

LM-79-08 Test Report

for

GREEN CREATIVE LTD

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

LED Tube System

Model: 22T5HO/4F/840/EXT/A4

(LED tube model: 22T5HO/4F/840/EXT 4pcs and LED driver model: 24T5HODRIVER/4CH 1pcs)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, Yuhang Dist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86 571 86376106

www.ledtestlab.com

Report No.: HZ18080024w

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

Review by:



Engineer: April Zou
Aug. 28, 2018

Approved by:



Manager: Jim Zhang
Aug. 28, 2018

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

TABLE OF CONTENT

LM-79-08 Test Report.....	1
Sample Photos.....	3
TEST RESULTS	4
Goniophotometer Method	5
Spectral Power Distribution - Sphere Spectroradiometer Method of CH1.....	6
Chromaticity Diagram - Sphere Spectroradiometer Method of CH1	7
Nominal CCT Quadrangles – Sphere Spectroradiometer Method of CH1.....	8
Zonal Lumen Tabulation- Goniophotometer Method of CH1.....	9
Luminous Intensity Distribution Plots- Goniophotometer Method of CH1	11
Luminous Intensity Data- Goniophotometer Method of CH1.....	12
EQUIPMENT LIST	14
TEST METHODS	14
Seasoning of SSL Product.....	14
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	14
Goniophotometer Method	15
Photometric and Electrical Measurements	15
Color Characteristics Measurements.....	15
Color Spatial Uniformity.....	15

Sample Photos

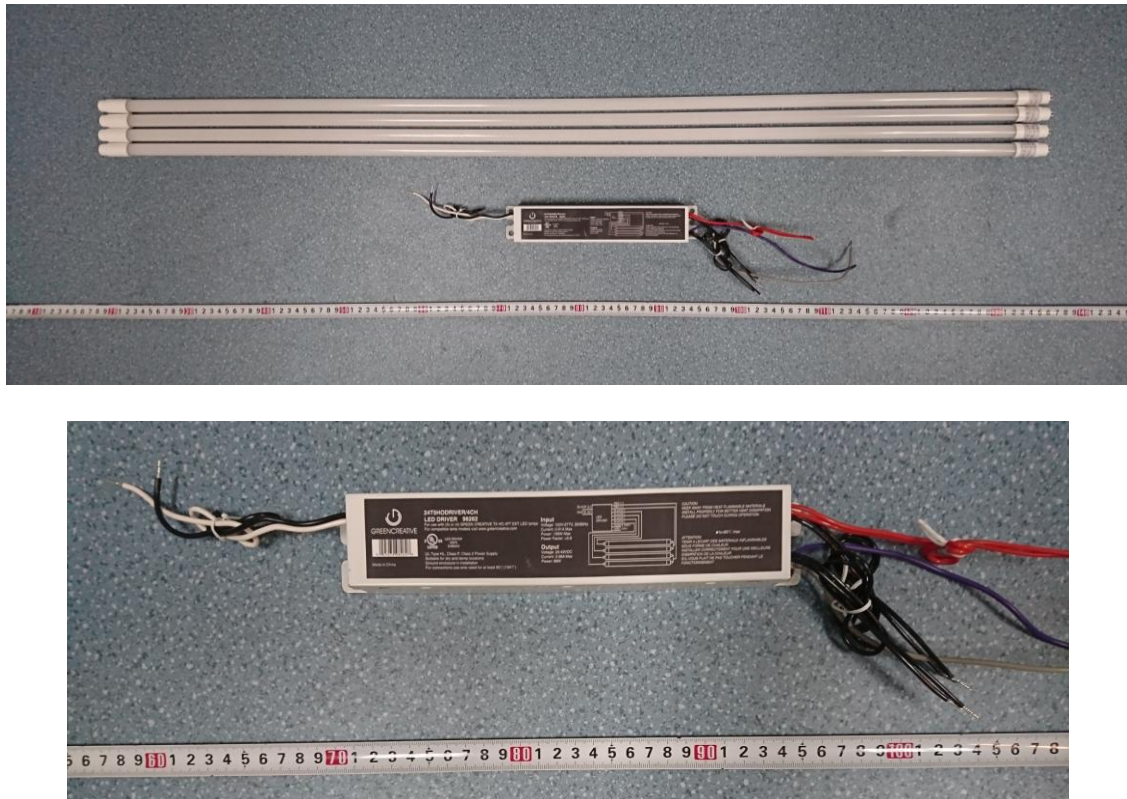


Figure 1- Overview of the sample

Equipment Under Test (EUT)

