



CEPT Report 86

In response to the EC Permanent Mandate to CEPT regarding the regular update of the technical annex of the Commission Decisions on harmonisation of radio spectrum for use by Short Range Devices (SRD)

“Harmonised technical parameters for SRD radiodetermination applications in the frequency range 116-260 GHz”

approved 8 March 2024

0 EXECUTIVE SUMMARY

This Report contains proposed requirements to the technical conditions for the following specific radiodetermination applications in the frequency range 116-260 GHz to be exempt from individual licensing:

- Generic indoor surveillance radar;
- Radiodetermination systems for industry automation (RDI);
- Level probing radar (LPR);
- Contour determination and acquisition (CDR);
- Tank level probing radar (TLPR);
- Radiodetermination systems for industry automation in shielded environments (RDI-S);
- Exterior vehicular radar (EVR);
- In-cabin vehicular radar (IVR).

The recommended new framework for SRD in the frequency range 116-260 GHz is summarised in sections 4.2 to 4.9 for the different specific radiodetermination applications.

The detailed harmonised technical conditions for these specific radiodetermination applications in the frequency range 116-260 GHz are presented in Annex 1.

With respect to RDI-S, only a limited subset of applications able to be operated without using the passive bands subject to RR No. 5.340 are proposed for EU harmonisation in this Report. Administrations wishing to allow usage of RDI-S applications in the full range 116-260 GHz, including the passive bands to satisfy the industry needs, should follow the regulations given in ECC Decision (22)03 [4], where CEPT has no plan to amend this ECC Decision in this respect.

The full inclusion in the EU framework of the regulations for RDI-S, including the RR No. 5.340 passive bands, will be re-assessed during the tenth update cycle of the permanent SRD mandate based on the experience gained from national implementations of ECC Decision (22)03.

This Report has been developed in response to the permanent mandate to CEPT relating to Short Range Devices (SRD). Detailed coexistence studies, including technical parameters, which are the basis for this Report are provided in ECC Report 334 [1] and ECC Report 351 [2].

SRD under these conditions are expected to be exempt from individual licensing. The harmonisation on an EU basis would support EU Directive 2014/53/EU [6] of the European Parliament and of the Council of 16 April 2014 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (RED). Considering the significant number of new applications altogether using the same specific and new sub-terahertz band 116-260 GHz, CEPT invites the European Commission to consider for harmonisation a new dedicated EC Decision, since it is expected that these radiodetermination applications will not be subject to regular changes.

Additionally, CEPT has developed ECC Decision (22)03 to foster wider regional harmonisation of the use of the frequency range 116-260 GHz by Short Range Devices.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
CDR	Contour determination and acquisition radar
CEPT	European Conference of Postal and Telecommunications Administrations
DBF-CDR	Digital beamforming contour determination and acquisition radar
e.i.r.p.	Effective isotropic radiated power
EC	European Commission
ECC	Electronic Communications Committee
EESS	Earth Exploration Satellite Service
ETSI	European Telecommunications Standards Institute
EU	European Union
EVR	Exterior Vehicular Radar
FS	Fixed Service
ISM	Industrial, Scientific and Medical
ITU-R	International Telecommunication Union, Radiocommunication Sector
IVR	In-cabin Vehicular Radar
LOS	Line Of Sight
LPR	Level Probing Radar
M-CDR	Mechanical contour determination and acquisition radar
MCL	Minimum Coupling Loss
MIMO	Multiple Input Multiple Output
MWI	Microwave Imager
OFR	Operating Frequency Range
OoB	Out-of-Band
PA-CDR	Phased-array contour determination and acquisition radar
RAS	Radio Astronomy Service
RED	Radio Equipment Directive
RDI	Radiodetermination systems for industry automation
RDI-S	Radiodetermination systems for industry automation in shielded environments
SRD	Short Range Devices
TLPR	Tank Level Probing Radar
UWB	Ultra-Wideband

1 INTRODUCTION

This Report addresses the possible designation of the frequency range 116-260 GHz for the implementation of new specific radiodetermination applications. This is in accordance with the permanent mandate to CEPT relating to Short Range Devices (SRD) (see Annex 3).

The detailed coexistence studies, including technical parameters, which are the basis for this Report are provided in ECC Report 334 [1] and ECC Report 351 [2].

ECC Report 334 and ECC Report 351 studied the coexistence scenarios between UWB radiodetermination applications in the frequency band 116-260 GHz and the incumbent usages of radio astronomy service (RAS), earth exploration satellite service (EESS), fixed service (FS) and amateur service. The outcome of these studies has been regulated in ECC Decision (22)03 [4] in order to allow free circulation and use of these specific radiodetermination equipment throughout Europe.

An overview of the radiodetermination applications which have been regulated in ECC Decision (22)03 is given in section 2.2.

2 RADIODETERMINATION USE CASES CONSIDERED

2.1 INTRODUCTION

Radiodetermination applications are advancing into frequency regions beyond 100 GHz where challenging measurement objectives can be adequately satisfied.

With the increasing digitisation of industrial production processes, an increase of especially industrial automation requirements is expected. More and more individualised products are expected of being fabricated in highly or fully automated lines which contain lots of compact and flexible production units. These units will contain sensors for both, supporting the production process itself and supporting reconfiguration and change.

Thickness measurements in the recently fast-growing field of extruded plastic pipes and quality inspection like roughness determination of surfaces highly benefit from covering a wide modulation bandwidth to achieve an excellent range resolution and high measurement precision.

All the sensor systems for industrial purposes have in common that they need to be small, to be easily mounted in all kinds of applications, easily operable and they have to reliably function in harsh and adverse production environments with an outstanding measurement accuracy. They further should be equipped with small or even already chip-integrated antennas. The capability of fulfilling the individual measuring task with very low transmit power goes along with the requirement of supporting short response times which enable the detection and tracking of fast movements within the observation area.

Indoor radar applications will also play an important role in the home automation market, for intrusion detection or the very challenging contactless vital sign tracking and observation of persons inside a building e.g. in a hospital setting.

All above-mentioned measurement objectives are only achievable with the new spectrum designations for these specific radiodetermination applications (see ECC Report 334, section 2.5 [1]) in the range above 116 GHz where larger modulation bandwidths can be realised and therefore challenging measurement objectives can adequately be satisfied. In addition to that, the interference potential towards other spectrum users is lower in this high frequency range due to the higher free space loss and tendentially higher atmospheric attenuation.

The provision of new frequency bands above 116 GHz goes along with the utilisation of new semiconductor technologies. Several publicly funded projects (see ETSI TR 103 498, section 5.2 [3]) showed that the necessary semiconductor technologies are already available. The 1 GHz available bandwidth between 122 GHz and 123 GHz and the 2 GHz wide band from 244 GHz to 246 GHz, designated to non-specific Short Range Devices and also designated for industrial, scientific and medical (ISM) applications as defined in ITU Radio Regulations, are in most cases not sufficient to properly solve the specific and challenging measurement task.

2.2 APPLICATION OVERVIEW

The following radiodetermination applications in the band 116-260 GHz have been identified and studied in compatibility and sharing analyses whose results were set down in ECC Report 334 [1] and ECC Report 351 [2]:

- Generic indoor surveillance radar (section 2.2.1);
- Radiodetermination systems for industry automation (RDI) (section 2.2.2);
- Level probing radar (LPR) (section 2.2.3);
- Contour determination and acquisition (CDR) (section 2.2.4);
- Tank level probing radar (TLPR) (section 2.2.5);
- Radiodetermination systems for industry automation in shielded environments (RDI-S) (section 2.2.6);
- Exterior vehicular radar (EVR) (section 2.2.7);
- In-cabin vehicular radar (IVR) (section 2.2.8).

The outcome of the ECC Report 334 [1] study has been regulated in ECC Decision (22)03 [4]. All above mentioned applications have their own and unique peculiarities, technical parameters and deployment scenarios which influence the interference potential and mechanisms to other spectrum users. Furthermore, different frequency ranges have been identified as appropriate and requested for the different applications. Therefore, it was necessary to treat all applications individually and thus to conduct distinct compatibility studies for each individual application with respect to the existing radiocommunication services inside or adjacent to the requested frequency range.

2.2.1 Generic indoor surveillance radar

Generic indoor surveillance radar is used for measuring different physical parameters like presence, distance, velocity, or material properties of a target object. The obtained information is further processed and used for automation purposes within the home and building environment (smart home). The generic indoor surveillance radar application is intended for private use and has been divided into the two subcategories hand-held/mobile and fixed generic indoor use.

2.2.2 Radiodetermination systems for industry automation (RDI)

RDI is solely an industrial and professional application used for measuring different physical parameters like presence, distance, velocity or material properties of a target object. The obtained information is further processed and used exclusively for industrial automation purposes.

2.2.3 Level probing radar (LPR)

Level probing radar (LPR) is an industrial and professional application used in many industries to measure the distance to the surface of various materials and substances (mostly liquids and solids) and thus indirectly the amount of these goods in open-air areas or in tanks with non-attenuating shells (e.g. plastic tanks).

2.2.4 Contour determination and acquisition (CDR)

Contour determination and acquisition radar sensors (CDR) are the most advanced sensors in the emerging field of bulk level measurement. These sensors are equipped to gather a plurality of distance values to different points located on the surface of the bulk material. These distance values can be used to form a digital representation of the bulk material surface or contour and can consequently be used to determine the volume or mass of material available in the current measurement scenario.

CDR devices are classified in the two categories:

- mechanical- and phased-array CDR (M-CDR and PA-CDR);
- digital beamforming-CDR (DBF-CDR).

The categorisation has been conducted based on the acquisition of angular direction information which can be realised by mechanical tilting of a single antenna (M-CDR) and/or by electronic beam steering of multiple antenna elements forming a MIMO (multiple input multiple output) antenna. In case of electronic beam steering, time multiplexed operation of the multiple transmit antenna elements (DBF-CDR) as well as parallel operation of the transmit antenna elements (PA-CDR) will be feasible.

2.2.5 Tank level probing radar (TLPR)

Tank level probing radar (TLPR) is an industrial and professional application used in many different industries to determine the amount of a substance (mostly liquids and solids) inside shielded tanks or containers by means of a distance measurement.

2.2.6 Radiodetermination systems for industry automation in shielded environments (RDI-S)

Radiodetermination devices for industry automation to be used indoors or in similarly shielded environments are potentially used in many different industries. All RDI-S sensors have in common that they are used to sense unique frequency dependent features in the wideband frequency response of target objects. One

category are RDI-S systems for plastic extrusion thickness measurement. Covering a wide contiguous frequency bandwidth allows RDI-S applications to achieve a superior range resolution and measurement precision. The operation of RDI-S sensors is envisaged for industrial purposes only.

2.2.7 Exterior vehicular radar (EVR)

To perform different functionalities for driving assistance, cars are equipped with different types of radars that are integrated in specific positions onboard the vehicle.

Front and corner radars are used for driving assistance applications requiring long and medium range such as automatic cruise control, lane keep, lane change assist, automatic emergency braking, etc.

On the other hand, applications providing the vehicle with higher degree of autonomy require short and ultra-short-range radars for front, side and rear-view, such that 360° sensing is enabled. Those radars allow to obtain a wide field of view (elevation and azimuth) in the close proximity of the vehicle and enables features like automated parking assistance or autonomous valet parking. To perform such features, the short-range detection radars should be capable to detect a wide range of objects different in nature to those traditionally detected for driving assistance radars (pedestrian, bicycles, vehicles, etc.).

2.2.8 In-cabin vehicular radar (IVR)

In-cabin applications include contactless gesture control, presence detection (including baby/child detection) and vital sign monitoring such as respiration rate, heart rate and heart rate variation. The use of higher frequency ranges further reduces the risk of interference with other automotive radars (e.g. 77 GHz or 79 GHz radars) or wireless communication devices using the 60 GHz band. With the increasing miniaturisation, angular resolution offers the possibility to discriminate between multiple seats inside a car with a single radar sensor with beamforming or MIMO capability.

Planned common use cases include:

- Gesture detection/proximity detection: for example, a fine finger motion for manipulating controls/settings;
- Passenger presence and seating location detection: for example, assessing occupancy at one or more seats, which can be in a vehicle or in a room. Such functions are often meant to classify the occupancy, e.g. distinguishing between a bag and a person on a seat, thus requiring accurate scene information. Distinguishing between multiple occupants can be done with digital beam forming;
- Forgotten occupant detection: for example, the presence of vital signs is detected by evaluating micro-motion caused by a heartbeat and/or breathing. This use-case also includes child presence detection, a human safety related feature, which is going to be awarded by the European New Car Assessment Programme (Euro NCAP) from 2023. The main function is to detect babies and small children left behind in a vehicle and to prevent harm or the possible death from heat stroke;
- Occupant posture detection: for example, assessing the contour of the body to determine upper body location, e.g. in support of vehicle safety systems deployment;
- Upper body/head position and tracking: for example, for detection of driver attentiveness of occupant's vital sign tracking (heartbeat/breathing): for example, assessment of the physical well-being e.g. inside a vehicle of a person (or persons) in the scene. The presence and evolution of life signs is detected by assessing micro-motion caused by a heartbeat and/or breathing;
- Intrusion detection system.

