

LM-79-08 TEST REPORT

for

GREEN CREATIVE LTD

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

LED Lamp

Model: 10PAR30DIM/830FL40/N

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ19070039c

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

Approved by:



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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/830FL40/N

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
102.5	1007.1	9.83	0.7355
CCT (K)	CRI	Stabilization Time (Light & Power)	
3024	83.0	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/830FL40/N
Electrical Ratings	: 120V, 60Hz, 10W
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)	0.112
Power Factor	0.7355
Test Power (W)	9.83
THD A%	67.10
Luminous Efficacy (lm/W)	102.5
Total Luminous Flux (lm)	1007.1
Color Rendering Index (CRI)	83.0
R9	7.0
Correlated Color Temperature (CCT)(K)	3024
Chromaticity Chroma x	0.4341
Chromaticity Chroma y	0.4013
Chromaticity Chroma u	0.2499
Chromaticity Chroma v	0.3466
Duv	-0.0007
Chromaticity Chroma u'	0.2499
Chromaticity Chroma v'	0.5199

Special Color Rendering Indices	
R1	82
R2	93.2
R3	93.6
R4	80.5
R5	82.9
R6	92.4
R7	81.2
R8	57.9
R9	7
R10	85.1
R11	80.5
R12	77.2
R13	85
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 25.1 °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)	0.110
Power Factor	0.7408
Power (W)	9.80
Luminous Efficacy (lm/W)	104.2
Total Luminous Flux (lm)	1020.8
Beam Angle (°)	38.0 (0°-180°) / 38.3 (90°-270°)
Center Beam Candle Power (cd)	1628
Maximum Beam Candle Power (cd)	1644 (At: C=170.0, Gamma=2.5)
Spacing Criteria	0.64 (0°-180°) / 0.62 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	95.03%
Zonal Lumens in the 60 °-90 °Zone	4.75%
Zonal Lumens in the 90 °-120 °Zone	0.09%
Zonal Lumens in the 120 °-180 °Zone	0.12%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