Name	: LED Tube System
Model	: 22T5HO/4F/840/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 4000K LED tube model: 22T5HO/4F/840/EXT 4 LED tubes supplied by a LED driver: 24T5HODRIVER/4CH
Manufacturer	: GREEN CREATIVE LTD
Address	: 756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai

Test specifications:

Date of Receipt	: Jul. 30, 2018
Date of Test	: Aug. 09, 2018
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

TEST RESULTS

Test ambient temperature was 25.0°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 70 minutes.

The LED driver has 4 channels, the tests were conducted at each channel with the same lamps.

Sphere-Spectroradiometer Method

Parameter	Result				Special Color Rendering Indices of CH1	
	CH1	CH2	CH3	CH4		
Test Voltage (V)	120.0	120.0	120.0	120.0	R1	79.2
Voltage frequency (Hz)	60	60	60	60	R2	87.2
Test Current (A)	0.880	0.880	0.879	0.880	R3	93.9
Power Factor	0.9967	0.9967	0.9967	0.9967	R4	81.1
Test Power (W)/4	26.31	26.32	26.28	26.30	R5	79.6
THD A%	3.69	3.58	3.68	3.57	R6	82.8
Luminous Efficacy (lm/W)	137.8	138.3	138.6	139.1	R7	85.7
Luminous Flux per lamp (lm)	3625.0	3639.0	3643.0	3657.0	R8	62.7
Color Rendering Index (CRI)	81.5	81.5	81.5	81.5	R9	1.2
R9	1.2	1.2	1.2	1.2	R10	70.2
Correlated Color Temperature (CCT)(K)	4049	4050	4050	4051	R11	80
Chromaticity Chroma x	0.3794	0.3794	0.3794	0.3793	R12	61.4
Chromaticity Chroma y	0.3800	0.3800	0.3799	0.3799	R13	81
Chromaticity Chroma u	0.2231	0.2231	0.2231	0.2231	R14	96.7
Chromaticity Chroma v	0.3352	0.3352	0.3352	0.3352	Rf	82
Duv	0.0012	0.0012	0.0012	0.0012	Rg	96
Chromaticity Chroma u'	0.2231	0.2231	0.2231	0.2231		
Chromaticity Chroma v'	0.5028	0.5028	0.5028	0.5028		

Table 1: 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 25.0°C.

The photometric distance is 30m.

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

The LED driver has 4 channels, the tests were conducted at each channel with the same lamps.

Parameter	Result			
	CH1	CH2	CH3	CH4
Test Voltage (V)	120.0	120.0	120.0	120.0
Voltage frequency (Hz)	60	60	60	60
Test Current (A)	0.880	0.881	0.879	0.880
Power Factor	0.9968	0.9968	0.9968	0.9968
Test Power (W)/4	26.32	26.33	26.28	26.31
Luminous Efficacy (lm/W)	136.4	136.8	137.3	137.6
Luminous Flux per lamp (lm)	3590.9	3602.1	3608.4	3618.7
Beam Angle (°)	119.6	119.6	119.6	119.6
Center Beam Candle Power (cd)	981	984	985	988
Spacing Criteria	1.22 (0°-180°)/ 1.31 (90°-270°)	1.22 (0°-180°)/ 1.31 (90°-270°)	1.22 (0°-180°)/ 1.31 (90°-270°)	1.22 (0°-180°)/ 1.31 (90°-270°)
Zonal Lumens in the 0°-60° Zone	63.38%	63.38%	63.37%	63.37%
Zonal Lumens in the 60°-90° Zone	25.88%	25.88%	25.89%	25.88%
Zonal Lumens in the 90°-120° Zone	7.93%	7.93%	7.93%	7.93%
Zonal Lumens in the 120°-180° Zone	2.81%	2.81%	2.81%	2.81%