3 REVIEW OF COEXISTENCE ISSUES

3.1 OVERVIEW

The concept, the technical properties and deployment characteristics of the related applications listed in section 2.2 were communicated to CEPT with appropriate request for authorisation of use of spectrum in ETSI TR 103 498 [3]. For these applications, different candidate frequency bands in the frequency range from 116 GHz up to 260 GHz have been identified (see ECC Report 334, section 2.2 and section 3.1 [1] and ECC Report 351, section 2.1.2 and section 2.2.2 [2]) and investigated in MCL-based deterministic analyses.

It should be noted that the analyses in ECC Report 334 and ECC Report 351 do not cover generic Extremely High Frequency (EHF) regulations for use by terrestrial services as authorised in one CEPT country. The studies performed when making these national regulations used different sharing criteria.

The following radio services, operating either in these candidate bands or adjacent to them, have been identified as possible victims of interference arising from the mentioned radiodetermination applications (ECC Report 334, section 3.2 and ECC Report 351, section 2.1.2):

- radio astronomy service;
- fixed service;
- earth exploration satellite service (passive);
- amateur service;
- mobile service (not studied).

A detailed graphical overview of the band assignments to these radiocommunication services, inside and nearby each investigated candidate band, is given in ECC Report 334, section 3.3.

The evaluation of the maximum interference ranges for the different radiodetermination applications under consideration for all terrestrial victims was carried out using an MCL deterministic approach by applying a worst-case interference scenario of one single interferer to one terrestrial victim receiver. All MCL calculations have been performed with line-of-sight (LOS) conditions (except for those interferers which are only located indoors) and without any natural shielding, like vegetation and other obstacles, located in the direct path from the interferer to the victim. It should be noted that as radiodetermination SRD are not defined as radiocommunication services and that there are a number of different radiodetermination applications being studied in this Report, a degree of caution has been taken when looking at sharing impacts and criteria used. As a result, all calculated interference impacts represent the most conservative estimates, which in many real-life scenarios will be further reduced due to the aforementioned natural shielding mechanisms.

For the space-based victims, like EESS, the margins to the protection criteria, i.e. the maximum interference level in the victim receiver, have been also calculated in a single-entry scenario assuming worst-case conditions. In addition, a scenario where the aggregation of numerous interfering devices located in the satellite field of view on Earth's surface have been considered.

The calculations are provided in separate calculation sheets which are annexed to ECC Report 334 and ECC Report 351. The results of these studies and the conclusions are provided in section 4.

Finally, it is worth to mention that the conducted calculations were supported by three specific actual measurement campaigns. In the first campaign the transmission attenuation of typical building materials has been evaluated in the frequency range 120-175 GHz (see ECC Report 334, annex 2). This was necessary in order to determine reasonable values for the indoor to outdoor attenuation for all applications which are only used indoors, like RDI-S.

In the second measurement trial, the reflection attenuation of a flat and smooth sand surface in different angles of incidence has been evaluated in the frequency range from 140 GHz up to 330 GHz (see ECC Report 334, annex 3). The reflection attenuation of this ideal sand surface has been used in the study for level probing radar (LPR) and contour detection radar (CDR) as a worst-case reflection scenario.

A third measurement campaign, documented in ECC Report 351, annex 1, investigated the attenuation provided by car bodies with and without sunroof towards EESS (passive).

190-191.8	5.340								
191.8-200									
200-209	5.340								
209-226									
226-231.5	5.340								
231.5-235									
235-238									
238-241									
241-250									
250-252	5.340								
252-260									

Note 1: RDI-S equipment shall only be operated indoors (i.e. inside a building) or inside similarly shielded environments

Compatibility can be ensured without the implementation of additional mitigation measures under the conditions summarised in

- ECC Report 334, section 8 and the technical conditions in chapters 4 to 7, and
- ECC Report 351, section 7 and the technical conditions in chapters 3 to 6.

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- ECC Report 334, section 8 and the technical conditions in chapters 4 to 7, and
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3.2 GENERIC INDOOR SURVEILLANCE RADAR

3.2.1 Summary

For generic indoor surveillance radar the candidate frequency bands 116-130 GHz, 134-141 GHz and 141-148.5 GHz have been studied for both categories of such devices, hand-held/mobile and fixed. It turned out that only in the bands 122.25-130 GHz, 134-141 GHz and 141-148.5 GHz compatibility between generic indoor surveillance radars and all investigated radio services can be ensured.

The lower portion, 116-122.25 GHz, of the whole candidate band 116-130 GHz has also been investigated. However, compatibility between generic indoor surveillance radar sensors and EESS (passive) cannot be ensured in this band portion assuming the power levels given in ECC Report 334, section 6.1.1 [1].

The following protection requirements have been assumed:

- radio astronomy: Separation distance smaller than 20 km;
- fixed service and amateur service: Separation distance smaller than 300 m;
- earth exploration satellite service (passive): positive margin to the maximum interference level in the victim receiver (see ECC Report 334, section 3.5.4.2).

All fixed generic indoor surveillance radars should comply with the following (installation) requirements:

- Fixed generic indoor surveillance radars shall only be installed and operated inside buildings;
- Users and installers have to ensure that fixed generic indoor surveillance radars, although installed inside a building, do not perform a function outside the building structure, such as for example the detection of persons outside the building (e.g. through wall imaging);
- The provider is required to inform the users and installers of fixed generic indoor surveillance equipment about the installation requirements and the additional special mounting instructions.

In addition, the following antenna requirement is proposed:

- For fixed generic indoor surveillance radars, the mean e.i.r.p. above 0° elevation shall be limited to 12 dBm (8 dB below the maximum mean e.i.r.p. of 20 dBm).

3.2.2 Radio astronomy

The separation distances in the lower frequency range 123-158.5 GHz obtained in the single-entry study are for the fixed generic indoor surveillance radar devices 35.2 km for the outdoor consideration and 10.7 km for the indoor case. For the hand-held/mobile generic indoor surveillance equipment the separation distances are 19 km for the outdoor consideration and 1.6 km for the indoor case.

Therefore, to reach compatibility for the fixed indoor equipment an installation requirement limiting the related mean e.i.r.p. to a maximal value of 12 dBm for elevation angles larger than 0° could be requested. In this case the separation distance would drop to 17.5 km for the outdoor consideration.

For the frequency bands 76-116 GHz, 148.5-151.5 GHz (adjacent frequency situation) compatibility can be ensured between both types of generic indoor surveillance radar equipment and RAS without the implementation of additional mitigation techniques. The separation distances obtained in the MCL calculations are all below 5 km.

Operational solutions to implement these separation distances were not studied in ECC Report 334 [1].

3.2.3 Fixed service

For evaluating the compatibility between generic indoor surveillance radar and FS the two worst-case interference scenarios in ECC Report 334, figure 3 and figure 4 have been defined (see ECC Report 334, section 2.2.1.6). In both scenarios it is valid that separation distances smaller than 300 m result in compatibility between RDI and FS such that a coexistence of both systems is always given. Separation distances larger than 300 m in contrast produce interference to the FS receiver such that the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled. In this case, the coexistence of both systems is not possible in the respective scenario without further protection measures.

For the hand-held/mobile and fixed generic indoor surveillance equipment the largest separation distance in the in-band interference situation was determined to be 290 m. For the adjacent band situation, the separation distance was determined to be 50 m.

If in addition the antenna pattern (8 dB below the maximum mean e.i.r.p. above an elevation of larger than 0°) was considered for the fixed generic indoor surveillance radar a smaller separation distance and thus a lower probability of interference would result. The same would apply to both generic indoor surveillance device categories if a clutter loss was considered in the terrestrial path.

In the aggregate consideration the number of required devices in order to interfere with the FS receiver (in the worst-case 17 per floor) would by far outnumber the expected device numbers per house (5) or per flat (3).

3.2.4 Earth exploration satellite service (Passive)

For the single-entry consideration, in all investigated frequency bands ample margins to the interference criteria can be ensured without the implementation of additional mitigation techniques (see ECC Report 334, table 84 [1]).

For the aggregate scenario, however, in the lower portion 116-122.25 GHz of the candidate band 116-130 GHz compatibility between generic indoor surveillance radar sensors and EESS (passive) (in-band scenario) cannot be ensured assuming the conditions shown in ECC Report 334, table 83 without the implementation of additional mitigation techniques. In the remaining portion 122.25-130 GHz of this band and in the bands 134 - 141 GHz and 141-148.5 GHz only an adjacent band situation occurs to EESS (passive). Under these circumstances, the aggregate studies have shown that compatibility could be reached without the implementation of additional mitigation techniques. The margins in ECC Report 334, table 85 [1] are only exceeded by 0.9 and 1.2 dB, respectively.

It is however important that the generated interference in the out-of-band domain is at least 20 dB below the in-band emission. That means the maximum mean e.i.r.p. and the maximum mean e.i.r.p. spectral density should be reduced in adjacent bands allocated to EESS (passive) by at least 20 dB.

If in addition an installation requirement limiting the related mean e.i.r.p. to a maximal value of 12 dBm for elevation angles larger than 0° for the fixed indoor equipment was applied, the margin for the aggregate interference would rise to 0.1 dB in the band 114.25-122.25 GHz.

3.2.5 Amateur service

For the amateur service the same criterion as for the fixed service has been consulted. In this interference scenario, separation distances smaller than 300 m result in compatibility between the interfering device and radio service such that a coexistence of both systems can be ensured. For separation distances larger than 300 m the probability of interference increases such that a compatibility cannot be ensured in all cases.

The results illustrated in ECC Report 334, table 113 [1] suggest that compatibility between generic indoor surveillance radar sensors for both types, hand-held/mobile and fixed, and amateur can be asserted in all investigated frequency bands without the implementation of additional mitigation techniques (see ECC Report 334, section 7.1.1).

3.3 RADIODETERMINATION SYSTEMS FOR INDUSTRY AUTOMATION (RDI)

3.3.1 Summary

For RDI the candidate frequency bands 116-130 GHz, 134-141 GHz, 174.8-182 GHz, 185-190 GHz and 231.5-250 GHz have been studied. It turned out that only in the upper three frequency ranges 174.8-182 GHz, 185-190 GHz and 231.5-250 GHz compatibility between RDI and all investigated radio services can be ensured.

The candidate bands 116-130 GHz and 134-141 GHz have also been investigated. However, compatibility between RDI and RAS cannot be ensured in these bands assuming the power levels given in ECC Report 334, section 4.2.1 without the implementation of additional mitigation techniques.

The following protection requirements have been assumed:

- radio astronomy: Separation distance smaller than 20 km;
- fixed service and amateur service: Separation distance smaller than 300 m;
- earth exploration satellite service (passive): positive margin to the maximum interference level in the victim receiver (see ECC Report 334, section 3.5.4.2).

All RDI sensors should furthermore comply with the following (installation) requirements:

- The operation of RDI sensors is envisaged for industrial purposes only;
- Installation and maintenance of RDI equipment shall be performed by professionally trained individuals only;
- RDI equipment shall not be marketed to private end customers;
- Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
- All outdoor RDI sensors under consideration shall be installed in heights from 0 m to 3 m above ground;
- In order to protect the radio astronomy service, inside a radius of 20 km around the stations of NOEMA and IRAM 30 m, the installation and operation of RDI devices should be prohibited, unless a special authorisation has been provided by the responsible national administration. Table 12 shows the locations of the two European observatories operating in the frequency range 116-260 GHz;
- The provider is required to inform the users and installers of RDI equipment about the installation requirements and the additional special mounting instructions.

In addition, the following antenna requirement is proposed:

- For RDI devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

3.3.2 Radio astronomy

The required separation distances in the lower frequency ranges 116-130 GHz and 134-141 GHz obtained in the single-entry study are 53.3 km and 63.0 km, respectively. These relatively large impact ranges increase the probability of interference to the affected radio astronomy stations. Therefore, compatibility between RDI and RAS cannot be ensured in these bands assuming the power levels given in ECC Report 334, table 52 [1] without the implementation of additional mitigation techniques (see ECC Report 334, section 4.2.1).

