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Infrared free air applications

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INFRARED FREE AIR APPLICATIONS

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.
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International Standard IEC 61920, has been prepared by technical area 3, Infrared systems and applications, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition published in 1998. This edition constitutes a technical revision.

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

FDIS	Report on voting
100/717/FDIS	100/749/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.

The committee has decided that the contents of this publication will remain unchanged until 2006. 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- withdrawn;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 at a later date.

INFRARED FREE AIR APPLICATIONS

1 Scope and object

This International Standard describes the classification of IR devices into groups and classes in order to identify and clarify problems caused by mutual interference. Mutual interference is caused by the increasing parallel application of different infrared (IR) systems.

Due to its physical characteristics, the possibility of local limitation is a special feature of IR radiation.

In this standard, the wavelength range from 700 nm to 1 600 nm is considered. All systems based on free air application which intentionally or unintentionally use IR radiation in this range, are included. Products which unintentionally emit IR radiation, such as illumination equipment are not deemed to be IR application systems. They are, however, integrated into this standard in order to enable facility planners to take into consideration and to foresee provisions against disturbance of IR application systems by such unintentionally emitted radiation.

The object of this standard is to prevent or at least to minimize mutual interference and to allow the coexistence of different IR products. It is intended to identify each IR product by its characteristics, according to the classification criteria.

It is not the object of this standard to describe the consequences of interference between IR systems or safety aspects of optical radiation.

All applications of fibre-optic technology are excluded.

In this context “free air” means freely radiated IR in indoor or outdoor applications.

If the IR systems are used for information transmission, this standard is only relevant in connection with the physical layer of the open systems interconnection (OSI) reference model (ISO 7498-1).

NOTE The reader should be aware that a risk of interference between different infrared systems as assessed by this standard is based on general parameters and therefore cannot take all the parameters involved into account. In many cases the practical results may differ from those expected, for example the positioning of sender and receiver and the choice of advanced coding and decoding schemes. All these factors beyond the physical layer may have an effect on the final result.

2 Normative references

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

IEC 60050-713:1998, *International Electrotechnical Vocabulary (IEV) – Part 713: Radio-communications: transmitters, receivers, networks and operation*

IEC 60050-845:1987, *International Electrotechnical Vocabulary (IEV) – Chapter 845: Lighting*

IEC 60417-DB:2002[1], *Graphical symbols for use on equipment*

IEC 60747-5-1:1997, *Discrete semiconductor devices and integrated circuits – Part 5-1: Optoelectronic devices – General*

ISO/IEC 7498-1:1994, *Information technology – Open systems interconnection – Basic reference model: The basic model*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1
bandwidth (of a receiver, amplifier or network)
extent of a continuous range of electrical frequencies or optical wavelengths over which the response does not differ from its nominal value by more than a specified amount

[IEV 713-06-19, modified]

3.2
directivity
defined by two angles β_A and β_B for describing the dependence of the receiver's sensitivity from the direction of incidence. The direction in which the receiver output V [mV] is maximum might be called optical receiver axis.

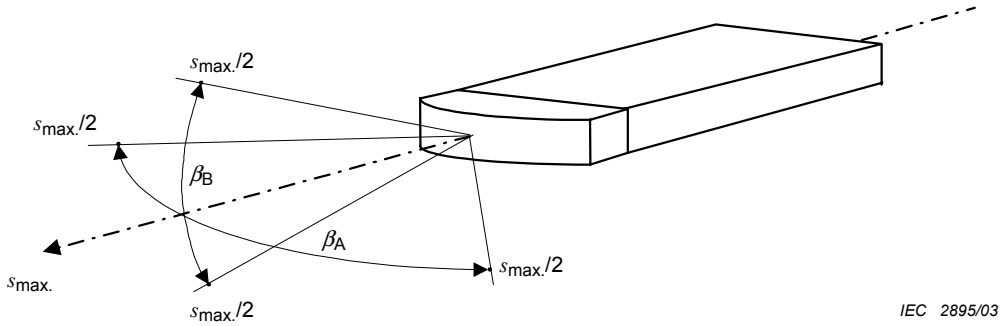

Figure 1 – Directivity and related characteristics

In a sensitivity diagram, the two angles β_A and β_B within which the sensitivity is greater than or equal to half of the maximum sensitivity (see Figure 1) characterize the directivity

[IEC 60747-5-1, 6.3.5.2, modified]

3.3
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

[IEV 845-07-26]

3.4
harmonic
integer multiple of a basic frequency

[1] 'DB' refers to the IEC on-line database.

3.5
interference
disturbance experienced in the reception of a wanted signal, caused by an unwanted signal or noise

3.6
infrared radiation
optical radiation for which the wavelengths are longer than those for visible radiation

[IEV 845-01-04]

NOTE For infrared radiation, the range between 780 nm and 1 mm is commonly subdivided into:

IR-A 780 nm to 1 400 nm;
IR-B 1,4 µm to 3 µm;
IR-C 3 µm to 1 mm.

3.7
infrared system
system which uses IR radiation in free air application consisting of IR radiator and IR receiver

3.8
irradiance
E
irradiance (at a point of a surface) is the quotient of the radiant flux $d\Phi_e$ incident on an element of the surface containing the point, by the area dA of that element
$E = d\Phi_e / dA$

NOTE Irradiance is expressed in [mW/m²].

[IEV 845-01-37]

3.9
modulation frequency
electrical signal frequency which modulates the IR radiation

3.10
peak intensity
$\boldsymbol{I_p}$
maximum intensity I_p [mW/sr] of the optical radiation inside the optical radiation pattern

NOTE It should be taken into account that a different radiation pattern may occur in different wavelength ranges in the same application.

3.11
radiant intensity
$\boldsymbol{I_e}$
quotient of the radiant flux $d\Phi_e$ leaving the source and propagated in the element of solid angle $d\Omega$ containing the given direction, by the element of solid angle

$$I_e = d\Phi_e / d\Omega$$

NOTE Radiant intensity is expressed in [mW/sr].

[IEV 845-01-30]

3.12
radiation characteristic
defined by two angles α_A and α_B for describing the beam characteristic of IR emission. References are the points of half optical radiant intensity. α_A is the angle of maximum divergence, α_B is the angle perpendicular to the plane expanded by α_A, where $\alpha_A \geq \alpha_B$ (similar to 3.2)

3.13
relative spectral electrical output
V_{rf}
of a receiver is its output V_f [mV/Hz] as a function of the frequency f divided through its maximum value V_{max} [mV/Hz]

$$V_{rf} = V_f / V_{max} \times 100$$

NOTE Relative spectral electrical output is expressed in [%].

3.14
relative spectral sensitivity
$s_{r\lambda}$
ratio of the sensitivity s_λ of the detector at wavelength λ to a given reference value s_{max}

$$s_{r\lambda} = s_\lambda / s_{max} \times 100$$

NOTE Relative spectral sensitivity is expressed in [%].

[IEV 845-05-57, modified]

3.15
(maximum) spectral sensitivity
s(max)
quotient of the (maximum) current of the photo diode $I_{(max)}$ [µA/nm] and the irradiance E [mW/m²] as a function of the wavelength λ

$$s_{max} = I_{max} / E$$

NOTE Spectral sensitivity is expressed in [(µA × m²)/(mW × nm)].

