Official Journal
of the European Union

EN
L series

2024/1467

31.5.2024

COMMISSION IMPLEMENTING DECISION (EU) 2024/1467

of 27 May 2024

amending Implementing Decision (EU) 2019/785 on the harmonisation of radio spectrum for equipment using ultra-wideband technology in the Union

(notified under document C(2024) 3377)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) ([1]), and in particular Article 4(3) thereof,

Whereas:

(1) Commission Implementing Decision (EU) 2019/785 ([2]) harmonises the technical conditions for spectrum use by radio equipment based on ultra-wideband ('UWB') technology in the Union. That Decision ensures that radio spectrum is available across the Union under harmonised conditions, eliminates barriers to the take-up of UWB technology and aims at creating an effective single market for UWB systems with significant economies of scale and benefits to the consumer.

(2) Although ultra-wideband signals are typically of extremely low power, the possibility of harmful interference with existing radiocommunication services exists and needs to be managed. Therefore, it is necessary to avoid harmful interference (including where this might arise from access to the radio spectrum by radio astronomy, earth exploration satellite and space research systems) and balance the incumbent services' interests against the overall policy objective of providing favourable conditions for the introduction of innovative technologies for the benefit of society.

(3) On 16 March 2017, the Commission issued a permanent mandate, pursuant to Decision 676/2002/EC, to the European Conference of Postal and Telecommunications Administrations (CEPT) to identify the technical conditions for the harmonised introduction of radio applications based on UWB technology in the Union in order to provide updated technical conditions for such applications. That permanent mandate was amended in 2019 following the adoption of Implementing Decision (EU) 2019/785 and repeal of Commission Decision 2007/131/EC ([3]).

(4) In response to that permanent mandate, on 7 July 2023 CEPT adopted a report ([4]) where it proposed to add the following use cases to the existing regulatory framework for UWB in the 6-8,5 GHz band: fixed outdoor usage for location tracking applications, general vehicular applications and higher-power indoor-only applications.

(5) The CEPT report also proposed clarifying that fixed outdoor usage and usage in aircraft and road and railway vehicles are excluded from the scope of generic UWB usage as well as improving the structure of certain sections of the Annex and the terminology used.

([1]) OJ L 108, 24.4.2002, p. 1, ELI: http://data.europa.eu/eli/dec/2002/676(1)/oj.

([2]) Commission Implementing Decision (EU) 2019/785 of 14 May 2019 on the harmonisation of radio spectrum for equipment using ultra-wideband technology in the Union and repealing Decision 2007/131/EC (OJ L 127, 16.5.2019, p. 23, ELI: http://data.europa.eu/eli/dec_impl/2019/785/oj).

([3]) Commission Decision 2007/131/EC of 21 February 2007 on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community (OJ L 55, 23.2.2007, p. 33, ELI: http://data.europa.eu/eli/dec/2007/131(1)/oj).

([4]) CEPT Report 84 – Report from CEPT to the European Commission in response to the Permanent Mandate on UWB: 'Ultra-Wideband technology review in view of a potential update of Commission Implementing Decision (EU) 2019/785', approved on 7 July 2023 by the Electronic Communications Committee.

(6) The potential of UWB for assistive devices is also known for example for environmental controllers for persons with physical impairments or supporting indoor navigation for persons with sensory impairments such as blind persons.

(7) It is necessary to support the overall harmonisation of the UWB regulatory framework in order to improve the consistency of limits and mitigation techniques between the different UWB regulations and allow for innovative solutions in the field of UWB technology.

(8) It is necessary to set out regulatory limits and identify mitigation techniques to ensure efficient usage of spectrum while ensuring coexistence with other spectrum users. Technological evolution may provide other solutions that ensure at least an equivalent level of spectrum protection. For this reason, the use of alternative mitigation techniques, such as solutions found in future possible harmonised standards produced by the European Standardisation Organisations, should be allowed provided they ensure at least an equivalent level of performance and spectrum protection and verifiably respect the established technical requirements of this regulatory framework.

