IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

LIGHTNING OPTOELECTRNIC TECHNOLOGY (SZ) Co., LTD.

Building B.WenTao Technological Park. Yingrenshi Community. Shiyan Street. Baoan District.ShenZhen.518108 China

Model:T20

Report Type: 6000 Hours Interim Report	**Product Type:** LED Package
Test Engineer:	Daniel Duan
Report Number:	RSZ140322513-10-6000-M1
Test Date:	2014-04-08 to 2014-12-14
Report Date:	2015-01-04
Reviewed By:	Jeanne Han /EE Manager
Revised Note:	This version report "No. RSZ140322513-10-6000-M1" at 2015-01-04 replaced the previous report "No. RSZ140322513-10-6000" at 2014-12-18
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China. Tel: +86-0769-86858888 Fax:+86-0769-86858588

TABLE OF CONTENTS

1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: T20
Part Type: LED Package
Nominal CCT: 2700K
Test Driver Current: 100 mA

LIGHTNING OPTOELECTRNIC TECHNOLOGY (SZ) Co., LTD. declare that their LED products listed in the following table use the same LED chip, identical materials and identical construction processes.
According to program guidance from ENERGY STAR, warm white and cool white products can be covered by tested model.

The tested model and the other LED package which attest similarity are designed with identical material and identical construction processes. The differences between the tested model and the other LED package which attest similarity are only sizes. The tested model is the largest LED package, with the greatest number of LED dies, the smallest die spacing, the greatest power density, and listed in the following table:

Model Name	CCT (K)	CRI	Number of Dies	Current (mA)	Volt (V)	Series	Parallel	Current Per Die (mA)	Current Density (mA/mm^2)	Power Density (W/mm$^{2)}$
T2027811P-01AA	2700	80	1	100	3	1	1	100	517	1550
T2027811A-08125TMG	2700	80	1	100	3	1	1	100	395	1186
T2027811A-19125TMG	2700	80	1	100	3	1	1	100	344	1033
T2027811A-20125TMG	2700	80	1	100	3	1	1	100	304	912
T2027811A-10125TMG	2700	80	1	100	3	1	1	100	235	705
T2027811Q-01AA	2700	80	1	100	3	1	1	100	517	1550
T2027811Q-02AA	2700	80	1	90	3	1	1	90	517	1550
T2027811Q-03AA	2700	80	1	100	3	1	1	100	517	1550
T2030811Q-01AA	3000	80	1	100	3	1	1	100	517	1550
T2030811Q-02AA	3000	80	1	100	3	1	1	100	517	1550
T2030811Q-03AA	3000	80	1	100	3	1	1	100	517	1550
T2030811Q-04AA	3000	80	1	90	3	1	1	90	517	1550
T2035811Q-01AA	3500	80	1	100	3	1	1	100	517	1550

T2040811Q-01AA	4000	80	1	100	3	1	1	100	517	1550
T2040811Q-02AA	4000	80	1	100	3	1	1	100	517	1550
T2040811Q-03AA	4000	80	1	100	3	1	1	100	517	1550
T2040811Q-04AA	4000	80	1	100	3	1	1	100	517	1550
T2040811Q-05AA	4000	80	1	90	3	1	1	90	517	1550
T2050811Q-01AA	5000	80	1	100	3	1	1	100	517	1550
T2050811Q-02AA	5000	80	1	90	3	1	1	90	517	1550
T2065811Q-01AA	6500	80	1	100	3	1	1	100	517	1550
T2065811Q-02AA	6500	80	1	100	3	1	1	100	517	1550
T2065811Q-03AA	6500	80	1	100	3	1	1	100	517	1550
T2065811Q-04AA	6500	80	1	100	3	1	1	100	517	1550
T2065811Q-05AA	6500	80	1	100	3	1	1	100	517	1550
T2065811Q-06AA	6500	80	1	90	3	1	1	90	517	1550
T2040711Q-02AA	4000	70	1	100	3	1	1	100	517	1550
T2065711Q-02AA	6500	70	1	100	3	1	1	100	517	1550
T2027811A-05125TME	2700	80	1	90	3	1	1	90	517	1550

1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products(This test method was not accredited by IAS)

1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date

Integral Sphere	EVERFINE	Diameter 0.3m	1011119	380-780nm, Diameter:0.3m,0-1999Lumen	2014-03-04	2015-03-04
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2014-03-12	2015-03-12
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2013-12-26	2014-12-26
Standard Light Source	EVERFINE	D062	1011093	N/A	2014-05-06	2015-05-06
Precision digital stabilized DC power supply	EVERFINE	WY605	G115987CJ 7321114	300VA	2014-03-12	2015-03-12
LM-80 Aging equipment	BACL	N/A	#5	N/A	2014-03-19	2015-03-19
Adjustable constant-current DC switching power supply	GOTER	LLA1200111 2-U	#4	（120V/1A）	2014-12-04	2015-12-04
Adjustable constant-current DC switching power supply	GOTER	LLA1200111 2-U	#5	（120V/1A）	2014-12-04	2015-12-04
Adjustable constant-current DC switching power supply	GOTER	LLA1200111 2-U	#6	（120V/1A）	2014-12-04	2015-12-04

