



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-2835FVW-S1-08-PCT-HR3

Report Type: 9000 Hours Test Report	Product Type: LED Package
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Report Date: 2015-10-26	
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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-2835FVW-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	G115987C J7321114	300VA	2015-03-05	2016-03-05
Multilayer aging machine	BACL	B2-270	20015	25°C~110°C	2015-03-05	2016-03-05
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	(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 2015-10-13. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Data Set 1: 55 °C, 120mA

Part Number:	HL-AT-2835FVW-S1-08-PCT-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 54.3$ °C
Actual Ambient Temperature(T_A):	$T_A = 53.5$ °C
Life Test Drive Current:	$I_F = 120$ mA
Measurement Current:	$I_F = 120$ mA

Data Set 2: 85 °C, 120mA

Part Number:	HL-AT-2835FVW-S1-08-PCT-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 84.3$ °C
Actual Ambient Temperature(T_A):	$T_A = 83.2$ °C
Life Test Drive Current:	$I_F = 120$ mA
Measurement Current:	$I_F = 120$ mA

Data Set 3: 105 °C, 120mA

Part Number:	HL-AT-2835FVW-S1-08-PCT-HR3
Number of Units:	25
Actual Case Temperature(T_S):	$T_S = 104.5$ °C
Actual Ambient Temperature(T_A):	$T_A = 103.2$ °C
Life Test Drive Current:	$I_F = 120$ mA
Measurement Current:	$I_F = 120$ mA

2 - SUMMARY OF TEST RESULT

Data Set:	Data Set 1, 55 °C, 120mA
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:	96.31%
Average Chromaticity Shift at 9000 hours ($\Delta u'v'$):	0.0026
Reported TM-21 L ₇₀ Lifetime:	>54000 hours

Data Set:	Data Set 2, 85 °C, 120mA
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:	94.54%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0026
Reported TM-21 L ₇₀ Lifetime:	51000 hours

Data Set:	Data Set 3, 105 °C, 120mA
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:	92.85%
Average Chromaticity Shift at 9000 hours($\Delta u'v'$):	0.0026
Reported TM-21 L ₇₀ Lifetime:	40000 hours

