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”

Report approved on 26 October 2018 by the ECC

0 EXECUTIVE SUMMARY

This Report describes Ultra-Wideband (UWB) technology used by Short Range Devices (SRD) and has been developed in 2017-2018 by the European Conference of Postal and Telecommunications Administrations (CEPT) in response to the Permanent Mandate to CEPT on Ultra-Wideband technology in view of a potential update of Commission Decision 2007/131/EC [1] (as amended by [3][4][5], following the CEPT Reports 27, 34 and 45 in [15][16][17]).

The Report addresses the following aspects of UWB technology and regulation and aims to identify the necessary revisions needed in the Commission Decision 2007/131/EC (examination procedure on a new Implementing Decision which will update the current UWB regulation) as well as ECC Decision (06)04 [2] (Harmonised conditions for devices using UWB technology in bands below 10.6 GHz) and ECC Decision (07)01 [14] (specific material sensing devices using UWB technology).

The following proposals are made in this Report:

- The EC Decision for UWB should for material sensing devices be described in a more neutral fashion in order to allow for innovative solutions;
- Clarify the possibility to use the generic UWB regulation also for material sensing applications without any violation of the technical requirements set out in the generic UWB regulation;
- Consistency of limits; the proposal is to use -65 dBm/MHz for all material sensing devices including BMA in the 8.5-10.6 GHz, also in line with the more generic concept for material sensing devices as described in section 3;
- Introduce a trigger-before-transmit mitigation possibility for vehicular access control systems based on UWB technology in the frequency ranges from 3.8-4.2 GHz and 6-8.5 GHz.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
BMA	Building Material Analysis
BWA	Broadband Wireless Access
CEPT	European Conference of Postal and Telecommunications Administrations
DAA	Detect and Avoid
dBi	dB relative to an isotropic radiator
dBm	Absolute power level expressed in decibels relative to 1 mW
DC	Duty Cycle
ECC	Electronic Communications Committee
EC	European Commission
e.i.r.p	effective isotropically radiated power
ETSI	European Telecommunications Standards Institute
FCC	Federal Commission for Communications
FMSC	Frequency Modulated Stepped Carrier
FSS	Fixed-Satellite Service
FWA	Fixed Wireless Access
LAES	Location Tracking Application for Emergency Services
LBT	Listen Before Talk
LDC	Low Duty Cycle
LPR	Level Probing Radar
LT1	Location Tracking type 1
LT2	Location Tracking Application at fixed industrial sites using Ultra-Wideband technology
LTA	Location Tracking and sensor applications
ODC	Object Discrimination and Characterisation
RAS	Radio Astronomy Service
SRD	Short Range Devices
TPC	Transmit Power Control
Tx	The telegraph abbreviation for transmission
UWB	Ultra-Wideband

1 INTRODUCTION

UWB started as impulse radio and was later renamed Ultra-Wideband. Only one technology, power level and bandwidth was proposed at that time. Later, it was decided in ITU-R to change to a characteristic of a system for which the emitted signal bandwidth exceeds the lesser of 500 MHz or 20% of the arithmetic centre frequency. This means that UWB is no longer strictly a pulse based system. A key element is the ability not to interfere with the incumbent narrow, medium and wideband applications in the frequency band the UWB system uses.

This means there are basically four different scenarios for UWB technology:

- The total amount of emitted power of the UWB device is limited (generic use);
- Technical mitigation is required towards the incumbent services (specific UWB);
- Usage conditions are required for specific UWB applications (e.g. licensing, tank mounting);
- The application does not classify as UWB even when the technical definition of UWB is fulfilled (high power radars).

The result is that only scenarios for generic use and specific UWB classify as UWB, the other scenarios might classify as systems using UWB technology.

A clear distinction needs to be made between the two categories especially when studies are going to be reused or when applications need to be merged in one overall application.

The following ETSI system reference documents which had been provided by ETSI provided information about the market demand and related technical characteristics:

1. ETSI TR 103 313: Technical characteristics for SRD equipment using Ultra-Wideband Sensor technology (UWB); Medical, wellness and assisted living applications [26];
2. ETSI TR 103 314: Short Range Devices (SRD) using UWB; Technical characteristics for SRD equipment using UWB sensor technology based on amended mitigation techniques for UWB [27];
3. ETSI TR 103 416: Technical characteristics and spectrum requirements for UWB based vehicular access systems for operation from 3.4 GHz to 4.8 GHz and from 6 GHz to 8.5 GHz frequency ranges [28].

ETSI TR 103 313 proposes a broader definition of material sensing and imaging devices as well as the harmonisation of regulatory rules.

ETSI TR 103 314 proposes inter-alia to allow generic fixed outdoor operation and fixed/quasi fixed indoor with increased power levels from 6 GHz to 9 GHz.

2 AVAILABLE REGULATION

The following Table 1 provides a list of the ECC Deliverables developed since the last amendment of the Commission Decision 2007/131/EC [1] and related ETSI Harmonised European Standards.

Table 1: Overview ECC deliverables

Document	Applications	Mitigation techniques	ETSI Harmonised European Standard
Decisions ECC/DEC/(06)04 [2] and ECC/DEC/(06)12 [6] were merged as part of the review of the generic UWB regulation in 2010/2011 resulting in the amended ECC/DEC/(06)04	Communications, measurement, imaging, surveillance and medical systems	DAA, LDC, TPC	EN 302 065-1 V2.1.1 [23]
	Location tracking in the range 6 to 9 GHz (former Type LT1)	DAA	EN 302 065-2 V2.1.1
	Applications in ground based vehicle (automotive)	TPC, DAA, specific LDC Exterior Limit can be interpreted as a kind of mitigation	EN 302 065-3 V2.1.1
ECC/REC/(11)09 [13] LT2	Location tracking Type 2 applications incl. fixed outdoor installations using UWB technology	DC, DAA (between 3.1 and 3.4 GHz) and also implementation of registration/coordination mechanisms	EN 302 065-2 V2.1.1
ECC/REC/(11)10 [11] LAES	Location application for emergency services using UWB technology	DC, DAA (between 3.1 and 3.4 GHz) and also implementation of registration/coordination mechanisms for training centres. Limited deployment/ use by emergency services only allows higher emission limits	EN 302 065-2 V2.1.1
ECC Decision (12)03 [12] for UWB onboard aircraft operating in the frequency range 6 to 8.5 GHz	UWB radio links for intra-aircraft communications purposes onboard an aircraft	Emission limit reduction; Alternative mitigation techniques offering equivalent protection such as the use of shielded portholes	EN 302 065-5 V1.1.1
ECC Report 175 [24] co-existence study considering UWB applications inside aircraft and existing radio services in 3.1 to 4.8 GHz/6.0 to 8.5 GHz	All short-haul aircraft such as A320 and B737 as well as all long range aircraft such as A330/340/350 or A380 and B747, B777 or B787	Emission limit reduction The study report considered two UWB devices transmitting simultaneously operating on the same frequencies (500 MHz) onboard an aircraft. In addition, ECC Report 175 did not consider mitigation techniques	EN 302 065-5 V1.1.1 Precise Implementations are specific to the type of aircraft
ECC Report 170 [8] on specific UWB	Automotive applications, LT2 and LAES	Automotive applications, relates to new LDC options	EN 302 065-2 V2.1.1 for LT2 and LAES

