required BLER $< 10^{-1}$	E_b/N_0 for required BLER $< 10^{-2}$
168 bits, TTI = 20 ms	4.1 dB	5.0 dB
360 bits, TTI = 20 ms	3.9 dB	4.8 dB

The reference for this requirement is TS 25.104 subclause 8.7.2.

8.8.3.3 Test purpose

The test shall verify the receiver’s ability to receive the test signal under static propagation conditions with a BLER not exceeding a specified limit.

8.8.3.4 Method of test

8.8.3.4.1 Initial conditions

Test environment: normal; see subclause 4.4.1.

RF channels to be tested: B, M and T; see subclause 4.8

Preamble threshold factor: chosen to fulfil the requirements on Pfa and Pd in subclauses 8.8.1 and 8.8.2

- 1) Connect the BS tester generating the wanted signal and AWGN generators to both BS antenna connectors for diversity reception via a combining network as shown in annex B.

8.8.3.4.2 Procedure

- 1) Adjust the AWGN generator to -84 dBm/3.84 MHz at the BS input.
- 2) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A.
- 3) Adjust the equipment so that required E_b/N_0 specified in table 8.20 is achieved. To achieve the specified E_b/N_0 , the wanted signal level (of the message part) at the BS input should be adjusted to: $-84+10*\text{Log}10(\text{TB}/(\text{TTI}*3.84*10^6))+E_b/N_0$ [dBm]. The wanted signal levels during transmission (of the message part) at the BS input for the specified E_b/N_0 levels in table 8.20 is found in table 8.21.

Table 8.21: Wanted signal levels (of the message part) during transmission in AWGN channel

<u>Transport Block size TB and TTI in frames</u>	<u>Wanted signal level during transmission for required BLER<10⁻¹</u>	<u>Wanted signal level during transmission for required BLER<10⁻²</u>
168 bits, TTI = 20 ms	-106.5 dBm	-105.6 dBm
360 bits, TTI = 20 ms	-103.4 dBm	-102.5 dBm

- 4) The test signal generator sends a preamble followed by the actual RACH message. This pattern is repeated (see figure 8.4). The receiver tries to detect the preamble and the message. The block error rate is calculated for the messages that have been decoded. Messages following undetected preambles shall not be taken into account in the BLER measurement.



Figure 8.4: RACH test signal pattern

8.8.3.5 Test requirements

The BLER measured according the subclause 8.8.3.4.2 shall not exceed the limits specified in table 8.20.

8.8.4 Demodulation of RACH message in multipath fading case 3

8.8.4.1 Definition and applicability

The performance requirement of RACH in multipath fading case 3 is determined by the maximum Block Error Ratio (BLER) allowed when the receiver input signal is at a specified E_b/N_0 limit. The BLER is calculated for each of the measurement channels supported by the base station.

The power on the preamble is set to meet or exceed the requirements on Pfa and Pd in subclauses 8.8.1 and 8.8.2. Only one signature is used and it is known by the receiver.

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

8.8.4.2 Conformance requirement

The BLER shall not exceed the limit for the E_b/N_0 specified in table 8.22.

Table 8.22: Performance requirements in fading case 3 channel

<u>Transport Block size TB and TTI in frames</u>	<u>E_b/N_0 for required BLER < 10⁻¹</u>	<u>E_b/N_0 for required BLER < 10⁻²</u>
168 bits, TTI = 20 ms	7.4 dB	8.5 dB
360 bits, TTI = 20 ms	7.3 dB	8.3 dB

The reference for this requirement is TS 25.104 subclause 8.7.2.

8.8.4.3 Test purpose

The test shall verify the receiver's ability to receive the test signal under multipath fading case 3 propagation conditions with a BLER not exceeding a specified limit.

8.8.4.4 Method of test

8.8.4.4.1 Initial conditions

Test environment: normal; see subclause 4.4.1.

RF channels to be tested: B, M and T; see subclause 4.8

Preamble threshold factor: chosen to fulfil the requirements on Pfa and Pd in subclauses 8.8.1 and 8.8.2

- 1) Connect the BS tester generating the wanted signal and AWGN generators to both BS antenna connectors for diversity reception via a combining network as shown in annex B.