3 - Test Data

3.1 Data Set 1, 55 °C, 120mA (Lumen Maintenance)

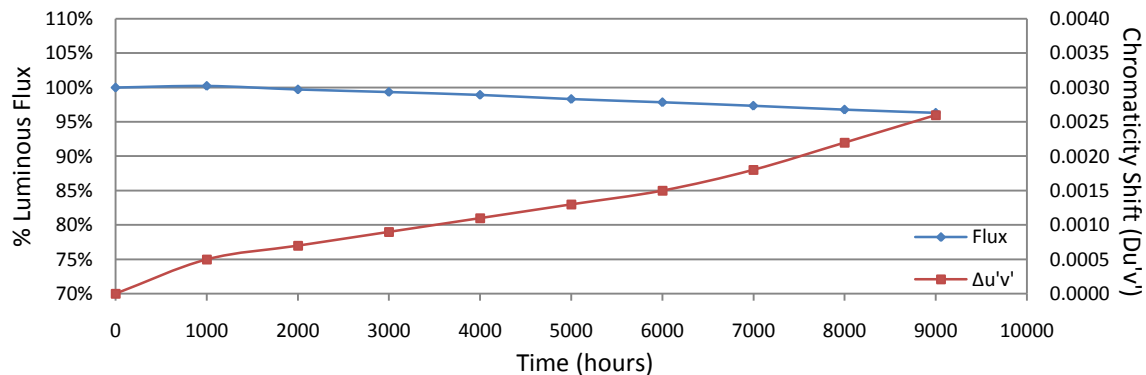
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	9.301	134.9	100.07	99.48	99.04	98.37	97.70	97.55	96.96	96.44	96.00
2	9.291	133.7	100.22	99.63	99.18	98.58	98.06	97.53	97.16	96.71	96.34
3	9.331	137.6	99.35	98.62	98.26	97.17	96.73	96.00	95.49	94.91	94.69
4	9.304	133.7	100.07	99.63	99.40	98.58	97.91	97.23	96.63	95.96	95.44
5	9.287	132.1	100.23	99.70	99.47	98.56	97.80	97.12	96.59	95.91	95.38
6	9.323	133.1	100.30	99.70	99.47	99.10	97.82	97.15	96.62	95.94	95.34
7	9.397	137.8	100.22	99.64	99.42	99.06	97.82	97.10	96.52	95.94	95.36
8	9.353	134.7	100.37	99.78	99.55	99.41	98.07	97.33	96.88	96.21	95.55
9	9.324	134.6	100.37	99.70	99.33	99.18	97.70	97.18	96.66	96.14	95.54
10	9.297	134.1	100.15	99.63	99.03	98.73	97.46	96.87	96.35	95.82	95.30
11	9.249	132.2	100.30	99.85	99.24	99.17	98.79	98.18	97.66	97.13	96.60
12	9.347	135.6	100.37	100.07	99.56	99.12	98.82	98.30	97.79	97.27	96.68
13	9.315	136.0	100.22	99.93	99.41	99.12	98.90	98.09	97.79	97.21	96.62
14	9.310	135.7	100.29	99.78	99.48	99.19	98.89	98.45	97.86	97.35	96.68
15	9.339	134.8	100.37	99.70	99.41	99.11	98.89	98.44	98.00	97.48	97.11
16	9.298	132.9	100.30	99.77	99.47	99.25	98.95	98.42	98.04	97.44	97.07
17	9.322	135.5	100.30	99.85	99.48	99.11	98.82	98.45	97.93	97.34	96.97
18	9.298	132.2	100.00	99.55	99.17	98.79	98.64	98.18	97.66	97.13	96.82
19	9.266	133.1	100.08	99.55	99.25	98.95	98.57	98.27	97.82	97.15	96.92
20	9.261	130.5	100.23	99.85	99.46	99.08	98.77	98.31	98.01	97.39	97.01
21	9.312	132.8	100.38	99.92	99.55	99.17	98.87	98.57	97.97	97.44	97.06
22	9.281	130.8	100.46	100.08	99.69	99.24	99.01	98.78	98.24	97.63	97.32
23	9.380	137.1	100.29	99.78	99.56	99.12	98.91	98.61	98.10	97.52	97.23
24	9.361	133.5	100.22	99.78	99.33	98.73	98.20	97.60	97.23	96.70	96.40
25	9.287	131.5	100.38	99.77	99.39	98.33	97.79	97.72	97.19	96.73	96.43
Ave.	9.313	134.0	100.22	99.71	99.34	98.89	98.32	97.82	97.33	96.76	96.31
Med.	9.310	133.7	100.29	99.77	99.41	99.10	98.57	98.09	97.66	97.13	96.60
st dev	0.0358	1.9847	0.2155	0.2713	0.2799	0.4626	0.6114	0.6939	0.7117	0.7224	0.7653
Min.	9.249	130.5	99.35	98.62	98.26	97.17	96.73	96.00	95.49	94.91	94.69
Max.	9.397	137.8	100.46	100.08	99.69	99.41	99.01	98.78	98.24	97.63	97.32

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 5.291E-06
 β : 1.010
Calculated L₇₀: 69000 hours
Reported L₇₀: >54000 hours

