TL-749

TEST REPORT

For

Beyond LED Technology

1939 Parker Ct, Stone Mountain, GA 30087, USA

Model Number:	BPLED-2x4-49/D10/U/35/HL BPLED-2x4-49/D10/U/40/HL BPLED-2x4-49/D10/U/50/HL	
Report Type:	Electrical, Photometric and ISTMT tests according to the following standards and show the compliance to DLC Program SSL Technical Requirements V4.4	
Standards:	IES LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products ANSI C82.77-10-2014: Harmonic Emission Limits – Related Power Quality Requirements for Lighting ANSI/UL 1598-2008: Standard for Safety of Luminaires CIE 190:2010 Calculation and presentation of unified glare rating tables for indoor lighting luminaires IES TM-30-18: IES Method for Evaluating Light Source Color Rendition	
Test Engineer:	George Yang	George Yang
Report Number:	RKSB191122018-10	
Sample Size:	Two samples were received on 2019-11-22 and used for testing.	
Test Date:	2019-12-25 to 2020-01-17	
Report Date:	2020-01-18	
Reviewed By:	Ray Gao/ EE Engineer	Ry Gao
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan). No.248 Chenghu Road, Kunshan, Jiangsu province, China. Tel: +86-0512-86175000 Fax:+86-0512-88934268	

1. Product Information and Description

Product Primary Use:	2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces
Voltage And Frequency:	120-277VAC, 50/60Hz
LED Source Manufacturer:	Lumileds Holding B.V.
LED Source Model:	L128-xx80RC35000Z1
Driver Model:	SDU48CC120V42DN3
Auxiliary Ballast Model:	NA
Auxiliary Housing Model:	NA

2. Product Rated Values

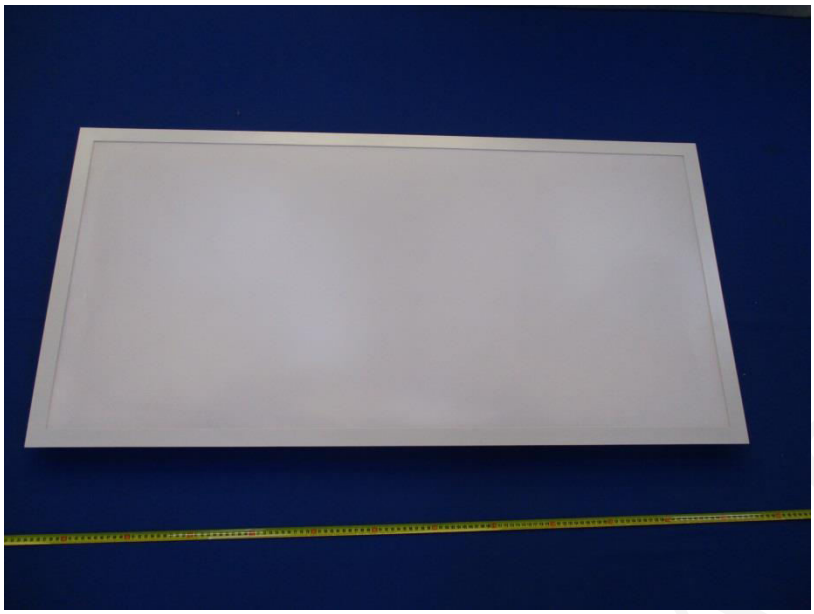
Test Model	CCT(K)	Light Output (lm)	Power(W)	Luminous Efficacy (lm/W)
BPLED-2x4-49/D10/U/35/HL	3500	6394.5	49	130.5
BPLED-2x4-49/D10/U/40/HL	4000	6468	49	132
BPLED-2x4-49/D10/U/50/HL	5000	6517	49	133

3. Test List

Test Model	Test Item			
	Goniophotometer Test	Integrating Sphere Test	THDi and PF Test	In-Situ Temperature Measurement Test
BPLED-2x4-49/D10/U/35/HL	Yes	Yes	Yes	Yes
BPLED-2x4-49/D10/U/50/HL	NA	Yes	NA	NA

4. Product Photo

Product photo of model: BPLED-2x4-49/D10/U/35/HL



5. Test Result

Test Model: BPLED-2x4-49/D10/U/35/HL

Integrating Sphere Test; Orientation: Downward; Test Voltage: 120V 60Hz;

Test Item	Test Result	DLC Requirements	DLC Requirements(With tolerances and/or allowances)	Conclusion
Total Efficacy(lm/W)	130.6	≥125	≥121.25	Pass
CCT(K)	3398	3220~3710	3220~3710	Pass
Duv	0.000106	-0.0055~0.0065	-0.0055~0.0065	Pass
R_a	84.1	≥80	≥78	Pass

Goniophotometer Test; Orientation: Downward; Test Voltage: 120V 60Hz;

Test Item	Test Result	DLC Requirements	DLC Requirements(With tolerances and/or allowances)	Conclusion
Light Output(lm)	6396.1	≥3000	≥2700	Pass
Power(W)	48.88	None.	None.	N/A
Total Efficacy(lm/W)	130.9	≥125	≥121.25	Pass
Zonal Lumen Distribution(0-60º)	82.97%	0-60º≥75%	0-60º≥72%	Pass
SC:0-180°	1.34	1.0≤SC≤2.0	0.9≤SC≤2.1	Pass
SC:90-270°	1.33	1.0≤SC≤2.0	0.9≤SC≤2.1	Pass

