NVLAP LAB CODE 200960-0

IES LM-80-08 Test Report

For

Bridgelux Inc.

101 Portola Avenue, Livermore, CA 94551
USA

3V, 60mA LED Chip
Model: BXEN-27E-11L-3A

Laboratory: Leading Testing Laboratories
NVLAP CODE: 200960-0
3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist, Hangzhou, Zhejiang Province, China 311100
Tel: +86 571 86376106
www.ledtestlab.com

Report No.: HZ16090030a/R3
This report is replaced by the old report HZ16090030a/R2 dated Oct. 24, 2016
The test data in this report base on the report HZ15020020q dated Jun. 22 2016

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

Test specifications:	
Date of Receipt	: Feb. 03, 2015
Date of Test	: Feb. 10, 2015 to Jun. 14, 2016
Test item	: 10000 hours Lumen Maintenance, 10000 hours Chromaticity Shift
Reference Standard	: IES LM-80-2008 Approved Method for Measuring Lumen Maintenance of LED Light Source

Review by: April Zou

Engineer: April Zou
Oct. 25, 2016

Approved by: Jim Zhang

Manager: Jim Zhang
Oct. 25, 2016

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Quality Assured

Test Summary

Model Number: BXEN-27E-11L-3A

Rated Ts (℃)	Measured Ts(℃)	Drive Current (A)	Number of LED Light Sources Tested	Average Lumen Maintenance (%) at 10000 hours	Average Chromaticity (Δu'v') at 10000 hours
105	104	0.06	25	97.0%	0.0020

IES LM-80-08 Test Report Requirement:

1. Number of LED Light Sources Tested

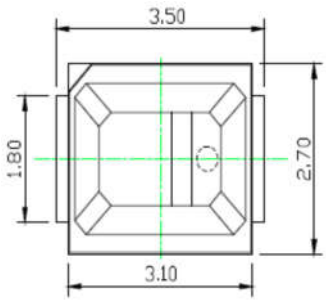
See test summary.

2. Description of LED light sources

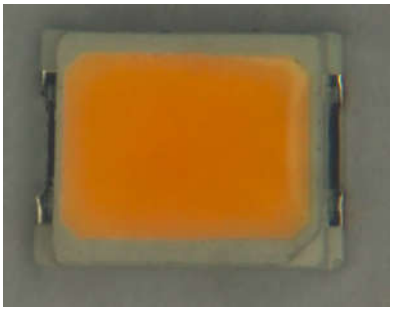
Device under test is LED package with model number: BXEN-27E-11L-3A, Nominal CCT 2700K.
The BXEN-27E-11L-3A part number covers all the BXEN part numbers in the following list.

CRI70	CRI80	CRI90
BXKN-27C-11L-3A	BXKN-27E-11L-3A	BXKN-27G-11L-3A
BXKN-30C-11L-3A	BXKN-30E-11L-3A	BXKN-30G-11L-3A
BXKN-35C-11L-3A	BXKN-35E-11L-3A	BXKN-35G-11L-3A
BXKN-40C-11L-3A	BXKN-40E-11L-3A	BXKN-40G-11L-3A
BXKN-50C-11L-3A	BXKN-50E-11L-3A	BXKN-50G-11L-3A
BXKN-57C-11L-3A	BXKN-57E-11L-3A	BXKN-57G-11L-3A
BXKN-65C-11L-3A	BXKN-65E-11L-3A	BXKN-65G-11L-3A
CRI70	CRI80	CRI90
BXKN-27C-11L-3B	BXKN-27E-11L-3B	BXKN-27G-11L-3B
BXKN-30C-11L-3B	BXKN-30E-11L-3B	BXKN-30G-11L-3B
BXKN-35C-11L-3B	BXKN-35E-11L-3B	BXKN-35G-11L-3B
BXKN-40C-11L-3B	BXKN-40E-11L-3B	BXKN-40G-11L-3B
BXKN-50C-11L-3B	BXKN-50E-11L-3B	BXKN-50G-11L-3B
BXKN-57C-11L-3B	BXKN-57E-11L-3B	BXKN-57G-11L-3B
BXKN-65C-11L-3B	BXKN-65E-11L-3B	BXKN-65G-11L-3B
CRI70	CRI80	CRI90
BXEN-27C-11M-3B	BXEN-27E-11M-3B	BXEN-27G-11M-3B
BXEN-30C-11M-3B	BXEN-30E-11M-3B	BXEN-30G-11M-3B
BXEN-35C-11M-3B	BXEN-35E-11M-3B	BXEN-35G-11M-3B
BXEN-40C-11M-3B	BXEN-40E-11M-3B	BXEN-40G-11M-3B
BXEN-45C-11M-3B	BXEN-45E-11M-3B	BXEN-45G-11M-3B
BXEN-50C-11M-3B	BXEN-50E-11M-3B	BXEN-50G-11M-3B
BXEN-57C-11M-3B	BXEN-57E-11M-3B	BXEN-57G-11M-3B
BXEN-65C-11M-3B	BXEN-65E-11M-3B	BXEN-65G-11M-3B

