IEC TR 63381

Edition 1.0 2025-03

TECHNICAL REPORT

Application of IEC 60335-2-27 for field inspections of UV emission of UV appliances

IEC TR 63381:2025-03(en)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC TR 63381

Edition 1.0 2025-03

TECHNICAL REPORT

Application of IEC 60335-2-27 for field inspections of UV emission of UV appliances

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 13.120; 97.170

ISBN 978-2-8327-0274-1

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

APPLICATION OF IEC 60335-2-27 FOR FIELD INSPECTIONS OF UV EMISSION OF UV APPLIANCES

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TR 63381 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
61/7339/DTR	61/7388/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

IEC 60335-2-27 provides requirements on the emission of UV radiation by UV appliances as covered by its scope. These requirements are intended for determining compliance during the type-testing of the products in a laboratory environment.

Later, market surveillance authorities would like to check this compliance at business locations in their territory, since the UV emission of these products can be influenced in different ways and health aspects can be ignored due to commercial interests, or just by a lack of knowledge.

The exchange of emitters can have an especially significant influence on the emission character of UV appliances. Fluorescent UV lamps and high-pressure metal halide lamps are showing strong ageing behaviour and are replaced for performance reasons at least every 1 000 hours.

IEC 60335-2-27 introduced in connection with IEC 61228 the so-called X/Y lamp equivalency code for UV fluorescent lamps and a marking on the appliances which lamps with which code are to be used with the appliance. Additionally, IEC 60335-2-27:2024, 7.12 states:

The instructions for UV appliances shall include the substance of the following:

– *identification of components that can influence the ultraviolet radiation, such as filters and reflectors;*
– *identification of replaceable UV emitters and a statement that they are only to be replaced by types marked on the appliance. For fluorescent UV lamps for tanning, it shall be stated that they are only to be replaced by types marked with an equivalency code, the UV component of which falls within the UV component equivalency code range that is marked on the appliance. In this case, an example of the equivalency code shall be given and the UV component aspect of the fluorescent UV lamp for tanning equivalency code shall be explained.*

This information given by the manufacturer gives a good first attempt to control the UV emission of a UV appliance in the market.

Unfortunately, there are external conditions which can additionally influence the UV emission of UV appliances, so a market surveillance authority would like to measure a UV appliance in the market. Due to the weight of the appliances, it cannot be moved into a laboratory.

So, the measurement will be performed under non-laboratory conditions, which can include:

– different and maybe instable line voltage,
– different and instable temperature,
– emitters of an unknown aging status.

Additionally, the accurate measurement equipment as requested by IEC 60335-2-27 is

– quite heavy (could be about 50 kg), and
– difficult to handle. Most of the accurate double-monochromators would need an acclimation and therefore calibration at the measurement location.
– Measuring UV emission in a precise manner is quite slow. It would need some hours to perform a high precision measurement.

Therefore, this document provides advice on how to perform an inspection of UV emission in the field under these conditions, different from the conditions of a laboratory type-test, as described in IEC 60335-2-27, and the necessary background information about the differences between type-testing and field inspection. Additionally, it shows a procedure with escalation steps to perform that is used by some market surveillance authorities:

– a good, fast and efficient inspection on-site,
– an efficient measurement on-site,
– a full measurement under laboratory conditions.

APPLICATION OF IEC 60335-2-27 FOR FIELD INSPECTIONS OF UV EMISSION OF UV APPLIANCES

1 Scope

This document brings clarification and guidance concerning the assessment of the UV emission output of UV appliances in the field with respect to the type-testing requirements of IEC 60335-2-27:2024, Clause 32.

NOTE Periodic electrical inspection following IEC 60335-1:2020, informative Annex A can be additionally required in some countries.

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.

IEC 60335-2-27:2024, *Household and similar electrical appliances – Safety – Part 2-27: Particular requirements for appliances for skin exposure to optical radiation*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60335-2-27:2024 apply.

