IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Shenzhen liangan optoelectronic technology Co., Ltd

No.1, Third Industrial Zone, Shiyan Town, Baoan District, Shenzhen City, Guangdong.

Model:LA-D5050P9H01-3E

Report Type: 10000 Hours Test Report	**Product Type:** LED array
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Report Number:	R2DG151009053-10-10000
Test Date:	2015-10-30 to 2016-12-19
Report Date:	2017-02-15
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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: LA-D5050P9H01-3E
Part Type: LED array
Nominal CCT: 3000K

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 array, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products(This test method was not accredited by IAS)

1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integral Sphere	EVERFINE	Diameter 0.3m	1011119	0.3m	2016-03-10	2017-03-09
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2016-03-04	2017-03-03
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2016-03-10	2017-03-09
Standard Light Source	EVERFINE	D062	1011093	3000K	2016-09-13	2017-09-12
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987C J7321114	300VA	2016-03-04	2017-03-03
Multilayer aging machine	BACL	B2-270	20022	25℃~110℃	2016-12-08	2017-12-07
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060002	(50/15A)	2016-07-07	2017-07-06
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	(50/15A)	2016-03-04	2017-03-03

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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℃ ± 2℃, RH <65%.

1.7 Photometry Measurement Uncertainty

The uncertainty of the light output measurements is U=1.59% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=21K (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 56Pcs;
Each Ts test condition is 13, 15, 16, 12Pcs
The samples tested at T_S 55℃ and T_S 105℃ were received at 2015-10-09 and tested during 2015-10-30 to 2016-12-19. The samples were numbered from 1 to 13, 14 to 29, 30 to 44 and 45 to 56

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Data Set 1: 55℃, 75mA	
Part Number:	LA-D5050P9H01-3E
Number of Units:	13
Nominal CRI:	80
Actual Case Temperature(TS):	T_S =54.6℃
Actual Ambient Temperature(T_A):	T_A =52.4℃
Life Test Drive Current:	I_F = 75mA
Measurement Current:	I_F = 75mA

Data Set 2: 105℃, 75mA	
Part Number:	LA-D5050P9H01-3E
Number of Units:	16
Nominal CRI:	80
Actual Case Temperature(T_S):	T_S =104.2℃
Actual Ambient Temperature(T_A):	T_A =102.5℃
Life Test Drive Current:	I_F = 75mA
Measurement Current:	I_F = 75mA

Data Set 3: 55℃, 75mA	
Part Number:	LA-D5050P9H01-3E
Number of Units:	15
Nominal CRI:	80
Actual Case Temperature(T_S):	T_S =54.2℃
Actual Ambient Temperature(T_A):	T_A =52.5℃
Life Test Drive Current:	I_F = 75mA
Measurement Current:	I_F = 75mA

Data Set 4: 105℃, 75mA	
Part Number:	LA-D5050P9H01-3E CRI95+
Number of Units:	12
Nominal CRI:	80
Actual Case Temperature(T_S):	T_S =103.3℃
Actual Ambient Temperature(T_A):	T_A =102.8℃
Life Test Drive Current:	I_F = 75mA
Measurement Current:	I_F = 75mA

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2 - Summary of Test Result

Data Set:	**Data Set 1, 55°C, 75mA**
Number of Units:	13
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h, 9000h,10000h
Average. Lumen Maintenance at 6000 hours:	98.81%
Average Chromaticity Shift at 6000 hours (Δu'v'):	0.0019
Average. Lumen Maintenance at 9000 hours:	98.06%
Average Chromaticity Shift at 9000 hours (Δu'v'):	0.0028
Average. Lumen Maintenance at 10000 hours:	97.81%
Average Chromaticity Shift at 10000 hours (Δu'v'):	0.0030
Reported TM-21 L_{70} Lifetime:	>55000hours

Data Set:	**Data Set 2, 105°C, 75mA**
Number of Units:	16
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h, 9000h,10000h
Average. Lumen Maintenance at 6000 hours:	97.94%
Average Chromaticity Shift at 6000 hours (Δu'v'):	0.0023
Average. Lumen Maintenance at 9000 hours:	96.52%
Average Chromaticity Shift at 9000 hours (Δu'v'):	0.0031
Average. Lumen Maintenance at 10000 hours:	96.19%
Average Chromaticity Shift at 10000 hours (Δu'v'):	0.0032
Reported TM-21 L_{70} Lifetime:	>55000hours

Data Set:	**Data Set 3, 55°C, 75mA**
Number of Units:	15
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h, 9000h,10000h
Average. Lumen Maintenance at 6000 hours:	98.58%
Average Chromaticity Shift at 6000 hours (Δu'v'):	0.0016
Average. Lumen Maintenance at 9000 hours:	97.77%
Average Chromaticity Shift at 9000 hours (Δu'v'):	0.0024

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Average. Lumen Maintenance at 10000 hours:	97.59%
Average Chromaticity Shift at 10000 hours (Δu'v'):	0.0029
Reported TM-21 L_{70} Lifetime:	>55000hours

