Date of issue	2018-03-21
Version	1.0
Total pages	15

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:

Architectural Flood and Spot Luminaires

Model No.:

84091, 841XX - 1000 - 57K was selected as the representative model.
All measurements are the same except CCT.

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.

Zac. Kuang

Jason zhou

Complied by: Zac Kuang **Review by: Jason zhou**

Project Engineer **Technical Manager**

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	Architectural Flood and Spot Luminaires
Model Number	84091, 841XX-1000-57K
Rated Inputs	AC 200-480V 50/60Hz
Rated Power	1000 W
Nominal CCT	3000K / 5700K
Date of Receipt Samples	2018-01-30
Date of Test	2018-02-01 to 2018-02-28

1.2 Standards or methods

- ANSI C78.377-2015: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
Goniophotometeric System	SENSING	GMS-3000	N.A	2018-09-20
AC Power Source	ALL POWER	APW-110N	992257	2018-08-26
Total Luminous Flux Standard Lamp	SENSING	110V/100W	S13100234	2018-09-14
Digital Power Meter	YOKOGAWA	WT310	C2QM02030V	2018-08-28
Integral Sphere	SENSING	SPR-600M	N.A	2018-08-26
Digital Power Meter	YOKOGAWA	WT210	91L929742	2018-08-28
Optical Color and Electrical Measurement System	SENSING	SPR-3000	N.A	2018-08-26
Temperature/humidity/clock	VICTOR	VC230	57636	2018-09-12
Digital Anemometer	TECMAN	TD8901	026141	2018-09-12

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°C ±1°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
84091	276.92	60	3.666	1006.10	0.991
841XX-1000-57K	276.91	60	3.663	1006.30	0.992

3.1.2 Photometric data

Model Number	Luminous Flux (lm)	Efficacy (lm/W)	CCT (K)	CRI	R9
84091	119424.07	118.7	2952	70.4	-38
841XX-1000-57K	130315.85	129.5	5464	72.1	-26

3.1.3 Chromaticity Coordinate

Model Number	Duv	x	y	u'	v'
84091	-0.00042	0.4397	0.4040	0.2524	0.5218
841XX-1000-57K	0.00316	0.3334	0.3481	0.2048	0.4812

3.2 Goniophotometer System

3.2.1 Electrical data

Model Number	Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
84091	277.29	60	3.6565	1005.70	0.9919

3.2.2 Photometric data

Luminous Flux (lm)	Efficacy (lm/W)	Zonal Lumen in 0-90°(%lm)
118960.00	118.29	99.878

3.3 Additional Test

Model Number	Test Item	Test Voltage (V)	Frequency(Hz)	Test Result
84091	Power Factor	480	60	0.942
	THD	480	60	13.6%

