



TEST REPORT

According to ANSI/IES LM-80-15
For

Hongli Zhihui Group Co.,Ltd. Guangzhou Branch

Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model: HL-AF-5060H324BS5FS10GC-S1-PLS-R

Report Type: 9000 Hours Test Report	Product Type: LED Package
Reviewed By: Pote Wang	<i>Pote Wang</i>
Report Number: SZ2230424-21879E-EE-9000	
Test Date: 2023-04-26 to 2024-06-07	
Report Date: 2024-06-14	
Approved by: Blake Zhang / EE Engineer	<i>Blake Zhang</i>
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TABLE OF CONTENTS

1 - General Information	3
1.1 Description of LED Light Sources [#]	3
1.2 Standards and Reference Documentations.....	4
1.3 Testing Equipment.....	5
1.4 Drive Level.....	5
1.5 Ambient Conditions for Maintenance Test.....	5
1.6 Photometric Measurement Method and Uncertainty.....	5
1.7 Statement of Traceability.....	5
1.8 Sample Set.....	6
2 Summary of Test Result	8
3 Test Data	10
3.1 Data Set 1, 55°C, 20mA (Lumen Maintenance).....	10
3.2 Data Set 1, 55°C, 20mA (Forward Voltage).....	11
3.3 Data Set 1, 55°C, 20mA (Chromaticity Shift).....	12
3.4 Data Set 2, 85°C, 20mA (Lumen Maintenance).....	13
3.5 Data Set 2, 85°C, 20mA (Forward Voltage).....	14
3.6 Data Set 2, 85°C, 20mA (Chromaticity Shift).....	15
3.7 Data Set 3, 55°C, 20mA (Lumen Maintenance).....	16
3.8 Data Set 3, 55°C, 20mA (Forward Voltage).....	17
3.9 Data Set 3, 55°C, 20mA (Chromaticity Shift).....	18
3.10 Data Set 4, 85°C, 20mA (Lumen Maintenance).....	19
3.11 Data Set 4, 85°C, 20mA (Forward Voltage).....	20
3.12 Data Set 4, 85°C, 20mA (Chromaticity Shift).....	21
3.13 Data Set 5, 55°C, 20mA (Lumen Maintenance).....	22
3.14 Data Set 5, 55°C, 20mA (Forward Voltage).....	23
3.15 Data Set 5, 55°C, 20mA (Chromaticity Shift).....	24
3.16 Data Set 6, 85°C, 20mA (Lumen Maintenance).....	25
3.17 Data Set 6, 85°C, 20mA (Forward Voltage).....	26
3.18 Data Set 6, 85°C, 20mA (Chromaticity Shift).....	27
4 DUT Photo	28
4.1 Mechanical Dimensions.....	28
4.2 DUT Photo.....	28
Directions	30

1 - General Information

1.1 Description of LED Light Sources[#]

Sample Size:

60 PCS test samples were in good condition and received on 2023-04-24. The samples were numbered from 1 to 30 and 31 to 60.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-AF-5060H324BS5FS10GC-S1-PLS-R
Part Type:	LED Package
Drive Level:	DC 20mA
Wavelength:	Red:621nm; Green:522nm; Blue:465nm
Power:	Red:0.04W; Green:0.06W; Blue:0.06W
Average Current Density per LED die:	Red:1063.1mA/mm ² ; Green:775.0mA/mm ² ; Blue:775.0mA/mm ²
Average Power Density per LED die:	Red:2.126W/mm ² ; Green:2.325W/mm ² ; Blue:2.325W/mm ²
CRI:	N/A
Die Spacing:	N/A

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.

Family products covered by this report:

According to *ENERGY STAR[®] Requirements for the Use of LM-80 Data*, the following products can be covered by this report base on the information and declaration provided by manufacturer. The information of these models shows that the covered products meet all section 4 requirements of *ENERGY STAR[®] Requirements for the Use of LM-80 Data* (September 28, 2017)

This report covers the following models:

Series Name	Model Name	Total Input Current (mA)	Power (W)	Wavelength (nm)	Number of dies	Driver current per die (mA)	Current Density per Die (mA/mm ²)	Power Density per PCB (W/mm ²)	Die Spacing (mm)
Test model	HL-AF-5060H324BS5FS10GC-S1-PLS-R	20	0.04	Red: 621	1	20	1063.1	0.00133	0.4
		20	0.06	Green: 522	1	20	775.0	0.002	
		20	0.06	Blue: 465	1	20	775.0	0.002	
Multiple model	HL-AF-5060****B****F*** *GC-S1-***_***	20	0.04	Red: 621	1	20	1063.1	0.00133	0.4
		20	0.06	Green: 522	1	20	775.0	0.002	
		20	0.06	Blue: 465	1	20	775.0	0.002	
Multiple model	HL-AF-5060****G****G** **FC-S1-***_***	20	0.04	Red: 621	1	20	1063.1	0.00133	0.4
		20	0.06	Green: 522	1	20	775.0	0.002	
		20	0.06	Blue: 465	1	20	775.0	0.002	
Multiple model	HL-AF-5060****G****F** **BC-S1-***_***	20	0.04	Red: 621	1	20	1063.1	0.00133	0.4
		20	0.06	Green: 522	1	20	775.0	0.002	
		20	0.06	Blue: 465	1	20	775.0	0.002	
Multiple model	HL-AF-5060****B****B** **FC-S1-***_***	20	0.04	Red: 621	1	20	1063.1	0.00133	0.4
		20	0.06	Green: 522	1	20	775.0	0.002	
		20	0.06	Blue: 465	1	20	775.0	0.002	
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		20	0.06	Green: 522	1	20	775.0	0.002	
		20	0.06	Blue: 465	1	20	775.0	0.002	
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		20	0.06	Green: 522	1	20	775.0	0.002	
		20	0.06	Blue: 465	1	20	775.0	0.002	

Note: The model name begins with "HL", such as "HL-AF-5060****B****F****GC-S1-***_***", " " is described in detail as follows:

1. The first "****" is the letter or number which stands for the internal code.
2. The second "****" is the letter or number which stands for the internal code.
3. The third "****" is the letter or number which stands for the internal code.
4. The fourth "****" which stands for the bracket equipped with steps or none, no impact on product performances or reliability.
5. The fifth "*" is the letter R or none, which stands for the positive and negative polarity direction of the product.
6. The sixth "****" is the letter, which stands for the customer code.

1.2 Standards and Reference Documentations

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- CIE 127:2007: Measurement of LEDs
- ENERGY STAR[®] Requirements for the Use of LM-80 Data (This standard was not accredited by IAS)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
High Accuracy Array Spectroradiometer	EVERFINE	HAAS 2000	P600674CM5391140	2023-09-02	2024-09-01
0.5M Integrating Sphere	EVERFINE	0.5m	NA	2023-09-02	2024-09-01
LED Test Source	EVERFINE	LTS-300	P185616CJ1391143	2023-09-02	2024-09-01
Standard Light Source	EVERFINE	D062	M133799CM1381112	2023-05-12	2025-05-11
Multilayer aging machine	BACL	B2-384	N/A	2023-10-13	2024-10-12
Multilayer aging machine	BACL	B2-270	20023	2023-10-16	2024-10-15
Multilayer aging machine	BACL	B2-270	20013	2023-10-16	2024-10-15
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090008	2023-09-02	2024-09-01
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090005	2023-09-02	2024-09-01
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060010	2023-09-02	2024-09-01

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 $\pm 3\%$ of the specified value of the manufacturer during maintenance test, and was within $\pm 0.5\%$ 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 $\pm 3\%$ 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 \pm 2°C, RH <65%.

1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate u'v'. 2 π measurement was used and sample was driven by DC power supply. The forward current was regulated to within $\pm 0.5\%$ of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to 25°C \pm 2°C, RH <65%. The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

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, 20mA(Red)

Part Number: HL-AF-5060H324BS5FS10GC-S1-PLS-R
Number of Units: 30
Case Temperature: >53°C
Ambient Temperature: >50°C
Life Test Drive Current: 20mA
Measurement Current: 20mA

Data Set 2: 85°C, 20mA(Red)

Part Number: HL-AF-5060H324BS5FS10GC-S1-PLS-R
Number of Units: 30
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 20mA
Measurement Current: 20mA

Data Set 3: 55°C, 20mA(Green)

Part Number: HL-AF-5060H324BS5FS10GC-S1-PLS-R
Number of Units: 30
Case Temperature: >53°C
Ambient Temperature: >50°C
Life Test Drive Current: 20mA
Measurement Current: 20mA

Data Set 4: 85°C, 20mA(Green)

Part Number: HL-AF-5060H324BS5FS10GC-S1-PLS-R
Number of Units: 30
Case Temperature: >83°C
Ambient Temperature: >80°C
Life Test Drive Current: 20mA
Measurement Current: 20mA

Data Set 5: 55°C, 20mA(Blue)

Part Number: HL-AF-5060H324BS5FS10GC-S1-PLS-R
Number of Units: 30
Case Temperature: >53°C
Ambient Temperature: >50°C

Life Test Drive Current: 20mA

Measurement Current: 20mA

Data Set 6: 85°C, 20mA(Blue)

Part Number: HL-AF-5060H324BS5FS10GC-S1-PLS-R

Number of Units: 30

Case Temperature: >83°C

Ambient Temperature: >80°C

Life Test Drive Current: 20mA

Measurement Current: 20mA

2 Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM-21 L ₇₀ Lifetime	Reported TM-21 L ₉₀ Lifetime
1	30	0	1000hrs	9000hrs	2.131E-06	1.005	>54000 Hours	52,000 Hours
2	30	0	1000hrs	9000hrs	2.479E-06	1.004	>54000 Hours	44,000 Hours
3	30	0	1000hrs	9000hrs	2.108E-06	1.004	>54000 Hours	52,000 Hours
4	30	0	1000hrs	9000hrs	2.468E-06	1.003	>54000 Hours	44,000 Hours
5	30	0	1000hrs	9000hrs	2.124E-06	1.004	>54000 Hours	51,000 Hours
6	30	0	1000hrs	9000hrs	2.313E-06	1.003	>54000 Hours	47,000 Hours

Average Lumen Maintenance (Percentage of Initial Luminous Flux)

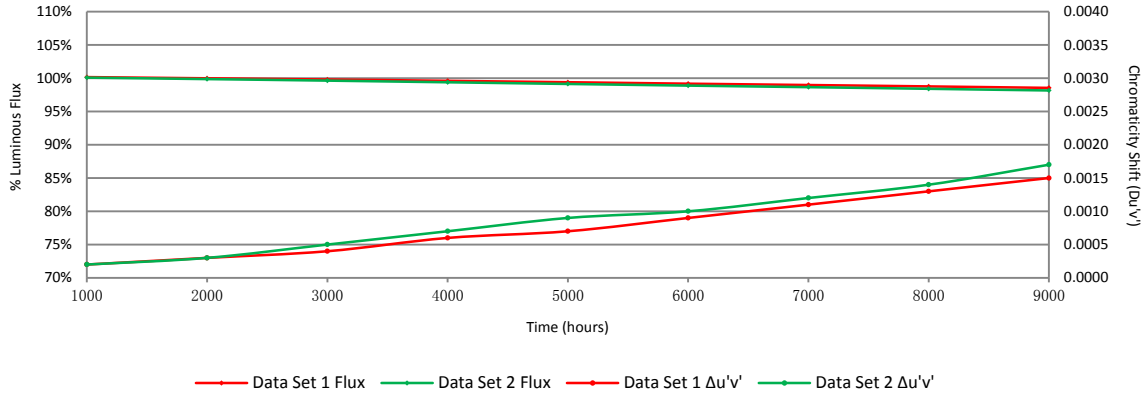
Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	100.17%	99.99%	99.81%	99.61%	99.40%	99.18%	98.98%	98.77%	98.55%
2	100.09%	99.87%	99.64%	99.39%	99.14%	98.89%	98.66%	98.41%	98.16%
3	100.16%	99.99%	99.80%	99.60%	99.40%	99.19%	98.97%	98.77%	98.56%
4	100.08%	99.85%	99.59%	99.34%	99.10%	98.85%	98.61%	98.37%	98.12%
5	100.16%	99.95%	99.73%	99.54%	99.33%	99.14%	98.92%	98.70%	98.49%
6	100.09%	99.86%	99.62%	99.38%	99.14%	98.92%	98.68%	98.47%	98.23%

