



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/840/BYP

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
Test Engineer:	George Yang <i>George Yang</i>
Report Number:	PKS180820082-10-4
Test Date:	2018-08-21 to 2018-08-23
Report Date:	2018-08-27
Reviewed By:	Ray Gao/EE Engineer <i>Ray Gao</i>
Prepared By:	Bay Area Compliance Laboratories Corp. (Kunshan). No.248 Chenghu Road, Kunshan, Jiangsu province, China. Tel: +86-0512-86175000 Fax: +86-0512-88934268
Test Facility:	Test facility was located at No.248 Chenghu Road, Kunshan, Jiangsu province, China.
Accreditation:	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/840/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: 4000K
 Nominal Lumen Output: 2000lm

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.

4π 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 (γ) 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**

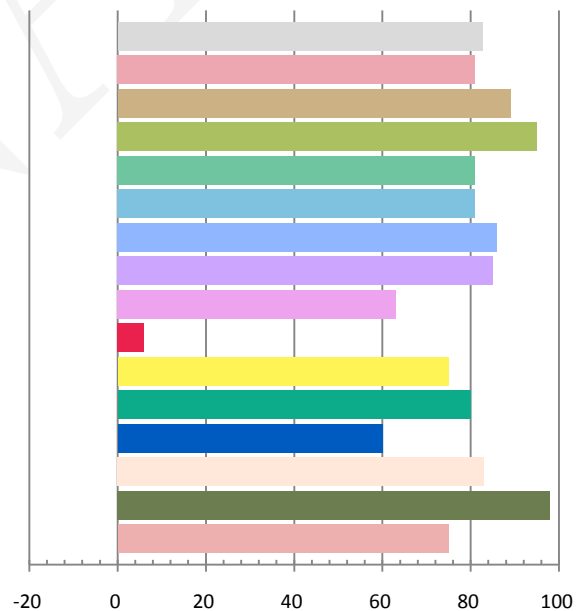
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1221	14.38	0.9812	2000.6	139.12

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.963	3932	0.00138	0.3845	0.3822	0.2256	0.5046

Color Rendering Index

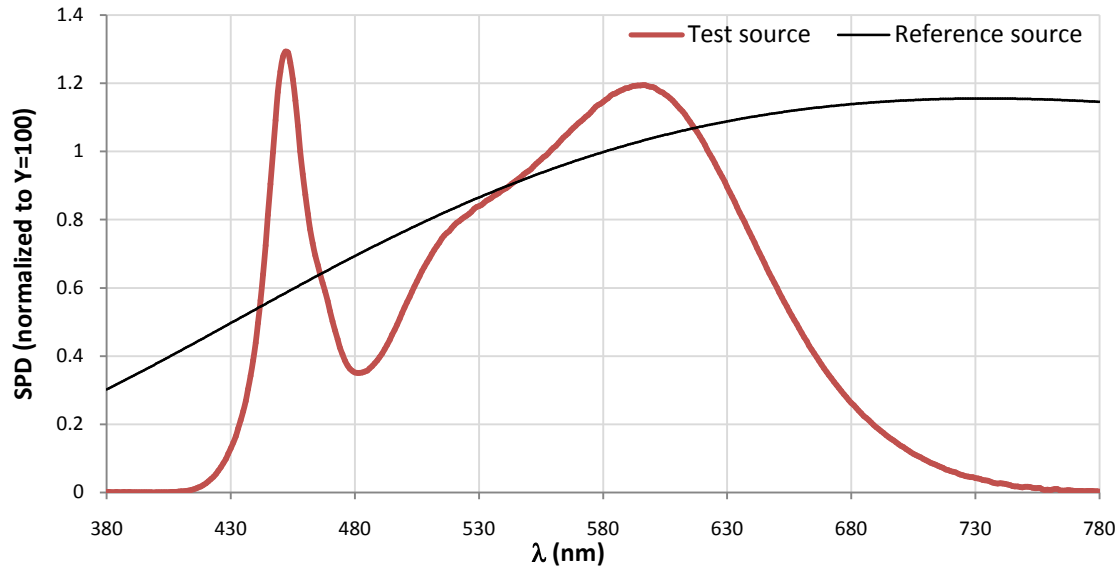
Ra 82.7			
R1 81	R2 89	R3 95	R4 81
R5 81	R6 86	R7 85	R8 63
R9 6	R10 75	R11 80	R12 60
R13 83	R14 98	R15 75	



