LM-79-19 TEST REPORT

for

GREEN CREATIVE LTD

Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

LED Tube

Model: 15T8/4F/835/HYB/R

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ22120037d

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

Review by: April Zou

Engineer: April Zou

Jan. 05, 2023

Approved by:

Manager: Jim Zhang

Jan. 05, 2023

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: **15T8/4F/835/HYB/R**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
123.8	2191.3	17.70	0.9949

CCT (K)	CRI	Stabilization Time (Light & Power)
3488	83.0	50

Table 1: Executive Data Summary

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

Test specifications:

Date of Receipt : Dec. 27, 2022

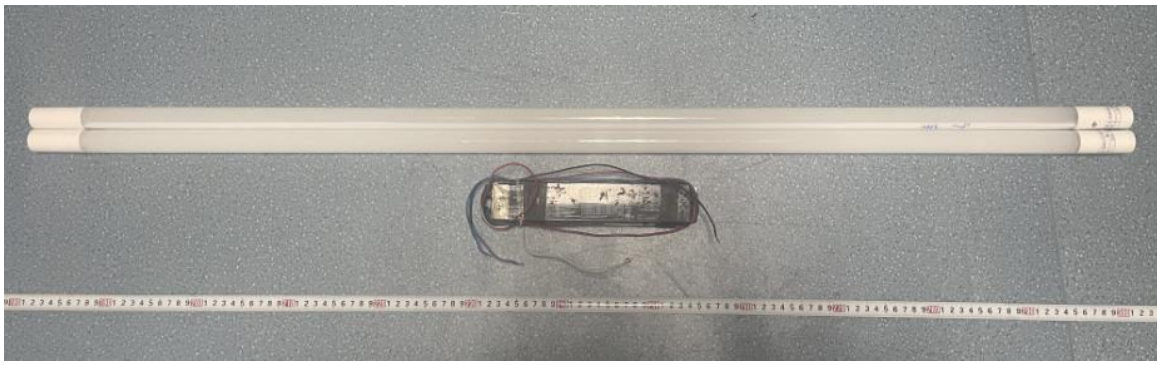
Date of Test : Dec. 28, 2022

Test item : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

Reference Standard : IESNA LM-79-2019 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

TABLE OF CONTENT

SAMPLE PHOTO



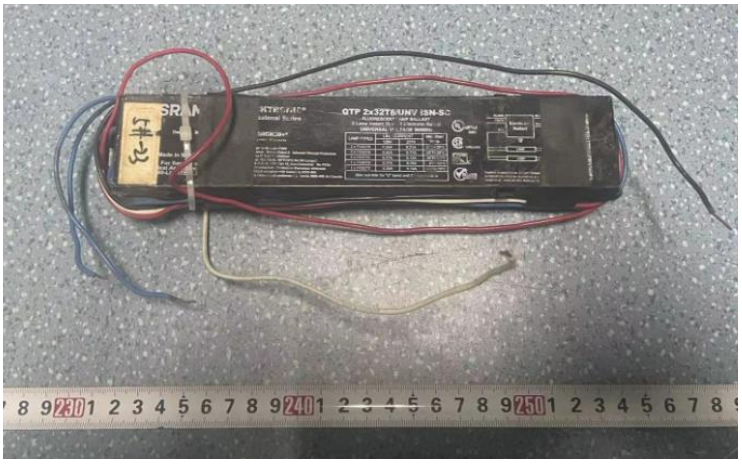


Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 15T8/4F/835/HYB/R
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: 3500K LED Tubes supplied by a high frequency fluorescent lamp ballast: QTP 2x32T8/UNV ISN-SC
Manufacturer	: GREEN CREATIVE LTD
Address	: Room 3603, Level 36, Tower 1, Enterprise Square Five, 38 Wang Chiu Road, Kowloon Bay, KL, Hong Kong

TEST RESULTS

Test ambient temperature was 26.0 ℃.

Base orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 50 minutes, and the total operating time including stabilization was 55 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.296	0.131
Power Factor	0.9949	0.9681
Test Power (W)/2	17.70	17.55
THD A%	7.93	11.87
Luminous Efficacy (lm/W)	123.8	124.9
Total Luminous Flux (lm)	2191.3	2191.9
Color Rendering Index (CRI)	83.0	
R9	9.2	
Correlated Color Temperature (CCT)(K)	3488	
Chromaticity Chroma x	0.4068	
Chromaticity Chroma y	0.3935	
Chromaticity Chroma u	0.2355	
Chromaticity Chroma v	0.3417	
Duv	0.0009	
Chromaticity Chroma u ’	0.2355	
Chromaticity Chroma v’	0.5126	

Special Color Rendering Indices	
R1	81.2
R2	89.2
R3	95.8
R4	82.1
R5	81.2
R6	85.8
R7	85.4
R8	63
R9	9.2
R10	75
R11	81.4
R12	65
R13	83
R14	97.8

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 24.8 ℃.

