



IES LM-79-08

MEASUREMENT AND TEST REPORT

For

GREEN CREATIVE LTD

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

Test Model: 13T8/4F/835/BYP/FF

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
Test Engineer:	George Yang <i>George Yang</i>
Report Number:	PKS180910088-10-3
Test Date:	2018-09-11 to 2018-09-12
Report Date:	2018-09-18
Reviewed By:	Ray Gao/EE Engineer <i>Ry 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 2018-09-10 and used for testing.

Model Tested: 13T8/4F/835/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: 13W
 Nominal CCT: 3500K
 Nominal Lumen Output: 1600lm

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**

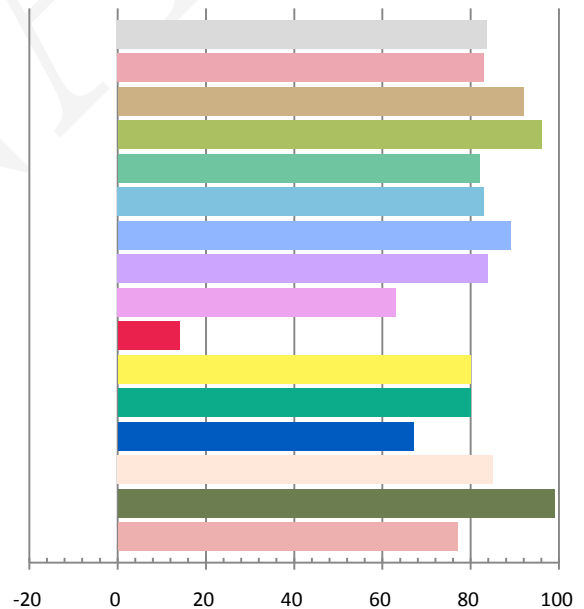
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1102	12.92	0.9768	1814.2	140.42

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.510	3398	-0.00146	0.4095	0.3894	0.2390	0.5114

Color Rendering Index

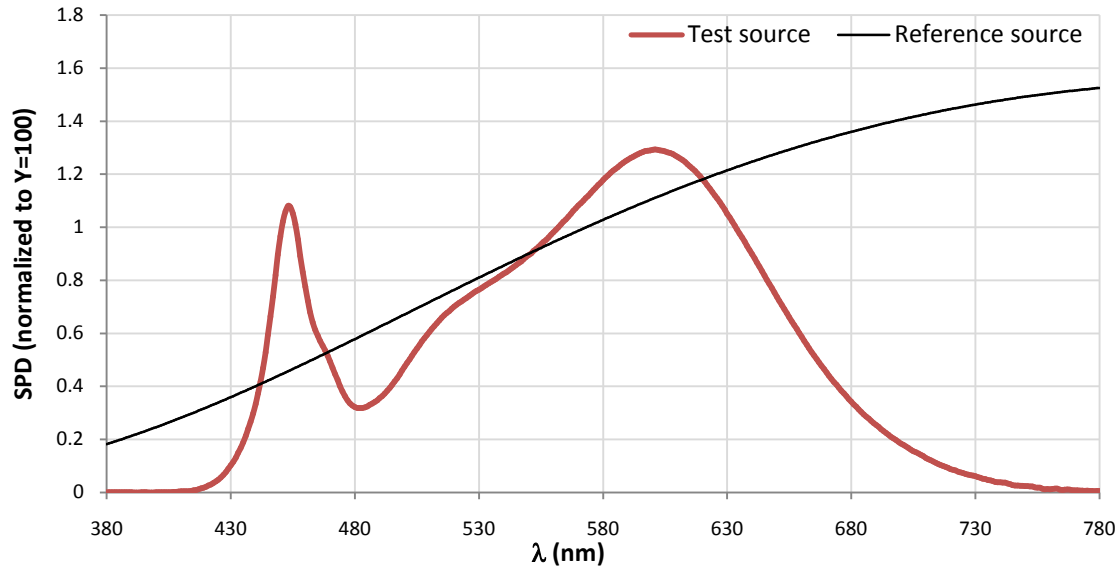
Ra 83.8			
R1 83	R2 92	R3 96	R4 82
R5 83	R6 89	R7 84	R8 63
R9 14	R10 80	R11 80	R12 67
R13 85	R14 99	R15 77	



