

Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

The European Standard EN 55015:1996 with the inclusion of
amendments A1:1997 and A2:1999 has the status of a British Standard

ICS 29.140.01; 33.100.10

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/210, Electromagnetic compatibility, to Subcommittee GEL/210/6, Equipment, lighting fittings and domestic appliances, upon which the following bodies were represented:

Association of Consulting Scientists
Association of Control Manufacturers [TACMA (BEAMA Ltd.)]
Association of Manufacturers of Domestic Electrical Appliances
BEAMA Ltd.
British Combustion Equipment Manufacturers' Association
British Lighting Association for the Preparation of Standards (BRITLAPS)
British Radio and Electronic Equipment Manufacturers' Association
British Sign Association
British Toy and Hobby Association
Coopted members
Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
ERA Technology Ltd.
Federation of the Electronics Industry
Lighting Industry Federation Ltd.
Portable Electric Tool Manufacturers' Association
Radio Society of Great Britain
Radiocommunications Agency

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 November 1996

© BSI 01-2001

First published June 1993
Second edition November 1996

The following BSI references relate to the work on this standard:
Committee reference GEL/210/6
Draft for comment 92/03067 DC

Amendments issued since publication

Amd. No.	Date	Comments
9766	December 1997	
10550	January 2000	Indicated by a sideline
13031 Corrigendum No. 1	January 2001	In national foreword, date of withdrawal of BS EN 55015:1993 corrected to 2000-01-01.

ISBN 0 580 26080 1

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	2
Text of EN 55015	5
List of references	Inside back cover

National foreword

This British Standard has been prepared by Subcommittee GEL/210/6 and is the English language version of EN 55015:1996 *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment*, including amendments A1:1997 and A2:1999, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with CISPR 15:1996 including Amendments 1:1997 and 2:1998, published by the International Electrotechnical Commission (IEC).

The foreword of the EN makes reference to the “date of withdrawal” (dow) of the relevant national standard. In this case the relevant national standard is BS EN 55015:1993 as amended by amendments Nos 1:1993 and 2:1998, which will be withdrawn on 2000-01-01.

The main technical changes are:

- limitation of the scope to electromagnetic disturbances only. A standard for immunity requirements for lighting equipment is prepared by IEC Technical Committee 34;
- full application of the limits to all kinds of lighting equipment; lamps, luminaires and auxiliaries;
- introduction of operating conditions for lighting equipment;
- change of the method of measurement of insertion loss.

Annex A and Annex B form an integral part of this standard. Annex C is for information only.

Cross-references

Publication referred to	Corresponding British Standard
IEC 50 (161):1990	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 1 <i>Terms common to power, telecommunications and electronics</i> Group 09:1991 <i>Electromagnetic compatibility</i>
EN 60155:1995 (IEC 155:1993)	BS EN 60155:1995 <i>Glow-starters for fluorescent lamps</i>
EN 60598 series IEC 598 series	BS EN 60598 <i>series Luminaires</i>
EN 55011:1991 CISPR 11:1990	BS EN 55011:1991 <i>Specification for limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment</i>

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 42, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Sidelining in this document indicates the most recent changes by amendment.

Descriptors: Radio disturbance, method of measurement, lighting equipment, luminaire, limit, evaluation, statistics

English version

Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment

(includes amendments A1:1997 and A2:1999)
(CISPR 15:1996 + A1:1997 + A2:1998)

Limites et méthodes de mesure des perturbations radioélectriques produits par les appareils électriques d'éclairage et les appareils analogues (inclut les amendements A1:1997 et A2:1999)
(CISPR 15:1996 + A1:1997 + A2:1998)

Grenzerte und Meßverfahren für Funkstörungen von elektrischen Beleuchtungseinrichtungen und ähnlichen Elektrogeräten (enthält Änderungen A1:1997 und A2:1999)
(CISPR 15:1996 + A1:1997 + A2:1998)

This European Standard was approved by CENELEC on 1995-11-28. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and 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

The text of document CISPR/F/186/FDIS + CISPR/F/186A/FDIS, future edition 5 of CISPR 15, prepared by CISPR SC F: Interference relating to household appliances, tools, lighting equipment and similar apparatus was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 55015 on 1995-11-28.

