



IES LM-79-08

MEASUREMENT AND TEST REPORT

For

GREEN CREATIVE LTD

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

Test Model: 10.5/T8/4F/835/BYP

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
Test Engineer:	George Yang <i>George Yang</i>
Report Number:	PKS181012082-10-3
Test Date:	2018-10-16
Report Date:	2018-10-18
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 2018-10-16 and used for testing.

Model Tested: 10.5/T8/4F/835/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 50/60Hz
 Rated Power: 10.5W
 Nominal CCT: 3500K
 Nominal Lumen Output: 1650lm

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**

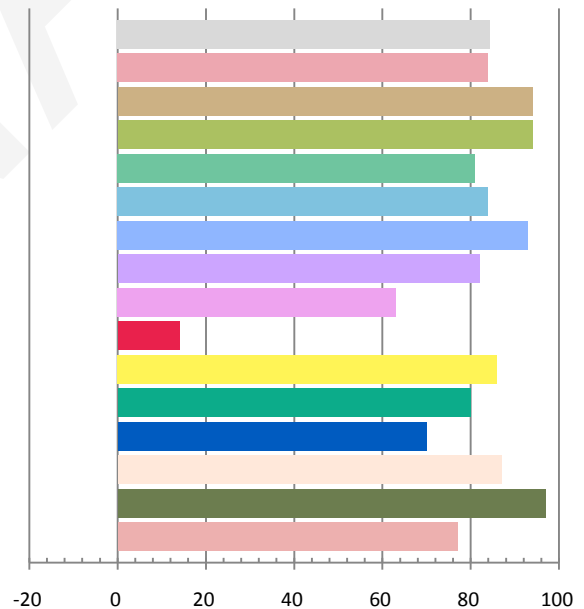
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.0947	11.11	0.9773	1658.8	149.3

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.016	3470	0.00088	0.4080	0.3941	0.2361	0.5130

Color Rendering Index

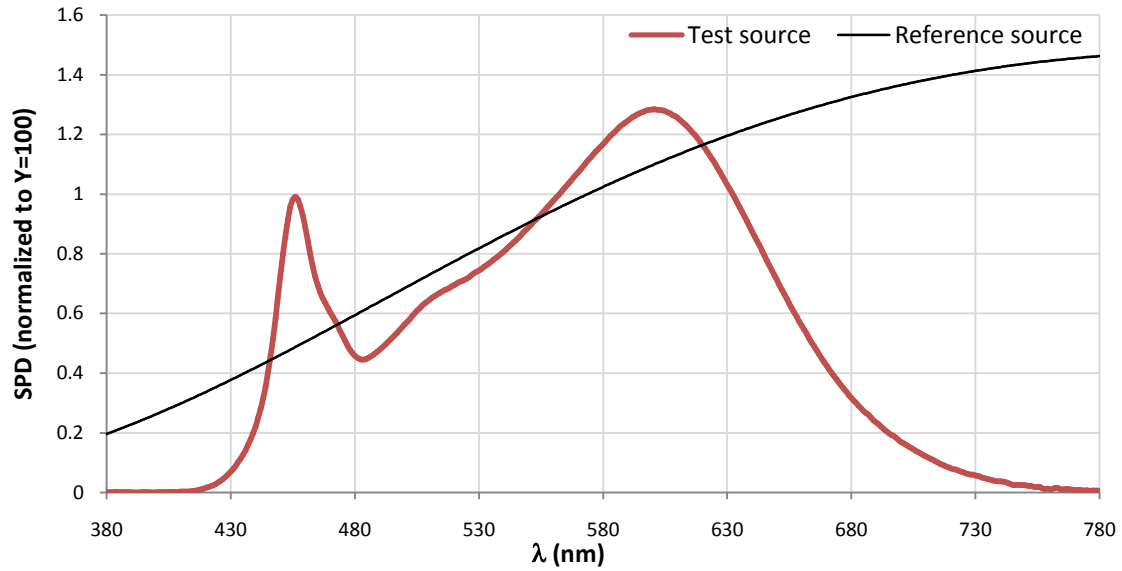
Ra 84.4			
R1 84	R2 94	R3 94	R4 81
R5 84	R6 93	R7 82	R8 63
R9 14	R10 86	R11 80	R12 70
R13 87	R14 97	R15 77	



