



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
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/830/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: 3000K
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**

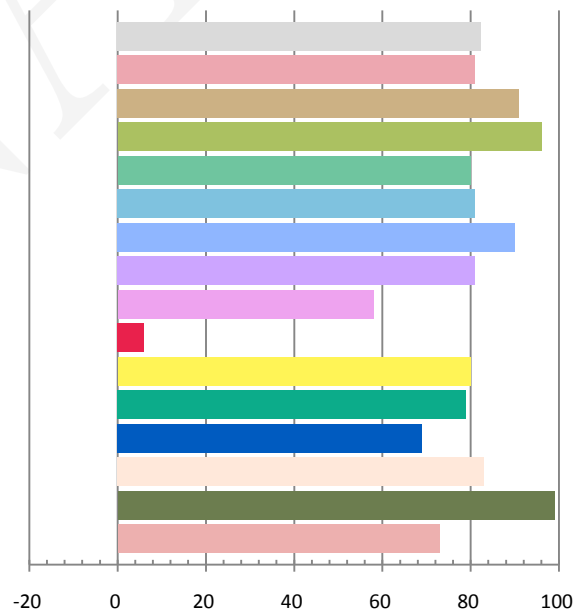
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1095	12.87	0.9792	1718.2	133.51

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
5.142	3015	-0.00009	0.4358	0.4035	0.2501	0.5210

Color Rendering Index

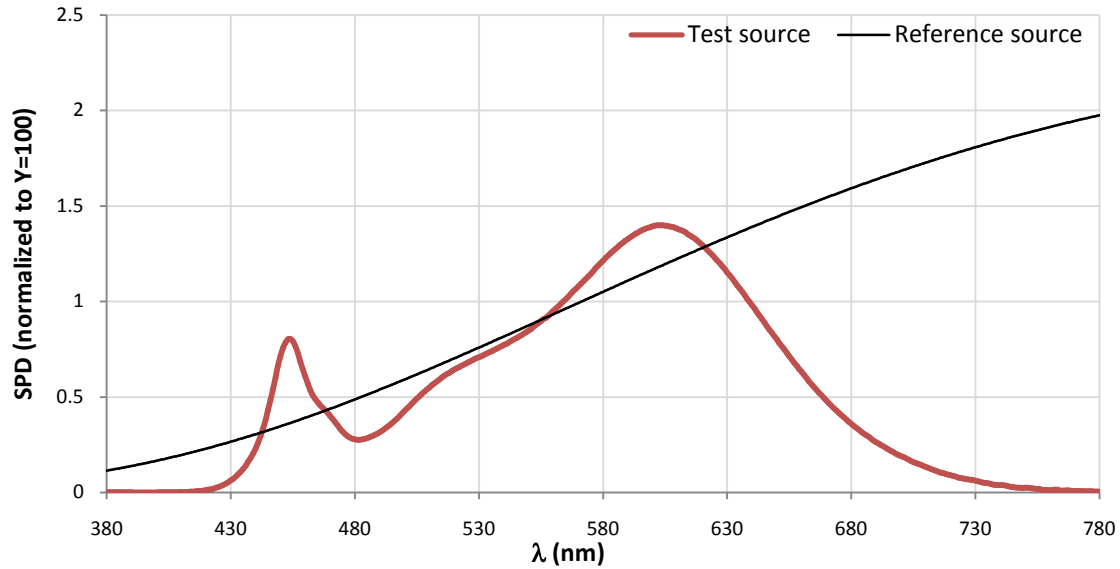
Ra 82.4			
R1 81	R2 91	R3 96	R4 80
R5 81	R6 90	R7 81	R8 58
R9 6	R10 80	R11 79	R12 69
R13 83	R14 99	R15 73	



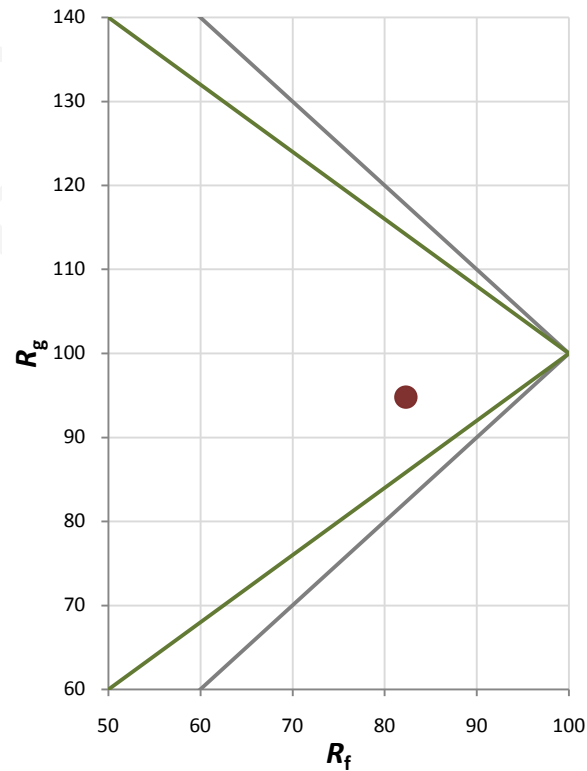
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	95

