



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/840/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:	PKS180910088-10-4
Test Date:	2018-09-11 to 2018-09-12
Report Date:	2018-09-18
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 2018-09-10 and used for testing.

Model Tested: 13T8/4F/840/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: 4000K
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**

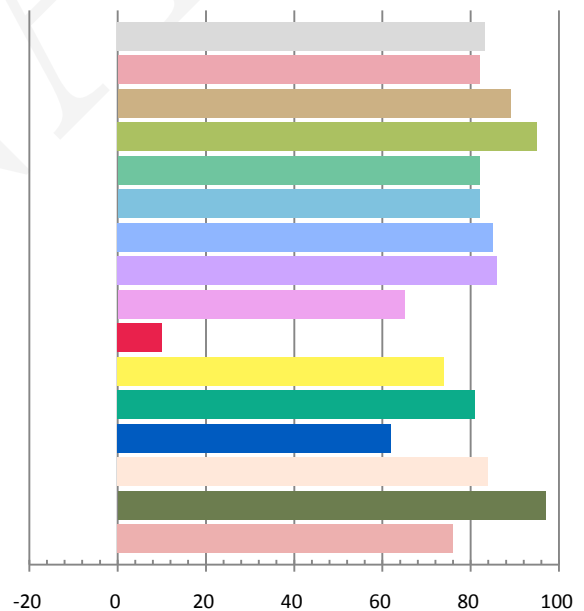
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1102	12.94	0.9784	1857.8	143.57

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.598	3934	-0.00016	0.3833	0.3782	0.2264	0.5026

Color Rendering Index

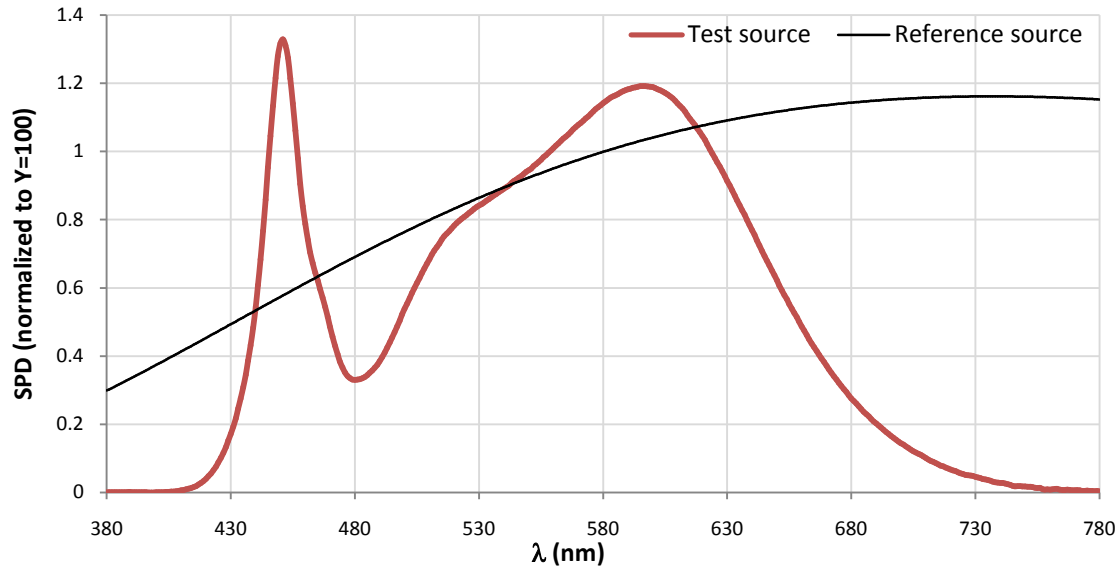
Ra 83.2			
R1 82	R2 89	R3 95	R4 82
R5 82	R6 85	R7 86	R8 65
R9 10	R10 74	R11 81	R12 62
R13 84	R14 97	R15 76	



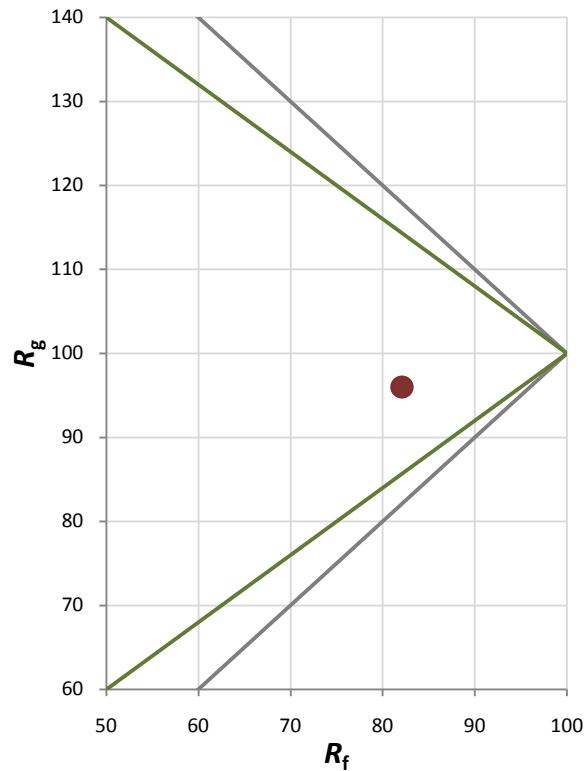
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	96