3.2 Data Set 1, 55 °C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	0.2599	0.5260	2761	0.0004	0.0006	0.0008	0.0009	0.0011	0.0013	0.0016	0.0020	0.0024
2	0.2603	0.5261	2751	0.0002	0.0004	0.0006	0.0008	0.0011	0.0013	0.0015	0.0019	0.0023
3	0.2610	0.5267	2734	0.0013	0.0014	0.0016	0.0017	0.0018	0.0021	0.0025	0.0028	0.0033
4	0.2601	0.5260	2757	0.0006	0.0008	0.0009	0.0012	0.0014	0.0015	0.0018	0.0023	0.0027
5	0.2598	0.5259	2764	0.0006	0.0008	0.0009	0.0012	0.0014	0.0016	0.0018	0.0023	0.0027
6	0.2611	0.5248	2741	0.0005	0.0007	0.0009	0.0012	0.0014	0.0015	0.0018	0.0021	0.0027
7	0.2604	0.5263	2749	0.0004	0.0007	0.0009	0.0011	0.0014	0.0015	0.0018	0.0022	0.0026
8	0.2589	0.5252	2787	0.0004	0.0008	0.0009	0.0011	0.0014	0.0015	0.0018	0.0022	0.0025
9	0.2605	0.5248	2754	0.0004	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0023	0.0027
10	0.2605	0.5249	2753	0.0005	0.0008	0.0010	0.0011	0.0014	0.0016	0.0019	0.0023	0.0027
11	0.2601	0.5233	2768	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0022	0.0027
12	0.2600	0.5261	2758	0.0004	0.0007	0.0009	0.0011	0.0012	0.0015	0.0016	0.0021	0.0025
13	0.2599	0.5253	2764	0.0004	0.0008	0.0009	0.0011	0.0014	0.0016	0.0018	0.0022	0.0026
14	0.2589	0.5251	2787	0.0004	0.0008	0.0009	0.0011	0.0013	0.0015	0.0016	0.0022	0.0025
15	0.2608	0.5260	2742	0.0004	0.0007	0.0009	0.0011	0.0012	0.0015	0.0017	0.0022	0.0027
16	0.2610	0.5258	2738	0.0005	0.0007	0.0009	0.0012	0.0012	0.0015	0.0018	0.0022	0.0026
17	0.2590	0.5235	2792	0.0005	0.0008	0.0009	0.0011	0.0014	0.0016	0.0018	0.0023	0.0027
18	0.2611	0.5241	2743	0.0004	0.0007	0.0009	0.0013	0.0014	0.0015	0.0018	0.0022	0.0025
19	0.2606	0.5260	2745	0.0005	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0022	0.0026
20	0.2587	0.5231	2800	0.0005	0.0007	0.0009	0.0012	0.0014	0.0015	0.0018	0.0022	0.0027
21	0.2587	0.5243	2794	0.0004	0.0006	0.0008	0.0009	0.0012	0.0016	0.0018	0.0023	0.0027
22	0.2589	0.5244	2790	0.0004	0.0007	0.0008	0.0012	0.0014	0.0014	0.0018	0.0022	0.0026
23	0.2578	0.5245	2813	0.0004	0.0006	0.0008	0.0011	0.0013	0.0014	0.0016	0.0021	0.0025
24	0.2599	0.5242	2769	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0016	0.0021	0.0025
25	0.2604	0.5246	2756	0.0004	0.0006	0.0008	0.0012	0.0013	0.0016	0.0018	0.0021	0.0025
Ave.	0.2599	0.5251	2764	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0022	0.0026
Med.	0.2601	0.5251	2758	0.0004	0.0007	0.0009	0.0011	0.0014	0.0015	0.0018	0.0022	0.0026
st dev	0.0009	0.0010	21.7141	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002
Min.	0.2578	0.5231	2734	0.0002	0.0004	0.0006	0.0008	0.0011	0.0013	0.0015	0.0019	0.0023
Max.	0.2611	0.5267	2813	0.0013	0.0014	0.0016	0.0017	0.0018	0.0021	0.0025	0.0028	0.0033



