



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Guangzhou Hongli Opto-Electronic Co., Ltd.

No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model: HL-AT-2835DW-S1-08-PCT-HR3

Report Type: 9000 Hours Test Report	Product Type: LED Package
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Report Number: RSZ140908502-10-9000	
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Report Date: 2015-10-27	
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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: HL-AT-2835DW-S1-08-PCT-HR3
 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, 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	2015-08-05	2016-08-05
Precision digital stabilized DC power supply	EVERFINE	WY605	G115987CJ 7321114	300VA	2015-03-05	2016-03-05
Multilayer aging machine	BACL	B2-270	20023	25°C~110°C	2015-03-05	2016-03-05
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090005	(50V/15A)	2015-03-05	2016-03-05

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 (luminous flux) 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. The uncertainty of the CRI is $U=1.7$ ($K=2$), 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 2014-09-08 and tested during 2014-09-30 to 2015-10-15. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Data Set 1: 55 °C, 150mA

Part Number:	HL-AT-2835DW-S1-08-PCT-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 54.6 \text{ }^\circ\text{C}$
Actual Ambient Temperature(T_A):	$T_A = 52.5 \text{ }^\circ\text{C}$
Life Test Drive Current:	$I_F = 150\text{mA}$
Measurement Current:	$I_F = 150\text{mA}$

Data Set 2: 85 °C,150mA

Part Number:	HL-AT-2835DW-S1-08-PCT-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 84.5 \text{ }^\circ\text{C}$
Actual Ambient Temperature(T_A):	$T_A = 83.8 \text{ }^\circ\text{C}$
Life Test Drive Current:	$I_F = 150\text{mA}$
Measurement Current:	$I_F = 150\text{mA}$

Data Set 3: 105 °C, 150mA

Part Number:	HL-AT-2835DW-S1-08-PCT-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 104.4 \text{ }^\circ\text{C}$
Actual Ambient Temperature(T_A):	$T_A = 103.2 \text{ }^\circ\text{C}$
Life Test Drive Current:	$I_F = 150\text{mA}$
Measurement Current:	$I_F = 150\text{mA}$

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 9000 hours:	96.40%
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0023
Reported TM-21 L ₇₀ Lifetime:	>54000 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 9000 hours:	95.40%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0024
Reported TM-21 L ₇₀ Lifetime:	>54000 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 9000 hours:	93.81%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0028
Reported TM-21 L ₇₀ Lifetime:	44000 hours

