

IES LM-79-08

MEASUREMENT AND TEST REPORT

For

P.Q.L., Inc.

2285 Ward Avenue / Simi Valley, CA 93065

Test Model: 83599

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution, THD, Power factor
Test Engineer:	Daniel Duan <i>Daniel Duan</i>
Report Number:	RSZ160620504-10
Test Date:	2016-06-22 to 2016-06-24
Report Date:	2016-06-28
Reviewed By:	Jeanne Han/Safety Manager <i>Jeanne Han</i>
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008
Test Facility:	Test facility was located at Pu Long Cun 69, Puxinghu Industrial Area, Tangxia Town, Dongguan, Guangdong, P.R.China.
Accreditation:	The NVLAP Lab Code is 200707-0.



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1. Product Description

General Information:

One sample was received on 2016-06-20 and used for testing.

Model Tested: 83599
 Manufacturer: P.Q.L., Inc.
 Brand Name: Superior Life®
 Product Designation: Outdoor Pole/Arm-mounted Area and Roadway Luminaires
 Architectural Flood and Spot Luminaires
 Burning Time Before Test: 0hour(For New Products)

Rated Values:

Rated Voltage/Frequency: AC200-480V
 Rated Power: 150 W
 Nominal CCT: 5000K
 Nominal Lumen Output: 18750 lm

2. Standards Used

IES LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products
 ANSI C82.77-2002: Harmonic Emission Limits – Related Power Quality Requirements for Lighting
 IES TM-30-15: IES Method for Evaluating Light Source Color Rendition (This method is not in NVLAP accreditation scope)

3. Description of Test Equipment

Device	Manufacturer	Model No	Serial No	Test Range	Calibration date	Calibration due date
2.0m integrating sphere	EVERFINE	R98	11010018	R98	2015-11-09	2016-11-08
High accuracy array spectroradiometer	EVERFINE	HAAS-2000	1012016T	380-780nm	2016-03-10	2017-03-09
Digital Power Meter	EVERFINE	PF2010A	1011004	600V/20A	2015-07-24	2016-07-23
Digital CC&CV DC Power Supply	EVERFINE	WY305-V1	1101047	30V/5A	2015-07-27	2016-07-26
Temperature/humidity/clock	Victor	VC230	EE023	0~40°C0~90%	2016-03-21	2017-03-20
Standard Light Source	SENSING	N/A	LSD090808	N/A	2015-09-25	2016-09-24
Special zero-voltage synchronous switching AC	EVERFINE	DPS1010-YF	1011001T	30V/5A	2016-03-04	2017-03-03
AC Power Supply	EVERFINE	VPS1030 PWM	1012017	0-150V, 0-300V	2016-03-04	2017-03-03
DC Power Supply	EVERFINE	WY12010	1009009	30V/5A	2016-03-04	2017-03-03
Power Meter	YOKOGAWA	WT-210	91KB35700	15/30/60/150/300/600 V	2016-03-04	2017-03-03
Goniophotometer	EVERFINE	GO-R5000	YG108492N10120001	1600mm,3000W/10A	2016-03-10	2017-03-09
Wireless Remote Sensor	N/A	433MHz	N/A	0°C~50°C;-20°C~60°C	2016-03-21	2017-03-20

Device	Manufacturer	Model No	Serial No	Test Range	Calibration date	Calibration due date
Standard Light Source	EVERFINE	D908	1012003	N/A	2015-09-08	2016-09-07
Variable-Voltage Transformer	CHKO	TDGC2G-3	201102	0-600v	N/A	N/A

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Shenzhen) 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 $U=1.8\%$ ($K=2$), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is $U=20\text{K}$ ($K=2$), at the 95% confidence level. The uncertainty of the CRI is $U=1.8\%$ ($K=2$), at the 95% confidence level.

The uncertainty of power meter AC current $U=0.19\%$ of rdg, AC Voltage $U=0.15\%$ of rdg, Power $U=0.20\%$ ($K=2$), 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 $U=1.6\%$ ($K=2$), at the 95% confidence level.

Additional Test

The Additional Test item may not be covered by IESNA LM-79-2008. Additional test including power factor, off-state power and THD, was measured by Digital Power Meter after stabilized at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. Test voltage for THD and power factor test would be equal to rated voltage or, in case of a voltage range, maximum value of that range.

The uncertainty of power meter AC current $U=0.19\%$ of rdg, AC Voltage $U=0.15\%$ of rdg, Power $U=0.20\%$ ($K=2$), at the 95% confidence level.

