

ECC Decision (06)04

The harmonised use, exemption from individual licensing and free circulation of devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz¹

approved 24 March 2006

latest amended on 18 November 2022

¹ Comparable technical specifications to those in this ECC Decision are given in EC Decision on 2007/131/EC as amended. EU member states and, if so approved by the EEA Joint Committee, Iceland, Liechtenstein and Norway are obliged to implement the EC Decision

EXPLANATORY MEMORANDUM

1 INTRODUCTION

This ECC Decision has been developed within the frame of EC mandates to CEPT to identify the conditions relating to the harmonised introduction in the European Union of radio applications based on ultra-wideband (UWB) technology.

The underlying objective of these mandates was to provide ECC and the European Commission with the necessary information to adopt one or more technical implementing measures harmonising the use of the radio spectrum to enable the timely introduction of UWB technology within Europe. To support the development and deployment of UWB technology it is essential that common spectrum, with the associated regulatory framework and Harmonised European Standards, becomes available throughout Europe as soon as possible.

UWB technology holds potential for a wide variety of new Short Range Devices (SRD) for communications, measurement, location tracking, imaging, surveillance and medical systems. This Decision defines conditions for the use of the radio spectrum by UWB devices. It also identifies some review mechanisms that will be required to ensure protection of radio services.

It should be noted that this ECC Decision was initially supplemented by ECC Decision (06)12 [1] on specific mitigation techniques for UWB devices operating in bands below 10.6 GHz. ECC Decision (06)04 and ECC Decision (06)12 were merged as part of the review of the generic UWB regulation in 2010/2011 and the publication of ECC Report 170 [2].

This ECC Decision has been further amended in 2019 and 2022. Regulatory provisions that apply to specific applications and/or type of installation were added.

CEPT has developed other ECC Decisions or Recommendations for specific classes of UWB device which do not meet the technical requirements of this Decision.

2 BACKGROUND

Pursuant to the first mandate issued by the European Commission to CEPT on March 11th, 2004 to develop technical implementing measures for the harmonised use of radio spectrum for UWB applications in the European Union, ECC established a Task Group to develop the ECC responses and complete the technical studies already initiated within CEPT. This ECC Decision applies to generic UWB devices below 10.6 GHz that are exempted from individual licensing and operating on a non-interference, non-protected basis.

3 REQUIREMENT FOR AN ECC DECISION

The allocation or designation of frequency bands under specified conditions in CEPT member countries is laid down by law, regulation or administrative action. ECC Decisions are required to deal with the carriage and use of equipment throughout Europe. The ECC also recognises that for UWB devices to be introduced successfully throughout Europe, confidence must be given on the one hand to manufacturers to make the necessary investments and on the other hand to users of existing services that their protection will be ensured.

The harmonisation on a European basis would support the Directive 2014/53/EU [3] 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.

A commitment by CEPT member countries to implement an ECC Decision will provide a clear indication that the required frequency range will be made available on time and on a Europe-wide basis and that the means to ensure protection of existing services will be applied.

ECC DECISION OF 24 MARCH 2006 ON THE HARMONISED USE, EXEMPTION FROM INDIVIDUAL LICENSING AND FREE CIRCULATION OF DEVICES USING ULTRA-WIDEBAND (UWB) TECHNOLOGY IN BANDS BELOW 10.6 GHZ (ECC DECISION (06)04), AMENDED ON 6 JULY 2007, AMENDED 9 DECEMBER 2011, AMENDED ON 8 MARCH 2019 AND AMENDED 18 NOVEMBER 2022

