TEST REPORT

According to ANSI/IES LM-80-15
For

Hongli Zhihui Group Co.,Ltd. Guangzhou Branch

Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China

Model: HL-LC2824H466W-80B18C18(Ra4)-S

Report Type: 10000 Hours Test Report	Product Type: LED Module
Reviewed By:	Pote Wang
Report Number:	SZ2220402-12239E-10-10000
Test Date:	2022-04-10 to 2023-07-04

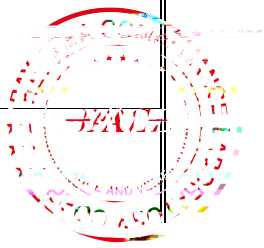


TABLE OF CONTENTS

1 - General Information

1.1 Description of LED Light Sources

Sample Size:

24 PCS test samples were in good condition and received on 2022-04-02. The samples were numbered from 1 to 12 and 13 to 24.

Manufacturer:	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Part Number:	HL-LC2824H466W-80B18C18(Ra4)-S
Part Type:	LED Module
Drive Level:	DC 2700mA
Nominal CCT:	2700K
Power:	149.58W
Average Current Density per LED die:	1033.335mA/mm^2
Average Power Density per LED die:	3.100W/mm^2
CRI:	90

[redacted]

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.

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:

Model type	Model name	CRI (typ.)	CCT (typ.)	Series	Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die(mA)	Distance between of dies(mm)	Current (mA)
Test model	HL-LC2824H466W-80B18C18(Ra4)-S	90	2700K	18	18	0.1946	1033.335	150	0.28	2700
Multiple models	HL-LC2824H466W-80B18C18(Ra4)-S	90	2200K~6500K	18	18	0.1946	1033.335	150	0.28	2700

Model type	Model name	CRI (typ.)	CCT (typ.)	Series	Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die(mA)	Distance between of dies(mm)	Current (mA)
Multiple models	HL-LC1810D4W-9B4C12(Ra4)-S	90	2200K~6500K	12	4	0.0678	516.668	150	0.38	600
Multiple models	HL-LC2009H421W-10B1C24(Ra4)-S	90	2200K~6500K	24	1	0.0343	861.113	150	0.42	150
Multiple models	HL-LC2009H421W-16B1C36(Ra4)-S	90	2200K~6500K	36	1	0.05140	861.113	150	0.63	150
Multiple models	HL-LC2009H384W-10B2C12(Ra4)-S	90	2200K~6500K	12	2	0.0343	775.002	150	0.55	300
Multiple models	HL-LC2009H384W-10B1C24(Ra4)-S	90	2200K~6500K	24	1	0.0343	775.002	150	0.55	150
Multiple models	HL-LC2009D4W-7B1C14(Ra4)-S	90	2200K~6500K	14	1	0.0199	516.668	150	0.79	150
Multiple models	HL-LC2009D4W-9B1C18(Ra4)-S	90	2200K~6500K	18	1	0.0257	516.668	150	0.59	150
Multiple models	HL-LC2009D4W-10B1C20(Ra4)-S	90	2200K~6500K	20	1	0.0286	516.668	150	0.59	150
Multiple models	HL-LC2009D4W-12B1C24(Ra4)-S	90	2200K~6500K	24	1	0.0343	516.668	150	0.50	150
Multiple models	HL-LC2009D4W-7B1C26(Ra4)-S	90	2200K~6500K	26	1	0.0371	516.668	150	0.33	150
Multiple models	HL-LC2009D4W-15B1C30(Ra4)-S	90	2200K~6500K	30	1	0.0428	516.668	150	0.40	150
Multiple models	HL-LC2009D4W-18B1C36(Ra4)-S	90	2200K~6500K	36	1	0.0514	516.668	150	0.30	150
Multiple models	HL-LC2009D4W-20B1C40(Ra4)-S	90	2200K~6500K	40	1	0.0571	516.668	150	0.29	150
Multiple models	HL-LC2009D4W-10B2C12(Ra4)-S	90	2200K~6500K	12	2	0.0343	516.668	150	0.50	300
Multiple models	HL-LC2009D4W-12B2C18(Ra4)-S	90	2200K~6500K	18	2	0.0514	516.668	150	0.33	300
Multiple models	HL-LC2009D4W-20B2C20(Ra4)-S	90	2200K~6500K	20	2	0.0571	516.668	150	0.29	300
Multiple models	HL-LC2009DV35W-10B3C8(Ra4)-S	90	2200K~6500K	8	3	0.0412	300.001	60	0.33	180
Multiple models	HL-LC2309D4W-12B1C24(Ra4)-S	90	2200K~6500K	24	1	0.0263	516.668	150	0.42	150
Multiple models	HL-LC2611H384W-12B1C30(Ra4)-S	90	2200K~6500K	30	1	0.0305	775.002	150	0.66	150
Multiple models	HL-LC2611H384W-20B2C24(Ra4)-S	90	2200K~6500K	24	2	0.0489	775.002	150	0.63	300
Multiple models	HL-LC2614H384W-30B1C62(Ra4)-S	90	2200K~6500K	62	1	0.0632	775.002	150	0.64	150
Multiple models	HL-LC2614H384W-30B2C36(Ra4)-S	90	2200K~6500K	36	2	0.0734	775.002	150	0.71	300
Multiple models	HL-LC2611D4W-13B1C26(Ra4)-S	90	2200K~6500K	26	1	0.0265	516.668	150	0.52	150
Multiple models	HL-LC2611D4W-15B1C30(Ra4)-S	90	2200K~6500K	30	1	0.0306	516.668	150	0.49	150
Multiple models	HL-LC2611D4W-18B1C36(Ra4)-S	90	2200K~6500K	36	1	0.0367	516.668	150	0.30	150