Data Set:	**Data Set 4, 105°C, 75mA**
Number of Units:	12
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h, 9000h,10000h
Average. Lumen Maintenance at 6000 hours:	97.81%
Average Chromaticity Shift at 6000 hours (Δu'v'):	0.0020
Average. Lumen Maintenance at 9000 hours:	96.43%
Average Chromaticity Shift at 9000 hours (Δu'v'):	0.0026
Average. Lumen Maintenance at 10000 hours:	96.14%
Average Chromaticity Shift at 10000 hours (Δu'v'):	0.0031
Reported TM-21 L_{70} Lifetime:	>55000hours

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3 - Test Data

3.1 Data Set 1, 55°C, 75mA (Lumen Maintenance)

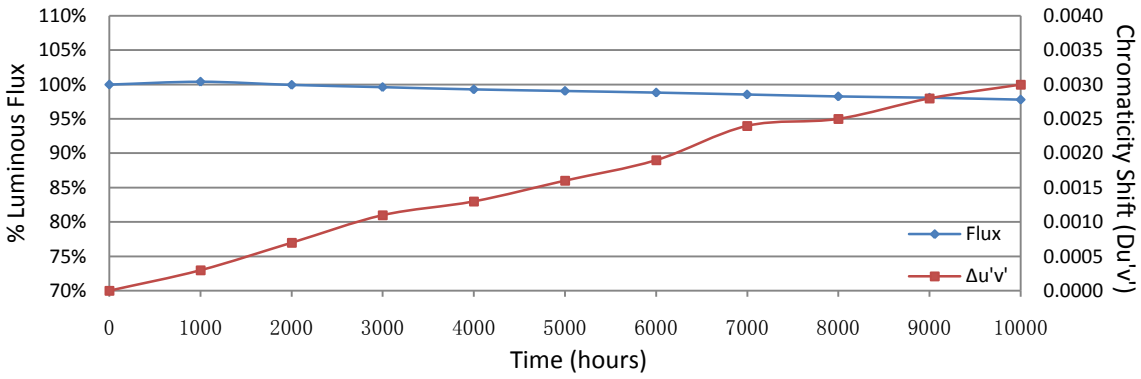
No.	V_F(V)	Φ(lm)	Ra	Lumen Maintenance (%)									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	2.817	29.49	93.0	100.20	99.63	99.22	98.88	98.51	98.30	98.13	97.90	97.80	97.59
2	2.819	29.56	92.6	100.37	100.14	99.86	99.56	99.39	99.12	98.88	98.61	98.55	98.17
3	2.814	28.41	92.9	100.35	99.82	99.51	99.40	99.26	98.91	98.66	98.31	98.13	97.96
4	2.816	28.31	93.2	100.39	100.14	99.72	99.40	99.26	99.05	98.62	98.30	98.16	97.92
5	2.812	28.75	92.6	100.49	100.28	99.83	99.23	98.92	98.75	98.57	98.37	98.12	97.81
6	2.814	28.02	92.8	100.29	99.71	99.39	99.00	98.82	98.50	98.25	97.93	97.82	97.64
7	2.811	30.02	93.2	100.20	99.47	98.97	98.63	98.47	98.13	97.80	97.44	97.17	96.97
8	2.812	29.84	93.3	100.57	100.20	100.07	99.66	99.46	99.33	99.06	98.93	98.83	98.59
9	2.813	28.41	93.4	100.28	100.21	99.72	99.33	99.05	98.87	98.63	98.35	98.13	97.82
10	2.813	28.62	93.2	100.42	99.90	99.65	99.34	99.16	98.92	98.67	98.39	98.15	98.04
11	2.812	28.65	93.3	100.66	100.21	99.93	99.72	99.44	99.16	98.78	98.36	98.01	97.66
12	2.819	28.89	93.0	100.59	99.86	99.79	99.62	99.45	99.34	99.10	98.93	98.75	98.62
13	2.814	29.89	93.2	100.27	99.50	99.06	98.73	98.39	98.09	97.62	97.36	97.09	96.75
Ave.	2.814	28.99	93.1	100.39	99.93	99.59	99.27	99.05	98.81	98.52	98.24	98.06	97.81
Med.	2.814	28.75	93.2	100.37	99.90	99.72	99.34	99.16	98.91	98.63	98.35	98.13	97.82
st dev	0.003	0.68	0.3	0.1491	0.2879	0.3415	0.3571	0.3904	0.4262	0.4505	0.4829	0.5167	0.5322
Min.	2.811	28.02	92.6	100.20	99.47	98.97	98.63	98.39	98.09	97.62	97.36	97.09	96.75
Max.	2.819	30.02	93.4	100.66	100.28	100.07	99.72	99.46	99.34	99.10	98.93	98.83	98.62

TM-21 Projection:

