



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Shenzhen Refond Optoelectronic Co., Ltd.

C 5th Floor, Konka R&D Building, No. 28 of Street 12, South Tech Area, Nanshan District, Shenzhen, China.

Model: RF-Q30RA27A-01-J2

Report Type: 9000 Hours Test Report	Product Type: LED Package
Test Engineer: Daniel Duan	<i>Daniel Duan</i>
Report Number: R2DG150415051-10-9000-M1	
Test Date: 2014-03-11 to 2015-06-17	
Report Date: 2016-03-28	
Reviewed By: Jeanne Han /EE Manager	
Revised Note:	The previous report R2DG150415051-10-9000 is replaced by this report on 2016-03-28
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

Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

TABLE OF CONTENTS

1 - GENERAL INFORMATION.....	3
1.1 DESCRIPTION OF LED LIGHT SOURCES	3
1.2 STANDARDS USED:.....	3
1.3 TEST FACILITY	4
1.4 DESCRIPTION OF AUXILIARY EQUIPMENT	4
1.5 OPERATING CYCLE.....	4
1.6 AMBIENT CONDITIONS	4
1.7 PHOTOMETRY MEASUREMENT UNCERTAINTY	5
1.8 SAMPLE SET	6
2 - SUMMARY OF TEST RESULT	7
3 - TEST DATA	8
3.1 DATA SET 1, 55°C, 200 mA (LUMEN MAINTENANCE).....	8
3.2 DATA SET 1, 55°C, 200 mA (CHROMATICITY SHIFT)	9
3.3 DATA SET 2, 85°C, 200 mA (LUMEN MAINTENANCE).....	11
3.4 DATA SET 2, 85°C, 200mA (CHROMATICITY SHIFT)	12
3.5 DATA SET 3, 105°C, 200 mA (LUMEN MAINTENANCE).....	14
3.6 DATA SET 3, 105°C, 200 mA (CHROMATICITY SHIFT)	15
APPENDIX A – EUT PHOTO	17
A.1 MECHANICAL DIMENSIONS (TA = 25°C)	17
A.2 EUT PHOTO	17
ATTACHMENT B – FAMILY DECLARATION LETTER	18

1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: RF-Q30RA27A-01-J2
 Part Type: LED Package
 Nominal CCT: 2700K

Family products covered by this report:

According to ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products, the following products can be covered by this report base on the declaration letter of manufacturer (see attachment B for more information). The information of these models shows that the covered products meet all section 3 item 7 requirements of ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products (September 9, 2011)

Nomenclature of RF-Q30RA serial models

RF-Q30RA * * * - * * - * *

A1 A2 A3 A4 A5 A6

A1: Letter RF can be RF or RT. It is an internal Market code which does not affect product property.

A2: Letter Q30RA is a fixed code.

A3: Letter * * represent CCT, it can be 27, 30, 35, 40, 45, 50, 55, 57, 60, 65.

A4: Letter * represent workshop code, it can be A, B, or C which does not affect product property.

A5: Letter * * represent work equipment serial number, it can be 01, 06, 07, 13, 14, 16, 17, 18, 19, 24, 25, 26, or FD which does not affect product property, Just use different spectral machine serial number

A6: Letter * * can be J2, C2 or H2, It is an internal market code which does not affect product property.

Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Bay Area Compliance Laboratories Corp. (Dongguan) isn't responsible or gives any guarantees for the truthfulness of the technical information.

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	2015-03-25	2016-03-25
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2015-03-05	2016-03-05
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2015-03-25	2016-03-25
Standard Light Source	EVERFINE	D062	1011093	N/A	2014-08-05	2015-08-05
Precision digital stabilized DC power supply	EVERFINE	WY605	G115987C J7321114	300VA	2015-03-05	2016-03-05
Multilayer aging machine	BACL	B2-270	20005	25°C~110°C	2014-08-11	2015-08-11
Adjustable constant-current DC switching power supply	GUTE	DK-60V50A	120 5037	60V 50A	2014-08-11	2015-08-11
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060010	(50/15A)	2014-07-11	2015-07-11
High-frequency DC power supply	GUTE	WYG-30100	20060111	0v~30v,10A~100 A	2014-08-11	2015-08-11

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 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 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).

FINAL

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 150Pcs;

Each Ts test condition 50Pcs

The samples tested at Ts 55°C, Ts 85°C and Ts 105°C were received at 2014-02-22 and tested during 2014-03-11 to 2015-03-21. The samples were numbered from 1 to 50, 51 to 100 and 101 to 150

Data Set 1: 55°C, 200mA

Part Number:	RF-Q30RA27A-01-J2
Number of Units:	50
Actual Case Temperature(T _S):	T _S =54.2°C
Actual Ambient Temperature(T _A):	T _A =53.5°C
Life Test Drive Current:	I _F = 200mA
Measurement Current:	I _F = 200mA

Data Set 2: 85°C,200mA

Part Number:	RF-Q30RA27A-01-J2
Number of Units:	50
Actual Case Temperature(T _S):	T _S =84.1°C
Actual Ambient Temperature(T _A):	T _A =83.2°C
Life Test Drive Current:	I _F =200mA
Measurement Current:	I _F = 200mA

Data Set 3: 105°C, 200mA

Part Number:	RF-Q30RA27A-01-J2
Number of Units:	50
Actual Case Temperature(T _S):	T _S =104.2°C
Actual Ambient Temperature(T _A):	T _A =103.5°C
Life Test Drive Current:	I _F = 200mA
Measurement Current:	I _F = 200mA

2 - SUMMARY OF TEST RESULT

Data Set:	Data Set 1, 55°C, 200mA
Number of Units:	50
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h 7000h,8000h,9000h
Average. Lumen Maintenance at 9000 hours:	95.46%
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0041
Reported TM-21 L_{70} Lifetime:	>54,000hours

Data Set:	Data Set 2, 85°C, 200mA
Number of Units:	50
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h, 7000h,8000h,9000h
Average. Lumen Maintenance at 9000 hours:	94.37%
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0044
Reported TM-21 L_{70} Lifetime:	>54,000hours

Data Set:	Data Set 3, 105°C, 200mA
Number of Units:	50
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h 7000h,8000h,9000h
Average. Lumen Maintenance at 9000 hours:	93.27%
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0047
Reported TM-21 L_{70} Lifetime:	49,000hours

