



# SLOVENSKI STANDARD

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Electromagnetic compatibility and Radio spectrum Matters (ERM); Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W; Part 1: Technical requirements and methods of measurement

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# ETSI EN 302 208-1 V1.1.2 (2006-07)

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*European Standard (Telecommunications series)*

**Electromagnetic compatibility  
and Radio spectrum Matters (ERM);  
Radio Frequency Identification Equipment operating in the  
band 865 MHz to 868 MHz with power levels up to 2 W;  
Part 1: Technical requirements and  
methods of measurement**

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## Reference

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## Foreword

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

Every EN prepared by ETSI is a voluntary standard. The present document contains technical characteristics and test methods for the equipment to which it relates. This text should be considered as guidance only and does not make the present document mandatory.

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) laying down a procedure for the provision of information in the field of technical standards and regulations.

Annex A provides normative specifications concerning radiated measurements.

Annex B provides normative guidelines on the technical performance of the spectrum analyser used for measurement of the EUT.

Annex C provides informative guidelines on the relationship between reference bandwidths and resolution bandwidths for measuring receivers.

The present document is part 1 of a multi-part deliverable covering Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W, as identified below:

**Part 1:** "Technical requirements and methods of measurement";

Part 2: "Harmonized EN under article 3.2 of the R&TTE Directive".

### National transposition dates

|  |                 |
|--|-----------------|
| Date of adoption of this EN:   | 14 July 2006    |
| Date of latest announcement of this EN (doa):  | 31 October 2006 |
| Date of latest publication of new National Standard or endorsement of this EN (dop/e): | 30 April 2007   |
| Date of withdrawal of any conflicting National Standard (dow):                         | 30 April 2007   |



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# 1 Scope

The present document covers the minimum characteristics considered necessary in order to make the best use of the available frequencies. It does not necessarily include all the characteristics that may be required by a user, nor does it necessarily represent the optimum performance achievable.

Radio frequency identification products covered within the present document are considered by definition short-range devices. Power limits up to a maximum e.r.p. of 2 W are specified for this equipment in the frequency range 865 MHz to 868 MHz.

The present document applies to RFID interrogators and tags operating together as a system. The interrogators transmit within 200 kHz sub-bands using a modulated carrier. The tags respond with a modulated signal. Interrogators may be used with either integral or external antennas.

ElectroMagnetic Compatibility (EMC) requirements are covered by EN 301 489-1 [4] and EN 301 489-3 [7].

The types of equipment covered by the present document are as follows:

- fixed interrogators;
- hand portable interrogators;
- batteryless tags;
- battery assisted tags;
- battery powered tags.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

- [1] ETSI TR 100 028 (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".
- [2] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".
- [3] CISPR 16-1: "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1: Radio disturbance and immunity measuring apparatus".
- [4] ETSI EN 301 489-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements".
- [5] ETSI TR 102 273 (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".

- [6] ANSI C63.5: "American National Standard for Electromagnetic Compatibility-Radiated Emission Measurements in Electromagnetic Interference (EMI) Control-Calibration of Antennas (9 kHz to 40 GHz)".
- [7] ETSI EN 301 489-3: "Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz".

## 3 Definitions, symbols and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**assigned frequency band:** frequency band within which the device is authorized to operate

**battery assisted tag:** transponder that includes a battery to enhance its receive performance and power its internal circuitry

**batteryless tag:** transponder that derives all of the power necessary for its operation from the field generated by an interrogator

**battery powered tag:** transponder that uses the power from its battery to perform all of its operational functions

**conducted measurements:** measurements which are made using a direct 50  $\Omega$  connection to the equipment under test

**dedicated antenna:** removable antenna supplied and type tested with the radio equipment, designed as an indispensable part of the equipment

**frequency agile technique:** the technique used to determine an unoccupied sub-band in order to minimize interference with other users of the same band

**full tests:** all tests specified in EN 302 208-1

**global scroll:** a mode in which an interrogator is able continuously to read the same tag

**integral antenna:** permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment

**interrogator:** equipment that will activate an adjacent tag and read its data. It may also enter or modify the information in a tag

**limited tests:** limited tests (see clauses 4.2.1 to 4.2.2.3 of EN 302 208-1) are as follows:

- transmitter frequency error for mains operated equipment, see clause 8.1 of EN 302 208-1;
- transmitter frequency stability under low voltage conditions, see clause 8.2 of EN 302 208-1;
- transmitter effective radiated power, see clause 8.3 of EN 302 208-1.

