



Shenzhen Belling Efficiency Testing Lab



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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:

High Bay Luminaires for Commercial and Industrial Buildings

Model No.:

903XX-500W-30K / 90388 / 903XX-500W-57K

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.

Complied by: Zac Kuang

Review by: Jason Zhou

Project Engineer

Technical Manager

Note: The test data was only valid for the test sample(s). 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 U.S. Government.



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	High Bay Luminaires for Commercial and Industrial Buildings
Model Number	903XX-500W-30K / 90388 / 903XX-500W-57K
Rated Inputs	AC 200-480V 50/60Hz
Rated Power	500 W
Nominal CCT	3000K / 5700K
Date of Receipt Samples	2018-04-19
Date of Test	2018-04-20 to 2018-04-27

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
Goniophotometric 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 $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$, 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
903XX-500W-30K	277.02	60	1.833	504.65	0.994
903XX-500W-57K	277.03	60	1.827	503.22	0.994

3.1.2 Photometric data

Model Number	Luminous Flux (lm)	Efficacy (lm/W)	CCT (K)	CRI	R9
903XX-500W-30K	64393.34	127.6	3027	81.9	9
903XX-500W-57K	66525.68	132.2	5534	84.7	19

3.1.3 Chromaticity Coordinate

Model Number	Duv	x	y	u'	v'
903XX-500W-30K	-0.00123	0.4333	0.3998	0.2501	0.5191
903XX-500W-57K	+0.00195	0.3317	0.3442	0.2052	0.4790

3.2 Goniophotometer System

3.2.1 Electrical data

Model Number	Input Voltage(V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
903XX-500W-30K	277.01	60	2.0073	502.48	0.9936

3.2.2 Photometric data

Luminous Flux (lm)	Efficacy (lm/W)	Zonal Lumen in 20-50°(%lm)
64029.00	127.43	62.587



3.3 Additional Test

Model Number	Test Item	Test Voltage (V)	Frequency(Hz)	Test Result
903XX-500W-30K	Power Factor	480	60	0.944
	THD	480	60	13.2%



4 Test Data

903XX-500W-30K

Test Condition

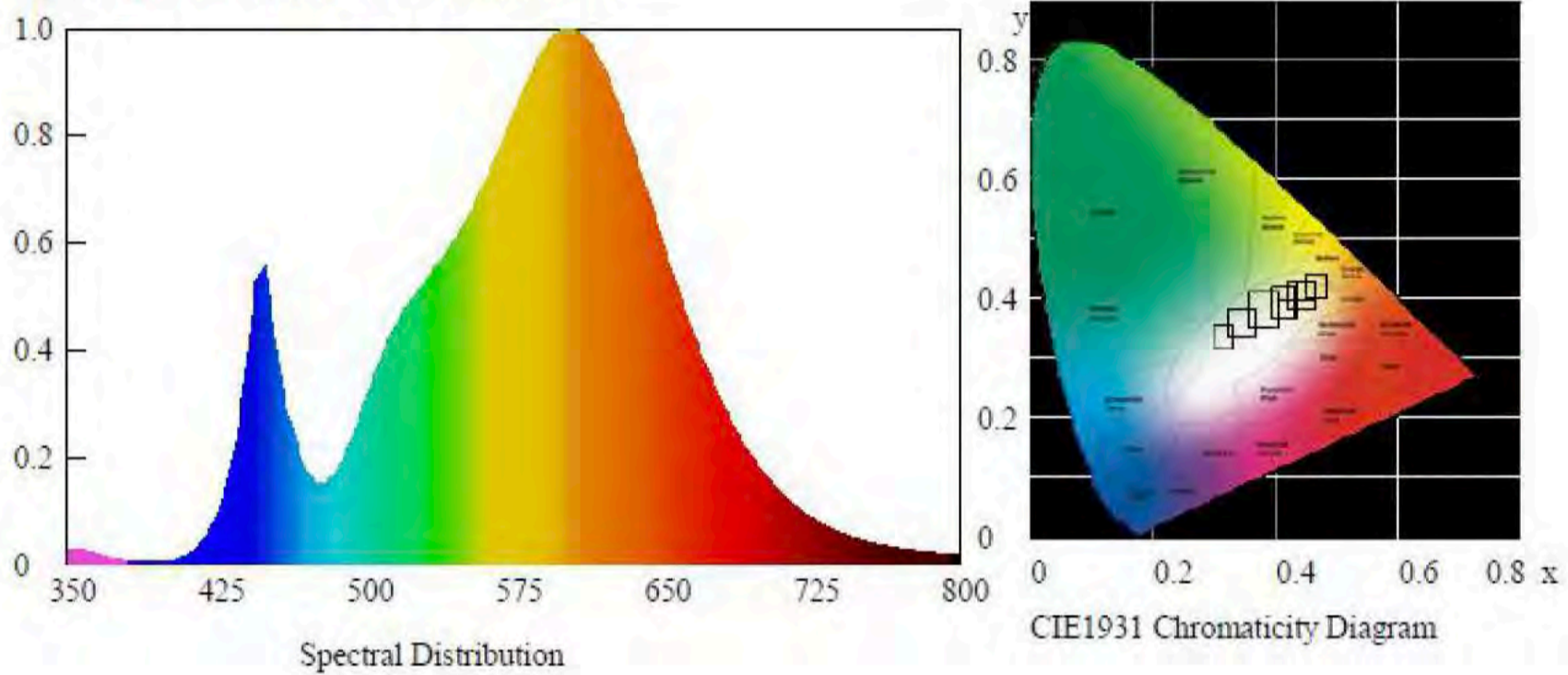
Temperature: 25°C

RH: 58%

Spectrum Range: 350-800 nm

Scan Step: 5 nm

Spectroradiometric Parameters

Chromaticity Coordinates: $x=0.4333$ $y=0.3998$ $u'=0.2501$ $v'=0.5191$

Correlated Color Temperature: 3027 K

Dominant Wavelength: 582.0 nm(E)

