



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/830/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:	PKS180910088-10-5
Test Date:	2018-09-11 to 2018-09-17
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/850/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: 5000K
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**

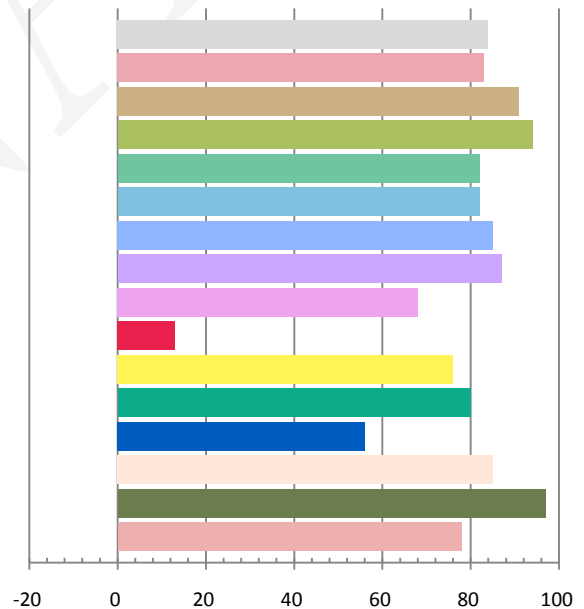
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.11	12.91	0.978	1810.5	140.24

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.606	4995	0.00105	0.3455	0.3540	0.2107	0.4859

Color Rendering Index

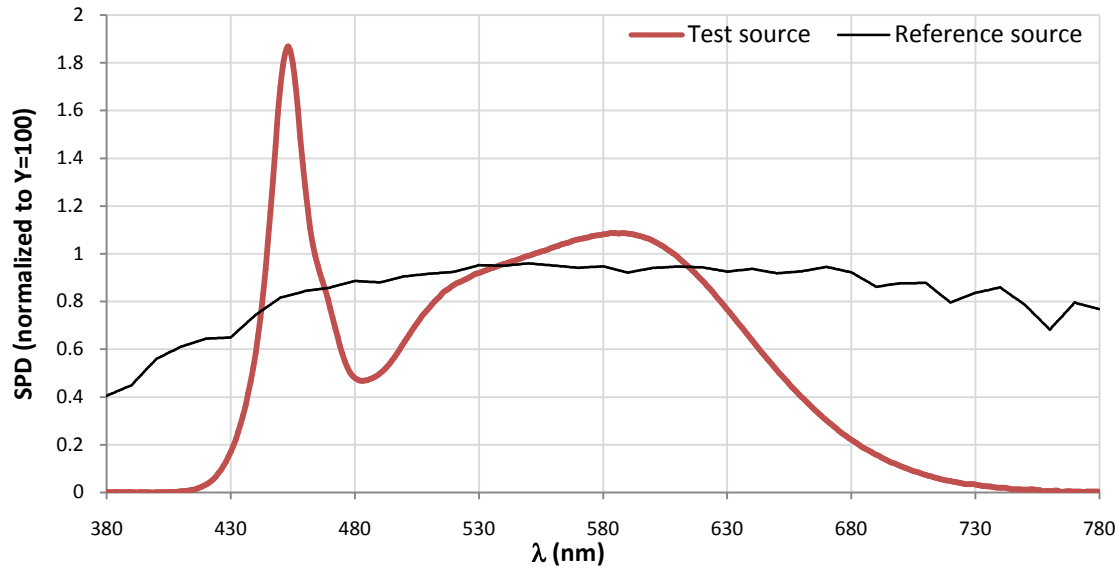
Ra 84.0			
R1 83	R2 91	R3 94	R4 82
R5 82	R6 85	R7 87	R8 68
R9 13	R10 76	R11 80	R12 56
R13 85	R14 97	R15 78	



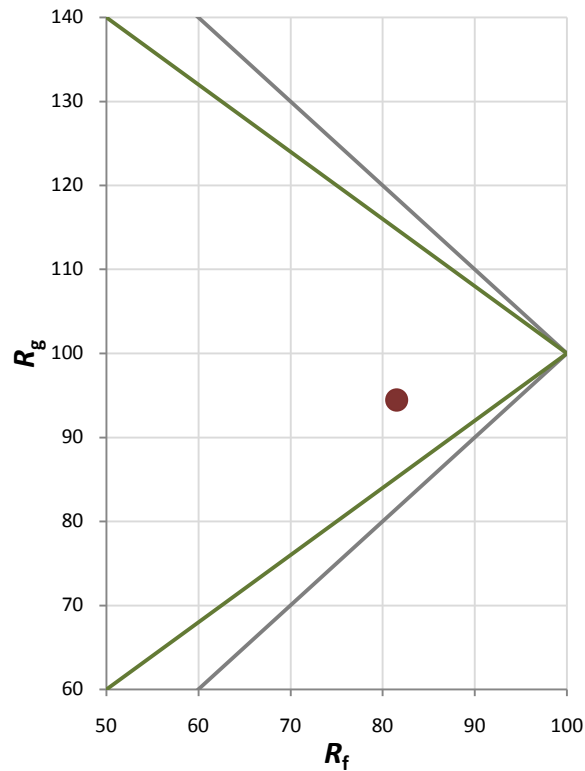
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	94

