LM-79-08 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 Downlight

Model: 3N1/12/90/CCTS/DIM120V

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ20090003j

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

Review by: April Zou

Engineer: April Zou

Sep. 11, 2020

Approved by: Jim Zhang

Manager: Jim Zhang

Sep. 11, 2020

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: **3N1/12/90/CCTS/DIM120V**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
84.0	1865.6	22.21	0.9899

CCT (K)	CRI	Stabilization Time (Light & Power)
3038	92.6	60

Table 1: Executive Data Summary

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

Test specifications:

Date of Receipt	: Sep. 03, 2020
Date of Test	: Sep. 07, 2020
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 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 Downlight
Model	: 3N1/12/90/CCTS/DIM120V
Electrical Ratings	: 120Vac, 60Hz, 24W
Product Description	: 3000K
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 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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result
Test Voltage (V)	120.0
Voltage frequency (Hz)	60
Test Current (A)	0.187
Power Factor	0.9899
Test Power (W)	22.21
THD A%	13.42
Luminous Efficacy (lm/W)	84.0
Total Luminous Flux (lm)	1865.6
Color Rendering Index (CRI)	92.6
R9	61.5
Correlated Color Temperature (CCT)(K)	3038
Chromaticity Chroma x	0.4330
Chromaticity Chroma y	0.4008
Chromaticity Chroma u	0.2494
Chromaticity Chroma v	0.3463
Duv	-0.0008
Chromaticity Chroma u ’	0.2494
Chromaticity Chroma v’	0.5195

Special Color Rendering Indices	
R1	92.8
R2	96.1
R3	97.4
R4	92.3
R5	92.2
R6	94.4
R7	92.5
R8	82.9
R9	61.5
R10	89.6
R11	92.5
R12	78.5
R13	93.7
R14	98

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 ℃.

The photometric distance is 2.47 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)	0.187
Power Factor	0.9903
Power (W)	22.27
Luminous Efficacy (lm/W)	84.6
Total Luminous Flux (lm)	1884.8
Beam Angle (°)	113.3 (0^o-180^o) / 113.3 (90^o-270^o)
Center Beam Candle Power (cd)	648
Maximum Beam Candle Power (cd)	648.9 (At: C=280.0, Gamma=1.0)
Spacing Criteria	1.27 (0^o-180^o) / 1.27 (90^o-270^o)
Zonal Lumens in the 0 °-60 °Zone	77.73%
Zonal Lumens in the 60 °-90 °Zone	22.19%
Zonal Lumens in the 90 °-120 °Zone	0.04%
Zonal Lumens in the 120 °-180 °Zone	0.05%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

