

BS EN 62493:2015



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Assessment of lighting equipment related to human exposure to electromagnetic field

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National foreword

This British Standard is the UK implementation of EN 62493:2015. It is identical to IEC 62493:2015. It supersedes BS EN 62493:2010, which will be withdrawn on 7 March 2018.

The UK participation in its preparation was entrusted to Technical Committee CPL/34, Lamps and Related Equipment.

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

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EUROPEAN STANDARD
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EN 62493

May 2015

ICS 29.020; 29.140

Supersedes EN 62493:2010

English Version

**Assessment of lighting equipment related to human exposure to
electromagnetic Field
(IEC 62493:2015)**

Évaluation d'un équipement d'éclairage relativement à
l'exposition humaine aux champs électromagnétiques
(IEC 62493:2015)

Beurteilung von Beleuchtungseinrichtungen bezüglich der
Exposition von Personen gegenüber elektromagnetischen
Feldern
(IEC 62493:2015)

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 34/222/FDIS, future edition 2 of IEC 62493, prepared by IEC/TC 34 "Lamps and related equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62493:2015.

The following dates are fixed:

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publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2018-04-14
standards conflicting with the
document have to be withdrawn

This document supersedes EN 62493:2010.

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Endorsement notice

The text of the International Standard IEC 62493:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

CISPR 15:2013	NOTE	Harmonized as EN 55015:2013 (not modified).
CISPR 16-1-2	NOTE	Harmonized as EN 55016-1-2.
CISPR 16-4-2:2003	NOTE	Harmonized as EN 55016-4-2:2004 ¹⁾ (not modified).
IEC 62226-2-1:2004	NOTE	Harmonized as EN 62226-2-1:2005 (not modified).

¹⁾ Superseded by EN 55016-4-2:2011 (CISPR 16-4-2:2011).

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62209-2	2010	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)	EN 62209-2	2010
IEC 62232	2011	Determination of RF field strength and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure	-	-
IEC 62311 (mod)	2007	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)	EN 62311	2008
IEC 62479 (mod)	2010	Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)	EN 62479	2010
CISPR 16-1-1	-	Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus	EN 55016-1-1	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ASSESSMENT OF LIGHTING EQUIPMENT RELATED
TO HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS**

FOREWORD

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International Standard IEC 62493 has been prepared by IEC technical committee 34: Lamps and related equipment.

This second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision.

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

- a) identification of lighting product types deemed to comply with the standard without the need for test;
- b) deletion of the need for CISPR-15-compliance as a prerequisite for IEC 62493 compliance;
- c) inclusion of the consequences of the ICNIRP 2010 guidelines for (up to 100 kHz);
- d) adding some guidance to the Van der Hoofden test head method to improve reproducibility of results;
- e) inclusion of compliance demonstration method for products having intentional radiators.

The text of this standard is based on the following documents:

FDIS	Report on voting
34/222/FDIS	34/228/RVD

Full information on the voting for the approval of this standard 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 in the IEC 62493 series, published under the general title *Assessment of lighting equipment related to human exposure to electromagnetic fields*, can be found on the IEC website.

The exposure limits given in Annex C (informative) are for information only; they do not comprise an exhaustive list and are valid only in certain regions of the world. It is the responsibility of users of this standard to ensure that they use the current version of the limit values specified by the applicable national authorities.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.

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 International Standard establishes a suitable evaluation method for the influence of the electromagnetic fields in the space around the equipment mentioned in the scope, and defines standardized operating conditions and measurement distances.

This standard is designed to assess, by measurements and/or calculations, electromagnetic (EM) fields and their potential effect on the human body by reference to exposure levels of the general public given by ICNIRP:1998 [1]¹, ICNIRP 2010 [2], IEEE C95.1:2005 [3] and IEEE C95.6:2002 [4]. The exposure levels with which to comply are basic restrictions (both ICNIRP- and IEEE-based).

Based on the lighting equipment operating properties, the frequency range of the applicable basic restrictions can be limited as follows:

- internal electric field between 20 kHz and 10 MHz;
- specific absorption rate (SAR) between 100 kHz and 300 MHz;
- power density is outside the scope.

