



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Samsung Electronics Co., LTD

1,Samsung-Ro,Giheung-Gu,Yongin-City,Gyeonggi-Do 17113, Korea

Model:SPMWHx229xxxxxxxxx

Report Type: 9000 Hours Test Report	Product Type: LED Package
Reviewed By: Pote Wang	<i>Pote Wang</i>
Report Number: RSZ150717507-10	
Test Date: 2015-07-17 to 2016-07-26	
Report Date: 2016-09-24	
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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: SPMWHx229xxxxxxxxx
 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	0.3m	2016-03-10	2017-03-09
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2016-03-04	2017-03-03
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2016-03-10	2017-03-09
Standard Light Source	EVERFINE	D062	1011093	3000K	2015-09-17	2016-09-16
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987CJ73 21114	300VA	2016-03-04	2017-03-03
Multilayer aging machine	BACL	B2-270	20015	25 °C~110 °C	2016-03-04	2017-03-03
DC Power Supply	Taishan Xingguang	T0150E8.5-80	ST06607	0~5V,0~40A	2015-10-30	2016-10-29
DC Power Supply	Taishan Xingguang	T0150E8.5-80	ST06606	0~5V,0~40A	2015-10-30	2016-10-29
DC Power Supply	Taishan Xingguang	T0150E8.5-80	ST06605	0~5V,0~40A	2015-10-30	2016-10-29

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 samples tested at Ts 55 °C, Ts 85 °C and Ts 105 °C were received at 2015-07-17 and tested during 2015-07-17 to 2016-07-26. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75

Data Set 1: 55 °C, 100mA

Part Number:	SPMWHx229xxxxxxxxxx
Number of Units:	25
Actual Case Temperature(T _S):	T _S =54.4 °C
Actual Ambient Temperature(T _A):	T _A =51.8 °C
Life Test Drive Current:	I _F = 100mA
Measurement Current:	I _F = 100mA

Data Set 2: 85 °C,100mA

Part Number:	SPMWHx229xxxxxxxxxx
Number of Units:	25
Actual Case Temperature(T _S):	T _S =84.4 °C
Actual Ambient Temperature(T _A):	T _A =82.6 °C
Life Test Drive Current:	I _F =100mA
Measurement Current:	I _F = 100mA

Data Set 3: 105 °C, 100mA

Part Number:	SPMWHx229xxxxxxxxxx
Number of Units:	25
Actual Case Temperature(T _S):	T _S =104.1 °C
Actual Ambient Temperature(T _A):	T _A =103.4 °C
Life Test Drive Current:	I _F = 100mA
Measurement Current:	I _F = 100mA

2 - Summary of Test Result

Data Set:	Data Set 1, 55 °C, 100mA
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:	98.50%
Average. Lumen Maintenance at 9000 hours:	97.61%
Average Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0012
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0020
Reported TM-21 L ₇₀ Lifetime:	>54,000 hours

Data Set:	Data Set 2, 85 °C, 100mA
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:	97.92%
Average. Lumen Maintenance at 9000 hours:	96.71%
Average Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0014
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0022
Reported TM-21 L ₇₀ Lifetime:	>54,000 hours

Data Set:	Data Set 3, 105 °C, 100mA
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:	97.30%
Average. Lumen Maintenance at 9000 hours:	95.75%
Average Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0016
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0025
Reported TM-21 L ₇₀ Lifetime:	>54,000 hours

