



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-EMC-2835DW-S1-HR3

Report Type: 9000 Hours Test Report	Product Type: LED Package
Test Engineer: Daniel Duan	<i>Daniel Duan</i>
Report Number:	RSZ140908503-10-9000
Test Date:	2014-10-15 to 2015-10-27
Report Date:	2015-10-28
Reviewed By: Jeanne Han /EE Manager	<i>Jeanne Han</i>
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	3
1.4 DESCRIPTION OF AUXILIARY EQUIPMENT	3
1.5 OPERATING CYCLE.....	3
1.6 AMBIENT CONDITIONS	4
1.7 PHOTOMETRY MEASUREMENT UNCERTAINTY	4
1.8 SAMPLE SET	5
2 - SUMMARY OF TEST RESULT	6
3 - TEST DATA	7
3.1 DATA SET 1, 55 °C, 150MA (LUMEN MAINTENANCE)	7
3.2 DATA SET 1, 55 °C, 150MA (CHROMATICITY SHIFT)	8
3.3 DATA SET 2, 85 °C, 150MA (LUMEN MAINTENANCE)	9
3.4 DATA SET 2, 85 °C, 150MA (CHROMATICITY SHIFT)	10
3.5 DATA SET 3, 105 °C, 150MA (LUMEN MAINTENANCE)	11
3.6 DATA SET 3, 105 °C, 150MA (CHROMATICITY SHIFT)	12
ATTACHMENT A – EUT PHOTO.....	13
A.1 MECHANICAL DIMENSIONS (TA = 25 °C).....	13
A.2 EUT PHOTO	13

1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: HL-EMC-2835DW-S1-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	B3-900	20030	25°C~110°C	2015-03-05	2016-03-05
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090006	(50V/15A)	2015-03-05	2016-03-05
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090009	(50V/15A)	2015-07-08	2016-07-08

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 2014-10-15 to 2015-10-27. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Data Set 1: 55 °C, 150mA

Part Number:	HL-EMC-2835DW-S1-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 54.4$ °C
Actual Ambient Temperature(T_A):	$T_A = 53.1$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

Data Set 2: 85 °C, 150mA

Part Number:	HL-EMC-2835DW-S1-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 84.4$ °C
Actual Ambient Temperature(T_A):	$T_A = 82.7$ °C
Life Test Drive Current:	$I_F = 150$ mA
Measurement Current:	$I_F = 150$ mA

Data Set 3: 105 °C, 150mA

Part Number:	HL-EMC-2835DW-S1-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 104.6$ °C
Actual Ambient Temperature(T_A):	$T_A = 103.5$ °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 9000 hours:	96.66%
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:	95.02%
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:	93.35%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0027
Reported TM-21 L ₇₀ Lifetime:	42000 hours

