LM-80-08 LUMEN MAINTENANCE TEST REPORT

Company : Everlight Electronics Co., LTD.

Sample Name : 5630

Sample Received : May 8 2012

Sample Tested : Jan 28 2013

TESTING LABORATORY IS ACCREDITED BY:

IEC/IECQ 17025 certificate of independent test laboratory approval

Certificate No. : T1091

ISO 17025 accredited in respect of laboratory is approved by TAF

Certificate No. : L0835-090819

Testing Laboratory
0835

ISO 9001 certificate is approved by TUV CERT certification body of TUV NORD Cert GmbH

EPA-Recognized Laboratories No. : 1112442

WE HEREBY CERTIFY THAT:

The test(s) shown in the attachment were conducted according to the indicating procedures. We assume full responsibility for the accuracy and completeness of these tests and vouch for the qualifications of all personnel performing them.

	Name	Signature	Date
Test Engineer	Max Chen	Max Chen	2013/2/8
Test Manager	Allan Tang	Allan Tseng	2013/2/8

Note :

1. This report will be invalid if reproduced in whole or in part.
2. This report refers only to the specimen(s) submitted to test, and is invalid if used separately.
3. This report is ONLY valid with the examination seal and signature of this institute.
4. The tested specimen(s) will only be preserved for thirty days from the date issued, if not collected by the applicant.

IST LM-80-08 CERTIFICATION

1. EPA Certificate Laboratory (ENERGY STAR® Program)

ENERGY STAR® website:
http://www.energystar.gov/index.cfm?fuseaction=recognized_bodies_list.show_RCB_search_ results

→ New Search → Company Name: Integrated Service Technology

Organization ID	Organization Name	Type of Recognized Body	If Lab is it 1st Party?	Programs	Organization Address	City	State	Country
1112214	Integrated Service Technology Inc. (Hsinchu) EXIT	Accredited Laboratory	N	Certified Lighting Subcomponents, Luminaires	No 18 Pu Ding Road	Hsin-Chu		TW

2. LED Lighting Facts® Approved Testing Laboratory

Lighting Facts website: http://www.lightingfacts.com/approvedlabs

Testing Laboratory Partner	LM-79: total flux and color (required label metrics; LM-79 sections 9 and 12)	LM-79: intensity distribution (optional metrics; LM-79 section 10)	In-situ Temperature Measurement Test (ISTMT)*	LM-80
Integrated Service Technology Inc.	No	No	No	9/10/2012 - 9/9/2015

3. EPA Recognized Lab. Accreditation Body

EPA website: http://www.energystar.gov/index.cfm?c=partners.epa_recognized_accreditation_bodies

Taiwan Accreditation Foundation (TAF)	Taiwan	www.taftw.org.tw

4. ISO-17025 Accredited Lab.

TAF (EPA approved Accredited Body) website: http://hr.taftw.org.tw/service/labinfoE.aspx?code=0835

Item

18.01 Commodity
LEDs (Package, Module, Array)
O008 Lumen maintenance
ENERGY STAR Solid State
Lighting Luminaries
For Lumen maintenance
(IES LM-80-08 Component performance)

Luminous flux : 1 lm to 10000 lm
Color temperature : 1500 K to 25000 K
Chromaticity Diagram (CIE 1931 x/y) : 0.000 to 1.000
Current: 3 A
Voltage: 240 V
Temperature: Max. 150 ℃

Approval Signatory : TSENG, Allan,LEE, General

TABLE OF CONTENTS

1. GENERAL INFORMATION

DESCRIPTION OF TEST UNIT

Manufacturer	: Everlight
Model Name	: 5630
Nominal CCT	: 2700 K
Device Type	: LED Package
Package Dimension	: 5.6 mm x 3.0 mm
Sample Quantity	: See Summary Test Report

2. SUMMARY OF LM-80-08 TEST

2.1 SUMMARY TEST RESULT OF LM-80-08

Date(s) Of Performance Of The Test : May,8,2012 ~ Jan,28,2013

LM-80 Nominal Case Temperature (T_s)	LM-80-08 Specified Temperature		Customer Selected
	55 ℃	85 ℃	45 ℃
Test Sample Size (ea)	25	25	25
Test Current (I_F)	150mA	150mA	150 mA
Actual Case Temperature [T_S] T_S ≧ Nominal T_S -2 ℃	56.4 ℃	86.2 ℃	45.6 ℃
Actual Ambient Temperature [T_A] T_A ≧ Nominal T_S -5 ℃	54.1 ℃	83.9 ℃	44.3 ℃
Actual Relative Humidity	60 %	60 %	60 %
Avg. CCT at 6,000 hours [K]	2696.30	2693.07	2691.65
Avg. Chromaticity Shift at 6,000 hours	0.0009	0.0011	0.0009
Avg. Lumen Maintenance at 6,000 hours	99.46 %	92.57 %	99.63 %

Based on ENERGY STAR published guidance:
http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/luminaires/ENERGY_STAR_Final_Lumen_Maintenance_Guidance.pdf

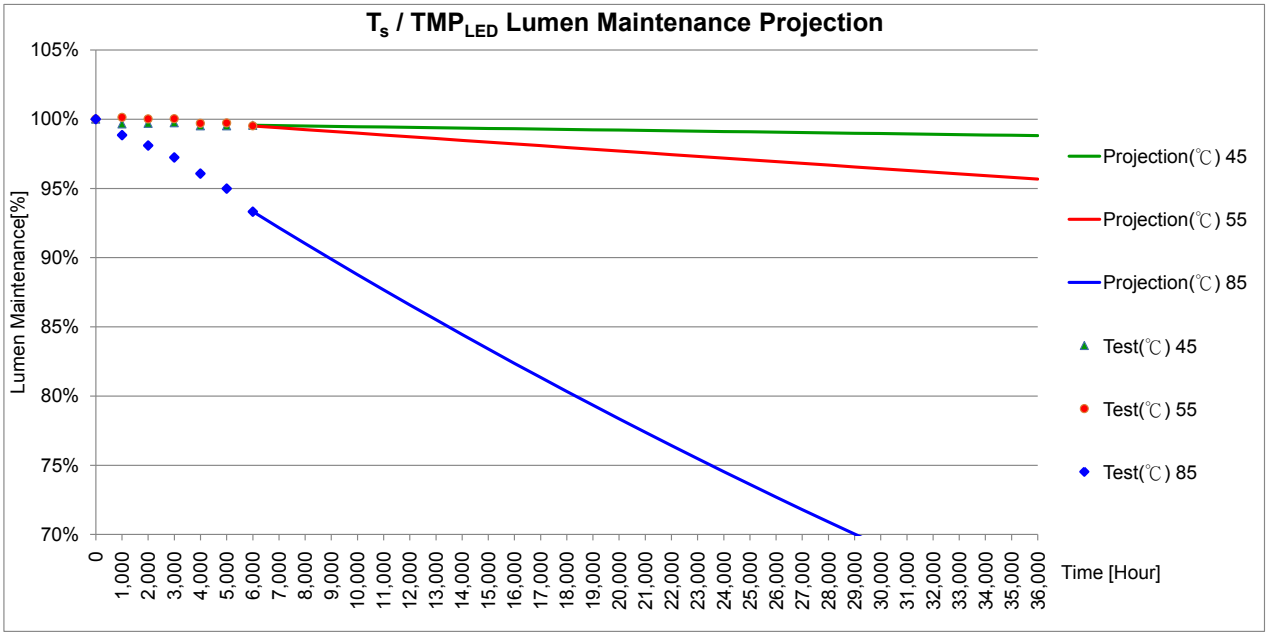
This LM-80 test report also applies to the following series product:

Tested device name : 5630

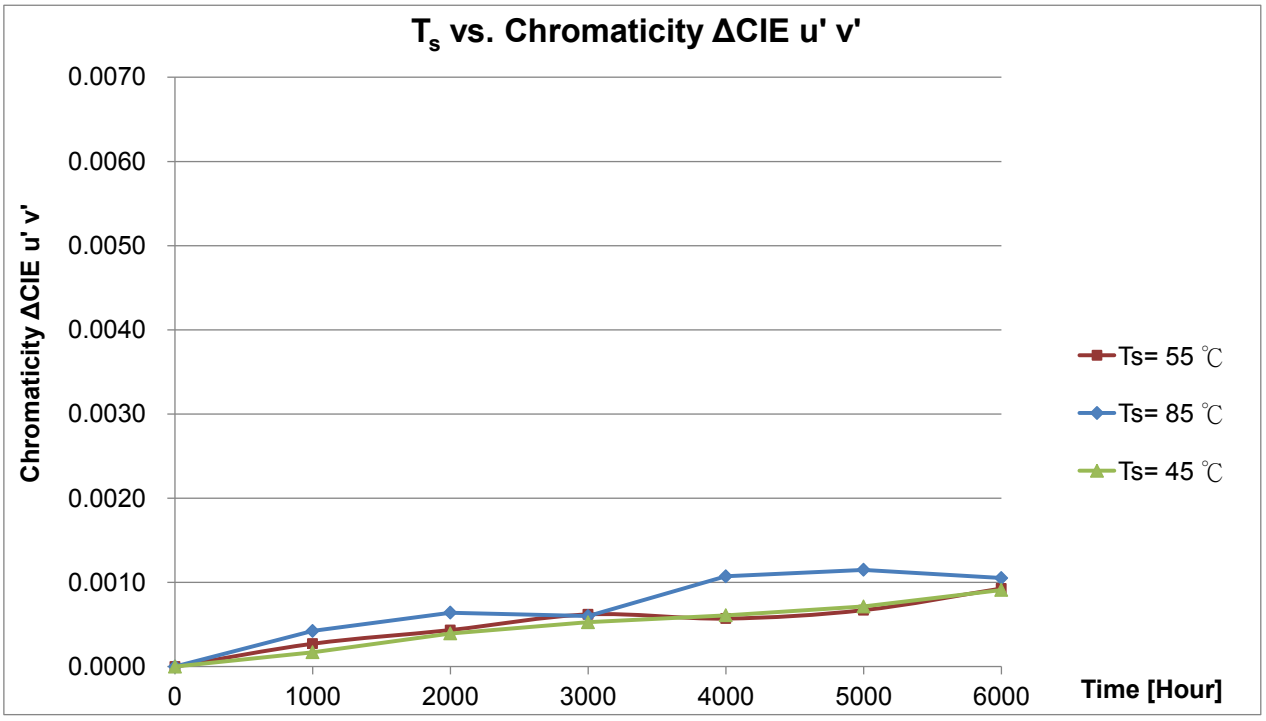
Series product

Part Number	CCT
62-217B-KK2C-S6565PAQAB42Z12/2T	6500K
62-217B-KK2C-S5757QAR3B42Z15/2T	5700K
62-217B-KK2C-S5050QAR3B42Z15/2T	5000K
62-217B/KK2C-S4040QAR2B42Z15/2T	4000K
62-217B/KK2C-S3030QAR2B42Z15/2T	3000K
62-217B/KK2C-S2727PAQAB42Z15/2T	2700K

2.2 CHART OF LUMEN MAINTENANCE AND TM-21 PROJECTION



2.3 CHART OF CHROMATICITY SHIFT



3. LUMEN MAINTENANCE TEST

3.1 TEST EQUIPMENT

Test Equipment	Model Name	Serial Number	Calibration Trace Code
LM-80 Test System	Vektrex Spike Safe 200	1080030002	N/A
LM-80 Chamber	Vektrex ITCS	406 421 404	A101-06-415-03 CLTS0359-101-421 A101-06-415-02
Integrating Sphere	Labsphere CY-03935-000 CSTM-LMS400	0329116790	N/A
Power Supply	KEITHLEY 2420	1014862	A101-05-480-01

3.2 LABORATORY AMBIENCE CONDITION

Item	Temperature	Relative Humidity
Laboratory Chamber Area	25 ± 5 ℃	55 %RH ± 10 %
Laboratory Photometry Area	25 ± 2 ℃	55 %RH ± 10 %

3.3 REFERENCE DOCUMENT

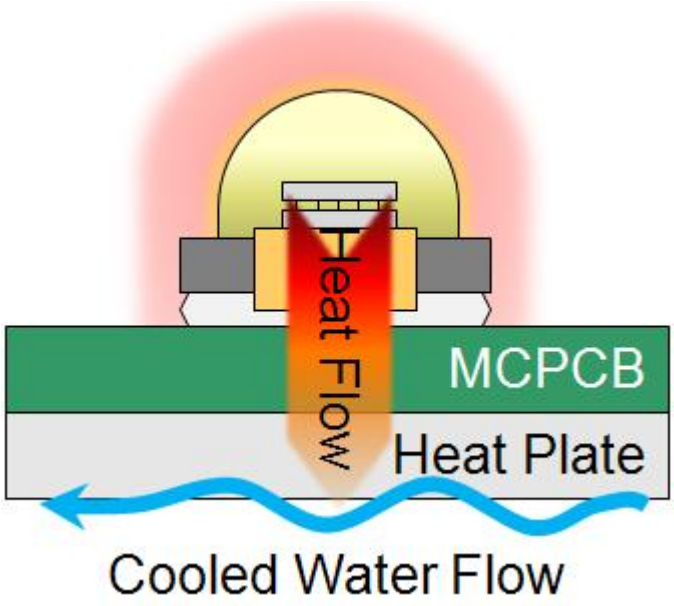
This test refer to IES-LM-80-08 Test Method

3.4 TEST CONDITION

Test Temperature : 45 ℃/ 55 ℃/ 85 ℃
Actual Ta/Ts Temperature : See Individual Test Report
Driver Current : Constant DC 150mA
Relative Humidity : ≦60%RH
Air Flow : 1 m/sec
Lumen Monitoring Interval : 0/1000/2000/3000/4000/5000/6000 hours.
Photometric measurement uncertainty : Calculated to k = 2 coverage (i.e. 95% coverage)

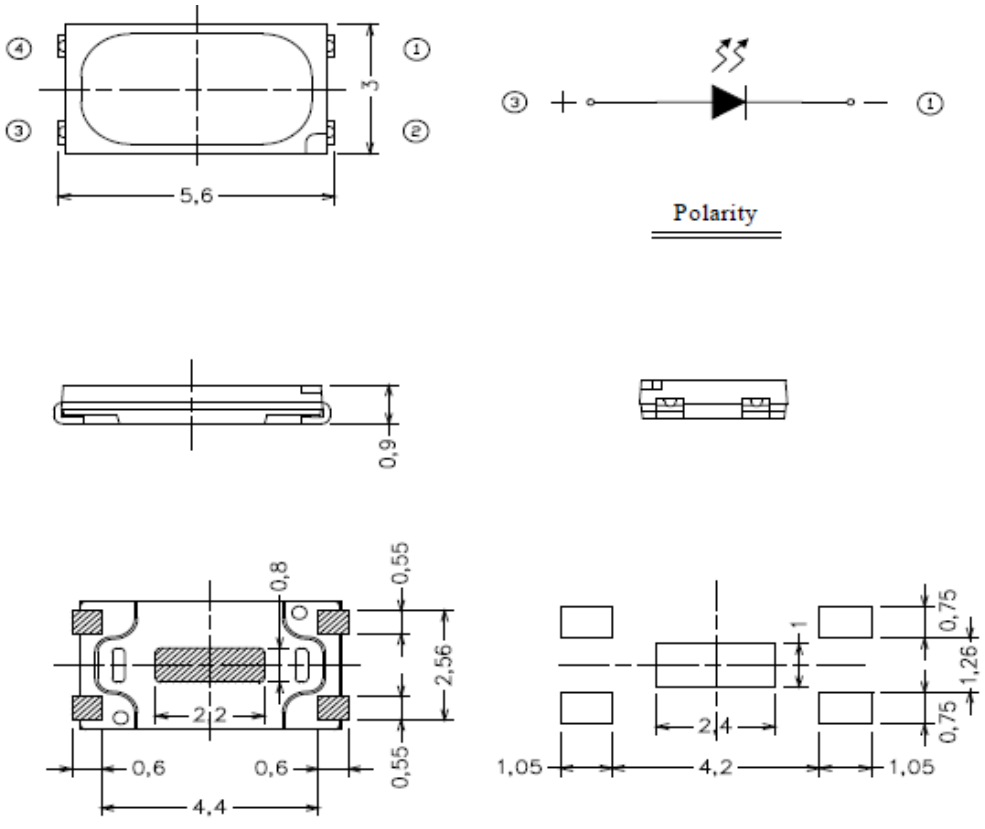
Item	Uncertainty
Luminous Flux (FV)	0.681%
Correlated Color Temperature (CCT)	0.156%

3.5 TEMPERATURE CONTROL METHOD



3.6 PHOTOGRAPH OF DEVICE

Device Outline Drawing



Note:
Tolerance unless mentioned is ±0.1mm; Unit = mm

3.7 TEMPERATURE MEASUREMENT POINT

Ta (Measured Point Of T_A=Ambient Temperature)