(9) The measures provided for in this Decision are in accordance with the opinion of the Radio Spectrum Committee,

HAS ADOPTED THIS DECISION:

Article 1

Implementing Decision (EU) 2019/785 is amended as follows:

(1) in Article 2, point (i) is replaced by the following:

‘(i) “total radiated power spectral density” (TRPsd) means the average of the mean radiated power spectral density (e.i.r.p.) values measured with a resolution of 15 degrees over a sphere around the UWB device (generic or vehicular use) or around the use case-related scenario (as indirect emissions for UWB devices determining materials;’;

(2) Article 3 is replaced by the following:

‘*Article 3*

Within 6 months after this Decision takes effect, Member States shall designate and make available the radio spectrum, on a non-interference and non-protected basis, for equipment using ultra-wideband technology provided that such equipment meets the conditions set out in the Annex and it is used indoors or, if it is used outdoors, it is not attached to a fixed installation, a fixed infrastructure or a fixed outdoor antenna.

Equipment using ultra-wideband technology that meets the conditions set out in the Annex shall also be allowed in motor and railway vehicles or be allowed to be attached to a fixed installation or fixed infrastructure or be used with a fixed outdoor antenna where explicitly permitted in the Annex.’;

(3) the Annex is replaced by the text in the Annex to this Decision.

Article 2

This Decision is addressed to the Member States.

Done at Brussels, 27 May 2024.

For the Commission
Thierry BRETON
Member of the Commission

ANNEX

1. **GENERIC ULTRA-WIDEBAND (UWB) USAGE**

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,6 GHz	- 90 dBm/MHz	- 50 dBm
1,6 < f ≤ 2,7 GHz	- 85 dBm/MHz	- 45 dBm
2,7 < f ≤ 3,1 GHz	- 70 dBm/MHz	- 36 dBm
3,1 < f ≤ 3,4 GHz	- 70 dBm/MHz or – 41,3 dBm/MHz using LDC ([1])or DAA ([2])	- 36 dBm or 0 dBm
3,4 < f ≤ 3,8 GHz	- 80 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) or DAA ([2])	- 40 dBm or 0 dBm
3,8 < f ≤ 4,8 GHz	- 70 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) or DAA ([2])	- 30 dBm or 0 dBm
4,8 < f ≤ 6 GHz	- 70 dBm/MHz	- 30 dBm
6 < f ≤ 8,5 GHz	– 41,3 dBm/MHz	0 dBm
8,5 < f ≤ 9 GHz	- 65 dBm/MHz or – 41,3 dBm/MHz using DAA ([2])	- 25 dBm or 0 dBm
9 < f ≤ 10,6 GHz	- 65 dBm/MHz	- 25 dBm
f > 10,6 GHz	- 85 dBm/MHz	- 45 dBm

([1]) Within the 3,1 GHz to 4,8 GHz band. The Low Duty Cycle ('LDC') mitigation technique and its limits are set out in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of 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 (OJ L 153, 22.5.2014, p. 62) and respect the technical requirements of this Decision.

([2]) Within the 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz bands. The Detect and Avoid ('DAA') mitigation technique and its limits are set out in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

The technical requirements mentioned in the table above shall not apply to:

(1) devices and infrastructure used at a fixed outdoor location or connected to a fixed outdoor antenna;

(2) devices installed in flying models, aircraft and other aviation;

(3) devices installed in road and railway vehicles.

2. **LOCATION TRACKING SYSTEMS Type 1 (LT1)**

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,6 GHz	- 90 dBm/MHz	- 50 dBm
1,6 < f ≤ 2,7 GHz	- 85 dBm/MHz	- 45 dBm
2,7 < f ≤ 3,4 GHz	- 70 dBm/MHz	- 36 dBm
3,4 < f ≤ 3,8 GHz	- 80 dBm/MHz	- 40 dBm
3,8 < f ≤ 6,0 GHz	- 70 dBm/MHz	- 30 dBm
6 < f ≤ 8,5 GHz	– 41,3 dBm/MHz	0 dBm
8,5 < f ≤ 9 GHz	- 65 dBm/MHz or – 41,3 dBm/MHz using DAA ([1])	- 25 dBm or 0 dBm
9 < f ≤ 10,6 GHz	- 65 dBm/MHz	- 25 dBm
f > 10,6 GHz	- 85 dBm/MHz	- 45 dBm

([1]) The DAA mitigation technique and its limits are set out in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-2 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

