

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 10PAR30DIM/840FL40/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19070039d

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

Review by:



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Aug. 01, 2019

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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: **10PAR30DIM/840FL40/N**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
110.8	1069.5	9.65	0.7306
CCT (K)	CRI	Stabilization Time (Light & Power)	
3884	82.0	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	: 10PAR30DIM/840FL40/N
Electrical Ratings	: 120V, 60Hz, 10W
Product Description	: 4000K
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)	0.110
Power Factor	0.7306
Test Power (W)	9.65
THD A%	67.67
Luminous Efficacy (lm/W)	110.8
Total Luminous Flux (lm)	1069.5
Color Rendering Index (CRI)	82.0
R9	3.8
Correlated Color Temperature (CCT)(K)	3884
Chromaticity Chroma x	0.3871
Chromaticity Chroma y	0.3850
Chromaticity Chroma u	0.2262
Chromaticity Chroma v	0.3374
Duv	0.0019
Chromaticity Chroma u'	0.2262
Chromaticity Chroma v'	0.5061

Special Color Rendering Indices	
R1	80
R2	90
R3	95.9
R4	78.6
R5	79.6
R6	85.7
R7	84.7
R8	61.6
R9	3.8
R10	75.6
R11	76.6
R12	60.6
R13	82.6
R14	98.1

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 24.9 °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)	0.109
Power Factor	0.7366
Power (W)	9.61
Luminous Efficacy (lm/W)	112.4
Total Luminous Flux (lm)	1079.8
Beam Angle (°)	38.0 (0°-180°) / 38.8 (90°-270°)
Center Beam Candle Power (cd)	1696
Maximum Beam Candle Power (cd)	1702 (At: C=210.0, Gamma=1.5)
Spacing Criteria	0.67 (0°-180°) / 0.63 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	94.90%
Zonal Lumens in the 60 °-90 °Zone	4.88%
Zonal Lumens in the 90 °-120 °Zone	0.10%
Zonal Lumens in the 120 °-180 °Zone	0.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