The photometric distance is 30 m.

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)	0.297
Power Factor	0.9951
Power (W)/2	17.71
Luminous Efficacy (lm/W)	124.7
Total Luminous Flux (lm)	2207.6
Beam Angle (°)	111.1 (0^o-180^o) / 210.2 (90^o-270^o)
Center Beam Candle Power (cd)	386
Maximum Beam Candle Power (cd)	387.8 (At: C=70.0, Gamma=5.5)
Spacing Criteria	1.24 (0^o-180^o) / 1.40 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	44.27%
Zonal Lumens in the 60 °-90 °Zone	26.70%
Zonal Lumens in the 90 °-120 °Zone	17.35%
Zonal Lumens in the 120 °-180 °Zone	11.69%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

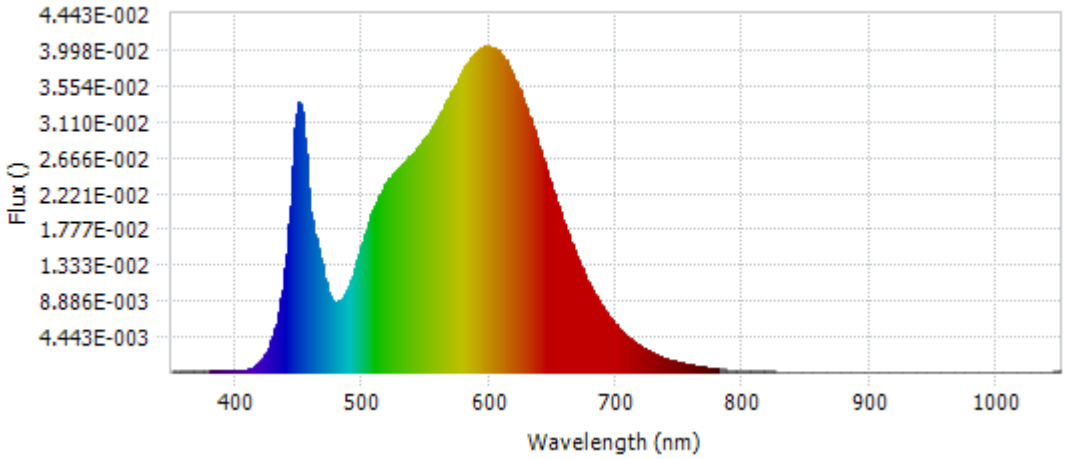
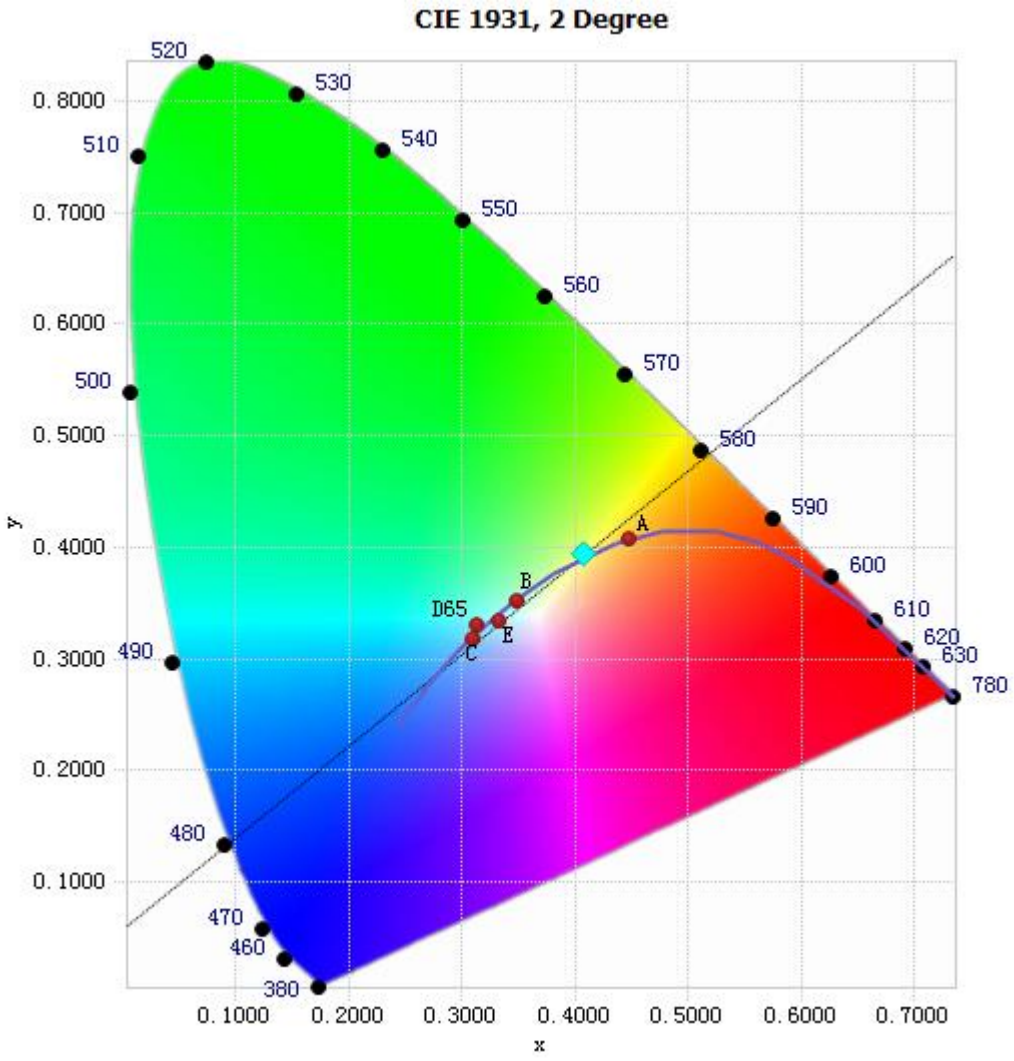