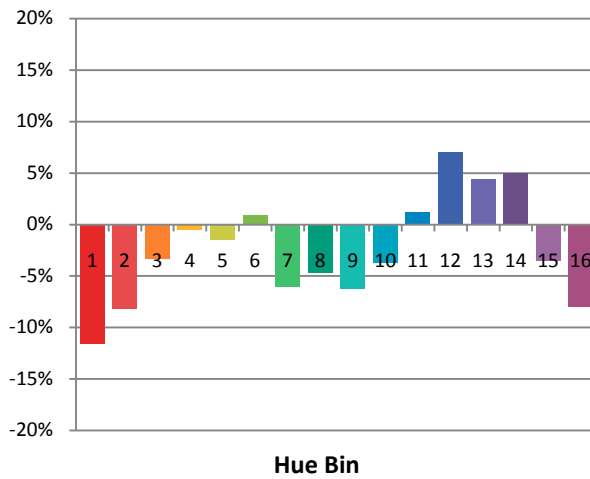
Spectral Power Distribution Comparison



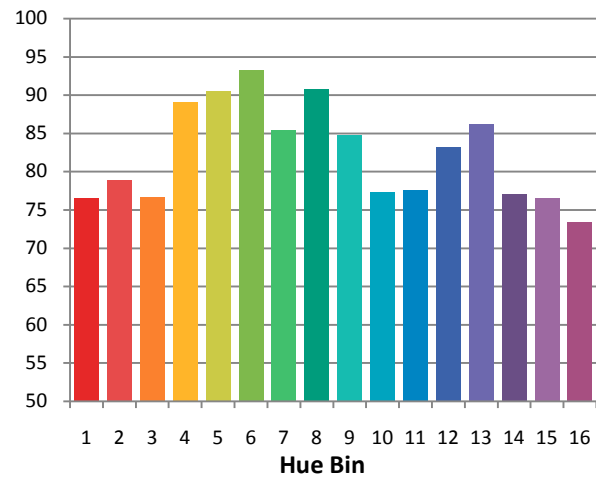
Plot of R_g versus R_f



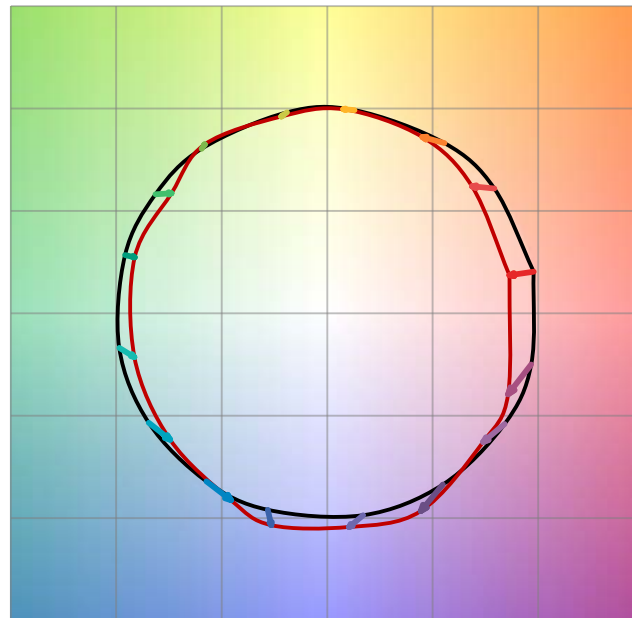
Chroma Shift by Hue



R_t by Hue

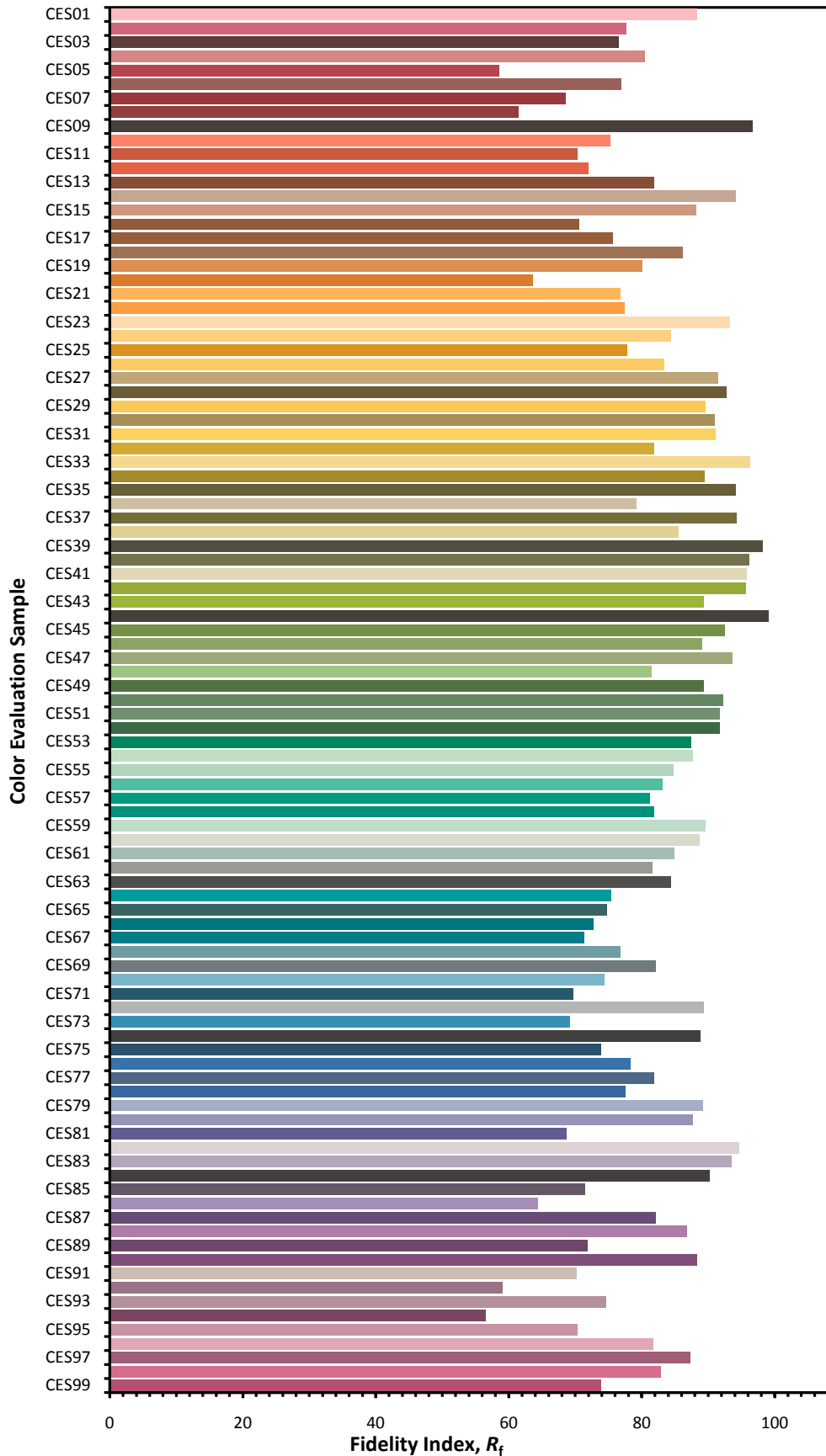


Color Vector Graphic

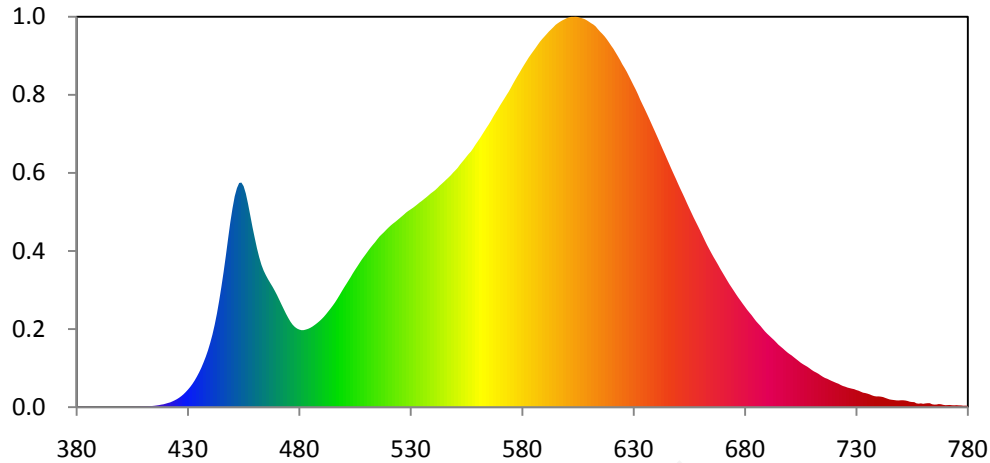


— Reference Illuminant — Test Source

Color Fidelity by CES Sample



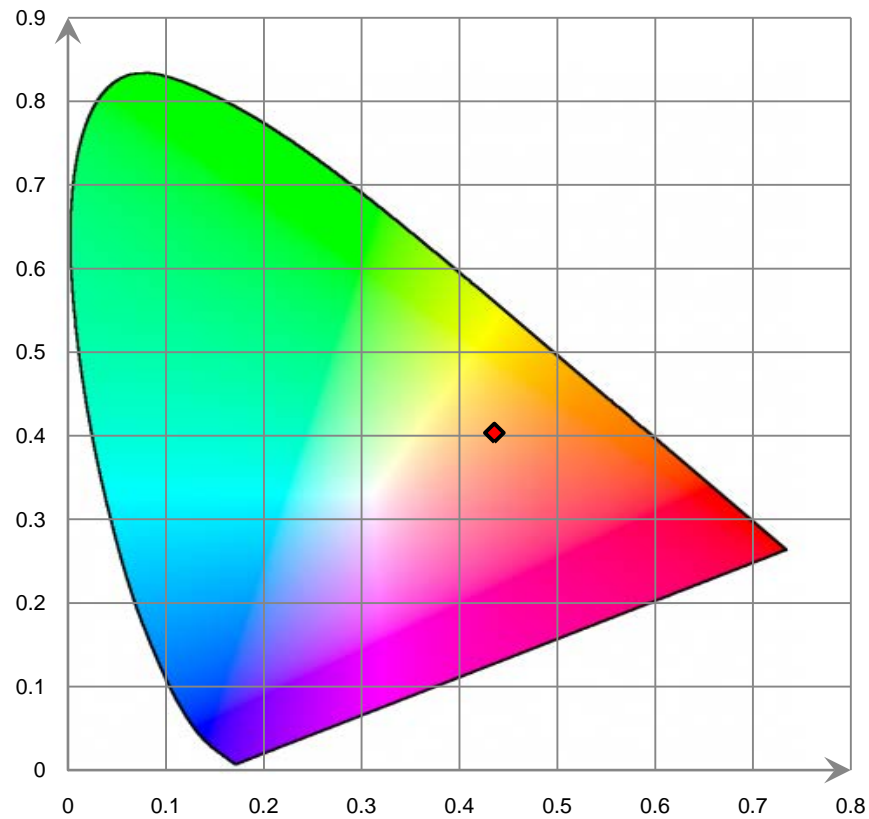
Relative Spectral Power Distribution



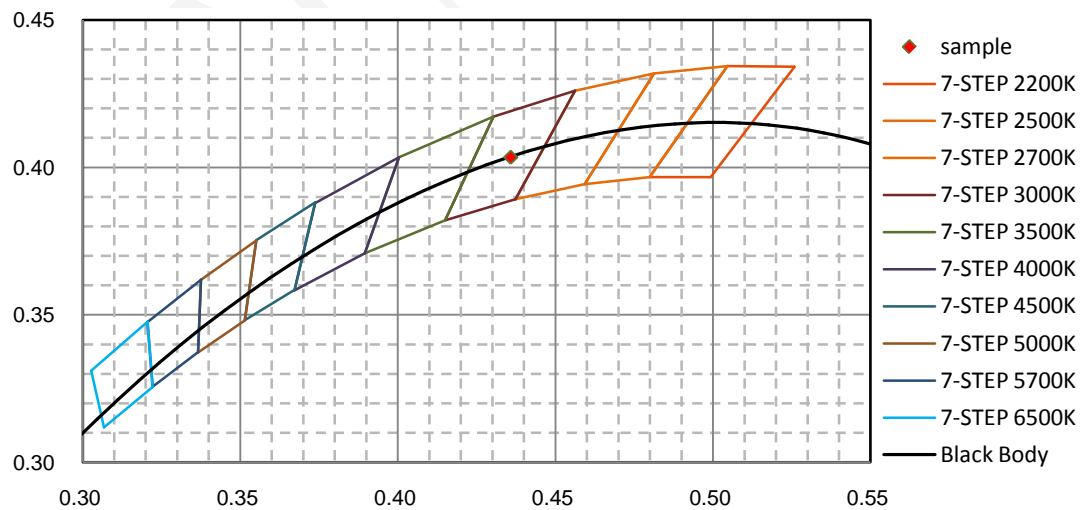
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.820E-02	421	3.748E-01	462	1.351E+01	503	1.171E+01	544	2.014E+01
381	2.740E-02	422	4.306E-01	463	1.283E+01	504	1.205E+01	545	2.032E+01
382	2.070E-02	423	5.167E-01	464	1.230E+01	505	1.237E+01	546	2.052E+01
383	2.600E-02	424	6.128E-01	465	1.188E+01	506	1.267E+01	547	2.070E+01
384	3.010E-02	425	7.191E-01	466	1.151E+01	507	1.299E+01	548	2.090E+01
385	2.180E-02	426	8.429E-01	467	1.118E+01	508	1.329E+01	549	2.113E+01
386	2.450E-02	427	9.909E-01	468	1.084E+01	509	1.357E+01	550	2.133E+01
387	2.600E-02	428	1.163E+00	469	1.048E+01	510	1.384E+01	551	2.155E+01
388	1.870E-02	429	1.360E+00	470	1.010E+01	511	1.412E+01	552	2.182E+01
389	2.260E-02	430	1.579E+00	471	9.674E+00	512	1.439E+01	553	2.207E+01
390	2.200E-02	431	1.818E+00	472	9.254E+00	513	1.463E+01	554	2.231E+01
391	9.800E-03	432	2.091E+00	473	8.839E+00	514	1.487E+01	555	2.257E+01
392	6.400E-03	433	2.398E+00	474	8.426E+00	515	1.513E+01	556	2.282E+01
393	9.900E-03	434	2.746E+00	475	8.053E+00	516	1.538E+01	557	2.303E+01
