

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 5.5PAR20DIM/830NF25/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ19070039k

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

Review by:



Engineer: April Zou

Aug. 01, 2019

Approved by:



Manager: Jim Zhang

Aug. 01, 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: 5.5PAR20DIM/830NF25/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
102.1	541.2	5.30	0.7132
CCT (K)	CRI	Stabilization Time (Light & Power)	
3016	83.3	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	: Jul. 25, 2019
Date of Test	: Jul. 31, 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



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Lamp
Model	: 5.5PAR20DIM/830NF25/N
Electrical Ratings	: 120V, 60Hz, 5.5W
Product Description	: 3000K
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 base up. 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.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.062
Power Factor	0.7132
Test Power (W)	5.30
THD A%	69.38
Luminous Efficacy (lm/W)	102.1
Total Luminous Flux (lm)	541.2
Color Rendering Index (CRI)	83.3
R9	8.3
Correlated Color Temperature (CCT)(K)	3016
Chromaticity Chroma x	0.4337
Chromaticity Chroma y	0.3995
Chromaticity Chroma u	0.2504
Chromaticity Chroma v	0.3461
Duv	-0.0014
Chromaticity Chroma u'	0.2504
Chromaticity Chroma v'	0.5191

Special Color Rendering Indices	
R1	82.5
R2	93.6
R3	93.5
R4	80.9
R5	83.4
R6	92.8
R7	81.2
R8	58.3
R9	8.3
R10	85.8
R11	81.1
R12	78.4
R13	85.4
R14	97

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 25.2 °C.

The photometric distance is 2.47 m.

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

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.061
Power Factor	0.7189
Power (W)	5.26
Luminous Efficacy (lm/W)	104.3
Total Luminous Flux (lm)	548.6
Beam Angle (°)	28.3 (0°-180°) / 28.5 (90°-270°)
Center Beam Candle Power (cd)	1537
Maximum Beam Candle Power (cd)	1559(At: C=190.0, Gamma=2.5)
Spacing Criteria	0.48 (0°-180°) / 0.49 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	97.48%
Zonal Lumens in the 60 °-90 °Zone	2.37%
Zonal Lumens in the 90 °-120 °Zone	0.02%
Zonal Lumens in the 120 °-180 °Zone	0.13%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