[IEV 845-05-56, modified]

3.16
steradian
SI unit of solid angle. Solid angle that, having its vertex at the centre of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides of length equal to the radius of the sphere

[IEV 845-01-20]

3.17
wavelength
distance in the direction of propagation of a periodic wave between two successive points at which the phase is the same

[IEV 845-01-14]

3.18
radiator
IR emitting source, consisting of one or more emitter components, with a specific radiation characteristic

3.19
(selective) receiver
one or more IR detectors, which are mostly embedded in signal processing components and representing a specific IR receiving directivity

NOTE Selective receivers have a limited spectral bandwidth within the whole IR spectrum.

4 Symbols

4.1 General

As this document is concerned with interference, commonly between two different IR systems (for example between the radiators of a system 1 and the receivers of a system 2), symbols of similar or equal meaning such as bandwidths B_i, wavelengths λ_i or frequencies f_i shall be identified in the following by the index 1 for radiators (⇒ system 1) and index 2 for receivers (⇒ system 2).

4.2 Radiators

B_{1f}	electrical bandwidth [kHz]
$B_{1\lambda}$	optical bandwidth [nm]
f_1	modulation frequency [kHz]
f_p	frequency at the modulated peak intensity I_{pf} [kHz]
f_{1l}	lower band limiting frequency [kHz]
f_{1u}	upper band limiting frequency [kHz]
I_o	time averaged total optical radiant intensity [mW/sr]
I_p	total optical peak intensity [mW/sr]
$I_{p\lambda}$	spectral optical peak intensity [mW/(sr × nm)]
$I_{e\lambda}$	spectral optical radiant intensity [mW/(sr × nm)]
I_{ef}	spectral modulated radiant intensity [mW/(sr × Hz)]
I_{pf}	spectral modulated peak intensity [mW/(sr × Hz)]
sr	steradian
α_A	angle of maximum divergence
α_B	angle perpendicular to α_A
λ_1	wavelength [nm]
λ_p	wavelength at the optical peak intensity $I_{p\lambda}$ [nm]
λ_{1l}	lower band limiting wavelength [nm]
λ_{1u}	upper band limiting wavelength [nm]

4.3 Receivers

B_{2f}	electrical bandwidth [kHz]
$B_{2\lambda}$	optical bandwidth [nm]
f_2	received frequency [kHz]
f_{max}	frequency at maximum response [kHz]
f_{2l}	lower band limiting frequency [kHz]
f_{2u}	upper band limiting frequency [kHz]
E	irradiance [mW/m²]
I_{max}	maximum photo current [µA/nm]
$s_{r\lambda}$	relative spectral sensitivity [%]
s_{max}	maximum spectral sensitivity [µA m²/mW × nm]
V_{rf}	relative spectral electrical output [%]

V_{max} maximum spectral electrical output [mV/Hz]

β_A angle of maximum reception

β_B angle perpendicular to β_A

λ_2 wavelength [nm]

λ_{max} wavelength at maximum sensitivity [nm]

λ_{2l} lower band limiting wavelength [nm]

λ_{2u} upper band limiting wavelength [nm]

5 Classification

5.1 General

The classification considers four main aspects for description of IR systems consisting of radiators and receivers:

– physical characteristics of radiators (see 5.2);
– physical characteristics of receivers (see 5.3);
– product groups (see 5.5);
– user areas (see 5.6).

5.2 Physical characteristics of radiators

5.2.1 General

There are five criteria, 1 to 5, on which the classification for physical characteristics of radiators is based. They are operating characteristics, selected from the rated values given by the manufacturer (see Table 1).

5.2.2 Ranges of wavelength (criterion 1)

The lower (λ_{1l}) and the upper (λ_{1u}) optical wavelengths determine the optical range of an IR radiator. Both the lower and the upper optical wavelengths of an IR radiator are defined by the reduction of the peak intensity $I_{p\lambda}$ by 3 dB, taking into account the effects of temperature and component deviations (see Figure 2).

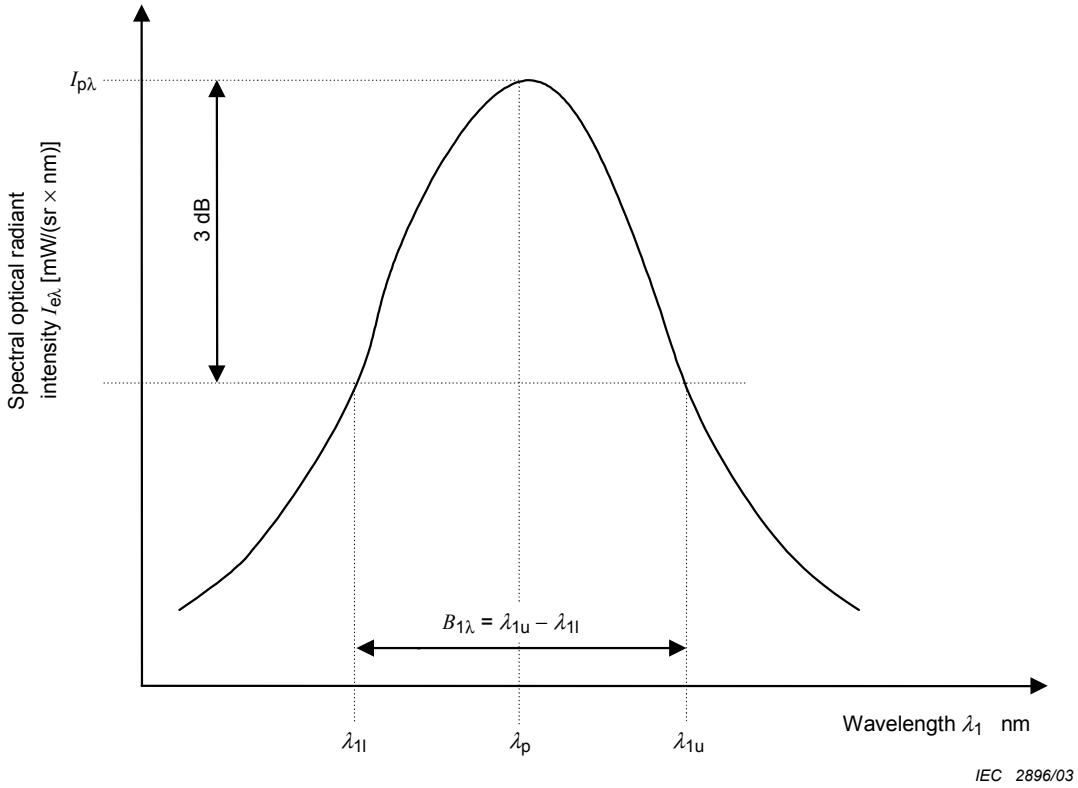

Figure 2 – Spectral emission and definition of optical bandwidth

5.2.3 Ranges of frequency (criterion 2)

The lower (f_{1l}) and upper (f_{1u}) modulation frequencies determine the bandwidth B_{1f} of the modulated IR radiant intensity. These frequencies are defined as those two utmost frequencies including any harmonics and measured with a meter having a bandwidth of at least 10 times the operating frequency, at which the intensity is 10 dB below the modulated peak intensity I_{pf} (see Figure 3).

