



IES LM-79-08

MEASUREMENT AND TEST REPORT

For

GREEN CREATIVE LTD

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

Test Model: 16T8/4F/840/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:	PKS180910087-10
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: 16T8/4F/840/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: 16W
 Nominal CCT: 4000K
 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

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**

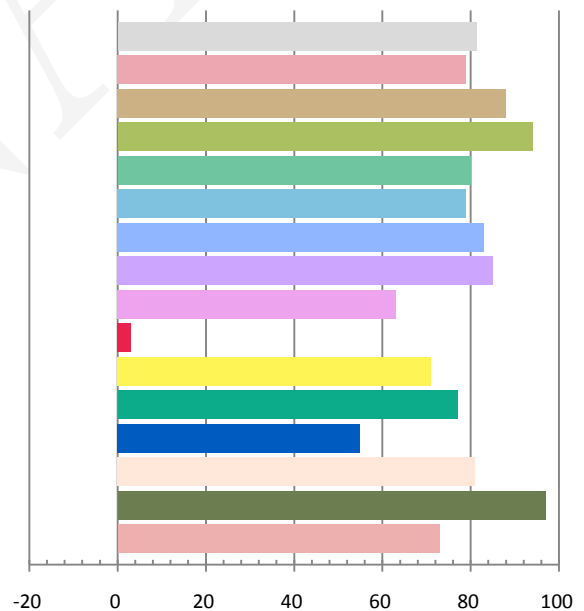
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.1359	15.95	0.978	2129.6	133.52

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
6.298	3929	0.00199	0.3851	0.3839	0.2253	0.5054

Color Rendering Index

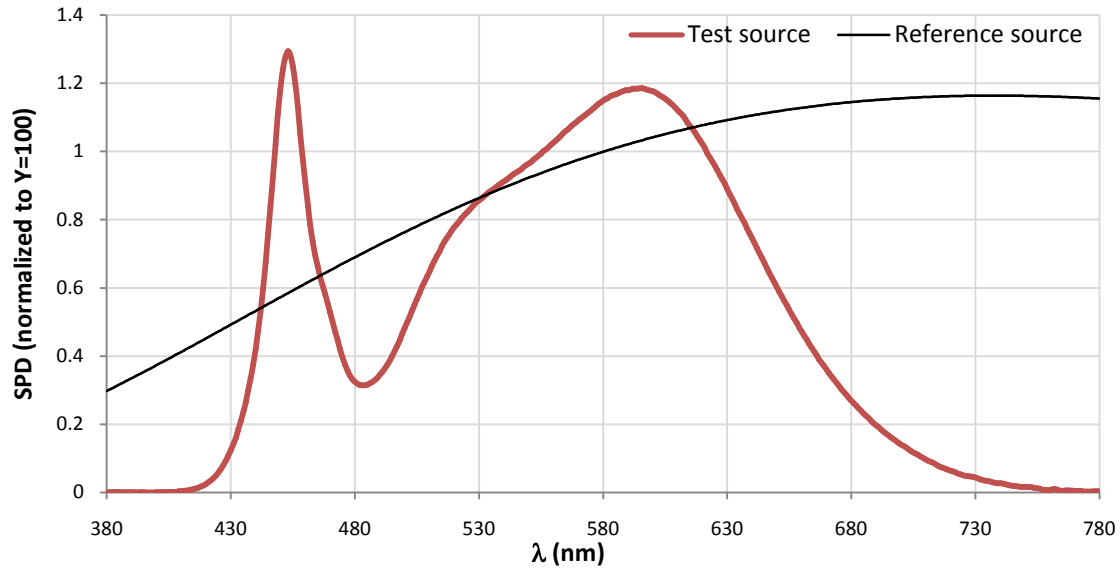
Ra 81.3			
R1 79	R2 88	R3 94	R4 80
R5 79	R6 83	R7 85	R8 63
R9 3	R10 71	R11 77	R12 55
R13 81	R14 97	R15 73	



