



## **LM-79-08 Test Report**

for

**Philips (China) Investment Co., Ltd.**

Building 9, Lane 888, Tianlin Road  
Shanghai, China

**InstantFit LEDtube**

**Model: 9290011808(2 lamps+ballast ICF-2S26-H1-LD)**

**Laboratory: Leading Testing Laboratories**

No.1805, DongLiu road, BinJiang District, Hangzhou, China  
Tel: +86-571-56680806  
[www.ledtestlab.com](http://www.ledtestlab.com)

Report No.: HZ15070027e

Review by:

Handwritten signature of April Zou in blue ink.

Engineer: April Zou  
Jul. 22, 2015

Approved by:



Handwritten signature of Jim Zhang in blue ink.

Manager: Jim Zhang  
Jul. 22, 2015

## Test Summary

Sample Tested: 9290011808(2 lamps+ballast ICF-2S26-H1-LD)

### Photometric and Electrical Measurements for two lamps

Voltage (V AC)	Current (A)	Test power (W) (ballast + 2 tubes)	Power Factor	Total Luminous Flux (lm)	Luminous Efficacy (lm/W)	Total Harmonic Distortion
120.0	0.174	20.73	0.9959	1839.4	88.7	5.84

### Photometric and Colorimetric Measurements for each lamp

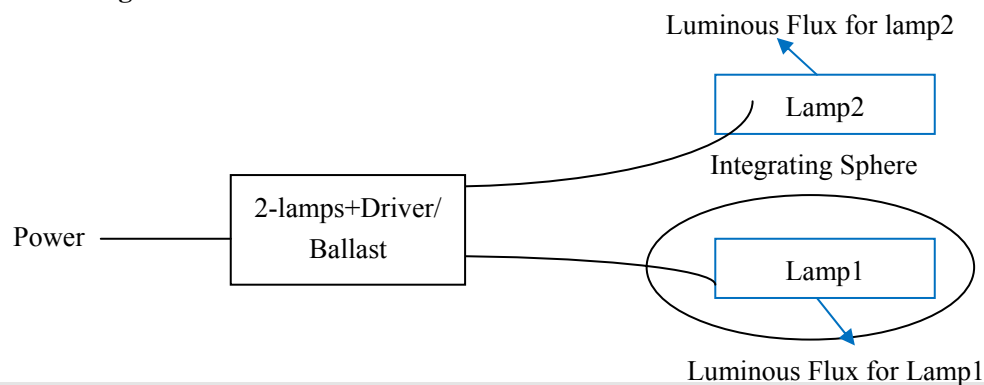
Sample Number	Luminous Flux(lm)	Correlated Color Temperature (K)	Color Rendering Index Ra
1#	918.6	2962	81.9
2#	920.8	2958	81.8
Sample Number	Color Rendering Index R9	Chromaticity Coordinate x	Chromaticity Coordinate y
1#	6.6	0.4413	0.4085
2#	6.6	0.4415	0.4086

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

Luminous Efficacy= (Luminous Flux for lamp1+ Luminous Flux for lamp2)/Power

Test figure is shown as following:



### Test specifications:

**Date of Receipt** : Jul. 16, 2015

**Date of Test** : Jul. 20, 2015 to Jul. 21, 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

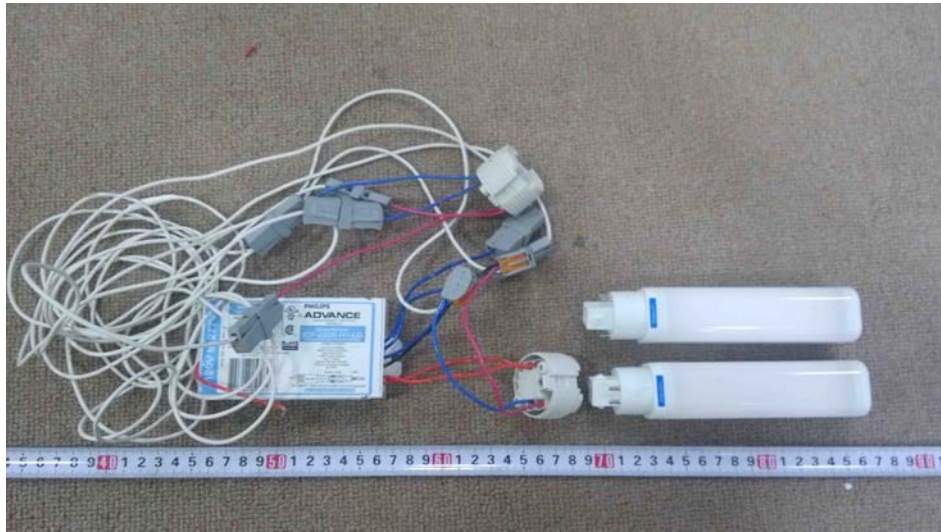


Figure 1- Overview of the sample

### Equipment Under Test (EUT)

<b>Name</b>	: InstantFit LEDtube
<b>Model</b>	: 9290011808(2 lamps+ballast ICF-2S26-H1-LD)
<b>Electrical Ratings</b>	: 120Vac, 60Hz, 8.5W
<b>Product Description</b>	: 3000K, Frosted Plastic lens, 8.5PL-C/T LED/26H-3000 IF 4P 10/1 LED lamps supplied by a high frequency fluorescent lamp ballast: Philips ICF-2S26-H1-LD
<b>Manufacturer</b>	: Philips (China) Investment Co., Ltd.
<b>Address</b>	: Building 9, Lane 888, Tianlin Road Shanghai, China

## TEST RESULTS

Test ambient temperature was 25.2°C.

