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: 11.5T8/4F/8CCTS/EXT/A4

Laboratory: Lea ding Testing Laboratories

NVLAP CODE: 200960-0

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

Tel: +86571 86376106

www.ltlqa.com

Report No.: HZ23060027o

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

Review by: Wei Fei

Engineer: Wei Fei

Jul. 07, 2023

Approved by: April Zou

Manager: April Zou

Jul. 07, 2023

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

TEST SUMMARY

Tested Model	11.5T8/4F/8CCTS/EXT/A4 3000K Setting	11.5T8/4F/8CCTS/EXT/A4 3500K Setting	11.5T8/4F/8CCTS/EXT/A4 4000K Setting
Luminous Efficacy (Lumens /Watt)	137.9	142.0	145.9
Total Luminous Flux (Lumens)	1795.8	1829.3	1853.2
Power (Watts)/4	13.02	12.88	12.70
Power Factor	0.9956	0.9956	0.9956
CCT (K)	3015	3480	3959
CRI	82.5	84.6	85.6
Stabilization Time (Light & Power)	50 mins	50 mins	50 mins
Note	3000K	3500K	4000K

Tested Model	11.5T8/4F/8CCTS/EXT/A4 5000K Setting	11.5T8/4F/8CCTS/EXT/A4 6500K Setting
Luminous Efficacy (Lumens /Watt)	145.9	142.6
Total Luminous Flux (Lumens)	1857.2	1841.2
Power (Watts)/4	12.73	12.91
Power Factor	0.9956	0.9957
CCT (K)	5068	6520
CRI	86.0	84.3
Stabilization Time (Light & Power)	50 mins	50 mins
Note	5000K	6500K

Table 1: Executive Data Summary

Test specifications:

Date of Receipt : Jun. 27, 2023

Date of Test : Jun. 28, 2023

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

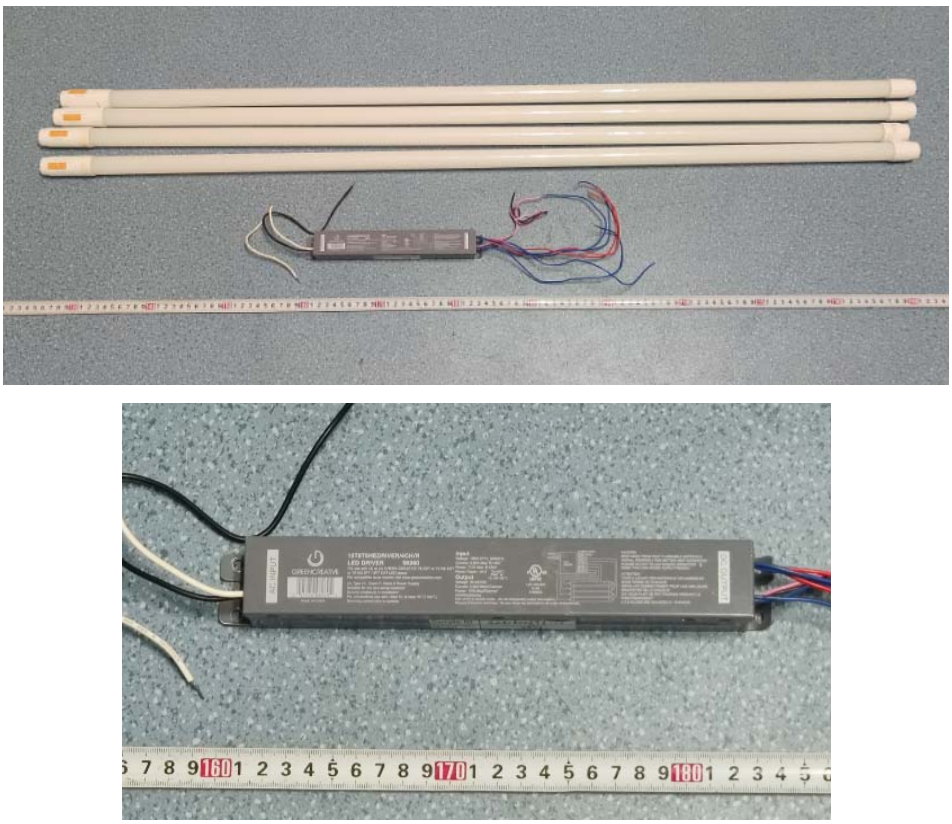


Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 11.5T8/4F/8CCTS/EXT/A4
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: Color- Tunable 3000K/3500K/4000K/5000K/6500K LED Tube supplied by a LED driver: 15T8T5HEDRIVER/ 4CH/R
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 (3000K Setting)

Test ambient temperature was 26.0°C.

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)	0.436	0.199
Power Factor	0.9956	0.9349
Test Power (W)/4	13.02	12.89
THD A%	5.69	6.97
Luminous Efficacy (lm/W)	137.9	139.3
Total Luminous Flux (lm)	1795.8	1795.9
Color Rendering Index (CRI)	82.5	
R9	6.8	
Correlated Color Temperature (CCT)(K)	3015	
Chromaticity Chroma x	0.4345	
Chromaticity Chroma y	0.4010	
Chromaticity Chroma u	0.2503	
Chromaticity Chroma v	0.3465	
Duv	-0.0009	
Chromaticity Chroma u ’	0.2503	
Chromaticity Chroma v’	0.5198	

Special Color Rendering Indices	
R1	81.8
R2	93.7
R3	92.7
R4	79
R5	82.3
R6	92.5
R7	80.4
R8	57.3
R9	6.8
R10	85.8
R11	78.5
R12	73.2
R13	85.1
R14	96.7

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).

Spectral Power Distribution - Sphere Spectroradiometer Method

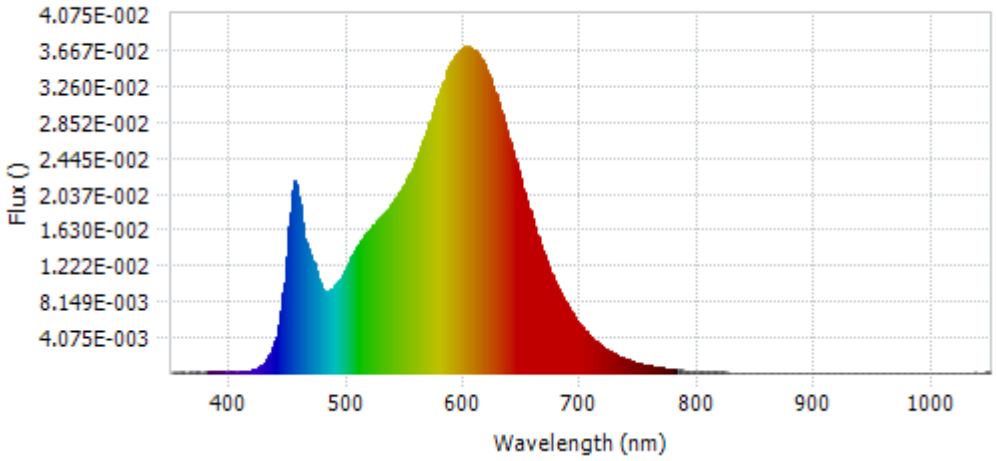
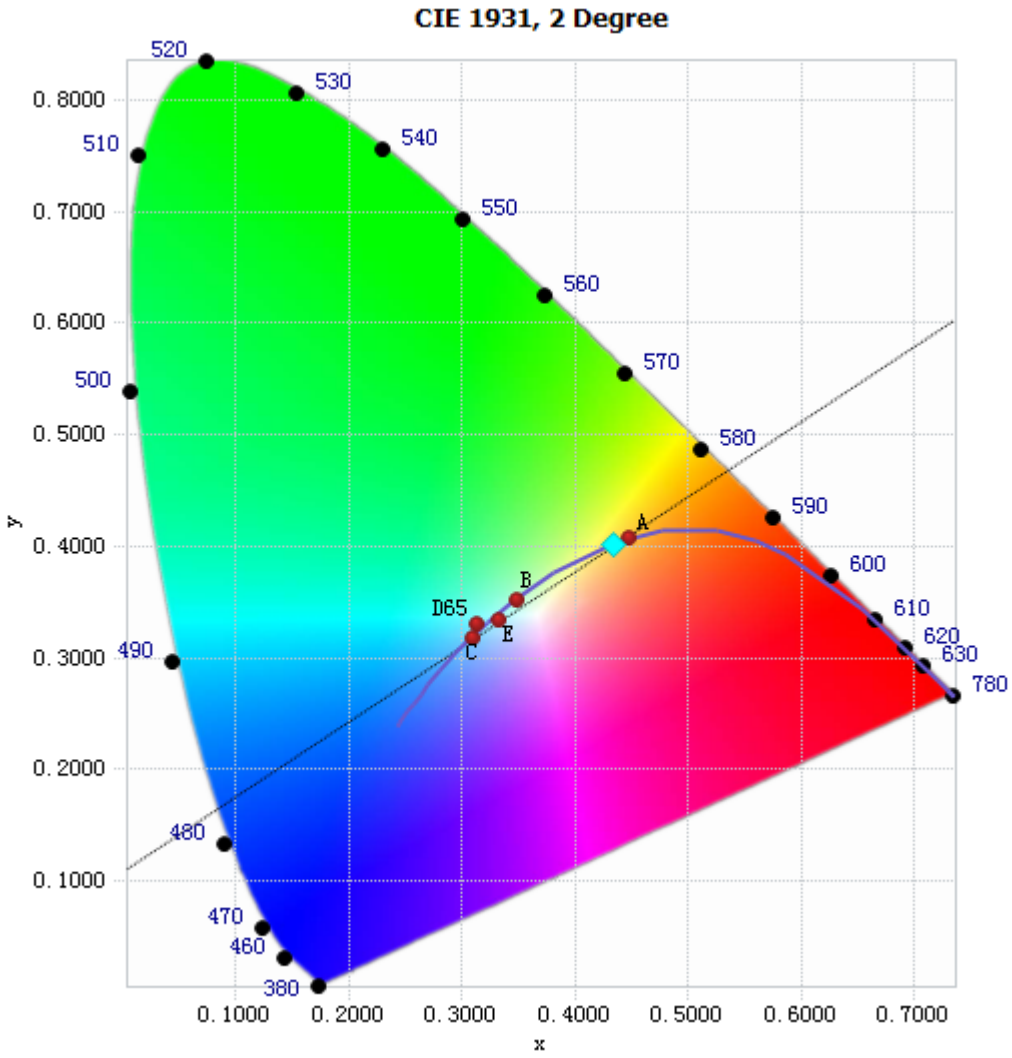


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.22E-04	485	9.40E-03	590	3.56E-02	695	6.21E-03
385	1.08E-04	490	1.01E-02	595	3.65E-02	700	5.34E-03
390	1.11E-04	495	1.10E-02	600	3.70E-02	705	4.52E-03
395	1.22E-04	500	1.23E-02	605	3.69E-02	710	3.88E-03
400	9.75E-05	505	1.35E-02	610	3.64E-02	715	3.32E-03
405	1.07E-04	510	1.47E-02	615	3.54E-02	720	2.84E-03
410	1.52E-04	515	1.57E-02	620	3.40E-02	725	2.42E-03
415	2.59E-04	520	1.63E-02	625	3.23E-02	730	2.06E-03
420	4.42E-04	525	1.72E-02	630	3.03E-02	735	1.74E-03
425	7.77E-04	530	1.80E-02	635	2.81E-02	740	1.48E-03
430	1.37E-03	535	1.87E-02	640	2.58E-02	745	1.28E-03
435	2.57E-03	540	1.96E-02	645	2.34E-02	750	1.09E-03
440	4.76E-03	545	2.06E-02	650	2.10E-02	755	9.24E-04
445	9.01E-03	550	2.17E-02	655	1.88E-02	760	8.01E-04
450	1.66E-02	555	2.30E-02	660	1.66E-02	765	6.77E-04
455	2.18E-02	560	2.47E-02	665	1.46E-02	770	5.84E-04
460	1.81E-02	565	2.64E-02	670	1.28E-02	775	4.96E-04
465	1.43E-02	570	2.83E-02	675	1.12E-02	780	4.32E-04
470	1.28E-02	575	3.04E-02	680	9.67E-03		
475	1.06E-02	580	3.23E-02	685	8.39E-03		
480	9.23E-03	585	3.43E-02	690	7.25E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4345, 0.4010)

