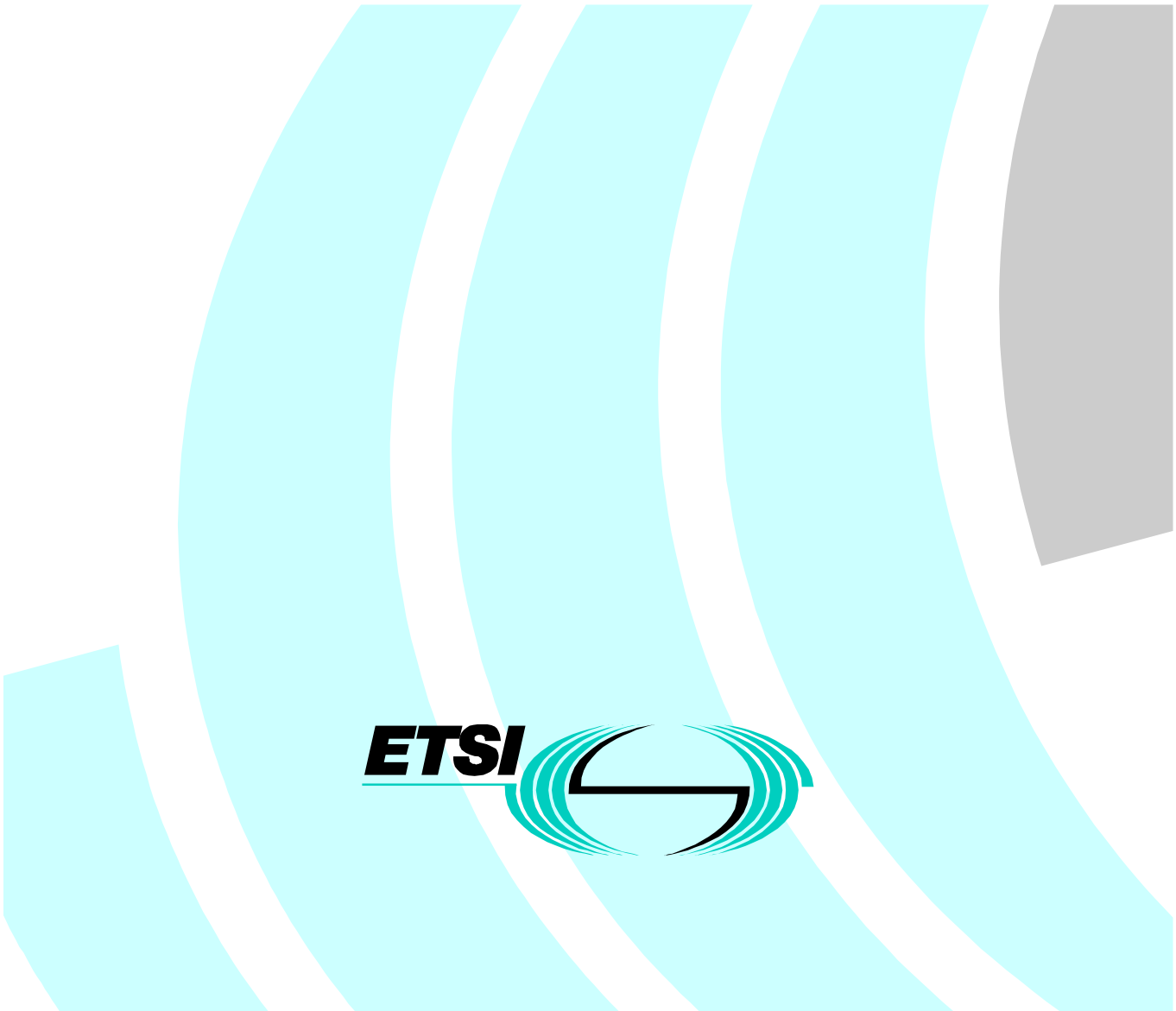
Final draft EN 301 126-1 V1.1.2 (1999-07)

European Standard (Telecommunications series)

Fixed Radio Systems; Conformance testing; Part 1: Point-to-Point equipment - Definitions, general requirements and test procedures



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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM) and is now submitted for the Voting phase of the ETSI standards Two-step Approval Procedure.

The present document defines the type approval testing requirements for radio specific parameters required directly by the relevant radio relay standard. Harmonized test methods, and test report format, for these parameters are also contained herein.

In addition to the main body of the present document there are two annexes, namely the Supplier Declaration (annex A) and the Test Report (annex B). The parameters in the two annexes are according to the main body of the present document.

The purpose of the test report form is to achieve uniform and comprehensive presentations of suppliers declarations and tests results.

The test report includes forms for presenting the measurement results, measurement uncertainty, limits for the measured values, references to the relevant test procedures and space for declaring the test equipment used. At the beginning of the test report the status of the test are summarized. Regarding the humidity conditions, this parameter is not to be controlled during the tests. However it has to be within the range given by the relevant specification. The initial value at each measurement should be registered.

The main body of the present document contains definitions, general requirements and test procedures for conformance testing of Digital Radio-Relay Systems (DRRS).

It is recommended that where a clarification of a test procedure or an agreed test procedure is required, this should be described on the final page of the test report titled "Additional information supplementary to the test report".

The present document is part 1 of a multi-part EN covering the Fixed Radio System; Conformance testing, as identified below:

Part 1: "Point-to-point equipment - Definitions, general requirements and test procedures";

Part 2-1: "Point-to-Multipoint equipment - Definitions and general requirements";

Part 2-2: "Point-to-Multipoint equipment - Test procedures for FDMA systems";

Part 2-3: "Point-to-Multipoint equipment - Test procedures for TDMA systems";

Part 2-4: "Point-to-Multipoint equipment - Test procedures for FH-CDMA systems";

Part 2-5: "Point-to-Multipoint equipment - Test procedures for DS-CDMA systems";

Part 3-1: "Point-to-Point antennas - Definitions, general requirements and test procedures";

Part 3-2: "Point-to-Multipoint antennas - Defintions, general requirements and test procedures".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document details standardized procedures for conformance testing of equipment for point to point Digital Radio-Relay Systems (DRRS).

Standardized procedures are required in order to fulfil ERC/DEC/(97)10 [1] on the mutual recognition, within CEPT, of the results of conformance tests on equipment carried out in individual CEPT countries.

The present document reflects the principles and definitions set out in the generic wordings for Standards on DRRS characteristics TR 101 036-1 [2] which defines the generic format for the editorial and technical content for all individual equipment standards relating to digital fixed point to point radio relay systems. The present document describes harmonized test objectives and test procedures for the parameters detailed in TR 101 036-1 [2]. Thus, it is intended to be applied in conjunction with the individual equipment standards and will enable commonality of test results, irrespective of the accredited body carrying out the test.

The conformance tests described in the present document are those related to radio specific parameters required directly by the relevant radio relay standards. Conformance tests to other boundary standards (e.g. those for system input/output interfaces and related baseband process) are outside the scope of the present document.

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] ERC/DEC/(97)10: "ERC Decision on the mutual recognition of conformity assessment procedures including marking of radio equipment and radio terminal equipment".

[2] TR 101 036-1: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRSS); Generic wordings for standards on DRRS characteristics; Part 1: General aspects and point-to-point equipment parameters".

[3] ETS 300 019 Parts 1 and 2: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1: Classification of environmental conditions; Introduction; Part 2: Specification of environmental tests; Introduction".

[4] ETS 300 132 Part 1 and Part 2: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources; Part 2: Operated by direct current (dc)".

[5] ETS 300 385: "Radio Equipment and Systems (RES); ElectroMagnetic Compatibility (EMC) standard for digital fixed links and ancillary equipment with data rates at around 2 Mbit/s and above".

[6] IEC 60835: "Methods of measurement for equipment used in digital microwave radio transmission systems".

[7] ITU-R Recommendation F. 746-3: "Radio-frequency channel arrangements for radio-relay systems".

[8] ITU-R Recommendation F.1191-1: "Bandwidths and unwanted emissions of digital radio-relay systems".

[9] EN 45001: "General criteria for the operation of testing laboratories".

[10] EN 45002: "General criteria for the assessment of testing laboratories".

[11] ISO/IEC Guide 25: "General requirements for the competence of calibration and testing laboratories".

[12] ISO/IEC Guide 28: "General rules for a model third party certification system for products".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

accreditation: Formal recognition that a testing laboratory is competent to carry out specific tests or specific types of test.

accreditation body: Body that conducts and administers a laboratory accreditation system and grants accreditation.

accreditation system: System that has its own rules of procedure and management for carrying out laboratory accreditation.

accredited laboratory: Testing laboratory to which accreditation has been granted in accordance with the ISO/IEC guides 25 [11] and 28 [12] or EN 45001 [9] and 45002 [10].

approval testing: Approval of the Implementation Under Test (IUT) by the appropriate authority for regulatory purposes. In this context approval implies that the IUT has met the essential requirements of the standard against which it has been tested.

complementary requirements: All those requirements not part of the essential requirements.

conformance testing: Type testing process to verify to what extent the IUT conforms to the standard.

essential requirements: The basic set of parameters and functions which are necessary to meet any regulatory obligations imposed for radio frequency co-ordination and ElectroMagnetic Compatibility (EMC).

full conformance: Status of the IUT when it has successfully passed all the requirements of the conformance testing process and therefore meets all the mandatory requirements of the standard.

mandatory requirements: Requirement is one which the IUT shall meet. To achieve full conformance all standard requirements are mandatory.

optional requirements: Used in a standard with two different meanings:

1) optional in the sense that the parameter or function itself is mandatory but there is more than one possible value or configuration which may be chosen (e.g. class of output power, baseband interface, etc.). Once an option is selected it becomes mandatory;

2) optional in the sense that the feature is not mandatory (e.g. Automatic Transmit Power Control (ATPC), service channels, etc.). However, once such an option has been implemented it becomes mandatory that it conforms to the requirements of the present document.

supplier: Organization requesting the approval.

Supplier's Declaration (SD): Declaration is the procedure by which a supplier gives written assurance that a parameter or function conforms to the present document.

type approval authority: National regulatory/licensing authority.

type approval testing: Process of type testing for approval. A type test is to be carried out successfully in order to achieve approval.

type testing: Type testing is when a representative sample of equipment is tested. The test result is considered to be applicable and representative for all other pieces of equipment manufactured identically.

3.2 Symbols

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

dB	decibel
dBm	decibel relative to 1 mW

3.3 Abbreviations

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

ATPC	Automatic Transmit Power Control
BB	Baseband
BBER	Background BER
BER	Bit Error Rate
BWe	evaluation Bandwidth
C/I	Carrier to Interference
CC	Co-channel
CR	Complementary Requirement
CT	Conformance Test
CW	Continuous Wave
DRRS	Digital Radio Relay Systems
EMC	ElectroMagnetic Compatibility
ER	Essential Requirement
Ext.	Extreme conditions
IF	Intermediate Frequency
IUT	Implementation Under Test
LO	Local Oscillator
Max.	Maximum
Min.	Minimum
Nom.	Nominal
OR	Optional requirement
Ref	Reference conditions
RF	Radio Frequency
RFC	Radio Frequency Channel
RSL	Received Signal Level
RTPC	Remote Transmit Power Control
SD	Supplier Declaration
TMN	Telecommunications Management Network
TR	Test Required
Tx	Transmit
XPIC	Cross-Polar Interference Canceller

4 Requirements related to DRRS equipment conformance test

Table 1: "Generic requirements" classification

Function or parameter description	Status for conformance			Requirement for conformance test			Power supply conditions		Climatic conditions for test		Limiting values	Test methods	
	ER	CR	OR	SD	TR	SD + TR (note 1)	Ref	Ref + Ext	Ref.	Ref. + Ext.		Clause Ref.	IEC 60835 [6] or other Ref.
Channel plan/operating frequency range	X			X								annex A.	ITU-R Recommendation F.746-3 [7]
Duplex frequency separation	X			X							xx MHz	annex A.	ITU-R Recommendation F.746-3 [7]
Centre gap	X			X							xx MHz	annex A	ITU-R Recommendation F.746-3 [7]
Co-polar channel spacing	X			X							xx MHz	annex A	ITU-R Recommendation F.746-3 [7]
Innermost channel spacing	X			X							xx MHz	annex A	ITU-R Recommendation F.746-3 [7]
Compatibility requirement between systems		X	X	X								annex A	
Performance and availability requirements													
Environmental conditions													
Weather protected locations	X (note 2)		X	X							(note 3)	4.4.2 (note 4)	ETS 300 019 [3]
Non-weather protected locations	X (note 2)		X	X							(note 3)	4.4.2 (note 4)	ETS 300 019 [3]
Power supply		X	X	X							(note 5)	annex A	ETS 300 132 [4]
EMC	X			X (note 6)								annex A (note 7)	ETS 300 385 [5]
System block diagram													
TMN interface		X	X	X								annex A (note 8)	
Branching/feeder/ antenna requirements													
Waveguide flanges (or other connectors)		X		X								annex A	
Return loss		X		X							[xx dB]	annex A	
Intermodulation products		X		X							[-xxx dBW]	annex A	
Parameters for digital Systems													
Transmission capacity	X (note 9)			X							xx Mbit/s	annex A	

Function or parameter description	Status for conformance			Requirement for conformance test			Power supply conditions		Climatic conditions for test		Limiting values	Test methods	
	ER	CR	OR	SD	TR	SD + TR (note 1)	Ref	Ref + Ext	Ref.	Ref. + Ext.		Clause Ref.	IEC 60835 [6] or other Ref.
Baseband parameters		X (note 10)	X (note 10)			X (note 11)	X		X		(note 10)	annex A	
Transmitter characteristics													
Transmitter power range													
Maximum power (declared value) (note 12)	X					X		X		X	≤xx dBm	annex A + 5.2.1	IEC 60835 [6]
Minimum power (note 13) (declared value) (note 12)		X	X			X		X		X	≥xx dBm	annex A + 5.2.2	IEC 60835 [6]
Automatic Tx. Power Control, (ATPC) (note 13)		X	X			X	X		X		range: xx dB upper limit ≤xx dB	5.2.3	
Remote Tx. Power Control, (RTPC) (note 13)		X	X			X	X		X		range: xx dB upper limit ≤xx dB	5.2.4	
Remote frequency control (note 13)		X	X			X	X		X		[MHz]	5.2.7	
Tx. output power tolerance	X					X		X		X	≤xx dB	5.2.1	
Tx. local oscillators frequency arrangements		X		X							± MHz	annex A	
RF spectrum mask -normal channels	X					X		X		X	mask(s) of relevant standard (note 14)	5.2.6	IEC 60835-2-4 [6]
Innermost channels		X	X			X		X		X		annex A + 5.2.6	IEC 60835-2-4 [6]
Spectral lines at the symbol rate	X				X			X		X	≤xx dBm or Atten ≥xx dBc	5.2.8	IEC 60835-1-2 [6] clause 4
Spurious emissions (TX.) -External	X				X		X (note 15)		X (note 15)		≤xx dBm and the frequency range	5.2.9	IEC 60835-1-2 [6] clause 4
Spurious emissions (TX.) -Internal		X (note 16)		X							≤xx dBm or Atten≥xx dBc	annex A	
Radio Frequency tolerance short-term portion	X					X (note 17)		X		X	± xx ppm ($=\delta f/f_o \times 10^6$)	5.2.5	IEC 60835-1-2 [6] clause 3
Radio Frequency tolerance long-term portion	X			X							± xx ppm ($=\delta f/f_o \times 10^6$)	annex A	