Colour Fidelity Index: $R_f=80$ Gamut Index: $R_g=98$

Luminous Flux: 64393.34 lm

Purity: 0.5012

Chromaticity Difference: -0.00123Duv

Peak Wavelength: 605.0 nm

Color Ratio: $K_r=44.5\%$ $K_g=48.6\%$ $K_b=6.9\%$

Bandwidth: 130.8nm

Radiant Flux: 177.682 W

Photosynthetically Active Radiation(PAR): 170.10W

Photosynthetic Photon Flux(PPF): 825.54 μ mol/sRendering Index: $R_a=81.9$ $R_1=80$ $R_2=89$ $R_3=96$ $R_4=81$ $R_5=80$ $R_6=86$ $R_7=84$ $R_8=60$ $R_9=9$ $R_{10}=75$ $R_{11}=80$ $R_{12}=69$ $R_{13}=83$ $R_{14}=98$ $R_{15}=74$ $R_e=76$

Electric Parameters

Voltage: 277.02 V

Current: 1.833 A

Power Factor: 0.994

Power: 504.65 W

Luminous Efficacy: 127.6 lm/W



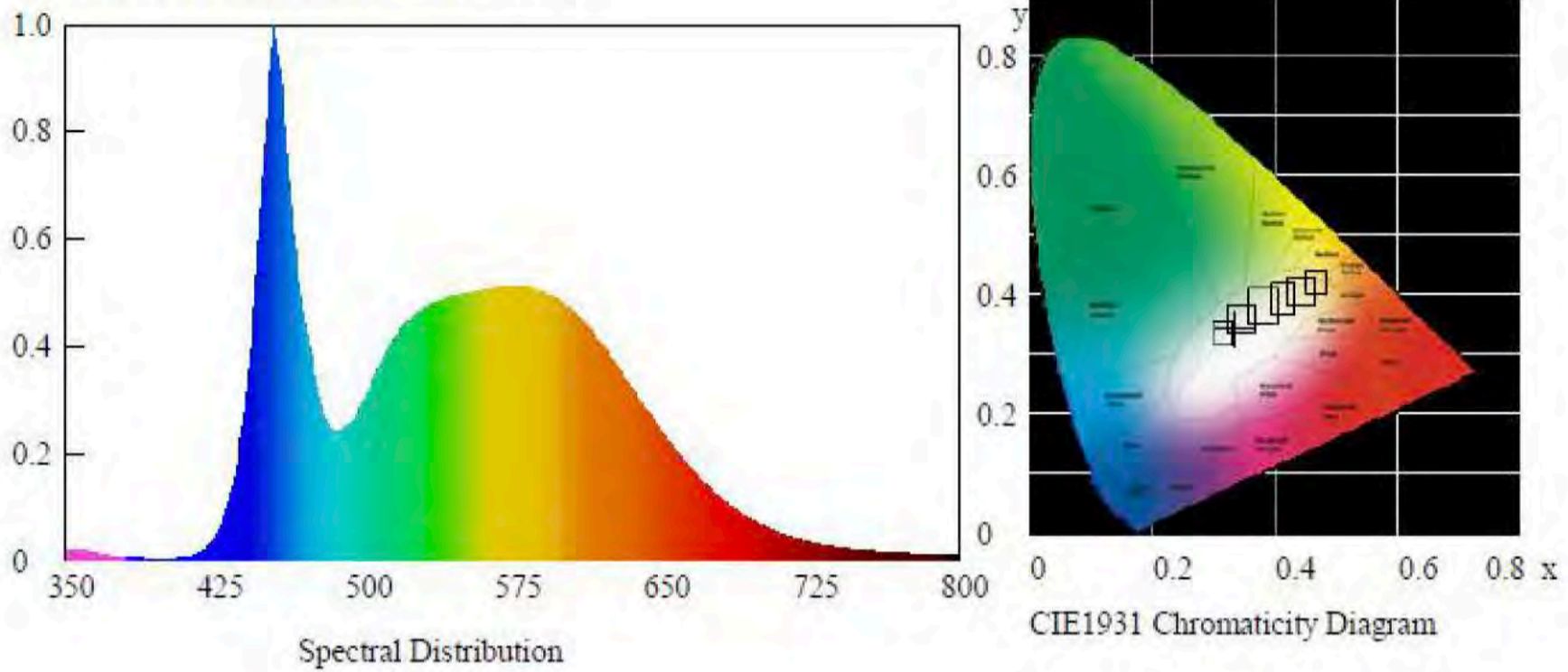
903XX-500W-57K

Test Condition

Temperature: 25°C
Spectrum Range: 350-800 nm

RH: 58%
Scan Step: 5 nm

Spectroradiometric Parameters



Chromaticity Coordinates: $x=0.3317$ $y=0.3442$ $u'=0.2052$ $v'=0.479$