For the frequency bands 174.8-182 GHz, 185-190 GHz and 231.5-250 GHz compatibility can be ensured between RDI and RAS when separation distances of 15.3 km, 9.6 km and 19.9 km, respectively, are respected without the implementation of additional mitigation techniques (see ECC Report 334, section 4.2.2).

3.3.3 Fixed service

For evaluating the compatibility between RDI and FS the two worst-case interference scenarios in ECC Report 334, figure 12 and figure 13 have been defined (see ECC Report 334, section 2.2.2.6). In both scenarios, it is valid that separation distances smaller than 300 m result in compatibility between RDI and FS such that a coexistence of both systems is always given. Separation distances larger than 300 m in contrast produce interference to the FS receiver such that the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled. In this case, the coexistence of both systems is not possible in the respective scenario without further protection measures.

All calculated separation distances for RDI in ECC Report 334, table 73 are smaller than 300 m (see ECC Report 334, section 5.2.2). Therefore, compatibility between RDI and FS can always be asserted for all investigated frequency bands, for both scenarios and both protection objectives without the implementation of additional mitigation techniques.

3.3.4 Earth exploration satellite service (Passive)

For the frequency band 116-130 GHz the protection criterion is exceeded for the single-entry case by 0.8 dB under the assumed conditions shown in ECC Report 334, table 86. However, a reduction of the mean power spectral density of at least 0.8 dB could be considered in order to ensure compatibility. In all other frequency bands the interference criteria can be ensured without the implementation of additional mitigation techniques. Even for the aggregate case, there is sufficient margin to the interference criteria. (see ECC Report 334, table 88).

3.3.5 Amateur service

For the amateur service the same criterion as for the fixed service has been consulted. In this interference scenario, separation distances smaller than 300 m result in compatibility between the interfering device and radio service such that a coexistence of both systems can be ensured. For separation distances larger than 300 m, the probability of interference increases such that a compatibility cannot be ensured in all cases.

The results illustrated in ECC Report 334, table 115 [1] suggest that compatibility between RDI and amateur can only be asserted in the investigated frequency band 231.5-250 GHz without the implementation of additional mitigation techniques (see ECC Report 334, section 7.2.2).

3.4 LEVEL PROBING RADAR (LPR)

3.4.1 Summary

For LPR the candidate frequency bands 116-148.5 GHz, 167-182 GHz and 231.5-250 GHz have been studied. It turned out that in all three frequency ranges compatibility between LPR and all investigated radio services can be ensured.

The following protection requirements have been assumed:

- radio astronomy: Separation distance smaller than 20 km;
- fixed service and amateur service: Separation distance smaller than 300 m;
- earth exploration satellite service (passive): positive margin to the maximum interference level in the victim receiver (see ECC Report 334, section 3.5.4.2 [1]).

All level probing radars should furthermore comply with the following (installation) requirements:

- The operation of LPR sensors is envisaged for industrial purposes only;
- Installation and maintenance of LPR equipment shall be performed by professionally trained individuals only;
- LPR equipment shall not be marketed to private end customers;
- Level probing radars are required to be installed at a permanent fixed position pointing in a downwards direction towards the ground. The equipment shall not operate while being moved, or while inside a moving container;
- Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
- In order to protect the radio astronomy service, inside a radius of 13 km around the stations of NOEMA and IRAM 30 m, the installation and operation of LPR devices should be prohibited, unless a special authorisation has been provided by the responsible national administration. Table 12 shows the locations of the two European observatories operating in the frequency range 116-260 GHz;
- The provider is required to inform the users and installers of LPR equipment about the installation requirements and the additional special mounting instructions.

In addition, the following two requirements are proposed:

- For LPR devices, the peak e.i.r.p. for elevations above 0° shall be limited to 0 dBm;
- For LPR devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

3.4.2 Radio astronomy

For the frequency bands 116-148.5 GHz, 167-182 GHz and 231.5-250 GHz compatibility can be ensured between LPR and RAS when separation distances of 13 km, 10 km and 6.4 km, respectively, are respected without the implementation of additional mitigation techniques (see ECC Report 334, section 4.5.2).

3.4.3 Fixed service

For evaluating the compatibility between LPR and FS the two worst-case interference scenarios in ECC Report 334, figure 38 and figure 39 have been defined (see ECC Report 334, section 2.2.5.6). In both scenarios, it is valid that separation distances smaller than 300 m result in compatibility between LPR and FS such that a coexistence of both systems is always given. Separation distances larger than 300 m in contrast produce interference to the FS receiver such that the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled. In this case, the coexistence of both systems is not possible in the respective scenario without further protection measures.

All calculated separation distances for LPR in ECC Report 334, table 75 are smaller than 300 m (see ECC Report 334, section 5.5.2). Therefore, compatibility between LPR and FS can always be asserted for both

scenarios, and both investigated protection objectives without the implementation of additional mitigation techniques.

In order to restrict the interference in unwanted directions, e.g. over sidelobes of the antenna, a limitation of the peak e.i.r.p. to 0 dBm is proposed for elevations above 0°.

3.4.4 Earth exploration satellite service (passive)

For the frequency band 116-148.5 GHz under the assumed conditions illustrated in ECC Report 334, table 95 [1] only a margin of 0.1 dB to the protection criterion can be ensured for the single-entry case. However, for all other frequency bands and in particular for the aggregate consideration in all bands, ample margins to the interference criteria can be ensured without the implementation of additional mitigation techniques (see ECC Report 334, section 6.5.2).

3.4.5 Amateur service

For the amateur service the same criterion as for the fixed service has been consulted. In this interference scenario, separation distances smaller than 300 m result in compatibility between the interfering device and radio service such that a coexistence of both systems can be ensured. For separation distances larger than 300 m the probability of interference increases such that a compatibility cannot be ensured in all cases.

The results illustrated in ECC Report 334, table 117 [1] suggest that compatibility between LPR and amateur can be asserted in all investigated frequency bands without the implementation of additional mitigation techniques (see ECC Report 334, section 7.5.2).

3.5 CONTOUR DETECTION AND ACQUISITION (CDR)

3.5.1 Summary

For CDR the candidate frequency bands 116-148.5 GHz, 167-182 GHz and 231.5-250 GHz have been studied for both categories of CDR devices, DBF-CDR and M-CDR/PA-CDR. It turned out that in all three frequency ranges compatibility between both CDR categories and all investigated radio services can be ensured.

The following protection requirements have been assumed:

- radio astronomy: Separation distance smaller than 20 km;
- fixed service and amateur service: Separation distance smaller than 300 m;
- earth exploration satellite service (passive): positive margin to the maximum interference level in the victim receiver (see ECC Report 334, section 3.5.4.2 [1]).

All contour determination and acquisition sensors should furthermore comply with the following (installation) requirements:

- The operation of CDR sensors is envisaged for industrial purposes only;
- Installation and maintenance of CDR equipment shall be performed by professionally trained individuals only;
- CDR equipment shall not be marketed to private end customers;
- CDR equipment is required to be installed at a permanent fixed position. The equipment shall not operate while being moved;
- Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
- In order to protect the radio astronomy service, inside a radius of 20 km around the stations of NOEMA and IRAM 30 m, the installation and operation of CDR devices should be prohibited, unless a special authorisation has been provided by the responsible national administration. Table 12 shows the locations of the two European observatories operating in the frequency range 116-260 GHz;
- The provider is required to inform the users and installers of CDR equipment about the installation requirements and the additional special mounting instructions.

In addition, the following antenna requirement is proposed:

- For CDR devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

In addition to the installation and antenna requirements above, applicable to all CDRs, the following condition is proposed to be met only for the subclass of DBF-CDR:

- DBF-CDRs are required to be pointing vertically downwards towards the ground.

In addition to the installation and antenna requirements above, applicable to all CDRs, the following conditions are proposed to be met only for the subclass of M-CDRs and PA-CDRs:

- M-CDRs and PA-CDRs shall have a permanent spatially scanning behaviour of the antenna main beam direction at any time during operation;
- The maximum tilting angle of the antenna main beam direction in relation to the vertical axis towards the ground shall never exceed 60°;
- The peak e.i.r.p. for elevations above 0° shall be limited to 0 dBm.

3.5.2 Radio astronomy

For the frequency bands 116-148.5 GHz, 167-182 GHz and 231.5-250 GHz compatibility can be ensured between both CDR systems and RAS when separation distances of 19.9 km, 18.3 km and 19.3 km, respectively, are respected without the implementation of additional mitigation techniques (see ECC Report 334, section 4.6.2).

3.5.3 Fixed service

For evaluating the compatibility between DBF-CDR and FS the same two worst-case interference scenarios as for LPR (see ECC Report 334, figure 38 and figure 39 [1]) have been used. In both scenarios it is valid that separation distances smaller than 300 m result in compatibility between DBF-CDR and FS such that a coexistence of both systems is always given. Separation distances larger than 300 m in contrast produce interference to the FS receiver such that the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled. In this case the coexistence of both systems is not possible in the respective scenario without further protection measures.

All calculated separation distances for DBF-CDR in ECC Report 334, table 77 are smaller than 300 m. Therefore, compatibility between DBF-CDR and FS can always be asserted for both scenarios and both investigated protection objectives without the implementation of additional mitigation techniques.

For evaluating the compatibility between M-CDR/PA-CDR and FS the four different worst-case interference scenarios in ECC Report 334, figure 44 to figure 47 have been assumed. In all scenarios, it is valid that separation distances smaller than 300 m result in compatibility between M-CDR/PA-CDR and FS such that a coexistence of both systems is always given. Separation distances larger than 300 m in contrast produce interference to the FS receiver such that the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled. In this case the coexistence of both systems is not possible in the respective scenario without further protection measures.

All calculated separation distances for M-CDR and PA-CDR for the long-term interference criterion in ECC Report 334, table 78 are smaller than 300 m. Therefore, compatibility between M-CDR/PA-CDR and FS can always be asserted for all four scenarios and the long-term interference criterion without the implementation of additional mitigation techniques.

For the peak power objective, however, for scenario 3 in ECC Report 334, figure 46, separation distances larger than 300 m result for both evaluated frequency ranges (see ECC Report 334, table 78). In this scenario a separation distance of 1.05 km is required. Consequently, the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled.

In order to eliminate this incompatibility in the peak power objective, the occurrence of scenario 3 must be prevented. This could be accomplished by the limitation of the maximum tilting angle of the M-CDR and PA-

CDR main beam direction to angles in the range smaller than 60° in relation to the vertical downward direction towards the ground. Such a measure is suggested and would eliminate the critical scenario 3, defined in ECC Report 334, figure 46, "CDR main beam direction in horizontal direction" completely.

In order to further restrict the interference in unwanted directions, e.g. over sidelobes of the antenna, a limitation of the peak e.i.r.p. to 0 dBm for M-CDR and PA-CDR equipment is proposed for elevations above 0°.

3.5.4 Earth exploration satellite service (Passive)

For all investigated frequency bands and both CDR categories, in the single-entry and in particular in the aggregate consideration, ample margins to the interference criteria can be ensured without the implementation of additional mitigation techniques (see ECC Report 334, section 6.6.2 [1]).

3.5.5 Amateur service

For the amateur service, the same criterion as for the fixed service has been consulted. In this interference scenario, separation distances smaller than 300 m result in compatibility between the interfering device and radio service such that a coexistence of both systems can be ensured. For separation distances larger than 300 m the probability of interference increases such that a compatibility cannot be ensured in all cases.

The results illustrated in ECC Report 334, table 119 and table 120 suggest that compatibility between both CDR systems and amateur can be asserted in all investigated frequency bands without the implementation of additional mitigation techniques.

3.6 TANK LEVEL PROBING RADAR (TLPR)

3.6.1 Summary

For TLPR the candidate frequency bands 116-148.5 GHz, 167-182 GHz and 231.5-250 GHz have been studied. It turned out that in all three frequency ranges compatibility between TLPR and all investigated radio services can be ensured.

The following protection requirements have been assumed:

- radio astronomy: Separation distance smaller than 20 km;
- fixed service and amateur service: Separation distance smaller than 300 m;
- earth exploration satellite service (passive): positive margin to the maximum interference level in the victim receiver (see ECC Report 334, section 3.5.4.2 [1]).