This European Standard supersedes EN 55015:1993.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2000-01-01

For dimmers and similar electronic switches the terminal voltage disturbance limits of EN 55014:1993 apply until 2000-01-01.

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex A, Annex B and Annex ZA are normative and Annex C is informative. Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of document CISPR/F/211/FDIS, future amendment 1 to CISPR 15:1996, prepared by CISPR SC F, Interference relating to household appliances, tools, lighting equipment and similar apparatus, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 55015:1996 on 1997-07-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-06-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2000-01-01

Foreword to amendment A2

The text of document CISPR/F/254/FDIS, future amendment 2 to CISPR 15:1996, prepared by CISPR SC F, Interference relating to household appliances, tools, lighting equipment and similar apparatus, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 55015:1996 on 1999-01-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-10-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2001-10-01

Contents

	Page	Page
Foreword	2	
1 Scope	5	
2 Normative references	5	
3 Definitions	5	
4 Limits	5	
4.1 Frequency ranges	5	
4.2 Insertion loss	6	
4.3 Disturbance voltages	6	
4.4 Radiated electromagnetic disturbances	6	
4.5 Limits at designated frequencies	6	
5 Application of the limits	7	
5.1 General	7	
5.2 Designated frequencies	7	
5.3 Indoor luminaires	8	
5.4 Independent auxiliaries exclusively for use with lighting equipment	8	
5.5 Self-ballasted lamps	9	
5.6 Outdoor lighting appliances	9	
5.7 UV and IR radiation appliances	10	
5.8 Transport lighting	10	
5.9 Neon and other advertising signs	10	
6 Operating conditions for lighting equipment	11	
6.1 General	11	
6.2 Lighting equipment	11	
6.3 Supply voltage and frequency	11	
6.4 Ambient conditions	11	
6.5 Lamps	11	
6.6 Replaceable starters	11	
7 Method of insertion loss measurement	11	
7.1 Circuits for the measurement of insertion loss	11	
7.2 Measuring arrangement and procedure	12	
7.3 Luminaire	12	
7.4 Measurement procedure	12	
8 Method of measurement of disturbance voltages	13	
8.1 Measuring arrangement and procedure	13	
8.2 Indoor and outdoor luminaires	13	
8.3 Independent light regulating devices	14	
8.4 Independent transformers and convertors for incandescent lamps	14	
		8.5 Independent ballasts for fluorescent and other discharge lamps 14
		8.6 Self-ballasted lamps and semi-luminaires 14
		8.7 UV and IR radiation appliances 15
		9 Method of measurement of radiated electromagnetic disturbances 15
		9.1 Measuring arrangement and procedure 15
		9.2 Indoor and outdoor luminaires 15
		9.3 Independent convertors for incandescent lamps 15
		9.4 Independent ballasts for fluorescent and other discharge lamps 15
		9.5 Self-ballasted lamps and semi-luminaires 16
		9.6 UV and IR radiation appliances 16
		9.7 Application of CISPR 16-1 16
		10 Interpretation of CISPR radio disturbance limits 16
		10.1 Significance of a CISPR limit 16
		10.2 Tests 16
		10.3 Statistical method of evaluation 16
		10.4 The banning of sales 17
		Annex A Electrical and constructional requirements for the low-capacitance balance-to-unbalance transformer 30
		Annex B Magnetic field induced current method 35
		Annex C Relative sensitivities and conversion factors for large-loop antennas (LLAs) 40
		Annex ZA (normative) Normative references to international publications with their corresponding European publications 42
		Figure 1 — Insertion loss measurement on linear and U-type fluorescent lamp luminaires 18
		Figure 2 — Insertion loss measurement on circular fluorescent lamp luminaires 19
		Figure 3 — Insertion loss measurement on luminaires for single-capped fluorescent lamps with integrated starter 20
		Figure 4a — Configuration of linear and U-type dummy lamps 21
		Figure 4b — Configuration of circular dummy lamps 22
		Figure 4c — Dummy lamp for 15 mm fluorescent lamps 23
		Figure 4d — Dummy lamp for 15 mm single capped fluorescent lamps 24

