



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/850/BYP

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
Test Engineer:	George Yang <i>George Yang</i>
Report Number:	PKS181120080-10-1
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/850/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: 5000K
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**

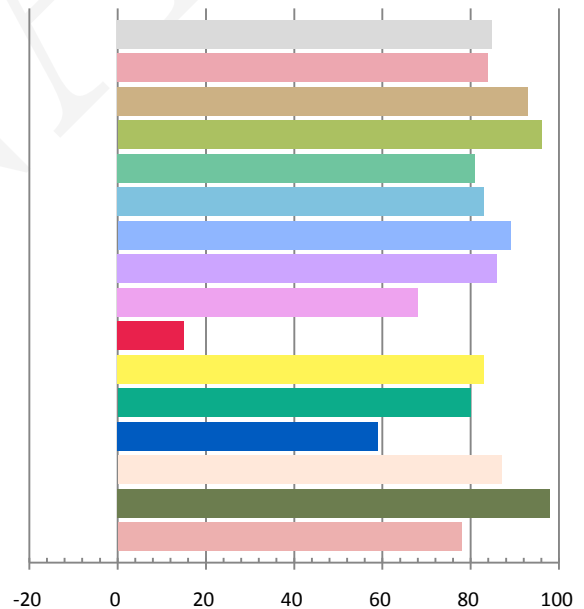
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1182	13.87	0.9775	2209.98	159.34

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
6.847	4954	0.00276	0.3470	0.3587	0.2100	0.4884

Color Rendering Index

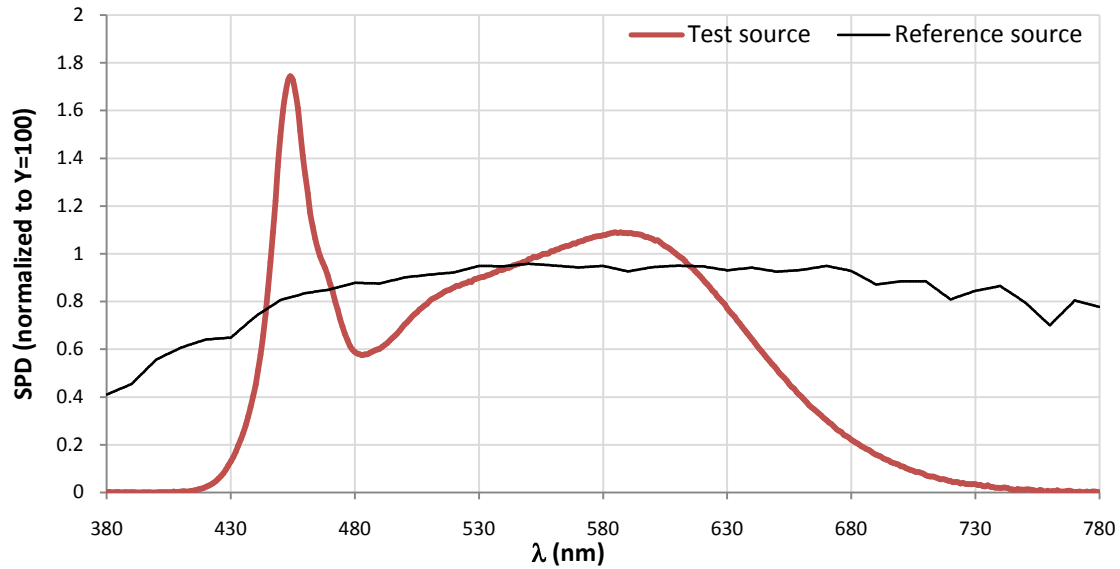
Ra 84.8			
R1 84	R2 93	R3 96	R4 81
R5 83	R6 89	R7 86	R8 68
R9 15	R10 83	R11 80	R12 59
R13 87	R14 98	R15 78	



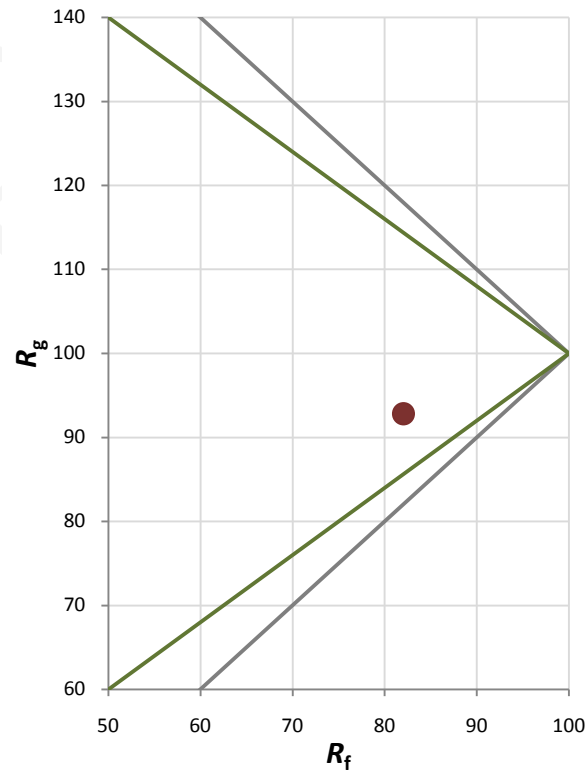
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	93

