



LM-79-08 Test Report

for

Philips (China) Investment Co., Ltd.

Building 9, Lane 888, Tianlin Road
Shanghai, China

InstantFit LEDtube

Model: 9290011199(2 lamps+ballast ICN-2P32-N)

Laboratory: Leading Testing Laboratories

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Report No.: HZ140600131

Review by:

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Jul. 01, 2014

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Manager: Jim Zhang
Jul. 01, 2014

Test Summary

Sample Tested: 9290011199(2 lamps+ballast ICN-2P32-N)

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	0.318	38.1	0.9976	4280.0	112.3	5.60

Photometric and Colorimetric Measurements for each lamp

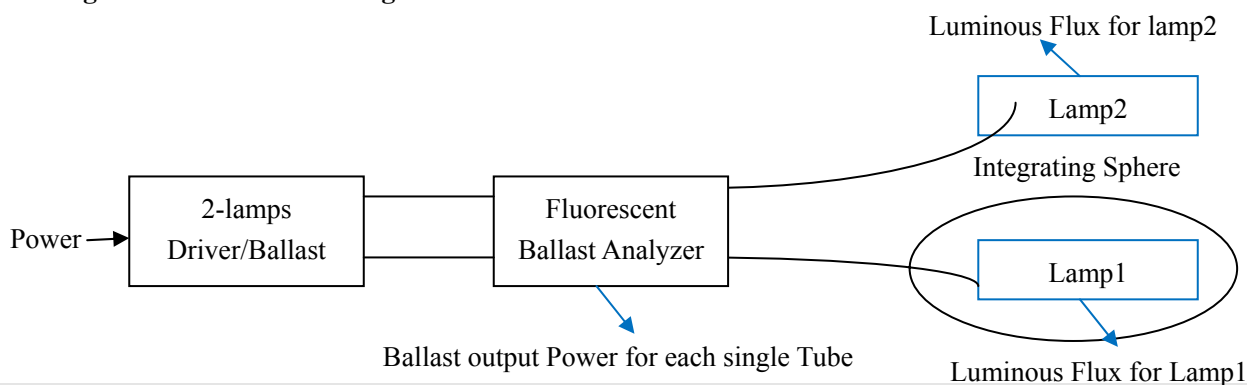
Sample Number	Luminous Flux(lm)	Test power (W)(bare tube)	Efficiency for single Tube (lm/W)	Correlated Color Temperature (K)
1#	2131.0	15.0	142.1	4917
2#	2149.0	15.0	143.3	4943
Sample Number	Color Rendering Index Ra	Color Rendering Index R9	Chromaticity Coordinate x	Chromaticity Coordinate y
1#	82.7	7.1	0.3477	0.3566
2#	82.7	7.3	0.3469	0.3561

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 : Jun. 17, 2014

Date of Test : Jun. 27, 2014

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

The Ballast output Power for single Tube was tested using the Fluorescent Ballast Analyzer as per Client's requirement.