Test Duration: 10000 hours
Failures Observed: 0
α: 2.534E-06
β: 1.003
Calculated L_{70}: 142000hours
Reported L_{70}: >55000hours

3.2 Data Set 1, 55°C, 75mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.2439	0.5172	3203	0.0003	0.0001	0.0002	0.0004	0.0005	0.0012	0.0014	0.0018	0.0020	0.0024
2	0.2432	0.5175	3220	0.0002	0.0006	0.0015	0.0017	0.0018	0.0021	0.0026	0.0030	0.0032	0.0035
3	0.2441	0.5167	3203	0.0004	0.0005	0.0009	0.0012	0.0015	0.0014	0.0016	0.0015	0.0020	0.0022
4	0.2442	0.5173	3195	0.0002	0.0006	0.0009	0.0008	0.0008	0.0015	0.0022	0.0025	0.0028	0.0029
5	0.2486	0.5222	3044	0.0002	0.0005	0.0008	0.0011	0.0015	0.0015	0.0021	0.0023	0.0027	0.0027
6	0.2464	0.5210	3109	0.0003	0.0009	0.0017	0.0021	0.0028	0.0032	0.0041	0.0040	0.0040	0.0041
7	0.2442	0.5175	3193	0.0007	0.0012	0.0009	0.0015	0.0017	0.0016	0.0017	0.0019	0.0021	0.0023
8	0.2443	0.5169	3195	0.0004	0.0007	0.0011	0.0011	0.0017	0.0023	0.0030	0.0031	0.0036	0.0038
9	0.2446	0.5175	3181	0.0005	0.0012	0.0017	0.0018	0.0021	0.0025	0.0028	0.0028	0.0032	0.0035
10	0.2449	0.5167	3179	0.0004	0.0010	0.0013	0.0014	0.0016	0.0021	0.0024	0.0025	0.0027	0.0031
11	0.2440	0.5175	3200	0.0003	0.0003	0.0008	0.0013	0.0013	0.0019	0.0023	0.0022	0.0026	0.0028
12	0.2435	0.5174	3212	0.0001	0.0007	0.0011	0.0013	0.0015	0.0020	0.0024	0.0023	0.0026	0.0030
13	0.2439	0.5173	3202	0.0003	0.0007	0.0010	0.0013	0.0016	0.0018	0.0024	0.0027	0.0026	0.0031
Ave.	0.2446	0.5179	3180	0.0003	0.0007	0.0011	0.0013	0.0016	0.0019	0.0024	0.0025	0.0028	0.0030
Med.	0.2442	0.5174	3195	0.0003	0.0007	0.0010	0.0013	0.0016	0.0019	0.0024	0.0025	0.0027	0.0030
st dev	0.0014	0.0017	49	0.0002	0.0003	0.0004	0.0004	0.0005	0.0005	0.0007	0.0007	0.0006	0.0006
Min.	0.2432	0.5167	3044	0.0001	0.0001	0.0002	0.0004	0.0005	0.0012	0.0014	0.0015	0.0020	0.0022
Max.	0.2486	0.5222	3220	0.0007	0.0012	0.0017	0.0021	0.0028	0.0032	0.0041	0.0040	0.0040	0.0041



