Draft ETSI EN 301 091-1 V2.1.0 (2016-04)

Short Range Devices;
Transport and Traffic Telematics (TTT);
Radar equipment operating in the 76 GHz to 77 GHz range;
Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU;
Part 1: Ground based vehicular radar

Reference
REN/ERM-TGSRR-69

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Contents

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.5] 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.

The present document is part 1 of a multi-part deliverable covering Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices; Transport and Traffic Telematics (TTT); Radar equipment operating in the 76 GHz to 77 GHz range, as identified below:

Part 1: "Ground based vehicular radar";

Part 2: "Fixed infrastructure radar equipment";

Part 3: "Railway/Road Crossings obstacle detection system applications".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	18 months after doa

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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document, together with ETSI EN 303 396 [1], covers the assessment of certain types of equipment as defined herein.

1 Scope

The present document applies to radar equipment for ground based vehicle applications in the frequency range from 76 GHz to 77 GHz. It covers integrated transceivers and separate transmit/receive modules.

Also the present document specifies the requirements for Short Range Devices (SRD) intended for the use in ground based vehicles. Example applications are: Adaptive Cruise Control (ACC), Collision Warning, Anti-Collision (AC) systems, obstacle detection, Stop and Go, blind spot detection, parking aid, backup aid and other future applications.

NOTE 1: High safety ratings (e.g. EURO NCAP) can only be obtained if such radar based safety applications are installed in a vehicle. The definition of "ground based vehicle" includes but is not limited to passenger cars, busses, trucks, rail engines, ships, aircraft while taxing.

NOTE 2: EURO ENCAP: Euro NCAP organizes crash-tests and provides motoring consumers with a realistic and independent assessment of the safety performance of some of the most popular cars sold in Europe. Established in 1997, Euro NCAP is composed of seven European Governments as well as motoring and consumer organizations in every European country.

The present document applies to:

- equipment with an integral antenna;
- ground based vehicle applications only;
- operating in the frequency range from 76 GHz to 77 GHz.

The present document contains the technical characteristics and test methods for ground based vehicle radar equipment fitted with integral antennas operating in the frequency range from 76 GHz to 77 GHz and references CEPT/ERC/ECC Recommendation 70-03 [i.1] and EC DEC (2013/752/EU [i.2]).

The present document does not necessarily include all the characteristics which may be required by a user, nor does it necessarily represent the optimum performance achievable.

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.

These radio equipment types are capable of operating in all or part of the frequency bands given in table 1.

Table 1: Permitted range of operation [i.2]

Permitted range of operation	
Transmit	76 GHz to 77 GHz
Receive	76 GHz to 77 GHz

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.

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 (V1.1.0) (04-2016): "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] 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] and the following apply:

ground based vehicle: includes but is not limited to passenger cars, busses, trucks, rail engines, trams, ships, constriction vehicle and aircraft while taxiing

NOTE: For details see CEPT/ERC Recommendation 70-03 [i.1].

pulse radars: EUTs, which determine distance (range) by the time-of-flight of short radar pulses which are not frequency modulated

3.2 Symbols

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

D	antenna scan duty factor

3.3 Abbreviations

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

e.r.p.	equivalent radiated power
NCAP	New Car Assessment Programme

4 Technical requirements specifications

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 supplier. 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

In this clause all general considerations for the testing of radar applications for ground based vehicle applications in the frequency range from 76 GHz to 77 GHz are given. The tests covers integrated transceivers and separate transmit/receive modules.

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 bandwidths, 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.

The meaning of EUT with scanning/steerable antenna is that the EUT TX antenna pattern is electronically or mechanically adjustable.

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 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

The upper and lower limits of the operating frequency range shall meet the following conditions:

- $f_H \leq 77$ GHz.
- $f_L \geq 76$ GHz.

4.3.1.4 Conformance

The conformance test 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 measurements uncertainty shall be as given in clause 4.6 of ETSI EN 303 396 [1].

4.3.2 Mean 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 6.2.5 applies.

4.3.2.3 Limits

The mean power shall not be greater than the limits in table 2.

Table 2: Mean power [i.2]

	EUTs others than pulsed radar	Pulsed radar
mean power (e.i.r.p.)	50 dBm	23,5 dBm
NOTE: For the purposes of this measurement, the averaging time shall be not greater than 100 ms. If the result varies through the EUT cycle time the maximum value shall be taken as the result.		

For constant pattern scanning antennas measured with the scanning inhibited (clause 4.3.5 of ETSI EN 303 396 [1]), the mean power P_{AV} shall be calculated from the measured result P_{MEAS} as shown in table 3.