Table 2: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method of CH1

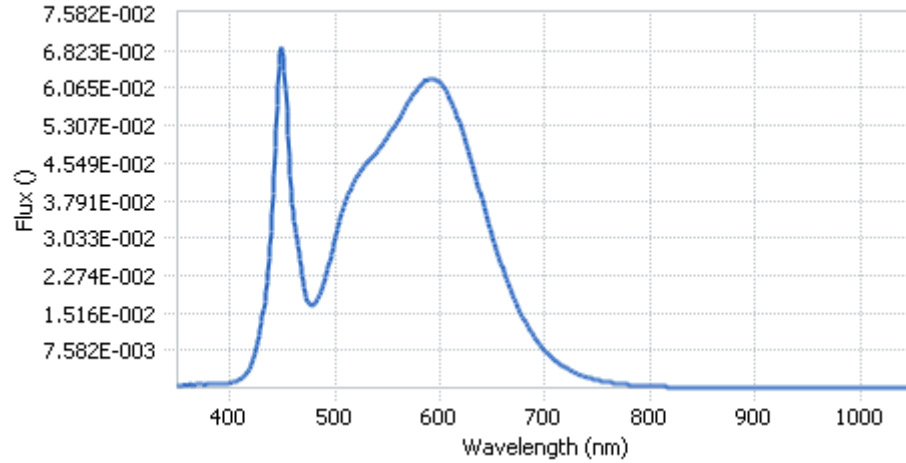
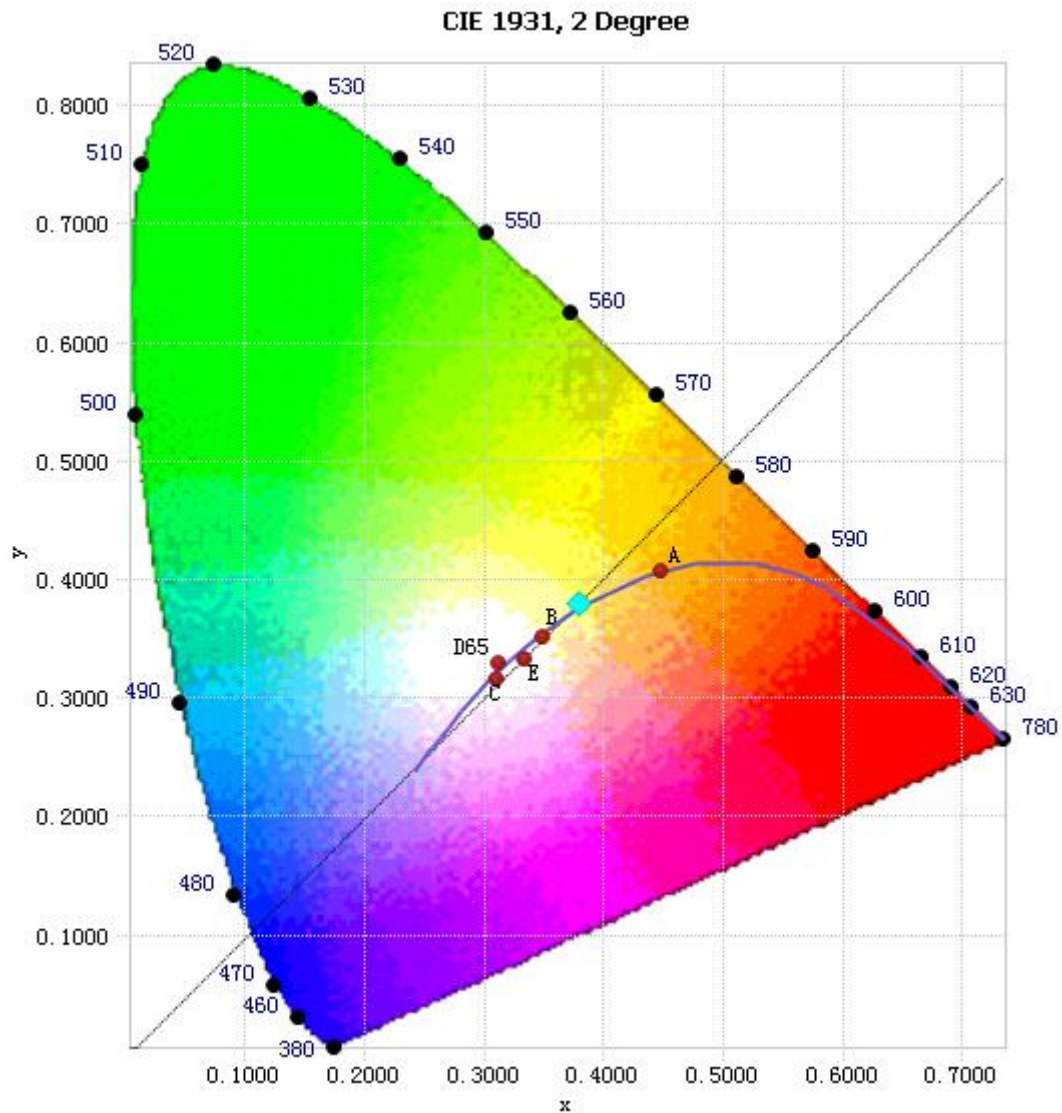


