ACCREDITED
Lab Code:TL-460

IES LM-80-2008

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

For

Guangzhou Hongli Opto-Electronic Co., Ltd.

West side of Dongfeng Highway, Automobile industrial Base, Huadu Dist, Guangzhou, China

Model: 3535HW

Report Type: 6000 Hours Test Report	**Product Type:** LED Package
Test Engineer:	Jack Zhou
Report Number:	RSZ110906506-10-M3
Test Date:	2011-08-20 to 2012-04-26
Report Date:	2013-05-27
Revision Note:	The previous report RSZ110906506-10-M2 is replaced by this report. A footnote is added in this report.
Reviewed By:	Jeanne Han /Safety Manager
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China. Tel: +86-0769-86858888 Fax:+86-0769-86858588

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). The previous report with report No: RSZ110906506-10-M1 was replaced by this report. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

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1 - GENERAL INFORMATION

1.1 Description of LED Light Sources

Devices tested

Part Number: 3535HW
Part Name: /
Part Type: LED Package
Nominal CCT: 3500K

1.2 Standards Used:

- IESNA LM-80-08: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

1.3 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan). is located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integral Sphere	EVERFINE	Diameter 0.3M	1011119	380-780nm, lamp length:0.3M ,0-1999LUMEN	2012-02-19	2013-02-18
Programmable Test Power for LEDs	EVERFINE	LED300E	1008002	15V/2000mA	2012-02-15	2013-02-14
Standard Light Source	EVERFINE	D062	1011064	N/A	2012-02-23	2013-02-22
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	/	2012-02-15	2013-02-14

1.5 Operating Cycle

Samples are driven with a constant direct current (DC)

1.6 Ambient conditions

For lumen maintenance test, samples were operated in thermal chambers with minimal ambient airflow. For long term reliability test, the case temperature was controlled by mounting several thermocouples on a sample reliability stress board at the designated thermal measurement point, as shown in APPENDIX. The ambient temperature T_A was measured by several thermocouples at a distance of 1.5 mm above the reliability test board. The relative humidity within chamber was less than 65%.

For photometry measurement, temperature was set to 25℃ ±2℃, RH <65%.

1.7 Photometry Measurement Uncertainty

The uncertainty of the light output measurements is U=1.50% (K=2), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is U=14K (K=2), at the 95% confidence level. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

1.8 Sample Set

Data Set 1: 55℃, 350mA	
Part Number:	3535HW
Number of Units:	25
Actual Case Temperature(T_S):	T_S =55.0℃
Actual Ambient Temperature(T_A):	T_A =53.8℃
Life Test Drive Current:	I_F = 350mA
Measurement Current:	I_F = 350mA

Data Set 2: 85℃, 350mA	
Part Number:	3535HW
Number of Units:	25
Actual Case Temperature(T_S):	T_S =84.9℃
Actual Ambient Temperature(T_A):	T_A =82.1℃
Life Test Drive Current:	I_F = 350mA
Measurement Current:	I_F =350mA

2 - SUMMARY OF TEST RESULT

Data Set:	**Data Set 1, 55℃, 350mA**
Number of Units:	25
Failures Observed:	0
Average. Lumen Maintenance at 6000 hours:	97.01%
Average Chromaticity Shift at 6000 hours (Δu'v'):	0.0014
Reported TM-21 L_{70} Lifetime	>36000 hours

Data Set:	**Data Set 2, 85℃, 350mA**
Number of Units:	25
Failures Observed:	0
Average. Lumen Maintenance at 6000 hours:	95.20%
Average Chromaticity Shift at 6000 hours(Δu'v'):	0.0021
Reported TM-21 L_{70} Lifetime	>36000 hours