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

The stabilization time of the sample was 70 minutes, and the total operating time including stabilization was 75 minutes.

### Sphere-Spectroradiometer Method

Parameter	Result	
	1#	2#
Test Voltage (V)	120.0	
Voltage frequency (Hz)	60	
Test Current (A)	0.174	
Power Factor	0.9959	
Test power (W) (ballast + 2 tubes)	20.73	
THD A%	5.84	
Luminous Efficacy (lm/W)	88.7	
Total Luminous Flux (lm)	918.6	920.8
Color Rendering Index (CRI)	81.9	81.8
R9	6.6	6.6
Correlated Color Temperature (CCT) (K)	2962	2958
Chromaticity Chroma x	0.4413	0.4415
Chromaticity Chroma y	0.4085	0.4086
Chromaticity Chroma u	0.2514	0.2516
Chromaticity Chroma v	0.3492	0.3492
Duv	0.0010	0.0009
Chromaticity Chroma u'	0.2514	0.2516
Chromaticity Chroma v'	0.5238	0.5238

Special Color Rendering Indices		
	1#	2#
R1	79.7	79.7
R2	90.2	90.3
R3	96.6	96.6
R4	79	79
R5	79.7	79.7
R6	87.9	87.9
R7	83	83
R8	58.7	58.6
R9	6.6	6.6
R10	77.8	77.9
R11	77.5	77.4
R12	69.4	69.5
R13	82.1	82.1
R14	98.7	98.7

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u',v') diagram,  $u' = u = 4x/(-2x+12y+3)$ ,  $v' = 3v/2 = 9y/(-2x+12y+3)$ .

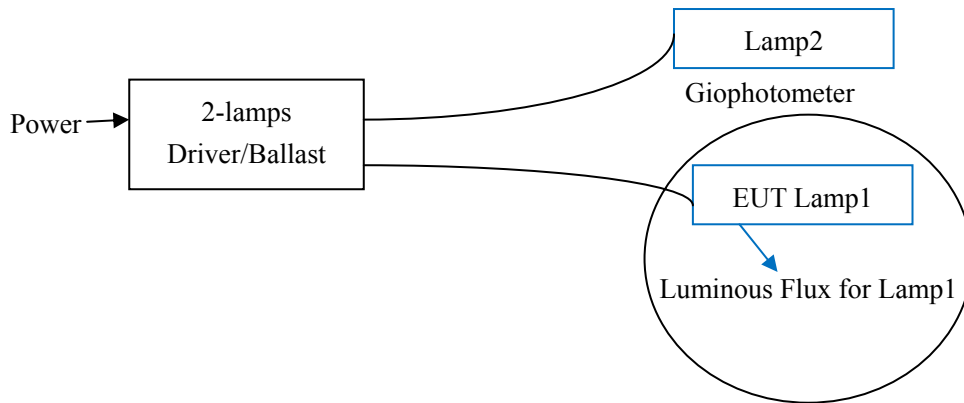
### Goniophotometer Method

Test ambient temperature was 25.1°C.

The photometric distance is 2.475m.

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

Test figure is shown as following:



Note: One lamp was tested in Goniophotometer system. The total electrical input data was recorded before the ballast and divided by 2 in table below to be used as the input data of the tested one lamp.

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.173
Power Factor	0.9956
Test Power (W) (ballast + 2 tubes)/2	10.34
Luminous Efficacy (lm/W)	90.6
Total Luminous Flux (lm) (Single tube)	936.3
Beam Angle (°)	110.7 (0°-180°)/ 123.1 (90°-270°)
Center Beam Candle Power (cd)	286
Maximum Beam Candle Power (cd)	286.0 (At: C=110.0, Gamma=1.0)
Spacing Criteria	1.24 (0°-180°)/ 1.28 (90°-270°)
Zonal Lumens in the 0°-60°Zone	69.70%
Zonal Lumens in the 60°-90°Zone	24.80%
Zonal Lumens in the 90°-120°Zone	4.82%
Zonal Lumens in the 120°-180°Zone	0.68%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution of 1# tube - Sphere Spectroradiometer Method