1.5 Operating Cycle

Samples are driven with a constant direct current (DC)

1.6 Ambient Conditions

For lumen maintenance test, samples were operated in thermal chambers with minimal ambient airflow. For long term reliability test, the case temperature was controlled by mounting several thermocouples on a sample reliability stress board at the designated thermal measurement point, as shown in APPENDIX. The ambient temperature T_A was measured by several thermocouples at a distance of 5 mm above the reliability test board. The relative humidity within chamber was less than 65%.

For photometry measurement, temperature was set to 25℃ ±2℃, RH <65%.

1.7 Photometry Measurement Uncertainty

The uncertainty of the light output measurements is U=1.59% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=21K (K=2), at the 95% confidence level. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

1.8 Sample Set

Sampling Method:
LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.
These manufacturing lots are picked to represent a wide parametric distribution.
Each Sample is soldered to all of the reliability stress boards for a given set of IESNA LM-80 tests.

Sample Size:
Total 75Pcs;
Each Ts test condition 25Pcs
The 75pcs samples tested at T_S 55 ℃, 85 ℃ and T_S 105 ℃ were received at 2014-04-06 and tested during 2014-04-08 to 2014-12-14. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Data Set 1: 55 ℃, 100mA	
Part Number:	T20
Number of Units:	25
Actual Case Temperature(T_S):	T_S =53.3 ℃
Actual Ambient Temperature(T_A):	T_A =51.6 ℃
Life Test Drive Current:	I_F = 100mA
Measurement Current:	I_F = 100mA

Data Set 2: 85°C, 100mA	
Part Number:	T20
Number of Units:	25
Actual Case Temperature(T_S):	T_S =83.8 ℃
Actual Ambient Temperature(T_A):	T_A =81.1 ℃
Life Test Drive Current:	I_F = 100mA
Measurement Current:	I_F = 100mA

Data Set 3: 105 ℃, 100mA	
Part Number:	T20
Number of Units:	25
Actual Case Temperature(T_S):	T_S =103.4 ℃
Actual Ambient Temperature(T_A):	T_A =101.1 ℃
Life Test Drive Current:	I_F = 100mA
Measurement Current:	I_F = 100mA

2 - SUMMARY OF TEST RESULT

Data Set:	**Data Set 1, 55℃, 100mA**
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	97.06%
Average Chromaticity Shift at 6000 hours (Δu'v'):	0.0022
Reported TM-21 L_{70} Lifetime:	>36,000

Data Set:	**Data Set 2, 85℃, 100mA**
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	96.58%
Average Chromaticity Shift at 6000 hours(Δu'v'):	0.0024
Reported TM-21 L_{70} Lifetime	>36,000

Data Set:	**Data Set 3, 105℃, 100mA**
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	96.02%
Average Chromaticity Shift at 6000 hours(Δu'v'):	0.0031
Reported TM-21 L_{70} Lifetime	>36,000

