TEST REPORT

ACCORDING TO IES LM-80-2015
For

Samsung Electronics Co., LTD.

1,Samsung-Ro,Giheung-Gu,Yongin-City,Gyeonggi-Do 17113, Korea

Model: SPMWH1228xxxxxxxxx

Report Type: 9000 Hours Test Report	**Product Type:** LED Package
Test Engineer:	Pote Wang
Report Number:	RSZ170122503-10
Test Date:	2016-01-02 to 2017-01-18
Report Date:	2017-01-24
Reviewed By:	Daniel Duan / EE Manager
Test Facility:	Test facility was located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China. Tel: +86-0769-86858888 Fax:+86-0769-86858588

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1 - General Information

1.1 Description of LED Light Sources

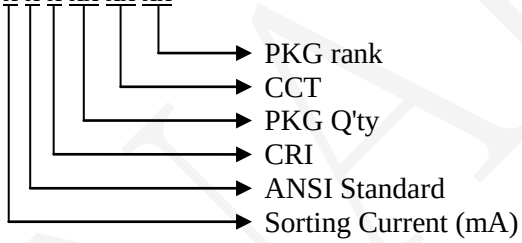
Sample Size:

75 PCS samples were received on 2016-01-02. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

Manufacturer:	Samsung Electronics Co., LTD.
Part Number:	SPMWH1228FD5WAW0xx
Part Type:	LED Package
Drive Level:	CC 120mA
Nominal CCT:	2700K

Covered models and nomenclature:

Multiple Models: SPMWH 1 228 x x x xx xx xx



Note:

1、The applicant Samsung Electronics Co., LTD. declared that their product with model SPMWH1228xxxxxxxxx are the same to the product in report# RSZ160102550-10 and is authorized by original applicant to use their test data. (See attachment A – Declaration Letter)

2、All the data in previous report (RSZ160102550-10) is shared in report.

1.2 Standards Used:

- IESNA LM-80-15: 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 Testing 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

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
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	G115987CJ7321114	300VA	2016-03-04	2017-03-03
Multilayer aging machine	BACL	B2-270	20005	25°C~110°C	2016-09-01	2017-09-01
DC Power Supply	Taishan Xingguang	T0150E8.5-80	ST06605	0~5V,0~40A	2016-10-27	2017-10-26
DC Power Supply	Taishan Xingguang	T0150E8.5-80	ST06604	0~5V,0~40A	2016-10-27	2017-10-26

1.4 Drive Level

Samples are driven with a constant direct current (DC) during maintenance test, photometric and electrical measurement. The current value was regulated to within ±3% of the specified value of the manufacturer during maintenance test, and was within ±0.5% during photometric and electrical measurement test.

1.5 Ambient Conditions for Maintenance Test

For lumen maintenance test, samples within one data set, were installed on cooling boards in thermal chambers with minimal ambient airflow. The case temperature and ambient temperature was monitored by thermocouples which one was soldered to the coldest DUTs' case (TMP_{LED}) location, while the other is mounted at a distance of 5 mm above the TMP location.

During life testing, TMP_{LED} of the coldest LEDs were maintained at a temperature that was greater than or equal to 2°C below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to 5°C below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with ASTM E230 Table 1 "Special Limits".

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within ±3% of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

For photometry measurement, the ambient temperature during test was set to 25°C ± 2°C, RH <65%.

1.6 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.

The uncertainty of the temperature is U=0.8671°C (K=2), at the 95% confidence level.

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Dongguan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Sample Set

Data Set 1: 55°C, 120mA

Part Number:	SPMWH1228xxxxxxxxx
Number of Units:	25
Case Temperature:	>53°C
Ambient Temperature:	>50°C
Life Test Drive Current:	120mA
Measurement Current:	120mA

Data Set 2: 85°C,120mA

Part Number:	SPMWH1228xxxxxxxxx
Number of Units:	25
Case Temperature:	>83°C
Ambient Temperature:	>80°C
Life Test Drive Current:	120mA
Measurement Current:	120mA

Data Set 3: 105°C,120mA

Part Number:	SPMWH1228xxxxxxxxx
Number of Units:	25
Case Temperature:	>105°C
Ambient Temperature:	>102°C
Life Test Drive Current:	120mA
Measurement Current:	120mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	Reported TM-21 L_{70} Lifetime	Reported TM-21 L_{90} Lifetime
1	25	0	1000	9000	>54,000hours	>54,000hours
2	25	0	1000	9000	>54,000hours	48,000hours
3	25	0	1000	9000	>54,000hours	42,000hours

Average Lumen Maintenance (Percentage of Initial Luminous Flux)

Data Set:	1000	2000	3000	4000	5000	6000	7000	8000	9000
1	100.08%	99.88%	99.75%	99.59%	99.42%	99.28%	99.16%	99.00%	98.82%
2	99.80%	99.65%	99.44%	99.27%	99.10%	98.85%	98.66%	98.42%	98.17%
3	99.55%	99.32%	99.12%	98.87%	98.68%	98.49%	98.24%	97.95%	97.66%

Average Color Maintenance

Data Set:	1000	2000	3000	4000	5000	6000	7000	8000	9000
1	0.0002	0.0003	0.0005	0.0006	0.0007	0.0008	0.0011	0.0013	0.0015
2	0.0003	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0013	0.0015
3	0.0004	0.0005	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0015

