



IES LM-79-08

MEASUREMENT AND TEST REPORT

For

P.Q.L., Inc.

2285 Ward Avenue / Simi Valley, CA 93065

Test Model: 91442

Report Type:	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
Test Engineer:	George Yang <i>George Yang</i>
Report Number:	RKS170626080-10A4-M2
Test Date:	2017-09-04 to 2017-09-05
Report Date:	2017-12-13
Reviewed By:	Ray Gao/EE Engineer <i>Ray Gao</i>
Revised Note:	The previous report RKS170829005-10A4-M1 is replaced by this report on 2017-12-13
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 2017-08-29 and used for testing.

Model Tested: 91442
 Manufacturer: P.Q.L., Inc.
 Brand Name: Superior Life®
 Product Designation: SSL Downlight Retrofits
 Aging Time Before Test: 0hour(For New Products)

Rated Values:

Rated Voltage/Frequency: 100-277V 50/60Hz
 Rated Power: 25W
 Nominal CCT: 5000K
 Nominal Lumen Output: 2000lm

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

3. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Test Range	Calibration date	Calibration due date
Integrating Sphere	INVENTFINE	Dia 1.5m	JWWCV090112	Dia 1.5m	2017-01-25	2018-01-25
Power Meter	INVENTFINE	WT500	GSJWQ20009	20/40/80/150/300/600V	2017-03-23	2018-03-22
Spectral photometer	INVENTFINE	CMS-3S	GSGSE100017	380nm~780nm	2017-01-25	2018-01-25
AC Power Supply	INVENTFINE	CHP500	JWJSD010071	0~150V 4.2A/0~300V 2.1A	2017-03-23	2018-03-22
Standard Light Source	INVENTFINE	N/A	JWWCR020106	24V/50W	2017-01-26	2018-01-26
Thermal Meter	KEJIAN	TA298	N/A	0~60°C	2016-10-17	2017-10-17
DC Power Supply	INVENTFINE	WL3005	JWWCP020069	30V/5A	2017-03-23	2018-03-22
AC Power Supply	INVENTFINE	CHP-5KVA	900511765	0-150V, 0-300V, 5KVA	2017-03-23	2018-03-22
DC Power Supply	INVENTFINE	WL3010	JWDMP030001	30V/10A	2017-03-23	2018-03-22
Power Meter	INVENTFINE	WT500	GSDSQ200007	20/40/80/150/300/600V	2017-03-23	2018-03-22
Goniophotometer	INVENTFINE	GPM-1900	YWGCF120001	0.001lx-99999lx	2017-01-25	2018-01-25
Wireless Weather Station	ZHONGXING	KG218	N/A	-40~65°C, 20%~99%RH	2016-10-17	2017-10-17
Standard Light Source	INVENTFINE	N/A	JWBYP040007	24V/150W	2017-01-25	2018-01-25

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_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**

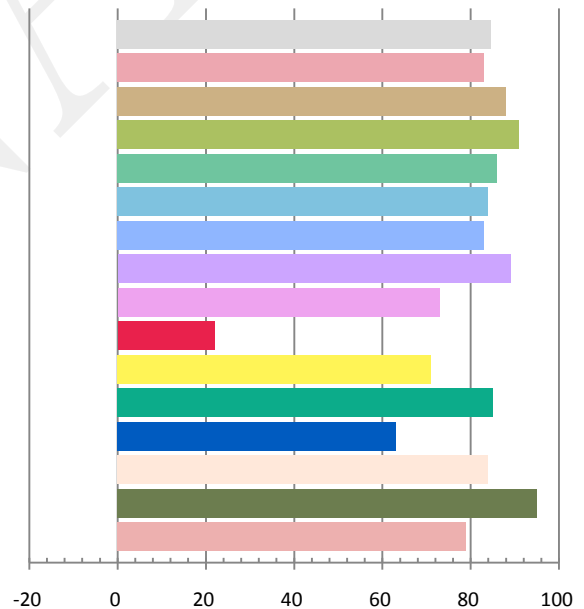
Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120.0	60	0.2156	25.46	0.9842	2443.2	95.97

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
7.643	4832	0.00233	0.3506	0.3607	0.2116	0.4898

