



# IES LM-79-08

## MEASUREMENT AND TEST REPORT

For

### GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai, China

**Test Model: 16T8/4F/850/BYP/FF**

<b>Report Type:</b>	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
<b>Test Engineer:</b>	George Yang <i>George Yang</i>
<b>Report Number:</b>	PKS180910087-10-3
<b>Test Date:</b>	2018-09-11 to 2018-09-12
<b>Report Date:</b>	2018-09-18
<b>Reviewed By:</b>	Ray Gao/EE Engineer <i>Ry Gao</i>
<b>Prepared By:</b>	Bay Area Compliance Laboratories Corp. (Kunshan). No.248 Chenghu Road, Kunshan, Jiangsu province, China. Tel: +86-0512-86175000 Fax: +86-0512-88934268
<b>Test Facility:</b>	Test facility was located at No.248 Chenghu Road, Kunshan, Jiangsu province, China.
<b>Accreditation:</b>	The IAS Accreditation Number TL-749.

**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. (Kunshan). 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:

one sample was received on 2018-09-10 and used for testing.

Model Tested: 16T8/4F/850/BYP/FF  
 Manufacturer: GREEN CREATIVE LTD  
 Brand Name: GREEN CREATIVE  
 Product Designation: LED Tube  
 Aging Time Before Test: 0hour(For New Products)

### Rated Values:

Rated Voltage/Frequency: 120-277VAC 50/60Hz  
 Rated Power: 16W  
 Nominal CCT: 5000K  
 Nominal Lumen Output: 2050lm

## 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

## 3. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
Integrating Sphere	INVENTFINE	Dia 1.5m	JWWCV090112	2018-01-24	2019-01-24
Power Meter	INVENTFINE	WT500	GSJWQ20009	2018-04-08	2019-04-08
Spectral photometer	INVENTFINE	CMS-3S	GSGSE100017	2018-01-24	2019-01-24
AC Power Supply	INVENTFINE	CHP500	JWJSD010071	2018-04-08	2019-04-08
Standard Light Source	INVENTFINE	N/A	JWWCR020106	2018-01-24	2019-01-24
Thermal Meter	KEJIAN	TA298	N/A	2017-11-14	2018-11-14
DC Power Supply	INVENTFINE	WL3005	JWWCP020069	2018-04-08	2019-04-08
AC Power Supply	INVENTFINE	CHP-5KVA	900511765	2018-04-08	2019-04-08
DC Power Supply	INVENTFINE	WL3010	JWDMP030001	2018-04-08	2019-04-08
Power Meter	INVENTFINE	WT500	GSDSQ200007	2018-04-08	2019-04-08
Goniophotometer	INVENTFINE	GPM-1900	YWGCF120001	2018-01-24	2019-01-24
Wireless Weather Station	ZHONGXING	KG218	N/A	2017-11-14	2018-11-14
Standard Light Source	INVENTFINE	N/A	JWBYR040007	2018-01-24	2019-01-24

Statement of Traceability: Bay Area Compliance Laboratories Corp.(Kunshan) 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  $U=2.6\%$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is  $U=24\text{K}$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the CRI is  $U=2.5(K=2)$ , at the 95% confidence level.

The uncertainty of power meter AC current  $U=0.16\%$  of rdg, AC Voltage  $U=0.18\%$  of rdg, Power  $U=0.14\%$  ( $K=2$ ), 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 flux is  $U=2.6\%$  ( $K=2$ ), at the 95% confidence level.

### Fidelity Index and Gamut Index Calculation

The  $R_i$ ,  $R_g$  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: **Downward**

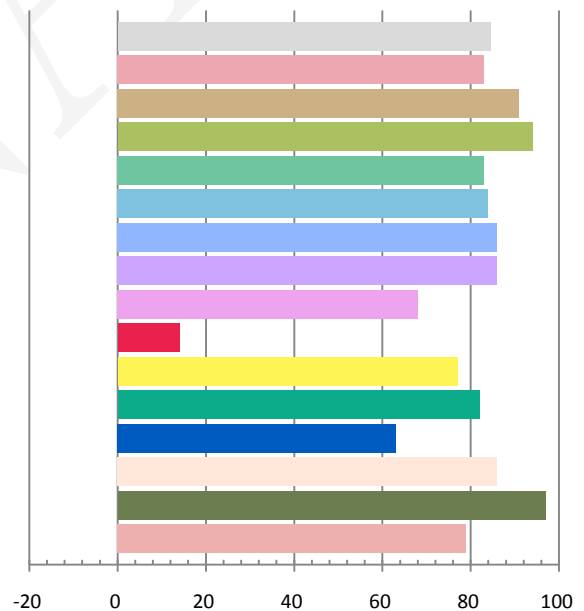
### Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1362	15.96	0.9764	2123.5	133.05

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
6.605	5004	0.00064	0.3451	0.3529	0.2109	0.4853

