



LM-79-08 Test Report

for

Philips (China) Investment Co., Ltd.

Building 9, Lane 888, Tianlin Road
Shanghai, China

InstantFit LEDtube

Model: 9290011807(2 lamps+ballast ICF-2S26-H1-LD)

Laboratory: Leading Testing Laboratories

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Report No.: HZ15070027d

Review by:

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Engineer: April Zou
Jul. 22, 2015

Approved by:



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Manager: Jim Zhang
Jul. 22, 2015

Test Summary

Sample Tested: 9290011807(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	0.173	20.67	0.9959	1820.0	88.1	5.89

Photometric and Colorimetric Measurements for each lamp

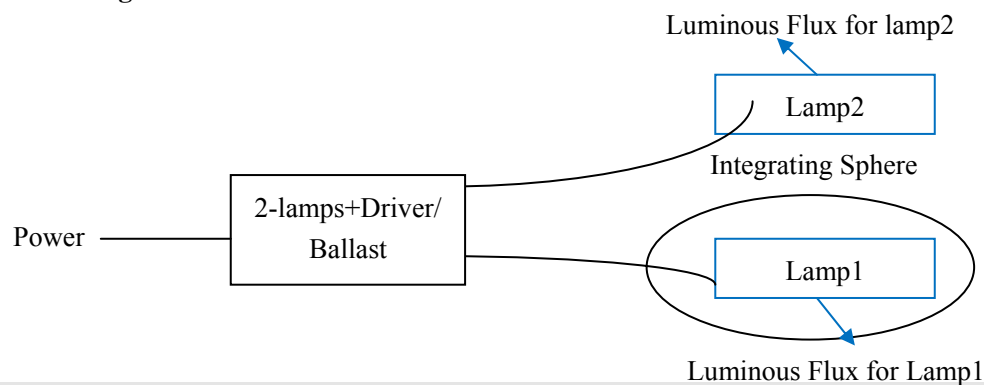
Sample Number	Luminous Flux(lm)	Correlated Color Temperature (K)	Color Rendering Index Ra
1#	909.0	2710	80.7
2#	911.0	2711	80.7
Sample Number	Color Rendering Index R9	Chromaticity Coordinate x	Chromaticity Coordinate y
1#	2.2	0.4592	0.4109
2#	2.1	0.4591	0.4108

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

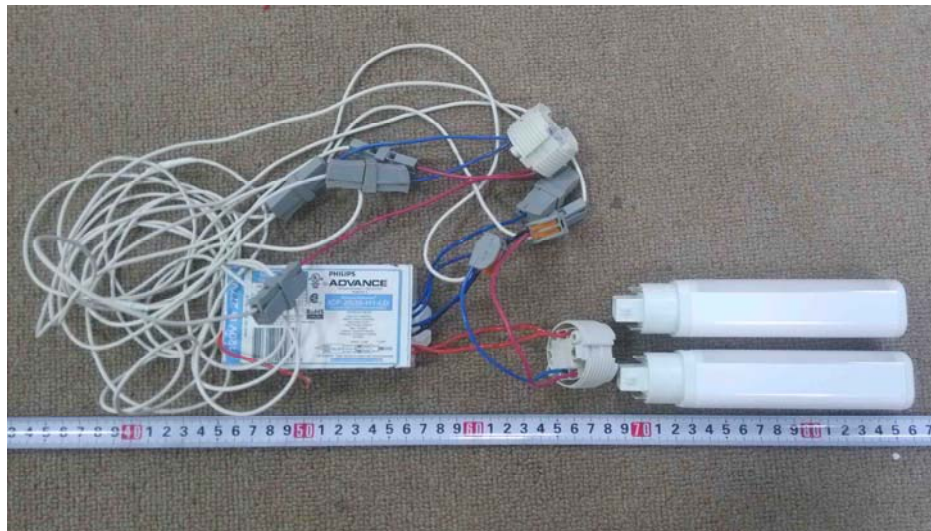


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: InstantFit LEDtube
Model	: 9290011807(2 lamps+ballast ICF-2S26-H1-LD)
Electrical Ratings	: 120Vac, 60Hz, 8.5W
Product Description	: 2700K, Frosted Plastic lens, 8.5PL-C/T LED/26H-2700 IF 4P 10/1 LED lamps supplied by a high frequency fluorescent lamp ballast: Philips ICF-2S26-H1-LD
Manufacturer	: Philips (China) Investment Co., Ltd.
Address	: Building 9, Lane 888, Tianlin Road Shanghai, China

TEST RESULTS

Test ambient temperature was 24.9°C.