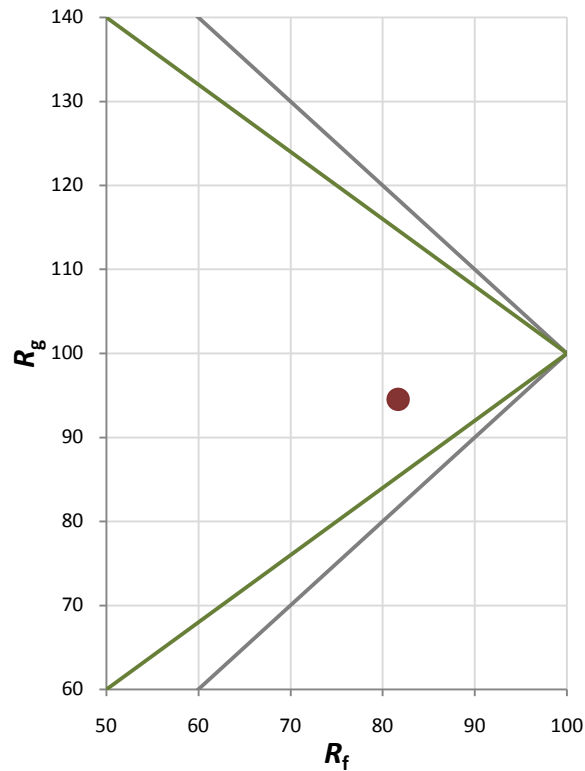
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	95