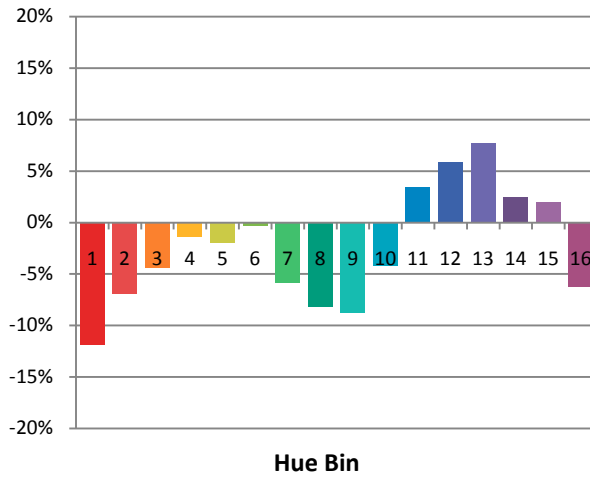
Spectral Power Distribution Comparison



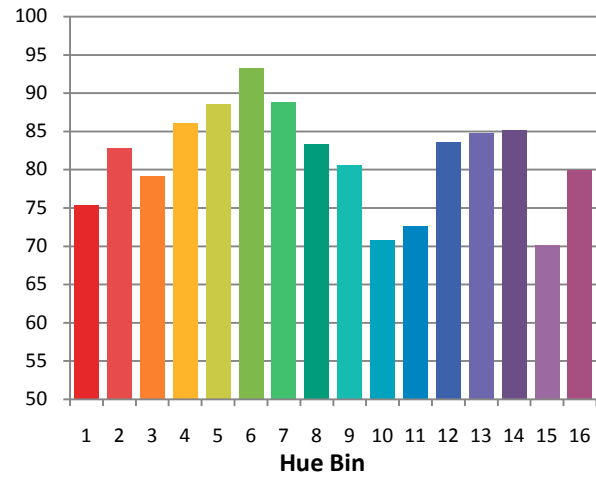
Plot of R_g versus R_f



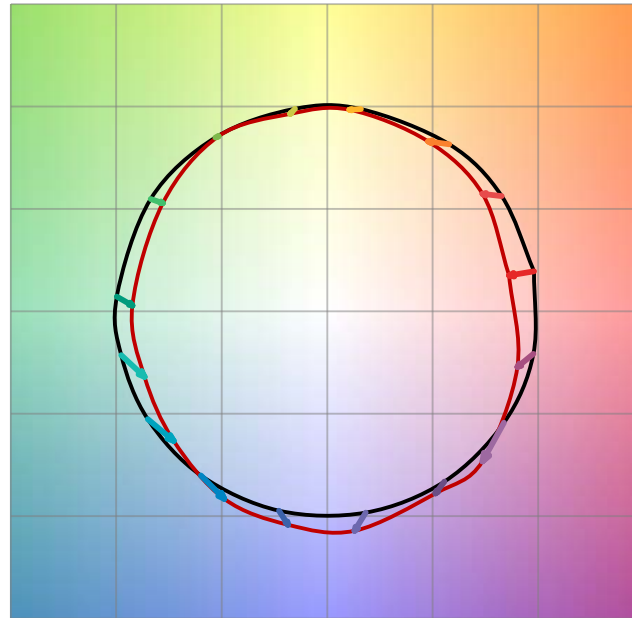
Chroma Shift by Hue



R_t by Hue

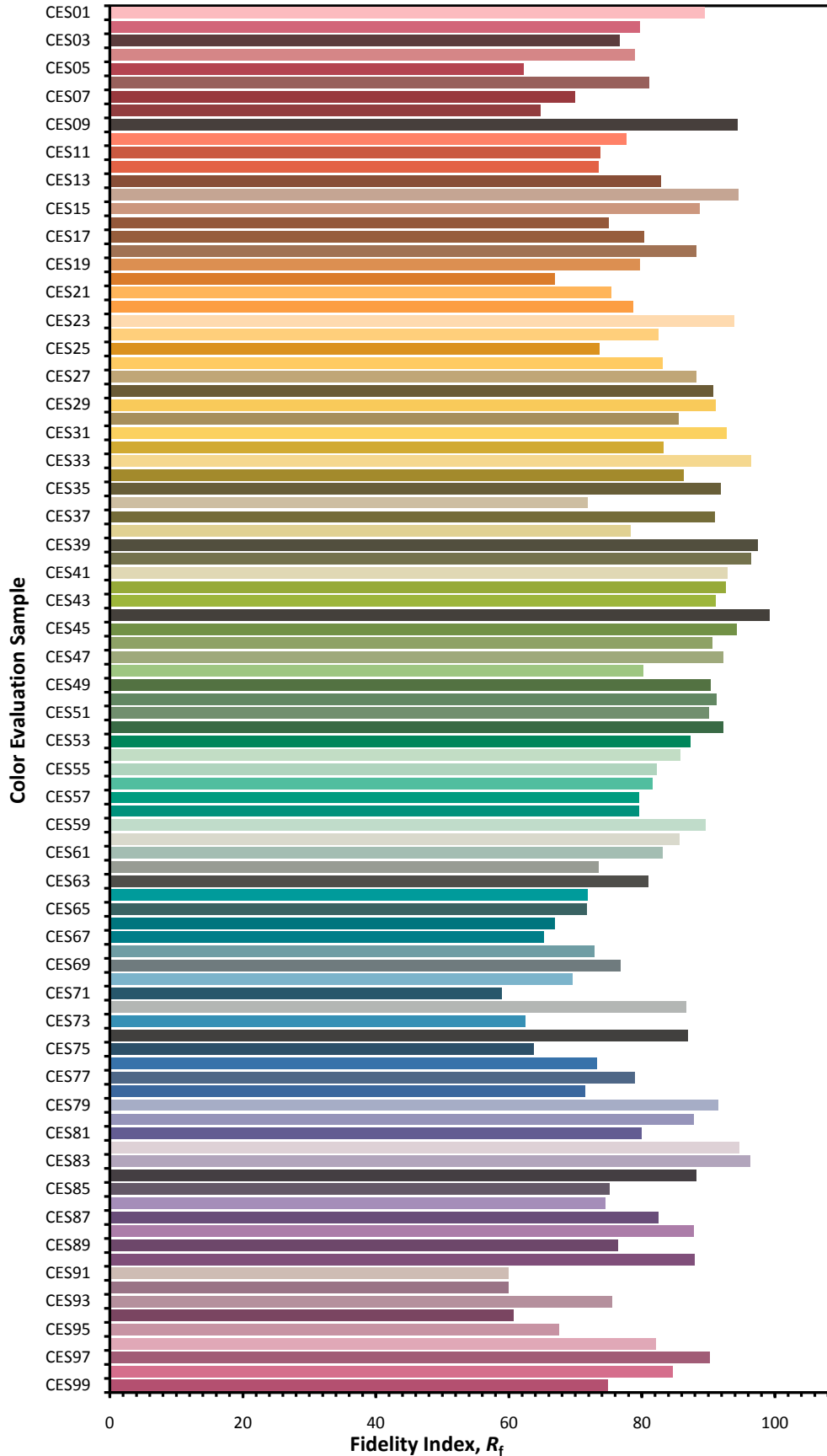


Color Vector Graphic

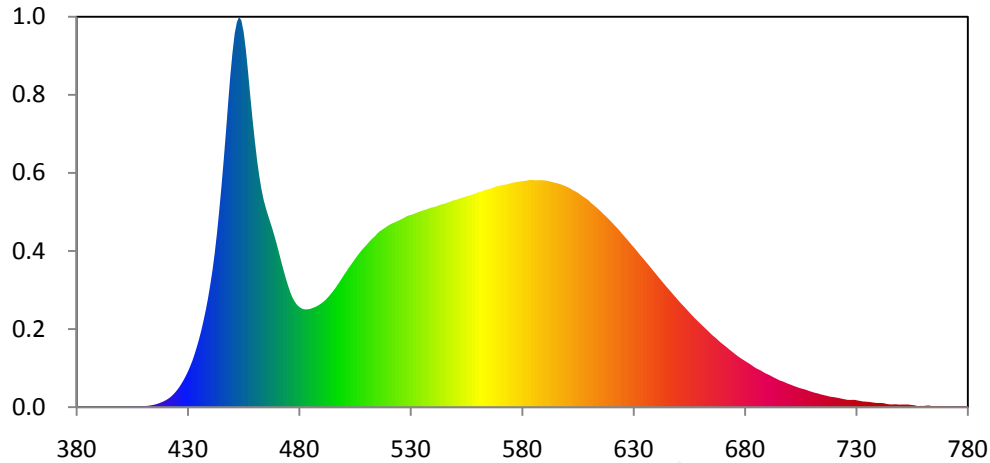


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



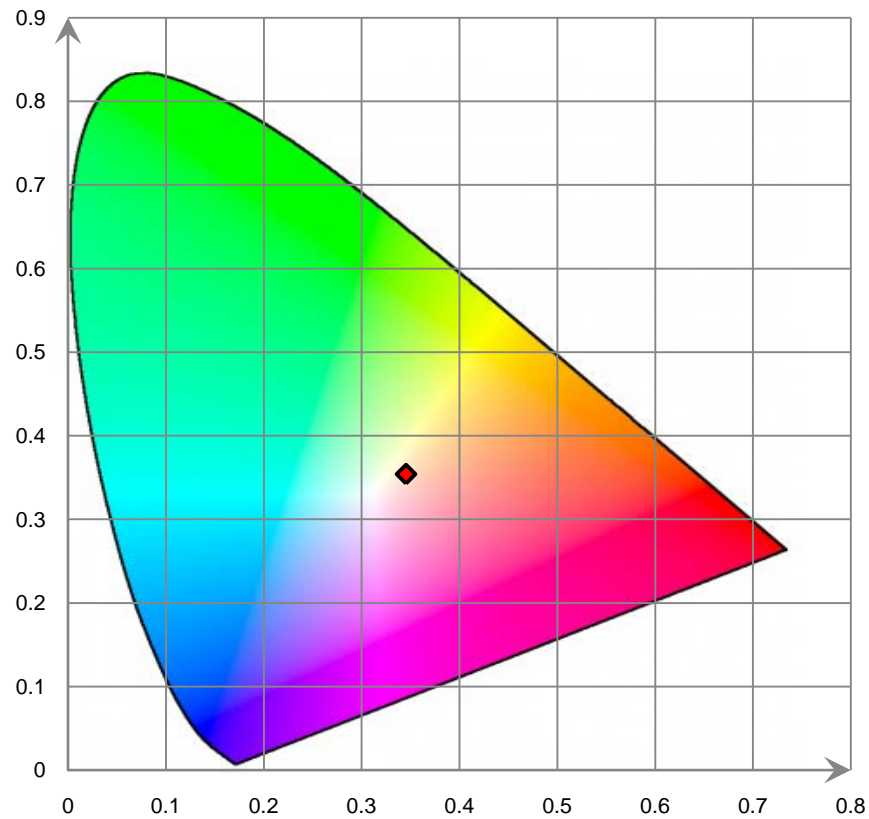
Relative Spectral Power Distribution



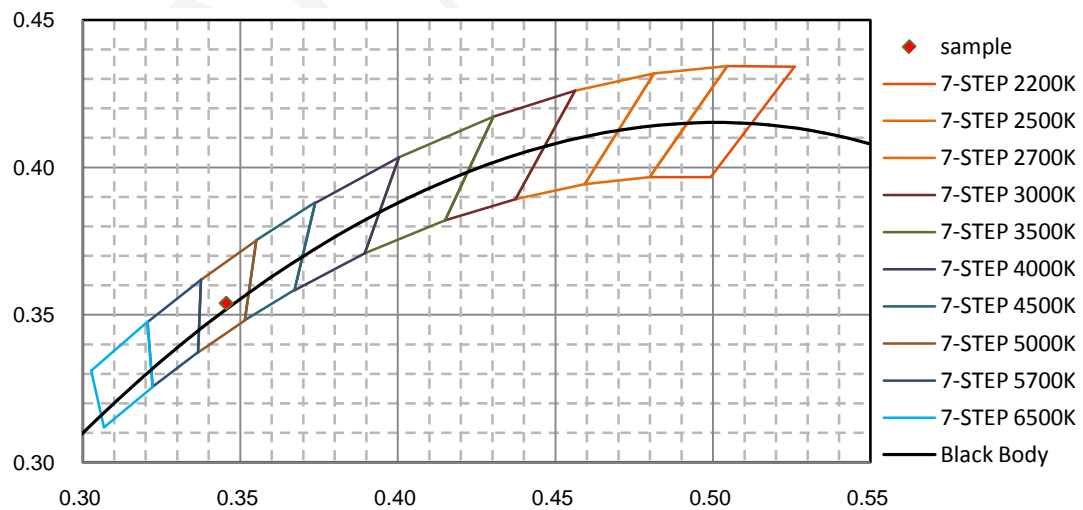
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	5.160E-02	421	1.045E+00	462	2.936E+01	503	1.798E+01	544	2.573E+01
381	3.500E-02	422	1.242E+00	463	2.765E+01	504	1.840E+01	545	2.579E+01
382	2.930E-02	423	1.498E+00	464	2.628E+01	505	1.880E+01	546	2.589E+01
383	4.760E-02	424	1.789E+00	465	2.524E+01	506	1.919E+01	547	2.599E+01
384	5.240E-02	425	2.121E+00	466	2.430E+01	507	1.956E+01	548	2.610E+01
385	3.460E-02	426	2.498E+00	467	2.342E+01	508	1.991E+01	549	2.621E+01
386	4.030E-02	427	2.934E+00	468	2.253E+01	509	2.023E+01	550	2.627E+01
387	4.540E-02	428	3.416E+00	469	2.155E+01	510	2.054E+01	551	2.635E+01
388	4.880E-02	429	3.938E+00	470	2.054E+01	511	2.086E+01	552	2.647E+01
389	5.370E-02	430	4.523E+00	471	1.944E+01	512	2.116E+01	553	2.656E+01
390	4.510E-02	431	5.173E+00	472	1.834E+01	513	2.145E+01	554	2.665E+01
391	2.410E-02	432	5.889E+00	473	1.730E+01	514	2.171E+01	555	2.675E+01
392	1.480E-02	433	6.727E+00	474	1.628E+01	515	2.202E+01	556	2.683E+01
393	2.150E-02	434	7.652E+00	475	1.537E+01	516	2.230E+01	557	2.689E+01
