



IES LM-79-08

MEASUREMENT AND TEST REPORT

For

GREEN CREATIVE LTD

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

Test Model: 14.5T8/4F/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:	PKS181120080-10
Test Date:	2018-11-20 to 2018-11-21
Report Date:	2018-11-22
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 2018-11-20 and used for testing.

Model Tested: 14.5T8/4F/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: 14.5W
Nominal CCT: 4000K
Nominal Lumen Output: 2200lm

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	2018-11-14	2019-11-14
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	2018-11-14	2019-11-14
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**

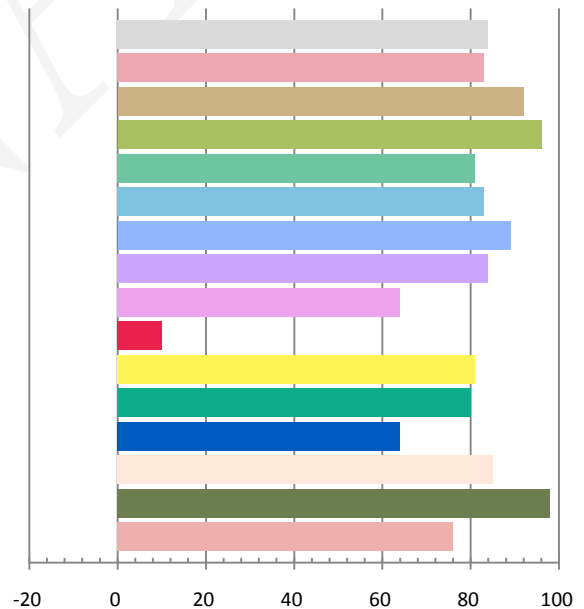
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1187	13.92	0.977	2241.11	161

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
6.753	4000	0.00134	0.3814	0.3802	0.2243	0.5032

Color Rendering Index

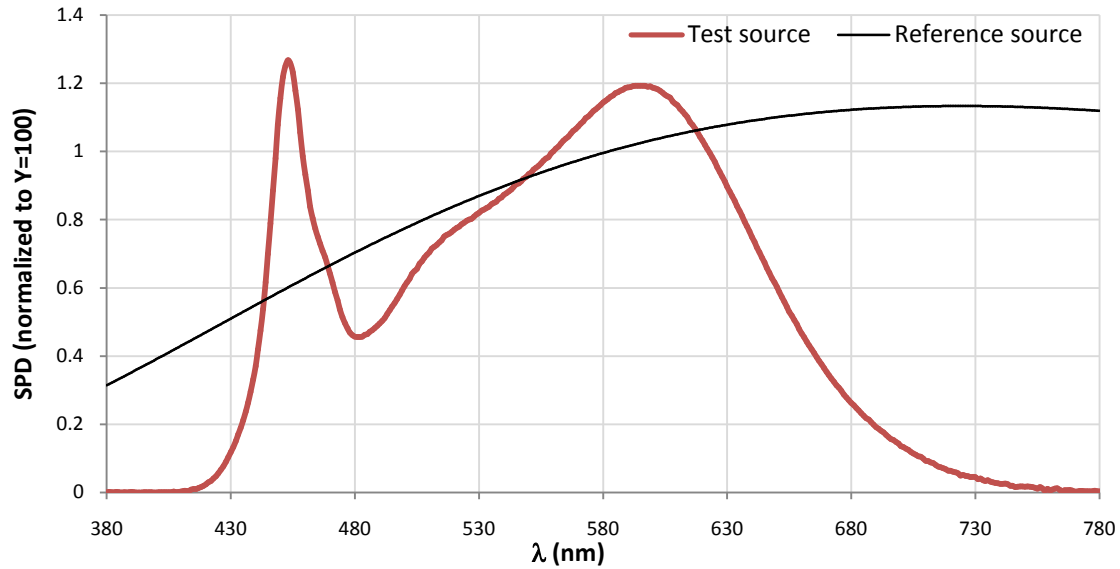
Ra 84.0			
R1 83	R2 92	R3 96	R4 81
R5 83	R6 89	R7 84	R8 64
R9 10	R10 81	R11 80	R12 64
R13 85	R14 98	R15 76	



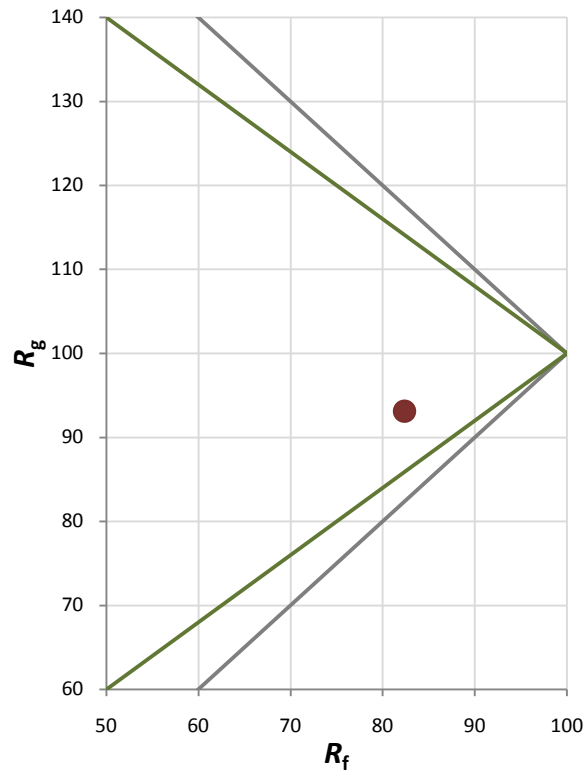
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	93

