



TEST REPORT

ACCORDING TO IES LM-80-2015

For

Seoul Semiconductor Co. Ltd

97-11, Sandan-ro 163beon-gil, Danwon-gu, Ansan-si, Gyeonggi-do, Republic of Korea

Model: STW9C2SB-NT (3000K)

| | | | |
|---|---|-------------------------------------|--|
| Report Type: 9000 Hours Test Report | | Product Type: LED Package | |
| Test Engineer: | Pote Wang | <i>Pote Wang</i> | |
| Report Number: | RSZ190618503-10 | | |
| Test Date: | 2016-11-11 to 2018-04-09 | | |
| Report Date: | 2019-06-19 | | |
| Reviewed By: | Bill Xiong / EE Engineer | <i>Bill Xiong</i> | |
| Test Facility: | Test facility was located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China. | | |
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Note: The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).
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1 - General Information

1.1 Description of LED Light Sources

Sample Size:

75 PCS samples were received on 2016-10-31. The samples were numbered from 1 to 25, 26 to 50 and 51 to 75.

| | |
|------------------------------|-----------------------------|
| Manufacturer: | Seoul Semiconductor Co. Ltd |
| Part Number: | STW9C2SB-NT (3000K) |
| Part Type: | LED Package |
| Drive Level: | DC 200mA |
| Nominal CCT: | 3000K |
| Power: | 1.2W |
| Current Density per LED die: | 402mA/mm ² |
| Power Density per LED die: | 2.653W/mm ² |
| CRI: | 90 |
| Die Spacing: | 0.15mm |

Note:

1. The applicant Seoul Semiconductor Co. Ltd. declare that their products with model STW9C2SB-NT (3000K) are the same to the products in report#RSZ161031510-10-9000-M1 and is authorized by original applicant to use their test data.

2. All the data in previous report (RSZ161031510-10-9000-M1) is shared in this report.

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)

| Series Name | Model Name | CCT (K) | Current (mA) | Power (W) | Power Density (W/mm ²) | Current Density (mA/mm ²) | Die Spacing (mm) |
|-------------|---------------------|---------|--------------|-----------|------------------------------------|---------------------------------------|------------------|
| EMC-3030 | STW9C2SB-NT (3000K) | 3000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW7C2SB-XT (2700K) | 2700 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (2700K) | 2700 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (2700K) | 2700 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW7C2SB-XT (3000K) | 3000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (3000K) | 3000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (3000K) | 3000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW7C2SB-XT (3500K) | 3500 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (3500K) | 3500 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (3500K) | 3500 | 200 | 1.2 | 0.133 | 402 | 0.15 |

| Series Name | Model Name | CCT (K) | Current (mA) | Power (W) | Power Density (W/mm ²) | Current Density (mA/mm ²) | Die Spacing (mm) |
|-------------|---------------------|---------|--------------|-----------|------------------------------------|---------------------------------------|------------------|
| EMC-3030 | STW7C2SB-XT (4000K) | 4000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (4000K) | 4000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (4000K) | 4000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW7C2SB-XT (4500K) | 4500 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (4500K) | 4500 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (4500K) | 4500 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW7C2SB-XT (5000K) | 5000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (5000K) | 5000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (5000K) | 5000 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW7C2SB-XT (5700K) | 5700 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (5700K) | 5700 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (5700K) | 5700 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW7C2SB-XT (6500K) | 6500 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW8C2SB-XT (6500K) | 6500 | 200 | 1.2 | 0.133 | 402 | 0.15 |
| EMC-3030 | STW9C2SB-XT (6500K) | 6500 | 200 | 1.2 | 0.133 | 402 | 0.15 |

1.2 Standards Used:

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

1.3 Testing Equipment

| Manufacture | Model No | Serial No | Calibration date | Calibration due date |
|---------------------------------------|----------|---------------|------------------|----------------------|
| 0.3m integrating sphere | EVERFINE | Diameter 0.3m | 2018-03-18 | 2019-03-18 |
| Programmable Test Power for LEDs | EVERFINE | LED300E | 2018-03-26 | 2019-03-26 |
| High accuracy array spectroradiometer | EVERFINE | HAAS-2000 | 2018-03-18 | 2019-03-18 |

| Manufacture | Model No | Serial No | Calibration date | Calibration due date |
|--|----------|------------|------------------|----------------------|
| Standard Light Source | EVERFINE | D062 | 2017-09-13 | 2018-09-13 |
| Precision digital stabilized DC power supply | EVERFINE | WY605-V110 | 2018-03-26 | 2019-03-26 |
| Multilayer aging machine | BACL | B3-900 | 2017-07-17 | 2018-07-17 |
| Digital CC&CV DC Power Supply | EVERFINE | WY5015 | 2018-03-26 | 2019-03-26 |
| Digital CC&CV DC Power Supply | EVERFINE | WY5015 | 2017-12-15 | 2018-12-15 |
| Digital CC&CV DC Power Supply | EVERFINE | WY5015 | 2018-03-26 | 2019-03-26 |

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 $\pm 3\%$ 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 $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 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 $U=0.8671^{\circ}C$ ($K=2$), 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: 85°C, 200mA

Part Number: STW9C2SB-NT (3000K)
Number of Units: 25
Case Temperature: $>83^{\circ}C$
Ambient Temperature: $>80^{\circ}C$
Life Test Drive Current: 200mA
Measurement Current: 200mA

Data Set 2: 105°C,200mA

Part Number: STW9C2SB-NT (3000K)
Number of Units: 25
Case Temperature: $>103^{\circ}C$
Ambient Temperature: $>100^{\circ}C$
Life Test Drive Current: 200mA
Measurement Current: 200mA

Data Set 3: 120°C,200mA

Part Number: STW9C2SB-NT (3000K)
Number of Units: 25
Case Temperature: $>118^{\circ}C$
Ambient Temperature: $>115^{\circ}C$
Life Test Drive Current: 200mA
Measurement Current: 200mA

2 - Summary of Test Result

| Data Set: | Sample Size | Failures Observed: | Test Interval | Test Duration | Reported TM-21 L ₇₀ Lifetime |
|-----------|-------------|--------------------|---------------|---------------|---|
| 1 | 25 | 0 | 1000 | 9000 | >54000hours |
| 2 | 25 | 0 | 1000 | 9000 | >54000hours |
| 3 | 25 | 0 | 1000 | 9000 | >54000hours |

Average Lumen Maintenance (Percentage of Initial Luminous Flux)

| Data Set: | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 |
|-----------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 100.16% | 99.87% | 99.65% | 99.42% | 99.15% | 98.87% | 98.58% | 98.32% | 98.06% |
| 2 | 99.95% | 99.61% | 99.30% | 98.98% | 98.66% | 98.33% | 98.02% | 97.71% | 97.41% |
| 3 | 99.76% | 99.37% | 99.04% | 98.68% | 98.34% | 98.01% | 97.66% | 97.28% | 96.95% |

Average Color Maintenance

| Data Set: | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1 | 0.0001 | 0.0004 | 0.0006 | 0.0010 | 0.0012 | 0.0015 | 0.0018 | 0.0021 | 0.0024 |
| 2 | 0.0004 | 0.0008 | 0.0011 | 0.0015 | 0.0017 | 0.0020 | 0.0023 | 0.0026 | 0.0028 |
| 3 | 0.0006 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0023 | 0.0026 | 0.0029 | 0.0032 |

