



IESNA LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Toyoda Gosei Co., Ltd.

1-1 Higashitakasuga, Futatsudeta, Ama, Aichi, 490-1207 Japan

Model:EESA3-YE167-F0

Report Type: 9000 Hours Test Report	Product Type: LED Package
Test Engineer: Pote Wang	<i>Pote Wang</i>
Report Number:	RSZ170417501-10-9000
Test Date:	2016-02-04 to 2017-02-14
Report Date:	2017-04-17
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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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TABLE OF CONTENTS

1 - General Information	3
1.1 Description of LED Light Sources	3
1.2 Standards Used:.....	4
1.3 Test Facility.....	4
1.4 Description of Auxiliary Equipment	4
1.5 Operating Cycle.....	5
1.6 Ambient Conditions	5
1.7 Photometry Measurement Uncertainty	5
1.8 Sample Set.....	6
2 - Summary of Test Result.....	7
3 - Test Data	8
3.1 Data Set 1, 55°C, 100mA (Lumen Maintenance).....	8
3.2 Data Set 1, 55°C, 100mA (Chromaticity Shift).....	9
3.3 Data Set 2, 85°C, 100mA (Lumen Maintenance).....	10
3.4 Data Set 2, 85°C, 100mA (Chromaticity Shift).....	11
3.5 Data Set 3, 105°C, 100mA (Lumen Maintenance).....	12
3.6 Data Set 3, 105°C, 100mA (Chromaticity Shift).....	13
Attachment A – EUT Photo	14
A.1 Mechanical Dimensions (Ta = 25°C).....	14
A.2 EUT Photo.....	14

1 - General Information

1.1 Description of LED Light Sources

Devices tested

Part Number: EESA3-YE167-F0
 Part Type: LED Package
 Nominal CCT: 2700K

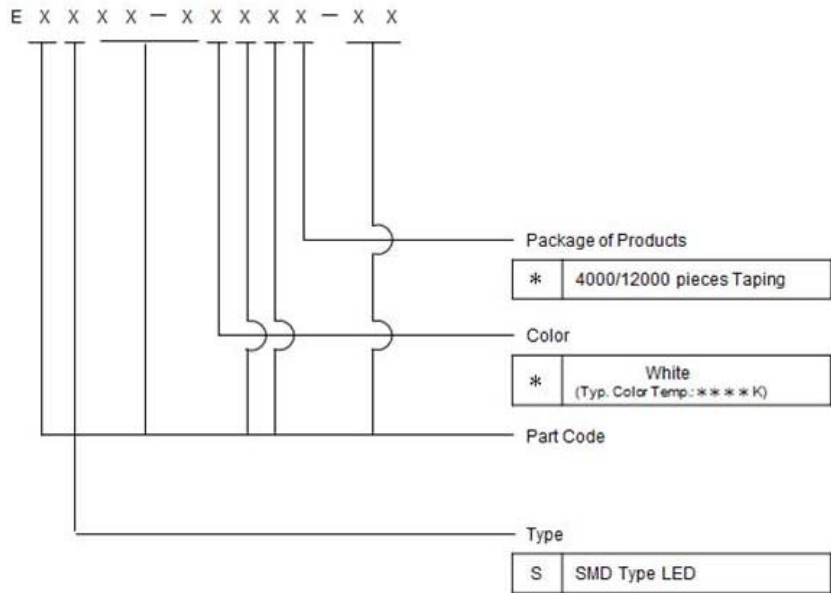
Note:

1. The applicant *Toyoda Gosei Co., Ltd.* declare that their product with model EESA3-YE167-F0 are the same to the product in report# RSZ160203508-10-9000 and is authorized by original applicant to use their test data.
2. All the data in previous report (RSZ160203508-10-9000) is shared in report.

Family products covered by this report:

According to ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products, the following products can be covered by this report base on the declaration letter of manufacturer. The information of these models shows that the covered products meet all section 3 item 7 requirements of ENERGY STAR® Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products (September 9, 2011)

Series Name	Model Number	CCT(K)	Number of Dies	Current (mA)	Volt (v)
2835	EXXXX-XXXXX-XX (Test model: EESA3-YE167-F0)	2200/2400/2700/3000/3500/4000/4500/5000/5700/6500	1	100mA	9V
2835	EXXXX-XX190-F0	2200/2400/2700/3000/3500/4000/4500/5000/5700/6500	1	100mA	3V
2835	EXXXX-XX167-F0	2200/2400/2700/3000/3500/4000/4500/5000/5700/6500	1	100mA	9V
2835	EXXXX-XX139-F0	2200/2400/2700/3000/3500/4000/4500/5000/5700/6500	1	100mA	3V
2835	EXXXX-XX157-F0	2200/2400/2700/3000/3500/4000/4500/5000/5700/6500	1	100mA	3V
2835	EXXXX-XX1L7-F0	2200/2400/2700/3000/3500/4000/4500/5000/5700/6500	1	100mA	3V



Disclaimer:

The truthfulness and accuracy of all the technical information above for the covered LED products is ensured by manufacturer of LED light source. Bay Area Compliance Laboratories Corp. (Dongguan) isn't responsible or gives any guarantees for the truthfulness of the technical information.