3 - Test Data

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

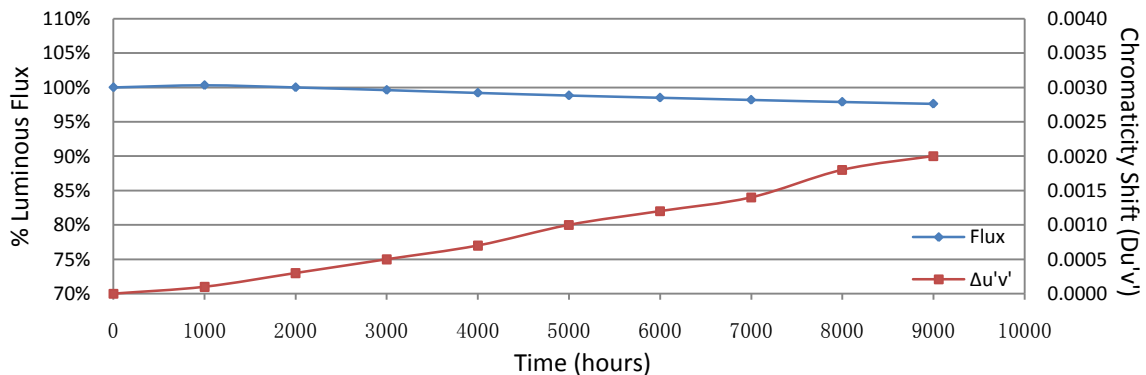
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	8.940	106.3	100.28	99.91	99.53	99.06	98.78	98.40	97.93	97.55	97.18
2	8.963	105.6	100.38	100.19	99.81	99.43	99.05	98.77	98.48	98.11	97.92
3	8.975	106.0	100.38	100.09	99.62	99.34	99.06	98.77	98.40	98.11	98.02
4	8.975	106.1	100.38	100.19	99.81	99.43	99.15	98.77	98.59	98.30	97.93
5	8.905	105.3	100.38	100.00	99.81	99.43	99.05	98.58	98.29	98.20	97.82
6	9.007	106.6	100.28	100.09	99.81	99.34	98.87	98.78	98.31	98.12	97.84
7	8.945	105.1	100.48	100.10	99.62	99.24	99.05	98.95	98.48	98.10	97.81
8	8.938	103.8	100.39	100.19	99.71	99.23	98.94	98.75	98.46	98.07	97.69
9	9.031	106.6	100.38	100.09	99.72	99.25	98.87	98.78	98.31	98.03	97.65
10	8.962	105.1	100.29	99.90	99.52	99.14	98.67	98.38	98.19	98.00	97.72
11	8.969	107.0	100.28	99.81	99.35	98.88	98.50	98.13	97.85	97.57	97.38
12	8.949	106.6	100.28	99.91	99.53	98.97	98.50	98.22	97.84	97.47	97.28
13	8.903	104.0	100.38	100.10	99.62	99.13	98.65	98.27	97.98	97.60	97.31
14	8.938	106.3	100.38	100.00	99.62	99.15	98.68	98.21	97.84	97.55	97.18
15	8.910	106.7	100.19	99.91	99.53	99.16	98.69	98.41	98.13	97.66	97.38
16	8.929	102.9	100.29	99.81	99.51	99.03	98.54	98.25	97.86	97.57	97.28
17	8.916	104.9	100.29	99.90	99.43	99.05	98.57	98.28	97.90	97.62	97.33
18	8.909	104.9	100.19	99.81	99.43	98.95	98.47	98.09	97.81	97.52	97.33
19	9.066	105.5	100.28	99.81	99.43	99.05	98.58	98.29	97.91	97.73	97.44
20	8.938	106.4	100.19	99.81	99.25	98.97	98.68	98.21	97.93	97.56	97.37
21	8.909	104.1	100.29	100.10	99.62	99.14	98.75	98.37	98.17	97.89	97.79
22	9.034	106.6	100.38	100.09	99.72	99.34	99.06	98.78	98.50	98.22	97.94
23	8.962	104.2	100.38	100.10	99.81	99.52	99.14	98.75	98.46	98.18	97.98
24	9.023	105.5	100.28	100.09	99.91	99.62	99.34	98.86	98.58	98.29	98.10
25	8.933	105.8	100.19	99.91	99.53	99.24	98.87	98.39	98.20	97.92	97.64
Ave.	8.957	105.5	100.31	100.00	99.61	99.20	98.82	98.50	98.18	97.88	97.61
Med.	8.945	105.6	100.29	100.00	99.62	99.16	98.78	98.40	98.19	97.92	97.65
st dev	0.045	1.1	0.0765	0.1328	0.1663	0.1928	0.2420	0.2691	0.2703	0.2866	0.2940
Min.	8.903	102.9	100.19	99.81	99.25	98.88	98.47	98.09	97.81	97.47	97.18
Max.	9.066	107.0	100.48	100.19	99.91	99.62	99.34	98.95	98.59	98.30	98.10

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 3.221E-06
 β : 1.004
Reported L₇₀: >54,000 hours