3 - Test Data

3.1 Data Set 1, 55℃, 100mA (Lumen Maintenance)

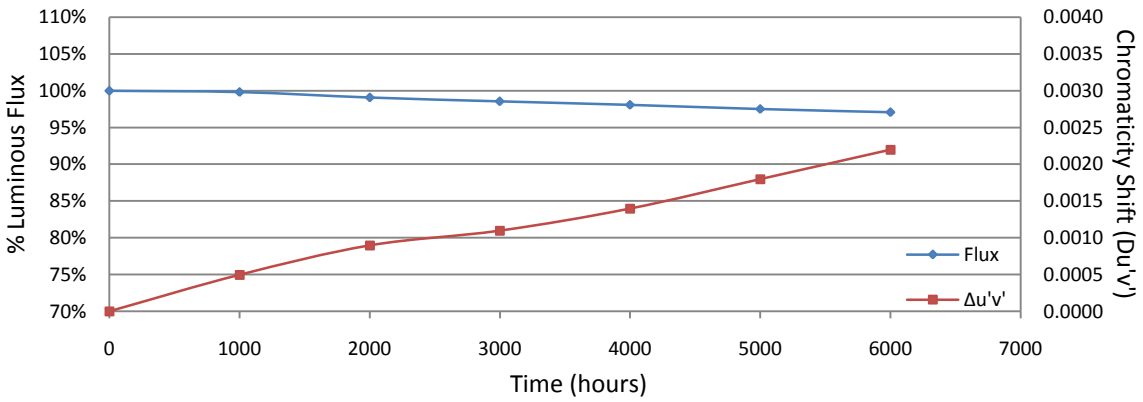
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	3.202	35.21	99.55	98.95	98.72	98.44	98.27	97.73
2	3.196	35.41	99.63	98.96	98.56	98.25	97.77	97.29
3	3.202	35.24	99.77	98.98	98.72	98.16	97.39	97.16
4	3.197	35.04	99.69	98.83	98.43	98.09	97.46	97.12
5	3.194	35.02	99.97	99.11	98.52	98.12	97.52	96.94
6	3.199	35.73	100.06	99.10	98.40	97.96	96.84	96.19
7	3.195	35.16	99.89	99.06	98.46	98.07	97.10	96.50
8	3.197	34.98	99.97	99.23	98.80	98.26	97.71	97.06
9	3.194	34.79	99.97	99.20	98.85	97.93	97.01	96.44
10	3.193	35.33	99.92	99.24	98.53	98.25	97.65	96.97
11	3.193	34.59	99.94	99.13	98.53	98.32	98.03	97.77
12	3.196	34.76	99.91	99.34	98.73	98.13	97.84	97.04
13	3.199	34.80	100.06	99.02	98.28	97.76	97.13	96.87
14	3.194	35.07	100.03	99.34	98.72	98.26	97.98	97.69
15	3.197	35.25	99.77	99.15	98.72	98.18	97.73	97.28
16	3.197	35.32	99.60	98.92	98.44	97.99	97.65	97.23
17	3.189	35.02	99.63	98.91	98.46	97.80	97.06	96.37
18	3.197	34.92	99.68	98.97	98.28	97.88	97.25	97.11
19	3.168	34.78	99.60	98.91	98.33	97.61	97.15	96.92
20	3.184	34.72	99.71	99.02	98.85	98.44	97.78	97.47
21	3.192	34.77	99.80	99.51	98.96	98.39	97.70	97.18
22	3.195	34.85	99.83	99.11	98.77	98.19	97.65	97.45
23	3.190	34.77	99.80	99.08	98.25	97.70	97.35	96.64
24	3.193	34.50	99.83	98.87	98.46	97.94	97.54	97.28
25	3.196	35.23	99.83	98.95	98.33	97.87	97.19	96.74
Ave.	3.194	35.01	99.82	99.08	98.56	98.08	97.51	97.06
Med.	3.195	35.02	99.83	99.06	98.53	98.12	97.54	97.11
st dev	0.0066	0.2873	0.1525	0.1657	0.2058	0.2292	0.3571	0.4162
Min.	3.168	34.50	99.55	98.83	98.25	97.61	96.84	96.19
Max.	3.202	35.73	100.06	99.51	98.96	98.44	98.27	97.77

TM-21 Projection:

Test Duration: 6000hrs
Failures Observed: 0
α: 5.514E-06
β: 1.003
Calculated L_{70}: 65,000
Reported L_{70}: >36,000

3.2 Data Set 1, 55 ℃, 100mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2582	0.5311	2775	0.0005	0.0008	0.0009	0.0012	0.0018	0.0022
2	0.2602	0.5334	2723	0.0004	0.0008	0.0009	0.0012	0.0018	0.0021
3	0.2601	0.5328	2728	0.0006	0.0009	0.0012	0.0013	0.0018	0.0022
4	0.2586	0.5311	2766	0.0009	0.0010	0.0011	0.0014	0.0017	0.0021
5	0.2560	0.5302	2826	0.0006	0.0009	0.0011	0.0013	0.0018	0.0022
6	0.2593	0.5321	2747	0.0008	0.0012	0.0014	0.0016	0.0018	0.0021
7	0.2606	0.5315	2723	0.0008	0.0011	0.0013	0.0015	0.0019	0.0023
8	0.2588	0.5327	2755	0.0008	0.0010	0.0012	0.0015	0.0018	0.0019
9	0.2593	0.5312	2751	0.0007	0.0010	0.0011	0.0017	0.0021	0.0025
10	0.2597	0.5326	2737	0.0003	0.0007	0.0010	0.0013	0.0018	0.0022
11	0.2602	0.5302	2737	0.0001	0.0007	0.0008	0.0011	0.0020	0.0026
12	0.2584	0.5318	2766	0.0006	0.0008	0.0009	0.0012	0.0017	0.0021
13	0.2586	0.5309	2767	0.0007	0.0010	0.0012	0.0015	0.0017	0.0020
14	0.2587	0.5309	2765	0.0004	0.0009	0.0011	0.0013	0.0016	0.0021
15	0.2584	0.5302	2775	0.0004	0.0008	0.0011	0.0014	0.0018	0.0022
16	0.2607	0.5315	2720	0.0002	0.0008	0.0009	0.0012	0.0015	0.0019
17	0.2593	0.5319	2748	0.0005	0.0009	0.0011	0.0015	0.0020	0.0025
18	0.2594	0.5317	2747	0.0005	0.0007	0.0009	0.0012	0.0017	0.0020
19	0.2601	0.5307	2736	0.0006	0.0009	0.0011	0.0013	0.0018	0.0021
20	0.2602	0.5324	2727	0.0004	0.0008	0.0009	0.0013	0.0017	0.0020
21	0.2589	0.5302	2764	0.0004	0.0006	0.0010	0.0015	0.0019	0.0022
22	0.2579	0.5307	2783	0.0004	0.0010	0.0012	0.0015	0.0018	0.0021
23	0.2604	0.5327	2723	0.0004	0.0009	0.0011	0.0015	0.0021	0.0026
24	0.2587	0.5307	2765	0.0003	0.0008	0.0010	0.0013	0.0017	0.0020
25	0.2609	0.5322	2714	0.0004	0.0008	0.0011	0.0014	0.0022	0.0024
Ave.	0.2593	0.5315	2751	0.0005	0.0009	0.0011	0.0014	0.0018	0.0022
Med.	0.2593	0.5315	2748	0.0005	0.0009	0.0011	0.0013	0.0018	0.0021
st dev	0.0011	0.0009	25.4354	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002
Min.	0.2560	0.5302	2714	0.0001	0.0006	0.0008	0.0011	0.0015	0.0019
Max.	0.2609	0.5334	2826	0.0009	0.0012	0.0014	0.0017	0.0022	0.0026



