

IES LM-79-08

MEASUREMENT AND TEST REPORT

For

GREEN CREATIVE LTD

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

Test Model: 16.5A21/850/277V/R

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
Test Engineer:	Hill Liu <i>Hill Liu</i>
Report Number:	R1KS181227093-10-1
Test Date:	2018-12-28 to 2018-12-30
Report Date:	2019-05-21
Reviewed By:	Bill Xiong / EE Engineer <i>Bill Xiong</i>
Prepared By:	Bay Area Compliance Laboratories Corp. (Dongguan). No.69, Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China. Tel: +86-0769-86858888 Fax: +86-0769-86858588
Test Facility:	Test facility was located at No.69, Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.
Accreditation:	The IAS Accreditation Number TL-460.

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. (Dongguan). 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 2018-10-28 and used for testing.

Model Tested: 16.5A21/850/277V/R
 Manufacturer: GREEN CREATIVE LTD
 Brand Name: GREEN CREATIVE
 Product Designation: LED Lamp
 Aging Time Before Test: 0hour(For New Products)

Rated Values:

Rated Voltage/Frequency: 120VAC 60Hz
 Rated Power: 16.5W
 Nominal CCT: 5000K
 Nominal Lumen Output: 2050lm

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 (This method is not in IAS accreditation scope)

3. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	2018-12-13	2019-12-13
spectroradiometer	EVERFINE	HAAS-2000	20140912	2018-12-13	2019-12-13
Digital Power Meter	EVERFINE	PF2010A	1011004	2018-07-28	2019-07-28
Digital CC&CV DC Power Supply	EVERFINE	WY305-V1	1101047	2018-06-15	2019-06-15
Rapid Recording Photometer	EVERFINE	PHOTO-2000F	1007010	2018-12-13	2019-12-13
Standard Light Source	EVERFINE	D204	G100283CJ6351178	2018-12-24	2019-12-24
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	2019-03-19	2020-03-18
AC POWER SUPPLY	EVERFINE	VPS1030 PWM	1012017	2019-03-19	2020-03-18
Digital CC&CV DC Power Supply	EVERFINE	WY12010	1009009	2019-03-26	2020-03-25
Digital power meter	YOKOGAWA	WT-210	91j926132	2019-03-26	2020-03-25
full-field speed goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	2019-03-18	2020-03-17
Wireless Remote Sensor	N/A	433MHz	N/A	2019-03-17	2020-03-16
Standard Light Source	EVERFINE	D908	1012001	2018-12-24	2019-12-24

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) 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 $U=2.1\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=31\text{K}$ ($K=2$), at the 95% confidence level. The uncertainty of the CRI is $U=2.1$ ($K=2$), at the 95% confidence level.

The uncertainty of power meter AC current $U=0.19\%$ of rdg, AC Voltage $U=0.18\%$ of rdg, Power $U=0.46\%$ ($K=2$), 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 intensity is $U=2.82\%$ ($K=2$), 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: **Base Up**

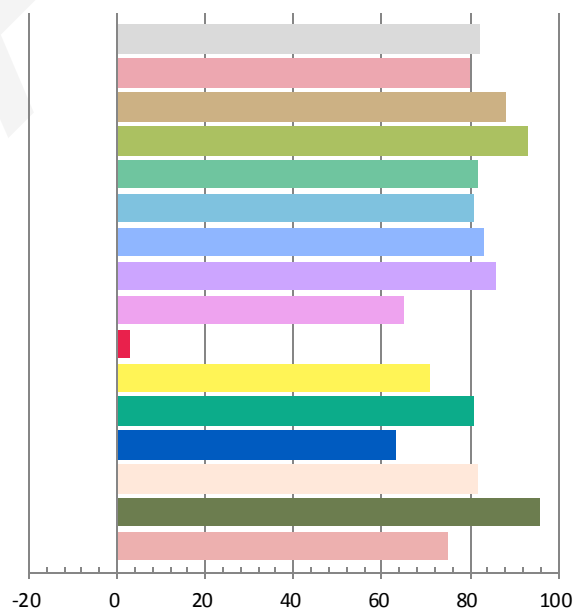
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1354	16.11	0.9912	2181.1	135.39

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
93.000	5067	0.00224	0.3436	0.3549	0.2092	0.4861