3 - Test Data

3.1 Data Set 1, 55℃, 350mA (Lumen Maintenance)

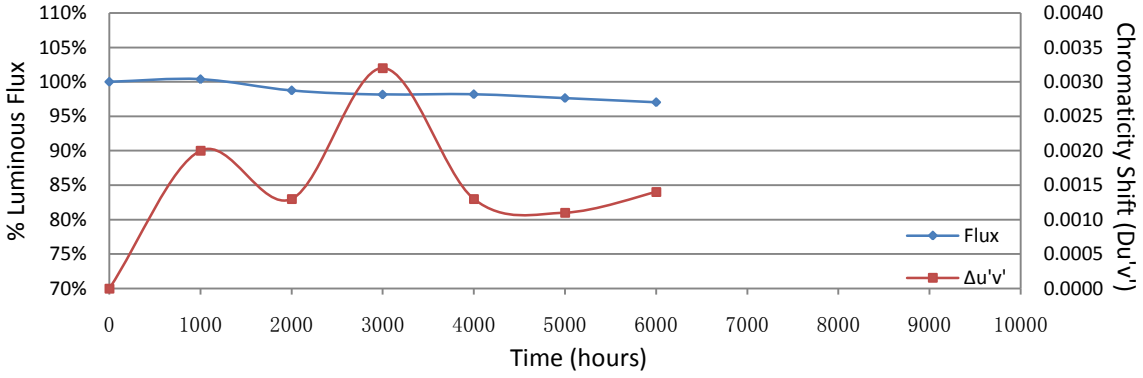
No.	VF(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	3.006	119.5	100.67	99.67	98.74	98.91	98.49	97.66
2	2.978	120.4	99.75	98.59	96.35	96.43	96.18	96.01
3	3.000	120.4	100.58	98.50	97.67	97.67	97.34	96.93
4	3.005	120.6	101.66	98.59	99.42	99.34	98.67	97.76
5	3.018	120.7	100.50	98.26	96.69	97.02	96.60	96.11
6	3.039	120.5	100.83	98.09	98.01	98.17	97.51	97.01
7	2.963	120.2	100.75	98.25	96.51	97.09	96.34	96.17
8	2.964	122.2	100.98	98.61	97.95	98.53	97.87	97.30
9	2.994	120.3	99.83	98.67	97.09	96.51	95.93	95.26
10	2.999	125.4	99.52	98.41	97.77	98.01	97.53	96.89
11	2.971	121.8	100.25	98.93	97.78	98.03	97.45	96.80
12	3.021	118.4	100.00	98.65	96.88	97.30	96.71	96.20
13	3.018	120.3	99.42	98.34	98.34	98.67	98.00	97.34
14	2.970	122.0	100.08	98.44	97.62	97.79	97.21	96.72
15	2.943	118.0	100.08	99.32	99.07	98.98	98.22	97.54
16	2.984	118.4	100.08	99.66	100.34	100.51	99.83	98.82
17	2.960	123.4	100.41	98.78	97.97	98.06	97.41	96.76
18	3.028	121.0	100.66	99.42	99.09	98.76	98.10	97.19
19	3.030	124.6	100.48	98.23	99.28	98.88	98.23	97.43
20	2.997	123.0	101.06	98.05	98.86	98.94	98.37	97.40
21	3.003	121.2	100.00	99.01	100.74	100.50	99.92	98.93
22	2.972	119.7	99.75	98.16	96.91	96.91	96.32	96.07
23	2.960	118.1	102.20	99.83	98.65	98.31	97.80	97.21
24	2.968	123.4	100.73	99.19	98.54	98.14	97.49	96.92
25	2.965	123.0	99.43	98.54	97.64	97.32	96.99	96.75
Ave.	2.990	121.1	100.39	98.73	98.16	98.19	97.62	97.01
Med.	2.994	120.6	100.41	98.59	97.97	98.14	97.51	96.93
st dev	0.0263	1.9641	0.0067	0.0052	0.0114	0.0106	0.0101	0.0082
Min.	2.943	118.0	99.42	98.05	96.35	96.43	95.93	95.26
Max.	3.039	125.4	102.20	99.83	100.74	100.51	99.92	98.93

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
α: 5.853E-06
β: 1.004
Calculated L_{70}: 62,000 hours
Reported L_{70}: >36000 hours