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Sample Photos

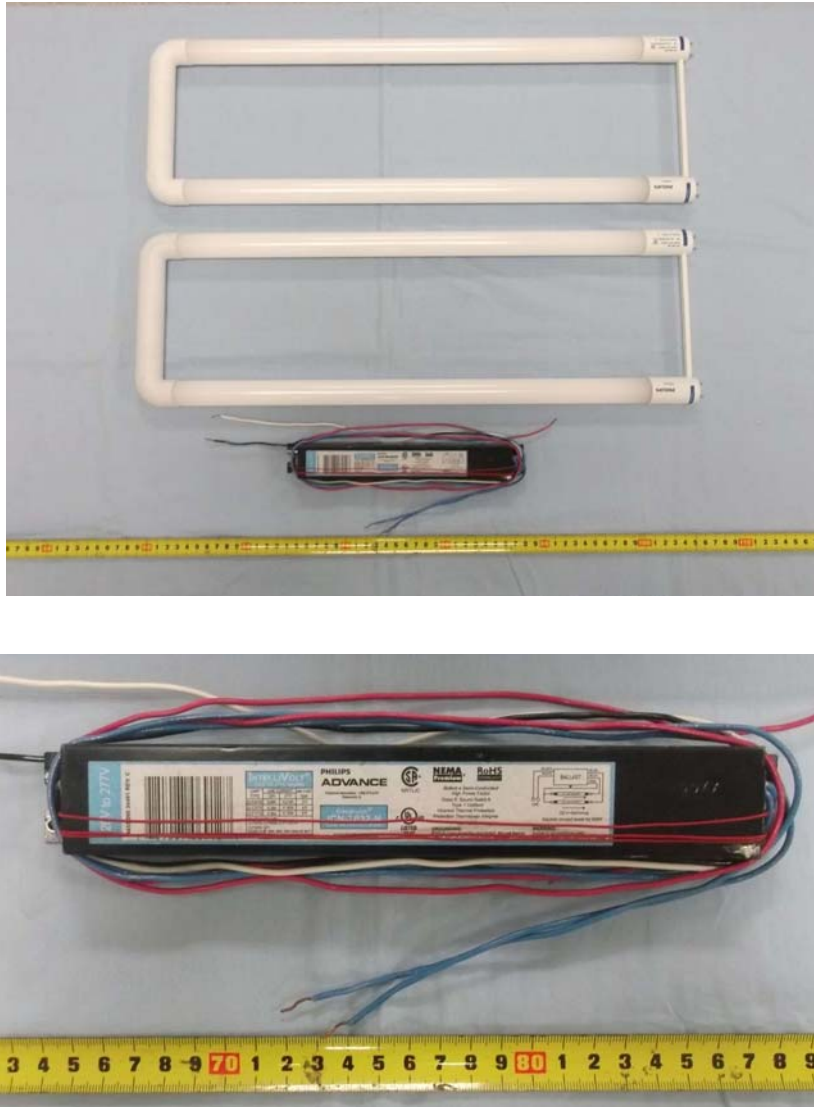


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: InstantFit LEDtube
Model	: 9290011199(2 lamps+ballast ICN-2P32-N)
Electrical Ratings	: 120V AC, 60Hz, 16.5W
Product Description	: 16.5T8/24-5000 IF-6U 10/1, G13 base, 5000K, U bent tube LED tubes supplied by a high frequency fluorescent lamp ballast: PHILIPS ICN-2P32-N
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 60 minutes, and the total operating time including stabilization was 70 minutes.

Sphere-Spectroradiometer Method

Parameter	Result		Special Color Rendering Indices		
	1#	2#			
Test Voltage (V)	120.0			1#	2#
Voltage frequency (Hz)	60		R1	80.5	80.6
Test Current (A)	0.318		R2	88.4	88.3
Power Factor	0.9976		R3	93.4	93.2
Test power (W) (ballast + 2 tubes)	38.1		R4	81.3	81.4
Luminous Efficacy (lm/W)	112.3		R5	80.9	80.9
THD A%	5.60		R6	83.1	83
Total Luminous Flux (lm)	2131.0	2149.0	R7	87.3	87.4
Test power (W) (bare tube)	15.0	15.0	R8	66.8	67
Efficiency for single Tube (lm/W)	142.1	143.3	R9	7.1	7.3
Color Rendering Index (CRI)	82.7	82.7	R10	71.9	71.7
R9	7.1	7.3	R11	79.8	79.9
Correlated Color Temperature (CCT) (K)	4917	4943	R12	59.5	59.4
Chromaticity (Chroma x, Chroma y)	(0.3477, 0.3566)	(0.3469, 0.3561)	R13	82.6	82.6
Chromaticity (Chroma u, Chroma v)	(0.2112, 0.3250)	(0.2109, 0.3247)	R14	96.6	96.5
Chromaticity (Chroma u', Chroma v')	(0.2112, 0.4875)	(0.2109, 0.4871)			
Duv	0.0014	0.0015			

Table 2: Test data per Sphere-Spectroradiometer Method

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

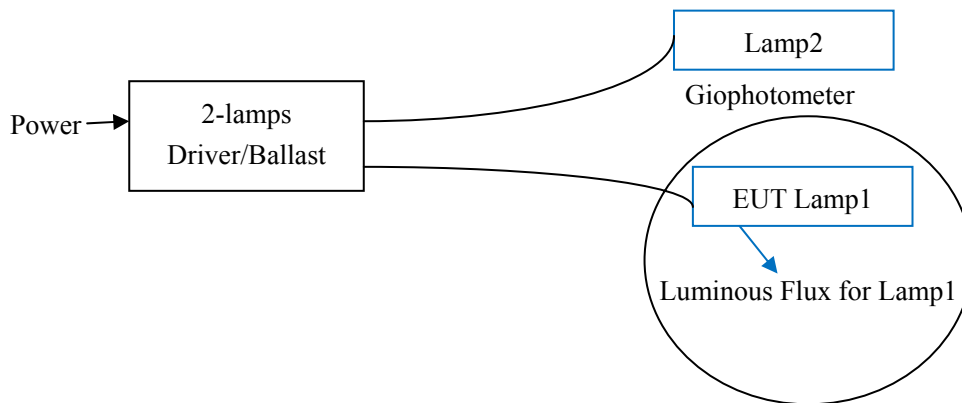
Goniophotometer Method

Test ambient temperature was 25.4°C

The photometric distance is 2.475m.

Luminous data was taken at 0.5°vertical intervals and 5°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)	0.313
Power Factor	0.9973
Test power (W) (ballast + 2 tubes)/2	18.7
Luminous Efficacy (lm/W)	113.6
Total Luminous Flux (lm) (Single tube)	2125.0
Test power (W) (bare tube)	15.0
Luminous Efficacy (lm/W) (bare tube)	141.7
Beam Angle (°)	109.6 (0°-180°)/ 165.0 (90°-270°)
Center Beam Candle Power (cd)	507
Maximum Beam Candle Power (cd)	508.6 (At: C=310.0, Gamma=4.0)
Spacing Criteria	1.20 (0°-180°)/ 1.41(90°-270°)
Zonal Lumens in the 0°-60°Zone	58.84%
Zonal Lumens in the 60°-90°Zone	29.47%
Zonal Lumens in the 90°-120°Zone	9.48%
Zonal Lumens in the 120°-180°Zone	2.21%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution of 1# tube - Sphere Spectroradiometer Method