 Correlated Color Temperature: 5534 K Dominant Wavelength: 546.0 nm(E)
 Colour Fidelity Index: $R_f=81$ Gamut Index: $R_g=93$
 Luminous Flux: 66525.68 lm Purity: 0.0283
 Chromaticity Difference: +0.00195Duv Peak Wavelength: 455.0 nm
 Color Ratio: $K_r=32.6\%$ $K_g=55.6\%$ $K_b=11.9\%$
 Bandwidth: 20.8nm Radiant Flux: 172.277 W
 Photosynthetically Active Radiation(PAR): 167.47W Photosynthetic Photon Flux(PPF):768.99 $\mu\text{mol/s}$
 Rendering Index: $R_a=84.7$
 $R_1=84$ $R_2=91$ $R_3=93$ $R_4=82$ $R_5=83$ $R_6=85$ $R_7=88$ $R_8=71$
 $R_9=19$ $R_{10}=77$ $R_{11}=81$ $R_{12}=58$ $R_{13}=87$ $R_{14}=96$ $R_{15}=80$ $R_e=78$

Electric Parameters

Voltage: 277.03 V Current: 1.827 A
 Power Factor: 0.994 Power: 503.22 W
 Luminous Efficacy: 132.2 lm/W



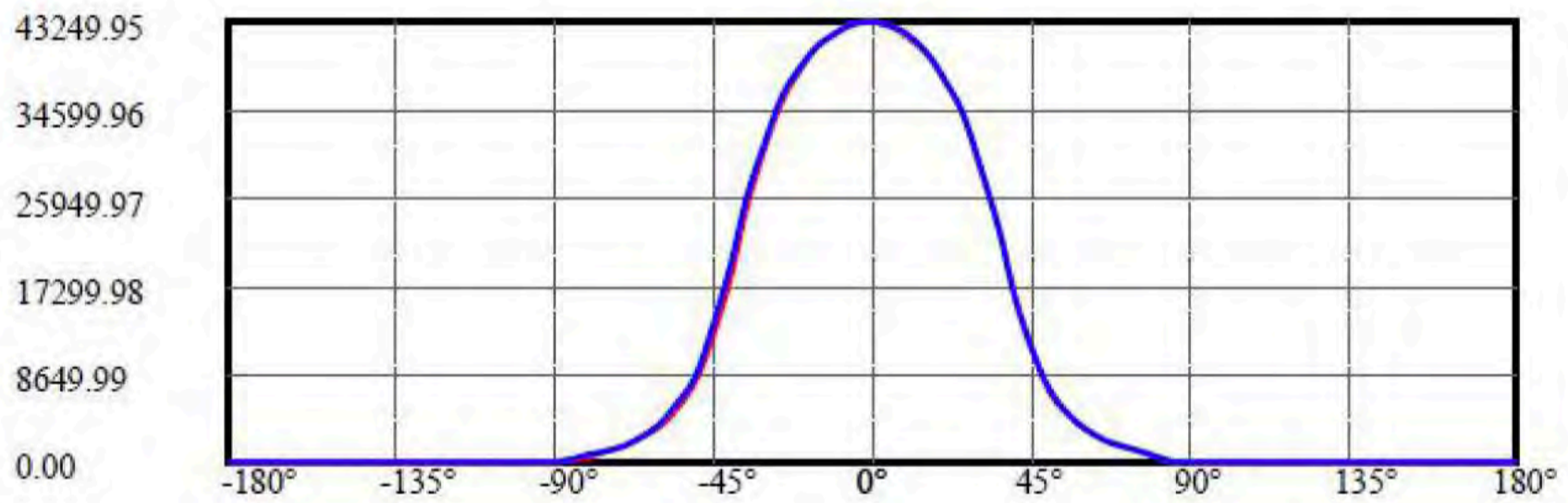
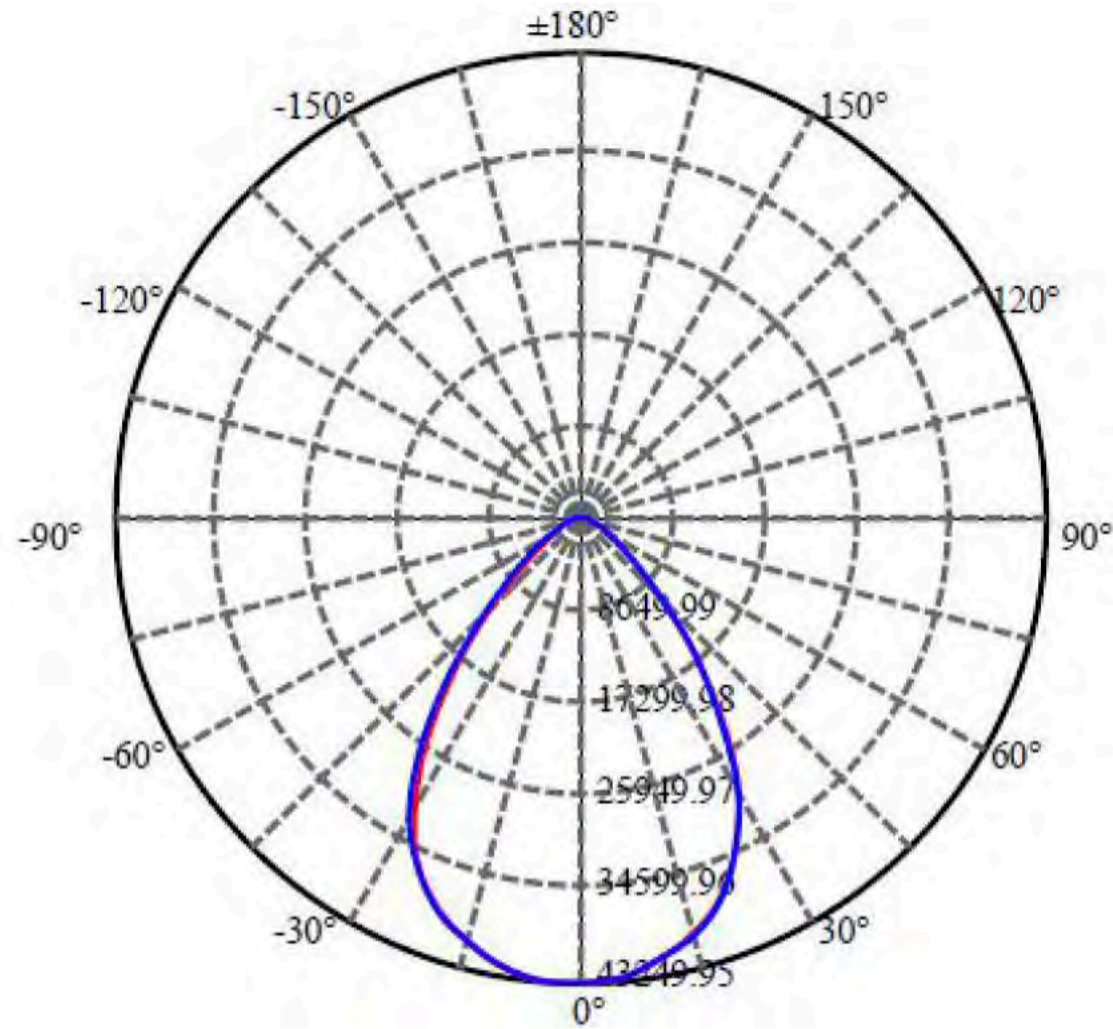
Zonal Flux Diagram