NOTE Operating frequencies of lighting equipment are higher than 20 kHz to avoid audible noise and infrared interference. Frequency contributions above 300 MHz can be neglected.

This standard is not meant to supplant definitions and procedures specified in exposure standards, but it is aimed at supplementing the procedure already specified for compliance with exposure.

¹ Numbers in square brackets refer to the Bibliography.

ASSESSMENT OF LIGHTING EQUIPMENT RELATED TO HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS

1 Scope

This International Standard applies to the assessment of lighting equipment related to human exposure to electromagnetic fields. The assessment consists of the induced internal electric field for frequencies from 20 kHz to 10 MHz and the specific absorption rate (SAR) for frequencies from 100 kHz to 300 MHz around lighting equipment.

Included in the scope of this standard are:

- all lighting equipment with a primary function of generating and/or distributing light intended for illumination purposes, and intended either for connection to the low voltage electricity supply or for battery operation; used indoor and/or outdoor;
- lighting part of multi-function equipment where one of the primary functions of this is illumination;
- independent auxiliaries exclusively for the use with lighting equipment;
- lighting equipment including intentional radiators for wireless communication or control.

Excluded from the scope of this standard are:

- lighting equipment for aircraft and airfields;
- lighting equipment for road vehicles; (except lighting used for the illumination of passenger compartments in public transport)
- lighting equipment for agriculture;
- lighting equipment for boats/vessels;
- photocopiers, slide projectors;
- apparatus for which the requirements of electromagnetic fields are explicitly formulated in other IEC standards.

NOTE The methods described in this standard are not suitable for comparing the fields from different lighting equipment.

This standard does not apply to built-in components for luminaires such as electronic controlgear.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62209-2:2010, *Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)*

IEC 62232:2011, *Determination of RF field strength and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure*

IEC 62311:2007, *Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)*

IEC 62479:2010, *Assessment of the compliance of low-power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)*

CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

3 Terms, definitions, physical quantities, units and abbreviations

3.1 Terms and definitions

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

3.1.1

ballast

unit inserted between the supply and one or more discharge lamps which by means of inductance, capacitance, or a combination of inductance and capacitance, serves mainly to limit the current of the lamp(s) to the required value

Note 1 to entry: It may also include means for transforming the supply voltage and arrangements that help provide starting voltage and pre-heating current.

3.1.2

basic restriction

basic limitations

restrictions on exposure to time-varying electric, magnetic and electromagnetic fields that are based on established biological effects and including a safety factor

Note 1 to entry: The basic restriction is the maximum level that should not be exceeded under any conditions.

3.1.3

built-in lamp controlgear

lamp controlgear generally designed to be built into a luminaire, a box, an enclosure or the like and not intended to be mounted outside a luminaire, etc. without special precautions

Note 1 to entry: The controlgear compartment in the base of a road lighting column is considered to be an enclosure.

3.1.4

compliance factor

F

factor determined using the Van der Hoofden head test method that represents the measured (weighted and summed) induced internal electric field due to the external electric field in the frequency range 20 kHz to 10 MHz

Note 1 to entry: See Annex D and Annex E.

3.1.5

electronic controlgear

mains-supplied a.c./d.c. to a.c./d.c. inverter including stabilizing elements for starting and operating one or more lamps, generally at high frequency

Note 1 to entry: All kinds of igniters, starters, switches, dimmers (including phase control units e.g. triac, GTO) and sensors are not considered as electronic controlgear.

3.1.6

exposure

exposure occurs whenever and wherever a person is subjected to electric, magnetic or electromagnetic fields or to contact currents other than those originating from physiological processes in the body and other natural phenomena

3.1.7

exposure distance

typical distance between lighting equipment and a person under normal conditions of use

3.1.8**fluorescent lamp**

discharge lamp of the low pressure mercury type in which most of the light is emitted by one or several layers of phosphors excited by the ultraviolet radiation from the discharge

Note 1 to entry: These lamps are frequently tubular and, in GB are then usually called fluorescent tubes.