4 Test Data

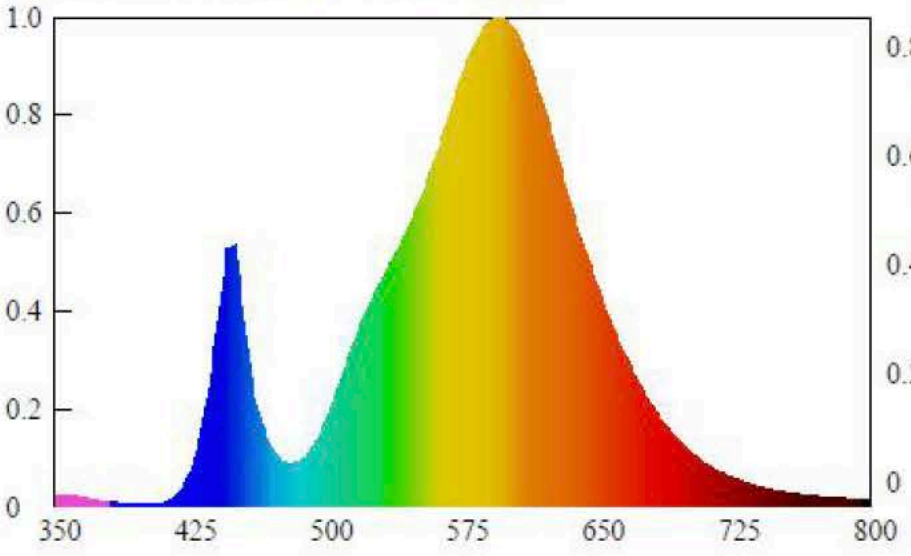
84091

Test Condition

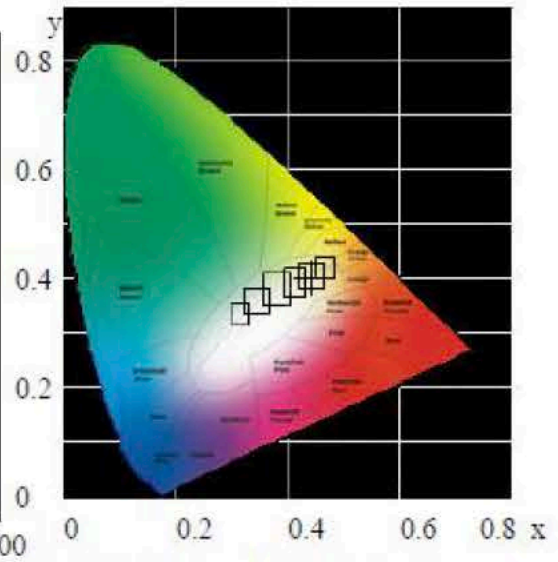
Temperature: 25°C RH: 58%

Spectrum Range: 350-800 nm Scan Step: 5 nm

Spectroradiometric Parameters



Spectral Distribution



CIE1931 Chromaticity Diagram

Chromaticity Coordinates: x=0.4397 y=0.4040 u'=0.2524 v'=0.5218

Correlated Color Temperature: 2952 K Dominant Wavelength: 582.0 nm(E)

Colour Fidelity Index: Rf=69 Gamut Index: Rg=94

Luminous Flux: 119424.07 lm Purity: 0.5332

Chromaticity Difference: -0.00042Duv Peak Wavelength: 595.0 nm

Color Ratio: Kr=45.3% Kg=49.6% Kb=5.1%

Bandwidth: 114.3nm Radiant Flux: 231.917 W

Photosynthetically Active Radiation(PAR): 223.80W Photosynthetic Photon Flux(PPF):1082.94μmol/s