Document	Applications	Mitigation techniques	ETSI Harmonised European Standard
applications in the bands 3.4 to 4.8 GHz and 6 to 8.5 GHz LAES, LT2 and LTA		and exterior limits concept. Does not work for all described applications, i.e. not each LDC option works for all UWB applications	EN 302 065-3 V2.1.1 for LTA
ECC Report 167 [7] on practical implementation of registration/coordination mechanism for UWB LT2 systems	LT2	Describes registration/ coordination requirements to ensure compatibility with primary service protection requirements	EN 302 065-2 V2.1.1
ECC Report 139 [9] Impact of LPR, using UWB Technology on radiocommunications services See also ECC/DEC/(11)02 [25]	Level Probing Radars (LPR) is a radio determination application targeting mainly a wide range of industrial applications LPR use UWB technology. This category covers Level Probing Radars (LPR) and mainly targets a wide range of industrial applications TLPR and LPR are both covered by the EC Decision for SRD. It is proposed to keep all SRD radio determination applications in one place	Usage restrictions related to their installation as well as TPC and specific antenna pointing and antenna pattern requirements also covered by the applicable Harmonised European Standard Note that three of the four LPR operating frequency ranges are above 10.6 GHz	EN 302 729 V2.1.1 [22] for LPR RAS site protection information included in the Harmonised European Standard

3 CONSISTENCY OF LIMITS/MITIGATIONS BETWEEN THE DIFFERENT UWB REGULATIONS

3.1 CONSISTENCY OF THE LIMITS IN THE RANGE 8.5-10.6 GHZ

The limit should be consistent and set to -65 dBm/MHz. This concerns mainly the BMA application in section 5.2 of the current EC Decision (-85 dBm/MHz; -45 dBm maximum peak power (e.i.r.p) defined in 50 MHz), while section 5.1 defines for all material sensing devices -65 dBm/MHz).

The proposal is to use -65 dBm/MHz for all material sensing devices including BMA in the future for 8.5-10.6 GHz, also in line with the more generic concept for material sensing devices as described in section 4.1.

The peak power (in dBm) should be also generic and set to -25 dBm maximum power as for the generic UWB applications.

3.2 CONSISTENCY BETWEEN THE GENERIC UWB REGULATION AND THE REGULATION FOR MATERIAL SENSING APPLICATIONS

The approach is to make it possible to use the generic UWB regulation in the Annex section 1 of the EC Decision also for material sensing applications without any violation of the technical requirements set out in the generic UWB regulation;

- It should be noted that the generic regulation excludes fixed outdoor installations;
- The emissions into the air from a material sensing device shall not exceed the limits of the generic regulation;
- The material sensing devices have to fulfil the mitigation techniques defined in the generic UWB rules.

This approach would support the over-all harmonisation of the UWB regulatory framework. Furthermore, the deployment of these devices in the core UWB bands 3.1 to 4.8 GHz and 6.0 to 9.0 GHz would be encouraged.

Material sensing devices should be split into two classes of sensing and imaging devices. These classes are:

- Contact-based sensors and imaging devices. The UWB transmitter is only switched on when in direct contact with the material under investigation;
- Non-contact-based sensor and imaging devices. The UWB transmitter is only switched on when in close proximity with the investigated material and the UWB transmitter is directed into the direction of the material under investigation (e.g. manually, by using a proximity sensor or by mechanical design).

In the following tables, the harmonised limits including the mitigation techniques are depicted. The limits in Tables 2 and 3 are applicable in all environments for material sensing devices, only note 4 in Tables 2 and 3 excludes fixed outdoor application in some applicable frequency ranges.

Table 2: Limits for contact based UWB material sensing devices

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
Below 1.73 GHz	-85 dBm/MHz (see note 1)	-45 dBm
1.73 to 2.2 GHz	-65 dBm/MHz	-25 dBm
2.2 to 2.5 GHz	-50 dBm/MHz	-10 dBm

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
2.5 to 2.69 GHz	-65 dBm/MHz (see notes 1 and 2)	-25 dBm
2.69 to 2.7 GHz (see note 3)	-55 dBm/MHz (see note 2*)	-15 dBm
2.7 to 2.9 GHz	-70 dBm/MHz (see note 1)	-30 dBm
2.9 to 3.4 GHz	-70 dBm/MHz (see notes 1, 5 and 5*)	-30 dBm
3.4 to 3.8 GHz (see note 3)	- 50 dBm/MHz (see notes 2, 5 and 5*)	-10 dBm
3.8 to 4.8 GHz	- 50 dBm/MHz (see notes 5 and 5*)	-10 dBm
4.8 to 5.0 GHz (see note 3)	-55 dBm/MHz (see notes 2 and 2*)	-15 dBm
5.0 to 5.25 GHz	-50 dBm/MHz	-10 dBm
5.25 to 5.35 GHz	-50 dBm/MHz	-10 dBm
5.35 to 5.6 GHz	-50 dBm/MHz	-10 dBm
5.6 to 5.65 GHz	-50 dBm/MHz	-10 dBm
5.65 to 5.725 GHz	-50 dBm/MHz	-10 dBm
5.725 to 6.0 GHz	-50 dBm/MHz	-10 dBm
6.0 to 8.5 GHz	-41.3 dBm/MHz (see note 4)	-0 dBm
8.5 to 9.0 GHz	-65 dBm/MHz (see note 5*)	-25 dBm
9.0 to 10.6 GHz	-65 dBm/MHz	-25 dBm
Above 10.6 GHz	-85 dBm/MHz	-45 dBm

NOTE 1: Devices using a Listen Before Talk (LBT) mechanism or other equivalent mechanisms, as described in the harmonised European standard ETSI EN 302 065-4 are permitted to operate in frequency range 1.215 GHz to 1.73 GHz with a maximum mean e.i.r.p. spectral density of -70 dBm/MHz and in the frequency ranges 2.5 GHz to 2.69 GHz and 2.7 GHz to 3.4 GHz with a maximum mean e.i.r.p. spectral density of -50 dBm/MHz. and a maximum peak e.i.r.p of -10dBm/50MHz.

NOTE 2: To protect the radio services, non-fixed installations must fulfil the following requirement for Total Radiated Power:

a) In the frequency ranges 2.5 GHz to 2.69 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be 10 dB below the max e.i.r.p. spectral density.

b) In the frequency ranges 3.4 GHz to 3.8 GHz, the Total Radiated Power spectral density has to be 5 dB below the max e.i.r.p. spectral density.

NOTE 2*: To protect the RAS bands 2.69 GHz to 2.7 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be below -65 dBm/MHz.

NOTE 3: Limitation of the Duty Cycle to 10 % per second.

NOTE 4: No fixed outdoor permitted.

NOTE 5: Within the band 3.1 GHz – 4.8 GHz, devices implementing Low Duty Cycle (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 Low Duty Cycle mitigation technique and its limits is defined in the harmonised European Standard ETSI EN 302 065-1. When LDC is implemented, Note 4 applies.

NOTE 5*: Within the bands 3.1 GHz – 4.8 GHz and 8.5 GHz - 9 GHz, devices implementing Detect And Avoid (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 Detect and Avoid mitigation technique and its limits is defined in the harmonised European Standard EN 302 065-1. When DAA is implemented, Note 4 applies.

