

IES LM-79-08

MEASUREMENT AND TEST REPORT

For

GREEN CREATIVE LTD

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

Test Model: 16.5A21/840/277V/R

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
Test Engineer:	Hill Liu <i>Hill Liu</i>
Report Number:	R1KS181227092-10-1
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:

Two samples were received on 2018-12-28. One was tested in integrating sphere and the other was tested in goniophotometer.

Model Tested: 16.5A21/840/277V/R
Manufacturer: GREEN CREATIVE LTD
Brand Name: GREEN CREATIVE
Product Designation: Omnidirectional LED Lamp
Burning Time Before Test: 0hour(For New Products)

Rated Values:

Rated Voltage/Frequency: 120VAC 60Hz
Rated Power: 16.5W
Nominal CCT: 4000K
Nominal Lumen Output: 2000lm

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**

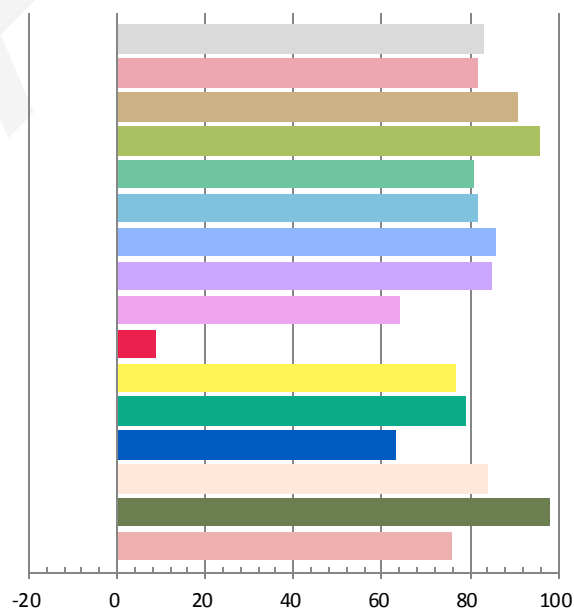
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1348	16.04	0.9914	2141.3	133.50

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
96.000	4038	-0.00065	0.3784	0.3741	0.2248	0.5001

Color Rendering Index

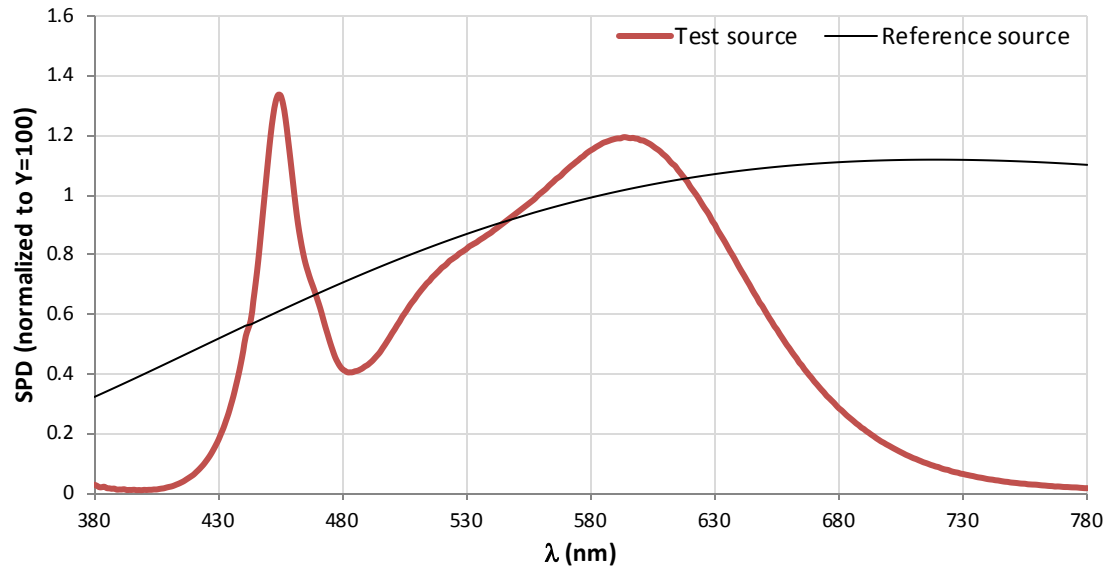
Ra			
83.3			
R1	R2	R3	R4
82	91	96	81
R5	R6	R7	R8
82	86	85	64
R9	R10	R11	R12
9	77	79	63
R13	R14	R15	
84	98	76	



