

IES LM-80 Test Report

Report Issue Date : January 22, 2021

Report Number :

I-191002-119-I-03

Testing Start Date : October 14, 2019

Testing Completion Date :

December 22, 2020

Revision Number : 03

Test Duration :

10 000 h

Manufacturer Information :

Applicant :

Seoul Semiconductor Co., LTD

Address :

97-11, Sandan-ro 163, Danwon-gu, Ansan, Gyeonggi-do, Korea 15429

Description of Test Samples :

Classification :

LED Package

PKG Name :

Z5M

Part Number :

SZ5-M4-Wx-Cx

Drive Current :

1050 mA

Test Procedure :

IES LM-80-15 Approved Method for Measuring Lumen Maintenance of LED Light Sources

Tested by



InHoi SIM, Research Engineer

Approved by

YoungJoon WON, Laboratory Manager



Seoul Semiconductor Testing Laboratory(TL-688) is accredited to ISO/IEC 17025:2005 for the above test procedure by IAS, USA which is a signatory to ILAC-MRA.

Seoul Semiconductor Testing Laboratory

If you need to verify the authenticity of this report, please contact the below address.

97-11, Sandan-ro 163, Danwon-gu, Ansan, Gyeonggi-do, Korea 15429, E-mail: LM80@seoulsemicon.com

Applicable Series Model Numbers

This LM-80 report is applicable to the following

Model Name	Forward Current	Typical VF	Power	LED Number	Power Density	Current Density	Minimum Spacing	CCT
SZ5-M4-WW-C7 Tested	1050 mA	3.2 V	3.4 W	1	1.41 W/mm ²	437 mA/mm ²	-	≥2200 K
SZ5-M4-W0-75	1050 mA	3.2 V	3.4 W	1	1.41 W/mm ²	437 mA/mm ²	-	≥2200 K
SZ5-M4-WN-75	1050 mA	3.2 V	3.4 W	1	1.41 W/mm ²	437 mA/mm ²	-	≥2200 K
SZ5-M4-WW-75	1050 mA	3.2 V	3.4 W	1	1.41 W/mm ²	437 mA/mm ²	-	≥2200 K