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.70E-04	485	1.86E-02	590	6.24E-02	695	8.75E-03
385	7.25E-04	490	2.15E-02	595	6.23E-02	700	7.53E-03
390	7.95E-04	495	2.57E-02	600	6.17E-02	705	6.42E-03
395	8.73E-04	500	3.03E-02	605	6.05E-02	710	5.48E-03
400	1.02E-03	505	3.44E-02	610	5.82E-02	715	4.69E-03
405	1.24E-03	510	3.76E-02	615	5.58E-02	720	4.04E-03
410	1.78E-03	515	4.04E-02	620	5.27E-02	725	3.44E-03
415	2.76E-03	520	4.24E-02	625	4.92E-02	730	2.93E-03
420	4.64E-03	525	4.42E-02	630	4.57E-02	735	2.50E-03
425	7.95E-03	530	4.55E-02	635	4.18E-02	740	2.14E-03
430	1.34E-02	535	4.66E-02	640	3.80E-02	745	1.82E-03
435	2.16E-02	540	4.78E-02	645	3.41E-02	750	1.58E-03
440	3.51E-02	545	4.92E-02	650	3.06E-02	755	1.35E-03
445	5.71E-02	550	5.07E-02	655	2.71E-02	760	1.16E-03
450	6.83E-02	555	5.23E-02	660	2.40E-02	765	1.00E-03
455	5.10E-02	560	5.40E-02	665	2.10E-02	770	8.56E-04
460	3.57E-02	565	5.60E-02	670	1.82E-02	775	7.35E-04
465	2.87E-02	570	5.79E-02	675	1.59E-02	780	6.33E-04
470	2.14E-02	575	5.95E-02	680	1.38E-02		
475	1.71E-02	580	6.10E-02	685	1.19E-02		
480	1.69E-02	585	6.20E-02	690	1.02E-02		

Table 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method of CH1



Tristimulus values(x, y): (0.3794, 0.3800)