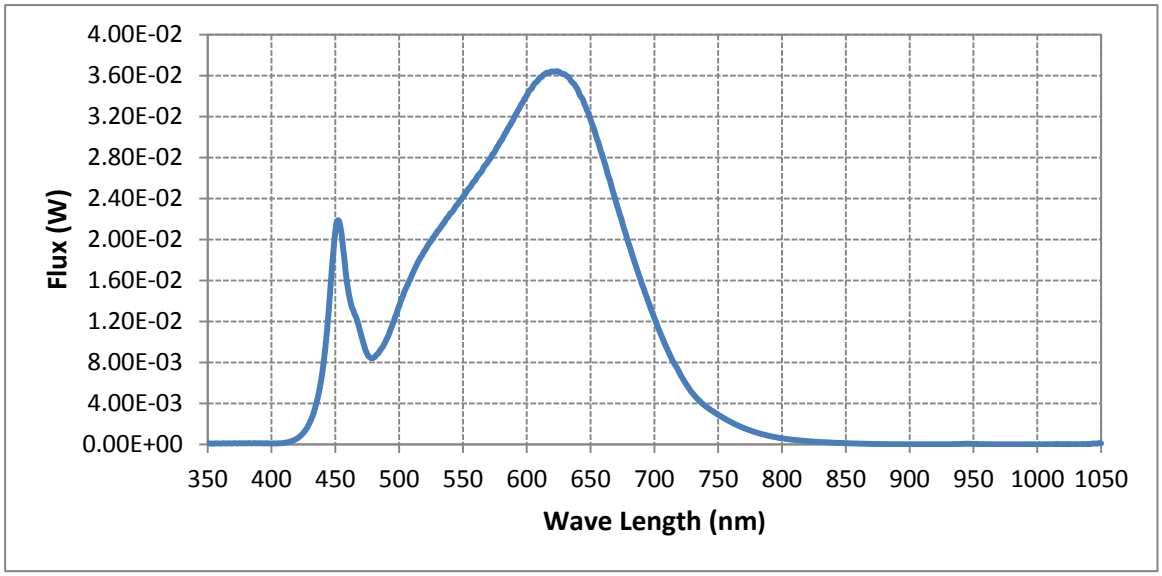
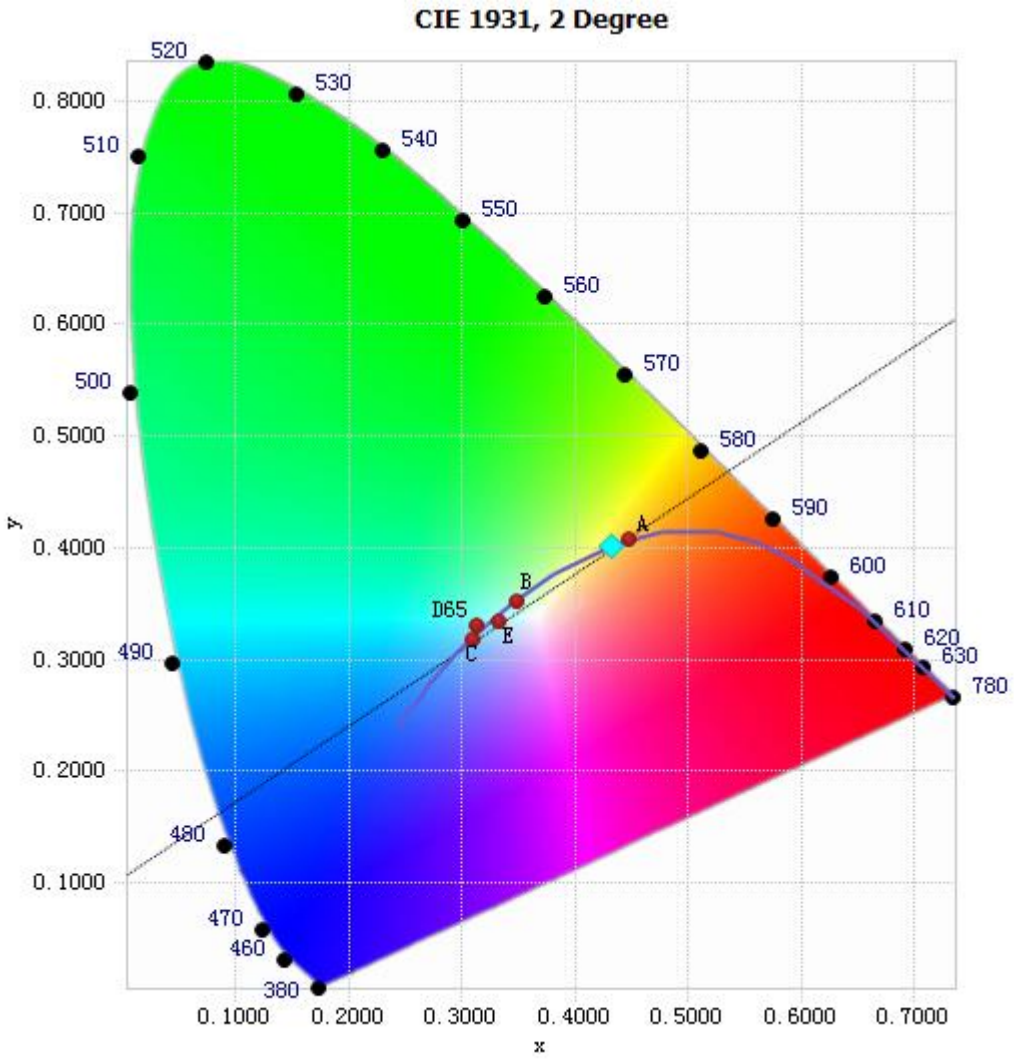