Fidelity Index and Gamut Index Calculation

The R_f , 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**

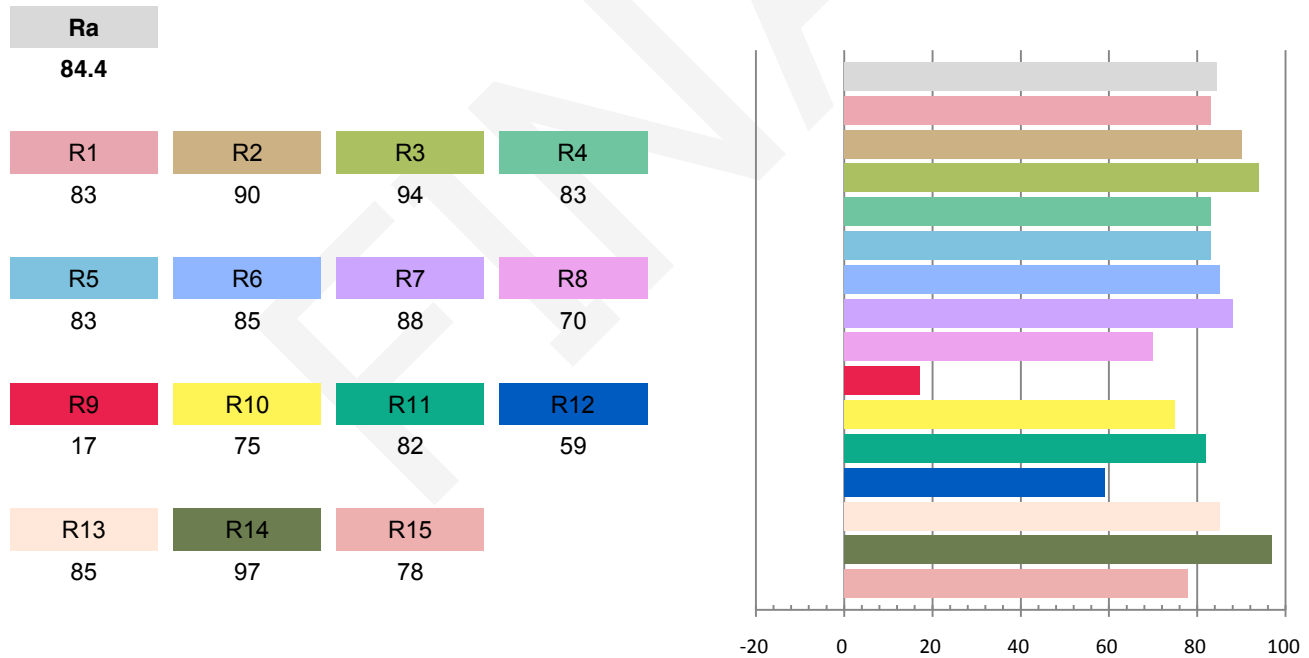
Test orientation: **Downward**

Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
480.0	60	0.328	146.9	0.9331	18840	128.24

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
59.014	4809	0.000718	0.3509	0.3576	0.2130	0.4884