Rendering Index: Ra=70.4

R1=67	R2=81	R3=93	R4=66	R5=65	R6=73	R7=76	R8=41
R9=-38	R10=57	R11=61	R12=48	R13=70	R14=96	R15=59	Re=61

Electric Parameters

Voltage: 276.92 V Current: 3.666 A

Power Factor: 0.991 Power: 1006.10 W

Luminous Efficacy: 118.7 lm/W

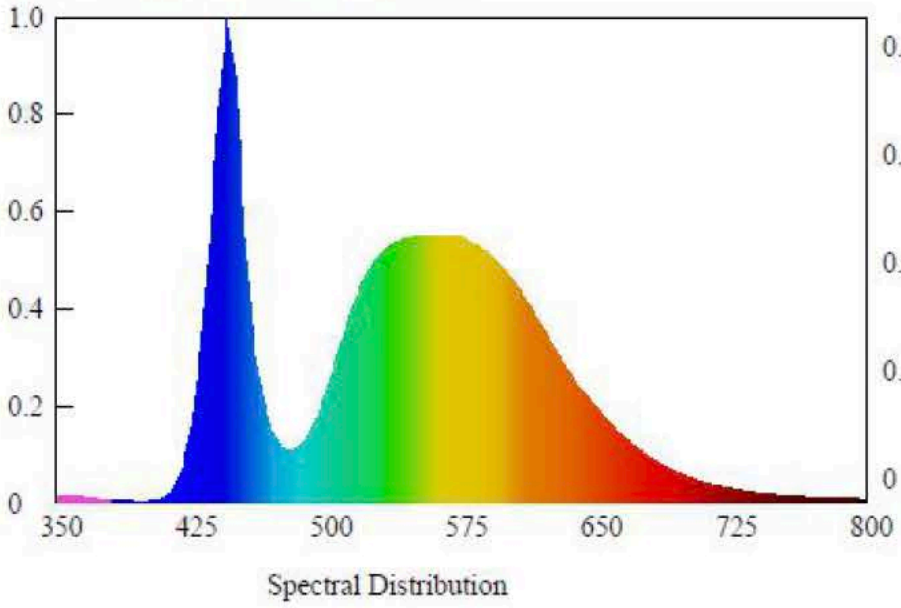
841XX-1000-57K

Test Condition

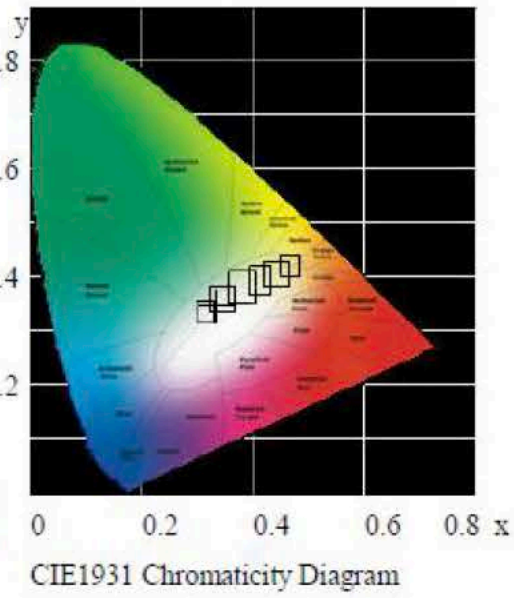
Temperature: 25°C RH: 58%

Spectrum Range: 350-800 nm Scan Step: 5 nm

Spectroradiometric Parameters



Spectral Distribution



CIE1931 Chromaticity Diagram

Chromaticity Coordinates: x=0.3334 y=0.3481 u'=0.2048 v'=0.4812

Correlated Color Temperature: 5464 K Dominant Wavelength: -554.0 nm(E)

Colour Fidelity Index: Rf=69 Gamut Index: Rg=96

Luminous Flux: 130315.85 lm Purity: 0.0314

Chromaticity Difference: +0.00316Duv Peak Wavelength: 445.0 nm

Color Ratio: Kr=31.3% Kg=59.4% Kb=9.2%

Bandwidth: 24.8nm Radiant Flux: 311.653 W

Photosynthetically Active Radiation(PAR): 303.83W Photosynthetic Photon Flux(PPF):1384.90μmol/s