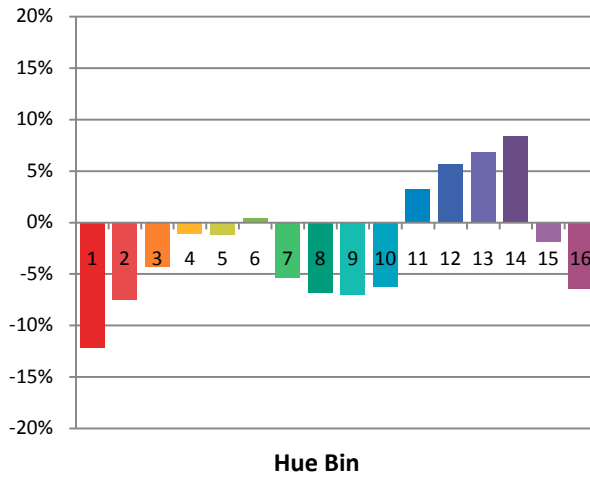
Spectral Power Distribution Comparison



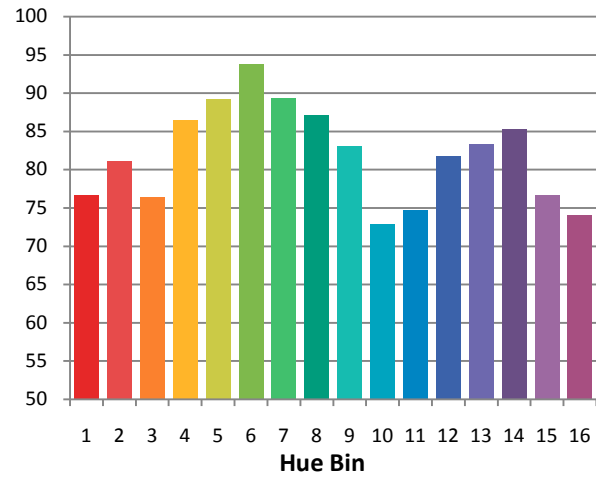
Plot of R_g versus R_f



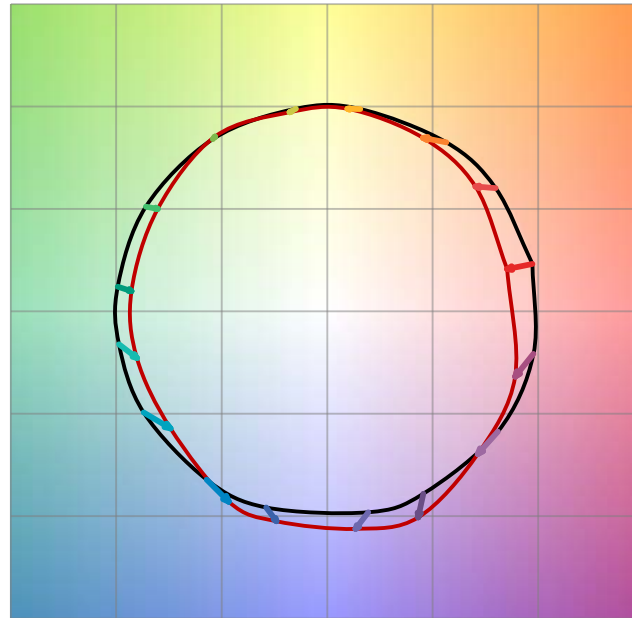
Chroma Shift by Hue



R_t by Hue

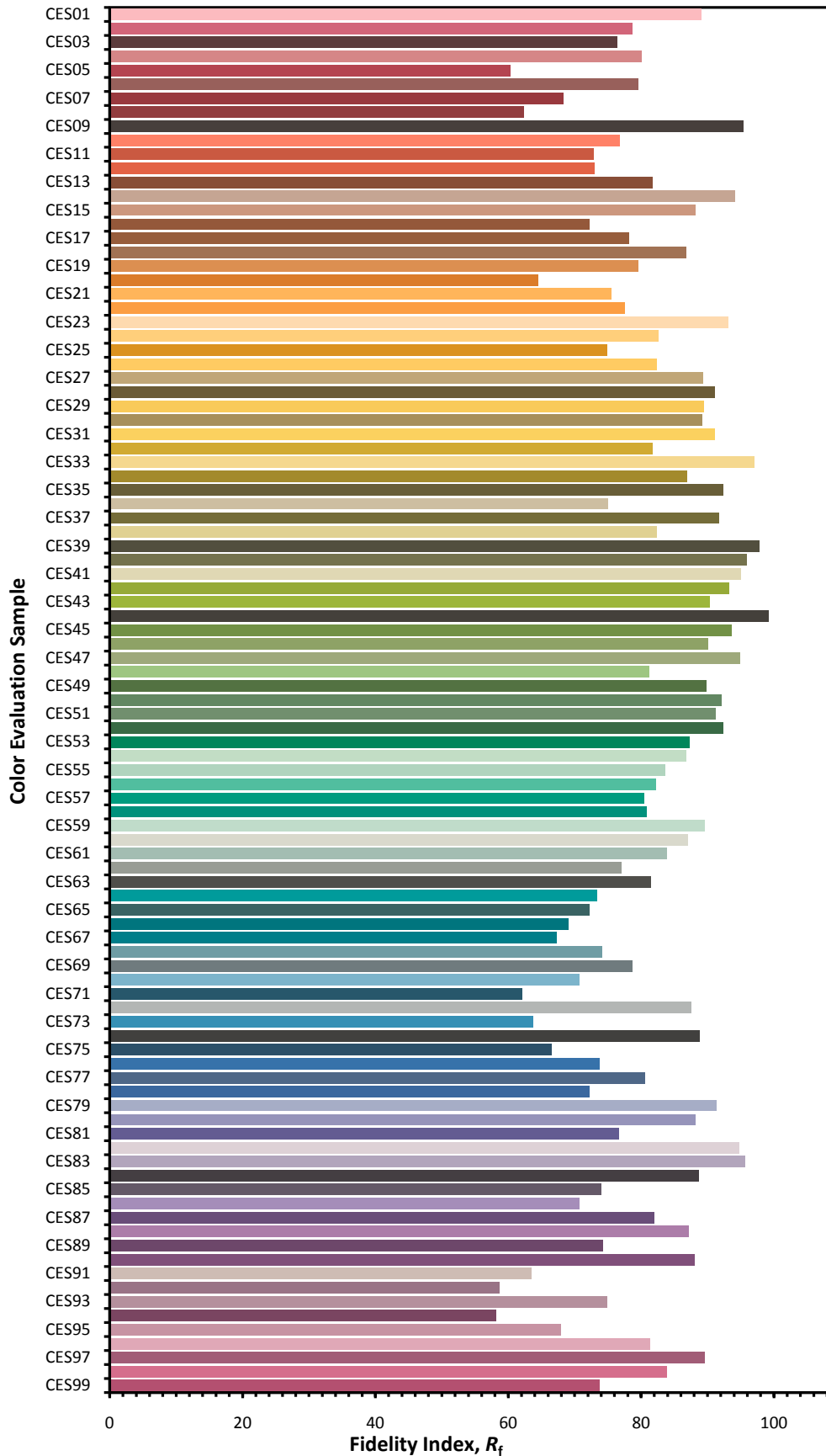


Color Vector Graphic

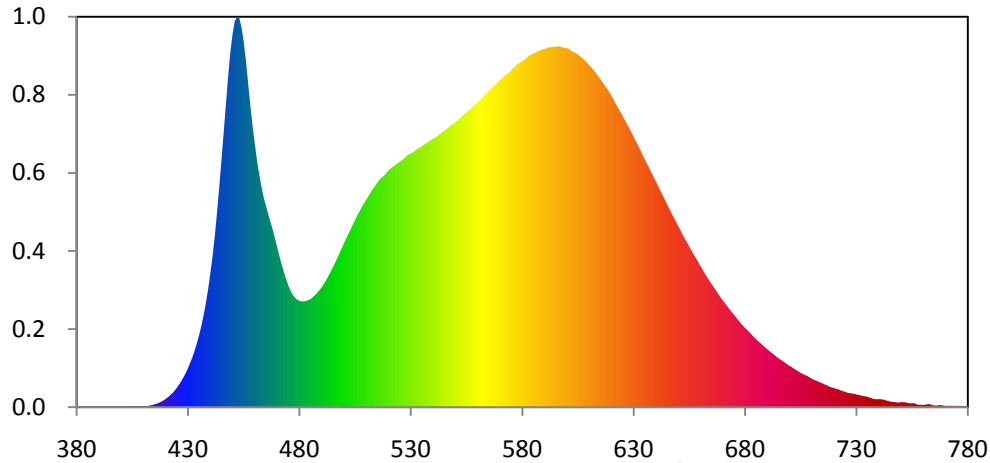


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



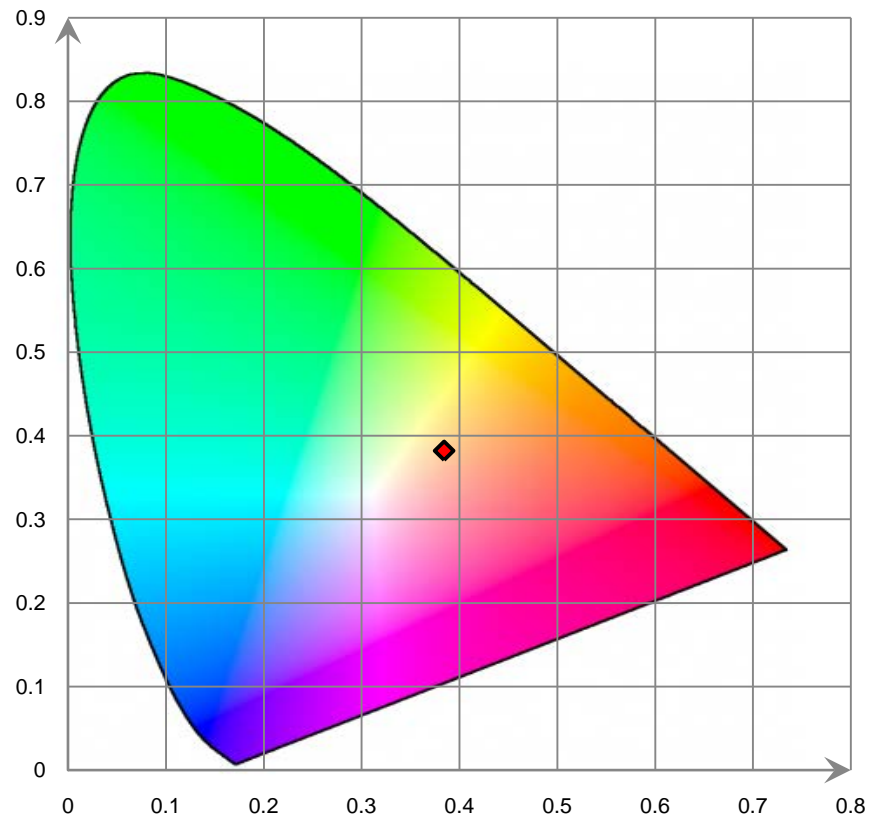
Relative Spectral Power Distribution



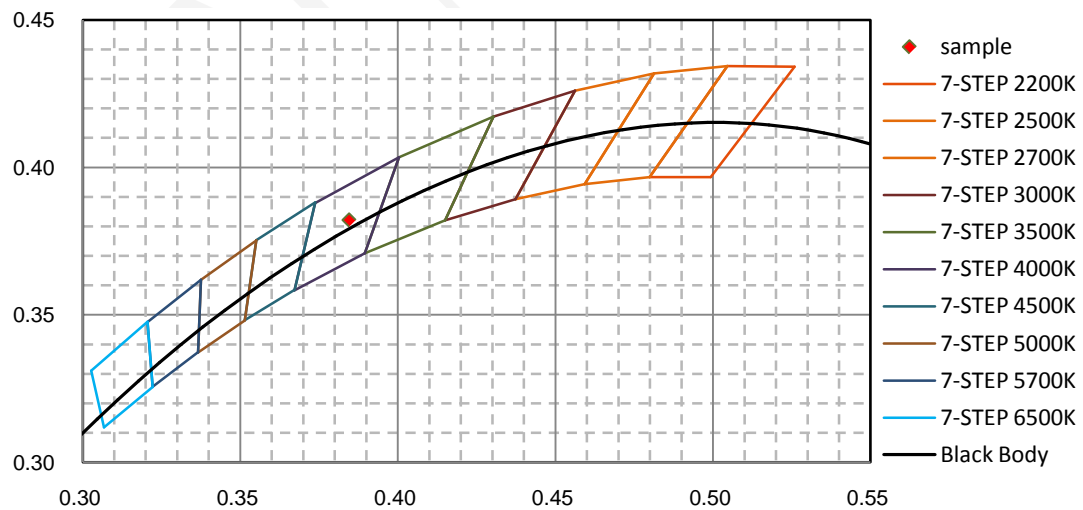
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	5.490E-02	421	9.704E-01	462	2.259E+01	503	1.724E+01	544	2.663E+01
381	4.660E-02	422	1.148E+00	463	2.140E+01	504	1.769E+01	545	2.679E+01
382	3.740E-02	423	1.357E+00	464	2.036E+01	505	1.814E+01	546	2.696E+01
383	3.700E-02	424	1.599E+00	465	1.954E+01	506	1.858E+01	547	2.712E+01
384	4.530E-02	425	1.876E+00	466	1.876E+01	507	1.898E+01	548	2.731E+01
385	3.500E-02	426	2.180E+00	467	1.800E+01	508	1.938E+01	549	2.749E+01
386	3.910E-02	427	2.522E+00	468	1.726E+01	509	1.976E+01	550	2.763E+01
387	4.130E-02	428	2.897E+00	469	1.642E+01	510	2.011E+01	551	2.779E+01
388	3.530E-02	429	3.313E+00	470	1.557E+01	511	2.047E+01	552	2.800E+01
389	4.080E-02	430	3.779E+00	471	1.470E+01	512	2.082E+01	553	2.821E+01
390	3.620E-02	431	4.283E+00	472	1.390E+01	513	2.116E+01	554	2.840E+01
391	2.170E-02	432	4.835E+00	473	1.316E+01	514	2.145E+01	555	2.860E+01
392	1.650E-02	433	5.481E+00	474	1.246E+01	515	2.178E+01	556	2.880E+01
393	1.800E-02	434	6.199E+00	475	1.186E+01	516	2.208E+01	557	2.894E+01
394	2.250E-02	435	6.969E+00	476	1.133E+01	517	2.227E+01	558	2.915E+01
395	1.970E-02	436	7.850E+00	477	1.091E+01	518	2.244E+01	559	2.940E+01
396	1.990E-02	437	8.879E+00	478	1.064E+01	519	2.269E+01	560	2.959E+01
397	1.720E-02	438	1.002E+01	479	1.043E+01	520	2.294E+01	561	2.977E+01
398	1.200E-02	439	1.134E+01	480	1.031E+01	521	2.316E+01	562	3.001E+01
399	5.600E-03	440	1.287E+01	481	1.026E+01	522	2.331E+01	563	3.026E+01
400	1.690E-02	441	1.453E+01	482	1.027E+01	523	2.348E+01	564	3.047E+01
401	2.020E-02	442	1.648E+01	483	1.031E+01	524	2.363E+01	565	3.066E+01
