



Shenzhen Belling Efficiency Testing Lab



TESTING
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**Test report of
IES LM-79-08
Approved Method: Electrical and Photometric
Measurements of Solid-State Lighting Products**

Applicant:

P.Q.L., Inc.

Address:

2285 Ward Avenue
Simi Valley, CA 93065

For Product:

1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces

Model No.:

55282, 55283, 5528_50K

Test laboratory: Shenzhen Belling Efficiency Testing Lab., 1/F., Building 1, 1F, No.1 building, Meibaohe industrial park, Dalang street, Shenzhen, Guangdong Prov.518101, China.

Sam Chen

Jason Zhou

Complied by: Sam Chen

Review by: Jason Zhou

Project Engineer

Technical Manager

Note: 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. This report must not be used by the customer to claim product certification, approval, or endorsement By NVLAP, NIST, or any agency of the Federal Government.



Model name	CCT(K)	Total Luminous(lm)	Power(W)	Luminous Efficacy(lm/W)
55282	3000K	4615.908	37.1	124.418
55283	4000K	4672.737 *1	36.9 *2	126.632 *3
5528_50K	5000K	4729.566	36.7	128.871

*1: This value is calculated and the calculation formula is as below:

$$4672.737=(4729.566-4615.908)/2+4615.908$$

*2: This value is calculated and the calculation formula is as below:

$$36.9=(37.1+36.7)/2$$

*3: This value is calculated and the calculation formula is as below:

$$126.632=4672.737/36.9$$



1 General

1.1 Product Information

Manufacturer	P.Q.L., Inc.
Manufacturer Address	2285 Ward Avenue Simi Valley, CA 93065
Brand Name	Superior Life®
Luminaire Type	1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces
Model Number	55282 55283 5528_50K
Rated Inputs	AC 100-277V 50/60Hz
Rated Power	35 W
Nominal CCT	3000K / 5000K
Date of Receipt Samples	2016-08-08

1.2 Standards or methods

- ANSI C78.377-2011: Specifications for the Chromaticity of Solid State Lighting Products
- ANSI C82.77-2002: Harmonic Emission Limits-Related Power Quality Requirements for Lighting Equipment
- CIE Publication No.13.3-1995: Method of Measuring and Specifying Color Rendering of Light Sources
- IESNA LM-79-08 Approved Method: Electric & Photometric Measurement of Solid-state Lighting Products



1.3 Equipment list

Device	Manufacture	Model No.	Serial No.	Calibration due date
Goniophotometric System	SENSING	GMS-3000	N.A	2016-09-22
AC Power Source	ALL POWER	APW-110N	992257	2017-08-27
Total Luminous Flux Standard Lamp	SENSING	110V/100W	S13100234	2016-09-16
Digital Power Meter	YOKOGAWA	WT310	C2QM02030V	2017-08-29
Integral Sphere	SENSING	SPR-600M	N.A	2017-08-27
Integral Sphere (2M)	SENSING	SD-20	N.A	2017-08-27
Digital Power Meter	YOKOGAWA	WT210	91L929742	2017-08-29
Optical Color and Electrical Measurement System	SENSING	SPR-3000	N.A	2017-08-27
Temperature/humidity/clock	VICTOR	VC230	57636	2016-09-14
Digital Anemometer	TECMAN	TD8901	026141	2016-09-14

Statement of Traceability: Shenzhen Belling Efficiency Testing Lab attests that all calibration has been performed using suitable standards traceable to national primary standards and International System of Unit (SI).



2 Test conducted and method

2.1 Ambient Condition

The ambient temperature in which measurements are being taken was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, the air flow around the sample(s) being tested did not affect the performance.

2.2 Power Supply Characteristics

The AC power supply had a sinusoidal voltage wave shape at the prescribed frequency (60 Hz) such that the RMS summation of the harmonic components does not exceed 3 percent of the fundamental during operation of the test item.

The voltage of AC power supply (RMS voltage) applied to the device under test was regulated to within ± 0.2 percent under load.

2.3 Seasoning and Stabilization

No seasoning was performed in accordance with IESNA LM-79-08. And before the measurement, the sample was stabilized until the light output and power variations were less than 0.5% in 30 minutes intervals (3 readings, 15 minutes apart).

2.4 Integrating Sphere System

The system includes AC power source, digital power meter, DC power supply, spectrophotometer, and integrating sphere. The integrating sphere system is calibrated by standard light source before measurement. The system and standard light source has been calibrated regularly and traceable to the National Primary Standards. 4π geometry was used during measurement. The product was operated in its intended orientation in application and was recorded in this report.