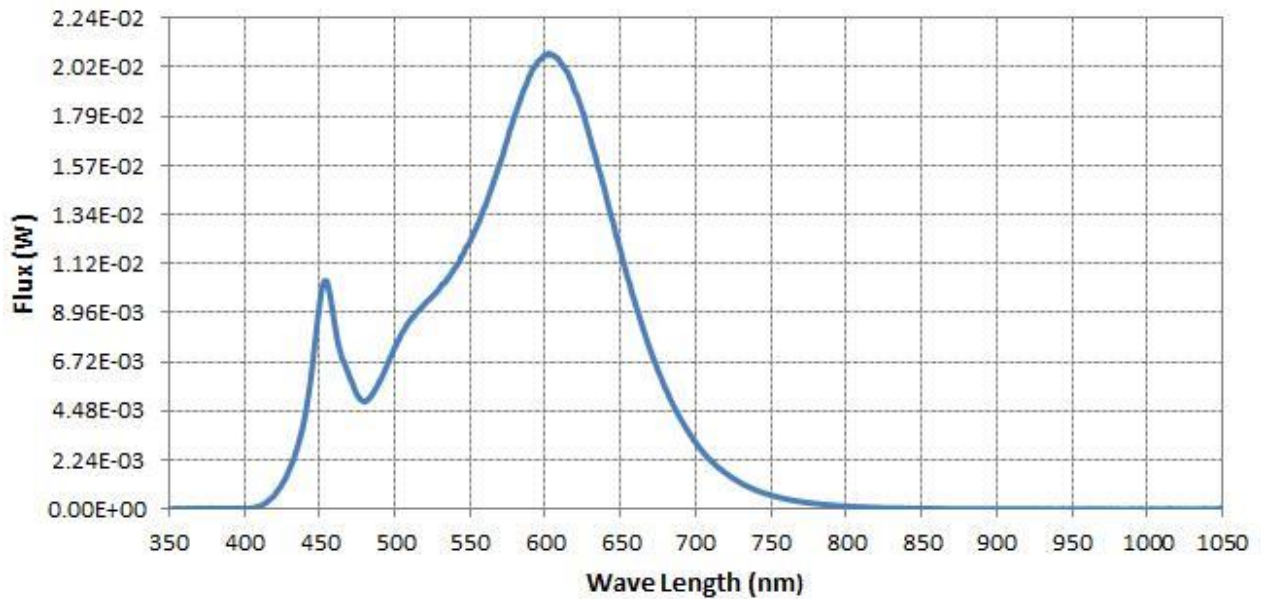
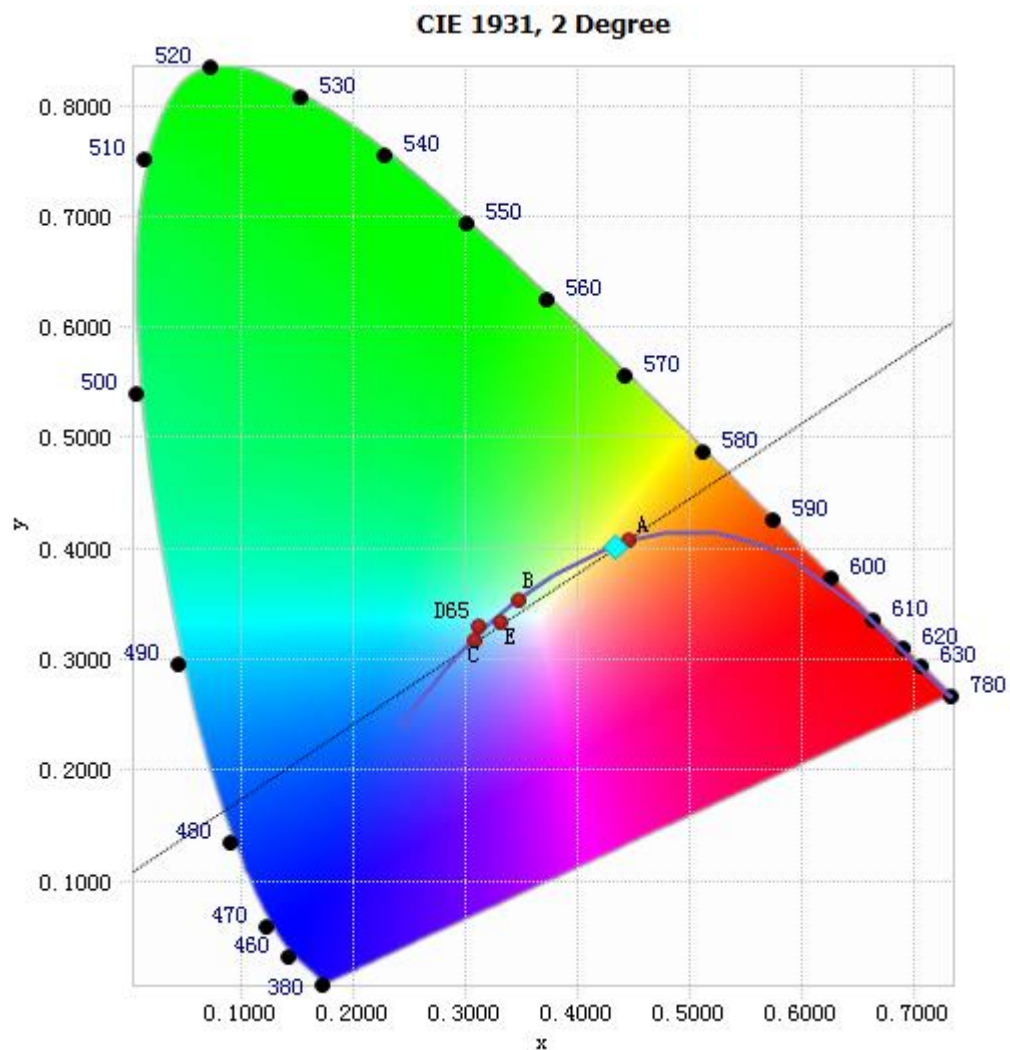