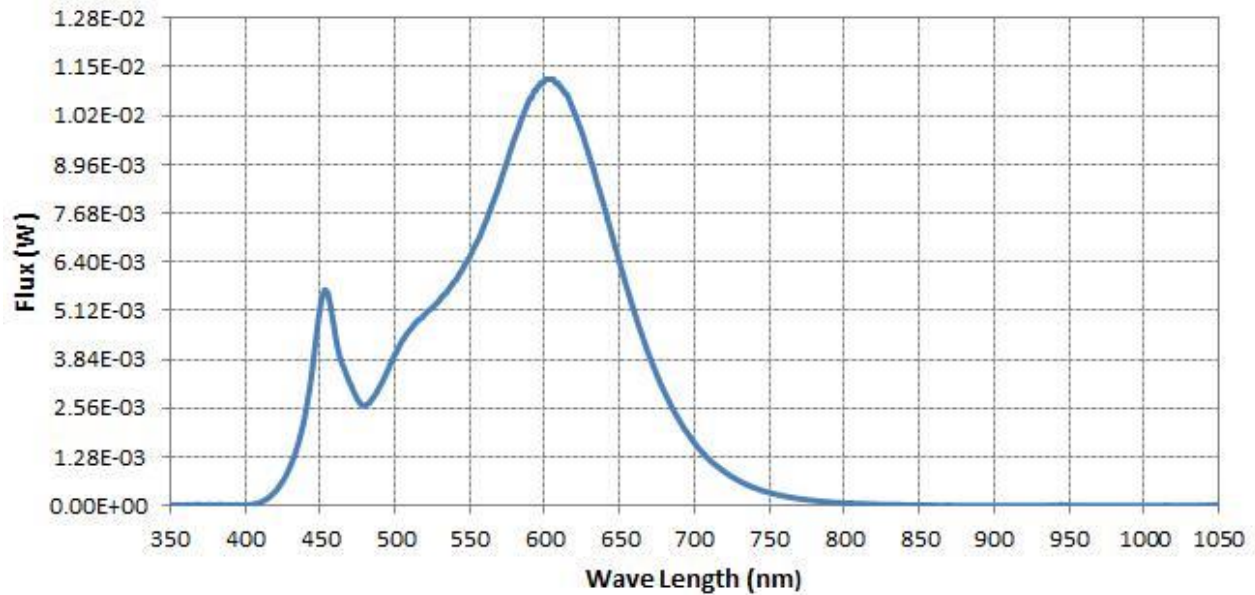
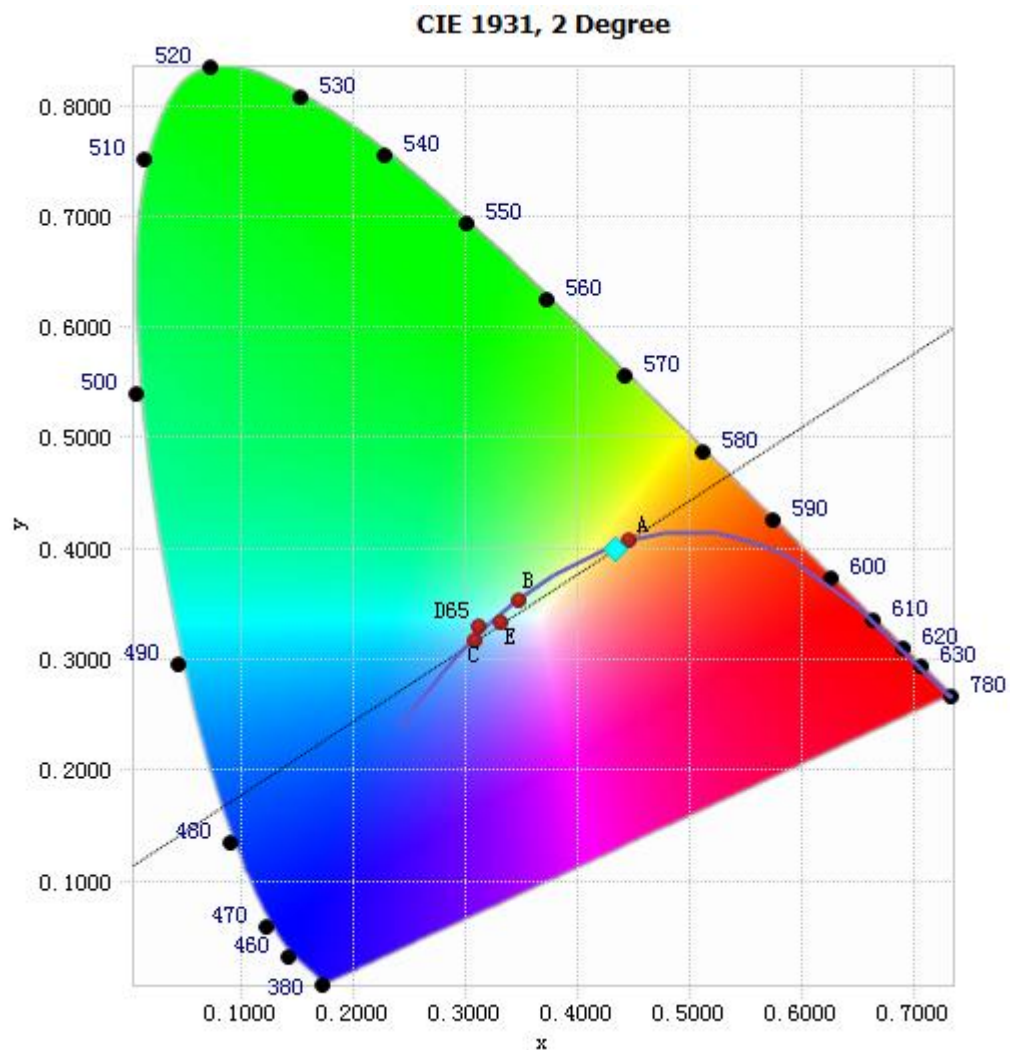