3.3 Data Set 2, 85 °C, 120mA (Lumen Maintenance)

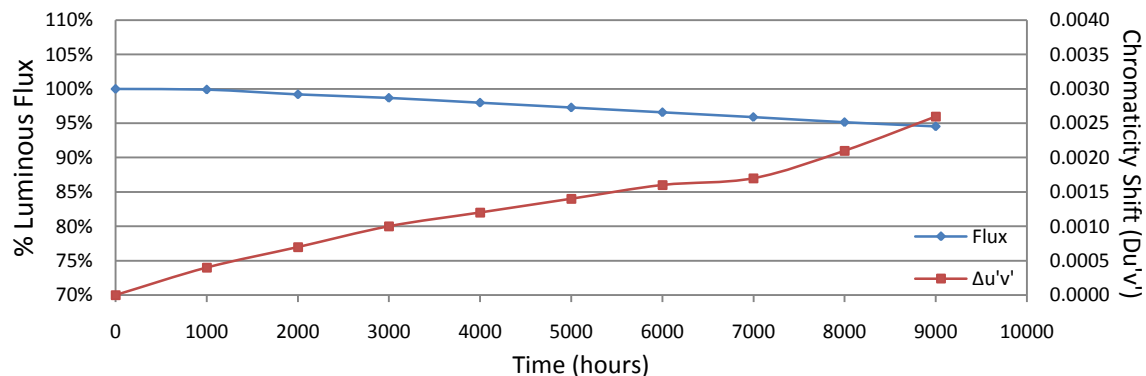
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	9.319	134.2	100.37	99.63	99.03	98.44	97.84	97.17	96.35	95.60	94.86
27	9.257	131.7	100.00	99.70	99.01	98.33	97.72	97.11	96.36	95.60	94.99
28	9.268	131.3	99.70	98.86	98.71	97.94	97.33	96.80	96.04	95.20	94.59
29	9.349	132.7	99.85	99.02	98.87	98.27	97.59	96.83	96.38	95.70	95.10
30	9.336	131.3	100.00	99.31	98.78	98.10	97.41	96.73	96.19	95.51	94.90
31	9.335	134.1	100.07	99.40	98.73	98.06	97.32	96.72	96.27	95.53	95.00
32	9.334	133.3	99.85	99.02	98.42	97.75	97.00	96.32	95.57	94.90	94.67
33	9.398	134.3	99.70	98.96	98.29	97.62	96.80	96.13	95.31	94.56	93.89
34	9.328	133.4	100.07	99.33	98.65	97.98	97.23	96.55	95.73	94.98	94.30
35	9.362	137.2	99.85	99.42	98.62	97.89	97.23	96.43	95.63	94.90	94.31
36	9.364	135.7	99.78	99.34	98.82	98.16	97.35	96.68	95.87	95.14	94.55
37	9.244	130.9	99.69	98.85	98.78	98.17	97.40	96.64	95.87	95.11	94.50
38	9.351	133.9	100.07	99.10	98.95	98.28	97.54	96.79	95.97	95.15	94.47
39	9.267	132.0	99.62	98.94	98.79	98.11	97.12	96.52	95.68	95.15	94.55
40	9.281	132.6	99.62	98.72	98.49	97.96	97.29	96.53	95.78	95.02	94.34
41	9.253	134.4	99.78	98.96	98.14	97.32	96.73	95.91	95.24	94.49	93.90
42	9.328	133.7	100.07	99.40	98.73	98.06	97.31	96.71	96.04	95.29	94.69
43	9.315	135.5	100.00	99.34	98.67	97.86	97.20	96.53	95.79	95.20	94.46
44	9.384	135.2	99.85	99.26	98.52	97.71	97.04	96.30	95.56	94.97	94.23
45	9.277	131.4	100.00	99.32	98.63	97.87	97.26	96.42	95.74	95.05	94.44
46	9.264	133.3	99.85	99.25	98.50	97.75	97.15	96.40	95.65	94.90	94.30
47	9.270	133.5	99.93	99.40	98.65	97.90	97.30	96.55	95.81	95.13	94.46
48	9.341	134.2	99.78	99.55	98.88	98.06	97.32	96.72	95.98	95.23	94.63
49	9.261	132.4	99.55	99.47	98.94	98.19	97.43	96.68	95.92	95.24	94.64
50	9.267	131.5	99.77	98.63	98.25	97.72	97.11	96.35	95.97	95.36	94.68
Ave.	9.310	133.3	99.87	99.21	98.67	97.98	97.28	96.58	95.87	95.16	94.54
Med.	9.319	133.4	99.85	99.31	98.71	97.98	97.30	96.55	95.87	95.15	94.55
st dev	0.0454	1.5932	0.1876	0.2836	0.2335	0.2515	0.2495	0.2763	0.3013	0.2969	0.3025
Min.	9.244	130.9	99.55	98.63	98.14	97.32	96.73	95.91	95.24	94.49	93.89
Max.	9.398	137.2	100.37	99.70	99.03	98.44	97.84	97.17	96.38	95.70	95.10

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
 α : 7.205E-06
 β : 1.008
Calculated L₇₀: 51000 hours
Reported L₇₀: 51000 hours