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 of CH1

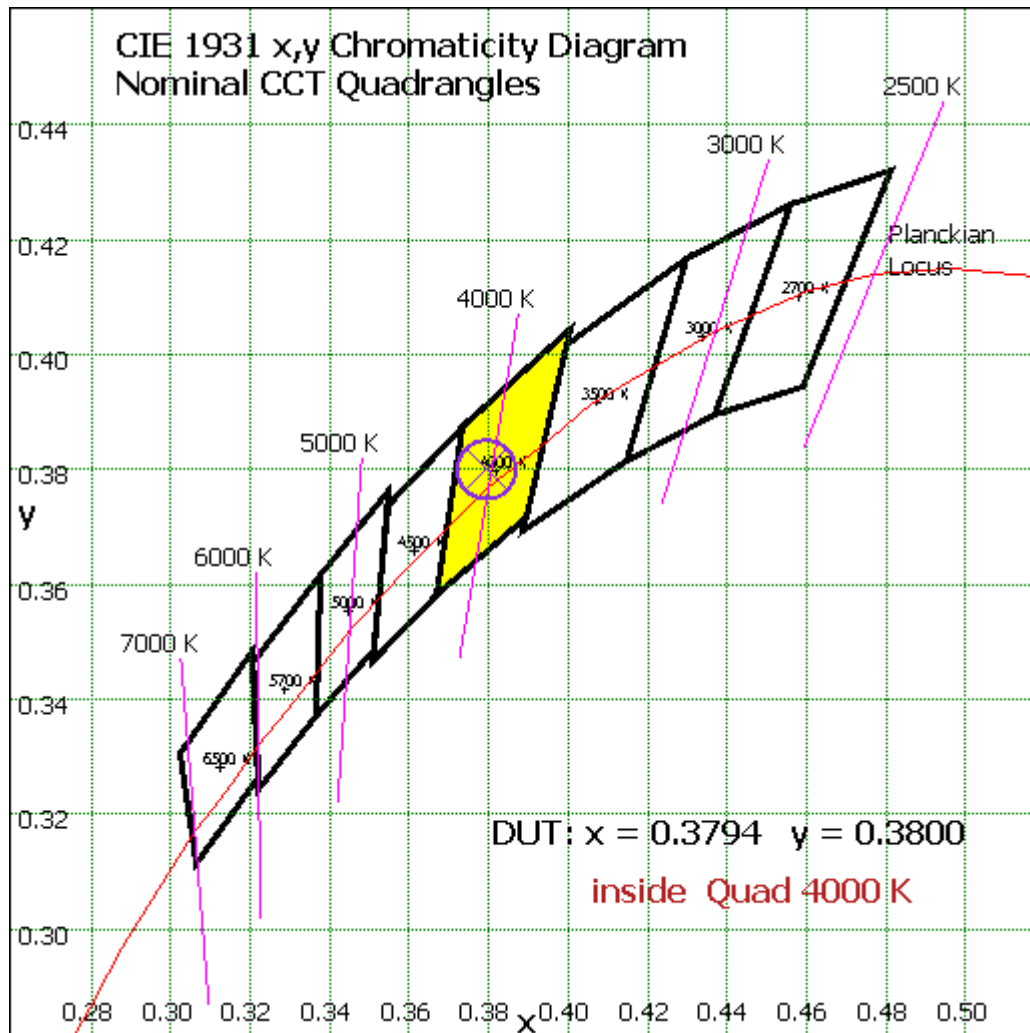


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method of CH1

$\gamma(^{\circ})$	Lumens	% Total
0- 10	92.837	2.59%
10- 20	266.618	7.42%
20- 30	406.387	11.32%
30- 40	495.026	13.79%
40- 50	523.233	14.57%
50- 60	492.003	13.70%
60- 70	413.258	11.51%
70- 80	308.648	8.60%
80- 90	207.424	5.78%
90-100	135.739	3.78%
100-110	89.652	2.50%
110-120	59.224	1.65%
120-130	39.824	1.11%
130-140	26.67	0.74%
140-150	17.406	0.48%
150-160	10.529	0.29%
160-170	5.1	0.14%
170-180	1.357	0.04%
Total	3590.9	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2276.104	63.38%
60- 90	929.33	25.88%
0-90	3205.434	89.26%
90- 180	385.501	10.74%
0- 180	3590.9	100%