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

The stabilization time of the sample was 65 minutes, and the total operating time including stabilization was 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
	1#	2#
Test Voltage (V)	120.0	
Voltage frequency (Hz)	60	
Test Current (A)	0.173	
Power Factor	0.9959	
Test power (W) (ballast + 2 tubes)	20.67	
THD A%	5.89	
Luminous Efficacy (lm/W)	88.1	
Total Luminous Flux (lm)	909.0	911.0
Color Rendering Index (CRI)	80.7	80.7
R9	2.2	2.1
Correlated Color Temperature (CCT) (K)	2710	2711
Chromaticity Chroma x	0.4592	0.4591
Chromaticity Chroma y	0.4109	0.4108
Chromaticity Chroma u	0.2619	0.2619
Chromaticity Chroma v	0.3516	0.3515
Duv	0.0002	0.0002
Chromaticity Chroma u'	0.2619	0.2619
Chromaticity Chroma v'	0.5273	0.5273

Special Color Rendering Indices		
	1#	2#
R1	79.8	79.7
R2	93.2	93.2
R3	91.4	91.4
R4	76.1	76.1
R5	80.2	80.2
R6	92.9	92.8
R7	78.5	78.5
R8	53.5	53.5
R9	2.2	2.1
R10	85.1	85.1
R11	74.9	74.8
R12	75.6	75.5
R13	83.1	83.1
R14	95.8	95.9

Table 2: Test data per Sphere-Spectroradiometer Method

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

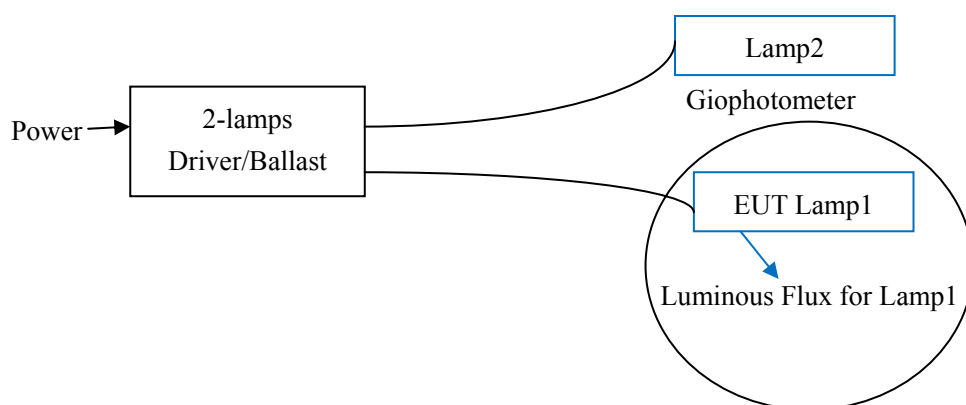
Goniophotometer Method

Test ambient temperature was 25.2°C.

The photometric distance is 2.475m.

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 Giophotometer 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)	0.177
Power Factor	0.9958
Test Power (W) (ballast + 2 tubes)/2	10.55
Luminous Efficacy (lm/W)	86.8
Total Luminous Flux (lm) (Single tube)	915.6
Beam Angle (°)	110.6 (0°-180°)/ 123.0 (90°-270°)
Center Beam Candle Power (cd)	280
Maximum Beam Candle Power (cd)	279.7 (At: C=320.0, Gamma=0.5)
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	24.81%
Zonal Lumens in the 90°-120°Zone	4.82%
Zonal Lumens in the 120°-180°Zone	0.67%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution of 1# tube - Sphere Spectroradiometer Method