394	2.970E-02	435	8.634E+00	476	1.454E+01	517	2.248E+01	558	2.700E+01
395	3.240E-02	436	9.734E+00	477	1.386E+01	518	2.265E+01	559	2.713E+01
396	3.110E-02	437	1.097E+01	478	1.335E+01	519	2.287E+01	560	2.722E+01
397	2.090E-02	438	1.230E+01	479	1.297E+01	520	2.305E+01	561	2.730E+01
398	1.520E-02	439	1.379E+01	480	1.271E+01	521	2.322E+01	562	2.739E+01
399	9.300E-03	440	1.548E+01	481	1.252E+01	522	2.334E+01	563	2.752E+01
400	1.820E-02	441	1.733E+01	482	1.242E+01	523	2.346E+01	564	2.759E+01
401	2.270E-02	442	1.949E+01	483	1.239E+01	524	2.359E+01	565	2.766E+01
402	3.000E-02	443	2.197E+01	484	1.242E+01	525	2.373E+01	566	2.774E+01
403	3.440E-02	444	2.479E+01	485	1.248E+01	526	2.387E+01	567	2.785E+01
404	3.800E-02	445	2.786E+01	486	1.258E+01	527	2.401E+01	568	2.796E+01
405	4.220E-02	446	3.116E+01	487	1.269E+01	528	2.419E+01	569	2.804E+01
406	5.810E-02	447	3.468E+01	488	1.283E+01	529	2.430E+01	570	2.811E+01
407	7.030E-02	448	3.841E+01	489	1.300E+01	530	2.438E+01	571	2.815E+01
408	7.240E-02	449	4.198E+01	490	1.319E+01	531	2.446E+01	572	2.820E+01
409	1.151E-01	450	4.498E+01	491	1.341E+01	532	2.459E+01	573	2.826E+01
410	1.507E-01	451	4.741E+01	492	1.368E+01	533	2.470E+01	574	2.832E+01
411	1.566E-01	452	4.885E+01	493	1.398E+01	534	2.481E+01	575	2.840E+01
412	1.739E-01	453	4.952E+01	494	1.432E+01	535	2.490E+01	576	2.848E+01
413	2.193E-01	454	4.902E+01	495	1.466E+01	536	2.499E+01	577	2.854E+01
414	2.661E-01	455	4.761E+01	496	1.504E+01	537	2.508E+01	578	2.858E+01
415	3.243E-01	456	4.536E+01	497	1.545E+01	538	2.519E+01	579	2.861E+01
416	4.009E-01	457	4.249E+01	498	1.587E+01	539	2.529E+01	580	2.866E+01