**listen before talk:** action taken by an interrogator to detect an unoccupied sub-band prior to transmitting (also known as "listen before transmit")

**provider:** means the manufacturer, or his authorized representative or the person responsible for placing on the market

**radiated measurements:** measurements which involve the absolute measurement of a radiated field

**scan mode:** a specific test mode of an interrogator that detects a signal on a pre-selected sub-band and transmits automatically on another sub-band

NOTE: See clause 4.2.4, section 5.

**tag:** transponder that holds data and responds to an interrogation signal

**talk mode:** transmission of intentional radiation by an interrogator

## 3.2 Symbols

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

|           |            |
|-----------|------------|
| dB        | decibel    |
| d         | distance   |
| $\lambda$ | wavelength |

## 3.3 Abbreviations

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

|        |  |
|--------|--|
| ANSI   | American National Standards Institute                                |
| BER    | Bit Error Rate   |
| CEPT   | European Conference of Postal and Telecommunications Administrations |
| e.r.p. | effective radiated power   |
| EMC    | ElectroMagnetic Compatibility  |
| emf    | electromotive force  |
| ERC    | European Radio communication Committee                               |
| EUT    | Equipment Under Test   |
| f      | frequency  |
| fc     | centre frequency   |
| fe     | maximum frequency drift  |
| FT     | Full Tests   |
| LT     | Limited Tests  |
| OATS   | Open Area Test Site  |
| R&TTE  | Radio and Telecommunications Terminal Equipment                      |
| RF     | Radio Frequency  |
| RFID   | Radio Frequency Identification                                       |
| SRD    | Short Range Device   |
| VSWR   | Voltage Standing Wave Ratio  |

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## 4 Technical requirement specifications

### 4.1 General requirements

Interrogators are only permitted where they employ frequency agile techniques using "listen before talk".

#### 4.1.1 General performance criteria

To minimise interference to other users, the receivers of interrogators must be able to detect emissions from other radio devices in the band according to the following criteria:

- a) Where the receiver of an interrogator detects that a sub-band is already occupied by another device, the interrogator will automatically switch to an unused sub-band before transmitting its carrier.
- b) In situations where the receiver of an interrogator detects that all of the sub-bands in the permitted band are occupied by other devices the interrogator shall remain in the idle mode. The interrogator shall not transmit its carrier until its receiver has detected a sub-band that is unused.

##### 4.1.1.1 Receiver functional specification

To ensure that the interrogator detects the presence of other devices with which it could potentially interfere, the receiver of the interrogator shall conform to the requirements of clauses 4.1.1.1.1 and 4.1.1.1.2.

#### 4.1.1.1.1 Listen mode

Immediately prior to each transmission by an interrogator, its receiver shall switch to the listen mode and monitor a selected sub-band for a period of not less than the limit defined in clause 9.2. While in the listen mode the sensitivity of the receiver in the interrogator shall be set to enable detection at the appropriate threshold level as defined in clause 9.1.3. Any signal detected by the receiver in excess of the threshold level shall indicate that another equipment already occupies the sub-band. In such a situation the interrogator shall not transmit but monitor other sub-bands within the permitted band until it detects one in which the received signals are below the threshold level. Alternatively, the interrogator may remain on the same sub-band until it is clear. The interrogator shall then implement the listen time in accordance with clause 9.2.

#### 4.1.1.1.2 Talk mode

An interrogator that has detected an unoccupied sub-band shall be permitted to transmit on that sub-band in accordance with the requirements of clause 8.6. At the same time the receiver of the interrogator shall switch to the "talk" mode. The provider shall determine the sensitivity of the receiver in the "talk" mode in accordance with the needs of the application (see clause 9.1.3).

In the event that an interrogator, which is engaged in a dialogue with a tag, is subjected to interference, it may switch to another sub-band having first determined that this sub-band is unoccupied.

An interrogator may transmit a continuous carrier for a period not exceeding the period defined in clause 8.6.3. At the end of the transmission the interrogator shall not transmit again on the same sub-band for the period defined in clause 8.6.3. Alternatively the interrogator may immediately listen on each of the other sub-bands for a period of not less than the limit specified in clause 9.2 to locate one that is unoccupied. If the interrogator determines that a sub-band is vacant it may send a further continuous transmission in accordance with the requirements of clause 8.6.3. There is no limit to the number of times that this process may be repeated.