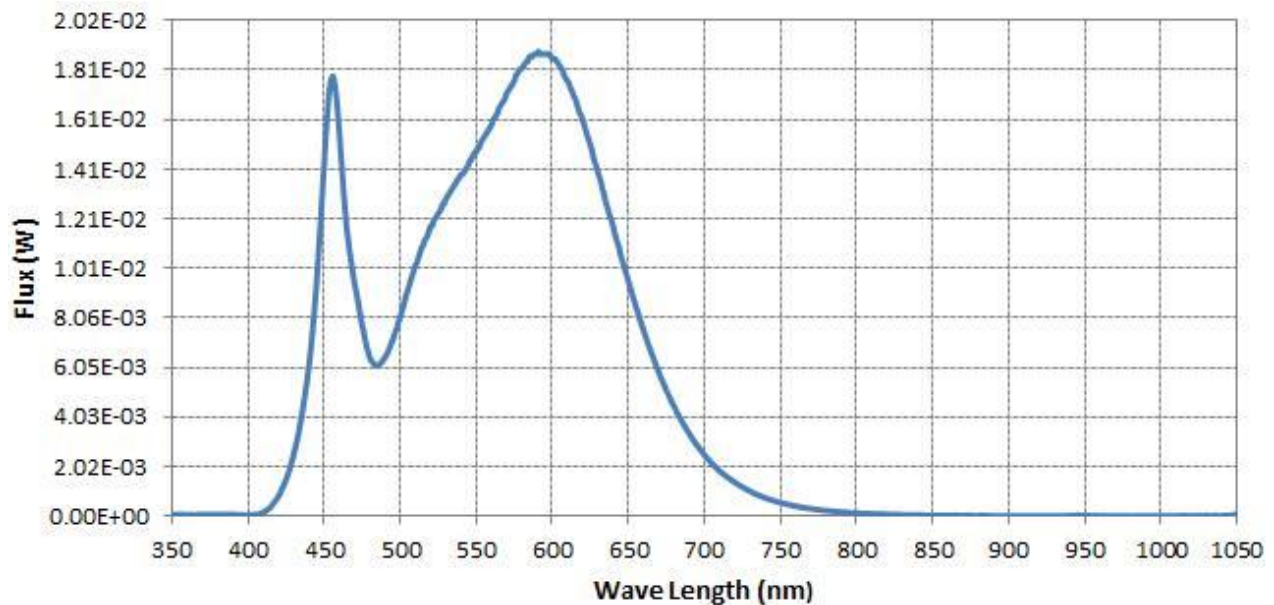
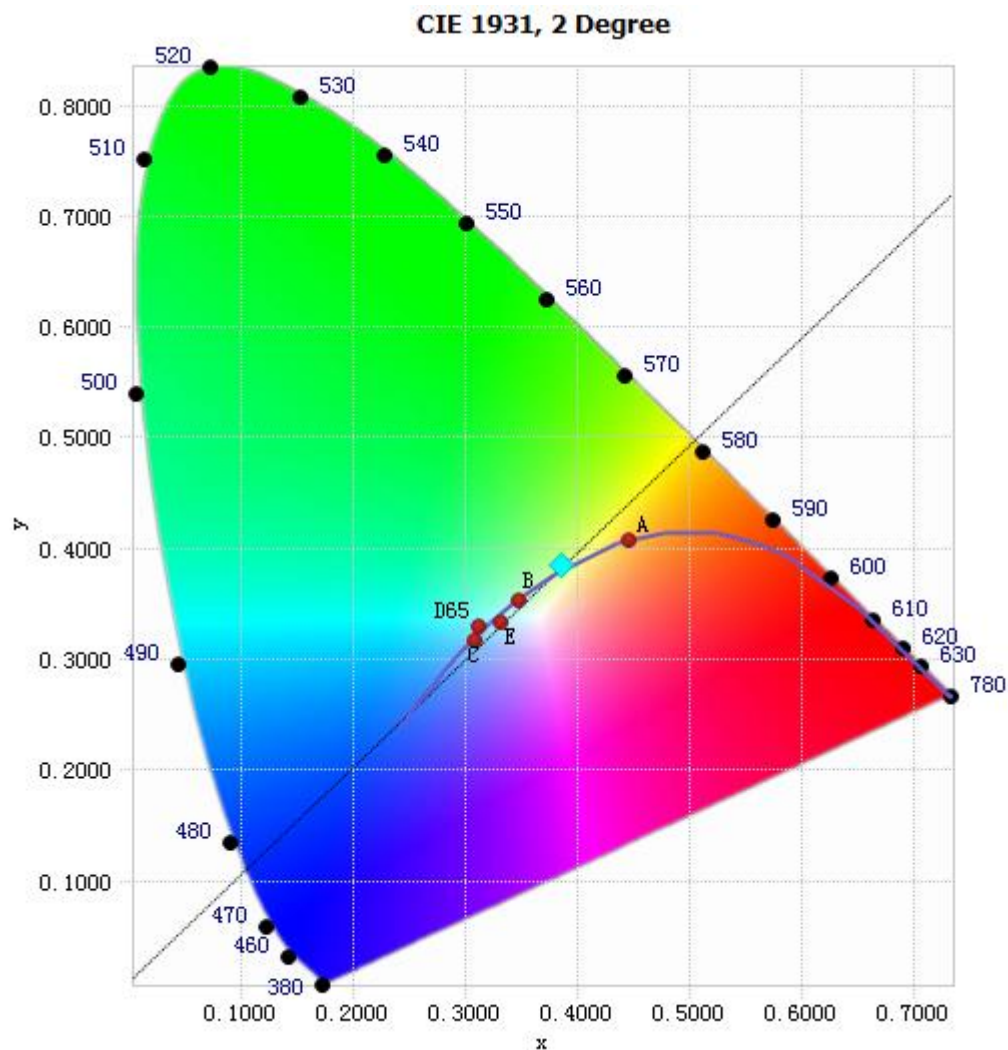