3 - Test Data

3.1 Data Set 1, 85°C, 200mA (Lumen Maintenance)

| No. | Φ(lm) | Lumen Maintenance (%) | | | | | | | | |
|--------|--------------|-----------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 1 | 159.1 | 99.94 | 99.62 | 99.43 | 99.12 | 98.99 | 98.87 | 98.55 | 98.30 | 98.05 |
| 2 | 161.8 | 100.12 | 99.69 | 99.44 | 99.20 | 98.95 | 98.58 | 98.33 | 98.21 | 97.84 |
| 3 | 161.2 | 100.06 | 99.63 | 99.50 | 99.32 | 99.01 | 98.70 | 98.45 | 98.14 | 97.83 |
| 4 | 156.3 | 100.19 | 99.94 | 99.68 | 99.49 | 99.23 | 98.98 | 98.85 | 98.59 | 98.27 |
| 5 | 158.2 | 100.06 | 99.81 | 99.56 | 99.24 | 98.93 | 98.61 | 98.17 | 97.79 | 97.60 |
| 6 | 158.5 | 100.13 | 99.87 | 99.75 | 99.50 | 99.12 | 98.80 | 98.49 | 98.23 | 97.92 |
| 7 | 161.1 | 100.12 | 99.81 | 99.63 | 99.44 | 99.13 | 98.82 | 98.57 | 98.14 | 97.95 |
| 8 | 159.1 | 100.13 | 99.87 | 99.69 | 99.62 | 99.37 | 99.06 | 98.81 | 98.43 | 98.11 |
| 9 | 157.6 | 100.19 | 99.81 | 99.56 | 99.43 | 99.24 | 99.05 | 98.67 | 98.41 | 98.29 |
| 10 | 159.4 | 100.13 | 99.94 | 99.62 | 99.31 | 99.12 | 98.93 | 98.62 | 98.37 | 98.24 |
| 11 | 157.8 | 100.25 | 99.81 | 99.56 | 99.37 | 99.11 | 98.86 | 98.61 | 98.54 | 98.35 |
| 12 | 158.7 | 100.13 | 99.87 | 99.62 | 99.43 | 99.05 | 98.74 | 98.36 | 98.05 | 97.86 |
| 13 | 161.2 | 100.25 | 99.94 | 99.81 | 99.57 | 99.26 | 99.01 | 98.64 | 98.33 | 97.95 |
| 14 | 157.7 | 100.06 | 99.87 | 99.68 | 99.49 | 99.37 | 99.05 | 98.86 | 98.54 | 98.22 |
| 15 | 157.0 | 100.19 | 99.81 | 99.75 | 99.43 | 99.17 | 98.98 | 98.66 | 98.47 | 98.15 |
| 16 | 158.0 | 100.25 | 99.94 | 99.68 | 99.62 | 99.30 | 98.99 | 98.61 | 98.35 | 98.10 |
| 17 | 160.5 | 100.31 | 100.12 | 99.94 | 99.75 | 99.44 | 99.13 | 98.82 | 98.44 | 98.13 |
| 18 | 161.9 | 100.19 | 100.06 | 99.75 | 99.51 | 99.32 | 99.07 | 98.76 | 98.52 | 98.27 |
| 19 | 158.9 | 100.13 | 99.94 | 99.69 | 99.43 | 99.24 | 98.99 | 98.74 | 98.49 | 98.11 |
| 20 | 157.6 | 100.25 | 99.87 | 99.75 | 99.56 | 99.24 | 98.92 | 98.79 | 98.48 | 98.16 |
| 21 | 155.5 | 100.06 | 99.81 | 99.61 | 99.49 | 99.16 | 98.97 | 98.59 | 98.33 | 98.14 |
| 22 | 160.5 | 100.19 | 99.88 | 99.56 | 99.25 | 99.00 | 98.69 | 98.44 | 98.26 | 98.13 |
| 23 | 161.0 | 100.06 | 99.75 | 99.44 | 99.13 | 98.82 | 98.51 | 98.20 | 98.07 | 97.89 |
| 24 | 156.5 | 100.26 | 100.06 | 99.74 | 99.36 | 98.98 | 98.59 | 98.34 | 98.15 | 97.83 |
| 25 | 160.9 | 100.25 | 100.12 | 99.75 | 99.38 | 99.07 | 98.76 | 98.57 | 98.26 | 98.01 |
| Ave. | 159.0 | 100.16 | 99.87 | 99.65 | 99.42 | 99.15 | 98.87 | 98.58 | 98.32 | 98.06 |
| Med. | 158.9 | 100.13 | 99.87 | 99.68 | 99.43 | 99.13 | 98.92 | 98.61 | 98.33 | 98.11 |
| st dev | 1.8 | 0.0873 | 0.1313 | 0.1231 | 0.1545 | 0.1568 | 0.1770 | 0.1950 | 0.1903 | 0.1843 |
| Min. | 155.5 | 99.94 | 99.62 | 99.43 | 99.12 | 98.82 | 98.51 | 98.17 | 97.79 | 97.60 |
| Max. | 161.9 | 100.31 | 100.12 | 99.94 | 99.75 | 99.44 | 99.13 | 98.86 | 98.59 | 98.35 |

TM-21 Projection:

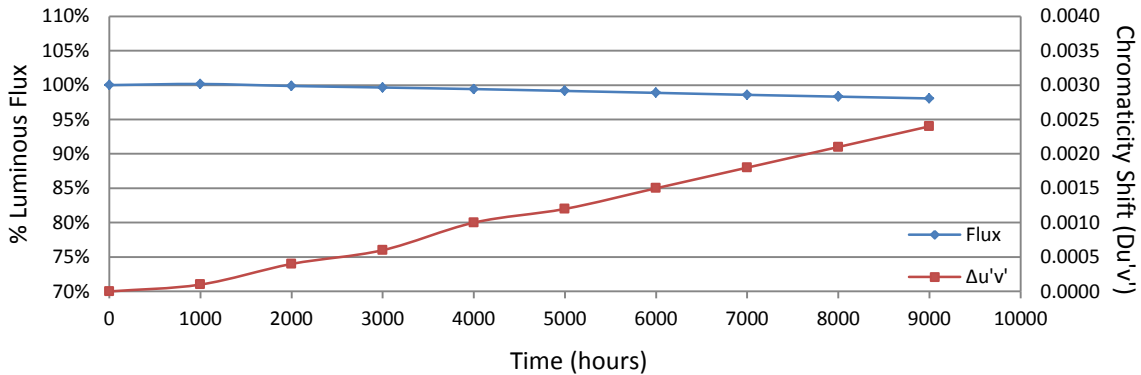
Test Duration: 9000 hours
Failures Observed: 0
 α : 2.772E-06
 β : 1.005
Reported L₇₀: >54000 hours