2.5 Goniophotometer System

The goniophotometer system is calibrated by standard light source before measurement. The standard light source has been calibrated regularly and traceable to the National Primary Standards.

Type C goniophotometer was used for measuring total luminous flux, luminous intensity distribution, and color spatial uniformity. The product was operated in its intended orientation in application and was recorded in this report. The method according to IESNA LM-79-08 following chapter.



3 Test Result Summary

3.1 Integrating Sphere System

3.1.1 Electrical data

Model Number	Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
55282	120.07	60	0.313	37.1	0.985
5528_50K	120.07	60	0.311	36.7	0.983

3.1.2 Additional Test

Test Item	Model	Test Voltage (V)	Frequency (Hz)	Test Result
Power factor	55282	120	60	0.985
		277	60	0.911
	5528_50K	120	60	0.983
		277	60	0.926
Total harmonic distortion	55282	120	60	12.2%
		277	60	16.5%
	5528_50K	120	60	13.7%
		277	60	17.9%
Off state power (W)	55282	120	60	0
	5528_50K	277	60	0

3.1.3 Photometric data

Model Number	Luminous Flux (lm)	Efficacy (lm/W)	CCT (K)	CRI	R9
55282	4615.908	124.418	2915	82.7	9
5528_50K	4729.566	128.871	4822	81.8	2

3.1.4 Chromaticity Coordinate

Model Number	Duv	x	y	u'	v'
55282	-0.0003	0.4427	0.4052	0.2538	0.5227
5528_50K	0.0048	0.3516	0.3666	0.2100	0.4927



3.2 Goniophotometer System

3.2.1 Electrical data

Model Number	Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
55282	120.06	60	0.3099	36.625	0.9844

3.2.2 Photometric data

Luminous Flux (lm)	Efficacy (lm/W)	S/MH (C0/180)	S/MH (C90/270)	Zonal Lumen in 0-60°(%lm)
4516.67	123.32	1.18	1.32	79.172



4 Test Data

Report of Spectroradiometric & Electric Analysis for Light Source

Model No.:

Application NO.:

Sample SN:

Applicant:

Manufacturer:

Date:

Tested By:

Reviewed By:

Description:

