



IESNA LM-80-08

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

MEASUREMENT AND TEST REPORT

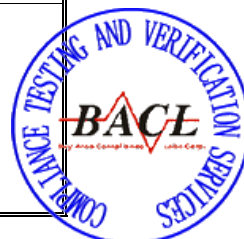
For

EVERSTAR OPTO ELECTRONICS PRIVATE LIMITED

1011 Filix Tower, Opp asian paint, LBS Marg,Bhandup(W)400078

Model:ES-17-XQ050-1450

Report Type: 6000 Hours Test Report		Product Type: LED Array	
Test Engineer:	Pote Wang <i>Pote Wang</i>		
Report Number:	R2DG180531060-10-M1		
Test Date:	2015-12-22 to 2016-08-28		
Report Date:	2018-08-03		
Reviewed By:	Bill Xiong / EE Engineer <i>Bill Xiong</i>		
Revised Note:	The previous report R2DG180531060-10 is replaced by this report on 2018-08-03		
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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

Devices tested

Part Number:	ES-17-XQ050-1450
Part Type:	LED Array
Nominal CCT:	2700K
Drive Level:	DC 1450mA
Power:	50W
Average Current Density per LED die:	388.84mA/mm ²
Average Power Density per LED die:	1.12W/mm ²
CRI:	90
Die Spacing:	0.3mm

Sampling Method

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days. These manufacturing lots are picked to represent a wide parametric distribution.

Note:

1. The applicant EVERSTAR OPTO ELECTRONICS PRIVATE LIMITED declare that their products with model ES-17-XQ050-1450 are the same to the products in report # R2DG151210052-10-M3 and is authorized by original applicant to use their test data.
2. All the data in previous report (R2DG151210052-10-M3) 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)

This report covers the following models:

Covered Model	CCT (K)	Power (W)	Input Current (mA)	The Number of Dies	Minimum Die Spacing (mm)	Power Density of PCB (W/mm ²)	Series	Parallel	Current Density (mA/mm ²)	Driver current of die
ES-17-XQ050-1450	2700/3000/4000/5700	50	1450	120	0.3	0.14	12	10	388.84	145
ES-07-XQ003-0350	2700/3000/4000/5700	3	350	9	2.22	0.02	3	3	312.95	116.7
ES-11-XQ003-0350	2700/3000/4000/5700	3	350	9	1.5	0.02	3	3	312.95	116.7
ES-11-XQ007-0200	2700/3000/4000/5700	7	200	24	0.75	0.04	12	2	268.17	100
ES-11-XQ009-0250	2700/3000/4000/5700	9	250	36	0.9	0.05	12	3	223.38	83.3
ES-11-XQ013-0350	2700/3000/4000/5700	13	350	48	0.5	0.08	12	4	234.65	87.5

Covered Model	CCT (K)	Power (W)	Input Current (mA)	The Number of Dies	Minimum Die Spacing (mm)	Power Density of PCB (W/mm ²)	Series	Parallel	Current Density (mA/mm ²)	Driver current of die
ES-17-XQ018-0500	2700/3000/4000/5700	18	500	60	0.78	0.05	12	5	268.17	100
ES-17-XQ024-0600	2700/3000/4000/5700	24	600	84	0.7	0.06	12	7	229.82	85.7

1.2 Standards Used:

- IESNA LM-80-08: 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 Test Facility

The testing facility used by Bay Area Compliance Laboratories Corp. (Dongguan), is located at No.69,Pulongcun ,Puxinhu Industrial Area, Tangxia , Dongguan, Guangdong, China.

1.4 Description of Auxiliary Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
1.0m integrating sphere	SENSING	SCD-20008	N/A	N/A	2016-07-11	2017-07-10
spectroradiometer	SENSING	SCD-20008	N/A	N/A	2016-07-11	2017-07-10
DC Power Supply	Hanshenpuyuan	HSPY-100-05	2013010210003	N/A	2016-05-18	2017-05-17
Standard Light Source	EVERFINE	D062	1011093	3000K	2015-09-12	2016-09-11
Multilayer aging machine	BACL	B2-270	20024	25°C~110°C	2016-03-04	2017-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11060002	(50/15A)	2016-07-07	2017-07-06
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090007	(50/15A)	2016-03-04	2017-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090005	(50/15A)	2016-03-04	2017-03-03
Digital CC&CV DC Power Supply	EVERFINE	WY5015	11090006	(50/15A)	2016-03-04	2017-03-03

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 5 mm above the reliability test board. The relative humidity within chamber was less than 65%.

