



**SLOVENSKI STANDARD**  
**SIST-TS CLC/TS 50238-2:2010**  
**01-december-2010**

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**Železniške naprave - Medobratovalnost 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

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

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

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**Ta slovenski standard je istoveten z: CLC/TS 50238-2:2010**

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**ICS:**

03.220.30	Železniški transport	Transport by rail
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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TECHNICAL SPECIFICATION  
SPÉCIFICATION TECHNIQUE  
TECHNISCHE SPEZIFIKATION

**CLC/TS 50238-2**

July 2010

ICS 29.280; 45.060.10

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 -  
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und Gleisfreimeldesystemen -  
Teil 2: Kompatibilität  
mit Gleisstromkreisen

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**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

This Technical Specification was prepared by SC 9XA, Communication, signalling and processing systems, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

It was circulated for voting in accordance with the Internal Regulations, Part 2, Subclause 11.3.3.3 and was approved by CENELEC as CLC/TS 50238-3 on 2010-07-09.

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

The following date was fixed:

- latest date by which the existence of the CLC/TS has to be announced at national level (doa) 2011-01-07

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

- Part 1: General <sup>1)</sup>
- Part 2: Compatibility with track circuits (this document)
- Part 3: Compatibility with axle counters.

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<sup>1)</sup> Existing EN 50238:2003 was renumbered EN 50238-1 once the voting procedure on Parts 2 & 3 was closed.

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## 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 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 conducted interference from rolling stock and the measurement method for verifying conformity of rolling stock to these limits.

The interference limits are only applicable to interoperable rolling stock which is intended to run on lines exclusively equipped with preferred track circuit 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.

This Technical Specification defines

- a set of interference current limits for RST (Rolling Stock) applicable for each of the following types of traction system:
  - DC (750 V, 1,5 kV and 3 kV);
  - 16,7 Hz AC;
  - 50 Hz AC.
- methodology for the demonstration of compatibility between rolling stock and track circuits,
- 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN/TR 50126 series, 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 50163, Railway applications - Supply voltages of traction systems

EN 50238, Railway applications - Compatibility between rolling stock and train detection systems

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

ENV 13005, Guide to the expression of uncertainty in measurements

### 3 Terms, definitions and abbreviations

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50238 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 (see Figure 1 for examples)

NOTE 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 traction detection system

NOTE 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**

the 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**

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

##### 3.1.6

##### **sources**

any interference source which can generate harmonics independently

##### 3.1.7

##### **train detection system**

this comprises of equipment to detect the presence of a train

##### 3.1.8

##### **traction power unit**

the unit on the train housing the converter/inverter equipment and its associated control to drive the propulsion system. It is also known as the motor car

##### 3.1.9

##### **traction subsystem**

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

##### 3.1.10

##### **train under test**

the influencing unit used for the test measurements

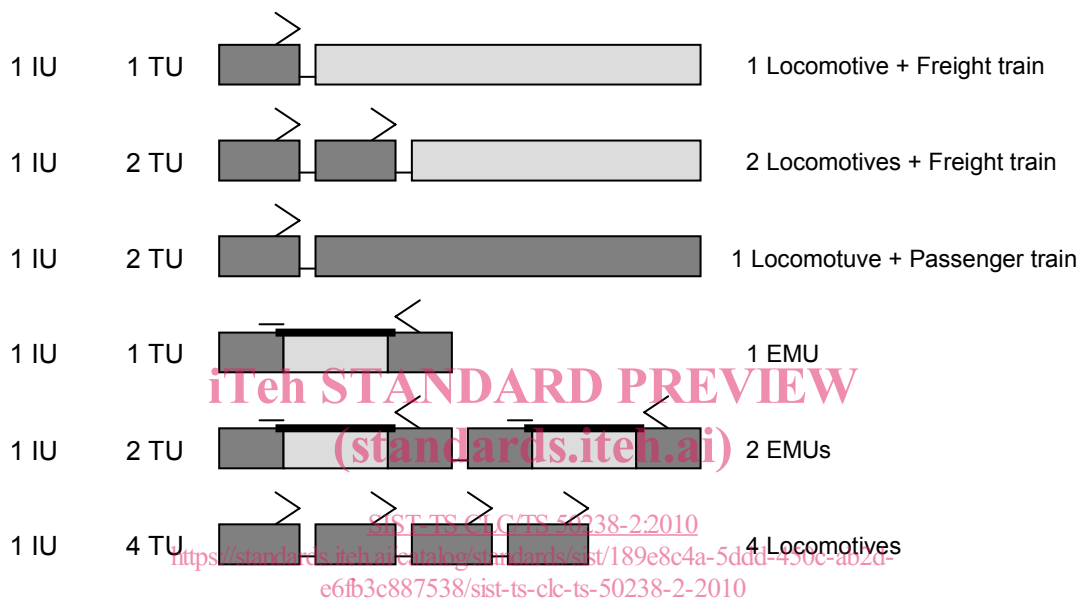
**3.1.11****traction unit**

a subset of influencing unit. Comprises all Traction Subsystems including auxiliary supplies and other power supplies, which can be collectively switched off by one collector/pantograph, see CLC/TR 50507

NOTE 1 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 2 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**

any 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 EN 50238 and the following apply.