Function or parameter description	Status for conformance			Requirement for conformance test			Power supply conditions		Climatic conditions for test		Limiting values	Test methods	
	ER	CR	OR	SD	TR	SD + TR (note 1)	Ref	Ref + Ext	Ref.	Ref. + Ext.		Clause Ref.	IEC 60835 [6] or other Ref.
Receiver Characteristics													
Input level range		X			X		X		X		- xx dBm to - xx dBm vs. BER threshold	5.3.1	IEC 60835-2-4 [6] clause 5 IEC 60835-1-4 [6] clause 3
Rx local oscillators frequency arrangements		X		X							± MHz	annex A	
Spurious emissions (Rx) External	X				X		X (note 15)		X (note 15)		as Tx.	annex A	IEC 60835-1-2 [6] subclause 3.2
Spurious emissions (Rx) Internal		X (note 16)		X							≤xx dBm or Atten ≥xx dBc	annex A	
Rx intermediate frequency		X	X	X							xx MHz	annex A	
Receiver image rejection		X		X							(note 18)	annex A	
Innermost channel selectivity		X		X							(note 18)	annex A	IEC 60835-2-4 [6] subclause 4.5
System performance without diversity													
BER vs. Rx signal level	X (note 19)				X		X			X	≤ mask in relevant ETS	5.3.3.1	IEC 60835-2-4 [6] subclause 5.2
Equipment background BER		X		X							≤xx errors /period	annex A	IEC 60835-1-4 [6] clause 2
Interference Sensitivity													
Co-channel interference sensitivity External	X				X		X		X (note 15)		comply with ETS	5.3.3.2	IEC 60835-2-10 [6] subclause 3.3
Co-channel interference sensitivity Internal (note 20)		X		X							comply with ETS	annex A	IEC 12E (Sec.) 255
Adjacent channel interference sensitivity	X				X		X		X		comply with ETS	5.3.3.3	IEC 60835-2-10 [6] subclause 3.3
CW spurious interference	X				X		X		X		comply with C/I threshold degradation in ETS	5.3.3.4	

Function or parameter description	Status for conformance			Requirement for conformance test			Power supply conditions		Climatic conditions for test		Limiting values	Test methods	
	ER	CR	OR	SD	TR	SD + TR (note 1)	Ref	Ref + Ext	Ref.	Ref. + Ext.		Clause Ref.	IEC 60835 [6] or other Ref.
Front end non linearity requirements (two tone CW Spurious Interference)		X		X								annex A	
Distortion sensitivity		X	X			X	X		X (note 15)		± xx MHz and xx dB mask(s) -time delay τ ns	5.3.3.5	IEC 60835-2-4 [6] subclause 5.3 IEC 60835-2-8 [6] subclause 3.4
Receiver third order intermodulation characteristic		X		X							??		
System characteristics with diversity (note 21)													
Differential delay compensation (note 13)		X		X							xx ns		IEC 60835-2-7 [6] subclause 3.3
BER Performance (note 13)	X				X		X			X	comply with ETS	5.3.4.2	IEC 60835-2-7 [6] subclause 3.3
Co-channel interference sensitivity (external) (note 13)	X					X	X		X		comply with ETS	5.3.4.2	IEC 60835-2-10 [6] subclause 3.3
Co-channel interference sensitivity (note 13) (internal) (note 20)		X		X							comply with ETS	5.3.4.2	IEC 12E (Sec.) 255
Adjacent channel interference sensitivity (note 13)	X					X	X		X		comply with ETS	5.3.4.2	IEC 60835-2-10 [6] subclause 3.3
Distortion sensitivity (note 13)		X	X			X	X		X		under study	5.3.4.3	IEC 60835-2-7 [6] subclause 4.2

Function or parameter description	Status for conformance			Requirement for conformance test			Power supply conditions		Climatic conditions for test		Limiting values	Test methods	
	ER	CR	OR	SD	TR	SD + TR (note 1)	Ref	Ref + Ext	Ref.	Ref. + Ext.		Clause Ref.	IEC 60835 [6] or other Ref.

NOTE 1: The Suppliers Declaration (SD) is intended for appropriate selection from available options or for information necessary to carry out the test.
NOTE 2: Essential from the point of view of the impact of environment on the other essential parameters.
NOTE 3: Selection from classes 3.1, 3.2, 3.3, 3.4, 3.5 in ETS 300 019 [3] or other climatic conditions foreseen by the relevant standard.
NOTE 4: According to ETS 300 019-2-3 [3] series.
NOTE 5: Selection of voltage ranges provided by ETS 300 132 Part 1 and/or Part 2 [4].
NOTE 6: SD for selection of the classes provided by ETS 300 385 [5] or, for traffic capacity lower than 2 Mbit/s, for the performance criteria to be used in conjunction with ETS 300 339 [6].
NOTE 7: ETS 300 385 where applicable (DRRS of 2 Mbit/s and above). The Generic Standard for EMC of radio equipment ETS 300 339 may be applicable in other cases. Other measurement may be agreed with national administrations.
NOTE 8: The TMN interface, if the option of standardized interface is selected, cannot currently be tested. However as soon as work on testing is completed by ETSI such methods shall be used.
NOTE 9: The transmission capacity(ies) and baseband parameters, selected by SD are considered essential only for choosing the reference base-band test signal for RF spectrum test.
NOTE 10: Selection of SDH, PDH, ISDN, Digital channels baseband interfaces, Analogue channels baseband interfaces. Relevant ITU-T Recommendations and/or TM standards to be included in SD.
NOTE 11: Test required if test procedures are produced by the relevant Technical Body.
NOTE 12: With and without ATPC.
NOTE 13: Delete if not applicable.
NOTE 14: A spectrum analyser resolution bandwidth shall be required, see clause 5.2.3.7 of the present document.
NOTE 15: If practical measurements should also be made at both Ref + Ext.
NOTE 16: Internal spurious emission limits are lower than those of the external. These requirements are thus complementary and subject to SD only.
NOTE 17: A supplier shall declare the short term tolerance.
NOTE 18: The supplier shall provide design data of the RF, IF and BB filters which cumulatively meet the required selectivity.
NOTE 19: Some Administrations consider that these items are essential for type approval.
NOTE 20: If XPIC is implemented.
NOTE 21: Subject to further study.

4.1 General requirements

The present document is intended to cover the conformance testing procedures of all the common parameters usually required by DRRS equipment standards. Where a test method is not included in the present document, a suitable method shall be agreed between the supplier, accredited test laboratory and the type approval authority, prior to testing, and a description of the test method included in the Test Report.

IEC 60835 [6] test methods are adopted, where applicable. Clear distinction is made between "essential parameters" which require the "approval test" for regulatory purpose and "complementary requirements" or "optional requirements" which fulfil the "conformance test" against the relevant standard.

Distinction and allowance for "supplier declaration" on some parameters are also provided.

Conformance to other boundary standards (e.g. those for system input/output interfaces and related baseband processing, Telecommunications Management Network (TMN) interface and power supply) is subject to Supplier Declaration (SD) and any specific standards on their related conformance tests.

The supplier shall be considered legally responsible for any statement in the declaration and shall take necessary action to ensure that all equipment of the same type will conform to the Implementation Under Test (IUT) presented for type approval testing.

Annex B contains the test report template for the parameters listed in table 1.

4.2 Requirements classification

4.2.1 DRRS classification

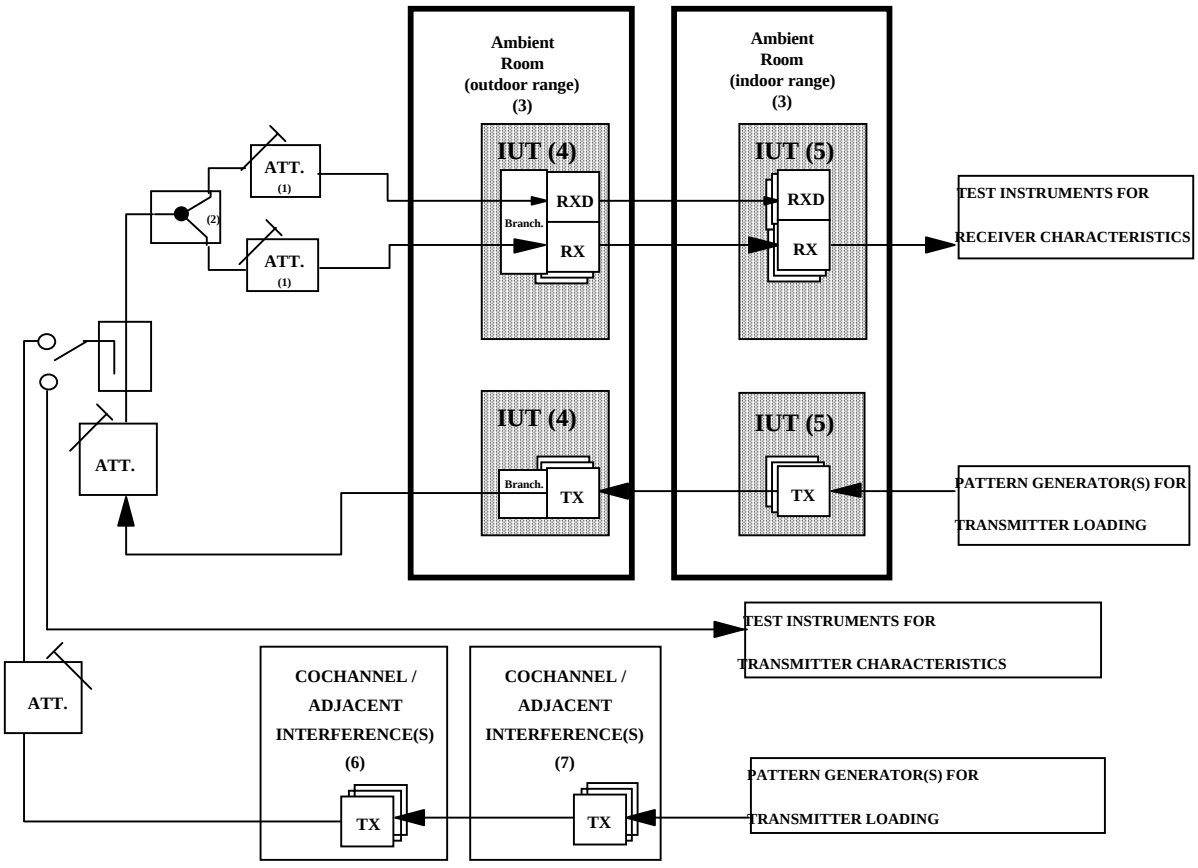
In table 1 the generic clauses and parameters contained in TR 101 036-1 [2] are classified, for conformance test purposes, in terms of the various categories defined in subclause 3.1. Table 1 also provides for defining the climatic conditions applicable during testing of the parameters e.g. reference or extreme conditions.

Shaded areas denote that Conformance Test (CT) and/or SD is not applicable.

4.3 IUT test arrangement for conformance test

General scheme for full indoor and split indoor/outdoor test arrangement is shown in figure 1 (e.g. IUT and climatic rooms with generic RF test bed for stand alone transceiver requirements and interference sensitivity).

All the test configurations shown in the document are typical/recommended.



(1) for level balance
(2) power splitter for space diversity option
(3) two ambient ranges if applicable
(4) outdoor section of IUT (if applicable)
(5) indoor section of IUT (if applicable
(6) outdoor sections of IUT (support for test)
(7) indoor sections of IUT (support for test)

Figure 1: Typical test set up

Corresponding transmitter and receiver are tested at the same temperature. Transmitter and receiver are tested on the same link.

When a split indoor/outdoor IUT is being tested the climatic cycles of the two required ambient rooms will be produced with the rules stated in ETS 300-019 [3], in "tracking mode" (i.e. the same climatic boundary such as reference, lower or uppermost conditions, will be produced in both).

The IUT presented for type approval shall be representative of production models and of a suitable conformation for the relevant test, i.e.:

- one single transceiver plus ancillary equipments for the relevant standard conformance;
- a fully equipped self-standing mechanical shelf for EMC conformance purpose;
- at least two transceivers when 1:1 or n:1 switching protection is to be included;
- an additional transceiver for systems which provide co-channel operation with XPIC (two Co-Channel (CC) transceivers in CC operation).

4.4 IUT environmental characteristics for conformance test

4.4.1 Test in the reference conditions

All conformance tests shall be carried out in environmental reference conditions. The result of the measurements under environmental reference conditions shall be taken to be reference performance. The reference performance will be used in comparison with representative measurements made at the climatic limits.

It is recognized that all requirements given in the standard are relevant for all combinations of temperature and humidity of the chosen climatic class. However some tests, as indicated in table 1 and in the Conformance Test Report, may be carried out only in environmental reference conditions for reasons of practicality and convenience.

The environmental reference condition is one of the possible existing combinations of temperature, humidity and air pressure falling within the limits given in table 2:

Table 2

temperature	+10°C to +35°C
relative humidity	10% to 80%
air pressure	$8,6 \times 10^4$ Pa to $1,06 \times 10^5$ Pa

4.4.2 Test in the extreme conditions

Conformance test shall be carried out for temperature variation only; mechanical, chemical and biological environmental stress are outside the scope of the present document. ETS 300 019-2 [3] shall apply.

The IUT shall be tested under extreme conditions according to the required or the selected class of operation reported in ETS 300 019-1 [3] or any other foreseen by the relevant standard.

The extreme condition test shall be made under the procedures required by the relevant ETS 300 019-2 [3].

The selection among the optional classes foreseen by the relevant standard, if any, will be made by the supplier declaration.

When non-ETS 300 019-1 [3] class is required by the relevant standard the test shall be carried out as the closest ETS 300 019-2 [3] class, provided that the extreme limits are widened or reduced accordingly.

Relative Humidity: The environmental tests should be conducted at the ambient relative humidity. Manufacturers shall declare that the equipment remains operational, within the limits of the relevant standard, at the lower and upper limits quoted in ETS 300 019 [3].

NOTE: Before testing at temperature extremes a period of stabilization is required.

4.5 DRRS test report

Annex B contains the harmonized test report. All test results shall be recorded by means of this test report format. Additional test details may be added to the test report where appropriate.

If a specific test parameter is not included in the standardized test report, the report should be used for guidance in producing the necessary addendum.

5 Test procedures for DRRS characteristics requirements

Where necessary, for better understanding of the application of test methods, reference is made to IEC 60835 [6] (Test methods).

5.1 General characteristics

5.1.1 Equipment Configuration

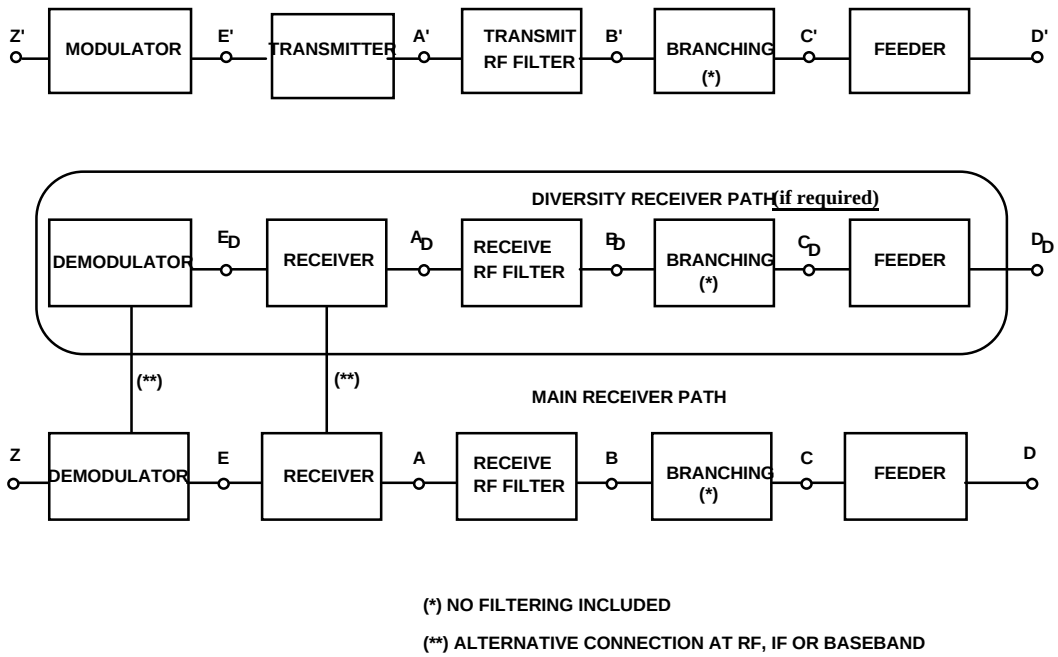


Figure 2: System Block diagram

5.2 Transmitter characteristics

5.2.1 Maximum output power

Objective:

Verify that the maximum output average power measured at reference point B' or C' is within the manufacturers declared value plus/minus the standard tolerance.