	Page		Page
Figure 4e — Dummy lamp for single-capped fluorescent lamps linear shaped, twin tube, tube diameter 12 mm	25	Table 1 — Minimum values of insertion loss	6
Figure 4f — Dummy lamp for single-capped fluorescent lamps linear shaped, quad tube, tube diameter 12 mm	26	Table 2a — Disturbance voltage limits at mains terminals	6
Figure 5 — Measuring arrangements for an independent light regulating device, transformer or convertor	27	Table 2b — Disturbance voltage limits at load and control terminals	6
Figure 6 — Measuring arrangements	28	Table 3 — Radiated electromagnetic disturbance limits	7
Figure 7 — Conical metal housing for self-ballasted fluorescent lamps	29	Table 4 — Limits of disturbance field strengths at frequencies designated for use by ISM equipment	7
Figure A.1 — Isolation test configuration	31	Table 5 — Sample size and corresponding k factor in a non-central t-distribution	17
Figure A.2a — Balance-to-unbalance transformer circuit	32		
Figure A.2b — Details of transformer core construction	33		
Figure A.2c — Details of transformer core construction	33		
Figure A.2d — Construction of transformer	34		
Figure B.1 — Test set-up for measuring magnetic fields in X, Y and Z direction (frequency range 9 kHz and 30 MHz)	36		
Figure B.2 — Large-loop construction	37		
Figure B.3 — Example of a slit construction for the large-loop antenna	38		
Figure B.4 — Test set-up for verification of the large-loop antenna	39		
Figure C.1 — Sensitivity of LLA's with a diameter of 1,0, 1,5, 3,0 and 4,0 m relative to an LLA having a diameter of 2,0 m	40		
Figure C.2 — Correlation between the current in the 2 m loop antenna and the magnetic field at the indicated distances	41		

1 Scope

This standard applies to the emission (radiated and conducted) of radiofrequency disturbances from:

- 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;
- the lighting part of multi-function equipment where one of the primary functions of this is illumination;
- independent auxiliaries exclusively for use with lighting equipment;
- UV and IR radiation equipment;
- neon advertising signs;
- street/flood lighting intended for outdoor use;
- transport lighting (installed in buses and trains).

Excluded from the scope of this standard are:

- lighting equipment for aircraft and airports;
- apparatus for which the electromagnetic compatibility requirements in the radio-frequency range are explicitly formulated in other IEC or CISPR standards.

NOTE Examples are:

- built-in lighting devices in other equipment, for example scale illumination or neon devices;
- photocopiers;
- slide projectors;
- lighting equipment for road vehicles.

The frequency range covered is 9 kHz to 400 GHz.

Multi-function equipment which is subjected simultaneously to different clauses of this standard and/or other standards shall meet the provisions of each clause/standard with the relevant functions in operation.

The limits in this standard have been determined on a probabilistic basis to keep the suppression of disturbances within economically reasonable limits while still achieving an adequate level of radio protection and electromagnetic compatibility. In exceptional cases additional provisions may be required.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions to the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(161):1990, *International Electrotechnical Vocabulary (IEV) — Chapter 161: Electromagnetic compatibility*.

IEC 50(845):1987, *International Electrotechnical Vocabulary (IEV) — Chapter 845: Lighting*.

IEC 155:1993, *Glow-starters for fluorescent lamps*.

IEC 598, *Luminaires*.

CISPR 11:1990, *Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment*.

CISPR 16-1:1993, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1: Radio disturbance and immunity measuring apparatus*.

3 Definitions

For the purpose of this International Standard, the definitions contained in IEC 50(161) apply.

Continuous disturbance may be either broadband, for instance caused by the switching operations or by unstable gas-discharges in the lamp electrode region, or may be narrowband, for instance caused by electronic control devices operating at dedicated frequencies.

NOTE Instead of the concept of “broadband” and “narrowband”, a distinction is made in this standard between two related kinds of disturbance, defined by the type of the applied detector. For this purpose, limits have been defined with respect to the measurement with the quasi-peak detector and with the average detector. By using this approach also a combination of broadband and narrowband disturbances can be assessed.

4 Limits

4.1 Frequency ranges

In 4.2, 4.3 and 4.4 limits are given as a function of frequency range. No measurements need to be performed at frequencies where no limits are specified.