3. **UWB DEVICES INSTALLED IN MOTOR AND RAILWAY VEHICLES**

3.1. **General technical requirements**

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,6 GHz	- 90 dBm/MHz	- 50 dBm
1,6 < f ≤ 2,7 GHz	- 85 dBm/MHz	- 45 dBm
2,7 < f ≤ 3,1 GHz	- 70 dBm/MHz	- 36 dBm
3,1 < f ≤ 3,4 GHz	- 70 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) + e.l. ([4]) or – 41,3 dBm/MHz using TPC ([3]) + DAA ([2]) + e.l. ([4])	- 36 dBm or ≤ 0 dBm or ≤ 0 dBm
3,4 < f ≤ 3,8 GHz	- 80 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) + e.l. ([4]) or – 41,3 dBm/MHz using TPC ([3]) +DAA ([2]) + e.l. ([4])	- 40 dBm or ≤ 0 dBm or ≤ 0 dBm
3,8 < f ≤ 4,8 GHz	- 70 dBm/MHz or – 41,3 dBm/MHz using LDC ([1]) + e.l. ([4]) or – 41,3 dBm/MHz using TPC ([3]) + DAA ([2]) + e.l. ([4])	- 30 dBm or ≤ 0 dBm or ≤ 0 dBm

4,8 < f ≤ 6 GHz	- 70 dBm/MHz	- 30 dBm
6 < f ≤ 8,5 GHz	− 53,3 dBm/MHz or − 41,3 dBm/MHz using LDC ([1]) + e.l. ([4]) or − 41,3 dBm/MHz using TPC ([3]) + e.l. ([4])	− 13,3 dBm or ≤ 0 dBm or ≤ 0 dBm
8,5 < f ≤ 9 GHz	- 65 dBm/MHz or − 41,3 dBm/MHz using TPC ([3]) + DAA ([2]) + e.l. ([4])	- 25 dBm or ≤ 0 dBm
9 < f ≤ 10,6 GHz	- 65 dBm/MHz	- 25 dBm
f > 10,6 GHz	- 85 dBm/MHz	- 45 dBm

([1]) The LDC mitigation technique and its limits are set out in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([2]) The DAA mitigation technique and its limits are set out in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 30 2065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([3]) The Transmit Power Control ('TPC') mitigation technique and its limits are set out in clauses 4.7.1.1, 4.7.1.2 and 4.7.1.3 of ETSI Standard EN 302 065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([4]) The exterior limit (e.l.) ≤ −53,3 dBm/MHz is required. The exterior limit is set out in clauses 4.3.4.1, 4.3.4.2 and 4.3.4.3 of ETSI Standard EN 302 065-3 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

3.2. **Specific technical requirements for vehicular access systems using trigger-before-transmit**

Technical requirements to be used within the bands 3,8-4,2 GHz and 6-8,5 GHz for vehicular access systems using trigger-before-transmit are set out in the following table.

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
3,8 < f ≤ 4,2 GHz	− 41,3 dBm/MHz with trigger-before-transmit operation and LDC ≤ 0,5 % (in 1h)	0 dBm
6 < f ≤ 8,5 GHz	− 41,3 dBm/MHz with trigger-before-transmit operation and LDC ≤ 0,5 % (in 1h) or TPC	0 dBm

'Trigger-before-transmit' mitigation is defined as a UWB transmission that is only initiated when necessary, specifically where the system indicates that UWB devices are nearby. The communication is either triggered by a user or by the vehicle. The subsequent communication can be considered as 'triggered communication'. The existing LDC mitigation applies (or alternatively TPC in the 6 GHz to 8,5 GHz range). An exterior limit requirement must not be applied when using the trigger-before-transmit mitigation technique for vehicular access systems.

Trigger-before-transmit mitigation techniques that provide an appropriate level of performance in order to comply with the essential requirements of Directive 2014/53/EU shall be used for vehicular access systems. If relevant techniques are described in harmonised standards or parts thereof the references of which have been published in the *Official Journal of the European Union* under Directive 2014/53/EU, performance at least equivalent to these techniques shall be ensured. These techniques shall respect the technical requirements of this Decision.

3.3. **Technical requirements for other vehicular applications in the 6-8,5 GHz band including applications that involve infrastructure-to-vehicle and vehicle-to-vehicle communications**

The technical requirements in the table below are applicable to vehicular applications operating in the 6-8,5 GHz band, including applications that involve infrastructure-to-vehicle and vehicle-to-vehicle communications. The technical requirements applicable to emissions below 6 GHz and above 8,5 GHz are those set out in the table in section 3.1 'UWB devices installed in motor and railway vehicles – general technical requirements'.

