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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:

Architectural Flood and Spot Luminaires

Model No.:

84086, 841XX - 300 - 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

Jasonzhou

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	84086, 841XX-300-57K
Rated Inputs	AC 200-480V 50/60Hz
Rated Power	300 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
84086	277.05	60	1.123	306.90	0.986
841XX-300-57K	277.05	60	1.136	309.00	0.982

3.1.2 Photometric data

Model Number	Luminous Flux (lm)	Efficacy (lm/W)	CCT (K)	CRI	R9
84086	38853.54	126.6	3040	81.8	8
841XX-300-57K	41251.50	133.5	5608	86.2	29

3.1.3 Chromaticity Coordinate

Model Number	Duv	x	y	u'	v'
84086	0.00009	0.4342	0.4034	0.2491	0.5207
841XX-300-57K	0.00426	0.3300	0.3473	0.2028	0.4803

3.2 Goniophotometer System

3.2.1 Electrical data

Model Number	Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
84086	277.22	60	1.1128	304.54	0.9872

3.2.2 Photometric data

Luminous Flux (lm)	Efficacy (lm/W)	Zonal Lumen in 0-90°(%lm)
38411.98	126.13	99.884

3.3 Additional Test

Model Number	Test Item	Test Voltage (V)	Frequency(Hz)	Test Result
84086	Power Factor	480	60	0.921
	THD	480	60	14.7%

4 Test Data

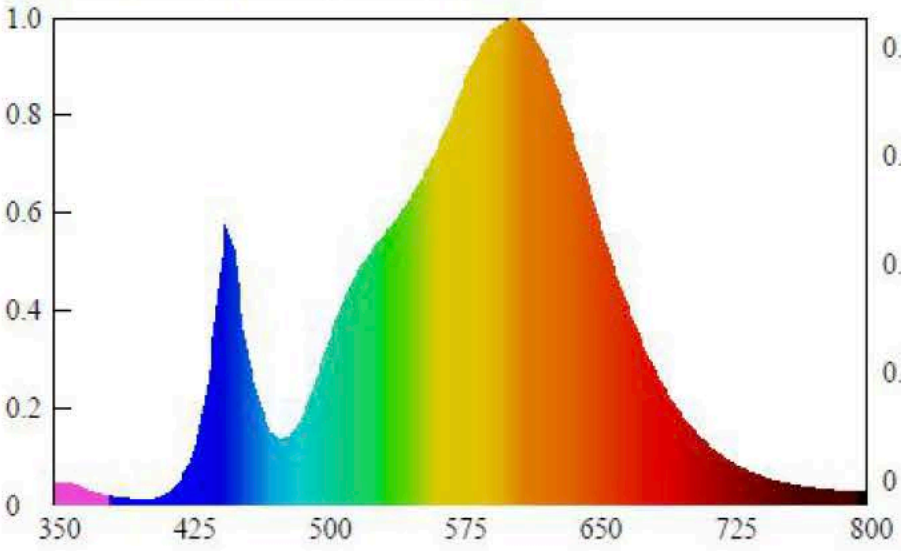
84086

Test Condition

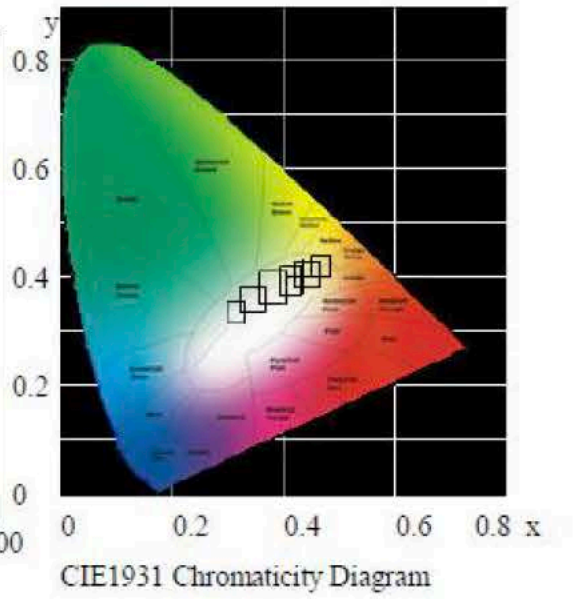
Temperature: 25°C RH: 58%

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

Spectroradiometric Parameters



Spectral Distribution



CIE1931 Chromaticity Diagram

Chromaticity Coordinates: x=0.4342 y=0.4034 u'=0.2491 v'=0.5207

Correlated Color Temperature: 3040 K Dominant Wavelength: 581.0 nm(E)

