SLOVENSKI STANDARD
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Inteligentni transportni sistemi (ITS) - Radiokomunikacijska oprema, ki deluje v frekvenčnem pasu od 63 GHz do 64 GHz - Harmonizirani EN, ki zajema bistvene zahteve člena 3.2 direktive R&TTE

Intelligent Transport Systems (ITS) - Radiocommunications equipment operating in the 63 GHz to 64 GHz frequency band - Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

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Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 63 GHz to 64 GHz frequency band; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

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Foreword

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

For non-EU countries, the present document may be used for regulatory (Type Approval) purposes.

The present document has been produced by ETSI in response to a mandate from the European Commission issued under Council Directive 98/34/EC (as amended) [i.4] laying down a procedure for the provision of information in the field of technical standards and regulations.

The present document is intended to become a Harmonized Standard, the reference of which will be published in the Official Journal of the European Communities referencing the Directive 1999/5/EC [i.9] 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 ("the R&TTE Directive").

The requirements relevant to Directive 1999/5/EC [i.9] are summarised in annex A.

Equipment compliant with the present document can be intended for fitment into road vehicles, therefore it is subject to automotive EMC type approval and Directive 95/54/EC [i.7]. For use on vehicles outside the scope of Directive 95/54/EC [i.7], compliance with an EMC directive/standard appropriate for that use is required.

National transposition dates	
Date of adoption of this EN:	31 January 2011
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Introduction

The present document is part of a set of standards developed by ETSI and is designed to fit in a modular structure to cover all radio and telecommunications terminal equipment within the scope of the R&TTE Directive. The modular structure is shown in EG 201 399 [i.8].

1 Scope

The present document applies to corporate communications using radio transmitters and receivers for Intelligent Transport Systems (ITS). ITS communications may comprise vehicle-to-vehicle, vehicle-to-infrastructure and infrastructure-to-vehicle.

The equipment is comprised of a transmitter and associated encoder and modulator and/or a receiver and associated demodulator and decoder. The types of equipment covered by the present document are as follows:

- OnBoard Equipment (OBE equipment fitted with an integral or dedicated antenna(s), intended for use in vehicles, e.g. a road or a rail vehicle).
- Road Side Equipment (RSE equipment fitted with an antenna socket, integral or dedicated antenna(s), normally used as a fixed station); e.g. a road or rail infrastructure.

These networks operate over a short range with very wideband communications using a variety of directional medium and high gain antennas to enable a high degree of spectrum reuse, and may use a flexible bandwidth scheme under which they normally operate in a wideband mode, and periodically reduce their bandwidth (e.g. for antenna training and other activities).

The technical characteristics of these applications are described in TR 102 400 [i.1], where ITS applications in the 63 GHz to 64 GHz band is described. The present document is also in line with the results of the of the spectrum compatibility study in the CEPT ECC Report 113 [i.3].

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

Table 1: Radiocommunications service frequency bands

	Radiocommunications service frequency bands
Transmit	63 GHz to 64 GHz
Receive	63 GHz to 64 GHz

The present document is intended to cover the provisions of Directive 1999/5/EC [i.9] (R&TTE Directive), article 3.2, which states that "….. radio equipment shall be so constructed that it effectively uses the spectrum allocated to terrestrial/space radio communications and orbital resources so as to avoid harmful interference".

In addition to the present document, other ENs that specify technical requirements in respect of essential requirements under other parts of article 3 of the R&TTE Directive may apply to equipment within the scope of the present document.

NOTE: A list of such ENs is included on the web site http://www.newapproach.org.

2 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 reference 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.

2.1 Normative references

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

[1] ETSI TR 100 028 (all parts) (V1.4.1): "Electromagnetic compatibility and Radio spectrum matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[2] CISPR 16 (2006) (parts 1-1, 1-4 and 1-5): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".

[3] ITU-T Recommendation O.153 (1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".

[4] ETSI TR 102 273 (all parts) (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties".

2.2 Informative references

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] ETSI TR 102 400 (V1.2.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Intelligent Transport Systems (ITS); Road Traffic and Transport Telematics (RTTT); Technical characteristics for communications equipment in the frequency band from 63 GHz to 64 GHz; System Reference Document".

[i.2] ETSI TS 103 051: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Expanded measurement uncertainty for the measurement of radiated electromagnetic fields".

[i.3] CEPT ECC Report 113: "Compatibility studies around 63 GHz between Intelligent Transportation Systems (ITS) and other systems".

[i.4] Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations.

[i.5] ETSI TS 103 052: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Radiated measurement methods and general arrangements for test sites up to 100 GHz".

