



# IES LM-79-08

## MEASUREMENT AND TEST REPORT

For

### Hengdian Group Tospo Lighting Co., Ltd

ABC

Hengdian Electronics Industrial Zone, Dongyang, Zhejiang, China

**Test Model: 791734**

<b>Report Type:</b>	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
<b>Test Engineer:</b>	Hill Liu <i>Hill Liu</i>
<b>Report Number:</b>	R1KS180612090-10-1
<b>Test Date:</b>	2018-06-13
<b>Report Date:</b>	2018-11-01
<b>Reviewed By:</b>	Bill Xiong / EE Engineer <i>Bill Xiong</i>
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<b>Test Facility:</b>	Test facility was located at No.69, Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.
<b>Accreditation:</b>	The IAS Accreditation Number TL-460.

**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 used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan). This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

## 1. Product Description

### General Information:

Two samples were received on 2018-06-12. One was tested in integrating sphere and the other was tested in goniophotometer.

Model Tested: 791734  
 Manufacturer: Hengdian Group Tospo Lighting Co., Ltd  
 Brand Name: TOSPO  
 Product Designation: Omnidirectional LED Lamp  
 Burning Time Before Test: 0hour(For New Products)

### Rated Values:

Rated Voltage/Frequency: 120VAC 60Hz  
 Rated Power: 11W  
 Nominal CCT: 2700K  
 Nominal Lumen Output: 1100lm

## 2. Standards Used

- 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 Equipment
- IES TM-30-15: IES Method for Evaluating Light Source Color Rendition (This method is not in IAS accreditation scope)

## 3. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	2017-12-14	2018-12-14
spectroradiometer	EVERFINE	HAAS-2000	20140912	2017-12-14	2018-12-14
Digital Power Meter	EVERFINE	PF2010A	1011004	2018-07-28	2019-07-28
Digital CC&CV DC Power Supply	EVERFINE	WY305-V1	1101047	2018-06-15	2019-06-15
Rapid Recording Photometer	EVERFINE	PHOTO-2000F	1007010	2017-12-14	2018-12-14
Standard Light Source	EVERFINE	D204	G100283CA8351158	2018-01-08	2019-01-08
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	2018-03-19	2019-03-19
AC POWER SUPPLY	EVERFINE	VPS1030 PWM	1012017	2018-03-19	2019-03-19
Digital CC&CV DC Power Supply	EVERFINE	WY12010	1009009	2018-03-26	2019-03-26
Digital power meter	YOKOGAWA	WT-210	91j926132	2018-03-26	2019-03-26
full-field speed goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	2018-03-18	2019-03-18
Wireless Remote Sensor	N/A	433MHz	N/A	2018-03-17	2019-03-17
Standard Light Source	EVERFINE	D908	1012003	2018-01-05	2019-01-05

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

#### 4. Test Method

Product was tested with no seasoning. All stabilization and measurements were made in compliance with IES LM-79-08. The product was operated at rated voltage or at voltage required by manufacturer. The ambient temperature of the sample was maintained at  $25^{\circ}\text{C}\pm 1^{\circ}\text{C}$  during measurement. And relative humidity is less than 65%.

##### **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.

$4\pi$  geometry was used during measurement. The product was operated in its intended orientation in application and was recorded in this report.

The uncertainty of the light output (luminous flux) measurements is  $U=2.1\%$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is  $U=31\text{K}$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the CRI is  $U=2.1(K=2)$ , at the 95% confidence level.

The uncertainty of power meter AC current  $U=0.19\%$  of rdg, AC Voltage  $U=0.18\%$  of rdg, Power  $U=0.46\%$  ( $K=2$ ), at the 95% confidence level.

##### **Goniophotometer System**

The goniophotometer system is calibrated by standard light source before measurement.

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 vertical angle ( $\gamma$ ) 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.

The uncertainty of the luminous intensity is  $U=2.82\%$  ( $K=2$ ), at the 95% confidence level.

##### **Fidelity Index and Gamut Index Calculation**

The  $R_f$ ,  $R_g$  was calculated according to IES TM-30-15 by using calculation tools. The calculation was based on the measured SPD from 380nm to 780nm with 1nm intervals. All the colors in this report is for reference only.

## 5. Test Result

### [Integrating Sphere System]

Total operating time for integrating sphere test: **1.0 hour**

Test orientation: **Base Up**

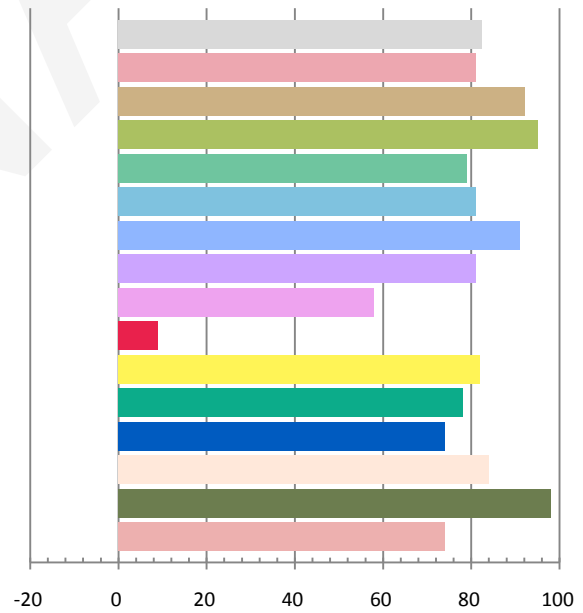
### Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
119.9	60	0.09569	10.98	0.9568	1146.1	104.38