3 - Test Data

3.1 Data Set 1, 55°C, 200 mA (Lumen Maintenance)

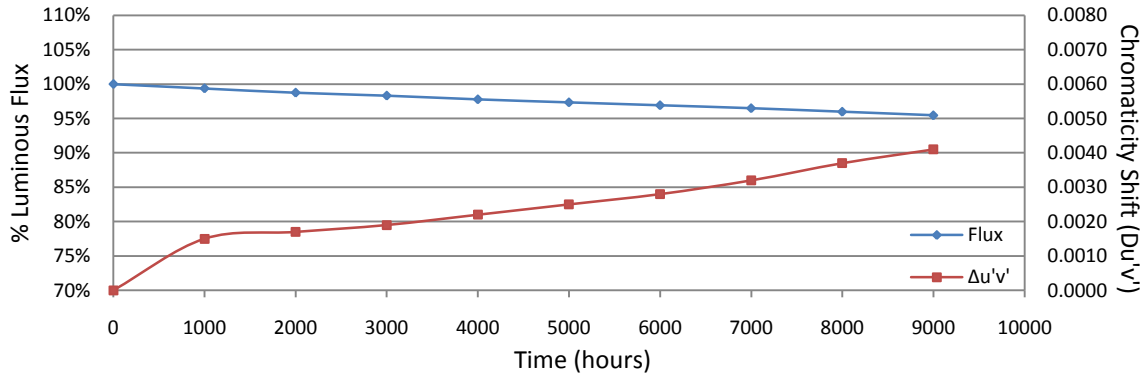
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	6.477	133.4	99.40	98.95	98.80	98.35	97.15	96.93	96.63	96.03	95.58
2	6.198	136.0	99.34	98.82	98.60	98.24	97.94	97.35	97.06	96.54	96.18
3	6.360	138.1	98.91	98.41	98.12	97.68	97.32	96.74	96.31	95.73	95.29
4	6.427	133.9	98.73	98.06	97.98	97.39	97.16	96.71	96.42	95.89	95.37
5	6.355	131.9	99.92	99.32	99.24	98.86	98.33	98.03	97.65	97.19	96.66
6	6.152	136.5	99.41	98.83	98.39	98.02	97.66	97.22	96.78	96.48	95.82
7	6.161	134.9	99.33	98.67	98.22	97.78	97.26	96.96	96.52	96.00	95.48
8	6.172	136.8	99.27	98.61	97.95	97.51	97.08	96.64	96.42	95.32	94.88
9	6.136	138.5	99.21	98.63	98.05	97.33	96.82	96.53	96.25	95.81	95.38
10	6.383	136.1	99.34	98.97	98.53	97.72	97.43	97.13	96.84	96.33	95.81
11	6.188	136.6	99.19	98.39	97.88	97.36	97.00	96.49	96.12	95.61	95.17
12	6.168	137.1	99.20	98.32	98.18	97.45	97.08	96.86	96.57	95.99	95.40
13	6.496	133.3	99.32	98.65	98.12	97.52	97.37	96.92	96.62	95.95	95.35
14	6.169	137.7	99.27	98.84	98.62	98.26	97.97	97.75	97.24	96.88	96.37
15	6.162	136.6	99.49	98.61	98.32	97.73	97.51	97.07	96.71	96.34	95.83
16	6.297	137.8	99.71	99.27	98.98	98.48	98.04	97.53	97.17	96.73	96.23
17	6.166	136.8	99.20	98.61	98.32	97.95	97.51	97.15	96.71	96.27	95.76
18	6.158	135.0	99.63	98.96	98.67	98.15	97.78	97.63	97.26	96.81	96.37
19	6.647	135.3	99.19	98.82	98.15	97.71	97.19	96.53	96.01	95.57	95.05
20	6.396	128.5	99.53	98.83	97.59	97.04	96.58	96.03	95.88	95.25	94.79
21	6.586	122.3	99.75	98.86	98.28	97.71	97.30	97.06	96.73	96.32	95.83
22	6.524	127.5	99.92	99.06	97.80	97.10	96.78	96.47	96.16	95.53	94.90
23	6.412	129.4	99.30	98.53	97.91	97.45	97.06	96.37	96.06	95.52	95.05
24	6.736	127.7	99.06	98.51	98.04	97.49	97.18	96.71	94.28	93.74	93.27
25	6.450	130.6	99.23	98.55	98.16	97.40	97.09	96.48	96.02	95.48	94.95
26	6.640	126.1	99.21	98.49	97.54	96.91	96.43	96.11	95.64	95.16	94.61
27	6.360	125.5	98.73	98.41	98.33	97.53	96.97	96.41	95.94	95.38	94.74
28	6.566	135.2	99.04	98.37	98.30	97.49	97.19	96.82	96.38	95.78	95.27
29	6.453	127.4	99.61	99.37	98.59	98.12	97.57	97.17	96.86	96.31	95.92
30	6.776	128.0	99.22	98.75	98.44	97.58	97.19	96.56	96.02	95.63	95.16
31	6.752	131.1	98.93	98.47	98.17	97.48	97.10	96.64	96.26	95.73	95.27
32	6.499	127.8	99.37	98.83	98.75	98.04	97.57	97.10	96.71	96.24	95.77
33	6.574	131.1	99.39	99.01	98.78	98.25	97.79	97.48	97.03	96.41	95.73
34	6.419	130.6	99.16	98.32	98.24	97.40	96.78	96.32	96.02	95.79	95.25
35	6.421	127.5	99.69	99.22	99.06	98.59	98.35	97.73	97.10	96.63	95.92
36	6.616	120.4	99.83	99.58	98.59	98.26	97.84	97.51	97.01	96.51	96.01
37	6.466	130.1	99.39	98.39	98.16	97.62	97.23	97.00	96.62	96.16	95.62
38	6.596	128.7	99.38	98.45	98.14	97.67	97.36	96.81	96.43	95.96	95.34
39	6.425	131.1	99.62	98.63	98.17	97.56	97.18	96.72	96.41	95.88	95.27
40	6.644	124.1	100.08	99.68	99.60	98.95	98.63	98.31	97.99	97.58	97.02
41	6.523	127.8	99.14	98.75	98.12	97.57	96.79	96.32	96.09	95.31	94.60
42	6.320	132.2	99.70	98.49	97.88	97.50	96.29	95.99	95.61	95.08	94.63
43	6.638	129.0	99.69	99.07	98.84	98.45	97.91	97.44	96.98	96.51	96.12
44	6.671	133.3	99.02	98.27	97.75	97.30	96.62	96.17	95.72	95.35	94.82
45	6.506	128.8	99.61	98.91	98.76	98.37	97.90	97.44	96.97	96.43	95.89
46	6.583	130.4	99.00	98.39	97.85	97.47	97.01	96.32	95.86	95.17	94.63
47	6.370	126.2	99.37	98.81	98.34	97.86	97.46	97.07	96.75	96.12	95.64
48	6.630	134.6	99.33	99.03	98.66	98.22	97.70	97.18	96.73	96.43	95.99
49	6.516	123.2	99.43	98.94	98.38	97.89	97.56	97.00	96.67	96.27	95.86
50	6.683	130.0	99.46	98.69	97.92	97.46	97.15	96.85	96.38	95.92	95.31
Ave.	6.440	131.4	99.37	98.75	98.32	97.78	97.34	96.92	96.49	95.98	95.46
Med.	6.452	131.1	99.34	98.72	98.26	97.68	97.25	96.89	96.54	95.97	95.39
st dev	0.184	4.6	0.29	0.34	0.42	0.46	0.49	0.52	0.60	0.63	0.64
Min.	6.136	120.4	98.73	98.06	97.54	96.91	96.29	95.99	94.28	93.74	93.27
Max.	6.776	138.5	100.08	99.68	99.60	98.95	98.63	98.31	97.99	97.58	97.02

