

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

LED Commercial Downlight

Model: 14CDLA4/830/277V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19050008a

The test data of **High setting** in this report comes from report No. HZ16020003c/R1 dated Mar. 31, 2016.

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

Review by:



Engineer: April Zou
May 15, 2019

Approved by:



Manager: Jim Zhang
May 15, 2019

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: 14CDLA4/830/277V (High Setting)

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
80.4	1100.0	13.68	0.9910
CCT (K)	CRI	Stabilization Time (Light & Power)	
3105	82.9	60	

Sample Tested: 14CDLA4/830/277V (Med Setting)

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
87.8	785.6	8.95	0.9867
CCT (K)	CRI	Stabilization Time (Light & Power)	
3047	83.0	60	

Sample Tested: 14CDLA4/830/277V (Low Setting)

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
93.6	559.9	5.98	0.9805
CCT (K)	CRI	Stabilization Time (Light & Power)	
3041	83.4	60	

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, 2019
Date of Test	: May 14, 2019
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 ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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SAMPLE PHOTO

The power and light output can be adjusted by this dip switch.

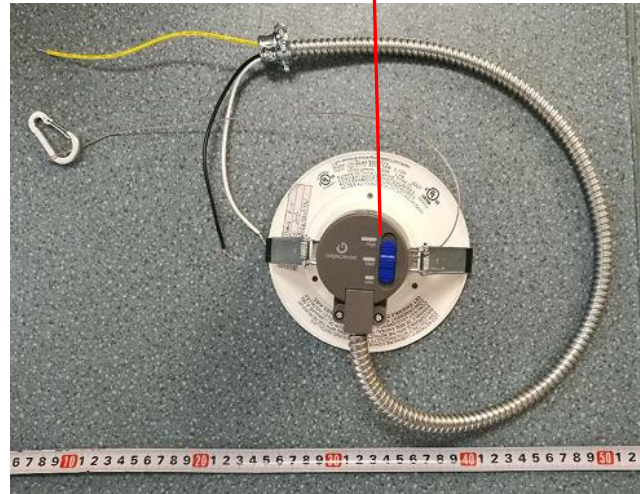


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Commercial Downlight
Model	: 14CDLA4/830/277V
Electrical Ratings	: 120-277V, 50/60Hz, 14W (Max)
Product Description	: 3000K, Non-dimmable, CRI80 Field-Adjustable Light Output (3 settings: Low, Mid and High) Manufacturer of LED light source: Lextar Electronics Corp Model of LED light source: PC35H11
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

TEST RESULTS

Test ambient temperature was 26.0 °C.

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

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 65 minutes.

This product has **Field-Adjustable Light Output function**, the tests were conducted at **High, Med** and **Low** settings separately adjusted by the **dip switch** on the back.

Sphere-Spectroradiometer Method

Parameter	Result						Special Color Rendering Indices of Med Setting	
	High setting		Med setting		Low setting			
Test Voltage (V)	120.0	277.0	120.0	277.0	120.0	277.0	R1	81.5
Voltage frequency (Hz)	60	60	60	60	60	60	R2	91.8
Test Current (A)	0.115	0.051	0.076	0.039	0.051	0.029	R3	95.6
Power Factor	0.9910	0.9124	0.9867	0.8750	0.9805	0.8159	R4	80.6
Test Power (W)	13.68	12.77	8.95	9.38	5.98	6.54	R5	82
THD A%	8.98	20.43	10.79	28.35	10.87	35.98	R6	90
Luminous Efficacy (lm/W)	80.4	79.5	87.8	85.8	93.6	88.8	R7	82.4
Total Luminous Flux (lm)	1100.0	1015.0	785.6	804.6	559.9	580.8	R8	59.2
Color Rendering Index (CRI)	82.9						R9	7.4
R9	7.4						R10	81.2
Correlated Color Temperature (CCT)(K)	3105						R11	80
Chromaticity Chroma x	0.4281						R12	73.4
Chromaticity Chroma y	0.3984						R13	84.1
Chromaticity Chroma u	0.2473						R14	98.3
Chromaticity Chroma v	0.3452							
Duv	0.0015							
Chromaticity Chroma u ’	0.2473							
Chromaticity Chroma v’	0.5178							

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 24.7 °C.

The photometric distance is 2.47 m.

Luminous data was taken at 0.5 vertical intervals and 10 horizontal intervals.

