



Shenzhen Belling Efficiency Testing Lab Co., Ltd

TEST REPORT

IES LM-80-15

MEASURING LUMEN MAINTENANCE OF LED LIGHT SOURCES

SHENZHEN LEDYI LIGHTING CO., LTD

3-4Floor, 2nd Building, HuiYe Industrial Park, Tangtou Road Central, Shiyan Street,
Bao'an, Shenzhen, China

Report No.: BL190122906-9

Product Description: LED Array

Model No.: LY-ST20Q480V24

Test Initiation Date: 2019-07-13

Test Completion Date: 2020-04-09

Report Issue Date: 2020-04-21

Test Standard: IES LM-80-15

Test Laboratory: Shenzhen Belling Efficiency Testing Lab Co., Ltd

Tested by

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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 use in part without prior written consent from Shenzhen Belling Efficiency Testing Lab Co., Ltd. This report must not be used by the customer to claim product certification, approval, or endorsement By NVLAP, NIST, or any agency of the U.S. Government.

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1-GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

Manufacturer: 6+(1=+(1 / (' <, / , * +7,1* &2 / 7'

Brand name: / (' < ,

Part Number: LY-ST20Q480V24

Part Type: LED Array

Product Description: DC 24V, 620mA, CCT: 3000K

Product name: COB LED Strip

Number of LED Light Source tested: See tables

Case temperature (test point temperature): See tables.

Drive current of the LED light source during lifetime test: See tables.

Initial luminous flux and forward voltage at photometric measurement current: See tables.

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 tables.

Observation of LED light source failure including the failure conditions and time of failure.: See tables.

LED light source monitoring interval: The LED array are inspected at regular interval (24 hours) throughout the 6000 hours test.

Photometric measurement uncertainty: 1.8% on flux measurements for LM-80 testing.

Chromaticity shift reported over the Measurement time: See tables.

LED Light Source Test interval: At regular intervals(1000 hours) throughout the 6000 hours test.

Date of Receiving Sample: 2019-07-13

Test Duration: 2019-07-14 - 2020-04-09

2-GENERAL INFORMATION

2.1 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.

2.2 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 $2^{\circ}C$ below the corresponding nominal case temperature.

Surrounding air was maintained at a temperature that was greater than or equal to $5^{\circ}C$ below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with Type K.

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.

Surrounding Air temperature for life test : controlled to within $-5^{\circ}C$ of the case temperature (T_s)

Humidity : $< 65\%$ RH

Ambient temperature for Photometry measurement : maintained at $25^{\circ}C \pm 2^{\circ}C$

2.3 Photometric measurement uncertainty

The uncertainty of the light output measurements is $U=1.8\%$ ($K=2$)

Long term measurement uncertainty is based on reproducibility tests done over a period of one year, calculated to $K=2$ coverage (i.e. 95% coverage).

2.4 Standards Used:

- IESNA LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- ENERGY STAR Program Guidance Regarding LED Package, LED Array and LED Module Lumen Maintenance Performance Data Supporting Qualification of Lighting Products (This test method was not accredited by NVLAP)
- CIE 127:2007: Measurement of LEDs (This test method was not accredited by NVLAP)

2.5 Test Facility Description

The test facility used by Shenzhen Belling Efficiency Testing Lab Co., Ltd is located at 1Floor, No.1 Building, Meibaohe Industrial Park, Dalang Street, Longhua District, Shenzhen, Guangdong Prov.518101 China.

2.6 Statement of Traceability

Shenzhen Belling Efficiency Testing Lab Co., Ltd attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

2.7 Test Equipment List

Device	Manufacture	Model No.	Serial No.	Calibration due date
Digital Power Meter	YOKOGAWA	WT210	91L929742	2021-04-02
Integral Sphere	SENSING	SPR-600M	N.A	2021-04-02
Optical Color and Electrical Measurement System	SENSING	SPR-3000	S1101108	2021-04-02
Stop watch	KISLO	K610	N/A	2020-05-12
LED aging equipment	Guangzhou CK	Box0516	N.A	2020-04-15
DC Power Supply	Hong Duo Yuan	APS300-5	N/A	2021-04-02
Thermocouple K	Type K	OMEGA	23736-1	2020-05-12

2.8 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 30Pcs; Each Ts test condition 10Pcs, The samples tested at T_s 55°C, T_s 85°C and T_s 105°C were received at 2019-07-13 and tested during 2019-07-14 to 2020-04-09. The samples were numbered from 1 to 10, 11 to 20 and 21 to 30.

