



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

LIGHTNING OPTOELECTRONIC TECHNOLOGY (SZ) Co., LTD.

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

Model:T3B

Report Type: 9000 Hours Report		Product Type: LED Package
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Report Number:	RSZ130913507-10-9000	
Test Date:	2013-09-28 to 2014-10-16	
Report Date:	2014-10-30	
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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).

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1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: T3B
 Part Name: 3014
 Part Type: LED Package
 Nominal CCT: 2700K

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, length: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	1011064	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	#2	N/A	2014-03-19	2015-03-19
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090004	(50/15A)	2014-03-12	2015-03-12

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 $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, 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 $U=21\text{K}$ ($K=2$), 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 °C, 85 °C and T_s 105 °C were received at 2013-09-13 and tested during 2013-09-28 to 2014-10-16. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Data Set 1: 55 °C, 60mA

Part Number:	T3B
Number of Units:	25
Actual Case Temperature(T_s):	$T_s = 54.4$ °C
Actual Ambient Temperature(T_A):	$T_A = 53.7$ °C
Life Test Drive Current:	$I_F = 60$ mA
Measurement Current:	$I_F = 60$ mA

Data Set 2: 85°C, 60mA

Part Number:	T3B
Number of Units:	25
Actual Case Temperature(T_s):	$T_s = 85.4$ °C
Actual Ambient Temperature(T_A):	$T_A = 83.3$ °C
Life Test Drive Current:	$I_F = 60$ mA
Measurement Current:	$I_F = 60$ mA

Data Set 3: 105 °C, 60mA

Part Number:	T3B
Number of Units:	25
Actual Case Temperature(T_s):	$T_s = 104.5$ °C
Actual Ambient Temperature(T_A):	$T_A = 103.4$ °C
Life Test Drive Current:	$I_F = 60$ mA
Measurement Current:	$I_F = 60$ mA

2 - SUMMARY OF TEST RESULT

Data Set:	Data Set 1, 55 °C, 60mA
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	97.06%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0019
Average. Lumen Maintenance at 9000 hours:	96.08%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0026
Reported TM-21 L ₇₀ Lifetime:	>54000hours

Data Set:	Data Set 2, 85°C, 60mA
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	96.53%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0021
Average. Lumen Maintenance at 9000 hours:	95.38%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0029
Reported TM-21 L ₇₀ Lifetime	>54000hours

Data Set:	Data Set 3, 105 °C, 60mA
Number of Units:	25
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	95.84%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0023
Average. Lumen Maintenance at 9000 hours:	94.53%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0030
Reported TM-21 L ₇₀ Lifetime	>54000hours

