



NVLAP LAB CODE 201008-0



Test report of ENERGY STAR® Program Requirements for Luminaires V1.2---Non-Directional Luminaires

Report Number:	SET2014-05456
Report Type:	Final report
Test Date:	2014-06-04
Report Date:	2014-06-10
Product Model:	83750
Product Type:	Non-Directional ceiling Luminaires
Product Description:	120V/60Hz/18W CCT: 4000K
Manufacture:	P.Q.L., Inc.
Manufacture Address:	2285 Ward Avenue Simi Valley, CA 93065
Product Criteria:	ENERGY STAR® PROGRAM REQUIREMENTS FOR LUMINAIRES ---V1.2
Reference Standards:	<ul style="list-style-type: none">• ANSI/NEMA/ ANSLG C78.377-2008 :Specifications for the Chromaticity of Solid State Lighting Products .• ANSI/ANSLG C81.61-2009: Specifications for Bases (Caps) for Electric Lamps• ANSI/ANSLG C81.62-2009 : Lamp holders for Electric Lamps• ANSI C82.77-2002: Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment• ANSI/IEEE C62.41.1-2002:IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits• ANSI/IEEE C62.41.2-2002: IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits• ANSI/UL 1598-2008: Standard for Safety of Luminaires• ANSI/UL 1993-2011: Self-Ballasted Lamps and Lamp Adapters• ANSI/UL 8750-2009: Standard for Light Emitting Diode (LED)

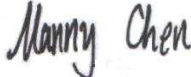

	<p>Equipment for Use in Lighting Products</p> <ul style="list-style-type: none"> • CIE Pub. No. 13.3-1995: Method of Measuring and Specifying Color Rendering of Light Sources • CIE Pub. No. 15:2004: Colorimetry • IES LM-79-08: Electrical and Photometric Measurements of Solid-State Lighting Products • IES LM-80-08: Measuring Lumen Maintenance of LED Light Sources • IES LM-82-12: IES Approved Method for the Characterization of LED Light Engines and Integrated LED Lamps for Electrical and Photometric Properties as a Function of Temperature • IES TM-21-11 : Projecting Long Term Lumen Maintenance of LED Sources
Test laboratory:	CCIC Southern Electronic Product Testing(Shenzhen) Co.,Ltd.
Lab Location:	Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China
	Tel: 86 755 26627338 Fax: 86 755 26627238
Tested By:	Manny Chen 
Reviewed By:	Xie Yu Zhang 

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1 – General Information

1.1 Product description for Equipment under Test (EUT)

Equipment under Test (EUT)	Rating	Manufacture	Test Model
Non-Directional ceiling Luminaires	120V/60Hz/ 18W	P.Q.L., Inc.	83750

Light source components	Number of LED Light source	Manufacture	Model
LED Package	108	Hongli	HL-A-2835DW-S1-08-HR3

1.2 Electrical Rating

Voltage	120V
Frequency	60Hz
Power	18W

1.3 Test Equipment List and Details

Device	Manufacture	Model No.	Serial No.	Calibration date	Calibration due date
Goniophotometric System	EVERFINE	GO-R5000	YG111493N12 040001	2014-03-21	2015-03-20
AC Power Source	ALL POWER	APW-105N	971499	2014-04-11	2015-04-10
Total Luminous Flux Standard Lamp	SENSING	24V/50W	LSD245033	2014-04-27	2015-04-26
Digital Power Meter	YOKOGAWA	WT210	91K310011	2014-04-28	2015-04-27
Integral Sphere	SENSING	Diameter 2.0M	A130301235	2014-03-22	2015-03-21
Optical Color and Electrical Measurement System	SENSING	SPR-3000	A130301237	2014-03-22	2015-03-21
Temperature/humidity/clock	Shanghai Meteorological Instrument Factory Co., Ltd.	J1-2B	808187	2013-12-13	2014-12-12
Temperature/humidity/clock	VICTOR	VC230	N/A	2014-04-11	2015-04-10
Digital Power Meter	EVERFINE	PF9811	G100696CJ732 1123	2014-04-27	2015-04-26
Frequency Converter	SZHPC	HPC-3190	0003458	2014-04-28	2015-04-27
Sound Level meter	N/A	AWA5661	N/A	2014-03-22	2015-03-21
Oscilloscope	Tektronix	TDS2024C	C014931	2014-05-28	2014-05-27

Statement of Traceability: CCIC Southern Electronic Product Testing attests that all calibration has been performed using suitable standards traceable to national primary standards and International System of Unit (SI).

