TSG RAN Meeting #20 **RP-030216**
Hämeenlinna, Finland, 3 - 6 June, 2003

Title	**CR (Rel-5) to TS 25.142**
Source	**TSG RAN WG4**
Agenda Item	**7.4.5**

RAN4 Tdoc	Spec	CR	R	Cat	Rel	Curr Ver	Title	Work Item
R4-020589	25.142	167	1	F	Rel-5	5.4.0	Statistical approach for BER BLER tests for TDD	TEI5

3GPP TSG RAN WG4 (Radio) Meeting #27 **R4-030589**
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CR-Form-v7

CHANGE REQUEST

⌘ 25.142	CR 167	⌘ rev	1	⌘	Current version:	5.4.0 ⌘

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

Proposed change affects: UICC apps⌘ [ ] ME [ ] Radio Access Network [X] Core Network [ ]

Title:	⌘	Statistical approach for BER BLER tests for TDD		
Source:	⌘	RAN WG4		
Work item code:	⌘	TEI5	***Date:*** ⌘	27/05/2003
Category:	⌘	**F**	***Release:*** ⌘	Rel-5
		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)* *Rel-6 (Release 6)*

Reason for change:	⌘	BER/BLER measurements have statistical nature. The current test requirements specify only a single BER BLER value without statistical significance.
Summary of change:	⌘	It introduces the statistical requirements and lays down how to carry out BER BLER tests taking into account test time optimisation. Isolated impact analysis: Does not affect BS implementation
Consequences if not approved:	⌘	Infinite test time, or if the test is finished after finite time, the results bear unknown statistical significance

Clauses affected:	⌘	2, 7.1, 7.2.4.2, 7.5.4.2.1, 7.5.4.2.2, 7.5.5, 8.1, Annex F(new)				
		Y	**N**			
Other specs affected:	⌘		X	Other core specifications	⌘	
			X	Test specifications		
			X	O&M Specifications		
Other comments:	⌘					

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2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.
- 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] 3GPP TS 25.105: "UTRA (BS) TDD: Radio transmission and reception".

[2] IEC 60721-3-3 (1994): "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weather protected locations"

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

[4] IEC 60068-2-1 (1990): "Environmental testing - Part 2: Tests. Tests A: Cold".

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

[6] Recommendation ITU-R SM.329-9: "Spurious emissions".

[7] Recommendation ITU-R SM.328-9: "Spectra and bandwidth of emissions".

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

[9] 3GPP TR 25.942: "RF System Scenarios".

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

<NEXT CHANGED SECTION>

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 clause 7 assume that the receiver is not equipped with diversity. Unless otherwise stated,, the tests for receiver with diversity shall 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.
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 defined in ITU-T Recommendation O.153 [10~~5~~] and Annex ~~C~~F.
Unless detailed the receiver characteristic are specified at each antenna connector of the BS.
Unless otherwise stated, all tests in this clause shall be performed at the BS antenna connector (test port A).If any external apparatus such as a RX amplifier, a filter or the combination of such devices is used, the tests according to subclauses 5.14.4 shall be performed to ensure that the requirements are met at test port B.

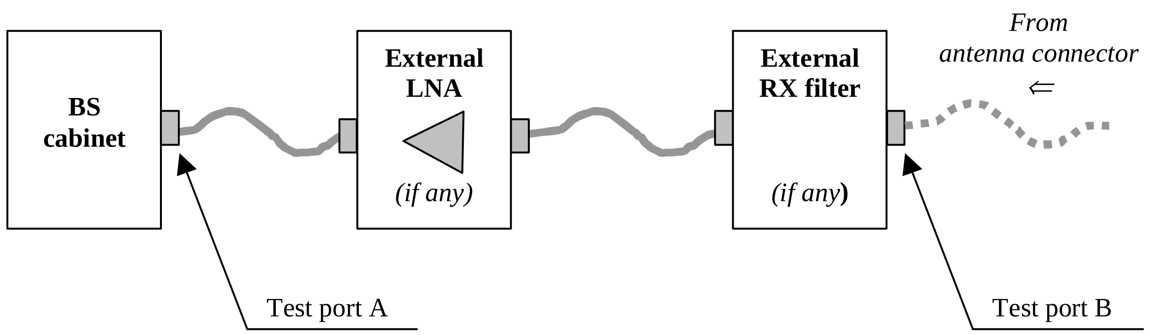

Figure 7.1: Receiver test ports

7.2 Reference sensitivity level

7.2.1 Definition and applicability

The reference sensitivity level is the minimum mean power received at the antenna connector at which the BER shall not exceed the specific value.
In this subclause, different requirements shall apply to Wide Area BS and Local Area BS.