2.9 Model Number Breakdown

Test model No.: LY-ST20Q480V24

For the Series model No. "LY-STxQyVz-Z":

"LY" denote LEDYI Lighting;

"S" denote COB LED Strip;

"Tx" denote the type of LED chips, "x" can be one digit number;

"Qy" denote quantities of LED chips, "y" can be one digit number;

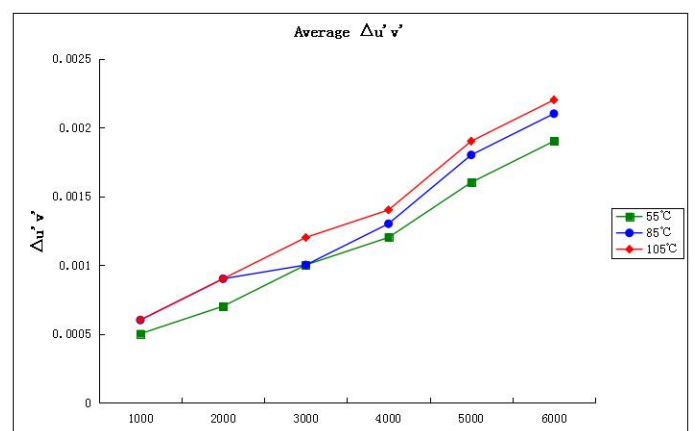
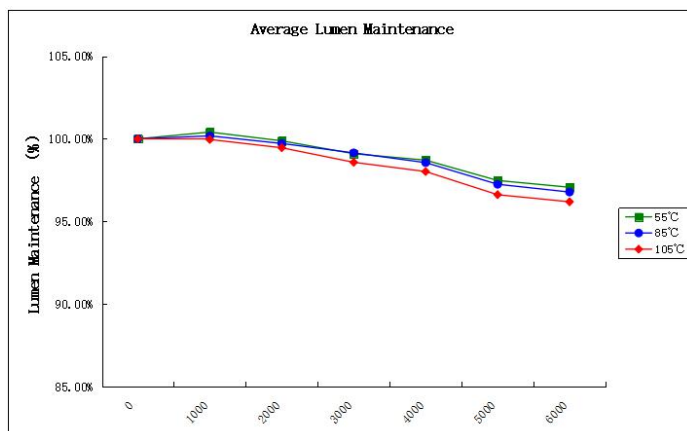
"Vz" denote The voltage of led strip, "z" can be one digit number;

"Z" denote some special features of led strip, It can be a letter or the combination of a letter and a number,

a=The LED strip can adjust the color temperature, c=The LED strip is with functions of constant current.

3-Summary of Test Result

Data Set	1	2	3
Nominal case temperatures	55°C	85°C	105°C
Drive Current	620 mA	620 mA	620 mA
Condition	Ts=53.6°C Ta=54.7°C R.H.<65%	Ts=84.1°C Ta=83.9°C R.H.<65%	Ts=104.2°C Ta=103.9°C R.H.<65%
Sample size	10	10	10
Duration (in Hours)	6000	6000	6000
Intervals (in Hours)	1000	1000	1000
Failure	0	0	0
α	7.030E-06	7.253E-06	8.138E-06
β	1.012	1.011	1.010
Calculated L ₇₀ (6000h)	52,000	51,000	45,000
Lumen Maintenance at 6000 hours	97.07%	96.78%	96.19%
Chromaticity Shift at 6000 hours ($\Delta u'v'$):	0.0019	0.0021	0.0022



4-Test Data

4.1 Data Set 1: 55°C; 620mA

Description of Light Sources tested :	15W
Case Temperature :	53.6°C
Ambient Temperature :	54.7°C
Drive Current :	620mA
Measure Current :	620mA
Failures Observed :	None
Number of Units:	10