Colour Fidelity Index: Rf=80 Gamut Index: Rg=98

Luminous Flux: 38853.54 lm Purity: 0.5162

Chromaticity Difference: +0.00009Duv Peak Wavelength: 605.0 nm

Color Ratio: Kr=44.2% Kg=48.9% Kb=6.9%

Bandwidth: 133.6nm Radiant Flux: 109.05 W

Photosynthetically Active Radiation(PAR): 103.77W Photosynthetic Photon Flux(PPF):503.68μmol/s

Rendering Index: Ra=81.8

R1=80	R2=88	R3=95	R4=81	R5=80	R6=85	R7=84	R8=61
R9=8	R10=73	R11=81	R12=68	R13=82	R14=97	R15=73	Re=76

Electric Parameters

Voltage: 277.05 V Current: 1.123 A

Power Factor: 0.986 Power: 306.90 W

Luminous Efficacy: 126.6 lm/W

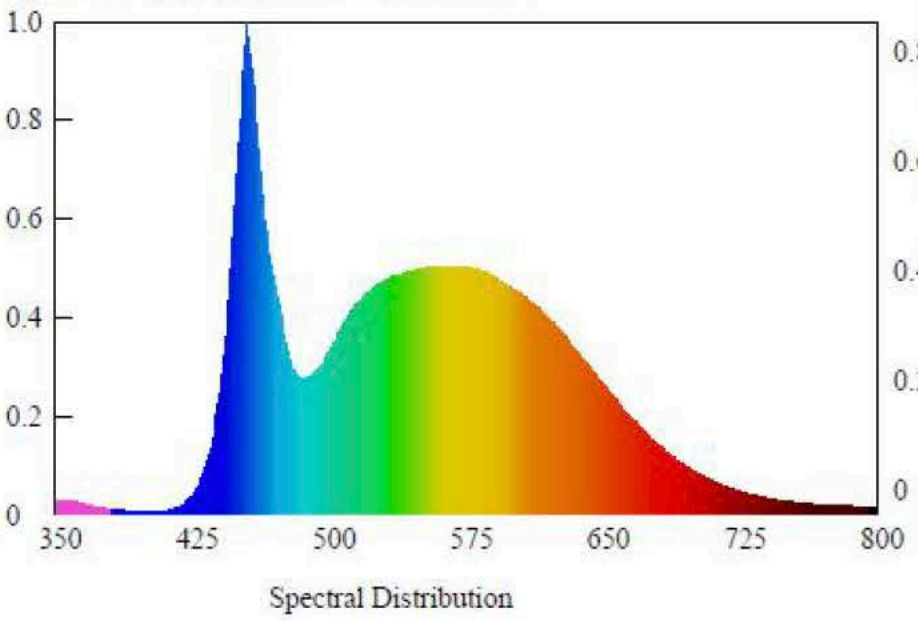
841XX-300-57K

Test Condition

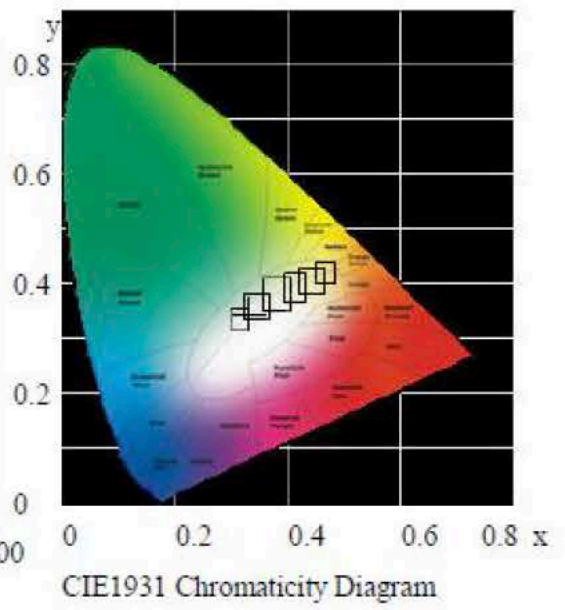
Temperature: 25°C RH: 58%

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

Spectroradiometric Parameters



Spectral Distribution



CIE1931 Chromaticity Diagram

Chromaticity Coordinates: x=0.3300 y=0.3473 u'=0.2028 v'=0.4803

Correlated Color Temperature: 5608 K Dominant Wavelength: 540.0 nm(E)