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.08E-04	485	9.17E-03	590	3.19E-02	695	1.40E-02
385	1.06E-04	490	1.02E-02	595	3.30E-02	700	1.24E-02
390	1.27E-04	495	1.18E-02	600	3.41E-02	705	1.08E-02
395	1.12E-04	500	1.35E-02	605	3.50E-02	710	9.33E-03
400	9.92E-05	505	1.52E-02	610	3.58E-02	715	8.02E-03
405	1.05E-04	510	1.65E-02	615	3.63E-02	720	6.92E-03
410	1.56E-04	515	1.79E-02	620	3.64E-02	725	5.87E-03
415	2.92E-04	520	1.89E-02	625	3.64E-02	730	4.99E-03
420	5.76E-04	525	1.98E-02	630	3.61E-02	735	4.30E-03
425	1.14E-03	530	2.08E-02	635	3.54E-02	740	3.75E-03
430	2.16E-03	535	2.16E-02	640	3.46E-02	745	3.31E-03
435	3.97E-03	540	2.25E-02	645	3.33E-02	750	2.91E-03
440	7.21E-03	545	2.33E-02	650	3.17E-02	755	2.53E-03
445	1.33E-02	550	2.42E-02	655	2.98E-02	760	2.18E-03
450	2.08E-02	555	2.50E-02	660	2.79E-02	765	1.88E-03
455	2.05E-02	560	2.58E-02	665	2.59E-02	770	1.61E-03
460	1.51E-02	565	2.67E-02	670	2.37E-02	775	1.38E-03
465	1.27E-02	570	2.77E-02	675	2.16E-02	780	1.16E-03
470	1.08E-02	575	2.86E-02	680	1.96E-02		
475	8.83E-03	580	2.96E-02	685	1.76E-02		
480	8.48E-03	585	3.08E-02	690	1.57E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4330, 0.4008)