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

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 General conditions for the tests

Due to the nature of the test environment in the field and the weight/size of the appliances, the assessment can follow a procedure with escalation steps as follows:

Step 1: Paperwork check

Step 2: On-site survey with handheld UV radiometers (integral measurements)

Step 3: On-site measurement with spectro-radiometers (spectral measurements)

Step 4: Laboratory test

In doubt of compliance with an assessment step, a higher step can be performed. The ultimate certainty can only be found with step 4, which is equivalent to the original type-testing.

4.1 Paperwork check

4.1.1 UV fluorescent lamps

The equivalency code marked on the UV fluorescent lamps is checked to verify that it is in the equivalency code range marked on the appliance as requested by IEC 60335-2-27:2024, 7.1.

4.1.2 Other lamps

Other lamps are checked to verify that they are identical to the type reference marked on the appliance (requirement in IEC 60335-2-27:2024, 7.1) or compatible to the type-reference marked on the appliance, based on compatibility documents of the lamp manufacturer.

4.1.3 Filters

Article numbers of the filters installed in the appliance are checked to verify that they are the article numbers as provided in the manufacturer's instructions.

4.1.4 Ballasts

The ballasts in the appliances are checked to verify that they are compatible (e.g. same brands, same electrical ratings, etc.) with those indicated in the instructions or markings of the appliance or in appliance documentation.

4.1.5 Reflectors

Article numbers of the reflectors installed in the appliance are checked to verify that they are the article numbers as provided in the manufacturer's instructions.

4.1.6 Classification

After completion of the paperwork inspection, the compliance classification is rated either C1 or S1 as described in Clause 5.

4.2 On-site survey with hand-held UV radiometer

4.2.1 Hand-held UV radiometer survey

A handheld UV radiometer can be used for a survey only.

– Use a handheld UV radiometer that has been validated against spectro-radiometer (see informative Annex A).
– Allow sufficient time to warm up the measurement equipment as indicated by the manufacturer of the handheld radiometer.
– Record the room temperature.
– Allow warm-up of the appliance for approximately half of the maximum exposure time.
– Measure different emitting surfaces separately.
– Cover all other emitting parts by a dark UV absorbing fabric.
– Use the measurement positions and distances, on the surfaces which are modelling the human body, as described in IEC 60335-2-27:2024, 32.101.1.
– Move the handheld radiometer around to find the maximum reading on the surfaces which are modelling the human body, as described in IEC 60335-2-27:2024, 32.101.1, Figure 104 and Figure 105.

4.2.2 Classification

Values measured with a handheld UV radiometer with the rounding guideline in informative Annex B are used to determine the compliance classification. If the value does not exceed 1,3 times the limit as given in IEC 60335-2-27:2024, it is classified as C2 as described in Clause 5. Otherwise, it is classified as S2 as described in Clause 5.

4.3 On-site measurement with spectro-radiometer

4.3.1 Spectro-radiometer measurements

Measurements and judgement follow the procedures as described by ISO/IEC 17025 and use IEC 60335-2-27:2024. A single-grating spectro-radiometer can be used instead of a double-monochromator, if the precision fits to the measurement task.

NOTE See informative Annex C for an example of a suitable laboratory.

4.3.2 Classification

Values measured with the rounding guideline in informative Annex B are used to determine the compliance classification. If the value does not exceed the limit as given in IEC 60335-2-27:2024, it is classified as C3 as described in Clause 5. Otherwise, it is classified as S3 as described in Clause 5.

4.4 Laboratory test

4.4.1 Laboratory test method

A full test in an ISO/IEC 17025 accredited laboratory under conditions as described in IEC 60335-2-27 in the edition the type-testing by the manufacturer was performed, and the results are compared with the results of the type-testing.

4.4.2 Classification

Values measured with the rounding guideline in informative Annex B are used to determine the compliance classification. If the value does not exceed the limit as given in IEC 60335-2-27:2024, it is classified as C4 as described in Clause 5. Otherwise, it is classified as NC as described in Clause 5.