2 – SUMMARY OF TEST RESULT

2.1 For Non-directionals Luminaires

Item	Measured	Result	Requirement
Luminaire Efficacy (initial)	99.506lm/W Test data obtained calculates from LM-82 report	pass	≥ 65 lm/W
Luminaire Light Output (initial)	1758.226lm Test data obtained calculates from LM-82 report	pass	≥ 800lm
Light Source Life and Lumen Maintenance	Projected L70 life: > 35000 hours 1 complete luminaire	pass	L70 lumen maintenance life shall be at least: <ul style="list-style-type: none"> • 25,000 hours for residential grade indoor luminaires • 35,000 hours for residential grade outdoor luminaires • 35,000 hours for commercial grade luminaires
Correlated Color Temperature	4220K Test data obtained calculates from LM-82 report	pass	Lamps shall have one of correlated color temperatures 2700, 3000, 3500, 4000Kelvin, 5000 Kelvin(commercial only). The luminaire shall fall within the corresponding 7-step chromaticity quadrangles as defined in ANSI/NEMA/ANSLG C78.377-2008.
CRI(Ra)	80.6 Test data obtained calculates from LM-82 report	pass	Ra ≥ 80

Item	Measured	Result	Requirement
<p>Color Maintenance</p>	<p><0.007(0-6000 hours) Gained from LM-80 report, refer to attachment A for LM-80 report summary.</p>	<p>pass</p>	<p>For all LM-80 samples, at any measurement point from zero through 6,000 hours, the distance of the chromaticity coordinates from the initial (zero-hour)chromaticitycoordinates shall not exceed 0.007 at the temperature(s) adjacent to the measured in situ TMPLED temperature, and at the corresponding drive current.</p>
<p>Source Start Time(s)</p>	<p>0.357s 3 complete luminaires measured</p>	<p>pass</p>	<p>Light source shall remain continuously illuminated within one second of application of electrical power. All samples shall pass.</p>
<p>Dimming Requirements</p>	<p>N/A</p>	<p>N/A</p>	<p>The luminaire and its components shall provide continuous dimming from 100% to 35% of total light output. Step dimming, if employed, shall provide at least two discrete light output levels $\geq 35\%$ of total light output and not including 100% output. All samples shall pass.</p>
<p>Power Factor</p>	<p>0.969 Test data obtained calculates from LM-82 report</p>	<p>pass</p>	<p>Total luminaire input power less than or equal to 5 watts: PF ≥ 0.5 Total luminaire input power greater than 5 watts: Residential: PF ≥ 0.7 Commercial: PF ≥ 0.9 All samples shall pass.</p>
<p>Off-State Power Consumption</p>	<p>0.0 W 1 complete luminaire measured</p>	<p>pass</p>	<p>Luminaires incorporating an integral method of switching shall not draw power in the off state.</p>

Item	Measured	Result	Requirement
Transient Protection	3 complete luminaires measured.	pass	The line transient shall consist of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode. All samples shall pass.
Operating Frequency	120.2Hz 3 complete luminaire measured.	pass	Frequency ≥ 120 Hz. All samples shall pass.
Noise Requirements	18.2 dBA 1 complete luminaire measured.	pass	All ballasts & drivers used within the luminaire shall have a Class A sound rating. Ballasts and drivers are recommended to be installed in the luminaire in such a way that in operation, the luminaire will not emit sound exceeding a measured level of 24 dBA.
Maximum Driver Case Temperature	57.5°C 1 complete luminaire measured.	pass	Measured temperature at the TMPC shall be less than or equal to the manufacturer recommended temperature
Minimum Operating Temperature	The luminaire can be operated normally at -18°C 1 complete luminaire measured.	pass	Luminaire shall have a minimum operating temperature of 0°F (-18°C) or below.

Note: The test data was only good for the test sample. It may have deviation for other test sample.

3 - Test Method

3.1 Initial Photometric and Electrical Parameters

2.1.1 The samples were tested with no seasoning. Before measurements were taken, the sample was operated for about 2 hours to reach stabilization and temperature equilibrium. It was judged that stability is reached when the variation (maximum -minimum) of at least 3 readings of the light output and electrical power over a period of 30min, taken 15 minutes apart, is less than 0.5%. The ambient temperature in the whole test process was kept in $25 \pm 1^\circ \text{C}$, and the samples were in its designated orientation for all the measurements.