All tank level probing radars should furthermore comply with the following (installation) requirements:

- The operation of TLPR sensors is envisaged for industrial purposes only;
- Installation and maintenance of TLPR equipment shall be performed by professionally trained individuals only;
- TLPR equipment shall not be marketed to private end customers;
- TLPRs shall be installed at a permanent fixed position at a closed metallic tank or concrete tank, or a similar enclosure structure made of comparable attenuating material;
- Flanges and attachments of the TLPR equipment shall provide the necessary microwave sealing by design;
- Sight glasses shall be coated with a microwave-proof coating when necessary (i.e. electrically conductive or microwave absorbing coating);
- Manholes or connection flanges attached to the tank shall be closed while the TLPR equipment is in operation to ensure a low-level leakage of the signal into the free space outside the tank;
- The provider is required to inform the users and installers of TLPR equipment about the installation requirements and the additional special mounting instructions.

In addition, the following antenna requirement is proposed:

- For TLPR devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

3.6.2 Radio astronomy

For the frequency bands 116-148.5 GHz, 167-182 GHz and 231.5-250 GHz compatibility can be ensured between TLPR and RAS when separation distances of 5.3 km, 2.7 km and 1 km, respectively, are respected without the implementation of additional mitigation techniques (see ECC Report 334, section 4.7.2 [1]). Industrial areas where TLPR sensors are usually installed and operated are not located in such close proximity to radio astronomy stations. Therefore, the implementation of specific exclusion zones around radio astronomy stations is not suggested.

3.6.3 Fixed service

For evaluating the compatibility between TLPR and FS the two worst-case interference scenarios in ECC Report 334, figure 53 and figure 54 have been defined. In both scenarios it is valid that separation distances smaller than 300 m result in compatibility between TLPR and FS such that a coexistence of both systems is always given. Separation distances larger than 300 m in contrast produce interference to the FS receiver such that the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled. In this case the coexistence of both systems is not possible in the respective scenario without further protection measures.

All calculated separation distances for TLPR in ECC Report 334, table 80 are smaller than 300 m. Therefore, compatibility between TLPR and FS can always be asserted for both scenarios, and both investigated protection objectives without the implementation of additional mitigation techniques.

3.6.4 Earth exploration satellite service (Passive)

For all investigated frequency bands in particular for the aggregate consideration ample margins to the interference criteria can be ensured without the implementation of additional mitigation techniques (see ECC Report 334, section 6.7.2).

3.6.5 Amateur service

For the amateur service the same criterion as for the fixed service has been consulted. In this interference scenario, separation distances smaller than 300 m result in compatibility between the interfering device and radio service such that a coexistence of both systems can be ensured. For separation distances larger than 300 m, the probability of interference increases such that a compatibility cannot be ensured in all cases.

The results illustrated in ECC Report 334, table 122 suggest that compatibility between TLPR and amateur can be asserted in all investigated frequency bands without the implementation of additional mitigation techniques (see ECC Report 334, section 7.7.2).

3.7 RADIODETERMINATION SYSTEMS FOR INDUSTRY AUTOMATION IN SHIELDED ENVIRONMENTS (RDI-S)

3.7.1 Summary

For RDI-S the frequency band 116-260 GHz has been studied. It turned out that in the whole frequency range compatibility between RDI-S and all investigated radio services can be ensured.

The following protection requirements have been assumed:

- radio astronomy: Separation distance smaller than 20 km;
- fixed service and amateur service: Separation distance smaller than 300 m;
- earth exploration satellite service (passive): positive margin to the maximum interference level in the victim receiver (see ECC Report 334, section 3.5.4.2 [1]).

All RDI-S sensors should furthermore comply with the following (installation) requirements:

- The operation of RDI-S sensors is envisaged for industrial purposes only;
- Installation and maintenance of RDI-S equipment shall be performed by professionally trained individuals only;
- RDI-S equipment shall not be marketed to private end customers;
- Installers have to ensure that the device main beam is not pointing towards windows or other weak shielded parts of the shielded environment. The direction of main radiation shall be indicated on the device;
- Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
- For RDI-S, the operating frequency range (OFR) shall be higher than 35 GHz, including discontinuities for the passive bands;
- In order to protect the radio astronomy service, inside a radius of 13.2 km around the stations of NOEMA and IRAM 30 m the installation and operation of RDI-S devices should be prohibited, unless a special authorisation has been provided by the responsible national administration. Table 12 shows the locations of the two European observatories operating in the frequency range 116-260 GHz;
- The provider is required to inform the users and installers of RDI-S equipment about the installation requirements and the additional special mounting instructions.

In addition, the following antenna requirement is proposed:

- For RDI-S devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

3.7.2 Radio astronomy

For the investigated frequency band compatibility can be ensured between RDI-S and RAS when a separation distance of 13.2 km is respected without the implementation of additional mitigation techniques (see ECC Report 334, section 4.8.2 [1]).

3.7.3 Fixed service

For evaluating the compatibility between RDI-S and FS the two worst-case interference scenarios in ECC Report 334, figure 60 and figure 61 [1] have been defined. In both scenarios, it is valid that separation distances smaller than 300 m result in compatibility between RDI-S and FS such that a coexistence of both systems is always given. Separation distances larger than 300 m in contrast produce interference to the FS receiver such that the protection requirements identified in ECC Report 334, section 3.5.3 are not fulfilled. In this case the coexistence of both systems is not possible in the respective scenario without further protection measures.

All calculated separation distances for RDI-S in ECC Report 334, table 82 are smaller than 300 m. Therefore, compatibility between RDI-S and FS can always be asserted for both scenarios and both investigated protection objectives without the implementation of additional mitigation techniques.

3.7.4 Earth exploration satellite service (Passive)

For the investigated frequency band, and for both, the single-entry and the aggregate consideration, ample margins to the interference criteria and therefore compatibility can be ensured without the implementation of additional mitigation techniques (see ECC Report 334, section 6.8.2).

3.7.5 Amateur service

For the amateur service the same criterion as for the fixed service has been consulted. In this interference scenario, separation distances smaller than 300 m result in compatibility between the interfering device and radio service such that a coexistence of both systems can be ensured. For separation distances larger than 300 m the probability of interference increases such that a compatibility cannot be ensured in all cases.

The results illustrated in ECC Report 334, table 124 [1] suggest, that compatibility between RDI-S and amateur can be asserted in the whole investigated frequency band without the implementation of additional mitigation techniques.

3.8 EXTERIOR VEHICULAR RADAR (EVR)

3.8.1 Summary

The following conditions need to be fulfilled for coexistence:

- In the band 116-122.25 GHz, EESS (passive) band, compatibility with EESS (passive) determines the allowable unwanted emissions, up to -50 dBm/MHz mean e.i.r.p. density and -76 dBm/MHz maximum e.i.r.p. density above 35 degrees elevation for duty cycles $\leq 50\%$, and up to -53 dBm/MHz mean e.i.r.p. density and 79 dBm/MHz maximum e.i.r.p. density above 35 degrees elevation for duty cycles $> 50\%$.
- In the bands 122.25-130 GHz and 134-141 GHz, sharing with RAS determines the operating conditions. Outside the coordination and exclusion zones, front radars can have a mean e.i.r.p. up to 32 dBm in a bandwidth of 8 GHz, while corner and short/ultra-short range radars can have up to 9 dBm mean e.i.r.p. in 8 GHz.

Between 130-134 GHz, compatibility with fixed services is the most critical. This is possible with:

- Maximum mean power spectral density of -33 dBm/MHz e.i.r.p. for the front radars;
- Maximum mean power spectral density of -36 dBm/MHz e.i.r.p. for the corner and short/ultra-short range radar.

In the band 141-148.5 GHz, sharing with fixed services determines the operating conditions. The maximum wanted emissions requirements for all types of radar are:

- power spectral density (PSD) of -36 dBm/MHz e.i.r.p.;
- -6 dBm mean e.i.r.p. within 1 GHz;
- -1 dBm peak e.i.r.p. within 1 GHz.

Finally, for the band 148.5-151 GHz, compatibility with EESS (passive) determines the allowable out-of-band emissions, up to -44 dBm/MHz mean e.i.r.p. density and up to -70 dBm/MHz mean e.i.r.p. density above 35 degrees elevation for duty cycles $\leq 50\%$, and up to -47 dBm/MHz mean e.i.r.p. density and up to -73 dBm/MHz mean e.i.r.p. density above 35 degrees elevation for duty cycles $> 50\%$.

In addition, in the immediate vicinity of RAS stations (e.g. 3 km radius) automatic switch-off of Short Range Devices should be considered. Likewise, coordination zones around RAS sites could be implemented to allow more flexibility regarding the transmission parameters.

3.8.2 Radio astronomy

A single-interferer scenario compatibility study between radio astronomy service (RAS) and radiodetermination devices for exterior vehicular radar has been conducted.

The study shows that separation distances are needed between the Short Range Devices and the observatories of NOEMA in France and IRAM 30 m in Spain in order to protect the RAS. These separation distances are dependent on the frequency and on the e.i.r.p. of the interfering Short Range Devices. The effectual mean e.i.r.p. of the SRD which has been considered for this single-interferer study were 9 and 32 dBm in a bandwidth of 8 GHz, corresponding to the maximum power levels of corner and short/ultra-short radars, or front radars, respectively.

The study shows that separation distances around the radioastronomy sites of NOEMA in France for a maximum allowed mean e.i.r.p. level of 32 dBm in a bandwidth of 8 GHz, and IRAM 30 m in Spain for e.i.r.p. levels of 9 and 32 dBm in a bandwidth of 8 GHz have to be respected for the emissions of the radio determination devices for exterior vehicular radar.

An implementation of an automatic system to disable the transmission of the short-range device coupled with geo-positioning of the vehicle, referred to as “exclusion zone”, should be considered in order to protect the immediate vicinity (e.g. 3 km radius) of each RAS site.

An implementation of an automatic system to adapt the transmission parameters of the short-range device coupled with geo-positioning of the vehicle, referred to as “coordination zone”, should be considered in order to overcome compatibility issues. Several proposals for the definition of coordination zones are provided in ECC Report 351, annex 3 for both NOEMA in France and IRAM 30 m in Spain.

Although no aggregated studies were performed, it was expected that single entry studies provide a reasonable approximation.

3.8.3 Fixed service

The single entry interference studies show that operation in the bands adjacent to fixed service is possible provided that the mean power densities in the fixed service bands are at most -33 dBm/MHz e.i.r.p. for the front radars and -36 dBm/MHz e.i.r.p. for the corner and short/ultra-short range radars. The corresponding peak power levels are 2 dBm e.i.r.p. within 1 GHz for the front radars and -1 dBm e.i.r.p. within 1 GHz for the corner and short/ultra-short range radars.

Co-channel operation in the 141-148.5 GHz band between the exterior vehicular radars and fixed services is only possible provided that the mean power densities are at most -33 dBm/MHz e.i.r.p. for the front radars and -36 dBm/MHz e.i.r.p. for the corner and short/ultra-short range radars. The corresponding peak power levels are 2 dBm e.i.r.p. within 1 GHz for the front radars and -1 dBm e.i.r.p. within 1 GHz for the corner and short/ultra-short range radars.

3.8.4 Earth exploration satellite service (Passive)

For all investigated frequency ranges, the EESS (passive) protection criterion is satisfied for the considered aggregate scenarios, for any radar types, including aggregation of all radar types. Under the assumed technical parameters, and the interference scenarios, it is concluded that compatibility of exterior vehicular radar can be ensured with EESS (passive).

Additional calculations have shown that a protection level of -49 dBm/MHz is required for the MWI system in the 116-122.25 GHz band as the most stringent requirement, while protection of system N1 outer in the 141-148.5 GHz band requires a protection level of -43.5 dBm/MHz.

A proposal for limiting radars' unwanted emissions towards the EESS bands is provided, intending to regulate maximum transmit power in the unwanted emissions domain and antenna directivity to ensure compatibility with EESS in the adjacent bands, for radars operating in the 122.25-130 GHz and 134-148.5 GHz bands.

3.8.5 Amateur service

For front EVR, MCL calculations reveal main beam to main beam separation distances of up to 14.5 km, but this does not take into account the possible vertical and horizontal separation, as well as clutter/shielding. Introducing 100 m of vertical separation into the same calculation, the distance reduces to 5.4 km. With 300 m of vertical separation, which may be difficult to achieve, the distance reduces to 0 km.

For corner or short/ultra-short EVR, MCL calculations reveal main beam to main beam separation distances of up to 4.6 km, but this does not take into account the possible vertical and horizontal separation, as well as clutter/shielding. With 100 m of vertical separation, the distance reduces to 0 km.

In general, the separation distance depends highly on transmission power level and angular offset (elevation and azimuth) between the vehicular radar transmitter to the amateur radio receiver. Due to the use of directive antennas, the areas where interference to the amateur radio receiver would be higher than the protection criteria (-6 dB I/N) are limited to a small angle around amateur radio receiver's azimuthal directivity.