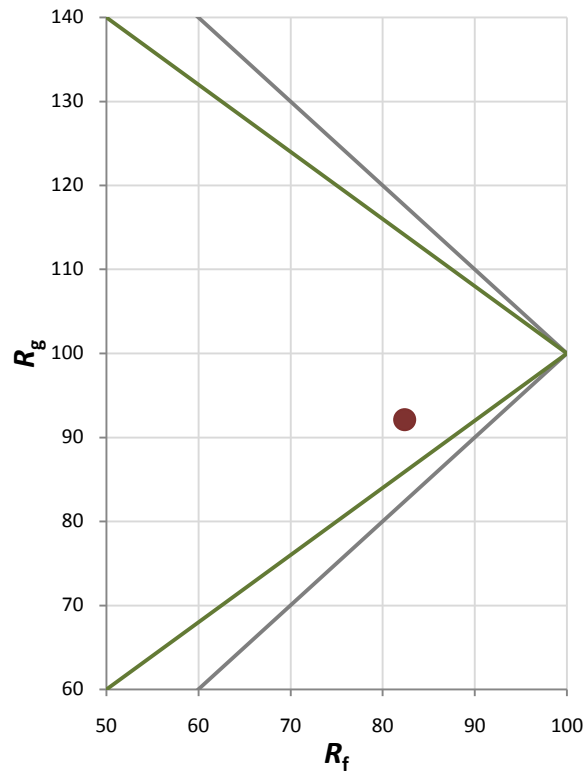
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	92