3.2 Data Set 1, 85°C, 200mA (Forward Voltage)

| No. | Forward Voltage (V) | | | | | | | | | |
|--------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 1 | 6.182 | 6.188 | 6.200 | 6.191 | 6.187 | 6.187 | 6.188 | 6.183 | 6.207 | 6.198 |
| 2 | 6.170 | 6.180 | 6.189 | 6.182 | 6.178 | 6.179 | 6.183 | 6.174 | 6.192 | 6.188 |
| 3 | 6.209 | 6.217 | 6.225 | 6.217 | 6.205 | 6.212 | 6.217 | 6.206 | 6.235 | 6.223 |
| 4 | 6.209 | 6.217 | 6.224 | 6.218 | 6.207 | 6.218 | 6.217 | 6.210 | 6.230 | 6.221 |
| 5 | 6.215 | 6.229 | 6.233 | 6.227 | 6.223 | 6.226 | 6.233 | 6.221 | 6.241 | 6.232 |
| 6 | 6.204 | 6.213 | 6.223 | 6.213 | 6.207 | 6.211 | 6.209 | 6.203 | 6.228 | 6.219 |
| 7 | 6.196 | 6.204 | 6.214 | 6.204 | 6.197 | 6.211 | 6.206 | 6.195 | 6.226 | 6.209 |
| 8 | 6.198 | 6.212 | 6.218 | 6.211 | 6.201 | 6.208 | 6.205 | 6.202 | 6.225 | 6.215 |
| 9 | 6.228 | 6.234 | 6.238 | 6.238 | 6.226 | 6.243 | 6.232 | 6.225 | 6.245 | 6.236 |
| 10 | 6.189 | 6.196 | 6.199 | 6.197 | 6.192 | 6.202 | 6.194 | 6.184 | 6.207 | 6.196 |
| 11 | 6.213 | 6.217 | 6.227 | 6.222 | 6.209 | 6.220 | 6.220 | 6.211 | 6.234 | 6.227 |
| 12 | 6.207 | 6.214 | 6.222 | 6.216 | 6.210 | 6.217 | 6.214 | 6.207 | 6.231 | 6.222 |
| 13 | 6.201 | 6.212 | 6.218 | 6.211 | 6.199 | 6.219 | 6.205 | 6.198 | 6.225 | 6.217 |
| 14 | 6.214 | 6.217 | 6.227 | 6.217 | 6.215 | 6.222 | 6.215 | 6.208 | 6.234 | 6.226 |
| 15 | 6.204 | 6.208 | 6.215 | 6.210 | 6.204 | 6.219 | 6.213 | 6.204 | 6.227 | 6.217 |
| 16 | 6.211 | 6.213 | 6.219 | 6.217 | 6.207 | 6.212 | 6.219 | 6.208 | 6.230 | 6.217 |
| 17 | 6.201 | 6.214 | 6.220 | 6.213 | 6.210 | 6.212 | 6.213 | 6.200 | 6.225 | 6.218 |
| 18 | 6.225 | 6.234 | 6.240 | 6.235 | 6.231 | 6.238 | 6.234 | 6.224 | 6.240 | 6.238 |
| 19 | 6.191 | 6.204 | 6.207 | 6.201 | 6.204 | 6.235 | 6.200 | 6.192 | 6.211 | 6.209 |
| 20 | 6.210 | 6.221 | 6.229 | 6.219 | 6.230 | 6.217 | 6.218 | 6.211 | 6.231 | 6.230 |
| 21 | 6.182 | 6.189 | 6.198 | 6.189 | 6.186 | 6.181 | 6.193 | 6.182 | 6.205 | 6.195 |
| 22 | 6.174 | 6.183 | 6.192 | 6.180 | 6.181 | 6.179 | 6.180 | 6.173 | 6.191 | 6.185 |
| 23 | 6.173 | 6.187 | 6.189 | 6.185 | 6.179 | 6.178 | 6.179 | 6.174 | 6.197 | 6.189 |
| 24 | 6.198 | 6.207 | 6.213 | 6.208 | 6.203 | 6.204 | 6.210 | 6.198 | 6.219 | 6.217 |
| 25 | 6.195 | 6.204 | 6.206 | 6.204 | 6.205 | 6.196 | 6.201 | 6.192 | 6.214 | 6.210 |
| Ave. | 6.200 | 6.209 | 6.215 | 6.209 | 6.204 | 6.210 | 6.208 | 6.199 | 6.222 | 6.214 |
| Med. | 6.201 | 6.212 | 6.218 | 6.211 | 6.205 | 6.212 | 6.210 | 6.202 | 6.226 | 6.217 |
| st dev | 0.015 | 0.015 | 0.015 | 0.015 | 0.015 | 0.018 | 0.015 | 0.015 | 0.015 | 0.015 |
| Min. | 6.170 | 6.180 | 6.189 | 6.180 | 6.178 | 6.178 | 6.179 | 6.173 | 6.191 | 6.185 |
| Max. | 6.228 | 6.234 | 6.240 | 6.238 | 6.231 | 6.243 | 6.234 | 6.225 | 6.245 | 6.238 |

3.3 Data Set 1, 85°C, 200mA (Chromaticity Shift)

| No. | u' | v' | CCT(K) | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|--------|--------------|--------|--------|--------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0hr(Initial) | | | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 1 | 0.2462 | 0.5186 | 3131 | 0.0001 | 0.0005 | 0.0009 | 0.0010 | 0.0012 | 0.0016 | 0.0018 | 0.0022 | 0.0025 |
| 2 | 0.2466 | 0.5171 | 3131 | 0.0001 | 0.0002 | 0.0005 | 0.0009 | 0.0011 | 0.0016 | 0.0019 | 0.0022 | 0.0024 |
| 3 | 0.2464 | 0.5184 | 3126 | 0.0001 | 0.0004 | 0.0007 | 0.0010 | 0.0011 | 0.0015 | 0.0018 | 0.0020 | 0.0023 |
| 4 | 0.2469 | 0.5186 | 3111 | 0.0001 | 0.0003 | 0.0005 | 0.0009 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0021 |
| 5 | 0.2466 | 0.5184 | 3122 | 0.0001 | 0.0004 | 0.0007 | 0.0010 | 0.0011 | 0.0015 | 0.0018 | 0.0023 | 0.0025 |
| 6 | 0.2462 | 0.5184 | 3131 | 0.0001 | 0.0003 | 0.0007 | 0.0009 | 0.0010 | 0.0014 | 0.0016 | 0.0021 | 0.0023 |
| 7 | 0.2461 | 0.5186 | 3134 | 0.0000 | 0.0003 | 0.0006 | 0.0009 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0023 |
| 8 | 0.2454 | 0.5186 | 3153 | 0.0001 | 0.0004 | 0.0006 | 0.0010 | 0.0012 | 0.0015 | 0.0018 | 0.0021 | 0.0024 |
| 9 | 0.2474 | 0.5184 | 3102 | 0.0001 | 0.0002 | 0.0006 | 0.0010 | 0.0011 | 0.0014 | 0.0018 | 0.0021 | 0.0023 |
| 10 | 0.2461 | 0.5180 | 3138 | 0.0000 | 0.0004 | 0.0006 | 0.0010 | 0.0011 | 0.0015 | 0.0019 | 0.0021 | 0.0024 |
| 11 | 0.2466 | 0.5172 | 3129 | 0.0002 | 0.0003 | 0.0005 | 0.0009 | 0.0010 | 0.0014 | 0.0017 | 0.0019 | 0.0023 |
| 12 | 0.2458 | 0.5187 | 3140 | 0.0002 | 0.0004 | 0.0006 | 0.0008 | 0.0012 | 0.0014 | 0.0017 | 0.0020 | 0.0023 |
| 13 | 0.2473 | 0.5187 | 3101 | 0.0001 | 0.0006 | 0.0007 | 0.0011 | 0.0014 | 0.0016 | 0.0020 | 0.0023 | 0.0026 |
| 14 | 0.2454 | 0.5181 | 3155 | 0.0001 | 0.0005 | 0.0006 | 0.0009 | 0.0012 | 0.0014 | 0.0017 | 0.0021 | 0.0024 |
| 15 | 0.2462 | 0.5186 | 3131 | 0.0001 | 0.0004 | 0.0007 | 0.0011 | 0.0014 | 0.0015 | 0.0019 | 0.0022 | 0.0025 |
| 16 | 0.2467 | 0.5183 | 3120 | 0.0001 | 0.0007 | 0.0006 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0022 | 0.0024 |
| 17 | 0.2462 | 0.5187 | 3130 | 0.0001 | 0.0004 | 0.0007 | 0.0010 | 0.0014 | 0.0015 | 0.0019 | 0.0023 | 0.0024 |
| 18 | 0.2462 | 0.5182 | 3133 | 0.0001 | 0.0003 | 0.0005 | 0.0009 | 0.0011 | 0.0014 | 0.0017 | 0.0021 | 0.0022 |
| 19 | 0.2471 | 0.5191 | 3105 | 0.0001 | 0.0004 | 0.0005 | 0.0009 | 0.0012 | 0.0014 | 0.0018 | 0.0021 | 0.0023 |
| 20 | 0.2463 | 0.5197 | 3120 | 0.0002 | 0.0004 | 0.0005 | 0.0009 | 0.0012 | 0.0015 | 0.0017 | 0.0021 | 0.0022 |
| 21 | 0.2481 | 0.5186 | 3082 | 0.0001 | 0.0005 | 0.0006 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0022 | 0.0025 |
| 22 | 0.2467 | 0.5178 | 3125 | 0.0001 | 0.0005 | 0.0007 | 0.0012 | 0.0013 | 0.0016 | 0.0020 | 0.0023 | 0.0025 |
| 23 | 0.2463 | 0.5177 | 3134 | 0.0002 | 0.0004 | 0.0005 | 0.0009 | 0.0011 | 0.0014 | 0.0017 | 0.0021 | 0.0024 |
| 24 | 0.2451 | 0.5195 | 3152 | 0.0000 | 0.0005 | 0.0005 | 0.0010 | 0.0012 | 0.0014 | 0.0017 | 0.0020 | 0.0022 |
| 25 | 0.2475 | 0.5184 | 3098 | 0.0001 | 0.0005 | 0.0006 | 0.0010 | 0.0012 | 0.0015 | 0.0018 | 0.0021 | 0.0023 |
| Ave. | 0.2465 | 0.5184 | 3125 | 0.0001 | 0.0004 | 0.0006 | 0.0010 | 0.0012 | 0.0015 | 0.0018 | 0.0021 | 0.0024 |
| Med. | 0.2463 | 0.5184 | 3130 | 0.0001 | 0.0004 | 0.0006 | 0.0010 | 0.0012 | 0.0015 | 0.0018 | 0.0021 | 0.0024 |
| st dev | 0.0007 | 0.0006 | 18 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| Min. | 0.2451 | 0.5171 | 3082 | 0.0000 | 0.0002 | 0.0005 | 0.0008 | 0.0010 | 0.0013 | 0.0015 | 0.0018 | 0.0021 |
| Max. | 0.2481 | 0.5197 | 3155 | 0.0002 | 0.0007 | 0.0009 | 0.0012 | 0.0014 | 0.0016 | 0.0020 | 0.0023 | 0.0026 |