CRI70	CRI80	CRI90
BXEN-27C-21L-3B	BXEN-27E-21L-3B	BXEN-27G-21L-3B
BXEN-30C-21L-3B	BXEN-30E-21L-3B	BXEN-30G-21L-3B
BXEN-35C-21L-3B	BXEN-35E-21L-3B	BXEN-35G-21L-3B
BXEN-40C-21L-3B	BXEN-40E-21L-3B	BXEN-40G-21L-3B
BXEN-50C-21L-3B	BXEN-50E-21L-3B	BXEN-50G-21L-3B
BXEN-57C-21L-3B	BXEN-57E-21L-3B	BXEN-57G-21L-3B
BXEN-65C-21L-3B	BXEN-65E-21L-3B	BXEN-65G-21L-3B
CRI70	CRI80	CRI90
BXEN-27C-11L-3A	BXEN-27E-11L-3A	BXEN-27G-11L-3A
BXEN-30C-11L-3A	BXEN-30E-11L-3A	BXEN-30G-11L-3A
BXEN-35C-11L-3A	BXEN-35E-11L-3A	BXEN-35G-11L-3A
BXEN-40C-11L-3A	BXEN-40E-11L-3A	BXEN-40G-11L-3A
BXEN-45C-11L-3A	BXEN-45E-11L-3A	BXEN-45G-11L-3A
BXEN-50C-11L-3A	BXEN-50E-11L-3A	BXEN-50G-11L-3A
BXEN-57C-11L-3A	BXEN-57E-11L-3A	BXEN-57G-11L-3A
BXEN-65C-11L-3A	BXEN-65E-11L-3A	BXEN-65G-11L-3A



Tolerance: ±0.25mm



Quality Assured

3. Description of auxiliary equipment

Test Equipment	Model	Calibration Date	Calibration Due Date
Lifetest thermal chamber	NMT 830	Jul. 16, 2016	Jul. 15, 2017
Lifetest thermal chamber	NMT 830	Jul. 17, 2015	Jul. 16, 2016
Lifetest thermal chamber	NMT 830	Jul. 18, 2014	Jul. 17, 2015
Lifetest data recorder	GRAPHTEC GL820	Jul. 16, 2016	Jul. 15, 2017
Lifetest data recorder	GRAPHTEC GL820	Jul. 17, 2015	Jul. 16, 2016
Lifetest data recorder	GRAPHTEC GL820	Jul. 18, 2014	Jul. 17, 2015
Photometric test current source	Itech IT6154	Jul. 16, 2016	Jul. 15, 2017
Photometric test current source	Itech IT6154	Jul. 17, 2015	Jul. 16, 2016
Photometric test current source	Itech IT6154	Jul. 18, 2014	Jul. 17, 2015
Photometric test system	0.5m Integrate Sphere system	Jul. 16, 2016	Jul. 15, 2017
Photometric test system	0.5m Integrate Sphere system	Jul. 17, 2015	Jul. 16, 2016
Photometric test system	0.5m Integrate Sphere system	Jul. 18, 2014	Jul. 17, 2015
Standard Lamp	10W	Jul. 16, 2016	Jul. 15, 2017
Standard Lamp	10W	Sep. 22, 2015	Sep. 21, 2016
Standard Lamp	10W	Sep. 23, 2014	Sep. 22, 2015

4. Operating cycle

LEDs are driven with a constant direct current (DC).