Table 3: Limits for non-contact based UWB material sensing devices

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
Below 1.73 GHz	-85 dBm/MHz (see note 1)	-60 dBm
1.73 to 2.2 GHz	- 70 dBm/MHz	-45 dBm
2.2 to 2.5 GHz	-50 dBm/MHz	-25 dBm
2.5 to 2.69 GHz	-65 dBm/MHz (see notes 1 and& 2)	-40 dBm
2.69 to 2.7 GHz (see note 3)	-70 dBm/MHz (see note 2*)	-45 dBm
2.7 to 2.9 GHz	- 70 dBm/MHz (see note 1)	-45 dBm
2.9 to 3.4 GHz	-70 dBm/MHz (see note 1, 5 and 5*)	-45 dBm
3.4 to 3.8 GHz (see note 3)	- 70 dBm/MHz (see notes 2, 5 and 5*)	-45 dBm
3.8 to 4.8 GHz	-50 dBm/MHz (see notes 5 and 5*)	-25 dBm
4.8 to 5.0 GHz (see note 3)	-55 dBm/MHz (see notes 2 and 2*)	-30 dBm
5.0 to 5.25 GHz	-55 dBm/MHz (	-30 dBm
5.25 to 5.35 GHz	-50 dBm/MHz	-25 dBm
5.35 to 5.6 GHz	-50 dBm/MHz	-25 dBm
5.6 to 5.65 GHz	-50 dBm/MHz	-25 dBm
5.65 to 5.725 GHz	-65 dBm/MHz	-40 dBm
5.725 to 6.0 GHz	-60 dBm/MHz	-35 dBm
6.0 to 8.5 GHz	-41.3 dBm/MHz (see note 4)	0 dBm
8.5 to 9.0 GHz	-65 dBm/MHz (see note 5*)	-25 dBm
9.0 to 10.6 GHz	-65 dBm/MHz	-25 dBm
Above 10.6 GHz	-85 dBm/MHz	-45 dBm

NOTE 1: Devices using a Listen Before Talk (LBT) mechanism or other equivalent mechanisms, as described in the harmonised European standard ETSI EN 302 065-4 are permitted to operate in frequency range 1.215 GHz to 1.73 GHz with a maximum mean e.i.r.p. spectral density of -70 dBm/MHz and in the frequency ranges 2.5 GHz to 2.69 GHz and 2.7 GHz to 3.4 GHz with a maximum mean e.i.r.p. spectral density of -50 dBm/MHz and a maximum peak e.i.r.p of -10dBm/50MHz.

NOTE 2: To protect the radio services, non-fixed installations must fulfil the following requirement for Total Radiated Power:

a) In the frequency ranges 2.5 GHz to 2.69 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be 10 dB below the max e.i.r.p. spectral density.

b) In the frequency ranges 3.4 GHz to 3.8 GHz, the Total Radiated Power spectral density has to be 5 dB below the max e.i.r.p. spectral density.

NOTE 2*: To protect the RAS bands 2.69 GHz to 2.7 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be below -65 dBm/MHz.

NOTE 3: Limitation of the Duty Cycle to 10 % per second.

NOTE 4: No fixed outdoor permitted.

NOTE 5: Within the band 3.1 GHz – 4.8 GHz, devices implementing Low Duty Cycle (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 Low Duty Cycle mitigation technique and its limits is defined in the harmonised European Standard ETSI EN 302 065-1. When LDC is implemented, Note 4 applies.

NOTE 5*: Within the bands 3.1 GHz – 4.8 GHz and 8.5 GHz - 9 GHz, devices implementing Detect And Avoid (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 Detect and Avoid mitigation technique and its limits is defined in the harmonised European Standard EN 302 065-1. When DAA is implemented, Note 4 applies.

4 NEW APPLICATIONS, MITIGATION FACTORS AND TECHNIQUES

4.1 MEDICAL APPLICATIONS AND OTHER NEW USE CASES FOR MATERIAL SENSING

ETSI TR 103 313 [26] proposes a broader definition of material sensing as well as the harmonisation of regulatory rules.

The EC Decision for UWB could for material sensing devices be described in a more neutral fashion in order to allow for innovative solutions. The approach should be as generic as possible. The idea is to have a generic material sensing regulation including material sensing and imaging, BMA and other sensing applications, e.g. medical applications (living being body sensing), food investigations, etc.:

- BMA is currently linked to a measurement method using a representative wall. If seen in a more abstractive way, other materials or objects under investigation, which are for their combined attenuation and absorption characteristics at least equivalent to the representative wall, could also be considered due to providing equivalent mitigation of interference (e.g. on-body sensing at living being bodies);
- One aspect linked to many material sensing/determination applications is that the selected use case and/or the construction of the material sensing device is for use inside a specific facility and in controlled environments, e.g. in controlled medical environments in healthcare facilities.

Common technical aspects: ensure for on-material sensing (or sufficient close proximity but non-contact-based) that the radiation is provided to the material under investigation and not into the air.

It is necessary to review wordings such as ‘machine’, ‘running sensor’ and ‘representative wall’ in the regulatory approach to be more generic for material sensing applications:

- The term ‘representative structure’ is also used in the current EC Decision and it is proposed to use this term instead of ‘representative wall’ for the more generic approach for material sensing applications;
- A more generic approach is based on using the terminology ‘contact-based’ and ‘non-contact-based’ material sensing. The words ‘machine’, ‘object’, ‘running sensors’ could be avoided.
- ..

The Harmonised European Standard EN 302 065-4 V1.1.1 [23] already allows devices for material determination which are different in their combined absorption and attenuation characteristics compared to the specified ‘representative wall’.

In addition, a revision of the Harmonised European Standard 302 065-4 (for material sensing/determination) and a new specific EN for medical use cases can provide guidance with regard to requirements for use in controlled specific environments.

4.2 TRIGGER-BEFORE-TRANSMIT FOR VEHICULAR ACCESS CONTROL SYSTEMS BASED ON UWB TECHNOLOGY

The results of the studies in ECC Report 278 [29] make it possible to consider for 3.8-4.2 GHz and 6-8.5 GHz the trigger-before-transmit mitigation technique without the need for an exterior limit for vehicular UWB applications (location tracking and sensor applications in the automotive UWB regulation for vehicular access control systems).

The operation of vehicular access devices for keyless entry systems without the application of the exterior limit, but instead operating like a generic LDC UWB device with an e.i.r.p. of -41.3 dBm / MHz causes no interference or interference with low probability. In general, the aggregated interference levels from UWB devices operating with the trigger before transmit mitigation technique is lower than those from UWB devices operating with the exterior limit. With respect to single entry scenarios, the same separation distance was

considered as for generic UWB devices operating with the exterior limit. Radio astronomy services can be protected by respecting a reasonable separation distance. Therefore, compatibility with the incumbent services in the bands 3.1-4.2 GHz and 6-8.5 GHz can be considered, when trigger-before-transmit mitigation is used.

The UWB technology enables precise and secure low-power distance measurements between the car and the key fob. This capability is required to prevent relay attacks on current passive keyless entry systems. Beyond the core access functionality, UWB will support the automakers' effort towards smart cars where centimetre-precise location of the key fob around and in the car enables new services.

The investigations in the band 3.4-3.8 GHz are related to 5G and may need to be further addressed at a later stage.

ECC Report 278 [29] 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.

In the band 4.2-4.8 GHz, the exterior limit has still to be applied.

Table 4: Proposed regulation for trigger-before-transmit for vehicular access systems based on UWB technology

Area of operation / Category	Frequency	Maximum Average power density (e.i.r.p.) (dBm/MHz) and maximum power (e.i.r.p.)
Vehicular access control systems	3.8 GHz to 4.2 GHz	-41.3 dBm/MHz and 0 dBm/50 MHz with trigger-before-transmit operation and LDC<0.5% (in 1h)
	6 GHz to 8.5 GHz	-41.3 dBm/MHz and 0 dBm/50 MHz with trigger-before-transmit operation and LDC<0.5% (in 1h) or TPC

"Trigger-before-transmit" mitigation is defined as an UWB transmission which is only initiated when necessary, in particular only if the system indicates that UWB devices are in the proximity. The communication is either triggered by a user or 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).

