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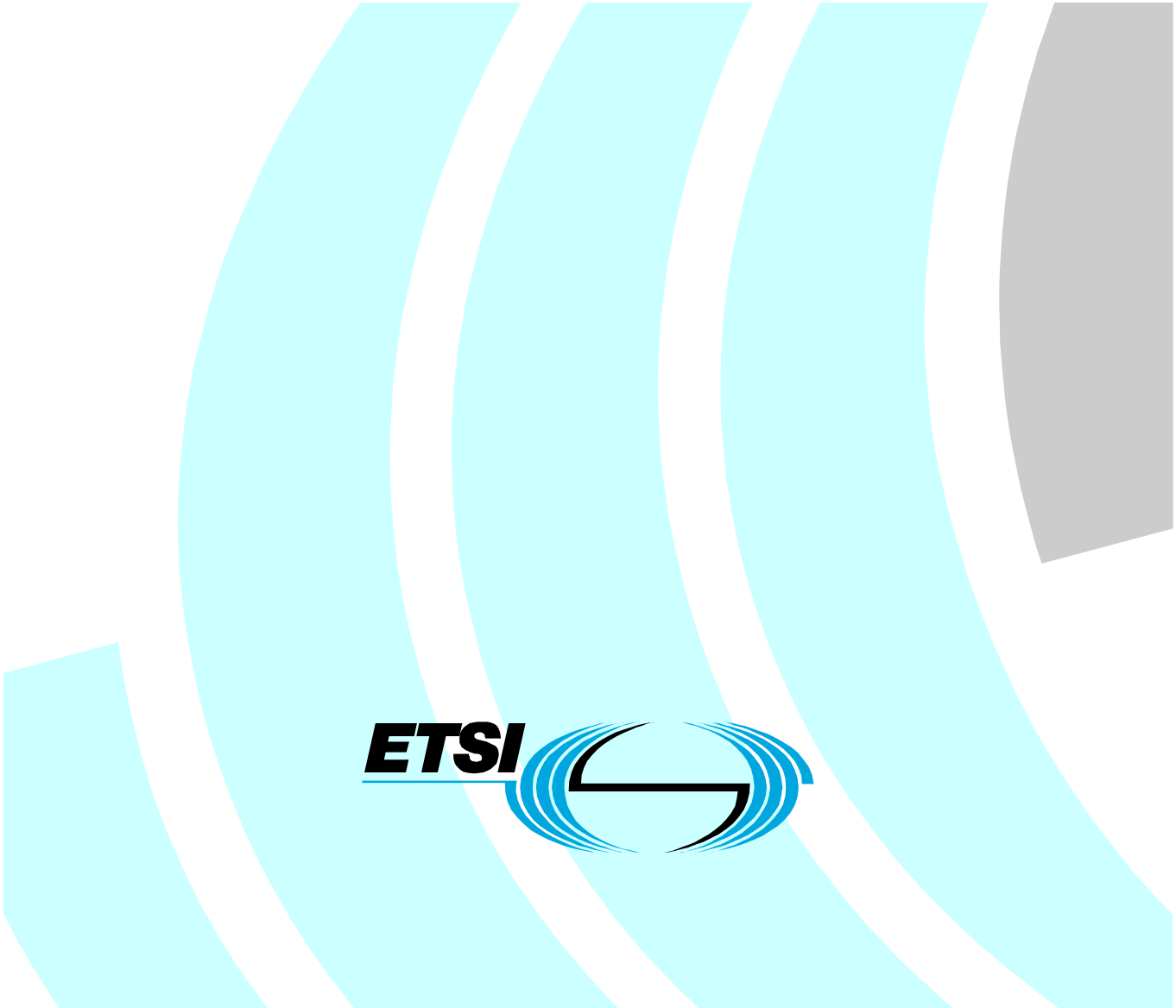
Candidate Harmonized European Standard (Telecommunications series)

Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive



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Contents

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Foreword

This Candidate Harmonized European Standard (Telecommunications series) has been produced by ETSI Project Broadband Radio Access Networks (BRAN), and is now submitted for an additional Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC [5] (as amended) laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Directive 1999/5/EC [1] of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity ("the R&TTE Directive").

Technical specifications relevant to Directive 1999/5/EC are given in annex A.

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

Introduction

The present document is part of a set of standards designed to fit in a modular structure to cover all radio and telecommunications terminal equipment under the R&TTE Directive [1]. Each standard is a module in the structure. The modular structure is shown in figure 1.

