



**Short Range Devices (SRD);
Radio equipment for Euroloop railway systems;
Harmonised Standard covering the essential requirements
of article 3.2 of the Directive 2014/53/EU**

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Foreword

This final 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 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.8] 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.1].

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.

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).

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Introduction

The Euroloop communication system is defined by the specifications [1] and [2] of the UNISIG consortia.

1 Scope

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

The present document applies to the following equipment:

- 1) The On-Board Equipment (OBE) receiving the Euroloop signal and the OBE comprises a receiver fitted with a dedicated antenna.
- 2) The Track-Side Equipment (Euroloop) transmitting the Euroloop signal that is always installed in an inner or outer foot of a rail.

The Euroloop transmission system operates in frequency bands listed in table 1 in accordance with the EC Decision 2013/752/EU [i.2], and ERC Recommendation 70-03 [i.3], annex 4.

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

Table 1: Radio communications frequencies

	Radio communications frequencies
OBE receive frequency band	11,1 -16,0 MHz
OBE transmit frequency band	27,09 - 27,10 MHz
Euroloop receiver frequency band	27,09 - 27,10 MHz
Euroloop transmit frequency band	11,1 -16,0 MHz
Euroloop transmit modulation	BPSK, DSSS chip rate 4,516 MHz

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] ERTMS/ETCS: "FFFIS for Euroloop", SUBSET-044, Issue 2.4.0, 29th February 2012.
- [2] ERTMS/ETCS: "Test Specification for Euroloop", SUBSET-103, Issue 1.1.0, 29th February 2012.

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] 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, (OJ L153, 22.5.2014, p62).
- [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] CEPT/ERC/Recommendation 70-03: "Relating to the use of Short Range Devices (SRD)".
- [i.4] ETSI TR 100 028-1 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".
- [i.5] ETSI TR 100 028-2 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".
- [i.6] ETSI EN 300 330 (V1.7.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Part 1: Technical characteristics and test methods".
- [i.7] CENELEC EN 50121-2 (2015-03): "Railway applications - Electromagnetic compatibility - Part 2: Emission of the whole railway system to the outside world" / Applies in conjunction with EN 50121-1 (2000-09)".
- [i.8] 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 following terms and definitions apply:

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

eurobalise: wayside transmission unit that uses the magnetic transponder technology

NOTE: 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.

euroloop: wayside transmission unit that uses the magnetic transmission technology

NOTE: Its main function is to transmit signals through the air gap. The Euroloop is a single device mounted on the track, which communicates with a train passing over it.

magnetic transmission technology: method that uses magnetic coupling in the air gap between a transmitter and a receiver

NOTE: In the Euroloop transmission system context, it considers systems using the band 11,1 - 16,0 MHz for Uplink (track to train) transmission.

rf carrier: fixed radio frequency prior to modulation

uplink: transmission link from the Euroloop to the OBE

3.2 Symbols

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

f	Frequency
Ω	Ohm
R	Distance
R _c	Chip rate
λ	wavelength

3.3 Abbreviations

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

BPSK	Binary Phase Shift Keying
CW	Continuous Wave
dB	deciBel (logarithmic scale)
DSSS	Direct Sequence Spread Spectrum
ERC	European Radiocommunications Committee
LOOMO	LOOp MOdem
OBE	On-Board Equipment
RF	Radio Frequency
RMS	Root Mean Square
SRD	Short Range Device
TX	Transmitter
UNISIG	UNion Industry of SIGnalling
VSWR	Voltage Standing Wave Ratio

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be declared by the manufacturer. 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.

4.2 Transmitter conformance requirements

4.2.1 OBE TX field strength and Transmitter mask

4.2.1.1 Applicability

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.

NOTE: Eurobalise-OBE tele-powering is used for wake-up of the Euroloop.

4.2.1.2 Limits

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

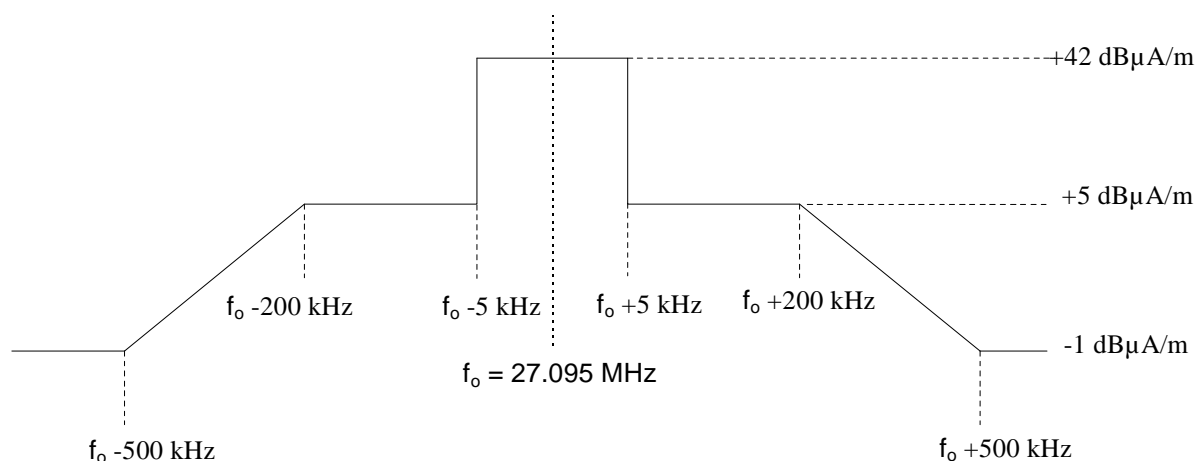


Figure 1: OBE transmitter mask

4.2.1.3 Conformance

The conformance test suite for OBE transmitter mask shall be as defined in clause 6.1.1 of the present document.