Test Condition

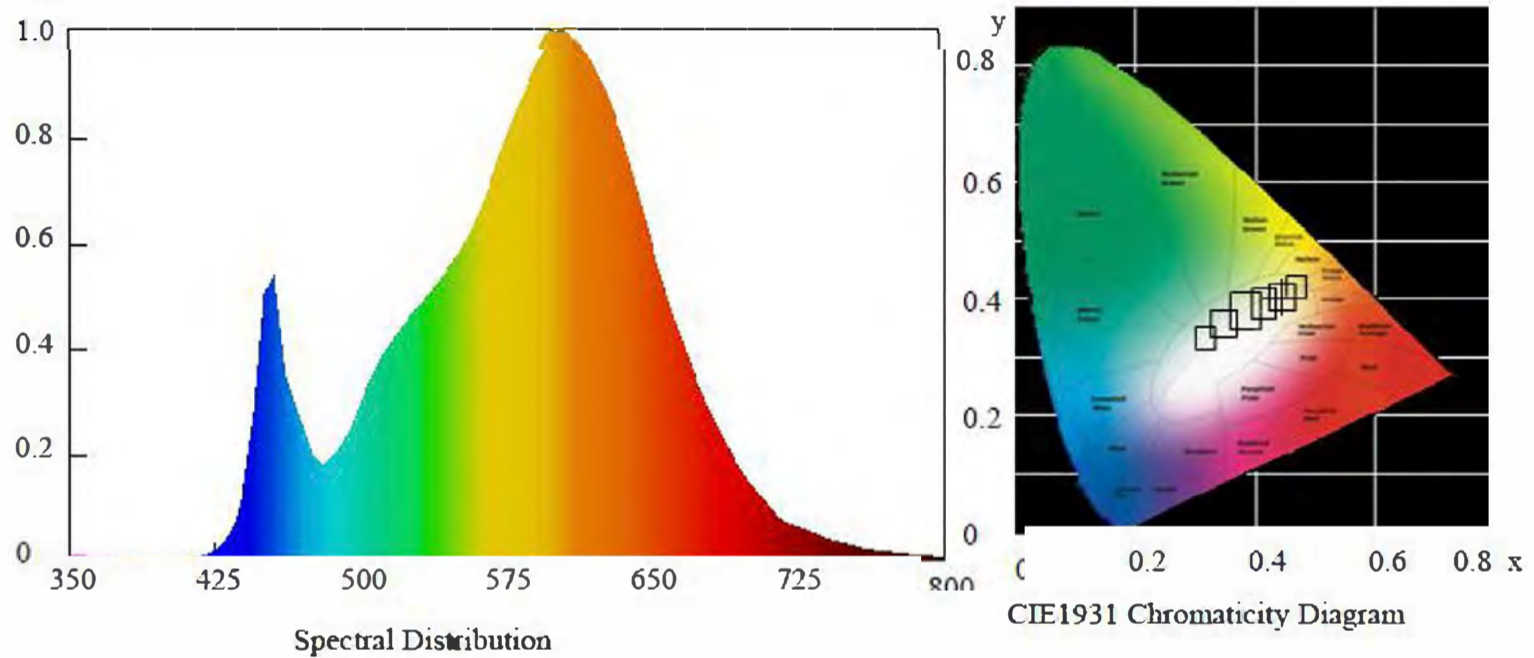
Temperature: 25°C

RH: 58%

Spectrum Range: 350-800 nm

Scan Step: 5 nm

Spectroradiometric Parameters

Chromaticity Coordinates: $x=0.4427$ $y=0.4052$ $u'=0.2538$ $v'=0.5227$

Correlated Color Temperature: 2915 K

Dominant Wavelength: 582.0 nm(E)

Luminous Flux: 4615.908 lm

Purity: 0.5464

Chromaticity Difference: -0.0003Duv

Peak Wavelength: 903.7 nm

Color Ratio: $K_r=45.8\%$ $K_g=47.1\%$ $K_b=7.1\%$

Bandwidth: 0nm

Radiant Flux: 13.655 W

Rendering Index: $R_a=82.7$

R1=81 R2=92 R3=96 R4=80 R5=81 R6=90 R7=82 R8=59

R9=9 R10=81 R11=80 R12=70 R13=85 R14=98 R15=74

Electric Parameters

Voltage: 120.07 V

Current: 0.313 A

Power Factor: 0.985

Power: 37.1 W

Luminous Efficacy: 124.418 lm/W

SENSING Instruments Co.,Ltd



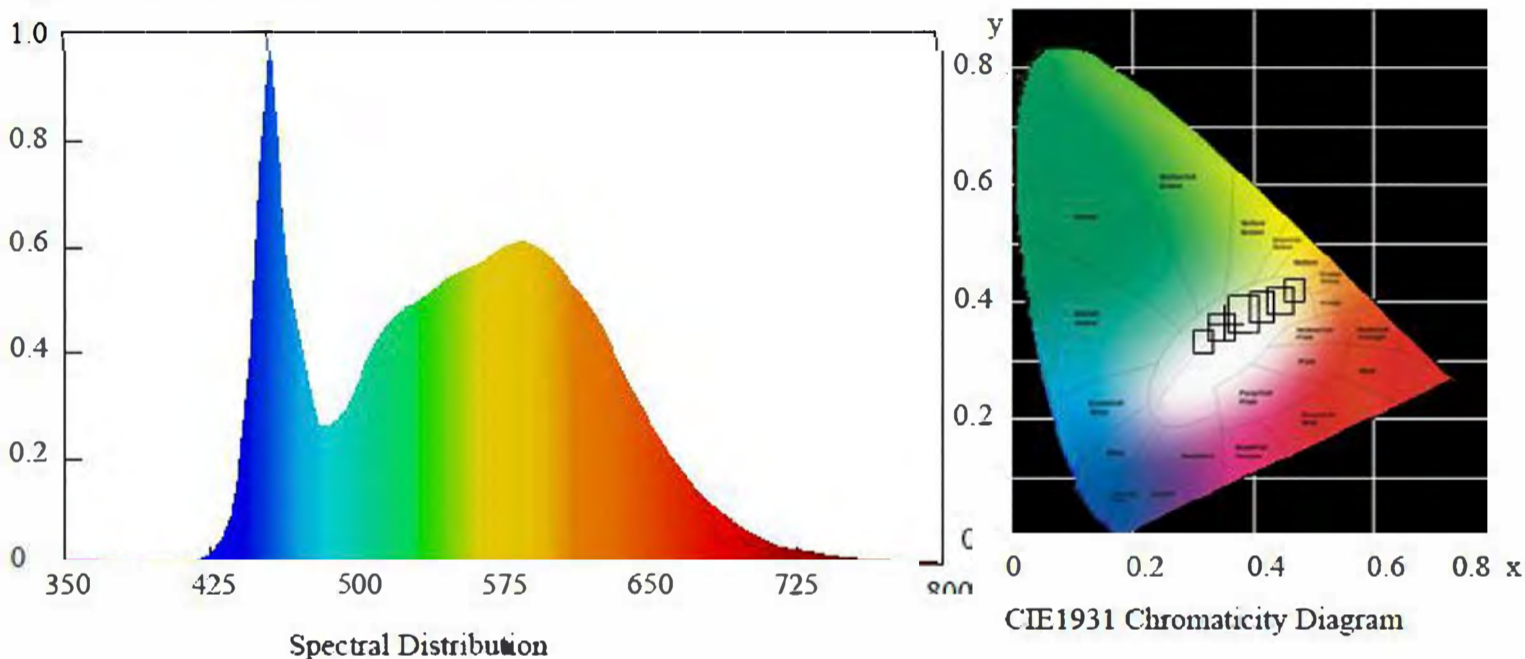
Report of Spectroradiometric & Electric Analysis for Light Source