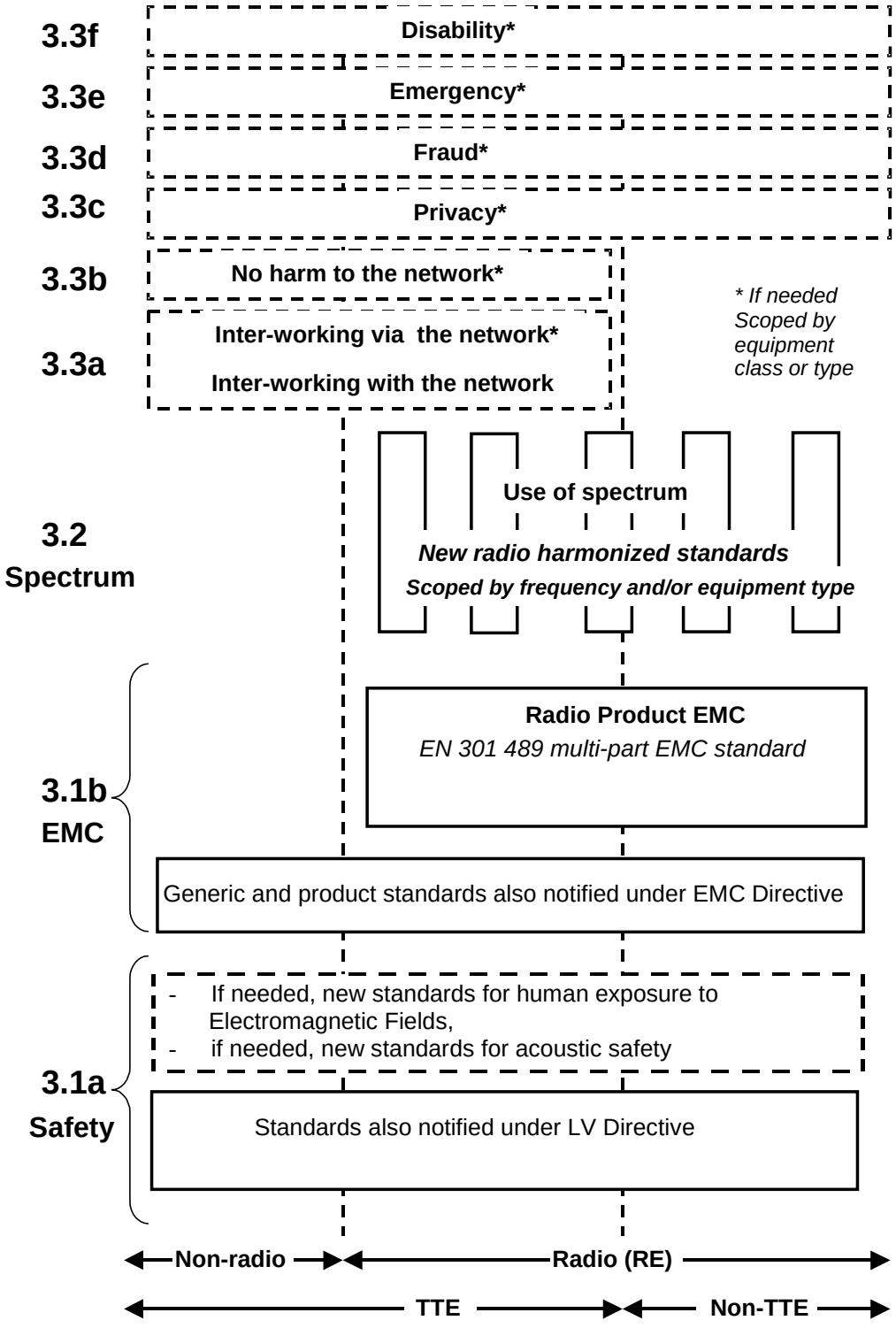


Figure 1: Modular structure for the various standards used under the R&TTE Directive [1]

The left hand edge of the figure 1 shows the different clauses of article 3 of the R&TTE Directive [1].

For article 3.3 various horizontal boxes are shown. Dotted lines indicate that at the time of publication of the present document essential requirements in these areas have to be adopted by the Commission. If such essential requirements are adopted, and as far and as long as they are applicable, they will justify individual standards whose scope is likely to be specified by function or interface type.

The vertical boxes show the standards under article 3.2 for the use of the radio spectrum by radio equipment. The scopes of these standards are specified either by frequency (normally in the case where frequency bands are harmonized) or by radio equipment type.

For article 3.1b the diagram shows EN 301 489, the multi-part product EMC standard for radio used under the EMC Directive [2].

For article 3.1a the diagram shows the existing safety standards currently used under the LV Directive [3] and new standards covering human exposure to electromagnetic fields. New standards covering acoustic safety may also be required.

The bottom of the figure shows the relationship of the standards to radio equipment and telecommunications terminal equipment. A particular equipment may be radio equipment, telecommunications terminal equipment or both. A radio spectrum standard will apply if it is radio equipment. An article 3.3 standard will apply as well only if the relevant essential requirement under the R&TTE Directive [1] is adopted by the Commission and if the equipment in question is covered by the scope of the corresponding standard. Thus, depending on the nature of the equipment, the essential requirements under the R&TTE Directive [1] may be covered in a set of standards.

The modularity principle has been taken because:

- it minimizes the number of standards needed. Because equipment may, in fact, have multiple interfaces and functions it is not practicable to produce a single standard for each possible combination of functions that may occur in an equipment;
- it provides scope for standards to be added:
  - under article 3.2 when new frequency bands are agreed; or
  - under article 3.3 should the Commission take the necessary decisions without requiring alteration of standards that are already published;
- it clarifies, simplifies and promotes the usage of Harmonized Standards as the relevant means of conformity assessment.

1 Scope

The present document applies to HIPERLAN 2 and other high performance RLAN equipment as follows:

a) for equipment intended to operate on any of the carrier frequencies per table 1; and

b) capable of avoiding occupied channels by employing a Dynamic Frequency Selection mechanism and capable of Transmit Power Control.

Table 1: Nominal carrier frequency allocations

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

The present document is intended to cover the provisions of Directive 1999/5/EC [1] (R&TTE Directive). Article 3.2 which states that "….. radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive will apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site http://www.newapproach.org.

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.

[1] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

[2] Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive).

[3] Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits (LV Directive).

[4] ETSI ETR 028 (1994): "Radio Equipment and Systems (RES); Uncertainties in the measurement of mobile radio equipment characteristics".

[5] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the R&TTE Directive and the following apply:

burst: period during which radio waves are intentionally transmitted, preceded and succeeded by periods during which no intentional transmission is made

environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

master: operational mode in which equipment (unit under test) can initiate a network

slave: operational mode in which equipment (unit under test) cannot initiate a network

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

3.2 Symbols

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

A	Measured power output (dBm)
B	Burst period
C	Antenna calibration value
Ch_f	Channel free from radars
Ch_r	Channel occupied by a radar
E	Field strength
E_o	Reference field strength
f_c	Carrier frequency
G	Antenna gain (dBi)
L	Burst length
P	Calculated EIRP
R	Distance
R_o	Reference distance
S0	Signal power
T0	Time instant
T1	Time instant
TD	Time instant
W	Pulse width
x	observed duty cycle

3.3 Abbreviations

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

AP	Access Point
ARP	Antenna Reference Point
DFS	Dynamic Frequency Selection
EMC	Electro-Magnetic Compatibility
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
LV	Low Voltage
ppm	parts per million
PRF	Pulse Repetition Frequency
R&TTE	Radio and Telecommunications Terminal Equipment
TPC	Transmit Power Control
Tx	Transmit, Transmitter
UUT	Unit Under Test

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the supplier. The equipment shall comply with all the appropriate technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

4.2 Carrier frequencies and channelization

4.2.1 Definition

The equipment is required to operate on the applicable specific carrier centre frequencies for the equipment that correspond to the nominal carrier frequencies f_c defined in table 1.

4.2.2 Limits

The actual carrier centre frequency for any given channel given in table 1 shall be maintained within the range f_c±20 ppm.