The trigger-before-transmit mitigation will be included in the Harmonised European Standard EN 302 065-3 [23].

In summary, it is proposed for vehicular access control systems operating within the frequency ranges 3.8-4.2 GHz and 6 to 8.5 GHz to not apply an exterior limit requirement when operated with trigger-before-transmit mode within the automotive UWB regulation.

4.3 UPDATE ON GPR/WPR

The implementation information for GPR/WPR applications has been reviewed in order to discuss whether a proposal for harmonisation by means of an amendment of Decision 2007/131/EC [1] is appropriate.

The implementation of ECC Decision (06)08 [10] on Ground and Wall Penetrating Radars operating in all or parts of the frequency range 30 MHz to 12.4 GHz in Europe is as follows:

Status (number)	Countries (detail)
Yes (28)	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Hungary, Iceland, Ireland, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland and Turkey **Implementations are based on license-exemption.**
Yes, partly (3)	Austria (limited), Germany (WPR only under individual . license for prof. users) and United Kingdom (GPR only)
Committed (1)	Sweden (upon license application, conditions of the ECC Decision will be applied)
Under study (4)	Andorra, Belgium, Cyprus and Montenegro
No (11)	Belarus, Georgia, Greece, Italy, Latvia, Macedonia (FYROM), Monaco, Russian Federation, Ukraine, San Marino and Vatican
No info (1)	Azerbaijan

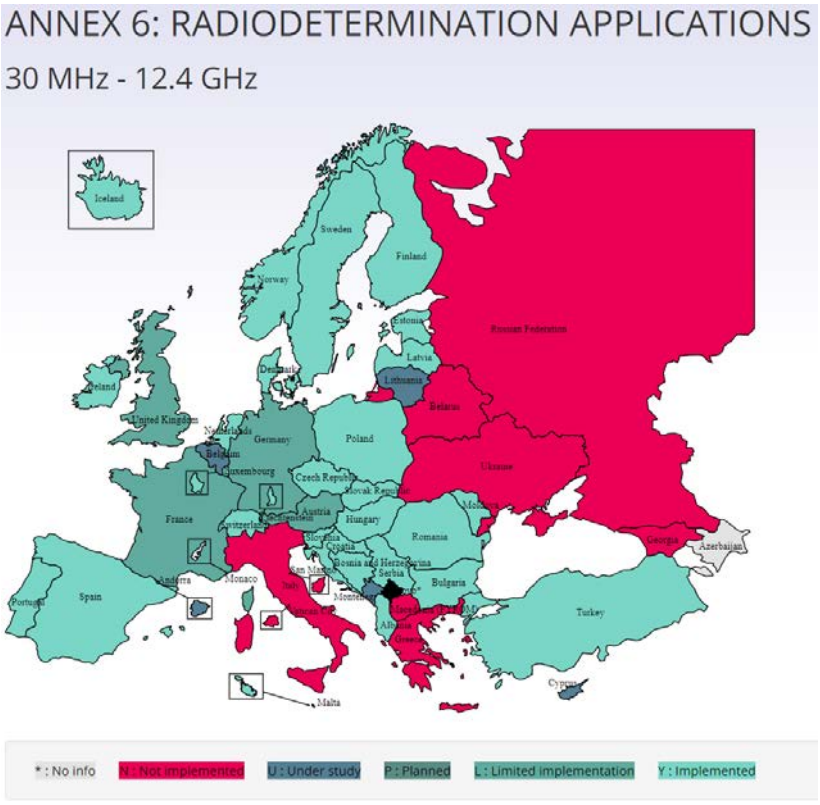


Figure 1: Implementation status of ECC Decision (06)08 (12 March 2018)

Implementations have mostly converged on license-exemption, though some exceptions exist. Within CEPT, there are still about 20 countries which have the ECC Decision either only partly implemented, or with individual licensee requirement, or are still studying implementation, or have the ECC Decision (06)08 [10] not implemented at all.

Only a limited number of products are on the market and some countries have not implemented a regulatory approach in absence of requests from the market or users. Germany counted 19 WPR professional users with an individual license (March 2018).

The Harmonised European Standard EN 302 066 [18] exists for Ground- and Wall Probing Radar applications (GPR/WPR) imaging systems. This Harmonised European Standard includes a measurement procedure for the peak power of GPR/WPR applications and the mean power is calculated from this.

The regulatory approach in ECC Decision (06)08 [10] is partly overlapping with the regulatory approach for BMA which could be seen as an alternative for many applications.

In conclusion, the regulatory approach in ECC Decision (06)08 [10] already led to a considerable harmonisation of the technical requirements and converged to a great extent on license-exemption for WPR/GPR applications. Nevertheless, the market for GPR/WPR is a small niche market and stakeholders did not express a strong wish for additional harmonisation by means of an amendment of Decision 2007/131/EC [1]. CEPT does therefore not make a proposal to include GPR/WPR in the EC Decision for UWB.