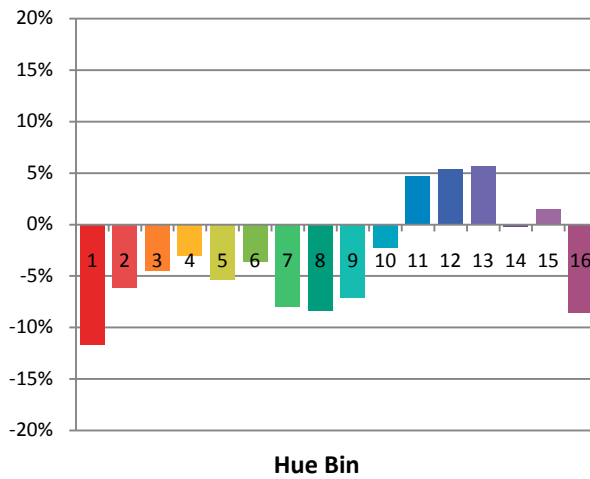
Spectral Power Distribution Comparison



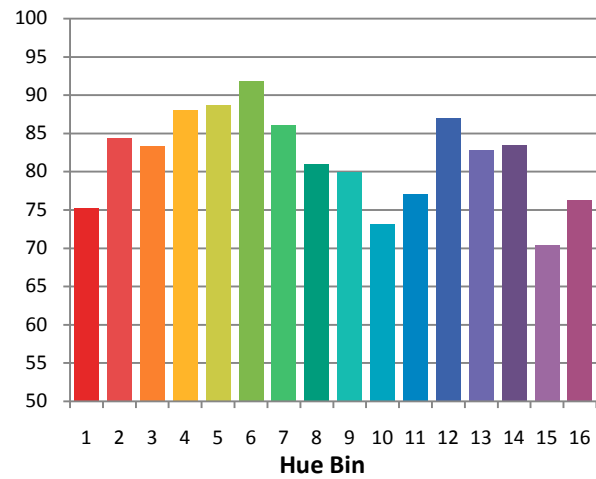
Plot of R_g versus R_f



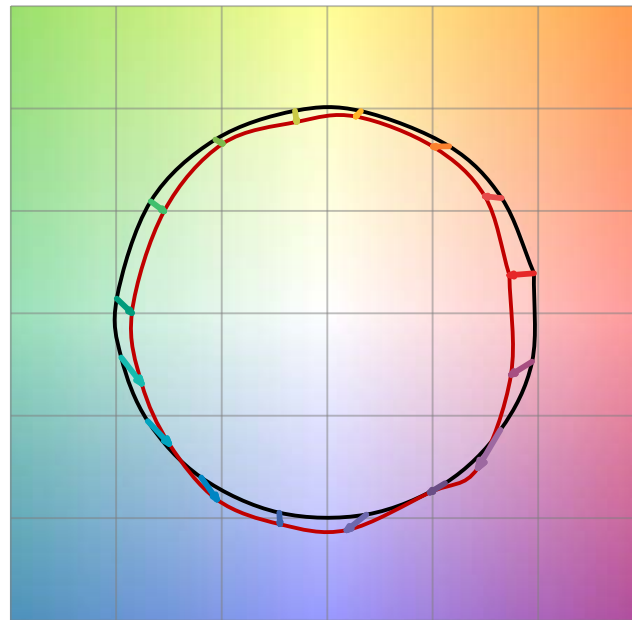
Chroma Shift by Hue



R_t by Hue

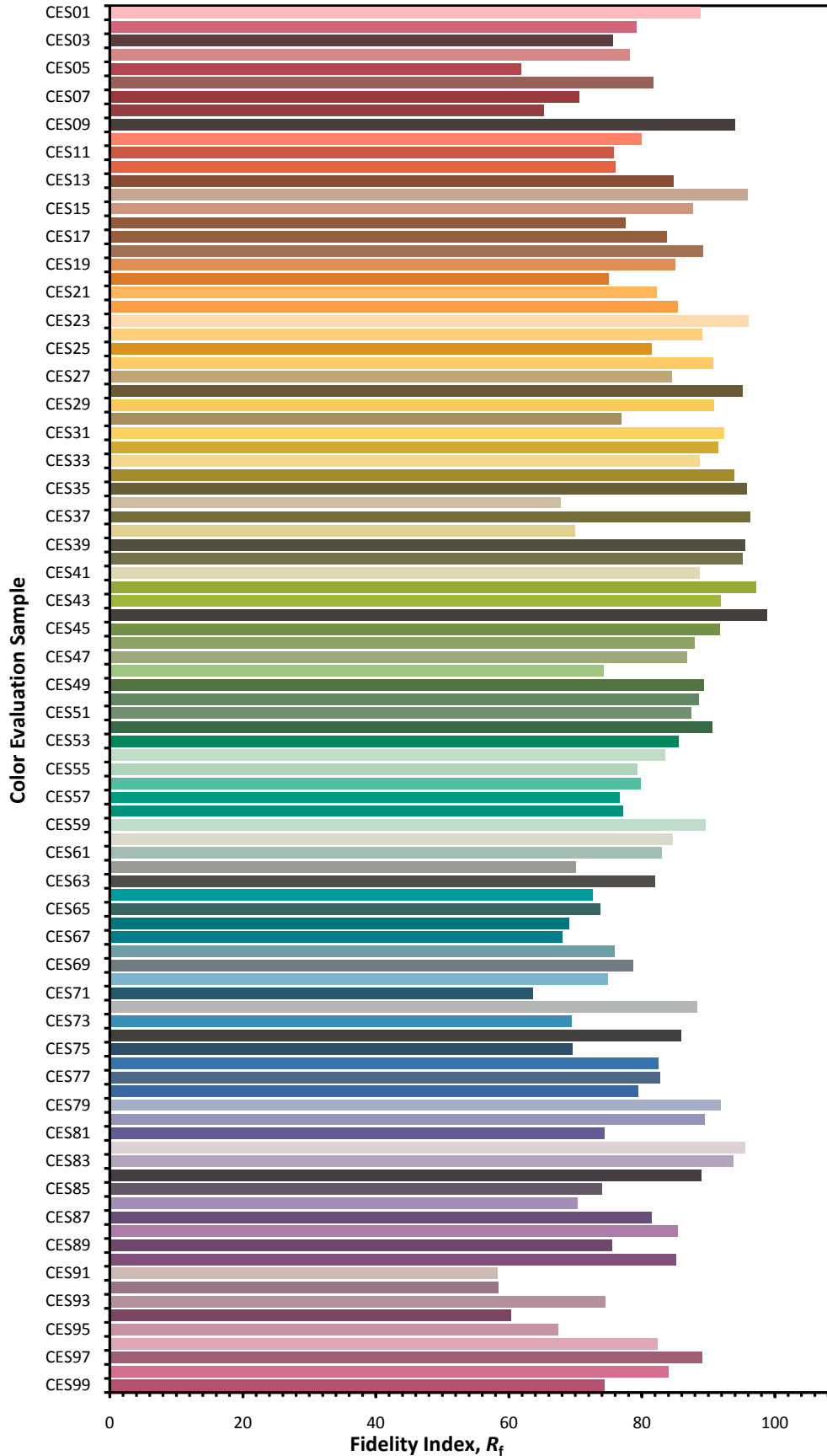


Color Vector Graphic

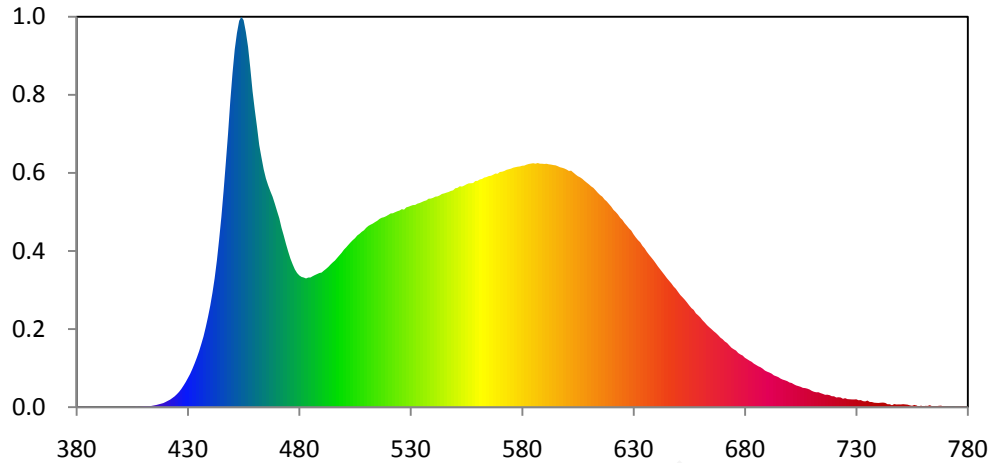


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



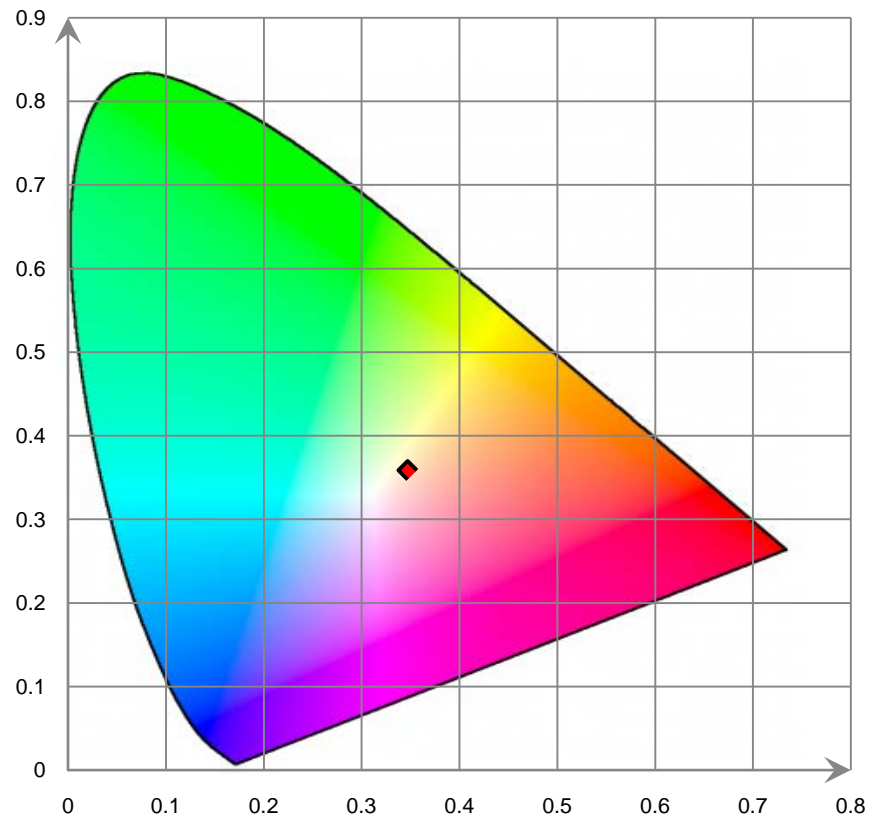
Relative Spectral Power Distribution



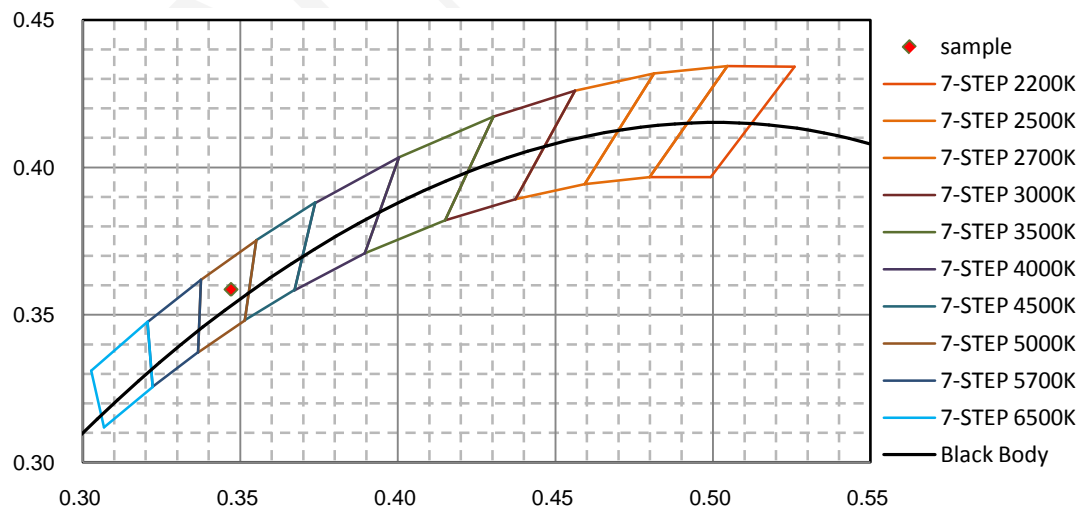
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.050E-02	421	9.275E-01	462	3.788E+01	503	2.381E+01	544	3.081E+01
381	6.540E-02	422	1.091E+00	463	3.608E+01	504	2.414E+01	545	3.089E+01
382	1.440E-02	423	1.318E+00	464	3.437E+01	505	2.442E+01	546	3.099E+01
383	1.960E-02	424	1.555E+00	465	3.304E+01	506	2.481E+01	547	3.109E+01
384	5.800E-02	425	1.861E+00	466	3.206E+01	507	2.504E+01	548	3.124E+01
385	5.150E-02	426	2.203E+00	467	3.120E+01	508	2.533E+01	549	3.133E+01
386	8.400E-03	427	2.616E+00	468	3.041E+01	509	2.555E+01	550	3.163E+01
387	3.010E-02	428	3.108E+00	469	2.940E+01	510	2.591E+01	551	3.168E+01
388	2.550E-02	429	3.626E+00	470	2.833E+01	511	2.619E+01	552	3.192E+01
389	1.920E-02	430	4.213E+00	471	2.730E+01	512	2.637E+01	553	3.187E+01
390	3.470E-02	431	4.812E+00	472	2.593E+01	513	2.653E+01	554	3.202E+01
391	2.130E-02	432	5.530E+00	473	2.480E+01	514	2.674E+01	555	3.219E+01
392	2.500E-03	433	6.315E+00	474	2.360E+01	515	2.694E+01	556	3.233E+01
393	1.130E-02	434	7.156E+00	475	2.249E+01	516	2.720E+01	557	3.235E+01