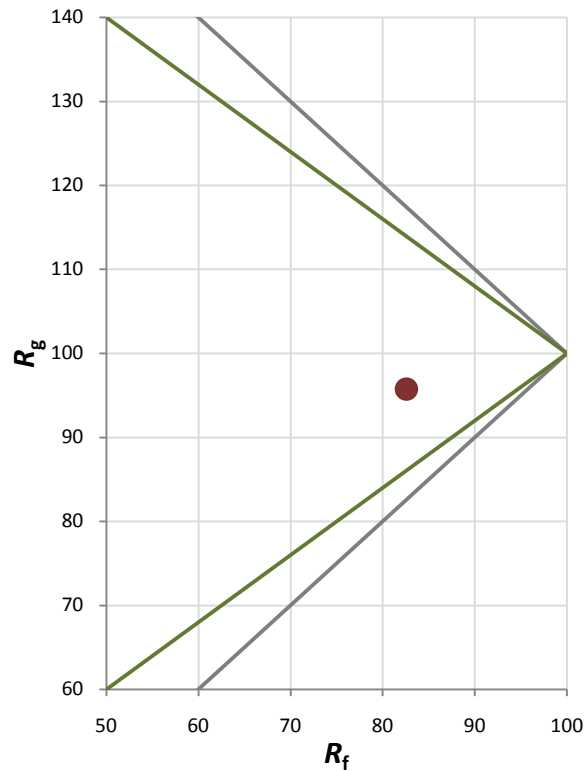
Fidelity Index and Gamut Index

Fidelity Index R_f	83
Gamut Index R_g	96

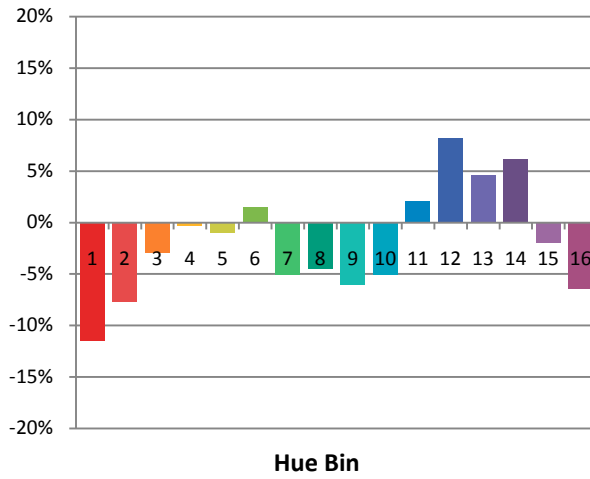
Spectral Power Distribution Comparison



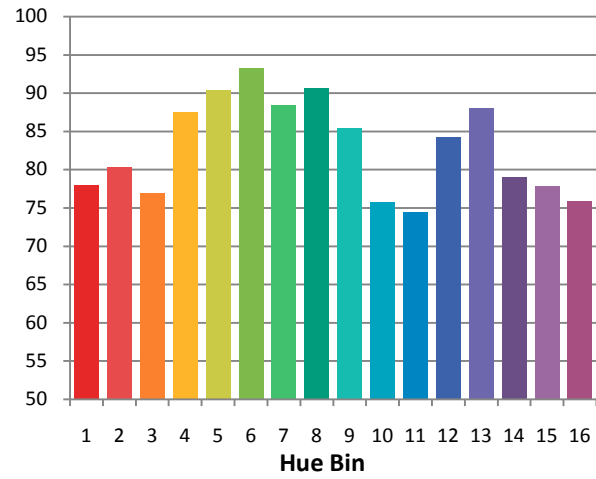
Plot of R_g versus R_f



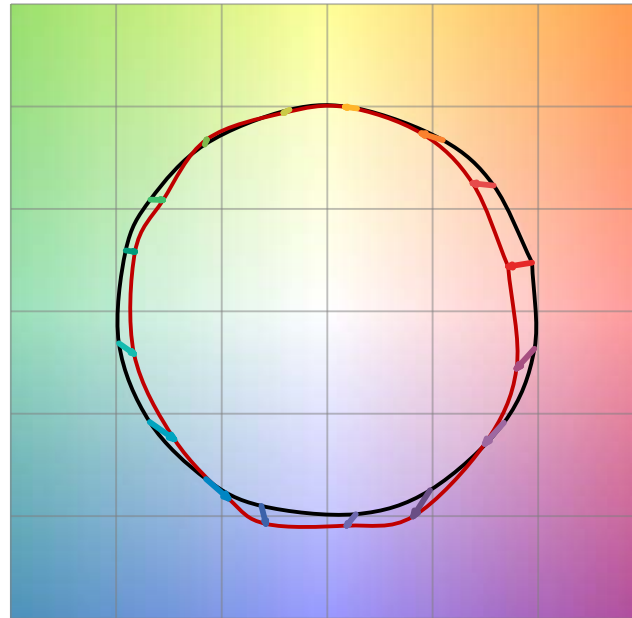
Chroma Shift by Hue



R_t by Hue

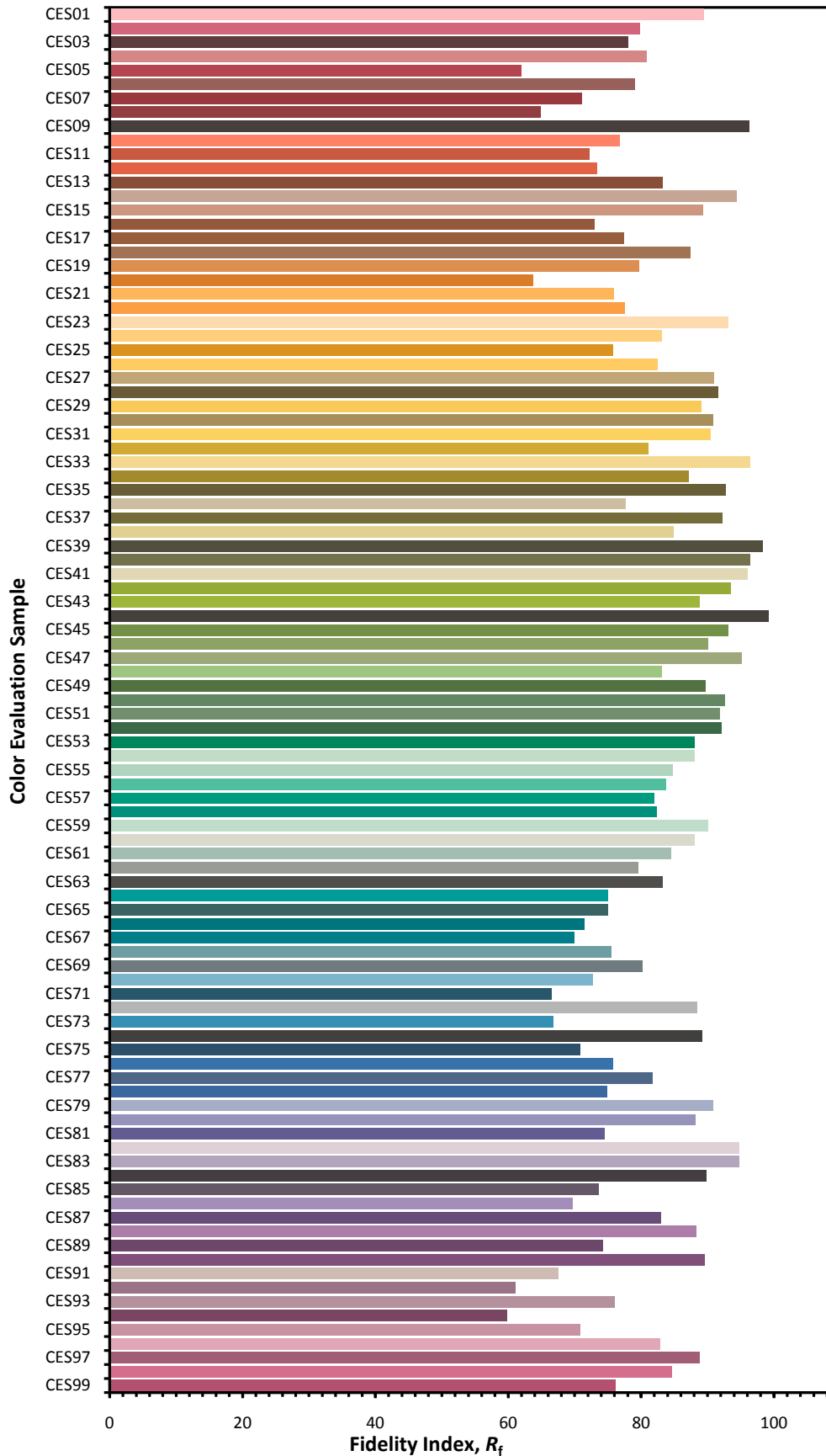


Color Vector Graphic

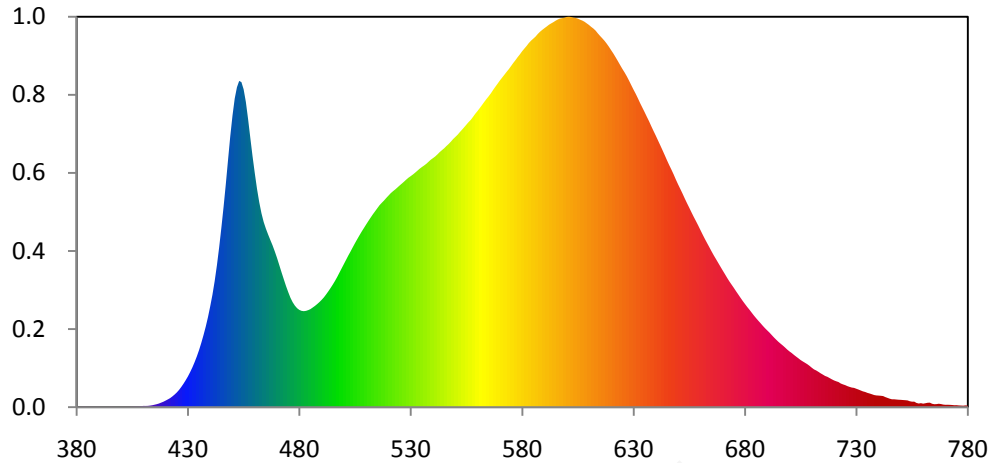


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



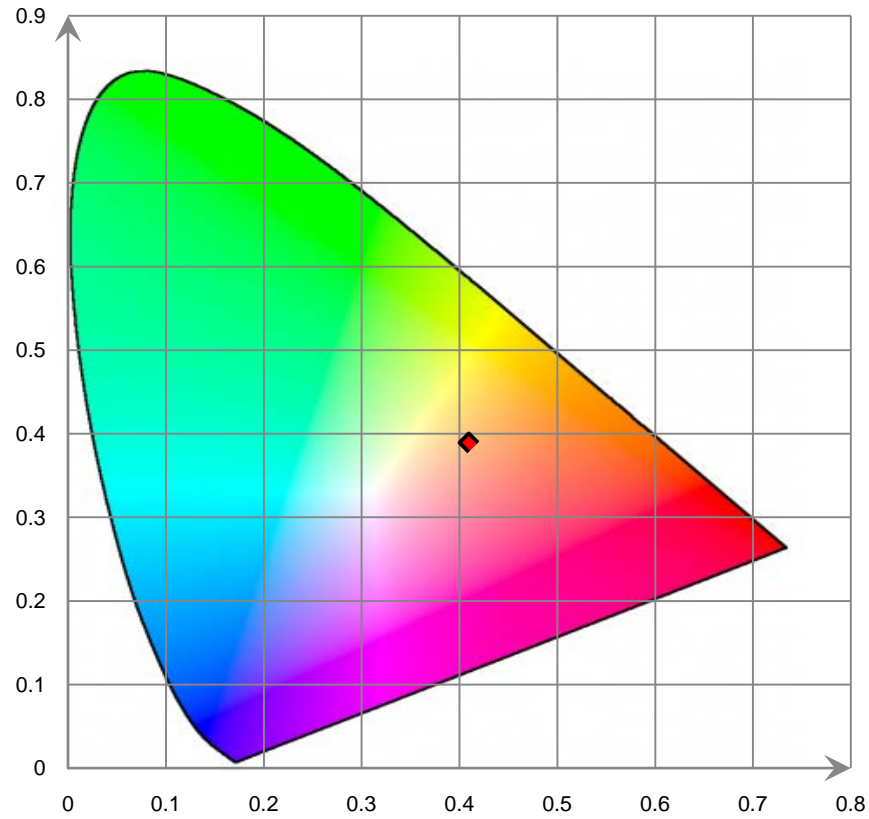
Relative Spectral Power Distribution



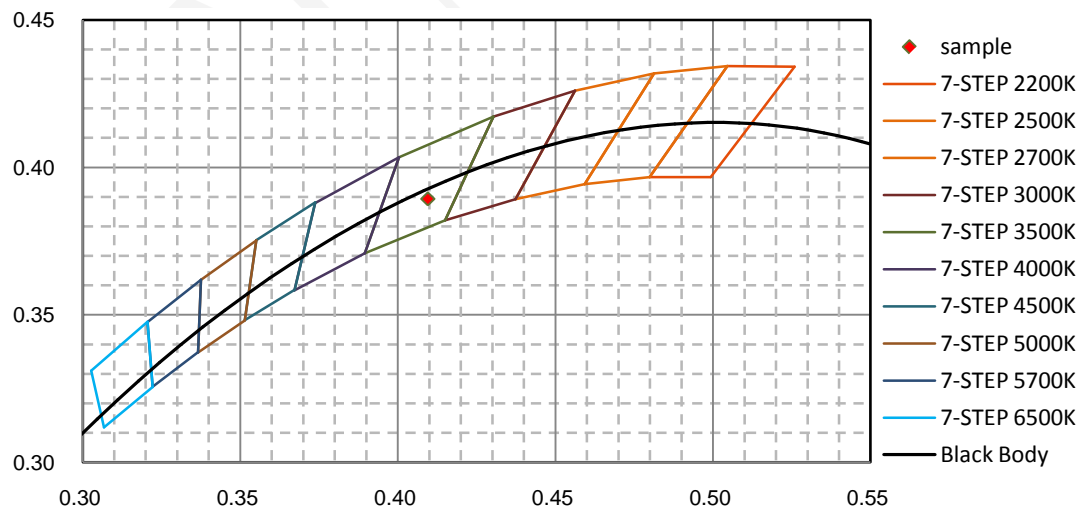
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.290E-02	421	6.877E-01	462	1.803E+01	503	1.369E+01	544	2.260E+01
381	2.030E-02	422	7.972E-01	463	1.706E+01	504	1.407E+01	545	2.277E+01
382	1.880E-02	423	9.450E-01	464	1.628E+01	505	1.443E+01	546	2.296E+01
383	2.930E-02	424	1.108E+00	465	1.569E+01	506	1.478E+01	547	2.314E+01
384	3.290E-02	425	1.295E+00	466	1.518E+01	507	1.512E+01	548	2.334E+01
385	2.030E-02	426	1.515E+00	467	1.470E+01	508	1.545E+01	549	2.357E+01
386	2.540E-02	427	1.774E+00	468	1.422E+01	509	1.576E+01	550	2.376E+01
387	2.480E-02	428	2.059E+00	469	1.369E+01	510	1.607E+01	551	2.395E+01
388	1.790E-02	429	2.374E+00	470	1.312E+01	511	1.637E+01	552	2.418E+01
389	2.630E-02	430	2.707E+00	471	1.250E+01	512	1.667E+01	553	2.440E+01
390	2.630E-02	431	3.086E+00	472	1.187E+01	513	1.696E+01	554	2.462E+01
391	1.270E-02	432	3.499E+00	473	1.126E+01	514	1.722E+01	555	2.485E+01
392	9.200E-03	433	3.962E+00	474	1.067E+01	515	1.749E+01	556	2.507E+01