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

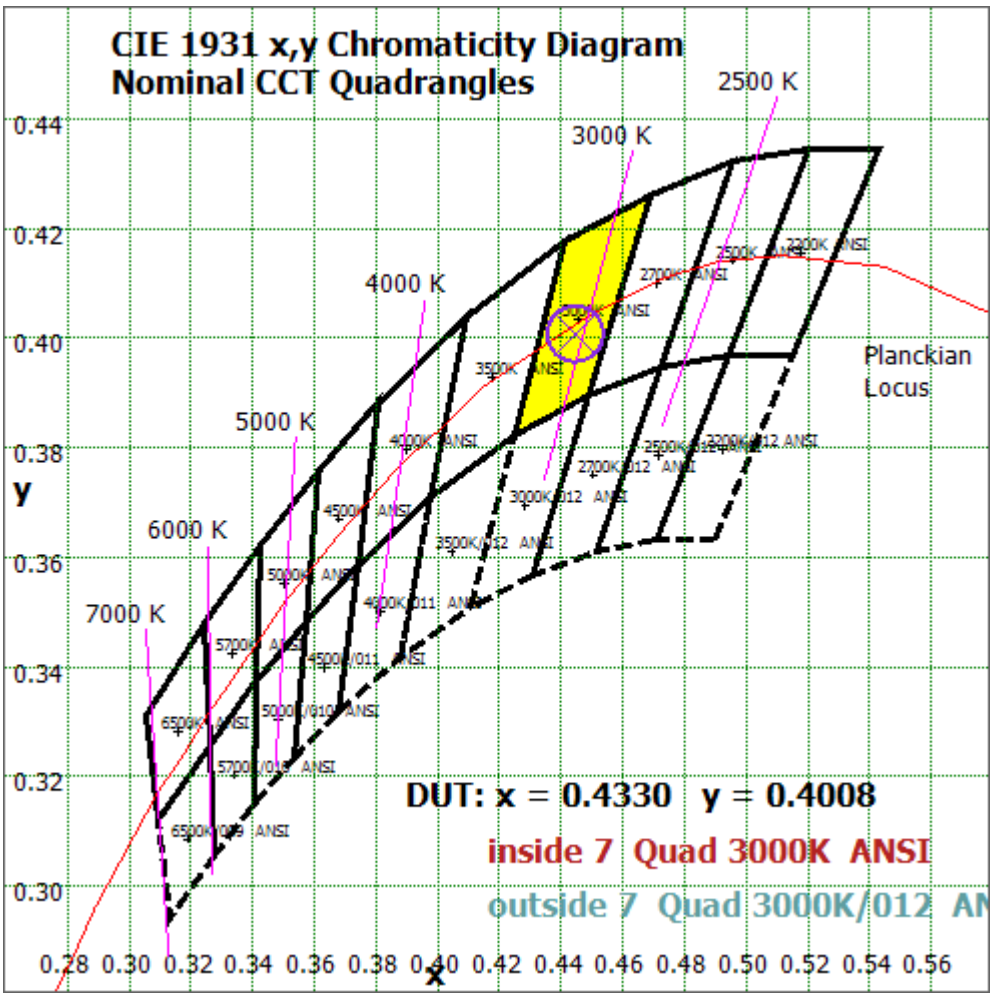


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