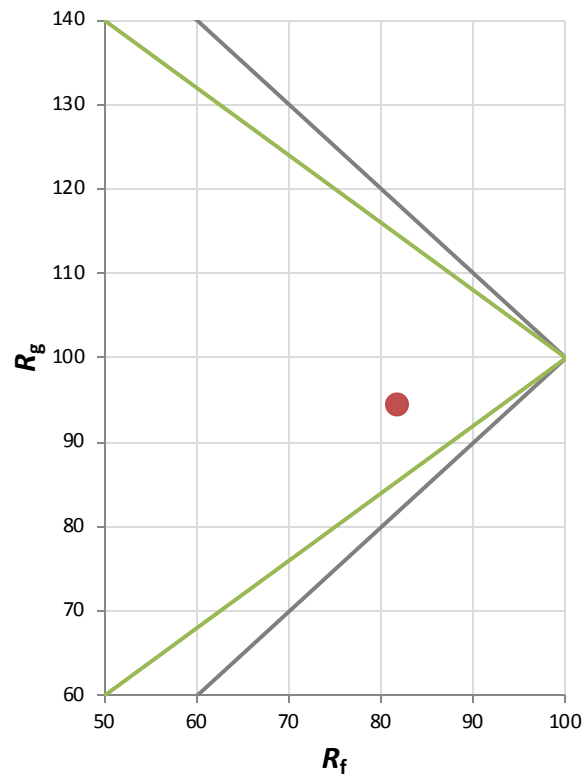
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	94

