ECC Decision (11)02

Industrial Level Probing Radars (LPR) operating in frequency bands 6-8.5 GHz, 24.05-26.5 GHz, 57-64 GHz and 75-85 GHz[1]

Approved 11 March 2011

Amended 05 July 2019

[1] Comparable technical specifications to those given in this ECC Decision are given in the amended EC Decision 2006/771/EC for SRD. EU Member States and, if so approved by the EEA Joint Committee, Iceland, Liechtenstein and Norway are obliged to implement the EC Decision.

EXPLANATORY MEMORANDUM

1 INTRODUCTION

This ECC Decision has been developed in response to market demands for industrial Level Probing Radar (LPR) applications, as formulated by ETSI in System Reference Document TR 102 601. This ECC Decision should ensure that industrial LPR devices are deployed under harmonised conditions to avoid interference occurrences by making LPR compliant with a clear set of regulatory and technical conditions.

LPRs are used in many industries concerned with process control to measure the amount of various substances (mostly liquids or granulates). LPRs are used for a wide range of applications such as process control, custody transfer measurement (government legal measurements), water and other liquid monitoring, spilling prevention and other industrial applications. The main purposes of using LPRs are:

- to increase reliability by preventing accidents;
- to increase industrial efficiency, quality and process control;
- to improve environmental conditions in production processes.

It should be noted that these LPR devices use Ultra-Wide Band (UWB) modulation technology. However, the industrial nature of LPR applications places them in a different regulatory category than the generic UWB devices described by ECC/DEC/(06)04 and some other kinds of specific UWB applications meant for use by the general public.

Four different bands were requested by ETSI TR 102 601 for LPR applications in order to provide the necessary choice of operating frequency depending on various factors. The bands 6-8.5 GHz and 24.05-26.5 GHz provide limited bandwidth options for less precise measurements in low market range, due to availability of UWB components and proven technology in this frequency range. The advantage of the 57-64 GHz band is the higher available bandwidth compared to the lower bands which directly translates into higher obtainable resolution. This band also provides for more efficient and compact designs thanks to lower wavelength, allowing using highly directional yet compact antennas, etc. Another special advantage of the 57 GHz band is the high atmospheric attenuation due to oxygen absorption over most of the band (in the order of 10dB/km). This should be providing for more favourable co-existence conditions. The 75-85 GHz band is important for future developments.

2 BACKGROUND

Harmonised frequency bands and a clear regulatory framework are required to ensure the timely and efficient deployment of LPR devices and at the same time avoid harmful interference to services in the used frequency ranges. Since LPR is an application intended for industrial purposes, it may be safely assumed that all LPR devices will be installed and maintained by professional trained personnel in order to meet the necessary installation requirements. In particular, LPR devices shall be always installed at permanent fixed positions, with no obstacles allowed in the downward main beam that might disperse/reflect the radiated signal. These operational conditions are implicit in order for LPR to perform its function of correctly measuring the level of substance beneath it.

Detailed compatibility studies were performed by CEPT and published in ECC Report 139. The studies considered introduction of different kinds of LPR devices in various deployment scenarios and their impact on identified potential victim radiocommunications services and applications used in the same or adjacent bands. The regulatory conditions set out in this Decision were derived from the findings of the ECC Report 139.

3 REQUIREMENT FOR AN ECC DECISION

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

The harmonisation on a European basis supports the Radio Equipment Directive 2014/53/EU.

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

ECC DECISION OF 11 MARCH 2011 ON INDUSTRIAL LEVEL PROBING RADARS (LPR) OPERATING IN FREQUENCY BANDS 6-8.5 GHZ, 24.05-26.5 GHZ, 57-64 GHZ AND 75-85 GHZ, UPDATED ON 17 NOVEMBER 2017 AND AMENDED ON 05 JULY 2019