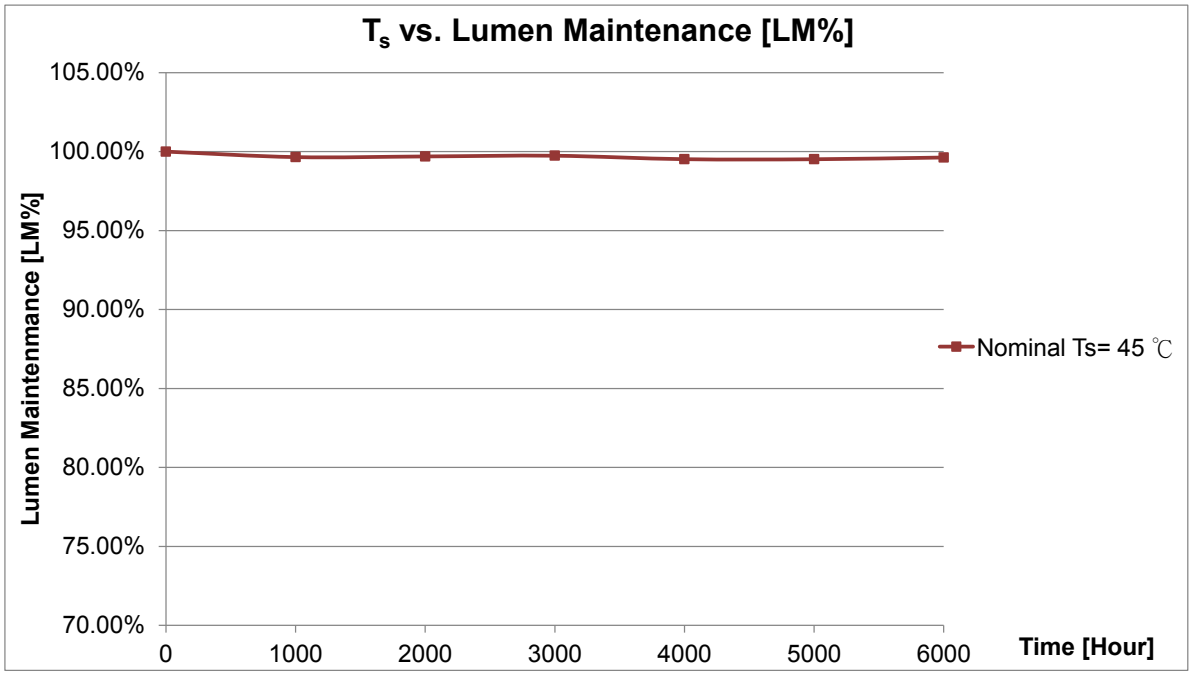
Ta is the temperature of the air at a distance of 5 mm above the reliability test board.

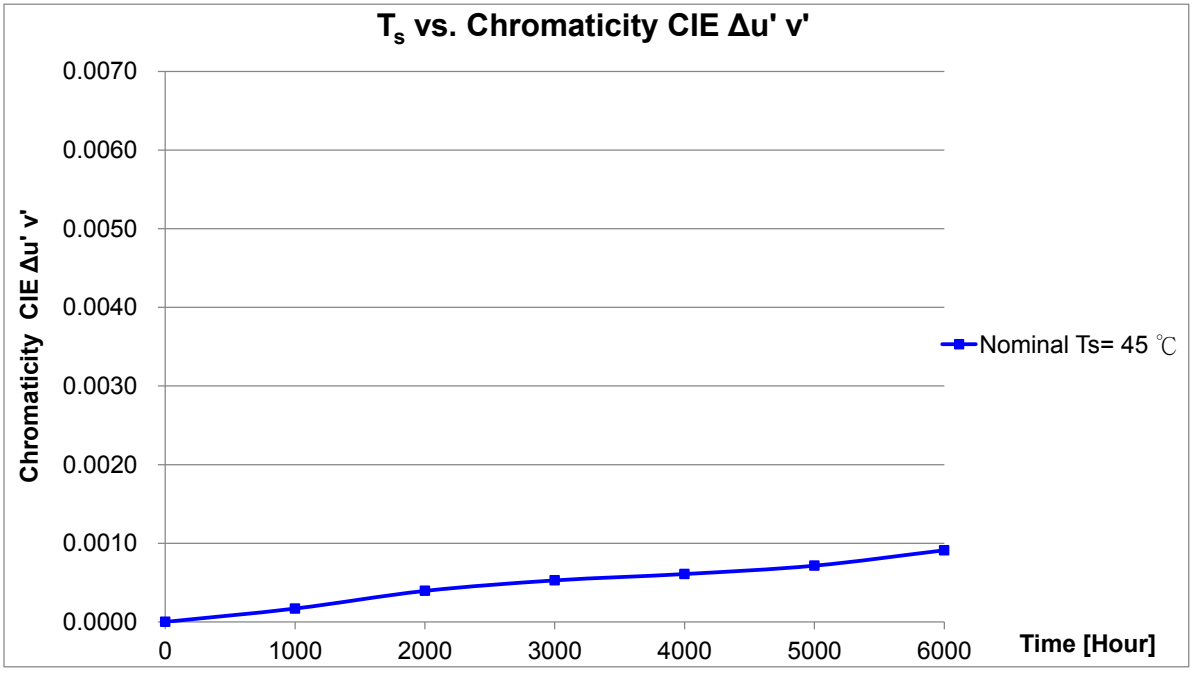
(Measured Point Of T_S=Case Temperature)

4. CONTENTS OF TEST

4.1 45℃ LUMEN MAINTENANCE AND CHROMATICITY SHIFT

Actual Case Temperature [T_S]	≧ 45.6℃
Actual Ambient Temperature [T_A]	≧ 44.3℃
Test Current (I_F)	: 150mA
Relative Humidity	: ≦60 %RH
Air Flow	: 1 m/sec





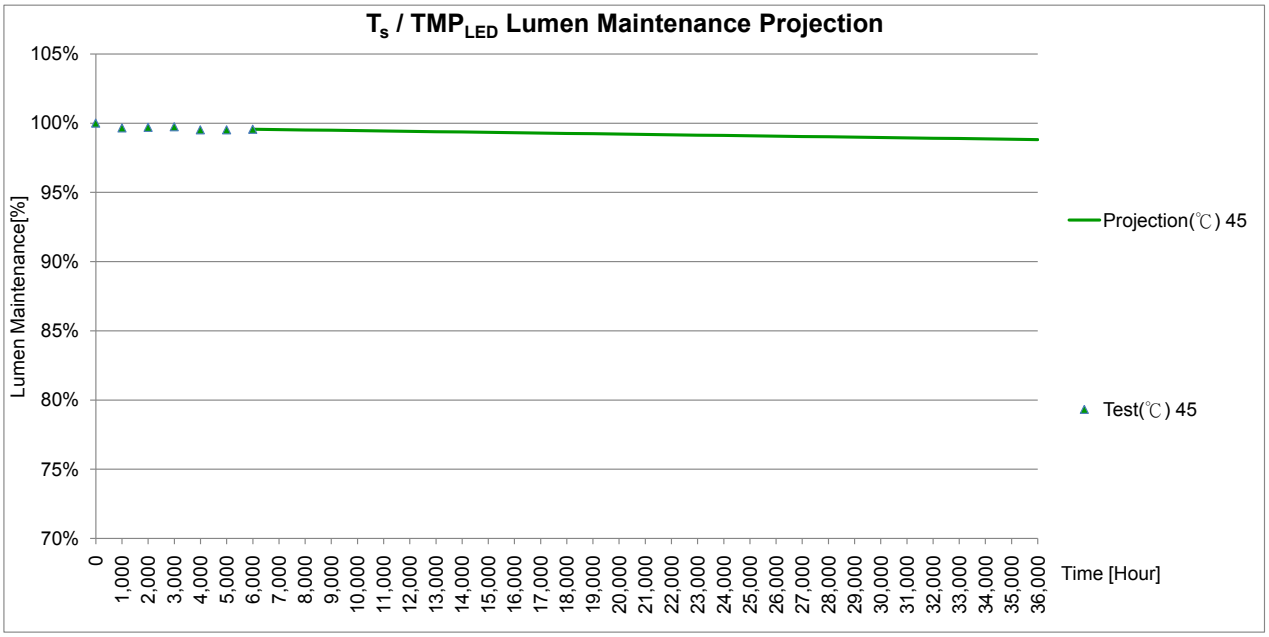
45℃ Luminous Maintenance (%) and Forward Voltage (Vf)