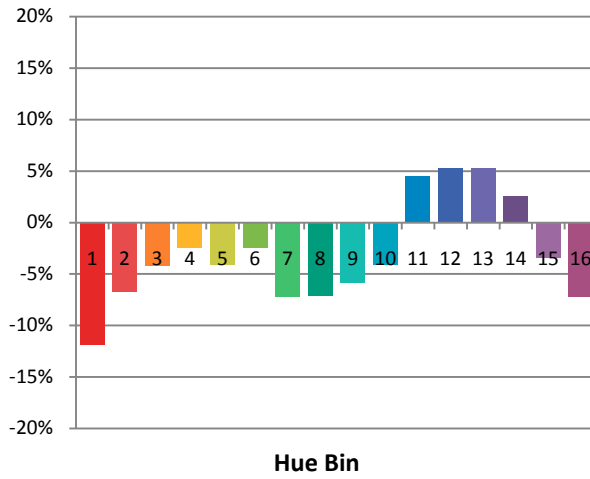
Spectral Power Distribution Comparison



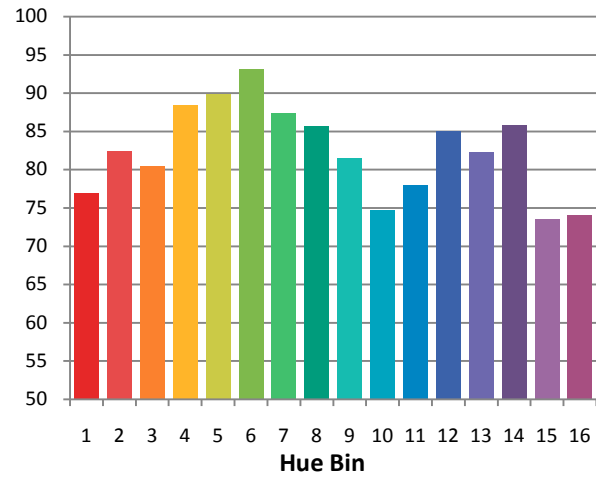
Plot of R_g versus R_f



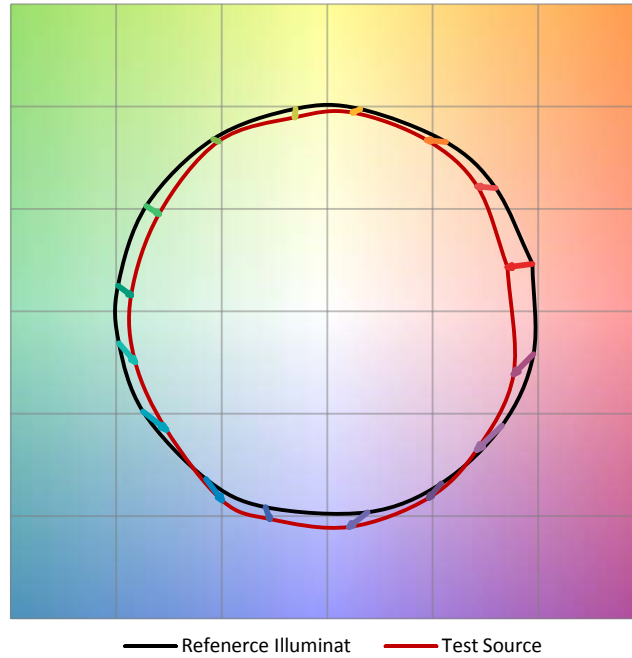
Chroma Shift by Hue



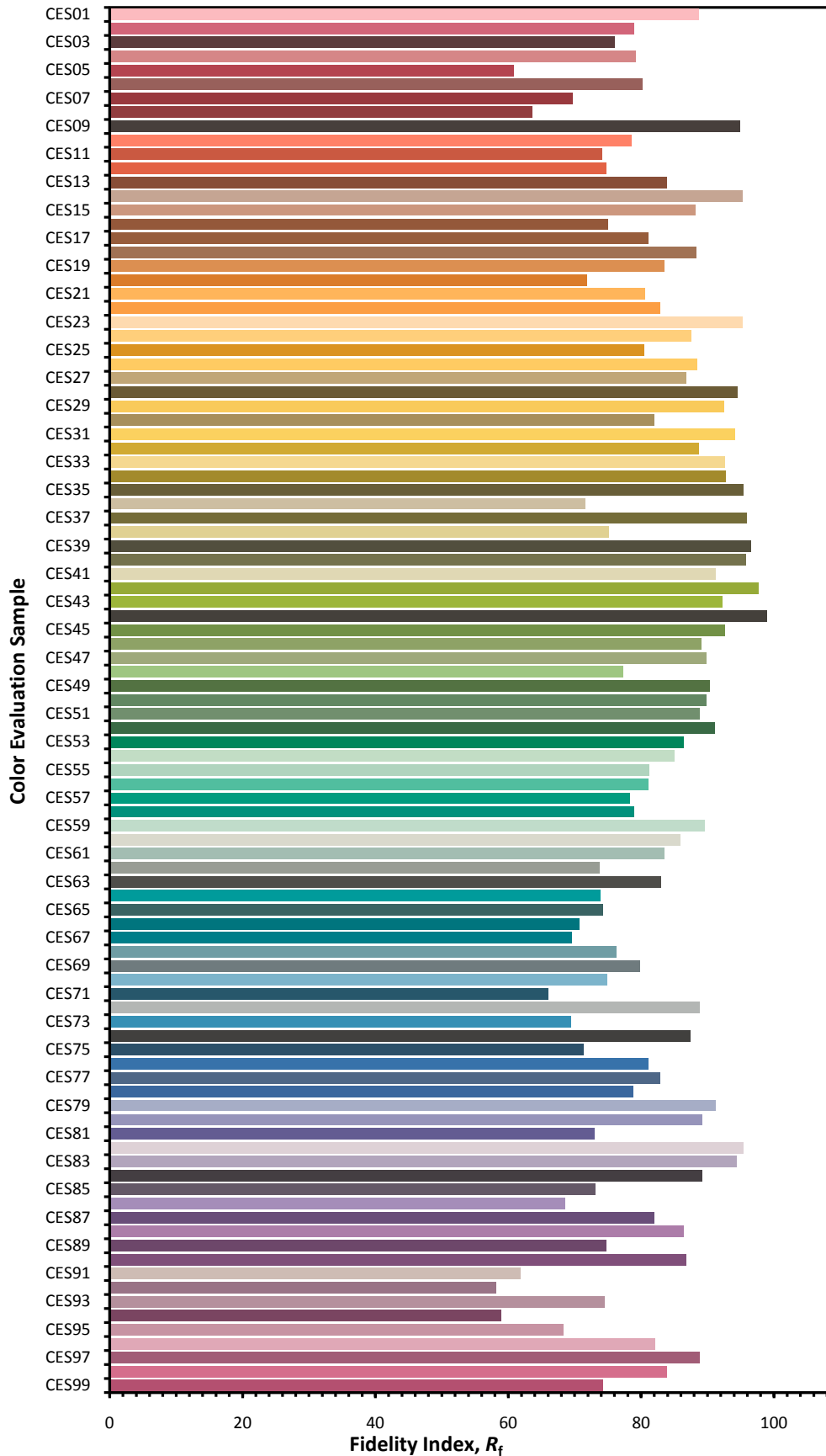
R_t by Hue



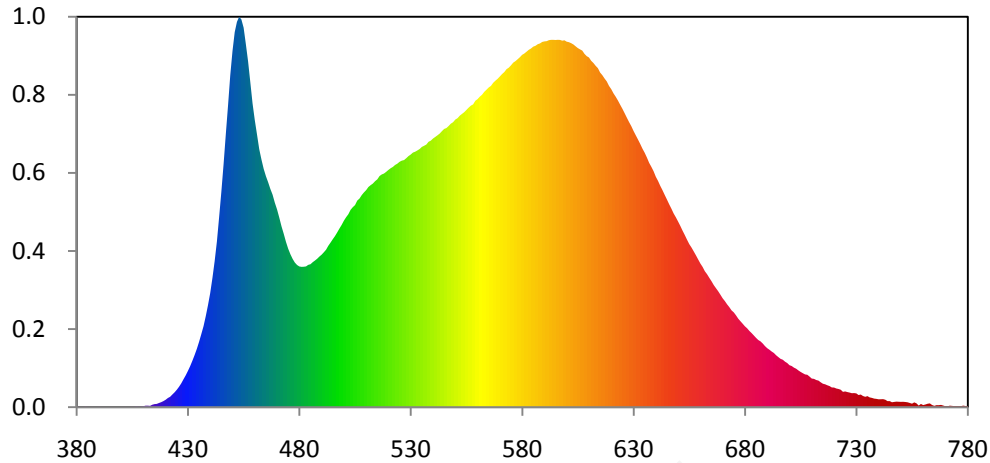
Color Vector Graphic



Color Fidelity by CES Sample



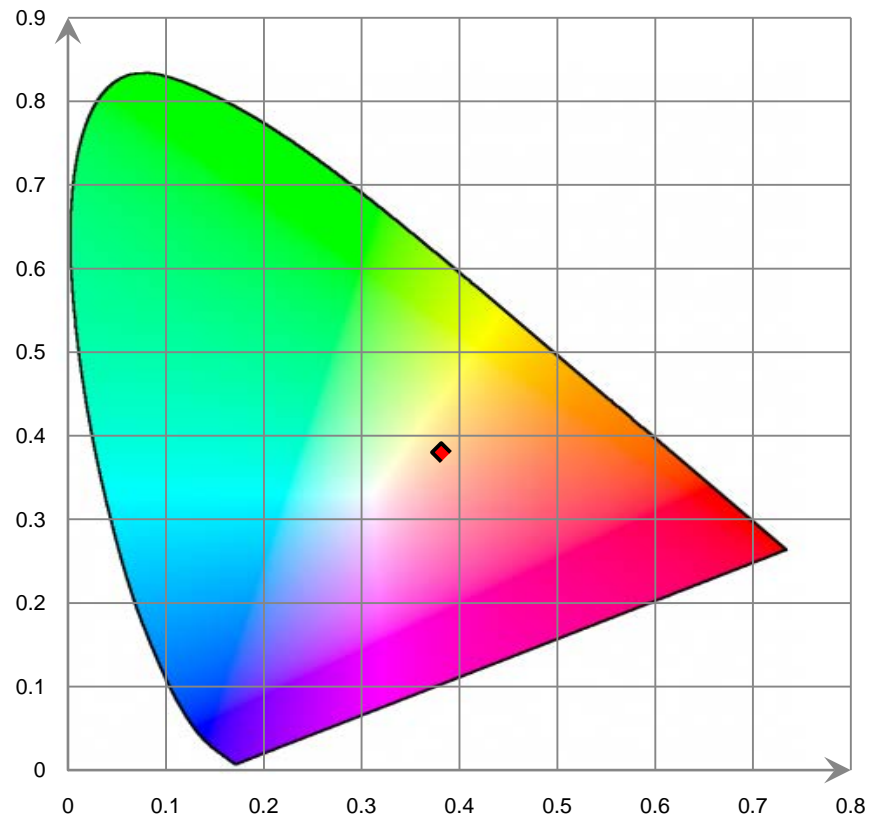
Relative Spectral Power Distribution



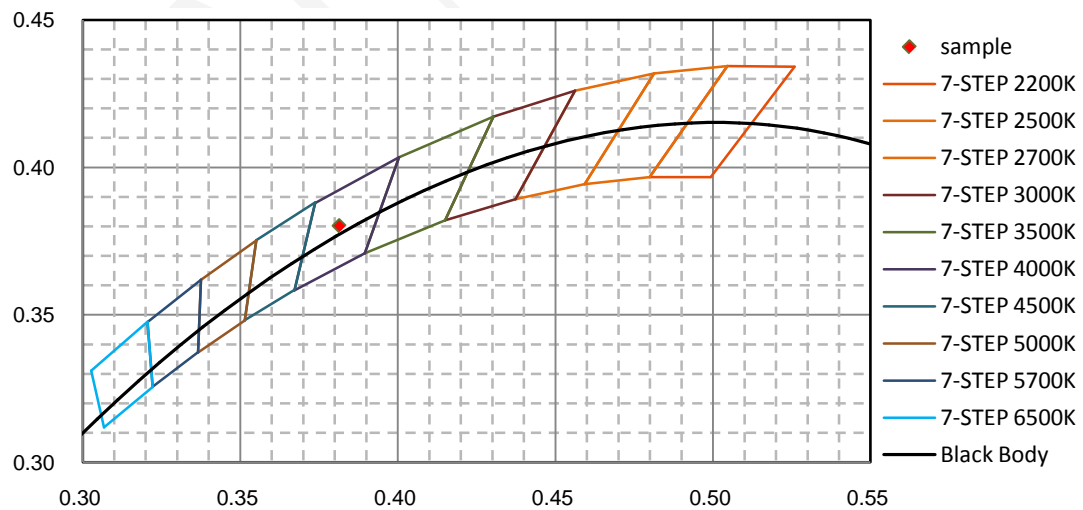
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	3.820E-02	421	9.771E-01	462	2.749E+01	503	2.102E+01	544	2.940E+01
381	4.590E-02	422	1.106E+00	463	2.638E+01	504	2.130E+01	545	2.964E+01
382	1.780E-02	423	1.346E+00	464	2.539E+01	505	2.153E+01	546	2.973E+01
383	1.430E-02	424	1.580E+00	465	2.461E+01	506	2.200E+01	547	2.995E+01
384	6.120E-02	425	1.854E+00	466	2.396E+01	507	2.222E+01	548	3.020E+01
385	3.320E-02	426	2.173E+00	467	2.324E+01	508	2.259E+01	549	3.035E+01
386	3.800E-03	427	2.537E+00	468	2.263E+01	509	2.288E+01	550	3.064E+01
387	3.840E-02	428	2.969E+00	469	2.179E+01	510	2.312E+01	551	3.078E+01
388	1.330E-02	429	3.388E+00	470	2.107E+01	511	2.345E+01	552	3.105E+01
389	1.380E-02	430	3.863E+00	471	2.019E+01	512	2.365E+01	553	3.124E+01
390	4.610E-02	431	4.373E+00	472	1.926E+01	513	2.382E+01	554	3.142E+01
391	2.300E-02	432	4.947E+00	473	1.847E+01	514	2.407E+01	555	3.166E+01
392	1.700E-03	433	5.558E+00	474	1.761E+01	515	2.427E+01	556	3.191E+01
393	1.000E-04	434	6.214E+00	475	1.688E+01	516	2.462E+01	557	3.212E+01
394	1.200E-03	435	6.961E+00	476	1.629E+01	517	2.479E+01	558	3.225E+01