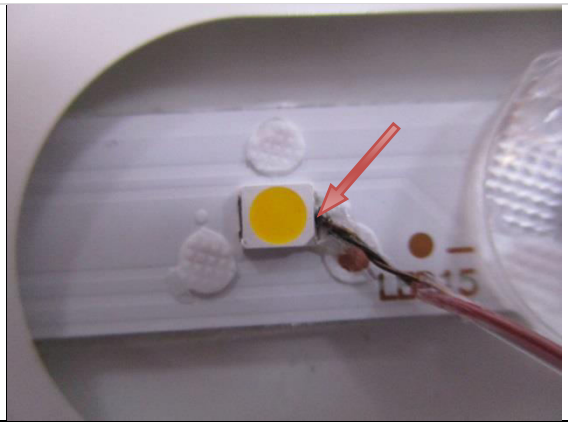
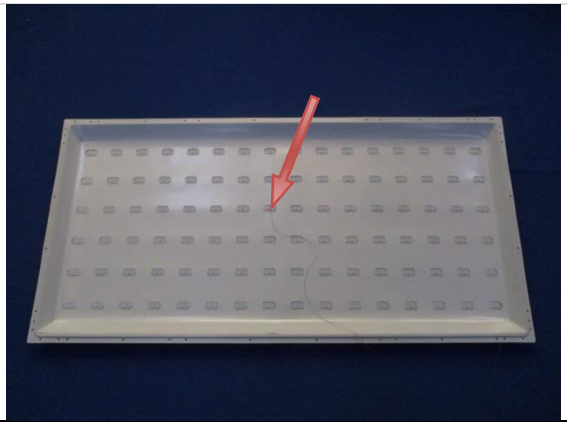
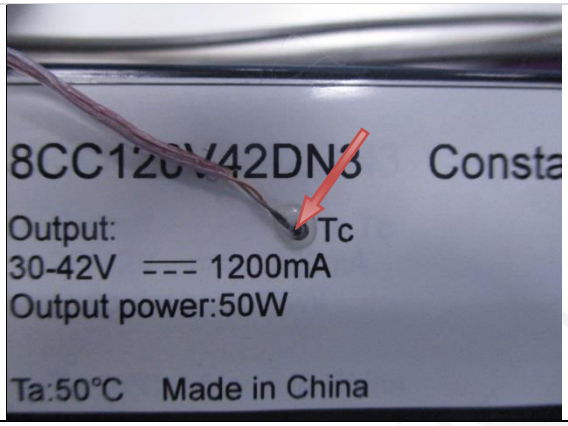
THDi、PF Test; Orientation: Downward;

Test Voltage	Test Item	Test Result	DLC Requirements	DLC Requirements(With tolerances and/or allowances)	Conclusion
120	Power Factor	0.9983	≥0.9	≥0.87	Pass
120	THDi	2.64%	≤20%	≤25%	Pass
277	Power Factor	0.944	≥0.9	≥0.87	Pass
277	THDi	8.67%	≤20%	≤25%	Pass

In-Situ Temperature Measurement Test: Test Voltage: 120V 60Hz;

Test Item	Test Result	DLC Requirements	DLC Requirements(With tolerances and/or allowances)	Conclusion
TMP_{LED}(°C)	34.6	≤98	With tolerance of ≤ 1.1°C or 0.4%, whichever is greater due to thermocouple tolerance	Pass
TMP_c(°C)	49.7	≤75	With tolerance of ≤ 1.1°C or 0.4%, whichever is greater due to thermocouple tolerance	Pass
Drive Current/Individual LED source(mA)	48.8	≤100	With +5% tolerance	Pass
TM-21 Projected Lumen Maintenance at 50000hours	88.58%	L_{70} Life≥50000	L_{70} Life≥50000	Pass
L_{70} Lumen Maintenance Life (Hours)	>54000			
L_{90} Lumen Maintenance Life (Hours)	44000	≥36000	≥36000	Pass

Note:
1. The test results were measured directly from the test equipment.
2. The DLC requirements were listed according to DLC Technical Requirements V4.4.
3. The conclusion is for reference only. Test report that indicate product performance meets DLC Technical Requirements do not represent official DLC product qualification. All decisions regarding product qualification are made by the DLC.

TMP_{LED}(Zoomed-in View)	TMP_{LED}(Bird's-eye View)
	
TMP_c(Zoomed-in View)	TMP_c (Bird's-eye View)
	

Test Data

[Integrating Sphere System]

Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.4094	48.97	0.9967	6395.5	130.6

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
19.422	3398	0.000106	0.4113	0.3939	0.2383	0.5135

