

## Comments/Recommendations

### Test Method:

#### 1) Section 5.1 A, 2, e

States: "Method of ensuring the light measured comes only from the UU"

Comment: This appears out of place in a list of required equipment. Additionally, it is asking the lab to come up with a method, when it is ENERGY STAR's job to do so. It should be moved to the Test Conduct Section, such as by adding another letter:

For example: D) 100% of the light measured must come from the UU. If relative photometry is used, isolate the UU in an enclosed test chamber or black box and document the steps taken to ensure no light from other sources is present.

#### 2) Section 7.1, E

The Test Method uses the term Fundamental Frequency whereas the Specification uses the term Periodic Frequency (001 times the periodic frequency to determine pass/fail). Assuming they are the same thing, either both documents should call them by the same name, or it should be stated that the Fundamental Frequency found in the Test Method should be used as the Periodic Frequency to calculate pass/fail. If they are not the same thing, it should be clarified how to obtain the Periodic Frequency in the Test Method.

#### 3) Sections 7.1, D 7.2, D, 7.2, I 7.2, J

Stabilization is required for measurement at Baseline, MaxLO, then for MinLO. Labs tell me the stabilization process takes one hour per measurement. In 7.2, I this is multiplied by 10 dimmers, making 20 measurements. In 7.2, J another 20 measurements are required. Add one hour for BLO. This is 41 hours of testing. If there is a difference between the stabilization period and the periods described in the sections listed above, it should be made clear. Otherwise, they should all be referred to as stabilization periods.

The range of hours expected for one measurement including stabilization time should be stated in the Test Method, with an explanation detailing the number of measurements expected for the entire dimming Test Method to be complete. Otherwise, it will not be clear what is expected.

#### 4) Sections 7.1, D 7.2, D, 7.2, I 7.2, J, 7.2 H2, 8, G

The report only asks only for Fundamental frequency at BLO. That might cause us to assume that only one reading is taken of the frequency, and that same frequency value is used for all 40 pass/fail calculations. However, In 7.2 E and H) 2), the waveform readings are taken at each measurement point. It is unclear whether each measurement of frequency is to be applied to the specific flicker index readings for the associated switch/lamp/circuit loading flicker index number to determine pass/fail (.001 times the periodic frequency). It should be made clear whether the lab takes 40 non-baseline frequency measurements each to be applied separately matched to the flicker indexes measured when calculating pass/fail for each or the lab uses the same baseline frequency for all flicker index pass/fail calculations.

#### 5) Sections 7.2 D, 7.2 F

The MaxLO and MinLO after stabilization should be recorded for each dimmer switch/lamp/circuit load combination. This requirement is not in the Test Method and should be added.

If these measurements are the ones used to fulfill 12.1 and 12.2, it should be so stated, so it cannot be interpreted that there must be separate instances for testing MinLO/MaxLO than for testing flicker. This is important for gauging the number of tests and stabilization periods required total. It should say something like: "The measurements for MinLO and MaxLO are taken during the procedure for flicker testing, directly after each stabilization is completed."

#### 6) Section 8

The following is a list of things that seem conspicuously absent from the Test Report. If these things are part of different required documentation other than the Test Report, then make that clear, or else consider adding them to the Report parameters:

- a) The percent that passed the MaxLO requirements (Spec#12.1) by staying within the tolerance of 10% above rated lumens, and 20% below "the light output of the lamp", and whether that value is 80% or greater, thereby meeting the requirement.
- b) The percent that passed the DimLO requirements (Specs # 12.2) by staying at or below 20% of MaxLO and whether that value is 80% or greater, thereby meeting the requirement.
- c) The number of tests in which periodic frequency could not be measured, and how many passed the percent flicker requirements.
- d) The number of tests in which periodic frequency were measured, and how many passed the flicker index requirement.

e) The combined percent of c) and d) above, and whether that value is 80% or greater, thereby meeting the requirement.

7) Recommendation for an additional parameter:

The three lamps on each dimmer circuit not being measured should be monitored visually for obvious deviations, such as visible flicker or inability to dim to 20%. If these deviations occur, it should cause a fail status of the specific test.

8) Recommendation for an additional test:

Measure the chromaticity coordinates for the lamp model in a one lamp per circuit configuration at the representative DimLO level. Record the coordinates and determine whether the light color falls within the MacAdam Ellipse at the designated CCT.

This test is to ensure color shift is not significant at dimmed states.

### **Specification:**

1) Section 12.1

The phrase “or fall below the light output of the lamp by more than 20%” is unclear. Does it mean 20% of the rated light output of the lamp or 20% of the baseline light output of the lamp?

2) Section 12.1 and Section 12.2

In the Supplemental Testing Guidance column, explain something like this:

The measurements for this test are taken during the procedure for flicker testing.

3) Section 12.3

In the Supplemental Testing Guidance column, explain something like this:

For testing 4 lamps per circuit, only one of the 4 lamps will be measured. The other 3 will be on the same dimming circuit, but isolated so as not to be measured.

40 Flicker Index measurements will be taken (10 with one lamp per circuit, 10 with 4 lamps per circuit). A stabilization period that is generally in the range of \_\_\_ to \_\_\_ minutes, is required between each measurement. During the Flicker test procedure, measurements to fulfill 12.1 and 12.2 are also taken.

Recommendation for an additional specification:

- 1) When tested in a one lamp per dimming circuit configuration at the representative DimLO level, the lamp must demonstrate chromaticity within a 7 Step MacAdam ellipse for the nominal CCT. If there is a problem for CFLs to meet this requirement, then limit it to dimmable LEDs.

Also, it is possible some LEDs will be designed to shift to warmer CCTs at dimmed states. It might be acceptable to include some tolerances for shifts horizontally to the right on the planckian locus for a product if the package is labeled as dimming to a warmer light color.

(Note: if in the future a 4 step ellipse is adopted for full light output, it might be OK to keep a 7 step ellipse for the standard at DimLO, depending on the general ability of LED products to meet a 4 step at dimmed states. )

None of the dimmer manufacturers seem to use the words "Single phase shift", or "double phase shift", in their websites as types of dimmer switches, and in conversations with their technical support, they don't easily recognize the terms.

The dimmer manufacturers do use forward phase cut (but not forward phase shift). More frequently they refer to these as dimmers designed for incandescent lighting, leading edge, or triac dimmers.

I can't find the term "double phase shift" in reference to a dimmer switch anywhere. Consider changing the term to something more recognizable, explaining it, or removing it.

Please consider adding a line after the list of conditions something like "In adhering to the conditions above, LED lamps must be tested with at least one Reverse Phase dimmer for which LED compatibility is specified by the manufacturer, and one Forward Phase dimmer". I say this because with the current list, manufacturers can game the system. For example, based on the current list a lab could test an LED without ever connecting to a forward phase cut dimmer, if it is tested on a reverse phase dimmer and a voltage compensation leading edge dimmer. Similarly they can test an LED without ever connecting it to a reverse phase dimmer if they use a CFL dimmer, a forward phase cut dimmer, and a dimmer with pre-set levels, or microprocessor.

Are all dimmers that state compatibility with LEDs electronic low voltage reverse phase? If not, please add any other dimmer types that claim to be compatible to the list and specify them as such.

Thanks.

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