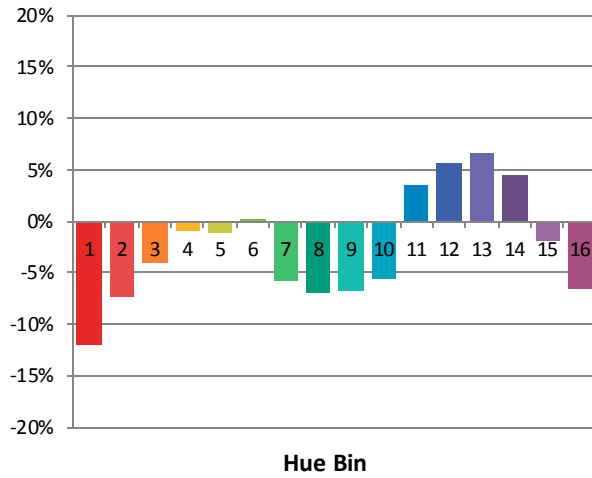
Spectral Power Distribution Comparison



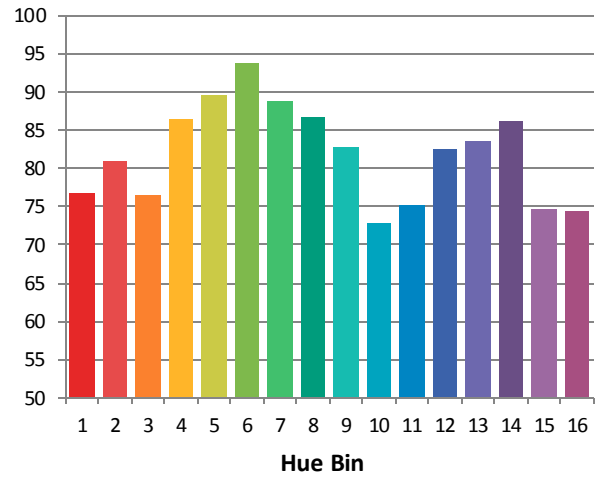
Plot of R_g versus R_f



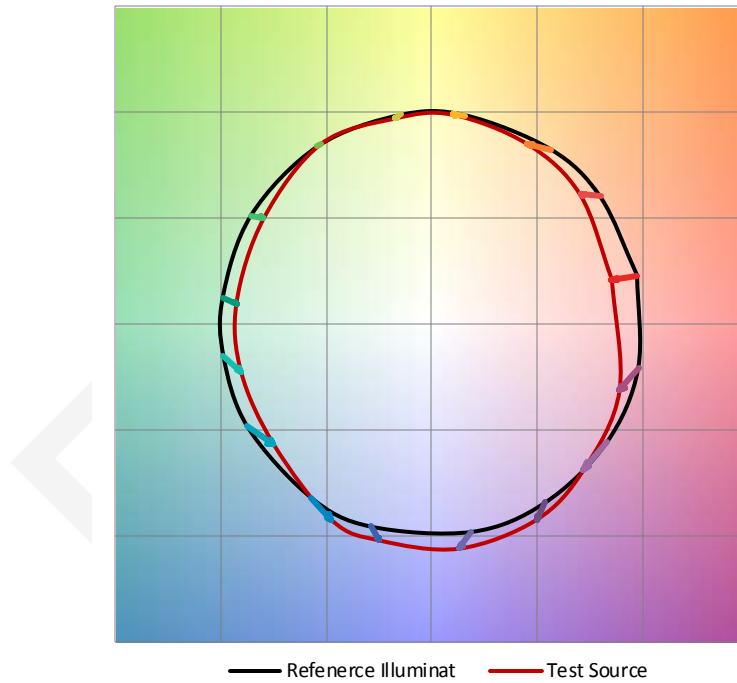
Chroma Shift by Hue



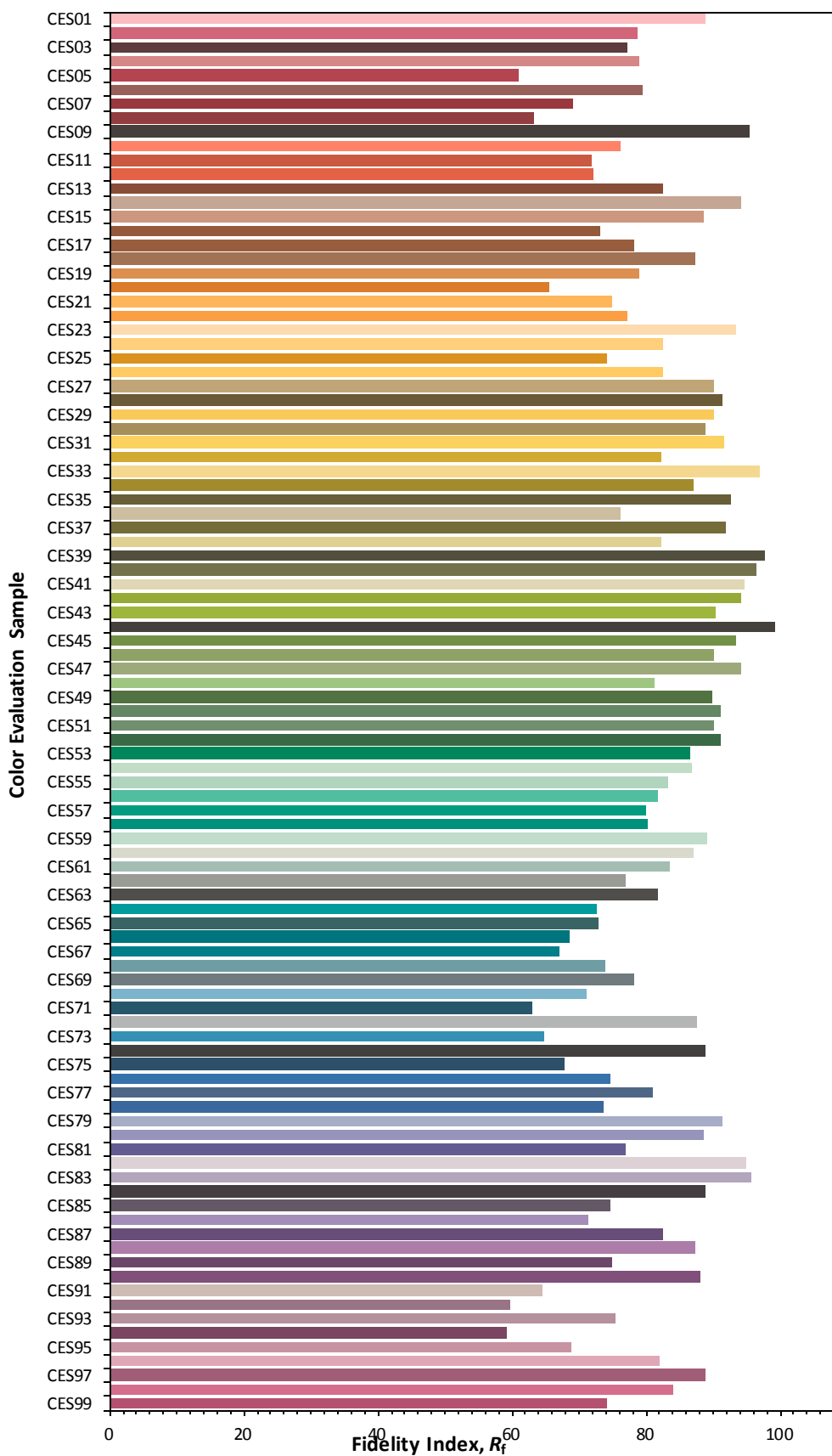
R_f by Hue



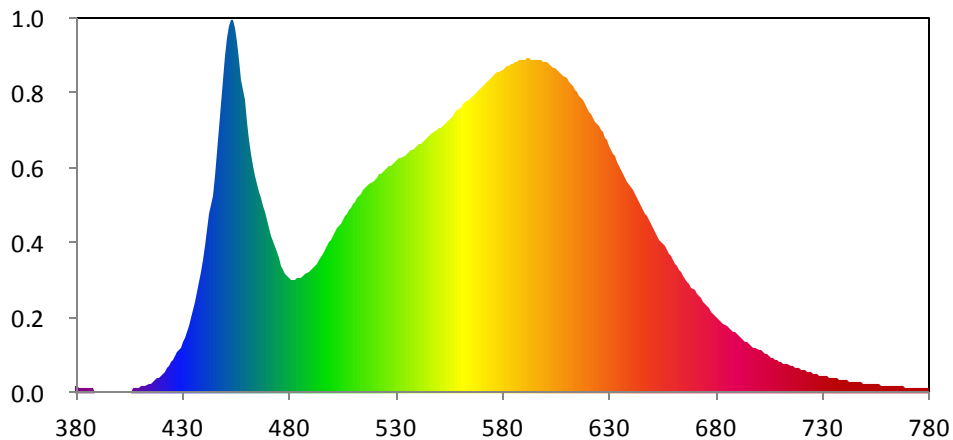
Color Vector Graphic



Color Fidelity by CES Sample



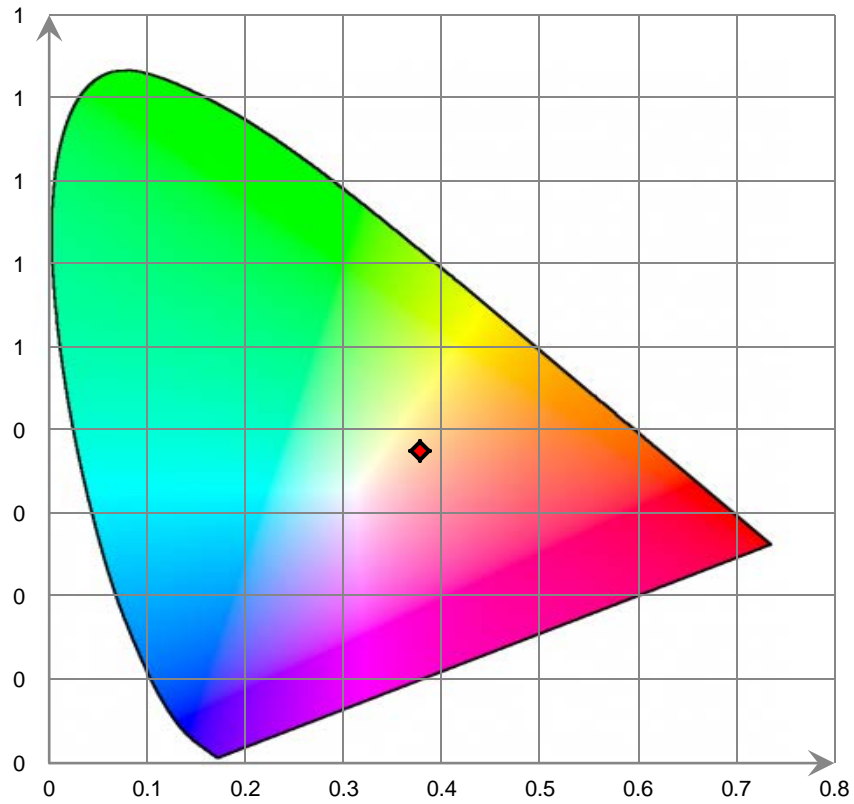
Relative Spectral Power Distribution



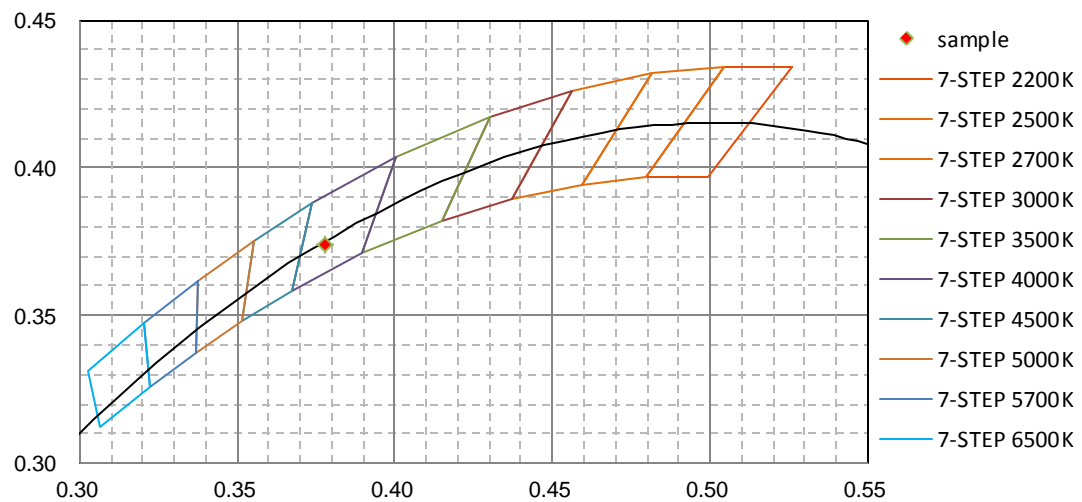
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	9.233E-01	421	2.241E+00	462	2.676E+01	503	1.855E+01	544	2.834E+01
381	8.119E-01	422	2.488E+00	463	2.537E+01	504	1.892E+01	545	2.859E+01
382	6.588E-01	423	2.765E+00	464	2.422E+01	505	1.931E+01	546	2.877E+01
383	6.630E-01	424	3.055E+00	465	2.333E+01	506	1.973E+01	547	2.900E+01
384	7.132E-01	425	3.402E+00	466	2.250E+01	507	2.009E+01	548	2.918E+01
385	5.607E-01	426	3.761E+00	467	2.179E+01	508	2.041E+01	549	2.935E+01
386	5.459E-01	427	4.166E+00	468	2.104E+01	509	2.080E+01	550	2.957E+01
387	4.947E-01	428	4.626E+00	469	2.025E+01	510	2.114E+01	551	2.977E+01
388	5.165E-01	429	5.117E+00	470	1.944E+01	511	2.147E+01	552	2.996E+01
389	4.063E-01	430	5.647E+00	471	1.850E+01	512	2.178E+01	553	3.018E+01
390	4.208E-01	431	6.273E+00	472	1.756E+01	513	2.210E+01	554	3.040E+01
391	4.173E-01	432	6.884E+00	473	1.670E+01	514	2.233E+01	555	3.061E+01
392	4.466E-01	433	7.634E+00	474	1.583E+01	515	2.267E+01	556	3.086E+01
393	3.658E-01	434	8.391E+00	475	1.505E+01	516	2.292E+01	557	3.112E+01
394	3.747E-01	435	9.293E+00	476	1.432E+01	517	2.318E+01	558	3.138E+01