3 - Test Data

3.1 Data Set 1, 55 °C, 60mA (Lumen Maintenance)

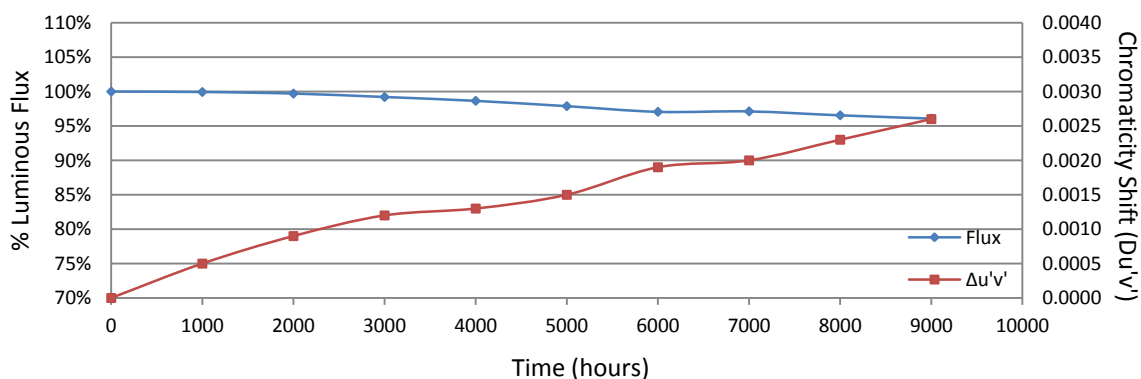
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	3.049	20.800	99.90	99.66	99.47	99.09	97.64	96.83	97.36	96.83	96.30
2	3.041	20.730	99.86	99.57	99.23	98.41	97.25	96.67	96.91	96.43	96.09
3	3.037	20.430	100.15	99.95	99.51	98.29	97.70	96.87	97.01	96.43	96.04
4	3.048	20.890	100.00	99.86	99.33	98.61	97.99	96.89	97.03	96.46	95.93
5	3.051	20.880	99.95	99.76	99.33	98.80	97.65	96.93	96.98	96.36	95.83
6	3.047	20.940	99.95	99.67	99.00	98.71	97.71	97.23	97.47	96.99	96.56
7	3.044	20.790	99.81	99.71	99.23	98.56	97.40	97.11	97.26	96.73	96.34
8	3.054	20.730	99.95	99.47	98.89	98.17	97.11	96.58	96.04	95.18	94.74
9	3.043	21.000	100.10	99.90	99.43	98.86	98.29	97.76	97.95	97.43	96.95
10	3.047	20.700	99.86	99.52	99.23	98.60	97.92	97.39	97.58	96.86	96.38
11	3.042	20.870	100.00	99.47	99.19	98.56	98.13	97.13	97.22	96.74	96.36
12	3.043	20.450	99.85	99.71	99.07	98.78	98.04	97.41	97.56	97.26	96.82
13	3.052	20.340	99.90	99.66	99.12	98.33	97.54	96.07	96.36	95.48	94.84
14	3.048	21.220	99.95	99.76	99.15	98.82	98.26	97.83	97.97	97.36	96.94
15	3.049	21.100	99.76	99.43	98.86	98.53	97.96	96.45	96.54	95.69	95.21
16	3.045	20.780	100.14	99.90	99.42	98.94	98.08	97.50	97.55	96.92	96.44
17	3.061	20.720	99.90	99.66	98.99	98.46	97.92	97.35	97.06	96.72	96.24
18	3.050	20.970	99.95	99.81	99.33	98.62	98.19	96.76	96.95	96.52	96.04
19	3.043	20.570	99.81	99.61	99.12	98.64	98.01	97.23	96.89	96.35	95.87
20	3.043	21.000	99.86	99.81	99.24	98.52	97.62	96.62	96.95	96.43	95.86
21	3.037	20.560	100.00	99.66	99.17	98.59	98.10	97.18	97.23	96.79	96.30
22	3.054	20.590	100.00	99.90	99.42	99.13	98.79	97.81	98.01	97.43	96.94
23	3.052	20.960	99.90	99.67	99.19	98.52	97.42	97.04	96.80	96.14	95.61
24	3.041	20.620	100.00	99.81	99.18	98.84	98.01	96.61	96.07	95.54	95.05
25	3.055	20.520	100.05	99.81	99.22	98.88	98.15	97.32	97.32	96.73	96.25
Ave.	3.047	20.766	99.94	99.71	99.21	98.65	97.88	97.06	97.12	96.55	96.08
Med.	3.047	20.780	99.95	99.71	99.22	98.61	97.96	97.11	97.06	96.72	96.24
st dev	0.0058	0.2212	0.1000	0.1457	0.1708	0.2364	0.3714	0.4420	0.5212	0.5953	0.6148
Min.	3.037	20.340	99.76	99.43	98.86	98.17	97.11	96.07	96.04	95.18	94.74
Max.	3.061	21.220	100.15	99.95	99.51	99.13	98.79	97.83	98.01	97.43	96.95

TM-21 Projection:

Test Duration: 9000hours
Failures Observed: 0
 α : 4.93E-06
 β : 1.004
Calculated L₇₀: 73,000hours
Reported L₇₀: >54,000hours