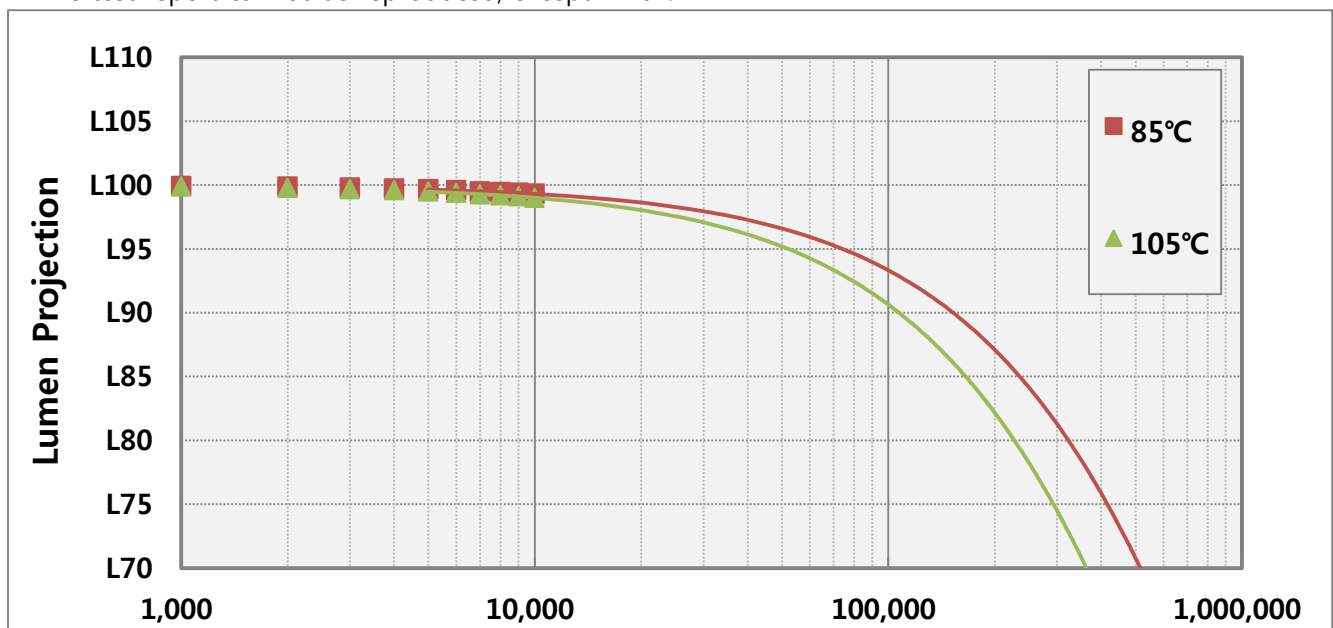
SEOUL SEMICONDUCTOR

1. Test Summary

Items	Nominal Case Temperature		
		85 °C	105 °C
Number of LED tested		20	20
Drive and Measurement Current		1 050 mA	1 050 mA
Test Duration		10 000 h	10 000 h
Actual Case Temperature		≥83.4 °C	≥103.4 °C
Actual Ambient Temperature		≥85.5 °C	≥102.6 °C
Air Flow Velocity		≤0.40 m/s	≤0.10 m/s
Averaged Initial Luminous Flux		370.3 lm	369.2 lm
Initial Nominal CCT		2700 K	2700 K
Average Initial CRI		69	68
Total Input Power		3.4 W	3.4 W
Average Current Density (mA/mm ²)		437	437
Average Power Density (W/mm ²)		1.41	1.41
Minimum Spacing from die edge to die edge		-	-
Average Lumen Maintenance		99.3 %	99.0 %
Average Chromacity Shift		0.000 8	0.001 6
α		6.911E-07	9.814E-07
B		1.000	1.000
TM-21 Projection L ₇₀		>60000	>60000
TM-21 Projection L ₈₀		>60000	>60000
TM-21 Projection L ₉₀		>60000	>60000

※ The results shown in this certificate refer only to the sample(s) tested unless otherwise stated.

This test report cannot be reproduced, except in full.



2. IES LM-80-08 Test Report Requirement :

Number of LED Light Sources Tested

See the Test Summary

Description of LED Light Sources

See the Description of Test samples at the cover of certificate

Description of auxiliary equipment

Active cooling Test System

Temperature controlling chamber for LED package/array/module consists of the water cooling heat-sink plates to control the case temperature of each device and of the power supply required by LM-80 test conditions.

Measurement System

Photometric measurement tester for LED package/array/module consists of the integrating sphere with temperature controlling system(TEC) and of programmable current source meter.

Operating Cycle

Constant Direct Current (DC)

Ambient Conditions Including Airflow, Temperature and Relative Humidity

Airflow : < 1 m/s

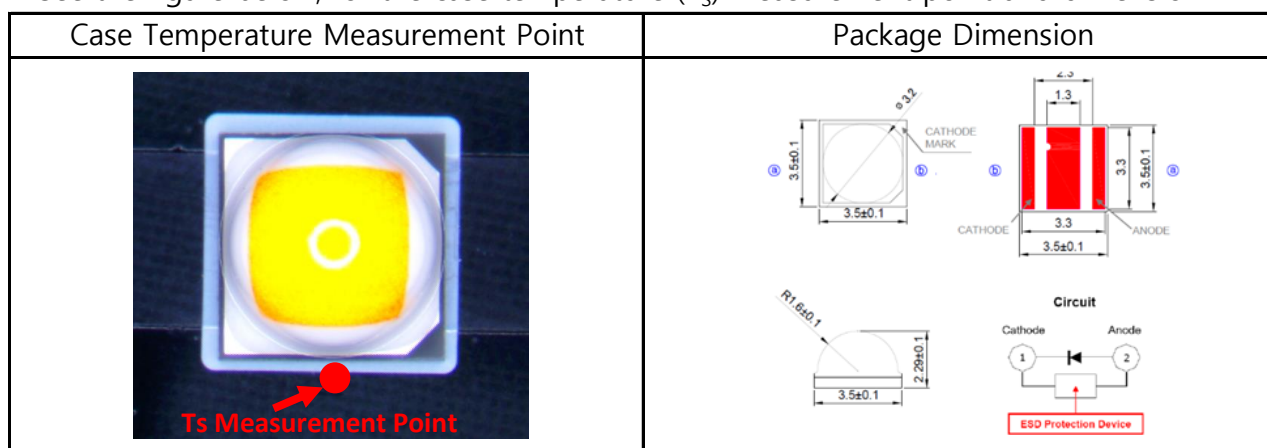
Ambient temperature : $\geq -5^{\circ}\text{C}$ of Nominal T_A