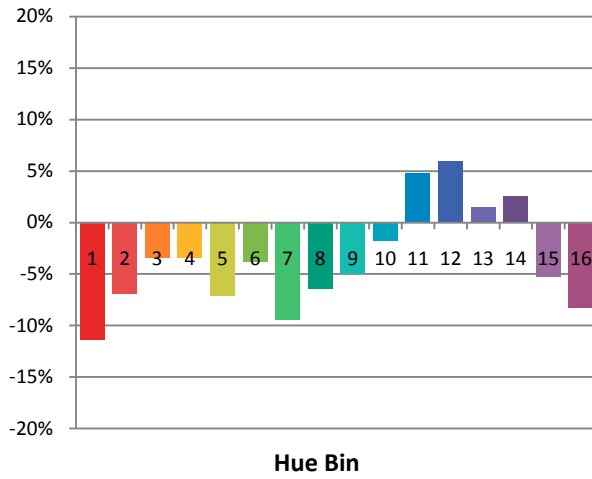
Spectral Power Distribution Comparison



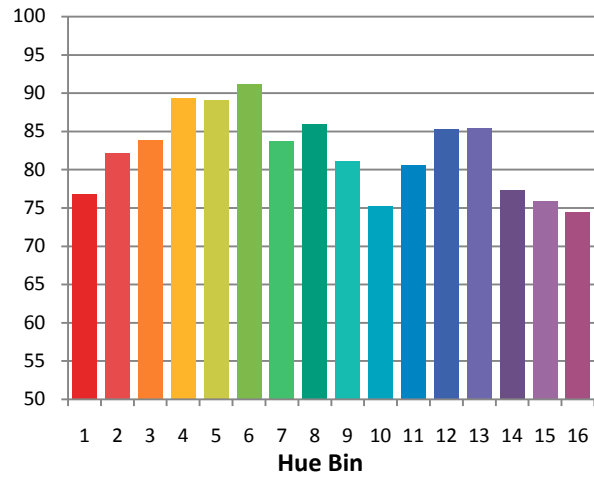
Plot of R_g versus R_f



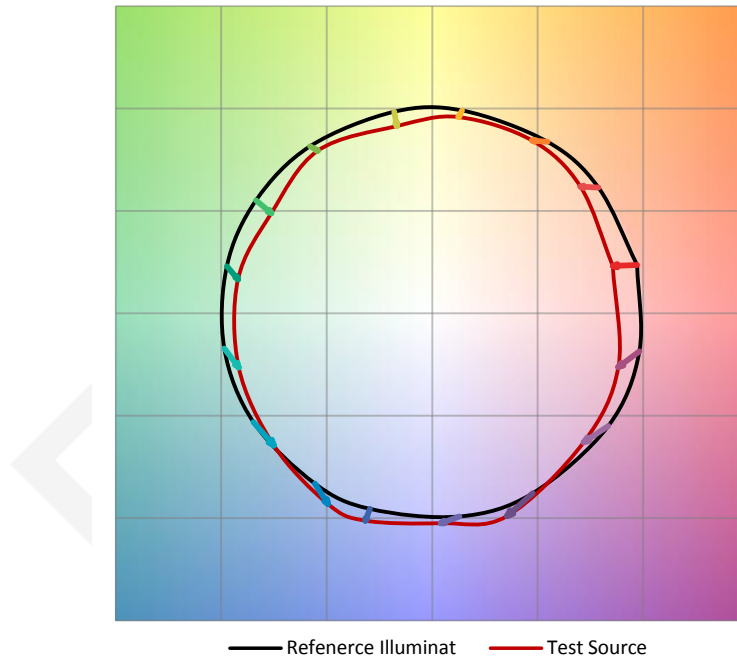
Chroma Shift by Hue



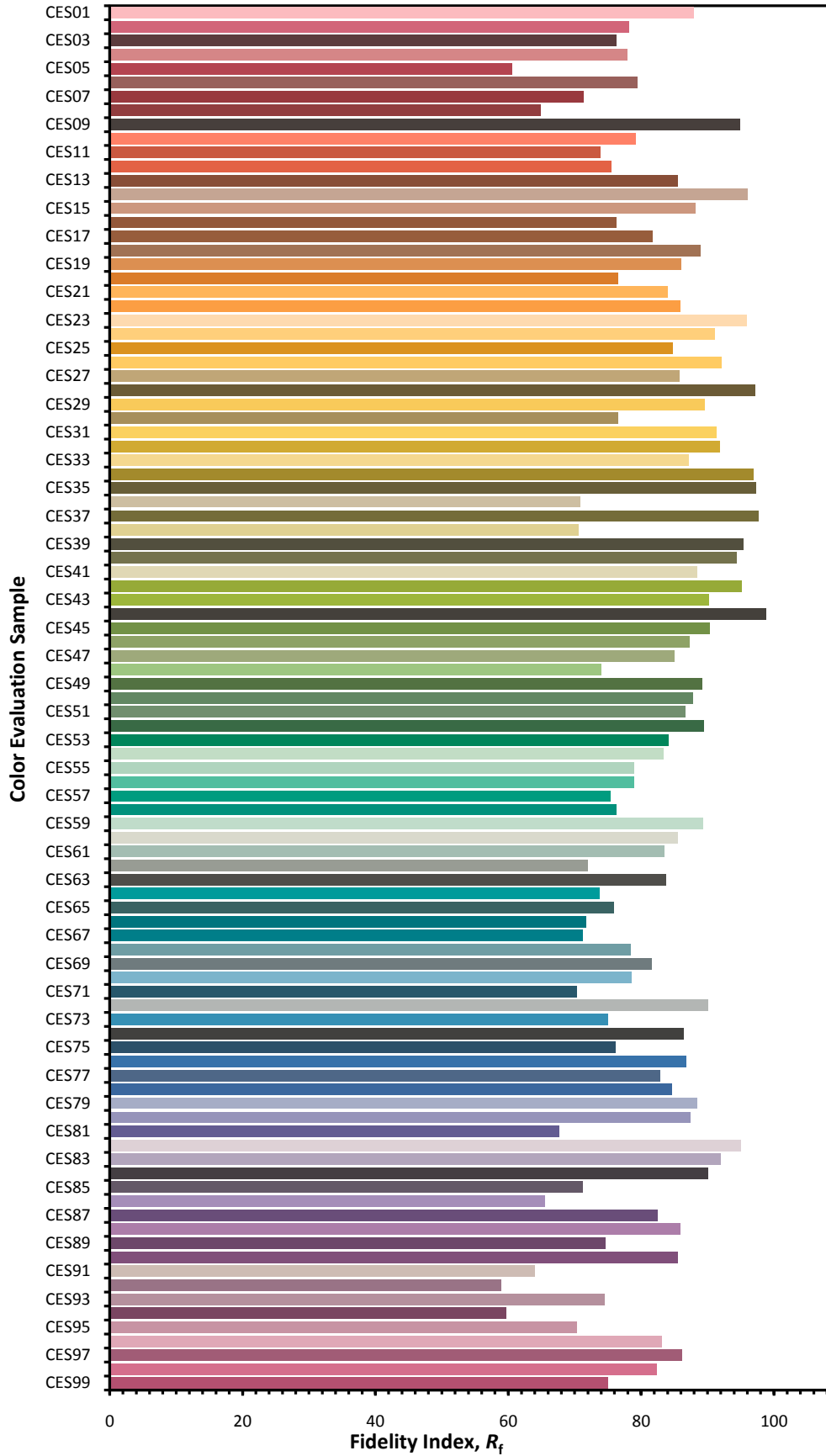
R_f by Hue



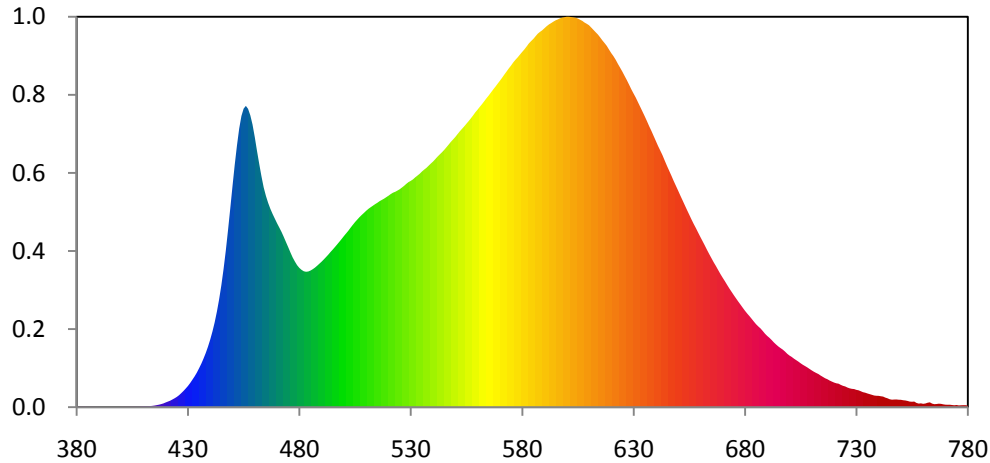
Color Vector Graphic



Color Fidelity by CES Sample



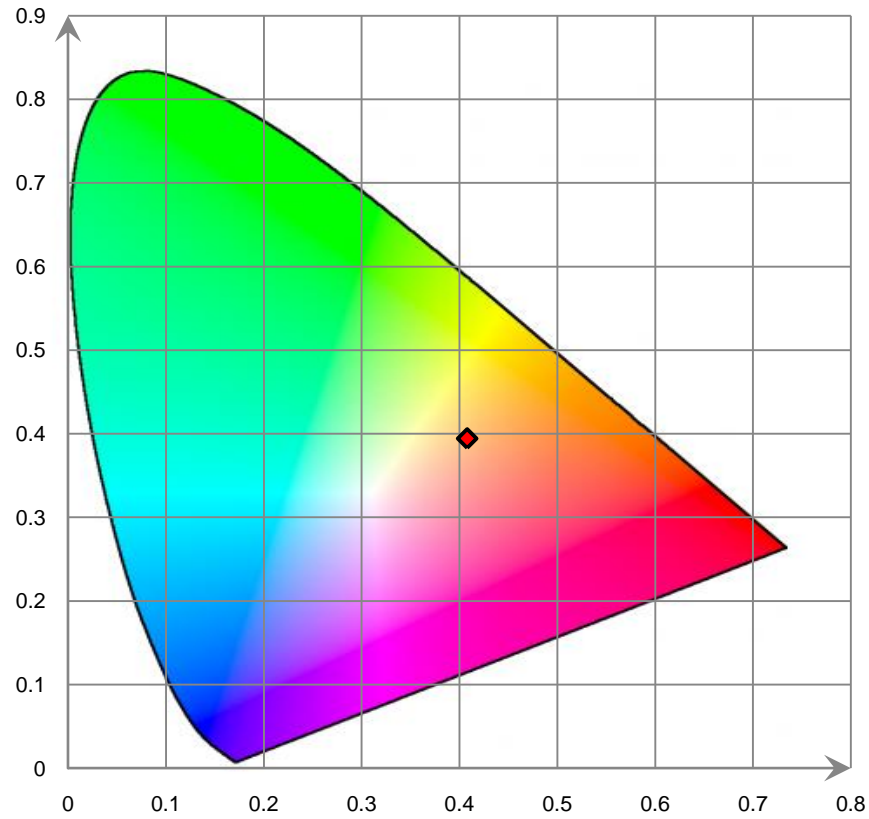
Relative Spectral Power Distribution



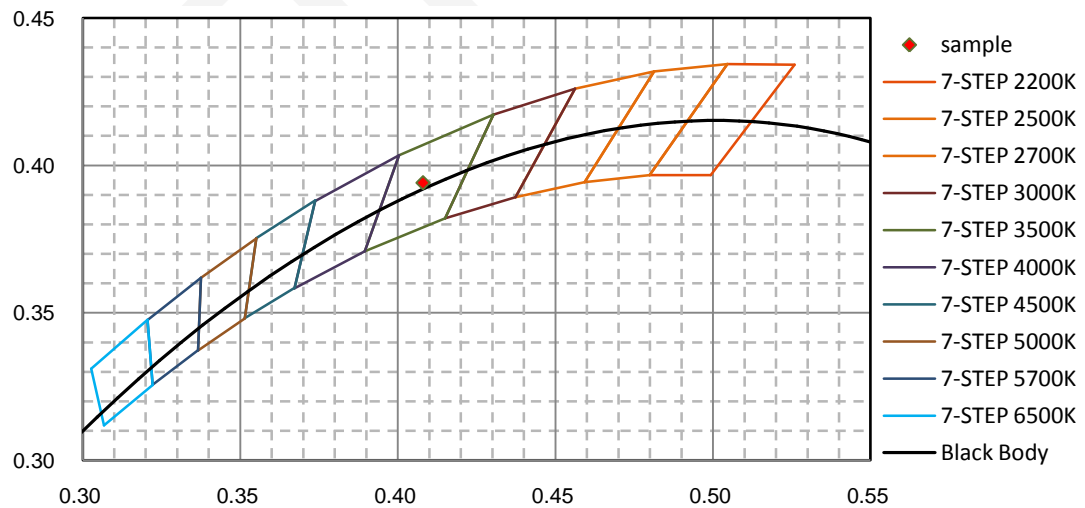
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	4.030E-02	421	4.461E-01	462	1.943E+01	503	1.433E+01	544	2.035E+01
381	3.090E-02	422	5.133E-01	463	1.843E+01	504	1.456E+01	545	2.054E+01
382	2.370E-02	423	6.102E-01	464	1.755E+01	505	1.478E+01	546	2.075E+01
383	3.260E-02	424	7.078E-01	465	1.687E+01	506	1.498E+01	547	2.096E+01
384	3.590E-02	425	8.193E-01	466	1.632E+01	507	1.517E+01	548	2.118E+01
385	2.330E-02	426	9.533E-01	467	1.584E+01	508	1.535E+01	549	2.138E+01
386	2.430E-02	427	1.119E+00	468	1.543E+01	509	1.551E+01	550	2.157E+01
387	2.700E-02	428	1.294E+00	469	1.505E+01	510	1.568E+01	551	2.180E+01
388	2.080E-02	429	1.486E+00	470	1.469E+01	511	1.583E+01	552	2.202E+01
389	2.500E-02	430	1.690E+00	471	1.435E+01	512	1.596E+01	553	2.222E+01
390	2.110E-02	431	1.926E+00	472	1.399E+01	513	1.608E+01	554	2.242E+01
391	1.130E-02	432	2.193E+00	473	1.360E+01	514	1.621E+01	555	2.263E+01
392	8.900E-03	433	2.461E+00	474	1.318E+01	515	1.632E+01	556	2.284E+01
393	1.050E-02	434	2.764E+00	475	1.278E+01	516	1.645E+01	557	2.306E+01
394	1.420E-02	435	3.104E+00	476	1.235E+01	517	1.654E+01	558	2.330E+01
395	1.510E-02	436	3.471E+00	477	1.196E+01	518	1.665E+01	559	2.354E+01
396	1.290E-02	437	3.879E+00	478	1.163E+01	519	1.676E+01	560	2.376E+01
397	1.210E-02	438	4.329E+00	479	1.134E+01	520	1.688E+01	561	2.398E+01
398	8.900E-03	439	4.829E+00	480	1.112E+01	521	1.701E+01	562	2.420E+01
399	4.000E-03	440	5.395E+00	481	1.096E+01	522	1.712E+01	563	2.443E+01
400	1.890E-02	441	6.036E+00	482	1.085E+01	523	1.720E+01	564	2.467E+01
401	2.390E-02	442	6.771E+00	483	1.081E+01	524	1.729E+01	565	2.489E+01