“The European Conference of Postal and Telecommunications Administrations,

considering

- a) that UWB technology shall mean technology for short-range radiocommunication, location tracking and radiodetermination applications, 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;
- b) that this Decision is applicable to technologies with bandwidth significantly wider than 50 MHz;
- c) that Short Range Devices (SRD) using UWB technology can be used for communications, measurement, location, imaging, surveillance and medical systems;
- d) that harmonised conditions across CEPT/EU help to establish an effective single market for these applications, with consequent economies of scale and benefits to the consumer, and avoid difficulties in enforcing divergent national regulations;
- e) that the devices using UWB technology which are permitted to operate under this Decision present the potential to transmit in bands allocated to passive services that are covered in the RR footnote 5.340 which prohibits all emissions;
- f) that this ECC Decision was in its first version primarily intended to respond to the market demand for UWB indoor and handheld devices providing communication applications;
- g) that some categories of UWB devices characterised by predominantly outdoor usage are explicitly excluded from the scope of this Decision or subject to specific provisions as they can present a significant risk of interference to radio services deployed outdoor and operating in frequency bands where maximum UWB emission levels would be allowed;
- h) that the protection requirements of radiocommunication systems below 10.6 GHz from Generic UWB Applications have been studied in ECC Report 64 assuming in particular for aggregate interference analyses 80% of UWB devices operating indoor, 20% outdoor and an average 5% activity factor;
- i) that the maximum mean e.i.r.p. spectral densities limits of -85 dBm/MHz around 2 GHz and -80 dBm/MHz at 3.5 GHz are based on single interference analyses with IMT services and BWA services respectively assuming minimum separation distance of 36 cm and receiver sensitivity;
- j) that the maximum mean e.i.r.p. spectral density limit of -70 dBm/MHz in the band 2.7-3.4 GHz is based on single interference analyses with aeronautical radars assuming in particular minimum separation distance of 170 m, a 7 dB main antenna beam attenuation and a 3 dB Multiple System/Technology Allowance factor;
- k) that in addition a maximum peak e.i.r.p. limit of -36dBm defined in 50 MHz in the band 2.7-3.4 GHz is based on test measurements with aeronautical radars and addresses the potential interference from UWB devices with low PRF and undithered pulses;
- l) that a maximum mean e.i.r.p. spectral density of -65 dBm/MHz in the band 8.5-9 GHz is based on single interference analyses with radar systems assuming a minimum separation distance of 25 m;
- m) that, for the Radio astronomy service, the protection levels given in ECC Report 64 [4] are well below the maximum mean e.i.r.p. spectral densities given in the Annex 1, but when taking into account mitigation factors specific to the operation of particular UWB applications a coexistence might be feasible;

- n) that ECC Report 64 has considered interference potential resulting from mean power and only limited consideration has been given to peak power interference, time gating and frequency hopping, and that any review of this Decision may be done in the light of these possible implications;
- o) that complementary technical studies presented in CEPT Report 9 [5] (using different propagation models and assuming 100% of UWB devices operating indoor with an average 1% activity factor) provide some level of confidence regarding the protection of outdoor stations from the Fixed Service and the Fixed-Satellite Service with a maximum mean e.i.r.p. spectral density level of -41.3 dBm/MHz;
- p) that the issue of compatibility of UWB devices operated on-board either an aircraft or a vessel is the responsibility of the relevant aeronautical and maritime regulatory authorities;
- q) that the compatibility studies performed within CEPT include, inter alia, the presumption that video signals will be transmitted using predominantly high-efficiency coding;
- r) that limitations on the duty cycle of UWB devices and the implementation of Detect and Avoid (DAA) mechanism can improve the coexistence with other radiocommunication systems;
- s) that technical requirements for LDC UWB devices to protect FWA terminals are presented in ECC Report 94 [6];
- t) that based on studies and measurement campaigns on the impact of LDC UWB devices on radars in the band 3.1-3.4 GHz, it was concluded in 2008 that the probability of a single LDC UWB device to radiate into the main beam of the radar was low and hence the risk of harmful interference was considered to be small;
- u) that one study showed that aggregation effects from LDC UWB devices on radars could cause unacceptable probability of interference in the band 3.1-3.4 GHz. However, the various regulatory provisions aiming to minimise outdoor use could be sufficient to reduce the aggregate interference;
- v) that technical requirements for DAA UWB devices to ensure the protection of radiolocation services in the bands 3.1-3.4 GHz and 8.5-9 GHz and BWA terminals in the band 3.4-4.2 GHz are presented in ECC Report 120 [7];
- w) that DAA technical requirements in the band 8.5-9 GHz are based on characteristics of monostatic radiolocation systems and may be revised subject to reported risk of interference to other classes of X-band radars considered to be deployed in the future, in particular passive radars;
- x) that DAA technical requirements given in Annex 3 need to be supplemented by adequate guidance on DAA measurement procedures and test patterns as defined in relevant standards (e.g. relevant versions of ETSI EN 302 065 [8] including Harmonised European Standards adopted under RE Directive 2014/53/EU [3]);
- y) that DAA technical requirements should safeguard the protection of BWA terminal stations for more than 99.75% of the time;
- z) that the band 3.4-3.6 GHz was identified for IMT applications at WRC-07 [9];
- aa) that the requirement of UWB DAA devices operating in the band 3.1-4.8 GHz to be capable of selecting an operating channel anywhere within the band 3.1-4.8 GHz band will provide additional mitigation to radio services operating in this band;
- bb) that, to reduce interference on outdoor radio stations, it is important to minimise the outdoor activity of UWB;
- cc) that special care may need to be given to deployment scenarios where a number of UWB transmitters with "mobile/nomadic" capabilities are operating outdoor under the provisions of this Decision in limited areas transmitting towards a "fixed" local UWB infrastructure (which is of "receive-only" nature) in case these UWB transmitters would remain permanently within the antenna main beam of a Fixed Service or Fixed-Satellite Service station;