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.70E-04	485	9.50E-03	590	3.97E-02	695	6.81E-03
385	1.74E-04	490	1.10E-02	595	4.02E-02	700	5.85E-03
390	1.71E-04	495	1.34E-02	600	4.04E-02	705	5.04E-03
395	1.47E-04	500	1.61E-02	605	4.00E-02	710	4.27E-03
400	1.57E-04	505	1.86E-02	610	3.93E-02	715	3.68E-03
405	1.99E-04	510	2.07E-02	615	3.81E-02	720	3.19E-03
410	4.01E-04	515	2.24E-02	620	3.64E-02	725	2.70E-03
415	8.14E-04	520	2.37E-02	625	3.44E-02	730	2.29E-03
420	1.50E-03	525	2.47E-02	630	3.24E-02	735	1.96E-03
425	2.73E-03	530	2.55E-02	635	3.00E-02	740	1.66E-03
430	4.77E-03	535	2.63E-02	640	2.76E-02	745	1.43E-03
435	8.37E-03	540	2.71E-02	645	2.51E-02	750	1.21E-03
440	1.46E-02	545	2.81E-02	650	2.26E-02	755	1.03E-03
445	2.55E-02	550	2.92E-02	655	2.02E-02	760	8.98E-04
450	3.35E-02	555	3.04E-02	660	1.80E-02	765	7.65E-04
455	2.70E-02	560	3.17E-02	665	1.59E-02	770	6.52E-04
460	1.89E-02	565	3.32E-02	670	1.39E-02	775	5.51E-04
465	1.54E-02	570	3.47E-02	675	1.22E-02	780	4.70E-04
470	1.18E-02	575	3.61E-02	680	1.06E-02		
475	9.19E-03	580	3.75E-02	685	9.19E-03		
480	8.77E-03	585	3.89E-02	690	7.93E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4068, 0.3935)