Average Chromaticity Shift

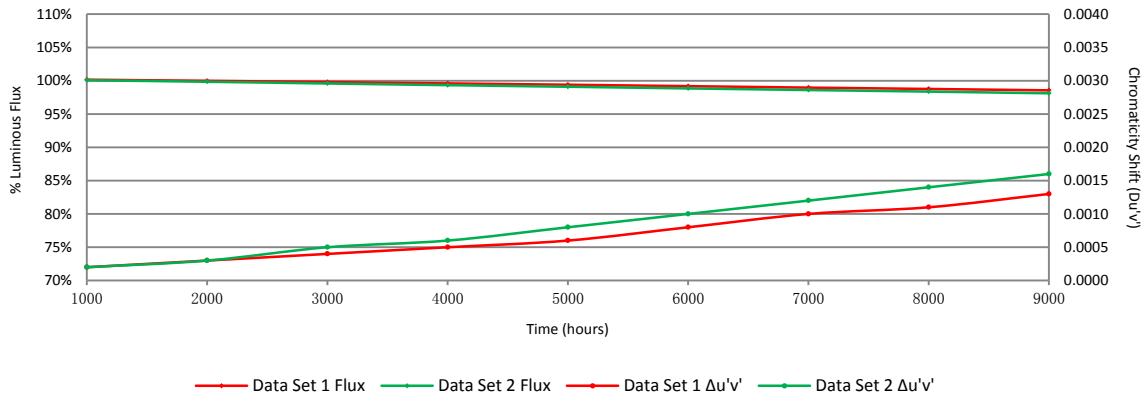
Data Set:	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009	0.0011	0.0013	0.0015
2	0.0002	0.0003	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014	0.0017
3	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0010	0.0011	0.0013
4	0.0002	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016
5	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0010	0.0012	0.0014
6	0.0002	0.0003	0.0005	0.0006	0.0008	0.0010	0.0011	0.0013	0.0015

Average Lumen Maintenance and Chromaticity Shift VS. Time

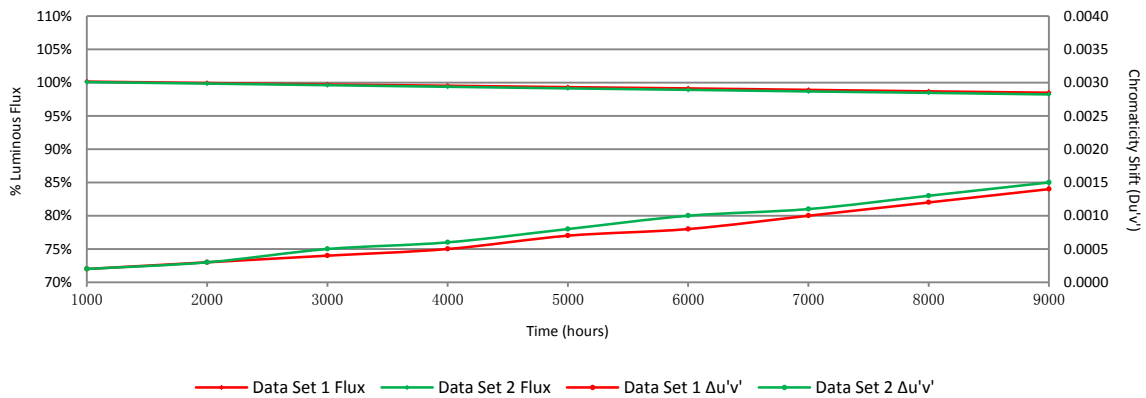
Red



Green



Blue



3 Test Data

3.1 Data Set 1, 55°C, 20mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	Ohr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	2.151	100.14	100.09	99.86	99.67	99.54	99.26	99.07	98.93	98.79
2	2.167	99.86	99.72	99.63	99.45	99.22	98.98	98.85	98.71	98.48
3	2.231	100.36	100.18	100.04	99.82	99.64	99.46	99.24	99.06	98.83
4	2.130	100.19	99.95	99.86	99.67	99.48	99.25	99.11	98.87	98.64
5	2.285	100.18	100.09	99.87	99.65	99.47	99.26	98.99	98.69	98.38
6	2.242	99.87	99.64	99.46	99.33	99.06	98.84	98.57	98.48	98.31
7	2.152	99.95	99.63	99.54	99.30	99.12	98.98	98.79	98.56	98.47
8	2.299	100.35	100.17	100.04	99.91	99.61	99.39	99.26	99.04	98.78
9	2.231	100.31	100.09	100.04	99.91	99.69	99.42	99.19	98.92	98.61
10	2.241	100.18	99.96	99.82	99.60	99.42	99.20	99.02	98.88	98.57
11	2.208	100.18	100.05	99.95	99.73	99.41	99.28	98.91	98.78	98.51
12	2.184	100.09	99.91	99.73	99.50	99.27	99.13	98.81	98.67	98.49
13	2.216	100.27	100.18	99.91	99.68	99.41	99.14	98.96	98.65	98.33
14	2.164	100.23	100.05	99.91	99.77	99.49	99.35	99.21	99.08	98.80
15	2.205	100.14	99.95	99.86	99.73	99.59	99.32	99.05	98.82	98.50
16	2.256	100.27	100.18	100.04	99.69	99.47	99.34	99.11	98.89	98.67
17	2.230	99.91	99.73	99.55	99.24	99.10	99.01	98.88	98.65	98.43
18	2.170	100.32	100.18	99.91	99.68	99.45	99.26	98.89	98.71	98.57
19	2.199	100.32	100.09	99.86	99.55	99.41	99.23	99.05	98.77	98.50
20	2.164	100.23	100.09	99.86	99.58	99.40	99.17	98.94	98.66	98.43
21	2.193	99.91	99.86	99.59	99.45	99.18	99.00	98.86	98.72	98.50
22	2.220	100.14	100.05	99.73	99.46	99.19	99.01	98.78	98.51	98.33
23	2.181	100.18	100.05	99.86	99.72	99.54	99.31	99.13	98.81	98.58
24	2.174	100.23	99.95	99.68	99.40	99.22	99.03	98.85	98.53	98.44
25	2.146	100.19	99.91	99.81	99.63	99.39	99.11	98.97	98.74	98.56
26	2.196	100.36	100.09	99.86	99.68	99.54	99.23	98.95	98.68	98.54
27	2.177	100.18	99.91	99.72	99.54	99.49	99.27	99.04	98.85	98.71
28	2.257	100.22	100.13	99.82	99.65	99.42	99.07	98.94	98.76	98.54
29	2.149	99.95	99.81	99.58	99.35	99.12	98.79	98.65	98.46	98.32
30	2.263	100.31	100.04	99.96	99.82	99.69	99.47	99.29	99.16	98.98
Avg.	2.203	100.17	99.99	99.81	99.61	99.40	99.18	98.98	98.77	98.55
Med.	2.198	100.19	100.05	99.86	99.65	99.42	99.23	98.97	98.75	98.52
st dev	0.044	0.15	0.16	0.16	0.18	0.18	0.17	0.17	0.18	0.17
Min.	2.130	99.86	99.63	99.46	99.24	99.06	98.79	98.57	98.46	98.31
Max.	2.299	100.36	100.18	100.04	99.91	99.69	99.47	99.29	99.16	98.98

3.2 Data Set 1, 55°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	2.071	2.073	2.073	2.075	2.074	2.076	2.076	2.076	2.074	2.074
2	2.061	2.062	2.064	2.064	2.065	2.065	2.065	2.065	2.065	2.064
3	2.048	2.049	2.050	2.053	2.053	2.053	2.055	2.053	2.053	2.052
4	2.060	2.064	2.063	2.065	2.065	2.065	2.067	2.067	2.067	2.063
5	2.070	2.071	2.071	2.072	2.072	2.074	2.074	2.074	2.072	2.071
6	2.075	2.074	2.075	2.075	2.076	2.078	2.078	2.076	2.075	2.076
7	2.074	2.073	2.074	2.075	2.076	2.076	2.076	2.074	2.074	2.076
8	2.075	2.075	2.076	2.077	2.078	2.080	2.080	2.076	2.075	2.077
9	2.052	2.053	2.054	2.055	2.055	2.055	2.057	2.057	2.053	2.055
10	2.072	2.074	2.075	2.076	2.076	2.076	2.078	2.074	2.076	2.075
11	2.054	2.056	2.057	2.059	2.057	2.057	2.059	2.059	2.057	2.058
12	2.065	2.070	2.071	2.061	2.059	2.059	2.059	2.057	2.058	2.058
13	2.072	2.076	2.076	2.080	2.078	2.078	2.080	2.080	2.077	2.078
14	2.065	2.068	2.071	2.076	2.072	2.072	2.074	2.074	2.072	2.073
15	2.062	2.066	2.066	2.072	2.070	2.070	2.070	2.070	2.068	2.069
16	2.075	2.075	2.076	2.080	2.078	2.080	2.078	2.078	2.077	2.076
17	2.066	2.071	2.070	2.076	2.074	2.074	2.074	2.074	2.072	2.072
18	2.066	2.072	2.073	2.080	2.076	2.076	2.078	2.076	2.073	2.076
19	2.065	2.070	2.072	2.076	2.074	2.072	2.074	2.074	2.072	2.075
20	2.073	2.078	2.079	2.084	2.082	2.080	2.082	2.082	2.079	2.084
21	2.070	2.074	2.077	2.082	2.078	2.078	2.078	2.078	2.076	2.079
22	2.052	2.056	2.059	2.063	2.059	2.061	2.061	2.061	2.059	2.061
23	2.066	2.071	2.074	2.076	2.072	2.074	2.076	2.074	2.074	2.077
24	2.070	2.074	2.077	2.082	2.078	2.078	2.080	2.080	2.077	2.081
25	2.047	2.052	2.055	2.057	2.055	2.055	2.057	2.055	2.055	2.056
26	2.056	2.056	2.058	2.063	2.061	2.059	2.059	2.059	2.057	2.062
27	2.049	2.054	2.054	2.059	2.055	2.057	2.055	2.055	2.057	2.059
28	2.070	2.075	2.077	2.082	2.078	2.078	2.078	2.080	2.075	2.080
29	2.070	2.074	2.075	2.078	2.076	2.076	2.076	2.076	2.075	2.078
30	2.072	2.077	2.078	2.082	2.078	2.078	2.080	2.080	2.078	2.082
Avg.	2.065	2.068	2.069	2.072	2.070	2.070	2.071	2.070	2.069	2.071
Med.	2.066	2.071	2.073	2.076	2.074	2.074	2.075	2.074	2.073	2.075
st dev	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Min.	2.047	2.049	2.050	2.053	2.053	2.053	2.055	2.053	2.053	2.052
Max.	2.075	2.078	2.079	2.084	2.082	2.080	2.082	2.082	2.079	2.084