7.2.2 Minimum Requirements

7.2.2.1 3,84 Mcps TDD option

Using the reference measurement channel specified in Annex A.2.1, the reference sensitivity level and performance of the BS shall be as specified in table 7.1.

Table 7.1: Minimum Requirements for BS reference sensitivity level

BS class	Reference measurement channel data rate	BS reference sensitivity level	BER
Wide Area BS	12,2 kbps	-109 dBm	BER shall not exceed 0,001
Local Area BS	12,2 kbps	-95 dBm	BER shall not exceed 0,001

The normative reference for this requirement is TS 25.105 [1] subclause 7.2.1.1.

7.2.2.2 1,28 Mcps option

Using the reference measurement channel specified in Annex A.2.1.2, the reference sensitivity level and performance of the BS shall be as specified in table 7.1A.

Table 7.1A: Minimum Requirements for BS reference sensitivity level (1,28 Mcps option)

BS class	Reference measurement channel data rate	BS reference sensitivity level	BER
Wide Area BS	12,2 kbps	-110 dBm	BER shall not exceed 0,001
Local Area BS	12,2 kbps	-96 dBm	BER shall not exceed 0,001

The normative reference for this requirement is TS 25.105 [1] subclause 7.2.1.2.

7.2.3 Test purpose

The test purpose is to verify the ability of the BS to receive a prescribed single-code test signal of minimum input power under defined conditions (no interference, no multipath propagation) with a BER not exceeding a specified limit. This test is also used as a reference case for other tests to allow the assessment of degradations due to various sources of interference.

7.2.4 Method of test

7.2.4.1 Initial conditions

7.2.4.1.0 General test requirements

Test environment: normal; see subclause 5.9.1.
RF channels to be tested: B, M and T; see subclause 5.3.
The following additional test shall be performed:
On each of B, M and T, the test shall be performed under extreme power supply as defined in subclause 5.9.4.

NOTE: Tests under extreme power supply also test extreme temperature.

7.2.4.1.1 3,84 Mcps TDD option

(1) Connect the BS tester (UE simulator) to the antenna connector of one BS Rx port.

(2) Terminate or disable any other BS Rx port not under test.

(3) Start transmission from the BS tester to the BS using the UL reference measurement channel (12.2 kbps) defined in Annex A.2.1.

(4) The level of the BS tester output signal measured at the BS antenna connector shall be adjusted to the Test Requirement for the BS reference sensitivity level specified in table 7.2.

7.2.4.1.2 1,28 Mcps TDD option

(1) Connect the BS tester (UE simulator) to the antenna connector of one BS Rx port.

(2) Terminate or disable any other BS Rx port not under test.

(3) Start transmission from the BS tester to the BS using the UL reference measurement channel (12.2 kbps) defined in Annex A.2.1.

(4) The level of BS tester output signal measured at the BS antenna connector shall be adjusted to –110 dBm.

7.2.4.2 Procedure

(1) ~~Measure the BER by comparing the bit sequence of the information data transmitted by the BS tester with the bit sequence obtained from the BS receiver.~~ Calculate BER according to annex ~~C~~F

(2) Set the test signal mean power as specified in table 7.1A

(3) Measure BER

(~~2~~4) Interchange the connections of the BS Rx ports and repeat the measurement according to (1).

7.2.5 Test Requirements

NOTE: If the Test Requirements below differ from the Minimum Requirements, then the Test Tolerance applied for this test is non-zero. The Test Tolerance for this test is defined in subclause 5.11 and the explanation of how the Minimum Requirement has been relaxed by the Test Tolerance is given in Annex D.