Parameter	Result		
	High setting	Med setting	Low setting
Test Voltage (V)	120.0	120.0	120.0
Voltage frequency (Hz)	60	60	60
Test Current (A)	0.118	0.076	0.051
Power Factor	0.9932	0.9862	0.9801
Power (W)	14.09	9.03	6.00
Luminous Efficacy (lm/W)	80.3	88.4	94.8
Total Luminous Flux (lm)	1131.5	798.4	568.7
Beam Angle (°)	96.5		
Center Beam Candle Power (cd)	497		
Spacing Criteria	1.19 (0°-180°)/ 1.18 (90°-270°)		
Zonal Lumens in the 0°-60° Zone	86.74%		
Zonal Lumens in the 60°-90° Zone	13.20%		
Zonal Lumens in the 90°-120° Zone	0.02%		
Zonal Lumens in the 120°-180° Zone	0.05%		

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method of High Setting

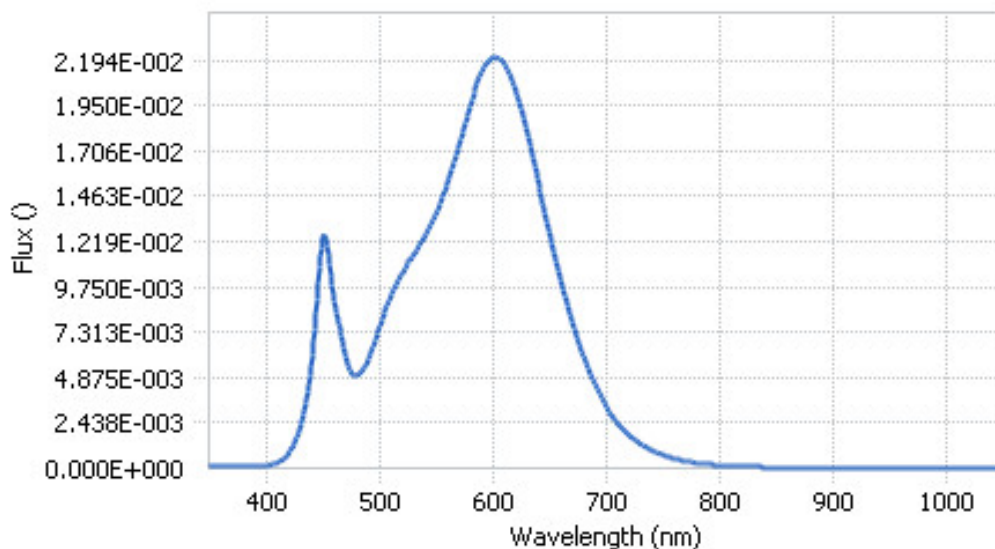
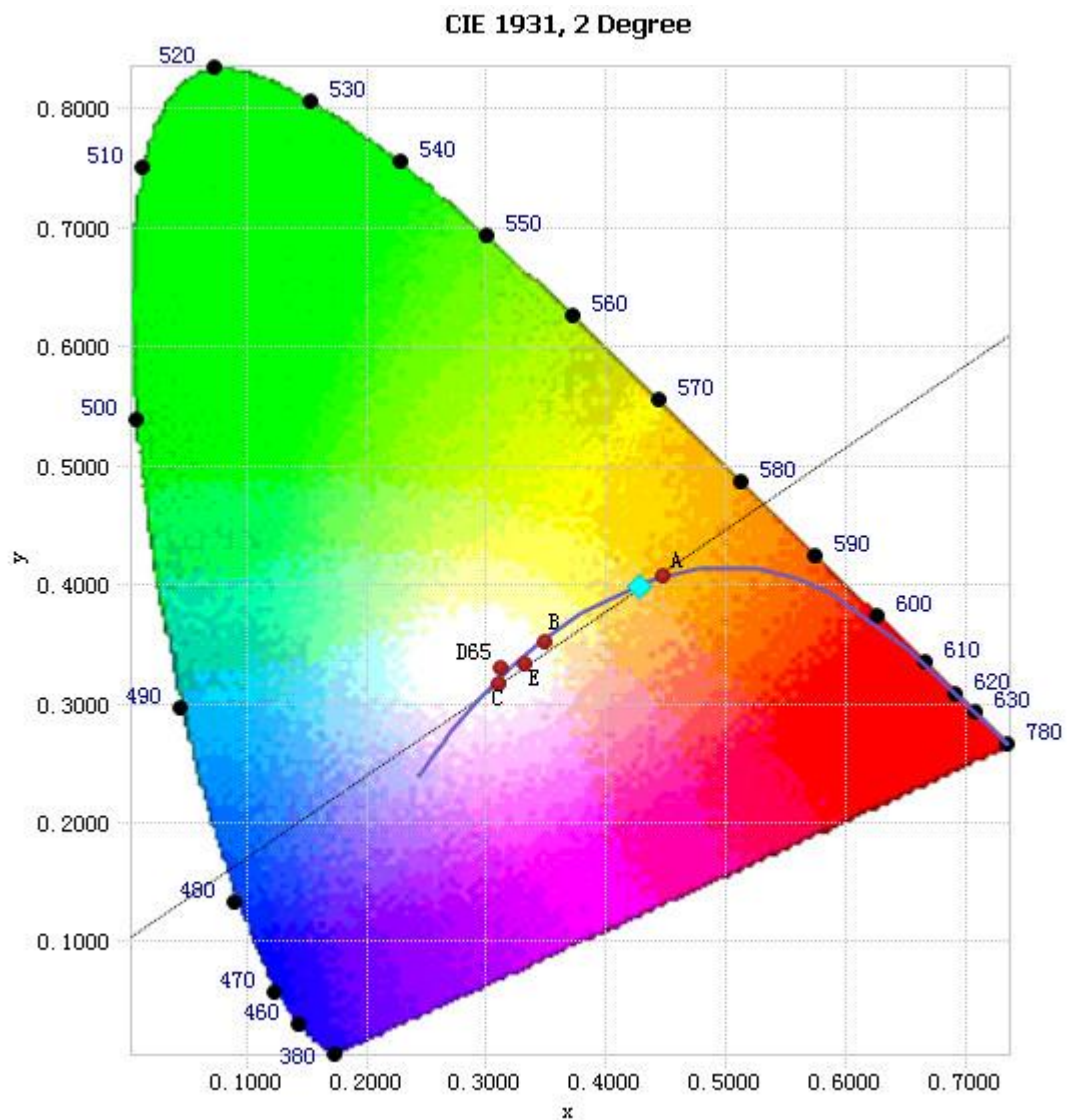