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.25E-05	485	6.14E-03	590	1.88E-02	695	2.90E-03
385	6.30E-05	490	6.45E-03	595	1.88E-02	700	2.49E-03
390	6.35E-05	495	7.14E-03	600	1.86E-02	705	2.14E-03
395	5.51E-05	500	8.10E-03	605	1.83E-02	710	1.83E-03
400	4.59E-05	505	9.18E-03	610	1.77E-02	715	1.59E-03
405	5.99E-05	510	1.02E-02	615	1.70E-02	720	1.37E-03
410	1.45E-04	515	1.10E-02	620	1.61E-02	725	1.18E-03
415	3.72E-04	520	1.18E-02	625	1.51E-02	730	1.02E-03
420	8.17E-04	525	1.23E-02	630	1.40E-02	735	8.63E-04
425	1.49E-03	530	1.29E-02	635	1.28E-02	740	7.45E-04
430	2.50E-03	535	1.34E-02	640	1.18E-02	745	6.36E-04
435	3.96E-03	540	1.39E-02	645	1.06E-02	750	5.49E-04
440	6.08E-03	545	1.43E-02	650	9.56E-03	755	4.75E-04
445	9.36E-03	550	1.48E-02	655	8.50E-03	760	4.11E-04
450	1.42E-02	555	1.54E-02	660	7.56E-03	765	3.54E-04
455	1.78E-02	560	1.59E-02	665	6.67E-03	770	3.03E-04
460	1.57E-02	565	1.66E-02	670	5.85E-03	775	2.60E-04
465	1.17E-02	570	1.72E-02	675	5.11E-03	780	2.27E-04
470	9.50E-03	575	1.77E-02	680	4.47E-03		
475	7.79E-03	580	1.82E-02	685	3.87E-03		
480	6.48E-03	585	1.87E-02	690	3.36E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3871, 0.3850)