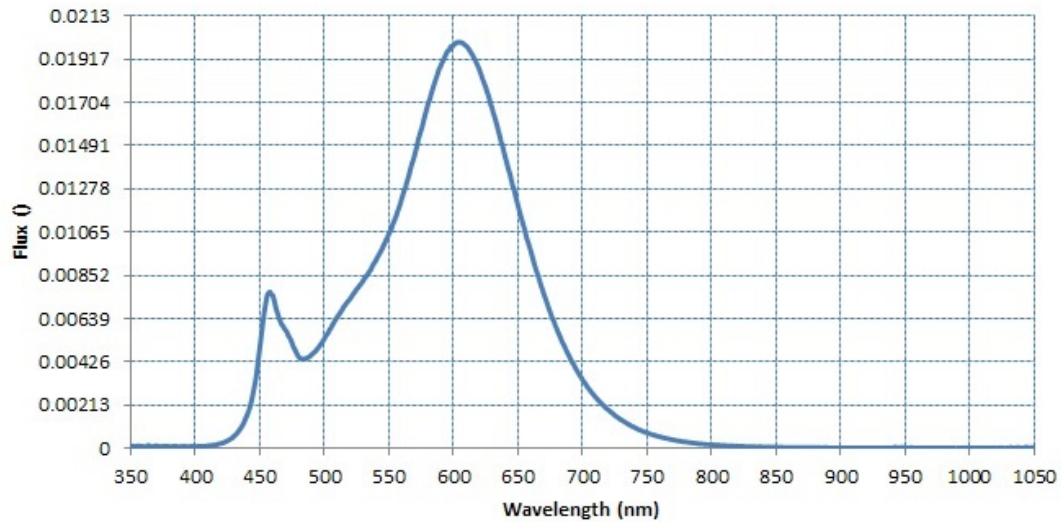
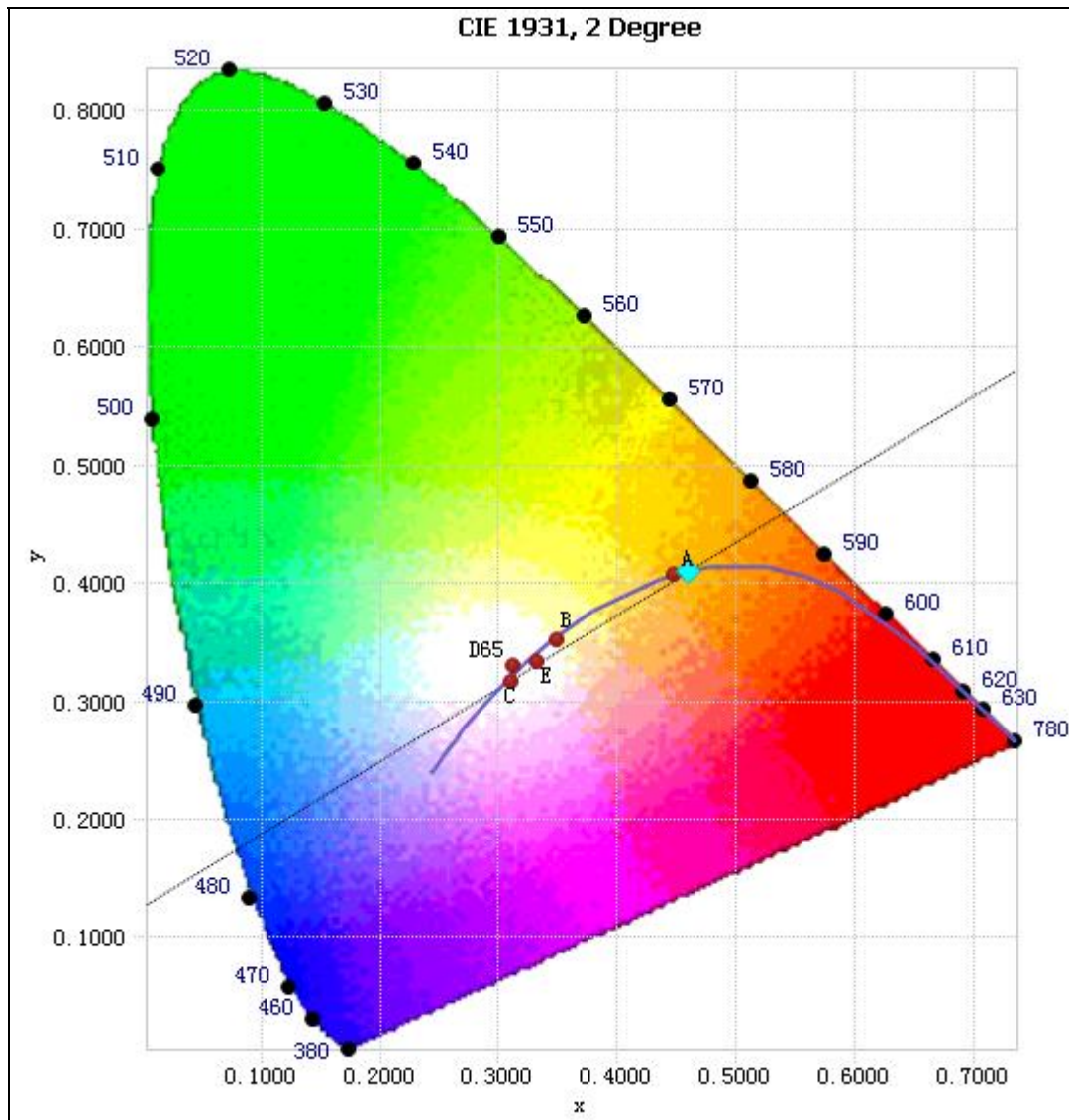