No.	0Hr. [Vf]	0Hr. [Lumen]	0Hr. [LM%]	1,000Hrs. [LM%]	2,000Hrs. [LM%]	3,000Hrs. [LM%]	4,000Hrs. [LM%]	5,000Hrs. [LM%]	6,000Hrs. [LM%]
1	3.462	34.163	100.00%	99.32%	99.45%	99.57%	99.23%	99.27%	99.50%
2	3.509	34.621	100.00%	99.58%	99.66%	99.72%	99.47%	99.43%	99.46%
3	3.471	34.996	100.00%	99.13%	99.13%	99.08%	98.87%	98.96%	99.04%
4	3.517	34.481	100.00%	99.87%	100.08%	100.19%	100.00%	100.01%	100.20%
5	3.519	34.290	100.00%	99.28%	99.40%	99.50%	99.34%	99.26%	99.37%
6	3.473	35.041	100.00%	99.86%	99.84%	99.71%	99.51%	99.38%	99.28%
7	3.536	34.099	100.00%	99.56%	99.55%	99.66%	99.49%	99.52%	99.51%
8	3.504	35.426	100.00%	99.46%	99.51%	99.67%	99.51%	99.61%	99.75%
9	3.481	34.597	100.00%	99.66%	99.51%	99.41%	99.14%	98.84%	98.73%
10	3.513	34.891	100.00%	99.97%	100.05%	100.19%	99.79%	99.88%	100.22%
11	3.511	34.722	100.00%	99.85%	99.81%	99.87%	99.52%	99.60%	99.80%
12	3.508	34.676	100.00%	99.87%	99.96%	100.20%	99.94%	100.02%	100.08%
13	3.579	34.942	100.00%	99.55%	99.51%	99.58%	99.33%	99.14%	99.01%
14	3.484	34.452	100.00%	99.70%	99.61%	99.46%	99.21%	99.07%	99.13%
15	3.576	35.255	100.00%	99.92%	100.00%	100.09%	99.92%	100.01%	100.11%
16	3.515	35.449	100.00%	99.75%	99.84%	99.99%	99.72%	99.82%	99.99%
17	3.529	35.135	100.00%	99.57%	99.61%	99.74%	99.71%	99.71%	99.89%
18	3.529	34.765	100.00%	99.50%	99.38%	99.31%	98.91%	98.53%	98.42%
19	3.478	34.473	100.00%	99.87%	99.93%	100.11%	99.92%	100.02%	100.09%
20	3.532	34.326	100.00%	99.78%	99.77%	99.81%	99.57%	99.51%	99.67%
21	3.543	35.317	100.00%	99.48%	99.55%	99.52%	99.38%	99.52%	99.64%
22	3.486	34.006	100.00%	99.70%	99.79%	99.62%	99.56%	99.58%	99.72%
23	3.440	34.626	100.00%	99.65%	99.82%	99.84%	99.70%	99.82%	100.09%
24	3.517	35.128	100.00%	99.64%	99.70%	99.70%	99.55%	99.63%	99.90%
25	3.505	34.551	100.00%	99.75%	99.87%	99.94%	99.67%	99.78%	100.06%
Avg.	3.509	34.737	100.00%	99.65%	99.69%	99.74%	99.52%	99.52%	99.63%
Min.	3.440	34.006	100.00%	99.13%	99.13%	99.08%	98.87%	98.53%	98.42%
Max.	3.579	35.449	100.00%	99.97%	100.08%	100.20%	100.00%	100.02%	100.22%
Med.	3.511	34.676	100.00%	99.66%	99.70%	99.71%	99.52%	99.58%	99.72%
St. Dev.	0.033	0.412	0.000	0.002	0.002	0.003	0.003	0.004	0.005

45℃ CIEx CIEy ,CCT and Chromaticity Shift (△u'v')

CIE u' v'	0Hr.				1,000Hrs.	2,000Hrs.	3,000Hrs.	4,000Hrs.	5,000Hrs.	6,000Hrs.
No.	CIE x	CIE y	CCT [K]	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'
1	0.4553	0.4005	2684.15	0.0000	0.0001	0.0003	0.0004	0.0004	0.0005	0.0009
2	0.4520	0.3966	2700.57	0.0000	0.0001	0.0003	0.0005	0.0005	0.0006	0.0008
3	0.4534	0.3976	2688.84	0.0000	0.0001	0.0003	0.0003	0.0005	0.0007	0.0008
4	0.4533	0.4007	2714.19	0.0000	0.0001	0.0003	0.0004	0.0005	0.0007	0.0008
5	0.4502	0.3959	2721.40	0.0000	0.0002	0.0003	0.0004	0.0006	0.0007	0.0009
6	0.4551	0.3957	2649.13	0.0000	0.0000	0.0003	0.0003	0.0005	0.0005	0.0007
7	0.4570	0.4005	2659.89	0.0000	0.0001	0.0003	0.0004	0.0005	0.0006	0.0008
8	0.4572	0.4001	2654.19	0.0000	0.0003	0.0006	0.0007	0.0008	0.0009	0.0011
9	0.4555	0.4006	2682.38	0.0000	0.0002	0.0005	0.0007	0.0008	0.0009	0.0011
10	0.4539	0.4003	2703.97	0.0000	0.0002	0.0004	0.0005	0.0005	0.0006	0.0009
11	0.4522	0.3963	2694.93	0.0000	0.0002	0.0003	0.0004	0.0005	0.0006	0.0009
12	0.4536	0.3995	2701.84	0.0000	0.0001	0.0004	0.0005	0.0006	0.0007	0.0009
13	0.4559	0.4038	2702.69	0.0000	0.0002	0.0004	0.0005	0.0006	0.0008	0.0010
14	0.4561	0.4003	2671.73	0.0000	0.0002	0.0005	0.0007	0.0007	0.0008	0.0010
15	0.4502	0.3947	2712.39	0.0000	0.0002	0.0003	0.0005	0.0006	0.0007	0.0008
16	0.4567	0.4006	2665.94	0.0000	0.0002	0.0005	0.0006	0.0007	0.0008	0.0008
17	0.4566	0.4021	2678.75	0.0000	0.0002	0.0002	0.0004	0.0006	0.0007	0.0009
18	0.4522	0.3992	2718.81	0.0000	0.0003	0.0006	0.0007	0.0008	0.0011	0.0015
19	0.4538	0.4010	2710.83	0.0000	0.0002	0.0003	0.0005	0.0006	0.0007	0.0008
20	0.4546	0.3976	2671.86	0.0000	0.0001	0.0004	0.0005	0.0005	0.0007	0.0008
21	0.4567	0.4006	2665.94	0.0000	0.0002	0.0005	0.0007	0.0007	0.0008	0.0009
22	0.4566	0.4021	2678.75	0.0000	0.0003	0.0005	0.0007	0.0006	0.0008	0.0010
23	0.4522	0.3992	2718.81	0.0000	0.0002	0.0005	0.0007	0.0007	0.0007	0.0009
24	0.4538	0.4010	2710.83	0.0000	0.0002	0.0003	0.0006	0.0006	0.0007	0.0009
25	0.4546	0.3976	2671.86	0.0000	0.0002	0.0005	0.0006	0.0008	0.0008	0.0010
Avg.	0.4543	0.3994	2689.39	0.0000	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009
Min.	0.4502	0.3947	2649.13	0.0000	0.0000	0.0002	0.0003	0.0004	0.0005	0.0007
Max.	0.4572	0.4038	2721.40	0.0000	0.0003	0.0006	0.0007	0.0008	0.0011	0.0015
Med.	0.4546	0.4003	2688.84	0.0000	0.0002	0.0004	0.0005	0.0006	0.0007	0.0009
St. Dev.	0.0021	0.0023	21.96	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002