3.4 Data Set 2, 105°C, 200mA (Lumen Maintenance)

| No. | Φ(lm) | Lumen Maintenance (%) | | | | | | | | |
|--------|--------------|-----------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Ohr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 26 | 156.6 | 100.19 | 99.94 | 99.68 | 99.43 | 99.11 | 98.79 | 98.53 | 98.21 | 97.96 |
| 27 | 157.1 | 100.06 | 99.75 | 99.55 | 99.30 | 99.05 | 98.60 | 98.28 | 98.03 | 97.77 |
| 28 | 157.5 | 100.13 | 99.68 | 99.37 | 98.98 | 98.79 | 98.54 | 98.22 | 97.84 | 97.52 |
| 29 | 156.5 | 99.94 | 99.49 | 99.04 | 98.79 | 98.53 | 98.21 | 97.96 | 97.70 | 97.32 |
| 30 | 155.4 | 100.13 | 99.68 | 99.29 | 98.91 | 98.58 | 98.33 | 98.01 | 97.62 | 97.43 |
| 31 | 157.4 | 99.94 | 99.49 | 99.17 | 98.86 | 98.60 | 98.22 | 97.84 | 97.46 | 97.08 |
| 32 | 156.4 | 100.06 | 99.74 | 99.42 | 99.04 | 98.53 | 98.08 | 97.63 | 97.31 | 96.99 |
| 33 | 157.7 | 99.81 | 99.49 | 99.24 | 98.86 | 98.54 | 98.10 | 97.84 | 97.53 | 97.34 |
| 34 | 156.9 | 99.94 | 99.68 | 99.30 | 99.04 | 98.73 | 98.34 | 97.96 | 97.71 | 97.32 |
| 35 | 161.5 | 99.88 | 99.75 | 99.44 | 99.07 | 98.76 | 98.39 | 98.20 | 97.83 | 97.52 |
| 36 | 156.9 | 100.13 | 99.81 | 99.49 | 99.24 | 98.85 | 98.47 | 98.09 | 97.83 | 97.64 |
| 37 | 160.2 | 100.06 | 99.69 | 99.50 | 99.13 | 98.88 | 98.56 | 98.19 | 98.00 | 97.63 |
| 38 | 155.0 | 99.94 | 99.61 | 99.35 | 99.03 | 98.77 | 98.58 | 98.32 | 98.06 | 97.74 |
| 39 | 157.6 | 99.87 | 99.37 | 99.18 | 98.98 | 98.67 | 98.41 | 98.16 | 98.03 | 97.72 |
| 40 | 157.2 | 99.94 | 99.55 | 99.30 | 99.05 | 98.66 | 98.28 | 97.90 | 97.58 | 97.33 |
| 41 | 155.6 | 99.81 | 99.36 | 99.04 | 98.78 | 98.52 | 98.26 | 98.01 | 97.56 | 97.17 |
| 42 | 154.6 | 99.68 | 99.35 | 99.09 | 98.77 | 98.45 | 98.12 | 97.80 | 97.41 | 97.09 |
| 43 | 156.3 | 99.81 | 99.42 | 99.04 | 98.53 | 98.14 | 97.95 | 97.50 | 97.18 | 96.74 |
| 44 | 157.2 | 99.87 | 99.68 | 99.36 | 98.92 | 98.47 | 98.16 | 97.90 | 97.52 | 97.20 |
| 45 | 161.0 | 100.06 | 99.81 | 99.50 | 99.13 | 98.76 | 98.45 | 98.07 | 97.83 | 97.52 |
| 46 | 156.6 | 99.87 | 99.62 | 99.36 | 99.17 | 98.91 | 98.53 | 98.15 | 97.83 | 97.51 |
| 47 | 157.5 | 99.94 | 99.49 | 99.17 | 98.79 | 98.54 | 98.22 | 97.97 | 97.65 | 97.59 |
| 48 | 160.1 | 100.06 | 99.69 | 99.31 | 99.00 | 98.69 | 98.31 | 98.06 | 97.69 | 97.50 |
| 49 | 160.3 | 99.81 | 99.63 | 99.19 | 99.00 | 98.57 | 98.13 | 98.00 | 97.75 | 97.50 |
| 50 | 161.6 | 99.88 | 99.50 | 99.13 | 98.70 | 98.39 | 98.27 | 97.90 | 97.46 | 97.22 |
| Ave. | 157.6 | 99.95 | 99.61 | 99.30 | 98.98 | 98.66 | 98.33 | 98.02 | 97.71 | 97.41 |
| Med. | 157.2 | 99.94 | 99.63 | 99.30 | 99.00 | 98.66 | 98.31 | 98.01 | 97.70 | 97.50 |
| st dev | 2.0 | 0.1292 | 0.1543 | 0.1727 | 0.1987 | 0.2111 | 0.1987 | 0.2190 | 0.2509 | 0.2765 |
| Min. | 154.6 | 99.68 | 99.35 | 99.04 | 98.53 | 98.14 | 97.95 | 97.50 | 97.18 | 96.74 |
| Max. | 161.6 | 100.19 | 99.94 | 99.68 | 99.43 | 99.11 | 98.79 | 98.53 | 98.21 | 97.96 |

TM-21 Projection:

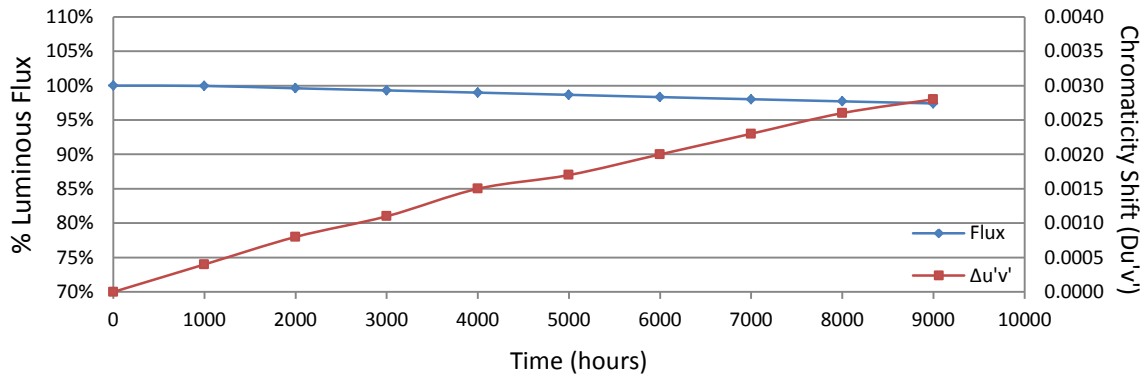
Test Duration: 9000 hours
Failures Observed: 0
 α : 3.204E-06
 β : 1.002
Reported L₇₀: >54000 hours