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
6 < f ≤ 8,5 GHz ([1]), ([2])	– 41,3 dBm/MHz	0 dBm

([1]) Within the 6-8,5 GHz band. The following additional requirements apply to fixed outdoor installations supporting communication with UWB devices installed in road and railway vehicles: Antennas are directive, down tilted and installed at a maximum height of 10 m. The duty cycle is limited to maximum 5 % per second.

([2]) Within the 6-8,5 GHz band. The following additional requirements apply to UWB devices installed in road and railway vehicles: Antennas are installed at a maximum height of 4 m. The duty cycle is limited to maximum 1 % per second.

4. SPECIFIC RADIODETERMINATION, LOCATION TRACKING, TRACING AND DATA ACQUISITION APPLICATIONS IN THE 6-8,5 GHz BAND

4.1. **Specific applications that involve fixed outdoor installations**

The technical requirements in the table below are applicable to devices and infrastructure used at a fixed outdoor location or connected to a fixed outdoor antenna and supporting radiodetermination, location tracking, tracing or data acquisition applications operating in the 6-8,5 GHz band.

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,6 GHz	- 90 dBm/MHz	- 50 dBm
1,6 < f ≤ 2,7 GHz	- 85 dBm/MHz	- 45 dBm
2,7 < f ≤ 3,1 GHz	- 70 dBm/MHz	- 36 dBm
3,1 < f ≤ 3,4 GHz	- 70 dBm/MHz	- 36 dBm
3,4 < f ≤ 3,8 GHz	- 80 dBm/MHz	- 40 dBm
3,8 < f ≤ 4,2 GHz	- 70 dBm/MHz	- 30 dBm
4,2 < f ≤ 4,8 GHz	- 70 dBm/MHz	- 30 dBm
4,8 < f ≤ 6 GHz	- 70 dBm/MHz	- 30 dBm
6 < f ≤ 8,5 GHz ([1]), ([2]), ([3])	– 41,3 dBm/MHz	0 dBm
8,5 < f ≤ 10,6 GHz	- 65 dBm/MHz	- 25 dBm
f > 10,6 GHz	- 85 dBm/MHz	- 45 dBm

(1) Within the 6-8,5 GHz band, the duty cycle is limited to maximum 5 % per second and antennas are installed at a maximum height of 10 m.
(2) For antenna heights above 2,5 m the maximum total radiated power spectral density (TRPsd) is limited to −46,3 dBm/MHz and the antennas must be directive and down tilted.
(3) Antennas for data acquisition for authentication/access control (PACS) are excluded from the antenna directivity requirements given under note 2.

4.2. **Specific applications that involve enhanced indoor devices**

The technical requirements in the table below are applicable to enhanced power devices operating indoor and supporting radiodetermination, location tracking, tracing or data acquisition applications operating in the 6-8,5 GHz band. The technical requirements applicable to emissions below 6 GHz and above 8,5 GHz are set out in the table in section 2 'Location tracking systems type 1 (LT1)'.

Technical requirements		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
6 < f ≤ 8,5 GHz (1)	− 31,3 dBm/MHz	10 dBm

(1) Within the 6-8,5 GHz band, the duty cycle is limited to maximum 5 % per second. Portable devices can operate with a maximum mean e.i.r.p. spectral density higher than −41,3 dBm/MHz and a maximum peak e.i.r.p. higher than 0 dBm defined in 50 MHz only within an identifiable network and subject to control by an indoor infrastructure.

5. **UWB ONBOARD AIRCRAFT**

The values for maximum mean power spectral density (e.i.r.p.) and maximum peak power (e.i.r.p.) for short-range devices using UWB technology, with or without use of mitigation techniques, are listed in the table below.