For photometry measurement, temperature was set to $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$, RH <65%.

1.7 Photometry 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 $U=21\text{K}$ ($K=2$), at the 95% confidence level. This calibration results traceable to the NATIONAL INSTITUTE OF METROLOGY (NIM).

1.8 Sample Set

Sampling Method:

LED samples for IESNA LM-80 testing consist of units built from a minimum of three manufacturing lots with each manufacturing lot built from different wafer lots built on non-consecutive days.

These manufacturing lots are picked to represent a wide parametric distribution.

Each Sample is soldered to all of the reliability stress boards for a given set of IESNA LM-80 tests.

Sample Size:

Total 32Pcs;

Each Ts test condition 16Pcs

The samples tested at Ts 55°C and Ts 105°C were received at 2015-12-10 and tested during 2015-12-22 to 2016-08-28. The samples were numbered from 1 to 16 and 17 to 32.

Data Set 1: 55°C, 1450mA

Part Number:	ES-17-XQ050-1450
Number of Units:	16
Actual Case Temperature(T_S):	$T_S = 54.2^\circ\text{C}$
Actual Ambient Temperature(T_A):	$T_A = 51.5^\circ\text{C}$
Life Test Drive Current:	$I_F = 1450\text{mA}$
Measurement Current:	$I_F = 1450\text{mA}$

Data Set 2: 105°C, 1450mA

Part Number:	ES-17-XQ050-1450
Number of Units:	16
Actual Case Temperature(T_S):	$T_S = 104.5^\circ\text{C}$
Actual Ambient Temperature(T_A):	$T_A = 103.1^\circ\text{C}$
Life Test Drive Current:	$I_F = 1450\text{mA}$
Measurement Current:	$I_F = 1450\text{mA}$

2 - Summary of Test Result

Data Set:	Data Set 1, 55°C, 1450mA
Number of Units:	16
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	98.33%
Average Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0012
Reported TM-21 L ₇₀ Lifetime:	>33000hours

Data Set:	Data Set 2, 105°C, 1450mA
Number of Units:	16
Failures Observed:	0
Test Interval and Test Duration:	0h,1000h,2000h,3000h,4000h,5000h,6000h
Average. Lumen Maintenance at 6000 hours:	97.75%
Average Chromaticity Shift at 6000 hours($\Delta u'v'$):	0.0015
Reported TM-21 L ₇₀ Lifetime:	>33000hours