3.3 Data Set 2, 105°C, 75mA (Lumen Maintenance)

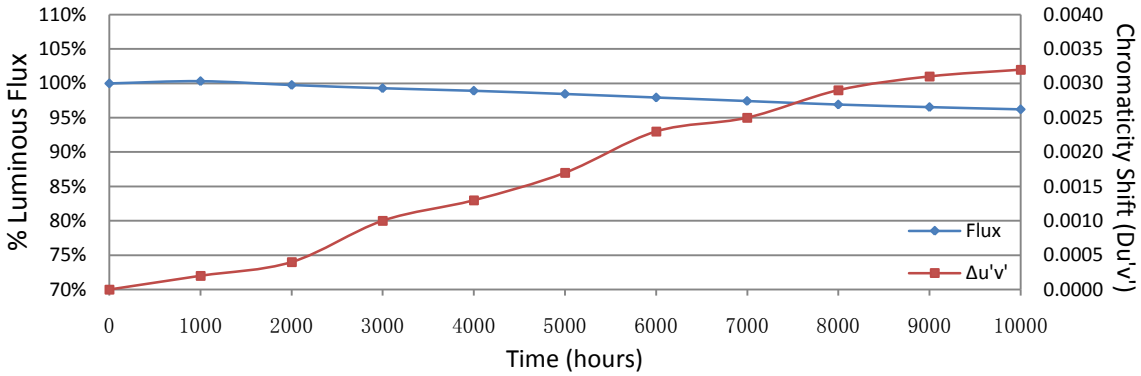
No.	V_F(V)	Φ(lm)	Ra	Lumen Maintenance (%)									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
14	2.818	29.48	93.1	100.24	99.56	99.08	98.74	98.30	97.93	97.32	96.68	96.34	96.00
15	2.842	29.42	93.4	100.58	99.86	99.29	98.61	98.10	97.79	97.21	96.80	96.43	96.19
16	2.814	29.90	93.0	100.17	99.70	99.36	99.16	98.56	97.89	97.22	96.72	96.42	96.15
17	2.815	29.68	93.4	100.17	99.53	99.09	98.62	98.18	97.81	97.27	96.66	96.29	95.99
18	2.817	29.40	93.0	100.71	100.07	99.56	99.25	98.64	98.16	97.69	97.24	96.90	96.56
19	2.813	29.92	92.9	100.67	99.87	99.57	99.26	98.73	98.23	97.69	97.19	96.76	96.56
20	2.814	29.72	93.3	100.64	100.24	99.90	99.56	99.06	98.69	98.25	97.85	97.41	97.14
21	2.815	29.29	93.0	100.38	99.93	99.42	99.01	98.70	98.26	97.71	97.13	96.79	96.52
22	2.813	29.67	92.7	100.13	99.80	99.33	98.89	98.45	98.08	97.57	96.90	96.56	96.26
23	2.816	29.69	93.2	100.24	99.70	99.16	98.75	98.15	97.61	97.17	96.73	96.23	95.89
24	2.815	29.22	93.6	100.21	99.69	99.28	98.87	98.39	97.98	97.40	96.89	96.44	95.96
25	2.816	29.49	93.3	100.20	99.76	99.25	98.85	98.41	97.83	97.32	96.81	96.58	96.20
26	2.820	29.14	93.1	100.21	99.73	99.18	99.11	98.59	98.08	97.46	96.98	96.57	96.33
27	2.818	29.49	93.3	100.10	99.56	98.91	98.78	98.27	97.73	97.15	96.64	96.20	95.80
28	2.815	29.82	92.9	100.20	99.70	99.03	98.86	98.39	97.72	97.28	96.78	96.28	95.84
29	2.813	29.80	93.2	100.13	99.43	98.69	98.32	97.89	97.32	96.88	96.48	96.07	95.70
Ave.	2.817	29.57	93.2	100.31	99.76	99.26	98.92	98.43	97.94	97.41	96.91	96.52	96.19
Med.	2.815	29.58	93.2	100.21	99.71	99.27	98.87	98.40	97.91	97.32	96.81	96.44	96.17
st dev	0.007	0.24	0.2	0.2125	0.2057	0.2835	0.3035	0.2876	0.3142	0.3178	0.3268	0.3295	0.3689
Min.	2.813	29.14	92.7	100.10	99.43	98.69	98.32	97.89	97.32	96.88	96.48	96.07	95.70
Max.	2.842	29.92	93.6	100.71	100.24	99.90	99.56	99.06	98.69	98.25	97.85	97.41	97.14

TM-21 Projection:

Test Duration: 10000 hours
Failures Observed: 0
α: 4.687E-06
β: 1.007
Calculated L_{70}: 78000hours
Reported L_{70}: >55000hours

3.4 Data Set 2, 105°C, 75mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
14	0.2455	0.5186	3150	0.0001	0.0002	0.0010	0.0012	0.0016	0.0022	0.0024	0.0029	0.0031	0.0034
15	0.2439	0.5168	3206	0.0002	0.0002	0.0009	0.0012	0.0017	0.0022	0.0023	0.0027	0.0029	0.0032
16	0.2435	0.5166	3220	0.0002	0.0004	0.0009	0.0013	0.0017	0.0023	0.0025	0.0029	0.0030	0.0033
17	0.2441	0.5168	3202	0.0002	0.0004	0.0009	0.0013	0.0017	0.0022	0.0025	0.0028	0.0030	0.0032
18	0.2437	0.5172	3210	0.0001	0.0004	0.0010	0.0015	0.0017	0.0023	0.0025	0.0029	0.0031	0.0033
19	0.2437	0.5174	3207	0.0001	0.0004	0.0011	0.0014	0.0019	0.0023	0.0025	0.0029	0.0030	0.0032
20	0.2448	0.5167	3183	0.0002	0.0004	0.0010	0.0013	0.0017	0.0022	0.0023	0.0027	0.0029	0.0032
21	0.2455	0.5177	3156	0.0001	0.0003	0.0009	0.0013	0.0017	0.0022	0.0024	0.0027	0.0029	0.0031
22	0.2438	0.5183	3197	0.0003	0.0004	0.0010	0.0013	0.0017	0.0022	0.0023	0.0028	0.0030	0.0032
23	0.2439	0.5175	3202	0.0001	0.0004	0.0010	0.0013	0.0019	0.0023	0.0026	0.0030	0.0032	0.0034
24	0.2442	0.5164	3201	0.0001	0.0003	0.0010	0.0013	0.0017	0.0023	0.0025	0.0029	0.0032	0.0033
25	0.2445	0.5171	3188	0.0002	0.0003	0.0009	0.0012	0.0016	0.0022	0.0025	0.0028	0.0031	0.0031
26	0.2451	0.5177	3167	0.0001	0.0004	0.0012	0.0014	0.0018	0.0023	0.0026	0.0030	0.0031	0.0034
27	0.2439	0.5172	3204	0.0001	0.0003	0.0010	0.0013	0.0017	0.0022	0.0025	0.0028	0.0031	0.0032
28	0.2439	0.5172	3203	0.0002	0.0004	0.0010	0.0013	0.0017	0.0023	0.0024	0.0029	0.0030	0.0032
29	0.2450	0.5184	3165	0.0003	0.0005	0.0013	0.0016	0.0021	0.0025	0.0028	0.0031	0.0033	0.0035
Ave.	0.2443	0.5174	3191	0.0002	0.0004	0.0010	0.0013	0.0017	0.0023	0.0025	0.0029	0.0031	0.0032
Med.	0.2440	0.5172	3202	0.0002	0.0004	0.0010	0.0013	0.0017	0.0022	0.0025	0.0029	0.0031	0.0032
st dev	0.0007	0.0007	21	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2435	0.5164	3150	0.0001	0.0002	0.0009	0.0012	0.0016	0.0022	0.0023	0.0027	0.0029	0.0031
Max.	0.2455	0.5186	3220	0.0003	0.0005	0.0013	0.0016	0.0021	0.0025	0.0028	0.0031	0.0033	0.0035