3 - Test Data

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

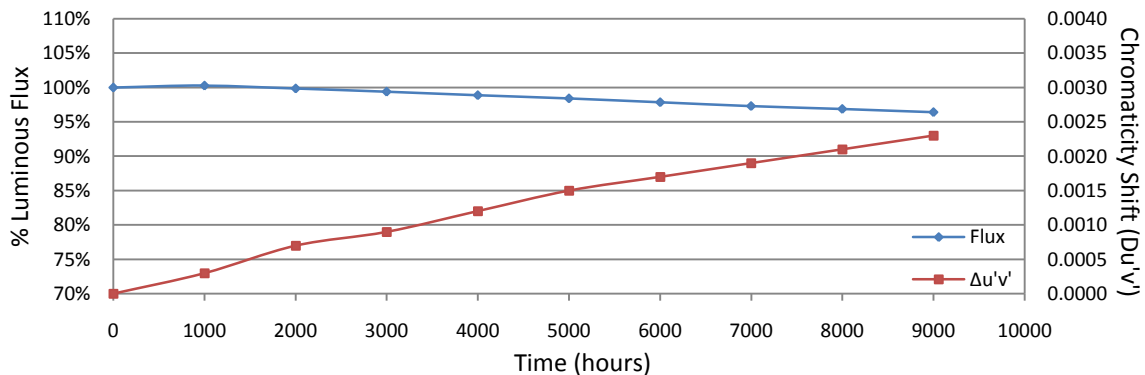
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	6.424	126.3	100.16	99.52	99.21	99.13	98.42	98.10	97.31	96.83	96.28
2	6.407	125.1	100.16	99.84	99.28	98.80	98.64	98.08	97.28	97.04	96.56
3	6.421	124.5	100.32	100.00	99.20	98.55	97.83	97.27	97.19	96.71	96.39
4	6.384	125.2	100.40	99.92	99.60	98.96	98.24	97.60	97.36	96.96	96.49
5	6.382	124.9	100.32	99.92	99.44	98.96	98.16	97.52	97.36	96.96	96.48
6	6.376	125.4	100.40	99.84	99.52	99.04	98.48	97.61	97.45	97.13	96.57
7	6.428	126.2	100.40	99.92	99.52	98.97	98.49	97.62	97.15	96.67	96.59
8	6.373	125.2	100.40	100.00	99.76	99.12	98.48	97.76	96.96	96.81	96.41
9	6.414	124.6	100.48	99.92	99.76	99.04	98.56	97.67	96.87	96.71	96.23
10	6.414	126.2	100.48	100.08	99.45	98.97	98.57	97.54	96.83	96.12	95.80
11	6.406	126.7	100.47	100.08	99.76	99.45	99.13	98.18	97.71	97.08	96.13
12	6.366	124.7	100.24	99.84	99.52	99.04	98.80	98.48	97.59	97.11	96.71
13	6.378	127.3	100.24	99.84	99.37	99.06	98.66	98.51	97.72	97.17	96.78
14	6.553	122.6	100.00	99.92	99.51	99.02	98.78	98.37	97.63	96.66	96.41
15	6.477	125.9	100.08	99.52	99.44	98.89	98.57	98.25	97.93	97.30	96.66
16	6.386	124.4	100.16	99.68	99.52	99.04	98.79	98.39	98.07	97.43	96.78
17	6.434	124.7	100.16	99.76	99.44	99.04	98.72	98.40	97.91	97.51	96.79
18	6.420	124.6	100.32	99.92	99.44	98.64	98.39	97.99	97.51	97.03	96.87
19	6.479	128.8	100.16	99.69	99.22	98.76	98.14	97.28	96.66	96.12	95.96
20	6.446	126.3	100.48	100.08	99.60	99.21	98.50	97.62	96.91	96.52	96.28
21	6.401	124.2	100.24	99.76	99.28	98.47	97.83	97.67	97.10	96.62	96.38
22	6.435	127.3	100.08	99.29	98.98	98.04	97.17	96.86	96.62	96.39	96.15
23	6.403	124.4	100.48	99.84	99.12	98.55	98.15	97.59	97.11	96.78	96.22
24	6.384	125.2	100.24	99.76	98.88	98.48	98.40	97.68	97.12	96.49	96.01
25	6.389	126.1	100.16	99.68	98.97	98.65	98.26	97.78	97.15	96.75	95.96
Ave.	6.415	125.5	100.28	99.83	99.39	98.87	98.41	97.83	97.30	96.84	96.40
Med.	6.407	125.2	100.24	99.84	99.44	98.97	98.48	97.68	97.28	96.81	96.41
st dev	0.0414	1.2713	0.1458	0.1879	0.2417	0.2985	0.3942	0.4249	0.3926	0.3583	0.2935
Min.	6.366	122.6	100.00	99.29	98.88	98.04	97.17	96.86	96.62	96.12	95.80
Max.	6.553	128.8	100.48	100.08	99.76	99.45	99.13	98.51	98.07	97.51	96.87

