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/A3

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.: HZ23060027n

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/A3 3000K Setting	11.5T8/4F/8CCTS/EXT/A3 3500K Setting	11.5T8/4F/8CCTS/EXT/A3 4000K Setting
Luminous Efficacy (Lumens /Watt)	137.7	142.5	145.4
Total Luminous Flux (Lumens)	1793.2	1832.5	1852.5
Power (Watts)/3	13.02	12.86	12.74
Power Factor	0.9920	0.9918	0.9918
CCT (K)	3016	3479	3958
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/A3 5000K Setting	11.5T8/4F/8CCTS/EXT/A3 6500K Setting
Luminous Efficacy (Lumens /Watt)	145.5	142.4
Total Luminous Flux (Lumens)	1855.2	1840.2
Power (Watts)/3	12.75	12.92
Power Factor	0.9918	0.9920
CCT (K)	5074	6521
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

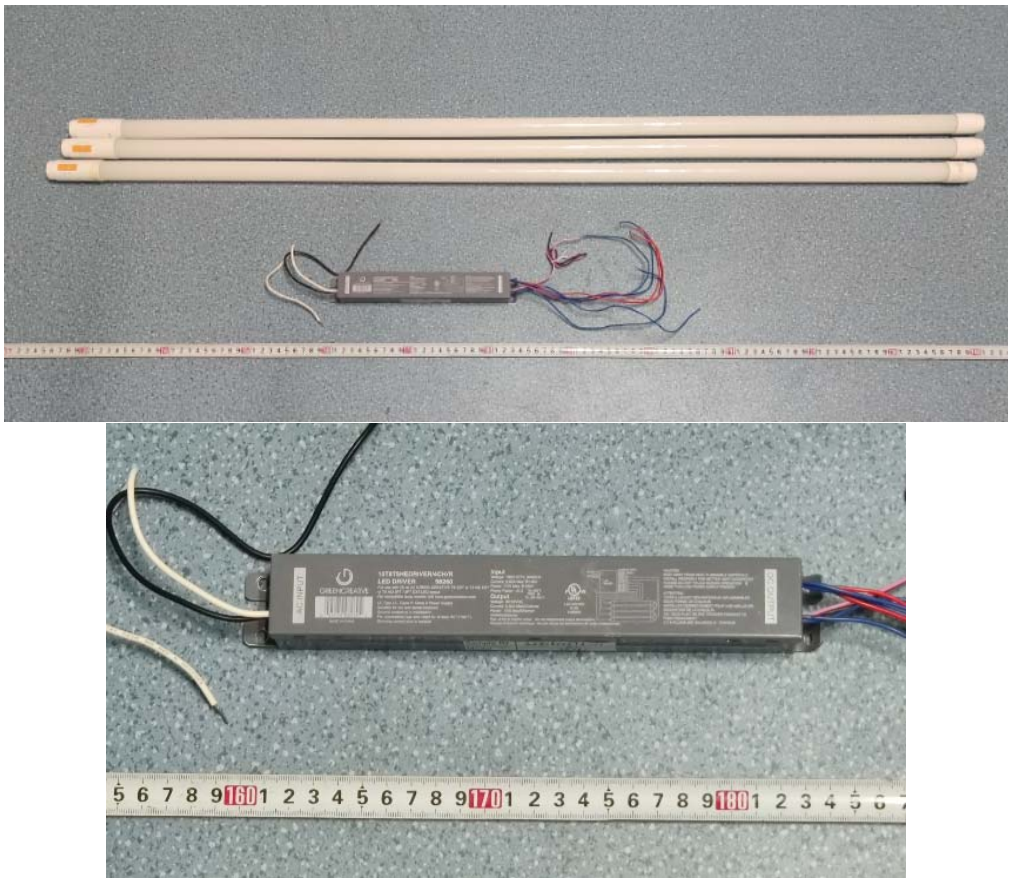


Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 11.5T8/4F/8CCTS/EXT/A3
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)	0.328	0.156
Power Factor	0.9920	0.9022
Test Power (W)/3	13.02	12.97
THD A%	5.96	8.48
Luminous Efficacy (lm/W)	137.7	138.2
Total Luminous Flux (lm)	1793.2	1792.1
Color Rendering Index (CRI)	82.5	
R9	6.8	
Correlated Color Temperature (CCT)(K)	3016	
Chromaticity Chroma x	0.4343	
Chromaticity Chroma y	0.4009	
Chromaticity Chroma u	0.2503	
Chromaticity Chroma v	0.3465	
Duv	-0.0009	
Chromaticity Chroma u ’	0.2503	
Chromaticity Chroma v’	0.5197	

Special Color Rendering Indices	
R1	81.8
R2	93.8
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	73.3
R13	85.1
R14	96.6

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

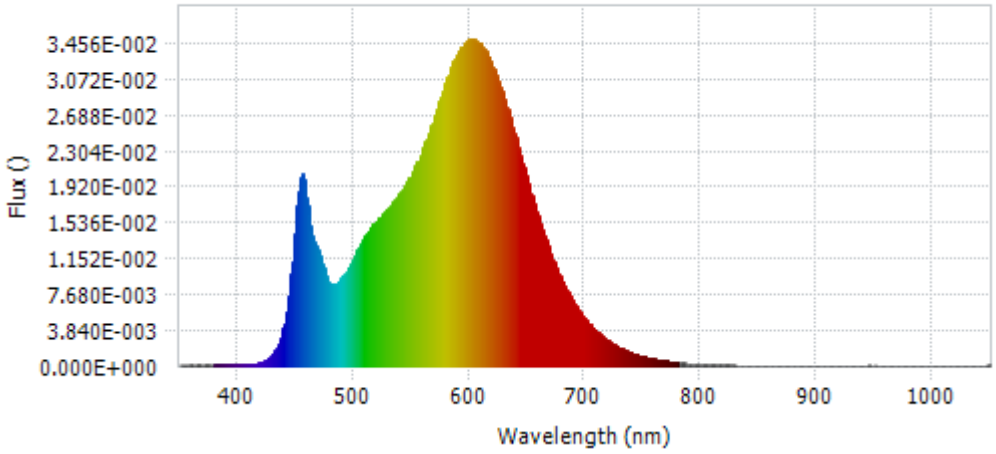
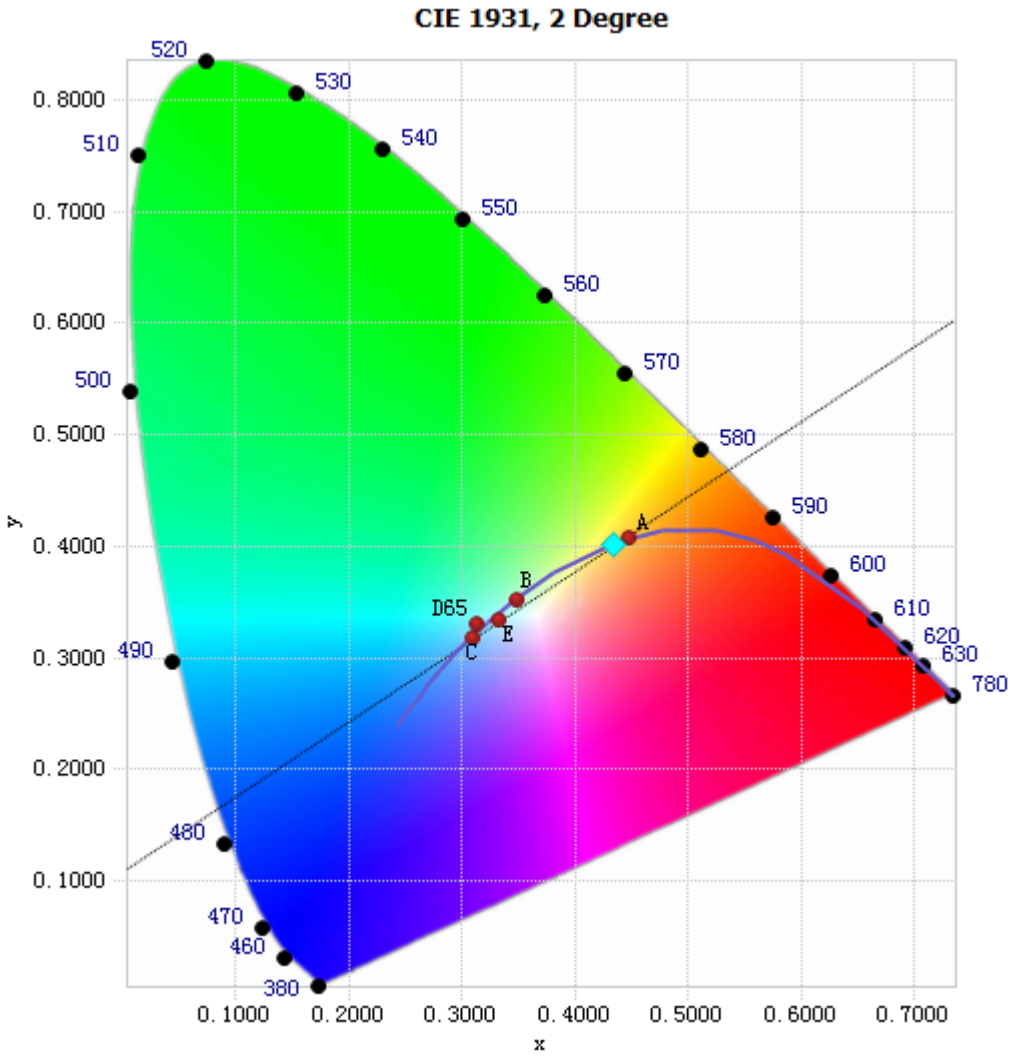


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.03E-04	485	9.37E-03	590	3.56E-02	695	6.24E-03
385	9.56E-05	490	1.01E-02	595	3.64E-02	700	5.31E-03
390	9.55E-05	495	1.10E-02	600	3.70E-02	705	4.56E-03
395	1.01E-04	500	1.23E-02	605	3.68E-02	710	3.87E-03
400	1.18E-04	505	1.35E-02	610	3.63E-02	715	3.32E-03
405	9.98E-05	510	1.47E-02	615	3.53E-02	720	2.83E-03
410	1.65E-04	515	1.57E-02	620	3.39E-02	725	2.42E-03
415	2.59E-04	520	1.64E-02	625	3.22E-02	730	2.07E-03
420	4.53E-04	525	1.72E-02	630	3.02E-02	735	1.75E-03
425	7.74E-04	530	1.80E-02	635	2.81E-02	740	1.48E-03
430	1.39E-03	535	1.87E-02	640	2.58E-02	745	1.26E-03
435	2.61E-03	540	1.96E-02	645	2.34E-02	750	1.09E-03
440	4.79E-03	545	2.06E-02	650	2.10E-02	755	9.29E-04
445	9.05E-03	550	2.16E-02	655	1.88E-02	760	7.92E-04
450	1.66E-02	555	2.31E-02	660	1.66E-02	765	6.71E-04
455	2.18E-02	560	2.46E-02	665	1.46E-02	770	5.81E-04
460	1.80E-02	565	2.64E-02	670	1.28E-02	775	4.98E-04
465	1.43E-02	570	2.83E-02	675	1.12E-02	780	4.18E-04
470	1.28E-02	575	3.03E-02	680	9.68E-03		
475	1.06E-02	580	3.23E-02	685	8.36E-03		
480	9.21E-03	585	3.41E-02	690	7.24E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4343, 0.4009)