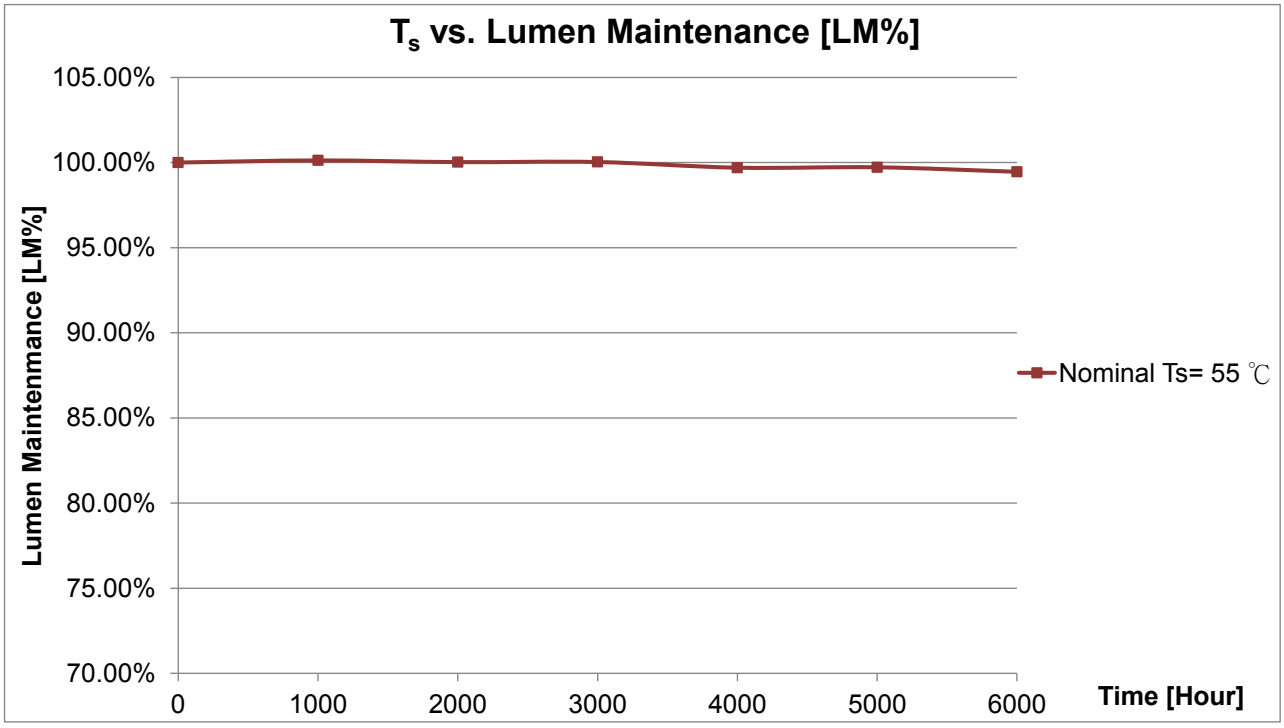
45℃ TM-21 Projection

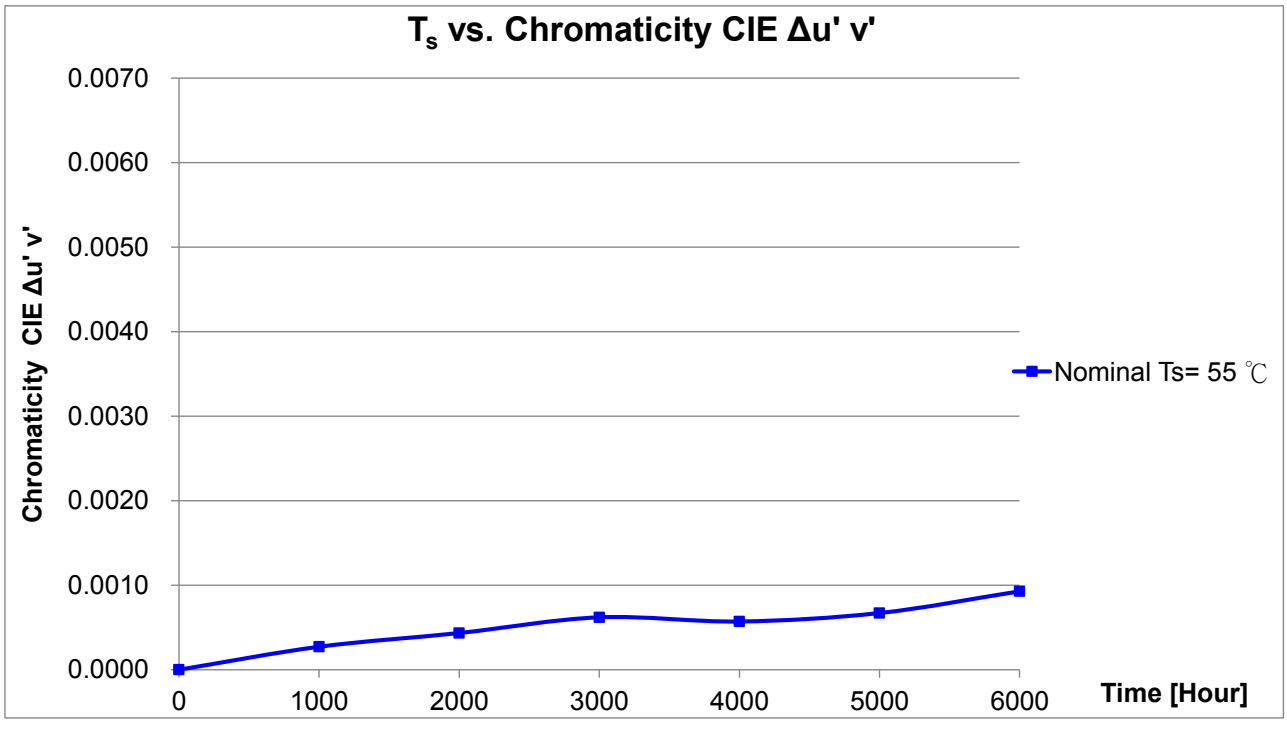


EPA Method	
Slope(m)	-2.508E-07
Intercept(b)	-2.885E-03
α1	2.508E-07
B 1	0.997
Calculated L_{70}(6k)	1,411,000
Reported L_{70}(6k)	>36,000

4.2 55℃ LUMEN MAINTENANCE AND CHROMATICITY SHIFT

Actual Case Temperature [T_S]	≧ 56.4℃
Actual Ambient Temperature [T_A]	≧ 54.1℃
Test Current (I_F)	: 150mA
Relative Humidity	: ≦60 %RH
Air Flow	: 1 m/sec





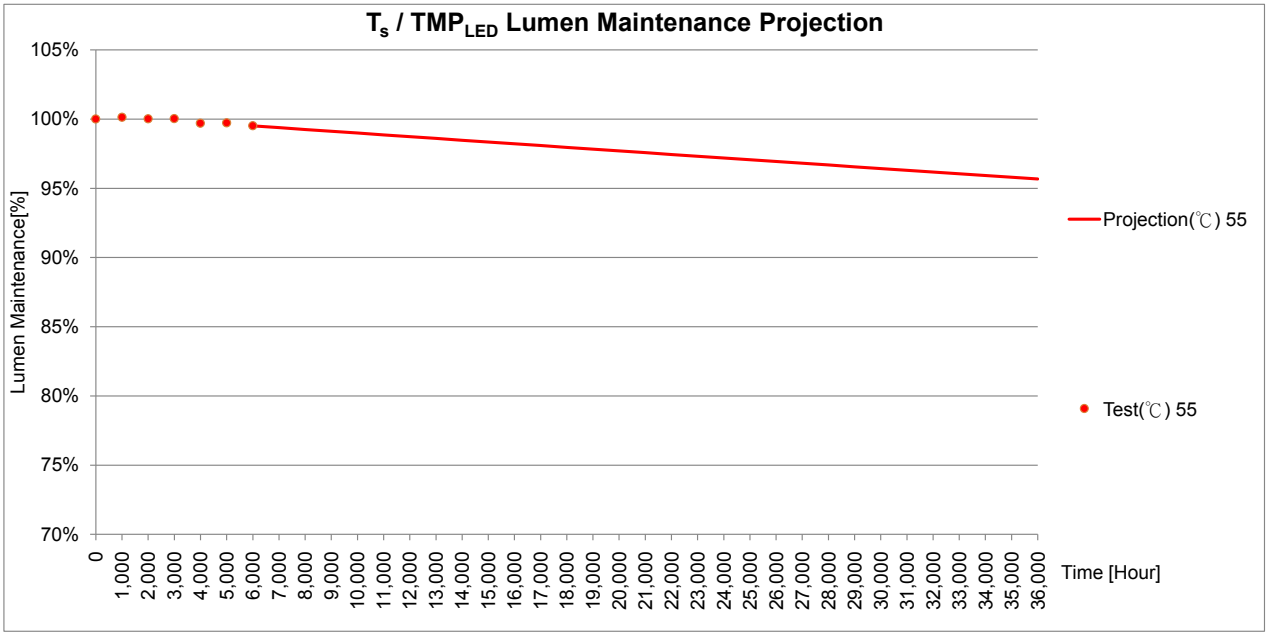
55℃ Luminous Maintenance (%) and Forward Voltage (Vf)