3.2 Data Set 1, 55°C, 200 mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2553	0.5294	2846	0.0014	0.0015	0.0017	0.0020	0.0023	0.0027	0.0031	0.0031	0.0035
2	0.2552	0.5306	2842	0.0015	0.0015	0.0017	0.0021	0.0023	0.0027	0.0030	0.0034	0.0039
3	0.2541	0.5313	2863	0.0015	0.0016	0.0016	0.0019	0.0023	0.0026	0.0030	0.0030	0.0034
4	0.2550	0.5285	2856	0.0014	0.0016	0.0017	0.0021	0.0024	0.0028	0.0032	0.0036	0.0040
5	0.2551	0.5316	2839	0.0016	0.0016	0.0018	0.0021	0.0025	0.0027	0.0034	0.0030	0.0033
6	0.2543	0.5302	2863	0.0015	0.0018	0.0019	0.0020	0.0022	0.0021	0.0024	0.0028	0.0033
7	0.2557	0.5309	2828	0.0017	0.0020	0.0021	0.0022	0.0023	0.0024	0.0029	0.0030	0.0036
8	0.2556	0.5317	2827	0.0017	0.0018	0.0021	0.0023	0.0026	0.0028	0.0033	0.0028	0.0034
9	0.2565	0.5320	2807	0.0016	0.0016	0.0018	0.0021	0.0023	0.0026	0.0031	0.0032	0.0034
10	0.2555	0.5317	2829	0.0016	0.0021	0.0022	0.0025	0.0027	0.0030	0.0033	0.0039	0.0043
11	0.2548	0.5330	2838	0.0013	0.0016	0.0016	0.0019	0.0022	0.0027	0.0030	0.0025	0.0030
12	0.2544	0.5321	2852	0.0014	0.0018	0.0023	0.0025	0.0027	0.0031	0.0036	0.0035	0.0035
13	0.2547	0.5303	2854	0.0015	0.0019	0.0021	0.0024	0.0027	0.0031	0.0036	0.0041	0.0044
14	0.2539	0.5334	2856	0.0017	0.0018	0.0020	0.0023	0.0025	0.0030	0.0034	0.0039	0.0042
15	0.2543	0.5335	2848	0.0014	0.0017	0.0018	0.0021	0.0025	0.0028	0.0031	0.0038	0.0041
16	0.2547	0.5284	2863	0.0015	0.0017	0.0017	0.0021	0.0023	0.0028	0.0034	0.0040	0.0045
17	0.2548	0.5317	2844	0.0014	0.0016	0.0017	0.0019	0.0022	0.0027	0.0031	0.0038	0.0041
18	0.2578	0.5347	2767	0.0015	0.0017	0.0018	0.0020	0.0022	0.0025	0.0029	0.0039	0.0041
19	0.2571	0.5288	2808	0.0013	0.0018	0.0020	0.0022	0.0025	0.0028	0.0032	0.0047	0.0049
20	0.2594	0.5327	2742	0.0012	0.0017	0.0021	0.0025	0.0028	0.0033	0.0035	0.0038	0.0046
21	0.2591	0.5297	2761	0.0014	0.0018	0.0022	0.0025	0.0028	0.0036	0.0041	0.0051	0.0057
22	0.2587	0.5306	2766	0.0014	0.0016	0.0018	0.0021	0.0024	0.0028	0.0029	0.0033	0.0038
23	0.2604	0.5303	2732	0.0013	0.0017	0.0017	0.0021	0.0025	0.0028	0.0029	0.0035	0.0038
24	0.2600	0.5289	2746	0.0011	0.0017	0.0019	0.0023	0.0025	0.0029	0.0031	0.0041	0.0045
25	0.2589	0.5296	2765	0.0013	0.0016	0.0017	0.0020	0.0022	0.0023	0.0026	0.0035	0.0039
26	0.2607	0.5302	2727	0.0012	0.0016	0.0017	0.0022	0.0025	0.0027	0.0028	0.0038	0.0043
27	0.2619	0.5316	2696	0.0014	0.0018	0.0019	0.0024	0.0027	0.0030	0.0033	0.0038	0.0043
28	0.2578	0.5272	2800	0.0013	0.0016	0.0022	0.0025	0.0028	0.0031	0.0036	0.0042	0.0047
29	0.2596	0.5321	2740	0.0015	0.0016	0.0019	0.0022	0.0026	0.0028	0.0033	0.0040	0.0046
30	0.2599	0.5318	2737	0.0017	0.0018	0.0024	0.0026	0.0028	0.0031	0.0034	0.0042	0.0047
31	0.2593	0.5294	2758	0.0013	0.0016	0.0020	0.0022	0.0025	0.0025	0.0030	0.0038	0.0045
32	0.2574	0.5265	2813	0.0016	0.0018	0.0023	0.0025	0.0027	0.0028	0.0033	0.0041	0.0047
33	0.2563	0.5258	2842	0.0013	0.0017	0.0019	0.0021	0.0023	0.0023	0.0028	0.0037	0.0042
34	0.2603	0.5332	2722	0.0014	0.0016	0.0017	0.0020	0.0023	0.0021	0.0025	0.0032	0.0038
35	0.2594	0.5315	2748	0.0014	0.0016	0.0018	0.0021	0.0023	0.0027	0.0030	0.0038	0.0044
36	0.2594	0.5307	2750	0.0017	0.0019	0.0021	0.0023	0.0024	0.0029	0.0033	0.0039	0.0045
37	0.2595	0.5298	2752	0.0013	0.0015	0.0016	0.0018	0.0021	0.0023	0.0027	0.0032	0.0039
38	0.2586	0.5301	2770	0.0014	0.0016	0.0017	0.0020	0.0023	0.0024	0.0030	0.0032	0.0037
39	0.2553	0.5263	2862	0.0015	0.0017	0.0022	0.0024	0.0026	0.0031	0.0036	0.0045	0.0049
40	0.2603	0.5316	2728	0.0019	0.0021	0.0023	0.0026	0.0028	0.0032	0.0036	0.0046	0.0052
41	0.2568	0.5275	2822	0.0014	0.0018	0.0019	0.0023	0.0025	0.0031	0.0033	0.0042	0.0047
42	0.2568	0.5285	2818	0.0016	0.0018	0.0020	0.0021	0.0024	0.0027	0.0030	0.0033	0.0039
43	0.2592	0.5335	2744	0.0015	0.0021	0.0022	0.0024	0.0026	0.0029	0.0031	0.0035	0.0040
44	0.2600	0.5331	2729	0.0014	0.0018	0.0021	0.0025	0.0027	0.0030	0.0033	0.0035	0.0040
45	0.2590	0.5270	2775	0.0013	0.0018	0.0020	0.0023	0.0026	0.0028	0.0031	0.0034	0.0041
46	0.2572	0.5274	2812	0.0013	0.0016	0.0018	0.0022	0.0024	0.0024	0.0028	0.0033	0.0039
47	0.2596	0.5307	2746	0.0015	0.0024	0.0026	0.0027	0.0030	0.0035	0.0041	0.0043	0.0049
48	0.2572	0.5271	2815	0.0014	0.0017	0.0018	0.0020	0.0023	0.0024	0.0031	0.0033	0.0039
49	0.2596	0.5278	2759	0.0015	0.0016	0.0020	0.0021	0.0024	0.0026	0.0033	0.0035	0.0041
50	0.2579	0.5293	2788	0.0015	0.0016	0.0021	0.0024	0.0028	0.0029	0.0033	0.0036	0.0042
Ave.	0.2575	0.5303	2794	0.0015	0.0017	0.0019	0.0022	0.0025	0.0028	0.0032	0.0037	0.0041
Med.	0.2576	0.5305	2804	0.0014	0.0017	0.0019	0.0022	0.0025	0.0028	0.0031	0.0036	0.0041
st dev	0.0022	0.0022	48.8723	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0005	0.0005
Min.	0.2539	0.5258	2696	0.0011	0.0015	0.0016	0.0018	0.0021	0.0021	0.0024	0.0025	0.0030
Max.	0.2619	0.5347	2863	0.0019	0.0024	0.0026	0.0027	0.0030	0.0036	0.0041	0.0051	0.0057

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 4.763E-06
 β : 0.997
Calculated L₇₀: 74,000hours
Reported L₇₀: >54,000hours



