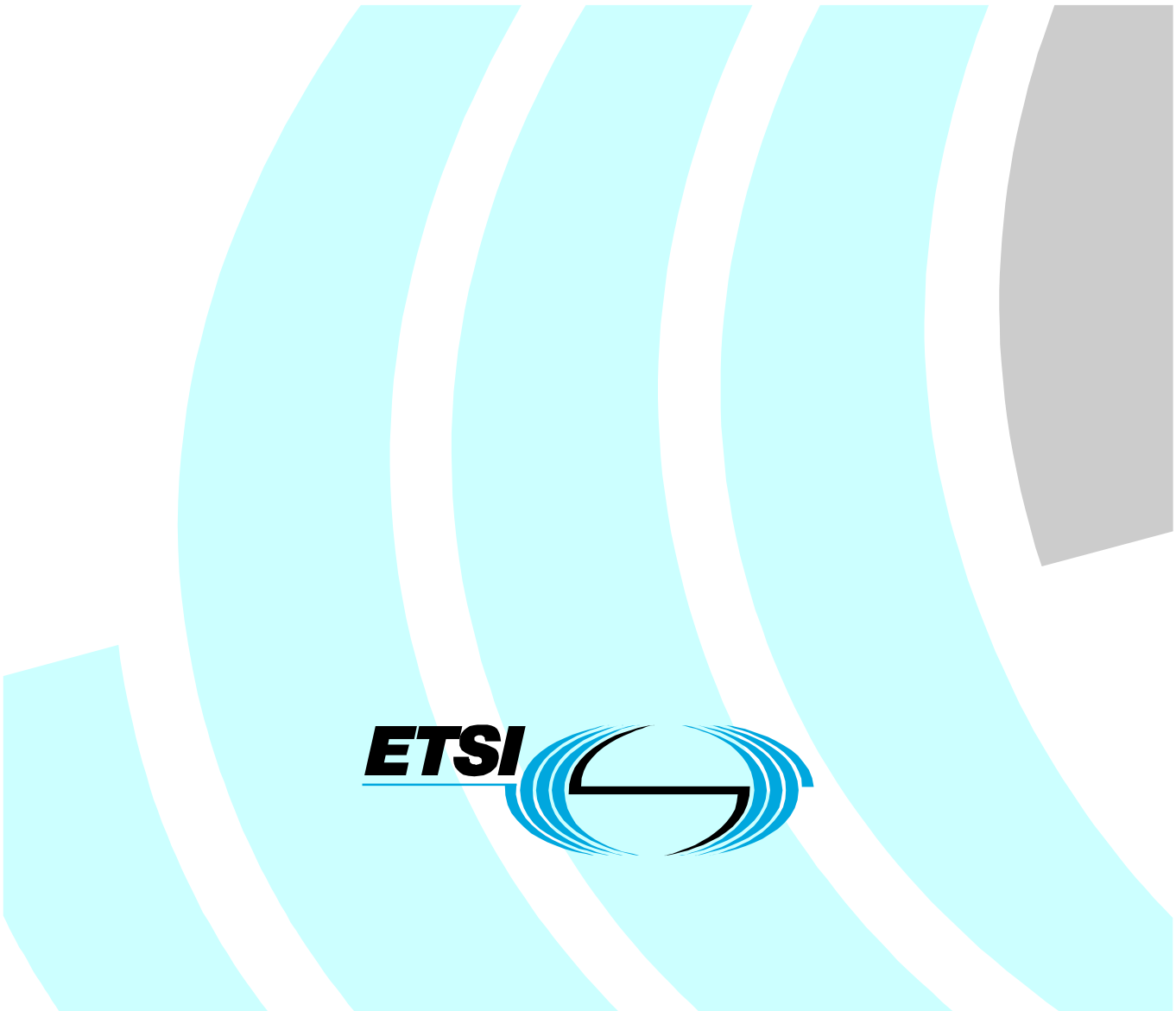
Final draft ETSI ES 202 131 V1.2.1 (2003-05)

ETSI Standard

Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band using spread spectrum modulation techniques and 5 GHz high performance RLAN equipment; Specification of Reference Receiver Performance Parameters for Spectrum Planning



Reference
RES/ERM-TG11-004

Keywords
data, ISM, LAN, mobile, radio, short range,
spread spectrum, SRD, testing, transmission,
UHF

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Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the ETSI standards Membership Approval Procedure.

