



# 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-A-5730DW-S1-08-HR3**

<b>Report Type:</b> 9000 Hours Test Report	<b>Product Type:</b> LED Package
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<b>Report Number:</b>	RSZ140908505-10-9000
<b>Test Date:</b>	2014-09-30 to 2015-10-16
<b>Report Date:</b>	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-A-5730DW-S1-08-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	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 2015-10-16. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

#### Data Set 1: 55 °C, 150mA

Part Number:	HL-A-5730DW-S1-08-HR3
Number of Units:	25
Actual Case Temperature( $T_S$ ):	$T_S = 54.5 \text{ }^\circ\text{C}$
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-A-5730DW-S1-08-HR3
Number of Units:	25
Actual Case Temperature( $T_S$ ):	$T_S = 84.3 \text{ }^\circ\text{C}$
Actual Ambient Temperature( $T_A$ ):	$T_A = 83.6 \text{ }^\circ\text{C}$
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-A-5730DW-S1-08-HR3
Number of Units:	25
Actual Case Temperature( $T_S$ ):	$T_S = 104.7 \text{ }^\circ\text{C}$
Actual Ambient Temperature( $T_A$ ):	$T_A = 103.6 \text{ }^\circ\text{C}$
Life Test Drive Current:	$I_F = 150\text{mA}$
Measurement Current:	$I_F = 150\text{mA}$

## 2 - SUMMARY OF TEST RESULT

<b>Data Set:</b>	<b>Data Set 1, 55 °C, 150mA</b>
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:	96.91%
Average Chromaticity Shift at 9000 hours ( $\Delta u'v'$ ):	0.0021
Reported TM-21 L <sub>70</sub> Lifetime:	>54000 hours

<b>Data Set:</b>	<b>Data Set 2, 85 °C, 150mA</b>
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:	94.92%
Average Chromaticity Shift at 9000 hours( $\Delta u'v'$ ):	0.0021
Reported TM-21 L <sub>70</sub> Lifetime:	52000 hours

<b>Data Set:</b>	<b>Data Set 3, 105 °C, 150mA</b>
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:	93.25%
Average Chromaticity Shift at 9000 hours( $\Delta u'v'$ ):	0.0022
Reported TM-21 L <sub>70</sub> Lifetime:	40000 hours

