



BSI Standards Publication

## **Radio interference characteristics of overhead power lines and high-voltage equipment**

---

Part 3: Code of practice for minimizing the generation of radio noise

## National foreword

This Published Document is the UK implementation of CISPR/TR 18-3:2017. It supersedes PD CISPR/TR 18-3:2010, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/210/11, EMC - Standards Committee.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018  
Published by BSI Standards Limited 2018

ISBN 978 0 580 90791 3

ICS 33.100.01; 29.240.20

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 January 2018.

### Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

---



# TECHNICAL REPORT



INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

---

**Radio interference characteristics of overhead power lines and high-voltage equipment –  
Part 3: Code of practice for minimizing the generation of radio noise**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 33.100.01

ISBN 978-2-8322-4893-5

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	7
4 Practical design of overhead power lines and associated equipment in order to control interference to radio broadcast sound and television reception .....	8
4.1 Overview.....	8
4.2 Corona on conductors.....	8
4.3 Corona on metal hardware.....	8
4.4 Surface discharges on insulators .....	9
4.4.1 Clean or slightly polluted insulators .....	9
4.4.2 Very polluted insulators .....	9
4.5 Spark and microsparks due to bad contacts, commutation effects .....	10
4.6 Defects on power lines and associated equipment in service .....	10
5 Methods of prediction of the reference level of an overhead line.....	10
5.1 General.....	10
5.2 Correlation of data given elsewhere in this publication .....	11
5.3 CIGRÉ formula.....	12
5.4 Determination of 80 % level .....	12
5.5 Conclusions .....	13
6 Preventive and remedial measures to minimize radio noise generated by bad contacts and their detection and location .....	13
6.1 General.....	13
6.2 Preventive and remedial measures .....	13
6.3 Methods of detecting and locating bad contacts .....	15
7 Formulae for predetermination of the radio noise field strength produced by large conductor bundles (more than four sub-conductors) and by tubular conductors .....	17
7.1 Basic principles.....	17
7.2 Calculation of corona radio noise field strengths due to large bundles .....	18
7.2.1 Procedure for the predetermination of the radio noise field strength .....	18
7.2.2 Calculation of the excitation function in heavy rain.....	19
7.2.3 Correction factor to evaluate the excitation function in other weather categories.....	19
7.2.4 Calculation of the radio noise field strength .....	19
7.3 Evaluation of corona radio noise field strength due to large tubular conductors .....	20
8 Figures .....	22
Annex A (informative) Formulae for predicting the radio noise field strength from the conductors of an overhead line .....	30
A.1 CIGRÉ formula for general use .....	30
A.2 Collation of predetermination formulae used by several institutions around the world.....	31
Annex B (informative) Configuration of an RF-based spark discharge detector and Direction Of Arrival (DOA) estimation method .....	42
B.1 Configuration of RF-based spark discharge detector .....	42

B.2	Direction of Arrival (DOA) estimation method based on Time Difference of Arrival (TDOA) [17] .....	42
Annex C (informative)	Analytical procedure for the predetermination of the radio noise field strength, at a given distance from an overhead line with large bundle conductors .....	44
C.1	Analytical procedure .....	44
C.2	Example of calculation of the radio noise field strength .....	45
Bibliography	.....	51
Figure 1	– Bundle conductors .....	22
Figure 2	– Line with conductors in a flat configuration .....	23
Figure 3	– Line with conductors in a delta configuration .....	24
Figure 4	– Line with conductors in a triangular configuration .....	25
Figure 5	– Line with conductors in a flat configuration .....	26
Figure 6	– Line with conductors in a delta configuration .....	27
Figure 7	– Line with conductors in a triangular configuration .....	28
Figure 8	– Tubular conductors of 40 cm diameter .....	29
Figure B.1	– Configuration of RF-based spark discharge detector [17] .....	42
Figure B.2	– Coordinates and arrangement of the four-antenna-square array .....	43
Figure C.1	– Designation of the geometrical quantities for the simplified analytical method .....	49
Figure C.2	– Lateral profiles of the radio noise field strengths produced by the individual phases and of the total field, as calculated in the given example .....	50
Table A.1	– Empirical methods, terms of the predetermination formulae developed by several institutions, survey .....	32
Table A.2	– Empirical methods, complete predetermination formulae developed by several institutions, survey .....	34
Table A.3	– Predetermination formulae, examples for calculation of the absolute field strength levels .....	36
Table A.4	– Empirical methods, complete predetermination formulae for DC lines developed by several institutions, survey .....	38
Table A.5	– Formulae for calculation of the excitation function in fair weather for DC lines developed by several institutions, survey .....	40