(See the Test Summary for actual T_A)

Relative Humidity : $\leq 65\%$ RH

Case Temperature (Test Point Temperature)

See the figure below, for the case temperature (T_S) measurement point and dimension



Drive Current of the LED Light Source During Lifetime Test

See the Test Summary

Initial Luminous Flux and Forward Voltage at Photometric Measurement Current

See the Test Summary

Lumen Maintenance Data for Each Individual LED Light Source Along with Median Value, Standard Deviation, Minimum and Maximum Lumen Maintenance Value for All of the LED Light Sources

See the table of each data set

Observation of LED light Sources Failures

No failure observed

LED Light Source Monitoring Interval

See the table of each data set

Photometric Measurement Uncertainty

Seoul Semiconductor maintain a tolerance of $\pm 3.0\%$ at 95 % confidence level ($k = 2$)

Chromaticity Shift Over the Measurement Time

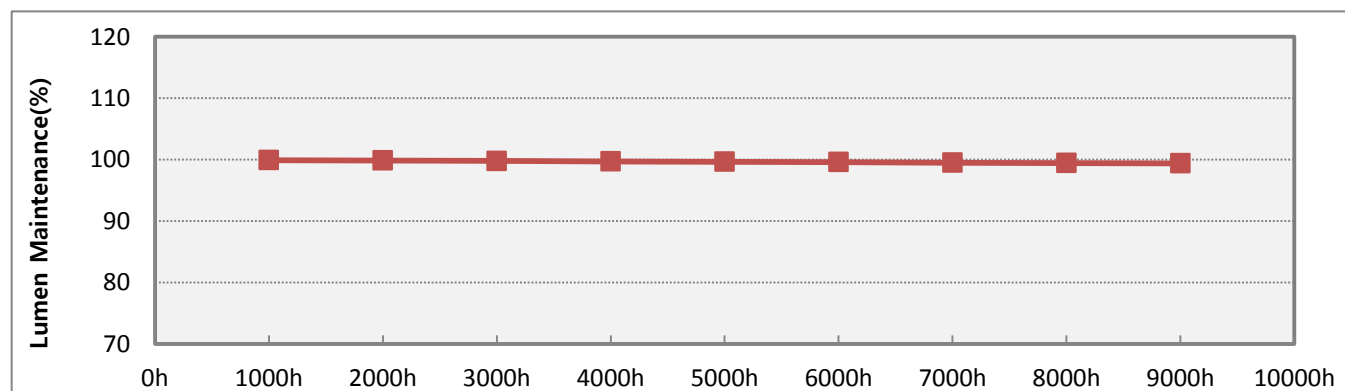
See the table of each data set

DUT Sampling Method

Each test units is made with 20 samples that are randomly taken from 40 samples of 3 manufacturing lot. 2 units are tested for LM-80 under 2 different temperature condition.