Harmonics greater than 1/10 of the highest intensity I_{pf} should be taken into account, notably with respect to the influences of temperature and component tolerances. For criterion 2 it is only important to know the upper and lower band limiting frequencies; the possible influence of modulation is not taken into account in this definition.

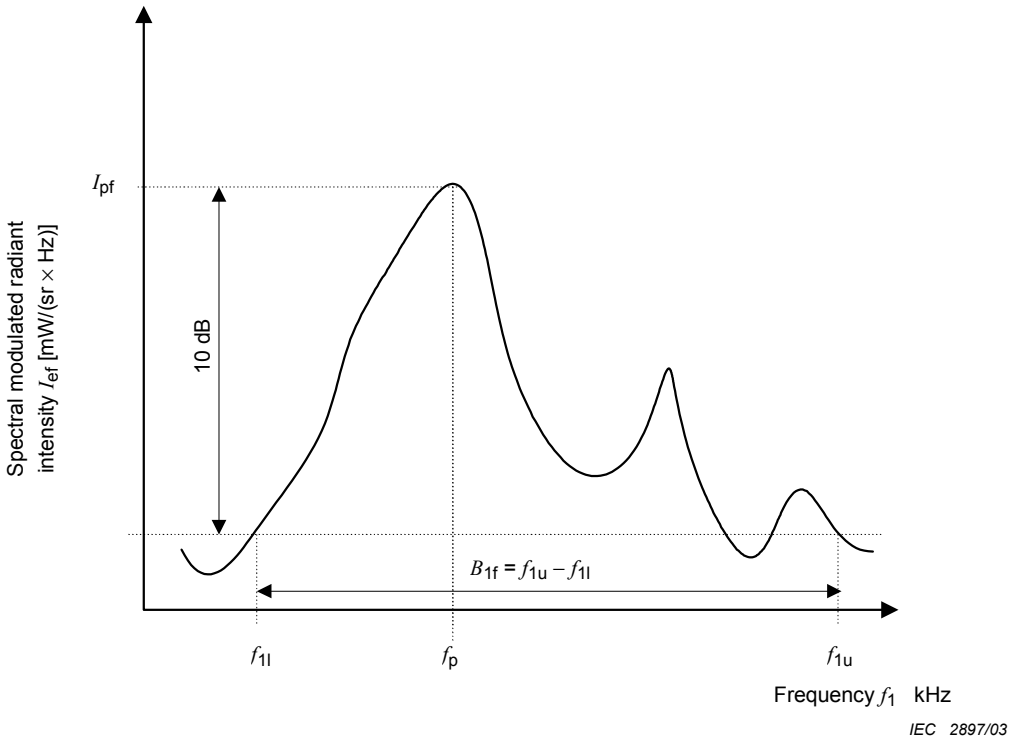

Figure 3 – Spectral emission and definition of electrical bandwidth

5.2.4 Radiant intensity (criterion 3)

The intensity of IR radiators is characterized by the time averaged total optical radiant intensity I_o [mW/sr] and the total optical peak intensity I_p [mW/sr].

5.2.5 Angle of radiation (criterion 4)

The angle of radiation α is related to the points of half intensity of beam divergence. This is the angle between the directions which are specified by points of half radiant intensity. Two angles α_A and α_B lying in two planes perpendicular to each other define the radiation characteristic of the IR radiator.

5.2.6 Duration of radiation (criterion 5)

The time characteristic of IR radiation is described by its duration. If an IR transmission is the consequence of a momentary operation, the result is called a short duration radiation (repetition in case of error handling included). Long duration operation occurs when the IR system is working in a continuous mode.

5.2.7 Identification example for a radiator

In order to illustrate the application of the characteristics introduced in 5.2.1 to 5.2.5, an example is given for the radiator of a home and building electronic system having the following characteristics:

Illumination control with
λ_{1l} = 930 nm
λ_{1u} = 980 nm
f_{1l} = 38 kHz
f_{1u} = 60 kHz
I_p = 45 mW/sr
I_o = 20 mW/sr
α_A = 60°
α_B = 30°
Class S: momentary activation of a push button

5.3 Physical characteristics of receivers

5.3.1 General

There are another 4 criteria (6 to 9) on which the classification for physical characteristics of receivers is based. They are operating characteristics selected from the rated values given by the manufacturers (see Table 2).

5.3.2 Ranges of wavelength and selectivity (criterion 6)

The lower (λ_{2l}) and the upper (λ_{2u}) optical wavelength determine the optical range of an IR receiver. They are defined by the reduction of the maximum sensitivity s_{max} by 6 dB (50 %) taking into account the effects of temperature and component deviations. Figure 4 shows the spectral sensitivity in terms of relative values $s_{r\lambda} = s_\lambda / s_{max} \times 100$ [%]. The optical bandwidth $B_{2\lambda}$ is a measure for the selectivity of the IR receiver.

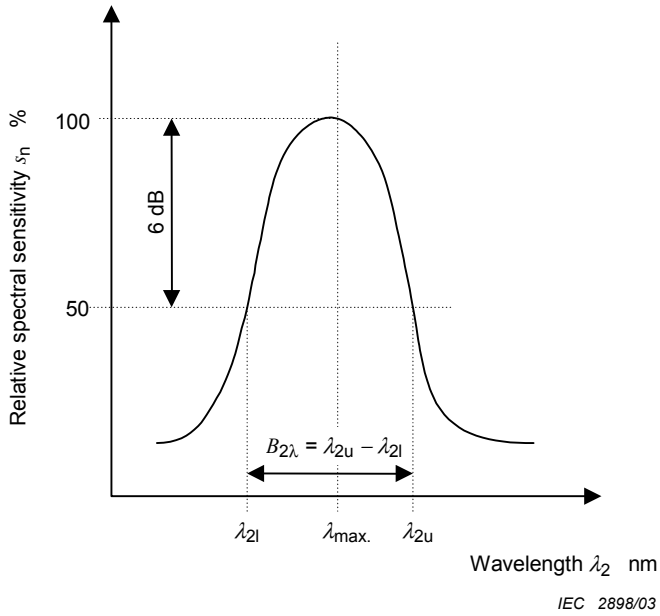

Figure 4 – Spectral sensitivity and definition of optical bandwidth

5.3.3 Frequency response (criterion 7)

The lower (f_{2l}) and upper (f_{2u}) frequencies determine the electrical bandwidth B_{2f} of the receiver. These frequencies are defined as those two at which the electrical output V is 20 dB below its maximum V_{max}. Figure 5 shows the frequency response in terms of relative values $V_{rf} = V_f/V_{max} \times 100$ [%].