393	1.230E-02	434	4.466E+00	475	1.013E+01	516	1.776E+01	557	2.527E+01
394	1.800E-02	435	5.026E+00	476	9.629E+00	517	1.797E+01	558	2.554E+01
395	2.740E-02	436	5.657E+00	477	9.232E+00	518	1.817E+01	559	2.581E+01
396	2.300E-02	437	6.344E+00	478	8.931E+00	519	1.839E+01	560	2.605E+01
397	1.330E-02	438	7.091E+00	479	8.702E+00	520	1.860E+01	561	2.631E+01
398	8.600E-03	439	7.922E+00	480	8.554E+00	521	1.881E+01	562	2.657E+01
399	4.200E-03	440	8.867E+00	481	8.471E+00	522	1.898E+01	563	2.684E+01
400	1.480E-02	441	9.887E+00	482	8.443E+00	523	1.914E+01	564	2.710E+01
401	1.700E-02	442	1.108E+01	483	8.469E+00	524	1.931E+01	565	2.734E+01
402	1.910E-02	443	1.246E+01	484	8.536E+00	525	1.949E+01	566	2.760E+01
403	2.090E-02	444	1.403E+01	485	8.626E+00	526	1.966E+01	567	2.790E+01
404	2.340E-02	445	1.576E+01	486	8.761E+00	527	1.983E+01	568	2.818E+01
405	3.120E-02	446	1.762E+01	487	8.904E+00	528	2.001E+01	569	2.845E+01
406	4.300E-02	447	1.960E+01	488	9.066E+00	529	2.018E+01	570	2.872E+01
407	4.870E-02	448	2.174E+01	489	9.240E+00	530	2.032E+01	571	2.898E+01
408	4.930E-02	449	2.382E+01	490	9.435E+00	531	2.046E+01	572	2.922E+01
409	8.650E-02	450	2.564E+01	491	9.652E+00	532	2.062E+01	573	2.948E+01
410	1.134E-01	451	2.714E+01	492	9.908E+00	533	2.080E+01	574	2.972E+01
411	1.115E-01	452	2.813E+01	493	1.018E+01	534	2.097E+01	575	2.999E+01
412	1.171E-01	453	2.869E+01	494	1.047E+01	535	2.112E+01	576	3.026E+01
413	1.391E-01	454	2.859E+01	495	1.078E+01	536	2.125E+01	577	3.051E+01
414	1.729E-01	455	2.795E+01	496	1.110E+01	537	2.140E+01	578	3.078E+01
415	2.178E-01	456	2.685E+01	497	1.145E+01	538	2.158E+01	579	3.103E+01