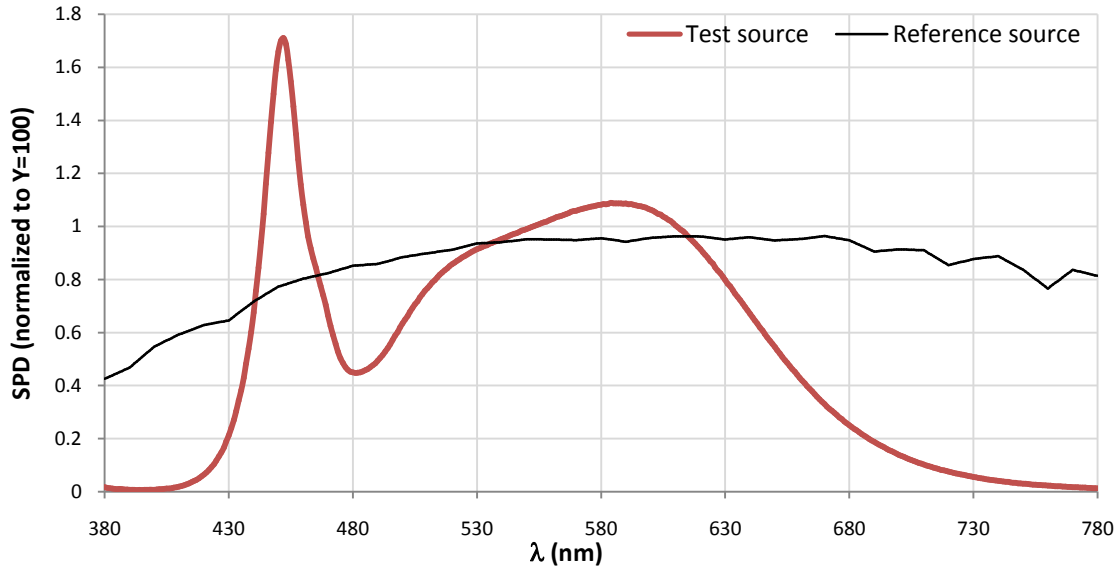
Color Rendering Index



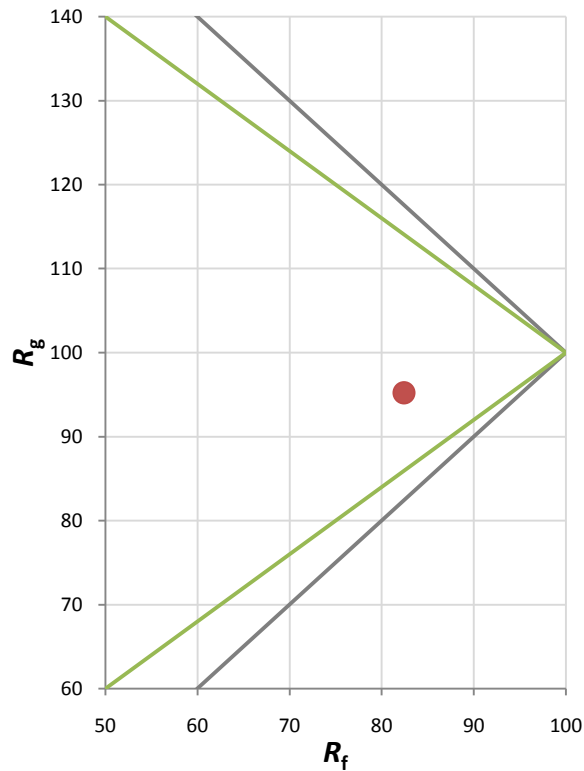
Fidelity Index and Gamut Index

Fidelity Index R_f	82
Gamut Index R_g	95

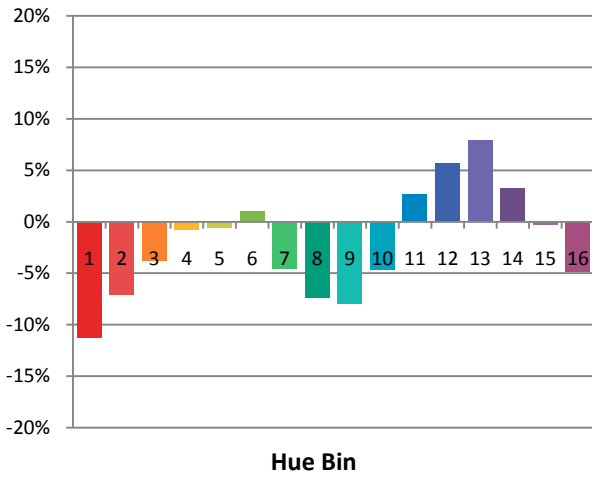
Spectral Power Distribution Comparison



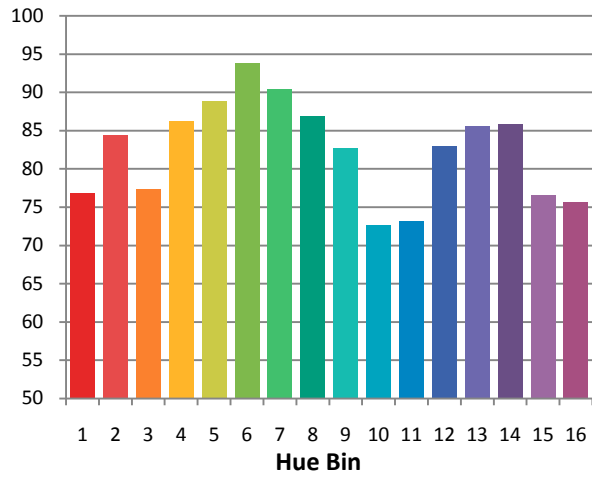
Plot of R_g versus R_f



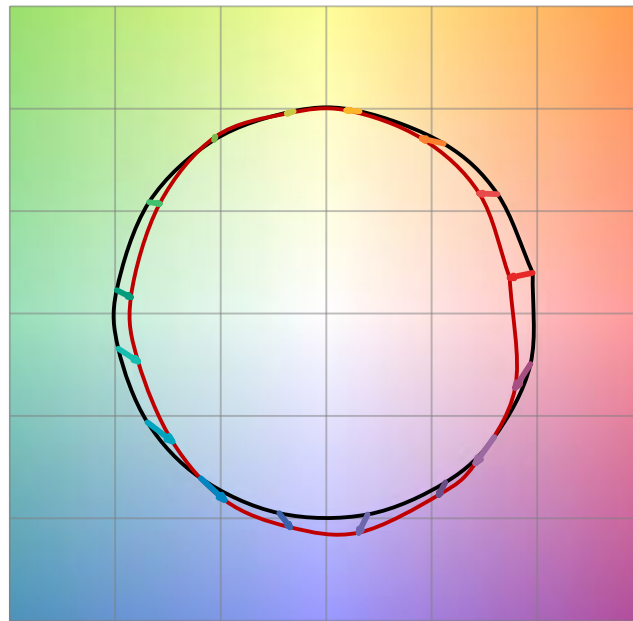
Chroma Shift by Hue



R_f by Hue

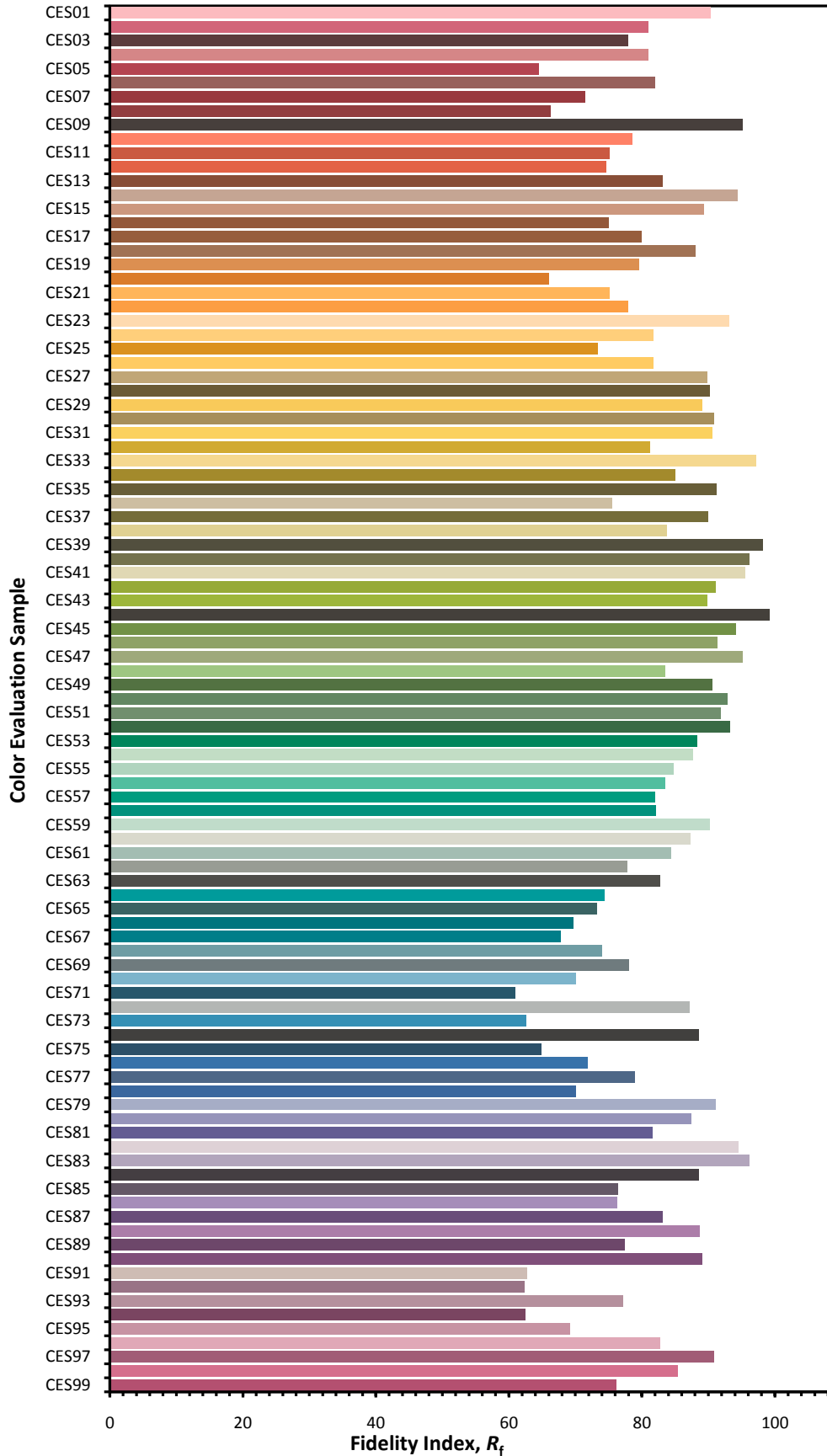


Color Vector Graphic

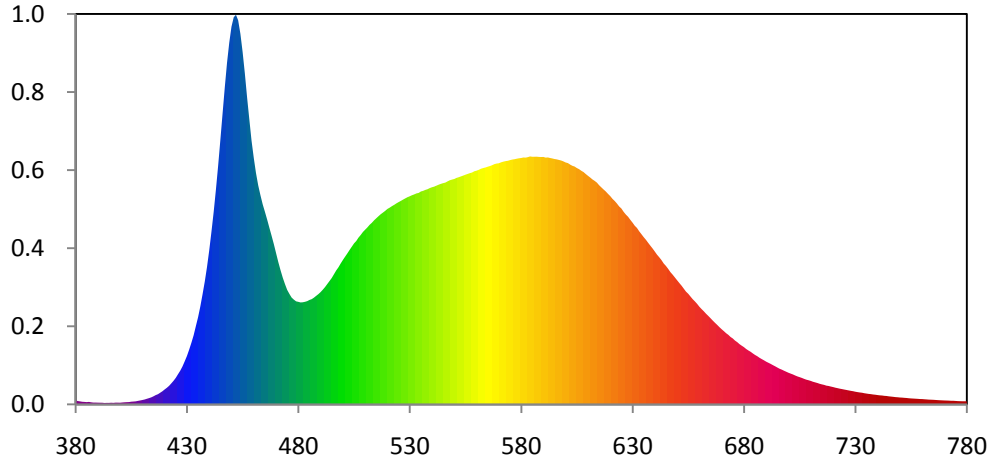


— Reference Illuminat — Test Source

Color Fidelity by CES Sample



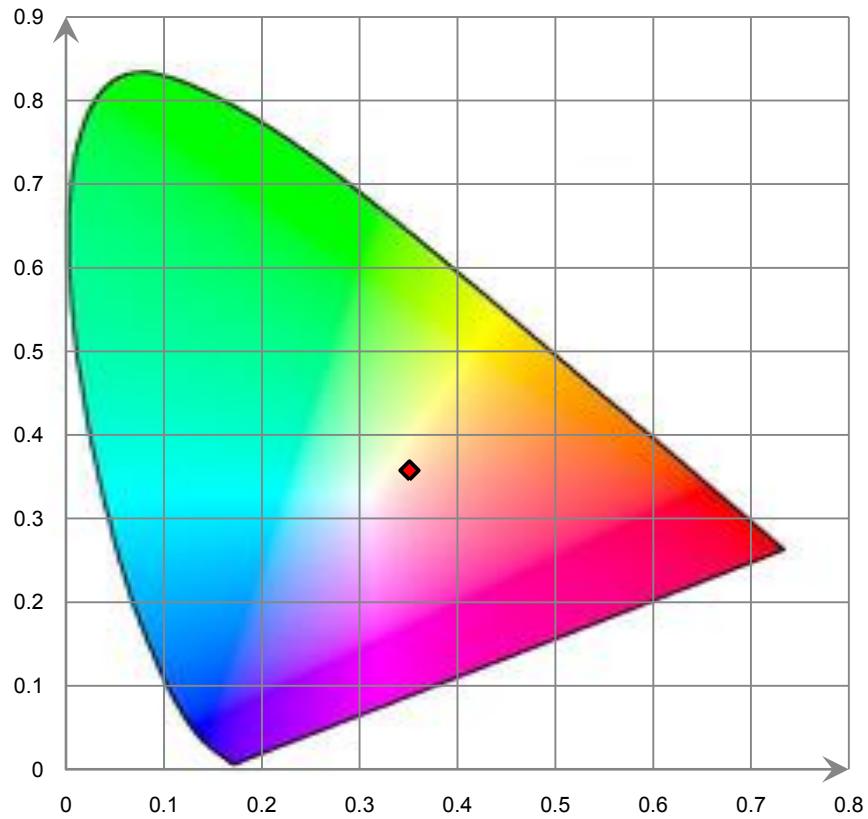
Relative Spectral Power Distribution



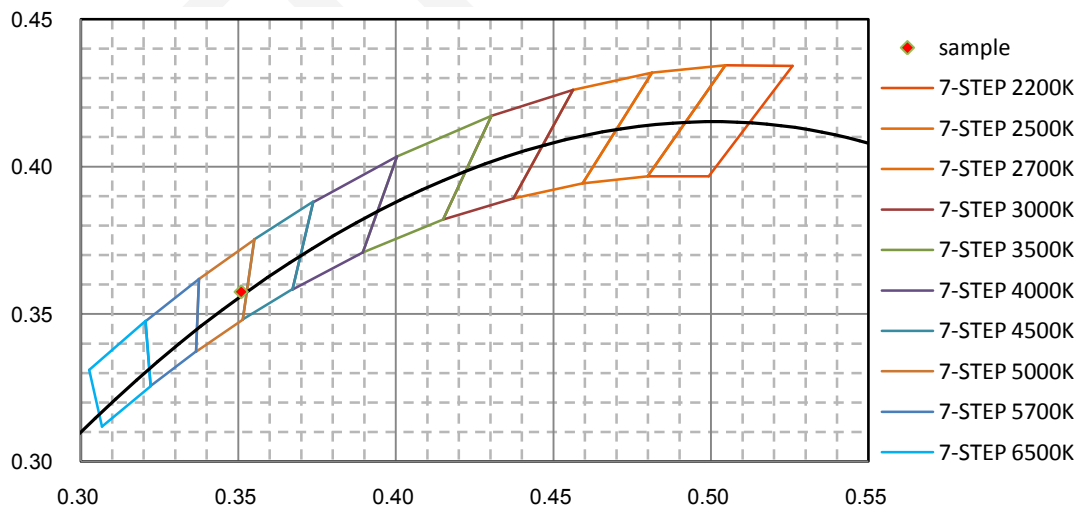
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	4.824E+00	421	2.010E+01	462	2.651E+02	503	1.870E+02	544	2.671E+02
381	4.029E+00	422	2.245E+01	463	2.532E+02	504	1.910E+02	545	2.680E+02
382	3.647E+00	423	2.549E+01	464	2.424E+02	505	1.950E+02	546	2.687E+02
383	3.152E+00	424	2.857E+01	465	2.332E+02	506	1.979E+02	547	2.701E+02
384	2.987E+00	425	3.215E+01	466	2.239E+02	507	2.020E+02	548	2.715E+02
385	2.746E+00	426	3.651E+01	467	2.139E+02	508	2.052E+02	549	2.723E+02