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
3.589	2736	-0.000739	0.4557	0.4077	0.2611	0.5256

### Color Rendering Index

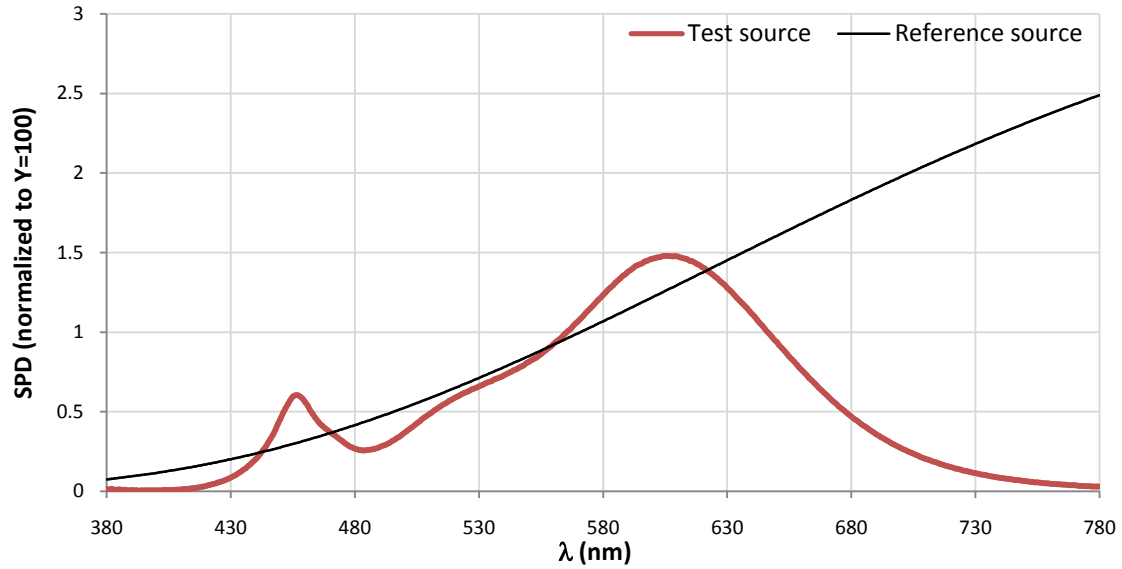
Ra			
82.4			
R1	R2	R3	R4
81	92	95	79
R5	R6	R7	R8
81	91	81	58
R9	R10	R11	R12
9	82	78	74
R13	R14	R15	
84	98	74	