### 3 - Test Data

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

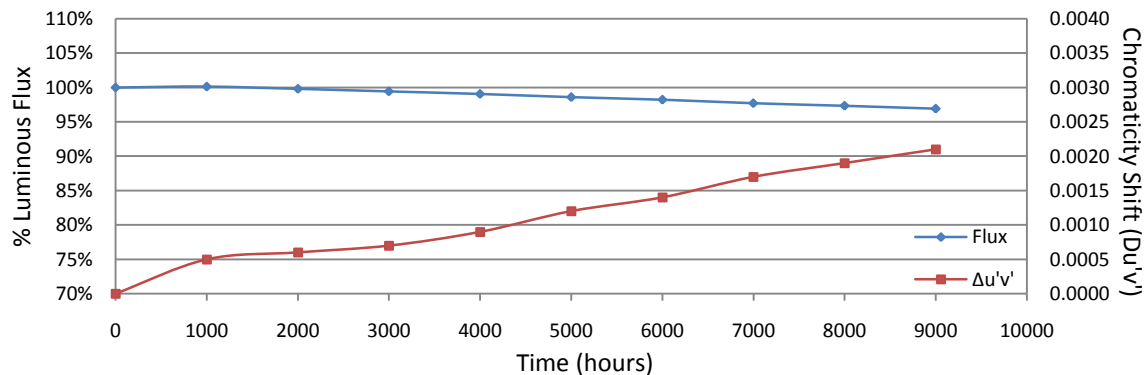
No.	V <sub>F</sub> (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	3.487	63.48	100.06	99.53	99.15	98.63	98.28	98.06	97.51	97.01	96.77
2	3.346	64.25	100.02	99.11	98.68	98.55	97.95	97.82	97.28	96.76	96.26
3	3.438	63.95	100.42	99.86	99.28	98.91	98.76	98.42	98.08	97.62	97.09
4	3.757	61.98	100.21	99.58	99.32	99.14	98.79	98.37	97.77	97.32	96.76
5	3.480	62.61	100.21	100.03	99.41	98.99	98.61	98.45	98.00	97.51	97.28
6	3.503	63.24	100.44	100.27	99.78	99.23	98.70	98.62	98.18	97.68	97.50
7	3.371	64.11	100.41	100.14	99.69	99.02	98.52	97.86	97.50	96.99	96.76
8	3.326	64.17	99.94	99.69	99.16	98.78	98.18	97.55	97.12	96.67	96.43
9	3.313	64.07	99.97	99.75	99.28	99.03	98.56	97.92	97.05	96.60	96.41
10	3.335	63.82	100.24	99.94	99.78	99.33	98.87	98.37	97.51	97.01	96.83
11	3.690	63.15	100.27	100.17	99.87	99.52	98.97	98.51	98.08	97.67	97.47
12	3.451	63.33	99.98	99.84	99.67	99.49	99.07	98.44	97.87	96.97	96.78
13	3.320	65.34	100.02	99.30	98.90	98.65	98.15	97.66	97.15	96.66	96.07
14	3.547	62.86	100.73	100.46	99.98	99.89	99.46	98.82	98.41	97.95	97.47
15	3.297	65.07	99.94	99.83	99.45	99.15	98.76	98.23	97.65	97.19	96.71
16	3.272	63.72	100.02	99.67	99.42	99.03	98.93	98.68	98.15	97.65	97.00
17	3.212	64.67	100.03	99.77	99.37	99.07	98.62	98.30	98.21	97.76	97.06
18	3.209	64.79	99.81	99.60	99.23	98.95	98.46	98.10	97.73	97.62	96.91
19	3.276	65.62	99.88	99.54	99.22	98.95	98.43	98.05	97.64	97.50	96.92
20	3.304	65.16	100.02	99.59	99.22	98.97	98.42	98.14	97.74	97.27	96.96
21	3.495	63.05	100.68	100.43	100.14	99.87	99.38	99.11	98.56	98.29	97.97
22	3.852	63.35	100.19	99.87	99.57	98.88	97.96	97.70	97.06	98.41	97.79
23	3.871	61.65	100.55	100.00	99.69	99.35	99.01	98.70	98.12	97.44	96.84
24	3.254	63.87	99.66	99.31	99.12	98.50	97.81	97.70	97.21	96.65	96.32
25	3.317	63.78	99.70	99.39	99.22	98.81	98.34	98.21	97.30	96.74	96.32
Ave.	3.429	63.80	100.14	99.79	99.42	99.07	98.60	98.23	97.72	97.32	96.91
Med.	3.346	63.82	100.03	99.77	99.37	99.02	98.61	98.23	97.73	97.32	96.84
st dev	0.1888	0.9892	0.2820	0.3458	0.3415	0.3601	0.4213	0.3977	0.4411	0.5103	0.4796
Min.	3.209	61.65	99.66	99.11	98.68	98.50	97.81	97.55	97.05	96.60	96.07
Max.	3.871	65.62	100.73	100.46	100.14	99.89	99.46	99.11	98.56	98.41	97.97

TM-21 Projection:

**Test Duration:** 9000 hours  
**Failures Observed:** 0  
 $\alpha$ : 4.418E-06  
 $\beta$ : 1.008  
**Calculated L<sub>70</sub>:** 83000 hours  
**Reported L<sub>70</sub>:** >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	0.2618	0.5260	2719	0.0004	0.0004	0.0008	0.0011	0.0013	0.0016	0.0018	0.0021	0.0022
2	0.2617	0.5278	2714	0.0005	0.0003	0.0006	0.0008	0.0013	0.0016	0.0018	0.0020	0.0021
3	0.2602	0.5266	2752	0.0004	0.0002	0.0005	0.0008	0.0012	0.0015	0.0016	0.0019	0.0020
4	0.2596	0.5261	2766	0.0005	0.0002	0.0004	0.0006	0.0011	0.0013	0.0015	0.0019	0.0021
5	0.2604	0.5261	2749	0.0004	0.0004	0.0005	0.0006	0.0011	0.0013	0.0016	0.0019	0.0021
6	0.2609	0.5266	2736	0.0003	0.0004	0.0005	0.0006	0.0008	0.0011	0.0014	0.0018	0.0018
7	0.2616	0.5266	2722	0.0005	0.0006	0.0007	0.0008	0.0009	0.0012	0.0016	0.0019	0.0021
8	0.2616	0.5262	2724	0.0005	0.0006	0.0008	0.0009	0.0011	0.0015	0.0017	0.0021	0.0022
9	0.2628	0.5271	2695	0.0004	0.0005	0.0006	0.0008	0.0011	0.0014	0.0016	0.0018	0.0021
10	0.2618	0.5267	2718	0.0006	0.0007	0.0008	0.0011	0.0012	0.0016	0.0017	0.0019	0.0023
11	0.2611	0.5275	2728	0.0003	0.0004	0.0005	0.0007	0.0009	0.0011	0.0015	0.0017	0.0021
12	0.2602	0.5263	2753	0.0005	0.0006	0.0007	0.0008	0.0011	0.0013	0.0016	0.0015	0.0018
13	0.2623	0.5279	2703	0.0006	0.0019	0.0021	0.0023	0.0025	0.0028	0.0030	0.0031	0.0034
14	0.2616	0.5258	2725	0.0004	0.0005	0.0006	0.0008	0.0010	0.0013	0.0016	0.0017	0.0021
15	0.2613	0.5268	2728	0.0006	0.0006	0.0008	0.0009	0.0011	0.0014	0.0016	0.0018	0.0021
16	0.2636	0.5277	2676	0.0004	0.0005	0.0006	0.0009	0.0011	0.0013	0.0016	0.0018	0.0021
17	0.2624	0.5259	2707	0.0005	0.0006	0.0008	0.0009	0.0011	0.0013	0.0017	0.0018	0.0022
18	0.2623	0.5282	2702	0.0006	0.0006	0.0007	0.0009	0.0011	0.0013	0.0016	0.0018	0.0021
19	0.2618	0.5273	2716	0.0004	0.0006	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0022
20	0.2630	0.5282	2686	0.0005	0.0006	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0021
21	0.2644	0.5284	2658	0.0004	0.0007	0.0008	0.0009	0.0011	0.0014	0.0016	0.0018	0.0021
22	0.2606	0.5270	2741	0.0004	0.0005	0.0007	0.0008	0.0011	0.0012	0.0015	0.0017	0.0021
23	0.2605	0.5261	2748	0.0007	0.0007	0.0009	0.0010	0.0012	0.0014	0.0017	0.0019	0.0021
24	0.2605	0.5262	2748	0.0006	0.0007	0.0008	0.0010	0.0011	0.0014	0.0016	0.0018	0.0019
25	0.2635	0.5274	2679	0.0004	0.0005	0.0007	0.0009	0.0011	0.0013	0.0015	0.0018	0.0019
Ave.	0.2617	0.5269	2720	0.0005	0.0006	0.0007	0.0009	0.0012	0.0014	0.0017	0.0019	0.0021
Med.	0.2616	0.5267	2722	0.0005	0.0006	0.0007	0.0009	0.0011	0.0013	0.0016	0.0018	0.0021
st dev	0.0012	0.0008	27.0702	0.0001	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Min.	0.2596	0.5258	2658	0.0003	0.0002	0.0004	0.0006	0.0008	0.0011	0.0014	0.0015	0.0018
Max.	0.2644	0.5284	2766	0.0007	0.0019	0.0021	0.0023	0.0025	0.0028	0.0030	0.0031	0.0034