### Color Rendering Index

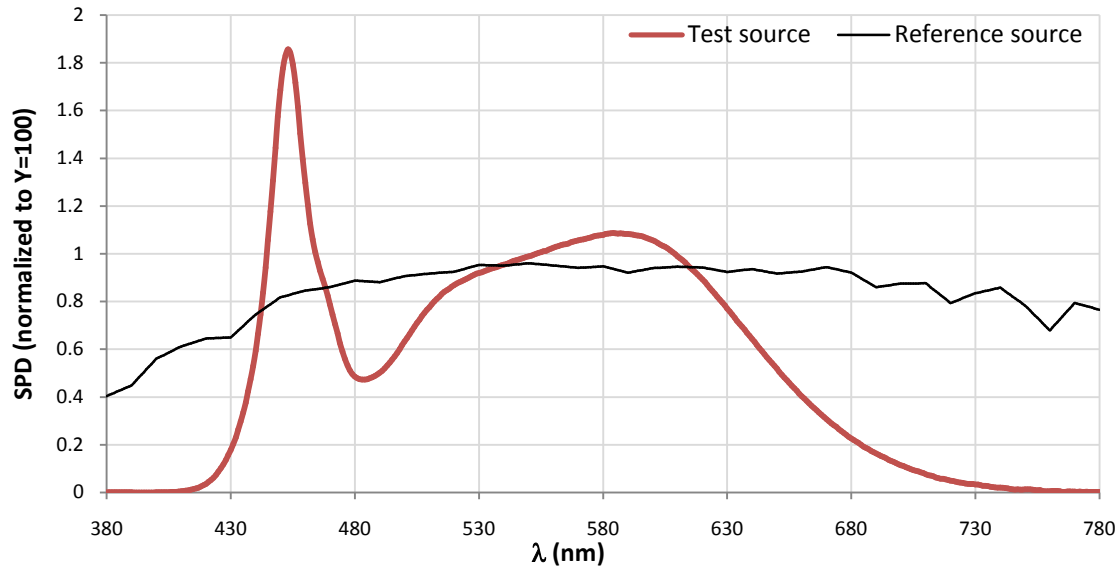
<b>Ra</b> <b>84.5</b>			
<b>R1</b> 83	<b>R2</b> 91	<b>R3</b> 94	<b>R4</b> 83
<b>R5</b> 84	<b>R6</b> 86	<b>R7</b> 86	<b>R8</b> 68
<b>R9</b> 14	<b>R10</b> 77	<b>R11</b> 82	<b>R12</b> 63
<b>R13</b> 86	<b>R14</b> 97	<b>R15</b> 79	



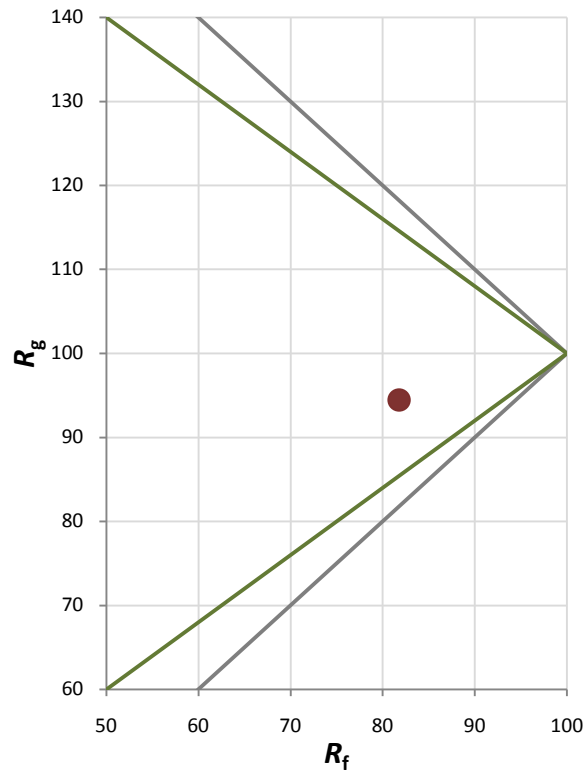
### Fidelity Index and Gamut Index

Fidelity Index $R_f$	82
Gamut Index $R_g$	94

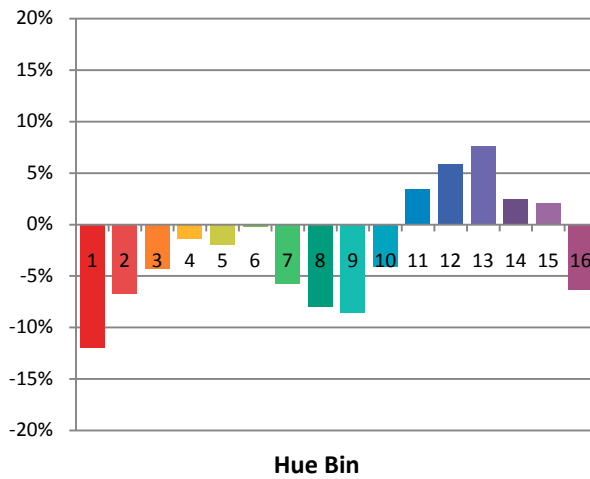
### Spectral Power Distribution Comparison