3.3 Data Set 2, 85ºC, 100mA (Lumen Maintenance)

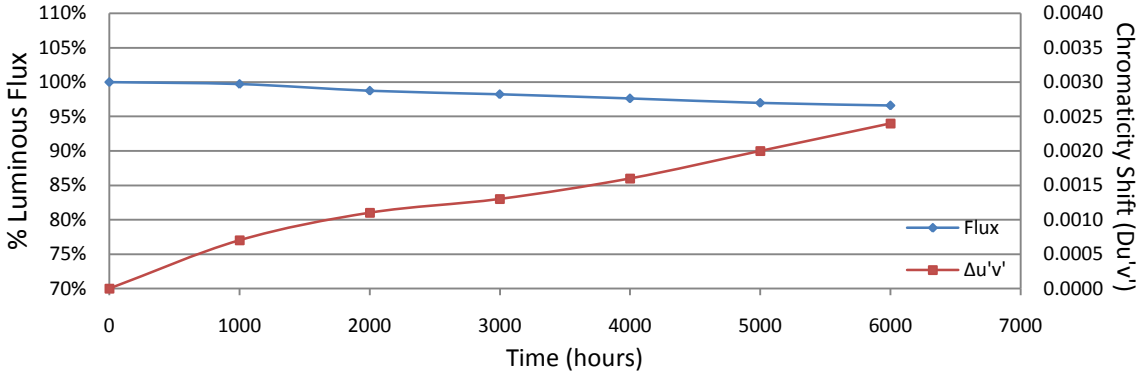
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	3.194	35.00	99.66	98.74	98.43	97.77	97.06	96.66
27	3.185	34.36	99.68	98.66	98.11	97.47	96.83	96.48
28	3.193	34.97	99.57	98.54	97.97	97.23	96.85	96.45
29	3.197	35.05	100.00	99.23	98.63	98.00	97.57	97.35
30	3.184	34.65	99.71	98.85	98.38	97.69	97.17	96.80
31	3.194	34.65	99.88	98.59	97.89	97.29	97.11	96.74
32	3.190	35.16	99.94	98.55	97.84	97.16	96.64	96.39
33	3.190	34.86	99.89	98.77	98.19	97.56	97.27	97.16
34	3.194	34.72	99.88	98.82	98.24	97.70	97.44	97.00
35	3.194	34.85	99.91	99.00	98.13	97.62	96.53	96.21
36	3.189	34.96	99.94	98.86	98.08	97.48	96.82	96.34
37	3.194	34.13	99.94	98.86	98.54	98.04	97.54	97.10
38	3.148	34.81	100.20	99.28	98.53	97.99	96.78	96.70
39	3.190	34.81	99.45	98.79	98.16	97.50	96.78	96.52
40	3.204	34.99	99.40	98.49	98.00	97.23	96.60	96.17
41	3.198	35.20	99.29	98.44	97.93	97.22	96.93	96.56
42	3.190	34.38	99.33	98.49	97.99	97.44	97.00	96.42
43	3.193	34.87	99.66	98.37	97.85	97.68	96.39	95.84
44	3.186	34.66	99.51	98.62	97.95	97.35	96.39	95.87
45	3.200	35.02	99.54	98.72	98.37	97.92	96.86	96.54
46	3.192	34.88	99.37	98.65	98.25	97.79	97.16	96.85
47	3.196	35.08	99.52	98.72	98.09	97.58	97.04	96.78
48	3.199	34.92	99.51	98.83	98.65	98.17	97.42	96.91
49	3.192	35.37	99.72	98.93	98.39	97.57	97.12	96.72
50	3.202	34.95	99.83	99.03	98.40	97.65	96.62	95.99
Ave.	3.192	34.85	99.69	98.75	98.20	97.60	96.96	96.58
Med.	3.193	34.88	99.68	98.74	98.16	97.58	96.93	96.56
st dev	0.0103	0.2747	0.2412	0.2290	0.2476	0.2794	0.3357	0.3842
Min.	3.148	34.13	99.29	98.37	97.84	97.16	96.39	95.84
Max.	3.204	35.37	100.20	99.28	98.65	98.17	97.57	97.35