3.2 Data Set 1, 55℃, 350mA (Chromaticity Shift)

No.	u'	v'	Chromaticity Shift (Δu'v')					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2337	0.5096	0.0017	0.0022	0.0028	0.0005	0.0010	0.0006
2	0.2356	0.5109	0.0019	0.0022	0.0041	0.0018	0.0020	0.0019
3	0.2361	0.5164	0.0017	0.0023	0.0041	0.0019	0.0015	0.0017
4	0.2359	0.5186	0.0019	0.0023	0.0034	0.0013	0.0012	0.0014
5	0.2346	0.5073	0.0017	0.0013	0.0038	0.0013	0.0008	0.0009
6	0.2395	0.5267	0.0012	0.0013	0.0031	0.0013	0.0011	0.0019
7	0.2323	0.5077	0.0017	0.0017	0.0040	0.0011	0.0007	0.0010
8	0.2371	0.5188	0.0016	0.0016	0.0041	0.0013	0.0011	0.0013
9	0.2308	0.5129	0.0001	0.0004	0.0032	0.0016	0.0013	0.0018
10	0.2341	0.5148	0.0027	0.0011	0.0039	0.0012	0.0009	0.0009
11	0.2340	0.5152	0.0029	0.0013	0.0040	0.0014	0.0010	0.0016
12	0.2362	0.5221	0.0028	0.0020	0.0045	0.0018	0.0016	0.0020
13	0.2332	0.5160	0.0049	0.0009	0.0026	0.0008	0.0011	0.0015
14	0.2377	0.5232	0.0033	0.0015	0.0042	0.0014	0.0013	0.0010
15	0.2302	0.5127	0.0000	0.0009	0.0020	0.0008	0.0010	0.0016
16	0.2316	0.5154	0.0000	0.0004	0.0011	0.0016	0.0017	0.0018
17	0.2407	0.5292	0.0027	0.0008	0.0036	0.0012	0.0010	0.0012
18	0.2385	0.5226	0.0027	0.0007	0.0029	0.0009	0.0009	0.0012
19	0.2405	0.5292	0.0017	0.0006	0.0027	0.0009	0.0009	0.0011
20	0.2421	0.5257	0.0029	0.0014	0.0034	0.0009	0.0007	0.0004
21	0.2387	0.5267	0.0001	0.0006	0.0003	0.0016	0.0017	0.0012
22	0.2337	0.5101	0.0031	0.0010	0.0036	0.0018	0.0015	0.0023
23	0.2360	0.5200	0.0007	0.0012	0.0025	0.0007	0.0005	0.0011
24	0.2423	0.5339	0.0029	0.0014	0.0034	0.0016	0.0015	0.0018
25	0.2403	0.5256	0.0026	0.0007	0.0028	0.0009	0.0008	0.0010
Ave.	0.2362	0.5189	0.0020	0.0013	0.0032	0.0013	0.0011	0.0014
Med.	0.2360	0.5186	0.0019	0.0013	0.0034	0.0013	0.0011	0.0013
st dev	0.0035	0.0074	0.0012	0.0006	0.0010	0.0004	0.0004	0.0005
Min.	0.2302	0.5073	0.0000	0.0004	0.0003	0.0005	0.0005	0.0004
Max.	0.2423	0.5339	0.0049	0.0023	0.0045	0.0019	0.0020	0.0023



3.3 Data Set 2, 85℃, 350mA (Lumen Maintenance)

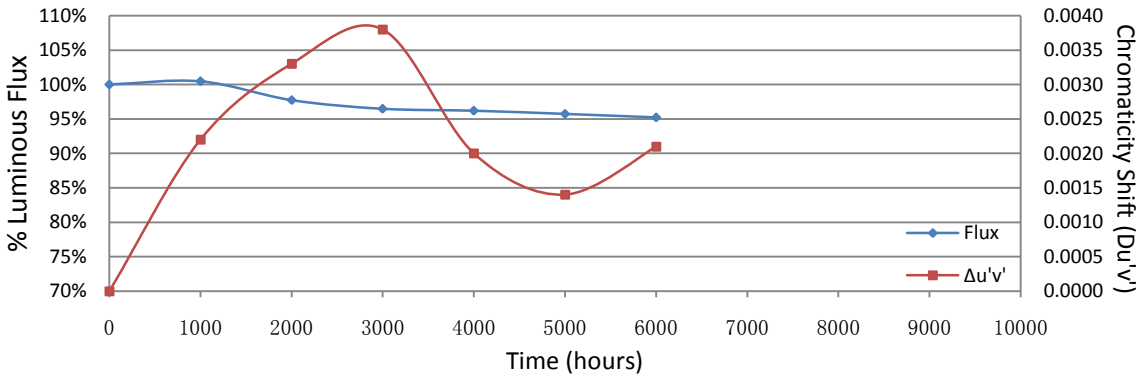
No.	VF(V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	2.995	124.6	99.68	97.11	95.51	95.18	94.70	94.46
2	2.950	119.1	100.08	98.91	96.56	95.21	94.63	94.37
3	2.960	124.9	99.20	97.44	94.24	94.32	94.00	93.76
4	3.024	124.5	100.48	97.27	97.19	96.71	96.22	95.66
5	3.061	119.0	103.36	97.90	97.06	96.81	96.30	95.63
6	3.010	126.9	100.00	97.64	96.22	95.98	95.51	95.04
7	3.037	123.2	99.84	97.97	96.67	96.27	95.86	95.45
8	3.006	126.7	99.45	97.32	95.66	96.05	95.58	95.03
9	3.012	121.1	98.35	97.52	94.14	94.22	94.05	93.81
10	2.997	123.0	99.76	97.15	96.34	95.93	95.53	94.96
11	2.978	122.0	100.25	97.70	96.64	96.23	95.74	95.00
12	2.980	121.1	100.08	97.69	96.53	96.12	95.54	95.05
13	3.053	123.5	100.97	98.62	97.73	97.41	96.92	96.03
14	2.977	123.1	101.22	98.46	97.32	96.67	96.18	95.45
15	3.012	123.6	99.76	97.33	95.87	95.79	95.39	94.98
16	3.011	125.8	100.79	98.33	97.85	97.62	97.22	96.58
17	2.965	121.0	101.16	98.10	95.95	96.20	95.79	95.37
18	3.023	122.5	101.14	98.53	97.63	97.55	96.98	96.16
19	2.967	119.1	102.85	98.24	98.74	97.65	97.23	96.39
20	2.980	120.5	98.67	97.10	97.18	97.51	97.10	96.18
21	2.982	118.1	99.92	97.29	96.53	95.94	95.43	95.09
22	3.001	121.3	100.33	97.20	96.37	96.13	95.71	95.05
23	3.023	118.7	103.62	97.39	96.97	95.70	95.20	94.78
24	3.026	125.1	99.92	97.76	96.72	96.80	96.32	95.84
25	2.970	118.5	100.08	97.05	94.26	94.60	94.18	93.84
Ave.	3.000	122.3	100.44	97.72	96.48	96.18	95.73	95.20
Med.	3.001	122.5	100.08	97.64	96.56	96.13	95.71	95.05
st dev	0.0290	2.6450	0.0128	0.0054	0.0112	0.0098	0.0095	0.0078
Min.	2.950	118.1	98.35	97.05	94.14	94.22	94.00	93.76
Max.	3.061	126.9	103.62	98.91	98.74	97.65	97.23	96.58