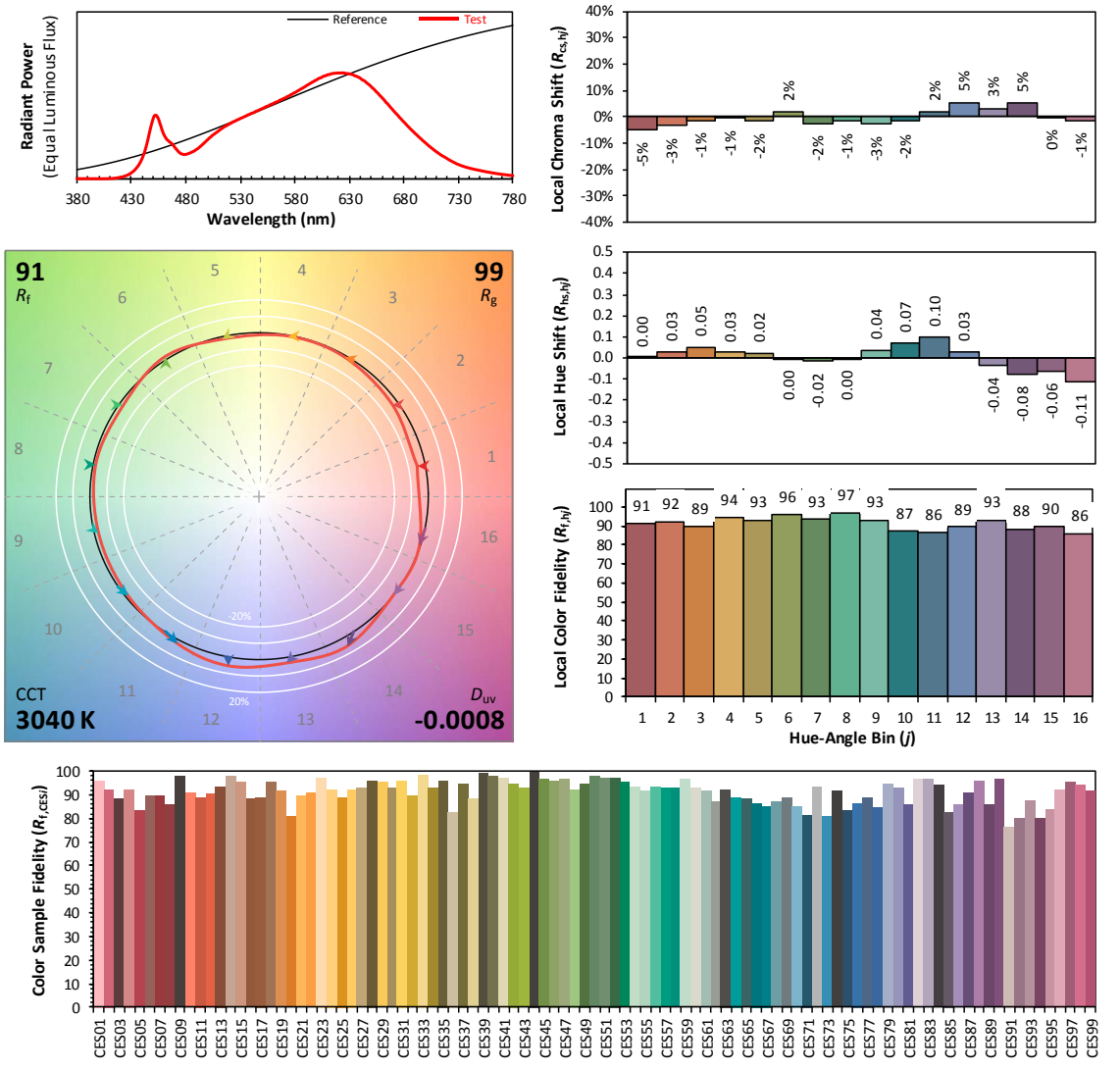
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: GREEN CREATIVE LTD