8.8.4.4.2 Procedure

- 1) Adjust the AWGN generator to -84 dBm/3.84 MHz at the BS input.
- 2) The characteristics of the wanted signal shall be configured according to the corresponding UL reference measurement channel defined in annex A.
- 3) Adjust the equipment so that required E_b/N_0 specified in table 8.22 is achieved. To achieve the specified E_b/N_0 , the wanted signal level (of the message part) at the BS input should be adjusted to: $-84 + 10 * \text{Log}_{10}(\text{TB}/(\text{TTI} * 3.84 * 10^6)) + E_b/N_0$ [dBm]. The wanted signal levels during transmission (of the message part) at the BS input for the specified E_b/N_0 levels in table 8.22 is found in table 8.23.

Table 8.23: Wanted signal levels (of the message part) during transmission in fading case 3 channel

<u>Transport Block size TB and TTI in frames</u>	<u>Wanted signal level during transmission for required BLER < 10⁻¹</u>	<u>Wanted signal level during transmission for required BLER < 10⁻²</u>
168 bits, TTI = 20 ms	-103.2 dBm	-102.1 dBm
360 bits, TTI = 20 ms	-100 dBm	-99 dBm

- 4) The test signal generator sends a preamble followed by the actual RACH message. This pattern is repeated (see figure 8.5). The receiver tries to detect the preamble and the message. The block error rate is calculated for the messages that have been decoded. Messages following undetected preambles shall not be taken into account in the BLER measurement.



Figure 8.5: RACH test signal pattern

8.8.4.5 Test requirements

The BLER measured according to subclause 8.8.4.4.2 shall not exceed the limits specified in table 8.22.

A.7 Reference measurement channels for UL RACH

The parameters for the UL RACH reference measurement channels are specified in Table A.7.

Table A.7: Reference measurement channels for UL RACH

<u>Parameter</u>		<u>Unit</u>	
RACH	<u>CRC</u>	<u>16</u>	<u>bits</u>
	<u>Channel Coding</u>	<u>Rate ½ conv. coding</u>	
	<u>TTI</u>	<u>20</u>	<u>ms</u>
	<u>TB size</u>	<u>168, 360</u>	<u>bits</u>
	<u>Rate Matching</u>	<u>Repetition</u>	
	<u>Number of diversity antennas</u>	<u>2</u>	
	<u>Preamble detection window size</u>	<u>256</u>	<u>chips</u>
<u>Power ratio of RACH Control/Data TB = 168</u>		<u>-2.69</u>	<u>dB</u>
<u>Power ratio of Control/Data TB = 360</u>		<u>-3.52</u>	<u>dB</u>

