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Multiple-Gigabit/s radio equipment operating in the 60 GHz band; Harmonised Standard for access to radio spectrum

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ETSI

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

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

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Foreword

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

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.6].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

National transposition dates	
Date of adoption of this EN:	5 July 2021
Date of latest announcement of this EN (doa):	31 October 2021
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 April 2022
Date of withdrawal of any conflicting National Standard (dow):	30 April 2023

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**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

60 GHz radio equipment are capable of operating at data rates of multiple-gigabit per second.

The spectrum usage conditions for this equipment are set in Commission Decision 2013/752/EU [i.4] and Commission Decision 2019/1345/EU [i.7] amending Commission Decision 2006/771/EC of 9 November 2006 [i.5] and ERC Recommendation 70-03 [i.3], annex 3.

1 Scope

The present document specifies technical characteristics and methods of measurements for radio equipment with integral antennas operating indoor or outdoor at data rates of multiple-gigabit per second in the 60 GHz frequency range.

These radio equipment operate with very wideband communications using a variety of directional medium and high gain antennas to enable a high degree of spectrum reuse, and may use a flexible bandwidth scheme under which they normally operate in a wideband mode, and periodically reduce their bandwidth (e.g. for antenna training and other activities).

The technical characteristics of applications using these radio equipment are further described in ETSI TR 102 555 [i.1].

Equipment in this frequency range intended for outdoor Fixed Local Area Network Extension (FLANE) or Fixed Point-to-Point applications are not in the scope of the present document.

These radio equipment types are capable of operating in all or any part of the frequency bands given in table 1.

Table 1: Radiocommunications service frequency band

	Radiocommunications service frequency band
Transmit	57 GHz to 71 GHz
Receive	57 GHz to 71 GHz

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.6] is given in annex A.

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

Not applicable.

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] ETSI TR 102 555: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Technical characteristics of multiple gigabit wireless systems in the 60 GHz range System Reference Document".

[i.2] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.3] ERC Recommendation 70-03 (Tromsø 1997 and subsequent amendments): "Related to the Use of Short Range Devices (SRD)".

[i.4] Commission Implementing Decision 2013/752/EU of 11 December 2013 amending Decision 2006/771/EC on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2005/928/EC (notified under document C(2013) 8776) Text with EEA relevance.

[i.5] Commission Decision 2006/771/EC of 9 November 2006 on harmonisation of the radio spectrum for use by short-range devices.

[i.6] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

[i.7] Commission Implementing Decision (EU) 2019/1345 of 2 August 2019 amending Decision 2006/771/EC updating harmonised technical conditions in the area of radio spectrum use for short-range devices (notified under document C(2019) 5660) Text with EEA relevance.

[i.8] IEEE 802.11-2020™: "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[i.9] ITU-R Radio Regulations.

[i.10] ERC Recommendation 74-01 (1998 and subsequent amendments): "Unwanted emissions in the spurious domain".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in Directive 2014/53/EU [i.6] and the following apply:

60 GHz range or 60 GHz band: one of the variously permitted frequencies of operation, between 57 GHz to 71 GHz

activity factor: percentage over any one minute time period when equipment is operating under a given set of conditions

adjacent channel: channels on either side of the nominal channel separated by the nominal channel bandwidth

channel separation: minimum separation (in MHz) between the centre frequencies of two adjacent channels in the channel plan of the radio equipment

integral antenna: antenna which is declared to be part of the radio equipment by the manufacturer

NOTE 1: In some cases, it may not be possible to remove an integral antenna or expose an antenna connector without changing the output characteristics of the radio equipment.

NOTE 2: Even with an integral antenna, it might still be possible to separate the antenna from the equipment using a special tool.

mean power: average power (transmitted or received) during the On Time of the signal

nominal channel bandwidth: bandwidth assigned to a single channel

NOTE: The nominal channel bandwidth is declared by the manufacturer as outlined in clause 5.3.1.

occupied bandwidth: bandwidth of the signal containing 99 % of the transmitted mean power

NOTE: Both below the lower and above the upper frequency limits, the mean power emitted is equal to 0,5 % of the total mean power of the emission.

operating channel: channel on which the RLAN equipment has started the Adaptivity mechanism to start transmissions

smart antenna system: equipment that combines multiple transmit and/or receive antenna elements with a signal processing function to increase its radiation and/or reception capabilities

NOTE: This includes techniques such as spatial multiplexing, beam forming, cyclic delay diversity, etc.

3.2 Symbols

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

dBc	decibel relative to the maximum spectral power density of the transmitted signal
dBm	decibel relative to one milliwatt
dBr	decibel relative to a given maximum power level
f	frequency
GHz	thousand millions of cycles per second
kHz	thousands of cycles per second
µs	millionths of second
W	watt power unit

3.3 Abbreviations

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

BW	BandWidth
CCA	Clear Channel Assessment
CW	Continuous Wave
EFTA	European Free Trade Association
EIRP	Equivalent Isotropically Radiated Power
ERP	Effective Radiated Power
FER	Frame Error Rate
FLANE	Fixed Local Area Network Extension
LBT	Listen Before Talk
MCS	Modulation and Coding Scheme
PD	Power Density
PDL	spectral Power Density Limit
RBW	Resolution BandWidth
RF	Radio Frequency
RMS	Root Mean Square
STA	Station
TXOP	Transmit Opportunity
UUT	Unit Under Test
VBW	Video BandWidth

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 in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

4.2 Conformance requirements

4.2.1 Spectral power density

4.2.1.0 Applicability

The present requirement applies to all equipment within the scope of the present document.