386	2.992E+00	427	4.083E+01	468	2.043E+02	509	2.088E+02	550	2.730E+02
387	2.535E+00	428	4.593E+01	469	1.942E+02	510	2.116E+02	551	2.743E+02
388	2.183E+00	429	5.211E+01	470	1.833E+02	511	2.144E+02	552	2.751E+02
389	2.171E+00	430	5.853E+01	471	1.724E+02	512	2.175E+02	553	2.761E+02
390	2.104E+00	431	6.627E+01	472	1.626E+02	513	2.199E+02	554	2.771E+02
391	2.027E+00	432	7.462E+01	473	1.536E+02	514	2.229E+02	555	2.782E+02
392	1.991E+00	433	8.357E+01	474	1.457E+02	515	2.255E+02	556	2.791E+02
393	1.715E+00	434	9.472E+01	475	1.387E+02	516	2.279E+02	557	2.801E+02
394	1.854E+00	435	1.055E+02	476	1.338E+02	517	2.303E+02	558	2.809E+02
395	1.799E+00	436	1.185E+02	477	1.294E+02	518	2.323E+02	559	2.823E+02
396	1.993E+00	437	1.331E+02	478	1.268E+02	519	2.344E+02	560	2.830E+02
397	1.864E+00	438	1.486E+02	479	1.248E+02	520	2.367E+02	561	2.841E+02
398	2.107E+00	439	1.661E+02	480	1.242E+02	521	2.383E+02	562	2.854E+02
399	2.099E+00	440	1.864E+02	481	1.235E+02	522	2.401E+02	563	2.862E+02
400	2.043E+00	441	2.088E+02	482	1.236E+02	523	2.416E+02	564	2.869E+02
401	2.329E+00	442	2.329E+02	483	1.242E+02	524	2.434E+02	565	2.878E+02
402	2.562E+00	443	2.599E+02	484	1.250E+02	525	2.449E+02	566	2.887E+02
403	2.677E+00	444	2.887E+02	485	1.264E+02	526	2.464E+02	567	2.897E+02