394	9.700E-03	435	8.071E+00	476	2.147E+01	517	2.737E+01	558	3.239E+01
395	2.530E-02	436	9.128E+00	477	2.064E+01	518	2.745E+01	559	3.268E+01
396	1.330E-02	437	1.023E+01	478	1.990E+01	519	2.760E+01	560	3.270E+01
397	2.180E-02	438	1.157E+01	479	1.938E+01	520	2.779E+01	561	3.291E+01
398	4.800E-03	439	1.303E+01	480	1.904E+01	521	2.799E+01	562	3.297E+01
399	5.900E-03	440	1.463E+01	481	1.882E+01	522	2.802E+01	563	3.318E+01
400	5.000E-04	441	1.651E+01	482	1.873E+01	523	2.817E+01	564	3.324E+01
401	2.520E-02	442	1.865E+01	483	1.860E+01	524	2.830E+01	565	3.339E+01
402	2.370E-02	443	2.120E+01	484	1.873E+01	525	2.841E+01	566	3.344E+01
403	4.610E-02	444	2.422E+01	485	1.874E+01	526	2.861E+01	567	3.358E+01
404	3.960E-02	445	2.746E+01	486	1.892E+01	527	2.854E+01	568	3.376E+01
405	4.190E-02	446	3.122E+01	487	1.909E+01	528	2.886E+01	569	3.373E+01
406	1.970E-02	447	3.530E+01	488	1.924E+01	529	2.896E+01	570	3.397E+01
407	1.137E-01	448	3.949E+01	489	1.938E+01	530	2.909E+01	571	3.402E+01
408	2.440E-02	449	4.418E+01	490	1.945E+01	531	2.920E+01	572	3.412E+01
409	8.230E-02	450	4.823E+01	491	1.973E+01	532	2.922E+01	573	3.429E+01
410	1.330E-01	451	5.166E+01	492	1.998E+01	533	2.941E+01	574	3.438E+01
411	1.732E-01	452	5.407E+01	493	2.026E+01	534	2.949E+01	575	3.446E+01
412	1.411E-01	453	5.583E+01	494	2.061E+01	535	2.964E+01	576	3.460E+01
413	1.415E-01	454	5.641E+01	495	2.092E+01	536	2.978E+01	577	3.467E+01
414	2.070E-01	455	5.591E+01	496	2.120E+01	537	2.988E+01	578	3.474E+01
415	2.703E-01	456	5.420E+01	497	2.157E+01	538	3.012E+01	579	3.479E+01
416	3.345E-01	457	5.203E+01	498	2.194E+01	539	3.014E+01	580	3.488E+01