7.2.5.1 3,84 Mcps TDD option

For any BS Rx port tested, the measured BER at the Test Requirement of the BS reference sensitivity level specified in table 7.2 shall not exceed 0,001.

Table 7.2: Test Requirement for BS reference sensitivity level

BS class	Reference measurement channel data rate	BS reference sensitivity level	BER
Wide Area BS	12,2 kbps	-108,3 dBm	BER shall not exceed 0,001
Local Area BS	12,2 kbps	-94,3 dBm	BER shall not exceed 0,001

7.2.5.2 1,28 Mcps TDD option

For any BS Rx port tested, the measured BER at the Test Requirement of the BS reference sensitivity level specified in table 7.2A shall not exceed 0,001.

Table 7.2A: Test Requirement for BS reference sensitivity level for 1,28 Mcps option

BS class	Reference measurement channel data rate	BS reference sensitivity level	BER
Wide Area BS	12,2 kbps	-109,3 dBm	BER shall not exceed 0,001
Local Area BS	12,2 kbps	-95,3 dBm	BER shall not exceed 0,001

7.5 Blocking characteristics

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7.5.4 Method of test

7.5.4.1 Initial conditions

Test environment: normal; see subclause 5.9.1.
RF channels to be tested: M; see subclause 5.3. The BS shall be configured to operate as close to the centre of the operating band as possible.

(1) Connect an UE simulator operating at the assigned channel frequency of the wanted signal and a signal generator to the antenna connector of one Rx port.

(2) Terminate or disable any other Rx port not under test.

(3) Start transmission from the BS tester to the BS using the UL reference measurement channel (12,2 kbps) defined in Annex A.2.1.The level of the UE simulator signal measured at the BS antenna connector shall be set to 6 dB above the reference sensitivity level specified in subclause 7.2.2.

7.5.4.2 Procedure

7.5.4.2.1 3,84 Mcps TDD option

(1) Set the signal generator to produce an interfering signal at a frequency offset Fuw from the assigned channel frequency of the wanted signal which is given by

$$Fuw = \pm (n \times 1 \text{ MHz}),$$

where n shall be increased in integer steps from n = 10 up to such a value that the center frequency of the interfering signal covers the range from 1 MHz to 12,75 GHz. The interfering signal level measured at the antenna connector shall be set in dependency of its center frequency, as specified in tables 7.6 to 7.10. The type of the interfering signal is either equivalent to a continuous wideband CDMA signal with one code of chip frequency 3,84 Mchip/s, filtered by an RRC transmit pulse-shaping filter with roll-off α = 0,22, or a CW signal; see tables 7.6 to 7.10.

(2) Measure the BER of the wanted signal at the BS receiver.

(3) Interchange the connections of the BS Rx ports and repeat the measurements according to steps (1) and (2).

~~NOTE: The test procedure as defined in steps (1) and (2) requests to carry out more than 10000 BER measurements. To reduce the time needed for these measurements, it may be appropriate to conduct the test in two phases: During phase 1, BER measurements are made on all center frequencies of the interfering signal as requested but with a reduced confidence level, with the aim to identify those frequencies which require more detailed investigation. In phase 2, detailed measurements are made only at those critical frequencies identified before, applying the required confidence level.~~

7.5.4.2.2 1,28 Mcps TDD option

(1) Set the signal generator to produce an interfering signal at a frequency offset Fuw from the assigned channel frequency of the wanted signal which is given by

$$Fuw=\pm(3{,}2 + n) \times 1 \text{ MHz}$$

where n shall be increased in integer steps from n = 0 up to such a value that the center frequency of the interfering signal covers the range from 1 MHz to 12,75 GHz. The interfering signal level measured at the antenna connector shall be set in dependency of its center frequency, as specified in tables 7.6A to 7.10A. The type of the interfering signal is either equivalent to a continuous wideband CDMA signal with one code of chip frequency 1,28 Mchip/s, filtered by an RRC transmit pulse-shaping filter with roll-off α = 0,22, or a CW signal; see tables 7.6A to 7.10A.

(2) Measure the BER of the wanted signal at the BS receiver.

(3) Interchange the connections of the BS Rx ports and repeat the measurements according to steps (1) and (2).

