

Final draft **ETSI EN 301 893** V1.5.1 (2008-08)

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*Harmonized European Standard (Telecommunications series)*

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

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**Reference**REN/BRAN-0060003

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**Keywords**access, broadband, HIPERLAN, LAN, layer 1,  
radio, testing

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**ETSI**650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

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Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
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## Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN), and is now submitted for the ETSI standards One-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 [i.3] (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 [1] are given in annex A.

<b>Proposed national transposition dates</b>	
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):	18 months after doa

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## Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive. The modular structure is shown in EG 201 399 [8].

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# 1 Scope

The present document applies to 5 GHz high performance wireless access systems (WAS) including RLAN equipment which is used in wireless local area networks. Such networks provide high speed data communications in between devices connected to the wireless infrastructure. The present document also applies to ad-hoc networking where these devices communicate directly with each other, without the use of a wireless infrastructure. The equipment uses a medium access protocol designed to facilitate spectrum sharing with other devices in the wireless network.

5 GHz high performance wireless access systems (WAS) including RLAN equipment covered by the present document, and further referred to as RLAN devices, are operated in accordance with the ECC Decision (04)08 [5] and the Commission Decision 2005/513/EC [6] as amended by the Commission Decision 2007/90/EC [7]. The equipment is intended to operate in the frequency ranges 5 150 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz.

The present document is intended to cover the provisions of article 3.2 of R&TTE Directive [1], 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".

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# 2 References

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.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

## 2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) 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] ETSI TR 100 028-1 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".
- [3] ETSI TR 100 028-2 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".

- [4] CISPR 16-1-1 (2006-11 Ed. 2.1 Consolidated Edition): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".
- [5] CEPT ECC/DEC(04)08: "ECC Decision of 12 November 2004 on the harmonized use of the 5 GHz frequency bands for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)".
- [6] Commission Decision 2005/513/EC of 11 July 2005 on the harmonized use of radio spectrum in the 5 GHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs).
- [7] Commission Decision 2007/90/EC of 12 February 2007 amending Decision 2005/513/EC on the harmonized use of radio spectrum in the 5 GHz frequency band for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs).
- [8] ETSI EG 201 399 V2.1.1 (2005-12): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".
- [9] IEEE 802.11a-1999 [ISO/IEC 8802-11:1999/Amd 1:2000(E)] (Supplement to IEEE Std 802.11, 1999 Edition): "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: High-speed Physical Layer in the 5 GHz Band".

## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] IEEE P802.11n: "Standard for Amendment to 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 Amendment: Enhancements for Higher Throughput".
- [i.2] IEEE 802.11n: "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 amendment: Enhancements for Higher Throughput" . .
- [i.3] Council Directive 98/34/EC: "Directive 98/48/EC of the european parliament and of the council of 20 July 1998 amending Directive 98/34/EC laying down a procedure for the provision of information in the field of technical standards and regulations".

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## 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 [1] and the following apply:

**5 GHz RLAN bands:** total frequency range that consists of 2 sub-bands:

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

**ad-hoc mode:** operating mode in which a RLAN device establishes a temporary wireless connection with other RLAN devices without a controlling network infrastructure



**antenna array:** two or more antennas connected to a single device and operating simultaneously

**Available Channel:** channel identified as available for immediate use as an *Operating Channel*

NOTE: *Usable Channels* whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz can be considered as *Available Channels* without further testing.

**beam forming gain:** additional (antenna) gain realized by using beam forming techniques in smart antenna systems

NOTE: Beam forming gain as used in the present document, does not include the gain of the antenna assembly.

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

**channel:** amount of spectrum used by a single RLAN device operating on one of the declared centre frequencies

**channel plan:** the combination of the centre frequencies and for each of the centre frequencies, the declared nominal bandwidth(s)

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

**dedicated antenna:** antenna external to the equipment, using an antenna connector with a cable or a wave-guide and which has been designed or developed for one or more specific types of equipment

NOTE: It is the combination of dedicated antenna and radio equipment that is expected to be compliant with the regulations.

**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

**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 as a fixed part of the equipment, without the use of an external connector and as such which can not be disconnected from the equipment by a user with the intent to connect another antenna

NOTE: An integral antenna may be fitted internally or externally. In the case where the antenna is external, a non-detachable cable or wave-guide can be used.