Model type	Model name	CRI (typ.)	CCT (typ.)	Series	Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die(mA)	Distance between of dies(mm)	Current (mA)
Multiple models	HL-LC2611D4W-22B1C44(Ra4)-S	90	2200K~6500K	44	1	0.0448	516.668	150	0.30	150
Multiple models	HL-LC2611D4W-20B1C50(Ra4)-S	90	2200K~6500K	50	1	0.0509	516.668	150	0.47	150
Multiple models	HL-LC2611D4W-24B1C54(Ra4)-S	90	2200K~6500K	54	1	0.0550	516.668	150	0.47	150
Multiple models	HL-LC2611D4W-27B1C60(Ra4)-S	90	2200K~6500K	60	1	0.0611	516.668	150	0.33	150
Multiple models	HL-LC2611D4W-24B1C62(Ra4)-S	90	2200K~6500K	62	1	0.0632	516.668	150	0.33	150
Multiple models	HL-LC2611D90W-18B1C36(Ra4)-S	90	2200K~6500K	36	1	0.0367	301.949	150	0.35	150
Multiple models	HL-LC2611D4W-24B2C26(Ra4)-S	90	2200K~6500K	26	2	0.0530	516.668	150	0.47	300
Multiple models	HL-LC2611D4W-27B2C30(Ra4)-S	90	2200K~6500K	30	2	0.0611	516.668	150	0.33	300
Multiple models	HL-LC2611D4W-16B3C12(Ra4)-S	90	2200K~6500K	12	3	0.0367	516.668	150	0.43	450
Multiple models	HL-LC2611DV35W-10B3C8(Ra4)-S	90	2200K~6500K	8	3	0.0293	300.001	60	0.63	180
Multiple models	HL-LC2614D4W-30B1C60(Ra4)-S	90	2200K~6500K	60	1	0.0611	516.668	150	0.64	150
Multiple models	HL-LC2614D4W-30B1C62(Ra4)-S	90	2200K~6500K	62	1	0.0632	516.668	150	0.34	150
Multiple models	HL-LC2614D4W-40B1C74(Ra4)-S	90	2200K~6500K	74	1	0.0754	516.668	150	0.40	150
Multiple models	HL-LC2614D90W-30B1C62(Ra4)-S	90	2200K~6500K	62	1	0.0632	516.668	150	0.33	150
Multiple models	HL-LC2614D4W-30B2C30(Ra4)-S	90	2200K~6500K	30	2	0.0611	516.668	150	0.64	300
Multiple models	HL-LC2614D4W-36B2C36(Ra4)-S	90	2200K~6500K	36	2	0.0734	516.668	150	0.53	300
Multiple models	HL-LC2614D4W-32B2C39(Ra4)-S	90	2200K~6500K	39	2	0.0795	516.668	150	0.46	300
Multiple models	HL-LC2614D4W-40B2C46(Ra4)-S	90	2200K~6500K	46	2	0.0938	516.668	150	0.42	300
Multiple models	HL-LC2614D4W-40B2C54(Ra4)-S	90	2200K~6500K	54	2	0.1101	516.668	150	0.31	300
Multiple models	HL-LC2614D4W-40B3C32(Ra4)-S	90	2200K~6500K	32	3	0.0979	516.668	150	0.42	450
Multiple models	HL-LC2614D4W-30B6C12(Ra4)-S	90	2200K~6500K	12	6	0.0734	516.668	150	0.42	900
Multiple models	HL-LC2614D4W-50B9C12(Ra4)-S	90	2200K~6500K	12	9	0.1101	516.668	150	0.31	1350
Multiple models	HL-LC2614D90W-30B1C62(Ra4)-S	90	2200K~6500K	62	1	0.0632	301.949	150	0.33	150
Multiple models	HL-LC2614D90W-36B2C36(Ra4)-S	90	2200K~6500K	36	2	0.0734	301.949	150	0.40	300
Multiple models	HL-LC2614D90W-40B2C46(Ra4)-S	90	2200K~6500K	46	2	0.0938	301.949	150	0.29	300