NOTE The World Administrative Radiocommunications Conference (WARC) has in 1979 reduced the lower frequency limit in Region 1 to 148,5 kHz; for applications falling within the scope of this standard, tests at 150 kHz are considered adequate, since 148,5 kHz falls within the receiver bandwidth.

4.2 Insertion loss

The minimum values of the insertion loss for the frequency range 150 kHz to 1 605 kHz are given in Table 1.

Table 1 — Minimum values of insertion loss

Frequency range kHz	Minimum values dB
150 to 160	28
160 to 1 400	28 to 20 ^a
1 400 to 1 605	20

^a Decreasing linearly with the logarithm of frequency.

4.3 Disturbance voltages

4.3.1 Mains terminals

The limits of the mains terminal disturbance voltages for the frequency range 9 kHz to 30 MHz are given in Table 2a.

Table 2a — Disturbance voltage limits at mains terminals

Frequency range	Limits dB(μV) ^a	
	Quasi-peak	Average
9 kHz to 50 kHz ^b	110	—
50 kHz to 150 kHz ^b	90 to 80 ^c	—
150 kHz to 0,5 MHz	66 to 56 ^c	56 to 46 ^c
0,5 MHz to 2,51 MHz	56	46
2,51 MHz to 3,0 MHz	73	63
3,0 MHz to 5,0 MHz	56	46
5 MHz to 30 MHz	60	50

NOTE In Japan the limits in the frequency range 9 kHz to 150 kHz are not applicable. Moreover, the limits 56 dB(μV) quasi-peak and 46 dB(μV) average apply in between 2,51 MHz and 3 MHz.

^a At the transition frequency the lower limit applies.

^b The limit values in the frequency range 9 kHz to 150 kHz are considered to be “provisional limits” which may be modified after some years of experience.

^c The limit decreases linearly with the logarithm of the frequency in the ranges 50 kHz to 150 kHz and 150 kHz to 0,5 MHz.

4.3.2 Load and control terminals

The limits of the load and control terminal disturbance voltages for the frequency range 150 kHz to 30 MHz are given in Table 2b.

Table 2b — Disturbance voltage limits at load and control terminals

Frequency range MHz	Limits dB(μV) ^a	
	Quasi-peak	Average
0,15 to 0,50	80	70
0,50 to 30	74	64

^a At the transition frequency the lower limit applies.

4.4 Radiated electromagnetic disturbances

The quasi-peak limits of the magnetic component of the radiated disturbance field strength in the frequency range 9 kHz to 30 MHz measured as a current in 2 m, 3 m or 4 m loop antennas around the lighting equipment, are given in Table 3.

The limits for the 2 m loop diameter apply to equipment not exceeding a length of 1,6 m, those for the 3 m loop diameter for equipment having a length in between 1,6 m and 2,6 m and those for the 4 m loop diameter for equipment having a length in between 2,6 m and 3,6 m.

4.5 Limits at designated frequencies

Certain frequencies are designated by the International Telecommunication Union (ITU) for use as fundamental frequencies for ISM equipment [Resolution No. 63 (1979) of the ITU regulations]. These frequencies and related field strength limits are listed in Table 4.

Limits of the terminal disturbance voltages within the frequency bands 6,765 to 6,795, 13,553 to 13,567 and 26,957 to 27,283 MHz are under consideration.

NOTE In individual countries, different or additional frequencies may be designated for use by ISM equipment.

Table 3 — Radiated electromagnetic disturbance limits

Frequency range				Limits for loop diameter dB (μA) ^a		
				2m	3m	4m
9	kHz to	70	kHz	88	81	75
70	kHz to	150	kHz	88 to 58 ^b	81 to 51 ^b	75 to 45 ^b
150	kHz to	2,2	MHz	58 to 26 ^b	51 to 22 ^b	45 to 16 ^b
2,2	MHz to	3,0	MHz	58	51	45
3,0	MHz to	30	MHz	22	15 to 16 ^c	9 to 12 ^c

NOTE In Japan, the limits for frequencies 9 kHz to 150 kHz do not apply.

^a At the transition frequency, the lower limit applies.
^b Decreasing linearly with the logarithm of the frequency.
^c Increasing linearly with the logarithm of the frequency.