Colour Fidelity Index: Rf=82 Gamut Index: Rg=93

Luminous Flux: 41251.50 lm Purity: 0.0333

Chromaticity Difference: +0.00426Duv Peak Wavelength: 455.0 nm

Color Ratio: Kr=31.9% Kg=55.6% Kb=12.6%

Bandwidth: 19.7nm Radiant Flux: 127.652 W

Photosynthetically Active Radiation(PAR): 122.69W Photosynthetic Photon Flux(PPF):565.00μmol/s

Rendering Index: Ra=86.2

R1=85	R2=92	R3=95	R4=83	R5=84	R6=87	R7=89	R8=74
R9=29	R10=80	R11=82	R12=59	R13=88	R14=97	R15=82	Re=80

Electric Parameters

Voltage: 277.05 V Current: 1.136 A

Power Factor: 0.982 Power: 309.00 W

Luminous Efficacy: 133.5 lm/W

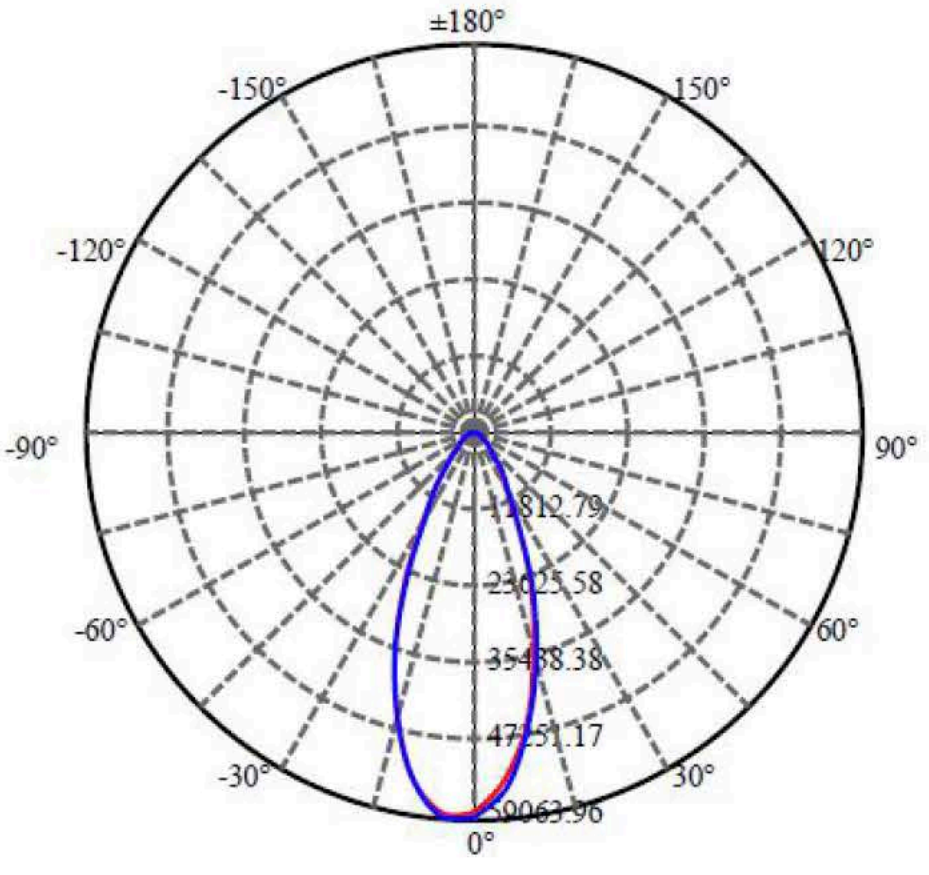
Zonal Flux Diagram

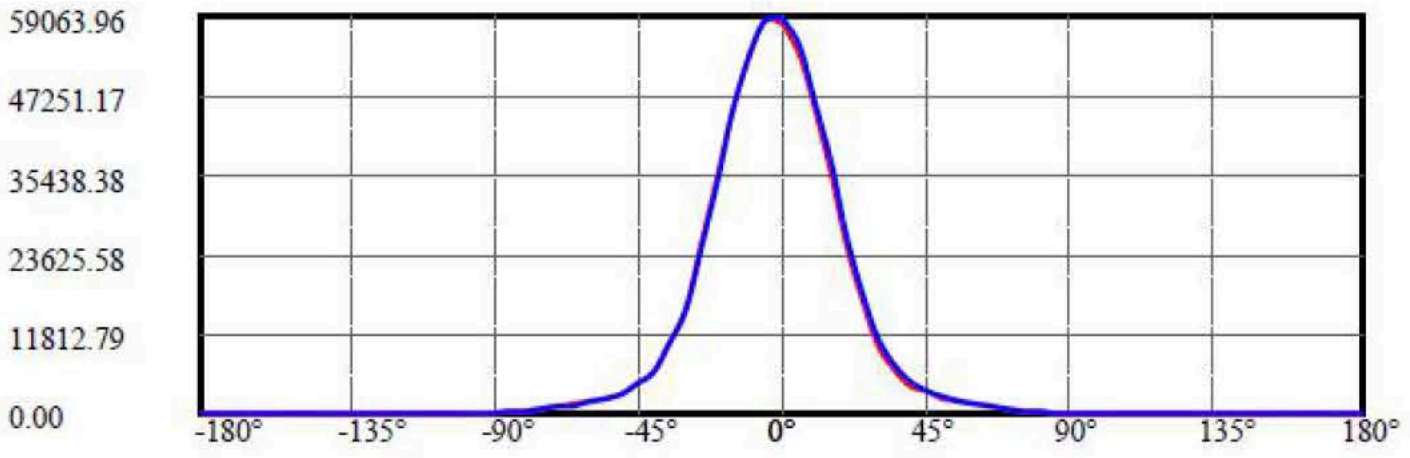
Zonal flux distribution table

γ(°)	Average I(cd)	Zonal F(lm)	Sum F(lm)	Eff Flux(%)	Eff Sum(%)
0.0	58620.250	.000	.000	.000%	.000%
5.0	56285.580	1373.667	1373.667	3.576%	3.576%
10.0	49973.230	3801.212	5174.878	9.896%	13.472%
15.0	40767.200	5382.660	10557.540	14.013%	27.485%
20.0	30395.590	5864.813	16422.350	15.268%	42.753%
25.0	20535.280	5341.708	21764.060	13.906%	56.660%
30.0	13014.740	4245.783	26009.840	11.053%	67.713%
35.0	8434.080	3158.489	29168.330	8.223%	75.936%
40.0	5377.917	2304.427	31472.760	5.999%	81.935%