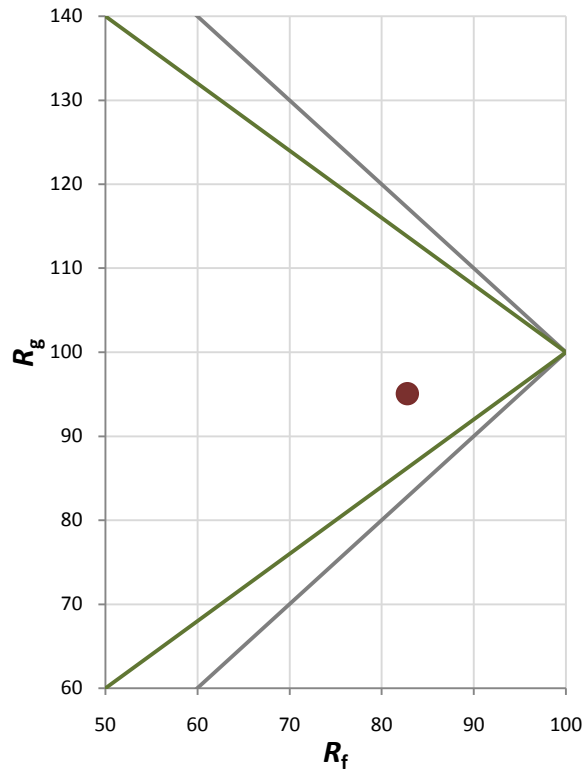
Fidelity Index and Gamut Index

Fidelity Index $R_f$	83
Gamut Index $R_g$	95

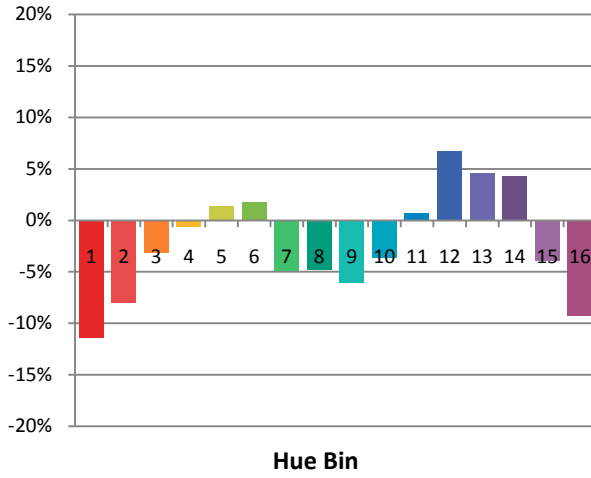
Spectral Power Distribution Comparison



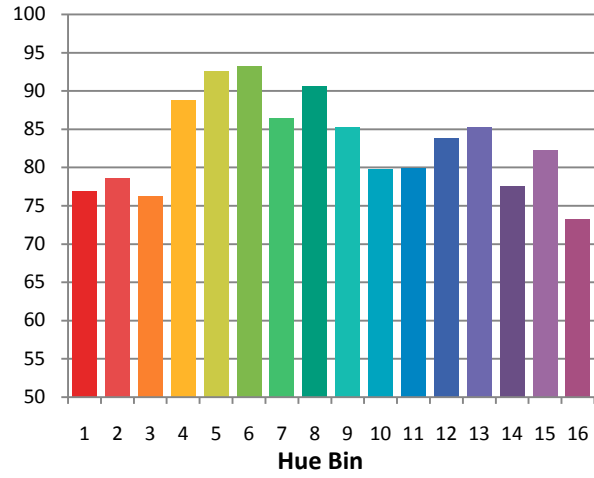
Plot of  $R_g$  versus  $R_f$



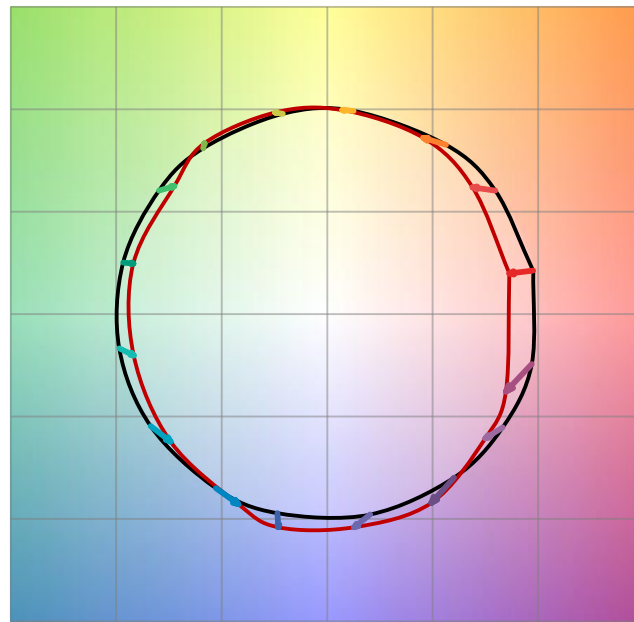
**Chroma Shift by Hue**



**R<sub>f</sub> by Hue**

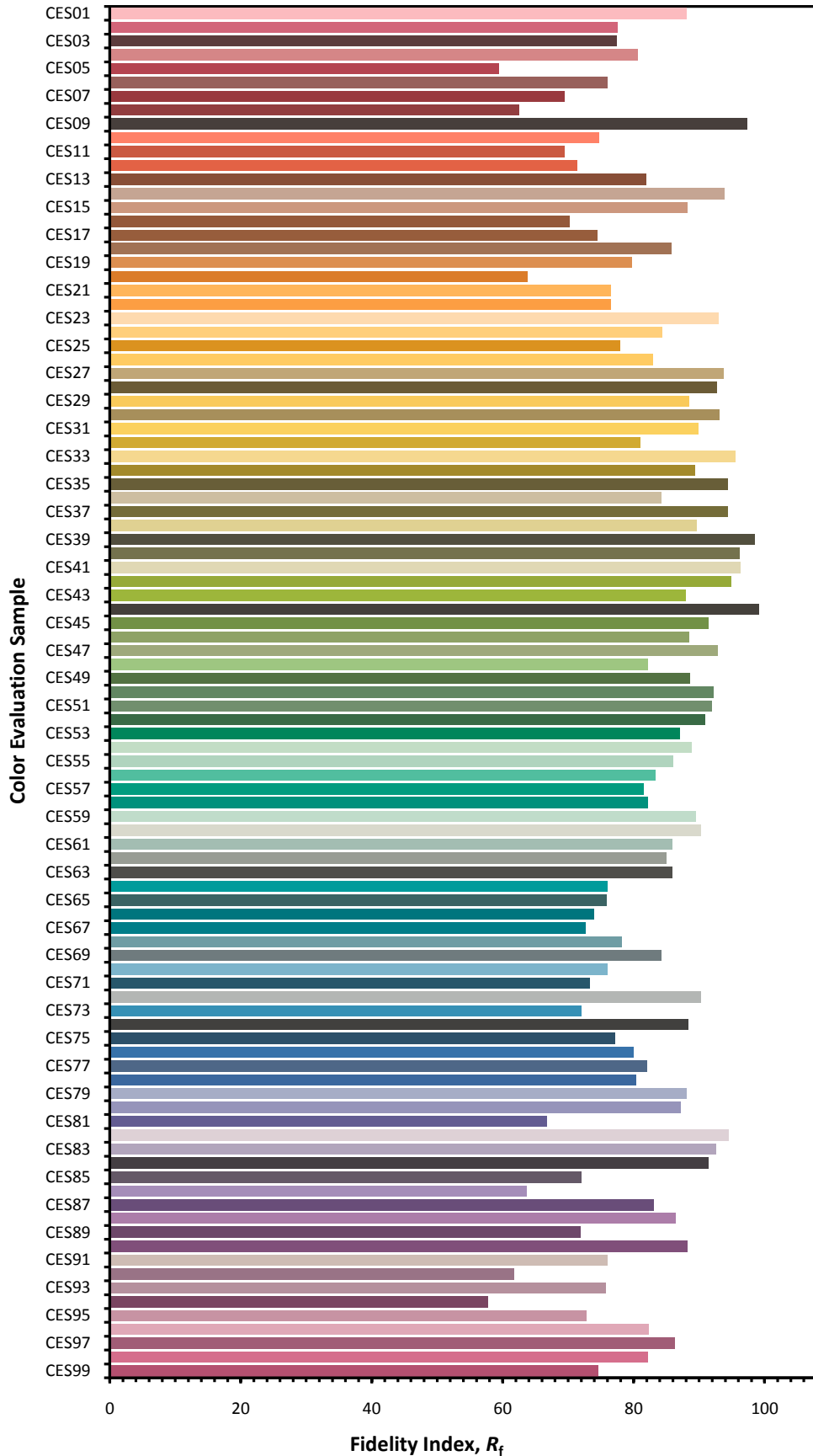


**Color Vector Graphic**

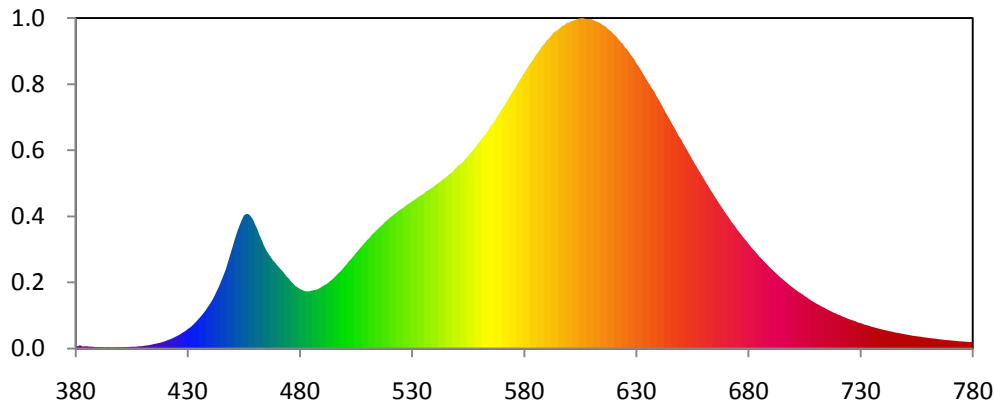


— Reference Illuminat — Test Source

**Color Fidelity by CES Sample**



**Relative Spectral Power Distribution**

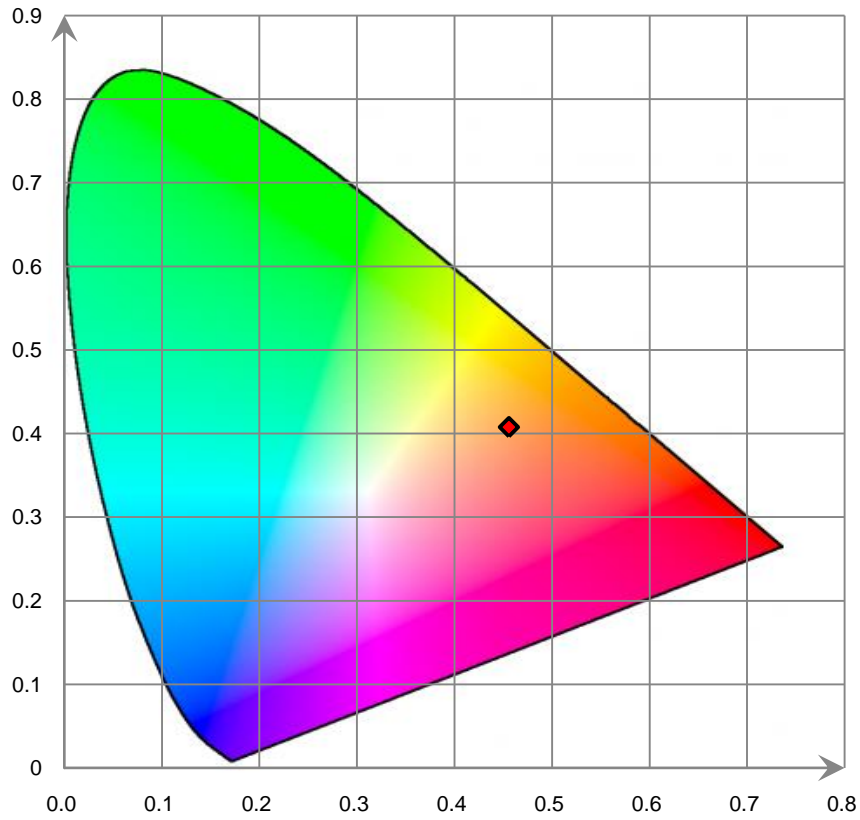


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.664E-01	421	6.332E-01	462	8.537E+00	503	6.753E+00	544	1.274E+01
381	1.803E-01	422	6.905E-01	463	8.173E+00	504	6.953E+00	545	1.286E+01
382	2.620E-01	423	7.610E-01	464	7.741E+00	505	7.181E+00	546	1.301E+01
383	1.651E-01	424	8.436E-01	465	7.413E+00	506	7.364E+00	547	1.315E+01
384	1.737E-01	425	9.293E-01	466	7.129E+00	507	7.573E+00	548	1.326E+01
385	1.872E-01	426	1.013E+00	467	6.894E+00	508	7.777E+00	549	1.348E+01
386	1.547E-01	427	1.123E+00	468	6.639E+00	509	7.952E+00	550	1.363E+01