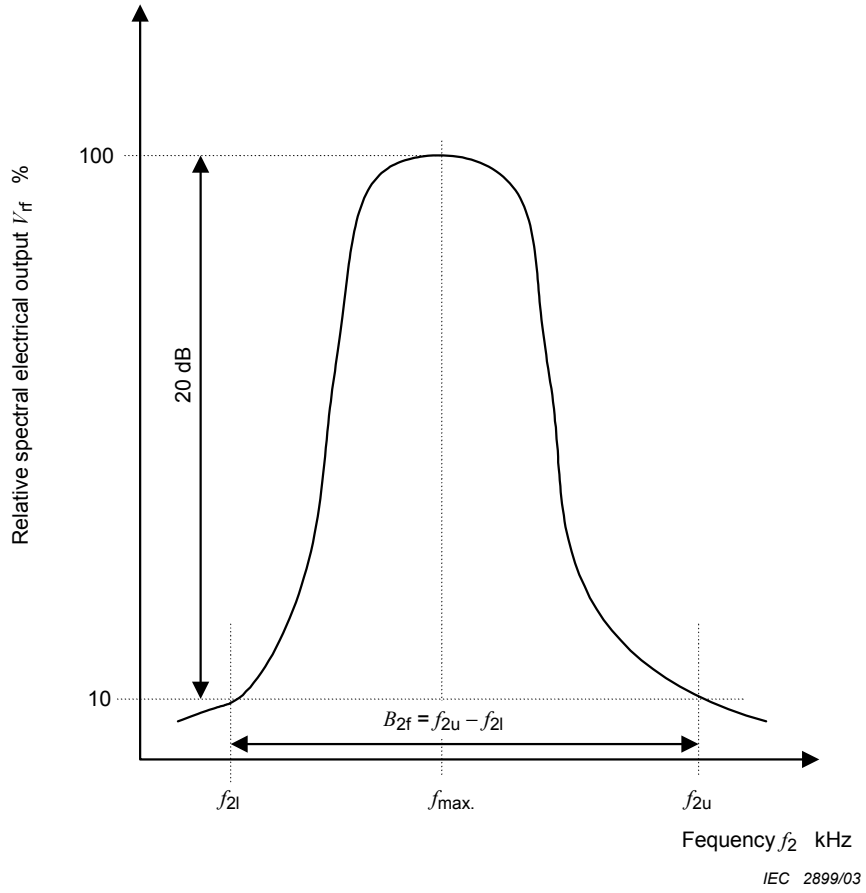

Figure 5 - Frequency response and definition of electrical bandwidth

5.3.4 Sensitivity (criterion 8)

Besides the selectivity according to 5.3.2 (criterion 6), the efficacy of IR receivers is characterized by the maximum sensitivity s_{max} [(µA × m²)/(mW × nm)] given by the quotient of the maximum current of the photo diode I_{max} [µA/nm] and the irradiance E [mW/m²].

5.3.5 Directivity (criterion 9)

Directivity is the sensitivity of the receiver in different directions. It is graphically depicted by the output signal as a function of the angle of incidence upon the receiver under constant irradiance (polar diagram). The angle of maximum reception (β_A) and the one in the perpendicular plane (β_B) are the horizontal and vertical optical viewing angles and characterize the directivity of the receiver.

5.3.6 Example of a receiver

Analogous to item 5.2.6 for illustrating the application of the characteristics introduced in 5.3.2 to 5.3.5, the following characteristics are given for the receiver of a home and building electronic system:

Illumination control with

λ_{2l} = 840 nm

λ_{2u} = 1075 nm

f_{2l} = 35 kHz

f_{2u} = 41 kHz

s_{max} = 600 [(μA × m²)/(mW × nm)]

β_A = 60°

β_B = 45°

5.4 Tolerances

5.4.1 Measurement conditions

The data which are required for the classification of IR products by the characteristics defined in 5.2.2 to 5.2.6 and 5.3.2 to 5.3.5 shall be determined under worst case conditions defined by the manufacturer of the IR product. The relevant statistical uncertainties, if applicable, shall be taken into account.

5.4.2 Tolerances of data

Measurements shall be carried out with sufficient accuracy to allow classification according to 5.2.2 to 5.2.6 and 5.3.2 to 5.3.5. For the accuracy of data, the following requirements apply:

a) The worst case of the tolerances of λ_1 (± 30 nm) and f_i (± 10 %) shall contain the tolerances of the measurement devices. Secondary maxima within the band of 700 nm to 1 600 nm shall be taken into account (see IEC 60747-5-1);

b) the values of the measured radiant intensities I_p and I_o, respectively, shall not differ by more than ±20 % from their nominal values;

c) the measured maximum sensitivities s_{max} shall not differ by more than ±30 % from their nominal values;

d) the values of the measured angles of radiation α_A and α_B, respectively, shall not differ by more than ±30° from their nominal values;

e) the values of the measured angles of reception β_A and β_B, respectively, shall not differ by more than ±50° from their nominal values;

f) diagrams showing the radiation characteristic and receiver directivity of an IR system using more than one diode should be provided by superposition of single IR component characteristics related to their mutual position.

These requirements for accuracy shall also be taken into account when interpreting the boundaries of IR product classification using the graphical representation (λ/f-diagrams) in accordance with 5.7.

For further references, see the Bibliography.

Table 1 – Classification criteria for radiators

Criterion 1 (optical level)	λ_{1l} lower band limiting wavelength
Ranges of wavelength [nm]	λ_{1u} upper band limiting wavelength
Criterion 2 (electrical level)	f_{1l} lower band limiting frequency
Ranges of frequency [kHz]	f_{1u} upper band limiting frequency
Criterion 3 (radiant intensity)	I_p peak radiant intensity
Radiant intensity [mW/sr]	I_o averaged radiant intensity
Criterion 4 (radiation characteristic)	α_A maximum divergence
Angle of radiation [degrees]	α_B perpendicular to maximum divergence
Criterion 5 (time level)	Class S: short
Duration of IR radiation	Class L: long

Table 2 - Classification criteria for receivers

Criterion 6 (optical level)	λ_{2l} lower band limiting wavelength
Ranges of wavelength [nm]	λ_{2u} upper band limiting wavelength
Criterion 7 (electrical level)	f_{2l} lower band limiting frequency
Ranges of frequency [kHz]	f_{2u} upper band limiting frequency
Criterion 8 (receiver sensitivity) [$\mu A \times m^2/mW \times nm$]	s_{max} maximum sensitivity
Criterion 9 (directivity)	β_A maximum reception
Angle of reception [degrees]	β_B perpendicular to maximum reception

5.5 Product groups

The following classification of product groups is related to their application. Table 3 shows different groups of IR systems. Examples indicate equipment related to the groups.

Table 3 – Product groups of IR systems

Group	Application	Examples of equipment
1	Individual control units	Consumer device control units
2	Installation	Home and building electronic systems, high speed data
3	Image and sound technology	Stereo headphones, image and sound transmission
4	Conference technology	Conference systems, interpreter systems
5	Traffic management	Traffic and transport managing systems
6	Illumination	Intentional: IR monitoring systems Unintentional: (fluorescent) lamps
7	Data processing equipment	Computer to computer communication Computer to peripherals communication
8	Others	Not yet specified

a) Group 1: individual control units

Control systems with low power and short duration, mainly mobile and battery powered.