[i.6] CEPT/ERC Recommendation 74-01 (2005): "Unwanted emissions in the spurious domain".

[i.7] Commission Directive 95/54/EC of 31 October 1995 adapting to technical progress Council Directive 72/245/EEC on the approximation of the laws of the Member States relating to the suppression of radio interference produced by spark-ignition engines fitted to motor vehicles and amending Directive 70/156/EEC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers.

[i.8] ETSI EG 201 399: "Electromagnetic compatibility and Radio spectrum Matters (ERM); A guide to the production of Harmonized Standards for application under the R&TTE Directive".

[i.9] 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.10] ITU-R Recommendation P.676-5 (2001): "Attenuation by atmospheric gases".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the R&TTE Directive [i.9] and the following apply:

channel separation: minimum separation (in MHz) between the centre frequencies of two adjacent channels in the channel plan of the radio equipment

environmental profile: declared range of environmental conditions under which equipment within the scope of the present document is required to be compliant

integral antenna: antenna which is declared to be part of the radio equipment by the supplier

NOTE 1: In some cases, it may not be possible to remove an integral antenna or expose an antenna connector without changing the output characteristics of the radio equipment.

NOTE 2: Even with an integral antenna, it might still be possible to separate the antenna from the equipment using a special tool.

mean power: when applied to a modulated signal, this is the power (transmitted or received) in a bandwidth

necessary bandwidth: width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions

smart antenna systems: equipment that combines multiple transmit and/or receive antenna elements with a signal processing function to increase its radiation and/or reception capabilities

NOTE: This includes techniques such as spatial multiplexing, beam forming, cyclic delay diversity, etc.

3.2 Symbols

For the purposes of the present document, the following symbols apply:

dBc	spectral density relative to the maximum spectral power density of the transmitted signal
dBm	decibel relative to one milliwatt
dBr	decibel relative to a given maximum power level
GHz	thousand millions of cycles
kHz	thousands of cycles
µs	millionths of seconds

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

e.i.r.p.	equivalent isotropically radiated power
emf	electromagnetic field
EUT	Equipment Under Testing
FAR	Fully Anechoic Room
FH	Frequency Hopping
FHSS	Frequency Hopping Spread Spectrum
FMCW	Frequency Modulated Carrier Wave
FSK	Frequency Shift Keying
FSL	Free Space Loss
IF	Intermediate Frequency
ITS	Intelligent Transport Systems
LO	Local Oscillator
NSA	Normalized Site Attenuatio
OATS	Open Area Test Site

PDL	spectral Power Density Limit
R&TTE	Radio equipment and Telecommunications Terminal Equipment
RBw	Resolution Bandwidth
RF	Radio Frequency
RMS	Root Mean Square
Rx	Receiver
Tx	Transmitter
VBW	Video Bandwidth
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specifications

4.1 General requirements

4.1.1 Receiver category

For ITS equipment in the scope of the present document, there is no need to distinguish between different receiver categories.

4.2 Presentation of equipment for testing purposes

Equipment submitted for testing, where applicable, shall fulfil the requirements of the present document on all frequencies over which it is intended to operate.

Where appropriate, testing shall be carried out on suitable frequencies for the equipment concerned.

If equipment is designed to operate with different carrier powers, measurements of each transmitter parameter shall be performed at the highest power level at which the transmitter is intended to operate.

Additionally, technical documentation and operating manuals, sufficient to allow testing to be performed, shall be available.

A test fixture for equipment with an integral antenna may be supplied (see clause 6.2.1).

To simplify and harmonize the testing procedures between the different testing laboratories, measurements shall be performed, according to the present document, on samples of equipment defined in clause 4.2.1.

These clauses are intended to give confidence that the requirements set out in the present document have been met without the necessity of performing measurements on all frequencies.

The provider shall declare the frequency range(s), the range of operation conditions and power requirements, as applicable, in order to establish the appropriate test conditions.

4.2.1 Choice of model for testing

One or more samples of the equipment, as appropriate, shall be tested.

Stand alone equipment shall be tested complete with any ancillary equipment needed for testing.

If equipment has several optional features, considered not to affect the RF parameters then the tests need only to be performed on the equipment configured with that combination of features considered to be the most complex.

4.2.2 Testing of equipment with alternative power levels

If a family of equipment has alternative output power levels provided by the use of separate power modules or add on stages, or additionally has alternative frequency coverage, then all these shall be declared. Each module or add on stage shall be tested in combination with the equipment. The necessary samples and tests shall be based on the requirements of clause 4. As a minimum, measurements of the radiated power (e.i.r.p.) and unwanted emissions shall be performed for each combination and shall be stated in the test report.