1 Scope

The present document specifies the reference receiver performance parameters, not covered by the harmonized standards EN 300 328 [1] and draft EN 301 893 [2], which are required for the purpose of spectrum planning and methods of investigation including resolving interference issues. These parameters play a fundamental role in the frequency planning and the respective compatibility analysis performed by responsible national administrations.

The present document applies to equipment utilizing wideband radio modulation techniques such as described in the IEEE 802.11 [4], [5], [6], [7] and [8], Hiperlan 2 [9], HomeRF [11] and Bluetooth™ [10] standards.

Fixed, mobile or portable applications, e.g.:

- stand-alone radio equipment with or without their own control provisions;
- plug-in radio devices intended for use with or within a variety of host systems, e.g. personal computers, hand-held terminals, etc.;
- plug-in radio devices intended for use within combined equipment, e.g. cable modems, set-top boxes, access points, etc.;
- combined equipment or a combination of a plug-in radio device and a specific type of host equipment.

This radio equipment is capable of operating in all or any part of the 2,4 GHz Industrial, Scientific and Medical (ISM) service frequency band shown in table 1 or on any of the carrier centre frequencies in the 5 GHz bands as listed in table 2.

Table 1: 2,4 GHz Industrial, Scientific and Medical (ISM) service frequency band

Direction of transmission	Industrial, Scientific and Medical (ISM) service frequency band
Transmit/Receive	2,4 GHz to 2,4835 GHz

Table 2: Nominal carrier frequency allocations in the 5 GHz bands

Carrier centre frequency f_C (MHz)
5 180
5 200
5 220
5 240
5 260
5 280
5 300
5 320
5 500
5 520
5 540
5 560
5 580
5 600
5 620
5 640
5 660
5 680
5 700

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI EN 300 328: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive".

[2] ETSI EN 301 893 (V1.2.1): "Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive".

[3] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[4] IEEE 802.11: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and Metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications".

[5] IEEE 802.11b: "Supplement to 802.11-1999,Wireless LAN MAC and PHY specifications: Higher speed Physical Layer (PHY) extension in the 2.4 GHz band".

[6] Void.

[7] IEEE 802.11a: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and Metropolitan networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High-speed Physical Layer in the 5 GHz Band".

[8] Void.

[9] ETSI TS 101 475: "Broadband Radio Access Networks (BRAN); HIPERLAN Type 2; Physical (PHY) layer".

[10] "Bluetooth Specification Version 1.1"; February 22, 2001.

[11] "HomeRF specification", HomeRF, Revision 2.01; July 1, 2002.

NOTE: ftp://server1.ece.neu.edu/pub/brady/.

3 Definitions and abbreviations

3.1 Definitions

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

5 GHz RLAN bands: frequency ranges: 5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz

Bluetooth™ system: equipment in compliance with Bluetooth™ specification

combined equipment: any combination of non-radio equipment that requires a plug-in radio device to offer full functionality

direct sequence spread spectrum: form of modulation where a combination of data to be transmitted and a known code sequence (chip sequence) is used to directly modulate a carrier, e.g. by phase shift keying

frequency hopping spread spectrum: spread spectrum technique in which the transmitter signal occupies a number of frequencies in time, each for some period of time, referred to as the dwell time

frequency range: range of operating frequencies over which the equipment can be adjusted

fixed station: equipment intended for use in a fixed location and fitted with one or more antennae

hand-portable station: equipment normally used on a stand-alone basis and to be carried by a person or held in the hand

HomeRF systems: equipment in compliance with HomeRF specification

host equipment: any equipment which has complete user functionality when not connected to the radio equipment part and to which the radio equipment part provides additional functionality and to which connection is necessary for the radio equipment part to offer functionality

integral antenna: antenna designed to be connected to the equipment without the use of a standard connector and considered to be part of the equipment

mobile station: equipment normally used in a vehicle or as a transportable station

operating frequency: nominal frequency at which the equipment can be operated; this is also referred to as the operating centre frequency

plug-in radio device: radio equipment module intended to be used with or within host, combined or multi-radio equipment, using their control functions and power supply

spread spectrum modulation: modulation technique in which the energy of a transmitted signal is spread throughout a relatively large portion of the frequency spectrum

stand-alone radio equipment: equipment that is intended primarily as communications equipment and that is normally used on a stand-alone basis

wide band modulation: wide band modulation is considered to include FHSS or DSSS modulation as well as other forms of modulation that meet the emission requirements as defined in ES 202 131