3.5 Data Set 3, 55°C, 75mA (Lumen Maintenance)

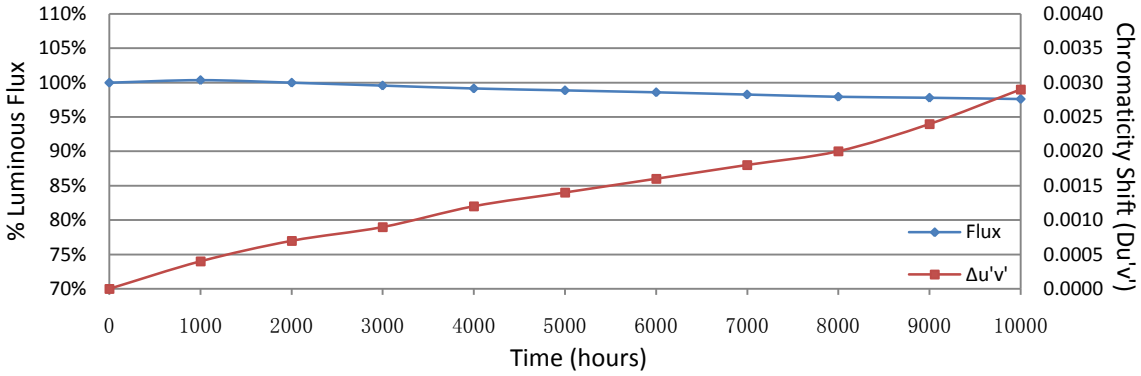
No.	V_F(V)	Φ(lm)	Ra	Lumen Maintenance (%)									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
30	2.814	28.33	95.7	100.32	99.86	99.36	99.19	98.91	98.73	98.48	98.20	98.02	97.92
31	2.878	27.58	96.0	100.18	99.60	99.24	98.84	98.51	98.08	97.93	97.72	97.53	97.46
32	2.814	28.52	96.3	100.25	100.04	99.51	98.98	98.56	98.35	98.11	97.79	97.69	97.51
33	2.820	28.28	96.1	100.39	100.18	99.72	99.36	99.01	98.66	98.44	98.20	98.06	97.81
34	2.814	28.55	95.9	100.60	100.49	99.93	99.58	99.09	98.88	98.60	98.28	98.00	97.76
35	2.826	27.81	96.1	100.50	100.14	99.75	99.32	98.99	98.67	98.35	97.95	97.84	97.70
36	2.813	29.83	96.0	100.54	100.03	99.60	99.23	98.96	98.63	98.29	97.99	97.72	97.39
37	2.824	29.62	96.1	100.27	99.70	99.32	98.99	98.82	98.58	98.11	97.70	97.37	97.27
38	2.813	29.76	96.4	100.64	100.27	99.56	98.96	98.59	98.42	98.08	97.85	97.82	97.58
39	2.819	29.67	95.8	100.20	99.83	99.39	98.92	98.65	98.31	97.91	97.57	97.44	97.24
40	2.814	29.28	95.9	100.14	99.80	99.66	99.45	99.32	99.18	98.77	98.33	98.19	97.95
41	2.816	28.36	96.1	100.32	100.11	99.65	99.26	99.01	98.77	98.41	98.10	98.06	97.88
42	2.818	28.60	96.0	100.49	100.14	99.76	99.48	99.06	98.81	98.50	98.22	97.90	97.73
43	2.890	27.14	95.3	100.33	99.74	99.23	98.60	98.34	98.01	97.61	97.31	97.13	97.02
44	2.813	28.63	96.0	100.28	100.00	99.69	99.30	98.92	98.60	98.32	97.97	97.83	97.66
Ave.	2.826	28.66	96.0	100.36	99.99	99.56	99.16	98.85	98.58	98.26	97.95	97.77	97.59
Med.	2.816	28.55	96.0	100.32	100.03	99.60	99.23	98.92	98.63	98.32	97.97	97.83	97.66
st dev	0.024	0.82	0.3	0.1561	0.2399	0.2084	0.2723	0.2636	0.3048	0.3030	0.2894	0.2978	0.2752
Min.	2.813	27.14	95.3	100.14	99.60	99.23	98.60	98.34	98.01	97.61	97.31	97.13	97.02
Max.	2.890	29.83	96.4	100.64	100.49	99.93	99.58	99.32	99.18	98.77	98.33	98.19	97.95