5 ON-GOING ETSI AND CEPT ACTIVITIES FOR UWB APPLICATIONS

Figure 2: Summary updates in ECC Decision (06)04

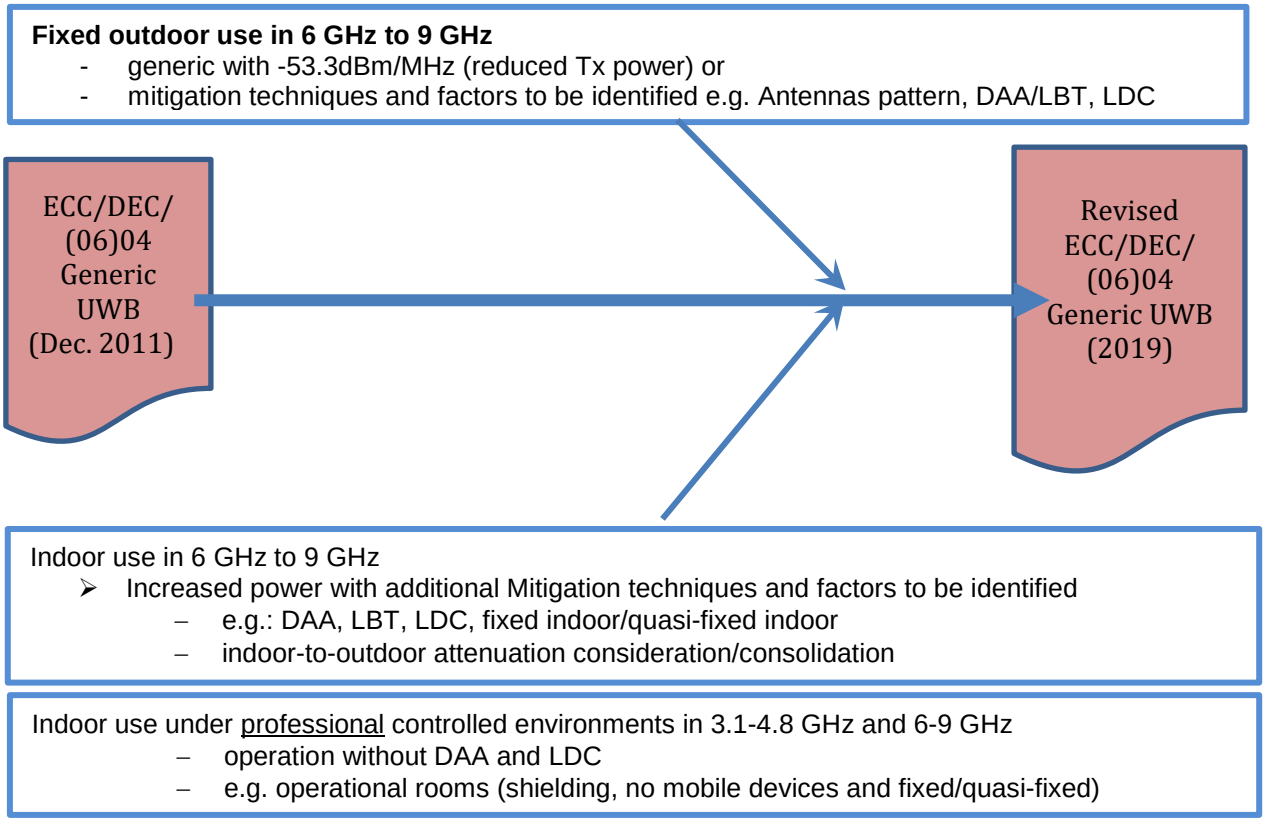
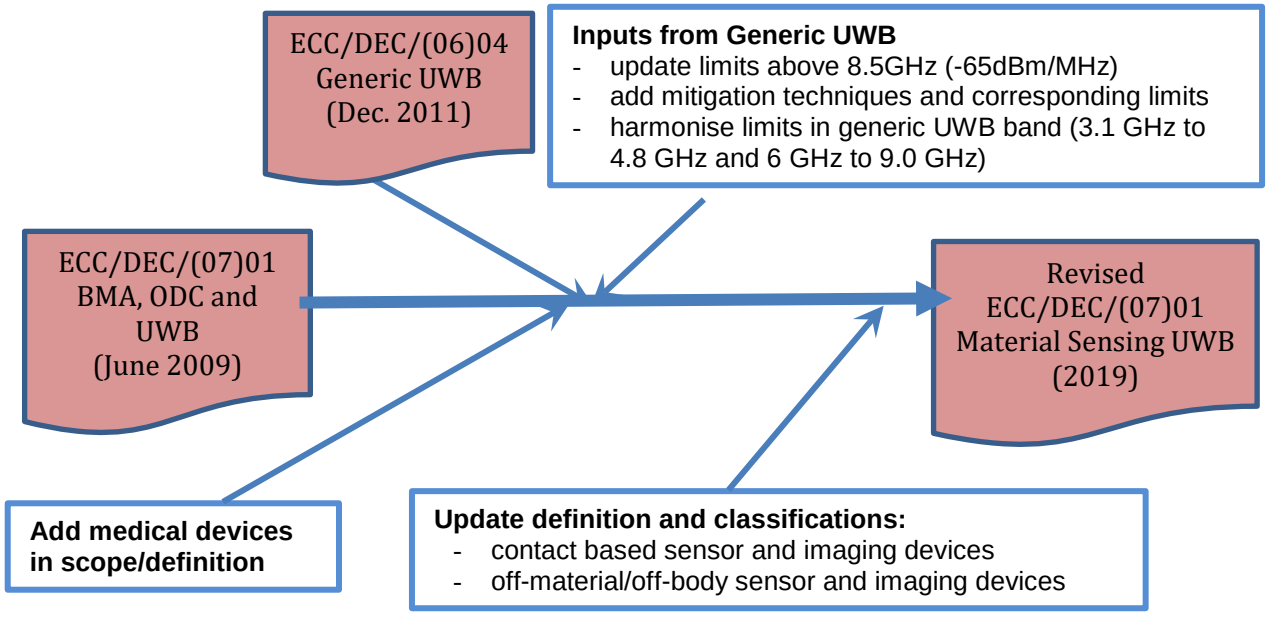


Figure 3: Summary updates in ECC Decision (07)01



6 RELATED STANDARDISATION ACTIVITIES

Table 5: Overview Harmonised European Standards

Harmonised European Standard	Scope	Structure and/or Mitigation techniques/Remarks
EN 302 065-1	Requirements for Generic UWB applications	Part 1-1: this Harmonised European Standard will focus on transceivers, transmitters or receivers utilising UWB technologies for communication purposes. These systems operate in the 3.1 to 4.8 GHz or 6 to 9 GHz frequency ranges. Part 1-2: requirements for generic UWB presence detection applications. This Harmonised European Standard will cover presence detection sensors operating in the frequency bands from 3.1 GHz to 4.8 GHz and 6.0 GHz to 9.0 GHz for fixed (indoor only), mobile or portable use. Part 1-3: requirements for generic UWB through-air non-contact vital signs applications. This Harmonised European Standard will cover through-air non-contact vital signs detection sensors operating in the frequency bands from 3.1 GHz to 4.8 GHz and 6.0 GHz to 9.0 GHz for fixed (indoor only), mobile or portable use.
EN 302 065-2	Requirements for UWB location tracking	Part 2-1: requirements for UWB location tracking applications within 6 to 9 GHz. This Harmonised European Standard will cover transceivers, transmitters or receivers utilising UWB technologies for location tracking type 1 (LT1) applications. These systems, operating in the 6 GHz to 9 GHz region (see CEPT Report 45), are intended for general location tracking of people and objects. Part 2-2: requirements for UWB location tracking applications within 3.1 to 4.8 GHz - this Harmonised European Standard will focus on transceivers, transmitters or receivers utilising UWB technologies for location tracking type 2 (LT2) applications. These systems, operating in the 3.1 GHz to 4.8 GHz region (see ECC/REC(11)09), are intended for person and object tracking and industrial applications at well-defined locations. The transmitting terminals in these systems may be located indoors or outdoors, and may be fixed or mobile.
EN 302 065-3	Requirements for UWB devices for ground based vehicular applications	The trigger-before-transmit mitigation will be included in the Harmonised European Standard EN 302 065-3. Part 3-1: requirements for UWB devices for keyless entry application on road vehicles - this Harmonised European Standard will cover vehicle installed devices for “UWB based vehicular access systems for operation in 6 GHz to 8.5 GHz frequency ranges”, using “Trigger-before-Transmit” mitigation technique.

Harmonised European Standard	Scope	Structure and/or Mitigation techniques/Remarks
EN 302 065-4	Material Sensing devices using UWB technology below 10.6 GHz	The current Harmonised European Standard already allows for using materials which are different in their combined absorption and attenuation characteristics compared to the specified 'representative wall'. A correction will be undertaken for the LBT mitigation techniques in this standard. Replaced [20][21] Part 4-1: Material Sensing devices for building material analysis below 10.6 GHz. This Harmonised European Standard will cover devices for handheld "building material analysis (BMA)" working within the frequency 2.2 to 8GHz.
EN 302 065-5	Devices using UWB technology on-board aircraft	
EN 302 066 [18]	Ground- and Wall-Probing Radar applications (GPR/WPR) imaging systems	

Because of on-going discussions about UWB receiver performance and related technical requirements in the harmonised European standards, the above part-structure of the EN 302 065 harmonised European standards family [23] can change in the future.

7 PROPOSALS FOR INCLUSION OF RELEVANT PARAMETERS IN THE COMMISSION DECISION

The following proposals are made in this Report:

- The EC Decision for UWB should for material sensing devices be described in a more neutral fashion in order to allow for innovative solutions;
- Clarify the possibility to use the generic UWB regulation also for material sensing applications without any violation of the technical requirements set out in the generic UWB regulation;
- Consistency of limits; the proposal is to use -65 dBm/MHz for all material sensing devices including BMA in the 8.5-10.6 GHz, also in line with the more generic concept for material sensing devices as described in section 3;

For the three points above, a complete replacement of the entire section 5 of the Annex of the EC Decision for UWB is proposed. BMA as a specific category of UWB devices will disappear from the EC Decision and the article 2.10 can be deleted since it contains the definition of BMA.