Color Rendering Index

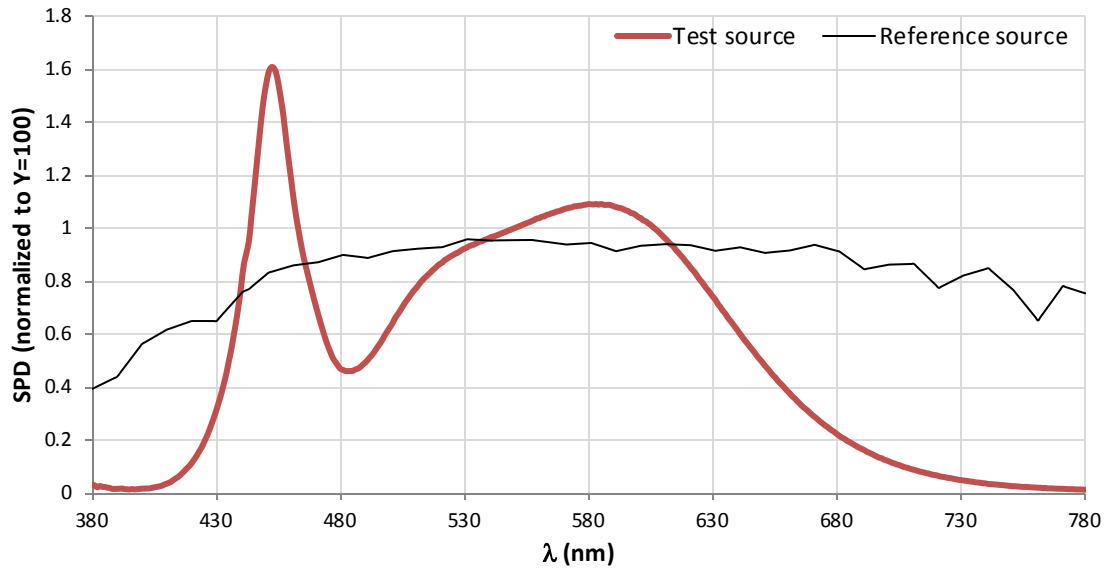
Ra			
82.4			
R1	R2	R3	R4
80	88	93	82
R5	R6	R7	R8
81	83	86	65
R9	R10	R11	R12
3	71	81	63
R13	R14	R15	
82	96	75	