However, given the typical deployments of amateur stations in this frequency range, a critical and persistent worst-case alignment with the external vehicle radars is highly unlikely, due to natural mitigating factors such as:

- Road traffic has to be inside of the relatively narrow interference area;
- The car's antenna must be directed towards the amateur station antenna;
- LOS conditions between EVR and the amateur station receiver must apply;
- Vertical separation between the amateur station location and the vehicle radars reduces the impact;
- Typical duty cycles (50%) and frequency hopping techniques (effective additional DC factor of 25%) used by front-radars with high antenna gain, low bandwidth reduce the average interference into the amateur receiver. This may significantly reduce the impact on many amateur applications;
- Calculations are representative of a static situation whereas in a real dynamic situation, any potential interference will not be present all time.

Therefore, potential interference from external vehicular radars to the amateur service seems to be negligible in the bands 122.25-123 GHz and 134-141 GHz.

For the amateur-satellite service operations, the antenna would be tilted skyward in which case the separation distances would be very much reduced due to side lobe coupling from the directional amateur station antenna. No specific studies of this scenario were deemed necessary.

Thus, it is concluded that in the bands 122.25-123 GHz and 134-141 GHz, coexistence between external vehicular radars and the amateur and amateur-satellite services can be achieved.

3.9 IN-CABIN VEHICULAR RADAR (IVR)

3.9.1 Summary

The following conditions need to be fulfilled for coexistence:

- For the in-cabin vehicular radar, the candidate frequency bands 116-130 GHz, 134-141 GHz and 141-148.5 GHz have been studied. The result of the studies showed that compatibility between in-cabin radar and investigated services in frequencies 122.25-130 GHz, 134-141 GHz and 141-148.5 GHz can be ensured under the technical assumptions used in the studies. In the light of the results of the studies, it is likely that the 134-148.5 GHz range can be considered as a single band since all assumptions used and the calculations made for 134-141 GHz and 141-148.5 GHz bands are same.

In most frequency bands, EESS (passive) is the critical service determining the conditions under which compatibility is possible. In the bands 122.25-130 and 134-148.5 GHz that implies:

- Downwards antenna orientation;
- "15 dB exit loss" from the radar main beam to the EESS (passive) sensors' directions;
- Maximum mean e.i.r.p. density -30 dBm/MHz;
- Maximum mean e.i.r.p. 3 dBm over the bandwidth;
- Maximum peak e.i.r.p. 16 dBm over the bandwidth;
- Minimum 1 GHz bandwidth.

In the EESS (passive) band 116-122.25 GHz, radars' unwanted emissions should stay below a maximum mean e.i.r.p. density of -45 dBm/MHz and in the EESS (passive) band 148.5-151 GHz below -39 dBm/MHz.

In the 130-134 GHz band, only 20 dB out-of-band attenuation is required, corresponding to a maximum unwanted emission level of -17 dBm/GHz.

In addition, in the immediate vicinity of RAS stations (e.g. 3 km radius) automatic switch-off of Short Range Devices should be considered.

3.9.2 Radio astronomy

A single interferer scenario compatibility study between radio astronomy service and in-cabin radar was conducted.

The calculated regions of zero margin for RAS stations IRAM 30 m in Spain and NOEMA in France are very limited and include only direct vicinity of both radio stations. No public roads or residential areas are located within the zero margin areas. However, in order to ensure protection of RAS stations it is proposed to define an exclusion zone in direct vicinity of each radio station.

Radio telescope community indicated the need to protect the immediate vicinity (e.g. 3 km radius around the RAS) of both telescopes with a very stringent power limit (ideally a switch-off), since it is possible that people would drive cars up to the telescope even in absence of public roads or bring cars up to the RAS using cable car.

An implementation of an automatic system to disable transmission of in-cabin radar devices coupled with geo-positioning of the vehicle, referred as "exclusion zone", should be considered to protect immediate vicinity of each RAS station. An exclusion zone is defined as a geographical area (typically the area within a circle with e.g. 3 km radius) within which the transmit operation of the radar equipment is automatically disabled (without manual intervention from the driver of the vehicle) to ensure no disturbance is generated towards a RAS in immediate vicinity.

The study showed that additional separation distances, beside exclusion zones in direct vicinity of RAS stations, are not needed between in-cabin vehicular radar and observatories NOEMA in France and IRAM 30 m in Spain.

Although no aggregated studies were performed, it was expected that single entry studies provide a reasonable approximation of a worst-case scenario.

3.9.3 Fixed service

The single entry interference studies show that sharing between in-cabin vehicular radars and fixed services is possible for the considered in-band power level of 3 dBm mean e.i.r.p. and 16 dBm peak e.i.r.p. within a bandwidth of 1 GHz. For adjacent band compatibility studies, a 20 dB out-of-band attenuation was assumed, leading to -17 dBm mean e.i.r.p. and -4 dBm peak e.i.r.p. in 1 GHz and hence showing compatibility.

3.9.4 Earth exploration satellite service (passive)

Results of the studies show that, for both single entry and aggregated interference scenarios, the protection of the EESS (passive) would be ensured for in-cabin radar operating in the adjacent frequency bands 122.25-130 GHz and 141-148.5 GHz. On the other hand, the case of the protection of the EESS (passive) from in-cabin radar operating co-frequency in the frequency band 116-130 GHz depicts large negative margins for aggregated study for the band 116-122.25 GHz.

No mitigation technique has been determined that could be considered to ensure the protection of EESS from in-cabin radar in the aggregated effect in the 116-122.25 GHz band. Therefore, coexistence cannot be ensured with in-cabin radars.

For in-cabin radar working in frequency bands 122.25-130 GHz and 134-148.5 GHz, the following technical conditions could apply (on per radar basis):

- Band 122.25-130 GHz:
 - Maximum (mean) e.i.r.p. density in adjacent (EESS) band 116-122.25 GHz: -45 dBm/MHz;
 - Downwards antenna orientation;
 - Report shows that sensors integrated in conventional cars or cars with sunroof ensure at least 15 dB of exit-loss (attenuation) from the radar main beam to the EESS (passive) sensors' directions. In other cases, e.g. convertible cars, the minimum of 15 dB exit-loss (in worst case) needs to be proven. Process of proving is to be specified and agreed.

- Band 134-148.5 GHz:
 - Maximum (mean) e.i.r.p. density in adjacent (EESS) band 148.5-151 GHz: -39 dBm/MHz;
 - Downwards antenna orientation.

ECC Report 351 shows that sensors integrated in conventional cars or cars with sunroof ensure at least 15 dB of exit-loss (attenuation) from the radar main beam to the EESS (passive) sensors' directions. In other cases, e.g. convertible cars, the minimum of 15 dB exit-loss (in worst case) needs to be proven. Process of proving is to be specified and agreed.

3.9.5 Amateur service

For in-cabin vehicular radars no interference could be found due to the low level of emissions and the body attenuation of the vehicle.

Thus, it is concluded that in the bands 122.25-123 GHz and 134-141 GHz, coexistence between in-cabin vehicular radars and the amateur and amateur-satellite services can be achieved.

4 RECOMMENDED FRAMEWORK

4.1 INTRODUCTION

The detailed harmonised technical conditions for specific radiodetermination applications in the frequency range 116-260 GHz as regulated in ECC Decision (22)03 [4] are presented in Annex 1.

The recommended new framework for SRD in the frequency range 116-260 GHz is summarised in sections 4.2 to 4.7 for the different specific radiodetermination applications.

4.2 GENERIC INDOOR SURVEILLANCE RADAR

4.2.1 Handheld and mobile generic indoor surveillance radar

Table 2: Recommended framework for hand-held and mobile generic indoor surveillance radar

Parameter	Limits/Requirements
Frequency bands	122.25-130 GHz and 134-148.5 GHz
Maximum mean e.i.r.p. spectral density	-20 dBm/MHz
Maximum peak e.i.r.p.	20 dBm (evaluated in 1 GHz bandwidth)
Duty cycle	Maximum 40% per second (observation time $T_{obs} = 1$ s)
Installation requirements	Indoor operation only.

4.2.2 Fixed generic indoor surveillance radar

Table 3: Recommended framework for fixed generic indoor surveillance radar

Parameter	Limits/Requirements
Frequency bands	122.25-130 GHz and 134-148.5 GHz
Maximum mean e.i.r.p. spectral density	-10 dBm/MHz
Maximum mean e.i.r.p. spectral density for elevations $>0^\circ$	-18 dBm/MHz
Maximum peak e.i.r.p.	30 dBm (evaluated in 1 GHz bandwidth)
Maximum peak e.i.r.p. for elevations $>0^\circ$	22 dBm (evaluated in 1 GHz bandwidth)
Duty cycle	Maximum 10% per second (observation time $T_{obs} = 1$ s)
Installation requirements	Only indoor operation at a permanent fixed position.

4.3 RADIODETERMINATION SYSTEMS FOR INDUSTRY AUTOMATION (RDI)

Table 4: Recommended framework for radiodetermination systems for industry automation (RDI)

Parameter	Limits/Requirements
Frequency bands	174.8-182 GHz, 185-190 GHz and 231.5-250 GHz
Maximum mean e.i.r.p. spectral density	-13.8 dBm/MHz (174.8-182 GHz and 185-190 GHz) -25.6 dBm/MHz (231.5-250 GHz)

Parameter	Limits/Requirements
Maximum peak e.i.r.p.	31 dBm for all three frequency bands (evaluated in 1 GHz bandwidth)
Duty cycle	Maximum 5% (measured over the whole measurement cycle T_{meas_cycle})
Installation requirements	Outdoor use is limited to installation heights from 0 m to 3 m above ground.

4.4 LEVEL PROBING RADAR (LPR)

Table 5: Recommended framework for level probing radar (LPR)

Parameter	Limits/Requirements
Frequency bands	116-148.5 GHz, 167-182 GHz and 231.5-250 GHz
Maximum mean e.i.r.p. spectral density	-8 dBm/MHz (116-148.5 GHz) -6 dBm/MHz (167-182 GHz and 231.5-250 GHz)
Maximum peak e.i.r.p.	37 dBm for all three frequency bands (evaluated in 1 GHz bandwidth)
Maximum peak e.i.r.p. for elevations $>0^\circ$	0 dBm for all three frequency bands (evaluated in 1 GHz bandwidth)
Duty cycle	Maximum 5% (measured over the whole measurement cycle T_{meas_cycle})
Installation requirements	Operation only in a permanent fixed position pointing in a downwards direction towards the ground.

4.5 CONTOUR DETERMINATION AND ACQUISITION RADAR (CDR)

4.5.1 Digital beamforming CDR (DBF-CDR)

Table 6: Recommended framework for digital beamforming CDR (DBF-CDR)

Parameter	Limits/Requirements
Frequency bands	116-148.5 GHz, 167-182 GHz and 231.5-250 GHz
Maximum mean e.i.r.p. spectral density	-32.6 dBm/MHz (116-148.5 GHz) -29.0 dBm/MHz (167-182 GHz) -23.0 dBm/MHz (231.5-250 GHz)
Maximum peak e.i.r.p.	15 dBm for all three frequency bands (evaluated in 1 GHz bandwidth)
Duty cycle	Maximum 10% (measured over the whole measurement cycle T_{meas_cycle})
Installation requirements	Operation only in a permanent fixed position pointing vertically downwards towards the ground.

4.5.2 Mechanical and phased-array CDR (M-CDR and PA-CDR)

Table 7: Recommended framework for mechanical and phased array CDR (M-CDR and PA-DCR)

Parameter	Limits/Requirements
Frequency bands	116-148.5 GHz, 167-182 GHz and 231.5-250 GHz
Maximum mean e.i.r.p. spectral density	-12.0 dBm/MHz (116-148.5 GHz); -9.0 dBm/MHz (167-182 GHz); -6 dBm/MHz (231.5-250 GHz)
Maximum peak e.i.r.p.	28.6 dBm (116-148.5 GHz) 34.6 dBm (167-182 GHz); 37 dBm (231.5-250 GHz) (evaluated in 1 GHz bandwidth)
Maximum peak e.i.r.p. for elevations >0°	0 dBm (evaluated in 1 GHz bandwidth)
Duty cycle	Maximum 10% (measured over the whole measurement cycle T_{meas_cycle})
Installation requirements	Operation only in a permanent fixed position. Tilting angle $\leq 60^\circ$ (angle between antenna main beam direction and vertical axis towards the ground).