3 - Test Data

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

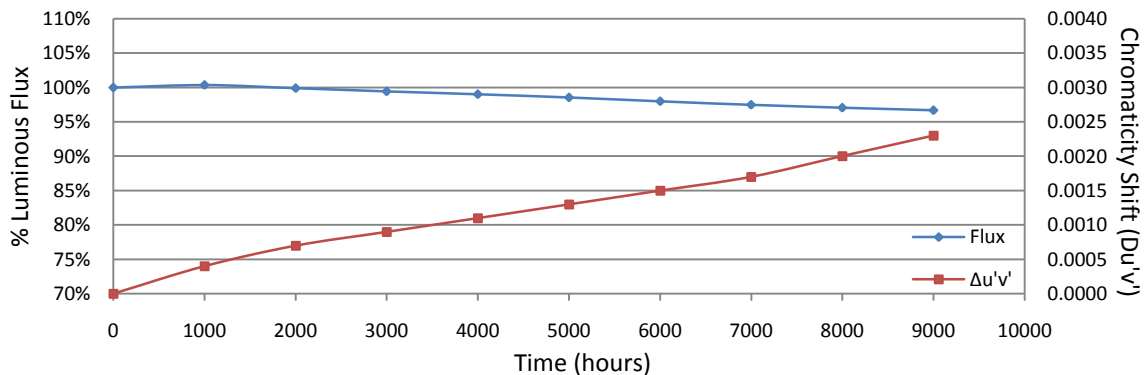
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	6.490	127.3	100.24	99.76	99.45	99.06	98.59	98.11	97.72	97.25	96.62
2	6.534	129.7	100.08	99.61	99.07	98.61	98.23	97.69	97.22	96.92	96.14
3	6.559	127.0	100.16	99.69	99.21	98.74	98.27	97.72	97.32	96.93	96.30
4	6.490	127.6	100.39	99.69	99.06	98.51	97.96	97.34	97.26	97.02	96.39
5	6.564	129.2	100.39	100.08	99.30	98.76	98.22	97.60	97.21	96.44	96.05
6	6.844	125.0	100.80	100.24	99.76	99.20	98.88	98.32	97.68	97.20	96.64
7	6.495	129.4	99.92	99.54	99.38	98.84	98.45	97.91	97.22	96.75	96.29
8	6.516	129.3	100.00	99.69	99.38	98.99	98.53	97.99	97.45	96.91	96.44
9	6.532	126.1	100.63	100.16	99.76	99.52	98.97	98.41	97.78	97.38	96.83
10	6.469	128.9	100.54	99.92	99.15	98.60	98.45	97.91	97.28	96.82	96.51
11	6.487	127.3	100.55	100.08	99.76	99.37	98.90	98.35	97.64	97.25	96.78
12	6.555	127.5	100.71	100.24	99.84	99.37	99.06	98.43	97.88	97.41	97.02
13	6.549	127.6	100.31	100.08	99.69	99.14	98.90	98.28	97.73	97.26	96.87
14	6.484	128.7	100.39	100.08	99.69	99.22	98.91	98.45	97.75	97.28	96.81
15	6.620	125.6	100.56	100.16	99.84	99.52	99.04	98.73	98.25	97.61	97.29
16	6.532	126.7	100.08	99.45	99.05	98.66	98.18	97.71	97.40	96.76	96.37
17	6.518	129.0	99.92	99.38	99.30	99.15	98.68	97.98	97.36	97.29	96.74
18	6.517	126.9	100.32	99.92	99.37	99.21	98.58	97.87	97.40	96.93	96.77
19	6.848	125.5	100.32	100.00	99.76	99.20	98.88	98.33	97.69	97.21	97.05
20	6.533	127.5	100.55	100.00	99.14	98.27	97.88	97.18	96.63	96.24	96.08
21	6.506	128.6	100.39	99.92	99.46	99.14	98.52	97.90	97.51	97.28	97.12
22	6.476	126.6	100.39	99.84	99.29	99.13	98.50	97.95	97.47	97.16	96.92
23	6.505	128.3	100.16	99.92	99.38	99.06	98.44	97.82	97.43	97.12	96.88
24	6.517	128.6	100.23	99.69	99.46	98.99	98.37	97.74	97.36	97.12	96.81
25	6.508	127.4	100.24	99.76	99.45	98.98	98.35	97.41	97.25	97.10	96.78
Ave.	6.546	127.7	100.33	99.88	99.44	99.01	98.55	97.96	97.48	97.07	96.66
Med.	6.517	127.5	100.32	99.92	99.38	99.06	98.52	97.91	97.43	97.12	96.77
st dev	0.0962	1.3023	0.2347	0.2420	0.2578	0.3178	0.3306	0.3823	0.3086	0.3052	0.3320
Min.	6.469	125.0	99.92	99.38	99.05	98.27	97.88	97.18	96.63	96.24	96.05
Max.	6.848	129.7	100.80	100.24	99.84	99.52	99.06	98.73	98.25	97.61	97.29

