



## LM-79-08 Test Report

for

### GREEN CREATIVE LTD

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

### LED PLL

### Model: 17PLL/835/DIR

#### Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ15100038b

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

Review by:

*April Zou*

Engineer: April Zou  
Oct. 28, 2015

Approved by:



*Jim Zhang*

Manager: Jim Zhang  
Oct. 28, 2015

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: 17PLL/835/DIR

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
100.7	2166.0	21.52	0.9948
CCT (K)	CRI	Stabilization Time (Light & Power)	
3572	86.2	70	

Table 1: Executive Data Summary

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

### Test specifications:

<b>Date of Receipt</b>	: Oct. 26, 2015
<b>Date of Test</b>	: Oct. 26, 2015 to Oct. 27, 2015
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: 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>	: LED PLL
<b>Model</b>	: 17PLL/835/DIR
<b>Electrical Ratings</b>	: 120-277Vac, 50/60Hz, 17W
<b>Product Description</b>	: 2G11 base, 3500K, Frosted lens LED PLL supplied by a high frequency fluorescent lamp ballast:SYLVANIA QTP 2x26/32/42 CF/UNV DM
<b>Manufacturer</b>	: GREEN CREATIVE LTD
<b>Address</b>	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

## TEST RESULTS

Test ambient temperature was 25.0°C.

Base orientation was Horizontal. 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	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.180	0.090
Power Factor	0.9948	0.8949
Test Power (W)	21.52	22.39
THD A%	9.02	23.19
Luminous Efficacy (lm/W)	100.7	
Total Luminous Flux (lm)	2166.0	
Color Rendering Index (CRI)	86.2	
R9	23	
Correlated Color Temperature (CCT) (K)	3572	
Chromaticity Chroma x	0.4002	
Chromaticity Chroma y	0.3858	
Chromaticity Chroma u	0.2344	
Chromaticity Chroma v	0.3390	
Duv	0.0011	
Chromaticity Chroma u'	0.2344	
Chromaticity Chroma v'	0.5084	

Special Color Rendering Indices	
R1	86.8
R2	97
R3	92.4
R4	82.8
R5	87
R6	94.5
R7	83.1
R8	65.7
R9	23
R10	92.5
R11	83.1
R12	75.4
R13	90.1
R14	96.3

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 30m.

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)	0.180
Power Factor	0.9945
Test Power (W)	21.54
Luminous Efficacy (lm/W)	101.9
Total Luminous Flux (lm)	2195.9
Beam Angle (°)	117.7
Center Beam Candle Power (cd)	613
Spacing Criteria	1.23 (0°-180°)/ 1.29(90°-270°)
Zonal Lumens in the 0°-60°Zone	63.51%
Zonal Lumens in the 60°-90°Zone	25.27%
Zonal Lumens in the 90°-120°Zone	7.35%
Zonal Lumens in the 120°-180°Zone	3.87%