Color Rendering Index

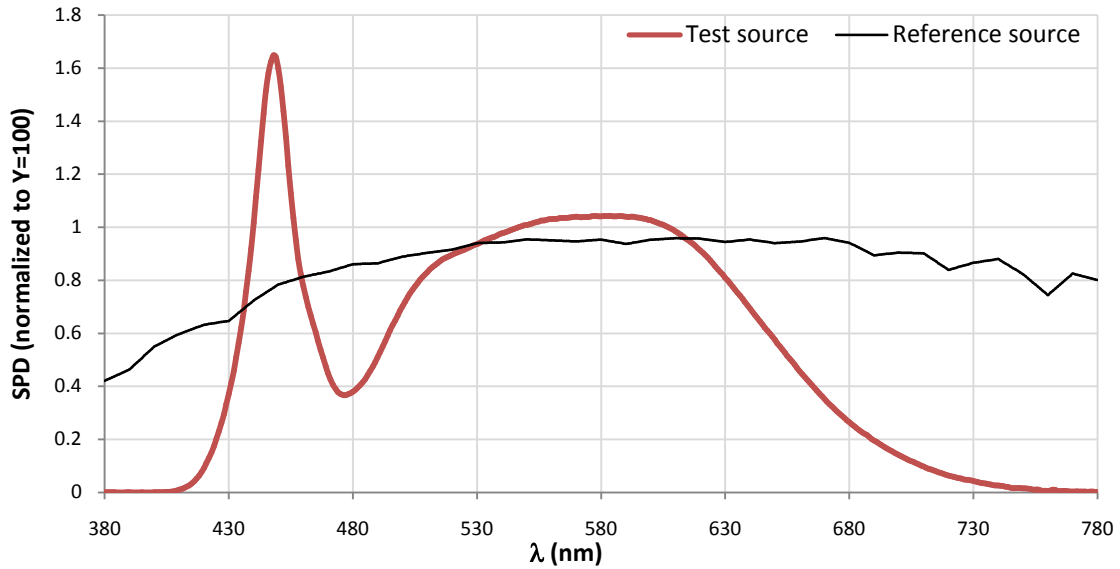
Ra			
84.6			
R1	R2	R3	R4
83	88	91	86
R5	R6	R7	R8
84	83	89	73
R9	R10	R11	R12
22	71	85	63
R13	R14	R15	
84	95	79	