5 Classification

C1 Paperwork conform

C2 On-site survey conform

C3 On-site precision measurement conform

C4 Compliant by laboratory test

S1 Under suspicion by paperwork

S2 Under suspicion by survey

S3 Under suspicion by on-site measurement

NC Non-compliant by laboratory test

Annex A
(informative)

Guideline for the use of handheld UV radiometer

Reliable UV measurements require instruments with the following attributes:

– Equipment used need only to be sensitive in the wavelength range to be judged:
  - between 200 nm and 280 nm for UVC,
  - between 280 nm and 400 nm erythemal weighted UV;
– Sensitive to 10^{-8} W/cm^2 (0,000 3 W/m^2 in the integral from 200 nm to 280 nm);
– Good stray-light reduction.

Currently no handheld integral radiometer with good uncertainty is known to produce such reliable measurements.

Therefore, handheld UV radiometers can only be used for a survey. They cannot be used for a measurement to ensure compliance.

Nevertheless, handheld UV radiometers fulfill some essential requirements if:

– the handheld UV radiometer is properly calibrated following the manufacturer's instructions;
– the spectral sensitivity is matched to the erythema action function given in IEC 60335-2-27:2024, Figure 103;

NOTE 1 Due to the difference of the spectral characteristics of the filters of the handheld UV radiometers from the erythema weighted action spectrum, their uncertainty can be expected to be at least 20 %. This is considered as major part of uncertainty in the assessment of 4.2.

NOTE 2 To provide this accuracy, the handheld radiometer is adapted to the spectrum to be measured. Typically,
  - Fluorescent lamps can have a good fit.
  - High pressure lamps can be way off the results of spectro-radiometers.

– the dynamic range is high enough to enable measurements of erythema weighted irradiance between 0,1 W/m^2 and 1 W/m^2; and
– there is good stray-light reduction.

Annex B
(informative)

Guideline for rounding of radiation measurements

Rounding of measurement results follows the rules as outlined in ISO 80000-1.

– Measured numbers in science and standards are rounded to the significant digits.
– A limit of 0,7 indicates one decimal digit and therefore all measured values are rounded to one decimal digit.
– Rounding in science means all digits of 1, 2, 3, 4 are rounded down to the next significant digit, all digits of 5, 6, 7, 8, 9 are rounded up to the next significant digit.
– This means, measurements up to 0,749 99…. will be rounded down to 0,7, otherwise the limit would need to give more significant decimal digits and be named 0,70 or 0,700.

NOTE For example, see the following rounding results:

Limit is 0,7:

E_{eff} = 0,749… is rounded to E_{eff} = 0,7

E_{eff} = 0,750… is rounded to E_{eff} = 0,8

Limit is 0,15:

E_{eff} = 0,1549…is rounded to E_{eff} = 0,15

E_{eff} = 0,155… is rounded to E_{eff} = 0,16

The application of these rounding principles is indicated in Table B.1, showing a combination of effective irradiance limits as defined in IEC 60335-2-27:2024 and the rounded insignificant digits in brackets.

Table B.1 – Limits of effective irradiance and their rounding

UV type appliance as defined in IEC 60335-2-27:2024 Annex BB	Measurement limits for effective irradiance W/m^2		
	250 nm to 320 nm	320 nm to 400 nm	Maximum total effective irradiance W/m^2
1	< 0,000 5(5)	≥ 0,15(5)	< 0,7(5)
2	0,000 5(5) - 0,15(49)	≥ 0,15(5)	< 0,7(5)
3	< 0,15(5)	< 0,15(5)	< 0,3(5)
4	≥ 0,15(5)	< 0,15(5)	< 0,7(5)

Annex C
(informative)

Example of requirements to laboratories for on-site field measurements

The Norwegian Radiation and Nuclear Safety Authority (DSA) accepts measurement reports from laboratories fulfilling the following 5 points:

- Accredited for measuring according to the current version of the sunbed standard EN 60335-2-27.
- Having a quality system and written procedures that document that the measurements are performed according to this document and otherwise meets the requirements given in ISO 17025 concerning measurement quality.
- Traceability to a standard laboratory, calibration routines to ensure stability and prevent wavelength shifts, and temperature stabilisation of the measuring instrument must be documented.
- Written procedures for measuring methods must be available upon request.
- Measurement results must be documented with a measurement report, including among other things the actual measured values for each wavelength and the maximum values measured in each part of the sunbed.