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**Železniške naprave - Združljivost voznih sredstev in sistemov za detekcijo vlaka -
2. del: Združljivost s tirnimi tokokrogi**

Railway applications - Compatibility between rolling stock and train detection systems -
Part 2: Compatibility with track circuits

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English Version

**Railway applications - Compatibility between rolling stock and
train detection systems - Part 2: Compatibility with track circuits**

Applications ferroviaires - Compatibilité entre le matériel
roulant et les systèmes de détection des trains - Partie 2 -
Compatibilité avec les circuits de voie

Bahnanwendungen - Kompatibilität zwischen Fahrzeugen
und Gleisfreimeldesystemen - Teil 2: Kompatibilität mit
Gleisstromkreisen

This Technical Specification was approved by CENELEC on 2015-04-20.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (CLC/TS 50238-2:2015) has been prepared by CLC/SC 9XA "Communication, signalling and processing systems" of Technical Committee CLC/TC 9X, "Electrical and electronic applications for railways".

This document supersedes CLC/TS 50238-2:2010.

CLC/TS 50238-2:2015 includes the following significant technical changes with respect to CLC/TS 50238-2:2010:

- The interference current limits for RST have been updated in the normative Annex A.
- The measurement and evaluation methods for verifying conformity of rolling stock to the limits for interference current emissions have been moved to the new normative Annex B.

This Technical Specification is intended to become Part 2 of the EN 50238 series published under the title *Railway applications — Compatibility between rolling stock and train detection systems*. The series consists of:

- *Part 1: General*¹⁾;
- *Part 2: Compatibility with track circuits* [this document];
- *Part 3: Compatibility with axle counters*.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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1) The existing EN 50238:2003 was renumbered EN 50238-1 when the voting procedure on Parts 2 and 3 was closed.

Introduction

This Technical Specification is being developed to permit compliance with the Interoperability Directives (High Speed and Conventional).

This Part 2 of the series defines:

- a set of interference current limits for rolling stock based on defined track circuits,
- measurement and evaluation methods to verify rolling stock interference current emissions and demonstrate compatibility with the track circuits;
- traceability of compatibility requirements (types of track circuit and associated limits).

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1 Scope

This Technical Specification defines, for the purpose of ensuring compatibility between rolling stock and track circuits, the limits for interference current emissions from rolling stock. The measurement and evaluation methods for verifying conformity of rolling stock to these limits are presented in a dedicated annex.

The interference limits are only applicable to interoperable rolling stock which is intended to run on lines exclusively equipped with preferred track circuits listed in this Technical Specification. National Notified Technical Rules are still to be used in all cases, where the line over which the rolling stock is intended to run is equipped with any type of older version or non-preferred track circuits that are not listed in this Technical Specification. However, the rolling stock test methodology (infrastructure conditions, test configurations, operational conditions, etc.) presented in this Technical Specification is also applicable to establish compatibility with non-preferred track circuits.

This Technical Specification gives guidance on the derivation of interference current limits specified for rolling stock and defines measurement methods and evaluation criteria in a dedicated annex.

This Technical Specification defines:

- a) a set of interference current limits for RST (Rolling Stock) applicable for each of the following types of traction system:
 - 1) DC (750 V, 1,5 kV and 3 kV);
 - 2) 16,7 Hz AC;
 - 3) 50 Hz AC;
- b) methodology for the demonstration of compatibility between rolling stock and track circuits;
- c) measurement method to verify interference current limits and evaluation criteria.

NOTE 1 The basic parameters of track circuits associated with the interference current limits for RST are not in the scope of this Technical Specification.

NOTE 2 Any phenomena linked to traction power supply and associated protection (over voltage, short-circuit current, under- and over-voltage if regenerative brakes are used) is part of the track circuit design and outside the scope of this Technical Specification.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50126 (all parts), *Railway applications — The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)*

EN 50128, *Railway applications — Communication, signalling and processing systems — Software for railway control and protection systems*

EN 50129, *Railway applications — Communication, signalling and processing systems — Safety related electronic systems for signalling*

EN 50238-1:2003, *Railway applications — Compatibility between rolling stock and train detection systems — Part 1: General*

CLC/TS 50238-3:2013, *Railway applications — Compatibility between rolling stock and train detection systems — Part 3: Compatibility with axle counters*

EN 50388, *Railway Applications — Power supply and rolling stock — Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability*

CLC/TR 50507, *Railway applications — Interference limits of existing track circuits used on European railways*

UIC 550, *Power supply installations for passenger stock*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50238-1:2003 and CLC/TS 50238-3:2013 and the following apply.