- Introduce a trigger-before-transmit mitigation possibility for vehicular access control systems based on UWB technology in the frequency ranges from 3.8-4.2 GHz and 6 GHz to 8.5 GHz;

This last point applies to section 3 of the Annex of the EC Decision for UWB and this new mitigation possibility should be added there.

Annex 2 of this Report includes in ready-text format these amendments with regard to the latest version of the Commission Implementing Decision on UWB.

The outstanding requests from ETSI in ETSI system reference documents TR 103 313 [26] and TR 103 314 [27] is still under investigation in CEPT/ECC (SE24_WI63) and results will need to be considered in the next following update of the EC Decision on UWB under the permanent mandate.

ANNEX 1: CEPT PERMANENT MANDATE ON UWB

EUROPEAN COMMISSION
Directorate-General for Communications Networks, Content and Technology

Electronic Communications Networks and Services
Radio Spectrum Policy

Brussels, 16 March 2017
DG CONNECT/B4

RSCOM17-04rev3

FINAL

RADIO SPECTRUM COMMITTEE

Working Document

Subject: **Permanent Mandate to CEPT to identify the technical conditions relating to the harmonised introduction of radio applications based on Ultra-Wideband (UWB) technology in the European Union**

Opinion of the RSC
pursuant to Advisory Procedure under Article 4 of Regulation 182/2011/EU and Article 4.2 of Radio Spectrum Decision 676/2002/EC

This is a Committee working document which does not necessarily reflect the official position of the Commission. No inferences should be drawn from this document as to the precise form or content of future measures to be submitted by the Commission. The Commission accepts no responsibility or liability whatsoever with regard to any information or data referred to in this document

PERMANENT MANDATE TO CEPT

TO IDENTIFY THE TECHNICAL CONDITIONS RELATING TO THE HARMONISED INTRODUCTION OF RADIO APPLICATIONS BASED ON ULTRA-WIDEBAND (UWB) TECHNOLOGY IN THE EUROPEAN UNION

Purpose

The underlying objective of this Mandate is to provide updated technical parameters to amend Commission Decision 2007/131/EC in order to:

- expand its scope to different operating environments and specific ultra-wideband applications according to market demand;
- ensure less restrictive operation and specific techniques to ensure appropriate mitigation of potential harmful interference to radiocommunication services and radio applications.

Pursuant to this permanent Mandate, CEPT shall provide the Commission, when needed, with an assessment on the needs for updating the technical annex of the Commission Decision on harmonising technical conditions for the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community.

If the assessment performed by CEPT points to a need to update the Commission Decision on UWB, CEPT will also provide a report to the Commission with all the technical parameters required to amend the Decision.

Justification

Pursuant to Article 4(2) of the Radio Spectrum Decision the Commission may issue mandates to the CEPT for the development of technical implementing measures with a view to ensuring harmonised conditions for the availability and efficient use of radio spectrum necessary for the functioning of the internal market. Such mandates shall set the tasks to be performed and their timetable. Pursuant to Article 1 of the Radio Spectrum Decision, activities under the Decision must facilitate policy making with regard to the strategic planning and harmonisation of radio spectrum use as well as ensure the effective implementation of radio spectrum policy in the EU while serving the aim of coordination of policy approaches. Furthermore, they shall take due account of the work of international organisations related to spectrum management such as the ITU.

This permanent mandate follows the five previous Mandates given by the Commission to CEPT on UWB on 2004, 2005, 2006, 2008 and 2012, and seeks to support the objectives and integrate the work undertaken in these earlier mandates into a more regular and predictable framework for future updates. Stakeholders or ETSI may submit demands to access spectrum for UWB to CEPT. Any such request should be carefully analysed in order to assess whether the current technical conditions of the EC Decision on UWB are able to respond to demand. Moreover CEPT when reviewing the framework, could make suggestions to improve it by removing frequency ranges from the list included in the technical annex, when required and duly justified (e.g. in case a particular use has become obsolete);

Objectives

In addition to the core objectives of the Decision itself, the aim of this permanent mandate is to provide relevant technical information necessary to:

a) Update, whenever appropriate, the technical conditions in the technical annex of the Decision;

b) According to market demand, this may include the identification of new frequency bands and/or new applications which should be added to the list included in the technical annex of the Decision, in order to consolidate the Single Market through spectrum harmonisation. If needed, the deletion of entries in the technical Annex in case no demand has been identified;

Duration

c) This mandate will be kept as long as the Commission Decision on UWB is applicable;

d) However, the Commission, having received the position opinion of the RSC on that matter and with due consultation with CEPT, may terminate or modify this mandate at a specified point in time in case it would have become redundant, obsolete or needs to be updated.

Task Order and Schedule

CEPT is hereby mandated to undertake all the activities required to assess specific technical compatibility issues between UWB applications (generic and specific) and potentially affected selected radio services and radio applications, based on realistic interference scenarios, with a view to setting spectrum usage conditions which allow the use of UWB equipment without creating harmful interference to existing radiocommunication services and radio applications.

In agreeing technical solutions, the utmost consideration should be given to the benefits for consumers of the lower cost of products instigated by global harmonisation and by the avoidance of undue equipment fragmentation or operational restrictions.

CEPT is requested to collaborate actively with the European Telecommunications Standardisation Institute (ETSI) which develops harmonised standards for conformity under the Radio Equipment Directive and to take into account emerging technologies and ETSI (harmonised) standards.

In particular, CEPT is tasked to:

- identify and submit appropriate technical parameters, where needed, for additional UWB applications where a common approach could be beneficial to the EU internal market;
- identify and submit proposals, where needed, for updating technical parameters harmonised by the latest version of the technical Annex of the Commission Decision.

CEPT is mandated to provide deliverables according to the following preliminary schedule:

Delivery date	Deliverable	Subject
1st November 2018 and tentatively every two years hereafter, pending CEPT's assessment of the need to update the UWB Decision	Report from CEPT to the Commission	All the technical parameters required to amend Decision 2007/131/EC, to be presented.

In addition, CEPT is requested to report on the progress of its work pursuant to this Mandate in the relevant meetings of the Radio Spectrum Committee.

The result of this Mandate may be made applicable in the European Union pursuant to Article 4 of the Radio Spectrum Decision[1].

In implementing this Mandate, the CEPT shall take the utmost account of Union law applicable.

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[1] Decision 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, OJ L 108 of 24.4.2002, p.1.

ANNEX 2: PROPOSED AMENDMENTS TO DECISION 2007/131/EC

The Annex to Decision 2007/131/EC is proposed to be amended as follows:

- The EC Decision for UWB should for material sensing devices be described in a more neutral fashion in order to allow for innovative solutions;
- Clarify the possibility to use the generic UWB regulation also for material sensing applications without any violation of the technical requirements set out in the generic UWB regulation;
- Consistency of limits; the proposal is to use -65 dBm/MHz for all material sensing devices including BMA in the 8.5-10.6 GHz, also in line with the more generic concept for material sensing devices as described in section 3;

For the three points above, a complete replacement of the entire section 5 of the Annex of the EC Decision for UWB is proposed. BMA as a specific category of UWB devices will disappear from the EC Decision and the article 2.10 can be deleted since it contains the definition of BMA.