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.13E-05	485	2.81E-03	590	1.07E-02	695	1.92E-03
385	2.57E-05	490	3.13E-03	595	1.10E-02	700	1.65E-03
390	2.44E-05	495	3.53E-03	600	1.12E-02	705	1.40E-03
395	2.75E-05	500	3.97E-03	605	1.12E-02	710	1.20E-03
400	2.06E-05	505	4.34E-03	610	1.10E-02	715	1.04E-03
405	3.69E-05	510	4.62E-03	615	1.08E-02	720	8.89E-04
410	8.41E-05	515	4.85E-03	620	1.03E-02	725	7.60E-04
415	1.88E-04	520	5.03E-03	625	9.78E-03	730	6.50E-04
420	3.66E-04	525	5.20E-03	630	9.15E-03	735	5.52E-04
425	6.42E-04	530	5.40E-03	635	8.47E-03	740	4.72E-04
430	1.02E-03	535	5.63E-03	640	7.81E-03	745	4.00E-04
435	1.56E-03	540	5.90E-03	645	7.09E-03	750	3.44E-04
440	2.36E-03	545	6.20E-03	650	6.37E-03	755	2.94E-04
445	3.61E-03	550	6.54E-03	655	5.70E-03	760	2.54E-04
450	5.17E-03	555	6.95E-03	660	5.06E-03	765	2.17E-04
455	5.60E-03	560	7.40E-03	665	4.47E-03	770	1.85E-04
460	4.57E-03	565	7.92E-03	670	3.91E-03	775	1.58E-04
465	3.70E-03	570	8.46E-03	675	3.42E-03	780	1.35E-04
470	3.22E-03	575	9.05E-03	680	2.98E-03		
475	2.79E-03	580	9.66E-03	685	2.58E-03		
480	2.63E-03	585	1.02E-02	690	2.23E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4337, 0.3995)