- dd) that the operation of UWB devices installed in road and rail vehicles with their intended emissions directed towards the inside can be justified based on studies presented in CEPT Report 17 [10];
- ee) that CEPT Report 17 concluded that the activity factor of UWB devices installed inside vehicles is less than the indoor activity factor and that the average screening attenuation is comparable with typical indoor/outdoor attenuation. In addition, there is a strong absorption loss due to human passengers providing an additional mitigation;
- ff) that CEPT Report 17 recommended to consider the additional impact of UWB devices installed in vehicles as negligible and to remove the prohibition to install UWB devices in vehicles from Decision. However, taking into account alternative scenario extrapolation considerations and that the transmit power can be reduced in a majority of the cases without significantly degrading performance of the in car applications due to smaller communication ranges, CEPT Report 17 recommended a general requirement for UWB devices installed inside road and rail vehicles the implementation of Transmit Power Control (TPC) for devices which do not implement Low Duty Cycle (LDC) mitigation technique in view of reducing the aggregate interference on outdoor stations of radio services within the frequency bands 3.1-4.8 GHz and 6-8.5 GHz;
- gg) that ECC Report 170 [2] provides compatibility studies in the bands 3.4-4.8 GHz and 6-8.5 GHz on the impact of LDC UWB devices installed inside road and rail vehicles assuming a penetration rate of 50%, 10 devices per vehicle (6 in 3.1-4.8 GHz and 4 devices per vehicle in 6-8.5 GHz) and their intended emissions directed towards the inside. ECC Report 170 concludes that an exterior limit of -53.3 dBm/MHz for emissions outside road and rail vehicles would provide a high level of confidence on the protection of most affected radio services;
- hh) that ECC Report 278 [11] concludes that compatibility with the incumbent services in the band 3.8-4.2 GHz and 6-8.5 GHz can be achieved when trigger-before-transmit mitigation is used;
- ii) that the definition of an exterior limit is primarily intended to improve the protection of radio services from UWB applications transmitting within the same vehicle towards an associated receiver but would also offer regulatory solutions for UWB installations with their intended emissions directed towards outside the vehicle;
- jj) that based on studies in ECC Report 170 an additional mitigation of around 3 dB would be required for applications with their intended emissions directed towards outside the vehicle, resulting in an emission limit emitting towards the outside of -56 dBm/MHz. However it is assumed that most of these outdoor automotive applications will operate in accordance with other spectrum regulations;
- kk) that for the band 4.2-4.8 GHz special care should be given to the aggregation of emissions from several UWB devices installed within the same vehicle and it was agreed that the duty cycle limit should be adjusted upon the vehicle speed;
- ll) that the Methanol line at 6.7 GHz has only relatively recently been discovered and is becoming a focus of radio-astronomical research but an exterior limit of -53.3 dBm/MHz maximum mean e.i.r.p. outside a vehicle equipped with a single device would only offer a protection distance of about 700 m which may impact the observations of several RAS stations operating in Europe (Effelsberg, Jodrell Bank, Cambridge, Sardinia, Bleien...);
- mm) that this Decision may be reviewed based on the outcome of the World Radio Conferences and/or on the actual UWB deployment, in particular if the deployment of UWB technology can present a significant risk of interference to radio services deployed in the band 6-8.5 GHz;
- nn) that CEPT has developed other Decisions or Recommendations for specific classes of UWB device which do not meet the technical requirements of this ECC Decision;
- oo) that CEPT overall approach and criteria for handling industry requests for specific UWB regulations is presented in CEPT Report 34 [12];
- pp) that CEPT Report 69 also clarified the possibility to use the generic UWB regulation in ECC Decision (06)04 for material sensing applications (ECC Decision (07)01, as amended [15]) without any violation of the technical requirements set out in the generic UWB regulation;