Model No.:	Application NO.:
Sample SN:	Applicant:
Manufacturer:	Date:
Tested By:	Reviewed By:
Description:	

Test Condition

Temperature: 25°C	RH: 58%
Spectrum Range: 350-800 nm	Scan Step: 5 nm

Spectroradiometric Parameters



Chromaticity Coordinates: $x=0.3516$ $y=0.3666$ $u'=0.2100$ $v'=0.4927$
 Correlated Color Temperature: 4822 K Dominant Wavelength: 570.0 nm(E)
 Luminous Flux: 4729.566 lm Purity: 0.1553
 Chromaticity Difference: 0.0048Duv Peak Wavelength: 449.1 nm
 Color Ratio: $K_r=34.4\%$ $K_g=54.4\%$ $K_b=11.2\%$
 Bandwidth: -445.8nm Radiant Flux: 14.013 W
 Rendering Index: $R_a=81.8$
 $R_1=80$ $R_2=90$ $R_3=95$ $R_4=77$ $R_5=79$ $R_6=85$ $R_7=85$ $R_8=63$
 $R_9=2$ $R_{10}=76$ $R_{11}=76$ $R_{12}=52$ $R_{13}=84$ $R_{14}=97$ $R_{15}=73$

Electric Parameters

Voltage: 120.07 V	Current: 0.311 A
Power Factor: 0.983	Power: 36.7 W
Luminous Efficacy: 128.871 lm/W	