Rendering Index: Ra=72.1

R1=71	R2=75	R3=79	R4=74	R5=72	R6=67	R7=79	R8=59
R9=-26	R10=42	R11=73	R12=46	R13=71	R14=88	R15=65	Re=62

Electric Parameters

Voltage: 276.91 V Current: 3.663 A

Power Factor: 0.992 Power: 1006.30 W

Luminous Efficacy: 129.5 lm/W

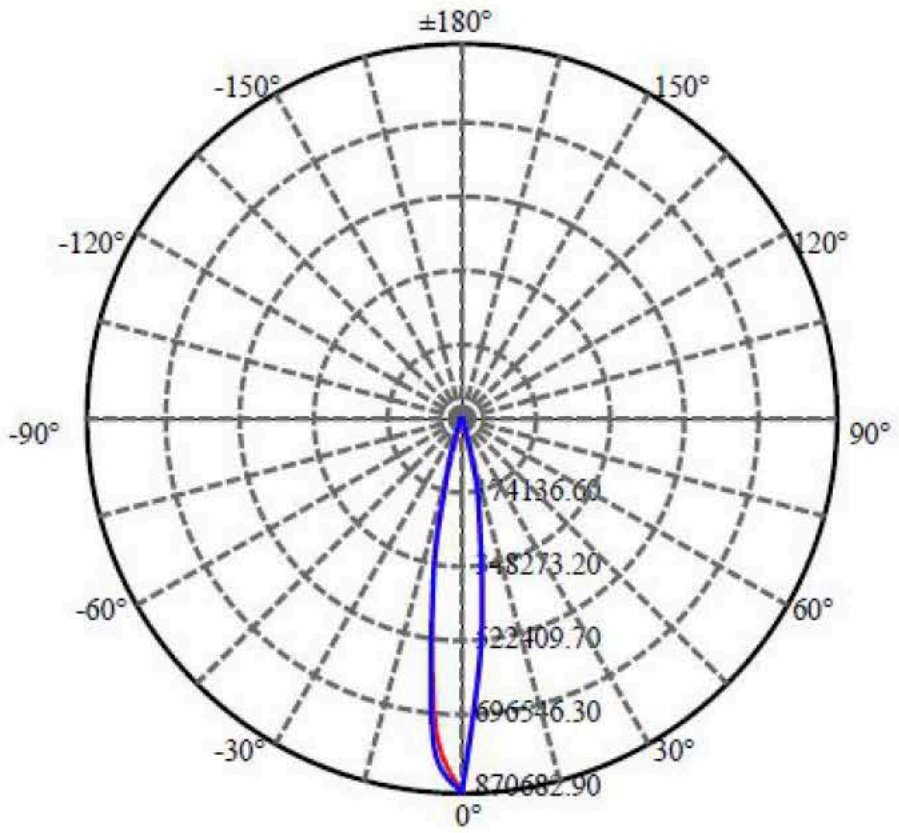
Zonal Flux Diagram

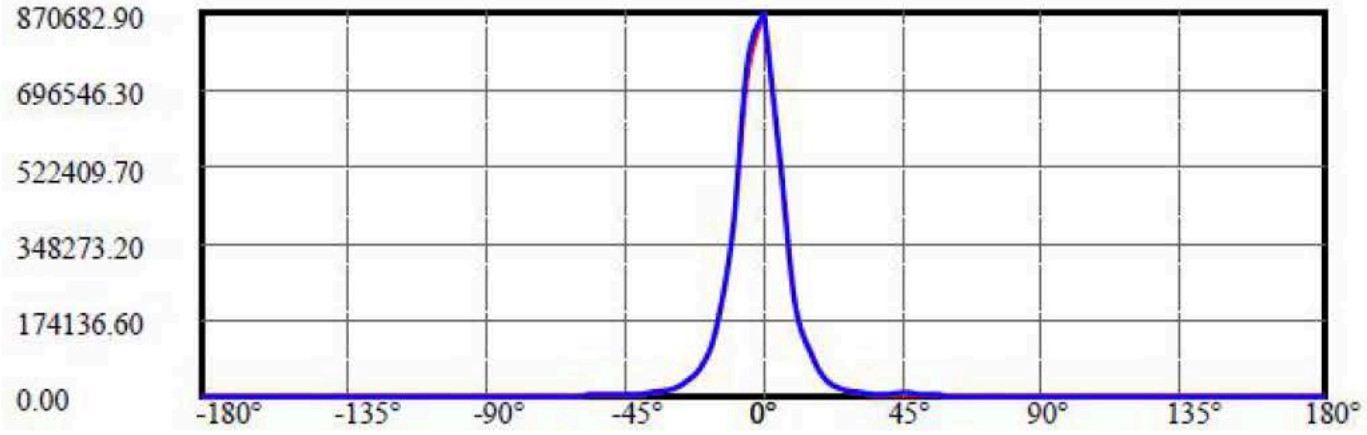
Zonal flux distribution table

γ(°)	Average I(cd)	Zonal F(lm)	Sum F(lm)	Eff Flux(%)	Eff Sum(%)
0.0	870682.900	.000	.000	.000%	.000%
5.0	634460.100	17993.550	17993.550	15.126%	15.126%
10.0	294868.400	33245.000	51238.560	27.946%	43.072%
15.0	125656.600	24945.260	76183.820	20.969%	64.042%
20.0	54595.380	14855.290	91039.110	12.488%	76.529%
25.0	25194.230	8368.457	99407.560	7.035%	83.564%
30.0	12793.380	4807.364	104214.900	4.041%	87.605%
35.0	8038.834	3067.689	107282.600	2.579%	90.184%
40.0	5584.770	2272.996	109555.600	1.911%	92.094%
45.0	4784.008	1919.864	111475.500	1.614%	93.708%
50.0	3604.390	1694.999	113170.500	1.425%	95.133%
55.0	2962.874	1427.942	114598.400	1.200%	96.334%
60.0	2405.088	1240.789	115839.200	1.043%	97.377%
65.0	1847.302	1033.764	116873.000	.869%	98.246%
70.0	1314.700	800.640	117673.600	.673%	98.919%
75.0	848.372	565.392	118239.000	.475%	99.394%
80.0	461.457	350.474	118589.500	.295%	99.689%
85.0	171.375	171.955	118761.400	.145%	99.833%
90.0	25.011	53.772	118815.200	.045%	99.878%
95.0	3.408	7.781	118823.000	.007%	99.885%
100.0	3.260	1.812	118824.800	.002%	99.886%
105.0	3.531	1.817	118826.600	.002%	99.888%
110.0	3.875	1.936	118828.600	.002%	99.890%
115.0	4.589	2.143	118830.700	.002%	99.891%
120.0	5.229	2.387	118833.100	.002%	99.893%
125.0	6.373	2.682	118835.800	.002%	99.896%
130.0	8.132	3.154	118838.900	.003%	99.898%
135.0	11.417	3.950	118842.900	.003%	99.902%
140.0	18.171	5.478	118848.400	.005%	99.906%
145.0	32.048	8.379	118856.700	.007%	99.913%
150.0	58.080	13.272	118870.000	.011%	99.924%
155.0	95.640	19.453	118889.500	.016%	99.941%
160.0	128.020	23.458	118912.900	.020%	99.960%
165.0	135.439	21.713	118934.600	.018%	99.979%
170.0	120.381	15.175	118949.800	.013%	99.991%
175.0	100.266	7.893	118957.700	.007%	99.998%
180.0	92.249	2.301	118960.000	.002%	100.000%

Luminous Intensity Distribution Diagram

Light Distribution Curve [Unit:cd]





C0/C180:

C90/C270:

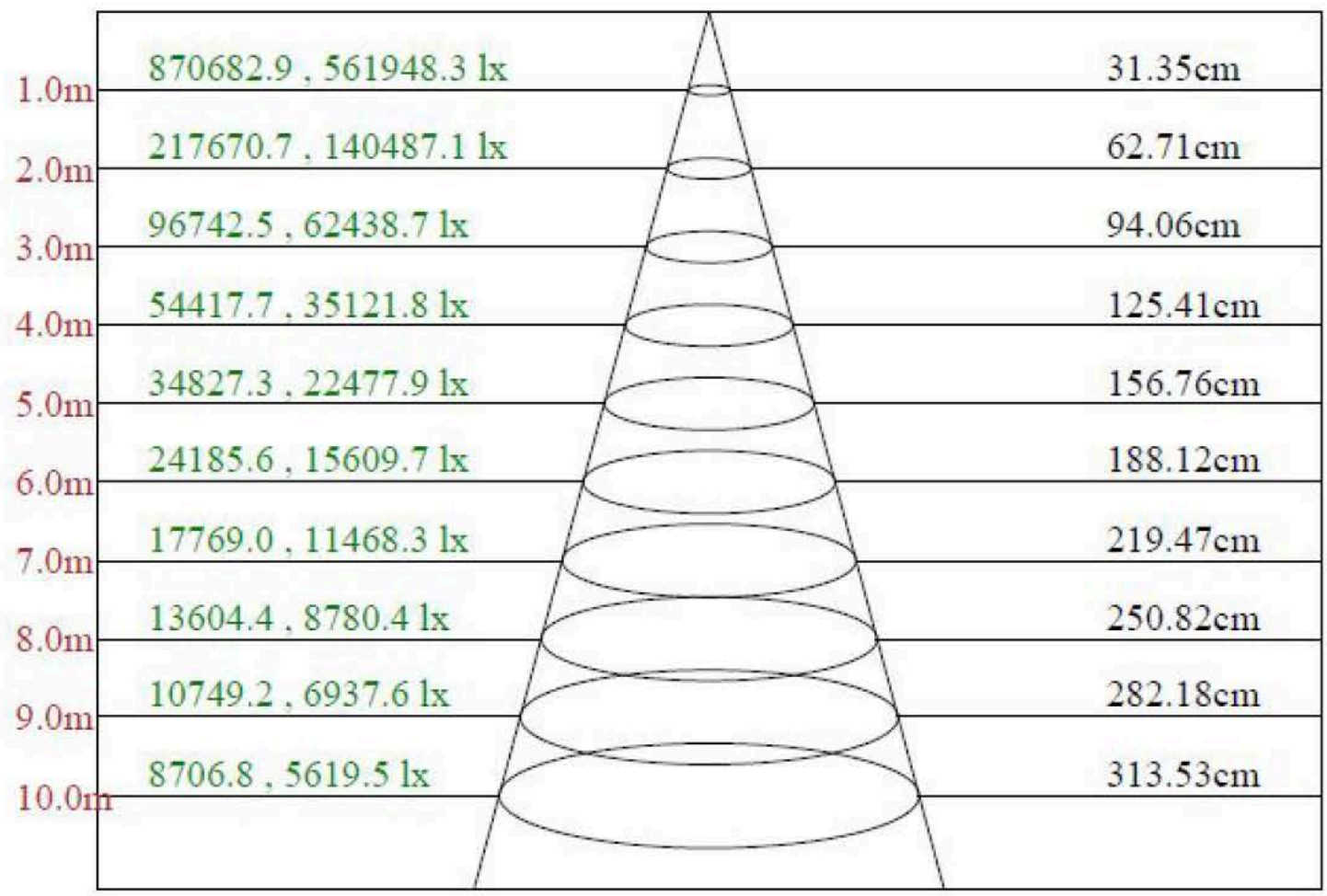
Field angle(10%Imax):C0/180Left:18.9 Right:15.7