The interrogator shall be so designed as to ensure that its length of transmission is no greater than is necessary to perform the intended operation.

#### 4.1.2 Receiver classification

Since "listen before talk" is mandatory, the receiver of the interrogator shall comply with all of the requirements specified for the "listen mode" contained in clause 9.

## 4.2 Presentation of equipment for testing purposes

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

Providers shall select frequencies of operation in accordance with the plan for sub-bands defined in clause 4.2.2.1 and in accordance with the power levels defined in table 4.

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

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 as defined in clauses 4.2.1 to 4.5. 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 at all frequencies.

### 4.2.1 Choice of model for testing

The provider shall provide one or more samples of the equipment, as appropriate, for testing.

If an equipment has several optional features considered not to affect the RF parameters then tests need only be performed on the equipment configured with that combination of features considered to be the most complex, as proposed by the provider and agreed by the test laboratory.

In the case of hand portable equipment without a 50  $\Omega$  external antenna connector, see clause 4.2.6.

## 4.2.2 Operational frequency ranges

### 4.2.2.1 Choice of frequencies

Interrogators shall operate within the band 865 MHz to 868 MHz in multiple sub-bands of 200 kHz. The centre frequency of the lowest sub-band shall be 865,1 MHz.

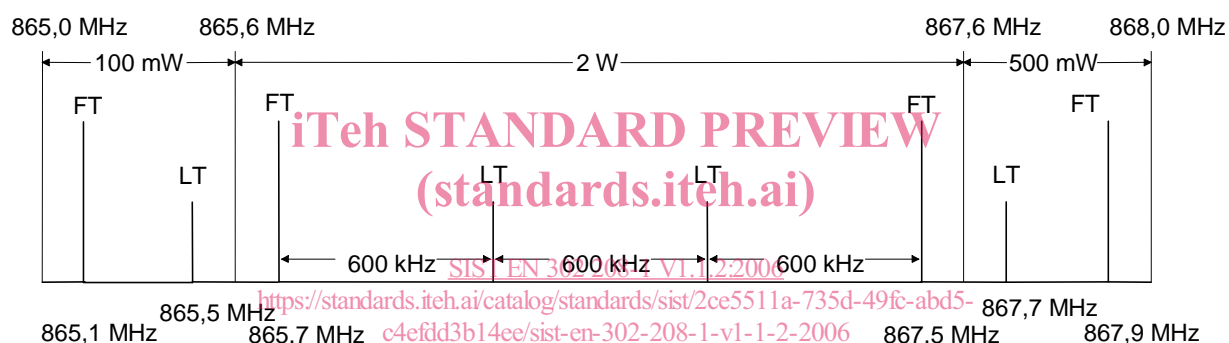
### 4.2.2.2 Sub-band range

When submitting equipment for testing, the provider shall state the frequencies of the sub-bands over which the interrogator will operate. The provider shall also confirm that the interrogator shall operate over all of the declared sub-bands without any change to the circuit or trimming of discrete components.

Trimming is an act by which the value (in this case relating to frequency) of a component is changed within the circuit. This act may include the physical alteration, substitution (by components of similar size and type) or activation/de-activation (via the setting of soldered bridges) of components.

### 4.2.2.3 Testing of operational frequencies

Figure 1 shows the permitted maximum power within the band. Full (FT) and Limited (LT) Tests, as defined in clause 3.1, shall be carried out within the applicable sub-band at the frequencies shown in figure 1.



Legend: LT: Limited tests, see clause 3.1.  
FT: Full tests, see clause 3.1.

**Figure 1: Tests on a single sample for equipment within the band 865,0 MHz to 868,0 MHz**

## 4.2.3 Number of samples for testing

Interrogators shall be submitted for test such that they may be configured to operate at the highest and lowest sub-band and at each of the intermediate sub-bands as specified in figure 1. It is only necessary for one sample of equipment to be tested.

The provider shall supply a quantity of at least 3 pre-programmed tags with each interrogator that is submitted for test.

## 4.2.4 Test mode

The interrogator shall include a suitable test mode to permit testing of the parameters defined in clauses 8, 9 and 10. The test mode shall be readily controlled by means, for example, of an external PC or terminal unit.