416	2.639E-01	457	2.534E+01	498	1.183E+01	539	2.176E+01	580	3.130E+01
417	3.228E-01	458	2.369E+01	499	1.221E+01	540	2.190E+01	581	3.153E+01
418	4.015E-01	459	2.207E+01	500	1.259E+01	541	2.205E+01	582	3.176E+01
419	4.804E-01	460	2.059E+01	501	1.296E+01	542	2.223E+01	583	3.202E+01
420	5.789E-01	461	1.921E+01	502	1.334E+01	543	2.243E+01	584	3.223E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.240E+01	626	2.943E+01	667	1.302E+01	708	3.780E+00	749	6.551E-01
586	3.258E+01	627	2.909E+01	668	1.269E+01	709	3.637E+00	750	6.460E-01
587	3.281E+01	628	2.871E+01	669	1.236E+01	710	3.472E+00	751	6.295E-01
588	3.301E+01	629	2.831E+01	670	1.203E+01	711	3.325E+00	752	6.142E-01
589	3.317E+01	630	2.792E+01	671	1.171E+01	712	3.226E+00	753	5.925E-01
590	3.333E+01	631	2.755E+01	672	1.138E+01	713	3.108E+00	754	5.205E-01
591	3.347E+01	632	2.715E+01	673	1.106E+01	714	2.978E+00	755	4.853E-01
592	3.362E+01	633	2.672E+01	674	1.078E+01	715	2.864E+00	756	4.870E-01
593	3.374E+01	634	2.633E+01	675	1.050E+01	716	2.745E+00	757	3.755E-01
594	3.385E+01	635	2.593E+01	676	1.020E+01	717	2.672E+00	758	3.241E-01
595	3.398E+01	636	2.553E+01	677	9.917E+00	718	2.562E+00	759	3.532E-01
596	3.409E+01	637	2.513E+01	678	9.628E+00	719	2.451E+00	760	3.099E-01
597	3.417E+01	638	2.470E+01	679	9.347E+00	720	2.352E+00	761	3.463E-01
598	3.421E+01	639	2.428E+01	680	9.082E+00	721	2.277E+00	762	3.892E-01
599	3.425E+01	640	2.387E+01	681	8.820E+00	722	2.211E+00	763	3.973E-01
600	3.432E+01	641	2.345E+01	682	8.578E+00	723	2.083E+00	764	3.019E-01
601	3.433E+01	642	2.303E+01	683	8.322E+00	724	2.004E+00	765	2.598E-01