**master mode:** mode which relates to the DFS functionality where the RLAN device uses a Radar Interference Detection function and controls the transmissions of RLAN devices operating in slave mode

NOTE: In this mode it is able to select a channel and initiate a network by sending enabling signals to other RLAN devices. A RLAN network always has at least one RLAN device operating in master mode when operating in the bands 5 250 MHz to 5 350 MHz and 5 470 MHz to 5 725 MHz.

**multi-radio equipment:** radio, host or combined equipment using more than one radio transceiver

**Operating Channel:** *Available Channel* on which the RLAN has started transmissions

NOTE: An *Operating Channel* becomes again an *Available Channel* if the RLAN stopped all transmissions on that channel and no radar signal was detected by the *In-Service Monitoring*.

**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

**receive chain:** receiver circuit with an associated antenna

NOTE: Two or more receive chains are combined in a smart antenna system.

**RLAN devices:** 5 GHz high performance wireless access systems (WAS) including RLAN equipment

**simulated radar burst:** series of periodic radio wave pulses for test purposes

**slave mode:** mode which relates to the DFS functionality where the transmissions of the RLAN are under control of a RLAN device operating in master mode

NOTE: A RLAN device in slave mode may use a Radar Interference Detection function.

**smart antenna systems:** equipment that combines multiple transmit and/or receive chains with a signal processing function to increase the throughput and/or to optimize its radiation and/or reception capabilities

NOTE: E.g. techniques such as spatial multiplexing, beam forming, cyclic delay diversity, MIMO, etc.

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

**transmit chain:** transmitter circuit with an associated antenna

NOTE: Two or more transmit chains are combined in a smart antenna system.

**Transmit Power Control (TPC):** technique in which the transmitter output power is controlled resulting in reduced interference to other systems

**Unavailable Channel:** channel which can not be considered by the RLAN device for a certain period of time (*Non Occupancy Period*) after a radar signal was detected on that channel

**Unusable Channel:** channel from the declared channel plan which may be declared as permanently unavailable due to one or more radar detections on the channel

**Usable Channel:** any channel from the declared channel plan, which may be considered by the RLAN for possible use, unless it is precluded by either:

- 1) the intended outdoor usage of the RLAN; or
- 2) previous detection of a radar on the channel (*Unavailable Channel or Unusable Channel*); or
- 3) national regulations; or
- 4) the restriction to only operate in the band 5 150 MHz to 5 250 MHz for RLAN devices without a radar detection capability; or
- 5) being used by other RLAN devices.

## 3.2 Symbols

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

A	Measured power output
B	Radar burst period
$Ch_r$	Channel occupied by a radar
D	Measured power density
E	Field strength
$E_o$	Reference field strength
$f_c$	Carrier frequency
G	Antenna gain
L	Radar burst length
n	Number of channels
$P_H$	Calculated EIRP at highest power level
$P_L$	Calculated EIRP at lowest power level
PD	Calculated power density
$P_d$	Detection Probability
R	Distance
$R_o$	Reference distance
S0	Signal power
T0	Time instant
T1	Time instant

T2	Time instant
T3	Time instant
W	Radar pulse width
x	Observed duty cycle
Y	Beam forming (antenna) gain

### 3.3 Abbreviations

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

CAC	Channel Availability Check
CSD	Cyclic Shift Diversity
CISPR	International Special Committee on Radio Interference (Comité International Spécial des Perturbations Radioélectriques)
BIT	Burst Interval Time
dB/div	dB per division
DFS	Dynamic Frequency Selection
EIRP	Equivalent Isotropically Radiated Power
EMC	Electro-Magnetic Compatibility
ERP	Effective Radiated Power
HT20	High Throughput in a 20 MHz channel
HT40	High Throughput in a 40 MHz channel
IEEE	Institute of Electrical and Electronic Engineers
MCS	Modulation Coding Scheme
PPB	Pulses Per Burst
ppm	parts per million
PRF	Pulse Repetition Frequency
PSD	Power Spectral Density
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
RLAN	Radio Local Area Network
TPC	Transmit Power Control
Tx	Transmit, Transmitter
UUT	Unit Under Test
WAS	Wireless Access Systems

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## 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 stated by the manufacturer.