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

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	0.2567	0.5276	2822	0.0001	0.0002	0.0004	0.0006	0.0009	0.0011	0.0015	0.0018	0.0020
2	0.2578	0.5304	2786	0.0001	0.0001	0.0003	0.0007	0.0009	0.0012	0.0014	0.0017	0.0020
3	0.2565	0.5277	2827	0.0001	0.0003	0.0004	0.0008	0.0010	0.0013	0.0015	0.0018	0.0020
4	0.2571	0.5286	2809	0.0001	0.0003	0.0004	0.0008	0.0011	0.0013	0.0016	0.0018	0.0022
5	0.2563	0.5280	2829	0.0001	0.0003	0.0005	0.0008	0.0012	0.0011	0.0015	0.0019	0.0022
6	0.2558	0.5269	2846	0.0001	0.0003	0.0005	0.0008	0.0009	0.0012	0.0015	0.0018	0.0021
7	0.2559	0.5291	2833	0.0001	0.0003	0.0004	0.0008	0.0009	0.0013	0.0015	0.0018	0.0020
8	0.2567	0.5276	2823	0.0001	0.0002	0.0004	0.0007	0.0010	0.0012	0.0014	0.0017	0.0021
9	0.2560	0.5258	2847	0.0001	0.0002	0.0005	0.0008	0.0010	0.0012	0.0015	0.0018	0.0020
10	0.2549	0.5274	2865	0.0001	0.0003	0.0005	0.0009	0.0010	0.0013	0.0015	0.0018	0.0021
11	0.2566	0.5287	2820	0.0001	0.0003	0.0005	0.0007	0.0009	0.0012	0.0014	0.0017	0.0021
12	0.2569	0.5286	2814	0.0000	0.0002	0.0004	0.0007	0.0010	0.0012	0.0014	0.0017	0.0021
13	0.2579	0.5275	2797	0.0000	0.0002	0.0004	0.0007	0.0009	0.0012	0.0015	0.0017	0.0019
14	0.2562	0.5284	2830	0.0001	0.0003	0.0004	0.0008	0.0009	0.0012	0.0015	0.0018	0.0021
15	0.2559	0.5272	2844	0.0001	0.0002	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0020
16	0.2582	0.5287	2785	0.0001	0.0003	0.0005	0.0007	0.0009	0.0013	0.0015	0.0018	0.0020
17	0.2559	0.5263	2847	0.0001	0.0002	0.0004	0.0007	0.0010	0.0012	0.0014	0.0017	0.0019
18	0.2567	0.5307	2807	0.0000	0.0002	0.0004	0.0008	0.0010	0.0012	0.0014	0.0017	0.0019
19	0.2601	0.5271	2751	0.0000	0.0002	0.0004	0.0007	0.0010	0.0012	0.0015	0.0017	0.0020
20	0.2575	0.5298	2795	0.0001	0.0002	0.0004	0.0008	0.0010	0.0012	0.0014	0.0017	0.0019
21	0.2575	0.5291	2799	0.0000	0.0002	0.0004	0.0007	0.0010	0.0012	0.0014	0.0017	0.0021
22	0.2563	0.5268	2836	0.0001	0.0002	0.0005	0.0008	0.0010	0.0013	0.0015	0.0019	0.0021
23	0.2580	0.5274	2796	0.0001	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0017	0.0020
24	0.2576	0.5289	2798	0.0001	0.0002	0.0005	0.0007	0.0009	0.0012	0.0013	0.0017	0.0021
25	0.2570	0.5280	2815	0.0001	0.0003	0.0006	0.0007	0.0010	0.0013	0.0014	0.0019	0.0021
Ave.	0.2569	0.5281	2817	0.0001	0.0003	0.0005	0.0007	0.0010	0.0012	0.0014	0.0018	0.0020
Med.	0.2567	0.5280	2820	0.0001	0.0002	0.0004	0.0007	0.0010	0.0012	0.0015	0.0017	0.0020
st dev	0.0011	0.0012	25	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Min.	0.2549	0.5258	2751	0.0000	0.0001	0.0003	0.0006	0.0009	0.0011	0.0013	0.0017	0.0019
Max.	0.2601	0.5307	2865	0.0001	0.0003	0.0006	0.0009	0.0012	0.0013	0.0016	0.0019	0.0022