395	3.705E-01	436	1.022E+01	477	1.379E+01	518	2.344E+01	559	3.159E+01
396	3.941E-01	437	1.130E+01	478	1.335E+01	519	2.372E+01	560	3.180E+01
397	3.500E-01	438	1.241E+01	479	1.305E+01	520	2.390E+01	561	3.202E+01
398	3.641E-01	439	1.365E+01	480	1.288E+01	521	2.413E+01	562	3.230E+01
399	3.424E-01	440	1.503E+01	481	1.273E+01	522	2.442E+01	563	3.254E+01
400	3.829E-01	441	1.654E+01	482	1.273E+01	523	2.460E+01	564	3.277E+01
401	3.678E-01	442	1.820E+01	483	1.274E+01	524	2.478E+01	565	3.303E+01
402	3.883E-01	443	2.015E+01	484	1.284E+01	525	2.496E+01	566	3.321E+01
403	3.876E-01	444	2.217E+01	485	1.289E+01	526	2.520E+01	567	3.341E+01
404	4.248E-01	445	2.442E+01	486	1.301E+01	527	2.536E+01	568	3.369E+01
405	4.216E-01	446	2.705E+01	487	1.315E+01	528	2.553E+01	569	3.394E+01
406	4.699E-01	447	2.976E+01	488	1.335E+01	529	2.572E+01	570	3.417E+01
407	5.131E-01	448	3.244E+01	489	1.349E+01	530	2.595E+01	571	3.440E+01
408	5.466E-01	449	3.511E+01	490	1.371E+01	531	2.610E+01	572	3.460E+01
409	6.228E-01	450	3.762E+01	491	1.394E+01	532	2.625E+01	573	3.482E+01
410	6.852E-01	451	3.965E+01	492	1.423E+01	533	2.639E+01	574	3.502E+01
411	7.375E-01	452	4.113E+01	493	1.452E+01	534	2.659E+01	575	3.526E+01
412	8.235E-01	453	4.186E+01	494	1.482E+01	535	2.676E+01	576	3.543E+01
413	9.330E-01	454	4.181E+01	495	1.522E+01	536	2.692E+01	577	3.568E+01
414	1.037E+00	455	4.093E+01	496	1.560E+01	537	2.711E+01	578	3.588E+01
415	1.160E+00	456	3.937E+01	497	1.601E+01	538	2.727E+01	579	3.605E+01
416	1.294E+00	457	3.725E+01	498	1.642E+01	539	2.744E+01	580	3.620E+01