4.2.3 Conformance

Conformance tests as defined in clause 5.3.1 shall be carried out.

4.3 Transmit Power Control (TPC)

The UUT shall employ Transmit Power Control (TPC) mechanism to ensure a mitigation factor of at least 3 dB on the aggregate power from a large number of devices.

4.3.1 RF output power at the highest power level

4.3.1.1 Definition

Mean equivalent isotropically radiated power during transmission when configured to operate at the highest declared power level.

4.3.1.2 Limits

The RF output power at the highest power level shall not exceed the levels given in table 2.

Table 2: Mean EIRP limits for RF output power at the highest power level

Frequency range [MHz]	mean EIRP [dBm]
5 150 to 5 350	23
5 470 to 5 725	30

4.3.1.3 Conformance

Conformance tests as defined in clause 5.3.2 shall be carried out.

4.3.2 RF output power at the lowest power level

4.3.2.1 Definition

Mean equivalent isotropically radiated power during transmission when configured to operate at the lowest declared power level.

4.3.2.2 Limits

The RF output power at the lowest power level shall not exceed the levels given in table 3.

Table 3: Mean EIRP limits for RF output power at the lowest power level

Frequency range [MHz]	mean EIRP [dBm]
5 150 to 5 350	17
5 470 to 5 725	24

4.3.2.3 Conformance

Conformance tests as defined in clause 5.3.2 shall be carried out.

4.4 Transmitter unwanted emissions

4.4.1 Transmitter unwanted emissions outside the 5 GHz RLAN bands

4.4.1.1 Definition

Radio frequency emissions outside the 5 GHz RLAN bands.

4.4.1.2 Limits

The level of unwanted emission shall not exceed the limits given in table 4.

Table 4: Transmitter unwanted emission limits outside the 5 GHz RLAN bands

Frequency range	Maximum power, ERP [dBm]	Bandwidth
25 MHz to 47 MHz	-36	100 kHz
47 MHz to 74 MHz	-54	100 kHz
74 MHz to 87,5 MHz	-36	100 kHz
87,5 MHz to 118 MHz	-54	100 kHz
118 MHz to 174 MHz	-36	100 kHz
174 MHz to 230 MHz	-54	100 kHz
230 MHz to 470 MHz	-36	100 kHz
470 MHz to 862 MHz	-54	100 kHz
862 MHz to 1 GHz	-36	100 kHz
1 GHz to 5,15 GHz	-30	1 MHz
5,35 GHz to 5,47 GHz	-30	1 MHz
5,725 GHz to 26,5 GHz	-30	1 MHz

4.4.1.3 Conformance

Conformance tests as defined in clause 5.3.3 shall be carried out.

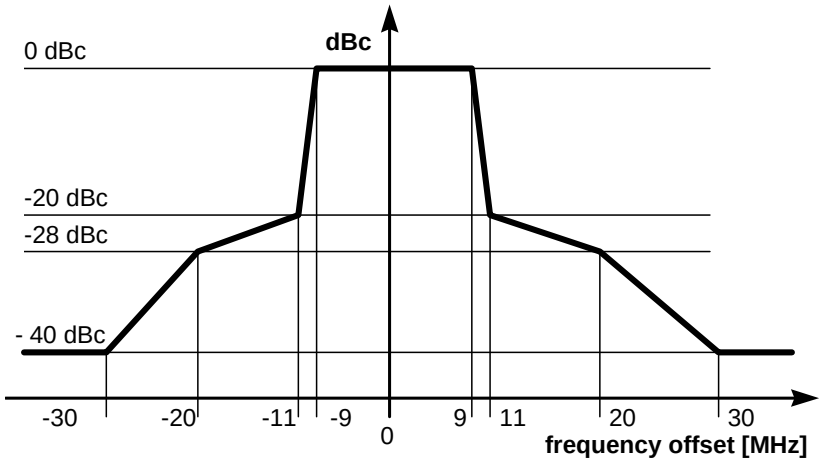
4.4.2 Transmitter unwanted emissions within the 5 GHz RLAN bands

4.4.2.1 Definition

Radio frequency emissions within the 5 GHz RLAN bands.

4.4.2.2 Limits

The average level of the transmitted spectrum shall not exceed the limits given in figure 2.



NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

Figure 2: Transmit spectral power mask

4.4.2.3 Conformance

Conformance tests as defined in clause 5.3.4 shall be carried out.

4.5 Receiver spurious emissions

4.5.1 Definition

Receiver spurious emissions are defined as emissions of the active receiver.

4.5.2 Limits

The spurious emissions of the receiver shall not exceed the limits given in table 5.

Table 5: Spurious radiated emission limits

Frequency range	Maximum power, ERP	Measurement bandwidth
25 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 26,5 GHz	-47 dBm	1 MHz

4.5.3 Conformance

Conformance tests as defined in clause 5.3.5 shall be carried out.

4.6 Dynamic Frequency Selection (DFS)

4.6.1 Definition

RLAN shall employ a Dynamic Frequency Selection (DFS) mechanism to detect interference from other systems and to avoid co-channel operation with other systems, notably radar systems. DFS associated with the channel selection mechanism shall be required to provide a uniform spread of the loading of the equipment across a minimum of 14 channels (or 330 MHz), or 255 MHz in the case of equipment used only in the band 5 470 MHz to 5 725 MHz.

DFS requirements as described later in this clause will apply to different operational modes per table 6. The supplier shall declare whether the UUT is capable of operating as a Master or as a Slave only.

Table 6: Applicability of DFS requirements for different operational modes

Requirement	Operational Mode	
	Master	Slave
Channel Availability Check Time	X	
Channel Clearing Time	X	X
Channel Closing Transmission Time	X	X
Channel Move Time	X	X

4.6.2 Limits

4.6.2.1 Initial Channel Availability Check

When the UUT (i.e. an AP or a terminal capable of initiating an ad-hoc network) is powered on and before it can initiate a network on a channel it shall check to identify whether there is a radar already operating on the channel. The UUT may start using the channel if no radar signal (table D.2) with a power greater than *Interference Threshold* (table D.1) is detected within *Channel Availability Check Time* (table D.1).

NOTE: Need for a separate Initial Channel Availability Check is under study in ITU-R.

4.6.2.2 Clearing the Operating Channel

The UUT shall cease normal transmissions on the operating channel within *Channel Clearing Time* (table D.1) if a radar interfering signal (table D.2) is present with a power greater than *Interference Threshold* (table D.1).