TM-21 Projection:

Test Duration: 6000hrs
Failures Observed: 0
α: 6.271E-06
β: 1.001
Calculated L_{70}: 57,000
Reported L_{70}: >36,000

3.4 Data Set 2, 85°C, 100mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
26	0.2594	0.5308	2750	0.0005	0.0009	0.0011	0.0014	0.0018	0.0023
27	0.2620	0.5312	2694	0.0005	0.0011	0.0012	0.0016	0.0020	0.0024
28	0.2594	0.5309	2749	0.0004	0.0009	0.0010	0.0014	0.0018	0.0023
29	0.2589	0.5318	2756	0.0004	0.0008	0.0010	0.0014	0.0018	0.0021
30	0.2570	0.5296	2807	0.0008	0.0011	0.0013	0.0017	0.0020	0.0024
31	0.2605	0.5312	2725	0.0007	0.0012	0.0011	0.0015	0.0021	0.0025
32	0.2586	0.5315	2763	0.0007	0.0012	0.0014	0.0017	0.0022	0.0025
33	0.2605	0.5325	2719	0.0006	0.0012	0.0012	0.0016	0.0019	0.0023
34	0.2614	0.5316	2706	0.0008	0.0013	0.0013	0.0016	0.0018	0.0022
35	0.2610	0.5324	2712	0.0008	0.0012	0.0015	0.0019	0.0025	0.0028
36	0.2579	0.5309	2781	0.0008	0.0011	0.0013	0.0017	0.0023	0.0026
37	0.2597	0.5324	2738	0.0009	0.0012	0.0013	0.0017	0.0023	0.0025
38	0.2609	0.5315	2716	0.0004	0.0009	0.0011	0.0014	0.0022	0.0026
39	0.2600	0.5323	2731	0.0007	0.0009	0.0010	0.0013	0.0021	0.0025
40	0.2566	0.5306	2811	0.0008	0.0012	0.0012	0.0015	0.0019	0.0023
41	0.2594	0.5313	2748	0.0007	0.0011	0.0012	0.0015	0.0021	0.0024
42	0.2589	0.5315	2758	0.0009	0.0011	0.0013	0.0016	0.0019	0.0023
43	0.2602	0.5310	2733	0.0008	0.0013	0.0012	0.0015	0.0019	0.0021
44	0.2617	0.5326	2696	0.0008	0.0011	0.0015	0.0017	0.0020	0.0025
45	0.2592	0.5323	2749	0.0008	0.0013	0.0014	0.0015	0.0018	0.0022
46	0.2595	0.5325	2741	0.0002	0.0007	0.0009	0.0012	0.0018	0.0023
47	0.2596	0.5314	2744	0.0008	0.0012	0.0013	0.0016	0.0016	0.0021
48	0.2608	0.5328	2713	0.0007	0.0012	0.0015	0.0018	0.0021	0.0023
49	0.2607	0.5313	2722	0.0009	0.0013	0.0014	0.0017	0.0018	0.0023
50	0.2606	0.5313	2724	0.0009	0.0013	0.0015	0.0020	0.0021	0.0026
Ave.	0.2598	0.5316	2739	0.0007	0.0011	0.0013	0.0016	0.0020	0.0024
Med.	0.2597	0.5315	2738	0.0008	0.0012	0.0013	0.0016	0.0020	0.0023
st dev	0.0013	0.0008	29.8134	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2566	0.5296	2694	0.0002	0.0007	0.0009	0.0012	0.0016	0.0021
Max.	0.2620	0.5328	2811	0.0009	0.0013	0.0015	0.0020	0.0025	0.0028