3.3 Data Set 2, 85°C, 200 mA (Lumen Maintenance)

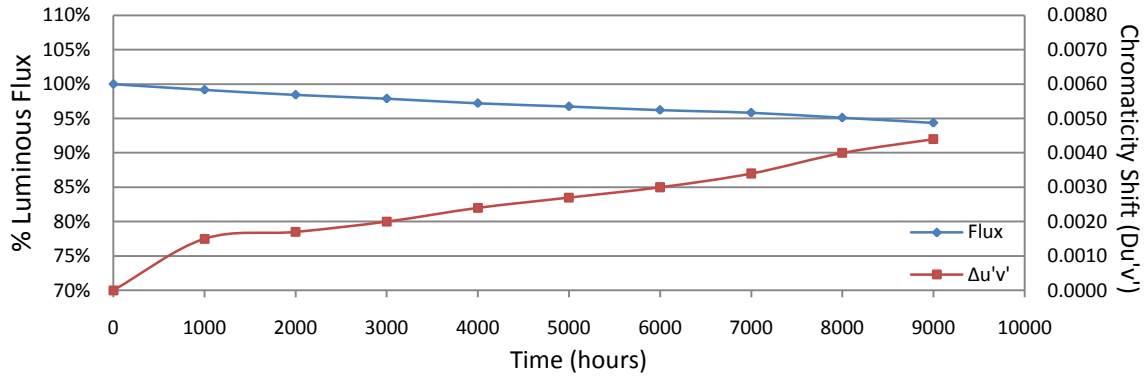
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	6.168	137.5	99.13	98.55	97.89	97.24	96.80	96.29	95.85	95.35	94.55
52	6.346	136.0	99.49	98.90	98.24	97.79	97.21	96.99	96.40	96.10	95.59
53	6.169	137.9	99.13	98.62	97.90	97.32	96.95	96.59	96.16	95.72	95.00
54	6.214	131.4	98.71	98.17	97.56	97.03	96.58	96.35	95.97	95.43	94.67
55	6.164	134.2	99.55	98.96	98.44	97.99	97.54	97.02	96.65	96.13	95.31
56	6.142	135.8	99.56	98.97	98.60	97.94	97.35	96.54	96.02	95.58	94.77
57	6.367	132.4	99.47	98.94	98.34	97.58	97.05	96.83	96.45	96.00	95.39
58	6.155	135.8	99.34	98.01	97.79	97.28	96.91	96.02	95.58	94.99	94.18
59	6.120	139.5	99.14	98.64	97.85	97.20	96.56	96.20	95.91	95.34	94.62
60	6.180	135.1	99.56	98.96	98.15	97.56	96.97	96.15	95.71	95.04	94.30
61	6.160	134.6	99.26	98.74	98.14	97.62	96.95	96.43	95.91	95.17	94.50
62	6.173	135.2	99.70	99.41	98.15	97.78	97.26	97.12	96.82	96.08	95.19
63	6.442	136.4	99.27	98.39	98.09	97.58	96.77	95.97	95.60	94.94	94.06
64	6.145	133.0	99.47	99.32	98.72	98.27	97.52	96.99	96.54	95.79	94.81
65	6.212	134.5	99.33	98.59	97.47	96.73	96.21	95.91	95.61	94.80	94.13
66	6.186	133.1	100.00	99.25	98.12	97.37	96.92	96.69	96.24	95.57	95.04
67	6.482	129.6	100.15	99.85	98.92	98.30	97.69	97.22	96.84	96.22	95.37
68	6.634	125.7	98.25	97.69	97.22	96.42	95.86	95.31	94.91	94.11	93.24
69	6.497	120.8	99.75	99.34	97.76	97.19	96.61	95.94	95.61	94.87	94.04
70	6.931	124.8	99.12	98.16	97.44	96.47	95.99	95.75	95.11	94.47	93.91
71	6.636	122.4	99.26	98.20	98.12	97.06	96.57	96.32	95.75	94.93	94.20
72	6.459	130.2	99.54	99.00	98.62	97.54	96.93	96.70	96.39	95.55	94.70
73	6.386	125.3	99.12	98.40	98.08	97.53	96.81	96.25	96.01	95.13	94.49
74	6.495	132.4	99.09	98.26	97.81	97.05	96.37	95.62	95.32	94.18	93.66
75	6.755	127.1	98.58	98.27	97.48	96.93	96.22	95.67	95.36	94.34	93.39
76	6.482	127.1	99.76	99.45	97.95	97.25	96.77	96.38	96.07	95.28	94.57
77	6.609	132.4	99.09	98.41	97.51	96.75	96.30	95.62	95.24	94.49	93.73
78	6.634	128.5	98.29	97.98	97.20	96.34	95.95	95.41	95.18	94.32	93.54
79	6.655	127.9	98.36	97.73	97.42	96.56	96.17	95.47	95.07	94.14	93.43
80	6.356	129.7	98.54	97.69	97.46	96.76	96.45	95.99	95.53	94.60	93.83
81	6.358	127.2	99.21	98.74	98.03	97.41	97.01	96.62	96.31	95.36	94.58
82	6.424	131.8	98.56	98.03	97.19	96.43	96.28	95.68	95.37	94.84	94.01
83	6.464	128.6	98.60	97.98	97.82	96.97	96.58	96.27	95.96	95.18	94.48
84	6.421	130.9	98.09	97.48	97.25	96.56	96.18	95.65	95.26	94.42	93.58
85	6.754	129.2	98.92	98.37	98.14	97.45	96.98	96.36	96.05	95.28	94.43
86	6.580	121.1	99.83	99.17	98.84	98.18	97.52	97.27	97.03	96.04	95.13
87	6.383	128.7	98.76	98.06	97.75	97.05	96.74	96.27	95.96	95.18	94.41
88	6.444	128.9	99.07	98.14	98.06	97.36	96.82	96.12	95.66	95.03	94.10
89	6.417	127.7	98.90	98.36	98.20	97.65	97.34	96.79	96.40	95.69	95.07
90	6.426	129.6	99.69	98.30	98.07	97.45	97.07	96.45	95.91	94.83	94.29
91	6.520	127.1	99.53	98.58	98.27	97.72	97.25	96.70	96.46	95.99	95.12
92	6.497	127.3	99.53	97.72	97.64	96.70	96.31	95.76	95.13	94.19	93.24
93	6.581	130.5	99.54	97.55	97.24	96.48	96.02	95.33	95.02	94.41	93.79
94	6.423	131.3	99.01	97.56	97.26	96.57	96.34	95.66	94.82	94.21	93.22
95	6.374	124.9	98.64	97.60	97.44	96.88	96.40	95.92	95.60	95.28	94.56
96	6.648	112.1	99.55	98.93	98.84	98.13	97.95	96.88	96.52	95.72	95.18
97	6.560	131.7	98.79	97.57	97.42	96.66	96.28	95.82	95.52	94.68	94.15
98	6.743	128.7	98.37	97.67	97.51	96.74	96.43	95.88	95.49	94.56	93.94
99	6.743	130.5	99.31	98.31	97.78	97.32	97.01	96.40	96.09	95.48	94.79
100	6.337	125.6	99.68	99.04	97.45	96.97	96.66	96.02	95.70	94.90	94.27
Ave.	6.429	130.0	99.17	98.44	97.89	97.22	96.75	96.23	95.84	95.12	94.37
Med.	6.425	130.0	99.24	98.38	97.87	97.24	96.77	96.26	95.88	95.15	94.42
st dev	0.199	5.0	0.49	0.59	0.47	0.53	0.49	0.51	0.54	0.60	0.62
Min.	6.120	112.1	98.09	97.48	97.19	96.34	95.86	95.31	94.82	94.11	93.22
Max.	6.931	139.5	100.15	99.85	98.92	98.30	97.95	97.27	97.03	96.22	95.59