Color Rendering Index

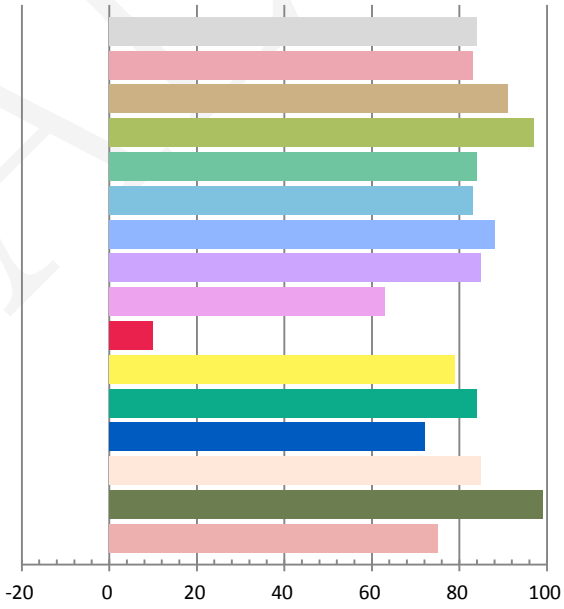
Ra
84.1

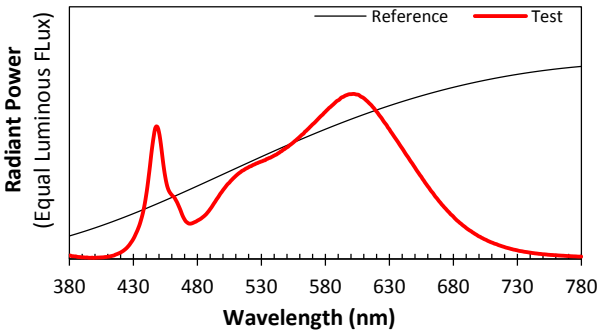
R1	R2	R3	R4
83	91	97	84

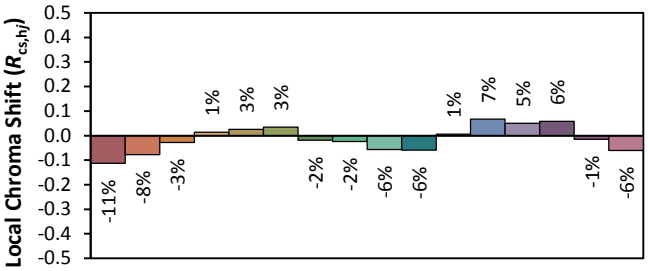
R5	R6	R7	R8
83	88	85	63

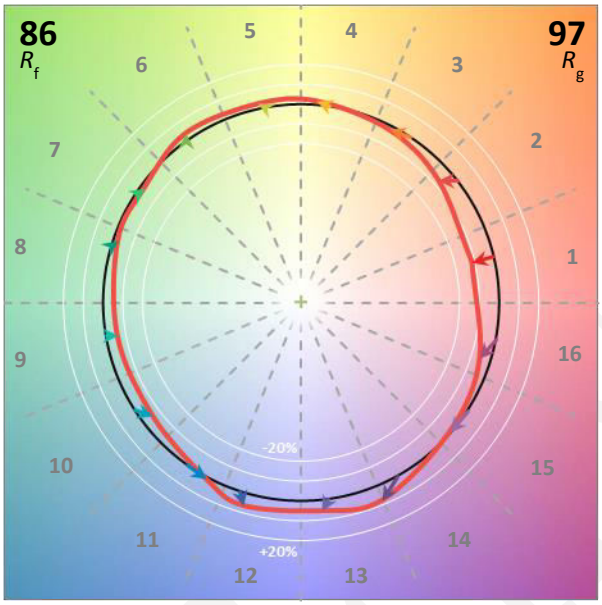
R9	R10	R11	R12
10	79	84	72

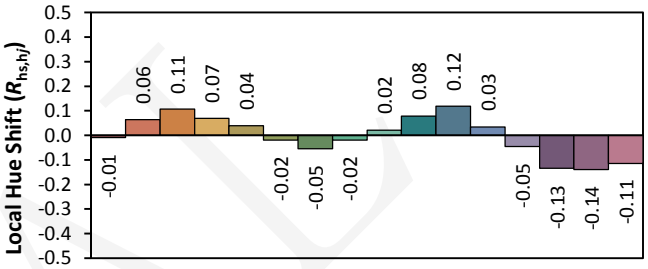
R13	R14	R15
85	99	75

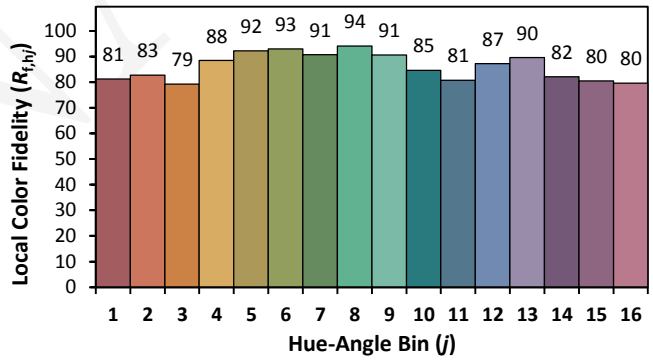


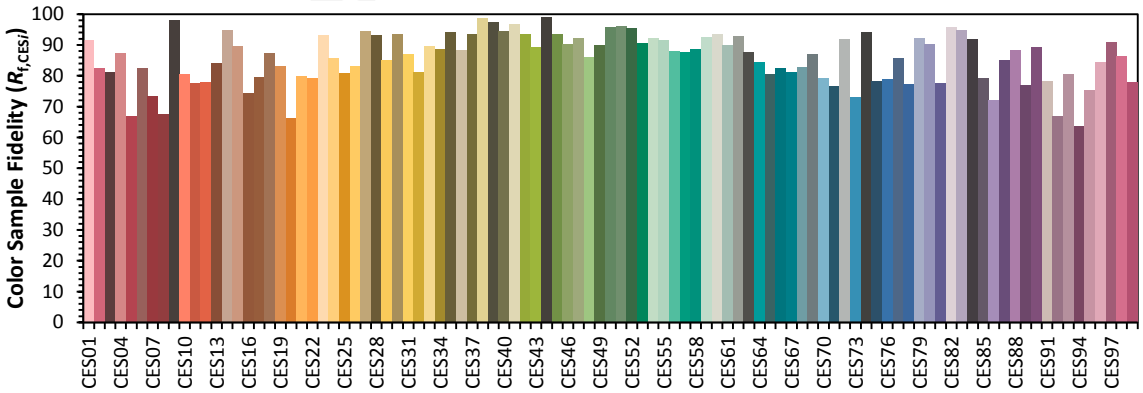

Reference
Test
Radiant Power
(Equal Luminous FLux)
380 430 480 530 580 630 680 730 780
Wavelength (nm)


Local Chroma Shift ($R_{cs,hj}$)
-11% -8% -3% 1% 3% 3% -2% -2% -6% -6% 1% 7% 5% 6% -1% -6%

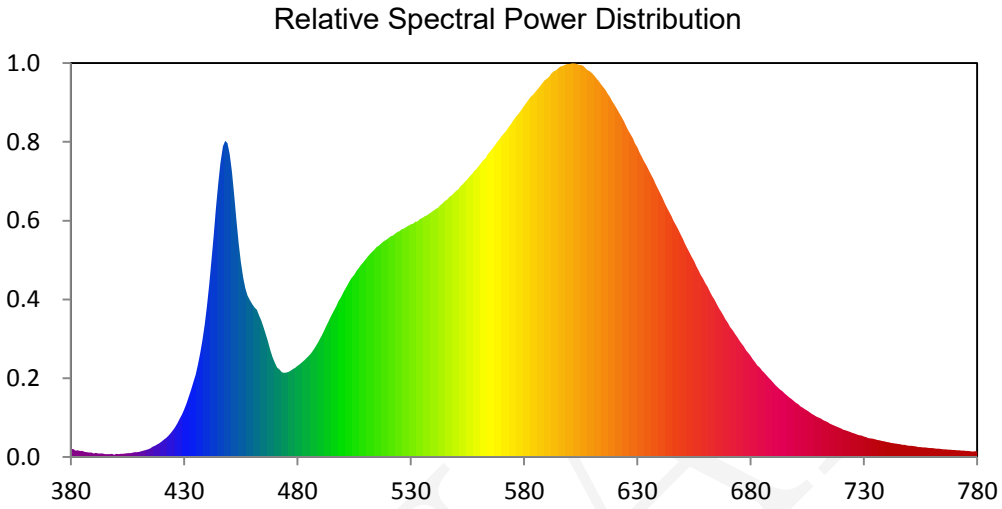

86
R_f
97
R_g
-20%
+20%


Local Hue Shift ($R_{hs,hj}$)
-0.01 0.06 0.11 0.07 0.04 -0.02 -0.05 -0.02 0.02 0.08 0.12 0.03 -0.05 -0.13 -0.14 -0.11