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.32E-04	485	5.23E-03	590	2.13E-02	695	3.87E-03
385	1.35E-04	490	5.81E-03	595	2.18E-02	700	3.30E-03
390	1.37E-04	495	6.63E-03	600	2.21E-02	705	2.82E-03
395	1.36E-04	500	7.58E-03	605	2.20E-02	710	2.41E-03
400	1.54E-04	505	8.52E-03	610	2.17E-02	715	2.07E-03
405	1.93E-04	510	9.32E-03	615	2.12E-02	720	1.78E-03
410	2.68E-04	515	9.99E-03	620	2.03E-02	725	1.52E-03
415	4.52E-04	520	1.05E-02	625	1.92E-02	730	1.30E-03
420	7.60E-04	525	1.10E-02	630	1.80E-02	735	1.11E-03
425	1.30E-03	530	1.14E-02	635	1.67E-02	740	9.40E-04
430	2.13E-03	535	1.19E-02	640	1.54E-02	745	8.05E-04
435	3.42E-03	540	1.25E-02	645	1.40E-02	750	6.83E-04
440	5.49E-03	545	1.30E-02	650	1.26E-02	755	5.93E-04
445	9.12E-03	550	1.37E-02	655	1.13E-02	760	5.07E-04
450	1.24E-02	555	1.45E-02	660	1.01E-02	765	4.34E-04
455	1.15E-02	560	1.54E-02	665	8.90E-03	770	3.73E-04
460	8.95E-03	565	1.64E-02	670	7.79E-03	775	3.20E-04
465	7.57E-03	570	1.74E-02	675	6.82E-03	780	2.76E-04
470	6.24E-03	575	1.85E-02	680	5.94E-03		
475	5.18E-03	580	1.95E-02	685	5.15E-03		
480	4.96E-03	585	2.05E-02	690	4.48E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method of High Setting



Tristimulus values(x, y): (0.4281, 0.3984)