Table 3: Mean power calculation (constant pattern scanning antenna)

	EUTs others than pulsed radar		Pulsed radar	
Illumination time t (see note 1)	t < 100 ms	t > 100 ms	t < 100 ms	t > 100 ms
mean power P_{AV} (see note 2)	$P_{AV} = P_{MEAS} + 10 \log(D)$	$P_{AV} = P_{MEAS}$	$P_{AV} = P_{MEAS} + 10 \log(D)$	$P_{AV} = P_{MEAS}$
NOTE 1: t is the illumination time defined in ETSI EN 303 396 [1]. NOTE 2: D is the antenna scan duty factor defined in ETSI EN 303 396 [1]. As D is smaller than 1 (i.e. 100 %), the log(D) value is negative and leads to a decrease in the result.				

4.3.2.4 Conformance

The conformance test suite for mean power shall be as defined in clause 6.3.4 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 measurements uncertainty shall be as given in clause 4.6 of ETSI EN 303 396 [1].

4.3.3 Peak Power

4.3.3.1 Applicability

This requirement applies to all EUT.

4.3.3.2 Description

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

4.3.3.3 Limits

The peak power for EUT with fixed beam or scanning antenna shall not be greater than 55 dBm.

4.3.3.4 Conformance

The conformance test suite for peak power shall be as defined in clause 6.3.3 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 measurements uncertainty shall be as given in clause 4.6 of ETSI EN 303 396 [1].

4.3.4 Unwanted emissions in the out-of-band domain

4.3.4.1 Applicability

This requirement applies to all EUT.

4.3.4.2 Description

The description in ETSI EN 303 396 [1], clause 6.2.11 applies.

4.3.4.3 Limits

The RMS mean power spectral density radiated in the calculated out-of-band domain (between F_1 to f_L and f_H to F_2 band) shall not be greater than the values given in table 4.

Table 4: Limits for out of band radiation [i.4]

Frequency [GHz]	RMS mean power spectral density [dBm/MHz]
$F_1 \leq f < f_L$	0
$f_H < f \leq F_2$	0

The values f_L and f_H are the results of the operating frequency range conformance test, see clause 4.3.1.4.

The values F1 and F2 are calculated as in ETSI EN 303 396 [1], clause 6.2.11.

NOTE: The out-of-band domain may be larger or smaller than the maximum permitted range of operation.

4.3.4.4 Conformance

The conformance test suite for unwanted emissions in the out of band domain shall be as defined in clause 6.3.10 of ETSI EN 303 396 [1].

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

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

4.3.5 Unwanted emissions in the spurious domain

4.3.5.1 Applicability

This requirement applies to all EUT.

4.3.5.2 Description

The description in ETSI EN 303 396 [1], clause 6.2.11 applies.

4.3.5.3 Limits

The effective radiated power of any radiated spurious emission shall be not greater than the values given in table 5.

Table 5: Limits of radiated spurious emissions [i.4]

Frequency range (MHz)	Limit values for spurious radiation	Detector type
47 to 74	-54 dBm e.r.p.	Quasi-Peak
87,5 to 118	-54 dBm e.r.p.	Quasi-Peak
174 to 230	-54 dBm e.r.p.	Quasi-Peak
470 to 790	-54 dBm e.r.p.	Quasi-Peak
otherwise in band 30 to 1 000	-36 dBm e.r.p.	Quasi-Peak
f > 1 000 to 300 000 (Note)	-30 dBm e.i.r.p.	Mean
NOTE: According to CEPT/ERC/REC 74-01 [i.1], spurious emission is measured up to the 2nd harmonic of the fundamental frequency.		

4.3.5.4 Conformance

The conformance test suite for unwanted emissions in the spurious domain shall be as defined in clause 6.3.10 of ETSI EN 303 396 [1].

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

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

4.4 Receiver Conformance Requirements

4.4.1 Introduction

ETSI EG 203 336 [i.5] lists candidate technical parameters to be included in a Harmonised Standard aimed at providing a presumption of conformity of radio equipment with the essential requirements in articles 3.1(b) and 3.2 of the Radio Equipment Directive 2014/53/EU [i.3].

Essential requirements are high level objectives described in European Directives. The purpose of the Harmonised Standard is to translate those high level objectives into detailed technical specifications.

The present document applies to radar systems for which the "classical" receiver parameters are not necessarily relevant. Where applicable, suitable alternative technical requirements are included, see clause 4.4.3.

4.4.2 Receiver spurious emissions

4.4.2.1 Applicability

Receiver spurious emission testing shall apply for any mode other than transmit mode.

NOTE: Otherwise receiver spurious emissions are measured as part of the transmitter spurious emissions, see clause 4.3.5.

4.4.2.2 Description

The description in ETSI EN 303 396 [1], clause 6.2.12 applies.

4.4.2.3 Limits

The effective radiated power of any narrowband receiver spurious emission shall be not greater than the values given in table 6.