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

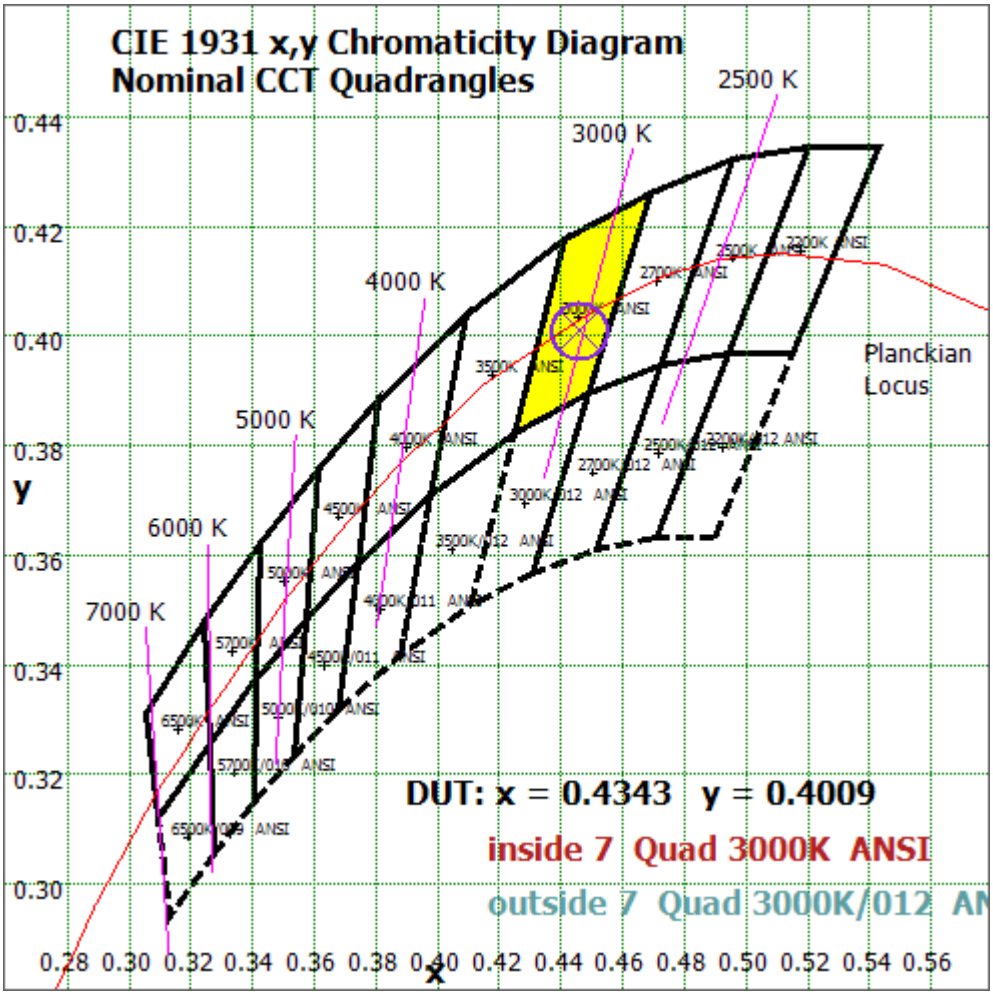


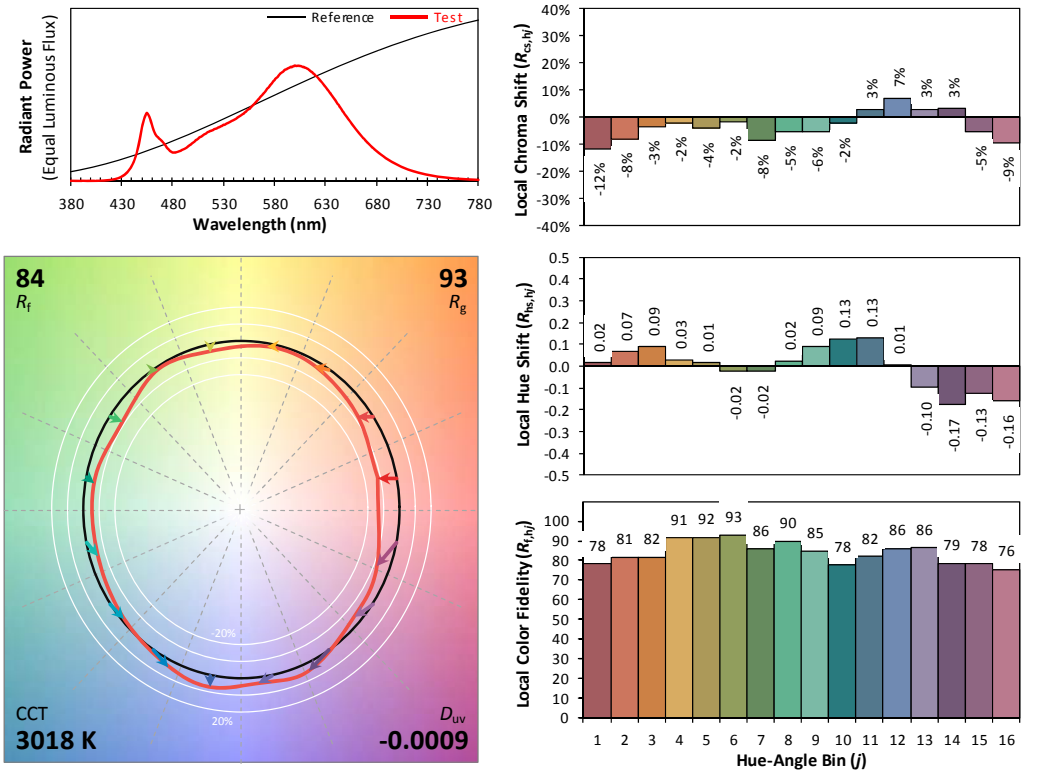
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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/A3



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

x	0.4343
y	0.4009
u'	0.2503
v'	0.5197

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)	0.330
Power Factor	0.9896
Power (W)/3	13.05
Luminous Efficacy (lm/W)	138.4
Total Luminous Flux (lm)	1805.7
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)	280.3 (At: C=90.0, Gamma=3.0)
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	26.598	1.47%
10- 20	77.479	4.29%
20- 30	121.602	6.73%
30- 40	155.408	8.61%
40- 50	176.621	9.78%
50- 60	184.403	10.21%
60- 70	179.542	9.94%
70- 80	164.958	9.14%
80- 90	146.074	8.09%
90-100	129.254	7.16%
100-110	113.87	6.31%
110-120	97.676	5.41%
120-130	80.905	4.48%
130-140	63.859	3.54%
140-150	45.701	2.53%
150-160	27.507	1.52%
160-170	11.542	0.64%
170-180	2.661	0.15%
Total	1805.7	100%

γ(°)	Lumens	% Total
0- 60	742.111	41.10%
60- 90	490.574	27.17%
0-90	1232.69	68.27%
90- 180	572.975	31.73%
0- 180	1805.7	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