394	1.400E-02	435	3.128E+00	476	7.708E+00	517	1.558E+01	558	2.332E+01
395	1.560E-02	436	3.548E+00	477	7.429E+00	518	1.577E+01	559	2.364E+01
396	1.570E-02	437	4.028E+00	478	7.227E+00	519	1.598E+01	560	2.393E+01
397	1.360E-02	438	4.541E+00	479	7.083E+00	520	1.618E+01	561	2.422E+01
398	9.700E-03	439	5.122E+00	480	6.990E+00	521	1.637E+01	562	2.453E+01
399	4.800E-03	440	5.796E+00	481	6.937E+00	522	1.654E+01	563	2.486E+01
400	1.640E-02	441	6.539E+00	482	6.944E+00	523	1.669E+01	564	2.517E+01
401	2.010E-02	442	7.415E+00	483	6.997E+00	524	1.685E+01	565	2.547E+01
402	2.070E-02	443	8.420E+00	484	7.066E+00	525	1.703E+01	566	2.580E+01
403	2.380E-02	444	9.566E+00	485	7.159E+00	526	1.719E+01	567	2.617E+01
404	2.830E-02	445	1.083E+01	486	7.278E+00	527	1.737E+01	568	2.650E+01
405	3.060E-02	446	1.217E+01	487	7.423E+00	528	1.755E+01	569	2.682E+01
406	3.750E-02	447	1.362E+01	488	7.577E+00	529	1.770E+01	570	2.716E+01
407	3.980E-02	448	1.515E+01	489	7.747E+00	530	1.783E+01	571	2.748E+01
408	3.300E-02	449	1.663E+01	490	7.934E+00	531	1.797E+01	572	2.780E+01
409	5.300E-02	450	1.792E+01	491	8.141E+00	532	1.812E+01	573	2.812E+01
410	6.340E-02	451	1.901E+01	492	8.376E+00	533	1.828E+01	574	2.844E+01
411	5.950E-02	452	1.974E+01	493	8.630E+00	534	1.845E+01	575	2.880E+01
412	6.400E-02	453	2.020E+01	494	8.885E+00	535	1.859E+01	576	2.917E+01
413	8.660E-02	454	2.024E+01	495	9.151E+00	536	1.876E+01	577	2.953E+01
414	1.085E-01	455	1.991E+01	496	9.431E+00	537	1.892E+01	578	2.987E+01
415	1.302E-01	456	1.924E+01	497	9.745E+00	538	1.909E+01	579	3.020E+01
416	1.582E-01	457	1.831E+01	498	1.008E+01	539	1.926E+01	580	3.055E+01