SENSING Instruments Co.,Ltd



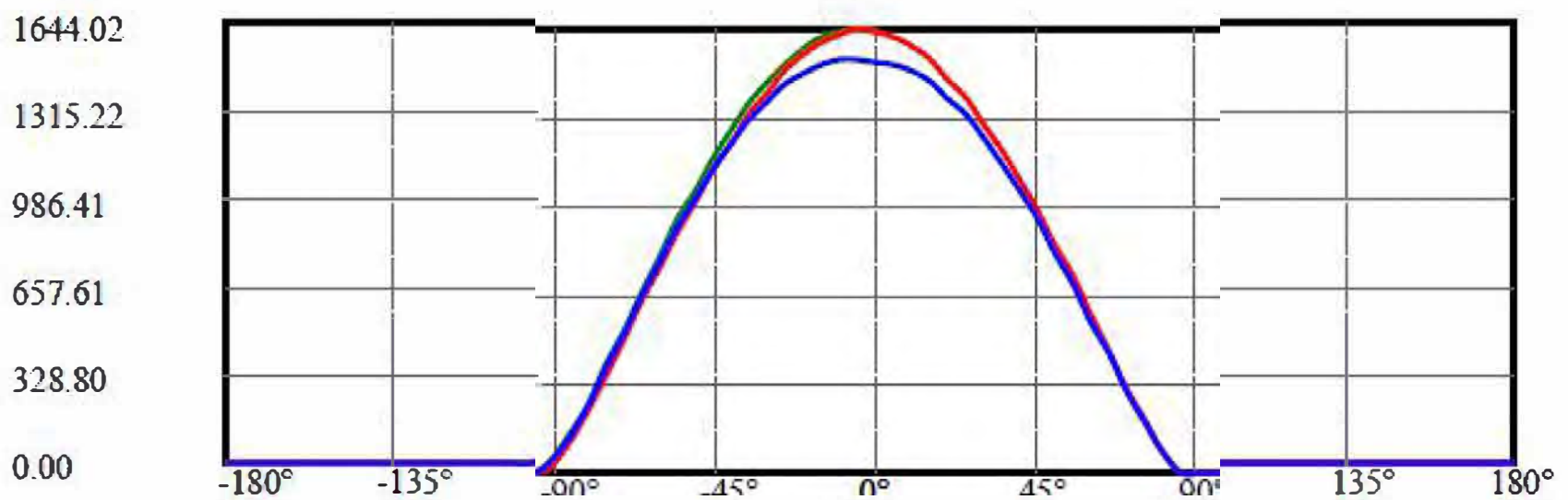
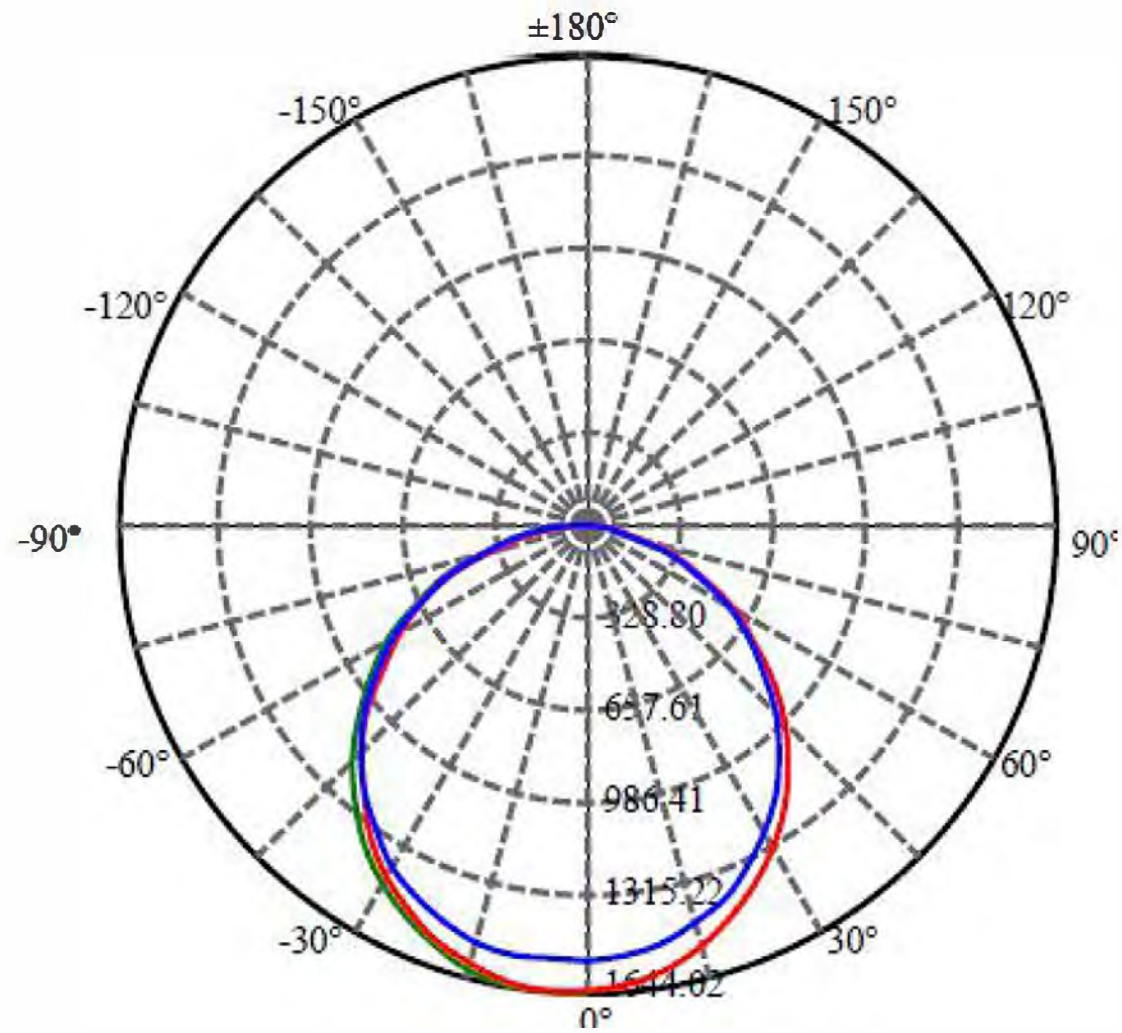
Zonal Flux Diagram