Date: 2020/09/07

Model: 3N1/12/90/CCTS/DIM120V



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

x	0.4330
y	0.4008
u'	0.2494
v'	0.5195

CIE 13.3-1995 (CRI)

R_a	93
R_9	62

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	61.341	3.25%
10- 20	175.682	9.32%
20- 30	266.433	14.14%
30- 40	321.864	17.08%
40- 50	335.076	17.78%
50- 60	304.638	16.16%
60- 70	235.46	12.49%
70- 80	140.624	7.46%
80- 90	42.091	2.23%
90-100	0.339	0.02%
100-110	0.139	0.01%
110-120	0.184	0.01%
120-130	0.206	0.01%
130-140	0.226	0.01%
140-150	0.218	0.01%
150-160	0.174	0.01%
160-170	0.113	0.01%
170-180	0.04	0.00%
Total	1884.8	100%

γ(°)	Lumens	% Total
0- 60	1465.034	77.73%
60- 90	418.175	22.19%
0-90	1883.209	99.91%
90- 180	1.639	0.09%
0- 180	1884.8	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

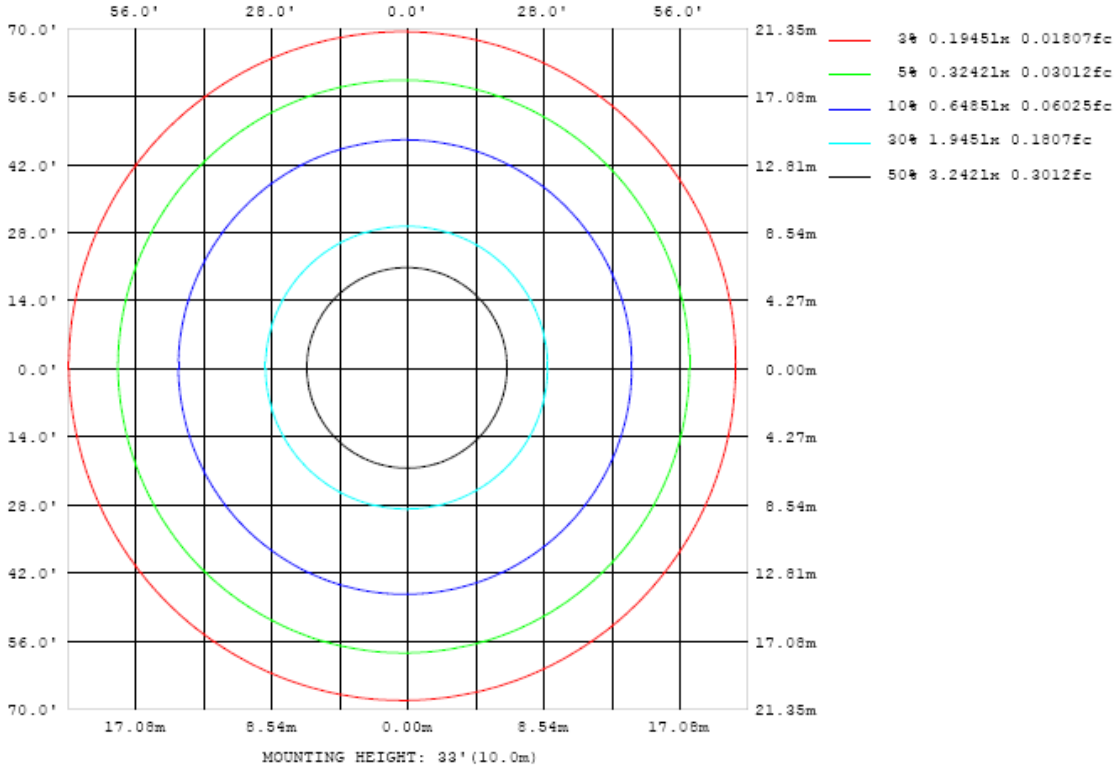


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

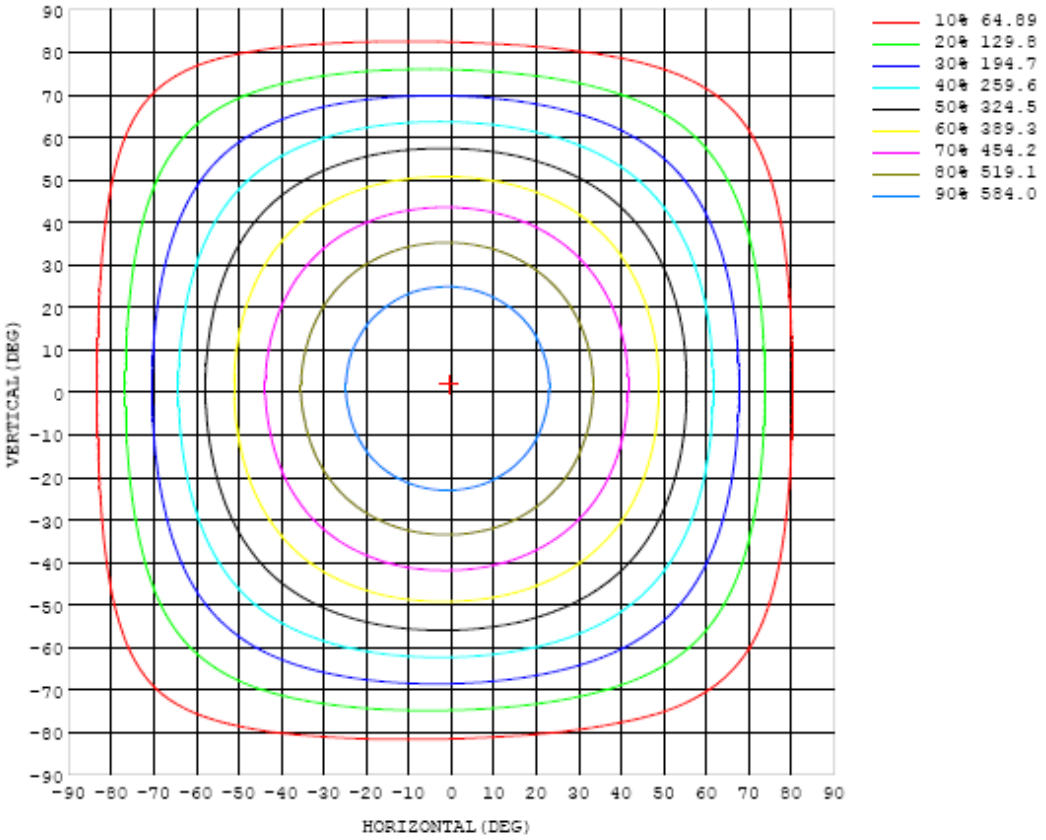


Chart 6: Isocandela Plot

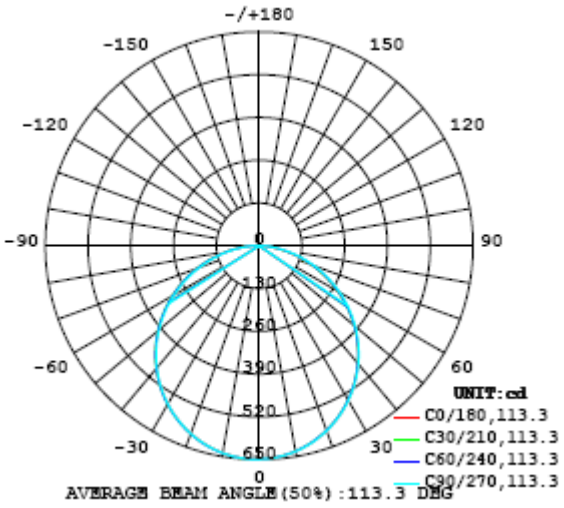


Chart 7: Polar Candela Distribution

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	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648
5	644	644	644	644	644	644	644	645	645	644	645	645	645	645	646	646	647	646	647
10	634	634	634	634	634	634	634	635	634	635	635	636	636	636	637	637	638	638	639
15	619	618	618	618	618	618	618	619	619	620	620	621	621	622	623	624	624	624	626
20	598	598	597	597	597	597	597	598	598	599	600	600	601	602	603	604	605	605	607
25	573	572	571	571	571	571	571	572	572	573	574	575	576	577	579	580	581	582	583
30	542	541	540	541	540	540	540	542	542	543	544	546	546	548	550	551	552	553	555
35	507	506	505	505	505	505	506	507	507	508	510	511	513	514	516	517	519	520	522
40	467	466	466	466	465	466	466	467	468	470	471	473	475	477	479	480	481	483	485
45	424	423	422	423	422	423	423	425	426	427	429	431	433	435	437	439	441	442	445