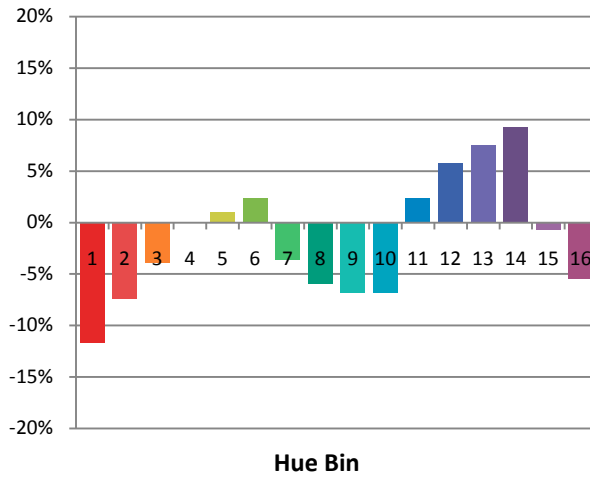
Spectral Power Distribution Comparison



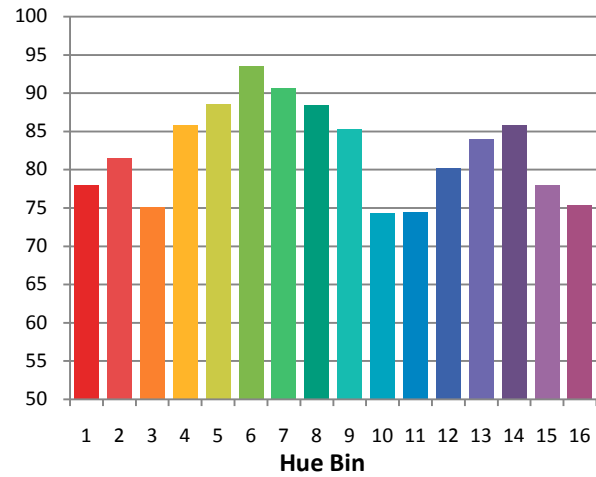
Plot of R_g versus R_f



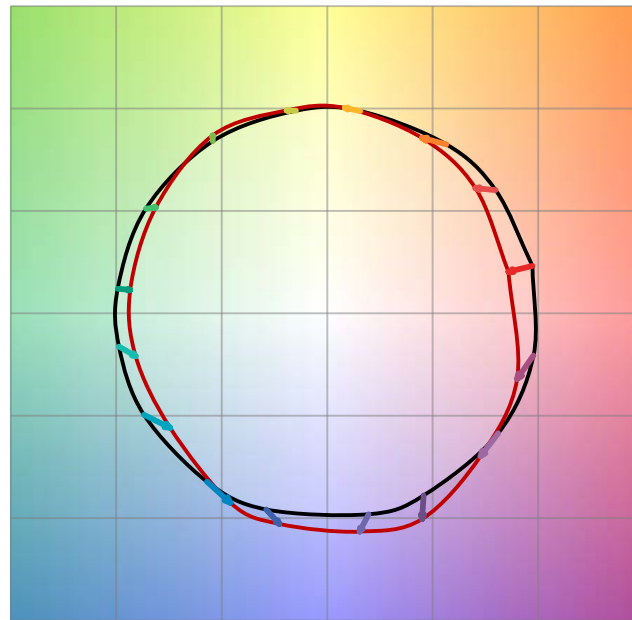
Chroma Shift by Hue



R_t by Hue

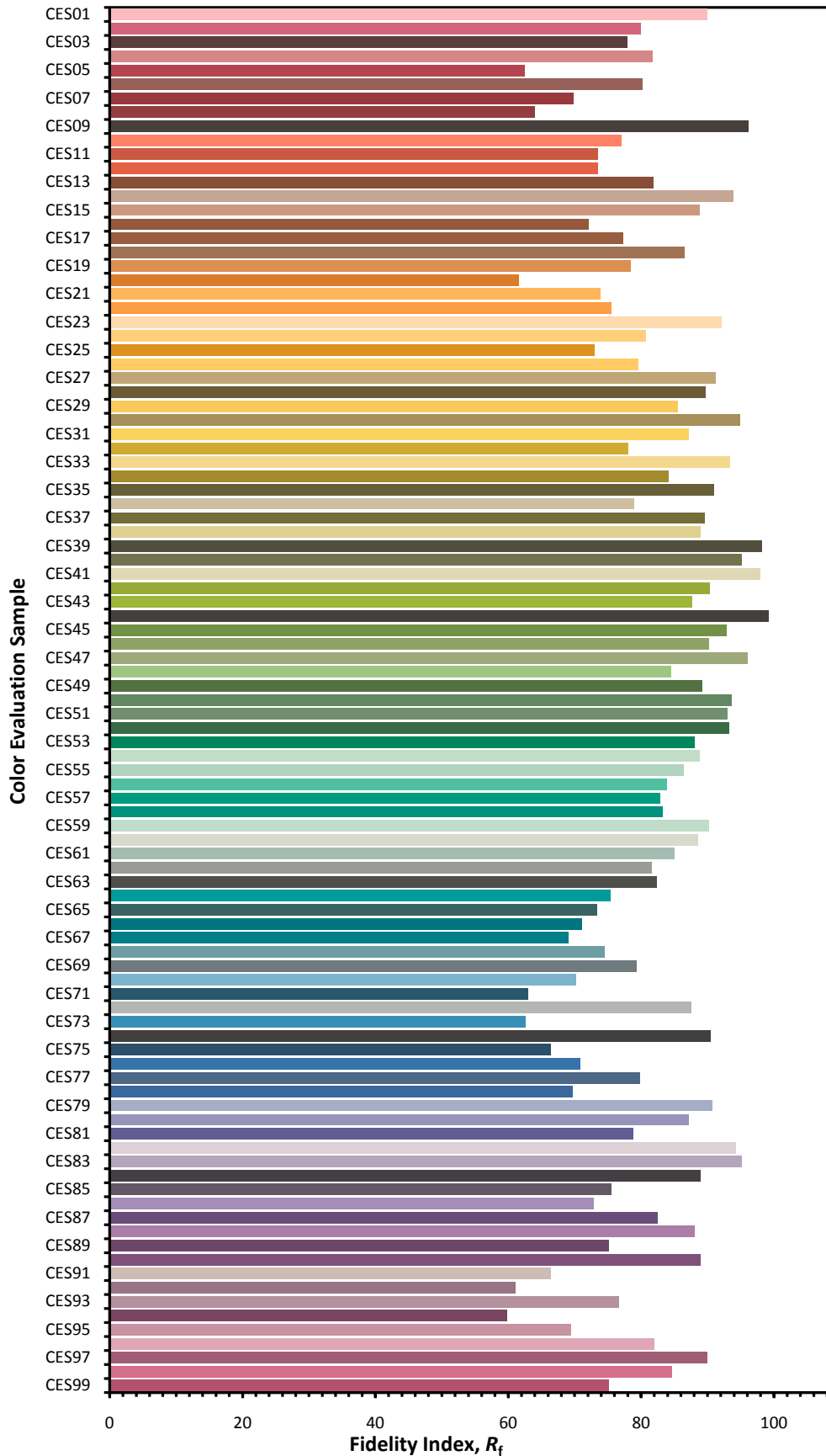


Color Vector Graphic

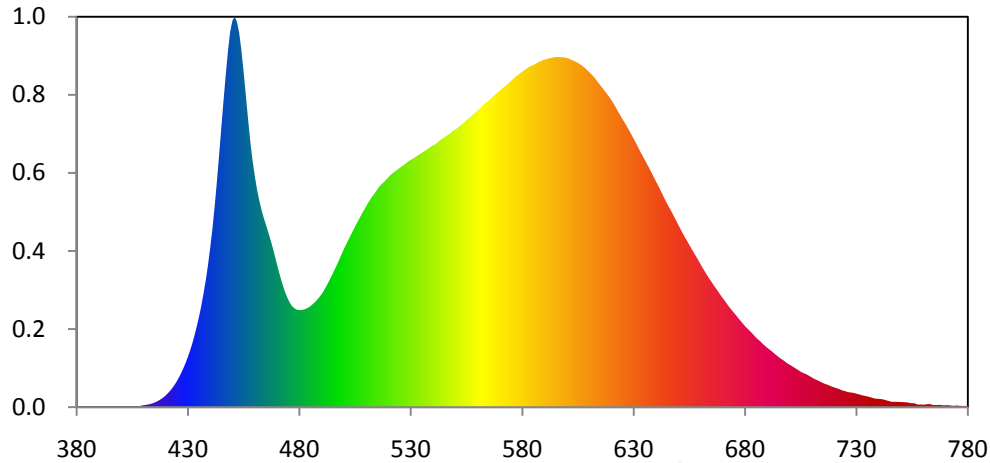


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



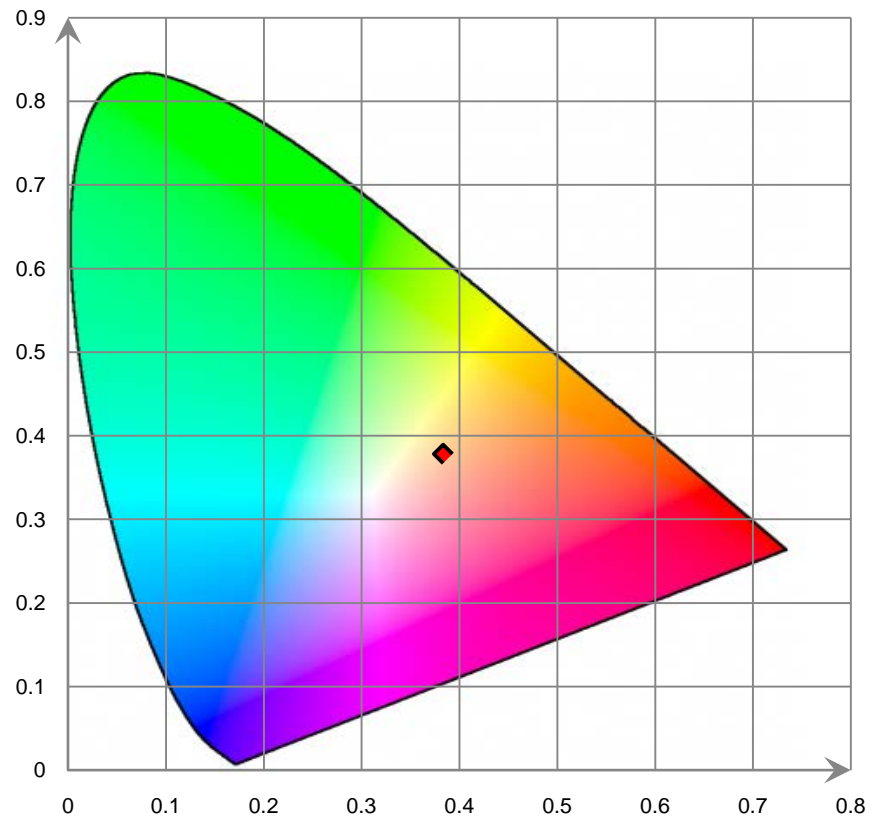
Relative Spectral Power Distribution



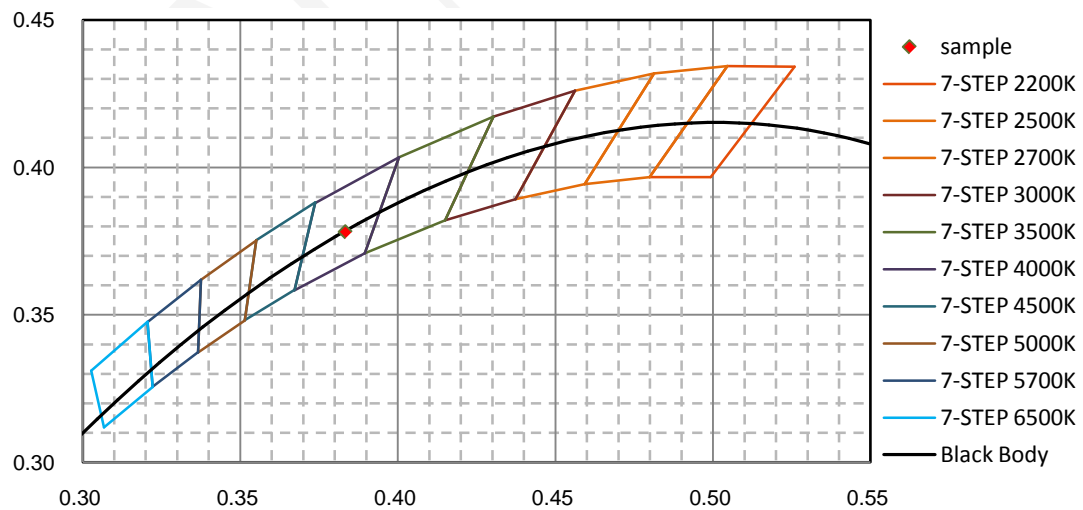
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	3.200E-02	421	1.292E+00	462	1.915E+01	503	1.589E+01	544	2.482E+01
381	2.930E-02	422	1.515E+00	463	1.829E+01	504	1.631E+01	545	2.495E+01
382	2.700E-02	423	1.773E+00	464	1.754E+01	505	1.671E+01	546	2.510E+01
383	2.590E-02	424	2.063E+00	465	1.690E+01	506	1.710E+01	547	2.524E+01
384	3.150E-02	425	2.392E+00	466	1.623E+01	507	1.749E+01	548	2.540E+01
385	1.950E-02	426	2.759E+00	467	1.553E+01	508	1.787E+01	549	2.557E+01
386	2.740E-02	427	3.171E+00	468	1.481E+01	509	1.824E+01	550	2.571E+01
387	3.080E-02	428	3.623E+00	469	1.401E+01	510	1.860E+01	551	2.583E+01
388	3.110E-02	429	4.123E+00	470	1.321E+01	511	1.895E+01	552	2.602E+01
389	3.730E-02	430	4.667E+00	471	1.242E+01	512	1.928E+01	553	2.619E+01
390	3.430E-02	431	5.264E+00	472	1.168E+01	513	1.958E+01	554	2.636E+01
391	1.740E-02	432	5.921E+00	473	1.102E+01	514	1.985E+01	555	2.654E+01
392	1.140E-02	433	6.683E+00	474	1.044E+01	515	2.015E+01	556	2.674E+01
393	1.540E-02	434	7.512E+00	475	9.970E+00	516	2.044E+01	557	2.688E+01