Table 3: Test data per Goniophotometer Method

## Spectral Power Distribution - Sphere Spectroradiometer Method

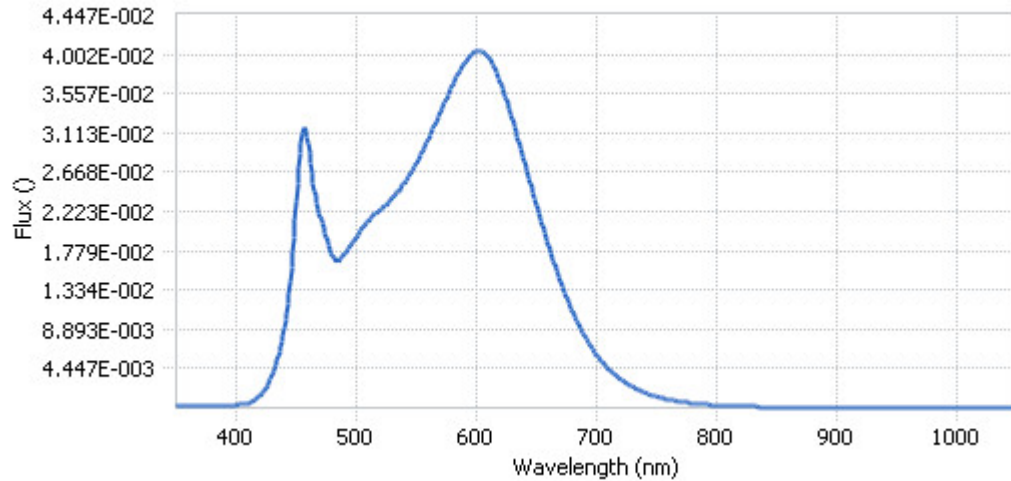


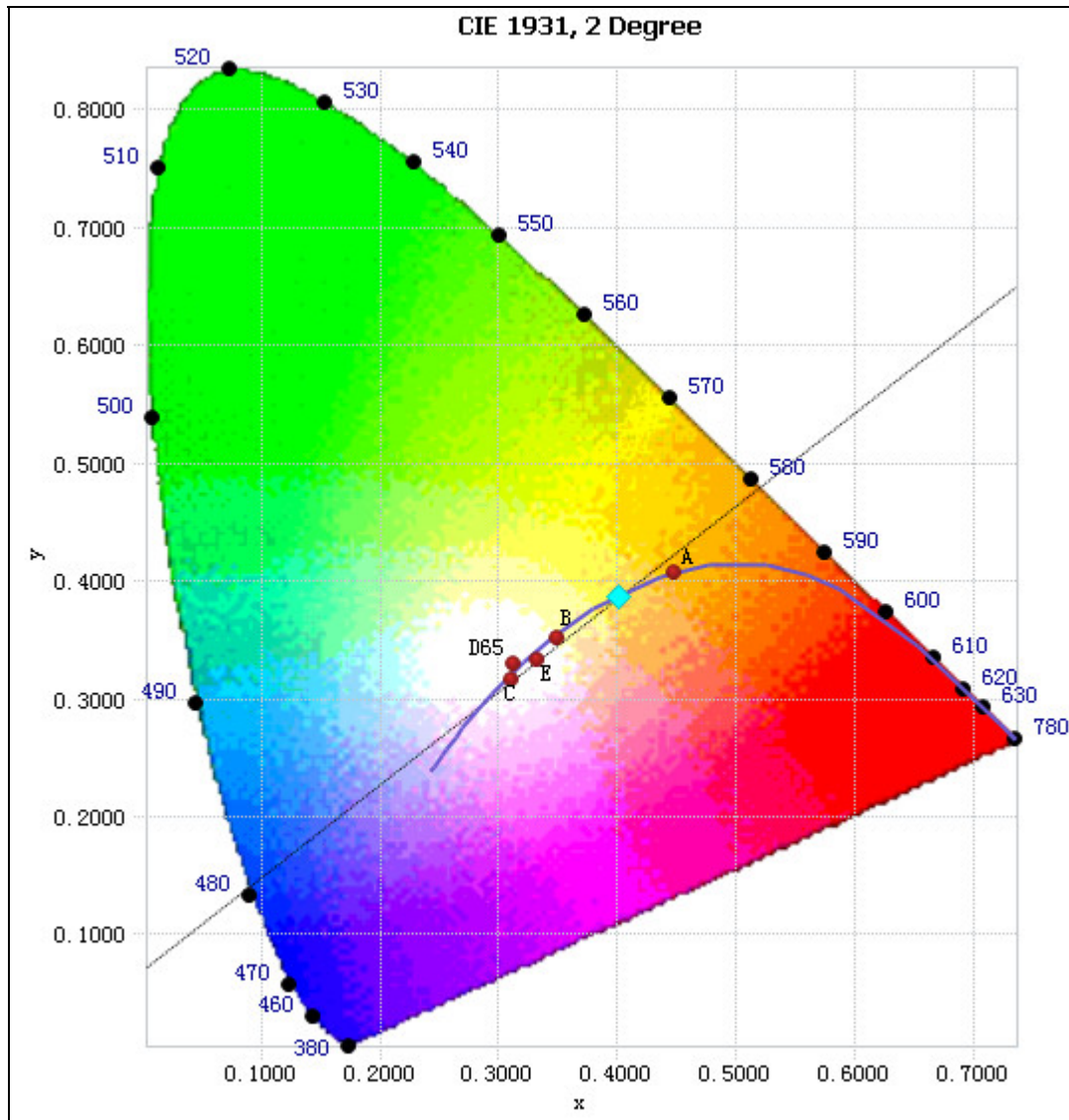
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.56E-04	485	1.67E-02	590	3.91E-02	695	7.00E-03
385	2.76E-04	490	1.74E-02	595	3.99E-02	700	6.01E-03
390	2.77E-04	495	1.84E-02	600	4.04E-02	705	5.18E-03
395	2.80E-04	500	1.92E-02	605	4.04E-02	710	4.43E-03
400	3.34E-04	505	2.04E-02	610	3.96E-02	715	3.82E-03
405	3.86E-04	510	2.12E-02	615	3.85E-02	720	3.26E-03
410	5.29E-04	515	2.19E-02	620	3.68E-02	725	2.79E-03
415	8.56E-04	520	2.24E-02	625	3.48E-02	730	2.39E-03
420	1.40E-03	525	2.30E-02	630	3.26E-02	735	2.03E-03
425	2.36E-03	530	2.38E-02	635	3.02E-02	740	1.73E-03
430	3.77E-03	535	2.46E-02	640	2.78E-02	745	1.48E-03
435	5.88E-03	540	2.55E-02	645	2.53E-02	750	1.27E-03
440	9.01E-03	545	2.66E-02	650	2.30E-02	755	1.09E-03
445	1.42E-02	550	2.78E-02	655	2.06E-02	760	9.39E-04
450	2.33E-02	555	2.91E-02	660	1.84E-02	765	8.02E-04
455	3.12E-02	560	3.05E-02	665	1.62E-02	770	6.97E-04
460	3.00E-02	565	3.20E-02	670	1.43E-02	775	5.93E-04
465	2.46E-02	570	3.36E-02	675	1.25E-02	780	5.22E-04
470	2.16E-02	575	3.50E-02	680	1.09E-02		
475	1.93E-02	580	3.65E-02	685	9.47E-03		
480	1.72E-02	585	3.80E-02	690	8.15E-03		