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.50E-05	485	4.41E-03	590	1.88E-02	695	3.90E-03
385	9.43E-05	490	4.59E-03	595	1.95E-02	700	3.38E-03
390	8.67E-05	495	4.92E-03	600	1.98E-02	705	2.93E-03
395	8.29E-05	500	5.38E-03	605	2.00E-02	710	2.53E-03
400	7.86E-05	505	5.90E-03	610	1.98E-02	715	2.18E-03
405	9.63E-05	510	6.46E-03	615	1.94E-02	720	1.89E-03
410	1.20E-04	515	6.96E-03	620	1.87E-02	725	1.62E-03
415	1.46E-04	520	7.36E-03	625	1.78E-02	730	1.39E-03
420	2.34E-04	525	7.83E-03	630	1.68E-02	735	1.20E-03
425	3.61E-04	530	8.25E-03	635	1.56E-02	740	1.03E-03
430	5.90E-04	535	8.71E-03	640	1.44E-02	745	8.77E-04
435	9.51E-04	540	9.25E-03	645	1.32E-02	750	7.61E-04
440	1.59E-03	545	9.84E-03	650	1.20E-02	755	6.48E-04
445	2.73E-03	550	1.05E-02	655	1.08E-02	760	5.62E-04
450	4.88E-03	555	1.13E-02	660	9.72E-03	765	4.81E-04
455	7.25E-03	560	1.23E-02	665	8.63E-03	770	4.17E-04
460	7.55E-03	565	1.33E-02	670	7.62E-03	775	3.56E-04
465	6.42E-03	570	1.44E-02	675	6.70E-03	780	3.09E-04
470	5.82E-03	575	1.57E-02	680	5.90E-03		
475	5.20E-03	580	1.69E-02	685	5.16E-03		
480	4.52E-03	585	1.79E-02	690	4.50E-03		

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

Chromaticity Diagram of 1# tube - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4592, 0.4109)

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

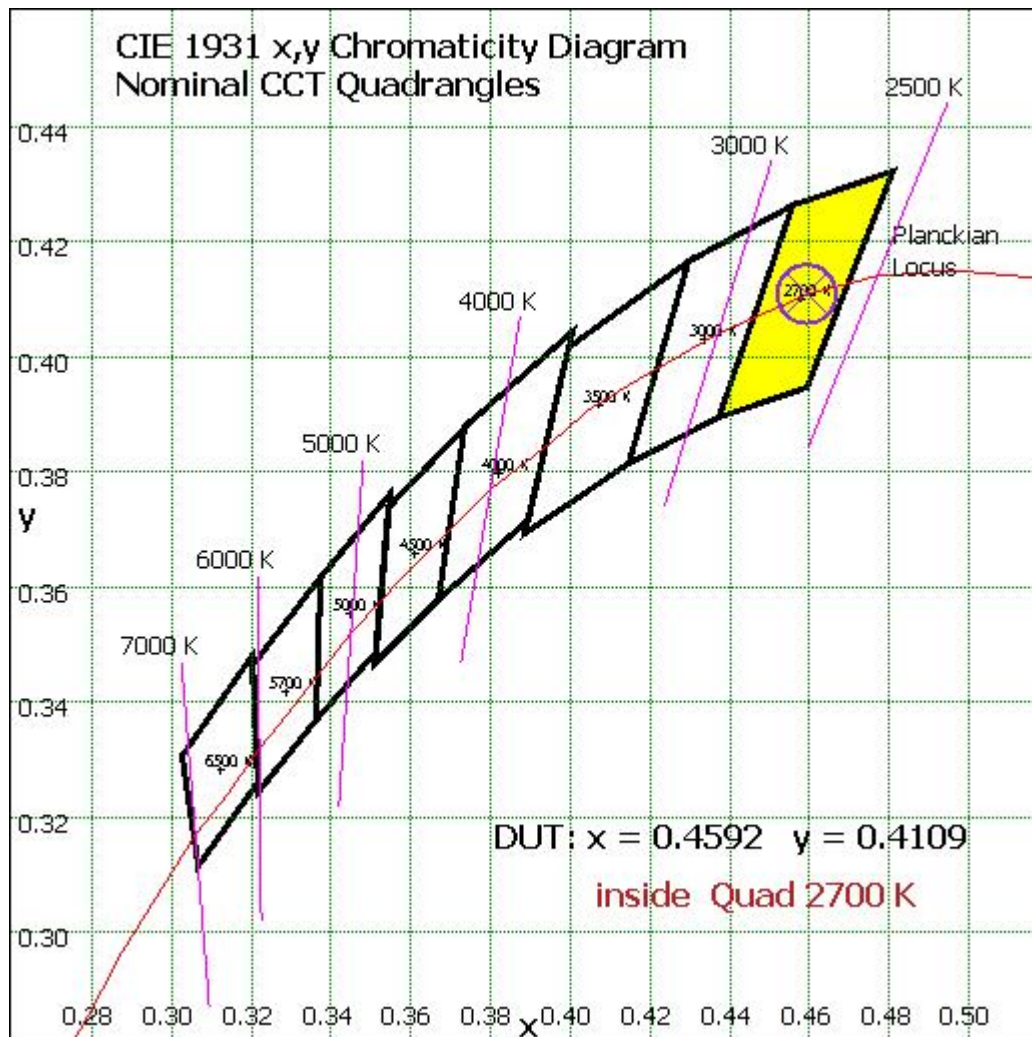


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	26.444	2.89%
10- 20	75.685	8.27%
20- 30	114.765	12.53%
30- 40	138.995	15.18%
40- 50	146.085	15.96%
50- 60	136.208	14.88%
60- 70	111.04	12.13%
70- 80	75.589	8.26%
80- 90	40.535	4.43%
90-100	22.415	2.45%
100-110	13.812	1.51%
110-120	7.851	0.86%
120-130	3.938	0.43%
130-140	1.55	0.17%
140-150	0.421	0.05%
150-160	0.151	0.02%
160-170	0.074	0.01%
170-180	0.023	0.00%
Total	915.6	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	638.182	69.70%
60- 90	227.164	24.81%
0-90	865.346	94.51%
90- 180	50.235	5.49%
0- 180	915.6	100%