Zonal flux distribution table

$\gamma(^{\circ})$	Average I(cd)	Zonal F(lm)	Sum F(lm)	Eff Flux(%)	Eff Sum(%)
0.0	43203.540	.000	.000	.000%	.000%
5.0	42900.210	1029.346	1029.346	1.608%	1.608%
10.0	41998.240	3037.085	4066.431	4.743%	6.351%
15.0	40428.020	4889.471	8955.902	7.636%	13.987%
20.0	38135.840	6474.767	15430.670	10.112%	24.100%
25.0	34891.050	7659.173	23089.840	11.962%	36.062%
30.0	30322.010	8252.770	31342.610	12.889%	48.951%
35.0	24295.100	8042.753	39385.360	12.561%	61.512%
40.0	17416.290	6959.232	46344.590	10.869%	72.381%
45.0	11438.040	5342.615	51687.210	8.344%	80.725%
50.0	7456.248	3817.868	55505.070	5.963%	86.687%
55.0	4911.764	2689.218	58194.290	4.200%	90.887%
60.0	3436.551	1929.690	60123.980	3.014%	93.901%
65.0	2356.762	1408.366	61532.350	2.200%	96.101%
70.0	1619.831	1006.899	62539.250	1.573%	97.673%
75.0	1074.178	704.171	63243.420	1.100%	98.773%
80.0	604.378	449.135	63692.560	.701%	99.475%
85.0	167.794	209.818	63902.380	.328%	99.802%
90.0	3.108	46.794	63949.170	.073%	99.875%
95.0	2.770	1.609	63950.780	.003%	99.878%
100.0	2.897	1.540	63952.320	.002%	99.880%
105.0	3.291	1.656	63953.970	.003%	99.883%
110.0	4.008	1.908	63955.880	.003%	99.886%
115.0	5.287	2.354	63958.230	.004%	99.889%
120.0	7.144	3.022	63961.260	.005%	99.894%
125.0	9.703	3.894	63965.150	.006%	99.900%
130.0	12.909	4.917	63970.070	.008%	99.908%
135.0	16.692	5.981	63976.050	.009%	99.917%
140.0	20.742	6.931	63982.980	.011%	99.928%
145.0	25.130	7.653	63990.630	.012%	99.940%
150.0	29.714	8.076	63998.710	.013%	99.953%
155.0	33.975	8.060	64006.770	.013%	99.965%
160.0	37.055	7.450	64014.210	.012%	99.977%
165.0	38.630	6.237	64020.450	.010%	99.987%
170.0	39.431	4.631	64025.080	.007%	99.994%
175.0	40.528	2.860	64027.940	.004%	99.998%
180.0	42.694	.995	64028.940	.002%	100.000%