394	1.730E-02	435	8.392E+00	476	9.572E+00	517	2.065E+01	558	2.709E+01
395	1.680E-02	436	9.386E+00	477	9.293E+00	518	2.084E+01	559	2.728E+01
396	1.350E-02	437	1.052E+01	478	9.126E+00	519	2.106E+01	560	2.746E+01
397	1.010E-02	438	1.175E+01	479	9.018E+00	520	2.128E+01	561	2.765E+01
398	9.800E-03	439	1.314E+01	480	8.982E+00	521	2.150E+01	562	2.784E+01
399	5.200E-03	440	1.476E+01	481	8.998E+00	522	2.167E+01	563	2.804E+01
400	1.730E-02	441	1.653E+01	482	9.034E+00	523	2.182E+01	564	2.823E+01
401	2.110E-02	442	1.857E+01	483	9.107E+00	524	2.198E+01	565	2.839E+01
402	2.480E-02	443	2.087E+01	484	9.215E+00	525	2.213E+01	566	2.855E+01
403	2.980E-02	444	2.335E+01	485	9.352E+00	526	2.229E+01	567	2.877E+01
404	3.740E-02	445	2.591E+01	486	9.535E+00	527	2.244E+01	568	2.896E+01
405	4.890E-02	446	2.842E+01	487	9.725E+00	528	2.260E+01	569	2.914E+01
406	6.820E-02	447	3.082E+01	488	9.938E+00	529	2.276E+01	570	2.932E+01
407	7.990E-02	448	3.304E+01	489	1.019E+01	530	2.289E+01	571	2.948E+01
408	8.830E-02	449	3.479E+01	490	1.046E+01	531	2.299E+01	572	2.965E+01
409	1.380E-01	450	3.579E+01	491	1.078E+01	532	2.313E+01	573	2.983E+01
410	1.805E-01	451	3.613E+01	492	1.115E+01	533	2.327E+01	574	2.999E+01
411	2.048E-01	452	3.565E+01	493	1.155E+01	534	2.341E+01	575	3.019E+01
412	2.472E-01	453	3.466E+01	494	1.196E+01	535	2.354E+01	576	3.039E+01
413	2.932E-01	454	3.302E+01	495	1.236E+01	536	2.368E+01	577	3.056E+01
414	3.505E-01	455	3.104E+01	496	1.279E+01	537	2.380E+01	578	3.073E+01
415	4.293E-01	456	2.886E+01	497	1.324E+01	538	2.395E+01	579	3.088E+01
416	5.201E-01	457	2.664E+01	498	1.369E+01	539	2.410E+01	580	3.105E+01