395	3.470E-02	436	7.781E+00	477	1.579E+01	518	2.489E+01	559	3.264E+01
396	1.450E-02	437	8.627E+00	478	1.540E+01	519	2.507E+01	560	3.281E+01
397	1.450E-02	438	9.691E+00	479	1.514E+01	520	2.527E+01	561	3.308E+01
398	1.660E-02	439	1.086E+01	480	1.499E+01	521	2.545E+01	562	3.328E+01
399	8.000E-04	440	1.215E+01	481	1.495E+01	522	2.559E+01	563	3.359E+01
400	0.000E+00	441	1.377E+01	482	1.496E+01	523	2.580E+01	564	3.382E+01
401	2.130E-02	442	1.557E+01	483	1.499E+01	524	2.594E+01	565	3.405E+01
402	3.170E-02	443	1.764E+01	484	1.516E+01	525	2.614E+01	566	3.422E+01
403	2.000E-02	444	2.024E+01	485	1.522E+01	526	2.626E+01	567	3.455E+01
404	2.990E-02	445	2.294E+01	486	1.544E+01	527	2.632E+01	568	3.478E+01
405	3.470E-02	446	2.588E+01	487	1.562E+01	528	2.652E+01	569	3.498E+01
406	2.710E-02	447	2.906E+01	488	1.581E+01	529	2.675E+01	570	3.523E+01
407	8.950E-02	448	3.213E+01	489	1.604E+01	530	2.691E+01	571	3.549E+01
408	3.360E-02	449	3.535E+01	490	1.624E+01	531	2.712E+01	572	3.570E+01
409	6.200E-02	450	3.792E+01	491	1.650E+01	532	2.721E+01	573	3.601E+01
410	1.029E-01	451	3.995E+01	492	1.677E+01	533	2.735E+01	574	3.616E+01
411	1.603E-01	452	4.104E+01	493	1.719E+01	534	2.750E+01	575	3.641E+01
412	1.603E-01	453	4.159E+01	494	1.753E+01	535	2.772E+01	576	3.670E+01
413	1.428E-01	454	4.129E+01	495	1.789E+01	536	2.785E+01	577	3.686E+01
414	2.609E-01	455	4.042E+01	496	1.823E+01	537	2.797E+01	578	3.706E+01
415	3.279E-01	456	3.867E+01	497	1.861E+01	538	2.827E+01	579	3.728E+01
416	3.503E-01	457	3.684E+01	498	1.903E+01	539	2.839E+01	580	3.753E+01
