



ENERGY STAR Lamps Version 1.0 Laboratory / AB / CB Round Table

Monday, October 24, 2011
San Diego, CA
Alex Baker, EPA



Here Today:
Dan Cronin, ICF International
Kirsten Murray, ICF International

On the Phone:
Emily Phan-Gruber, D&R International
David Ryan, D&R International



lamps@energystar.gov

Two Ground Rules:

- must stick to schedule**
- avoid discussions of draft performance levels – please save for November 30 stakeholder round table**

End of the Day: Cameron Miller, NIST TM-21 Overview with Q&A



Introductions



**ENERGY STAR® Lamps Version 1.0 Specification
Round Table Meeting Agenda
Monday, October 24, 2011
Paradise Point Resort
“Dockside” Meeting Room**

EPA's round table meeting is open to EPA-recognized Laboratories, Certification Bodies and Accreditation Bodies, as well as other interested stakeholders. Attendees are asked to review the first draft of the Lamps V1.0 specification (forthcoming) prior to attending this round table. The meeting will present an opportunity to discuss draft requirements language, referenced documents, standards and methods of measurement as they relate to testing and certification for ENERGY STAR. (Please note: draft performance levels will not be discussed at this meeting.) Those interested in the TM-21 session are also asked to review the document, [now available](#) from the IES.

ENERGY STAR program representatives will be available throughout the week to answer questions about all lighting specifications. Please contact certification@energystar.gov with advance questions about the round table.

7:45am - 8:30am Breakfast in “Sunset V” Meeting Room

8:30am - 10:00am Lamps V1.0 Review: Photometric Methods of Measurement

- Efficacy & light output
- Color rendering & CCT
- Lumen & color maintenance
- Intensity distribution & directional lamp beam quality
- Color angular uniformity

10:00am - 10:30am Break

10:30am - 12:00pm Lamps V1.0 Review: Electrical Methods of Measurement

8:30am - 10:00am	<p>Lamps V1.0 Review: Photometric Methods of Measurement</p> <ul style="list-style-type: none"> • Efficacy & light output • Color rendering & CCT • Lumen & color maintenance • Intensity distribution & directional lamp beam quality • Color angular uniformity
10:00am - 10:30am	Break
10:30am - 12:00pm	<p>Lamps V1.0 Review: Electrical Methods of Measurement</p> <ul style="list-style-type: none"> • Start time • Run up time • Power factor • Operating frequency • Transient protection
12:00pm - 1:30pm	<p>Lunch in "Sunset V" Meeting Room Table discussions: Feasibility of testing requirements. Topics and table leaders to be assigned.</p>
1:30pm - 3:00pm	<p>Lamps V1.0 Review: Additional Testing</p> <ul style="list-style-type: none"> • Rapid cycle stress test • Elevated temperature test • Noise • Dimming
3:00pm - 3:30pm	Coffee Break
3:30pm - 5:00pm	<p>IES TM-21-11 Overview and Q&A Session (Cameron Miller, NIST) This session will review the recently published lumen maintenance projection method for LED light sources, referenced in the Luminaires V1.1 specification. Example calculations will be run, with time for questions and discussion.</p>

ENERGY STAR Program Guidance Regarding Lumen Maintenance Performance Data



ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products

September 9, 2011

Section 1: Purpose of this Document & Timeline for Implementation

The purpose of this document is to provide guidance regarding lumen maintenance testing and reporting (i.e. IES LM-80-08, or "LM-80") for LED packages, LED arrays, and LED modules ("subcomponent(s)") referenced to demonstrate compliance with ENERGY STAR lumen maintenance and/or color maintenance performance requirements detailed in Program specifications for lighting products ("product(s)").

The most commonly employed approach to fulfilling ENERGY STAR lumen maintenance performance requirements is through projections based in part upon LM-80 test reports. This guidance addresses topics related to subcomponent-level lumen maintenance data that are not explicitly covered in ENERGY STAR lighting specifications because of the quickly evolving nature of solid state lighting technology. The U.S. Environmental Protection Agency (EPA) will periodically review this guidance to ensure its content acknowledges the latest technological improvements to solid state lighting subcomponents.

This document supports all ENERGY STAR lighting specifications that include solid state lighting within their scope, and is intended to ensure uniform treatment of lumen maintenance data by ENERGY STAR manufacturing partners ("partners"), subcomponent manufacturers, and EPA-Recognized Laboratories and Certification Bodies.