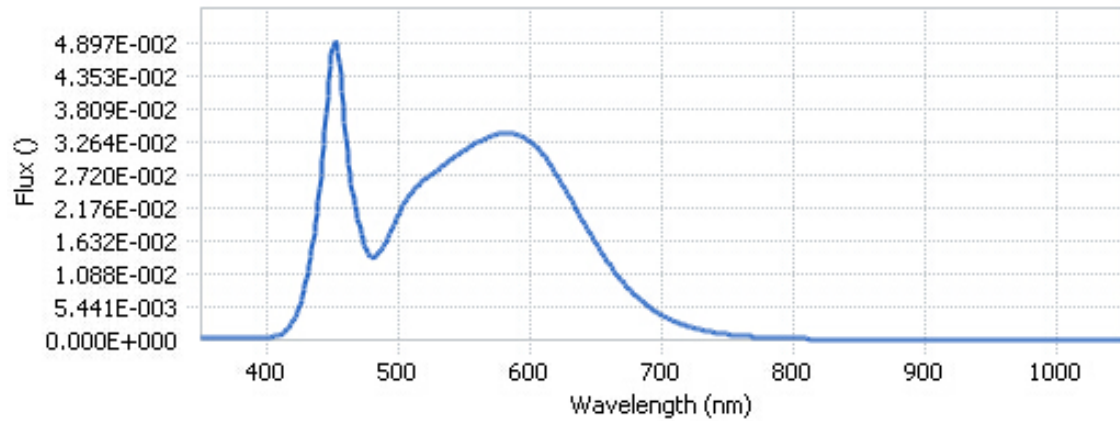
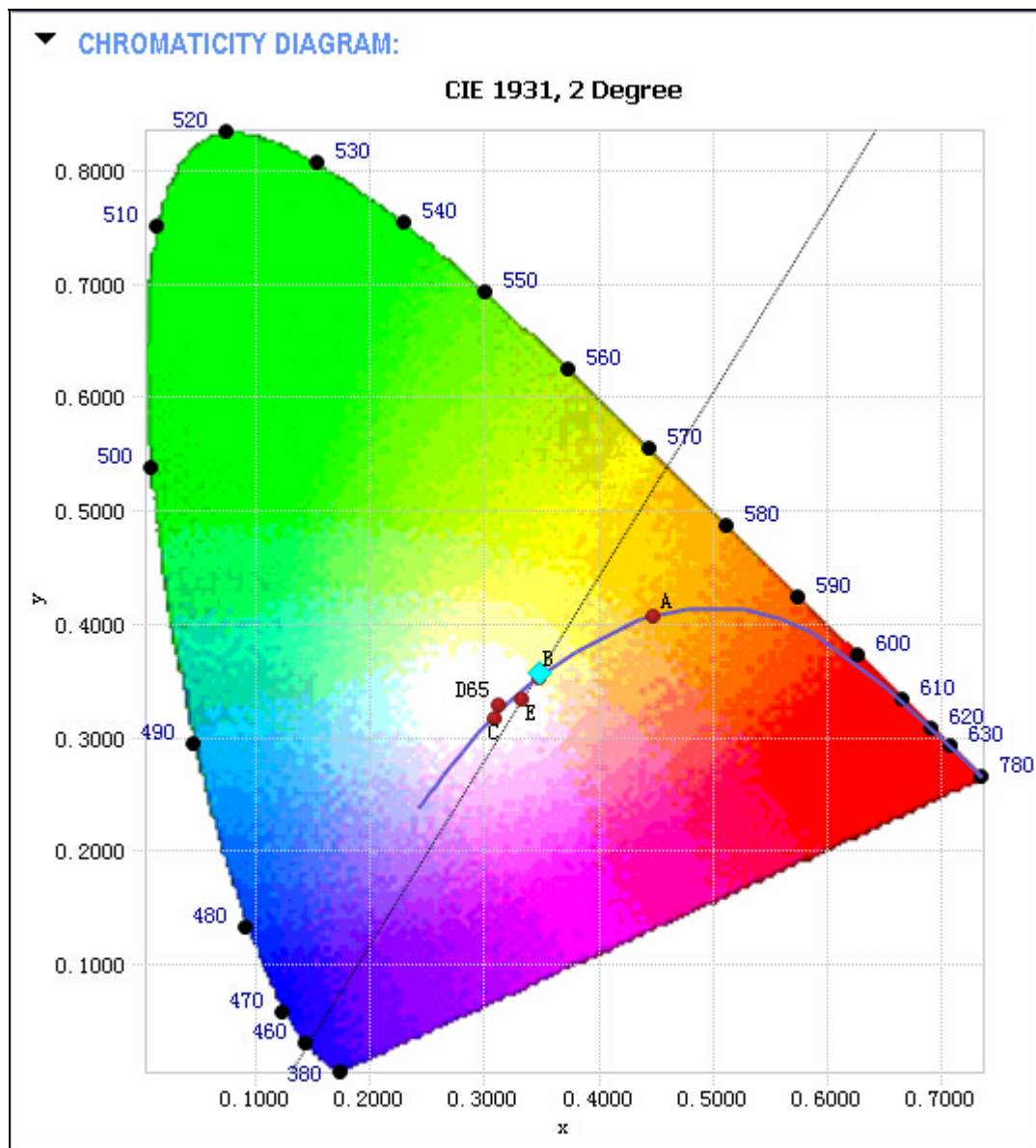