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

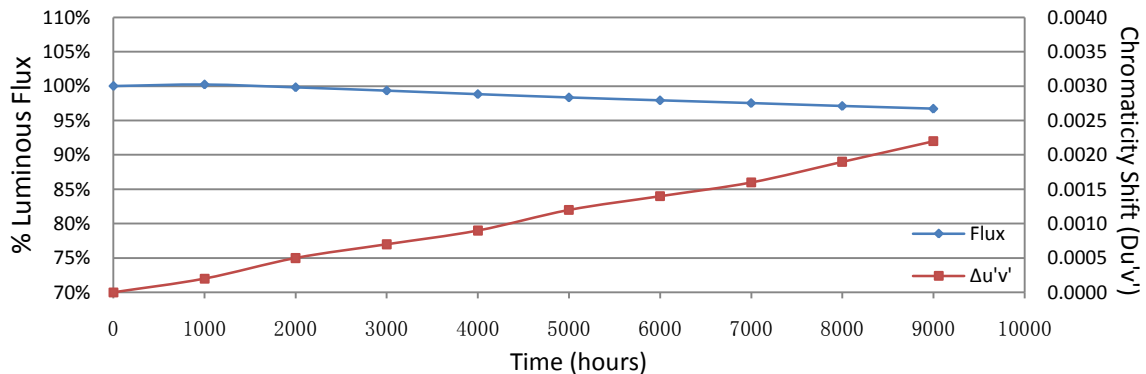
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	8.946	106.1	100.19	99.91	99.43	98.96	98.59	98.11	97.83	97.46	96.89
27	8.950	106.0	100.00	99.62	99.25	98.77	98.21	97.83	97.55	97.17	96.79
28	8.994	105.0	100.19	99.71	99.33	98.76	98.38	98.00	97.52	97.05	96.57
29	8.936	105.6	100.28	99.72	99.34	98.77	98.30	97.92	97.63	97.25	96.69
30	8.924	105.6	100.28	99.91	99.43	98.86	98.30	97.82	97.44	97.16	96.69
31	8.896	104.3	100.19	99.90	99.42	98.85	98.27	97.89	97.51	97.12	96.74
32	8.989	106.3	100.09	99.72	99.15	98.68	98.02	97.74	97.27	96.90	96.52
33	8.886	105.2	100.38	99.81	99.43	98.86	98.29	97.91	97.43	97.05	96.67
34	8.881	104.3	100.29	99.81	99.42	98.75	98.37	97.89	97.51	97.12	96.74
35	8.930	106.0	100.19	99.62	99.25	98.77	98.21	97.83	97.26	96.89	96.51
36	8.948	106.8	100.19	99.81	99.25	98.60	98.22	97.85	97.38	96.82	96.54
37	8.985	103.9	100.19	99.81	99.13	98.56	98.08	97.69	97.21	96.73	96.54
38	9.032	105.3	100.28	99.91	99.43	98.86	98.48	97.91	97.44	97.06	96.68
39	8.962	103.3	100.29	99.71	99.32	98.84	98.45	97.97	97.58	97.00	96.52
40	9.011	106.4	100.38	99.91	99.25	98.87	98.59	98.12	97.74	97.37	96.90
41	8.977	106.5	100.28	99.91	99.44	98.87	98.31	98.03	97.65	97.28	96.90
42	8.936	105.8	100.19	99.91	99.43	98.96	98.39	98.02	97.83	97.35	96.98
43	8.898	103.6	100.29	99.81	99.32	98.84	98.36	97.88	97.59	97.30	96.91
44	9.002	104.9	100.19	99.90	99.43	98.95	98.47	97.90	97.62	97.24	96.95
45	8.963	106.1	100.19	99.91	99.43	98.96	98.40	97.93	97.64	97.17	96.80
46	8.946	106.6	100.28	99.81	99.44	99.06	98.50	98.12	97.56	97.09	96.81
47	9.034	105.2	100.29	99.81	99.33	98.86	98.48	98.00	97.62	97.24	96.86
48	8.992	106.3	100.28	99.81	99.25	98.78	98.40	97.93	97.46	96.99	96.61
49	8.907	104.2	100.10	99.81	99.23	98.66	98.27	97.79	97.31	96.83	96.45
50	8.892	104.3	100.00	99.71	99.14	98.66	98.18	97.89	97.51	96.93	96.55
Ave.	8.953	105.3	100.22	99.81	99.33	98.82	98.34	97.92	97.52	97.10	96.71
Med.	8.948	105.6	100.19	99.81	99.33	98.84	98.36	97.91	97.52	97.12	96.69
st dev	0.045	1.0	0.0976	0.0909	0.1049	0.1221	0.1432	0.1105	0.1618	0.1876	0.1613
Min.	8.881	103.3	100.00	99.62	99.13	98.56	98.02	97.69	97.21	96.73	96.45
Max.	9.034	106.8	100.38	99.91	99.44	99.06	98.59	98.12	97.83	97.46	96.98