This document addresses:

- the content of LM-80 test reports (section 3)
- the application of LM-80 test reports in support of product qualification (section 4)
- the use of preexisting test reports while testing of successors is underway (section 5)

EPA's intention is for testing and reporting to follow this guidance going forward.

This guidance as it relates to testing applies to LM-80 testing not already initiated as of November 9, 2011, and thus does not apply to testing already completed, currently underway or in the final planning stages.

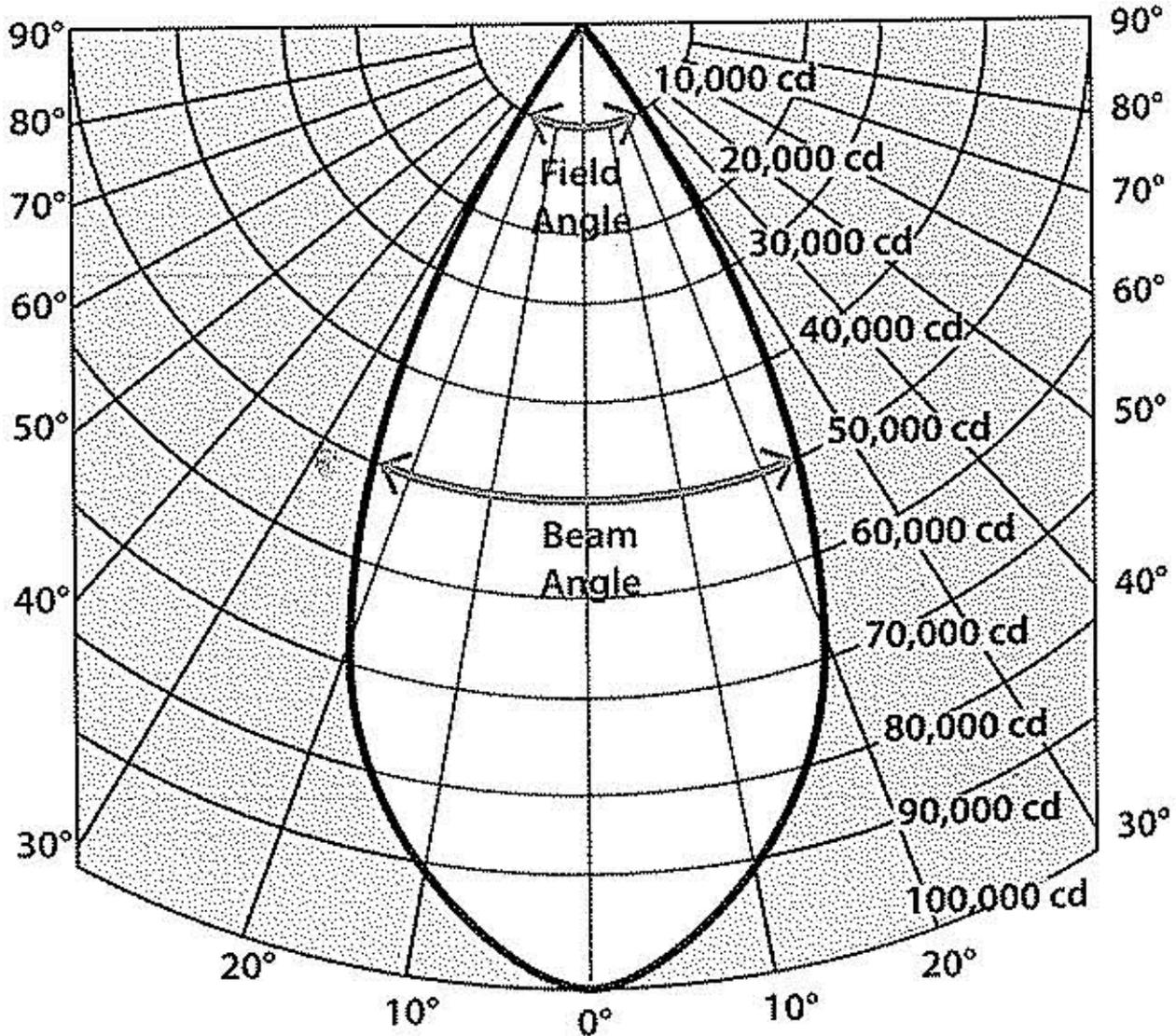
This guidance as it relates to reporting of LM-80 test data applies to all reports issued or revised on or after September 9, 2011. Preexisting test reports issued prior to September 9, 2011 may be referenced as existing without any changes.