INTERNATIONAL ELECTROTECHNICAL COMMISSION  
INTERNATIONAL SPECIAL COMMITTEE ON RADIO INTERFERENCE

---

**RADIO INTERFERENCE CHARACTERISTICS  
OF OVERHEAD POWER LINES  
AND HIGH-VOLTAGE EQUIPMENT –**

**Part 3: Code of practice for minimizing  
the generation of radio noise**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

CISPR 18-3, which is a technical report, has been prepared by CISPR subcommittee B: Interference relating to industrial, scientific and medical radio-frequency apparatus, to other (heavy) industrial equipment, to overhead power lines, to high voltage equipment and to electric traction.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) localisation system of spark discharges which might contain frequency components up to 3 GHz;
- b) information regarding equations for predetermination of the radio noise level from HVDC overhead power lines.

The text of this technical report is based on the following documents:

DTR	Report on voting
CIS/B/655/DTR	CIS/B/676/RVDTR

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the CISPR 18 series can be found under the general title *Radio interference characteristics of overhead power lines and high-voltage equipment*, on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued later on.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

This Technical Report is the third of a three-part series dealing with radio noise generated by electrical power transmission and distribution facilities (overhead lines and substations). It contains recommendations for minimizing the generation of radio noise emanating from high-voltage (HV) power systems which include, but are not restricted to, HVAC or HVDC overhead power lines, HVAC substations and HVDC converter stations, hardware, etc., in order to promoting protection of radio reception.

The recommendations given in this Part 3 of the CISPR 18 series are intended to be a useful aid to engineers involved in design, erection and maintenance of overhead lines and HV stations and also to anyone concerned with checking the radio noise performance of a line to ensure satisfactory protection of radio reception. Information on the physical phenomena involved in the generation of electromagnetic noise fields is found in CISPR TR 18-1. It also includes the main properties of such fields and their numerical values. CISPR TR 18-2 contains recommendations for methods of measurement for use on-site or in a laboratory. It furthermore recommends procedures for determination of limits for the radio noise from HV power systems.

The second editions of CISPR 18-1, -2, -3 underwent thorough edition in the maintenance work. The purpose of the maintenance work was to review for update in the measurement conditions, terminology, and the lateral profiles of radio noise, etc. Other updates belonged to the description of HVDC systems and to the upper edge measurement frequency.

The review for this third edition of CISPR 18-3 focused on the following issues:

- a) description on gap noise locating system involved in the expansion of upper measuring frequency from 300 MHz to 3 GHz;
- b) collation of predetermination formulae of radio noise level for DC power lines involved in update on DC description.

The CISPR 18 series does not deal with biological effects on living matter or any issues related to exposure to electromagnetic fields.

Considering

- a) that the radiation of electromagnetic energy from overhead power lines causes interference,
- b) that the level of this noise may be reduced by the design and lay-out of a line,
- c) that when defects cause unusually high levels of interference there is need to detect and locate these faults,

this document recommends as CODE OF PRACTICE for minimizing the generation of radio noise, that the latest edition of CISPR Publication 18-3, including amendments, be used as guide for minimizing the generation of such noise caused by overhead power lines.

CISPR TR 18-1 describes the main properties of the physical phenomena involved in the production of 123 disturbing electromagnetic fields by overhead lines and provides numerical values of such fields.

In CISPR TR 18-2 methods of measurement and procedures for determining limits of such radio 125 interference are recommended.

This CISPR TR 18-3 forms a "Code of Practice" to reduce to a minimum the production of radio noise by power lines and equipment.

NOTE The recommendation above is based on CISPR RECOMMENDATION No. 57.

# RADIO INTERFERENCE CHARACTERISTICS OF OVERHEAD POWER LINES AND HIGH-VOLTAGE EQUIPMENT –

## Part 3: Code of practice for minimizing the generation of radio noise

### 1 Scope

This part of CISPR 18, which is a technical report, applies to radio noise from overhead power lines and high-voltage equipment which may cause interference to radio reception, excluding the fields from power line carrier signals.

The frequency range covered is 0,15 MHz to 3 GHz.

### 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.

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

CISPR TR 18-1:\_\_\_<sup>1</sup>, *Radio interference characteristics of overhead power lines and high-voltage equipment – Part 1: Description of phenomena*

CISPR TR 18-2:\_\_\_<sup>2</sup>, *Radio interference characteristics of overhead power lines and high-voltage equipment – Part 2: Methods of measurement and procedure for determining limits*

ISO IEC Guide 99, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

NOTE Informative references are listed in the Bibliography.

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 and the ISO IEC Guide 99 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

---

<sup>1</sup> Under preparation. Stage at the time of publication: CISPR/RPUB 18-1:2017.

<sup>2</sup> Under preparation. Stage at the time of publication: CISPR/RPUB 18-2:2017.