"The European Conference of Postal and Telecommunications Administrations,

considering

a) that the ETSI TR 102 601 has provided information on parameters and requirements of emerging industrial LPR applications, proposing CEPT to establish relevant regulatory provisions for deployment of LPR devices on a pan-European basis;

b) that the set of operating frequency bands for LPR had been requested by ETSI TR 102 601 in order to provide suitable choice of operating bands for LPR devices deployed in different market segments and to meet different operational requirements;

c) that the impact of LPR on radio communication services has been investigated in ECC Report 139, making a distinction between LPRs used within indoor (covered) industrial environments and those used outdoors;

d) that the studies reported in ECC Report 139 concluded that LPR devices may be deployed on a licence-exempt basis subject to ensuring compliance with a respective sets of regulatory conditions;

e) that the LPR devices are intended to be installed in industrial environments, by professionally trained personnel, which provides confidence for being able to implement the required regulatory provisions;

f) that the use of Adaptive Power Control (APC) in LPR transmitters was demonstrated as an effective mitigation technique that further decreases the interference potential of LPR devices;

g) that the Radio Astronomy Service was identified as the most vulnerable victim service and therefore the most elaborate provisions for protection of Radio Astronomy stations are included in the regulatory framework for LPR as set out by this Decision;

h) that the list of European Radio Astronomy stations currently to be protected by the provisions of this Decision is provided in **Annex 3**;

i) that the compatibility studies in ECC Report 139 are based on conservative worst-case assumptions regarding the scenarios and modes of LPR operation, and therefore the regulatory conditions derived from findings of that Report should be more than adequate in the majority of typical LPR deployment scenarios, and should not constrain future primary radio services development;

j) that the theoretical compatibility studies in ECC Report 139 have been complemented by several practical measurement campaigns, which provide high degree of confidence in expecting marginal levels of interfering emissions in horizontal direction and, consequently, insignificant interference potential for most typical interference scenarios under standard LPR installation configuration;

k) that the technical requirements set out in this Decision, such as provisions for implementation and utilisation of the APC mechanism, are supplemented by adequate implementation guidance in the EN 302 729 harmonised European standard developed by ETSI for LPR devices;

l) that for ease of enforceability it is desirable to require that the APC mechanism be implemented for LPR devices irrespectively of their outdoor or indoor type of use;

m) that the manufacturers of LPR devices will be required to make relevant provisions in the design of LPR devices and the content of LPR installation manuals (and any respective training material) to achieve the proper implementation of objectives and details of the regulatory requirements set out in this Decision;

n) that administrations are encouraged to regularly inspect installations and conduct measurements on the characteristics of LPR devices, in order to verify compliance with the requirements set out in this Decision, and bring to the attention of CEPT any cases of interference from LPR devices that were installed in compliance with the requirements set out in this Decision;

o) that in EU/EFTA countries the radio equipment that is under the scope of this Decision shall comply with the Radio Equipment Directive (2014/53/EU). Conformity with the essential requirements of the

Directive may be demonstrated by compliance with the applicable harmonised European standard(s) or by using the other conformity assessment procedures set out in the Directive.

DECIDES

1. that this ECC Decision defines harmonised conditions for use in CEPT countries of industrial Level Probing Radar (LPR) devices, manufactured and installed in accordance with the provisions set out herein;

2. that, for the purpose of this Decision, the LPR shall be defined as a radio transmitting and receiving device, that uses Ultra-Wide Band (UWB) emission technology, deployed in an industrial environment by professionally trained personnel and used in process controls to measure the (vertical variation of) level of various substances, mostly liquids or granulates;

3. that LPR devices permitted in accordance with this Decision shall operate on a non-interference, non-protected basis and shall comply with general requirements set out in **Annex 1**;

4. that LPR devices that show their compliance with the general requirements set out in **Annex 1** and additional requirements set out in **Annex 2** shall be allowed to operate on a licence-exempt basis;

5. that this Decision enters into force on 11 March 2011;

6. that the preferred date for implementation of this Decision shall be 30 September 2011;

7. that CEPT administrations shall communicate the national measures implementing this Decision to the ECC Chairman and the Office when the Decision is nationally implemented."

Note:

Please check the Office documentation database https://www.ecodocdb.dk for the up to date position on the implementation of this and other ECC Decisions.