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
α: 9.507E-06
β: 1.002
Calculated L_{70}: 38,000 hours
Reported L_{70}: >36000 hours

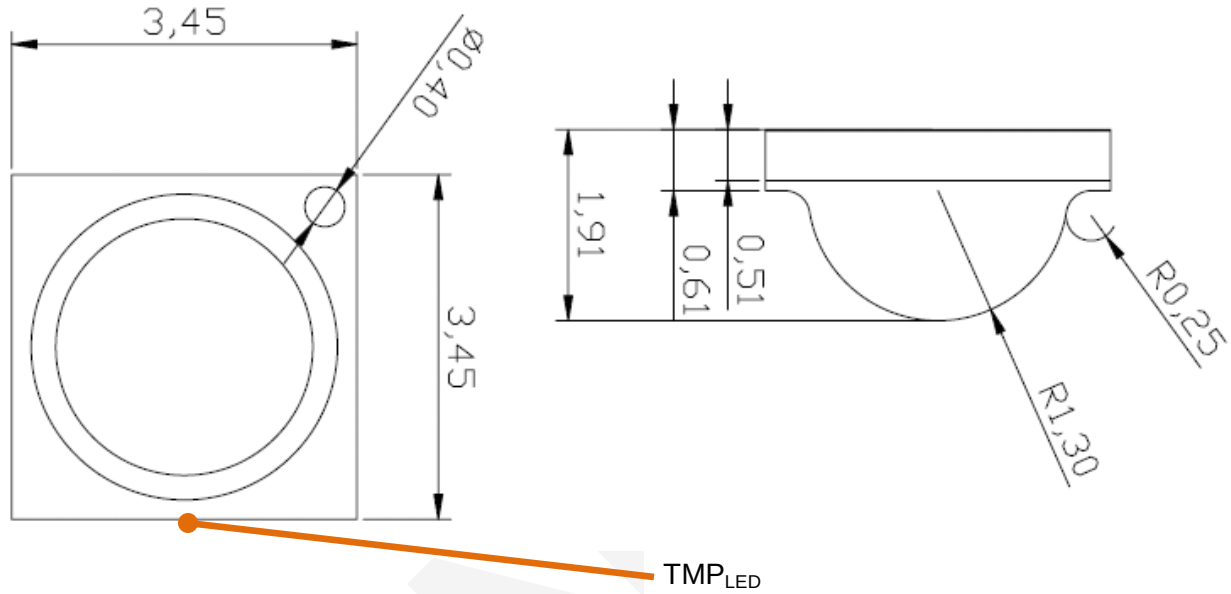
3.4 Data Set 2, 85 ℃, 350mA (Chromaticity Shift)