3.2 Data Set 1, 55 ℃, 60mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2562	0.5301	2823	0.0003	0.0006	0.0007	0.0011	0.0018	0.0021	0.0024	0.0026	0.0029
2	0.2563	0.5302	2820	0.0007	0.0007	0.0008	0.0009	0.0011	0.0013	0.0016	0.0018	0.0021
3	0.2589	0.5309	2760	0.0008	0.0008	0.0010	0.0012	0.0013	0.0015	0.0017	0.0020	0.0024
4	0.2561	0.5286	2831	0.0004	0.0010	0.0014	0.0015	0.0014	0.0018	0.0021	0.0023	0.0027
5	0.2574	0.5286	2803	0.0007	0.0011	0.0014	0.0013	0.0018	0.0018	0.0017	0.0020	0.0024
6	0.2562	0.5280	2832	0.0005	0.0007	0.0008	0.0005	0.0011	0.0014	0.0015	0.0017	0.0020
7	0.2561	0.5296	2827	0.0007	0.0010	0.0011	0.0011	0.0013	0.0015	0.0016	0.0018	0.0021
8	0.2555	0.5289	2842	0.0006	0.0011	0.0014	0.0016	0.0019	0.0021	0.0022	0.0026	0.0028
9	0.2570	0.5297	2807	0.0007	0.0011	0.0011	0.0014	0.0016	0.0017	0.0017	0.0020	0.0022
10	0.2586	0.5305	2768	0.0005	0.0009	0.0011	0.0012	0.0014	0.0016	0.0016	0.0019	0.0023
11	0.2563	0.5300	2821	0.0004	0.0005	0.0010	0.0011	0.0009	0.0014	0.0015	0.0019	0.0022
12	0.2556	0.5291	2840	0.0006	0.0010	0.0014	0.0015	0.0018	0.0020	0.0019	0.0021	0.0024
13	0.2560	0.5291	2831	0.0005	0.0010	0.0014	0.0015	0.0016	0.0022	0.0025	0.0028	0.0032
14	0.2550	0.5283	2856	0.0005	0.0013	0.0014	0.0014	0.0012	0.0019	0.0018	0.0021	0.0023
15	0.2557	0.5289	2838	0.0006	0.0009	0.0013	0.0013	0.0015	0.0021	0.0021	0.0025	0.0029
16	0.2559	0.5275	2841	0.0002	0.0006	0.0009	0.0009	0.0015	0.0016	0.0017	0.0019	0.0022
17	0.2575	0.5302	2794	0.0002	0.0005	0.0009	0.0012	0.0013	0.0016	0.0019	0.0021	0.0025
18	0.2565	0.5286	2822	0.0003	0.0007	0.0012	0.0013	0.0016	0.0017	0.0018	0.0021	0.0024
19	0.2576	0.5299	2792	0.0005	0.0011	0.0012	0.0014	0.0017	0.0018	0.0018	0.0022	0.0026
20	0.2567	0.5307	2808	0.0003	0.0006	0.0012	0.0014	0.0018	0.0023	0.0025	0.0029	0.0032
21	0.2551	0.5285	2853	0.0003	0.0006	0.0010	0.0012	0.0017	0.0022	0.0024	0.0026	0.0030
22	0.2557	0.5297	2835	0.0007	0.0012	0.0013	0.0016	0.0017	0.0020	0.0022	0.0024	0.0027
23	0.2579	0.5316	2778	0.0007	0.0008	0.0011	0.0014	0.0016	0.0022	0.0022	0.0026	0.0030
24	0.2564	0.5311	2814	0.0009	0.0011	0.0015	0.0016	0.0019	0.0025	0.0025	0.0030	0.0034
25	0.2557	0.5279	2843	0.0007	0.0012	0.0013	0.0015	0.0016	0.0023	0.0024	0.0026	0.0028
Ave.	0.2565	0.5294	2819	0.0005	0.0009	0.0012	0.0013	0.0015	0.0019	0.0020	0.0023	0.0026
Med.	0.2562	0.5296	2823	0.0005	0.0009	0.0012	0.0013	0.0016	0.0018	0.0019	0.0021	0.0025
st dev	0.0010	0.0011	25.3191	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004
Min.	0.2550	0.5275	2760	0.0002	0.0005	0.0007	0.0005	0.0009	0.0013	0.0015	0.0017	0.0020
Max.	0.2589	0.5316	2856	0.0009	0.0013	0.0015	0.0016	0.0019	0.0025	0.0025	0.0030	0.0034