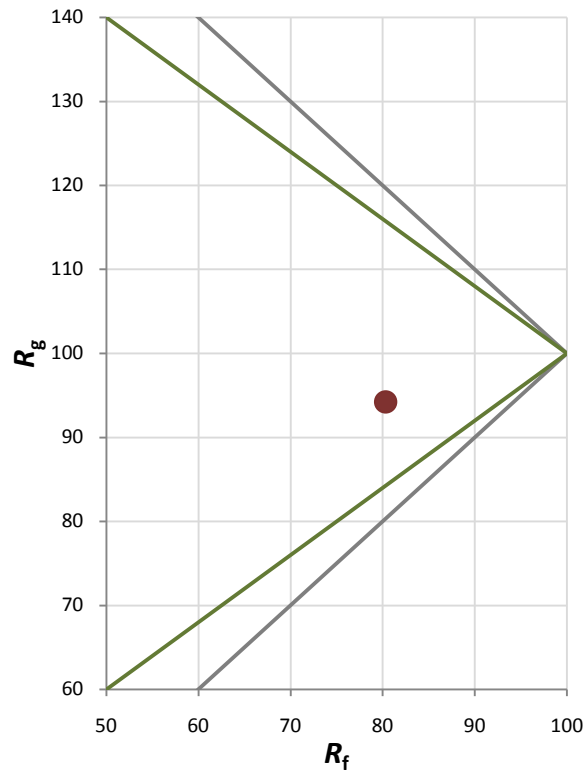
Fidelity Index and Gamut Index

Fidelity Index R_f	80
Gamut Index R_g	94

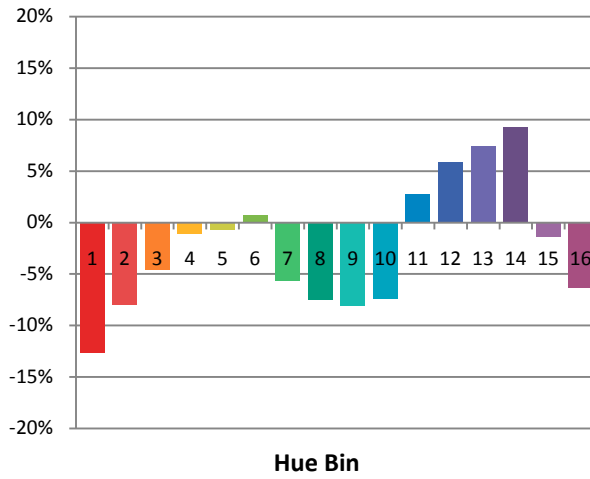
Spectral Power Distribution Comparison



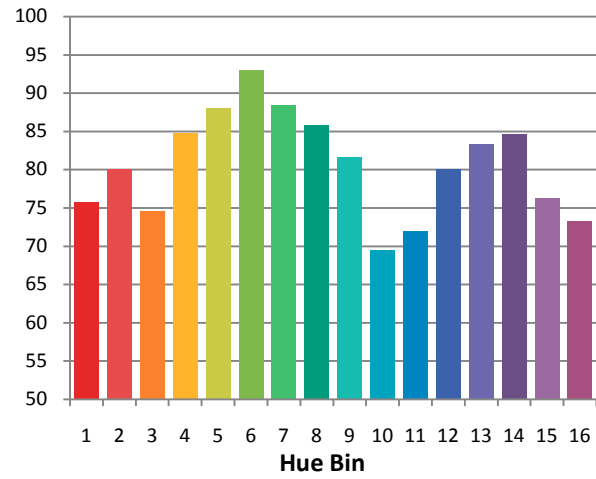
Plot of R_g versus R_f



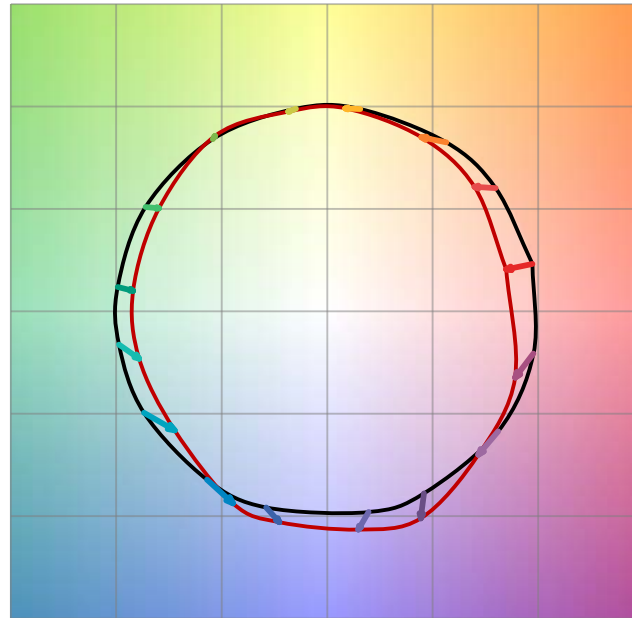
Chroma Shift by Hue



R_t by Hue

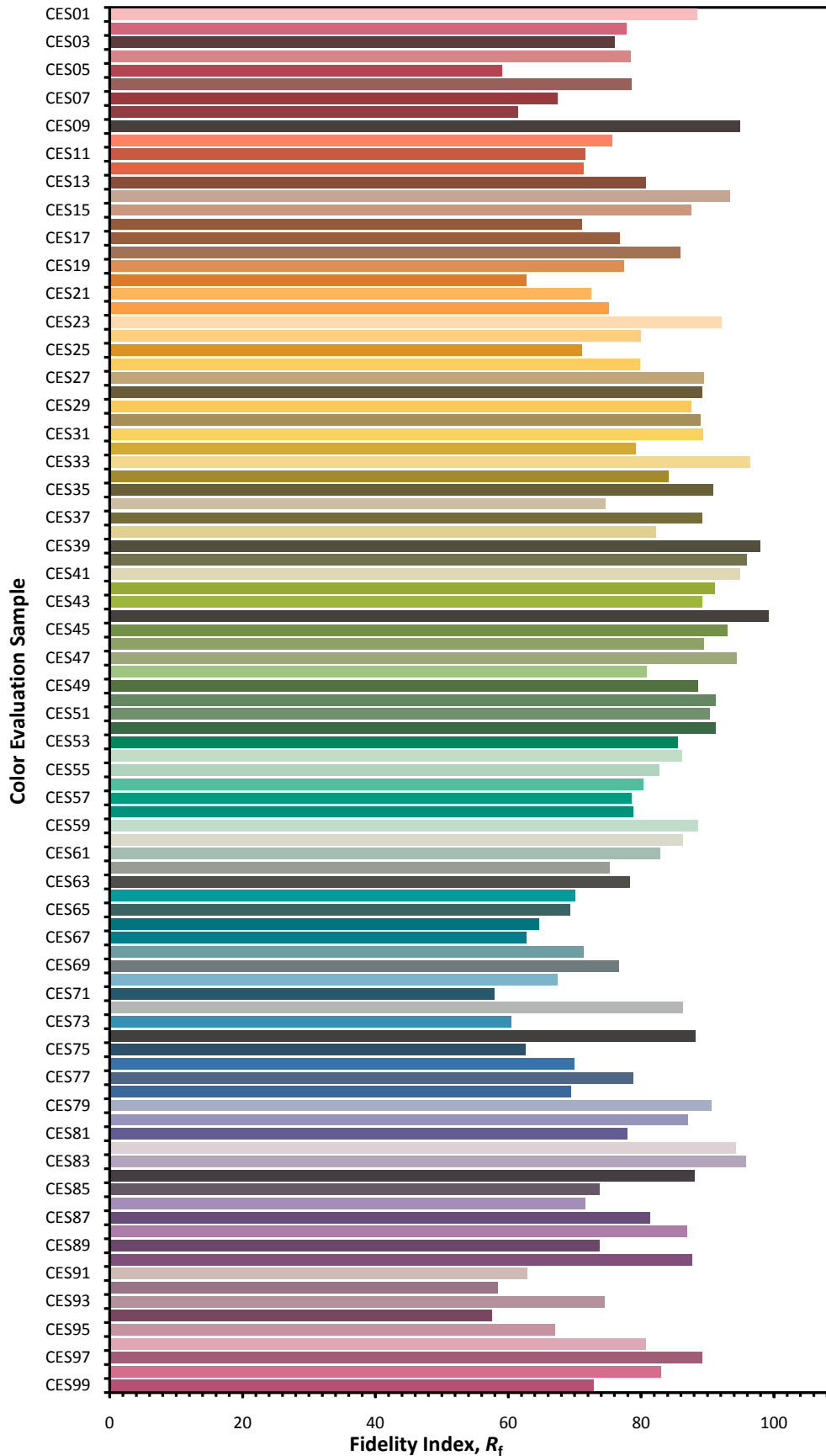


Color Vector Graphic

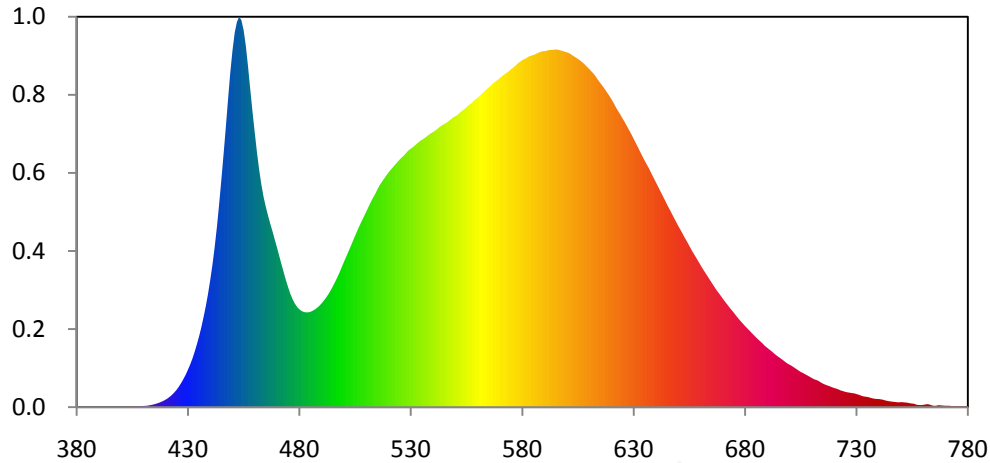


— Reference Illuminant — Test Source

Color Fidelity by CES Sample



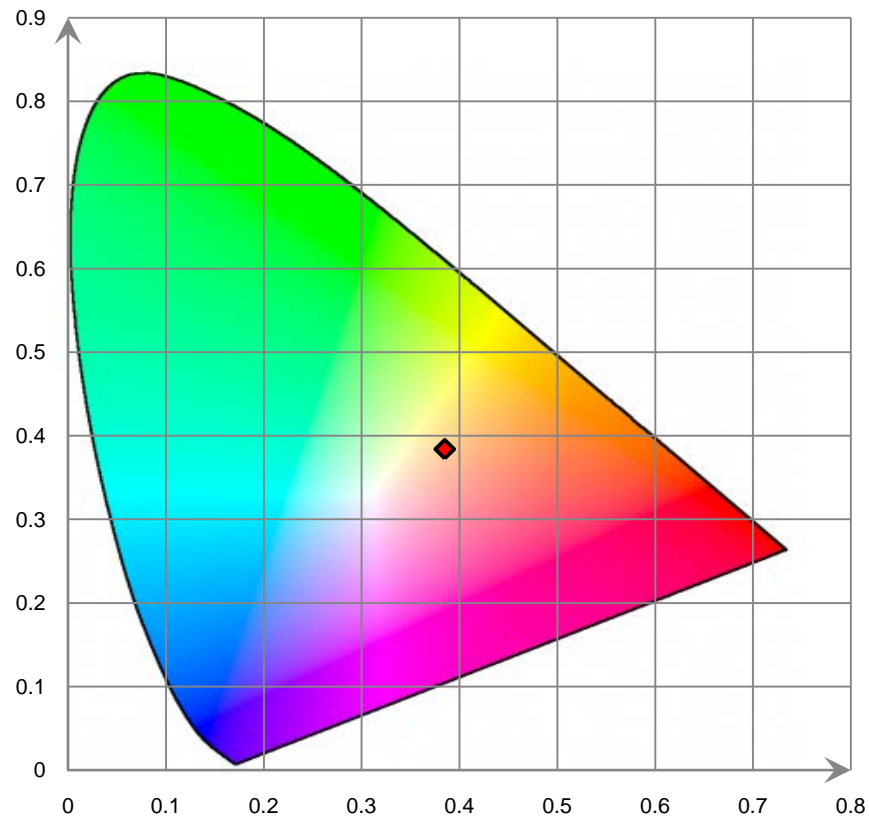
Relative Spectral Power Distribution



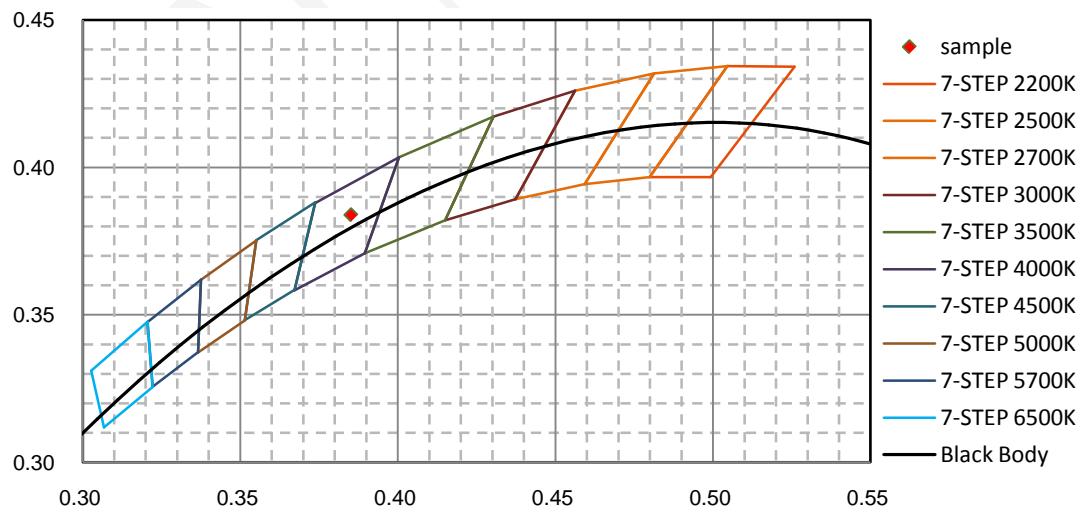
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.340E-02	421	9.278E-01	462	2.449E+01	503	1.659E+01	544	2.912E+01
381	2.000E-02	422	1.104E+00	463	2.295E+01	504	1.715E+01	545	2.924E+01
382	3.350E-02	423	1.309E+00	464	2.167E+01	505	1.769E+01	546	2.939E+01
383	4.580E-02	424	1.554E+00	465	2.065E+01	506	1.822E+01	547	2.956E+01
384	4.990E-02	425	1.821E+00	466	1.975E+01	507	1.874E+01	548	2.973E+01
385	3.370E-02	426	2.146E+00	467	1.892E+01	508	1.923E+01	549	2.993E+01
386	2.560E-02	427	2.519E+00	468	1.814E+01	509	1.970E+01	550	3.006E+01
387	2.150E-02	428	2.917E+00	469	1.730E+01	510	2.018E+01	551	3.020E+01
388	1.800E-02	429	3.356E+00	470	1.648E+01	511	2.068E+01	552	3.041E+01
389	2.760E-02	430	3.863E+00	471	1.561E+01	512	2.116E+01	553	3.060E+01
390	2.780E-02	431	4.406E+00	472	1.475E+01	513	2.160E+01	554	3.079E+01
391	1.430E-02	432	5.006E+00	473	1.393E+01	514	2.201E+01	555	3.099E+01
392	1.090E-02	433	5.710E+00	474	1.312E+01	515	2.247E+01	556	3.121E+01