417	6.273E-01	458	2.459E+01	499	1.418E+01	540	2.422E+01	581	3.118E+01
418	7.599E-01	459	2.283E+01	500	1.464E+01	541	2.434E+01	582	3.133E+01
419	9.100E-01	460	2.141E+01	501	1.505E+01	542	2.448E+01	583	3.149E+01
420	1.089E+00	461	2.016E+01	502	1.548E+01	543	2.467E+01	584	3.159E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.166E+01	626	2.634E+01	667	1.100E+01	708	2.999E+00	749	4.828E-01
586	3.177E+01	627	2.600E+01	668	1.070E+01	709	2.880E+00	750	4.831E-01
587	3.190E+01	628	2.563E+01	669	1.040E+01	710	2.756E+00	751	4.646E-01
588	3.199E+01	629	2.524E+01	670	1.011E+01	711	2.632E+00	752	4.572E-01
589	3.208E+01	630	2.486E+01	671	9.834E+00	712	2.537E+00	753	4.432E-01
590	3.215E+01	631	2.448E+01	672	9.544E+00	713	2.438E+00	754	3.848E-01
591	3.221E+01	632	2.408E+01	673	9.257E+00	714	2.339E+00	755	3.645E-01
592	3.229E+01	633	2.367E+01	674	8.998E+00	715	2.239E+00	756	3.721E-01
593	3.231E+01	634	2.329E+01	675	8.757E+00	716	2.149E+00	757	2.736E-01
594	3.237E+01	635	2.291E+01	676	8.508E+00	717	2.089E+00	758	2.373E-01
595	3.241E+01	636	2.252E+01	677	8.243E+00	718	1.997E+00	759	2.515E-01
596	3.240E+01	637	2.214E+01	678	8.004E+00	719	1.913E+00	760	2.278E-01
597	3.240E+01	638	2.174E+01	679	7.759E+00	720	1.840E+00	761	2.573E-01
598	3.239E+01	639	2.134E+01	680	7.510E+00	721	1.765E+00	762	2.787E-01
599	3.236E+01	640	2.092E+01	681	7.298E+00	722	1.707E+00	763	2.917E-01
600	3.232E+01	641	2.053E+01	682	7.102E+00	723	1.613E+00	764	2.220E-01
601	3.225E+01	642	2.012E+01	683	6.892E+00	724	1.537E+00	765	1.971E-01
602	3.216E+01	643	1.969E+01	684	6.666E+00	725	1.490E+00	766	1.931E-01