3.2 Abbreviations

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

BER	Bit Error Rate
DFS	Dynamic Frequency Selection
DS	Direct Sequence
DSSS	Direct Sequence Spread Spectrum
ERP	Extended Rate PHY
FER	Frame Error Rate
FH	Frequency Hopping
FHSS	Frequency Hopping Spread Spectrum
ISM	Industrial, Scientific and Medical
N.A.	Not Applicable
OFDM	Orthogonal Frequency Division Multiplex
PBCC	Packet Binary Convolutional Coding
PDU	Protocol Data Unit
PLCP	PHY Layer Convergence Procedure
PSDU	PLCP Service Data Units
RF	Radio Frequency
Rx	Receiver
TDMA	Time-Division Multiple Access

4 Receiver performance parameters

4.1 Introduction

The purpose of the present document is to provide additional information on receiver performance parameters which are not included in a product harmonized standard. This additional information can be used for spectrum planning, methods of investigation and resolving interference issues.

4.2 Applicability overview

Table 3 indicates the parameters which are considered applicable for the various technologies that are covered by the present document.

Table 3: Applicability overview

System	Rx Sensitivity	Blocking or desensitization	Adjacent channel selectivity
IEEE 802.11 [4] (FH)	Yes	Yes	No
IEEE 802.11 [4] (DS) and IEEE 802.11b [5]	Yes	Yes	Yes
IEEE 802.11g	Yes	Yes	Yes
IEEE 802.11a/h	Yes	Yes	Yes
HIPERLAN 2	Yes	Yes	Yes
HomeRF	Yes	Yes	No
Bluetooth	Yes	Yes	No

4.3 Receiver parameter definitions

4.3.1 Rx sensitivity

The receiver sensitivity is the minimum power level at the receiver RF input produced by a carrier at the nominal frequency of the receiver, modulated with the normal modulation (see clause 5.1.2) which will, without interference, produce after demodulation a data signal with either a specified Bit Error Rate (BER) or a Frame Error Rate (FER).

4.3.2 Blocking or desensitization

Blocking is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal outside the 2,4 GHz ISM band and 5 GHz RLAN bands at frequencies other than those of the spurious responses.

4.3.3 Adjacent channel selectivity

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal that differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

For IEEE 802.11 [4] systems using direct sequence spread spectrum, the adjacent channel is defined as the non-overlapping channel which is at least 30 MHz separated from the wanted signal.

For IEEE 802.11b [5] and IEEE 802.11g systems, the adjacent channel is defined as the non-overlapping channel which is at least 25 MHz separated from the wanted signal.

For IEEE 802.11a [7], IEEE 802.11h and Hiperlan 2 [9], the adjacent channel is defined as the channel which is 20 MHz separated from the wanted signal.

4.4 Reference values

4.4.1 IEEE 802.11 - FH systems

The minimum receiver sensitivity shall not be less than the reference values as stated in table 4.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 4, except at frequencies on which spurious responses are found.

Table 4: Reference values for IEEE 802.11 - FH systems

Parameter	Data rate	Value for a FER ≤ 3 % at a PSDU length of 400 bytes
Rx sensitivity	1 Mbit/s	-80 dBm
	2 Mbit/s	-75 dBm
Blocking or desensitization	1 Mbit/s	40 dB
	2 Mbit/s	30 dB
Adjacent channel selectivity		N.A.

4.4.2 IEEE 802.11 - DS and IEEE 802.11b systems

The minimum receiver sensitivity shall not be less than the reference values as stated in table 5.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 5, except at frequencies on which spurious responses are found.

The adjacent channel selectivity shall not be less than the values as stated in table 5.

Table 5: Reference values for IEEE 802.11 - DS and IEEE 802.11b systems

Parameter	Data rate	Value for a FER ≤ 8 % at a PSDU length of 1 024 bytes
Rx sensitivity	2 Mbit/s	-80 dBm
	11 Mbit/s	-76 dBm
Blocking or desensitization	2 Mbit/s	50 dB
	11 Mbit/s	50 dB
Adjacent channel selectivity	2 Mbit/s	35 dB
	11 Mbit/s	35 dB

4.4.3 IEEE 802.11g systems - ERP OFDM operation

The minimum receiver sensitivity shall not be less than the reference values as stated in table 6.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 6, except at frequencies on which spurious responses are found.

The adjacent channel selectivity shall not be less than the values as stated in table 6.