Zonal flux distribution table

$\gamma(^{\circ})$	Average I(cd)	Zonal F(lm)	Sum F(lm)	Eff Flux(%)	Eff Sum(%)
0.0	1602.942	.000	.000	.000%	.000%
5.0	1596.147	38.244	38.244	.847%	.847%
10.0	1577.345	113.526	151.770	2.513%	3.360%
15.0	1541.319	184.997	336.767	4.096%	7.456%
20.0	1491.073	249.912	586.679	5.533%	12.989%
25.0	1426.923	306.044	892.723	6.776%	19.765%
30.0	1352.186	351.699	1244.421	7.787%	27.552%
35.0	1263.228	385.138	1629.559	8.527%	36.079%
40.0	1162.578	404.728	2034.287	8.961%	45.040%
45.0	1054.502	410.510	2444.797	9.089%	54.128%
50.0	938.052	402.625	2847.422	8.914%	63.043%
55.0	816.071	381.405	3228.826	8.444%	71.487%
60.0	685.558	347.097	3575.923	7.685%	79.172%
65.0	551.252	300.671	3876.594	6.657%	85.829%
70.0	417.421	245.274	4121.869	5.430%	91.259%
75.0	285.802	183.811	4305.680	4.070%	95.329%
80.0	164.769	120.560	4426.240	2.669%	97.998%
85.0	66.663	62.886	4489.125	1.392%	99.390%
90.0	16.970	22.899	4512.025	.507%	99.897%
95.0	.000	4.646	4516.671	.103%	100.000%
100.0	.000	.000	4516.671	.000%	100.000%
105.0	.000	.000	4516.671	.000%	100.000%
110.0	.000	.000	4516.671	.000%	100.000%
115.0	.000	.000	4516.671	.000%	100.000%
120.0	.000	.000	4516.671	.000%	100.000%
125.0	.000	.000	4516.671	.000%	100.000%
130.0	.000	.000	4516.671	.000%	100.000%
135.0	.000	.000	4516.671	.000%	100.000%
140.0	.000	.000	4516.671	.000%	100.000%
145.0	.000	.000	4516.671	.000%	100.000%
150.0	.000	.000	4516.671	.000%	100.000%
155.0	.000	.000	4516.671	.000%	100.000%
160.0	.000	.000	4516.671	.000%	100.000%
165.0	.000	.000	4516.671	.000%	100.000%
170.0	.000	.000	4516.671	.000%	100.000%
175.0	.000	.000	4516.671	.000%	100.000%
180.0	.000	.000	4516.671	.000%	100.000%



Luminous Intensity Distribution Diagram Light Distribution Curve [Unit:cd]



C225(Max): 

C0/C180: 

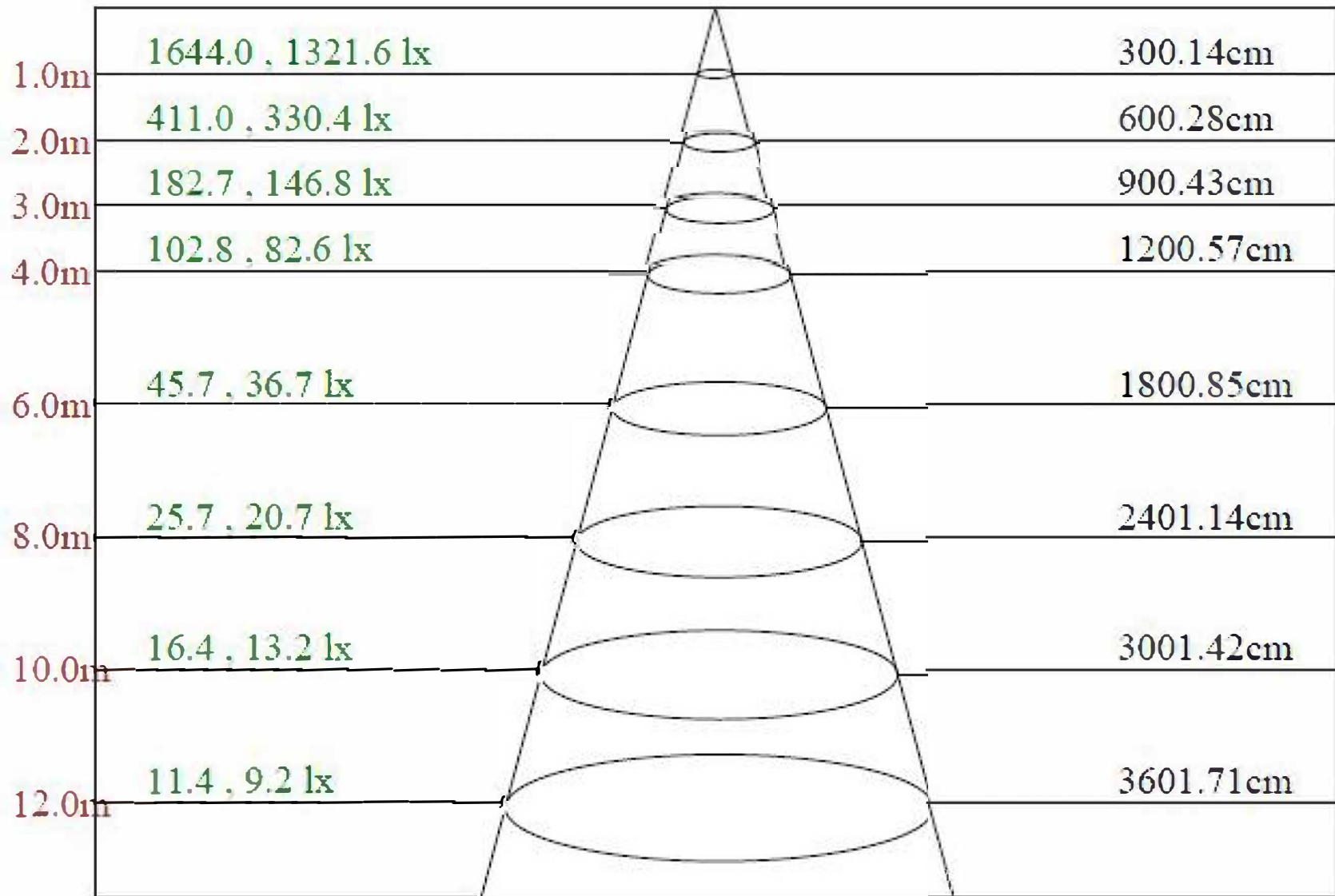
C90/C270: 