387	1.519E-01	428	1.228E+00	469	6.454E+00	510	8.158E+00	551	1.380E+01
388	1.412E-01	429	1.330E+00	470	6.242E+00	511	8.310E+00	552	1.393E+01
389	1.041E-01	430	1.465E+00	471	6.053E+00	512	8.534E+00	553	1.407E+01
390	1.196E-01	431	1.578E+00	472	5.874E+00	513	8.696E+00	554	1.428E+01
391	1.072E-01	432	1.721E+00	473	5.672E+00	514	8.865E+00	555	1.448E+01
392	1.145E-01	433	1.889E+00	474	5.451E+00	515	9.031E+00	556	1.467E+01
393	7.881E-02	434	2.062E+00	475	5.287E+00	516	9.192E+00	557	1.486E+01
394	9.847E-02	435	2.258E+00	476	5.066E+00	517	9.336E+00	558	1.510E+01
395	9.058E-02	436	2.443E+00	477	4.894E+00	518	9.531E+00	559	1.528E+01
396	8.318E-02	437	2.653E+00	478	4.709E+00	519	9.654E+00	560	1.551E+01
397	8.834E-02	438	2.875E+00	479	4.612E+00	520	9.815E+00	561	1.574E+01
398	9.750E-02	439	3.125E+00	480	4.493E+00	521	9.953E+00	562	1.597E+01
399	1.024E-01	440	3.378E+00	481	4.408E+00	522	1.008E+01	563	1.616E+01
400	1.046E-01	441	3.657E+00	482	4.336E+00	523	1.021E+01	564	1.642E+01
401	1.003E-01	442	3.977E+00	483	4.305E+00	524	1.035E+01	565	1.671E+01
402	1.122E-01	443	4.335E+00	484	4.304E+00	525	1.046E+01	566	1.692E+01
403	1.230E-01	444	4.692E+00	485	4.346E+00	526	1.058E+01	567	1.714E+01