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



## Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4002, 0.3858)

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

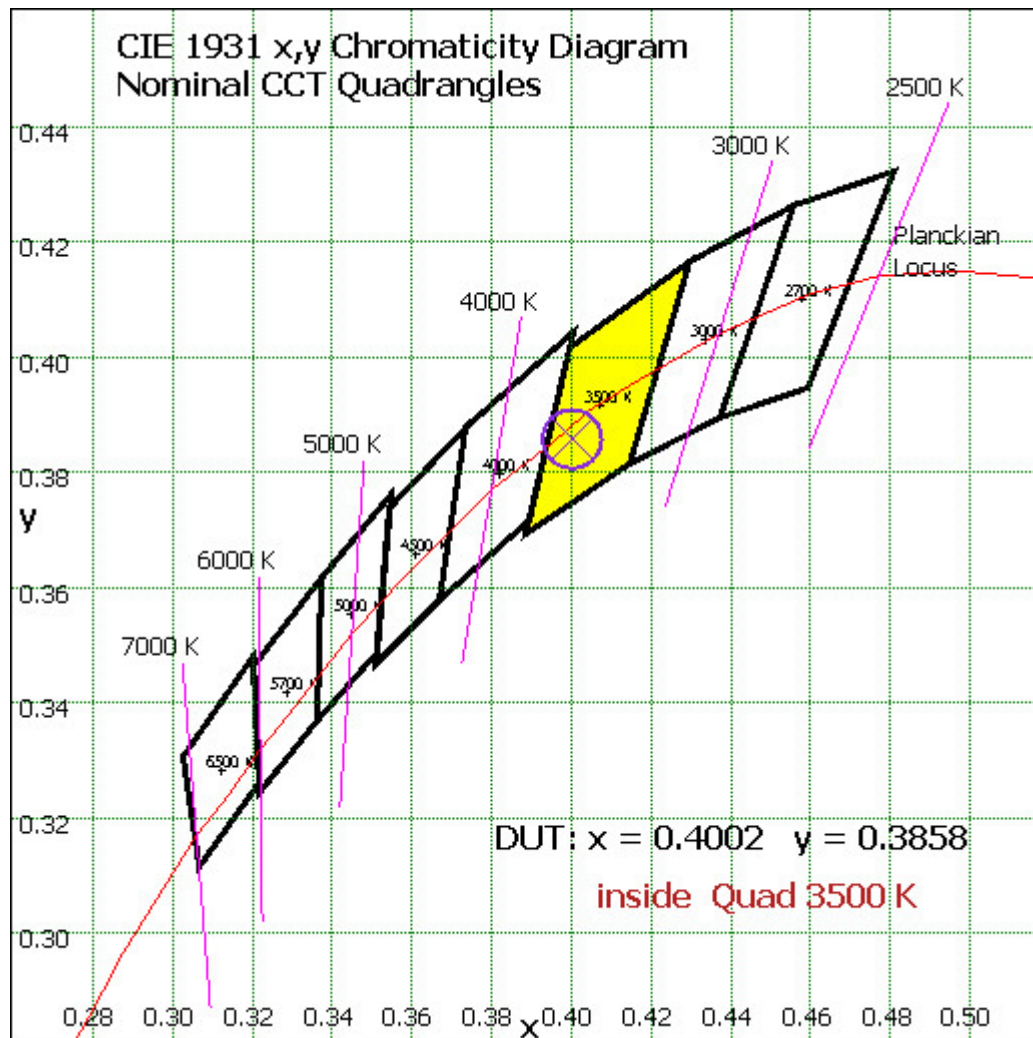


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

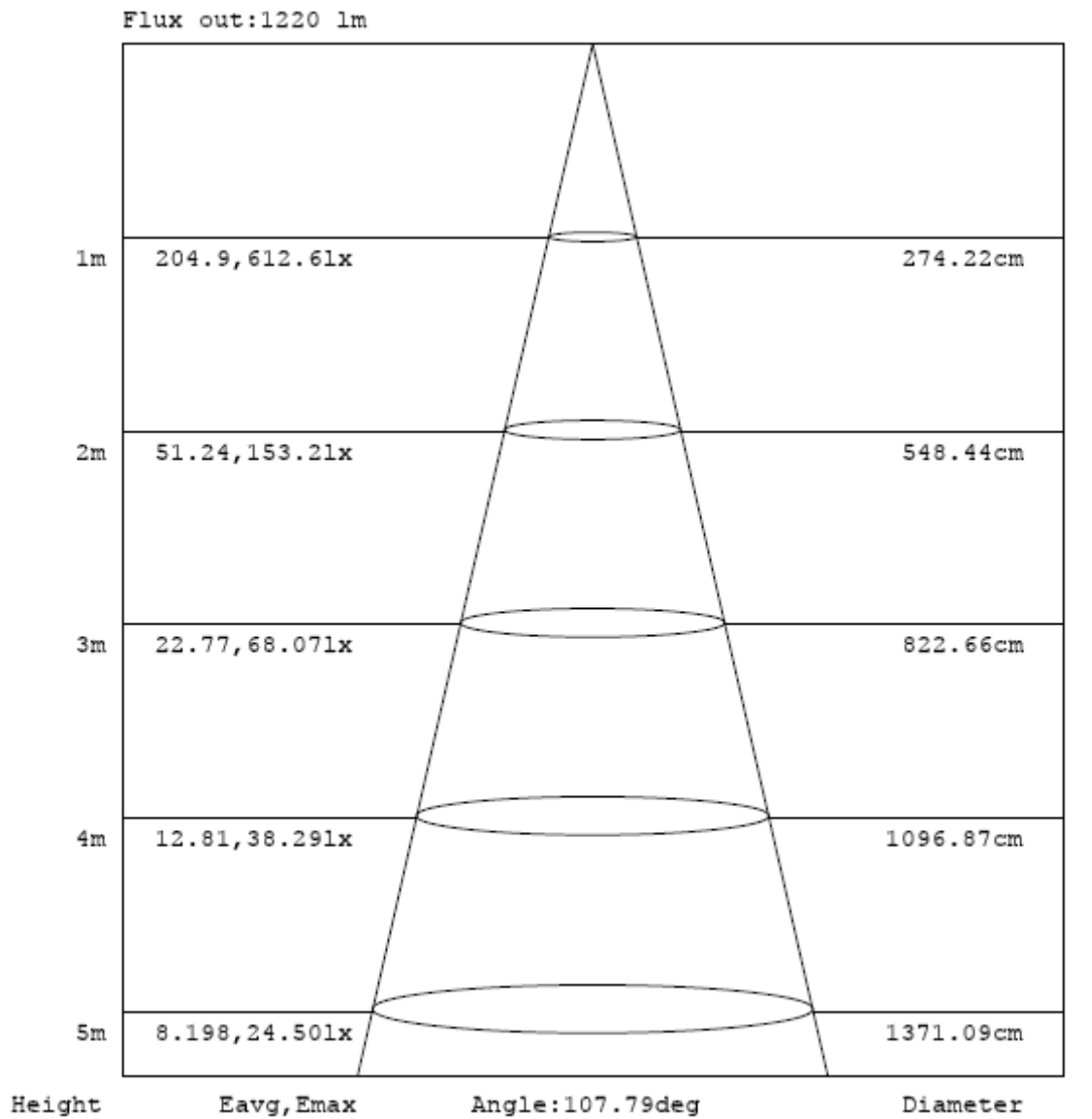
### Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	57.936	2.64%
10- 20	165.714	7.55%
20- 30	250.808	11.42%
30- 40	303.144	13.80%
40- 50	318.53	14.51%
50- 60	298.5	13.59%
60- 70	249.863	11.38%
70- 80	184.486	8.40%
80- 90	120.508	5.49%
90-100	76.834	3.50%
100-110	50.54	2.30%
110-120	34.187	1.56%
120-130	25.25	1.15%
130-140	20.527	0.93%
140-150	16.854	0.77%
150-160	12.869	0.59%
160-170	7.421	0.34%
170-180	1.971	0.09%
Total	2195.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1394.632	63.51%
60- 90	554.857	25.27%
0-90	1949.489	88.78%
90- 180	246.453	11.22%
0- 180	2195.9	100%

