



# IES LM-79-08

## MEASUREMENT AND TEST REPORT

For

### GREEN CREATIVE LTD

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

**Test Model: 14.5T5HE/4F/830/BYP**

<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>	PKS180820082-10
<b>Test Date:</b>	2018-08-21 to 2018-08-23
<b>Report Date:</b>	2018-08-27
<b>Reviewed By:</b>	Ray Gao/EE Engineer <i>Ray 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 2018-08-20 and used for testing.

Model Tested: 14.5T5HE/4F/830/BYP  
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 60Hz  
Rated Power: 14.5W  
Nominal CCT: 3000K  
Nominal Lumen Output: 1750lm

## 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**

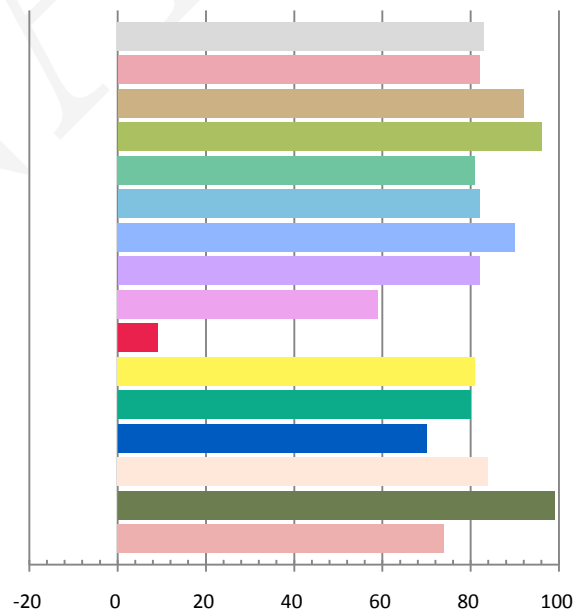
### Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1221	14.41	0.9834	1932.6	134.11

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.828	3039	0.00039	0.4347	0.4043	0.2491	0.5211

### Color Rendering Index

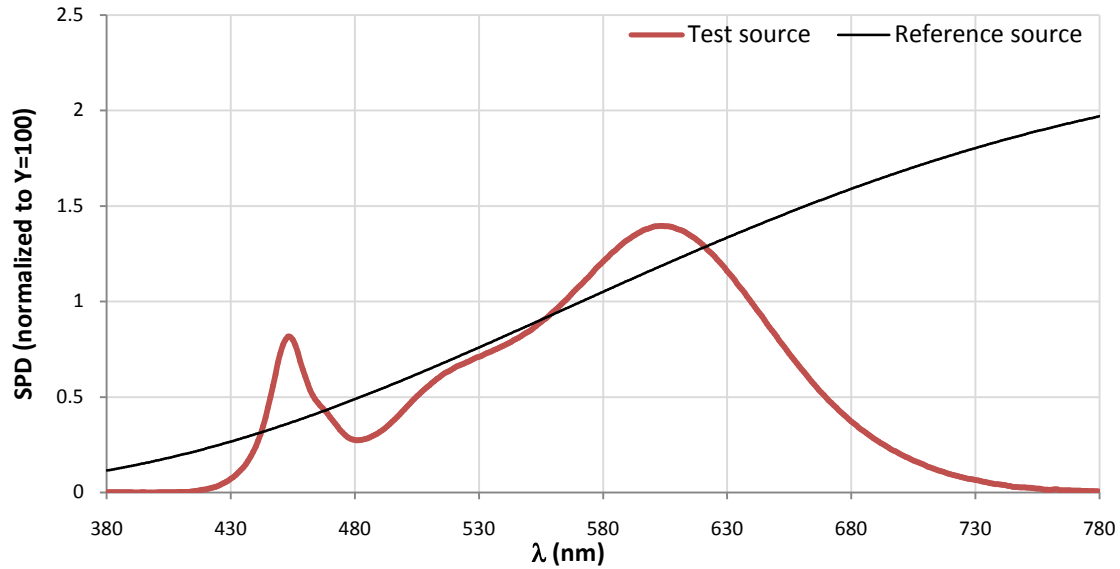
<b>Ra</b> <b>83.0</b>			
<b>R1</b> 82	<b>R2</b> 92	<b>R3</b> 96	<b>R4</b> 81
<b>R5</b> 82	<b>R6</b> 90	<b>R7</b> 82	<b>R8</b> 59
<b>R9</b> 9	<b>R10</b> 81	<b>R11</b> 80	<b>R12</b> 70
<b>R13</b> 84	<b>R14</b> 99	<b>R15</b> 74	