Table 6: Narrowband spurious emission limits for receivers [i.4]

Frequency range	Limit
30 MHz to 1 GHz	-57 dBm (e.r.p.)
above 1 GHz to 300 GHz	-47 dBm (e.i.r.p.)
NOTE: According to CEPT/ERC/REC 74-01 [i.1], spurious emission is measured up to the 2nd harmonic of the fundamental frequency.	

Wideband receiver spurious emissions shall be not greater than the values given in table 7.

Table 7: Wideband spurious emission limits for receivers [i.4]

Frequency range	Limit
30 MHz to 1 GHz	-47 dBm/MHz (e.r.p.)
above 1 GHz to 300 GHz	-37 dBm/MHz (e.i.r.p.)
NOTE: According to CEPT/ERC/REC 74-01 [i.1], spurious emission is measured up to the 2nd harmonic of the fundamental frequency.	

4.4.2.4 Conformance

The conformance test suite for unwanted receiver spurious emissions shall be as defined in clause 6.3.11 of ETSI EN 303 396 [1].

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

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

4.4.3 Receiver in-band, out-of-band and remote-band signals handling

4.4.3.1 Applicability

This requirement applies to all devices under test.

4.4.3.2 Description

The description in ETSI EN 303 396 [1], clause 6.2.13 applies.

4.4.3.3 Limits

The EUT shall achieve the wanted performance criterion, see clause 4.2.2, in the presence of unwanted signals defined in ETSI EN 303 396 [1], clause 6.3.12.4.

If the wanted performance criterion is not achieved then the EUT shall issue a respective blindness message.

4.4.3.4 Conformance

The conformance test suite for receiver in-band, out-of-band and remote-band signals handling shall be as defined in clause 6.3.12 of ETSI EN 303 396 [1].

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

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

4.4.4 Receiver sensitivity

Receiver sensitivity is not specified in the present document in order to allow manufacturers the freedom to tailor equipment to specific circumstances.

For instance, equipment covered by the present document may be intended to detect a target at maximum range or may be intended to discriminate features such as size, shape or velocity at shorter range. The level of minimum usable signal would be different in each case.

5 General considerations for performing the tests

The provisions of ETSI EN 303 396 [1], clause 4 shall apply except as varied herein.

6 Test setup and procedures

The provisions of ETSI EN 303 396 [1], clause 5 shall apply except as varied herein.

7 Conformance methods of measurement for transmitter and receiver

The provisions of ETSI EN 303 396 [1], clause 6 shall apply except as varied herein.

All measurement results shall be recorded in a test report, see clause 4.7 in ETSI EN 303 396 [1].

Annex A (normative): Relationship between the present document and the essential requirements of Directive 2014/53/EU

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.5] 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.

Table A.1: Relationship between the present document and the essential requirements of Directive 2014/53/EU

Harmonised Standard ETSI EN 301 091-1 The following requirements are relevant to the presumption of conformity under the article 3.2 of Directive 2014/53/EU [i.3]				
Requirement			**Requirement Conditionality**	
No	**Description**	**Reference: Clause No**	**U/C**	**Condition**
1	Operating Frequency Range	4.3.1	U	
2	Mean Power	4.3.2	U	
3	Peak Power	4.3.3	U	
4	Unwanted emissions in the out-of-band domain	4.3.4	U	
5	Unwanted emissions in the spurious domain	4.3.5	U	
6	Receiver spurious emissions	4.4.2	C	It applies for any mode other than transmit mode.
7	Receiver in-band, out-of-band and remote-band signal handling	4.4.3	U	

Key to columns:

Requirement:

No A unique identifier for one row of the table which may be used to identify a requirement.

Description A textual reference to the requirement.

Clause Number Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

U/C Indicates whether the requirement shall be unconditionally applicable (U) or is conditional upon the manufacturers claimed functionality of the equipment (C).

Condition Explains the conditions when the requirement shall or shall not be applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

Other Union legislation may be applicable to the product(s) falling within the scope of the present document.

Annex B (informative): Bibliography

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).

Annex C (informative): Change History

Date	Version	Information about changes
January 2016	2.1.1._0.0.1	Initial version for TG SRR#23
January 2016	2.1.1_0.0.2 and 0.0.3	Draft version during TG SRR#23
January 2015	2.1.1._0.0.4	Stable draft during TG SRR#23
January 2016	2.1.1_0.0.5	Outcome TG SRR#23 for RC (amendment for ENAP)
January 2016	2.1.1._0.0.6	Revision during RC to collect the comments
January 2016	2.1.1._2.0.0	Final version accepted by TG SRR for ENAP

History

Document history		
V1.1.1	June 1998	Publication as ETSI EN 301 091
V1.2.1	November 2004	Publication
V1.3.3	June 2006	Publication
V2.1.0	April 2016	EN Approval Procedure AP 20160717: 2016-04-18 to 2016-07-18