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 4.288E-06
β: 1.005
Reported L₇₀: >54,000 hours

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

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	0.2563	0.5256	2841	0.0002	0.0004	0.0007	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022
27	0.2564	0.5289	2822	0.0002	0.0005	0.0008	0.0009	0.0012	0.0014	0.0016	0.0021	0.0022
28	0.2563	0.5277	2832	0.0003	0.0006	0.0007	0.0010	0.0013	0.0015	0.0016	0.0020	0.0023
29	0.2563	0.5292	2823	0.0002	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0021
30	0.2571	0.5271	2816	0.0003	0.0005	0.0008	0.0009	0.0013	0.0015	0.0017	0.0020	0.0022
31	0.2583	0.5297	2777	0.0002	0.0004	0.0007	0.0009	0.0011	0.0014	0.0016	0.0019	0.0021
32	0.2560	0.5286	2834	0.0002	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0019	0.0022
33	0.2560	0.5263	2845	0.0004	0.0006	0.0009	0.0010	0.0013	0.0016	0.0017	0.0021	0.0023
34	0.2590	0.5313	2757	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0018	0.0022
35	0.2567	0.5285	2818	0.0003	0.0005	0.0008	0.0009	0.0012	0.0014	0.0016	0.0019	0.0022
36	0.2561	0.5296	2826	0.0002	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0019	0.0022
37	0.2575	0.5288	2801	0.0002	0.0006	0.0008	0.0010	0.0013	0.0014	0.0016	0.0020	0.0022
38	0.2568	0.5262	2827	0.0002	0.0005	0.0008	0.0010	0.0012	0.0014	0.0016	0.0019	0.0022
39	0.2578	0.5279	2798	0.0001	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0020
40	0.2563	0.5289	2825	0.0002	0.0005	0.0008	0.0010	0.0013	0.0014	0.0016	0.0019	0.0022
41	0.2569	0.5288	2814	0.0003	0.0005	0.0008	0.0009	0.0012	0.0014	0.0016	0.0020	0.0022
42	0.2562	0.5280	2833	0.0003	0.0004	0.0007	0.0010	0.0012	0.0014	0.0016	0.0020	0.0022
43	0.2576	0.5298	2793	0.0002	0.0004	0.0008	0.0009	0.0012	0.0014	0.0016	0.0019	0.0023
44	0.2581	0.5316	2774	0.0002	0.0005	0.0008	0.0009	0.0012	0.0013	0.0016	0.0019	0.0022
45	0.2579	0.5299	2786	0.0002	0.0005	0.0007	0.0010	0.0011	0.0014	0.0016	0.0020	0.0022
46	0.2568	0.5285	2816	0.0002	0.0004	0.0007	0.0009	0.0012	0.0014	0.0016	0.0019	0.0022
47	0.2564	0.5257	2839	0.0002	0.0005	0.0008	0.0010	0.0013	0.0016	0.0017	0.0021	0.0023
48	0.2569	0.5287	2812	0.0001	0.0004	0.0007	0.0009	0.0013	0.0014	0.0016	0.0019	0.0022
49	0.2573	0.5278	2808	0.0002	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0020	0.0022
50	0.2575	0.5283	2802	0.0002	0.0004	0.0007	0.0009	0.0012	0.0014	0.0016	0.0019	0.0022
Ave.	0.2570	0.5285	2813	0.0002	0.0005	0.0007	0.0009	0.0012	0.0014	0.0016	0.0019	0.0022
Med.	0.2568	0.5286	2816	0.0002	0.0004	0.0007	0.0009	0.0012	0.0014	0.0016	0.0019	0.0022
st dev	0.0008	0.0015	22	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2560	0.5256	2757	0.0001	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0018	0.0020
Max.	0.2590	0.5316	2845	0.0004	0.0006	0.0009	0.0010	0.0013	0.0016	0.0017	0.0021	0.0023