3.5 Data Set 2, 105°C, 200mA (Forward Voltage)

| No. | Forward Voltage (V) | | | | | | | | | |
|--------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 26 | 6.201 | 6.208 | 6.212 | 6.209 | 6.215 | 6.203 | 6.211 | 6.205 | 6.223 | 6.209 |
| 27 | 6.171 | 6.185 | 6.190 | 6.186 | 6.191 | 6.179 | 6.185 | 6.173 | 6.191 | 6.182 |
| 28 | 6.178 | 6.191 | 6.197 | 6.190 | 6.186 | 6.182 | 6.191 | 6.179 | 6.204 | 6.192 |
| 29 | 6.070 | 6.078 | 6.084 | 6.078 | 6.075 | 6.117 | 6.076 | 6.071 | 6.087 | 6.080 |
| 30 | 6.057 | 6.067 | 6.069 | 6.064 | 6.064 | 6.063 | 6.066 | 6.061 | 6.078 | 6.069 |
| 31 | 6.215 | 6.224 | 6.232 | 6.223 | 6.222 | 6.228 | 6.229 | 6.218 | 6.232 | 6.226 |
| 32 | 6.213 | 6.214 | 6.223 | 6.216 | 6.210 | 6.217 | 6.223 | 6.210 | 6.229 | 6.217 |
| 33 | 6.184 | 6.187 | 6.193 | 6.186 | 6.190 | 6.254 | 6.191 | 6.178 | 6.196 | 6.189 |
| 34 | 6.169 | 6.171 | 6.179 | 6.171 | 6.173 | 6.178 | 6.172 | 6.164 | 6.187 | 6.175 |
| 35 | 6.206 | 6.209 | 6.220 | 6.209 | 6.210 | 6.211 | 6.212 | 6.206 | 6.220 | 6.213 |
| 36 | 6.200 | 6.199 | 6.211 | 6.205 | 6.198 | 6.204 | 6.205 | 6.196 | 6.214 | 6.204 |
| 37 | 6.169 | 6.173 | 6.181 | 6.176 | 6.169 | 6.171 | 6.173 | 6.165 | 6.186 | 6.176 |
| 38 | 6.217 | 6.223 | 6.227 | 6.222 | 6.217 | 6.222 | 6.223 | 6.213 | 6.235 | 6.221 |
| 39 | 6.186 | 6.192 | 6.197 | 6.191 | 6.196 | 6.196 | 6.190 | 6.185 | 6.205 | 6.192 |
| 40 | 6.217 | 6.219 | 6.237 | 6.223 | 6.227 | 6.219 | 6.224 | 6.213 | 6.232 | 6.226 |
| 41 | 6.171 | 6.175 | 6.191 | 6.176 | 6.174 | 6.171 | 6.179 | 6.169 | 6.182 | 6.179 |
| 42 | 6.216 | 6.217 | 6.229 | 6.222 | 6.227 | 6.228 | 6.221 | 6.220 | 6.233 | 6.226 |
| 43 | 6.199 | 6.206 | 6.210 | 6.205 | 6.207 | 6.206 | 6.215 | 6.197 | 6.218 | 6.204 |
| 44 | 6.193 | 6.200 | 6.203 | 6.203 | 6.192 | 6.194 | 6.194 | 6.191 | 6.208 | 6.200 |
| 45 | 6.210 | 6.217 | 6.231 | 6.217 | 6.209 | 6.235 | 6.224 | 6.207 | 6.226 | 6.216 |
| 46 | 6.192 | 6.198 | 6.202 | 6.199 | 6.199 | 6.191 | 6.196 | 6.192 | 6.211 | 6.197 |
| 47 | 6.173 | 6.179 | 6.191 | 6.175 | 6.176 | 6.172 | 6.182 | 6.173 | 6.188 | 6.173 |
| 48 | 6.226 | 6.235 | 6.239 | 6.229 | 6.226 | 6.227 | 6.233 | 6.225 | 6.244 | 6.227 |
| 49 | 6.200 | 6.213 | 6.220 | 6.212 | 6.202 | 6.207 | 6.211 | 6.203 | 6.219 | 6.208 |
| 50 | 6.192 | 6.200 | 6.213 | 6.200 | 6.197 | 6.214 | 6.202 | 6.194 | 6.214 | 6.206 |
| Ave. | 6.185 | 6.191 | 6.199 | 6.191 | 6.190 | 6.196 | 6.193 | 6.184 | 6.202 | 6.192 |
| Med. | 6.193 | 6.200 | 6.210 | 6.203 | 6.198 | 6.204 | 6.202 | 6.194 | 6.214 | 6.204 |
| st dev | 0.040 | 0.040 | 0.041 | 0.040 | 0.040 | 0.039 | 0.041 | 0.040 | 0.040 | 0.039 |
| Min. | 6.057 | 6.067 | 6.069 | 6.064 | 6.064 | 6.063 | 6.066 | 6.061 | 6.078 | 6.069 |
| Max. | 6.226 | 6.235 | 6.239 | 6.229 | 6.227 | 6.254 | 6.233 | 6.225 | 6.244 | 6.227 |

3.6 Data Set 2, 105°C, 200mA (Chromaticity Shift)

| No. | u' | v' | CCT(K) | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|--------|--------------|--------|--------|--------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0hr(Initial) | | | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 26 | 0.2467 | 0.5179 | 3122 | 0.0004 | 0.0008 | 0.0011 | 0.0014 | 0.0016 | 0.0018 | 0.0021 | 0.0025 | 0.0027 |
| 27 | 0.2473 | 0.5186 | 3101 | 0.0003 | 0.0008 | 0.0011 | 0.0015 | 0.0016 | 0.0017 | 0.0020 | 0.0023 | 0.0026 |
| 28 | 0.2463 | 0.5182 | 3131 | 0.0002 | 0.0008 | 0.0011 | 0.0016 | 0.0016 | 0.0018 | 0.0019 | 0.0023 | 0.0025 |
| 29 | 0.2459 | 0.5185 | 3139 | 0.0002 | 0.0006 | 0.0009 | 0.0014 | 0.0016 | 0.0017 | 0.0018 | 0.0019 | 0.0022 |
| 30 | 0.2464 | 0.5176 | 3133 | 0.0003 | 0.0009 | 0.0012 | 0.0016 | 0.0017 | 0.0022 | 0.0025 | 0.0025 | 0.0028 |
| 31 | 0.2466 | 0.5188 | 3117 | 0.0003 | 0.0008 | 0.0010 | 0.0014 | 0.0016 | 0.0020 | 0.0023 | 0.0027 | 0.0026 |
| 32 | 0.2467 | 0.5188 | 3116 | 0.0004 | 0.0007 | 0.0011 | 0.0015 | 0.0016 | 0.0020 | 0.0023 | 0.0026 | 0.0027 |
| 33 | 0.2462 | 0.5182 | 3132 | 0.0003 | 0.0007 | 0.0011 | 0.0014 | 0.0016 | 0.0021 | 0.0023 | 0.0027 | 0.0027 |
| 34 | 0.2459 | 0.5184 | 3140 | 0.0005 | 0.0009 | 0.0012 | 0.0016 | 0.0017 | 0.0022 | 0.0025 | 0.0027 | 0.0029 |
| 35 | 0.2464 | 0.5187 | 3125 | 0.0004 | 0.0007 | 0.0010 | 0.0016 | 0.0018 | 0.0022 | 0.0024 | 0.0027 | 0.0029 |
| 36 | 0.2503 | 0.5188 | 3022 | 0.0004 | 0.0009 | 0.0009 | 0.0016 | 0.0015 | 0.0018 | 0.0021 | 0.0025 | 0.0028 |
| 37 | 0.2467 | 0.5177 | 3124 | 0.0004 | 0.0008 | 0.0009 | 0.0014 | 0.0017 | 0.0021 | 0.0024 | 0.0027 | 0.0029 |
| 38 | 0.2466 | 0.5190 | 3116 | 0.0004 | 0.0007 | 0.0010 | 0.0016 | 0.0017 | 0.0022 | 0.0024 | 0.0027 | 0.0029 |
| 39 | 0.2456 | 0.5187 | 3145 | 0.0004 | 0.0007 | 0.0010 | 0.0015 | 0.0018 | 0.0022 | 0.0024 | 0.0027 | 0.0029 |
| 40 | 0.2466 | 0.5194 | 3115 | 0.0004 | 0.0008 | 0.0011 | 0.0016 | 0.0017 | 0.0021 | 0.0024 | 0.0027 | 0.0028 |
| 41 | 0.2456 | 0.5185 | 3149 | 0.0004 | 0.0009 | 0.0012 | 0.0017 | 0.0018 | 0.0022 | 0.0025 | 0.0029 | 0.0029 |
| 42 | 0.2468 | 0.5172 | 3124 | 0.0004 | 0.0007 | 0.0010 | 0.0016 | 0.0017 | 0.0021 | 0.0023 | 0.0027 | 0.0029 |
| 43 | 0.2463 | 0.5180 | 3133 | 0.0005 | 0.0010 | 0.0013 | 0.0017 | 0.0018 | 0.0022 | 0.0025 | 0.0028 | 0.0030 |
| 44 | 0.2456 | 0.5195 | 3141 | 0.0003 | 0.0006 | 0.0010 | 0.0016 | 0.0017 | 0.0021 | 0.0024 | 0.0027 | 0.0030 |
| 45 | 0.2469 | 0.5194 | 3106 | 0.0004 | 0.0009 | 0.0011 | 0.0015 | 0.0018 | 0.0022 | 0.0025 | 0.0029 | 0.0030 |
| 46 | 0.2469 | 0.5176 | 3119 | 0.0004 | 0.0009 | 0.0011 | 0.0016 | 0.0018 | 0.0022 | 0.0024 | 0.0027 | 0.0029 |
| 47 | 0.2472 | 0.5189 | 3103 | 0.0004 | 0.0009 | 0.0012 | 0.0016 | 0.0017 | 0.0021 | 0.0025 | 0.0028 | 0.0029 |
| 48 | 0.2473 | 0.5186 | 3102 | 0.0004 | 0.0007 | 0.0010 | 0.0016 | 0.0016 | 0.0020 | 0.0024 | 0.0026 | 0.0029 |
| 49 | 0.2460 | 0.5177 | 3142 | 0.0003 | 0.0006 | 0.0009 | 0.0014 | 0.0016 | 0.0020 | 0.0023 | 0.0027 | 0.0030 |
| 50 | 0.2472 | 0.5183 | 3107 | 0.0004 | 0.0008 | 0.0011 | 0.0016 | 0.0017 | 0.0021 | 0.0024 | 0.0028 | 0.0028 |
| Ave. | 0.2466 | 0.5184 | 3120 | 0.0004 | 0.0008 | 0.0011 | 0.0015 | 0.0017 | 0.0020 | 0.0023 | 0.0026 | 0.0028 |
| Med. | 0.2466 | 0.5185 | 3124 | 0.0004 | 0.0008 | 0.0011 | 0.0016 | 0.0017 | 0.0021 | 0.0024 | 0.0027 | 0.0029 |
| st dev | 0.0009 | 0.0006 | 25 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0002 |
| Min. | 0.2456 | 0.5172 | 3022 | 0.0002 | 0.0006 | 0.0009 | 0.0014 | 0.0015 | 0.0017 | 0.0018 | 0.0019 | 0.0022 |
| Max. | 0.2503 | 0.5195 | 3149 | 0.0005 | 0.0010 | 0.0013 | 0.0017 | 0.0018 | 0.0022 | 0.0025 | 0.0029 | 0.0030 |