3.1.2 The samples were first subjected to color, lumen output and electrical parameters measurement by spectroradiometer with 2 meters integrated sphere (4π) and power analyzer.

3.1.3 After integrated sphere test, one of the samples was removed to a mirror-type goniophotometer (Type C) with photometer ($f1 < 1.5\%$) for light distribution test. The angle interval was settled based on the sample beam angle, and horizontal angle interval was 15° , vertical angle interval was 5° .

3.1.4 After luminous intensity distribution test, the same sample was subjected to color spatial uniformity measurement by the same goniophotometer with another colorimeter. The horizontal angle interval was 90° , however the vertical was 1° .

3.2 Minimum Starting Temperature

The samples were placed in chamber of -18°C to verify if can be normally operated or not. A low temperature chamber was used for the measurement.

3.3 Start Time Test

3.3.1 Start time was measured by digital oscilloscope and photometer.

3.3.2 The ambient temperature in the whole test process was kept in $25 \pm 1^\circ \text{C}$, and the samples were in its designated orientation for start time test.

3.4 In Situ Temperature Measurement Test

3.4.1 The LED module and driver used in the luminaire were tested in accordance with ANSI/UL 1598-2008 and ANSI/UL 8750-2009.

3.4.2 Thermocouples were in contact with the TMPLD location described in LM-80 test report and TMPC location of LED driver as detailed by manufacture. In order to gain the maximum temperature, if appropriate, more than one thermocouple was contact in these locations.

3.4.3 The sample was mounted in the test alcove, in contact with the two walls and top of the alcove which in accordance with UL 1598.

3.4.4 The sample was operated for 7.5 hours to obtain constant temperatures, an Agilent data logger was used for data recording.

3.4.5 The ambient temperature was kept in $25 \pm 5^\circ \text{C}$, and final measured values were normalized to an ambient of 25°C . The sample was in its designated orientation.

3.5 Transient Protection Test

3.5.1 The line transient was consisting of seven strikes of a 100 kHz ring wave, 2.5 kV level, for both common mode and differential mode.

3.5.2 The ambient temperature was kept in $25 \pm 5^{\circ}$ C, and the sample was in its designated orientation.

3.6 Operating Frequency

3.6.1 The sample light output waveform was measured by oscilloscope with a photodetector.

3.6.2 The test was conducted at normal operation and dimming operation at all light output levels.

3.6.3 The ambient temperature was kept in $25 \pm 1^{\circ}$ C, and the sample was in its designated orientation.

3.7 Audible Noise Test

3.7.1 The sample was operated in centre of an anechoic room with a background noise lower than 15 dBA. The microphone was located in 30 cm distance from center of the sample in different directions, and maximum value was used as the test result.

3.7.2 The ambient temperature was kept in $25 \pm 5^{\circ}$ C, and the sample was in its designated orientation.

3.8 Dimming test

3.8.1 The sample was connected with a customer recommended dimmer firstly.

3.8.2 Then adjust the dimmer to measure the light output dimming range by a photometer.

3.8.3 The ambient temperature was kept in $25 \pm 1^{\circ}$ C, and the sample was in its designated orientation.

4 – Test Data

4.1 TMP verification of LEDs inside integral lamp declared drive current test(Requirements for Interim Qualification with IES LM-80-08 and TMP Verification)

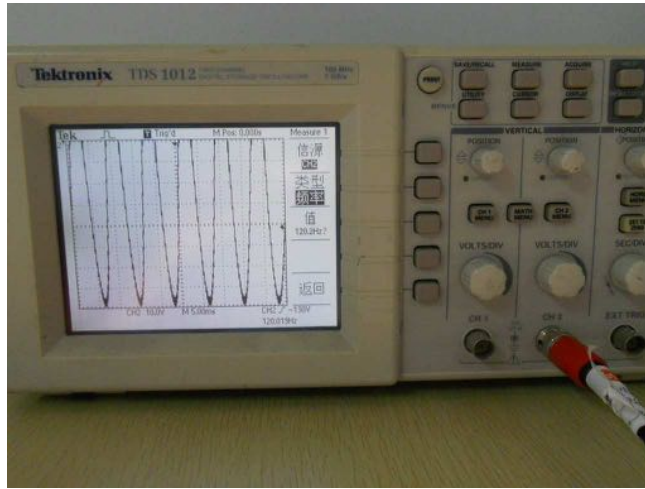
TMP verification of LEDs inside integral lamp + declared drive current				
Sample No.	TMP verification of LEDs inside integral lamp		Declared drive current of LEDs inside integral lamp	
S2	Measured(°C)	LM-80 Reported Ts(°C)	Measured(mA)	Lm-80 Declared Driver Current of LED(mA)
	48.2	85	50	150
Result	48.2°C < 85.0°C PASS		50mA < 150mA PASS	