3.3 Data Set 1, 55°C, 20mA (Chromaticity Shift)

No.	u'	v'	Wavelength (nm)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	0.5306	0.5202	622.7	0.0002	0.0004	0.0005	0.0005	0.0006	0.0009	0.0012	0.0011	0.0015
2	0.5297	0.5203	622.4	0.0002	0.0003	0.0005	0.0005	0.0007	0.0009	0.0011	0.0011	0.0014
3	0.5281	0.5206	622.0	0.0003	0.0003	0.0005	0.0007	0.0008	0.0011	0.0012	0.0012	0.0015
4	0.5291	0.5204	622.3	0.0002	0.0004	0.0004	0.0007	0.0009	0.0010	0.0014	0.0014	0.0017
5	0.5256	0.5209	621.4	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0009	0.0013	0.0015
6	0.5274	0.5207	621.9	0.0003	0.0003	0.0004	0.0005	0.0006	0.0007	0.0010	0.0012	0.0014
7	0.5305	0.5202	622.6	0.0001	0.0002	0.0004	0.0007	0.0009	0.0008	0.0009	0.0012	0.0014
8	0.5245	0.5211	621.1	0.0001	0.0002	0.0004	0.0007	0.0008	0.0009	0.0009	0.0013	0.0014
9	0.5265	0.5208	621.7	0.0002	0.0003	0.0005	0.0007	0.0008	0.0008	0.0010	0.0012	0.0013
10	0.5257	0.5210	621.4	0.0002	0.0003	0.0006	0.0006	0.0008	0.0007	0.0011	0.0013	0.0015
11	0.5263	0.5209	621.6	0.0001	0.0003	0.0004	0.0007	0.0009	0.0011	0.0013	0.0013	0.0015
12	0.5268	0.5208	621.7	0.0003	0.0003	0.0005	0.0007	0.0007	0.0010	0.0013	0.0014	0.0016
13	0.5245	0.5211	621.1	0.0002	0.0002	0.0005	0.0006	0.0007	0.0009	0.0009	0.0010	0.0013
14	0.5269	0.5208	621.7	0.0001	0.0001	0.0003	0.0006	0.0008	0.0009	0.0010	0.0011	0.0014
15	0.5278	0.5207	621.9	0.0002	0.0003	0.0004	0.0005	0.0008	0.0011	0.0011	0.0012	0.0015
16	0.5253	0.5210	621.3	0.0002	0.0004	0.0004	0.0006	0.0007	0.0012	0.0012	0.0014	0.0014
17	0.5258	0.5210	621.4	0.0001	0.0001	0.0002	0.0005	0.0008	0.0011	0.0012	0.0013	0.0015
18	0.5266	0.5208	621.7	0.0001	0.0002	0.0003	0.0004	0.0005	0.0008	0.0011	0.0012	0.0014
19	0.5273	0.5207	621.8	0.0002	0.0005	0.0005	0.0006	0.0010	0.0009	0.0014	0.0013	0.0015
20	0.5259	0.5209	621.5	0.0001	0.0003	0.0003	0.0005	0.0008	0.0011	0.0012	0.0012	0.0016
21	0.5250	0.5211	621.2	0.0001	0.0001	0.0004	0.0004	0.0008	0.0011	0.0013	0.0014	0.0015
22	0.5257	0.5209	621.5	0.0001	0.0003	0.0003	0.0005	0.0008	0.0011	0.0014	0.0015	0.0016
23	0.5274	0.5207	621.8	0.0002	0.0002	0.0004	0.0005	0.0009	0.0011	0.0013	0.0014	0.0017
24	0.5255	0.5210	621.3	0.0001	0.0001	0.0002	0.0003	0.0006	0.0010	0.0011	0.0014	0.0016
25	0.5270	0.5207	621.8	0.0001	0.0001	0.0003	0.0004	0.0005	0.0008	0.0011	0.0013	0.0016
26	0.5257	0.5209	621.5	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0011	0.0014	0.0015
27	0.5271	0.5207	621.8	0.0001	0.0003	0.0003	0.0004	0.0006	0.0007	0.0010	0.0011	0.0014
28	0.5261	0.5209	621.6	0.0002	0.0003	0.0004	0.0006	0.0007	0.0008	0.0011	0.0013	0.0015
29	0.5291	0.5204	622.3	0.0001	0.0001	0.0003	0.0004	0.0008	0.0007	0.0010	0.0012	0.0014
30	0.5249	0.5210	621.2	0.0001	0.0003	0.0005	0.0006	0.0007	0.0007	0.0010	0.0011	0.0013
Avg.	0.5268	0.5208	621.7	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009	0.0011	0.0013	0.0015
Med.	0.5266	0.5208	621.7	0.0002	0.0003	0.0004	0.0005	0.0008	0.0009	0.0011	0.0013	0.0015
st dev	0.0017	0.0003	0.4	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0001
Min.	0.5245	0.5202	621.1	0.0001	0.0001	0.0002	0.0003	0.0004	0.0005	0.0009	0.0010	0.0013
Max.	0.5306	0.5211	622.7	0.0003	0.0005	0.0006	0.0007	0.0010	0.0012	0.0014	0.0015	0.0017

3.4 Data Set 2, 85°C, 20mA (Lumen Maintenance)

No.	Φ(m)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	2.207	100.23	100.05	99.95	99.77	99.46	99.05	98.78	98.50	98.32
32	2.229	100.18	99.96	99.78	99.46	99.28	99.01	98.79	98.56	98.25
33	2.169	99.95	99.82	99.63	99.40	99.08	98.85	98.62	98.29	98.11
34	2.243	100.18	99.91	99.69	99.47	99.20	99.06	98.84	98.66	98.44
35	2.126	100.05	99.91	99.58	99.39	99.01	98.82	98.68	98.40	98.12
36	2.107	99.91	99.72	99.57	99.34	99.19	98.91	98.62	98.39	98.15
37	2.149	100.19	99.81	99.63	99.40	99.07	98.88	98.70	98.51	98.23
38	2.145	99.58	99.63	99.53	99.30	99.11	98.83	98.55	98.23	97.95
39	2.176	100.18	100.05	99.82	99.49	99.22	98.99	98.90	98.67	98.30
40	2.260	100.31	99.96	99.65	99.38	99.12	98.76	98.58	98.36	98.14
41	2.175	100.18	99.95	99.77	99.45	99.13	98.85	98.62	98.34	97.98
42	2.192	100.05	99.91	99.73	99.50	99.27	99.04	98.72	98.45	98.27
43	2.161	100.09	99.77	99.63	99.40	99.12	98.98	98.70	98.47	98.24
44	2.159	100.32	99.95	99.68	99.44	99.12	98.89	98.66	98.33	98.15
45	2.145	100.09	99.77	99.53	99.25	99.02	98.74	98.60	98.32	97.95
46	2.153	100.05	99.81	99.54	99.26	99.07	98.79	98.56	98.28	98.05
47	2.096	100.14	99.95	99.86	99.62	99.33	99.14	98.95	98.66	98.28
48	2.146	100.33	99.95	99.67	99.39	99.21	98.88	98.60	98.32	98.09
49	2.115	100.33	100.09	99.86	99.43	99.15	98.87	98.68	98.39	98.06
50	2.143	100.23	100.09	99.77	99.44	99.21	98.97	98.79	98.37	98.13
51	2.195	99.95	99.82	99.54	99.23	99.00	98.72	98.45	98.18	97.95
52	2.124	99.91	99.81	99.48	99.15	98.87	98.73	98.54	98.31	98.12
53	2.122	100.09	99.76	99.53	99.39	99.06	98.73	98.54	98.30	98.07
54	2.201	99.91	99.73	99.55	99.36	99.00	98.73	98.46	98.32	98.23
55	2.128	100.14	99.91	99.58	99.34	99.15	98.87	98.64	98.40	98.26
56	2.097	100.05	99.86	99.52	99.28	99.05	98.76	98.62	98.38	98.24
57	2.133	99.81	99.62	99.44	99.25	99.11	98.92	98.64	98.50	98.17
58	2.107	99.91	99.81	99.43	99.19	99.00	98.77	98.48	98.39	98.20
59	2.161	100.05	99.86	99.68	99.40	99.26	99.12	98.89	98.66	98.47
60	2.119	100.24	99.95	99.72	99.48	99.29	99.06	98.73	98.35	98.02
Avg.	2.156	100.09	99.87	99.64	99.39	99.14	98.89	98.66	98.41	98.16
Med.	2.148	100.09	99.88	99.63	99.39	99.12	98.88	98.64	98.38	98.15
st dev	0.042	0.17	0.12	0.13	0.13	0.12	0.13	0.13	0.13	0.13
Min.	2.096	99.58	99.62	99.43	99.15	98.87	98.72	98.45	98.18	97.95
Max.	2.260	100.33	100.09	99.95	99.77	99.46	99.14	98.95	98.67	98.47

3.5 Data Set 2, 85°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	2.067	2.074	2.071	2.078	2.076	2.076	2.082	2.076	2.076	2.079
32	2.069	2.076	2.076	2.080	2.080	2.078	2.084	2.080	2.079	2.081
33	2.052	2.059	2.058	2.061	2.061	2.059	2.065	2.059	2.060	2.064
34	2.067	2.075	2.074	2.078	2.078	2.076	2.084	2.076	2.076	2.081
35	2.059	2.064	2.065	2.070	2.067	2.065	2.072	2.070	2.066	2.072
36	2.067	2.074	2.077	2.078	2.078	2.076	2.082	2.076	2.077	2.082
37	2.062	2.069	2.072	2.072	2.070	2.072	2.076	2.074	2.069	2.076
38	2.041	2.046	2.048	2.051	2.051	2.051	2.055	2.051	2.048	2.054
39	2.045	2.050	2.053	2.055	2.055	2.055	2.059	2.055	2.052	2.058
40	2.064	2.070	2.073	2.072	2.072	2.072	2.076	2.074	2.072	2.075
41	2.077	2.076	2.079	2.080	2.078	2.078	2.082	2.080	2.078	2.084
42	2.069	2.071	2.074	2.076	2.074	2.074	2.078	2.074	2.073	2.075
43	2.072	2.074	2.076	2.080	2.078	2.078	2.082	2.078	2.077	2.080
44	2.064	2.067	2.070	2.072	2.070	2.072	2.074	2.070	2.069	2.071
45	2.073	2.074	2.075	2.078	2.076	2.078	2.078	2.078	2.077	2.079
46	2.048	2.050	2.054	2.057	2.053	2.053	2.055	2.055	2.054	2.055
47	2.063	2.067	2.069	2.072	2.070	2.072	2.072	2.070	2.068	2.073
48	2.067	2.072	2.074	2.076	2.074	2.076	2.080	2.076	2.074	2.076
49	2.045	2.051	2.052	2.053	2.053	2.053	2.053	2.051	2.052	2.053
50	2.066	2.071	2.071	2.072	2.072	2.074	2.074	2.072	2.073	2.074
51	2.054	2.055	2.058	2.059	2.059	2.061	2.059	2.059	2.059	2.059
52	2.045	2.051	2.051	2.053	2.051	2.055	2.051	2.053	2.053	2.053
53	2.048	2.052	2.054	2.055	2.053	2.055	2.053	2.055	2.055	2.056
54	2.069	2.072	2.074	2.074	2.074	2.076	2.076	2.076	2.075	2.075
55	2.051	2.056	2.058	2.059	2.059	2.059	2.061	2.059	2.059	2.058
56	2.072	2.072	2.071	2.074	2.074	2.074	2.074	2.074	2.073	2.072
57	2.050	2.055	2.055	2.057	2.057	2.059	2.057	2.057	2.057	2.055
58	2.064	2.070	2.071	2.072	2.072	2.072	2.072	2.072	2.071	2.069
59	2.066	2.070	2.071	2.072	2.074	2.074	2.074	2.072	2.073	2.071
60	2.048	2.052	2.053	2.055	2.055	2.055	2.055	2.055	2.054	2.053
Avg.	2.060	2.065	2.066	2.068	2.067	2.068	2.070	2.068	2.067	2.069
Med.	2.064	2.070	2.071	2.072	2.071	2.072	2.074	2.072	2.070	2.072
st dev	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.010	0.010	0.010
Min.	2.041	2.046	2.048	2.051	2.051	2.051	2.051	2.051	2.048	2.053
Max.	2.077	2.076	2.079	2.080	2.080	2.078	2.084	2.080	2.079	2.084

