



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. Shiyuan Street. Baoan
District.ShenZhen.518108 China

Model: T34

Report Type: 9000 Hours Test Report		Product Type: LED Package	
Test Engineer:	Daniel Duan	<i>Daniel Duan</i>	
Report Number:	RSZ130913509-10-9000		
Test Date:	2013-09-18 to 2014-10-09		
Report Date:	2014-10-24		
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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: T34
 Part Name: 3020
 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	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	WYG-5V40A	1#	0~5V,0~40A	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 2013-09-18 to 2014-10-09. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Data Set 1: 55 °C, 150mA

Part Number:	T34
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 54.2$ °C
Actual Ambient Temperature(T_A):	$T_A = 52.6$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

Data Set 2: 85 °C,150mA

Part Number:	T34
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 83.7$ °C
Actual Ambient Temperature(T_A):	$T_A = 82.1$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

Data Set 3: 105 °C, 150mA

Part Number:	T34
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 103.6$ °C
Actual Ambient Temperature(T_A):	$T_A = 102.2$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

2 - SUMMARY OF TEST RESULT

Data Set:	Data Set 1, 55 °C, 150mA
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:	96.92%
Average Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0018
Average. Lumen Maintenance at 9000 hours:	95.91%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0026
Reported TM-21 L ₇₀ Lifetime:	>54,000 hours

Data Set:	Data Set 2, 85 °C, 150mA
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:	96.25%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0020
Average. Lumen Maintenance at 9000 hours:	95.06%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0028
Reported TM-21 L ₇₀ Lifetime	>54,000 hours

Data Set:	Data Set 3, 105 °C, 150mA
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:	95.43%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0022
Average. Lumen Maintenance at 9000 hours:	94.11%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0031
Reported TM-21 L ₇₀ Lifetime	52,000 hours