417	4.947E-01	458	3.944E+01	499	1.630E+01	540	2.537E+01	581	2.869E+01
418	6.091E-01	459	3.651E+01	500	1.675E+01	541	2.543E+01	582	2.874E+01
419	7.270E-01	460	3.387E+01	501	1.716E+01	542	2.553E+01	583	2.880E+01
420	8.732E-01	461	3.140E+01	502	1.759E+01	543	2.565E+01	584	2.882E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	2.880E+01	626	2.163E+01	667	8.754E+00	708	2.146E+00	749	3.280E-01
586	2.876E+01	627	2.131E+01	668	8.494E+00	709	2.037E+00	750	3.311E-01
587	2.878E+01	628	2.098E+01	669	8.228E+00	710	1.950E+00	751	3.350E-01
588	2.880E+01	629	2.064E+01	670	8.005E+00	711	1.853E+00	752	3.369E-01
589	2.878E+01	630	2.032E+01	671	7.787E+00	712	1.795E+00	753	3.423E-01
590	2.876E+01	631	1.999E+01	672	7.557E+00	713	1.719E+00	754	3.108E-01
591	2.872E+01	632	1.964E+01	673	7.318E+00	714	1.623E+00	755	2.697E-01
592	2.867E+01	633	1.929E+01	674	7.089E+00	715	1.567E+00	756	2.511E-01
593	2.858E+01	634	1.896E+01	675	6.869E+00	716	1.492E+00	757	1.659E-01
594	2.851E+01	635	1.863E+01	676	6.647E+00	717	1.430E+00	758	1.454E-01
595	2.846E+01	636	1.829E+01	677	6.432E+00	718	1.345E+00	759	1.658E-01
596	2.839E+01	637	1.795E+01	678	6.237E+00	719	1.304E+00	760	1.523E-01
597	2.829E+01	638	1.760E+01	679	6.051E+00	720	1.271E+00	761	1.840E-01
598	2.820E+01	639	1.725E+01	680	5.873E+00	721	1.216E+00	762	2.114E-01
599	2.808E+01	640	1.691E+01	681	5.688E+00	722	1.169E+00	763	2.047E-01
600	2.796E+01	641	1.657E+01	682	5.522E+00	723	1.103E+00	764	1.101E-01
601	2.783E+01	642	1.622E+01	683	5.327E+00	724	1.047E+00	765	7.880E-02
602	2.767E+01	643	1.588E+01	684	5.122E+00	725	9.923E-01	766	1.040E-01