393	1.430E-02	434	6.483E+00	475	1.237E+01	516	2.291E+01	557	3.135E+01
394	1.710E-02	435	7.310E+00	476	1.170E+01	517	2.327E+01	558	3.157E+01
395	1.690E-02	436	8.240E+00	477	1.114E+01	518	2.358E+01	559	3.180E+01
396	1.080E-02	437	9.293E+00	478	1.070E+01	519	2.393E+01	560	3.197E+01
397	6.100E-03	438	1.042E+01	479	1.036E+01	520	2.424E+01	561	3.218E+01
398	3.400E-03	439	1.168E+01	480	1.011E+01	521	2.452E+01	562	3.239E+01
399	1.800E-03	440	1.313E+01	481	9.942E+00	522	2.479E+01	563	3.262E+01
400	1.780E-02	441	1.471E+01	482	9.841E+00	523	2.506E+01	564	3.284E+01
401	2.560E-02	442	1.653E+01	483	9.796E+00	524	2.532E+01	565	3.304E+01
402	3.070E-02	443	1.861E+01	484	9.804E+00	525	2.558E+01	566	3.324E+01
403	3.400E-02	444	2.096E+01	485	9.852E+00	526	2.581E+01	567	3.346E+01
404	3.750E-02	445	2.349E+01	486	9.964E+00	527	2.602E+01	568	3.364E+01
405	5.150E-02	446	2.614E+01	487	1.010E+01	528	2.628E+01	569	3.381E+01
406	5.690E-02	447	2.891E+01	488	1.027E+01	529	2.653E+01	570	3.402E+01
407	6.350E-02	448	3.180E+01	489	1.048E+01	530	2.671E+01	571	3.419E+01
408	7.000E-02	449	3.454E+01	490	1.073E+01	531	2.687E+01	572	3.437E+01
409	1.064E-01	450	3.685E+01	491	1.101E+01	532	2.707E+01	573	3.455E+01
410	1.285E-01	451	3.871E+01	492	1.131E+01	533	2.727E+01	574	3.471E+01
411	1.385E-01	452	3.981E+01	493	1.166E+01	534	2.747E+01	575	3.491E+01
412	1.602E-01	453	4.034E+01	494	1.204E+01	535	2.762E+01	576	3.509E+01
413	2.045E-01	454	3.999E+01	495	1.247E+01	536	2.777E+01	577	3.529E+01
414	2.491E-01	455	3.896E+01	496	1.292E+01	537	2.794E+01	578	3.551E+01
415	3.066E-01	456	3.732E+01	497	1.339E+01	538	2.813E+01	579	3.567E+01