Field angle(10%Imax):C0/180Left:82.9 Right:76.4
:C90/270Left:84.3 Right:76.4

Beam Angle(50%Imax):C0/180Left:57.8 Right:51.2
:C90/270Left:60.7 Right:52.1



Lux distance Curve



Max , Ave Beam angle of C225plane111.86

**Luminous Intensity Distribution Data**

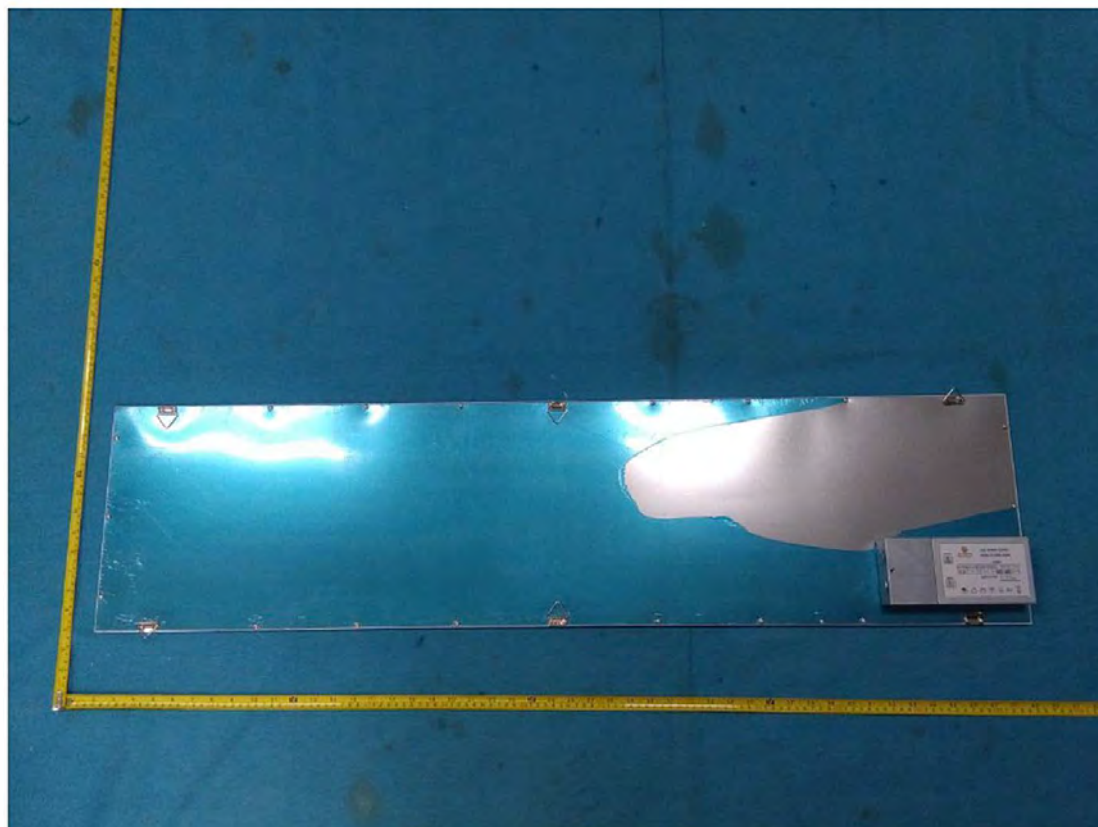
C/ γ ($^{\circ}$)	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0
0.0	1636.44	1616.21	1583.35	1532.79	1464.53	1386.16	1300.20	1199.08	1087.84
22.5	1636.44	1616.21	1580.82	1530.26	1464.53	1383.63	1292.62	1196.55	1085.31
45.0	1641.50	1618.74	1588.41	1537.84	1477.17	1398.80	1315.37	1214.25	1105.54
67.5	1568.18	1558.07	1535.32	1494.87	1434.19	1365.93	1282.51	1186.44	1080.26
90.0	1525.20	1515.09	1489.81	1446.83	1393.74	1322.96	1242.06	1148.52	1047.39
112.5	1563.12	1547.96	1517.62	1469.58	1413.97	1338.12	1259.75	1166.21	1060.03
135.0	1626.33	1606.10	1575.77	1527.73	1467.06	1391.21	1307.79	1206.66	1100.48
157.5	1626.33	1611.16	1575.77	1530.26	1462.00	1388.69	1300.20	1204.13	1092.90
180.0	1636.44	1638.97	1626.33	1593.46	1550.48	1487.28	1413.97	1328.01	1229.42
202.5	1636.44	1638.97	1628.86	1598.52	1555.54	1497.39	1426.61	1340.65	1244.58
225.0	1641.50	1644.02	1636.44	1611.16	1570.71	1515.09	1451.89	1368.46	1274.92
247.5	1568.18	1583.35	1578.29	1553.01	1520.15	1472.11	1408.91	1335.60	1244.58
270.0	1525.20	1527.73	1535.32	1512.56	1482.23	1436.72	1381.10	1305.26	1221.83
292.5	1563.12	1558.07	1560.60	1547.96	1510.03	1469.58	1411.44	1338.12	1249.64
315.0	1626.33	1628.86	1611.16	1590.93	1553.01	1499.92	1434.19	1353.29	1254.70
337.5	1626.33	1628.86	1613.69	1583.35	1537.84	1477.17	1406.38	1320.43	1221.83
360.0	1636.44	1616.21	1583.35	1532.79	1464.53	1386.16	1300.20	1199.08	1087.84
C/ γ ($^{\circ}$)	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0
0.0	974.08	847.67	721.27	589.81	453.29	319.30	195.42	84.19	3.29
22.5	971.55	845.14	718.74	584.75	450.76	316.77	187.84	79.13	3.29
45.0	984.19	862.84	731.38	592.33	453.29	314.24	190.37	79.13	0.00
67.5	969.02	840.09	716.21	584.75	445.70	314.24	187.84	79.13	0.00
90.0	936.16	812.28	693.46	564.53	440.65	306.66	182.78	76.60	0.00
112.5	943.74	824.92	708.63	579.69	440.65	314.24	187.84	79.13	0.76
135.0	986.72	862.84	736.44	599.92	465.93	324.36	200.48	89.24	5.82
157.5	981.66	860.31	731.38	599.92	468.46	331.94	203.01	91.77	13.40