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.30E-04	485	1.44E-02	590	3.39E-02	695	4.73E-03
385	3.13E-04	490	1.60E-02	595	3.35E-02	700	4.06E-03
390	3.34E-04	495	1.83E-02	600	3.27E-02	705	3.52E-03
395	3.37E-04	500	2.07E-02	605	3.18E-02	710	3.03E-03
400	4.10E-04	505	2.28E-02	610	3.06E-02	715	2.61E-03
405	5.58E-04	510	2.44E-02	615	2.90E-02	720	2.25E-03
410	8.88E-04	515	2.54E-02	620	2.73E-02	725	1.93E-03
415	1.62E-03	520	2.65E-02	625	2.54E-02	730	1.66E-03
420	3.11E-03	525	2.73E-02	630	2.35E-02	735	1.42E-03
425	5.66E-03	530	2.81E-02	635	2.15E-02	740	1.23E-03
430	9.98E-03	535	2.89E-02	640	1.96E-02	745	1.05E-03
435	1.63E-02	540	2.98E-02	645	1.77E-02	750	9.09E-04
440	2.49E-02	545	3.06E-02	650	1.58E-02	755	7.87E-04
445	3.73E-02	550	3.13E-02	655	1.41E-02	760	6.76E-04
450	4.82E-02	555	3.19E-02	660	1.25E-02	765	5.94E-04
455	4.58E-02	560	3.27E-02	665	1.10E-02	770	5.11E-04
460	3.32E-02	565	3.31E-02	670	9.62E-03	775	4.40E-04
465	2.45E-02	570	3.35E-02	675	8.38E-03	780	3.82E-04
470	1.91E-02	575	3.40E-02	680	7.29E-03		
475	1.52E-02	580	3.41E-02	685	6.36E-03		
480	1.36E-02	585	3.42E-02	690	5.50E-03		

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

Chromaticity Diagram of 1# tube - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3477, 0.3566)