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

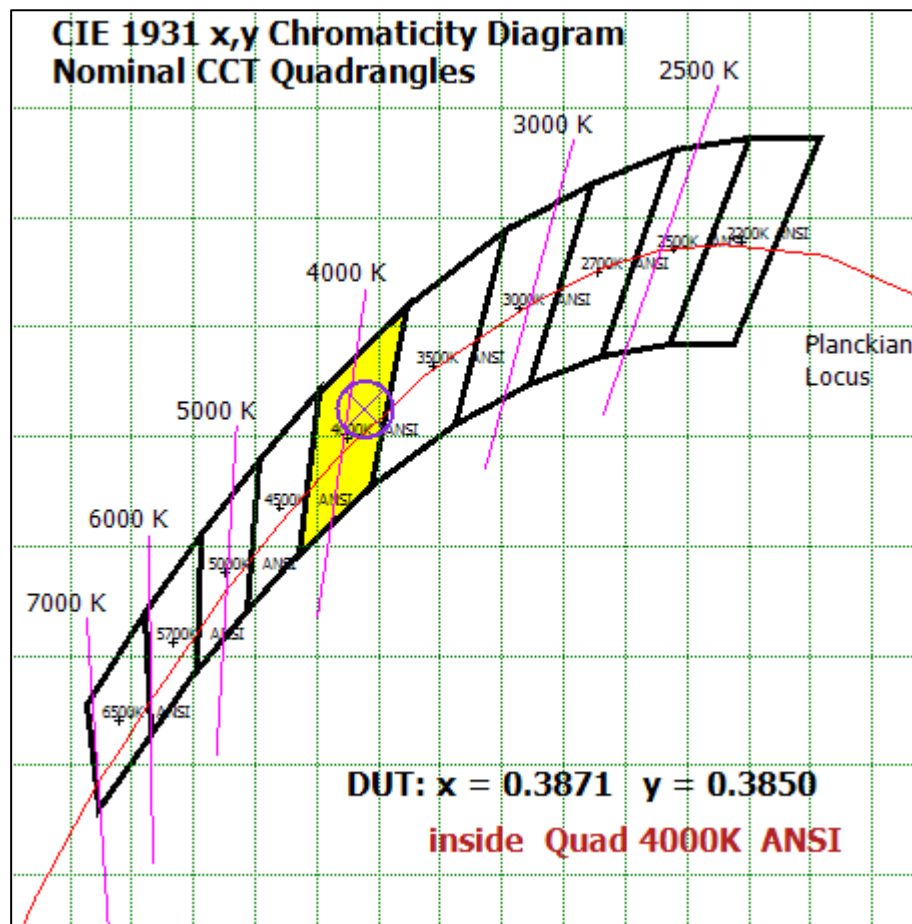
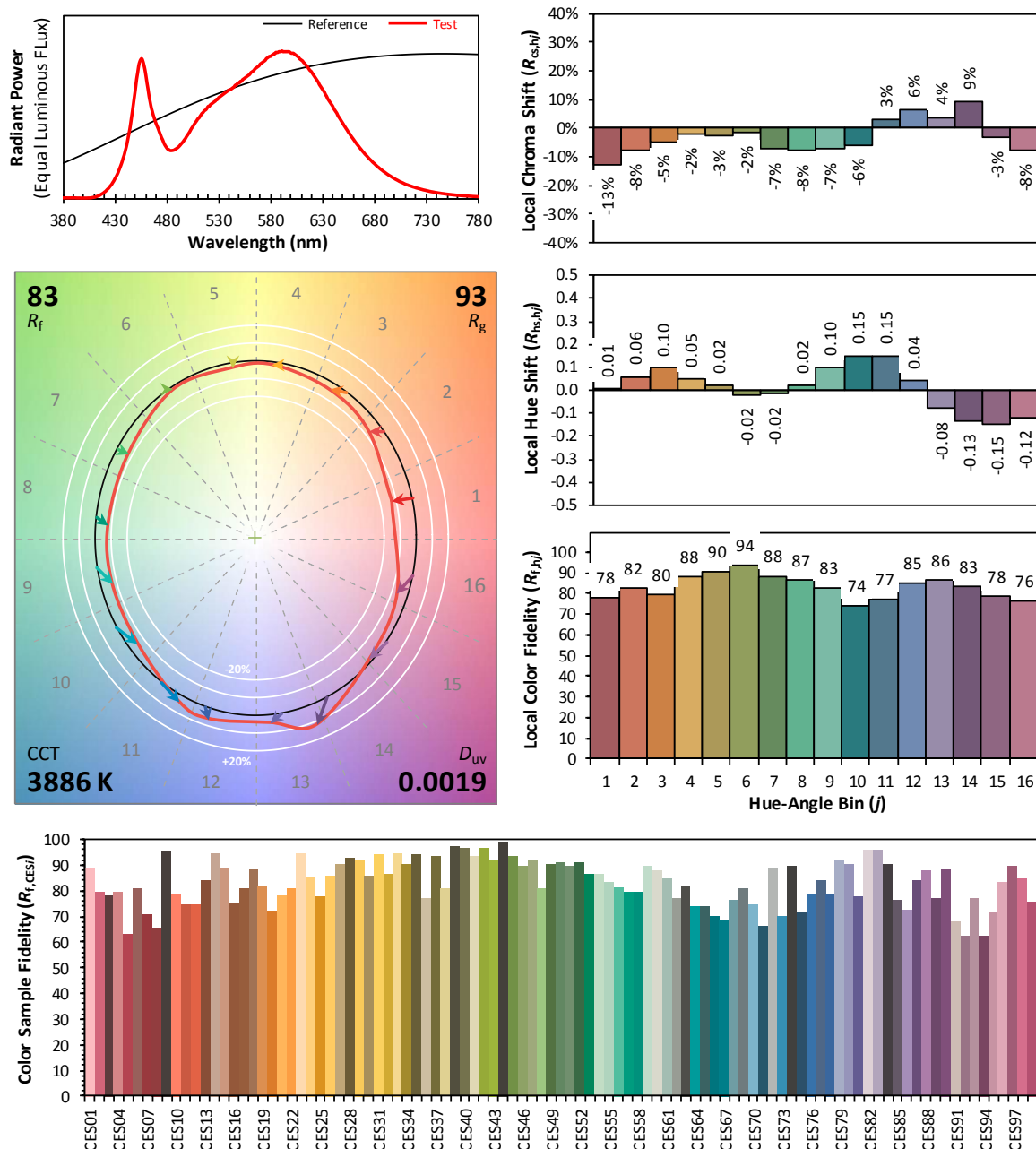


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3871
 y 0.3850
 u' 0.2262
 v' 0.5061