3 - Test Data

3.1 Data Set 1, 55°C, 1450mA (Lumen Maintenance)

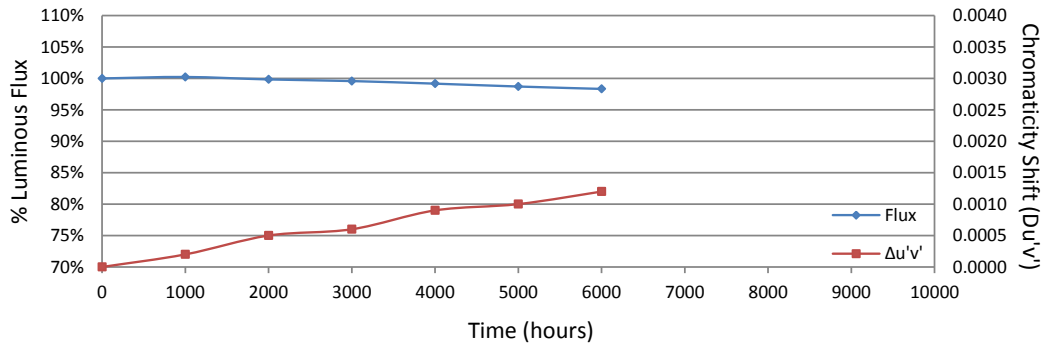
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	37.35	6100.15	100.04	99.60	99.32	99.10	98.72	98.21
2	38.90	6258.10	100.24	99.49	99.40	99.00	98.35	98.11
3	38.98	6285.34	100.28	99.98	99.68	99.09	98.75	98.32
4	38.63	6138.28	100.15	99.83	99.53	99.36	99.04	98.63
5	38.00	6252.66	100.33	99.82	99.56	99.42	99.16	98.75
6	37.60	6252.66	100.10	99.37	99.02	98.50	97.96	97.60
7	38.34	6236.32	100.06	99.81	99.78	99.31	98.70	98.53
8	37.66	6176.40	100.14	99.83	99.55	99.24	98.57	98.14
9	38.02	5985.77	100.09	99.63	99.51	98.89	98.77	98.55
10	37.60	6203.64	100.20	100.18	99.66	99.46	98.90	98.33
11	38.24	6241.76	100.24	99.57	99.28	98.67	98.12	97.93
12	37.82	6176.40	100.42	100.34	100.19	99.52	99.11	98.58
13	38.70	6258.10	100.43	100.32	100.02	99.67	99.16	98.56
14	38.26	6279.89	100.08	100.07	99.71	99.33	98.90	98.40
15	38.30	6138.28	100.37	99.53	99.25	98.84	98.60	98.19
16	38.08	6269.00	100.46	100.15	99.78	99.34	98.62	98.47
Avg.	38.16	6203.30	100.23	99.84	99.58	99.17	98.71	98.33
Med.	38.16	6239.04	100.22	99.82	99.56	99.28	98.73	98.37
st dev	0.48	80.92	0.1411	0.3035	0.2943	0.3228	0.3490	0.2947
Min.	37.35	5985.77	100.04	99.37	99.02	98.50	97.96	97.60
Max.	38.98	6285.34	100.46	100.34	100.19	99.67	99.16	98.75

TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
 α : 3.828E-06
 β : 1.006
Reported L₇₀: >33000hours

3.2 Data Set 1, 55°C, 1450mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
1	0.2573	0.5282	2806	0.0002	0.0006	0.0009	0.0009	0.0011	0.0013
2	0.2592	0.5278	2768	0.0002	0.0005	0.0006	0.0008	0.0010	0.0014
3	0.2585	0.5288	2778	0.0004	0.0006	0.0006	0.0007	0.0011	0.0012
4	0.2576	0.5290	2796	0.0001	0.0003	0.0007	0.0012	0.0014	0.0016
5	0.2595	0.5283	2760	0.0001	0.0003	0.0007	0.0008	0.0010	0.0011
6	0.2597	0.5279	2758	0.0001	0.0001	0.0003	0.0006	0.0007	0.0008
7	0.2575	0.5284	2800	0.0002	0.0003	0.0005	0.0010	0.0011	0.0010
8	0.2580	0.5285	2790	0.0003	0.0003	0.0003	0.0008	0.0011	0.0015
9	0.2611	0.5276	2728	0.0003	0.0010	0.0013	0.0017	0.0021	0.0023
10	0.2574	0.5286	2802	0.0001	0.0003	0.0006	0.0005	0.0004	0.0004
11	0.2592	0.5278	2768	0.0001	0.0004	0.0004	0.0007	0.0010	0.0013
12	0.2602	0.5287	2742	0.0002	0.0007	0.0006	0.0006	0.0006	0.0012
13	0.2570	0.5281	2814	0.0001	0.0002	0.0004	0.0005	0.0007	0.0006
14	0.2589	0.5281	2772	0.0001	0.0004	0.0004	0.0006	0.0007	0.0008
15	0.2576	0.5285	2800	0.0003	0.0010	0.0011	0.0013	0.0013	0.0015
16	0.2592	0.5280	2766	0.0003	0.0007	0.0006	0.0006	0.0008	0.0012
Avg.	0.2586	0.5283	2778	0.0002	0.0005	0.0006	0.0009	0.0010	0.0012
Med.	0.2587	0.5283	2775	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012
st dev	0.0012	0.0004	24	0.0001	0.0003	0.0003	0.0003	0.0004	0.0004
Min.	0.2570	0.5276	2728	0.0001	0.0001	0.0003	0.0005	0.0004	0.0004
Max.	0.2611	0.5290	2814	0.0004	0.0010	0.0013	0.0017	0.0021	0.0023