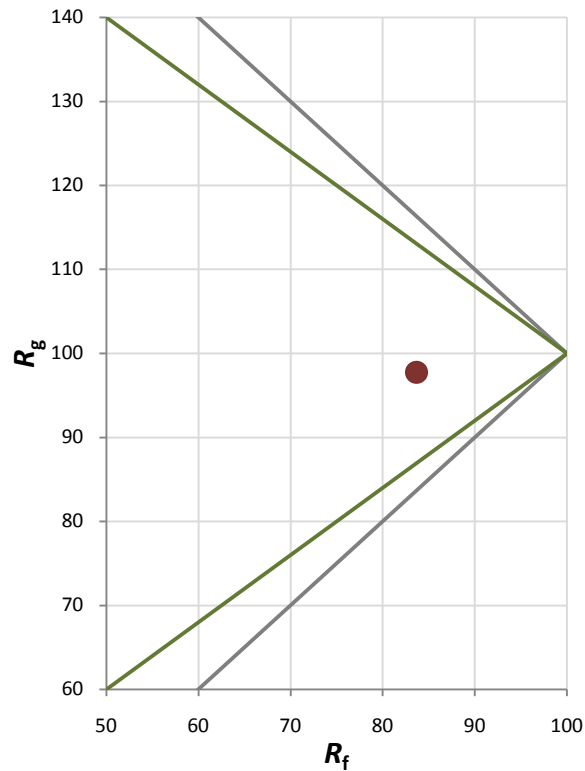
Fidelity Index and Gamut Index

Fidelity Index R_f	84
Gamut Index R_g	98

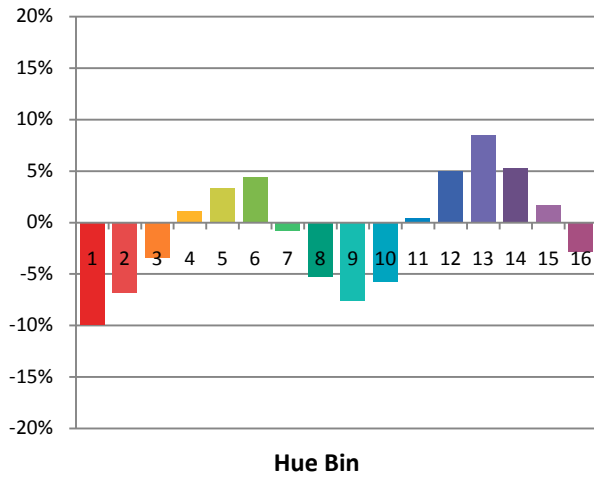
Spectral Power Distribution Comparison



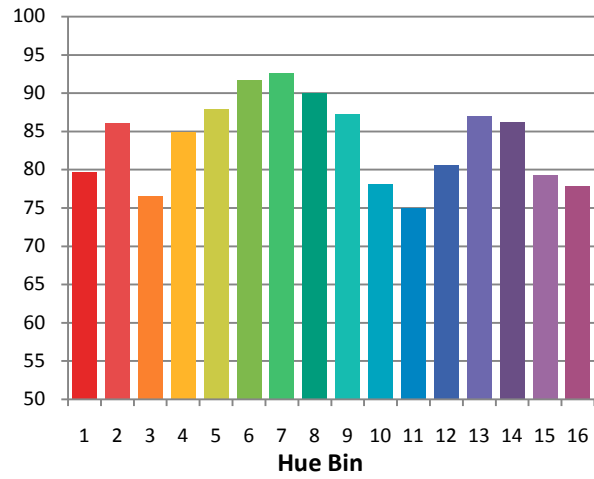
Plot of R_g versus R_f



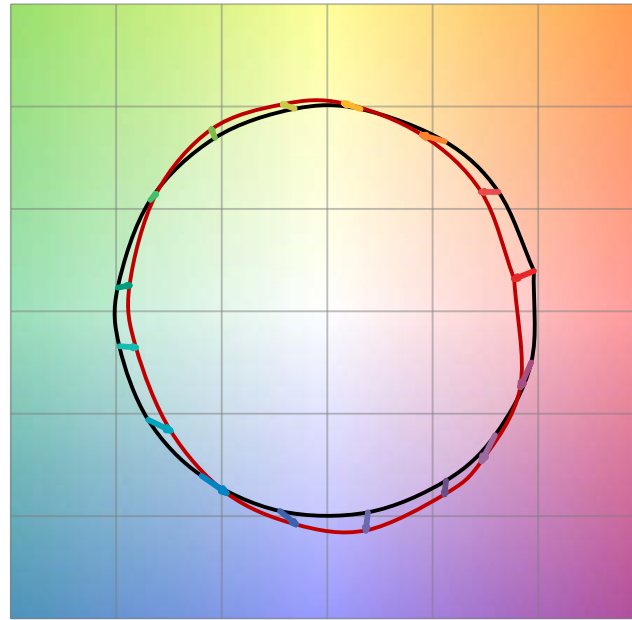
Chroma Shift by Hue



R_f by Hue

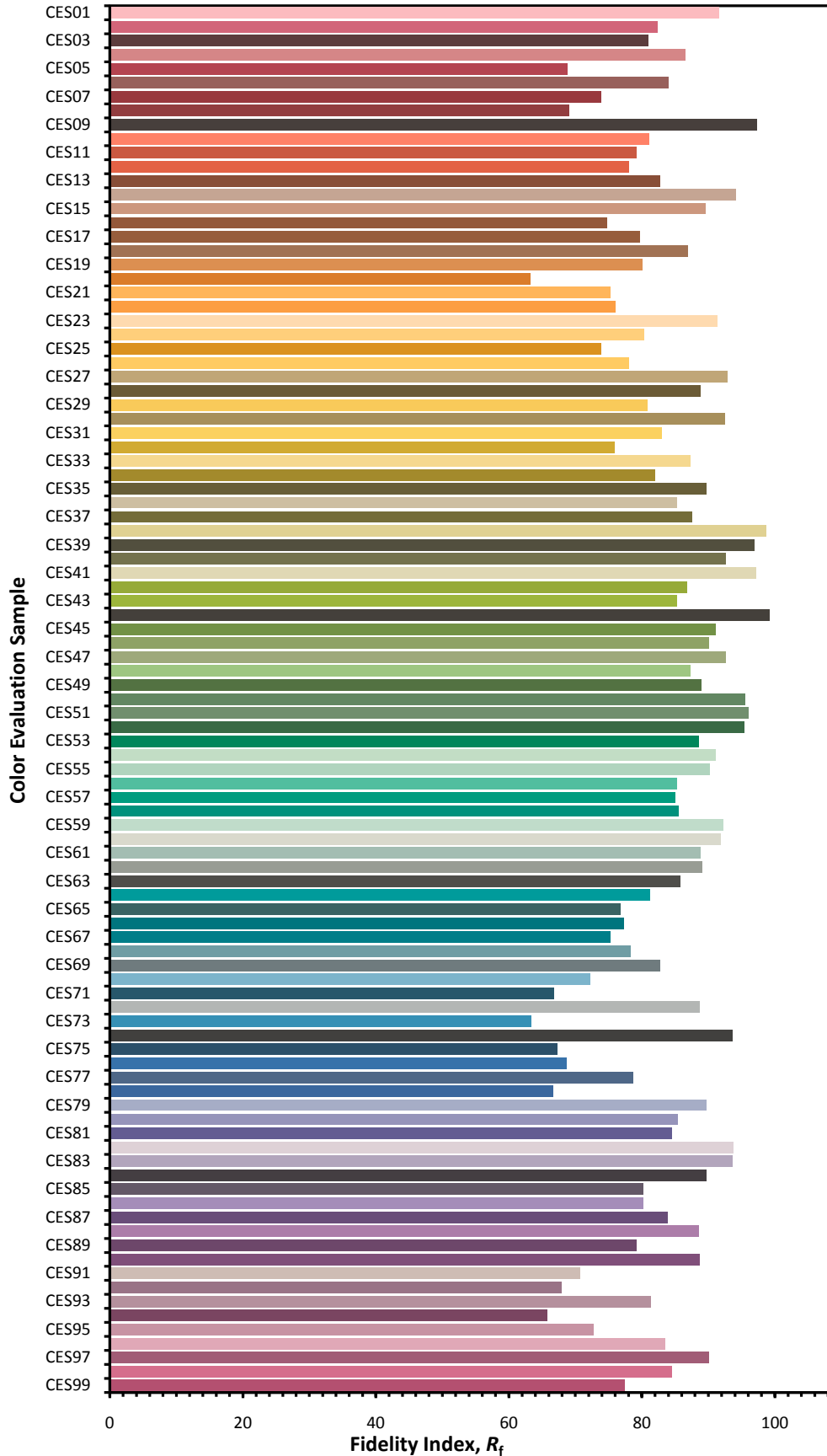


Color Vector Graphic

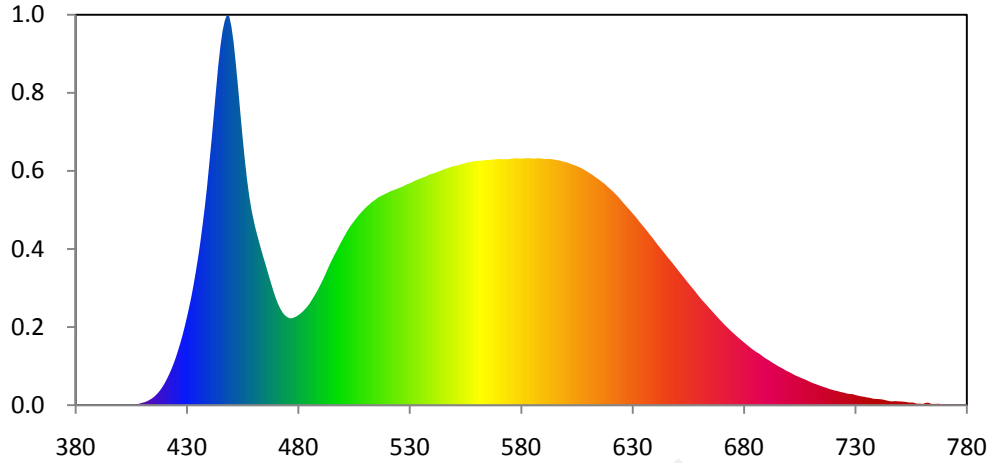


— Reference Illuminant — Test Source

Color Fidelity by CES Sample



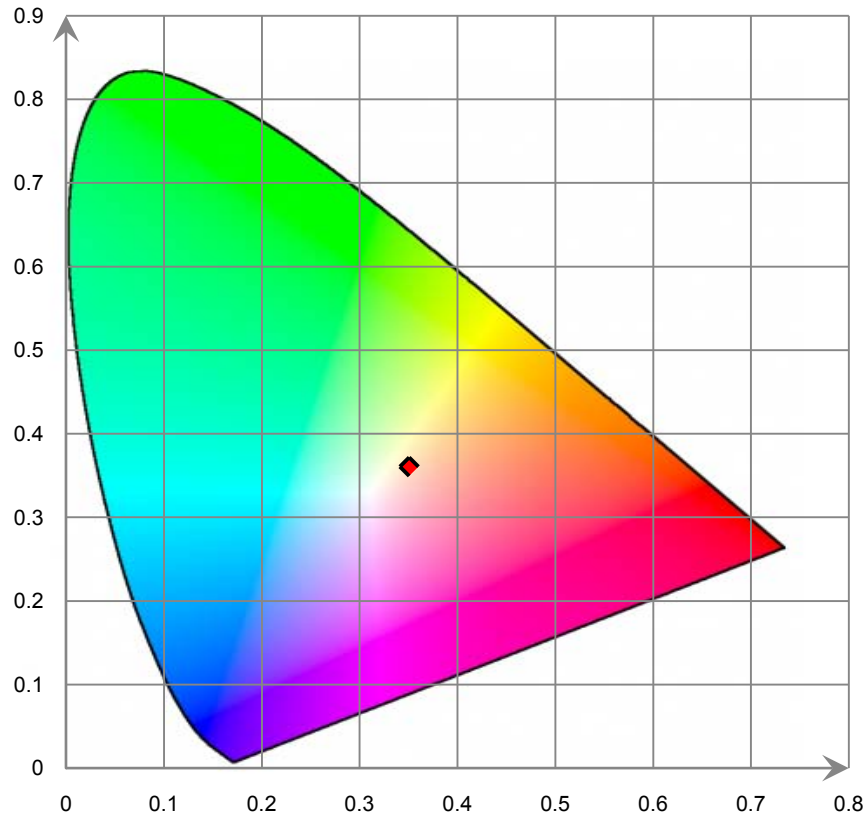
Relative Spectral Power Distribution



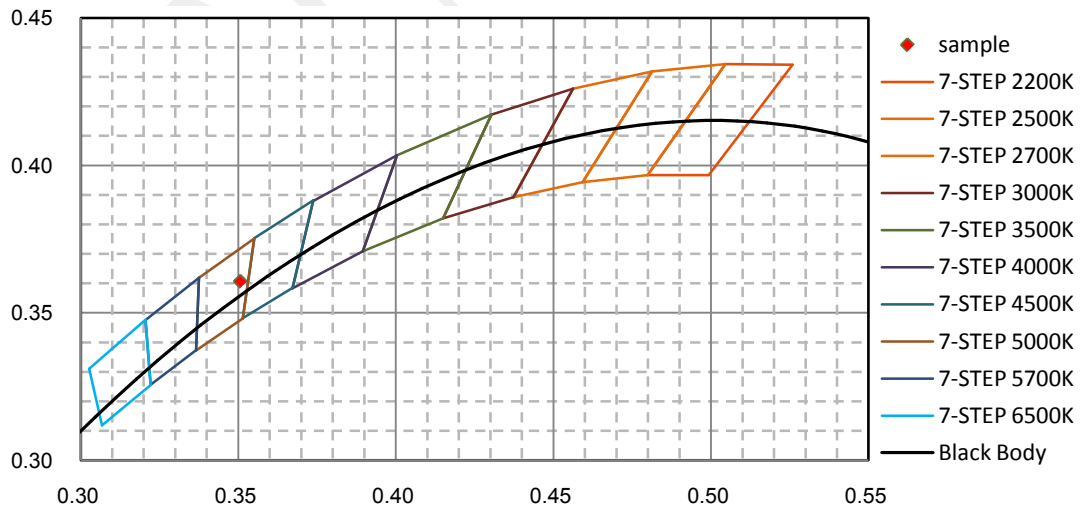
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	1.890E-02	421	3.948E+00	462	2.512E+01	503	2.684E+01	544	3.543E+01
381	2.430E-02	422	4.646E+00	463	2.389E+01	504	2.733E+01	545	3.554E+01
382	2.510E-02	423	5.403E+00	464	2.269E+01	505	2.777E+01	546	3.569E+01
383	2.080E-02	424	6.247E+00	465	2.157E+01	506	2.822E+01	547	3.579E+01
384	1.970E-02	425	7.186E+00	466	2.042E+01	507	2.864E+01	548	3.591E+01
385	1.380E-02	426	8.233E+00	467	1.926E+01	508	2.903E+01	549	3.603E+01
386	1.410E-02	427	9.345E+00	468	1.814E+01	509	2.939E+01	550	3.609E+01
387	1.390E-02	428	1.054E+01	469	1.705E+01	510	2.975E+01	551	3.616E+01
388	9.300E-03	429	1.186E+01	470	1.607E+01	511	3.007E+01	552	3.626E+01
389	2.100E-02	430	1.328E+01	471	1.522E+01	512	3.036E+01	553	3.637E+01
390	2.250E-02	431	1.479E+01	472	1.452E+01	513	3.065E+01	554	3.645E+01
391	1.060E-02	432	1.638E+01	473	1.397E+01	514	3.089E+01	555	3.654E+01
392	1.040E-02	433	1.821E+01	474	1.356E+01	515	3.114E+01	556	3.666E+01
393	1.460E-02	434	2.017E+01	475	1.330E+01	516	3.139E+01	557	3.668E+01
394	1.520E-02	435	2.227E+01	476	1.314E+01	517	3.158E+01	558	3.677E+01
395	1.910E-02	436	2.456E+01	477	1.312E+01	518	3.174E+01	559	3.686E+01
396	1.190E-02	437	2.714E+01	478	1.323E+01	519	3.190E+01	560	3.687E+01
397	9.100E-03	438	2.985E+01	479	1.338E+01	520	3.206E+01	561	3.689E+01
398	8.100E-03	439	3.289E+01	480	1.359E+01	521	3.224E+01	562	3.690E+01
399	3.600E-03	440	3.635E+01	481	1.384E+01	522	3.238E+01	563	3.696E+01
400	2.230E-02	441	3.982E+01	482	1.415E+01	523	3.250E+01	564	3.702E+01