Table 5: Zonal Lumen Data

Illuminance Plots- Goniophotometer Method

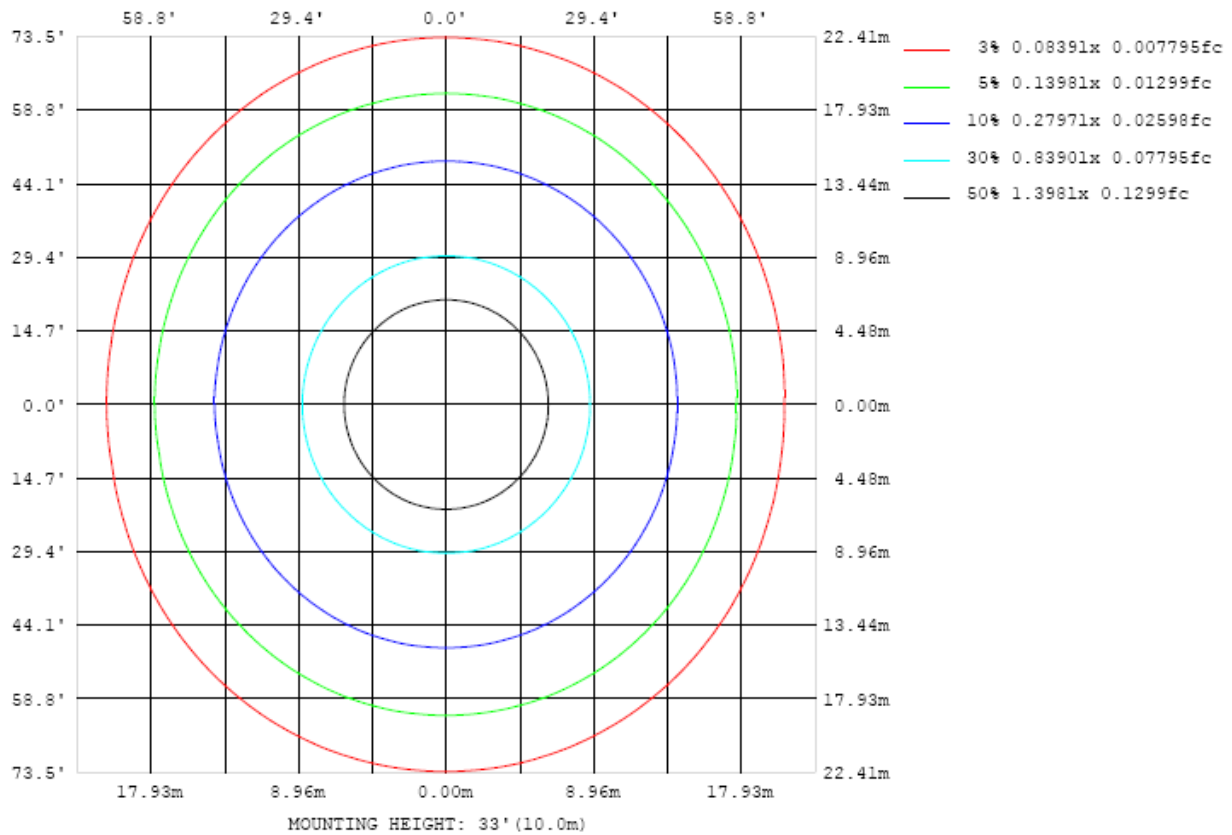


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

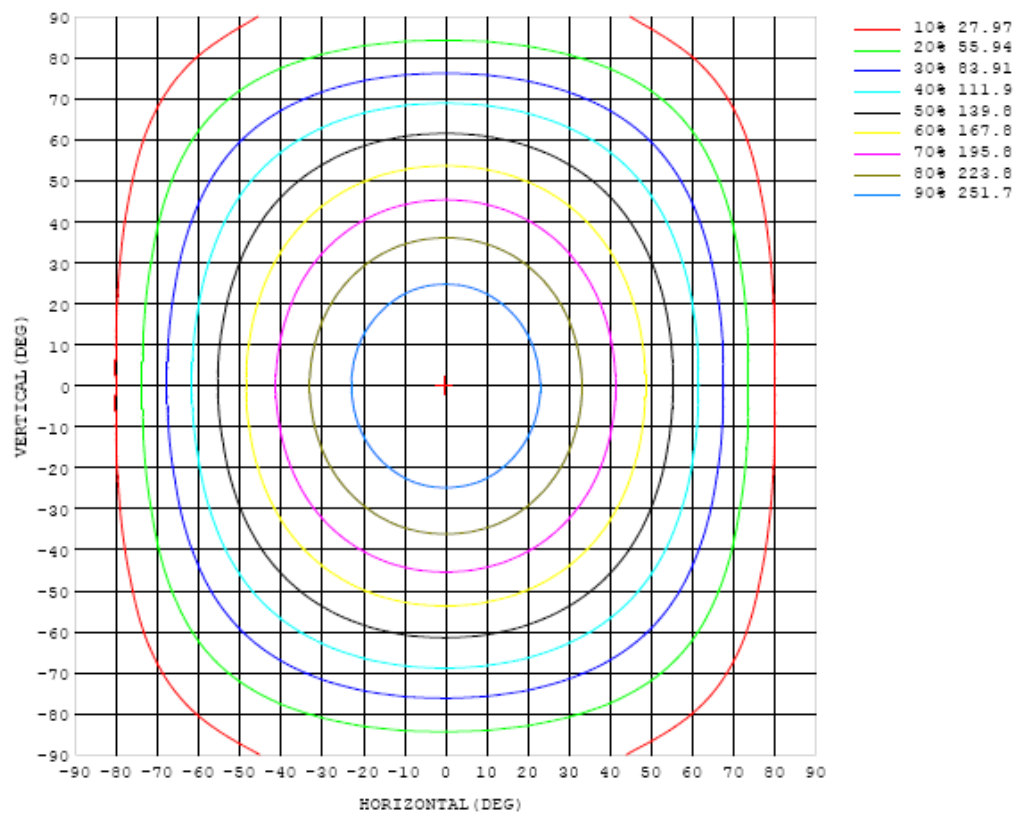


Chart 5: Isocandela Plot

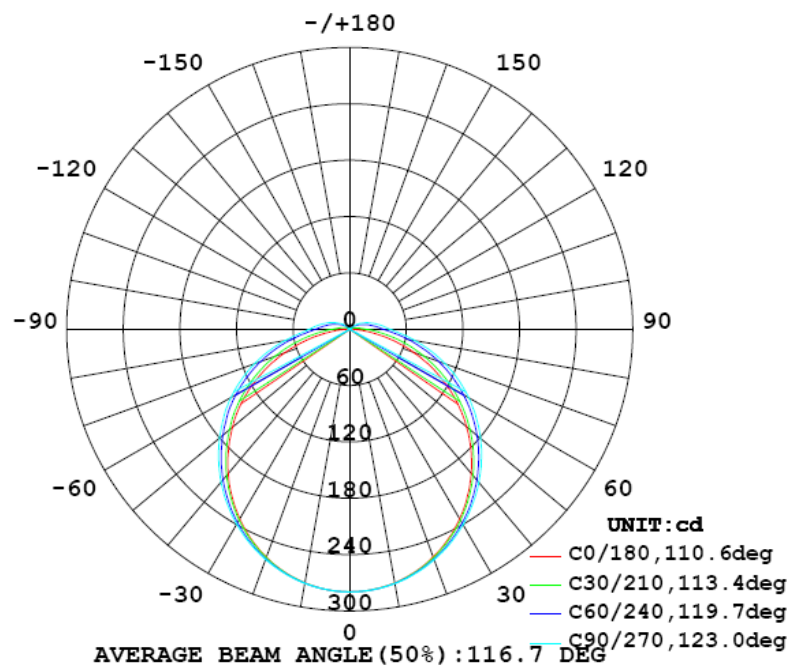


Chart 6: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1

UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
5	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278
10	274	274	274	274	274	274	275	275	275	275	275	275	275	274	275	274	274	274	274
15	267	267	268	268	268	268	269	269	269	269	269	269	269	268	268	268	268	267	268
20	258	258	259	259	259	260	261	261	261	261	261	261	260	260	260	259	259	258	258
25	247	247	247	248	249	249	250	251	251	252	252	251	250	249	249	248	247	247	247
30	233	233	234	235	236	237	238	239	240	240	240	239	238	237	236	235	234	233	233
35	217	218	218	220	221	223	225	226	227	227	227	226	225	223	222	220	219	218	218
40	200	201	202	203	205	207	209	211	212	213	213	211	210	208	206	203	202	201	201
45	182	182	183	185	188	191	193	195	197	197	197	196	194	191	188	186	183	182	182
50	162	162	164	166	169	173	176	179	180	181	180	179	176	173	170	167	164	162	162
55	140	141	143	146	150	154	158	161	163	163	163	161	158	155	151	147	144	141	142
60	118	119	122	126	130	135	139	142	145	145	145	143	139	135	131	126	122	120	120
65	95.3	96.6	99.9	105	110	115	120	124	126	127	126	124	120	116	111	105	101	97.2	96.9
70	71.8	73.5	77.8	83.4	89.3	95.2	100	104	107	108	107	105	101	95.8	90.2	84.3	78.7	74.3	73.6
75	49.4	51.7	56.9	63.5	69.7	75.5	80.9	85.1	87.8	88.7	88.0	85.6	81.7	76.4	70.2	64.4	57.9	52.6	50.5
80	27.9	30.9	37.1	44.3	51.3	57.7	63.2	67.3	69.6	70.5	69.9	67.6	63.9	58.5	52.2	45.3	38.2	31.8	29.0
85	11.2	14.3	20.9	28.1	35.2	41.5	46.9	50.9	53.4	54.2	53.6	51.4	47.6	42.3	36.1	29.1	21.9	15.2	11.9