3 - Test Data

3.1 Data Set 1, 55 °C, 150mA (Lumen Maintenance)

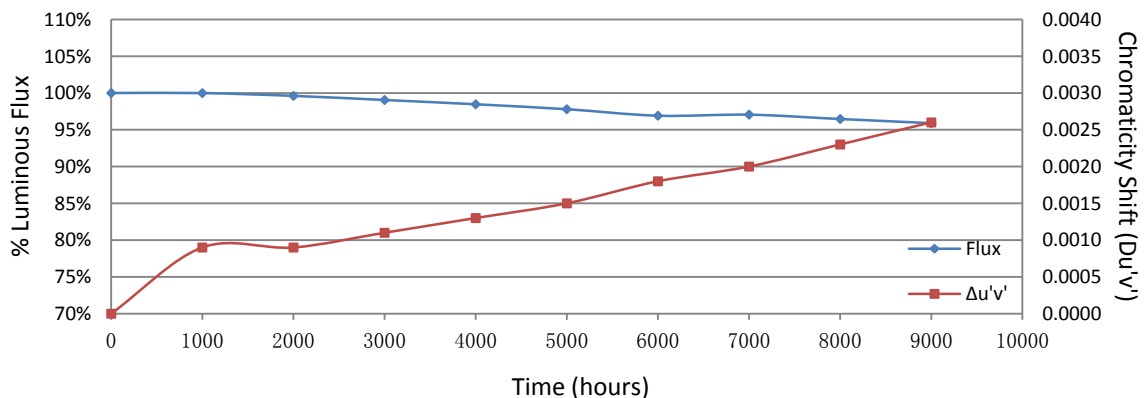
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	3.099	49.70	100.00	100.34	99.48	98.65	97.95	96.78	97.22	96.62	96.10
2	3.068	49.40	100.04	99.92	99.74	98.40	97.79	97.33	97.11	96.38	95.67
3	3.075	49.32	99.98	100.49	99.90	98.97	98.34	97.95	97.85	97.28	96.47
4	3.069	49.67	100.08	100.50	99.90	98.93	97.99	97.56	97.70	97.22	96.58
5	3.062	49.56	99.94	99.39	98.95	98.31	97.09	96.61	97.03	96.59	96.19
6	3.068	49.04	100.41	100.51	99.88	98.67	98.02	97.70	98.02	97.49	97.02
7	3.065	49.50	100.20	100.22	99.62	98.40	98.02	97.13	96.95	96.44	95.96
8	3.079	49.82	99.84	98.88	98.43	98.17	97.55	96.79	97.01	96.67	96.05
9	3.079	49.16	99.78	99.04	98.33	98.15	97.11	96.66	96.81	96.42	95.87
10	3.060	49.34	99.76	99.76	99.13	98.60	97.47	96.35	96.74	96.11	95.60
11	3.071	49.96	99.86	100.74	99.82	98.76	97.80	96.42	96.56	96.14	95.56
12	3.064	49.52	100.24	100.06	99.19	98.61	98.16	96.95	96.99	96.22	95.68
13	3.063	49.91	99.78	98.96	98.34	98.04	97.05	96.09	96.29	95.43	95.09
14	3.075	49.47	99.84	99.51	98.97	98.67	98.16	96.62	96.73	96.00	95.43
15	3.072	50.31	99.94	99.42	98.75	98.55	97.91	97.04	96.82	96.04	95.49
16	3.075	50.14	99.64	98.30	98.07	97.93	97.63	96.37	96.99	96.49	95.91
17	3.067	49.19	100.55	100.43	99.65	98.82	98.29	97.54	97.32	96.89	96.34
18	3.065	50.00	100.30	100.10	99.46	98.56	97.82	97.06	97.44	96.90	96.40
19	3.065	49.58	100.14	99.82	99.19	98.59	97.88	96.53	96.97	96.41	95.91
20	3.069	49.82	100.44	99.64	98.94	98.62	97.67	96.11	96.29	95.89	95.32
21	3.071	49.65	100.06	99.48	98.85	98.57	98.23	97.54	97.60	96.86	96.17
22	3.083	49.33	99.64	99.25	98.66	98.05	97.30	96.63	97.08	96.45	95.82
23	3.071	50.07	99.84	98.46	98.16	98.08	97.88	96.80	96.88	96.25	95.75
24	3.084	49.70	99.64	98.29	98.13	97.97	97.53	96.76	96.54	95.47	94.87
25	3.062	49.86	99.94	98.82	98.74	98.62	98.28	97.71	97.61	97.01	96.61
Ave.	3.071	49.64	99.99	99.61	99.05	98.47	97.80	96.92	97.06	96.47	95.91
Med.	3.069	49.65	99.94	99.64	98.97	98.57	97.88	96.79	96.99	96.44	95.91
st dev	0.0087	0.3242	0.2535	0.7289	0.6018	0.3016	0.3792	0.5209	0.4527	0.5139	0.4996
Min.	3.060	49.04	99.64	98.29	98.07	97.93	97.05	96.09	96.29	95.43	94.87
Max.	3.099	50.31	100.55	100.74	99.90	98.97	98.34	97.95	98.02	97.49	97.02

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 4.895E-06
 β : 1.002
Calculated L₇₀: 73,000 hours
Reported L₇₀: >54,000 hours