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 5.148E-06
 β : 1.009
Calculated L₇₀: 71000 hours
Reported L₇₀: >54000 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	0.2604	0.5255	2751	0.0004	0.0009	0.0010	0.0013	0.0014	0.0018	0.0019	0.0021	0.0023
2	0.2614	0.5259	2729	0.0004	0.0009	0.0011	0.0015	0.0018	0.0021	0.0022	0.0023	0.0024
3	0.2611	0.5267	2732	0.0004	0.0009	0.0011	0.0016	0.0018	0.0021	0.0022	0.0023	0.0025
4	0.2602	0.5266	2752	0.0004	0.0008	0.0009	0.0013	0.0016	0.0018	0.0020	0.0021	0.0022
5	0.2602	0.5260	2753	0.0002	0.0008	0.0009	0.0011	0.0014	0.0016	0.0019	0.0020	0.0022
6	0.2589	0.5252	2785	0.0002	0.0007	0.0008	0.0009	0.0012	0.0014	0.0017	0.0018	0.0020
7	0.2590	0.5256	2781	0.0003	0.0007	0.0008	0.0010	0.0011	0.0014	0.0018	0.0019	0.0021
8	0.2614	0.5260	2728	0.0003	0.0009	0.0012	0.0014	0.0016	0.0018	0.0021	0.0023	0.0024
9	0.2601	0.5258	2756	0.0003	0.0009	0.0012	0.0014	0.0015	0.0018	0.0021	0.0022	0.0025
10	0.2607	0.5253	2746	0.0003	0.0009	0.0012	0.0014	0.0015	0.0017	0.0018	0.0021	0.0023
11	0.2599	0.5254	2763	0.0003	0.0008	0.0010	0.0012	0.0013	0.0014	0.0016	0.0018	0.0019
12	0.2607	0.5264	2741	0.0003	0.0009	0.0013	0.0016	0.0018	0.0020	0.0021	0.0022	0.0023
13	0.2597	0.5251	2770	0.0003	0.0005	0.0011	0.0012	0.0013	0.0014	0.0016	0.0017	0.0018
14	0.2604	0.5252	2753	0.0003	0.0006	0.0008	0.0014	0.0016	0.0018	0.0019	0.0020	0.0021
15	0.2608	0.5262	2740	0.0003	0.0006	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0025
16	0.2595	0.5244	2776	0.0003	0.0003	0.0006	0.0010	0.0011	0.0014	0.0018	0.0019	0.0021
17	0.2607	0.5249	2748	0.0004	0.0006	0.0010	0.0014	0.0015	0.0017	0.0020	0.0023	0.0025
18	0.2601	0.5236	2767	0.0003	0.0004	0.0006	0.0010	0.0012	0.0013	0.0014	0.0018	0.0020
19	0.2601	0.5260	2757	0.0004	0.0006	0.0010	0.0014	0.0016	0.0018	0.0020	0.0023	0.0025
20	0.2607	0.5252	2748	0.0003	0.0004	0.0006	0.0011	0.0014	0.0015	0.0017	0.0020	0.0023
21	0.2615	0.5255	2728	0.0004	0.0007	0.0010	0.0014	0.0016	0.0018	0.0020	0.0022	0.0025
22	0.2587	0.5234	2798	0.0003	0.0005	0.0007	0.0012	0.0015	0.0016	0.0018	0.0022	0.0024
23	0.2605	0.5266	2745	0.0004	0.0006	0.0009	0.0011	0.0014	0.0016	0.0021	0.0023	0.0026
24	0.2607	0.5262	2742	0.0003	0.0006	0.0010	0.0011	0.0014	0.0016	0.0019	0.0021	0.0025
25	0.2590	0.5249	2785	0.0003	0.0005	0.0007	0.0008	0.0009	0.0011	0.0014	0.0017	0.0020
Ave.	0.2603	0.5255	2755	0.0003	0.0007	0.0009	0.0012	0.0015	0.0017	0.0019	0.0021	0.0023
Med.	0.2604	0.5255	2752	0.0003	0.0007	0.0010	0.0013	0.0015	0.0017	0.0019	0.0021	0.0023
st dev	0.0008	0.0008	19.1147	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2587	0.5234	2728	0.0002	0.0003	0.0006	0.0008	0.0009	0.0011	0.0014	0.0017	0.0018
Max.	0.2615	0.5267	2798	0.0004	0.0009	0.0013	0.0016	0.0018	0.0021	0.0022	0.0023	0.0026



