



LM-79-08 Test Report

for

IKIO LED LIGHTING

8470 Allison Pointe Blvd, Suite 128
Indianapolis, IN 46250

LED Corn Bulb Lamp Premium

Model: IK-CRA-L120-0045-E(X)3950

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15052112p/R1

This report is replaced the old report No. HZ15050012p dated Jun. 01, 2015

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

Review by:

Engineer: April Zou
Jun. 04, 2015

Approved by:

Manager: Jim Zhang
Jun. 04, 2015

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Test Summary

Sample Tested: **IK-CRA-L120-0045-E(X)3950**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
128.6	5786.0	45.0	0.9872
CCT (K)	CRI	Stabilization Time (Light & Power)	
5351	82.5	65	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Test specifications:

Date of Receipt	: May 08, 2015
Date of Test	: May 26, 2015
Test item	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
Reference Standard	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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Sample Photos



E26 base



E39 base



Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Corn Bulb Lamp Premium
Model	: IK-CRA-L120-0045-E(X)3950
Electrical Ratings	: 100-277Vac, 50-60Hz, 45W
Product Description	: E26 base, 5000K, Non-dimmable Model of the LED light source: 5630 2 nd Generation Manufacturer of the LED light source: Samsung Quantity of LED light source: 135pcs
Manufacturer	: IKIO LED LIGHTING
Address	: 8470 Allison Pointe Blvd, Suite 128 Indianapolis, IN 46250

TEST RESULTS

Test ambient temperature was 24.9°C.

Base orientation was Base down. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 65 minutes, and the total operating time including stabilization was 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result			Special Color Rendering Indices	
Test Voltage (V)	120.0	100.0	277.0	R1	80.5
Voltage frequency (Hz)	60	60	60	R2	86.1
Test Current (A)	0.380	0.460	0.179	R3	90.9
Power Factor	0.9872	0.9883	0.9153	R4	83.6
Test Power (W)	45.0	45.43	45.40	R5	82.2
THD A%	14.34	14.13	15.59	R6	81.9
Luminous Efficacy (lm/W)	128.3			R7	86.5
Total Luminous Flux (lm)	5786.0			R8	68.5
Color Rendering Index (CRI)	82.5			R9	6.8
R9	6.8			R10	67.9
Correlated Color Temperature (CCT) (K)	5351			R11	83.7
Chromaticity Chroma x	0.3361			R12	67.9
Chromaticity Chroma y	0.3510			R13	81.4
Chromaticity Chroma u	0.2055			R14	95.1
Chromaticity Chroma v	0.3220				
Duv	0.0032				
Chromaticity Chroma u'	0.2055				
Chromaticity Chroma v'	0.4831				

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u', v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

Goniophotometer Method

Test ambient temperature was 24.5°C.

The photometric distance is 2.475m.

Luminous data was taken at 0.5°vertical intervals and 22.5°horizontal intervals.

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.381
Power Factor	0.9872
Test Power (W)	45.11
Luminous Efficacy (lm/W)	126.2
Total Luminous Flux (lm)	5693.4
Beam Angle (°)	316.0
Center Beam Candle Power (cd)	241
Maximum Beam Candle Power (cd)	577.3(At: C=0.0, Gamma=68.5)
Spacing Criteria	2.58 (0°-180°)/ 2.54(90°-270°)
Zonal Lumens in the 0°-60°Zone	24.88%
Zonal Lumens in the 60°-90°Zone	30.21%
Zonal Lumens in the 90°-120°Zone	28.81%
Zonal Lumens in the 120°-180°Zone	16.10%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