Table 6: Reference values for IEEE 802.11g systems - ERP OFDM operation

Parameter	Data rate	Value for a FER ≤ 10 % at a PSDU length of 1 000 bytes
Rx sensitivity	6 Mbit/s	-82 dBm
	9 Mbit/s	-81 dBm
	12 Mbit/s	-79 dBm
	18 Mbit/s	-77 dBm
	24 Mbit/s	-74 dBm
	36 Mbit/s	-70 dBm
	48 Mbit/s	-66 dBm
	54 Mbit/s	-65 dBm
Blocking or desensitization	6 Mbit/s	47 dB
	54 Mbit/s	30 dB
Adjacent channel selectivity	6 Mbit/s	16 dB
	9 Mbit/s	15 dB
	12 Mbit/s	13 dB
	18 Mbit/s	11 dB
	24 Mbit/s	8 dB
	36 Mbit/s	4 dB
	48 Mbit/s	0 dB
	54 Mbit/s	-1 dB

4.4.4 IEEE 802.11g systems - ERP PBCC operation

The minimum receiver sensitivity shall not be less than the reference values as stated in table 7.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 7, except at frequencies on which spurious responses are found.

The adjacent channel selectivity shall not be less than the values as stated in table 7.

Table 7: Reference values for IEEE 802.11g systems - ERP PBCC operation

Parameter	Data rate	Value for a FER ≤ 8 % at a PSDU length of 1 024 bytes
Rx sensitivity	22 Mbit/s	-76 dBm
	33 Mbit/s	-74 dBm
Blocking or desensitization	22 Mbit/s	30 dB
	33 Mbit/s	30 dB
Adjacent channel selectivity	22 Mbit/s	35 dB
	33 Mbit/s	35 dB

4.4.5 IEEE 802.11a and IEEE 802.11h systems

The minimum receiver sensitivity shall not be less than the reference values as stated in table 8.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 8, except at frequencies on which spurious responses are found.

The adjacent channel selectivity shall not be less than the values as stated in table 8.

Table 8: Reference values for IEEE 802.11a and IEEE 802.11h systems

Parameter	Data rate	Value for a FER ≤ 10 % at a PSDU length of 1 000 bytes
Rx sensitivity	6 Mbit/s	-82 dBm
	9 Mbit/s	-81 dBm
	12 Mbit/s	-79 dBm
	18 Mbit/s	-77 dBm
	24 Mbit/s	-74 dBm
	36 Mbit/s	-70 dBm
	48 Mbit/s	-66 dBm
	54 Mbit/s	-65 dBm
Blocking or desensitization	6 Mbit/s	45 dB
	54 Mbit/s	27 dB
Adjacent channel selectivity	6 Mbit/s	16 dB
	9 Mbit/s	15 dB
	12 Mbit/s	13 dB
	18 Mbit/s	11 dB
	24 Mbit/s	8 dB
	36 Mbit/s	4 dB
	48 Mbit/s	0 dB
	54 Mbit/s	-1 dB

4.4.6 Hiperlan 2

The minimum receiver sensitivity shall not be less than the reference values as stated in table 9.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 9, except at frequencies on which spurious responses are found.

The adjacent channel selectivity shall not be less than the values as stated in table 9.

Table 9: Reference values for Hiperlan 2 systems

Parameter	Data rate	Value for a FER ≤ 10 % at a PDU length of 54 bytes
Rx sensitivity	6 Mbit/s	-85 dBm
	9 Mbit/s	-83 dBm
	12 Mbit/s	-81 dBm
	18 Mbit/s	-79 dBm
	27 Mbit/s	-75 dBm
	36 Mbit/s	-73 dBm
	54 Mbit/s	-68 dBm
Blocking or desensitization	6 Mbit/s	52 dB
	54 Mbit/s	35 dB
Adjacent channel selectivity	6 Mbit/s	21 dB
	9 Mbit/s	19 dB
	12 Mbit/s	17 dB
	18 Mbit/s	15 dB
	27 Mbit/s	11 dB
	36 Mbit/s	9 dB
	54 Mbit/s	4 dB

4.4.7 HomeRF systems

The minimum receiver sensitivity shall not be less than the reference values as stated in table 10.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 10, except at frequencies on which spurious responses are found.