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



C0/C180: —

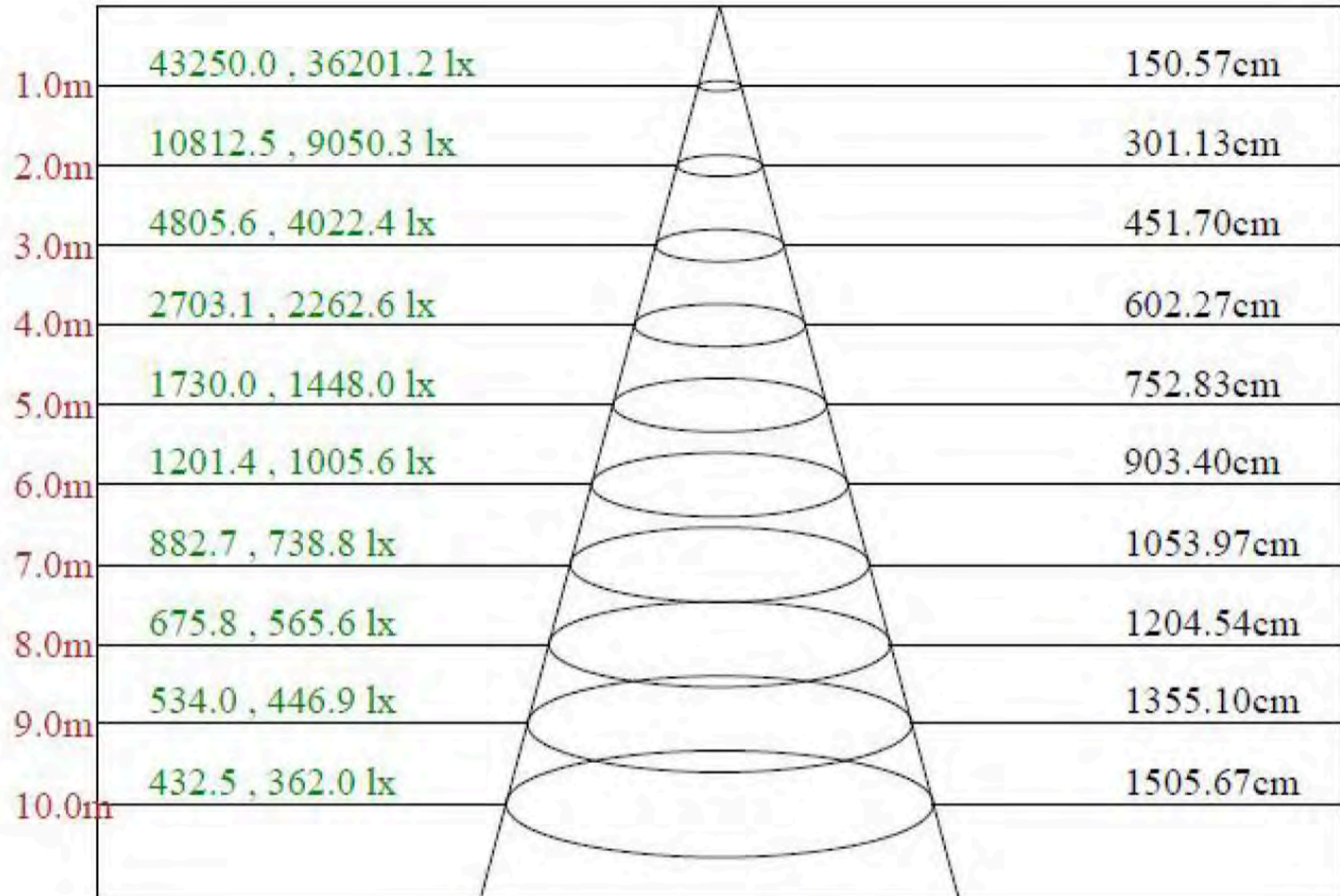
C90/C270: —

Field angle(10%Imax):C0/180Left:57.6 Right:55.6
:C90/270Left:58.5 Right:55.6

Beam Angle(50%Imax):C0/180Left:37.5 Right:36.1
:C90/270Left:38.3 Right:35.9



Lux distance Curve



Max , Ave

Beam angle of C22.5plane73.92

**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	43225.20	42770.70	41706.45	40012.20	37530.45	34033.95	29020.95	23132.70	16189.20
22.5	43249.95	42777.45	41742.45	39994.20	37456.20	34031.70	29209.95	22853.70	15982.20
45.0	43211.70	42766.20	41724.45	40012.20	37573.20	34049.70	29135.70	22734.45	16123.95
67.5	43146.45	42743.70	41751.45	40043.70	37606.95	34049.70	29239.20	22887.45	16036.20
90.0	43182.45	42779.70	41776.20	40097.70	37694.70	34175.70	29205.45	22770.45	16092.45
112.5	43193.70	42799.95	41832.45	40138.20	37654.20	34252.20	29284.20	22824.45	16094.70
135.0	43209.45	42822.45	41854.95	40237.20	37818.45	34315.20	29407.95	23112.45	16132.95
157.5	43209.45	42883.20	41953.95	40329.45	37903.95	34452.45	29803.95	23384.70	16360.20
180.0	43225.20	43060.95	42264.45	40806.45	38590.20	35554.95	31108.95	25092.45	18034.20
202.5	43249.95	43078.95	42262.20	40862.70	38758.95	35732.70	31401.45	25704.45	18679.95
225.0	43211.70	43024.95	42280.20	40887.45	38812.95	35982.45	31813.20	26055.45	19280.70
247.5	43146.45	43006.95	42268.95	40880.70	38851.20	35944.20	31988.70	26325.45	19368.45
270.0	43182.45	43020.45	42237.45	40808.70	38869.20	35878.95	31734.45	26026.20	19339.20
292.5	43193.70	42968.70	42156.45	40693.95	38542.95	35534.70	31408.20	25675.20	18803.70
315.0	43209.45	42975.45	42109.20	40567.95	38315.70	35291.70	30881.70	25438.95	18335.70
337.5	43209.45	42923.70	42050.70	40475.70	38194.20	34976.70	30508.20	24703.20	17806.95
360.0	43225.20	42770.70	41706.45	40012.20	37530.45	34033.95	29020.95	23132.70	16189.20
C/ γ ($^{\circ}$)	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0
0.0	10451.70	6804.45	4473.45	3264.53	2267.33	1565.10	1049.85	571.95	125.55
22.5	10525.95	6894.45	4453.65	3211.65	2234.93	1532.93	1001.48	535.73	114.98