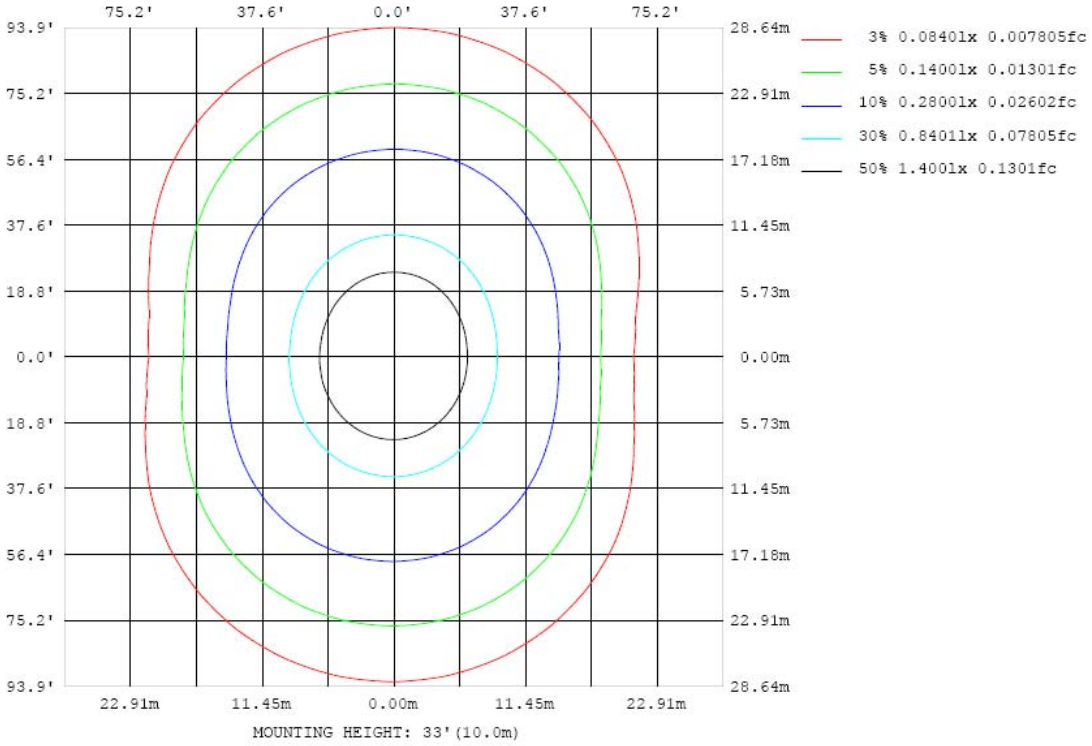


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

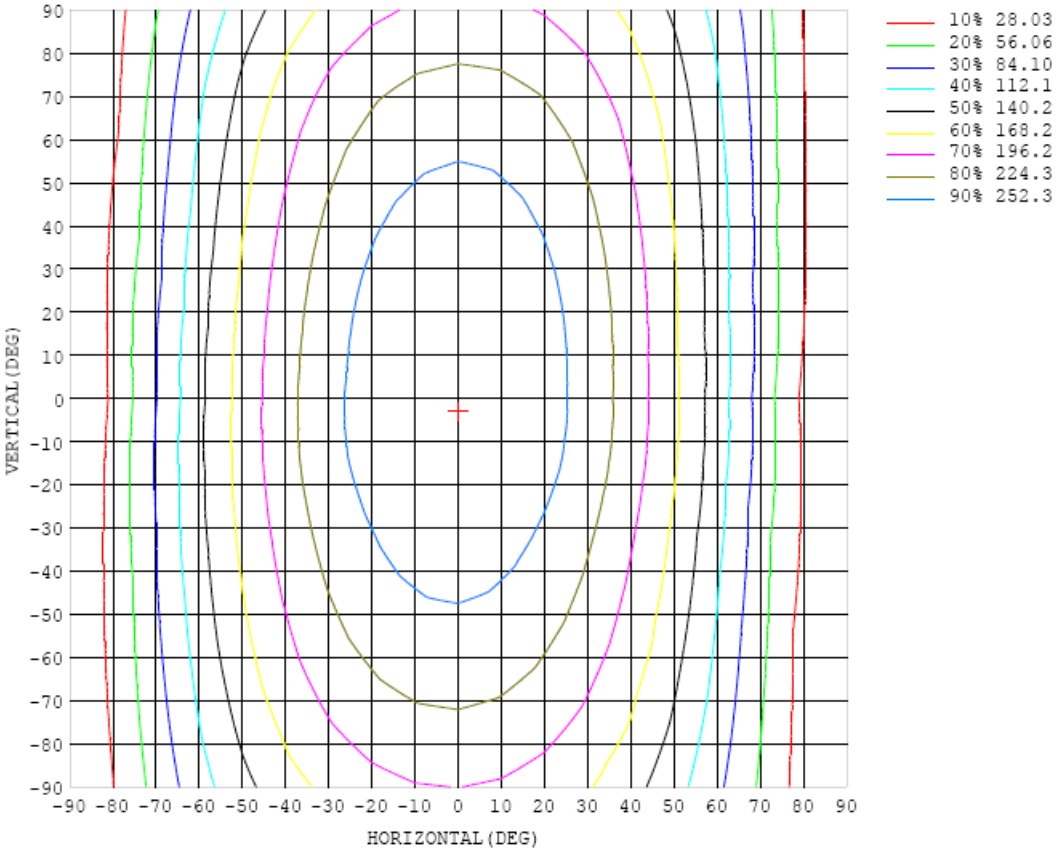


Chart 6: Isocandela Plot

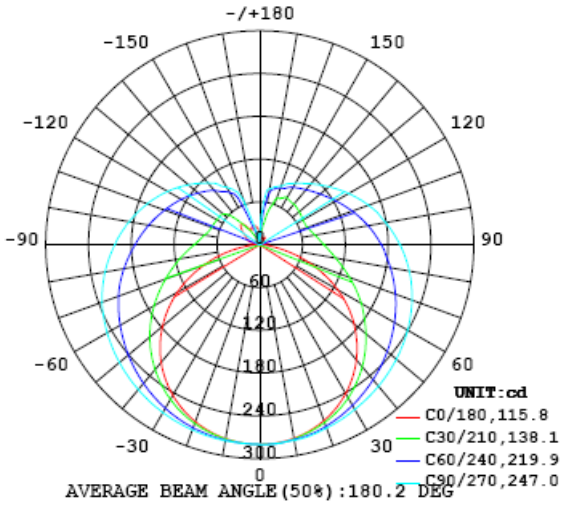


Chart 7: Polar Candela Distribution

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	279	280	280	280	280	280	280	280	280	280	280	280	280	279	279	279
10	276	276	276	277	277	277	277	278	278	278	278	278	278	277	277	277	277	277	276
15	270	271	271	271	273	274	275	276	277	277	277	276	276	275	274	272	272	272	271
20	263	263	264	265	268	269	271	272	273	274	273	273	272	271	269	267	265	265	264
25	253	254	255	258	260	263	266	268	270	270	270	269	267	265	262	260	257	256	255
30	241	242	244	248	252	256	260	263	266	267	266	265	262	258	254	251	248	245	244
35	227	228	231	236	242	248	254	258	261	263	262	260	256	251	246	240	236	232	231
40	211	213	217	223	231	240	247	253	257	259	258	255	250	244	236	229	222	217	215
45	192	195	200	209	220	231	240	248	253	255	254	250	244	236	226	216	207	200	198
50	173	175	183	194	208	222	233	242	247	250	249	245	237	227	215	202	191	182	178
55	150	154	165	179	196	212	226	236	242	245	244	239	230	219	204	188	174	163	157
60	126	131	144	164	184	203	218	229	236	239	238	233	223	210	193	175	156	141	133
65	100	106	124	149	173	193	210	223	230	233	232	226	216	201	182	161	138	119	109
70	73.4	81.1	105	134	162	184	202	216	224	227	225	219	208	192	171	147	119	95.7	83.0
75	47.1	57.3	86.6	120	151	175	194	208	217	220	218	212	200	183	161	133	102	73.5	57.9
80	23.3	36.7	71.4	108	141	167	186	200	209	213	211	204	192	174	151	121	86.5	53.2	33.1
85	6.42	22.4	60.0	98.1	131	158	178	192	201	205	203	196	183	166	141	110	73.9	37.1	13.1
90	1.41	15.9	52.5	90.0	123	150	170	184	193	197	195	187	175	157	132	101	64.5	27.5	3.28
95	2.04	13.0	47.9	83.7	116	142	162	176	184	188	186	179	168	149	124	93.5	58.3	23.9	2.63
100	6.49	14.1	44.4	78.4	109	134	154	168	176	179	177	171	159	141	117	87.5	54.7	24.1	6.18
105	11.1	17.2	43.4	74.1	103	127	146	160	168	172	170	163	150	133	110	82.7	53.1	27.0	11.5
110	11.7	21.3	45.0	71.0	97.3	120	138	151	159	162	160	154	142	125	104	79.3	53.3	31.5	17.9
115	10.6	25.3	48.1	69.9	92.8	114	130	143	150	153	151	145	134	118	99.0	77.1	54.9	37.1	20.2
120	6.69	28.0	52.2	70.1	89.7	108	123	134	141	144	142	136	126	112	94.9	75.9	57.3	43.4	23.2
125	4.64	31.2	56.1	71.0	87.6	103	117	127	133	135	133	128	119	107	91.6	75.4	60.2	49.9	27.6
130	3.53	36.2	59.3	72.3	86.1	99.4	111	119	125	127	125	120	112	102	89.1	75.7	63.4	56.3	33.2
135	6.29	42.4	60.7	73.4	85.3	96.1	105	113	117	119	117	113	107	97.6	87.1	76.5	65.5	60.0	38.2
140	10.1	45.0	64.4	74.5	84.6	93.3	101	107	110	112	110	107	101	94.2	85.9	75.9	67.3	61.8	38.2
145	12.9	40.2	62.5	74.6	83.6	91.0	96.7	101	104	105	104	101	97.0	91.3	84.4	76.0	71.2	60.9	29.0
150	10.5	35.3	68.8	76.2	81.5	88.0	93.2	96.6	98.7	99.5	98.7	96.6	93.3	88.6	81.5	76.3	73.0	63.4	23.6
155	8.47	31.1	58.8	72.8	80.8	84.2	87.8	91.7	93.8	94.5	93.9	92.1	88.2	84.0	80.7	77.5	73.4	62.3	27.1
160	10.7	19.7	48.4	69.0	78.2	82.5	84.6	86.3	87.3	87.6	87.1	86.1	84.7	82.7	80.3	77.1	74.1	55.3	24.7
165	8.97	13.8	27.8	51.6	67.4	77.7	81.1	83.1	84.0	84.2	83.9	83.3	82.0	79.9	78.4	76.6	69.0	49.9	26.3
170	11.4	14.0	18.7	29.2	44.5	60.5	72.6	78.3	79.8	79.7	79.7	79.3	78.7	78.5	75.1	67.4	56.2	38.4	24.5
175	13.6	13.0	13.7	16.0	19.6	24.8	33.6	44.3	53.3	58.4	59.4	58.9	57.3	53.4	47.0	40.0	32.8	26.8	21.6
180	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0

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	279	279	279	280	280	279	279	279	279	279	279	279		
10	276	276	277	277	278	278	279	279	279	279	279	278	277	277	276	276	276		
15	271	271	272	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	269	266	264	263		
25	255	257	259	263	266	269	272	274	274	274	272	270	266	263	259	256	254		
30	244	246	251	255	260	265	268	271	272	271	269	265	261	256	250	246	242		
35	231	235	240	247	254	260	264	267	269	268	265	260	254	247	240	233	229		
40	216	221	228	237	246	254	260	264	265	264	261	255	247	238	228	220	213		
45	199	206	215	227	238	247	255	259	261	260	256	249	239	228	215	204	195		
50	180	189	201	215	229	241	249	255	257	256	251	242	231	217	202	187	176		
55	160	171	186	204	220	233	243	250	252	251	245	235	222	206	187	169	155		
60	137	152	171	192	211	226	237	244	247	245	239	228	214	195	173	151	133		
65	114	132	156	180	201	218	231	239	241	240	233	221	205	183	159	132	110		
70	89.6	112	141	168	192	211	224	232	235	233	226	214	196	173	145	114	86.5		
75	66.2	93.7	127	157	183	202	216	225	228	226	219	206	188	163	132	97.9	65.4		
80	44.4	78.1	114	146	173	193	208	217	220	218	211	198	179	153	121	84.2	46.6		
85	27.0	65.0	102	136	163	184	199	208	212	210	203	189	170	144	112	73.5	33.4		
90	17.0	54.3	92.0	125	153	175	190	200	203	202	194	181	162	136	104	66.7	27.0		
95	11.7	47.1	84.2	118	145	167	182	191	195	193	186	173	154	128	97.1	61.8	25.2		
100	11.1	42.6	78.6	110	137	158	173	182	186	184	177	165	146	121	91.5	58.5	26.0		
105	12.5	41.7	74.1	104	130	150	164	173	177	175	169	156	138	115	87.0	56.9	28.1		
110	14.2	41.4	72.0	98.8	123	142	156	164	168	166	160	148	131	109	83.5	56.7	27.3		
115	7.19	40.0	70.8	94.8	117	135	147	155	159	157	151	140	124	103	80.5	57.4	27.5		
120	1.71	38.7	69.7	91.3	111	127	139	147	149	148	142	131	117	98.5	78.5	56.6	25.3		
125	3.56	37.7	69.0	87.8	106	120	131	138	140	139	133	124	111	94.4	75.0	57.0	21.6		
130	3.07	33.5	66.5	84.4	100	113	122	128	131	129	124	116	104	90.3	72.4	58.5	18.3		
135	2.87	23.1	57.0	81.9	94.8	106	114	120	122	121	116	109	98.9	84.1	69.9	54.0	12.9		
140	7.40	11.0	38.3	78.6	88.3	99.3	107	111	113	112	108	102	90.7	79.9	66.1	40.7	7.37		
145	9.56	8.63	25.9	69.9	83.6	90.9	96.8	102	104	102	97.8	92.3	84.6	73.2	60.4	22.7	4.47		
150	9.11	8.57	15.1	35.1	77.3	84.7	89.0	91.9	93.6	92.7	89.8	86.1	76.0	60.5	36.6	9.01	4.94		
155	9.65	11.2	9.74	18.3	36.6	70.7	80.3	82.8	83.7	83.2	81.6	72.9	56.4	37.1	15.8	4.57	5.42		
160	9.33	11.1	11.4	11.9	16.5	23.1	34.6	51.1	59.6	60.1	50.4	37.2	24.8	10.9	9.56	4.59	9.23		
165	13.7	8.55	9.50	9.53	14.2	12.0	14.1	17.9	20.7	14.6	10.1	10.2	14.4	9.77	5.15	6.89	7.30		
170	17.7	11.4	10.1	9.34	6.18	9.95	10.8	8.89	7.54	8.80	8.43	10.2	8.71	6.00	9.47	10.2	8.64		
175	18.5	15.9	12.9	10.1	9.03	10.6	12.3	10.7	7.15	12.4	12.7	11.8	10.1	8.34	8.31	11.7	14.4		
180	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0		