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

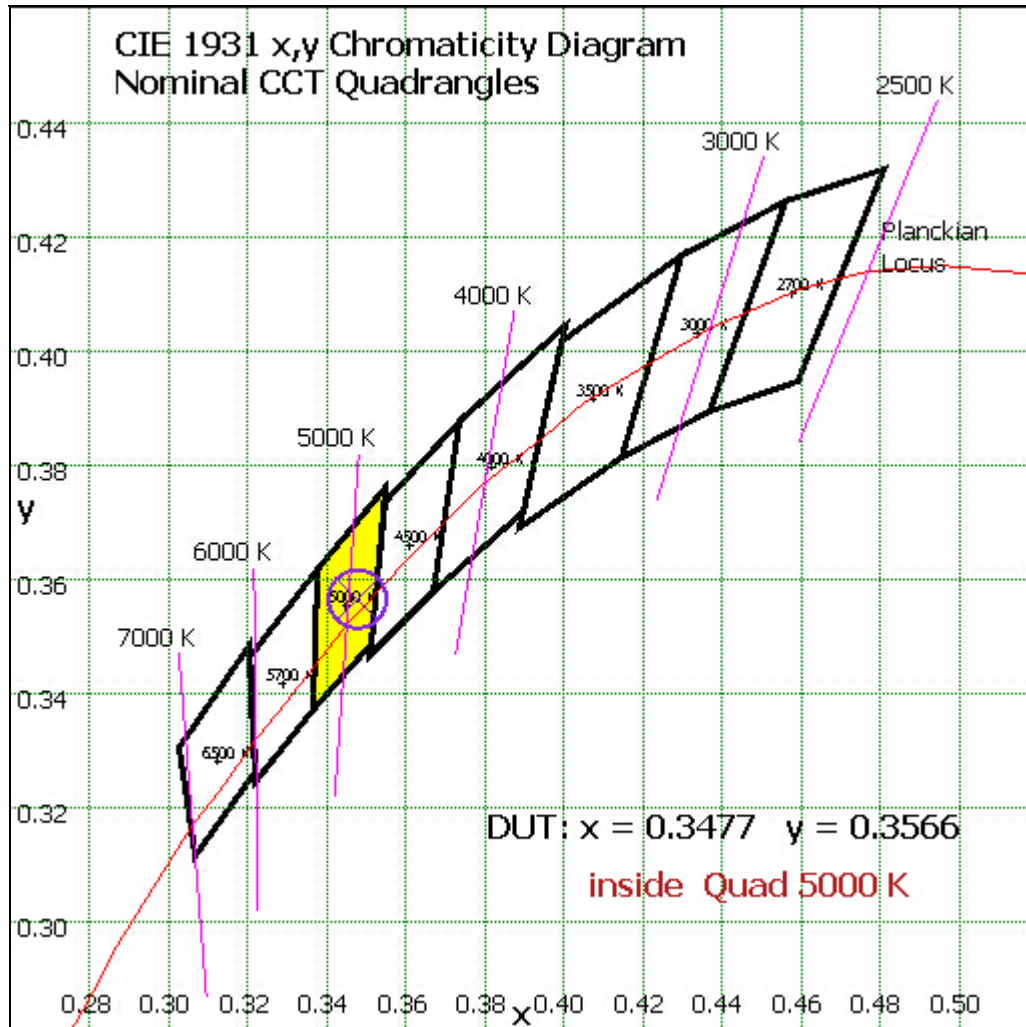


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

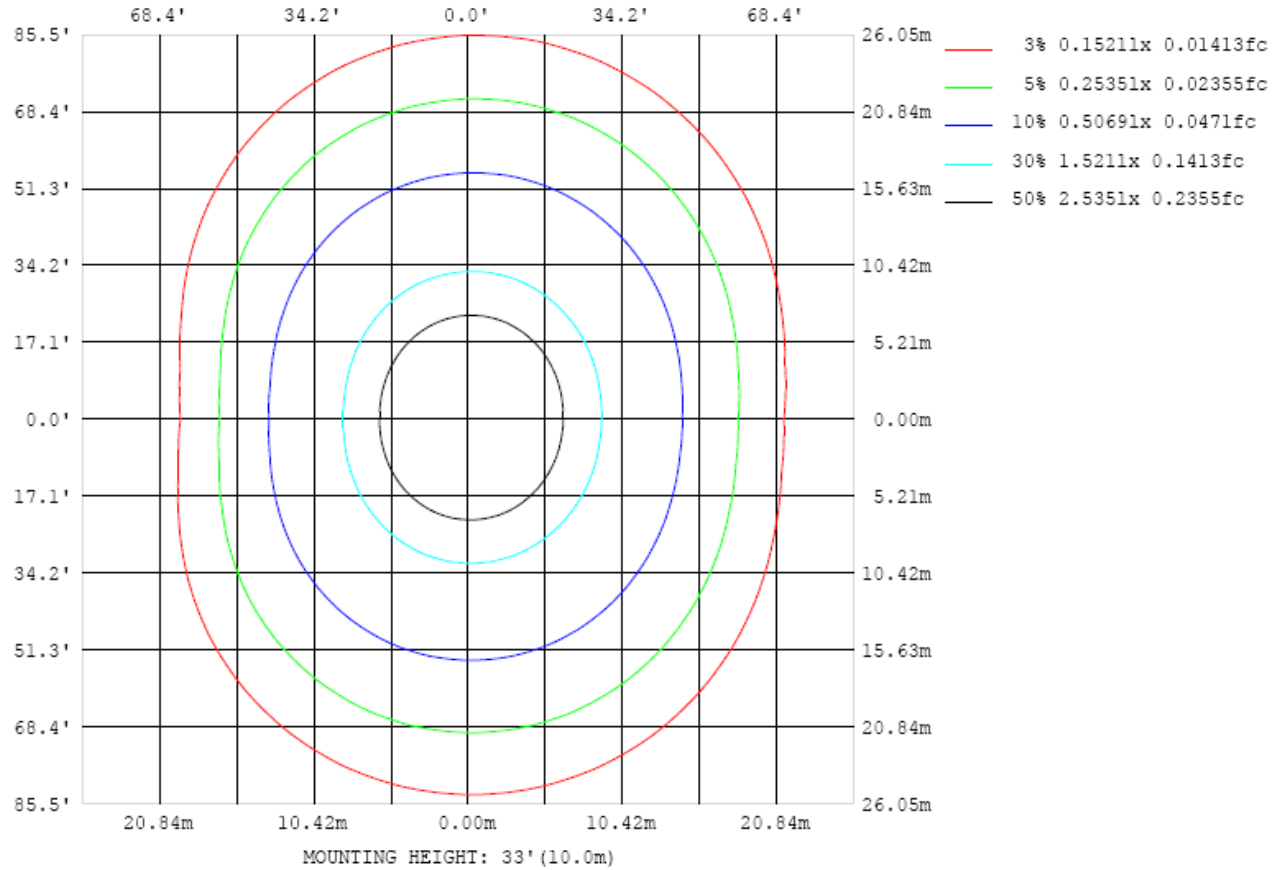
Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	48.089	2.26%
10- 20	139.005	6.54%
20- 30	214.682	10.10%
30- 40	267.227	12.58%
40- 50	292.181	13.75%
50- 60	289.103	13.61%
60- 70	261.883	12.32%
70- 80	218.131	10.27%
80- 90	146.182	6.88%
90-100	84.703	3.99%
100-110	73.348	3.45%
110-120	43.383	2.04%
120-130	24.041	1.13%
130-140	12.505	0.59%
140-150	6.083	0.29%
150-160	2.853	0.13%
160-170	1.258	0.06%
170-180	0.295	0.01%
Total	2125.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1250.287	58.84%
60- 90	626.196	29.47%
0-90	1876.483	88.31%
90- 180	248.469	11.69%
0- 180	2125.0	100%