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

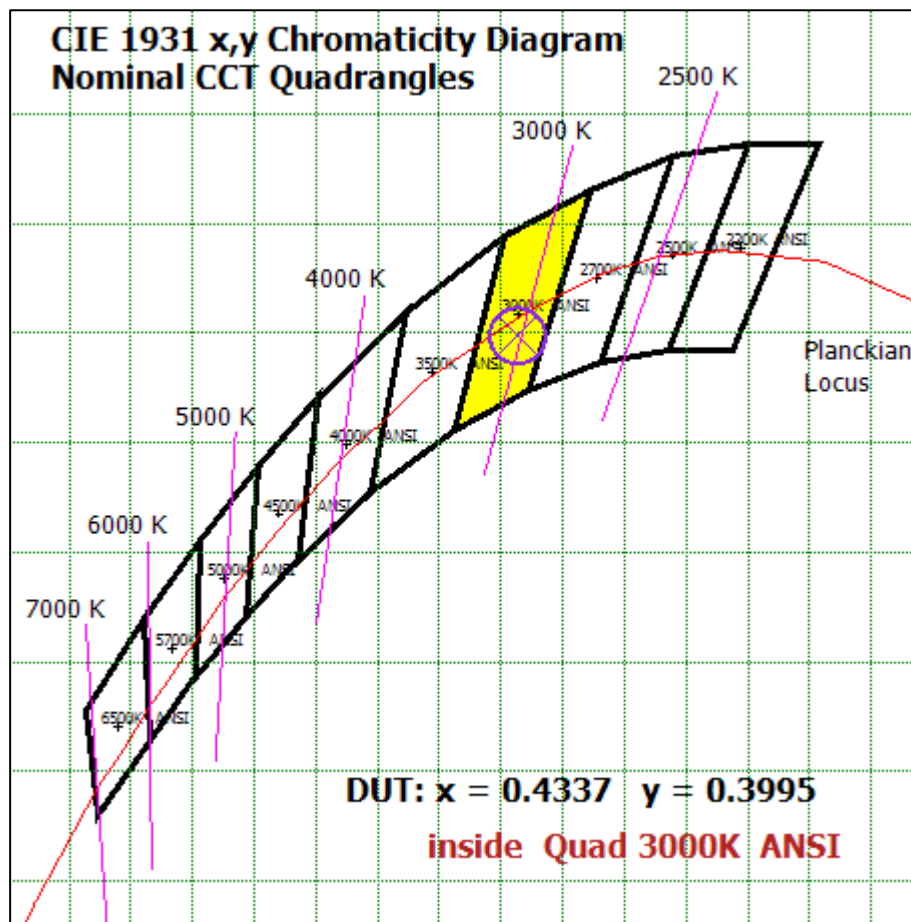
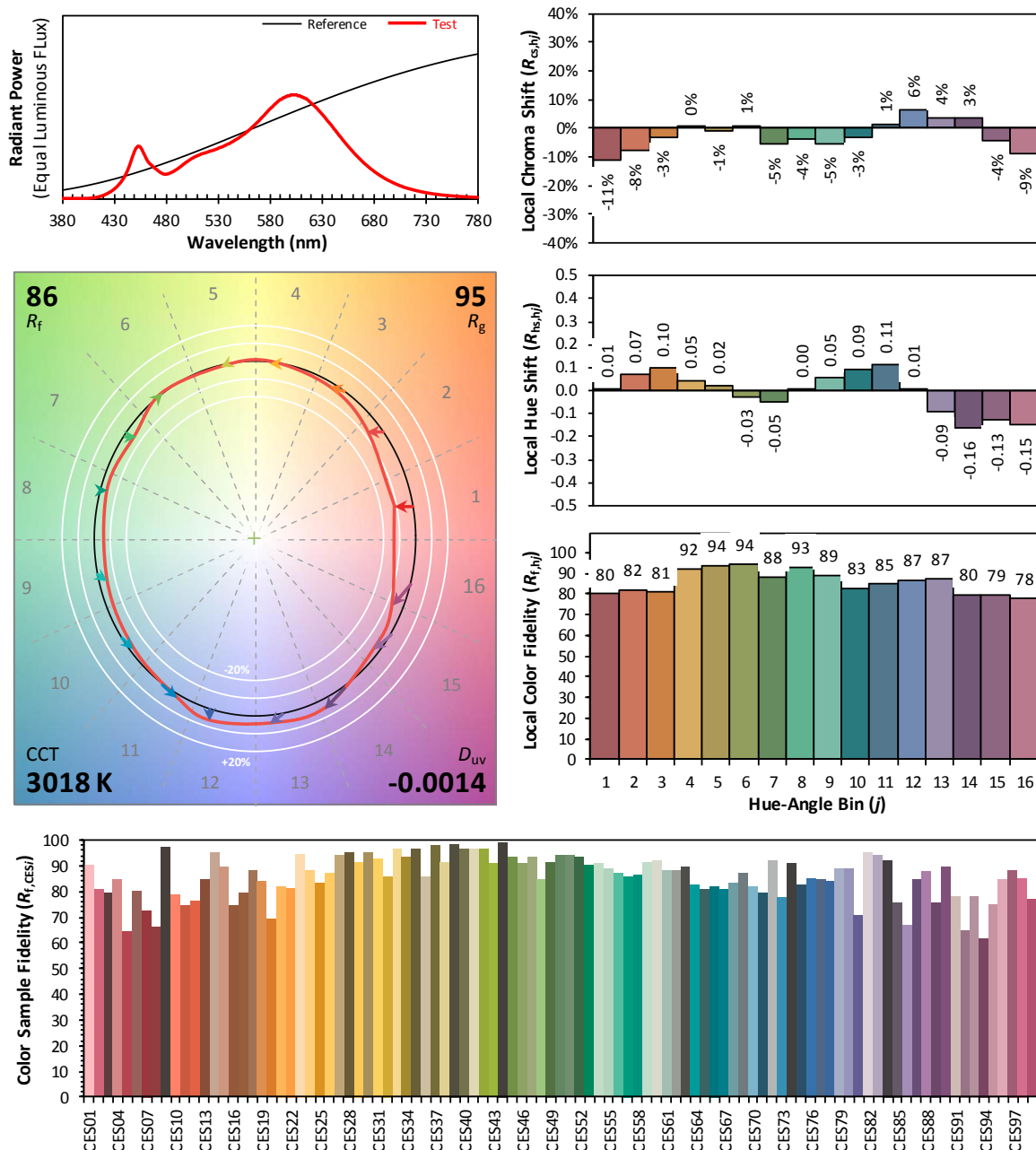