Model type	Model name	CRI (typ.)	CCT (typ.)	Series	Parallel	Power density (W/mm^2)	Current density per LED die (mA/mm^2)	Current per die(mA)	Distance between of dies(mm)	Current (mA)
Multiple models	HL-LC2614D90W-40B2C54(Ra4)-S	90	2200K~6500K	54	2	0.1101	301.949	150	0.28	300
Multiple models	HL-LC2614D90W-40B3C36(Ra4)-S	90	2200K~6500K	36	3	0. 1101	301.949	150	0.28	450

1.2 Standards and Reference Documentations

- ANSI/IES LM-80-15: IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- *CIE 127:2007: Measurement of LEDs (This standard was not accredited by NVLAP)
- *ENERGY STAR® Requirements for the Use of LM-80 Data (This standard was not accredited by NVLAP)

1.3 Testing Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
1.0m integrating sphere	SENSING	SCD-20008	N/A	2022-11-10	2023-11-09
spectroradiometer	SENSING	SCD-20008	N/A	2022-11-10	2023-11-09
DC Power Supply	Hanshenpuyuan	HSPY-100-05	2013010210003	2022-11-10	2023-11-09
Standard Light Source	EVERFINE	D204	N/A	2023-05-12	2025-05-11
DC Power Supply	BACL	B25001	90020	2022-11-10	2023-11-09
Multilayer aging machine	BACL	B3-900	20030	2022-10-19	2023-10-18
Programmable D.C. Power Supply	Xinnuoer	ATP-5005	N/A	2022-11-18	2023-11-17
Programmable D.C. Power Supply	Xinnuoer	ATP-5005	N/A	2022-11-18	2023-11-17

1.4 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 ±3% of the specified value of the manufacturer during maintenance test, and was within ±0.5% du ring photometric and electrical measurement test.

1.5 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 $_{LED}$) 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℃ below the corresponding nominal case temperature. Surrounding air was maintained at a temperature that was greater than or equal to 5℃ below the corresponding nominal case temperature. Thermocouples were shielded from direct DUT optical radiation and comply with

.

Samples were connected to DC power supply in series circuits with a constant current. The forward current was regulated to within ±3% of the specified value of the manufacturer.

The relative humidity within chamber was kept less than 65% during test.

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

1.6 Photometric Measurement Method and Uncertainty

Integrating sphere and spectroradiometer is used to measure luminous flux and chromaticity coordinate u v . 2 measurement was used and sample was drived by DC power supply. The forward current was regulated to within ±0.5% of the nominal value. The test system was calibrated by halogen reference lamp. The ambient temperature during test was set to 25℃ ± 2℃, RH <65% . The temperature measurement point was located in the sphere and the temperature was detected by a temperature probe.

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=21K (K=2), at the 95% confidence level.

The uncertainty of the temperature is U=0.8671℃ (K=2), at the 95% confidence level.