Table 5: Zonal Lumen Data

Illuminance Plots- Goniophotometer Method



Luminous Intensity Distribution Plots- Goniophotometer Method

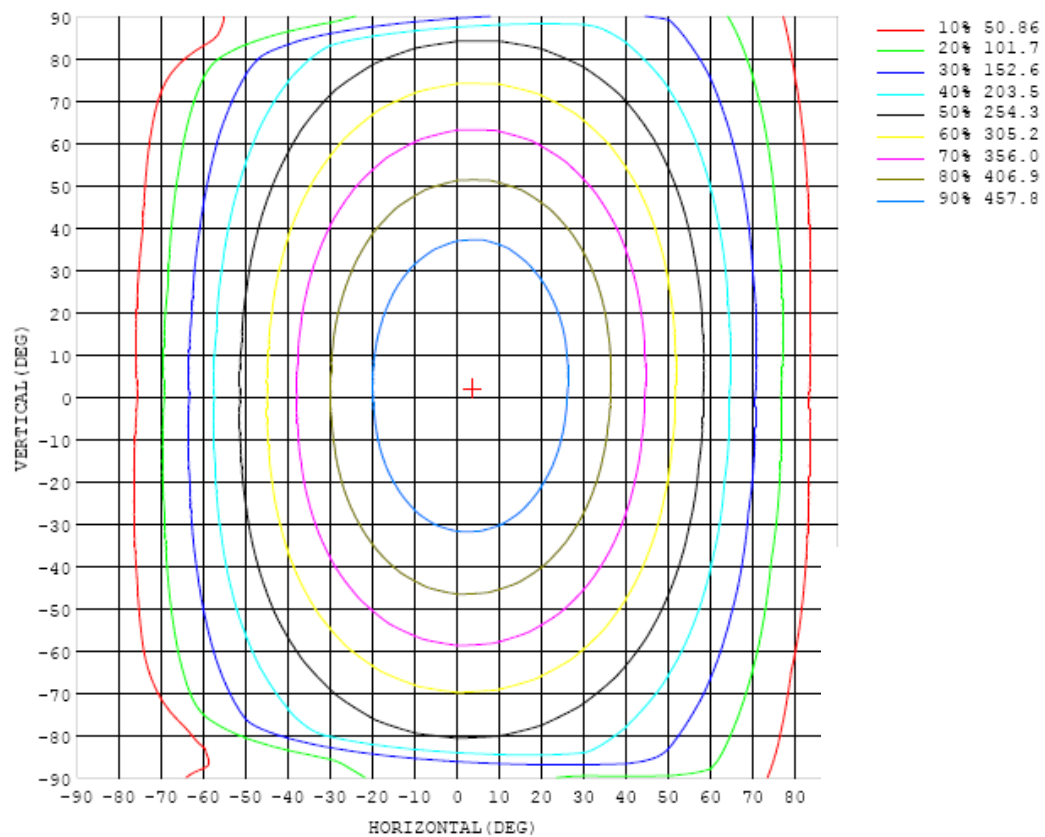


Chart 5: Isocandela Plot

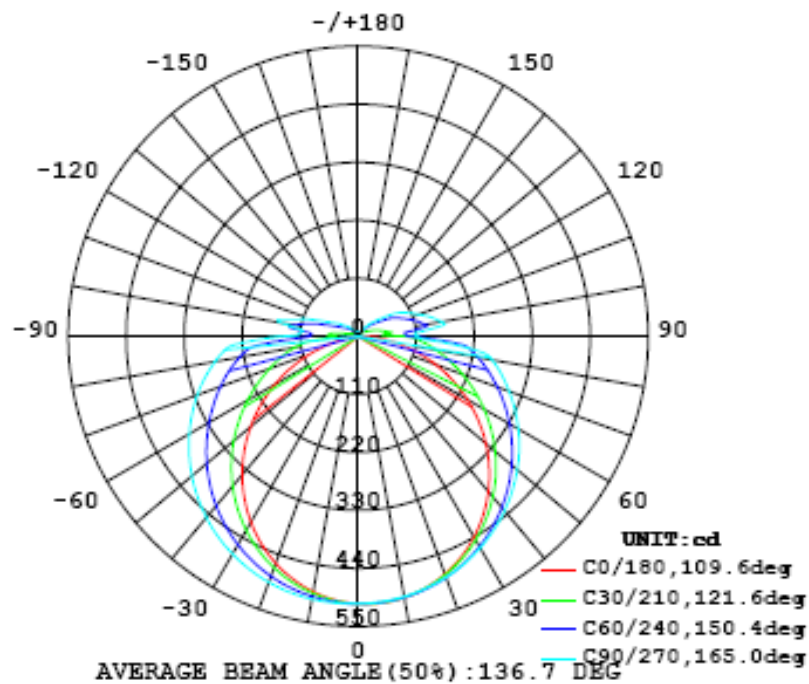


Chart 6: Polar Candela Distribution

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	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507
5	508	507	507	507	507	507	506	506	505	505	505	504	503	503	502	502	502	502	502
10	503	503	503	502	503	503	503	502	502	501	500	499	497	496	494	493	492	491	492
15	494	494	494	494	495	496	496	496	496	495	493	491	488	485	483	480	478	477	477
20	480	480	480	482	483	485	487	488	488	486	484	481	477	472	468	463	460	458	458
25	462	461	463	465	469	472	475	476	477	476	473	469	463	457	450	444	439	435	434
30	439	439	442	446	451	456	460	463	464	463	460	454	447	439	430	421	413	408	407
35	413	414	417	423	430	437	443	447	449	448	444	438	429	418	407	395	385	378	376
40	384	384	389	397	406	416	424	429	432	432	427	420	409	396	382	367	355	345	342
45	351	352	359	369	381	393	403	410	414	413	409	400	388	372	355	338	322	310	305
50	316	318	326	339	354	368	380	389	394	394	389	379	365	347	327	307	288	272	266
55	278	281	292	308	325	342	356	367	372	373	368	357	342	322	299	275	252	233	225
60	239	242	256	275	296	315	331	343	350	351	345	334	317	296	271	244	216	193	183
65	198	203	220	243	267	288	306	319	327	328	322	311	293	270	243	213	181	154	140
70	156	163	184	211	237	261	281	295	303	305	299	287	269	245	216	183	148	115	96.5
75	114	123	149	180	209	235	256	271	280	282	276	264	245	220	190	155	117	79.5	56.4
80	73.9	85.1	116	150	182	209	231	247	256	258	253	240	221	195	164	127	88.5	50.0	22.8
85	38.6	52.7	87.0	123	156	183	203	204	195	182	166	147	126	104	80.5	63.6	36.1	15.1	2.37