416	3.808E-01	457	3.516E+01	498	1.390E+01	539	2.830E+01	580	3.585E+01
417	4.499E-01	458	3.280E+01	499	1.445E+01	540	2.842E+01	581	3.596E+01
418	5.523E-01	459	3.049E+01	500	1.500E+01	541	2.857E+01	582	3.607E+01
419	6.561E-01	460	2.836E+01	501	1.552E+01	542	2.875E+01	583	3.623E+01
420	7.774E-01	461	2.630E+01	502	1.606E+01	543	2.896E+01	584	3.632E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.639E+01	626	2.947E+01	667	1.218E+01	708	3.285E+00	749	5.017E-01
586	3.648E+01	627	2.906E+01	668	1.187E+01	709	3.156E+00	750	5.198E-01
587	3.659E+01	628	2.863E+01	669	1.156E+01	710	3.023E+00	751	5.076E-01
588	3.669E+01	629	2.822E+01	670	1.124E+01	711	2.890E+00	752	4.822E-01
589	3.677E+01	630	2.775E+01	671	1.093E+01	712	2.814E+00	753	4.629E-01
590	3.678E+01	631	2.730E+01	672	1.063E+01	713	2.715E+00	754	4.091E-01
591	3.683E+01	632	2.686E+01	673	1.033E+01	714	2.568E+00	755	3.804E-01
592	3.690E+01	633	2.638E+01	674	1.005E+01	715	2.438E+00	756	3.494E-01
593	3.691E+01	634	2.592E+01	675	9.766E+00	716	2.331E+00	757	2.525E-01
594	3.693E+01	635	2.548E+01	676	9.459E+00	717	2.249E+00	758	2.232E-01
595	3.696E+01	636	2.505E+01	677	9.180E+00	718	2.161E+00	759	2.192E-01
596	3.694E+01	637	2.464E+01	678	8.908E+00	719	2.069E+00	760	2.363E-01
597	3.688E+01	638	2.416E+01	679	8.654E+00	720	1.986E+00	761	2.851E-01
598	3.681E+01	639	2.370E+01	680	8.400E+00	721	1.918E+00	762	3.158E-01
599	3.674E+01	640	2.325E+01	681	8.159E+00	722	1.830E+00	763	2.621E-01
600	3.667E+01	641	2.280E+01	682	7.923E+00	723	1.727E+00	764	1.824E-01
601	3.659E+01	642	2.234E+01	683	7.682E+00	724	1.661E+00	765	1.379E-01