4.3 Mechanical and electrical design

4.3.1 General

The equipment tested shall be designed, constructed and manufactured in accordance with good engineering practice and with the aim of minimizing harmful interference to other equipment and services.

Transmitters and receivers may be individual or combination units.

4.3.2 Controls

Those controls which, if maladjusted, might increase the interfering potentialities of the equipment shall not be easily accessible to the user.

4.3.3 Transmitter shut-off facility

If the transmitter is equipped with an automatic transmitter shut-off facility, it should be made inoperative for the duration of the test. In the case this not possible, a proper test method shall be described and documented.

4.3.4 Receiver automatic switch-off

If the receiver is equipped with a battery-saving circuit for automatic switch-off, this circuit shall be made inoperative for the duration of the tests. In the case this not possible, a proper test method shall be described and documented.

4.3.5 Marking (equipment identification)

4.3.5.1 Equipment identification

The marking shall include as a minimum:

- the name of the manufacturer or his trademark;
- the type designation.

4.3.5.2 Marking

The equipment shall be marked in a visible place. This marking shall be legible and durable. In cases where the equipment is too small to carry the marking, it is sufficient to provide the relevant information in the users' manual.

4.4 Auxiliary test equipment

All necessary test signal sources and set-up information shall accompany the equipment when it is submitted for testing.

The following product information shall be provided by the manufacturer:

- the type of modulation technology implemented in the equipment (e.g. FMCW or pulsed);
- the operating frequency range(s) of the equipment;

- the intended combination of the transmitter/transceiver and its antenna and their corresponding e.i.r.p. levels in the main beam;
- the nominal power supply voltages of the radio equipment;
- for FMCW, FH, FSK or similar carrier based modulation schemes, it is important to describe the modulation parameters in order to ensure that the right settings of the measuring receiver are used. Important parameters are the modulation period, deviation or dwell times within a modulation period, rate of modulation (Hz/s);
- the implementation of features such as gating, hopping or stepped frequency hopping;
- the implementation of any mitigation techniques such as duty cycle;
- for pulsed equipment, the Pulse Repetition Frequency PRF shall be stated.

4.5 General requirements for RF cables

All RF cables including their connectors at both ends used within the measurement arrangements and set-ups shall be of coaxial or waveguide type featuring within the frequency range they are used:

- a VSWR of less than 1,2 at either end;
- a shielding loss in excess of 60 dB.

When using coaxial cables for frequencies above 40 GHz attenuation features increase significantly and decrease of return loss due to mismatching caused by joints at RF connectors and impedance errors shall be considered.

All RF cables and waveguide interconnects shall be routed suitably in order to reduce impacts on antenna radiation pattern, antenna gain, antenna impedance. Table 2 provides some information about connector systems that can be used in connection with the cables.

Table 2: Connector systems

Connector System	Frequency	Recommended coupling torque
N	18 GHz	0,68 Nm to 1,13 Nm
SMA	18 GHz (some up to 26 GHz)	~ 0,56 Nm
3,50 mm	26,5 GHz	0,8 Nm to 1,1 Nm
2,92 mm	40 GHz (some up to 46 GHz)	0,8 Nm to 1,1 Nm
2,40 mm	50 GHz (some up to 60 GHz)	0,8 Nm to 1,1 Nm
1,85 mm	65 GHz (some up to 75 GHz)	0,8 Nm to1,1 Nm

4.6 RF waveguides

Wired signal transmission in the millimeter range is preferably realized by means of waveguides because they offer low attenuation and high reproducibility. Unlike coaxial cables, the frequency range in which waveguides can be used is limited also towards lower frequencies (highpass filter characteristics). Wave propagation in the waveguide is not possible below a certain cutoff frequency where attenuation of the waveguide is very high. Beyond a certain upper frequency limit, several wave propagation modes are possible so that the behaviour of the waveguide is no longer unambiguous. In the unambiguous range of a rectangular waveguide, only H10 waves are capable of propagation.

The dimensions of rectangular and circular waveguides are defined by international standards such as 153-IEC for various frequency ranges. These frequency ranges are also referred to as waveguide bands. They are designated using different capital letters depending on the standard. Table 3 provides an overview of the different waveguide bands together with the designations of the associated waveguides and flanges.

For rectangular waveguides, which are mostly used in measurements, harmonic mixers with matching flanges are available for extending the frequency coverage of measuring receivers. Table 3 provides some information on waveguides.