SLOVENSKI STANDARD
oSIST prEN 50617-1:2022

01-marec-2022

Železniške naprave - Tehnični parametri sistemov za ugotavljanje lokacije vlakov, ki zagotavljajo medobratovalnost vseevropskega železniškega sistema - 1. del: Tirni tokokrog

Railway applications - Technical parameters of train detection systems for the interoperability of the trans-European railway system - Part 1: Track circuits

Bahnanwendungen - Technische Parameter von Gleisfreimeldesystemen für die Interoperabilität des transeuropäischen Eisenbahnsystems - Teil 1: Gleisstromkreise

Applications ferroviaires - Paramètres techniques des systèmes de détection des trains pour lInteropérabilité du système ferroviaire transeuropéen - Partie 1: Circuits de voie

Ta slovenski standard je istoveten z: **prEN 50617-1**

ICS:

45.020	Železniška tehnika na splošno	Railway engineering in general

oSIST prEN 50617-1:2022 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 50617-1

February 2022

ICS 29.260.99

Will supersede EN 50617-1:2015 and all of its amendments and corrigenda (if any)

English Version

Railway applications - Technical parameters of train detection systems for the interoperability of the trans-European railway system - Part 1: Track circuits

Applications ferroviaires - Paramètres techniques des systèmes de détection des trains pour l¿Interopérabilité du système ferroviaire transeuropéen - Partie 1: Circuits de voie

Bahnanwendungen - Technische Parameter von Gleisfreimeldesystemen für die Interoperabilität des transeuropäischen Eisenbahnsystems - Teil 1: Gleisstromkreise

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2022-04-29.

It has been drawn up by CLC/SC 9XA.

If this draft becomes a European Standard, CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CENELEC in three official versions (English, French, German).
A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Project: 71560

Ref. No. prEN 50617-1 E

Contents

Page

Foreword

This document (prEN 50617-1:2022) has been prepared by CLC/SC 9XA “Communication, signalling and processing systems” of CLC/TC 9X “Electrical and electronic applications for railways”.

This document is currently submitted to the Enquiry.

The following dates are fixed:

— latest date by which the existence of this document has to be announced at national level	(doa)	dor + 6 months
— latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	dor + 12 months
— latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	dor + 36 months (to be confirmed or modified when voting)

This document will supersede EN 50617-1:2015.

The significant technical changes with respect to EN 50617-1:2015 are the following:

— Clause 6: Technical parameters have been enhanced to provide the requirements to demonstrate compliance with the Frequency Management published in ERA/ERTMS/033281;

— Clause 7: It is now amended and consistent with ERA/ERTMS/033281;

— Clause 8: Track parameters have been re-defined;

— Clause 9 has been enhanced with practical examples;

— Annex A: Parameters are revisited for consistency;

— Annex E: New Table has been added for parameters of track circuits which are already defined as compatible with the Frequency Management in ERA/ERTMS/033281. A subclause is introduced to define the link between the current standard and the new standard being developed for Measurements of RST emissions for compatibility with track circuits by SC9XB/WG34;

— Annex F “Vehicle Impedance / guidance for RST design to support the FrM” has been deleted, consequently the Annexes G to K have been renumbered as Annexes F to J;

— New Annex K: New informative annex which defines proposed Out of Band Frequency Limits for 25 kV 50 Hz and DC power networks.

— Annex L has been deleted;

This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZZ, which is an integral part of this document.

EN 50617, *Railway applications – Technical parameters of train detection systems*, will consist of

— Part 1: Track circuits;

— Part 2: Axle counters.

Introduction

The working group SC9XA WGA4-2 has developed the limits for electromagnetic compatibility between rolling stock and train detection systems, specifically track circuits and axle counter systems and correspondingly published two technical specifications CLC/TS 50238-2 and CLC/TS 50238-3. These limits and associated measurement methods are based on preferred existing systems (as defined in CLC/TS 50238-2 and CLC/TS 50238-3) which are well established and still put forward for signalling renewals by infrastructure managers.

To meet the requirements for compatibility between train detection systems and rolling stock in the future and to achieve interoperability and free movement within the European Union, ERA/ERTMS/033281 defines the relevant parameters for compatibility with track circuits and axle counter systems.