3.7 Data Set 3, 120°C, 200mA (Lumen Maintenance)

| No. | Φ(lm) | Lumen Maintenance (%) | | | | | | | | |
|--------|--------------|-----------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | Ohr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 51 | 161.5 | 99.94 | 99.50 | 99.20 | 98.82 | 98.58 | 98.39 | 98.14 | 97.71 | 97.52 |
| 52 | 160.8 | 99.81 | 99.44 | 99.07 | 98.76 | 98.32 | 98.07 | 97.70 | 97.33 | 96.95 |
| 53 | 157.1 | 99.75 | 99.36 | 99.11 | 98.60 | 98.35 | 97.90 | 97.58 | 97.33 | 97.01 |
| 54 | 160.9 | 99.81 | 99.38 | 99.07 | 98.63 | 98.26 | 98.07 | 97.58 | 97.27 | 96.89 |
| 55 | 155.8 | 99.61 | 98.97 | 98.65 | 98.20 | 97.95 | 97.63 | 97.30 | 96.92 | 96.73 |
| 56 | 157.1 | 99.94 | 99.68 | 99.49 | 99.17 | 98.73 | 98.28 | 97.96 | 97.58 | 97.14 |
| 57 | 157.5 | 99.81 | 99.49 | 99.17 | 98.98 | 98.67 | 98.35 | 98.16 | 97.78 | 97.40 |
| 58 | 156.5 | 99.68 | 99.30 | 99.04 | 98.66 | 98.53 | 98.08 | 97.70 | 97.51 | 97.19 |
| 59 | 158.0 | 99.75 | 99.18 | 99.05 | 98.61 | 98.35 | 98.10 | 97.66 | 97.41 | 97.15 |
| 60 | 156.0 | 99.62 | 99.10 | 98.78 | 98.40 | 98.01 | 97.76 | 97.44 | 97.18 | 97.05 |
| 61 | 158.0 | 99.68 | 99.30 | 98.80 | 98.42 | 98.10 | 97.66 | 97.28 | 96.90 | 96.65 |
| 62 | 160.9 | 99.63 | 99.25 | 98.88 | 98.45 | 98.26 | 97.89 | 97.45 | 97.08 | 96.71 |
| 63 | 157.9 | 99.87 | 99.43 | 99.11 | 98.73 | 98.48 | 98.16 | 97.66 | 97.34 | 96.83 |
| 64 | 160.9 | 99.63 | 99.32 | 98.88 | 98.51 | 98.07 | 97.82 | 97.45 | 97.02 | 96.58 |
| 65 | 158.2 | 99.87 | 99.43 | 99.05 | 98.67 | 98.29 | 97.91 | 97.53 | 97.09 | 96.71 |
| 66 | 158.7 | 99.94 | 99.50 | 99.18 | 98.87 | 98.49 | 98.11 | 97.79 | 97.29 | 96.98 |
| 67 | 157.9 | 99.75 | 99.37 | 99.05 | 98.61 | 98.35 | 97.91 | 97.66 | 97.15 | 96.77 |
| 68 | 157.3 | 99.81 | 99.55 | 99.17 | 98.92 | 98.54 | 98.28 | 98.09 | 97.65 | 97.20 |
| 69 | 161.6 | 99.57 | 99.26 | 98.82 | 98.45 | 98.14 | 97.77 | 97.52 | 97.03 | 96.66 |
| 70 | 156.0 | 99.62 | 99.29 | 98.91 | 98.53 | 98.21 | 97.76 | 97.31 | 96.92 | 96.67 |
| 71 | 156.5 | 99.68 | 99.30 | 98.98 | 98.59 | 98.21 | 97.89 | 97.51 | 97.06 | 96.74 |
| 72 | 156.9 | 99.87 | 99.62 | 99.17 | 98.85 | 98.47 | 98.28 | 97.90 | 97.32 | 96.94 |
| 73 | 161.1 | 99.69 | 99.38 | 99.01 | 98.76 | 98.51 | 98.14 | 97.83 | 97.52 | 97.21 |
| 74 | 155.5 | 99.81 | 99.49 | 99.10 | 98.84 | 98.33 | 97.94 | 97.75 | 97.49 | 97.11 |
| 75 | 158.9 | 99.87 | 99.43 | 99.18 | 98.93 | 98.43 | 97.99 | 97.61 | 97.23 | 96.98 |
| Ave. | 158.3 | 99.76 | 99.37 | 99.04 | 98.68 | 98.34 | 98.01 | 97.66 | 97.28 | 96.95 |
| Med. | 157.9 | 99.75 | 99.38 | 99.05 | 98.66 | 98.35 | 97.99 | 97.66 | 97.29 | 96.95 |
| st dev | 2.0 | 0.1151 | 0.1564 | 0.1744 | 0.2183 | 0.2002 | 0.2149 | 0.2483 | 0.2520 | 0.2485 |
| Min. | 155.5 | 99.57 | 98.97 | 98.65 | 98.20 | 97.95 | 97.63 | 97.28 | 96.90 | 96.58 |
| Max. | 161.6 | 99.94 | 99.68 | 99.49 | 99.17 | 98.73 | 98.39 | 98.16 | 97.78 | 97.52 |