Table 4 — Limits of disturbance field strengths at frequencies designated for use by ISM equipment

Central frequency MHz	Frequency band MHz		Limit of disturbance field strength dB (μV/m) measured at 10 m distance	No. of appropriate footnote to the table of frequency allocation of the ITU radio regulations
6,780	6,765	to 6,795	100 (magnetic component)	524 ^a
13,560	13,553	to 13,567	100 (magnetic component)	534
27,120	26,957	to 27,283	100 (magnetic component)	546
40,680	40,660	to 40,700	100 (electric component)	548
433,922	433,050	to 434,790	100 (electric component)	661 ^a , 662 (region 1 only)
915	902	to 928	100 (electric component)	707 (region 2 only)
2 450	2 400	to 2 500	100 (electric component)	752
5 800	5 725	to 5 875	100 (electric component)	806
24 125	24 000	to 24 250	100 (electric component)	881
61 250	61 000	to 61 500	100 (electric component)	911 ^a
122 500	122 000	to 123 000	100 (electric component)	916 ^a
245 000	244 000	to 246 000	100 (electric component)	922 ^a

^a Use of these frequency bands shall be subjected to special authorization by administrations concerned in agreement with other administrations whose radio communication services might be affected.

5 Application of the limits

5.1 General

Application of the limits for the various kinds of lighting equipment as mentioned in the scope of this standard are given in **5.3**, **5.4**, **5.5**, **5.6**, **5.7**, **5.8** and **5.9**.

No emission requirements apply to lamps other than self-ballasted lamps nor to auxiliaries incorporated in luminaires, in self-ballasted lamps or in semi-luminaires. (See, however, note 2 of **5.4.1** in this respect.)

The disturbance caused by manual or automatic operation of a switch (external or included in equipment) to connect or disconnect the mains shall be disregarded. This includes manual on/off switches or, for example, switches activated by sensors or ripple control receivers. However, switches which will be repeatedly operated (e.g. such as those of advertising signs) are not included in this exception.

5.2 Designated frequencies

Any kind of lighting equipment may operate at the designated frequencies as described in **4.5**. Such equipment shall comply with:

- the field strength limits as given in Table 4;

- the disturbance voltage limits as given in 4.3 except for the designated frequency bands listed in Table 4 where the limits are under consideration;
- the radiated disturbance limits outside the frequency bands as given in Table 3.

5.3 Indoor luminaires

5.3.1 General

The following conditions apply to all kinds of indoor luminaires irrespective of the environment in which they are used.

5.3.2 Incandescent lamp luminaires

Incandescent lamp luminaires, where the lamps are a.c. mains or d.c. operated or which do not incorporate a light regulating device or electronic switch, are not expected to produce electro-magnetic disturbance. Therefore they are deemed to fulfil all relevant requirements of this standard without further testing.

NOTE Where in this standard the term “incandescent lamp” is used, all types of incandescent lamps including halogen lamps are meant.

5.3.3 Fluorescent lamp luminaires

The minimum values of insertion loss of Table 1 shall apply where a fluorescent lamp luminaire is a starter switch operated type and designed for one of the following lamp types:

- linear fluorescent lamps with a nominal diameter of 15 mm, 25 mm or 38 mm;
- circular fluorescent lamps with a nominal diameter of 28 mm or 32 mm;
- U-type fluorescent lamps with a nominal diameter of 15 mm, 25 mm or 38 mm;
- single-capped fluorescent lamps, without integrated starter and with a nominal diameter of 15 mm;
- single-capped fluorescent lamps, linear shaped, twin and quad tube, with integrated starter and having a nominal tube diameter of 12 mm.

5.3.4 Other luminaires

Indoor luminaires other than described in 5.3.2 or 5.3.3 shall comply with the mains terminal voltage limits given in Table 2a.

Where the luminaire supplies the lamp(s) with a current having an operation frequency in excess of 100 Hz, it shall comply with the field strength limits given in Table 3.

Where the light output of the luminaire is regulated by an external device, the disturbance voltage at the control terminals shall not exceed the limits given in Table 2b.