3.3 Data Set 2, 85°C, 60mA (Lumen Maintenance)

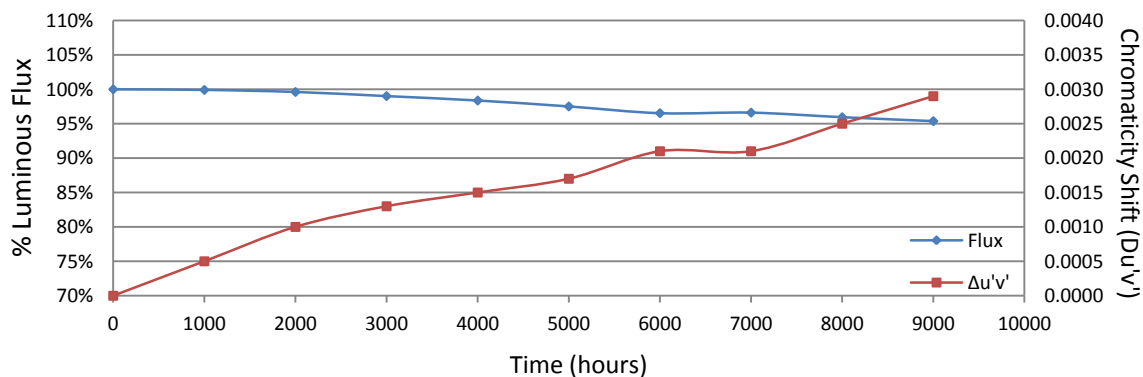
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	3.050	20.710	99.90	99.66	99.03	98.50	97.30	96.43	96.76	96.19	95.65
27	3.050	20.560	99.90	99.56	98.98	98.30	97.32	96.89	97.52	96.98	96.30
28	3.045	20.640	100.05	99.81	99.37	98.59	98.16	97.43	97.00	96.41	95.78
29	3.048	20.690	99.81	99.66	98.84	98.45	96.91	96.18	96.33	95.55	95.02
30	3.046	21.080	99.81	99.43	99.00	98.34	97.63	96.82	97.01	96.35	95.78
31	3.042	20.500	99.71	99.27	98.73	98.00	97.41	96.54	96.68	96.15	95.66
32	3.040	20.640	100.00	99.90	99.27	98.50	97.34	96.32	96.27	95.69	95.16
33	3.053	20.390	99.95	99.80	99.12	98.14	97.55	96.57	96.52	95.78	95.29
34	3.053	20.870	99.81	99.47	98.95	98.23	98.08	96.93	96.74	96.02	95.50
35	3.058	20.920	100.10	99.95	99.47	98.52	97.51	96.80	96.99	96.51	95.89
36	3.027	20.500	99.95	99.66	98.98	98.20	97.66	96.54	96.88	96.10	95.56
37	3.042	20.970	100.05	99.81	99.28	98.09	96.90	96.47	96.57	95.85	95.18
38	3.051	20.700	99.95	99.37	98.84	98.45	97.39	96.43	96.91	96.18	95.75
39	3.050	21.100	99.91	99.53	98.91	98.53	97.63	96.11	95.92	95.26	94.64
40	3.048	20.780	99.81	99.57	98.80	98.08	96.97	96.29	96.29	95.67	95.14
41	3.051	20.710	100.05	99.86	99.08	98.60	98.02	96.48	96.28	95.56	94.88
42	3.055	20.340	99.95	99.46	99.02	98.13	97.15	96.41	96.31	95.53	94.99
43	3.049	21.400	99.91	99.39	98.79	97.99	96.73	96.03	96.40	95.79	95.14
44	3.047	20.770	99.81	99.47	98.89	98.60	97.64	96.24	95.86	95.33	94.70
45	3.052	20.870	99.95	99.86	99.23	98.71	98.47	96.89	97.32	96.60	96.07
46	3.049	20.870	99.76	99.57	99.19	98.71	97.60	96.45	96.65	95.83	95.35
47	3.049	20.630	99.90	99.52	98.89	98.64	98.11	97.14	97.33	96.85	96.12
48	3.045	20.620	99.81	99.47	98.88	98.25	97.33	96.51	96.27	95.49	94.91
49	3.037	20.700	99.95	99.52	98.79	98.07	97.34	96.33	96.14	95.31	94.78
50	3.047	20.900	100.05	99.76	98.95	98.56	97.56	96.03	96.36	95.69	95.12
Ave.	3.047	20.754	99.91	99.61	99.01	98.37	97.51	96.53	96.61	95.95	95.38
Med.	3.049	20.710	99.91	99.57	98.98	98.45	97.51	96.47	96.57	95.83	95.29
st dev	0.0063	0.2349	0.1031	0.1865	0.1970	0.2337	0.4247	0.3434	0.4328	0.4752	0.4649
Min.	3.027	20.340	99.71	99.27	98.73	97.99	96.73	96.03	95.86	95.26	94.64
Max.	3.058	21.400	100.10	99.95	99.47	98.71	98.47	97.43	97.52	96.98	96.30