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	150.696	13.96%
10- 20	307.655	28.49%
20- 30	253.916	23.52%
30- 40	164.242	15.21%
40- 50	94.596	8.76%
50- 60	53.663	4.97%
60- 70	30.445	2.82%
70- 80	16.019	1.48%
80- 90	6.21	0.58%
90-100	0.969	0.09%
100-110	0.038	0.00%
110-120	0.039	0.00%
120-130	0.085	0.01%
130-140	0.193	0.02%
140-150	0.315	0.03%
150-160	0.352	0.03%
160-170	0.266	0.02%
170-180	0.09	0.01%
Total	1079.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1024.768	94.90%
60- 90	52.674	4.88%
0-90	1077.442	99.78%
90- 180	2.347	0.22%
0- 180	1079.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

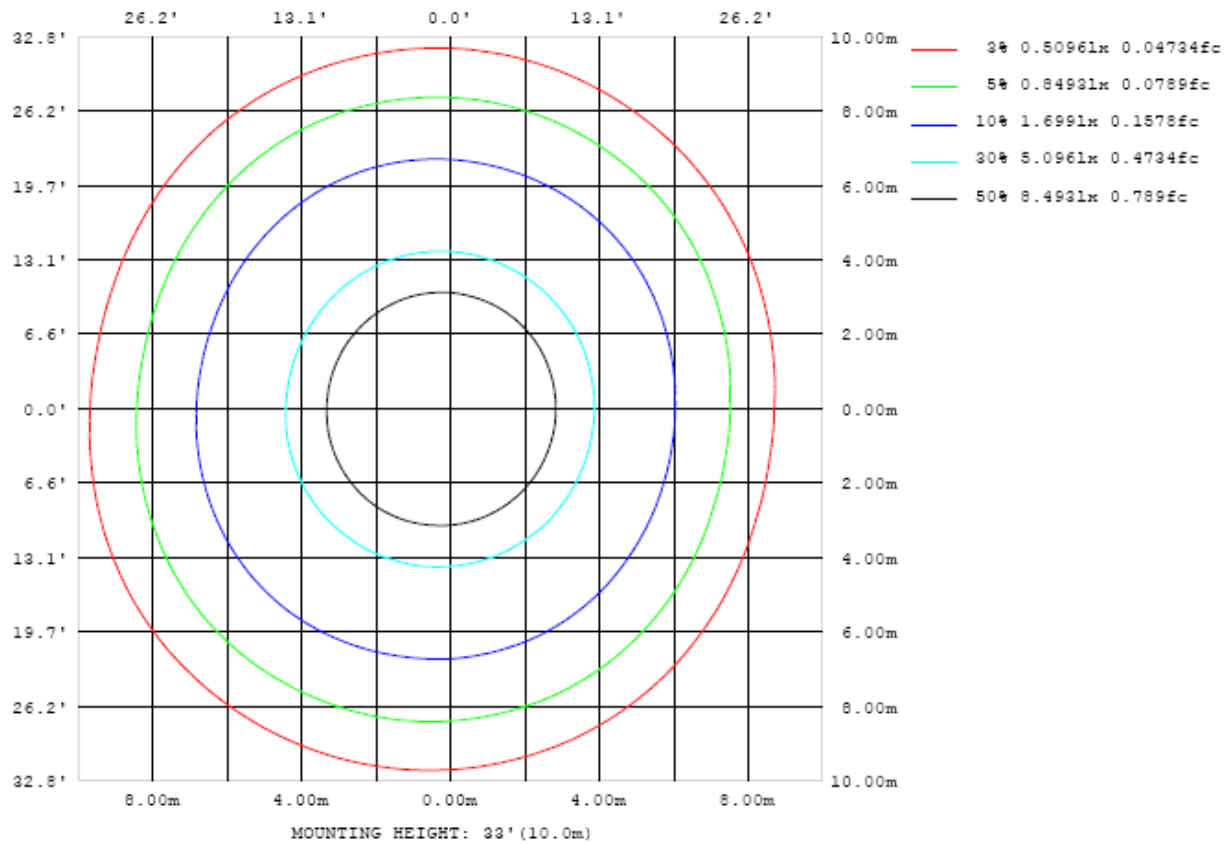


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

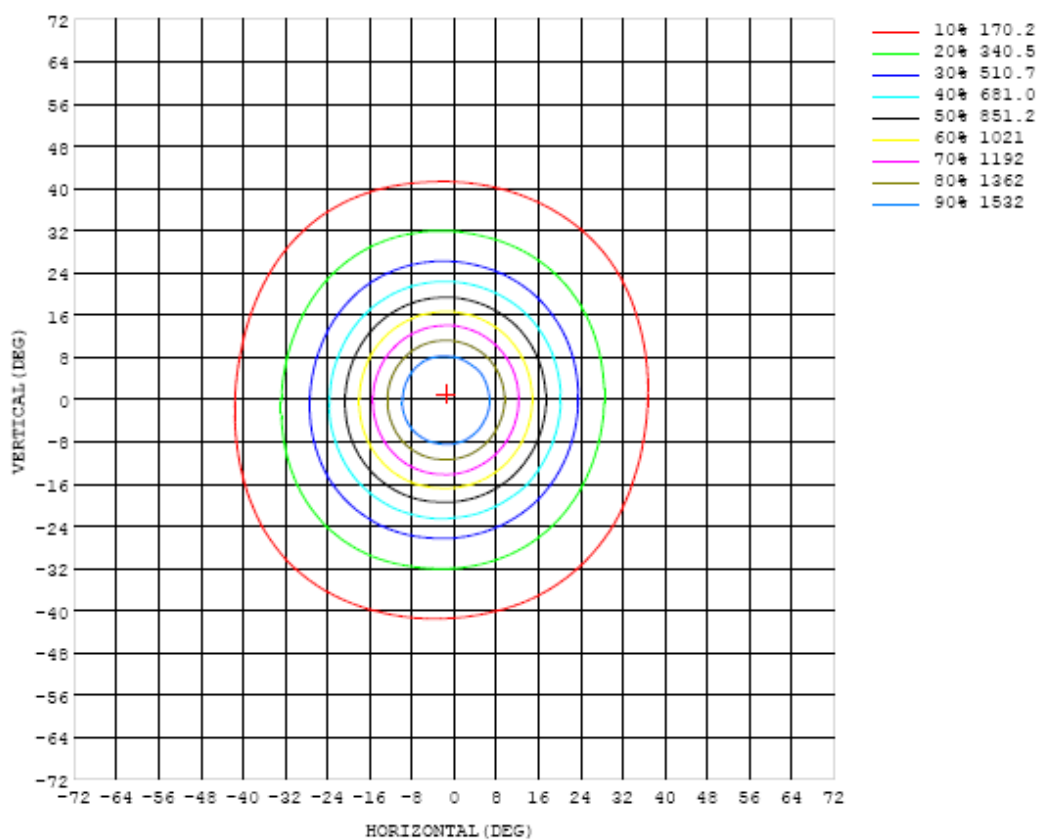


Chart 6: Isocandela Plot

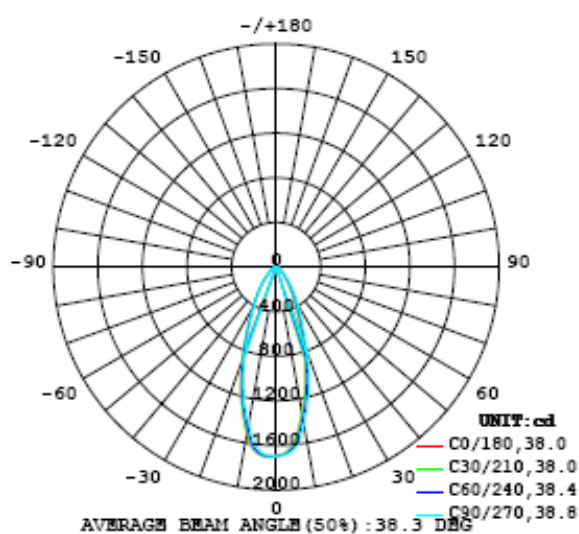


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696
5	1611	1615	1617	1621	1627	1632	1638	1644	1650	1660	1663	1671	1676	1681	1683	1686	1688	1689	1689
10	1332	1332	1336	1342	1353	1368	1383	1401	1418	1437	1447	1468	1486	1498	1514	1520	1526	1528	1521
15	1006	1008	1013	1024	1038	1056	1073	1093	1113	1134	1152	1174	1191	1206	1214	1218	1222	1221	1218
20	693	690	694	703	719	738	756	775	796	814	831	854	873	885	895	901	902	900	894
25	451	450	455	464	478	494	509	526	540	556	570	587	603	611	621	628	624	620	612
30	298	297	302	311	324	339	353	367	380	392	401	414	427	433	439	439	434	428	421
35	195	194	198	207	218	231	244	256	265	274	282	290	300	306	308	306	301	294	287
40	129	128	131	137	146	155	165	174	181	189	196	202	207	211	213	210	205	199	193
45	88.1	87.6	89.1	93.3	98.9	105	112	118	124	129	133	138	141	143	144	142	138	133	128
50	64.2	63.7	64.9	67.4	70.2	74.6	78.5	82.1	85.6	89.1	91.7	94.2	95.8	96.4	96.5	95.9	93.5	89.7	86.5
55	46.7	46.4	47.2	48.9	51.1	53.9	56.4	58.7	60.9	63.4	65.0	66.4	67.1	67.3	67.5	66.8	65.1	62.8	60.6