417	4.443E-01	458	3.462E+01	499	1.942E+01	540	2.862E+01	581	3.767E+01
418	5.335E-01	459	3.236E+01	500	1.986E+01	541	2.879E+01	582	3.787E+01
419	6.497E-01	460	3.059E+01	501	2.023E+01	542	2.896E+01	583	3.807E+01
420	7.884E-01	461	2.905E+01	502	2.055E+01	543	2.915E+01	584	3.821E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.840E+01	626	3.132E+01	667	1.267E+01	708	3.452E+00	749	5.769E-01
586	3.849E+01	627	3.083E+01	668	1.235E+01	709	3.260E+00	750	5.655E-01
587	3.866E+01	628	3.037E+01	669	1.198E+01	710	3.050E+00	751	5.750E-01
588	3.875E+01	629	2.994E+01	670	1.160E+01	711	3.016E+00	752	5.550E-01
589	3.890E+01	630	2.942E+01	671	1.130E+01	712	2.893E+00	753	5.182E-01
590	3.896E+01	631	2.897E+01	672	1.095E+01	713	2.831E+00	754	4.505E-01
591	3.899E+01	632	2.851E+01	673	1.065E+01	714	2.655E+00	755	3.748E-01
592	3.909E+01	633	2.804E+01	674	1.031E+01	715	2.500E+00	756	5.116E-01
593	3.913E+01	634	2.754E+01	675	1.010E+01	716	2.439E+00	757	4.076E-01
594	3.913E+01	635	2.710E+01	676	9.782E+00	717	2.334E+00	758	1.717E-01
595	3.911E+01	636	2.660E+01	677	9.427E+00	718	2.246E+00	759	3.447E-01
596	3.913E+01	637	2.603E+01	678	9.153E+00	719	2.101E+00	760	2.264E-01
597	3.912E+01	638	2.560E+01	679	8.887E+00	720	2.092E+00	761	2.890E-01
598	3.904E+01	639	2.513E+01	680	8.612E+00	721	1.994E+00	762	3.659E-01
599	3.908E+01	640	2.455E+01	681	8.402E+00	722	1.938E+00	763	4.019E-01
600	3.893E+01	641	2.410E+01	682	8.123E+00	723	1.859E+00	764	2.315E-01
601	3.888E+01	642	2.358E+01	683	7.895E+00	724	1.633E+00	765	1.398E-01
602	3.877E+01	643	2.311E+01	684	7.640E+00	725	1.676E+00	766	2.167E-01