The equipment shall comply in any of the operating modes with all the technical requirements of the present document at all times when operating within the boundary limits of the stated operational environmental profile.

### 4.2 Centre frequencies

#### 4.2.1 Definition

The centre frequency is the centre of the channel declared by the manufacturer as part of the declared channel plan(s).

#### 4.2.2 Limits

The actual centre frequency for any given channel declared by the manufacturer shall be maintained within the range  $f_c \pm 20$  ppm.

### 4.2.3 Conformance

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

## 4.3 Nominal Channel Bandwidth and Occupied Channel Bandwidth

### 4.3.1 Definition

The nominal channel bandwidth is the widest band of frequencies, inclusive of guard bands, assigned to a single channel.

The occupied channel bandwidth is the frequency bandwidth of the signal power at the -6 dBc points when measured with a 100 kHz resolution bandwidth.

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

### 4.3.2 Limits

The nominal bandwidth shall be in the range from 5 MHz to 40 MHz.

The occupied channel bandwidth shall be between 80 % and 100 % of the declared nominal channel bandwidth. In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement.

NOTE: The limit for occupied bandwidth is not applicable for devices with a nominal bandwidth of 40 MHz when temporarily operating in a mode in which they transmit only in the upper or lower 20 MHz part of a 40 MHz channel (e.g. to transmit a packet in the upper or lower 20 MHz part of a 40 MHz channel).

### 4.3.3 Conformance

Conformance tests as defined in clause 5.3.3 shall be carried out to determine the occupied channel bandwidth.

## 4.4 RF output power, Transmit Power Control (TPC) and power density

### 4.4.1 Definitions

#### 4.4.1.1 RF output power

The RF output power is the mean equivalent isotropically radiated power (EIRP) during a transmission burst.

#### 4.4.1.2 Transmit Power Control (TPC)

Transmit Power Control (TPC) is a mechanism to be used by the UUT to ensure a mitigation factor of at least 3 dB on the aggregate power from a large number of devices. This requires the UUT to have a TPC range from which the lowest value is at least 6 dB below the values for mean EIRP given in table 1.

TPC is not required for channels whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz.

#### 4.4.1.3 Power density

The power density is the mean Equivalent Isotropically Radiated Power (EIRP) density during a transmission burst.

## 4.4.2 Limits

The limits below are applicable to the system as a whole and in any possible configuration. This includes smart antenna systems (devices with multiple transmit chains).

### 4.4.2.1 RF output power and power density at the highest power level

For devices with TPC, the RF output power and the power density when configured to operate at the highest stated power level of the TPC range shall not exceed the levels given in table 1.

For devices without TPC, the limits in table 1 shall be reduced by 3 dB, except when operating on channels whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz.

**Table 1: Mean EIRP limits for RF output power and power density at the highest power level**

Frequency range	Mean EIRP limit	Mean EIRP density limit
5 150 MHz to 5 350 MHz	23 dBm	10 dBm/MHz
5 470 MHz to 5 725 MHz	30 dBm (see note)	17 dBm/MHz (see note)
NOTE: For Slave devices without a Radar Interference Detection function the mean EIRP shall be less than 23 dBm and the mean EIRP density shall be less than 10 dBm/MHz.		

### 4.4.2.2 RF output power at the lowest power level of the TPC range

For devices using TPC, the RF output power during a transmission burst when configured to operate at the lowest stated power level of the TPC range shall not exceed the levels given in table 2.

**Table 2: Mean EIRP limits for RF output power at the lowest power level of the TPC range**

Frequency range	Mean EIRP
5 250 MHz to 5 350 MHz	17 dBm
5 470 MHz to 5 725 MHz	24 dBm (see note)
NOTE: For Slave devices without a Radar Interference Detection function the mean EIRP shall be less than 17 dBm.	

The limits in table 2 do not apply for devices without TPC or when operating on channels whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz.

## 4.4.3 Conformance

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

## 4.5 Transmitter unwanted emissions

### 4.5.1 Transmitter unwanted emissions outside the 5 GHz RLAN bands

#### 4.5.1.1 Definition

These are radio frequency emissions outside the 5 GHz RLAN bands.