402	1.790E-02	443	1.873E+01	484	1.038E+01	525	2.378E+01	566	3.087E+01
403	2.050E-02	444	2.121E+01	485	1.048E+01	526	2.393E+01	567	3.111E+01
404	2.600E-02	445	2.383E+01	486	1.066E+01	527	2.411E+01	568	3.130E+01
405	3.120E-02	446	2.649E+01	487	1.086E+01	528	2.434E+01	569	3.150E+01
406	4.320E-02	447	2.921E+01	488	1.110E+01	529	2.450E+01	570	3.171E+01
407	4.810E-02	448	3.196E+01	489	1.134E+01	530	2.459E+01	571	3.188E+01
408	4.560E-02	449	3.438E+01	490	1.162E+01	531	2.471E+01	572	3.208E+01
409	8.220E-02	450	3.614E+01	491	1.194E+01	532	2.488E+01	573	3.227E+01
410	1.061E-01	451	3.741E+01	492	1.231E+01	533	2.505E+01	574	3.241E+01
411	1.119E-01	452	3.786E+01	493	1.270E+01	534	2.516E+01	575	3.264E+01
412	1.238E-01	453	3.777E+01	494	1.311E+01	535	2.531E+01	576	3.289E+01
413	1.642E-01	454	3.690E+01	495	1.353E+01	536	2.547E+01	577	3.311E+01
414	2.105E-01	455	3.551E+01	496	1.397E+01	537	2.559E+01	578	3.327E+01
415	2.741E-01	456	3.366E+01	497	1.443E+01	538	2.573E+01	579	3.339E+01
416	3.443E-01	457	3.148E+01	498	1.492E+01	539	2.590E+01	580	3.354E+01
417	4.269E-01	458	2.930E+01	499	1.539E+01	540	2.602E+01	581	3.371E+01
418	5.336E-01	459	2.733E+01	500	1.587E+01	541	2.614E+01	582	3.387E+01
419	6.498E-01	460	2.559E+01	501	1.634E+01	542	2.630E+01	583	3.407E+01
420	8.003E-01	461	2.395E+01	502	1.680E+01	543	2.649E+01	584	3.421E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.427E+01	626	2.789E+01	667	1.131E+01	708	3.021E+00	749	4.374E-01
586	3.439E+01	627	2.749E+01	668	1.099E+01	709	2.890E+00	750	4.822E-01
587	3.451E+01	628	2.709E+01	669	1.067E+01	710	2.762E+00	751	4.906E-01
588	3.460E+01	629	2.667E+01	670	1.037E+01	711	2.652E+00	752	4.690E-01
589	3.471E+01	630	2.623E+01	671	1.009E+01	712	2.566E+00	753	4.241E-01
590	3.473E+01	631	2.581E+01	672	9.806E+00	713	2.477E+00	754	3.751E-01
591	3.482E+01	632	2.539E+01	673	9.516E+00	714	2.377E+00	755	3.835E-01
592	3.490E+01	633	2.495E+01	674	9.242E+00	715	2.289E+00	756	3.954E-01
593	3.491E+01	634	2.451E+01	675	8.984E+00	716	2.185E+00	757	2.722E-01
594	3.494E+01	635	2.405E+01	676	8.708E+00	717	2.102E+00	758	2.304E-01