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

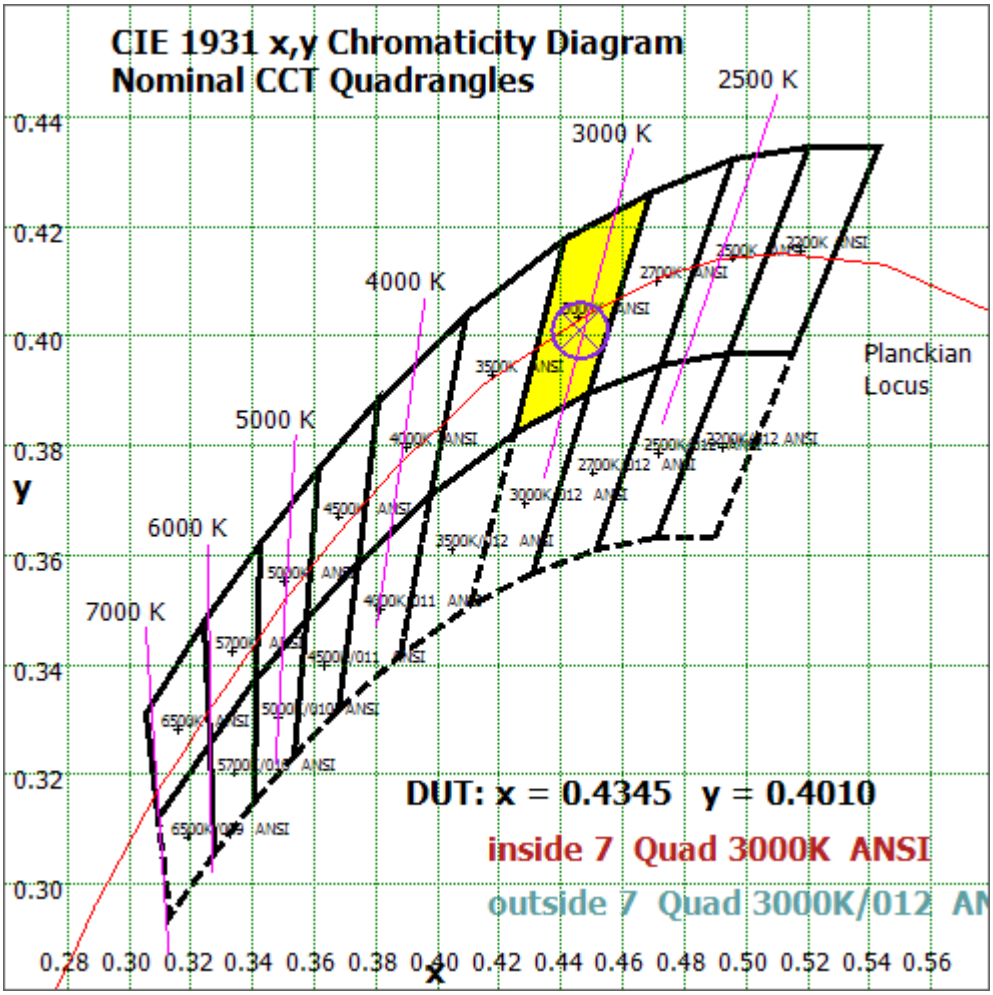


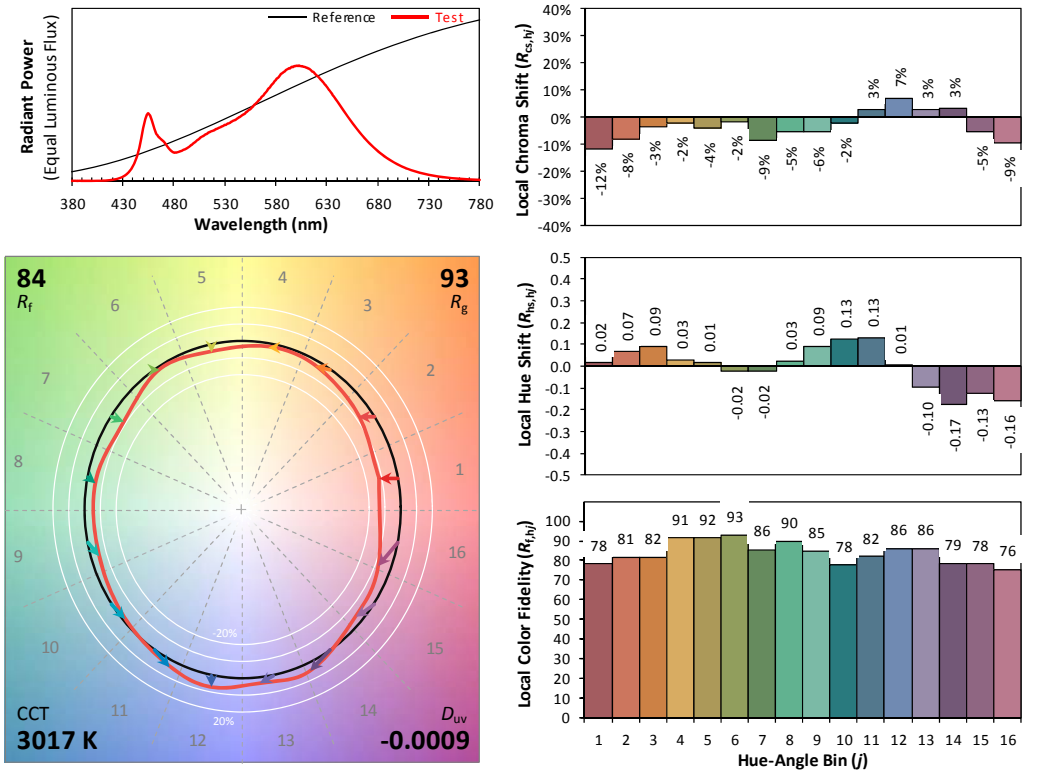
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2023/06/28 **Model:** 11.5T8/4F/8CCTS/EXT/A4



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

x	0.4345
y	0.4010
u'	0.2503
v'	0.5198

CIE 13.3-1995 (CRI)

R_a	83
R_9	7

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.

Goniophotometer Method

Test ambient temperature was 25.1°C.

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)	0.438
Power Factor	0.9923
Power (W)/4	13.05
Luminous Efficacy (lm/W)	138.5
Total Luminous Flux (lm)	1807.7
Beam Angle (°)	115.8 (0^o-180^o) / 247.0 (90^o-270^o)
Center Beam Candle Power (cd)	280
Maximum Beam Candle Power (cd)	280.5 (At: C=90.0, Gamma=4.0)
Spacing Criteria	1.29 (0^o-180^o) / 1.47 (90^o-270^o)
Zonal Lumens in the 0°-60°Zone	41.10%
Zonal Lumens in the 60°-90°Zone	27.17%
Zonal Lumens in the 90°-120°Zone	18.87%
Zonal Lumens in the 120°-180°Zone	12.86%

Table 4: Test data per Goniophotometer Method

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	26.623	1.47%
10- 20	77.561	4.29%
20- 30	121.747	6.74%
30- 40	155.587	8.61%
40- 50	176.811	9.78%
50- 60	184.591	10.21%
60- 70	179.729	9.94%
70- 80	165.119	9.13%
80- 90	146.225	8.09%
90-100	129.385	7.16%
100-110	113.966	6.30%
110-120	97.771	5.41%
120-130	80.983	4.48%
130-140	63.852	3.53%
140-150	45.587	2.52%
150-160	27.277	1.51%
160-170	11.813	0.65%
170-180	3.031	0.17%
Total	1807.7	100%

γ(°)	Lumens	% Total
0- 60	742.92	41.10%
60- 90	491.073	27.17%
0-90	1233.99	68.26%
90- 180	573.665	31.74%
0- 180	1807.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