602	3.431E+01	643	2.260E+01	684	8.069E+00	725	1.940E+00	766	2.724E-01
603	3.426E+01	644	2.217E+01	685	7.831E+00	726	1.850E+00	767	3.022E-01
604	3.423E+01	645	2.172E+01	686	7.605E+00	727	1.783E+00	768	2.731E-01
605	3.416E+01	646	2.130E+01	687	7.388E+00	728	1.722E+00	769	2.315E-01
606	3.407E+01	647	2.089E+01	688	7.163E+00	729	1.697E+00	770	2.093E-01
607	3.400E+01	648	2.047E+01	689	6.948E+00	730	1.621E+00	771	2.112E-01
608	3.389E+01	649	2.002E+01	690	6.754E+00	731	1.548E+00	772	2.054E-01
609	3.375E+01	650	1.959E+01	691	6.565E+00	732	1.467E+00	773	1.923E-01
610	3.361E+01	651	1.919E+01	692	6.352E+00	733	1.388E+00	774	1.722E-01
611	3.344E+01	652	1.878E+01	693	6.140E+00	734	1.336E+00	775	1.746E-01
612	3.329E+01	653	1.835E+01	694	5.943E+00	735	1.258E+00	776	1.552E-01
613	3.311E+01	654	1.794E+01	695	5.754E+00	736	1.203E+00	777	1.441E-01
614	3.286E+01	655	1.754E+01	696	5.586E+00	737	1.138E+00	778	1.349E-01
615	3.264E+01	656	1.714E+01	697	5.426E+00	738	1.069E+00	779	1.568E-01
616	3.243E+01	657	1.674E+01	698	5.249E+00	739	1.033E+00	780	1.435E-01
617	3.221E+01	658	1.637E+01	699	5.063E+00	740	1.020E+00		
618	3.196E+01	659	1.599E+01	700	4.902E+00	741	1.003E+00		
619	3.168E+01	660	1.559E+01	701	4.761E+00	742	9.780E-01		
620	3.138E+01	661	1.519E+01	702	4.596E+00	743	8.895E-01		
621	3.108E+01	662	1.481E+01	703	4.448E+00	744	8.188E-01		
622	3.076E+01	663	1.444E+01	704	4.298E+00	745	7.451E-01		
623	3.042E+01	664	1.408E+01	705	4.145E+00	746	6.937E-01		
624	3.008E+01	665	1.371E+01	706	4.021E+00	747	6.927E-01		
625	2.974E+01	666	1.335E+01	707	3.899E+00	748	6.745E-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**