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)	0.325	0.154
Power Factor	0.9918	0.9004
Test Power (W)/3	12.86	12.81
THD A%	6.00	8.73
Luminous Efficacy (lm/W)	142.5	143.0
Total Luminous Flux (lm)	1832.5	1832.4
Color Rendering Index (CRI)	84.6	
R9	17.1	
Correlated Color Temperature (CCT)(K)	3479	
Chromaticity Chroma x	0.4027	
Chromaticity Chroma y	0.3816	
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	80.6
R12	71
R13	88.9
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

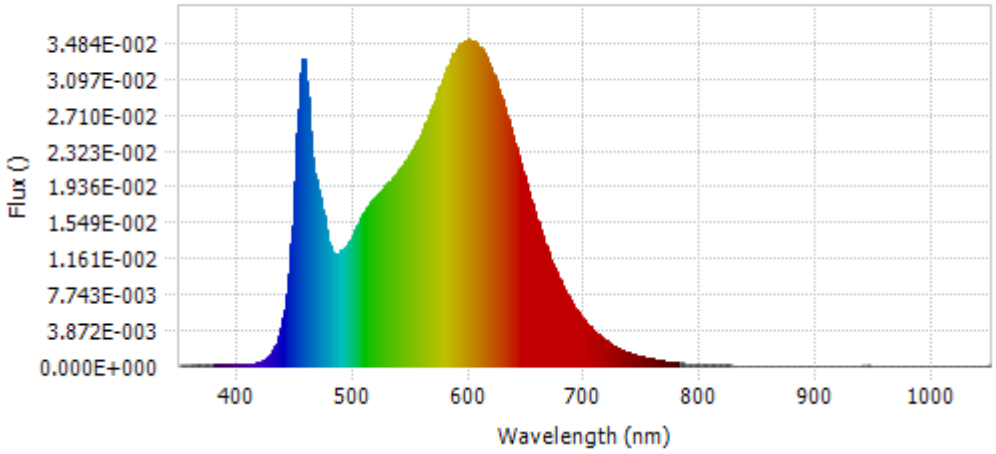
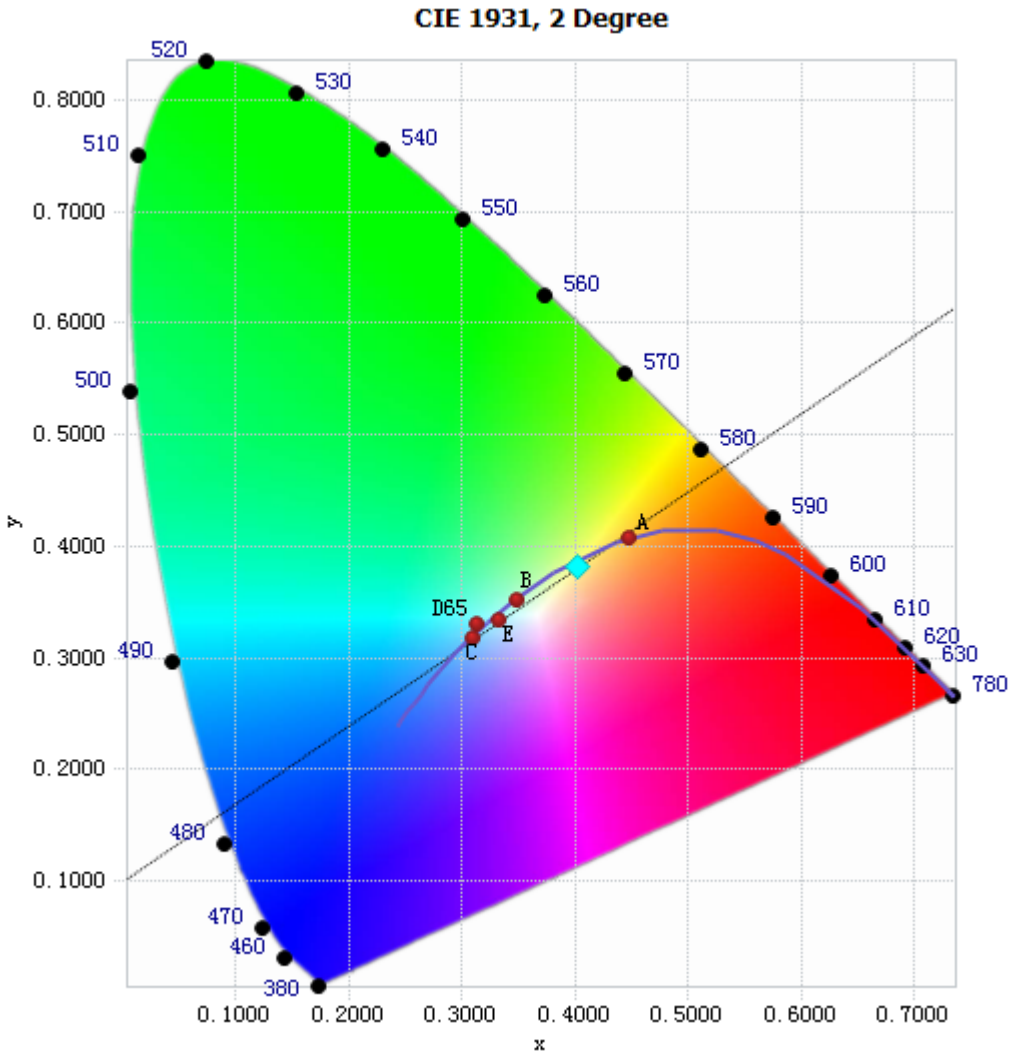


Chart 8: Spectral Power Distribution

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	3.44E-02	695	5.60E-03
385	1.54E-04	490	1.26E-02	595	3.50E-02	700	4.78E-03
390	1.72E-04	495	1.32E-02	600	3.52E-02	705	4.10E-03
395	1.46E-04	500	1.43E-02	605	3.48E-02	710	3.48E-03
400	1.54E-04	505	1.56E-02	610	3.41E-02	715	2.97E-03
405	1.56E-04	510	1.67E-02	615	3.31E-02	720	2.56E-03
410	1.84E-04	515	1.77E-02	620	3.16E-02	725	2.17E-03
415	2.97E-04	520	1.83E-02	625	2.99E-02	730	1.83E-03
420	5.06E-04	525	1.91E-02	630	2.79E-02	735	1.56E-03
425	8.91E-04	530	1.99E-02	635	2.58E-02	740	1.34E-03
430	1.63E-03	535	2.04E-02	640	2.36E-02	745	1.14E-03
435	3.14E-03	540	2.12E-02	645	2.14E-02	750	9.77E-04
440	5.98E-03	545	2.21E-02	650	1.92E-02	755	8.28E-04
445	1.15E-02	550	2.31E-02	655	1.72E-02	760	7.19E-04
450	2.25E-02	555	2.43E-02	660	1.51E-02	765	6.10E-04
455	3.30E-02	560	2.55E-02	665	1.33E-02	770	5.22E-04
460	2.89E-02	565	2.71E-02	670	1.16E-02	775	4.54E-04
465	2.14E-02	570	2.87E-02	675	1.01E-02	780	3.81E-04
470	1.87E-02	575	3.03E-02	680	8.74E-03		
475	1.54E-02	580	3.19E-02	685	7.55E-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): (0.4027, 0.3816)