TM-21 Projection:

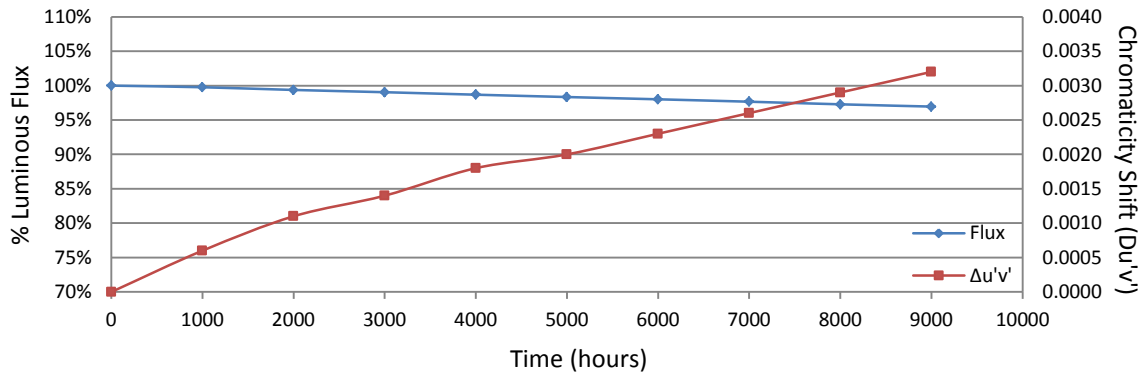
Test Duration: 9000 hours
Failures Observed: 0
α: 3.558E-06
β: 1.001
Reported L₇₀: >54000 hours

3.8 Data Set 3, 120°C, 200mA (Forward Voltage)

| No. | Forward Voltage (V) | | | | | | | | | |
|--------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0hr(Initial) | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 51 | 6.191 | 6.203 | 6.205 | 6.198 | 6.197 | 6.197 | 6.203 | 6.190 | 6.211 | 6.196 |
| 52 | 6.231 | 6.243 | 6.245 | 6.242 | 6.243 | 6.237 | 6.242 | 6.232 | 6.250 | 6.238 |
| 53 | 6.180 | 6.192 | 6.191 | 6.192 | 6.194 | 6.192 | 6.211 | 6.181 | 6.198 | 6.189 |
| 54 | 6.215 | 6.228 | 6.231 | 6.231 | 6.221 | 6.262 | 6.228 | 6.214 | 6.239 | 6.224 |
| 55 | 6.213 | 6.224 | 6.228 | 6.226 | 6.220 | 6.223 | 6.227 | 6.215 | 6.233 | 6.224 |
| 56 | 6.215 | 6.224 | 6.237 | 6.225 | 6.228 | 6.223 | 6.230 | 6.212 | 6.237 | 6.221 |
| 57 | 6.201 | 6.210 | 6.210 | 6.212 | 6.204 | 6.214 | 6.217 | 6.199 | 6.222 | 6.205 |
| 58 | 6.081 | 6.092 | 6.096 | 6.093 | 6.091 | 6.084 | 6.090 | 6.085 | 6.098 | 6.090 |
| 59 | 6.223 | 6.232 | 6.231 | 6.235 | 6.230 | 6.227 | 6.227 | 6.219 | 6.239 | 6.228 |
| 60 | 6.243 | 6.253 | 6.252 | 6.254 | 6.247 | 6.248 | 6.255 | 6.244 | 6.261 | 6.255 |
| 61 | 6.161 | 6.168 | 6.175 | 6.175 | 6.164 | 6.164 | 6.170 | 6.164 | 6.186 | 6.166 |
| 62 | 6.201 | 6.208 | 6.214 | 6.211 | 6.204 | 6.207 | 6.211 | 6.199 | 6.225 | 6.205 |
| 63 | 6.223 | 6.227 | 6.234 | 6.235 | 6.226 | 6.227 | 6.235 | 6.222 | 6.239 | 6.229 |
| 64 | 6.194 | 6.202 | 6.209 | 6.209 | 6.224 | 6.195 | 6.204 | 6.194 | 6.216 | 6.196 |
| 65 | 6.207 | 6.215 | 6.215 | 6.215 | 6.211 | 6.204 | 6.212 | 6.207 | 6.229 | 6.211 |
| 66 | 6.206 | 6.218 | 6.216 | 6.217 | 6.211 | 6.210 | 6.218 | 6.206 | 6.231 | 6.211 |
| 67 | 6.210 | 6.224 | 6.221 | 6.226 | 6.216 | 6.218 | 6.220 | 6.213 | 6.235 | 6.215 |
| 68 | 6.162 | 6.168 | 6.172 | 6.177 | 6.164 | 6.167 | 6.171 | 6.164 | 6.179 | 6.167 |
| 69 | 6.198 | 6.206 | 6.208 | 6.212 | 6.197 | 6.206 | 6.200 | 6.196 | 6.213 | 6.198 |
| 70 | 6.067 | 6.069 | 6.075 | 6.075 | 6.071 | 6.073 | 6.073 | 6.066 | 6.080 | 6.068 |
| 71 | 6.200 | 6.209 | 6.209 | 6.210 | 6.204 | 6.201 | 6.203 | 6.197 | 6.217 | 6.207 |
| 72 | 6.178 | 6.183 | 6.190 | 6.190 | 6.179 | 6.183 | 6.183 | 6.180 | 6.198 | 6.184 |
| 73 | 6.189 | 6.199 | 6.204 | 6.203 | 6.191 | 6.195 | 6.200 | 6.191 | 6.208 | 6.193 |
| 74 | 6.219 | 6.226 | 6.226 | 6.232 | 6.223 | 6.224 | 6.222 | 6.222 | 6.234 | 6.224 |
| 75 | 6.208 | 6.212 | 6.219 | 6.222 | 6.211 | 6.213 | 6.216 | 6.211 | 6.229 | 6.212 |
| Ave. | 6.193 | 6.201 | 6.205 | 6.205 | 6.199 | 6.200 | 6.203 | 6.193 | 6.212 | 6.198 |
| Med. | 6.201 | 6.210 | 6.214 | 6.212 | 6.211 | 6.207 | 6.212 | 6.199 | 6.225 | 6.207 |
| st dev | 0.041 | 0.042 | 0.041 | 0.041 | 0.041 | 0.043 | 0.042 | 0.040 | 0.042 | 0.041 |
| Min. | 6.067 | 6.069 | 6.075 | 6.075 | 6.071 | 6.073 | 6.073 | 6.066 | 6.080 | 6.068 |
| Max. | 6.243 | 6.253 | 6.252 | 6.254 | 6.247 | 6.262 | 6.255 | 6.244 | 6.261 | 6.255 |

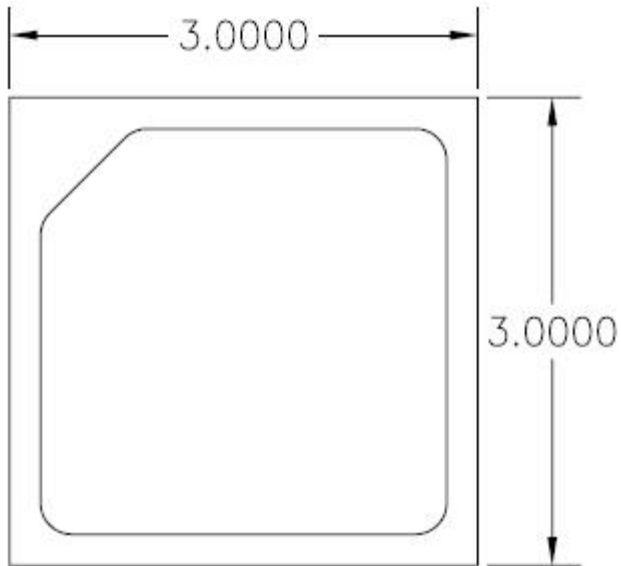
3.9 Data Set 3, 120°C, 200mA (Chromaticity Shift)

