



## 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-L120-0080-50**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No. : HZ15050112r

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

Review by:

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Jun. 01, 2015

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Jun. 01, 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-L120-0080-50**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
128.0	10130.0	79.13	0.9886
CCT (K)	CRI	Stabilization Time (Light & Power)	
5391	82.8	65	

Table 1: Executive Data Summary

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

### Test specifications:

<b>Date of Receipt</b>	: May 08, 2015
<b>Date of Test</b>	: May 14, 2015 to May 18, 2015
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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## Sample Photos



Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: LED Corn Bulb Lamp Premium
<b>Model</b>	: IK-CRA-L120-0080-50
<b>Electrical Ratings</b>	: 100-277Vac, 50-60Hz, 80W
<b>Product Description</b>	: E39 base, 5000K, Non-dimmable Model of the LED light source: 5630 2 <sup>nd</sup> Generation Manufacturer of the LED light source: Samsung Quantity of LED light source: 234pcs
<b>Manufacturer</b>	: IKIO LED LIGHTING
<b>Address</b>	: 8470 Allison Pointe Blvd, Suite 128 Indianapolis, IN 46250

## TEST RESULTS

Test ambient temperature was 25.1 °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	80.7
Voltage frequency (Hz)	60	60	60	R2	86.8
Test Current (A)	0.667	0.802	0.337	R3	91.6
Power Factor	0.9886	0.9932	0.8412	R4	83.5
Test Power (W)	79.13	79.68	78.63	R5	82.2
THD A%	10.03	8.99	14.99	R6	82.5
Luminous Efficacy (lm/W)	128.0			R7	86.9
Total Luminous Flux (lm)	10130.0			R8	68.4
Color Rendering Index (CRI)	82.8			R9	7
R9	7			R10	69.4
Correlated Color Temperature (CCT) (K)	5391			R11	83.2
Chromaticity Chroma x	0.3350			R12	66.8
Chromaticity Chroma y	0.3495			R13	82
Chromaticity Chroma u	0.2054			R14	95.5
Chromaticity Chroma v	0.3214				
Duv	0.0029				
Chromaticity Chroma u'	0.2054				
Chromaticity Chroma v'	0.4822				

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 25.1 °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)	0.673
Power Factor	0.9893
Test Power (W)	79.94
Luminous Efficacy (lm/W)	124.8
Total Luminous Flux (lm)	9978.5
Beam Angle (°)	320.7
Center Beam Candle Power (cd)	278
Maximum Beam Candle Power (cd)	1082(At: C=270.0, Gamma=76.0)
Spacing Criteria	3.19 (0°-180°)/ 3.21(90°-270°)
Zonal Lumens in the 0°-60°Zone	22.86%
Zonal Lumens in the 60°-90°Zone	32.07%
Zonal Lumens in the 90°-120°Zone	29.86%
Zonal Lumens in the 120°-180°Zone	15.21%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