404	2.812E+00	445	3.202E+02	486	1.274E+02	527	2.480E+02	568	2.910E+02
405	3.249E+00	446	3.522E+02	487	1.293E+02	528	2.495E+02	569	2.917E+02
406	3.442E+00	447	3.842E+02	488	1.314E+02	529	2.509E+02	570	2.920E+02
407	3.683E+00	448	4.137E+02	489	1.335E+02	530	2.521E+02	571	2.931E+02
408	4.223E+00	449	4.382E+02	490	1.360E+02	531	2.533E+02	572	2.939E+02
409	4.740E+00	450	4.574E+02	491	1.390E+02	532	2.543E+02	573	2.946E+02
410	5.293E+00	451	4.688E+02	492	1.421E+02	533	2.555E+02	574	2.950E+02
411	5.926E+00	452	4.718E+02	493	1.458E+02	534	2.561E+02	575	2.958E+02
412	6.767E+00	453	4.651E+02	494	1.495E+02	535	2.578E+02	576	2.965E+02
413	7.588E+00	454	4.488E+02	495	1.531E+02	536	2.586E+02	577	2.969E+02
414	8.520E+00	455	4.267E+02	496	1.577E+02	537	2.598E+02	578	2.975E+02
415	9.794E+00	456	4.007E+02	497	1.622E+02	538	2.606E+02	579	2.980E+02
416	1.124E+01	457	3.720E+02	498	1.660E+02	539	2.620E+02	580	2.984E+02
417	1.232E+01	458	3.453E+02	499	1.706E+02	540	2.630E+02	581	2.990E+02
418	1.408E+01	459	3.195E+02	500	1.749E+02	541	2.637E+02	582	2.989E+02
419	1.588E+01	460	2.985E+02	501	1.789E+02	542	2.649E+02	583	2.994E+02
420	1.807E+01	461	2.802E+02	502	1.828E+02	543	2.661E+02	584	3.003E+02