3.4 Data Set 2, 85 °C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	0.2608	0.5249	2745	0.0004	0.0006	0.0009	0.0011	0.0012	0.0015	0.0016	0.0021	0.0025
27	0.2586	0.5231	2801	0.0004	0.0006	0.0009	0.0011	0.0012	0.0015	0.0016	0.0021	0.0025
28	0.2586	0.5227	2803	0.0003	0.0006	0.0008	0.0010	0.0013	0.0015	0.0016	0.0021	0.0025
29	0.2596	0.5255	2768	0.0005	0.0007	0.0010	0.0012	0.0014	0.0016	0.0017	0.0023	0.0026
30	0.2595	0.5248	2775	0.0004	0.0007	0.0010	0.0012	0.0014	0.0016	0.0016	0.0021	0.0025
31	0.2592	0.5237	2786	0.0003	0.0006	0.0009	0.0011	0.0014	0.0016	0.0017	0.0021	0.0025
32	0.2577	0.5242	2816	0.0003	0.0006	0.0008	0.0011	0.0013	0.0016	0.0017	0.0022	0.0025
33	0.2593	0.5235	2785	0.0004	0.0006	0.0012	0.0014	0.0015	0.0017	0.0018	0.0023	0.0028
34	0.2606	0.5259	2745	0.0004	0.0006	0.0009	0.0011	0.0014	0.0015	0.0016	0.0021	0.0025
35	0.2603	0.5258	2754	0.0004	0.0005	0.0010	0.0013	0.0014	0.0016	0.0017	0.0022	0.0025
36	0.2587	0.5244	2794	0.0005	0.0008	0.0011	0.0013	0.0015	0.0017	0.0018	0.0023	0.0026
37	0.2591	0.5241	2786	0.0004	0.0007	0.0009	0.0011	0.0014	0.0015	0.0016	0.0021	0.0025
38	0.2592	0.5257	2777	0.0006	0.0009	0.0012	0.0014	0.0016	0.0018	0.0019	0.0023	0.0028
39	0.2602	0.5246	2760	0.0004	0.0006	0.0010	0.0011	0.0014	0.0015	0.0016	0.0021	0.0025
40	0.2575	0.5227	2829	0.0005	0.0007	0.0011	0.0012	0.0014	0.0016	0.0017	0.0021	0.0027
41	0.2584	0.5244	2801	0.0005	0.0008	0.0012	0.0016	0.0018	0.0020	0.0021	0.0025	0.0029
42	0.2608	0.5256	2743	0.0004	0.0007	0.0010	0.0011	0.0014	0.0016	0.0017	0.0021	0.0025
43	0.2591	0.5243	2785	0.0003	0.0006	0.0009	0.0011	0.0013	0.0015	0.0016	0.0020	0.0025
44	0.2600	0.5250	2762	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0016	0.0020	0.0025
45	0.2609	0.5255	2742	0.0004	0.0006	0.0010	0.0011	0.0014	0.0016	0.0016	0.0021	0.0025
46	0.2599	0.5248	2766	0.0004	0.0007	0.0010	0.0012	0.0014	0.0016	0.0017	0.0021	0.0025
47	0.2587	0.5253	2790	0.0004	0.0007	0.0011	0.0012	0.0015	0.0017	0.0018	0.0022	0.0026
48	0.2608	0.5262	2741	0.0004	0.0007	0.0009	0.0011	0.0014	0.0016	0.0016	0.0021	0.0025
49	0.2602	0.5243	2761	0.0003	0.0006	0.0009	0.0011	0.0014	0.0016	0.0016	0.0020	0.0025
50	0.2581	0.5237	2810	0.0003	0.0006	0.0009	0.0011	0.0014	0.0017	0.0017	0.0021	0.0025
Ave.	0.2594	0.5246	2777	0.0004	0.0007	0.0010	0.0012	0.0014	0.0016	0.0017	0.0021	0.0026
Med.	0.2593	0.5246	2777	0.0004	0.0006	0.0010	0.0011	0.0014	0.0016	0.0017	0.0021	0.0025
st dev	0.0010	0.0010	25.0998	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2575	0.5227	2741	0.0003	0.0005	0.0008	0.0010	0.0012	0.0015	0.0016	0.0020	0.0025
Max.	0.2609	0.5262	2829	0.0006	0.0009	0.0012	0.0016	0.0018	0.0020	0.0021	0.0025	0.0029