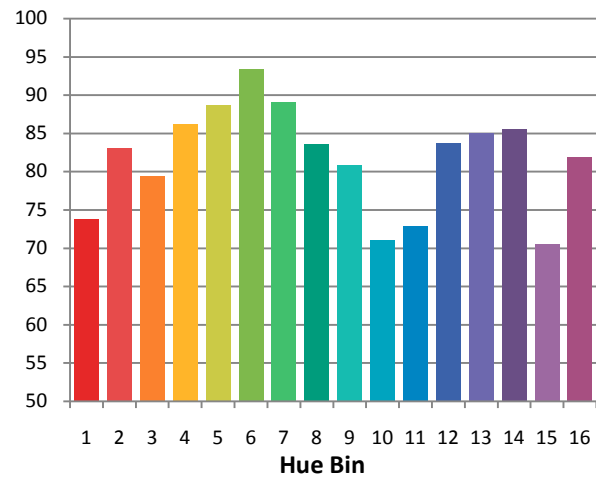
### Plot of $R_g$ versus $R_f$



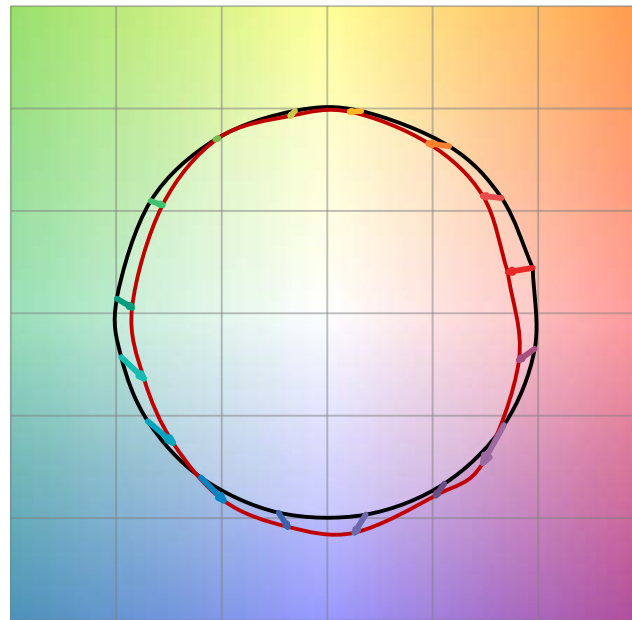
Chroma Shift by Hue



$R_t$  by Hue

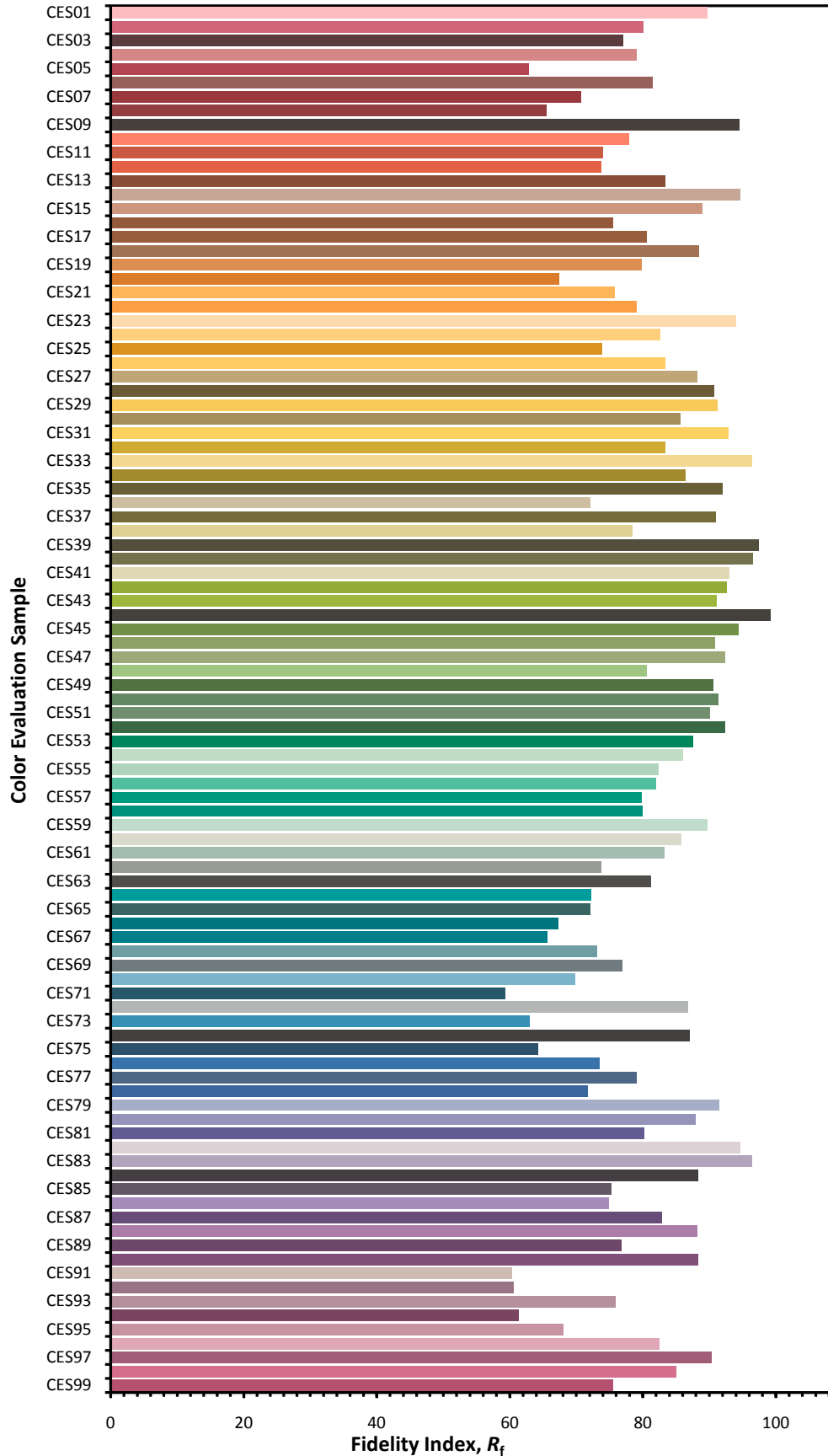


Color Vector Graphic

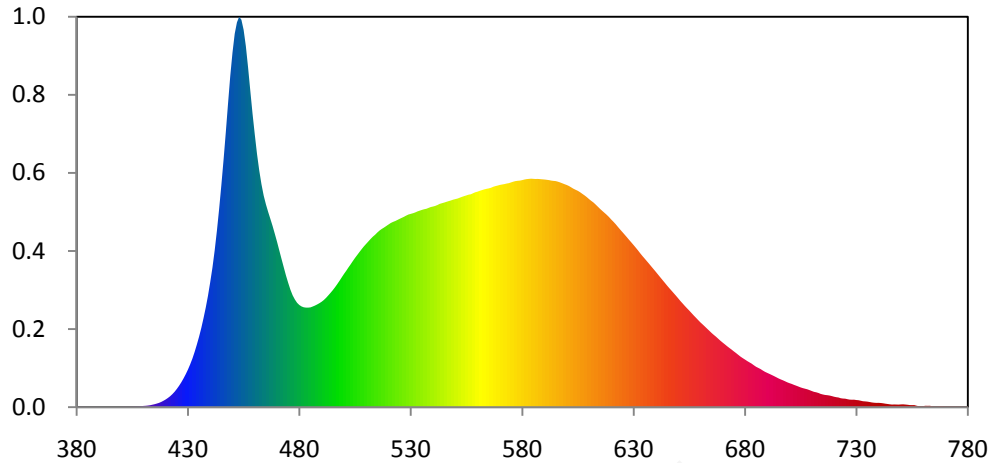


— Reference Illuminant — Test Source

### Color Fidelity by CES Sample



### Relative Spectral Power Distribution

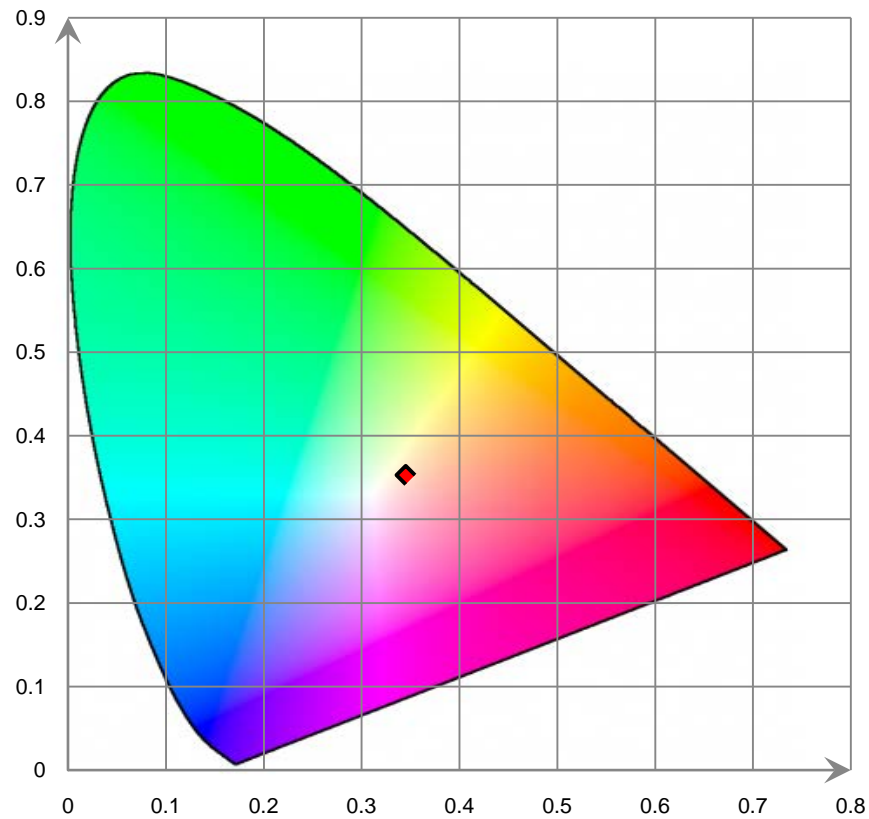


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	4.880E-02	421	1.363E+00	462	3.501E+01	503	2.110E+01	544	3.015E+01
381	4.160E-02	422	1.617E+00	463	3.297E+01	504	2.159E+01	545	3.024E+01
382	3.490E-02	423	1.921E+00	464	3.128E+01	505	2.206E+01	546	3.035E+01
383	3.210E-02	424	2.274E+00	465	2.999E+01	506	2.250E+01	547	3.045E+01
384	3.890E-02	425	2.687E+00	466	2.887E+01	507	2.294E+01	548	3.055E+01
385	2.760E-02	426	3.150E+00	467	2.784E+01	508	2.337E+01	549	3.067E+01
386	2.700E-02	427	3.667E+00	468	2.678E+01	509	2.377E+01	550	3.075E+01
387	2.890E-02	428	4.236E+00	469	2.562E+01	510	2.414E+01	551	3.084E+01
388	2.230E-02	429	4.864E+00	470	2.444E+01	511	2.450E+01	552	3.096E+01