417	4.253E-01	458	4.899E+01	499	2.231E+01	540	3.024E+01	581	3.490E+01
418	5.059E-01	459	4.567E+01	500	2.275E+01	541	3.041E+01	582	3.504E+01
419	5.988E-01	460	4.298E+01	501	2.308E+01	542	3.046E+01	583	3.514E+01
420	7.564E-01	461	4.052E+01	502	2.345E+01	543	3.060E+01	584	3.519E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.525E+01	626	2.659E+01	667	1.071E+01	708	2.679E+00	749	3.992E-01
586	3.518E+01	627	2.622E+01	668	1.040E+01	709	2.558E+00	750	3.957E-01
587	3.527E+01	628	2.582E+01	669	1.006E+01	710	2.357E+00	751	4.354E-01
588	3.518E+01	629	2.551E+01	670	9.813E+00	711	2.229E+00	752	4.013E-01
589	3.517E+01	630	2.498E+01	671	9.490E+00	712	2.155E+00	753	3.647E-01
590	3.514E+01	631	2.453E+01	672	9.272E+00	713	2.162E+00	754	2.699E-01
591	3.517E+01	632	2.414E+01	673	8.916E+00	714	2.024E+00	755	2.057E-01
592	3.509E+01	633	2.382E+01	674	8.580E+00	715	1.921E+00	756	3.264E-01
593	3.505E+01	634	2.331E+01	675	8.365E+00	716	1.790E+00	757	2.557E-01
594	3.498E+01	635	2.294E+01	676	8.181E+00	717	1.803E+00	758	8.260E-02
595	3.494E+01	636	2.244E+01	677	7.825E+00	718	1.737E+00	759	2.294E-01
596	3.482E+01	637	2.201E+01	678	7.615E+00	719	1.586E+00	760	1.224E-01
597	3.467E+01	638	2.162E+01	679	7.458E+00	720	1.574E+00	761	1.902E-01
598	3.459E+01	639	2.122E+01	680	7.136E+00	721	1.401E+00	762	1.809E-01
599	3.448E+01	640	2.077E+01	681	6.939E+00	722	1.440E+00	763	2.939E-01
600	3.432E+01	641	2.032E+01	682	6.729E+00	723	1.398E+00	764	1.416E-01
601	3.413E+01	642	1.990E+01	683	6.558E+00	724	1.213E+00	765	1.286E-01
602	3.417E+01	643	1.949E+01	684	6.298E+00	725	1.305E+00	766	1.453E-01