~~NOTE: The test procedure as defined in steps (1) and (2) requests to carry out more than 10000 BER measurements. To reduce the time needed for these measurements, it may be appropriate to conduct the test in two phases: During phase 1, BER measurements are made on all center frequencies of the interfering signal as requested but with a reduced confidence level, with the aim to identify those frequencies which require more detailed investigation. In phase 2, detailed measurements are made only at those critical frequencies identified before, applying the required confidence level.~~

7.5.5 Test Requirements

NOTE 1: If the Test Requirement below 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 5.11 and the explanation of how the Minimum Requirement has been relaxed by the Test Tolerance is given in Annex D.

In all measurements made according to subclause 7.5.4.2, the BER shall not exceed 0,001.

NOTE 2: Annex ~~C~~F describes the procedure for BER tests taking into account the statistical consequence of frequent repetition of BER measurements within the blocking test . The consequence is: a DUT exactly on the limit may fail due to the statistical nature 2.55 times(mean value) in 12750 BER measurements using the predefined wrong decision probability of 0.02%. If the fail cases are ≤12, it is allowed to repeat the fail cases 1 time before the final verdict.

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8 Performance requirements

8.1 General

Performance requirements for the BS are specified for the measurement channels defined in Annex A and the propagation conditions in Annex B. The requirements only apply to those measurement channels that are supported by the base station. All Bit Error Ratio (BER) and Block Error ratio (BLER) measurements shall be carried out according to the general rules for statistical testing defined in ITU-T Recommendation O.153 [~~5~~10] and Annex ~~C~~F.
The characteristics of the white noise source, simulating interference from other cells (I_{oc}), shall comply with the AWGN interferer definition in subclause 5.18.
The requirements only apply to a base station with dual receiver antenna diversity. The required $\hat{I}_{or}/I_{oc}$ shall be applied separately at each antenna port.

Table 8.1: Summary of Base Station performance targets

Physical channel	Measurement channel	Static	Multi-path Case 1	Multi-path Case 2	Multi-path Case 3
		Performance metric			
DCH	12,2 kbps	BLER < 10^{-2}	BLER < 10^{-2}	BLER < 10^{-2}	BLER < 10^{-2}
	64 kbps	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}, 10^{-3}
	144 kbps	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}, 10^{-3}
	384 kbps	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}	BLER < 10^{-1}, 10^{-2}, 10^{-3}

<NEXT CHANGED SECTION>

Annex ~~C~~F (normative):
General rules for statistical testing ~~for 1.28Mcps TDD~~

~~C~~F.1 Statistical testing of receiver BER/BLER performance

~~C~~F.1.1 Error Definition

1) Bit Error Ratio (BER)

The Bit Error Ratio is defined as the ratio of the bits wrongly received to all data bits sent. The bits are the data bits above the convolutional/turbo decoder. The BER is the overall BER independent of frame erasures or when erased frames are not defined.

2) Block Error Ratio (BLER)

A Block Error Ratio is defined as the ratio of the number of erroneous blocks received to the total number of blocks sent. An erroneous block is defined as a Transport Block, the cyclic redundancy check (CRC) of which is wrong.

~~C~~F.1.2 Test Method

Each test is performed in the following manner:

a) Setup the required test conditions.

b) Record the number of samples tested and the number of occurred events (bit error or block error)

c) Stop the test at a stop criterion which is minimum test time or an early pass or an early fail event.

d) Once the test is stopped decide according to the pass fail decision rules (subclause ~~C~~F.1.7)

~~C~~F.1.3 Test Criteria

The test shall fulfil the following requirements:

a) good pass fail decision

1) to keep reasonably low the probability (risk) of passing a bad unit for each individual test;

2) to have high probability of passing a good unit for each individual test;

b) good balance between test time and statistical significance

3) to perform measurements with a high degree of statistical significance;

4) to keep the test time as low as possible.

~~C~~F.1.4 Calculation assumptions

~~C~~F.1.4.1 Statistical independence

(a) It is assumed, that error events are rare (lim BER BLER → 0) independent statistical events. However the memory of the convolutional /turbo coder is terminated after oneTTI. Samples and errors are summed up everyTTI. So the assumption of independent error events is justified.