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

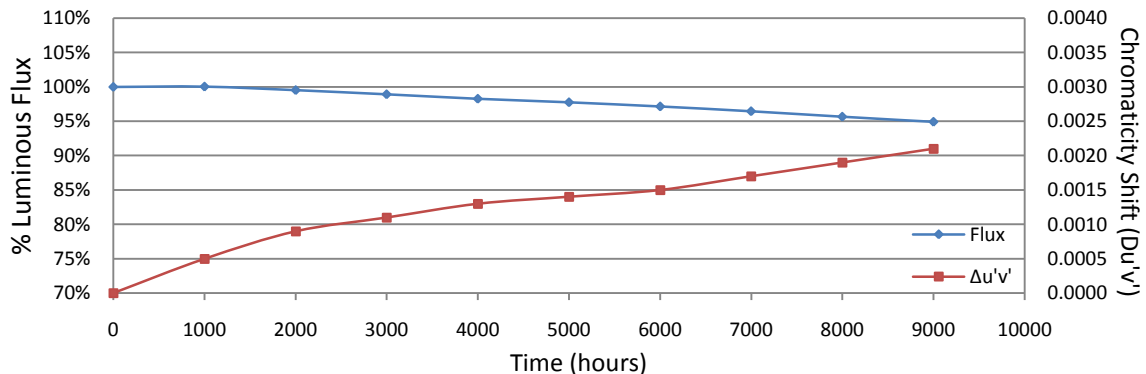
No.	V <sub>F</sub> (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
26	3.225	64.74	99.85	99.27	98.67	98.24	97.61	97.05	96.26	95.46	94.61
27	3.231	66.10	99.79	99.32	98.67	98.21	97.56	97.03	96.25	95.51	94.80
28	3.244	63.96	99.69	99.12	98.55	97.98	97.48	96.90	96.12	95.36	94.65
29	3.359	64.29	99.92	99.46	98.80	98.38	97.87	97.14	96.39	95.63	94.93
30	3.280	65.10	99.86	99.28	98.66	98.13	97.59	96.96	96.22	95.47	94.79
31	3.230	65.24	99.98	99.31	98.73	98.21	97.58	97.06	96.29	95.49	94.76
32	3.264	65.63	100.06	99.53	98.63	98.23	97.58	96.98	96.27	95.46	94.76
33	3.291	64.93	100.02	99.54	98.78	98.12	97.61	97.06	96.00	95.46	94.76
34	3.546	64.79	100.52	99.98	99.26	98.53	98.04	97.48	96.81	95.88	95.11
35	3.515	63.63	100.61	100.16	99.39	98.62	98.13	97.55	96.90	95.98	95.16
36	3.410	63.80	100.08	99.87	99.28	98.48	98.03	97.46	96.72	95.80	95.02
37	3.230	65.47	100.11	99.57	99.07	98.29	97.72	97.27	96.46	95.43	94.72
38	3.216	63.55	100.05	99.59	99.10	98.35	97.84	97.32	96.55	95.59	94.76
39	3.705	63.63	100.31	99.87	99.29	98.62	98.18	97.61	97.93	96.97	96.15
40	3.496	63.03	100.14	99.75	99.21	98.78	98.00	97.60	97.29	96.35	95.53
41	3.533	62.81	100.19	99.55	99.12	98.34	97.90	97.53	96.83	96.00	95.45
42	3.271	64.03	99.77	99.03	98.42	97.63	97.11	96.75	96.03	95.22	94.47
43	3.385	64.56	99.83	99.32	98.56	97.94	97.41	96.69	95.93	95.21	94.75
44	3.260	65.38	99.63	99.10	98.49	97.69	97.23	96.38	95.70	95.01	94.49
45	3.379	63.92	100.02	99.47	98.76	97.98	97.50	96.71	96.03	95.35	94.76
46	3.260	65.29	99.92	99.25	98.62	97.92	97.26	96.42	95.65	94.98	94.50
47	3.347	63.29	100.02	99.46	98.96	98.21	97.69	97.06	96.27	95.61	94.86
48	3.555	63.52	99.92	99.56	99.02	98.32	97.72	96.71	96.02	95.36	94.65
49	3.541	63.45	99.94	99.48	99.24	98.69	98.05	97.45	96.85	96.06	95.29
50	3.779	60.88	100.57	99.84	99.41	98.95	98.51	97.88	96.99	96.12	95.29
Ave.	3.382	64.20	100.03	99.51	98.91	98.27	97.73	97.12	96.43	95.63	94.92
Med.	3.347	64.03	100.02	99.48	98.80	98.24	97.69	97.06	96.27	95.49	94.76
st dev	0.1601	1.1296	0.2552	0.2838	0.3093	0.3216	0.3274	0.3900	0.5179	0.4401	0.3852
Min.	3.216	60.88	99.63	99.03	98.42	97.63	97.11	96.38	95.65	94.98	94.47
Max.	3.779	66.10	100.61	100.16	99.41	98.95	98.51	97.88	97.93	96.97	96.15

