ANSI/IES LM-80-21

Illuminating ENGINEERING SOCIETY

# APPROVED METHOD:
# MEASURING MAINTENANCE OF LIGHT OUTPUT CHARACTERISTICS OF SOLID-STATE LIGHT SOURCES

## AN AMERICAN NATIONAL STANDARD

Approved American National Standard ANSI

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Publication of this document
has been approved by IES.
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**Prepared for IES**
**IES Testing Procedures Committee**


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J. Hulett,
*Technical Coordinator*
A. Belyaev
C. Bloomfield
E. Bretschneider
A. Feldman
K. C. Fletcher
Y. Harada
J. Jiao
M. Kotrebai
K. Liepmann
J. Lockner
C. C. Miller
Y. Ohno
E. Radkov
A. Thorseth
R. Tuttle
Y. Zong

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# 1.0 Introduction and Scope

## 1.1 Introduction

The output in optical radiation from solid-state light sources such as LEDs and laser diodes eventually decreases over time. This characteristic of declining output without sudden and permanent failure creates a risk that products incorporating a solid-state light source, that is operating near end of life may be performing outside the products' specifications, or outside required codes, standard practices, or regulations. These solid-state light sources may also undergo gradual shifts in the emitted spectrum over time that may result in unacceptable appearance, color rendering, efficacy, or efficiency.

Product characteristics obtained using this procedure are measured under controlled conditions that may allow direct comparison of results obtained at different laboratories. The resulting data may be used for direct evaluation and comparison of solid-state light source components, and they may be utilized in models that project long-term changes in performance characteristics.

## 1.2 Scope

This Approved Method describes the procedures by which solid-state light sources, such as LED packages, arrays and modules; or laser diode packages, arrays and modules may be tested for flux maintenance over time, including luminous flux, radiant flux, and photon flux maintenance. This document also provides methods for measurement of spectrum-dependent characteristic maintenance, including changes in chromaticity coordinates, peak wavelength, dominant wavelength, centroid wavelength, and spectral power distribution over time, when carried out under controlled environmental and operational conditions. For the purposes of this document, *solid-state light sources* include ultraviolet, visible, and infrared sources emitting optical radiation in the range of 200 nm to 2,000 nm.

This Approved Method does not cover lamps, light engines, or luminaires and does not provide guidance regarding predictive estimations or extrapolation for the maintenance characteristics beyond the duration of the actual measurements.

# 2.0 Normative References

## 2.1 ANSI/IES LS-1-20

Illuminating Engineering Society. Recommended Practice: Nomenclature and Definitions for Illuminating Engineering. New York: IES; 2020. Online: www.ies.org/standards/definitions/ (Accessed 2020 Dec 7).

## 2.2 ANSI/IES TM-27-20

Illuminating Engineering Society. Technical Memorandum: IES Standard Format for the Electronic Transfer of Spectral Data. New York: IES; 2020.

## 2.3 ASTM Standard E230/E23M-112

ASTM International. ASTM E230/E230M-17, Standard Specification and Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples. West Conshohocken, PA: ASTM International; 2017.

# 3.0 Definitions

Definitions found in this section are for the purpose of this document. Definitions not found in this section may be found in *ANSI/IES LS-1-20, Recommended Practice: Nomenclature and Definitions for Illuminating Engineering* (see **Section 2.1).**

## 3.1 air temperature ($T_A$)

The temperature of the air surrounding the DUT (device under test) during the maintenance test.

## 3.2 centroid wavelength ($\lambda_c$)

The wavelength calculated as the weighted center of a spectral distribution according to:

$$\lambda_c = \frac{\int_{\lambda_1}^{\lambda_2} \lambda \bullet \Phi_\lambda(\lambda)\, d\lambda}{\int_{\lambda_1}^{\lambda_2} \Phi_\lambda(\lambda)\, d\lambda},$$