417	1.466E+00	458	3.503E+01	499	1.686E+01	540	2.767E+01	581	3.638E+01
418	1.634E+00	459	3.271E+01	500	1.725E+01	541	2.785E+01	582	3.653E+01
419	1.807E+00	460	3.041E+01	501	1.769E+01	542	2.797E+01	583	3.668E+01
420	1.989E+00	461	2.838E+01	502	1.808E+01	543	2.816E+01	584	3.684E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.693E+01	626	2.956E+01	667	1.243E+01	708	3.829E+00	749	1.138E+00
586	3.702E+01	627	2.912E+01	668	1.213E+01	709	3.708E+00	750	1.115E+00
587	3.712E+01	628	2.860E+01	669	1.178E+01	710	3.621E+00	751	1.087E+00
588	3.720E+01	629	2.825E+01	670	1.149E+01	711	3.505E+00	752	1.050E+00
589	3.727E+01	630	2.772E+01	671	1.118E+01	712	3.399E+00	753	1.034E+00
590	3.731E+01	631	2.729E+01	672	1.088E+01	713	3.283E+00	754	1.021E+00
591	3.731E+01	632	2.687E+01	673	1.060E+01	714	3.202E+00	755	9.711E-01
592	3.742E+01	633	2.644E+01	674	1.027E+01	715	3.108E+00	756	9.541E-01
593	3.743E+01	634	2.597E+01	675	1.003E+01	716	3.003E+00	757	9.385E-01
594	3.737E+01	635	2.550E+01	676	9.768E+00	717	2.926E+00	758	9.315E-01
595	3.733E+01	636	2.508E+01	677	9.513E+00	718	2.833E+00	759	9.098E-01
596	3.736E+01	637	2.463E+01	678	9.212E+00	719	2.777E+00	760	8.751E-01
597	3.729E+01	638	2.414E+01	679	8.946E+00	720	2.666E+00	761	8.491E-01
598	3.726E+01	639	2.367E+01	680	8.741E+00	721	2.573E+00	762	8.345E-01
599	3.711E+01	640	2.323E+01	681	8.490E+00	722	2.511E+00	763	8.067E-01
600	3.709E+01	641	2.280E+01	682	8.231E+00	723	2.467E+00	764	7.865E-01
601	3.697E+01	642	2.234E+01	683	8.010E+00	724	2.358E+00	765	7.730E-01