417	1.878E-01	458	1.726E+01	499	1.042E+01	540	1.941E+01	581	3.088E+01
418	2.271E-01	459	1.620E+01	500	1.075E+01	541	1.956E+01	582	3.120E+01
419	2.591E-01	460	1.524E+01	501	1.107E+01	542	1.975E+01	583	3.152E+01
420	3.162E-01	461	1.431E+01	502	1.139E+01	543	1.996E+01	584	3.180E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.208E+01	626	3.056E+01	667	1.316E+01	708	3.647E+00	749	6.062E-01
586	3.236E+01	627	3.021E+01	668	1.281E+01	709	3.505E+00	750	6.235E-01
587	3.265E+01	628	2.981E+01	669	1.245E+01	710	3.354E+00	751	6.212E-01
588	3.293E+01	629	2.941E+01	670	1.211E+01	711	3.223E+00	752	6.003E-01
589	3.317E+01	630	2.900E+01	671	1.177E+01	712	3.120E+00	753	5.591E-01
590	3.340E+01	631	2.861E+01	672	1.143E+01	713	3.008E+00	754	4.938E-01
591	3.362E+01	632	2.818E+01	673	1.110E+01	714	2.868E+00	755	4.630E-01
592	3.384E+01	633	2.771E+01	674	1.079E+01	715	2.738E+00	756	4.552E-01
593	3.404E+01	634	2.729E+01	675	1.049E+01	716	2.629E+00	757	3.442E-01
594	3.424E+01	635	2.688E+01	676	1.018E+01	717	2.555E+00	758	3.182E-01
595	3.445E+01	636	2.645E+01	677	9.888E+00	718	2.451E+00	759	3.444E-01
596	3.460E+01	637	2.601E+01	678	9.608E+00	719	2.357E+00	760	3.017E-01
597	3.473E+01	638	2.556E+01	679	9.323E+00	720	2.273E+00	761	3.387E-01
598	3.485E+01	639	2.511E+01	680	9.052E+00	721	2.185E+00	762	3.576E-01
599	3.495E+01	640	2.467E+01	681	8.776E+00	722	2.111E+00	763	3.579E-01
600	3.505E+01	641	2.422E+01	682	8.530E+00	723	1.997E+00	764	2.647E-01
601	3.513E+01	642	2.375E+01	683	8.288E+00	724	1.908E+00	765	2.337E-01
602	3.517E+01	643	2.329E+01	684	8.015E+00	725	1.846E+00	766	2.396E-01