45.0	3743.424	1688.890	33161.650	4.397%	86.332%
50.0	2724.468	1306.932	34468.580	3.402%	89.734%
55.0	2047.374	1037.557	35506.140	2.701%	92.435%
60.0	1534.685	827.983	36334.130	2.156%	94.591%
65.0	1164.974	656.292	36990.420	1.709%	96.299%
70.0	888.846	520.041	37510.460	1.354%	97.653%
75.0	620.039	394.398	37904.860	1.027%	98.680%
80.0	391.309	270.609	38175.460	.704%	99.384%
85.0	155.675	148.629	38324.090	.387%	99.771%
90.0	2.858	43.408	38367.500	.113%	99.884%
95.0	1.605	1.222	38368.720	.003%	99.887%
100.0	1.592	.869	38369.590	.002%	99.890%
105.0	1.775	.901	38370.490	.002%	99.892%
110.0	1.984	.982	38371.470	.003%	99.895%
115.0	2.388	1.107	38372.580	.003%	99.897%
120.0	3.080	1.329	38373.910	.003%	99.901%
125.0	3.889	1.611	38375.520	.004%	99.905%
130.0	5.233	1.983	38377.500	.005%	99.910%
135.0	7.164	2.505	38380.000	.007%	99.917%
140.0	9.775	3.136	38383.140	.008%	99.925%
145.0	13.207	3.834	38386.980	.010%	99.935%
150.0	17.226	4.481	38391.460	.012%	99.947%
155.0	21.507	4.902	38396.360	.013%	99.959%
160.0	25.304	4.910	38401.270	.013%	99.972%
165.0	27.966	4.390	38405.660	.011%	99.984%
170.0	29.454	3.406	38409.070	.009%	99.992%
175.0	30.694	2.152	38411.220	.006%	99.998%
180.0	31.921	.749	38411.970	.002%	100.000%

