



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/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:	PKS181012082-10-4
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/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 50/60Hz
 Rated Power: 10.5W
 Nominal CCT: 4000K
 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**

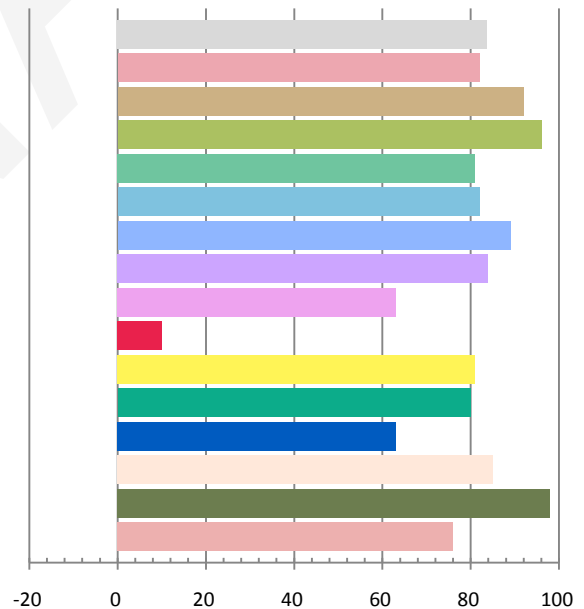
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.0939	11.02	0.9779	1754.7	159.28

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.273	3935	0.00131	0.3843	0.3820	0.2256	0.5044

Color Rendering Index

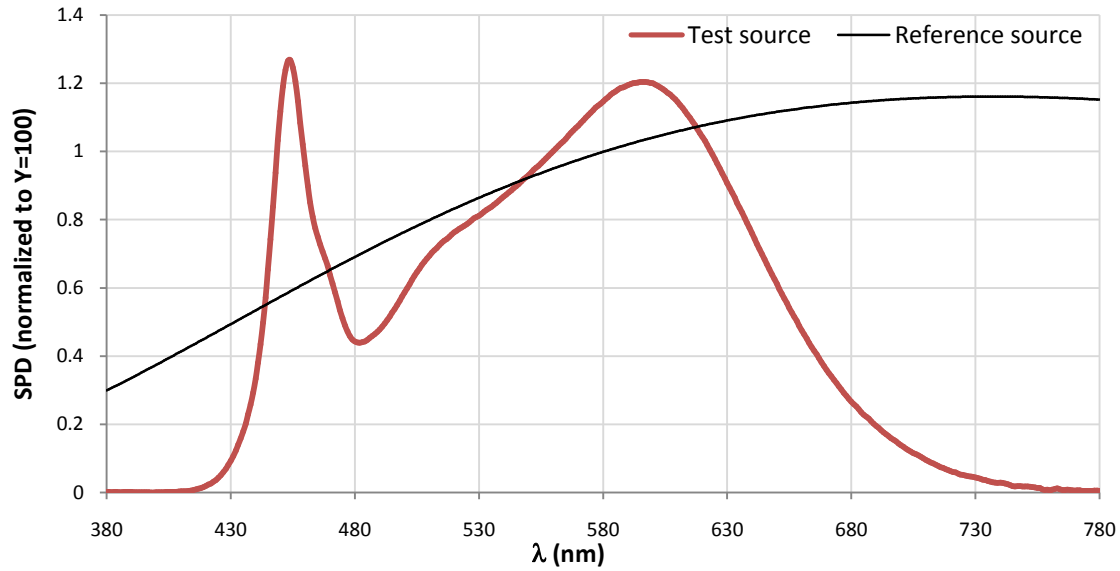
Ra 83.8			
R1 82	R2 92	R3 96	R4 81
R5 82	R6 89	R7 84	R8 63
R9 10	R10 81	R11 80	R12 63
R13 85	R14 98	R15 76	



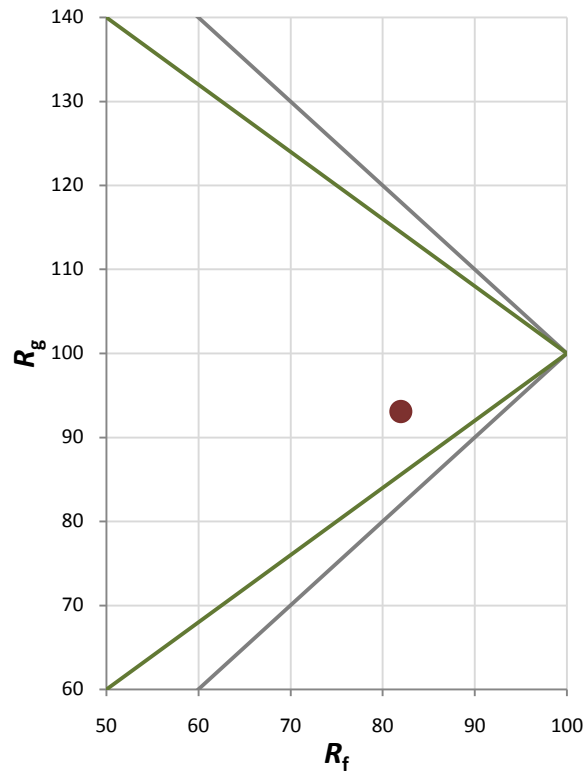
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	93