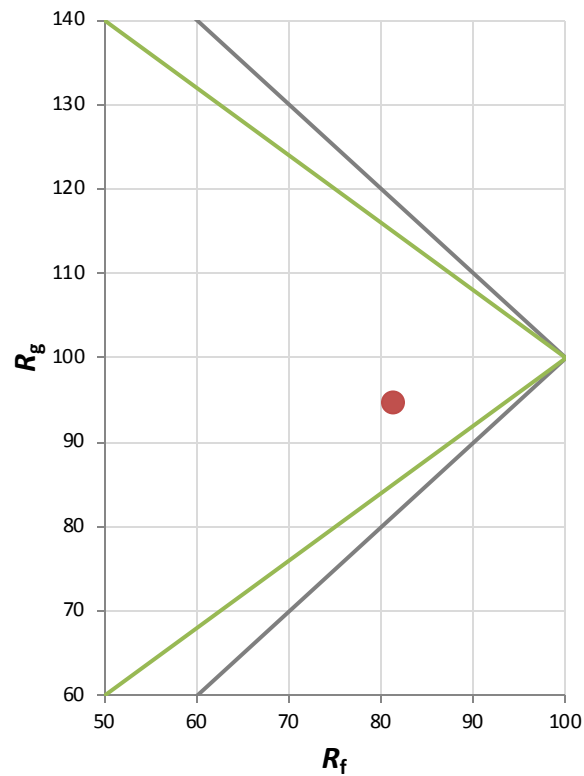
Fidelity Index and Gamut Index

Fidelity Index R_f	81
Gamut Index R_g	95

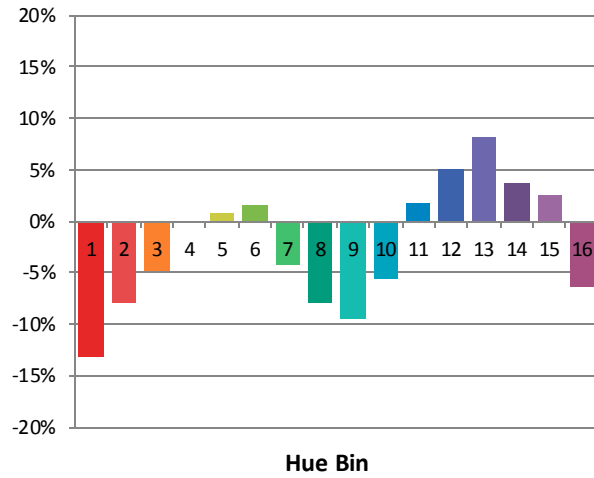
Spectral Power Distribution Comparison



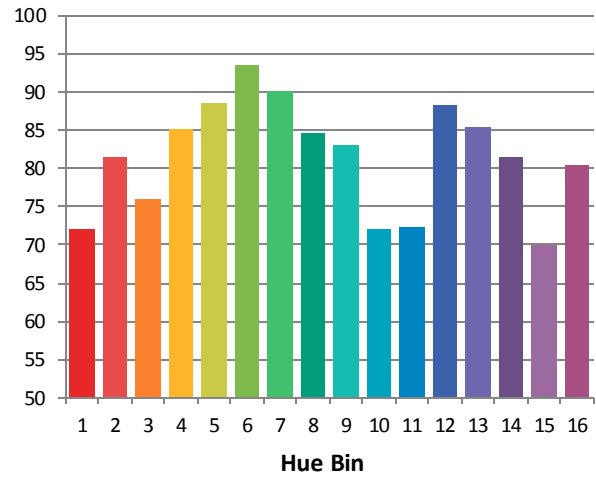
Plot of R_g versus R_f



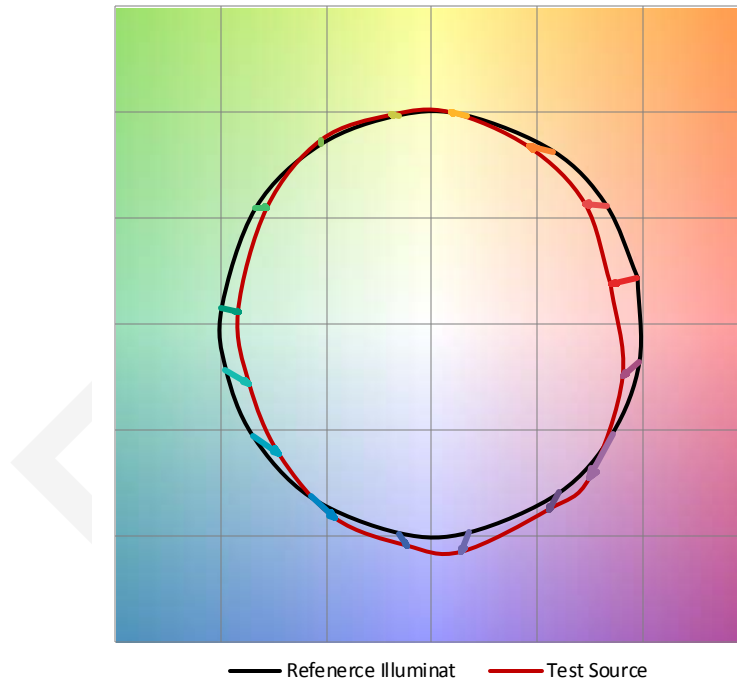
Chroma Shift by Hue



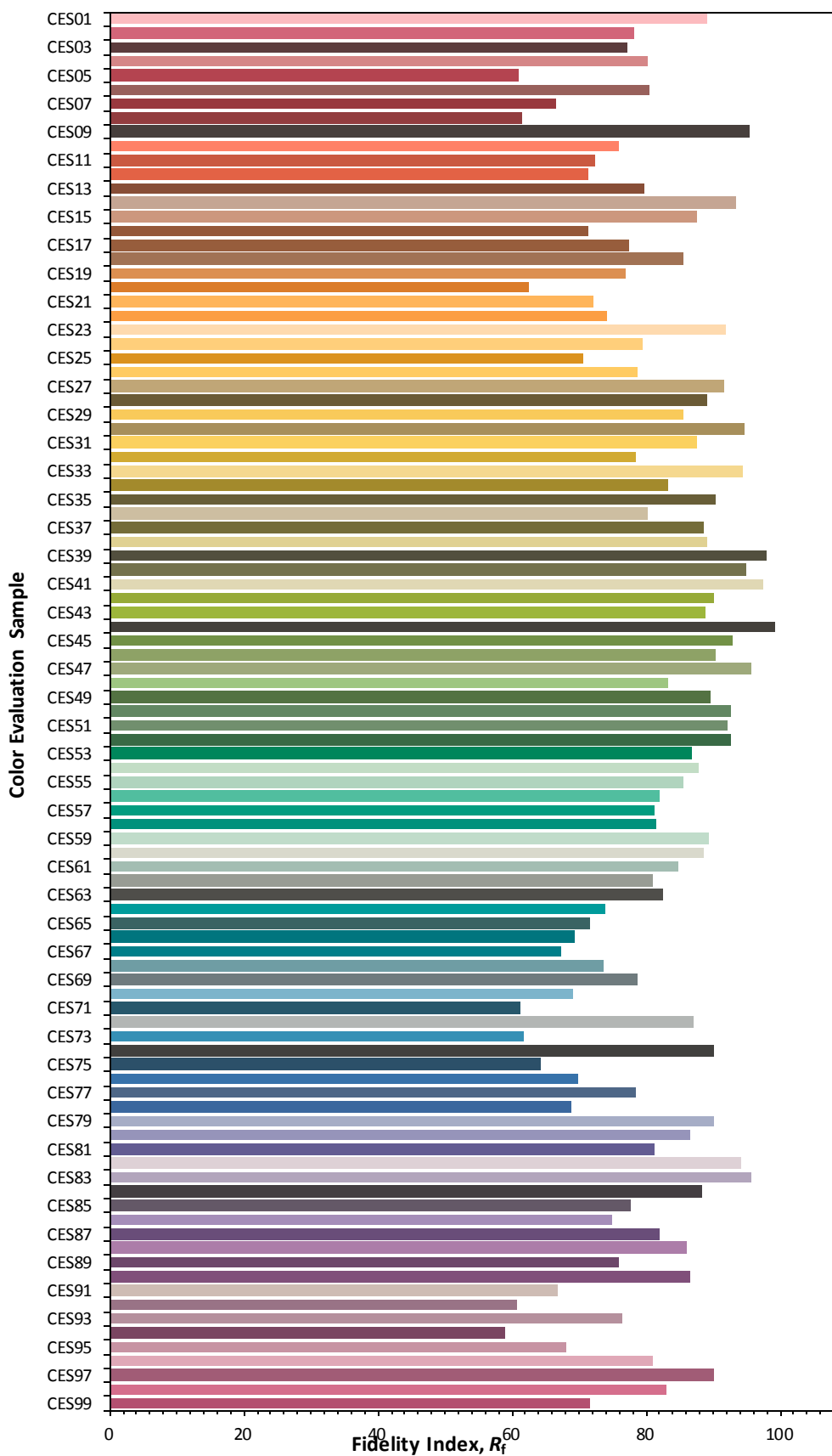
R_f by Hue



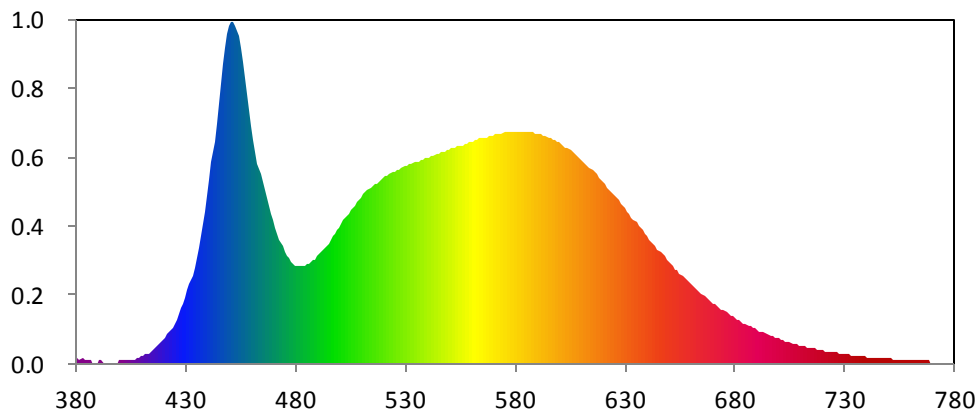
Color Vector Graphic



Color Fidelity by CES Sample



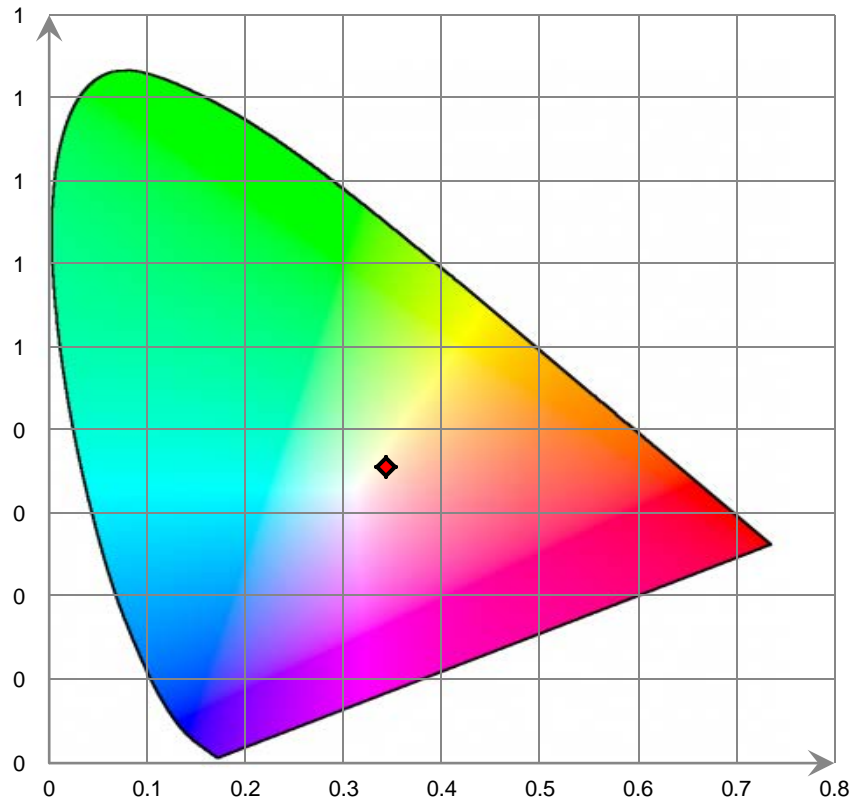
Relative Spectral Power Distribution



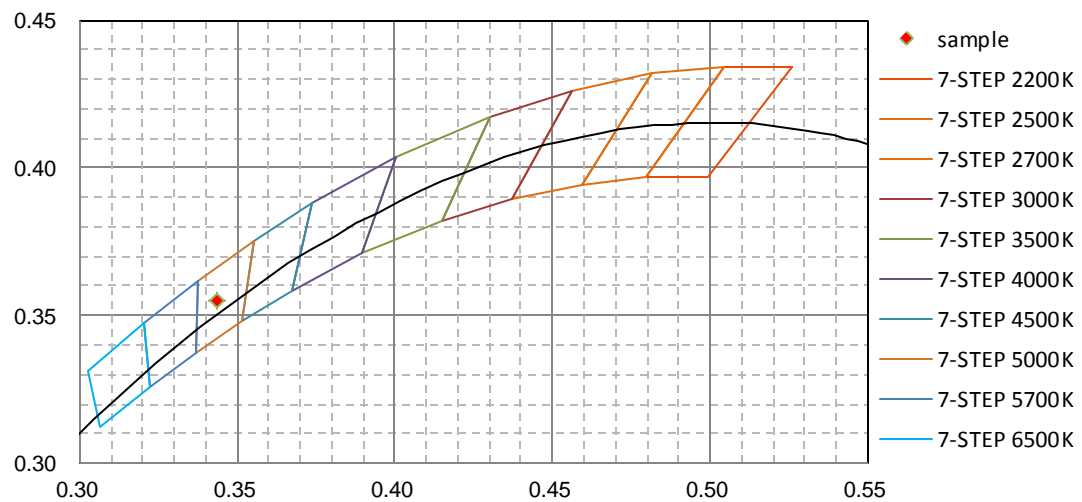
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	1.088E+00	421	4.092E+00	462	3.175E+01	503	2.201E+01	544	3.136E+01
381	9.509E-01	422	4.539E+00	463	3.010E+01	504	2.251E+01	545	3.149E+01
382	7.443E-01	423	5.047E+00	464	2.857E+01	505	2.298E+01	546	3.163E+01
383	9.099E-01	424	5.550E+00	465	2.731E+01	506	2.340E+01	547	3.173E+01
384	8.011E-01	425	6.191E+00	466	2.611E+01	507	2.381E+01	548	3.188E+01
385	7.899E-01	426	6.816E+00	467	2.490E+01	508	2.423E+01	549	3.199E+01
386	7.051E-01	427	7.550E+00	468	2.372E+01	509	2.460E+01	550	3.210E+01
387	6.625E-01	428	8.356E+00	469	2.260E+01	510	2.492E+01	551	3.227E+01
388	5.563E-01	429	9.195E+00	470	2.152E+01	511	2.536E+01	552	3.232E+01
389	5.572E-01	430	1.010E+01	471	2.047E+01	512	2.568E+01	553	3.249E+01
390	5.549E-01	431	1.107E+01	472	1.948E+01	513	2.599E+01	554	3.258E+01
391	5.807E-01	432	1.211E+01	473	1.850E+01	514	2.627E+01	555	3.271E+01
392	5.951E-01	433	1.325E+01	474	1.768E+01	515	2.655E+01	556	3.279E+01