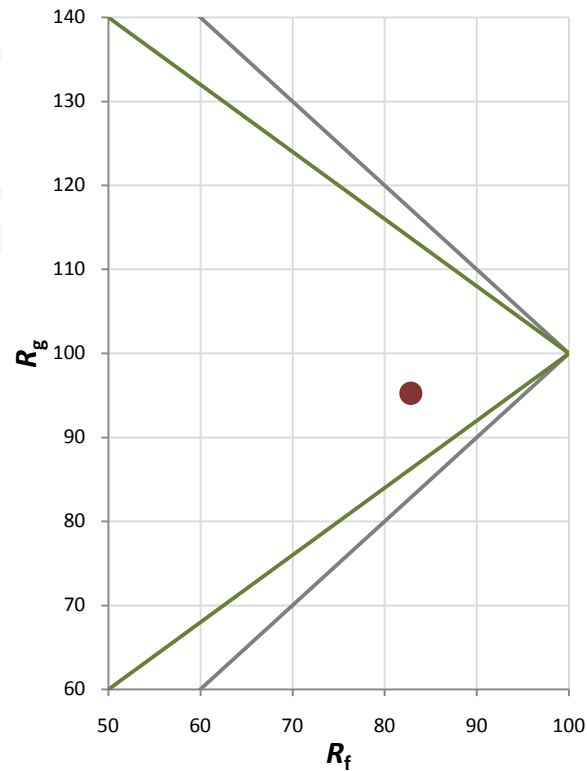
### Fidelity Index and Gamut Index

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

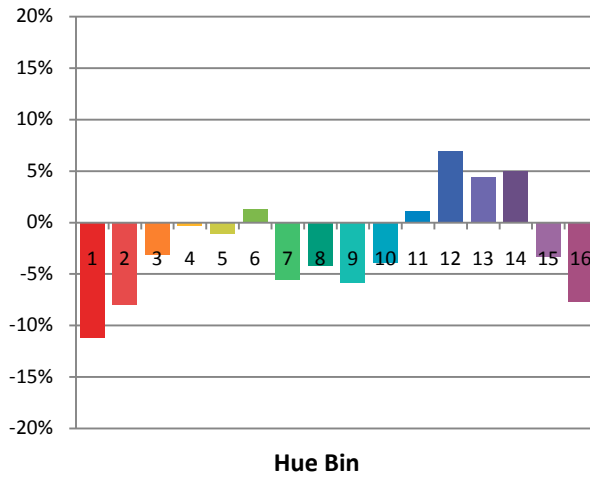
### Spectral Power Distribution Comparison