402	2.710E-02	443	7.631E+00	484	1.083E+01	525	1.740E+01	566	2.513E+01
403	2.870E-02	444	8.609E+00	485	1.091E+01	526	1.753E+01	567	2.537E+01
404	3.310E-02	445	9.743E+00	486	1.102E+01	527	1.767E+01	568	2.559E+01
405	3.440E-02	446	1.104E+01	487	1.114E+01	528	1.783E+01	569	2.583E+01
406	3.740E-02	447	1.251E+01	488	1.129E+01	529	1.797E+01	570	2.606E+01
407	3.740E-02	448	1.414E+01	489	1.146E+01	530	1.807E+01	571	2.630E+01
408	3.120E-02	449	1.587E+01	490	1.162E+01	531	1.819E+01	572	2.655E+01
409	5.970E-02	450	1.763E+01	491	1.180E+01	532	1.835E+01	573	2.680E+01
410	7.430E-02	451	1.935E+01	492	1.199E+01	533	1.849E+01	574	2.704E+01
411	6.520E-02	452	2.089E+01	493	1.218E+01	534	1.863E+01	575	2.727E+01
412	6.760E-02	453	2.224E+01	494	1.239E+01	535	1.881E+01	576	2.753E+01
413	8.650E-02	454	2.325E+01	495	1.259E+01	536	1.897E+01	577	2.774E+01
414	1.049E-01	455	2.384E+01	496	1.279E+01	537	1.910E+01	578	2.793E+01
415	1.324E-01	456	2.406E+01	497	1.300E+01	538	1.928E+01	579	2.815E+01
416	1.651E-01	457	2.382E+01	498	1.322E+01	539	1.945E+01	580	2.836E+01
417	1.997E-01	458	2.330E+01	499	1.344E+01	540	1.961E+01	581	2.856E+01
418	2.470E-01	459	2.256E+01	500	1.366E+01	541	1.980E+01	582	2.880E+01
419	2.980E-01	460	2.157E+01	501	1.387E+01	542	2.000E+01	583	2.904E+01
420	3.776E-01	461	2.047E+01	502	1.409E+01	543	2.018E+01	584	2.923E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	2.940E+01	626	2.645E+01	667	1.126E+01	708	3.175E+00	749	5.959E-01
586	2.961E+01	627	2.611E+01	668	1.095E+01	709	3.052E+00	750	5.896E-01
587	2.982E+01	628	2.576E+01	669	1.063E+01	710	2.937E+00	751	5.565E-01
588	2.996E+01	629	2.538E+01	670	1.034E+01	711	2.825E+00	752	5.353E-01
589	3.009E+01	630	2.505E+01	671	1.006E+01	712	2.732E+00	753	4.982E-01
590	3.025E+01	631	2.472E+01	672	9.769E+00	713	2.644E+00	754	4.471E-01
591	3.042E+01	632	2.435E+01	673	9.481E+00	714	2.521E+00	755	4.336E-01
592	3.056E+01	633	2.398E+01	674	9.217E+00	715	2.415E+00	756	4.479E-01
593	3.066E+01	634	2.361E+01	675	8.948E+00	716	2.312E+00	757	3.393E-01
594	3.078E+01	635	2.324E+01	676	8.693E+00	717	2.232E+00	758	2.871E-01