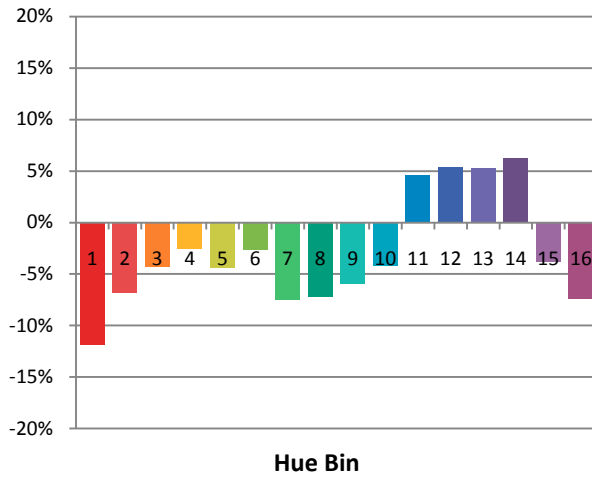
Spectral Power Distribution Comparison



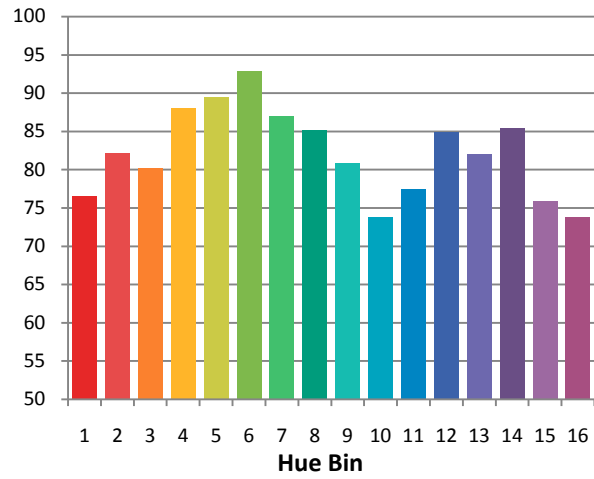
Plot of R_g versus R_f



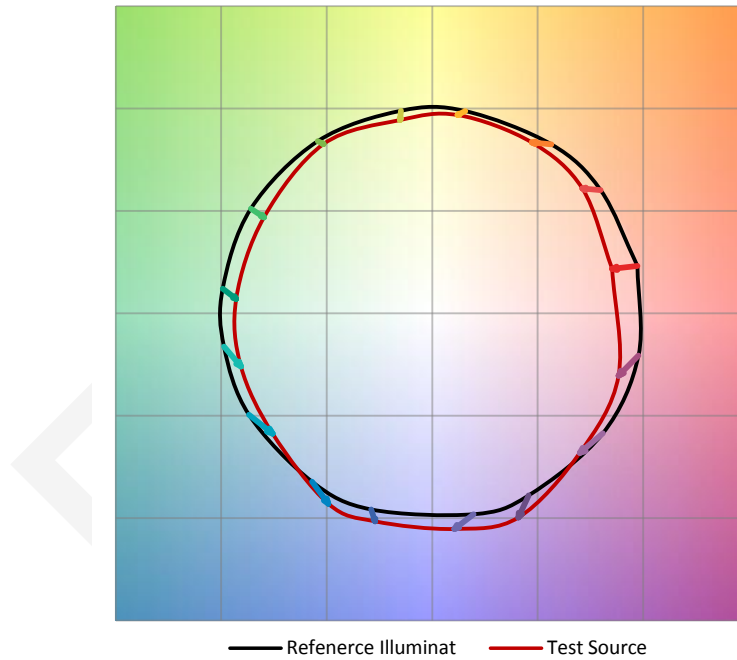
Chroma Shift by Hue



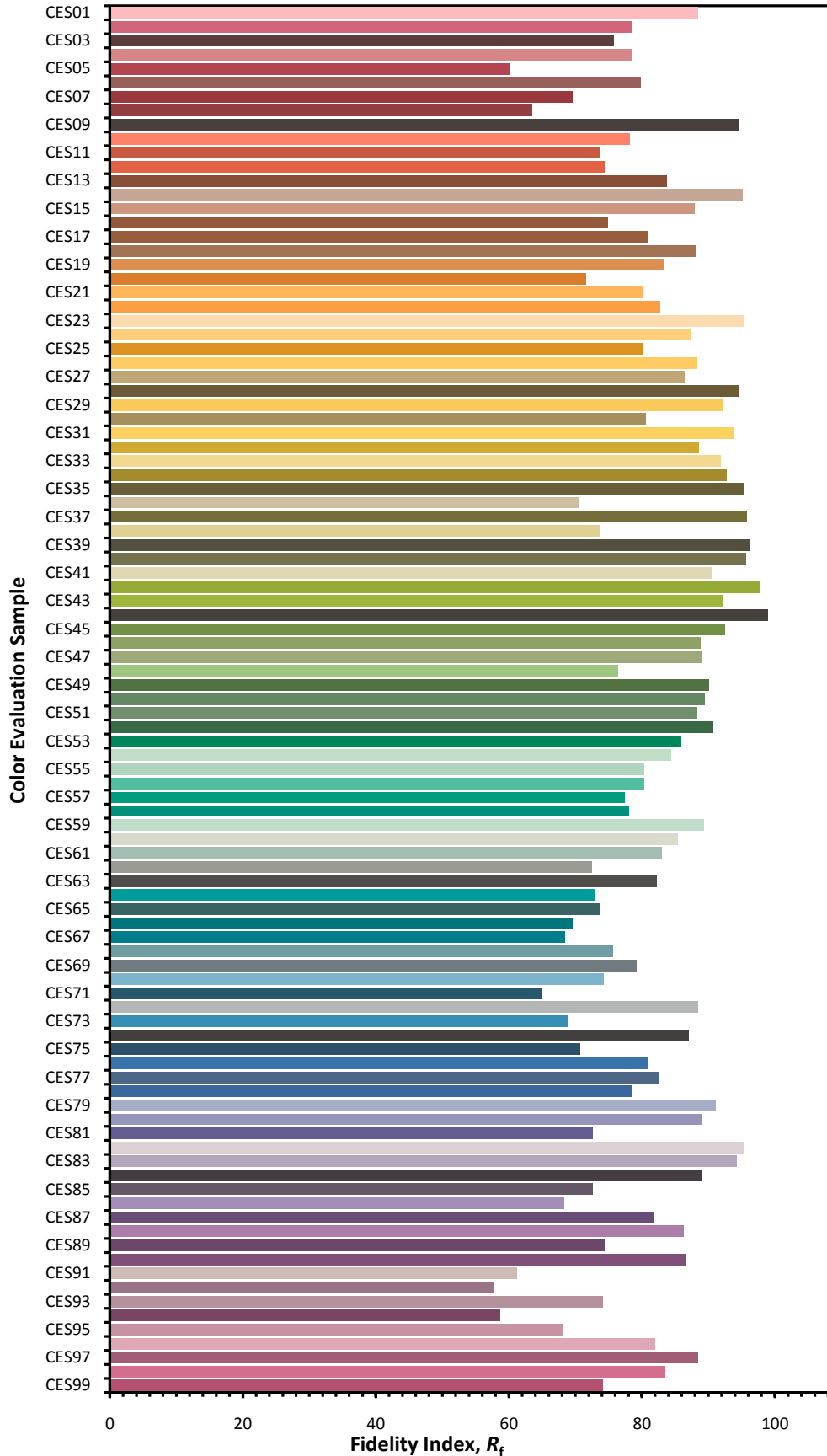
R_f by Hue



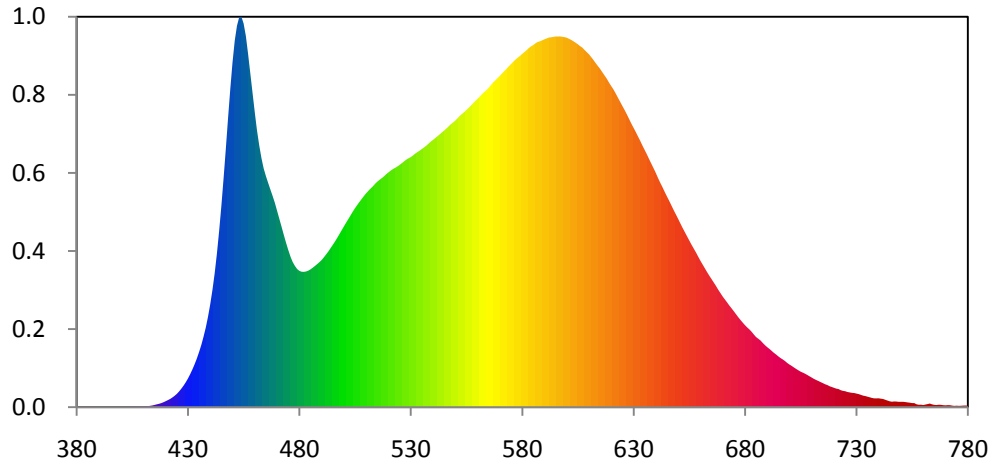
Color Vector Graphic



Color Fidelity by CES Sample



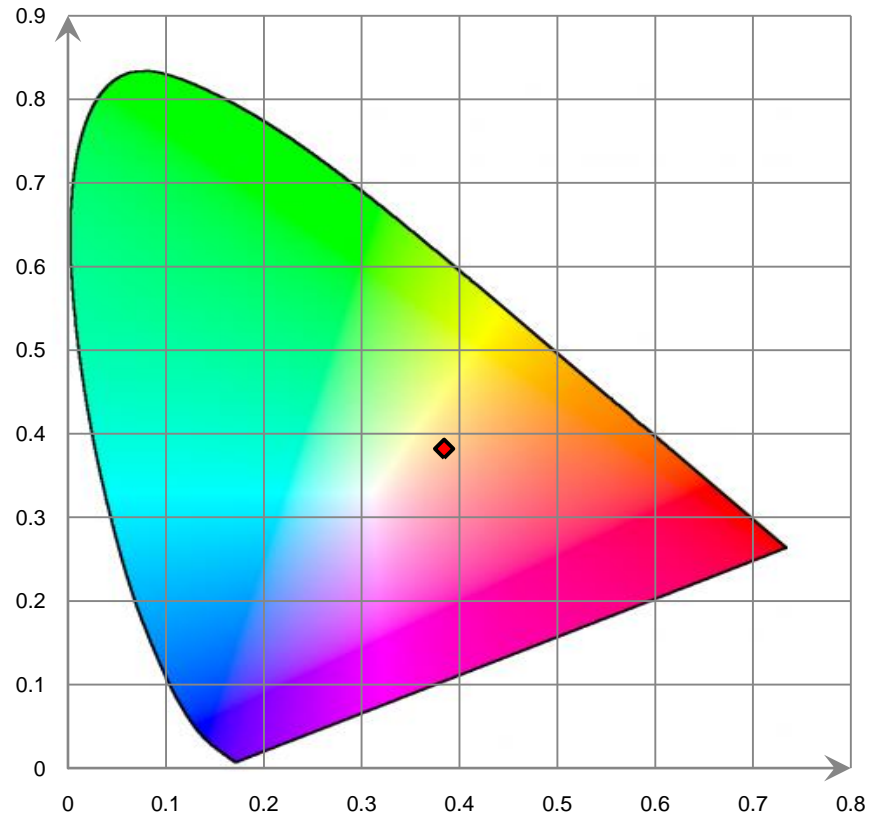
Relative Spectral Power Distribution



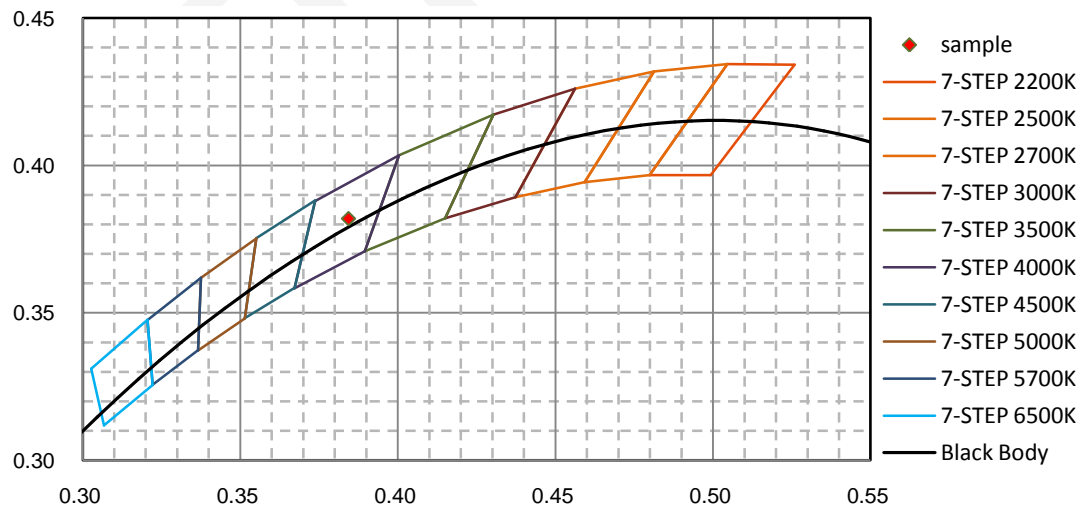
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	4.060E-02	421	5.901E-01	462	2.184E+01	503	1.600E+01	544	2.291E+01
381	3.660E-02	422	6.836E-01	463	2.077E+01	504	1.631E+01	545	2.307E+01
382	3.300E-02	423	8.080E-01	464	1.991E+01	505	1.660E+01	546	2.324E+01
383	4.150E-02	424	9.452E-01	465	1.927E+01	506	1.687E+01	547	2.342E+01
384	4.730E-02	425	1.106E+00	466	1.871E+01	507	1.712E+01	548	2.360E+01
385	2.960E-02	426	1.305E+00	467	1.816E+01	508	1.737E+01	549	2.375E+01
386	3.390E-02	427	1.534E+00	468	1.762E+01	509	1.762E+01	550	2.390E+01
387	3.870E-02	428	1.785E+00	469	1.705E+01	510	1.783E+01	551	2.410E+01
388	3.620E-02	429	2.072E+00	470	1.639E+01	511	1.805E+01	552	2.429E+01
389	4.430E-02	430	2.388E+00	471	1.573E+01	512	1.824E+01	553	2.446E+01
390	3.750E-02	431	2.748E+00	472	1.506E+01	513	1.841E+01	554	2.461E+01
391	1.860E-02	432	3.150E+00	473	1.439E+01	514	1.863E+01	555	2.479E+01
392	1.260E-02	433	3.582E+00	474	1.373E+01	515	1.881E+01	556	2.497E+01
393	1.700E-02	434	4.061E+00	475	1.313E+01	516	1.896E+01	557	2.515E+01
394	2.210E-02	435	4.598E+00	476	1.257E+01	517	1.910E+01	558	2.535E+01