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 4.869E-06
 β : 1.009
Calculated L₇₀: 75000 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	0.2601	0.5285	2746	0.0003	0.0007	0.0008	0.0009	0.0012	0.0015	0.0020	0.0021	0.0025
2	0.2597	0.5286	2753	0.0004	0.0008	0.0009	0.0011	0.0012	0.0016	0.0019	0.0021	0.0026
3	0.2602	0.5278	2746	0.0004	0.0006	0.0007	0.0011	0.0012	0.0015	0.0017	0.0023	0.0026
4	0.2610	0.5276	2730	0.0003	0.0005	0.0006	0.0009	0.0010	0.0012	0.0015	0.0021	0.0024
5	0.2590	0.5273	2775	0.0003	0.0006	0.0007	0.0009	0.0011	0.0014	0.0015	0.0019	0.0023
6	0.2611	0.5280	2726	0.0004	0.0006	0.0010	0.0011	0.0013	0.0015	0.0017	0.0020	0.0024
7	0.2613	0.5285	2720	0.0006	0.0007	0.0010	0.0012	0.0014	0.0015	0.0018	0.0020	0.0024
8	0.2602	0.5282	2744	0.0006	0.0008	0.0010	0.0012	0.0014	0.0015	0.0017	0.0022	0.0025
9	0.2594	0.5282	2761	0.0004	0.0006	0.0007	0.0011	0.0013	0.0015	0.0017	0.0020	0.0024
10	0.2585	0.5261	2790	0.0004	0.0009	0.0009	0.0012	0.0014	0.0017	0.0018	0.0022	0.0024
11	0.2600	0.5273	2753	0.0004	0.0008	0.0009	0.0012	0.0014	0.0015	0.0018	0.0022	0.0024
12	0.2598	0.5266	2761	0.0006	0.0008	0.0009	0.0012	0.0013	0.0016	0.0017	0.0022	0.0023
13	0.2584	0.5269	2789	0.0007	0.0008	0.0010	0.0012	0.0014	0.0017	0.0019	0.0022	0.0024
14	0.2608	0.5278	2734	0.0004	0.0008	0.0009	0.0011	0.0014	0.0016	0.0018	0.0022	0.0024
15	0.2597	0.5269	2762	0.0006	0.0009	0.0010	0.0012	0.0015	0.0017	0.0019	0.0022	0.0024
16	0.2599	0.5270	2755	0.0005	0.0008	0.0009	0.0012	0.0014	0.0016	0.0017	0.0021	0.0023
17	0.2578	0.5266	2804	0.0003	0.0007	0.0009	0.0011	0.0013	0.0015	0.0016	0.0019	0.0022
18	0.2576	0.5262	2809	0.0003	0.0008	0.0009	0.0012	0.0013	0.0016	0.0017	0.0020	0.0022
19	0.2586	0.5265	2788	0.0003	0.0006	0.0007	0.0010	0.0012	0.0014	0.0015	0.0018	0.0021
20	0.2597	0.5268	2760	0.0003	0.0010	0.0013	0.0015	0.0016	0.0018	0.0021	0.0023	0.0025
21	0.2590	0.5268	2777	0.0003	0.0005	0.0008	0.0010	0.0011	0.0014	0.0015	0.0018	0.0020
22	0.2602	0.5271	2750	0.0003	0.0005	0.0007	0.0010	0.0012	0.0014	0.0016	0.0019	0.0021
23	0.2577	0.5259	2809	0.0004	0.0005	0.0006	0.0010	0.0011	0.0014	0.0015	0.0018	0.0020
24	0.2586	0.5276	2781	0.0004	0.0005	0.0007	0.0011	0.0012	0.0014	0.0016	0.0019	0.0021
25	0.2609	0.5276	2733	0.0005	0.0006	0.0008	0.0011	0.0012	0.0014	0.0017	0.0019	0.0022
Ave.	0.2596	0.5273	2762	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0017	0.0020	0.0023
Med.	0.2597	0.5273	2760	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0017	0.0021	0.0024
st dev	0.0011	0.0008	25.8445	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002
Min.	0.2576	0.5259	2720	0.0003	0.0005	0.0006	0.0009	0.0010	0.0012	0.0015	0.0018	0.0020
Max.	0.2613	0.5286	2809	0.0007	0.0010	0.0013	0.0015	0.0016	0.0018	0.0021	0.0023	0.0026