Luminous Intensity Distribution Diagram

Light Distribution Curve [Unit:cd]





C0/C180:

C90/C270:

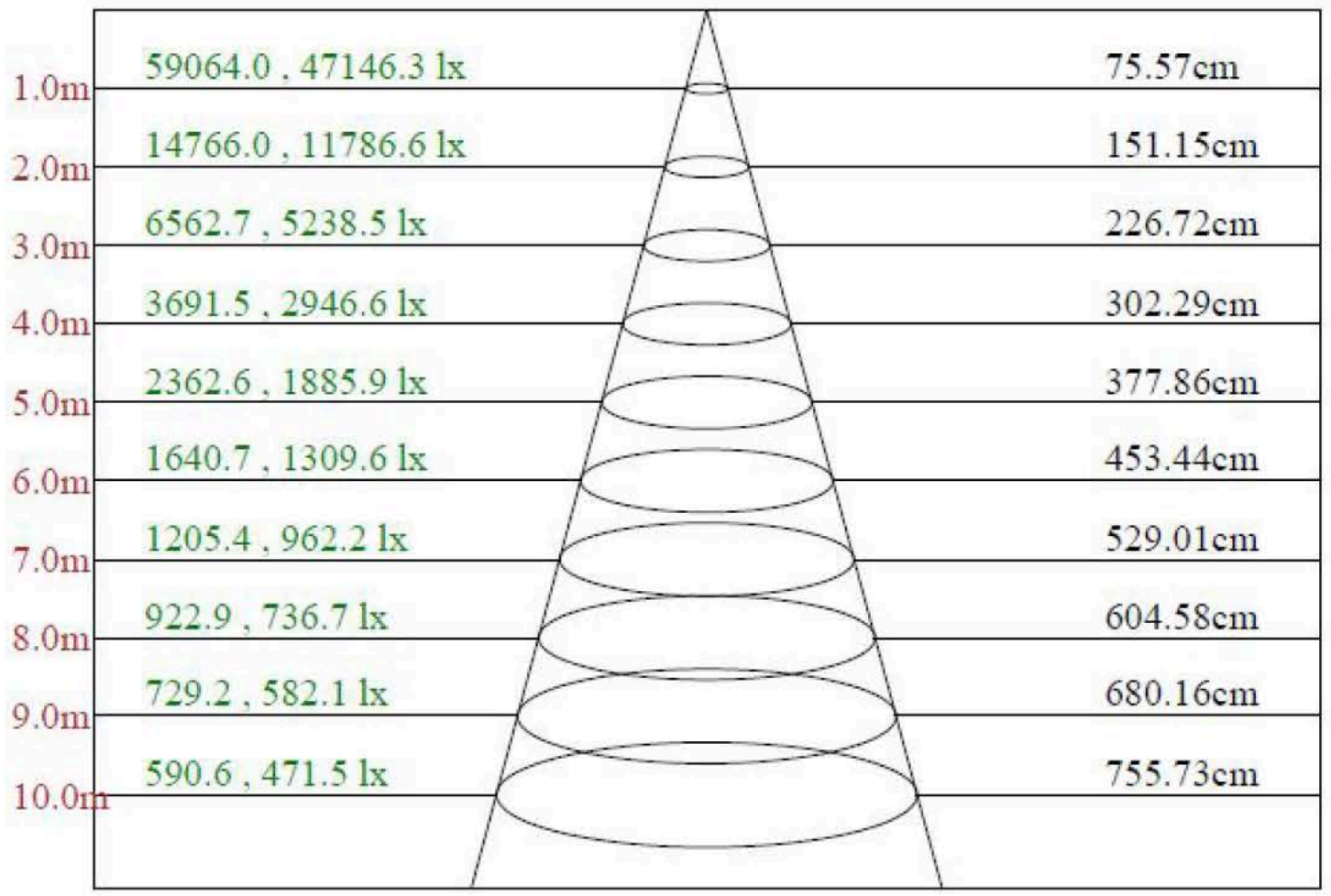
Field angle(10%Imax):C0/180Left:36.4 Right:41.3