3 - Test Data

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

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	51.16	100.08	99.65	99.51	99.49	99.47	99.35	99.22	99.02	98.83
2	51.40	100.10	99.71	99.55	99.47	99.44	99.36	99.20	99.09	98.97
3	51.37	100.10	99.79	99.44	99.40	99.30	99.28	99.10	98.97	98.77
4	51.43	99.96	99.88	99.59	99.42	99.32	99.22	99.05	98.91	98.72
5	51.07	100.16	99.92	99.78	99.43	99.31	99.22	99.20	98.84	98.77
6	51.64	100.19	99.90	99.77	99.42	99.28	99.19	99.15	98.93	98.84
7	51.54	100.12	99.88	99.77	99.57	99.32	99.17	99.15	98.99	98.87
8	51.55	100.12	99.86	99.79	99.57	99.34	99.17	99.15	98.89	98.76
9	51.41	100.16	99.90	99.84	99.59	99.32	99.20	99.09	98.91	98.79
10	51.20	100.10	99.86	99.71	99.55	99.28	99.14	99.02	99.00	98.91
11	51.29	100.10	99.92	99.81	99.63	99.34	99.22	99.16	98.87	98.77
12	51.62	100.12	99.94	99.77	99.61	99.44	99.24	99.05	98.95	98.84
13	51.51	100.21	99.94	99.79	99.63	99.42	99.22	99.09	98.89	98.72
14	51.19	100.23	99.98	99.88	99.71	99.51	99.32	99.18	99.08	98.98
15	51.27	100.12	99.90	99.77	99.61	99.40	99.22	99.04	98.95	98.93
16	51.58	100.08	99.90	99.77	99.61	99.40	99.26	99.17	99.03	98.99
17	51.50	100.33	99.90	99.71	99.55	99.34	99.22	99.13	99.05	98.83
18	51.16	100.18	100.12	100.08	99.96	99.69	99.53	99.49	99.39	99.14
19	51.84	99.90	99.85	99.79	99.61	99.36	99.17	99.11	98.98	98.73
20	51.45	99.79	99.71	99.59	99.49	99.24	99.13	98.95	98.81	98.54
21	51.40	99.92	99.86	99.77	99.63	99.46	99.22	99.11	99.05	98.81
22	51.61	100.04	99.98	99.92	99.79	99.63	99.40	99.17	99.15	98.88
23	51.53	99.92	99.86	99.79	99.63	99.61	99.38	99.18	99.07	98.70
24	51.40	99.98	99.92	99.81	99.67	99.61	99.49	99.36	99.05	98.75
25	51.49	100.00	99.94	99.75	99.73	99.69	99.57	99.44	99.05	98.70
Ave.	51.42	100.08	99.88	99.75	99.59	99.42	99.28	99.16	99.00	98.82
Med.	51.43	100.10	99.90	99.77	99.61	99.40	99.22	99.15	98.99	98.81
st dev	0.18	0.1197	0.0956	0.1334	0.1260	0.1331	0.1213	0.1216	0.1174	0.1223
Min.	51.07	99.79	99.65	99.44	99.40	99.24	99.13	98.95	98.81	98.54
Max.	51.84	100.33	100.12	100.08	99.96	99.69	99.57	99.49	99.39	99.14

TM-21 Projection:

Test Duration: 9,000 hours

Failures Observed: 0

α: 1.506E-06

β: 1.002

Reported L_{70}: >54,000 hours

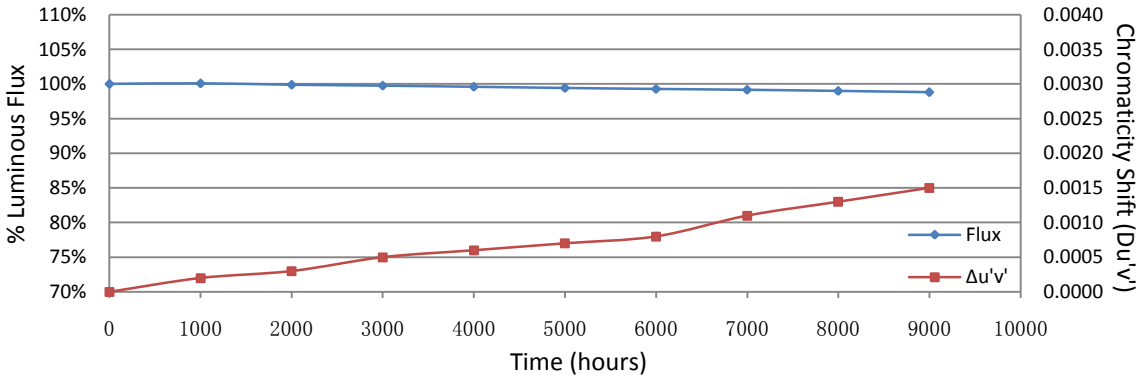
Reported L_{90}: >54,000 hours

3.2 Data Set 1, 55°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	2.820	2.817	2.819	2.822	2.815	2.821	2.812	2.810	2.810	2.807
2	2.810	2.818	2.809	2.815	2.803	2.809	2.813	2.810	2.805	2.805
3	2.830	2.815	2.829	2.809	2.814	2.809	2.813	2.817	2.806	2.806
4	2.820	2.823	2.813	2.832	2.813	2.816	2.811	2.808	2.832	2.808
5	2.810	2.818	2.822	2.808	2.811	2.809	2.810	2.809	2.807	2.807
6	2.810	2.812	2.812	2.813	2.808	2.808	2.815	2.807	2.807	2.807
7	2.810	2.813	2.823	2.813	2.824	2.809	2.821	2.826	2.809	2.810
8	2.820	2.813	2.838	2.818	2.808	2.809	2.809	2.822	2.807	2.807
9	2.820	2.814	2.813	2.820	2.808	2.814	2.813	2.810	2.809	2.808
10	2.810	2.815	2.810	2.821	2.807	2.812	2.812	2.826	2.809	2.809
11	2.820	2.813	2.809	2.810	2.807	2.805	2.808	2.809	2.803	2.805
12	2.810	2.815	2.813	2.813	2.808	2.810	2.811	2.817	2.809	2.810
13	2.810	2.813	2.810	2.811	2.813	2.810	2.811	2.813	2.808	2.808
14	2.810	2.811	2.808	2.807	2.805	2.804	2.811	2.804	2.805	2.807
15	2.820	2.823	2.809	2.807	2.810	2.808	2.813	2.807	2.806	2.807
16	2.810	2.833	2.823	2.835	2.811	2.821	2.811	2.807	2.808	2.815
17	2.810	2.816	2.810	2.807	2.808	2.805	2.812	2.832	2.803	2.806
18	2.820	2.821	2.813	2.818	2.811	2.810	2.814	2.807	2.808	2.809
19	2.810	2.813	2.812	2.807	2.808	2.805	2.811	2.805	2.806	2.809
20	2.810	2.809	2.808	2.819	2.804	2.806	2.813	2.804	2.804	2.808
21	2.820	2.812	2.810	2.823	2.807	2.806	2.831	2.806	2.807	2.805
22	2.810	2.813	2.815	2.813	2.810	2.812	2.815	2.808	2.808	2.808
23	2.830	2.816	2.814	2.811	2.811	2.811	2.812	2.807	2.808	2.808
24	2.810	2.810	2.812	2.816	2.832	2.805	2.806	2.805	2.804	2.806
25	2.830	2.837	2.826	2.822	2.826	2.824	2.840	2.819	2.819	2.819
Ave.	2.8156	2.8165	2.8152	2.8156	2.8113	2.8103	2.8139	2.8118	2.8083	2.8082
Med.	2.8100	2.8150	2.8130	2.8130	2.8100	2.8090	2.8120	2.8090	2.8070	2.8080
st dev	0.0071	0.0066	0.0076	0.0075	0.0068	0.0053	0.0072	0.0077	0.0058	0.0031
Min.	2.8100	2.8090	2.8080	2.8070	2.8030	2.8040	2.8060	2.8040	2.8030	2.8050
Max.	2.8300	2.8370	2.8380	2.8350	2.8320	2.8240	2.8400	2.8320	2.8320	2.8190

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

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.2623	0.5248	2714	0.0001	0.0006	0.0006	0.0007	0.0008	0.0009	0.0012	0.0015	0.0018
2	0.2612	0.5259	2733	0.0002	0.0003	0.0004	0.0006	0.0006	0.0007	0.0011	0.0012	0.0014
3	0.2623	0.5250	2714	0.0001	0.0004	0.0006	0.0008	0.0008	0.0009	0.0013	0.0016	0.0017
4	0.2624	0.5238	2717	0.0001	0.0003	0.0005	0.0006	0.0007	0.0008	0.0011	0.0014	0.0016
5	0.2625	0.5226	2719	0.0000	0.0003	0.0004	0.0006	0.0006	0.0007	0.0012	0.0013	0.0015
6	0.2613	0.5244	2738	0.0001	0.0004	0.0004	0.0006	0.0008	0.0008	0.0011	0.0014	0.0016
7	0.2620	0.5246	2722	0.0001	0.0004	0.0004	0.0006	0.0007	0.0007	0.0011	0.0013	0.0016
8	0.2620	0.5254	2719	0.0001	0.0004	0.0004	0.0006	0.0007	0.0008	0.0011	0.0012	0.0015
9	0.2627	0.5246	2707	0.0001	0.0004	0.0005	0.0006	0.0007	0.0008	0.0011	0.0013	0.0016
10	0.2610	0.5241	2746	0.0001	0.0004	0.0005	0.0006	0.0007	0.0008	0.0012	0.0013	0.0015
11	0.2611	0.5245	2741	0.0001	0.0003	0.0004	0.0006	0.0008	0.0008	0.0012	0.0015	0.0016
12	0.2622	0.5253	2715	0.0000	0.0002	0.0004	0.0006	0.0007	0.0008	0.0011	0.0013	0.0015
13	0.2621	0.5252	2717	0.0000	0.0003	0.0004	0.0006	0.0006	0.0008	0.0011	0.0011	0.0014
14	0.2626	0.5246	2710	0.0002	0.0003	0.0005	0.0006	0.0008	0.0008	0.0012	0.0013	0.0015
15	0.2616	0.5243	2731	0.0002	0.0002	0.0004	0.0006	0.0007	0.0008	0.0011	0.0013	0.0016
16	0.2623	0.5259	2711	0.0002	0.0003	0.0005	0.0006	0.0008	0.0008	0.0011	0.0013	0.0016
17	0.2619	0.5255	2720	0.0002	0.0002	0.0004	0.0006	0.0006	0.0007	0.0010	0.0013	0.0015
18	0.2619	0.5253	2721	0.0002	0.0003	0.0004	0.0006	0.0007	0.0008	0.0010	0.0012	0.0014
19	0.2608	0.5253	2744	0.0002	0.0001	0.0004	0.0005	0.0006	0.0006	0.0011	0.0013	0.0014
20	0.2623	0.5244	2715	0.0004	0.0004	0.0006	0.0007	0.0009	0.0008	0.0014	0.0016	0.0017
21	0.2620	0.5247	2720	0.0002	0.0001	0.0004	0.0006	0.0007	0.0007	0.0010	0.0013	0.0015
22	0.2620	0.5261	2716	0.0003	0.0003	0.0004	0.0006	0.0008	0.0007	0.0010	0.0013	0.0015
23	0.2625	0.5254	2707	0.0002	0.0002	0.0004	0.0006	0.0007	0.0007	0.0009	0.0014	0.0016
24	0.2627	0.5252	2705	0.0004	0.0004	0.0006	0.0007	0.0008	0.0008	0.0011	0.0014	0.0016
25	0.2623	0.5244	2716	0.0002	0.0002	0.0004	0.0006	0.0006	0.0006	0.0009	0.0013	0.0015
Ave.	0.2620	0.5249	2721	0.0002	0.0003	0.0005	0.0006	0.0007	0.0008	0.0011	0.0013	0.0015
Med.	0.2621	0.5248	2717	0.0002	0.0003	0.0004	0.0006	0.0007	0.0008	0.0011	0.0013	0.0015
st dev	0.0005	0.0008	12	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2608	0.5226	2705	0.0000	0.0001	0.0004	0.0005	0.0006	0.0006	0.0009	0.0011	0.0014
Max.	0.2627	0.5261	2746	0.0004	0.0006	0.0006	0.0008	0.0009	0.0009	0.0014	0.0016	0.0018