3. 85°C Data Set

No.	Initial Characteristics			Lumen Maintenance								
	Vf (V)	Flux (lm)	CCT (K)	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
01	3.24	373.42	2616	99.8	99.8	99.8	99.7	99.7	99.5	99.4	99.3	99.4
02	3.20	355.90	2629	99.7	99.8	99.7	99.6	99.5	99.4	99.3	99.2	99.3
03	3.20	376.69	2666	100.0	100.0	99.8	99.9	99.8	99.8	99.5	99.6	99.3
04	3.23	374.95	2630	99.8	99.8	99.6	99.6	99.5	99.5	99.5	99.2	99.2
05	3.24	372.52	2609	99.8	99.9	99.8	99.7	99.6	99.6	99.5	99.4	99.3
06	3.28	376.88	2616	99.8	99.7	99.7	99.6	99.6	99.4	99.6	99.4	99.3
07	3.22	355.18	2614	100.3	100.3	100.2	100.2	100.1	100.1	100.0	99.7	99.8
08	3.20	372.65	2605	99.9	99.9	99.9	99.8	99.9	99.8	99.7	99.5	99.6
09	3.22	377.21	2633	99.9	100.0	99.9	99.7	99.6	99.7	99.6	99.4	99.4
10	3.18	368.41	2622	100.0	99.7	99.8	99.6	99.7	99.6	99.5	99.5	99.5
11	3.23	367.19	2617	100.1	99.9	99.8	99.9	99.9	99.7	99.5	99.4	99.4
12	3.23	371.75	2611	99.9	99.9	99.8	99.7	99.6	99.6	99.6	99.6	99.5
13	3.26	380.54	2642	100.0	99.8	99.9	99.7	99.7	99.7	99.5	99.5	99.6
14	3.21	371.51	2602	99.8	99.7	99.7	99.5	99.6	99.5	99.4	99.6	99.2
15	3.34	365.12	2609	99.9	99.7	99.7	99.4	99.5	99.3	99.2	99.4	99.2
16	3.22	357.76	2639	100.0	99.9	99.9	99.9	99.7	99.7	99.6	99.5	99.5
17	3.26	379.86	2616	99.8	99.8	99.6	99.6	99.5	99.4	99.4	99.3	99.3
18	3.25	373.75	2615	99.8	99.9	99.7	99.6	99.5	99.6	99.5	99.5	99.4
19	3.24	374.45	2614	100.1	100.0	99.8	99.9	99.6	99.7	99.4	99.6	99.4
20	3.29	360.18	2627	99.9	99.8	99.6	99.5	99.6	99.3	99.2	99.3	99.3
Ave.	3.24	370.30	2622	99.9	99.9	99.8	99.7	99.7	99.6	99.5	99.4	99.4
Med.	3.23	372.58	2616	99.9	99.9	99.8	99.7	99.6	99.6	99.5	99.5	99.4
Min.	3.18	355.18	2602	99.7	99.7	99.6	99.4	99.5	99.3	99.2	99.2	99.2
Max.	3.34	380.54	2666	100.3	100.3	100.2	100.2	100.1	100.1	100.0	99.7	99.8
σ	0.04	7.74	15	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1



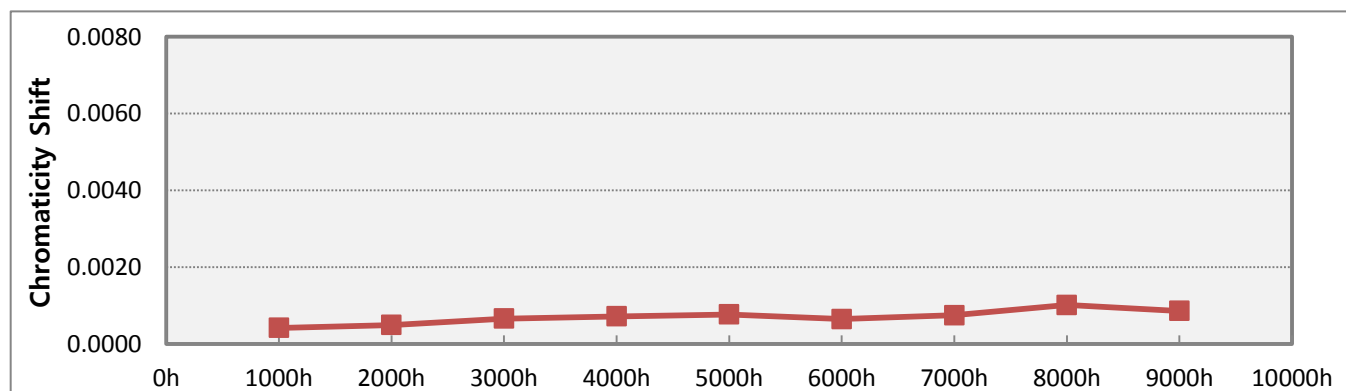


3. 85°C Data Set

No.				Lumen Maintenance								
				10000 h								
01				99.2								
02				99.0								
03				99.4								
04				99.2								
05				99.3								
06				99.3								
07				99.8								
08				99.5								
09				99.3								
10				99.4								
11				99.4								
12				99.3								
13				99.3								
14				99.2								
15				99.3								
16				99.4								
17				99.2								
18				99.2								
19				99.4								
20				99.2								
Ave.				99.3								
Med.				99.3								
Min.				99.0								
Max.				99.8								
σ				0.2								