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

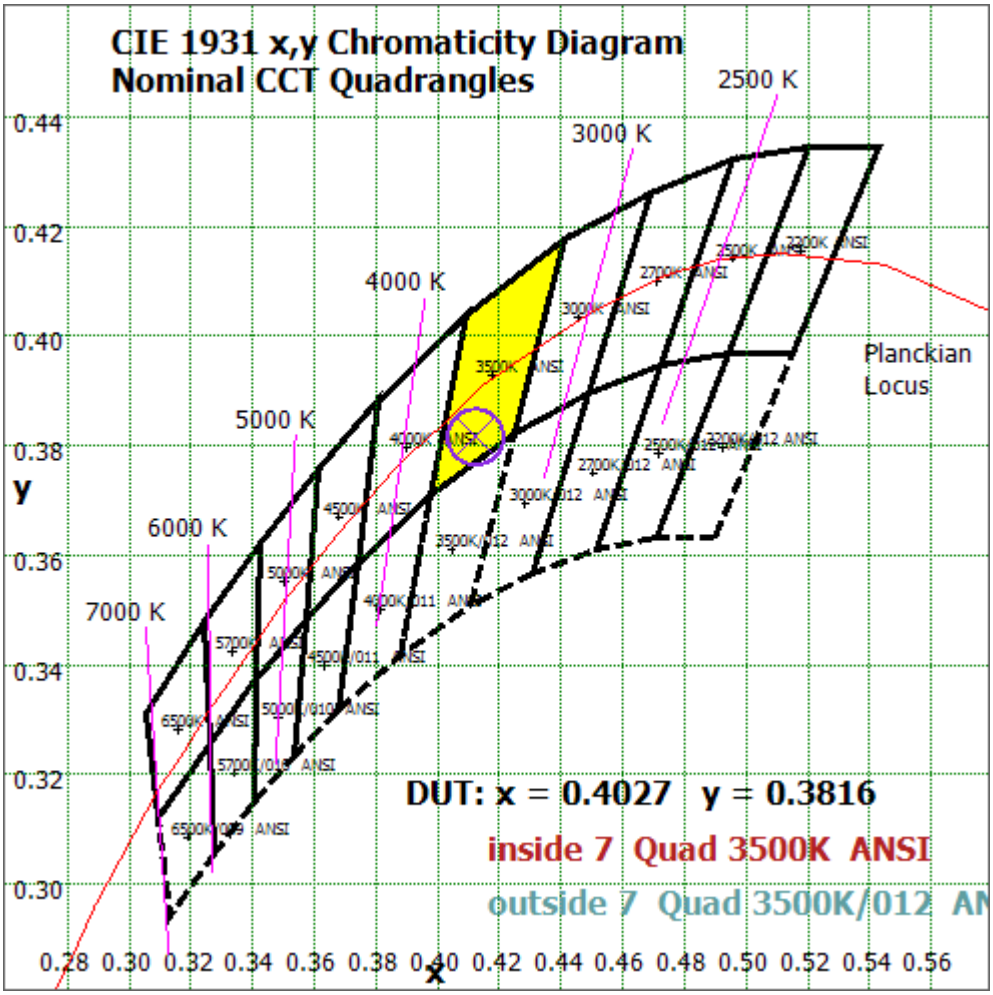


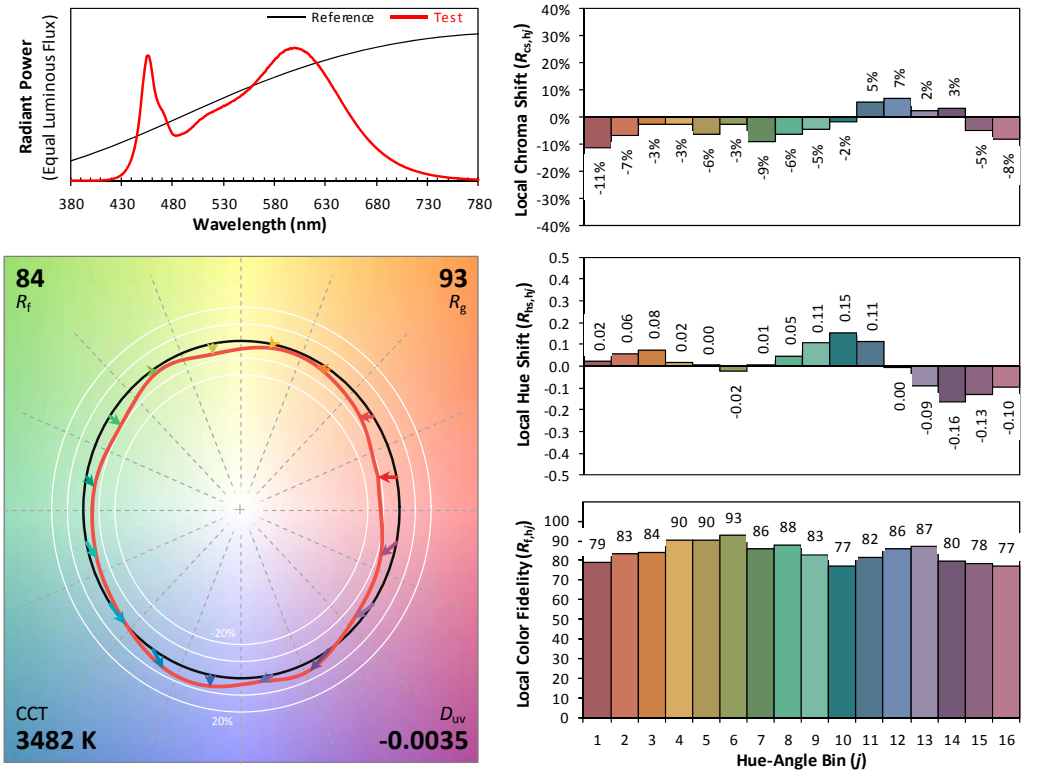
Chart 10: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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/A3



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

x	0.4027
y	0.3816
u'	0.2378
v'	0.5070

CIE 13.3-1995 (CRI)

R_a	85
R_9	17

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)	0.321	0.152
Power Factor	0.9918	0.9016
Test Power (W)/3	12.74	12.69
THD A%	6.08	8.97
Luminous Efficacy (lm/W)	145.4	146.0
Total Luminous Flux (lm)	1852.5	1852.4
Color Rendering Index (CRI)	85.6	
R9	22.8	
Correlated Color Temperature (CCT)(K)	3958	
Chromaticity Chroma x	0.3793	
Chromaticity Chroma y	0.3675	
Chromaticity Chroma u	0.2281	
Chromaticity Chroma v	0.3315	
Duv	-0.0041	
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

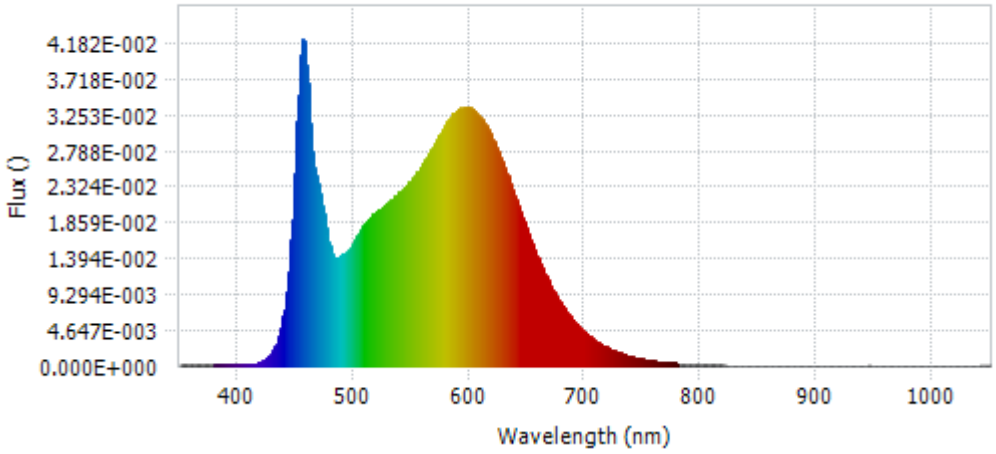
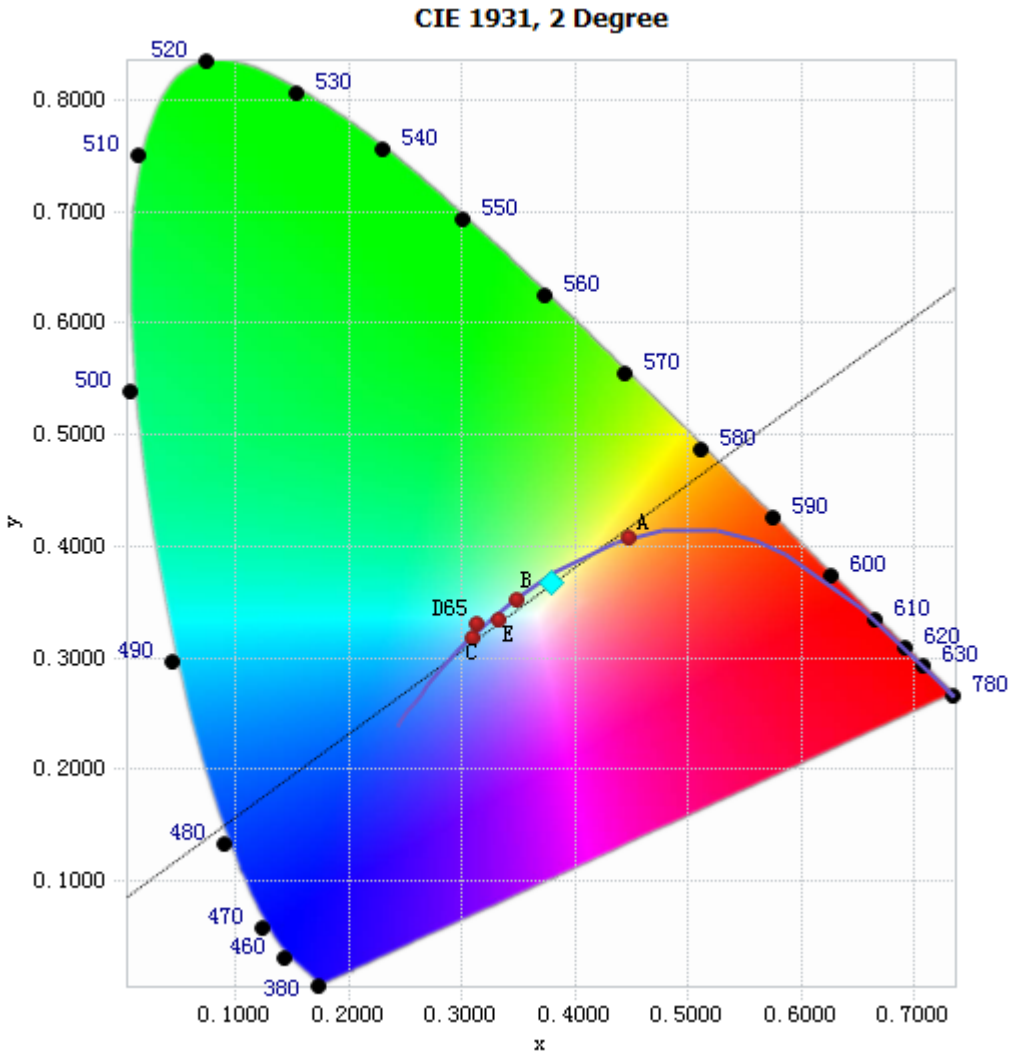


Chart 12: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.04E-04	485	1.40E-02	590	3.32E-02	695	5.04E-03
385	1.66E-04	490	1.45E-02	595	3.35E-02	700	4.30E-03
390	1.75E-04	495	1.49E-02	600	3.35E-02	705	3.67E-03
395	1.88E-04	500	1.60E-02	605	3.29E-02	710	3.12E-03
400	1.82E-04	505	1.73E-02	610	3.20E-02	715	2.68E-03
405	1.87E-04	510	1.84E-02	615	3.09E-02	720	2.29E-03
410	2.08E-04	515	1.93E-02	620	2.93E-02	725	1.95E-03
415	3.26E-04	520	1.99E-02	625	2.76E-02	730	1.67E-03
420	5.75E-04	525	2.06E-02	630	2.57E-02	735	1.41E-03
425	1.06E-03	530	2.13E-02	635	2.37E-02	740	1.20E-03
430	1.97E-03	535	2.18E-02	640	2.16E-02	745	1.03E-03
435	3.79E-03	540	2.25E-02	645	1.95E-02	750	8.80E-04
440	7.37E-03	545	2.33E-02	650	1.74E-02	755	7.51E-04
445	1.42E-02	550	2.41E-02	655	1.55E-02	760	6.38E-04
450	2.81E-02	555	2.51E-02	660	1.37E-02	765	5.51E-04
455	4.21E-02	560	2.62E-02	665	1.20E-02	770	4.75E-04
460	3.66E-02	565	2.75E-02	670	1.04E-02	775	4.00E-04
465	2.64E-02	570	2.88E-02	675	9.11E-03	780	3.41E-04
470	2.29E-02	575	3.01E-02	680	7.89E-03		
475	1.86E-02	580	3.14E-02	685	6.82E-03		
480	1.48E-02	585	3.26E-02	690	5.89E-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