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 of High Setting

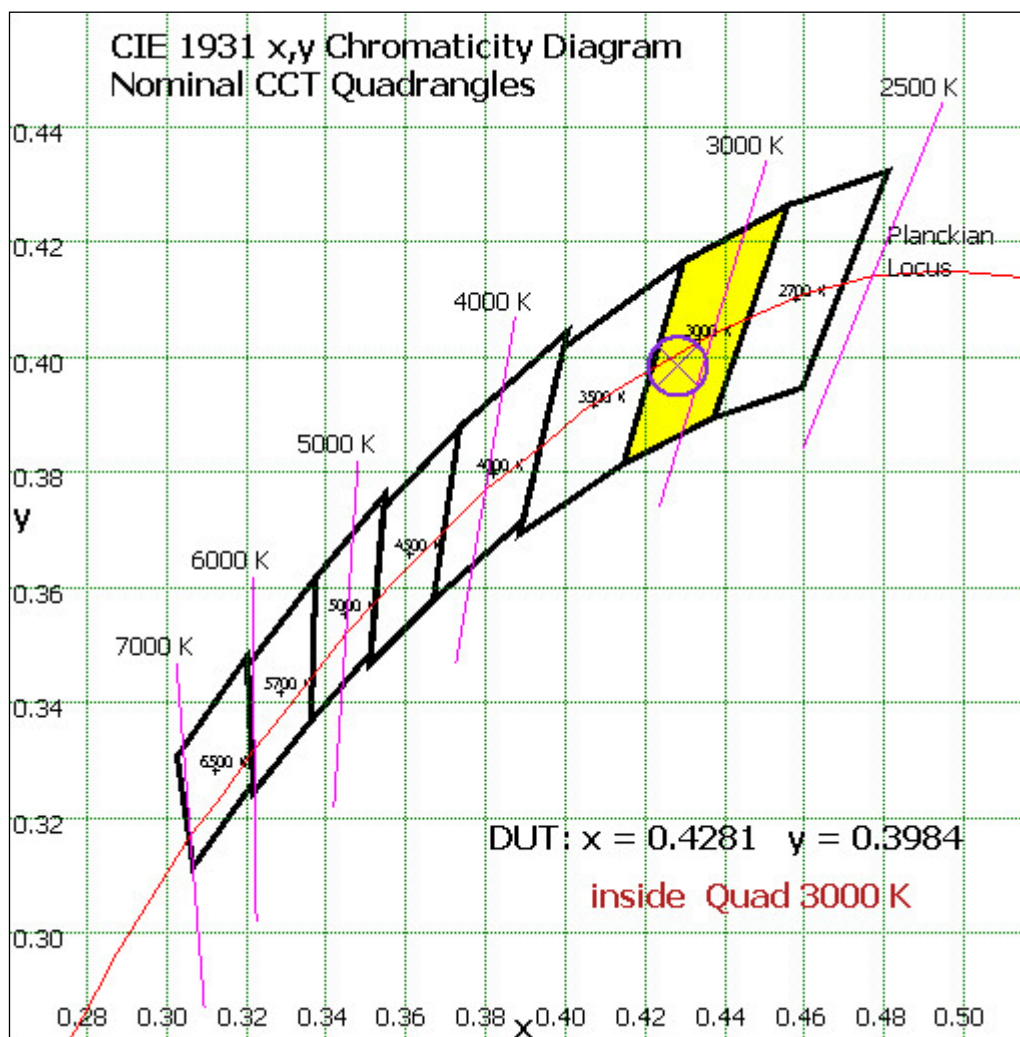
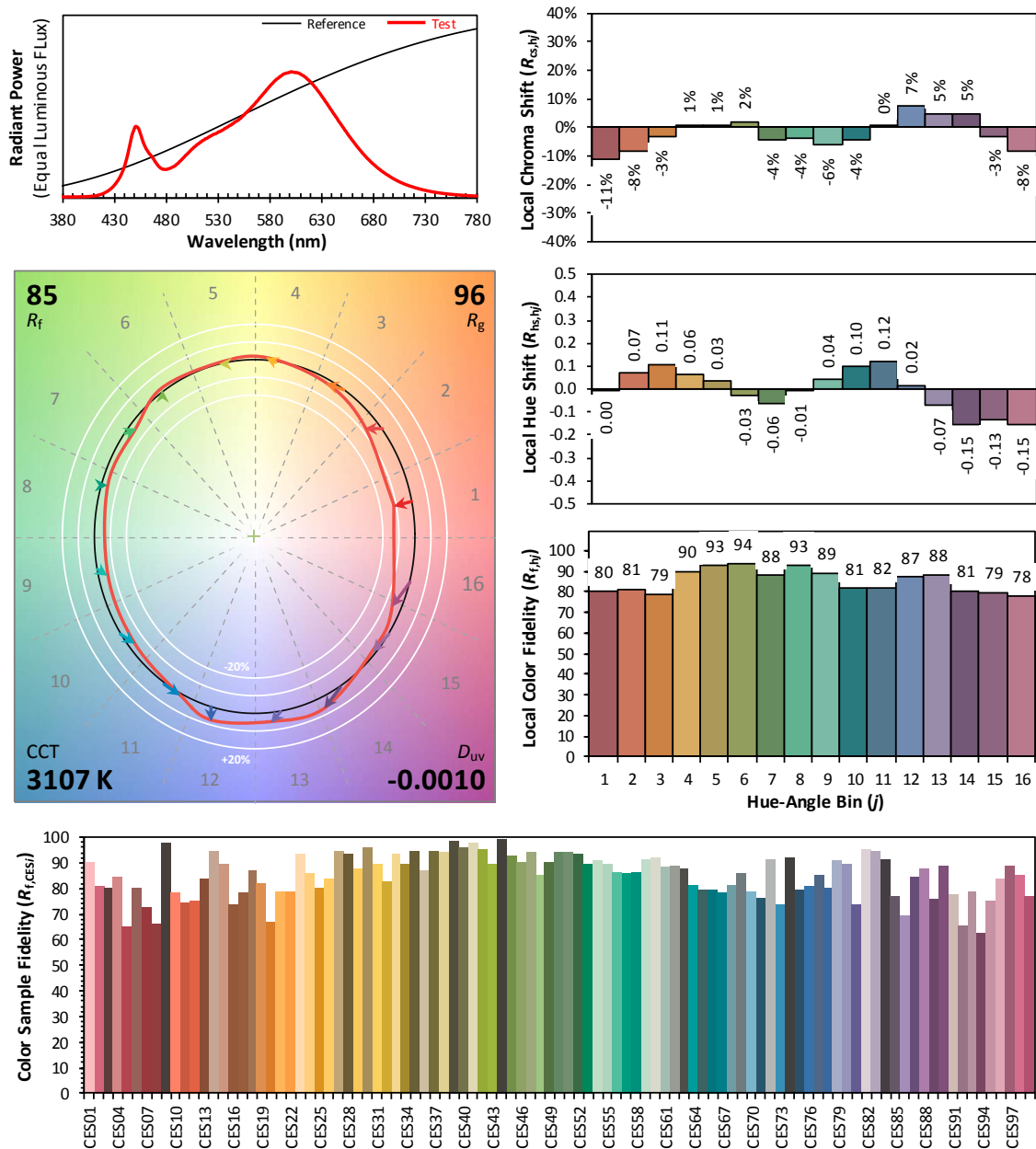