Table 10: Reference values for HomeRF

Parameter	Modulation	Value for a FER ≤ 3 % for a standard TDMA PSDU
Rx sensitivity	LR 2-FSK	-75 dBm
	LR 4-FSK	-65 dBm
	HR 2-FSK	-80 dBm
	HR 4-FSK	-70 dBm
Blocking or desensitization	LR 2-FSK	35 dB
	LR 4-FSK	25 dB
	HR 2-FSK	35 dB
	HR 4-FSK	25 dB
Adjacent channel selectivity		N.A.

4.4.8 Bluetooth™ systems

The minimum receiver sensitivity shall not be less than the reference values as stated in table 11.

The blocking (ratio), for any frequency within the specified ranges, shall not be less than the values given in table 11, except at frequencies on which spurious responses are found.

Table 11: Reference values for Bluetooth™ systems

Parameter	Value for a BER ≤ 0,1 %
Rx sensitivity	-70 dBm
Blocking or desensitization	40 dB (see note)
Adjacent channel selectivity	N.A.
NOTE: The interference signal is within the range 2 000 MHz to 2 400 MHz and 2 483,5 MHz to 3 000 MHz except where spurious responses are found.	

5 Recommended methods of measurement

5.1 Test conditions

All tests described in the present document need only be performed under normal test conditions.

5.1.1 Normal test conditions

5.1.1.1 Normal temperature and humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- temperature: +15°C to +35°C;
- relative humidity: 20 % to 75 %.

5.1.1.2 Normal power source

5.1.1.2.1 Mains voltage

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the voltage(s) for which the equipment was designed.

The frequency of the test power source corresponding to the AC mains shall be between 49 Hz and 51 Hz.

5.1.1.2.2 Lead-acid battery power sources used on vehicles

When radio equipment is intended for operation from the usual, alternator fed lead-acid battery power source used on vehicles, then the normal test voltage shall be 1,1 times the nominal voltage of the battery (6 V, 12 V, etc.).

5.1.1.2.3 Other power sources

For operation from other power sources or types of battery (primary or secondary), the nominal test voltage shall be as stated by the equipment manufacturer.

5.1.2 Normal modulation

The manufacturer shall describe the modulation to be used by the signal generator(s) during the measurements described in the present document. This modulation should be representative of normal use of the equipment. The same modulation shall be used for all measurements on the same equipment.

5.2 Test arrangements

Radiated RF measurements are less precise than conducted measurements and therefore conducted measurements are recommended.

Equipment used for testing may be provided with a suitable connector for conducted RF measurements. Where this is not possible, a suitable test fixture shall be used. Alternatively, radiated measurements shall be performed.

Plug-in radio devices may be tested together with a suitable test jig and/or typical host equipment.

For 5 GHz equipment with DFS capabilities, this feature shall be disabled during the tests.

5.3 Minimum Rx sensitivity

5.3.1 Method of measurement

The measurement procedure shall be as follows:

a) an input signal with a frequency equal to the nominal frequency (±20 ppm) of the receiver, using normal modulation (see clause 5.1.2), shall be applied to the receiver input;

b) depending on the type of system, the bit pattern of the modulating signal or the frame packets shall be compared to those obtained from the receiver after demodulation to calculate the Bit Error Rate (BER), or the Frame Error Rate (FER) in case the frame packets contain means for detecting frame errors;

c) the level of the input signal to the receiver is adjusted until the stated maximum Bit Error Ratio (BER) or Frame Error Rate (FER) is met;

d) the maximum usable sensitivity is the mean level of the input signal to the receiver.

The minimum receiver sensitivity may vary with the datarate. Therefore the above procedure may need to be repeated for the different datarates of the equipment.

5.4 Blocking or desensitization

This measurement method can be used for all types of equipment specified in table 3.

Two signal generators A and B shall be connected to the receiver via a combining network, either:

a) via a test fixture to the integrated or dedicated receiver antenna; or

b) directly to the permanent or temporary receiver antenna connector.

Signal generator A shall be at the nominal frequency (middle frequency) of the receiver, with normal modulation (see clause 5.1.2) of the wanted signal.

Signal generator B, except for HomeRF systems, shall be unmodulated and be adjusted to test frequencies above and below the band edges as specified below. In the case of HomeRF systems, signal generator B shall be adjusted and modulated in accordance with the HomeRF system specifications.

Initially signal generator B shall be switched off and using signal generator A the level which still gives sufficient response shall be established. The output level of generator A shall then be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria are met.