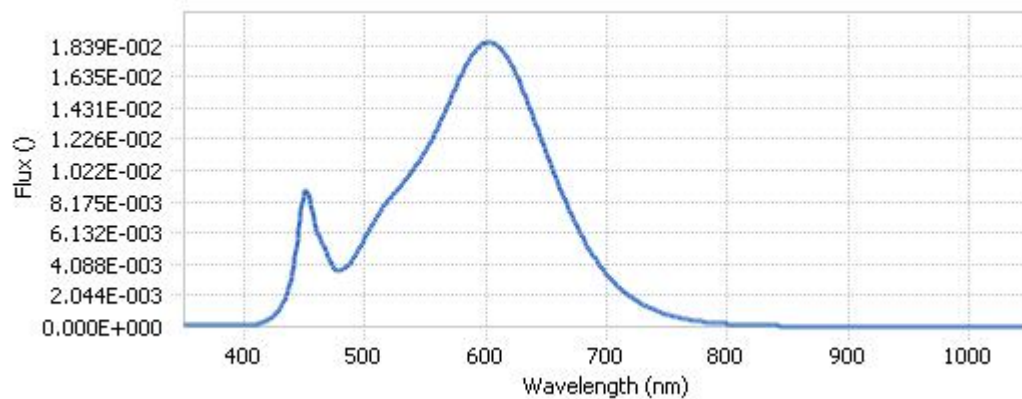


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	8.89E-05	485	3.93E-03	590	1.79E-02	695	3.96E-03
385	1.08E-04	490	4.41E-03	595	1.83E-02	700	3.43E-03
390	9.27E-05	495	5.08E-03	600	1.86E-02	705	2.98E-03
395	9.76E-05	500	5.83E-03	605	1.85E-02	710	2.58E-03
400	1.03E-04	505	6.55E-03	610	1.83E-02	715	2.25E-03
405	1.28E-04	510	7.22E-03	615	1.79E-02	720	1.95E-03
410	1.81E-04	515	7.83E-03	620	1.73E-02	725	1.69E-03
415	2.67E-04	520	8.32E-03	625	1.65E-02	730	1.46E-03
420	4.59E-04	525	8.79E-03	630	1.56E-02	735	1.24E-03
425	7.66E-04	530	9.29E-03	635	1.46E-02	740	1.07E-03
430	1.30E-03	535	9.80E-03	640	1.35E-02	745	9.26E-04
435	2.15E-03	540	1.03E-02	645	1.25E-02	750	7.89E-04
440	3.67E-03	545	1.09E-02	650	1.14E-02	755	6.85E-04
445	6.40E-03	550	1.16E-02	655	1.04E-02	760	5.90E-04
450	8.86E-03	555	1.22E-02	660	9.37E-03	765	5.09E-04
455	7.94E-03	560	1.30E-02	665	8.38E-03	770	4.33E-04
460	6.21E-03	565	1.39E-02	670	7.45E-03	775	3.77E-04
465	5.37E-03	570	1.47E-02	675	6.61E-03	780	3.23E-04
470	4.41E-03	575	1.56E-02	680	5.85E-03		
475	3.75E-03	580	1.65E-02	685	5.16E-03		
480	3.66E-03	585	1.73E-02	690	4.52E-03		