3.2 Data Set 1, 55 °C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	0.2579	0.5314	2778	0.0007	0.0008	0.0008	0.0014	0.0017	0.0021	0.0022	0.0025	0.0029
2	0.2570	0.5301	2804	0.0009	0.0012	0.0014	0.0016	0.0020	0.0022	0.0023	0.0025	0.0028
3	0.2583	0.5301	2776	0.0008	0.0008	0.0011	0.0013	0.0015	0.0018	0.0020	0.0021	0.0024
4	0.2566	0.5306	2810	0.0007	0.0007	0.0009	0.0011	0.0011	0.0016	0.0018	0.0020	0.0023
5	0.2577	0.5299	2791	0.0006	0.0004	0.0007	0.0010	0.0010	0.0019	0.0021	0.0023	0.0026
6	0.2562	0.5291	2825	0.0008	0.0007	0.0009	0.0012	0.0012	0.0016	0.0019	0.0021	0.0024
7	0.2584	0.5317	2768	0.0008	0.0008	0.0010	0.0013	0.0013	0.0016	0.0018	0.0021	0.0024
8	0.2574	0.5311	2792	0.0007	0.0005	0.0008	0.0012	0.0012	0.0017	0.0017	0.0020	0.0021
9	0.2576	0.5308	2789	0.0008	0.0011	0.0013	0.0014	0.0018	0.0022	0.0026	0.0028	0.0031
10	0.2591	0.5315	2753	0.0010	0.0010	0.0012	0.0013	0.0015	0.0016	0.0021	0.0024	0.0025
11	0.2557	0.5300	2835	0.0008	0.0009	0.0012	0.0013	0.0014	0.0011	0.0008	0.0013	0.0017
12	0.2581	0.5303	2781	0.0008	0.0009	0.0011	0.0011	0.0017	0.0016	0.0021	0.0023	0.0026
13	0.2583	0.5312	2773	0.0011	0.0011	0.0013	0.0014	0.0017	0.0020	0.0023	0.0027	0.0030
14	0.2580	0.5311	2778	0.0007	0.0007	0.0011	0.0012	0.0011	0.0017	0.0019	0.0023	0.0026
15	0.2573	0.5304	2798	0.0009	0.0010	0.0012	0.0012	0.0016	0.0020	0.0024	0.0028	0.0031
16	0.2582	0.5313	2773	0.0008	0.0009	0.0012	0.0014	0.0012	0.0018	0.0021	0.0023	0.0027
17	0.2575	0.5301	2794	0.0011	0.0011	0.0015	0.0016	0.0016	0.0019	0.0019	0.0022	0.0026
18	0.2575	0.5307	2791	0.0009	0.0009	0.0013	0.0013	0.0013	0.0016	0.0018	0.0021	0.0023
19	0.2582	0.5298	2780	0.0010	0.0011	0.0013	0.0016	0.0018	0.0020	0.0021	0.0024	0.0028
20	0.2577	0.5292	2794	0.0010	0.0010	0.0011	0.0014	0.0016	0.0019	0.0021	0.0024	0.0027
21	0.2566	0.5310	2809	0.0009	0.0008	0.0010	0.0013	0.0014	0.0017	0.0018	0.0023	0.0026
22	0.2596	0.5323	2739	0.0009	0.0009	0.0013	0.0015	0.0017	0.0018	0.0019	0.0022	0.0026
23	0.2564	0.5298	2819	0.0009	0.0008	0.0012	0.0014	0.0016	0.0017	0.0018	0.0023	0.0027
24	0.2577	0.5301	2789	0.0009	0.0009	0.0013	0.0014	0.0013	0.0021	0.0021	0.0027	0.0031
25	0.2582	0.5306	2777	0.0009	0.0009	0.0013	0.0014	0.0016	0.0021	0.0022	0.0025	0.0030
Ave.	0.2576	0.5306	2789	0.0009	0.0009	0.0011	0.0013	0.0015	0.0018	0.0020	0.0023	0.0026
Med.	0.2577	0.5306	2789	0.0009	0.0009	0.0012	0.0013	0.0015	0.0018	0.0021	0.0023	0.0026
st dev	0.0009	0.0008	21.3812	0.0001	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003
Min.	0.2557	0.5291	2739	0.0006	0.0004	0.0007	0.0010	0.0010	0.0011	0.0008	0.0013	0.0017
Max.	0.2596	0.5323	2835	0.0011	0.0012	0.0015	0.0016	0.0020	0.0022	0.0026	0.0028	0.0031