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

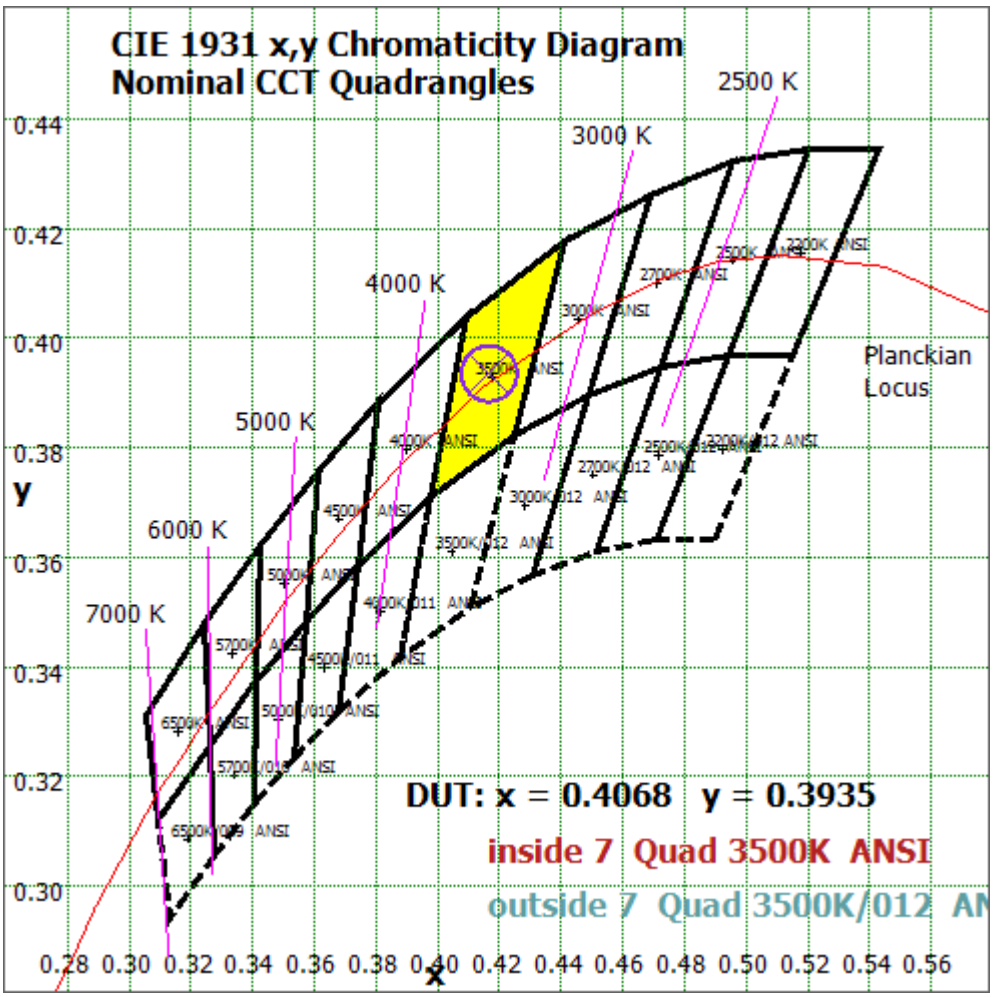


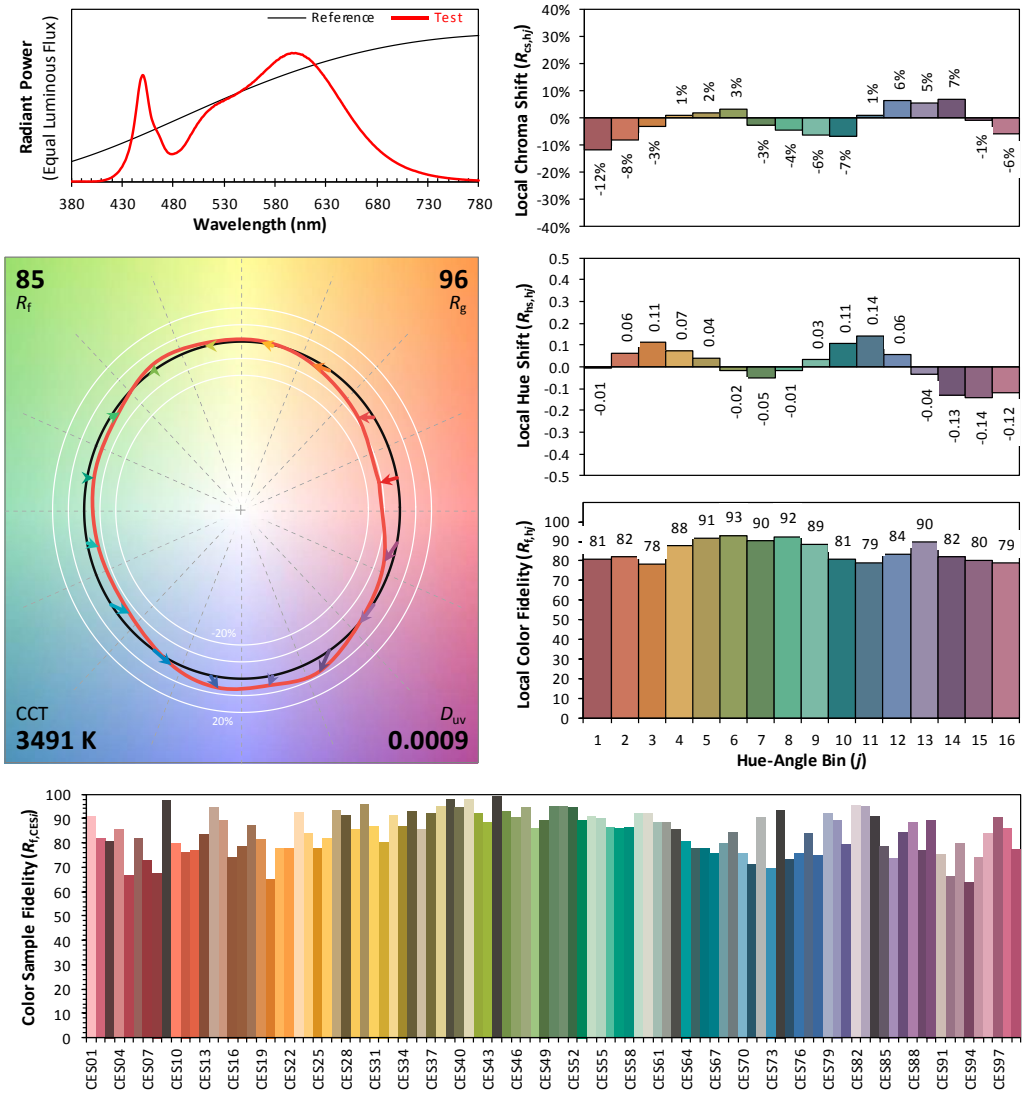
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