After a radar presence has been detected, the aggregate transmission time of control signalling shall not exceed *Channel Closing Transmission Time* (table D.1), and all transmissions shall be ceased on the operating channel within *Channel Move Time* (table D.1).

NOTE: For detailed descriptions of the *Channel Closing Transmission Time* and the *Channel Move Time* see Channels Clearing clause in ITU-R M.[8A-9B.RLAN.DFS] (see Bibliography).

4.6.3 Conformance

4.6.3.1 Conformance to radar detection requirements

Conformance tests for the requirements defined in clause 4.6.2 are given in clause 5.3.6.

4.6.3.2 Conformance to uniform spreading

Conformance tests for the requirement to provide a uniform spread of the loading per clause 4.6.1 are not defined in the present document.

5 Testing for compliance with technical requirements

5.1 Conditions for testing

5.1.1 Environmental conditions for testing

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

5.1.2 Test sequences

5.1.2.1 General test transmission sequences

Unless mentioned otherwise, all the tests in the present document shall be performed by using a test transmission sequence that shall consist of regularly transmitted bursts with transmission interval of e.g. 2 ms. The bursts shall be fixed in length in a sequence and shall exceed the transmitter minimum activity ratio of 10 %. The minimum duration of the sequence shall be adequate for the test purposes. The test sequence shall be declared in the test report. General structure of the test sequence is shown in figure 3.

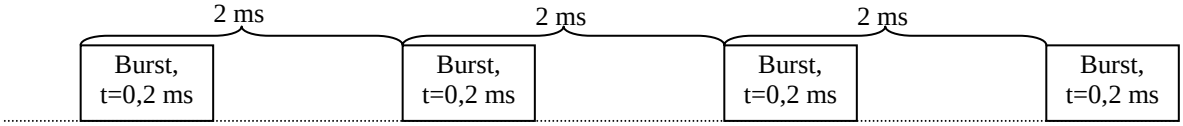


Figure 3: General structure of the test transmission sequences

5.2 Interpretation of the measurement results

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

- the measured value related to the corresponding limit will be used to decide whether an equipment meets the requirements of the present document;
- the value of the measurement uncertainty for the measurement of each parameter shall be included in the test report;
- the recorded value of the measurement uncertainty shall be, for each measurement, equal to or lower than the figures in table 7.

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with ETR 028 [4] 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 7 is based on such expansion factors.

Table 7: Maximum measurement uncertainty

Parameter	Uncertainty
RF frequency	1×10^{-7}
RF power conducted	0,75 dB
RF power radiated	6 dB
Spurious emissions, conducted	3 dB
Spurious emissions, radiated	6 dB

5.3 Essential radio test suites

5.3.1 Carrier frequencies and channelization

5.3.1.1 Test conditions

The UUT shall be set to operate at a normal RF power output level.

For UUT without an integral antenna, conducted measurements may be used in conjunction with the declaration of the gain of the applicable antenna(s). For UUT with an integral antenna, radiated measurements shall be used.

5.3.1.2 Test methods

5.3.1.2.1 Conducted measurement

The UUT shall be connected to a spectrum analyser of sufficient accuracy (see clause 5.2).

The test procedure shall be as follows:

a) The UUT transmitter is activated and set to operate at a given carrier frequency either without modulation or with only one fixed sub-carrier in use.

b) The output spectrum is displayed on a spectrum analyser set to display a frequency range of 100 MHz centred on the selected carrier frequency.

c) The observed frequency is recorded.

Steps a through c are performed for the carrier frequencies that the UUT is capable of operating at – as declared by the manufacturer.

5.3.1.2.2 Radiated measurement

The test set up as described in annex B shall be used with a spectrum analyser of sufficient accuracy attached to the test antenna (see clause 5.2).

The test procedure is as described under clause 5.3.1.2.1.

5.3.2 Transmit Power Control (TPC)

5.3.2.1 Test conditions

The conformance requirements in clause 4.3.1 shall be verified at the lowest, the middle, and the highest carrier centre frequency (see table 1) of the declared frequency range(s) when configured to operate at the highest declared power level. The conformance requirements in clause 4.3.2 shall be verified at the lowest, the middle, and the highest carrier centre frequency (see table 1) of the declared frequency range(s) when configured to operate at the lowest declared power level. The measurements shall be performed using normal operation of the equipment with test signal applied (see clause 5.1.2.1).

NOTE: Special test functions may be needed in the UUT to make this test possible.

For UUT without an integral antenna, conducted measurements may be used in conjunction with the declaration of the gain of the applicable antenna(s). For UUT with an integral antenna, radiated measurements shall be used.

5.3.2.2 Test method

5.3.2.2.1 Conducted measurement

Step 1:

a) using suitable attenuators, the output power of the transmitter shall be coupled to a diode detector. The output of the diode detector shall be connected to the vertical channel of an oscilloscope;

b) the combination of the diode detector and the oscilloscope shall be capable of faithfully reproducing the duty cycle of the transmitter output signal;

c) the observed duty cycle of the transmitter (Tx on/(Tx on + Tx off)) shall be noted as x ($0 < x \leq 1$), and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal to or greater than 0,1 (see clause 5.1.2).

Step 2:

a) the average output power of the transmitter shall be determined using a wideband calibrated RF power meter with a thermocouple detector or an equivalent thereof and with an integration period that exceeds the repetition period of the transmitter by a factor 5 or more. The observed value shall be noted as "A" (in dBm);

b) the eirp shall be calculated from the above measured power output A (in dBm) the observed duty cycle x, and the declared antenna gain(s) "G" in dBi, according to the formula:

c) $P = A + G + 10 \log (1/x)$ (dBm);

d) P shall be recorded in the test report.

5.3.2.2.2 Radiated measurement

The test set up as described in annexes B and C shall be used with a RF power meter of sufficient accuracy attached to the test antenna (see clause 5.2).

The test procedure is as described under clause 5.3.2.2.1.

5.3.3 Transmitter unwanted emissions outside the 5 GHz RLAN bands

5.3.3.1 Test conditions

The conformance requirements in clause 4.5.1 shall be verified under normal operating conditions, and at the lowest, the middle, and the highest carrier centre frequency (see table 1) of the declared frequency range(s). The UUT shall be configured to operate at the highest declared power level.