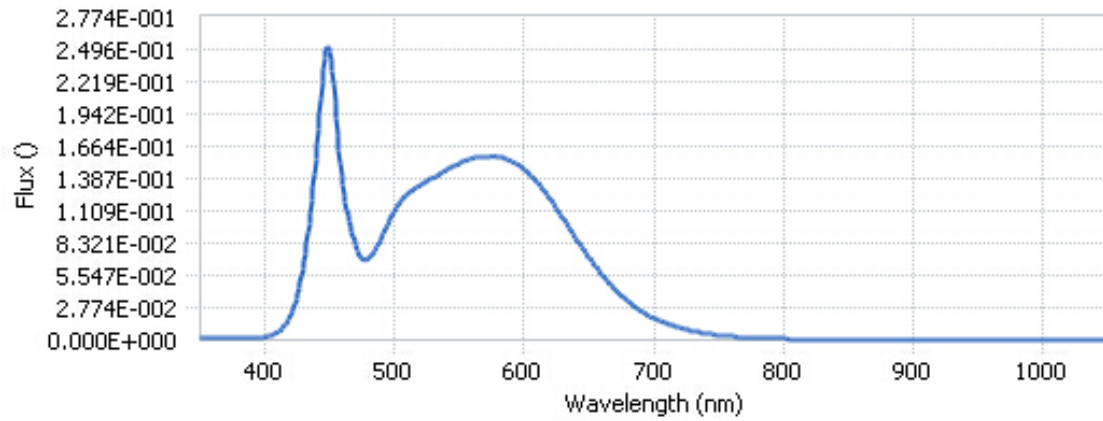


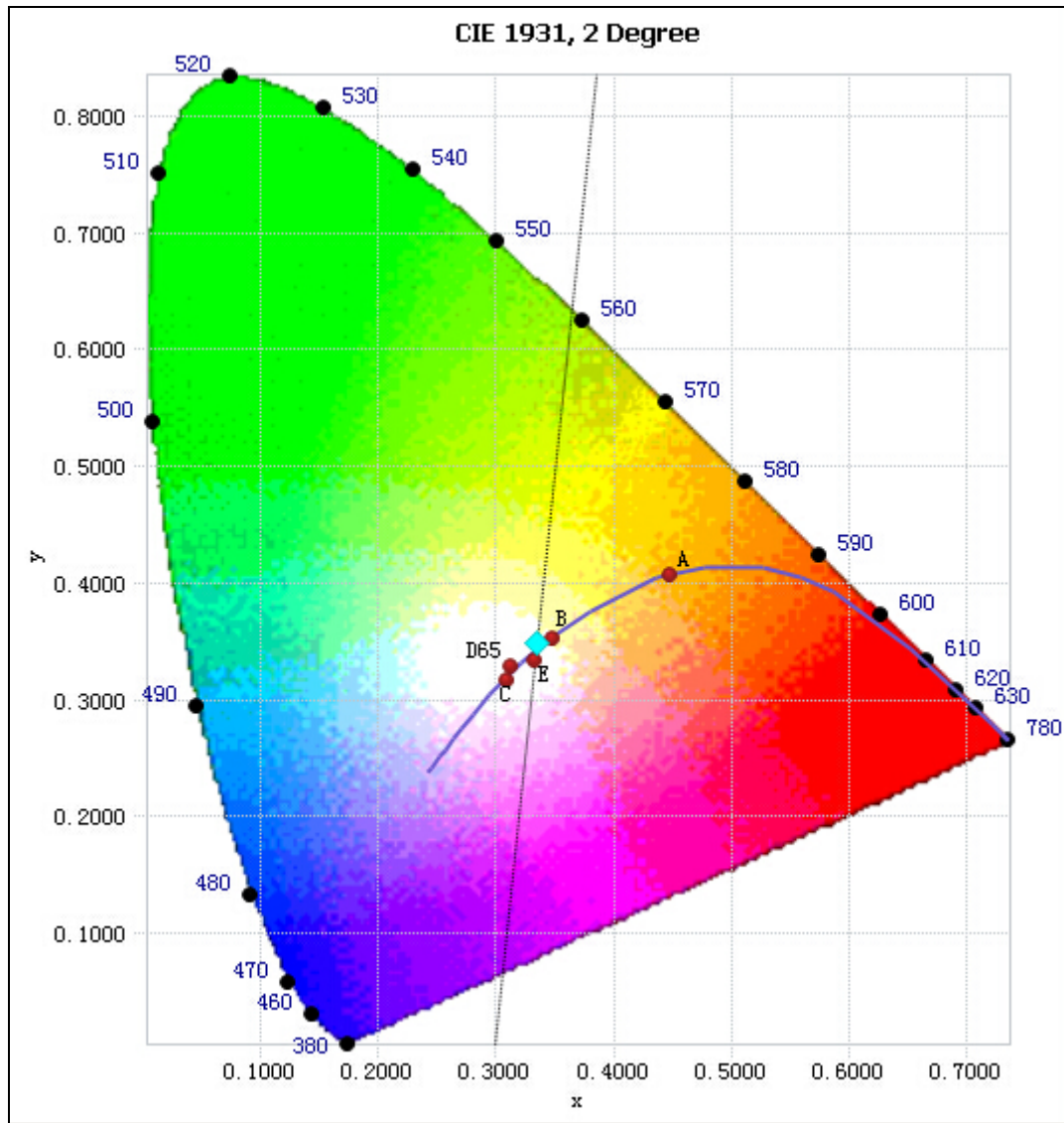
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.82E-03	485	7.76E-02	590	1.53E-01	695	2.20E-02
385	1.93E-03	490	8.82E-02	595	1.51E-01	700	1.89E-02
390	2.04E-03	495	1.00E-01	600	1.47E-01	705	1.63E-02
395	2.30E-03	500	1.11E-01	605	1.41E-01	710	1.40E-02
400	2.77E-03	505	1.20E-01	610	1.36E-01	715	1.21E-02
405	3.99E-03	510	1.25E-01	615	1.29E-01	720	1.05E-02
410	6.58E-03	515	1.30E-01	620	1.21E-01	725	8.99E-03
415	1.22E-02	520	1.33E-01	625	1.13E-01	730	7.74E-03
420	2.19E-02	525	1.36E-01	630	1.05E-01	735	6.58E-03
425	3.99E-02	530	1.39E-01	635	9.60E-02	740	5.69E-03
430	6.82E-02	535	1.43E-01	640	8.73E-02	745	4.88E-03
435	1.10E-01	540	1.46E-01	645	7.91E-02	750	4.23E-03
440	1.68E-01	545	1.49E-01	650	7.09E-02	755	3.64E-03
445	2.32E-01	550	1.51E-01	655	6.34E-02	760	3.12E-03
450	2.49E-01	555	1.54E-01	660	5.63E-02	765	2.73E-03
455	1.90E-01	560	1.56E-01	665	4.98E-02	770	2.35E-03
460	1.33E-01	565	1.57E-01	670	4.36E-02	775	2.01E-03
465	1.02E-01	570	1.58E-01	675	3.83E-02	780	1.72E-03
470	8.08E-02	575	1.58E-01	680	3.35E-02		
475	6.96E-02	580	1.57E-01	685	2.92E-02		
480	7.03E-02	585	1.56E-01	690	2.53E-02		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3350, 0.3495)