3.5 Data Set 3, 105 °C, 120mA (Lumen Maintenance)

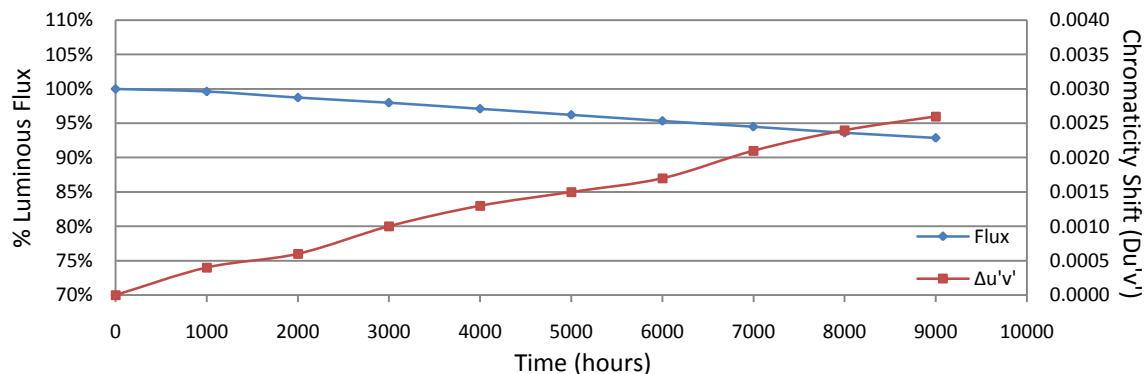
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	9.337	134.6	99.78	98.74	97.99	97.10	96.43	95.47	94.58	93.54	92.64
52	9.274	133.9	99.93	98.88	98.36	97.31	96.71	95.82	94.77	93.80	92.83
53	9.394	135.4	99.78	98.67	98.08	97.12	96.23	95.35	94.46	93.50	92.69
54	9.290	130.1	99.69	98.62	98.08	97.16	96.46	95.62	94.70	93.77	92.70
55	9.286	131.8	99.77	98.79	98.25	97.19	96.51	95.75	94.84	94.08	93.10
56	9.273	133.8	99.85	98.80	98.21	96.64	96.04	95.44	94.47	93.35	92.30
57	9.294	135.4	99.70	98.45	97.78	96.82	96.09	95.20	94.39	93.72	92.61
58	9.301	132.5	100.08	99.09	98.79	97.66	96.91	96.00	95.09	94.19	93.28
59	9.367	137.0	99.71	98.69	98.10	97.15	96.50	95.62	94.67	93.72	92.92
60	9.368	135.3	99.93	98.97	98.00	97.27	96.45	95.71	94.75	93.72	93.13
61	9.275	131.5	99.70	98.86	97.95	97.19	96.27	95.29	94.52	93.54	92.70
62	9.368	135.1	99.78	99.11	98.00	97.04	96.37	95.48	94.52	93.63	92.97
63	9.284	133.0	99.55	98.72	97.89	96.99	96.02	95.26	94.29	93.46	92.78
64	9.407	135.3	99.85	98.74	98.00	97.12	96.08	95.20	94.53	93.57	92.98
65	9.290	134.0	99.63	99.10	97.99	96.94	96.04	95.07	94.10	93.06	92.54
66	9.308	133.5	99.18	98.35	97.45	96.48	95.51	94.61	94.01	93.03	92.43
67	9.305	133.1	99.32	98.42	97.60	96.47	95.64	94.82	94.06	93.09	92.56
68	9.359	132.4	99.09	98.34	97.51	96.53	95.62	94.71	93.96	92.98	92.45
69	9.353	133.2	99.10	98.20	97.37	96.32	95.50	94.59	93.92	92.94	92.42
70	9.354	132.8	99.25	98.27	97.82	96.99	95.93	94.88	93.90	92.92	92.39
71	9.260	132.0	99.47	98.56	97.80	97.27	96.36	95.38	94.24	93.56	92.80
72	9.303	133.8	99.33	98.43	97.46	97.09	95.96	94.84	93.80	93.05	92.15
73	9.371	134.2	99.63	98.96	98.06	97.69	96.72	95.83	95.01	94.56	93.74
74	9.307	131.8	99.92	99.24	98.48	98.03	96.97	96.13	95.37	94.99	94.23
75	9.318	131.9	99.77	98.94	98.18	97.42	96.44	95.53	94.77	94.62	93.93
Ave.	9.322	133.5	99.63	98.72	97.97	97.08	96.23	95.34	94.47	93.62	92.85
Med.	9.307	133.5	99.70	98.74	98.00	97.12	96.27	95.38	94.52	93.56	92.70
st dev	0.0421	1.5831	0.2757	0.2870	0.3326	0.3981	0.4057	0.4289	0.4057	0.5457	0.5049
Min.	9.260	130.1	99.09	98.20	97.37	96.32	95.50	94.59	93.80	92.92	92.15
Max.	9.407	137.0	100.08	99.24	98.79	98.03	96.97	96.13	95.37	94.99	94.23