395	2.270E-02	436	5.192E+00	477	1.212E+01	518	1.925E+01	559	2.554E+01
396	2.140E-02	437	5.871E+00	478	1.178E+01	519	1.943E+01	560	2.572E+01
397	1.580E-02	438	6.631E+00	479	1.152E+01	520	1.958E+01	561	2.591E+01
398	8.700E-03	439	7.528E+00	480	1.137E+01	521	1.973E+01	562	2.611E+01
399	6.200E-03	440	8.571E+00	481	1.130E+01	522	1.986E+01	563	2.628E+01
400	1.900E-02	441	9.764E+00	482	1.129E+01	523	1.996E+01	564	2.644E+01
401	2.770E-02	442	1.116E+01	483	1.132E+01	524	2.008E+01	565	2.663E+01
402	2.890E-02	443	1.281E+01	484	1.138E+01	525	2.020E+01	566	2.687E+01
403	2.990E-02	444	1.468E+01	485	1.149E+01	526	2.035E+01	567	2.708E+01
404	3.610E-02	445	1.677E+01	486	1.163E+01	527	2.050E+01	568	2.726E+01
405	3.810E-02	446	1.907E+01	487	1.178E+01	528	2.064E+01	569	2.746E+01
406	4.640E-02	447	2.152E+01	488	1.193E+01	529	2.075E+01	570	2.763E+01
407	5.380E-02	448	2.407E+01	489	1.209E+01	530	2.086E+01	571	2.783E+01
408	5.120E-02	449	2.652E+01	490	1.227E+01	531	2.099E+01	572	2.803E+01
409	7.430E-02	450	2.871E+01	491	1.249E+01	532	2.114E+01	573	2.822E+01
410	8.920E-02	451	3.055E+01	492	1.274E+01	533	2.128E+01	574	2.842E+01
411	8.330E-02	452	3.181E+01	493	1.298E+01	534	2.140E+01	575	2.861E+01
412	9.190E-02	453	3.252E+01	494	1.326E+01	535	2.153E+01	576	2.881E+01
413	1.121E-01	454	3.257E+01	495	1.353E+01	536	2.167E+01	577	2.899E+01
414	1.449E-01	455	3.200E+01	496	1.382E+01	537	2.181E+01	578	2.915E+01
415	1.896E-01	456	3.096E+01	497	1.411E+01	538	2.198E+01	579	2.929E+01
416	2.364E-01	457	2.947E+01	498	1.444E+01	539	2.215E+01	580	2.946E+01