## TM-21 Projection:

**Test Duration:** 9000 hours  
**Failures Observed:** 0  
**α:** 7.021E-06  
**β:** 1.012  
**Calculated L<sub>70</sub>:** 52000 hours  
**Reported L<sub>70</sub>:** 52000 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	0.2610	0.5272	2732	0.0006	0.0010	0.0011	0.0012	0.0013	0.0015	0.0017	0.0020	0.0021
27	0.2622	0.5276	2706	0.0006	0.0009	0.0010	0.0011	0.0013	0.0014	0.0017	0.0018	0.0021
28	0.2629	0.5277	2691	0.0006	0.0009	0.0011	0.0012	0.0013	0.0013	0.0016	0.0019	0.0021
29	0.2627	0.5283	2692	0.0004	0.0008	0.0009	0.0011	0.0012	0.0012	0.0015	0.0017	0.0018
30	0.2611	0.5272	2729	0.0005	0.0011	0.0013	0.0014	0.0015	0.0013	0.0016	0.0018	0.0020
31	0.2611	0.5265	2733	0.0005	0.0009	0.0012	0.0013	0.0014	0.0013	0.0016	0.0018	0.0020
32	0.2621	0.5274	2709	0.0006	0.0009	0.0012	0.0013	0.0014	0.0014	0.0016	0.0018	0.0020
33	0.2605	0.5273	2741	0.0004	0.0008	0.0013	0.0014	0.0013	0.0015	0.0016	0.0018	0.0020
34	0.2614	0.5265	2727	0.0004	0.0007	0.0012	0.0013	0.0014	0.0014	0.0016	0.0018	0.0020
35	0.2626	0.5279	2696	0.0004	0.0008	0.0011	0.0013	0.0014	0.0015	0.0016	0.0018	0.0020
36	0.2611	0.5268	2733	0.0006	0.0010	0.0013	0.0015	0.0016	0.0017	0.0018	0.0020	0.0021
37	0.2624	0.5260	2708	0.0005	0.0009	0.0011	0.0013	0.0015	0.0016	0.0016	0.0018	0.0020
38	0.2613	0.5269	2728	0.0006	0.0009	0.0011	0.0013	0.0014	0.0015	0.0016	0.0018	0.0020
39	0.2604	0.5254	2753	0.0004	0.0008	0.0011	0.0013	0.0014	0.0016	0.0014	0.0017	0.0019
40	0.2614	0.5267	2725	0.0005	0.0008	0.0011	0.0013	0.0015	0.0017	0.0017	0.0019	0.0021
41	0.2620	0.5279	2709	0.0007	0.0010	0.0013	0.0014	0.0016	0.0018	0.0018	0.0020	0.0021
42	0.2609	0.5264	2738	0.0005	0.0009	0.0012	0.0014	0.0016	0.0017	0.0018	0.0019	0.0022
43	0.2623	0.5272	2705	0.0004	0.0009	0.0011	0.0012	0.0014	0.0016	0.0017	0.0018	0.0021
44	0.2610	0.5269	2734	0.0002	0.0006	0.0008	0.0009	0.0011	0.0013	0.0015	0.0016	0.0018
45	0.2612	0.5275	2727	0.0006	0.0009	0.0012	0.0013	0.0014	0.0016	0.0018	0.0019	0.0022
46	0.2635	0.5283	2676	0.0004	0.0008	0.0011	0.0012	0.0014	0.0016	0.0017	0.0019	0.0021
47	0.2618	0.5268	2717	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0016	0.0018	0.0021
48	0.2630	0.5264	2694	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017	0.0018	0.0020	0.0023
49	0.2616	0.5272	2720	0.0005	0.0010	0.0011	0.0013	0.0017	0.0019	0.0020	0.0022	0.0024
50	0.2605	0.5256	2750	0.0005	0.0009	0.0011	0.0012	0.0014	0.0016	0.0017	0.0019	0.0023
Ave.	0.2617	0.5270	2719	0.0005	0.0009	0.0011	0.0013	0.0014	0.0015	0.0017	0.0019	0.0021
Med.	0.2614	0.5272	2725	0.0005	0.0009	0.0011	0.0013	0.0014	0.0015	0.0016	0.0018	0.0021
st dev	0.0009	0.0007	19.6849	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
Min.	0.2604	0.5254	2676	0.0002	0.0006	0.0008	0.0009	0.0011	0.0012	0.0014	0.0016	0.0018
Max.	0.2635	0.5283	2753	0.0007	0.0011	0.0013	0.0015	0.0017	0.0019	0.0020	0.0022	0.0024