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

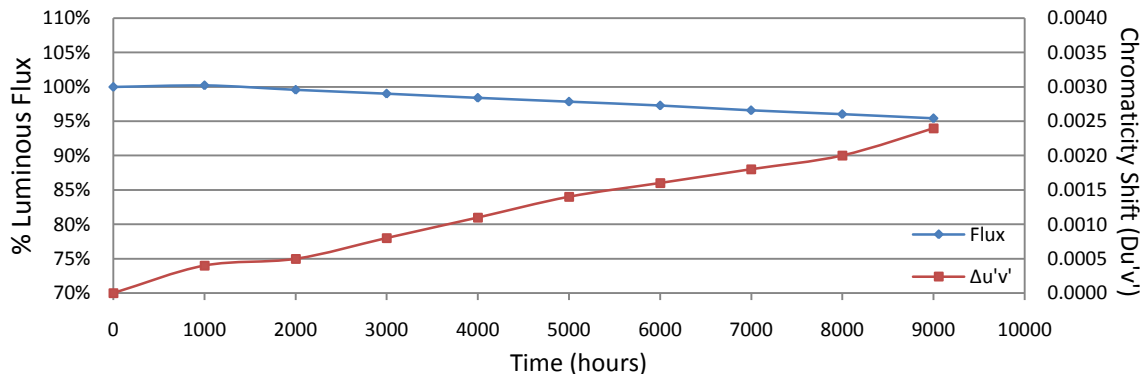
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	6.405	127.6	100.24	99.61	98.90	98.59	98.28	97.88	97.34	96.63	95.69
27	6.481	124.8	100.40	99.76	99.12	98.88	98.40	97.92	97.76	97.04	96.47
28	6.427	127.2	100.47	99.76	99.21	98.74	98.35	97.88	97.64	96.93	96.38
29	6.404	127.9	100.31	99.53	99.06	98.44	98.28	97.65	97.42	96.72	95.78
30	6.503	123.9	100.24	99.68	98.87	98.31	97.98	97.09	96.45	96.21	95.64
31	6.470	124.8	100.32	99.92	99.20	98.48	98.24	97.36	96.47	96.39	95.99
32	6.434	125.5	100.40	99.84	99.12	98.25	98.17	97.21	96.41	96.10	95.78
33	6.487	127.0	100.47	99.76	99.13	98.35	97.80	97.17	96.30	96.06	95.91
34	6.426	126.3	100.08	99.37	98.97	98.57	97.94	97.47	96.60	95.88	95.57
35	6.465	125.4	99.92	99.28	98.56	98.17	97.61	97.05	96.33	95.69	94.90
36	6.415	126.3	100.08	99.60	98.81	98.26	97.78	97.39	96.52	95.96	95.17
37	6.447	123.4	101.05	100.49	99.84	99.19	98.70	98.30	97.41	97.24	96.03
38	6.503	126.7	99.76	99.13	98.42	98.03	97.40	96.84	96.21	95.26	94.95
39	6.428	126.5	99.92	99.21	98.50	98.10	97.31	96.92	96.28	95.26	95.10
40	6.407	127.8	99.84	99.30	98.59	98.20	97.34	97.03	96.24	95.31	95.07
41	6.428	126.5	100.08	99.45	98.81	98.02	97.63	96.92	96.52	95.73	94.78
42	6.404	127.1	99.92	99.21	98.82	97.95	97.40	96.85	95.91	95.44	94.81
43	6.482	126.8	99.92	99.37	99.05	98.19	97.56	96.92	96.14	95.74	95.03
44	6.524	125.5	100.32	99.60	99.20	98.33	97.85	97.13	96.33	95.78	95.06
45	6.508	121.5	99.84	99.18	98.77	97.94	97.37	96.71	95.97	95.47	94.81
46	6.442	125.2	100.40	99.76	99.20	98.40	97.84	97.44	96.33	95.93	95.29
47	6.510	126.9	100.32	99.68	99.21	98.42	97.95	97.16	96.45	96.06	95.27
48	6.513	125.6	100.32	99.76	99.52	98.81	98.09	97.85	96.89	96.26	96.02
49	6.463	127.3	100.24	99.61	98.98	98.51	97.72	97.09	96.54	95.76	94.82
50	6.464	123.2	100.00	99.43	98.78	98.38	97.56	97.08	96.43	95.54	94.81
Ave.	6.458	125.9	100.19	99.57	98.99	98.38	97.86	97.29	96.60	96.02	95.40
Med.	6.463	126.3	100.24	99.60	98.98	98.35	97.84	97.16	96.45	95.93	95.27
st dev	0.0391	1.5908	0.2824	0.2978	0.3170	0.3020	0.3804	0.4121	0.5120	0.5563	0.5293
Min.	6.404	121.5	99.76	99.13	98.42	97.94	97.31	96.71	95.91	95.26	94.78
Max.	6.524	127.9	101.05	100.49	99.84	99.19	98.70	98.30	97.76	97.24	96.47