Target group: controlling of consumer devices (for example repeatable switching operations for the control of audio and video devices, autofocus, car locking systems).

b) Group 2: installation

Control and data transfer systems with low and medium power, short and long duration, mobile and stationary control devices.

Target group: controlling and adjustment of devices and building installations (illumination, temperature, air conditioning, etc.); IR usage in communication (mobile telephones, etc.).

c) Group 3: image and sound technology

Signal transmission with high power and long duration in stationary or mobile installations.

Target group: audio, video, mainly home and studio areas (for example wireless videocameras, stereo headphones, etc.).

d) Group 4: conference technology

Transmission systems with medium or high power and continuous function in stationary or mobile installations.

Target group: multichannel equipment for meeting rooms (for example language distribution systems, microphone management systems, voting/audience response systems, simultaneous interpretation systems).

e) Group 5: traffic management

Transmission with high power and long duration in fixed installations and vehicles (mobile installation).

Target group: control information in interactive dynamic traffic management, store administration, etc.

f) Group 6: IR illumination

Systems which intentionally emit IR radiation for other purposes than IR communication, such as IR monitoring systems, alarm systems, etc. According to the type of source radiation, interference with other IR applications may occur.

Lighting equipment, which in some cases unintentionally emits IR radiation, may interfere with the proper functioning of IR transmission systems. Designers of such systems should take this into account and should make provisions to avoid interferences (see Figure B.2).

g) Group 7: data processing equipment

Data transmission systems with low, medium or high power including occasional, burst or quasi-continuous transmission.

Target group: computer applications of any kind which, for example, include data acquisition, data transmission between computers and associated peripherals, local area networks based on infrared with mobile terminals or keyboards.

h) Group 8: others

This group is provided for future IR products which cannot be classified in the groups above.

5.6 User areas

Realistic considerations show that not all of the above mentioned groups of IR products are likely to be used in the same space. Therefore, the concept of “user areas” is introduced. These describe groups of applications which are likely to be required to coexist, and enable the user of IR products to set priorities between IR applications for use in a given space.

It is not possible to standardize user areas. The following list gives an overview of which kinds of local environment are possible. An example which illustrates how user areas may be related to product groups is provided in Table A.1.

The main user areas are:

a) Residential

In this area, IR products are used under private responsibility, therefore no official planning basis is given to coordinate the usage of IR applications free of interference (private houses, apartments, restaurants, hotels).

b) Offices

Application of IR products in planned projects or environments, mainly office spaces in industry and administration.

c) Industrial

This user area includes manufacturing plants, workshops and similar functional buildings and areas, even if not roofed, but with limited extension.

d) Medical

Medical rooms in hospitals (not administration departments), physicians’ consulting rooms. The main aspect is the usage of IR where patient safety is to be considered.

e) Conference

This area is mainly defined by a high degree of information distribution and communication in combination with other environmental control systems (lighting, etc.). Convention facilities in congress centres and convention hotels, multipurpose halls, exhibition areas, language distribution systems and tour guide systems in museums, etc. are included.

f) Traffic

Public areas with traffic management, traffic information and control systems.

5.7 Graphical representation of IR systems

In order to simplify the evaluation of individual priorities, a λ/f-diagram should be used indicating the IR and modulation bands employed. Figure 6 provides a blank form of such a diagram, whereas examples are given in Annex B. It is recommended that the system planner, purchaser, etc. establishes such a λ/f-diagram with the actual data of all the infrared radiators and receivers, that occur in, or are planned for, a specific environment. Based upon this diagram, the applications can be assigned priorities, as described in Annex A.

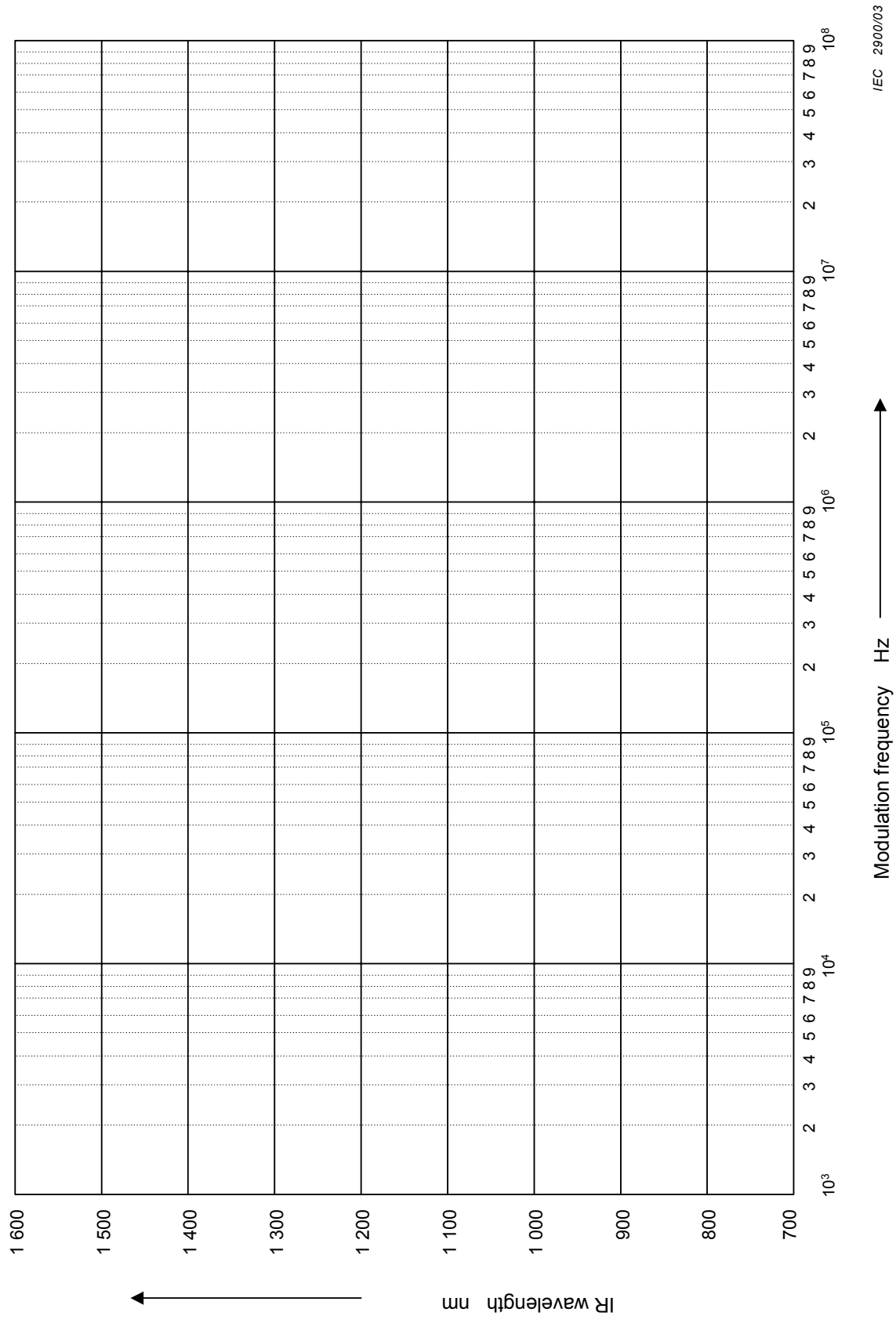

Figure 6 - λ/f-diagram

6 Method for minimizing mutual interferences

It is the responsibility of the project planner or user to compare the criteria of IR products provided for simultaneous operation. The priority list shown in Table A.1 is only an example of how to assign priorities to several IR products.