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

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	51.46	99.94	99.65	99.34	99.20	99.03	98.83	98.72	98.48	98.15
27	51.42	100.08	99.79	99.47	99.36	99.16	98.99	98.95	98.77	98.44
28	52.05	99.83	99.69	99.48	99.33	99.08	98.89	98.66	98.41	98.17
29	50.96	99.88	99.74	99.55	99.41	99.08	98.92	98.69	98.49	98.14
30	51.84	99.79	99.69	99.48	99.44	99.23	98.82	98.78	98.42	98.19
31	51.33	99.77	99.69	99.47	99.40	99.20	98.81	98.73	98.38	98.13
32	51.63	99.77	99.67	99.50	99.36	99.23	98.84	98.78	98.41	98.37
33	51.17	99.88	99.77	99.61	99.32	99.26	98.89	98.77	98.57	98.20
34	51.33	99.94	99.71	99.63	99.45	99.34	98.95	98.73	98.68	98.29
35	51.26	99.84	99.67	99.59	99.34	99.26	98.93	98.60	98.36	98.30
36	51.25	99.82	99.65	99.53	99.32	99.30	98.91	98.67	98.46	98.13
37	51.25	99.84	99.59	99.51	99.28	99.24	98.87	98.54	98.19	98.07
38	51.32	99.77	99.55	99.47	99.20	99.10	98.79	98.50	98.25	97.90
39	51.21	99.73	99.55	99.41	99.24	99.18	98.89	98.59	98.50	98.16
40	51.28	99.77	99.59	99.38	99.20	99.06	98.71	98.67	98.42	97.99
41	51.86	99.90	99.73	99.52	99.38	98.92	99.00	98.75	98.57	98.19
42	51.53	99.81	99.67	99.44	99.24	99.07	98.86	98.68	98.41	98.06
43	51.23	99.73	99.59	99.36	99.12	99.00	98.77	98.56	98.42	98.13
44	51.21	99.77	99.63	99.34	99.22	99.00	98.85	98.65	98.36	98.07
45	51.26	99.55	99.45	99.20	99.04	98.87	98.69	98.56	98.30	98.11
46	51.27	99.86	99.73	99.47	99.28	99.12	98.95	98.69	98.48	98.34
47	51.60	99.73	99.59	99.26	99.21	98.95	98.88	98.68	98.31	98.29
48	51.51	99.65	99.59	99.36	99.15	98.89	98.80	98.60	98.33	98.21
49	51.35	99.71	99.59	99.34	99.12	98.91	98.75	98.48	98.21	97.99
50	51.39	99.67	99.57	99.32	99.10	98.89	98.77	98.48	98.37	98.27
Ave.	51.40	99.80	99.65	99.44	99.27	99.10	98.85	98.66	98.42	98.17
Med.	51.33	99.79	99.65	99.47	99.28	99.08	98.86	98.67	98.41	98.16
st dev	0.24	0.1085	0.0784	0.1086	0.1117	0.1406	0.0797	0.1097	0.1342	0.1271
Min.	50.96	99.55	99.45	99.20	99.04	98.87	98.69	98.48	98.19	97.90
Max.	52.05	100.08	99.79	99.63	99.45	99.34	99.00	98.95	98.77	98.44

TM-21 Projection:

Test Duration: 9,000 hours

Failures Observed: 0

α: 2.237E-06

β: 1.002

Reported L_{70}: >54,000 hours

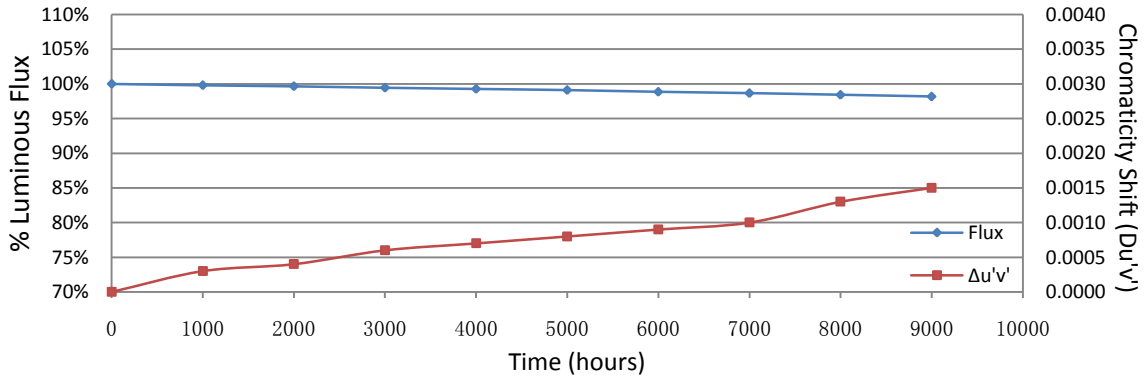
Reported L_{90}: 48,000 hours

3.5 Data Set 2, 85°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	2.820	2.837	2.815	2.815	2.813	2.820	2.828	2.809	2.812	2.810
27	2.820	2.837	2.821	2.811	2.815	2.809	2.820	2.811	2.809	2.809
28	2.820	2.832	2.826	2.826	2.821	2.818	2.833	2.820	2.819	2.819
29	2.830	2.812	2.810	2.803	2.804	2.802	2.819	2.802	2.804	2.805
30	2.840	2.838	2.823	2.823	2.837	2.825	2.826	2.820	2.822	2.821
31	2.810	2.809	2.806	2.814	2.809	2.803	2.810	2.805	2.806	2.806
32	2.830	2.812	2.823	2.834	2.809	2.808	2.814	2.807	2.806	2.807
33	2.820	2.807	2.807	2.811	2.807	2.804	2.810	2.802	2.804	2.802
34	2.830	2.813	2.812	2.808	2.825	2.820	2.810	2.804	2.808	2.807
35	2.810	2.808	2.806	2.804	2.808	2.808	2.807	2.801	2.803	2.806
36	2.860	2.811	2.815	2.809	2.809	2.808	2.813	2.808	2.810	2.809
37	2.810	2.811	2.824	2.811	2.812	2.808	2.813	2.804	2.806	2.804
38	2.850	2.811	2.811	2.812	2.807	2.803	2.815	2.803	2.807	2.806
39	2.820	2.820	2.811	2.809	2.807	2.809	2.810	2.806	2.807	2.807
40	2.830	2.820	2.810	2.808	2.803	2.803	2.813	2.801	2.806	2.804
41	2.830	2.818	2.815	2.809	2.813	2.810	2.822	2.809	2.809	2.810
42	2.820	2.807	2.813	2.806	2.807	2.813	2.811	2.805	2.808	2.810
43	2.820	2.810	2.812	2.804	2.810	2.808	2.818	2.807	2.807	2.804
44	2.820	2.815	2.813	2.807	2.814	2.813	2.815	2.805	2.812	2.807
45	2.820	2.812	2.811	2.809	2.807	2.812	2.814	2.809	2.815	2.811
46	2.810	2.807	2.806	2.804	2.807	2.807	2.813	2.801	2.803	2.804
47	2.810	2.813	2.807	2.804	2.805	2.808	2.811	2.805	2.806	2.805
48	2.830	2.826	2.817	2.808	2.808	2.810	2.830	2.812	2.808	2.807
49	2.810	2.807	2.816	2.806	2.803	2.807	2.817	2.806	2.805	2.803
50	2.810	2.817	2.815	2.810	2.813	2.815	2.819	2.809	2.826	2.806
Ave.	2.8232	2.8164	2.8138	2.8106	2.8109	2.8100	2.8164	2.8068	2.8091	2.8076
Med.	2.8200	2.8120	2.8130	2.8090	2.8090	2.8080	2.8140	2.8060	2.8070	2.8070
st dev	0.0128	0.0099	0.0059	0.0073	0.0075	0.0059	0.0068	0.0050	0.0058	0.0044
Min.	2.8100	2.8070	2.8060	2.8030	2.8030	2.8020	2.8070	2.8010	2.8030	2.8020
Max.	2.8600	2.8380	2.8260	2.8340	2.8370	2.8250	2.8330	2.8200	2.8260	2.8210

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

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
26	0.2621	0.5250	2717	0.0002	0.0003	0.0005	0.0006	0.0007	0.0007	0.0011	0.0015	0.0016
27	0.2616	0.5248	2730	0.0003	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0013	0.0016
28	0.2612	0.5251	2737	0.0002	0.0003	0.0004	0.0005	0.0007	0.0007	0.0009	0.0013	0.0014
29	0.2627	0.5244	2708	0.0002	0.0004	0.0005	0.0006	0.0008	0.0008	0.0011	0.0013	0.0015
30	0.2626	0.5246	2710	0.0002	0.0004	0.0006	0.0006	0.0008	0.0008	0.0009	0.0013	0.0016
31	0.2612	0.5234	2744	0.0002	0.0004	0.0005	0.0006	0.0008	0.0008	0.0010	0.0012	0.0014
32	0.2594	0.5231	2785	0.0002	0.0002	0.0005	0.0005	0.0007	0.0008	0.0008	0.0011	0.0012
33	0.2619	0.5250	2722	0.0002	0.0004	0.0005	0.0007	0.0008	0.0010	0.0011	0.0013	0.0016
34	0.2610	0.5246	2744	0.0003	0.0004	0.0006	0.0008	0.0008	0.0009	0.0009	0.0011	0.0014
35	0.2618	0.5251	2723	0.0001	0.0003	0.0005	0.0006	0.0007	0.0008	0.0009	0.0013	0.0015
36	0.2618	0.5243	2728	0.0002	0.0004	0.0006	0.0007	0.0008	0.0009	0.0009	0.0012	0.0014
37	0.2623	0.5254	2712	0.0002	0.0004	0.0005	0.0007	0.0008	0.0009	0.0009	0.0012	0.0014
38	0.2610	0.5244	2744	0.0003	0.0004	0.0006	0.0007	0.0008	0.0010	0.0011	0.0013	0.0016
39	0.2605	0.5241	2756	0.0001	0.0003	0.0005	0.0007	0.0007	0.0009	0.0011	0.0013	0.0014
40	0.2625	0.5259	2705	0.0004	0.0004	0.0006	0.0007	0.0008	0.0010	0.0010	0.0013	0.0015
41	0.2600	0.5258	2759	0.0004	0.0004	0.0006	0.0007	0.0006	0.0010	0.0010	0.0013	0.0015
42	0.2618	0.5262	2721	0.0004	0.0004	0.0006	0.0008	0.0009	0.0010	0.0011	0.0014	0.0016
43	0.2627	0.5246	2708	0.0002	0.0004	0.0006	0.0008	0.0008	0.0010	0.0011	0.0014	0.0016
44	0.2617	0.5244	2729	0.0002	0.0005	0.0006	0.0008	0.0008	0.0009	0.0009	0.0013	0.0016
45	0.2627	0.5266	2700	0.0006	0.0008	0.0009	0.0010	0.0011	0.0013	0.0012	0.0018	0.0020
46	0.2620	0.5265	2714	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0013	0.0019
47	0.2617	0.5257	2724	0.0003	0.0004	0.0006	0.0008	0.0009	0.0010	0.0010	0.0013	0.0015
48	0.2613	0.5254	2732	0.0002	0.0004	0.0006	0.0006	0.0007	0.0008	0.0010	0.0012	0.0015
49	0.2619	0.5259	2718	0.0003	0.0004	0.0005	0.0007	0.0007	0.0010	0.0010	0.0016	0.0016
50	0.2617	0.5258	2723	0.0002	0.0004	0.0006	0.0007	0.0008	0.0010	0.0010	0.0014	0.0018
Ave.	0.2616	0.5250	2728	0.0003	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0013	0.0015
Med.	0.2618	0.5250	2723	0.0002	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0013	0.0015
st dev	0.0008	0.0009	19	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
Min.	0.2594	0.5231	2700	0.0001	0.0002	0.0004	0.0005	0.0006	0.0007	0.0008	0.0011	0.0012
Max.	0.2627	0.5266	2785	0.0006	0.0008	0.0009	0.0010	0.0011	0.0013	0.0012	0.0018	0.0020