417	2.812E-01	458	2.784E+01	499	1.476E+01	540	2.229E+01	581	2.962E+01
418	3.394E-01	459	2.622E+01	500	1.507E+01	541	2.244E+01	582	2.977E+01
419	4.107E-01	460	2.460E+01	501	1.539E+01	542	2.260E+01	583	2.995E+01
420	4.995E-01	461	2.309E+01	502	1.569E+01	543	2.275E+01	584	3.010E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.021E+01	626	2.478E+01	667	1.012E+01	708	2.686E+00	749	4.450E-01
586	3.035E+01	627	2.442E+01	668	9.802E+00	709	2.577E+00	750	4.454E-01
587	3.046E+01	628	2.404E+01	669	9.517E+00	710	2.469E+00	751	4.490E-01
588	3.052E+01	629	2.366E+01	670	9.236E+00	711	2.357E+00	752	4.263E-01
589	3.060E+01	630	2.331E+01	671	8.985E+00	712	2.267E+00	753	3.986E-01
590	3.068E+01	631	2.295E+01	672	8.737E+00	713	2.183E+00	754	3.751E-01
591	3.075E+01	632	2.258E+01	673	8.479E+00	714	2.092E+00	755	3.408E-01
592	3.083E+01	633	2.222E+01	674	8.246E+00	715	2.003E+00	756	3.408E-01
593	3.085E+01	634	2.182E+01	675	8.004E+00	716	1.912E+00	757	2.411E-01
594	3.088E+01	635	2.145E+01	676	7.758E+00	717	1.848E+00	758	2.014E-01
595	3.092E+01	636	2.108E+01	677	7.505E+00	718	1.748E+00	759	2.073E-01
596	3.091E+01	637	2.068E+01	678	7.277E+00	719	1.681E+00	760	1.783E-01
597	3.092E+01	638	2.031E+01	679	7.057E+00	720	1.617E+00	761	2.184E-01
598	3.090E+01	639	1.993E+01	680	6.844E+00	721	1.548E+00	762	2.590E-01
599	3.086E+01	640	1.953E+01	681	6.654E+00	722	1.511E+00	763	3.028E-01
600	3.082E+01	641	1.911E+01	682	6.486E+00	723	1.415E+00	764	2.338E-01
601	3.073E+01	642	1.872E+01	683	6.291E+00	724	1.360E+00	765	1.915E-01
602	3.063E+01	643	1.835E+01	684	6.059E+00	725	1.332E+00	766	1.798E-01