603	3.517E+01	644	2.284E+01	685	7.752E+00	726	1.768E+00	767	2.820E-01
604	3.518E+01	645	2.238E+01	686	7.529E+00	727	1.717E+00	768	2.626E-01
605	3.516E+01	646	2.192E+01	687	7.313E+00	728	1.666E+00	769	2.123E-01
606	3.509E+01	647	2.146E+01	688	7.064E+00	729	1.626E+00	770	1.791E-01
607	3.504E+01	648	2.102E+01	689	6.826E+00	730	1.546E+00	771	1.915E-01
608	3.497E+01	649	2.058E+01	690	6.617E+00	731	1.483E+00	772	1.993E-01
609	3.486E+01	650	2.013E+01	691	6.431E+00	732	1.394E+00	773	1.755E-01
610	3.473E+01	651	1.968E+01	692	6.242E+00	733	1.310E+00	774	1.680E-01
611	3.459E+01	652	1.926E+01	693	6.053E+00	734	1.273E+00	775	1.839E-01
612	3.448E+01	653	1.883E+01	694	5.853E+00	735	1.222E+00	776	1.655E-01
613	3.431E+01	654	1.838E+01	695	5.636E+00	736	1.154E+00	777	1.617E-01
614	3.406E+01	655	1.794E+01	696	5.466E+00	737	1.066E+00	778	1.339E-01
615	3.384E+01	656	1.751E+01	697	5.299E+00	738	9.981E-01	779	1.413E-01
616	3.364E+01	657	1.709E+01	698	5.117E+00	739	9.669E-01	780	1.247E-01
617	3.342E+01	658	1.668E+01	699	4.943E+00	740	9.722E-01		
618	3.316E+01	659	1.628E+01	700	4.793E+00	741	9.487E-01		
619	3.287E+01	660	1.587E+01	701	4.659E+00	742	9.106E-01		
620	3.257E+01	661	1.545E+01	702	4.494E+00	743	8.327E-01		
621	3.228E+01	662	1.503E+01	703	4.334E+00	744	7.638E-01		
622	3.195E+01	663	1.462E+01	704	4.175E+00	745	6.965E-01		
623	3.162E+01	664	1.423E+01	705	4.014E+00	746	6.642E-01		
624	3.127E+01	665	1.386E+01	706	3.881E+00	747	6.402E-01		
625	3.089E+01	666	1.350E+01	707	3.763E+00	748	6.117E-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**