389	3.590E-02	430	5.553E+00	471	2.318E+01	512	2.487E+01	553	3.109E+01
390	3.570E-02	431	6.325E+00	472	2.192E+01	513	2.520E+01	554	3.120E+01
391	1.800E-02	432	7.172E+00	473	2.069E+01	514	2.549E+01	555	3.130E+01
392	1.130E-02	433	8.161E+00	474	1.947E+01	515	2.581E+01	556	3.141E+01
393	1.060E-02	434	9.250E+00	475	1.838E+01	516	2.611E+01	557	3.147E+01
394	1.130E-02	435	1.042E+01	476	1.737E+01	517	2.634E+01	558	3.163E+01
395	1.420E-02	436	1.171E+01	477	1.654E+01	518	2.654E+01	559	3.177E+01
396	1.480E-02	437	1.317E+01	478	1.592E+01	519	2.677E+01	560	3.186E+01
397	1.080E-02	438	1.473E+01	479	1.543E+01	520	2.700E+01	561	3.198E+01
398	7.600E-03	439	1.647E+01	480	1.510E+01	521	2.721E+01	562	3.209E+01
399	6.500E-03	440	1.848E+01	481	1.489E+01	522	2.738E+01	563	3.219E+01
400	2.760E-02	441	2.063E+01	482	1.476E+01	523	2.750E+01	564	3.227E+01
401	4.700E-02	442	2.316E+01	483	1.472E+01	524	2.767E+01	565	3.234E+01
402	5.040E-02	443	2.606E+01	484	1.472E+01	525	2.783E+01	566	3.243E+01
403	4.000E-02	444	2.928E+01	485	1.475E+01	526	2.799E+01	567	3.257E+01
404	4.540E-02	445	3.281E+01	486	1.488E+01	527	2.815E+01	568	3.268E+01