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

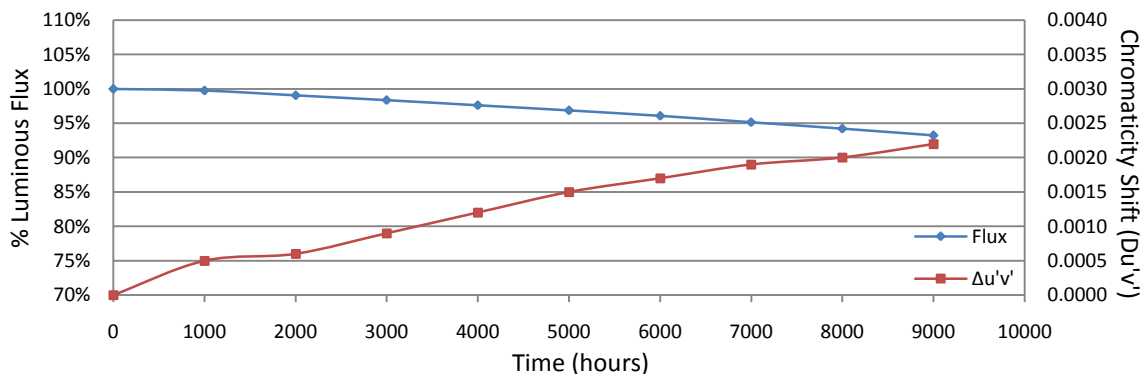
No.	V <sub>F</sub> (V)	Φ(lm)	Lumen Maintenance (%)								
			0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	3.343	63.48	99.76	99.07	98.36	97.48	96.85	96.03	95.07	94.16	93.45
52	3.257	64.62	99.69	98.98	98.33	97.59	96.66	95.85	95.03	94.09	93.33
53	3.270	65.44	99.66	98.85	98.35	97.62	96.53	95.77	94.90	94.01	93.31
54	3.273	65.54	99.48	98.73	98.08	97.27	96.63	95.62	94.80	93.87	92.92
55	3.615	61.95	99.77	99.37	98.82	98.05	97.32	96.59	95.53	94.61	93.70
56	3.313	65.09	99.48	98.76	98.03	97.20	96.62	95.93	94.93	94.07	93.01
57	3.211	65.28	99.53	98.74	98.18	97.29	96.55	95.79	95.01	94.04	93.08
58	3.254	65.30	99.65	98.82	98.24	97.75	96.66	95.97	94.90	94.21	93.22
59	3.246	65.56	99.42	98.63	98.05	97.24	96.51	95.79	94.77	93.97	93.04
60	3.443	63.57	99.72	99.13	98.66	97.73	97.04	96.40	95.33	94.60	93.61
61	3.412	63.52	99.75	98.84	98.02	97.84	97.09	96.22	95.37	94.44	93.73
62	3.204	64.50	99.60	98.88	98.03	97.40	96.67	95.77	94.99	94.16	93.29
63	3.542	64.29	100.06	99.49	98.58	97.88	97.22	96.28	95.54	94.52	93.84
64	3.206	64.73	99.68	98.84	98.05	97.44	96.65	95.74	94.90	93.97	92.88
65	3.292	65.63	99.50	98.89	97.88	97.21	96.51	95.64	94.80	93.81	92.72
66	3.472	61.47	99.90	99.06	98.31	98.05	97.28	96.40	95.51	94.63	93.62
67	3.515	62.98	99.83	98.95	98.73	97.95	97.17	96.32	95.55	94.55	93.47
68	3.697	61.55	99.87	99.14	98.47	97.55	96.73	96.93	96.21	95.21	94.12
69	3.339	64.26	100.02	99.38	98.71	97.60	96.62	95.75	94.77	93.82	92.90
70	3.334	64.47	99.88	99.69	98.93	98.03	97.11	96.22	95.28	94.06	92.99
71	3.264	64.41	99.91	99.55	98.80	97.92	96.97	96.12	95.12	93.93	92.83
72	3.255	65.09	99.57	99.39	98.45	97.79	96.84	96.05	94.99	93.76	92.69
73	3.584	63.82	100.45	99.69	99.04	98.76	97.76	97.02	96.00	94.83	93.73
74	3.254	63.82	99.67	98.75	97.81	97.04	97.13	96.26	95.27	94.19	92.98
75	3.254	64.40	99.78	98.68	97.67	96.55	95.87	95.02	94.11	93.96	92.78
Ave.	3.354	64.19	99.74	99.05	98.34	97.61	96.84	96.06	95.15	94.22	93.25
Med.	3.292	64.41	99.72	98.95	98.33	97.60	96.73	96.03	95.03	94.09	93.22
st dev	0.1413	1.2006	0.2244	0.3247	0.3699	0.4339	0.3780	0.4308	0.4327	0.3622	0.3973
Min.	3.204	61.47	99.42	98.63	97.67	96.55	95.87	95.02	94.11	93.76	92.69
Max.	3.697	65.63	100.45	99.69	99.04	98.76	97.76	97.02	96.21	95.21	94.12