- qq) that the amendments of this ECC Decision adopted in 2022 relating to the use of the band 6-8.5 GHz are supported by technical studies presented in ECC Report 327 [13] that provides compatibility studies in the band 6-8.5 GHz for specific UWB applications for radiodetermination, location tracking, tracing, data acquisition and vehicular with Fixed Service (FS), Fixed-Satellite Service (FSS), Radio astronomy (RAS), Earth Exploration-Satellite Service (EESS), EESS (passive), Space Research Service (SRS) and Meteorological Satellite Service (MetSat) which were based on an expected device density;
- rr) that the studies in ECC Report 327 in relation to the coexistence with Fixed Service (FS) used a proxy for the FS short-term protection criteria where the space- and time-based distribution of the UWB interference was compared to a protection criterion based on errored seconds (ER);
- ss) that in EU/EFTA countries the radio equipment that is under the scope of this Decision shall comply with the RE Directive. Conformity with the essential requirements of the RE Directive may be demonstrated by compliance with the applicable relevant versions of the Harmonised European Standard EN 302 065 [8] or by using the other conformity assessment procedures set out in the RE Directive;

DECIDES

1. that this ECC Decision defines general harmonised conditions for the use in Europe of devices using UWB technology in bands below 10.6 GHz;
2. that, for the purpose of the Decision, the following definitions apply:
 - a) Maximum mean e.i.r.p. spectral density: the highest signal strength measured in any direction at any frequency within the defined range. The mean e.i.r.p. spectral density is measured with a 1 MHz resolution bandwidth, an RMS detector and an averaging time of 1 ms or less.
 - b) Maximum peak e.i.r.p.: the highest signal strength measured in any direction at any frequency within the defined range. The peak e.i.r.p. is defined within a 50 MHz bandwidth.
 - c) LDC UWB devices are defined as devices using UWB technology that meet the technical requirements for Low Duty Cycle (LDC) mitigation technique given in Annex 2.
 - d) DAA UWB devices are defined as devices using UWB technology that meet the technical requirements for Detect And Avoid (DAA) mitigation technique given in Annex 3.
3. that the devices permitted under this ECC Decision are exempt from individual licensing and operate on a non-interference, non-protected basis;
4. that this ECC Decision is not applicable to devices installed in flying models, aircraft and other aviation;
5. that the technical requirements detailed in Annex 1 apply to devices permitted under this ECC Decision;
6. that CEPT administrations shall exempt from individual licensing and allow free circulation and use of devices using UWB technology covered by this Decision;
7. that this Decision enters into force on 18 November 2022;
8. that the preferred date for implementation of this Decision shall be 18 May 2023;
9. that CEPT administrations shall communicate the national measures implementing this Decision to the ECC Chairman and the Office when the Decision is nationally implemented."

Note:

Please check the Office documentation database <https://docdb.cept.org> for the up to date position on the implementation of this and other ECC Decisions.

ANNEX 1: TECHNICAL REQUIREMENTS FOR DEVICES USING UWB TECHNOLOGY IN BANDS BELOW 10.6 GHZ

A1.1 GENERAL CASE

The technical requirements below are not applicable to:

- a) devices and infrastructure used at a fixed outdoor location or connected to a fixed outdoor antenna;
- b) devices installed in flying models, aircraft and other aviation;
- c) devices installed in road and rail vehicles.

Table 1: Maximum e.i.r.p. limits

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
$f \leq 1.6$ GHz	-90 dBm/MHz	-50 dBm
$1.6 < f \leq 2.7$ GHz	-85 dBm/MHz	-45 dBm
$2.7 < f \leq 3.1$ GHz	-70 dBm/MHz	-36 dBm
$3.1 < f \leq 3.4$ GHz (Notes 1 and 2)	-70 dBm/MHz	-36 dBm
$3.4 < f \leq 3.8$ GHz (Notes 1 and 2)	-80 dBm/MHz	-40 dBm
$3.8 < f \leq 4.2$ GHz (Notes 1 and 2)	-70 dBm/MHz	-30 dBm
$4.2 < f \leq 4.8$ GHz (Notes 1 and 2)	-70 dBm/MHz	-30 dBm
$4.8 < f \leq 6$ GHz	-70 dBm/MHz	-30 dBm
$6 < f \leq 8.5$ GHz	-41.3 dBm/MHz	0 dBm
$8.5 < f \leq 10.6$ GHz (Note 2)	-65 dBm/MHz	-25 dBm
$f > 10.6$ GHz	-85 dBm/MHz	-45 dBm

Note 1: Within the band 3.1-4.8 GHz, devices implementing **Low Duty Cycle (LDC) mitigation technique** (see Annex 2) 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.

Note 2: Within the bands 3.1-4.8 GHz and 8.5-9 GHz, devices implementing **Detect And Avoid (DAA) mitigation technique** (see Annex 3) 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.