Table 5: Zonal Lumen Data

## Illuminance Plots- Goniophotometer Method



Note: The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 4: Beam Angle

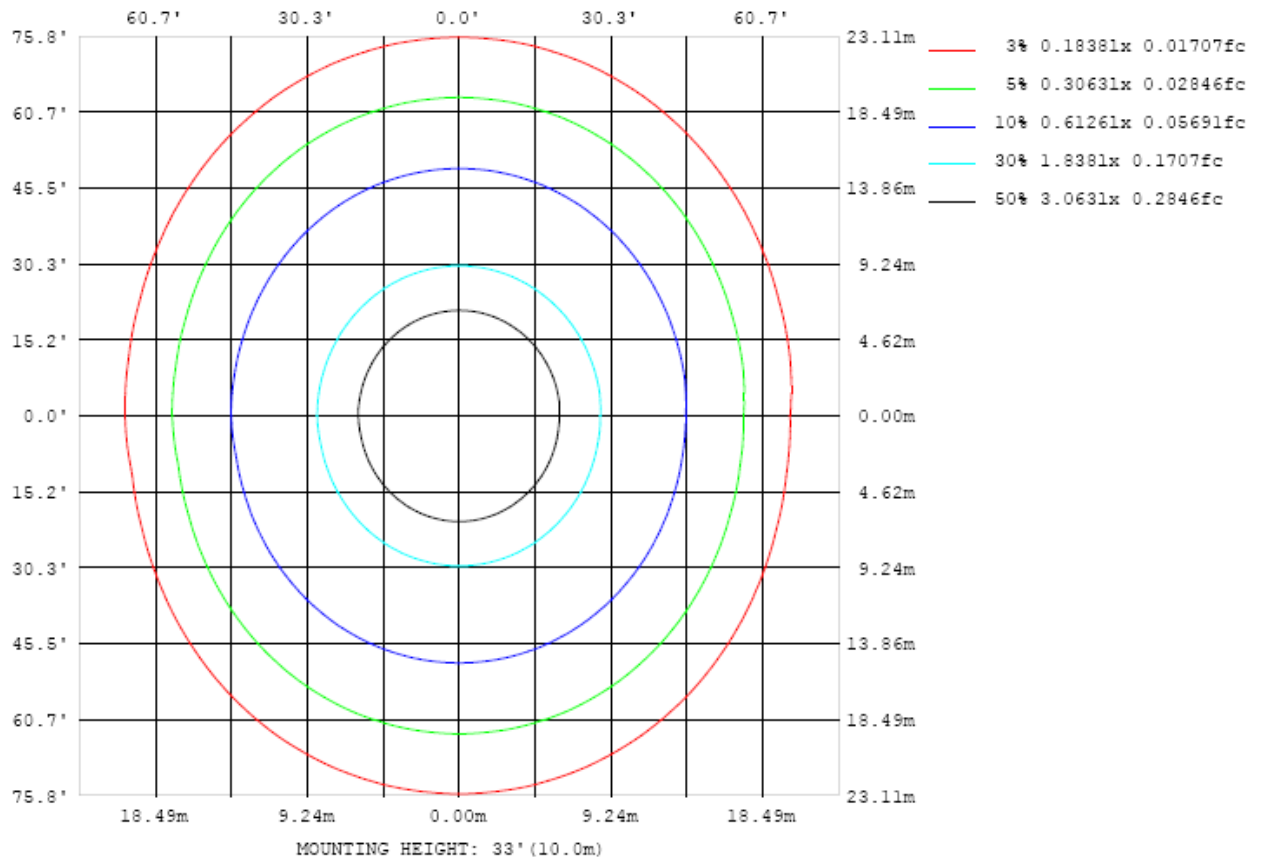


Chart 5: Illuminance Plot (Footcandles)