4.2.1.4 Maximum Allowable Measurement Uncertainty

See table 5 in clause 5.3.

4.2.2 OBE unwanted emissions

4.2.2.1 Applicability

This test only applies to the OBE. Unwanted emissions consist of out-of-band and spurious emissions outside the frequency range $27,095 \text{ MHz} \pm 500 \text{ kHz}$ as defined in clause 4.2.1.2.

NOTE: Eurobalise-OBE tele-powering is used for wake-up of the Euroloop.

4.2.2.2 Limits

The limits in table 2 (expressed in $\text{dB}\mu\text{A}/\text{m}$ at a distance of 10 m for frequencies below 30 MHz and expressed in $\text{dB}\mu\text{V}/\text{m}$ 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
$9 \text{ kHz} \leq f < 150 \text{ kHz}$	44 $\text{dB}\mu\text{A}/\text{m}$ at 9 kHz decreasing with logarithm of frequency to 19 $\text{dB}\mu\text{A}/\text{m}$ at 150 kHz
$150 \text{ kHz} \leq f < 30 \text{ MHz}$	54 $\text{dB}\mu\text{A}/\text{m}$ at 150 kHz decreasing with logarithm of frequency to 4 $\text{dB}\mu\text{A}/\text{m}$ at 30 MHz
$30 \text{ MHz} \leq f \leq 1 \text{ GHz}$	79 $\text{dB}\mu\text{V}/\text{m}$ at 30 MHz decreasing with logarithm of frequency to 54 $\text{dB}\mu\text{V}/\text{m}$ at 1 GHz
NOTE:	The values are based on the assumption that the system operates in a rail environment installed below a rail vehicle. The values are extracted from the EMC limits for rail equipment given in figure 1 (150 kHz to 1 GHz) and figure C.1 (below 150 kHz) of CENELEC EN 50121-2:2015 [i.7]. The most stringent EMC limits (Category C) decreased by 6 dB have been chosen for the limits in clause 4.2.2.2 table 2.

4.2.2.3 Conformance

The conformance test suite for OBE unwanted emission shall be as defined in clause 6.1.2 of the present document.

4.2.2.4 Maximum Allowable Measurement Uncertainty

See table 5 in clause 5.3.

4.2.3 Euroloop transmitter field strength

4.2.3.1 Applicability

This only applies to the Euroloop transmitter.

4.2.3.2 Limits

The transmitted magnetic field strength shall not exceed -7 dB μ A/m at 10 m distance within the frequency range of 11,1 MHz to 16,0 MHz measured in a bandwidth of 10 kHz spatially averaged over any 200 m length of the loop.

4.2.3.3 Conformance

The conformance test suite for the Euroloop transmitter field strength shall be as defined in clause 6.1.4 of the present document.

4.2.4 Euroloop transmitter mask

4.2.4.1 Applicability

This test only applies to the Euroloop transmitter consisting of out-of-band and spurious emissions outside the frequency range 11,1 MHz to 16,0 MHz as defined in clause 4.2.3.2.

4.2.4.2 Limit

The measured spectrum (field strength) shall not exceed the relative frequency mask values of figure 2.

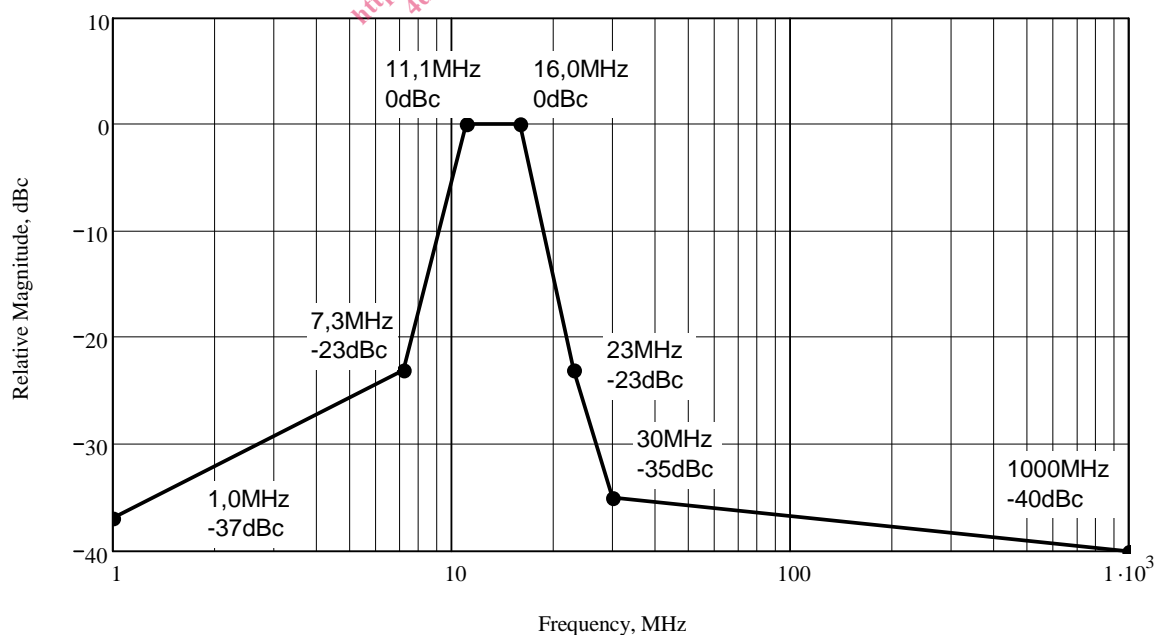


Figure 2: Euroloop transmitter spectrum and spurious mask