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4337
 y 0.3995
 u' 0.2504
 v' 0.5191

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

$\gamma(^{\circ})$	Lumens	% Total
0- 10	127.454	23.23%
10- 20	192.123	35.02%
20- 30	114.384	20.85%
30- 40	65.382	11.92%
40- 50	25.368	4.62%
50- 60	10.041	1.83%
60- 70	7.647	1.39%
70- 80	4.173	0.76%
80- 90	1.203	0.22%
90-100	0.075	0.01%
100-110	0.004	0.00%
110-120	0.008	0.00%
120-130	0.027	0.00%
130-140	0.082	0.01%
140-150	0.17	0.03%
150-160	0.214	0.04%
160-170	0.164	0.03%
170-180	0.053	0.01%
Total	548.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	534.752	97.48%
60- 90	13.023	2.37%
0-90	547.775	99.85%
90- 180	0.797	0.15%
0- 180	548.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

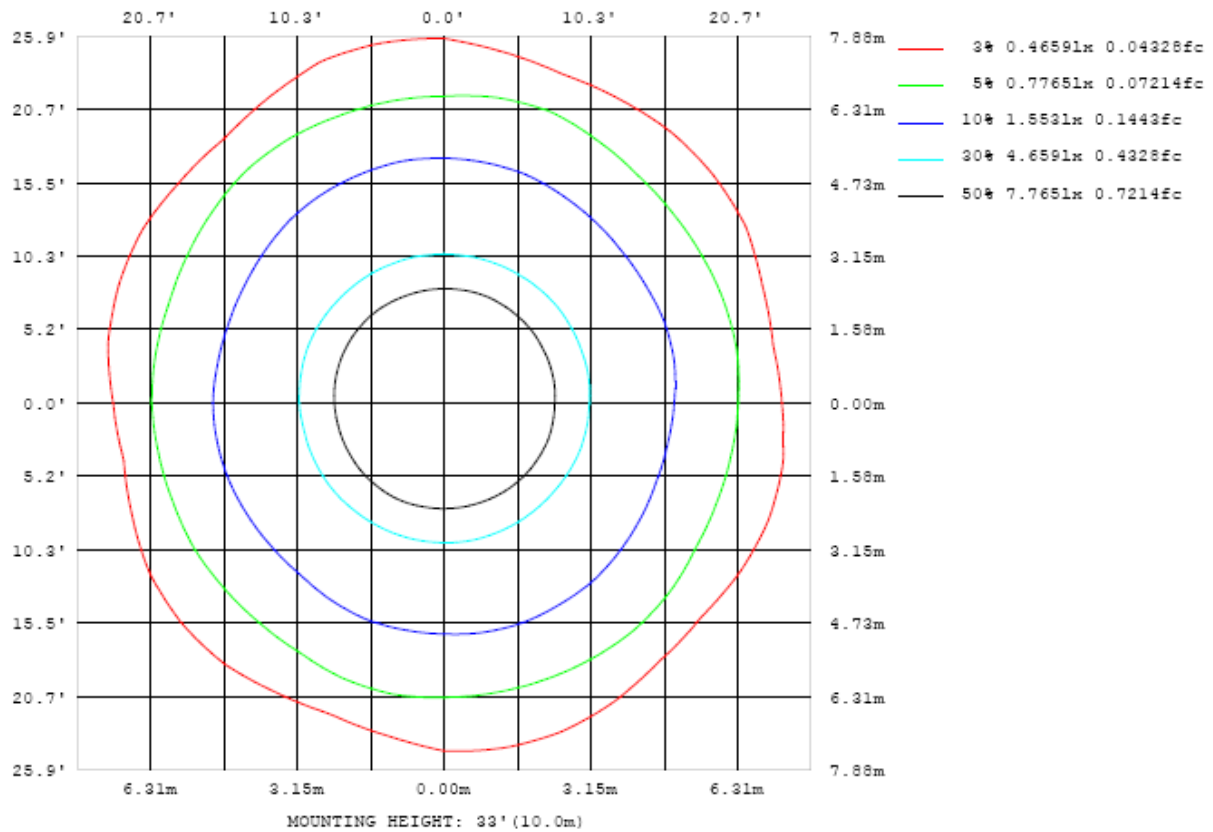


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

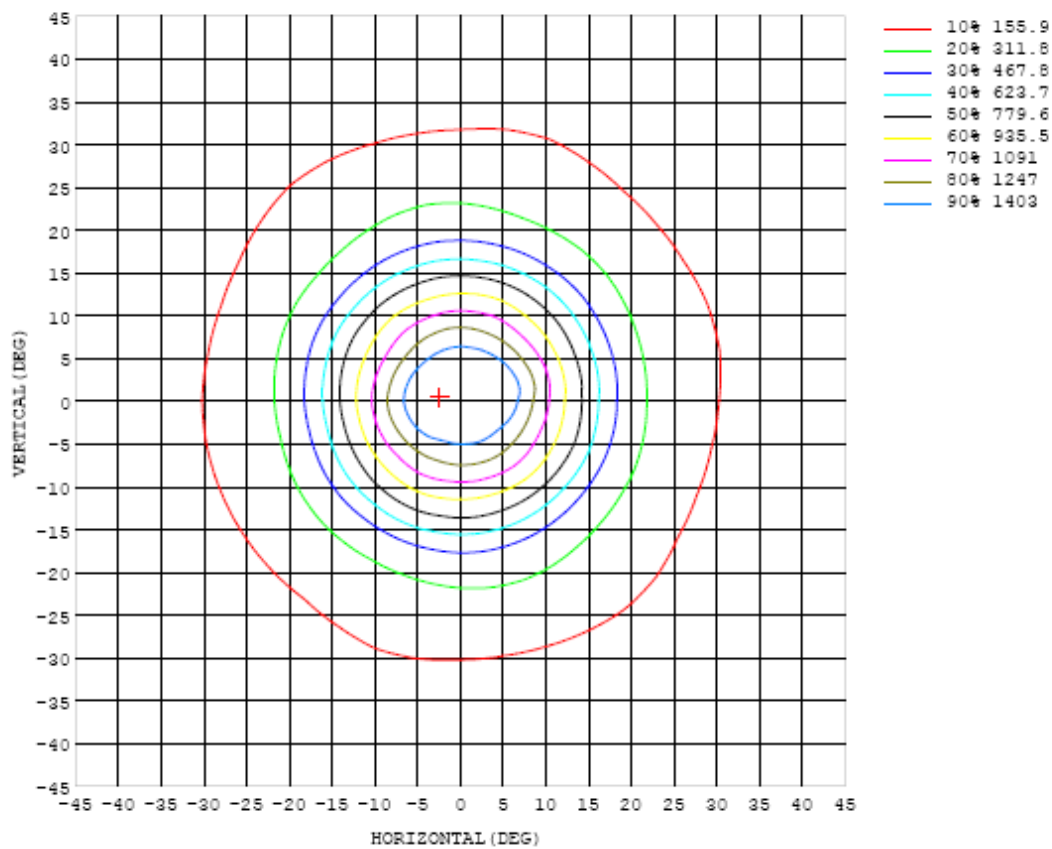


Chart 6: Isocandela Plot

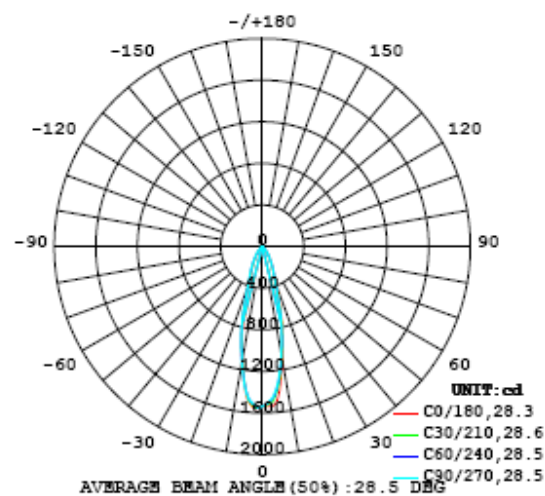


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537
5	1509	1490	1466	1444	1429	1422	1418	1411	1405	1403	1402	1402	1412	1430	1450	1470	1484	1495	1501
10	1122	1105	1089	1081	1081	1075	1061	1052	1047	1044	1046	1057	1067	1066	1068	1084	1097	1113	1127
