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Optics and photonics - Lasers and laser-related equipment - Test methods for laser beam radiant power, radiant energy and temporal characteristics (ISO 11554:2025, Corrected version 2025-10)

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ESTONIAN CENTRE FOR STANDARDISATION AND ACCREDITATION

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Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
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ICS 31.260

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 11554

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ICS 31.260

Supersedes EN ISO 11554:2017

English Version

Optics and photonics - Lasers and laser-related equipment - Test methods for laser beam radiant power, radiant energy and temporal characteristics (ISO 11554:2025, Corrected version 2025-10)

Optique et photonique - Lasers et équipements associés aux lasers - Méthodes d'essai de la puissance rayonnante, de l'énergie rayonnante et des caractéristiques temporelles des faisceaux lasers (ISO 11554:2025, Version corrigée 2025-10)

Optik und Photonik - Laser und Laseranlagen - Prüfverfahren für Leistung, Energie und Kenngrößen des Zeitverhaltens von Laserstrahlen (ISO 11554:2025, korrigierte Fassung 2025-10)

This European Standard was approved by CEN on 13 November 2023.

This European Standard was corrected and reissued by the CEN-CENELEC Management Centre on 05 November 2025.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN ISO 11554:2025 E

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European foreword

This document (EN ISO 11554:2025) has been prepared by Technical Committee ISO/TC 172 "Optics and photonics" in collaboration with Technical Committee CEN/TC 123 “Lasers and photonics” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2025, and conflicting national standards shall be withdrawn at the latest by December 2025.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 11554:2017.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

Any feedback and questions on this document should be directed to the users’ national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

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Endorsement notice

The text of ISO 11554:2025, Corrected version 2025-10 has been approved by CEN as EN ISO 11554:2025 without any modification.

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Contents

Page

Foreword ... **iv**
Introduction ... **vi**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Symbols and units of measurement ... **2**
5 Measurement principles ... **3**
6 Measurement configuration, test equipment and auxiliary devices ... **3**
6.1 Preparation ... 3
6.1.1 Sources with small divergence angles ... 3
6.1.2 Sources with large divergence angles ... 3
6.1.3 RIN measurement ... 4
6.1.4 Measurement of small signal cut off frequency ... 5
6.2 Control of environmental impacts ... 6
6.3 Detectors ... 6
6.4 Beam-forming optics ... 7
6.5 Optical attenuators ... 7
7 Measurements ... **7**
7.1 General ... 7
7.2 Radiant power of cw lasers ... 7
7.3 Radiant power stability of cw lasers ... 8
7.4 Radiant pulse energy of pulsed lasers ... 8
7.5 Radiant energy stability of pulsed lasers ... 8
7.6 Temporal radiant pulse shape, radiant pulse duration, rise time, fall time and peak radiant power ... 8
7.7 Radiant pulse duration stability ... 8
7.8 Radiant pulse repetition rate ... 8
7.9 Relative intensity noise, RIN ... 9
7.10 Small signal cut-off frequency ... 9
8 Evaluation ... **9**
8.1 General ... 9
8.2 Radiant power of cw lasers ... 10
8.3 Radiant power stability of cw lasers ... 10
8.4 Radiant pulse energy of pulsed lasers ... 10
8.5 Radiant energy stability of pulsed lasers ... 11
8.6 Temporal radiant pulse shape, radiant pulse duration, rise time, fall time and peak radiant power ... 11
8.7 Radiant pulse duration stability ... 13
8.8 Radiant pulse repetition rate ... 13
8.9 Relative intensity noise, RIN ... 13
8.10 Small signal cut-off frequency ... 13
9 Test report ... **13**
Annex A (informative) **Relative intensity noise (RIN)** ... **17**
Bibliography ... **19**

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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 document 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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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 fifth edition cancels and replaces the fourth edition (ISO 11554:2017) which has been technically revised.

The main changes are as follows:

a) Whole document: The term “power" and “energy” that mean optical power and optical energy have been replaced by “radiant power” and “radiant energy”, respectively, and the word “spectral density” has been replaced by “spectral” in order to align with ISO 80000-7:2019 and the International Electrotechnical Vocabulary.

b) Normative references: IEC 61040:1990 has been removed because it was withdrawn in August 2011.

c) In 3.1, the definition of RIN has been corrected. The word “relative intensity noise spectral density” has been replaced by “spectral relative intensity noise”.

d) In Figure 2, keys 4, 5 and 6 have been amended.

e) In 6.3, the explanatory text has been added instead of referencing IEC 61040:1990.

f) In 6.5,The term “laser power density” has been replaced by “irradiance” in order to align with ISO 80000-7: 2019.

g) In 7.9, measurement procedure has been modified to clarify the method for removing thermal and shot noise terms as well as pre-amplifier noise from the measured noise power.

h) In Clause 9 c) 5), the terms “current or energy input”, “pulse energy”, “pulse duration” and “pulse repetition rate” have been modified in order to clarify their characteristics.

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i) In Annex A, the word “spectral density of the power fluctuations” and “spectral density function $S_{\Delta P}(f)$” have been replaced by “spectral irradiation fluctuations” and “power spectrum $S_{\Delta P}(f)$”, respectively.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This corrected version of ISO 11554:2017 incorporates the following correction:

— Formula (7) was corrected.

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Introduction

The measurement of laser radiant power (radiant energy for pulsed lasers) is a common type of measurement performed by laser manufacturers and users. Radiant power (radiant energy) measurements are needed for laser safety classification, stability specifications, maximum laser output specifications, damage avoidance, specific application requirements, etc. This document provides guidance on performing laser radiant power (radiant energy) measurements as applied to stability characterization. The stability criteria are described for various temporal regions (e.g. short-term, medium term and long term) and provide methods to quantify these specifications. This document also covers pulse measurements where detector response speed can be critically important when analysing pulse shape or peak radiant power of short pulses. To standardize reporting of radiant power (radiant energy) measurement results, a report template is also included.

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Optics and photonics — Lasers and laser-related equipment — Test methods for laser beam radiant power, radiant energy and temporal characteristics

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1 Scope

This document specifies test methods for determining the radiant power and radiant energy of continuous wave and pulsed laser beams, as well as their temporal characteristics of pulse shape, pulse duration and pulse repetition rate. Test and evaluation methods are also given for the radiant power stability of cw-lasers, radiant energy stability of pulsed lasers and pulse duration stability.

The test methods given in this document are used for the testing and characterization of lasers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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)*

3 Terms and definitions

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

ISO and IEC maintain terminological 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
relative intensity noise
RIN
$R(f)$
quotient of the radiant power mean square fluctuations to the square of the mean radiant power, normalized to a frequency band of unit width

$$R(f) = \frac{\left\langle \Delta P(f)^2 \right\rangle}{\langle P \rangle^2} \cdot \frac{1}{\Delta f}$$

where Δf is the equivalent noise bandwidth.

Note 1 to entry: The relative intensity noise $R(f)$ or RIN [see Formula] is explicitly spoken of as the “spectral relative intensity noise”, but usually simply referred to as RIN.

Note 2 to entry: For further details, see Annex A.

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