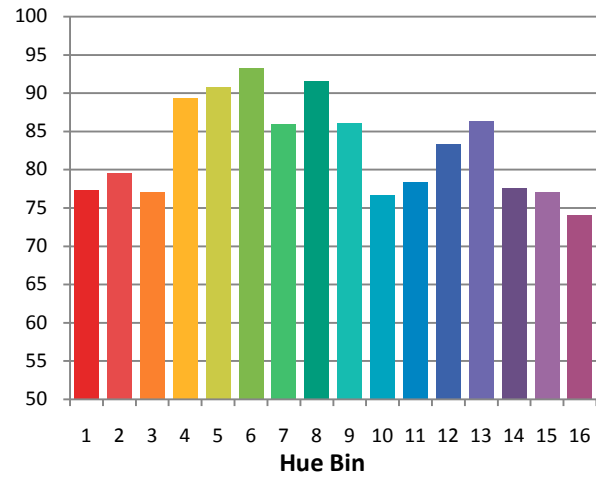
### Plot of $R_g$ versus $R_f$



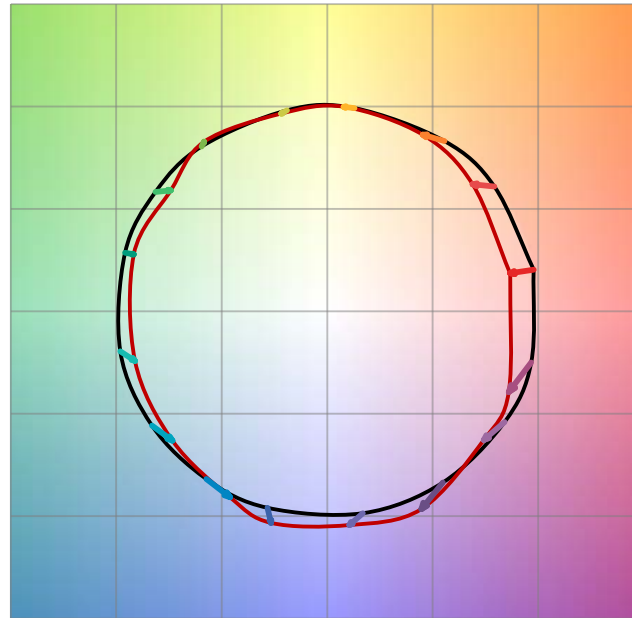
Chroma Shift by Hue



$R_t$  by Hue

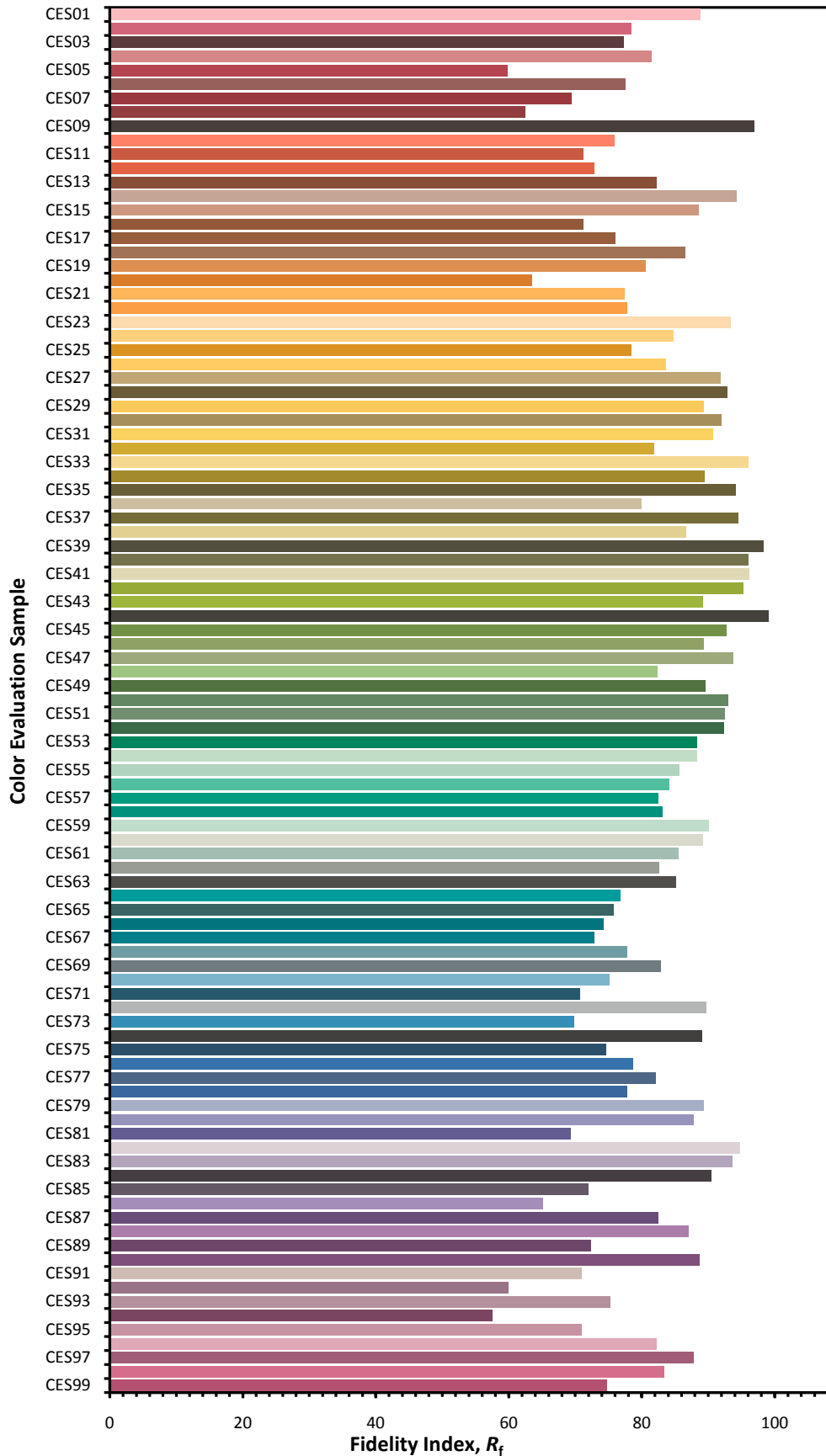


Color Vector Graphic

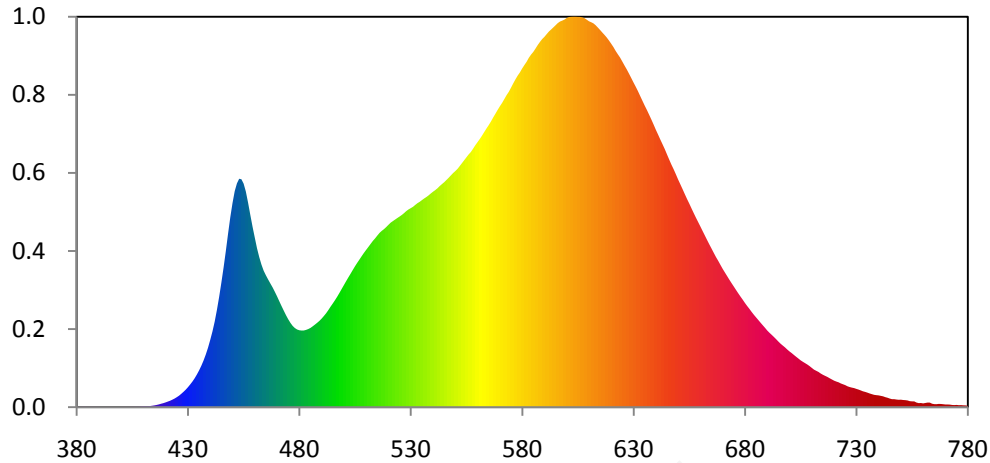


— Reference Illuminat — Test Source

### Color Fidelity by CES Sample



### Relative Spectral Power Distribution

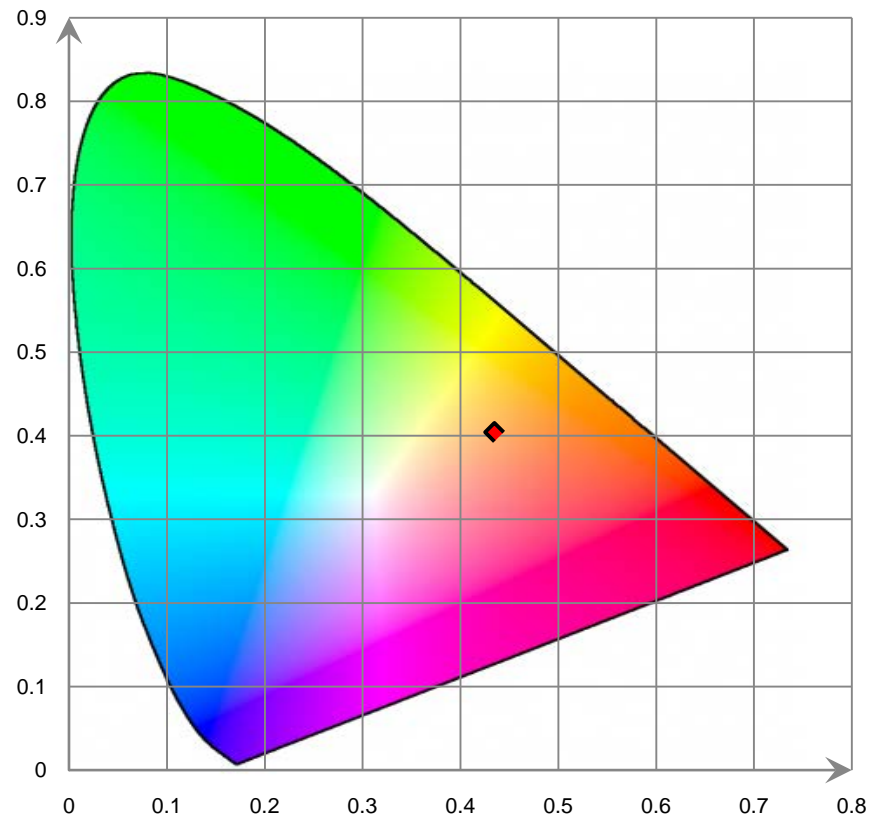


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	4.180E-02	421	5.681E-01	462	1.517E+01	503	1.349E+01	544	2.254E+01
381	3.270E-02	422	6.524E-01	463	1.441E+01	504	1.387E+01	545	2.274E+01
382	2.230E-02	423	7.582E-01	464	1.379E+01	505	1.424E+01	546	2.295E+01
383	3.770E-02	424	8.736E-01	465	1.333E+01	506	1.460E+01	547	2.318E+01
384	4.360E-02	425	1.009E+00	466	1.291E+01	507	1.493E+01	548	2.342E+01
385	3.140E-02	426	1.161E+00	467	1.250E+01	508	1.527E+01	549	2.366E+01
386	2.740E-02	427	1.348E+00	468	1.211E+01	509	1.559E+01	550	2.386E+01
387	3.220E-02	428	1.550E+00	469	1.167E+01	510	1.590E+01	551	2.408E+01
388	2.720E-02	429	1.770E+00	470	1.120E+01	511	1.620E+01	552	2.437E+01