TM-21 Projection:

Test Duration: 10000 hours
Failures Observed: 0
α: 2.630E-06
β: 1.001
Calculated L_{70}: 136000hours
Reported L_{70}: >55000hours

3.6 Data Set 3, 55°C, 75mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
30	0.2439	0.5181	3197	0.0002	0.0004	0.0007	0.0008	0.0008	0.0010	0.0014	0.0017	0.0019	0.0025
31	0.2443	0.5164	3200	0.0003	0.0004	0.0007	0.0008	0.0009	0.0010	0.0013	0.0017	0.0019	0.0024
32	0.2445	0.5166	3191	0.0002	0.0001	0.0002	0.0005	0.0006	0.0007	0.0010	0.0013	0.0017	0.0023
33	0.2446	0.5168	3188	0.0002	0.0002	0.0003	0.0004	0.0005	0.0008	0.0009	0.0012	0.0016	0.0023
34	0.2442	0.5172	3194	0.0005	0.0008	0.0003	0.0001	0.0003	0.0006	0.0006	0.0008	0.0013	0.0019
35	0.2454	0.5175	3159	0.0004	0.0007	0.0016	0.0018	0.0019	0.0020	0.0021	0.0025	0.0026	0.0031
36	0.2438	0.5182	3197	0.0006	0.0011	0.0018	0.0023	0.0028	0.0031	0.0036	0.0040	0.0043	0.0044
37	0.2441	0.5171	3199	0.0006	0.0010	0.0010	0.0012	0.0007	0.0010	0.0012	0.0010	0.0016	0.0022
38	0.2445	0.5172	3187	0.0005	0.0008	0.0010	0.0012	0.0016	0.0012	0.0011	0.0015	0.0016	0.0025
39	0.2446	0.5183	3175	0.0004	0.0008	0.0011	0.0013	0.0017	0.0022	0.0024	0.0029	0.0033	0.0036
40	0.2452	0.5198	3149	0.0005	0.0008	0.0016	0.0021	0.0029	0.0032	0.0037	0.0040	0.0044	0.0045
41	0.2438	0.5159	3218	0.0001	0.0007	0.0010	0.0017	0.0019	0.0026	0.0031	0.0031	0.0038	0.0039
42	0.2442	0.5165	3202	0.0007	0.0008	0.0006	0.0010	0.0011	0.0011	0.0008	0.0009	0.0014	0.0020
43	0.2458	0.5210	3125	0.0004	0.0008	0.0008	0.0012	0.0012	0.0012	0.0014	0.0016	0.0021	0.0026
44	0.2439	0.5164	3209	0.0005	0.0004	0.0013	0.0011	0.0019	0.0018	0.0019	0.0024	0.0027	0.0034
Ave.	0.2445	0.5175	3186	0.0004	0.0007	0.0009	0.0012	0.0014	0.0016	0.0018	0.0020	0.0024	0.0029
Med.	0.2443	0.5172	3194	0.0004	0.0008	0.0010	0.0012	0.0012	0.0012	0.0014	0.0017	0.0019	0.0025
st dev	0.0006	0.0014	25	0.0002	0.0003	0.0005	0.0006	0.0008	0.0009	0.0010	0.0011	0.0011	0.0009
Min.	0.2438	0.5159	3125	0.0001	0.0001	0.0002	0.0001	0.0003	0.0006	0.0006	0.0008	0.0013	0.0019
Max.	0.2458	0.5210	3218	0.0007	0.0011	0.0018	0.0023	0.0029	0.0032	0.0037	0.0040	0.0044	0.0045