595	3.496E+01	636	2.363E+01	677	8.434E+00	718	1.989E+00	759	2.382E-01
596	3.499E+01	637	2.321E+01	678	8.180E+00	719	1.917E+00	760	2.105E-01
597	3.498E+01	638	2.277E+01	679	7.927E+00	720	1.852E+00	761	2.465E-01
598	3.490E+01	639	2.235E+01	680	7.702E+00	721	1.777E+00	762	2.881E-01
599	3.484E+01	640	2.191E+01	681	7.489E+00	722	1.729E+00	763	2.950E-01
600	3.482E+01	641	2.146E+01	682	7.265E+00	723	1.623E+00	764	1.988E-01
601	3.473E+01	642	2.102E+01	683	7.044E+00	724	1.550E+00	765	1.647E-01
602	3.457E+01	643	2.059E+01	684	6.804E+00	725	1.494E+00	766	1.619E-01
603	3.444E+01	644	2.015E+01	685	6.579E+00	726	1.402E+00	767	2.019E-01
604	3.434E+01	645	1.970E+01	686	6.390E+00	727	1.363E+00	768	1.983E-01
605	3.419E+01	646	1.927E+01	687	6.214E+00	728	1.330E+00	769	1.610E-01
606	3.403E+01	647	1.883E+01	688	6.009E+00	729	1.304E+00	770	1.335E-01
607	3.386E+01	648	1.842E+01	689	5.803E+00	730	1.235E+00	771	1.263E-01
608	3.365E+01	649	1.801E+01	690	5.615E+00	731	1.194E+00	772	1.377E-01
609	3.342E+01	650	1.759E+01	691	5.451E+00	732	1.140E+00	773	1.320E-01
610	3.318E+01	651	1.717E+01	692	5.271E+00	733	1.079E+00	774	1.186E-01
611	3.296E+01	652	1.675E+01	693	5.097E+00	734	1.056E+00	775	1.361E-01
612	3.273E+01	653	1.636E+01	694	4.926E+00	735	1.003E+00	776	1.257E-01
613	3.245E+01	654	1.597E+01	695	4.753E+00	736	9.230E-01	777	1.241E-01
614	3.214E+01	655	1.558E+01	696	4.605E+00	737	8.501E-01	778	1.023E-01
615	3.184E+01	656	1.520E+01	697	4.473E+00	738	7.904E-01	779	1.010E-01
616	3.152E+01	657	1.482E+01	698	4.317E+00	739	7.681E-01	780	9.330E-02
617	3.123E+01	658	1.445E+01	699	4.146E+00	740	7.855E-01		
618	3.094E+01	659	1.408E+01	700	4.013E+00	741	7.722E-01		
619	3.059E+01	660	1.371E+01	701	3.895E+00	742	7.454E-01		
620	3.022E+01	661	1.334E+01	702	3.731E+00	743	6.793E-01		
621	2.985E+01	662	1.298E+01	703	3.595E+00	744	6.207E-01		
622	2.943E+01	663	1.262E+01	704	3.464E+00	745	5.554E-01		
623	2.905E+01	664	1.227E+01	705	3.331E+00	746	5.216E-01		
624	2.867E+01	665	1.195E+01	706	3.210E+00	747	5.091E-01		
625	2.827E+01	666	1.164E+01	707	3.115E+00	748	4.643E-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**