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method of High Setting



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x 0.4281

y 0.3984

u' 0.2473

v' 0.5178

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

Zonal Lumen Tabulation- Goniophotometer Method of High Setting

$\gamma(^{\circ})$	Lumens	% Total
0- 10	46.925	4.15%
10- 20	132.514	11.71%
20- 30	194.957	17.23%
30- 40	225.042	19.89%
40- 50	214.153	18.93%
50- 60	167.853	14.83%
60- 70	102.594	9.07%
70- 80	38.448	3.40%
80- 90	8.283	0.73%
90-100	0.035	0.00%
100-110	0.057	0.01%
110-120	0.082	0.01%
120-130	0.108	0.01%
130-140	0.139	0.01%
140-150	0.141	0.01%
150-160	0.109	0.01%
160-170	0.07	0.01%
170-180	0.025	0.00%
Total	1131.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	981.444	86.74%
60- 90	149.325	13.20%
0-90	1130.769	99.93%
90- 180	0.766	0.07%
0- 180	1131.5	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method of High Setting

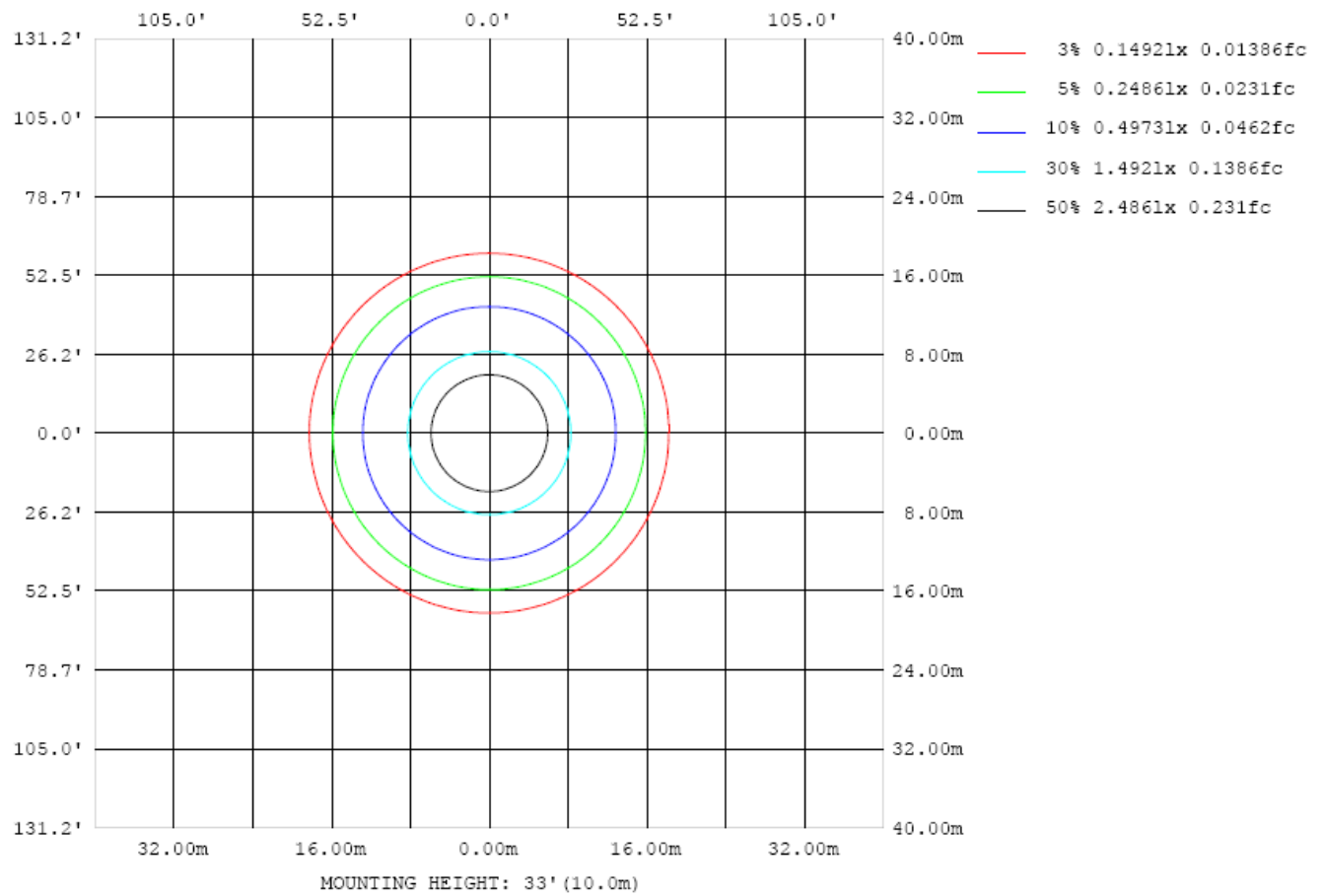


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method of High Setting

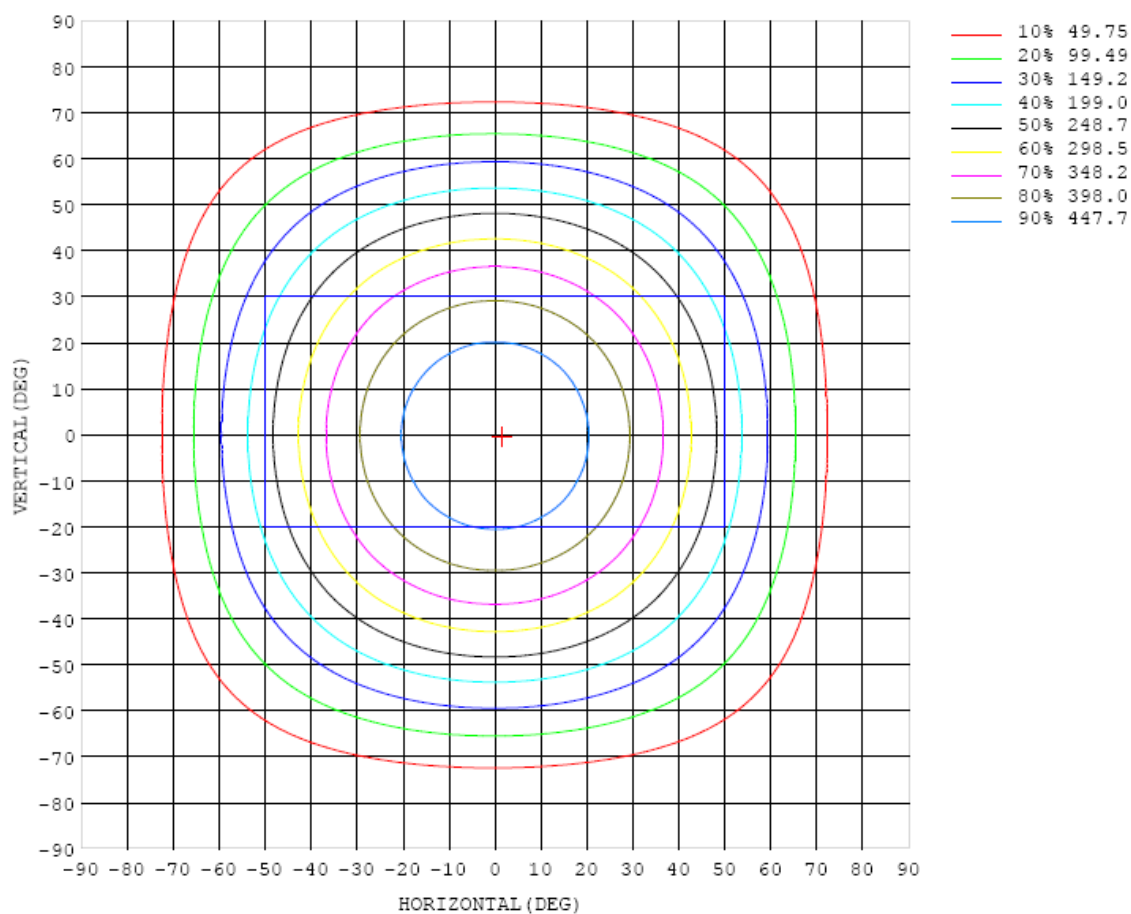


Chart 6: Isocandela Plot

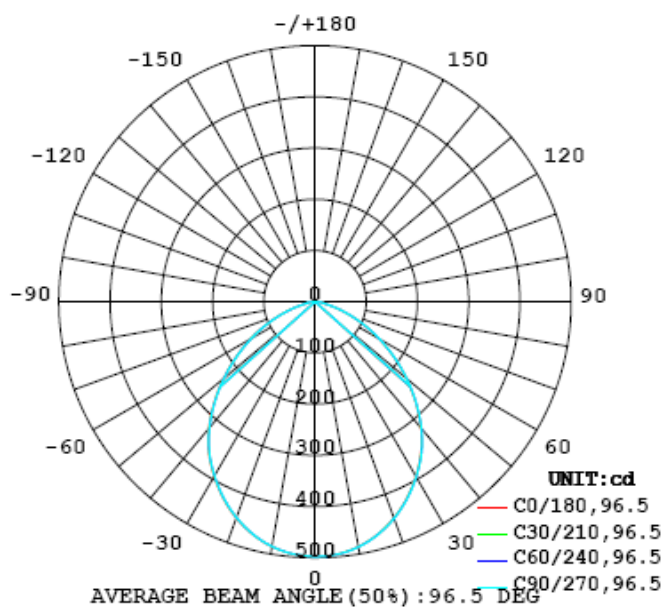


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method of High Setting

Table---1 UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497
5	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	494	495	494	494
10	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	485	486
15	470	471	471	471	471	471	471	471	471	471	471	471	471	471	471	471	471	470	470
20	449	449	450	450	450	450	450	451	451	451	451	450	450	450	450	450	450	450	450
25	423	424	423	424	424	424	425	425	425	425	425	425	425	425	424	424	424	424	424
30	393	394	394	394	394	394	395	395	395	395	395	395	395	395	395	395	395	394	394
35	360	360	360	361	361	362	362	362	362	362	362	362	362	362	362	362	362	361	362
40	321	321	322	322	322	323	323	323	323	323	323	323	323	323	323	323	323	322	323
45	278	278	278	278	279	279	279	279	279	279	279	279	279	279	279	279	279	278	279
50	232	232	233	233	233	233	233	234	234	234	234	234	234	234	234	234	233	233	234
55	187	187	187	188	188	188	188	188	188	188	189	189	189	189	189	188	188	188	189
60	144	144	144	144	144	144	144	145	145	145	145	145	145	145	145	145	145	145	146
65	102	102	103	103	103	103	103	103	104	104	104	104	104	104	104	104	104	104	105
70	64.5	64.5	64.5	64.7	64.9	65.0	65.6	65.5	65.7	66.0	66.1	66.3	66.3	66.3	66.4	66.3	66.3	66.1	66.9