4.2 LED Operating Frequency and Noise Test

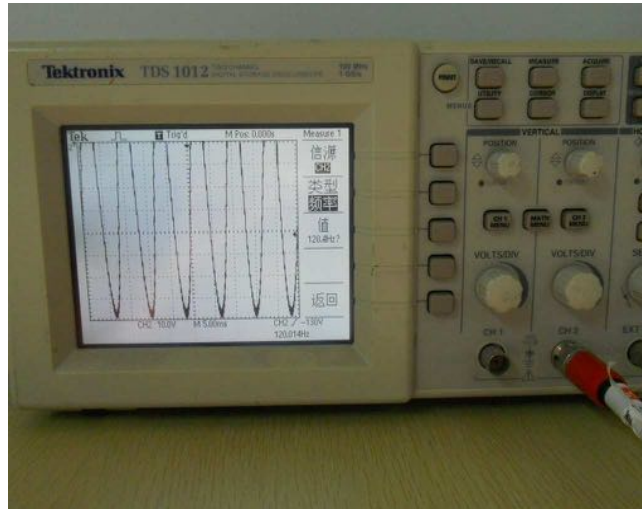
Sample No.	Base Orientation	LED Operating Frequency (Hz)	Noise Test
S1	Base up	120.2	17.8
S2	Base up	120.4	18.3
S3	Base up	120.1	18.5
AVG	Base up	120.2	18.2

4.3 Minimum Operating Temperature

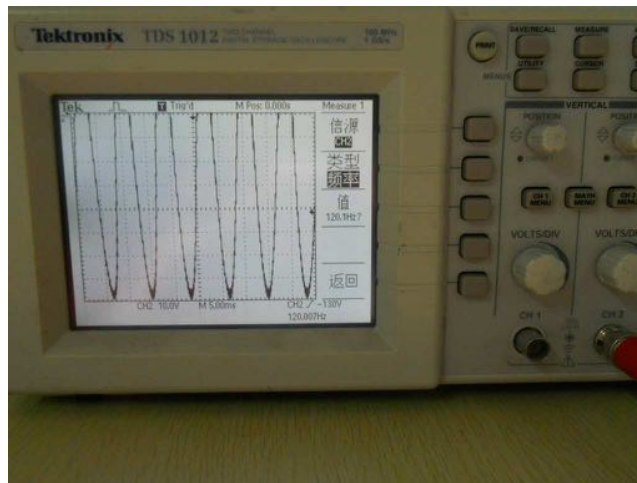
Minimum Operating Temperature Test (°C)	
Sample No.	Minimum Operating Temperature Test (°C)
S1	-18°C



Picture 1 :83750 S01



Picture 2 :83750 S02



Picture 3 :83750 S03

4.4 Transient Protection Test

Sample NO.	Transient Protection Test
S1	PASS
S2	PASS
S3	PASS

4.5 Photometric and Electrical Data

Sample No.	Power (W)	PF	CCT (K)	CRI	Luminaire Efficacy (lm/w)	Light output(lm)
S1	17.67	0.97	4220	80.6	99.514	1758.741
S2	17.67	0.969	4220	80.6	99.500	1757.814
S3	17.67	0.969	4220	80.6	99.505	1758.123
Avg	17.67	0.969	4220	80.6	99.506	1758.226

4.6 Maximum Measured Ballast or Driver Case Temperature Test

Maximum Measured Ballast or Driver Case Temperature		
Sample No.	Maximum Temperature Test (°C)	Manufacturer Recommended Temperature(°C)
S02	57.5	75
Result	57.5°C < 75°C PASS	