3.6 Data Set 2, 85°C, 20mA (Chromaticity Shift)

No.	u'	v'	Wavelength (nm)	Chromaticity Shift ($\Delta u'v'$)								
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	0.5270	0.5207	621.8	0.0003	0.0004	0.0006	0.0007	0.0008	0.0011	0.0011	0.0012	0.0016
32	0.5255	0.5209	621.4	0.0001	0.0002	0.0005	0.0006	0.0009	0.0013	0.0012	0.0014	0.0016
33	0.5278	0.5206	621.9	0.0002	0.0003	0.0005	0.0008	0.0009	0.0012	0.0013	0.0014	0.0017
34	0.5263	0.5209	621.6	0.0001	0.0004	0.0006	0.0008	0.0009	0.0010	0.0014	0.0014	0.0018
35	0.5296	0.5204	622.4	0.0001	0.0001	0.0003	0.0006	0.0008	0.0009	0.0011	0.0015	0.0018
36	0.5305	0.5202	622.6	0.0001	0.0004	0.0004	0.0006	0.0007	0.0009	0.0011	0.0013	0.0017
37	0.5276	0.5207	621.9	0.0001	0.0004	0.0004	0.0006	0.0009	0.0011	0.0013	0.0014	0.0019
38	0.5295	0.5204	622.4	0.0002	0.0002	0.0004	0.0006	0.0008	0.0009	0.0011	0.0013	0.0016
39	0.5280	0.5206	622.0	0.0002	0.0004	0.0006	0.0007	0.0008	0.0009	0.0009	0.0012	0.0014
40	0.5266	0.5209	621.6	0.0002	0.0005	0.0006	0.0008	0.0010	0.0010	0.0011	0.0013	0.0014
41	0.5244	0.5198	622.3	0.0003	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009	0.0012	0.0014
42	0.5267	0.5195	622.8	0.0001	0.0002	0.0003	0.0006	0.0009	0.0011	0.0012	0.0015	0.0016
43	0.5257	0.5196	622.6	0.0003	0.0004	0.0006	0.0007	0.0010	0.0011	0.0013	0.0015	0.0017
44	0.5273	0.5193	623.0	0.0002	0.0004	0.0006	0.0009	0.0010	0.0013	0.0013	0.0014	0.0016
45	0.5288	0.5191	623.4	0.0002	0.0004	0.0006	0.0008	0.0010	0.0009	0.0012	0.0016	0.0017
46	0.5276	0.5193	623.1	0.0002	0.0003	0.0004	0.0005	0.0008	0.0010	0.0013	0.0016	0.0019
47	0.5274	0.5193	623.1	0.0003	0.0002	0.0004	0.0006	0.0010	0.0011	0.0014	0.0017	0.0018
48	0.5267	0.5194	622.9	0.0001	0.0002	0.0004	0.0006	0.0009	0.0012	0.0014	0.0017	0.0020
49	0.5291	0.5191	623.5	0.0002	0.0004	0.0007	0.0009	0.0009	0.0011	0.0012	0.0015	0.0018
50	0.5271	0.5193	623.0	0.0002	0.0001	0.0004	0.0006	0.0009	0.0011	0.0012	0.0013	0.0016
51	0.5263	0.5195	622.7	0.0003	0.0003	0.0005	0.0007	0.0006	0.0008	0.0009	0.0014	0.0016
52	0.5290	0.5191	623.5	0.0001	0.0002	0.0006	0.0008	0.0008	0.0009	0.0010	0.0013	0.0014
53	0.5279	0.5192	623.2	0.0001	0.0002	0.0005	0.0008	0.0007	0.0009	0.0011	0.0014	0.0017
54	0.5268	0.5194	622.9	0.0001	0.0002	0.0004	0.0007	0.0010	0.0010	0.0012	0.0014	0.0017
55	0.5267	0.5195	622.8	0.0003	0.0004	0.0007	0.0007	0.0009	0.0012	0.0014	0.0017	0.0019
56	0.5292	0.5191	623.5	0.0001	0.0003	0.0004	0.0005	0.0005	0.0009	0.0010	0.0012	0.0015
57	0.5265	0.5194	622.8	0.0001	0.0004	0.0005	0.0007	0.0008	0.0011	0.0014	0.0015	0.0017
58	0.5276	0.5193	623.0	0.0001	0.0003	0.0004	0.0006	0.0006	0.0009	0.0012	0.0013	0.0015
59	0.5269	0.5194	622.9	0.0001	0.0003	0.0006	0.0008	0.0008	0.0011	0.0012	0.0015	0.0015
60	0.5277	0.5193	623.1	0.0003	0.0005	0.0006	0.0009	0.0011	0.0012	0.0014	0.0017	0.0018
Avg.	0.5275	0.5198	622.7	0.0002	0.0003	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014	0.0017
Med.	0.5274	0.5195	622.8	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0012	0.0014	0.0017
st dev	0.0013	0.0006	0.6	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002
Min.	0.5244	0.5191	621.4	0.0001	0.0001	0.0003	0.0005	0.0005	0.0007	0.0009	0.0012	0.0014
Max.	0.5305	0.5209	623.5	0.0003	0.0005	0.0007	0.0009	0.0011	0.0013	0.0014	0.0017	0.0020

3.7 Data Set 3, 55°C, 20mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	4.723	100.25	100.06	99.83	99.62	99.45	99.30	99.13	98.88	98.64
2	4.785	100.17	99.98	99.75	99.54	99.35	99.14	98.89	98.79	98.62
3	4.890	99.92	99.71	99.57	99.43	99.30	99.04	98.92	98.77	98.59
4	4.774	99.96	99.87	99.77	99.52	99.27	99.12	98.95	98.70	98.51
5	4.813	100.27	100.06	99.81	99.61	99.42	99.27	99.00	98.79	98.46
6	4.927	100.14	100.04	99.86	99.72	99.47	99.23	99.05	98.70	98.50
7	4.802	100.19	100.04	99.90	99.65	99.52	99.38	99.08	98.83	98.67
8	4.943	100.14	99.96	99.84	99.68	99.53	99.31	99.05	98.87	98.71
9	4.761	100.08	99.98	99.79	99.54	99.39	99.14	98.97	98.68	98.49
10	4.718	100.32	100.11	99.94	99.70	99.45	99.22	98.94	98.62	98.39
11	4.829	99.98	99.75	99.57	99.36	99.25	99.05	98.92	98.67	98.38
12	4.711	100.23	100.11	99.92	99.81	99.49	99.30	99.11	98.98	98.75
13	4.714	100.23	100.02	99.92	99.70	99.58	99.30	99.13	98.92	98.73
14	4.815	99.96	99.77	99.65	99.48	99.31	99.11	98.90	98.63	98.44
15	4.928	100.02	99.88	99.76	99.53	99.37	99.19	98.99	98.76	98.52
16	4.676	100.06	99.94	99.76	99.49	99.36	99.08	98.87	98.74	98.57
17	4.895	100.12	99.94	99.75	99.53	99.24	99.02	98.75	98.63	98.43
18	4.766	100.23	100.13	99.98	99.85	99.64	99.45	99.18	98.91	98.59
19	4.829	100.04	99.94	99.69	99.57	99.36	99.21	98.99	98.86	98.67
20	4.730	100.19	99.98	99.85	99.58	99.43	99.18	98.96	98.79	98.58
21	4.736	100.19	100.08	99.98	99.68	99.56	99.32	99.09	98.92	98.65
22	4.777	100.21	100.04	99.85	99.60	99.27	99.02	98.83	98.68	98.56
23	4.912	100.20	100.10	99.80	99.53	99.33	99.19	98.90	98.72	98.45
24	4.748	100.06	99.92	99.66	99.39	99.20	99.09	98.82	98.67	98.46
25	4.816	100.23	99.96	99.77	99.61	99.42	99.11	98.80	98.61	98.48
26	4.806	100.35	100.04	99.73	99.52	99.27	98.96	98.75	98.59	98.42
27	4.912	100.31	100.18	100.04	99.92	99.67	99.41	99.19	98.92	98.70
28	4.922	100.10	99.90	99.63	99.43	99.33	99.13	98.94	98.82	98.66
29	4.726	100.36	100.02	99.77	99.60	99.32	99.05	98.94	98.77	98.60
30	4.710	100.17	100.06	99.83	99.72	99.58	99.28	99.13	98.94	98.66
Avg.	4.803	100.16	99.99	99.80	99.60	99.40	99.19	98.97	98.77	98.56
Med.	4.794	100.18	100.00	99.79	99.59	99.38	99.18	98.96	98.77	98.58
st dev	0.080	0.12	0.11	0.12	0.13	0.12	0.13	0.12	0.11	0.11
Min.	4.676	99.92	99.71	99.57	99.36	99.20	98.96	98.75	98.59	98.38
Max.	4.943	100.36	100.18	100.04	99.92	99.67	99.45	99.19	98.98	98.75

3.8 Data Set 3, 55°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	3.108	3.115	3.120	3.121	3.124	3.122	3.123	3.127	3.130	3.118
2	3.108	3.118	3.122	3.123	3.127	3.124	3.125	3.126	3.131	3.118
3	3.103	3.106	3.113	3.113	3.118	3.116	3.115	3.118	3.126	3.110
4	3.109	3.114	3.119	3.118	3.125	3.123	3.124	3.124	3.128	3.117
5	3.109	3.113	3.117	3.117	3.122	3.119	3.121	3.119	3.126	3.116
6	3.112	3.115	3.119	3.119	3.125	3.122	3.128	3.123	3.127	3.118
7	3.108	3.107	3.111	3.115	3.118	3.116	3.120	3.115	3.122	3.110
8	3.116	3.119	3.121	3.124	3.125	3.124	3.127	3.126	3.132	3.118
9	3.096	3.100	3.102	3.106	3.107	3.106	3.105	3.108	3.111	3.100
10	3.109	3.113	3.118	3.119	3.120	3.119	3.120	3.119	3.127	3.113
11	3.104	3.103	3.114	3.110	3.118	3.113	3.109	3.113	3.121	3.105
12	3.110	3.110	3.121	3.118	3.120	3.119	3.117	3.119	3.125	3.115
13	3.111	3.113	3.119	3.117	3.122	3.118	3.119	3.121	3.126	3.115
14	3.114	3.118	3.124	3.124	3.127	3.128	3.125	3.129	3.137	3.126
15	3.114	3.122	3.123	3.121	3.129	3.127	3.125	3.128	3.134	3.125
16	3.086	3.091	3.094	3.092	3.098	3.097	3.096	3.096	3.105	3.097
17	3.106	3.108	3.105	3.110	3.118	3.116	3.116	3.119	3.124	3.117
18	3.108	3.109	3.111	3.110	3.117	3.115	3.116	3.118	3.124	3.116
19	3.104	3.106	3.109	3.109	3.127	3.124	3.125	3.128	3.131	3.124
20	3.114	3.114	3.116	3.118	3.126	3.121	3.122	3.124	3.130	3.124
21	3.117	3.120	3.123	3.122	3.130	3.126	3.127	3.131	3.135	3.126
22	3.100	3.103	3.107	3.109	3.115	3.110	3.111	3.114	3.118	3.109
23	3.116	3.119	3.125	3.126	3.124	3.125	3.123	3.130	3.131	3.123
24	3.111	3.116	3.125	3.125	3.126	3.125	3.123	3.128	3.123	3.124
25	3.096	3.101	3.107	3.108	3.109	3.108	3.107	3.114	3.106	3.107
26	3.092	3.095	3.105	3.102	3.105	3.102	3.101	3.105	3.101	3.101
27	3.104	3.105	3.115	3.114	3.117	3.115	3.114	3.120	3.114	3.111
28	3.115	3.117	3.122	3.124	3.128	3.126	3.125	3.130	3.125	3.124
29	3.112	3.114	3.118	3.122	3.125	3.122	3.122	3.127	3.119	3.121
30	3.088	3.091	3.094	3.095	3.098	3.099	3.097	3.103	3.096	3.097
Avg.	3.107	3.110	3.115	3.115	3.120	3.118	3.118	3.120	3.123	3.115
Med.	3.109	3.113	3.118	3.118	3.122	3.119	3.121	3.121	3.126	3.117
st dev	0.008	0.008	0.009	0.009	0.009	0.008	0.009	0.009	0.010	0.009
Min.	3.086	3.091	3.094	3.092	3.098	3.097	3.096	3.096	3.096	3.097
Max.	3.117	3.122	3.125	3.126	3.130	3.128	3.128	3.131	3.137	3.126