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 8.983E-06
β: 1.006
Calculated L₇₀: 40000 hours
Reported L₇₀: 40000 hours

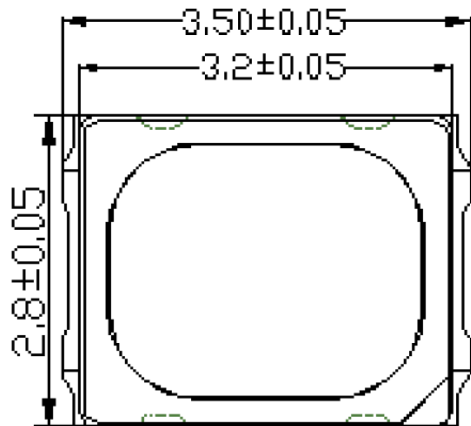
3.6 Data Set 3, 105 °C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	0.2605	0.5240	2758	0.0004	0.0007	0.0011	0.0013	0.0015	0.0018	0.0021	0.0023	0.0027
52	0.2586	0.5236	2800	0.0002	0.0006	0.0009	0.0011	0.0013	0.0016	0.0020	0.0021	0.0024
53	0.2588	0.5245	2791	0.0004	0.0006	0.0009	0.0011	0.0015	0.0017	0.0021	0.0023	0.0026
54	0.2595	0.5236	2780	0.0003	0.0006	0.0009	0.0011	0.0014	0.0016	0.0021	0.0023	0.0025
55	0.2581	0.5236	2810	0.0004	0.0007	0.0009	0.0011	0.0014	0.0017	0.0021	0.0023	0.0026
56	0.2597	0.5242	2774	0.0004	0.0007	0.0010	0.0011	0.0014	0.0016	0.0021	0.0023	0.0024
57	0.2583	0.5248	2800	0.0004	0.0008	0.0011	0.0013	0.0015	0.0018	0.0023	0.0025	0.0027
58	0.2593	0.5230	2788	0.0006	0.0009	0.0012	0.0013	0.0016	0.0018	0.0023	0.0026	0.0028
59	0.2595	0.5235	2780	0.0004	0.0006	0.0009	0.0012	0.0013	0.0016	0.0021	0.0023	0.0025
60	0.2594	0.5247	2776	0.0001	0.0006	0.0009	0.0011	0.0013	0.0015	0.0020	0.0023	0.0024
61	0.2587	0.5229	2800	0.0004	0.0006	0.0010	0.0013	0.0015	0.0017	0.0021	0.0023	0.0025
62	0.2608	0.5255	2744	0.0004	0.0006	0.0009	0.0013	0.0015	0.0016	0.0021	0.0024	0.0025
63	0.2606	0.5243	2753	0.0004	0.0006	0.0009	0.0012	0.0014	0.0016	0.0021	0.0023	0.0025
64	0.2611	0.5261	2735	0.0003	0.0006	0.0009	0.0011	0.0014	0.0016	0.0019	0.0023	0.0023
65	0.2610	0.5261	2737	0.0004	0.0006	0.0008	0.0011	0.0014	0.0018	0.0022	0.0025	0.0026
66	0.2602	0.5263	2753	0.0004	0.0006	0.0010	0.0013	0.0016	0.0017	0.0021	0.0025	0.0025
67	0.2593	0.5253	2776	0.0004	0.0006	0.0009	0.0013	0.0015	0.0016	0.0021	0.0023	0.0025
68	0.2604	0.5259	2750	0.0004	0.0006	0.0010	0.0013	0.0015	0.0017	0.0021	0.0024	0.0025
69	0.2605	0.5252	2752	0.0005	0.0008	0.0011	0.0014	0.0016	0.0018	0.0022	0.0025	0.0026
70	0.2608	0.5256	2743	0.0004	0.0006	0.0009	0.0013	0.0015	0.0017	0.0021	0.0025	0.0025
71	0.2603	0.5250	2756	0.0004	0.0006	0.0010	0.0013	0.0015	0.0016	0.0021	0.0025	0.0025
72	0.2598	0.5241	2772	0.0006	0.0009	0.0014	0.0017	0.0019	0.0021	0.0025	0.0030	0.0031
73	0.2596	0.5250	2773	0.0004	0.0005	0.0011	0.0013	0.0016	0.0018	0.0023	0.0027	0.0030
74	0.2579	0.5244	2813	0.0004	0.0006	0.0009	0.0013	0.0014	0.0016	0.0021	0.0025	0.0029
75	0.2588	0.5243	2791	0.0003	0.0004	0.0009	0.0013	0.0015	0.0016	0.0021	0.0025	0.0028
Ave.	0.2597	0.5246	2772	0.0004	0.0006	0.0010	0.0013	0.0015	0.0017	0.0021	0.0024	0.0026
Med.	0.2596	0.5245	2774	0.0004	0.0006	0.0009	0.0013	0.0015	0.0017	0.0021	0.0024	0.0025
st dev	0.0009	0.0010	23.1805	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
Min.	0.2579	0.5229	2735	0.0001	0.0004	0.0008	0.0011	0.0013	0.0015	0.0019	0.0021	0.0023
Max.	0.2611	0.5263	2813	0.0006	0.0009	0.0014	0.0017	0.0019	0.0021	0.0025	0.0030	0.0031