45.0	10543.95	6946.20	4444.88	3195.00	2168.33	1495.13	990.45	527.63	100.80
67.5	10672.20	7033.95	4454.55	3122.10	2139.75	1492.43	981.23	534.15	96.30
90.0	10505.70	6937.20	4471.20	3148.65	2138.18	1502.78	988.20	523.35	83.93
112.5	10514.70	6932.70	4463.55	3183.75	2198.48	1515.60	985.95	500.18	88.65
135.0	10487.70	6871.95	4458.83	3270.83	2258.10	1543.73	1017.00	531.23	93.60
157.5	10588.95	6991.20	4439.03	3309.98	2321.78	1577.03	1013.85	537.30	113.85
180.0	11950.20	7690.95	5146.20	3584.70	2509.20	1699.20	1125.45	654.30	213.53
202.5	12292.20	7929.45	5348.70	3643.20	2482.20	1710.45	1132.20	656.33	222.53
225.0	12784.95	8264.70	5499.45	3744.45	2506.95	1705.95	1147.95	670.73	232.65
247.5	12868.20	8442.45	5611.95	3742.20	2482.20	1714.95	1152.45	685.80	247.50
270.0	12832.20	8311.95	5589.45	3760.20	2506.95	1705.95	1154.70	685.58	243.23
292.5	12400.20	8104.95	5465.70	3681.45	2529.45	1721.70	1145.70	691.65	243.68
315.0	12004.20	7715.70	5222.70	3609.45	2493.45	1735.20	1156.95	682.20	233.55
337.5	11585.70	7427.70	5044.95	3512.70	2470.95	1699.20	1143.45	681.98	230.40
360.0	10451.70	6804.45	4473.45	3264.53	2267.33	1565.10	1049.85	571.95	125.55
C/ γ ($^{\circ}$)	90.0	95.0	100.0	105.0	110.0	115.0	120.0	125.0	130.0
0.0	3.38	2.70	3.15	3.60	4.28	5.63	7.88	10.58	14.18
22.5	2.93	2.70	2.93	3.38	4.05	5.85	7.65	10.35	13.73
45.0	2.93	2.70	2.70	3.38	4.05	5.63	7.88	10.35	13.95
67.5	2.93	2.70	2.70	3.38	4.28	5.63	7.43	10.35	13.95
90.0	3.15	2.70	3.15	3.60	4.28	5.63	7.65	10.58	13.73
112.5	2.93	2.70	2.93	3.15	4.28	5.63	7.43	10.35	13.73
135.0	2.93	2.70	2.93	3.15	4.05	5.40	7.43	10.35	13.50
157.5	2.93	2.70	2.70	3.38	4.05	5.63	7.43	10.13	13.05
180.0	3.15	2.93	2.93	3.15	4.05	5.18	6.98	9.45	12.38
202.5	2.93	2.93	2.93	3.15	4.05	5.18	6.75	9.00	12.15
225.0	3.38	2.70	2.70	3.38	4.05	4.73	6.53	9.00	12.15
247.5	3.15	2.93	2.93	3.15	3.83	4.95	6.75	9.00	12.15
270.0	3.38	2.70	2.70	3.15	3.60	4.73	6.75	9.00	11.93
292.5	3.15	2.93	2.93	3.15	3.60	4.95	6.53	9.00	11.93
315.0	3.38	2.70	2.93	3.38	3.83	4.95	6.53	8.78	11.93
337.5	3.15	2.93	3.15	3.15	3.83	4.95	6.75	9.00	12.15
360.0	3.38	2.70	3.15	3.60	4.28	5.63	7.88	10.58	14.18