:C90/270Left:19.1 Right:15.4

Beam Angle(50%Imax):C0/180Left:9.2 Right:6.3

:C90/270Left:9.2 Right:6.4

Lux distance Curve



Max , Ave Beam angle of C0plane17.81

Luminous Intensity Distribution Data

C/γ(°)	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0
0.0	870682.90	515014.50	209255.60	94851.72	39002.45	18288.88	10013.69	6763.85	5094.64
22.5	870682.90	521903.90	213507.40	94320.26	38384.37	19178.60	10417.21	6685.11	5175.34
45.0	870682.90	519935.50	217975.70	93493.52	39026.07	20849.78	11045.14	6990.21	5322.97
67.5	870682.90	516982.90	213664.90	91938.48	39220.94	20052.58	10631.77	6718.57	5169.44
90.0	870682.90	522297.60	211027.20	91328.27	38693.41	18885.31	10267.61	6620.15	5065.11
112.5	870682.90	520132.40	207149.50	91584.16	38990.64	19408.91	10310.92	6620.15	5084.79
135.0	870682.90	515605.00	212621.60	91210.16	39191.42	20086.04	10814.83	6801.25	5177.31
157.5	870682.90	525250.30	206027.50	90737.75	39161.89	19251.43	10084.55	6539.45	5057.24
180.0	870682.90	726027.90	377422.80	153811.50	68258.52	30051.70	14580.00	8710.60	5968.61
202.5	870682.90	730555.30	374667.00	157157.80	68750.62	30169.80	14894.95	9663.31	6033.57
225.0	870682.90	735476.30	371911.20	160110.40	69813.56	31350.85	15820.10	9737.72	6198.91
247.5	870682.90	746302.60	373289.10	160897.80	70502.51	30839.06	15190.21	9659.38	5994.20
270.0	870682.90	755947.80	376635.40	158338.80	71565.45	30366.65	14363.48	8807.06	5956.80
292.5	870682.90	765592.90	382146.90	159323.00	71781.97	31134.32	14894.95	8584.63	5939.08
315.0	870682.90	763624.60	390414.30	160700.90	70561.55	31882.32	15898.84	9875.51	6165.45
337.5	870682.90	770710.80	380178.50	160700.90	70620.61	31311.48	15465.79	9844.41	5952.86
360.0	870682.90	515014.50	209255.60	94851.72	39002.45	18288.88	10013.69	6763.85	5094.64

C/γ(°)	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0
0.0	3907.29	3357.52	2827.62	2248.12	1639.49	1119.43	698.00	343.68	97.83
22.5	4427.35	3408.69	2801.64	2222.14	1671.97	1156.83	707.05	342.90	101.37
45.0	4321.05	3500.03	2850.65	2244.18	1709.17	1177.31	720.24	348.21	98.81
67.5	4285.62	3426.21	2810.89	2234.54	1692.24	1161.36	697.41	336.99	92.52
90.0	8391.72	3411.25	2843.56	2229.62	1620.20	1093.65	671.23	322.23	85.23
112.5	4411.60	3406.14	2794.16	2203.24	1662.13	1134.39	683.24	324.79	86.02
135.0	4299.40	3431.33	2797.90	2199.70	1669.01	1147.78	696.82	333.65	91.53
157.5	3884.66	3321.89	2756.36	2179.23	1659.96	1142.27	689.34	325.77	88.78
180.0	4787.56	3803.36	3145.91	2624.28	2019.98	1433.40	974.76	555.09	232.08
202.5	4876.14	3813.20	3118.35	2588.85	2029.82	1490.48	990.50	578.71	241.52
225.0	4996.22	3888.00	3163.63	2610.50	2057.38	1506.23	1006.25	601.15	253.53
247.5	4824.96	3783.68	3090.80	2559.33	2012.11	1496.39	1008.22	585.21	254.91
270.0	4752.13	3738.40	3118.35	2616.41	2027.86	1466.86	976.73	584.62	246.64
292.5	4761.98	3748.24	3065.21	2563.26	2019.98	1492.45	1006.25	590.92	253.73
315.0	4864.33	3842.73	3132.13	2604.60	2043.60	1510.16	1027.90	609.81	260.81
337.5	4752.13	3789.58	3088.83	2553.42	2021.95	1506.23	1020.03	599.58	256.68
360.0	3907.29	3357.52	2827.62	2248.12	1639.49	1119.43	698.00	343.68	97.83

C/γ(°)	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0
0.0	4.13	3.94	3.74	3.94	4.33	5.12	5.91	7.28	9.25
22.5	3.54	3.15	3.35	3.74	4.33	4.92	5.91	7.28	9.25
45.0	3.74	3.74	3.15	3.74	4.13	4.72	5.51	6.89	8.86
67.5	3.74	3.35	3.35	3.74	4.13	5.12	5.71	6.89	9.06
90.0	3.54	3.54	3.54	3.74	3.94	4.72	5.51	6.89	8.86
112.5	3.54	3.35	3.35	3.54	4.13	5.12	5.51	6.69	9.06
135.0	3.54	3.54	3.35	3.74	4.13	4.92	5.71	6.89	9.06
157.5	3.54	3.15	3.15	3.74	4.33	4.72	5.51	6.89	9.06
180.0	37.20	3.54	3.54	3.54	3.94	4.13	4.72	5.91	7.09
202.5	40.75	3.35	3.15	3.15	3.35	3.94	4.92	5.71	7.09
225.0	43.90	3.15	2.95	3.35	3.54	4.13	4.72	5.91	7.68
247.5	47.24	3.74	3.15	3.54	3.35	4.33	4.53	5.71	7.28
270.0	49.01	3.35	2.95	3.35	3.54	4.53	4.92	5.91	6.89
292.5	52.56	3.35	3.15	3.15	3.54	4.33	4.72	5.71	7.09
315.0	49.60	3.15	3.15	3.15	3.54	4.13	4.72	5.51	7.09
337.5	50.59	3.15	3.15	3.35	3.74	4.53	5.12	5.91	7.48
360.0	4.13	3.94	3.74	3.94	4.33	5.12	5.91	7.28	9.25