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.49E-05	485	5.23E-03	590	1.98E-02	695	3.53E-03
385	3.75E-05	490	5.84E-03	595	2.04E-02	700	3.03E-03
390	3.45E-05	495	6.57E-03	600	2.07E-02	705	2.58E-03
395	2.20E-05	500	7.36E-03	605	2.07E-02	710	2.21E-03
400	2.32E-05	505	8.05E-03	610	2.04E-02	715	1.90E-03
405	5.18E-05	510	8.60E-03	615	1.99E-02	720	1.64E-03
410	1.35E-04	515	9.02E-03	620	1.90E-02	725	1.40E-03
415	3.23E-04	520	9.37E-03	625	1.81E-02	730	1.19E-03
420	6.33E-04	525	9.70E-03	630	1.69E-02	735	1.02E-03
425	1.13E-03	530	1.01E-02	635	1.56E-02	740	8.66E-04
430	1.81E-03	535	1.05E-02	640	1.44E-02	745	7.40E-04
435	2.73E-03	540	1.10E-02	645	1.31E-02	750	6.34E-04
440	4.10E-03	545	1.16E-02	650	1.18E-02	755	5.42E-04
445	6.36E-03	550	1.22E-02	655	1.05E-02	760	4.66E-04
450	9.30E-03	555	1.30E-02	660	9.32E-03	765	3.98E-04
455	1.04E-02	560	1.38E-02	665	8.22E-03	770	3.40E-04
460	8.51E-03	565	1.48E-02	670	7.21E-03	775	2.92E-04
465	6.89E-03	570	1.58E-02	675	6.30E-03	780	2.50E-04
470	6.03E-03	575	1.69E-02	680	5.47E-03		
475	5.22E-03	580	1.80E-02	685	4.74E-03		
480	4.90E-03	585	1.90E-02	690	4.11E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4341, 0.4013)