603	3.052E+01	644	1.795E+01	685	5.851E+00	726	1.265E+00	767	2.056E-01
604	3.040E+01	645	1.758E+01	686	5.708E+00	727	1.232E+00	768	1.965E-01
605	3.026E+01	646	1.721E+01	687	5.562E+00	728	1.194E+00	769	1.675E-01
606	3.012E+01	647	1.683E+01	688	5.362E+00	729	1.183E+00	770	1.494E-01
607	2.999E+01	648	1.645E+01	689	5.173E+00	730	1.135E+00	771	1.692E-01
608	2.979E+01	649	1.608E+01	690	5.007E+00	731	1.095E+00	772	1.661E-01
609	2.961E+01	650	1.572E+01	691	4.859E+00	732	1.031E+00	773	1.300E-01
610	2.943E+01	651	1.533E+01	692	4.696E+00	733	9.642E-01	774	1.088E-01
611	2.920E+01	652	1.497E+01	693	4.535E+00	734	9.290E-01	775	1.232E-01
612	2.896E+01	653	1.461E+01	694	4.392E+00	735	8.766E-01	776	1.117E-01
613	2.870E+01	654	1.426E+01	695	4.236E+00	736	8.260E-01	777	1.202E-01
614	2.846E+01	655	1.391E+01	696	4.095E+00	737	7.723E-01	778	1.322E-01
615	2.822E+01	656	1.356E+01	697	3.978E+00	738	7.371E-01	779	1.395E-01
616	2.793E+01	657	1.324E+01	698	3.845E+00	739	7.320E-01	780	1.235E-01
617	2.766E+01	658	1.291E+01	699	3.687E+00	740	7.400E-01		
618	2.739E+01	659	1.256E+01	700	3.555E+00	741	7.100E-01		
619	2.707E+01	660	1.222E+01	701	3.441E+00	742	6.845E-01		
620	2.678E+01	661	1.190E+01	702	3.311E+00	743	6.142E-01		
621	2.650E+01	662	1.159E+01	703	3.191E+00	744	5.517E-01		
622	2.616E+01	663	1.127E+01	704	3.074E+00	745	4.884E-01		
623	2.582E+01	664	1.097E+01	705	2.964E+00	746	4.562E-01		
624	2.547E+01	665	1.069E+01	706	2.880E+00	747	4.785E-01		
625	2.512E+01	666	1.040E+01	707	2.790E+00	748	4.695E-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**