C/γ(°)	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	175.0
0.0	13.58	22.05	40.16	70.08	105.31	123.22	117.71	102.75	93.30
22.5	13.78	22.64	40.35	70.47	107.48	128.93	125.39	108.07	94.48
45.0	13.39	22.64	40.16	72.04	112.40	139.17	138.38	117.12	97.44
67.5	13.39	22.24	40.75	73.82	116.33	146.84	149.40	125.59	101.37
90.0	13.39	22.24	41.14	75.39	116.14	149.60	154.13	130.31	102.95
112.5	13.19	22.24	40.94	72.44	115.94	148.02	151.17	129.13	102.16
135.0	13.39	21.85	39.76	70.86	111.81	139.95	138.97	119.29	97.63
157.5	12.99	21.65	38.58	68.89	106.49	127.95	123.42	106.49	93.30
180.0	9.45	14.17	23.82	44.09	77.16	110.03	117.91	106.29	93.30
202.5	9.25	13.98	23.82	44.09	77.56	112.79	123.22	112.20	96.06
225.0	9.25	14.37	23.62	44.29	80.51	118.70	135.23	125.39	103.93
247.5	9.65	13.98	24.02	44.88	81.69	123.62	143.50	135.43	109.84
270.0	9.45	14.17	23.62	44.68	82.08	124.40	145.27	137.20	110.43
292.5	9.45	13.98	24.02	44.09	81.49	123.22	143.50	133.66	107.28
315.0	9.45	14.17	23.82	44.49	79.72	118.11	135.03	124.21	103.34
337.5	9.65	14.37	24.21	44.68	78.15	113.77	124.80	112.99	97.44
360.0	13.58	22.05	40.16	70.08	105.31	123.22	117.71	102.75	93.30

C/γ(°)	180.0
0.0	92.25
22.5	92.25
45.0	92.25
67.5	92.25
90.0	92.25
112.5	92.25
135.0	92.25
157.5	92.25
180.0	92.25
202.5	92.25
225.0	92.25
247.5	92.25
270.0	92.25
292.5	92.25
315.0	92.25
337.5	92.25
360.0	92.25

5 Performance Assessment

Model name	CCT(K)	Total Luminous(lm)	Power(W)	Luminous Efficacy(lm/W)
84091	3000K	119424.07	1006.10	118.7
841XX-1000-35K	3500K	121602.43 *1	1006.20 *2	120.9 *3
841XX-1000-40K	4000K	123780.78 *1	1006.20 *2	123.0 *3
841XX-1000-45K	4500K	125959.14 *1	1006.20 *2	125.2 *3
84112	5000K	128137.49 *1	1006.20 *2	127.3 *3
841XX-1000-57K	5700K	130315.85	1006.30	129.5