Test instruments:

1) power meter;

2) power sensor.

Test configuration:

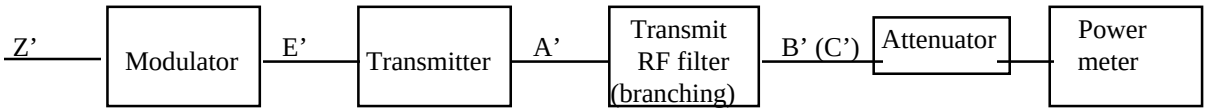


Figure 3

Test procedure:

With the transmitter power level set to maximum the average power output of the transmitter at point B'(C') is to be measured. Full account shall be taken of all losses between the test point and power meter.

5.2.2 Minimum output power

Objective:

Verify that the minimum output average power of equipment, fitted with power control circuitry, measured at reference point B' or C' is within the specified limit of the declared value.

Test instruments:

As for maximum power test.

Test configuration:

As for maximum power test.

Test procedure:

With the transmitter power level set to minimum the transmitter output at B' (C') is to be measured. Full account shall be taken of all losses between the test point and power meter.

5.2.3 Automatic Transmit Power Control (ATPC)

ATPC is an optional feature. However, when fitted, the minimum and maximum output average power levels shall be checked. In addition, satisfactory operation of the automatic facility shall be demonstrated. Where a standard does not include a specification for ATPC the test is to be conducted against the manufacturers specification.

Objective:

To verify the correct operation of the control loop i.e., when ATPC is implemented, that the transmitter output power can be manually set to the maximum and minimum level. In addition, the control loop is to be checked for satisfactory operation ie: Tx output power is related to the input level at the far receiver.

Test instruments:

As for maximum power test.

Test configuration (manual):

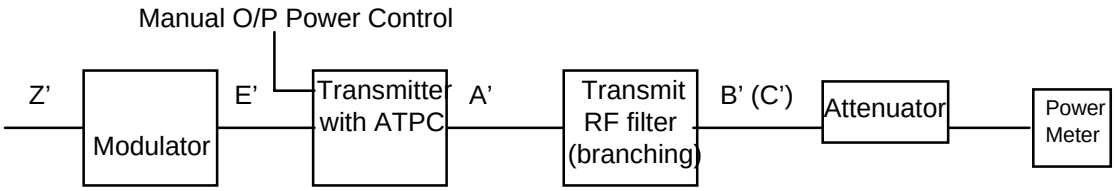


Figure 4

Test configuration (automatic):

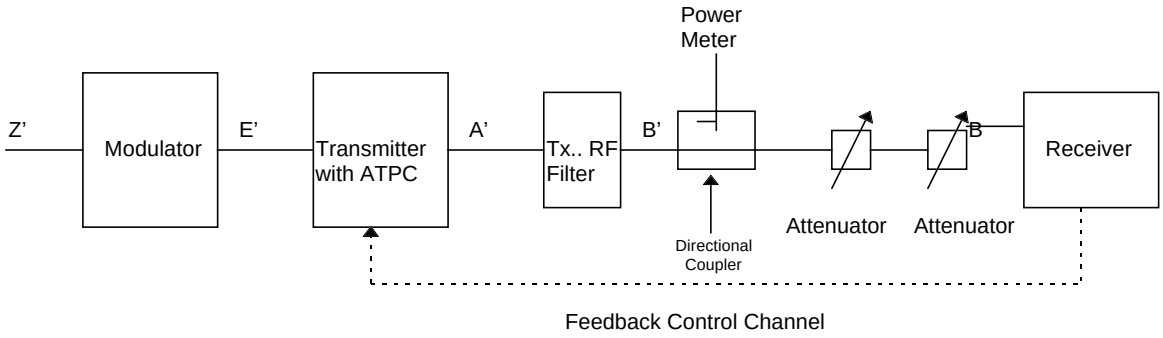


Figure 5

Test procedure:

With the maximum transmitter output level selected the average power level at point B'(C') is to be measured. The test is to be repeated with minimum transmitter output power selected. All losses between point B'(C') and the power meter shall taken into account.

All equipment fitted with automatic power control shall be checked for satisfactory closed loop operation. Attenuator B (see figure 5), initially set to produce the minimum transmitter output level is to be increased until the transmitter reaches its maximum output level. Throughout the transmitter's power range the receiver input level is to be maintained within the limits stated in the relevant standard or manufacturers guaranteed operating criteria. The test is to be repeated to verify that the automatic power control performance, between maximum transmitter power and minimum transmitter power meets the relevant standard or manufacturers performance limits.

5.2.4 Remote Transmit Power Control (RTPC)

Where remote transmit power control is an available function it is to be checked and recorded during the transmitter output power test.

5.2.5 Frequency accuracy

Objective:

To verify the Tx output frequency is within the limits specified in the relevant standard. Where transmitters cannot be placed in the CW condition the manufacturer is to seek an agreement with the accredited laboratory on the frequency accuracy test method. The preferred method is to use a frequency counter capable of measuring the centre frequency of a modulated signal. When this type of counter is not available the LO frequency is to be measured and the output frequency is to be calculated using the relevant formula.

Where practical, frequency accuracy measurements are to be conducted at the lowest, mid-band and highest channel of the unit under test.

Test instruments:

- Frequency Counter.

Test configuration:

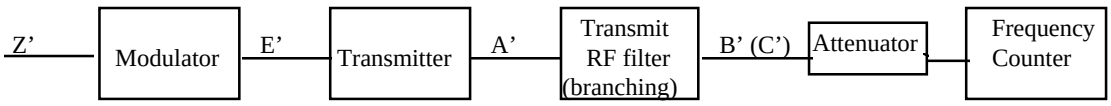


Figure 6

Test procedure:

The Tx is to be operated in the CW condition and frequency measurements conducted on the channel previously selected by the test house. The measured frequency is to be within the tolerance stated in the relevant standard.

5.2.6 RF spectrum mask

The measurement shall be made with a suitable spectrum analyser connected to the transmitter port via a suitable attenuator.

Where practical, RF spectrum mask measurements are to be conducted at the lowest, mid-band and highest channel of the unit under test.

Where a standard allows spectral lines at the symbol rate to exceed the spectrum mask limits, this relaxation has to be taken into consideration.

If more than one spectrum mask is available in the standard then the appropriate mask should be recorded in the test report.

Objective:

To verify that the output frequency spectrum is within the specified limits of the relevant standard.

Test instruments:

1) spectrum analyser;

2) plotter.

Test configuration:

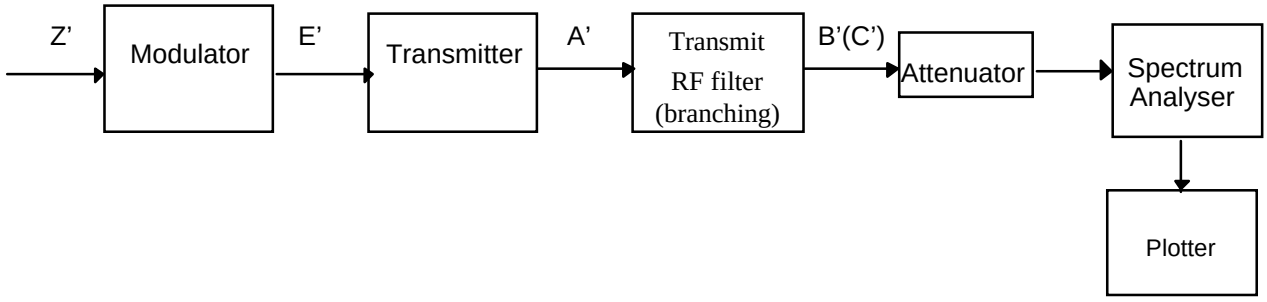


Figure 7

Test procedure:

The transmitter output port shall be connected to either a spectrum analyser via an attenuator or an artificial load with some means of monitoring the emissions with a spectrum analyser. The spectrum analyser shall have a variable persistence display or digital storage facility. The resolution bandwidth, frequency span, scan time and video filter settings of the spectrum analyser are to be set in accordance with the relevant standard.

With the transmitter modulated by a signal having the characteristics given in the relevant standard, the Tx power density shall be measured by the spectrum analyser and plotted. Where possible, transmitter spectral power density plots at the lowest, mid-band and highest channels, are to be recorded. In addition, plots shall be taken at normal and extreme power supply voltages at the ambient temperature and environmental extremes.

NOTE: Where a standard permits spectral lines at the symbol rate to exceed the spectrum mask, this relaxation should be taken into consideration.

5.2.7 Remote frequency control

Remote frequency control is an optional feature. However, when fitted the function shall be tested during the frequency accuracy test.

5.2.8 Spectral lines at the symbol rate

Objective:

To verify that the power level of spectral lines at a distance from the channel centre frequency equal to the symbol rate is less than -x dBm or x dB below the average power level of the carrier.

The requirement of the relevant standard may be either an attenuation relative to the average carrier power or an absolute level.

See note in subclause 5.2.6.

5.2.9 Spurious emissions (external)

Objective:

To verify that any spurious emissions generated by the transmitter are within the limits quoted in the relevant standard. Spurious emissions are emissions outside the bandwidth necessary to transfer the input data at the transmitter to the receiver, whose level may be reduced without affecting the corresponding transfer of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products,

Test instruments:

1) spectrum analyser;
2) spectrum analyser mixer units - as required;
3) plotter.

Test configuration:

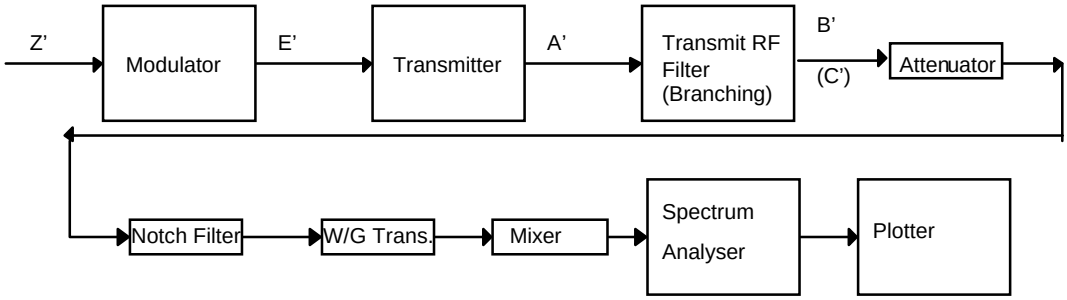


Figure 8

Test procedure:

The transmitter output port shall be connected to either a spectrum analyser via a suitable attenuator and/or notch filter to limit the power into the front end of the analyser. In some cases, where the upper frequency limit exceeds the basic operating range of the analyser, suitable waveguide transitions and mixer will be required. It is important that the circuit between the transmitter and the input to the mixer, or spectrum analyser, is characterized over the frequency range to be measured. These losses should be used to set the limit line of the analyser to a value which ensures that the specification criteria at point C' is not exceeded (see figure 8).

The transmitter is to be operated at the manufacturers maximum rated output power and the level and frequency of all significant signals are to be measured and plotted throughout the frequency band quoted in the relevant specification. It is recommended that each scan be taken in 5 GHz steps below 21, 2 GHz and 10 GHz steps above 21, 2 GHz. However, spurious emissions close to the limit should be plotted over a restricted range which clearly demonstrates that the signal does not exceed the relevant limit.

NOTE 1: Where a specification states that the spurious emission test is to be conducted with the equipment in the modulated condition, the resolution bandwidth of the spectrum analyser is to be set to the level quoted in the specification. The frequency span and scan rate of the analyser should be adjusted to maintain the noise floor below the limit line and maintain the spectrum analyser in the calibrated condition.

NOTE 2: Measurement of spurious emission levels from equipment operating in the CW condition can be conducted with resolution bandwidth, frequency span and scan rates which maintain the spectrum analyser in the calibrated condition while keeping the difference between noise floor and limit line at least 10 dB.

NOTE 3: Due to the low levels of RF signal and the wideband modulation used in this type of equipment, radiated RF power measurements have greater measurement uncertainty than to conducted measurements. Therefore where equipment is normally fitted with an integral antenna, the manufacturer shall supply a documented test fixture that converts the radiated signal into a conducted signal into a 50 A termination.

Due to the lack of standardization, most of the DRRS standards have requirements which may appear not well defined.

In particular two measuring parameters may be missed:

- the evaluation BandWidth (BWe) to be used in the spectrum analyser test;
- the exclusion bandwidth across the nominal centre frequency where emissions are to be considered "out of band emissions" and thus are not considered "spurious emissions".

In this cases the requirement shall be considered as CEPT provisional for "unmodulated carrier condition" (i.e. CW emissions are only considered). The exclusion bandwidth across the nominal frequency shall be taken, in accordance with ITU-R Study Group 9 Recommendation F.1191-1 [8] as ± 250% of the relevant channel spacing.

BWe shall be taken as 100/120 kHz for frequency below 1 GHz and 1 MHz above this limit.

However if BWe are stated in the equipment standard then these should be used.

As most of the modern DRRS are not able to deliver an unmodulated carrier, in this case the measurement shall be carried out with modulated carrier, provided that the level limits for noise like spurious emissions (e.g. harmonics and mixer image frequencies) were regarded as "maximum level in any elementary band equal to BWe".

In other cases the relevant standard may ask explicitly for modulated carrier conditions and give the parameters for test procedure.

5.3 Receiver characteristics

5.3.1 Input level range

Objective:

To verify that the receiver meets the Bit Error Rate (BER) criteria, given in the relevant specification, over a defined range of receiver input levels.

Test instruments:

1) power sensor and meter;
2) pattern generator/error detector.