393	5.249E-01	434	1.449E+01	475	1.693E+01	516	2.686E+01	557	3.293E+01
394	5.118E-01	435	1.598E+01	476	1.624E+01	517	2.711E+01	558	3.310E+01
395	4.846E-01	436	1.741E+01	477	1.581E+01	518	2.740E+01	559	3.314E+01
396	5.360E-01	437	1.914E+01	478	1.537E+01	519	2.763E+01	560	3.333E+01
397	4.912E-01	438	2.089E+01	479	1.500E+01	520	2.782E+01	561	3.335E+01
398	5.206E-01	439	2.290E+01	480	1.487E+01	521	2.811E+01	562	3.354E+01
399	5.500E-01	440	2.512E+01	481	1.475E+01	522	2.828E+01	563	3.361E+01
400	5.843E-01	441	2.754E+01	482	1.473E+01	523	2.849E+01	564	3.373E+01
401	5.941E-01	442	3.028E+01	483	1.475E+01	524	2.865E+01	565	3.381E+01
402	6.043E-01	443	3.313E+01	484	1.477E+01	525	2.882E+01	566	3.394E+01
403	6.073E-01	444	3.602E+01	485	1.495E+01	526	2.897E+01	567	3.400E+01
404	6.821E-01	445	3.904E+01	486	1.504E+01	527	2.915E+01	568	3.411E+01
405	7.422E-01	446	4.205E+01	487	1.524E+01	528	2.934E+01	569	3.423E+01
406	8.000E-01	447	4.494E+01	488	1.553E+01	529	2.949E+01	570	3.431E+01
407	8.624E-01	448	4.743E+01	489	1.578E+01	530	2.964E+01	571	3.440E+01
408	9.463E-01	449	4.927E+01	490	1.611E+01	531	2.980E+01	572	3.443E+01
409	1.082E+00	450	5.071E+01	491	1.646E+01	532	2.990E+01	573	3.456E+01
410	1.195E+00	451	5.129E+01	492	1.681E+01	533	3.000E+01	574	3.459E+01
411	1.310E+00	452	5.125E+01	493	1.724E+01	534	3.016E+01	575	3.464E+01
412	1.482E+00	453	5.065E+01	494	1.769E+01	535	3.030E+01	576	3.466E+01
413	1.701E+00	454	4.921E+01	495	1.811E+01	536	3.038E+01	577	3.474E+01
414	1.890E+00	455	4.740E+01	496	1.860E+01	537	3.054E+01	578	3.478E+01
415	2.108E+00	456	4.534E+01	497	1.913E+01	538	3.063E+01	579	3.484E+01
