



**SLOVENSKI STANDARD**  
**SIST-TP CLC/TR 50453:2007**

**01-september-2007**

**BUXca Yý U**  
**SIST R014-001:2001**

---

**Ocenitev elektromagnetnih polj okoli elektroenergetskih transformatorjev**

Evaluation of electromagnetic fields around power transformers

Bewertung von elektromagnetischen Feldern in der Umgebung von Leistungstransformatoren

Evaluation des champs électromagnétiques autour des transformateurs de puissance

**iTeh STANDARD PREVIEW**  
**(standard not for sale)**

**Ta slovenski standard je istoveten z: CLC/TR 50453:2007**

[SIST-TP CLC/TR 50453:2007  
http://standards.iteh.org/standards/sist/50453-2007/CLC-TR-50453-2007-9347-31f76fd12436/sist-tp-clc-tr-50453-2007](http://standards.iteh.org/standards/sist/50453-2007/CLC-TR-50453-2007-9347-31f76fd12436/sist-tp-clc-tr-50453-2007)

---

**ICS:**

29.180	Transformatorji. Dušilke	Transformers. Reactors
33.100.01	Elektromagnetna združljivost na splošno	Electromagnetic compatibility in general

**SIST-TP CLC/TR 50453:2007**

**en,fr**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST-TP CLC/TR 50453:2007](https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-31f76fd12436/sist-tp-clc-tr-50453-2007)

<https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-31f76fd12436/sist-tp-clc-tr-50453-2007>

English version

**Evaluation of electromagnetic fields  
around power transformers**

Evaluation  
des champs électromagnétiques  
autour des transformateurs de puissance

Bewertung  
von elektromagnetischen Feldern  
in der Umgebung  
von Leistungstransformatoren

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

This Technical Report was approved by CENELEC on 2006-01-14.

[SIST-TP CLC/TR 50453:2007](#)

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, 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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

This Technical Report was prepared by Technical Committee CENELEC TC 14, Power Transformers.

The text of the draft was circulated for vote in accordance with the Internal Regulations, Part 2, Subclause 11.4.3.3 and was approved by CENELEC as CLC/TR 50453 on 2006-01-14.

This Technical Report supersedes R014-001:1999.

---

## iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST-TP CLC/TR 50453:2007

<https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-31f76fd12436/sist-tp-clc-tr-50453-2007>

## Contents

	page
Introduction	4
1 Scope.....	5
2 References.....	5
3 Definitions .....	5
4 Emission.....	6
4.1 Radiated emission.....	6
4.2 Conducted emission.....	6
5 Immunity.....	7
5.1 Radiated disturbances .....	7
5.2 Conducted disturbances .....	7
Annex A (informative) Method of calculation of power frequency magnetic field.....	8
Annex B (informative) Method of calculation of power frequency electric field.....	11
Bibliography.....	13

**STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST-TP CLC/TR 50453:2007  
<https://standards.iteh.ai/catalog/standards/sist/25160911-2625-4508-9347-31f76fd12436/sist-tp-clc-tr-50453-2007>

## Introduction

EMC is covered by three kinds of standardisation documents:

- Basic Standards:

Basic Standards are mainly informative documents covering disturbance phenomena, disturbance levels and test and measurement techniques. For example, EN 61000/IEC 61000 is a Basic Standard.

- Generic Standards:

Generic Standards are intended to cover a range of products for which no Product Standard exists. For example, EN 61000-3 and EN 61000-4, EN 61000-1 and EN 61000-2 are Generic Standards.

- Product Standards:

Product Standards are intended to deal with a specific family of electrical or electronic equipment.

Power transformers however, are considered as passive equipment and as such, the above referenced documents are not applicable.

This Technical Report is intended to give guidance on EMC phenomena associated with power transformers.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST-TP CLC/TR 50453:2007](https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-31f76fd12436/sist-tp-clc-tr-50453-2007)

<https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-31f76fd12436/sist-tp-clc-tr-50453-2007>

## 1 Scope

This Report provides guidance for the evaluation of electromagnetic fields around power transformers.

This Report applies to power transformers covered by EN 60076 series with the following characteristics:

- apparent rating P:  $5 \text{ kVA} \leq P \leq 1\,000 \text{ MVA}$
- insulating level, according to EN 60076-3:
  - high voltage winding:  $U_m$  from 7,2 kV to 525 kV
  - low voltage winding:  $U_m$  up to 525 kV

Reactors are excluded from the present Report.