3.1.9**high-intensity discharge lamp****HID lamp**

electric discharge lamp in which the light-producing arc is stabilized by wall temperature and the arc has a bulb wall loading in excess of 3 W/cm²

Note 1 to entry: HID lamps include groups of lamps known as high pressure mercury, metal halide and high pressure sodium lamps.

Note 2 to entry: This note applies to the French language only.

3.1.10**high-pressure lamp**

high intensity discharge lamp in which the major portion of the light is produced, directly or indirectly, by radiation from mercury or sodium vapour operating at relatively high levels of partial pressure

3.1.11**independent auxiliary**

auxiliaries consisting of one or more separate elements designed so that it can be mounted separately outside a luminaire, with protection according to the marking of the auxiliaries and without any additional enclosure

EXAMPLE: Examples are dimmers, transformers and convertors for incandescent lamps or LED light sources, ballasts for discharge lamps (including fluorescent lamps) and semi-luminaires for compact fluorescent lamps, incandescent lamps or LED light sources

Note 1 to entry: This may consist of a built-in auxiliary housed in a suitable enclosure which provides all the necessary protection according to its markings.

3.1.12**independent lamp controlgear****independent electronic converter**

lamp controlgear consisting of one or more separate elements so designed that it can be mounted separately outside a luminaire, with protection according to the marking of the lamp controlgear and without any additional enclosure

Note 1 to entry: This may consist of a built-in lamp controlgear housed in a suitable enclosure that provides all the necessary protection according to its markings.

3.1.13**integral lamp controlgear**

lamp controlgear which forms a non-replaceable part of a luminaire and which cannot be tested separately from the luminaire

3.1.14**intentional radiator**

any device that is designed to produce electromagnetic fields on purpose in order to provide functions such as wireless communication, control, detection, etc.

3.1.15**lamp controlgear**

one or more components between the supply and one or more lamps which may serve to transform the supply voltage, limit the current of the lamp(s) to the required value, provide starting voltage and preheating current, prevent cold starting, correct power factor or reduce radio interference

3.1.16**light emitting diode****LED**

solid state device embodying a p-n junction, emitting optical radiation when excited by an electric current

Note 1 to entry: This note applies to the French language only.

3.1.17**lighting equipment**

equipment with a primary function of generating and/or regulating and/or distributing optical radiation by electric light source(s)

3.1.18**low-pressure lamp**

discharge lamp in which the light is produced by radiation from sodium vapour or mercury

3.1.19**measurement distance**

distance between the lighting equipment and the external surface of the measurement test-head

Note 1 to entry: See Annex A.

3.1.20**measurement point**

position and location of the measurement test head relative to the lighting equipment

3.1.21**organic light emitting diode****OLED**

light emitting semiconductor that has an electroluminescent zone made of organic compounds consisting of a cathode, an anode, and organic electroluminescent layers

Note 1 to entry: This note applies to the French language only.

3.1.22**self-ballasted lamp**

unit which can be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and additional elements necessary for starting and for stable operating of the light source

3.2 Physical quantities and units

For the purposes of this document the following physical quantities and units given in Table 1 apply.

Table 1 – Physical quantities and units

Quantity	Symbol	Unit	Dimension
Conductivity	σ	Siemens per metre	S/m
Current density	J	Ampere per square metre	A/m ²
Electric field strength	E	Volt per metre	V/m
Frequency	f	Hertz	Hz
Magnetic field strength	H	Ampère per metre	A/m
Magnetic flux density	B	Tesla	T (Wb/m ² , Vs/m ²)
Power	P	Watt	W
Current	I	Ampere	A

3.3 Abbreviations

For the purposes of this document the following abbreviations apply.

a.c.	alternating current
BR	basic restriction
CISPR	Comité International Spécial des Perturbations Radioélectriques
d.c.	direct current
DUT	device under test
EIRP	equivalent isotropically radiated power
EMF	electromagnetic field
EMI	electromagnetic interference
ERP	effective radiated power
GTO	gate turn off
HID	high intensity discharge
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IR	Infrared
LED	light emitting diode
LLA	large loop antenna
NWA	network analyser
OLED	organic light emitting diode
PRF	pulse repetition frequency
RF	radio frequency
r.m.s.	root mean square
SAR	specific absorption rate
UV	ultraviolet
WBA	whole-body average

4 Limits

4.1 General

The basic restrictions or reference levels for the general public of either IEEE C95.1-2005 or ICNIRP 1998 and ICNIRP 2010 are used, see Annex C.