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

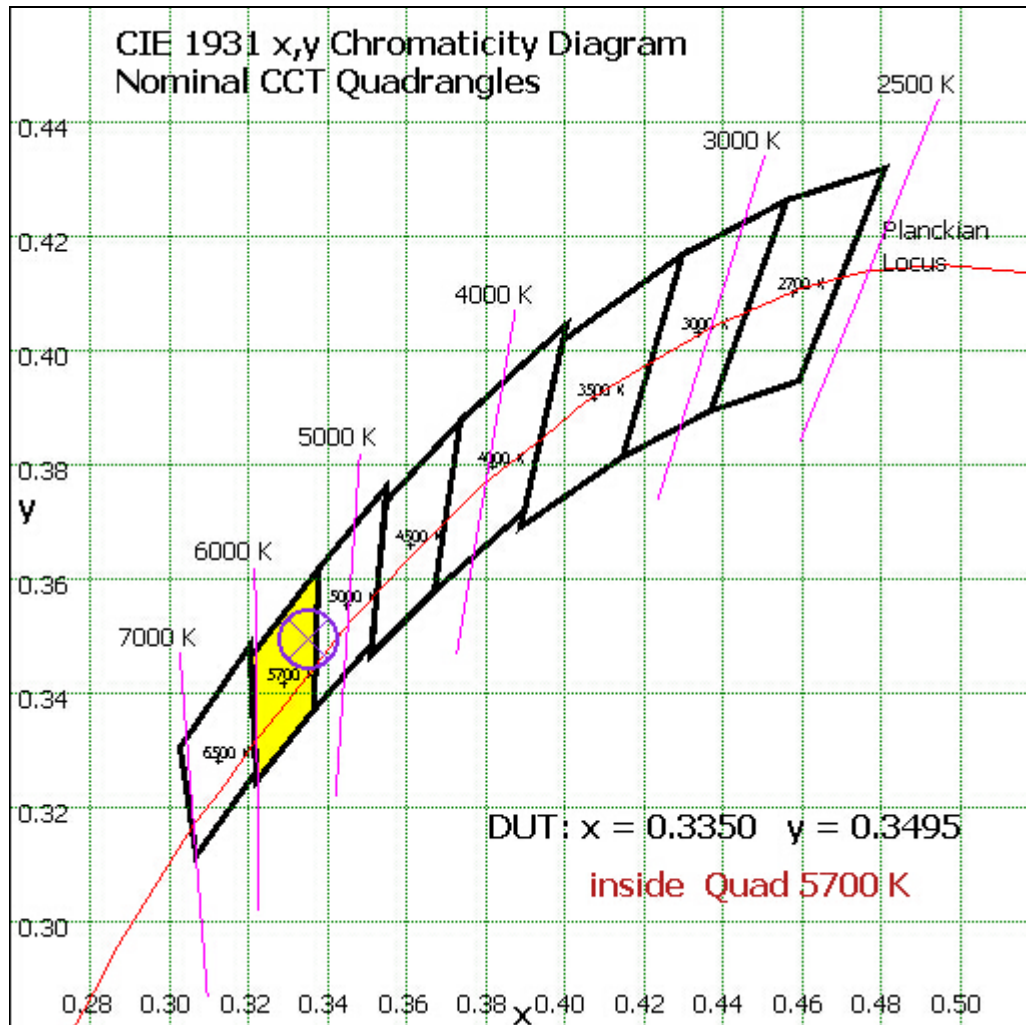


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

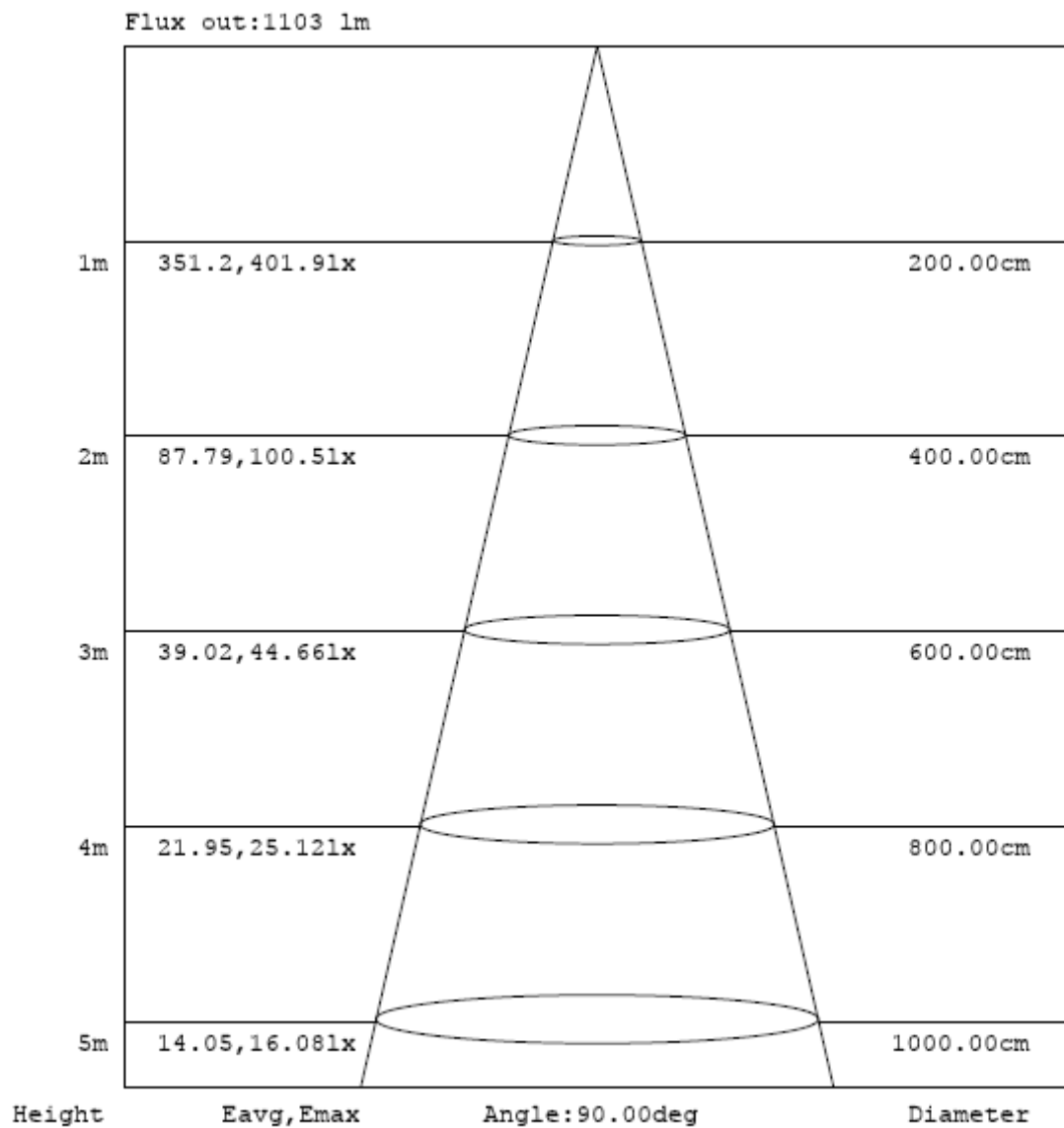
### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total	$\gamma(^{\circ})$	Lumens	% Total
0~ 5	6.854	0.07%	90~95	558.156	5.59%
5~10	21.738	0.22%	95~100	547.572	5.49%
10~15	40.684	0.41%	100~105	526.615	5.28%
15~20	66.753	0.67%	105~110	493.018	4.94%
20~25	100.817	1.01%	110~115	450.063	4.51%
25~30	142.024	1.42%	115~120	403.819	4.05%
30~35	190.491	1.91%	120~125	356.318	3.57%
35~40	241.507	2.42%	125~130	307.08	3.08%
40~45	292.311	2.93%	130~135	255.551	2.56%
45~50	343.499	3.44%	135~140	202.72	2.03%
50~55	393.877	3.95%	140~145	152.422	1.53%
55~60	440.747	4.42%	145~150	108.58	1.09%
60~65	481.21	4.82%	150~155	70.049	0.70%
65~70	512.709	5.14%	155~160	39.794	0.40%
70~75	535.798	5.37%	160~165	18.363	0.18%
75~80	550.461	5.52%	165~170	6.037	0.06%
80~85	558.303	5.60%	170~175	1.094	0.01%
85~90	561.394	5.63%	175~180	0.062	0.00%

$\gamma(^{\circ})$	Lumens	% Total
0-135	9379.369	94.00%
135-180	599.121	6.00%
0-180	9978.5	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