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	2.999E+02	626	2.332E+02	667	9.886E+01	708	2.992E+01	749	8.589E+00
586	2.999E+02	627	2.299E+02	668	9.629E+01	709	2.921E+01	750	8.310E+00
587	2.999E+02	628	2.272E+02	669	9.355E+01	710	2.840E+01	751	8.202E+00
588	2.997E+02	629	2.235E+02	670	9.103E+01	711	2.738E+01	752	7.931E+00
589	2.996E+02	630	2.201E+02	671	8.865E+01	712	2.662E+01	753	7.733E+00
590	2.997E+02	631	2.163E+02	672	8.622E+01	713	2.586E+01	754	7.432E+00
591	2.989E+02	632	2.136E+02	673	8.423E+01	714	2.492E+01	755	7.204E+00
592	2.990E+02	633	2.096E+02	674	8.169E+01	715	2.420E+01	756	7.068E+00
593	2.984E+02	634	2.061E+02	675	7.983E+01	716	2.361E+01	757	6.876E+00
594	2.978E+02	635	2.026E+02	676	7.725E+01	717	2.270E+01	758	6.725E+00
595	2.972E+02	636	1.994E+02	677	7.538E+01	718	2.227E+01	759	6.480E+00
596	2.967E+02	637	1.957E+02	678	7.297E+01	719	2.163E+01	760	6.438E+00
597	2.960E+02	638	1.922E+02	679	7.114E+01	720	2.101E+01	761	6.191E+00
598	2.953E+02	639	1.888E+02	680	6.931E+01	721	2.023E+01	762	5.998E+00
599	2.942E+02	640	1.851E+02	681	6.711E+01	722	1.968E+01	763	5.751E+00
600	2.930E+02	641	1.813E+02	682	6.529E+01	723	1.905E+01	764	5.658E+00
601	2.922E+02	642	1.781E+02	683	6.370E+01	724	1.856E+01	765	5.548E+00
602	2.904E+02	643	1.747E+02	684	6.171E+01	725	1.797E+01	766	5.322E+00
603	2.889E+02	644	1.706E+02	685	5.986E+01	726	1.746E+01	767	5.174E+00
604	2.881E+02	645	1.677E+02	686	5.833E+01	727	1.693E+01	768	5.011E+00
605	2.862E+02	646	1.641E+02	687	5.642E+01	728	1.642E+01	769	4.859E+00
606	2.849E+02	647	1.602E+02	688	5.487E+01	729	1.595E+01	770	4.741E+00
607	2.829E+02	648	1.571E+02	689	5.336E+01	730	1.533E+01	771	4.616E+00
608	2.814E+02	649	1.537E+02	690	5.174E+01	731	1.485E+01	772	4.537E+00
609	2.790E+02	650	1.504E+02	691	5.037E+01	732	1.440E+01	773	4.328E+00
610	2.768E+02	651	1.470E+02	692	4.902E+01	733	1.410E+01	774	4.345E+00
611	2.747E+02	652	1.438E+02	693	4.752E+01	734	1.352E+01	775	4.184E+00
612	2.725E+02	653	1.402E+02	694	4.615E+01	735	1.310E+01	776	3.992E+00
613	2.707E+02	654	1.366E+02	695	4.464E+01	736	1.267E+01	777	3.880E+00
614	2.686E+02	655	1.340E+02	696	4.318E+01	737	1.241E+01	778	3.781E+00
615	2.654E+02	656	1.307E+02	697	4.210E+01	738	1.198E+01	779	3.767E+00
616	2.628E+02	657	1.275E+02	698	4.077E+01	739	1.169E+01	780	3.774E+00
617	2.603E+02	658	1.247E+02	699	3.953E+01	740	1.128E+01		
618	2.578E+02	659	1.217E+02	700	3.831E+01	741	1.092E+01		
619	2.549E+02	660	1.183E+02	701	3.726E+01	742	1.071E+01		
620	2.522E+02	661	1.154E+02	702	3.621E+01	743	1.036E+01		
621	2.489E+02	662	1.128E+02	703	3.501E+01	744	1.017E+01		
622	2.463E+02	663	1.098E+02	704	3.387E+01	745	9.745E+00		
623	2.433E+02	664	1.071E+02	705	3.295E+01	746	9.457E+00		
624	2.397E+02	665	1.044E+02	706	3.199E+01	747	9.183E+00		
625	2.372E+02	666	1.015E+02	707	3.094E+01	748	8.789E+00		

CIE 1931 x y Chromaticity Diagram



7-Step Chromaticity Quadrangles



[Goniophotometer System]