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 6.224E-06
β: 1.009
Calculated L₇₀: 59000 hours
Reported L₇₀: >54000 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	0.2601	0.5258	2757	0.0003	0.0006	0.0010	0.0012	0.0015	0.0016	0.0018	0.0021	0.0025
27	0.2604	0.5255	2752	0.0003	0.0003	0.0008	0.0009	0.0012	0.0014	0.0016	0.0018	0.0022
28	0.2598	0.5259	2763	0.0003	0.0002	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0020
29	0.2606	0.5262	2745	0.0003	0.0005	0.0010	0.0012	0.0015	0.0016	0.0019	0.0021	0.0026
30	0.2603	0.5252	2754	0.0003	0.0006	0.0008	0.0011	0.0015	0.0016	0.0018	0.0021	0.0025
31	0.2609	0.5257	2740	0.0004	0.0006	0.0008	0.0011	0.0015	0.0016	0.0018	0.0021	0.0025
32	0.2608	0.5248	2746	0.0004	0.0006	0.0007	0.0012	0.0014	0.0016	0.0018	0.0021	0.0025
33	0.2608	0.5258	2743	0.0003	0.0004	0.0005	0.0008	0.0010	0.0011	0.0014	0.0015	0.0019
34	0.2599	0.5251	2764	0.0004	0.0003	0.0005	0.0008	0.0012	0.0013	0.0014	0.0016	0.0021
35	0.2607	0.5263	2743	0.0004	0.0006	0.0009	0.0012	0.0016	0.0018	0.0019	0.0022	0.0025
36	0.2605	0.5262	2748	0.0004	0.0006	0.0009	0.0011	0.0015	0.0017	0.0018	0.0021	0.0025
37	0.2597	0.5247	2771	0.0005	0.0007	0.0009	0.0012	0.0016	0.0017	0.0019	0.0021	0.0025
38	0.2594	0.5248	2776	0.0006	0.0008	0.0011	0.0014	0.0017	0.0020	0.0021	0.0024	0.0028
39	0.2600	0.5241	2766	0.0004	0.0006	0.0009	0.0012	0.0016	0.0018	0.0020	0.0023	0.0026
40	0.2604	0.5260	2749	0.0003	0.0005	0.0009	0.0012	0.0016	0.0018	0.0019	0.0022	0.0025
41	0.2601	0.5256	2758	0.0004	0.0003	0.0006	0.0008	0.0011	0.0013	0.0014	0.0017	0.0020
42	0.2608	0.5266	2740	0.0005	0.0007	0.0011	0.0013	0.0017	0.0019	0.0022	0.0023	0.0027
43	0.2608	0.5263	2741	0.0002	0.0003	0.0006	0.0008	0.0011	0.0012	0.0014	0.0016	0.0020
44	0.2607	0.5263	2741	0.0006	0.0007	0.0011	0.0014	0.0017	0.0020	0.0023	0.0024	0.0028
45	0.2576	0.5237	2822	0.0004	0.0004	0.0005	0.0009	0.0013	0.0014	0.0017	0.0021	0.0023
46	0.2604	0.5254	2753	0.0007	0.0008	0.0011	0.0014	0.0018	0.0019	0.0023	0.0026	0.0028
47	0.2602	0.5260	2754	0.0002	0.0002	0.0004	0.0008	0.0010	0.0013	0.0015	0.0019	0.0020
48	0.2608	0.5265	2739	0.0003	0.0003	0.0005	0.0008	0.0011	0.0014	0.0015	0.0018	0.0025
49	0.2592	0.5254	2778	0.0001	0.0003	0.0004	0.0008	0.0012	0.0015	0.0019	0.0021	0.0023
50	0.2588	0.5243	2793	0.0003	0.0007	0.0008	0.0010	0.0013	0.0017	0.0021	0.0023	0.0025
Ave.	0.2601	0.5255	2757	0.0004	0.0005	0.0008	0.0011	0.0014	0.0016	0.0018	0.0020	0.0024
Med.	0.2604	0.5257	2753	0.0004	0.0006	0.0008	0.0011	0.0015	0.0016	0.0018	0.0021	0.0025
st dev	0.0008	0.0008	19.3177	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
Min.	0.2576	0.5237	2739	0.0001	0.0002	0.0004	0.0008	0.0010	0.0011	0.0014	0.0015	0.0019
Max.	0.2609	0.5266	2822	0.0007	0.0008	0.0011	0.0014	0.0018	0.0020	0.0023	0.0026	0.0028