3.4 Data Set 2, 85°C, 200mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	0.2551	0.5331	2831	0.0014	0.0014	0.0015	0.0019	0.0022	0.0026	0.0033	0.0037	0.0038
52	0.2545	0.5291	2865	0.0017	0.0018	0.0018	0.0021	0.0024	0.0031	0.0037	0.0045	0.0048
53	0.2554	0.5328	2826	0.0016	0.0018	0.0020	0.0022	0.0025	0.0030	0.0034	0.0044	0.0047
54	0.2537	0.5323	2865	0.0014	0.0015	0.0017	0.0019	0.0022	0.0028	0.0032	0.0041	0.0046
55	0.2564	0.5334	2803	0.0014	0.0016	0.0017	0.0019	0.0021	0.0025	0.0028	0.0037	0.0042
56	0.2565	0.5349	2792	0.0015	0.0017	0.0023	0.0027	0.0030	0.0030	0.0034	0.0041	0.0047
57	0.2544	0.5308	2859	0.0019	0.0022	0.0026	0.0029	0.0032	0.0033	0.0038	0.0041	0.0050
58	0.2545	0.5316	2852	0.0015	0.0016	0.0020	0.0025	0.0026	0.0029	0.0043	0.0045	0.0043
59	0.2547	0.5327	2842	0.0017	0.0020	0.0024	0.0028	0.0031	0.0032	0.0035	0.0048	0.0050
60	0.2544	0.5292	2865	0.0016	0.0018	0.0023	0.0026	0.0028	0.0031	0.0035	0.0044	0.0055
61	0.2552	0.5312	2839	0.0016	0.0017	0.0023	0.0025	0.0028	0.0030	0.0034	0.0039	0.0047
62	0.2542	0.5309	2861	0.0017	0.0017	0.0017	0.0020	0.0023	0.0028	0.0034	0.0043	0.0050
63	0.2539	0.5312	2867	0.0020	0.0021	0.0025	0.0027	0.0031	0.0033	0.0038	0.0040	0.0047
64	0.2552	0.5281	2855	0.0018	0.0019	0.0024	0.0025	0.0027	0.0033	0.0039	0.0043	0.0049
65	0.2546	0.5291	2863	0.0014	0.0017	0.0020	0.0022	0.0025	0.0027	0.0032	0.0036	0.0045
66	0.2568	0.5329	2797	0.0014	0.0015	0.0018	0.0022	0.0025	0.0027	0.0031	0.0033	0.0040
67	0.2563	0.5278	2831	0.0015	0.0016	0.0019	0.0022	0.0026	0.0029	0.0032	0.0035	0.0041
68	0.2585	0.5266	2788	0.0013	0.0014	0.0020	0.0025	0.0027	0.0030	0.0034	0.0038	0.0043
69	0.2578	0.5303	2787	0.0012	0.0014	0.0020	0.0023	0.0025	0.0029	0.0034	0.0035	0.0038
70	0.2608	0.5328	2713	0.0015	0.0017	0.0023	0.0028	0.0032	0.0035	0.0040	0.0044	0.0047
71	0.2569	0.5256	2827	0.0014	0.0016	0.0018	0.0023	0.0025	0.0026	0.0032	0.0044	0.0048
72	0.2574	0.5284	2804	0.0015	0.0016	0.0022	0.0026	0.0029	0.0035	0.0037	0.0045	0.0047
73	0.2588	0.5334	2751	0.0015	0.0017	0.0022	0.0024	0.0028	0.0035	0.0041	0.0043	0.0047
74	0.2564	0.5277	2829	0.0014	0.0015	0.0021	0.0025	0.0027	0.0032	0.0039	0.0039	0.0044
75	0.2596	0.5284	2757	0.0015	0.0017	0.0021	0.0025	0.0029	0.0031	0.0035	0.0044	0.0047
76	0.2609	0.5301	2722	0.0015	0.0016	0.0022	0.0026	0.0029	0.0032	0.0035	0.0045	0.0049
77	0.2592	0.5325	2748	0.0012	0.0014	0.0017	0.0022	0.0026	0.0030	0.0033	0.0040	0.0044
78	0.2590	0.5292	2765	0.0012	0.0016	0.0019	0.0023	0.0026	0.0031	0.0036	0.0044	0.0047
79	0.2594	0.5281	2762	0.0013	0.0015	0.0018	0.0021	0.0025	0.0032	0.0036	0.0044	0.0047
80	0.2590	0.5282	2771	0.0015	0.0017	0.0021	0.0025	0.0028	0.0031	0.0033	0.0042	0.0045
81	0.2609	0.5314	2717	0.0016	0.0019	0.0021	0.0023	0.0025	0.0027	0.0032	0.0040	0.0042
82	0.2569	0.5255	2828	0.0013	0.0016	0.0021	0.0023	0.0024	0.0027	0.0032	0.0042	0.0046
83	0.2578	0.5276	2798	0.0013	0.0015	0.0016	0.0019	0.0021	0.0025	0.0029	0.0034	0.0038
84	0.2596	0.5298	2751	0.0013	0.0015	0.0016	0.0021	0.0023	0.0025	0.0027	0.0034	0.0037
85	0.2581	0.5274	2794	0.0015	0.0018	0.0021	0.0025	0.0028	0.0034	0.0038	0.0043	0.0047
86	0.2580	0.5280	2792	0.0013	0.0015	0.0015	0.0020	0.0024	0.0027	0.0033	0.0037	0.0041
87	0.2566	0.5272	2827	0.0013	0.0016	0.0018	0.0020	0.0023	0.0026	0.0031	0.0036	0.0040
88	0.2601	0.5302	2739	0.0015	0.0017	0.0019	0.0023	0.0026	0.0028	0.0032	0.0037	0.0041
89	0.2579	0.5269	2800	0.0013	0.0014	0.0018	0.0022	0.0025	0.0026	0.0031	0.0039	0.0043
90	0.2575	0.5296	2797	0.0016	0.0018	0.0019	0.0022	0.0025	0.0026	0.0030	0.0036	0.0039
91	0.2587	0.5305	2767	0.0016	0.0020	0.0020	0.0024	0.0027	0.0030	0.0034	0.0040	0.0043
92	0.2588	0.5302	2766	0.0018	0.0021	0.0023	0.0026	0.0031	0.0032	0.0034	0.0040	0.0043
93	0.2566	0.5278	2824	0.0016	0.0019	0.0021	0.0025	0.0028	0.0030	0.0034	0.0042	0.0044
94	0.2576	0.5292	2796	0.0015	0.0020	0.0021	0.0024	0.0027	0.0025	0.0029	0.0037	0.0040
95	0.2604	0.5293	2735	0.0014	0.0018	0.0021	0.0022	0.0026	0.0028	0.0030	0.0038	0.0044
96	0.2577	0.5279	2800	0.0019	0.0021	0.0025	0.0028	0.0031	0.0032	0.0035	0.0040	0.0046
97	0.2572	0.5282	2810	0.0017	0.0021	0.0021	0.0025	0.0029	0.0029	0.0031	0.0034	0.0039
98	0.2609	0.5316	2715	0.0020	0.0026	0.0028	0.0031	0.0034	0.0042	0.0047	0.0046	0.0050
99	0.2586	0.5287	2776	0.0017	0.0021	0.0021	0.0024	0.0028	0.0030	0.0033	0.0035	0.0041
100	0.2593	0.5285	2763	0.0015	0.0020	0.0020	0.0022	0.0025	0.0031	0.0034	0.0036	0.0041
Ave.	0.2574	0.5298	2799	0.0015	0.0017	0.0020	0.0024	0.0027	0.0030	0.0034	0.0040	0.0044
Med.	0.2576	0.5293	2798	0.0015	0.0017	0.0020	0.0024	0.0026	0.0030	0.0034	0.0040	0.0045
st dev	0.0021	0.0022	44.4746	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004
Min.	0.2537	0.5255	2713	0.0012	0.0014	0.0015	0.0019	0.0021	0.0025	0.0027	0.0033	0.0037
Max.	0.2609	0.5349	2867	0.0020	0.0026	0.0028	0.0031	0.0034	0.0042	0.0047	0.0048	0.0055