603	2.749E+01	644	1.554E+01	685	4.943E+00	726	9.333E-01	767	1.456E-01
604	2.735E+01	645	1.521E+01	686	4.797E+00	727	9.200E-01	768	1.393E-01
605	2.719E+01	646	1.488E+01	687	4.669E+00	728	9.231E-01	769	1.184E-01
606	2.698E+01	647	1.456E+01	688	4.499E+00	729	9.356E-01	770	9.980E-02
607	2.678E+01	648	1.423E+01	689	4.326E+00	730	8.856E-01	771	1.049E-01
608	2.659E+01	649	1.391E+01	690	4.194E+00	731	8.278E-01	772	1.036E-01
609	2.641E+01	650	1.358E+01	691	4.072E+00	732	7.758E-01	773	7.310E-02
610	2.618E+01	651	1.325E+01	692	3.916E+00	733	7.223E-01	774	7.070E-02
611	2.588E+01	652	1.295E+01	693	3.762E+00	734	7.092E-01	775	9.460E-02
612	2.566E+01	653	1.266E+01	694	3.626E+00	735	6.815E-01	776	1.068E-01
613	2.541E+01	654	1.235E+01	695	3.476E+00	736	6.578E-01	777	1.171E-01
614	2.517E+01	655	1.204E+01	696	3.354E+00	737	6.148E-01	778	1.040E-01
615	2.491E+01	656	1.173E+01	697	3.263E+00	738	5.720E-01	779	1.129E-01
616	2.463E+01	657	1.143E+01	698	3.143E+00	739	5.420E-01	780	9.440E-02
617	2.437E+01	658	1.115E+01	699	3.014E+00	740	5.392E-01		
618	2.409E+01	659	1.087E+01	700	2.910E+00	741	5.298E-01		
619	2.381E+01	660	1.060E+01	701	2.802E+00	742	5.202E-01		
620	2.352E+01	661	1.033E+01	702	2.684E+00	743	4.497E-01		
621	2.322E+01	662	1.006E+01	703	2.585E+00	744	3.922E-01		
622	2.291E+01	663	9.787E+00	704	2.482E+00	745	3.561E-01		
623	2.263E+01	664	9.511E+00	705	2.391E+00	746	3.398E-01		
624	2.229E+01	665	9.230E+00	706	2.315E+00	747	3.615E-01		
625	2.195E+01	666	8.983E+00	707	2.241E+00	748	3.639E-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**