90	0.22	4.44	10.7	17.5	24.2	30.3	35.5	39.4	41.8	42.5	42.0	39.8	36.1	31.1	25.2	18.6	11.9	5.95	2.46
95	0.09	1.57	5.98	12.0	18.3	24.2	29.2	33.0	35.4	36.2	35.5	33.4	29.8	25.0	19.3	13.1	7.06	2.37	0.66
100	0.09	0.64	3.57	8.34	13.8	19.1	23.8	27.4	29.6	30.4	29.8	27.7	24.3	19.9	14.7	9.25	4.39	1.38	0.61
105	0.14	0.50	2.15	5.76	10.3	14.9	19.1	22.3	24.4	25.2	24.6	22.7	19.6	15.6	11.1	6.56	2.88	1.01	0.60
110	0.18	0.08	1.14	3.94	7.58	11.5	15.0	17.9	19.8	20.4	19.9	18.2	15.5	12.1	8.28	4.65	1.93	0.81	0.59
115	0.19	0.11	0.97	2.60	5.43	8.61	11.6	14.1	15.7	16.3	15.8	14.4	12.1	9.17	6.07	3.27	1.42	0.69	0.54
120	0.22	0.26	0.36	1.34	3.79	6.29	8.74	10.8	12.1	12.6	12.2	11.0	9.15	6.79	4.36	2.12	0.95	0.52	0.50
125	0.25	0.27	0.31	0.98	1.85	4.44	6.36	7.99	9.09	9.50	9.20	8.24	6.71	4.89	2.83	1.21	0.63	0.49	0.47
130	0.22	0.28	0.34	0.64	1.30	2.18	4.44	5.70	6.56	6.88	6.66	5.92	4.75	2.92	1.45	0.80	0.52	0.46	0.45
135	0.29	0.29	0.32	0.46	0.80	1.39	1.92	3.26	4.44	4.79	4.58	3.61	2.33	1.49	0.87	0.58	0.45	0.44	0.43
140	0.25	0.26	0.32	0.26	0.54	0.84	1.18	1.39	1.54	1.83	1.72	1.41	1.04	0.78	0.59	0.46	0.42	0.42	0.42
145	0.27	0.29	0.33	0.34	0.35	0.55	0.60	0.75	0.82	0.81	0.74	0.67	0.60	0.51	0.44	0.39	0.39	0.40	0.40
150	0.20	0.20	0.22	0.23	0.24	0.23	0.35	0.41	0.47	0.47	0.45	0.43	0.40	0.37	0.36	0.35	0.36	0.37	0.37
155	0.22	0.22	0.21	0.21	0.22	0.23	0.25	0.25	0.31	0.26	0.30	0.31	0.30	0.30	0.31	0.33	0.34	0.35	0.35
160	0.23	0.22	0.22	0.22	0.22	0.23	0.23	0.24	0.24	0.24	0.22	0.24	0.26	0.27	0.28	0.30	0.31	0.32	0.32
165	0.23	0.23	0.22	0.22	0.23	0.23	0.23	0.22	0.22	0.23	0.24	0.24	0.24	0.26	0.27	0.29	0.30	0.30	0.30
170	0.24	0.23	0.23	0.23	0.23	0.22	0.22	0.21	0.22	0.22	0.22	0.21	0.22	0.23	0.26	0.27	0.27	0.28	0.29
175	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.25	0.26	0.27