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 No.69, Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, 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	2017-03-09	2018-03-08
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2017-03-03	2018-03-02
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2017-03-09	2018-03-08
Standard Light Source	EVERFINE	D062	1011093	3000K	2016-09-13	2017-09-12

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Precision digital stabilized DC power supply	EVERFINE	WY605-V110	G115987C J7321114	300VA	2017-03-03	2018-03-02
Multilayer aging machine	BACL	B2-270	20015	25°C~130°C	2017-03-03	2018-03-02
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090008	(50/15A)	2016-07-07	2017-07-06
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)	2017-03-03	2018-03-02

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 $25^\circ\text{C} \pm 2^\circ\text{C}$, 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 $U=21\text{K}$ ($K=2$), 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 90Pcs;

Each Ts test condition 30Pcs

The samples tested at Ts 55°C, Ts 85°C and Ts 105°C were received at 2016-02-03 and tested during 2016-02-04 to 2017-02-14. The samples were numbered from 1 to 30, 31 to 60 and 61 to 90

Data Set 1: 55°C, 100mA

Part Number:	EESA3-YE167-F0
Number of Units:	30
Actual Case Temperature(T _S):	T _S =54.6°C
Actual Ambient Temperature(T _A):	T _A =52.1°C
Life Test Drive Current:	I _F = 100mA
Measurement Current:	I _F = 100mA

Data Set 2: 85°C,100mA

Part Number:	EESA3-YE167-F0
Number of Units:	30
Actual Case Temperature(T _S):	T _S =84.9°C
Actual Ambient Temperature(T _A):	T _A =81.4°C
Life Test Drive Current:	I _F =100mA
Measurement Current:	I _F = 100mA

Data Set 3: 105°C, 100mA

Part Number:	EESA3-YE167-F0
Number of Units:	30
Actual Case Temperature(T _S):	T _S =104.3°C
Actual Ambient Temperature(T _A):	T _A =102.8°C
Life Test Drive Current:	I _F = 100mA
Measurement Current:	I _F = 100mA

2 - Summary of Test Result

Data Set:	Data Set 1, 55°C, 100mA
Number of Units:	30
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	98.94%
Average Chromaticity Shift at 6000 hours (Δu^*v^*):	0.0012
Average. Lumen Maintenance at 9000 hours:	98.35%
Average Chromaticity Shift at 9000 hours (Δu^*v^*):	0.0022
Reported TM-21 L ₇₀ Lifetime:	>54000 hours

Data Set:	Data Set 2, 85°C, 100mA
Number of Units:	30
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	98.40%
Average Chromaticity Shift at 6000 hours(Δu^*v^*):	0.0015
Average. Lumen Maintenance at 9000 hours:	97.63%
Average Chromaticity Shift at 9000 hours (Δu^*v^*):	0.0023
Reported TM-21 L ₇₀ Lifetime:	>54000 hours

Data Set:	Data Set 3, 105°C, 100mA
Number of Units:	30
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h,7000h,8000h,9000h
Average. Lumen Maintenance at 6000 hours:	97.84%
Average Chromaticity Shift at 6000 hours(Δu^*v^*):	0.0017
Average. Lumen Maintenance at 9000 hours:	96.96%
Average Chromaticity Shift at 9000 hours (Δu^*v^*):	0.0027
Reported TM-21 L ₇₀ Lifetime:	>54000 hours