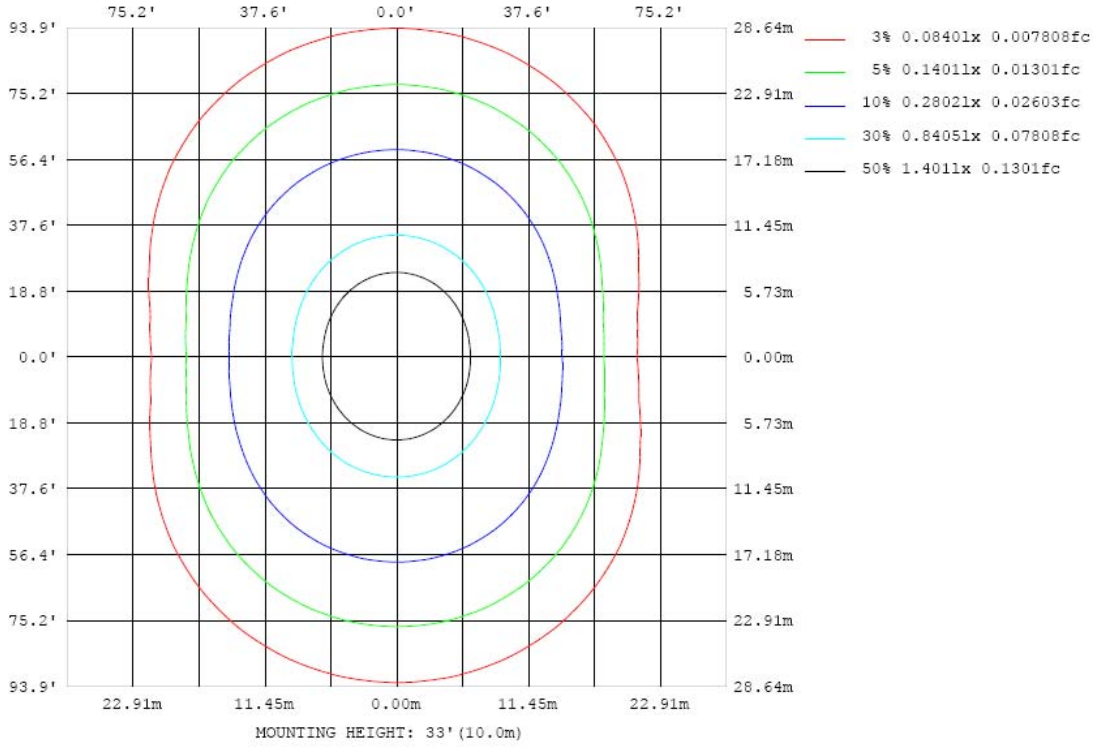


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

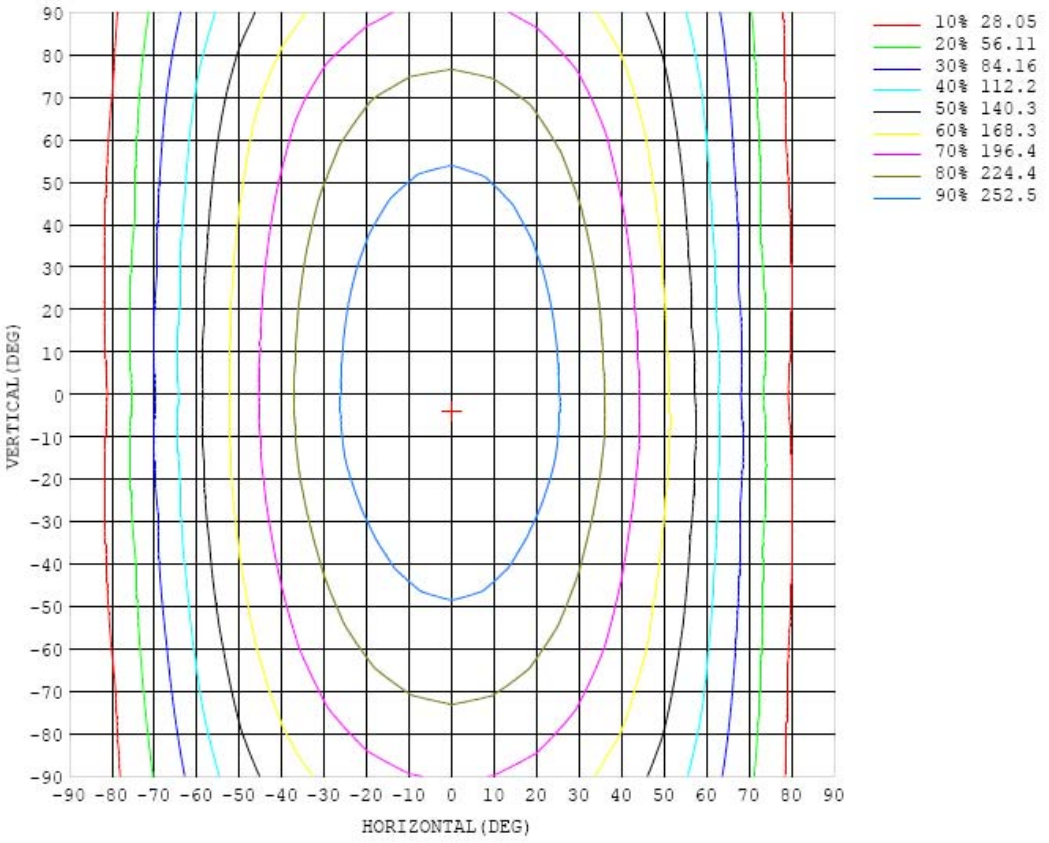


Chart 6: Isocandela Plot

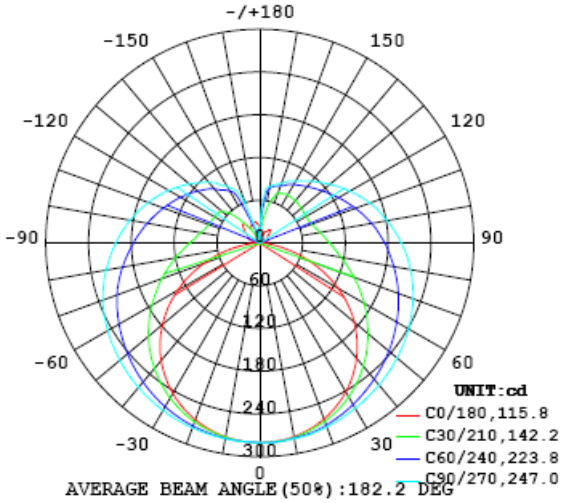


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

C(DEG) / γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
5	279	279	279	280	280	280	280	280	280	280	280	280	280	280	280	280	280	279	279
10	276	276	277	277	277	278	278	278	279	279	279	278	278	278	278	277	277	276	276
15	270	271	272	272	273	275	276	277	277	278	277	277	276	275	274	273	272	272	271
20	263	264	265	266	269	271	272	273	274	274	274	274	272	271	269	267	266	265	264
25	253	254	256	259	262	265	267	269	271	271	271	269	267	265	263	260	257	256	255
30	241	243	245	249	253	258	262	265	267	268	267	265	262	258	255	251	247	245	244
35	227	229	233	238	244	250	256	260	263	264	263	260	256	251	245	240	235	232	230
40	211	214	219	226	234	242	249	255	259	260	259	255	250	243	235	228	221	217	215
45	193	196	203	212	223	234	243	250	254	256	254	250	243	235	225	215	206	200	198
50	173	177	185	198	212	225	236	244	249	251	249	245	237	226	213	201	189	181	178
55	151	156	168	183	200	216	229	238	244	246	244	239	229	217	202	186	172	161	157
60	126	133	149	169	189	207	222	232	239	241	239	232	222	208	190	172	153	139	133
65	101	109	129	154	178	198	214	226	233	235	233	226	214	198	179	157	134	116	109
70	74.0	85.2	111	140	168	189	207	219	226	229	226	219	206	189	167	142	114	92.1	82.7
75	47.9	62.3	93.7	127	157	180	199	212	219	222	219	211	198	180	157	128	96.0	69.2	57.7
80	24.5	42.7	79.2	116	148	173	191	204	212	215	212	204	190	171	146	115	79.8	47.7	32.9
85	7.97	28.9	68.2	106	138	164	183	196	204	207	204	195	182	163	137	104	66.6	30.7	13.1
90	2.56	22.2	60.7	97.9	130	156	175	188	196	198	196	187	174	154	128	94.9	57.3	21.0	3.27
95	2.33	19.1	55.9	91.4	123	148	167	180	188	190	187	179	166	146	120	87.6	51.6	18.3	2.10
100	6.18	19.3	52.0	86.0	116	140	159	172	179	181	178	171	158	138	112	82.0	48.7	19.5	5.28
105	10.7	21.8	50.2	81.3	109	133	151	164	171	173	171	163	149	130	106	77.9	48.1	23.2	10.2
110	12.7	25.8	50.9	77.6	104	126	143	155	162	164	161	154	141	123	101	75.2	49.3	28.5	16.1
115	13.5	30.4	53.3	75.6	98.7	119	135	146	153	155	152	145	133	116	96.2	73.6	51.8	34.2	16.9
120	11.9	34.2	56.8	75.0	94.8	113	127	138	144	146	143	136	125	110	92.5	73.0	55.1	40.6	18.8
125	12.0	38.2	60.5	75.2	92.0	107	120	130	135	137	134	128	118	105	89.7	73.2	58.8	47.2	23.1
130	13.8	43.6	63.4	76.0	90.0	103	114	122	127	128	126	121	112	101	87.6	74.0	62.6	53.9	28.5
135	18.9	48.9	64.6	76.9	88.6	99.4	108	115	119	120	118	114	106	96.9	86.1	75.1	65.1	58.3	33.7
140	23.0	52.7	68.0	77.8	87.5	96.1	103	109	112	113	111	107	101	93.7	85.0	75.0	67.2	60.2	35.2
145	22.9	49.0	67.8	77.6	86.4	93.3	98.8	103	106	106	105	102	97.1	91.1	84.0	75.9	70.9	58.8	27.8
150	18.7	48.4	73.1	77.9	83.8	90.4	95.1	98.1	100	101	99.5	97.1	93.5	88.7	81.6	76.2	73.2	61.3	23.9
155	17.2	43.6	66.8	76.5	82.4	86.0	90.5	93.8	95.3	95.6	94.9	92.7	89.0	84.1	80.7	77.5	73.6	61.7	28.3
160	12.4	32.8	60.0	75.1	81.2	83.6	85.7	87.3	88.3	88.5	87.9	86.5	84.8	82.9	80.5	77.6	74.6	56.9	27.1
165	10.6	20.9	42.2	62.5	75.0	81.3	83.0	84.2	84.7	84.7	84.4	83.8	82.7	80.7	78.8	77.5	71.6	54.0	30.2
170	13.3	17.2	26.3	40.9	57.3	70.3	77.5	80.0	80.5	80.6	80.5	80.1	79.4	78.7	77.5	71.3	61.6	45.4	29.0
175	13.1	14.4	17.3	21.3	28.1	38.5	48.7	56.4	61.6	64.8	66.1	65.7	64.4	62.2	57.4	49.6	40.9	32.9	26.6
180	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1

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	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
5	279	279	279	279	279	280	280	280	280	280	280	279	279	279	279	279	279
10	276	276	277	277	278	278	279	279	279	279	279	278	278	277	276	276	276
15	271	272	273	274	275	276	277	278	278	278	277	276	275	273	272	271	270
20	264	265	267	269	271	273	275	276	276	276	275	273	271	268	266	264	263
25	255	257	260	263	267	270	272	274	274	273	272	269	266	262	258	255	254
30	244	247	251	256	261	265	269	271	271	270	268	264	260	254	249	245	242
35	231	235	241	248	254	260	265	267	268	267	264	259	253	246	238	232	228
40	217	222	230	239	247	255	260	264	265	263	259	253	245	236	226	218	212
45	200	207	217	229	239	248	255	259	261	259	254	246	237	225	213	202	194
50	181	191	204	218	231	242	250	255	256	254	249	240	228	214	199	185	175
55	161	173	190	207	222	235	244	250	251	249	243	232	219	202	184	166	153
60	139	155	175	195	213	228	238	244	246	244	237	225	210	190	168	147	130
65	116	136	160	184	204	221	232	239	241	238	230	218	200	178	153	127	107
70	92.9	117	146	173	195	213	225	232	234	231	223	210	191	167	139	108	82.7
75	70.4	99.8	133	162	186	205	217	225	227	224	216	202	182	157	125	90.8	60.6
80	49.7	84.9	120	151	176	195	209	217	219	216	208	193	173	147	114	76.2	40.8
85	33.2	72.2	108	140	166	186	200	208	210	208	199	185	164	138	104	65.0	26.9
90	23.0	61.4	98.2	131	157	177	191	200	202	199	191	177	156	129	96.2	58.2	20.6
95	17.0	53.9	90.4	122	149	169	183	191	194	191	182	168	148	121	89.5	53.7	19.2
100	15.5	49.0	84.2	115	141	160	174	182	185	182	174	160	140	114	84.2	51.0	20.7
105	16.3	47.4	79.2	108	133	152	165	173	176	173	165	151	132	108	80.1	50.0	23.3
110	17.2	46.5	76.6	103	126	144	156	164	166	164	156	143	125	103	77.2	49.5	22.3
115	10.2	44.9	74.9	98.2	119	136	148	155	157	155	147	135	118	97.7	75.1	50.1	22.0
120	5.21	43.6	73.3	94.1	113	128	139	146	148	145	138	127	112	93.4	73.3	48.7	19.0
125	6.49	42.0	72.1	90.2	107	121	131	137	138	136	130	120	106	89.1	70.7	48.1	14.8
130	5.19	36.9	68.8	86.4	102	113	122	127	129	127	121	112	100	85.2	69.3	47.9	11.1
135	3.88	25.2	58.6	83.5	95.8	107	114	119	120	118	113	106	94.5	79.7	66.0	41.4	6.86
140	7.15	12.1	40.9	79.5	89.0	99.3	106	110	111	110	106	97.7	86.9	76.0	58.8	28.3	4.00
145	9.05	8.97	28.6	68.5	84.4	90.8	96.0	99.2	101	98.8	94.9	89.5	80.4	69.5	47.8	13.2	4.33
150	8.91	8.59	14.7	34.3	75.2	83.9	88.2	90.4	91.4	90.2	87.8	82.1	70.1	50.8	23.8	5.17	5.90
155	10.1	10.8	10.2	17.8	31.8	62.8	79.2	80.9	82.3	81.7	77.0	65.0	45.8	25.3	9.41	4.06	6.27
160	10.2	10.4	11.3	11.4	14.2	21.9	28.4	39.6	46.8	44.6	36.6	27.6	15.9	9.58	7.10	6.55	10.5
165	15.5	8.96	8.91	9.22	13.2	13.2	11.9	14.6	15.5	10.9	10.5	13.9	12.8	6.16	5.82	7.05	8.07
170	19.9	13.4	10.3	11.0	7.57	6.84	10.3	11.0	5.30	11.2	12.9	9.93	6.43	9.82	10.4	8.82	10.4
175	21.4	18.3	15.7	13.2	10.6	9.01	9.35	5.87	4.12	8.03	8.29	7.94	7.97	10.1	13.4	14.3	13.2
180	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1

Table 7: Luminous Intensity Data

TEST RESULTS (3500K Setting)

Test ambient temperature was 26.0°C.