603	3.389E+01	644	1.907E+01	685	6.106E+00	726	1.166E+00	767	1.983E-01
604	3.362E+01	645	1.864E+01	686	5.914E+00	727	1.144E+00	768	2.253E-01
605	3.338E+01	646	1.826E+01	687	5.769E+00	728	1.123E+00	769	1.230E-01
606	3.321E+01	647	1.788E+01	688	5.559E+00	729	1.118E+00	770	9.590E-02
607	3.300E+01	648	1.743E+01	689	5.288E+00	730	1.138E+00	771	6.640E-02
608	3.270E+01	649	1.710E+01	690	5.129E+00	731	9.979E-01	772	1.071E-01
609	3.244E+01	650	1.665E+01	691	5.002E+00	732	1.026E+00	773	2.310E-02
610	3.219E+01	651	1.621E+01	692	4.848E+00	733	8.742E-01	774	4.940E-02
611	3.190E+01	652	1.587E+01	693	4.593E+00	734	8.349E-01	775	1.119E-01
612	3.168E+01	653	1.553E+01	694	4.475E+00	735	9.603E-01	776	5.020E-02
613	3.133E+01	654	1.513E+01	695	4.344E+00	736	7.579E-01	777	1.162E-01
614	3.097E+01	655	1.470E+01	696	4.129E+00	737	7.458E-01	778	1.108E-01
615	3.065E+01	656	1.432E+01	697	3.985E+00	738	6.512E-01	779	8.570E-02
616	3.041E+01	657	1.405E+01	698	3.882E+00	739	6.274E-01	780	3.070E-02
617	3.001E+01	658	1.355E+01	699	3.761E+00	740	6.111E-01		
618	2.972E+01	659	1.327E+01	700	3.568E+00	741	6.462E-01		
619	2.934E+01	660	1.296E+01	701	3.491E+00	742	6.651E-01		
620	2.897E+01	661	1.255E+01	702	3.301E+00	743	6.174E-01		
621	2.851E+01	662	1.222E+01	703	3.145E+00	744	4.308E-01		
622	2.821E+01	663	1.185E+01	704	3.049E+00	745	4.269E-01		
623	2.784E+01	664	1.155E+01	705	2.943E+00	746	2.833E-01		
624	2.738E+01	665	1.128E+01	706	2.792E+00	747	4.540E-01		
625	2.706E+01	666	1.097E+01	707	2.756E+00	748	3.881E-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**

