



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-L120-0036-E(X)3950

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15051012m/R1

This report is replaced the old report No. HZ15050012m 1 dated Jun. 01, 2015

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

Review by:

April Zou

Engineer: April Zou
Jun. 04, 2015

Approved by  *Jim Zhang*

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-L120-0036-E(X)3950**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
125.9	4495.0	35.70	0.9707
CCT (K)	CRI	Stabilization Time (Light & Power)	
5312	83.4	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 15, 2015 to May 18, 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-L120-0036-E(X)3950
Electrical Ratings	: 100-277Vac, 50-60Hz, 36W
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: 108pcs
Manufacturer	: IKIO LED LIGHTING
Address	: 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	81.5
Voltage frequency (Hz)	60	60	60	R2	87.5
Test Current (A)	0.307	0.385	0.143	R3	92.1
Power Factor	0.9707	0.9408	0.9030	R4	84.1
Test Power (W)	35.70	36.20	35.63	R5	83
THD A%	13.48	13.41	14.06	R6	83.3
Luminous Efficacy (lm/W)	125.9			R7	87.1
Total Luminous Flux (lm)	4495.0			R8	69
Color Rendering Index (CRI)	83.4			R9	9.5
R9	9.5			R10	70.9
Correlated Color Temperature (CCT) (K)	5312			R11	84
Chromaticity Chroma x	0.3370			R12	67.7
Chromaticity Chroma y	0.3504			R13	82.8
Chromaticity Chroma u	0.2064			R14	95.8
Chromaticity Chroma v	0.3219				
Duv	0.0024				
Chromaticity Chroma u'	0.2064				
Chromaticity Chroma v'	0.4829				

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)	0.305
Power Factor	0.9771
Test Power (W)	35.78
Luminous Efficacy (lm/W)	123.9
Total Luminous Flux (lm)	4432.1
Beam Angle (°)	316.3
Center Beam Candle Power (cd)	186
Maximum Beam Candle Power (cd)	435.9(At: C=112.5, Gamma=64.5)
Spacing Criteria	2.60 (0°-180°)/ 2.60(90°-270°)
Zonal Lumens in the 0°-60°Zone	25.19%
Zonal Lumens in the 60°-90°Zone	30.21%
Zonal Lumens in the 90°-120°Zone	28.60%
Zonal Lumens in the 120°-180°Zone	16.00%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