| No. | u' | v' | CCT(K) | Chromaticity Shift ($\Delta u'v'$) | | | | | | | | |
|--------|--------------|--------|--------|--------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 0hr(Initial) | | | 1000hrs | 2000hrs | 3000hrs | 4000hrs | 5000hrs | 6000hrs | 7000hrs | 8000hrs | 9000hrs |
| 51 | 0.2460 | 0.5178 | 3141 | 0.0006 | 0.0011 | 0.0014 | 0.0017 | 0.0020 | 0.0022 | 0.0026 | 0.0029 | 0.0030 |
| 52 | 0.2465 | 0.5178 | 3128 | 0.0006 | 0.0010 | 0.0013 | 0.0017 | 0.0020 | 0.0022 | 0.0026 | 0.0029 | 0.0032 |
| 53 | 0.2456 | 0.5183 | 3150 | 0.0004 | 0.0009 | 0.0012 | 0.0016 | 0.0020 | 0.0023 | 0.0026 | 0.0028 | 0.0031 |
| 54 | 0.2466 | 0.5192 | 3116 | 0.0007 | 0.0009 | 0.0012 | 0.0017 | 0.0018 | 0.0022 | 0.0025 | 0.0027 | 0.0029 |
| 55 | 0.2460 | 0.5179 | 3140 | 0.0007 | 0.0010 | 0.0013 | 0.0017 | 0.0020 | 0.0023 | 0.0026 | 0.0030 | 0.0032 |
| 56 | 0.2474 | 0.5195 | 3094 | 0.0007 | 0.0010 | 0.0013 | 0.0018 | 0.0020 | 0.0023 | 0.0026 | 0.0030 | 0.0031 |
| 57 | 0.2457 | 0.5183 | 3145 | 0.0006 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0023 | 0.0026 | 0.0028 | 0.0031 |
| 58 | 0.2472 | 0.5181 | 3108 | 0.0007 | 0.0012 | 0.0014 | 0.0018 | 0.0020 | 0.0024 | 0.0027 | 0.0030 | 0.0032 |
| 59 | 0.2470 | 0.5189 | 3109 | 0.0007 | 0.0013 | 0.0014 | 0.0018 | 0.0020 | 0.0024 | 0.0027 | 0.0030 | 0.0033 |
| 60 | 0.2492 | 0.5167 | 3065 | 0.0006 | 0.0011 | 0.0014 | 0.0018 | 0.0021 | 0.0025 | 0.0029 | 0.0031 | 0.0033 |
| 61 | 0.2461 | 0.5181 | 3136 | 0.0006 | 0.0011 | 0.0015 | 0.0018 | 0.0021 | 0.0024 | 0.0026 | 0.0030 | 0.0034 |
| 62 | 0.2472 | 0.5182 | 3109 | 0.0006 | 0.0012 | 0.0015 | 0.0019 | 0.0021 | 0.0024 | 0.0027 | 0.0030 | 0.0033 |
| 63 | 0.2469 | 0.5183 | 3114 | 0.0006 | 0.0011 | 0.0013 | 0.0019 | 0.0020 | 0.0023 | 0.0025 | 0.0028 | 0.0032 |
| 64 | 0.2482 | 0.5181 | 3081 | 0.0005 | 0.0010 | 0.0014 | 0.0018 | 0.0020 | 0.0023 | 0.0027 | 0.0029 | 0.0033 |
| 65 | 0.2456 | 0.5188 | 3145 | 0.0007 | 0.0013 | 0.0015 | 0.0019 | 0.0022 | 0.0025 | 0.0027 | 0.0030 | 0.0033 |
| 66 | 0.2463 | 0.5182 | 3130 | 0.0007 | 0.0012 | 0.0014 | 0.0018 | 0.0020 | 0.0024 | 0.0027 | 0.0029 | 0.0032 |
| 67 | 0.2467 | 0.5180 | 3123 | 0.0006 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0024 | 0.0026 | 0.0029 | 0.0032 |
| 68 | 0.2469 | 0.5189 | 3111 | 0.0006 | 0.0010 | 0.0013 | 0.0019 | 0.0020 | 0.0024 | 0.0026 | 0.0030 | 0.0032 |
| 69 | 0.2473 | 0.5188 | 3100 | 0.0005 | 0.0011 | 0.0013 | 0.0018 | 0.0019 | 0.0023 | 0.0024 | 0.0029 | 0.0032 |
| 70 | 0.2465 | 0.5186 | 3122 | 0.0007 | 0.0012 | 0.0014 | 0.0019 | 0.0020 | 0.0024 | 0.0027 | 0.0030 | 0.0032 |
| 71 | 0.2459 | 0.5191 | 3136 | 0.0006 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0024 | 0.0026 | 0.0030 | 0.0032 |
| 72 | 0.2458 | 0.5187 | 3142 | 0.0007 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0023 | 0.0026 | 0.0030 | 0.0032 |
| 73 | 0.2470 | 0.5171 | 3119 | 0.0005 | 0.0010 | 0.0014 | 0.0018 | 0.0020 | 0.0024 | 0.0026 | 0.0029 | 0.0032 |
| 74 | 0.2480 | 0.5177 | 3091 | 0.0007 | 0.0011 | 0.0014 | 0.0018 | 0.0022 | 0.0025 | 0.0027 | 0.0030 | 0.0034 |
| 75 | 0.2467 | 0.5186 | 3117 | 0.0007 | 0.0010 | 0.0013 | 0.0018 | 0.0020 | 0.0023 | 0.0026 | 0.0030 | 0.0032 |
| Ave. | 0.2467 | 0.5183 | 3119 | 0.0006 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0023 | 0.0026 | 0.0029 | 0.0032 |
| Med. | 0.2467 | 0.5183 | 3119 | 0.0006 | 0.0011 | 0.0014 | 0.0018 | 0.0020 | 0.0024 | 0.0026 | 0.0030 | 0.0032 |
| st dev | 0.0009 | 0.0006 | 22 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| Min. | 0.2456 | 0.5167 | 3065 | 0.0004 | 0.0009 | 0.0012 | 0.0016 | 0.0018 | 0.0022 | 0.0024 | 0.0027 | 0.0029 |
| Max. | 0.2492 | 0.5195 | 3150 | 0.0007 | 0.0013 | 0.0015 | 0.0019 | 0.0022 | 0.0025 | 0.0029 | 0.0031 | 0.0034 |



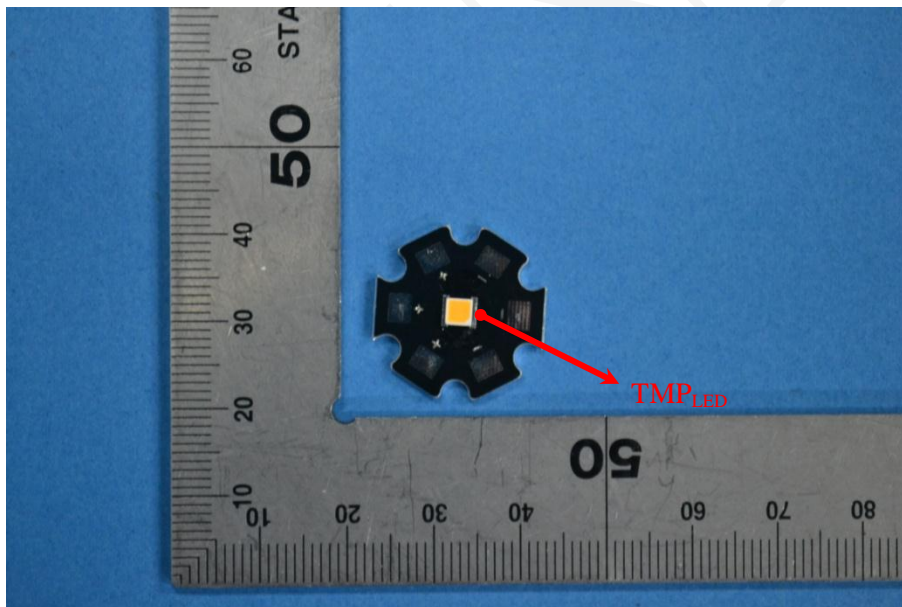
4 - EUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 EUT Photo



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