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

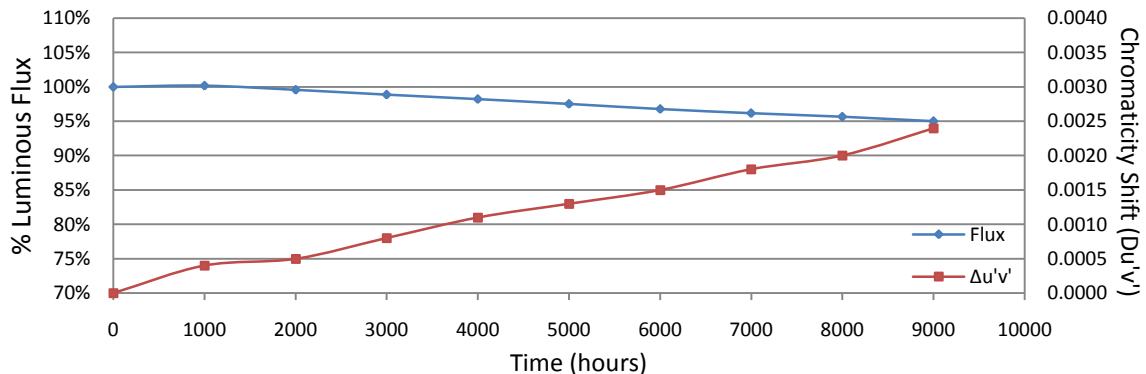
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	6.544	127.1	100.31	99.69	99.53	99.29	98.51	97.72	97.17	97.09	96.54
27	6.506	125.8	100.24	99.60	98.89	98.57	98.01	97.62	96.98	96.50	95.87
28	6.478	128.8	100.47	99.77	99.07	98.84	98.14	97.83	97.20	96.51	95.96
29	6.495	128.1	100.31	99.61	98.91	98.36	98.05	97.66	97.03	96.33	95.55
30	6.560	129.7	100.08	99.38	98.69	98.00	97.76	97.15	96.76	96.14	95.30
31	6.479	128.9	100.00	99.53	98.76	97.98	97.28	96.51	95.81	95.66	95.19
32	6.525	127.3	100.16	99.45	98.74	98.04	97.41	96.54	95.92	95.68	95.21
33	6.496	127.9	100.31	99.53	98.91	98.12	97.50	97.03	96.09	95.86	95.54
34	6.492	129.0	100.16	99.53	98.76	98.06	97.44	96.67	96.05	95.50	95.27
35	6.513	129.2	100.31	99.61	98.76	98.22	97.45	96.59	95.98	95.59	95.05
36	6.523	128.0	100.39	99.53	98.91	98.20	97.34	96.48	95.94	95.47	95.00
37	6.535	128.5	100.08	99.38	98.68	97.98	97.12	96.42	95.88	95.41	94.94
38	6.581	128.7	100.23	99.92	99.22	98.37	97.59	96.74	96.19	95.80	94.48
39	6.526	128.9	99.77	99.53	98.76	97.98	97.05	96.35	95.81	95.35	94.34
40	6.493	127.7	100.08	99.84	99.06	98.28	97.42	96.55	96.01	95.54	94.52
41	6.490	129.3	100.23	99.61	98.76	98.22	97.37	96.52	95.82	95.36	94.66
42	6.557	126.6	100.16	99.76	98.97	97.95	97.39	96.60	95.97	95.26	94.79
43	6.547	127.8	100.16	99.53	99.06	98.12	97.42	96.48	95.85	94.99	94.68
44	6.490	126.8	100.24	99.61	99.05	98.34	97.40	96.61	96.06	95.19	94.79
45	6.552	127.3	100.00	99.37	98.82	97.88	97.17	96.31	95.60	94.97	94.50
46	6.547	125.7	100.16	99.60	99.12	98.17	97.37	96.50	95.86	95.23	94.75
47	6.481	128.0	100.16	99.45	98.67	98.20	97.42	96.56	95.78	95.31	94.69
48	6.562	125.5	100.16	99.52	98.49	98.09	97.45	96.49	96.18	95.30	94.82
49	6.592	129.7	100.08	99.31	98.30	97.92	97.15	96.53	95.91	95.22	94.37
50	6.518	130.6	100.00	99.31	98.70	98.01	97.17	96.71	96.40	95.56	94.64
Ave.	6.523	128.0	100.17	99.56	98.86	98.21	97.50	96.77	96.17	95.63	95.02
Med.	6.523	128.0	100.16	99.53	98.82	98.12	97.42	96.56	95.98	95.50	94.82
st dev	0.0332	1.3127	0.1470	0.1556	0.2473	0.3131	0.3480	0.4556	0.4712	0.5192	0.5435
Min.	6.478	125.5	99.77	99.31	98.30	97.88	97.05	96.31	95.60	94.97	94.34
Max.	6.592	130.6	100.47	99.92	99.53	99.29	98.51	97.83	97.20	97.09	96.54