No.	0Hr. [Vf]	0Hr. [Lumen]	0Hr. [LM%]	1,000Hrs. [LM%]	2,000Hrs. [LM%]	3,000Hrs. [LM%]	4,000Hrs. [LM%]	5,000Hrs. [LM%]	6,000Hrs. [LM%]
1	3.534	34.630	100.00%	99.93%	99.97%	99.93%	99.52%	99.62%	99.44%
2	3.524	33.739	100.00%	100.05%	99.97%	99.95%	99.48%	99.44%	99.17%
3	3.535	34.252	100.00%	100.58%	100.65%	100.75%	100.39%	100.47%	100.34%
4	3.519	34.113	100.00%	100.15%	100.19%	100.17%	99.73%	99.74%	99.38%
5	3.478	34.027	100.00%	100.24%	100.17%	100.07%	99.71%	99.71%	99.55%
6	3.509	34.082	100.00%	100.10%	99.76%	99.53%	99.08%	99.06%	98.60%
7	3.502	34.820	100.00%	100.23%	100.21%	100.27%	99.96%	100.17%	99.90%
8	3.527	35.092	100.00%	100.26%	100.24%	100.46%	100.18%	100.23%	99.90%
9	3.517	34.410	100.00%	99.91%	99.49%	99.46%	99.05%	98.91%	98.58%
10	3.474	34.280	100.00%	100.29%	100.11%	100.04%	99.73%	99.82%	99.56%
11	3.497	34.755	100.00%	100.21%	100.17%	100.19%	99.96%	100.04%	99.89%
12	3.478	35.031	100.00%	100.38%	100.26%	100.26%	99.88%	100.06%	99.75%
13	3.534	34.529	100.00%	99.63%	99.54%	99.58%	99.22%	99.08%	98.71%
14	3.483	34.092	100.00%	99.83%	99.69%	99.57%	99.24%	99.14%	98.67%
15	3.553	35.146	100.00%	100.16%	100.21%	100.31%	100.07%	100.15%	100.06%
16	3.449	34.840	100.00%	100.12%	100.00%	100.07%	99.84%	99.73%	99.81%
17	3.499	35.195	100.00%	99.78%	99.70%	99.74%	99.48%	99.27%	98.58%
18	3.489	33.953	100.00%	99.52%	99.27%	99.32%	98.92%	98.39%	97.56%
19	3.525	35.123	100.00%	100.38%	100.27%	100.34%	100.05%	100.13%	100.03%
20	3.528	34.389	100.00%	99.98%	99.80%	99.72%	99.34%	99.45%	99.11%
21	3.512	34.824	100.00%	100.23%	100.22%	100.35%	100.14%	100.28%	100.14%
22	3.530	34.659	100.00%	100.44%	100.33%	100.39%	100.07%	100.28%	100.18%
23	3.516	34.733	100.00%	100.03%	99.95%	99.93%	99.67%	99.81%	99.72%
24	3.526	35.188	100.00%	100.35%	100.26%	100.28%	100.03%	100.23%	100.16%
25	3.485	33.932	100.00%	100.32%	100.17%	100.07%	99.68%	99.81%	99.59%
Avg.	3.509	34.553	100.00%	100.12%	100.02%	100.03%	99.70%	99.72%	99.46%
Min.	3.449	33.739	100.00%	99.52%	99.27%	99.32%	98.92%	98.39%	97.56%
Max.	3.553	35.195	100.00%	100.58%	100.65%	100.75%	100.39%	100.47%	100.34%
Med.	3.516	34.630	100.00%	100.16%	100.17%	100.07%	99.73%	99.81%	99.59%
St. Dev.	0.025	0.450	0.000	0.003	0.003	0.004	0.004	0.005	0.007

55℃ CIEx CIEy,CCT and Chromaticity Shift (△u'v')

CIE u' v'	0Hr.				1,000Hrs.	2,000Hrs.	3,000Hrs.	4,000Hrs.	5,000Hrs.	6,000Hrs.
No.	CIE x	CIE y	CCT [K]	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'
1	0.4541	0.3988	2688.62	0.0000	0.0003	0.0005	0.0006	0.0006	0.0006	0.0008
2	0.4519	0.3969	2704.59	0.0000	0.0002	0.0004	0.0007	0.0005	0.0005	0.0007
3	0.4525	0.3984	2708.53	0.0000	0.0003	0.0004	0.0007	0.0005	0.0006	0.0008
4	0.4524	0.3984	2709.24	0.0000	0.0002	0.0004	0.0006	0.0005	0.0005	0.0008
5	0.4571	0.4010	2663.08	0.0000	0.0004	0.0006	0.0008	0.0007	0.0008	0.0011
6	0.4552	0.4000	2681.86	0.0000	0.0003	0.0005	0.0004	0.0006	0.0007	0.0010
7	0.4569	0.4019	2673.51	0.0000	0.0003	0.0005	0.0006	0.0006	0.0007	0.0010
8	0.4500	0.3952	2718.78	0.0000	0.0003	0.0005	0.0008	0.0007	0.0007	0.0009
9	0.4502	0.3952	2716.17	0.0000	0.0003	0.0005	0.0007	0.0006	0.0008	0.0010
10	0.4514	0.3963	2707.02	0.0000	0.0003	0.0004	0.0006	0.0006	0.0007	0.0009
11	0.4550	0.4004	2688.15	0.0000	0.0003	0.0005	0.0007	0.0006	0.0007	0.0008
12	0.4508	0.3950	2705.47	0.0000	0.0002	0.0003	0.0004	0.0004	0.0005	0.0007
13	0.4532	0.4018	2725.66	0.0000	0.0005	0.0005	0.0008	0.0007	0.0010	0.0012
14	0.4563	0.4032	2692.25	0.0000	0.0002	0.0004	0.0006	0.0005	0.0006	0.0008
15	0.4498	0.3946	2716.49	0.0000	0.0003	0.0004	0.0006	0.0005	0.0007	0.0008
16	0.4558	0.4003	2675.45	0.0000	0.0002	0.0004	0.0006	0.0007	0.0005	0.0009
17	0.4558	0.4003	2675.45	0.0000	0.0003	0.0005	0.0007	0.0006	0.0009	0.0012
18	0.4558	0.4003	2675.45	0.0000	0.0004	0.0005	0.0007	0.0007	0.0009	0.0016
19	0.4558	0.4003	2675.45	0.0000	0.0002	0.0004	0.0007	0.0006	0.0006	0.0008
20	0.4558	0.4003	2675.45	0.0000	0.0001	0.0003	0.0005	0.0004	0.0005	0.0009
21	0.4558	0.4003	2675.45	0.0000	0.0002	0.0003	0.0005	0.0004	0.0006	0.0008
22	0.4553	0.4002	2682.55	0.0000	0.0003	0.0005	0.0007	0.0006	0.0007	0.0010
23	0.4568	0.4009	2665.89	0.0000	0.0003	0.0004	0.0007	0.0006	0.0007	0.0009
24	0.4511	0.3966	2714.50	0.0000	0.0002	0.0003	0.0005	0.0005	0.0005	0.0007
25	0.4497	0.3928	2702.57	0.0000	0.0002	0.0003	0.0006	0.0005	0.0006	0.0008
Avg.	0.4538	0.3988	2692.71	0.0000	0.0003	0.0004	0.0006	0.0006	0.0007	0.0009
Min.	0.4497	0.3928	2663.08	0.0000	0.0001	0.0003	0.0004	0.0004	0.0005	0.0007
Max.	0.4571	0.4032	2725.66	0.0000	0.0005	0.0006	0.0008	0.0007	0.0010	0.0016
Med.	0.4550	0.4002	2688.62	0.0000	0.0003	0.0004	0.0006	0.0006	0.0007	0.0009
St. Dev.	0.0025	0.0027	18.82	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002