Total operating time for luminous intensity distribution: **1.0 hour**

Test orientation: **Downward**

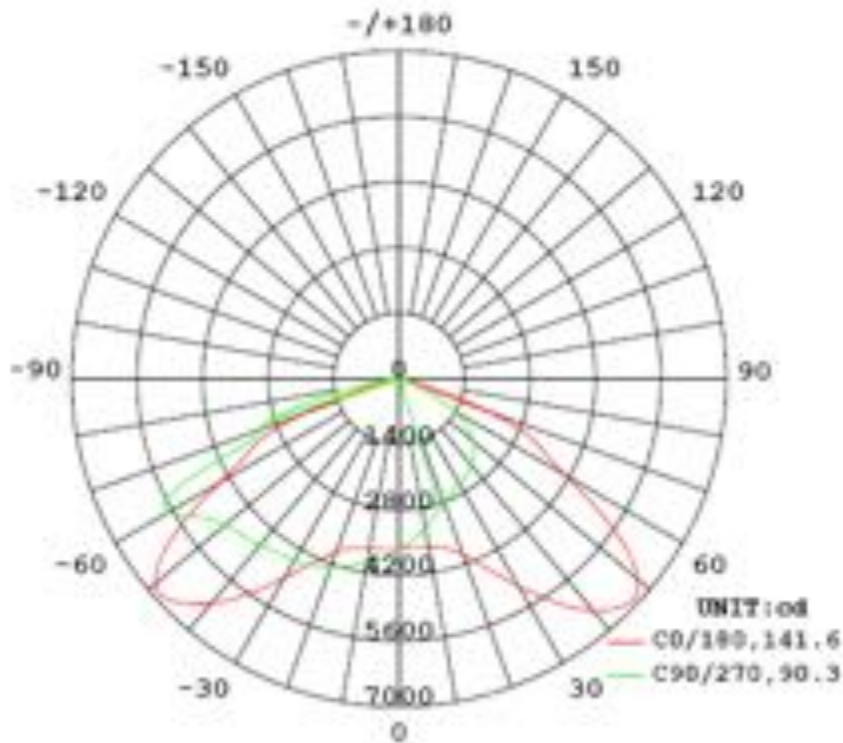
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
480.3	60	0.3282	146.9	0.9321

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
18853.5	128.32	7688	2.11	1.05

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	141.6	67.6	90.3	64.3	91.0
Field Angle (10% I _{max}):	157.0	156.7	148.2	156.5	154.6

Luminous Intensity (cd) Distribution Data

C \ γ	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	3641	3641	3641	3641	3641	3641	3641	3641
5.0°	3655	3724	3777	3809	3813	3796	3758	3697
10.0°	3669	3822	3922	3971	3976	3957	3910	3809
15.0°	3734	3994	4106	4134	4131	4134	4132	4033
20.0°	3926	4291	4354	4301	4274	4324	4433	4410
25.0°	4325	4731	4671	4467	4391	4522	4803	4933
30.0°	4908	5277	5046	4633	4478	4723	5225	5537
35.0°	5598	5914	5503	4794	4541	4923	5738	6235
40.0°	6276	6681	6029	4980	4631	5138	6305	7024
45.0°	6733	7216	6526	5187	4724	5355	6814	7500
50.0°	6807	7608	6730	5313	4842	5480	7030	7675
55.0°	5935	7351	6978	5579	5157	5748	7377	7020
60.0°	4437	5969	7474	6145	5714	6264	7625	5387
65.0°	3458	4074	7258	6243	4693	6243	6730	3808
70.0°	2203	3129	5331	3980	3142	3968	4489	2800
75.0°	820	1551	2683	3349	2158	3328	2268	1171
80.0°	298	480	1781	1581	851	1550	1789	352
85.0°	101	129	1029	543	262	511	796	90
90.0°	5	2	25	3	36	2	2	14
95.0°	2	1	1	1	0	1	1	1
100.0°	2	2	1	1	1	1	1	2
105.0°	3	2	1	1	1	1	1	2
110.0°	3	2	1	1	1	1	2	2
115.0°	3	2	1	1	1	1	2	2
120.0°	3	2	1	1	1	1	2	2
125.0°	3	2	2	1	1	1	2	2
130.0°	3	3	2	2	1	2	2	3
135.0°	3	3	2	2	2	2	3	3
140.0°	4	3	3	2	2	3	3	4
145.0°	4	4	4	3	3	3	4	4
150.0°	5	5	4	4	4	4	5	5
155.0°	5	5	5	4	4	5	5	5
160.0°	5	5	5	5	5	5	6	6
165.0°	5	5	5	5	5	5	5	5
170.0°	4	5	5	5	5	5	5	5
175.0°	5	4	4	4	4	5	5	5
180.0°	4	4	4	4	4	4	4	4

Luminous Intensity (cd) Distribution Data (cont.)