603	3.206E+01	644	1.927E+01	685	6.437E+00	726	1.407E+00	767	2.202E-01
604	3.197E+01	645	1.886E+01	686	6.250E+00	727	1.373E+00	768	2.000E-01
605	3.187E+01	646	1.849E+01	687	6.076E+00	728	1.349E+00	769	1.706E-01
606	3.174E+01	647	1.811E+01	688	5.868E+00	729	1.316E+00	770	1.765E-01
607	3.160E+01	648	1.772E+01	689	5.671E+00	730	1.251E+00	771	1.893E-01
608	3.143E+01	649	1.732E+01	690	5.503E+00	731	1.201E+00	772	1.647E-01
609	3.124E+01	650	1.691E+01	691	5.341E+00	732	1.137E+00	773	1.348E-01
610	3.104E+01	651	1.651E+01	692	5.177E+00	733	1.078E+00	774	1.308E-01
611	3.082E+01	652	1.613E+01	693	5.001E+00	734	1.044E+00	775	1.573E-01
612	3.062E+01	653	1.575E+01	694	4.830E+00	735	9.903E-01	776	1.335E-01
613	3.036E+01	654	1.540E+01	695	4.662E+00	736	9.419E-01	777	1.225E-01
614	3.008E+01	655	1.504E+01	696	4.509E+00	737	8.751E-01	778	1.111E-01
615	2.981E+01	656	1.467E+01	697	4.374E+00	738	8.113E-01	779	1.217E-01
616	2.955E+01	657	1.432E+01	698	4.219E+00	739	7.844E-01	780	9.430E-02
617	2.929E+01	658	1.398E+01	699	4.059E+00	740	7.750E-01		
618	2.901E+01	659	1.362E+01	700	3.932E+00	741	7.525E-01		
619	2.874E+01	660	1.325E+01	701	3.824E+00	742	7.244E-01		
620	2.844E+01	661	1.290E+01	702	3.681E+00	743	6.632E-01		
621	2.812E+01	662	1.256E+01	703	3.557E+00	744	6.038E-01		
622	2.776E+01	663	1.223E+01	704	3.426E+00	745	5.459E-01		
623	2.739E+01	664	1.190E+01	705	3.281E+00	746	4.959E-01		
624	2.702E+01	665	1.159E+01	706	3.178E+00	747	4.979E-01		
625	2.667E+01	666	1.129E+01	707	3.097E+00	748	4.972E-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**