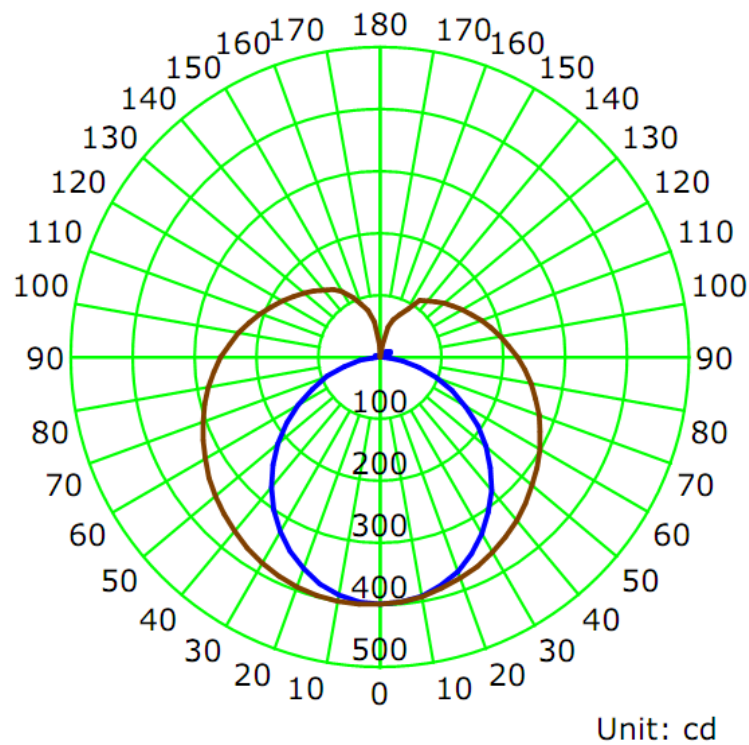
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1180	13.87	0.9800