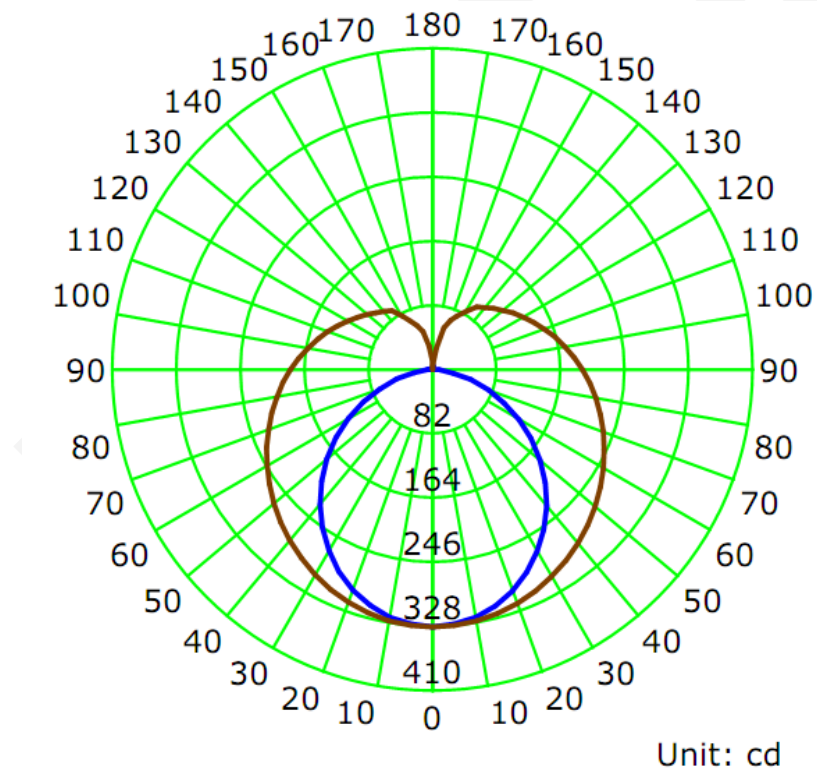
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.0940	11.02	0.9810