595	3.089E+01	636	2.285E+01	677	8.437E+00	718	2.131E+00	759	3.061E-01
596	3.096E+01	637	2.245E+01	678	8.193E+00	719	2.046E+00	760	2.696E-01
597	3.104E+01	638	2.207E+01	679	7.946E+00	720	1.968E+00	761	2.928E-01
598	3.111E+01	639	2.167E+01	680	7.705E+00	721	1.908E+00	762	3.544E-01
599	3.114E+01	640	2.126E+01	681	7.481E+00	722	1.877E+00	763	3.866E-01
600	3.118E+01	641	2.086E+01	682	7.275E+00	723	1.785E+00	764	2.876E-01
601	3.118E+01	642	2.049E+01	683	7.062E+00	724	1.705E+00	765	2.415E-01
602	3.115E+01	643	2.012E+01	684	6.837E+00	725	1.655E+00	766	2.531E-01
603	3.113E+01	644	1.969E+01	685	6.625E+00	726	1.568E+00	767	2.776E-01
604	3.110E+01	645	1.928E+01	686	6.447E+00	727	1.506E+00	768	2.650E-01
605	3.103E+01	646	1.888E+01	687	6.289E+00	728	1.466E+00	769	2.267E-01
606	3.094E+01	647	1.848E+01	688	6.086E+00	729	1.445E+00	770	1.989E-01
607	3.085E+01	648	1.807E+01	689	5.866E+00	730	1.384E+00	771	1.942E-01
608	3.071E+01	649	1.768E+01	690	5.689E+00	731	1.346E+00	772	1.976E-01
609	3.061E+01	650	1.730E+01	691	5.538E+00	732	1.273E+00	773	1.700E-01
610	3.050E+01	651	1.690E+01	692	5.362E+00	733	1.197E+00	774	1.543E-01
611	3.031E+01	652	1.652E+01	693	5.168E+00	734	1.157E+00	775	1.731E-01
612	3.013E+01	653	1.614E+01	694	5.004E+00	735	1.096E+00	776	1.399E-01
613	2.994E+01	654	1.575E+01	695	4.848E+00	736	1.043E+00	777	1.522E-01
614	2.976E+01	655	1.537E+01	696	4.716E+00	737	9.876E-01	778	1.599E-01
615	2.953E+01	656	1.500E+01	697	4.596E+00	738	9.309E-01	779	1.585E-01
616	2.929E+01	657	1.464E+01	698	4.440E+00	739	9.108E-01	780	1.318E-01
617	2.908E+01	658	1.429E+01	699	4.262E+00	740	9.041E-01		
618	2.884E+01	659	1.394E+01	700	4.121E+00	741	8.716E-01		
619	2.856E+01	660	1.359E+01	701	4.013E+00	742	8.487E-01		
620	2.827E+01	661	1.325E+01	702	3.876E+00	743	7.669E-01		
621	2.802E+01	662	1.291E+01	703	3.756E+00	744	7.065E-01		
622	2.774E+01	663	1.255E+01	704	3.639E+00	745	6.335E-01		
623	2.741E+01	664	1.222E+01	705	3.507E+00	746	5.972E-01		
624	2.710E+01	665	1.189E+01	706	3.385E+00	747	6.116E-01		
625	2.679E+01	666	1.156E+01	707	3.283E+00	748	6.142E-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**