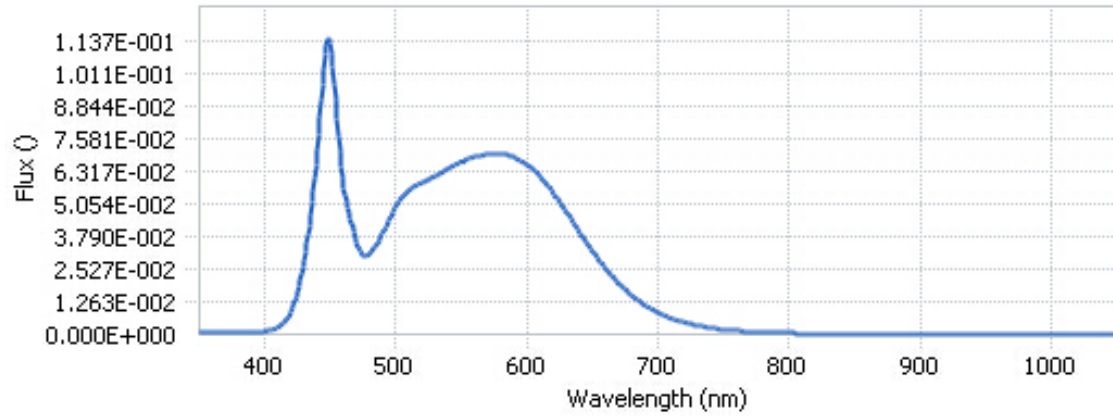
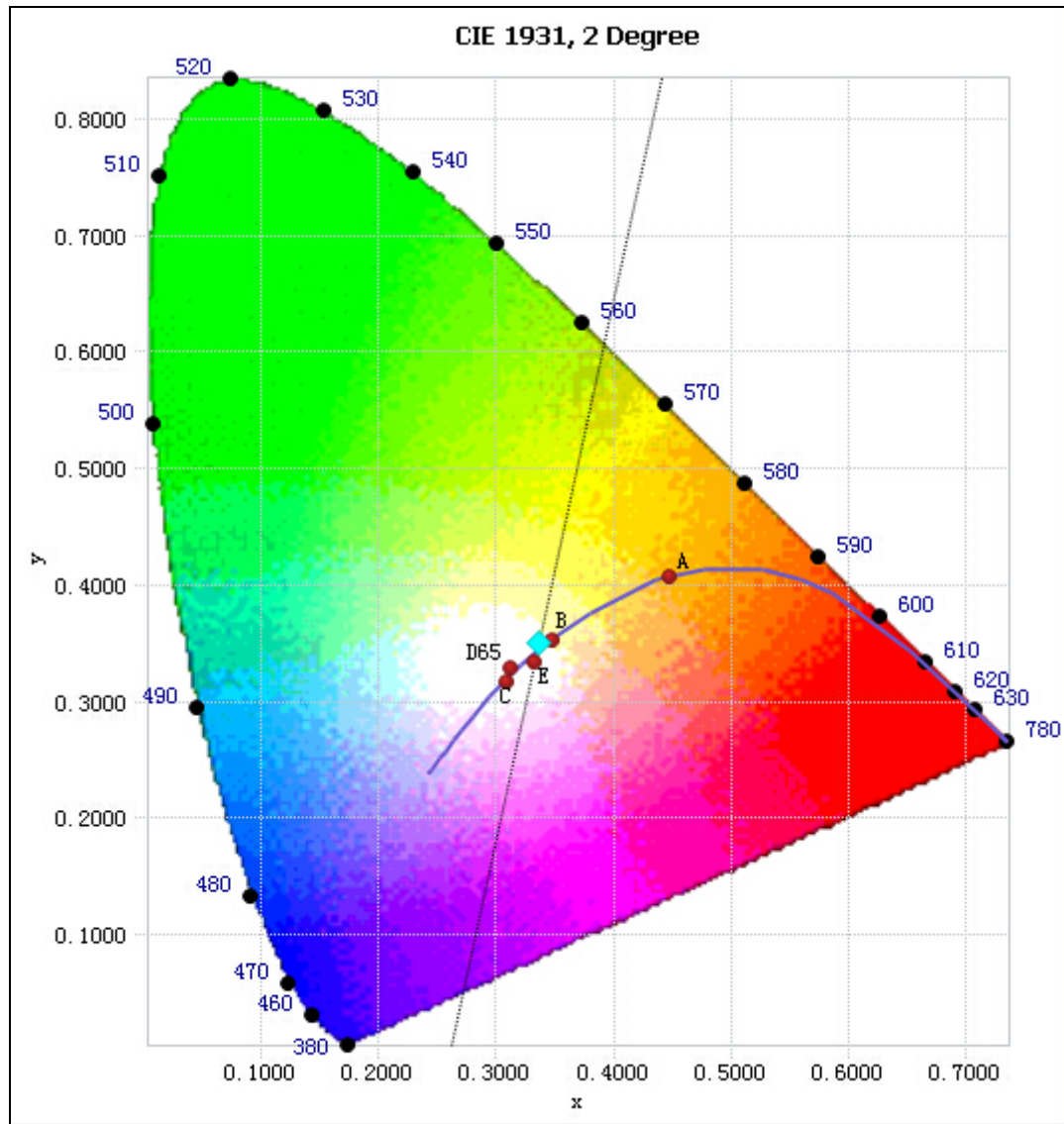


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.56E-04	485	3.47E-02	590	6.86E-02	695	9.80E-03
385	8.21E-04	490	3.94E-02	595	6.75E-02	700	8.46E-03
390	8.92E-04	495	4.47E-02	600	6.57E-02	705	7.25E-03
395	9.15E-04	500	4.96E-02	605	6.38E-02	710	6.22E-03
400	1.14E-03	505	5.33E-02	610	6.12E-02	715	5.37E-03
405	1.60E-03	510	5.59E-02	615	5.81E-02	720	4.64E-03
410	2.64E-03	515	5.75E-02	620	5.48E-02	725	3.97E-03
415	4.87E-03	520	5.89E-02	625	5.12E-02	730	3.40E-03
420	8.99E-03	525	6.01E-02	630	4.75E-02	735	2.93E-03
425	1.66E-02	530	6.13E-02	635	4.36E-02	740	2.51E-03
430	2.87E-02	535	6.27E-02	640	3.98E-02	745	2.13E-03
435	4.66E-02	540	6.44E-02	645	3.59E-02	750	1.84E-03
440	7.16E-02	545	6.56E-02	650	3.23E-02	755	1.58E-03
445	1.03E-01	550	6.70E-02	655	2.88E-02	760	1.37E-03
450	1.13E-01	555	6.79E-02	660	2.56E-02	765	1.16E-03
455	8.35E-02	560	6.88E-02	665	2.26E-02	770	1.02E-03
460	5.64E-02	565	6.91E-02	670	1.97E-02	775	8.69E-04
465	4.50E-02	570	6.96E-02	675	1.73E-02	780	7.52E-04
470	3.56E-02	575	6.97E-02	680	1.52E-02		
475	3.04E-02	580	6.97E-02	685	1.31E-02		
480	3.14E-02	585	6.95E-02	690	1.13E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3370, 0.3504)