3. 85°C Data Set

No.	Initial Characteristics			Chromaticity Shift du'v'								
	u'	v'	CRI	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
01	0.2645	0.5395	68	0.0005	0.0005	0.0007	0.0007	0.0009	0.0007	0.0005	0.0009	0.0011
02	0.2639	0.5394	69	0.0003	0.0004	0.0006	0.0006	0.0009	0.0007	0.0006	0.0009	0.0007
03	0.2619	0.5393	69	0.0002	0.0003	0.0004	0.0005	0.0004	0.0005	0.0005	0.0007	0.0009
04	0.2639	0.5391	69	0.0005	0.0006	0.0006	0.0007	0.0008	0.0008	0.0008	0.0010	0.0011
05	0.2649	0.5395	69	0.0004	0.0005	0.0007	0.0008	0.0008	0.0008	0.0006	0.0010	0.0010
06	0.2644	0.5401	68	0.0004	0.0005	0.0007	0.0006	0.0009	0.0005	0.0008	0.0009	0.0012
07	0.2646	0.5391	69	0.0005	0.0006	0.0008	0.0007	0.0009	0.0005	0.0008	0.0011	0.0012
08	0.2652	0.5391	69	0.0004	0.0005	0.0006	0.0006	0.0008	0.0007	0.0008	0.0010	0.0006
09	0.2637	0.5392	69	0.0005	0.0005	0.0007	0.0008	0.0007	0.0009	0.0009	0.0011	0.0007
10	0.2642	0.5395	69	0.0004	0.0005	0.0007	0.0008	0.0008	0.0006	0.0006	0.0012	0.0012
11	0.2645	0.5394	69	0.0005	0.0005	0.0008	0.0008	0.0007	0.0007	0.0008	0.0013	0.0007
12	0.2647	0.5400	69	0.0003	0.0004	0.0006	0.0007	0.0007	0.0007	0.0010	0.0011	0.0005
13	0.2631	0.5396	69	0.0003	0.0004	0.0005	0.0006	0.0006	0.0010	0.0009	0.0012	0.0009
14	0.2652	0.5400	69	0.0005	0.0005	0.0007	0.0009	0.0008	0.0005	0.0006	0.0009	0.0010
15	0.2648	0.5401	69	0.0004	0.0005	0.0007	0.0007	0.0007	0.0007	0.0008	0.0008	0.0007
16	0.2633	0.5395	69	0.0004	0.0005	0.0008	0.0007	0.0008	0.0005	0.0004	0.0010	0.0006
17	0.2645	0.5395	69	0.0003	0.0003	0.0005	0.0007	0.0007	0.0005	0.0006	0.0009	0.0010
18	0.2646	0.5396	69	0.0005	0.0006	0.0007	0.0009	0.0007	0.0006	0.0010	0.0011	0.0008
19	0.2645	0.5402	69	0.0004	0.0005	0.0005	0.0007	0.0006	0.0004	0.0010	0.0011	0.0005
20	0.2641	0.5387	69	0.0005	0.0006	0.0007	0.0008	0.0009	0.0005	0.0008	0.0011	0.0008
Ave.	0.2642	0.5395	69	0.0004	0.0005	0.0007	0.0007	0.0008	0.0006	0.0007	0.0010	0.0009
Med.	0.2645	0.5395	69	0.0004	0.0005	0.0007	0.0007	0.0008	0.0007	0.0008	0.0010	0.0009
Min.	0.2619	0.5387	68	0.0002	0.0003	0.0004	0.0005	0.0004	0.0004	0.0004	0.0007	0.0005
Max.	0.2652	0.5402	69	0.0005	0.0006	0.0008	0.0009	0.0009	0.0010	0.0010	0.0013	0.0012
σ	0.0008	0.0004	0.2	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0002