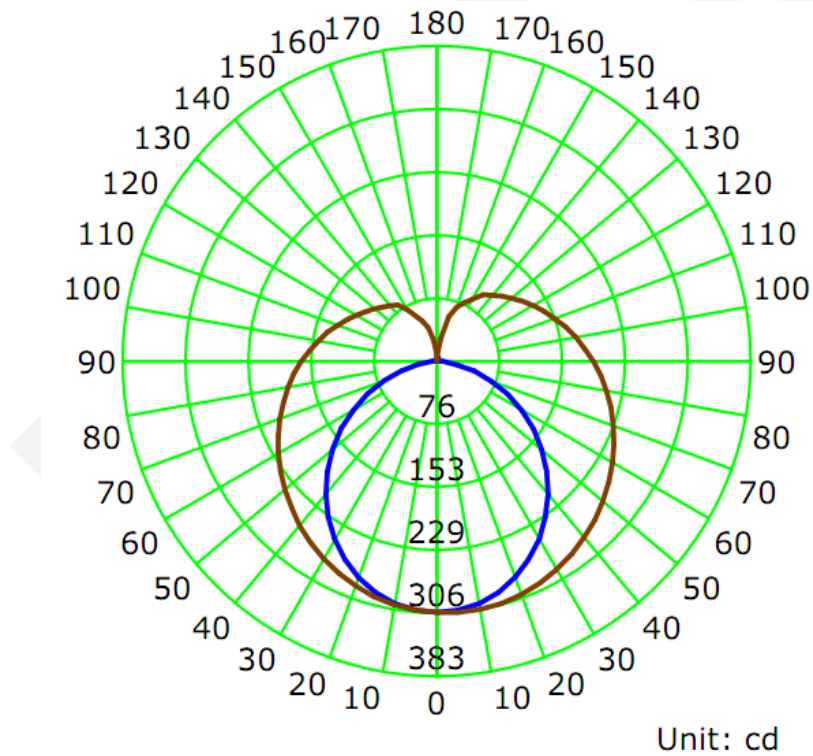
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.0950	11.12	0.9800