Lumen Maintenance (%)								
Sample No.	V _F (V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)							
L1	24.0	1368	100.30	99.80	99.34	99.00	97.31	96.83
L2	24.0	1359	100.14	99.70	98.90	98.70	97.5	96.92
L3	24.0	1366	100.60	99.93	99.17	98.56	97.61	97.21
L4	24.0	1371	100.42	99.96	99.31	98.67	97.39	96.94
L5	24.0	1362	100.51	99.96	99.03	98.47	97.44	97.09
L6	24.0	1356	100.60	99.95	99.12	98.81	97.39	96.95
L7	24.0	1392	100.43	100.12	99.12	98.61	97.57	97.19
L8	24.0	1385	100.70	100.10	99.00	98.76	97.48	97.10
L9	24.0	1376	100.30	99.70	99.01	98.91	97.58	97.25
L10	24.0	1384	100.05	99.55	99.04	98.64	97.51	97.18
AV	24.0	1372	100.41	99.88	99.10	98.71	97.48	97.07
Med.	24.0	1370	100.43	99.94	99.08	98.69	97.49	97.10
MIN	24.0	1356	100.05	99.55	98.90	98.47	97.31	96.83
MAX	24.0	1392	100.70	100.12	99.34	99.00	97.61	97.25
STDEV	0.0	12.05	0.21	0.18	0.14	0.16	0.10	0.15

Description of Light Sources tested :	15W
Case Temperature :	53.6°C
Ambient Temperature :	54.7°C
Drive Current :	620mA
Measure Current :	620mA
Failures Observed :	None
Number of Units:	10

Chromaticity Shift ($\Delta u'v'$)									
Sample No.	u'	v'	CCT(K)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)								
L1	0.2523	0.5226	2952	0.0004	0.0008	0.0010	0.0012	0.0015	0.0018
L2	0.2519	0.5229	2959	0.0006	0.0008	0.0008	0.0011	0.0017	0.0019
L3	0.2508	0.5235	2982	0.0005	0.0008	0.0012	0.0012	0.0014	0.0018
L4	0.2530	0.5225	2935	0.0003	0.0005	0.0008	0.0011	0.0018	0.0020
L5	0.2517	0.5223	2968	0.0005	0.0006	0.0009	0.0011	0.0015	0.0019
L6	0.2529	0.5231	2934	0.0005	0.0007	0.0010	0.0013	0.0017	0.0017
L7	0.2528	0.5237	2933	0.0005	0.0006	0.0009	0.0011	0.0014	0.0017
L8	0.2532	0.5223	2931	0.0005	0.0008	0.0010	0.0014	0.0019	0.0022
L9	0.2519	0.5228	2959	0.0005	0.0007	0.0009	0.0013	0.0015	0.0018
L10	0.2508	0.5220	2991	0.0004	0.0008	0.0010	0.0014	0.0020	0.0023
AV	0.2521	0.5228	2954	0.0005	0.0007	0.0010	0.0012	0.0016	0.0019
Med.	0.2521	0.5227	2956	0.0005	0.0008	0.0010	0.0012	0.0016	0.0019
MIN	0.2508	0.522	2931	0.0003	0.0005	0.0008	0.0011	0.0014	0.0017
MAX	0.2532	0.5237	2991	0.0006	0.0008	0.0012	0.0014	0.0020	0.0023
STDEV	0.0009	0.0005	21.43	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002

4.2 Data Set 2: 85°C; 620mA

Description of Light Sources tested :	15W
Case Temperature :	84.1°C
Ambient Temperature :	83.9°C
Drive Current :	620mA
Measure Current :	620mA
Failures Observed :	None
Number of Units:	10

Lumen Maintenance (%)								
Sample No.	V _F (V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)							
L11	24.0	1369	99.95	99.51	99.16	98.82	97.28	96.83
L12	24.0	1371	100.05	99.69	99.34	98.58	97.17	96.86
L13	24.0	1362	100.10	99.75	99.15	98.75	97.38	96.93
L14	24.0	1378	100.00	99.65	99.34	98.44	97.15	96.72
L15	24.0	1382	100.65	100.20	99.24	98.34	97.34	96.81
L16	24.0	1369	99.90	99.64	99.34	98.74	97.01	96.70
L17	24.0	1358	100.60	99.84	99.44	98.58	97.41	96.61
L18	24.0	1381	100.25	100.05	98.84	98.58	97.26	96.78
L19	24.0	1366	99.95	99.36	98.76	98.46	97.14	96.73
L20	24.0	1372	100.30	99.50	98.89	98.29	97.36	96.86
AV	24	1371	100.18	99.72	99.15	98.56	97.25	96.78
Med.	24	1370	100.08	99.67	99.20	98.58	97.27	96.80
MIN	24	1358	99.90	99.36	98.76	98.29	97.01	96.61
MAX	24	1382	100.65	100.20	99.44	98.82	97.41	96.93
STDEV	0.0	7.84	0.27	0.26	0.24	0.18	0.13	0.09