603	3.864E+01	644	2.261E+01	685	7.382E+00	726	1.611E+00	767	2.140E-01
604	3.844E+01	645	2.212E+01	686	7.152E+00	727	1.556E+00	768	2.464E-01
605	3.825E+01	646	2.161E+01	687	7.009E+00	728	1.489E+00	769	1.729E-01
606	3.811E+01	647	2.114E+01	688	6.782E+00	729	1.501E+00	770	9.790E-02
607	3.798E+01	648	2.064E+01	689	6.511E+00	730	1.467E+00	771	1.013E-01
608	3.763E+01	649	2.023E+01	690	6.283E+00	731	1.292E+00	772	1.602E-01
609	3.739E+01	650	1.978E+01	691	6.118E+00	732	1.347E+00	773	1.386E-01
610	3.725E+01	651	1.931E+01	692	5.930E+00	733	1.190E+00	774	1.174E-01
611	3.690E+01	652	1.881E+01	693	5.773E+00	734	1.108E+00	775	1.260E-01
612	3.666E+01	653	1.834E+01	694	5.532E+00	735	1.176E+00	776	1.067E-01
613	3.636E+01	654	1.784E+01	695	5.335E+00	736	1.039E+00	777	1.105E-01
614	3.611E+01	655	1.738E+01	696	5.149E+00	737	9.886E-01	778	1.669E-01
615	3.565E+01	656	1.701E+01	697	5.051E+00	738	9.130E-01	779	1.260E-01
616	3.536E+01	657	1.660E+01	698	4.848E+00	739	8.853E-01	780	1.341E-01
617	3.501E+01	658	1.618E+01	699	4.700E+00	740	8.409E-01		
618	3.470E+01	659	1.574E+01	700	4.470E+00	741	8.441E-01		
619	3.422E+01	660	1.530E+01	701	4.384E+00	742	8.549E-01		
620	3.388E+01	661	1.494E+01	702	4.213E+00	743	7.962E-01		
621	3.343E+01	662	1.449E+01	703	4.097E+00	744	6.448E-01		
622	3.307E+01	663	1.417E+01	704	3.913E+00	745	6.436E-01		
623	3.267E+01	664	1.378E+01	705	3.755E+00	746	5.258E-01		
624	3.222E+01	665	1.342E+01	706	3.618E+00	747	5.601E-01		
625	3.179E+01	666	1.301E+01	707	3.489E+00	748	5.905E-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**