## TM-21 Projection:

**Test Duration:** 9000 hours  
**Failures Observed:** 0  
**α:** 9.151E-06  
**β:** 1.014  
**Calculated L<sub>70</sub>:** 40000 hours  
**Reported L<sub>70</sub>:** 40000 hours

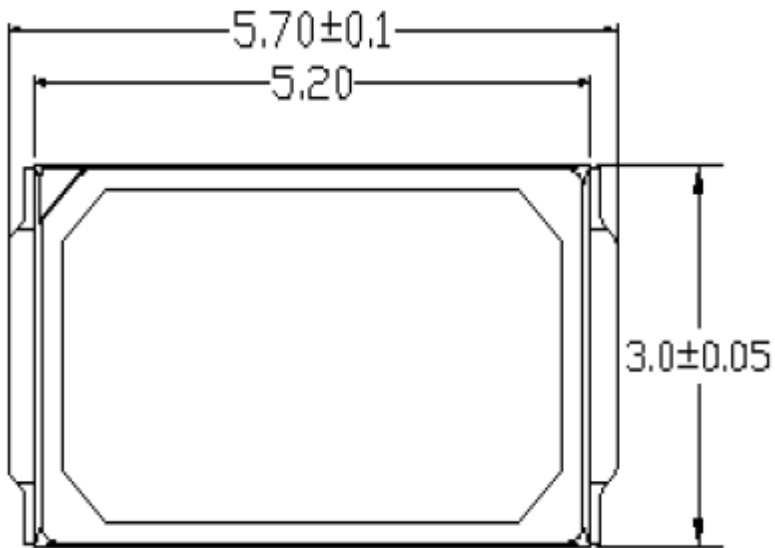
### 3.6 Data Set 3, 105 °C, 150mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ( $\Delta u'v'$ )								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
51	0.2623	0.5266	2708	0.0006	0.0007	0.0011	0.0013	0.0016	0.0017	0.0019	0.0021	0.0023
52	0.2630	0.5284	2686	0.0005	0.0006	0.0011	0.0013	0.0015	0.0016	0.0018	0.0021	0.0022
53	0.2622	0.5270	2709	0.0005	0.0007	0.0011	0.0013	0.0016	0.0018	0.0018	0.0021	0.0023
54	0.2614	0.5276	2721	0.0006	0.0007	0.0010	0.0013	0.0016	0.0018	0.0018	0.0021	0.0022
55	0.2612	0.5268	2729	0.0004	0.0006	0.0008	0.0012	0.0015	0.0017	0.0018	0.0020	0.0022
56	0.2604	0.5270	2745	0.0005	0.0006	0.0008	0.0012	0.0016	0.0017	0.0018	0.0021	0.0021
57	0.2618	0.5270	2715	0.0005	0.0006	0.0008	0.0013	0.0015	0.0017	0.0018	0.0021	0.0023
58	0.2633	0.5274	2684	0.0005	0.0007	0.0009	0.0013	0.0016	0.0017	0.0018	0.0021	0.0022
59	0.2626	0.5279	2696	0.0004	0.0006	0.0009	0.0013	0.0016	0.0018	0.0018	0.0020	0.0021
60	0.2614	0.5269	2724	0.0004	0.0006	0.0008	0.0012	0.0015	0.0016	0.0018	0.0020	0.0021
61	0.2612	0.5272	2727	0.0004	0.0006	0.0009	0.0014	0.0016	0.0017	0.0018	0.0021	0.0021
62	0.2634	0.5272	2682	0.0005	0.0007	0.0008	0.0011	0.0015	0.0017	0.0018	0.0020	0.0021
63	0.2607	0.5274	2737	0.0006	0.0007	0.0010	0.0012	0.0016	0.0018	0.0019	0.0021	0.0023
64	0.2628	0.5279	2692	0.0005	0.0006	0.0009	0.0012	0.0016	0.0017	0.0018	0.0021	0.0022
65	0.2627	0.5281	2692	0.0005	0.0007	0.0009	0.0013	0.0018	0.0019	0.0020	0.0022	0.0023
66	0.2629	0.5276	2690	0.0004	0.0005	0.0008	0.0011	0.0014	0.0016	0.0017	0.0019	0.0021
67	0.2623	0.5264	2708	0.0004	0.0006	0.0009	0.0011	0.0015	0.0017	0.0018	0.0021	0.0021
68	0.2638	0.5280	2670	0.0004	0.0007	0.0008	0.0012	0.0015	0.0017	0.0019	0.0019	0.0021
69	0.2624	0.5260	2708	0.0006	0.0006	0.0009	0.0013	0.0016	0.0019	0.0020	0.0021	0.0023
70	0.2615	0.5275	2721	0.0005	0.0006	0.0008	0.0011	0.0014	0.0017	0.0018	0.0019	0.0021
71	0.2632	0.5279	2685	0.0005	0.0007	0.0010	0.0011	0.0015	0.0018	0.0019	0.0021	0.0022
72	0.2612	0.5275	2727	0.0005	0.0007	0.0008	0.0011	0.0014	0.0018	0.0018	0.0020	0.0022
73	0.2606	0.5269	2741	0.0004	0.0006	0.0008	0.0010	0.0013	0.0016	0.0017	0.0019	0.0020
74	0.2626	0.5266	2701	0.0001	0.0004	0.0009	0.0011	0.0014	0.0017	0.0018	0.0020	0.0022
75	0.2624	0.5263	2706	0.0005	0.0006	0.0010	0.0013	0.0016	0.0018	0.0021	0.0021	0.0023
Ave.	0.2621	0.5272	2708	0.0005	0.0006	0.0009	0.0012	0.0015	0.0017	0.0019	0.0020	0.0022
Med.	0.2623	0.5272	2708	0.0005	0.0006	0.0009	0.0012	0.0015	0.0017	0.0018	0.0021	0.0022
st dev	0.0009	0.0006	20.2560	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2604	0.5260	2670	0.0001	0.0004	0.0008	0.0010	0.0013	0.0016	0.0017	0.0019	0.0020
Max.	0.2638	0.5284	2745	0.0006	0.0007	0.0011	0.0014	0.0018	0.0019	0.0021	0.0022	0.0023