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

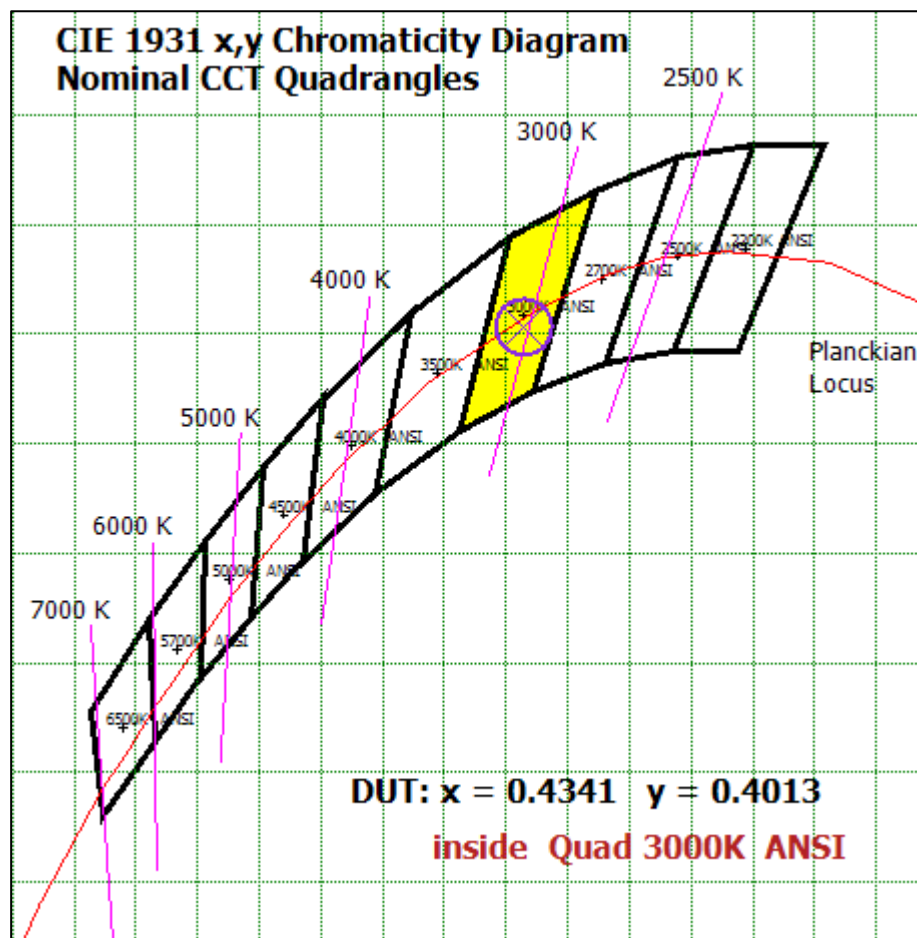
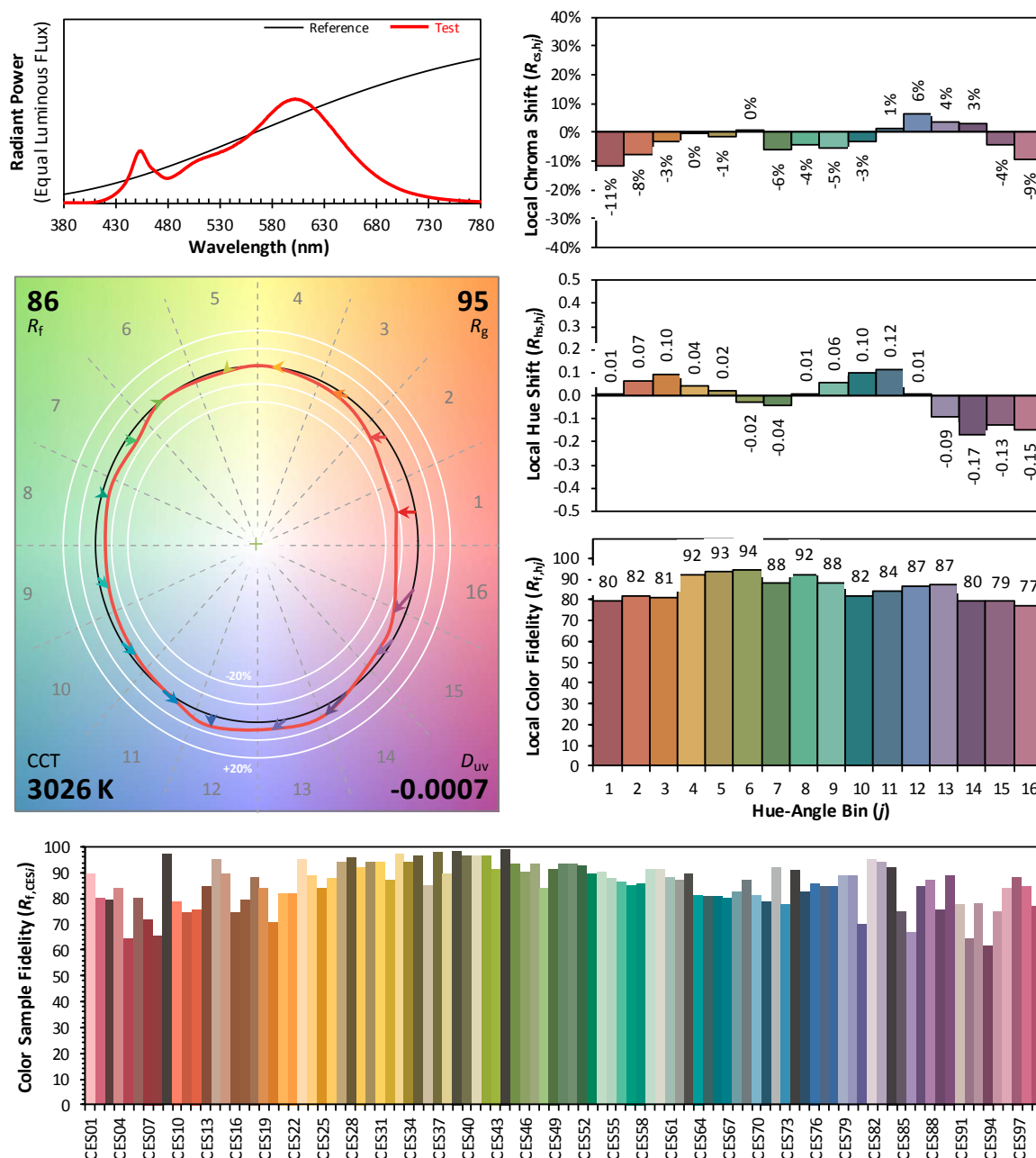