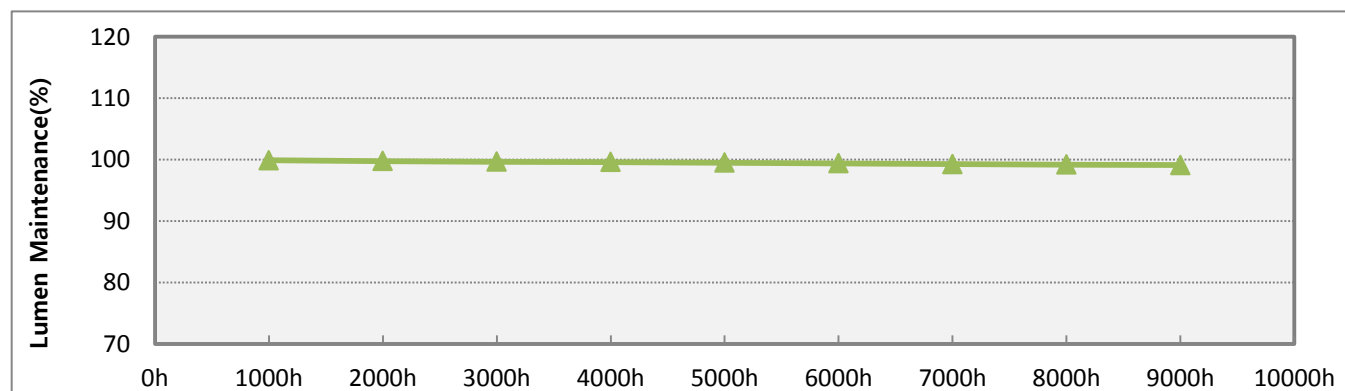


3. 85°C Data Set

No.					Chromaticity Shift du'v'								
					10000 h								
01					0.0011								
02					0.0008								
03					0.0006								
04					0.0005								
05					0.0005								
06					0.0007								
07					0.0007								
08					0.0008								
09					0.0009								
10					0.0006								
11					0.0007								
12					0.0006								
13					0.0007								
14					0.0012								
15					0.0011								
16					0.0006								
17					0.0006								
18					0.0009								
19					0.0009								
20					0.0008								
Ave.					0.0008								
Med.					0.0007								
Min.					0.0005								
Max.					0.0012								
σ					0.0002								

4. 105°C Data Set

No.	Initial Characteristics			Lumen Maintenance								
	Vf (V)	Flux (lm)	CCT (K)	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
01	3.22	337.46	2591	99.8	99.6	99.6	99.5	99.3	99.2	99.2	99.1	99.0
02	3.21	375.00	2584	99.8	99.7	99.7	99.6	99.3	99.2	99.2	99.1	99.0
03	3.21	377.68	2583	99.8	99.6	99.6	99.4	99.4	99.4	99.2	99.1	99.1
04	3.20	358.23	2557	99.8	99.7	99.7	99.5	99.3	99.2	99.2	99.1	98.9
05	3.24	376.29	2588	99.9	99.8	99.7	99.7	99.6	99.5	99.3	99.2	99.2
06	3.25	377.35	2575	99.8	99.7	99.5	99.4	99.4	99.3	99.3	99.2	99.2
07	3.24	370.15	2589	100.0	99.8	99.8	99.6	99.6	99.4	99.2	99.2	99.0
08	3.40	371.99	2559	99.9	99.7	99.6	99.6	99.5	99.4	99.3	99.2	99.1
09	3.25	370.67	2528	99.8	99.8	99.6	99.5	99.5	99.3	99.2	99.1	99.0
10	3.23	360.34	2543	100.1	100.1	99.9	99.8	99.8	99.7	99.5	99.4	99.3
11	3.22	382.15	2587	100.0	99.8	99.8	99.8	99.7	99.5	99.4	99.4	99.3
12	3.19	370.59	2528	99.8	99.8	99.6	99.6	99.5	99.5	99.2	99.1	99.1
13	3.23	357.82	2546	99.9	99.7	99.6	99.6	99.3	99.2	99.1	99.0	98.9
14	3.22	380.76	2584	99.9	99.9	99.7	99.6	99.5	99.5	99.3	99.2	99.2
15	3.26	376.26	2544	99.9	99.8	99.7	99.7	99.6	99.3	99.3	99.2	99.2
16	3.20	363.01	2575	99.8	99.5	99.7	99.6	99.5	99.5	99.4	99.3	99.2
17	3.23	375.39	2566	99.9	99.9	99.7	99.6	99.6	99.6	99.4	99.3	99.3
18	3.27	371.54	2535	99.7	99.6	99.6	99.6	99.5	99.3	99.2	99.1	99.1
19	3.21	374.54	2553	100.0	99.7	99.7	99.5	99.4	99.3	99.2	99.2	99.1
20	3.25	356.12	2543	99.8	99.6	99.5	99.5	99.5	99.4	99.2	99.2	99.2
Ave.	3.24	369.17	2563	99.9	99.8	99.7	99.6	99.5	99.4	99.3	99.2	99.1
Med.	3.23	371.77	2563	99.8	99.7	99.7	99.6	99.5	99.4	99.2	99.2	99.1
Min.	3.19	337.46	2528	99.7	99.5	99.5	99.4	99.3	99.2	99.1	99.0	98.9
Max.	3.40	382.15	2591	100.1	100.1	99.9	99.8	99.8	99.7	99.5	99.4	99.3
σ	0.04	10.77	22	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1



