
Reference

REN/ERM-TGSRR-77

Keywordsharmonised standard, radar, radio, RTTT, SRD,
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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.9] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU 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 [i.3].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

National transposition dates	
Date of adoption of this EN:	5 December 2016
Date of latest announcement of this EN (doa):	31 March 2017
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 September 2017
Date of withdrawal of any conflicting National Standard (dow):	30 September 2018

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document applies to the following equipment types:

- automotive radar equipment operating in the 24,05 GHz to 24,25 GHz frequency range (narrowband radar equipment);
 - automotive radar equipment operating in the 24,05 GHz to 24,50 GHz frequency range (WLAM wideband low activity mode radar equipment). The WLAM mode can be activated and operated in three different sub-modes (SM) as defined in CEPT/ECC Report 164 [i.8]:
 - SM1: Forward facing Radars, Front-permanent Calibration sub-mode.
 - SM2: Forward facing Radars, Front Emergency APPS sub-mode, activated for emergency braking support in case of a crash event monitored by a camera, for a vehicle speed above 20 km/h.
 - SM3: Rear facing Radars, Rear-parking sub-mode, activated only when the vehicle moves back to better discriminate pedestrians, $v < 30$ km/h.
- A radar EUT can work in one, two, or three of these sub-modes. The radar sensor manufacturer has to declare in which sub-modes the EUT operates and how to switch between the sub-modes.

The present document contains the technical characteristics and test methods for narrowband radar equipment fitted with integral antennas operating in the frequency range from 24,05 GHz to 24,25 GHz or from 24,05 GHz to 24,50 GHz and references CEPT/ERC Recommendation 70-03 [i.1] and EC Decision 2013/752/EU [i.2].

Table 1 shows the frequency bands as designated to narrowband radar and WLAM radar devices.

Table 1: Narrowband and WLAM radar devices frequency of operation

Frequency bands / frequencies	
Transmit 1	24,05 GHz to 24,25 GHz
Receive 1	24,05 GHz to 24,25 GHz
Transmit 2	24,05 GHz to 24,50 GHz (see note)
Receive 2	24,05 GHz to 24,50 GHz (see note)
NOTE: For WLAM operation mode only.	

The present document contains requirements to demonstrate that radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.

In case of differences (for instance concerning special conditions, definitions, abbreviations) between the present document and ETSI EN 303 396 [1], the provisions of the present document take precedence.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI EN 303 396 (V1.1.1) (12-2016): "Short Range Devices; Measurement Techniques for Automotive and Surveillance Radar Equipment".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] CEPT/ERC Recommendation 70-03: "Relating to the use of Short Range Devices (SRD)".
- [i.2] EC Decision 2013/752/EU: "Commission implementing Decision of 11 December 2013 amending Decision 2006/771/EC on harmonisation of the radio spectrum for use by short-range devices and repealing Decision 2005/928/EC".
- [i.3] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.
- [i.4] CEPT/ERC/REC 74-01: "Unwanted emissions in the spurious domain".
- [i.5] ETSI EG 203 336: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".
- [i.6] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).
- [i.7] CEPT/ECC Report 134: "Analysis of potential impact of mobile vehicle Radars (VR) on Radar Speed Meters (RSM) operating at 24 GHz".
- [i.8] CEPT/ECC Report 164: "Compatibility between wide band low activity mode (WLAM) automotive radars in the frequency range 24.25 GHz to 24.5 GHz and other radiocommunication systems/services".
- [i.9] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 303 396 [1], clause 3.1 apply.

3.2 Symbols

For the purposes of the present document, the symbols given in ETSI EN 303 396 [1], clause 3.2 apply.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI EN 303 396 [1] and the following apply:

APPS	Active Pedestrian Protection System
e.r.p	equivalent radiated power
RSM	Radar Speed Meter
SM	Sub-Mode
WLAM	Wideband Low Activity Mode

4 Technical requirements specification

4.1 Environmental conditions

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the declared operational environmental profile.

The normal and extreme test conditions are defined in clauses 4.4.3 and 4.4.4 of ETSI EN 303 396 [1].

4.2 General

4.2.1 Background information

For narrowband radar devices table 2 gives an overview of frequency bands, power limits and spectrum access conditions and introduces different signal categories.

Table 2: Emission limits for peak e.i.r.p. and spectrum access conditions in the frequency band from 24,05 GHz to 24,25 GHz

Frequency band GHz	Power limit, e.i.r.p. (Peak), dBm	Spectrum access conditions	Comments	Signal category
24,050 to 24,075	20	No restrictions		A
24,075 to 24,150	-10	No restrictions		B
	20	Fast modulation condition: ≤ 4 μs/40 kHz dwell time accumulated over every 3 ms (accumulated dwell time), see note	The spectrum access and mitigation requirement for devices mounted behind a bumper. If mounted without a bumper, the requirement should be 3 μs/40 kHz maximum dwell time every 3 ms.	C
		Slow modulation condition: ≤ 1 ms/40 kHz dwell time every 40 ms (repeating dwell time), see note	The spectrum access and mitigation requirement for devices mounted either behind a bumper or mounted without a bumper.	D
24,150 to 24,250	20	No restrictions		E

NOTE: A requirement for minimum frequency modulation range (applicable to FMCW or stepped frequency signals) or minimum instantaneous bandwidth (applicable to pulsed signals) of 250 kHz applies in addition to the requirement on maximum dwell time.