180	0.23	0.23	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	0.22	0.21	0.24	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	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280		
5	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278		
10	274	274	274	274	274	274	275	275	275	275	275	275	274	274	274	274	274		
15	267	268	268	268	268	268	269	269	269	269	269	268	268	268	268	268	267		
20	258	258	259	259	260	260	261	261	261	261	261	260	260	259	259	258	258		
25	247	247	248	248	249	250	251	251	251	251	251	250	249	248	248	247	247		
30	233	234	235	236	237	238	239	239	240	240	239	238	237	236	235	234	233		
35	218	219	220	221	223	224	226	226	227	226	226	224	223	221	220	218	218		
40	201	202	203	205	207	209	211	212	212	212	211	209	207	205	203	201	201		
45	182	184	185	188	190	193	195	196	197	196	195	193	190	188	185	183	182		
50	163	164	166	169	173	176	178	180	180	180	178	176	172	169	166	164	163		
55	142	144	147	151	155	158	161	163	163	162	161	158	155	151	147	144	142		
60	121	123	127	131	135	139	143	145	145	145	143	139	135	131	126	123	120		
65	97.9	101	106	111	116	120	124	126	127	126	124	120	115	110	105	101	97.4		
70	75.0	79.1	84.4	90.2	95.7	101	104	107	107	107	104	100	95.3	89.8	83.9	78.5	74.4		
75	52.6	57.7	63.9	70.2	76.2	81.3	85.3	87.7	88.4	87.5	84.9	80.9	75.7	69.7	63.3	57.0	51.9		
80	31.9	37.9	44.8	51.6	57.7	63.0	66.8	69.2	69.9	69.1	66.5	62.5	57.2	51.0	44.2	37.3	31.2		
85	15.6	21.8	28.9	35.7	41.9	47.0	50.8	53.1	53.7	52.9	50.5	46.6	41.4	35.2	28.3	21.2	14.9		
90	5.93	12.0	18.8	25.4	31.4	36.4	40.1	42.4	43.0	42.3	39.9	36.1	30.9	24.8	18.1	11.2	4.81		
95	2.48	7.13	13.2	19.5	25.3	30.2	33.9	36.1	36.8	36.0	33.7	29.9	24.9	19.0	12.6	6.45	1.85		
100	1.47	4.58	9.47	15.0	20.3	24.8	28.3	30.4	31.1	30.3	28.1	24.5	19.9	14.5	8.90	3.99	0.83		