3 - Test Data

3.1 Data Set 1, 55°C, 100mA (Lumen Maintenance)

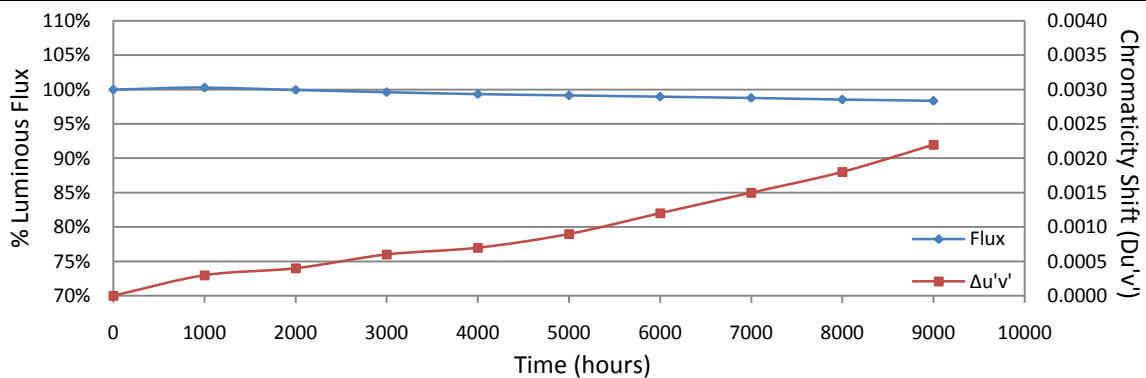
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	9.266	120.1	100.42	100.08	99.75	99.50	99.25	99.08	98.83	98.58	98.42
2	9.239	119.4	100.25	99.83	99.58	99.25	99.08	98.74	98.41	98.24	97.91
3	9.256	120.2	100.42	100.25	100.17	99.83	99.75	99.58	99.33	99.25	99.00
4	9.260	122.0	100.41	99.92	99.59	99.43	99.26	99.18	98.93	98.85	98.69
5	9.242	121.6	100.33	99.84	99.67	99.34	99.10	98.93	98.85	98.77	98.60
6	9.286	120.9	100.25	99.92	99.83	99.50	99.34	99.17	99.01	98.92	98.68
7	9.261	120.0	100.33	100.08	99.92	99.58	99.50	99.25	99.17	98.92	98.58
8	9.248	119.2	100.34	100.17	100.08	99.83	99.75	99.58	99.50	99.24	99.16
9	9.265	120.3	100.25	100.08	99.50	99.25	99.09	98.92	98.67	98.42	98.34
10	9.288	121.6	100.16	99.84	99.42	99.18	98.77	98.68	98.52	98.36	98.19
11	9.266	120.4	100.33	100.17	99.92	99.67	99.42	99.25	99.00	98.59	98.50
12	9.264	118.8	100.17	99.92	99.49	99.33	99.16	98.91	98.74	98.65	98.48
13	9.271	120.5	100.41	100.25	99.92	99.67	99.50	99.42	99.25	99.09	98.92
14	9.266	119.5	100.25	100.17	99.83	99.50	99.16	99.00	98.74	98.66	98.41
15	9.266	119.9	100.17	99.75	99.42	99.25	99.17	98.83	98.67	98.58	98.50
16	9.241	119.0	100.25	99.83	99.41	99.08	98.74	98.57	98.49	98.40	98.15
17	9.266	120.1	100.33	100.08	99.50	99.17	98.75	98.42	98.33	98.17	98.00
18	9.249	120.4	100.17	99.67	99.17	98.84	98.67	98.50	98.26	98.09	97.92
19	9.254	118.5	100.25	99.83	99.58	99.16	98.90	98.73	98.48	98.23	97.97
20	9.266	121.0	100.33	99.92	99.50	99.17	98.84	98.51	98.18	98.10	97.77
21	9.278	120.2	100.25	99.83	99.42	99.25	98.92	98.67	98.42	98.17	97.84
22	9.223	116.6	100.26	99.91	99.57	99.31	99.14	98.89	98.71	98.54	98.37
23	9.258	120.2	100.17	99.75	99.42	99.17	98.84	98.59	98.42	98.34	98.00
24	9.257	120.6	100.33	99.83	99.59	99.25	99.00	98.76	98.51	98.09	97.93
25	9.269	121.2	100.17	99.75	99.50	99.01	98.93	98.76	98.68	98.51	98.18
26	9.267	119.7	100.25	99.92	99.67	99.42	99.33	99.08	98.75	98.50	98.33
27	9.266	119.7	100.17	99.67	99.42	99.16	99.08	98.91	98.83	98.75	98.66
28	9.246	119.9	100.33	99.83	99.58	99.33	99.25	99.17	99.08	99.00	98.67
29	9.185	117.8	100.25	99.92	99.58	99.15	99.07	98.81	98.56	98.05	97.71
30	9.266	119.9	100.33	100.08	99.83	99.67	99.58	99.33	99.08	98.83	98.58
Ave.	9.258	120.0	100.28	99.94	99.63	99.34	99.14	98.94	98.75	98.56	98.35
Med.	9.265	120.1	100.25	99.92	99.58	99.28	99.12	98.91	98.73	98.56	98.39
st dev	0.0194	1.1151	0.0821	0.1660	0.2249	0.2381	0.2896	0.3126	0.3280	0.3479	0.3769
Min.	9.185	116.6	100.16	99.67	99.17	98.84	98.67	98.42	98.18	98.05	97.71
Max.	9.288	122.0	100.42	100.25	100.17	99.83	99.75	99.58	99.50	99.25	99.16

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 1.989E-06
β: 1.001
Reported L₇₀: >54000 hours

3.2 Data Set 1, 55°C, 100mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2595	0.5257	2771	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0013	0.0017	0.0021