3.7 Data Set 4, 105°C, 75mA (Lumen Maintenance)

No.	V_F(V)	Φ(lm)	Ra	Lumen Maintenance (%)									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
45	2.812	28.46	96.3	100.42	99.89	99.33	98.70	98.10	97.82	97.40	96.94	96.63	96.28
46	2.813	28.64	95.7	100.21	99.86	99.37	98.74	98.15	97.56	97.07	96.72	96.33	96.09
47	2.812	28.67	96.0	100.21	99.48	98.92	98.22	97.73	97.17	96.62	96.16	95.78	95.43
48	2.817	28.24	95.7	100.25	100.00	99.40	99.08	98.62	98.19	97.80	97.27	96.92	96.60
49	2.819	28.20	95.5	100.14	99.68	99.33	99.15	98.48	98.09	97.52	97.06	96.56	96.28
50	2.815	28.13	96.2	100.25	99.57	99.11	98.65	98.44	98.15	97.55	96.98	96.59	96.23
51	2.819	28.36	95.6	100.21	99.86	99.22	98.70	98.20	97.78	97.28	96.76	96.40	96.09
52	2.819	28.13	95.9	100.14	99.64	99.04	98.47	98.01	97.58	97.05	96.55	96.05	95.88
53	2.819	28.25	95.6	100.14	99.75	99.15	98.69	98.23	97.88	97.42	97.03	96.57	96.18
54	2.811	28.25	95.5	100.25	99.29	98.73	98.44	97.81	97.27	96.71	96.14	95.82	95.61
55	2.817	28.04	95.5	100.32	99.93	99.47	99.32	98.75	98.25	97.72	97.22	96.83	96.58
56	2.810	28.29	96.0	100.21	99.79	99.22	98.97	98.44	98.02	97.63	97.07	96.68	96.47
Ave.	2.815	28.31	95.8	100.23	99.73	99.19	98.76	98.25	97.81	97.31	96.82	96.43	96.14
Med.	2.816	28.25	95.7	100.21	99.77	99.22	98.70	98.22	97.85	97.41	96.96	96.56	96.20
st dev	0.003	0.20	0.3	0.0802	0.2061	0.2158	0.3184	0.3117	0.3557	0.3818	0.3743	0.3692	0.3584
Min.	2.810	28.04	95.5	100.14	99.29	98.73	98.22	97.73	97.17	96.62	96.14	95.78	95.43
Max.	2.819	28.67	96.3	100.42	100.00	99.47	99.32	98.75	98.25	97.80	97.27	96.92	96.60

TM-21 Projection:

Test Duration: 10000 hours
Failures Observed: 0
α: 4.464E-06
β: 1.004
Calculated L_{70}: 81000hours
Reported L_{70}: >55000hours