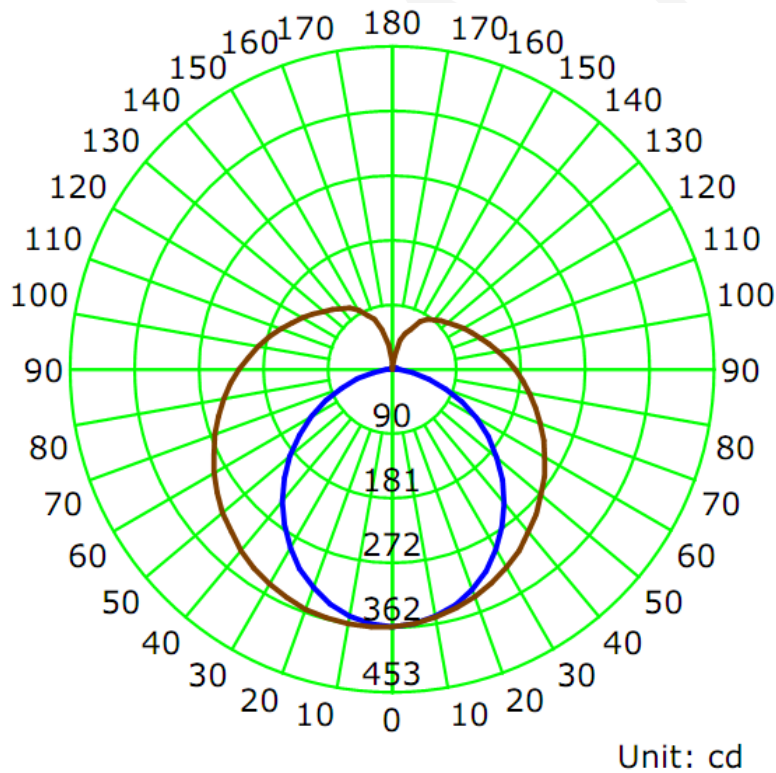
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1100	12.95	0.9820

