

PHILIPS
LUMILEDS

The Latest in Lighting Standards and Test Methods

2014 ENERGY STAR® Products Partner Meeting
Arizona

Alex Baker, MSc, LC, MIES
Philips Lumileds Lighting Company
29 October 2014

1204



Caution

Standards development is a dynamic process with input from many stakeholders.

New standards & revisions often have different outcomes than originally anticipated at project fruition.

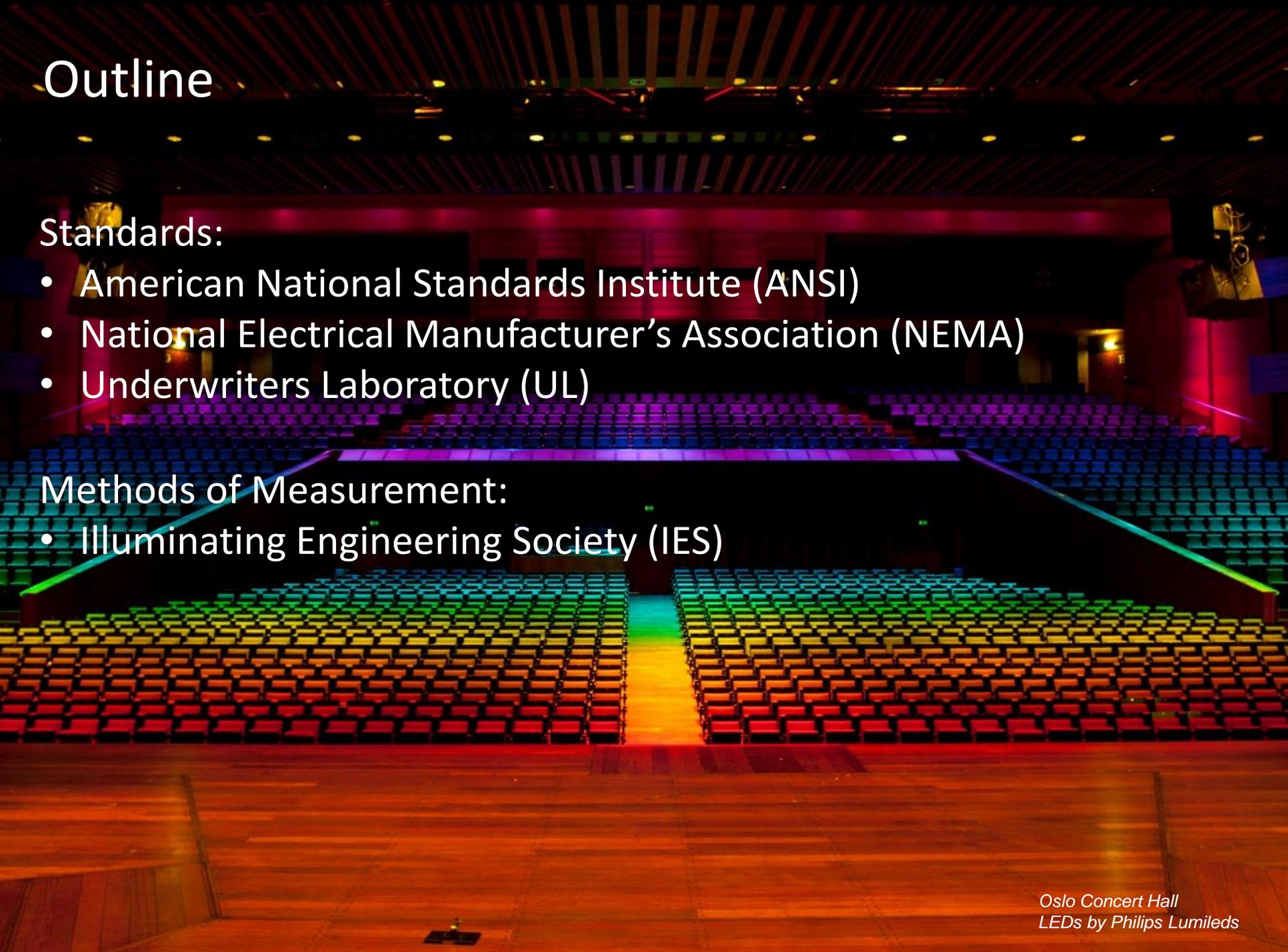
It is strongly recommended that you not make business or design decisions based upon standards in draft.