389	3.400E-02	430	2.018E+00	471	1.071E+01	512	1.650E+01	553	2.467E+01
390	2.870E-02	431	2.292E+00	472	1.023E+01	513	1.680E+01	554	2.496E+01
391	1.400E-02	432	2.585E+00	473	9.763E+00	514	1.706E+01	555	2.526E+01
392	1.140E-02	433	2.918E+00	474	9.305E+00	515	1.734E+01	556	2.555E+01
393	1.850E-02	434	3.297E+00	475	8.891E+00	516	1.761E+01	557	2.579E+01
394	2.350E-02	435	3.715E+00	476	8.522E+00	517	1.782E+01	558	2.613E+01
395	2.570E-02	436	4.182E+00	477	8.215E+00	518	1.799E+01	559	2.648E+01
396	1.590E-02	437	4.713E+00	478	8.001E+00	519	1.820E+01	560	2.679E+01
397	8.300E-03	438	5.315E+00	479	7.851E+00	520	1.843E+01	561	2.711E+01
398	5.000E-03	439	5.998E+00	480	7.774E+00	521	1.865E+01	562	2.745E+01
399	2.600E-03	440	6.793E+00	481	7.746E+00	522	1.881E+01	563	2.781E+01
400	1.790E-02	441	7.646E+00	482	7.752E+00	523	1.897E+01	564	2.817E+01
401	2.910E-02	442	8.640E+00	483	7.809E+00	524	1.912E+01	565	2.851E+01
402	3.280E-02	443	9.818E+00	484	7.896E+00	525	1.927E+01	566	2.887E+01
403	2.840E-02	444	1.113E+01	485	8.011E+00	526	1.943E+01	567	2.928E+01
404	3.280E-02	445	1.258E+01	486	8.174E+00	527	1.961E+01	568	2.966E+01