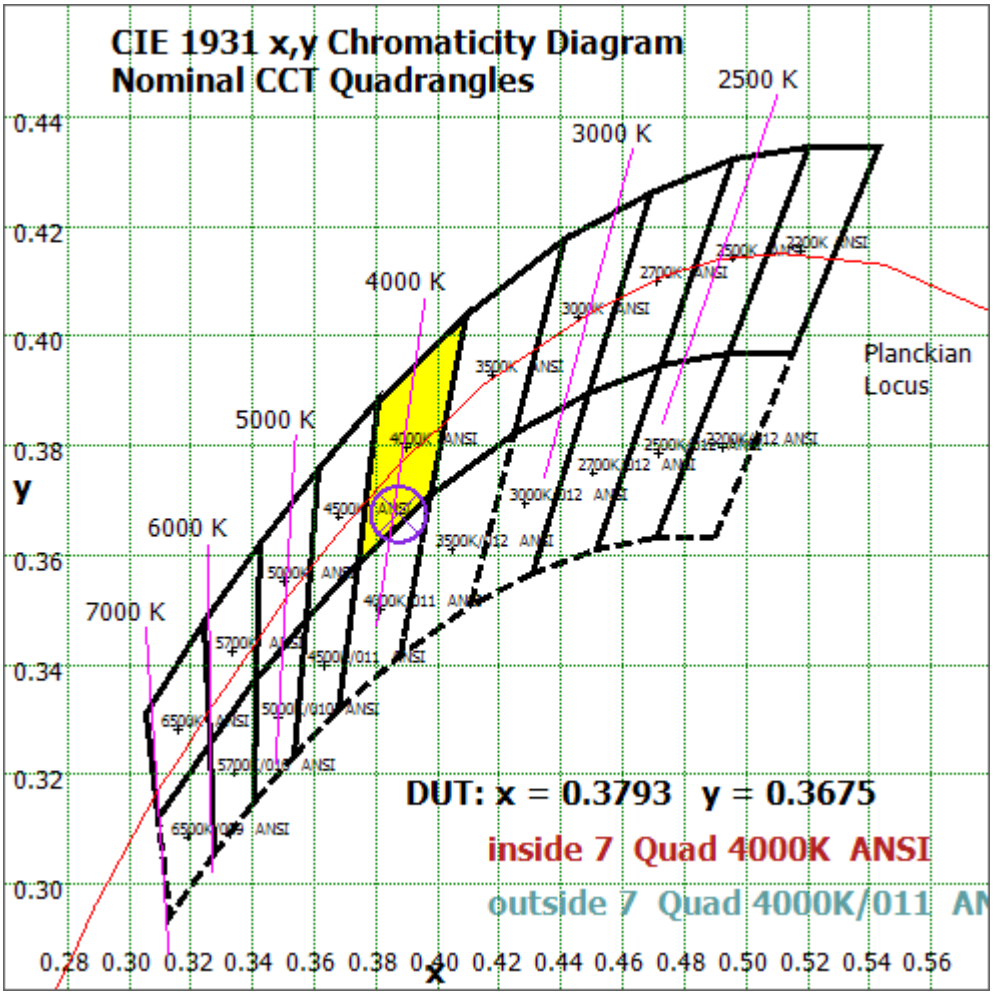


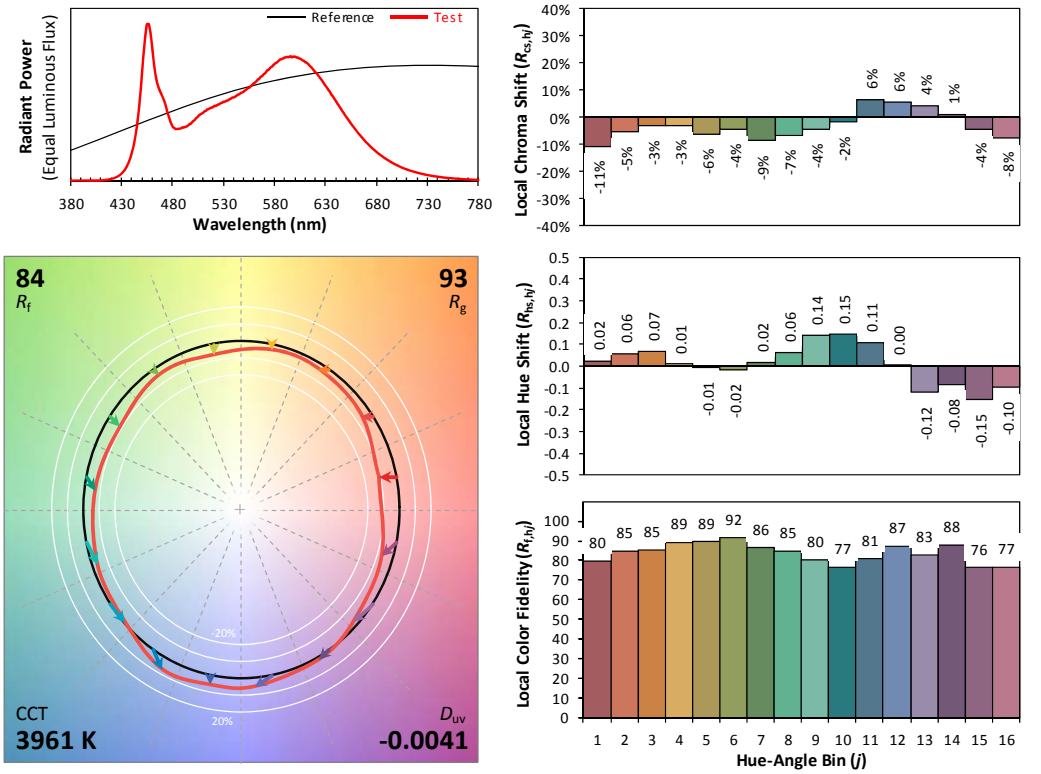
Chart14: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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/A3



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)	0.322	0.153
Power Factor	0.9918	0.9011
Test Power (W)/3	12.75	12.70
THD A%	6.16	8.78
Luminous Efficacy (lm/W)	145.5	146.1
Total Luminous Flux (lm)	1855.2	1855.6
Color Rendering Index (CRI)	86.0	
R9	22.6	
Correlated Color Temperature (CCT)(K)	5074	
Chromaticity Chroma x	0.3427	
Chromaticity Chroma y	0.3458	
Chromaticity Chroma u	0.2120	
Chromaticity Chroma v	0.3210	
Duv	-0.0019	
Chromaticity Chroma u ’	0.2120	
Chromaticity Chroma v’	0.4815	

Special Color Rendering Indices	
R1	87.2
R2	96.8
R3	93
R4	82
R5	86.5
R6	90.6
R7	83.7
R8	68.5
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

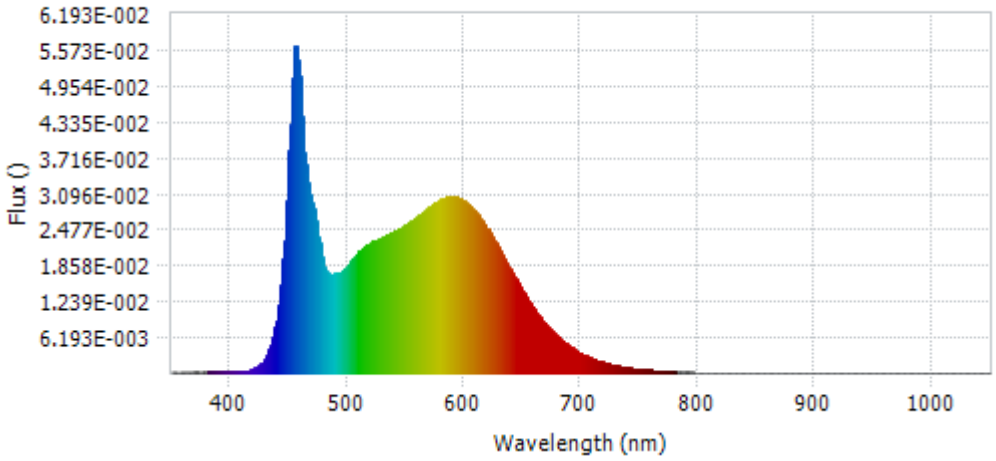
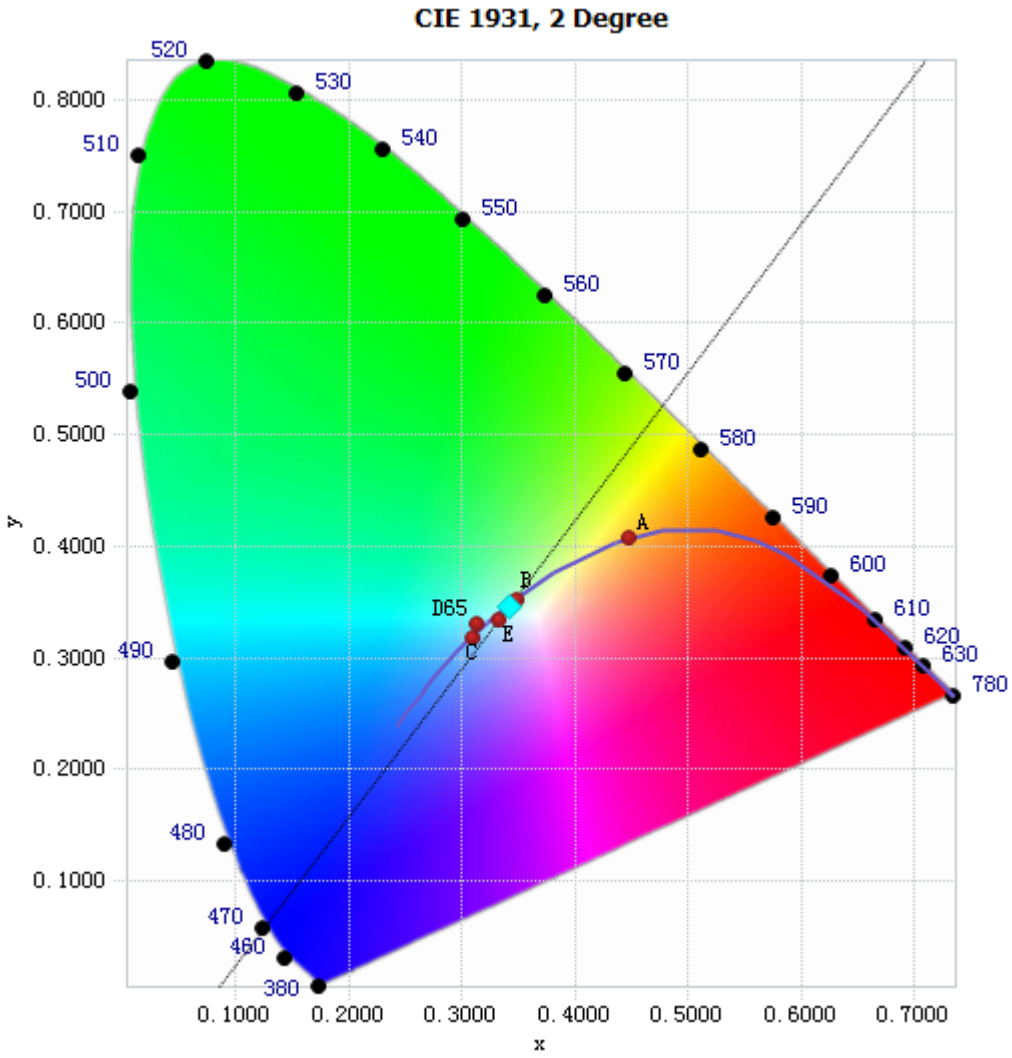