3.3 Data Set 2, 85 °C, 150mA (Lumen Maintenance)

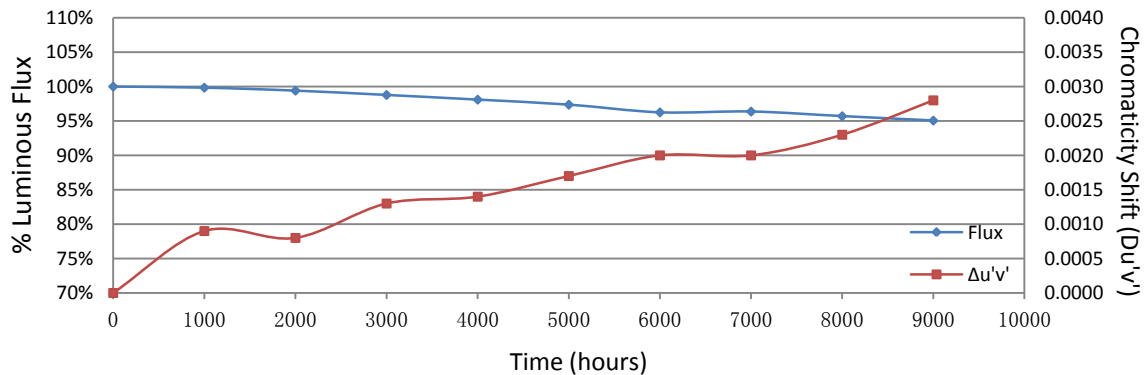
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	3.083	49.43	99.31	99.09	98.50	97.96	97.47	96.24	96.38	95.81	95.19
27	3.070	49.62	100.16	99.84	99.42	97.92	97.24	96.53	96.84	96.01	95.30
28	3.069	49.80	99.92	99.70	99.20	97.93	97.33	96.22	96.53	95.88	95.26
29	3.069	49.48	99.94	99.29	98.85	97.92	97.78	96.91	96.83	96.38	95.84
30	3.068	49.48	99.45	98.85	98.63	98.02	97.80	96.58	96.38	95.90	95.39
31	3.072	50.09	99.98	99.58	99.26	98.22	97.90	96.57	96.97	96.13	95.47
32	3.064	48.90	99.53	99.94	98.10	97.69	97.08	95.54	95.99	95.42	94.74
33	3.067	49.87	99.80	99.12	98.56	98.07	97.93	96.93	97.01	96.41	95.75
34	3.077	49.25	99.65	99.55	98.31	97.95	97.56	96.53	96.45	95.78	95.19
35	3.067	49.53	99.56	98.97	98.20	97.98	97.31	96.26	96.75	96.10	95.48
36	3.068	49.99	100.06	99.08	98.92	98.44	97.88	95.96	96.18	95.62	94.92
37	3.071	50.26	99.74	98.77	98.61	98.09	97.41	96.30	96.42	95.84	95.28
38	3.065	49.99	100.18	99.22	98.96	98.42	97.88	95.86	96.54	95.86	95.14
39	3.068	49.01	99.94	98.84	98.57	98.37	97.18	96.29	96.55	95.92	95.37
40	3.093	48.99	99.55	99.24	98.96	98.45	97.33	96.31	96.31	95.59	94.88
41	3.072	50.18	100.06	98.82	98.59	98.09	97.13	95.24	95.74	94.88	94.28
42	3.081	49.90	99.76	100.26	98.82	98.26	96.95	95.23	95.17	94.25	93.59
43	3.082	49.46	99.90	100.36	98.89	98.28	97.51	96.00	96.14	95.59	94.95
44	3.065	49.59	100.36	99.88	99.31	98.19	97.34	96.75	97.06	96.43	95.83
45	3.079	49.48	99.58	100.77	99.74	98.65	97.35	95.90	96.00	95.05	94.34
46	3.065	49.50	99.90	99.11	98.61	98.02	97.13	96.67	95.96	95.15	94.48
47	3.075	49.84	100.02	99.44	98.31	97.99	97.03	96.29	96.23	95.87	95.30
48	3.063	49.11	99.71	98.76	98.25	97.72	96.76	96.52	96.99	96.09	95.54
49	3.065	49.62	100.12	99.60	99.03	98.02	97.16	96.90	96.82	96.33	95.69
50	3.076	49.43	99.88	99.15	98.83	97.88	96.86	95.63	95.10	94.13	93.43
Ave.	3.072	49.59	99.84	99.41	98.78	98.10	97.37	96.25	96.37	95.70	95.06
Med.	3.069	49.53	99.90	99.24	98.82	98.02	97.33	96.29	96.42	95.86	95.26
st dev	0.0074	0.3699	0.2566	0.5354	0.4074	0.2357	0.3391	0.4817	0.5200	0.6049	0.6307
Min.	3.063	48.90	99.31	98.76	98.10	97.69	96.76	95.23	95.10	94.13	93.43
Max.	3.093	50.26	100.36	100.77	99.74	98.65	97.93	96.93	97.06	96.43	95.84

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 5.944E-06
 β : 1.003
Calculated L₇₀: 60,000 hours
Reported L₇₀: >54,000 hours