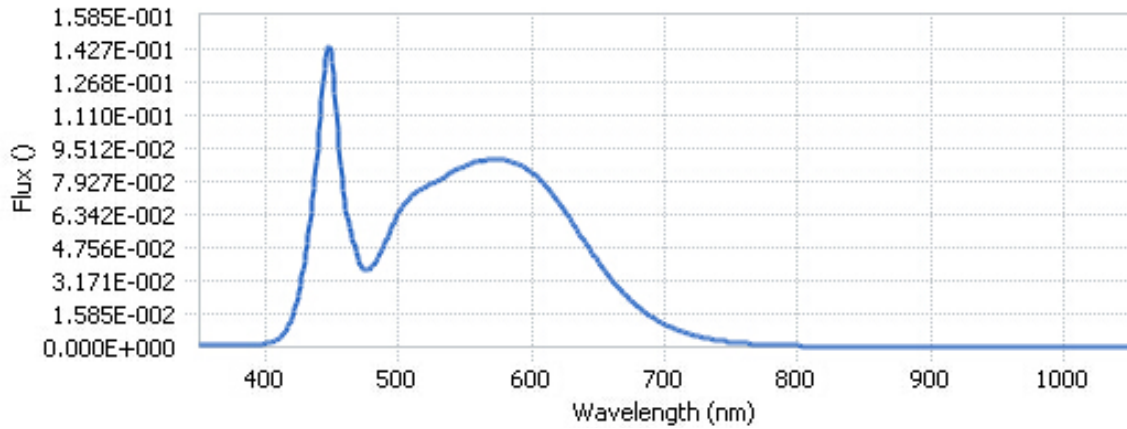
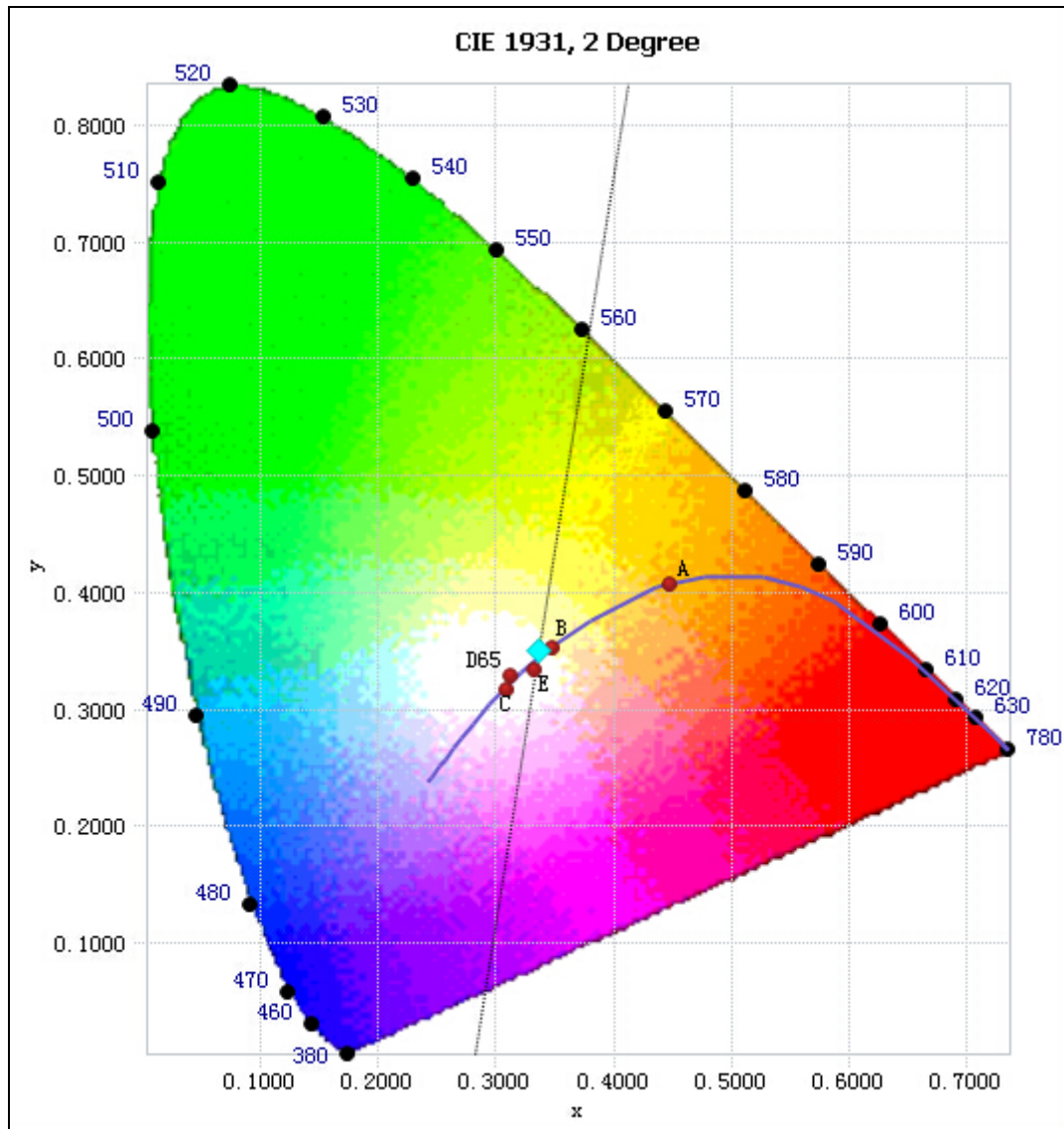