602	3.683E+01	643	2.191E+01	684	7.798E+00	725	2.280E+00	766	7.313E-01
603	3.669E+01	644	2.142E+01	685	7.578E+00	726	2.226E+00	767	7.405E-01
604	3.650E+01	645	2.097E+01	686	7.348E+00	727	2.179E+00	768	7.262E-01
605	3.630E+01	646	2.056E+01	687	7.163E+00	728	2.088E+00	769	6.973E-01
606	3.613E+01	647	2.006E+01	688	6.924E+00	729	2.050E+00	770	6.793E-01
607	3.593E+01	648	1.973E+01	689	6.772E+00	730	1.985E+00	771	6.782E-01
608	3.567E+01	649	1.928E+01	690	6.552E+00	731	1.933E+00	772	6.587E-01
609	3.546E+01	650	1.884E+01	691	6.383E+00	732	1.874E+00	773	6.439E-01
610	3.520E+01	651	1.840E+01	692	6.182E+00	733	1.830E+00	774	6.399E-01
611	3.487E+01	652	1.801E+01	693	6.014E+00	734	1.762E+00	775	6.300E-01
612	3.461E+01	653	1.756E+01	694	5.813E+00	735	1.703E+00	776	5.998E-01
613	3.441E+01	654	1.723E+01	695	5.644E+00	736	1.666E+00	777	5.827E-01
614	3.403E+01	655	1.679E+01	696	5.469E+00	737	1.621E+00	778	5.593E-01
615	3.371E+01	656	1.640E+01	697	5.335E+00	738	1.561E+00	779	5.604E-01
616	3.337E+01	657	1.600E+01	698	5.173E+00	739	1.509E+00	780	5.614E-01
617	3.305E+01	658	1.560E+01	699	5.037E+00	740	1.475E+00		
618	3.271E+01	659	1.526E+01	700	4.890E+00	741	1.446E+00		
619	3.226E+01	660	1.487E+01	701	4.743E+00	742	1.393E+00		
620	3.190E+01	661	1.451E+01	702	4.605E+00	743	1.370E+00		
621	3.155E+01	662	1.417E+01	703	4.465E+00	744	1.321E+00		
622	3.118E+01	663	1.375E+01	704	4.331E+00	745	1.274E+00		
623	3.075E+01	664	1.347E+01	705	4.200E+00	746	1.237E+00		
624	3.032E+01	665	1.308E+01	706	4.062E+00	747	1.216E+00		
625	2.992E+01	666	1.276E+01	707	3.952E+00	748	1.165E+00		