For UUT without an integral antenna, conducted measurements may be used in conjunction with the declaration of the gain of the applicable antenna(s). For UUT with an integral antenna, radiated measurements shall be used.

5.3.3.2 Test Method

5.3.3.2.1 Conducted measurement

The UUT shall be connected to a spectrum analyser capable of RF power measurements. The test procedure shall be as follows:

a) the settings of the spectrum analyser shall be as follows:

- Sensitivity: at least 6 dB below the limit given in table 4;
- Video bandwidth: 1 MHz;
- Video averaging on, or peak hold;

The video signal of the spectrum analyser shall be "gated" such that the spectrum measured shall be measured between 4,0 μs before the start of the burst to 4,0 μs after the end of the burst.

NOTE: The "start of the burst" is the centre of the first sample of the preamble heading the burst. The "end of the burst" is the centre of the last sample in the burst.

This gating may be analogue or numerical, dependent upon the design of the spectrum analyser.

b) initially the power level shall be measured in the ranges:

- 47 MHz to 74 MHz;
- 87,5 MHz to 118 MHz;
- 174 MHz to 230 MHz;
- 470 MHz to 862 MHz

with a resolution bandwidth of 1 MHz and in a frequency scan mode;

c) if any measurement in b) is greater than –54 dBm then measurements shall be taken with a resolution bandwidth of 100 kHz, zero frequency scan, at the 11 frequencies spaced 100 kHz apart in a band ±0,5 MHz centred on the failing frequency;

EXAMPLE 1: A UUT fails at 495 MHz. Measurements are made in a 100 kHz bandwidth on 494,5 MHz, 494,6 MHz, 494,7 MHz. etc. up to 495,5 MHz.

d) initially the power level shall be measured in the ranges:

- 25 MHz to 47 MHz;
- 74 MHz to 87,5 MHz;
- 118 MHz to 174 MHz;
- 230 MHz to 470 MHz;

- 862 MHz to 1 GHz

with a resolution bandwidth of 1 MHz and in a frequency scan mode;

e) if any measurement in d) is greater than -36 dBm then measurements shall be taken with a resolution bandwidth of 100 kHz, zero frequency scan, at the 11 frequencies spaced 100 kHz apart in a band ±0,5 MHz centred on the failing frequency;

EXAMPLE 2: A UUT fails at 285 MHz. Measurements are made in a 100 kHz bandwidth on 284,5 MHz, 284,6 MHz, 284,7 MHz. etc. up to 285,5 MHz.

f) the power level shall be measured in the ranges:

- 1 GHz to 5,15 GHz;
- 5,725 GHz to 26,5 GHz

with a resolution bandwidth of 1 MHz and in a frequency scan mode;

g) the power level shall be measured in the range:

- 5,35 GHz to 5,47 GHz

with a resolution bandwidth of 1 MHz with zero frequency scan.

5.3.3.2.2 Radiated measurement

The test set up as described in annex B shall be used with a spectrum analyser of sufficient accuracy attached to the test antenna (see clause 5.2).

The test procedure is as described under clause 5.3.3.2.1.

5.3.4 Transmitter unwanted emissions within the 5 GHz RLAN bands

5.3.4.1 Test conditions

The conformance requirements in clause 4.5.2 shall be verified under normal operating conditions, and at the lowest, the middle, and the highest carrier centre frequency (see table 1) of the declared frequency range(s). The UUT shall be configured to operate at the highest declared power level.

For UUT without an integral antenna, conducted measurements may be used in conjunction with the declaration of the gain of the applicable antenna(s). For UUT with an integral antenna, radiated measurements shall be used.

5.3.4.2 Test Method

5.3.4.2.1 Conducted measurement

The settings of the spectrum analyser shall be as follows:

- resolution bandwidth: 1 MHz;
- video bandwidth: 30 kHz;
- video averaging on.

The video signal of the spectrum analyser shall be "gated" such that the spectrum measured shall be measured between 4,0 μs before the start of the burst to 4,0 μs after the end of the burst.

NOTE: The "start of the burst" is the centre of the first sample of the preamble heading the burst. The "end of the burst" is the centre of the last sample in the burst.

This gating may be analogue or numerical, dependent upon the design of the spectrum analyser.

Determination of the reference average power level

The spectrum analyser shall be tuned to measurement frequencies at every 1 MHz interval within f_c - 9 MHz to f_c + 9 MHz, with zero frequency scan. The maximum average power within f_c - 9 MHz to f_c + 9 MHz (except f_c) is the reference level for relative power measurements on the channel centred at f_c and shall be recorded to compute relative power levels as described below.

Determination of the relative average power levels

The power level shall be measured in the ranges:

- 5 150 MHz to 5 350 MHz;
- 5 470 MHz to 5 725 MHz

excluding the interval f_c - 9 MHz to f_c + 9 MHz with a resolution bandwidth of 1 MHz and in a frequency scan mode. The average value of power relative to the reference average power level for the channel shall be noted.

5.3.4.2.2 Radiated measurement

The test set up as described in annex B shall be used with a spectrum analyser of sufficient accuracy attached to the test antenna (see clause 5.2).

The test procedure is as described under clause 5.3.4.2.1.

5.3.5 Receiver Spurious Emissions

5.3.5.1 Test conditions

The conformance requirements in clause 4.6 shall be verified under normal operating conditions, and at the lowest, the middle, and the highest carrier centre frequency (see table 1) of the declared frequency range(s).

For UUT without an integral antenna, conducted measurements may be used in conjunction with the declaration of the gain of the applicable antenna(s). For UUT with an integral antenna, radiated measurements shall be used.

Test sequence (see clause 5.1.2.1) shall be applied to the receiver input at the reference sensitivity level according to the nominal bit rate.

5.3.5.2 Test Method

5.3.5.2.1 Conducted measurement

Using a directional coupler, circulator or gating to remove the test data transmissions (and/or other means to isolate the emissions measurements instrument from the test data signals transmitted) the radio emissions from the UUT shall be measured while the UUT receives test data.

a) the settings of the spectrum analyser shall be as follows:
   - frequency scan allowed;
   - resolution bandwidth: 1 MHz or 100 kHz;
   - video bandwidth: 1 MHz;
   - video averaging on, or peak hold;

b) tuning the spectrum analyser centre frequency over the measurement frequency bands specified in table 5, the power level of UUT receiver emissions shall be measured during test data transmissions. If gating is used to remove the unwanted energy from the test data transmissions, the tuning of the spectrum analyser shall not change during the gated-out time interval;

5.3.5.2.2 Radiated measurement

The test set up as described in annex B shall be used with a spectrum analyser of sufficient accuracy attached to the test antenna (see clause 5.2).