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
1660.9	149.41	306.7	1.22	1.40

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	106.0	141.7	206.9	150.8	151.4
Field Angle (10% I_{max}):	157.4	330.5	338.5	326.5	288.2

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	306	306	306	306	306	306	306	306
5.0°	304	304	305	306	307	307	306	305
10.0°	299	301	303	305	306	306	304	302
15.0°	291	294	298	302	305	303	300	296
20.0°	280	284	291	298	302	300	293	287
25.0°	266	272	282	292	298	295	285	275
30.0°	250	257	271	285	292	289	275	261
35.0°	231	240	258	276	287	281	264	245
40.0°	211	222	245	267	280	273	252	228
45.0°	190	203	230	258	272	264	239	209
50.0°	167	183	216	248	265	255	226	190
55.0°	144	163	202	238	256	245	212	171
60.0°	120	142	187	228	248	235	199	151
65.0°	95	123	174	218	239	225	186	132
70.0°	71	103	161	208	229	216	174	115
75.0°	47	87	149	197	220	206	162	99
80.0°	26	72	138	188	211	195	151	85
85.0°	9	60	129	178	201	184	141	74
90.0°	1	53	120	168	191	174	132	65
95.0°	2	48	114	160	182	166	125	61
100.0°	3	47	108	153	172	157	118	58
105.0°	2	46	102	145	163	149	112	56
110.0°	2	47	98	137	154	141	106	55
115.0°	1	48	94	130	145	134	102	56
120.0°	1	50	90	122	136	126	97	57
125.0°	1	49	87	116	128	119	93	56
130.0°	1	50	84	110	120	112	90	55
135.0°	1	50	82	104	113	106	87	54
140.0°	1	51	78	99	106	99	80	53
145.0°	1	50	74	95	99	93	73	47
150.0°	1	47	71	84	88	81	62	38
155.0°	2	44	67	77	79	72	50	30
160.0°	5	39	62	69	71	55	35	20
165.0°	5	31	49	57	56	35	19	12
170.0°	3	18	31	36	28	18	8	5
175.0°	2	5	9	12	6	4	2	2
180.0°	0	0	0	0	0	0	0	0

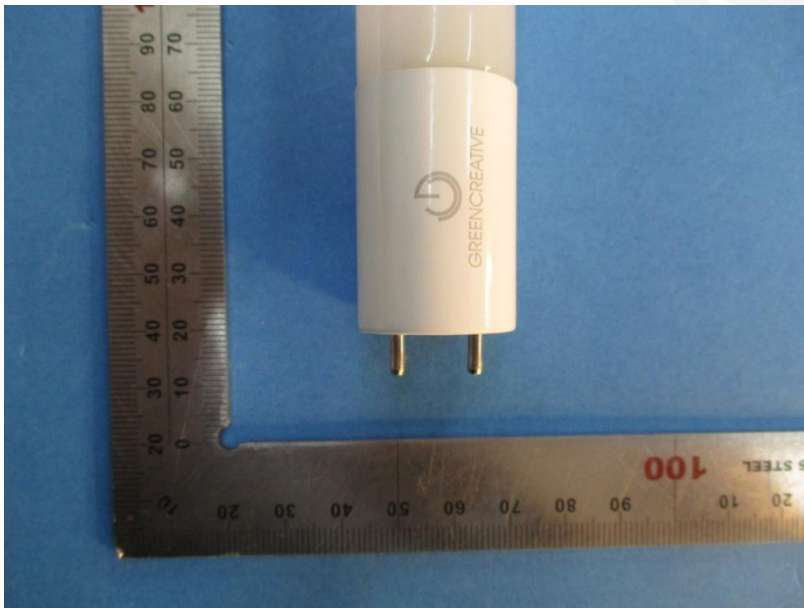
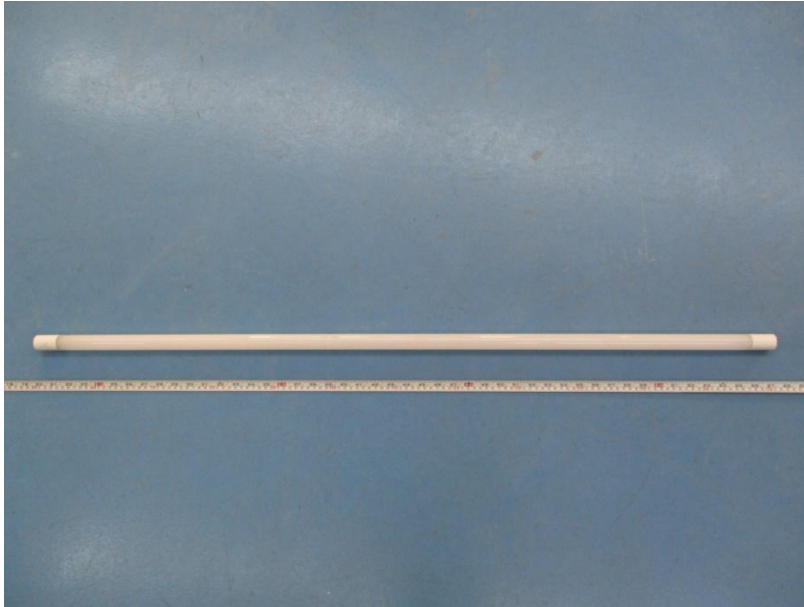
Luminous Intensity (cd) Distribution Data (cont.)

C γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	306	306	306	306	306	306	306	306
5.0°	304	304	304	304	304	304	303	303
10.0°	299	299	300	300	301	300	299	298
15.0°	291	291	293	296	296	295	292	290
20.0°	280	281	285	289	291	289	284	280
25.0°	266	268	275	281	284	282	274	267
30.0°	250	252	262	273	277	273	262	252
35.0°	232	235	249	263	269	264	249	236
40.0°	211	217	234	252	261	254	236	218
45.0°	190	197	219	241	252	243	223	199
50.0°	167	177	205	230	243	233	209	180
55.0°	143	157	190	219	233	223	195	160
60.0°	118	136	176	208	224	213	182	141
65.0°	94	116	162	197	214	202	169	123
70.0°	69	96	148	186	205	191	157	106
75.0°	45	80	136	176	195	179	145	91
80.0°	24	65	124	165	185	169	134	77
85.0°	8	53	113	155	176	160	123	66
90.0°	2	45	105	146	166	151	115	58
95.0°	3	40	97	137	157	142	107	53
100.0°	4	38	92	129	148	134	100	50
105.0°	4	37	86	122	139	126	94	47
110.0°	4	38	81	115	130	119	89	47
115.0°	3	40	78	108	122	112	85	47
120.0°	2	40	74	102	114	105	81	48
125.0°	1	37	72	96	107	99	78	48
130.0°	1	36	70	91	100	94	76	43
135.0°	1	36	69	87	94	89	74	42
140.0°	1	33	61	83	89	85	71	41
145.0°	1	27	54	79	84	81	59	39
150.0°	1	19	46	63	72	66	54	35
155.0°	1	18	38	56	60	57	49	29
160.0°	2	13	32	46	53	50	43	24
165.0°	2	7	20	31	43	41	31	16
170.0°	2	3	12	18	28	27	19	7
175.0°	2	2	3	5	9	8	5	2
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	7.3	0.44	0-5	7.3	0.44
5-10	21.7	1.31	0-10	29.0	1.74
10-15	35.4	2.13	0-15	64.4	3.88
15-20	48.1	2.90	0-20	112.5	6.78
20-25	59.5	3.58	0-25	172.0	10.35
25-30	69.1	4.16	0-30	241.1	14.52
30-35	76.9	4.63	0-35	318.0	19.15
35-40	82.8	4.98	0-40	400.8	24.13
40-45	86.7	5.22	0-45	487.5	29.35
45-50	88.7	5.34	0-50	576.2	34.69
50-55	88.9	5.36	0-55	665.2	40.05
55-60	87.5	5.27	0-60	752.7	45.32
60-65	84.7	5.10	0-65	837.4	50.42
65-70	80.8	4.86	0-70	918.2	55.28
70-75	75.9	4.57	0-75	994.1	59.85
75-80	70.6	4.25	0-80	1064.7	64.10
80-85	65.2	3.92	0-85	1129.9	68.03
85-90	60.2	3.63	0-90	1190.1	71.66
90-95	56.2	3.38	0-95	1246.3	75.04
95-100	52.6	3.17	0-100	1298.9	78.21
100-105	49.2	2.96	0-105	1348.1	81.17
105-110	45.7	2.75	0-110	1393.8	83.92
110-115	42.2	2.54	0-115	1435.9	86.46
115-120	38.7	2.33	0-120	1474.6	88.78
120-125	35.1	2.11	0-125	1509.7	90.90
125-130	31.5	1.89	0-130	1541.2	92.79
130-135	28.0	1.69	0-135	1569.2	94.48
135-140	24.5	1.47	0-140	1593.7	95.95
140-145	20.7	1.24	0-145	1614.3	97.20
145-150	16.4	0.99	0-150	1630.7	98.19
150-155	12.3	0.74	0-155	1643.1	98.93
155-160	8.8	0.53	0-160	1651.9	99.46
160-165	5.5	0.33	0-165	1657.4	99.79
165-170	2.7	0.16	0-170	1660.1	99.95
170-175	0.8	0.05	0-175	1660.8	100.00
175-180	0.1	0.00	0-180	1660.9	100.00

6. Product Photo



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