50	378	377	376	376	376	376	377	379	380	382	384	386	388	390	392	394	396	398	400
55	328	327	326	326	327	327	329	330	332	334	336	338	341	343	345	347	349	350	353
60	276	276	275	275	276	276	278	280	281	283	285	288	290	293	295	297	299	301	304
65	223	222	222	222	223	224	225	227	229	232	234	236	239	241	244	246	247	249	252
70	169	169	169	169	170	171	173	175	177	179	182	184	186	189	191	193	195	196	200
75	117	116	116	117	118	119	121	123	125	127	130	132	135	137	139	141	143	144	148
80	67.3	67.0	67.2	67.9	69.6	69.7	71.8	74.4	75.9	78.2	80.5	83.0	85.2	87.5	89.4	91.3	92.7	94.0	97.5
85	22.8	22.7	22.7	23.4	24.3	25.7	27.2	29.1	31.1	33.3	35.5	37.8	39.8	42.0	43.8	45.5	46.8	47.9	50.4
90	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.17	0.22	1.64	2.10	3.27	4.18	4.91	6.11	6.07	7.18	8.01	10.2
95	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08
100	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.10
105	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.13
110	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.16
115	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.16
120	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.17
125	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.18
130	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.21
135	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.25
140	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.29
145	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.32
150	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.35
155	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.37
160	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38
165	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.38
170	0.44	0.44	0.44	0.43	0.43	0.44	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.40
175	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.41
180	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43