The following is an overview only.



*Times Square New Years Eve Ball
LEDs by Philips Lumileds*

Outline



Standards:

- American National Standards Institute (ANSI)
- National Electrical Manufacturer's Association (NEMA)
- Underwriters Laboratory (UL)

Methods of Measurement:

- Illuminating Engineering Society (IES)

Standards



Standards: ANSI / IES



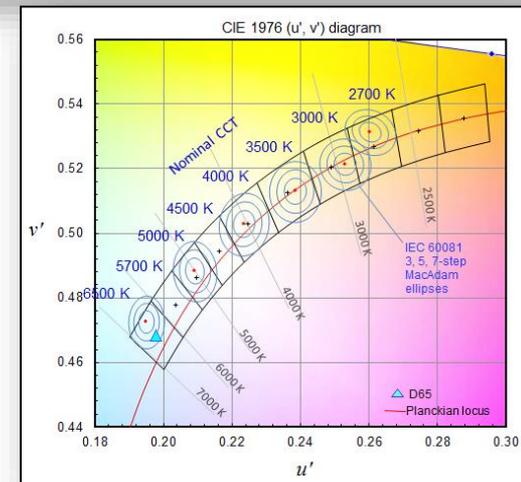
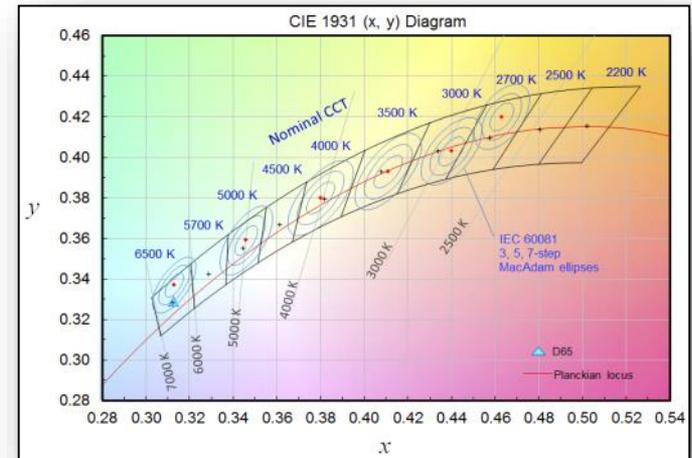
ANSI / IES [RP-16-10](#): Nomenclature and Definitions for Illuminating Engineering

- **Purpose:** details nomenclature and definitions for production, measurement, application of light and radiant energy (IR & UV)
- **Status:** in effect, under continuous revision
- Most North American standards & regulations reference this document
 - LED package
 - LED array (or LED module)
 - LED driver

Standards: ANSI / ANSLG

ANSI/ANSLG [C78.377-2011](#): Specifications for the Chromaticity of Solid State Lighting Products

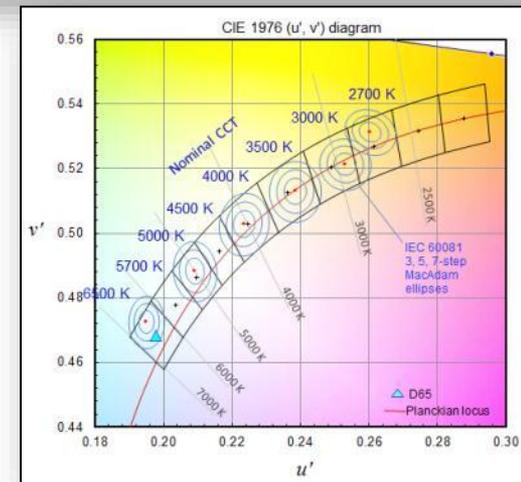
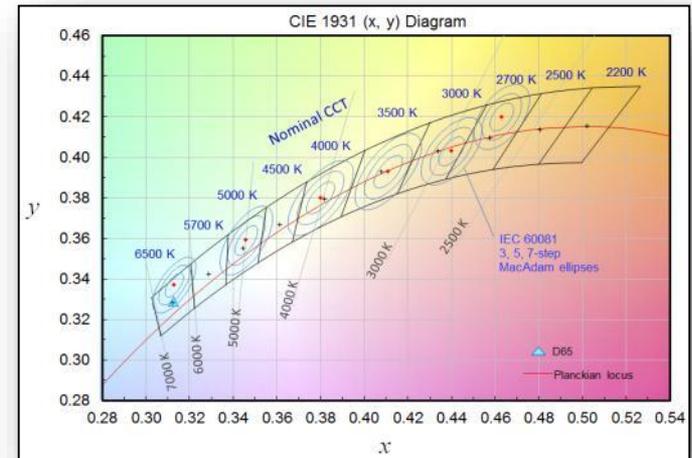
- **Scope:** complete lamps & luminaires connecting to line voltage
- **Status:** in effect, revision in development
- Specifies white light for general lighting
 - Nominal CCTs 2700K to 6500K
 - “Flexible CCTs”
- Also used extensively for LED package/array/module binning
- Enables communication of white light chromaticities to consumers and end users