4.6 TANK LEVEL PROBING RADAR (TLPR)

Table 8: Recommended framework for tank level probing radar (TLPR)

Parameter	Limits/Requirements
Frequency bands	116-148.5 GHz, 167-182 GHz and 231.5-250 GHz
Maximum mean e.i.r.p. spectral density	12 dBm/MHz for all three frequency bands
Maximum peak e.i.r.p.	42 dBm for all three frequency bands (evaluated in 1 GHz bandwidth)
Duty cycle	No limitation of the duty cycle.
Installation requirements	Operation only in a permanent fixed position in closed metallic or concrete tanks (no outdoor operation).

4.7 RADIODETERMINATION SYSTEMS FOR INDUSTRY AUTOMATION IN SHIELDED ENVIRONMENTS (RDI-S)

Table 9: Recommended framework for radiodetermination systems for industry automation in shielded environments (RDI-S)

Parameter	Limits/Requirements
Frequency bands	116-148.5 GHz, 151.5-164 GHz, 167-182 GHz, 185-190 GHz, 191.8-200 GHz, 209-226 GHz, 231.5-250 GHz and 252-260 GHz
Maximum mean e.i.r.p. spectral density	between -5 dBm and 10 dBm depending on the sub frequency range (see A1.7)
Maximum peak e.i.r.p.	between 45 dBm and 60 dBm depending on the sub frequency range (see A1.7)

Parameter	Limits/Requirements
Duty cycle	No limitation of the duty cycle
Bandwidth requirement	The operating frequency range (OFR) shall be equal to or higher than 35 GHz, including discontinuities for the passive bands
Installation requirements	Only indoor operation (i.e. inside a building) or inside similarly shielded environments. Antenna main beam shall not point directly towards windows.

4.8 EXTERIOR VEHICULAR RADAR (EVR)

Table 10: Recommended framework for exterior vehicular radars (EVR)

Designated frequency band	Front radars		Corner and short/ultra-short range radars	
	Maximum mean e.i.r.p. (Note)	Maximum peak e.i.r.p.	Maximum mean e.i.r.p. (Note)	Maximum peak e.i.r.p.
122.25-130 GHz	32 dBm		9 dBm	
134-141 GHz	32 dBm		9 dBm	
141-148.5 GHz	-6 dBm within 1 GHz	-1 dBm within 1 GHz	-6 dBm within 1 GHz	-1 dBm within 1 GHz

Note: Maximum mean e.i.r.p. is the radiated mean power during transmitter signal repetition time as defined in ETSI EN 303 883-1, section 5.3.1 [7], with the effect of duty cycle included.

4.9 IN-CABIN VEHICULAR RADAR (IVR)

Table 11: Recommended framework for in-cabin vehicular radars (IVR)

Designated frequency band	Maximum mean e.i.r.p. density	Maximum mean e.i.r.p. over the bandwidth	Maximum peak e.i.r.p. over the bandwidth
122.25-130 GHz	-30 dBm/MHz	3 dBm	16 dBm
134-148.5 GHz	-30 dBm/MHz	3 dBm	16 dBm

Note: Maximum mean e.i.r.p. is the radiated mean power during transmitter signal repetition time as defined in ETSI EN 303 883-1, section 5.3.1 [7], with the effect of duty cycle included.

ANNEX 1: PROPOSED HARMONISED TECHNICAL CONDITIONS FOR RADIODETERMINATION APPLICATIONS IN THE FREQUENCY RANGE 116-260 GHz USING SPECIFIC RADIODETERMINATION TECHNOLOGY

A1.1 PROTECTION OF RADIO ASTRONOMY SERVICE (RAS) SITES

Table 12 lists the RAS stations in CEPT member countries operating in the range 116-260 GHz. The related exclusion zones to be implemented by different specific radiodetermination applications can be extracted from Table 13.

Table 12: European radio astronomy observatories operating in the frequency range 116-260 GHz

Country / administration	Observatory name and location	Geographic Latitude	Geographic Longitude
France	NOEMA, Plateau de Bure	44°38'02" N	05°54'28" E
Spain	IRAM 30 m, Pico Veleta	37°04'06" N	03°23'55" W

Table 13: Exclusion zones around RAS sites to be implemented by different specific radiodetermination applications

Specific radiodetermination applications	Exclusion zone around RAS site
Hand-held/mobile generic indoor surveillance radar	1.6 km
Fixed generic indoor surveillance radar	10.7 km
Radiodetermination systems for industry automation (RDI)	20.0 km
Level Probing Radar (LPR)	13.0 km
Contour determination and acquisition radar (CDR)	20.0 km
Radiodetermination systems for industry automation in shielded environments (RDI-S)	13.2 km
Exterior vehicular radar applications (EVR) (Note 1)	3.0 km
In-cabin vehicular radar applications (IVR)	3.0 km
Note 1: Additional coordination zones are required for exterior vehicular radar applications. Administrations can define these at a national level.	

A1.2 TECHNICAL REQUIREMENTS FOR GENERIC INDOOR SURVEILLANCE RADAR

Table 14: Technical requirements for hand-held/mobile generic indoor surveillance radar in the designated bands

Designated frequency band	Maximum mean e.i.r.p. (Note 1)	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 5)	Spectrum access and mitigation requirements (Note 3)	Minimum unwanted emissions attenuation (Note 4)
	A	B	C	D	E
122.25-130 GHz	10 dBm	-20 dBm/MHz	20 dBm	$\sum T_{meas} \leq 400$ ms within $T_{obs} = 1$ s is equivalent to a maximum duty cycle of 40%	20 dB
134-148.5 GHz	10 dBm	-20 dBm/MHz	20 dBm	$\sum T_{meas} \leq 400$ ms within $T_{obs} = 1$ s is equivalent to a maximum duty cycle of 40%	20 dB

Note 1: Maximum mean e.i.r.p. within the OFR (see Note 4) and during T_{meas} (time when transmission is on).
 Note 2: These limits should be measured with an RMS detector and averaging time of 1 ms.
 Note 3: The maximum duty cycle is not included in the maximum mean e.i.r.p. and maximum mean e.i.r.p. spectral density values. Consequently, these values must be reduced by 4 dB when averaging over the observation time $T_{obs} = 1$ s because of the inclusion of the maximum duty cycle of 40%.
 Note 4: The operating frequency range (OFR) is defined over the 20 dB reduction of the intentional transmission ("20 dB bandwidth") radiated by the equipment into the air. The unwanted emissions attenuation applies to the frequencies outside the OFR and shall be applied to the maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. The measurement bandwidth for the unwanted emissions domain is 1 MHz.
 Note 5: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.

Table 15: Technical requirements for fixed generic indoor surveillance radar in the designated bands

Designated frequency band	Maximum mean e.i.r.p. (Note 1)	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 5)	Spectrum access and mitigation requirements (Note 3)	Minimum unwanted emissions attenuation (Note 4)
	A	B	C	D	E
122.25-130 GHz	20 dBm and 12 dBm > 0° elevation	-10 dBm/MHz and -18 dBm/MHz > 0° elevation	30 dBm and 22 dBm > 0° elevation	$\sum T_{meas} \leq 100$ ms within $T_{obs} = 1$ s is equivalent to a maximum duty cycle of 10%	20 dB
134-148.5 GHz	20 dBm and 12 dBm > 0° elevation	-10 dBm/MHz and -18 dBm/MHz > 0° elevation	30 dBm and 22 dBm > 0° elevation	$\sum T_{meas} \leq 100$ ms within $T_{obs} = 1$ s is equivalent to a maximum duty cycle of 10%	20 dB

Note 1: Maximum mean e.i.r.p. within the OFR (see Note 4) and during T_{meas} (time when transmission is on).
 Note 2: These limits should be measured with an RMS detector and averaging time of 1 ms.
 Note 3: The maximum duty cycle is not included in the maximum mean e.i.r.p. and maximum mean e.i.r.p. spectral density values. Consequently, these values must be reduced by 10 dB when averaging over the observation time $T_{obs} = 1$ s because of the inclusion of the maximum duty cycle of 10%.
 Note 4: The operating frequency range (OFR) is defined over the 20 dB reduction of the intentional transmission ("20 dB bandwidth") radiated by the equipment into the air. The unwanted emissions attenuation applies to the frequencies outside the OFR and shall be applied to the maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. The measurement bandwidth for the unwanted emissions domain is 1 MHz.
 Note 5: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.

Additional requirements for generic indoor surveillance radars to allow licence-exempt use:

1. All generic indoor surveillance radars (hand-held/mobile and fixed) shall only be operated indoors (i.e. inside a building) or inside similarly shielded environments;
2. Fixed generic indoor surveillance radars shall be installed at a permanent fixed position indoors (i.e. inside a building) or inside similarly shielded environments;
3. Users and installers have to ensure that fixed generic indoor surveillance radars, although installed inside a building, do not perform a function outside the building structure, such as for example the detection of persons outside the building (e.g. through-wall imaging);
4. For fixed generic indoor surveillance radars, the mean e.i.r.p. above 0° elevation shall be limited to 12 dBm (8 dB below the maximum mean e.i.r.p. of 20 dBm);
5. The provider is required to inform the users and installers of fixed generic indoor surveillance radars about the installation requirements and additional special mounting instructions.

A1.3 TECHNICAL REQUIREMENTS FOR RADIODETERMINATION SYSTEMS FOR INDUSTRY AUTOMATION (RDI)

Table 16: Technical requirements for RDI devices in the designated bands

Designated frequency band	Maximum duty cycle	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 3)	Minimum unwanted emissions attenuation (Note 1)
	A	B	C	D
174.8-182 GHz	5%	-13.8 dBm/MHz	31 dBm	20 dB
185-190 GHz	5%	-13.8 dBm/MHz	31 dBm	20 dB
231.5-250 GHz	5%	-25.6 dBm/MHz	31 dBm	20 dB

Note 1: The operating frequency range (OFR) is defined over the 20 dB reduction of the intentional transmission ("20 dB bandwidth") radiated by the equipment into the air. The unwanted emissions attenuation applies to the frequencies outside the OFR and shall be applied to the maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. The measurement bandwidth for the unwanted emissions domain is 1 MHz.

Note 2: The maximum duty cycle of 5% is already included in this mean e.i.r.p. limit value. Consequently, the given maximum mean e.i.r.p. spectral density limit is valid for averaging over the whole measurement cycle $T_{\text{meas_cycle}}$ of the device including any T_{off} times in 1 MHz resolution bandwidth of the measuring receiver.

Note 3: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.

Additional requirements for radiodetermination systems for industry automation (RDI) to allow licence-exempt use:

1. The operation of RDI sensors is envisaged for industrial purposes only;
2. Installation and maintenance of RDI equipment shall be performed by professionally trained personnel only;
3. RDI equipment shall not be marketed to private end customers;
4. Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
5. Outdoor RDI sensors shall only be installed in heights from 0 m to 3 m above ground;
6. The provider is required to inform the users and installers of RDI equipment about the installation requirements and additional special mounting instructions;
7. For RDI devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

A1.4 TECHNICAL REQUIREMENTS FOR LEVEL PROBING RADAR (LPR)

Table 17: Technical requirements for LPR devices in the designated bands

Designated frequency band	Maximum duty cycle	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 3)	Minimum unwanted emissions attenuation (Note 1)
	A	B	C	D
116-148.5 GHz	5%	-8.0 dBm/MHz	37 dBm	20 dB
167-182 GHz	5%	-6.0 dBm/MHz	37 dBm	20 dB
231.5-250 GHz	5%	-6.0 dBm/MHz	37 dBm	20 dB
<p>Note 1: The operating frequency range (OFR) is defined over the 20 dB reduction of the intentional transmission (“20 dB bandwidth”) radiated by the equipment into the air. The unwanted emissions attenuation applies to the frequencies outside the OFR and shall be applied to the maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. The measurement bandwidth for the unwanted emissions domain is 1 MHz.</p> <p>Note 2: The duty cycle of 5% is already included in this mean e.i.r.p. limit value. Consequently, the given maximum mean e.i.r.p. spectral density is valid for averaging over the whole measurement cycle T_{meas_cycle} of the device including any T_{off} times in 1 MHz resolution bandwidth of the measuring receiver.</p> <p>Note 3: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.</p>				

Additional requirements for level probing radars (LPR) to allow licence-exempt use:

1. The operation of LPR sensors is envisaged for industrial purposes only;
2. Installation and maintenance of LPR equipment shall be performed by professionally trained individuals only;
3. LPR equipment shall not be marketed to private end customers;
4. Level probing radars are required to be installed at a permanent fixed position pointing in a downwards direction towards the ground. The equipment shall not operate while being moved, or while inside a moving container;
5. Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
6. The provider is required to inform the users and installers of LPR equipment about the installation requirements and additional special mounting instructions;
7. For LPR devices, the peak e.i.r.p. for elevations above 0° shall be limited to 0 dBm;
8. For LPR devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

A1.5 TECHNICAL REQUIREMENTS FOR CONTOUR DETERMINATION AND ACQUISITION RADAR (CDR)

Table 18: Technical requirements for DBF-CDR devices in the designated bands

Designated frequency band	Maximum duty cycle	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 3)	Minimum unwanted emissions attenuation (Note 1)
	A	B	C	D
116-148.5 GHz	10%	-32.6 dBm/MHz	15 dBm	20 dB
167-182 GHz	10%	-29.0 dBm/MHz	15 dBm	20 dB
231.5-250 GHz	10%	-23.0 dBm/MHz	15 dBm	20 dB

Note 1: The operating frequency range (OFR) is defined over the 20 dB reduction of the intentional transmission ("20 dB bandwidth") radiated by the equipment into the air. The unwanted emissions attenuation applies the frequencies outside the OFR and shall be applied to the maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. The measurement bandwidth for the unwanted emissions domain is 1 MHz.