5.4 Independent auxiliaries exclusively for use with lighting equipment

5.4.1 General

Independent auxiliaries are electric or electronic devices designed to be applied external to a luminaire and to be used to control the current or voltage of a discharge or incandescent lamp. Examples are dimmers, transformers and convertors for lamps, ballasts for discharge lamps (including fluorescent lamps) and semi-luminaires for compact fluorescent lamps and for incandescent lamps.

NOTE 1 The requirements described in this subclause (5.4) are for the sole purpose of checking the electromagnetic emission characteristics of the auxiliary itself. Due to the variety of wiring circuits, it is impossible to describe requirements for the installation. In this respect, it is recommended that the manufacturer give guide-lines for the proper use of the auxiliary.

NOTE 2 The requirements of this subclause (5.4) may be used for testing auxiliaries intended to be built in to a luminaire. However, there is no obligation for such testing. Moreover, even when the auxiliary complies with the requirements of this subclause, the luminaire shall always be tested.

5.4.2 Independent light regulating devices

5.4.2.1 Types of devices

There are two types of light regulating devices: those like dimmers which directly regulate the lamps and those which have a remote control function to regulate the light output via a ballast or convertor.

5.4.2.2 Independent directly operating light regulating devices

Where such devices incorporate semiconductors, they shall comply with the terminal voltage limits given in Table 2a and Table 2b, otherwise no limits apply.

5.4.2.3 Independent remote control devices

Where such devices generate a d.c. or low-frequency (<500 Hz) control signal, no limits apply. For radiofrequency or infrared operating devices, this standard does not apply. Other independent remote control devices shall comply with the terminal voltage limits given in Table 2a and Table 2b.

5.4.3 Independent transformers and convertors for incandescent lamps

5.4.3.1 General

Transformers for incandescent lamps change only the voltage and do not convert the mains frequency, whereas convertors also convert the frequency. Both kinds of device can incorporate means for regulating the light output of the lamps.

5.4.3.2 *Independent transformers*

For voltage transformers for incandescent lamps which do not regulate the voltage by means of active electronic components, the condition of **5.3.2** applies. Other independent transformers for incandescent lamps shall comply with the terminal voltage limits given in Table 2a and Table 2b.

5.4.3.3 *Independent convertors*

Independent electronic convertors for incandescent lamps shall either:

- a) comply with the terminal voltage limits given in Table 2a and Table 2b; or
- b) where the convertor has a non-detachable load supply cable, or where the manufacturer gives strict installation instructions which define the position, type and maximum length of cable(s) to be connected to the lamp(s), then the convertor shall comply with the terminal voltage limits given in Table 2a and with the field strength limits given in Table 3, under these conditions.

5.4.4 *Independent ballasts for fluorescent and other discharge lamps*

5.4.4.1 Independent ballasts designed for a type of fluorescent lamp as mentioned in **5.3.3** and operated with starter shall comply with the minimum values of insertion loss given in Table 1.

5.4.4.2 Other independent ballasts shall comply with the mains terminal voltage limits given in Table 2a.

Where the ballast supplies the lamp with a current having a frequency in excess of 100 Hz, it shall comply with the field strength limits given in Table 3.

Where the light is regulated by an external device, the voltage limit at the control terminals of the ballast shall not exceed the limits given in Table 2b.

5.4.5 *Semi-luminaires*

Semi-luminaires for compact fluorescent lamps and for incandescent lamps, sometimes called adaptors, are devices equipped on the one side with an Edison screw or bayonet cap to allow mounting in a standard incandescent lampholder and on the other side with a lampholder to allow the insertion of a replaceable light source.

Semi-luminaires shall comply with the terminal voltage limits given in Table 2a.

Where the light source is operated at a frequency exceeding 100 Hz, the unit shall comply with the field strength limits given in Table 3.

5.5 *Self-ballasted lamps*

For self-ballasted lamps the ballasting and starting arrangements are encapsulated with the lamp into one single unit. These lamps are fitted with Edison screw or bayonet caps and can be inserted directly into an appropriate holder.

Self-ballasted lamps shall comply with the terminal voltage limits given in Table 2a.

Where the light source is operated at a frequency exceeding 100 Hz, the unit shall comply with the field strength limits given in Table 3.