TM-21 Projection:

Test Duration: 9000hours
Failures Observed: 0
 α : 5.768E-06
 β : 1.004
Calculated L₇₀: 63,000hours
Reported L₇₀: >54,000hours

3.4 Data Set 2, 85°C, 60mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	0.2568	0.5280	2819	0.0005	0.0009	0.0012	0.0016	0.0017	0.0021	0.0020	0.0024	0.0028
27	0.2561	0.5267	2840	0.0004	0.0006	0.0011	0.0012	0.0013	0.0016	0.0017	0.0020	0.0025
28	0.2568	0.5290	2813	0.0005	0.0009	0.0013	0.0014	0.0020	0.0022	0.0022	0.0025	0.0029
29	0.2556	0.5272	2848	0.0002	0.0010	0.0014	0.0015	0.0020	0.0020	0.0021	0.0026	0.0030
30	0.2545	0.5282	2868	0.0004	0.0010	0.0012	0.0015	0.0018	0.0021	0.0020	0.0024	0.0027
31	0.2552	0.5277	2855	0.0004	0.0011	0.0013	0.0015	0.0019	0.0023	0.0022	0.0026	0.0029
32	0.2560	0.5292	2831	0.0005	0.0012	0.0015	0.0015	0.0020	0.0025	0.0026	0.0030	0.0032
33	0.2562	0.5277	2833	0.0004	0.0012	0.0015	0.0017	0.0020	0.0027	0.0029	0.0031	0.0034
34	0.2545	0.5287	2866	0.0002	0.0009	0.0013	0.0015	0.0016	0.0023	0.0025	0.0029	0.0033
35	0.2566	0.5297	2814	0.0007	0.0008	0.0014	0.0019	0.0018	0.0025	0.0027	0.0029	0.0034
36	0.2551	0.5277	2857	0.0005	0.0007	0.0012	0.0015	0.0019	0.0020	0.0021	0.0024	0.0027
37	0.2583	0.5311	2771	0.0007	0.0008	0.0011	0.0015	0.0018	0.0023	0.0022	0.0026	0.0030
38	0.2559	0.5277	2841	0.0006	0.0011	0.0013	0.0014	0.0016	0.0020	0.0024	0.0028	0.0032
39	0.2571	0.5298	2803	0.0008	0.0013	0.0013	0.0016	0.0015	0.0017	0.0019	0.0023	0.0028
40	0.2542	0.5298	2868	0.0003	0.0009	0.0014	0.0015	0.0015	0.0017	0.0009	0.0014	0.0013
41	0.2553	0.5265	2860	0.0003	0.0008	0.0012	0.0014	0.0020	0.0018	0.0016	0.0019	0.0024
42	0.2551	0.5256	2868	0.0004	0.0009	0.0013	0.0014	0.0017	0.0023	0.0025	0.0028	0.0032
43	0.2577	0.5297	2792	0.0005	0.0012	0.0015	0.0016	0.0020	0.0024	0.0026	0.0031	0.0035
44	0.2556	0.5285	2843	0.0004	0.0008	0.0012	0.0012	0.0013	0.0020	0.0021	0.0026	0.0030
45	0.2550	0.5276	2860	0.0004	0.0007	0.0012	0.0013	0.0017	0.0016	0.0018	0.0022	0.0026
46	0.2554	0.5302	2839	0.0008	0.0013	0.0015	0.0015	0.0017	0.0022	0.0023	0.0026	0.0030
47	0.2567	0.5290	2816	0.0009	0.0011	0.0013	0.0014	0.0016	0.0018	0.0020	0.0023	0.0028
48	0.2559	0.5291	2833	0.0009	0.0011	0.0013	0.0017	0.0018	0.0020	0.0022	0.0026	0.0030
49	0.2576	0.5289	2796	0.0009	0.0010	0.0015	0.0017	0.0017	0.0020	0.0021	0.0024	0.0028
50	0.2567	0.5294	2815	0.0009	0.0009	0.0010	0.0016	0.0014	0.0016	0.0018	0.0021	0.0024
Ave.	0.2560	0.5285	2834	0.0005	0.0010	0.0013	0.0015	0.0017	0.0021	0.0021	0.0025	0.0029
Med.	0.2559	0.5287	2839	0.0005	0.0009	0.0013	0.0015	0.0017	0.0020	0.0021	0.0026	0.0029
st dev	0.0011	0.0013	26.6934	0.0002	0.0002	0.0001	0.0002	0.0002	0.0003	0.0004	0.0004	0.0004
Min.	0.2542	0.5256	2771	0.0002	0.0006	0.0010	0.0012	0.0013	0.0016	0.0009	0.0014	0.0013
Max.	0.2583	0.5311	2868	0.0009	0.0013	0.0015	0.0019	0.0020	0.0027	0.0029	0.0031	0.0035