404	1.280E-01	445	5.102E+00	486	4.391E+00	527	1.071E+01	568	1.744E+01
405	1.417E-01	446	5.519E+00	487	4.412E+00	528	1.084E+01	569	1.771E+01
406	1.412E-01	447	5.962E+00	488	4.468E+00	529	1.094E+01	570	1.796E+01
407	1.450E-01	448	6.521E+00	489	4.564E+00	530	1.106E+01	571	1.823E+01
408	1.780E-01	449	7.071E+00	490	4.666E+00	531	1.117E+01	572	1.850E+01
409	1.797E-01	450	7.627E+00	491	4.777E+00	532	1.129E+01	573	1.878E+01
410	2.006E-01	451	8.213E+00	492	4.859E+00	533	1.142E+01	574	1.905E+01
411	2.282E-01	452	8.741E+00	493	5.001E+00	534	1.152E+01	575	1.932E+01
412	2.444E-01	453	9.202E+00	494	5.135E+00	535	1.161E+01	576	1.961E+01
413	2.739E-01	454	9.616E+00	495	5.278E+00	536	1.178E+01	577	1.988E+01
414	3.030E-01	455	9.992E+00	496	5.446E+00	537	1.188E+01	578	2.017E+01
415	3.484E-01	456	1.011E+01	497	5.641E+00	538	1.198E+01	579	2.041E+01
416	3.780E-01	457	1.013E+01	498	5.779E+00	539	1.209E+01	580	2.071E+01
417	4.188E-01	458	9.975E+00	499	5.966E+00	540	1.221E+01	581	2.096E+01
418	4.539E-01	459	9.738E+00	500	6.177E+00	541	1.236E+01	582	2.125E+01
419	5.109E-01	460	9.361E+00	501	6.363E+00	542	1.247E+01	583	2.148E+01
420	5.621E-01	461	9.002E+00	502	6.587E+00	543	1.260E+01	584	2.171E+01