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4341

y 0.4013

u' 0.2499

v' 0.5199

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	145.162	14.22%
10- 20	294.73	28.87%
20- 30	240.484	23.56%
30- 40	154.227	15.11%
40- 50	86.672	8.49%
50- 60	48.762	4.78%
60- 70	27.898	2.73%
70- 80	14.865	1.46%
80- 90	5.771	0.57%
90-100	0.887	0.09%
100-110	0.033	0.00%
110-120	0.035	0.00%
120-130	0.079	0.01%
130-140	0.182	0.02%
140-150	0.3	0.03%
150-160	0.337	0.03%
160-170	0.254	0.02%
170-180	0.086	0.01%
Total	1020.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	970.037	95.03%
60- 90	48.534	4.75%
0-90	1018.571	99.79%
90- 180	2.193	0.21%
0- 180	1020.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

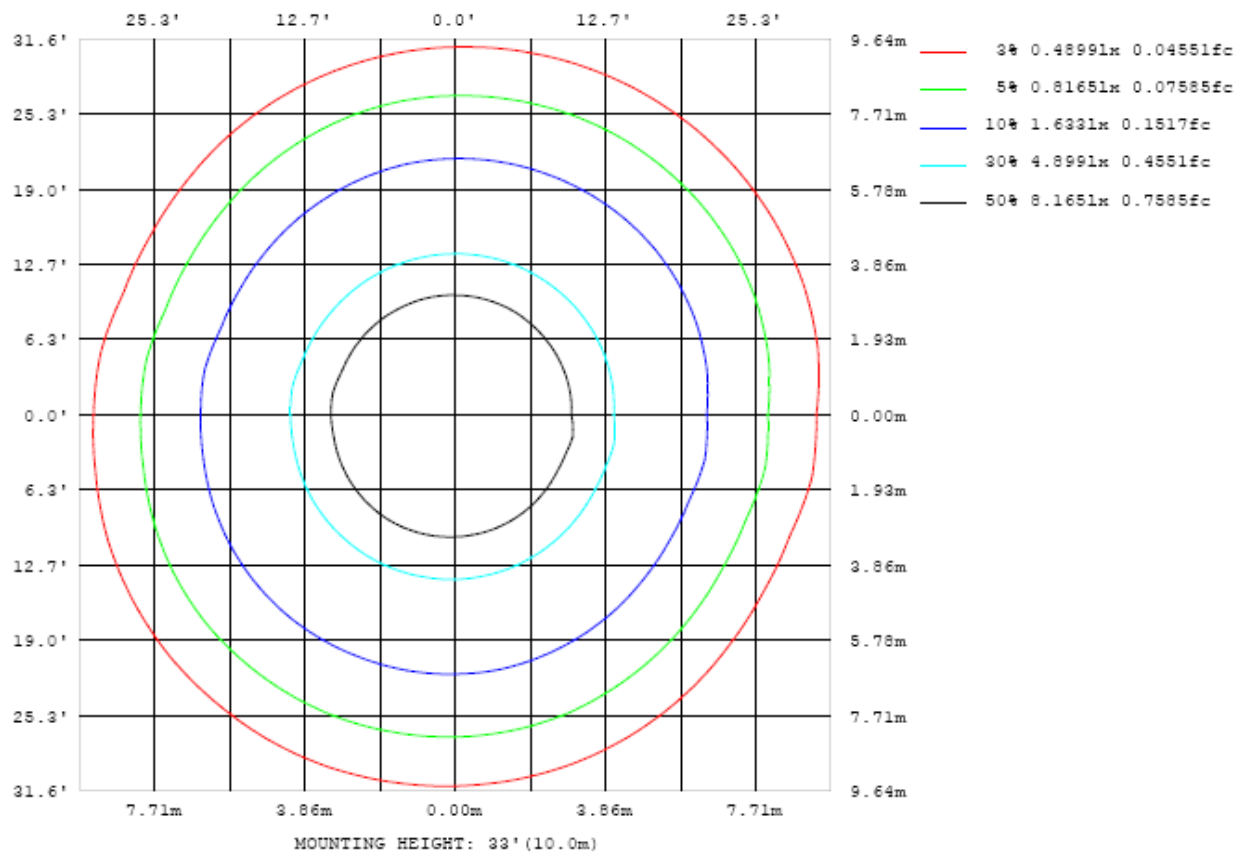


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

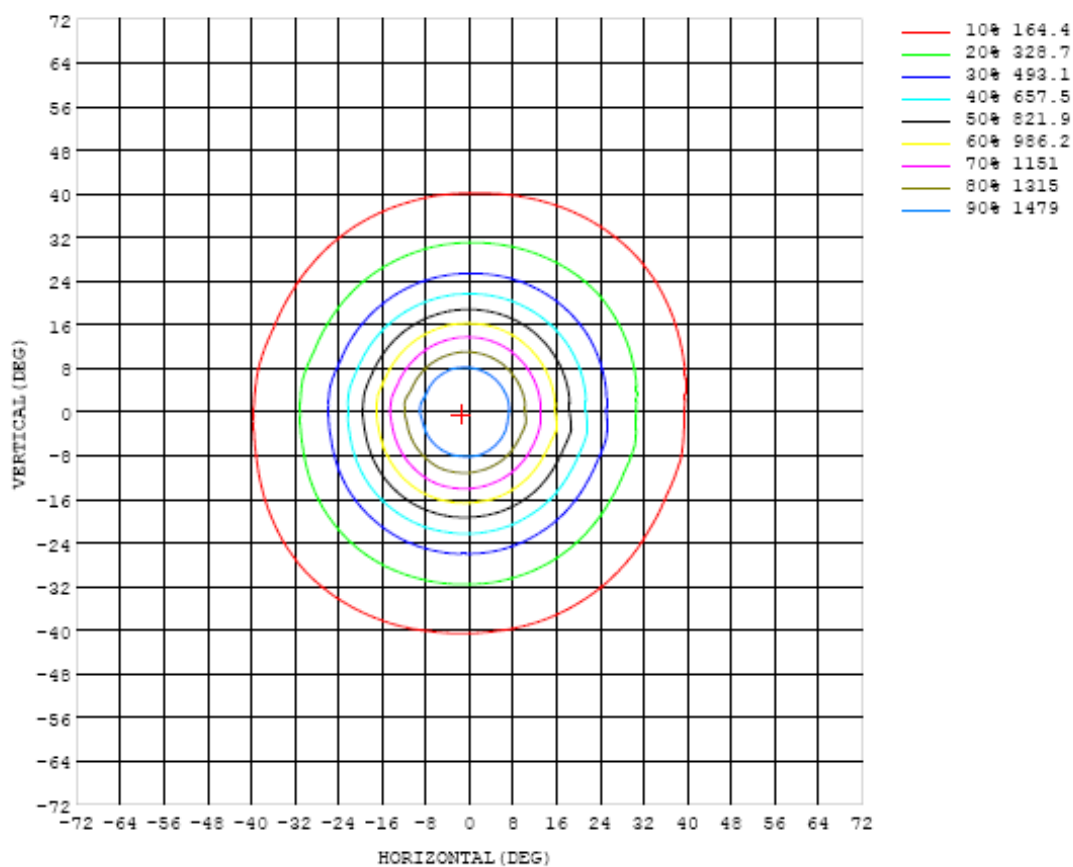


Chart 6: Isocandela Plot

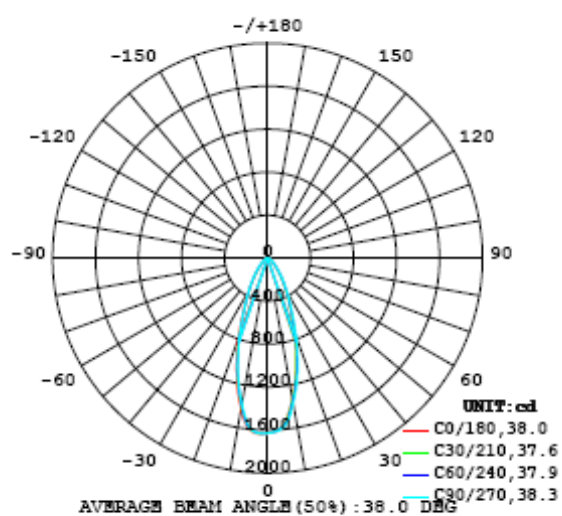


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628
5	1573	1565	1566	1572	1573	1576	1580	1584	1587	1591	1595	1597	1598	1597	1599	1601	1603	1617	1623
10	1325	1348	1333	1331	1340	1347	1353	1361	1367	1374	1383	1391	1399	1402	1409	1411	1410	1412	1427
15	1029	1067	1038	1032	1043	1053	1062	1072	1082	1092	1100	1110	1118	1119	1119	1119	1116	1113	1123
20	728	760	735	731	740	749	757	767	773	781	789	793	801	803	802	801	796	791	796