3.9 Data Set 3, 55°C, 20mA (Chromaticity Shift)

No.	u'	v'	Wavelength (nm)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	0.0529	0.5697	521.9	0.0002	0.0002	0.0004	0.0006	0.0007	0.0009	0.0011	0.0014	0.0017
2	0.0529	0.5686	521.3	0.0002	0.0001	0.0004	0.0005	0.0007	0.0009	0.0010	0.0013	0.0014
3	0.0528	0.5688	521.4	0.0003	0.0001	0.0003	0.0004	0.0005	0.0007	0.0009	0.0011	0.0014
4	0.0536	0.5691	521.8	0.0002	0.0002	0.0003	0.0004	0.0005	0.0009	0.0009	0.0012	0.0014
5	0.0536	0.5692	521.9	0.0002	0.0001	0.0002	0.0005	0.0006	0.0008	0.0009	0.0011	0.0013
6	0.0537	0.5695	522.1	0.0003	0.0001	0.0002	0.0004	0.0004	0.0006	0.0008	0.0010	0.0012
7	0.0527	0.5684	521.1	0.0002	0.0001	0.0002	0.0003	0.0004	0.0006	0.0008	0.0009	0.0011
8	0.0531	0.5688	521.5	0.0001	0.0001	0.0002	0.0003	0.0004	0.0006	0.0010	0.0010	0.0011
9	0.0524	0.5681	520.9	0.0002	0.0001	0.0003	0.0003	0.0004	0.0005	0.0008	0.0010	0.0013
10	0.0527	0.5689	521.4	0.0001	0.0002	0.0004	0.0004	0.0005	0.0007	0.0011	0.0012	0.0012
11	0.0529	0.5684	521.2	0.0001	0.0003	0.0004	0.0004	0.0005	0.0006	0.0009	0.0012	0.0013
12	0.0526	0.5688	521.3	0.0001	0.0004	0.0005	0.0006	0.0007	0.0007	0.0010	0.0012	0.0014
13	0.0526	0.5688	521.3	0.0003	0.0003	0.0004	0.0005	0.0006	0.0007	0.0009	0.0013	0.0014
14	0.0543	0.5696	522.3	0.0002	0.0004	0.0004	0.0006	0.0007	0.0007	0.0009	0.0012	0.0015
15	0.0540	0.5693	522.1	0.0002	0.0003	0.0004	0.0004	0.0006	0.0007	0.0009	0.0012	0.0014
16	0.0531	0.5689	521.5	0.0002	0.0005	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0014
17	0.0527	0.5686	521.2	0.0001	0.0002	0.0004	0.0004	0.0005	0.0008	0.0009	0.0010	0.0013
18	0.0532	0.5693	521.8	0.0002	0.0002	0.0005	0.0004	0.0006	0.0006	0.0009	0.0010	0.0012
19	0.0531	0.5689	521.5	0.0000	0.0002	0.0005	0.0004	0.0006	0.0007	0.0008	0.0009	0.0011
20	0.0530	0.5699	522.0	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008	0.0011	0.0012	0.0014
21	0.0539	0.5697	522.3	0.0001	0.0002	0.0005	0.0005	0.0006	0.0008	0.0009	0.0011	0.0013
22	0.0524	0.5680	520.8	0.0001	0.0003	0.0004	0.0004	0.0007	0.0009	0.0011	0.0012	0.0013
23	0.0529	0.5687	521.4	0.0001	0.0003	0.0004	0.0005	0.0008	0.0010	0.0012	0.0013	0.0014
24	0.0537	0.5694	522.0	0.0003	0.0005	0.0005	0.0006	0.0009	0.0010	0.0012	0.0014	0.0015
25	0.0528	0.5684	521.2	0.0001	0.0003	0.0004	0.0006	0.0008	0.0008	0.0011	0.0012	0.0014
26	0.0526	0.5682	521.0	0.0001	0.0004	0.0003	0.0004	0.0008	0.0010	0.0010	0.0011	0.0013
27	0.0528	0.5683	521.1	0.0001	0.0002	0.0003	0.0006	0.0006	0.0009	0.0010	0.0010	0.0012
28	0.0533	0.5690	521.7	0.0001	0.0002	0.0004	0.0006	0.0007	0.0010	0.0010	0.0012	0.0013
29	0.0527	0.5698	521.9	0.0001	0.0002	0.0003	0.0005	0.0008	0.0009	0.0011	0.0012	0.0013
30	0.0527	0.5686	521.2	0.0002	0.0002	0.0003	0.0006	0.0007	0.0009	0.0009	0.0011	0.0013
Avg.	0.0531	0.5689	521.5	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0010	0.0011	0.0013
Med.	0.0529	0.5689	521.5	0.0002	0.0002	0.0004	0.0005	0.0006	0.0008	0.0010	0.0012	0.0013
st dev	0.0005	0.0005	0.4	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.0524	0.5680	520.8	0.0000	0.0001	0.0002	0.0003	0.0004	0.0005	0.0008	0.0009	0.0011
Max.	0.0543	0.5699	522.3	0.0003	0.0005	0.0005	0.0006	0.0009	0.0010	0.0012	0.0014	0.0017

3.10 Data Set 4, 85°C, 20mA (Lumen Maintenance)

No.	Φ(m)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	4.909	100.12	99.96	99.74	99.51	99.19	99.02	98.84	98.53	98.25
32	4.643	100.15	99.91	99.68	99.42	99.16	98.88	98.64	98.45	98.21
33	4.792	99.94	99.73	99.48	99.25	99.10	98.79	98.66	98.35	98.14
34	4.892	99.92	99.61	99.47	99.28	99.06	98.88	98.55	98.26	98.14
35	4.926	100.18	99.94	99.68	99.33	99.17	99.01	98.72	98.50	98.23
36	4.644	100.22	99.96	99.74	99.46	99.25	99.01	98.71	98.43	98.17
37	4.654	100.34	100.17	99.91	99.55	99.29	98.97	98.60	98.43	98.17
38	4.866	100.23	99.96	99.61	99.28	99.16	98.87	98.56	98.34	98.11
39	4.809	100.12	99.81	99.50	99.25	98.94	98.71	98.48	98.27	98.09
40	4.768	100.21	99.98	99.77	99.43	99.27	98.91	98.68	98.43	98.07
41	4.848	100.12	99.83	99.65	99.40	99.05	98.72	98.47	98.27	98.04
42	4.892	100.33	100.12	99.73	99.45	99.24	98.83	98.53	98.20	97.89
43	4.662	100.19	99.91	99.61	99.25	99.10	98.76	98.41	98.20	97.96
44	4.840	99.94	99.63	99.46	99.21	99.09	98.74	98.60	98.33	98.04
45	4.701	100.23	100.04	99.77	99.55	99.30	98.96	98.70	98.55	98.43
46	4.814	100.12	99.85	99.54	99.31	99.04	98.86	98.69	98.42	98.13
47	4.694	100.23	100.09	99.79	99.42	99.08	98.85	98.62	98.42	98.21
48	4.726	100.02	99.72	99.53	99.22	98.92	98.67	98.35	98.20	98.01
49	4.851	99.98	99.79	99.48	99.24	98.82	98.62	98.45	98.27	98.08
50	4.698	100.04	99.81	99.43	99.23	98.96	98.74	98.53	98.28	98.13
51	4.887	100.04	99.84	99.59	99.28	99.02	98.69	98.51	98.14	97.91
52	4.879	99.94	99.61	99.43	99.24	99.00	98.79	98.50	98.28	97.95
53	4.847	99.83	99.63	99.36	99.24	98.91	98.60	98.37	98.21	98.00
54	4.900	100.06	99.73	99.51	99.24	99.12	98.88	98.65	98.43	98.22
55	4.833	99.88	99.75	99.40	99.30	99.01	98.84	98.70	98.47	98.16
56	4.763	100.08	99.92	99.75	99.60	99.33	99.12	98.91	98.72	98.38
57	4.767	100.02	99.85	99.69	99.33	99.20	99.06	98.78	98.47	98.09
58	4.742	99.96	99.75	99.58	99.43	99.18	98.99	98.78	98.61	98.23
59	4.675	99.85	99.72	99.44	99.29	99.06	98.80	98.61	98.42	98.14
60	4.885	100.02	99.84	99.53	99.28	99.08	98.85	98.55	98.34	97.93
Avg.	4.794	100.08	99.85	99.59	99.34	99.10	98.85	98.61	98.37	98.12
Med.	4.812	100.07	99.84	99.58	99.30	99.10	98.85	98.61	98.38	98.13
st dev	0.091	0.14	0.15	0.14	0.11	0.13	0.13	0.13	0.14	0.13
Min.	4.643	99.83	99.61	99.36	99.21	98.82	98.60	98.35	98.14	97.89
Max.	4.926	100.34	100.17	99.91	99.60	99.33	99.12	98.91	98.72	98.43

3.11 Data Set 4, 85°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	3.106	3.111	3.114	3.122	3.124	3.124	3.121	3.127	3.118	3.122
32	3.109	3.113	3.117	3.125	3.127	3.125	3.124	3.129	3.122	3.124
33	3.097	3.101	3.105	3.111	3.113	3.114	3.108	3.115	3.108	3.110
34	3.112	3.116	3.122	3.128	3.128	3.126	3.126	3.128	3.124	3.126
35	3.115	3.122	3.126	3.132	3.131	3.132	3.128	3.132	3.126	3.130
36	3.106	3.115	3.115	3.124	3.119	3.123	3.119	3.126	3.119	3.121
37	3.096	3.104	3.105	3.114	3.109	3.114	3.107	3.116	3.111	3.109
38	3.096	3.107	3.103	3.111	3.106	3.110	3.107	3.113	3.109	3.108
39	3.103	3.111	3.111	3.118	3.114	3.118	3.116	3.119	3.113	3.116
40	3.101	3.110	3.130	3.118	3.116	3.116	3.117	3.119	3.113	3.117
41	3.120	3.131	3.130	3.139	3.135	3.137	3.134	3.140	3.132	3.142
42	3.110	3.121	3.120	3.126	3.124	3.125	3.125	3.127	3.119	3.129
43	3.107	3.116	3.115	3.120	3.118	3.122	3.120	3.123	3.113	3.125
44	3.111	3.124	3.120	3.128	3.123	3.127	3.124	3.127	3.120	3.129
45	3.103	3.118	3.110	3.119	3.116	3.120	3.119	3.118	3.114	3.123
46	3.097	3.110	3.105	3.114	3.116	3.113	3.110	3.115	3.106	3.116
47	3.099	3.116	3.109	3.119	3.117	3.118	3.117	3.121	3.110	3.122
48	3.113	3.127	3.123	3.130	3.126	3.128	3.127	3.129	3.121	3.132
49	3.100	3.113	3.107	3.115	3.113	3.115	3.110	3.115	3.106	3.118
50	3.107	3.121	3.117	3.123	3.121	3.123	3.120	3.123	3.115	3.124
51	3.100	3.107	3.110	3.117	3.115	3.117	3.114	3.117	3.109	3.117
52	3.099	3.108	3.109	3.117	3.114	3.114	3.113	3.116	3.106	3.116
53	3.101	3.109	3.109	3.117	3.113	3.113	3.115	3.118	3.106	3.116
54	3.113	3.120	3.121	3.130	3.127	3.126	3.126	3.130	3.121	3.128
55	3.100	3.106	3.113	3.117	3.116	3.119	3.111	3.119	3.107	3.116
56	3.102	3.115	3.116	3.121	3.119	3.120	3.114	3.122	3.108	3.128
57	3.098	3.107	3.110	3.121	3.116	3.115	3.111	3.120	3.109	3.123
58	3.107	3.118	3.121	3.130	3.130	3.125	3.122	3.131	3.119	3.130
59	3.096	3.103	3.109	3.116	3.117	3.111	3.109	3.115	3.104	3.117
60	3.097	3.106	3.109	3.114	3.118	3.113	3.110	3.118	3.105	3.118
Avg.	3.104	3.114	3.114	3.121	3.119	3.120	3.117	3.122	3.114	3.122
Med.	3.103	3.113	3.114	3.120	3.118	3.120	3.117	3.121	3.113	3.122
st dev	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Min.	3.096	3.101	3.103	3.111	3.106	3.110	3.107	3.113	3.104	3.108
Max.	3.120	3.131	3.130	3.139	3.135	3.137	3.134	3.140	3.132	3.142