4.2.1.1 Definition

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

4.2.1.2 Limit

The maximum spectral power density is applicable to the system as a whole when operated at the highest power spectral density level (EIRP). The maximum spectral power density shall be as indicated in table 2.

Table 2: Spectral Power Density Limit (PDL)

Maximum spectral power density (EIRP)
23 dBm/MHz

4.2.1.3 Conformance

Conformance tests as defined in clause 5.3.3 shall be carried out and result compared to the limit.

4.2.2 RF output power

4.2.2.0 Applicability

The present requirement applies to all equipment within the scope of the present document.

4.2.2.1 Definition

The RF output power is the mean Equivalent Isotropically Radiated Power (EIRP) for the equipment during a transmission burst.

4.2.2.2 Limit

The maximum RF output power is applicable to the system as a whole when operated at the highest stated power level. For a smart antenna system, the limit applies to the configuration that results in the highest EIRP. In case of multiple (adjacent or non-adjacent) channels the total RF output power of all channels shall be less than or equal to the limits in table 3.

The maximum RF output power shall be as indicated in table 3.

Table 3: RF output power limit

Maximum power level (EIRP)
40 dBm

4.2.2.3 Conformance

Conformance tests as defined in clause 5.3.4 shall be carried out and result compared to the limit.

4.2.3 Transmitter unwanted emissions in the spurious domain

4.2.3.0 Applicability

The present requirement applies to all equipment within the scope of the present document.

4.2.3.1 Definition

Transmitter spurious emissions are 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. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude out-of-band emissions (article 1, No. 1.145 of the ITU-R Radio Regulations [i.9]).

The lower boundary between the spurious domain and the out-of-band domain shall be at a frequency Fl:

- Fl = min (57 GHz; fc - min(2,5 × nominal channel BW, 1,5 × nominal channel BW + 0,5 GHz))

where fc is the nominal centre frequency of the transmission.

The upper boundary between the spurious domain and the out-of-band domain shall be at a frequency Fh:

- Fh = max (71 GHz; fc + min(2,5 × nominal channel BW, 1,5 × nominal channel BW + 0,5 GHz))

4.2.3.2 Limit

The level of unwanted emissions in the spurious domain shall be less than or equal to the limits given in table 4.

Table 4: Transmitter spurious emissions

Frequency range	Emission Limit ERP (≤ 1 GHz) EIRP (> 1 GHz)	Measurement Bandwidth
30 MHz ≤ f < 87,5 MHz	-36 dBm	100 kHz
87,5 MHz ≤ f ≤ 118 MHz	-54 dBm	100 kHz
118 MHz < f < 174 MHz	-36 dBm	100 kHz
174 MHz ≤ f ≤ 230 MHz	-54 dBm	100 kHz
230 MHz < f < 470 MHz	-36 dBm	100 kHz
470 MHz ≤ f ≤ 694 MHz	-54 dBm	100 kHz
694 MHz < f ≤ 1 GHz	-36 dBm	100 kHz
1 GHz < f < Fl GHz	-30 dBm	1 MHz
Fh GHz < f < 142 GHz	-30 dBm	1 MHz
NOTE: Information in this table is based on ERC Recommendation 74-01 [i.10].		

4.2.3.3 Conformance

Conformance tests as defined in clause 5.3.5 shall be carried out and result compared to the limit.

4.2.4 Receiver unwanted emissions

4.2.4.0 Applicability

The present requirement applies to all equipment within the scope of the present document.

4.2.4.1 Definition

These are unwanted emissions in the spurious domain while the equipment is receiving a transmission.

4.2.4.2 Limit

The level of unwanted emissions in the spurious domain shall be less than or equal to the limits given in table 5.

Table 5: Receiver spurious emissions

Frequency band	Emission Limit ERP (≤ 1 GHz) EIRP (> 1 GHz)	Measurement Bandwidth
30 MHz ≤ f ≤ 1 GHz	-57 dBm	100 kHz
1 GHz < f ≤ 142 GHz	-47 dBm	1 MHz
NOTE: Information in this table is based on ERC Recommendation 74-01 [i.10].		

4.2.4.3 Conformance

Conformance tests as defined in clause 5.3.6 shall be carried out and result compared to the limit.

4.2.5 Adaptivity (medium access protocol)

4.2.5.1 Applicability

The present requirement applies to all equipment within the scope of the present document.

4.2.5.2 Definition

Adaptivity (medium access protocol) is a mechanism designed to facilitate spectrum sharing with other devices.

4.2.5.3 Requirement

Adaptivity (medium access protocol) shall be implemented by the equipment and shall be active under all circumstances.

LBT is mandatory to facilitate spectrum sharing.

The LBT mechanism is as follows:

1) Before a single transmission or a burst of transmissions on an Operating Channel, the equipment that initiates transmission shall perform a Clear Channel Assessment (CCA) Check in the Operating Channel.

2) If it finds an Operating Channel occupied, it shall not transmit in that channel and it shall not enable other equipment(s) to transmit in that channel. If the CCA check has determined the channel to be no longer occupied and transmission was deferred for the number of empty slots defined by the CCA Check procedure, it may resume transmissions or enable other equipment to transmit on this channel.

3) The equipment that initiates transmission shall perform the CCA check using "energy detect". The Operating Channel shall be considered occupied for a slot time of 5 µs if the energy level in the channel exceeds the threshold corresponding to the power level given in step 7) below. It shall observe the Operating Channel(s) for the duration of the CCA observation time measured by multiple slot times.