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 6.555E-06
β: 1.007
Calculated L₇₀: 56000 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	0.2600	0.5269	2755	0.0004	0.0005	0.0008	0.0011	0.0012	0.0014	0.0016	0.0018	0.0019
27	0.2581	0.5261	2798	0.0004	0.0004	0.0006	0.0009	0.0011	0.0013	0.0014	0.0018	0.0021
28	0.2593	0.5267	2771	0.0004	0.0005	0.0007	0.0010	0.0012	0.0013	0.0018	0.0020	0.0022
29	0.2581	0.5270	2795	0.0004	0.0005	0.0008	0.0011	0.0012	0.0014	0.0016	0.0019	0.0023
30	0.2606	0.5290	2732	0.0006	0.0006	0.0009	0.0012	0.0013	0.0015	0.0018	0.0020	0.0024
31	0.2600	0.5271	2755	0.0004	0.0005	0.0008	0.0011	0.0013	0.0015	0.0017	0.0019	0.0021
32	0.2611	0.5283	2724	0.0004	0.0005	0.0007	0.0011	0.0012	0.0014	0.0017	0.0018	0.0022
33	0.2611	0.5284	2725	0.0002	0.0004	0.0007	0.0010	0.0011	0.0013	0.0016	0.0018	0.0021
34	0.2600	0.5281	2749	0.0004	0.0006	0.0008	0.0011	0.0011	0.0014	0.0017	0.0019	0.0024
35	0.2601	0.5275	2751	0.0003	0.0006	0.0008	0.0012	0.0011	0.0015	0.0017	0.0020	0.0023
36	0.2603	0.5278	2744	0.0004	0.0006	0.0008	0.0011	0.0013	0.0014	0.0017	0.0019	0.0022
37	0.2609	0.5289	2727	0.0003	0.0004	0.0007	0.0011	0.0012	0.0014	0.0017	0.0020	0.0023
38	0.2603	0.5271	2748	0.0004	0.0005	0.0009	0.0012	0.0013	0.0016	0.0017	0.0020	0.0024
39	0.2598	0.5278	2754	0.0004	0.0005	0.0009	0.0011	0.0014	0.0016	0.0017	0.0020	0.0026
40	0.2586	0.5272	2784	0.0004	0.0005	0.0008	0.0011	0.0013	0.0016	0.0017	0.0020	0.0024
41	0.2593	0.5270	2768	0.0003	0.0005	0.0008	0.0012	0.0014	0.0016	0.0017	0.0019	0.0026
42	0.2596	0.5265	2764	0.0003	0.0004	0.0009	0.0011	0.0012	0.0015	0.0018	0.0019	0.0024
43	0.2607	0.5297	2729	0.0004	0.0006	0.0009	0.0012	0.0013	0.0015	0.0016	0.0021	0.0025
44	0.2589	0.5266	2780	0.0004	0.0006	0.0009	0.0013	0.0015	0.0016	0.0017	0.0021	0.0024
45	0.2602	0.5272	2750	0.0004	0.0006	0.0009	0.0013	0.0016	0.0017	0.0018	0.0022	0.0027
46	0.2590	0.5276	2772	0.0003	0.0005	0.0008	0.0011	0.0016	0.0017	0.0019	0.0023	0.0026
47	0.2605	0.5270	2743	0.0003	0.0005	0.0008	0.0012	0.0015	0.0016	0.0016	0.0021	0.0026
48	0.2608	0.5279	2734	0.0004	0.0006	0.0010	0.0013	0.0016	0.0016	0.0020	0.0022	0.0027
49	0.2600	0.5269	2755	0.0004	0.0006	0.0009	0.0013	0.0017	0.0016	0.0021	0.0022	0.0025
50	0.2589	0.5269	2778	0.0004	0.0005	0.0008	0.0013	0.0016	0.0017	0.0024	0.0025	0.0027
Ave.	0.2598	0.5275	2755	0.0004	0.0005	0.0008	0.0011	0.0013	0.0015	0.0018	0.0020	0.0024
Med.	0.2600	0.5272	2754	0.0004	0.0005	0.0008	0.0011	0.0013	0.0015	0.0017	0.0020	0.0024
st dev	0.0009	0.0009	21.3288	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002
Min.	0.2581	0.5261	2724	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013	0.0014	0.0018	0.0019
Max.	0.2611	0.5297	2798	0.0006	0.0006	0.0010	0.0013	0.0017	0.0017	0.0024	0.0025	0.0027