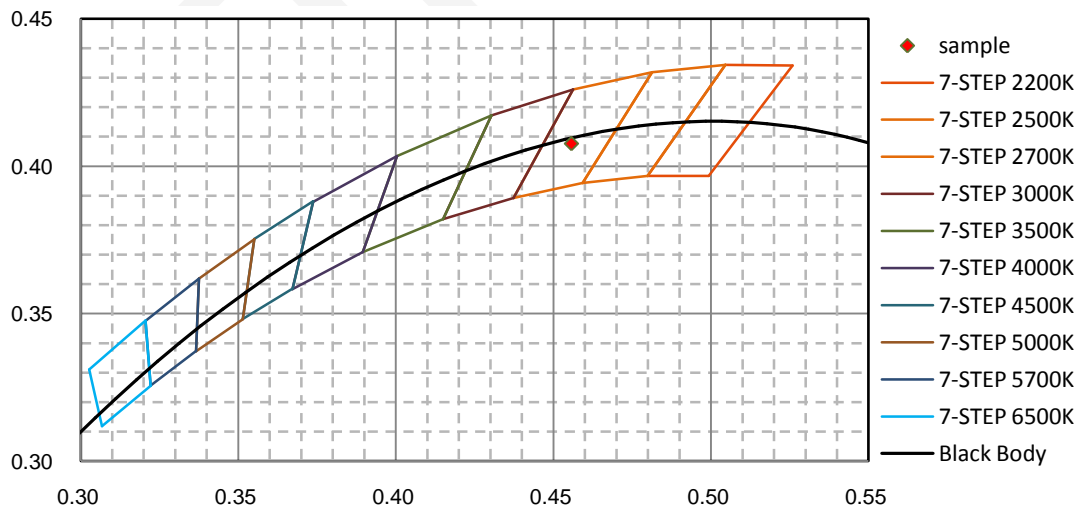


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	2.200E+01	626	2.247E+01	667	1.090E+01	708	3.612E+00	749	1.107E+00
586	2.222E+01	627	2.221E+01	668	1.065E+01	709	3.519E+00	750	1.075E+00
587	2.245E+01	628	2.197E+01	669	1.039E+01	710	3.410E+00	751	1.045E+00
588	2.273E+01	629	2.177E+01	670	1.014E+01	711	3.322E+00	752	1.015E+00
589	2.288E+01	630	2.145E+01	671	9.906E+00	712	3.227E+00	753	9.739E-01
590	2.315E+01	631	2.123E+01	672	9.645E+00	713	3.138E+00	754	9.591E-01
591	2.331E+01	632	2.095E+01	673	9.411E+00	714	3.058E+00	755	9.258E-01
592	2.351E+01	633	2.066E+01	674	9.213E+00	715	2.959E+00	756	9.147E-01
593	2.371E+01	634	2.038E+01	675	8.938E+00	716	2.871E+00	757	8.814E-01
594	2.384E+01	635	2.009E+01	676	8.743E+00	717	2.792E+00	758	8.540E-01
595	2.394E+01	636	1.984E+01	677	8.520E+00	718	2.698E+00	759	8.386E-01
596	2.409E+01	637	1.955E+01	678	8.290E+00	719	2.644E+00	760	8.156E-01
597	2.425E+01	638	1.932E+01	679	8.111E+00	720	2.554E+00	761	7.887E-01
598	2.431E+01	639	1.898E+01	680	7.899E+00	721	2.496E+00	762	7.786E-01
599	2.447E+01	640	1.870E+01	681	7.671E+00	722	2.405E+00	763	7.518E-01
600	2.451E+01	641	1.842E+01	682	7.478E+00	723	2.349E+00	764	7.329E-01
601	2.460E+01	642	1.810E+01	683	7.303E+00	724	2.279E+00	765	7.114E-01
602	2.466E+01	643	1.777E+01	684	7.088E+00	725	2.205E+00	766	6.919E-01
603	2.469E+01	644	1.749E+01	685	6.900E+00	726	2.152E+00	767	6.669E-01
604	2.480E+01	645	1.718E+01	686	6.729E+00	727	2.101E+00	768	6.455E-01
605	2.481E+01	646	1.688E+01	687	6.547E+00	728	2.036E+00	769	6.385E-01
606	2.484E+01	647	1.659E+01	688	6.376E+00	729	1.955E+00	770	6.220E-01
607	2.479E+01	648	1.629E+01	689	6.196E+00	730	1.919E+00	771	6.035E-01
608	2.477E+01	649	1.595E+01	690	6.019E+00	731	1.856E+00	772	5.865E-01
609	2.478E+01	650	1.572E+01	691	5.870E+00	732	1.794E+00	773	5.744E-01
610	2.477E+01	651	1.539E+01	692	5.713E+00	733	1.755E+00	774	5.543E-01
611	2.467E+01	652	1.510E+01	693	5.552E+00	734	1.703E+00	775	5.448E-01
612	2.459E+01	653	1.481E+01	694	5.390E+00	735	1.645E+00	776	5.332E-01
613	2.454E+01	654	1.451E+01	695	5.260E+00	736	1.600E+00	777	5.173E-01
614	2.445E+01	655	1.420E+01	696	5.104E+00	737	1.552E+00	778	5.046E-01
615	2.430E+01	656	1.392E+01	697	4.965E+00	738	1.506E+00	779	5.008E-01
616	2.425E+01	657	1.365E+01	698	4.819E+00	739	1.464E+00	780	5.017E-01
617	2.407E+01	658	1.336E+01	699	4.685E+00	740	1.424E+00		
618	2.394E+01	659	1.307E+01	700	4.564E+00	741	1.380E+00		
619	2.380E+01	660	1.280E+01	701	4.428E+00	742	1.347E+00		
620	2.362E+01	661	1.251E+01	702	4.303E+00	743	1.300E+00		
621	2.347E+01	662	1.224E+01	703	4.193E+00	744	1.282E+00		
622	2.324E+01	663	1.195E+01	704	4.092E+00	745	1.232E+00		
623	2.306E+01	664	1.170E+01	705	3.965E+00	746	1.193E+00		
624	2.288E+01	665	1.142E+01	706	3.855E+00	747	1.177E+00		
625	2.263E+01	666	1.117E+01	707	3.730E+00	748	1.134E+00		