To use these classifications for the application of the standard, it is necessary to consider in which user areas the different IR product groups can interfere with other product groups. If the optical range of the IR radiator of a system 1 does not overlap with the one of the receiver of a system 2 because of its selectivity shown in a λ/f-diagram (see Figure 6), immunity against mutual interferences of those two IR systems can be achieved.

In applications where selective IR receivers are not available, further classification criteria are needed to prevent or minimize interference (Table 1, criteria 3 to 5 and Table 2, criteria 8 and 9).

a) In the case of an overlapping in the λ/f-diagram, the spatial location of the IR systems regarding criteria 3, 4 and 8, 9 respectively is to be considered.

b) If further collisions exist in IR applications, the temporal criterion (5) determines whether simultaneous application of the two IR systems is possible or not (user acceptance).

c) In the case of unacceptable interference, only one IR system (usually the one with the highest priority – see Table A.1) can be used interference-free at one and the same time and location (priority based decision).

7 Marking

The technical documents of IR products using infrared in accordance with Table 3 shall include the following information:

a) the symbol 60417-5938 (DB:2002-10) (reproduced in Figure 7), and

b) the classification characteristics in accordance with 5.2 as shown in the example given in 5.2.7 and according to 5.3 as given in the example of 5.3.6.

Packaging of products of product group 1 (individual control units) shall be marked with the symbol 60417-5938 (DB:2002-10).

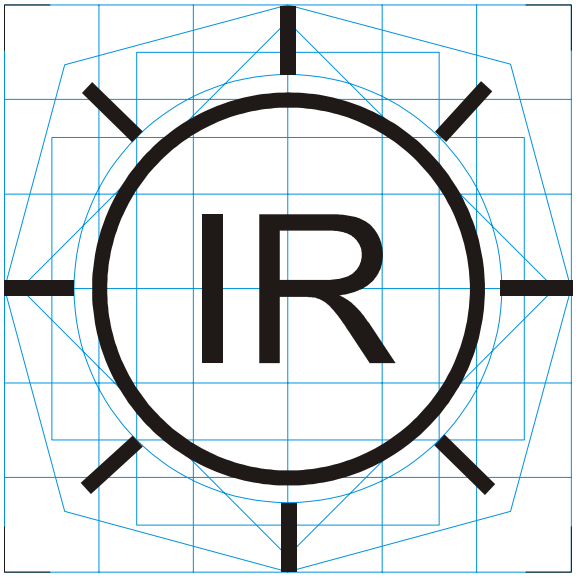

Figure 7 – Symbol for infrared

NOTE Manufacturers of lamps have to separate between criteria of IR radiation (assignment to technical data of lamps – criteria 1 and 3) and enclosure related criteria (assignment to housing units, i.e. ballasts, reflectors, etc. – criteria 2 and 4).

Criterion 5 is class L in every case.

8 Relationship between IR basic standard and application standards

Infrared application standards describe the specific requirements of certain product families or products in detail.

As far as the infrared related aspects in these standards are concerned, application standards shall be consistent with this standard. In particular, an infrared application standard shall refer unambiguously to the relevant product group of 5.5. If the identification of an appropriate product group is not possible, the application standard shall at least contain a normative reference to this standard.

Annex A
(informative)

Example for possible priorization

Table 3 shows sources of infrared radiation which are likely to interfere with each other in such a way that the use of infrared for communication purposes may be impaired or totally impossible.

Depending on the intention of the user, different priorities result if the user has to choose systems according to his needs. It is therefore important that the user is aware of the risk of interference, before a decision is made on which system he procures.

Table A.1 shows an example for possible user priorities of IR source choice depending on the user area. This table should in any case only be taken as an example because individual needs can influence the order of priority dramatically. It is important to note that in this context, a certain user area does not necessarily relate to a whole premises; it may be limited to a restricted area within the premises. In a hospital, for example, only the operating theatres and related rooms might be classified as medical areas. IR transmission of numerically controlled devices for diagnosis and therapy purposes would have priority 1, whereas in the residential area IR audio transmission could have priority 1 (see Clause 6).

Table A.1 – Possible priority of product groups within user areas

Priority	Residential	Office	Industrial	Medical	Conference	Traffic
1	Image and sound	Installation	Installation	Installation	Conference systems	Traffic management
2	Individual controls	Data processing	Data processing	Data processing	Individual controls	Individual control units
3	Installation		Traffic controls		Installation	Data processing
4					Image and sound	Installation

Annex B
(informative)

Examples of λ/f-diagrams

Subclause 5.7 introduces the λ/f-diagram, and Figure 6 shows a blank form. The demand for necessary information to determine the interference risk of different IR sources or applications requires that every source be described in such a diagram.

Besides the description of IR radiators and receivers by the λ/f-diagram, the mutual immunity of applications of different systems in that area should be shown. There again the λ/f-diagram is of help if it shows the sensitivity of a product to the wavelength and modulation frequency range. The combination of the source radiation diagram and the application immunity diagram are necessary to determine the amount of interference.

The following two λ/f-diagrams are examples for the user area “Residential” and the product group “Illumination”. For the interpretation of the diagrams, the following information is important:

a) The different boxes in Figure B.1 indicate the known ranges of both modulation frequency and IR wavelength of several product groups. When drawing the λ/f-diagram for a specific analysis, the actual frequency and wavelength of the particular product is marked on the diagram to indicate the situation in that specific case.

b) Unwanted IR radiation from light sources can occur over the whole range of modulation frequency. In order to keep Figure B.1 more readable, no indication of interfering light sources is included. Additionally, therefore, Figure B.2 provides a λ/f-diagram for fluorescent light sources.

c) Figure B.1 shows only radiator specific λ/f-claims of IR products; the commonly used types of receivers detect all IR radiation in the range of 800 to 1 100 nm, so there is no differentiation possible only at the based wavelength. The criteria of modulation frequency allows to separate between different modulation bands. Together with additional means such as geometric positioning of IR systems, it is possible to reduce mutual interference.

   In Figure B.3, two IR systems are shown with its radiation and reception bandwidths. The radiators of both systems are located at wavelengths which cannot be detected by the receiver of the other IR system. In this case, a separation of signals, independently from modulation frequencies, is possible. The introduction of selective receivers minimizes mutual interference without additional means, i.e. modulation frequency and geometric positioning, simplifies the use of IR products and makes IR transmission safer.