Test configuration:

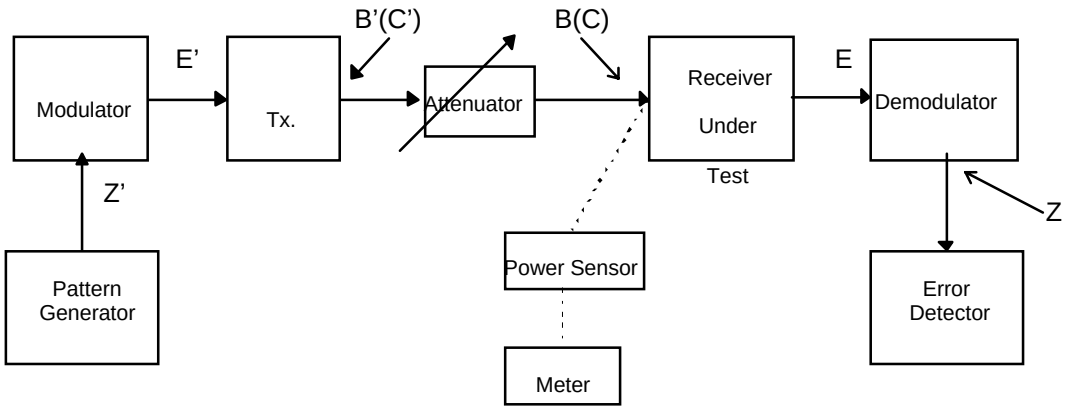


Figure 9

Test procedure:

Connect the pattern generator output to the BaseBand (BB) Tx input Z' and the error detector to the BB Rx output Z. Switch the transmitter to standby and adjust the variable attenuator to provide maximum attenuation. Disconnect the receiver under test. Connect the power meter, through a suitable power sensor, to point B(C) (see figure 9). Switch on the transmitter and adjust the attenuator to set the power to the upper limit for the input level range test. Switch the transmitter to standby and reconnect the receiver under test. Measure and record the BER for the upper range.

Increase the level of attenuation until the signal input level at the receiver causes BER equal to the lower limit quoted in the relevant specification, measure and record the BER at this level. The receiver input level range is the signal range between the upper and lower receiver input levels provided the BER is met.

5.3.2 Spurious emissions

The same test method as described in subclause 5.2.9 is applicable. Spurious emission levels from a transmitter and receiver of duplex equipment using a common port are measured simultaneously and the test only needs to be conducted once.

Objective:

To verify that spurious emissions from the receiver are within the limits.

5.3.3 System performance without diversity

5.3.3.1 BER as a function of Receiver input Signal Level (RSL)

Objective:

Received signal level versus BER thresholds are verified. This is typically measured at the three BER levels specified in the relevant standard.

Test instruments:

1) pattern generator/error detector;

2) power sensor and meter.

Test configuration:

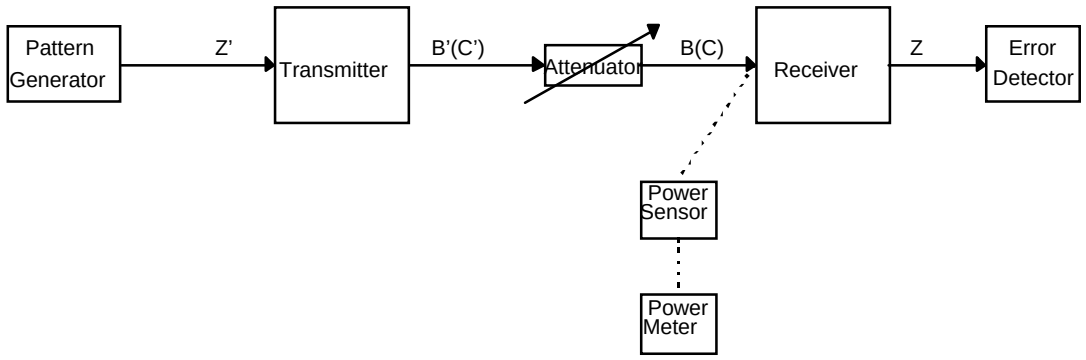


Figure 10

Test procedure:

Connect the pattern generator output to the BB input of the Tx. Send the BB output signal of the Rx to the Error detector. Then take record of BER curve by varying the received field. Verify that the RSL, corresponding to the BER thresholds are within the specifications.

5.3.3.2 Co-channel interference sensitivity- external

There are variations in some of the standard as to the measurement requirements for Co-channel Interference Sensitivity. The variations have been covered by providing Methods 1 and 2 for these tests. The test house should apply the approach stated in the relevant equipment standard.

Method 1:

Objectives:

To verify that the BER at point Z, of the receiver under test, remains below the relevant specification limit in the presence of an interfering like modulated signal on the same channel. The signal levels of the wanted and interfering signals at point B(C) shall be set at the levels given in the relevant specification.

Test instruments.

1) 2 bit pattern generators;
2) error detector;
3) power sensor and meter.

Test configuration 1:

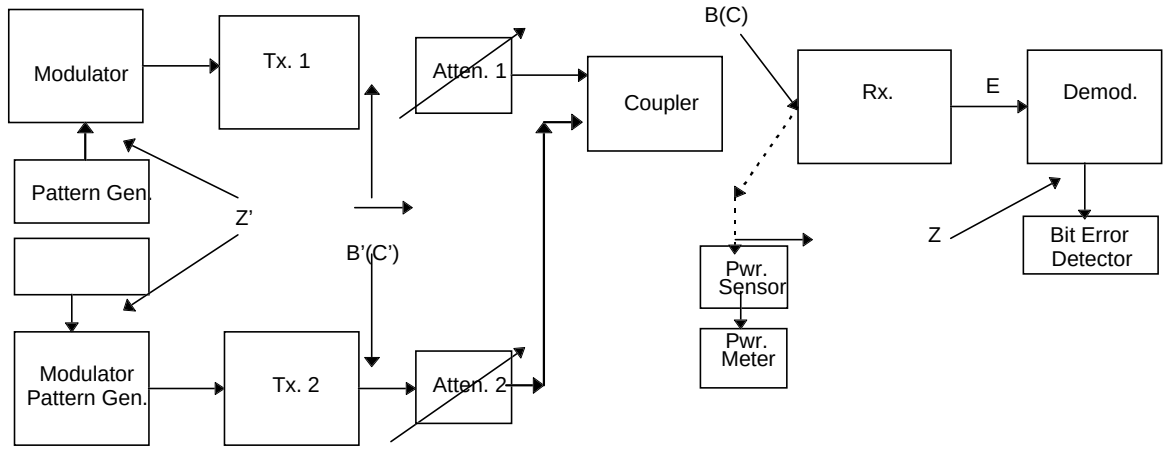


Figure 11

Test procedure for test configuration 1:

During this test both transmitters shall transmit on the same frequency and be modulated with different signals having the same characteristics. Switch the transmitters to standby and disconnect the waveguide or cable at point B(C) (see figure 11). Connect a suitable power sensor and meter. Switch on Tx 1 and adjust attenuator 1 to set the signal to a convenient level, say -30 dBm. Switch Tx 1 to standby and Tx 2 on. Adjust attenuator 2 to set the interfering signal to a level below the reference signal, measured previously, which is equal to the Carrier to Interfer (C/I) ratio given in the specification. Switch Tx 2 to standby.

Reconnect the receiver under test, switch on Tx 1 and increase attenuator 1 until the 10^{-6} level required by the standard is achieved. Increase attenuator 2 by the same amount attenuator 1 was increased, switch on Tx 2 and record the BER for the C/I as stated in the standard.

Decrease attenuator 2 until the receiver BER equals the limit quoted in the specification. Calculate and record the C/I ratio.

Alternative procedure 1**:**

NOTE: This procedure uses an additional attenuator between the combiner and receiver to control the absolute wanted and unwanted signal levels into the receiver. The functions of attenuators 1 and 2 is to maintain the correct C/I ratio.

Test configuration 2:

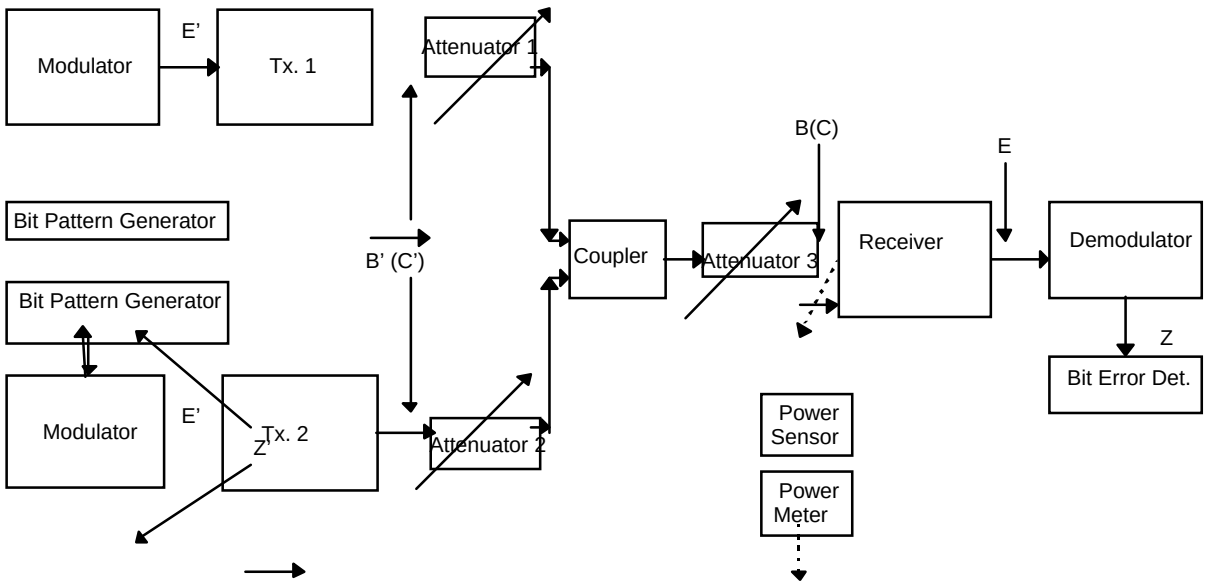


Figure 12

Test procedure for test configuration 2:

With the transmitters at standby set attenuators 1 and 2 to their maximum values and attenuator 3 to zero. Disconnect the waveguide or cable at point B(C) (see figure 12) and connect a suitable power sensor and meter. Switch on Tx 1 and reduce attenuator 1 to produce a suitable level, say -30 dBm. Record the measured level. Switch Tx 1 to standby and Tx 2 on. Reduce attenuator 2 to produce a signal below the level previously measured by an amount equal to the C/I ratio. Increase attenuator 3 to set the wanted receiver input level to that quoted in the specification.

With both transmitters on standby disconnect the power sensor and reconnect the receiver under test. Switch both transmitters on in the modulated condition and measure and record the receiver BER on the error detector.

Decrease attenuator 2 until the receiver BER equals the limit quoted in the specification. Calculate and record the wanted to unwanted ratio.

Method 2:

Objective:

To verify that the maximum C/I value for 1 dB and 3 dB degradation on 10^{-6} and 10^{-3} BER remains below the relevant specification limit in presence of an interfering like modulated signal on the same channel.

Test instruments:

1) 2 pattern generator;

2) error detector;

3) power sensor and meter.

Test configuration:

See figure 11.

Test procedure:

During this test both transmitters shall transmit on the same channel and be modulated with signals that have the same characteristics. With the transmitters to standby set both attenuators to their maximum values.

Connect power meter at point B(C). Switch on Tx 1 and adjust attenuator 1 to set the wanted signal to the level required by the standard for 10^{-6} (or 10^{-3}). Decrease attenuator 1 by 1 dB (or 3 dB) and record its setting. Switch on the interferer and reduce attenuator 2 to achieve a BER of 10^{-6} (or 10^{-3}) on the error detector. Switch both transmitters off and disconnect the waveguide, or cable, at point B(C) - see figure 10. Record the setting of attenuator 2 and connect the power sensor and meter to the waveguide or cable.

Switch Tx 1 on and reduce attenuator 1 to produce a wanted signal level within the calibrated range of the power meter. Record the power level and reduction in attenuation.

- Calculate $Power_{wanted\ signal}$ = Measured power level - change in attenuation.
- Switch off Tx. 1, switch on Tx. 2 and repeat the procedure to calculate the $Power_{unwanted\ signal.}$

The maximum co-channel C/I value for 1 dB or 3 dB degradation on 10^{-6} or 10^{-3} is:

- $C/I = Power_{wanted\ signal} - Power_{unwanted\ signal}$.

5.3.3.3 Adjacent channel interference sensitivity

There are variations in some of the standards as to the measurement requirements for adjacent channel interference sensitivity. The variations have been covered by providing Method 1 and Method 2 options for these tests. The test house should apply the approach stated in the relevant equipment standard.

NOTE 1: In many cases the C/I ratio will be negative thus producing an interferer with a higher level than the wanted signal.

Method 1:

Objective:

To verify that the BER at point Z, of the receiver under test, remains below the relevant specification limit in the presence of an interfering like modulated signal on the adjacent channel. The signal levels of the wanted and interfering signals at point B(C) shall be set at the levels given in the relevant specification.

Test instruments:

Same as co-channel test.

Test configuration 1:

Same as co-channel test (see figure 11).

Test procedure for test configuration 1:

During this test the interfering transmitter shall be modulated with signals having the same characteristics as the modulating signal of the wanted transmission and be tuned to an adjacent channel. Switch the transmitters to standby and disconnect the waveguide or cable at point B(C). Connect a suitable power sensor and meter. Switch on Tx 1 and adjust attenuator 1 to set the wanted signal at a convenient level, say -30 dBm. Switch Tx 1 to standby and Tx 2 on. Adjust attenuator 2 to set the interfering signal to a level above the reference signal, measured previously, which is equal to the C/I ratio given in the specification. Switch Tx 2 to standby.

Reconnect the receiver under test and increase both attenuators by equal amounts which ensure that the wanted and unwanted signal levels into the receiver are at their correct values. Switch on and modulate both transmitters. Record the receiver BER.

Repeat the test with the interfering transmitter tuned to the other adjacent channel.

Alternative procedure 1:

NOTE 2: This procedure uses an additional attenuator between the combiner and receiver to control the absolute wanted and unwanted signal levels into the receiver. The functions of attenuators 1 and 2 is to maintain the correct C/I ratio.

Test configuration 2:

Same as Alternative 1, Co-channel test (see figure 12).

Test procedure for test configuration 2:

With the transmitters at standby set attenuators 1 and 2 to their maximum values and attenuator 3 to zero. Disconnect the waveguide or cable at point B(C) and connect a suitable power sensor and meter. Switch on Tx 1 and reduce attenuator 1 to produce a suitable level, say -30 dBm. Record the measured level. Switch Tx 1 to standby and Tx 2 on. Reduce attenuator 2 to produce a signal level above that previously measured, by an amount equal to the C/I ratio. Increase attenuator 3 to provide the receiver with an input equal to the specified receiver level.

With both transmitters on standby disconnect the power sensor and reconnect the receiver under test. Switch both transmitters on in the modulated condition and measure and record the receiver BER on the error detector.

Repeat the test with the interfering transmitter tuned to the other adjacent channel.

Method 2:

Objective:

To verify that the maximum C/I value for 1 dB and 3 dB degradation on 10^{-6} and 10^{-3} BER remains below the relevant specification limit in the presence of an interfering like modulated signal on the adjacent channel.

Test instruments:

1) 2 pattern generator;

2) error detector;

3) power sensor and meter.

Test configuration:

See figure 11.

Test procedure:

During this test the interferer (Tx 2) shall transmit on one of the adjacent channels and be modulated with a signal having the same characteristics as the signal modulating the wanted transmitter. With both transmitters on standby set the attenuators to their maximum values.

Connect power meter at point B(C). Switch on Tx 1 and adjust attenuator 1 to set the wanted signal to the level required by the standard for 10^{-6} (or 10^{-3}). Decrease attenuator 1 by 1 dB (or 3 dB) and record its setting. Switch on the interfere and reduce attenuator 2 to achieve a BER of 10^{-6} (or 10^{-3}) on the error detector. Switch both transmitters off and disconnect the waveguide, or cable, at point B(C) - see figure 10. Record the setting of attenuator 2 and connect the power sensor and meter to the waveguide or cable.

Switch Tx. 1 on and reduce attenuator 1 to produce a wanted signal level within the calibrated range of the power meter. Record the power level and reduction in attenuation:

- Calculate $\text{Power}_{\text{wanted signal}}$ = Measured power level - change in attenuation.