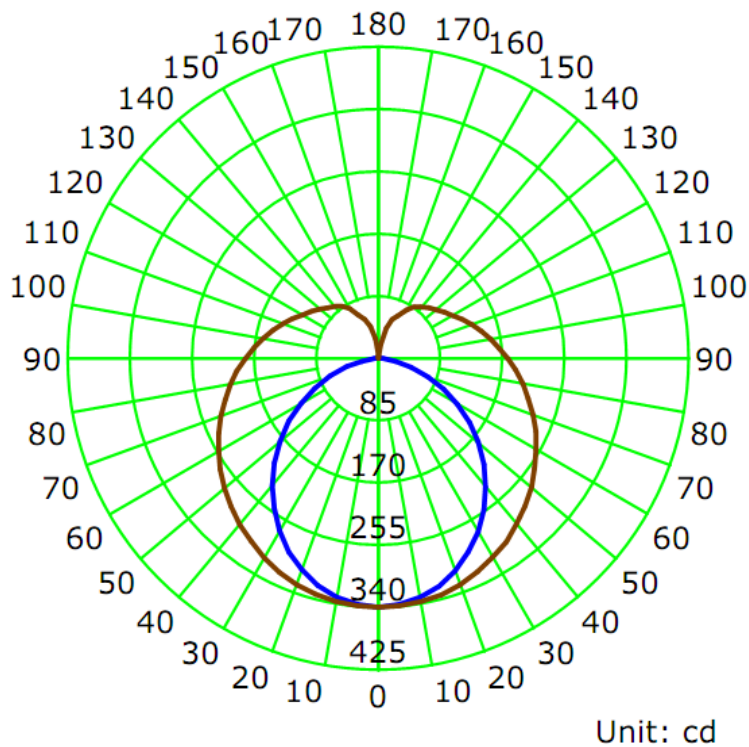
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1090	12.87	0.9820