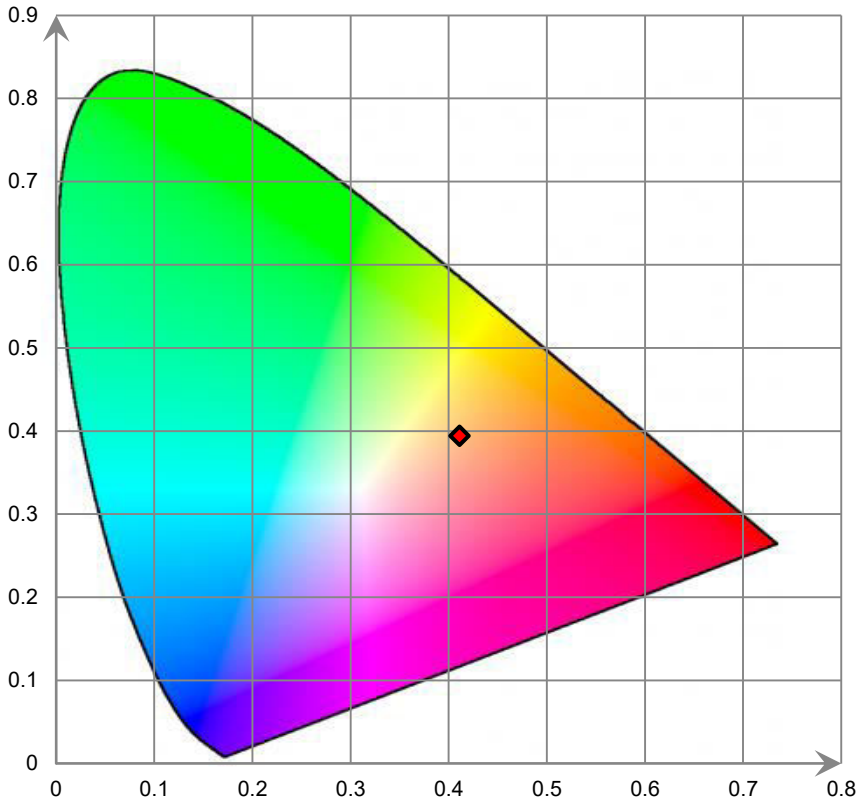

Local Color Fidelity ($R_{f,hj}$)
81 83 79 88 92 93 91 94 91 85 81 87 90 82 80 80
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Hue-Angle Bin (j)


Color Sample Fidelity ($R_{f,CESi}$)
CES01 CES04 CES07 CES10 CES13 CES16 CES19 CES22 CES25 CES28 CES31 CES34 CES37 CES40 CES43 CES46 CES49 CES52 CES55 CES58 CES61 CES64 CES67 CES70 CES73 CES76 CES79 CES82 CES85 CES88 CES91 CES94 CES97

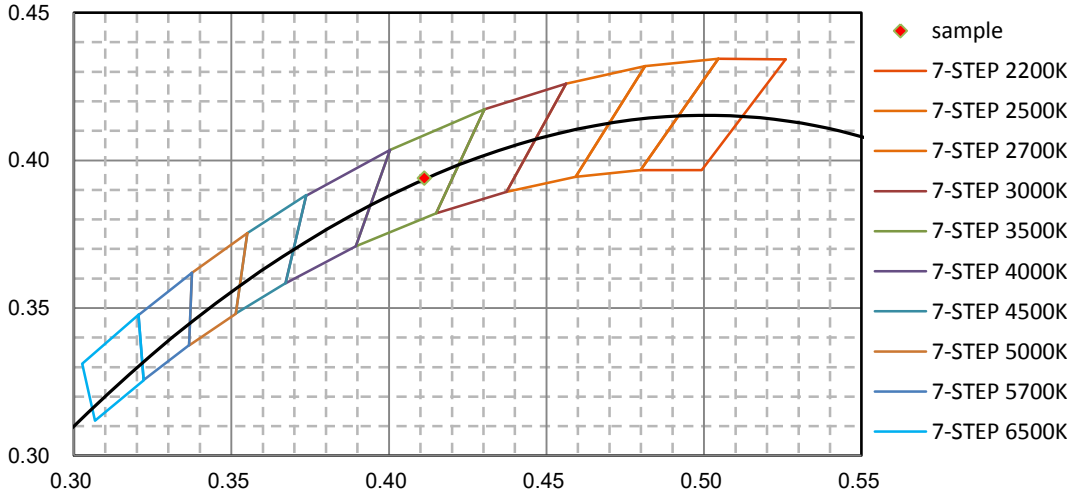
IES R_f	86
IES R_g	97
IES Rcs,h1	-11%



CIE 1931 x y Chromaticity Diagram



7-Step Chromaticity Quadrangles



[Goniophotometer System]

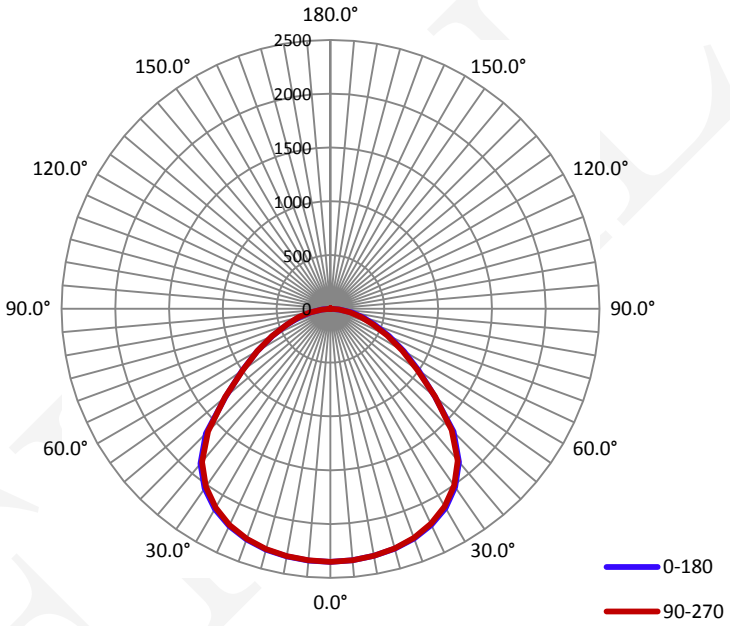
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.381	48.88	0.998