Table 6: Luminous Intensity Data

Table--2 UNIT: cd

γ (DEG) \ C (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648	648		
5	646	647	648	647	647	647	647	647	647	646	646	646	646	646	645	645	644		
10	639	639	640	640	640	640	640	639	639	639	638	638	637	637	636	635	635		
15	626	626	626	627	627	627	627	627	626	626	624	624	623	622	621	621	620		
20	608	608	608	608	609	608	608	608	607	607	606	604	603	603	602	601	600		
25	584	585	585	585	585	585	585	584	584	582	581	580	579	578	576	575	574		
30	556	556	557	557	557	556	556	556	555	554	552	550	549	548	546	545	544		
35	523	524	524	524	524	524	523	522	521	519	518	517	515	513	512	510	509		
40	486	487	487	487	487	486	486	484	483	482	481	478	476	475	473	471	470		
45	446	446	447	447	446	445	445	443	441	440	438	436	434	432	430	428	427		
50	401	402	403	402	401	401	400	398	396	395	393	391	388	386	384	382	381		
55	354	355	355	355	354	353	352	350	348	346	344	342	339	337	335	333	331		
60	305	305	305	305	304	303	302	300	298	296	293	290	288	286	283	281	280		
65	253	254	254	253	252	251	250	248	245	243	240	237	235	232	230	228	226		
70	201	201	201	200	200	198	197	194	192	190	187	184	181	179	176	174	173		
75	149	149	149	149	148	146	145	142	140	137	134	131	128	126	124	122	120		
80	98.1	98.5	98.2	97.5	96.6	95.0	93.1	90.9	88.5	85.8	83.2	80.3	77.7	75.1	73.1	71.4	70.0		
85	50.9	51.0	50.7	49.9	48.8	47.3	45.5	43.3	41.0	38.5	36.2	33.6	31.4	29.2	27.5	26.1	25.3		
90	10.3	10.2	9.33	8.59	7.54	6.26	4.73	3.15	1.61	0.44	0.08	0.07	0.07	0.07	0.07	0.07	0.07		
95	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		
100	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12		
105	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15		
110	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17		
115	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.19	0.18	0.18		
120	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19		
125	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20	0.20		
130	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22		
135	0.25	0.25	0.25	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26		
140	0.29	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29		
145	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.33		
150	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36		
155	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37		
160	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38		
165	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38		
170	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.40		
175	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41		
180	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43		

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, 2020	Aug. 04, 2021
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2020	Aug. 04, 2021
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2020	Aug. 04, 2021
Standard source	D908	HZTE012-01	Aug. 05, 2020	Aug. 04, 2021
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

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.

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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 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 expended uncertainty is 2.3% with a coverage factor k=2.

Color Characteristics Measurements

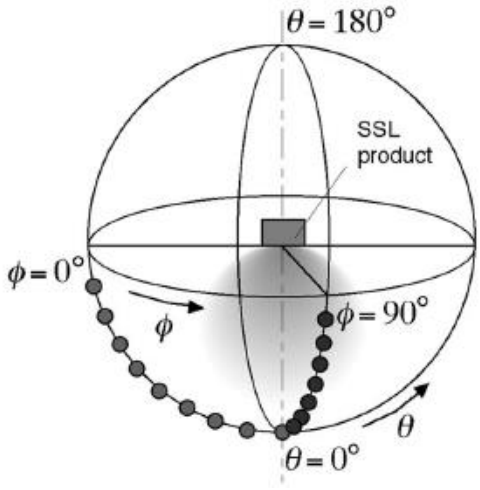
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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

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°/180° and C=90°/270°) 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, Δu'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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