60	34.7	34.5	35.0	36.0	37.4	39.1	40.6	41.9	43.2	44.7	45.8	46.5	47.1	47.3	47.0	46.7	45.6	44.1	42.9
65	25.5	25.4	25.7	26.4	27.3	28.4	29.2	30.0	30.9	31.7	32.5	33.2	33.6	33.8	33.7	33.5	32.7	31.9	31.0
70	18.6	18.5	18.8	19.1	19.7	20.3	20.8	21.3	21.9	22.6	23.2	23.6	24.0	24.1	24.2	24.0	23.6	23.1	22.7
75	12.9	12.9	13.1	13.2	13.7	14.0	14.3	14.7	15.1	15.6	16.1	16.4	16.6	16.8	16.8	16.7	16.5	16.3	16.0
80	8.22	8.24	8.33	8.40	8.67	8.84	9.01	9.31	9.57	9.87	10.2	10.4	10.4	10.7	10.8	10.7	10.7	10.6	10.4
85	4.61	4.62	4.68	4.78	4.93	5.09	5.22	5.45	5.65	5.85	6.12	6.28	6.28	6.50	6.61	6.54	6.61	6.58	6.52
90	1.64	1.64	1.66	1.71	1.78	1.85	1.93	2.03	2.16	2.29	2.44	2.59	2.71	2.85	2.94	2.99	3.03	3.03	2.99
95	0.47	0.47	0.47	0.50	0.53	0.56	0.60	0.64	0.69	0.74	0.80	0.86	0.91	0.96	0.99	1.02	1.03	1.02	1.00
100	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.11	0.13	0.14	0.16	0.18	0.19	0.20	0.20	0.21	0.21	0.21	0.20
105	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	0.01	0.01	0.02	0.01	0.01
110	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	0.02	0.02	0.02	0.02	0.02	0.02
115	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
120	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.05
125	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.06	0.08
130	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.14
135	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.16	0.16	0.25
140	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29	0.28	0.28	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.24	0.39
145	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.37	0.37	0.36	0.35	0.35	0.34	0.34	0.33	0.55
150	0.51	0.51	0.51	0.50	0.50	0.50	0.49	0.49	0.48	0.48	0.47	0.47	0.46	0.45	0.45	0.44	0.44	0.43	0.71
155	0.62	0.62	0.62	0.62	0.61	0.61	0.61	0.60	0.60	0.59	0.58	0.58	0.57	0.57	0.56	0.56	0.56	0.54	0.85