Standards: ANSI / ANSLG

ANSI/ANSLG C78.377-201x: Specifications for the Chromaticity of Solid State Lighting Products

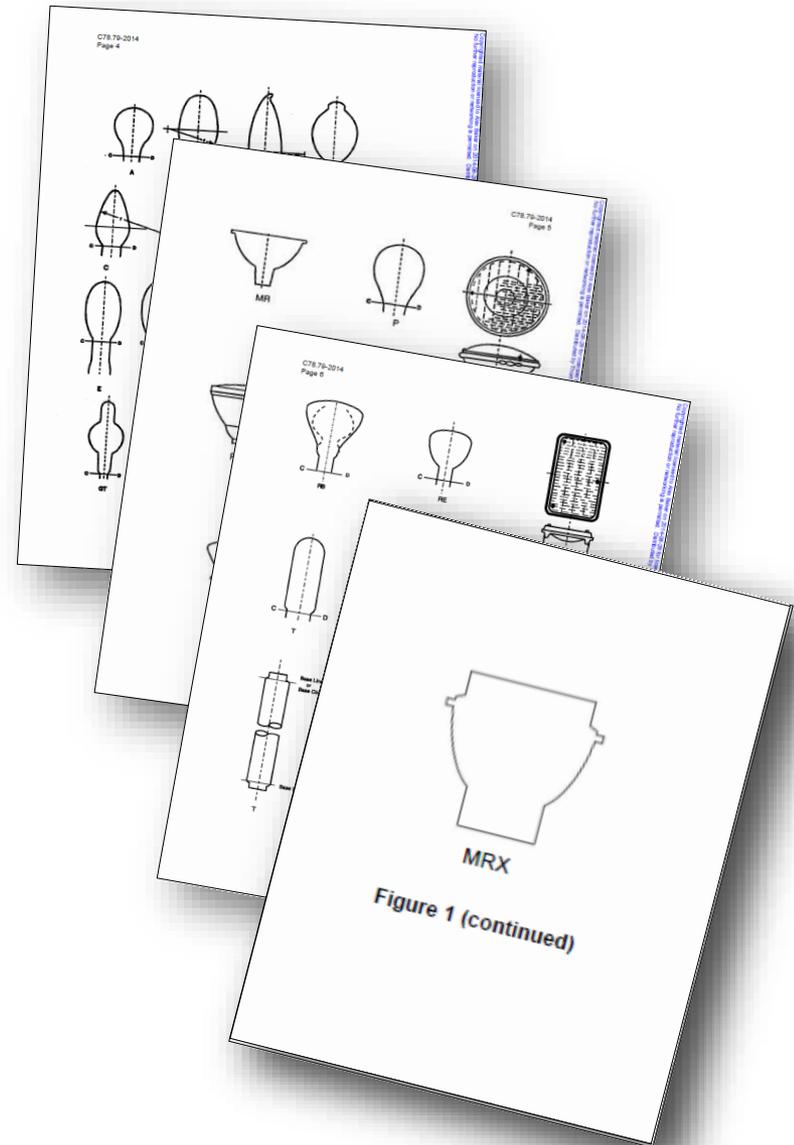
- The forthcoming revision (2014?) adds:
 - 2200K and 2500K nominal CCTs
 - 4-step chromaticity tolerance circles, per the new [CIE Technical Note](#)
 - 4-step tolerance quadrangles



