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Optics and photonics — Lasers and laser-related equipment — Test methods for the spectral characteristics of lasers

Optique et photonique — Lasers et équipement associé aux lasers — Méthodes d'essai des caractéristiques spectrales des lasers

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 172, *Optics and Photonics*, Subcommittee SC 9, *Laser and electro-optical systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 123, *Lasers and photonics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 13595:2004) of which it constitutes a minor revision.

The main changes are as follows:

— editorial changes related to the new format;

— the symbol for side-mode suppression ratio was adapted from *SMS* to R_{SMS};

— lg was changed to $\log_{10}$ in 3.15;

— the title of the SC 9 was updated;

— intensity was adapted to irradiance;

— in the Bibliography Reference 2 was updated and replaced by References 2 and 3.

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Introduction

The spectral characteristics of a laser, such as its peak wavelength or spectral linewidth, are important for potential applications. Examples are the specific application requirements of interferometry and lithography. This document gives definitions of key parameters describing the spectral characteristics of a laser, and provides guidance on performing measurements to determine these parameters for common laser types.

The acceptable level of uncertainty in the measurement of wavelength will vary according to the intended application. Therefore, equipment selection and measurement and evaluation procedures are outlined for three accuracy classes. To standardize reporting of spectral characteristics measurement results, a report example is also included.

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Optics and photonics — Lasers and laser-related equipment — Test methods for the spectral characteristics of lasers

1 Scope

This document specifies methods by which the spectral characteristics such as wavelength, bandwidth, spectral distribution and wavelength stability of a laser beam can be measured. This document is applicable to both continuous wave (cw) and pulsed laser beams. The dependence of the spectral characteristics of a laser on its operating conditions may also be important.

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.

ISO 11145, *Optics and photonics — Lasers and laser-related equipment — Vocabulary and symbols*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11145, ISO/IEC Guide 99 and IEC 60747-5-1, and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
wavelength in vacuum
λ_0
wavelength of an infinite, plane electromagnetic wave propagating in vacuum

Note 1 to entry: For a wave of frequency f, the wavelength in vacuum is then given by $\lambda_0 = c/f$, where c = 299 792 458 m/s.

3.2
wavelength in air
λ_{air}
wavelength of radiation propagating in the air and related to the wavelength in vacuum by the relationship:

$$\lambda_{air} = \lambda_0 / n_{air}$$

where n_{air} denotes the refractive index of ambient air (see 6.4)

Note 1 to entry: The specific properties of the ambient atmosphere, such as humidity, pressure, temperature and composition all influence n_{air}. Therefore it is better to report the wavelength in vacuum, or the wavelength in standard air. These can be calculated from λ_{air} and n_{air} using the equation given in 6.4.

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