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.08E-03	485	4.37E-02	590	8.75E-02	695	1.26E-02
385	1.08E-03	490	5.05E-02	595	8.59E-02	700	1.08E-02
390	1.19E-03	495	5.76E-02	600	8.36E-02	705	9.28E-03
395	1.38E-03	500	6.44E-02	605	8.10E-02	710	7.99E-03
400	1.77E-03	505	6.92E-02	610	7.75E-02	715	6.88E-03
405	2.44E-03	510	7.27E-02	615	7.37E-02	720	5.93E-03
410	4.19E-03	515	7.50E-02	620	6.94E-02	725	5.07E-03
415	7.85E-03	520	7.65E-02	625	6.51E-02	730	4.32E-03
420	1.49E-02	525	7.84E-02	630	6.02E-02	735	3.71E-03
425	2.67E-02	530	7.99E-02	635	5.51E-02	740	3.20E-03
430	4.50E-02	535	8.18E-02	640	5.04E-02	745	2.76E-03
435	7.03E-02	540	8.38E-02	645	4.55E-02	750	2.36E-03
440	1.03E-01	545	8.55E-02	650	4.11E-02	755	2.04E-03
445	1.39E-01	550	8.67E-02	655	3.66E-02	760	1.76E-03
450	1.36E-01	555	8.82E-02	660	3.24E-02	765	1.50E-03
455	9.48E-02	560	8.88E-02	665	2.87E-02	770	1.31E-03
460	6.57E-02	565	8.94E-02	670	2.52E-02	775	1.13E-03
465	5.23E-02	570	8.98E-02	675	2.20E-02	780	9.67E-04
470	4.08E-02	575	8.96E-02	680	1.92E-02		
475	3.67E-02	580	8.94E-02	685	1.67E-02		
480	3.86E-02	585	8.87E-02	690	1.45E-02		

Table 4: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3361, 0.3510)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