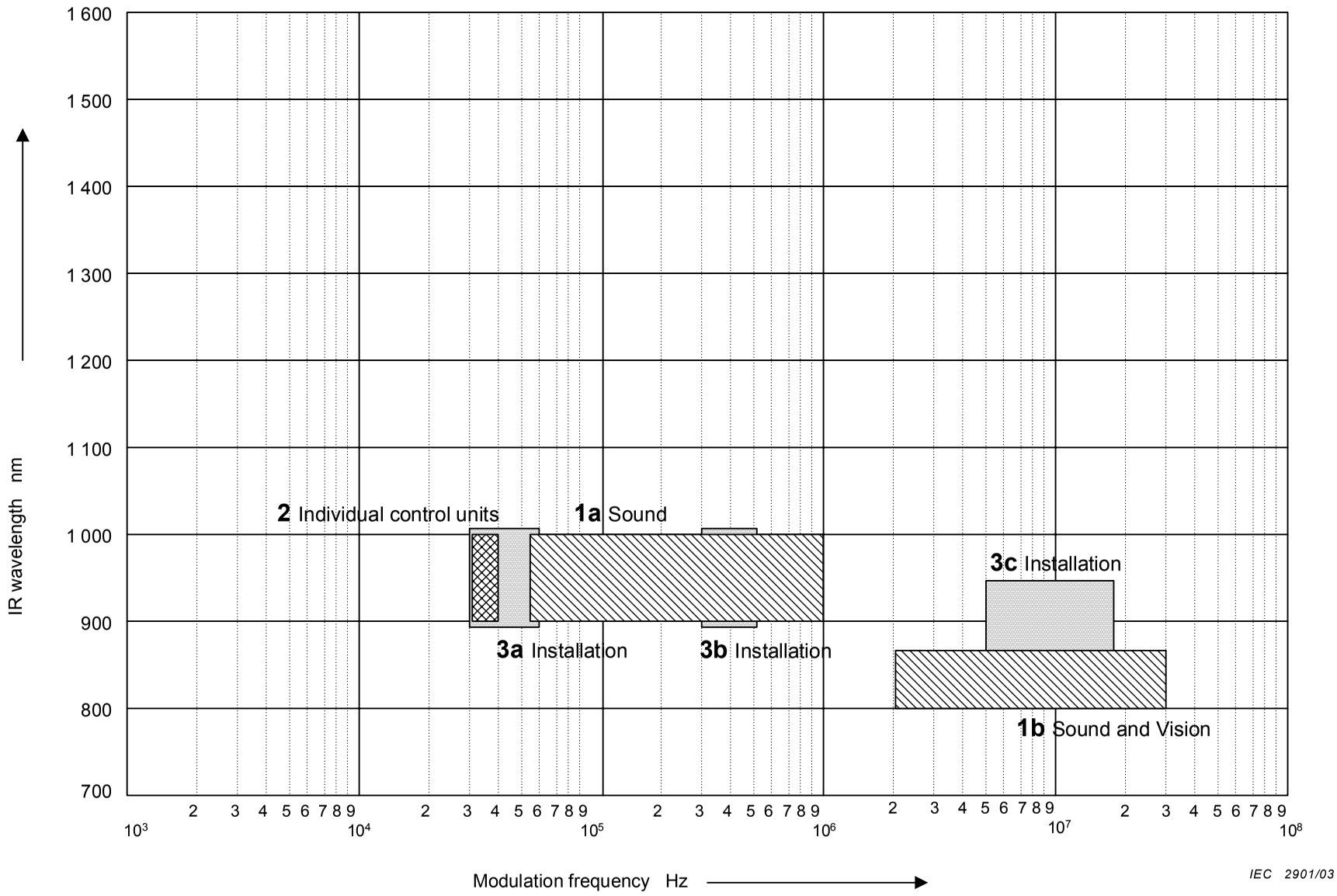

Figure B.1 - Residential

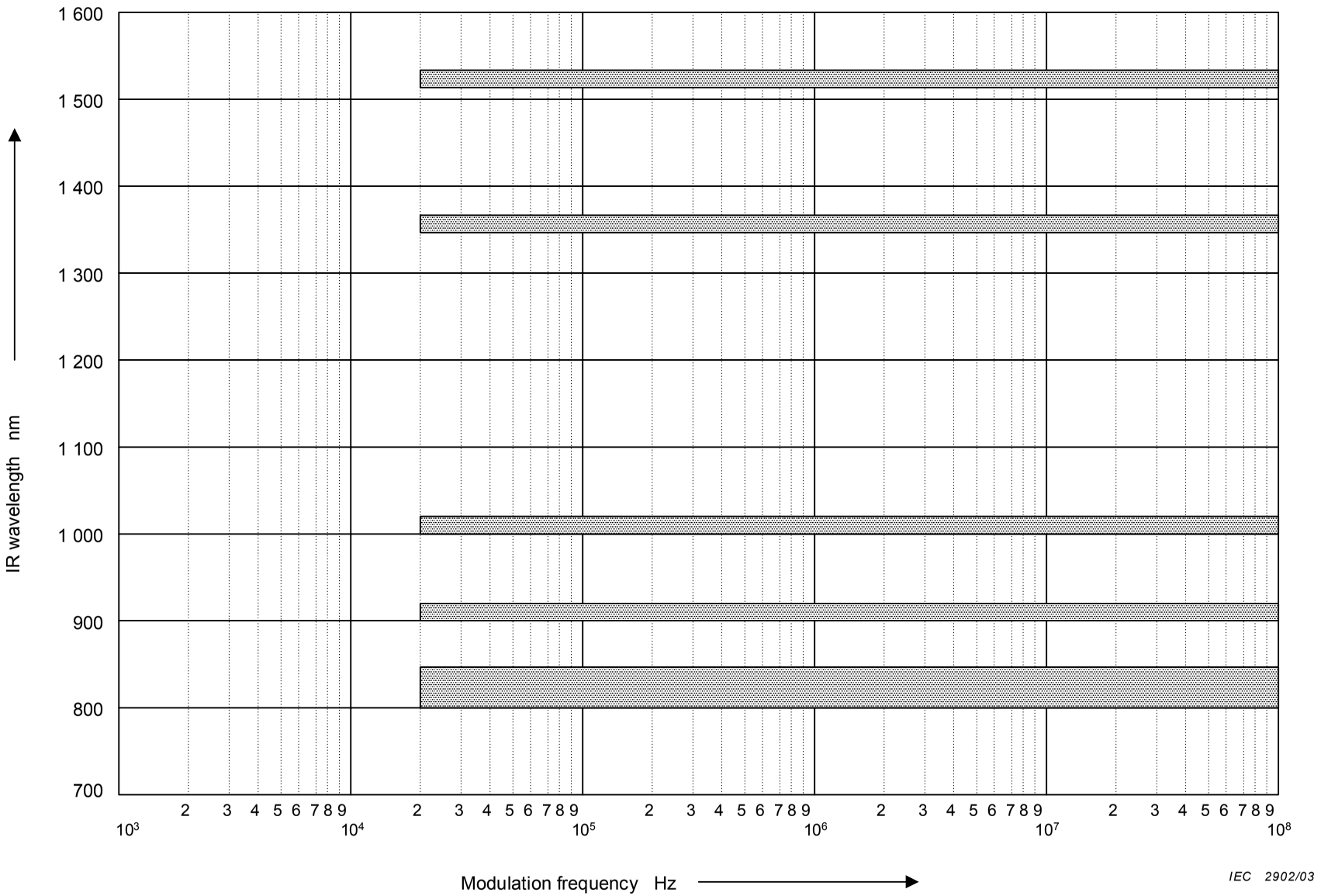

Figure B.2 - Typical spectral emission of fluorescent lamps

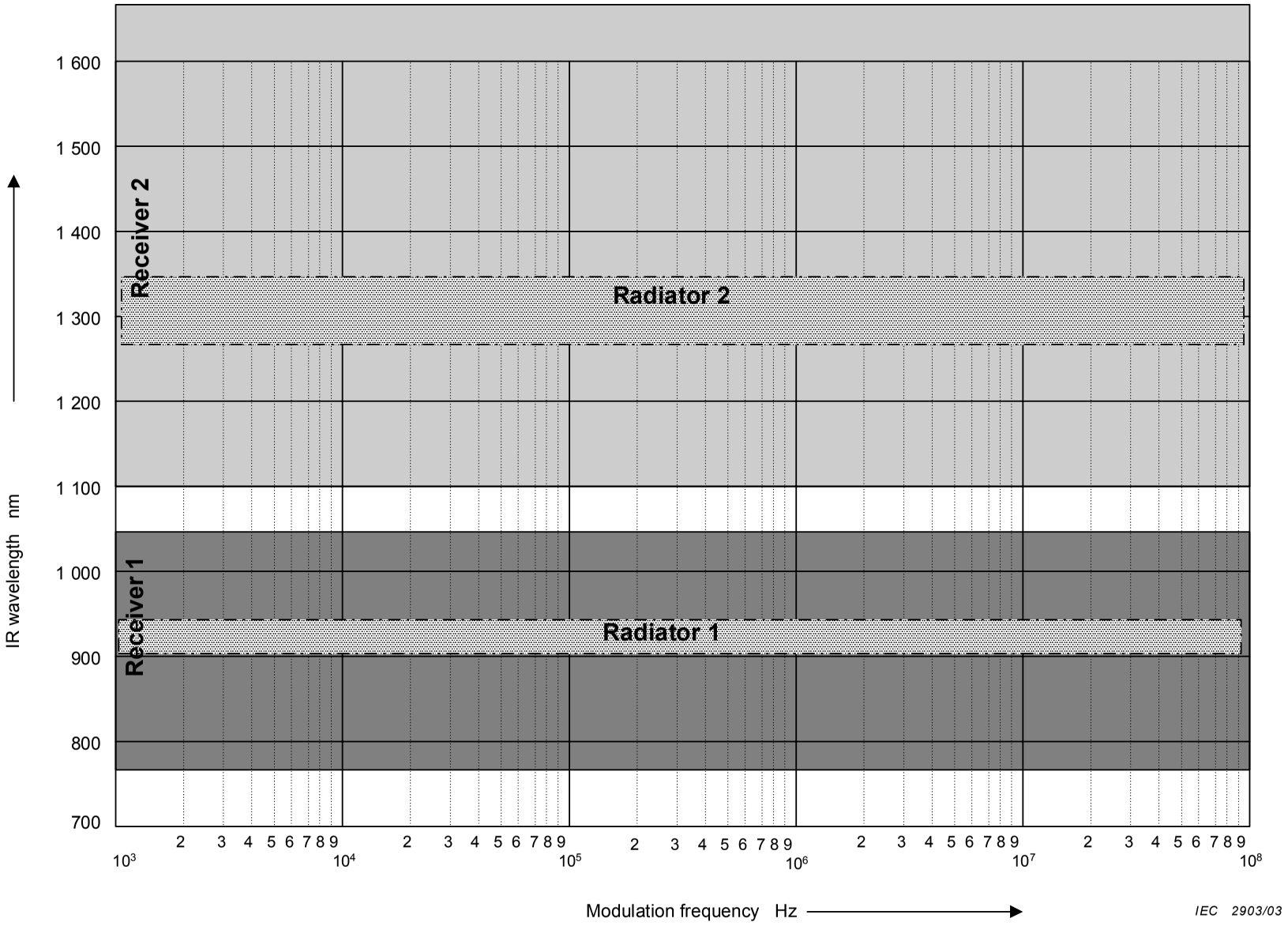

Figure B.3 - IR applications with selective receivers

Annex C
(informative)

Survey of standardization activities in the field of Infrared

Based upon the product groups (see 5.5), Table C.1 provides a current survey of standardization activities at international (IEC) and European (CENELEC and CEN) level as well as related activities. Furthermore, the relevant documents that were available at the time of publication of this standard are indicated.

Table C.1 – Current survey of standardization activities

Product group	Responsible committee	Document
Individual control units	IEC/TC 100 TA3	
Installation	CENELEC/TC 205 CENELEC/TC 79	
Image and sound technology	IEC/TC 100 TA3	IEC 61603-1 IEC 61603-2 IEC 61603-6
Conference technology	IEC/TC 100 TA3	IEC 61603-1 IEC 61603-3
Traffic management	CENELEC/TC 214 CEN/TC 278	
Illumination	IEC/TC 34 Z	
Data processing equipment	IEEE 802.11 IrDA (see note)	IEEE 802.11
General	IEC/TC100 TA3 IEC/TC100 TA3/TC 76 CENELEC/TC 76 CEN/TC 214	IEC 61920 IEC 60825-1 EN 60825-1 EN 61920
NOTE IrDA (Infrared Data Association), not a standards body, is an industrial consortium, setting *de facto* standards in the area of data processing applications.		

Bibliography

IEC 60825-1:1993, Safety of laser products – Part 1: Equipment classification, requirements and user's guide
Amendment 2 (2001)