Technical requirements			
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)	Requirements for mitigation techniques
f ≤ 1,6 GHz	- 90 dBm/MHz	- 50 dBm	
1,6 < f ≤ 2,7 GHz	- 85 dBm/MHz	- 45 dBm	
2,7 < f ≤ 3,4 GHz	- 70 dBm/MHz	- 36 dBm	
3,4 < f ≤ 3,8 GHz	- 80 dBm/MHz	- 40 dBm	
3,8 < f ≤ 6,0 GHz	- 70 dBm/MHz	- 30 dBm	
6,0 < f ≤ 6,650 GHz	− 41,3 dBm/MHz	0 dBm	
6,650 < f ≤ 6,6752 GHz	− 62,3 dBm/MHz	- 21 dBm	notch of 21 dB shall be implemented to meet the − 62,3 dBm/MHz (1) level
6,6752 < f ≤ 8,5 GHz	− 41,3 dBm/MHz	0 dBm	7,25 to 7,75 GHz (FSS and MetSat (7,45 to 7,55 GHz) protection) (1) (2) 7,75 to 7,9 GHz (MetSat protection) (1) (3)
8,5 < f ≤ 10,6 GHz	- 65 dBm/MHz	- 25 dBm	
f > 10,6 GHz	- 85 dBm/MHz	- 45 dBm	

(1) Alternative mitigation techniques, such as the use of shielded portholes, may be used if they ensure at least equivalent performance.
(2) 7,25 to 7,75 GHz (Fixed Satellite Service) and 7,45 to 7,55 GHz (Meteorological Satellite) protection: $-51{,}3 - 20*\log_{10}(10[km]/x [km])$(dBm/MHz) for heights above ground of over 1 000 m, where x is the aircraft height above ground in kilometres, −71,3 dBm/MHz for heights above ground of 1 000 m and below.
(3) 7,75 to 7,9 GHz (Meteorological Satellite) protection: $-44{,}3 - 20*\log_{10}(10 [km]/x [km])$ (dBm/MHz) for heights above ground of over 1 000 m, where x is the aircraft height above ground in kilometres, and −64,3 dBm/MHz for heights above ground of 1 000 m and below.

6. MATERIAL SENSING DEVICES USING UWB TECHNOLOGY

6.1. Introduction

UWB material sensing devices are split into two classes:

— Contact based UWB material sensing devices, for which the UWB transmitter is only switched on when in direct contact with the material under investigation;

— Non-contact based UWB material sensing devices, for which the UWB transmitter is only switched on when it is near the investigated material and the UWB transmitter is directed towards the material under investigation (for example manually by using a proximity sensor or by mechanical design).

Material sensing devices based on UWB technology shall comply either with the generic UWB regulation based on technical conditions specified in section 1 of this Annex or with the specific limits for material sensing devices as set out in sections 6.2 and 6.3.

The generic UWB regulation set out in section 1 excludes fixed outdoor installations. Emissions radiated by a material sensing device must not exceed the limits of the regulation for generic UWB usage specified in section 1. Material sensing devices must fulfil the requirements of mitigation techniques specified for the generic use of UWB in section 1.

The specific limits for material sensing devices including the mitigation techniques are listed in the following tables. Emissions radiating from material sensing devices permitted under this Decision must be kept to a minimum and in any case not exceed the emission limits within the following tables. Compliance with the specific limits must be ensured by the device placed on a representative structure of the investigated material. The specific limits listed in the following tables are applicable in all environments for material sensing devices, except those to which note 5 of these tables, which excludes fixed outdoor installation in certain applicable frequency ranges, applies.

6.2. Contact based material sensing devices

The specific limits for maximum mean power spectral density (e.i.r.p.) and maximum peak power (e.i.r.p.) for contact based material sensing devices using UWB technology are set out in the table below.

Technical requirements for contact based UWB material sensing devices

Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,73 GHz	- 85 dBm/MHz (1)	- 45 dBm
1,73 < f ≤ 2,2 GHz	- 65 dBm/MHz	- 25 dBm
2,2 < f ≤ 2,5 GHz	- 50 dBm/MHz	- 10 dBm
2,5 < f ≤ 2,69 GHz	- 65 dBm/MHz (1) (2)	- 25 dBm
2,69< f ≤ 2,7 GHz (4)	- 55 dBm/MHz (3)	- 15 dBm
2,7 < f ≤ 2,9 GHz	- 70 dBm/MHz (1)	- 30 dBm
2,9 < f ≤ 3,4 GHz	- 70 dBm/MHz (1), (6), (7)	- 30 dBm
3,4 < f ≤ 3,8 GHz (4)	- 50 dBm/MHz (2), (6), (7)	- 10 dBm
3,8 < f ≤ 4,8 GHz	- 50 dBm/MHz (6), (7)	- 10 dBm