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)	0.432	0.197
Power Factor	0.9956	0.9338
Test Power (W)/4	12.88	12.75
THD A%	5.51	7.26
Luminous Efficacy (lm/W)	142.0	143.6
Total Luminous Flux (lm)	1829.3	1830.8
Color Rendering Index (CRI)	84.6	
R9	17.1	
Correlated Color Temperature (CCT)(K)	3480	
Chromaticity Chroma x	0.4026	
Chromaticity Chroma y	0.3815	
Chromaticity Chroma u	0.2378	
Chromaticity Chroma v	0.3380	
Duv	-0.0035	
Chromaticity Chroma u ’	0.2378	
Chromaticity Chroma v’	0.5070	

Special Color Rendering Indices	
R1	85.4
R2	96.4
R3	91.8
R4	80.8
R5	85.5
R6	93
R7	81.3
R8	62.5
R9	17.1
R10	90.9
R11	80.7
R12	71.1
R13	89
R14	96.3

Table 8: 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).

Spectral Power Distribution - Sphere Spectroradiometer Method

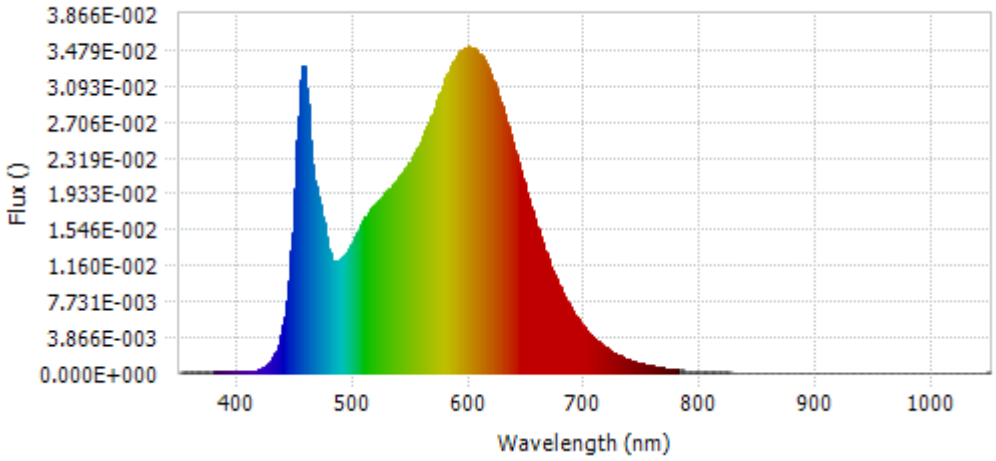
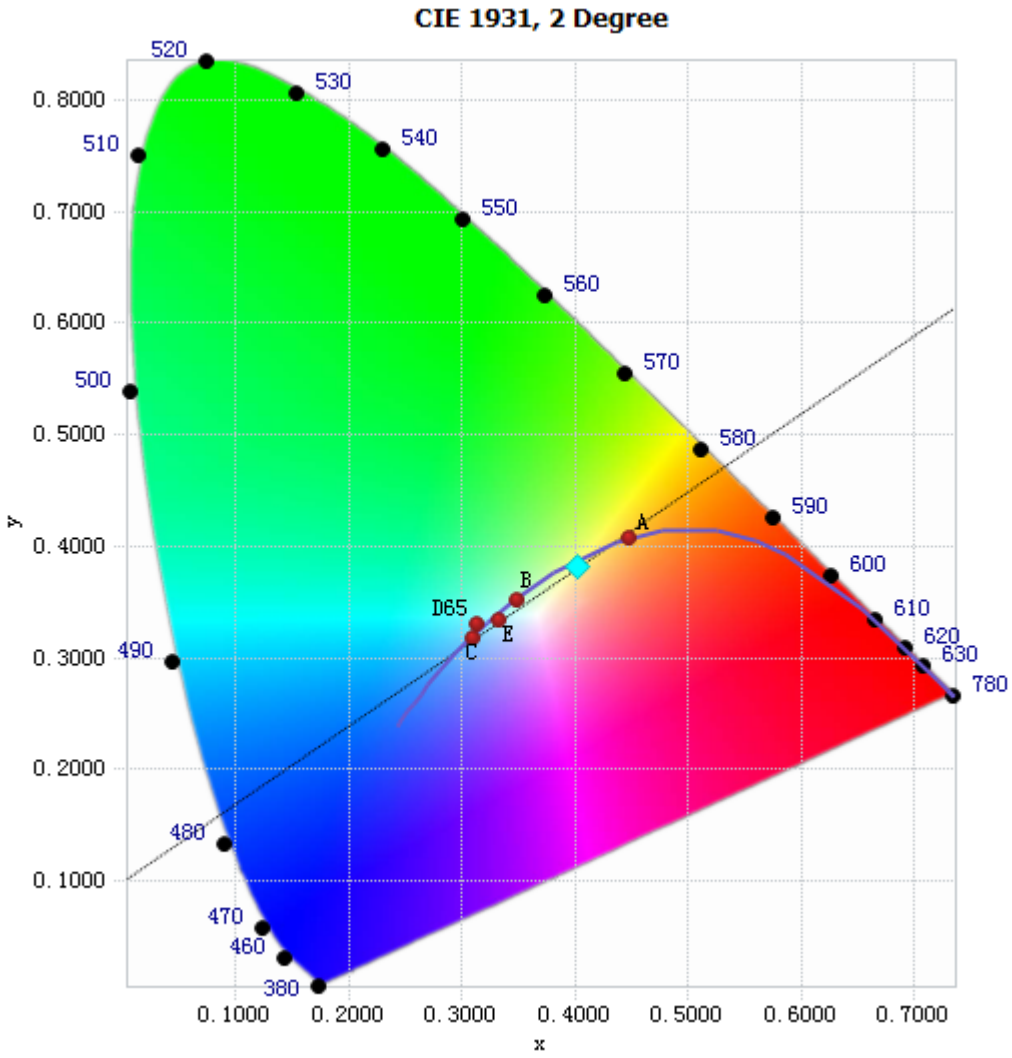


Chart 8: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.55E-04	485	1.21E-02	590	3.43E-02	695	5.59E-03
385	1.50E-04	490	1.25E-02	595	3.49E-02	700	4.77E-03
390	1.74E-04	495	1.32E-02	600	3.51E-02	705	4.09E-03
395	1.70E-04	500	1.43E-02	605	3.48E-02	710	3.48E-03
400	1.54E-04	505	1.56E-02	610	3.40E-02	715	2.99E-03
405	1.54E-04	510	1.67E-02	615	3.30E-02	720	2.53E-03
410	1.94E-04	515	1.77E-02	620	3.15E-02	725	2.18E-03
415	2.79E-04	520	1.83E-02	625	2.98E-02	730	1.85E-03
420	4.81E-04	525	1.91E-02	630	2.79E-02	735	1.57E-03
425	8.99E-04	530	1.98E-02	635	2.58E-02	740	1.33E-03
430	1.65E-03	535	2.04E-02	640	2.36E-02	745	1.13E-03
435	3.09E-03	540	2.12E-02	645	2.13E-02	750	9.72E-04
440	5.97E-03	545	2.21E-02	650	1.91E-02	755	8.33E-04
445	1.15E-02	550	2.30E-02	655	1.71E-02	760	7.01E-04
450	2.25E-02	555	2.42E-02	660	1.51E-02	765	6.09E-04
455	3.30E-02	560	2.55E-02	665	1.32E-02	770	5.19E-04
460	2.89E-02	565	2.70E-02	670	1.15E-02	775	4.41E-04
465	2.14E-02	570	2.85E-02	675	1.01E-02	780	3.79E-04
470	1.86E-02	575	3.03E-02	680	8.70E-03		
475	1.53E-02	580	3.19E-02	685	7.56E-03		
480	1.25E-02	585	3.34E-02	690	6.52E-03		

Table 9: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4026, 0.3815)