Lighting equipment shall comply with the Van der Hoofden test limit (4.2.3), unless it is inherently compliant (4.2.2). If equipped with intentional radiators, it shall also pass the assessment procedure for intentional radiators (4.3). An overview of the routes to demonstrate compliance against these limits is given in Figure 1.

4.2 Unintentional radiating part of lighting equipment

4.2.1 General

This subclause 4.2 applies for lighting equipment, excluding the intentional radiating part (as far as applicable).

4.2.2 Lighting equipment deemed to comply with the Van der Hoofden test without testing

Lighting equipment is deemed to comply with the requirements of this standard without testing if it fulfils one of the following inherent-compliance conditions:

- 1) it contains no electronic controlgear;
- 2) it is incandescent-lamp technology, including halogen;
- 3) it is a LED-light-source technology;
- 4) it is an OLED light-source technology;
- 5) it is high-pressure discharge lamp technologies;
- 6) it is based on low-pressure discharge lamp technologies with an exposure distance larger than or equal to 50 cm (according to Table A.1);
- 7) it is an independent auxiliary.

The background and rationale for these conditions is given in the informative Annex H.

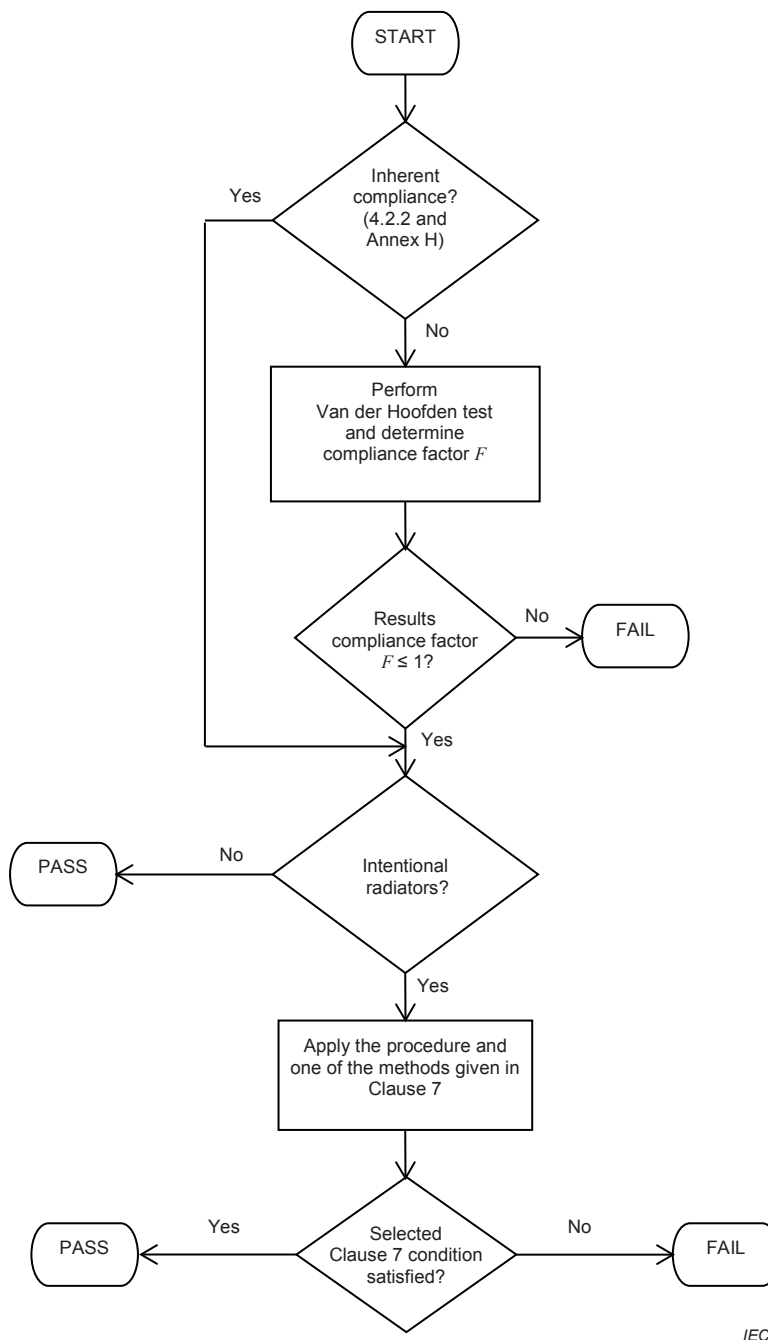
Lighting equipment that does not fulfil any of these conditions is subject to the requirements given in 4.2.3.