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
1865.9	144.14	363.0	1.20	1.39

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	103.7	134.0	191.0	145.7	143.6
Field Angle (10% I _{max}):	156.9	326.8	336.4	322.9	285.8

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	361	361	361	361	361	361	361	361
5.0°	359	358	358	358	358	357	358	359
10.0°	352	352	352	352	353	353	352	352
15.0°	343	342	343	346	347	347	343	343
20.0°	329	328	332	336	340	339	333	330
25.0°	312	312	318	326	331	329	320	314
30.0°	292	293	302	315	322	318	306	295
35.0°	270	272	285	300	311	306	291	275
40.0°	246	249	268	286	299	293	275	253
45.0°	220	225	248	272	287	280	257	231
50.0°	193	201	229	258	274	266	241	209
55.0°	165	177	211	244	262	252	224	185
60.0°	137	152	193	229	249	239	207	163
65.0°	109	128	176	215	235	225	191	142
70.0°	81	106	160	202	222	212	176	122
75.0°	54	86	144	188	209	199	161	104
80.0°	30	69	131	176	197	185	148	88
85.0°	11	55	119	163	185	172	135	74
90.0°	3	46	109	152	173	160	124	64
95.0°	4	40	100	143	162	150	115	58
100.0°	7	38	93	134	152	140	107	53
105.0°	7	37	87	125	142	131	99	51
110.0°	7	39	83	118	132	123	93	50
115.0°	6	41	79	110	124	116	89	50
120.0°	5	41	76	104	116	108	84	50
125.0°	4	37	74	99	109	102	81	52
130.0°	2	37	73	94	103	97	79	46
135.0°	1	38	72	90	98	92	76	43
140.0°	1	38	68	87	92	87	73	41
145.0°	1	37	59	84	87	83	59	36
150.0°	2	35	55	72	79	68	49	29
155.0°	2	31	51	60	62	56	38	21
160.0°	3	27	47	53	54	42	25	15
165.0°	3	21	36	44	43	25	13	9
170.0°	2	12	21	25	20	12	6	4
175.0°	2	3	7	9	5	4	2	2
180.0°	0	0	0	0	0	0	0	0

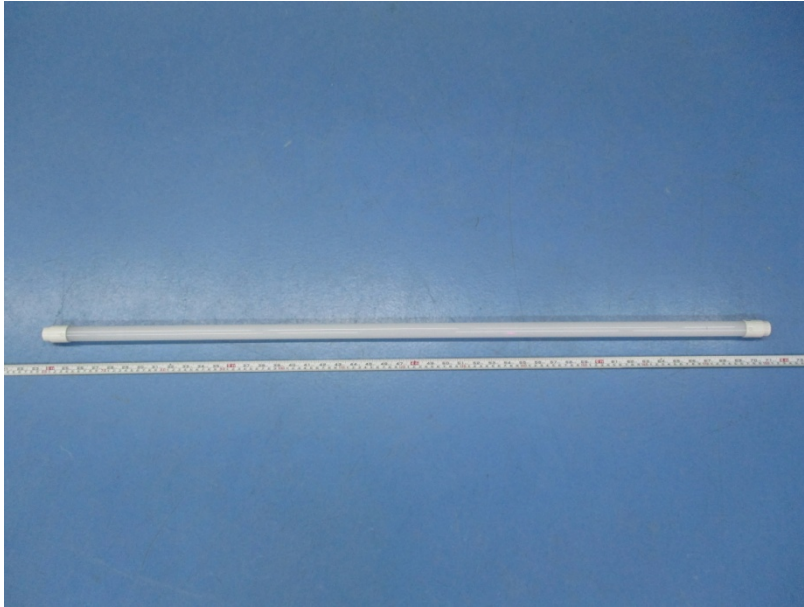
Luminous Intensity (cd) Distribution Data (cont.)