## Luminous Intensity Distribution Plots- Goniophotometer Method

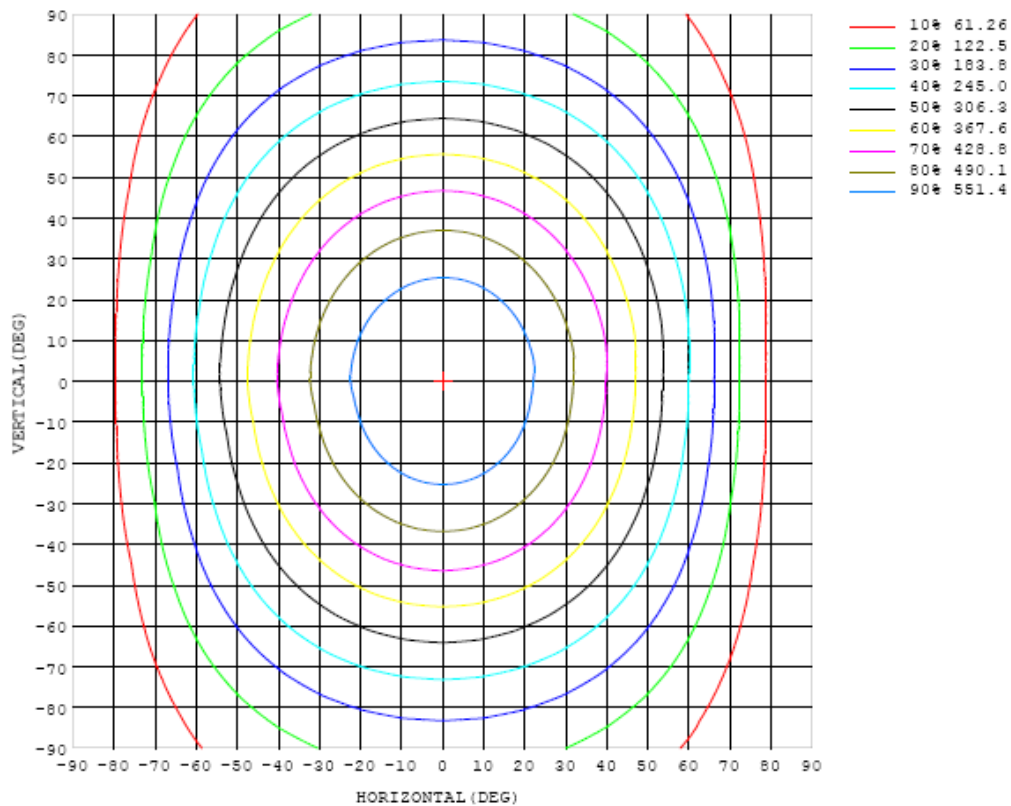


Chart 6: Isocandela Plot

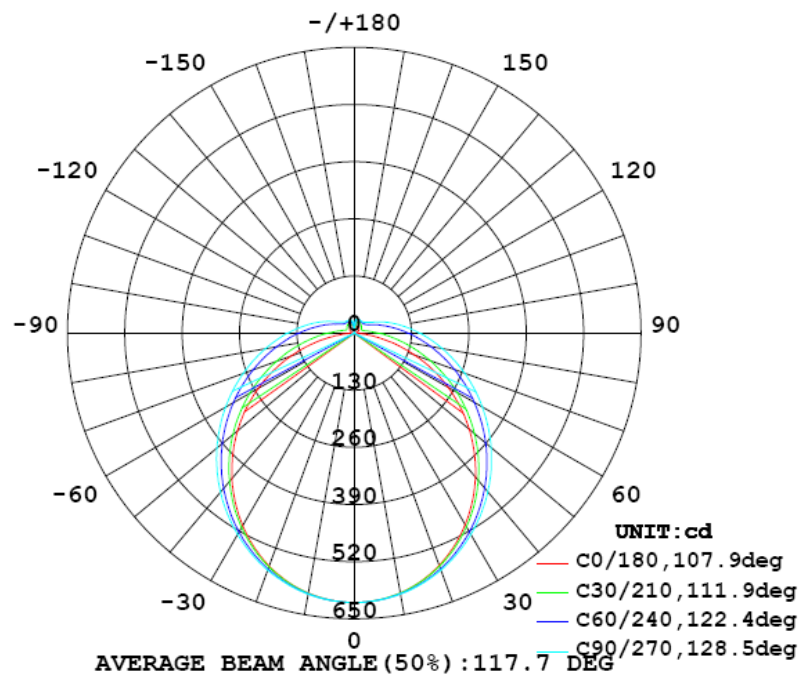


Chart 7: Polar Candela Distribution

## 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	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613
5	610	609	609	609	610	610	610	610	610	610	610	610	610	610	609	609	609	610	610
10	600	599	600	600	601	601	602	602	603	603	603	602	602	601	600	600	599	600	601
15	584	583	584	585	586	588	589	590	590	590	590	590	588	587	586	584	583	584	585
20	562	561	563	564	567	569	571	572	573	574	573	572	570	568	566	564	562	561	564
25	535	534	536	539	542	545	548	551	552	553	552	551	548	544	541	538	535	534	537
30	503	503	505	509	513	517	522	526	528	529	528	525	521	517	512	508	504	502	506
35	467	467	470	475	480	486	492	497	500	501	500	497	492	486	479	473	469	466	470
40	427	428	431	437	445	452	460	466	470	471	470	465	459	452	444	436	430	427	431
45	385	385	390	397	406	416	425	432	437	439	437	432	425	415	405	396	389	385	390
50	340	341	347	356	367	378	389	397	403	405	403	397	388	377	366	355	346	340	345
55	293	295	302	313	326	339	351	361	368	370	368	361	351	338	325	312	301	294	299
60	245	247	256	269	284	300	314	325	333	335	332	325	314	299	284	268	255	247	252
65	195	199	210	225	243	261	277	290	298	300	298	290	277	261	243	225	209	198	203
70	145	150	164	183	204	224	241	255	263	266	263	255	241	224	204	183	164	150	154
75	95.8	103	121	143	167	189	207	222	230	233	230	222	208	189	167	144	121	103	105
80	50.7	60.1	81.8	108	134	157	176	191	200	203	200	191	176	157	134	108	82.5	61.1	58.4
85	15.0	26.9	51.4	78.2	105	128	148	162	171	174	171	162	148	129	105	79.3	53.0	28.5	21.0
90	0.26	9.35	30.6	56.2	81.0	104	123	137	146	149	146	137	123	105	82.0	57.9	32.7	11.1	1.32
