

LM-79-19 TEST REPORT

for

ESPEN TECHNOLOGY, INC.

12257 FLORENCE AVE SANTA FE SPRINGS, CA. 90670-3805. LOS ANGELES US

LED Tube

Model: LB31T8U/8T/13P-AB

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ24030021f

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

Review by:

Wei Fei



Approved by:

April Zou

Engineer: Wei Fei
Mar. 18, 2024

Manager: April Zou
Mar. 18, 2024

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	LB31T8U/8T/13P-AB 3500K Setting	LB31T8U/8T/13P-AB 4000K Setting	LB31T8U/8T/13P-AB 5000K Setting
Luminous Efficacy (Lumens /Watt)	127.8	133.4	129.4
Total Luminous Flux (Lumens)	1873.0	1949.9	1950.4
Power (Watts)/2	14.65	14.62	15.07
Power Factor	0.9953	0.9953	0.9953
CCT (K)	3489	4121	5116
CRI	85.3	86.2	84.8
Stabilization Time(Light & Power)	50	50	50
Note	3500K	4000K	5000K

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Oct. 27, 2022
Date of Test	: Oct. 28, 2022
Test item	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
Reference Standard	: IESNA LM-79-2019 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

TABLE OF CONTENT

LM-79-19 TEST REPORT.....	1
TEST SUMMARY	2
SAMPLE PHOTO	5
TEST RESULTS (3500K Setting)	6
Sphere-Spectroradiometer Method.....	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	9
Color Rendition Report – Sphere Spectroradiometer Method	10
Goniophotometer Method	11
Zonal Lumen Tabulation- Goniophotometer Method	12
Illuminance Plots- Goniophotometer Method	13
Luminous Intensity Distribution Plots- Goniophotometer Method.....	14
Luminous Intensity Data- Goniophotometer Method	15
TEST RESULTS (4000K Setting)	17
Sphere-Spectroradiometer Method.....	17
Spectral Power Distribution - Sphere Spectroradiometer Method	18
Chromaticity Diagram - Sphere Spectroradiometer Method.....	19
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	20
Color Rendition Report – Sphere Spectroradiometer Method	21
TEST RESULTS (5000K Setting)	22
Sphere-Spectroradiometer Method.....	22
Spectral Power Distribution - Sphere Spectroradiometer Method	23
Chromaticity Diagram - Sphere Spectroradiometer Method.....	24
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	25
Color Rendition Report – Sphere Spectroradiometer Method	26
EQUIPMENT LIST	27

TEST METHODS	27
Seasoning of SSL Product.....	27
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	27
Goniophotometer Method	28
Photometric and Electrical Measurements	28
Color Characteristics Measurements.....	28