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

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	52.37	99.66	99.52	99.31	99.14	99.05	98.61	98.42	98.03	97.78
52	51.60	99.63	99.52	99.28	99.11	98.90	98.62	98.20	97.87	97.44
53	51.31	99.55	99.49	99.28	99.05	98.91	98.69	98.30	98.11	97.80
54	51.59	99.57	99.34	99.26	99.01	98.90	98.64	98.35	98.06	97.71
55	51.18	99.59	99.43	99.22	98.98	98.85	98.77	98.30	98.01	97.52
56	51.60	99.55	99.28	99.15	98.93	98.78	98.55	98.37	98.00	97.64
57	51.21	99.59	99.36	99.20	99.02	98.81	98.73	98.44	98.16	97.81
58	51.98	99.52	99.25	99.06	98.90	98.73	98.58	98.33	98.00	97.65
59	51.23	99.59	99.22	99.12	98.89	98.79	98.71	98.42	98.03	97.85
60	51.16	99.63	99.22	99.14	98.94	98.81	98.51	98.46	98.12	97.69
61	52.15	99.65	99.33	99.21	99.04	98.89	98.56	98.43	98.27	97.97
62	52.27	99.56	99.20	99.02	98.83	98.64	98.49	98.24	97.90	97.74
63	51.34	99.57	99.22	99.12	98.85	98.66	98.58	98.23	97.94	97.80
64	51.22	99.57	99.16	98.98	98.77	98.61	98.42	98.20	97.93	97.62
65	51.35	99.42	99.07	99.03	98.58	98.50	98.34	98.05	97.76	97.53
66	51.58	99.53	99.38	99.09	98.78	98.53	98.45	98.14	97.81	97.60
67	51.91	99.48	99.31	99.06	98.73	98.48	98.44	98.13	97.86	97.63
68	51.74	99.59	99.44	99.13	98.84	98.61	98.40	98.16	97.91	97.72
69	51.21	99.59	99.43	99.14	98.81	98.57	98.40	98.24	97.91	97.56
70	50.85	99.55	99.39	99.08	98.82	98.54	98.37	98.17	97.88	97.56
71	51.53	99.51	99.38	99.07	98.64	98.54	98.25	98.20	97.79	97.54
72	51.36	99.47	99.28	98.99	98.71	98.46	98.17	98.13	97.86	97.51
73	51.40	99.40	99.22	98.99	98.72	98.46	98.25	98.05	97.84	97.53
74	51.63	99.48	99.24	98.99	98.82	98.49	98.30	98.16	97.81	97.60
75	51.51	99.53	99.26	98.99	98.85	98.51	98.33	97.98	97.88	97.71
Ave.	51.53	99.55	99.32	99.12	98.87	98.68	98.49	98.24	97.95	97.66
Med.	51.51	99.56	99.31	99.12	98.85	98.64	98.49	98.23	97.91	97.64
st dev	0.37	0.0662	0.1165	0.1027	0.1433	0.1737	0.1643	0.1325	0.1280	0.1287
Min.	50.85	99.40	99.07	98.98	98.58	98.46	98.17	97.98	97.76	97.44
Max.	52.37	99.66	99.52	99.31	99.14	99.05	98.77	98.46	98.27	97.97

TM-21 Projection:

Test Duration: 9,000 hours

Failures Observed: 0

α: 2.468E-06

β: 0.999

Reported L_{70}: >54,000 hours

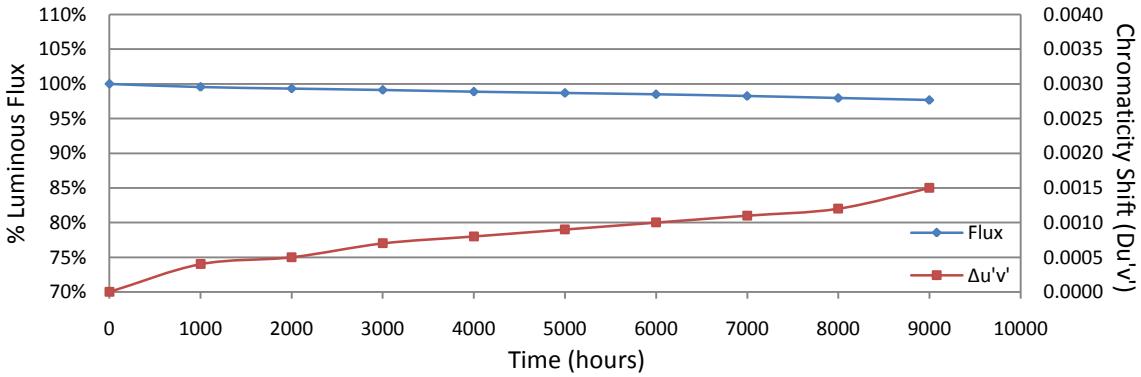
Reported L_{90}: 42,000 hours

3.8 Data Set 3, 105°C, 120mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	2.830	2.821	2.825	2.832	2.818	2.822	2.828	2.815	2.817	2.817
52	2.830	2.810	2.820	2.812	2.816	2.814	2.830	2.806	2.810	2.807
53	2.820	2.810	2.816	2.805	2.806	2.806	2.828	2.803	2.806	2.804
54	2.820	2.813	2.811	2.808	2.808	2.813	2.829	2.809	2.808	2.808
55	2.810	2.814	2.807	2.806	2.804	2.808	2.827	2.804	2.805	2.806
56	2.810	2.808	2.806	2.804	2.804	2.808	2.818	2.803	2.807	2.805
57	2.810	2.813	2.806	2.815	2.803	2.805	2.830	2.803	2.805	2.807
58	2.820	2.815	2.811	2.814	2.812	2.812	2.819	2.809	2.809	2.810
59	2.820	2.819	2.818	2.810	2.810	2.811	2.814	2.809	2.844	2.807
60	2.810	2.809	2.807	2.805	2.807	2.805	2.809	2.803	2.811	2.803
61	2.830	2.839	2.834	2.829	2.834	2.831	2.835	2.829	2.832	2.830
62	2.820	2.818	2.815	2.809	2.810	2.815	2.812	2.813	2.813	2.809
63	2.820	2.815	2.811	2.808	2.808	2.834	2.810	2.809	2.809	2.807
64	2.810	2.824	2.806	2.807	2.804	2.858	2.805	2.806	2.807	2.803
65	2.850	2.811	2.812	2.807	2.808	2.810	2.808	2.807	2.811	2.811
66	2.830	2.818	2.810	2.805	2.805	2.807	2.808	2.807	2.808	2.806
67	2.830	2.817	2.819	2.814	2.814	2.820	2.832	2.813	2.819	2.814
68	2.820	2.814	2.816	2.807	2.809	2.815	2.808	2.808	2.808	2.807
69	2.820	2.807	2.819	2.806	2.802	2.806	2.807	2.806	2.806	2.805
70	2.820	2.805	2.809	2.804	2.805	2.807	2.807	2.802	2.806	2.804
71	2.820	2.811	2.815	2.810	2.813	2.808	2.811	2.810	2.807	2.808
72	2.810	2.816	2.809	2.806	2.806	2.806	2.807	2.866	2.803	2.805
73	2.820	2.807	2.815	2.806	2.805	2.804	2.806	2.804	2.805	2.808
74	2.830	2.810	2.816	2.807	2.807	2.814	2.807	2.807	2.805	2.808
75	2.820	2.815	2.815	2.813	2.808	2.807	2.811	2.807	2.807	2.809
Ave.	2.8212	2.8144	2.8139	2.8100	2.8090	2.8138	2.8162	2.8103	2.8107	2.8083
Med.	2.8200	2.8140	2.8150	2.8070	2.8080	2.8100	2.8110	2.8070	2.8080	2.8070
st dev	0.0093	0.0069	0.0065	0.0070	0.0066	0.0120	0.0102	0.0128	0.0092	0.0055
Min.	2.8100	2.8050	2.8060	2.8040	2.8020	2.8040	2.8050	2.8020	2.8030	2.8030
Max.	2.8500	2.8390	2.8340	2.8320	2.8340	2.8580	2.8350	2.8660	2.8440	2.8300