C Y	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	361	361	361	361	361	361	361	361
5.0°	358	360	362	363	363	362	362	361
10.0°	352	355	359	362	363	363	359	356
15.0°	341	347	353	359	361	360	353	348
20.0°	327	335	345	354	359	355	345	336
25.0°	310	319	334	348	354	350	335	321
30.0°	289	301	320	338	348	342	324	304
35.0°	266	279	305	328	341	332	310	284
40.0°	241	257	287	317	332	322	295	263
45.0°	215	234	269	304	322	311	279	241
50.0°	189	209	251	292	313	300	264	219
55.0°	161	184	233	279	302	288	247	196
60.0°	133	159	216	265	290	276	231	173
65.0°	105	135	199	251	278	262	217	152
70.0°	77	113	183	238	266	249	201	132
75.0°	51	92	167	225	254	234	187	115
80.0°	28	75	153	211	242	221	174	99
85.0°	10	61	140	199	229	210	160	86
90.0°	3	52	131	188	217	199	151	77
95.0°	4	48	122	176	204	187	140	72
100.0°	5	47	115	166	192	176	133	69
105.0°	5	47	109	158	180	166	125	66
110.0°	5	48	104	148	168	156	119	65
115.0°	5	50	99	139	157	146	113	65
120.0°	4	51	95	131	147	137	108	66
125.0°	4	51	92	123	137	129	103	67
130.0°	3	51	89	116	128	121	99	64
135.0°	2	50	87	110	120	115	96	62
140.0°	1	45	80	104	113	108	93	61
145.0°	1	34	74	99	106	102	83	57
150.0°	2	28	65	86	96	91	77	50
155.0°	2	21	54	78	84	81	71	42
160.0°	2	15	42	65	75	73	59	33
165.0°	2	8	27	42	58	55	44	22
170.0°	2	3	15	22	36	35	26	10
175.0°	2	2	3	7	10	11	7	2
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	8.6	0.46	0-5	8.6	0.46
5-10	25.6	1.37	0-10	34.2	1.83
10-15	41.8	2.24	0-15	76.0	4.07
15-20	56.6	3.04	0-20	132.6	7.11
20-25	69.8	3.74	0-25	202.4	10.85
25-30	81.0	4.34	0-30	283.4	15.19
30-35	89.9	4.82	0-35	373.3	20.01
35-40	96.3	5.16	0-40	469.6	25.17
40-45	100.4	5.38	0-45	570.1	30.55
45-50	102.3	5.48	0-50	672.4	36.04
50-55	102.1	5.47	0-55	774.5	41.51
55-60	99.9	5.35	0-60	874.4	46.86
60-65	96.2	5.15	0-65	970.6	52.02
65-70	91.1	4.88	0-70	1061.7	56.90
70-75	85.1	4.56	0-75	1146.8	61.46
75-80	78.5	4.21	0-80	1225.3	65.67
80-85	71.9	3.86	0-85	1297.2	69.52
85-90	66.0	3.54	0-90	1363.3	73.06
90-95	61.1	3.28	0-95	1424.4	76.34
95-100	56.9	3.05	0-100	1481.3	79.39
100-105	52.9	2.83	0-105	1534.2	82.22
105-110	48.9	2.62	0-110	1583.1	84.84
110-115	45.0	2.41	0-115	1628.1	87.25
115-120	41.2	2.21	0-120	1669.3	89.46
120-125	37.4	2.00	0-125	1706.6	91.46
125-130	33.5	1.80	0-130	1740.1	93.26
130-135	29.7	1.59	0-135	1769.8	94.85
135-140	25.9	1.39	0-140	1795.8	96.24
140-145	21.8	1.17	0-145	1817.6	97.41
145-150	17.3	0.93	0-150	1834.9	98.34
150-155	12.9	0.69	0-155	1847.9	99.03
155-160	9.1	0.49	0-160	1856.9	99.52
160-165	5.6	0.30	0-165	1862.5	99.82
165-170	2.6	0.14	0-170	1865.1	99.96
170-175	0.7	0.04	0-175	1865.9	100.00
175-180	0.1	0.00	0-180	1865.9	100.00

6. Product Photo



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