

<b>STN</b>	<b>Zariadenia s krátkym dosahom Meracie techniky pre automobilové a sledovacie radarové zariadenia</b>	<b>STN EN 303 396 V1.1.1</b>  87 3396
------------	--	---

Short Range Devices; Measurement Techniques for Automotive and Surveillance Radar Equipment

Táto norma obsahuje anglickú verziu európskej normy.  
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 01/18

Obsahuje: EN 303 396 V1.1.1:2016

**126043**

---

Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, 2018  
Podľa zákona č. 264/1999 Z. z. o technických požiadavkách na výrobky a o posudzovaní zhody a o zmene a doplnení niektorých zákonov v znení neskorších predpisov sa slovenská technická norma a časti slovenskej technickej normy môžu rozmnožovať alebo rozširovať len so súhlasom slovenského národného normalizačného orgánu.

# ETSI EN 303 396 V1.1.1 (2016-12)



## **Short Range Devices; Measurement Techniques for Automotive and Surveillance Radar Equipment**

---

**Reference**

DEN/ERM-TGSRR-77

---

**Keywords**measurement uncertainty, power measurement,  
radio measurements**ETSI**650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**The present document can be downloaded from:  
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at  
<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:  
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.  
All rights reserved.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.  
**3GPP™** and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.  
**GSM®** and the GSM logo are Trade Marks registered and owned by the GSM Association.

# Contents

Intellectual Property Rights .....	6
Foreword.....	6
Modal verbs terminology.....	6
Introduction .....	6
1 Scope .....	8
2 References .....	8
2.1 Normative references .....	8
2.2 Informative references.....	8
3 Definitions, symbols and abbreviations .....	9
3.1 Definitions .....	9
3.2 Symbols.....	11
3.3 Abbreviations .....	12
4 General Considerations for performing the tests.....	13
4.1 Overview .....	13
4.2 Product information.....	13
4.3 Requirements for the EUT.....	13
4.3.1 EUT version and configuration.....	13
4.3.2 Presentation.....	14
4.3.3 Multiple operating bandwidths .....	14
4.3.4 Requirement on the modulation during testing.....	14
4.3.5 Requirements in case of EUT with scanning antennas .....	14
4.3.5.1 Classification.....	14
4.3.5.2 Measurement of fixed beam EUT .....	14
4.3.5.3 Measurement of constant pattern EUT.....	14
4.3.5.4 Measurement of variable pattern EUT .....	15
4.4 Test conditions .....	15
4.4.1 Introduction.....	15
4.4.2 Power sources .....	15
4.4.3 Normal test conditions .....	15
4.4.3.1 Normal temperature and humidity .....	15
4.4.3.2 Normal power source .....	15
4.4.3.2.1 Mains voltage .....	15
4.4.3.2.2 Lead-acid battery power sources used on vehicles .....	15
4.4.3.2.3 Other power sources .....	16
4.4.4 Extreme test conditions.....	16
4.4.4.1 Extreme temperatures.....	16
4.4.4.1.1 Procedure for tests at extreme temperatures .....	16
4.4.4.1.2 Extreme temperature ranges .....	16
4.4.4.2 Extreme test source voltages .....	16
4.4.4.2.1 Mains voltage .....	16
4.4.4.2.2 Other power sources .....	16
4.5 Reference bandwidth of the measuring receiver .....	16
4.6 Interpretation of test results and permitted measurement uncertainty .....	17
4.6.0 General.....	17
4.6.1 Maximum permitted measurement uncertainty .....	18
4.6.2 Measurement uncertainty is equal to or less than maximum permitted uncertainty .....	18
4.6.3 Measurement uncertainty is larger than maximum permitted uncertainty .....	18
4.7 Test Report.....	18
5 Test setups and procedures.....	19
5.1 Introduction .....	19
5.2 Initial measurement steps .....	19
5.3 Radiated measurements .....	19
5.3.1 General.....	19