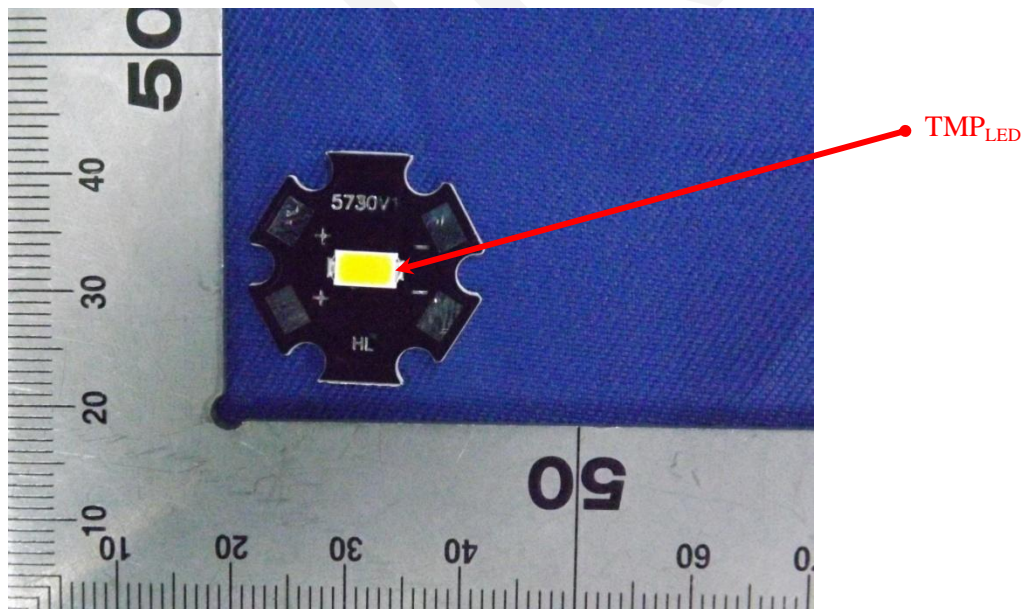
## Attachment A – EUT PHOTO

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



All dimensions are in millimeter

### A.2 EUT Photo



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