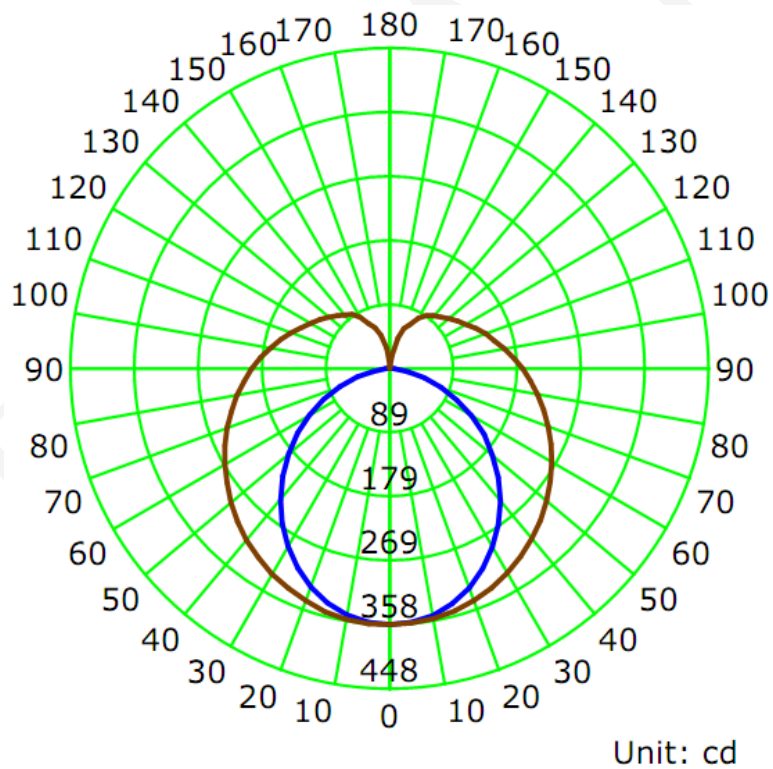
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	0	0.1100	12.92	0.9820