(b) In the BLER test with fading there is the memory of the multipath fading channel which interferes the statistical independence. A minimum test time is introduced to average fluctuations of the multipath fading channel. So the assumption of independent error events is justified approximately.

~~C~~F.1.4.2 Applied formulas

The formulas, applied to describe the BER BLER test, are based on the following experiments:

(1) After having observed a certain number of errors (**ne**) the number of samples are counted to calculate BER BLER. Provisions are made (note 1) such that the complementary experiment is valid as well:
(2) After a certain number of samples (**ns**) the number of errors, occurred, are counted to calculate BER BLER.
Experiment (1) stipulates to use the following Chi Square Distribution with degree of freedom ne:
2*dchisq(2*NE,2*ne).
Experiment (2) stipulates to use the Poisson Distribution: dpois(ne,NE)
(NE: mean of the distribution)
To determine the early stop conditions, the following inverse cumulative operation is applied:
0.5 * qchisq(D,2*ne). This is applicable for experiment (1) and (2).
D: wrong decision risk per test step
Note: other inverse cumulative operations are available, however only this is suited for experiment (1) and (2).

~~C~~F.1.4.3 Approximation of the distribution

The test procedure is as follows:
During a running measurement for a ~~UE~~BS ns (number of samples) and ne (number of errors) are accumulated and from this the preliminary BER BLER is calculated. Then new samples up to the next error are taken. The entire past and the new samples are basis for the next preliminary BER BLER. Depending on the result at every step, the ~~UE~~BS can pass, can fail or must continue the test.
As early pass- and early fail-~~UE~~BSs leave the statistical totality under consideration, the experimental conditions are changed every step resulting in a distribution that is truncated more and more towards the end of the entire test. Such a distribution can not any more be handled analytically. The unchanged distribution is used as an approximation to calculate the early fail and early pass bounds.

~~C~~F.1.5 Definition of good pass fail decision.

This is defined by the probability of wrong decision F at the end of the test. The probability of a correct decision is 1-F.
The probability (risk) to fail a good DUT shall be ≤ F according to the following definition: The failed DUT is still better than the specified error ratio (Test requirement)with a probability of ≤ F.
The probability to pass a bad DUT shall be ≤ F according to the following definition: The passed DUT is still worse than M times the specified error ratio (M>1 is the bad DUT factor) with a probability of ≤ F.
This definitions lead to an early pass and an early fail limit:
Early fail: ber≥ $berlim_{fail}$

$$berlim_{fail}(D,ne) = \frac{2*ne}{qchisq(D,2*ne)} \qquad (1)$$

For ne≥ 7

Early pass: ber ≤$berlimbad_{pass}$

$$berlimbad_{pass}(D,ne) = \frac{2*ne*M}{qchisq(1-D,2*ne)} \qquad (2)$$

For ne ≥ 1

With

- ber (normalized BER,BLER): BER,BLER according to ~~C~~F.1.1 divided by Test requirement
- D: wrong decision probability for a test step . This is a numerically evaluated fraction of F, the wrong decision probability at the end of the test. See table ~~C~~F.1.6.1.
- ne: Number of error events
- M: bad DUT factor see table ~~C~~F.1.6.1.
- qchisq: inverse-cumulative-function of the chi-squared-distribution

~~C~~F.1.6 Good balance between test time and statistical significance

Three independent test parameters are introduced into the test and shown in Table ~~C~~F.1.6.1. These are the obvious basis of test time and statistical significance. From the first two of them four dependent test parameters are derived. The third independent test parameter is justified separately.

Table ~~C~~F.1.6.1 independent and dependant test parameters

Independent parameters			**Dependant parameters**		
Test Parameter	Value	Reference	Test parameter	Value	Reference
Bad DUT factor M	1.5	Table ~~C~~F.1.8	Early pass/fail condition	Curves	Subclause ~~C~~F.1.5 Figure ~~C~~F.1.9
Final probability of wrong pass/fail decision F	0.2%, (0.02%, note 2)	Subclause ~~C~~F.1.5	Target number of error events	345	Table F~~C~~.1.8
			Probability of wrong pass/fail decision per test step D	0.0085%, (0.0008% and 0.008%, note 2)	
			Test limit factor TL	1.234	Table ~~C~~F.1.8
Minimum test time		Table ~~C~~F.1.6.2 and Table ~~C~~F.1.6.3			

The minimum test time is derived from the following justification:

1) For no propagation conditions and static propagation condition

   No early fail calculated from fractional number of errors <1 (see note 1)

2) For multipath fading condition

   No stop of the test until [~~10~~990] wavelengths are crossed during relevant BS reception timeslots, relevant for BER BLER testing, with the speed given in the fading profile.