3.4 Data Set 2, 85 °C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	0.2578	0.5320	2778	0.0006	0.0007	0.0011	0.0013	0.0016	0.0016	0.0015	0.0019	0.0024
27	0.2583	0.5315	2771	0.0008	0.0007	0.0012	0.0013	0.0015	0.0018	0.0018	0.0022	0.0028
28	0.2565	0.5307	2813	0.0006	0.0006	0.0010	0.0011	0.0012	0.0015	0.0017	0.0018	0.0023
29	0.2573	0.5305	2797	0.0006	0.0009	0.0010	0.0010	0.0013	0.0014	0.0014	0.0017	0.0020
30	0.2577	0.5293	2794	0.0010	0.0007	0.0012	0.0015	0.0020	0.0022	0.0021	0.0024	0.0026
31	0.2583	0.5325	2765	0.0006	0.0004	0.0009	0.0009	0.0015	0.0016	0.0019	0.0021	0.0025
32	0.2556	0.5285	2842	0.0009	0.0010	0.0013	0.0015	0.0017	0.0023	0.0023	0.0025	0.0030
33	0.2569	0.5307	2804	0.0007	0.0006	0.0013	0.0013	0.0017	0.0019	0.0022	0.0026	0.0029
34	0.2596	0.5321	2742	0.0010	0.0011	0.0016	0.0016	0.0016	0.0019	0.0018	0.0022	0.0027
35	0.2587	0.5315	2762	0.0009	0.0010	0.0015	0.0016	0.0015	0.0024	0.0026	0.0027	0.0031
36	0.2579	0.5324	2775	0.0010	0.0008	0.0014	0.0015	0.0017	0.0026	0.0025	0.0029	0.0034
37	0.2567	0.5303	2811	0.0009	0.0008	0.0014	0.0016	0.0019	0.0021	0.0016	0.0018	0.0023
38	0.2570	0.5306	2803	0.0007	0.0006	0.0011	0.0013	0.0016	0.0018	0.0017	0.0019	0.0022
39	0.2560	0.5289	2832	0.0008	0.0007	0.0013	0.0016	0.0016	0.0020	0.0018	0.0021	0.0026
40	0.2564	0.5286	2825	0.0008	0.0009	0.0014	0.0016	0.0019	0.0021	0.0021	0.0025	0.0031
41	0.2567	0.5305	2810	0.0008	0.0006	0.0011	0.0013	0.0016	0.0021	0.0024	0.0026	0.0030
42	0.2582	0.5316	2773	0.0012	0.0012	0.0015	0.0016	0.0019	0.0023	0.0021	0.0025	0.0031
43	0.2597	0.5313	2741	0.0009	0.0010	0.0014	0.0016	0.0018	0.0022	0.0020	0.0025	0.0031
44	0.2562	0.5304	2820	0.0008	0.0007	0.0013	0.0014	0.0016	0.0020	0.0020	0.0023	0.0027
45	0.2575	0.5315	2787	0.0009	0.0009	0.0015	0.0015	0.0017	0.0020	0.0019	0.0023	0.0026
46	0.2569	0.5302	2806	0.0010	0.0010	0.0014	0.0016	0.0017	0.0023	0.0024	0.0028	0.0032
47	0.2579	0.5307	2784	0.0012	0.0012	0.0013	0.0015	0.0018	0.0023	0.0025	0.0028	0.0032
48	0.2599	0.5316	2737	0.0010	0.0009	0.0011	0.0014	0.0016	0.0020	0.0023	0.0026	0.0030
49	0.2580	0.5308	2779	0.0007	0.0006	0.0013	0.0013	0.0015	0.0016	0.0020	0.0022	0.0025
50	0.2578	0.5299	2788	0.0009	0.0010	0.0014	0.0016	0.0016	0.0019	0.0021	0.0026	0.0031
Ave.	0.2576	0.5307	2790	0.0009	0.0008	0.0013	0.0014	0.0017	0.0020	0.0020	0.0023	0.0028
Med.	0.2577	0.5307	2788	0.0009	0.0008	0.0013	0.0015	0.0016	0.0020	0.0020	0.0024	0.0028
st dev	0.0011	0.0011	27.9554	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0004
Min.	0.2556	0.5285	2737	0.0006	0.0004	0.0009	0.0009	0.0012	0.0014	0.0014	0.0017	0.0020
Max.	0.2599	0.5325	2842	0.0012	0.0012	0.0016	0.0016	0.0020	0.0026	0.0026	0.0029	0.0034



