

# ETSI EN 300 328 V1.9.1 (2015-02)



**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Wideband transmission systems;  
Data transmission equipment operating  
in the 2,4 GHz ISM band and  
using wide band modulation techniques;  
Harmonized EN covering the essential requirements  
of article 3.2 of the R&TTE Directive**

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Reference

REN/ERM-TG11-010

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Keywords

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## Foreword

This Harmonized European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

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.12] as amended by Directive 98/48/EC [i.5].

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 [i.1].

See article 5.1 of Directive 1999/5/EC [i.1] for information on presumption of conformity and Harmonized Standards or parts thereof the references of which have been published in the Official Journal of the European Union.

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

### National transposition dates

Date of adoption of this EN:	10 February 2015
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Date of withdrawal of any conflicting National Standard (dow):	30 November 2016

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## Modal verbs terminology

In the present document **"shall"**, **"shall not"**, **"should"**, **"should not"**, **"may"**, **"may not"**, **"need"**, **"need not"**, **"will"**, **"will not"**, **"can"** and **"cannot"** are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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



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# 1 Scope

The present document applies to Wide Band Data Transmission equipment.

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

Wide Band Data Transmission equipment covered by the present document is operated in accordance with the ERC Recommendation 70-03 [i.6], annex 3 or Commission Decision 2006/771/EC [i.7] (and its amendments).

Examples of Wide Band Data Transmission equipment are equipments such as IEEE 802.11™ RLANs [i.3], Bluetooth® wireless technologies, Zigbee™, etc.

This equipment can be used in fixed, mobile or nomadic 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 the band 2,4 GHz to 2,4835 GHz.

Applications using Ultra Wide Band (UWB) technology are not covered by the present document.

The present document is intended to cover the provisions of Directive 1999/5/EC (R&TTE Directive) [i.1], 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".

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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 reference document (including any amendments) applies.

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

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| [1] | 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".    |
| [2] | ETSI TS 103 051 (V1.1.1) (08-2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Expanded measurement uncertainty for the measurement of radiated electromagnetic fields". |
| [3] | ETSI TS 103 052 (V1.1.1) (03-2011): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".      |

## 2.2 Informative 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 reference document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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 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).
- [i.2] ETSI EG 201 399 (V2.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the R&TTE Directive".
- [i.3] 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".
- [i.4] IEEE Std. 802.15.4™-2011: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements. Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs)".
- [i.5] 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.6] CEPT ERC Recommendation 70-03 (1997): "Relating to the use of Short Range Devices (SRD)".
- [i.7] Commission Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices.
- [i.8] ETSI TR 102 273-2 (V1.2.1): "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".
- [i.9] ETSI TR 102 273-3 (V1.2.1): "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".
- [i.10] ETSI TR 102 273-4 (V1.2.1): "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".
- [i.11] 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".
- [i.12] 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 and of rules on Information Society services.
- [i.13] Council Directive 93/42/EEC of 14 June 1993 concerning medical devices (Medical Devices Directive).

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the terms and definitions given in the Directive 1999/5/EC (R&TTE Directive) [i.1], the Council Directive 93/42/EEC (Medical Devices Directive) [i.13] and the following apply:

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

**adaptive frequency hopping:** mechanism that allows a frequency hopping equipment to adapt to its radio environment by identifying channels that are being used and excluding them from the list of available channels

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

**adjacent hopping frequency:** neighbouring hopping frequency which is separated by the minimum hopping frequency separation

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

NOTE: The gain of an antenna assembly (G) in dBi, does not include the additional gain that may result out of beamforming. This term (antenna assembly) refers to an antenna connected to one transmit chain.

**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.

**blacklisted frequency:** hopping frequency occupied by frequency hopping equipment without having transmissions during the dwell time

**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 equipment to offer full functionality

**dedicated antenna:** antenna external to the equipment using an antenna connector, with or without a cable, 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.

**detect and avoid:** mechanism which mitigates interference potential by avoiding use of frequencies upon detection of other transmissions on those frequencies

**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

NOTE: The transmitted bandwidth is determined by the chip rate and the modulation scheme.

**dwell time:** time between frequency changes for Frequency Hopping equipment

NOTE: The Dwell Time might comprise transmit, receive and idle phases of the equipment.

**energy detect:** mechanism used by an LBT based adaptive equipment to determine the presence of other devices 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:** equipment where the transmit/receive structure is not directly demand-driven, i.e. it may be altered by configuration changes but there is always a minimum Idle Period following a transmit period

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

NOTE: Transmitter and receiver follow the same frequency hop pattern. The frequency range is determined by the lowest and highest hop positions and the bandwidth per hop position.

**geo-location capability:** capability of equipment to determine its geographical location

**hopping frequency:** any of the (centre) frequencies defined within the hopping sequence of a FHSS equipment

**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

**idle period:** period in time following a transmission sequence during which the equipment does not transmit

**integral antenna:** antenna designed as a fixed part of the equipment, without the use of an external connector and 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 may be used.

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

**load based equipment:** equipment where, opposite to a frame based equipment, the transmit/receive structure is demand-driven

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

**necessary bandwidth:** width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

**nominal channel bandwidth:** band of frequencies assigned to a single channel

NOTE: The Nominal Channel Bandwidth is declared by the manufacturer as outlined in clause 5.3.1.

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

NOTE: Equipment may be adjustable for operation at more than one operating frequency.

**out-of-band emission:** emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding emissions in the spurious domain

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

**power envelope:** RF power versus frequency contour

**power spectral density:** mean power in a given reference bandwidth

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

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

**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.

**spurious emissions:** emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

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

**supplier:** person or entity submitting the equipment for testing

**transmission burst:** period in time during a transmission during which the transmitter is continuously on

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

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

**ultra wide band technology:** technology for short-range radiocommunication, involving the intentional generation and transmission of radio-frequency energy that spreads over a very large frequency range, which may overlap several frequency bands allocated to radiocommunication services

**wide band modulation:** wide band modulation is considered to include FHSS, DSSS, OFDM, etc. that meet the emission requirements as defined in the present document

## 3.2 Symbols

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

$A_{ch}$	number of active transmit chains
$BW_{CHAN}$	Channel Bandwidth
dBm	dB relative to 1 milliwatt
dBr	dB relative to peak power
dBW	dB relative to 1 Watt
$F_{HS}$	Hopping Frequency Separation
GHz	GigaHertz
Hz	Hertz
kHz	kiloHertz
MHz	MegaHertz
mW	milliWatt
ms	millisecond
MS/s	Mega Samples per second
N	Number of hopping frequencies
Pout	Output Power
TxOff	Transmitter Off
TxOn	Transmitter On

iTech STANDARD PREVIEW  
(standards.iteh.ai)  
Full standard:  
https://standards.iteh.ai/catalog/standards/sist/a21e539c-881-4948-8eee-1e11524e16b/etsi-en-300-328-v1.9.0-2014-12

## 3.3 Abbreviations

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

AC	Alternating Current
AC/DC	Alternating Current/Direct Current
ACK	Acknowledgement
AFH	Adaptive Frequency Hopping
BW	BandWidth
CCA	Clear Channel Assessment
CE	Conformité Européenne
CSD	Cyclic Shift Diversity
CW	Continuous Wave
DAA	Detect And Avoid
DC	Duty Cycle
DSSS	Direct Sequence Spread Spectrum
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
EMC	ElectroMagnetic Compatibility
FAR	Fully Anechoic Room
FFT	Fast Fourier Transformation