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

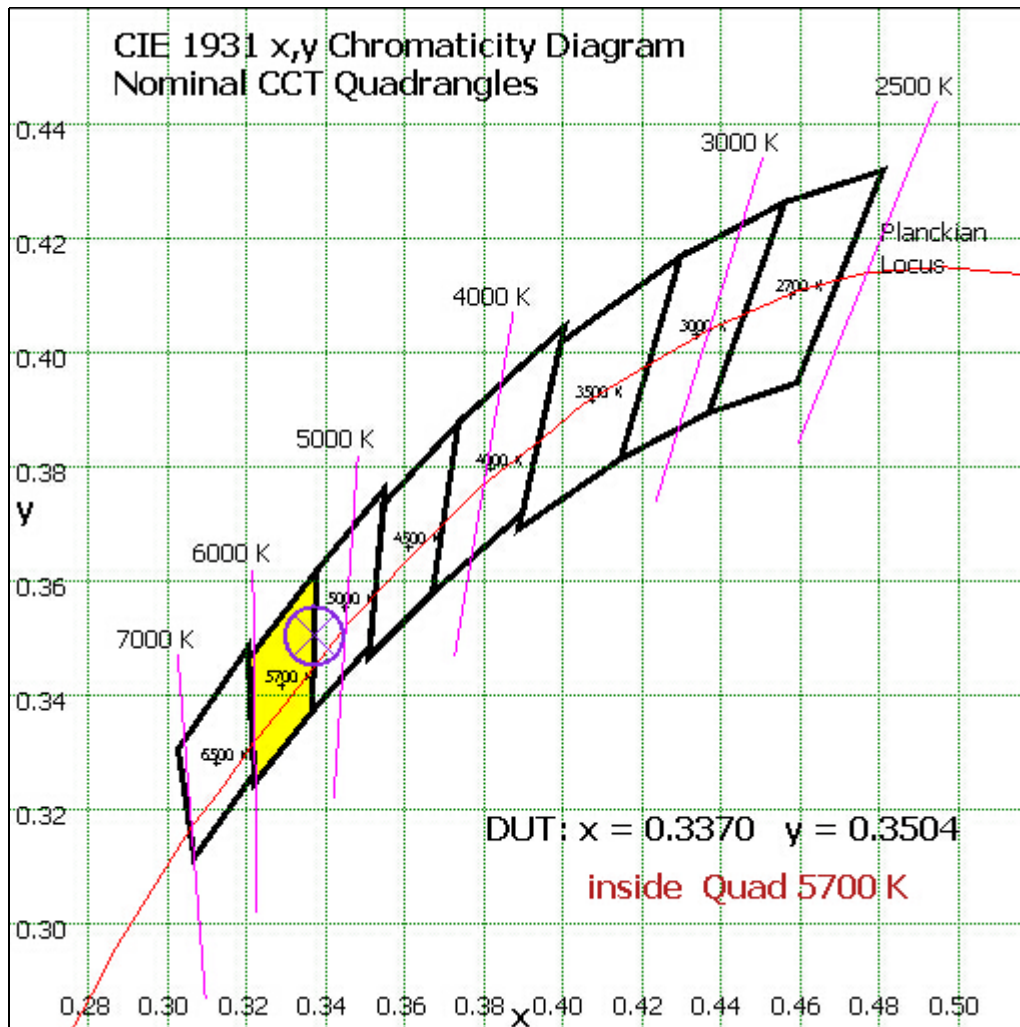


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

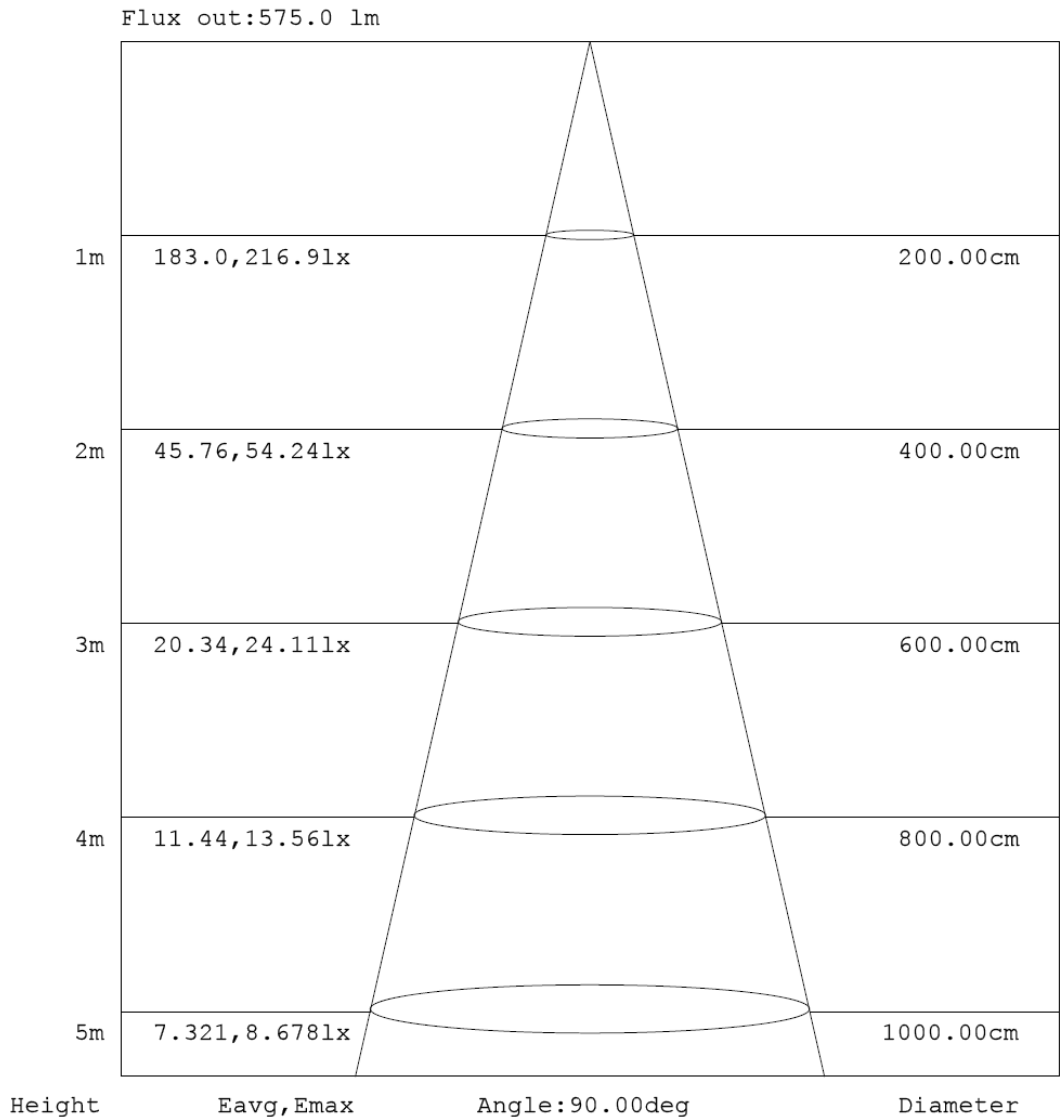
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total	$\gamma(^{\circ})$	Lumens	% Total
0~5	4.474	0.10%	90~95	232.169	5.24%
5~10	13.734	0.31%	95~100	228.03	5.14%
10~15	24.747	0.56%	100~105	220.77	4.98%
15~20	38.918	0.88%	105~110	210.158	4.74%
20~25	56.196	1.27%	110~115	196.423	4.43%
25~30	75.653	1.71%	115~120	179.982	4.06%
30~35	97.588	2.20%	120~125	161.247	3.64%
35~40	120.715	2.72%	125~130	140.559	3.17%
40~45	142.949	3.23%	130~135	118.196	2.67%
45~50	163.613	3.69%	135~140	94.979	2.14%
50~55	181.453	4.09%	140~145	72.195	1.63%
55~60	196.338	4.43%	145~150	52.529	1.19%
60~65	208.271	4.70%	150~155	35.095	0.79%
65~70	217.079	4.90%	155~160	20.536	0.46%
70~75	223.495	5.04%	160~165	9.818	0.22%
75~80	227.729	5.14%	165~170	3.281	0.07%
80~85	229.622	5.18%	170~175	0.585	0.01%
85~90	232.917	5.26%	175~180	0.038	0.00%