3.5 Data Set 3, 105 °C, 150mA (Lumen Maintenance)

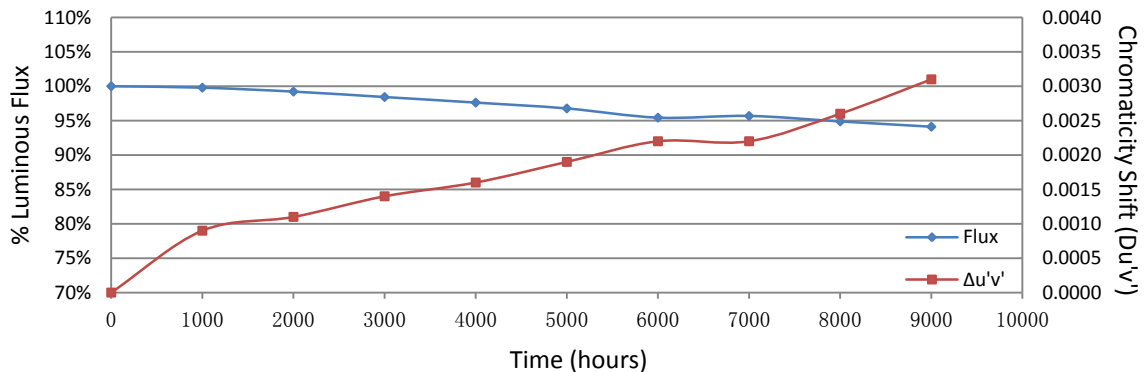
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	3.069	50.19	99.60	99.24	98.68	97.93	97.33	96.02	96.13	95.28	94.48
52	3.072	50.47	99.56	99.23	98.22	97.50	97.01	96.04	96.16	95.58	94.87
53	3.068	49.88	99.68	99.44	98.44	97.77	97.05	95.97	96.23	95.29	94.53
54	3.067	49.66	99.70	99.09	98.03	97.26	96.72	94.80	94.93	93.84	93.03
55	3.069	49.36	99.35	98.80	98.08	97.16	96.33	95.34	95.54	94.77	94.02
56	3.065	49.39	99.51	99.03	98.26	97.83	97.08	96.27	96.44	95.85	95.04
57	3.069	50.02	100.02	99.54	98.76	98.12	97.44	96.32	96.70	96.08	95.28
58	3.067	49.27	99.72	99.49	98.68	98.01	96.94	96.25	96.61	95.92	95.13
59	3.070	50.16	99.36	99.32	98.56	97.79	96.53	95.04	95.30	94.70	93.96
60	3.066	49.63	100.04	99.64	98.85	97.34	96.66	95.29	95.16	94.28	93.65
61	3.065	49.74	99.52	98.59	97.93	97.19	96.30	94.65	94.41	93.61	92.86
62	3.065	49.70	99.86	99.32	98.25	97.59	96.58	94.43	94.95	94.10	93.36
63	3.066	49.45	100.00	98.97	98.02	97.53	96.80	94.38	94.70	94.07	93.23
64	3.065	49.38	99.70	98.99	98.14	97.65	96.46	95.34	95.63	94.90	94.24
65	3.065	49.65	99.52	98.79	98.49	98.15	96.76	95.29	95.18	94.30	93.65
66	3.067	50.04	99.90	98.58	97.82	97.10	96.46	94.32	96.20	95.57	94.85
67	3.064	49.48	99.88	99.98	98.85	97.82	96.79	95.98	95.75	95.01	94.14
68	3.071	49.68	99.66	98.87	98.19	97.28	96.50	95.53	96.41	95.65	94.85
69	3.069	50.13	100.16	100.08	98.96	98.18	97.61	96.65	96.12	95.44	94.72
70	3.071	49.99	100.28	100.02	98.80	98.02	97.46	96.04	95.74	94.85	94.07
71	3.067	49.73	100.06	99.58	98.47	97.59	96.88	95.58	94.39	93.80	92.97
72	3.074	49.20	99.78	99.39	98.60	97.26	96.06	94.23	95.86	95.09	94.31
73	3.070	50.29	100.20	98.67	98.45	97.22	96.42	95.51	94.91	94.43	93.46
74	3.067	49.88	100.26	99.16	98.82	97.69	96.31	94.85	95.41	94.74	93.97
75	3.078	49.43	99.41	98.73	98.40	97.49	96.66	95.75	95.62	94.88	94.11
Ave.	3.068	49.75	99.79	99.22	98.43	97.62	96.77	95.43	95.68	94.88	94.11
Med.	3.067	49.70	99.72	99.23	98.45	97.59	96.72	95.51	0.6870	0.7168	0.7207
st dev	0.0033	0.3429	0.2817	0.4347	0.3255	0.3366	0.4008	0.7012	94.39	93.61	92.86
Min.	3.064	49.20	99.35	98.58	97.82	97.10	96.06	94.23	96.70	96.08	95.28
Max.	3.078	50.47	100.28	100.08	98.96	98.18	97.61	96.65	96.13	95.28	94.48