75	33.8	33.9	33.9	34.0	34.2	34.2	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.1	35.1	35.1	35.1	35.0	35.2
80	16.4	16.3	16.3	16.3	16.3	16.3	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.3	16.3	16.3
85	7.36	7.36	7.39	7.39	7.41	7.41	7.46	7.49	7.51	7.52	7.52	7.54	7.52	7.51	7.52	7.49	7.49	7.42	7.55
90	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
95	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.04
100	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.05
105	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.07
110	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.09
115	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.10
120	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.12
125	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.14
130	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.17
135	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.21
140	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.24
145	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.27
150	0.18	0.18	0.18	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.28
155	0.19	0.18	0.18	0.19	0.19	0.18	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.19	0.18	0.19	0.19	0.19	0.28
160	0.19	0.19	0.19	0.19	0.20	0.19	0.20	0.20	0.20	0.20	0.19	0.20	0.20	0.19	0.20	0.20	0.20	0.19	0.28
165	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.28
170	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.28
175	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.28
180	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) Y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497	497		
5	494	494	494	494	494	494	494	494	494	494	494	494	494	494	494	495	495		
10	485	485	485	485	485	485	485	485	485	485	485	485	485	486	486	486	486		
15	470	470	470	470	470	470	470	470	470	470	470	470	470	470	470	470	470		
20	449	449	449	449	448	448	448	448	448	448	448	448	449	449	449	449	449		
25	424	423	423	423	423	422	422	423	422	422	423	422	423	423	423	423	423		
30	394	393	393	393	393	393	393	393	392	392	392	392	393	393	393	393	393		
35	361	361	361	360	360	360	360	360	360	360	359	359	359	360	360	360	360		
40	322	322	321	321	321	321	321	321	321	320	321	320	320	321	321	321	321		
45	279	278	278	278	277	277	277	277	277	277	277	277	277	277	277	278	278		
50	233	233	233	232	232	232	232	232	231	231	231	231	232	232	232	232	232		
55	188	188	188	188	187	187	187	187	187	187	187	187	187	187	187	187	187		