The test mode shall include the features listed below:

- 1) It shall be possible to set the interrogator to transmit a continuously un-modulated carrier on any one of the declared sub-bands of operation.
- 2) While the interrogator is transmitting on a preset sub-band, it shall be possible to read and log the identity of any valid tags that are present in the interrogation field.

- 3) It shall be possible to cause the interrogator continuously to transmit normal test signals as defined in clause 6.1 at its maximum data rate as declared by the provider.
- 4) It shall be possible to configure a tag in a test mode such that in the presence of an interrogation field it transmits a continuous modulated response. Alternatively this requirement may be satisfied by a suitably configured test tag with an output that is representative of the production version.
- 5) In order to test the "listen before talk" feature, it shall be possible initially to pre-select a sub-band of operation for the interrogator. In the event that the interrogator, prior to transmission, detects another station on the pre-selected sub-band, the interrogator will move automatically to the next higher sub-band. If the highest sub-band in the operating band has been pre-selected, the interrogator shall switch to its lowest sub-band.

## 4.2.5 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, then each module or add-on stage shall be tested in combination with the equipment. The necessary number of samples and additional tests can be proposed by the provider and shall be agreed by the test laboratory based on the requirements of clause 4.2.

## 4.2.6 Testing of equipment that does not have an external 50 $\Omega$ RF connector (integral antenna equipment)

### 4.2.6.1 Equipment with an internal permanent or temporary antenna connector

The means to access and/or implement the internal permanent or temporary antenna connector shall be stated by the provider with the aid of a diagram. The fact that use has been made of the internal antenna connection, or of a temporary connection, to facilitate measurements shall be recorded in the test report.

No connection shall be made to any internal permanent or temporary antenna connector during the performance of radiated emissions measurements, unless such action forms an essential part of the normal intended operation of the equipment, as declared by the provider.

### 4.2.6.2 Equipment with a temporary antenna connector

The provider may submit one set of equipment with the normal antenna connected, to enable the radiated measurements to be made. The provider shall attend the test laboratory at conclusion of the radiated measurements, to disconnect the antenna and fit the temporary connector. The testing laboratory staff shall not connect or disconnect any temporary antenna connector.

Alternatively, the provider may submit two sets of equipment to the test laboratory, one fitted with a temporary antenna connector with the antenna disconnected and the other with the antenna connected. Equipment shall be used for the appropriate tests. The provider shall declare that the two sets of equipment are identical in all respects.

## 4.3 Mechanical and electrical design

### 4.3.1 General

The equipment submitted by the provider 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.

Interrogators shall operate with the correct power source.

### 4.3.2 Controls

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

### 4.3.3 Transmitter shut-off facility

If the interrogator is equipped with an automatic transmitter shut-off facility, where appropriate, it should be made inoperative for the duration of the test.

### 4.3.4 CE Marking

The equipment shall be marked in a visible place. This marking shall be legible and durable.

In cases where the devices are too small to carry legible marking, it is sufficient to provide the relevant information in the user's manual and on the product packaging.

#### 4.3.4.1 Equipment identification, additional marking

The marking should be based on the CEPT/ERC/REC 70-03 [2] e.g.: and in addition include:

- receiver classification, see clause 4.1.2;
- temperature range, see clause 5.4.1;
- other relevant information.

## 4.4 Declarations by the provider

The provider shall declare all necessary information concerning the equipment in respect of the technical requirements set out in the present document. In particular, the provider shall supply a written description of the "frequency agile listen before talk" operation of the interrogator and explain how it conforms to the requirements of clauses 8.6 and 9.2.

## 4.5 Auxiliary test equipment

All necessary test signal sources including sample tags and setting up information shall accompany the equipment when it is submitted for testing.

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# 5 Test conditions, power sources and ambient temperatures

## 5.1 Normal and extreme test conditions

Testing shall be performed under normal test conditions, and also, where stated, under extreme test conditions.

The test conditions and procedures shall be as specified in clauses 5.2 to 5.4.

## 5.2 Test power sources

The equipment shall be tested using the appropriate test power source as specified in clauses 5.2.1 or 5.2.2. Where equipment can be powered using either external or internal power sources, then equipment shall be tested using the external test power source as specified in clause 5.2.1 then repeated using the internal power source as specified in clause 5.2.2.

The test power source used shall be stated.