

A close-up photograph of a flexible LED strip light. The strip is populated with numerous small, square LED chips, each emitting a bright blue light. The strip is curved, and the lights are arranged in a regular pattern. The background is dark, making the blue light stand out.

LED Radiation Safety FAQ

In today's world, products that span industries — including consumer and medical technologies, laboratory equipment and beyond — can employ an LED. UL Solutions' LED optical radiation services provide manufacturers with the testing and evaluation data to meet their specific needs, ranging from simple optical output measurement results to full IEC CB test reports with CB certificates.

What are some product types that might employ LEDs?

LEDs can be found in a variety of product types such as:

- Bar code imagers
- Sensors
- Augmented/Virtual reality headsets
- Security cameras
- Fiber optics
- Power tools
- Lighting
- Endoscopy
- UV sterilizer
- UV curing

What are the LED radiation safety requirements?

LED radiation safety requirements are generally contained in the ANSI/IES RP-27 and IEC 62471 series of standards. These standards consider the photobiological — interaction of radiant energy on living beings — effects of radiation on the skin and eyes. These standards contain requirements for classifying the potential hazard from LED radiation, labeling, user manual statements, etc.

How is a potential LED radiation hazard from a product conveyed?

When evaluated to the LED radiation safety standards, LED radiation is assigned a Risk Group classification. There are four possible risk groups: risk group exempt, risk group 1, risk group 2 and risk group 3. Risk group exempt is the least hazardous, and risk group 3 is the most hazardous. The higher the risk group, the more safeguards you should expect to see on the product.

Is the radiation emitted by lamps also evaluated for photobiological effects?

Yes, lamps — such as discharge lamps, incandescent lamps, etc. — are also included in the ANSI RP-27 and IEC 62471 series of standards. They are evaluated in a manner similar to LEDs.

How are LED-based image projectors evaluated for radiation safety?

IEC 62471-5 — “Photobiological safety lamps and lamp systems — Part 5: Image projectors” addresses radiation safety specifically from projectors incorporating LEDs and lamps, as well as laser-illuminated projectors that fulfill the requirements specified in IEC 60825-1:2014 (Ed. 3).

How is the risk group of LED radiation determined?

The risk group of LED radiation is determined by a series of irradiance and radiance measurements on the radiation. Once these irradiance and radiance values are measured, they are used in summation equations for comparison to various exposure limits defined in the standards. For example, there are limits for hazards such as ultraviolet (UV), blue light, infrared, etc.

Also, the standards consider some wavelengths to be more hazardous than others, so there are weighting factors applied to certain wavelengths in some cases. Each risk group (Exempt, 1, 2 and 3) has Limits for each of these various hazards. When it is determined that all the measurement results fall below all Exposure Limits in a risk group, the radiation is then described as belonging to that particular risk group.

How do I know if the LED radiation emitted from a product is hazardous?

The risk group of the radiation emitted by the product is a key component to understanding the potential hazard from the LED radiation.

The following table summarizes the risk groups:

LED Risk Group	Description
Exempt	The lamp/LED does not pose any photobiological hazard.
1	The lamp/LED does not pose a hazard due to normal behavioral limitations on exposure.
2	The lamp/LED does not pose a hazard due to the aversion response (head turn or eye blink, for example) to very bright light sources or due to thermal discomfort.
3	The lamp/LED may pose a hazard, even for momentary or brief exposure.

In addition, the ANSI/IES RP-27 and IEC 62471 series of standards may also require the product to employ a label that conveys the level of precaution needed for the potential hazard.

Is there a difference in how LEDs used for lighting are evaluated vs. LEDs used outside of lighting products?

Yes. For example, the IEC 62471 standard separates product types into two categories: general lighting service (GLS) and non-GLS. GLS products are those that typically illuminate spaces occupied by people, such as the lights in a school, home or office. Non-GLS would be any other product, such as LED bar code imagers, cameras with infrared LEDs for night vision, etc. In IEC 62471, the measurement distances for these two product types can differ, with GLS products typically assessed at the measurement distance at which the light produces 500 lux (illuminance) and non-GLS products typically assessed at a 200 mm distance.

Can UL Solutions issue a Certification Body (CB) Test Certificate to IEC 62471?

Yes. As a National Certification Body (NCB), UL Solutions has IEC 62471 in its IECCE CB Scope and has global locations that are Certification Body Testing Laboratories (CBTLs) for IEC 62471. This means that UL Solutions has been authorized by the IECCE to perform IEC 62471 testing, generate a CB Test Report and issue a CB Test Certificate. A CB Test Certificate means that a CBTL has confirmed complete compliance with the standard.

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