Chart 9: 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

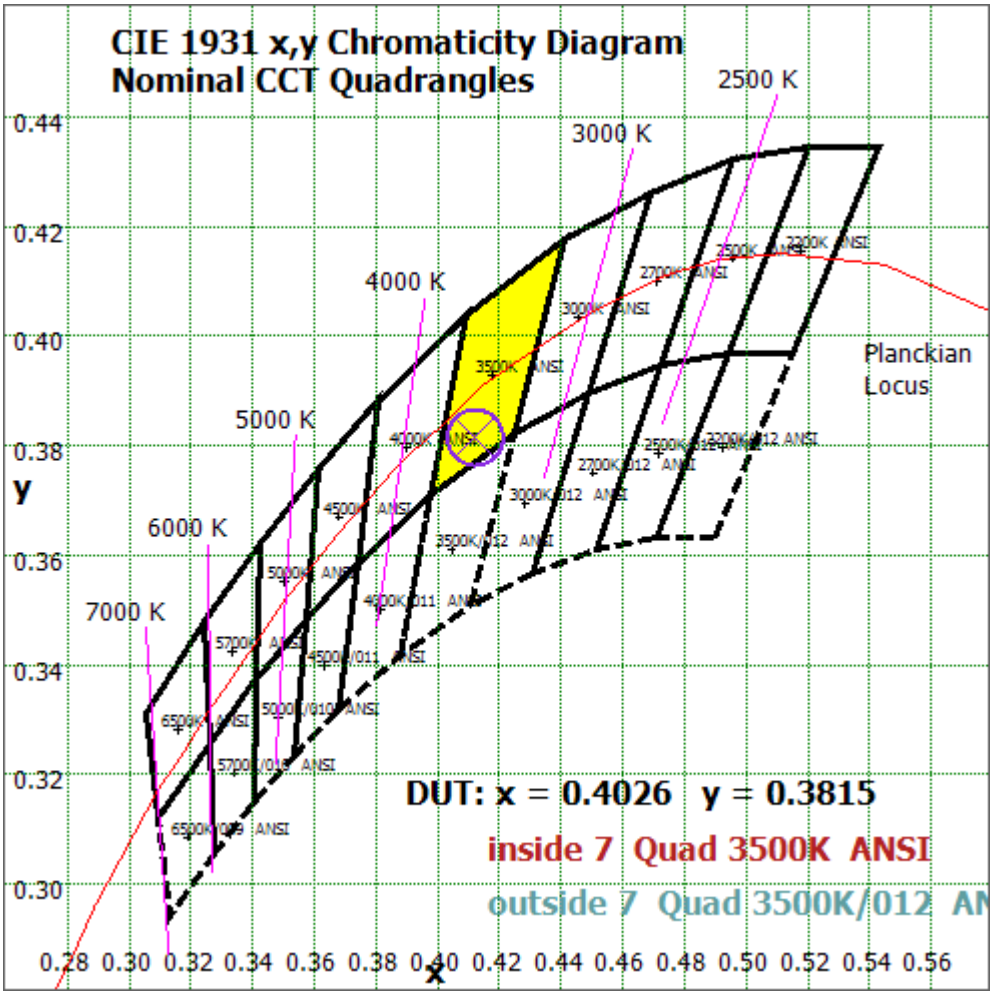


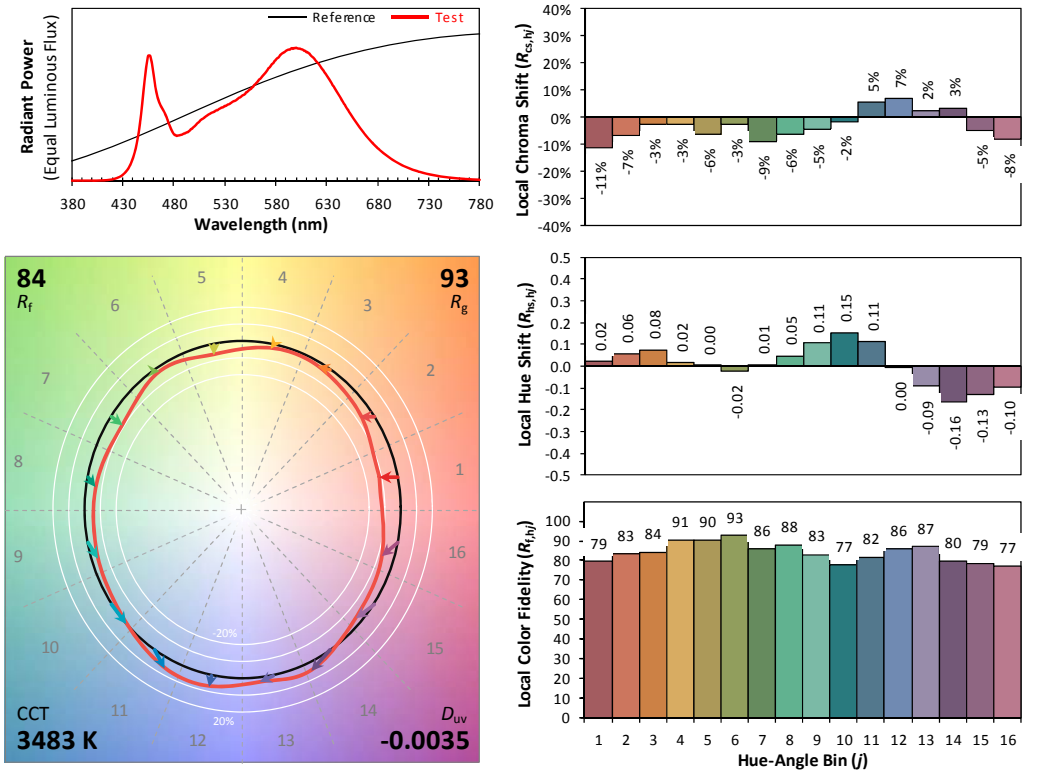
Chart 10: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

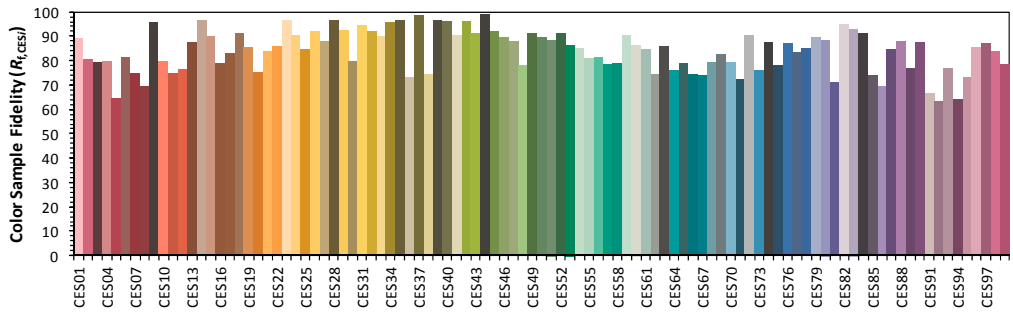
Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2023/06/28 **Model:** 11.5T8/4F/8CCTS/EXT/A4





Notes:			
This is a recommended method for displaying ANSI/IES TM-30-18 information.	x	0.4026	CIE 13.3-1995 (CRI)
	y	0.3815	R_a 85
	u'	0.2378	R_9 17
	v'	0.5070	

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

Chart 11: 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 8 due to rounding.

TEST RESULTS (4000K Setting)

Test ambient temperature was 26.0°C.

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)	0.426	0.195
Power Factor	0.9956	0.9326
Test Power (W)/4	12.71	12.58
THD A%	5.41	7.57
Luminous Efficacy (lm/W)	145.8	147.3
Total Luminous Flux (lm)	1853.2	1853.6
Color Rendering Index (CRI)	85.6	
R9	22.8	
Correlated Color Temperature (CCT)(K)	3959	
Chromaticity Chroma x	0.3793	
Chromaticity Chroma y	0.3675	
Chromaticity Chroma u	0.2281	
Chromaticity Chroma v	0.3315	
Duv	-0.0040	
Chromaticity Chroma u ’	0.2281	
Chromaticity Chroma v’	0.4973	

Special Color Rendering Indices	
R1	87
R2	97.3
R3	92.2
R4	81.5
R5	86.5
R6	92.3
R7	82.4
R8	66
R9	22.8
R10	92.4
R11	81.5
R12	67.5
R13	90.8
R14	96.6

Table 10: 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).

Spectral Power Distribution - Sphere Spectroradiometer Method

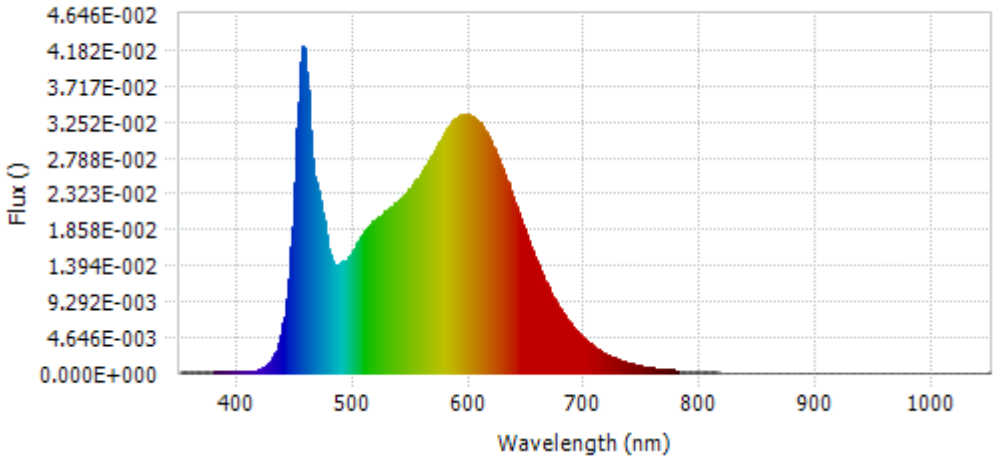
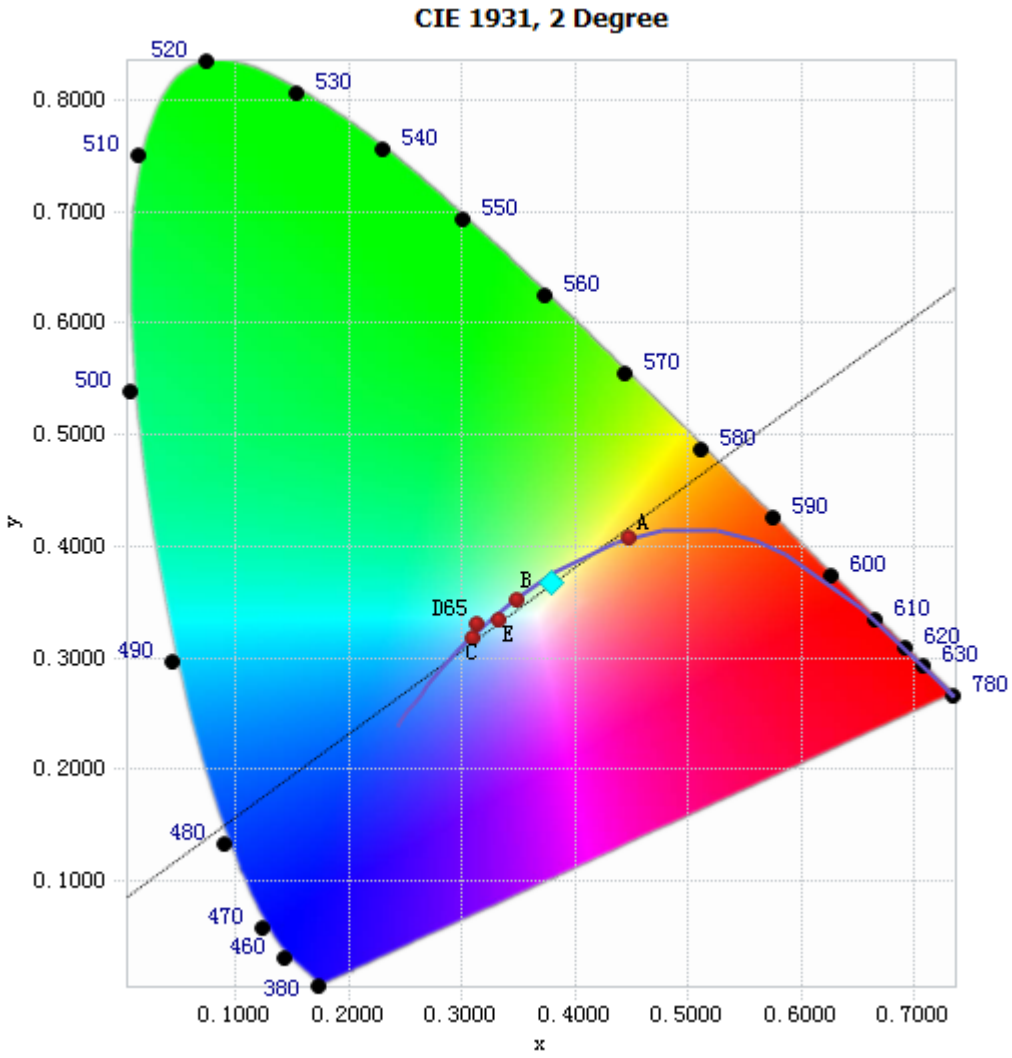


Chart 12: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.05E-04	485	1.41E-02	590	3.32E-02	695	5.05E-03
385	1.65E-04	490	1.44E-02	595	3.35E-02	700	4.30E-03
390	1.79E-04	495	1.49E-02	600	3.35E-02	705	3.66E-03
395	2.03E-04	500	1.61E-02	605	3.29E-02	710	3.14E-03
400	1.65E-04	505	1.73E-02	610	3.20E-02	715	2.68E-03
405	1.69E-04	510	1.84E-02	615	3.09E-02	720	2.29E-03
410	2.26E-04	515	1.93E-02	620	2.94E-02	725	1.95E-03
415	3.16E-04	520	1.99E-02	625	2.77E-02	730	1.65E-03
420	5.65E-04	525	2.06E-02	630	2.57E-02	735	1.40E-03
425	1.06E-03	530	2.13E-02	635	2.37E-02	740	1.20E-03
430	1.96E-03	535	2.18E-02	640	2.16E-02	745	1.03E-03
435	3.80E-03	540	2.25E-02	645	1.95E-02	750	8.72E-04
440	7.36E-03	545	2.33E-02	650	1.75E-02	755	7.45E-04
445	1.42E-02	550	2.41E-02	655	1.56E-02	760	6.33E-04
450	2.81E-02	555	2.51E-02	660	1.37E-02	765	5.44E-04
455	4.21E-02	560	2.62E-02	665	1.20E-02	770	4.77E-04
460	3.66E-02	565	2.75E-02	670	1.05E-02	775	4.04E-04
465	2.65E-02	570	2.88E-02	675	9.13E-03	780	3.51E-04
470	2.29E-02	575	3.01E-02	680	7.89E-03		
475	1.87E-02	580	3.15E-02	685	6.82E-03		
480	1.48E-02	585	3.26E-02	690	5.86E-03		