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



## Chromaticity Diagram of 1# tube - Sphere Spectroradiometer Method

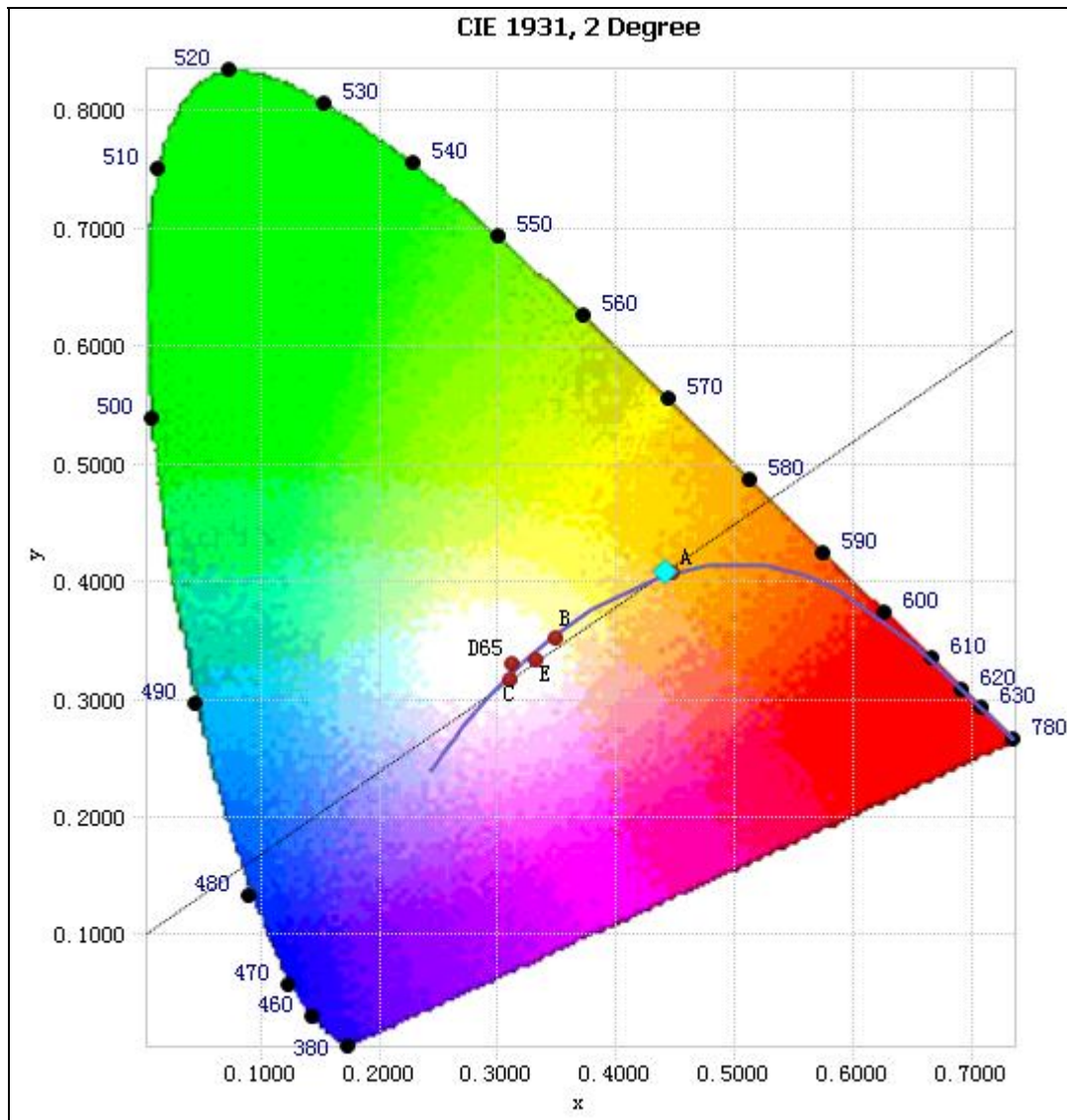


Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.