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

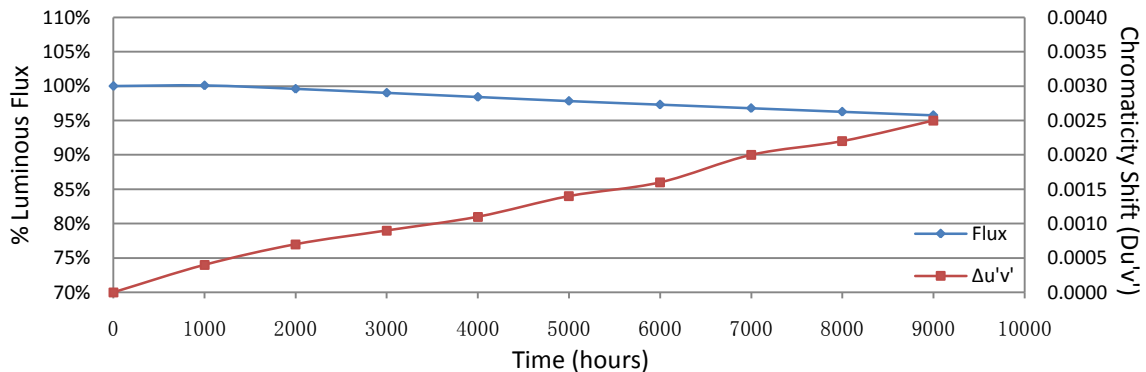
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	8.910	102.8	100.19	99.81	99.32	98.93	98.44	97.96	97.37	96.79	96.30
52	8.950	105.6	100.09	99.62	99.05	98.48	98.01	97.54	97.16	96.69	96.02
53	8.973	107.1	100.19	99.63	99.07	98.51	98.04	97.57	97.01	96.45	96.08
54	8.929	106.4	100.09	99.72	99.15	98.50	97.84	97.37	96.90	96.43	95.96
55	8.959	105.9	100.09	99.72	99.06	98.39	97.83	97.26	96.88	96.41	95.94
56	8.946	106.0	99.91	99.53	99.06	98.40	97.74	97.08	96.60	96.04	95.38
57	9.061	104.2	100.10	99.52	98.94	98.46	97.89	97.41	96.83	96.35	95.78
58	8.931	104.0	99.90	99.52	98.94	98.37	97.79	97.40	96.92	96.25	95.67
59	8.905	106.3	100.09	99.62	98.87	98.12	97.65	97.08	96.71	96.05	95.48
60	8.929	105.6	100.00	99.53	98.86	98.30	97.73	97.25	96.78	96.21	95.55
61	9.056	105.3	100.09	99.43	98.86	98.20	97.53	96.96	96.39	95.92	95.35
62	8.915	101.9	100.10	99.51	99.02	98.33	97.64	97.15	96.47	95.98	95.58
63	8.916	105.5	100.19	99.53	98.86	98.48	97.82	97.25	96.68	96.21	95.73
64	8.933	105.0	100.29	99.90	99.33	98.76	98.38	97.90	97.43	96.86	96.29
65	8.956	104.7	100.29	99.71	99.04	98.38	97.90	97.33	96.85	96.28	95.70
66	8.922	104.0	100.10	99.62	99.04	98.46	97.79	97.21	96.63	96.15	95.77
67	8.966	103.4	100.00	99.71	99.23	98.55	97.87	97.39	96.81	96.42	95.94
68	8.900	103.8	100.19	99.61	99.04	98.46	97.88	97.30	96.72	96.15	95.86
69	8.900	104.9	100.10	99.52	98.95	98.28	97.62	97.24	96.66	96.09	95.61
70	8.936	106.3	100.19	99.62	99.06	98.49	97.84	97.27	96.71	96.05	95.58
71	8.998	104.8	100.10	99.52	98.95	98.47	97.81	97.14	96.76	96.18	95.52
72	9.056	105.9	100.09	99.62	98.96	98.39	97.92	97.26	96.69	96.32	95.75
73	8.994	106.3	99.91	99.34	98.87	98.12	97.65	97.27	96.61	96.14	95.77
74	8.966	106.6	100.00	99.44	98.78	98.22	97.56	97.00	96.53	96.06	95.59
75	8.970	105.5	99.91	99.43	98.86	98.20	97.44	96.97	96.49	96.02	95.45
Ave.	8.955	105.1	100.09	99.59	99.01	98.41	97.82	97.30	96.78	96.26	95.75
Med.	8.946	105.5	100.09	99.61	99.02	98.40	97.82	97.26	96.72	96.21	95.73
st dev	0.047	1.3	0.1096	0.1271	0.1412	0.1822	0.2291	0.2456	0.2535	0.2464	0.2557
Min.	8.900	101.9	99.90	99.34	98.78	98.12	97.44	96.96	96.39	95.92	95.35
Max.	9.061	107.1	100.29	99.90	99.33	98.93	98.44	97.96	97.43	96.86	96.30