:C90/270Left:40.9 Right:37.5

Beam Angle(50%Imax):C0/180Left:18.0 Right:22.9

:C90/270Left:22.5 Right:18.6

Lux distance Curve



Max , Ave Beam angle of C157.5plane41.39

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	58082.59	53321.89	45575.32	35141.88	24827.03	16030.19	10008.32	6416.92	4142.22
22.5	58312.27	53572.46	45763.24	35041.65	24801.98	16069.86	10050.08	6531.76	4164.15
45.0	58416.67	53447.17	45679.72	35586.63	25060.89	16307.89	10352.85	6611.10	4159.14
67.5	58479.32	54073.58	46013.80	35966.64	25808.40	16896.71	10578.35	6719.68	4878.04
90.0	58750.75	54491.19	46514.93	36939.67	26388.88	17351.90	10866.50	6963.98	4804.96
112.5	58855.16	54908.79	47287.50	37499.25	27180.24	17928.20	11240.26	7068.38	4790.35
135.0	59001.32	55409.91	47851.27	38438.87	27733.57	18270.63	11438.62	7277.19	4823.76
157.5	59063.96	55785.77	48665.60	39008.90	28228.43	18558.78	11747.65	7354.44	4863.43
180.0	58082.59	58166.11	53572.46	45303.88	35511.04	24778.59	15883.61	10412.98	6385.60
202.5	58312.27	58416.67	54073.58	45867.64	35678.08	25154.44	16092.41	10392.10	6469.12
225.0	58416.67	58562.84	54219.75	46076.45	35845.13	24903.87	16113.29	10371.22	6406.48
247.5	58479.32	58500.20	53864.78	45575.32	35552.80	24653.31	15653.92	10559.14	6341.75
270.0	58750.75	58354.03	53593.34	45115.96	34717.59	24152.18	15257.20	10454.74	6220.64
292.5	58855.16	58145.23	52841.65	44426.91	33903.26	23108.17	14797.83	9939.42	5984.70
315.0	59001.32	57832.03	52403.16	43466.41	32880.13	22565.29	14171.43	9056.18	5861.50
337.5	59063.96	57581.46	51651.47	42819.13	32211.96	21834.48	13983.50	8816.06	5750.84
360.0	58082.59	53321.89	45575.32	35141.88	24827.03	16030.19	10008.32	6416.92	4142.22

C/γ(°)	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0
0.0	3169.83	2370.95	1763.34	1353.46	1040.25	774.03	522.22	324.27	47.82
22.5	3184.87	2379.51	1789.86	1357.22	1036.70	771.73	533.28	322.39	51.16
45.0	3237.27	2410.42	1807.60	1363.90	1052.57	782.38	531.82	332.21	63.06
67.5	3235.81	2392.25	1809.90	1387.91	1060.09	797.63	542.68	322.18	66.19
90.0	3292.19	2419.81	1835.58	1382.90	1063.01	791.36	541.63	330.53	78.09
112.5	3321.21	2428.16	1849.57	1404.41	1065.73	794.08	545.60	330.95	72.04
135.0	3355.25	2456.35	1893.42	1427.58	1085.15	807.23	554.37	337.43	74.96
157.5	3427.70	2511.69	1918.90	1435.73	1095.38	811.62	550.20	350.58	80.60
180.0	4299.66	3051.02	2313.95	1731.39	1303.35	1036.08	727.26	464.59	268.52
202.5	4358.13	3096.96	2301.42	1731.39	1294.99	1031.90	718.70	461.87	246.81
225.0	4341.42	3122.02	2318.13	1710.51	1286.64	997.87	694.27	453.94	243.88
247.5	4310.10	3069.81	2299.33	1691.72	1276.20	1033.99	703.04	447.67	220.29
270.0	4245.37	3044.76	2253.40	1668.75	1246.97	940.86	686.33	443.08	245.55
292.5	4107.56	2990.47	2217.90	1639.52	1244.88	940.86	682.99	445.79	231.14
315.0	4036.57	2927.83	2205.37	1641.61	1244.88	956.73	691.35	442.24	233.02
337.5	3971.84	2919.48	2180.32	1626.99	1242.79	953.18	694.90	451.22	267.69
360.0	3169.83	2370.95	1763.34	1353.46	1040.25	774.03	522.22	324.27	47.82