The train detection systems, track circuits and axle counters are an integral part of the CCS trackside subsystem in the context of the Rail Interoperability Directive. The relevant technical parameters are enumerated in the CCS and LOC&PAS TSI and specified in the mandatory Specification (ERA/ERTMS/033281). This document refers whenever needed to this Specification. Although the demand for FrM is driven by Interoperability requirements, it is independent from the drive to introduce systems like ERTMS level 3 or level 2.

This document is based on the current understanding of the railway experts represented at WGA4-2 that track circuits and axle counter systems will continue to be the essential two train detection systems for the foreseeable future.

The published specification CLC/TS 50238-2 can be used to ascertain conformity of individual train detection systems to the requirements of the TSIs, that will be in place for the parameters still declared “open points” in ERA/ERTMS/033281.

In this document, the defined parameters are structured and allocated according to their basic references as follows:

— track circuit system parameters;

— train based parameters;

— track based parameters;

— environmental and other parameters.

Where possible, the parameters as defined are consistent with other European Standards.

Each parameter is defined by a short general description, the definition of the requirement, the relation to other standards and a procedure to show the fulfilment of the requirement as far as necessary. An overview of the safety relevance of each parameter is given – in the context of this document – in a separate table.

1 Scope

This document specifies the technical parameters of track circuits associated with the disturbing current emissions limits for RST in the context of interoperability defined in the form of Frequency Management in ERA/ERTMS/033281. The limits for compatibility between rolling stock and track circuits addressed in this document allow provision for known interference phenomena linked to traction power supply and associated protection (over voltage, short-circuit current and basic transient effects like in-rush current and power cut-off).

This document is intended to be used to assess compliance of track circuits equipment and other forms of train detection systems using the rails as part of their detection principles, in the context of the European Directive on the interoperability of the trans-European railway system and the associated technical specification for interoperability relating to the control-command and signalling track-side subsystems.

The document describes technical parameters to consider for achieving the compatibility of the track circuit with the emissions limits defined in the frequency management for rolling stock (ERA/ERTMS/033281). These parameters are structured and allocated according to their basic references as follows:

— Technical track circuit parameters;

— Train based parameters;

— Track based parameters;

— Environmental and other parameters including EMC.

Each parameter is defined by a short general description, the definition of the requirement, the relation to other standards and a procedure to show the fulfilment of the requirement as far as necessary. An overview of the safety relevance of each parameter is given – in the context of this document – in a separate table.

The immunity limits of the track circuits installed on non-interoperable lines, or on interoperable lines built before the publication date of this document, are not defined in this document and remain the responsibility of individual infrastructure managers, NSAs and/or suppliers of train detection systems. In this case, the limits for compatibility are usually given in the infrastructure registers and/or the notified national rules.

This document is applicable to track circuits installations on all lines, including non-electrified lines. However, for track circuits intended to be installed only on non-electrified lines, some parameters may be not applicable.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 13146-5:2012, *Railway applications - Track - Test methods for fastening systems - Part 5: Determination of electrical resistance*

EN 50121-4:2016,[1] *Railway applications - Electromagnetic compatibility - Part 4: Emission and immunity of the signalling and telecommunications apparatus*

EN 50122-1:2011,[2] *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock*

[1] As impacted by EN 50121-4:2016/A1:2019.

[2] As impacted by EN 50122-1:2011/A1:2011, EN 50122-1:2011/A2:2016, EN 50122-1:2011/A3:2016, EN 50122-1:2011/A4:2017 and EN 50122-1:2011/AC:2012.

EN 50122-2:2010, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 2: Provisions against the effects of stray currents caused by d.c. traction systems*

EN 50122-3:2010, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 3: Mutual Interaction of a.c. and d.c. traction systems*

EN 50124-2:2017, *Railway applications - Insulation coordination - Part 2: Overvoltages and related protection*

EN 50125-3:2003, *Railway applications - Environmental conditions for equipment - Part 3: Equipment for signalling and telecommunications*

EN 50126-1:2017, *Railways applications — The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 1: Generic RAMS process*

EN 50126-2:2017, *Railways applications — The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 2: Systems approach to safety*

EN 50128:2011, *Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems*

EN 50129:2018, *Railway applications - Communication, signalling and processing systems - Safety related electronic systems for signalling*

EN 50238-1:2019, *Railway applications - Compatibility between rolling stock and train detection systems - Part 1: General*

CLC/TS 50238-2:2020, *Railway applications - Compatibility between rolling stock and train detection systems - Part 2: Compatibility with track circuits*

EN 60529:1991,[3] *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60721-3 (series), Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities (IEC 60721-3, all parts)

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
ballast resistance
insulation of the track, or insulation between both rails

Note 1 to entry: Its value is linked to the environment of the track circuit (weather conditions, hygrometry, cleanliness of the ballast, crosstie type, etc.).