160	0.73	0.73	0.73	0.73	0.72	0.72	0.72	0.71	0.71	0.70	0.70	0.69	0.69	0.68	0.68	0.68	0.67	0.66	0.96
165	0.80	0.80	0.80	0.80	0.80	0.80	0.79	0.79	0.79	0.78	0.78	0.78	0.77	0.77	0.77	0.77	0.77	0.75	1.02
170	0.83	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.82	0.82	0.80	1.00
175	0.87	0.87	0.87	0.87	0.87	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.85	0.89
180	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696		
5	1688	1689	1688	1688	1683	1677	1671	1662	1655	1642	1637	1631	1625	1620	1616	1613	1611		
10	1518	1513	1507	1499	1491	1473	1458	1437	1421	1405	1392	1379	1368	1356	1346	1339	1334		
15	1217	1211	1206	1195	1186	1171	1158	1143	1127	1105	1086	1070	1056	1040	1027	1015	1007		
20	889	884	877	870	863	852	841	825	810	790	774	756	742	726	712	701	694		
25	606	600	598	595	591	586	578	567	555	540	527	514	502	488	475	465	456		
30	415	412	411	412	413	410	405	397	388	375	366	357	346	335	323	312	303		
35	283	281	283	285	288	288	284	279	271	262	255	246	239	230	219	208	201		
40	188	189	191	194	197	198	196	191	186	181	176	169	162	155	147	140	134		
45	125	126	129	133	135	135	133	131	128	124	120	116	111	106	101	95.9	91.5		
50	85.1	85.8	88.2	90.8	92.4	92.5	91.8	90.7	89.4	87.1	84.4	81.2	78.2	75.0	71.6	68.4	65.7		
55	59.7	60.3	61.8	63.4	64.6	64.9	64.5	63.9	63.1	61.6	59.8	57.7	55.6	53.5	51.3	49.3	47.6		
60	42.4	42.7	43.6	44.7	45.4	45.6	45.4	45.0	44.5	43.5	42.5	41.3	40.1	38.8	37.5	36.3	35.3		
65	30.7	30.8	31.3	31.9	32.3	32.4	32.2	32.0	31.7	31.1	30.5	29.7	28.9	28.0	27.3	26.6	25.9		
70	22.5	22.4	22.6	22.8	23.0	23.0	22.8	22.6	22.4	22.0	21.6	21.1	20.6	20.1	19.6	19.1	18.8		
75	15.8	15.8	15.7	15.8	15.8	15.8	15.6	15.4	15.3	14.9	14.7	14.4	14.0	13.7	13.4	13.0	12.8		
80	10.3	10.2	10.0	10.0	9.95	9.85	9.74	9.60	9.49	9.30	9.24	9.06	8.88	8.69	8.50	8.21	8.07		