- Introduce a trigger-before-transmit mitigation possibility for vehicular access control systems based on UWB technology in the frequency ranges from 3.8-4.2 GHz and 6-8.5 GHz.

This last point applies to section 3 of the Annex of the EC Decision for UWB and this new mitigation possibility should be added there.

In the following, a ready-text proposal is made for the changes proposed above.

5 - MATERIAL SENSING DEVICES USING UWB TECHNOLOGY

Material Sensing Devices can use the generic UWB regulation in the Annex section 1 of this Decision without any violation of the technical requirements set out in the generic UWB regulation.

It should be noted that the generic UWB regulation excludes fixed outdoor installations. Emissions into the air from a material sensing device shall not exceed the limits of the generic regulation. Material sensing devices have to fulfil the mitigation techniques defined in the generic UWB rules.

This approach supports the over-all harmonisation of the UWB regulatory framework. Furthermore, the deployment of these devices in the core UWB bands 3.1 to 4.8 GHz and 6.0 to 9.0 GHz would be encouraged.

Material sensing devices are split into two classes of sensing and imaging devices. These classes are:

- Contact-based sensors and imaging devices. The UWB transmitter is only switched on when in direct contact with the material under investigation;
- Non-contact-based sensor and imaging devices. The UWB transmitter is only switched on when in close proximity with the investigated material and the UWB transmitter is directed into the direction of the material under investigation (e.g. manually, by using a proximity sensor or by mechanical design).

In the following Tables 6 and 7, the harmonised limits including the mitigation techniques are depicted. Emissions radiating from material sensing devices permitted under this Decision shall be kept to a minimum and in any case not exceed the emission limits within the following Tables. The compliance with the limits has to be ensured with the device on a representative structure of the investigated material. The limits in Tables 6 and 7 are applicable in all environments for material sensing devices, only note 4 in Tables 6 and 7 excludes fixed outdoor application in some applicable frequency ranges.

Table 6: Limits for contact based UWB material sensing devices

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
Below 1.73 GHz	-85 dBm/MHz (see note 1)	-45 dBm
1.73 to 2.2 GHz	-65 dBm/MHz	-25 dBm
2.2 to 2.5 GHz	-50 dBm/MHz	-10 dBm
2.5 to 2.69 GHz	-65 dBm/MHz (see notes 1 and 2)	-25 dBm
2.69 to 2.7 GHz (see note 3)	-55 dBm/MHz (see note 2*)	-15 dBm
2.7 to 2.9 GHz	-70 dBm/MHz (see note 1)	-30 dBm
2.9 to 3.4 GHz	-70 dBm/MHz (see notes 1, 5 and 5*)	-30 dBm
3.4 to 3.8 GHz (see note 3)	- 50 dBm/MHz (see notes 2, 5 and 5*)	-10 dBm
3.8 to 4.8 GHz	- 50 dBm/MHz (see notes 5 and 5*)	-10 dBm
4.8 to 5.0 GHz (see note 3	-55 dBm/MHz (see notes 2 and 2*)	-15 dBm
5.0 to 5.25 GHz	-50 dBm/MHz	-10 dBm
5.25 to 5.35 GHz	-50 dBm/MHz	-10 dBm
5.35 to 5.6 GHz	-50 dBm/MHz	-10 dBm
5.6 to 5.65 GHz	-50 dBm/MHz	-10 dBm
5.65 to 5.725 GHz	-50 dBm/MHz	-10 dBm
5.725 to 6.0 GHz	-50 dBm/MHz	-10 dBm
6.0 to 8.5 GHz	-41.3 dBm/MHz (see note 4)	-0 dBm
8.5 to 9.0 GHz	-65 dBm/MHz (see note 5*)	-25 dBm
9.0 to 10.6 GHz	-65 dBm/MHz	-25 dBm
Above 10.6 GHz	-85 dBm/MHz	-45 dBm

NOTE 1: Devices using a Listen Before Talk (LBT) mechanism or other equivalent mechanisms, as described in the harmonised European standard ETSI EN 302 065-4 are permitted to operate in frequency range 1.215 GHz to 1.73 GHz with a maximum mean e.i.r.p. spectral density of -70 dBm/MHz and in the frequency ranges 2.5 GHz to 2.69 GHz and 2.7 GHz to 3.4 GHz with a maximum mean e.i.r.p. spectral density of -50 dBm/MHz. and a maximum peak e.i.r.p of -10dBm/50MHz.

NOTE 2: To protect the radio services, non-fixed installations must fulfil the following requirement for Total Radiated Power:

a) In the frequency ranges 2.5 GHz to 2.69 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be 10 dB below the max e.i.r.p. spectral density.

b) In the frequency ranges 3.4 GHz to 3.8 GHz, the Total Radiated Power spectral density has to be 5 dB below the max e.i.r.p. spectral density.

NOTE 2*: To protect the RAS bands 2.69 GHz to 2.7 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be below -65 dBm/MHz.

NOTE 3: Limitation of the Duty Cycle to 10 % per second.
NOTE 4: No fixed outdoor permitted.
NOTE 5: Within the band 3.1 GHz – 4.8 GHz, devices implementing Low Duty Cycle (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 Low Duty Cycle mitigation technique and its limits is defined in the harmonised European Standard ETSI EN 302 065-1. When LDC is implemented, Note 4 applies.
NOTE 5*: Within the bands 3.1 GHz – 4.8 GHz and 8.5 GHz - 9 GHz, devices implementing Detect And Avoid (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 Detect and Avoid mitigation technique and its limits is defined in the harmonised European Standard EN 302 065-1. When DAA is implemented, Note 4 applies.

Table 7: Limits for non-contact based UWB material sensing devices

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
Below 1.73 GHz	-85 dBm/MHz (see note 1)	-60 dBm
1.73 to 2.2 GHz	- 70 dBm/MHz	-45 dBm
2.2 to 2.5 GHz	-50 dBm/MHz	-25 dBm
2.5 to 2.69 GHz	-65 dBm/MHz (see notes 1 and& 2)	-40 dBm
2.69 to 2.7 GHz (see note 3)	-70 dBm/MHz (see note 2*)	-45 dBm
2.7 to 2.9 GHz	- 70 dBm/MHz (see note 1)	-45 dBm
2.9 to 3.4 GHz	-70 dBm/MHz (see note 1, 5 and 5*)	-45 dBm
3.4 to 3.8 GHz (see note 3)	- 70 dBm/MHz (see notes 2, 5 and 5*)	-45 dBm
3.8 to 4.8 GHz	-50 dBm/MHz (see notes 5 and 5*)	-25 dBm
4.8 to 5.0 GHz (see note 3)	-55 dBm/MHz (see notes 2 and 2*)	-30 dBm
5.0 to 5.25 GHz	-55 dBm/MHz	-30 dBm
5.25 to 5.35 GHz	-50 dBm/MHz	-25 dBm
5.35 to 5.6 GHz	-50 dBm/MHz	-25 dBm
5.6 to 5.65 GHz	-50 dBm/MHz	-25 dBm
5.65 to 5.725 GHz	-65 dBm/MHz	-40 dBm
5.725 to 6.0 GHz	-60 dBm/MHz	-35 dBm
6.0 to 8.5 GHz	-41.3 dBm/MHz (see note 4)	0 dBm
8.5 to 9.0 GHz	-65 dBm/MHz	-25 dBm

Frequency range	Maximum mean e.i.r.p. spectral density	Maximum peak e.i.r.p. (defined in 50 MHz)
	(see note 5*)	
9.0 to 10.6 GHz	-65 dBm/MHz	-25 dBm
Above 10.6 GHz	-85 dBm/MHz	-45 dBm

NOTE 1: Devices using a Listen Before Talk (LBT) mechanism or other equivalent mechanisms, as described in the harmonised European standard ETSI EN 302 065-4 are permitted to operate in frequency range 1.215 GHz to 1.73 GHz with a maximum mean e.i.r.p. spectral density of -70 dBm/MHz and in the frequency ranges 2.5 GHz to 2.69 GHz and 2.7 GHz to 3.4 GHz with a maximum mean e.i.r.p. spectral density of -50 dBm/MHz and a maximum peak e.i.r.p of -10dBm/50MHz.