3.5 Data Set 3, 105℃, 100mA (Lumen Maintenance)

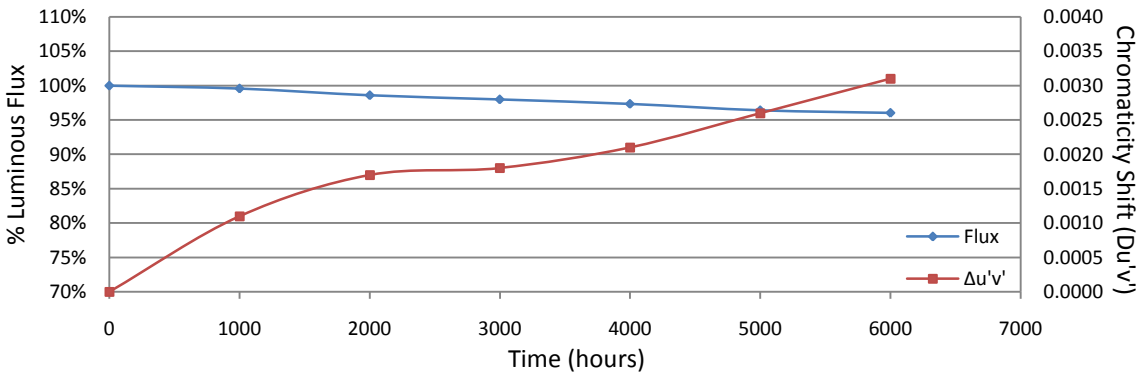
No.	V_F(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
51	3.330	35.23	99.66	98.98	98.35	97.62	97.19	96.85
52	3.189	34.93	99.74	98.57	98.08	97.37	96.65	96.28
53	3.192	34.77	99.77	98.73	98.07	97.58	96.66	96.17
54	3.195	35.20	99.57	98.72	97.98	97.30	96.85	96.28
55	3.193	35.20	99.60	98.64	97.87	97.33	96.39	95.88
56	3.188	35.28	99.55	98.41	97.76	97.11	96.06	95.52
57	3.190	34.59	99.65	98.79	98.44	98.01	97.34	96.94
58	3.192	34.69	99.91	98.73	97.92	97.03	96.02	95.62
59	3.191	34.72	99.77	98.65	98.04	97.18	96.31	95.91
60	3.187	35.10	99.77	98.86	98.15	97.41	96.52	96.21
61	3.200	35.35	99.63	98.67	98.02	97.31	96.29	96.01
62	3.196	34.83	99.89	98.94	98.42	97.96	96.61	96.38
63	3.193	34.61	99.57	98.73	97.86	97.26	96.27	96.13
64	3.177	35.10	99.29	98.49	97.86	97.07	96.21	95.75
65	3.191	35.18	99.52	98.66	97.84	97.38	96.59	96.19
66	3.185	35.00	99.29	98.20	97.69	97.11	96.00	95.40
67	3.191	34.69	99.37	98.24	97.84	97.58	96.83	96.45
68	3.192	34.82	99.45	98.28	97.87	97.16	96.52	96.15
69	3.186	35.00	99.71	98.74	98.09	97.23	96.69	96.46
70	3.195	34.60	99.74	98.64	98.12	97.60	96.27	95.95
71	3.188	34.95	99.20	98.31	97.83	97.22	95.97	95.34
72	3.192	34.94	99.31	98.14	97.65	97.08	95.76	95.39
73	3.191	35.27	99.35	98.53	98.10	97.36	96.29	95.72
74	3.190	34.52	99.28	98.52	97.83	97.10	96.15	95.89
75	3.187	34.65	99.51	98.67	97.84	97.06	96.02	95.56
Ave.	3.196	34.93	99.56	98.59	97.98	97.34%	96.42%	96.02%
Med.	3.191	34.94	99.57	98.65	97.92	97.30	96.31	96.01
st dev	0.0282	0.2551	0.2040	0.2248	0.2088	0.2639	0.3835	0.4270
Min.	3.177	34.52	99.20	98.14	97.65	97.03	95.76	95.34
Max.	3.330	35.35	99.91	98.98	98.44	98.01	97.34	96.94

TM-21 Projection:

Test Duration: 6000hrs
Failures Observed: 0
α: 7.267E-06
β: 1.002
Calculated L_{70}: 49,000
Reported L_{70}: >36,000