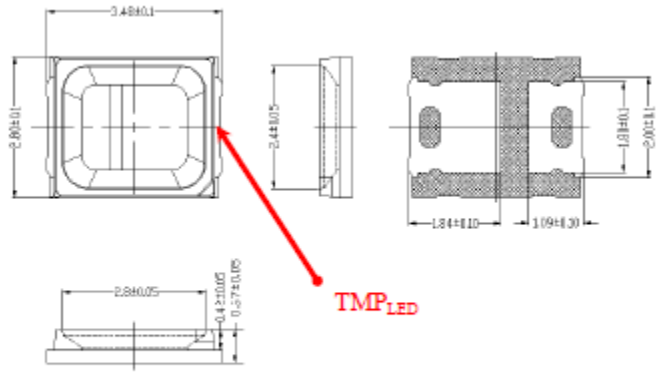
3.9 Data Set 3, 105°C, 120mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift (Δu'v')								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
51	0.2615	0.5253	2730	0.0003	0.0006	0.0005	0.0008	0.0008	0.0009	0.0011	0.0010	0.0014
52	0.2615	0.5243	2733	0.0002	0.0005	0.0005	0.0007	0.0008	0.0008	0.0011	0.0010	0.0014
53	0.2617	0.5247	2727	0.0004	0.0006	0.0007	0.0008	0.0011	0.0011	0.0014	0.0014	0.0016
54	0.2618	0.5246	2726	0.0003	0.0005	0.0006	0.0007	0.0008	0.0008	0.0011	0.0013	0.0015
55	0.2615	0.5247	2732	0.0003	0.0006	0.0006	0.0007	0.0008	0.0011	0.0013	0.0013	0.0017
56	0.2610	0.5248	2742	0.0004	0.0006	0.0006	0.0007	0.0009	0.0009	0.0011	0.0012	0.0015
57	0.2614	0.5237	2738	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0012	0.0013	0.0015
58	0.2619	0.5262	2717	0.0003	0.0006	0.0007	0.0008	0.0009	0.0009	0.0011	0.0012	0.0013
59	0.2619	0.5270	2714	0.0003	0.0005	0.0007	0.0008	0.0008	0.0010	0.0011	0.0013	0.0015
60	0.2619	0.5251	2722	0.0004	0.0006	0.0007	0.0009	0.0009	0.0010	0.0011	0.0013	0.0014
61	0.2620	0.5268	2712	0.0004	0.0006	0.0008	0.0009	0.0010	0.0011	0.0012	0.0013	0.0015
62	0.2620	0.5281	2708	0.0004	0.0006	0.0007	0.0008	0.0009	0.0009	0.0011	0.0013	0.0014
63	0.2624	0.5248	2712	0.0004	0.0005	0.0007	0.0008	0.0009	0.0009	0.0011	0.0012	0.0014
64	0.2623	0.5246	2716	0.0004	0.0005	0.0006	0.0008	0.0008	0.0008	0.0011	0.0012	0.0015
65	0.2615	0.5241	2734	0.0004	0.0004	0.0007	0.0008	0.0008	0.0009	0.0009	0.0011	0.0013
66	0.2617	0.5263	2721	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0014
67	0.2616	0.5249	2729	0.0004	0.0005	0.0006	0.0008	0.0009	0.0009	0.0010	0.0011	0.0013
68	0.2610	0.5243	2745	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0014
69	0.2622	0.5252	2716	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0016
70	0.2623	0.5239	2718	0.0005	0.0006	0.0008	0.0009	0.0009	0.0010	0.0011	0.0012	0.0014
71	0.2623	0.5245	2715	0.0004	0.0006	0.0007	0.0008	0.0009	0.0009	0.0011	0.0013	0.0015
72	0.2610	0.5248	2742	0.0006	0.0006	0.0008	0.0010	0.0010	0.0011	0.0013	0.0013	0.0016
73	0.2623	0.5244	2716	0.0005	0.0005	0.0008	0.0009	0.0009	0.0011	0.0011	0.0013	0.0015
74	0.2613	0.5270	2727	0.0004	0.0005	0.0007	0.0008	0.0009	0.0009	0.0011	0.0012	0.0013
75	0.2625	0.5254	2709	0.0004	0.0004	0.0008	0.0008	0.0010	0.0010	0.0016	0.0017	0.0018
Ave.	0.2618	0.5252	2724	0.0004	0.0005	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0015
Med.	0.2618	0.5248	2722	0.0004	0.0006	0.0007	0.0008	0.0009	0.0010	0.0011	0.0012	0.0015
st dev	0.0004	0.0011	11	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.2610	0.5237	2708	0.0002	0.0004	0.0005	0.0007	0.0008	0.0008	0.0009	0.0010	0.0013
Max.	0.2625	0.5281	2745	0.0006	0.0006	0.0008	0.0010	0.0011	0.0011	0.0016	0.0017	0.0018



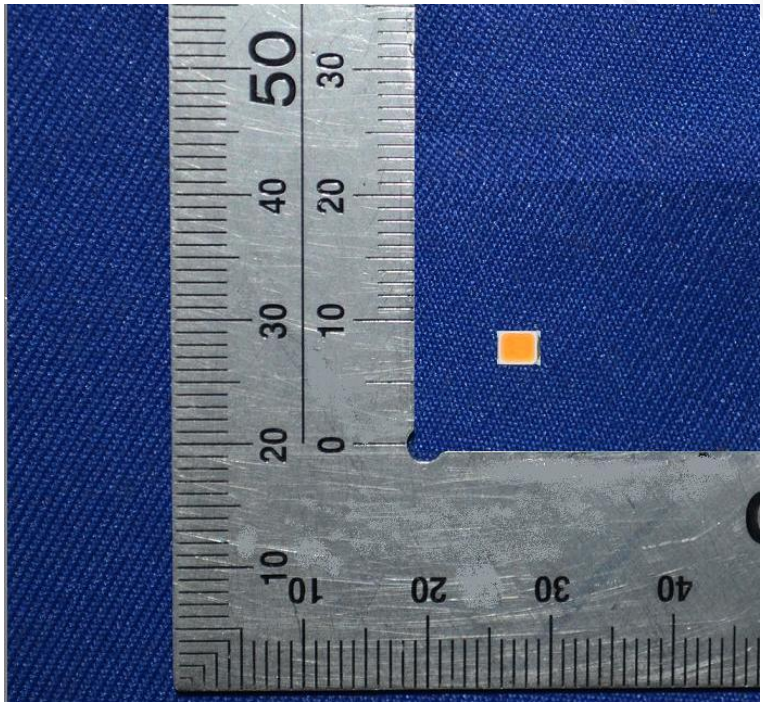
4 - EUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 EUT Photo



Attachment A – Declaration Letter

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