85	6.44	6.34	6.19	6.13	6.08	5.98	5.86	5.73	5.61	5.45	5.37	5.24	5.10	4.97	4.83	4.66	4.60		
90	2.94	2.87	2.77	2.67	2.58	2.47	2.34	2.24	2.16	2.08	2.02	1.95	1.88	1.81	1.75	1.70	1.66		
95	0.98	0.96	0.93	0.89	0.86	0.81	0.76	0.72	0.68	0.65	0.62	0.59	0.56	0.54	0.51	0.50	0.48		
100	0.19	0.19	0.18	0.17	0.17	0.16	0.16	0.15	0.14	0.12	0.11	0.09	0.08	0.07	0.06	0.06	0.06		
105	0.01	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		
110	0.02	0.02	0.02	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		
115	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
120	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.07		
125	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12		
130	0.15	0.15	0.15	0.16	0.17	0.17	0.18	0.19	0.19	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.20		
135	0.26	0.26	0.27	0.28	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.34	0.34	0.35	0.35	0.35	0.34		
140	0.41	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49	0.50	0.51	0.51	0.51	0.52	0.52	0.50		
145	0.58	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.66	0.67	0.68	0.68	0.69	0.69	0.70	0.70	0.68		
150	0.75	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.87	0.88	0.85		
155	0.91	0.90	0.91	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	0.99	1.00	1.00	1.01	0.97		
160	1.03	1.03	1.03	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.08	1.09	1.09	1.09	1.10	1.11	1.06		
165	1.12	1.11	1.11	1.11	1.12	1.12	1.12	1.12	1.13	1.13	1.13	1.13	1.14	1.14	1.14	1.15	1.09		
170	1.13	1.11	1.12	1.12	1.12	1.12	1.11	1.11	1.11	1.11	1.11	1.10	1.10	1.10	1.11	1.12	1.03		
175	1.02	1.02	1.02	1.02	1.02	1.02	1.01	1.01	1.00	1.00	0.99	0.99	0.99	0.98	0.98	0.99	0.90		
180	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95		

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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