5.3.2	Guidance on the use of a radiation test site.....	19
5.3.2.0	Introduction.....	19
5.3.2.1	Verification of the test site.....	20
5.3.2.2	Mounting bracket.....	20
5.3.2.3	Range length.....	20
5.3.2.4	Test Site preparation.....	21
5.3.3	Standard test methods.....	21
5.4	Testing of host connected devices.....	21
6	Test procedures.....	21
6.1	General.....	21
6.2	Descriptions.....	22
6.2.1	Introduction.....	22
6.2.2	Operating frequency range.....	22
6.2.3	Total Power.....	22
6.2.4	Peak e.i.r.p.....	23
6.2.5	Mean (average) e.i.r.p.....	23
6.2.6	Mean e.i.r.p. spectral density.....	23
6.2.7	Power Duty Cycle.....	23
6.2.8	Spectrum Access Duty Cycle.....	24
6.2.9	Dwell time and repetition time.....	24
6.2.10	Frequency modulation range.....	24
6.2.11	Unwanted emissions in the out-of-band and spurious domains.....	24
6.2.12	Receiver spurious emissions.....	25
6.2.13	Receiver in-band, out-of-band and remote-band signals handling.....	25
6.3	Method of measurements of the EUT.....	25
6.3.1	Introduction.....	25
6.3.2	Operating Frequency Range.....	25
6.3.3	Peak e.i.r.p.....	26
6.3.3.1	General.....	26
6.3.3.2	Method with a spectrum analyser.....	26
6.3.3.3	Method with an average power meter.....	26
6.3.3.4	Method with a peak power meter.....	26
6.3.4	Mean e.i.r.p.....	26
6.3.4.1	General.....	26
6.3.4.2	Method with a spectrum analyser.....	27
6.3.4.3	Method with an average power meter.....	27
6.3.4.4	Method with a peak power meter.....	27
6.3.5	Mean E.I.R.P spectral density.....	27
6.3.6	Power Duty Cycle.....	28
6.3.6.1	General.....	28
6.3.6.2	Method with the spectrum analyser.....	28
6.3.6.3	Alternative method with an oscilloscope.....	28
6.3.6.3.1	Description.....	28
6.3.6.3.2	General test setup.....	28
6.3.7	Spectrum access duty cycle.....	29
6.3.7.1	Introduction.....	29
6.3.7.2	Measurement of spectrum access duty cycle.....	30
6.3.8	Dwell time and repetition time.....	30
6.3.8.1	Introduction.....	30
6.3.8.2	Measurement of accumulated dwell time over a given observation time interval.....	31
6.3.8.3	Measurement of a repeating dwell time.....	32
6.3.9	Frequency modulation range.....	32
6.3.9.1	Introduction.....	32
6.3.9.2	Measurement of frequency modulation range.....	33
6.3.10	Unwanted emissions in the out-of-band and spurious domains.....	33
6.3.11	Receiver spurious emissions.....	35
6.3.11.1	General.....	35
6.3.11.2	Test set-up.....	35
6.3.12	Receiver in-band, out-of-band and remote-band signals handling.....	36
6.3.12.1	Introduction.....	36
6.3.12.2	Test set-up.....	36

6.3.12.3	Test procedure.....	36
6.3.12.4	Unwanted signals specification.....	36
<b>Annex A (normative):</b>	<b>Test sites and general arrangements for measurements involving the use of radiated fields.....</b>	<b>37</b>
A.1	Introduction.....	37
A.2	Anechoic chamber.....	37
A.3	Anechoic chamber with a conductive ground plane.....	38
A.4	Extreme conditions test.....	39
A.4.1	Radio transparent temperature chamber.....	39
A.4.2	Use of a test fixture.....	39
A.4.2.0	General.....	39
A.4.2.1	Characteristics.....	39
A.4.2.2	Validation of the test fixture in the temperature chamber.....	40
A.4.2.3	Use of the test fixture for measurement in the temperature chamber.....	42
A.5	Test antenna.....	42
A.5.1	General.....	42
A.5.2	Substitution antenna.....	42
A.5.3	Measuring antenna.....	43
<b>Annex B (normative):</b>	<b>Standard test methods.....</b>	<b>44</b>
B.1	Radiated test set-up calibrated by using the Rx link budget calculation.....	44
B.2	Radiated test set-up calibrated by using substitution method.....	44
<b>Annex C (normative):</b>	<b>Rx link budget calculation.....</b>	<b>46</b>
<b>Annex D (normative):</b>	<b>Measuring receivers.....</b>	<b>49</b>
D.1	General remarks.....	49
D.2	Power Meter.....	49
D.3	Spectrum analyser.....	50
D.4	Signal analyser.....	50
D.5	Oscilloscope.....	51
<b>Annex E (informative):</b>	<b>Bibliography.....</b>	<b>52</b>
<b>Annex F (informative):</b>	<b>Change History.....</b>	<b>53</b>
History.....		54

---

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

---

## Foreword

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

It is intended to be used in conjunction with an appropriate harmonised standard for the purposes of assessing conformity with the Radio Equipment Directive [i.3].