Switch off Tx 1, switch on Tx 2 and repeat the procedure to calculate the $\text{Power}_{\text{unwanted signal}}$.

The maximum co-channel C/I value for 1 dB or 3 dB degradation on 10^{-6} or 10^{-3} is:

- $C/I = \text{Power}_{\text{wanted signal}} - \text{Power}_{\text{unwanted signal}}$.

Repeat the test with the interfere on the other adjacent channel.

5.3.3.4 CW spurious interference

Objective:

This test is designed to identify specific frequencies at which the receiver may have a spurious response e.g. image frequency, harmonic response of the receive filter etc. The frequency range of the test should be in accordance with the relevant specification.

Test instruments:

1) pattern generator;
2) error detector;
3) signal generator;
4) power sensor and meter.

Test configuration:

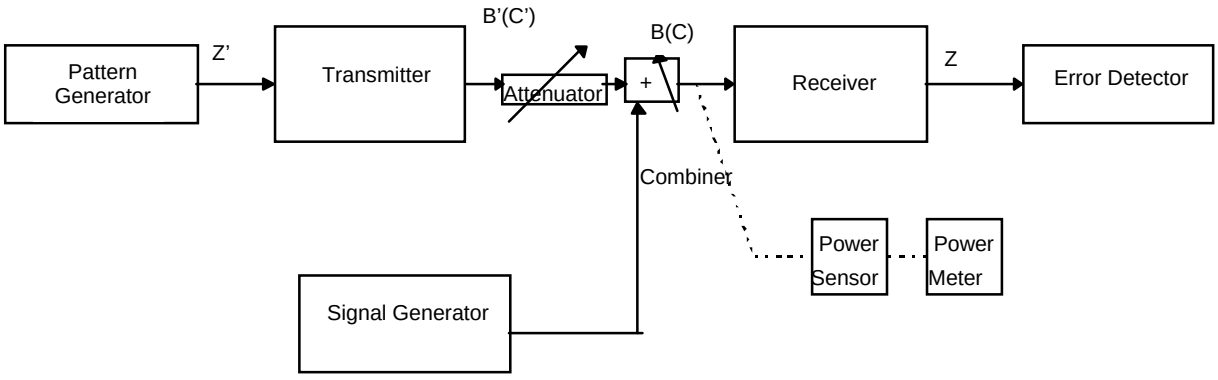


Figure 13

Test procedure:

With the signal generator output turned off, measure the transmitter RF output power at point B(C) using a suitable power sensor, with a known level of attenuation. Replace the power sensor with the receiver under test, and increase the level of attenuation until the level required by the standard is measured. Record the BER for this receiver level (dBm) where applicable.

Switch off the transmitter, replace the receiver under test with a power sensor. Calibrate the signal generator across the frequency range required by the standard at a level x dB above the level (dBm), where x is the required increase in level for the interfering CW signal.

Replace the power sensor with the receiver under test and confirm the BER level has not changed. Sweep the signal generator through the required frequency range at the calibrated level, taking into account any exclusion band stated in the relevant EN/ETS.

Any frequencies which cause the BER to exceed the level stated in the standard shall be recorded. It is recommended that the calibration be rechecked at these frequencies.

NOTE 1: The use of a stepped signal generator is permitted provided that the step size is not greater than one third of the bandwidth of the receiver under test.

NOTE 2: This test may require the use of low pass filters on the output of the signal generator to prevent harmonics of the signal generator falling into the receiver exclusion band.

5.3.3.5 Distortion sensitivity

Objective:

The test is only applicable to certain (high capacity) systems.

This is a test of the equipment's immunity against propagation distortion. The results are given in the form of signatures.

Test instruments:

1) pattern generator;

2) error detector;

3) RF synthesizer;

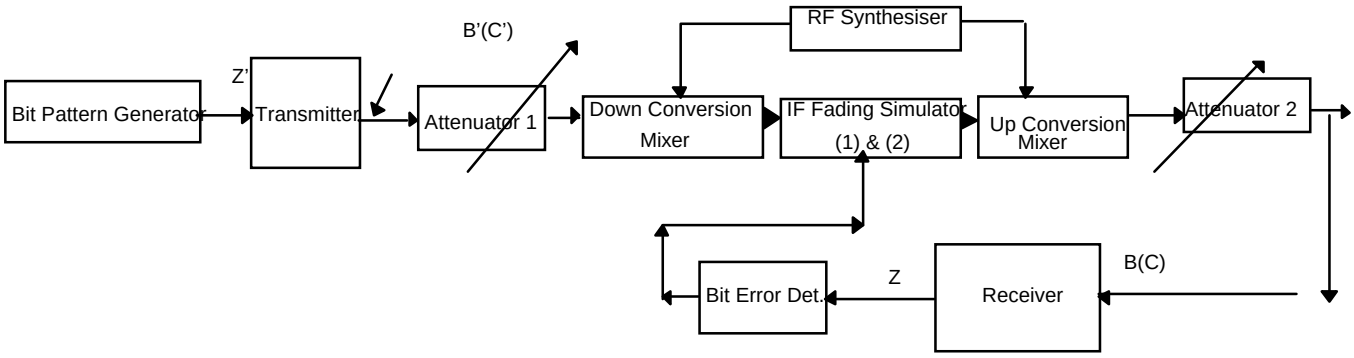
4) IF fading simulator.

Test configuration:

Two test configurations are considered.

Test configuration 1:

This test configuration may be used with all types of Rx implementation, and is particularly useful for test of Rx with direct demodulation:



(1): IF fading simulator may include an error detector;
(2): IF fading simulator frequency may be different from Rx. IF frequency;
(3): RF branch may also be allowed between points B'(C.) and B(C).

Figure 14

Test procedure for Test configuration 1:

1) connect the pattern generator output to the BB TX input;

2) connect TX RF output and RX RF input to the corresponding RF access points of the signature test bench;

3) connect the error detector at the BB RX output;

4) set the RF Synthesizer Frequency to channel nominal center frequency + IF FADING SIMULATOR frequency.

NOTE 1: If selectable, it is recommended that IF FADING SIMULATOR frequency be high.

NOTE 2: In some particular cases, the RF synthesizer frequency may be chosen as channel nominal center frequency - IF FADING SIMULATOR frequency.

Test instruments:

1) pattern generator / error detector STM-1 (155 Mbit/s);

2) fading simulator.

Test configuration 2:

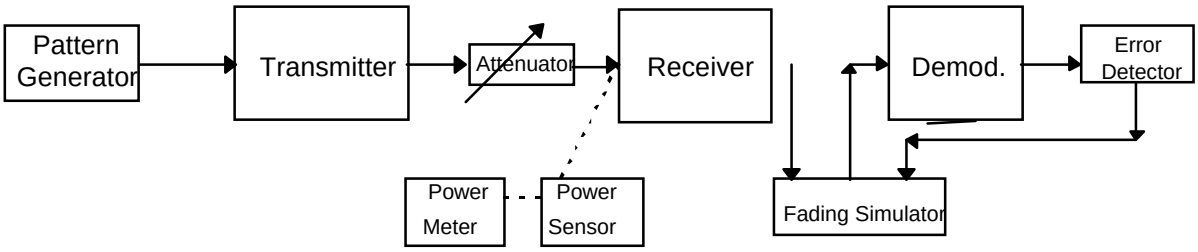


Figure 15

Test procedure for test configuration 2:

Connect the pattern generator output to the BB input of the Tx. Connect the fading simulator (delay 6,3 ns) between the Rx. IF amplifier and the demodulator input and measure the BER at the BB Rx output.

5.3.4 System characteristics with diversity

5.3.4.1 BER performance

Same test method can be use as described in subclause 5.2.5.1. An improvement of the threshold shall be within the limits in the specification.

5.3.4.2 Interference sensitivity

For further study.

5.3.4.3 Distortion sensitivity

It is to be noted that neither TR 101 036-1 [2] nor any standards presently state any requirements for distortion sensitivity in system with diversity. This is mainly due to the difficulties to control the high number of parameters involved and the complexity of a suitable test set up. However a practical and generic test set-up together with some possible measurements are reported in annex C.

Annex A (normative): Supplier's declaration

A.1 Supplier's declaration

A.1.1 Supplier declaration of conformity

Hereby we:

.....

Company name:

.....

Company address:

.....

.....

Declare under our sole responsibility that the Digital Radio Relay System:

.....

Product name, description:

.....

Product type/data rate(s):

.....

.....

Is in conformity with the appended supplier specification:

.....

.....

Specification:

.....

.....

And the following relevant standards:

.....

.....

.....

.....

Place, date:

.....

Company:

.....

Authorized signature:

.....

A.1.2 Supplier declaration summary

Parameter	T	I	NA	Comments
General characteristics				
Channel plan, centre gap, etc.				
Compatibility requirement between systems				
Environmental conditions				
Power supply				
Electromagnetic compatibility (EMC)				
TMN interface				
Waveguide flanges				
Return loss				
Intermodulation products				
Parameters for digital systems				
Baseband parameters				
Transmitter characteristics				
Tx power range and tolerance				
ATPC				
RTPC				
RFC				
LO frequency arrangements				
RF spectrum mask - innermost channels				
Spurious emissions (Tx) - internal				
Short term radio frequency tolerance				
Long term radio frequency tolerance				
Receiver characteristics				
Spurious emissions (Rx) - internal				
Rx intermediate frequency				
Receiver image rejection				
Innermost channel Rx selectivity				
System characteristics without diversity				
Equipment background BER				
Co-channel interference sensitivity - Internal				
Front end non linearity requirements				
Distortion sensitivity				
Receiver third order intermodulation immunity				
System characteristics with diversity				
Differential delay compensation				
Co-channel interference sensitivity				
Adjacent channel interference sensitivity				
Distortion sensitivity				
Parameters for co-ordination purposes				
Tx bandwidth				
Rx bandwidth				
Rx noise figure				
Receiver mask				
Input level for BER 10^{-6}				

NOTE: T: Test to be carried out to the declared value.
I: Information needed for testing, approval or co-ordination.
NA: Supplier's declaration for this parameter is not applicable.

A.1.3 General characteristics

A.1.3.1 Channel plan (operating frequency range), centre gap, channel spacing, innermost channels spacing, duplex frequency separation

Declare parameters for frequency band, channel arrangement and reference to relevant standard on channel plan used:

Channel plan reference:						
					Yes	**No**
Alternate frequency channel arrangement:						
Co-polar channel arrangement:						
Interleaved channel arrangement:						
Frequency range: (GHz)						
Centre gap: (MHz)						
Innermost channels spacing: (MHz)						
Transmitter receiver duplex frequency separation: (MHz)						
Payload bit rate (Mbit/s)						
Gross bit rate (Mbit/s)						
Channel spacing (MHz)						

A.1.3.2 Compatibility requirements between systems

	Yes	**No**
The IUT fulfils the compatibility requirements given by the standard to which it is to be tested.		
Comment and additional information:		

A.1.3.3 Environmental conditions

In this clause the environmental (climatic only) stresses which the equipment shall withstand shall be declared. The requirements are generally given in the **ETS 300 019 [**3**]**, which defines weather protected and non-weather protected locations, classes and test severity.

A.1.3.3.1 Equipment within weather protected locations - indoor locations

	Yes	**No**
ETS 300 019 [3], class 3.1		
ETS 300 019 [3], class 3.2		
ETS 300 019 [3], class 3.3		
ETS 300 019 [3], class 3.4		
ETS 300 019 [3], class 3.5		

A.1.3.3.2 Equipment for non weather-protected locations - outdoor locations

	Yes	No
ETS 300 019 [3], class 4.1		
ETS 300 019 [3], class 4.1E		

A.1.3.4 Power supply

	Yes	No
The power supply conforms to ETS 300 132 [4], part 1 or part 2.		

State the following power supply parameters. They are to be used for setting up the correct test conditions.

Nominal input voltage (V)	
Maximum input voltage (V)	
Minimum input voltage (V)	
Type of voltage (AC or DC)	

A.1.3.5 ElectroMagnetic Compatibility (EMC)

Status of the EMC conformance test shall be indicated in the table below. The relevant standard to which the equipment conforms shall be declared as well.

	Status	Comments
Not tested		
Compliant		
Not compliant		
Relevant standard or recommendation:		
NOTE: If a test or re-test is scheduled the date may be declared as a comment.		

	Yes	No
The IUT conforms to EMC class A requirements:		
The IUT conforms to EMC class B requirements:		
Reference to certificate number:		

A.1.3.6 TMN interface

TMN interfaces cannot currently be tested due to lack of standards.

	Status	Comments
Not tested		
Not applicable		
Compliant		
Not compliant		
NOTE: If a test or re-test is scheduled the date may be declared as a comment. Also a reference to an eventual test report may be stated.		

A.1.3.7 Branching and feeder requirements

A.1.3.7.1 Waveguide flanges (or other connectors)

Type of waveguide flanges used:	

A.1.3.7.2 Return loss

Minimum return loss of the branching system, reference. point C, (dB):	
Minimum return loss of the branching system, reference. point C', (dB):	
NOTE: For systems with integrated antennas there are no requirements on return loss.	

A.1.3.7.3 Intermodulation products

Each intermodulation product at reference point B is less than or equal to: (dBm)			
Type of product (e.g. $2f_1 - f_2$ or $f_1 - f_2 + f_3$ etc.)			
Transmit frequencies: (MHz)			
Transmit levels: (dBm)			
NOTE: The measurement shall be referenced to point B on the receive side in order to take into account contributions from both Tx and Rx side.			

A.1.4 Parameters for digital systems

A.1.4.1 Baseband parameters

Status of the baseband conformance test(s) shall be indicated in the table below. The relevant standard to which the equipment conforms shall be declared as well.

PDH interfaces	**Status**	**Comments**
Not tested		
Not applicable		
Compliant		
Not compliant		
Relevant standard or recommendation:		
SDH interface	**Status**	**Comments**
Not tested		
Not applicable		
Compliant		
Not compliant		
Relevant standard or recommendation:		
ISDN interfaces (primary rate)	**Status**	**Comments**
Not tested		
Not applicable		
Compliant		
Not compliant		
Relevant standard or recommendation:		
Data channel baseband interface	**Status**	**Comments**
Not tested		
Not applicable		
Compliant		
Not compliant		
Relevant standard or recommendation:		
NOTE: If a test or re-test is scheduled the date may be declared as a comment. Also a reference to an eventual test report may be stated.		

A.1.4.2 Transmitter characteristics

A.1.4.2.1 Transmitter power range and Tx output power tolerance

Maximum transmitter output power ± tolerance; x dBm ± k dB	
Minimum transmitter output power ± tolerance; x dBm ± k dB	
NOTE: k shall be according to relevant standard. For some systems only the maximum Tx output power is relevant.	

A.1.4.2.2 Automatic Transmit Power Control (ATPC) and Remote Transmit Power Control (RTPC)

ATPC implemented: **Yes** ☐ **No** ☐	
ATPC power range, Tx output ranges from X to Y (dBm)	
ATPC power tolerances: (dB)	
Activation threshold: (dBm)	
Deactivation threshold: (dBm)	
Activation and deactivation description	

RTPC implemented: **Yes** ☐ **No** ☐	
RTPC power range: (dBm)	
RTPC power tolerances: (dB)	
RTPC step size: (dB)	

A.1.4.2.3 Remote Frequency Control (RFC)

RFC implemented: **Yes** ☐ **No** ☐	
RFC frequency range: (GHz)	
RFC frequency tolerances: (ppm)	

A.1.4.2.4 LO frequency arrangements

The supplier shall declare the Tx and Rx local oscillator arrangement used. Figure A.1 presents an example of oscillator arrangements. The supplier should declare the arrangement in a similar format, indicating the relative position of the local oscillator(s) and stating the frequency offset(s). If the relative frequency of the LO is different in certain parts of the frequency band this could be indicated in another drawing, or by a dashed line on the same drawing. If there is no LO, this can be indicated by a note: no LO.