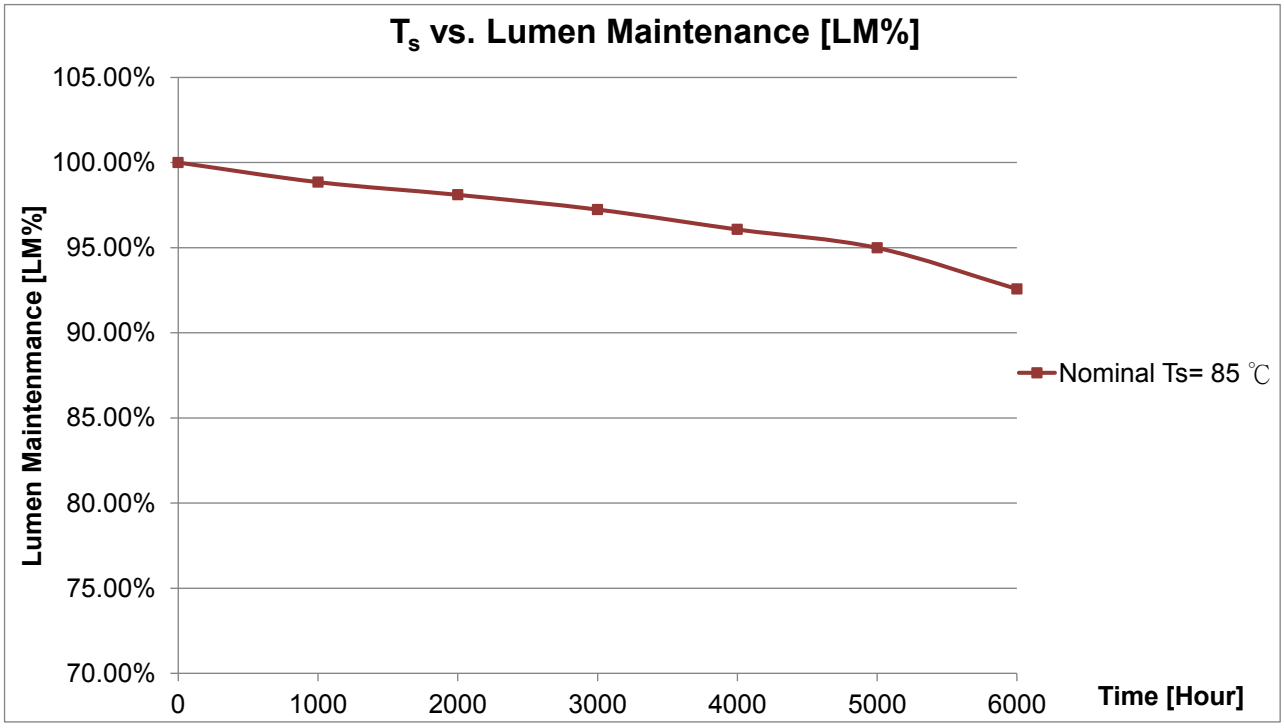
55℃ TM-21 Projection

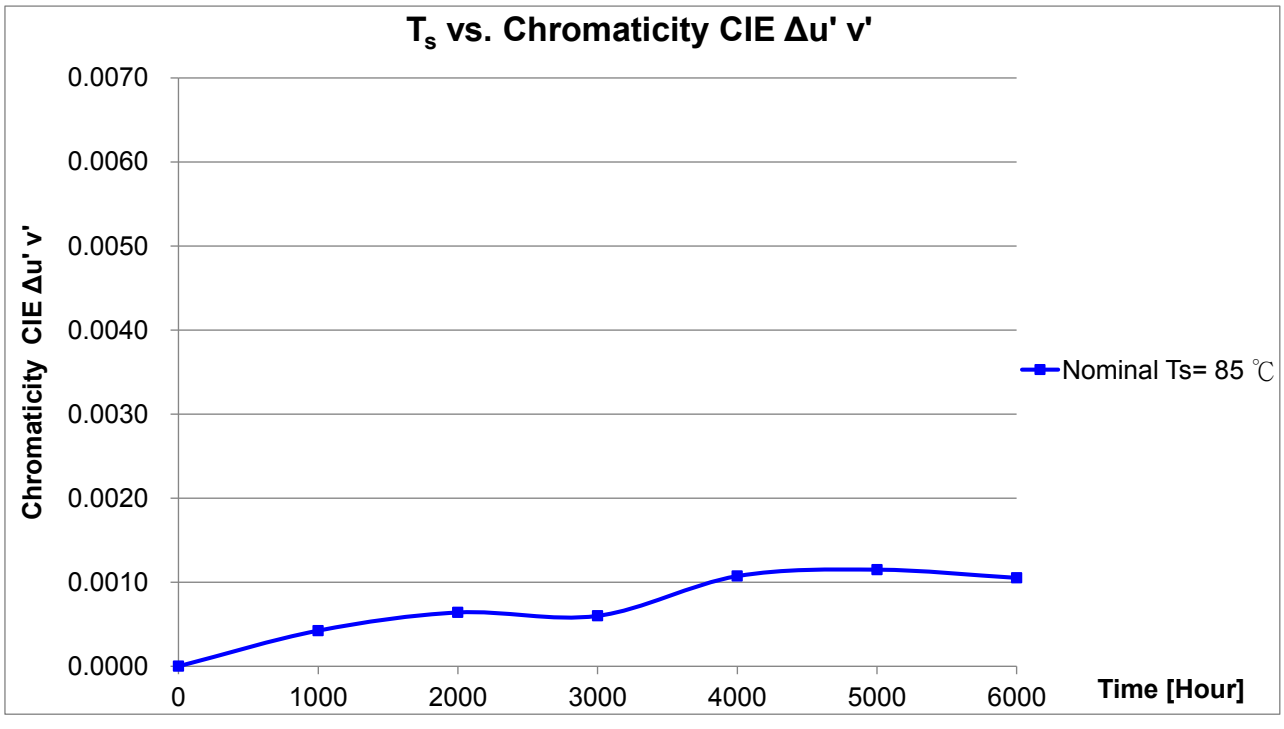


EPA Method	
Slope(m)	-1.312E-06
Intercept(b)	3.004E-03
α1	1.312E-06
B 1	1.003
Calculated L_{70}(6k)	274,000
Reported L_{70}(6k)	>36,000

4.3 85℃ LUMEN MAINTENANCE AND CHROMATICITY SHIFT

Actual Case Temperature [T_S]	≧ 86.2 ℃
Actual Ambient Temperature [T_A]	≧ 83.9 ℃
Test Current (I_F)	: 150mA
Relative Humidity	: ≦60 %RH
Air Flow	: 1 m/sec





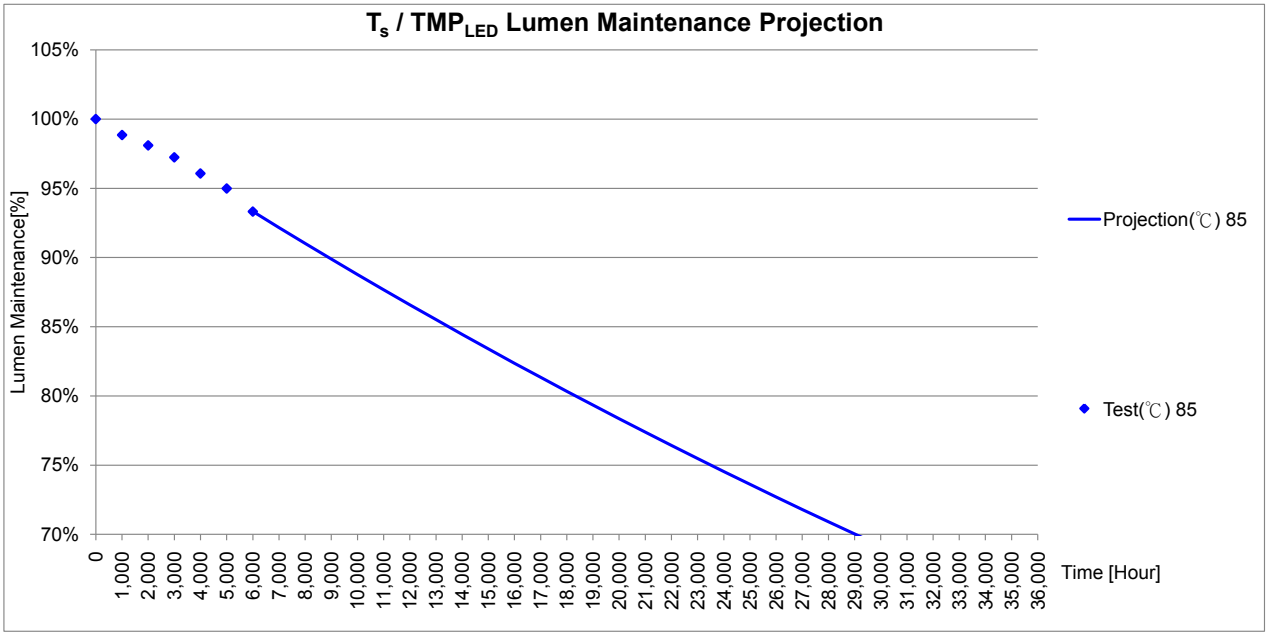
85℃ Luminous Maintenance (%) and Forward Voltage (Vf)