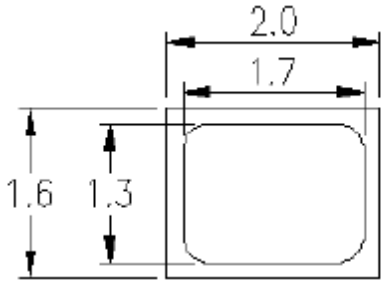
3.6 Data Set 3, 105℃, 100mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
51	0.2596	0.5319	2742	0.0008	0.0013	0.0014	0.0018	0.0026	0.0030
52	0.2597	0.5321	2738	0.0004	0.0011	0.0012	0.0017	0.0026	0.0030
53	0.2613	0.5316	2708	0.0008	0.0012	0.0013	0.0017	0.0023	0.0028
54	0.2588	0.5327	2756	0.0011	0.0015	0.0015	0.0019	0.0026	0.0031
55	0.2609	0.5325	2713	0.0010	0.0015	0.0016	0.0021	0.0026	0.0030
56	0.2603	0.5317	2729	0.0010	0.0016	0.0016	0.0021	0.0028	0.0034
57	0.2605	0.5314	2724	0.0010	0.0016	0.0015	0.0016	0.0023	0.0026
58	0.2587	0.5309	2765	0.0011	0.0017	0.0020	0.0024	0.0028	0.0032
59	0.2601	0.5306	2738	0.0014	0.0018	0.0020	0.0024	0.0028	0.0032
60	0.2592	0.5313	2753	0.0012	0.0017	0.0018	0.0021	0.0026	0.0032
61	0.2590	0.5319	2755	0.0013	0.0017	0.0017	0.0021	0.0025	0.0029
62	0.2601	0.5319	2732	0.0014	0.0020	0.0020	0.0022	0.0025	0.0030
63	0.2584	0.5323	2766	0.0014	0.0017	0.0018	0.0021	0.0023	0.0028
64	0.2571	0.5308	2798	0.0013	0.0020	0.0022	0.0026	0.0028	0.0031
65	0.2596	0.5309	2746	0.0014	0.0021	0.0022	0.0024	0.0026	0.0030
66	0.2609	0.5315	2717	0.0010	0.0017	0.0018	0.0022	0.0027	0.0029
67	0.2596	0.5312	2745	0.0012	0.0019	0.0020	0.0022	0.0027	0.0032
68	0.2587	0.5312	2763	0.0010	0.0017	0.0018	0.0021	0.0027	0.0033
69	0.2609	0.5317	2715	0.0011	0.0016	0.0017	0.0022	0.0029	0.0034
70	0.2613	0.5325	2703	0.0012	0.0018	0.0020	0.0022	0.0028	0.0033
71	0.2577	0.5312	2785	0.0013	0.0019	0.0020	0.0024	0.0025	0.0030
72	0.2587	0.5315	2761	0.0012	0.0017	0.0020	0.0023	0.0027	0.0032
73	0.2600	0.5306	2739	0.0013	0.0019	0.0021	0.0025	0.0025	0.0031
74	0.2575	0.5294	2796	0.0007	0.0015	0.0016	0.0020	0.0031	0.0038
75	0.2615	0.5318	2703	0.0008	0.0014	0.0015	0.0018	0.0023	0.0028
Ave.	0.2596	0.5315	2744	0.0011	0.0017	0.0018	0.0021	0.0026	0.0031
Med.	0.2596	0.5315	2742	0.0011	0.0017	0.0018	0.0021	0.0026	0.0031
st dev	0.0012	0.0007	26.8344	0.0003	0.0002	0.0003	0.0003	0.0002	0.0002
Min.	0.2571	0.5294	2703	0.0004	0.0011	0.0012	0.0016	0.0023	0.0026
Max.	0.2615	0.5327	2798	0.0014	0.0021	0.0022	0.0026	0.0031	0.0038