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 6.847E-06
 β : 1.001
Calculated L₇₀: 52,000 hours
Reported L₇₀: 52,000 hours

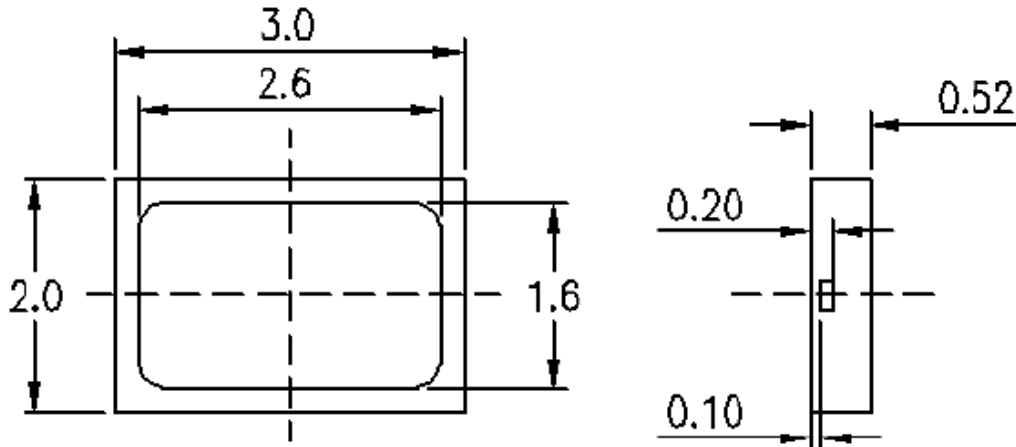
3.6 Data Set 3, 105 °C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	0.2574	0.5305	2795	0.0008	0.0011	0.0014	0.0015	0.0017	0.0018	0.0020	0.0024	0.0030
52	0.2572	0.5303	2800	0.0010	0.0011	0.0014	0.0016	0.0018	0.0019	0.0019	0.0023	0.0027
53	0.2567	0.5288	2817	0.0008	0.0011	0.0014	0.0016	0.0017	0.0019	0.0018	0.0022	0.0027
54	0.2578	0.5305	2786	0.0009	0.0012	0.0015	0.0017	0.0021	0.0019	0.0018	0.0021	0.0026
55	0.2551	0.5303	2845	0.0009	0.0013	0.0014	0.0015	0.0017	0.0018	0.0018	0.0021	0.0025
56	0.2568	0.5309	2805	0.0009	0.0011	0.0016	0.0018	0.0017	0.0018	0.0021	0.0023	0.0027
57	0.2565	0.5301	2815	0.0012	0.0016	0.0016	0.0016	0.0017	0.0020	0.0017	0.0022	0.0026
58	0.2575	0.5308	2790	0.0009	0.0012	0.0016	0.0018	0.0021	0.0020	0.0021	0.0025	0.0029
59	0.2573	0.5311	2795	0.0009	0.0011	0.0016	0.0018	0.0021	0.0021	0.0024	0.0028	0.0034
60	0.2581	0.5317	2773	0.0007	0.0010	0.0013	0.0014	0.0021	0.0021	0.0020	0.0025	0.0030
61	0.2575	0.5300	2794	0.0008	0.0009	0.0014	0.0016	0.0017	0.0019	0.0016	0.0015	0.0022
62	0.2585	0.5326	2761	0.0006	0.0006	0.0012	0.0016	0.0021	0.0022	0.0023	0.0026	0.0032
63	0.2566	0.5310	2809	0.0012	0.0010	0.0014	0.0015	0.0019	0.0026	0.0028	0.0031	0.0037
64	0.2579	0.5307	2782	0.0010	0.0012	0.0015	0.0015	0.0020	0.0020	0.0028	0.0032	0.0036
65	0.2586	0.5313	2765	0.0010	0.0013	0.0015	0.0016	0.0017	0.0029	0.0022	0.0026	0.0031