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

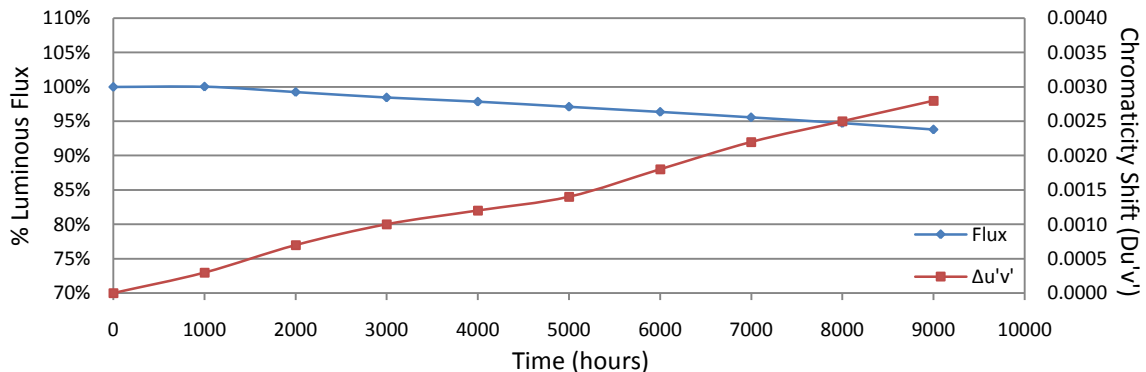
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	6.471	124.9	100.08	99.36	99.12	98.32	97.52	97.04	96.24	95.68	94.56
52	6.442	123.0	100.08	99.27	98.62	98.37	97.56	96.99	96.34	94.72	93.98
53	6.420	125.5	100.08	99.12	98.41	98.25	97.37	96.97	96.41	94.58	94.02
54	6.443	126.0	100.16	99.29	98.17	98.10	97.46	96.83	96.11	94.84	93.89
55	6.425	123.7	100.24	99.51	98.54	98.46	97.57	97.09	96.28	95.39	94.42
56	6.399	125.8	100.00	99.13	98.33	97.93	97.14	96.82	95.87	95.07	94.04
57	6.527	126.1	100.00	99.29	98.49	98.10	97.15	96.43	96.03	95.24	94.05
58	6.385	126.4	99.84	99.29	98.58	98.02	97.07	96.52	95.81	95.25	94.30
59	6.389	125.8	99.92	99.36	98.41	98.09	97.14	96.58	96.10	95.15	94.28
60	6.388	123.4	99.92	99.27	98.38	97.89	97.08	96.19	95.87	95.22	94.17
61	6.461	126.9	100.00	99.37	98.42	97.95	97.01	96.30	95.82	95.35	94.25
62	6.386	124.3	99.44	98.87	97.83	97.43	96.62	95.74	95.41	94.61	93.81
63	6.597	127.0	100.08	99.37	98.50	97.80	97.17	96.22	95.59	94.96	94.25
64	6.408	123.8	100.00	99.11	98.22	97.58	96.93	96.12	94.91	94.43	93.86
65	6.418	122.2	100.25	99.35	98.53	97.87	97.14	96.32	95.25	94.60	94.19
66	6.416	126.0	100.24	99.37	98.65	98.02	97.14	96.27	95.24	94.44	93.57
67	6.495	126.3	100.08	99.45	98.65	97.78	97.31	96.28	95.25	94.54	93.51
68	6.381	122.1	100.00	99.02	98.36	97.46	96.81	95.82	95.00	94.19	93.20
69	6.395	124.8	100.00	99.12	98.32	97.60	97.04	95.99	95.03	94.31	93.27
70	6.417	124.8	99.84	99.04	98.32	97.44	96.88	95.83	94.79	94.07	93.27
71	6.376	127.6	99.92	99.14	98.28	97.57	96.87	95.92	95.06	94.12	93.18
72	6.369	127.1	100.00	99.29	98.58	97.56	96.85	96.14	95.20	94.26	93.39
73	6.425	126.3	100.08	99.37	98.50	97.55	96.99	96.12	95.33	94.38	93.43
74	6.350	127.3	100.00	99.06	98.35	97.41	96.54	95.76	95.05	94.11	93.24
75	6.390	125.7	100.00	99.28	98.57	97.61	96.74	95.94	95.23	94.11	93.24
Ave.	6.423	125.3	100.01	99.24	98.45	97.85	97.08	96.33	95.57	94.70	93.81
Med.	6.416	125.8	100.00	99.29	98.42	97.87	97.08	96.27	95.41	94.60	93.89
st dev	0.0544	1.5643	0.1612	0.1531	0.2280	0.3189	0.2770	0.4230	0.5073	0.4785	0.4430
Min.	6.350	122.1	99.44	98.87	97.83	97.41	96.54	95.74	94.79	94.07	93.18
Max.	6.597	127.6	100.25	99.51	99.12	98.46	97.57	97.09	96.41	95.68	94.56