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

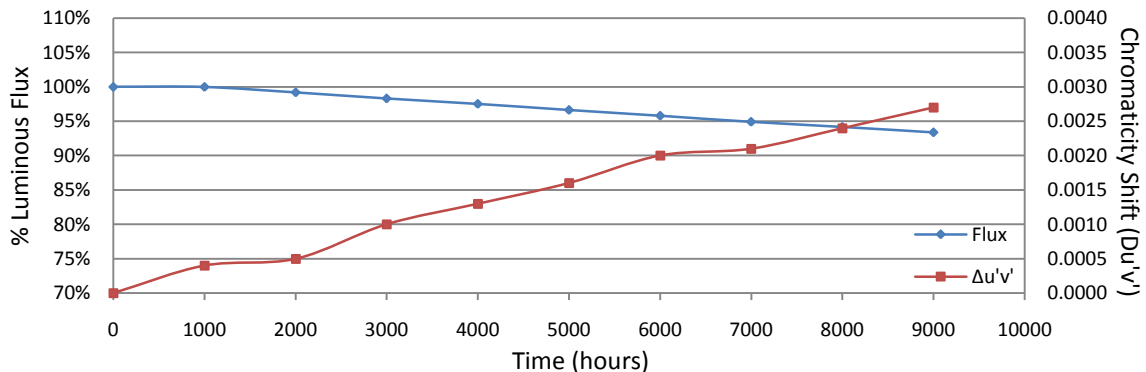
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	6.522	127.9	100.08	99.14	98.75	98.05	97.42	96.87	96.09	95.47	94.76
52	6.552	126.5	99.84	99.13	98.10	97.23	96.36	95.57	94.55	93.52	92.89
53	6.553	127.8	99.92	99.14	98.12	97.10	96.32	95.54	94.60	93.35	92.80
54	6.570	129.5	100.08	99.31	98.22	97.37	96.22	95.60	94.59	93.59	92.66
55	6.510	129.6	100.00	99.38	98.53	98.15	97.07	96.45	95.60	94.68	93.67
56	6.516	128.1	99.92	99.30	98.36	98.13	97.03	96.33	95.47	94.46	93.44
57	6.537	127.5	100.08	99.45	98.59	97.96	97.10	96.39	95.53	94.75	93.65
58	6.573	127.7	100.00	99.45	98.43	98.04	97.10	96.32	95.61	94.83	93.74
59	6.490	129.1	100.08	99.54	98.61	98.14	97.13	96.51	95.66	94.73	93.65
60	6.504	126.6	100.00	99.53	98.58	98.18	97.24	96.21	95.81	94.87	93.84
61	6.522	127.4	99.84	99.29	98.35	97.49	96.86	95.92	95.21	94.66	93.64
62	6.792	126.1	100.16	99.60	98.81	97.86	96.91	95.96	94.92	94.29	93.97
63	6.538	126.6	99.92	99.53	98.66	97.79	96.84	95.81	94.87	94.08	93.52
64	6.657	125.3	100.16	99.36	98.80	98.00	97.05	96.01	95.13	94.09	93.62
65	6.550	126.7	100.16	99.37	98.50	97.95	97.00	95.97	95.11	94.16	93.29
66	6.508	128.8	99.92	99.22	98.29	97.36	96.74	95.81	94.88	93.87	93.09
67	6.584	129.6	100.00	99.15	98.15	97.30	96.60	95.60	94.75	93.90	93.06
68	6.572	129.3	99.92	98.99	98.30	97.45	96.75	95.75	94.90	93.97	92.96
69	6.543	125.3	99.84	98.80	98.08	97.29	96.73	95.77	94.81	93.85	93.06
70	6.542	130.0	99.69	98.69	97.77	96.77	95.54	94.69	93.85	93.69	92.92
71	6.468	127.6	99.92	98.82	98.28	97.18	96.08	95.06	94.20	94.04	93.18
72	6.496	128.8	99.84	98.76	97.75	96.89	95.73	94.95	94.02	93.79	93.01
73	6.530	128.2	99.84	98.67	97.66	96.65	95.71	94.77	93.92	93.76	92.90
74	6.465	128.5	100.00	98.91	97.82	96.89	96.11	95.10	94.24	94.09	93.15
75	6.531	128.0	99.92	98.75	97.81	96.88	96.02	95.16	94.14	93.98	93.20
Ave.	6.545	127.9	99.97	99.17	98.29	97.52	96.63	95.77	94.90	94.18	93.35
Med.	6.537	127.9	99.92	99.22	98.30	97.45	96.75	95.81	94.88	94.08	93.20
st dev	0.0651	1.3279	0.1175	0.2947	0.3430	0.4999	0.5283	0.5733	0.6273	0.5080	0.4660
Min.	6.465	125.3	99.69	98.67	97.66	96.65	95.54	94.69	93.85	93.35	92.66
Max.	6.792	130.0	100.16	99.60	98.81	98.18	97.42	96.87	96.09	95.47	94.76