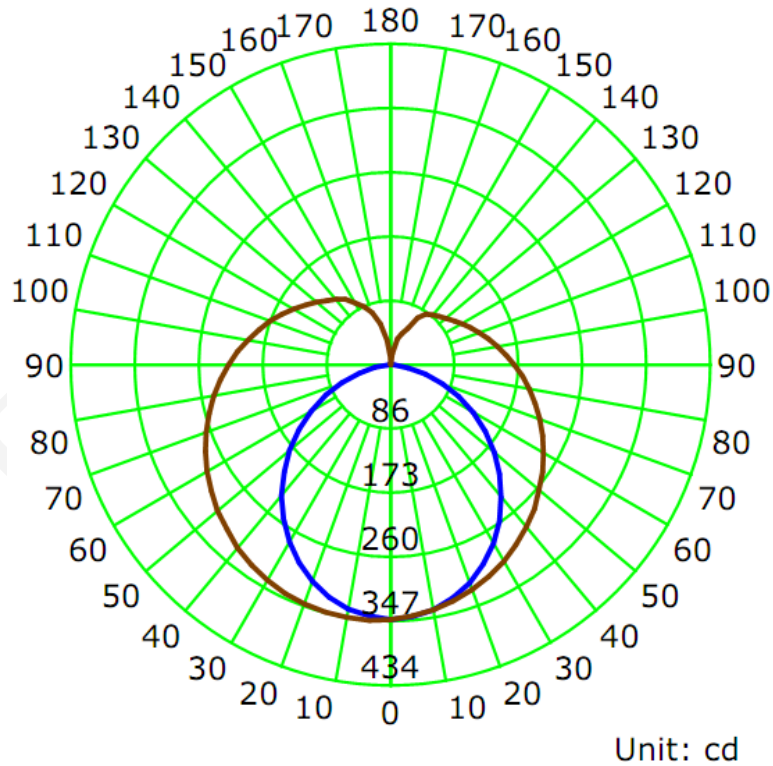
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1100	12.92	0.9780

