

**Railway applications -  
Compatibility between rolling stock and train detection systems -  
Part 3: Compatibility with axle counters**

Applications ferroviaires -  
Compatibilité entre le matériel roulant  
et les systèmes de détection des trains -  
Partie 3: Compatibilité avec les compteurs  
d'essieux

Bahnanwendungen -  
Kompatibilität zwischen Fahrzeugen  
und Gleisfreimeldesystemen -  
Teil 3: Kompatibilität mit Achszähler

This Technical Specification was approved by CENELEC on 2010-07-07.

CENELEC members are required to announce the existence of this TS in the same way as for an EN and to make the TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force.

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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**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 2010-07-07.

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 3 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
- Part 3: Compatibility with axle counters (this document).

---

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

## Contents

<b>Introduction</b>	<b>5</b>
<b>1 Scope</b>	<b>5</b>
<b>2 Normative references</b>	<b>6</b>
<b>3 Terms, definitions and abbreviations</b>	<b>6</b>
3.1 Terms and definitions	6
3.2 Abbreviations	7
<b>4 General aspects</b>	<b>7</b>
4.1 Interference mechanism	7
4.2 Reliability margin	8
4.3 Specific axle counter parameters	9
<b>5 Measurement specification for vehicle emissions</b>	<b>9</b>
5.1 Rolling stock emission limits	9
5.2 Methodology for the demonstration of vehicle compatibility	10
<b>Annex A (normative) Rolling stock emission limits</b>	<b>20</b>
A.1 Emissions limits and evaluation parameters (narrow band)	20
A.2 Broad band emission limits	21
A.3 Weighting of short duration interference	21
<b>Annex B (informative) Frequency management (proposal)</b>	<b>22</b>
<b>Annex C (informative) Test specification for immunity of axle counters</b>	<b>25</b>
C.1 Testing for susceptibility	25
C.2 Validation tests before final issue as a standard	35
<b>Annex D (informative) Design guide for rolling stock measurement antennas</b>	<b>36</b>
<b>Bibliography</b>	<b>37</b>
<b>Figures</b>	
Figure 1 – Orientation of the coordinates	6
Figure 2 – Axle counter detector, schematic	7
Figure 3 – Duration dependent limits	9
Figure 4 – Measurement antenna	11
Figure 5 – Centre point coordinates	11
Figure 6 – Mounting measurement antenna between two sleepers	12
Figure 7 – Velocity conditions, traction force (Z) – velocity (v) diagram (example)	13
Figure 8 – Measurement approach	15
Figure 9 – Evaluation method, broadband emission limits (e.g. analogue)	16
Figure 10 – Typical analogue measurement	17
Figure 11 – Typical digital measurement	17
Figure B.1 – Filter bandwidth for an axle counter in area I (example)	23
Figure B.2 – Frequency management, limit curves in X-direction	23
Figure B.3 – Frequency management, limit curves in Y-direction	24

Figure B.4 – Frequency management, limit curves in Z-direction .....	24
Figure C.1 – Homogeneity of field generation antenna FGA .....	25
Figure C.2 – Axle counter detector, schematic .....	27
Figure C.3 – Test set-up (Y-Z direction) .....	28
Figure C.4 – Test set-up for homogeneous fields in X-Z direction (front view) .....	29
Figure C.5 – Test set-up for homogeneous fields in X-Z direction (side view) .....	29
Figure C.6 – Axle counter detector response to sinusoidal pulses .....	30
Figure C.7 – Test set-up for rail current tests .....	32
Figure C.8 – Test set-up for inhomogeneous field tests .....	33
Figure C.9 – FGA movement / field distribution for inhomogeneous field tests .....	34
Figure D.1 - Side view (Y and Z coils, dimensions 50 mm to 150 mm) .....	36

## Tables

Table 1 - Y1 and Z1 coordinates of the centre point of the measurement antennas .....	11
Table A.1 - Emission limits and evaluation parameters (narrow band) .....	20
Table A.2 - Broad band emission limits .....	21
Table A.3 - Weighting of short duration interference ( $T_{int}$ according Table A.1) .....	21
Table C.1 – Documentation of test results .....	35

This document is a preview generated by EVS

## Introduction

This Technical Specification is being developed to permit compliance with the interoperability Directives (High Speed and Conventional). It is recommended that the vehicle test methodology presented in this Technical Specification is also applied to establish compatibility with all types of axle counters, incl. those not covered by this Technical Specification.