$C/\gamma(^{\circ})$	135.0	140.0	145.0	150.0	155.0	160.0	165.0	170.0	175.0
0.0	17.78	22.05	26.78	31.50	35.78	38.93	40.28	40.95	41.85
22.5	18.00	22.05	26.33	31.50	35.55	38.70	39.83	40.50	41.63
45.0	17.78	22.05	26.33	30.83	34.88	38.03	39.15	39.83	40.95
67.5	18.00	21.60	26.10	30.15	34.43	36.90	38.48	39.83	40.73
90.0	17.78	21.83	26.10	30.15	34.20	37.35	38.70	39.60	40.73
112.5	17.78	21.83	26.10	30.60	34.20	37.13	38.48	39.60	40.95
135.0	17.33	21.38	26.10	30.38	34.43	37.80	39.38	40.05	41.40
157.5	17.10	21.15	25.65	30.38	34.65	37.80	39.60	39.83	41.18
180.0	15.75	20.03	24.98	29.93	34.43	37.13	39.15	39.83	40.50
202.5	15.98	20.03	24.30	29.25	33.98	37.35	38.93	39.38	40.50
225.0	15.75	19.80	24.30	28.80	33.53	36.68	38.48	39.38	40.28
247.5	15.53	19.80	24.08	28.58	32.85	36.00	37.35	38.48	39.83
270.0	15.53	19.58	23.63	28.13	32.18	35.55	37.35	38.03	39.15
292.5	15.53	19.35	23.63	28.13	32.40	35.33	36.90	38.03	39.15
315.0	15.75	19.58	23.63	28.13	32.63	35.55	37.80	38.70	39.60
337.5	15.75	19.80	24.08	29.03	33.53	36.68	38.25	38.93	40.05
360.0	17.78	22.05	26.78	31.50	35.78	38.93	40.28	40.95	41.85

$C/\gamma(^{\circ})$	180.0
0.0	43.65
22.5	43.20
45.0	42.53
67.5	42.53
90.0	42.08
112.5	42.53
135.0	42.30
157.5	42.75
180.0	43.65
202.5	43.20
225.0	42.53
247.5	42.53
270.0	42.08
292.5	42.53
315.0	42.30
337.5	42.75
360.0	43.65



5 Performance Assessment

Model name	CCT(K)	Total Luminous(lm)	Power(W)	Luminous Efficacy(lm/W)
903XX-500W-30K	3000K	64393.34	504.65	127.6
903XX-500W-35K	3500K	64819.81 * ¹	503.94 * ²	128.6 * ³
903XX-500W-40K	4000K	65246.28 * ¹	503.94 * ²	129.5 * ³
903XX-500W-45K	4500K	65672.74 * ¹	503.94 * ²	130.3 * ³
90388	5000K	66099.21 * ¹	503.94 * ²	131.2 * ³
903XX-500W-57K	5700K	66525.68	503.22	132.2