3.12 Data Set 4, 85°C, 20mA (Chromaticity Shift)

No.	u'	v'	Wavelength (nm)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
31	0.0528	0.5686	521.2	0.0002	0.0003	0.0005	0.0005	0.0009	0.0010	0.0012	0.0013	0.0015
32	0.0532	0.5688	521.5	0.0002	0.0004	0.0006	0.0006	0.0009	0.0011	0.0013	0.0013	0.0015
33	0.0527	0.5682	521.0	0.0001	0.0003	0.0004	0.0007	0.0008	0.0010	0.0011	0.0012	0.0014
34	0.0531	0.5688	521.5	0.0002	0.0004	0.0006	0.0006	0.0009	0.0011	0.0013	0.0014	0.0016
35	0.0526	0.5683	521.1	0.0002	0.0003	0.0005	0.0007	0.0005	0.0010	0.0012	0.0014	0.0014
36	0.0527	0.5695	521.7	0.0003	0.0004	0.0007	0.0006	0.0009	0.0012	0.0014	0.0014	0.0016
37	0.0527	0.5685	521.2	0.0003	0.0004	0.0006	0.0006	0.0009	0.0011	0.0014	0.0016	0.0017
38	0.0530	0.5687	521.4	0.0003	0.0003	0.0004	0.0008	0.0008	0.0009	0.0012	0.0014	0.0016
39	0.0530	0.5684	521.2	0.0002	0.0003	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014	0.0015
40	0.0532	0.5689	521.6	0.0002	0.0004	0.0004	0.0007	0.0008	0.0009	0.0012	0.0014	0.0016
41	0.0532	0.5692	521.8	0.0003	0.0003	0.0004	0.0007	0.0007	0.0008	0.0010	0.0013	0.0016
42	0.0528	0.5684	521.2	0.0004	0.0004	0.0005	0.0006	0.0009	0.0010	0.0012	0.0015	0.0016
43	0.0530	0.5687	521.4	0.0003	0.0004	0.0005	0.0006	0.0009	0.0009	0.0011	0.0013	0.0015
44	0.0532	0.5688	521.5	0.0003	0.0004	0.0005	0.0006	0.0008	0.0011	0.0012	0.0014	0.0016
45	0.0532	0.5698	522.1	0.0003	0.0004	0.0006	0.0005	0.0009	0.0010	0.0012	0.0014	0.0015
46	0.0533	0.5686	521.5	0.0003	0.0005	0.0006	0.0008	0.0009	0.0010	0.0012	0.0015	0.0016
47	0.0526	0.5685	521.1	0.0002	0.0004	0.0005	0.0007	0.0009	0.0010	0.0013	0.0015	0.0016
48	0.0533	0.5692	521.8	0.0001	0.0004	0.0006	0.0006	0.0009	0.0011	0.0012	0.0015	0.0017
49	0.0531	0.5687	521.4	0.0001	0.0002	0.0005	0.0005	0.0008	0.0009	0.0011	0.0013	0.0015
50	0.0525	0.5687	521.2	0.0002	0.0002	0.0004	0.0006	0.0008	0.0009	0.0012	0.0014	0.0016
51	0.0533	0.5688	521.6	0.0003	0.0001	0.0004	0.0004	0.0007	0.0009	0.0011	0.0013	0.0015
52	0.0527	0.5686	521.2	0.0002	0.0001	0.0004	0.0005	0.0008	0.0010	0.0012	0.0013	0.0015
53	0.0522	0.5679	520.7	0.0002	0.0001	0.0004	0.0006	0.0008	0.0010	0.0011	0.0014	0.0015
54	0.0527	0.5685	521.2	0.0002	0.0003	0.0005	0.0007	0.0010	0.0011	0.0013	0.0014	0.0016
55	0.0534	0.5688	521.6	0.0001	0.0003	0.0006	0.0007	0.0010	0.0011	0.0013	0.0014	0.0016
56	0.0526	0.5682	521.0	0.0001	0.0002	0.0006	0.0006	0.0009	0.0011	0.0012	0.0014	0.0017
57	0.0526	0.5682	521.0	0.0001	0.0003	0.0007	0.0007	0.0009	0.0011	0.0013	0.0014	0.0017
58	0.0538	0.5697	522.2	0.0001	0.0002	0.0005	0.0007	0.0009	0.0011	0.0013	0.0014	0.0016
59	0.0530	0.5690	521.6	0.0002	0.0002	0.0005	0.0006	0.0009	0.0010	0.0013	0.0013	0.0015
60	0.0524	0.5683	520.9	0.0002	0.0002	0.0004	0.0006	0.0008	0.0009	0.0012	0.0013	0.0015
Avg.	0.0529	0.5687	521.4	0.0002	0.0003	0.0005	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016
Med.	0.0530	0.5687	521.4	0.0002	0.0003	0.0005	0.0006	0.0009	0.0010	0.0012	0.0014	0.0016
st dev	0.0004	0.0004	0.3	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Min.	0.0522	0.5679	520.7	0.0001	0.0001	0.0004	0.0004	0.0005	0.0008	0.0010	0.0012	0.0014
Max.	0.0538	0.5698	522.2	0.0004	0.0005	0.0007	0.0008	0.0010	0.0012	0.0014	0.0016	0.0017

3.13 Data Set 5, 55°C, 20mA (Lumen Maintenance)

No.	Φ(lm)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	1.133	100.26	100.18	99.91	99.74	99.47	99.29	99.12	98.85	98.59
2	1.120	100.27	100.09	99.73	99.46	99.20	99.02	98.93	98.75	98.66
3	1.196	100.17	99.92	99.75	99.58	99.41	99.16	99.00	98.75	98.49
4	1.131	100.18	99.91	99.73	99.56	99.29	98.94	98.76	98.67	98.50
5	1.165	100.26	100.09	99.74	99.48	99.40	99.23	98.97	98.71	98.63
6	1.161	100.17	99.91	99.74	99.48	99.22	99.14	98.97	98.71	98.54
7	1.123	100.09	99.91	99.64	99.47	99.20	99.02	98.84	98.66	98.31
8	1.148	100.09	99.83	99.65	99.39	99.13	98.95	98.78	98.69	98.43
9	1.182	100.17	99.92	99.75	99.58	99.32	99.07	98.90	98.82	98.65
10	1.134	100.09	99.91	99.65	99.47	99.29	99.12	98.94	98.68	98.59
11	1.160	100.09	99.83	99.66	99.57	99.31	99.14	99.05	98.79	98.62
12	1.124	100.27	100.09	99.73	99.56	99.47	99.29	99.02	98.67	98.40
13	1.130	100.27	100.09	99.73	99.56	99.38	99.12	98.94	98.76	98.41
14	1.129	100.27	99.91	99.82	99.65	99.47	99.29	99.11	98.85	98.67
15	1.167	100.26	100.09	99.83	99.66	99.40	99.06	98.80	98.46	98.29
16	1.112	100.09	99.91	99.82	99.55	99.46	99.28	99.01	98.65	98.47
17	1.208	100.25	99.92	99.67	99.50	99.25	99.09	98.84	98.68	98.51
18	1.143	100.09	99.91	99.74	99.48	99.39	99.13	98.95	98.69	98.43
19	1.177	100.17	99.92	99.83	99.58	99.41	99.32	99.07	98.90	98.64
20	1.147	100.26	99.91	99.65	99.48	99.30	99.13	98.87	98.78	98.69
21	1.119	100.18	99.91	99.64	99.55	99.37	99.11	98.84	98.57	98.48
22	1.158	99.91	99.74	99.57	99.31	99.14	98.88	98.70	98.53	98.27
23	1.130	100.18	99.91	99.73	99.47	99.20	99.12	98.94	98.85	98.67
24	1.133	100.09	99.91	99.74	99.65	99.29	99.21	98.94	98.68	98.41
25	1.178	100.17	100.08	99.83	99.66	99.49	99.32	98.98	98.64	98.30
26	1.174	99.91	99.74	99.57	99.40	99.15	98.98	98.81	98.55	98.38
27	1.180	100.08	99.92	99.75	99.49	99.24	99.07	98.81	98.64	98.31
28	1.124	100.09	99.91	99.82	99.56	99.38	99.29	99.02	98.75	98.49
29	1.131	100.09	99.91	99.82	99.65	99.47	99.29	98.94	98.59	98.32
30	1.146	100.26	100.09	99.74	99.65	99.30	99.04	98.78	98.69	98.43
Avg.	1.149	100.16	99.95	99.73	99.54	99.33	99.14	98.92	98.70	98.49
Med.	1.145	100.17	99.91	99.74	99.55	99.32	99.12	98.94	98.69	98.48
st dev	0.025	0.10	0.11	0.08	0.09	0.11	0.12	0.11	0.10	0.13
Min.	1.112	99.91	99.74	99.57	99.31	99.13	98.88	98.70	98.46	98.27
Max.	1.208	100.27	100.18	99.91	99.74	99.49	99.32	99.12	98.90	98.69

3.14 Data Set 5, 55°C, 20mA (Forward Voltage)

No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
1	3.048	3.051	3.055	3.049	3.054	3.048	3.054	3.051	3.048	3.052
2	3.045	3.050	3.055	3.049	3.052	3.049	3.053	3.048	3.049	3.048
3	3.043	3.046	3.052	3.048	3.050	3.046	3.048	3.045	3.048	3.047
4	3.053	3.054	3.057	3.055	3.054	3.053	3.055	3.052	3.054	3.053
5	3.033	3.033	3.036	3.035	3.033	3.032	3.034	3.033	3.032	3.033
6	3.023	3.023	3.027	3.027	3.022	3.024	3.027	3.025	3.023	3.028
7	3.044	3.042	3.046	3.046	3.043	3.043	3.045	3.042	3.043	3.044
8	3.048	3.046	3.049	3.051	3.047	3.047	3.049	3.047	3.048	3.048
9	3.016	3.014	3.020	3.019	3.015	3.016	3.018	3.015	3.018	3.017
10	3.044	3.042	3.045	3.046	3.041	3.043	3.045	3.041	3.044	3.044
11	3.017	3.015	3.018	3.018	3.019	3.016	3.017	3.014	3.019	3.017
12	3.027	3.026	3.030	3.028	3.029	3.027	3.028	3.026	3.027	3.029
13	3.050	3.048	3.051	3.048	3.048	3.048	3.050	3.047	3.047	3.049
14	3.051	3.048	3.052	3.051	3.050	3.048	3.050	3.047	3.048	3.050
15	3.027	3.025	3.029	3.029	3.027	3.026	3.028	3.022	3.025	3.027
16	3.045	3.045	3.050	3.051	3.046	3.044	3.047	3.044	3.045	3.046
17	3.033	3.035	3.034	3.037	3.032	3.033	3.033	3.031	3.034	3.035
18	3.037	3.040	3.039	3.043	3.037	3.036	3.038	3.034	3.040	3.040
19	3.036	3.038	3.037	3.041	3.035	3.034	3.034	3.034	3.036	3.037
20	3.052	3.051	3.051	3.054	3.049	3.046	3.049	3.047	3.051	3.051
21	3.046	3.046	3.045	3.051	3.044	3.044	3.047	3.045	3.045	3.045
22	3.025	3.029	3.026	3.033	3.025	3.023	3.031	3.025	3.026	3.025
23	3.048	3.051	3.049	3.054	3.045	3.045	3.052	3.048	3.048	3.047
24	3.038	3.041	3.039	3.043	3.036	3.035	3.040	3.039	3.036	3.039
25	3.042	3.044	3.042	3.046	3.038	3.039	3.044	3.041	3.040	3.042
26	3.025	3.025	3.027	3.031	3.023	3.023	3.027	3.024	3.023	3.023
27	3.020	3.020	3.022	3.026	3.019	3.017	3.022	3.020	3.021	3.017
28	3.042	3.043	3.043	3.045	3.040	3.038	3.043	3.043	3.041	3.039
29	3.054	3.054	3.055	3.056	3.051	3.050	3.054	3.053	3.054	3.052
30	3.041	3.042	3.041	3.044	3.041	3.037	3.042	3.041	3.040	3.040
Avg.	3.038	3.039	3.041	3.042	3.038	3.037	3.040	3.037	3.038	3.039
Med.	3.042	3.042	3.043	3.046	3.041	3.039	3.044	3.041	3.041	3.041
st dev	0.011	0.012	0.012	0.011	0.012	0.011	0.011	0.011	0.011	0.011
Min.	3.016	3.014	3.018	3.018	3.015	3.016	3.017	3.014	3.018	3.017
Max.	3.054	3.054	3.057	3.056	3.054	3.053	3.055	3.053	3.054	3.053