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 8.377E-06
β: 1.012
Calculated L₇₀: 44000 hours
Reported L₇₀: 44000 hours

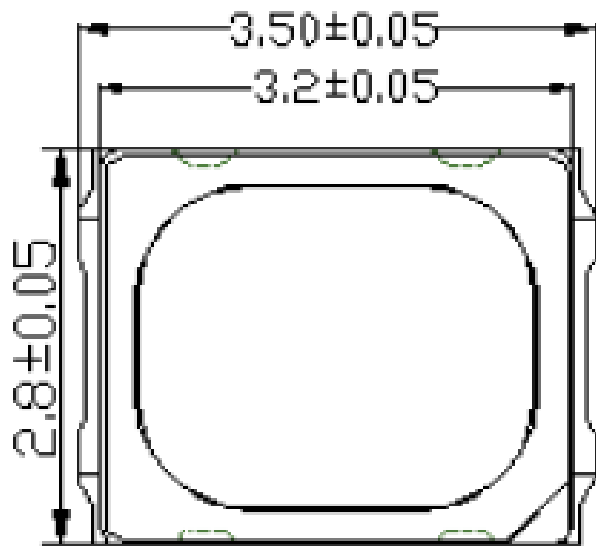
3.6 Data Set 3, 105 °C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	0.2610	0.5266	2734	0.0002	0.0007	0.0008	0.0011	0.0015	0.0019	0.0025	0.0026	0.0027
52	0.2596	0.5250	2772	0.0004	0.0007	0.0008	0.0009	0.0012	0.0016	0.0021	0.0025	0.0027
53	0.2604	0.5252	2752	0.0003	0.0007	0.0009	0.0011	0.0016	0.0019	0.0023	0.0028	0.0030
54	0.2608	0.5254	2744	0.0003	0.0007	0.0011	0.0012	0.0015	0.0019	0.0023	0.0027	0.0030
55	0.2600	0.5249	2763	0.0002	0.0006	0.0009	0.0011	0.0015	0.0018	0.0023	0.0027	0.0029
56	0.2610	0.5255	2740	0.0003	0.0007	0.0009	0.0008	0.0013	0.0015	0.0019	0.0023	0.0025
57	0.2607	0.5243	2751	0.0002	0.0002	0.0006	0.0007	0.0009	0.0014	0.0017	0.0020	0.0022
58	0.2608	0.5266	2739	0.0003	0.0004	0.0006	0.0007	0.0010	0.0012	0.0016	0.0019	0.0021
59	0.2607	0.5265	2742	0.0003	0.0006	0.0012	0.0013	0.0015	0.0019	0.0023	0.0027	0.0029
60	0.2582	0.5245	2804	0.0004	0.0008	0.0009	0.0010	0.0013	0.0016	0.0019	0.0023	0.0025
61	0.2611	0.5269	2730	0.0004	0.0008	0.0013	0.0015	0.0016	0.0020	0.0024	0.0027	0.0030
62	0.2575	0.5241	2822	0.0005	0.0009	0.0015	0.0016	0.0017	0.0021	0.0025	0.0028	0.0031
63	0.2599	0.5257	2761	0.0004	0.0006	0.0012	0.0013	0.0014	0.0018	0.0023	0.0027	0.0029
64	0.2579	0.5251	2809	0.0003	0.0008	0.0013	0.0014	0.0016	0.0018	0.0023	0.0026	0.0029
65	0.2578	0.5250	2812	0.0003	0.0007	0.0012	0.0014	0.0015	0.0018	0.0023	0.0026	0.0028
66	0.2601	0.5264	2755	0.0006	0.0010	0.0015	0.0016	0.0018	0.0021	0.0025	0.0028	0.0032
67	0.2588	0.5248	2791	0.0002	0.0007	0.0010	0.0012	0.0013	0.0016	0.0021	0.0025	0.0027
68	0.2599	0.5254	2763	0.0003	0.0008	0.0012	0.0014	0.0015	0.0019	0.0023	0.0027	0.0030
69	0.2612	0.5261	2733	0.0005	0.0009	0.0014	0.0016	0.0017	0.0020	0.0025	0.0028	0.0030
70	0.2588	0.5239	2793	0.0002	0.0008	0.0012	0.0014	0.0016	0.0018	0.0023	0.0026	0.0029
71	0.2607	0.5261	2743	0.0002	0.0007	0.0013	0.0014	0.0016	0.0018	0.0023	0.0026	0.0029
72	0.2603	0.5252	2756	0.0002	0.0003	0.0005	0.0008	0.0010	0.0012	0.0016	0.0019	0.0022
73	0.2610	0.5257	2739	0.0002	0.0007	0.0009	0.0013	0.0014	0.0016	0.0021	0.0024	0.0027
74	0.2592	0.5253	2778	0.0002	0.0007	0.0010	0.0014	0.0018	0.0019	0.0022	0.0025	0.0028
75	0.2602	0.5259	2755	0.0003	0.0007	0.0009	0.0011	0.0014	0.0016	0.0019	0.0023	0.0026
Ave.	0.2599	0.5254	2763	0.0003	0.0007	0.0010	0.0012	0.0014	0.0018	0.0022	0.0025	0.0028
Med.	0.2602	0.5254	2755	0.0003	0.0007	0.0010	0.0013	0.0015	0.0018	0.0023	0.0026	0.0029
st dev	0.0011	0.0008	27.2539	0.0001	0.0002	0.0003	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003
Min.	0.2575	0.5239	2730	0.0002	0.0002	0.0005	0.0007	0.0009	0.0012	0.0016	0.0019	0.0021
Max.	0.2612	0.5269	2822	0.0006	0.0010	0.0015	0.0016	0.0018	0.0021	0.0025	0.0028	0.0032