**CIE 1931 x y Chromaticity Diagram**



**7-Step Chromaticity Quadrangles**



**[Goniophotometer System]**

Total operating time for luminous intensity distribution: **1.0 hours**

Test orientation: **Base Up**

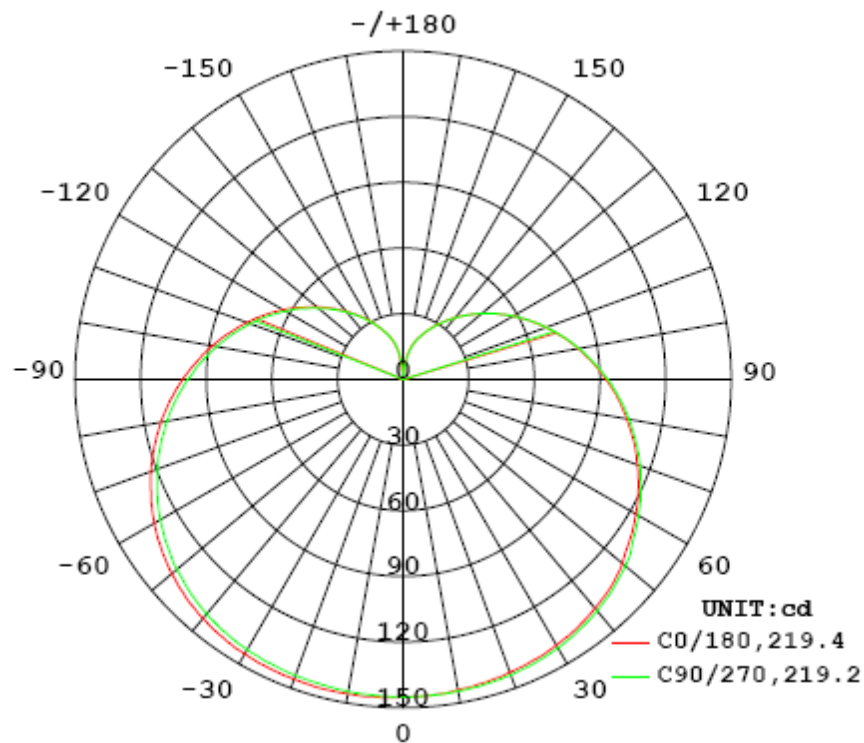
**Electrical Measurement**

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.0945	10.98	0.9677

**Photometric Measurement**

Luminous Flux (lm)	Efficacy (lm/W)	I <sub>max</sub> (cd)	S/MH (C0/180)	S/MH (C90/270)
1154.06	105.11	146	1.47	1.48

**Luminous Intensity Distribution**



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I <sub>max</sub> ):	219.4	219.2	219.2	219.4	219.3
Field Angle (10% I <sub>max</sub> ):	335.4	335.5	335.4	335.4	335.4