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 2017

---

## 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

Automotive and surveillance radar equipments are low power millimetre wave devices that are able to detect and characterize targets in their environment.

The following use cases are included (but are not limited to):

- automotive Advanced Driver Assistance Systems (ADAS) applications, such as Adaptive Cruise Control (ACC), Blind Spot Detection (BSD), parking aid, backup aid, autonomous braking and Pre-Crash Systems (PCS);
- surveillance radars for other kind of ground based vehicles, such as trains, trams, aircrafts while taxiing;
- fixed infrastructure radars for traffic monitoring;
- railway/road crossings obstacle detection radars;

- helicopter obstacle detection radars.

Detailed information about use cases can be found in the related Harmonised Standards (ETSI EN 301 091-1 [i.7], ETSI EN 301 091-2 [i.8], ETSI EN 301 091-3 [i.9], ETSI EN 302 264 [i.10], ETSI EN 302 858 [i.11]).

The current generation of radars uses mainly FMCW modulations, such as slow-ramp and fast-ramp (chirp or pulse compression) modulations. Radars may have multiple transmitting antennas and receiving antennas to enable adaptive field-of-views or digital beam forming. Scanning systems, electronically or mechanically, also exist on the market.



---

# 1 Scope

The present document describes possible measurement techniques and procedures for the conformance measurements applicable to automotive and surveillance radar equipments.

The present document will be used as a reference for existing and future ETSI standards covering automotive and surveillance radar equipments.

---

## 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 <https://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] CISPR 16-1-1 (2006), CISPR 16-1-4 (2010) and CISPR 16-1-5 (2014): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".
- [2] ETSI TR 100 028 (V1.4.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [3] ETSI TR 102 273 (V1.2.1) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".
- [4] ETSI TS 102 321 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Normalized Site Attenuation (NSA) and validation of a fully lined anechoic chamber up to 40 GHz".
- [5] ANSI C63.5-2006: "American National Standard for Electromagnetic Compatibility - Radiated Emission Measurements in Electromagnetic Interference (EMI) Control - Calibration of Antennas (9 kHz to 40 GHz)".

### 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 74-01: "Unwanted emissions in the spurious domain".
- [i.2] ITU Radio Regulations.

- [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] Recommendation ITU-R SM.329-12 (2012): "Unwanted emissions in the spurious domain".
- [i.5] Recommendation ITU-R SM.328-11 (2006): "Spectra and Bandwidth of Emissions".
- [i.6] Recommendation ITU-R SM.1754 (2006): "Measurement techniques of ultra-wideband transmissions".
- [i.7] ETSI EN 301 091-1: "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".
- [i.8] ETSI EN 301 091-2: "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 2: Fixed infrastructure radar equipment".
- [i.9] ETSI EN 301 091-3: "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 3: Railway/Road Crossings obstacle detection system applications".
- [i.10] ETSI EN 302 264: "Short Range Devices; Transport and Traffic Telematics (TTT); Short Range Radar equipment operating in the 77 GHz to 81 GHz band; Harmonised Standard covering essential requirements of article 3.2 of the Directive 2014/53/EU".
- [i.11] ETSI EN 302 858: "Short Range Devices; Transport and Traffic Telematics (TTT); Harmonised Standard covering the essential requirements of article 3.2 of the Directive 2014/53/EU; Radar equipment operating in the 24,05 GHz to 24,25 GHz or 24,05 GHz to 24,50 GHz range".
- [i.12] ECC Recommendation (07)01: "Frequency Measurements Using Fast Fourier Transform (FFT) Techniques".
- [i.13] ETSI TR 103 366: "Short Range Devices (SRD) using Ultra Wide Band technology (UWB); Time Domain based Low Duty Cycle Measurement Procedure".
- [i.14] ETSI EG 203 367 (V1.1.1): "Guide to the application of harmonised standards covering article 3.1b and 3.2 of the Directive 2014/53/EU (RED) to multi-radio and combined radio and non-radio equipment".

**koniec náhľadu – text ďalej pokračuje v platenej verzii STN**