Source: LED **Manufacturer:** GREEN CREATIVE LTD

Date: 2022/12/28 **Model:** 15T8/4F/835/HYB/R



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.4068
y	0.3935
u'	0.2355
v'	0.5126

CIE 13.3-1995 (CRI)

R_a	83
R_9	9

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	36.646	1.66%
10- 20	105.989	4.80%
20- 30	164.405	7.45%
30- 40	206.613	9.36%
40- 50	229.78	10.41%
50- 60	233.769	10.59%
60- 70	221.362	10.03%
70- 80	197.621	8.95%
80- 90	170.357	7.72%
90-100	147.308	6.67%
100-110	127.316	5.77%
110-120	108.341	4.91%
120-130	89.454	4.05%
130-140	70.712	3.20%
140-150	51.022	2.31%
150-160	31.482	1.43%
160-170	12.831	0.58%
170-180	2.542	0.12%
Total	2207.6	100%

γ(°)	Lumens	% Total
0- 60	977.202	44.27%
60- 90	589.34	26.70%
0-90	1566.54	70.96%
90- 180	641.008	29.04%
0- 180	2207.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

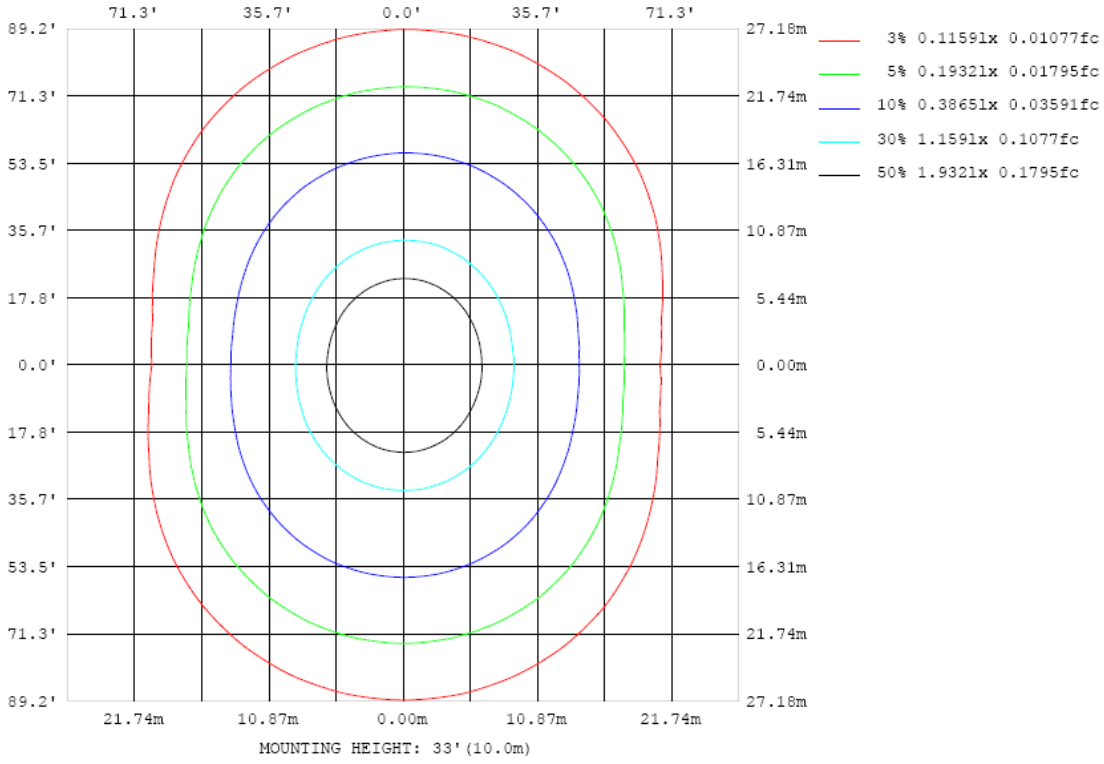


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

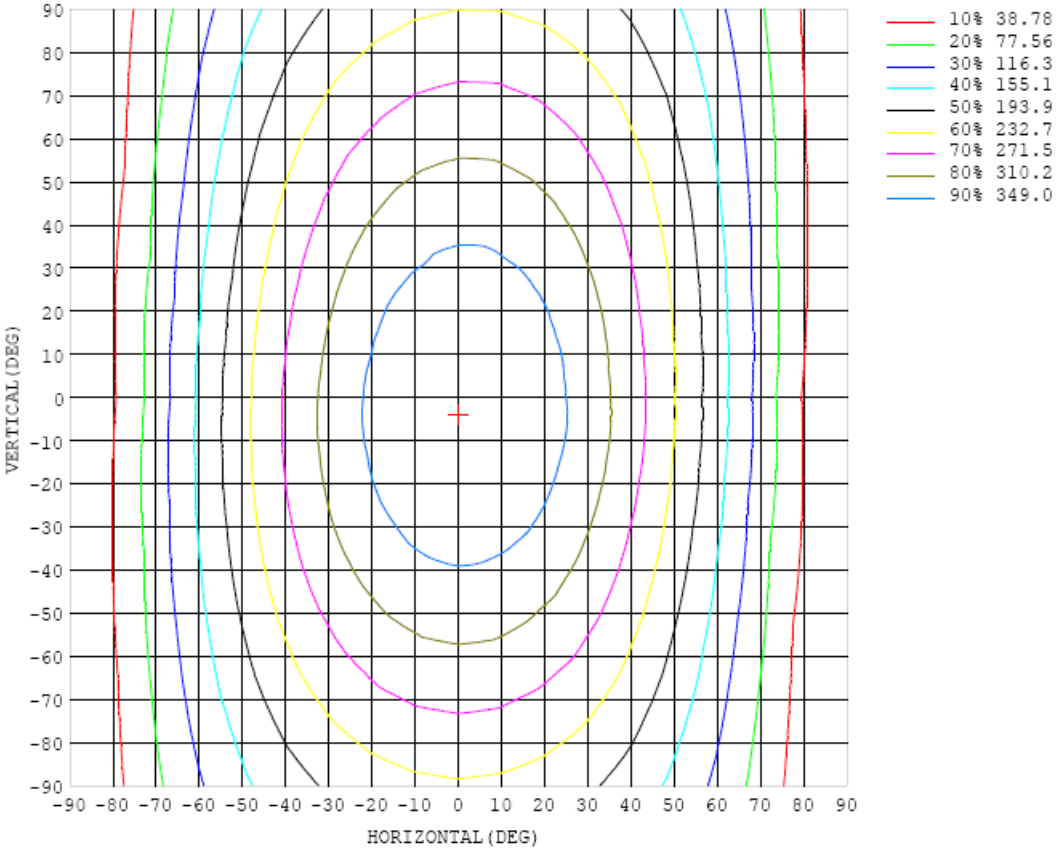


Chart 6: Isocandela Plot

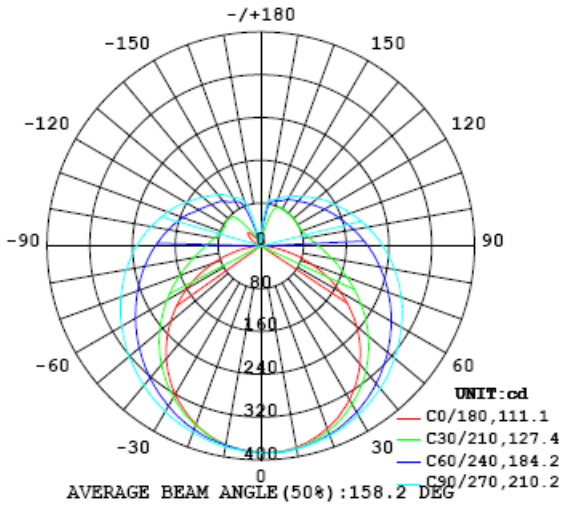


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386
5	386	386	386	386	387	387	387	387	387	387	387	387	386	386	386	385	384	384	383
10	382	382	383	384	385	385	385	385	385	385	385	383	383	382	381	380	379	378	378
15	374	375	377	378	378	380	381	381	381	381	381	379	377	376	374	372	370	369	368
20	363	365	367	368	370	373	375	376	377	377	376	374	371	369	365	361	358	357	355