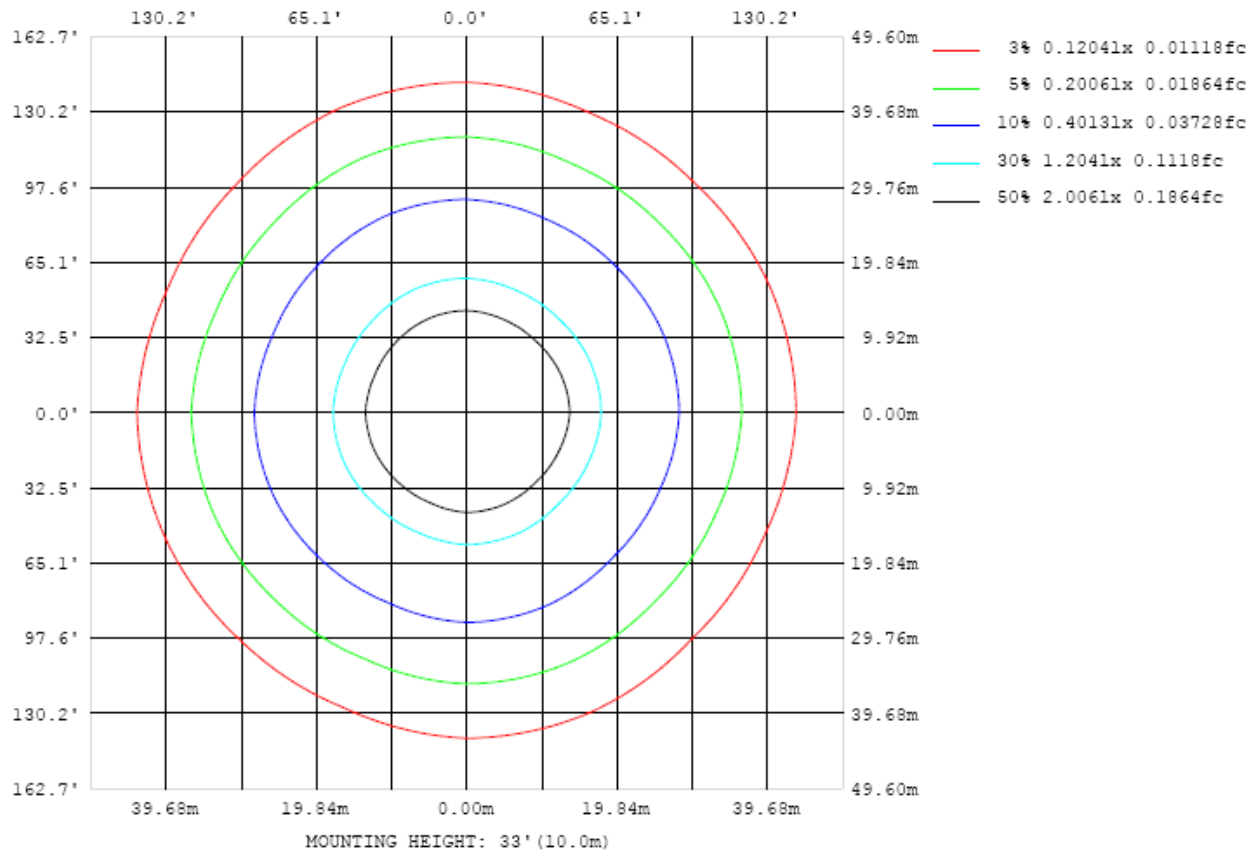


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

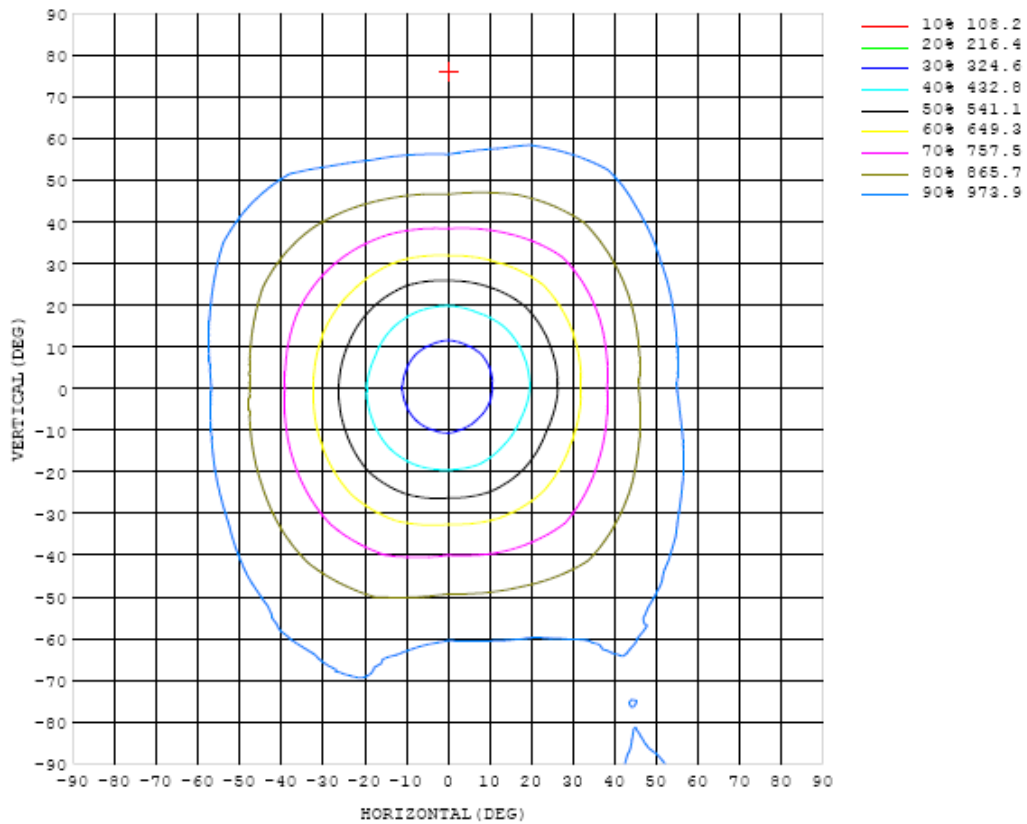


Chart 6: Isocandela Plot

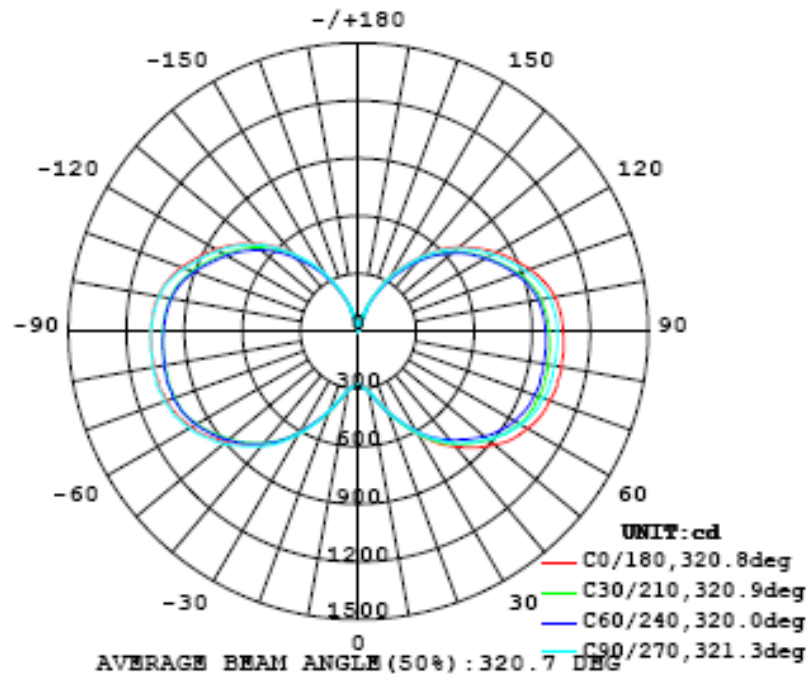


Chart 7: Polar Candela Distribution

## 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	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278			
5	293	294	294	294	294	294	293	292	290	289	289	289	290	290	291	292			
10	319	321	323	321	319	320	317	317	317	317	314	314	313	314	314	317			
15	370	378	378	371	369	369	368	369	367	373	367	365	362	369	364	367			
20	439	451	448	438	440	433	432	438	439	447	440	437	438	442	435	438			
25	519	530	520	516	520	506	505	515	520	525	520	517	528	525	513	518			
30	610	616	600	594	604	587	583	595	604	606	608	602	615	611	599	605			
35	708	696	675	675	685	665	664	682	697	689	694	694	708	695	676	693			
40	784	763	737	743	756	730	732	750	768	759	764	769	781	766	747	764			
45	856	824	795	808	817	789	790	815	834	819	826	837	846	824	814	831			
50	919	879	852	866	874	840	846	873	894	871	879	896	908	880	870	896			
55	975	926	897	919	929	891	897	929	954	921	929	956	963	931	924	954			