3.15 Data Set 5, 55°C, 20mA (Chromaticity Shift)

No.	u'	v'	Wavelength (nm)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
1	0.1695	0.1321	465.3	0.0002	0.0002	0.0004	0.0007	0.0008	0.0011	0.0013	0.0016	0.0017
2	0.1715	0.1280	464.8	0.0002	0.0004	0.0003	0.0004	0.0006	0.0008	0.0010	0.0011	0.0016
3	0.1690	0.1328	465.5	0.0001	0.0003	0.0004	0.0004	0.0005	0.0006	0.0009	0.0010	0.0013
4	0.1693	0.1329	465.4	0.0001	0.0003	0.0003	0.0005	0.0005	0.0007	0.0008	0.0009	0.0012
5	0.1688	0.1332	465.5	0.0001	0.0003	0.0004	0.0005	0.0005	0.0006	0.0008	0.0010	0.0011
6	0.1691	0.1326	465.5	0.0001	0.0002	0.0003	0.0005	0.0006	0.0007	0.0007	0.0009	0.0010
7	0.1689	0.1335	465.5	0.0001	0.0003	0.0003	0.0005	0.0008	0.0010	0.0013	0.0015	0.0016
8	0.1718	0.1281	464.8	0.0002	0.0002	0.0003	0.0006	0.0007	0.0009	0.0012	0.0013	0.0015
9	0.1686	0.1331	465.6	0.0002	0.0002	0.0003	0.0005	0.0006	0.0008	0.0009	0.0013	0.0016
10	0.1719	0.1283	464.8	0.0002	0.0004	0.0004	0.0007	0.0008	0.0008	0.0011	0.0011	0.0013
11	0.1697	0.1315	465.3	0.0001	0.0003	0.0004	0.0005	0.0007	0.0009	0.0009	0.0010	0.0011
12	0.1709	0.1308	465.0	0.0002	0.0005	0.0006	0.0009	0.0009	0.0012	0.0013	0.0013	0.0016
13	0.1720	0.1289	464.8	0.0001	0.0004	0.0006	0.0007	0.0009	0.0011	0.0013	0.0016	0.0018
14	0.1697	0.1327	465.3	0.0002	0.0004	0.0004	0.0007	0.0007	0.0009	0.0011	0.0014	0.0017
15	0.1686	0.1331	465.6	0.0001	0.0002	0.0002	0.0005	0.0005	0.0006	0.0007	0.0009	0.0012
16	0.1718	0.1288	464.8	0.0001	0.0001	0.0002	0.0004	0.0006	0.0007	0.0009	0.0010	0.0013
17	0.1706	0.1296	465.1	0.0001	0.0002	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009	0.0011
18	0.1683	0.1348	465.7	0.0002	0.0004	0.0005	0.0005	0.0006	0.0007	0.0008	0.0011	0.0012
19	0.1687	0.1332	465.5	0.0001	0.0002	0.0005	0.0004	0.0006	0.0007	0.0009	0.0011	0.0012
20	0.1691	0.1345	465.5	0.0001	0.0003	0.0004	0.0006	0.0009	0.0011	0.0014	0.0015	0.0017
21	0.1715	0.1294	464.9	0.0002	0.0002	0.0003	0.0004	0.0006	0.0007	0.0011	0.0012	0.0014
22	0.1695	0.1314	465.3	0.0002	0.0005	0.0004	0.0005	0.0007	0.0009	0.0011	0.0013	0.0014
23	0.1723	0.1267	464.6	0.0000	0.0003	0.0004	0.0006	0.0008	0.0009	0.0011	0.0014	0.0015
24	0.1718	0.1294	464.8	0.0003	0.0002	0.0003	0.0004	0.0006	0.0006	0.0009	0.0011	0.0015
25	0.1709	0.1293	465.0	0.0001	0.0001	0.0003	0.0006	0.0006	0.0007	0.0008	0.0009	0.0011
26	0.1693	0.1320	465.4	0.0001	0.0002	0.0004	0.0004	0.0005	0.0008	0.0008	0.0009	0.0011
27	0.1698	0.1314	465.3	0.0002	0.0002	0.0004	0.0004	0.0005	0.0007	0.0009	0.0010	0.0012
28	0.1721	0.1275	464.7	0.0003	0.0004	0.0004	0.0006	0.0006	0.0008	0.0009	0.0011	0.0013
29	0.1696	0.1329	465.3	0.0002	0.0004	0.0004	0.0005	0.0007	0.0009	0.0010	0.0012	0.0015
30	0.1713	0.1301	464.9	0.0002	0.0002	0.0006	0.0005	0.0007	0.0009	0.0011	0.0011	0.0014
Avg.	0.1702	0.1311	465.2	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0010	0.0012	0.0014
Med.	0.1697	0.1315	465.3	0.0002	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.0011	0.0014
st dev	0.0013	0.0022	0.3	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002
Min.	0.1683	0.1267	464.6	0.0000	0.0001	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009	0.0010
Max.	0.1723	0.1348	465.7	0.0003	0.0005	0.0006	0.0009	0.0009	0.0012	0.0014	0.0016	0.0018

3.16 Data Set 6, 85°C, 20mA (Lumen Maintenance)

No.	Φ(m)	Lumen Maintenance (%)								
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	1.152	100.09	99.83	99.65	99.39	99.13	98.96	98.70	98.44	98.18
32	1.130	100.09	99.91	99.82	99.56	99.38	99.03	98.76	98.50	98.23
33	1.171	100.17	99.83	99.66	99.32	99.15	98.98	98.80	98.55	98.29
34	1.130	100.18	99.91	99.65	99.38	99.20	98.94	98.76	98.41	98.14
35	1.149	100.09	99.91	99.65	99.48	99.22	99.04	98.78	98.52	98.26
36	1.116	100.18	99.82	99.64	99.37	99.10	98.84	98.66	98.48	98.30
37	1.132	99.91	99.73	99.56	99.38	99.03	98.85	98.59	98.50	98.32
38	1.183	100.08	99.83	99.66	99.49	99.15	98.82	98.56	98.31	98.14
39	1.198	100.08	99.75	99.50	99.25	99.00	98.75	98.50	98.41	98.16
40	1.166	100.17	99.91	99.66	99.49	99.14	98.80	98.63	98.37	98.20
41	1.143	100.17	99.91	99.65	99.39	99.13	98.78	98.60	98.43	98.16
42	1.182	100.08	99.92	99.75	99.58	99.24	99.07	98.73	98.39	98.22
43	1.123	100.09	99.82	99.55	99.20	99.02	98.84	98.58	98.49	98.22
44	1.160	99.91	99.74	99.48	99.31	99.05	98.71	98.53	98.45	98.10
45	1.133	99.82	99.65	99.47	99.21	98.94	98.68	98.59	98.32	97.97
46	1.161	100.09	99.83	99.57	99.40	99.14	99.05	98.88	98.62	98.45
47	1.119	100.18	99.82	99.64	99.46	99.20	99.11	98.75	98.57	98.21
48	1.112	100.09	99.91	99.64	99.37	99.19	98.92	98.65	98.47	98.38
49	1.196	100.08	99.83	99.50	99.33	99.25	99.00	98.83	98.66	98.33
50	1.121	100.18	99.91	99.73	99.46	99.11	98.84	98.75	98.48	98.31
51	1.090	99.91	99.82	99.54	99.17	99.08	98.90	98.72	98.44	98.26
52	1.200	100.17	99.92	99.75	99.50	99.25	99.00	98.67	98.50	98.17
53	1.161	100.26	99.91	99.66	99.31	99.05	98.79	98.62	98.45	98.19
54	1.136	100.09	99.82	99.56	99.38	99.12	98.94	98.77	98.68	98.50
55	1.103	99.91	99.82	99.55	99.18	99.00	98.82	98.55	98.28	98.10
56	1.144	100.26	100.09	99.74	99.48	99.30	99.13	98.78	98.60	98.34
57	1.157	100.09	99.91	99.65	99.22	99.05	98.79	98.53	98.36	98.01
58	1.159	100.09	99.91	99.57	99.40	99.31	99.22	98.88	98.45	98.19
59	1.094	100.18	99.82	99.54	99.36	99.09	98.90	98.54	98.45	98.26
60	1.090	100.09	99.91	99.72	99.45	99.27	99.08	98.62	98.44	98.17
Avg.	1.144	100.09	99.86	99.62	99.38	99.14	98.92	98.68	98.47	98.23
Med.	1.144	100.09	99.83	99.64	99.38	99.14	98.91	98.66	98.45	98.22
st dev	0.031	0.11	0.08	0.09	0.11	0.10	0.13	0.11	0.10	0.11
Min.	1.090	99.82	99.65	99.47	99.17	98.94	98.68	98.50	98.28	97.97
Max.	1.200	100.26	100.09	99.82	99.58	99.38	99.22	98.88	98.68	98.50

3.17 Data Set 6, 85°C, 20mA (Forward Voltage)

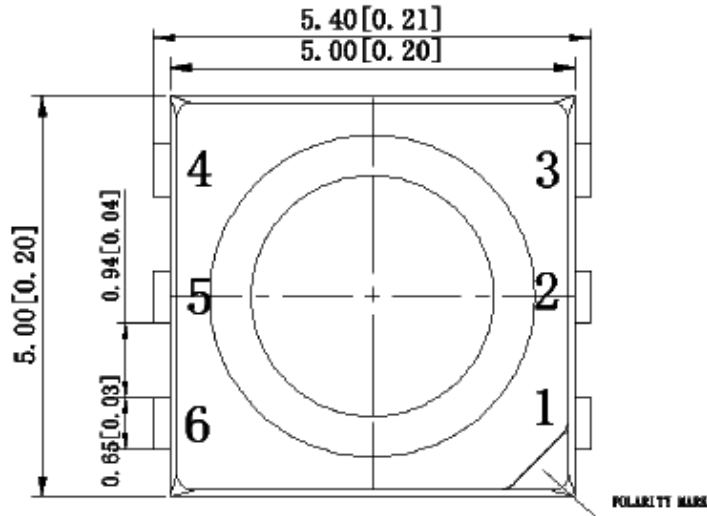
No.	Forward Voltage (V)									
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs
31	3.044	3.051	3.044	3.049	3.043	3.048	3.049	3.047	3.052	3.046
32	3.046	3.054	3.046	3.053	3.046	3.052	3.052	3.050	3.055	3.050
33	3.012	3.017	3.012	3.017	3.011	3.017	3.016	3.014	3.018	3.015
34	3.045	3.049	3.044	3.049	3.045	3.051	3.051	3.049	3.051	3.048
35	3.046	3.051	3.046	3.051	3.046	3.050	3.051	3.048	3.052	3.049
36	3.049	3.054	3.046	3.052	3.047	3.052	3.053	3.048	3.056	3.051
37	3.040	3.045	3.036	3.043	3.040	3.043	3.043	3.041	3.046	3.044
38	3.035	3.041	3.033	3.036	3.035	3.038	3.039	3.036	3.039	3.038
39	3.038	3.044	3.036	3.042	3.038	3.044	3.042	3.041	3.044	3.041
40	3.023	3.030	3.020	3.027	3.023	3.029	3.028	3.024	3.029	3.025
41	3.030	3.036	3.029	3.035	3.031	3.035	3.033	3.032	3.036	3.033
42	3.029	3.034	3.027	3.033	3.029	3.033	3.031	3.030	3.033	3.031
43	3.044	3.051	3.043	3.046	3.042	3.047	3.045	3.043	3.047	3.046
44	3.022	3.030	3.020	3.026	3.022	3.026	3.024	3.023	3.028	3.025
45	3.051	3.058	3.049	3.051	3.050	3.054	3.052	3.054	3.057	3.054
46	3.045	3.052	3.040	3.046	3.045	3.046	3.048	3.046	3.051	3.050
47	3.042	3.047	3.037	3.041	3.041	3.043	3.041	3.038	3.044	3.042
48	3.044	3.048	3.039	3.044	3.043	3.046	3.044	3.044	3.047	3.044
49	3.046	3.052	3.041	3.048	3.046	3.048	3.050	3.045	3.049	3.048
50	3.036	3.043	3.033	3.040	3.036	3.037	3.041	3.036	3.042	3.040
51	3.034	3.040	3.029	3.032	3.031	3.033	3.033	3.031	3.034	3.032
52	3.039	3.049	3.040	3.043	3.041	3.043	3.043	3.041	3.043	3.042
53	3.016	3.022	3.015	3.018	3.016	3.017	3.016	3.014	3.016	3.016
54	3.045	3.052	3.041	3.046	3.044	3.046	3.045	3.044	3.045	3.045
55	3.047	3.053	3.043	3.048	3.046	3.046	3.046	3.048	3.046	3.047
56	3.049	3.056	3.048	3.049	3.048	3.052	3.049	3.050	3.051	3.052
57	3.027	3.034	3.026	3.032	3.027	3.030	3.029	3.027	3.028	3.028
58	3.036	3.045	3.033	3.038	3.035	3.035	3.036	3.037	3.037	3.037
59	3.025	3.035	3.027	3.031	3.028	3.030	3.028	3.029	3.028	3.029
60	3.031	3.037	3.027	3.032	3.029	3.031	3.029	3.028	3.029	3.032
Avg.	3.037	3.044	3.035	3.040	3.037	3.040	3.040	3.038	3.041	3.039
Med.	3.040	3.046	3.037	3.043	3.041	3.043	3.043	3.041	3.044	3.042
st dev	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011
Min.	3.012	3.017	3.012	3.017	3.011	3.017	3.016	3.014	3.016	3.015
Max.	3.051	3.058	3.049	3.053	3.050	3.054	3.053	3.054	3.057	3.054