For 2,4 GHz equipment, the frequency for signal generator B shall be at the following frequencies:

- The measurements shall be at approximately +5 MHz, +10 MHz, +20 MHz and +50 MHz from the upper band edge.
- The tests shall be repeated at approximately -5 MHz, -10 MHz, -20 MHz and -50 MHz from the lower band edge.
- Frequencies at which spurious responses are found should be ignored.

For 5 GHz equipment, the frequency for signal generator B shall be at the following frequencies:

- The measurements shall be at approximately +20 MHz, +50 MHz and +100 MHz from the upper band edges i.e. 5 350 MHz and 5 725 MHz.
- The tests shall be repeated at approximately -20 MHz, -50 MHz and -100 MHz from the lower band edges i.e. 5 150 MHz and 5 470 MHz.
- Frequencies at which spurious responses are found should be ignored.

The blocking or desensitization is the ratio in dB between the level of the unwanted signal (generator B) and the level of the wanted signal (generator A).

Except for HomeRF (see table 10) and Bluetooth (see table 11), the test shall be performed at the lowest and highest possible datarate of the equipment (see tables 4 to 9).

5.5 Adjacent channel selectivity

5.5.1 General

This parameter is applicable for equipment where specific carrier frequencies or a channelization is specified.

FH systems have inherent immunity to adjacent channel signals and therefore adjacent channel selectivity is not applicable to HomeRF [11], Bluetooth™ [10] and IEEE 802.11 [4] FH systems.

5.5.2 Method of measurement

This measurement shall be conducted under normal conditions.

Two signal generators A and B shall be connected to the receiver via a combining network, either:

a) via a test fixture to the integrated or dedicated receiver antenna; or

b) directly to the permanent or temporary receiver antenna connector.

Signal generator A shall be at the nominal frequency of the receiver, with normal modulation (see clause 5.1.2) of the wanted signal. Signal generator B shall be modulated using normal modulation (see clause 5.1.2) and shall be adjusted to the adjacent channel frequency above that of the wanted signal.

Initially signal generator B shall be switched off and using signal generator A the level that still gives sufficient response shall be established. The output level of generator A, except for IEEE 802.11g systems operating in the ERP OFDM mode (see clause 4.4.3), shall then be increased by 6 dB. In case of IEEE 802.11g systems operating in the ERP OFDM mode, the output level of generator A shall be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria are met.

The measurements shall be repeated for the adjacent channel below the wanted signal.

For IEEE 802.11 [4] systems using direct sequence spread spectrum, the adjacent channel is defined as the non-overlapping channel which is at least 30 MHz separated from the wanted signal.

For IEEE 802.11b [5] and IEEE 802.11g systems, the adjacent channel is defined as the non-overlapping channel which is at least 25 MHz separated from the wanted signal.

For IEEE 802.11a [7], IEEE 802.11h and Hiperlan 2 [9], the adjacent channel is defined as the channel which is 20 MHz separated from the wanted signal.

The adjacent channel selectivity is the ratio in dB between the level of the unwanted signal (generator B) and the level of the wanted signal (generator A).

6 Interpretation of measurement results

The interpretation of the results for the measurements described in the present document shall be as follows:

- the measured value will be compared to the corresponding reference value;
- the measurement uncertainty value for the measurement of each parameter shall be noted;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 12.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028 [3] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 12 is based on such expansion factors.

Table 12: Maximum measurement uncertainty

Parameter	Uncertainty
radio frequency	$\pm 1 \times 10^{-5}$
RX sensitivity	±3 dB
2-signal measurements	±4 dB
temperature	±1°C
humidity	±5 %
DC and low frequency voltages	±3 %

Annex A (informative): Bibliography

ERC Report 109: "Compatibility of Bluetooth™ with other existing and proposed radiocommunication systems in the 2,45 GHz frequency band".

ECC/REC 02-01: "Specification of Reference Receiver Performance Parameters".

IEEE 802.11g: "DRAFT Supplement to STANDARD [for] Information Technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Further Higher-Speed Physical Layer Extension in the 2.4 GHz Band".

IEEE 802.11h: " Draft Supplement to STANDARD FOR Telecommunications and Information Exchange Between Systems - LAN/MAN Specific Requirements - Part 11: Wireless Medium Access Control (MAC) and physical layer (PHY) specifications: Spectrum and Transmit Power Management extensions in the 5GHz band in Europe".

History

Document history		
V1.1.1	January 2003	Publication
V1.2.1	May 2003	Membership Approval Procedure MV 20030704: 2003-05-06 to 2003-07-04