This Part 3 of the series defines:

- a set of interference limits for magnetic fields generated by both rail current and equipment on the vehicles.
- measurement and evaluation methods to verify rolling stock emissions and demonstrate compatibility with the interference limits.
- traceability of requirements (type of axle counters considered for the limits).

In the relevant frequency range of the axle counters the magnetic field is dominant and only this type of field is considered. Experience has shown that the effects of electric fields are insignificant and therefore not considered.

Annex C is informative and describes a test procedure for the determination of the magnetic field limits of axle counters by laboratory tests. This test procedure has already been used by axle counter manufacturers for the determination of the given limits in this Technical Specification and is recommended to be used to determine compatibility limits for non-preferred axle counters not covered by this Technical Specification and also for future developments of axle counters.

It is intended that the test specification for immunity tests of axle counters (Annex C) will be published in a separate standard.

## 1 Scope

This Technical Specification defines, for the purpose of ensuring compatibility between rolling stock and axle counters, the electromagnetic interference limits for rolling stock and the measurement and evaluation methods to verify rolling stock emissions and demonstrate compatibility with the interference limits.

Compliance with the limits for rolling stock is necessary for a reliable and safe operation of the railway.

The interference limits have been defined for application to interoperable rolling stock. They are for a set of preferred types of axle counters which are defined by Railway Infrastructure Managers for use on new signalling projects on interoperable lines. If the interoperable line over which the rolling stock is intended to run is equipped with an older version or non-listed axle counters then National Notified Technical Rules apply. 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 selected types and their limits for compatibility are drawn on the basis of established performance criteria, the trend will be that newly signalled interoperable lines are fitted with types which meet the compatibility limits published in the Technical Specification and measured in accordance with the test specification in Annex C.

To ensure an adequate operational availability, a margin of 9 dB between the measured axle counter limit and the limit for rolling stock has been applied. If rolling stock does not comply with the defined limits, the availability of the axle counters may be reduced. The measurement condition for railway vehicles with voltage DC-link are provided as an example.

NOTE 1 The influence from metal parts or inductively coupled resonant circuits on the vehicle, eddy current brakes or magnetic brakes is out of the scope of the Technical Specification. Compatibility is established through individual testing according to EN 50238-1 or National Notified Technical Rules.

NOTE 2 Wheel sensors and crossing loops are not part of this Technical Specification.

As the electromagnetic interference coupling between rolling stock and axle counters is multidimensional and difficult to handle, a proposal is made in this Technical Specification for frequency management with fixed frequency ranges (and limits) in Annex B informative, to allow for future developments of rolling stock and axle counters with the aim to decrease the development risk and to minimize the homologation effort for both, rolling stock and axle counters.

## 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 50238, Railway applications – Compatibility between rolling stock and train detection systems

## 3 Terms, definitions and abbreviations

### 3.1 Terms and definitions

For the purposes of this document, the terms, definitions and abbreviations given in EN 50238 and the following apply.

#### 3.1.1

##### **axle counter detector**

consists of the sensor and the detection circuit which includes in general filters and rectifiers

#### 3.1.2

##### **inflection point**

the transition between the static (continuous wave) and the dynamic immunity (short duration) behaviour of the axle counter detector. On the left side of the inflection point the duration is less than the integration time. The inflection point is the transition of 105 % of the steady state threshold concluded from sinusoidal bursts by lab tests. The corresponding burst duration is equivalent to the integration time used for evaluation

#### 3.1.3

##### **integration time**

a parameter for evaluation defined as the window size over which the root mean square (RMS) of the output of the band-pass filter is calculated

#### 3.1.4

##### **measurement antenna**

a magnetic field antenna mounted in the track to capture magnetic field. The measurement covers the axes X, Y and Z

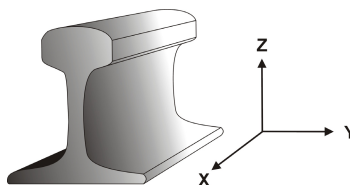


Figure 1 – Orientation of the coordinates