2	0.2615	0.5256	2729	0.0002	0.0004	0.0006	0.0008	0.0010	0.0014	0.0016	0.0020	0.0023
3	0.2638	0.5285	2668	0.0003	0.0006	0.0007	0.0010	0.0012	0.0014	0.0016	0.0020	0.0022
4	0.2599	0.5267	2757	0.0003	0.0004	0.0006	0.0006	0.0009	0.0011	0.0014	0.0019	0.0021
5	0.2618	0.5255	2722	0.0003	0.0005	0.0007	0.0009	0.0011	0.0012	0.0015	0.0020	0.0024
6	0.2601	0.5267	2753	0.0003	0.0005	0.0007	0.0008	0.0010	0.0011	0.0015	0.0019	0.0021
7	0.2618	0.5251	2724	0.0002	0.0005	0.0005	0.0007	0.0009	0.0010	0.0013	0.0017	0.0020
8	0.2591	0.5238	2788	0.0003	0.0005	0.0007	0.0007	0.0009	0.0010	0.0013	0.0017	0.0020
9	0.2608	0.5275	2735	0.0002	0.0004	0.0006	0.0006	0.0008	0.0010	0.0014	0.0018	0.0020
10	0.2607	0.5251	2748	0.0002	0.0004	0.0006	0.0007	0.0009	0.0010	0.0014	0.0017	0.0021
11	0.2600	0.5267	2755	0.0002	0.0004	0.0006	0.0007	0.0008	0.0009	0.0013	0.0016	0.0018
12	0.2619	0.5267	2714	0.0002	0.0004	0.0007	0.0009	0.0009	0.0011	0.0013	0.0016	0.0020
13	0.2616	0.5274	2719	0.0003	0.0004	0.0007	0.0009	0.0011	0.0010	0.0014	0.0017	0.0020
14	0.2593	0.5259	2774	0.0002	0.0004	0.0007	0.0009	0.0011	0.0010	0.0013	0.0017	0.0020
15	0.2580	0.5236	2814	0.0002	0.0004	0.0009	0.0010	0.0012	0.0012	0.0014	0.0017	0.0020
16	0.2611	0.5248	2739	0.0003	0.0005	0.0007	0.0009	0.0012	0.0011	0.0013	0.0016	0.0019
17	0.2602	0.5252	2759	0.0003	0.0004	0.0007	0.0009	0.0012	0.0013	0.0014	0.0017	0.0020
18	0.2600	0.5257	2760	0.0002	0.0004	0.0006	0.0008	0.0011	0.0014	0.0015	0.0017	0.0021
19	0.2618	0.5263	2718	0.0006	0.0011	0.0015	0.0017	0.0022	0.0027	0.0033	0.0036	0.0041
20	0.2590	0.5255	2783	0.0002	0.0003	0.0004	0.0006	0.0007	0.0013	0.0013	0.0016	0.0020
21	0.2582	0.5255	2799	0.0002	0.0004	0.0004	0.0005	0.0007	0.0014	0.0014	0.0017	0.0021
22	0.2590	0.5239	2789	0.0002	0.0003	0.0004	0.0004	0.0005	0.0012	0.0011	0.0015	0.0020
23	0.2597	0.5249	2771	0.0003	0.0004	0.0003	0.0001	0.0005	0.0013	0.0013	0.0017	0.0021
24	0.2603	0.5247	2759	0.0002	0.0003	0.0004	0.0002	0.0004	0.0013	0.0015	0.0017	0.0022
25	0.2610	0.5266	2734	0.0004	0.0004	0.0004	0.0003	0.0004	0.0011	0.0013	0.0016	0.0020
26	0.2604	0.5247	2755	0.0002	0.0003	0.0004	0.0003	0.0004	0.0013	0.0017	0.0017	0.0023
27	0.2595	0.5256	2772	0.0002	0.0004	0.0006	0.0005	0.0003	0.0011	0.0015	0.0018	0.0023
28	0.2612	0.5253	2737	0.0002	0.0003	0.0005	0.0004	0.0001	0.0011	0.0017	0.0019	0.0024
29	0.2595	0.5222	2787	0.0002	0.0003	0.0004	0.0006	0.0003	0.0012	0.0017	0.0019	0.0024
30	0.2605	0.5239	2757	0.0003	0.0003	0.0005	0.0006	0.0008	0.0009	0.0016	0.0018	0.0023
Ave.	0.2604	0.5255	2753	0.0003	0.0004	0.0006	0.0007	0.0009	0.0012	0.0015	0.0018	0.0022
Med.	0.2603	0.5255	2756	0.0002	0.0004	0.0006	0.0007	0.0009	0.0011	0.0014	0.0017	0.0021
st dev	0.0012	0.0013	30.3383	0.0001	0.0002	0.0002	0.0003	0.0004	0.0003	0.0004	0.0004	0.0004
Min.	0.2580	0.5222	2668	0.0002	0.0003	0.0003	0.0001	0.0001	0.0009	0.0011	0.0015	0.0018
Max.	0.2638	0.5285	2814	0.0006	0.0011	0.0015	0.0017	0.0022	0.0027	0.0033	0.0036	0.0041