3.18 Data Set 6, 85°C, 20mA (Chromaticity Shift)

No.	u'	v'	Wavelength (nm)	Chromaticity Shift ($\Delta u'v'$)								
				0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs
31	0.1702	0.1305	465.2	0.0001	0.0002	0.0003	0.0006	0.0007	0.0009	0.0011	0.0013	0.0015
32	0.1696	0.1328	465.3	0.0003	0.0005	0.0007	0.0009	0.0010	0.0011	0.0012	0.0014	0.0017
33	0.1684	0.1333	465.6	0.0001	0.0003	0.0004	0.0007	0.0009	0.0009	0.0010	0.0013	0.0014
34	0.1713	0.1287	464.9	0.0002	0.0003	0.0005	0.0007	0.0009	0.0011	0.0014	0.0013	0.0016
35	0.1708	0.1304	465.1	0.0003	0.0005	0.0004	0.0005	0.0008	0.0009	0.0012	0.0013	0.0014
36	0.1696	0.1334	465.3	0.0002	0.0004	0.0005	0.0008	0.0009	0.0011	0.0014	0.0016	0.0018
37	0.1714	0.1308	464.9	0.0001	0.0001	0.0003	0.0003	0.0006	0.0007	0.0010	0.0013	0.0015
38	0.1692	0.1328	465.4	0.0002	0.0004	0.0004	0.0006	0.0006	0.0007	0.0008	0.0011	0.0013
39	0.1701	0.1322	465.2	0.0003	0.0005	0.0006	0.0006	0.0007	0.0008	0.0011	0.0011	0.0014
40	0.1693	0.1319	465.4	0.0002	0.0004	0.0005	0.0005	0.0008	0.0008	0.0009	0.0010	0.0013
41	0.1717	0.1287	464.8	0.0001	0.0002	0.0004	0.0007	0.0009	0.0010	0.0011	0.0013	0.0014
42	0.1683	0.1337	465.6	0.0001	0.0003	0.0005	0.0006	0.0008	0.0010	0.0010	0.0011	0.0013
43	0.1702	0.1312	465.2	0.0003	0.0005	0.0007	0.0008	0.0009	0.0011	0.0014	0.0016	0.0015
44	0.1682	0.1338	465.7	0.0002	0.0004	0.0006	0.0008	0.0010	0.0011	0.0014	0.0015	0.0017
45	0.1698	0.1316	465.3	0.0002	0.0004	0.0005	0.0005	0.0008	0.0011	0.0013	0.0016	0.0017
46	0.1715	0.1290	464.9	0.0002	0.0003	0.0006	0.0006	0.0008	0.0010	0.0013	0.0014	0.0016
47	0.1717	0.1290	464.8	0.0002	0.0004	0.0006	0.0007	0.0007	0.0009	0.0010	0.0012	0.0015
48	0.1716	0.1300	464.9	0.0003	0.0003	0.0004	0.0007	0.0007	0.0009	0.0011	0.0013	0.0014
49	0.1691	0.1327	465.4	0.0002	0.0002	0.0004	0.0005	0.0007	0.0009	0.0010	0.0012	0.0014
50	0.1717	0.1295	464.8	0.0003	0.0002	0.0004	0.0005	0.0006	0.0009	0.0010	0.0011	0.0014
51	0.1724	0.1273	464.6	0.0002	0.0005	0.0004	0.0005	0.0005	0.0009	0.0010	0.0011	0.0013
52	0.1689	0.1336	465.5	0.0001	0.0004	0.0005	0.0005	0.0008	0.0011	0.0012	0.0014	0.0016
53	0.1701	0.1312	465.2	0.0003	0.0004	0.0005	0.0007	0.0007	0.0009	0.0010	0.0012	0.0013
54	0.1711	0.1292	464.9	0.0002	0.0004	0.0006	0.0009	0.0009	0.0011	0.0012	0.0013	0.0016
55	0.1701	0.1315	465.2	0.0002	0.0005	0.0006	0.0009	0.0011	0.0012	0.0013	0.0013	0.0016
56	0.1695	0.1315	465.3	0.0001	0.0002	0.0004	0.0006	0.0009	0.0011	0.0015	0.0015	0.0016
57	0.1696	0.1315	465.3	0.0001	0.0003	0.0004	0.0006	0.0007	0.0009	0.0012	0.0016	0.0019
58	0.1681	0.1343	465.7	0.0001	0.0001	0.0003	0.0004	0.0005	0.0006	0.0009	0.0013	0.0017
59	0.1711	0.1295	464.9	0.0002	0.0002	0.0004	0.0005	0.0007	0.0010	0.0013	0.0016	0.0017
60	0.1715	0.1289	464.9	0.0001	0.0003	0.0004	0.0007	0.0010	0.0009	0.0012	0.0016	0.0019
Avg.	0.1702	0.1312	465.2	0.0002	0.0003	0.0005	0.0006	0.0008	0.0010	0.0011	0.0013	0.0015
Med.	0.1701	0.1314	465.2	0.0002	0.0003	0.0005	0.0006	0.0008	0.0009	0.0012	0.0013	0.0015
st dev	0.0012	0.0019	0.3	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002	0.0002
Min.	0.1681	0.1273	464.6	0.0001	0.0001	0.0003	0.0003	0.0005	0.0006	0.0008	0.0010	0.0013
Max.	0.1724	0.1343	465.7	0.0003	0.0005	0.0007	0.0009	0.0011	0.0012	0.0015	0.0016	0.0019

4 DUT Photo

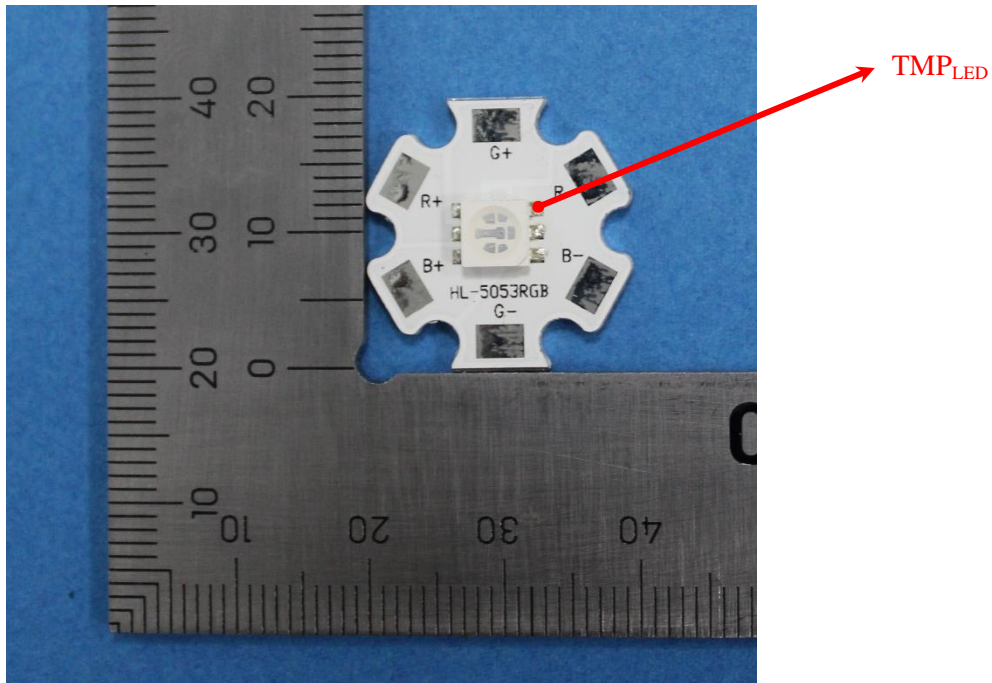
4.1 Mechanical Dimensions



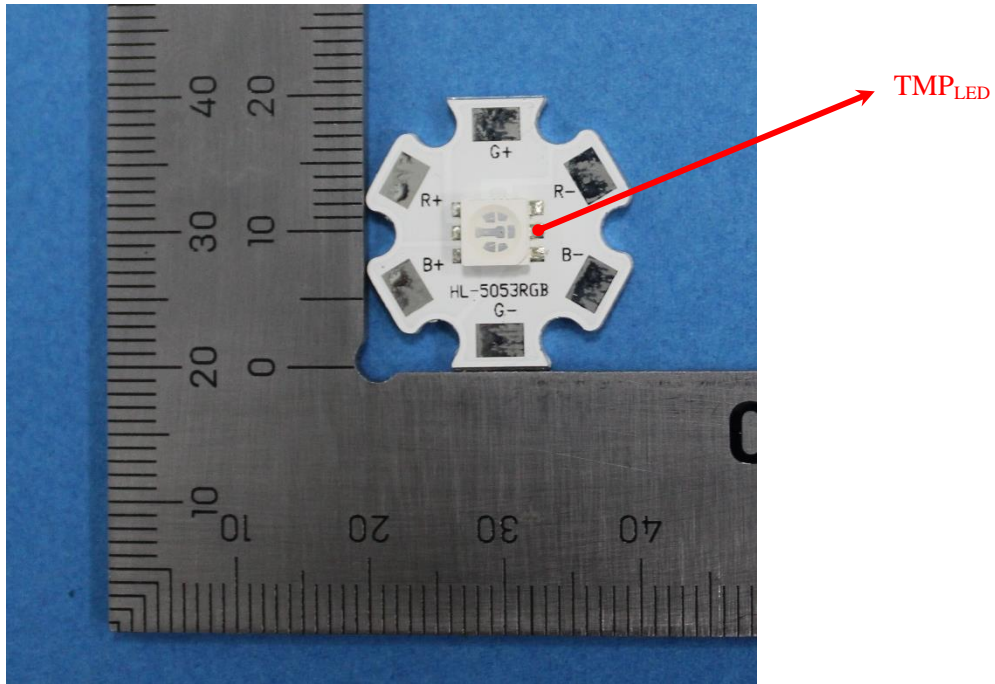
All dimensions are in millimeter

4.2 DUT Photo

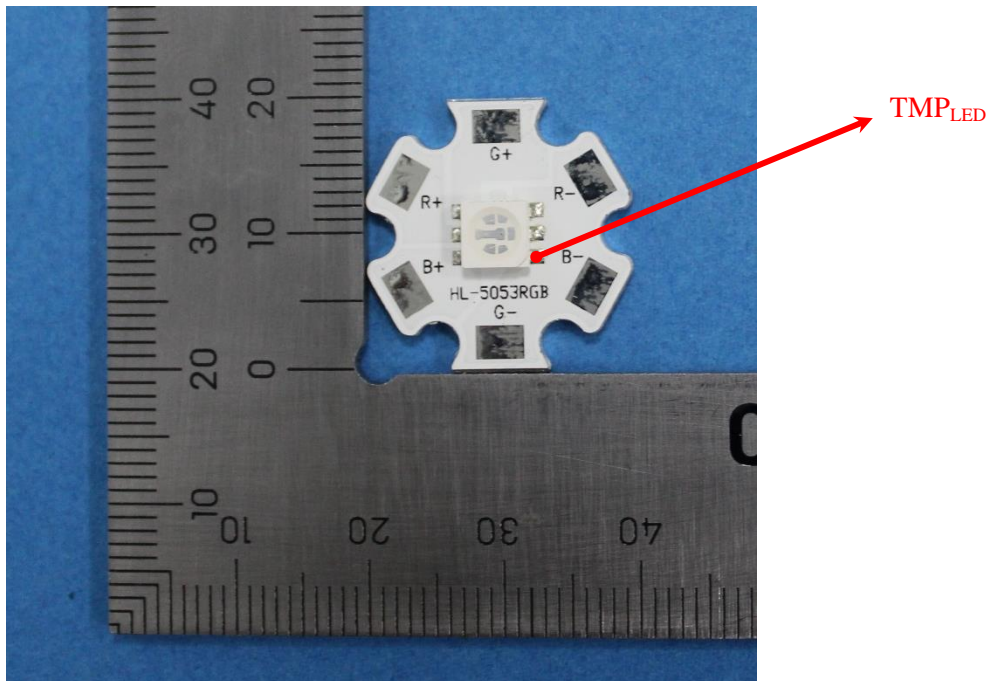
Red



Green



Blue



Directions

1. The information marked “superscript #” is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.
2. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
3. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor $K=2$ with the 95% confidence interval.
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*****END OF REPORT*****