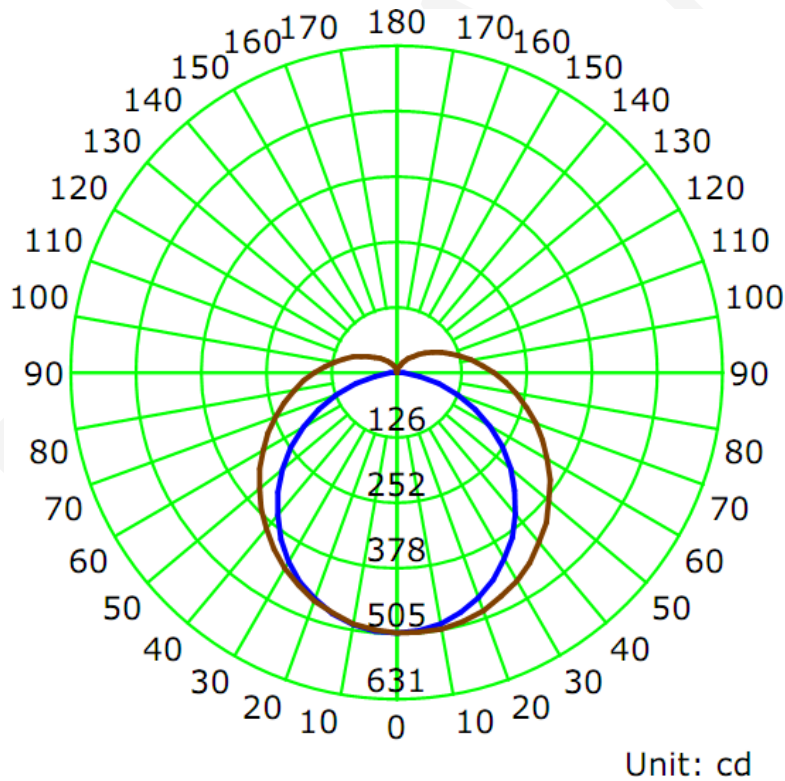
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1220	14.39	0.9830