A1.2 VEHICULAR APPLICATION, INCLUDING UWB DEVICES INSTALLED IN ROAD AND RAIL VEHICLES

A1.2.1 General case for UWB devices installed in road and rail vehicles

The technical requirements below are applicable for the operation of UWB devices installed in road and rail vehicles:

Table 2: Maximum e.i.r.p. limits

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
$f \leq 1.6$ GHz	-90 dBm/MHz	-50 dBm
$1.6 < f \leq 2.7$ GHz	-85 dBm/MHz	-45 dBm
$2.7 < f \leq 3.1$ GHz	-70 dBm/MHz	-36 dBm
$3.1 < f \leq 3.4$ GHz (Notes 1 and 2)	-70 dBm/MHz	-36 dBm
$3.4 < f \leq 3.8$ GHz (Notes 1 and 2)	-80 dBm/MHz	-40 dBm
$3.8 < f \leq 4.2$ GHz (Notes 1 and 2)	-70 dBm/MHz	-30 dBm
$4.2 < f \leq 4.8$ GHz (Notes 1 and 2)	-70 dBm/MHz	-30 dBm
$4.8 < f \leq 6$ GHz	-70 dBm/MHz	-30 dBm
$6 < f \leq 8.5$ GHz (Notes 1 and 3)	-53.3 dBm/MHz	-13.3 dBm
$8.5 < f \leq 10.6$ GHz (Note 2)	-65 dBm/MHz	-25 dBm
$f > 10.6$ GHz	-85 dBm/MHz	-45 dBm

Note 1: Within the band 3.1-4.8 GHz and 6-8.5 GHz, devices implementing Low Duty Cycle (LDC) mitigation technique (see Annex 2) 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. Operation is in addition subject to the implementation of an exterior limit (see Annex 5) of -53.3 dBm/MHz.

Note 2: Within the bands 3.1-4.8 GHz and 8.5-9 GHz, devices implementing Detect And Avoid (DAA) mitigation technique (see Annex 3) 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. Operation is in addition subject to the implementation of Transmit Power Control (TPC) mitigation technique (see Annex 4) and an exterior limit (see Annex 5) of -53.3 dBm/MHz.

Note 3: Within the band 6-8.5 GHz devices implementing Transmit Power Control (TPC) mitigation technique (see Annex 4) and an exterior limit (see Annex 5) of -53.3 dBm/MHz 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.

Alternative technical requirements can be used for specific applications involving UWB devices including those installed in road and rail vehicles as defined in sections below.

A1.2.2 Specific vehicular access systems using trigger-before-transmit

Technical requirements to be used within 3.8-4.2 GHz and 6-8.5 GHz for vehicular access systems using trigger-before-transmit are defined in Table 3. The technical requirements applicable to ultra-wideband emissions below 3.8 GHz, within 4.2-6 GHz and above 8.5 GHz are defined in A.1.2.1, Table 2.

Table 3: Technical requirements for vehicular access systems using trigger-before-transmit

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
$3.8 < f \leq 4.2$ GHz	-41.3 dBm/MHz with trigger-before-transmit operation and LDC $\leq 0.5\%$ (in 1h)	0 dBm
$6 < f \leq 8.5$ GHz	-41.3 dBm/MHz with trigger-before-transmit operation and LDC $\leq 0.5\%$ (in 1h) or TPC	0 dBm

"Trigger-before-transmit" mitigation is defined as an UWB transmission which is initiated only when necessary, in particular only where the system indicates that UWB devices are in the proximity. The communication is either triggered by a user or by the vehicle. The subsequent communication can be viewed as "triggered communication". The existing LDC mitigation applies (or alternatively TPC in the range from 6 GHz to 8.5 GHz). No exterior limit requirement shall apply when using the trigger-before-transmit mitigation technique for vehicular access systems.

The trigger-before-transmit mitigation technique for vehicular access systems and its limits are defined in the ETSI Harmonised European Standard EN 302 065-3-1 [16].

A1.2.3 Other vehicular applications, including applications involving infrastructure to vehicle and vehicle to vehicle communications in 6-8.5 GHz

The technical requirements of Table 4 are applicable to vehicular applications operating in 6-8.5 GHz, including applications involving infrastructure to vehicle and vehicle to vehicle communications. The technical requirements applicable to ultra-wideband emissions below 6 GHz and above 8.5 GHz are to be used from A.1.2.1, Table 2, which define ultra-wideband emissions outside the 6-8.5 GHz. Note 1 of A.1.2.1, Table 2 does not apply for the frequency range 6-8.5 GHz. Note 3 of A.1.2.1, Table 2 does not apply.