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 5.823E-06
 β : 0.996
Calculated L₇₀: 61,000hours
Reported L₇₀: >54,000hours



3.5 Data Set 3, 105°C, 200 mA (Lumen Maintenance)

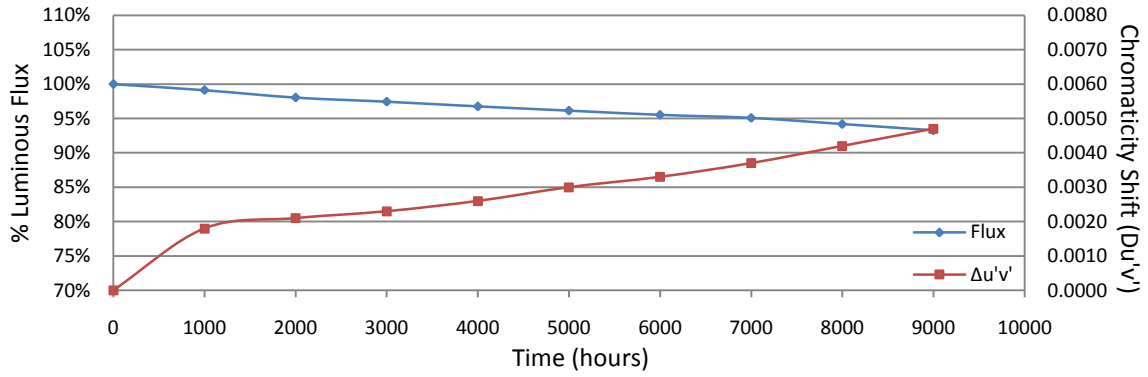
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
101	6.177	136.9	98.90	98.10	97.44	96.79	96.35	95.76	95.33	94.38	93.35
102	6.491	132.8	99.47	98.80	97.97	97.29	96.69	96.23	95.93	94.95	93.98
103	6.168	137.2	97.74	97.08	96.79	96.21	95.77	95.34	94.90	94.17	93.44
104	6.369	135.5	99.19	98.30	97.79	97.20	96.83	96.24	95.87	94.98	93.95
105	6.191	135.4	99.70	98.89	98.38	97.86	97.34	96.31	94.46	93.72	92.76
106	6.143	135.2	99.56	98.52	98.00	97.34	96.75	96.15	95.71	94.90	94.08
107	6.160	137.4	98.98	98.33	97.82	96.94	96.29	95.71	95.12	94.18	93.30
108	6.482	131.6	99.54	98.78	98.25	97.49	96.81	96.35	95.67	94.68	93.84
109	6.404	132.7	99.02	97.97	97.36	96.76	96.31	95.70	95.33	94.27	93.44
110	6.327	134.9	99.41	98.30	97.63	96.81	96.22	95.77	95.33	94.14	93.18
111	6.163	135.3	99.11	98.08	96.60	95.86	95.49	94.90	94.53	93.64	92.76
112	6.135	138.0	99.20	97.97	97.32	96.67	96.30	95.36	95.00	94.20	93.48
113	6.172	136.3	99.34	98.31	97.73	97.07	96.63	95.96	95.67	94.64	93.91
114	6.152	134.9	99.26	97.92	97.55	97.11	96.59	95.70	95.18	94.29	93.40
115	6.317	129.7	99.77	98.46	98.23	97.61	96.99	96.53	96.07	95.14	94.14
116	6.549	134.6	99.48	98.37	97.99	97.33	96.43	96.14	95.77	95.17	94.35
117	6.547	123.6	99.11	98.14	97.90	97.25	96.68	95.63	95.15	94.42	93.45
118	6.739	121.5	99.09	98.02	97.45	96.79	96.13	95.47	95.06	94.07	93.09
119	6.403	130.9	98.55	97.02	96.56	95.95	95.11	94.58	93.96	92.97	92.21
120	6.532	127.4	99.14	97.72	96.94	96.23	95.60	94.90	94.43	93.64	92.94
121	6.456	129.6	99.46	98.07	97.38	96.45	96.06	95.52	95.14	94.44	93.52
122	6.632	115.4	99.39	98.27	98.01	97.40	96.88	95.75	95.49	94.97	94.11
123	6.394	127.2	98.82	97.64	97.41	96.86	95.99	95.75	95.36	94.65	93.87
124	6.403	127.9	98.28	97.26	96.56	95.93	95.07	94.45	94.14	93.35	92.49
125	6.510	124.7	98.96	98.08	97.67	96.79	95.99	95.51	95.19	94.55	93.58
126	6.463	125.8	98.89	98.33	97.85	97.14	96.50	95.71	95.31	94.44	93.48
127	6.707	131.3	98.40	97.79	97.11	96.50	95.66	94.82	94.44	93.98	92.84
128	6.546	128.5	98.52	97.35	96.96	96.26	95.64	94.71	94.24	93.23	92.37
129	6.553	128.4	99.53	97.82	97.43	96.73	95.95	95.25	94.70	93.85	92.76
130	6.535	130.7	99.08	98.39	98.01	97.48	96.86	96.25	95.79	94.80	93.88
131	6.731	129.2	98.84	97.14	96.59	95.82	95.20	94.66	94.27	93.27	92.34
132	6.528	128.0	98.98	97.27	97.03	96.41	96.02	95.47	94.84	93.91	92.89
133	6.695	123.8	99.27	97.50	97.09	96.45	95.88	95.23	94.83	93.13	92.16
134	6.542	134.1	99.63	98.21	97.17	96.50	95.97	95.30	95.00	94.18	93.29
135	6.627	120.1	99.50	98.25	98.08	97.09	96.50	96.09	95.67	94.67	93.34
136	6.602	133.9	99.25	98.21	97.54	96.94	96.34	95.59	95.15	94.17	93.35
137	6.441	126.6	99.68	98.74	97.31	96.76	95.97	95.66	95.34	94.31	93.76
138	6.760	123.6	99.27	97.90	97.82	96.93	95.95	95.63	95.47	94.58	93.53
139	6.682	133.3	98.87	97.45	97.30	96.47	95.57	94.75	94.52	93.92	93.10
140	6.633	120.0	99.67	98.17	97.42	96.75	96.08	95.50	95.25	94.50	93.50
141	6.564	125.6	98.96	98.01	97.13	96.42	96.02	95.62	94.90	94.27	93.31
142	6.581	129.7	98.84	98.15	97.15	96.53	95.68	95.14	94.91	93.75	92.83
143	6.588	128.2	98.52	97.50	97.04	96.26	95.40	94.85	94.31	92.82	91.81
144	6.590	126.9	99.05	98.19	97.08	96.38	95.98	95.19	94.80	93.77	92.83
145	6.633	118.1	99.58	98.39	97.12	96.61	96.10	95.51	95.00	93.73	92.63
146	6.647	114.9	99.48	98.69	97.21	96.69	96.17	95.56	95.04	94.26	93.30
147	6.571	125.9	98.81	98.09	97.78	97.06	96.19	95.63	95.23	94.28	93.57
148	6.389	130.4	98.77	97.62	97.09	96.32	95.63	95.32	95.09	94.40	93.71
149	6.377	128.3	99.14	98.29	97.74	96.96	96.26	95.71	95.40	94.31	93.69
150	6.503	134.1	99.18	98.21	97.17	96.50	95.97	95.30	94.78	93.74	92.84
Ave.	6.470	129.3	99.12	98.04	97.44	96.76	96.14	95.52	95.08	94.18	93.27
Med.	6.519	129.7	99.14	98.12	97.41	96.76	96.09	95.58	95.13	94.26	93.35
st dev	0.179	5.7	0.41	0.46	0.46	0.47	0.50	0.50	0.50	0.55	0.57
Min.	6.135	114.9	97.74	97.02	96.56	95.82	95.07	94.45	93.96	92.82	91.81
Max.	6.760	138.0	99.77	98.89	98.38	97.86	97.34	96.53	96.07	95.17	94.35