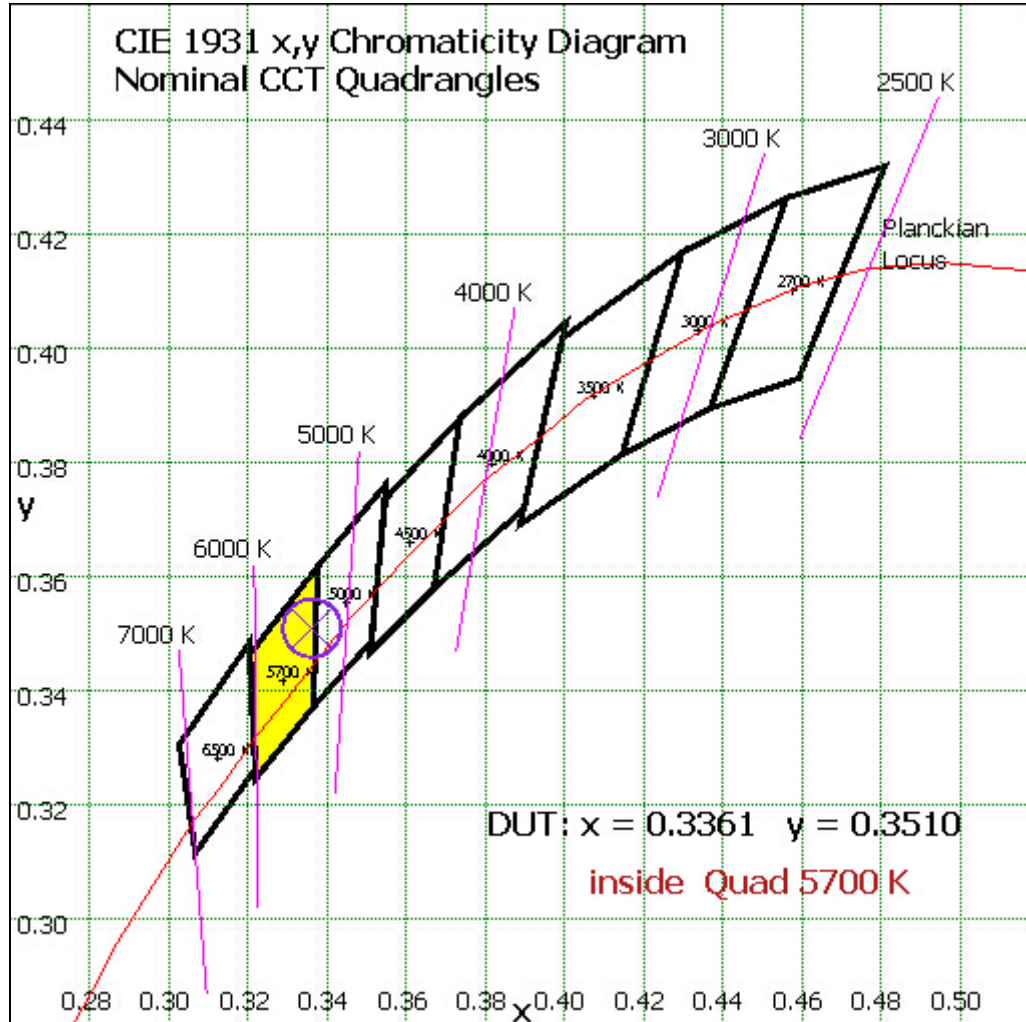


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

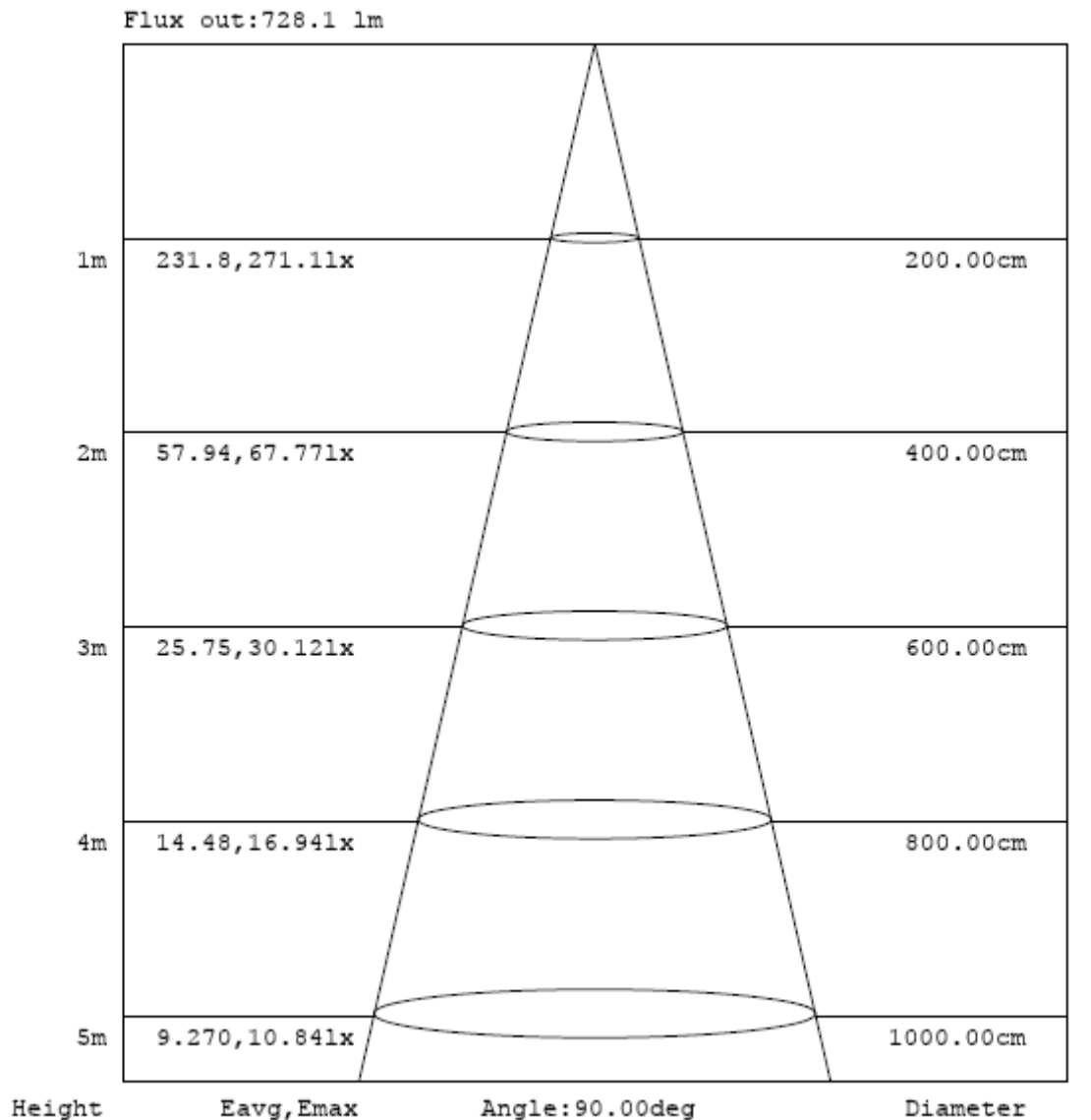
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total	$\gamma(^{\circ})$	Lumens	% Total
0~ 5	5.783	0.10%	90~95	300.071	5.27%
5~10	17.763	0.31%	95~100	295	5.18%
10~15	31.802	0.56%	100~105	285.731	5.02%
15~20	49.481	0.87%	105~110	272.108	4.78%
20~25	71.023	1.25%	110~115	254.395	4.47%
25~30	95.614	1.68%	115~120	233.027	4.09%
30~35	123.407	2.17%	120~125	208.544	3.66%
35~40	152.494	2.68%	125~130	181.441	3.19%
40~45	180.715	3.17%	130~135	152.443	2.68%
45~50	206.811	3.63%	135~140	122.477	2.15%
50~55	230.58	4.05%	140~145	93.263	1.64%
55~60	250.762	4.40%	145~150	67.699	1.19%
60~65	266.738	4.69%	150~155	45.759	0.80%
65~70	278.958	4.90%	155~160	27.144	0.48%
70~75	287.525	5.05%	160~165	12.786	0.22%
75~80	291.457	5.12%	165~170	4.325	0.08%
80~85	295.73	5.19%	170~175	0.792	0.01%
85~90	299.682	5.26%	175~180	0.053	0.00%

$\gamma(^{\circ})$	Lumens	% Total
0-135	5319.085	93.43%
135-180	374.298	6.57%
0-180	5693.4	100%