405	3.650E-02	446	1.411E+01	487	8.346E+00	528	1.982E+01	569	3.004E+01
406	4.300E-02	447	1.576E+01	488	8.528E+00	529	1.999E+01	570	3.041E+01
407	4.690E-02	448	1.751E+01	489	8.721E+00	530	2.012E+01	571	3.075E+01
408	4.670E-02	449	1.918E+01	490	8.952E+00	531	2.025E+01	572	3.114E+01
409	8.400E-02	450	2.062E+01	491	9.211E+00	532	2.044E+01	573	3.153E+01
410	1.060E-01	451	2.183E+01	492	9.489E+00	533	2.062E+01	574	3.187E+01
411	9.910E-02	452	2.262E+01	493	9.806E+00	534	2.075E+01	575	3.229E+01
412	9.720E-02	453	2.309E+01	494	1.015E+01	535	2.092E+01	576	3.272E+01
413	1.133E-01	454	2.304E+01	495	1.048E+01	536	2.109E+01	577	3.313E+01
414	1.480E-01	455	2.259E+01	496	1.081E+01	537	2.123E+01	578	3.351E+01
415	1.857E-01	456	2.179E+01	497	1.117E+01	538	2.140E+01	579	3.384E+01
416	2.301E-01	457	2.067E+01	498	1.155E+01	539	2.160E+01	580	3.422E+01
417	2.832E-01	458	1.944E+01	499	1.194E+01	540	2.178E+01	581	3.457E+01
418	3.525E-01	459	1.824E+01	500	1.234E+01	541	2.194E+01	582	3.491E+01
419	4.103E-01	460	1.715E+01	501	1.273E+01	542	2.212E+01	583	3.531E+01
420	4.848E-01	461	1.607E+01	502	1.312E+01	543	2.235E+01	584	3.564E+01