401	3.240E-02	442	4.355E+01	483	1.450E+01	524	3.262E+01	565	3.702E+01
402	3.330E-02	443	4.738E+01	484	1.488E+01	525	3.276E+01	566	3.703E+01
403	3.800E-02	444	5.106E+01	485	1.532E+01	526	3.291E+01	567	3.708E+01
404	4.950E-02	445	5.416E+01	486	1.585E+01	527	3.303E+01	568	3.711E+01
405	6.320E-02	446	5.651E+01	487	1.641E+01	528	3.321E+01	569	3.715E+01
406	9.630E-02	447	5.808E+01	488	1.697E+01	529	3.339E+01	570	3.718E+01
407	1.344E-01	448	5.895E+01	489	1.758E+01	530	3.349E+01	571	3.715E+01
408	1.791E-01	449	5.870E+01	490	1.824E+01	531	3.365E+01	572	3.713E+01
409	2.675E-01	450	5.712E+01	491	1.892E+01	532	3.383E+01	573	3.715E+01
410	3.665E-01	451	5.466E+01	492	1.966E+01	533	3.399E+01	574	3.713E+01
411	4.535E-01	452	5.137E+01	493	2.042E+01	534	3.413E+01	575	3.716E+01
412	5.840E-01	453	4.784E+01	494	2.118E+01	535	3.425E+01	576	3.722E+01
413	7.530E-01	454	4.405E+01	495	2.188E+01	536	3.438E+01	577	3.727E+01
414	9.546E-01	455	4.038E+01	496	2.255E+01	537	3.449E+01	578	3.728E+01
415	1.194E+00	456	3.702E+01	497	2.319E+01	538	3.465E+01	579	3.725E+01
416	1.501E+00	457	3.401E+01	498	2.385E+01	539	3.483E+01	580	3.723E+01
417	1.847E+00	458	3.150E+01	499	2.450E+01	540	3.494E+01	581	3.726E+01
418	2.261E+00	459	2.946E+01	500	2.511E+01	541	3.504E+01	582	3.727E+01
419	2.755E+00	460	2.783E+01	501	2.571E+01	542	3.516E+01	583	3.730E+01
420	3.310E+00	461	2.638E+01	502	2.632E+01	543	3.530E+01	584	3.729E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	3.723E+01	626	3.049E+01	667	1.371E+01	708	3.790E+00	749	5.914E-01
586	3.724E+01	627	3.012E+01	668	1.333E+01	709	3.636E+00	750	5.607E-01
587	3.727E+01	628	2.974E+01	669	1.297E+01	710	3.475E+00	751	5.488E-01
588	3.728E+01	629	2.937E+01	670	1.261E+01	711	3.329E+00	752	5.155E-01
589	3.725E+01	630	2.897E+01	671	1.226E+01	712	3.208E+00	753	4.710E-01
590	3.718E+01	631	2.858E+01	672	1.191E+01	713	3.089E+00	754	4.046E-01
591	3.716E+01	632	2.818E+01	673	1.159E+01	714	2.953E+00	755	3.927E-01
592	3.718E+01	633	2.774E+01	674	1.127E+01	715	2.836E+00	756	3.986E-01
593	3.717E+01	634	2.734E+01	675	1.095E+01	716	2.723E+00	757	2.794E-01
594	3.712E+01	635	2.693E+01	676	1.065E+01	717	2.630E+00	758	2.242E-01