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

121602.43=(130315.85-119424.07) /5+119424.07

123780.78=(130315.85-119424.07) /5+121602.43

125959.14=(130315.85-119424.07) /5+123780.78

128137.49=(130315.85-119424.07) /5+125959.14

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

1006.20 =(1006.10+1006.30)/2

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

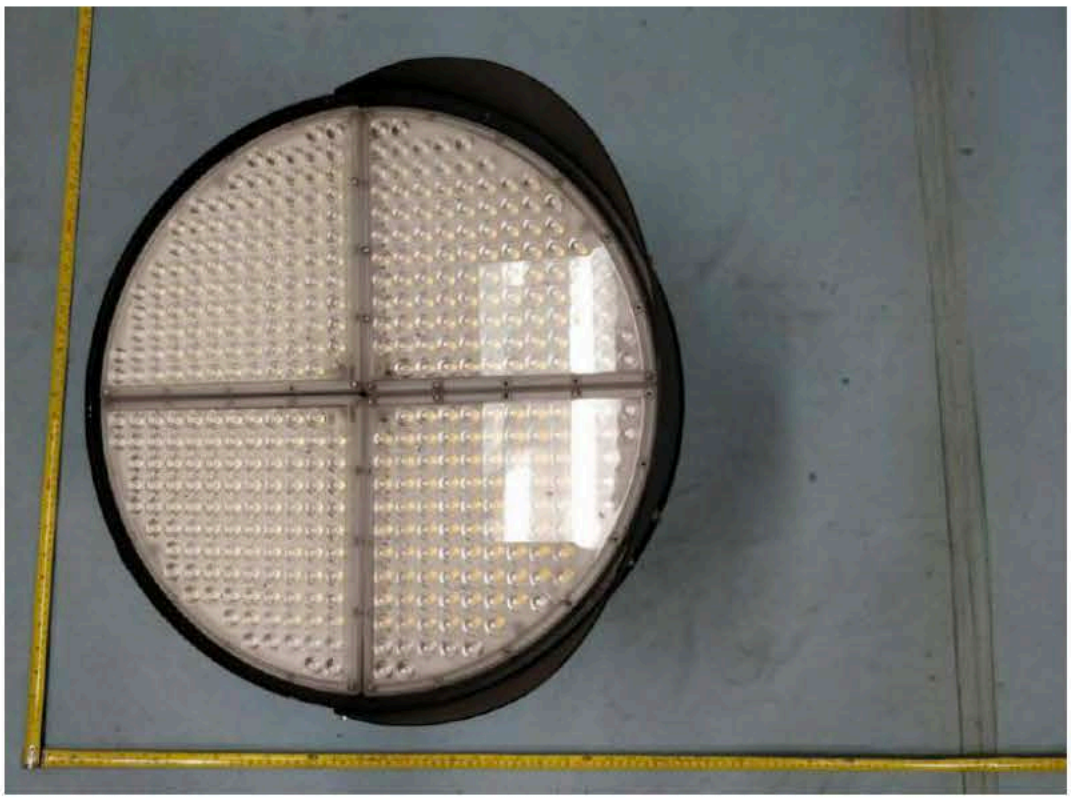
120.9 =121602.43 /1006.20

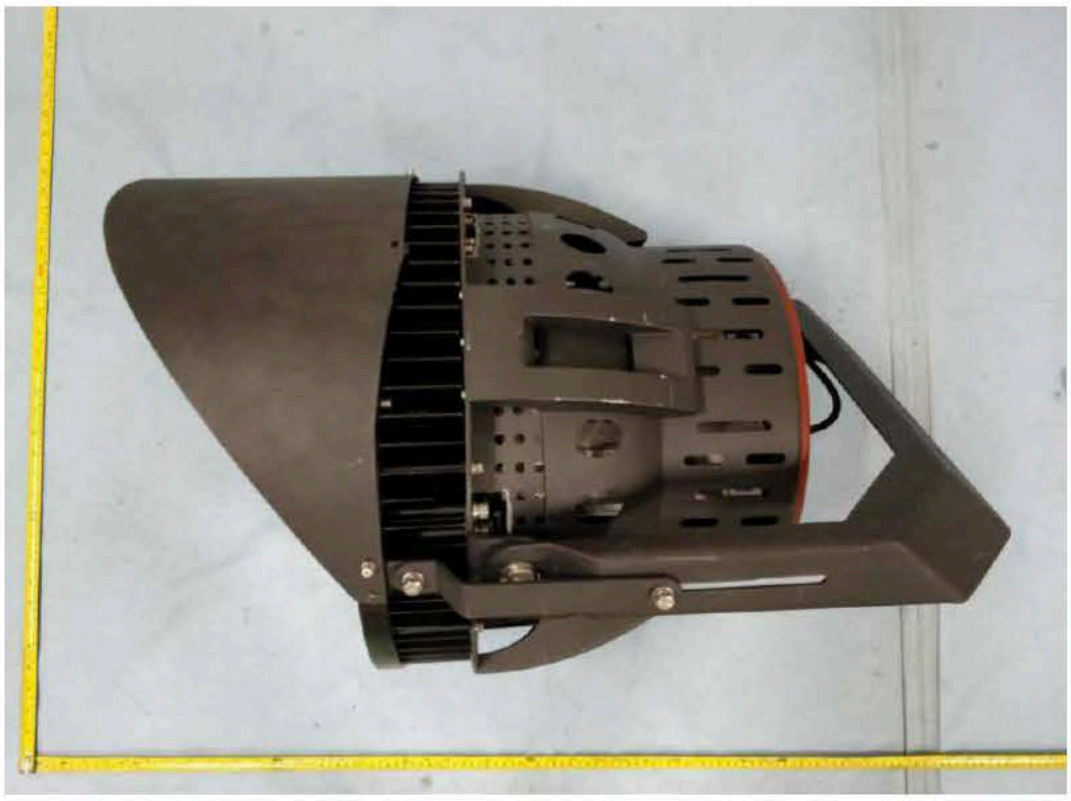
123.0=123780.78 /1006.20

125.2=125959.14 /1006.20

127.3=128137.49 /1006.20

Photo Document





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