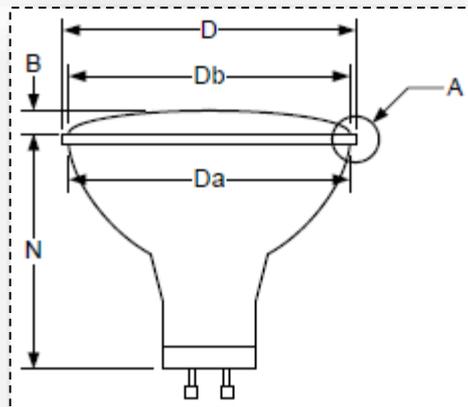
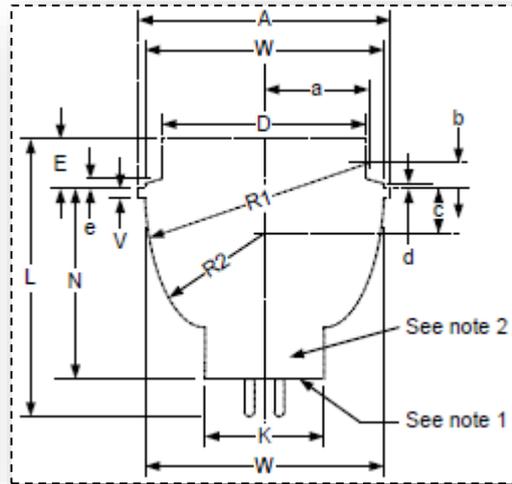
Standards: ANSI / NEMA

ANSI C78.79-2014: Electric Lamps – Nomenclature for Envelope Shapes Intended for Use with Electric Lamps

- **Scope:** a system of nomenclature designating lamp shapes for electric lamps
- **Status:** in effect, no pending revisions
- Redesignation of ANSI C79.1, which was for lamps with glass bulbs
- “Glass bulbs” → “envelope shapes”
- Redesignation incorporates solid-state light sources as functional replacements for other sources
- Added shapes relevant to LED: the “extended” top surface modifier, e.g. MRX-16 lamps: “extended” MR-16 lamps



Standards: ANSI / NEMA



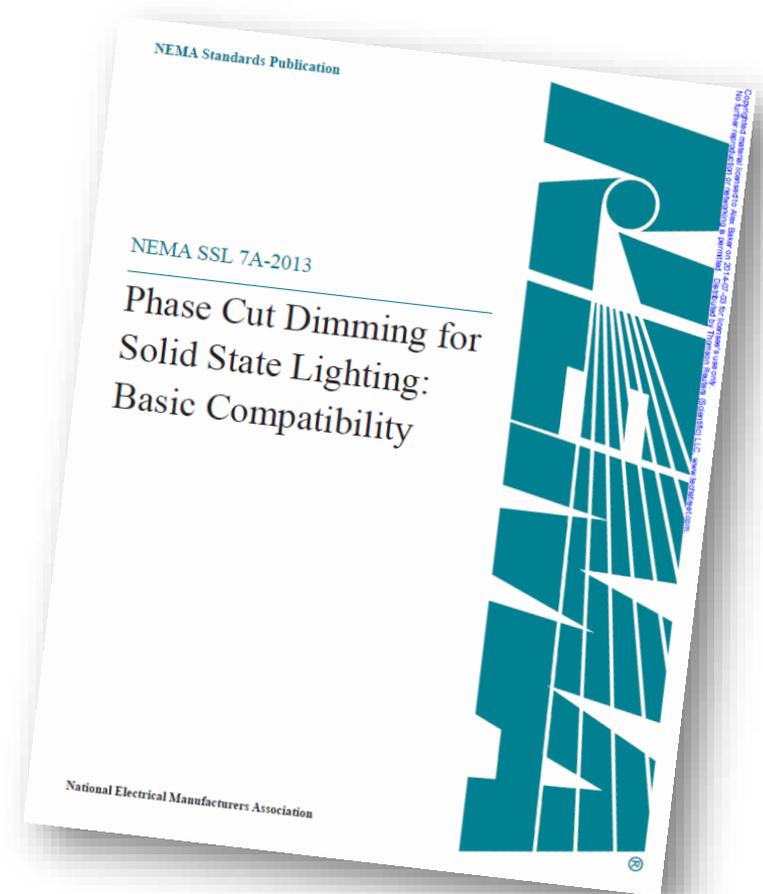
ANSI C78.50-2014: Electric Lamps – Assigned LED Lamp Codes

- **Scope:** physical and electrical characteristics of LED lamps with integral drivers
- **Status:** in effect, no pending revisions
- A new ANSI standard, not a revision
- First publication includes only MRX-16 and PAR16
 - Max outline dimensions for MRX-16
 - Min & max outline dimensions for PAR16
- Lamp bases and gauges as per ANSI C81.61 and .63