4,8 < f ≤ 5,0 GHz ([4])	- 55 dBm/MHz ([2]), ([3])	- 15 dBm
5,0 < f ≤ 5,25 GHz	- 50 dBm/MHz	- 10 dBm
5,25<f ≤ 5,35 GHz	- 50 dBm/MHz	- 10 dBm
5,35<f ≤ 5,6 GHz	- 50 dBm/MHz	- 10 dBm
5,6<f ≤ 5,65 GHz	- 50 dBm/MHz	- 10 dBm
5,65<f≤ 5,725 GHz	- 50 dBm/MHz	- 10 dBm
5,725<f≤ 6,0 GHz	- 50 dBm/MHz	- 10 dBm
6,0<f≤ 8,5 GHz	– 41,3 dBm/MHz ([5])	0 dBm
8,5<f≤ 9,0 GHz	- 65 dBm/MHz ([7])	- 25 dBm
9,0<f≤ 10,6 GHz	- 65 dBm/MHz	- 25 dBm
f > 10,6 GHz	- 85 dBm/MHz	- 45 dBm

([1]) Devices using the Listen Before Talk ('LBT') mechanism are permitted to operate in the 1,215 GHz to 1,73 GHz frequency range with a maximum mean e.i.r.p. spectral density of -70 dBm/MHz and in the 2,5 GHz to 2,69 GHz and 2,7 GHz to 3,4 GHz frequency ranges with a maximum mean e.i.r.p. spectral density of -50 dBm/MHz and a maximum peak e.i.r.p. of -10 dBm/50 MHz. The LBT mechanism is set out in clauses 4.5.2.1, 4.5.2.2 and 4.5.2.3 of ETSI Standard EN 302 065-4 V1.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([2]) To protect the radio services, non-fixed installations must fulfil the following requirement for total radiated power spectral density:

a) In the 2,5 GHz to 2,69 GHz and 4,8 GHz to 5 GHz frequency ranges, the total radiated power spectral density must be 10 dB below the maximum e.i.r.p. spectral density.

b) In the 3,4 GHz to 3,8 GHz frequency range, the total radiated power spectral density must be 5 dB below the maximum e.i.r.p. spectral density.

([3]) To protect the Radio Astronomy Service (RAS) in the 2,69 GHz to 2,7 GHz and 4,8 GHz to 5 GHz bands, the total radiated power spectral density must be below - 65 dBm/MHz.

([4]) Limitation of the duty cycle to 10 % per second.

([5]) No fixed outdoor installation is permitted.

([6]) Within the 3,1 GHz to 4,8 GHz band, devices implementing LDC mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of –41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The LDC mitigation technique and its limits are set out in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When LDC is implemented, note 5 applies.

([7]) Within the 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz bands, devices implementing DAA mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of –41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The DAA mitigation technique and its limits are set out in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When DAA is implemented, note 5 applies.

6.3. **Non-contact based material sensing devices**

The specific limits for maximum mean power spectral density (e.i.r.p.) and maximum peak power (e.i.r.p.) for non-contact based material sensing devices using UWB technology are set out in the table below.

Technical requirements for non-contact based UWB material sensing devices		
Frequency range	Maximum mean power spectral density (e.i.r.p.)	Maximum peak power (e.i.r.p.) (defined in 50 MHz)
f ≤ 1,73 GHz	- 85 dBm/MHz ([1])	- 60 dBm
1,73 < f ≤ 2,2 GHz	- 70 dBm/MHz	- 45 dBm
2,2 < f ≤ 2,5 GHz	- 50 dBm/MHz	- 25 dBm