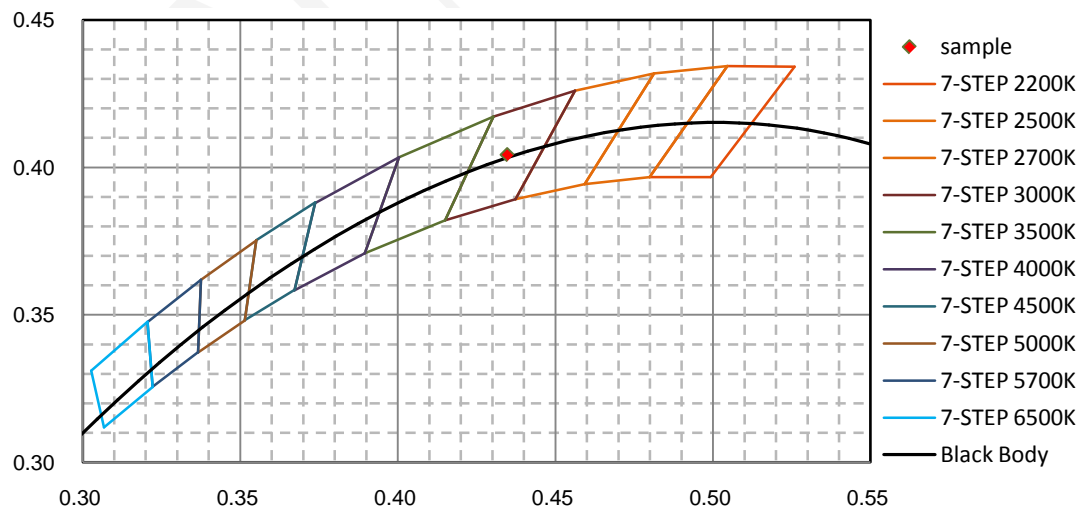


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.590E+01	626	3.452E+01	667	1.518E+01	708	4.313E+00	749	7.517E-01
586	3.624E+01	627	3.412E+01	668	1.479E+01	709	4.154E+00	750	7.587E-01
587	3.660E+01	628	3.370E+01	669	1.439E+01	710	3.973E+00	751	7.260E-01
588	3.692E+01	629	3.326E+01	670	1.399E+01	711	3.797E+00	752	7.086E-01
589	3.721E+01	630	3.281E+01	671	1.362E+01	712	3.676E+00	753	6.780E-01
590	3.743E+01	631	3.238E+01	672	1.326E+01	713	3.564E+00	754	6.077E-01
591	3.770E+01	632	3.193E+01	673	1.289E+01	714	3.406E+00	755	5.880E-01
592	3.796E+01	633	3.145E+01	674	1.254E+01	715	3.276E+00	756	5.833E-01
593	3.817E+01	634	3.097E+01	675	1.220E+01	716	3.166E+00	757	4.683E-01
594	3.838E+01	635	3.049E+01	676	1.185E+01	717	3.059E+00	758	4.097E-01
595	3.860E+01	636	3.004E+01	677	1.151E+01	718	2.929E+00	759	4.241E-01
596	3.882E+01	637	2.956E+01	678	1.118E+01	719	2.805E+00	760	3.826E-01
597	3.898E+01	638	2.908E+01	679	1.087E+01	720	2.683E+00	761	4.254E-01
598	3.907E+01	639	2.857E+01	680	1.054E+01	721	2.594E+00	762	4.656E-01
599	3.918E+01	640	2.805E+01	681	1.023E+01	722	2.519E+00	763	4.626E-01
600	3.934E+01	641	2.756E+01	682	9.939E+00	723	2.403E+00	764	3.514E-01
601	3.943E+01	642	2.706E+01	683	9.633E+00	724	2.318E+00	765	3.069E-01
602	3.945E+01	643	2.658E+01	684	9.344E+00	725	2.235E+00	766	3.051E-01
603	3.946E+01	644	2.610E+01	685	9.077E+00	726	2.116E+00	767	3.299E-01
604	3.946E+01	645	2.556E+01	686	8.814E+00	727	2.038E+00	768	3.237E-01
605	3.945E+01	646	2.503E+01	687	8.543E+00	728	1.979E+00	769	2.989E-01
606	3.945E+01	647	2.452E+01	688	8.285E+00	729	1.931E+00	770	2.732E-01
607	3.940E+01	648	2.405E+01	689	8.027E+00	730	1.851E+00	771	2.738E-01
608	3.932E+01	649	2.355E+01	690	7.755E+00	731	1.779E+00	772	2.614E-01
609	3.916E+01	650	2.302E+01	691	7.527E+00	732	1.693E+00	773	2.255E-01
610	3.901E+01	651	2.253E+01	692	7.318E+00	733	1.600E+00	774	2.146E-01
611	3.891E+01	652	2.204E+01	693	7.099E+00	734	1.542E+00	775	2.295E-01
612	3.879E+01	653	2.154E+01	694	6.875E+00	735	1.466E+00	776	2.022E-01
613	3.860E+01	654	2.105E+01	695	6.637E+00	736	1.386E+00	777	2.085E-01
614	3.836E+01	655	2.059E+01	696	6.418E+00	737	1.312E+00	778	1.899E-01
615	3.812E+01	656	2.010E+01	697	6.229E+00	738	1.247E+00	779	1.819E-01
616	3.787E+01	657	1.962E+01	698	6.042E+00	739	1.216E+00	780	1.456E-01
617	3.762E+01	658	1.916E+01	699	5.830E+00	740	1.193E+00		
618	3.735E+01	659	1.871E+01	700	5.634E+00	741	1.144E+00		
619	3.705E+01	660	1.827E+01	701	5.465E+00	742	1.098E+00		
620	3.673E+01	661	1.781E+01	702	5.274E+00	743	1.013E+00		
621	3.639E+01	662	1.736E+01	703	5.096E+00	744	9.555E-01		
622	3.600E+01	663	1.691E+01	704	4.918E+00	745	8.711E-01		
623	3.565E+01	664	1.647E+01	705	4.737E+00	746	8.105E-01		
624	3.532E+01	665	1.604E+01	706	4.588E+00	747	8.087E-01		
625	3.492E+01	666	1.560E+01	707	4.451E+00	748	7.744E-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**

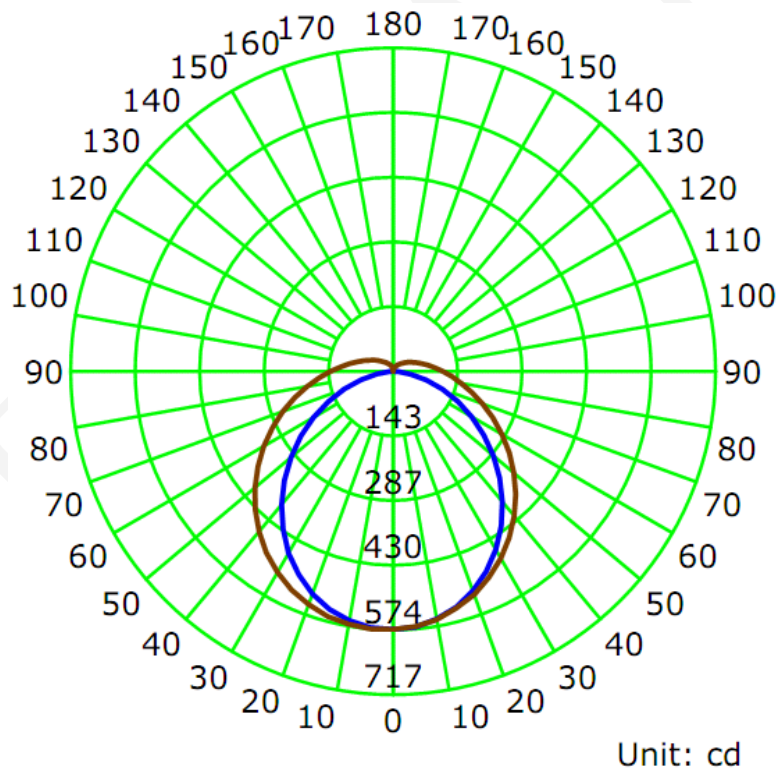
### Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1220	14.41	0.9840

### Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	$I_{max}$ (cd)	S/MH (C0/180)	S/MH (C90/270)
1936	134.40	574.0	1.20	1.29

### Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% $I_{max}$ ):	101.7	111.6	125.3	115.3	113.5
Field Angle (10% $I_{max}$ ):	155.0	193.6	225.3	202.9	194.2

### Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	573	573	573	573	573	573	573	573
5.0°	570	568	566	565	568	569	569	568
10.0°	558	555	556	555	559	558	560	559
15.0°	542	539	538	538	544	545	546	543
20.0°	519	515	515	520	527	526	525	523
25.0°	490	487	491	496	504	504	501	497
30.0°	457	454	458	469	479	478	473	466
35.0°	419	416	425	437	451	449	442	431
40.0°	378	376	388	403	419	417	407	391
45.0°	335	335	350	369	386	382	370	350
50.0°	292	293	310	332	351	346	332	307
55.0°	246	249	272	297	316	311	294	265
60.0°	202	207	234	260	280	276	257	224
65.0°	158	167	199	228	245	241	220	183
70.0°	117	129	165	195	212	208	186	147
75.0°	76	95	136	166	181	177	155	113
80.0°	41	66	110	140	154	150	128	84
85.0°	12	43	88	117	131	127	104	60
90.0°	0	26	69	97	111	105	84	42
95.0°	0	16	55	82	93	88	69	29
100.0°	0	10	44	68	79	74	55	21
105.0°	0	7	35	57	67	62	45	15
110.0°	0	5	28	47	57	52	36	12
115.0°	0	5	23	40	48	43	29	9
120.0°	0	4	19	33	41	36	24	8
125.0°	0	4	16	28	34	31	21	7
130.0°	0	4	13	24	29	26	17	7
135.0°	0	3	12	20	24	21	15	5
140.0°	0	3	11	18	20	18	13	5
145.0°	0	4	10	15	17	15	11	4
150.0°	0	4	9	14	14	13	8	3
155.0°	0	4	8	10	11	9	5	2
160.0°	0	3	6	8	8	6	4	2
165.0°	0	2	5	6	7	4	1	0
170.0°	0	0	3	4	3	0	0	0
175.0°	0	0	0	0	0	0	0	0
180.0°	0	0	0	0	0	0	0	0