Note 2 to entry: Admittance between both rails being proportional to track circuit zone length, ballast resistance Rb is inversely proportional to the track circuit length and measured in Ω.km.

Note 3 to entry: The ballast resistance is defined for 1 km track length.

[3] As impacted by EN 60529:1991/A1:2000, EN 60529:1991/A2:2013, EN 60529:1991/A2:2013/AC:2019-02, EN 60529:1991/AC:2016-12, and EN 60529:1991/corrigendum May 1993;

3.1.2
broken rail
complete disconnection in one rail which results in electrical isolation

3.1.3
dynamic shunt impedance
equivalent impedance seen from the TC REC for a detection of RST axle

Note 1 to entry: It includes the axle shunt value, the impedance of the contact rail-wheel, and the impedance characteristic of the track.

Note 2 to entry: Dynamic shunt is determined in the TC safety case.

3.1.4
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 traction units (as defined in CLC/TS 50238-2:2020) and up to 16 coaches.

3.1.5
maximum allowed shunt impedance
value which guarantees the occupation of the track circuit (defined by the manufacturer/designer)

3.1.6
neutral section
section of a contact line provided with a sectioning point at each end to prevent successive electrical sections differing in voltage, phase or frequency being connected together by the passage of current collectors

[SOURCE: IEC 60050-811:2017, 811-36-16]

3.1.7
return current unbalance
ratio of the difference of current in the 2 rails

$\left|\left(\frac{I_{r1}-I_{r2}}{I_{r1}+I_{r2}}\right)\right| \times 100\%$, where I_{r1}, I_{r2} are the currents in both rails

Note 1 to entry: Other definition of return current unbalance: $I_{r1} - I_{r2}$.

3.1.8
S-bond
equipotential cable in some electrical joint type

3.1.9
track section clear
state of the track section which the TC output state gives the information that the track section is clear of RST

3.1.10
track section occupied
TC output state which corresponds to the information either that the track section is occupied by a vehicle or that the TC is not able to clear the track section (e.g. in case of failure)

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply.

AC	Alternating current
AFTC	Audio Frequency Track Circuit
CCS	Control-command and signalling
DC	Direct current
EMC	Electromagnetic compatibility
ERA	European Railway Agency
ERTMS	European Rail Traffic Management System
EUREMCO	European Electromagnetic Compatibility project
I_0	Steady-state interference current limit for RST (one influencing unit)
FFT	Fast Fourrier Transform
FrM	Frequency Management
IM	Infrastructure Manager
IP	Ingress Protection Rating
IRJ	Insulated rail joint
ITU	International Telecommunications Union
LOC&PAS	Locomotives and passenger rolling stock
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
NSA	National Safety Authority
OHS	Overhead system
RAMS	Reliability, Availability, Maintainability and Safety
Rb	Ballast resistance
REC	Receiver
RSF	Right Side Failure
RST	Rolling Stock
S&C	Switch and crossing
SIL	Safety Integrity Level
SMS	Safety Management System
T_{pi}	Pick-up delay time of the track circuit
TC	Track Circuit
TDS	Train Detection System
TR	Transmitter
TSI	Technical Specification for Interoperability
WSF	Wrong Side Failure

X m Length of the electrical joint

4 Description of train detection system

Train detection systems for route proving are fully automatic and are integrated into railway signalling and safety systems. The train detection is part of the route proving procedure and contributes to safe railway operation.

The train detection equipment provides information about whether track sections are ‘clear’ or ‘occupied’.

This document applies to train detection systems using the rails to detect the presence of a vehicle, also known as track circuits.

Rails are the transmission path between the TC TR and REC. When the RST is standing over the track circuit, any of its axles present a short circuit between the two rails causing the status of the track circuit to change to ‘occupied’.

Figure 1 defines the logical components of a track circuit system. This includes the track evaluation units, the track connection units (receivers and transmitters) and the track connections. The track connection units contain also coupling units providing electrical coupling (e.g. filtering) between the rails and the receiver/transmitter.