5.6 *Outdoor lighting appliances*

5.6.1 *General*

For the purpose of this standard, the term “outdoor lighting” is used for the general lighting of public areas such as streets, walkways, cycle paths, motorways, tunnels, car parks, service stations and outdoor sports and recreational areas, for security and floodlighting of buildings and the like. Moreover, requirements described in this subclause (**5.6**) apply to the (outdoor) lighting appliances on private grounds, industrial estates and the like.

However, such lighting equipment may be subject to specific emission requirements which are not covered by this standard, for example airport lighting.

This subclause (**5.6**) does not apply to neon and other advertising signs.

5.6.2 *Mounting system*

Generally an outdoor lighting appliance is built up of a support and one or more luminaires. The support could be:

- a pipe (bracket) or the like;
- a mast (column) arm;
- a post top;
- a span or suspension wires;
- a wall or ceiling.

Unless otherwise stated, the emission requirements described in this subclause (**5.6**) apply to the luminaire (including the lamp) and no requirements apply to the luminaire support.

5.6.3 *Integrated switching devices*

Disturbances caused by the operation of integrated switching devices such as ripple control receivers shall be disregarded.

5.6.4 *Incandescent lamp luminaires*

The condition of **5.3.2** applies.

5.6.5 *Fluorescent lamp luminaires*

Luminaires using a type of fluorescent lamp as mentioned in 5.3.3 and operating with starter shall comply with the minimum values of insertion loss given in Table 1.

5.6.6 *Other luminaires*

Outdoor luminaires other than described in 5.6.4 or 5.6.5 shall comply with the mains terminal voltage limits given in Table 2a.

Where the lamp(s) in the luminaire is (are) supplied with a current having a frequency in excess of 100 Hz, the electronic ballast shall be incorporated in the luminaire. The luminaire shall comply with the field strength limits given in Table 3.

Additional limits for the electrical component of the disturbing field strength are under consideration.

Where the light output of the luminaire is regulated by an external device, the disturbance voltage at the control terminals shall not exceed the limits given in Table 2b.

5.7 *UV and IR radiation appliances*

5.7.1 *General*

Ultraviolet and infrared radiation appliances are appliances used for medical and cosmetic care, for industrial purposes and for instant zone heating.

This subclause (5.7) applies to appliances which are mainly used in the residential environment. For other appliances CISPR 11 applies.

5.7.2 *IR radiation appliances*

For appliances which only contain mains frequency operated incandescent radiation sources (infrared emitters) and which do not include any active electronic components, the condition of 5.3.2 applies.

5.7.3 *UV fluorescent lamp appliances*

UV appliances using UV lamps identical to those types of fluorescent lamp mentioned in 5.3.3 and operating with a replaceable starter shall comply with the minimum values of insertion loss given in Table 1.

5.7.4 *Other UV and/or IR appliances*

UV and IR appliances other than described in 5.7.2 or 5.7.3 shall comply with the mains terminal voltage limits given in Table 2a.

Appliances supplying the radiation source(s) with a current having a (modulating) frequency in excess of 100 Hz shall comply with the field strength limits given in Table 3.

Where the radiation of the appliance is regulated by an external device, the disturbance voltage at the control terminals shall not exceed the terminal voltage limits given in Table 2b.

5.8 *Transport lighting*

5.8.1 *General*

Light sources are used in transport vehicles for:

- external lighting and signalling purposes;
- lighting of on-board instruments;
- lighting of interior cabins and rooms.

This subclause (5.8) sets requirements for lighting equipment used on board ships and rail vehicles. Lighting equipment used in/on aircraft is subject to special conditions and falls outside the scope of this standard.

NOTE Requirements for lighting equipment used in road vehicles are dealt with by CISPR subcommittee D.

5.8.2 *External lighting and signalling*

Where devices for lighting or signalling are equipped with incandescent lamps they are deemed to fulfil all relevant requirements of this Standard without further testing. If gas-discharge lamps are used the lamp and its ballast shall be mounted in one unit which shall comply with the terminal voltage limits given in Table 2a and the field strength limits given in Table 3.

5.8.3 *Lighting of on-board instruments*

Lighting of on-board instruments is considered to be subject to the requirements for the instruments.