No.	u'	v'	Chromaticity Shift (Δu'v')					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2322	0.5061	0.0033	0.0046	0.0055	0.0032	0.0022	0.0029
2	0.2353	0.5182	0.0001	0.0004	0.0010	0.0005	0.0005	0.0007
3	0.2379	0.5188	0.0034	0.0049	0.0056	0.0030	0.0023	0.0027
4	0.2338	0.5180	0.0032	0.0043	0.0048	0.0025	0.0015	0.0027
5	0.2362	0.5132	0.0013	0.0030	0.0029	0.0012	0.0008	0.0017
6	0.2360	0.5183	0.0031	0.0044	0.0055	0.0031	0.0016	0.0019
7	0.2380	0.5167	0.0034	0.0052	0.0051	0.0025	0.0010	0.0016
8	0.2340	0.5158	0.0033	0.0046	0.0045	0.0016	0.0010	0.0018
9	0.2347	0.5214	0.0033	0.0044	0.0047	0.0021	0.0014	0.0023
10	0.2365	0.5204	0.0031	0.0043	0.0047	0.0025	0.0019	0.0033
11	0.2333	0.5121	0.0023	0.0024	0.0036	0.0017	0.0016	0.0025
12	0.2310	0.5055	0.0001	0.0030	0.0040	0.0020	0.0019	0.0024
13	0.2347	0.5101	0.0019	0.0021	0.0038	0.0016	0.0013	0.0026
14	0.2340	0.5180	0.0017	0.0021	0.0037	0.0016	0.0012	0.0022
15	0.2334	0.5095	0.0019	0.0022	0.0040	0.0007	0.0006	0.0016
16	0.2354	0.5145	0.0030	0.0031	0.0037	0.0016	0.0013	0.0021
17	0.2344	0.5224	0.0016	0.0018	0.0036	0.0007	0.0004	0.0019
18	0.2348	0.5133	0.0016	0.0020	0.0038	0.0017	0.0013	0.0013
19	0.2341	0.5153	0.0018	0.0040	0.0046	0.0019	0.0015	0.0018
20	0.2306	0.5059	0.0037	0.0016	0.0021	0.0005	0.0006	0.0023
21	0.2352	0.5206	0.0024	0.0049	0.0024	0.0028	0.0023	0.0016
22	0.2364	0.5132	0.0025	0.0050	0.0017	0.0027	0.0025	0.0024
23	0.2374	0.5210	0.0004	0.0041	0.0011	0.0025	0.0014	0.0012
24	0.2303	0.5050	0.0000	0.0025	0.0040	0.0013	0.0013	0.0019
25	0.2340	0.5078	0.0016	0.0011	0.0053	0.0034	0.0022	0.0035
Ave.	0.2345	0.5144	0.0022	0.0033	0.0038	0.0020	0.0014	0.0021
Med.	0.2347	0.5153	0.0023	0.0031	0.0040	0.0019	0.0014	0.0021
st dev	0.0021	0.0055	0.0011	0.0014	0.0013	0.0009	0.0006	0.0006
Min.	0.2303	0.5050	0.0000	0.0004	0.0010	0.0005	0.0004	0.0007
Max.	0.2380	0.5224	0.0037	0.0052	0.0056	0.0034	0.0025	0.0035

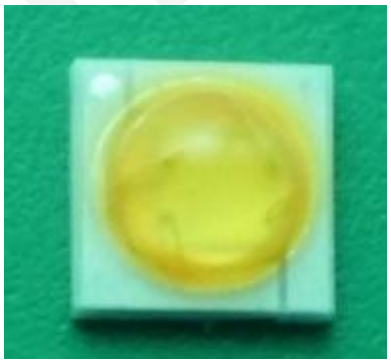


Appendix A – EUT PHOTO

A.1 Mechanical Dimensions (Ta = 25℃)



A.2 EUT Photo



Appendix B – REVISION HISTORY

Report Number	Report Date	Contents
RSZ110906506-10	2012/04/07	Original report.
RSZ110906506-10-M1	2012/04/28	Correct the typos of some titles.
RSZ110906506-10-M2	2013/02/01	Update the Logo of lab, note information on page 1. Remove the inappropriate description in section 1.2 and 1.3. Correct typos in section 1.6. Update part of border, font and shading. Add unit for forward voltage and life time.
RSZ110906506-10-M3	2013/05/27	A footnote is added in the first page.

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