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
1813.1	140.38	347.6	1.20	1.40

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	103.6	139.6	198.1	145.2	146.6
Field Angle (10% I _{max}):	155.1	326.6	335.4	319.7	284.2

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	345	345	345	345	345	345	345	345
5.0°	343	342	342	341	342	342	343	342
10.0°	337	335	336	337	337	337	337	336
15.0°	327	326	327	330	332	331	329	326
20.0°	315	314	317	322	325	323	318	314
25.0°	298	298	305	312	316	314	306	299
30.0°	280	281	290	301	308	303	292	281
35.0°	258	261	274	289	298	292	277	262
40.0°	234	240	258	276	287	281	262	240
45.0°	209	218	240	264	276	267	246	219
50.0°	184	195	224	250	264	254	229	196
55.0°	157	172	207	238	252	241	212	174
60.0°	130	150	190	225	240	228	196	151
65.0°	102	128	174	212	228	215	180	131
70.0°	75	107	159	199	216	203	165	110
75.0°	49	88	145	186	204	190	151	92
80.0°	25	72	132	175	192	177	138	76
85.0°	6	59	121	163	180	165	126	63
90.0°	0	49	110	151	169	153	115	54
95.0°	0	43	102	142	158	143	106	47
100.0°	0	40	94	132	147	134	97	43
105.0°	0	38	88	124	137	125	91	41
110.0°	0	38	82	116	128	117	85	41
115.0°	0	40	79	108	120	109	81	42
120.0°	0	42	75	101	112	102	77	44
125.0°	0	38	73	96	105	96	74	41
130.0°	0	35	71	92	99	92	73	36
135.0°	0	34	71	88	94	87	72	33
140.0°	0	33	68	84	89	83	65	32
145.0°	0	33	57	82	84	79	51	28
150.0°	0	32	49	68	74	61	39	21
155.0°	0	30	45	54	55	48	32	16
160.0°	2	26	41	46	46	34	20	10
165.0°	2	20	33	38	37	21	10	5
170.0°	0	11	19	22	16	11	3	0
175.0°	0	0	4	5	2	0	0	0
180.0°	0	0	0	0	0	0	0	0