Standards: NEMA

NEMA [SSL 7A-2013](#): Phase Cut Dimming for Solid State Lighting: Basic Compatibility

- **Scope:** details compatibility requirements when using a forward phase-cut dimmer with LED lamp(s) and luminaire(s)
- **Status:** in effect, no pending revisions
- “Compatibility” is defined as:
 - Reliability of dimmer & lamp/luminaire are not affected by the combination
 - Dimming behavior meets/exceeds requirements for stability, inrush current, repetitive peak current/voltage, many others
- Referenced in ENERGY STAR Lamps V1.2 and Zhaga specifications
- Round robin testing is underway



Standards: UL

ANSI/UL [8750](#): Light Emitting Diode Equipment for Use in Lighting Products

- **Scope:** LED equipment integral to lamps & luminaires including LED packages, arrays & modules, and drivers
- **Status:** in effect, under constant revision
- Topics currently being considered for revision (partial list):
 - Changes to the LED Package Dielectric Voltage Withstand Test
 - LED package lens securement
 - Temperature index for insulating materials



Philips Lumileds LUXEON COB series

Standards: UL

ANSI/UL 8750: Light Emitting Diode Equipment for Use in Lighting Products

- Horizontal standard supporting safety listing of:
 - Electric Signs, UL 48
 - Portable Electric Luminaires, UL 153
 - Underwater Luminaires and Submersible Junction Boxes, UL 676
 - Emergency Lighting and Power Equipment, UL 924
 - Stage and Studio Luminaires and Connector Strips, UL 1573
 - Track Lighting Systems, UL 1574
 - Luminaires, UL 1598
 - Direct Plug-In Nightlights, UL 1786
 - Low Voltage Landscape Lighting Systems, UL 1838
 - Self-Ballasted Lamps and Lamp Adapters, UL 1993
 - Luminous Egress Path Marking Systems, UL 1994
 - Low Voltage Lighting Systems, UL 2108



Methods of
Measurement
& Technical
Memoranda

Methods of Measurement: IES

IES [LM-79-08](#): IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

- **Scope:** LED lamps & luminaires requiring AC mains or DC power supply
- **Status:** in effect (2008), revision in development
- Photometric measurements by integrating sphere or goniophotometer (type C)
- Normatively referenced in standards & regulations globally



Methods of Measurement: IES

IES LM-79-xx: IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

- Working group is pursuing improvements and clarifications which would not negatively impact regulatory references to it, namely:
 - Measurements of I_{rms} & THD
 - Detector timing issues
 - Color angular uniformity



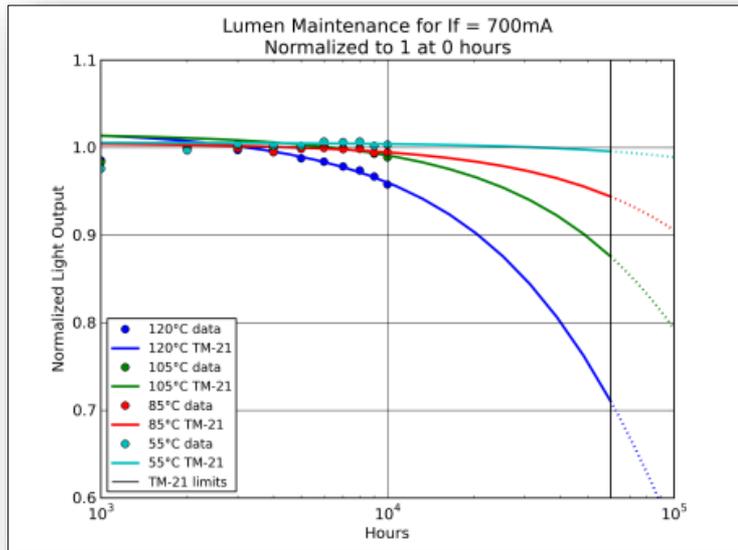
Methods of Measurement: IES

IES [LM-80-08](#): IES Approved Method for Measuring Lumen Maintenance of LED Light Sources



- **Scope:** LED packages, arrays & modules
- **Status:** in effect with [Addendum A \(2014\)](#), revision in development
- Existing standard originally published 2008
- De facto standard worldwide: normatively referenced in national regulations, IEC standards