90	11.6	27.8	62.3	88.1	96.1	95.5	96.3	105	110	112	110	104	93.8	81.1	70.3	59.9	38.7	13.5	1.92
95	2.75	9.82	31.5	48.3	67.1	78.2	91.2	104	116	127	135	139	139	118	91.2	61.7	33.9	8.01	1.84
100	2.09	7.15	28.2	54.8	81.2	106	128	146	157	161	157	147	130	107	81.2	54.1	23.2	5.72	2.05
105	2.32	6.04	20.7	44.1	69.8	93.6	114	129	139	142	138	128	113	93.3	70.5	41.0	13.2	5.30	2.33
110	2.49	4.59	15.6	35.7	58.4	79.1	97.5	111	120	122	120	111	97.7	80.3	55.0	25.2	10.5	4.84	2.72
115	2.52	3.93	11.7	25.8	48.1	67.5	82.7	94.8	102	105	103	95.6	83.2	61.7	35.9	20.1	8.62	4.49	3.03
120	2.46	3.48	9.12	20.2	34.0	52.7	68.7	80.3	87.2	89.5	86.6	76.8	60.4	42.2	28.1	15.8	7.09	4.19	3.16
125	2.27	2.98	7.03	14.7	26.0	37.9	49.8	60.2	66.5	68.2	63.4	54.6	43.7	32.8	22.4	11.6	6.10	4.00	3.33
130	2.44	2.83	5.59	11.4	19.0	28.9	36.8	44.5	48.6	49.3	46.8	41.4	34.5	26.1	16.1	9.34	5.37	3.95	3.46
135	2.61	2.72	4.77	8.75	14.4	20.9	27.8	33.8	37.0	37.7	36.0	32.1	25.7	18.6	12.8	7.81	4.79	4.23	3.59
140	2.82	2.66	4.15	6.97	11.0	15.4	19.9	23.6	26.4	27.0	25.5	22.5	18.4	14.5	10.2	6.54	4.29	4.25	3.69
145	2.96	2.46	3.66	5.68	8.45	11.7	14.6	17.1	18.7	19.1	18.4	16.6	14.1	11.1	8.04	5.46	3.89	4.19	3.72
150	2.99	2.43	3.36	4.68	6.54	8.67	10.7	12.4	13.4	13.8	13.4	12.2	10.5	8.41	6.36	4.61	4.11	4.14	3.74
155	3.14	2.73	3.05	3.92	5.03	6.43	7.77	8.89	9.62	9.86	9.62	8.90	7.78	6.42	5.06	3.97	4.28	4.07	3.79
160	2.80	2.58	2.59	3.37	4.07	4.85	5.61	6.30	6.76	6.95	6.79	6.39	5.72	4.85	4.03	3.99	4.27	3.89	3.77
165	2.41	2.24	2.45	2.87	3.32	3.82	4.25	4.60	4.83	4.86	4.77	4.52	4.05	3.78	3.91	4.07	3.99	3.66	3.60
170	1.95	1.79	1.84	2.45	2.72	3.05	3.58	3.78	3.79	3.74	3.65	3.72	3.84	3.93	3.89	3.68	3.39	3.34	3.43
175	2.00	1.96	1.88	1.98	2.02	2.33	2.50	2.59	2.63	3.07	3.21	3.30	3.04	2.88	2.92	2.97	3.07	3.13	3.22
180	2.86	2.87	2.87	2.79	2.96	3.15	2.50	2.06	1.62	3.62	0.14	1.88	2.16	2.26	2.24	2.71	2.94	3.01	2.88