3.3 Data Set 2, 105°C, 1450mA (Lumen Maintenance)

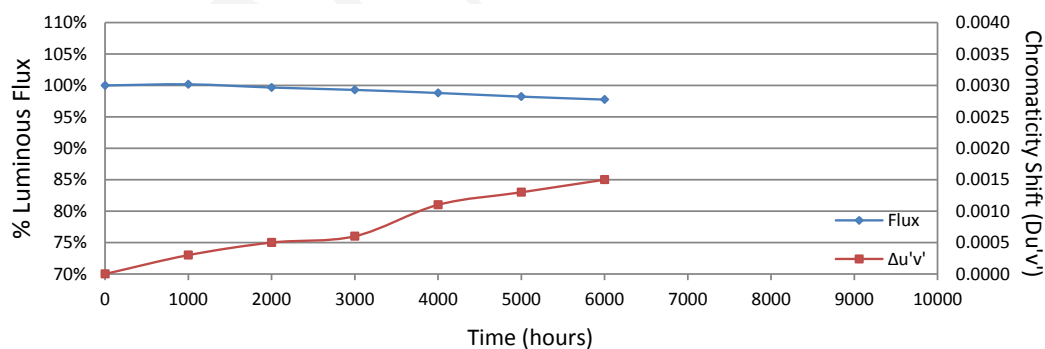
No.	V _F (V)	Φ(lm)	Lumen Maintenance (%)					
	0hr(Initial)		1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
17	38.32	6236.32	100.32	99.63	99.13	98.83	98.41	98.06
18	38.08	6285.34	100.20	99.48	98.80	98.15	97.55	97.19
19	37.18	6160.06	99.93	99.20	98.66	98.30	97.66	97.27
20	37.57	6181.85	100.16	99.96	99.37	98.80	98.34	97.87
21	37.73	6269.00	100.05	99.20	99.06	98.61	98.08	97.62
22	38.39	6290.78	100.36	99.62	99.44	98.81	98.30	97.64
23	37.58	6258.10	100.23	99.68	99.23	99.05	98.50	98.15
24	38.25	6176.40	100.07	99.68	99.35	98.79	98.12	97.67
25	37.88	6236.32	100.15	99.45	99.12	98.28	97.56	97.12
26	37.54	6236.32	100.34	99.63	99.30	98.67	98.12	97.62
27	38.01	5980.33	100.22	100.16	100.06	99.54	99.12	98.68
28	38.01	6013.01	100.28	100.22	100.08	99.86	99.12	98.45
29	38.07	6187.30	99.88	99.20	98.72	98.42	97.98	97.34
30	38.46	6258.10	100.36	99.77	99.30	98.84	98.33	97.87
31	38.39	6279.89	100.38	100.07	99.68	98.86	98.17	97.62
32	38.66	6296.23	100.03	99.72	99.39	98.97	98.19	97.83
Avg.	38.01	6209.08	100.18	99.67	99.29	98.80	98.22	97.75
Med.	38.04	6236.32	100.21	99.65	99.30	98.80	98.18	97.65
st dev	0.40	93.52	0.1576	0.3216	0.4055	0.4410	0.4515	0.4341
Min.	37.18	5980.33	99.88	99.20	98.66	98.15	97.55	97.12
Max.	38.66	6296.23	100.38	100.22	100.08	99.86	99.12	98.68