C/γ(°)	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0
0.0	1.67	1.46	1.25	1.67	1.46	2.30	2.92	4.18	5.85
22.5	1.88	1.88	1.88	2.09	2.09	2.71	3.55	4.39	6.26
45.0	2.09	1.67	1.88	2.09	2.30	2.51	3.55	4.39	6.26
67.5	1.88	1.67	1.88	2.09	2.30	2.71	3.55	4.39	6.06
90.0	2.09	1.67	1.46	1.88	2.30	2.71	3.34	4.59	5.85
112.5	2.09	1.67	1.67	1.88	2.51	2.92	3.34	4.18	5.64
135.0	1.88	1.67	1.88	1.88	2.09	2.51	3.34	4.39	5.85
157.5	2.09	1.67	1.67	2.09	2.30	2.51	3.76	4.39	5.64
180.0	5.43	1.25	1.25	1.46	1.67	1.88	2.51	3.13	4.39
202.5	3.97	1.67	1.46	1.46	1.67	2.09	2.71	3.34	4.59
225.0	3.76	1.67	1.46	1.67	1.88	2.09	2.71	3.34	4.39
247.5	3.55	1.46	1.67	1.67	1.67	2.30	2.71	3.34	4.39
270.0	3.76	1.46	1.46	1.67	1.88	2.09	2.92	3.55	4.59
292.5	3.34	1.67	1.46	1.67	1.88	2.30	2.71	3.34	4.59
315.0	3.34	1.46	1.67	1.67	1.88	2.30	2.71	3.55	4.59
337.5	2.92	1.67	1.46	1.46	1.88	2.30	2.92	3.76	4.80
360.0	1.67	1.46	1.25	1.67	1.46	2.30	2.92	4.18	5.85

C/γ(°)	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	175.0
0.0	7.93	11.48	14.83	19.63	24.01	27.98	30.28	31.32	31.74
22.5	8.35	11.69	15.24	19.63	24.22	27.98	30.28	31.53	32.36
45.0	8.35	11.69	15.24	19.42	23.80	27.35	29.44	30.69	31.74
67.5	8.56	11.28	15.24	19.21	23.39	26.73	28.82	29.86	31.74
90.0	8.14	11.07	15.03	19.00	22.97	26.52	28.40	29.65	31.11
112.5	8.14	10.86	14.83	18.79	22.76	26.10	28.40	29.65	31.53
135.0	7.93	10.86	14.41	18.58	22.76	26.10	29.02	29.86	31.32
157.5	7.73	10.65	13.99	18.17	22.34	25.89	28.61	29.86	31.53
180.0	5.85	7.73	10.86	14.62	19.00	23.18	26.52	28.40	29.65
202.5	6.06	7.73	11.07	14.83	19.00	23.18	26.10	28.61	29.65
225.0	6.06	8.14	11.07	15.03	19.21	23.18	26.52	28.40	29.44
247.5	6.26	8.35	11.28	15.03	19.63	23.60	26.10	28.19	29.23
270.0	6.26	8.35	11.69	15.45	19.63	23.80	26.52	27.98	29.44
292.5	6.26	8.56	11.90	15.87	20.05	23.80	26.73	28.40	29.65
315.0	6.26	8.98	12.11	15.87	20.46	24.22	27.35	29.02	30.07
337.5	6.47	8.98	12.53	16.50	20.88	25.27	28.40	29.86	30.90
360.0	7.93	11.48	14.83	19.63	24.01	27.98	30.28	31.32	31.74