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**

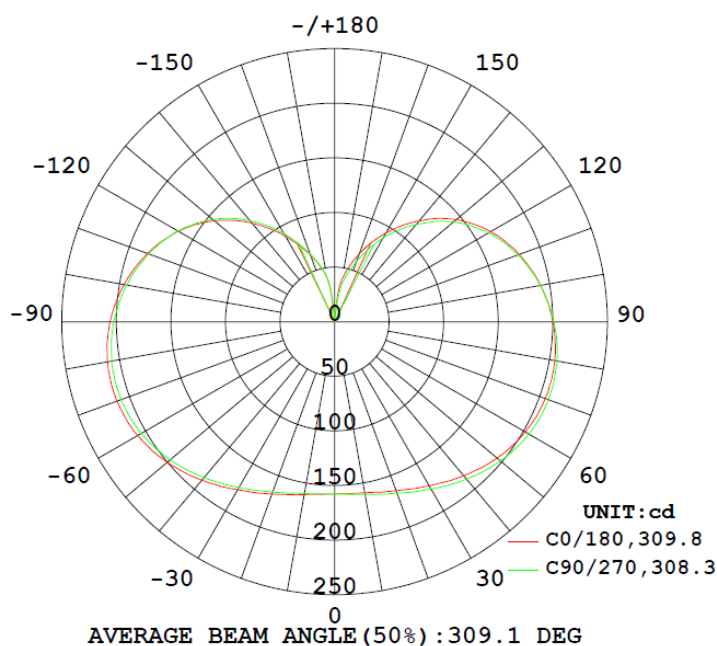
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1369	16.23	0.9880

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
2183.55	134.54	214.5	1.76	1.79

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	309.8	309.6	308.3	308.4	309.1
Field Angle (10% I _{max}):	348.0	348.2	347.1	347.6	347.7