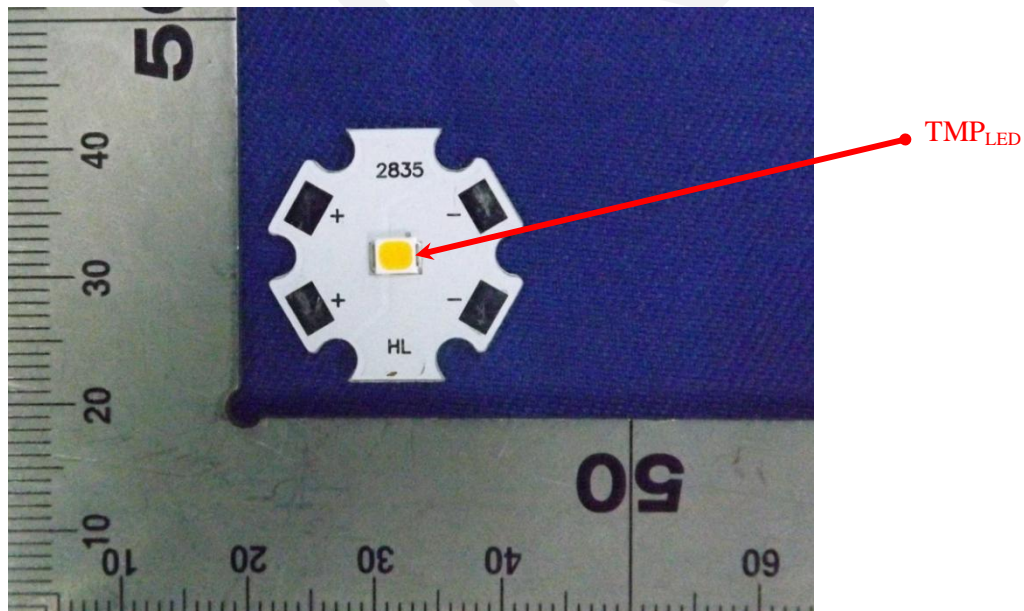
Attachment A – EUT PHOTO

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



All dimensions are in millimeter

A.2 EUT Photo



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