C/γ(°)	180.0
0.0	31.74
22.5	32.16
45.0	31.74
67.5	31.74
90.0	31.74
112.5	32.16
135.0	31.95
157.5	32.16
180.0	31.74
202.5	32.16
225.0	31.74
247.5	31.74
270.0	31.74
292.5	32.16
315.0	31.95
337.5	32.16
360.0	31.74

5 Performance Assessment

Model name	CCT(K)	Total Luminous(lm)	Power(W)	Luminous Efficacy(lm/W)
84086	3000K	38853.54	306.90	126.6
841XX-300-35K	3500K	39333.13 *1	307.95 *2	127.7 *3
841XX-300-40K	4000K	39812.72 *1	307.95 *2	129.3 *3
841XX-300-45K	4500K	40292.32 *1	307.95 *2	130.8 *3
84107	5000K	40771.91 *1	307.95 *2	132.4 *3
841XX-300-57K	5700K	41251.50	309.00	133.5

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

39333.13=(41251.50-38853.54) /5+38853.54

39812.72=(41251.50-38853.54) /5+39333.13

40292.32=(41251.50-38853.54) /5+39812.72

40771.91=(41251.50-38853.54) /5+40292.32

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

307.95 =(306.90+309.00)/2

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

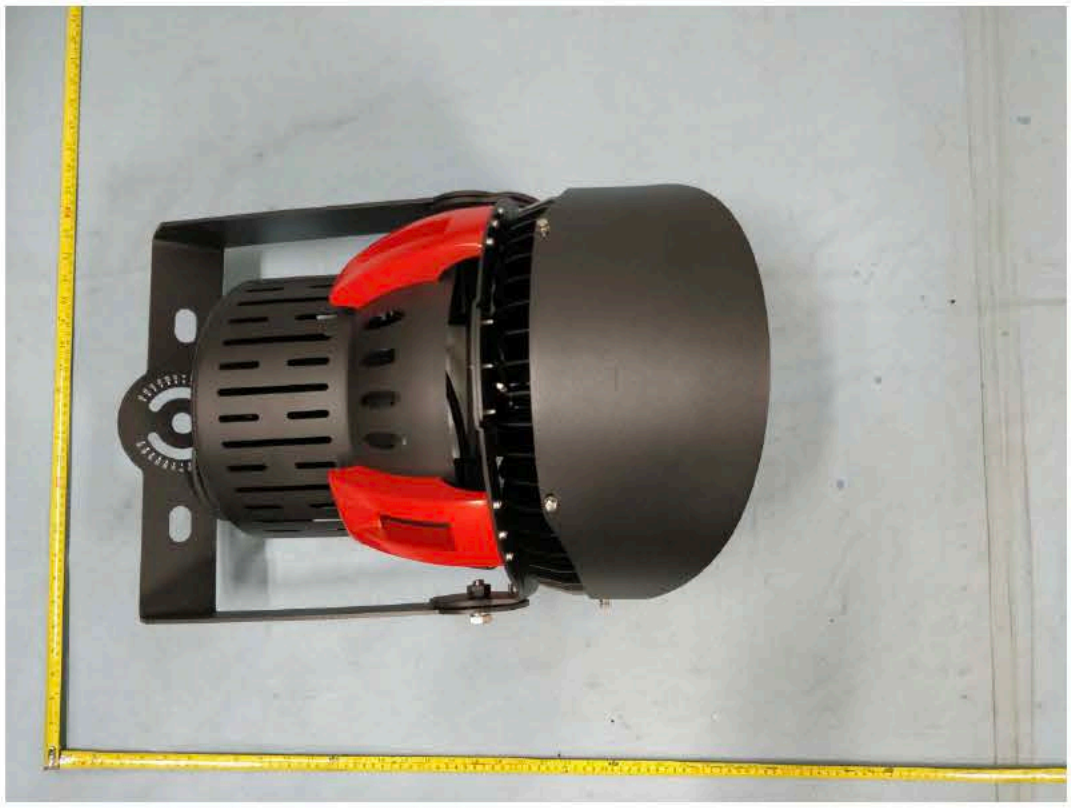
127.7 =39333.13 /307.95

129.3=39812.72 /307.95

130.8=40292.32 /307.95

132.4=40771.91 /307.95

Photo Document



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