3.1.1

coupled vehicles

part of the influencing unit which may be considered as an individual source of interference, different to the Traction Subsystem

Note 1 to entry: See Figure 1 for examples.

Note 2 to entry: Since one influencing unit may consist of multiple sources of influence, it is normally ensured that the resulting interference current emitted by the influencing unit into the power supply network does not exceed the interference current limits for RST value.

3.1.2

influencing unit

rolling stock influencing the train detection system

Note 1 to entry: One influencing unit comprises all coupled/connected vehicles, e.g. complete train with single or multiple traction, single vehicle, multiple connected/coupled vehicles and wagons, e.g. one complete passenger train, consisting of one or more TUs and up to 16 coaches.

3.1.3

integration time

window size over which the output of the bandpass filter is calculated using RMS

3.1.4

interference source

equivalent to traction unit which is fed from its own power supply interface point (pantograph or shoe gear)

3.1.5

propulsion system

electrical/mechanical system that produces mechanical force to push the train forward

3.1.6

sources

interference sources which can generate harmonics independently

3.1.7

train detection system

system which comprises of equipment to detect the presence of a train

3.1.8

traction power unit

unit on the train housing, the converter/inverter equipment and its associated control to drive the propulsion system

Note 1 to entry: It is also known as the motor car.

3.1.9

traction subsystem

subset of the Traction Unit which produces traction force or electric brake force

3.1.10

train under test

influencing unit used for the test measurements

3.1.11**traction unit**

subset of influencing unit, which comprises all Traction Subsystems including auxiliary supplies and other power supplies, which can be collectively switched off by one collector/pantograph

Note 1 to entry: See CLC/TR 50507.

Note 2 to entry: The influencing unit may consist of several "traction units" (TU). Each TU is fed from one pantograph. One TU may be:

- one locomotive;
- one electric multiple unit, with one or several propulsion systems or traction power units (motor cars);
- one complete passenger train, consisting of individual passenger coaches.

Note 3 to entry: The number of TUs that form one IU depends on the type of rolling stock and its application. Therefore, the definition of such numbers is out of the scope of this Technical Specification. The following figure shows some examples for various types and compositions of traction units, forming one influencing unit in each case:

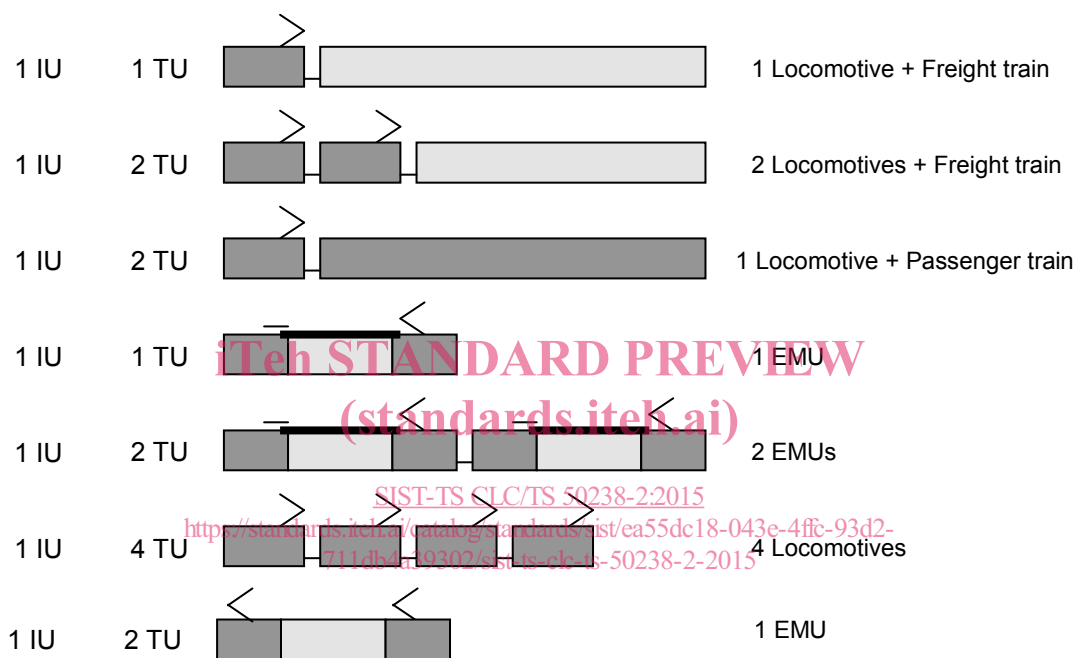


Figure 1 — Examples of IUs

3.1.12**transmitter breakthrough**

background interference which can be present at the track circuit receiver from rolling stock on adjacent tracks or substation harmonics due to shared cross bonds and/or electrical imbalance of the track circuit

3.2 Abbreviations

For the purposes of this document, the abbreviations given in CLC/TS 50238-3:2013 and the following apply.

AC	Alternating Current
A/D	Analogue to Digital
DC	Direct Current
EMU	Electrical Multiple Unit
FFT	Fast Fourier Transforms
FSK	Frequency Shift Keying
HVI	High Voltage Impulse

IU	Influencing Unit
PC	Personal Computer
PWM	Pulse Width Modulation
RMS	Root Mean Square
RSF	Right Side Failure
RST	Rolling stock
TC	Track Circuit
TDS	Train Detection System
TS	Traction Subsystem
TU	Traction Unit
WSF	Wrong Side Failure

4 General aspects of interference current limits for RST

4.1 Derivation of interference current limits for RST

The interference limits are defined for a set of preferred types of existing track circuits which are also defined by Railway Infrastructure companies for use on future new signalling projects on interoperable lines²⁾. If it is found that the line over which the rolling stock is intended to run is equipped with an older version or with non-preferred track circuit then National Notified Technical Rules shall be used. It is not the intention of this Technical Specification to mandate any particular type of train detection but it is expected that because the list of preferred types and their limits for compatibility are drawn on the basis of established performance criteria, the trend will be that upgraded interoperable lines are fitted with types which meet the compatibility limits published in this Technical Specification. The complete set of compatibility requirements for existing preferred and future types of track circuits to be installed on interoperable lines is outside the scope of this Technical Specification.

In principle, the preferred types of track circuits from CLC/TR 50507 have been considered in defining the interference current limits for RST. Where new upgrades of track circuits are available, their improved susceptibility limits have been taken into account in this Technical Specification.

Annex A defines the interference current limits for compatibility with track circuits. The interference current limits for RST are defined up to and including the highest frequency range occupied by existing track circuits.

The limits I_0 are defined under worst case credible failure conditions of the track circuit such as unbalance or broken bonds or rails as defined by national authorities.

The transfer function between the interference current limit I_0 and the susceptibility of the track circuit can be different for different infrastructure conditions. In the worst case, if the transfer function ratio is one, the total interference current limit is defined by the susceptibility of the track circuit, taking into account any contribution from the power supply.

2) The interference current limits and the measurement specification defined in this standard apply to rolling stock intended to run over interoperable lines equipped with preferred types of track circuits as defined by national infrastructure authorities.

4.2 Application of Interference current limits to RST design

The interference current limits for RST apply to one influencing unit.

By definition, the interference current limits for RST are based on the maximum steady state interference signal to which the track circuit may be exposed.

The rolling stock interference current limits incorporate the established margins for the relevant track circuits which take into account the interference current generated by other vehicles on adjacent or the same tracks. Specific traction supply harmonics circulated through the impedance of the influencing unit are dealt with as part of the evaluation methods presented in Annex B.

In the case of testing of single traction units on the operational railway the interference current limits for RST will have to be applied to the influencing unit by using applicable summation rules, as explained in Annex B.

The interference current limits for RST are defined at absolute frequencies and therefore not dependent on mains frequency variations. The measured RST interference current is dependant on the mains frequency variations.

A vehicle is required to conform only to the interference current limits for RST for the traction system(s) (DC, 16,7 Hz, 50 Hz) on which it is intended to operate.

4.3 System definition

4.3.1 Structure

The overall system to be considered is shown in Figure 2³⁾. It consists of four main parts that are defined in the following subclauses.

Example characterization of parts of the system based on a recent measurement campaign in different railway networks can be found in Annex C.

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3) If the configuration is applied to DC, normally DC transducers are placed in the 'Hot path'.