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
6396.1	130.9	2350.6	1.34	1.33

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	103.6	106.1	103.4	105.6	104.7
Field Angle (10% I_{max}):	156.6	158.5	156.0	158.4	157.4

UGR Value

Reflectances:		
Ceiling (cavity)	0.7	
Wall	0.5	
Reference plane	0.2	
Room dimensions	Viewed crosswise	Viewed endwise
X=4H Y=8H	19	18.7

Luminous Intensity (cd) Distribution Data

C / γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	2350.6	2350.6	2350.6	2350.6	2350.6	2350.6	2350.6	2350.6
5.0°	2345.1	2344.8	2343.7	2343.6	2345.2	2347.2	2348.4	2348.6
10.0°	2331.6	2330.0	2328.6	2328.0	2331.0	2334.4	2336.4	2338.5
15.0°	2308.4	2305.8	2302.7	2301.3	2306.6	2309.8	2312.5	2317.1
20.0°	2272.7	2267.3	2263.2	2261.4	2265.6	2269.3	2275.1	2282.3
25.0°	2217.1	2209.0	2203.0	2200.6	2205.9	2210.3	2217.3	2227.2
30.0°	2137.1	2126.5	2121.1	2116.8	2121.2	2125.4	2135.2	2145.6
35.0°	2022.1	2013.4	2008.0	2004.3	2003.9	2009.0	2023.3	2035.1
40.0°	1860.8	1849.9	1829.1	1834.8	1841.5	1853.4	1866.8	1881.9
45.0°	1616.1	1588.9	1573.7	1582.4	1591.8	1602.2	1616.4	1645.3
50.0°	1269.5	1291.3	1301.1	1281.6	1268.1	1277.3	1314.9	1325.1
55.0°	1000.2	1014.6	1075.7	1005.0	981.5	990.6	1073.1	1020.2
60.0°	789.0	802.8	849.8	776.1	769.6	780.1	836.0	788.4
65.0°	598.1	642.2	637.5	618.5	579.4	625.4	620.5	630.2
70.0°	440.6	493.8	481.9	479.2	420.0	474.6	476.1	487.3
75.0°	319.4	349.0	354.5	338.1	294.8	331.0	349.2	347.7
80.0°	208.5	212.9	212.3	199.7	184.7	197.1	206.1	208.3
85.0°	90.6	91.4	92.9	81.0	76.4	78.6	86.6	82.9
90.0°	1.0	3.4	6.6	4.5	2.8	2.5	1.4	0.0
95.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
105.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
115.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
125.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
135.0°	0.0	1.2	1.0	1.1	1.0	1.0	0.8	0.7
140.0°	1.1	1.7	1.5	1.8	1.8	2.0	1.9	1.4
145.0°	2.2	2.7	2.7	2.8	2.6	2.7	2.7	2.3
150.0°	2.4	3.1	3.4	3.4	3.3	2.8	3.2	3.0
155.0°	3.1	3.6	3.7	3.5	3.6	3.0	3.6	3.1
160.0°	3.2	3.0	3.5	3.6	3.7	3.4	3.9	3.6
165.0°	3.4	4.3	3.7	3.8	4.0	4.3	4.3	4.2
170.0°	3.8	4.1	4.1	4.5	5.0	5.0	4.1	4.7
175.0°	3.9	4.2	4.2	4.3	4.8	5.2	4.3	4.5
180.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Luminous Intensity (cd) Distribution Data (cont.)

C / γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	2350.6	2350.6	2350.6	2350.6	2350.6	2350.6	2350.6	2350.6
5.0°	2348.3	2349.6	2349.5	2348.2	2347.4	2346.0	2344.6	2345.0
10.0°	2338.0	2339.8	2339.5	2337.5	2334.8	2332.0	2329.9	2330.7
15.0°	2316.8	2319.7	2317.9	2315.4	2311.6	2307.2	2304.7	2306.0
20.0°	2282.2	2285.6	2282.0	2277.3	2274.6	2267.4	2265.1	2267.0
25.0°	2227.9	2230.5	2227.2	2220.3	2216.9	2209.0	2207.7	2206.5
30.0°	2150.8	2150.5	2146.9	2138.2	2134.1	2126.0	2125.1	2124.6
35.0°	2037.2	2040.9	2036.6	2023.9	2019.7	2013.6	2008.8	2008.1
40.0°	1877.9	1883.1	1869.4	1862.1	1858.9	1844.7	1827.0	1836.5
45.0°	1638.4	1638.0	1625.7	1617.8	1608.0	1581.6	1558.4	1566.4
50.0°	1276.7	1323.7	1337.2	1304.6	1277.8	1279.6	1296.4	1271.8
55.0°	1002.5	1016.6	1093.4	1024.9	991.3	1015.1	1075.5	996.8
60.0°	785.8	793.8	858.9	804.1	787.9	793.1	849.2	792.2
65.0°	593.9	634.4	642.3	644.5	600.9	636.0	638.9	632.5
70.0°	430.3	487.8	482.1	491.8	438.7	488.7	491.9	489.5
75.0°	297.8	343.4	353.6	343.7	310.7	346.7	365.3	346.9
80.0°	185.2	204.9	215.8	206.8	196.2	210.3	216.0	207.0
85.0°	72.8	81.5	90.2	86.7	84.2	90.5	97.6	87.1
90.0°	0.0	0.0	3.2	3.7	3.7	3.6	1.8	0.0
95.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
105.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
115.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
125.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
135.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.1
140.0°	0.0	0.9	1.1	1.1	1.1	1.3	1.8	2.1
145.0°	0.0	1.5	1.5	1.3	1.8	1.8	2.9	2.8
150.0°	2.0	2.0	2.4	2.3	2.3	2.8	3.2	3.1
155.0°	2.4	2.3	2.9	2.5	2.8	3.0	3.7	3.5
160.0°	2.9	2.7	3.8	3.3	3.1	3.3	3.9	3.9
165.0°	3.2	3.6	3.8	3.7	3.7	4.0	4.4	4.2
170.0°	3.3	4.2	4.2	4.7	4.6	4.3	5.4	5.1
175.0°	3.3	3.2	4.4	4.2	5.6	5.5	4.9	4.8
180.0°	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Test Model: BPLED-2x4-49/D10/U/50/HL