Table 11: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3793, 0.3675)

Chart 13: 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

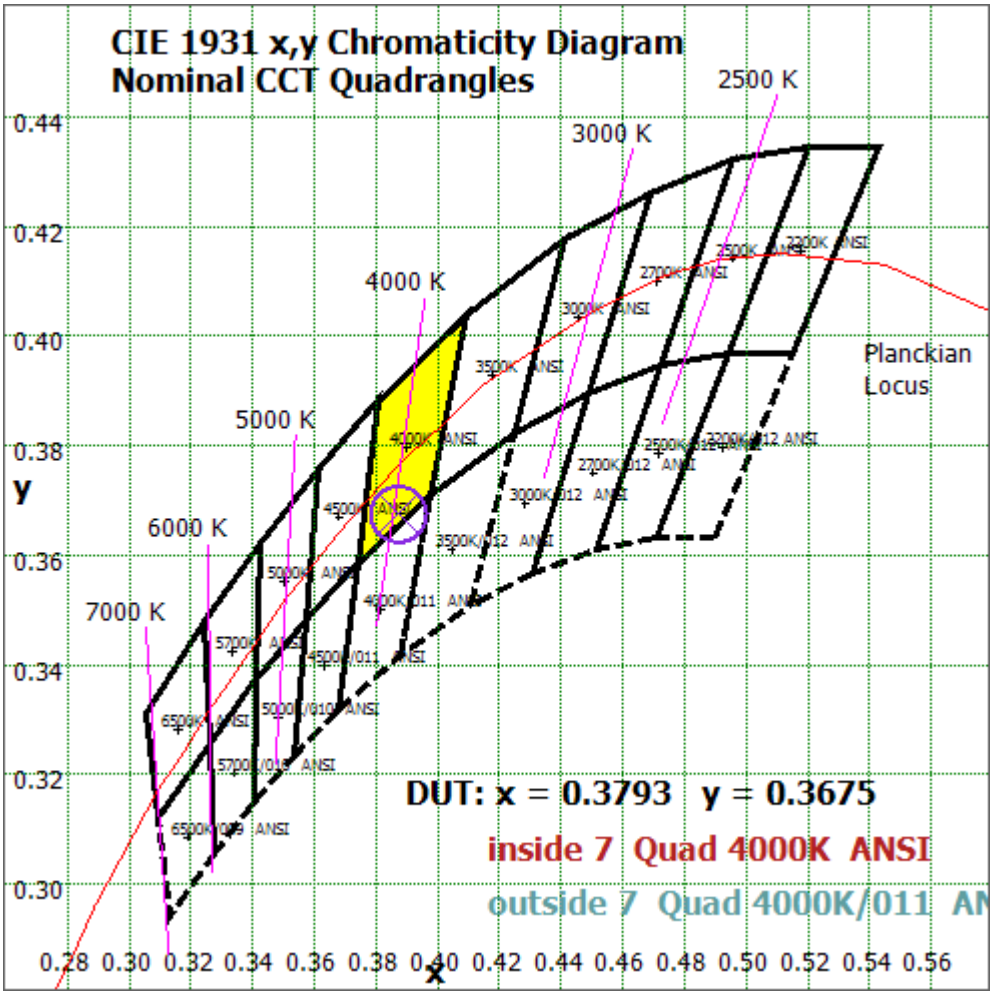


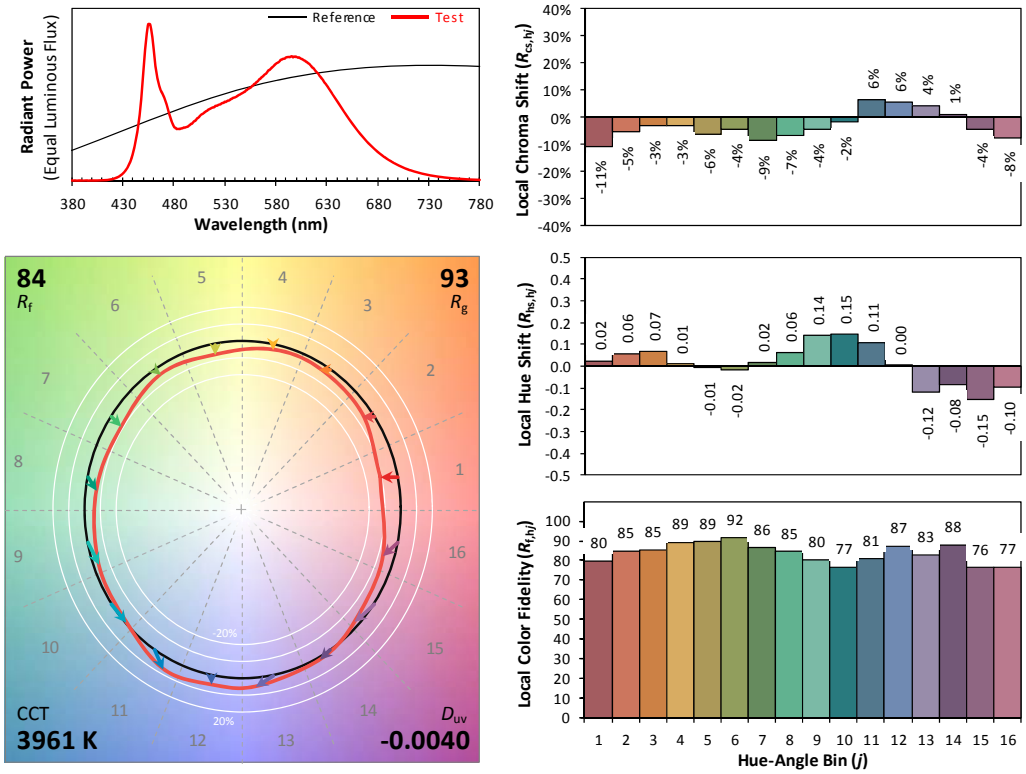
Chart14: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2023/06/28 **Model:** 11.5T8/4F/8CCTS/EXT/A4



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

x	0.3793
y	0.3675
u'	0.2281
v'	0.4973

CIE 13.3-1995 (CRI)

R_a	86
R_9	23

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

Chart 15: 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 10 due to rounding.

TEST RESULTS (5000K Setting)

Test ambient temperature was 26.0°C.

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)	0.426	0.195
Power Factor	0.9956	0.9328
Test Power (W)/4	12.73	12.60
THD A%	5.39	7.16
Luminous Efficacy (lm/W)	145.9	147.4
Total Luminous Flux (lm)	1857.2	1856.8
Color Rendering Index (CRI)	86.0	
R9	22.6	
Correlated Color Temperature (CCT)(K)	5068	
Chromaticity Chroma x	0.3428	
Chromaticity Chroma y	0.3460	
Chromaticity Chroma u	0.2121	
Chromaticity Chroma v	0.3210	
Duv	-0.0019	
Chromaticity Chroma u ’	0.2121	
Chromaticity Chroma v’	0.4816	

Special Color Rendering Indices	
R1	87.2
R2	96.8
R3	93
R4	82
R5	86.4
R6	90.6
R7	83.7
R8	68.4
R9	22.6
R10	91.1
R11	82.3
R12	66.2
R13	91.2
R14	97.1

Table 12: 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).

Spectral Power Distribution - Sphere Spectroradiometer Method

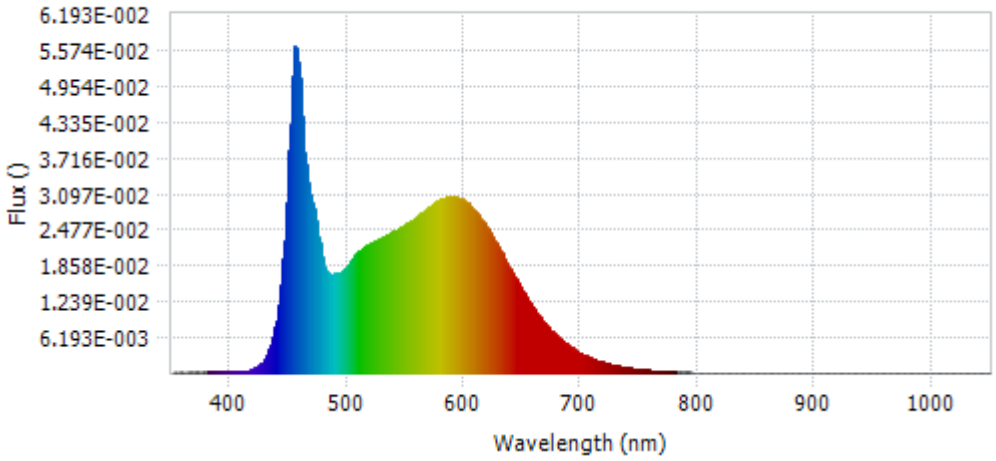
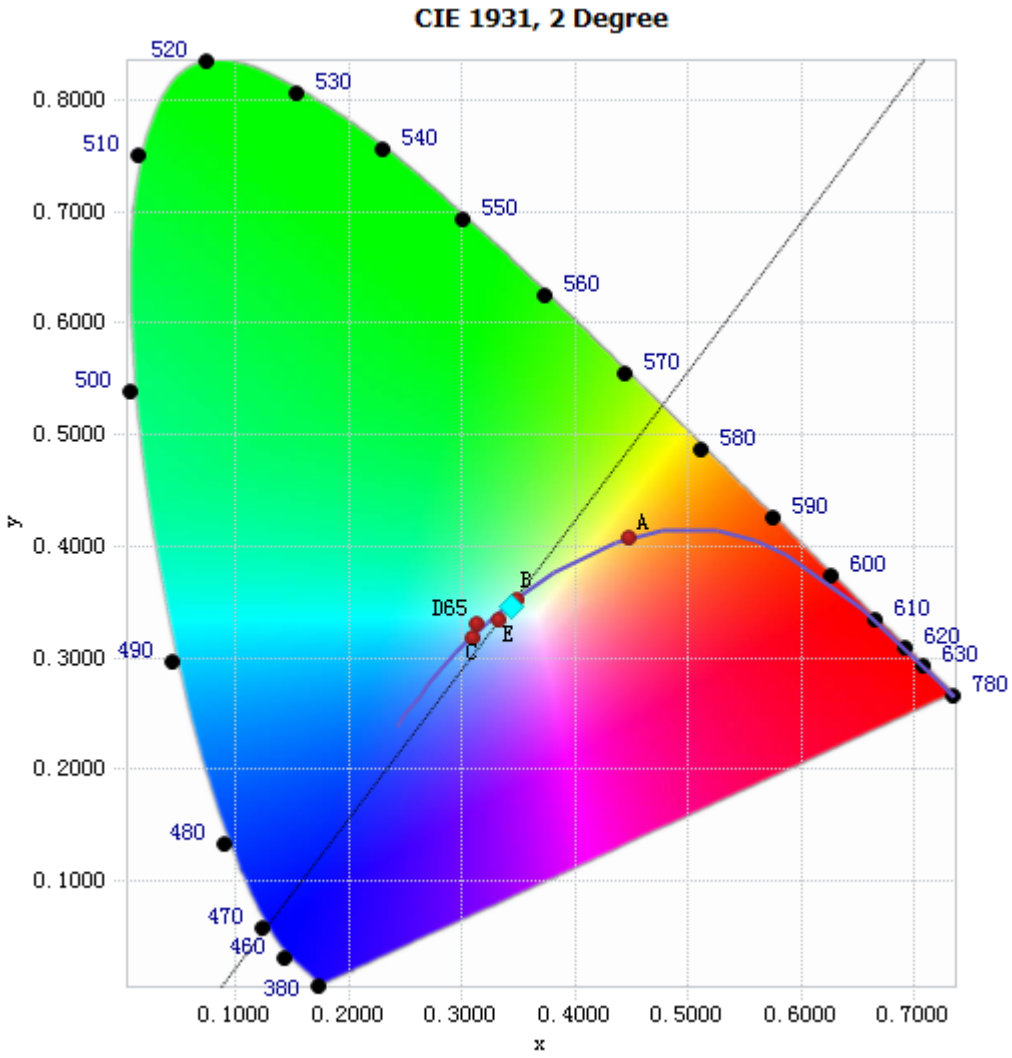