105	1.12	3.07	6.84	11.3	15.9	20.1	23.3	25.2	25.9	25.2	23.1	19.8	15.7	10.9	6.31	2.53	0.67		
110	0.90	2.10	4.93	8.51	12.2	15.9	18.5	20.3	20.8	20.2	18.3	15.6	12.1	8.16	4.43	1.55	0.49		
115	0.77	1.56	3.51	6.28	9.37	12.3	14.6	16.1	16.5	16.0	14.4	12.1	9.08	5.95	3.05	1.03	0.32		
120	0.57	1.07	2.39	4.58	7.01	9.32	11.3	12.5	12.8	12.4	11.1	8.98	6.71	4.21	1.80	0.68	0.29		
125	0.51	0.68	1.44	3.27	5.19	6.88	8.48	9.46	9.76	9.38	8.30	6.70	4.73	2.84	1.18	0.48	0.29		
130	0.48	0.56	0.90	1.73	3.71	4.98	6.19	6.96	7.19	6.88	6.04	4.80	3.26	1.32	0.77	0.39	0.29		
135	0.46	0.49	0.65	1.08	1.82	3.19	4.35	4.92	5.09	4.85	4.21	2.89	1.52	0.99	0.55	0.35	0.31		
140	0.43	0.45	0.52	0.72	1.10	1.58	2.11	2.63	2.83	2.56	2.00	1.55	1.05	0.67	0.44	0.35	0.33		
145	0.41	0.41	0.43	0.52	0.69	0.92	1.16	1.35	1.43	1.40	1.22	0.94	0.68	0.50	0.39	0.35	0.32		
150	0.38	0.38	0.38	0.41	0.47	0.56	0.66	0.73	0.77	0.74	0.69	0.58	0.48	0.39	0.34	0.29	0.25		
155	0.36	0.35	0.35	0.35	0.36	0.38	0.42	0.47	0.48	0.45	0.41	0.33	0.29	0.26	0.24	0.23	0.23		
160	0.33	0.32	0.32	0.31	0.30	0.30	0.31	0.32	0.32	0.31	0.29	0.27	0.26	0.25	0.25	0.24	0.24		
165	0.30	0.30	0.30	0.29	0.29	0.28	0.28	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.26	0.25		
170	0.29	0.29	0.29	0.29	0.29	0.28	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25		
175	0.27	0.27	0.27	0.27	0.26	0.26	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25		
180	0.23	0.23	0.23	0.23	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		

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 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 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

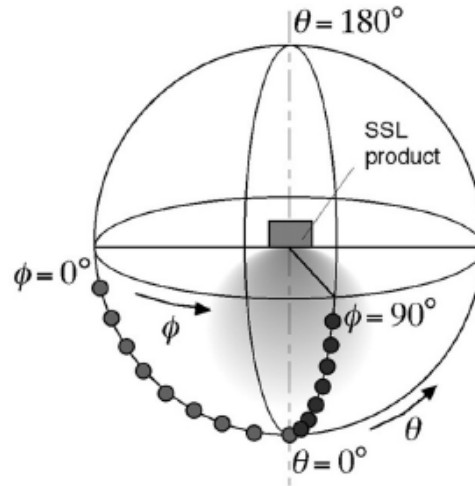
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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