The logical system boundary of a track circuit system is given by an interface to the next level operational train control system (e.g. Interlocking). The physical boundaries of a track section are given by insulated mechanical or electrical based joints.

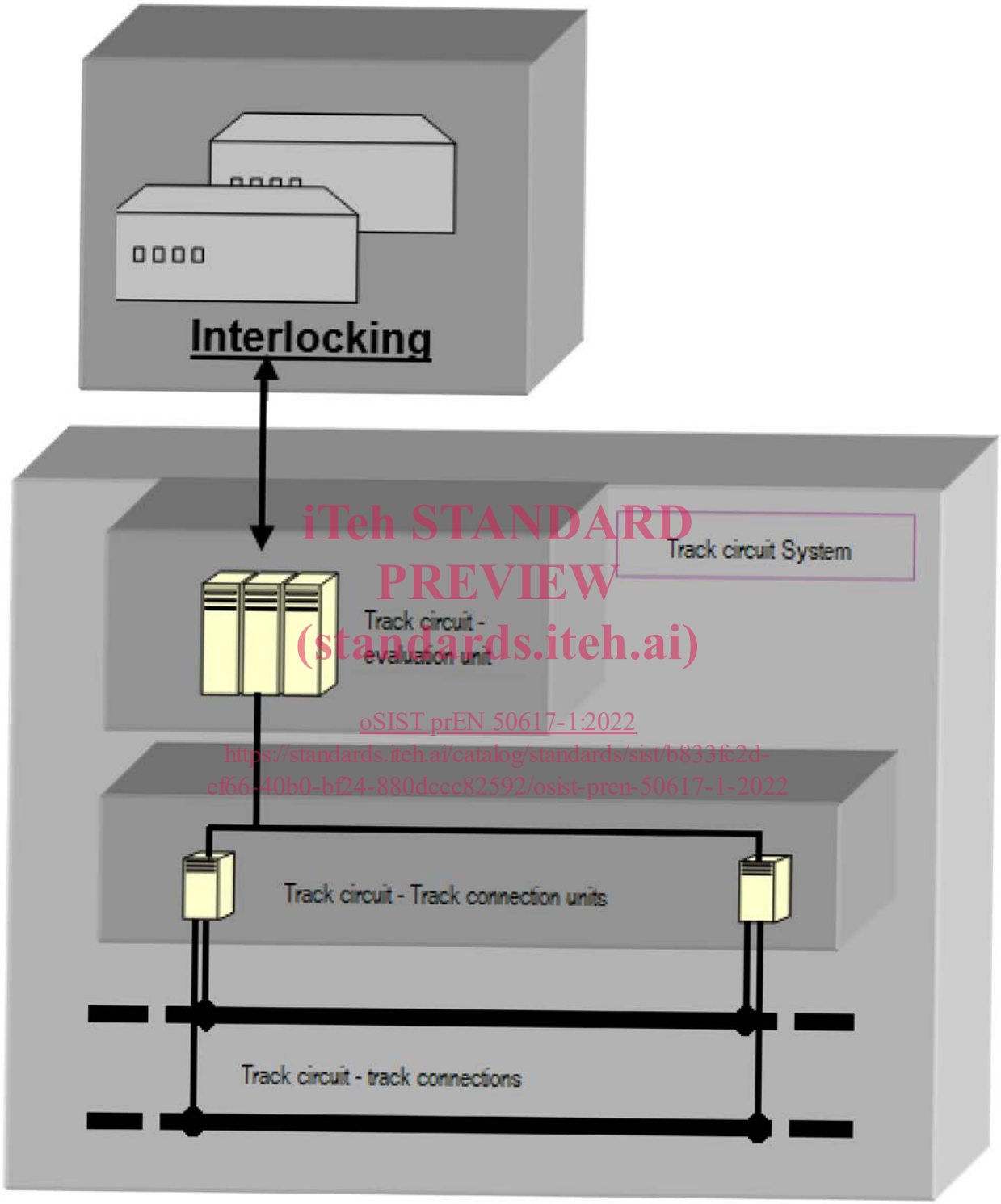

Figure 1 — System boundary for track circuit system

Track circuit is a general description of a whole range of train detection equipment based on the shunt caused by the wheel sets of a train. Today there are many different types in use throughout Europe.