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 5.446E-06
β: 1.005
Reported L₇₀: >54,000 hours

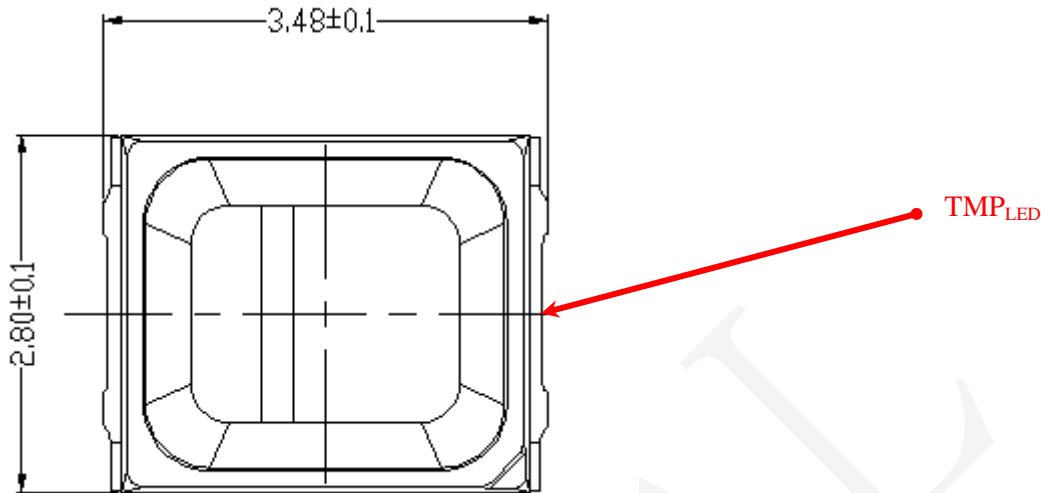
3.6 Data Set 3, 105 °C, 100mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	0.2570	0.5285	2812	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0019	0.0022	0.0024
52	0.2574	0.5289	2801	0.0004	0.0005	0.0009	0.0011	0.0013	0.0015	0.0018	0.0020	0.0024
53	0.2552	0.5284	2851	0.0004	0.0006	0.0008	0.0010	0.0014	0.0016	0.0019	0.0021	0.0023
54	0.2559	0.5271	2843	0.0004	0.0007	0.0009	0.0012	0.0016	0.0017	0.0020	0.0022	0.0025
55	0.2564	0.5279	2828	0.0004	0.0006	0.0009	0.0011	0.0014	0.0016	0.0019	0.0021	0.0024
56	0.2560	0.5275	2839	0.0004	0.0006	0.0009	0.0011	0.0014	0.0016	0.0019	0.0021	0.0025
57	0.2584	0.5273	2787	0.0006	0.0008	0.0012	0.0013	0.0016	0.0018	0.0021	0.0023	0.0026
58	0.2585	0.5272	2785	0.0003	0.0006	0.0009	0.0011	0.0014	0.0016	0.0019	0.0021	0.0024
59	0.2570	0.5289	2810	0.0004	0.0006	0.0009	0.0009	0.0013	0.0015	0.0018	0.0020	0.0023
60	0.2577	0.5284	2798	0.0004	0.0006	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0025
61	0.2561	0.5253	2848	0.0004	0.0007	0.0010	0.0012	0.0015	0.0017	0.0020	0.0022	0.0026
62	0.2557	0.5246	2861	0.0004	0.0007	0.0009	0.0011	0.0014	0.0015	0.0019	0.0021	0.0025
63	0.2570	0.5277	2816	0.0004	0.0008	0.0010	0.0012	0.0015	0.0017	0.0021	0.0023	0.0025
64	0.2567	0.5273	2825	0.0004	0.0009	0.0011	0.0013	0.0016	0.0017	0.0021	0.0022	0.0025
65	0.2560	0.5278	2838	0.0004	0.0007	0.0010	0.0012	0.0014	0.0017	0.0020	0.0022	0.0025
66	0.2573	0.5288	2804	0.0003	0.0006	0.0009	0.0012	0.0014	0.0016	0.0019	0.0022	0.0025
67	0.2569	0.5281	2816	0.0004	0.0006	0.0009	0.0011	0.0013	0.0016	0.0019	0.0021	0.0024
68	0.2562	0.5279	2832	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0021	0.0022	0.0025
69	0.2580	0.5276	2795	0.0004	0.0006	0.0009	0.0011	0.0013	0.0016	0.0019	0.0022	0.0024
70	0.2549	0.5264	2870	0.0004	0.0008	0.0009	0.0012	0.0014	0.0017	0.0019	0.0022	0.0025
71	0.2586	0.5300	2771	0.0004	0.0007	0.0009	0.0010	0.0014	0.0017	0.0019	0.0021	0.0024
72	0.2549	0.5272	2864	0.0003	0.0006	0.0008	0.0010	0.0013	0.0015	0.0019	0.0022	0.0025
73	0.2580	0.5265	2800	0.0004	0.0007	0.0009	0.0012	0.0014	0.0017	0.0020	0.0023	0.0025
74	0.2564	0.5285	2826	0.0004	0.0008	0.0009	0.0011	0.0014	0.0017	0.0019	0.0022	0.0025
75	0.2564	0.5247	2844	0.0004	0.0006	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0025
Ave.	0.2567	0.5275	2823	0.0004	0.0007	0.0009	0.0011	0.0014	0.0016	0.0020	0.0022	0.0025
Med.	0.2567	0.5277	2825	0.0004	0.0007	0.0009	0.0011	0.0014	0.0016	0.0019	0.0022	0.0025
st dev	0.0011	0.0013	26	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2549	0.5246	2771	0.0003	0.0005	0.0008	0.0009	0.0013	0.0015	0.0018	0.0020	0.0023
Max.	0.2586	0.5300	2870	0.0006	0.0009	0.0012	0.0013	0.0016	0.0018	0.0021	0.0023	0.0026