Continuous conducted and radiated emissions are considered for power transformers operating under nominal working conditions of voltage and current.

Fault conditions and low occurrence transient events, such as

- short-circuits,
- lightning and switching transients,
- overloads (inrush currents, etc.),
- overvoltages,
- tap-changer operations,

are not considered as normal working conditions.

Immunity conditions are considered to ensure the power transformer operates as intended in its normal working environment. The immunity capability of the power transformer is considered for steady state and transient working conditions.

## 2 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 60076	series	Power transformers (IEC 60076 series)
EN 61000	series	Electromagnetic compatibility (IEC 61000 series)
IEC 60050-161	1990	International Electrotechnical Vocabulary Chapter 161: Electromagnetic Compatibility

## 3 Definitions

The definitions quoted in IEC 60050-161, in EN 60076 series as well as those mentioned in the above referenced standards apply.

## 4 Emission

### 4.1 Radiated emission

#### 4.1.1 Power frequency magnetic field

The most significant value of the power frequency magnetic field is due to the current flowing in the LV terminals. The magnetic field of the transformer, produced by the currents flowing in the windings, can be neglected.

The power frequency magnetic field radiated by a transformer without enclosure along its lateral faces has the same order of magnitude as the field radiated by the currents flowing in the LV terminals.

The effect of this field can be reduced by providing a suitable enclosure or shielding.

As a guide, magnetic fields from simple busbar arrangements can be calculated to provide approximate values for the transformer environment, as illustrated in Annex A.

#### 4.1.2 Power frequency electric field

The electric field is produced by the energized conductors. The magnitude of the electric field in space is proportional to the voltage level and is highly dependent on the position and shape of the other conducting objects (energized or grounded) in the close environment.

Except for some special dry type transformers without an enclosure, the electric radiated field is only significantly produced by the busbars and terminals.

For liquid immersed transformers supplied by screened cables (e.g. oil immersed with plug-in bushings) and dry type transformers in enclosure, the electric field is negligible.

As a guide, electric fields from simple busbar arrangements can be calculated to provide approximate values for the transformer environment, as illustrated in Annex B.

#### 4.1.3 Radio frequency fields (corona effect)

The main source of field is due to corona and partial discharges from high voltage busbar connections and surface partial discharges on the bushings. The source of radio frequency field from the inner parts of the transformer is negligible in comparison. The dominant radio frequency field is determined by external factors and not by the transformer.

NOTE EN 55016-1-x describes measurement techniques and CISPR 18 gives some typical levels found near overhead lines and other high voltage equipment.

### 4.2 Conducted emission

#### 4.2.1 Harmonics of no-load current

The no-load current and the harmonics of the no-load current are significantly lower than the nominal current, except for some special designs.

Purchaser specifications may contain requirements.



## 5 Immunity

Control devices of transformers should be suitable to operate correctly in electromagnetic environment, according the relevant standards (see note in 5.1).

### 5.1 Radiated disturbances

Transformers are not generally sensitive to radiated magnetic, electric or electromagnetic fields.

NOTE Cases of maloperation due to radiated disturbances are known. It was found that the transient magnetic field under short circuit conditions could operate Buchholz relays of the magnetic reed type. This problem can be overcome with suitable shielding.

### 5.2 Conducted disturbances

Power transformers may be subjected to the following conducted disturbances:

- network voltage fluctuations;
- frequency variations;
- voltage harmonics;
- fast transients;
- lightning and switching transients;
- current harmonics.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST-TP CLC/TR 50453:2007](https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-315761121561/clc-tr-50453-2007)

[https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-](https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-315761121561/clc-tr-50453-2007)

[315761121561/clc-tr-50453-2007](https://standards.iteh.ai/catalog/standards/sist/231b09f1-2b25-4308-9347-315761121561/clc-tr-50453-2007)

The immunity of power transformers to transient overvoltages is demonstrated by the tests specified in EN 60076-3.

Continuous overvoltages beyond that specified in EN 60076-3, significant frequency variations and high levels of voltage and/or current harmonics are admissible only when agreed between purchaser and supplier.