Table 4: Maximum e.i.r.p. limits

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
6 < f ≤ 8.5 GHz (Notes 1 and 2)	-41.3 dBm/MHz	0 dBm
<p><i>Note 1:</i> Within the band 6-8.5 GHz, the following additional requirements apply to fixed outdoor installations supporting communication with UWB devices installed in road and rail vehicles:</p> <ul style="list-style-type: none"> - Antennas are directive, down tilted and installed at a maximum height of 10 m; - The duty cycle is limited to maximum 5% per second. <p><i>Note 2:</i> Within the band 6-8.5 GHz, the following additional requirements apply to UWB devices installed in road and rail vehicles:</p> <ul style="list-style-type: none"> - Antennas are installed at a maximum height of 4 m; - The duty cycle is limited to maximum 1% per second. 		

A1.3 SPECIFIC RADIODETERMINATION, LOCATION TRACKING, TRACING AND DATA ACQUISITION APPLICATIONS IN 6-8.5 GHz

A1.3.1 Specific applications involving fixed outdoor installations

The technical requirements of Table 5 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 6-8.5 GHz. The technical requirements applicable to ultra-wideband emissions below 6 GHz and above 8.5 GHz are defined in A.1.1, Table 1.

Table 5: Maximum e.i.r.p. limits

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak 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

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
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 (Notes 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

Note 1: Within the band 6-8.5 GHz, the duty cycle is limited to maximum 5% per second and antennas are installed at a maximum height of 10 m.

Note 2: For antenna heights above 2.5 m the maximum total radiated power density (t.r.p.) is limited to -46.3 dBm/MHz and the antennas must be directive and down tilted.

Note 3: Antennas for data acquisition for authentication/access control (PACS) are excluded from the antenna directivity requirements given under Note 2.

A1.3.2 Specific applications involving enhanced indoor devices

The technical requirements of Table 6 are applicable to enhanced power devices operating indoor and supporting radiodetermination, location tracking, tracing or data acquisition applications operating in 6-8.5 GHz. The technical requirements applicable to ultra-wideband emissions below 6 GHz and above 8.5 GHz are defined in A.1.1, Table 1.

Table 6: Maximum e.i.r.p. limits

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
6 < f ≤ 8.5 GHz (Note 1)	-31.3 dBm/MHz	10 dBm

Note 1: Within the band 6-8.5 GHz, 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.

ANNEX 2²: TECHNICAL REQUIREMENTS FOR LOW DUTY CYCLE (LDC) MITIGATION TECHNIQUE

Ton max = 5 ms
Toff mean \geq 38 ms (averaged over 1 sec)
 Σ **Toff > 950 ms per second**
 Σ **Ton < 18 s per hour** (see Note 1)

Note 1: in case of UWB devices installed in road and rail vehicles, within the band 3.4-4.8 GHz, this requirement does not apply for operation with vehicle speed above 40 km/h. For vehicle speeds between 20 km/h and 40 km/h a gradual implementation of the long term duty cycle limit from 18 seconds to 180 seconds per hour would be required as shown in Figure 1.