1.7 Statement of Traceability

Bay Area Compliance Laboratories Corp. (Shenzhen) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

1.8 Sample Set

Data Set 1: 55℃, 2700mA

Part Number:	HL-LC2824H466W-80B18C18(Ra4)-S
Number of Units:	12
Case Temperature:	>53℃
Ambient Temperature:	>50℃
Life Test Drive Current:	2700mA
Measurement Current:	2700mA

Data Set 2: 105℃ , 2700mA

Part Number:	HL-LC2824H466W-80B18C18(Ra4)-S
Number of Units:	12
Case Temperature:	>103℃
Ambient Temperature:	>100℃
Life Test Drive Current:	2700mA
Measurement Current:	2700mA

2 - Summary of Test Result

Data Set:	Sample Size	Failures Observed:	Test Interval	Test Duration	α	β	Reported TM -21 L_{70} Lifetime	Reported TM -21 L_{90} Lifetime
1	12	0	1000hrs	10000hrs	2.628E-06	1.001	>55,000 hours	41,000 hours
2	12	0	1000hrs	10000hrs	3.159E-06	0.999	>55,000 hours	33,000 hours

3.3 Data Set 1, 55℃ , 2700mA (Chromaticity Shift)

No.			CCT(K)										
	0hr(Initial)			1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
1	0.2589	0.5303	2763	0.0004	0.0008	0.0009	0.0010	0.0012	0.0013	0.0016	0.0017	0.0019	0.0020
2	0.2594	0.5303	2753	0.0003	0.0006	0.0007	0.0009	0.0012	0.0013	0.0015	0.0018	0.0019	0.0020
3	0.2582	0.5294	2782	0.0002	0.0004	0.0006	0.0008	0.0010	0.0011	0.0014	0.0015	0.0016	0.0017
4	0.2589	0.5301	2763	0.0001	0.0002	0.0004	0.0005	0.0008	0.0009	0.0011	0.0012	0.0014	0.0016
5	0.2595	0.5305	2750	0.0001	0.0003	0.0004	0.0007	0.0010	0.0012	0.0013	0.0016	0.0018	0.0020
6	0.2565	0.5299	2816	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0021	0.0022	0.0024
7	0.2596	0.5305	2748	0.0002	0.0004	0.0006	0.0009	0.0011	0.0013	0.0015	0.0017	0.0018	0.0019
8	0.2589	0.5287	2771	0.0003	0.0006	0.0007	0.0009	0.0010	0.0012	0.0014	0.0016	0.0017	0.0019
9	0.2580	0.5276	2796	0.0002	0.0004	0.0006	0.0007	0.0009	0.0012	0.0014	0.0014	0.0016	0.0018
10	0.2596	0.5301	2750	0.0001	0.0003	0.0005	0.0006	0.0007	0.0010	0.0011	0.0012	0.0015	0.0018
11	0.2595	0.5308	2749	0.0001	0.0003	0.0005	0.0008	0.0008	0.0010	0.0012	0.0013	0.0014	0.0015
12	0.2596	0.5304	2747	0.0003	0.0006	0.0008	0.0011	0.0013	0.0014	0.0016	0.0016	0.0018	0.0020
Avg.	0.2589	0.5299	2766	0.0002	0.0005	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0017	0.0019
Med.	0.2592	0.5302	2758	0.0002	0.0004	0.0006	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0019
st dev	0.0009	0.0009	22	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002
Min.	0.2565	0.5276	2747	0.0001	0.0002	0.0004	0.0005	0.0007	0.0009	0.0011	0.0012	0.0014	0.0015
Max.	0.2596	0.5308	2816	0.0004	0.0008	0.0010	0.0012	0.0014	0.0016	0.0018	0.0021	0.0022	0.0024

3.4 Data Set 2, 105℃ , 2700mA (Lumen Maintenance)

No.		Lumen Maintenance (%)
	0hr(Initial)	