416	2.394E+00	457	4.272E+01	498	1.961E+01	539	3.077E+01	580	3.481E+01
417	2.687E+00	458	4.029E+01	499	2.006E+01	540	3.091E+01	581	3.480E+01
418	3.009E+00	459	3.797E+01	500	2.053E+01	541	3.097E+01	582	3.485E+01
419	3.298E+00	460	3.559E+01	501	2.115E+01	542	3.114E+01	583	3.477E+01
420	3.667E+00	461	3.352E+01	502	2.156E+01	543	3.131E+01	584	3.485E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.476E+01	626	2.485E+01	667	1.002E+01	708	3.025E+00	749	9.032E-01
586	3.474E+01	627	2.448E+01	668	9.733E+00	709	2.925E+00	750	8.788E-01
587	3.476E+01	628	2.409E+01	669	9.460E+00	710	2.853E+00	751	8.723E-01
588	3.469E+01	629	2.369E+01	670	9.214E+00	711	2.763E+00	752	8.411E-01
589	3.458E+01	630	2.333E+01	671	8.989E+00	712	2.669E+00	753	8.162E-01
590	3.448E+01	631	2.282E+01	672	8.710E+00	713	2.598E+00	754	7.925E-01
591	3.440E+01	632	2.244E+01	673	8.477E+00	714	2.536E+00	755	7.962E-01
592	3.435E+01	633	2.200E+01	674	8.233E+00	715	2.447E+00	756	7.747E-01
593	3.422E+01	634	2.165E+01	675	8.039E+00	716	2.393E+00	757	7.474E-01
594	3.407E+01	635	2.117E+01	676	7.796E+00	717	2.296E+00	758	7.265E-01
595	3.398E+01	636	2.081E+01	677	7.589E+00	718	2.242E+00	759	7.181E-01
596	3.377E+01	637	2.042E+01	678	7.388E+00	719	2.198E+00	760	6.941E-01
597	3.370E+01	638	2.001E+01	679	7.148E+00	720	2.104E+00	761	6.837E-01
598	3.351E+01	639	1.961E+01	680	6.923E+00	721	2.029E+00	762	6.576E-01
599	3.327E+01	640	1.919E+01	681	6.723E+00	722	1.992E+00	763	6.590E-01
600	3.314E+01	641	1.877E+01	682	6.582E+00	723	1.926E+00	764	6.135E-01
601	3.286E+01	642	1.838E+01	683	6.353E+00	724	1.875E+00	765	6.208E-01
602	3.277E+01	643	1.801E+01	684	6.201E+00	725	1.832E+00	766	6.051E-01