405	5.310E-02	446	3.659E+01	487	1.502E+01	528	2.832E+01	569	3.275E+01
406	6.700E-02	447	4.063E+01	488	1.518E+01	529	2.848E+01	570	3.285E+01
407	7.760E-02	448	4.487E+01	489	1.537E+01	530	2.857E+01	571	3.291E+01
408	8.520E-02	449	4.896E+01	490	1.558E+01	531	2.866E+01	572	3.297E+01
409	1.366E-01	450	5.240E+01	491	1.584E+01	532	2.878E+01	573	3.305E+01
410	1.828E-01	451	5.519E+01	492	1.616E+01	533	2.893E+01	574	3.311E+01
411	2.072E-01	452	5.688E+01	493	1.652E+01	534	2.905E+01	575	3.322E+01
412	2.406E-01	453	5.771E+01	494	1.690E+01	535	2.916E+01	576	3.333E+01
413	2.912E-01	454	5.726E+01	495	1.729E+01	536	2.925E+01	577	3.341E+01
414	3.615E-01	455	5.577E+01	496	1.772E+01	537	2.932E+01	578	3.346E+01
415	4.359E-01	456	5.337E+01	497	1.818E+01	538	2.946E+01	579	3.349E+01
416	5.309E-01	457	5.021E+01	498	1.867E+01	539	2.958E+01	580	3.356E+01
417	6.370E-01	458	4.676E+01	499	1.917E+01	540	2.966E+01	581	3.365E+01
418	7.753E-01	459	4.338E+01	500	1.967E+01	541	2.975E+01	582	3.371E+01
419	9.443E-01	460	4.033E+01	501	2.014E+01	542	2.988E+01	583	3.374E+01
420	1.137E+00	461	3.744E+01	502	2.063E+01	543	3.005E+01	584	3.377E+01