IEC 61603-1:1997, *Transmission of audio and/or video and related signals using infrared radiation – Part 1: General*

IEC 61603-2:1997, *Transmission of audio and/or video and related signals using infrared radiation – Part 2: Transmission systems for audio wide band and related signals*

IEC 61603-3:1997, *Transmission of audio and/or video and related signals using infrared radiation – Part 3: Transmission systems for audio signals for conference and similar applications* [2]

IEC 61603-6:2001, *Transmission of audio and/or video and related signals using infrared radiation – Part 6: Video and audiovisual signals* [2]

CIE No. 63, *The spectroradiometric measurement of light sources*

DIN 5030-1, *Spektrale Strahlungsmessung: Begriffe, Größen, Kennzahlen (Spectral measurement of radiation: terminology, quantities, characteristic values)*

DIN 5030-2, *Spektrale Strahlungsmessung: Strahler für spektrale Strahlungsmessungen. Auswahlkriterien (Spectral measurement of radiation: radiation sources; selection criteria*)

DIN 5030-3, *Spektrale Strahlungsmessung: Spektrale Aussonderung, Begriffe und Kennzeichnungsmerkmale (Spectral measurement of radiation: spectral isolation; definitions and characteristics)*

DIN 5030-5, *Spektrale Strahlungsmessung; Physikalische Empfänger für spektrale Strahlungsmessungen, Begriffe, Kenngrößen, Auswahlkriterien (Spectral measurement of radiation: physical detectors for spectral measurement of radiation; terminology, characteristic quantities, selection criteria).*

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2 To be published.

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