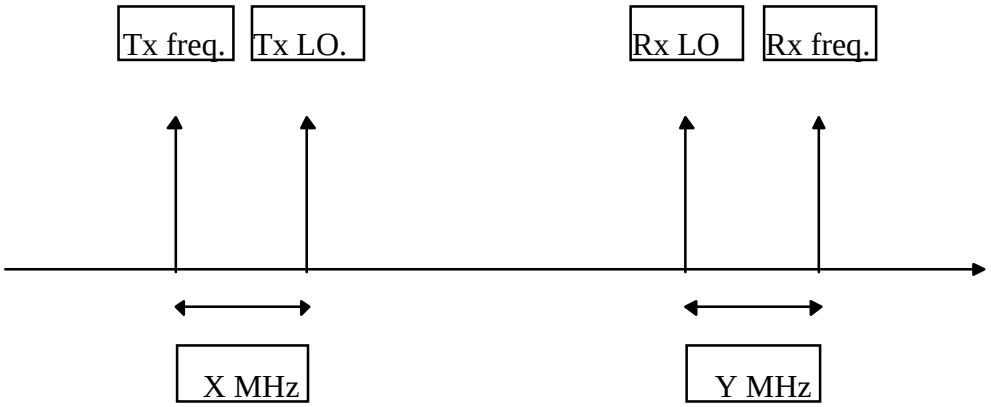


Figure A.1

Declaration of local oscillator arrangement:

.....

.....

.....

.....

.....

.....

.....

.....

A.1.4.2.5 RF spectrum mask - innermost channels

The RF spectrum mask for innermost channels is to be declared by the supplier.

Supply a plot in the annex and provide the annex reference.

Annex reference	

An example of a diagram for providing a plot is shown in figure A.2.

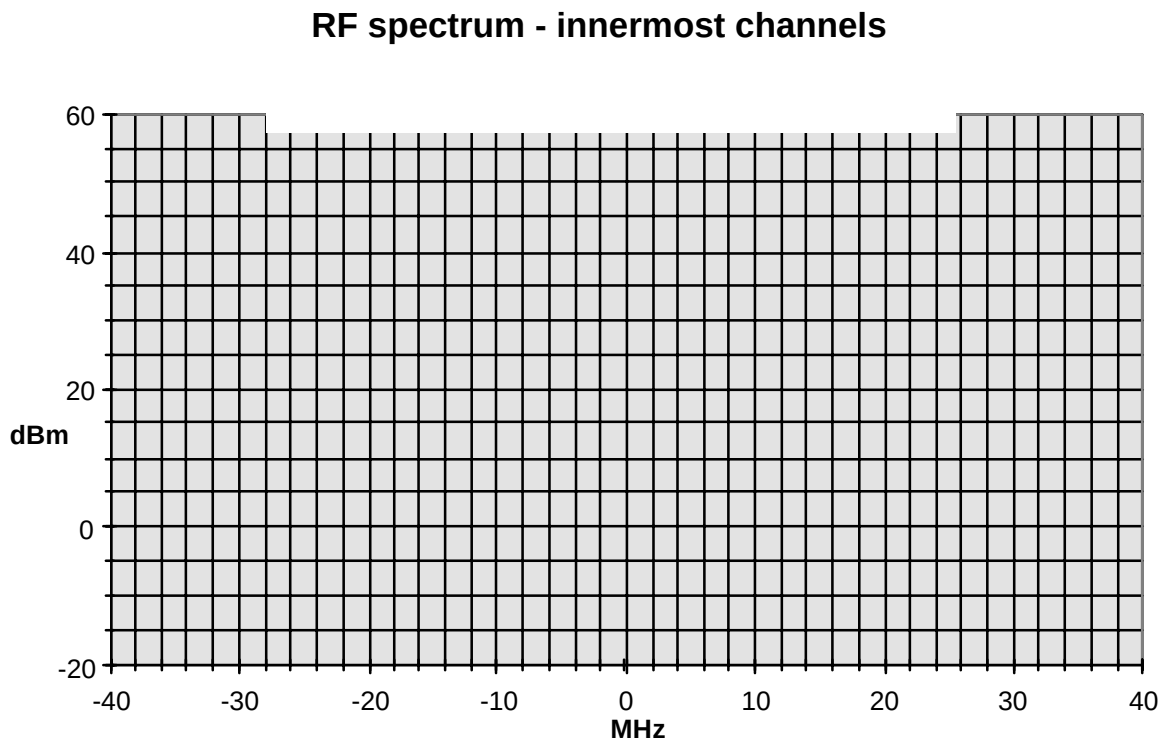


Figure A.2

A.1.4.2.6 Spurious emissions (Tx) - internal

Spurious emission frequency relative to channel assigned frequency	**Controlling factor for requirement application**	**Declaration (dBm)**	**Specification limit**
The average level of all spurious signals both discrete CW and noise-like (including LO, ± IF, ±2 IF), evaluated as total signal level	**If spurious signal's frequency falls within receiver half band, for digital systems with multi-channel branching networks**		**< -XX dBm**
	If spurious signal's frequency falls within receiver half band, for digital systems without branching networks (i.e. with duplexer)		**< -YY dBm**
Other spurious evaluated as for "Spurious emissions - external" case.	**If spurious signal's frequency falls within transmitter half band**		**see note**
NOTE: Limits are specified in the relevant standard or EN 301 390 (Preliminary generic standard on spurious emissions and receiver immunity at equipment/antenna port of digital radio relay system).			

A.1.4.2.7 Short term radio frequency tolerance

Short term radio frequency tolerance: (ppm)	

A.1.4.2.8 Long term radio frequency tolerance

Long term radio frequency tolerances: (ppm)	
Guaranteed time period for the long term tolerance: (years)	

A.1.4.3 Receiver characteristics

A.1.4.3.1 Spurious emissions (Rx) - internal

One of the following alternative shall be used to declare the internal spurious emissions of the system.

	Frequency (GHz)	Level (dBm)	Limit (dBm)
Internal spurious emission at reference point B for DRRS with multi channel branching networks, < -XX dBm:			
Internal spurious emission at reference point C for DRRS without branching networks, < -YY dBm:			
NOTE: Maximum value of the emissions shall be declared.			

A.1.4.3.2 Rx Intermediate Frequency (IF)

For receivers with direct demodulation the following declaration is not applicable:

Rx Intermediate Frequency (IF):	IF_1	
	IF_2	
	IF_3	

A.1.4.3.3 Receiver image rejection

For receivers with direct demodulation the following declaration is not applicable.

	Declaration (dB)	Limit (dB)
If applicable, the receiver image(s) rejection shall be ≥ XX dB		

If applicable also the following requirement shall be fulfilled and the values be declared.

	Declaration (dB)	Limit (dB)
Receiver rejection at image frequencies falling within the transmitter half band shall be ≥ YY dB		

A.1.4.3.4 Innermost channel Rx selectivity

Supply a plot in the annex and provide below annex reference.

Annex reference	

A.1.4.4 System characteristics without diversity

A.1.4.4.1 Equipment Background BER (BBER)

The equipment BBER conforms to the requirements in the relevant standard.	Yes ☐ No ☐

A.1.4.4.2 Co-channel interference sensitivity - internal

The "Co-channel interference sensitivity - internal" conforms to the requirements in the relevant standard.	Yes ☐ No ☐

A.1.4.4.3 Front end non linearity requirements (two tone CW spurious interference)

Maximum registered BER for any two tone, equal power, CW spurious interference (according to the requirements in the relevant standard) shall be declared in the table below. CW interferer frequencies and level(s) at actual BER shall be declared as well.

Detected two tone CW spurious interference					
CW_1 interferer frequency (GHz)	**CW_2 interferer frequency (GHz)**	**CW interferer level (dBm)**	**Measured BER**		**Limit BER**
			BER =		$BER \leq 10^{-5}$
			BER =		$BER \leq 10^{-5}$
			BER =		$BER \leq 10^{-5}$
			BER =		$BER \leq 10^{-5}$
			BER =		$BER \leq 10^{-5}$

A.1.4.4.4 Distortion sensitivity

The guaranteed signature, to which the test is to be carried out, shall be declared.

Supply a plot in the annex and provide below annex reference.

Annex reference	

A.1.4.4.5 Receiver third order intermodulation immunity

Receiver third order intermodulation immunity			
Intermodulation frequency (GHz)	**Intermodulation level (dBm)**	**Measured BER**	**Limit BER**
			$BER \leq 10^{-5}$
			$BER \leq 10^{-5}$

A.1.4.5 System characteristics with diversity

A.1.4.5.1 Differential delay compensation

In case of diversity system, declare the maximum differential delay that can be compensated for.

Maximum Compensatable differential delay (ns):	

A.1.4.5.2 Interference sensitivity

A.1.4.5.2.1 Co-channel interference sensitivity

For further study.

A.1.4.5.2.2 Adjacent channel interference sensitivity

For further study.

A.1.4.5.2.3 Distortion sensitivity

For further study.

A.1.4.6 Additional parameters for co-ordination purposes

A.1.4.6.1 Tx bandwidth

The 99 % bandwidth of the Tx signal at reference point B' (C') shall be stated by the supplier. The parameter is important for national and international co-ordination purposes.

Tx bandwidth (99%): (MHz)	

A.1.4.6.2 Rx bandwidth

The bandwidth of the receiver at reference point E shall be stated by the supplier. Either the noise bandwidth, the 3 dB bandwidth or the 6 dB bandwidth may be declared. The parameter is important for national and international co-ordination purposes.

Rx bandwidth: (MHz)	

Type of bandwidth definition measured according to (tick appropriate alternative):

Bandwidth definition:	**(X)**
Noise bandwidth	
3 dB bandwidth	
6 dB bandwidth	

A.1.4.6.3 Rx noise figure

The nominal noise figure of the receiver, at reference point E, shall be stated by the supplier. The parameter is important for national and international co-ordination purposes.

Noise figure: (dB)	

A.1.4.6.4 Receiver mask

The receiver mask is required to obtain a generalized selectivity characteristic which can be used to compute, with a sufficient level of accuracy, the contribution of any interferer with a known and determined spectrum envelope.

"Receiver" should mean the complete receiving section, between the points C and Z, as defined in the generic block diagram of digital radio relay systems, as the selectivity of the branching filters and demodulator shall be taken into account.

Proposed measurement procedure:

1) a CW signal of variable frequency and output level is used;

2) the received level is set 3 dB above the actual threshold level corresponding to BER = 10^{-6}. The central frequency of the receiver is F_0;

3) The CW interferer is varied in frequency and level in order to cause a measured BER equal to 10^{-6} (see note). Both values, frequency and level, are recorded and plotted;

NOTE: The threshold level corresponding to BER = 10^{-6} is relevant for systems with a capacity of 2 Mbit/s and above. BER = 10^{-3} threshold can be used for systems with capacities below 2 Mbit/s.

4) the measurement is performed within the limits of $F_0 \pm dF$. The level of the CW interferer is limited to 50 dB above the wanted signal.

The set of results can then be used to compute the contribution of each fractional part of the spectrum of the interferer.

Supply a plot in the annex and provide the annex reference.

Annex reference	

A.1.4.6.5 Input level for BER = 10^{-6}

The input level for the BER of 10^{-6} shall be stated by the supplier. This information may be recorded during type testing.

Input level for BER of 10^{-6} (dBm)	

Annex B (normative): Test report

B.1 Test results

B.1.1 Summary of tests

Parameter	C	NC	NT	NA	Reference to remark
Transmitter characteristics					
Transmitter power range					
Maximum output power tolerance					
Minimum output power tolerance					
Automatic Transmit Power Control (ATPC)					
Remote Transmit Power Control (RTPC)					
Remote Frequency Control (RFC)					
RF spectrum mask					
Spectral lines at the symbol rate					
Spurious emissions, external					
Tx frequency tolerance (short term)					
Receiver characteristics					
Input level range					
Spurious emissions					
System performance without diversity					
BER vs. Rx signal level					
Interference sensitivity					
Co-channel interference - external and adjacent channel interference					
CW spurious interference					
Distortion sensitivity					
System performance with diversity					
BER vs. Rx signal level					
Interference sensitivity					
Distortion sensitivity					

NOTE: C: The parameter is compliant with the requirements.
NC: The parameter is not compliant with the requirements.
NT: The parameter is not tested.
NA: The test of this parameter is not applicable.

B.1.2 General information about the tests

General information about the tests shall be given below.

Name of accredited laboratory performing the tests	
Test report reference number	
Standard applied	
Dates of test (from - to)	
Name of manufacturer	
Manufacturer's declared type designation	
Type of equipment	
Equipment serial number(s)	
Module:	**Serial number**

B.1.3 Test result forms

B.1.3.1 Transmitter characteristics

B.1.3.1.1 Transmitter power range

The test is divided in two parts. The first one is maximum output power and the second one (if applicable) is minimum output power.

B.1.3.1.1.1 Maximum output power

Method of measurement:

See subclause 5.2.1.

Results:

Ambient temperature: °C Relative humidity: %

Rated output power: dBm.

Test conditions		Transmitter power level (dBm)		
		RF channel low (GHz)	RF channel mid (GHz)	RF channel high (GHz)
T_{nom} ( )	V_{nom} ( )			
T_{min} ( )	V_{min} ( )			
	V_{max} ( )			
T_{max} ( )	V_{min} ( )			
	V_{max} ( )			
Measurement uncertainty (dB)				
NOTE: Use the number of columns that are required depending on how many frequency channels are to be tested.				

Limits:

Maximum allowed power (dBm)	
Tolerance (rated power), all test conditions (dB)	

Test equipment used: (Item numbers)	

B.1.3.1.1.2 Minimum output power

Method of measurement:

See subclause 5.2.2.

Results:

Ambient temperature: °C Relative humidity: %

Rated output power: dBm

Test conditions		Transmitter power level(dBm)		
		RF channel low (GHz)	RF channel mid (GHz)	RF channel high (GHz)
T_{nom} ( )	V_{nom}.( )			
T_{min}.( )	V_{min} ( )			
	V_{max}.( )			
T_{max}.( )	V_{min} ( )			
	V_{max}.( )			
Measurement uncertainty (dB)				
NOTE: Use the number of columns that are required depending on how many frequency channels are to be tested.				

Limits:

Minimum allowed power (dBm)	
Tolerance (rated), all test conditions (dB)	

Test equipment used: (Item numbers)	

B.1.3.1.2 Automatic transmit power control (ATPC)

Method of measurement:

See subclause 5.2.3.

Results:

Ambient temperature: °C Relative humidity: %

Input voltage, V_{nom}: V

For results from Tx performance verification, the relevant sections for transmitter power range, RF spectrum mask, spurious emissions and output power tolerance shall be used.

For the control loop performance, one of the directions shall be tested only, and the results stated below.

Control loop performance		
	OK	**Not OK**
Power level control functionality: Minimum power level increasing to maximum power level (according to declaration by the supplier).		
Power level control functionality: Maximum power level decreasing to minimum power level (according to declaration by the supplier).		

Test equipment used: (Item numbers)	

B.1.3.1.3 Remote Transmit Power Control (RTPC)

This measurement, if applicable, has been carried out under the "output power tolerance" tests.	**Yes ☐**	**No ☐**	**Not applicable ☐**

B.1.3.1.4 Remote Frequency Control (RFC)

This measurement, if applicable, has been carried out under the "Radio Frequency Tolerance" tests.	**Yes ☐**	**No ☐**	**Not applicable ☐**

B.1.3.1.5 RF spectrum mask

This clause is to be used for normal channels case or, if applicable, innermost channels case.