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
1725.7	134.13	340.2	1.19	1.38

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	102.7	132.6	189.1	144.0	142.1
Field Angle (10% I_{max}):	155.5	324.9	335.2	322.1	284.4

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	340	340	340	340	340	340	340	340
5.0°	337	338	339	340	339	339	339	339
10.0°	331	333	335	337	337	337	335	334
15.0°	322	324	328	332	334	333	329	326
20.0°	309	312	318	325	328	327	320	314
25.0°	292	296	306	316	322	319	309	300
30.0°	273	279	292	306	314	310	297	283
35.0°	252	259	277	295	306	299	283	264
40.0°	229	237	259	282	295	289	268	243
45.0°	204	215	242	269	285	278	253	223
50.0°	179	192	224	255	274	265	237	200
55.0°	152	169	206	242	262	252	221	178
60.0°	125	145	189	229	249	239	205	157
65.0°	99	122	173	216	238	226	190	137
70.0°	72	101	158	203	226	214	175	118
75.0°	47	82	142	190	213	201	161	101
80.0°	25	66	130	178	201	188	148	86
85.0°	7	52	119	166	189	175	136	73
90.0°	0	43	109	155	178	164	125	63
95.0°	0	38	101	146	167	153	117	57
100.0°	3	37	94	137	156	144	108	53
105.0°	3	36	88	128	146	134	101	51
110.0°	3	37	84	120	136	126	95	49
115.0°	2	39	79	112	127	118	90	49
120.0°	0	40	76	106	119	110	86	50
125.0°	0	38	74	100	111	104	82	51
130.0°	0	38	72	94	104	97	79	46
135.0°	0	39	71	89	98	92	76	45
140.0°	0	38	67	86	92	87	72	44
145.0°	0	37	60	82	86	81	60	38
150.0°	0	35	57	72	77	69	51	30
155.0°	0	31	54	63	65	59	41	22
160.0°	1	27	49	57	57	44	26	15
165.0°	1	22	37	45	44	26	13	8
170.0°	0	11	22	26	20	11	4	2
175.0°	0	1	5	7	3	1	0	0
180.0°	0	0	0	0	0	0	0	0