15	714	712	718	700	685	678	674	671	670	669	666	675	677	677	684	695	691	694	710
20	378	377	373	365	361	361	366	368	368	365	357	350	347	352	358	361	362	364	375
25	237	233	232	234	237	241	245	250	249	243	239	236	232	227	227	231	235	239	241
30	159	153	151	152	161	164	162	159	158	159	162	162	151	145	146	149	153	157	160
35	97.3	101	101	98.6	94.7	97.0	101	104	104	104	97.3	91.4	93.2	97.7	98.9	99.2	91.3	84.6	91.1
40	53.6	61.5	64.7	60.5	55.0	55.5	63.1	69.3	70.9	66.2	56.5	53.6	56.3	59.0	58.4	52.4	47.1	46.1	47.8
45	23.1	23.4	26.5	31.3	34.7	35.6	33.6	32.6	32.5	32.7	34.4	34.8	31.3	26.9	21.9	20.2	20.4	21.2	21.6
50	11.7	11.6	12.3	14.7	17.0	17.5	16.2	13.9	13.0	14.9	17.1	17.8	16.2	13.5	11.8	11.5	11.6	11.8	11.8
55	9.85	9.80	9.90	10.5	11.4	11.7	11.1	10.5	10.2	10.6	11.5	12.0	11.4	10.4	9.98	9.86	10.1	10.3	10.2
60	8.55	8.47	8.62	9.05	9.79	10.3	9.83	9.14	8.89	9.26	10.1	10.5	9.86	9.12	8.70	8.54	8.73	9.01	8.84
65	7.01	6.95	7.10	7.40	8.03	8.44	8.13	7.56	7.36	7.66	8.27	8.51	8.09	7.47	7.12	6.99	7.19	7.41	7.32
70	5.32	5.29	5.41	5.59	5.96	6.23	6.05	5.73	5.63	5.81	6.10	6.20	5.96	5.64	5.43	5.28	5.42	5.62	5.54
75	3.60	3.62	3.73	3.80	3.94	4.05	3.98	3.87	3.84	3.89	3.98	3.99	3.90	3.79	3.68	3.59	3.67	3.80	3.77
80	2.00	2.04	2.10	2.11	2.13	2.15	2.15	2.13	2.14	2.14	2.13	2.11	2.09	2.07	2.04	1.97	2.00	2.07	2.07
85	0.98	0.98	0.97	0.98	0.99	1.00	1.00	1.00	0.99	0.99	0.99	0.98	0.97	0.96	0.96	0.96	0.98	1.00	1.03
90	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	0.19	0.19	0.20	0.20	0.21
95	0.05	0.05	0.05	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	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
120	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
125	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03
130	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.06
135	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.13
140	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.22
145	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	0.20	0.35
150	0.26	0.26	0.26	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	0.26	0.27	0.49
155	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.35	0.61
160	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.43	0.69
165	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.48	0.71
170	0.48	0.48	0.48	0.48	0.48	0.48	0.47	0.48	0.48	0.48	0.48	0.48	0.49	0.49	0.49	0.49	0.49	0.51	0.69
175	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.51	0.60
180	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49