ANNEX 1: GENERAL TECHNICAL REQUIREMENTS FOR INDUSTRIAL LEVEL PROBING RADARS USING UWB TECHNOLOGY

1. The technical requirements outlined in this Annex should be achieved under all circumstances. This means in particular that LPR devices shall operate only with dedicated/integrated certified antennas, which comply with the requirements for the maximum width of main beam specified in Table 1 (Column C) below;
2. Emissions of LPR devices shall comply with the mean e.i.r.p. spectral density and peak e.i.r.p. limits, specified in Table 1 (Columns A, B and D);
3. Strict (stable) orientation of LPR antennas under any operating conditions shall be ensured by appropriate installation;

Table 1: Essential technical requirements for LPR devices

Frequency band	Antenna orientation and tilt angle	Maximum mean e.i.r.p. spectral density (dBm/MHz) *(Notes 1 and 5)*	Maximum peak e.i.r.p. (dBm measured in 50 MHz) *(Notes 2 and 5)*	Maximum antenna beamwidth (degree)	Maximum mean e.i.r.p. spectral density on half-sphere (dBm/MHz) *(Notes 4 and 5)*
		A	**B**	**C**	**D**
6.0-8.5 GHz	Strict downward	-33	+7	12 (note 3)	-55
24.05-26.5 GHz	Strict downward	-14	+26	12 (note 3)	-41.3
57-64 GHz	Strict downward	-2	+35	8 (note 3)	-41.3
75-85 GHz	Strict downward	-3	+34	8 (note 3)	-41.3
75-85 GHz	Downward +/- 15°	-3	+34	(note 6)	-41.3
75-85 GHz	Downward +/- 30°	-10	+34	(note 6)	-41.3
75-85 GHz	Downward +/- 45°	-20	+20	(note 6)	-41.3

Notes:

(1) Mean e.i.r.p. spectral density within LPR antenna mainbeam is the average power per unit bandwidth radiated in the direction of the maximum level;

(2) Peak e.i.r.p. within mainbeam is the power contained within a 50 MHz bandwidth at the frequency at which the highest mean radiated power occurs. If measured in a bandwidth of x MHz, this level is to be scaled down by a factor of 20log(50/x) dB;

(3) Defined by -3 dB level, relative to maximum gain. Note that in EN 302 729 expressed as ± HalfBeamWidth, here it is expressed as total opening angle. The LPR antenna gain in the elevation angles above 60 degrees from the main beam direction has to fulfil a maximum value of -10 dBi;

(4) The maximum mean e.i.r.p. spectral density limits on half sphere around LPR installation accounts for both the LPR antenna side-lobe emissions and any reflections from the measured material/object. Compliance with these limits is assumed in case LPR devices comply with measured maximum mean e.i.r.p. spectral density and the maximum peak e.i.r.p. limits within main beam (Table 1, Columns A and B) and use the prescribed antenna (see note 3);

(5) The related limits in unwanted emissions domain radiated by LPR are those as listed in Table 2 below for LPR devices operating in the 6.0-8.5 GHz band. For LPR operating in the other bands, the limits for emissions in the unwanted emissions domain are at least 20 dB less than the in-band limits specified in Table 1. For LPR operating within the 24.05-26.5 GHz band, the unwanted emissions in the 23.6-24.0 GHz "passive band" are at least 30 dB less than the in-band limits specified in Table 1.

Table 2: Limits of unwanted emissions for LPR operated in 6.0-8.5 GHz band

Frequency range	Max. mean e.i.r.p. spectral density limit (dBm/MHz) (Note 1)	Max. mean e.i.r.p. spectral density limit on half-sphere (dBm/MHz) (Note 4)
Below 1.73 GHz	-63	-85
1.73-2.7 GHz	-58	-80
2.7-5 GHz	-48	-70
5-6 GHz	-43	-65
8.5-10.6 GHz	-43	-65
Above 10.6 GHz	-63	-85

(6) The following maximum mean e.i.r.p. spectral density limits apply for LPR applications with non-strict downward orientation as an safeguard to avoid interference to radio systems (these limits were derived from the scenarios/studies in ECC Report 139):

- -41,3 dBm/MHz e.i.r.p. above 60°, related to the vertical axis of the tilted LPR device;
- -35 dBm/MHz e.i.r.p. between 24° and 60°, related to the vertical axis of the tilted LPR device. For positive elevation angles, the maximum mean e.i.r.p. spectral density on half-sphere (dBm/MHz) of -41.3 dBm/MHz has to be fulfilled.

