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Harmonized European Standard (Telecommunications series)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment for Eurobalise railway systems; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

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Foreword

This Harmonized European Standard (Telecommunications series) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the Public Enquiry phase of the ETSI standards Two-step Approval Procedure.

The present document has been produced by ETSI in response to mandate M/364 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.

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 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").

Technical specifications relevant to Directive 1999/5/EC are given in annex A.

These specifications are complementary with the system and interoperability requirements for these devices established under Commission Decision 2004/447/EC.

In addition, relevant parts of EN 50121 are applicable for the electromagnetic compatibility of railway applications (part 3-2 for the OBE and part 4 for the Eurobalise equipment).

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

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 (see bibliography).

The Eurobalise transmission system is defined by the specifications of the UNISIG consortium (see bibliography).

1 Scope

The present document covers the technical requirements for radio transmitters and receivers used in the Eurobalise transmission system. The system is only used in railway systems.

It applies to the following equipment units:

a) the On-board Equipment (OBE) Tele-powering the Eurobalise; and

b) the Eurobalise that is always installed in between the rails.

The OBE comprises a transmitter (normally un-modulated) and a receiver fitted with an integral or dedicated antenna.

The Eurobalise FSK-modulated transmitter is Tele-powered by the OBE and has an integral antenna.

The Eurobalise transmission system operates in accordance with ERC Recommendation 70-03, annex 4.

These radio equipment types are capable of operating at the following frequencies as given in table 1.

Table 1: Radio communications frequencies

	Radio communications frequencies
OBE transmit centre frequency	27,095 MHz
Eurobalise transmit centre frequency	4,234 MHz

The present document is intended to cover the provisions of Directive 1999/5/EC (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".

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 a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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

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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 indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI TR 102 273 (2001-12) (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".

[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] ETSI TR 100 028 (2001-12) (all parts): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics".

[4] 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)".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

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

down-link: optional binary ASK- modulated transmission link from the OBE to trackside units

duty cycle: defined as the ratio, expressed as a percentage, of the maximum transmitter "on" time monitored over one hour, relative to a one hour period

Eurobalise: A wayside transmission unit that uses the magnetic transponder technology. Its main function is to transmit and/or receive signals through the air gap. The Eurobalise is a single device mounted on the track, which communicates with a train passing over it.

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

magnetic transponder technology: method that uses magnetic coupling in the air gap between a transmitter and a receiver for conveying data and energy. In the Eurobalise transmission system context, it considers systems using the 27,095 MHz for Tele-powering and 4,234 MHz for Up-link transmission.

On-Board Equipment (OBE): consists of antenna unit(s) (for magnetic transponder technology) and the Balise transmission function. It functionally matches the air-gap interface and is installed on a train.

RF carrier: fixed radio frequency prior to modulation

Tele-powering: signal transmitted by the OBE, which activates the Eurobalise upon passage. The signal is normally an un-modulated RF carrier (CW). However, it may optionally be binary ASK- modulated for the transmission of down-link data.

up-link: transmission link from the Eurobalise to the OBE

3.2 Symbols

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

f	Frequency
S	Power Density
λ	Wavelength

3.3 Abbreviations

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

AC	Alternating Current
ASK	Amplitude Shift Keying
CW	Continuous Wave
EUT	Equipment Under Test
FSK	Frequency Shift Keying
HS	Harmonized Standard
OATS	Open Area Test Site
OBE	On-Board Equipment
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
SRD	Short Range Device
VSWR	Voltage Standing Wave Ratio

4 Technical Requirements Specification

4.1 Technical Requirements

4.1.1 OBE Transmitter Mask

4.1.1.1 Definition

This test only applies to the OBE.

The radiated H-field mask is defined in the direction of maximum field strength under specified conditions of measurement.

4.1.1.2 Test Procedure

This test is performed using a radiated measurement (see clause 7.1).

4.1.1.3 Limit

The limits of figure 1 (expressed in dBµA/m at a distance of 10 m) shall not be exceeded.