Chart16: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.23E-04	485	1.70E-02	590	3.06E-02	695	3.98E-03
385	2.17E-04	490	1.72E-02	595	3.02E-02	700	3.40E-03
390	2.28E-04	495	1.76E-02	600	2.97E-02	705	2.90E-03
395	2.36E-04	500	1.86E-02	605	2.88E-02	710	2.47E-03
400	2.24E-04	505	1.99E-02	610	2.77E-02	715	2.10E-03
405	2.16E-04	510	2.10E-02	615	2.63E-02	720	1.80E-03
410	2.74E-04	515	2.19E-02	620	2.48E-02	725	1.55E-03
415	4.39E-04	520	2.24E-02	625	2.31E-02	730	1.30E-03
420	7.92E-04	525	2.30E-02	630	2.13E-02	735	1.11E-03
425	1.48E-03	530	2.36E-02	635	1.95E-02	740	9.52E-04
430	2.80E-03	535	2.38E-02	640	1.77E-02	745	8.19E-04
435	5.43E-03	540	2.44E-02	645	1.59E-02	750	6.92E-04
440	1.04E-02	545	2.50E-02	650	1.41E-02	755	5.84E-04
445	1.98E-02	550	2.55E-02	655	1.25E-02	760	5.22E-04
450	3.83E-02	555	2.62E-02	660	1.09E-02	765	4.37E-04
455	5.63E-02	560	2.71E-02	665	9.56E-03	770	3.69E-04
460	4.78E-02	565	2.78E-02	670	8.29E-03	775	3.20E-04
465	3.42E-02	570	2.86E-02	675	7.21E-03	780	2.75E-04
470	2.94E-02	575	2.93E-02	680	6.22E-03		
475	2.34E-02	580	3.00E-02	685	5.38E-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): (0.3427, 0.3458)

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

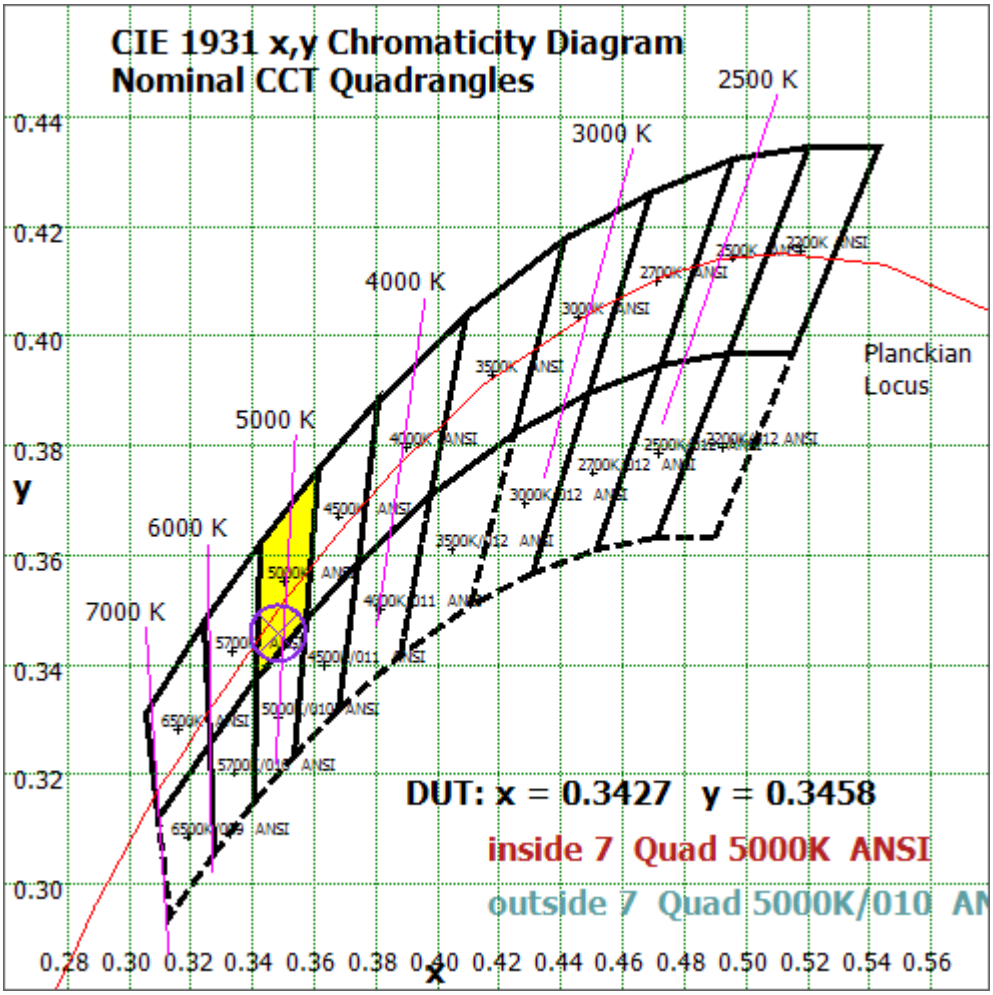


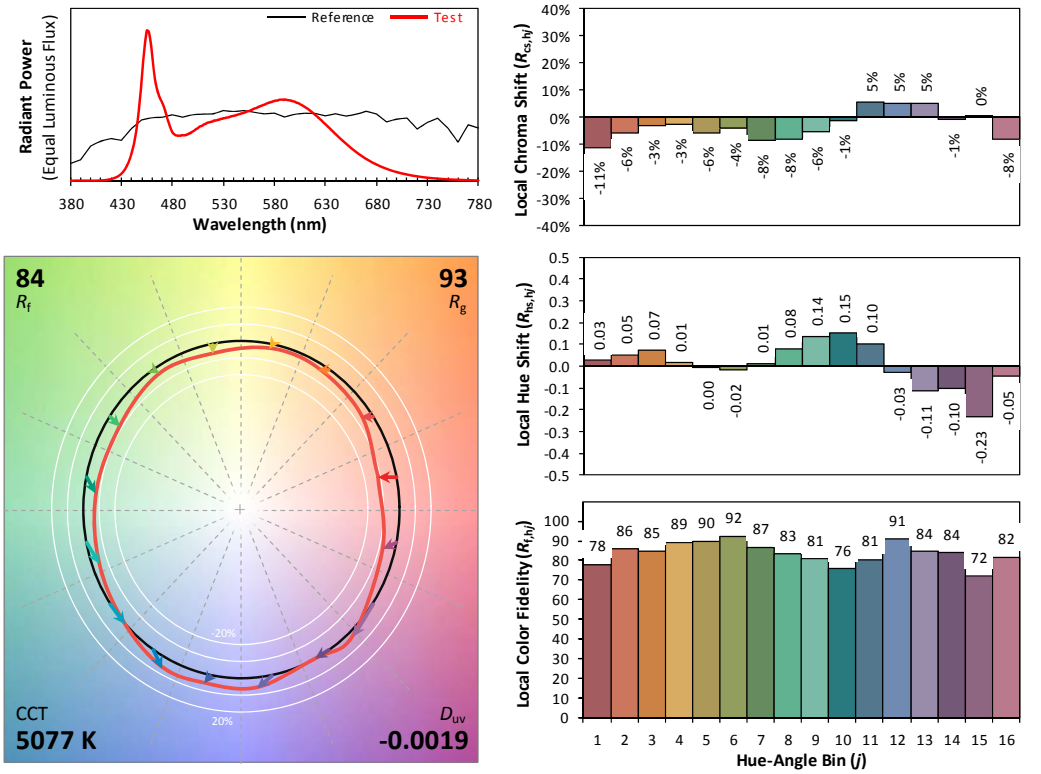
Chart 18: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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/A3



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

x	0.3427
y	0.3458
u'	0.2120
v'	0.4815

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)	0.326	0.155
Power Factor	0.9920	0.9011
Test Power (W)/3	12.92	12.89
THD A%	6.21	8.72
Luminous Efficacy (lm/W)	142.4	142.8
Total Luminous Flux (lm)	1840.2	1841.2
Color Rendering Index (CRI)	84.3	
R9	11.9	
Correlated Color Temperature (CCT)(K)	6521	
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	83.1
R6	88.8
R7	84.3
R8	67.6
R9	11.9
R10	86.5
R11	78.8
R12	59
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