4.7 Source Start Time Data

Sample NO.	Start time (ms)
S1	350.2
S2	400.5
S3	320.4
Average	357.0

4.8 Dimming Test (N/A)

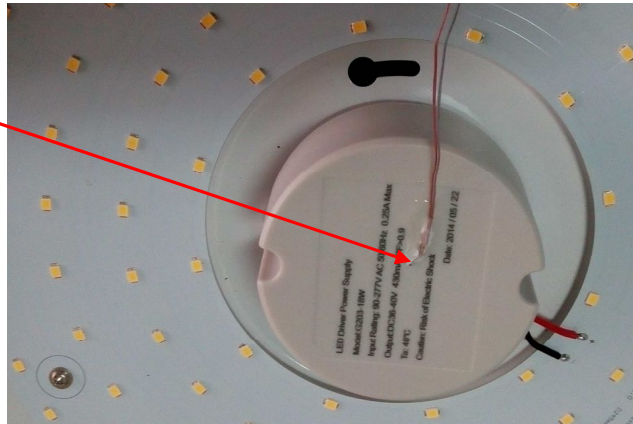
Sample NO.	Dimming range
S1	N/A
S2	N/A
S3	N/A

4.9 Tb location temperature

Sample NO.	Tb location temperature
S1	49.3
S2	49.6
S3	49.5

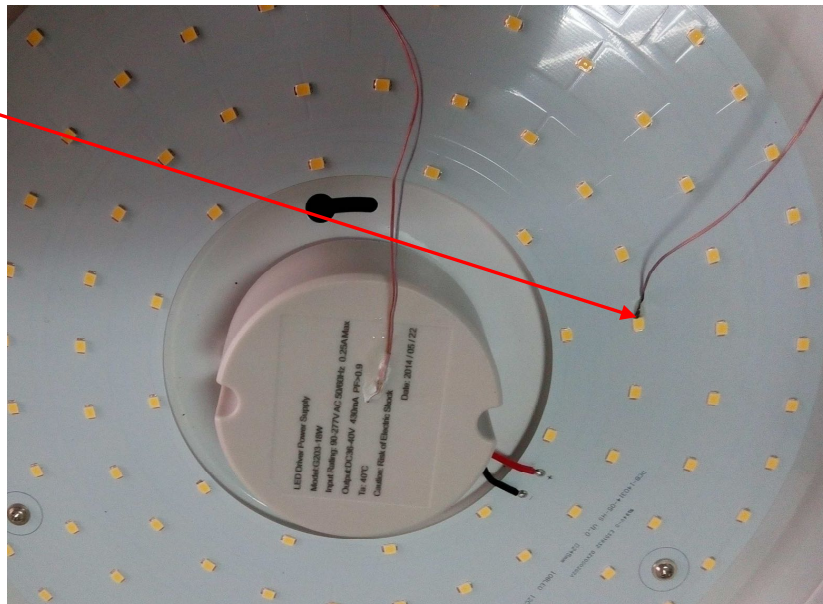
4.10 Maximum Measured Power Supply Case Temperature

Case Temperature Point



4.11 In-situ photo Ts

Ts location



Attachment A –EUT PHOTO



Attachment B – LM-80 Report

Attachment C LED LM-80 Report Summary

Report originated by	Bay Area Compliance Laboratories Corp.
Manufactured by	Guangzhou Hongli Opto-Electronic Co.,Ltd
LM-80 report No.	RSZ120424502-10-M4
LED Model	HL-A-2835DW-S1-08-HR3
LED Part Number	HL-A-2835DW-S1-08-HR3
Number of LED light source tested	25 units
Drive Current	150mA

Case temperature	55° C	75° C	85° C
6000 hours lumen maintenance	97.34%	96.95%	95.19
6000 hours color maintenance($\Delta u' v'$)	0.0009	0.0009	0.0011

Attachment D TM-21 Report

Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)					
Test Condition 1 - 55° C Case		Test Condition 2 - 75° C Case		Test Condition 3 - 85° C Case	
Sample size	25	Sample size	25	Sample size	25
Number of failures	0	Number of failures	0	Number of failures	0
DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150	DUT drive current used in the test (mA)	150
Test duration (hours)	6,000	Test duration (hours)	6,000	Test duration (hours)	6,000
Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000	Test duration used for projection (hour to hour)	1,000 - 6,000
Tested case temperature (° C)	55	Tested case temperature (° C)	75	Tested case temperature (° C)	85
α	5.773E-06	α	6.474E-06	α	1.050E-05
B	1.008	B	1.009	B	1.014
Calculated L70(6k) (hours)	63,000	Calculated L70(6k) (hours)	56,000	Calculated L70(6k) (hours)	35,000
Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	>36000	Reported L70(6k) (hours)	35,000

----End of report----