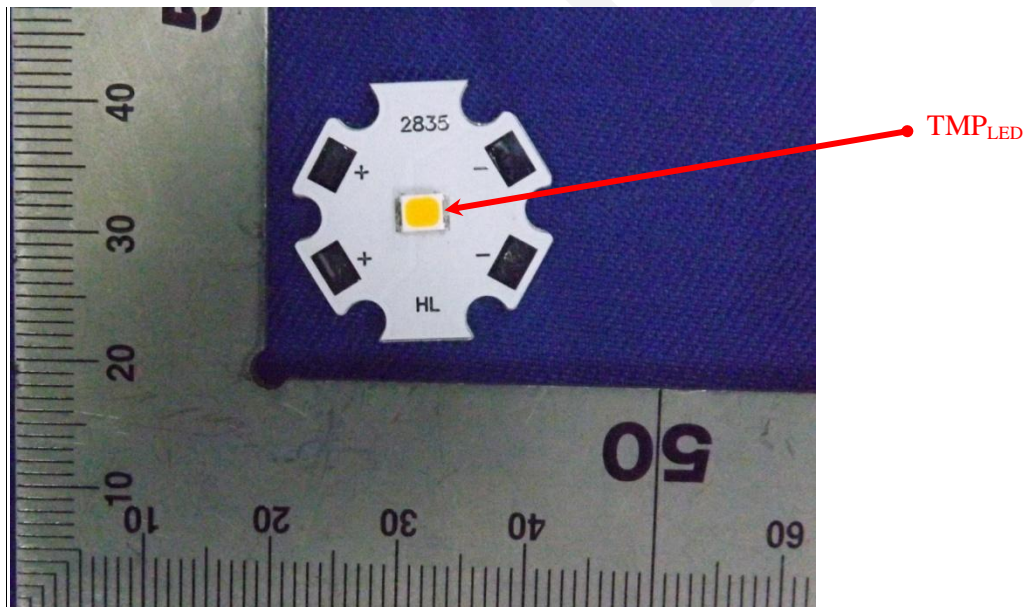
Attachment A – EUT PHOTO

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



All dimensions are in millimeter

A.2 EUT Photo



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