3.3 Data Set 2, 85°C, 100mA (Lumen Maintenance)

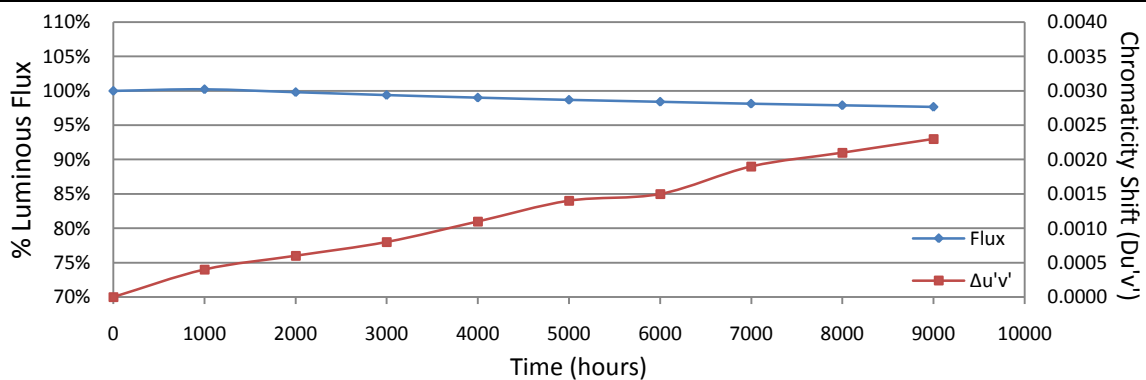
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	9.238	122.3	100.16	99.84	99.43	99.10	98.94	98.69	98.45	98.04	97.71
32	9.260	120.6	100.08	99.67	99.34	98.92	98.67	98.34	98.01	97.93	97.68
33	9.246	120.5	100.17	99.42	99.25	98.84	98.59	98.34	98.17	97.84	97.51
34	9.250	121.7	100.33	100.08	99.59	99.34	99.10	99.01	98.69	98.27	98.03
35	9.257	120.9	100.25	99.92	99.42	99.01	98.84	98.68	98.51	98.43	98.26
36	9.255	121.3	100.33	100.16	99.67	99.18	98.93	98.60	98.27	98.19	98.02
37	9.279	120.4	100.25	99.92	99.34	99.00	98.50	98.26	98.01	97.92	97.76
38	9.238	120.9	100.17	100.08	99.50	99.09	98.68	98.26	97.93	97.85	97.60
39	9.272	120.3	100.25	100.17	99.67	99.25	98.92	98.67	98.34	97.92	97.67
40	9.253	120.7	100.08	99.67	99.09	98.59	98.51	98.34	98.09	98.01	97.60
41	9.259	120.9	100.17	99.83	99.26	98.92	98.68	98.43	98.26	98.10	97.93
42	9.254	118.2	100.34	99.92	99.41	99.07	98.82	98.56	98.31	98.22	98.05
43	9.263	120.5	100.41	100.33	99.83	99.34	98.92	98.59	98.42	98.34	98.01
44	9.273	120.9	100.17	99.75	99.34	99.01	98.76	98.43	98.18	97.93	97.52
45	9.256	122.6	100.16	99.67	99.18	98.86	98.78	98.61	98.29	97.88	97.63
46	9.245	120.8	100.08	99.50	99.17	98.76	98.43	98.26	98.01	97.85	97.52
47	9.235	122.4	100.25	99.67	99.18	98.86	98.45	98.12	97.71	97.63	97.39
48	9.263	120.4	100.17	99.83	99.50	99.17	98.92	98.67	98.42	98.26	98.01
49	9.248	120.2	100.25	99.75	99.67	99.33	99.00	98.59	98.17	97.84	97.50
50	9.260	120.8	100.17	99.67	99.34	98.76	98.43	98.18	98.01	97.93	97.76
51	9.270	119.4	100.34	99.92	99.41	98.99	98.83	98.49	98.16	97.99	97.74
52	9.248	121.6	100.33	99.75	99.42	98.93	98.77	98.27	97.86	97.53	97.12
53	9.268	120.2	100.17	99.58	99.17	98.84	98.59	98.34	98.00	97.92	97.67
54	9.238	120.8	100.08	99.34	98.84	98.34	97.93	97.52	97.19	96.94	96.77
55	9.271	122.0	100.16	99.43	99.02	98.61	98.28	98.03	97.79	97.62	97.21
56	9.249	119.5	100.33	100.25	99.92	99.58	99.08	98.58	98.24	98.08	97.82
57	9.255	121.6	100.08	99.75	99.59	99.18	98.68	98.44	98.03	97.78	97.45
58	9.263	120.4	100.17	99.50	99.17	98.75	98.59	98.26	98.01	97.76	97.43
59	9.251	120.3	100.08	99.42	99.09	98.59	98.25	97.92	97.51	97.17	96.92
60	9.288	119.7	100.17	99.92	99.67	99.33	99.00	98.50	98.16	97.91	97.58
Ave.	9.257	120.8	100.20	99.79	99.38	98.98	98.69	98.40	98.11	97.90	97.63
Med.	9.256	120.8	100.17	99.75	99.37	99.00	98.72	98.43	98.16	97.92	97.65
st dev	0.0128	0.9354	0.0946	0.2588	0.2486	0.2736	0.2686	0.2816	0.3023	0.3122	0.3335
Min.	9.235	118.2	100.08	99.34	98.84	98.34	97.93	97.52	97.19	96.94	96.77
Max.	9.288	122.6	100.41	100.33	99.92	99.58	99.10	99.01	98.69	98.43	98.26