602	3.645E+01	643	2.188E+01	684	7.445E+00	725	1.590E+00	766	1.626E-01
603	3.629E+01	644	2.143E+01	685	7.208E+00	726	1.532E+00	767	2.113E-01
604	3.614E+01	645	2.096E+01	686	6.989E+00	727	1.501E+00	768	1.870E-01
605	3.600E+01	646	2.052E+01	687	6.783E+00	728	1.457E+00	769	1.669E-01
606	3.583E+01	647	2.008E+01	688	6.563E+00	729	1.432E+00	770	1.498E-01
607	3.564E+01	648	1.964E+01	689	6.322E+00	730	1.361E+00	771	1.482E-01
608	3.544E+01	649	1.920E+01	690	6.136E+00	731	1.294E+00	772	1.415E-01
609	3.520E+01	650	1.876E+01	691	5.956E+00	732	1.208E+00	773	1.127E-01
610	3.497E+01	651	1.835E+01	692	5.767E+00	733	1.125E+00	774	9.290E-02
611	3.472E+01	652	1.794E+01	693	5.567E+00	734	1.091E+00	775	9.170E-02
612	3.447E+01	653	1.751E+01	694	5.378E+00	735	1.055E+00	776	8.610E-02
613	3.418E+01	654	1.711E+01	695	5.210E+00	736	9.965E-01	777	9.650E-02
614	3.383E+01	655	1.669E+01	696	5.042E+00	737	9.295E-01	778	1.238E-01
615	3.352E+01	656	1.626E+01	697	4.872E+00	738	8.804E-01	779	1.164E-01
616	3.322E+01	657	1.587E+01	698	4.696E+00	739	8.524E-01	780	1.030E-01
617	3.290E+01	658	1.549E+01	699	4.524E+00	740	8.452E-01		
618	3.256E+01	659	1.510E+01	700	4.397E+00	741	8.090E-01		
619	3.222E+01	660	1.471E+01	701	4.266E+00	742	7.695E-01		
620	3.185E+01	661	1.432E+01	702	4.110E+00	743	6.995E-01		
621	3.146E+01	662	1.397E+01	703	3.958E+00	744	6.462E-01		
622	3.102E+01	663	1.361E+01	704	3.800E+00	745	6.032E-01		
623	3.063E+01	664	1.325E+01	705	3.646E+00	746	5.726E-01		
624	3.026E+01	665	1.289E+01	706	3.534E+00	747	5.502E-01		
625	2.986E+01	666	1.254E+01	707	3.407E+00	748	5.222E-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**