3.5 Data Set 3, 105 ℃, 60mA (Lumen Maintenance)

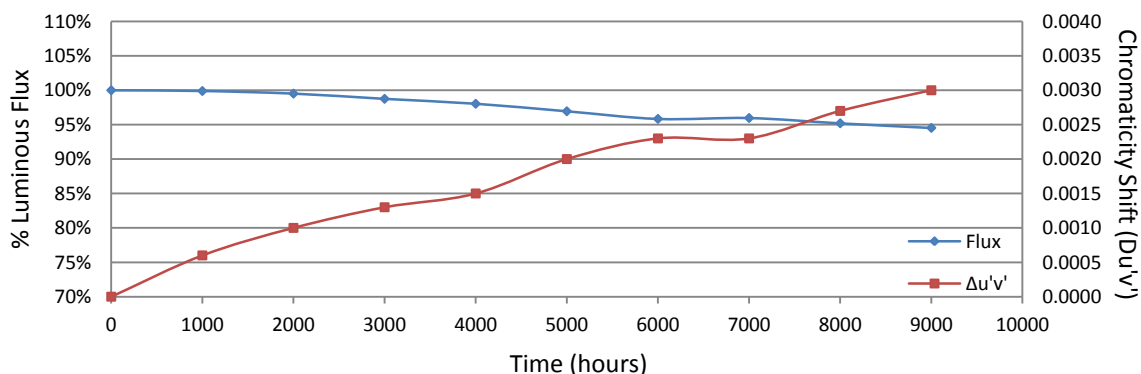
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	3.036	20.530	99.85	99.66	98.64	98.05	96.74	95.66	95.86	94.93	94.20
52	3.049	20.830	99.95	99.66	98.75	98.03	97.31	96.21	96.78	96.11	95.58
53	3.056	20.450	99.85	99.41	98.58	98.09	96.72	95.65	95.99	95.21	94.62
54	3.047	20.590	99.85	99.61	98.83	98.35	97.23	96.50	96.36	95.48	94.71
55	3.048	21.000	99.90	99.52	99.00	98.29	97.67	96.48	96.76	96.14	95.71
56	3.042	20.630	100.00	99.71	99.08	98.45	97.24	96.61	96.80	95.98	95.40
57	3.054	20.350	99.95	99.61	98.67	97.84	96.46	95.92	96.27	95.43	94.69
58	3.054	20.180	100.00	99.80	98.91	98.22	96.88	95.49	95.69	94.80	94.05
59	3.045	20.940	100.05	99.90	99.14	98.28	97.42	96.37	96.51	95.85	95.18
60	3.049	20.820	99.66	99.18	98.51	97.74	96.88	96.35	96.06	95.34	94.67
61	3.044	20.890	99.62	99.14	98.37	97.56	96.65	95.31	95.69	94.88	94.11
62	3.045	20.820	99.76	99.23	98.66	97.93	96.97	95.53	95.15	94.14	93.42
63	3.051	20.580	99.81	99.76	99.03	98.40	96.99	95.43	95.97	95.53	94.90
64	3.049	20.800	99.76	99.28	98.94	98.17	96.73	95.72	95.77	95.19	94.62
65	3.043	20.570	99.95	99.66	99.03	98.44	96.89	96.06	96.31	95.58	94.90
66	3.038	20.470	99.85	99.51	98.68	97.66	96.53	95.21	94.92	94.24	93.45
67	3.054	20.310	99.80	99.31	98.57	97.78	96.55	95.67	95.57	94.98	94.19
68	3.052	20.860	100.00	99.66	98.71	98.23	96.98	95.11	95.69	94.82	94.20
69	3.047	20.380	99.90	99.51	98.63	98.38	96.76	96.07	96.07	95.14	94.41
70	3.040	20.910	100.00	99.57	98.61	97.75	96.60	95.46	95.60	94.69	94.02
71	3.040	20.660	100.00	99.52	98.64	97.68	96.81	96.08	96.18	95.21	94.58
72	3.045	20.720	99.90	99.28	98.55	97.73	96.91	95.70	95.75	95.37	94.74
73	3.046	20.950	99.90	99.33	98.62	97.95	97.09	95.75	95.89	95.08	94.46
74	3.050	21.410	99.95	99.30	98.65	97.80	97.06	95.38	95.56	94.77	94.11
75	3.052	20.770	100.00	99.66	98.84	98.17	97.59	96.20	95.96	95.04	94.32
Ave.	3.047	20.697	99.89	99.51	98.75	98.04	96.95	95.84	95.97	95.20	94.53
Med.	3.047	20.720	99.90	99.52	98.67	98.05	96.89	95.72	95.96	95.19	94.58
st dev	0.0053	0.2679	0.1105	0.2078	0.2003	0.2777	0.3209	0.4328	0.4686	0.5099	0.5666
Min.	3.036	20.180	99.62	99.14	98.37	97.56	96.46	95.11	94.92	94.14	93.42
Max.	3.056	21.410	100.05	99.90	99.14	98.45	97.67	96.61	96.80	96.14	95.71