25	496	513	492	490	496	503	511	519	528	530	536	540	542	541	540	539	533	527	530
30	341	351	335	333	337	344	352	359	367	370	372	375	378	378	376	374	369	360	359
35	232	239	225	224	227	234	240	247	252	255	257	259	261	263	262	258	252	243	240
40	156	159	148	148	151	156	161	166	170	172	174	177	178	178	178	175	169	162	159
45	105	106	99.0	98.6	101	105	109	112	114	115	117	119	120	119	118	116	113	108	105
50	72.6	74.7	69.1	69.3	70.6	72.7	74.9	77.0	78.2	79.2	80.4	81.3	81.8	81.4	80.6	79.0	76.8	73.5	71.5
55	51.4	52.4	49.5	49.4	50.3	51.8	53.5	54.9	55.9	56.7	57.6	57.8	58.1	57.6	56.9	55.9	54.2	52.0	50.7
60	37.0	37.9	35.9	35.9	36.6	37.7	38.7	39.6	40.2	40.6	41.1	41.1	41.1	40.8	40.3	39.6	38.6	37.4	36.5
65	26.6	27.3	26.0	26.1	26.6	27.5	28.0	28.6	28.9	29.1	29.3	29.3	29.2	29.0	28.9	28.6	28.1	27.4	26.9
70	18.9	19.6	18.7	18.8	19.1	19.6	20.0	20.2	20.4	20.6	20.8	20.8	20.9	20.8	20.9	20.8	20.6	20.2	20.1
75	13.0	13.5	12.9	13.0	13.2	13.5	13.8	14.0	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.8	14.7	14.4	14.3
80	8.11	8.51	8.11	8.20	8.22	8.48	8.68	8.84	9.02	9.10	9.19	9.17	9.32	9.46	9.56	9.58	9.54	9.32	9.33
85	4.76	4.93	4.72	4.77	4.77	4.90	5.03	5.14	5.26	5.35	5.41	5.43	5.56	5.66	5.75	5.78	5.75	5.63	5.73
90	1.84	1.88	1.80	1.83	1.85	1.89	1.94	2.00	2.06	2.12	2.17	2.21	2.25	2.32	2.37	2.39	2.38	2.36	2.43
95	0.59	0.57	0.55	0.56	0.57	0.58	0.60	0.61	0.64	0.66	0.67	0.68	0.70	0.72	0.74	0.76	0.76	0.76	0.80
100	0.11	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.13	0.13	0.14
105	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.02
110	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	0.02	0.02	0.02
115	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	0.04
120	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06
125	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	0.07	0.09
130	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.16
135	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.27
140	0.27	0.27	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	0.42
145	0.36	0.37	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.58
150	0.47	0.52	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.44	0.74
155	0.57	0.60	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.55	0.87
160	0.69	0.72	0.67	0.67	0.67	0.67	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.65	0.97
165	0.76	0.77	0.75	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.73	1.02
170	0.80	0.81	0.78	0.79	0.79	0.79	0.79	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.79	0.79	0.77	0.99
175	0.85	0.84	0.81	0.82	0.82	0.82	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.82	0.82	0.82	0.82	0.81	0.88
180	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88

