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**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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## Foreword

This Harmonized European Standard (EN) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN).

The present document has been produced by ETSI in response to mandate M/284 issued from the European Commission under Directive 98/34/EC [i.3] as amended by Directive 98/48/EC [i.1].

The title and reference to the present document are intended to be included in the publication in the Official Journal of the European Union of titles and references of Harmonized Standard under the Directive 1999/5/EC [1].

The requirements relevant to Directive 1999/5/EC [1] are summarized in annex A.

<b>National transposition dates</b>	
Date of adoption of this EN:	20 March 2015
Date of latest announcement of this EN (doa):	30 June 2015
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 December 2015
Date of withdrawal of any conflicting National Standard (dow):	31 December 2016

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## Modal verbs terminology

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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 [1]. The modular structure is shown in ETSI EG 201 399 [i.2].



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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 present document also describes spectrum access requirements to facilitate spectrum sharing with other equipment.

5 GHz high performance wireless access systems (WAS) including RLAN equipment are further referred to as RLAN devices in the present document.

The spectrum usage conditions for this RLAN equipment are set in 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 which have been allocated by WRC-03 to the *mobile service* on a primary basis for the implementation of WAS/RLANs covered by the present document.

The present document is intended to cover the provisions of article 3.2 of the 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

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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- [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) (12-2001): "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) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [4] Void.
- [5] ECC/DEC/(04)08: ECC Decision of 9 July 2004 on the harmonised use of the 5 GHz frequency bands for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) (30/10/2009).
- [6] Commission Decision 2005/513/EC of 11 July 2005 on the harmonised 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 harmonised 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] IEEE Std. 802.11™-2012: "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".
- [9] IEEE Std. 802.11ac™-2013: "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 - Amendment 4: Enhancements for Very High Throughput for Operation in Bands below 6 GHz".
- [10] ETSI TR 102 273-2 (V1.2.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 2: Anechoic chamber".
- [11] ETSI TR 102 273-3 (V1.2.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 3: Anechoic chamber with a ground plane".
- [12] ETSI TR 102 273-4 (V1.2.1) (12-2001): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 4: Open area test site".

## 2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] 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.
- [i.2] ETSI EG 201 399 (V2.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of candidate Harmonized Standards for application under the R&TTE Directive".
- [i.3] 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.

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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 the 5 150 MHz to 5 350 MHz and the 5 470 MHz to 5 725 MHz sub-bands

**adaptive equipment:** equipment operating in an adaptive mode

**adaptive mode:** mechanism by which equipment can adapt to its environment by identifying other transmissions present in the band

**ad-hoc mode:** operating mode in which an 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

**antenna assembly:** combination of the antenna (integral or dedicated), its coaxial cable and if applicable, its antenna connector and associated switching components

NOTE 1: This term (antenna assembly) refers to an antenna connected to one transmit chain.

NOTE 2: The gain of an antenna assembly  $G$  in dBi, does not include the additional gain that may result out of beamforming.

**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.

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

NOTE: Beamforming 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:** minimum amount of spectrum used by a single RLAN device

NOTE: An RLAN device is permitted to operate (transmit/receive) in one or more adjacent or non-adjacent channels simultaneously.

EXAMPLE: For the purpose of the present document, an IEEE 802.11™ [8] device operating in a 40 MHz mode may be considered as operating in 2 adjacent 20 MHz channels simultaneously.

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

**clear channel assessment:** mechanism used by an equipment to identify other transmissions in the channel

**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.

**energy detect:** mechanism used by an adaptive system to determine the presence of another device operating on the channel based on detecting the signal level of that other device

**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

**Frame Based Equipment (FBE):** equipment where the transmit/receive structure is not directly demand-driven but has fixed timing

NOTE: I.e. it may be altered by configuration changes but there is always a minimum Idle Period following a transmit period.

**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) which cannot 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.

**Listen Before Talk (LBT):** mechanism by which an equipment applies clear channel assessment (CCA) before using the channel

**Load Based Equipment (LBE):** equipment where the transmit/receive structure is not fixed in time but demand-driven

**manufacturer:** company that has manufactured the equipment and who submits it for test

NOTE: Alternatively, the importer or any other person or entity that submits the equipment for test can be considered as the manufacturer for the purpose of the present document.

**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. An 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 an RLAN device operating in master mode

NOTE: An 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: These are techniques such as spatial multiplexing, beamforming, 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

**sub-band:** portion of the 5 GHz RLAN bands

NOTE: See definition for "5 GHz RLAN bands".

**total occupied bandwidth:** total of the Nominal Channel Bandwidths in case of simultaneous transmissions in adjacent or non-adjacent channels

NOTE: The Total Occupied Bandwidth may change with time/payload.

**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 cannot 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

## 3.2 Symbols

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

A	Measured power output
AC	Alternating Current
$T_{ch}$	Number of active transmit chains
B	Radar burst period
$Ch_r$	Channel in which radar test signals are inserted to simulate the presence of a radar
D	Measured power density
dBm	dB relative to 1 milliwatt
DC	Direct Current
E	Field strength
$E_o$	Reference field strength
$f_c$	Carrier frequency
G	Antenna gain
GHz	GigaHertz
Hz	Hertz
kHz	kiloHertz
L	Radar burst length
MHz	MegaHertz
ms	millisecond
MS/s	Mega Samples per second
mW	milliWatt
n	Number of channels
$P_H$	Calculated e.i.r.p. at highest power level
$P_L$	Calculated e.i.r.p. at lowest power level
$P_{burst}$	RMS (mean) power over the transmission burst
PD	Calculated power density
$P_d$	Detection Probability
R	Distance
$R_{ch}$	Number of active receive chains
$R_o$	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	Beamforming (antenna) gain

## 3.3 Abbreviations

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

ACK	Acknowledgement
BIT	Burst Interval Time
BW	BandWidth

CAC	Channel Availability Check
CCA	Clear Channel Assessment
CSD	Cyclic Shift Diversity
DFS	Dynamic Frequency Selection
e.i.r.p.	equivalent isotropically radiated power
ECCA	Extended CCA
EMC	Electro-Magnetic Compatibility
FAR	Fully Anechoic Room
HT20	High Throughput in a 20 MHz channel
HT40	High Throughput in a 40 MHz channel
IEEE	Institute of Electrical and Electronic Engineers
LBT	Listen Before Talk
LPDA	Logarithmic Periodic Dipole Antenna
MCS	Modulation Coding Scheme
MIMO	Multiple Input, Multiple Output
NACK	Not Acknowledged
OATS	Open Area Test Site
PPB	Pulses Per Burst
ppm	parts per million
PPS	Pulses Per Second
PRF	Pulse Repetition Frequency
R&TTE	Radio and Telecommunications Terminal Equipment
RBW	Resolution Bandwidth
RF	Radio Frequency
RLAN	Radio Local Area Network
RMS	Root Mean Square
SAR	Semi Anechoic Room
TL	Threshold Level
TPC	Transmit Power Control
Tx	Transmit, Transmitter
UUT	Unit Under Test
VBW	Video Bandwidth
VSWR	Voltage Standing Wave Ratio
WAS	Wireless Access Systems
WRC-03	World Radiocommunications Conference 2003

## 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.

Where multiple combinations of radio equipment and antenna (antenna assemblies) are intended, each combination shall comply with all the technical requirements of the present document.

### 4.2 Centre frequencies

#### 4.2.1 General

RLAN equipment typically operates on a fixed frequency. The equipment is allowed to change its normal operating frequency when interference is detected, or to prevent causing interference into other equipment or for frequency planning purposes.

#### 4.2.2 Definition

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