Table ~~C~~F.1.6.2 : minimum Test time

Fading profile	**Minimum test time**
Multipath propagation 3 km/h	[~~1.8~~164 s*TSPF/TSRX*)]
~~Multipath propagation 50 km/h~~	~~[0.1 s* TSPF/TSRX]~~
Multipath propagation 120 km/h	[~~45~~4.1 ~~m~~s* TSPF/TSRX]
*) TSPF = Time slots per frame, TSRX = relevant reception timeslots per frame, relevant for the BER BLER test	

TSPF and TSRX form the prolongation factor and depend on the user data rate and the TDD Option (3.84 Mchip/s or 1.28 Mchip/s)

Table ~~C~~F.1.6.3 : Prolongation factor for minimum Test time

User Data rate	**TSPF/TSRX for TDD 3.84 Mchip/s**	**TSPF/TSRX for TDD 1.28 Mchip/s**
12.2 kbit/s	15/1	7/1
64 kbit/s	15/1	7/1
144 kbit/s	15/1	7/2
384 kbit/s	15/3	7/4

In table ~~C~~F.1.8 the minimum test time is converted in minimum number of samples.

~~C~~F.1.7 Pass fail decision rules

No decision is allowed before the minimum test time is elapsed.

1) If minimum Test time < time for target number of error events then the following applies: The required confidence level 1-F (= correct decision probability) shall be achieved. This is fulfilled at an early pass or early fail event.

For BER:

For every TTI (Transmit Time Interval) sum up the number of bits (ns) and the number if errors (ne) from the beginning of the test and calculate

BER_1 (including the artificial error at the beginning of the test (Note 1))and

BER_0 (excluding the artificial error at the beginning of the test (Note 1)).

If BER_0 is above the early fail limit, fail the DUT.

If BER_1 is below the early pass limit, pass the DUT.

Otherwise continue the test

For BLER:

For every TTI sum up the number of blocks (ns) and the number of erroneous blocks (ne) from the beginning of the test and calculate

$BLER_1$ (including the artificial error at the beginning of the test (Note 1))and

$BLER_0$ (excluding the artificial error at the beginning of the test (Note 1)).

If $BLER_1$ is below the early pass limit, pass the DUT.

If $BLER_0$ is above the early fail limit, fail the DUT.

Otherwise continue the test

2) If the minimum test time ≥ time for target error events, then the test runs for the minimum test time and the decision is done by comparing the result with the test limit.

For BER:

For every TTI (Transmit Time Interval) sum up the number of bits (ns) and the number if errors (ne) from the beginning of the test and calculate BER_0

For BLER:

For every TTI sum up the number of blocks (ns) and the number of erroneous blocks (ne) from the beginning of the test and calculate $BLER_0$

If BER_0/$BLER_0$ is above the test limit, fail the DUT.

If BER_0/$BLER_0$ is on or below the test limit, pass the DUT.

~~C~~F.1.8. Test conditions for BER,BLER Tests

Table ~~C~~F.1.8: Test conditions for BER/BLER tests

Table ~~C~~F.1.8-1: Test conditions for BER tests Type of test **(BER)**	**Propagation conditions**	**Test requirement (BER)**	**Test limit (BER)= Test requirement (BER)x TL TL**	**Target number of error events** (time) (Note: the time in the bracket means the reception time)	**Minimum number of samples**	**Prob that good unit will fail = Prob that bad unit will pass (%)**	**Bad unit BER factor M**
Reference Sensitivity Level	-	0.001	1.234	345 (22.9s)	Note 1	0.2	1.5
Dynamic Range	-	0.001	1.234	345 (22.9s)	Note 1	0.2	1.5
Adjacent Channel Selectivity	-	0.001	1.234	345 (22.9s)	Note 1	0.2	1.5
Blocking Characteristics Pass condition Note 2	-	0.001	1.251	402 (26.3s)	Note 1	0.2	1.5
Blocking Characteristics Fail condition Note 2	-	0.001	1.251	402 (26.3s)	Note 1	0.02	1.5
Intermodulation Characteristics	-	0.001	1.234	345 (22.9s)	Note 1	0.2	1.5

