

# Proposed Testing Protocol for Measurement of UV-C LED Lamp Output

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## Abstract

For many years the measurement of UV Low Pressure mercury-based lamps was not standardized, resulting in an inability to benchmark lamp performance within the industry. The International Ultraviolet Association, operating through a working group of the Manufacturers Council, published a testing protocol for the measurement of low-pressure lamp output intensity. This protocol has enabled agreement on lamp testing methods and reporting that enables greater transparency to system designers, regulators, researchers and end users. UV-C Light Emitting Diode (LED) technology has developed over the past decade to the point of commercialization for water, air and surface disinfection applications. However, much like the former situation with Low Pressure lamps, there are no commonly agreed upon or accepted methods for the determination of UV-C LED output.

This paper will describe a new IUVA initiative, undertaken by a working group of the IUVA Manufacturers Council to present a consistent methodology for the determination and benchmarking of UV-C output from LEDs. The protocol can be used for testing and comparing different UV-C LED lamps, to compare testing results from different laboratories and to compare operation under different ambient conditions. The protocol will accommodate both single device and multiple device lamps, showing emission spectra (i.e. power and wavelength) as well as absolute optical output power. The testing protocol will not cover angular distribution, aging, or mounting configuration. It is not intended for general manufacturing quality control or quality assurance testing.

The testing protocol will be in a similar format to the IUVA low pressure lamp method and, as such, will include descriptions of the following areas:

- a. Safety
- b. Measurement equipment
- c. Measurement conditions
- d. Measurement procedure
- e. Calibration
- f. Reporting

The mechanism used to refine and validate the protocol will also follow the precedent set by the IUVA low pressure lamp

Participants in Protocol Testing	Contacts
AquiSense Technologies (UV system manufacturer)	Jennifer Pagan Oliver Lawal
Crystal IS (UV LED manufacturer)	Leo Schowalter Rajul Randive
DOWA (UV LED manufacturer)	Hiramichi Asahara
HexaTech, Inc. (UV LED manufacturer)	Baxter Moody Joseph Smart
Nikkiso Giken (UV LED manufacturer)	Harald Maiweg Hidesama Tomozawa
Provital Solutions (UV system manufacturer)	Paw Juul Malte Eriksen
RayVio (UV LED manufacturer)	Yitao Liao Doug Collins
Seoul Viosys (UV LED manufacturer)	Jaden Seo Dr. JJ Kim
SETi (UV LED manufacturer)	Tim Bettles
Trojan Technologies (UV system manufacturer)	Gordon Knight Jin Chang
Univ. of Colorado-Boulder (Research institution)	Karl Linden
Univ. of British Columbia (Research institution)	Fariborz Tagipour
Watersprint AB (UV system manufacturer)	Anders Ruland

method, i.e. round robin testing will occur at various industry laboratories given in the chart and consisting of UV LED manufacturers, UV system manufacturers and research institutions, using the same UV LED lamp, same UV radiometer and sensor and each laboratory’s internal spectral measurement equipment. The results will be compiled by a third party and anonymously reported. After each complete round of testing, the results will be evaluated to seek an understanding for any variations between laboratories. As such, the protocol will be refined before final IUVA approval and publication. ■