2,5 < f ≤ 2,69 GHz	- 65 dBm/MHz ([1]), ([2])	- 40 dBm
2,69< f ≤ 2,7 GHz ([4])	- 70 dBm/MHz ([3])	- 45 dBm
2,7 < f ≤ 2,9 GHz	- 70 dBm/MHz ([1])	- 45 dBm
2,9 < f ≤ 3,4 GHz	- 70 dBm/MHz ([1]), ([6]), ([7])	- 45 dBm
3,4 < f ≤ 3,8 GHz ([4])	- 70 dBm/MHz ([2]), ([6]), ([7])	- 45 dBm
3,8 < f ≤ 4,8 GHz	- 50 dBm/MHz ([6]), ([7])	- 25 dBm
4,8 < f ≤ 5,0 GHz ([4])	- 55 dBm/MHz ([2]), ([3])	- 30 dBm
5,0 < f ≤ 5,25 GHz	- 55 dBm/MHz	- 30 dBm
5,25<f ≤ 5,35 GHz	- 50 dBm/MHz	- 25 dBm
5,35<f ≤ 5,6 GHz	- 50 dBm/MHz	- 25 dBm
5,6<f ≤ 5,65 GHz	- 50 dBm/MHz	- 25 dBm
5,65<f≤ 5,725 GHz	- 65 dBm/MHz	- 40 dBm
5,725<f≤ 6,0 GHz	- 60 dBm/MHz	- 35 dBm
6,0<f≤ 8,5 GHz	− 41,3 dBm/MHz ([5])	0 dBm
8,5<f≤ 9,0 GHz	- 65 dBm/MHz ([7])	- 25 dBm
9,0<f≤ 10,6 GHz	- 65 dBm/MHz	- 25 dBm
f > 10,6 GHz	- 85 dBm/MHz	- 45 dBm

([1]) Devices using the LBT mechanism are permitted to operate in the 1,215 GHz to 1,73 GHz frequency range with a maximum mean e.i.r.p. spectral density of -70 dBm/MHz and in the 2,5 GHz to 2,69 GHz and 2,7 GHz to 3,4 GHz frequency ranges with a maximum mean e.i.r.p. spectral density of -50 dBm/MHz and a maximum peak e.i.r.p. of -10 dBm/50 MHz. The LBT mechanism is set out in clauses 4.5.2.1, 4.5.2.2 and 4.5.2.3 of ETSI Standard EN 302 065-4 V1.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision.

([2]) To protect the radio services, non-fixed installations must fulfil the following requirement for total radiated power spectral density:

a) In the 2,5 GHz to 2,69 GHz and 4,8 GHz to 5 GHz frequency ranges, the total radiated power spectral density must be 10 dB below the maximum e.i.r.p. spectral density.

b) In the 3,4 GHz to 3,8 GHz frequency ranges, the total radiated power spectral density must be 5 dB below the maximum e.i.r.p. spectral density.

([3]) To protect the RAS in the 2,69 GHz to 2,7 GHz and 4,8 GHz to 5 GHz bands, the total radiated power spectral density must be below -65 dBm/MHz.

([4]) Limitation of the duty cycle to 10 % per second.

([5]) No fixed outdoor installation is permitted.

([6]) Within the 3,1 GHz to 4,8 GHz band, devices implementing LDC mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of −41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The LDC mitigation technique and its limits are set out in clauses 4.5.3.1, 4.5.3.2 and 4.5.3.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When LDC is implemented, note 5 applies.

([7]) Within the 3,1 GHz to 4,8 GHz and 8,5 GHz to 9 GHz bands, devices implementing DAA mitigation technique are permitted to operate with a maximum mean e.i.r.p. spectral density of −41,3 dBm/MHz and a maximum peak e.i.r.p. of 0 dBm defined in 50 MHz. The DAA mitigation technique and its limits are set out in clauses 4.5.1.1, 4.5.1.2 and 4.5.1.3 of ETSI Standard EN 302 065-1 V2.1.1. Alternative mitigation techniques may be used if they ensure at least an equivalent performance and level of spectrum protection in order to comply with the corresponding essential requirements of Directive 2014/53/EU and respect the technical requirements of this Decision. When DAA is implemented, note 5 applies.

Peak power threshold values for the LBT mechanism to ensure the protection of radio services listed below are set out in the following table.

Technical requirements of the LBT mechanism for material sensing devices		
Frequency range	Radio service to be detected	Peak power threshold value
1,215 <f ≤ 1,4 GHz	Radiodetermination service	+ 8 dBm/MHz
1,61<f ≤ 1,66 GHz	Mobile satellite service	- 43 dBm/MHz
2,5 < f ≤ 2,69 GHz	Land mobile service	- 50 dBm/MHz
2,9 < f ≤ 3,4 GHz	Radiodetermination service	- 7 dBm/MHz

Additional requirements for radar detection: continuously listening and automatic switch-off within 10 ms for the related frequency range if the threshold value is exceeded (table with LBT mechanism). A silent time of at least 12 s while listening continuously is necessary before the transmitter can be switched on again. This silent time during which only the LBT receiver is active must be ensured even after the device is switched off.