### Nominal CCT Quadrangles of 1# tube – Sphere Spectroradiometer Method

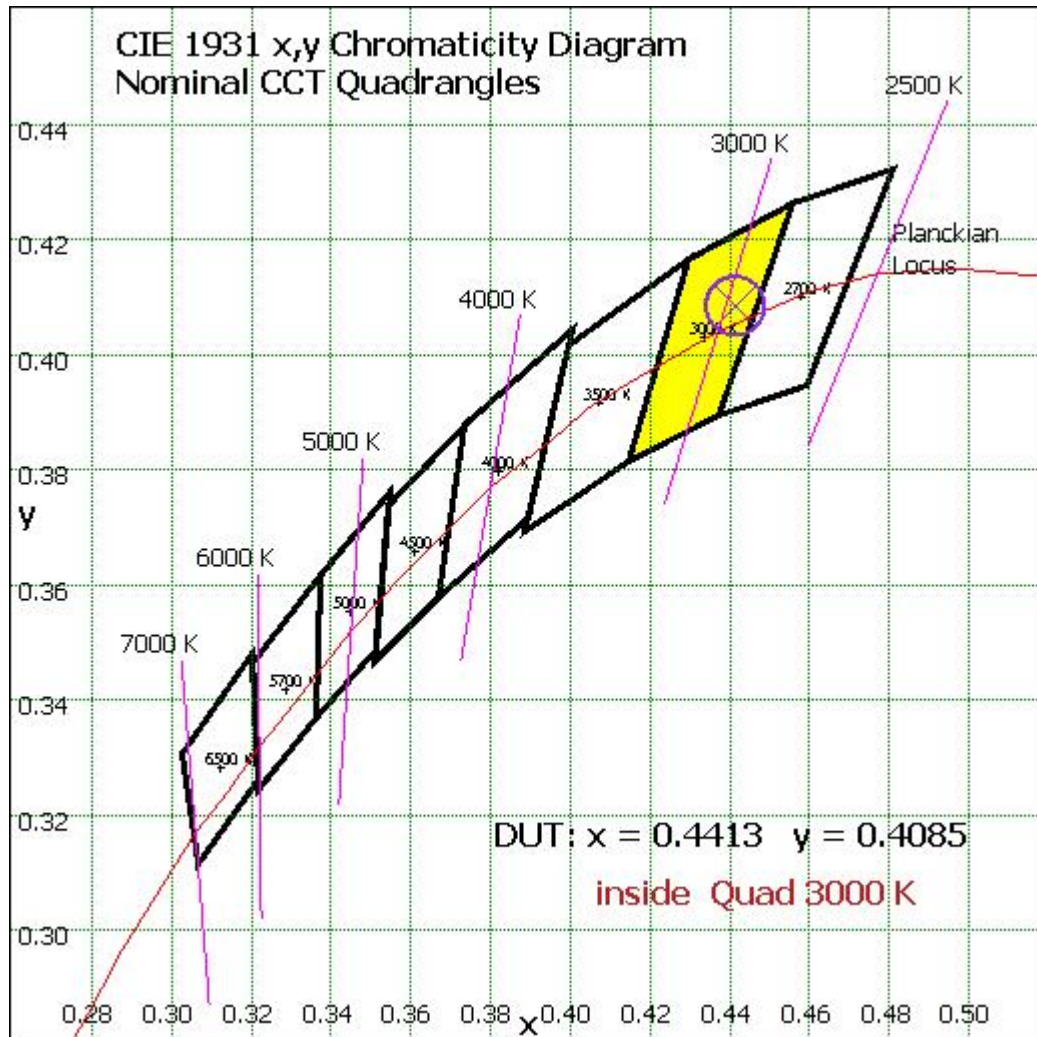


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	27.031	2.89%
10- 20	77.375	8.26%
20- 30	117.339	12.53%
30- 40	142.129	15.18%
40- 50	149.407	15.96%
50- 60	139.311	14.88%
60- 70	113.592	12.13%
70- 80	77.243	8.25%
80- 90	41.385	4.42%
90-100	22.869	2.44%
100-110	14.142	1.51%
110-120	8.11	0.87%
120-130	4.069	0.43%
130-140	1.58	0.17%
140-150	0.434	0.05%
150-160	0.155	0.02%
160-170	0.075	0.01%
170-180	0.024	0.00%
Total	936.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	652.592	69.70%
60- 90	232.22	24.80%
0-90	884.812	94.50%
90- 180	51.458	5.50%
0- 180	936.3	100%