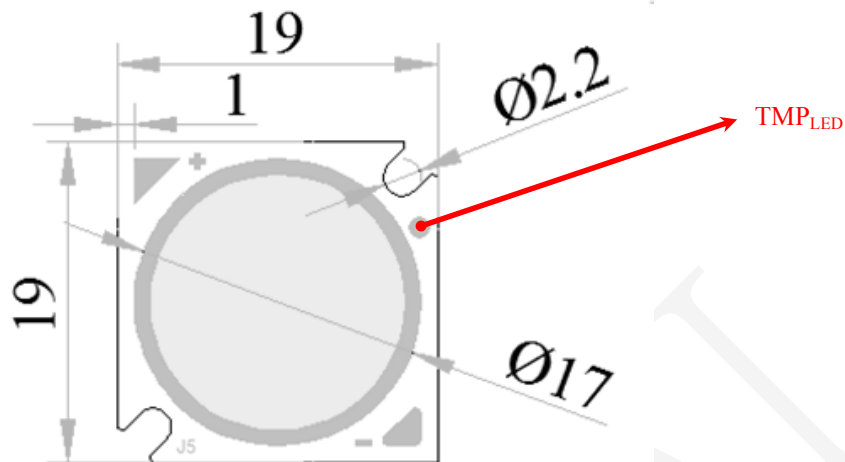
TM-21 Projection:

Test Duration: 6000 hours
Failures Observed: 0
 α : 4.905E-06
 β : 1.007
Reported L₇₀: >33000hours

3.4 Data Set 2, 105°C, 1450mA (Chromaticity Shift)

No.	u'	v'	CCT(K)	Chromaticity Shift ($\Delta u'v'$)					
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
17	0.2586	0.5284	2776	0.0001	0.0004	0.0005	0.0009	0.0008	0.0010
18	0.2593	0.5278	2764	0.0001	0.0002	0.0004	0.0011	0.0013	0.0017
19	0.2589	0.5287	2770	0.0005	0.0009	0.0011	0.0020	0.0022	0.0024
20	0.2577	0.5286	2796	0.0004	0.0006	0.0006	0.0012	0.0015	0.0016
21	0.2587	0.5274	2780	0.0002	0.0006	0.0006	0.0013	0.0014	0.0016
22	0.2585	0.5278	2782	0.0003	0.0006	0.0005	0.0011	0.0013	0.0015
23	0.2595	0.5278	2760	0.0002	0.0004	0.0006	0.0011	0.0013	0.0015
24	0.2613	0.5294	2718	0.0002	0.0003	0.0005	0.0012	0.0015	0.0019
25	0.2593	0.5277	2766	0.0004	0.0003	0.0002	0.0011	0.0014	0.0017
26	0.2594	0.5276	2766	0.0001	0.0004	0.0003	0.0012	0.0012	0.0011
27	0.2627	0.5279	2694	0.0004	0.0006	0.0007	0.0010	0.0014	0.0018
28	0.2627	0.5271	2696	0.0004	0.0002	0.0005	0.0010	0.0010	0.0011
29	0.2614	0.5290	2716	0.0004	0.0006	0.0007	0.0010	0.0009	0.0015
30	0.2588	0.5283	2776	0.0003	0.0004	0.0007	0.0009	0.0009	0.0012
31	0.2587	0.5279	2778	0.0002	0.0003	0.0004	0.0012	0.0013	0.0016
32	0.2588	0.5275	2778	0.0002	0.0006	0.0008	0.0009	0.0011	0.0013
Avg.	0.2596	0.5281	2757	0.0003	0.0005	0.0006	0.0011	0.0013	0.0015
Med.	0.2591	0.5279	2768	0.0003	0.0004	0.0006	0.0011	0.0013	0.0016
st dev	0.0015	0.0006	32	0.0001	0.0002	0.0002	0.0003	0.0003	0.0003
Min.	0.2577	0.5271	2694	0.0001	0.0002	0.0002	0.0009	0.0008	0.0010
Max.	0.2627	0.5294	2796	0.0005	0.0009	0.0011	0.0020	0.0022	0.0024



Attachment A – EUT Photo**A.1 Mechanical Dimensions (Ta = 25°C)**

All dimensions are in millimeter

A.2 EUT Photo