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
2002.3	139.20	505.1	1.24	1.33

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	109.6	123.3	146.6	128.2	126.9
Field Angle (10% I _{max}):	158.6	216.0	258.9	228.6	215.5

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	504	504	504	504	504	504	504	504
5.0°	501	502	503	503	504	504	505	504
10.0°	493	496	497	500	503	503	500	499
15.0°	480	485	489	493	498	496	492	489
20.0°	464	469	477	482	490	488	482	473
25.0°	442	449	460	471	478	476	467	456
30.0°	417	427	440	454	466	461	449	433
35.0°	390	400	417	434	448	444	428	408
40.0°	358	371	391	413	429	423	405	380
45.0°	324	338	363	389	409	400	380	348
50.0°	288	304	335	365	385	377	351	315
55.0°	249	268	303	340	362	352	322	280
60.0°	209	231	273	314	337	326	292	245
65.0°	168	193	243	287	312	300	263	209
70.0°	125	156	213	260	287	274	234	174
75.0°	84	121	183	234	261	249	205	141
80.0°	45	88	156	211	235	223	178	111
85.0°	14	61	132	186	212	200	154	84
90.0°	0	42	110	164	189	175	131	63
95.0°	0	28	91	144	167	154	112	47
100.0°	0	19	76	125	147	134	93	36
105.0°	0	14	63	107	127	116	78	27
110.0°	0	11	52	91	110	99	65	21
115.0°	0	10	43	77	94	84	54	17
120.0°	0	9	36	65	80	71	45	14
125.0°	0	7	29	55	67	58	38	13
130.0°	0	7	25	45	55	49	31	12
135.0°	0	7	21	37	46	40	26	10
140.0°	0	7	19	31	37	32	21	9
145.0°	0	7	16	26	29	26	17	7
150.0°	0	7	14	22	23	20	13	6
155.0°	0	7	12	17	18	15	8	4
160.0°	0	6	11	13	14	10	6	2
165.0°	0	3	8	10	9	6	0	0
170.0°	0	0	4	6	4	0	0	0
175.0°	0	0	0	0	0	0	0	0
180.0°	0	0	0	0	0	0	0	0

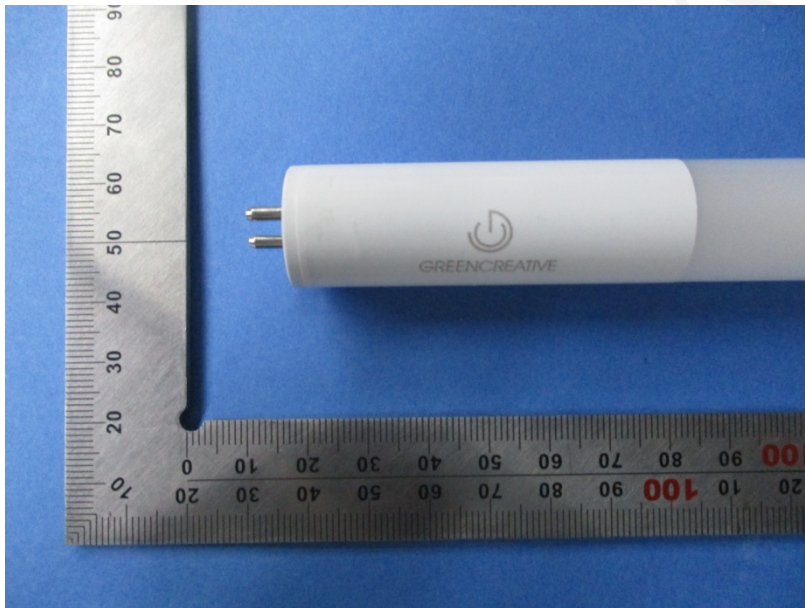
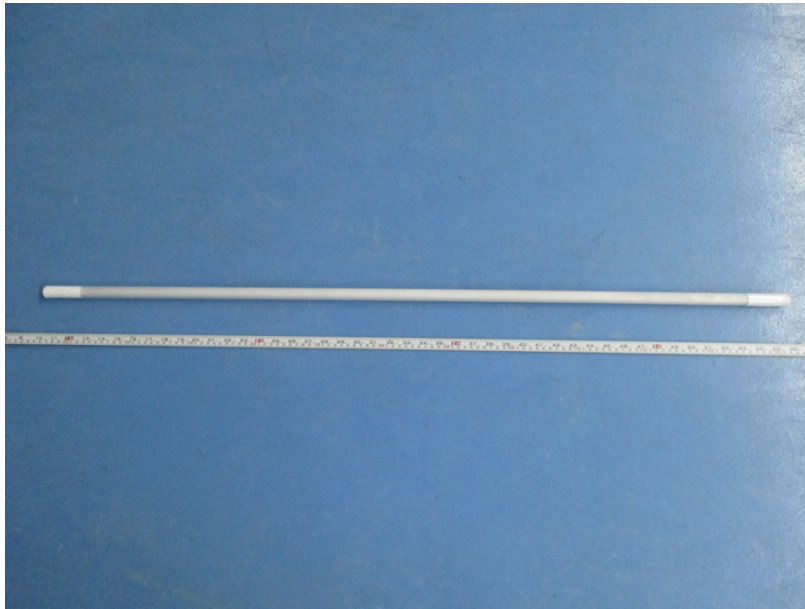
Luminous Intensity (cd) Distribution Data (cont.)