180.0	1120.71	1009.47	888.12	761.72	630.26	496.27	359.75	230.82	114.52
202.5	1140.93	1027.17	908.35	781.94	647.95	511.44	374.92	243.46	127.16
225.0	1168.74	1054.98	938.68	804.69	668.18	534.19	395.14	258.63	139.80
247.5	1148.52	1039.81	923.52	794.58	660.59	531.66	392.61	261.15	142.33
270.0	1125.76	1019.58	908.35	781.94	650.48	521.55	385.03	253.57	134.75
292.5	1151.04	1047.39	926.04	799.64	663.12	531.66	390.09	256.10	139.80
315.0	1153.57	1044.86	920.99	789.53	655.54	521.55	382.50	245.98	124.64
337.5	1115.65	1009.47	885.59	759.19	625.20	488.68	357.22	228.29	117.05
360.0	974.08	847.67	721.27	589.81	453.29	319.30	195.42	84.19	3.29
C/ γ ($^{\circ}$)	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
157.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180.0	23.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202.5	31.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225.0	38.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
247.5	41.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
270.0	41.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
292.5	38.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
315.0	33.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
337.5	23.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
360.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



C/γ(°)	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	175.0
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
67.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
135.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
157.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
247.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
270.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
292.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
315.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
337.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
360.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C/γ(°)	180.0								
0.0	0.00								
22.5	0.00								
45.0	0.00								
67.5	0.00								
90.0	0.00								
112.5	0.00								
135.0	0.00								
157.5	0.00								
180.0	0.00								
202.5	0.00								
225.0	0.00								
247.5	0.00								
270.0	0.00								
292.5	0.00								
315.0	0.00								
337.5	0.00								
360.0	0.00								



Photo Document



****End of test report****