Note 2: The duty cycle of 10% is already included in this mean e.i.r.p. value. Consequently, the given maximum mean e.i.r.p. spectral density is valid for averaging over the whole measurement cycle T_{meas_cycle} of the device including any T_{off} times in 1 MHz resolution bandwidth of the measuring receiver.

Note 3: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.

Table 19: Technical requirements for M-CDR and PA-CDR devices in the designated bands

Designated frequency band	Maximum duty cycle	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 3)	Minimum unwanted emissions attenuation (Note 1)
	A	B	C	D
116-148.5 GHz	10%	-12.0 dBm/MHz	28.6 dBm	20 dB
167-182 GHz	10%	-9.0 dBm/MHz	34.6 dBm	20 dB
231.5-250 GHz	10%	-6.0 dBm/MHz	37 dBm	20 dB

Note 1: The operating frequency range (OFR) is defined over the 20 dB reduction of the intentional transmission ("20 dB bandwidth") radiated by the equipment into the air. The unwanted emissions attenuation applies to the frequencies outside the OFR and shall be applied to the maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. The measurement bandwidth for the unwanted emissions domain is 1 MHz.

Note 2: The duty cycle of 10% is already included in this mean e.i.r.p. value. Consequently, the given maximum mean e.i.r.p. spectral density is valid for averaging over the whole measurement cycle T_{meas_cycle} of the device including any T_{off} times in 1 MHz resolution bandwidth of the measuring receiver.

Note 3: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.

Additional requirements for contour determination and acquisition radars (CDR) to allow licence-exempt use:

1. The operation of CDR sensors is envisaged for industrial purposes only;
2. Installation and maintenance of CDR equipment shall be performed by professionally trained individuals only;
3. CDR equipment shall not be marketed to private end customers;
4. CDR equipment is required to be installed at a permanent fixed position. The equipment shall not operate while being moved;
5. Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
6. The provider is required to inform the users and installers of CDR equipment about the installation requirements and additional special mounting instructions;
7. For CDR devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

For digital beamforming contour determination and acquisition radar (DBF-CDR) applications the following additional requirement shall apply:

1. DBF-CDRs are required to be pointing vertically downwards towards the ground.

For mechanical- and phased-array contour determination and acquisition radar (M-CDR and PA-CDR) applications the following additional requirements shall apply:

1. M-CDRs and PA-CDRs shall have a permanent spatially scanning behaviour of the antenna main beam direction at any time during operation;
2. The maximum tilting angle of the antenna main beam direction in relation to the vertical axis towards the ground shall never exceed 60°;
3. The peak e.i.r.p. for elevations above 0° shall be limited to 0 dBm.

A1.6 TECHNICAL REQUIREMENTS FOR TANK LEVEL PROBING RADAR (TLPR)

Table 20: Technical requirements for TLPR devices in the designated bands

Designated frequency band	Maximum duty cycle	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 3)	Minimum unwanted emissions attenuation (Note 1)
	A	B	C	D
116-148.5 GHz	100%	12 dBm/MHz	42 dBm	20 dB
167-182 GHz	100%	12 dBm/MHz	42 dBm	20 dB
231.5-250 GHz	100%	12 dBm/MHz	42 dBm	20 dB

Note 1: The operating frequency range (OFR) is defined over the 20 dB reduction of the intentional transmission (“20 dB bandwidth”) radiated by the equipment into the air. The unwanted emissions attenuation applies to the frequencies outside the OFR and shall be applied to the maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. The measurement bandwidth for the unwanted emissions domain is 1 MHz.

Note 2: The given maximum mean e.i.r.p. spectral density is valid for averaging over the whole measurement cycle T_{meas_cycle} of the device including any T_{off} times in 1 MHz resolution bandwidth of the measuring receiver.

Note 3: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.

Additional requirements for tank level probing radars (TLPR) to allow licence-exempt use:

1. The operation of TLPR sensors is envisaged for industrial purposes only;
2. Installation and maintenance of TLPR equipment shall be performed by professionally trained individuals only;
3. TLPR equipment shall not be marketed to private end customers;
4. TLPRs shall be installed at a permanent fixed position at a closed metallic tank or concrete tank, or a similar enclosure structure made of comparable attenuating material;
5. Flanges and attachments of the TLPR equipment shall provide the necessary microwave sealing by design;
6. Sight glasses shall be coated with a microwave-proof coating when necessary (i.e. electrically conductive or microwave absorbing coating);
7. Manholes or connection flanges attached to the tank shall be closed while the TLPR equipment is in operation to ensure a low-level leakage of the signal into the free space outside the tank;
8. The provider is required to inform the users and installers of TLPR equipment about the installation requirements and additional special mounting instructions;
9. For TLPR devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

A1.7 TECHNICAL REQUIREMENTS FOR RADIODETERMINATION SYSTEMS FOR INDUSTRY AUTOMATION IN SHIELDED ENVIRONMENTS (RDI-S)

Table 21: Technical requirements for RDI-S devices in the frequency range 116-260 GHz

Frequency range	Maximum duty cycle	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 4)	Unwanted emission limits (Notes 1 & 3)
	A	B	C	D
116-122.5 GHz	100%	-5 dBm/MHz	45 dBm	-15 dBm/MHz max. mean e.i.r.p. spectral density (Note 2) and 35 dBm max. peak e.i.r.p. (Note 4)
122.5-123 GHz	100%	-5 dBm/MHz	45 dBm	
123-130 GHz	100%	+10 dBm/MHz	60 dBm	
130-134 GHz	100%	-5 dBm/MHz	45 dBm	
134-141 GHz	100%	+10 dBm/MHz	60 dBm	
141-148.5 GHz	100%	-5 dBm/MHz	45 dBm	
151.5-158.5 GHz	100%	-5 dBm/MHz	45 dBm	
158.5-164 GHz	100%	-5 dBm/MHz	45 dBm	
167-174.5 GHz	100%	-5 dBm/MHz	45 dBm	
174.5-174.8 GHz	100%	-5 dBm/MHz	45 dBm	
174.8-182 GHz	100%	+10 dBm/MHz	60 dBm	
185-190 GHz	100%	-5 dBm/MHz	45 dBm	
191.8-200 GHz	100%	-5 dBm/MHz	45 dBm	
209-226 GHz	100%	-5 dBm/MHz	45 dBm	
231.5-235 GHz	100%	-5 dBm/MHz	45 dBm	

Frequency range	Maximum duty cycle	Maximum mean e.i.r.p. spectral density (Note 2)	Maximum peak e.i.r.p. (Note 4)	Unwanted emission limits (Notes 1 & 3)
235-238 GHz	100%	-5 dBm/MHz	45 dBm	
238-241 GHz	100%	-5 dBm/MHz	45 dBm	
241-244 GHz	100%	-5 dBm/MHz	45 dBm	
244-246 GHz	100%	-5 dBm/MHz	45 dBm	
246-250 GHz	100%	-5 dBm/MHz	45 dBm	
252-260 GHz	100%	-5 dBm/MHz	45 dBm	

Note 1: The operating frequency range (OFR) is defined over the 10 dB reduction of the intentional transmission (“10 dB bandwidth”) radiated by the equipment into the air. The unwanted emission limits apply to the frequencies outside the OFR. The measurement bandwidth for the unwanted emissions domain is 1 MHz.

Note 2: The given maximum mean e.i.r.p. spectral density is valid for averaging over the whole measurement cycle T_{meas_cycle} of the device including any T_{off} times in 1 MHz resolution bandwidth of the measuring receiver.

Note 3: These limits also apply to emissions in passive bands subject to RR No. 5.340 within the frequency range 116-260 GHz.

Note 4: The maximum peak e.i.r.p. shall be measured/evaluated in 1 GHz bandwidth.

Additional requirements for radiodetermination systems for industry automation in shielded environments (RDI-S) to allow licence-exempt use:

1. For RDI-S, the operating frequency range (OFR) shall be equal to or higher than 35 GHz, including discontinuities for the passive bands;
2. The operation of RDI-S sensors is envisaged for industrial purposes only;
3. Installation and maintenance of RDI-S equipment shall be performed by professionally trained individuals only;
4. RDI-S equipment shall not be marketed to private end customers;
5. RDI-S equipment shall only be operated indoors (i.e. inside a building) or inside similarly shielded environments;
6. Installers have to ensure that the device main beam is not pointing towards windows or other weak shielded parts of the shielded environment. The direction of main radiation shall be indicated on the specific radiodetermination device;
7. Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;
8. The provider is required to inform the users and installers of RDI-S equipment about the installation requirements and additional special mounting instructions;

For RDI-S devices using an antenna gain smaller than 20 dBi, the maximum conducted peak output power shall be limited to 15 dBm.

Administrations wishing to implement RDI-S in the full range of 116-260 GHz, including the bands protected by RR No. 5.340 to satisfy the needs of the industry, should follow the regulations given in ECC Decision (22)03.

A1.8 TECHNICAL REQUIREMENTS FOR EXTERIOR VEHICULAR RADAR (EVR)

Table 22: Technical requirements for exterior vehicular radars (EVR)

Designated frequency band	Front radars		Corner and short/ultra-short range radars	
	Maximum mean e.i.r.p. (Note)	Maximum peak e.i.r.p.	Maximum mean e.i.r.p. (Note)	Maximum peak e.i.r.p.
122.25-130 GHz	32 dBm		9 dBm	
134-141 GHz	32 dBm		9 dBm	
141-148.5 GHz	-6 dBm within 1 GHz	-1 dBm within 1 GHz	-6 dBm within 1 GHz	-1 dBm within 1 GHz

Note: Maximum mean e.i.r.p. is the radiated mean power during transmitter signal repetition time as defined in ETSI EN 303 883-1, section 5.3.1 [7], with the effect of duty cycle included.

Additional requirements:

1. Unwanted emission limits in the band 116-122.25 GHz for any type of radar depend on the maximum duty cycle and elevation.
2. For radars with a maximum duty cycle up to 50% during signal repetition time of the radar, for elevations up to 35 degrees, the maximum mean e.i.r.p. density shall stay below -50 dBm/MHz, and for elevations above 35 degrees, below -76 dBm/MHz.
For radars with a maximum duty cycle higher than 50% during signal repetition time of the radar, for elevations up to 35 degrees, the maximum mean e.i.r.p. density shall stay below -53 dBm/MHz, and for elevations above 35 degrees, below -79 dBm/MHz.
3. Unwanted emissions in the band 130-134 GHz shall stay below a maximum mean power spectral density of -33 dBm/MHz e.i.r.p. for front radars and of -36 dBm/MHz e.i.r.p. for corner and short/ultra-short range radars. Additionally, the maximum peak e.i.r.p. within 1 GHz should be below 2 dBm for the front radars and below -1 dBm for the corner and short/ultra-short range radars.
4. Unwanted emission limits in the band 148.5-151 GHz for any type of radar depend on the maximum duty cycle and elevation.
For radars with a maximum duty cycle up to 50% during signal repetition time of the radar, for elevations up to 35 degrees, the maximum mean e.i.r.p. density shall stay below -44 dBm/MHz, and for elevations above 35 degrees, below -70 dBm/MHz.
For radars with a maximum duty cycle higher than 50% during signal repetition time of the radar, for elevations up to 35 degrees, the maximum mean e.i.r.p. density shall stay below -47 dBm/MHz, and for elevations above 35 degrees, below -73 dBm/MHz.

A1.9 TECHNICAL REQUIREMENTS FOR IN-CABIN VEHICULAR RADAR (IVR)

Table 23: Technical requirements for in-cabin vehicular radars (IVR)

Designated frequency band	Maximum mean e.i.r.p. density	Maximum mean e.i.r.p. over the bandwidth	Maximum peak e.i.r.p. over the bandwidth
122.25-130 GHz	-30 dBm/MHz	3 dBm	16 dBm
134-148.5 GHz	-30 dBm/MHz	3 dBm	16 dBm

Note: Maximum mean e.i.r.p. is the radiated mean power during transmitter signal repetition time as defined in ETSI EN 303 883-1, section 5.3.1 [7], with the effect of duty cycle included.