595	3.708E+01	636	2.652E+01	677	1.034E+01	718	2.484E+00	759	2.304E-01
596	3.701E+01	637	2.609E+01	678	1.005E+01	719	2.380E+00	760	1.839E-01
597	3.695E+01	638	2.566E+01	679	9.769E+00	720	2.293E+00	761	2.700E-01
598	3.688E+01	639	2.525E+01	680	9.485E+00	721	2.194E+00	762	3.751E-01
599	3.678E+01	640	2.479E+01	681	9.209E+00	722	2.133E+00	763	3.507E-01
600	3.670E+01	641	2.434E+01	682	8.932E+00	723	2.028E+00	764	2.084E-01
601	3.660E+01	642	2.393E+01	683	8.655E+00	724	1.944E+00	765	1.879E-01
602	3.647E+01	643	2.351E+01	684	8.401E+00	725	1.888E+00	766	1.926E-01
603	3.634E+01	644	2.308E+01	685	8.158E+00	726	1.770E+00	767	2.179E-01
604	3.621E+01	645	2.266E+01	686	7.941E+00	727	1.708E+00	768	1.875E-01
605	3.610E+01	646	2.223E+01	687	7.747E+00	728	1.682E+00	769	1.463E-01
606	3.596E+01	647	2.184E+01	688	7.487E+00	729	1.649E+00	770	1.235E-01
607	3.578E+01	648	2.143E+01	689	7.218E+00	730	1.540E+00	771	1.450E-01
608	3.561E+01	649	2.099E+01	690	7.003E+00	731	1.457E+00	772	1.478E-01
609	3.541E+01	650	2.056E+01	691	6.808E+00	732	1.374E+00	773	1.360E-01
610	3.520E+01	651	2.013E+01	692	6.589E+00	733	1.312E+00	774	1.171E-01
611	3.499E+01	652	1.972E+01	693	6.368E+00	734	1.265E+00	775	1.276E-01
612	3.477E+01	653	1.929E+01	694	6.170E+00	735	1.185E+00	776	9.510E-02
613	3.451E+01	654	1.886E+01	695	5.961E+00	736	1.139E+00	777	1.056E-01
614	3.428E+01	655	1.844E+01	696	5.775E+00	737	1.068E+00	778	1.142E-01
615	3.405E+01	656	1.803E+01	697	5.603E+00	738	9.709E-01	779	1.001E-01
616	3.378E+01	657	1.763E+01	698	5.400E+00	739	9.429E-01	780	8.660E-02
617	3.353E+01	658	1.722E+01	699	5.205E+00	740	9.355E-01		
618	3.325E+01	659	1.679E+01	700	5.040E+00	741	9.068E-01		
619	3.293E+01	660	1.636E+01	701	4.886E+00	742	8.709E-01		
620	3.263E+01	661	1.596E+01	702	4.688E+00	743	7.932E-01		
621	3.233E+01	662	1.558E+01	703	4.511E+00	744	7.107E-01		
622	3.199E+01	663	1.521E+01	704	4.365E+00	745	6.312E-01		
623	3.166E+01	664	1.484E+01	705	4.211E+00	746	5.805E-01		
624	3.129E+01	665	1.446E+01	706	4.076E+00	747	5.908E-01		
625	3.089E+01	666	1.408E+01	707	3.939E+00	748	6.072E-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**