66	0.2560	0.5307	2824	0.0006	0.0010	0.0014	0.0016	0.0018	0.0029	0.0022	0.0024	0.0027
67	0.2583	0.5309	2773	0.0010	0.0012	0.0016	0.0017	0.0017	0.0022	0.0025	0.0028	0.0033
68	0.2581	0.5310	2777	0.0009	0.0011	0.0013	0.0015	0.0021	0.0023	0.0028	0.0031	0.0036
69	0.2558	0.5297	2832	0.0012	0.0012	0.0015	0.0017	0.0018	0.0026	0.0025	0.0029	0.0032
70	0.2573	0.5307	2796	0.0010	0.0010	0.0011	0.0014	0.0016	0.0023	0.0029	0.0033	0.0036
71	0.2567	0.5299	2811	0.0011	0.0012	0.0015	0.0017	0.0020	0.0027	0.0023	0.0028	0.0032
72	0.2587	0.5303	2768	0.0012	0.0013	0.0014	0.0014	0.0016	0.0023	0.0024	0.0027	0.0032
73	0.2560	0.5297	2828	0.0009	0.0010	0.0011	0.0012	0.0018	0.0022	0.0030	0.0033	0.0037
74	0.2573	0.5311	2794	0.0009	0.0014	0.0016	0.0017	0.0018	0.0023	0.0022	0.0026	0.0031
75	0.2580	0.5317	2777	0.0010	0.0011	0.0013	0.0015	0.0021	0.0016	0.0023	0.0026	0.0031
Ave.	0.2573	0.5307	2796	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0022	0.0026	0.0031
Med.	0.2573	0.5307	2795	0.0009	0.0011	0.0014	0.0016	0.0018	0.0021	0.0004	0.0004	0.0004
st dev	0.0009	0.0008	22.2526	0.0002	0.0002	0.0001	0.0001	0.0002	0.0004	0.0016	0.0015	0.0022
Min.	0.2551	0.5288	2761	0.0006	0.0006	0.0011	0.0012	0.0016	0.0016	0.0030	0.0033	0.0037
Max.	0.2587	0.5326	2845	0.0012	0.0016	0.0016	0.0018	0.0021	0.0029	0.0020	0.0024	0.0030



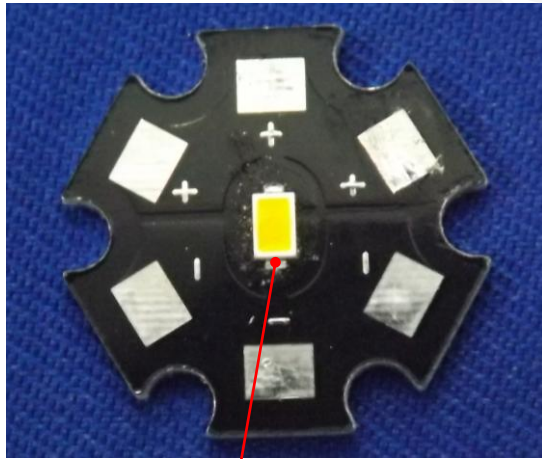
Appendix A – EUT PHOTO

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



All dimensions are in millimeter

A.2 EUT Photo



TMP_{LED}

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