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
1820.1	140.93	358.7	1.20	1.38

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	103.0	132.6	189.4	144.1	142.3
Field Angle (10% I_{max}):	155.5	324.8	335.1	321.9	284.3

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	359	359	359	359	359	359	359	359
5.0°	357	357	357	358	358	358	358	356
10.0°	351	351	352	354	356	355	354	351
15.0°	340	341	345	349	352	351	347	343
20.0°	327	329	335	342	346	344	337	331
25.0°	309	313	322	333	339	337	326	316
30.0°	288	294	307	323	331	327	313	298
35.0°	266	273	291	311	321	316	298	277
40.0°	242	251	273	297	310	304	283	256
45.0°	216	227	254	284	300	292	266	234
50.0°	189	202	236	270	288	279	248	210
55.0°	162	178	217	255	275	265	232	188
60.0°	133	153	199	241	263	252	215	165
65.0°	104	129	182	227	250	239	200	143
70.0°	77	107	166	213	237	225	184	123
75.0°	50	86	150	200	224	211	169	105
80.0°	26	69	137	188	212	198	156	90
85.0°	7	55	125	175	199	185	143	76
90.0°	0	46	114	162	187	172	132	66
95.0°	0	41	106	153	175	162	122	60
100.0°	1	39	99	144	164	152	114	56
105.0°	2	38	93	136	153	142	106	53
110.0°	2	40	88	127	143	132	100	52
115.0°	1	41	84	118	134	124	95	52
120.0°	0	42	80	111	125	117	89	52
125.0°	0	40	78	105	117	109	86	53
130.0°	0	40	76	100	110	102	82	48
135.0°	0	41	74	95	103	97	79	46
140.0°	0	41	71	90	97	91	76	45
145.0°	0	39	63	86	91	85	64	39
150.0°	0	37	60	76	82	72	53	30
155.0°	0	33	57	66	68	63	42	22
160.0°	0	29	51	59	60	46	26	14
165.0°	1	21	37	46	45	26	12	7
170.0°	0	11	22	26	20	10	4	2
175.0°	0	1	5	8	3	2	0	0
180.0°	0	0	0	0	0	0	0	0

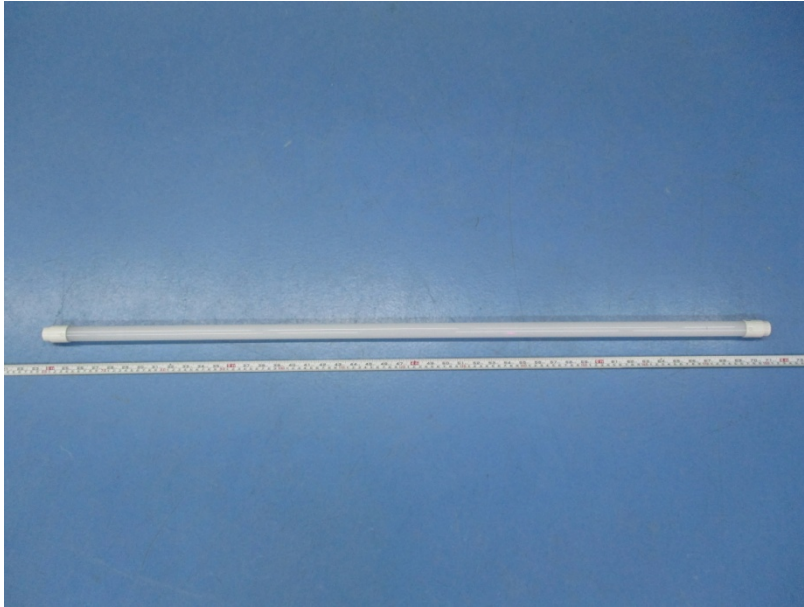
Luminous Intensity (cd) Distribution Data (cont.)