60	1012	963	933	962	968	933	938	979	999	965	970	1006	1009	972	964	995			
65	1042	985	959	994	1003	959	968	1011	1039	999	1002	1039	1046	999	996	1029			
70	1055	995	970	1011	1020	970	985	1030	1055	1010	1018	1059	1068	1013	1009	1044			
75	1068	997	974	1017	1027	979	990	1041	1074	1021	1020	1073	1079	1021	1015	1058			
80	1065	997	973	1019	1030	977	990	1040	1072	1018	1021	1075	1081	1018	1018	1057			
85	1066	993	973	1019	1032	979	991	1042	1075	1016	1015	1071	1077	1015	1013	1055			
90	1060	986	968	1016	1030	978	989	1039	1073	1011	1009	1065	1073	1010	1009	1049			
95	1051	977	961	1009	1022	973	983	1032	1067	1004	1000	1055	1063	1001	1000	1041			
100	1032	959	945	990	1005	959	967	1014	1052	989	983	1037	1047	986	985	1023			
105	996	928	915	958	972	931	937	979	1021	962	953	1003	1013	957	953	989			
110	945	881	869	912	921	884	890	930	973	915	904	951	959	906	904	936			
115	884	824	815	856	863	828	835	871	914	858	844	889	899	849	847	875			
120	822	767	759	793	802	775	780	810	852	802	787	827	838	795	791	813			
125	754	708	700	728	739	720	723	746	785	744	726	761	774	739	734	750			
130	683	641	634	659	668	658	657	677	712	678	657	691	702	672	664	677			