$\gamma(^{\circ})$	Lumens	% Total
0-135	4143.025	93.48%
135-180	289.056	6.52%
0-180	4432.1	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

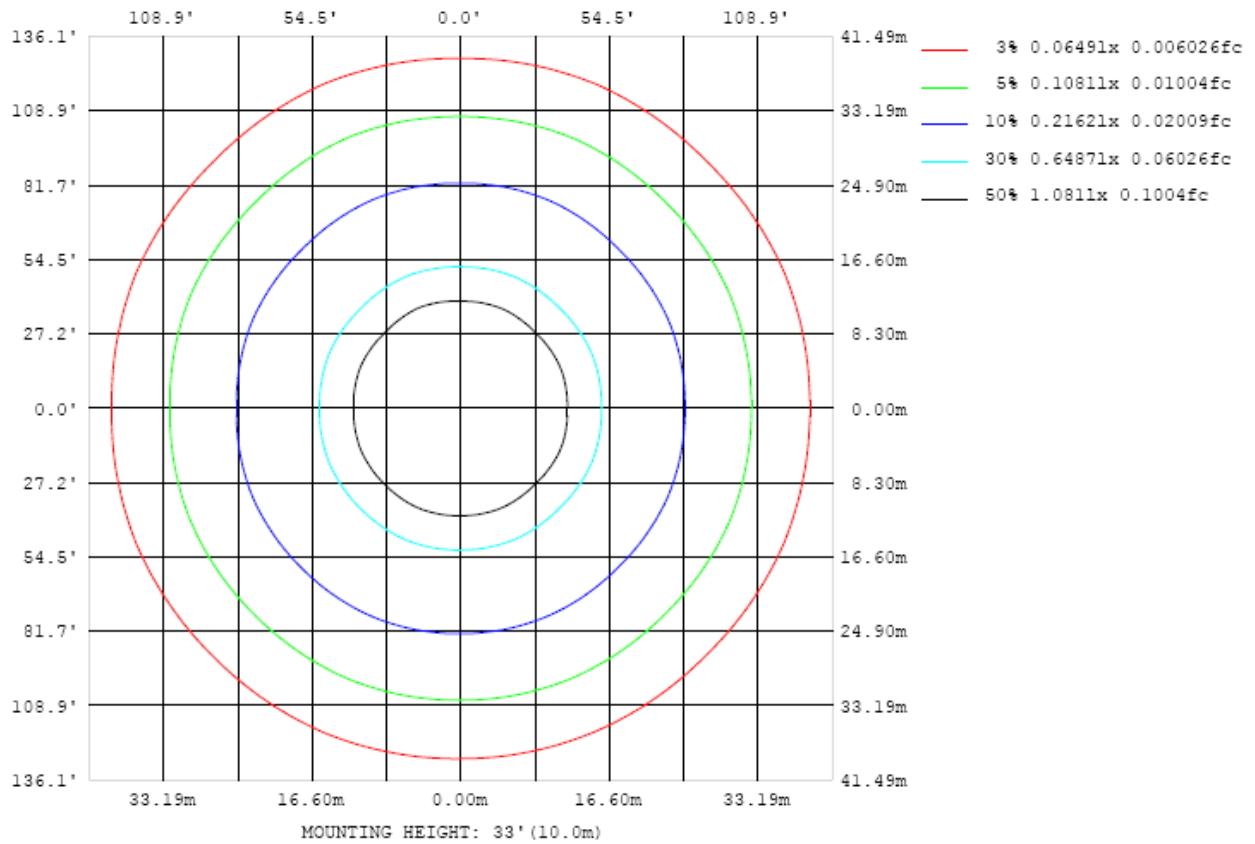


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

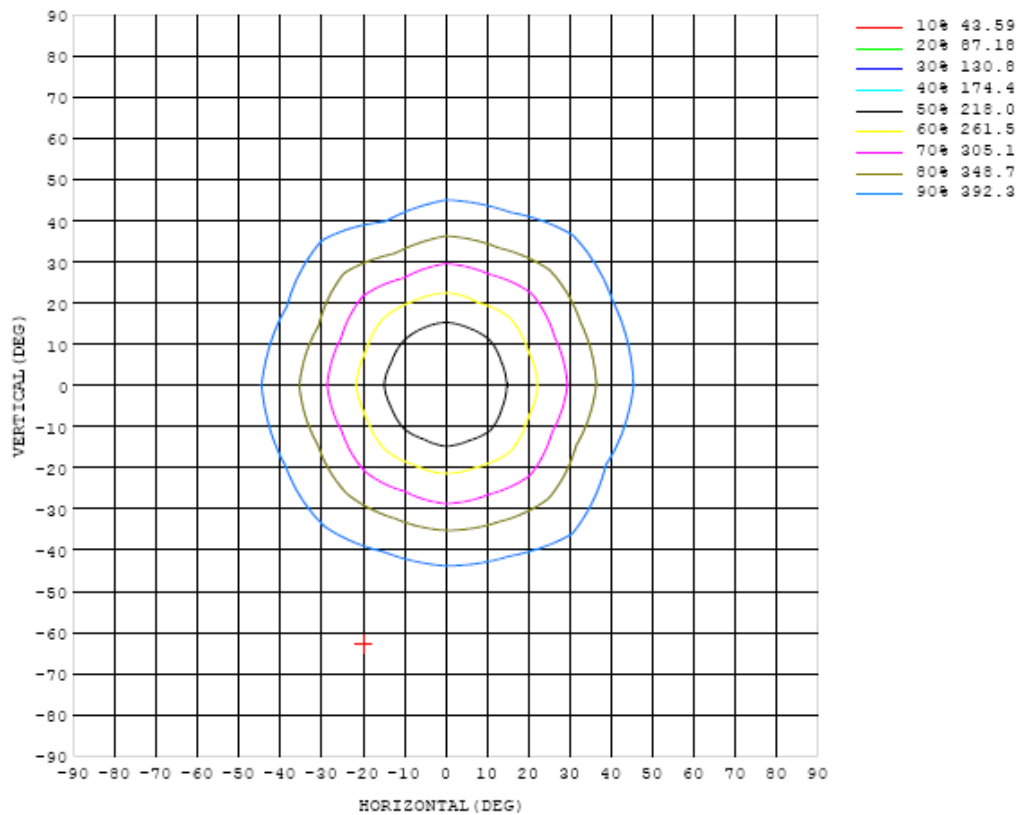


Chart 6: Isocandela Plot

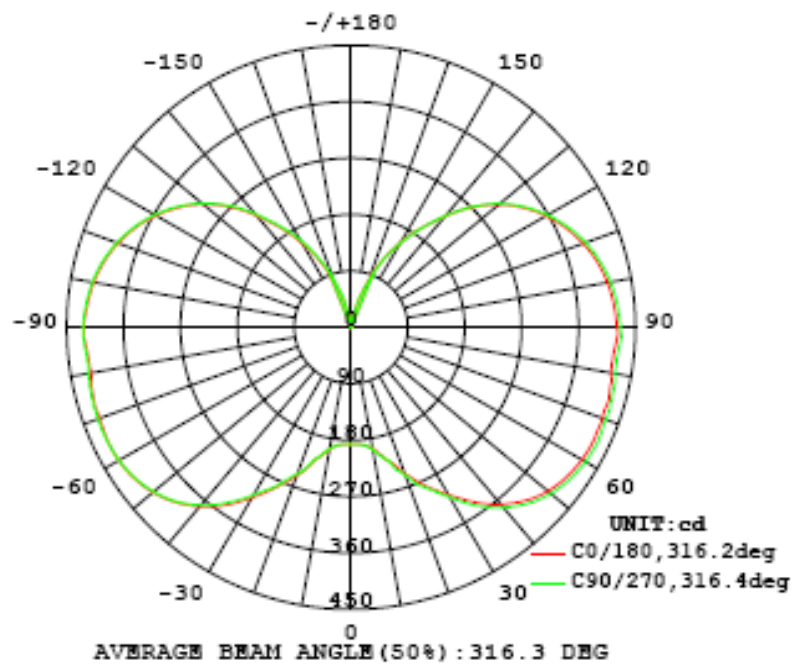


Chart 7: Polar Candela Distribution

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	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186	186			
5	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188	188			
10	196	197	196	198	197	199	198	199	198	197	197	197	196	196	196	196			
15	220	219	216	220	218	222	220	223	218	221	219	219	217	219	217	221			
20	249	251	248	254	251	257	253	257	251	254	249	252	249	254	247	252			
25	279	285	277	284	283	291	285	289	282	288	281	286	279	280	277	283			
30	309	318	308	316	313	320	317	323	313	322	310	319	309	313	305	314			
35	341	352	340	347	347	352	348	355	346	357	342	356	341	346	338	345			
40	369	381	368	375	375	379	375	380	373	382	369	384	370	374	366	373			
45	391	401	389	398	397	402	396	401	394	403	393	405	393	395	388	395			
