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Environmental Protection Agency
Energy Star Program
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Subject: Philips Lumileds feedback to ENERGY STAR Lamps Specification Framework.

Date: April 29, 2011

Dear Mr. Baker:

Philips Lumileds continues to actively support the development and expansion of the ENERGY STAR program and strongly believes that it will have a positive impact on market confidence and adoption of LED lighting. Our collaboration with EPA is intended to assure technical and business alignment and to remove barriers to the design, development and market introduction of new, energy efficient, lighting solutions.

We were pleased to see the focus on developing the new ENERGY STAR Lamp Specification and to have the opportunity to comment on the proposed framework. We have reviewed the documents and have the following comments on the specific sections cited:

Section	Subsection	Subsection	Comments
III. Efficiency, Performance, and Quality	a) Energy Efficiency	i. Luminous efficacy	Propose that the specification should update minimum lm/w periodically in accordance with the DOE LED efficacy curves. The yearly DOE R&D SSL Multi Year Program Plan should serve as the reference document
		ii. Power factor	Propose to keep the existing Energy Star LED power factor categories based on lamp wattage (< 5W no requirement; and >5W PF >?)
		iii. 6. End of life for LED products	Propose that lamps, as a maximum, have indicator(s) for information only as an option, but have no requirements for cutoff/shutdown feature
	c) Quality	i. Color consistency	Propose to move to Delta E94 calculation for initial color consistency that implements the intention of 5 MacAdam ellipses to improve the quality of light (currently ANSI 7 MacAdam ellipse) but not to implement any specification over the life time of the lamp
		ii. Color quality	Propose to use CQS

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		iii. Life Requirements	Propose to set up separate classes of lamps (A, B, C etc.)based on longevity (khours) to encourage price/performance market forces. Reliability and longevity of lamps needs to be de-coupled from LM -80 lumen depreciation data because LED lumen depreciation is only one on many factors which determine the functional longevity of a lamp. A "full system" analysis which includes the LED light engine, driver components, optical components and mechanical components needs to be developed.

		v. Quality questions:	
		7	Propose to move to Delta E94 calculation for initial color consistency that implements the intention of 5 MacAdam ellipses to improve the quality of light but not to implement any specification over the life time of the lamp. Today 3 MacAdam ellipse LED products are available on the market.
		8	Propose to use CQS

		9	Propose to use CQS as above or augment CRI with R9
		10	Propose to keep a 100 point metric which corresponds to academic grading which everyone understands.
		13	Propose to adopt a new definition of "life" that does not rely only on lumen depreciation and LM-80 data. The new definition of life needs to incorporate the longevity of the non-LED components as stated in Life Requirements above.
IV. General Topics	ii. Harmonization with the ROW		Propose for Energy Star to harmonize with IEC, CIE where possible.
	iii. Environmental Benefits		Propose to agree with Energy Star Luminaire 1.0
	iv. Questions	17	Propose that the primary factors that define the lumen maintenance behavior of a LED Package or Array are: 1. Thermal resistance – If the thermal resistance of an LED Package or Array changes and it causes the Tj to exceed the Tj reported in the LM-80 test report (which it will) then it must be considered a successor unless operating is de-rated to the lower Ts reported in the LM-80 test report. For example, an

			LED package thermal resistance increases causing the Tj to raise above the value it had at the Ta/85C test, the Ts has to be de-rated to a value interpolated between 55C and 85C which will meet EnergyStar requirements. 2. Material system - photonic path of the photons after exiting the Epi, including deposition methods. 3. Current density (Current per die area (mm2)). 4. Ts (EPA definition)
			LED design changes that Do Not impact Lumen Maintenance; therefore, Do Not require new LM-80 testing 1. Epi improvements 2. Phosphor variations resulting in higher CCT 3. Package changes (size, wire bonds, reflector, etc.) 4. Same or lower thermal resistance 5. Radiation patter changes 6. New die size – with current density that

			is less than/equal to the previously tested version

			LED design changes that Do impact Lumen Maintenance; therefore, Do require new LM-80 testing 1. Phosphor variations resulting in lower CCT • Rudi commented that this may not be a good idea. That we should call it a material change. 2. Increase thermal resistance 3. New die size – with current density that is higher than the previously tested version 4. Higher qualification temperature than previously tested version 5. New lens material

Best regards.

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