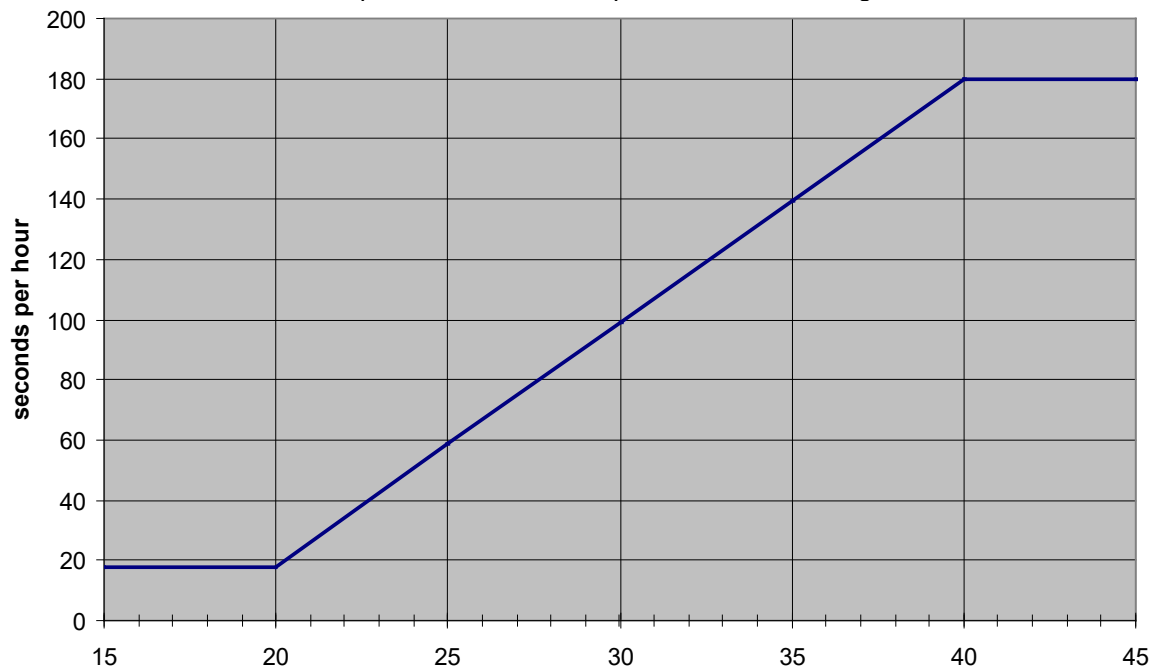


Figure 1: Duty Cycle in seconds per hour in dependence of the vehicle speed

Ton

Ton is defined as the duration of a burst irrespective of the number of pulses contained.

Toff

Toff is defined as the time interval between two consecutive bursts when the UWB emission is kept idle.

Limit definition

The mean e.i.r.p. spectral density and peak e.i.r.p. power limits are defined during Ton.

² The content of this Annex is meant to be duly taken into account by ETSI in the development of Harmonised European Standards.

ANNEX 3³: TECHNICAL REQUIREMENTS FOR DETECT AND AVOID (DAA) MITIGATION TECHNIQUE

The flexible DAA proposal is based on the definition of different zones for which an appropriate UWB emission power level (maximum mean e.i.r.p. spectral density) is authorised. A zone is defined by a range of isolation between a device/system of a victim radio service and the UWB device. These zones and associated range of isolation correspond to the maximum mean e.i.r.p. spectral density levels specified in Table 1.

In the first zone, the UWB device shall operate at an emission level applied in the avoidance bandwidth as defined in Table 1. In the last zone, the UWB device can operate without restriction up to the maximum permitted power level of -41.3 dBm/MHz or as defined in a future DAA regulation for the corresponding operational frequency range except in road and rail vehicles where additional restrictions apply. Between these extreme zones, a transition zone is defined for the band 3.4-4.8 GHz.

Before initiating UWB communications, the UWB device shall perform a monitoring of the RF environment during a minimum time to detect any actively operating victim signal (minimum initial channel availability check time value given in Table 1). Based on the result of this detection process, the UWB device has to determine the corresponding zone it occupies and react accordingly.

This function shall be able to detect victim systems signals and measure if this power level in a given bandwidth is above or below a detection threshold in any of the frequency bands denoted here after. This detection threshold is specified at the antenna connector assuming a 0 dBi antenna gain for each detection operation and may be based on multiple levels. This detection threshold can alternatively be expressed as a field strength limit.

The DAA UWB devices shall be able to continuously detect any change of the RF configuration (e.g. modification of operating zone) and switch to corresponding emission level within a maximum detect and avoid time according to the victim service and procedural tests defined in relevant standards (e.g. relevant versions of ETSI EN 302 065 [8], including Harmonised European Standards adopted under Directive 2014/53/EU [3]).

³ The content of this Annex is meant to be duly taken into account by ETSI in the development of Harmonised European Standards.

Table 7: Technical parameters to be used by UWB DAA devices

	Operational frequency	3.1-3.4 GHz	3.4-3.8 GHz	3.8-4.8 GHz (note 1)	8.5-9 GHz
	Minimum initial channel availability check time	14s	5.1s		14s
Zone 1 for Signal detection level S > A	Maximum mean e.i.r.p. spectral density	-70 dBm/MHz	-80 dBm/MHz	-70 dBm/MHz	-65 dBm/MHz
	Default Avoidance bandwidth	300 MHz	200 MHz		500 MHz
Signal Detection threshold A		-38 dBm	-38 dBm		-61 dBm
Zone 2 for Signal detection level A > S > B	Maximum mean e.i.r.p. spectral density	-41.3 dBm/MHz	-65 dBm/MHz		-41.3 dBm/MHz
	Default Avoidance bandwidth	-	200 MHz		-
Signal Detection threshold B			-61 dBm		
Zone 3 for Signal detection level S < B	Maximum mean e.i.r.p. spectral density	-	-41.3 dBm/MHz		-
Definitions of the DAA parameters can be found in ECC Report 120 [8]. Note 1 Detection mechanism needs to be validated to protect existing operation of victim stations of radio services such as BWA terminals					

Additional requirement for operation in the band 3.1-4.8 GHz

UWB DAA devices shall be capable of selecting an operating channel anywhere within the band 3.1-4.8 GHz.