Description of Light Sources tested :	15W
Case Temperature :	84.1°C
Ambient Temperature :	83.9°C
Drive Current :	620mA
Measure Current :	620mA
Failures Observed :	None
Number of Units:	10

Chromaticity Shift ($\Delta u'v'$)									
Sample No.	u'	v'	CCT(K)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)								
L11	0.2521	0.5235	2949	0.0005	0.0009	0.0009	0.0013	0.0015	0.0019
L12	0.2526	0.5240	2937	0.0008	0.0008	0.0010	0.0011	0.0018	0.0020
L13	0.2522	0.5229	2952	0.0005	0.0009	0.0012	0.0013	0.0014	0.0020
L14	0.2526	0.5235	2939	0.0004	0.0008	0.0009	0.0011	0.0019	0.0023
L15	0.2528	0.5232	2935	0.0005	0.0007	0.0010	0.0013	0.0016	0.0019
L16	0.2510	0.5223	2983	0.0005	0.0008	0.0011	0.0014	0.0017	0.0019
L17	0.2523	0.5217	2956	0.0006	0.0008	0.0009	0.0012	0.0015	0.0018
L18	0.2542	0.5211	2915	0.0008	0.0009	0.0010	0.0014	0.0023	0.0027
L19	0.2505	0.5231	2993	0.0005	0.0009	0.0010	0.0014	0.0017	0.0019
L20	0.2530	0.5219	2938	0.0008	0.0012	0.0014	0.0016	0.0026	0.0028
AV	0.2523	0.5227	2950	0.0006	0.0009	0.0010	0.0013	0.0018	0.0021
Med.	0.25245	0.523	2944	0.0005	0.0009	0.0010	0.0013	0.0017	0.0020
MIN	0.2505	0.5211	2915	0.0004	0.0007	0.0009	0.0011	0.0014	0.0018
MAX	0.2542	0.524	2993	0.0008	0.0012	0.0014	0.0016	0.0026	0.0028
STDEV	0.0010	0.0009	23.24	0.0002	0.0001	0.0002	0.0002	0.0004	0.0004

4.3 Data Set 3: 105°C; 620mA

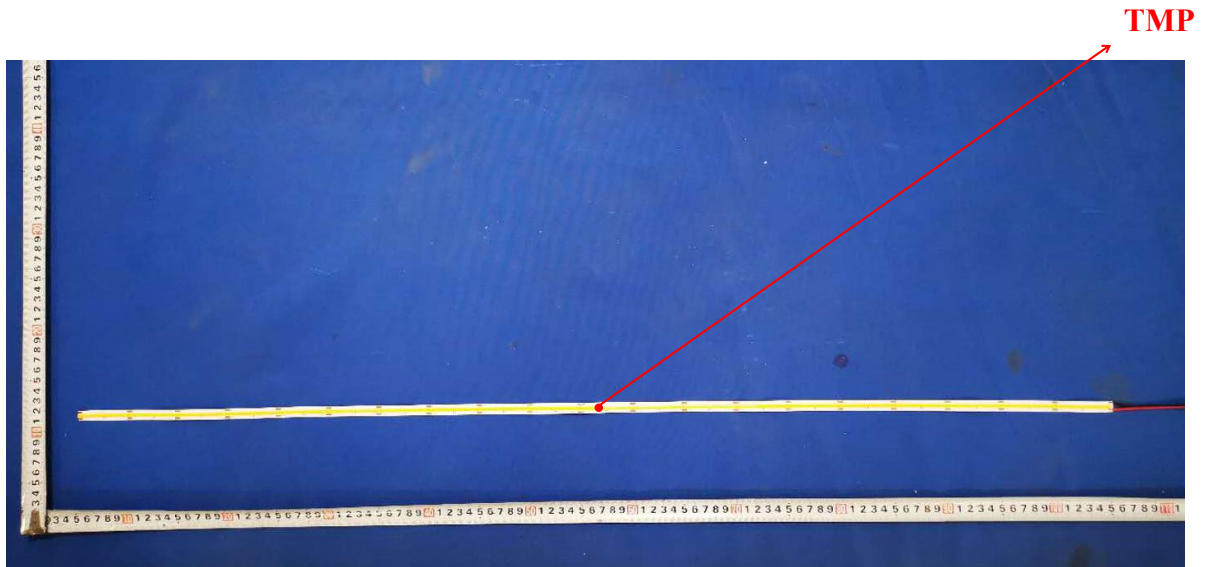
Description of Light Sources tested :	15W
Case Temperature :	104.2°C
Ambient Temperature :	103.9°C
Drive Current :	620mA
Measure Current :	620mA
Failures Observed :	None
Number of Units:	10