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 2.735E-06
β: 1.000
Reported L₇₀: >54000 hours

3.4 Data Set 2, 85°C, 100mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
31	0.2614	0.5256	2731	0.0004	0.0006	0.0009	0.0011	0.0014	0.0015	0.0022	0.0029	0.0030
32	0.2615	0.5260	2727	0.0004	0.0006	0.0009	0.0012	0.0016	0.0012	0.0017	0.0020	0.0023
33	0.2608	0.5247	2746	0.0004	0.0006	0.0008	0.0011	0.0015	0.0014	0.0015	0.0019	0.0022
34	0.2622	0.5264	2710	0.0004	0.0006	0.0008	0.0010	0.0014	0.0018	0.0019	0.0023	0.0025
35	0.2611	0.5269	2730	0.0003	0.0005	0.0006	0.0008	0.0012	0.0011	0.0011	0.0016	0.0018
36	0.2605	0.5258	2749	0.0005	0.0008	0.0009	0.0012	0.0016	0.0017	0.0020	0.0021	0.0021
37	0.2585	0.5244	2798	0.0003	0.0005	0.0007	0.0009	0.0013	0.0014	0.0017	0.0016	0.0019
38	0.2585	0.5255	2793	0.0004	0.0007	0.0007	0.0011	0.0013	0.0014	0.0019	0.0017	0.0019
39	0.2584	0.5264	2792	0.0004	0.0006	0.0008	0.0011	0.0013	0.0017	0.0020	0.0021	0.0023
40	0.2592	0.5241	2784	0.0004	0.0007	0.0009	0.0012	0.0014	0.0020	0.0023	0.0025	0.0025
41	0.2599	0.5251	2764	0.0003	0.0006	0.0007	0.0010	0.0013	0.0014	0.0018	0.0020	0.0021
42	0.2589	0.5265	2779	0.0004	0.0006	0.0008	0.0011	0.0014	0.0014	0.0018	0.0019	0.0020
43	0.2601	0.5257	2758	0.0004	0.0007	0.0009	0.0010	0.0013	0.0014	0.0017	0.0019	0.0019
44	0.2597	0.5234	2776	0.0004	0.0006	0.0009	0.0011	0.0014	0.0017	0.0020	0.0022	0.0023
45	0.2610	0.5244	2743	0.0004	0.0006	0.0009	0.0013	0.0014	0.0021	0.0025	0.0025	0.0028
46	0.2615	0.5245	2733	0.0004	0.0007	0.0011	0.0013	0.0015	0.0023	0.0028	0.0029	0.0031
47	0.2598	0.5263	2761	0.0004	0.0006	0.0010	0.0014	0.0014	0.0021	0.0025	0.0028	0.0029
48	0.2601	0.5267	2754	0.0003	0.0007	0.0008	0.0012	0.0016	0.0014	0.0017	0.0018	0.0019
49	0.2612	0.5256	2735	0.0005	0.0009	0.0013	0.0018	0.0021	0.0024	0.0026	0.0029	0.0030
50	0.2592	0.5253	2780	0.0003	0.0004	0.0008	0.0013	0.0015	0.0013	0.0016	0.0016	0.0019
51	0.2607	0.5257	2745	0.0003	0.0004	0.0009	0.0013	0.0016	0.0011	0.0015	0.0017	0.0018
52	0.2602	0.5233	2766	0.0004	0.0005	0.0009	0.0014	0.0017	0.0023	0.0029	0.0035	0.0038
53	0.2606	0.5255	2748	0.0003	0.0004	0.0008	0.0013	0.0018	0.0014	0.0018	0.0019	0.0021
54	0.2594	0.5244	2778	0.0003	0.0004	0.0006	0.0009	0.0016	0.0014	0.0018	0.0020	0.0023
55	0.2600	0.5258	2760	0.0004	0.0005	0.0007	0.0009	0.0014	0.0014	0.0017	0.0019	0.0024
56	0.2598	0.5248	2768	0.0003	0.0004	0.0006	0.0008	0.0012	0.0011	0.0016	0.0018	0.0023
57	0.2613	0.5261	2731	0.0004	0.0005	0.0007	0.0010	0.0014	0.0014	0.0017	0.0019	0.0023
58	0.2601	0.5235	2767	0.0004	0.0005	0.0007	0.0009	0.0014	0.0011	0.0014	0.0016	0.0021
59	0.2596	0.5250	2771	0.0004	0.0005	0.0007	0.0009	0.0013	0.0013	0.0016	0.0018	0.0023
60	0.2618	0.5249	2724	0.0004	0.0005	0.0006	0.0008	0.0013	0.0012	0.0016	0.0018	0.0022
Ave.	0.2602	0.5253	2757	0.0004	0.0006	0.0008	0.0011	0.0014	0.0015	0.0019	0.0021	0.0023
Med.	0.2601	0.5255	2759	0.0004	0.0006	0.0008	0.0011	0.0014	0.0014	0.0018	0.0019	0.0023
st dev	0.0010	0.0010	22.9469	0.0001	0.0001	0.0002	0.0002	0.0002	0.0004	0.0004	0.0005	0.0005
Min.	0.2584	0.5233	2710	0.0003	0.0004	0.0006	0.0008	0.0012	0.0011	0.0011	0.0016	0.0018
Max.	0.2622	0.5269	2798	0.0005	0.0009	0.0013	0.0018	0.0021	0.0024	0.0029	0.0035	0.0038