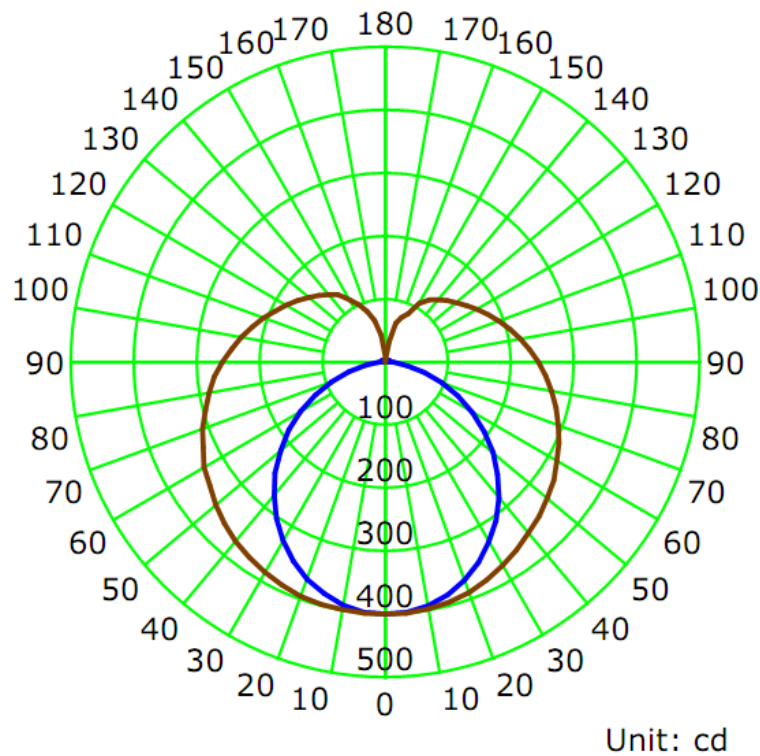
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1180	13.93	0.9800