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°	158	158	158	158	158	158	158	158
5.0°	159	159	158	158	158	158	158	158
10.0°	161	161	160	160	160	159	159	159
15.0°	164	164	163	163	163	162	161	162
20.0°	168	168	167	167	166	165	165	165
25.0°	173	172	172	171	170	169	169	169
30.0°	178	178	177	176	175	175	174	174
35.0°	184	183	183	182	181	180	179	179
40.0°	189	189	189	188	186	185	184	184
45.0°	195	195	194	193	192	190	190	190
50.0°	200	201	200	199	197	195	195	195
55.0°	205	205	205	203	201	199	199	199
60.0°	208	209	209	207	205	203	202	202
65.0°	211	212	212	210	207	205	205	204
70.0°	212	214	214	212	208	206	206	206
75.0°	212	215	215	212	208	206	206	206
80.0°	211	214	214	211	207	205	205	205
85.0°	209	212	212	209	206	203	203	203
90.0°	206	209	209	206	202	201	200	200
95.0°	201	205	205	202	198	197	196	196
100.0°	196	200	200	196	193	192	191	191
105.0°	190	193	193	190	188	187	186	186
110.0°	183	186	186	183	181	180	179	179
115.0°	175	178	178	176	174	174	172	172
120.0°	166	169	169	167	166	165	164	164
125.0°	155	158	159	157	157	156	155	155
130.0°	144	146	147	146	146	146	145	145
135.0°	131	134	134	134	134	134	133	133
140.0°	118	120	121	120	121	121	121	120
145.0°	104	106	107	107	107	108	107	107
150.0°	90	92	93	93	93	93	93	93
155.0°	77	79	79	79	79	80	80	80
160.0°	65	66	66	66	66	66	66	66
165.0°	53	55	55	54	54	54	55	54
170.0°	41	42	42	42	41	42	42	41
175.0°	4	6	8	8	9	9	8	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°	158	158	158	158	158	158	158	158
5.0°	158	158	158	158	159	159	159	159
10.0°	159	159	160	160	161	161	161	161
15.0°	162	162	162	163	164	164	164	164
20.0°	165	165	166	167	167	168	168	168
25.0°	169	170	170	171	172	172	172	172
30.0°	173	174	175	176	177	177	177	178
35.0°	179	180	181	182	182	183	183	183
40.0°	184	185	186	187	188	189	189	189
45.0°	189	191	192	193	193	194	194	194
50.0°	194	195	197	198	198	199	199	199
55.0°	198	200	201	202	202	203	202	203
60.0°	202	203	204	205	205	206	206	206
65.0°	204	206	206	207	208	208	208	209
70.0°	205	206	207	208	208	209	209	210
75.0°	206	207	207	208	208	208	208	210
80.0°	205	205	206	207	207	207	207	208
85.0°	203	203	204	205	204	204	205	206
90.0°	200	200	200	201	201	201	202	203
95.0°	196	196	196	197	197	196	197	199
100.0°	192	191	191	192	192	191	192	194
105.0°	186	186	185	186	186	185	186	188
110.0°	180	179	179	180	179	179	180	181
115.0°	173	172	172	172	171	171	172	173
120.0°	165	164	163	164	163	162	163	164
125.0°	156	155	154	154	153	153	154	154
130.0°	145	144	143	143	142	141	143	143
135.0°	134	133	131	131	130	129	130	130
140.0°	120	119	118	117	116	116	116	117
145.0°	107	107	105	104	103	102	102	103
150.0°	94	93	92	90	88	87	88	89
155.0°	80	80	78	75	73	72	73	75
160.0°	66	66	64	61	59	58	59	61
165.0°	53	53	51	48	46	44	45	49
170.0°	40	40	37	34	30	29	31	33
175.0°	9	10	9	7	6	6	7	8
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	3.8	0.17	0-5	3.8	0.17
5-10	11.4	0.69	0-10	15.2	0.69
10-15	19.1	1.57	0-15	34.3	1.57
15-20	27.1	2.81	0-20	61.4	2.81
20-25	35.4	4.43	0-25	96.8	4.43
25-30	43.9	6.44	0-30	140.7	6.44
30-35	52.6	8.85	0-35	193.3	8.85
35-40	61.5	11.67	0-40	254.8	11.67
40-45	70.3	14.89	0-45	325.0	14.89
45-50	78.8	18.49	0-50	403.8	18.49
50-55	86.8	22.47	0-55	490.7	22.47
55-60	94.1	26.78	0-60	584.8	26.78
60-65	100.4	31.38	0-65	685.1	31.38
65-70	105.4	36.21	0-70	790.6	36.21
70-75	109.2	41.21	0-75	899.8	41.21
75-80	111.5	46.31	0-80	1011.3	46.31
80-85	112.4	51.46	0-85	1123.6	51.46
85-90	111.8	56.58	0-90	1235.4	56.58
90-95	109.8	61.61	0-95	1345.2	61.61
95-100	106.5	66.48	0-100	1451.7	66.48
100-105	102.0	71.15	0-105	1553.6	71.15
105-110	96.3	75.56	0-110	1650.0	75.56
110-115	89.8	79.68	0-115	1739.8	79.68
115-120	82.3	83.45	0-120	1822.1	83.45
120-125	74.1	86.84	0-125	1896.2	86.84
125-130	65.2	89.83	0-130	1961.4	89.83
130-135	56.0	92.39	0-135	2017.4	92.39
135-140	46.5	94.52	0-140	2063.9	94.52
140-145	37.5	96.24	0-145	2101.4	96.24
145-150	29.0	97.57	0-150	2130.4	97.57
150-155	21.4	98.55	0-155	2151.8	98.55
155-160	14.9	99.23	0-160	2166.7	99.23
160-165	9.5	99.66	0-165	2176.2	99.66
165-170	5.4	99.91	0-170	2181.6	99.91
170-175	1.9	100.00	0-175	2183.5	100.00
175-180	0.1	100.00	0-180	2183.5	100.00

6. Product Photo



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