25	349	351	353	356	359	364	368	370	371	371	370	367	363	359	353	348	344	341	339
30	332	334	337	341	347	353	359	362	365	364	363	360	354	348	340	333	327	323	320
35	311	314	318	325	333	341	348	353	356	356	354	350	343	335	326	316	308	302	299
40	288	291	296	306	316	327	336	342	347	348	345	339	331	321	309	297	286	279	275
45	262	266	273	285	298	312	323	331	336	338	335	329	319	306	292	277	264	254	249
50	234	237	247	262	280	296	310	319	325	326	324	317	305	291	274	256	239	227	221
55	203	208	220	240	261	280	296	307	314	315	312	305	292	276	256	235	214	199	191
60	171	176	193	216	241	264	282	294	302	304	301	292	278	260	238	213	189	169	160
65	138	144	165	193	222	248	268	281	289	292	288	280	265	245	220	192	164	141	128
70	103	111	139	172	204	232	254	268	277	279	276	267	251	230	203	173	140	111	94.9
75	68.1	78.9	113	152	187	217	240	255	264	267	263	254	238	216	188	154	118	83.1	63.1
80	36.0	50.6	91.3	135	172	203	226	242	251	254	251	241	224	202	173	139	98.1	58.4	34.6
85	10.8	29.3	74.3	120	158	190	213	229	238	242	238	228	211	189	160	124	82.2	39.3	11.0
90	0.91	18.6	62.8	108	147	177	200	216	226	229	225	215	199	177	149	112	70.6	28.1	0.63
95	0.91	15.2	55.8	98.4	136	165	188	204	213	216	212	203	187	165	138	103	63.0	24.0	1.13
100	1.63	17.1	52.3	91.0	126	155	176	191	201	203	200	191	175	155	128	94.8	58.3	24.5	2.70
105	2.75	21.8	51.6	85.6	118	146	165	180	188	191	188	179	165	145	120	88.8	56.1	27.8	5.80