50	407	415	404	413	412	418	412	417	409	418	408	420	408	413	404	412			
55	416	423	413	423	423	428	422	427	419	426	418	428	418	424	414	423			
60	422	427	419	428	429	434	428	432	425	432	423	433	424	429	420	429			
65	424	429	422	430	431	436	430	434	426	434	425	434	426	431	422	432			
70	423	428	421	429	429	434	430	433	424	432	424	434	426	431	422	430			
75	423	426	420	427	428	433	427	432	422	431	423	433	425	429	420	429			
80	418	423	416	424	425	432	426	427	419	429	421	430	423	427	418	425			
85	418	422	416	424	425	430	424	428	420	428	420	430	422	426	415	425			
90	421	424	417	425	426	432	427	431	423	431	422	432	424	427	418	428			
95	417	421	414	421	423	429	423	427	419	427	419	429	421	424	415	424			
100	412	416	409	415	417	423	417	421	414	422	413	424	416	419	410	419			
105	404	407	400	406	408	413	408	412	405	413	404	415	407	411	401	411			
110	391	395	387	394	395	400	395	400	393	401	391	403	395	399	389	398			
115	375	380	371	378	379	384	379	383	377	385	375	388	379	384	373	383			
120	356	361	352	358	359	364	359	363	357	366	356	368	359	365	354	364			
125	333	338	328	334	335	340	336	339	334	342	333	345	336	342	331	341			