Additional requirements:

1. Unwanted emissions in the band 116-122.25 GHz shall stay below a maximum mean e.i.r.p. density of -45 dBm/MHz;
2. Unwanted emissions in the 130-134 GHz band shall stay below a maximum mean e.i.r.p. density of -17 dBm/GHz and -4 dBm/GHz peak e.i.r.p.;
3. Unwanted emissions in the band 148.5-151 GHz shall stay below a maximum mean e.i.r.p. density of -39 dBm/MHz;
4. Downwards antenna orientation;
5. For convertible cars, emissions above 0-degree elevation outside the car shall be 15 dB lower than the power levels given in Table 23;
6. Minimum 1 GHz bandwidth.

ANNEX 2: GUIDANCE TO CEPT ON THE NEXT UPDATE OF THE SRD DECISIONS (AS PER ECC(21)065)

GUIDANCE TO CEPT

ON THE NEXT UPDATE OF THE SRD DECISIONS

1. PERMANENT MANDATE ON UPDATING THE TECHNICAL ANNEX TO SRD DECISIONS (DECISION 2006/771/EC, DECISION (EU) 2018/1538)

This document provides the Commission services' guidance to CEPT for the next update of the technical annex to the Short Range Devices (SRD) Decisions – Decision 2006/771/EC and Decision 2018/1538/EU. Both Decisions are jointly referred to as the SRD Decisions. Such guidance is foreseen in the permanent Mandate to CEPT regarding the annual update of the technical annex of the Commission Decision 2006/771/EC on harmonisation of radio spectrum for use by short range devices¹. As guiding principles, the proposed evolution of the European regulatory framework for short-range devices should take into due consideration backward compatibility with current SRD systems in harmonised bands and relevant incumbent non-SRD usage, as well as efficient use of spectrum and spectrum sharing. The current guidance takes into account recommendations for further work under the next update which were formulated in the CEPT² Report 77.

2. RECOMMENDED FOCUS FOR THE NEXT UPDATE

The CEPT regularly adds new entries to the ERC Recommendation 70-03 based on new spectrum demands expressed in the ETSI System Reference documents (SRdocs) and assessed in compatibility studies. The non-mandatory, flexible harmonisation at CEPT level within ERC Recommendation 70-03 is a beneficial source for potential future EU harmonisation. When CEPT identifies potential elements for EU harmonisation and is making proposals accordingly in response to this permanent SRD mandate, relevant entries from ERC 70-03 may be included, as appropriate, into the CEPT report which will be the basis for updating the SRD Decisions. This should lead to legally binding implementations across the EU in view of allowing manufacturers and users of SRDs reaping the benefits of the Digital Single Market.

The Commission invites CEPT to:

- a. *Consider the bands recently added or currently under discussion for addition to ERC Recommendation 70-03 with a potential for EU harmonisation and for potential inclusion in the next update of the SRD Decision 2006/771/EC;*

A comprehensive review of terminology and definitions should be undertaken with the aim to improve their clarity. As suggested by CEPT Report 77, this work item should be considered as a broader and more general follow-up on task b) from the 8th update. The above task is focussing on re-assessing the technical parameters, in particular related to 'other usage restrictions' of the relevant

¹ RSCOM06-27 Rev (5 July 2006)

² CEPT Report 77 in response to the EC Permanent Mandate on the "Annual update of the technical annex of the Commission Decision on the technical harmonisation of radio spectrum for use by short-range devices, <https://docdb.cept.org/download/139> and RSCOM21-07.

SRD categories in both SRD Decisions 2006/771/EC (as amended) and (EU) 2018/1538 (as amended).

The Commission invites CEPT to:

- b. Review terminology and definitions contained in both SRD Decisions 2006/771/EC and (EU) 2018/1538 (as amended) with the aim to closely align, as appropriate, with the terminology used in ERC Recommendation 70-03 and to provide more clarity, as appropriate, with respect to the use of the relevant technical terms used in the SRD legislative framework;*

Radio spectrum resources are scarce and need to be used efficiently. Spectrum sharing is important in achieving this goal. Spectrum usage rules, i.e. radio interface specifications including spectrum sharing rules, fall under the competence of the spectrum managers. In the interest of promoting regulatory certainty, the technical conditions for spectrum sharing, resulting from CEPT studies should provide a clear framework for the development of harmonised standards by ETSI in order to implement the essential requirements of the equipment regulation, notably Article 3.2 of the Radio Equipment Directive.

The Commission invites CEPT to:

- c. Investigate, as appropriate, the development of basic solutions for spectrum sharing and relevant mitigation techniques (e.g. duty cycle mechanisms, channelling and/or channel access and occupational rules), in a technology neutral way, in order to address relevant requirements of both SRD Decisions 2006/771/EC and (EU) 2018/1538 (as amended);*

Radio spectrum resources can be shared in frequency, time and space. Cognitive techniques³³, can be considered as a separate and specific category of sharing solutions, allowing for more efficient use of spectrum by sharing along all three above dimensions. In this context, cognitive-radio enabled SRDs could open new frequency bands for SRDs in the future. CEPT Report 59 contains an initial analysis of cognitive techniques for SRDs and concludes that such an approach to spectrum usage could be further encouraged by rewarding principles (e.g., increased duty cycle allowances when certain cognitive techniques are applied).

The Commission invites CEPT to:

- d. Investigate opportunities for cognitive-radio enabled SRDs where rewarding principles could be introduced taking, as appropriate, into account relevant requests from stakeholders;*


Concerning the various above tasks relating to Implementing Decision (EU) 2018/1538 (as amended), CEPT should take due consideration of the harmonised use of Railway Mobile Radio (RMR) in the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz subject to Commission Implementing Decision (EU) 2021/1730. When addressing these tasks, the coexistence and regulatory status, where relevant, between SRDs in the 874-874,4 MHz and 917,4-919,4 MHz frequency bands and RMR in the adjacent frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz as well as the

³ The terms "cognitive techniques" and "cognitive radio" are often understood as limited to sensing of other use only. In this context they are used with a broad meaning and further include other approaches such as geo-location databases, without prejudice to any specific solution.

incumbent use in the bands covered by Implementing Decision (EU) 2018/1538 (as amended) shall be considered.

3. ROADMAP FOR THE NEXT UPDATE CYCLE

1. ECC (November 2021): launch of the next update cycle. CEPT to start work on the update proposal pursuant to the permanent Mandate and the current guidance document.
2. ECC (June 2023): Approval for public consultation of the draft CEPT report.
3. RSC (July 2023): CEPT to submit its draft report (subject to public consultation) pursuant to the permanent Mandate. Commission services to examine the CEPT proposal for the amendment of the technical annex to the SRD Decisions.
4. RSC (March 2024): CEPT to submit its final report to function as basis of any subsequent draft Commission Implementing Decision updating the technical annex to Decision 2006/771/EC and draft Commission Implementing Decision updating the technical annex to Decision (EU) 2018/1538.

 Electronically signed on 21/10/2021 12:34 (UTC+02) in accordance with article 11 of Commission Decision C(2020) 4482

ANNEX 3: CEPT MANDATE



EUROPEAN COMMISSION

Information Society and Media Directorate-General

Electronic Communications Policy

Radio Spectrum Policy

Brussels, 5 July 2006

DG INFSO/B4

FINAL

PERMANENT MANDATE TO CEPT REGARDING THE ANNUAL UPDATE OF THE TECHNICAL ANNEX OF THE COMMISSION DECISION ON THE TECHNICAL HARMONISATION OF RADIO SPECTRUM FOR USE BY SHORT RANGE DEVICES

This mandate is issued to the CEPT without prejudice to the one-month right of scrutiny by the European Parliament, pursuant to Council Decision 1999/468/EC of 28 June 1999 (OJ L 184, 17.7.1999, p. 23) on Comitology procedure.

This one-month period is extended until 28 September 2006.



Title

Permanent Mandate to CEPT regarding the annual update of the technical annex of the Commission Decision on the technical harmonisation of radio spectrum for use by short range devices.⁴

Purpose

Pursuant to Article 4 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; such mandates shall set the task to be performed and the timetable therefor.

Pursuant to this permanent Mandate, CEPT shall provide the Commission with a yearly report on needs for revising the technical annex of the Commission Decision on the technical harmonisation of radio spectrum for use by short range devices (SRDs).

The yearly proposal will serve as a basis for an amendment, when needed, of the technical annex of the Commission Decision on SRDs.

Justification

The Commission Decision for SRDs foresees a regular update of the list of frequencies, as well as their associated conditions of use. This update should be performed on a regular basis in order to take due account of the rapid technological and market developments prevailing in this area. This permanent Mandate to CEPT is to formalise the preparation of the yearly proposal by CEPT for updating the technical annex of Commission Decision on SRDs.

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. Modify, whenever appropriate, the technical conditions of use of the frequency bands included in the technical annex;
- b. Identify new frequency bands and/or new applications (types of SRDs) which should be added to the list included in the technical annex of the Decision in order to further the “Class I” equipment category and providing such equipment with legal certainty on EU level, thereby consolidating the Single Market through spectrum harmonisation;

⁴Commission Decision 2006/ 771/EC on the technical harmonisation of radio spectrum for use by short range radio devices.

- c. Remove frequency bands (and hence types of SRDs) from the list included in the technical annex, when required and duly justified (e.g. in case a particular use has become obsolete);
- d. Continuously improve the presentation of the technical annex to reflect best practices.

The European Commission may provide, on a yearly basis, input and orientation to CEPT reflecting EU policy priorities requiring special attention in the context of spectrum usage by SRDs. This input and orientation, which aims at focussing the CEPT analysis, would be delivered in time to allow to be taken into account by CEPT when preparing the annual report with proposals for revising the technical annex.

The Commission, with the assistance of the Radio Spectrum Committee (RSC) pursuant to the Radio Spectrum Decision, may consider applying the results of this permanent Mandate in the European Union.

Duration

This mandate will be kept as long as the Commission Decision on SRDs is applicable.

However, the Commission, having received the advice of the RSC in the 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.

Order and Schedule

1. CEPT is hereby mandated to undertake all relevant work to meet the objectives stated above.
2. The CEPT is mandated to produce a yearly report to the European Commission including the proposed revision of the technical annex of the Commission Decision on SRDs. This report shall take into account the input and orientation given by the Commission if provided. The CEPT report shall be delivered in **July** of each year.
3. An indicative schedule of the process is given in table 1.

In implementing this mandate, the CEPT shall, where relevant, take the utmost account of Community law applicable, notably the RTTE Directive, 1999/5/EC, and to support the principles of technological neutrality, non-discrimination and proportionality.

Table 1 – **Schedule for review of SRD Decision** (revolving cycle)

The reference date of the annual cycle of revision of the technical annex of the Commission Decision on SRDs is July of each year at which time CEPT is expected to deliver its annual report containing the proposal for revising the technical annex of the Commission Decision on SRDs.

Year Y-1

November-December	Optional: input and orientation presented by the Commission to the RSC in view of formal transmission to CEPT by the end of year Y-1
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Year Y

July	CEPT to finalise the response to the Mandate for year Y and submit formally a report to the Commission.
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ANNEX 4: LIST OF REFERENCES

- [1] [ECC Report 334](#): "UWB radiodetermination applications in the frequency range 116-260 GHz", approved January 2022
- [2] [ECC Report 351](#): "UWB radiodetermination applications within the frequency range 116 GHz to 148.5 GHz for vehicular use", approved February 2023
- [3] ETSI TR 103 498 "System Reference document (SRdoc); Short Range Devices (SRD) using Ultra Wide Band (UWB); Transmission characteristics; Radiodetermination applications within the frequency range 120 GHz to 260 GHz"
- [4] [ECC Decision \(22\)03](#): "Technical characteristics, exemption from individual licensing and free circulation and use of specific radiodetermination applications in the frequency range 116-260 GHz", approved November 2022, latest amended 8 March 2024
- [5] ITU Radio Regulations, Edition 2020
- [6] Directive 2014/53/EU of the European parliament and of the council of 16 April 2014 on the harmonisation of the laws of the member states relating to the making available on the market of radio equipment and repealing directive 1999/5/EC
- [7] ETSI EN 303 883-1: "Short Range Devices (SRD) and Ultra Wide Band (UWB); Part 1: Measurement techniques for transmitter requirements"