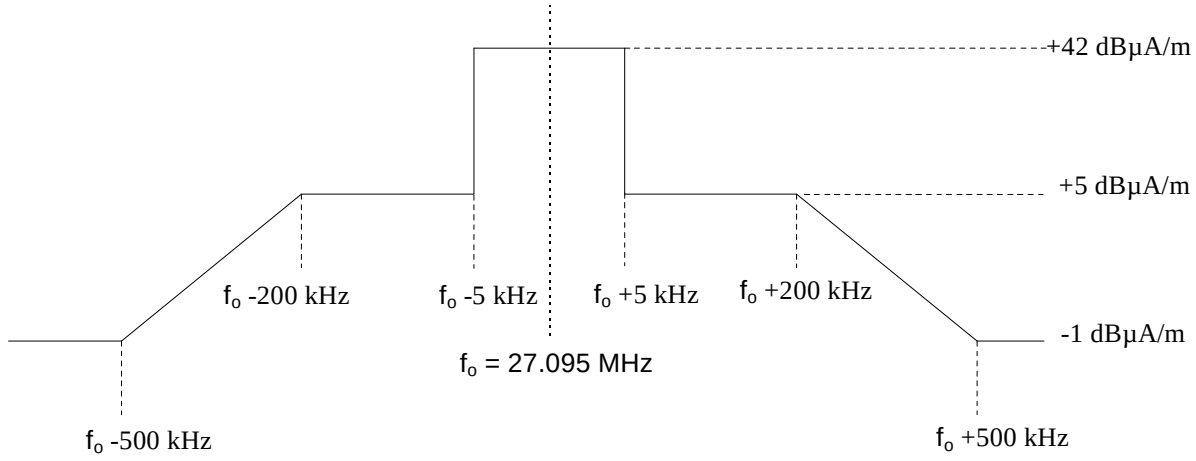

Figure 1: OBE transmitter mask

4.1.1.4 Maximum Allowable Measurement Uncertainty

See table 5 in clause 6.

4.1.2 OBE Unwanted Emissions

4.1.2.1 Definition

This test only applies to the OBE. Unwanted emissions consist of out-of-band and spurious emissions outside the frequency range 27,095 MHz ± 500 kHz as defined in clause 4.1.1.3.

4.1.2.2 Test Procedure

This test is performed using a radiated measurement (see clause 7.2).

4.1.2.3 Limit

The limits in table 2 (expressed in dBµA/m at a distance of 10 m for frequencies below 30 MHz and expressed in dBµV/m at a distance of 10 m for frequencies equal or greater than 30 MHz) shall not be exceeded.

Table 2: OBE unwanted emissions limits

Frequency: (f)	Limit
9 kHz ≤ f < 150 kHz	44 dBµA/m at 9 kHz decreasing with logarithm of frequency to 19 dBµA/m at 150 kHz
150 kHz ≤ f < 30 MHz	54 dBµA/m at 150 kHz decreasing with logarithm of frequency to 4 dBµA/m at 30 MHz
30 MHz ≤ f ≤ 1 GHz	79 dBµV/m at 30 MHz decreasing with logarithm of frequency to 54 dBµV/m at 1 GHz

4.1.2.4 Maximum Allowable Measurement Uncertainty

See table 5 in clause 6.

4.1.3 Eurobalise Transmitter Mask

4.1.3.1 Definition

This test only applies to Eurobalises.

The radiated H-field uplink mask is defined in the direction of maximum field strength under specified conditions of measurement.

4.1.3.2 Test Procedure

This test is performed using a radiated measurement (see clause 7.3).

4.1.3.3 Limit

The limits of figure 2 (expressed in dBµA/m at a distance of 10 m) shall not be exceeded.