NOTE 2: To protect the radio services, non-fixed installations must fulfil the following requirement for Total Radiated Power:

a) In the frequency ranges 2.5 GHz to 2.69 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be 10 dB below the max e.i.r.p. spectral density.

b) In the frequency ranges 3.4 GHz to 3.8 GHz, the Total Radiated Power spectral density has to be 5 dB below the max e.i.r.p. spectral density.

NOTE 2*: To protect the RAS bands 2.69 GHz to 2.7 GHz and 4.8 GHz to 5 GHz, the Total Radiated Power spectral density has to be below -65 dBm/MHz.

NOTE 3: Limitation of the Duty Cycle to 10 % per second.

NOTE 4: No fixed outdoor permitted.

NOTE 5: Within the band 3.1 GHz – 4.8 GHz, devices implementing Low Duty Cycle (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 Low Duty Cycle mitigation technique and its limits is defined in the harmonised European Standard ETSI EN 302 065-1. When LDC is implemented, Note 4 applies.

NOTE 5*: Within the bands 3.1 GHz – 4.8 GHz and 8.5 GHz - 9 GHz, devices implementing Detect And Avoid (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 Detect and Avoid mitigation technique and its limits is defined in the harmonised European Standard EN 302 065-1. When DAA is implemented, Note 4 applies.

Peak power threshold values for the “Listen Before Talk” (LBT) mechanism to ensure the protection of the listed services are defined within Table 8 below.

Table 8: Technical Requirements of the “Listen Before Talk” Mechanism for Material Sensing Devices

Frequency range	Radio service to be detected	Peak power threshold value
1.215 - 1.4 GHz	Radiodetermination Service	+8 dBm/MHz
1.61 - 1.66 GHz	Mobile Satellite service	-43 dBm/MHz
2.5 – 2.69 GHz	Land mobile service	-50 dBm/MHz
2.9 – 3.4 GHz	Radiodetermination service	-7 dBm/MHz

Additional requirements for Radar detection: Continuously listening and automatic switch-off within 10ms for the related frequency range if the threshold value is exceeded (Table 8). A silent time of at least 12s while listening continuously is necessary before the transmitter can be switched on again. This silent time during which only the LBT receiver is active has to be ensured even after the device is switched off.

3- UWB DEVICES INSTALLED IN ROAD AND RAIL VEHICLES

It is proposed to add at the end of section 3 of Annex 1 of the EC Decision for UWB the following which will complement the existing information:

Technical requirements to be used within 3.8-4.2 GHz and 6-8.5 GHz when using trigger-before-transmit for vehicular access systems:

Table 9: 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 ≤ 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 an UWB transmission which is only initiated when necessary, in particular only if the system indicates that UWB devices are in the proximity. The communication is either triggered by a user or 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 applies 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 ETSI EN 302 065-3.

ANNEX 3: LIST OF REFERENCES

[1] Commission Decision 2007/131/EC on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community

[2] ECC Decision (06)04 on the harmonised conditions for devices using UWB technology in bands below 10.6 GHz

[3] Commission Decision 2009/343/EC amending Decision 2007/131/EC on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community

[4] Commission Implementing Decision 2014/702/EU amending 2007/131/EC on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community

[5] Commission Implementing Decision (EU) 2017/1438 amending Decision 2007/131/EC on allowing the use of the radio spectrum for equipment using ultra-wideband technology in a harmonised manner in the Community

[6] ECC Decision (06)12 on supplementary regulatory provisions to Decision ECC/DEC/(06)04 for UWB devices using mitigation techniques

[7] ECC Report 167: “Practical implementation of registration/coordination mechanism for UWB LT2 systems”

[8] ECC Report 170: “Specific UWB applications in the bands 3.4 to 4.8 GHz and 6 to 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)”

[9] ECC Report 139: “Impact of Level Probing Radars (LPR), using Ultra-Wideband Technology on Radiocommunications Services”

[10] ECC Decision (06)08 on the conditions for use of the radio spectrum by Ground- and Wall- Probing Radar (GPR/WPR) imaging systems

[11] ECC Recommendation (11)10 Location tracking application for emergency and disaster situations

[12] ECC Decision (12)03 on the harmonised conditions for UWB applications onboard aircraft

[13] ECC Recommendation (11)09 UWB Location Tracking Systems Type2 (LT2)

[14] ECC Decision (07)01 on specific Material Sensing devices using Ultra-Wideband (UWB) technology

[15] CEPT Report 27: “Report A from CEPT to EC in response to the Mandate 4 on Ultra-Wideband (UWB)”

[16] CEPT Report 34: “Report B from CEPT to European Commission in response to the Mandate 4 on Ultra-Wideband (UWB)”

[17] CEPT Report 45: “Report from CEPT to the European Commission in response to the Fifth Mandate to CEPT on ultra-wideband technology to clarify the technical parameters in view of a potential update of Commission Decision 2007/131/EC”

[18] ETSI EN 302 066: Short Range Devices (SRD); Ground- and Wall- Probing Radar applications (GPR/WPR) imaging systems; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU

[19] 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-WideBand (UWB) technology”

[20] ETSI EN 300 435: Building Material Analysis and Classification equipment applications operating in the frequency band from 2.2 GHz to 8.5 GHz (replaced by EN 302 065-4)

[21] ETSI EN 300 498: Object Discrimination and Characterization Applications for power tool devices operating in the frequency band from 2.2 GHz to 8.5 GHz (replaced by EN 302 065-4)

[22] ETSI EN 302 729: Short Range Devices (SRD); Level Probing Radar (LPR) equipment operating in the frequency ranges 6 GHz to 8.5 GHz, 24.05 GHz to 26.5 GHz, 57 GHz to 64 GHz, 75 GHz to 85 GHz; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU

[23] ETSI EN 302 065-1 to -5: Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Requirements for Generic UWB applications; Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU

[24] ECC Report 175: "Co-existence study considering UWB applications inside aircraft and existing radio services in the frequency bands from 3.1 GHz to 4.8 GHz and from 6.0 GHz to 8.5 GHz”

[25] ECC Decision (11)02 on industrial Level Probing Radars (LPR) operating in frequency bands 6 to 8.5 GHz, 24.05 to 26.5 GHz, 57 to 64 GHz and 75 to 85 GHz

[26] ETSI TR 103 313: Technical characteristics for SRD equipment using Ultra Wide Band Sensor technology (UWB); Medical, wellness and assisted living applications;

[27] ETSI TR 103 314: Short Range Devices (SRD) using Ultra Wide Band (UWB); Technical characteristics for SRD equipment using Ultra Wide Band Sensor technology (UWB) based on amended mitigation techniques for UWB;
[28] ETSI TR 103 416: Technical characteristics and spectrum requirements for UWB based vehicular access systems for operation in the 3.4 GHz to 4.8 GHz and 6 GHz to 8.5 GHz frequency ranges
[29] 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”