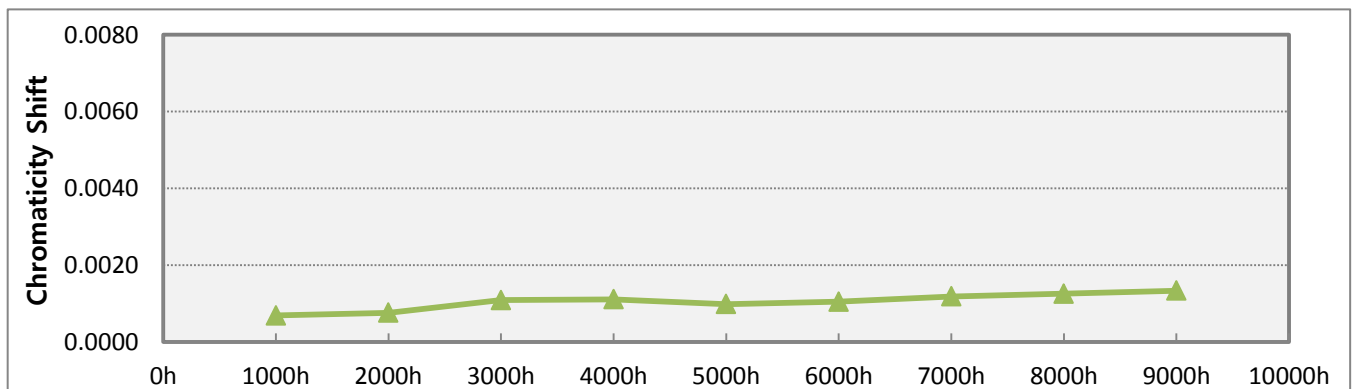


4. 105°C Data Set

No.				Lumen Maintenance								
				10000 h								
01				98.8								
02				98.9								
03				98.9								
04				98.9								
05				99.1								
06				99.0								
07				99.0								
08				99.0								
09				98.9								
10				99.3								
11				99.0								
12				99.1								
13				98.9								
14				99.1								
15				99.1								
16				99.1								
17				99.1								
18				98.9								
19				99.0								
20				99.0								
Ave.				99.0								
Med.				99.0								
Min.				98.8								
Max.				99.3								
σ				0.1								