Table 5: Zonal Lumen Data

Illuminance Plots- Goniophotometer Method



Note: The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 4: Beam Angle

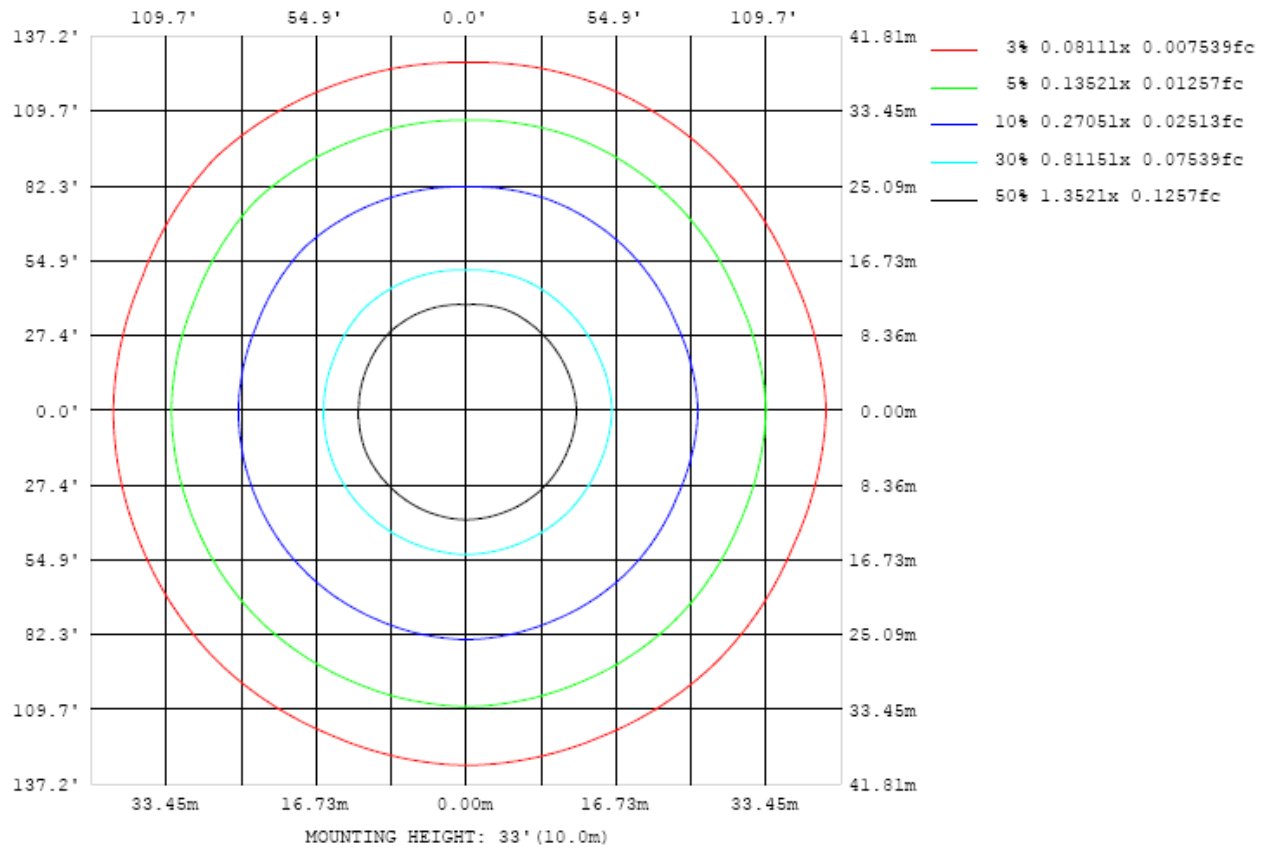


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

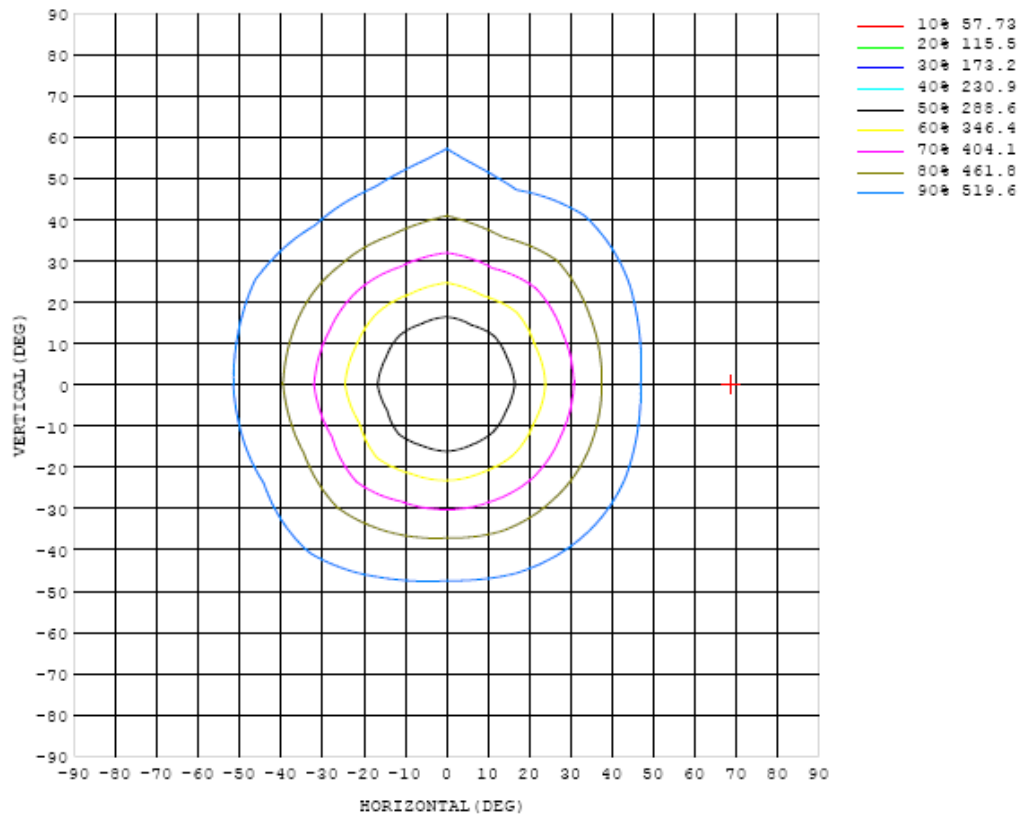


Chart 6: Isocandela Plot

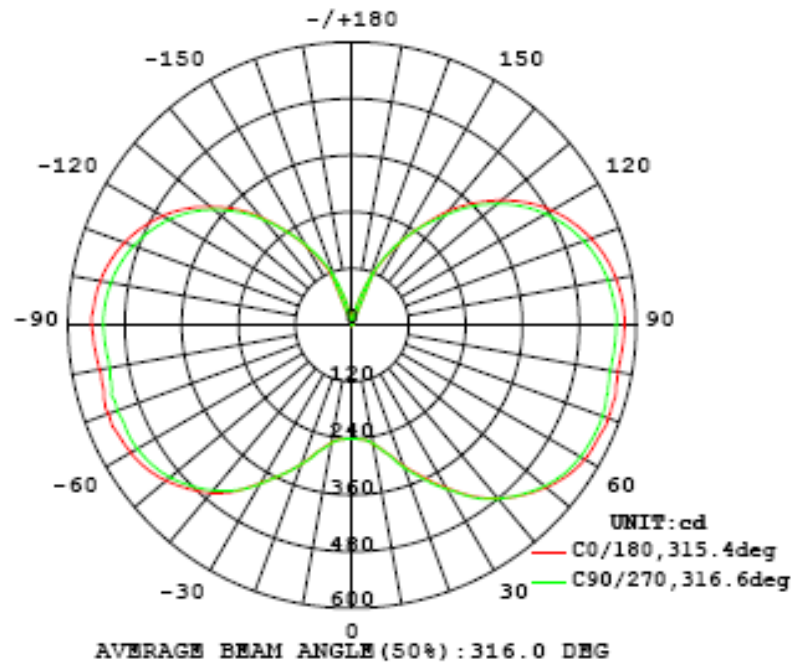


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table---1 UNIT: cd

C (DEG) γ (DEG)	0	23	45	68	90	113	135	158	180	203	225	248	270	293	315	338			
0	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241	241			
5	243	243	243	243	243	243	243	243	243	243	243	243	243	243	243	243			
10	254	255	255	256	255	255	254	256	253	255	254	255	254	256	254	254			
15	281	283	283	283	281	282	278	283	277	281	279	281	278	284	280	282			
20	317	322	322	321	321	320	315	321	313	317	316	319	313	321	316	320			
25	355	362	360	362	361	361	352	362	349	356	355	357	349	362	353	360			
30	398	404	402	403	401	402	389	402	387	396	396	400	388	404	393	400			
35	442	444	445	442	445	441	434	440	430	434	441	437	427	441	434	440			
40	479	481	480	479	480	476	468	476	464	470	475	474	457	476	466	476			
45	509	508	507	507	507	504	494	503	490	496	503	500	482	503	493	503			
50	535	528	529	526	531	524	517	522	513	515	527	518	502	522	517	523			
55	555	542	545	541	548	538	535	536	530	529	546	532	516	536	533	537			
60	568	550	554	550	557	547	546	545	540	535	556	540	524	542	544	545			
65	572	552	557	552	562	550	553	548	546	539	560	542	526	544	548	547			
70	576	555	558	553	563	552	557	550	548	539	563	541	528	544	551	547			
75	576	550	557	549	559	543	547	539	543	533	559	538	526	544	549	546			
