



Approved Method: **Spectroradiometric  
Measurement Methods  
for Light Sources**

**IES Approved Method for Spectroradiometric  
Measurement Methods for Light Sources**

Publication of this Approved  
Method has been approved by the IES.  
Suggestions for revisions  
should be directed to the IES.

**Prepared by:**  
**The Sub-Committee on Photometry of Light Sources**  
**of the IES Testing Procedures Committee**

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## FOREWORD

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This guide is a revision of *IESNA LM-58-1994 IES Guide to Spectroradiometric Measurements*. Significant changes have been made to update information to be representative of the current technologies available, to give clearer guidelines for requirements, and to promote uniformity and accuracy in spectroradiometric measurements. Also incorporated in this revision is information formerly found in *IES LM 55-96 IESNA Guide for the Measurement of Ultraviolet Radiation from Sources*, dealing with spectral measurements in the UV (ultraviolet) region.

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## INTRODUCTION

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In evaluating the color performance of light sources, there are two factors to be considered:

- The light source color appearance (hue and saturation).
- The color rendering (the effect of the light source on the appearance of objects compared to their appearance under a reference source).

The perceived color of a light source is its appearance apart from its luminance, geometry and time variations. This, in turn, depends upon the relative Spectral Power Distribution (SPD) of the radiant energy from the source and the observer adaptation. Two sources may have the same color appearance, and yet have entirely different relative spectral power distributions (i.e., they may produce a metameric match); but if they have the same relative spectral power distributions, they will have the same color appearance – all other factors being constant.

The SPD constitutes the basic data needed for the computation of chromaticity coordinates and metrics that describe color rendering. These data are obtained by spectroradiometry, whereby the light from the source is dispersed into its component wavelengths and the power in each narrow band of wavelengths is measured. Spectroradiometry has been practiced since Newton discovered the dispersive properties of a prism on light. Spectroradiometry is now recognized as the most accurate, precise, and dependable method of determining chromaticity of any light source.

Where visual phenomena such as color are involved, the SPD usually is determined between wavelengths

of 380 nm to 780 nm, and should be measured at sufficiently narrow bandwidths to show the desired resolution. For more complete coverage the SPD should be determined between wavelengths of 360 nm to 830 nm. Often, the curves are plotted at five-nanometer intervals, and are based on a spectral band pass of approximately five nanometers. Recently, computer plotted spectral power distributions have become common at intervals much smaller than five nanometers. For sources containing line spectra, it has been found necessary for accurate resolution of spectra to utilize a band pass of approximately two nanometers.

Obtaining luminous, chromaticity, and color rendering values has been greatly simplified as the pertinent calculations are now done by the application software, which operates on the SPDs measured by the spectroradiometer. Sufficient accuracy is attainable with modern spectroradiometric systems so that they can be used for defining standards for other methods of colorimetry (e.g., with tristimulus colorimeters). In general, a spectroradiometer consists of a monochromator (dispersing instrument), a detector to measure the power at the output of the monochromator, and a device for recording data. A standard light source of known spectral power distribution is used for calibration.

The spectroradiometric method is advantageous because once calibration has been carried out against one standard source (usually an incandescent filament lamp), the spectroradiometer can determine—with equal accuracy—the SPD of light sources of any color, providing only that the unknown SPD is within the range of calibration. This range can comfortably run from 380 nm to 780 nm and more desirable from 360 nm to 830 nm and, therefore, covers the visible region of interest for determining chromaticity.

### Safety Precautions

Since overexposure to the bactericidal (germicidal) and erythema ultraviolet radiation may result in erythema (reddening of the skin) or keratoconjunctivitis (inflammation of the cornea and conjunctiva, the exposed eye membranes), it is imperative that suitable eye protection and clothing be used when conducting measurements in these spectral regions. Lamp manufacturers' recommendations for safety precautions should be followed.<sup>1</sup>

Strong ultraviolet sources, such as deuterium lamps, can produce ozone. Adequate ventilation should be maintained.