C Y	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	504	504	504	504	504	504	504	504
5.0°	501	502	500	499	499	499	500	500
10.0°	494	493	494	492	492	492	491	491
15.0°	483	482	482	481	481	482	479	479
20.0°	465	465	466	468	469	467	463	462
25.0°	446	445	447	451	453	451	445	439
30.0°	421	419	425	432	436	431	424	416
35.0°	393	392	400	411	416	411	400	389
40.0°	360	362	373	386	395	388	374	359
45.0°	327	328	342	361	373	364	347	326
50.0°	290	294	312	336	349	339	318	293
55.0°	251	256	281	309	325	314	289	258
60.0°	210	218	251	281	300	289	261	223
65.0°	168	179	220	255	276	263	231	188
70.0°	126	142	189	229	251	238	202	154
75.0°	83	106	161	204	227	212	176	123
80.0°	45	76	135	180	204	188	152	95
85.0°	14	50	111	159	182	168	128	71
90.0°	0	32	93	139	161	148	110	52
95.0°	0	21	76	119	141	129	91	39
100.0°	0	14	62	102	123	111	77	29
105.0°	0	10	51	88	107	95	64	22
110.0°	0	8	41	74	91	81	53	17
115.0°	0	7	33	62	76	68	45	14
120.0°	0	6	28	52	64	58	37	12
125.0°	0	6	23	43	53	47	30	11
130.0°	0	5	19	36	44	39	25	10
135.0°	0	5	16	29	36	32	21	9
140.0°	0	4	14	24	29	27	18	8
145.0°	0	3	12	20	24	22	15	7
150.0°	0	3	10	16	19	18	14	7
155.0°	0	2	7	13	15	15	11	6
160.0°	0	2	6	10	12	11	9	5
165.0°	0	0	4	6	9	8	7	4
170.0°	0	0	3	4	6	6	5	2
175.0°	0	0	0	0	2	2	0	0
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	12.0	0.60	0-5	12.0	0.60
5-10	35.7	1.78	0-10	47.7	2.38
10-15	58.2	2.91	0-15	105.9	5.29
15-20	78.9	3.94	0-20	184.8	9.23
20-25	97.2	4.85	0-25	282.0	14.08
25-30	112.5	5.62	0-30	394.5	19.70
30-35	124.5	6.22	0-35	519.0	25.92
35-40	132.9	6.64	0-40	651.8	32.55
40-45	137.5	6.87	0-45	789.4	39.42
45-50	138.5	6.92	0-50	927.9	46.34
50-55	136.0	6.79	0-55	1063.9	53.13
55-60	130.2	6.50	0-60	1194.1	59.64
60-65	121.7	6.08	0-65	1315.9	65.72
65-70	111.0	5.54	0-70	1426.8	71.26
70-75	98.4	4.92	0-75	1525.3	76.18
75-80	85.1	4.25	0-80	1610.4	80.43
80-85	72.1	3.60	0-85	1682.5	84.03
85-90	60.4	3.02	0-90	1743.0	87.05
90-95	50.7	2.53	0-95	1793.7	89.58
95-100	42.5	2.12	0-100	1836.3	91.71
100-105	35.4	1.77	0-105	1871.6	93.47
105-110	29.1	1.45	0-110	1900.8	94.93
110-115	23.7	1.18	0-115	1924.5	96.11
115-120	19.1	0.96	0-120	1943.6	97.07
120-125	15.2	0.76	0-125	1958.8	97.83
125-130	12.0	0.60	0-130	1970.8	98.42
130-135	9.3	0.46	0-135	1980.1	98.89
135-140	7.1	0.35	0-140	1987.2	99.24
140-145	5.3	0.27	0-145	1992.5	99.51
145-150	3.9	0.19	0-150	1996.4	99.70
150-155	2.7	0.13	0-155	1999.1	99.84
155-160	1.7	0.09	0-160	2000.8	99.92
160-165	1.0	0.05	0-165	2001.8	99.97
165-170	0.4	0.02	0-170	2002.2	99.99
170-175	0.1	0.00	0-175	2002.3	100.00
175-180	0.0	0.00	0-180	2002.3	100.00

6. Product Photo



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