Method of measurement:

See subclause 5.2.6.

Results:

The results shall be represented by plots provided in the annex. Annex references shall be stated below. An example of a diagram for providing a plot is shown below.

NOTE: Use the number of tables that are required, depending on how many frequency channels are to be tested.

Ambient temperature: °C Relative humidity: %

Input voltage, V_{nom}: V

Test conditions		
Radio frequency channel (GHz)		**Reference to plot in the annex**
T_{nom}	V_{nom}	
T_{min}	V_{min}	
T_{max}	V_{min}	
T_{min}	V_{max}	
T_{max}	V_{max}	

Test conditions		
Radio frequency channel (GHz)		**Reference to plot in the annex**
T_{nom}	V_{nom}	
T_{min}	V_{min}	
T_{max}	V_{min}	
T_{min}	V_{max}	
T_{max}	V_{max}	

Test conditions		
Radio frequency channel (GHz)		**Reference to plot in the annex**
T_{nom}	V_{nom}	
T_{min}	V_{min}	
T_{max}	V_{min}	
T_{min}	V_{max}	
T_{max}	V_{max}	

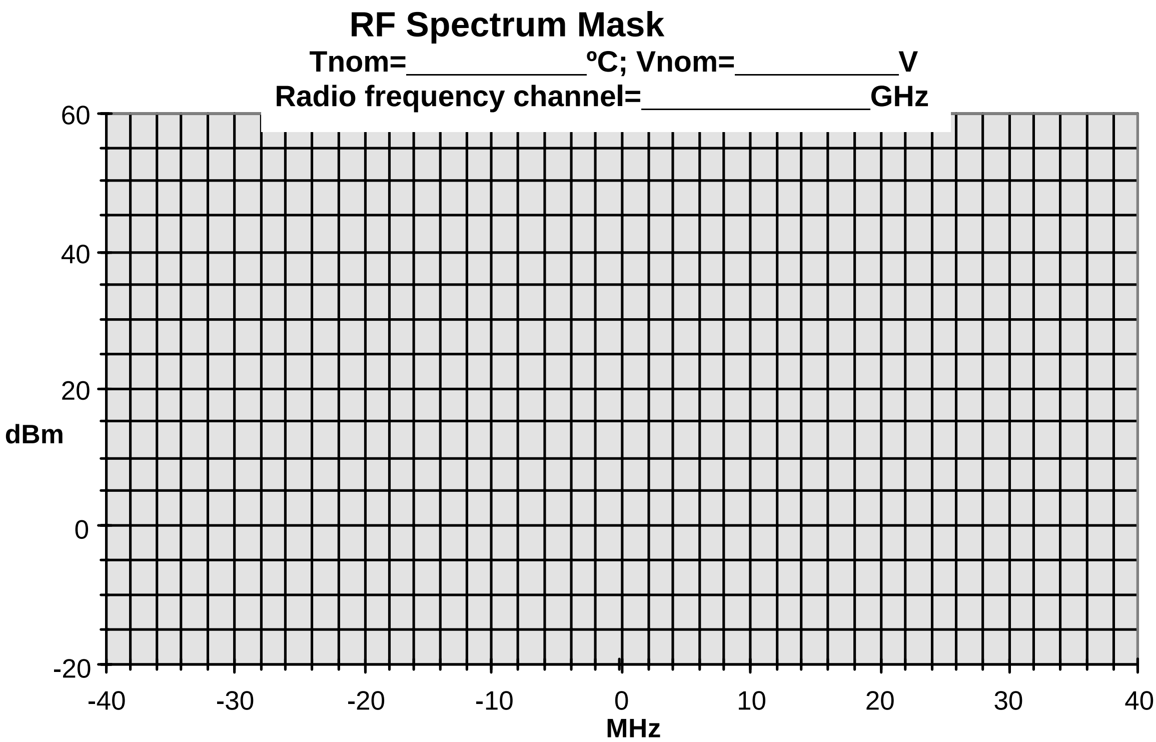


Figure B.1

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.1.6 Spectral lines at the symbol rate

Method of measurement:

See subclause 5.2.8.

Results:

NOTE: Use the number of tables that are required, depending on how many frequency channels are to be tested.

The worst case of the measured values shall be presented.

Ambient temperature: °C Relative humidity: %

Input voltage, V_{nom}: V

Radio frequency (GHz):			
Frequency offset from f_c (MHz)	**Power level of spectral lines (dBm / dB)**	**Limiting values**	**(dBm / dBc)**

Radio frequency (GHz):			
Frequency offset from f_c (MHz)	**Power level of spectral lines (dBm / dB)**	**Limiting values**	**(dBm / dBc)**

Radio frequency (GHz):			
Frequency offset from f_c (MHz)	**Power level of spectral lines (dBm / dB)**	**Limiting values**	**(dBm / dBc)**

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.1.7 Spurious emissions (Tx) - external

Method of measurement:

See subclause 5.2.9.

Limits:

Limits are specified in the relevant standard.

Results:

The results shall be presented by plots.

Annex references shall be stated below. An example of a diagram for providing a plot is shown below.

NOTE: If the measurement for "spurious emissions (Tx) - external" and "spurious emissions (Rx) - external" can be carried out at the same time the results may be presented in the same plots. In that case only one of these clauses will be used and this fact be clearly declared in the test report.

Ambient temperature: °C Relative humidity: %

Input voltage, V_{nom}: V

Frequency (GHz) By plot range	Reference to plot in annex		
	RF channel low (GHz)	RF channel mid (GHz)	RF channel high (GHz)
Measurement uncertainty (dB)			

Limits:

Insert diagram showing spurious emissions(Tx) - external measurements

Example of diagram that can be used for presenting the measurements:

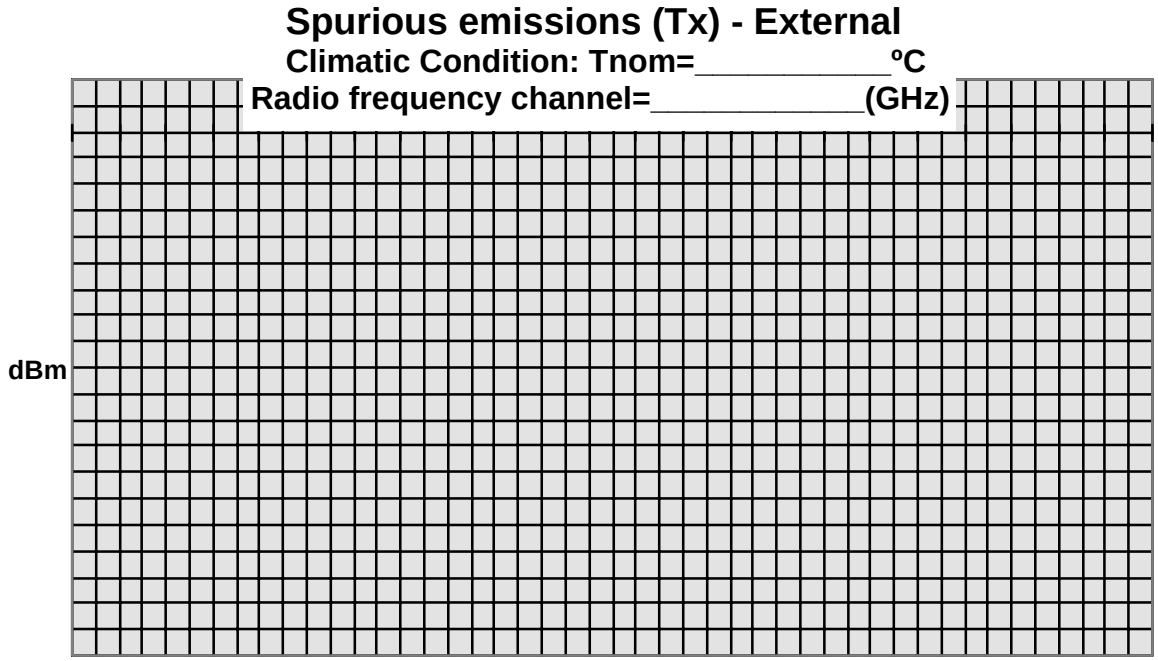


Figure B.2

Test equipment used: (item numbers)	

B.1.3.1.8 Tx radio frequency tolerance (short term)

Method of measurement:

See subclause 5.2.5.

Results:

Ambient temperature: °C Relative humidity: %

Test conditions		**Frequency error (kHz / ppm)**		
		RF channel low (GHz)	**RF channel mid (GHz)**	**RF channel high (GHz)**
T_{nom} ( )	**V_{min} ( )**			
	V_{nom} ( )			
	V_{max} ( )			
T_{min} ( )	**V_{min} ( )**			
	V_{max} ( )			
T_{max} ( )	**V_{min} ( )**			
	V_{max} ( )			
Measurement Uncertainty (kHz / ppm)				

Limits:

Limit (kHz / ppm)	

Test equipment used: (item numbers)	

B.1.3.2 Receiver characteristics

B.1.3.2.1 Input level range

Method of measurement:

See subclause 5.3.1.

Results:

Ambient temperature: °C Relative humidity: %

Input voltage, V_{nom}: V

Test Conditions	**RF channel low (GHz)**	**RF channel mid (GHz)**	**RF channel high (GHz)**
Upper level (dBm) BER=			
Lower level (dBm) BER=			
NOTE: Use the number of columns that are required, depending on how many frequency channels are to be tested.			

Limits:

	Limit Level (dBm)	**Limit BER**
Upper level		
Lower level		

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.2.2 Spurious emissions (Rx) - external

Method of measurement:

See subclause 5.3.2.

Limits:

Limits are specified in the relevant standard.

Results:

The results shall be presented by plots.

Annex references shall be stated below. An example of a diagram for providing a plot is shown below.

NOTE: If the measurement for "Spurious emissions (Tx) - external" and "Spurious emissions (Rx) - external" can be carried out at the same time the results may be presented in the same plots. In that case only one of these clauses will be used and this fact be clearly declared in the test report.

Ambient temperature: °C Relative humidity: %

Input voltage, V_{nom}: V

Frequency (GHz) By plot range	**Reference to plot in annex**		
	RF channel low (GHz)	**RF channel mid (GHz)**	**RF channel high (GHz)**
Measurement Uncertainty (dB)			

Limits:

Insert diagram showing spurious emissions(Rx) - external measurements

Example of diagram that can be used for presenting the measurements is presented in figure B.3.

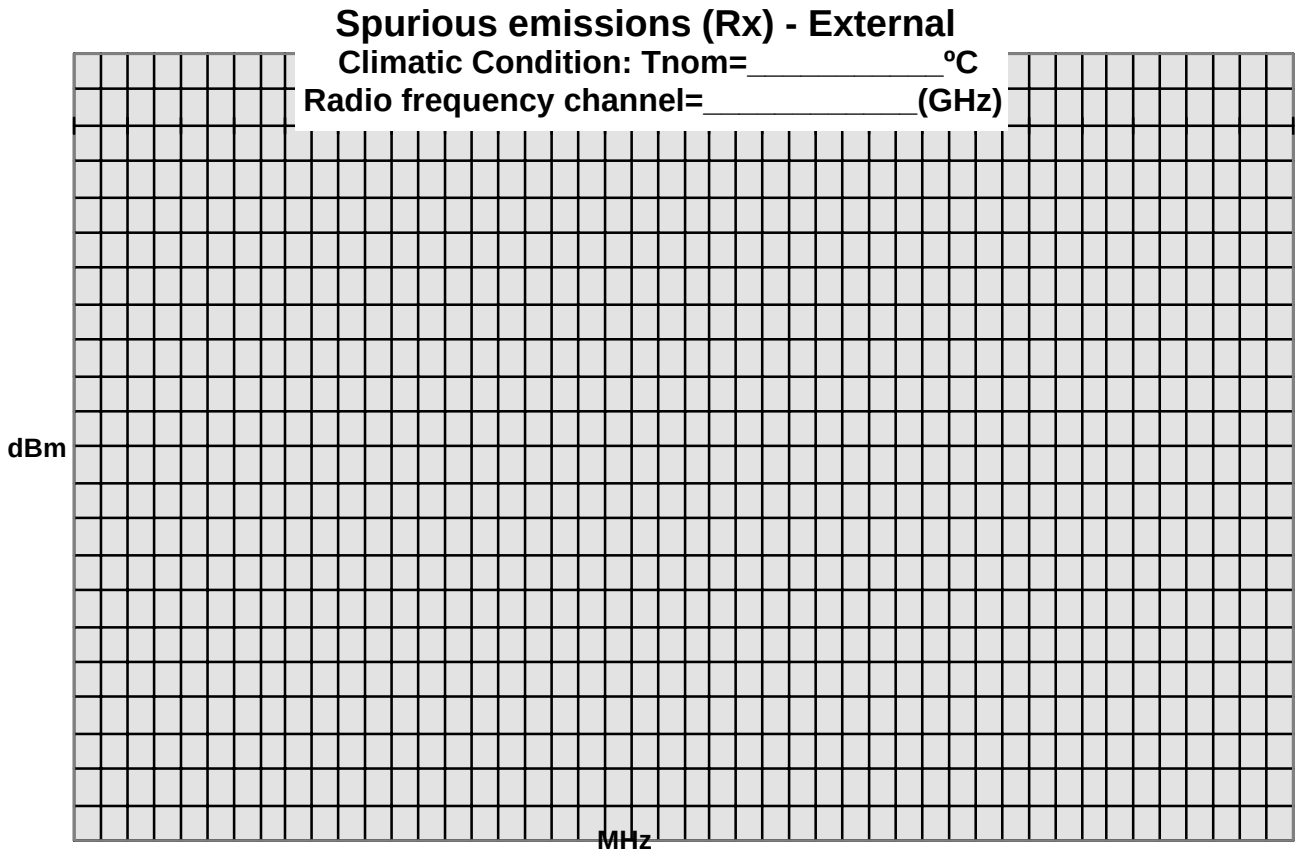


Figure B.3

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.3 System performance without diversity

B.1.3.3.1 BER vs. Rx signal level

Method of measurement:

See subclause 5.3.3.1.

Results:

The results can be presented in table form.

The relevant testpoints (BER-values) according to the standard shall be declared together with the measured received signal level values. Only one frequency channel will normally be tested.

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

Climatic condition	T_{nom}=	T_{min}=	T_{max}=
Received signal level (dBm) at BER=			
Received signal level (dBm) at BER=			
Received signal level (dBm) at BER=			

Limits:

	BER =	BER =	BER =
Limit level (dBm)			

Alternatively plots may be used and in that case be supplied in the annex and referenced to in the table below.