130	305	311	300	305	307	311	307	311	306	314	305	317	308	314	304	313			
135	271	279	267	272	273	276	272	276	273	281	272	284	275	281	272	279			
140	232	240	228	232	233	236	232	237	233	244	233	248	237	242	233	239			
145	193	200	188	193	193	197	193	199	194	204	194	208	198	202	195	200			
150	156	161	152	157	155	160	154	160	156	160	157	161	161	162	160	161			
155	119	120	113	118	118	118	115	121	117	112	120	114	122	118	121	119			
160	78.0	76.4	73.2	75.0	72.6	75.2	75.1	76.4	76.3	71.4	79.8	74.2	82.8	75.0	80.7	74.4			
165	43.3	41.7	40.3	42.1	42.0	42.2	39.3	40.5	40.2	39.3	45.5	40.5	48.1	43.9	47.3	44.7			
170	16.2	14.2	14.3	15.1	15.0	14.4	11.1	6.92	12.8	13.0	16.3	15.8	17.4	17.5	17.7	16.2			
175	2.68	2.58	2.61	3.06	2.40	2.64	2.71	2.13	2.48	2.55	2.99	3.27	3.31	3.63	3.58	3.69			
180	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37			

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 $k=2$.

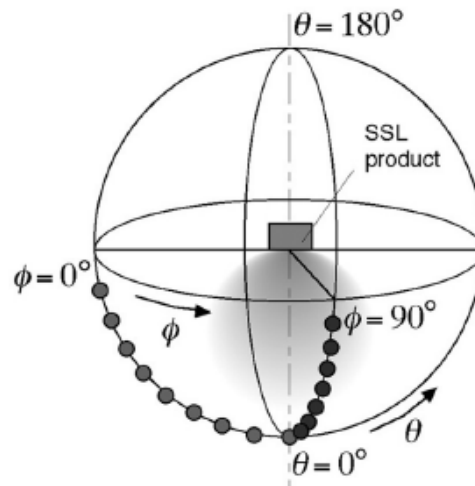
Color Characteristics Measurements

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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