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I_{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
2212.4	159.56	400.6	1.22	1.41

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I_{max}):	106.8	139.0	212.4	162.3	155.1
Field Angle (10% I_{max}):	158.4	330.6	339.4	327.8	289.1

Luminous Intensity (cd) Distribution Data

C γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	399	399	399	399	399	399	399	399
5.0°	397	398	397	396	396	397	397	397
10.0°	392	391	391	391	393	393	391	391
15.0°	381	381	383	385	387	387	384	382
20.0°	368	367	371	377	380	380	374	368
25.0°	351	351	357	367	373	371	362	352
30.0°	330	330	342	355	364	361	349	333
35.0°	307	309	325	343	354	350	335	313
40.0°	281	284	306	329	344	339	318	291
45.0°	253	258	286	315	334	327	303	268
50.0°	224	232	266	301	322	315	286	245
55.0°	193	204	246	287	311	303	269	221
60.0°	161	176	227	273	299	290	253	197
65.0°	129	148	208	259	286	278	237	174
70.0°	97	122	190	246	274	264	222	154
75.0°	66	97	173	231	261	250	206	134
80.0°	38	76	158	218	249	237	192	116
85.0°	16	60	144	204	236	223	178	101
90.0°	6	48	132	192	223	210	165	89
95.0°	6	42	123	182	210	198	155	81
100.0°	11	40	115	172	199	187	145	75
105.0°	14	40	108	162	187	176	136	71
110.0°	17	42	102	152	176	165	128	69
115.0°	19	44	97	142	164	155	121	69
120.0°	19	39	94	134	155	146	115	69
125.0°	18	40	91	128	144	137	110	68
130.0°	16	40	90	120	136	129	106	60
135.0°	14	41	86	115	128	121	102	56
140.0°	8	39	74	111	120	115	91	52
145.0°	2	37	68	101	113	105	75	46
150.0°	0	34	66	83	91	83	62	37
155.0°	0	32	61	73	77	70	47	26
160.0°	0	27	54	64	65	52	31	16
165.0°	0	18	40	51	52	30	12	4
170.0°	0	6	20	27	21	10	2	1
175.0°	0	0	2	2	0	1	0	0
180.0°	0	0	0	0	0	0	0	0