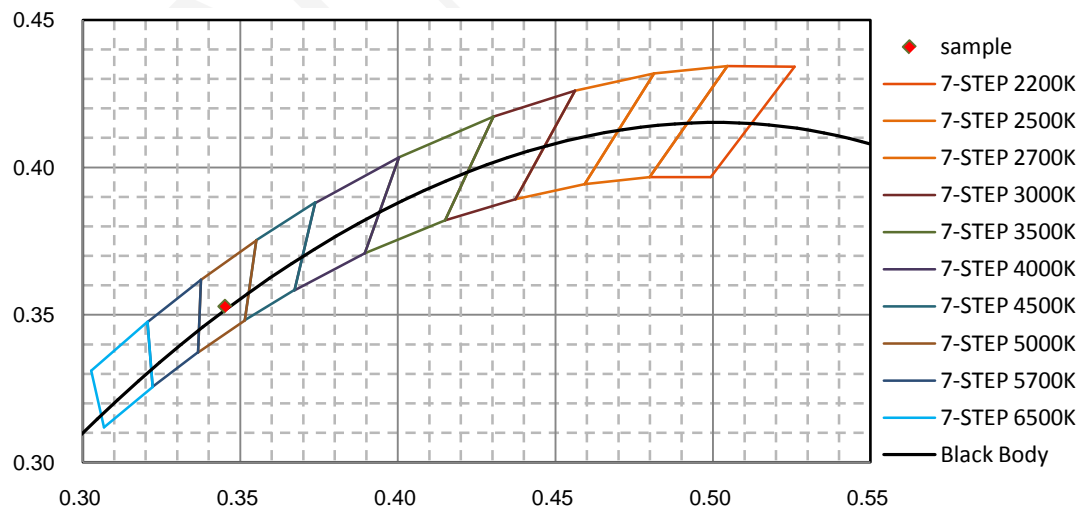


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.375E+01	626	2.551E+01	667	1.042E+01	708	2.640E+00	749	3.819E-01
586	3.373E+01	627	2.513E+01	668	1.012E+01	709	2.522E+00	750	4.123E-01
587	3.373E+01	628	2.474E+01	669	9.825E+00	710	2.389E+00	751	4.205E-01
588	3.371E+01	629	2.436E+01	670	9.549E+00	711	2.267E+00	752	3.944E-01
589	3.368E+01	630	2.398E+01	671	9.287E+00	712	2.200E+00	753	3.584E-01
590	3.365E+01	631	2.358E+01	672	9.012E+00	713	2.103E+00	754	3.133E-01
591	3.361E+01	632	2.318E+01	673	8.760E+00	714	1.960E+00	755	3.048E-01
592	3.356E+01	633	2.275E+01	674	8.520E+00	715	1.878E+00	756	3.124E-01
593	3.350E+01	634	2.235E+01	675	8.256E+00	716	1.807E+00	757	2.167E-01
594	3.345E+01	635	2.197E+01	676	8.007E+00	717	1.771E+00	758	1.447E-01
595	3.342E+01	636	2.158E+01	677	7.737E+00	718	1.717E+00	759	1.465E-01
596	3.334E+01	637	2.119E+01	678	7.482E+00	719	1.637E+00	760	1.540E-01
597	3.322E+01	638	2.079E+01	679	7.255E+00	720	1.549E+00	761	2.050E-01
598	3.310E+01	639	2.040E+01	680	7.045E+00	721	1.479E+00	762	2.030E-01
599	3.296E+01	640	2.001E+01	681	6.829E+00	722	1.432E+00	763	2.087E-01
600	3.284E+01	641	1.960E+01	682	6.633E+00	723	1.323E+00	764	1.496E-01
601	3.269E+01	642	1.920E+01	683	6.438E+00	724	1.277E+00	765	9.970E-02
602	3.250E+01	643	1.880E+01	684	6.195E+00	725	1.256E+00	766	1.007E-01
603	3.230E+01	644	1.840E+01	685	5.973E+00	726	1.183E+00	767	1.357E-01
604	3.214E+01	645	1.800E+01	686	5.808E+00	727	1.120E+00	768	1.423E-01
605	3.198E+01	646	1.762E+01	687	5.636E+00	728	1.102E+00	769	1.198E-01
606	3.178E+01	647	1.725E+01	688	5.427E+00	729	1.105E+00	770	1.037E-01
607	3.154E+01	648	1.687E+01	689	5.227E+00	730	1.056E+00	771	9.860E-02
608	3.131E+01	649	1.649E+01	690	5.072E+00	731	1.028E+00	772	1.091E-01
609	3.106E+01	650	1.610E+01	691	4.925E+00	732	9.522E-01	773	9.720E-02
610	3.077E+01	651	1.571E+01	692	4.767E+00	733	8.800E-01	774	9.370E-02
611	3.050E+01	652	1.534E+01	693	4.606E+00	734	8.553E-01	775	1.010E-01
612	3.026E+01	653	1.497E+01	694	4.439E+00	735	8.176E-01	776	8.490E-02
613	2.995E+01	654	1.462E+01	695	4.263E+00	736	7.631E-01	777	8.690E-02
614	2.963E+01	655	1.428E+01	696	4.117E+00	737	6.962E-01	778	6.970E-02
615	2.931E+01	656	1.393E+01	697	3.981E+00	738	6.568E-01	779	6.840E-02
616	2.900E+01	657	1.357E+01	698	3.830E+00	739	6.366E-01	780	8.220E-02
617	2.872E+01	658	1.323E+01	699	3.677E+00	740	6.414E-01		
618	2.842E+01	659	1.288E+01	700	3.551E+00	741	6.191E-01		
619	2.810E+01	660	1.254E+01	701	3.437E+00	742	5.797E-01		
620	2.774E+01	661	1.224E+01	702	3.300E+00	743	5.206E-01		
621	2.740E+01	662	1.193E+01	703	3.182E+00	744	4.735E-01		
622	2.704E+01	663	1.161E+01	704	3.055E+00	745	4.254E-01		
623	2.664E+01	664	1.130E+01	705	2.919E+00	746	3.870E-01		
624	2.626E+01	665	1.098E+01	706	2.814E+00	747	4.030E-01		
625	2.588E+01	666	1.069E+01	707	2.730E+00	748	3.908E-01		