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

$$64819.81=(66525.68-64393.34) /5+64393.34$$

$$65246.28=(66525.68-64393.34) /5+64819.81$$

$$65672.74=(66525.68-64393.34) /5+65246.28$$

$$66099.21=(66525.68-64393.34) /5+65672.74$$

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

$$503.94=(504.65+503.22)/2$$

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

$$128.6=64819.81 /503.94$$

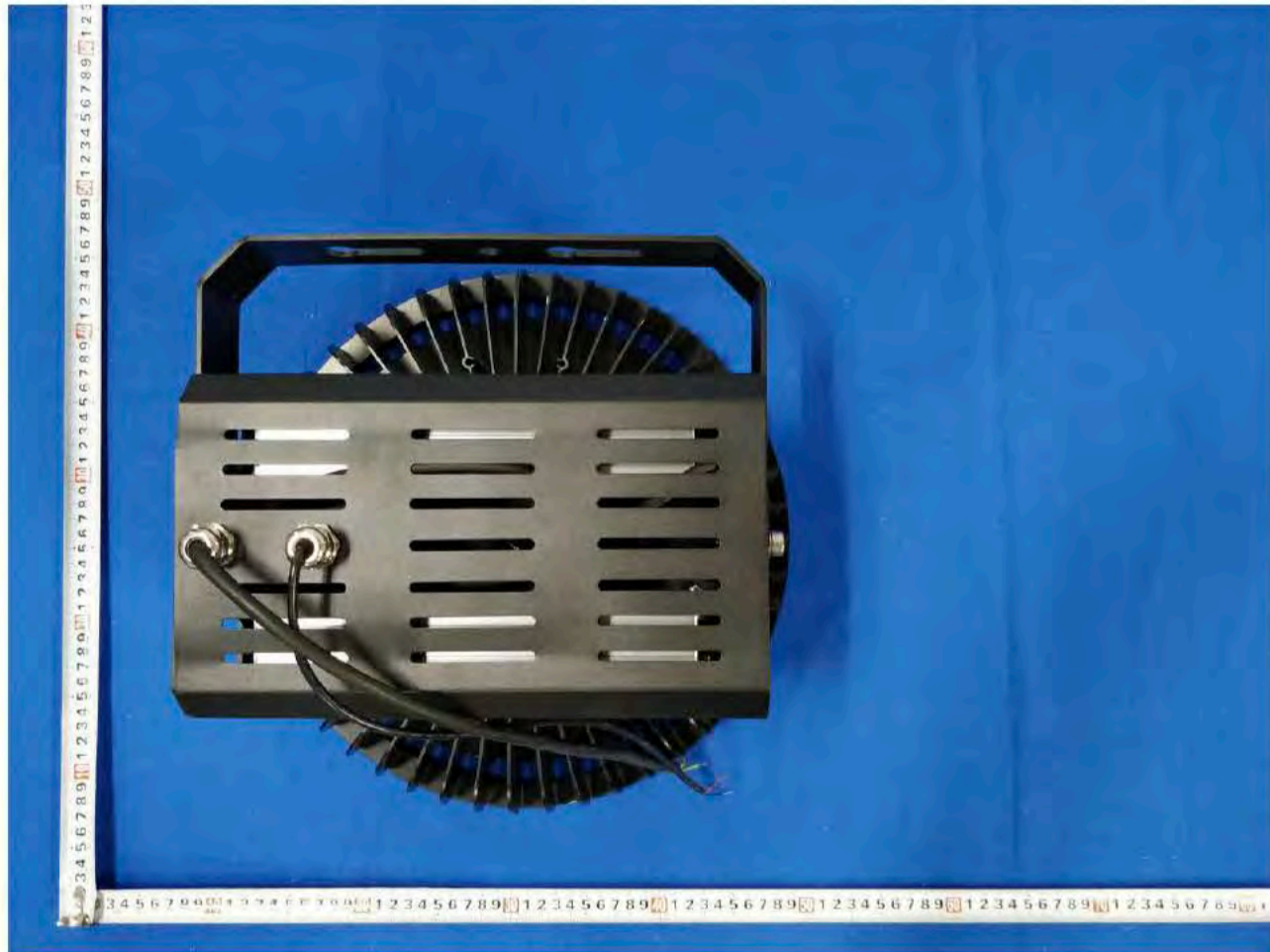
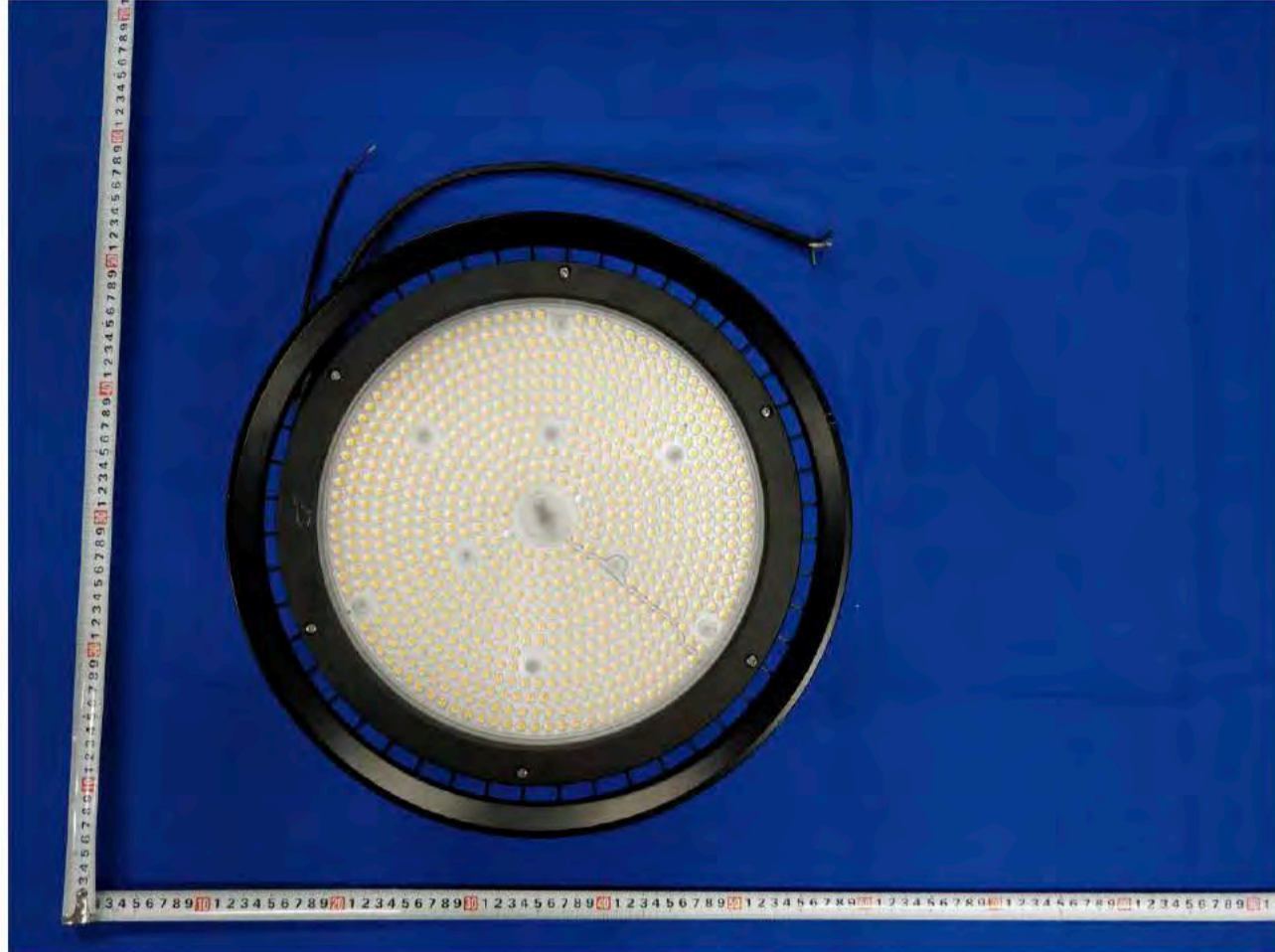
$$129.5=65246.28 /503.94$$

$$130.3=65672.74 /503.94$$

$$131.2=66099.21 /503.94$$



Photo Document



End of test report