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	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537	1537		
5	1502	1494	1493	1481	1474	1472	1471	1468	1470	1475	1480	1486	1497	1503	1508	1510	1511		
10	1121	1113	1108	1114	1127	1130	1130	1140	1139	1139	1142	1135	1129	1131	1140	1151	1149		
15	723	736	747	748	752	751	751	756	755	752	754	753	753	752	742	734	733		
20	385	392	394	389	393	400	404	408	408	404	399	398	400	399	393	389	383		
25	240	241	247	250	256	264	273	278	275	267	261	256	254	250	246	245	244		
30	156	156	160	171	181	183	183	183	184	188	187	177	167	163	164	169	169		
35	100	102	105	106	108	113	116	116	117	117	116	111	109	107	106	99.3	95.1		
40	56.2	65.4	65.1	59.9	59.0	67.7	80.6	84.7	81.6	70.3	61.8	65.3	70.9	69.5	63.0	52.9	50.0		
45	22.4	25.0	30.9	35.3	38.7	39.4	39.9	42.6	42.0	41.4	40.7	38.0	33.7	29.6	25.4	24.6	24.2		
50	11.8	12.3	14.3	17.9	19.5	19.2	17.5	15.9	17.9	20.7	22.0	19.5	15.9	12.6	11.8	12.0	11.8		
55	10.1	10.2	10.6	11.5	12.2	11.9	11.2	10.9	11.4	12.6	13.1	12.1	10.7	10.1	9.87	9.98	9.93		
60	8.73	8.78	9.14	9.89	10.5	10.4	9.80	9.54	9.98	11.0	11.3	10.2	9.24	8.75	8.64	8.74	8.66		
65	7.26	7.30	7.55	8.20	8.67	8.61	8.28	8.12	8.47	9.12	9.30	8.50	7.75	7.33	7.22	7.38	7.27		
70	5.49	5.51	5.70	6.16	6.46	6.48	6.34	6.24	6.42	6.84	6.86	6.32	5.87	5.60	5.50	5.62	5.54		
75	3.77	3.78	3.91	4.18	4.32	4.38	4.35	4.34	4.41	4.55	4.53	4.28	4.03	3.89	3.81	3.86	3.81		
80	2.10	2.12	2.19	2.28	2.36	2.40	2.42	2.43	2.44	2.43	2.38	2.33	2.25	2.20	2.13	2.15	2.11		
85	1.05	1.09	1.11	1.16	1.20	1.23	1.25	1.26	1.26	1.25	1.23	1.20	1.15	1.12	1.08	1.07	1.04		
90	0.22	0.25	0.24	0.24	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.21		
95	0.04	0.04	0.04	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.05		
100	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00		
115	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
120	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02		
125	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03		
130	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07		
135	0.13	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13		
140	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23		
145	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.35	0.35	0.36		
150	0.49	0.48	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.49		
155	0.61	0.60	0.60	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.60	0.61		
160	0.69	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.70		
165	0.72	0.72	0.72	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.73		
170	0.70	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.70	0.70		
175	0.61	0.60	0.60	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.60		
180	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49		

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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