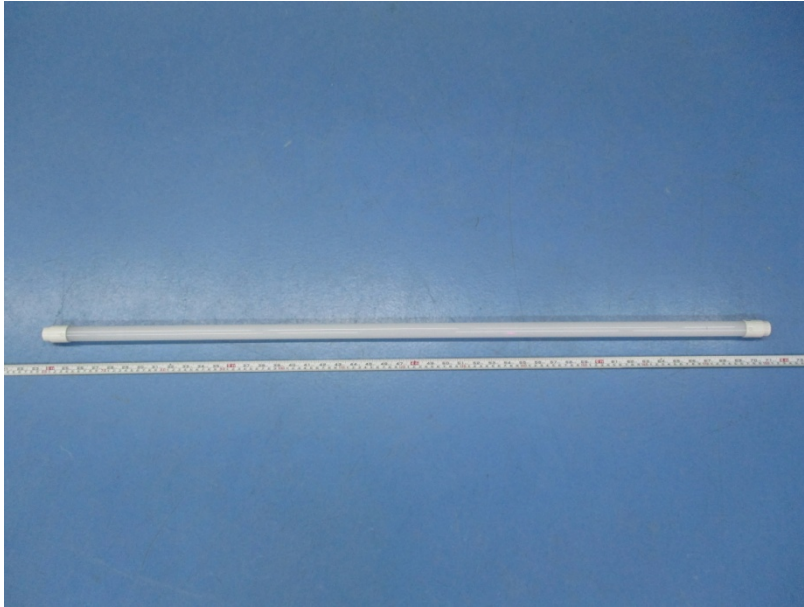
Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	340	340	340	340	340	340	340	340
5.0°	338	339	340	339	340	339	338	339
10.0°	331	334	336	337	337	336	335	334
15.0°	321	324	328	332	334	333	328	325
20.0°	307	311	319	326	329	326	319	313
25.0°	291	296	307	316	322	319	308	299
30.0°	272	278	294	307	314	310	295	281
35.0°	250	258	278	297	305	300	282	262
40.0°	226	237	260	284	296	289	267	242
45.0°	202	214	243	272	286	277	252	221
50.0°	176	191	225	259	276	265	236	199
55.0°	150	167	208	246	265	254	221	178
60.0°	123	144	192	232	253	241	206	157
65.0°	97	121	175	219	241	229	191	137
70.0°	71	100	160	207	230	215	176	118
75.0°	45	81	146	194	218	202	163	101
80.0°	24	64	132	181	206	189	151	87
85.0°	6	51	120	169	195	179	138	75
90.0°	0	42	111	159	183	168	129	65
95.0°	0	38	102	148	172	157	119	60
100.0°	2	36	96	139	160	147	112	56
105.0°	3	36	90	131	150	138	105	54
110.0°	2	37	85	122	139	129	99	53
115.0°	2	39	81	115	130	121	93	53
120.0°	2	39	77	107	121	113	89	53
125.0°	1	37	75	101	113	106	85	55
130.0°	0	37	73	95	106	100	82	50
135.0°	0	37	71	91	99	95	80	47
140.0°	0	34	65	86	93	90	77	46
145.0°	0	25	57	82	88	86	67	45
150.0°	0	20	49	69	79	74	60	40
155.0°	0	14	43	61	66	63	55	32
160.0°	0	9	32	50	58	56	47	25
165.0°	0	3	20	33	46	44	34	16
170.0°	0	0	10	16	28	26	19	4
175.0°	0	0	0	2	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	8.1	0.47	0-5	8.1	0.47
5-10	24.1	1.40	0-10	32.2	1.87
10-15	39.3	2.28	0-15	71.6	4.15
15-20	53.3	3.09	0-20	124.9	7.24
20-25	65.7	3.81	0-25	190.6	11.04
25-30	76.1	4.41	0-30	266.7	15.46
30-35	84.4	4.89	0-35	351.1	20.35
35-40	90.4	5.24	0-40	441.5	25.59
40-45	94.2	5.46	0-45	535.7	31.04
45-50	95.8	5.55	0-50	631.5	36.59
50-55	95.4	5.53	0-55	726.9	42.12
55-60	93.3	5.40	0-60	820.2	47.53
60-65	89.6	5.19	0-65	909.8	52.72
65-70	84.7	4.91	0-70	994.4	57.63
70-75	78.8	4.57	0-75	1073.3	62.20
75-80	72.6	4.21	0-80	1145.9	66.40
80-85	66.3	3.84	0-85	1212.2	70.24
85-90	60.6	3.51	0-90	1272.8	73.76
90-95	55.9	3.24	0-95	1328.7	77.00
95-100	51.9	3.01	0-100	1380.5	80.00
100-105	48.0	2.78	0-105	1428.6	82.78
105-110	44.2	2.56	0-110	1472.8	85.35
110-115	40.6	2.35	0-115	1513.4	87.70
115-120	37.0	2.15	0-120	1550.5	89.85
120-125	33.5	1.94	0-125	1584.0	91.79
125-130	30.0	1.74	0-130	1613.9	93.52
130-135	26.6	1.54	0-135	1640.5	95.07
135-140	23.2	1.35	0-140	1663.7	96.41
140-145	19.5	1.13	0-145	1683.2	97.54
145-150	15.4	0.89	0-150	1698.7	98.44
150-155	11.4	0.66	0-155	1710.1	99.10
155-160	8.0	0.46	0-160	1718.1	99.56
160-165	4.8	0.28	0-165	1722.9	99.84
165-170	2.2	0.13	0-170	1725.1	99.97
170-175	0.5	0.03	0-175	1725.6	100.00
175-180	0.0	0.00	0-180	1725.7	100.00

6. Product Photo



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