The test procedure is as described under clause 5.3.5.2.1.

5.3.6 Dynamic Frequency Selection (DFS)

5.3.6.1 Test conditions

The conformance requirements in clause 4.6.2 shall be verified under normal operating conditions, and in each of the declared frequency range(s), and with each of the applicable radar signals defined in annex D.

For UUT without an integral antenna, conducted measurements may be used in conjunction with the declaration of the gain of the applicable antenna(s). In this case if the UUT is capable of operating as a Master the output power of the signal generator shall provide a received signal power at the antenna reference point (ARP) of (*Interference Threshold* + C) [dBm]. The C is a calibration value and depends on the antenna gain.

NOTE: Special test functions may be needed in the UUT to make this test possible.

For UUT with an integral antenna, radiated measurements shall be used. In this case if the UUT is capable of operating as a Master the output power of the signal generator should provide a received signal power at the antenna of *Interference Threshold* (table D.1).

5.3.6.2 Test Method

For an UUT capable of operating as a Master, the test scenario consists of an UUT, a signal generator and a protocol test unit. For an UUT capable of operating only as a Slave the test scenario consists of an UUT and a protocol test unit. The UUT is capable of transmitting a test transmission sequence. The signal generator is capable of generating any of the radar test signals (table D.2). The protocol test unit is capable of generating or interpreting any of the control signalling required to clear the operating channel.

5.3.6.2.1 Conducted measurement

Initial Channel Availability Check

a) Two channels are selected from the declared frequency range(s): Ch_r (channel occupied by a radar) and Ch_f (channel free from radars).

b) Signal generator and UUT are connected and the power of the UUT is switched off.

c) The signal generator transmits a radar test signal (table D.2) on channel Ch_r.

d) At a certain time T0 the UUT is switched on to check on channel Ch_r. T1 denotes the beginning of the first radar burst, which is completely received by the UUT.

e) Time difference between T1 and instant TD when the UUT starts transmitting on channel Ch_f shall be noted.

Clearing the Operating Channel

Master:

a) A channel is selected from the declared frequency range(s).

b) Signal generator, protocol test unit and UUT are connected.

c) The UUT transmits a test transmission sequence on the channel and the protocol test unit listens on the same channel.

d) At a certain time T0 the signal generator starts transmitting a radar test signal on the channel. T1 denotes the beginning of the first radar burst, which is completely received by the UUT.

e) TD is the time instant when the protocol test unit has received a message indicating that the UUT has detected a radar. Time difference between T1 and TD shall be noted.

f) Aggregate transmission time of control signalling following instant TD on the channel shall be noted.

g) Time difference between TD and instant when the UUT has ceased all transmissions on the channel shall be noted.

Slave:

a) A channel is selected from the declared frequency range(s).

b) Protocol test unit and UUT are connected.

c) The UUT transmits a test transmission sequence on the channel.

d) At a certain time T0 the protocol test unit starts transmitting control signalling to clear the operating channel on the channel. T1 denotes the beginning of the first control signalling, which is completely received by the UUT.

e) Time difference between T1 and instant TD when the UUT has ceased normal transmissions on the channel shall be noted.

f) Aggregate transmission time of control signalling from the UUT following instant TD on the channel shall be noted.

g) Time difference between TD and instant when the UUT has ceased all transmissions on the channel shall be noted.

5.3.6.2.2 Radiated measurement

The test set up as described in annex B shall be used with a spectrum analyser of sufficient accuracy attached to the test antenna (see clause 5.2).

The test procedure is as described under clause 5.3.6.2.1.

Annex A (normative): The EN Requirements Table (EN-RT)

The EN Requirements Table (EN-RT) serves a number of purposes, as follows:

- it provides a tabular summary of all the requirements;
- it shows the status of each EN-R, whether it is essential to implement in all circumstances (Mandatory), or whether the requirement is dependent on the supplier having chosen to support a particular optional service or functionality (Optional). In particular it enables the EN-Rs associated with a particular optional service or functionality to be grouped and identified;
- when completed in respect of a particular equipment it provides a means to undertake the static assessment of conformity with the EN.

Table A.1: EN Requirements Table (EN-RT)

EN Reference		EN 301 893				Comment
No.	**Reference**	**EN-R** (note)	**Status**			
1	4.2	Carrier frequencies and channelization	M			
2	4.3.1	RF output power at the highest power level	M			
3	4.3.2	RF output power at the lowest power level	M			
4	4.4.1	Transmitter unwanted emissions outside the HIPERLAN bands	M			
5	4.4.2	Transmitter unwanted emissions within the HIPERLAN bands	M			
6	4.5	Receiver spurious emissions	M			
7	4.6	Dynamic Frequency Selection (DFS)	M			
NOTE: These EN-Rs are justified under article 3.2 of the R&TTE Directive.						

Key to columns:

No Table entry number;

Reference Clause reference number of conformance requirement within the present document;

EN-R Title of conformance requirement within the present document;

Status Status of the entry as follows:

- M Mandatory, shall be implemented under all circumstances;
- O Optional, may be provided, but if provided shall be implemented in accordance with the requirements;
- O.n this status is used for mutually exclusive or selectable options among a set. The integer "n" shall refer to a unique group of options within the EN-RT. A footnote to the EN-RT shall explicitly state what the requirement is for each numbered group. For example, "It is mandatory to support at least one of these options", or, "It is mandatory to support exactly one of these options".

Comments To be completed as required.

Annex B (normative): Test sites and arrangements for radiated measurements

B.1 Open air test sites

The term "open air" should be understood from an electromagnetic point of view. Such a test site may be really in open air or alternatively with walls and ceiling transparent to the radio waves at the frequencies considered.