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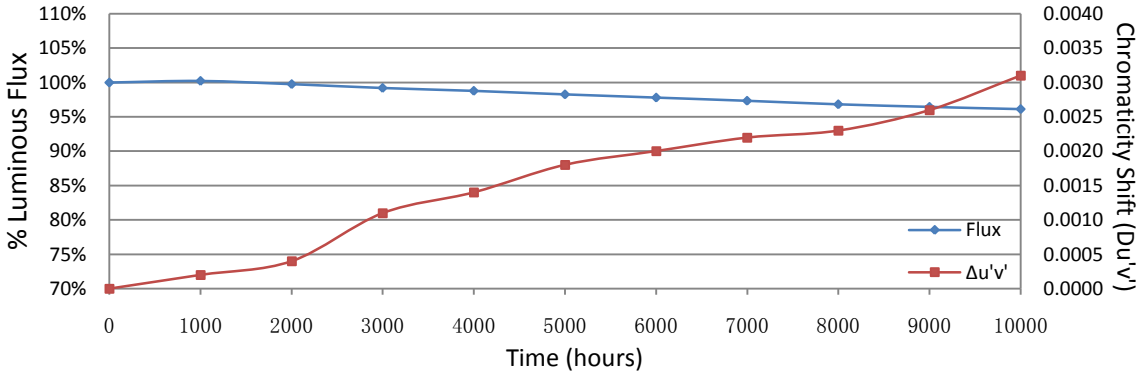
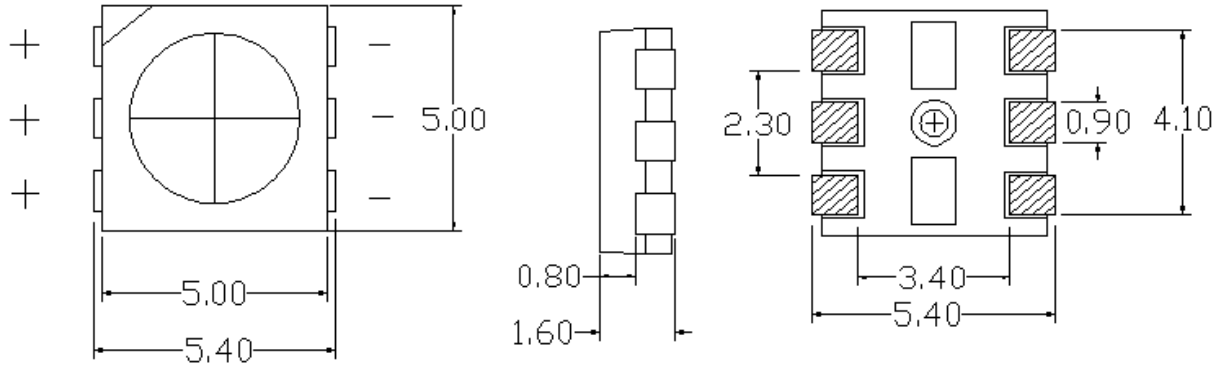
3.8 Data Set 4, 105°C, 75mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')									
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
45	0.2451	0.5169	3174	0.0002	0.0001	0.0010	0.0013	0.0017	0.0020	0.0021	0.0023	0.0025	0.0031
46	0.2434	0.5170	3218	0.0003	0.0003	0.0009	0.0012	0.0016	0.0020	0.0021	0.0022	0.0025	0.0031
47	0.2443	0.5167	3198	0.0003	0.0005	0.0012	0.0015	0.0019	0.0021	0.0022	0.0024	0.0025	0.0031
48	0.2439	0.5170	3206	0.0001	0.0003	0.0010	0.0013	0.0018	0.0020	0.0021	0.0022	0.0025	0.0031
49	0.2441	0.5180	3192	0.0002	0.0003	0.0009	0.0013	0.0017	0.0019	0.0020	0.0022	0.0025	0.0029
50	0.2438	0.5162	3215	0.0001	0.0003	0.0009	0.0013	0.0016	0.0019	0.0020	0.0022	0.0025	0.0029
51	0.2438	0.5177	3203	0.0001	0.0003	0.0009	0.0012	0.0017	0.0019	0.0020	0.0022	0.0025	0.0030
52	0.2437	0.5165	3214	0.0002	0.0003	0.0009	0.0012	0.0015	0.0020	0.0021	0.0021	0.0025	0.0030
53	0.2442	0.5173	3195	0.0001	0.0004	0.0011	0.0015	0.0018	0.0021	0.0022	0.0023	0.0026	0.0031
54	0.2465	0.5199	3114	0.0003	0.0005	0.0011	0.0014	0.0018	0.0021	0.0023	0.0024	0.0028	0.0032
55	0.2473	0.5208	3088	0.0004	0.0006	0.0013	0.0016	0.0020	0.0022	0.0023	0.0024	0.0027	0.0032
56	0.2441	0.5164	3205	0.0004	0.0008	0.0016	0.0019	0.0022	0.0025	0.0026	0.0028	0.0031	0.0036
Ave.	0.2445	0.5175	3185	0.0002	0.0004	0.0011	0.0014	0.0018	0.0020	0.0022	0.0023	0.0026	0.0031
Med.	0.2441	0.5170	3201	0.0002	0.0003	0.0010	0.0013	0.0017	0.0020	0.0021	0.0023	0.0025	0.0031
st dev	0.0012	0.0014	41	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Min.	0.2434	0.5162	3088	0.0001	0.0001	0.0009	0.0012	0.0015	0.0019	0.0020	0.0021	0.0025	0.0029
Max.	0.2473	0.5208	3218	0.0004	0.0008	0.0016	0.0019	0.0022	0.0025	0.0026	0.0028	0.0031	0.0036



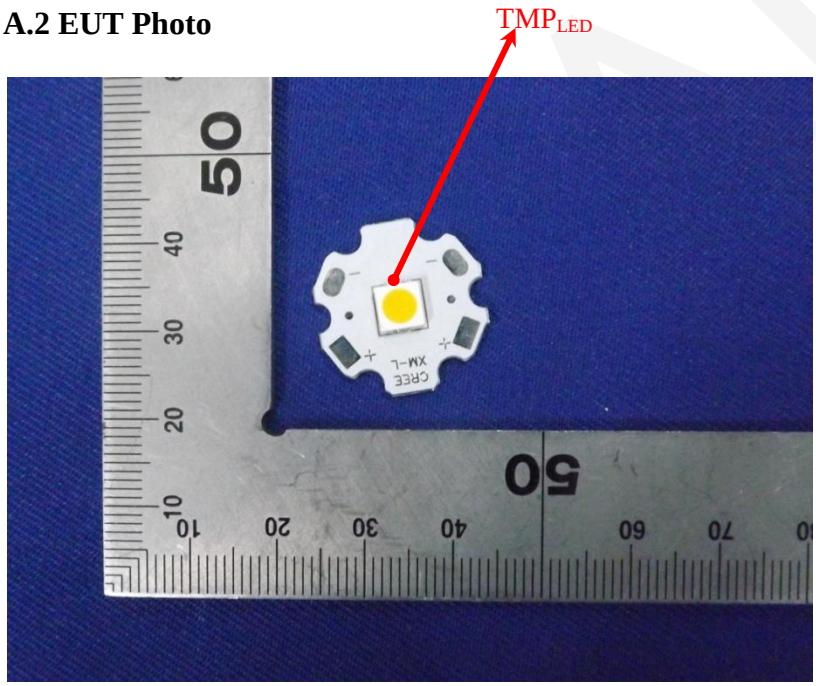
Attachment A – EUT Photo

A.1 Mechanical Dimensions (Ta = 25°C)



All dimensions are in millimeter

A.2 EUT Photo



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