603	3.251E+01	644	1.763E+01	685	6.021E+00	726	1.764E+00	767	5.822E-01
604	3.232E+01	645	1.727E+01	686	5.855E+00	727	1.708E+00	768	5.822E-01
605	3.203E+01	646	1.688E+01	687	5.658E+00	728	1.645E+00	769	5.684E-01
606	3.180E+01	647	1.646E+01	688	5.516E+00	729	1.611E+00	770	5.670E-01
607	3.153E+01	648	1.613E+01	689	5.363E+00	730	1.563E+00	771	5.438E-01
608	3.123E+01	649	1.576E+01	690	5.226E+00	731	1.533E+00	772	5.230E-01
609	3.092E+01	650	1.538E+01	691	5.028E+00	732	1.484E+00	773	5.148E-01
610	3.064E+01	651	1.504E+01	692	4.906E+00	733	1.433E+00	774	5.153E-01
611	3.032E+01	652	1.469E+01	693	4.763E+00	734	1.404E+00	775	4.982E-01
612	3.001E+01	653	1.429E+01	694	4.613E+00	735	1.344E+00	776	4.779E-01
613	2.977E+01	654	1.401E+01	695	4.460E+00	736	1.315E+00	777	4.896E-01
614	2.934E+01	655	1.363E+01	696	4.317E+00	737	1.279E+00	778	4.622E-01
615	2.903E+01	656	1.330E+01	697	4.240E+00	738	1.232E+00	779	4.631E-01
616	2.868E+01	657	1.301E+01	698	4.072E+00	739	1.210E+00	780	4.639E-01
617	2.835E+01	658	1.267E+01	699	3.978E+00	740	1.137E+00		
618	2.793E+01	659	1.234E+01	700	3.859E+00	741	1.128E+00		
619	2.762E+01	660	1.204E+01	701	3.720E+00	742	1.106E+00		
620	2.719E+01	661	1.170E+01	702	3.629E+00	743	1.080E+00		
621	2.686E+01	662	1.144E+01	703	3.513E+00	744	1.052E+00		
622	2.650E+01	663	1.111E+01	704	3.422E+00	745	1.017E+00		
623	2.604E+01	664	1.082E+01	705	3.313E+00	746	1.000E+00		
624	2.565E+01	665	1.051E+01	706	3.192E+00	747	9.639E-01		
625	2.529E+01	666	1.026E+01	707	3.118E+00	748	9.309E-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: **Base Up**