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	145	145	145	145	145	145	145	145
5.0°	146	145	145	145	145	145	144	145
10.0°	146	146	146	145	145	144	144	144
15.0°	146	146	146	145	144	144	144	143
20.0°	146	146	145	144	144	144	143	143
25.0°	145	145	145	144	143	143	142	142
30.0°	145	145	144	143	143	142	141	140
35.0°	144	144	143	142	141	141	140	139
40.0°	143	142	142	141	140	139	138	137
45.0°	141	141	140	139	138	137	135	134
50.0°	138	138	138	136	135	134	132	131
55.0°	135	135	135	133	132	131	129	128
60.0°	131	132	131	130	128	127	125	124
65.0°	127	128	127	126	124	123	121	120
70.0°	123	123	122	121	120	118	117	115
75.0°	118	118	118	116	115	113	112	110
80.0°	113	113	112	111	110	108	106	105
85.0°	107	107	107	106	104	103	101	100
90.0°	101	101	101	100	99	97	95	94
95.0°	95	95	95	94	93	91	90	88
100.0°	89	89	89	88	87	85	84	82
105.0°	82	83	83	82	81	79	78	77
110.0°	76	77	77	76	74	73	72	71
115.0°	70	70	70	70	68	67	66	65
120.0°	64	64	64	63	62	61	60	59
125.0°	57	58	58	57	56	55	54	53
130.0°	52	52	52	52	51	50	48	47
135.0°	46	46	47	46	45	44	43	42
140.0°	41	41	41	41	40	39	38	37
145.0°	36	36	36	36	35	34	33	33
150.0°	31	31	32	31	31	30	29	28
155.0°	27	27	27	27	26	26	25	24
160.0°	22	23	23	23	22	22	21	21
165.0°	18	19	19	18	19	18	17	17
170.0°	12	13	13	13	13	13	12	12
175.0°	1	1	2	5	5	4	3	2
180.0°	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°	145	145	145	145	145	145	145	145
5.0°	145	145	145	145	145	145	145	145
10.0°	144	144	144	144	145	145	145	145
15.0°	143	143	144	144	144	145	145	146
20.0°	142	142	143	143	144	144	145	145
25.0°	141	141	142	142	143	144	144	145
30.0°	140	140	140	141	142	143	144	144
35.0°	139	138	139	139	140	141	142	143
40.0°	136	136	136	137	138	139	141	142
45.0°	134	133	134	134	135	137	138	140
50.0°	131	130	130	131	133	134	136	137
55.0°	127	126	126	127	128	131	132	134
60.0°	123	122	122	123	124	126	128	130
65.0°	119	118	118	119	120	122	124	125
70.0°	114	113	113	114	115	117	119	121
75.0°	109	108	108	109	110	112	114	116
80.0°	104	103	103	104	105	107	109	110
85.0°	98	98	98	98	99	101	103	105
90.0°	93	92	92	92	94	95	97	99
95.0°	87	86	86	86	88	89	91	93
100.0°	81	80	80	81	82	83	85	87
105.0°	75	75	74	75	76	77	79	81
110.0°	69	69	68	69	70	71	73	75
115.0°	64	63	63	63	64	65	67	68
120.0°	58	57	57	57	58	59	61	62
125.0°	52	52	51	52	52	54	55	56
130.0°	47	46	46	46	47	48	49	51
135.0°	42	41	41	41	42	43	44	45
140.0°	37	36	36	36	37	38	39	40
145.0°	32	32	31	32	32	33	34	35
150.0°	28	27	27	27	28	28	29	30
155.0°	24	23	23	23	24	24	25	26
160.0°	20	20	20	19	20	20	21	22
165.0°	16	16	16	16	16	16	17	18
170.0°	11	11	11	10	10	10	11	12
175.0°	2	2	0	0	0	0	0	0
180.0°	0	0	0	0	0	0	0	0

**Zonal Lumen Density Measurement**

Deg	Flux (lm)	%
0-5	3.5	0.30
5-10	10.4	0.90
10-15	17.2	1.49
15-20	23.8	2.05
20-25	30.1	2.61
25-30	36.1	3.14
30-35	41.7	3.61
35-40	46.7	4.05
40-45	51.1	4.43
45-50	54.8	4.74
50-55	57.5	4.99
55-60	59.5	5.15
60-65	60.6	5.25
65-70	60.9	5.27
70-75	60.3	5.23
75-80	59.0	5.12
80-85	57.0	4.94
85-90	54.4	4.71
90-95	51.2	4.43
95-100	47.6	4.13
100-105	43.6	3.78
105-110	39.4	3.41
110-115	35.2	3.05
115-120	30.8	2.67
120-125	26.6	2.31
125-130	22.5	1.95
130-135	18.7	1.62
135-140	15.2	1.32
140-145	12.1	1.05
145-150	9.3	0.80
150-155	6.9	0.60
155-160	4.9	0.42
160-165	3.2	0.28
165-170	1.8	0.15
170-175	0.6	0.05
175-180	0.0	0.00

Deg	Flux (lm)	%
0-5	3.5	0.30
0-10	13.8	1.20
0-15	31.0	2.69
0-20	54.8	4.74
0-25	84.9	7.35
0-30	121.0	10.49
0-35	162.7	14.10
0-40	209.5	18.15
0-45	260.6	22.58
0-50	315.3	27.32
0-55	372.9	32.31
0-60	432.3	37.46
0-65	492.9	42.71
0-70	553.8	47.98
0-75	614.1	53.21
0-80	673.1	58.33
0-85	730.1	63.27
0-90	784.5	67.98
0-95	835.7	72.41
0-100	883.3	76.54
0-105	926.9	80.32
0-110	966.4	83.73
0-115	1001.5	86.78
0-120	1032.4	89.45
0-125	1059.0	91.76
0-130	1081.5	93.71
0-135	1100.2	95.33
0-140	1115.4	96.65
0-145	1127.5	97.70
0-150	1136.8	98.50
0-155	1143.7	99.10
0-160	1148.5	99.52
0-165	1151.7	99.80
0-170	1153.5	99.95
0-175	1154.1	100.00
0-180	1154.1	100.00

## 6. Product Photo



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