Lumen Maintenance (%)								
Sample No.	V _F (V)	Φ(lm)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)							
L21	24.0	1375	99.94	99.43	98.67	98.03	96.45	95.94
L22	24.0	1364	99.92	99.31	98.61	98.21	96.73	96.42
L23	24.0	1381	99.82	99.12	98.20	98.05	96.54	96.21
L24	24.0	1373	99.94	99.62	98.42	98.06	96.63	96.27
L25	24.0	1369	100.01	99.52	99.03	97.92	96.68	96.30
L26	24.0	1361	99.82	99.25	98.50	98.14	96.83	96.58
L27	24.0	1387	100.01	99.64	98.66	98.06	96.60	95.93
L28	24.0	1376	100.09	99.42	98.46	98.10	96.48	96.03
L29	24.0	1358	100.27	99.93	98.66	97.81	96.44	95.97
L30	24.0	1381	99.78	99.38	98.61	97.85	96.77	96.20
AV	24.0	1373	99.96	99.46	98.58	98.02	96.62	96.19
Med.	24.0	1374	99.94	99.43	98.61	98.06	96.62	96.21
MIN	24.0	1358	99.78	99.12	98.20	97.81	96.44	95.93
MAX	24.0	1387	100.27	99.93	99.03	98.21	96.83	96.58
STDEV	0.0	9.43	0.15	0.23	0.21	0.13	0.14	0.22

Description of Light Sources tested :	15W
Case Temperature :	104.2°C
Ambient Temperature :	103.9°C
Drive Current :	620mA
Measure Current :	620mA
Failures Observed :	None
Number of Units:	10

Chromaticity Shift ($\Delta u'v'$)									
Sample No.	u'	v'	CCT(K)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs
	0hr(Initial)								
L21	0.2516	0.5231	2964	0.0005	0.0009	0.0010	0.0013	0.0016	0.0019
L22	0.2505	0.5225	2994	0.0007	0.0009	0.0010	0.0011	0.0019	0.0021
L23	0.2519	0.5234	2957	0.0006	0.0010	0.0012	0.0012	0.0015	0.0021
L24	0.2522	0.5217	2959	0.0004	0.0008	0.0011	0.0013	0.0018	0.0024
L25	0.2525	0.5232	2943	0.0005	0.0007	0.0011	0.0014	0.0016	0.0021
L26	0.2525	0.5222	2949	0.0006	0.0009	0.0012	0.0014	0.0017	0.0020
L27	0.2527	0.5208	2953	0.0006	0.0008	0.0010	0.0013	0.0017	0.0019
L28	0.2516	0.5211	2975	0.0008	0.0009	0.0011	0.0014	0.0028	0.0028
L29	0.2517	0.5213	2974	0.0005	0.0010	0.0011	0.0015	0.002	0.0021
L30	0.2513	0.5222	2977	0.0008	0.0013	0.0017	0.0016	0.0026	0.0030
AV	0.2519	0.5222	2965	0.0006	0.0009	0.0012	0.0014	0.0019	0.0022
Med.	0.2518	0.5222	2962	0.0006	0.0009	0.0011	0.0014	0.0018	0.0021
MIN	0.2505	0.5208	2943	0.0004	0.0007	0.0010	0.0011	0.0015	0.0019
MAX	0.2527	0.5234	2994	0.0008	0.0013	0.0017	0.0016	0.0028	0.0030
STDEV	0.0007	0.0009	15.45	0.0001	0.0002	0.0002	0.0001	0.0004	0.0004

5-EUT Photos



----End of report----