95	0.97	4.51	19.1	39.7	62.8	83.5	101	115	123	126	123	115	102	84.7	64.6	42.3	21.0	5.22	1.04
100	2.72	4.53	13.4	29.9	48.7	67.1	83.1	95.7	103	106	104	96.3	84.3	68.8	50.7	31.6	14.5	4.71	2.53
105	5.03	6.22	11.5	22.9	38.5	54.4	68.4	79.3	86.6	89.0	87.0	80.3	69.9	56.2	40.2	24.2	12.0	6.41	4.81
110	7.13	7.81	11.9	19.6	30.8	43.9	56.2	65.9	71.4	74.2	72.5	67.2	57.7	45.4	32.1	20.2	12.0	8.05	7.24
115	9.18	9.46	13.4	18.5	26.6	36.1	45.7	54.0	59.5	61.6	60.2	55.0	47.0	37.3	27.4	18.8	13.7	9.87	9.21
120	11.3	11.5	15.2	18.9	24.6	31.6	38.7	44.9	49.1	50.7	49.5	45.6	39.6	32.3	25.0	19.1	15.4	12.1	11.0
125	13.2	13.5	17.1	20.1	24.0	29.1	34.3	38.9	42.1	43.2	42.3	39.3	34.8	29.5	24.2	20.3	17.2	14.0	13.0
130	14.5	15.1	19.0	21.5	24.4	27.9	31.7	35.1	37.4	38.2	37.5	35.3	32.0	28.2	24.5	21.6	19.2	16.1	14.3
135	15.4	16.2	20.8	23.0	25.1	27.8	30.4	32.8	34.4	35.0	34.5	33.0	30.6	27.9	25.4	23.1	20.7	17.8	15.3
140	16.1	17.3	22.3	24.4	26.2	28.0	30.0	31.6	32.7	33.1	32.8	31.8	30.1	28.3	26.3	24.7	22.6	20.0	16.3
145	16.5	17.5	23.6	25.8	27.4	28.8	30.1	31.2	31.9	32.2	32.1	31.4	30.4	29.0	27.6	25.9	24.2	21.6	16.9
150	17.5	18.8	24.4	27.3	28.5	29.7	30.7	31.4	31.9	32.1	32.0	31.7	31.0	29.9	28.7	27.3	24.6	21.5	18.3
155	17.8	20.9	25.7	28.0	30.1	30.6	31.4	31.9	32.2	32.3	32.4	32.2	31.7	30.9	29.9	28.8	26.6	23.0	19.4
160	17.3	18.9	22.9	29.2	30.2	31.5	32.1	32.4	32.7	32.8	32.9	32.7	32.5	31.8	31.2	27.8	25.8	22.6	19.3
165	16.9	17.4	19.0	25.7	30.1	29.7	32.1	32.6	32.8	33.0	33.2	32.9	32.6	30.7	26.8	24.9	22.1	19.9	18.9
170	16.4	16.3	15.7	17.9	24.0	29.2	31.2	31.5	31.1	30.8	30.6	30.2	27.4	23.5	21.0	19.5	19.1	18.5	18.1
175	17.9	17.4	16.5	17.9	17.8	18.5	21.8	25.3	26.3	24.1	21.8	18.3	17.1	17.5	17.7	18.2	19.3	18.9	19.8
180	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82