Please note: this document includes guidance which may be in addition to, or in place of, the testing and reporting requirements that are detailed in IES LM-80-08. Laboratories must clearly note in their test reports any and all variances from the IES LM-80-08 method of measurement.

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Beam + Field Angle



Uniformity Requirement: Evaluated, Not Included in Draft 1



For lamps with luminous distributions $\geq 50^\circ$, vertical angular scanning resolution shall be 10° across the beam on the 0° and 90° vertical plane and luminous flux shall be reported for each vertical angle measured.

For lamps with luminous distributions $< 50^\circ$, vertical angular scanning resolution shall be 5 steps across the beam on the 0° and 90° vertical plane and luminous flux shall be reported for each vertical angle measured.

Vertical Scanning Resolution: Preliminary Ideas



- Generally, standard measurement granularity is to take measurements every 10°
- However, if you are measuring a lamp with a luminous distribution of 20° , that would mean taking only 3 measurements on each vertical plane, which is not enough to determine conformity with the requirements.
- EPA would like laboratories when measuring lamps with a luminous distribution $<50^\circ$ to take intensity and color measurements at 5 equidistant points across the field of the light on the 0° and 90° planes.
- For products with luminous distributions $\geq 50^\circ$, 10° granularity is acceptable.

Measurements at 0°, 90°

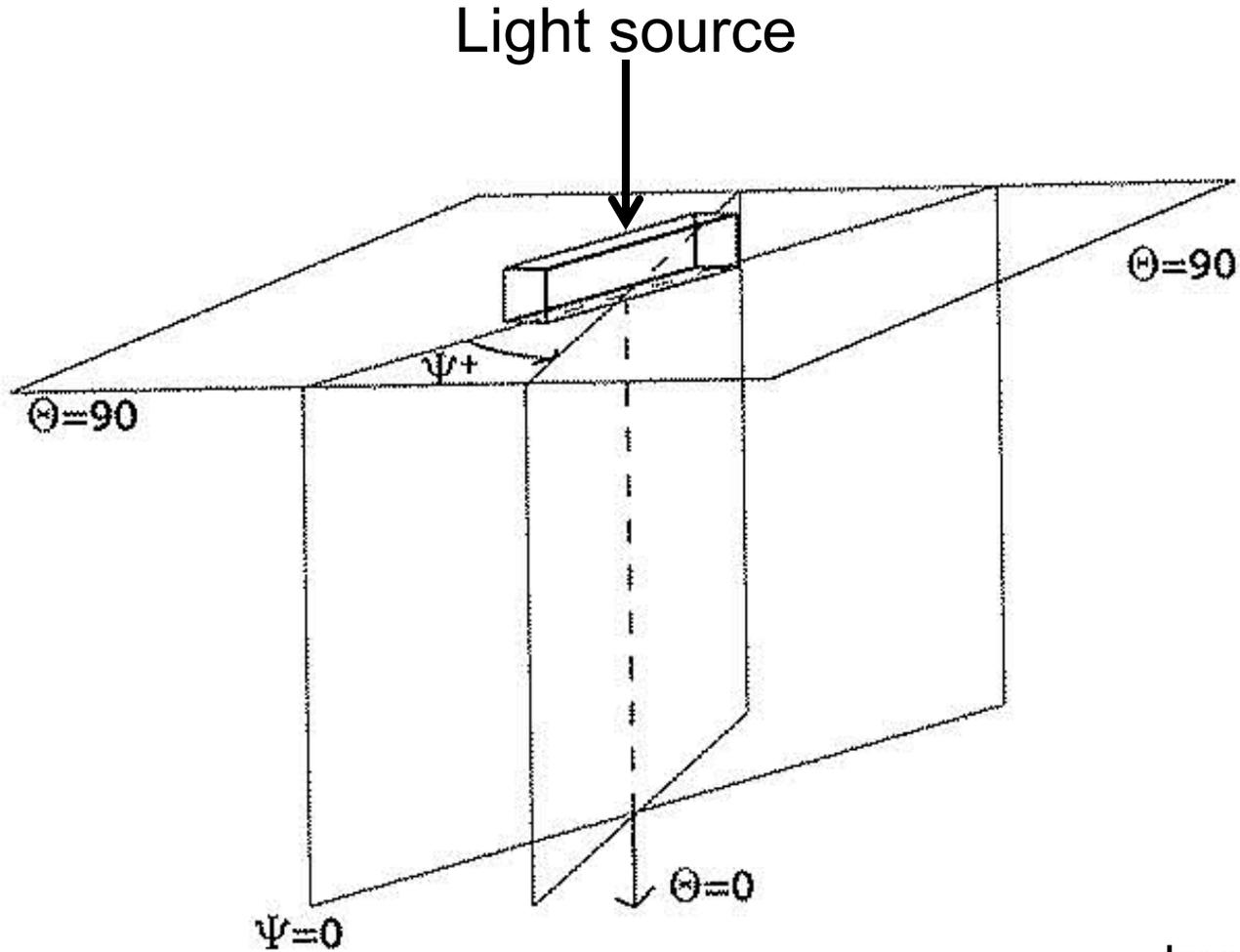


Image from IES
Lighting Handbook

Operating Frequency/Waveforms



- Operating frequency requirement was originally included to cut down visible “flicker”
- The operating frequency requirement works fine for CFLs, but not for LEDs
- Need to set requirements for, and measure photometric waveform rather than operating frequency

Operating Frequency: Preliminary Ideas



Method of Measurement

- Light output waveform shall be measured with a photodetector, transimpedance amplifier and oscilloscope.
- Temporal response, amplification and filtering characteristics of the system shall be suitably designed to capture the photometric waveform.
- Digitized photometric waveform data and an image of the relative photometric amplitude waveform shall be recorded.

Sample Size

1 model

Passing

Sample shall meet the requirement

Allowable Tolerance

Allowable tolerances for photometric waveform/kHz requirement?

Transient Protection



Method of Measurement