80	570	544	550	544	553	541	547	538	542	531	557	533	520	536	543	539			
85	573	546	552	547	556	544	550	542	546	533	560	535	523	540	547	541			
90	575	549	554	549	558	546	553	545	550	535	563	538	526	542	549	543			
95	573	546	551	546	555	544	550	542	546	532	561	535	524	540	547	541			
100	567	539	545	539	549	536	543	534	540	525	554	528	518	533	541	535			
105	555	528	534	528	537	525	530	523	529	514	543	518	507	523	530	524			
110	537	513	518	512	521	510	513	508	512	499	527	503	491	508	514	509			
115	514	494	496	492	499	490	491	488	490	479	506	484	472	488	492	490			
120	487	469	470	466	472	465	464	463	463	455	479	459	447	464	466	465			
125	453	439	438	436	439	435	431	433	430	426	447	430	418	435	435	435			
130	412	402	401	400	401	398	392	397	391	391	408	396	381	400	397	400			
135	366	359	357	357	356	353	350	353	348	350	363	354	339	359	353	359			
140	315	311	307	306	303	303	299	304	297	301	310	305	293	310	303	311			
145	256	259	255	256	254	254	247	255	244	254	253	253	243	261	249	262			
150	203	210	205	208	204	206	197	208	193	210	205	205	196	217	202	215			
155	150	157	153	155	153	155	147	156	144	159	160	153	152	163	155	161			
160	98.8	102	101	101	98.7	101	95.4	103	94.2	102	105	100	105	108	105	105			
165	53.9	56.4	56.5	56.0	54.0	55.6	53.1	57.0	51.9	53.5	56.4	45.5	54.7	53.9	57.8	54.7			
170	21.0	20.5	20.6	21.5	20.1	20.8	20.3	20.7	19.9	20.6	19.6	11.8	8.29	19.3	22.4	22.0			
175	4.38	4.42	4.53	4.47	4.34	4.48	4.44	4.19	4.01	4.08	3.40	3.56	3.86	3.04	2.95	4.19			
180	0.50	0.51	0.51	0.51	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51			

Table 6: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2014	Sep. 17, 2015