ANNEX 4⁴: TECHNICAL REQUIREMENTS FOR TRANSMIT POWER CONTROL (TPC) MITIGATION TECHNIQUE

Devices implementing Transmit Power Control (TPC) should fulfil at least a dynamic range of 12 dB (mean e.i.r.p. range of -41.3 to -53.3 dBm/MHz).

⁴ The content of this Annex is meant to be duly taken into account by ETSI in the development of Harmonised European Standards.

ANNEX 5⁵: TECHNICAL REQUIREMENTS FOR THE EXTERIOR LIMIT FOR ROAD AND RAIL VEHICLE APPLICATIONS

The exterior limit is defined, for each UWB device installed in a road or rail vehicle, as the maximum mean e.i.r.p. spectral density for the emissions outside the vehicle at elevation angles higher than 0 degree.

Within the bands 3.1-4.8 GHz, 6-8.5 GHz and 8.5-9 GHz, an exterior limit of -53.3 dBm/MHz applies. No exterior limit requirement applies when using the trigger-before-transmit mitigation technique for vehicular access systems.

⁵ The content of this Annex is meant to be duly taken into account by ETSI in the development of Harmonised European Standards

ANNEX 6: LIST OF REFERENCES

- [1] [ECC Decision \(06\)12](#): “Supplementary regulatory provisions to Decision ECC/DEC/(06)04 for UWB devices using mitigation techniques”, approved 1 December 2006 and withdrawn by ECC Decision (06)04 on 9 December 2011
- [2] [ECC Report 170](#): “Specific UWB applications in the bands 3.4-4.8 GHz and 6-8.5 GHz Location Tracking Applications for Emergency Services (LAES), location tracking applications type 2 (LT2) and location tracking and sensor applications for automotive and transportation environments (LTA)”, approved October 2011
- [3] 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
- [4] [ECC Report 64](#): “The protection requirements of radiocommunications systems below 10.6 GHz from generic UWB applications”, approved February 2005
- [5] [CEPT Report 9](#): “Report from CEPT to the European Commission in response to the Mandate to Harmonise radio spectrum use for Ultra-Wideband systems in the European Union”, approved October 2005
- [6] [ECC Report 94](#): “Technical requirements for UWB LDC devices to ensure the protection of FWA systems”, approved December 2006
- [7] [ECC Report 120](#): “Technical requirements for UWB DAA (Detect and Avoid) devices to ensure the protection of radiolocation services in the bands 3.1 - 3.4 GHz and 8.5 - 9 GHz and BWA terminals in the band 3.4 - 4.2 GHz”, approved July 2008
- [8] ETSI EN 302 065: “Short Range Devices (SRD) using Ultra Wide Band technology (UWB)”
- [9] ITU Radio Regulations, Edition of 2020
- [10] [CEPT Report 17](#): “Report from CEPT to the European Commission in response to the Mandate to: identify the conditions relating to the harmonised introduction in the European Union of radio applications based on Ultra-Wide Band (UWB) technology”, approved March 2007
- [11] [ECC Report 278](#): “Specific UWB applications in the bands 3.4-4.8 GHz and 6.0-8.5 GHz: Location tracking and sensor applications (LTA) for vehicular access systems”, approved April 2018
- [12] [CEPT Report 34](#): “Report B from CEPT to European Commission in response to the Mandate 4 on Ultra-Wideband (UWB)”, approved October 2009
- [13] [ECC Report 327](#): “Technical studies for the update of the Ultra Wide Band (UWB) regulatory framework in the band 6.0 GHz to 8.5 GHz”, approved October 2021
- [14] [CEPT Report 69](#): “Report from CEPT to the European Commission in response to the Mandate “Ultra-Wideband technology in view of a potential update of Commission Decision 2007/131/EC”, approved October 2018
- [15] [ECC Decision \(07\)01](#): “ECC Decision of 30 March 2007 on the harmonised use, exemption from individual licensing and free circulation of Material Sensing Devices using Ultra-Wideband (UWB) technology”
- [16] ETSI EN 302 065-3-1: “UWB devices installed in motor and railway vehicles Sub-part 1: Requirements for UWB devices for vehicular access systems”