Table 5: Zonal Lumen Data

## Illuminance Plots- Goniophotometer Method

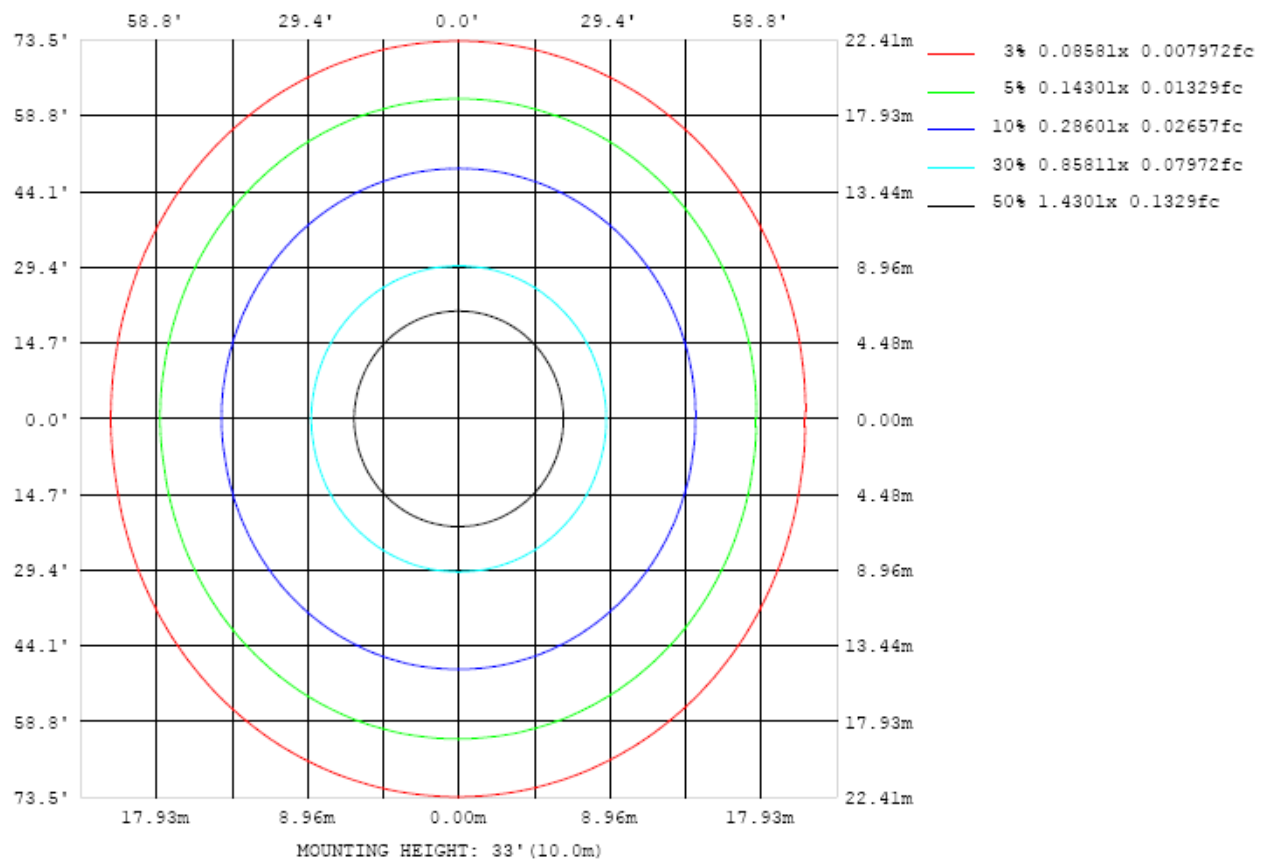


Chart 4: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

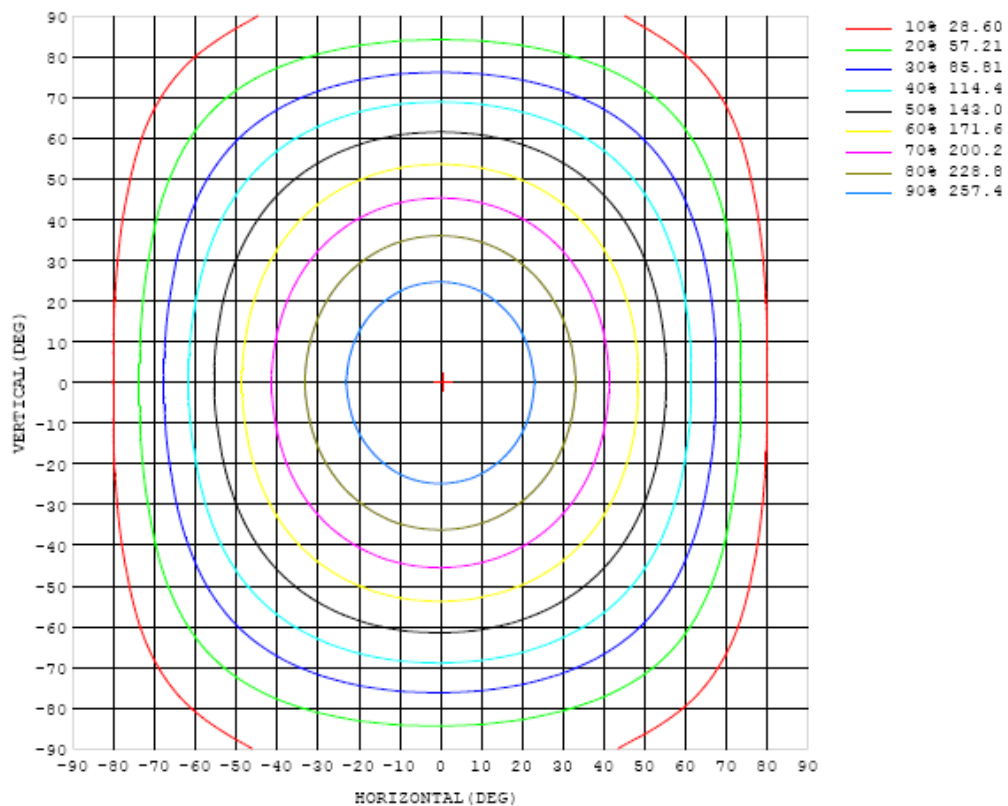


Chart 5: Isocandela Plot

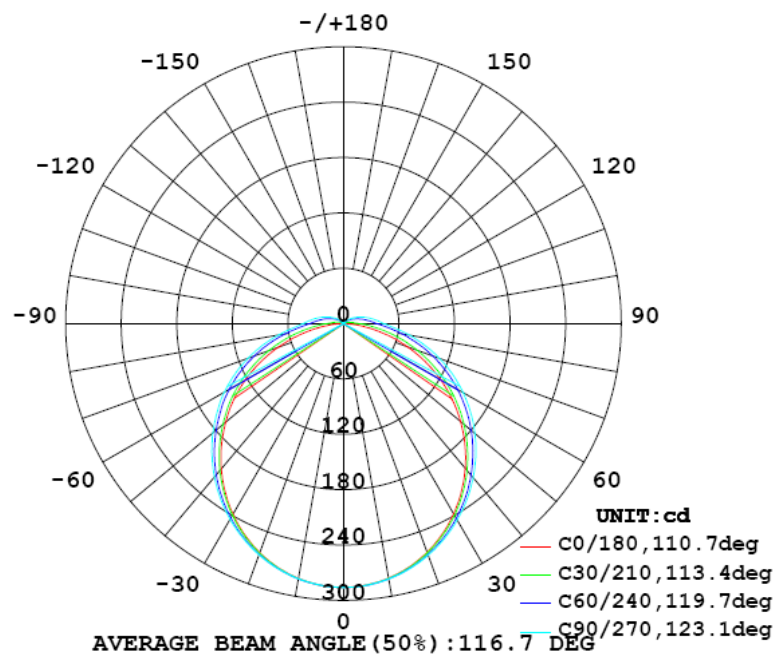


Chart 6: Polar Candela Distribution

## 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	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286
5	284	284	284	284	284	284	285	285	284	285	284	285	285	284	285	284	285	285	284
10	280	280	280	280	280	280	281	281	281	281	281	281	281	281	281	281	280	281	280
15	273	273	273	274	274	274	275	275	275	275	275	275	275	275	274	274	274	274	274
20	264	264	264	265	265	265	266	266	267	267	267	267	267	266	266	265	265	265	264
25	252	252	253	253	254	255	256	257	257	257	257	257	256	255	255	254	253	253	253
30	238	238	239	240	241	242	244	245	245	246	245	245	244	243	242	240	239	239	239
35	222	222	223	224	226	228	230	231	232	232	232	232	230	229	227	225	224	223	223
40	205	205	206	208	210	212	214	216	217	218	218	217	215	213	211	208	207	206	205
45	185	186	187	189	192	195	198	200	201	202	202	201	198	196	193	190	188	187	186
50	165	166	167	170	173	176	180	183	184	185	185	183	181	178	174	171	168	167	166
55	143	144	146	149	153	157	161	164	167	168	167	165	162	159	155	151	147	145	145
60	121	122	124	128	133	138	142	146	148	149	149	147	143	139	134	130	126	123	123
65	97.3	98.5	102	107	112	117	122	126	129	130	129	127	124	119	114	108	103	99.7	99.2
70	73.3	74.9	79.2	84.9	91.0	96.9	102	107	109	110	110	108	104	98.7	92.9	86.7	80.9	76.3	75.2
75	50.3	52.4	57.8	64.4	70.7	77.0	82.6	86.9	89.7	90.9	90.3	88.0	84.0	78.7	72.2	66.2	59.7	54.0	51.5
80	28.4	31.1	37.4	44.8	52.0	58.6	64.3	68.9	70.9	73.1	71.5	69.4	65.7	60.4	53.9	46.8	39.5	32.9	29.5
85	11.2	14.2	20.8	28.3	35.5	42.1	47.7	51.9	54.6	55.6	55.1	52.9	49.0	43.8	37.4	30.3	22.9	15.9	12.2