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 8.705E-06
 β : 1.009
Calculated L₇₀: 42000 hours
Reported L₇₀: 42000 hours

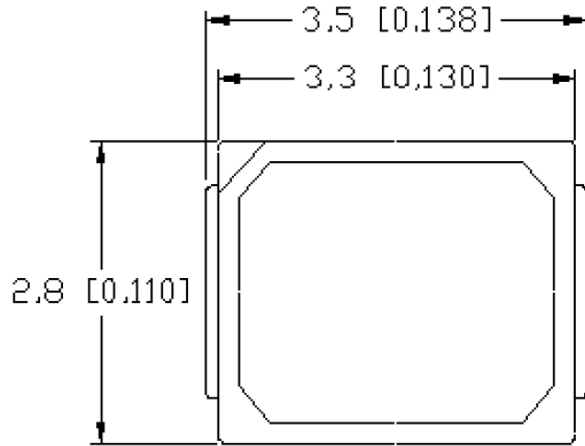
3.6 Data Set 3, 105 °C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	0.2606	0.5280	2737	0.0004	0.0005	0.0009	0.0015	0.0017	0.0021	0.0021	0.0025	0.0028
52	0.2603	0.5272	2748	0.0006	0.0006	0.0012	0.0013	0.0017	0.0021	0.0021	0.0025	0.0028
53	0.2595	0.5268	2766	0.0004	0.0005	0.0011	0.0013	0.0016	0.0020	0.0021	0.0025	0.0027
54	0.2594	0.5281	2762	0.0004	0.0006	0.0010	0.0011	0.0016	0.0019	0.0021	0.0023	0.0026
55	0.2602	0.5277	2748	0.0004	0.0006	0.0011	0.0013	0.0017	0.0021	0.0022	0.0025	0.0028
56	0.2597	0.5272	2759	0.0004	0.0004	0.0009	0.0011	0.0015	0.0018	0.0021	0.0023	0.0026
57	0.2596	0.5277	2759	0.0004	0.0006	0.0009	0.0011	0.0014	0.0018	0.0019	0.0023	0.0025
58	0.2604	0.5273	2743	0.0004	0.0005	0.0010	0.0012	0.0016	0.0021	0.0022	0.0024	0.0028
59	0.2602	0.5279	2746	0.0003	0.0004	0.0009	0.0011	0.0016	0.0018	0.0021	0.0023	0.0027
60	0.2612	0.5276	2727	0.0004	0.0005	0.0010	0.0011	0.0016	0.0019	0.0021	0.0024	0.0026
61	0.2610	0.5275	2731	0.0004	0.0005	0.0011	0.0013	0.0016	0.0019	0.0022	0.0024	0.0028
62	0.2588	0.5264	2782	0.0003	0.0003	0.0009	0.0012	0.0015	0.0018	0.0021	0.0023	0.0025
63	0.2605	0.5273	2742	0.0004	0.0005	0.0010	0.0013	0.0016	0.0020	0.0021	0.0024	0.0027
64	0.2590	0.5265	2779	0.0004	0.0004	0.0009	0.0013	0.0016	0.0018	0.0021	0.0023	0.0026
65	0.2606	0.5270	2741	0.0004	0.0005	0.0010	0.0013	0.0016	0.0019	0.0021	0.0024	0.0026
66	0.2603	0.5282	2742	0.0003	0.0005	0.0009	0.0013	0.0015	0.0018	0.0021	0.0023	0.0026
67	0.2589	0.5266	2780	0.0004	0.0006	0.0011	0.0013	0.0016	0.0020	0.0021	0.0025	0.0028
68	0.2592	0.5269	2773	0.0004	0.0005	0.0010	0.0013	0.0016	0.0019	0.0021	0.0024	0.0027
69	0.2591	0.5265	2774	0.0002	0.0004	0.0009	0.0012	0.0014	0.0018	0.0019	0.0023	0.0025
70	0.2598	0.5275	2757	0.0004	0.0004	0.0009	0.0013	0.0016	0.0021	0.0022	0.0023	0.0026
71	0.2601	0.5275	2750	0.0004	0.0005	0.0010	0.0013	0.0016	0.0021	0.0022	0.0023	0.0027
72	0.2611	0.5282	2727	0.0004	0.0005	0.0010	0.0013	0.0016	0.0021	0.0022	0.0024	0.0026
73	0.2612	0.5275	2728	0.0004	0.0005	0.0010	0.0014	0.0016	0.0021	0.0022	0.0024	0.0027
74	0.2609	0.5290	2728	0.0004	0.0006	0.0011	0.0013	0.0015	0.0021	0.0022	0.0024	0.0027
75	0.2611	0.5279	2726	0.0003	0.0004	0.0009	0.0012	0.0015	0.0020	0.0021	0.0023	0.0025
Ave.	0.2601	0.5274	2750	0.0004	0.0005	0.0010	0.0013	0.0016	0.0020	0.0021	0.0024	0.0027
Med.	0.2602	0.5275	2748	0.0004	0.0005	0.0010	0.0013	0.0016	0.0020	0.0021	0.0024	0.0027
st dev	0.0008	0.0006	18.1361	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2588	0.5264	2726	0.0002	0.0003	0.0009	0.0011	0.0014	0.0018	0.0019	0.0023	0.0025
Max.	0.2612	0.5290	2782	0.0006	0.0006	0.0012	0.0015	0.0017	0.0021	0.0022	0.0025	0.0028