3.6 Data Set 3, 105°C, 200 mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	Ohr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
101	0.2565	0.5331	2802	0.0016	0.0020	0.0022	0.0026	0.0030	0.0032	0.0036	0.0038	0.0038
102	0.2561	0.5309	2820	0.0017	0.0020	0.0022	0.0026	0.0030	0.0032	0.0037	0.0038	0.0038
103	0.2548	0.5323	2842	0.0025	0.0031	0.0032	0.0036	0.0039	0.0039	0.0044	0.0052	0.0055
104	0.2546	0.5323	2846	0.0016	0.0021	0.0021	0.0023	0.0026	0.0031	0.0035	0.0036	0.0039
105	0.2570	0.5335	2790	0.0020	0.0024	0.0025	0.0027	0.0031	0.0038	0.0042	0.0044	0.0047
106	0.2566	0.5330	2799	0.0015	0.0018	0.0019	0.0022	0.0026	0.0028	0.0033	0.0034	0.0038
107	0.2544	0.5287	2869	0.0016	0.0018	0.0020	0.0024	0.0027	0.0030	0.0036	0.0038	0.0039
108	0.2540	0.5324	2858	0.0019	0.0022	0.0023	0.0027	0.0029	0.0033	0.0039	0.0041	0.0045
109	0.2561	0.5331	2810	0.0018	0.0022	0.0023	0.0026	0.0030	0.0031	0.0038	0.0040	0.0043
110	0.2551	0.5348	2824	0.0014	0.0018	0.0018	0.0022	0.0027	0.0028	0.0034	0.0039	0.0044
111	0.2541	0.5306	2865	0.0015	0.0017	0.0020	0.0024	0.0028	0.0030	0.0034	0.0039	0.0043
112	0.2550	0.5298	2850	0.0015	0.0018	0.0019	0.0023	0.0027	0.0033	0.0037	0.0043	0.0048
113	0.2546	0.5277	2868	0.0018	0.0021	0.0024	0.0028	0.0032	0.0034	0.0039	0.0046	0.0050
114	0.2557	0.5330	2820	0.0014	0.0018	0.0018	0.0022	0.0025	0.0028	0.0033	0.0037	0.0041
115	0.2551	0.5316	2839	0.0018	0.0019	0.0021	0.0023	0.0028	0.0033	0.0035	0.0043	0.0048
116	0.2592	0.5319	2750	0.0016	0.0020	0.0021	0.0025	0.0029	0.0032	0.0034	0.0041	0.0048
117	0.2582	0.5295	2781	0.0017	0.0019	0.0023	0.0025	0.0029	0.0033	0.0036	0.0043	0.0050
118	0.2620	0.5322	2690	0.0016	0.0018	0.0020	0.0024	0.0029	0.0031	0.0034	0.0039	0.0047
119	0.2604	0.5318	2726	0.0018	0.0022	0.0026	0.0030	0.0032	0.0035	0.0037	0.0042	0.0048
120	0.2592	0.5292	2761	0.0016	0.0019	0.0025	0.0029	0.0034	0.0037	0.0044	0.0049	0.0055
121	0.2570	0.5283	2813	0.0021	0.0023	0.0026	0.0030	0.0034	0.0037	0.0040	0.0043	0.0051
122	0.2562	0.5269	2838	0.0018	0.0021	0.0023	0.0026	0.0030	0.0035	0.0038	0.0042	0.0048
123	0.2584	0.5309	2770	0.0016	0.0019	0.0020	0.0023	0.0027	0.0031	0.0034	0.0038	0.0045
124	0.2591	0.5300	2760	0.0016	0.0021	0.0024	0.0028	0.0031	0.0033	0.0040	0.0043	0.0051
125	0.2587	0.5295	2770	0.0018	0.0020	0.0022	0.0025	0.0028	0.0033	0.0039	0.0043	0.0048
126	0.2587	0.5281	2776	0.0017	0.0020	0.0021	0.0026	0.0027	0.0031	0.0036	0.0040	0.0047
127	0.2579	0.5275	2796	0.0015	0.0018	0.0020	0.0024	0.0025	0.0031	0.0036	0.0038	0.0045
128	0.2587	0.5290	2774	0.0017	0.0019	0.0019	0.0022	0.0027	0.0031	0.0035	0.0036	0.0042
129	0.2581	0.5270	2795	0.0018	0.0021	0.0024	0.0028	0.0031	0.0035	0.0039	0.0040	0.0047
130	0.2584	0.5324	2765	0.0016	0.0020	0.0022	0.0026	0.0029	0.0033	0.0036	0.0041	0.0045
131	0.2580	0.5267	2798	0.0020	0.0021	0.0023	0.0026	0.0029	0.0033	0.0039	0.0044	0.0049
132	0.2586	0.5277	2781	0.0016	0.0020	0.0021	0.0025	0.0030	0.0032	0.0037	0.0044	0.0049
133	0.2616	0.5335	2694	0.0023	0.0026	0.0028	0.0031	0.0036	0.0038	0.0041	0.0048	0.0053
134	0.2558	0.5244	2860	0.0019	0.0021	0.0024	0.0027	0.0031	0.0036	0.0041	0.0047	0.0052
135	0.2564	0.5263	2835	0.0018	0.0020	0.0021	0.0026	0.0027	0.0031	0.0034	0.0041	0.0046
136	0.2598	0.5314	2740	0.0018	0.0021	0.0024	0.0027	0.0030	0.0035	0.0039	0.0045	0.0050
137	0.2598	0.5316	2738	0.0017	0.0019	0.0021	0.0024	0.0027	0.0029	0.0033	0.0042	0.0045
138	0.2602	0.5309	2733	0.0017	0.0020	0.0022	0.0028	0.0030	0.0034	0.0038	0.0045	0.0050
139	0.2598	0.5316	2739	0.0021	0.0024	0.0024	0.0029	0.0031	0.0034	0.0038	0.0041	0.0046
140	0.2568	0.5272	2822	0.0017	0.0019	0.0022	0.0025	0.0029	0.0032	0.0036	0.0040	0.0045
141	0.2586	0.5278	2781	0.0017	0.0021	0.0022	0.0026	0.0027	0.0031	0.0036	0.0040	0.0046
142	0.2586	0.5310	2766	0.0016	0.0021	0.0025	0.0028	0.0031	0.0033	0.0039	0.0043	0.0048
143	0.2591	0.5297	2762	0.0018	0.0022	0.0022	0.0026	0.0029	0.0032	0.0036	0.0040	0.0045
144	0.2587	0.5285	2775	0.0019	0.0021	0.0026	0.0029	0.0033	0.0034	0.0039	0.0044	0.0049
145	0.2584	0.5268	2789	0.0018	0.0021	0.0023	0.0026	0.0029	0.0032	0.0035	0.0041	0.0046
146	0.2581	0.5266	2796	0.0021	0.0023	0.0024	0.0027	0.0029	0.0032	0.0036	0.0040	0.0045
147	0.2553	0.5266	2859	0.0019	0.0019	0.0022	0.0026	0.0029	0.0032	0.0034	0.0041	0.0045
148	0.2579	0.5286	2791	0.0018	0.0022	0.0025	0.0028	0.0032	0.0035	0.0039	0.0044	0.0049
149	0.2587	0.5269	2782	0.0020	0.0023	0.0023	0.0026	0.0030	0.0032	0.0038	0.0044	0.0048
150	0.2577	0.5296	2792	0.0019	0.0022	0.0023	0.0027	0.0030	0.0034	0.0036	0.0040	0.0046
Ave.	0.2576	0.5299	2794	0.0018	0.0021	0.0023	0.0026	0.0030	0.0033	0.0037	0.0042	0.0047
Med.	0.2581	0.5298	2792	0.0018	0.0021	0.0022	0.0026	0.0029	0.0033	0.0037	0.0041	0.0047
st dev	0.0020	0.0024	43.8881	0.0002	0.0002	0.0003	0.0003	0.0003	0.0002	0.0003	0.0003	0.0004
Min.	0.2540	0.5244	2690	0.0014	0.0017	0.0018	0.0022	0.0025	0.0028	0.0033	0.0034	0.0038
Max.	0.2620	0.5348	2869	0.0025	0.0031	0.0032	0.0036	0.0039	0.0039	0.0044	0.0052	0.0055