110	3.06	27.8	53.2	82.3	111	136	155	168	177	179	176	168	155	136	112	84.6	56.0	32.8	8.88
115	4.57	34.9	56.0	80.3	106	128	146	158	165	168	165	157	145	128	106	81.7	57.3	39.0	11.5
120	7.59	41.8	59.5	79.8	101	121	137	149	155	157	155	148	137	121	101	80.2	59.7	45.7	16.5
125	8.42	40.6	63.8	79.9	98.0	115	129	139	146	148	145	139	128	114	97.4	79.5	62.7	52.2	23.2
130	5.91	36.6	67.8	80.7	95.5	110	122	131	136	138	136	130	121	109	94.5	79.6	66.2	57.8	29.8
135	3.78	37.3	70.7	80.4	93.9	106	115	123	128	129	127	122	114	104	92.3	80.2	68.4	60.9	35.0
140	6.44	44.4	72.3	79.1	92.7	102	110	116	120	121	119	115	108	100	91.0	79.5	70.6	59.9	30.8
145	9.14	44.2	72.7	80.6	89.7	98.9	105	110	113	114	112	109	104	97.1	88.3	79.5	75.1	58.8	20.5
150	11.7	34.2	70.9	79.7	85.6	94.0	101	104	107	107	106	104	99.7	93.1	85.6	80.8	76.9	61.0	19.3
155	11.2	20.9	66.2	79.8	84.4	89.6	93.5	97.6	101	101	100	97.6	93.1	88.9	85.4	82.4	78.3	58.1	20.6
160	11.2	17.4	43.0	74.4	82.9	86.6	89.9	91.7	93.0	93.4	92.6	91.7	89.9	87.6	85.3	83.3	74.8	44.8	18.1
165	12.1	11.9	21.4	47.8	69.9	82.9	85.5	88.0	89.7	89.7	89.4	88.8	87.9	86.8	85.5	80.4	65.2	41.3	21.0
170	12.0	14.8	14.3	21.8	36.2	54.2	72.1	80.8	84.8	86.8	87.3	87.2	86.2	82.1	72.9	62.7	45.7	28.2	21.2
175	12.4	16.9	15.6	12.4	13.0	18.3	26.1	34.1	42.0	47.5	47.9	45.8	43.5	38.7	31.5	26.0	23.6	22.5	20.5
180	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8