5.8.4 *Lighting of interior cabins and rooms*

Equipment for the interior lighting of ships and passenger rail vehicles is considered as indoor lighting equipment and the relevant requirements of 5.3 apply.

5.9 *Neon and other advertising signs*

Limits and method of measurement are under consideration.

5.10 *Self-contained emergency lighting luminaires*

5.10.1 *General*

Luminaires designed for the purpose of providing emergency lighting in the event of disruption of the mains supply, shall be measured in both the mains on mode and emergency mode (mains off) of operation as detailed in 5.10.2 and 5.10.3.

- Mains on mode: the state of a self-contained emergency luminaire which is ready to operate while the public network supply is on. In the case of a supply failure, the luminaire automatically changes over to the emergency mode.

— Emergency mode: the state of a self-contained emergency luminaire which provides lighting when energized by its internal power source, the public network supply having failed (mains off).

NOTE The limit and the measurement method of the field strength for the flashing type emergency lighting luminaire utilizing xenon lamps are under consideration.

5.10.2 Measurement in the mains on mode, i.e. operating condition prior to the disruption of the mains supply

The luminaire shall comply with the mains terminal disturbance voltage limits given in Table 2a. Where the luminaire supplies the lamp(s) with a current having an operation frequency in excess of 100 Hz, it shall comply with the field strength limits given in Table 3. Where the light output of the luminaire is regulated by an external device, the disturbance voltage at the control terminal shall not exceed the limits given in Table 2b.

5.10.3 Measurement in emergency mode, i.e. operating condition after disruption of the mains supply

Luminaires which supply the lamp(s) with a current having an operation frequency in excess of 100 Hz while in the emergency mode, shall comply with the field strength limits given in Table 3.

6 Operating conditions for lighting equipment

6.1 General

When measurements of disturbances or insertion loss of lighting equipment are being made, the equipment shall be operated under the conditions specified in 6.2, 6.3, 6.4, 6.5 and 6.6.

The special conditions given in clauses 7, 8 and 9 for the different methods of measurement are to be observed additionally as appropriate.

6.2 Lighting equipment

The lighting equipment is to be tested as delivered by the manufacturer under normal operating conditions, for example, as given in IEC 598 for luminaires.

6.3 Supply voltage and frequency

The supply voltage shall be within $\pm 2\%$ of the rated voltage. The nominal frequency of the mains supply shall be as rated for the equipment.

6.4 Ambient conditions

Measurements shall be carried out in normal laboratory conditions. The ambient temperature shall be within the range 15 °C to 25 °C.

6.5 Lamps

6.5.1 Type of lamp used

Terminal disturbance voltage and radiated field measurements shall be carried out with lamps for which the lighting equipment is designed. Lamps of the highest wattage rating allowed for the lighting equipment shall be used.

6.5.2 Ageing time of lamps

Measurements shall be carried out with lamps which have been in operation for at least:

- 2 h for incandescent lamps;
- 100 h for fluorescent and other discharge lamps.

6.5.3 Stabilization time of lamps

Prior to a measurement, the lamp(s) shall be operated until stabilization has been reached. Unless otherwise stated in this standard or specified by the manufacturer, the following stabilization times shall be observed:

- 5 min for incandescent lamps;
- 15 min for fluorescent lamps;
- 30 min for other discharge lamps.

6.6 Replaceable starters

When IEC 155 glow-switch starters are used, the capacitor is replaced by a capacitor of 5 000 pF $\pm 10\%$. The starter shall be retained in its socket unless otherwise specified. Care shall be taken that it maintains its characteristics over the whole frequency range covered by the measurements.

If the manufacturer fits a capacitor external to the starter, the luminaire is measured as manufactured including the starter capacitor.

7 Method of insertion loss measurement

7.1 Circuits for the measurement of insertion loss

7.1.1 For luminaires as described in 5.3.3 and in 5.6.5, the insertion loss is measured as shown in:

- Figure 1 for luminaires for linear and U-type fluorescent lamps;
- Figure 2 for luminaires for circular fluorescent lamps;
- Figure 3 for luminaires for single-capped fluorescent lamps having integral starter.

Dummy lamps are specified in 7.2.4.