Integrating Sphere Test; Orientation: Downward; Test Voltage: 120V 60Hz;

Test Item	Test Result	DLC Requirements	DLC Requirements(With tolerances and/or allowances)	Conclusion
Light Output(lm)	6517	≥3000	≥2700	Pass
Total Efficacy(lm/W)	133.83	≥125	≥121.25	Pass
CCT(K)	4949	4746~5312	4746~5312	Pass
Duv	0.00178	-0.004~0.008	-0.004~0.008	Pass
R_a	84.1	≥80	≥78	Pass

Note:
1. The test results were measured directly from the test equipment.
2. The DLC requirements were listed according to DLC Technical Requirements V4.4.
3. The conclusion is for reference only. Test report that indicate product performance meets DLC Technical Requirements do not represent official DLC product qualification. All decisions regarding product qualification are made by the DLC.

Test Data

[Integrating Sphere System]

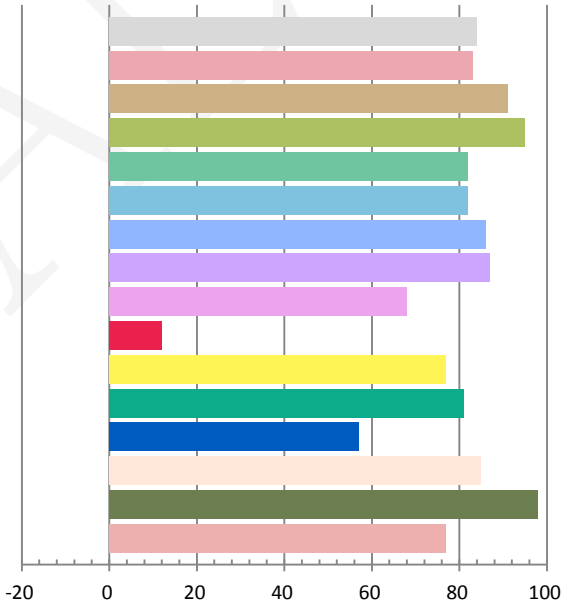
Photometric and Electrical Measurement Result

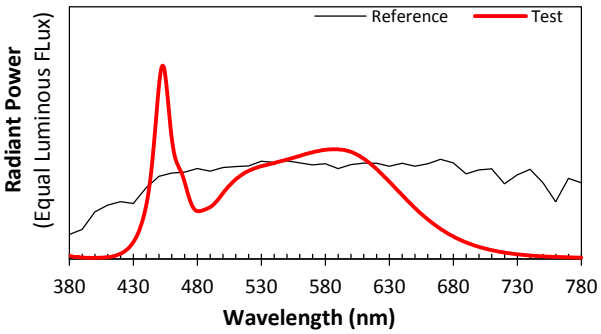
Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.1	60	0.4069	48.7	0.9968	6517	133.83

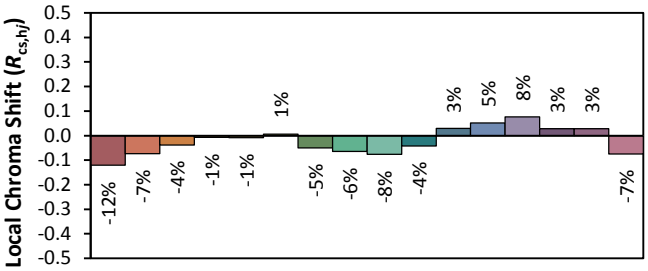
Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
20.267	4949	0.00178	0.3469	0.3566	0.2107	0.4874

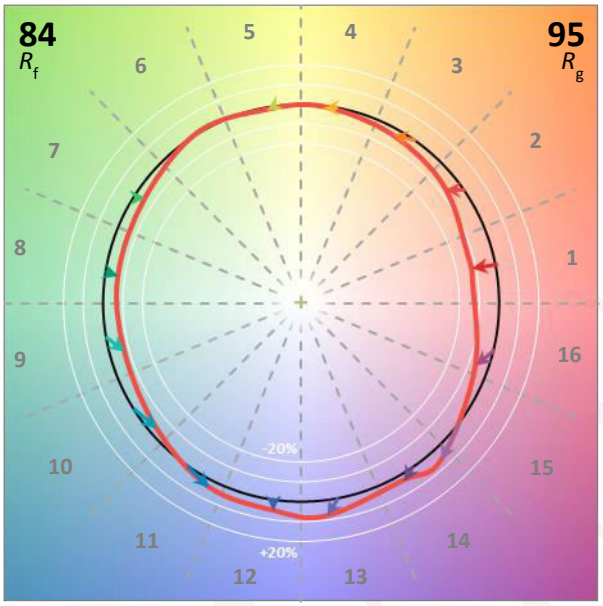
Color Rendering Index

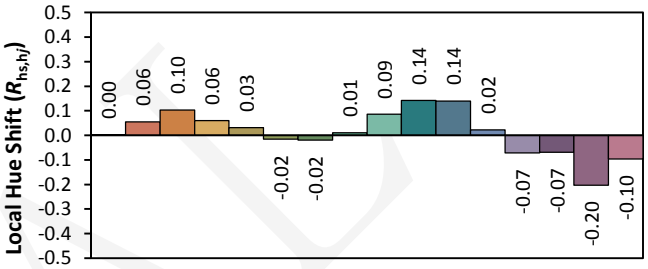
Ra			
84.1			
R1	R2	R3	R4
83	91	95	82
R5	R6	R7	R8
82	86	87	68
R9	R10	R11	R12
12	77	81	57
R13	R14	R15	
85	98	77	