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
2243.3	161.09	400.6	1.22	1.43

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	106.9	140.8	219.6	162.4	157.4
Field Angle (10% I_{max}):	158.0	331.2	339.6	327.9	289.2

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	400	400	400	400	400	400	400	400
5.0°	400	398	398	399	401	400	400	397
10.0°	393	392	394	394	398	396	396	391
15.0°	383	383	384	388	395	390	389	384
20.0°	369	369	374	380	390	384	379	370
25.0°	351	353	360	369	382	375	368	354
30.0°	331	333	345	360	374	367	355	336
35.0°	307	312	329	347	365	357	341	316
40.0°	282	288	311	336	355	347	325	294
45.0°	253	262	293	322	346	335	309	270
50.0°	224	236	272	309	336	323	291	246
55.0°	193	208	253	297	327	311	275	223
60.0°	161	181	234	284	315	299	257	198
65.0°	128	153	215	270	305	287	242	175
70.0°	96	128	198	257	293	274	227	153
75.0°	64	104	183	245	281	261	212	133
80.0°	36	84	169	232	269	248	199	116
85.0°	13	68	157	222	257	236	185	102
90.0°	2	57	147	211	244	225	175	90
95.0°	2	51	135	197	231	213	163	82
100.0°	6	48	126	186	218	199	152	75
105.0°	8	47	119	174	206	187	143	72
110.0°	8	49	112	165	192	175	134	70
115.0°	7	51	107	155	180	165	126	70
120.0°	5	50	104	145	168	154	119	71
125.0°	4	47	100	137	158	145	115	71
130.0°	3	48	98	130	148	137	110	63
135.0°	0	50	97	123	138	129	106	60
140.0°	0	50	89	118	130	121	103	59
145.0°	0	51	78	113	122	114	82	54
150.0°	0	50	75	96	108	91	70	46
155.0°	0	46	71	82	86	79	56	34
160.0°	2	42	66	74	77	61	41	25
165.0°	2	34	55	64	64	40	23	14
170.0°	0	18	34	41	34	20	9	5
175.0°	0	3	8	13	5	4	0	0
180.0°	0	0	0	0	0	0	0	0