4.2.3 Application of limits

Lighting equipment, as described in the scope, and which does not fulfil one of the inherent compliance conditions mentioned in 4.2.2, complies with this standard if the compliance factor F (see 3.1.4) is less than or equal to 1.

4.3 Intentional radiating part of lighting equipment

If one or more intentional radiators are part of the lighting equipment, then for compliance with this standard, one of the methods given in Clause 7 shall be applied and the conditions satisfied. See also Annex I for details.



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Figure 1 – Compliance routes and pass/fail criteria for lighting equipment

5 General requirements Van der Hoofden test

5.1 Measurand

The induced internal electric field level is determined by measuring the capacitive current $I_{\text{cap}}(f_n)$ into a standardised test head (see Figure 4 and Annex E for details). The capacitive current is measured as a voltage $V(f_n)$ by a spectrum analyser or receiver through a coupling network (see Figure 3), the voltage being a function of the frequency. This Clause 5 gives details on the test head, the measuring instrumentation and the measuring conditions.

5.2 Supply voltage and frequency

For a.c.-operated equipment, measurements shall be carried out at mains a.c.-voltage within $\pm 2\%$ of the maximum rated supply voltage.

Equipment which can be operated from different a.c.-supply voltages and a.c.-supply frequencies shall be measured only at one a.c.-supply voltage within ± 2 % of the maximum rated supply voltage and at one a.c.-supply frequency (50 Hz or 60 Hz).

Equipment which can be operated from both (multiple) a.c.- and/or d.c. supplies shall be measured only at one d.c.-supply voltage within ± 2 % of the maximum rated d.c.-supply voltage.

5.3 Measurement frequency range

The measurement frequency range considered is from 20 kHz to 10 MHz (see Annex E).

5.4 Ambient temperature

Measurements shall be carried out in the ambient temperature range 15 °C to 25 °C.

5.5 Measurement equipment requirements

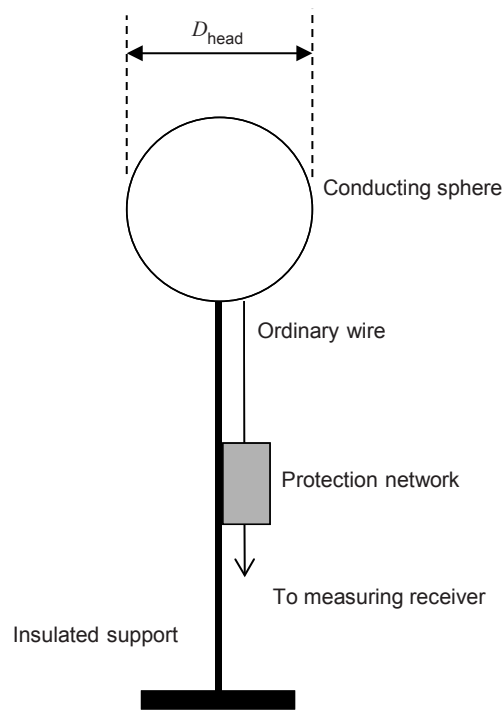
An electromagnetic interference (EMI) test receiver or spectrum analyser according to CISPR 16-1-1 is required, with the settings given in Table 2:

Table 2 – Receiver or spectrum analyser settings

Frequency range	B_6	Measurement time	f_{step}	Detector
20 kHz to 150 kHz	200 Hz	100 ms	220 Hz	Peak
150 kHz to 10 MHz	9 kHz	20 ms	10 kHz	Peak

B_6 is the 6 dB bandwidth as specified in CISPR 16-1-1.

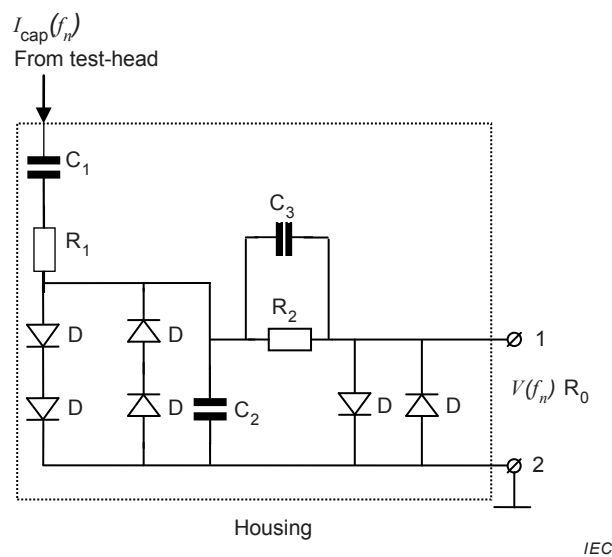
A Van der Hoofden test head, as depicted in Figure 2, consists of a conducting sphere with an outside diameter of $D_{\text{head}} = 210 \text{ mm} \pm 5 \text{ mm}$ mounted on an insulated (e.g. wood, plastic) support and connected via an ordinary wire to a protection network.



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Figure 2 – The Van der Hoofden test head

An example of the protection circuit can be found in Figure 3.

**Example** $C_1 = 470 \text{ pF}$ $C_2 = 10 \text{ nF}$ $C_3 = \text{optional capacitor } (\sim 56 \text{ pF})$ to fulfill the transfer function
requirements of Annex F $R_1 = 470 \text{ } \Omega$ $R_2 = 150 \text{ } \Omega$

D = Schottky diode

 $R_0 = 50 \text{ } \Omega$ input of EMI receiver

Terminals 1 and 2 are to be connected to an EMI receiver or spectrum analyzer via coaxial cable

Figure 3 – Example of a protection circuit

The transfer function of the protection network is given by Equation (1)

$$g(f_n) = \frac{V(f_n)}{I_{\text{cap}}(f_n)} = \frac{R_0}{\sqrt{1 + [(R_0 + R_2) \cdot 2 \cdot \pi \cdot f_n \cdot C_2]^2}} \quad (1)$$

The transfer function of the protection network shall not deviate more than $\pm 1 \text{ dB}$ from the calculated characteristic (see Annex F for calculation). The calibration of the protection network shall be done according to the procedure described in detail in Annex F.

An overview of the measurement set-up is given in 6.4.

5.6 Measurement instrumentation uncertainty

A basic measurement instrumentation uncertainty U_{basic} is estimated to be 30 %. The actual instrumentation uncertainty of the measurement method applied within a laboratory (U_{lab}) shall be calculated. The actual uncertainty shall be used for compliance evaluation of the result (see 5.8). An example for the calculation of U_{lab} can be found in Annex G.

NOTE Guidance to assess uncertainty can be found in IEC 61786:1998 [5].

5.7 Test report

The test report shall include at least the following items:

- identification of the lighting equipment;
- specification of the measuring equipment;
- operating mode, measurement point(s) and distance(s)