Table ~~C~~F.1.8-2: Test conditions for BLER tests **Type of test (BLER)**	**InformationBit rate(kbit/s)**	**Test requirement (BLER)**	**Test limit (BLER)= Test requirement (BLER)x TL** **TL**	**Target number of error events** (time)	**Minimum number of samples (time)** TDD 3.84 Mchip/s	**Minimum number of samples (time)** TDD 1.28 Mchip/s	**Prob that bad unit will pass = Prob that good unit will fail (%)**
Demodulation in Static Propagation conditions	 12.2 64 144 384	 0.01 0.1 0.01 0.1 0.01 0.1 0.01	1.234	345 (559s) (55.9s) (559s) (55.9s) (559s) (28s) (280s)	Note1	Note1	0.2
Demodulation of DCH in Multi-path Fading Propagation conditions							
3km/h (Case 1, Case 2)	 12.2 64 144 384	 0.01 0.1 0.01 0.1 0.01 0.1 0.01	1.234	345 (559s) (55.9s) (559s) (55.9s) (559s) (28s) (280s)	[(2460s)] [123000] [123000] [123000] [123000] [123000] [(820s)] [82000] [82000]	[(1148s)] [5740] [5740] [5740] [(574s)] [2870] [2870] [(278s)] [27800] [27800]	0.2
120 km/h (Case3)	 12.2 64 144 384	 0.01 0.1 0.01 0.1 0.01 0.1 0.01	1.234	345 (559s) (55.9s) (559s) (55.9s) (559s) (28s) (280s)	[(61.5s)] [3075] [3075] [3075] [3075] [3075] [(20.5s)] [2050] [2050]	[(28.7s)] [1435] [1435] [1435] [(14.35s)] [718] [718] [(7.175s)] [718] [718]	0.2

~~C~~F.1.9 Practical Use (informative)

See figure ~~C~~F.1.9:
The early fail limit represents formula (1) in ~~C~~F.1.5. The range of validity is ne≥7 (≥8 in case of blocking test) to ne =345
The early pass limit represents formula (2) in ~~C~~F.1.5. The range of validity is ne=1 to ne =345. See note 1
The intersection co-ordinates of both curves are : target number of errors ne =345 and test limit TL =1.234.
The range of validity for TL is ne>345.
A typical BER BLER test, calculated from the number of samples and errors (~~C~~F.1.2.(b)) using experimental method (1) or (2) (see ~~C~~F.1.4.2 calculation assumptions) runs along the yellow trajectory. With an errorless sample the trajectory goes down vertically. With an erroneous sample it jumps up right. The tester checks if the BER BLER test intersects the early fail or early pass limits. The real time processing can be reduced by the following actions:

- $BLER_0$ (excluding the artificial error at the beginning of the test (Note 1)). is calculated only in case of an error event.

- BER_0 (excluding the artificial error at the beginning of the test (Note 1)). is calculated only in case of an error event within a TTI.

So the early fail limit cannot be missed by errorless samples.
The check against the early pass limit may be done by transforming formula (2) in ~~C~~F.1.5 such that the tester checks against a Limit-Number-of-samples (NL(ne)) depending on the current number of errors (including the artificial error at the beginning of the test (Note 1)).
Early pass if

$$NL(ne) \geq \frac{qchisq(1-D,2*ne)}{2*TR*M}$$

TR: test requirement (0.001)