### CIE 1931 x y Chromaticity Diagram



### 7-Step Chromaticity Quadrangles



## [Goniophotometer System]

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

Test orientation: **Downward**

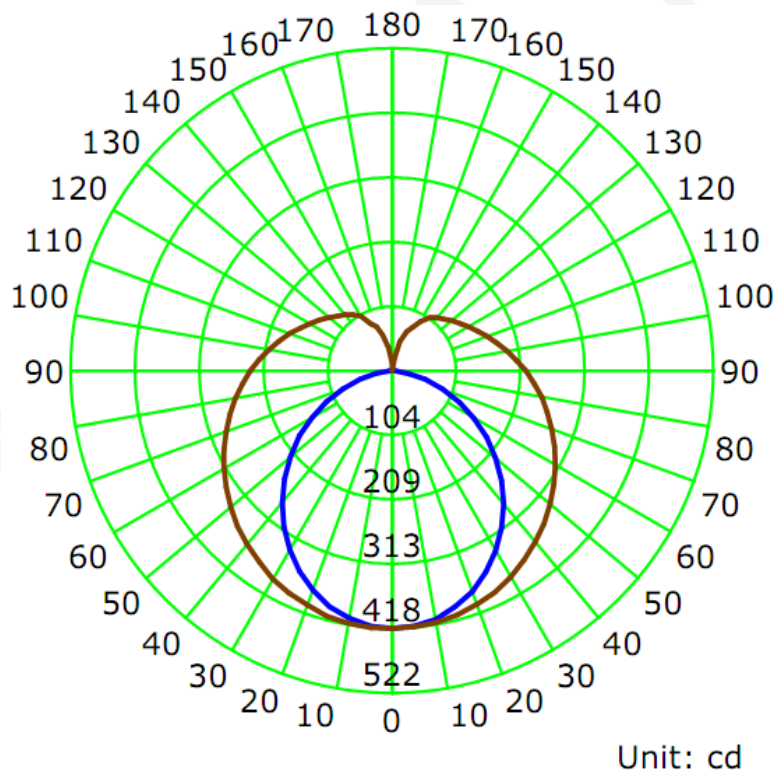
### Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1360	15.95	0.9800

### Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	$I_{max}$ (cd)	S/MH (C0/180)	S/MH (C90/270)
2130.8	133.64	418.1	1.20	1.39

### Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% $I_{max}$ ):	102.9	136.8	191.1	139.7	142.6
Field Angle (10% $I_{max}$ ):	154.9	327.0	335.7	321.2	284.7

### Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	418	418	418	418	418	418	418	418
5.0°	416	416	416	416	417	417	417	417
10.0°	409	410	412	412	414	414	412	410
15.0°	396	399	403	407	410	408	404	400
20.0°	381	384	392	398	402	400	393	385
25.0°	360	366	377	388	396	390	379	366
30.0°	338	344	360	376	386	379	362	346
35.0°	311	321	342	363	375	366	345	321
40.0°	282	294	321	348	363	353	326	296
45.0°	252	268	301	333	350	338	304	269
50.0°	220	240	281	318	336	322	285	241
55.0°	188	212	260	302	322	305	264	213
60.0°	154	184	240	286	307	289	244	186
65.0°	121	158	220	270	292	273	226	160
70.0°	88	133	201	253	277	257	206	135
75.0°	56	110	183	237	261	242	189	113
80.0°	28	92	168	223	247	225	172	94
85.0°	6	75	155	208	232	210	158	78
90.0°	0	64	142	194	218	195	144	67
95.0°	0	58	132	182	204	183	134	60
100.0°	0	54	123	171	190	170	124	56
105.0°	0	52	115	160	177	160	116	53
110.0°	0	52	108	149	165	149	109	53
115.0°	0	54	103	139	154	140	104	54
120.0°	0	57	99	131	144	131	99	57
125.0°	0	52	95	124	135	123	95	52
130.0°	0	50	92	117	127	116	92	50
135.0°	0	50	91	112	119	111	90	49
140.0°	0	50	86	107	113	104	81	47
145.0°	0	49	76	103	107	99	69	38
150.0°	0	46	70	87	93	80	57	28
155.0°	0	42	66	75	78	69	44	22
160.0°	3	36	60	67	68	49	26	13
165.0°	2	27	44	52	49	28	12	6
170.0°	0	12	26	30	21	12	2	0
175.0°	0	0	4	6	2	0	0	0
180.0°	0	0	0	0	0	0	0	0