C Y	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	3641	3641	3641	3641	3641	3641	3641	3641
5.0°	3621	3547	3487	3456	3452	3475	3520	3583
10.0°	3636	3446	3298	3233	3236	3280	3360	3496
15.0°	3736	3359	3072	2974	3004	3045	3142	3390
20.0°	3994	3343	2843	2727	2807	2809	2896	3322
25.0°	4469	3490	2684	2532	2679	2615	2695	3393
30.0°	5109	3778	2627	2380	2591	2457	2596	3638
35.0°	5822	4120	2626	2258	2507	2319	2573	3973
40.0°	6458	4397	2614	2142	2399	2188	2564	4281
45.0°	6835	4528	2541	2008	2269	2056	2519	4452
50.0°	6673	4450	2387	1831	2077	1877	2400	4474
55.0°	5597	4000	2136	1584	1766	1618	2164	4156
60.0°	4085	3198	1770	1281	1321	1295	1814	3423
65.0°	3252	2277	1327	894	724	925	1406	2478
70.0°	1960	1356	823	465	368	499	902	1532
75.0°	704	527	386	265	221	277	421	633
80.0°	271	231	175	171	153	176	186	260
85.0°	84	76	78	81	83	87	95	106
90.0°	1	1	1	1	1	1	1	4
95.0°	1	1	2	2	2	2	2	1
100.0°	1	2	2	2	2	2	2	2
105.0°	2	2	2	2	2	3	2	2
110.0°	2	2	3	3	3	3	3	3
115.0°	2	3	3	3	3	3	3	3
120.0°	2	3	3	4	3	4	3	3
125.0°	3	3	4	4	4	4	4	3
130.0°	3	4	4	4	4	4	4	4
135.0°	3	4	4	4	4	4	4	4
140.0°	3	4	4	4	4	4	4	4
145.0°	3	4	4	4	4	4	4	4
150.0°	3	3	3	4	4	4	4	4
155.0°	3	3	3	4	4	4	4	4
160.0°	3	3	3	3	4	4	3	4
165.0°	3	3	3	3	4	4	3	4
170.0°	3	3	3	3	4	4	4	4
175.0°	4	4	4	4	4	4	4	4
180.0°	4	4	4	4	4	4	4	4

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	87.0	0.46	0-5	87.0	0.46
5-10	259.7	1.38	0-10	346.7	1.84
10-15	430.3	2.28	0-15	777.0	4.12
15-20	602.8	3.20	0-20	1379.8	7.32
20-25	788.6	4.18	0-25	2168.4	11.50
25-30	999.4	5.30	0-30	3167.8	16.80
30-35	1237.2	6.56	0-35	4405.0	23.36
35-40	1499.1	7.96	0-40	5904.1	31.32
40-45	1756.2	9.31	0-45	7660.4	40.63
45-50	1964.1	10.42	0-50	9624.5	51.05
50-55	2071.4	10.99	0-55	11695.9	62.04
55-60	2048.5	10.86	0-60	13744.4	72.90
60-65	1886.5	10.01	0-65	15630.9	82.91
65-70	1469.4	7.79	0-70	17100.3	90.70
70-75	937.1	4.97	0-75	18037.5	95.67
75-80	497.6	2.64	0-80	18535.0	98.31
80-85	242.7	1.29	0-85	18777.8	99.60
85-90	58.8	0.31	0-90	18836.5	99.91
90-95	1.2	0.01	0-95	18837.7	99.92
95-100	0.7	0.00	0-100	18838.5	99.92
100-105	0.9	0.00	0-105	18839.4	99.92
105-110	1.0	0.01	0-110	18840.4	99.93
110-115	1.1	0.01	0-115	18841.5	99.94
115-120	1.2	0.00	0-120	18842.7	99.94
120-125	1.2	0.01	0-125	18843.9	99.95
125-130	1.3	0.01	0-130	18845.1	99.96
130-135	1.3	0.00	0-135	18846.4	99.96
135-140	1.3	0.01	0-140	18847.7	99.97
140-145	1.2	0.01	0-145	18848.9	99.98
145-150	1.2	0.00	0-150	18850.0	99.98
150-155	1.0	0.01	0-155	18851.1	99.99
155-160	0.9	0.00	0-160	18852.0	99.99
160-165	0.7	0.01	0-165	18852.7	100.00
165-170	0.5	0.00	0-170	18853.1	100.00
170-175	0.3	0.00	0-175	18853.4	100.00
175-180	0.1	0.00	0-180	18853.5	100.00

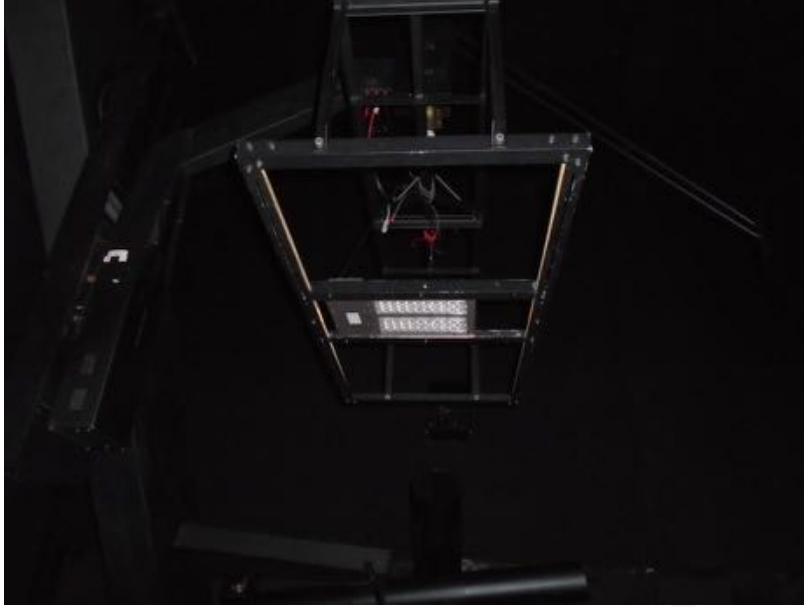
[Additional Test]

Test Item	Test Voltage (V)	Frequency (Hz)	Test Result
Total Harmonic Distortion:	480.0	60	7.14%
Total Harmonic Distortion:	200.0	60	6.20%
Power Factor:	200.0	60	0.9999

6. Product Photo



7. Product Test orientation in the Goniophotometer



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