TM-21 Projection:

Test Duration: 9000hours
Failures Observed: 0
 α : 6.731E-06
 β : 1.004
Calculated L₇₀: 54,000hours
Reported L₇₀: >54,000hours

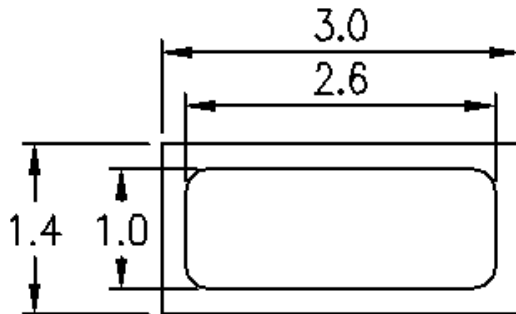
3.6 Data Set 3, 105 ℃, 60mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	0.2551	0.5271	2860	0.0006	0.0009	0.0012	0.0014	0.0020	0.0022	0.0024	0.0026	0.0030
52	0.2567	0.5288	2817	0.0004	0.0008	0.0012	0.0014	0.0014	0.0018	0.0016	0.0021	0.0024
53	0.2547	0.5279	2866	0.0006	0.0012	0.0014	0.0015	0.0016	0.0023	0.0022	0.0028	0.0032
54	0.2571	0.5298	2804	0.0005	0.0014	0.0016	0.0017	0.0020	0.0027	0.0026	0.0031	0.0036
55	0.2564	0.5287	2825	0.0008	0.0010	0.0016	0.0019	0.0019	0.0026	0.0023	0.0028	0.0032
56	0.2557	0.5286	2839	0.0004	0.0007	0.0015	0.0015	0.0019	0.0017	0.0016	0.0020	0.0024
57	0.2549	0.5277	2862	0.0007	0.0008	0.0013	0.0017	0.0021	0.0025	0.0025	0.0031	0.0037
58	0.2563	0.5269	2836	0.0006	0.0009	0.0012	0.0017	0.0021	0.0025	0.0025	0.0030	0.0035
59	0.2564	0.5293	2822	0.0005	0.0010	0.0012	0.0015	0.0018	0.0017	0.0017	0.0020	0.0023
60	0.2571	0.5303	2801	0.0008	0.0012	0.0014	0.0017	0.0020	0.0023	0.0022	0.0026	0.0030
61	0.2562	0.5310	2818	0.0004	0.0006	0.0009	0.0012	0.0017	0.0018	0.0019	0.0022	0.0026
62	0.2562	0.5275	2835	0.0009	0.0012	0.0014	0.0017	0.0023	0.0025	0.0026	0.0032	0.0036
63	0.2569	0.5282	2815	0.0009	0.0012	0.0014	0.0017	0.0024	0.0024	0.0025	0.0030	0.0034
64	0.2563	0.5295	2822	0.0003	0.0007	0.0009	0.0011	0.0019	0.0019	0.0019	0.0023	0.0027
65	0.2572	0.5311	2795	0.0004	0.0008	0.0012	0.0014	0.0020	0.0022	0.0020	0.0022	0.0026