No.	0Hr. [Vf]	0Hr. [Lumen]	0Hr. [LM%]	1,000Hrs. [LM%]	2,000Hrs. [LM%]	3,000Hrs. [LM%]	4,000Hrs. [LM%]	5,000Hrs. [LM%]	6,000Hrs. [LM%]
1	3.482	34.082	100.00%	98.96%	97.91%	96.46%	95.23%	93.40%	90.98%
2	3.503	34.788	100.00%	98.81%	98.12%	96.78%	94.94%	92.71%	90.27%
3	3.479	34.785	100.00%	99.00%	98.26%	97.55%	96.89%	96.16%	93.75%
4	3.479	34.227	100.00%	98.90%	98.13%	97.30%	96.11%	95.72%	93.38%
5	3.473	35.411	100.00%	98.55%	97.57%	96.94%	95.41%	93.26%	90.98%
6	3.514	34.671	100.00%	98.71%	97.94%	96.74%	95.78%	94.83%	92.27%
7	3.531	34.090	100.00%	98.80%	97.88%	96.79%	95.82%	93.42%	91.02%
8	3.521	34.699	100.00%	98.78%	98.17%	97.14%	96.06%	95.23%	92.76%
9	3.471	34.514	100.00%	98.83%	97.92%	97.67%	96.45%	95.38%	93.03%
10	3.492	34.164	100.00%	99.07%	98.41%	97.70%	96.72%	94.74%	92.29%
11	3.535	34.020	100.00%	99.03%	98.08%	97.01%	95.67%	93.84%	91.54%
12	3.508	34.619	100.00%	98.97%	98.19%	97.84%	96.98%	96.64%	94.95%
13	3.493	34.137	100.00%	98.38%	97.22%	96.48%	94.74%	92.69%	90.29%
14	3.507	35.425	100.00%	98.71%	98.07%	97.53%	96.34%	95.17%	92.67%
15	3.537	35.294	100.00%	99.33%	98.89%	98.10%	97.07%	96.01%	93.47%
16	3.513	34.978	100.00%	98.87%	98.25%	97.10%	95.76%	95.66%	92.94%
17	3.461	34.636	100.00%	98.42%	97.44%	95.63%	94.39%	93.28%	90.88%
18	3.470	34.270	100.00%	98.52%	97.40%	95.76%	94.65%	93.61%	91.21%
19	3.508	34.958	100.00%	98.72%	98.19%	97.55%	96.44%	96.03%	93.53%
20	3.480	35.314	100.00%	99.07%	98.64%	97.68%	96.45%	95.51%	92.92%
21	3.460	34.386	100.00%	98.95%	98.33%	97.75%	96.58%	95.87%	93.30%
22	3.500	34.565	100.00%	98.68%	98.00%	97.59%	96.43%	95.59%	93.27%
23	3.454	34.746	100.00%	99.00%	98.34%	97.96%	96.81%	96.67%	94.21%
24	3.533	34.667	100.00%	99.28%	98.82%	98.16%	97.18%	96.57%	94.08%
25	3.513	33.956	100.00%	98.88%	98.36%	97.72%	96.78%	96.66%	94.30%
Avg.	3.497	34.616	100.00%	98.85%	98.10%	97.24%	96.07%	94.98%	92.57%
Min.	3.454	33.956	100.00%	98.38%	97.22%	95.63%	94.39%	92.69%	90.27%
Max.	3.537	35.425	100.00%	99.33%	98.89%	98.16%	97.18%	96.67%	94.95%
Med.	3.500	34.636	100.00%	98.87%	98.13%	97.53%	96.34%	95.38%	92.92%
St. Dev.	0.025	0.442	0.000	0.002	0.004	0.007	0.008	0.013	0.013

85℃ CIEx CIEy ,CCT and Chromaticity Shift (△u'v')

CIE u' v'	0Hr.				1,000Hrs.	2,000Hrs.	3,000Hrs.	4,000Hrs.	5,000Hrs.	6,000Hrs.
No.	CIE x	CIE y	CCT [K]	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'	△CIE u'v'
1	0.4502	0.3951	2715.08	0.0000	0.0005	0.0007	0.0006	0.0011	0.0010	0.0009
2	0.4549	0.4005	2689.82	0.0000	0.0004	0.0006	0.0005	0.0010	0.0012	0.0012
3	0.4591	0.4049	2665.72	0.0000	0.0005	0.0007	0.0006	0.0011	0.0008	0.0008
4	0.4503	0.3943	2707.10	0.0000	0.0006	0.0009	0.0008	0.0011	0.0013	0.0014
5	0.4552	0.3992	2674.88	0.0000	0.0005	0.0007	0.0008	0.0011	0.0010	0.0012
6	0.4509	0.3966	2716.95	0.0000	0.0005	0.0006	0.0006	0.0012	0.0013	0.0012
7	0.4536	0.3981	2690.03	0.0000	0.0004	0.0006	0.0008	0.0012	0.0015	0.0012
8	0.4570	0.3998	2655.49	0.0000	0.0002	0.0005	0.0004	0.0009	0.0013	0.0012
9	0.4547	0.4006	2693.52	0.0000	0.0004	0.0007	0.0007	0.0010	0.0013	0.0012
10	0.4534	0.4012	2718.74	0.0000	0.0004	0.0006	0.0005	0.0008	0.0010	0.0010
11	0.4506	0.3951	2709.11	0.0000	0.0004	0.0007	0.0004	0.0008	0.0011	0.0008
12	0.4562	0.4006	2671.76	0.0000	0.0004	0.0005	0.0005	0.0012	0.0008	0.0011
13	0.4482	0.3933	2730.52	0.0000	0.0005	0.0006	0.0005	0.0012	0.0013	0.0009
14	0.4520	0.3971	2705.63	0.0000	0.0004	0.0006	0.0006	0.0008	0.0009	0.0009
15	0.4505	0.3958	2716.75	0.0000	0.0004	0.0004	0.0004	0.0009	0.0009	0.0008
16	0.4577	0.4014	2658.19	0.0000	0.0004	0.0006	0.0005	0.0012	0.0009	0.0008
17	0.4531	0.3969	2687.64	0.0000	0.0004	0.0006	0.0011	0.0019	0.0022	0.0021
18	0.4526	0.3970	2695.93	0.0000	0.0005	0.0009	0.0010	0.0012	0.0015	0.0012
19	0.4522	0.3980	2709.00	0.0000	0.0005	0.0008	0.0007	0.0010	0.0011	0.0009
20	0.4530	0.3975	2693.15	0.0000	0.0004	0.0007	0.0005	0.0010	0.0006	0.0005
21	0.4505	0.3958	2716.75	0.0000	0.0004	0.0006	0.0006	0.0012	0.0014	0.0011
22	0.4577	0.4014	2658.19	0.0000	0.0003	0.0006	0.0006	0.0010	0.0012	0.0011
23	0.4531	0.3969	2687.64	0.0000	0.0005	0.0007	0.0005	0.0012	0.0012	0.0009
24	0.4526	0.3970	2695.93	0.0000	0.0003	0.0005	0.0004	0.0009	0.0006	0.0006
25	0.4522	0.3980	2709.00	0.0000	0.0006	0.0007	0.0005	0.0011	0.0012	0.0012
Avg.	0.4533	0.3981	2694.90	0.0000	0.0004	0.0006	0.0006	0.0011	0.0011	0.0011
Min.	0.4482	0.3933	2655.49	0.0000	0.0002	0.0004	0.0004	0.0008	0.0006	0.0005
Max.	0.4591	0.4049	2730.52	0.0000	0.0006	0.0009	0.0011	0.0019	0.0022	0.0021
Med.	0.4530	0.3975	2695.93	0.0000	0.0004	0.0006	0.0006	0.0011	0.0012	0.0011
St. Dev.	0.0027	0.0027	21.16	0.0000	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003

85℃ TM-21 Projection



EPA Method	
Slope(m)	-1.249E-05
Intercept(b)	5.775E-03
α1	1.249E-05
B 1	1.006
Calculated L_{70}(6k)	29,000
Reported L_{70}(6k)	29,000