ANNEX 2: ADDITIONAL REQUIREMENTS FOR INDUSTRIAL LEVEL PROBING RADARS TO ALLOW LICENCE-EXEMPT USE

1. LPR devices to be operated under license-exempt conditions shall include technical provisions to limit the radiation in all directions regardless of the installation heights and reflecting material below the LPR. A practical technical solution to achieve this is to have Adaptive Power Control (APC) implemented with a dynamic range of at least about 20 dB or an equivalent mitigation technique. The APC function for tilted operation shall provide the same mitigation control of sideways and vertical reflections as for LPR devices which point directly downward. APC as well as equivalent techniques for LPR devices are described in the Harmonised European Standard EN 302 729;

2. RAS stations (a list of presently known sites is provided in Annex 3) shall be additionally protected as follows:
    a) From 0 km up to 4 km radius around any RAS station, installation of LPR devices operating in 6.6 GHz, 24 GHz and 75 GHz bands shall be prohibited unless a special authorisation has been provided by the responsible national administration.

    b) From 4 to 40 km around any RAS station, the antenna height of an LPR installation of devices operating in 6.6 GHz, 24 GHz and 75 GHz bands shall not exceed 15 m.

ANNEX 3: LIST OF RADIO ASTRONOMY STATIONS TO BE PROTECTED FROM LPR IMPACT

The following list of Radio Astronomy Stations that may need to be protected from LPR emissions was compiled from information tables provided by CRAF (www.craf.eu).

This Annex provides information on Radio Astronomy sites in Europe for LPR equipment manufacturers and installers.

Country	Name of the station	Geographic Latitude	Geographic Longitude	Frequency Band (see note below)
Finland	Metsähovi	60°13'04" N	24°23'37" E	A, B and C
	Tuorla	60°24'56" N	22°26'31" E	A and B
France	Plateau de Bure	44°38'01" N	05°54'26" E	B and C
Germany	Effelsberg	50°31'32" N	06°53'00" E	A, B and C
Hungary	Penc	47°47'22" N	19°16'53" E	B
Italy	Medicina	44°31'14" N	11°38'49" E	B
	Noto	36°52'34" N	14°59'21" E	B
	Sardinia	39°29'50" N	09°14'40"E	A, B and C
Latvia	Ventspils	57°33'12" N	21°51'17" E	A and B
Poland	Kraków – Fort Skala	50°03'18" N	19°49'36" E	B
	Toruń - Piwnice	52°54'48" N	18°33'30" E	A
Russia	Badari	51° 45'27" N	102 ° 13'16" E	A
	Dmitrov	56°26'00" N	37°27'00" E	B
	Kalyazin	57°13'22" N	37°54'01" E	B
	Pushchino	54°49'00" N	37°40'00" E	B
	Svetloe	61 ° 05' N	29 ° 46'54" E	A
	Zelenchukskaya	43°49'53" N	41°35'32" E	A and B
Spain	Yebes	40°31'27" N	03°05'22" W	A, B and C
	Robledo	40°25'38" N	04°14'57" W	B
	Pico Veleta	37°03'58" N	03°23'34" W	C
Switzerland	Bleien	47°20'26" N	08°06'44" E	B
Sweden	Onsala	57°23'45" N	11°55'35" E	A, B and C
The Netherlands	Westerbork	52°55'01" N	06°36'15" E	A
Turkey	Kayseri	38°59'45" N	36°17'58" E	A
UK	Cambridge	52°09'59" N	00°02'20" E	B
	Darnhall	53°09'22" N	02°32'03" W	B
	Jodrell Bank	53°14'10" N	02°18'26" W	A and B
	Knockin	52°47'24" N	02°59'45" W	B
	Pickmere	53°17'18" N	02°26'38" W	B
Band A: 6 GHz to 8.5 GHz Band B: 24.05 GHz to 26.5 GHz Band C: 75 GHz to 85 GHz				

This list was compiled at the moment of producing this Decision and should be updated by CEPT administrations as considered necessary. The possible omission of stations for certain frequency ranges does not mean that future use of these frequency ranges is excluded.