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	D908	HZTE012-01	Sep. 18, 2014	Sep. 17, 2015
Integrate Sphere system	2M	HZTE015-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	6154	HZTE004-04	Sep. 18, 2014	Sep. 17, 2015
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	SCL-1400	HZTE012-02	Sep. 18, 2014	Sep. 17, 2015

Table 7: Test Equipment List

TEST METHODS

Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning. Therefore, no seasoning was performed.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is 4π . Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.

Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated BR30s) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expended uncertainty is 1.39% with a coverage factor $k=2$.

Goniophotometer Method

Photometric and Electrical Measurements

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated BR30s) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 1.8% with a coverage factor $k=2$.

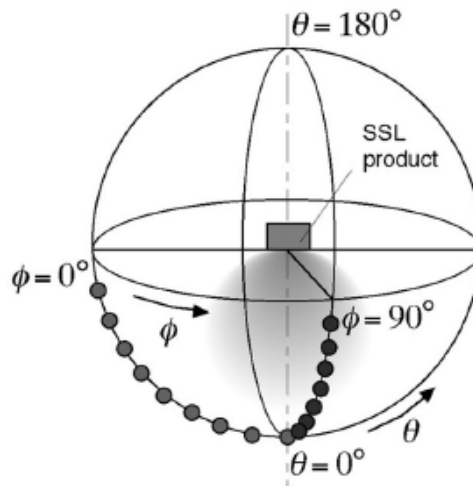
Color Characteristics Measurements

The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ($C=0^\circ/180^\circ$ and $C=90^\circ/270^\circ$) and at 10° or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate was calculated from these points. The data was then analyzed to check for delta color differences of the u' , v' chromaticity coordinates. The spatial non-uniformity of chromaticity, $\Delta u'v'$, is determined as the maximum deviation (distance on the CIE (u' , v') diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



*** End of Report ***

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