Table 4: Zonal Lumen Data

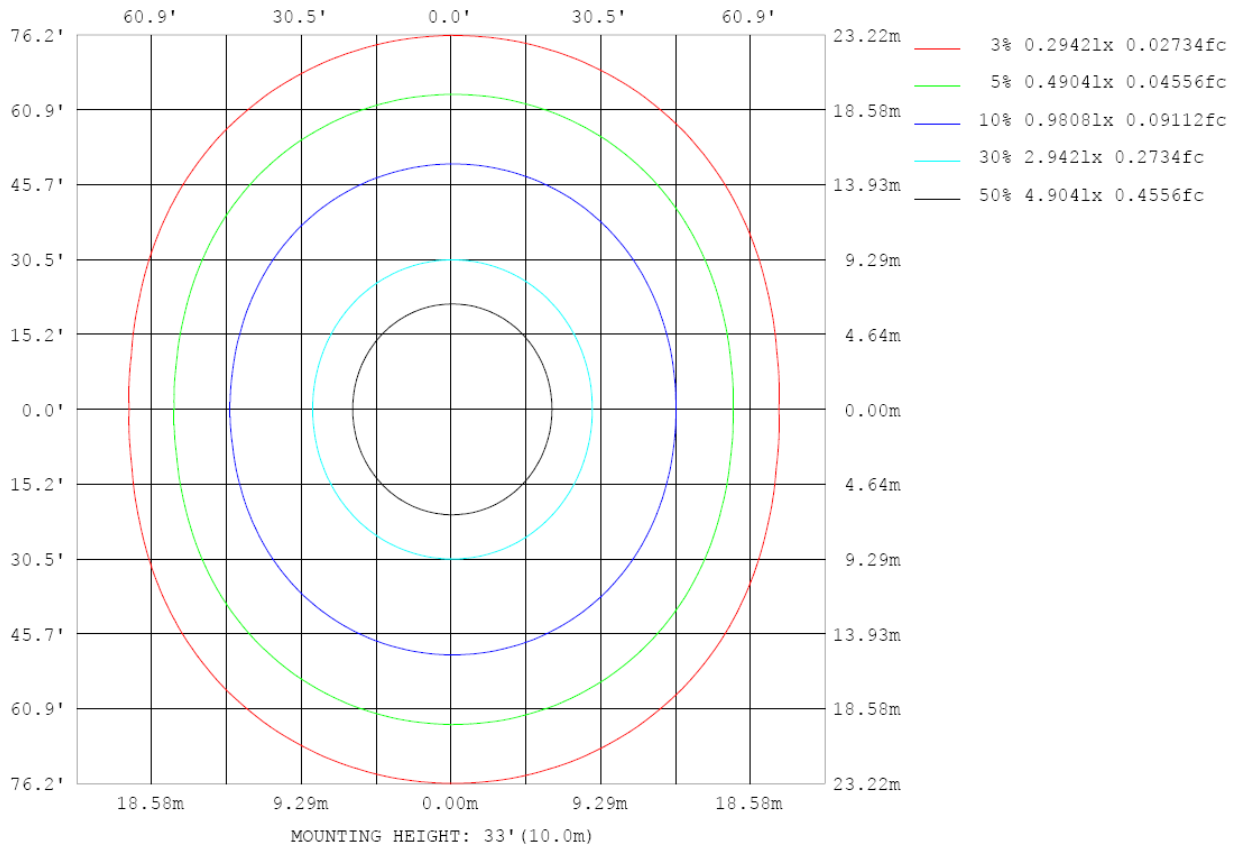


Chart 4: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method of CH1

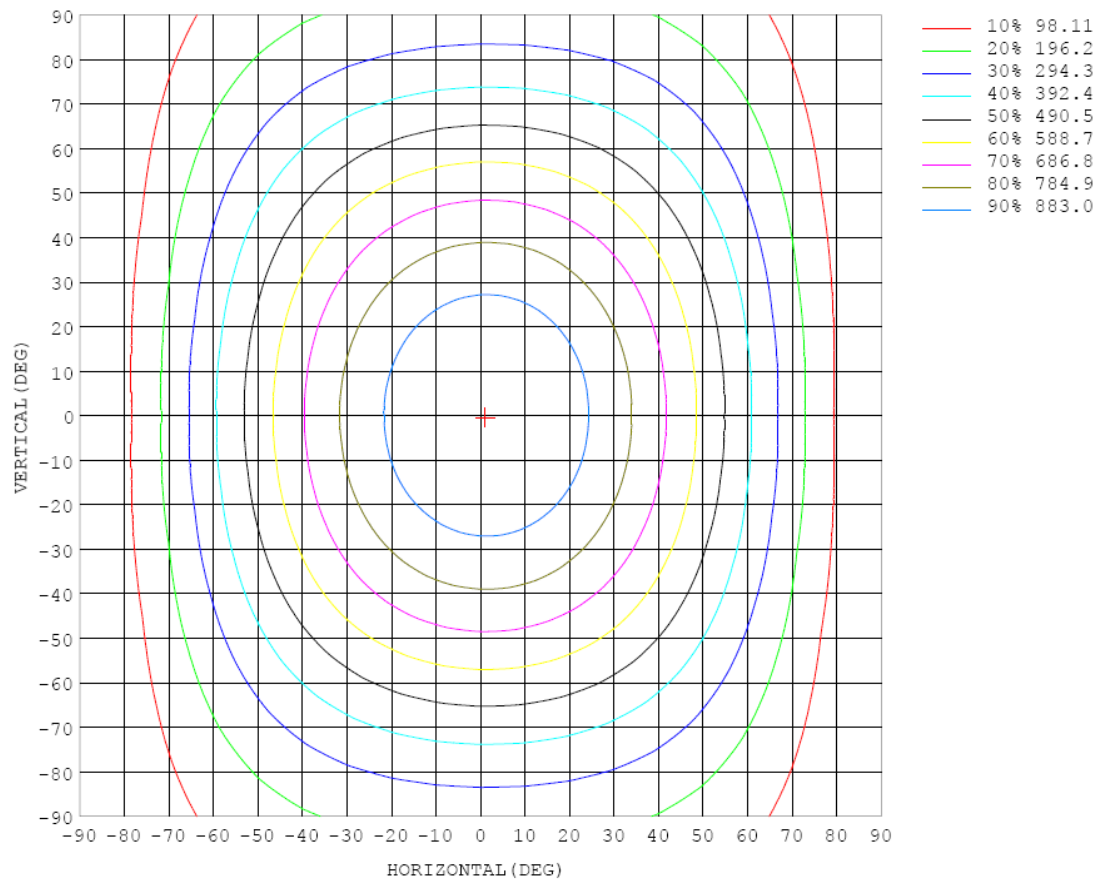


Chart 5: Isocandela Plot

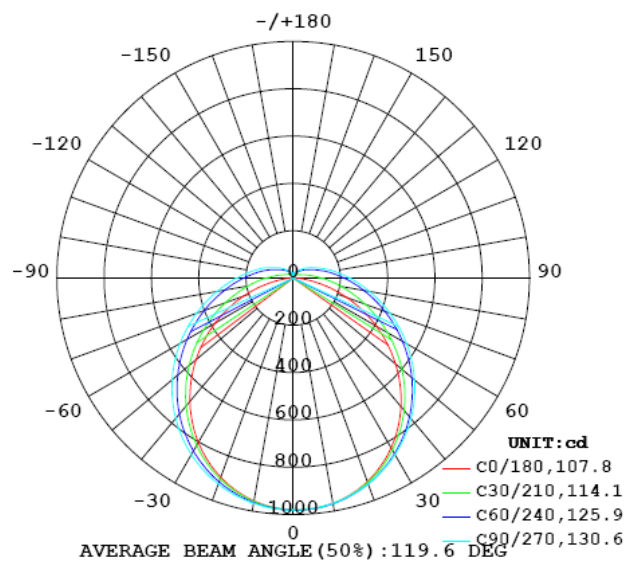


Chart 6: Polar Candela Distribution

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	PF2010A	HZTE028-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	DPS1060	HZTE001-06	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	WY12010	HZTE004-03	Aug. 10, 2017	Aug. 09, 2018
Temperature recorder	JM624U	HZTE018-08	Aug. 17, 2017	Aug. 16, 2018
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 16, 2017	Aug. 15, 2018
Standard source	D908	HZTE012-01	Aug. 20, 2017	Aug. 19, 2018
Integrate Sphere system	2M	HZTE015-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	WT210	HZTE008-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	PCR 500L	HZTE001-07	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	IT6154	HZTE004-04	Aug. 10, 2017	Aug. 09, 2018
Standard source	SCL-1400	HZTE012-02	Aug. 20, 2017	Aug. 19, 2018
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 16, 2017	Aug. 15, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 2018

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

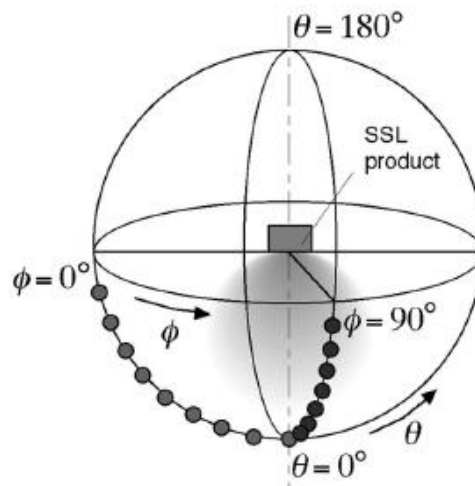
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.