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	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386	386		
5	384	384	383	383	383	383	384	384	384	385	385	385	385	385	385	385	386		
10	377	377	377	378	378	379	379	380	381	382	382	382	381	381	381	381	381		
15	367	367	369	370	371	373	375	376	377	377	377	377	376	375	374	374	374		
20	354	355	357	360	362	365	368	370	371	372	372	370	368	367	365	364	363		
25	338	340	343	347	352	356	360	363	365	366	364	362	359	356	354	351	349		
30	320	322	327	333	340	346	351	355	358	358	356	353	349	344	339	335	332		
35	299	303	309	317	326	335	341	347	349	350	347	343	337	330	323	317	311		
40	275	281	289	301	312	323	331	338	341	341	338	332	324	315	305	296	290		
45	250	257	269	283	297	310	320	327	331	331	328	320	311	298	286	274	265		
50	223	232	247	265	282	297	309	318	322	322	317	309	296	282	265	250	238		
55	194	206	225	246	266	284	297	307	311	311	306	296	282	264	245	225	209		
60	164	180	203	228	252	271	285	295	301	300	294	283	267	247	223	199	179		
65	133	154	182	211	236	258	273	285	289	289	283	271	253	230	203	173	148		
70	103	129	162	194	222	245	262	273	279	278	271	258	239	214	183	149	117		
75	73.8	106	143	179	209	233	250	262	267	266	260	246	226	199	165	127	88.6		
80	48.5	86.2	127	165	196	221	238	251	256	255	248	234	213	185	149	107	64.2		
85	29.0	70.7	114	152	184	209	227	239	244	243	236	222	201	172	136	92.3	45.9		
90	18.7	60.7	103	141	173	197	215	227	232	232	224	210	189	161	124	81.3	35.6		
95	14.5	54.3	94.7	131	162	187	204	215	221	220	212	198	178	150	115	74.0	31.9		
100	15.2	50.5	88.3	123	152	176	193	204	209	208	201	187	167	141	108	69.8	32.1		
105	18.1	49.1	82.9	116	143	166	182	192	197	196	189	176	158	133	102	67.9	33.8		
110	21.7	49.8	78.7	108	135	156	171	181	186	185	178	166	148	125	97.4	68.0	35.7		
115	24.5	52.2	77.2	102	124	145	160	170	174	173	168	156	140	119	94.0	69.2	37.5		
120	17.4	50.5	77.3	97.9	118	135	148	157	162	162	157	147	132	113	91.8	71.5	39.0		
125	4.14	46.6	79.0	95.0	112	128	139	147	152	151	147	138	125	109	89.4	71.3	39.7		
130	3.37	44.2	78.4	92.6	108	121	131	139	142	142	138	130	119	105	88.8	72.3	36.7		
135	2.10	36.8	75.8	90.0	104	115	124	130	133	133	129	123	113	99.8	85.8	69.0	30.9		
140	2.82	23.1	63.5	87.7	97.7	109	118	122	125	125	122	116	106	94.6	87.1	55.9	19.7		
145	8.52	10.7	38.3	86.9	93.4	100	108	114	117	116	112	106	98.9	91.7	83.1	37.7	12.3		
150	10.4	11.6	26.2	65.7	91.0	95.9	100	103	105	106	104	100	93.7	86.3	63.4	19.8	11.2		
155	10.6	11.1	13.1	25.4	70.4	88.8	94.4	96.6	98.3	98.3	96.7	93.5	83.0	66.6	29.4	12.5	13.0		
160	9.61	10.4	7.67	15.9	20.9	45.5	71.9	83.2	86.7	87.1	82.0	68.0	47.9	25.4	11.7	14.3	13.0		
165	9.08	9.65	12.0	10.4	9.99	16.8	21.4	24.7	28.8	29.2	24.7	17.6	12.1	13.9	9.76	13.5	14.8		
170	13.2	12.9	11.0	15.9	10.8	11.7	16.2	14.5	15.7	12.9	17.3	17.3	11.6	12.9	14.7	15.0	12.2		
175	14.8	10.4	13.0	17.3	15.9	13.4	13.9	15.1	10.4	14.2	14.8	15.8	17.2	16.8	15.3	12.6	9.18		
180	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2022	Aug. 04, 2023
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2022	Aug. 04, 2023
Standard source	D908	HZTE012-01	Aug. 05, 2022	Aug. 04, 2023
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2022	Aug. 04, 2023
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2022	Aug. 04, 2023
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2022	Aug. 04, 2023
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2022	Aug. 04, 2023
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2022	Aug. 04, 2023
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2022	Aug. 04, 2023
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2022	Aug. 04, 2023

Table 7: 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 3 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 Tubes) 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 20 min, taken 10 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.

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The uncertainty of integrating sphere system reported in this document is expended 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 Tubes) 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 20 min, taken 10 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 expended 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.

*** End of Report ***