Methods of Measurement: IES

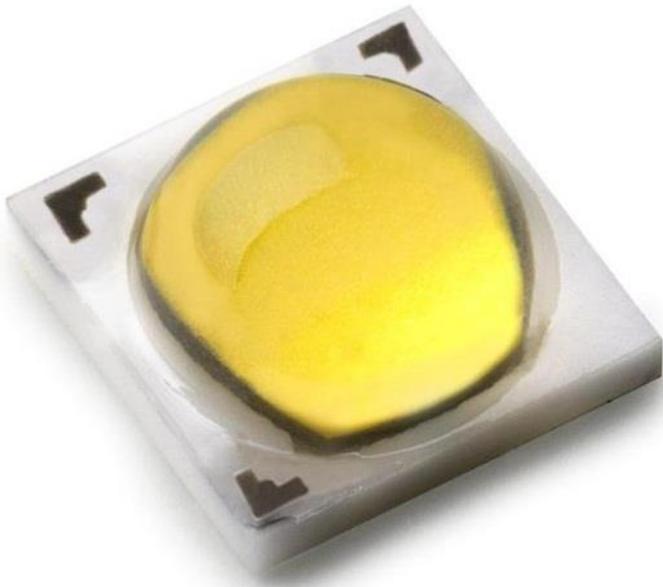


IES LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources

- Measures lumen maintenance of LED packages & arrays over a minimum of 6,000 hours
- Measurements every min 1,000 hours
- Originally a minimum of 3 case temperatures: 55C, 85C and a 3rd temp selected by LED manufacturer
- 2014 Addendum A:
 - Replaces section 4.4.2.
 - Now requires only 2 case temperatures, one must be 55C or 85C, clarifies temperature & humidity requirements

Methods of Measurement: IES

IES LM-80-1x: IES Approved Method for Measuring **Luminous Flux and Color Maintenance** of LED Light Sources



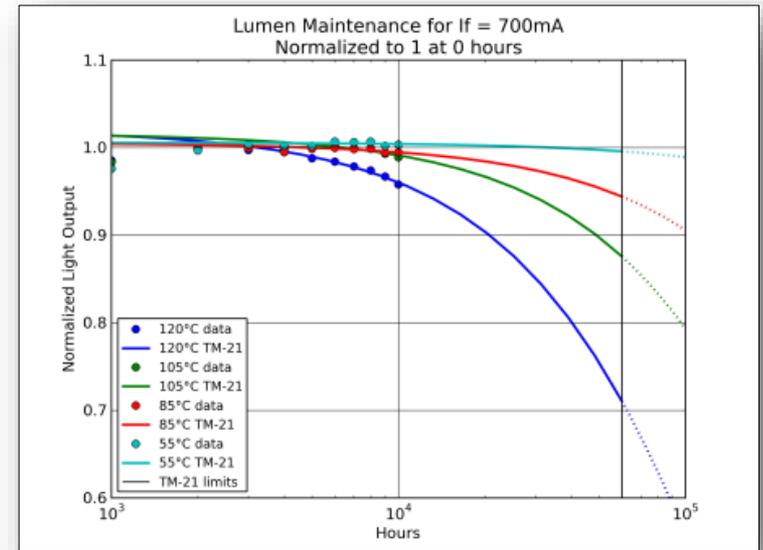
Philips Lumileds LUXEON TX

- 2014 revision was recently balloted within the IES Testing Procedures Committee
- Scope expanded to include:
 - luminous, radiant & photon flux
 - various types of drive current including PWM, DC constant current, DC constant voltage, AC regulated voltage
- Requires minimum of 2 case temperatures, one must be 55C or 85C
- Reporting requirements clarified