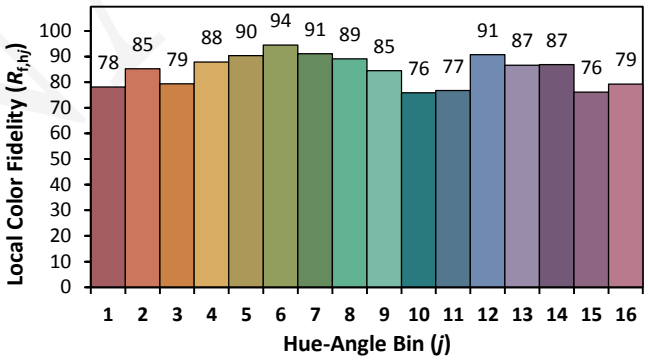


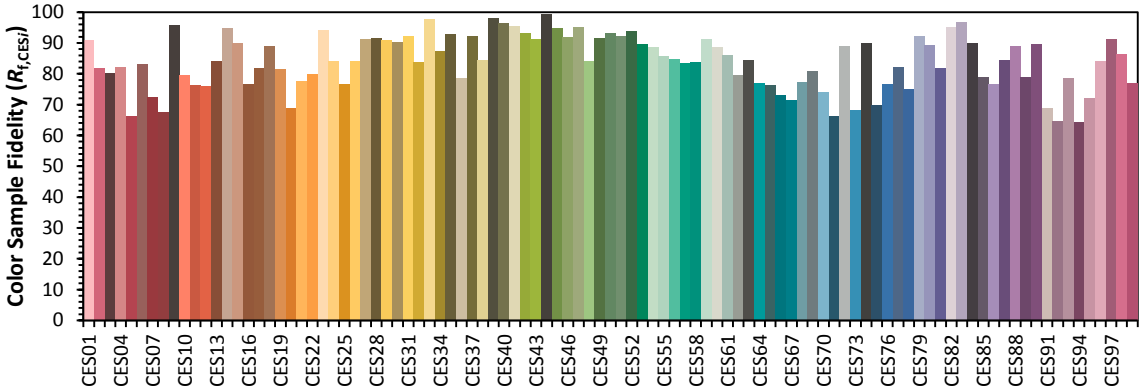

Reference
Test
Radiant Power
(Equal Luminous FLux)
380 430 480 530 580 630 680 730 780
Wavelength (nm)


Local Chroma Shift ($R_{cs,hj}$)
0.5 0.4 0.3 0.2 0.1 0.0 -0.1 -0.2 -0.3 -0.4 -0.5
-12% -7% -4% -1% -1% 1% -5% -6% -8% -4% 3% 5% 8% 3% 3% -7%

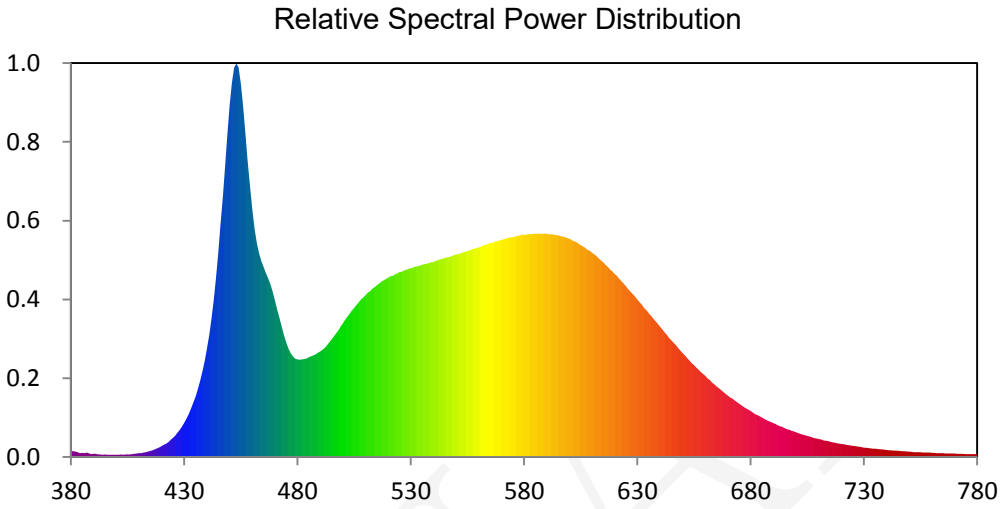

84
R_f
95
R_g
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
-20%
+20%


Local Hue Shift ($R_{hs,hj}$)
0.5 0.4 0.3 0.2 0.1 0.0 -0.1 -0.2 -0.3 -0.4 -0.5
0.00 0.06 0.10 0.06 0.03 -0.02 -0.02 0.01 0.09 0.14 0.14 0.02 -0.07 -0.07 -0.20 -0.10