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
1757.1	159.49	328.2	1.21	1.39

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	105.7	139.4	203.3	148.8	149.3
Field Angle (10% I_{max}):	157.2	331.0	338.9	326.8	288.5

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	328	328	328	328	328	328	328	328
5.0°	326	327	327	328	328	328	327	327
10.0°	321	322	323	325	326	325	324	322
15.0°	313	314	317	321	323	321	318	315
20.0°	301	303	308	314	318	316	310	305
25.0°	286	290	298	307	312	309	300	291
30.0°	269	274	286	298	305	301	289	276
35.0°	249	255	271	288	298	292	276	258
40.0°	227	236	256	278	290	283	262	239
45.0°	205	215	241	267	281	273	248	219
50.0°	180	194	225	256	272	262	234	198
55.0°	155	172	209	245	263	251	219	178
60.0°	128	150	194	233	253	241	205	157
65.0°	102	128	180	223	243	230	192	137
70.0°	76	108	166	212	233	220	179	119
75.0°	50	90	153	201	223	209	166	102
80.0°	28	74	141	190	213	197	155	88
85.0°	10	61	131	179	202	186	144	75
90.0°	2	53	121	169	192	176	134	67
95.0°	2	48	114	161	182	166	126	61
100.0°	3	46	108	153	172	157	118	58
105.0°	3	45	102	145	162	149	112	56
110.0°	2	46	97	136	153	141	106	55
115.0°	2	47	92	128	144	133	101	55
120.0°	1	49	89	121	135	125	96	56
125.0°	1	47	86	115	127	117	92	55
130.0°	1	47	83	109	119	111	89	53
135.0°	1	48	82	103	111	104	86	52
140.0°	1	48	76	98	104	98	79	51
145.0°	1	49	71	94	98	93	70	46
150.0°	2	47	68	81	87	78	60	38
155.0°	3	44	64	74	76	70	49	30
160.0°	5	39	60	66	68	54	35	21
165.0°	6	32	49	56	56	36	19	12
170.0°	3	18	31	36	29	18	8	5
175.0°	2	5	9	12	7	5	2	2
180.0°	0	0	0	0	0	0	0	0

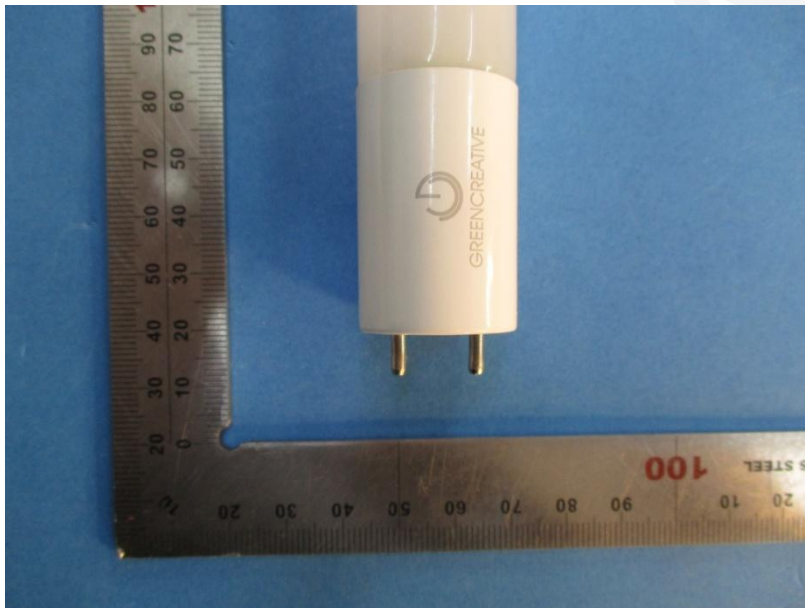
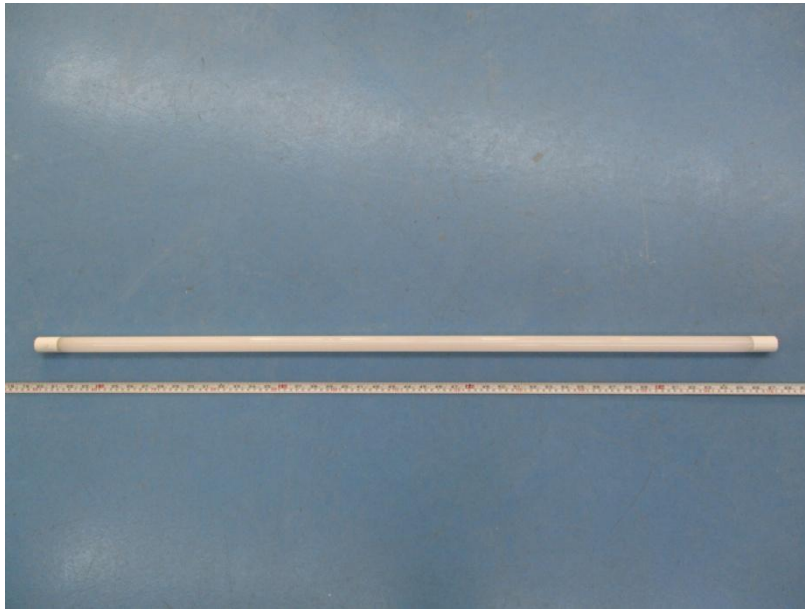
Luminous Intensity (cd) Distribution Data (cont.)

C γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	328	328	328	328	328	328	328	328
5.0°	326	327	327	328	328	327	327	327
10.0°	321	322	324	325	326	325	323	322
15.0°	312	314	317	320	322	321	317	314
20.0°	300	303	308	314	317	315	308	303
25.0°	285	288	298	306	310	307	298	289
30.0°	267	272	284	297	303	298	286	274
35.0°	247	253	270	287	294	288	273	256
40.0°	225	233	254	275	285	278	258	237
45.0°	202	213	238	263	276	266	243	217
50.0°	177	191	222	252	266	255	228	196
55.0°	152	169	206	239	256	244	214	175
60.0°	125	146	191	227	245	233	200	154
65.0°	99	124	175	215	235	221	185	134
70.0°	73	104	161	204	224	209	172	116
75.0°	48	85	147	192	214	197	159	99
80.0°	25	70	135	180	203	185	147	85
85.0°	8	57	123	170	193	176	136	73
90.0°	2	48	115	161	183	167	127	64
95.0°	3	44	107	150	173	157	118	59
100.0°	5	42	101	142	163	147	111	56
105.0°	5	41	95	135	153	140	105	53
110.0°	4	42	90	127	143	132	100	52
115.0°	4	44	86	120	134	124	94	53
120.0°	3	43	82	113	126	116	90	54
125.0°	2	42	79	106	118	110	87	53
130.0°	1	42	77	100	110	104	84	50
135.0°	1	41	76	95	104	98	81	49
140.0°	1	39	67	91	98	93	78	48
145.0°	1	31	61	86	92	89	67	46
150.0°	1	23	53	71	80	74	62	42
155.0°	2	20	45	64	69	66	57	33
160.0°	2	15	37	54	61	59	51	27
165.0°	2	8	23	36	51	48	36	19
170.0°	2	3	14	21	31	30	22	8
175.0°	2	2	3	6	10	10	6	2
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	7.8	0.45	0-5	7.8	0.45
5-10	23.3	1.32	0-10	31.1	1.77
10-15	38.0	2.16	0-15	69.1	3.93
15-20	51.6	2.94	0-20	120.7	6.87
20-25	63.7	3.62	0-25	184.4	10.50
25-30	74.0	4.21	0-30	258.4	14.70
30-35	82.2	4.68	0-35	340.6	19.38
35-40	88.3	5.03	0-40	428.9	24.41
40-45	92.4	5.26	0-45	521.3	29.67
45-50	94.4	5.37	0-50	615.7	35.04
50-55	94.5	5.38	0-55	710.2	40.42
55-60	92.8	5.28	0-60	803.0	45.70
60-65	89.7	5.11	0-65	892.8	50.81
65-70	85.4	4.86	0-70	978.2	55.67
70-75	80.2	4.56	0-75	1058.3	60.23
75-80	74.4	4.24	0-80	1132.7	64.47
80-85	68.6	3.90	0-85	1201.4	68.37
85-90	63.3	3.61	0-90	1264.7	71.98
90-95	59.0	3.36	0-95	1323.7	75.34
95-100	55.2	3.14	0-100	1378.9	78.48
100-105	51.5	2.93	0-105	1430.4	81.41
105-110	47.8	2.72	0-110	1478.2	84.13
110-115	44.1	2.51	0-115	1522.3	86.64
115-120	40.4	2.30	0-120	1562.6	88.93
120-125	36.6	2.08	0-125	1599.2	91.02
125-130	32.8	1.87	0-130	1632.0	92.88
130-135	29.2	1.66	0-135	1661.2	94.54
135-140	25.5	1.45	0-140	1686.7	95.99
140-145	21.5	1.23	0-145	1708.2	97.22
145-150	17.1	0.97	0-150	1725.3	98.19
150-155	12.9	0.73	0-155	1738.2	98.93
155-160	9.3	0.53	0-160	1747.5	99.45
160-165	5.9	0.33	0-165	1753.3	99.79
165-170	2.8	0.16	0-170	1756.2	99.95
170-175	0.8	0.05	0-175	1757.0	100.00
175-180	0.1	0.00	0-180	1757.1	100.00

6. Product Photo



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