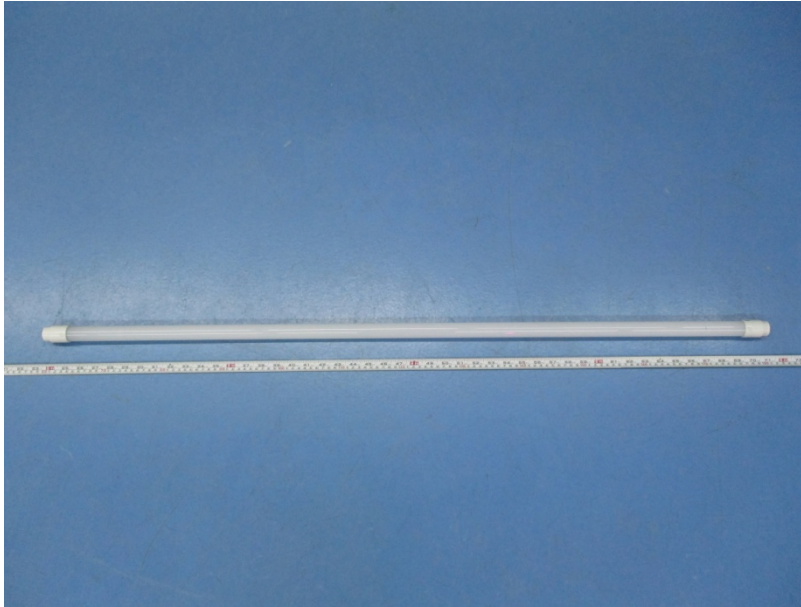
Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	418	418	418	418	418	418	418	418
5.0°	415	416	416	417	418	417	417	416
10.0°	407	410	412	414	415	413	412	410
15.0°	396	399	404	408	412	409	404	398
20.0°	379	383	393	399	405	401	393	383
25.0°	359	364	379	390	398	391	378	366
30.0°	335	343	362	379	389	380	362	344
35.0°	309	318	343	367	378	368	344	320
40.0°	278	293	323	352	368	354	326	295
45.0°	249	267	303	337	356	340	305	268
50.0°	217	240	284	322	343	325	286	240
55.0°	184	211	263	308	329	310	267	213
60.0°	151	183	243	293	316	295	247	186
65.0°	119	157	224	277	302	281	229	160
70.0°	86	131	205	261	288	264	211	136
75.0°	55	110	188	246	273	249	194	114
80.0°	27	91	172	230	260	232	179	96
85.0°	5	76	158	217	245	219	164	81
90.0°	0	64	146	205	231	207	153	70
95.0°	0	59	136	191	217	194	141	65
100.0°	0	55	128	179	203	182	133	61
105.0°	0	54	121	169	191	171	125	60
110.0°	0	54	114	159	178	160	118	59
115.0°	0	56	108	149	166	150	113	61
120.0°	0	58	103	139	155	140	108	63
125.0°	0	55	99	131	145	133	103	62
130.0°	0	54	96	124	136	126	101	59
135.0°	0	54	93	117	127	119	98	58
140.0°	0	52	89	111	119	113	94	57
145.0°	0	43	78	106	113	108	83	54
150.0°	0	31	69	92	103	93	76	47
155.0°	0	27	57	81	86	81	70	38
160.0°	0	19	47	70	76	73	60	31
165.0°	0	11	29	46	61	57	44	21
170.0°	0	5	17	26	39	37	26	11
175.0°	0	0	4	7	13	12	9	2
180.0°	0	0	0	0	0	0	0	0

### Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	10.0	0.47	0-5	10.0	0.47
5-10	29.6	1.39	0-10	39.6	1.86
10-15	48.4	2.27	0-15	88.0	4.13
15-20	65.5	3.08	0-20	153.5	7.20
20-25	80.7	3.79	0-25	234.2	10.99
25-30	93.6	4.39	0-30	327.8	15.38
30-35	103.8	4.87	0-35	431.6	20.25
35-40	111.2	5.22	0-40	542.8	25.47
40-45	115.8	5.44	0-45	658.6	30.91
45-50	117.9	5.53	0-50	776.5	36.44
50-55	117.5	5.52	0-55	894.0	41.96
55-60	114.9	5.39	0-60	1009.0	47.35
60-65	110.5	5.18	0-65	1119.4	52.53
65-70	104.4	4.90	0-70	1223.9	57.44
70-75	97.2	4.56	0-75	1321.1	62.00
75-80	89.6	4.20	0-80	1410.7	66.20
80-85	81.9	3.84	0-85	1492.6	70.05
85-90	75.0	3.52	0-90	1567.6	73.57
90-95	69.4	3.26	0-95	1637.0	76.83
95-100	64.3	3.02	0-100	1701.3	79.84
100-105	59.4	2.79	0-105	1760.7	82.63
105-110	54.7	2.57	0-110	1815.4	85.20
110-115	50.3	2.36	0-115	1865.7	87.56
115-120	46.1	2.16	0-120	1911.8	89.72
120-125	41.7	1.96	0-125	1953.5	91.68
125-130	37.3	1.75	0-130	1990.8	93.43
130-135	33.2	1.56	0-135	2024.0	94.99
135-140	29.1	1.36	0-140	2053.0	96.35
140-145	24.5	1.15	0-145	2077.5	97.50
145-150	19.3	0.91	0-150	2096.8	98.40
150-155	14.3	0.67	0-155	2111.1	99.08
155-160	10.0	0.47	0-160	2121.2	99.55
160-165	6.1	0.29	0-165	2127.3	99.83
165-170	2.8	0.13	0-170	2130.1	99.96
170-175	0.7	0.03	0-175	2130.8	100.00
175-180	0.0	0.00	0-180	2130.8	100.00

## 6. Product Photo



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