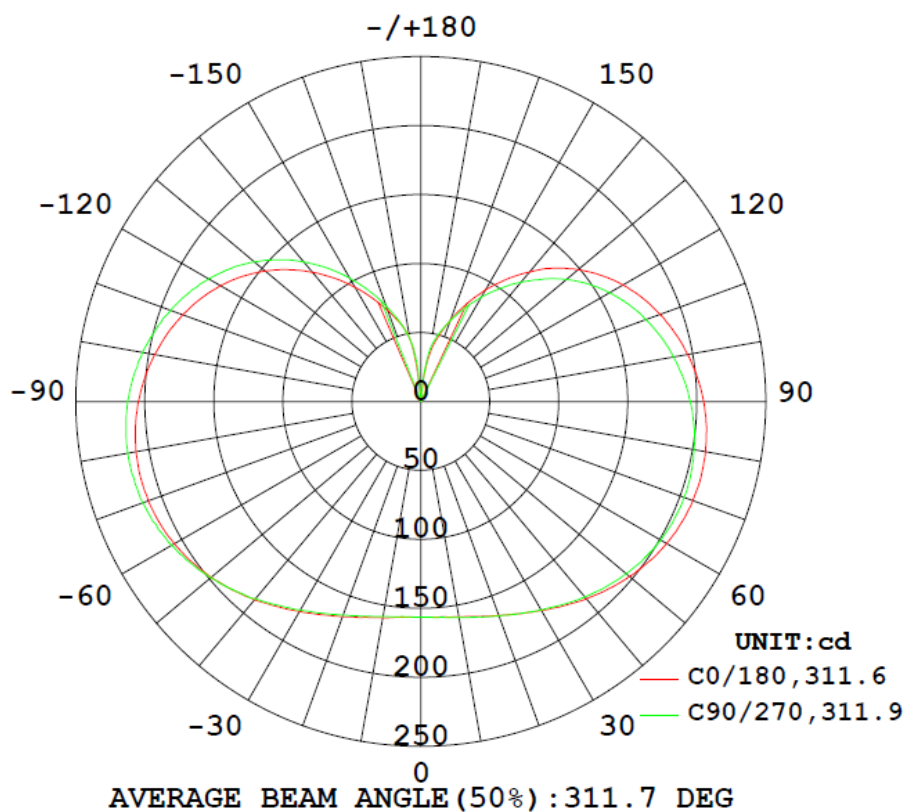
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
119.9	60	0.1368	16.22	0.9886

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
2206.39	136.03	219.1	1.79	1.78

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	311.6	312.2	311.9	311.2	311.7
Field Angle (10% I _{max}):	347.3	348.3	348.6	348.3	348.1

Luminous Intensity (cd) Distribution Data

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	156	156	156	156	156	156	156	156
5.0°	157	157	157	157	157	157	157	157
10.0°	159	159	159	158	158	158	159	159
15.0°	162	162	162	161	161	161	161	162
20.0°	166	166	165	165	165	165	165	165
25.0°	171	170	170	169	169	169	170	170
30.0°	176	176	175	175	175	175	175	175
35.0°	182	181	181	180	180	181	182	181
40.0°	188	187	187	187	187	187	188	188
45.0°	193	193	193	193	193	194	194	194
50.0°	198	199	199	198	199	200	200	199
55.0°	203	203	204	204	204	205	206	204
60.0°	206	207	208	208	209	210	211	209
65.0°	209	210	211	211	212	214	215	212
70.0°	210	212	213	213	214	217	217	214
75.0°	211	212	213	214	215	218	219	215
80.0°	210	211	213	213	216	218	219	215
85.0°	208	210	211	212	214	217	218	214
90.0°	205	207	208	210	213	215	215	211
95.0°	201	203	205	206	209	211	212	207
100.0°	196	199	200	202	205	207	207	203
105.0°	190	193	195	197	199	201	201	197
110.0°	184	187	188	190	193	195	195	191
115.0°	176	180	181	184	186	187	187	183
120.0°	168	171	173	176	178	178	178	175
125.0°	158	162	164	166	168	168	168	165
130.0°	147	151	153	156	158	157	157	154
135.0°	135	139	141	144	145	145	144	141
140.0°	122	126	128	131	132	131	130	128
145.0°	109	113	115	117	118	117	115	113
150.0°	96	99	101	103	103	102	100	97
155.0°	83	85	87	88	88	86	84	81
160.0°	70	73	74	74	74	71	68	65
165.0°	59	61	62	62	60	57	53	51
170.0°	46	47	50	49	46	43	38	35
175.0°	7	11	15	16	16	14	10	7
180.0°	0	0	0	0	0	0	0	0

Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ \gamma \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	156	156	156	156	156	156	156	156
5.0°	157	157	157	157	157	157	157	157
10.0°	159	159	159	159	159	159	159	159
15.0°	161	162	162	162	162	162	162	162
20.0°	165	165	165	165	165	165	166	166
25.0°	170	170	170	170	170	170	170	170
30.0°	175	175	174	174	174	174	175	176
35.0°	181	181	180	180	180	180	181	181
40.0°	187	186	185	185	185	185	186	187
45.0°	192	192	191	190	190	190	191	192
50.0°	197	197	195	194	194	194	196	198
55.0°	202	201	199	198	198	198	200	202
60.0°	206	204	202	201	201	201	203	205
65.0°	208	206	204	202	202	203	205	207
70.0°	210	207	204	203	203	203	206	209
75.0°	210	207	204	203	203	203	206	208
80.0°	209	206	203	201	201	202	205	208
85.0°	208	204	201	199	199	199	202	205
90.0°	205	201	198	196	195	196	199	202
95.0°	201	197	194	192	191	192	195	198
100.0°	196	192	189	187	186	187	190	193
105.0°	191	186	184	181	180	182	184	187
110.0°	185	180	177	175	174	175	177	180
115.0°	177	173	170	167	166	168	170	173
120.0°	169	164	162	159	158	159	162	164
125.0°	160	155	152	150	148	150	152	154
130.0°	149	144	142	139	138	139	141	144
135.0°	137	132	130	127	126	127	129	132
140.0°	123	118	116	114	113	114	116	118
145.0°	108	105	103	101	100	101	103	105
150.0°	93	91	89	88	87	88	90	92
155.0°	78	76	75	75	74	75	77	79
160.0°	63	62	61	62	62	64	65	66
165.0°	49	48	47	49	51	53	55	56
170.0°	33	33	33	36	38	42	43	41
175.0°	6	7	6	5	4	3	8	9
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	3.7	0.17	0-5	3.7	0.17
5-10	11.3	0.68	0-10	15.0	0.68
10-15	19.0	1.54	0-15	34.1	1.54
15-20	26.9	2.76	0-20	61.0	2.76
20-25	35.2	4.36	0-25	96.2	4.36
25-30	43.6	6.34	0-30	139.8	6.34
30-35	52.4	8.71	0-35	192.2	8.71
35-40	61.3	11.49	0-40	253.5	11.49
40-45	70.1	14.67	0-45	323.6	14.67
45-50	78.7	18.24	0-50	402.4	18.24
50-55	86.8	22.17	0-55	489.2	22.17
55-60	94.2	26.44	0-60	583.4	26.44
60-65	100.6	31.00	0-65	684.1	31.00
65-70	105.9	35.80	0-70	789.9	35.80
70-75	109.8	40.78	0-75	899.7	40.78
75-80	112.3	45.87	0-80	1012.0	45.87
80-85	113.3	51.00	0-85	1125.3	51.00
85-90	112.9	56.12	0-90	1238.3	56.12
90-95	111.1	61.16	0-95	1349.3	61.16
95-100	107.9	66.05	0-100	1457.3	66.05
100-105	103.5	70.74	0-105	1560.8	70.74
105-110	98.0	75.18	0-110	1658.8	75.18
110-115	91.4	79.32	0-115	1750.2	79.32
115-120	84.0	83.13	0-120	1834.2	83.13
120-125	75.7	86.56	0-125	1909.8	86.56
125-130	66.8	89.59	0-130	1976.6	89.59
130-135	57.4	92.19	0-135	2034.0	92.19
135-140	47.9	94.36	0-140	2081.9	94.36
140-145	38.7	96.11	0-145	2120.6	96.11
145-150	30.0	97.47	0-150	2150.6	97.47
150-155	22.3	98.48	0-155	2172.9	98.48
155-160	15.5	99.19	0-160	2188.4	99.19
160-165	10.1	99.64	0-165	2198.5	99.64
165-170	5.8	99.90	0-170	2204.2	99.90
170-175	2.1	100.00	0-175	2206.3	100.00
175-180	0.1	100.00	0-180	2206.4	100.00

6. Product Photo



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