B.2.6 Receiver spurious emission

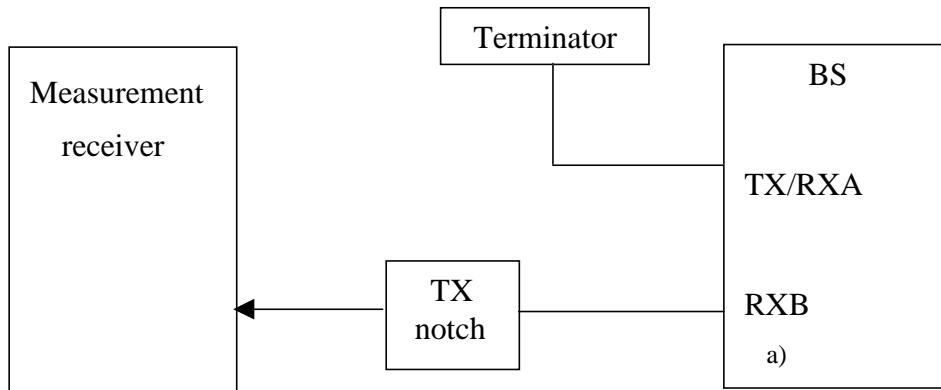


Figure B.12: Measuring system Set-up for Receiver spurious emission

B.3 Performance requirement

B.3.1 Demodulation of DCH and RACH in static conditions

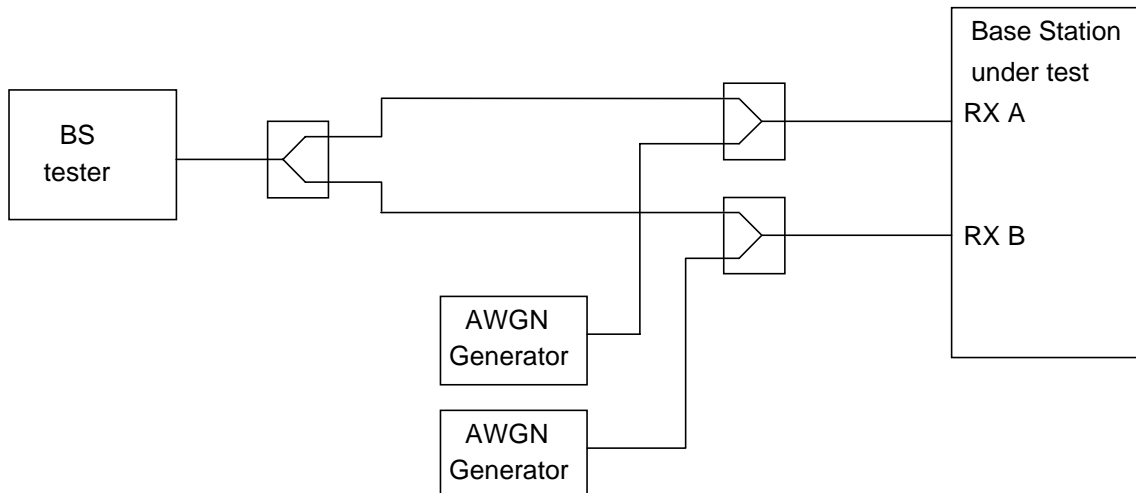


Figure B.13: Functional Set-up for Demodulation of DCH and RACH in static conditions

B.3.2 Demodulation of DCH and RACH in multipath fading conditions

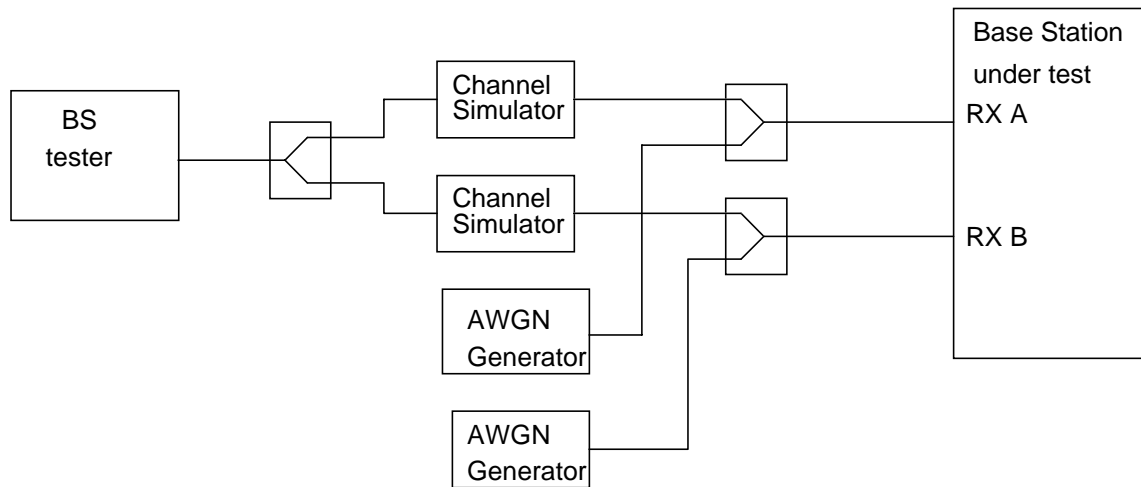


Figure B.14: Functional Set-up for Demodulation of DCH and RACH in multipath fading conditions

B.3.3 Verification of the internal BLER calculation

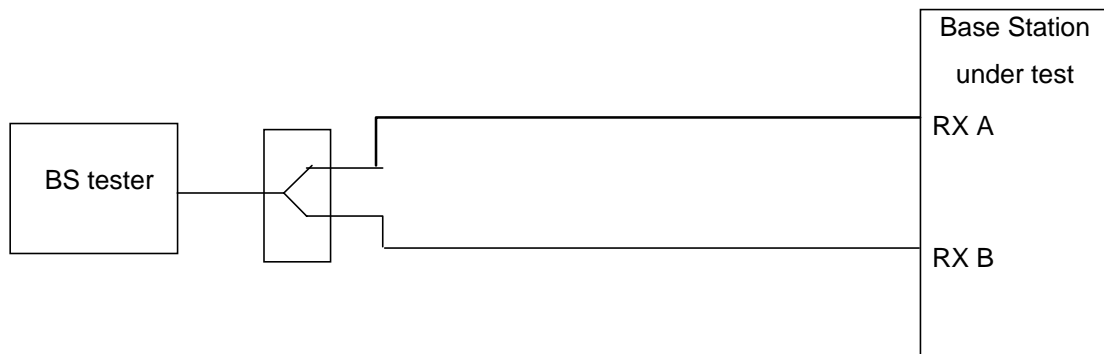


Figure B.15: Functional Set-up for Verification of the internal BLER calculation