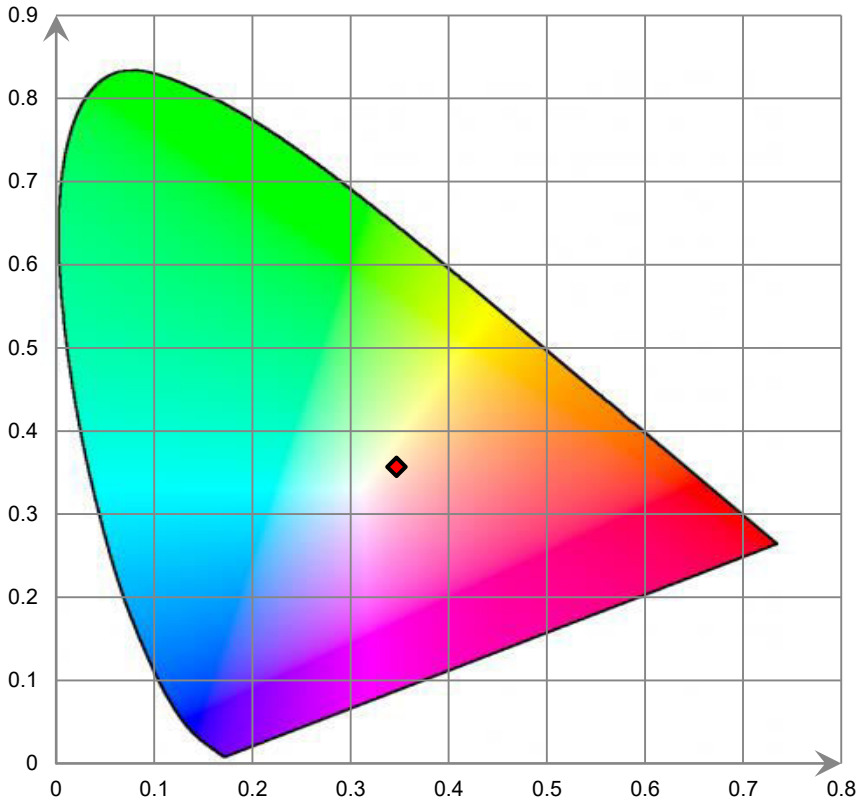

Local Color Fidelity ($R_{f,hj}$)
100 90 80 70 60 50 40 30 20 10 0
78 85 79 88 90 94 91 89 85 76 77 91 87 87 76 79
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Hue-Angle Bin (j)


Color Sample Fidelity ($R_{f,CESi}$)
100 90 80 70 60 50 40 30 20 10 0
CES01 CES04 CES07 CES10 CES13 CES16 CES19 CES22 CES25 CES28 CES31 CES34 CES37 CES40 CES43 CES46 CES49 CES52 CES55 CES58 CES61 CES64 CES67 CES70 CES73 CES76 CES79 CES82 CES85 CES88 CES91 CES94 CES97

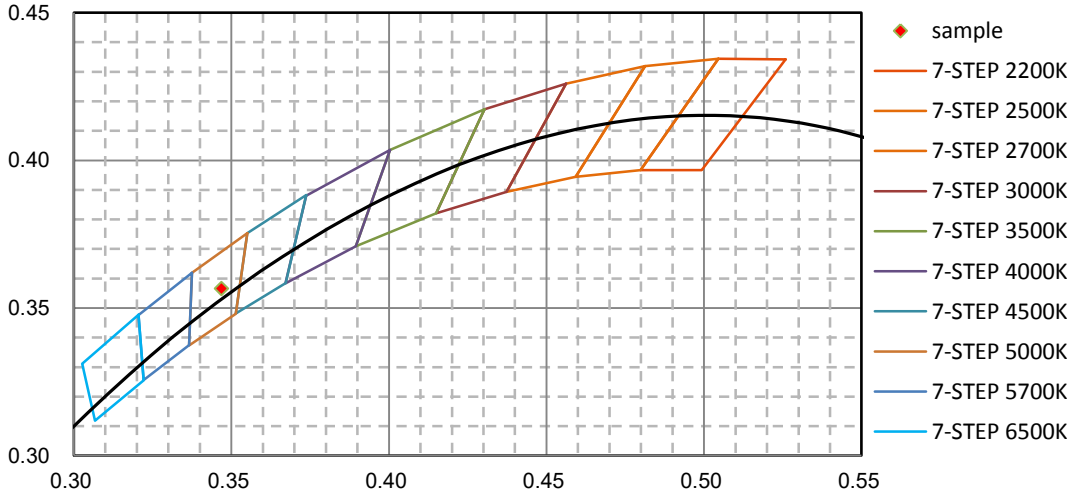
IES R_f	84
IES R_g	95
IES Rcs,h1	-12%



CIE 1931 x y Chromaticity Diagram



7-Step Chromaticity Quadrangles



6. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	G121960CS1361154D	2019-12-24	2020-12-23
spectroradiometer	EVERFINE	HAAS-2000	M12048CS1361148	2019-12-24	2020-12-23
Digital CC&CV DC Power Supply	EVERFINE	WY305	G115986CN1361134	2019-02-14	2020-02-13
Temperature/humidity/clock	KEJIAN	TA298	EE053	2019-12-02	2020-12-01
Standard Light Source	INVENTFINE	N/A	JWWCR020106	2019-11-19	2020-11-18
Digital Power Meter	YOKOGAWA	WT210	91KB35700	2019-04-23	2020-04-22
Intelligence ac power supply	EVERFINE	DPS1005	G119890CS1361121	2019-02-14	2020-02-13
AC Power Supply	INVENTFINE	CHP-5KVA	900511765	2019-04-23	2020-04-22
DC Power Supply	INVENTFINE	WL3010	JWDMP030001	2019-04-23	2020-04-22
Power Meter	INVENTFINE	WT500	GSDSQ200007	2019-04-23	2020-04-22
Goniophotometer	INVENTFINE	GPM-1900	YWGCF120001	2019-12-24	2020-12-23
Wireless Weather Station	ZHONGXING	KG218	N/A	2019-12-02	2020-12-01
Standard Light Source	INVENTFINE	N/A	JWBYR040008	2019-03-08	2020-03-07
Digital Multimeter	FLUKE	115C	37840512WS	2019-10-08	2020-10-07
Hybrid Recorder	YOKOGAWA	DR230	4TJH0903	2019-04-24	2020-04-23
Power Supply	SC	SC/BP-11003	1608110030553	2019-12-14	2020-12-13

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

7. Test Method

Product was tested with no seasoning. All stabilization and measurements were made in compliance with IES LM-79-08. The ambient temperature of the sample was maintained at 25°C±1°C during measurement. And relative humidity is less than 65%.The product was operated in its intended orientation in application during all testing.

Integrating Sphere System
The system includes AC power source, digital power meter, DC power supply, Spectroradiometer, and integrating sphere. The integrating sphere system is calibrated by standard spectrum light source before measurement. 4π geometry was used during measurement.

Goniophotometer System
Type C goniophotometer was used for measuring luminous intensity distribution. The vertical angle (γ) test intervals were set no more than 1 degree while data for 5 degree intervals is reported. The horizontal angle (C plane) test intervals were set no more than 22.5 degree.

ISTMT Test
The LED which has the highest temperature was measured at the location of LED case which is specified by LED source manufacturer and detailed by LM-80 report. The drive current of LED package/module/ array was calculated as the total output current of the driver measured by multimeter, divided by the number of branches in parallel of LEDs.

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