135	601	564	557	578	590	583	580	601	627	600	580	609	619	592	585	594			
140	502	479	471	486	497	498	494	509	525	514	492	513	524	506	497	501			
145	415	392	381	397	407	409	407	418	422	423	409	426	439	422	412	417			
150	320	307	296	302	317	324	320	326	328	335	325	330	343	336	326	323			
155	230	218	205	212	222	230	228	233	231	241	235	239	247	246	237	232			
160	145	136	126	131	137	146	147	147	146	158	152	155	161	162	152	146			
165	72.8	67.4	62.9	63.3	66.8	73.6	76.5	74.7	74.5	84.5	80.3	83.1	87.7	87.2	81.0	77.3			
170	23.9	21.8	20.1	19.7	21.2	23.4	25.1	27.1	27.7	30.8	30.9	32.8	33.4	33.2	30.4	27.4			
175	4.45	3.82	3.30	3.11	3.25	3.59	4.26	5.03	6.76	7.29	7.80	7.94	7.85	7.18	6.38	5.61			
180	0.72	0.72	0.72	0.73	0.74	0.73	0.73	0.72	0.72	0.72	0.72	0.73	0.72	0.73	0.73	0.73			

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  $4\pi$ . 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  $k=2$ .

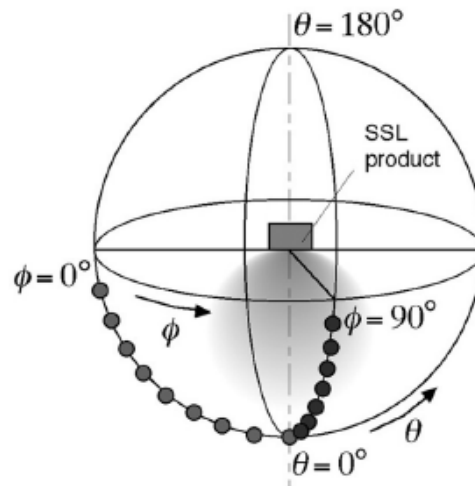
### **Color Characteristics Measurements**

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  $10^\circ$  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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