3.5 Data Set 3, 105°C, 100mA (Lumen Maintenance)

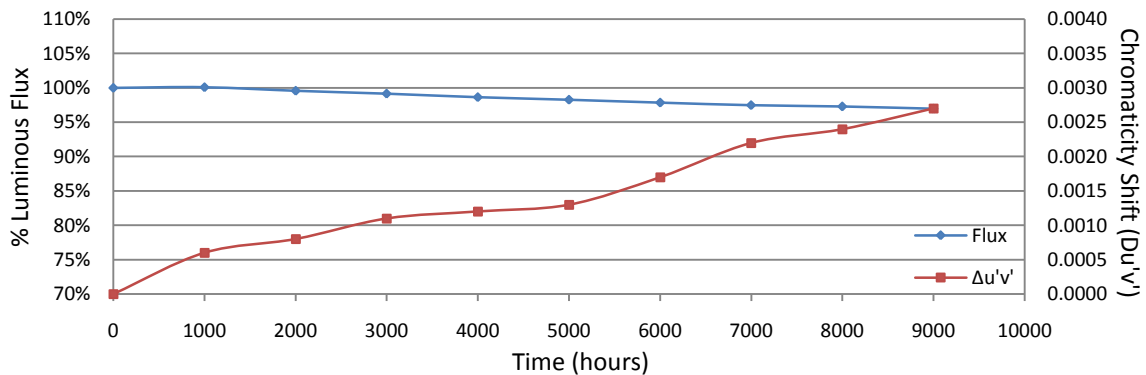
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)								
			Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
61	9.269	120.2	100.25	99.75	99.25	98.84	98.59	98.25	97.75	97.67	97.42
62	9.263	119.8	99.92	99.50	99.00	98.58	98.16	97.75	97.33	97.08	96.91
63	9.254	119.2	100.08	99.33	98.91	98.49	98.15	97.65	97.23	97.15	96.81
64	9.171	117.6	99.91	99.40	98.89	98.38	98.04	97.62	97.28	96.94	96.60
65	9.266	121.3	99.92	99.34	99.01	98.60	98.02	97.53	97.03	96.87	96.54
66	9.273	120.4	100.25	99.83	99.25	99.09	98.50	98.17	97.92	97.59	97.18
67	9.255	120.7	99.92	99.50	99.17	98.76	98.26	97.76	97.43	97.35	97.02
68	9.239	119.4	100.08	99.58	99.33	98.74	98.41	98.07	97.82	97.57	97.24
69	9.255	119.5	100.17	99.41	99.00	98.58	98.08	97.66	97.32	97.15	96.90
70	9.231	120.3	100.08	99.67	99.17	98.75	98.42	97.92	97.42	97.09	96.67
71	9.272	121.1	100.17	99.42	99.09	98.51	98.18	97.77	97.44	97.36	97.11
72	9.273	121.5	100.08	99.59	98.93	98.35	98.02	97.78	97.28	97.20	96.95
73	9.245	119.0	100.25	99.66	99.24	98.74	98.40	97.90	97.48	97.06	96.72
74	9.269	122.7	100.24	99.76	99.27	99.02	98.70	98.21	97.96	97.56	97.23
75	9.250	120.6	100.17	99.67	99.25	98.92	98.59	98.26	97.68	97.51	97.10
76	9.254	120.3	100.08	99.75	99.25	98.67	98.25	98.00	97.67	97.51	97.26
77	9.234	120.4	100.17	99.58	99.17	98.50	98.01	97.67	97.18	97.01	96.59
78	9.266	120.5	100.08	99.67	99.34	98.84	98.34	97.93	97.68	97.51	97.10
79	9.261	120.9	99.83	99.67	99.09	98.43	97.93	97.60	97.27	97.19	96.86
80	9.273	121.2	99.92	99.50	99.09	98.60	98.10	97.61	97.11	96.95	96.70
81	9.267	120.9	100.08	99.34	99.01	98.59	98.35	97.93	97.44	96.94	96.69
82	9.259	120.7	100.17	99.42	99.09	98.76	98.26	97.85	97.43	97.35	97.18
83	9.258	121.4	100.08	99.34	99.01	98.52	98.27	97.78	97.20	96.87	96.54
84	9.261	120.8	100.17	99.59	99.01	98.51	98.34	97.85	97.35	96.94	96.69
85	9.236	119.7	100.25	99.83	99.42	99.08	98.50	98.08	97.83	97.66	97.49
86	9.256	119.6	100.17	99.75	99.33	98.83	98.41	97.83	97.49	97.41	97.24
87	9.260	120.1	100.25	100.08	99.42	98.75	98.50	98.08	97.67	97.42	97.09
88	9.268	120.3	100.08	99.58	98.92	98.34	98.00	97.67	97.42	97.34	97.17
89	9.271	120.5	99.92	99.50	98.92	98.26	97.93	97.51	97.34	97.18	96.93
90	9.274	119.8	99.83	99.33	98.83	98.33	97.91	97.58	97.33	97.25	96.91
Ave.	9.256	120.3	100.09	99.58	99.12	98.65	98.25	97.84	97.46	97.26	96.96
Med.	9.261	120.4	100.08	99.58	99.09	98.60	98.26	97.80	97.43	97.22	96.94
st dev	0.0202	0.9343	0.1318	0.1827	0.1663	0.2223	0.2200	0.2200	0.2416	0.2496	0.2655
Min.	9.171	117.6	99.83	99.33	98.83	98.26	97.91	97.51	97.03	96.87	96.54
Max.	9.274	122.7	100.25	100.08	99.42	99.09	98.70	98.26	97.96	97.67	97.49