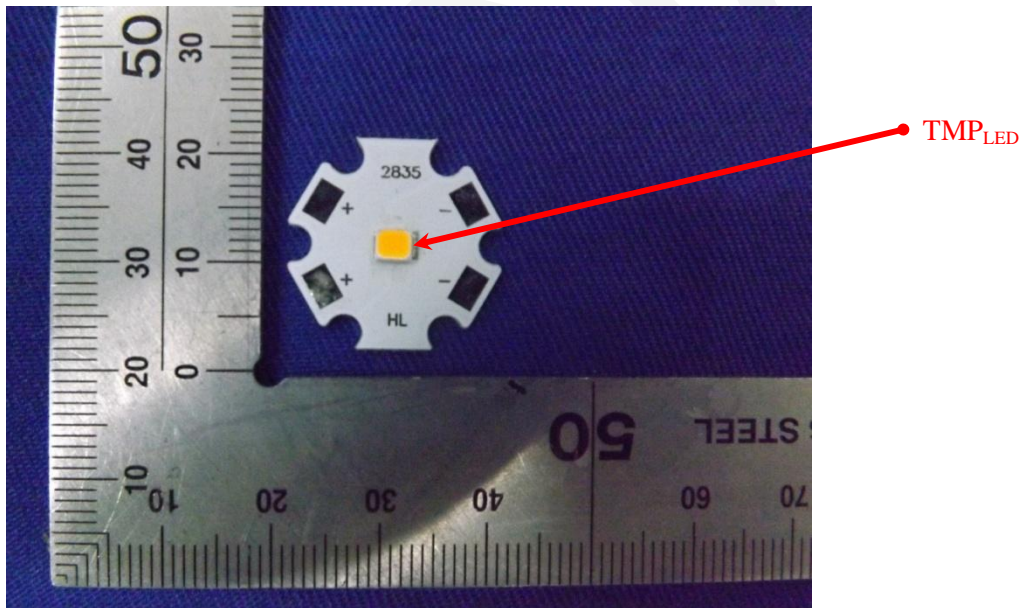
Attachment A – EUT PHOTO

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



All dimensions are in millimeter

A.2 EUT Photo



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