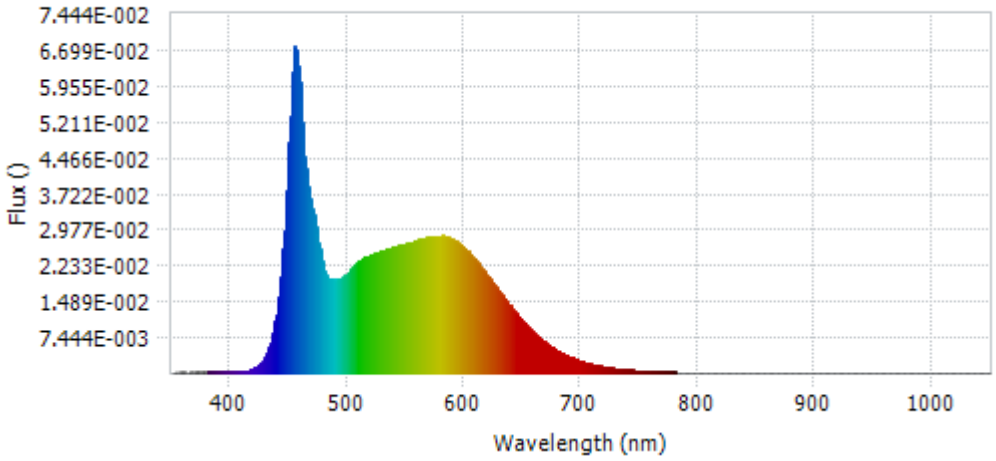
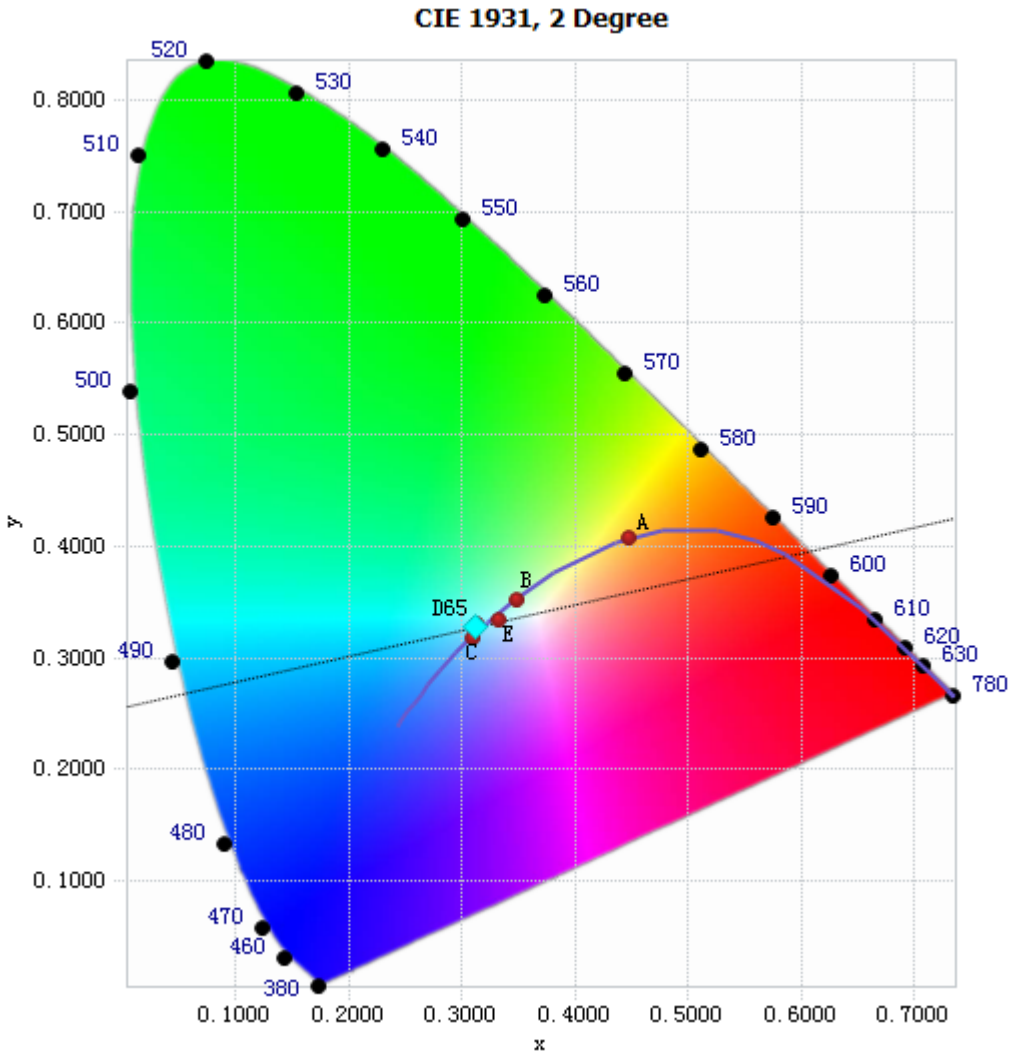


Chart 20: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.54E-04	485	1.95E-02	590	2.78E-02	695	2.93E-03
385	2.40E-04	490	1.94E-02	595	2.69E-02	700	2.50E-03
390	2.69E-04	495	1.97E-02	600	2.60E-02	705	2.12E-03
395	2.42E-04	500	2.08E-02	605	2.47E-02	710	1.81E-03
400	2.42E-04	505	2.20E-02	610	2.33E-02	715	1.55E-03
405	2.54E-04	510	2.31E-02	615	2.18E-02	720	1.33E-03
410	3.53E-04	515	2.41E-02	620	2.02E-02	725	1.14E-03
415	5.73E-04	520	2.44E-02	625	1.85E-02	730	9.77E-04
420	1.06E-03	525	2.50E-02	630	1.69E-02	735	8.27E-04
425	1.95E-03	530	2.55E-02	635	1.53E-02	740	7.07E-04
430	3.78E-03	535	2.56E-02	640	1.37E-02	745	6.07E-04
435	7.32E-03	540	2.60E-02	645	1.21E-02	750	5.11E-04
440	1.38E-02	545	2.64E-02	650	1.07E-02	755	4.56E-04
445	2.58E-02	550	2.67E-02	655	9.44E-03	760	3.92E-04
450	4.80E-02	555	2.70E-02	660	8.21E-03	765	3.31E-04
455	6.77E-02	560	2.75E-02	665	7.13E-03	770	2.92E-04
460	5.62E-02	565	2.79E-02	670	6.19E-03	775	2.56E-04
465	4.03E-02	570	2.81E-02	675	5.35E-03	780	2.19E-04
470	3.43E-02	575	2.84E-02	680	4.59E-03		
475	2.70E-02	580	2.84E-02	685	3.97E-03		
480	2.11E-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

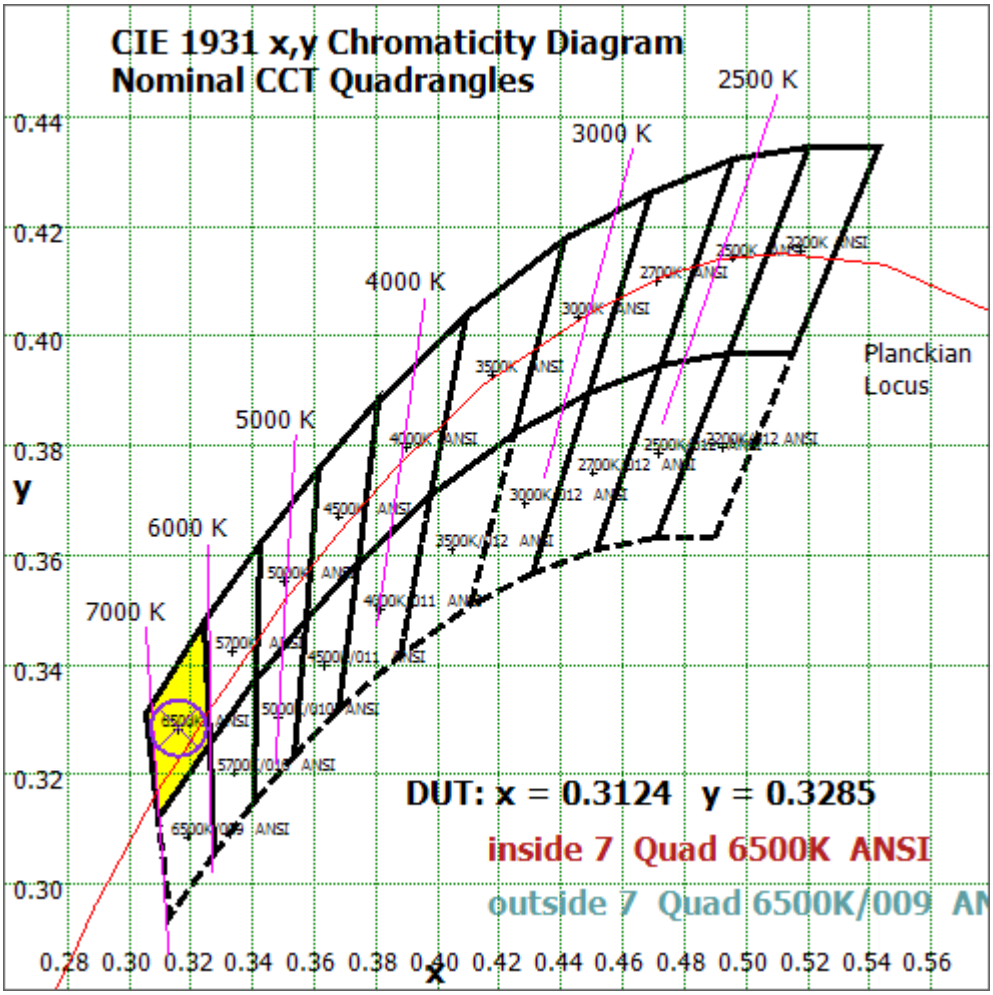


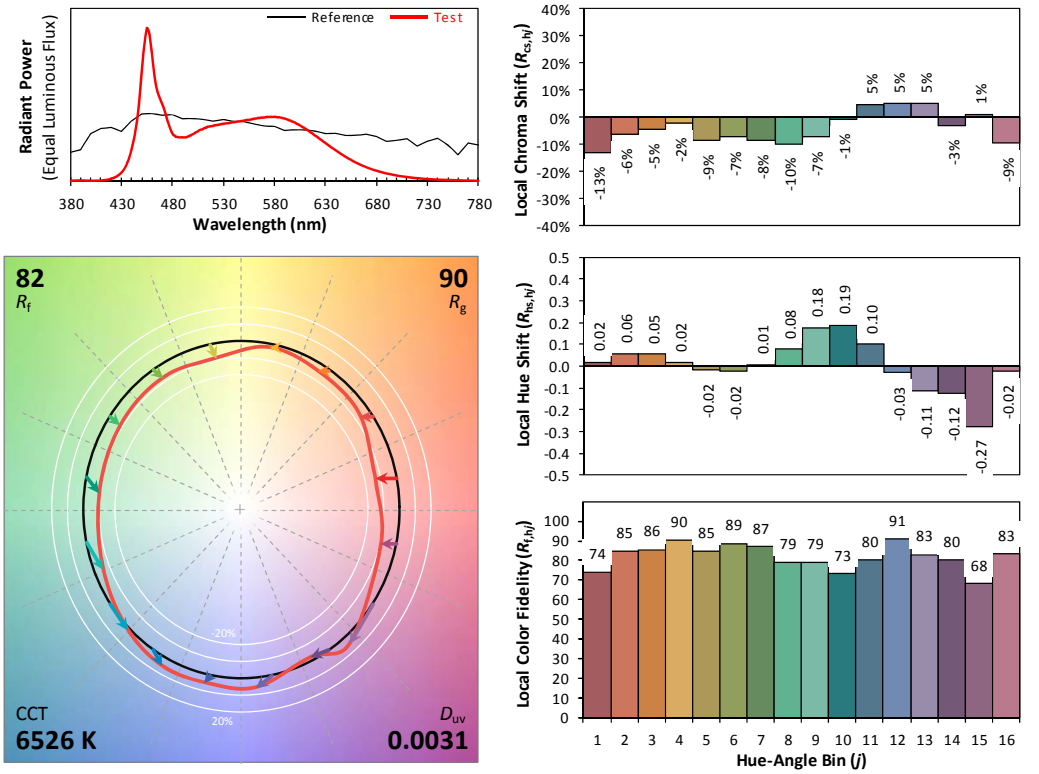
Chart 22: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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/A3



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.

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 ***