For the fast modulation condition, the expression "accumulated" means that within the same 40 kHz range the sum of individual dwell times in a 3 ms interval has to be smaller than 4 μs.

For the slow modulation condition, access to a 40 kHz range is allowed during maximum 1 ms with a minimum repetition time of 40 ms. During the 1 ms duration, the 40 kHz range may be left and re-entered. Outside of the 1 ms period, access at any other time to the same 40 kHz range is only allowed with less than -10 dBm e.i.r.p. or with fulfilling the fast modulation condition.

For further information and explanation of the parameters and the limits of table 2 please refer to the summary and conclusions of the CEPT/ECC Report 134 [i.7] and the CEPT/ERC Recommendation 70-03 [i.1], annex 5.

For WLAM radar devices table 3 defines the frequency, power limits and spectrum access conditions and introduces different signal categories.

Table 3: Emission limits for peak e.i.r.p. and spectrum access conditions in the frequency band from 24,05 GHz to 24,50 GHz

Frequency band (GHz)	Power limit, e.i.r.p. (Peak) dBm	Spectrum access conditions	Sub-modes	Signal category
24,050 to 24,250		See table 2	SM1, SM2, SM3	A-E
24,250 to 24,495	-11	$\leq 0,25\%$ / 1 s/25 MHz duty cycle	SM1	F
24,495 to 24,500	-8	$\leq 1,5\%$ / 1 s/25 MHz duty cycle	SM1	G
24,250 to 24,500	20	$\leq 5,6\%$ / 1 s/25 MHz duty cycle	SM2	H
	16	$\leq 2,3\%$ / 1 s/25 MHz duty cycle	SM3	I

For further information and explanation of the parameters and the limits of table 3 please refer to the summary and conclusions of the CEPT/ECC Report 164 [i.8] and the CEPT/ERC Recommendation 70-03 [i.1], annex 5.

All operating bandwidths of the equipment (see clause 4.3.1) shall be declared by the equipment manufacturer (see clause 4.2 of ETSI EN 303 396 [1]).

Where equipment has more than one operating bandwidth, a sufficient number of operating bandwidths shall be chosen for testing so as to encompass the lower and higher limits of the operating frequency and the minimum and maximum bandwidth.

The EUT modulation during testing should be representative of normal use of the equipment. The manufacturer shall employ the mode of operation of the equipment which results in the highest transmitter activity consistent with the requirement to measure the highest power transmission which would be available in operation, and should ensure that:

- transmissions occur regularly in time;
- sequences of transmissions can be repeated accurately.

For transmitters that have multi-modulation schemes incorporated, it may be necessary to test each scheme.

4.2.2 Wanted performance criteria

The wanted performance criterion is that the EUT shall indicate the properties of a given target at a given distance.

Since EUT considered here typically are tailored to very specific applications, no single wanted performance criterion can be defined here.

Therefore:

- the relevant properties (e.g. presence, range, relative speed, azimuth angle) shall be declared by the manufacturer;
- the type and RCS of the target and the distance shall be declared by the manufacturer.

4.2.3 Fixed and scanning antennas

The provisions of ETSI EN 303 396 [1], clause 4.3.5 apply.

4.3 Transmitter Conformance Requirements

4.3.1 Operating Frequency Range

4.3.1.1 Applicability

This requirement applies to all EUT.

4.3.1.2 Description

The description in ETSI EN 303 396 [1], clause 6.2.2 applies.

4.3.1.3 Limits

For narrowband radar equipment, the upper and lower limits of the operating frequency range shall meet the following conditions:

- $f_H \leq 24,25$ GHz.
- $f_L \geq 24,05$ GHz.

For WLAM radar equipment, the upper and lower limits of the operating frequency range shall meet the following conditions:

- $f_H \leq 24,50$ GHz.
- $f_L \geq 24,05$ GHz.

4.3.1.4 Conformance

The conformance test suite for operating frequency range shall be as defined in clause 6.3.2 of ETSI EN 303 396 [1].

Conformance shall be established under normal and extreme test conditions defined in clause 4.1.

The interpretation of the results for the measurement uncertainty shall be as given in clause 4.6 of ETSI EN 303 396 [1].

4.3.2 Peak Power

4.3.2.1 Applicability

This requirement applies to all EUT.

4.3.2.2 Description

The description in ETSI EN 303 396 [1], clause 6.2.4 applies.

4.3.2.3 Limits

For narrowband radar equipment, the peak power shall not be greater than the limits in table 4.

Table 4: Narrowband radar limits for maximum radiated peak power [i.2]

Signal category	Frequency range	Maximum radiated peak power (e.i.r.p.)	Comments
A	24,05 GHz to 24,075 GHz	20 dBm	
B	24,075 GHz to 24,15 GHz	-10 dBm	Alternatively to C or D
C, D	24,075 GHz to 24,15 GHz	20 dBm	See also the note
E	24,15 GHz to 24,25 GHz	20 dBm	

NOTE: Additional conditions and limits for dwell time and repetition time according to clause 4.2 shall be met.