C Y	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	359	359	359	359	359	359	359	359
5.0°	356	357	358	358	359	358	357	357
10.0°	351	352	353	356	356	356	353	351
15.0°	340	341	346	350	353	351	347	342
20.0°	326	328	336	344	346	345	337	330
25.0°	308	312	324	335	339	337	325	314
30.0°	287	294	309	324	332	328	313	296
35.0°	264	272	293	313	323	316	298	276
40.0°	240	249	275	301	313	305	282	255
45.0°	213	226	256	288	303	293	266	233
50.0°	186	201	238	274	292	280	250	210
55.0°	158	177	220	260	279	268	232	187
60.0°	130	152	203	246	269	255	217	164
65.0°	102	128	185	232	256	242	202	144
70.0°	75	106	169	219	243	228	186	124
75.0°	48	86	154	206	231	214	173	106
80.0°	24	68	140	192	219	200	159	91
85.0°	6	54	127	180	206	189	146	78
90.0°	0	45	117	169	194	178	136	68
95.0°	0	40	108	157	182	166	126	63
100.0°	2	38	102	147	170	156	119	60
105.0°	2	38	96	139	159	146	111	57
110.0°	1	39	90	130	148	137	105	55
115.0°	1	42	86	121	138	128	98	55
120.0°	0	41	82	114	129	120	94	56
125.0°	0	40	79	108	120	112	90	58
130.0°	0	40	77	101	112	106	87	53
135.0°	0	40	76	96	105	100	84	50
140.0°	0	36	68	92	99	95	82	49
145.0°	0	27	61	88	94	90	71	47
150.0°	0	22	53	73	84	78	64	41
155.0°	0	15	45	64	70	67	58	34
160.0°	0	10	34	54	61	60	50	26
165.0°	0	4	21	35	49	47	36	17
170.0°	0	0	10	17	29	28	20	5
175.0°	0	0	0	3	5	6	3	0
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	8.6	0.47	0-5	8.6	0.47
5-10	25.4	1.40	0-10	34.0	1.87
10-15	41.5	2.28	0-15	75.5	4.15
15-20	56.2	3.09	0-20	131.7	7.24
20-25	69.3	3.81	0-25	201.0	11.04
25-30	80.3	4.41	0-30	281.3	15.45
30-35	89.0	4.89	0-35	370.3	20.34
35-40	95.3	5.24	0-40	465.6	25.58
40-45	99.3	5.46	0-45	564.9	31.04
45-50	101.0	5.55	0-50	665.9	36.59
50-55	100.6	5.53	0-55	766.6	42.12
55-60	98.4	5.41	0-60	865.0	47.52
60-65	94.5	5.19	0-65	959.5	52.72
65-70	89.4	4.91	0-70	1048.8	57.62
70-75	83.2	4.57	0-75	1132.0	62.19
75-80	76.6	4.21	0-80	1208.6	66.40
80-85	70.0	3.84	0-85	1278.6	70.25
85-90	64.0	3.51	0-90	1342.5	73.76
90-95	59.0	3.24	0-95	1401.5	77.00
95-100	54.7	3.01	0-100	1456.3	80.01
100-105	50.7	2.78	0-105	1506.9	82.79
105-110	46.7	2.57	0-110	1553.6	85.36
110-115	42.8	2.35	0-115	1596.5	87.71
115-120	39.0	2.14	0-120	1635.5	89.86
120-125	35.3	1.94	0-125	1670.8	91.80
125-130	31.6	1.74	0-130	1702.5	93.53
130-135	28.0	1.54	0-135	1730.5	95.07
135-140	24.5	1.35	0-140	1755.0	96.42
140-145	20.6	1.13	0-145	1775.6	97.55
145-150	16.2	0.89	0-150	1791.8	98.44
150-155	12.1	0.66	0-155	1803.9	99.11
155-160	8.4	0.46	0-160	1812.3	99.57
160-165	5.1	0.28	0-165	1817.3	99.85
165-170	2.3	0.12	0-170	1819.6	99.97
170-175	0.5	0.03	0-175	1820.1	100.00
175-180	0.0	0.00	0-180	1820.1	100.00

6. Product Photo



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