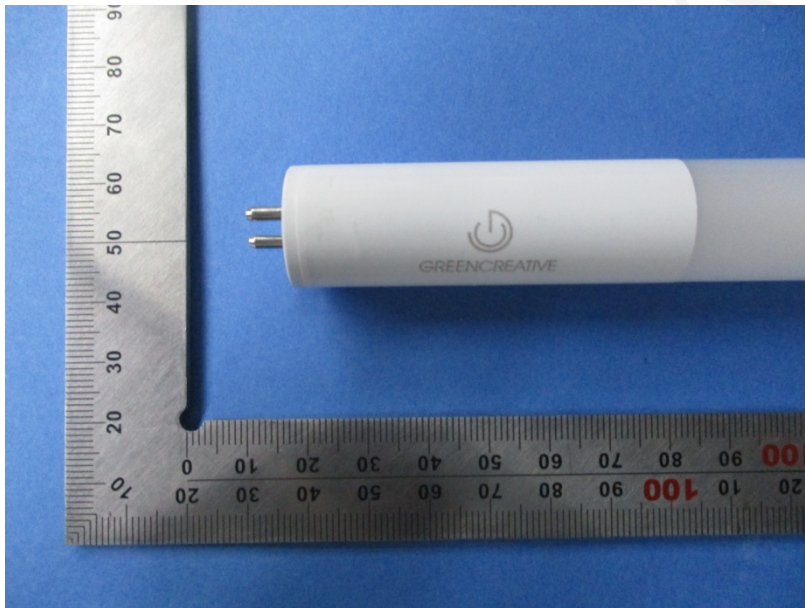
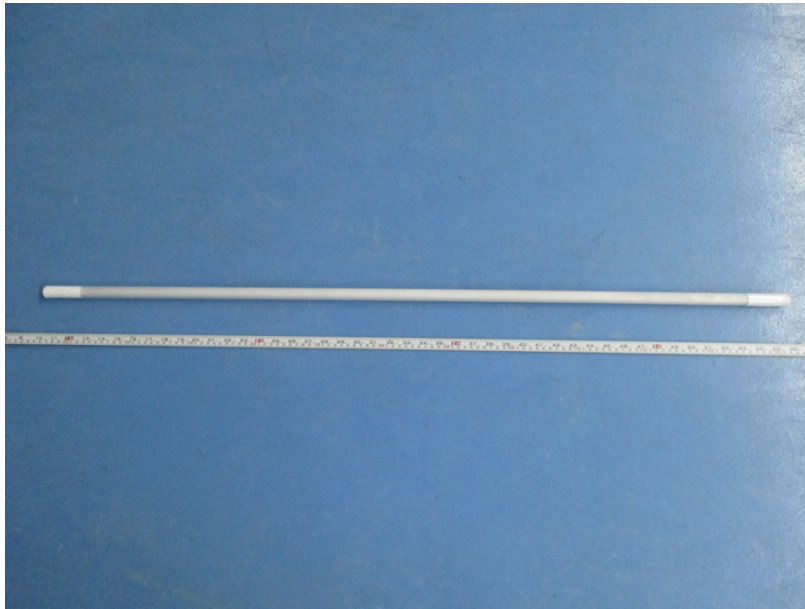
Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	573	573	573	573	573	573	573	573
5.0°	571	571	574	573	574	573	571	567
10.0°	562	565	568	569	570	569	565	559
15.0°	547	551	556	561	563	561	552	542
20.0°	526	532	542	547	550	547	536	522
25.0°	498	507	521	532	535	529	514	495
30.0°	466	476	495	509	515	508	490	465
35.0°	427	440	465	484	492	481	460	431
40.0°	386	402	430	453	464	453	428	393
45.0°	342	361	393	422	434	420	392	354
50.0°	297	317	354	387	401	388	356	312
55.0°	251	273	316	350	368	352	319	271
60.0°	205	229	275	313	333	317	281	229
65.0°	159	186	237	277	296	280	245	190
70.0°	116	144	200	241	262	244	208	154
75.0°	75	107	166	207	227	210	176	121
80.0°	38	76	135	175	194	179	146	91
85.0°	10	50	108	149	165	152	120	68
90.0°	0	32	87	125	139	129	99	49
95.0°	0	20	70	103	117	108	80	36
100.0°	0	13	56	86	99	90	66	27
105.0°	0	10	45	72	83	75	54	20
110.0°	0	8	36	61	70	64	45	16
115.0°	0	6	30	50	59	54	37	13
120.0°	0	6	24	42	50	45	31	12
125.0°	0	6	20	35	42	39	27	10
130.0°	0	5	18	30	35	32	22	9
135.0°	0	5	16	26	30	27	19	9
140.0°	0	4	14	21	26	23	17	8
145.0°	0	3	12	18	22	20	15	7
150.0°	0	3	10	16	18	17	13	7
155.0°	0	2	7	13	16	14	11	6
160.0°	0	1	6	10	12	11	9	5
165.0°	0	0	4	6	9	9	7	4
170.0°	0	0	2	4	6	6	4	0
175.0°	0	0	0	0	0	0	0	0
180.0°	0	0	0	0	0	0	0	0

### Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	13.7	0.71	0-5	13.7	0.71
5-10	40.5	2.09	0-10	54.1	2.80
10-15	65.8	3.40	0-15	120.0	6.20
15-20	88.8	4.59	0-20	208.8	10.78
20-25	108.6	5.61	0-25	317.4	16.40
25-30	124.6	6.44	0-30	442.1	22.83
30-35	136.3	7.04	0-35	578.3	29.87
35-40	143.3	7.40	0-40	721.6	37.27
40-45	145.6	7.52	0-45	867.2	44.79
45-50	143.6	7.42	0-50	1010.8	52.21
50-55	137.6	7.11	0-55	1148.4	59.32
55-60	128.1	6.62	0-60	1276.5	65.94
60-65	116.0	5.99	0-65	1392.5	71.93
65-70	101.9	5.26	0-70	1494.4	77.19
70-75	86.8	4.49	0-75	1581.3	81.68
75-80	71.8	3.71	0-80	1653.1	85.39
80-85	57.9	2.99	0-85	1711.0	88.38
85-90	46.1	2.38	0-90	1757.1	90.76
90-95	37.0	1.91	0-95	1794.0	92.67
95-100	29.8	1.54	0-100	1823.8	94.21
100-105	24.0	1.24	0-105	1847.8	95.45
105-110	19.3	1.00	0-110	1867.1	96.44
110-115	15.5	0.80	0-115	1882.6	97.24
115-120	12.5	0.64	0-120	1895.1	97.89
120-125	10.0	0.52	0-125	1905.1	98.40
125-130	8.0	0.41	0-130	1913.1	98.82
130-135	6.3	0.33	0-135	1919.5	99.15
135-140	5.0	0.26	0-140	1924.5	99.41
140-145	3.9	0.20	0-145	1928.4	99.61
145-150	2.9	0.15	0-150	1931.3	99.76
150-155	2.1	0.11	0-155	1933.4	99.87
155-160	1.4	0.07	0-160	1934.8	99.94
160-165	0.8	0.04	0-165	1935.6	99.98
165-170	0.4	0.02	0-170	1935.9	100.00
170-175	0.1	0.00	0-175	1936.0	100.00
175-180	0.0	0.00	0-180	1936.0	100.00

## 6. Product Photo



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