TM-21 Projection:

Test Duration: 9000 hours
Failures Observed: 0
α: 3.448E-06
β: 0.999
Reported L₇₀: >54000 hours

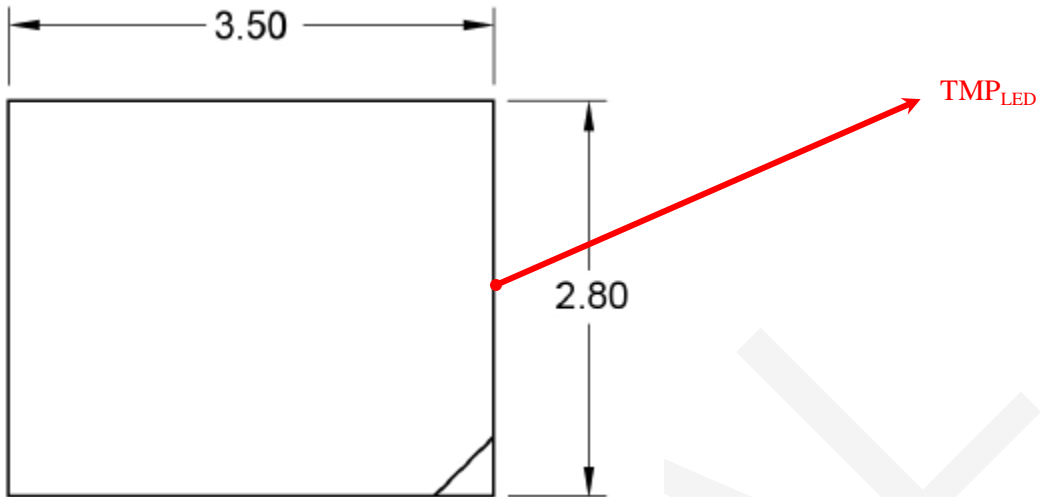
3.6 Data Set 3, 105°C, 100mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
61	0.2603	0.5255	2754	0.0006	0.0008	0.0009	0.0010	0.0014	0.0017	0.0021	0.0021	0.0026
62	0.2604	0.5258	2752	0.0006	0.0008	0.0009	0.0009	0.0014	0.0015	0.0019	0.0021	0.0025
63	0.2613	0.5263	2730	0.0006	0.0008	0.0009	0.0010	0.0014	0.0018	0.0021	0.0019	0.0025
64	0.2594	0.5212	2793	0.0005	0.0007	0.0009	0.0009	0.0012	0.0013	0.0017	0.0021	0.0024
65	0.2604	0.5250	2755	0.0006	0.0008	0.0010	0.0011	0.0012	0.0018	0.0021	0.0023	0.0026
66	0.2611	0.5254	2738	0.0006	0.0007	0.0010	0.0011	0.0012	0.0013	0.0016	0.0021	0.0023
67	0.2597	0.5244	2772	0.0006	0.0008	0.0010	0.0012	0.0013	0.0016	0.0020	0.0023	0.0026
68	0.2602	0.5248	2760	0.0007	0.0009	0.0012	0.0014	0.0014	0.0016	0.0019	0.0021	0.0025
69	0.2604	0.5264	2749	0.0005	0.0006	0.0009	0.0011	0.0012	0.0016	0.0021	0.0021	0.0025
70	0.2623	0.5240	2718	0.0007	0.0009	0.0011	0.0012	0.0013	0.0020	0.0024	0.0027	0.0030
71	0.2582	0.5241	2807	0.0006	0.0007	0.0010	0.0012	0.0013	0.0018	0.0021	0.0023	0.0027
72	0.2601	0.5256	2759	0.0006	0.0008	0.0010	0.0011	0.0013	0.0015	0.0020	0.0021	0.0023
73	0.2606	0.5241	2754	0.0006	0.0009	0.0010	0.0011	0.0012	0.0016	0.0019	0.0021	0.0025
74	0.2604	0.5240	2760	0.0006	0.0009	0.0012	0.0013	0.0014	0.0020	0.0023	0.0024	0.0028
75	0.2622	0.5264	2710	0.0007	0.0009	0.0011	0.0014	0.0014	0.0014	0.0018	0.0023	0.0024
76	0.2618	0.5257	2722	0.0006	0.0009	0.0010	0.0012	0.0013	0.0016	0.0021	0.0022	0.0025
77	0.2595	0.5241	2777	0.0006	0.0008	0.0011	0.0012	0.0012	0.0013	0.0016	0.0022	0.0025
78	0.2596	0.5242	2776	0.0006	0.0009	0.0012	0.0013	0.0013	0.0021	0.0029	0.0030	0.0034
79	0.2597	0.5234	2777	0.0007	0.0009	0.0011	0.0012	0.0013	0.0018	0.0024	0.0025	0.0028
80	0.2606	0.5234	2758	0.0006	0.0009	0.0011	0.0012	0.0013	0.0021	0.0028	0.0028	0.0033
81	0.2598	0.5233	2776	0.0006	0.0009	0.0011	0.0012	0.0013	0.0020	0.0026	0.0027	0.0030
82	0.2581	0.5237	2811	0.0006	0.0009	0.0011	0.0012	0.0013	0.0015	0.0021	0.0022	0.0025
83	0.2606	0.5243	2752	0.0006	0.0008	0.0010	0.0012	0.0013	0.0021	0.0028	0.0030	0.0033
84	0.2613	0.5259	2732	0.0006	0.0010	0.0013	0.0014	0.0014	0.0023	0.0030	0.0031	0.0034
85	0.2607	0.5248	2750	0.0006	0.0009	0.0010	0.0012	0.0013	0.0016	0.0022	0.0024	0.0027
86	0.2611	0.5238	2745	0.0006	0.0009	0.0010	0.0013	0.0013	0.0016	0.0022	0.0023	0.0025
87	0.2614	0.5254	2732	0.0006	0.0007	0.0009	0.0011	0.0013	0.0021	0.0024	0.0026	0.0029
88	0.2618	0.5253	2723	0.0006	0.0008	0.0010	0.0012	0.0013	0.0019	0.0024	0.0026	0.0028
89	0.2605	0.5260	2749	0.0007	0.0010	0.0012	0.0014	0.0015	0.0016	0.0022	0.0024	0.0028
90	0.2608	0.5276	2735	0.0006	0.0009	0.0011	0.0014	0.0014	0.0016	0.0022	0.0024	0.0026
Ave.	0.2605	0.5248	2754	0.0006	0.0008	0.0011	0.0012	0.0013	0.0017	0.0022	0.0024	0.0027
Med.	0.2605	0.5248	2753	0.0006	0.0009	0.0010	0.0012	0.0013	0.0016	0.0021	0.0023	0.0026
st dev	0.0010	0.0013	24.6176	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0004	0.0003	0.0003
Min.	0.2581	0.5212	2710	0.0005	0.0006	0.0009	0.0009	0.0012	0.0013	0.0016	0.0019	0.0023
Max.	0.2623	0.5276	2811	0.0007	0.0010	0.0013	0.0014	0.0015	0.0023	0.0030	0.0031	0.0034



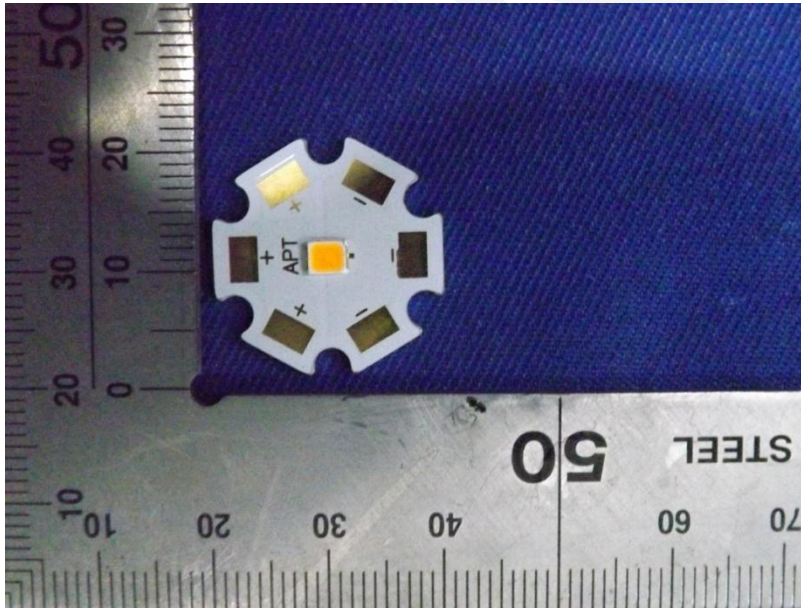
Attachment A – EUT Photo

A.1 Mechanical Dimensions (Ta = 25°C)



All dimensions are in millimeter

A.2 EUT Photo



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