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	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507	507		
5	502	503	503	504	505	505	506	507	507	508	508	508	508	508	508	508	508		
10	492	493	495	497	499	501	503	505	506	507	507	507	507	506	505	504	504		
15	478	480	483	487	490	494	497	500	502	503	503	503	502	500	498	497	495		
20	459	462	467	473	478	484	489	493	496	498	497	496	494	491	487	484	481		
25	436	441	447	455	464	471	479	484	488	489	489	486	483	478	473	468	464		
30	409	416	425	435	446	456	465	472	477	478	477	474	468	462	455	448	442		
35	379	387	399	412	426	439	450	459	464	465	463	459	451	443	433	424	417		
40	346	356	371	387	404	419	433	442	448	450	447	441	432	421	409	398	389		
45	310	323	340	360	380	398	413	424	431	433	429	422	410	397	382	368	357		
50	272	287	308	332	354	375	392	405	412	413	409	400	387	371	353	337	323		
55	232	251	275	302	328	351	370	384	391	393	388	377	362	343	323	303	287		
60	190	213	242	273	301	327	347	362	370	371	365	353	336	315	292	269	249		
65	149	176	210	244	275	302	324	340	348	349	342	329	309	286	260	233	211		
70	109	141	179	216	249	278	301	317	325	325	318	304	283	257	228	198	172		
75	71.2	109	151	189	224	254	277	292	301	301	294	279	257	230	198	165	133		
80	39.8	80.1	123	163	198	228	252	268	276	276	268	253	231	202	169	133	96.8		
85	12.8	43.9	80.8	118	152	188	216	238	249	250	242	227	205	176	143	104	64.9		
90	7.10	27.4	42.0	60.7	78.8	94.4	107	123	142	156	164	166	157	147	116	78.7	39.2		
95	4.03	24.6	54.4	83.2	98.7	101	101	105	108	107	102	93.3	82.2	69.2	53.0	33.3	13.0		
100	3.16	11.2	36.5	69.6	96.8	124	147	154	146	134	121	107	90.1	71.5	47.9	31.9	11.8		
105	3.13	8.21	19.6	43.6	70.4	95.1	112	121	125	121	109	90.9	71.0	53.5	38.9	24.8	7.72		
110	2.94	6.58	15.0	27.5	45.3	63.9	79.2	89.3	93.2	90.3	81.2	66.9	51.3	41.6	30.1	17.5	6.76		
115	2.78	5.58	12.4	21.6	32.8	44.7	55.1	62.2	65.1	63.6	58.3	51.2	41.9	32.4	21.8	13.8	6.06		
120	2.70	4.76	10.3	17.8	25.9	34.5	42.9	48.8	51.5	51.1	47.5	41.0	32.0	24.0	17.0	11.2	5.38		
125	2.85	4.19	8.49	14.5	21.4	27.7	33.0	37.6	39.9	39.5	36.3	30.8	24.5	18.8	13.8	8.98	5.14		
130	3.35	3.67	7.00	11.8	16.9	22.6	26.9	29.9	31.2	30.7	28.4	24.5	19.6	14.9	11.0	7.12	4.63		
135	3.41	3.32	5.87	9.58	13.6	18.1	21.7	24.0	25.0	24.6	22.6	19.5	15.5	11.7	8.73	7.04	4.09		
140	3.87	3.20	4.94	7.70	10.8	13.7	17.1	18.9	19.6	19.2	17.7	15.2	12.0	9.18	6.97	6.57	3.72		
145	4.09	3.54	4.23	6.15	8.38	10.6	12.4	14.4	15.0	14.7	13.4	11.5	9.24	7.04	7.81	5.64	3.36		
150	4.15	3.72	3.84	5.07	6.44	8.00	9.30	9.95	11.1	10.8	9.95	8.62	7.14	7.91	6.77	4.65	3.32		
155	4.09	4.21	3.86	4.67	5.80	6.04	6.81	7.36	7.44	7.80	7.35	7.38	7.99	7.21	5.77	4.14	3.18		
160	3.86	4.14	4.24	4.34	4.64	5.83	6.67	6.83	6.93	7.44	7.83	7.91	7.03	6.29	5.21	3.68	3.03		
165	3.55	3.78	4.15	4.37	4.39	4.83	5.37	5.59	5.96	6.19	6.36	6.29	6.25	5.31	3.97	3.37	2.92		
170	3.42	3.45	3.62	3.87	4.19	4.42	4.52	4.57	4.86	5.73	5.26	4.76	4.37	3.69	3.27	3.09	2.73		
175	3.22	3.27	3.27	3.29	3.26	3.22	3.15	3.07	2.97	2.76	2.70	2.43	2.77	2.67	2.53	2.12	1.99		
180	2.90	2.93	2.91	2.84	2.79	2.83	2.82	2.46	2.19	1.84	1.59	1.65	1.98	2.23	2.38	2.47	2.53		

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, 2013	Sep. 17, 2014
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2013	Sep. 17, 2014
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2013	Sep. 17, 2014
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2013	Sep. 17, 2014
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2013	Sep. 17, 2014
Standard source	D908	HZTE012-01	Sep. 18, 2013	Sep. 17, 2014
Integrate Sphere system	2M	HZTE015-01	Sep. 18, 2013	Sep. 17, 2014
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2013	Sep. 17, 2014
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2013	Sep. 17, 2014
DC Power Supply	6154	HZTE004-04	Sep. 18, 2013	Sep. 17, 2014
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 18, 2013	Sep. 17, 2014
Standard source	SCL-1400	HZTE012-02	Sep. 18, 2013	Sep. 17, 2014
Fluorescent Ballast Analyzer	HB-6B	HZTE002-01	Sep. 18, 2013	Sep. 17, 2014

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

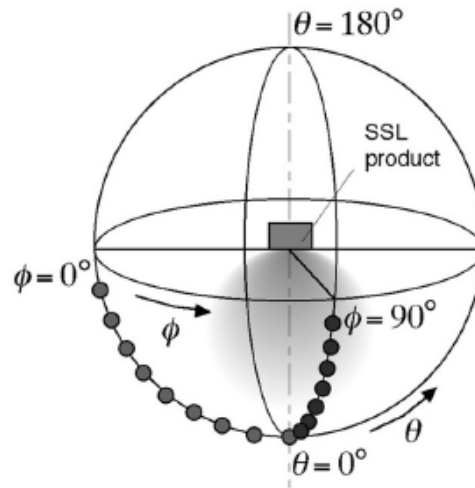
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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