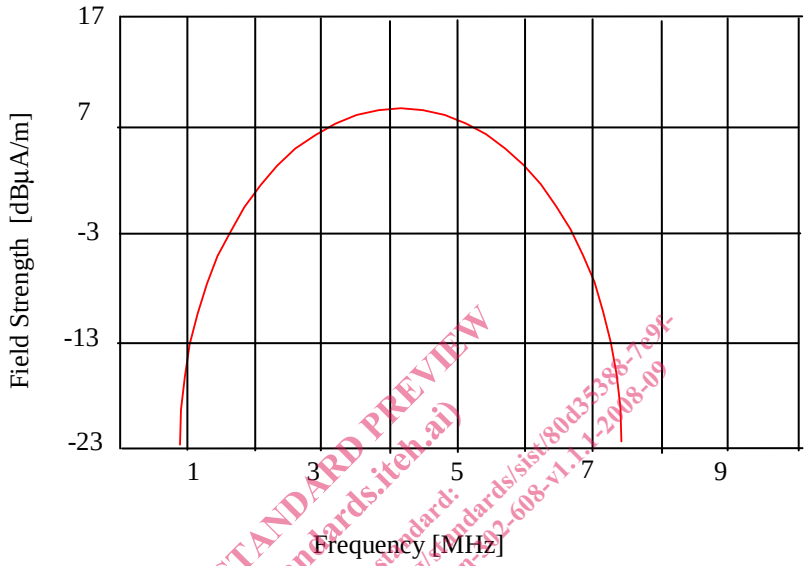

Figure 2: Eurobalise transmitter mask

The defined in-band frequency range is limited to the frequency range 4,234 MHz ± 1 MHz. The maximum value in the graph of figure 2 is 9 dBµA/m.

NOTE: ERC Recommendation 70-03, annex 4 recommends a maximum duty cycle of 1 % for the Eurobalise transmitter. This duty cycle can not be exceeded during normal operation due to the fact that the train never stops above the Eurobalise, i.e. the train only stops after the Eurobalise has been passed. In principle, it is impossible to exceed the duty cycle with moving trains due to the distance between trains versus Eurobalise operating range.

The provider shall declare the maximum duty cycle to not exceed 1 %.

4.1.3.4 Maximum Allowable Measurement Uncertainty

See table 5 in clause 6.

4.1.4 Eurobalise Unwanted Emissions

4.1.4.1 Definition

This test only applies to Eurobalises. Unwanted emissions consist of out-of-band and spurious emissions outside the frequency range 27,095 MHz ± 500 kHz as defined in clause 4.1.1.3 and outside the frequency range 4,234 MHz ± 1 MHz as defined in clause 4.1.3.3.

4.1.4.2 Test Procedure

This test is performed using a radiated measurement (see clause 7.4).

4.1.4.3 Limit

The limits in table 3 (expressed in dBµA/m at a distance of 10 m for frequencies below 30 MHz and expressed in dBµV/m at a distance of 10 m for frequencies equal or greater than 30 MHz) shall not be exceeded.

Table 3: Eurobalise unwanted emissions limits

Frequency: (f)	Limit
9 kHz ≤ f < 150 kHz	44 dBµA/m at 9 kHz decreasing with logarithm of frequency to 19 dBµA/m at 150 kHz
150 kHz ≤ f < 30 MHz	54 dBµA/m at 150 kHz decreasing with logarithm of frequency to 4 dBµA/m at 30 MHz
30 MHz ≤ f ≤ 1 GHz	79 dBµV/m at 30 MHz decreasing with logarithm of frequency to 54 dBµV/m at 1 GHz

4.1.4.4 Maximum allowable measurement uncertainty

See table 5 in clause 6.

5 Test Conditions

5.1 General

Testing shall be made under normal test conditions.

NOTE: The Eurobalise system components (OBE as well as the Eurobalise) are built for interoperability and the UNISIG specifications apply over the full operating temperature range (including the spectrum masks).

The test conditions and procedures shall be as specified in clauses 5.2 and 5.3.

5.2 Test Power Source

The OBE equipment shall be tested using the appropriate test power source.

The test power source used shall be stated in the test report.

The Eurobalise is purely Tele-powered during the test.

During the tests, the power source of the equipment shall be replaced by an external test power source capable of producing normal test voltages as specified in clause 5.3.2. The internal impedance of the external test power source shall be low enough for its effect on the test results to be negligible. For the purpose of the tests, the voltage of the external test power source shall be measured at the input terminals of the equipment. For radiated measurements any external power leads should be so arranged so as not to affect the measurements.

During tests the test power source voltages shall be within a tolerance of < ±1 % relative to the voltage at the beginning of each test. The value of this tolerance can be critical for certain measurements. Using a smaller tolerance will provide a better uncertainty value for these measurements.

5.3 Normal Test Conditions

5.3.1 Normal Temperature and Humidity

The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges:

- Temperature +15 °C to +35 °C;