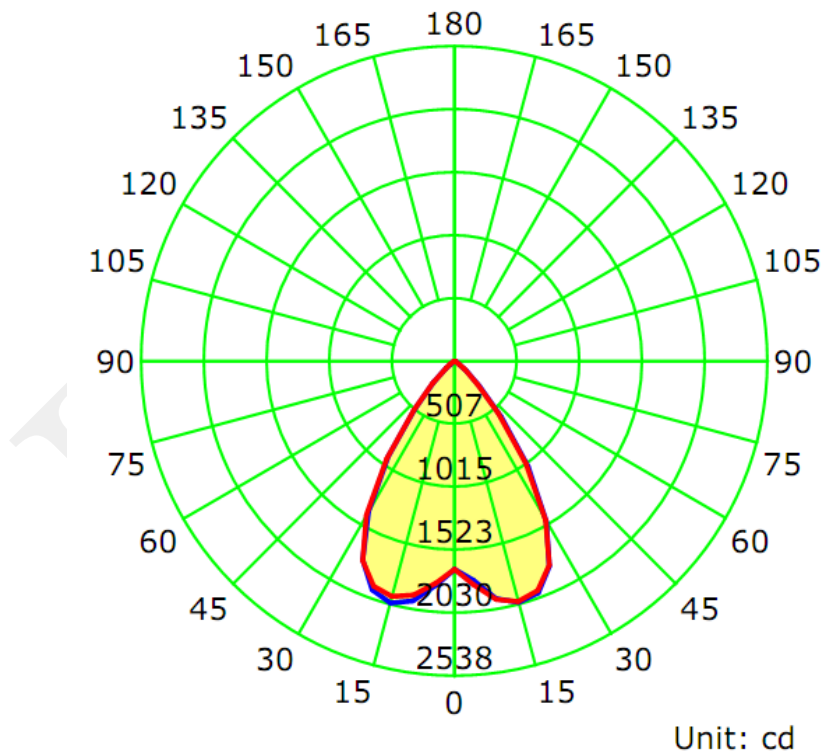
Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.2150	25.45	0.9880

Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I _{max} (cd)	S/MH (C0/180)	S/MH (C90/270)
2451.8	96.34	2030.9	1.21	1.21

Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I _{max}):	69.6	69.6	69.7	69.7	69.7
Field Angle (10% I _{max}):	94.1	94.0	93.8	93.8	93.9

Luminous Intensity (cd) Distribution Data

C Y	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	1681	1681	1681	1681	1681	1681	1681	1681
5.0°	1775	1792	1802	1805	1809	1813	1815	1809
10.0°	1946	1954	1966	1966	1951	1943	1945	1958
15.0°	2014	2020	2031	2030	2007	1990	1997	2012
20.0°	1986	1986	1992	1985	1973	1960	1962	1967
25.0°	1825	1830	1829	1815	1817	1807	1799	1793
30.0°	1497	1500	1489	1483	1485	1469	1456	1446
35.0°	1042	1039	1036	1022	1015	996	986	979
40.0°	589	590	578	570	555	547	540	539
45.0°	284	284	277	272	264	261	258	259
50.0°	124	123	118	115	109	107	105	105
55.0°	53	52	49	49	48	50	50	53
60.0°	22	22	21	19	19	19	19	19
65.0°	5	5	5	5	6	5	5	5
70.0°	4	4	4	4	4	4	4	4
75.0°	3	3	3	3	3	3	3	3
80.0°	3	3	3	3	3	3	3	3
85.0°	2	2	2	2	2	2	2	2
90.0°	1	1	1	1	1	1	1	1
95.0°	1	1	1	1	1	1	1	1
100.0°	1	1	1	1	1	1	1	1
105.0°	1	1	1	1	1	1	1	1
110.0°	1	1	1	1	1	1	1	1
115.0°	1	1	1	1	1	1	1	1
120.0°	1	1	1	1	1	1	1	1
125.0°	1	1	1	1	1	1	1	1
130.0°	1	1	1	1	1	1	1	1
135.0°	1	1	1	1	1	1	1	1
140.0°	1	1	1	1	1	1	1	1
145.0°	1	1	1	1	1	1	1	1
150.0°	1	1	1	1	1	1	1	1
155.0°	1	1	1	1	1	1	1	1
160.0°	1	1	1	1	1	1	1	1
165.0°	1	1	1	1	1	1	1	1
170.0°	1	1	1	1	1	1	1	1
175.0°	1	1	1	1	1	1	1	1
180.0°	0	0	0	0	0	0	0	0

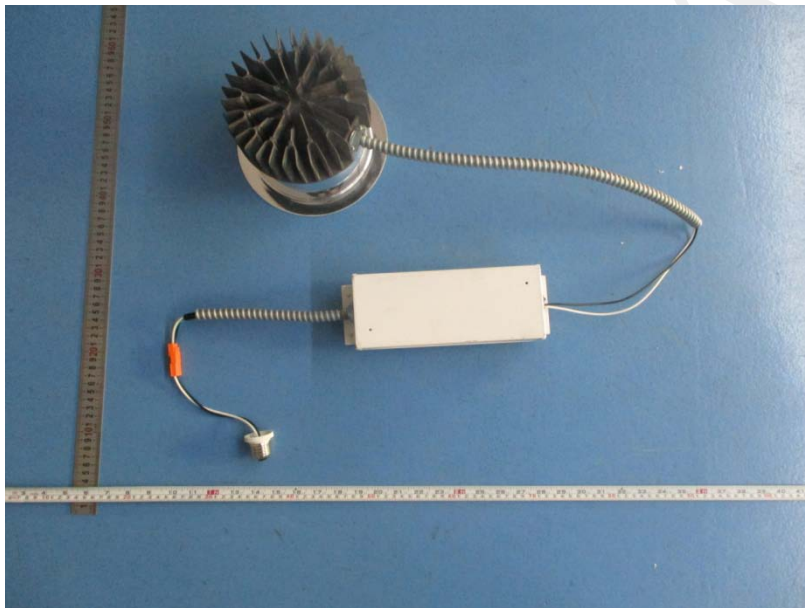
Luminous Intensity (cd) Distribution Data (cont.)

C γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	1681	1681	1681	1681	1681	1681	1681	1681
5.0°	1816	1814	1809	1803	1797	1790	1779	1781
10.0°	1964	1960	1951	1935	1914	1910	1917	1940
15.0°	2017	2019	2012	1993	1967	1951	1960	1992
20.0°	1960	1971	1971	1953	1929	1921	1928	1958
25.0°	1770	1786	1790	1775	1772	1775	1780	1790
30.0°	1401	1406	1424	1423	1436	1440	1448	1457
35.0°	942	939	953	954	962	965	979	994
40.0°	509	517	518	520	519	531	540	542
45.0°	247	250	254	256	255	252	256	261
50.0°	96	100	99	101	98	102	105	105
55.0°	43	45	45	47	48	46	50	51
60.0°	15	15	15	16	16	17	18	19
65.0°	5	5	5	5	5	5	5	5
70.0°	4	4	4	4	4	4	4	4
75.0°	3	3	3	3	3	3	3	3
80.0°	2	2	2	3	3	3	3	3
85.0°	2	2	2	2	2	2	2	2
90.0°	1	1	1	1	1	1	1	1
95.0°	1	1	1	1	1	1	1	1
100.0°	1	1	1	1	1	1	1	1
105.0°	1	1	1	1	1	1	1	1
110.0°	1	1	1	1	1	1	1	1
115.0°	1	1	1	1	1	1	1	1
120.0°	1	1	1	1	1	1	1	1
125.0°	1	1	1	1	1	1	1	1
130.0°	1	1	1	1	1	1	1	1
135.0°	1	1	1	1	1	1	1	1
140.0°	1	1	1	1	1	1	1	1
145.0°	1	1	1	1	1	1	1	1
150.0°	1	1	1	1	1	1	1	1
155.0°	1	1	1	1	1	1	1	1
160.0°	1	1	1	1	1	1	1	1
165.0°	1	1	1	1	1	1	1	1
170.0°	1	1	1	1	1	1	1	1
175.0°	1	1	1	1	1	1	1	1
180.0°	0	0	0	0	0	0	0	0

Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	41.6	1.70	0-5	41.6	1.70
5-10	134.0	5.47	0-10	175.6	7.16
10-15	234.1	9.55	0-15	409.7	16.71
15-20	326.6	13.32	0-20	736.3	30.03
20-25	394.3	16.08	0-25	1130.6	46.11
25-30	411.4	16.78	0-30	1542.0	62.89
30-35	359.5	14.66	0-35	1901.6	77.56
35-40	255.6	10.42	0-40	2157.1	87.98
40-45	149.2	6.09	0-45	2306.3	94.07
45-50	74.6	3.04	0-50	2380.9	97.11
50-55	33.9	1.38	0-55	2414.8	98.49
55-60	15.5	0.63	0-60	2430.2	99.12
60-65	5.6	0.23	0-65	2435.8	99.35
65-70	2.2	0.09	0-70	2438.1	99.44
70-75	1.8	0.07	0-75	2439.9	99.52
75-80	1.5	0.06	0-80	2441.4	99.58
80-85	1.2	0.05	0-85	2442.6	99.63
85-90	0.9	0.04	0-90	2443.5	99.66
90-95	0.7	0.03	0-95	2444.2	99.69
95-100	0.7	0.03	0-100	2444.9	99.72
100-105	0.7	0.03	0-105	2445.6	99.75
105-110	0.7	0.03	0-110	2446.3	99.78
110-115	0.7	0.03	0-115	2447.0	99.80
115-120	0.6	0.03	0-120	2447.6	99.83
120-125	0.6	0.02	0-125	2448.2	99.85
125-130	0.6	0.02	0-130	2448.8	99.88
130-135	0.5	0.02	0-135	2449.3	99.90
135-140	0.5	0.02	0-140	2449.8	99.92
140-145	0.4	0.02	0-145	2450.3	99.94
145-150	0.4	0.02	0-150	2450.7	99.95
150-155	0.3	0.01	0-155	2451.0	99.97
155-160	0.3	0.01	0-160	2451.3	99.98
160-165	0.2	0.01	0-165	2451.5	99.99
165-170	0.2	0.01	0-170	2451.7	100.00
170-175	0.1	0.00	0-175	2451.8	100.00
175-180	0.0	0.00	0-180	2451.8	100.00

6. Product Photo



7. Report Revision

Report Number	Report Date	Contents
RKS170829005-10A4	2017-09-08	Original report
RKS170829005-10A4-M1	2017-11-08	Update the Rated Voltage/Frequency on page 2.
RKS170829005-10A4-M2	2017-12-13	Modify product type.

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