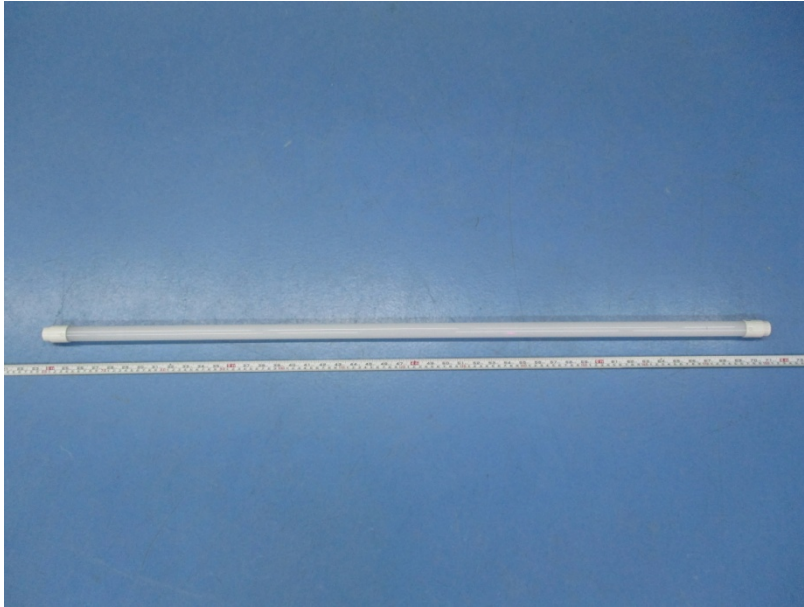
Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	345	345	345	345	345	345	345	345
5.0°	342	344	345	346	347	347	346	344
10.0°	336	339	344	346	348	347	345	340
15.0°	326	331	339	344	347	345	339	332
20.0°	313	320	331	340	345	341	332	321
25.0°	296	306	321	334	341	336	322	307
30.0°	277	289	308	327	337	329	310	290
35.0°	255	268	294	319	331	321	297	272
40.0°	231	248	279	310	324	312	284	252
45.0°	206	226	264	299	316	302	268	230
50.0°	180	204	248	288	308	292	253	208
55.0°	153	181	232	276	298	281	238	185
60.0°	126	157	215	265	288	270	223	163
65.0°	98	135	199	252	278	258	208	142
70.0°	71	114	185	241	267	246	193	122
75.0°	45	96	170	229	256	233	180	104
80.0°	22	79	158	217	245	220	168	89
85.0°	4	67	146	206	233	210	156	77
90.0°	0	58	137	196	221	200	147	68
95.0°	0	54	129	183	210	189	137	63
100.0°	0	52	122	173	198	178	130	61
105.0°	0	52	115	164	186	168	123	60
110.0°	0	52	110	156	175	158	117	59
115.0°	0	54	105	146	163	149	112	61
120.0°	0	56	100	137	153	140	107	62
125.0°	0	55	97	128	142	132	103	62
130.0°	0	55	93	121	133	124	99	61
135.0°	0	53	90	114	124	117	96	60
140.0°	0	49	84	109	116	110	92	57
145.0°	0	40	79	103	109	104	83	52
150.0°	0	30	69	90	98	92	79	45
155.0°	0	23	55	82	88	84	70	36
160.0°	0	15	44	67	76	72	57	27
165.0°	0	7	27	44	58	54	41	17
170.0°	0	1	14	23	34	33	22	6
175.0°	0	0	1	5	9	8	4	0
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	8.2	0.45	0-5	8.2	0.45
5-10	24.4	1.35	0-10	32.7	1.80
10-15	39.9	2.20	0-15	72.6	4.00
15-20	54.2	2.99	0-20	126.8	6.99
20-25	66.9	3.69	0-25	193.7	10.68
25-30	77.6	4.28	0-30	271.3	14.96
30-35	86.2	4.76	0-35	357.5	19.72
35-40	92.6	5.11	0-40	450.2	24.83
40-45	96.8	5.34	0-45	547.0	30.17
45-50	98.8	5.45	0-50	645.8	35.62
50-55	98.8	5.45	0-55	744.6	41.07
55-60	97.0	5.35	0-60	841.6	46.42
60-65	93.5	5.16	0-65	935.1	51.57
65-70	88.8	4.90	0-70	1023.9	56.47
70-75	83.1	4.58	0-75	1107.0	61.06
75-80	76.9	4.24	0-80	1183.9	65.30
80-85	70.7	3.90	0-85	1254.6	69.20
85-90	65.1	3.59	0-90	1319.7	72.79
90-95	60.5	3.33	0-95	1380.2	76.12
95-100	56.1	3.10	0-100	1436.3	79.22
100-105	52.0	2.87	0-105	1488.4	82.09
105-110	48.1	2.65	0-110	1536.5	84.74
110-115	44.3	2.44	0-115	1580.8	87.19
115-120	40.7	2.24	0-120	1621.4	89.43
120-125	36.8	2.03	0-125	1658.3	91.46
125-130	32.9	1.82	0-130	1691.2	93.28
130-135	29.2	1.61	0-135	1720.4	94.89
135-140	25.5	1.41	0-140	1745.9	96.30
140-145	21.4	1.18	0-145	1767.3	97.48
145-150	16.8	0.93	0-150	1784.2	98.41
150-155	12.4	0.68	0-155	1796.5	99.09
155-160	8.5	0.47	0-160	1805.1	99.56
160-165	5.1	0.28	0-165	1810.2	99.84
165-170	2.3	0.13	0-170	1812.5	99.97
170-175	0.6	0.03	0-175	1813.1	100.00
175-180	0.0	0.00	0-180	1813.1	100.00

6. Product Photo



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