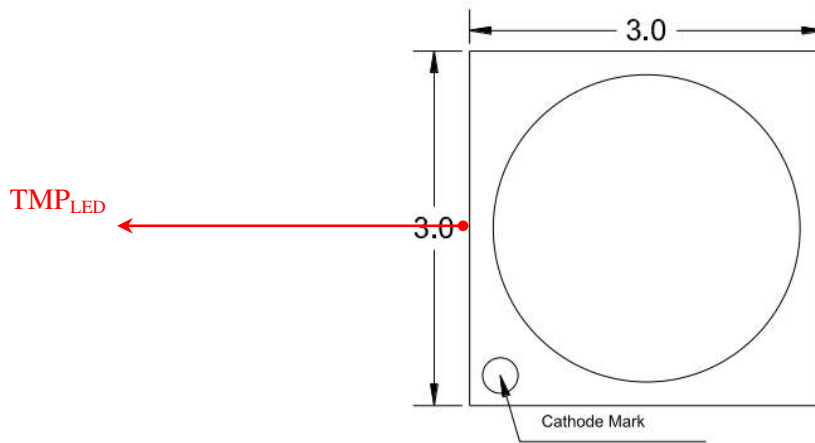
TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 7.145E-06
 β : 0.997
Calculated L₇₀: 49,000 hours
Reported L₇₀: 49,000 hours



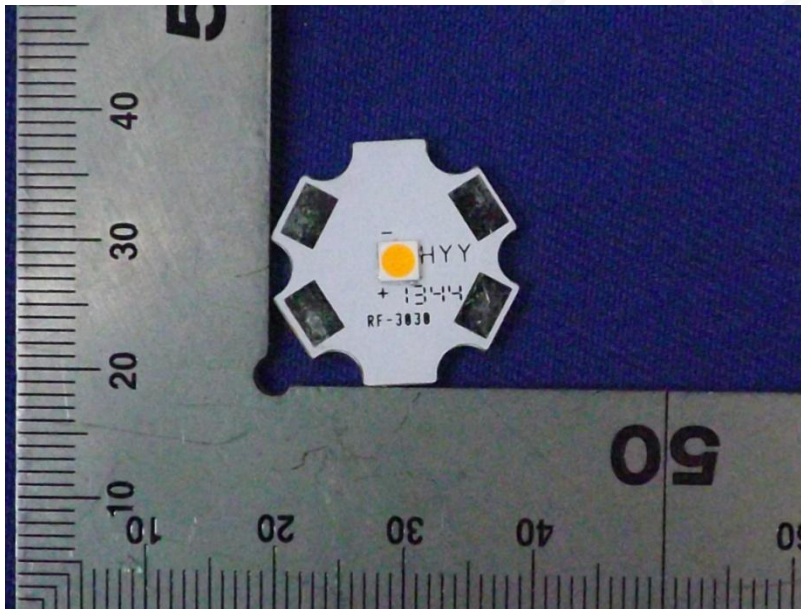
Appendix A – EUT PHOTO

A.1 Mechanical Dimensions (Ta = 25°C)



All dimensions are in millimeter

A.2 EUT Photo



Attachment B – Family declaration Letter



SHENZHEN REFOND OPTOELECTRONICS CO., LTD.

ATTESTATION OF SIMILARITY

To Whom It May Concern,

We, | SHENZHEN REFOND OPTOELECTRONICS CO., LTD |, hereby attests the series model **RF-Q30RA****-****** and the series model **RT-Q30RA****-****** are designed with identical material and construction processes. only different in expressions between the two series. And the model **RF-Q30RA27A-01-J2** is tested by BACL. The results of which are featured in BACL project No.R2DG150415051-10-9000.

The tested model **RF-Q30RA27A-01-J2** and the other LED package model 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 CCT. Their differences are listed in the following table

Details as below:

Series name	Model name	CCT (K)	Number of Dies	Current (mA)	Volt (v)
3030	RF-Q30RA****-**** (Test model: RF-Q30RA27A-01-J2	2700/3000//3500/4000/4500/ 5000/5500/5700/6000/6500	1	200	6
3030	RT-Q30RA****-****	2700/3000//3500/4000/4500/ 5000/5500/5700/6000/6500	1	200	6

Model Number Format:

RF-Q30RA * * * - * * - * *

A1 A2 A3 A4 A5 A6

A1 A2 A3 A4 A5 A6
Fixed Code Fixed Code CCT Workshop Code Internal Code Internal Code

Note::

- A1: Letter RF can be RF or RT. It is an internal Market code which does not affect product property.
- A2: Letter Q30RA is a fixed code.
- A3: Letter * * represent CCT, it can be 27, 30, 35, 40, 45, 50, 55, 57, 60, 65. The CCT are listed in the follow form.
- A4: Letter * represent workshop code, it can be A, B, or C which does not affect product property.
- A5: Letter * represent Work equipment serial number, it can be 01, 06, 07, 13, 14, 16, 17, 18, 19, 24, 25, 26, or FD which does not affect product property. Just use different spectral machine serial number
- A6: Letter * * can be J2, C2 or H2, It is an internal Market code which does not affect product property.

SHENZHEN REFOND OPTOELECTRONICS CO., LTD
Mail: tongwen.yu@refond.com Tel: 0755-29675000 Fax: 0755-29675111 |



Model description as below is part of items according to the two cases, It can be further described by other model number if the new item follows above regulation.

Notes: Product model with different production workshop, according to different buyers, lead to changes in the name of product, but the product at the same process and materials.

Besides the differences in the table above, we declare the products are identical
We guarantee all the information provided above is true, and notice that we'll bear all the consequences caused by any false information or concealing

Best Regards

Signature: *Tommy 2016.3.27*
Print Name:
Title: *Yutong wen*

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