90	0.73	4.07	10.6	17.5	24.4	30.7	36.1	40.2	42.8	43.7	43.2	41.1	37.4	32.4	26.3	19.6	12.7	6.43	2.38
95	0.07	1.43	5.75	11.9	18.3	24.4	29.7	33.7	36.2	37.2	36.6	34.5	30.9	26.0	20.2	13.8	7.54	2.66	0.65
100	0.10	0.53	3.43	8.24	13.8	19.3	24.2	27.9	30.3	31.3	30.8	28.7	25.3	20.8	15.5	9.90	4.84	1.53	0.63
105	0.14	0.45	2.07	5.68	10.3	15.1	19.4	22.8	25.0	25.9	25.4	23.6	20.5	16.4	11.8	7.11	3.22	1.12	0.62
110	0.18	0.24	1.21	3.90	7.58	11.6	15.3	18.3	20.3	21.1	20.6	19.0	16.3	12.8	8.85	5.08	2.18	0.87	0.61
115	0.19	0.13	0.74	2.61	5.44	8.69	11.8	14.4	16.1	16.8	16.4	15.0	12.7	9.73	6.52	3.61	1.51	0.73	0.56
120	0.21	0.12	0.48	1.31	3.82	6.35	8.89	11.0	12.4	13.0	12.7	11.5	9.62	7.25	4.73	2.30	1.01	0.55	0.52
125	0.13	0.15	0.34	0.87	2.04	4.52	6.48	8.18	9.34	9.81	9.56	8.62	7.10	5.24	3.25	1.32	0.68	0.51	0.49
130	0.23	0.26	0.29	0.58	0.91	2.37	4.48	5.68	6.75	7.12	6.95	6.20	5.06	3.43	1.63	0.87	0.55	0.48	0.46
135	0.28	0.28	0.28	0.41	0.74	1.09	2.18	3.59	4.56	4.81	4.64	3.96	2.63	1.65	0.96	0.62	0.48	0.46	0.45
140	0.29	0.30	0.29	0.34	0.50	0.76	1.13	1.60	1.98	2.07	1.89	1.53	1.11	0.84	0.63	0.48	0.43	0.43	0.43
145	0.27	0.20	0.30	0.32	0.38	0.51	0.70	0.99	1.07	1.05	0.94	0.79	0.66	0.55	0.46	0.41	0.40	0.41	0.40
150	0.22	0.21	0.27	0.29	0.32	0.37	0.42	0.50	0.57	0.58	0.54	0.48	0.44	0.40	0.37	0.36	0.37	0.38	0.38
155	0.22	0.22	0.21	0.21	0.22	0.24	0.28	0.31	0.34	0.35	0.35	0.34	0.33	0.32	0.32	0.33	0.34	0.35	0.35
160	0.22	0.23	0.22	0.21	0.22	0.23	0.24	0.25	0.27	0.28	0.27	0.27	0.28	0.28	0.30	0.31	0.32	0.32	0.33
165	0.24	0.24	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.25	0.24	0.27	0.28	0.29	0.30	0.30	0.30
170	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.22	0.22	0.23	0.24	0.25	0.26	0.27	0.27	0.28	0.29
175	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.23	0.23	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.27
180	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.23	0.23	0.23	0.23	0.21	0.23