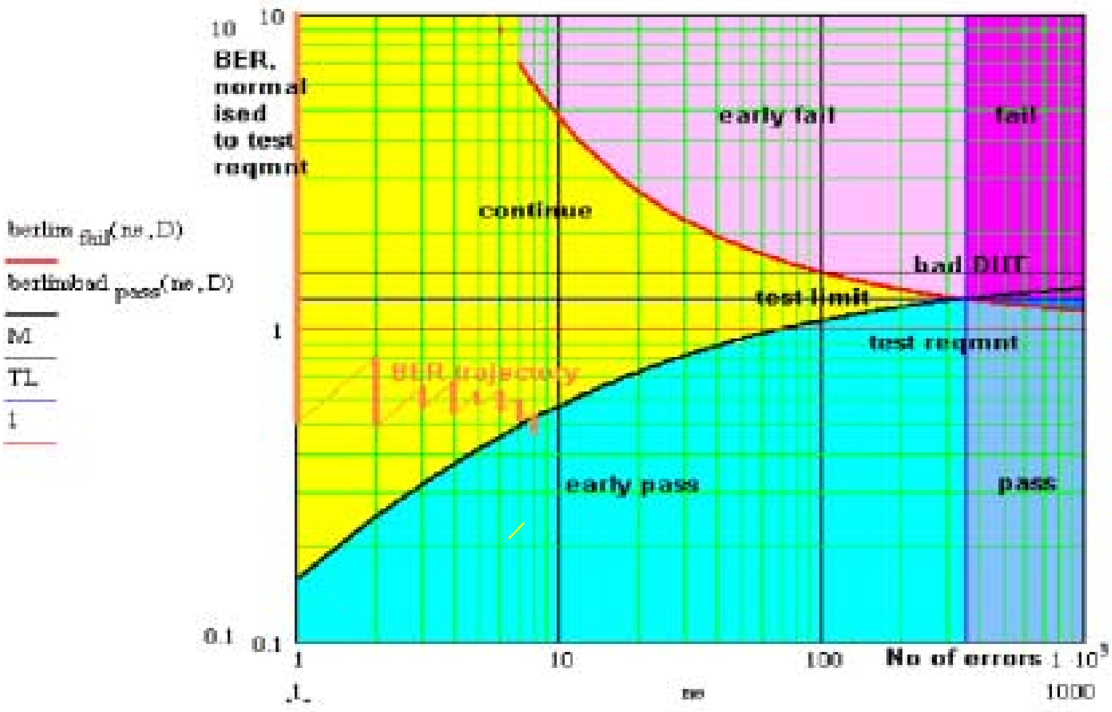

Figure ~~C~~F.1.9

Note 1: At the beginning of the test, an artificial error is introduced. This ensures that an ideal DUT meets the valid range of the early pass limit. In addition this ensures that the complementary experiment (~~C~~F.1.4.2 bullet point (2)) is applicable as well.

For the check against the early fail limit the artificial erroneous sample, introduced at the beginning of the test , is disregarded.

Due to the nature of the test, namely discrete error events, the early fail condition shall not be valid, when fractional errors <1 are used to calculate the early fail limit: Any early fail decision is postponed until number of errors ne ≥7. In the blocking test any early fail decision is postponed until number of errors ne ≥ 8.

Note2: F=0.2% is intended to be used for a test containing a few BER/BLER tests (e.g. receiver sensitivity is repeated 12 times(3 RF Channels * 2 Power-supplies * 2 Temperatures). For a test containing many BER/BLER tests (e.g. blocking test) this value is not appropriate for a single BER/BLER test.

The blocking test contains approx. 12750 single BER tests. A DUT on the limit will fail approx. 25 to 26 times due to statistical reasons using wrong decision probability at the end of the test F= 0.2%. This shall be solved by the following rule:

All passes (based on F=0.2%) are accepted, including the wrong decisions due to statistical reasons.

An early fail limit based on F=0.02% instead of 0.2% is established. That ensures that wrong decisions due to statistical reasons are reduced to 2 to 3 in 12750 BER measurements. If the fail cases are ≤12, it is allowed to repeat each fail cases 1 time before the final verdict.

These asymmetric test conditions ensure that a DUT on the limit consumes hardly more test time for a blocking test than in the symmetric case and reduces the wrong decision probability considerably and on the other hand the repetition allowance sufficiently suppresses the residual statistically caused wrong verdict for the aggregate test.

Annex ~~F~~ G (informative): Change history