Below is an example of a diagram in which a plot can be presented:

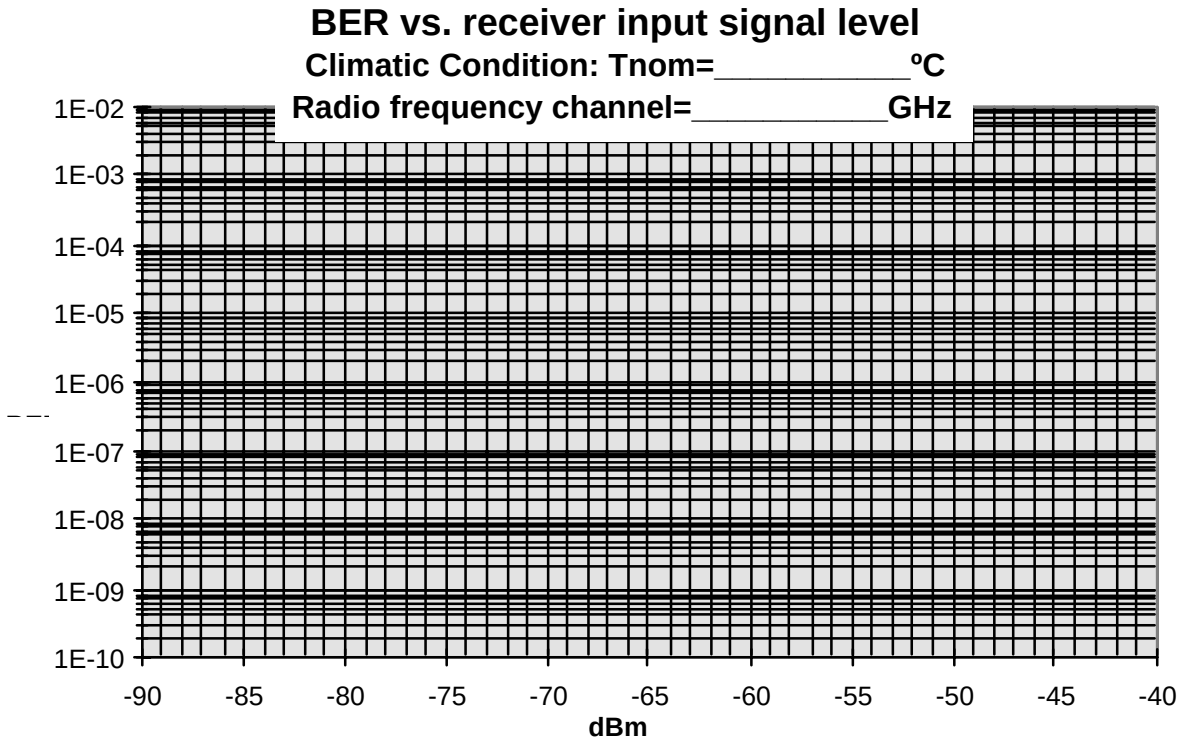


Figure B.4

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

Test conditions	Reference to plot in the annex
T_{nom}=	
T_{min}=	
T_{max}=	

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.3.2 Interference sensitivity

B.1.3.3.2.1 Co-channel interference sensitivity - external and adjacent channel interference sensitivity

Method of measurement:

See subclauses 5.3.3.2 and 5.3.3.3.

Results:

The results shall be presented in table form. Both the results from the co-channel interference and adjacent channel interference measurements shall be presented. Two approaches exist and the one which conforms to the relevant standard shall be used. Only one frequency channel will normally be tested.

Method 1:

State the maximum C/I (dB) values measured.

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

Bit rate (Mbit/s)	Channel spacing (MHz)	Measured C/I resulting in a degradation from BER = 10^{-6} to BER = 10^{-5}

Limits:

C/I Limit (dB)	

Measurement uncertainty	

Test equipment used: (Item numbers)	

Method 2:

State the maximum C/I (dB) values measured.

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

	RSL @ BER	RSL @ 10^{-3}		RSL @ 10^{-6}	
	Degradation	1 dB	3 dB	1 dB	3 dB
Bit rate (Mbit/s)	Channel spacing (MHz)				

Limits:

	1 dB 10^{-3}	3 dB 10^{-3}	1 dB 10^{-6}	3 dB10^{-6}
C/I Limit (dB)				

B.1.3.3.2.2 CW spurious interference

Method of measurement:

See subclause 5.3.3.4.

Results

Maximum registered BER for any CW frequency (according to the measurement methods) shall be presented in the table below. CW interferer frequency(ies) and level(s) at actual BER shall be presented as well. Only one frequency channel will normally be tested.

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

CW spurious interference			
CW interferer frequency (MHz)	**Minimum CW interferer level (dBm)**	**Measured BER**	**Measured C/I (dB)**

Limits:

Limit BER at C/I (dB)	**BER=**	**C/I=**

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.3.3 Distortion sensitivity

Method of measurement:

See subclause 5.3.3.5.

Results:

The measurement results shall be presented in plots provided in the annex. References to the plots shall be given in the table below. Only one frequency channel will normally be tested.

Both minimum phase and non-minimum phase signatures can be presented in the same diagram.

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

Test conditions	Reference to plot in the annex
Outage signature	
Return signature	

Below is an example of a diagram in which signature curves can be presented:

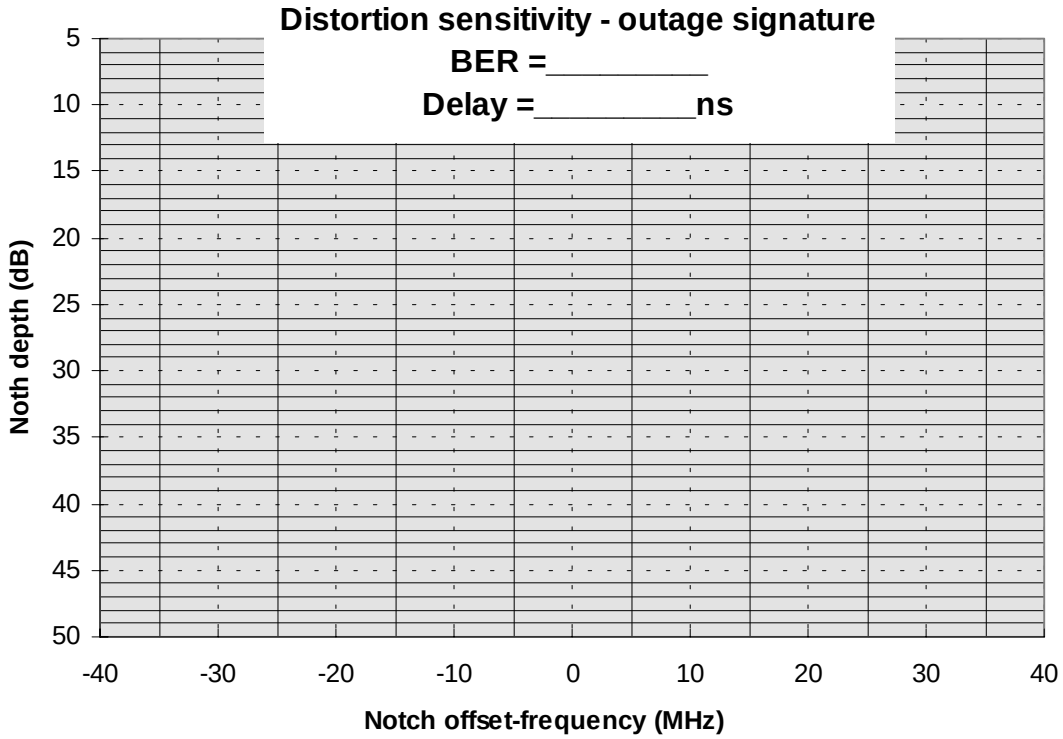


Figure B.5

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.4 System performance with diversity

B.1.3.4.1 BER vs. Rx signal level

NOTE: In this clause BER is the acronym for Bit Error Ratio.

Method of measurement:

See subclause 5.3.4.1.

Results:

The results can be presented in table form.

The relevant testpoints (BER-values) according to the standard shall be declared together with the measured received signal level values. Only one direction (go or return) will normally be tested.

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

Climatic condition	T_{nom}=	T_{min}=	T_{max}=
Received signal level (dBm) at BER=			
Received signal level (dBm) at BER=			
Received signal level (dBm) at BER=			

Alternatively plots may be used and in that case be supplied in the annex and referenced to in the table below.

Below is an example of a diagram in which a plot can be presented:

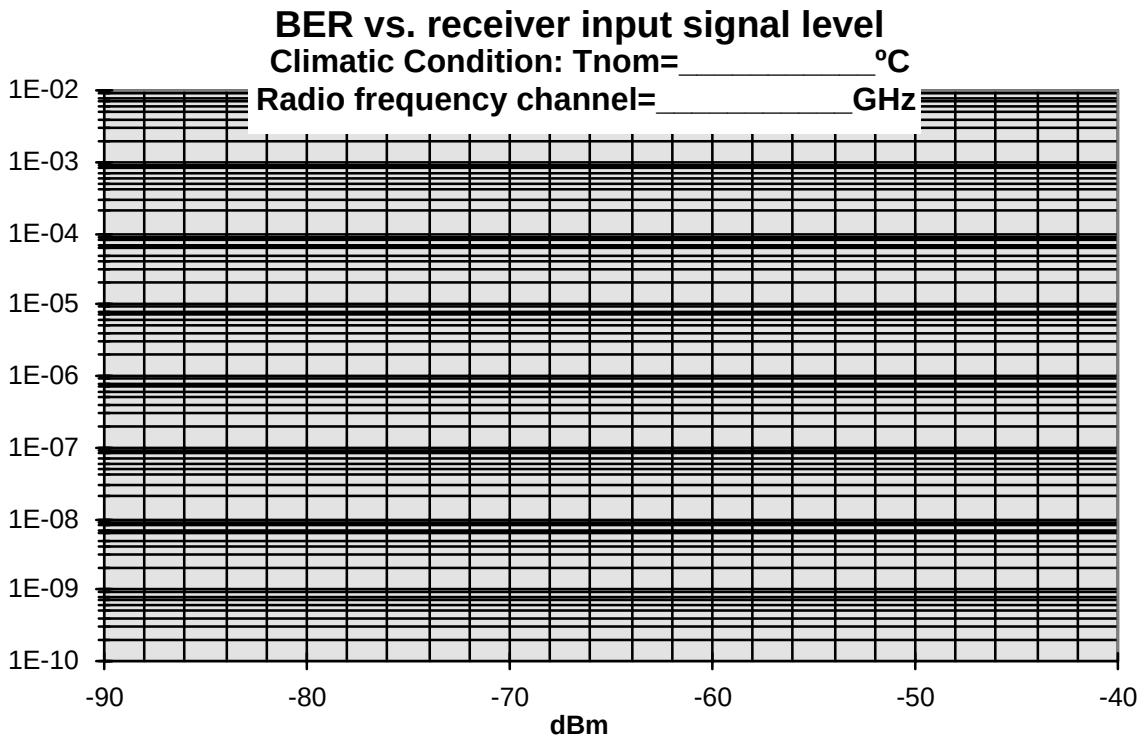


Figure B.6

Ambient temperature: °C Relative humidity: %

RF channel frequency: GHz Input voltage, V_{nom}: V

Test conditions	Reference to plot in the annex
T_{nom}	
T_{min}	
T_{max}	

Limiting values:

Enhanced input level limits for specified BER values:	
For IF or baseband combining systems	> 2,5 dB
For RF combining systems	> 1,5 dB
For baseband switch systems	no improvement

Measurement uncertainty	

Test equipment used: (Item numbers)	

B.1.3.4.2 Interference sensitivity

B.1.3.4.2.1 Co-channel interference sensitivity

See subclause 5.3.4.2.

B.1.3.4.2.2 Adjacent channel interference sensitivity

See subclause 5.3.4.2.

B.1.3.4.3 Distortion sensitivity

See subclause 5.3.4.3.

B.2 Photographs of IUT

Photographs of the equipment are to be provided as part of the test report.

As a minimum the photographs shall be of:

1) assembly of units or parts;
2) front of unit (showing controls, labelling, etc.);
3) rear of unit (showing antenna connector, labelling, etc.).

If the label or identifying mark is affixed on a surface other than 2) or 3) above, a photograph of this shall be provided.

The equipment (**only after type testing is completed**) shall be opened and photographs of the internal construction shall be made.

The photographs shall be colour plate and of a size not less than 170 mm x 120 mm.

Each photograph shall be clearly identified and mounted on a separate page.

B.3 Test equipment used for tests

In the following table the test equipment used for the test shall be listed by the test laboratory.

In each separate part of the test report the used test equipment shall be stated. The instruments are then identified by a number which refers to the table below.

No.	Test equipment	Type	Manufacturer	Serial number	Calibration due date
01					
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

B.4 Additional information supplementary to the test report

Remarks:

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.....

.....

.....

Annex C (informative): Distortion sensitivity for diversity receivers

Objective:

The test is applicable to systems which optionally use diversity combining techniques.

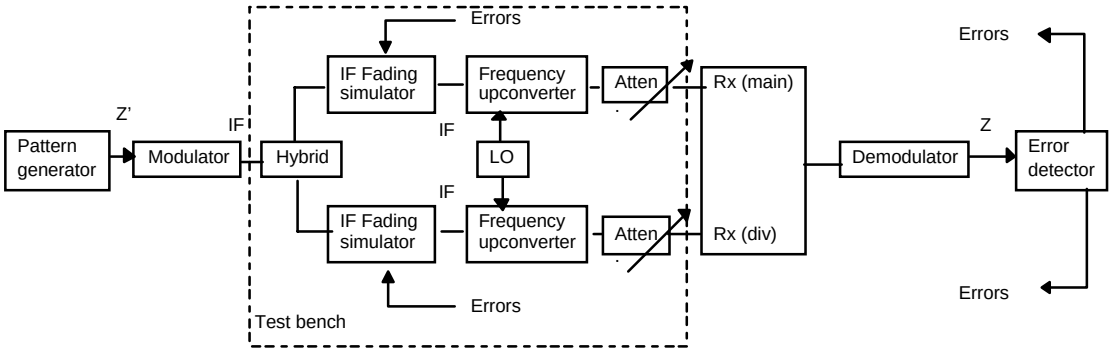
This test verifies the equipment immunity against propagation distortion, extending the concept of "signature" also to a radio receiver with diversity technique protection, for obtaining a so called "pseudo-signature".

The test set-up is suitable for equipments with IF interface at modulator output; however it could be extended to RF level, provided that RF fading simulators are available.

The measurements should be made applying a two rays fading simulator at RF level for each of the two receiver inputs (main and diversity).

Some kind of simplification could be made according to the practical implementation of the diversity receiver.

Test configuration:



Test instruments:

1) pattern generator/error detector;

2) fading simulator.

Test procedure:

Connect the pattern generator output to the BB TX input. Control the two fading simulator (delay 6,3 ns) in order to produce the multipath distortion (a notch). Produce families of pseudosignatures on the basis of errors detected at BB Rx output in the following condition:

a) control the fading simulator on the main Rx path in order to have flat condition (no distortion); control the fading simulator on the diversity Rx path in order to have a notch: vary the frequency of the notch (at 1 MHz step), increasing and decreasing its frequency in the modulated signal band; vary the depth of the notch(es) from 10 dB to 30 dB in 1 dB steps, with minimum and non minimum phase condition. Control the attenuation of the variable attenuators, and repeat the measurements at different level of received signal;

b) interchange the situation, having a notch on the main Rx path and a flat condition on the diversity Rx path;

c) control the fading simulator on the main Rx path and on the diversity Rx path in order to have notches; vary the frequency of one notch (at 1 MHz step) increasing and decreasing frequency in the modulated signal band and keeping the second in a fixed position, and vary the depth of the notch(es) from 10 dB to 30 dB in 1 dB steps, with minimum and non minimum phase condition. Control the attenuation of the variable attenuators, and repeat the measurements at different level of received signal.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- EN 300 339: "Electromagnetic compatibility and Radio spectrum Matters (ERM); General ElectroMagnetic Compatibility (EMC) for radio communications equipment".
- EN 301 390: "Transmission and Multiplexing (TM); Digital Radio Relay Systems (DRRS);Spurious emissions and receiver immunity at equipment antenna ports of DRRS".

History

Document history				
V1.1.1	December 1997	Public Enquiry	PE 9817:	1997-12-26 to 1997-04-24
V1.1.2	July 1999	Vote	V 9938:	1999-07-05 to 1999-09-03