SAMPLE PHOTO

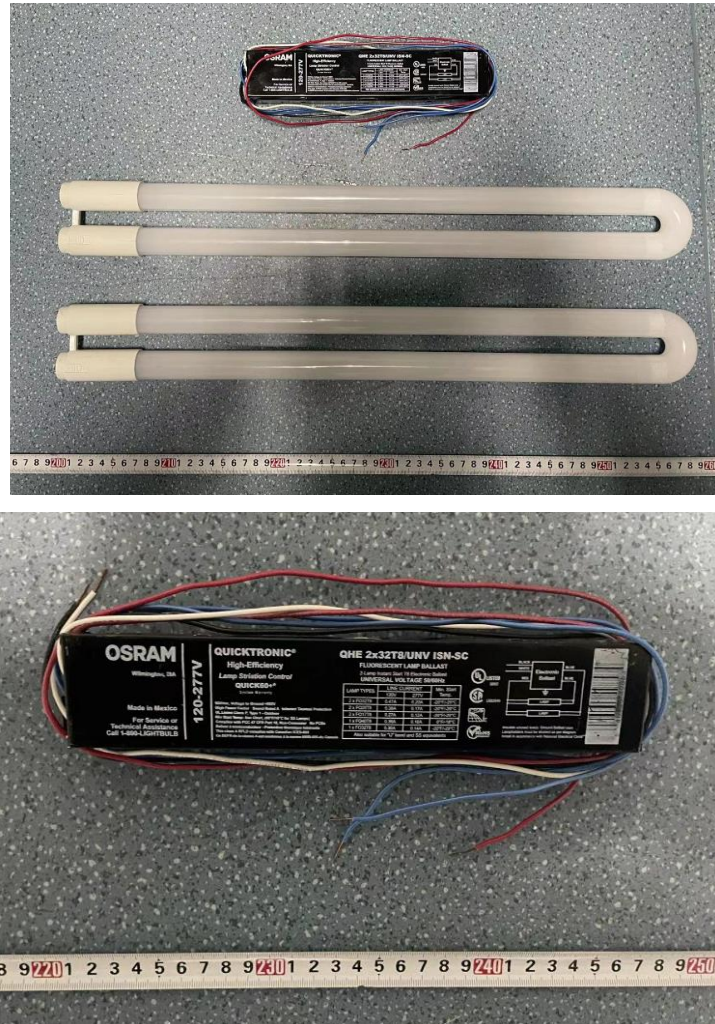


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: LB31T8U/8T/13P-AB
Electrical Ratings	: 120-277V, 50/60Hz, 13W
Product Description	: Color- Tunable 3500K/4000K/5000K LED Tubes supplied by a high frequency fluorescent lamp ballast: QHE 2x32T8/UNV ISN-SC

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)	0.245	0.112
Power Factor	0.9953	0.9550
Test Power (W)/2	14.65	14.80
THD A%	5.68	14.07
Luminous Efficacy (lm/W)	127.8	126.6
Total Luminous Flux (lm)	1873.0	1873.2
Color Rendering Index (CRI)	85.3	
R9	18.6	
Correlated Color Temperature (CCT)(K)	3489	
Chromaticity Chroma x	0.4043	
Chromaticity Chroma y	0.3870	
Chromaticity Chroma u	0.2366	
Chromaticity Chroma v	0.3397	
Duv	-0.0014	
Chromaticity Chroma u'	0.2366	
Chromaticity Chroma v'	0.5096	

Special Color Rendering Indices	
R1	84.3
R2	90.7
R3	95.9
R4	85.5
R5	84.8
R6	88.3
R7	86
R8	66.6
R9	18.6
R10	78.7
R11	86.3
R12	73.4
R13	85.7
R14	97.8

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u', v') diagram, $u' = u = 4x/(-2x+12y+3)$, $v' = 3v/2 = 9y/(-2x+12y+3)$.