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	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286	286		
5	285	284	285	285	284	285	285	284	284	284	285	284	284	284	284	284	284		
10	280	280	281	281	281	281	281	281	281	281	281	281	280	280	280	280	280		
15	274	274	274	274	274	275	275	275	275	275	275	274	274	274	274	273	273		
20	264	264	265	265	266	266	266	267	267	267	266	266	265	265	264	264	264		
25	253	253	253	254	255	256	256	256	257	256	256	255	255	254	253	252	252		
30	239	239	240	241	242	243	244	245	245	245	244	243	242	241	239	239	238		
35	223	223	225	226	228	229	231	231	232	231	231	229	227	226	224	223	222		
40	205	206	208	210	212	214	215	217	217	217	216	214	212	209	207	206	205		
45	187	188	189	192	195	197	199	200	201	201	199	197	194	192	189	187	186		
50	166	168	170	173	176	180	182	184	184	184	182	179	176	173	170	168	166		
55	146	148	151	154	158	161	164	166	166	166	164	161	158	154	150	147	145		
60	123	126	129	134	138	142	146	148	149	148	146	142	138	134	129	125	123		
65	100.0	103	108	113	118	123	126	129	129	129	126	123	118	113	108	103	99.7		
70	76.4	80.5	85.9	91.8	97.4	103	106	109	110	109	107	103	97.6	91.9	86.0	80.4	76.3		
75	53.4	58.4	64.8	71.3	77.4	82.7	86.9	89.4	90.3	89.4	86.9	82.8	77.6	71.5	65.0	58.5	53.2		
80	32.1	38.1	45.2	52.1	58.5	63.9	68.0	70.5	71.3	70.5	68.0	64.0	58.6	52.4	45.4	38.4	32.1		
85	15.4	21.7	29.0	36.0	42.3	47.7	51.6	54.0	54.7	54.0	51.7	47.7	42.5	36.2	29.2	22.0	15.4		
90	5.59	11.7	18.6	25.4	31.5	36.7	40.6	43.0	43.7	43.0	40.8	36.9	31.7	25.6	18.8	11.8	5.41		
95	2.26	6.78	12.9	19.4	25.3	30.4	34.2	36.6	37.4	36.7	34.4	30.6	25.5	19.6	13.1	6.83	2.06		
100	1.38	4.35	9.23	14.8	20.3	24.9	28.6	30.8	31.6	30.9	28.7	25.1	20.4	15.0	9.34	4.30	1.00		
105	1.06	2.91	6.63	11.2	16.0	20.2	23.5	25.6	26.3	25.6	23.6	20.4	16.2	11.3	6.65	2.75	0.69		
110	0.87	1.99	4.76	8.46	12.4	16.1	19.0	20.8	21.5	20.9	19.1	16.2	12.5	8.49	4.69	1.73	0.51		
115	0.75	1.47	3.40	6.27	9.49	12.5	15.0	16.6	17.2	16.7	15.1	12.6	9.51	6.23	3.24	0.94	0.33		
120	0.56	0.99	2.20	4.57	7.10	9.57	11.6	12.9	13.3	12.9	11.6	9.58	7.07	4.47	1.96	0.72	0.29		
125	0.52	0.66	1.29	3.19	5.18	7.11	8.70	9.76	10.1	9.78	8.72	7.08	5.11	2.99	1.10	0.49	0.28		
130	0.49	0.55	0.85	1.60	3.51	5.12	6.34	7.16	7.44	7.16	6.34	5.06	3.40	1.27	0.79	0.38	0.29		
135	0.46	0.49	0.63	1.02	1.70	2.87	4.42	5.05	5.26	5.04	4.39	2.80	1.46	1.01	0.55	0.34	0.31		
140	0.44	0.45	0.51	0.69	1.04	1.49	1.99	2.46	2.66	2.46	1.93	1.44	1.04	0.67	0.43	0.33	0.32		
145	0.41	0.41	0.43	0.51	0.66	0.88	1.11	1.29	1.35	1.34	1.18	0.92	0.68	0.52	0.38	0.34	0.32		
150	0.39	0.38	0.38	0.40	0.46	0.55	0.64	0.71	0.74	0.71	0.67	0.57	0.47	0.41	0.35	0.31	0.27		
155	0.36	0.36	0.35	0.34	0.35	0.38	0.40	0.42	0.43	0.43	0.38	0.32	0.28	0.25	0.23	0.22	0.22		
160	0.33	0.33	0.32	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.28	0.26	0.25	0.25	0.26	0.23	0.23		
165	0.31	0.30	0.30	0.29	0.29	0.28	0.27	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		
170	0.29	0.29	0.29	0.28	0.28	0.28	0.27	0.26	0.25	0.25	0.25	0.26	0.25	0.26	0.25	0.24	0.24		
175	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.24	0.24	0.24	0.23	0.24	0.24	0.24	0.25	0.25		
180	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23		

Table 7: 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
Fluorescent Ballast Analyzer	HB-6B	HZTE002-01	Sep. 18, 2014	Sep. 17, 2015

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  $4\pi$ . 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 expended uncertainty is 1.06% 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 1.94% with a coverage factor  $k=2$ .

### **Color Characteristics Measurements**

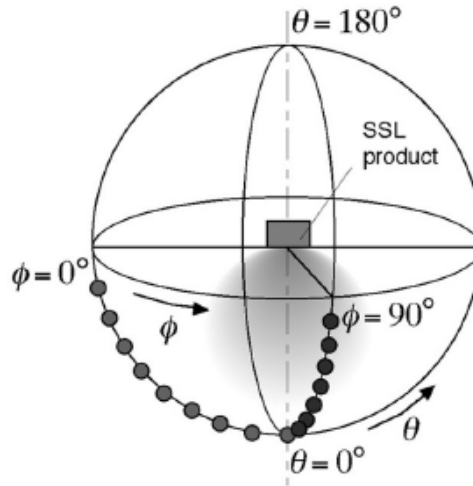
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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  $10^\circ$  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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