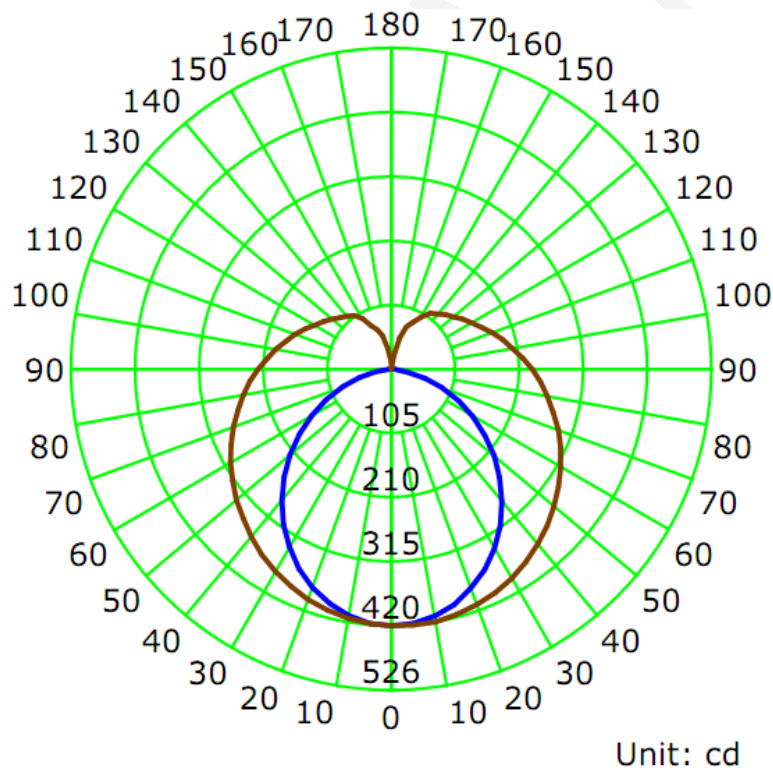
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.1360	15.96	0.9810