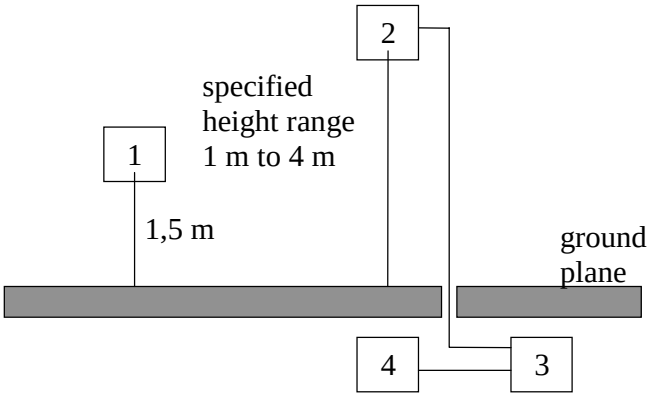
An open air test site may be used to perform the measurements using the radiated measurement methods described in clause 5. Absolute or relative measurements may be performed on transmitters or on receivers; absolute measurements of field strength require a calibration of the test site.

For measurements at frequencies below 1 GHz, a measurement distance appropriate to the frequency shall be used. For frequencies above 1 GHz, any suitable measuring distance may be used. The equipment size (excluding the antenna) shall be less than 20 % of the measuring distance. The height of the equipment or of the substitution antenna shall be 1,5 m; the height of the test antenna (transmit or receive) shall vary between 1 m and 4 m.

Sufficient precautions shall be taken to ensure that reflections from extraneous objects adjacent to the site do not degrade the measurement results, in particular:

- no extraneous conducting objects having any dimension in excess of a quarter wavelength of the highest frequency tested shall be in the immediate vicinity of the site according to CISPR 16-1;
- all cables shall be as short as possible; as much of the cables as possible shall be on the ground plane or preferably below; and the low impedance cables shall be screened.

The general measurement arrangement is shown in figure B.1.



1) equipment under test
2) test antenna
3) high pass filter (as required)
4) spectrum analyser or measuring receiver

Figure B.1: Measuring arrangement

Alternative arrangements to an open air test site may be used, such as an anechoic chamber or indoor test site.

B.2 Test antenna

When the test site is used for radiation measurements the test antenna shall be used to detect the field from both the test sample and the substitution antenna. When the test site is used for the measurement of receiver characteristics the antenna shall be used as a transmitting antenna. This antenna shall be mounted on a support capable of allowing the antenna to be used in either horizontal or vertical polarization and for the height of its centre above the ground to be varied over the specified range. Preferably test antennas with pronounced directivity should be used. The size of the test antenna along the measurement axis shall not exceed 20 % of the measuring distance.

B.3 Substitution antenna

The substitution antenna shall be used to replace the UUT in substitution measurements. For measurements below 1 GHz the substitution antenna shall be a half wavelength dipole resonant at the frequency under consideration, or a shortened dipole, calibrated to the half wavelength dipole. For measurements between 1 GHz and 4 GHz either a half wavelength dipole or a horn radiator may be used. For measurements above 4 GHz a horn radiator shall be used. The centre of this antenna shall coincide with the reference point of the test sample it has replaced. This reference point shall be the volume centre of the sample when its antenna is mounted inside the cabinet, or the point where an outside antenna is connected to the cabinet.

The distance between the lower extremity of the dipole and the ground shall be at least 30 cm.

NOTE: The gain of a horn antenna is generally expressed relative to an isotropic radiator.

Annex C (normative): General description of measurement

This annex gives the general methods of measurements for RF signals using the test sites and arrangements described in annex B.

C.1 Conducted measurements

Conducted measurements may be applied to equipment provided with an antenna connector e.g. by means of a spectrum analyser.

C.2 Radiated measurements

Radiated measurements shall be performed with the aid of a test antenna and measurement instruments as described in annex B. The test antenna and measurement instrument shall be calibrated according to the procedure defined in this annex. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level. This position shall be recorded in the measurement report. The frequency range shall be measured in this position.

Radiated measurements should be performed in an anechoic chamber. For other test sites corrections may be needed (see annex B). The following test procedure applies:

a) a test site which fulfils the requirements of the specified frequency range of this measurement shall be used. The test antenna shall be oriented initially for vertical polarization unless otherwise stated and the transmitter under test shall be placed on the support in its standard position (clause B.1.1) and switched on;

b) for average power measurements a non-selective voltmeter or wideband spectrum analyser shall be used. For other measurements a spectrum analyser or selective voltmeter shall be used and tuned to the measurement frequency.

In either case a) or b), the test antenna shall be raised or lowered, if necessary, through the specified height range until the maximum signal level is detected on the spectrum analyser or selective voltmeter.

The test antenna need not be raised or lowered if the measurement is carried out on a test site according to clause B.1.2.

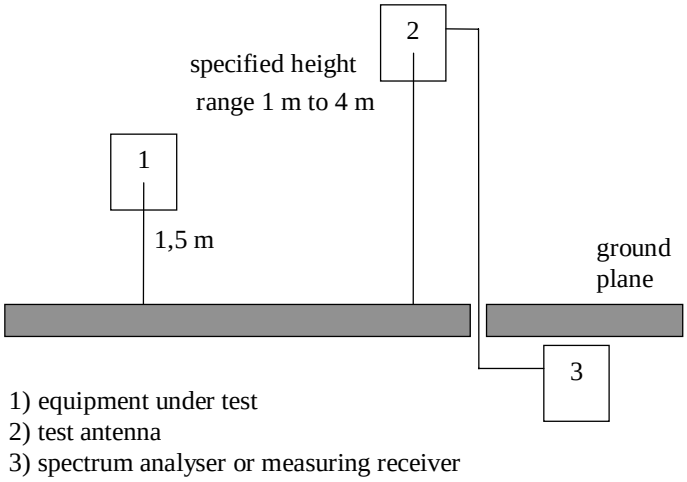


Figure C.1: Measurement arrangement 1

a) the transmitter shall be rotated through 360° about a vertical axis until a higher maximum signal is received;

b) the test antenna shall be raised or lowered again, if necessary, through the specified height range until a maximum is obtained. This level shall be recorded.

NOTE: This maximum may be a lower value than the value obtainable at heights outside the specified limits.

The test antenna need not be raised or lowered if the measurement is carried out on a test site according to clause B.1.2. This measurement shall be repeated for horizontal polarization. The result of the measurement shall be taken as the sum of the powers measured with vertical and horizontal polarization.