60	145	145	145	145	145	144	144	144	144	143	144	143	144	144	144	144	144		
65	104	104	104	104	103	103	103	103	103	103	103	103	103	103	103	103	103		
70	66.7	66.5	66.4	66.1	65.9	65.7	65.5	65.4	65.2	65.1	65.1	65.1	65.1	65.2	65.3	65.4	65.4		
75	35.2	35.1	34.9	34.8	34.6	34.4	34.2	34.1	34.0	34.0	33.9	34.0	34.0	34.0	34.0	34.0	34.1		
80	16.3	16.3	16.3	16.3	16.3	16.3	16.4	16.4	16.4	16.4	16.5	16.5	16.5	16.5	16.5	16.5	16.4		
85	7.51	7.49	7.47	7.46	7.43	7.41	7.41	7.41	7.41	7.41	7.40	7.42	7.40	7.44	7.46	7.45	7.48		
90	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
95	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04		
100	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
105	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07		
110	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		
115	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10		
120	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12		
125	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14		
130	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17		
135	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21		
140	0.24	0.24	0.24	0.25	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		
145	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27		
150	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28		
155	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
160	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.28	0.29	0.29	0.28		
165	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28		
170	0.29	0.29	0.29	0.29	0.29	0.28	0.29	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
175	0.29	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.28	0.29	0.29	0.29	0.29	0.28	0.29	0.29	0.29		
180	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	3M	HZTE015-04	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

Table 8: 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 LED lamps) 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 expanded uncertainty is 2.1% 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 LED lamps) 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 2.3% with a coverage factor $k=2$.

Color Characteristics Measurements

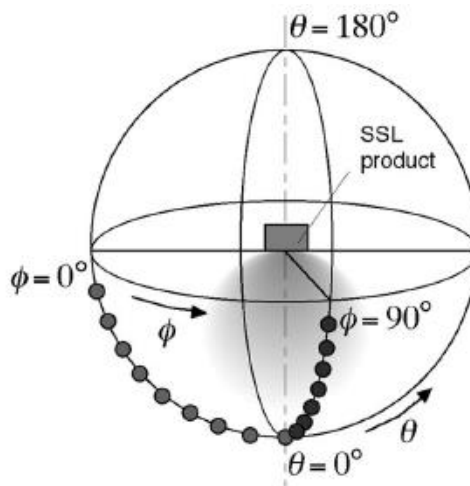
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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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