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
2142.1	134.26	421.0	1.20	1.39

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	102.8	136.8	190.8	140.0	142.6
Field Angle (10% I _{max}):	154.9	326.7	335.5	321.1	284.6

Luminous Intensity (cd) Distribution Data

C y	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	420	420	420	420	420	420	420	420
5.0°	419	419	420	420	420	421	421	419
10.0°	411	414	416	420	420	418	417	413
15.0°	399	403	409	414	416	415	409	404
20.0°	383	388	398	407	411	408	400	390
25.0°	363	370	385	398	404	399	386	371
30.0°	340	349	368	386	396	389	371	350
35.0°	313	326	350	373	386	377	353	326
40.0°	284	300	330	360	375	364	334	300
45.0°	253	273	310	345	363	350	314	273
50.0°	221	245	289	330	350	334	294	246
55.0°	188	217	268	315	336	318	274	218
60.0°	155	189	247	298	321	302	254	191
65.0°	122	162	228	282	307	286	234	164
70.0°	88	136	209	266	292	270	215	139
75.0°	57	114	191	250	276	255	197	117
80.0°	28	95	175	235	260	239	182	98
85.0°	7	79	162	220	246	223	166	82
90.0°	0	67	149	206	232	207	153	70
95.0°	0	61	139	193	217	195	142	63
100.0°	0	57	130	182	202	182	133	60
105.0°	0	56	122	171	189	170	124	57
110.0°	0	56	115	160	177	159	117	57
115.0°	0	58	109	149	164	149	111	58
120.0°	0	60	105	140	154	140	106	60
125.0°	0	57	100	132	144	131	101	57
130.0°	0	55	98	125	135	124	98	55
135.0°	0	56	96	119	127	117	96	55
140.0°	0	55	91	113	119	111	87	52
145.0°	0	53	81	108	113	104	76	41
150.0°	0	50	77	93	99	87	63	31
155.0°	0	45	72	83	85	75	48	23
160.0°	2	38	64	73	75	52	28	14
165.0°	2	29	47	56	53	30	14	7
170.0°	0	13	28	33	23	13	3	0
175.0°	0	1	4	6	3	0	0	0
180.0°	0	0	0	0	0	0	0	0

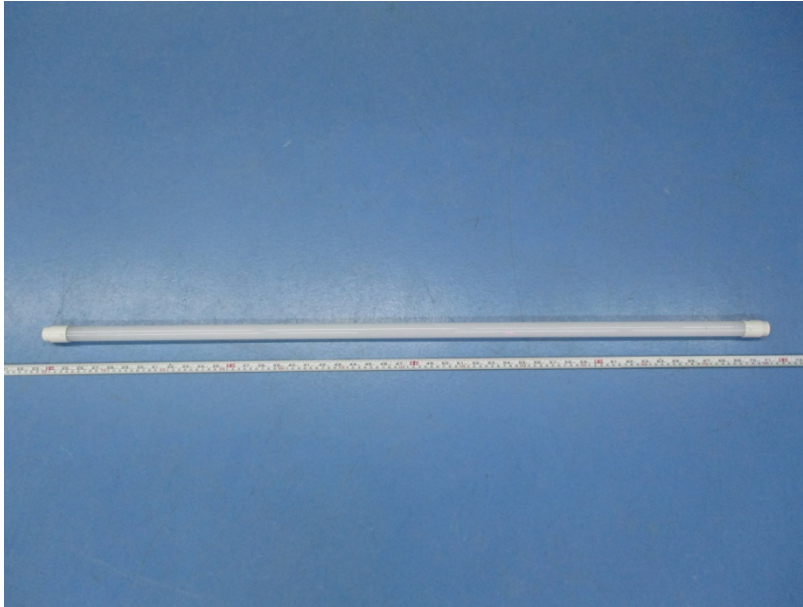
Luminous Intensity (cd) Distribution Data (cont.)