Chart16: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.29E-04	485	1.71E-02	590	3.06E-02	695	3.98E-03
385	2.03E-04	490	1.72E-02	595	3.02E-02	700	3.39E-03
390	2.29E-04	495	1.75E-02	600	2.98E-02	705	2.89E-03
395	2.33E-04	500	1.86E-02	605	2.88E-02	710	2.46E-03
400	2.27E-04	505	1.99E-02	610	2.78E-02	715	2.10E-03
405	2.29E-04	510	2.10E-02	615	2.64E-02	720	1.82E-03
410	2.81E-04	515	2.18E-02	620	2.48E-02	725	1.54E-03
415	4.37E-04	520	2.24E-02	625	2.31E-02	730	1.31E-03
420	7.90E-04	525	2.30E-02	630	2.13E-02	735	1.12E-03
425	1.46E-03	530	2.36E-02	635	1.95E-02	740	9.52E-04
430	2.77E-03	535	2.39E-02	640	1.77E-02	745	8.15E-04
435	5.40E-03	540	2.44E-02	645	1.58E-02	750	6.92E-04
440	1.04E-02	545	2.50E-02	650	1.41E-02	755	5.90E-04
445	1.98E-02	550	2.55E-02	655	1.25E-02	760	5.12E-04
450	3.84E-02	555	2.62E-02	660	1.10E-02	765	4.36E-04
455	5.63E-02	560	2.70E-02	665	9.55E-03	770	3.74E-04
460	4.78E-02	565	2.78E-02	670	8.30E-03	775	3.24E-04
465	3.42E-02	570	2.86E-02	675	7.22E-03	780	2.79E-04
470	2.94E-02	575	2.94E-02	680	6.27E-03		
475	2.35E-02	580	3.00E-02	685	5.39E-03		
480	1.83E-02	585	3.05E-02	690	4.64E-03		

Table 13: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3428, 0.3460)

Chart 17: 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

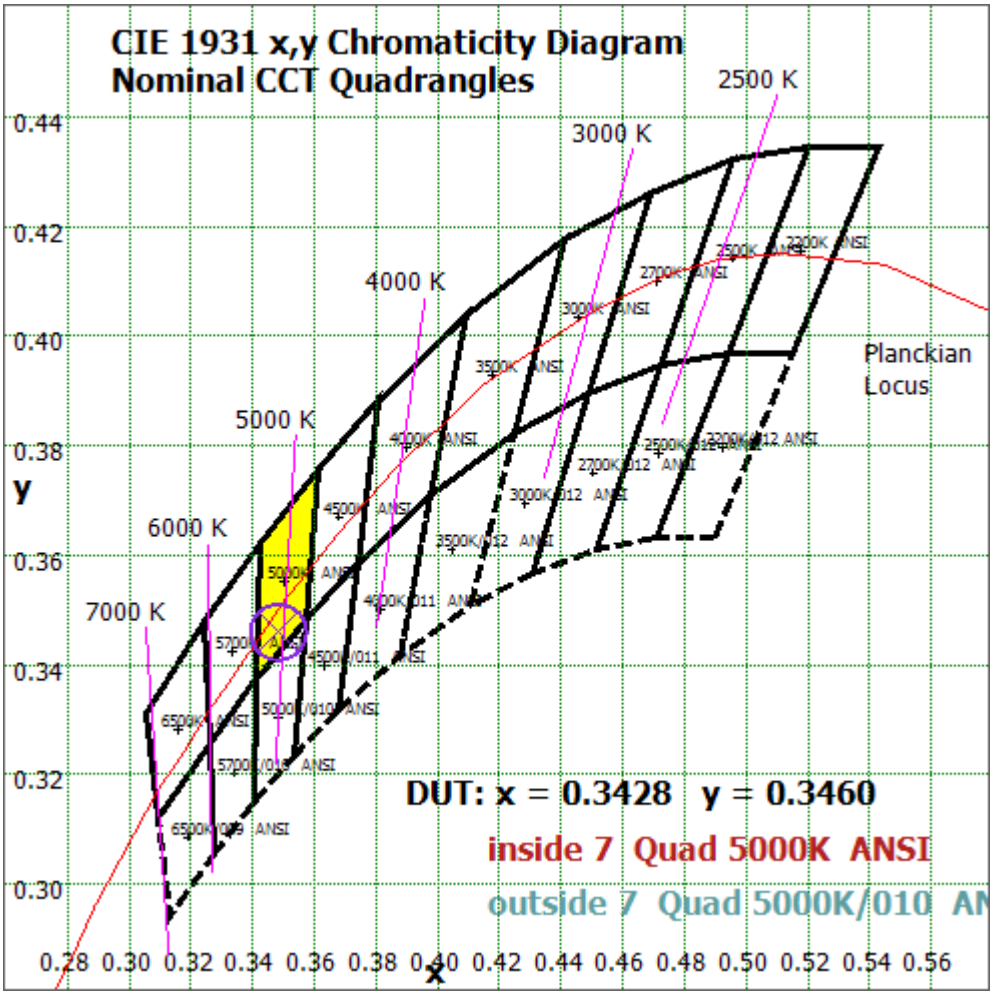


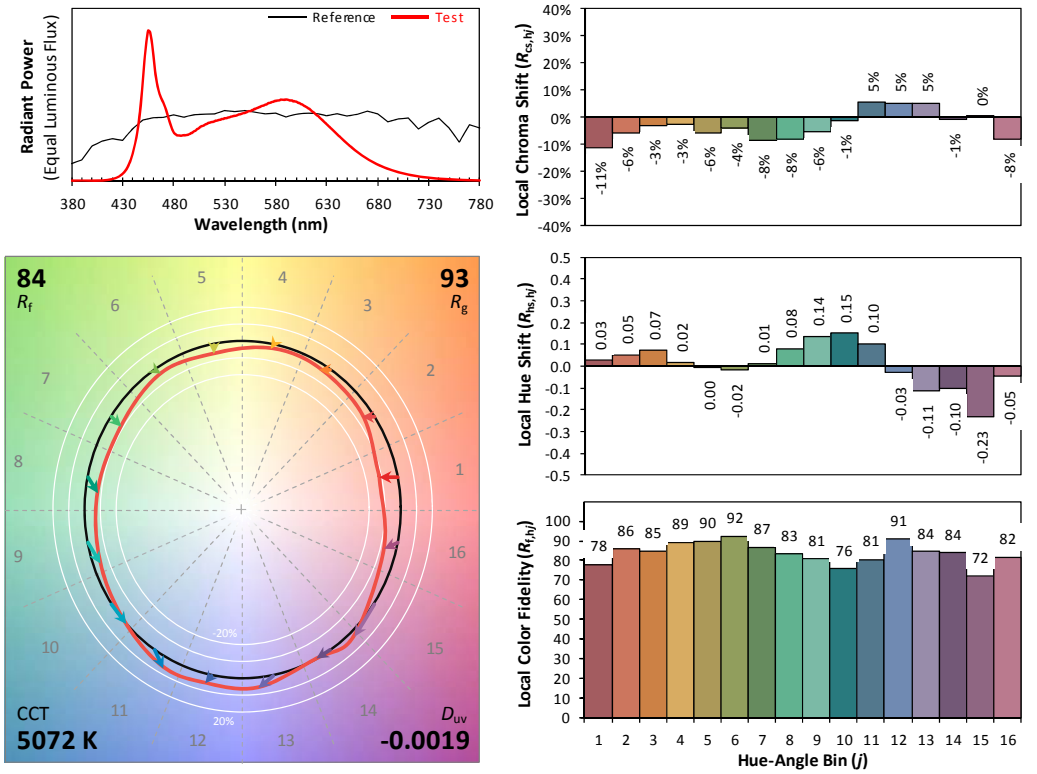
Chart 18: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2023/06/28 **Model:** 11.5T8/4F/8CCTS/EXT/A4



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

x	0.3428
y	0.3460
u'	0.2121
v'	0.4816

CIE 13.3-1995 (CRI)

R_a	86
R_9	23

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

Chart 19: 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 12 due to rounding.

TEST RESULTS (6500K Setting)

Test ambient temperature was 26.0°C.

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)	0.433	0.197
Power Factor	0.9957	0.9343
Test Power (W)/4	12.91	12.78
THD A%	5.42	7.26
Luminous Efficacy (lm/W)	142.6	144.0
Total Luminous Flux (lm)	1841.2	1839.7
Color Rendering Index (CRI)	84.3	
R9	11.8	
Correlated Color Temperature (CCT)(K)	6520	
Chromaticity Chroma x	0.3124	
Chromaticity Chroma y	0.3285	
Chromaticity Chroma u	0.1978	
Chromaticity Chroma v	0.3120	
Duv	0.0031	
Chromaticity Chroma u ’	0.1978	
Chromaticity Chroma v’	0.4680	

Special Color Rendering Indices	
R1	84.2
R2	95.1
R3	93.2
R4	78.4
R5	83
R6	88.7
R7	84.3
R8	67.6
R9	11.8
R10	86.4
R11	78.8
R12	58.9
R13	88.7
R14	96.9

Table 14: 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).