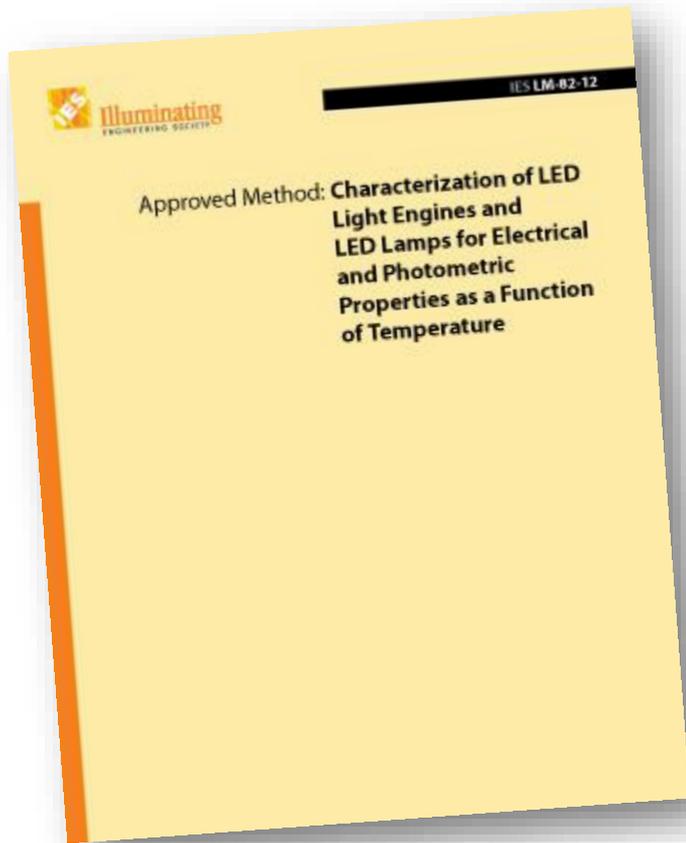
Technical Memorandum: IES

IES TM-21-11: Projecting Long Term Lumen Maintenance of LED Light Sources

- **Scope**: Same as IES LM-80
- **Status**: in effect with Addendum A (2014), revision in development
- Provides recommendations for projecting long-term lumen maintenance using LM-80 data
- Addendum A issued this year to provide clarifications
 - Includes clarifications on measurement intervals
- Revisions being considered include drive current interpretation



Methods of Measurement: IES



IES LM-82-12: IES Approved Method: Characterizing LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

- **Scope:** LED light engines and LED lamps
- **Status:** in effect, no pending revisions
- LM-79 is normatively referenced for all electrical & photometric tests
- LM-82 is essentially LM-79 as a function of temperature
- Reports: light output, power dissipation, efficacy, CCT & CRI as a function of temperature (T ; $T + 25C$; $T + \Delta T$)
- Useful for measuring luminaires that cannot fit in goniophotometers or integrating spheres

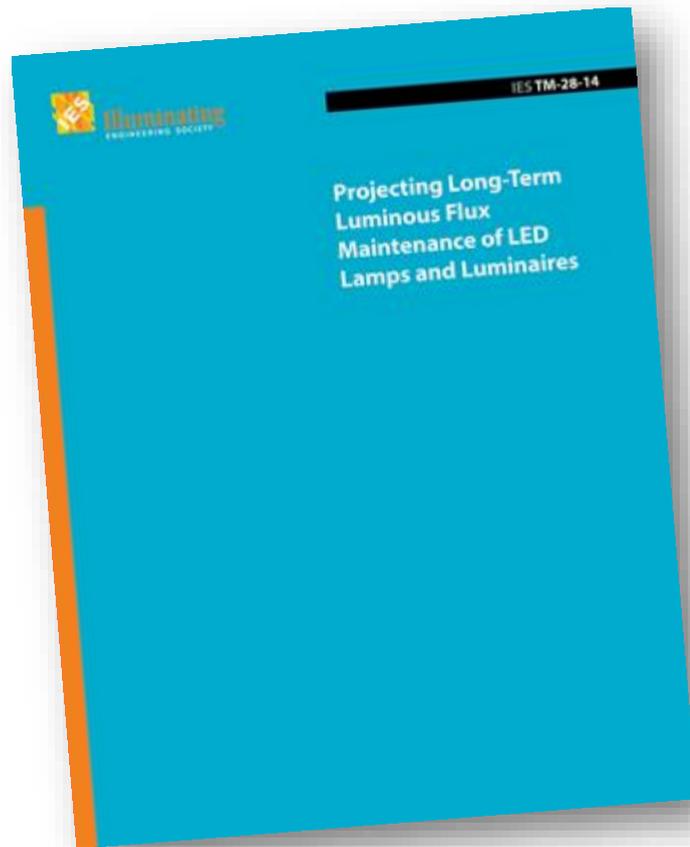
Methods of Measurement: IES

IES LM-84-14: IES Approved Method for Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires

- **Scope:** Like LM-80, but measures lumen maintenance at the LED lamp, light engine or luminaire level
- **Status:** in effect, no pending revisions
- Comprehensively captures all lumen degradation mechanisms:
 - LED lumen depreciation
 - LED driver output depreciation
 - Degradation of secondary optics, reflectors, paint finishes, etc
 - No regulatory / program references yet



Technical Memorandum: IES



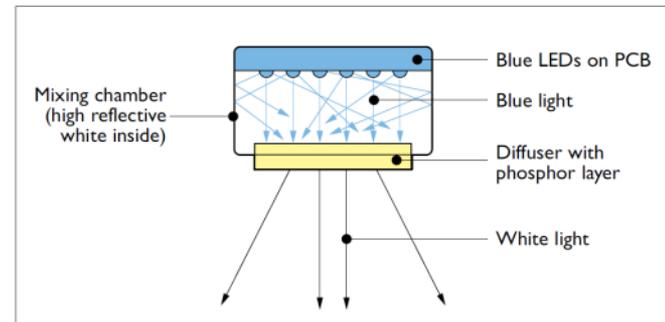
IES TM-28-14: Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires

- **Scope:** same as LM-84
- **Status:** in effect, no pending revisions
- Projects long-term lumen maintenance of lamps & luminaires using LM-84 data
- Allows the use of min 3,000 hr LM-84 data plus min 6,000 hr LM-80 data to calculate projections
- Very recently published, little industry experience using this method
- No regulatory / program references yet

Methods of Measurement: IES

IES LM-86-1x: IES Approved Method for Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components

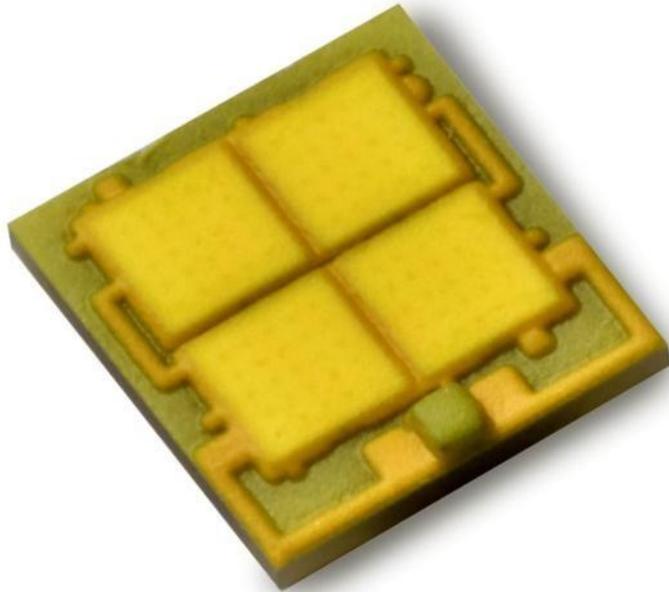
- **Scope:** remote phosphor components (e.g. plastic & glass coated / embedded with phosphor)
- **Status:** in development, currently at recirculation ballot
- Measures luminous flux and color maintenance of remote phosphor components of lamps & luminaires
- Units under test are not electrical components



Mixing chamber in Fortimo LED Downlight Module enabling uniform white light

Methods of Measurement: IES

IES LM-87: Robustness Tests for LEDs (working title)



Philips Lumileds LUXEON MZ

- **Scope:** LED packages
- **Status:** in development, early stages
- Details accelerated / overstress testing of LED packages based on adaptations of JEDEC standards and industry best practices
- Will not make predictions about future performance
- Recent discussions:
 - Outside the scope of the IES?
 - Abandon this effort?
 - Reframe to higher integration level?
Focus on LED lamp & luminaires?

Methods of Measurement: IES

IES Color Metrics Task Group

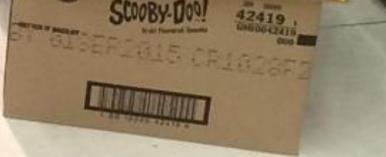
- **Scope:** an improved metric for evaluating the fidelity of LED lighting, to compliment the color rendering index (CRI), not to replace it
- **Status:** in development, nearing completion



LUMILEDS

The Brighter LED

Alex Baker, MSc, LC, MIES
Global Standards Manager
Philips Lumileds Lighting Company
+1 202 374 4348
alex.baker@philips.com





Red Morris
Paradise Cove
BEACH CAFE
Malibu





Thank you