C.3 Substitution measurement

The actual signal generated by the measured equipment may be determined by means of a substitution measurement in which a known signal source replaces the device to be measured, see figure C.2. This method of measurement should be used in an anechoic chamber. For other test sites corrections may be needed, see annex B.

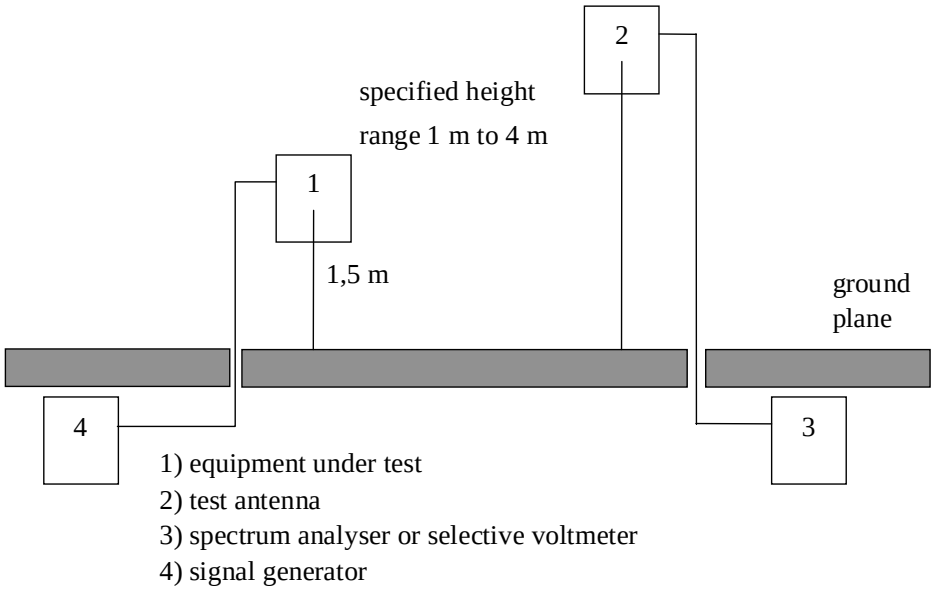


Figure C.2: Measurement arrangement N82

Using measurement arrangement 2, figure C.2, the substitution antenna shall replace the transmitter antenna in the same position and in vertical polarization. The frequency of the signal generator shall be adjusted to the measurement frequency. The test antenna shall be raised or lowered, if necessary, to ensure that the maximum signal is still received. The input signal to the substitution antenna shall be adjusted in level until an equal or a known related level to that detected from the transmitter is obtained in the test receiver.

The test antenna need not be raised or lowered if the measurement is carried out on a test site according to clause B.1.2.

The radiated power is equal to the power supplied by the signal generator, increased by the known relationship if necessary and after corrections due to the gain of the substitution antenna and the cable loss between the signal generator and the substitution antenna.

This measurement shall be repeated with horizontal polarization. The result of the measurement shall be taken as the sum of the powers measured with vertical and horizontal polarization.

Annex D (normative): DFS parameters

NOTE: Values in this annex are still preliminary and shall be revisited after the Public Enquiry, before submitting this Candidate Harmonized European Standard to Vote.

Table D.1: DFS requirement values

Parameter	Value
Interference Threshold	-52 dBm
Channel Availability Check Time	10 s
Channel Clearing Time	0,2 s
Channel Closing Transmission Time	0,02 s
Channel Move Time	10 s

Table D.2: Parameters of DFS test signals

Radar test signal	Operating frequency range [MHz]	Bandwidth [MHz]	Pulse repetition frequency PRF [pps]	Pulse width W [µs]	Burst length L [ms]/No. of pulses	Burst Period B [sec]
Radar signal 1	>5 250	14	700	1	26/18	10
Radar signal 2 (Maritime)	5 450 to 5 820	2		0,2	5/10	2
Radar signal 3 (Meteorological)	5 600 to 5 800	0,6	330	2	500/165	144

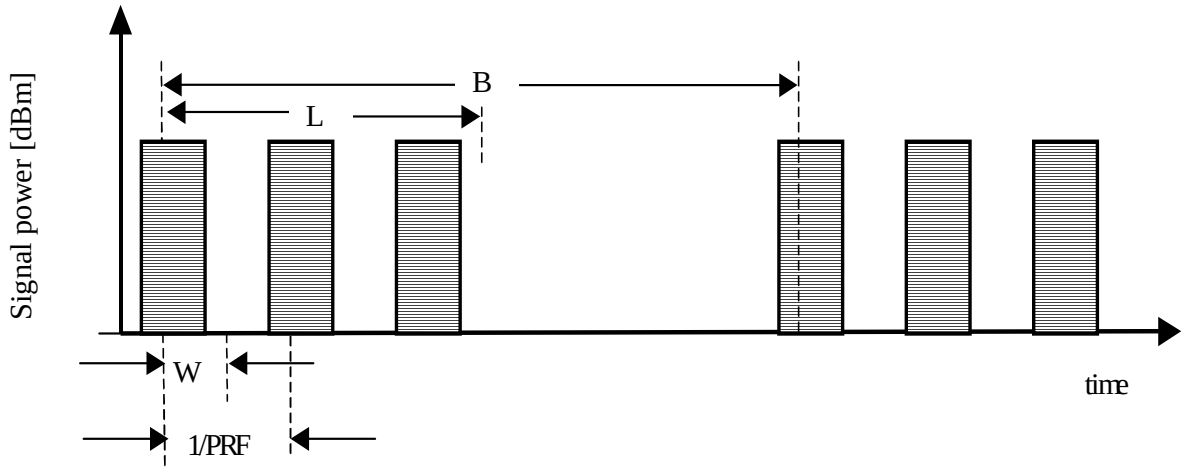


Figure D.1: General structure of the DFS test transmission sequences

Annex E (informative): Bibliography

Working document towards a Preliminary Draft New Recommendation ITU-R M.[8A-9B.RLAN.DFS].

ETSI EN 301 489 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services."

Annex F (informative): The EN title in the official languages

Language	EN title
Danish	
Dutch	
English	Broadband Radio Access Networks (BRAN); 5 GHz high performance RLAN; Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive
Finnish	
French	
German	
Greek	
Icelandic	
Italian	
Portuguese	
Spanish	
Swedish	

History

Document history				
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