$\begin{matrix} C \\ \backslash \\ Y \end{matrix}$	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	420	420	420	420	420	420	420	420
5.0°	418	418	418	417	418	418	418	418
10.0°	410	410	412	412	414	413	412	411
15.0°	397	399	403	406	408	406	403	400
20.0°	381	383	390	397	402	398	390	383
25.0°	361	364	375	386	393	387	375	365
30.0°	336	342	357	374	383	375	357	343
35.0°	311	317	338	359	371	361	340	319
40.0°	281	290	318	344	359	347	320	293
45.0°	249	264	297	330	346	332	300	266
50.0°	218	237	278	315	334	317	280	238
55.0°	185	209	258	299	319	302	261	210
60.0°	152	182	236	283	306	287	242	184
65.0°	119	155	217	267	291	272	223	158
70.0°	86	129	200	252	276	255	205	133
75.0°	55	107	182	237	262	239	188	112
80.0°	27	88	166	221	248	223	173	94
85.0°	6	73	151	208	234	210	158	79
90.0°	0	61	140	195	220	198	147	68
95.0°	0	55	129	181	206	184	135	62
100.0°	0	52	122	169	193	173	127	58
105.0°	0	51	114	159	180	163	119	57
110.0°	0	51	108	150	168	152	112	56
115.0°	0	52	101	140	157	142	107	57
120.0°	0	55	97	132	147	133	102	60
125.0°	0	51	93	123	137	126	98	58
130.0°	0	49	91	117	129	119	95	54
135.0°	0	48	89	111	120	113	94	53
140.0°	0	48	83	106	114	107	91	52
145.0°	0	40	72	102	108	103	78	50
150.0°	0	28	63	85	97	88	70	44
155.0°	0	25	53	73	79	75	64	35
160.0°	0	18	44	63	70	67	57	29
165.0°	0	10	27	42	58	54	41	19
170.0°	0	4	16	24	36	34	25	10
175.0°	0	0	4	5	12	11	8	1
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	10.0	0.47	0-5	10.0	0.47
5-10	29.8	1.39	0-10	39.8	1.86
10-15	48.6	2.27	0-15	88.4	4.13
15-20	65.9	3.08	0-20	154.4	7.21
20-25	81.2	3.79	0-25	235.6	11.00
25-30	94.1	4.39	0-30	329.7	15.39
30-35	104.3	4.87	0-35	434.0	20.26
35-40	111.7	5.22	0-40	545.7	25.48
40-45	116.4	5.44	0-45	662.2	30.91
45-50	118.6	5.53	0-50	780.7	36.45
50-55	118.2	5.52	0-55	898.9	41.97
55-60	115.6	5.40	0-60	1014.5	47.36
60-65	111.1	5.19	0-65	1125.7	52.55
65-70	105.1	4.90	0-70	1230.7	57.46
70-75	97.9	4.57	0-75	1328.6	62.03
75-80	90.2	4.21	0-80	1418.8	66.23
80-85	82.4	3.85	0-85	1501.2	70.08
85-90	75.5	3.53	0-90	1576.8	73.61
90-95	69.7	3.26	0-95	1646.5	76.86
95-100	64.5	3.01	0-100	1711.0	79.88
100-105	59.7	2.79	0-105	1770.7	82.66
105-110	55.0	2.57	0-110	1825.7	85.23
110-115	50.5	2.36	0-115	1876.3	87.59
115-120	46.3	2.16	0-120	1922.5	89.75
120-125	41.9	1.95	0-125	1964.4	91.71
125-130	37.4	1.75	0-130	2001.8	93.45
130-135	33.3	1.55	0-135	2035.0	95.00
135-140	29.2	1.36	0-140	2064.2	96.36
140-145	24.6	1.15	0-145	2088.7	97.51
145-150	19.3	0.90	0-150	2108.1	98.41
150-155	14.3	0.67	0-155	2122.4	99.08
155-160	10.0	0.47	0-160	2132.4	99.55
160-165	6.1	0.28	0-165	2138.5	99.84
165-170	2.8	0.13	0-170	2141.3	99.97
170-175	0.7	0.03	0-175	2142.0	100.00
175-180	0.0	0.00	0-180	2142.1	100.00

6. Product Photo



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