5. Ambient conditions including airflow, temperature, and relative humidity

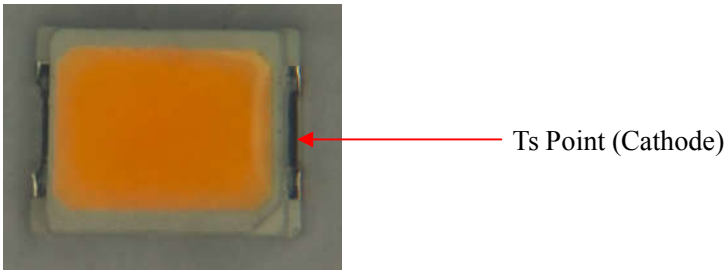
Ambient Temperature (Ta): See Tables

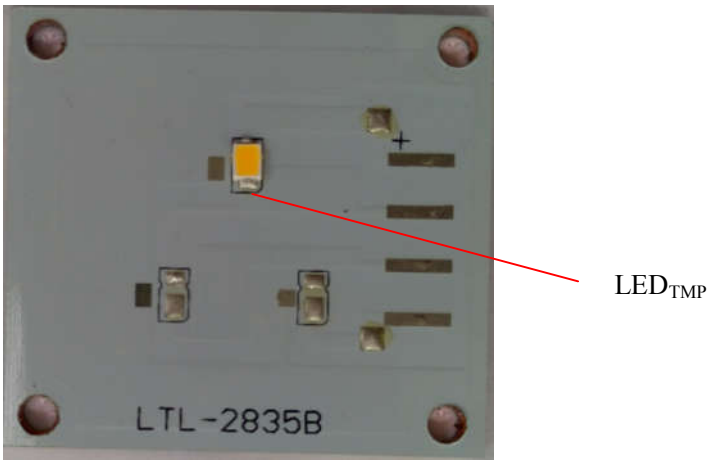
Humidity: <65%

No force air flow

6. Case temperatures (test point temperature)

In all cases, both Tsand Ta meet the IES LM-80-08 limits.





7. Drive current of the LED light source during Lumen maintenance test.
See tables.

8. Initial luminous flux and forward voltage at photometric measurement current
See tables.

9. Lumen maintenance for data for each individual light source along with median value, standard deviation, minimum and maximum lumen maintenance value for all of the light sources
See tables.

10. Observation of LED light source failures including the failure conditions and time of failure
No failures observed.

11. LED light source monitoring interval
See tables

12. Photometric measurement uncertainty
Flux measurement: 1.06% (k=2)

13. Chromaticity shift reported over the measurement time
See tables.

14. Sampling Method/Sample size
IES LM-80 tests require LED samples to be operated at drive current 60mA, one temperatures of 105C chosen by the LED manufacturer.
25 pieces of LED samples are selected randomly from different production date of products. These samples are picked to represent a wide parametric distribution.

Quality Assured

Test Result:

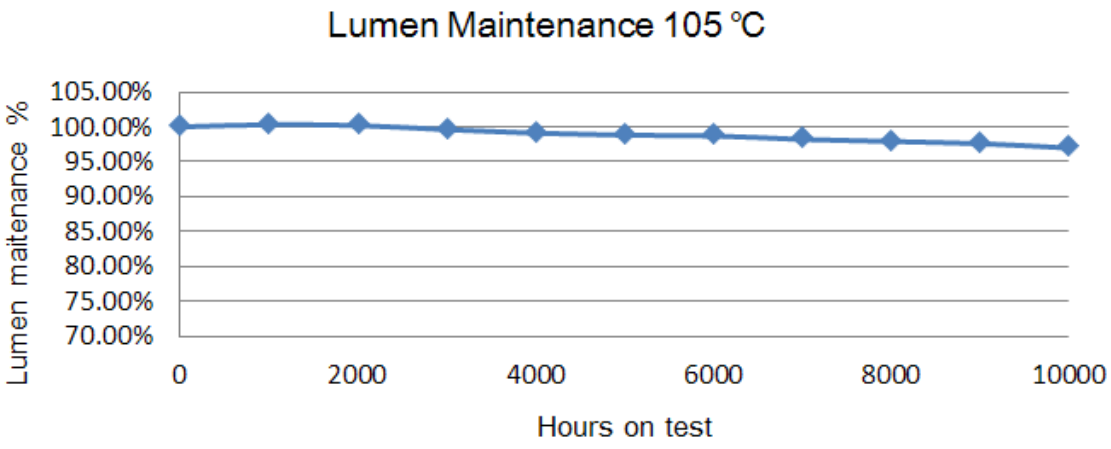
Model Number: BXEN-27E-11L-3A

Case temperature: **105℃**

Drive current: 0.06 A

Lumen Maintenance Data:

Sample No.	0h		Lumen Maintenace (%)									
	Vf (V)	Flux (lm)	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	2.90	23.85	100.2%	100.0%	99.3%	98.7%	98.5%	98.4%	97.8%	97.3%	97.0%	96.5%
2	2.89	21.71	100.4%	100.1%	99.6%	99.0%	98.7%	98.6%	98.3%	97.8%	97.4%	96.7%
3	2.89	21.37	100.0%	99.9%	99.1%	98.5%	98.3%	98.1%	97.6%	97.3%	97.0%	96.2%
4	2.89	23.55	99.9%	99.6%	98.9%	98.5%	98.3%	98.1%	97.7%	97.2%	97.0%	96.4%
5	2.92	24.78	99.7%	99.5%	99.1%	98.5%	98.2%	98.0%	97.6%	97.3%	97.1%	96.4%
6	2.89	23.12	100.4%	100.2%	99.8%	99.3%	99.0%	98.8%	98.4%	98.1%	97.7%	96.8%
7	2.87	21.27	101.5%	101.3%	100.8%	100.4%	100.0%	99.9%	99.4%	99.2%	98.9%	98.6%
8	2.87	20.97	101.7%	101.6%	101.0%	100.5%	100.3%	100.1%	99.6%	99.2%	98.8%	98.6%
9	2.87	24.00	99.9%	99.7%	99.0%	98.4%	98.2%	98.1%	97.6%	97.2%	96.9%	96.3%
10	2.85	24.15	101.1%	100.8%	100.4%	99.7%	99.5%	99.4%	99.1%	98.8%	98.6%	97.8%
11	2.89	24.61	99.4%	99.2%	98.6%	98.0%	97.8%	97.7%	97.3%	96.9%	96.6%	95.7%
12	2.90	24.98	99.6%	99.4%	98.9%	98.4%	98.2%	98.0%	97.7%	97.4%	97.2%	96.5%
13	2.85	24.57	99.8%	99.6%	98.9%	98.5%	98.3%	98.2%	97.9%	97.5%	97.2%	96.8%
14	2.87	21.29	99.8%	99.8%	99.3%	98.8%	98.7%	98.6%	98.0%	97.7%	97.4%	96.7%
15	2.87	24.49	101.4%	101.3%	100.7%	100.3%	100.1%	99.9%	99.3%	99.0%	98.6%	98.3%
16	2.88	23.06	100.0%	99.9%	99.4%	98.9%	98.6%	98.4%	98.0%	97.8%	97.4%	96.9%
17	2.87	23.67	100.4%	100.3%	99.8%	99.4%	99.0%	98.8%	98.4%	97.9%	97.7%	97.3%
18	2.90	22.81	101.2%	100.9%	100.3%	99.9%	99.7%	99.6%	99.1%	98.7%	98.3%	97.8%
19	2.91	23.41	100.3%	100.2%	99.6%	99.1%	98.9%	98.8%	98.2%	97.8%	97.5%	96.7%
20	2.89	24.13	100.1%	99.9%	99.2%	98.6%	98.4%	98.2%	97.9%	97.6%	97.3%	96.6%
21	2.91	23.5	100.5%	100.0%	99.8%	99.2%	99.6%	98.4%	98.2%	98.6%	98.1%	95.9%
22	2.9	21.89	100.1%	99.2%	99.5%	99.4%	99.1%	99.2%	98.4%	98.2%	98.1%	97.9%
23	2.85	24.06	100.2%	100.0%	100.7%	99.3%	98.6%	97.9%	97.2%	98.1%	98.5%	98.4%
24	2.89	22.45	99.5%	101.3%	100.5%	100.3%	98.0%	98.5%	97.9%	97.1%	96.9%	96.6%
25	2.86	24.75	101.1%	101.2%	98.6%	98.2%	99.0%	99.3%	99.3%	97.5%	96.9%	97.7%
Avg	2.88	23.30	100.3%	100.2%	99.6%	99.1%	98.8%	98.7%	98.2%	97.9%	97.6%	97.0%
Max	2.92	24.98	101.7%	101.6%	101.0%	100.5%	100.3%	100.1%	99.6%	99.2%	98.9%	98.6%
Min	2.85	20.97	99.4%	99.2%	98.6%	98.0%	97.8%	97.7%	97.3%	96.9%	96.6%	95.7%



Quality Assured

Model Number: BXEN-27E-11L-3A
Case temperature: **105**℃
Drive current: 0.06 A
Chromaticity Shift Data:

Sample No.	0h			Chromaticity Shift									
	u'	v'	CCT K	1000h	2000h	3000h	4000h	5000h	6000h	7000h	8000h	9000h	10000h
1	0.2591	0.5313	2755	0.0009	0.0009	0.0013	0.0015	0.0017	0.0016	0.0018	0.002	0.0023	0.0027
2	0.2608	0.5343	2708	0.0013	0.0016	0.0017	0.0016	0.0017	0.0019	0.002	0.0023	0.0026	0.0026
3	0.2598	0.5308	2743	0.0006	0.0006	0.0005	0.0011	0.001	0.0011	0.0012	0.0015	0.0018	0.0022
4	0.2605	0.5326	2721	0.001	0.0013	0.0011	0.0014	0.0012	0.0015	0.0015	0.0017	0.002	0.0023
5	0.2574	0.5311	2791	0.0009	0.001	0.0008	0.0012	0.0011	0.0011	0.0015	0.0018	0.0021	0.0021
6	0.2596	0.5295	2752	0.0008	0.001	0.0012	0.0013	0.0012	0.0015	0.0015	0.0018	0.0021	0.0021
7	0.2614	0.5326	2701	0.0006	0.0005	0.0006	0.0006	0.0008	0.0009	0.0012	0.0015	0.0018	0.0019
8	0.2606	0.5324	2719	0.0007	0.0006	0.0008	0.0008	0.0011	0.0013	0.0012	0.0014	0.0017	0.0016
9	0.2632	0.5315	2670	0.001	0.0011	0.0011	0.0012	0.0011	0.001	0.0014	0.0016	0.0019	0.0022
10	0.2602	0.5335	2723	0.0001	0.0001	0.0002	0.0005	0.0004	0.0006	0.0006	0.0009	0.0011	0.0013
11	0.2606	0.5297	2730	0.0009	0.0007	0.0005	0.0011	0.001	0.001	0.0014	0.0016	0.0018	0.0021
12	0.2589	0.5331	2751	0.0007	0.0009	0.0007	0.0011	0.0012	0.0015	0.0014	0.0017	0.002	0.002
13	0.2613	0.5318	2706	0.0008	0.001	0.0008	0.0012	0.0011	0.0013	0.0015	0.0018	0.0021	0.0025
14	0.2597	0.5335	2733	0.0009	0.0009	0.0008	0.0007	0.0008	0.0008	0.0012	0.0015	0.0018	0.0017
15	0.2585	0.5334	2757	0.0004	0.0003	0.0004	0.0006	0.0006	0.001	0.0009	0.0012	0.0014	0.0017
16	0.2612	0.5328	2705	0.0007	0.0008	0.0012	0.0013	0.0013	0.0017	0.0016	0.0019	0.0022	0.0025
17	0.2604	0.5314	2727	0.0006	0.0007	0.0006	0.0008	0.0009	0.001	0.0011	0.0014	0.0017	0.0017
18	0.2611	0.5312	2714	0.0002	0.0002	0.0005	0.0009	0.0008	0.0012	0.0012	0.0015	0.0018	0.0017
19	0.2583	0.5320	2768	0.001	0.0009	0.0013	0.0014	0.0011	0.0013	0.0016	0.0018	0.0021	0.0023
20	0.2583	0.5305	2774	0.0006	0.0011	0.0011	0.0014	0.0014	0.0015	0.0016	0.0018	0.0021	0.0022
21	0.2631	0.5330	2666	0.0004	0.0011	0.0005	0.001	0.0009	0.0008	0.0014	0.0019	0.0017	0.002
22	0.2631	0.5318	2671	0.0006	0.0009	0.0011	0.0005	0.0016	0.0007	0.001	0.001	0.002	0.0015
23	0.2605	0.5305	2729	0.0009	0.0009	0.0007	0.0011	0.0017	0.0015	0.0018	0.0011	0.0013	0.0018
24	0.2586	0.5306	2768	0.0009	0.0016	0.0014	0.0006	0.0013	0.0016	0.0016	0.0019	0.0026	0.0021
25	0.2602	0.5302	2736	0.0007	0.0004	0.0016	0.0014	0.0005	0.0012	0.0009	0.0009	0.0019	0.0015
Avg	0.2603	0.5318	2729	0.0007	0.0008	0.0009	0.0011	0.0011	0.0012	0.0014	0.0016	0.0019	0.0020
Max	0.2632	0.5343	2791	0.0013	0.0016	0.0017	0.0016	0.0017	0.0019	0.0020	0.0023	0.0026	0.0027
Min	0.2574	0.5295	2666	0.0001	0.0001	0.0002	0.0005	0.0004	0.0006	0.0006	0.0009	0.0011	0.0013