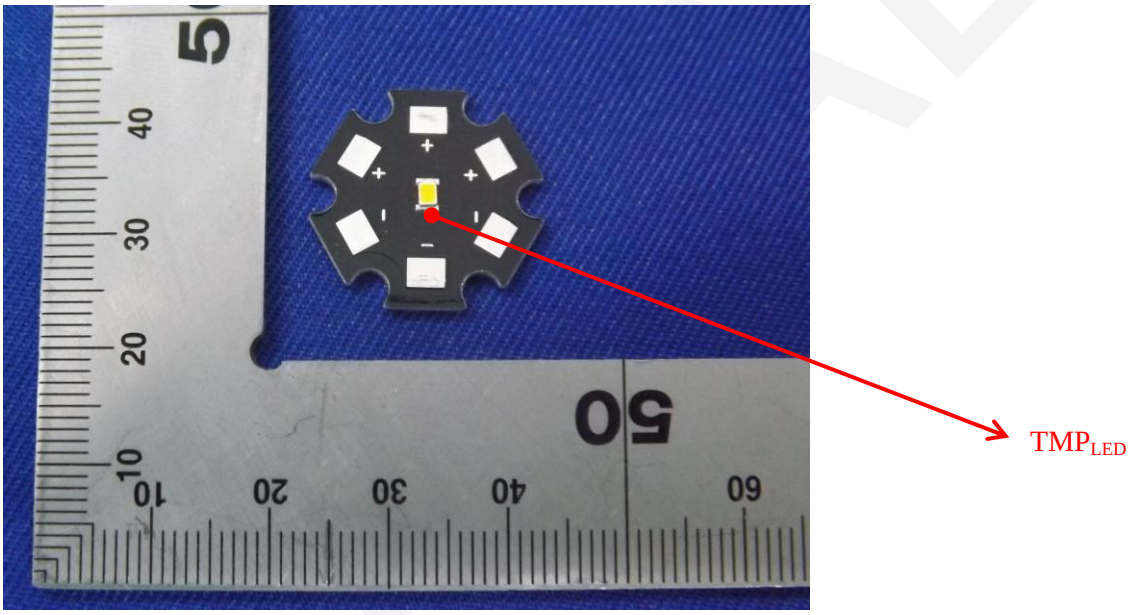
Appendix A – EUT PHOTO

A.1 Mechanical Dimensions (Ta = 25℃)



All dimensions are in millimeter

A.2 EUT Photo



Attachment B – Family declaration letter

LIGHTNING

LIGHTNING OPTOELECTRONIC TECHNOLOGY (SZ) Co., LTD
Building B ,Wen Tao Technological Park,Yingrenshi Community,Shiyan Street,Baoan District,Shenzhen,China

ATTESTATION OF SIMILARITY

To Whom It May Concern:

LIGHTNING OPTOELECTRONIC TECHNOLOGY(SZ) Co.,LTD. hereby attest LED2016 EMC100mA series are designed with identical material and construction processes. And the tested model T2027811P-01AAare tested by BACL, the results of which are featured in BACL projectRSZ140328513-10.
The tested model and the other LED package which attest similarity are designed with identical material and identical construction processes. The differences between the tested model and the other LEDpackage which attest similarity are onlycurrent densityand power density. The tested model is the greatest current densityand power density, and listed in the following table:

Series Name	Model Name	CCT (K)	CRI	Number of Dies	Current (mA)	Volt (V)	Chip Layout		Current Per Die (mA)	Current Density (mA/mm2)	Power Density (W/mm2)
							Series	Parallel			
2016 EMC	T2027811P-01AA	2700	80	1	100	3	1	1	100	517	1550
2016 EMC	T2027811A-08125TMG	2700	80	1	100	3	1	1	100	395	1186
2016 EMC	T2027811A-19125TMG	2700	80	1	100	3	1	1	100	344	1033
2016 EMC	T2027811A-20125TMG	2700	80	1	100	3	1	1	100	304	912
2016 EMC	T2027811A-10125TMG	2700	80	1	100	3	1	1	100	235	705
2016 EMC	T2027811Q-01AA	2700	80	1	100	3	1	1	100	517	1550
2016 EMC	T2027811Q-02AA	2700	80	1	90	3	1	1	90	517	1550
2016 EMC	T2027811Q-03AA	2700	80	1	100	3	1	1	100	517	1550
2016 EMC	T2030811Q-01AA	3000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2030811Q-02AA	3000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2030811Q-03AA	3000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2030811Q-04AA	3000	80	1	90	3	1	1	90	517	1550
2016 EMC	T2035811Q-01AA	3500	80	1	100	3	1	1	100	517	1550
2016 EMC	T2040811Q-01AA	4000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2040811Q-02AA	4000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2040811Q-03AA	4000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2040811Q-04AA	4000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2040811Q-05AA	4000	80	1	90	3	1	1	90	517	1550
2016 EMC	T2050811Q-01AA	5000	80	1	100	3	1	1	100	517	1550
2016 EMC	T2050811Q-02AA	5000	80	1	90	3	1	1	90	517	1550
2016 EMC	T2065811Q-01AA	6500	80	1	100	3	1	1	100	517	1550
2016 EMC	T2065811Q-02AA	6500	80	1	100	3	1	1	100	517	1550
2016 EMC	T2065811Q-03AA	6500	80	1	100	3	1	1	100	517	1550
2016 EMC	T2065811Q-04AA	6500	80	1	100	3	1	1	100	517	1550
2016 EMC	T2065811Q-05AA	6500	80	1	100	3	1	1	100	517	1550
2016 EMC	T2065811Q-06AA	6500	80	1	90	3	1	1	90	517	1550
2016 EMC	T2040711Q-02AA	4000	70	1	100	3	1	1	100	517	1550
2016 EMC	T2065711Q-02AA	6500	70	1	100	3	1	1	100	517	1550
2016 EMC	T2027811A-05125TME	2700	80	1	90	3	1	1	90	517	1550

Signature: Ray 2014.11.25
Print name: Ray yuan
Title: NPI Manager
LIGHTNING OPTOELECTRONIC TECHNOLOGY(SZ) Co.,LTD.

**********END OF REPORT**********