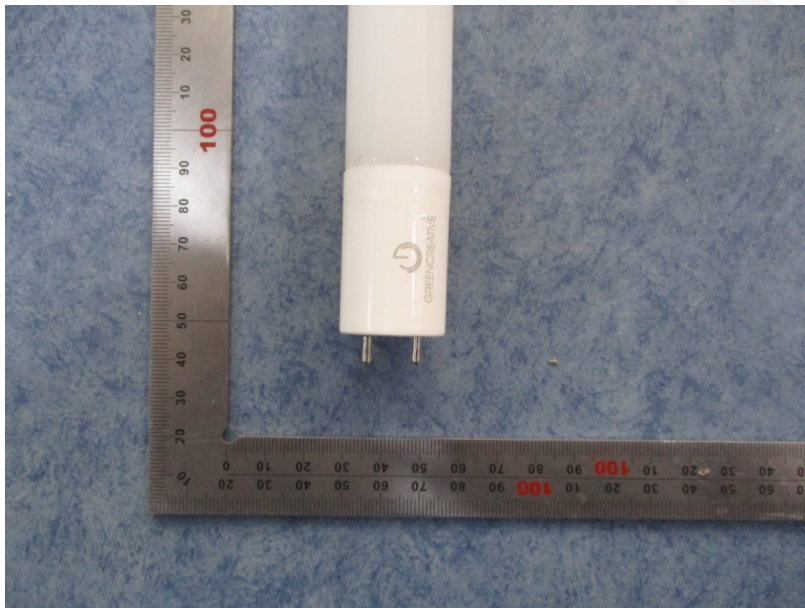
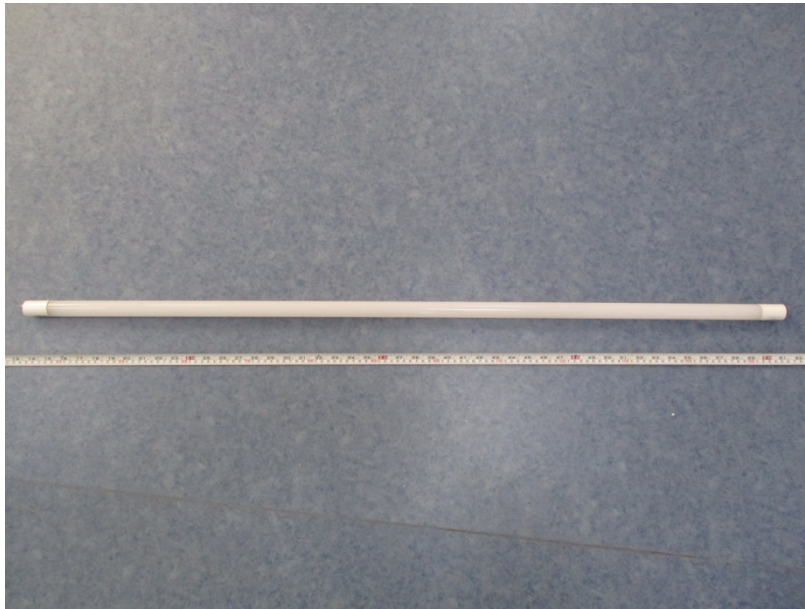
Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	400	400	400	400	400	400	400	400
5.0°	399	398	400	400	401	401	400	399
10.0°	392	393	396	399	400	399	399	395
15.0°	381	383	389	396	399	397	391	385
20.0°	367	371	381	389	396	391	384	373
25.0°	349	354	368	380	391	383	373	357
30.0°	327	334	354	371	385	375	360	340
35.0°	303	313	336	360	380	366	345	319
40.0°	277	289	319	347	372	356	330	298
45.0°	249	263	300	336	364	345	315	274
50.0°	219	237	281	323	353	333	298	249
55.0°	188	209	262	308	342	320	281	226
60.0°	157	182	243	295	334	308	265	200
65.0°	124	155	223	282	321	296	249	178
70.0°	92	128	205	270	310	285	234	156
75.0°	61	104	189	258	298	273	220	136
80.0°	33	84	176	246	285	261	208	119
85.0°	11	69	164	235	274	251	195	107
90.0°	2	59	154	223	260	240	186	98
95.0°	3	53	144	209	246	227	174	89
100.0°	6	50	135	198	233	215	163	83
105.0°	7	51	128	187	220	203	154	80
110.0°	7	53	121	176	207	190	146	79
115.0°	7	56	116	166	194	180	138	79
120.0°	7	54	111	158	182	169	132	79
125.0°	5	54	108	149	171	159	127	81
130.0°	3	53	105	140	160	150	123	76
135.0°	2	54	103	133	151	141	118	73
140.0°	0	49	92	126	141	133	114	70
145.0°	0	36	86	120	132	125	100	66
150.0°	0	30	71	102	115	109	92	61
155.0°	0	21	60	90	100	96	83	52
160.0°	0	14	50	72	86	84	72	40
165.0°	0	6	31	48	69	67	54	25
170.0°	0	0	15	24	44	41	29	10
175.0°	0	0	0	5	9	11	6	0
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	9.6	0.43	0-5	9.6	0.43
5-10	28.4	1.27	0-10	38.0	1.69
10-15	46.5	2.07	0-15	84.5	3.77
15-20	63.3	2.82	0-20	147.7	6.59
20-25	78.2	3.49	0-25	226.0	10.07
25-30	91.1	4.06	0-30	317.0	14.13
30-35	101.6	4.53	0-35	418.7	18.66
35-40	109.7	4.89	0-40	528.3	23.55
40-45	115.3	5.14	0-45	643.6	28.69
45-50	118.2	5.27	0-50	761.8	33.96
50-55	118.9	5.30	0-55	880.8	39.26
55-60	117.6	5.24	0-60	998.3	44.50
60-65	114.2	5.09	0-65	1112.5	49.59
65-70	109.3	4.87	0-70	1221.9	54.47
70-75	103.4	4.61	0-75	1325.3	59.08
75-80	96.7	4.31	0-80	1422.0	63.39
80-85	90.1	4.02	0-85	1512.2	67.41
85-90	84.2	3.75	0-90	1596.3	71.16
90-95	78.6	3.50	0-95	1675.0	74.66
95-100	73.2	3.26	0-100	1748.2	77.93
100-105	68.2	3.04	0-105	1816.4	80.97
105-110	63.2	2.82	0-110	1879.6	83.79
110-115	58.3	2.60	0-115	1937.8	86.38
115-120	53.3	2.37	0-120	1991.1	88.76
120-125	48.2	2.15	0-125	2039.3	90.91
125-130	43.2	1.92	0-130	2082.5	92.83
130-135	38.2	1.70	0-135	2120.7	94.53
135-140	33.2	1.48	0-140	2153.9	96.01
140-145	27.9	1.24	0-145	2181.8	97.26
145-150	22.0	0.98	0-150	2203.8	98.24
150-155	16.4	0.73	0-155	2220.2	98.97
155-160	11.5	0.51	0-160	2231.8	99.48
160-165	7.2	0.32	0-165	2239.0	99.81
165-170	3.4	0.15	0-170	2242.4	99.96
170-175	0.9	0.04	0-175	2243.3	100.00
175-180	0.0	0.00	0-180	2243.3	100.00

6. Product Photo



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