66	0.2568	0.5307	2806	0.0008	0.0013	0.0015	0.0018	0.0025	0.0030	0.0028	0.0032	0.0036
67	0.2565	0.5275	2828	0.0006	0.0010	0.0012	0.0015	0.0024	0.0027	0.0028	0.0030	0.0033
68	0.2560	0.5284	2836	0.0007	0.0007	0.0009	0.0012	0.0021	0.0025	0.0027	0.0028	0.0032
69	0.2558	0.5279	2841	0.0009	0.0010	0.0013	0.0014	0.0023	0.0029	0.0030	0.0034	0.0038
70	0.2557	0.5285	2840	0.0004	0.0008	0.0009	0.0012	0.0018	0.0021	0.0019	0.0020	0.0024
71	0.2560	0.5286	2834	0.0005	0.0008	0.0011	0.0014	0.0017	0.0021	0.0020	0.0024	0.0027
72	0.2554	0.5292	2843	0.0005	0.0009	0.0012	0.0014	0.0017	0.0021	0.0019	0.0020	0.0024
73	0.2561	0.5300	2824	0.0004	0.0010	0.0012	0.0015	0.0025	0.0026	0.0023	0.0023	0.0027
74	0.2569	0.5296	2810	0.0004	0.0009	0.0015	0.0018	0.0017	0.0023	0.0024	0.0030	0.0034
75	0.2560	0.5291	2830	0.0006	0.0011	0.0011	0.0012	0.0018	0.0026	0.0025	0.0030	0.0034
Ave.	0.2562	0.5289	2828	0.0006	0.0010	0.0013	0.0015	0.0020	0.0023	0.0023	0.0027	0.0030
Med.	0.2562	0.5287	2828	0.0006	0.0009	0.0012	0.0015	0.0020	0.0023	0.0023	0.0028	0.0032
st dev	0.0007	0.0012	18.4682	0.0002	0.0002	0.0002	0.0002	0.0003	0.0004	0.0004	0.0005	0.0005
Min.	0.2547	0.5269	2795	0.0003	0.0006	0.0009	0.0011	0.0014	0.0017	0.0016	0.0020	0.0023
Max.	0.2572	0.5311	2866	0.0009	0.0014	0.0016	0.0019	0.0025	0.0030	0.0030	0.0034	0.0038



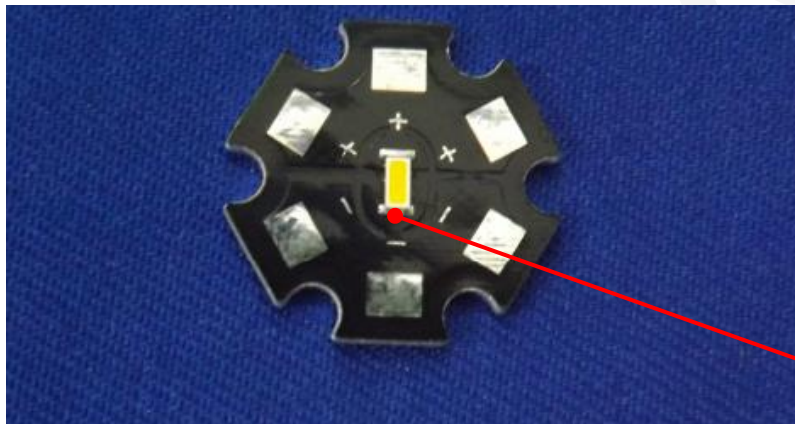
Appendix A – EUT PHOTO

A.1 Mechanical Dimensions (Ta = 25 °C)



All dimensions are in millimeter

A.2 EUT Photo



TMP_{LED}

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