

Infrared free air applications

The European Standard EN 61920:2004 has the status of a
British Standard

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National foreword

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Summary of pages

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English version

Infrared free air applications
(IEC 61920:2004)

Applications infrarouge
en mode non guidé
(CEI 61920:2004)

Nichtleitungsgebundene
Infrarot-Anwendungen
(IEC 61920:2004)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 100/717/FDIS, future edition 2 of IEC 61920, prepared by IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61920 on 2004-03-01.

This European Standard supersedes EN 61920:1998.

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) 2004-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2007-03-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61920:2004 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:

IEC 60825-1	NOTE	Harmonized as EN 60825-1:1994 (not modified).
IEC 61603-1	NOTE	Harmonized as EN 61603-1:1997 (not modified).
IEC 61603-2	NOTE	Harmonized as EN 61603-2:1997 (not modified).
IEC 61603-3	NOTE	Harmonized as EN 61603-3:1998 (not modified).
IEC 61603-6	NOTE	Harmonized as EN 61603-6:2002 (not modified).

CONTENTS

1	Scope and object	4
2	Normative references.....	4
3	Terms and definitions	5
4	Symbols	8
4.1	General	8
4.2	Radiators.....	8
4.3	Receivers	8
5	Classification	9
5.1	General	9
5.2	Physical characteristics of radiators	9
5.2.1	General	9
5.2.2	Ranges of wavelength (criterion 1)	9
5.2.3	Ranges of frequency (criterion 2)	11
5.2.4	Radiant intensity (criterion 3)	11
5.2.5	Angle of radiation (criterion 4)	11
5.2.6	Duration of radiation (criterion 5).....	11
5.2.7	Identification example for a radiator	12
5.3	Physical characteristics of receivers.....	12
5.3.1	General	12
5.3.2	Ranges of wavelength and selectivity (criterion 6)	12
5.3.3	Frequency response (criterion 7).....	13
5.3.4	Sensitivity (criterion 8)	13
5.3.5	Directivity (criterion 9).....	13
5.3.6	Example of a receiver	13
5.4	Tolerances	14
5.4.1	Measurement conditions	14
5.4.2	Tolerances of data	14
5.5	Product groups	16
5.6	User areas.....	17
5.7	Graphical representation of IR systems.....	17
6	Method for minimizing mutual interferences	19
7	Marking	20
8	Relationship between IR basic standard and application standards.....	20
	Annex A (informative) Example for possible prioritization.....	21
	Annex B (informative) Examples of λf -diagrams.....	22
	Annex C (informative) Survey of standardization activities in the field of Infrared.....	26
	Annex ZA (normative) Normative references to international publications with their corresponding European publications	27
	Bibliography	28

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:2002¹, *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.

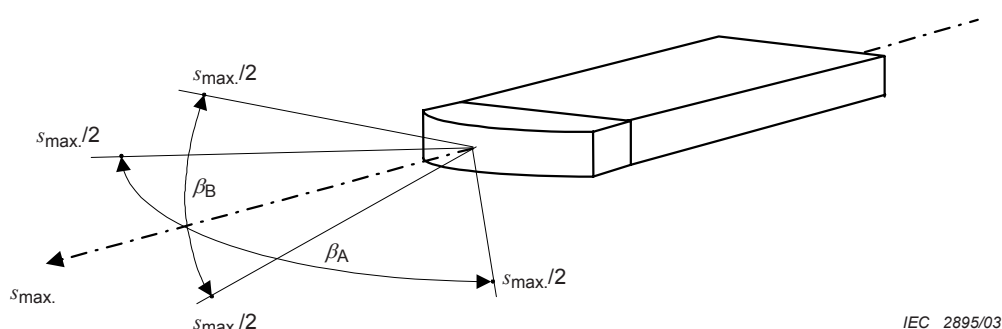


Figure 1 – Directivity and related characteristics

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 $[\text{mW}/\text{m}^2]$.

[IEV 845-01-37]

3.9**modulation frequency**

electrical signal frequency which modulates the IR radiation

3.10**peak intensity**

I_p

maximum intensity I_p $[\text{mW}/\text{sr}]$ 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**

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 $[\text{mW}/\text{sr}]$.

[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 $I_{(max)}$ [μ A/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 [(μ A $\times$ m²)/(mW $\times$ 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 ($\Rightarrow$ system 1) and index 2 for receivers ($\Rightarrow$ 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 $\times$ nm)]
$I_{e\lambda}$	spectral optical radiant intensity [mW/(sr $\times$ nm)]
I_{ef}	spectral modulated radiant intensity [mW/(sr $\times$ Hz)]
I_{pf}	spectral modulated peak intensity [mW/(sr $\times$ 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/m ²]
$I_{\max}$	maximum photo current [μ A/nm]
$s_{r\lambda}$	relative spectral sensitivity [%]
$s_{\max}$	maximum spectral sensitivity [μ A m ² /mW $\times$ nm]
V_{rf}	relative spectral electrical output [%]