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	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628	1628		
5	1617	1615	1615	1613	1610	1609	1608	1611	1608	1606	1603	1597	1590	1585	1581	1579	1577		
10	1423	1401	1403	1401	1397	1390	1384	1381	1374	1366	1358	1354	1345	1340	1338	1334	1331		
15	1123	1094	1088	1087	1082	1078	1076	1074	1068	1065	1061	1057	1052	1046	1041	1038	1035		
20	797	770	766	760	757	755	752	752	750	750	749	749	748	746	744	742	737		
25	534	509	506	504	503	504	507	508	509	510	513	514	515	516	515	511	507		
30	360	341	338	340	342	345	349	353	355	356	358	361	364	365	363	360	354		
35	239	225	223	225	230	234	239	243	246	247	250	253	255	256	255	252	244		
40	156	146	146	149	153	158	161	165	167	169	171	173	174	175	175	172	166		
45	103	96.1	95.9	98.3	102	105	107	109	111	113	115	117	118	118	118	116	113		
50	70.7	66.3	66.2	67.6	69.7	71.8	73.2	74.6	76.2	77.8	79.1	80.4	81.2	81.5	81.2	80.3	77.8		
55	50.6	47.6	47.5	48.1	49.4	50.8	51.8	52.7	53.7	54.8	55.6	56.5	56.9	57.1	57.0	56.3	54.5		
60	36.6	34.6	34.6	34.9	35.6	36.5	36.9	37.4	38.1	38.8	39.4	39.9	40.2	40.3	40.2	39.7	38.7		
65	27.3	25.9	25.8	25.9	26.4	26.8	27.0	27.2	27.4	27.8	28.2	28.5	28.6	28.7	28.6	28.4	27.7		
70	20.6	19.5	19.4	19.5	19.6	19.8	19.8	19.8	19.9	20.1	20.2	20.3	20.4	20.4	20.3	20.1	19.7		
75	14.8	13.8	13.8	13.8	13.9	13.8	13.8	13.8	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.5	13.3		
80	9.81	9.21	9.15	9.05	9.06	8.92	8.86	8.82	8.70	8.59	8.56	8.49	8.41	8.44	8.41	8.24	8.25		
85	5.97	5.65	5.58	5.52	5.47	5.37	5.30	5.25	5.16	5.08	5.03	4.95	4.87	4.91	4.86	4.78	4.81		
90	2.52	2.36	2.29	2.25	2.20	2.15	2.11	2.06	2.02	1.99	1.95	1.91	1.88	1.86	1.85	1.85	1.84		
95	0.85	0.79	0.76	0.75	0.73	0.71	0.70	0.68	0.67	0.66	0.64	0.62	0.60	0.58	0.58	0.58	0.57		
100	0.15	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.14	0.13	0.13	0.12	0.11	0.10	0.10	0.09		
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	0.02	0.02	0.02		
110	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03		
115	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		
120	0.06	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.06	0.06	0.06	0.06		
125	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10		
130	0.17	0.16	0.16	0.16	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.17	0.17		
135	0.29	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.31	0.30	0.30	0.30	0.30	0.29		
140	0.44	0.42	0.43	0.43	0.43	0.44	0.44	0.45	0.45	0.46	0.46	0.46	0.46	0.46	0.45	0.45	0.44		
145	0.62	0.59	0.60	0.60	0.60	0.61	0.61	0.62	0.62	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.61		
150	0.79	0.76	0.76	0.77	0.77	0.77	0.78	0.78	0.78	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.77		
155	0.94	0.90	0.90	0.91	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.93	0.92	0.92	0.92	0.93	0.90		
160	1.05	1.01	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.03	1.00		
165	1.12	1.07	1.07	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.07	1.07	1.07	1.08	1.04		
170	1.11	1.07	1.06	1.06	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.05	1.05	1.06	1.07	1.01		
175	0.99	0.98	0.95	0.96	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.89		
180	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88		

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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