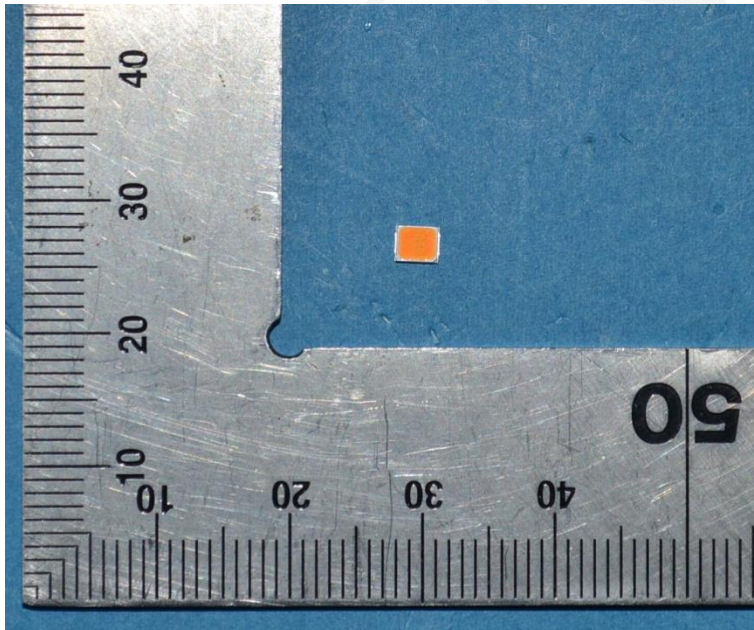
Attachment A – EUT Photo

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



All dimensions are in millimeter

A.2 EUT Photo



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