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	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613	613		
5	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610		
10	600	601	601	601	602	602	602	603	603	603	602	602	602	602	601	601	601		
15	585	585	586	587	588	589	590	590	591	590	590	589	588	588	587	586	586		
20	564	565	566	567	569	571	572	573	574	574	573	571	570	568	567	565	565		
25	537	539	541	543	546	549	551	552	553	553	551	549	547	544	542	540	539		
30	506	508	511	514	518	522	526	528	529	528	526	523	519	515	512	509	507		
35	471	473	477	482	488	493	498	500	502	501	498	494	488	483	478	474	472		
40	432	435	440	447	454	461	467	470	472	471	467	462	455	448	441	436	434		
45	391	394	401	409	418	427	434	438	440	439	434	427	419	410	402	396	392		
50	347	352	359	369	380	391	399	404	407	405	399	391	381	371	360	353	348		
55	301	307	317	329	342	354	363	370	372	370	364	354	343	330	318	308	302		
60	254	261	273	288	303	317	327	334	337	335	328	317	303	289	274	262	255		
65	206	215	230	247	264	280	292	300	302	300	292	280	265	248	231	216	207		
70	158	170	188	208	227	244	257	265	268	266	257	244	227	208	189	171	159		
75	111	128	149	171	192	210	224	233	235	233	224	210	192	171	149	128	111		
80	67.5	88.3	113	138	161	179	193	202	205	202	193	179	160	138	113	87.8	66.9		
85	32.8	56.6	83.3	109	132	151	165	173	176	173	165	151	132	109	82.5	55.4	31.4		
90	13.0	35.0	60.4	85.2	108	126	140	149	152	149	140	126	107	84.6	59.4	33.8	11.6		
95	5.85	22.3	44.0	66.5	87.4	105	118	126	129	126	118	104	86.7	65.7	43.1	21.3	5.24		
100	4.96	15.4	33.0	52.4	70.9	86.8	98.9	106	109	106	98.4	86.2	70.1	51.5	32.0	14.6	4.67		
105	6.24	12.6	25.2	41.6	57.7	71.9	82.7	89.4	91.7	89.3	82.3	71.2	56.9	40.7	24.4	12.0	6.07		
110	8.25	12.4	21.0	33.2	46.8	59.2	68.8	74.8	76.8	74.6	68.3	58.5	46.0	32.4	20.4	12.1	8.11		
115	10.3	13.5	19.3	28.3	38.5	48.4	56.6	61.9	63.6	61.6	56.1	47.8	37.8	27.7	19.0	13.3	9.80		
120	12.1	15.3	19.3	25.6	33.3	41.0	47.3	51.3	52.6	51.1	46.9	40.4	32.7	25.2	19.1	15.0	11.8		
125	14.3	17.3	20.2	24.6	30.2	35.9	40.7	43.9	45.0	43.8	40.4	35.5	29.8	24.4	20.0	17.0	12.6		
130	15.3	19.1	21.7	24.7	28.7	32.9	36.4	38.7	39.5	38.6	36.2	32.6	28.5	24.5	21.5	18.7	14.4		
135	15.9	20.5	23.3	25.5	28.3	31.2	33.8	35.5	36.1	35.5	33.8	31.1	28.1	25.4	23.1	19.8	15.7		
140	16.6	20.5	24.2	26.6	28.6	30.6	32.3	33.6	34.0	33.6	32.5	30.6	28.4	26.6	24.5	20.0	15.6		
145	17.5	21.0	25.3	26.9	28.5	30.6	31.8	32.7	32.9	32.7	32.1	30.7	29.2	27.8	25.2	20.1	15.9		
150	18.9	21.8	25.5	28.3	26.3	29.8	31.9	32.5	32.6	32.5	32.1	31.2	30.1	28.3	25.3	20.9	18.3		
155	20.3	22.4	25.1	27.5	29.6	27.3	30.2	32.2	32.3	32.4	32.1	31.5	30.3	28.4	26.1	22.6	18.8		
160	18.2	20.7	24.1	27.3	29.0	29.4	26.6	31.2	32.2	32.4	32.4	31.6	30.4	28.8	26.1	21.2	17.7		
165	18.1	18.6	19.7	21.4	24.7	29.1	29.8	29.5	30.1	30.7	30.7	30.9	30.9	29.4	24.8	18.4	16.1		
170	18.1	18.1	18.0	18.1	18.5	19.3	22.9	28.9	29.9	29.4	30.8	30.4	28.4	24.3	18.3	16.1	16.2		
175	19.0	19.0	19.1	18.6	19.6	18.5	17.7	16.6	16.1	22.3	22.1	18.9	17.5	17.3	14.9	15.9	18.4		
180	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82	4.82		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 17, 2015	Jul. 16, 2016
Digital Power Meter	PF2010A	HZTE028-01	Jul. 17, 2015	Jul. 16, 2016
AC Power Supply	PCR 500L	HZTE001-08	Jul. 17, 2015	Jul. 16, 2016
DC Power Supply	WY12010	HZTE004-03	Jul. 17, 2015	Jul. 16, 2016
Temperature Meter	TES1310	HZTE017-01	Jul. 17, 2015	Jul. 16, 2016
Standard source	D908	HZTE012-01	Jul. 23, 2015	Jul. 22, 2016
Integrate Sphere system	2M	HZTE015-01	Jul. 16, 2015	Jul. 15, 2016
Digital Power Meter	WT210	HZTE008-01	Jul. 17, 2015	Jul. 16, 2016
AC Power Supply	PCR 500L	HZTE001-07	Jul. 17, 2015	Jul. 16, 2016
DC Power Supply	6154	HZTE004-04	Jul. 17, 2015	Jul. 16, 2016
Temperature and humidity recorder	JR900	HZTE018-01	Jul. 21, 2015	Jul. 20, 2016
Standard source	SCL-1400	HZTE012-02	Oct. 21, 2015	Oct. 20, 2016

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 expanded 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**

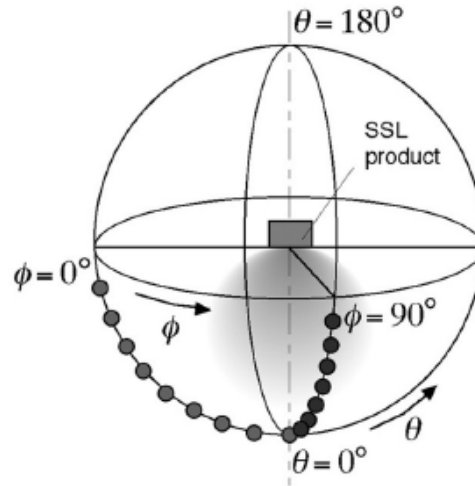
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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