Spectral Power Distribution - Sphere Spectroradiometer Method

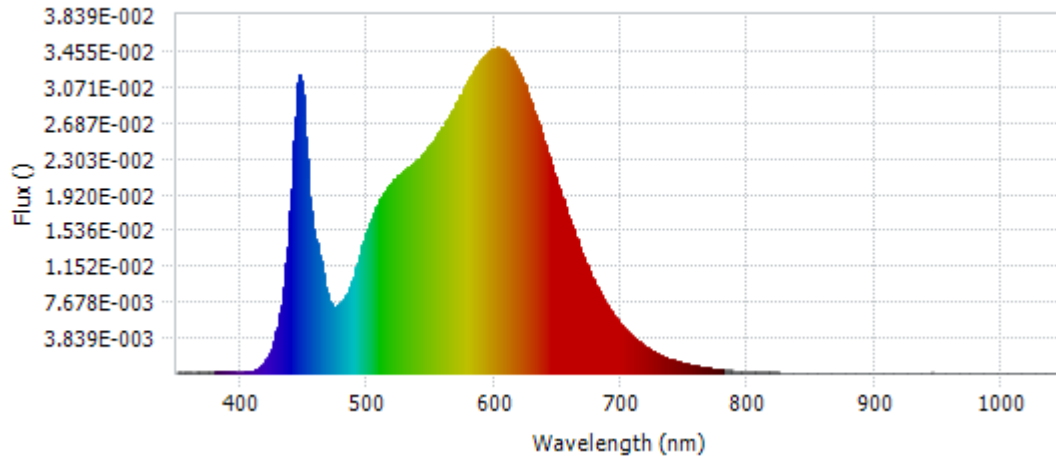
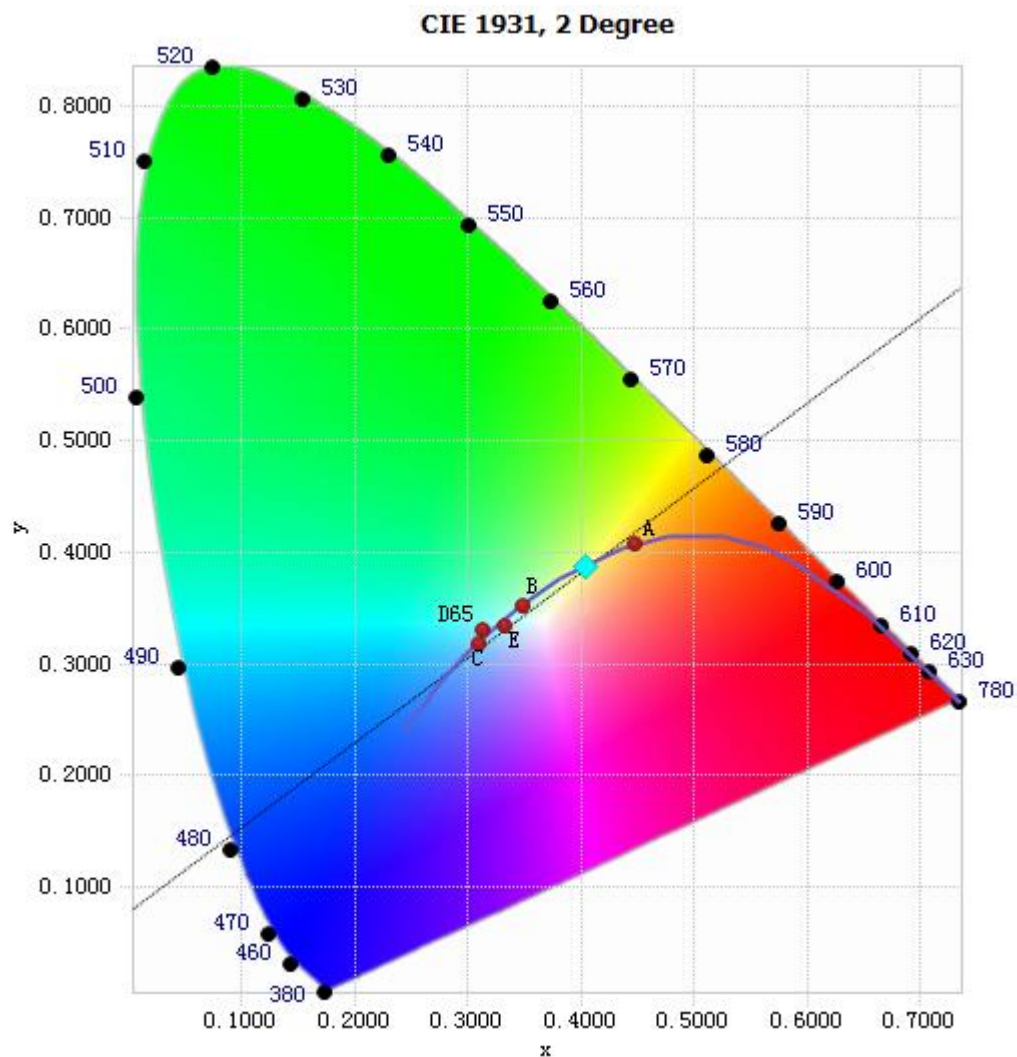