3.5 Data Set 2, 105℃ , 2700mA (Forward Voltage)

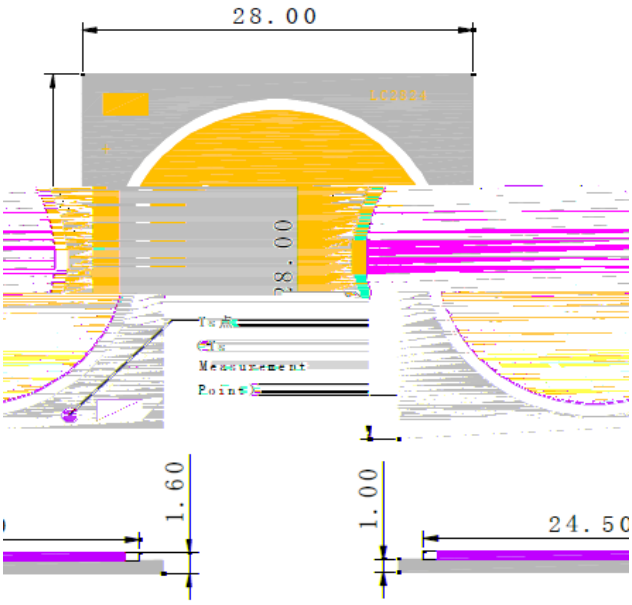
No.	Forward Voltage (V)										
	0hr(Initial)	1000hrs	2000hrs	3000hrs	4000hrs	5000hrs	6000hrs	7000hrs	8000hrs	9000hrs	10000hrs
13	56.26	56.30	56.30	56.61	56.57	56.51	56.41	56.58	56.65	56.53	56.59
14	56.30	56.37	56.21	56.60	56.58	56.52	56.44	56.51	56.69	56.57	56.64
15	55.92	56.03	56.32	56.52	56.46	56.36	56.20	56.43	56.62	56.69	56.64
16	56.05	56.12	56.10	56.16	56.05	56.16	56.26	56.52	56.26	56.34	56.26
17	56.32	56.48	56.74	56.28	56.22	56.11	56.24	56.33	56.37	56.46	56.50
18	56.28	56.27	56.33	56.27	56.39	56.46	56.45	56.44	56.59	56.57	56.63
19	56.23	56.31	56.37	56.31	56.28	56.22	56.13	56.29	56.35	56.43	56.57
20	55.92	56.09	56.71	56.26	56.22	56.16	56.06	56.28	56.32	56.49	56.48
21	56.16	56.19	56.70	56.13	56.09	56.03	56.13	56.38	56.41	56.35	56.49
22	55.97	56.05	56.61	56.67	56.70	56.73	56.69	56.75	56.69	56.60	56.69
23	56.24	56.23	56.46	56.60	56.56	56.49	56.38	56.42	56.69	56.54	56.57
24	56.05	56.08	56.46	56.50	56.43	56.31	56.12	56.43	56.62	56.65	56.62
Avg.	56.14	56.21	56.44	56.41	56.38	56.34	56.29	56.45	56.52	56.52	56.56
Med.	56.20	56.21	56.42	56.41	56.41	56.34	56.25	56.43	56.61	56.54	56.58
st dev	0.15	0.14	0.21	0.19	0.21	0.21	0.18	0.13	0.17	0.11	0.11
Min.	55.92	56.03	56.10	56.13	56.05	56.03	56.06	56.28	56.26	56.34	56.26
Max.	56.32	56.48	56.74	56.67	56.70	56.73	56.69	56.75	56.69	56.69	56.69

3.6 Data Set 2, 105℃ , 2700mA (Chromaticity Shift)

No.			

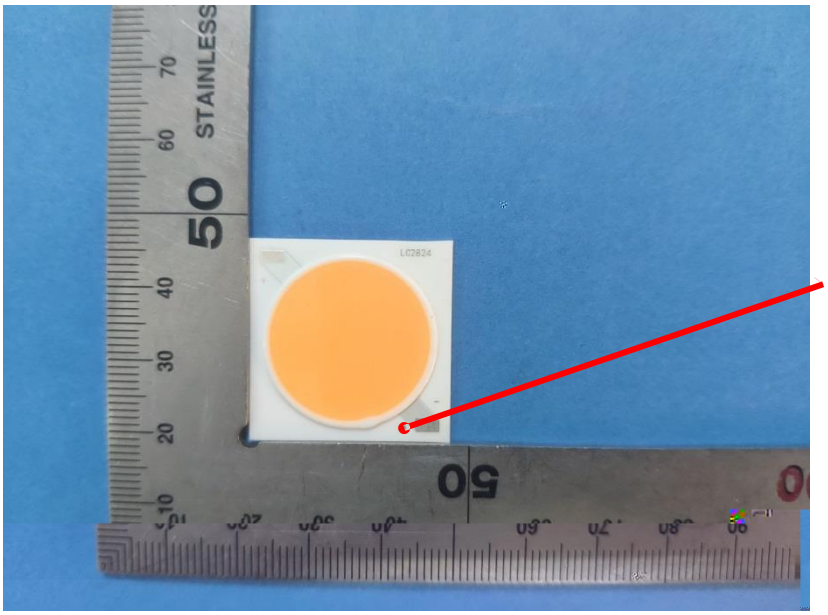
4 - DUT Photo

4.1 Mechanical Dimensions



All dimensions are in millimeter

4.2 DUT Photo



Directions

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