4. 105°C Data Set

No.	Initial Characteristics			Chromaticity Shift du'v'								
	u'	v'	CRI	1000 h	2000 h	3000 h	4000 h	5000 h	6000 h	7000 h	8000 h	9000 h
01	0.2657	0.5402	69	0.0007	0.0008	0.0010	0.0010	0.0010	0.0011	0.0012	0.0013	0.0013
02	0.2657	0.5426	68	0.0008	0.0009	0.0015	0.0013	0.0011	0.0012	0.0013	0.0014	0.0015
03	0.2657	0.5430	68	0.0009	0.0009	0.0008	0.0012	0.0011	0.0012	0.0013	0.0015	0.0015
04	0.2672	0.5425	68	0.0008	0.0009	0.0015	0.0014	0.0011	0.0012	0.0013	0.0014	0.0015
05	0.2655	0.5426	68	0.0010	0.0010	0.0009	0.0012	0.0013	0.0013	0.0015	0.0015	0.0016
06	0.2662	0.5428	68	0.0010	0.0010	0.0008	0.0008	0.0013	0.0013	0.0015	0.0015	0.0016
07	0.2655	0.5424	68	0.0005	0.0006	0.0009	0.0012	0.0008	0.0009	0.0011	0.0012	0.0012
08	0.2670	0.5431	68	0.0006	0.0006	0.0010	0.0015	0.0009	0.0009	0.0010	0.0011	0.0012
09	0.2687	0.5433	68	0.0006	0.0007	0.0009	0.0010	0.0009	0.0010	0.0012	0.0012	0.0013
10	0.2679	0.5429	68	0.0006	0.0007	0.0014	0.0015	0.0009	0.0009	0.0011	0.0012	0.0013
11	0.2654	0.5432	68	0.0008	0.0009	0.0013	0.0007	0.0012	0.0012	0.0014	0.0015	0.0016
12	0.2687	0.5435	68	0.0004	0.0005	0.0014	0.0010	0.0007	0.0008	0.0010	0.0010	0.0010
13	0.2678	0.5426	68	0.0005	0.0006	0.0008	0.0012	0.0008	0.0009	0.0010	0.0011	0.0012
14	0.2656	0.5433	68	0.0005	0.0006	0.0012	0.0010	0.0008	0.0009	0.0010	0.0010	0.0011
15	0.2678	0.5432	68	0.0006	0.0007	0.0011	0.0014	0.0009	0.0009	0.0011	0.0012	0.0012
16	0.2662	0.5428	68	0.0004	0.0005	0.0007	0.0012	0.0008	0.0009	0.0010	0.0010	0.0011
17	0.2666	0.5430	68	0.0007	0.0008	0.0012	0.0011	0.0010	0.0011	0.0012	0.0014	0.0015
18	0.2682	0.5437	68	0.0006	0.0007	0.0015	0.0006	0.0010	0.0010	0.0012	0.0012	0.0013
19	0.2674	0.5430	68	0.0009	0.0010	0.0007	0.0007	0.0011	0.0012	0.0013	0.0013	0.0014
20	0.2679	0.5430	68	0.0006	0.0007	0.0011	0.0010	0.0009	0.0009	0.0010	0.0012	0.0012
Ave.	0.2668	0.5428	68	0.0007	0.0008	0.0011	0.0011	0.0010	0.0010	0.0012	0.0013	0.0013
Med.	0.2668	0.5430	68	0.0006	0.0007	0.0010	0.0011	0.0010	0.0010	0.0012	0.0012	0.0013
Min.	0.2654	0.5402	68	0.0004	0.0005	0.0007	0.0006	0.0007	0.0008	0.0010	0.0010	0.0010
Max.	0.2687	0.5437	69	0.0010	0.0010	0.0015	0.0015	0.0013	0.0013	0.0015	0.0015	0.0016
σ	0.0012	0.0007	0.3	0.0002	0.0002	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002



4. 105°C Data Set

No.					Chromaticity Shift du'v'								
					10000 h								
01					0.0015								
02					0.0020								
03					0.0019								
04					0.0020								
05					0.0014								
06					0.0019								
07					0.0018								
08					0.0016								
09					0.0019								
10					0.0011								
11					0.0019								
12					0.0015								
13					0.0018								
14					0.0013								
15					0.0011								
16					0.0009								
17					0.0016								
18					0.0018								
19					0.0019								
20					0.0014								
Ave.					0.0016								
Med.					0.0017								
Min.					0.0009								
Max.					0.0020								
σ					0.0003								