- Is this requirement needed given the voltage requirements in UL 1993?

Sample Size

5 units, base up

Passing

All samples shall survive

Lunch Table Discussions: Some Questions to Consider



- What are the impacts of proposed changes on lab capacity?
- What are the impacts on cost to Partners?
- What are the impacts on lead time?
- Impacts on good will? Trade off between quality and partner ire?

Other Requirements



- Rapid Cycle Stress Test
- Elevated Temperature Test
- Noise
- Dimming

Rapid Cycle Stress Test



Cycle time

- 5 min on, 5 min off
- One cycle for every hour of claimed life
- 10,000 cycles minimum

Methods of Measurement

- ANSI C78.5-2003
- LM-65-10 (clauses 2, 3, 4, 5, 6)

Sample Size

10 units

Passing

9 out of 10 sample lamps survive rapid cycle test

Noise: History of “Class A” Designation



- Developed in the 1950s to characterize ambient noise levels in Air Force base offices.
- Classes A through H
- “Class A” means an ambient noise level likely to cause “no annoyance” to residents of a neighborhood/office.
- Characterizes ambient noise levels, not actual measured performance of a product.
- Outmoded metric, alternate test methods exist.
- Need to develop a new designation system which references performance levels rather than ambient noise levels.

Dimming



- Need to define dimming curve
- Need to define a method of measurement
- Need to identify a set of reference dimmers for testing the performance of a lamp on those dimmers

Sample Size

Need to determine sample size

Passing

Need to determine pass/fail requirements



Thank you!

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CRI/CQS



- The Color Rendering Index (CRI) is the international industry standard for evaluating color rendering of light sources.
- CIE Technical Committee 1-69 is currently investigating "new methods for assessing the color rendition properties of white-light sources used for illumination, including solid-state light sources, with the goal of recommending new assessment procedures."
- The committee has nearly 40 members internationally.
- CIE has recently implemented a new Code of Procedure which changes committee balloting rules to require unanimous agreement within a committee.
- At the July 2011 CIE meeting in South Africa, TC 1-69 came close to reaching an agreement, but is still attempting to address remaining dissenting members.
- Until the TC agrees and publishes a new recommended test procedure, ENERGY STAR will continue to reference the industry standard CRI (CIE 13.3) metric.