Spectral Power Distribution - Sphere Spectroradiometer Method

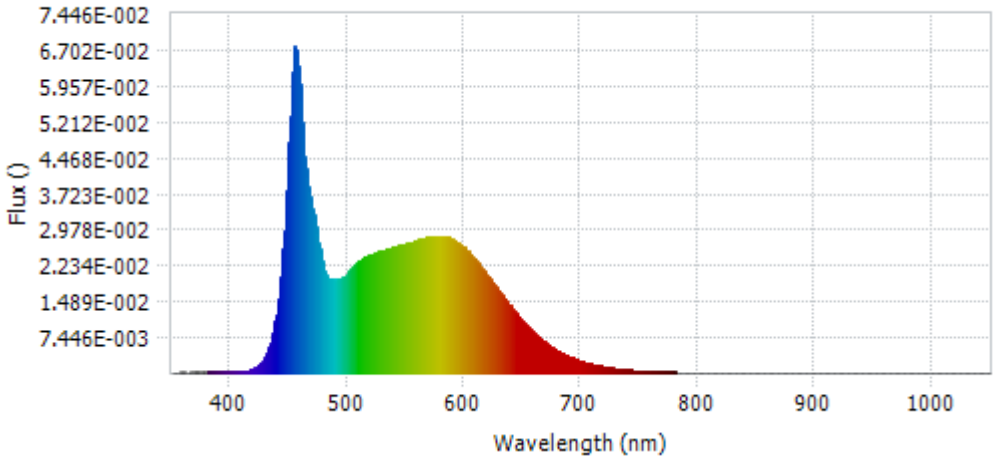
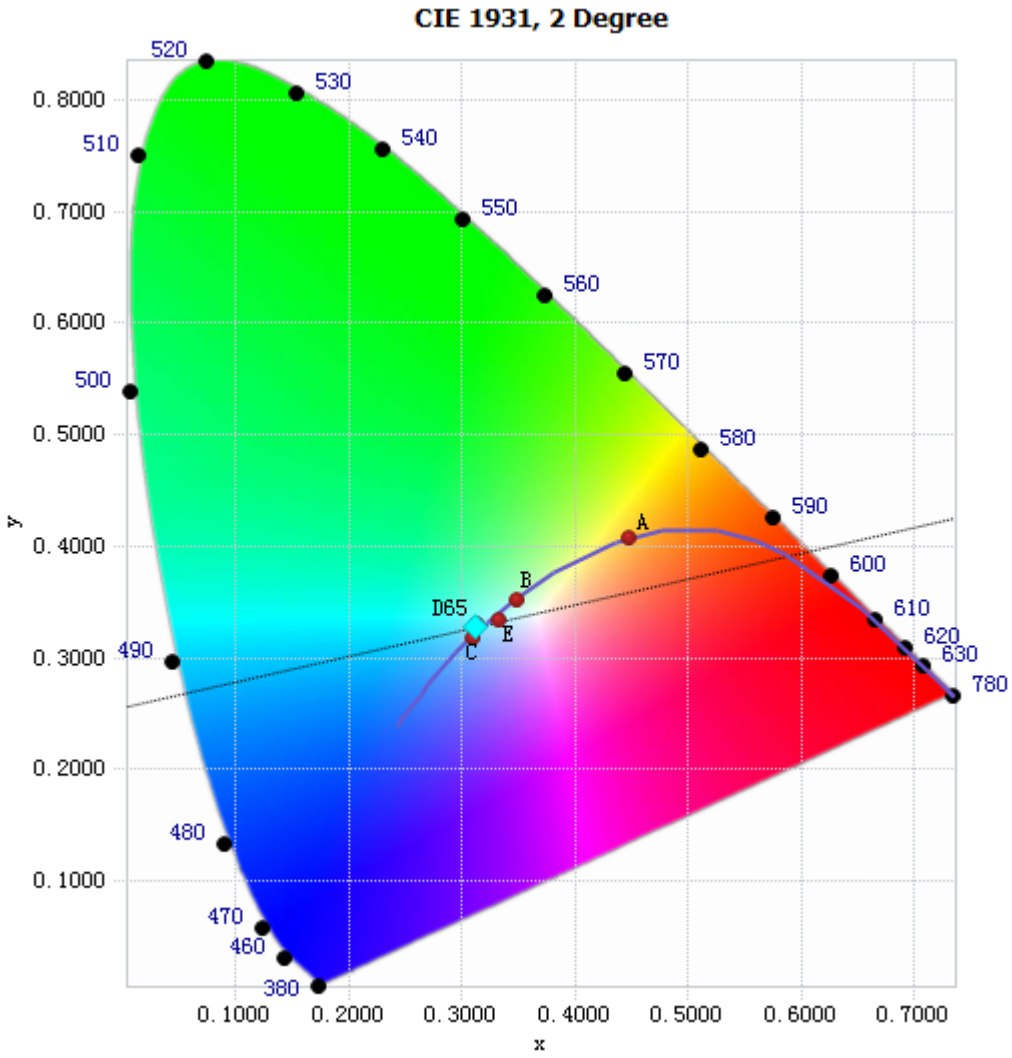


Chart 20: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.63E-04	485	1.95E-02	590	2.78E-02	695	2.92E-03
385	2.20E-04	490	1.94E-02	595	2.69E-02	700	2.51E-03
390	2.50E-04	495	1.97E-02	600	2.60E-02	705	2.14E-03
395	2.35E-04	500	2.07E-02	605	2.46E-02	710	1.81E-03
400	2.37E-04	505	2.20E-02	610	2.33E-02	715	1.55E-03
405	2.37E-04	510	2.31E-02	615	2.17E-02	720	1.33E-03
410	3.20E-04	515	2.40E-02	620	2.01E-02	725	1.14E-03
415	5.72E-04	520	2.44E-02	625	1.85E-02	730	9.66E-04
420	1.03E-03	525	2.50E-02	630	1.69E-02	735	8.41E-04
425	1.98E-03	530	2.55E-02	635	1.53E-02	740	7.12E-04
430	3.78E-03	535	2.57E-02	640	1.37E-02	745	6.10E-04
435	7.33E-03	540	2.61E-02	645	1.22E-02	750	5.29E-04
440	1.39E-02	545	2.65E-02	650	1.07E-02	755	4.54E-04
445	2.58E-02	550	2.67E-02	655	9.43E-03	760	3.85E-04
450	4.80E-02	555	2.71E-02	660	8.22E-03	765	3.32E-04
455	6.77E-02	560	2.75E-02	665	7.14E-03	770	2.83E-04
460	5.62E-02	565	2.79E-02	670	6.20E-03	775	2.43E-04
465	4.03E-02	570	2.82E-02	675	5.36E-03	780	2.20E-04
470	3.42E-02	575	2.84E-02	680	4.61E-03		
475	2.70E-02	580	2.84E-02	685	3.97E-03		
480	2.10E-02	585	2.83E-02	690	3.42E-03		

Table 15: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3124, 0.3285)

Chart 21: 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

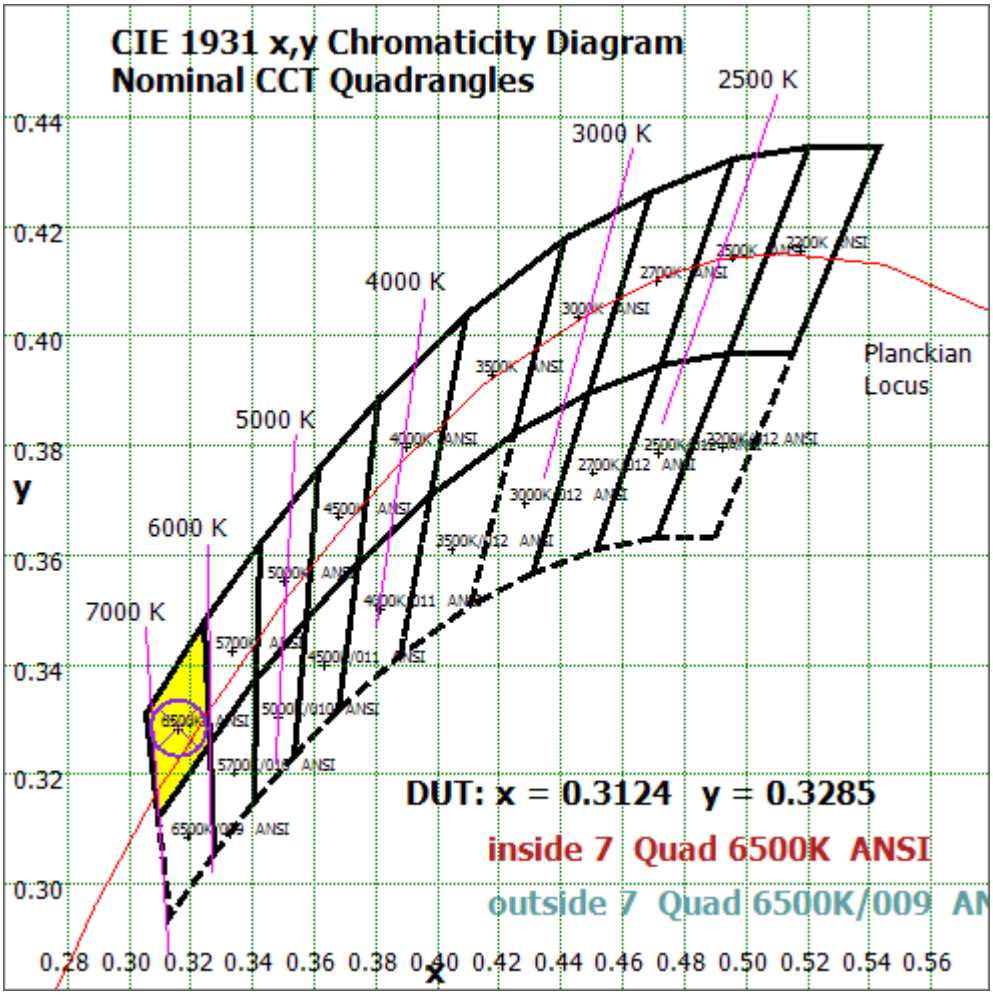


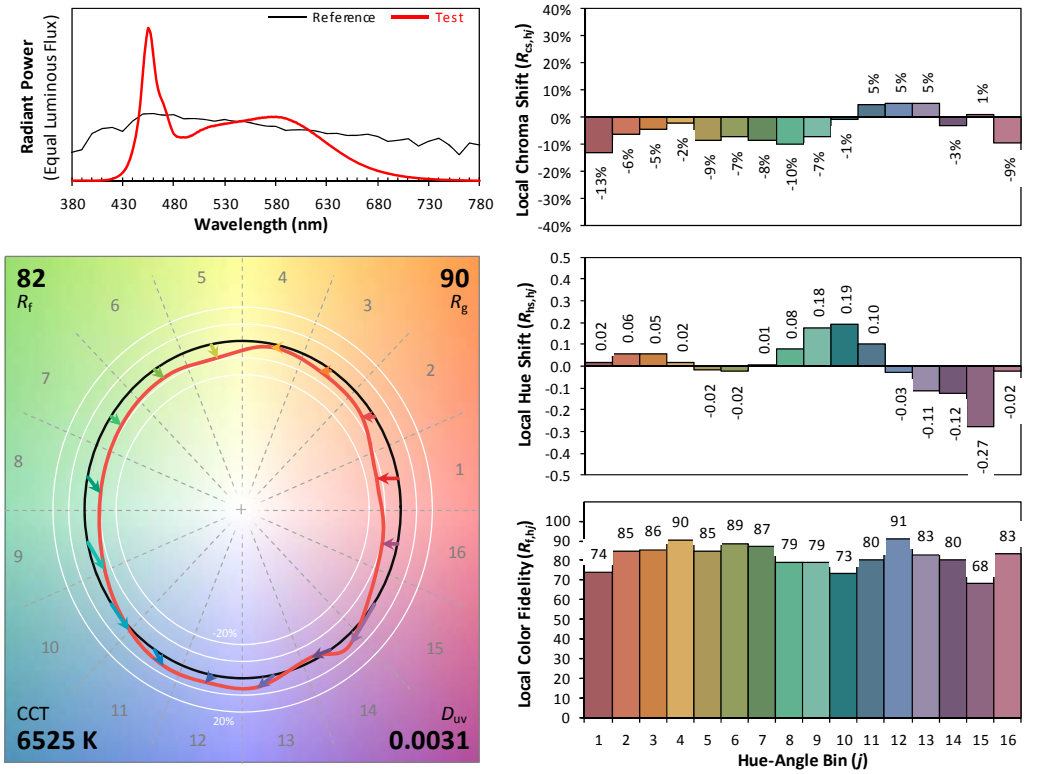
Chart 22: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

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

Date: 2023/06/28 **Model:** 11.5T8/4F/8CCTS/EXT/A4



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

x	0.3124
y	0.3285
u'	0.1978
v'	0.4680

CIE 13.3-1995 (CRI)

R_a	84
R_9	12

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

Chart 23: 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 14 due to rounding.

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
Multi-Meter	FLUKE15B	HZTE020-01	Aug. 05, 2022	Aug. 04, 2023

Table 16: 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 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 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.

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100
Tel: +86 571 86376106 www.ltlqa.com

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 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 ***

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100
Tel: +86 571 86376106 www.ltlqa.com