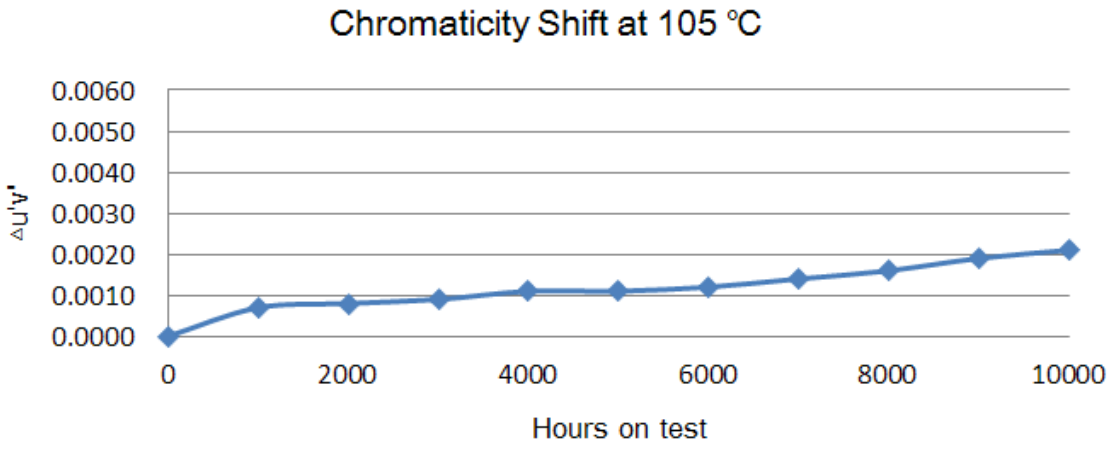


Table 1: Report at each LM-80 Test Condition					
Description of LED Light Source Tested (manufacturer, model, catalog number)	Bridgelux. BXEN-27E-11L-3A				
Test Condition 1 - 105^{0}C Case Temp					
Sample size	25	Sample size	-	Sample size	-
Number of failures	0	Number of failures	-	Number of failures	-
DUT drive current used in the test (mA)	60	DUT drive current used in the test (mA)	-	DUT drive current used in the test (mA)	-
Test duration (hours)	10,000	Test duration (hours)	-	Test duration (hours)	-
Test duration used for projection (hour to hour)	5,000 - 10,000	Test duration used for projection (hour to hour)	-	Test duration used for projection (hour to hour)	-
Tested case temperature (^{0}C)	105	Tested case temperature (^{0}C)	-	Tested case temperature (^{0}C)	-
α	3.79E-06	α	-	α	-
B	1.01	B	-	B	-
Calculated L70(10k) (hours)	96000	Calculated L70(10k) (hours)	-	Calculated L70(10k) (hours)	-
Reported L70(10k) (hours)	>60000	Reported L70(10k) (hours)	-	Reported L70(10k) (hours)	-

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200960-0

Leading Testing Laboratories

Hangzhou
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Energy Efficient Lighting Products

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2015-12-07 through 2016-12-31
Effective Dates

DEPARTMENT OF COMMERCE • UNITED STATES OF AMERICA •

For the National Voluntary Laboratory Accreditation Program

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 200960-0

Leading Testing Laboratories

Hangzhou
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Energy Efficient Lighting Products

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2015-01-01 through 2015-12-31
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program

Quality Assured

NVLAP® National Voluntary Laboratory Accreditation Program

ENERGY EFFICIENT LIGHTING PRODUCTS **NVLAP LAB CODE 200960-**

22/S24	ANSI C62.41.2:2002	IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
22/S28	IEC 62301:2011	Household Electrical Appliances - Measurement of Standby Power

SSL Life Tests

Code	*Designation*	*Description*
22/S08	IES LM-80:2008	Solid State Lighting Luminaires - Lumen Maintenance
22/S08a	IES LM-80:2015	Solid State Lighting Luminaires - Lumen Maintenance
22/S14	EPA Integral LED Lamps v. 1.4 (Appendix E)	ENERGY STAR® Elevated Temperature Testing for Integral LED Lamps
22/S18	EPA Lamps v. 1.0	Ambient Temperature Life Testing
22/S19	EPA Lamps v. 1.0	Elevated Temperature Life Testing
22/S25	IES LM-84:2014	Approved Method for Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires

End of the Report