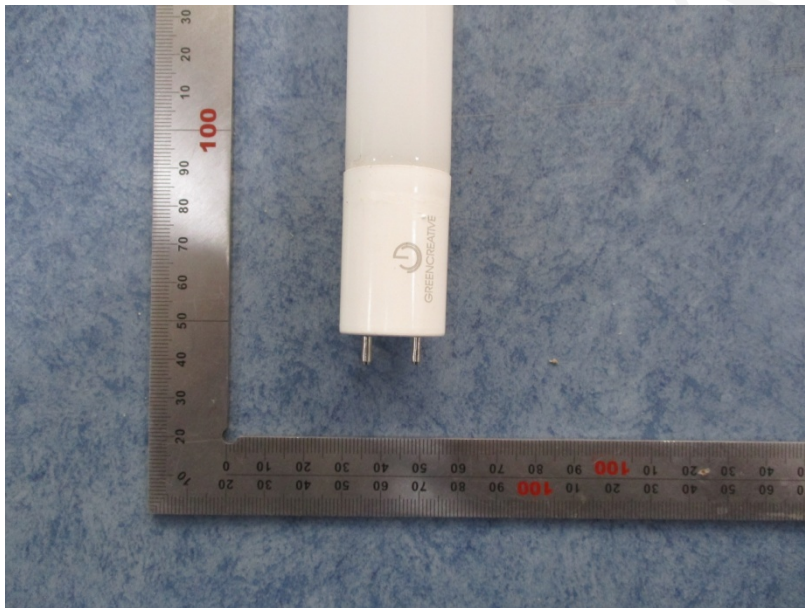
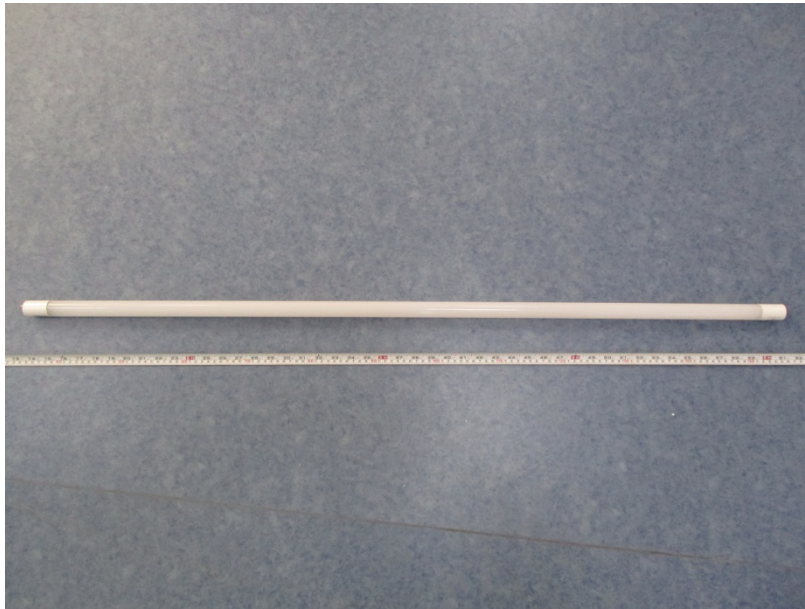
Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	399	399	399	399	399	399	399	399
5.0°	397	398	399	399	400	401	400	398
10.0°	389	392	395	399	400	400	397	394
15.0°	379	383	389	395	398	397	392	385
20.0°	364	369	380	389	395	392	385	374
25.0°	346	353	368	381	390	387	375	359
30.0°	324	333	354	373	383	380	364	342
35.0°	301	311	337	362	377	371	350	322
40.0°	274	287	319	351	368	363	336	301
45.0°	246	261	299	338	359	352	321	278
50.0°	217	234	280	325	349	341	305	254
55.0°	186	206	260	312	339	330	289	230
60.0°	154	178	241	298	328	318	274	206
65.0°	122	150	223	284	317	304	258	184
70.0°	92	122	205	270	306	291	243	163
75.0°	61	98	188	258	295	277	228	144
80.0°	33	78	173	244	283	265	214	127
85.0°	13	62	159	231	271	254	200	112
90.0°	5	51	148	220	259	243	190	102
95.0°	5	48	140	208	246	230	178	96
100.0°	7	48	134	199	233	218	170	92
105.0°	7	48	127	190	220	207	162	89
110.0°	9	51	122	181	208	197	154	86
115.0°	8	55	117	170	195	186	147	86
120.0°	6	55	113	161	183	175	140	85
125.0°	3	55	109	152	172	165	134	86
130.0°	1	56	107	144	162	155	128	86
135.0°	0	55	105	136	152	146	124	81
140.0°	0	53	98	129	143	137	119	79
145.0°	0	43	90	122	134	130	111	75
150.0°	0	37	76	109	124	119	99	70
155.0°	0	29	66	97	107	104	89	65
160.0°	0	25	59	78	93	91	81	55
165.0°	0	18	42	59	78	77	66	40
170.0°	0	11	27	35	58	55	44	24
175.0°	0	6	13	17	22	26	19	12
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	9.5	0.43	0-5	9.5	0.43
5-10	28.3	1.28	0-10	37.8	1.71
10-15	46.3	2.09	0-15	84.1	3.80
15-20	63.0	2.85	0-20	147.1	6.65
20-25	77.8	3.52	0-25	224.9	10.17
25-30	90.6	4.10	0-30	315.6	14.26
30-35	101.1	4.57	0-35	416.6	18.83
35-40	109.0	4.93	0-40	525.6	23.76
40-45	114.4	5.17	0-45	640.1	28.93
45-50	117.3	5.30	0-50	757.4	34.24
50-55	117.9	5.33	0-55	875.3	39.57
55-60	116.4	5.26	0-60	991.7	44.83
60-65	112.9	5.10	0-65	1104.6	49.93
65-70	107.9	4.88	0-70	1212.5	54.81
70-75	101.7	4.60	0-75	1314.2	59.40
75-80	94.7	4.28	0-80	1409.0	63.69
80-85	87.7	3.96	0-85	1496.7	67.65
85-90	81.2	3.67	0-90	1577.9	71.32
90-95	75.8	3.43	0-95	1653.7	74.75
95-100	71.1	3.22	0-100	1724.8	77.96
100-105	66.7	3.01	0-105	1791.5	80.98
105-110	62.1	2.81	0-110	1853.6	83.78
110-115	57.5	2.60	0-115	1911.0	86.38
115-120	52.6	2.38	0-120	1963.6	88.76
120-125	47.7	2.16	0-125	2011.3	90.91
125-130	42.8	1.93	0-130	2054.1	92.85
130-135	37.8	1.71	0-135	2091.9	94.56
135-140	32.7	1.48	0-140	2124.6	96.03
140-145	27.3	1.23	0-145	2151.9	97.27
145-150	21.5	0.97	0-150	2173.4	98.24
150-155	16.1	0.73	0-155	2189.4	98.96
155-160	11.3	0.51	0-160	2200.7	99.48
160-165	7.1	0.32	0-165	2207.8	99.79
165-170	3.4	0.15	0-170	2211.2	99.95
170-175	1.0	0.05	0-175	2212.3	100.00
175-180	0.1	0.00	0-180	2212.4	100.00

6. Product Photo



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