<b>AC</b>	Alternating Current
<b>A/D</b>	Analogue to Digital
<b>DAT</b>	Digital Audio Tape
<b>DC</b>	Direct Current
<b>EMU</b>	Electrical Multiple Unit
<b>FFT</b>	Fast Fourier Transforms
<b>FSK</b>	Frequency Shift Keying
<b>IU</b>	Influencing Unit
<b>PC</b>	Personal Computer

<b>PWM</b>	Pulse Width Modulation
<b>RMS</b>	Root Mean Square
<b>RSF</b>	Right Side Failure
<b>RST</b>	Rolling stock
<b>TC</b>	Track Circuit
<b>TDS</b>	Train Detection System
<b>TS</b>	Traction Subsystem
<b>TU</b>	Traction Unit
<b>WSF</b>	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 lines<sup>1)</sup>. 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. These upgraded track circuits whose limits are incorporated in the interference current limits for RST are marked with a star in the lists of track circuits provided in Clause 6.

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 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.

### 4.2 Application of Interference current limits to RST design

The interference current limits for RST and associated test methods 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 for RST incorporate the established margins for the relevant track circuits which take into account for interference current already generated by other vehicles on adjacent tracks. Specific traction supply harmonics circulated through the impedance of the influencing unit are dealt with as part of the evaluation methods.

<sup>1)</sup> 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.

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. See also Clause 7 and 8.1.

The interference current limits for RST are defined at absolute frequencies and therefore not dependent on mains variations.

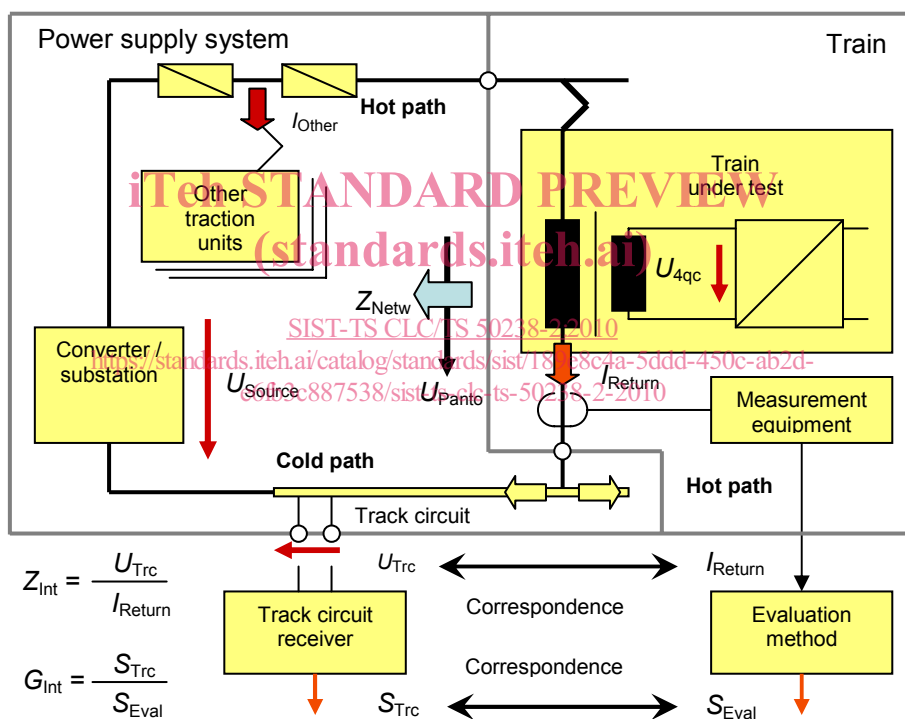
A vehicle is required to conform only to the interference current limits for RST for the traction system(s) (DC, 16,7 Hz, 50 Hz) on which it is intended to operate.

### 4.3 System definition

#### 4.3.1 Structure

The overall system to be considered is shown in Figure 2<sup>1)</sup>. It consists of four main parts that are defined in the following subclauses.

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



Cold path	Return current path between the traction unit and the energy source via rails
$G_{Int}$	Ratio of signal at the track circuit receiver and measured interference signal
Hot path	Path between the energy source and the traction unit for drawing current
$I_{Other}$	Current measured in the pantograph of other trains
$I_{Return}$	Current measured in the pantograph of the train under test
$S_{Eval}$	Interference signal processed using established evaluation criteria
$S_{Trc}$	Actual interference signal at the track circuit receiver produced by the train under test while over the TC
$U_{Panto}$	Voltage measured at the pantograph of the train
$U_{Source}$	Voltage measured at the substation(s) or converter(s). Some railway systems have multiple side feeding arrangements
$U_{Trc}$	Voltage measured at the track circuit receiver while occupied by the train
$U_{4qc}$	Voltage developed at the four quadrant converter of the train
$Z_{Int}$	Railway impedance as seen by the train. It defines the transfer function (coupling factor) between interference signal produced by RST and the track circuit

Figure 2 - System configuration considered for interference

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