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.65E-04	485	8.94E-03	590	3.36E-02	695	6.09E-03
385	1.50E-04	490	1.09E-02	595	3.43E-02	700	5.21E-03
390	1.26E-04	495	1.32E-02	600	3.46E-02	705	4.45E-03
395	1.05E-04	500	1.54E-02	605	3.48E-02	710	3.80E-03
400	9.93E-05	505	1.72E-02	610	3.43E-02	715	3.25E-03
405	1.37E-04	510	1.86E-02	615	3.34E-02	720	2.79E-03
410	2.89E-04	515	1.98E-02	620	3.21E-02	725	2.37E-03
415	6.94E-04	520	2.06E-02	625	3.04E-02	730	2.01E-03
420	1.46E-03	525	2.12E-02	630	2.86E-02	735	1.70E-03
425	2.93E-03	530	2.18E-02	635	2.65E-02	740	1.45E-03
430	5.72E-03	535	2.23E-02	640	2.44E-02	745	1.23E-03
435	1.05E-02	540	2.29E-02	645	2.23E-02	750	1.04E-03
440	1.98E-02	545	2.37E-02	650	2.02E-02	755	8.93E-04
445	3.10E-02	550	2.45E-02	655	1.81E-02	760	7.73E-04
450	2.76E-02	555	2.55E-02	660	1.62E-02	765	6.57E-04
455	1.74E-02	560	2.65E-02	665	1.43E-02	770	5.55E-04
460	1.39E-02	565	2.76E-02	670	1.25E-02	775	4.82E-04
465	1.06E-02	570	2.90E-02	675	1.10E-02	780	4.04E-04
470	7.74E-03	575	3.02E-02	680	9.53E-03		
475	7.18E-03	580	3.15E-02	685	8.25E-03		
480	7.75E-03	585	3.27E-02	690	7.11E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4043, 0.3870)

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

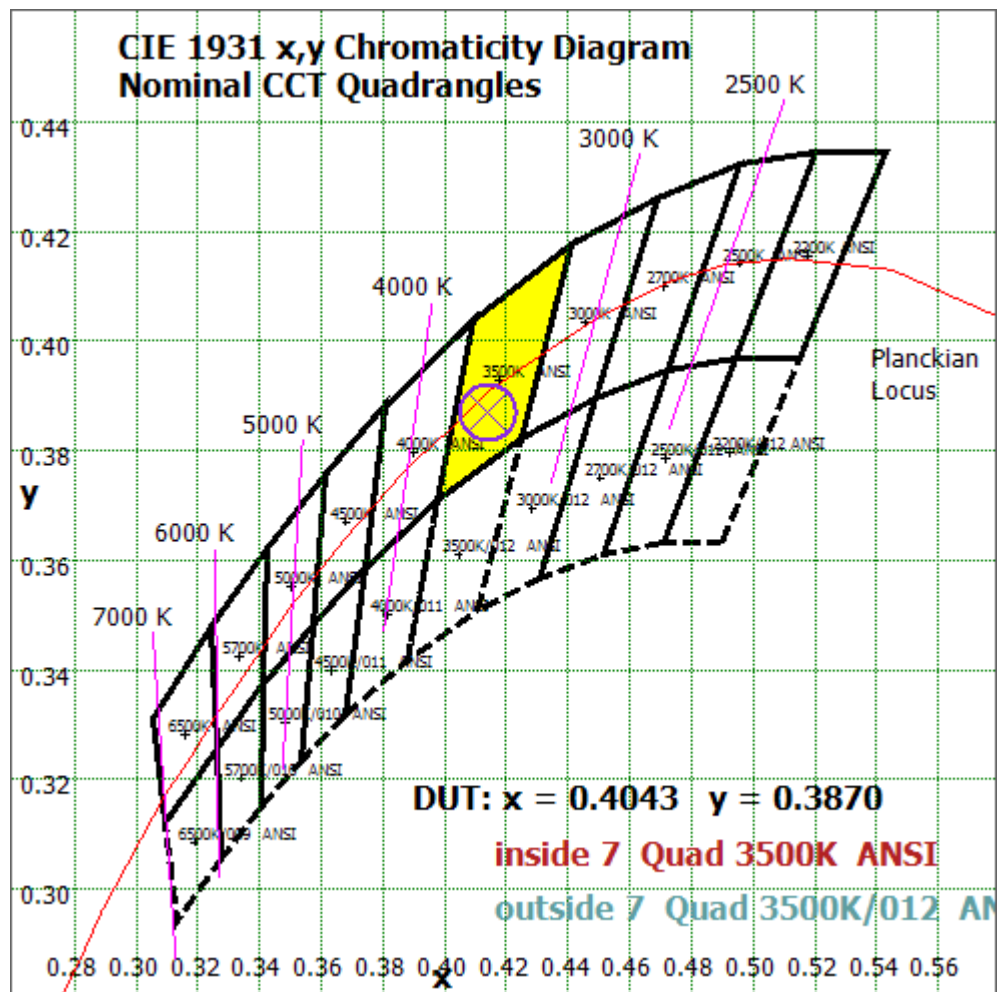


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

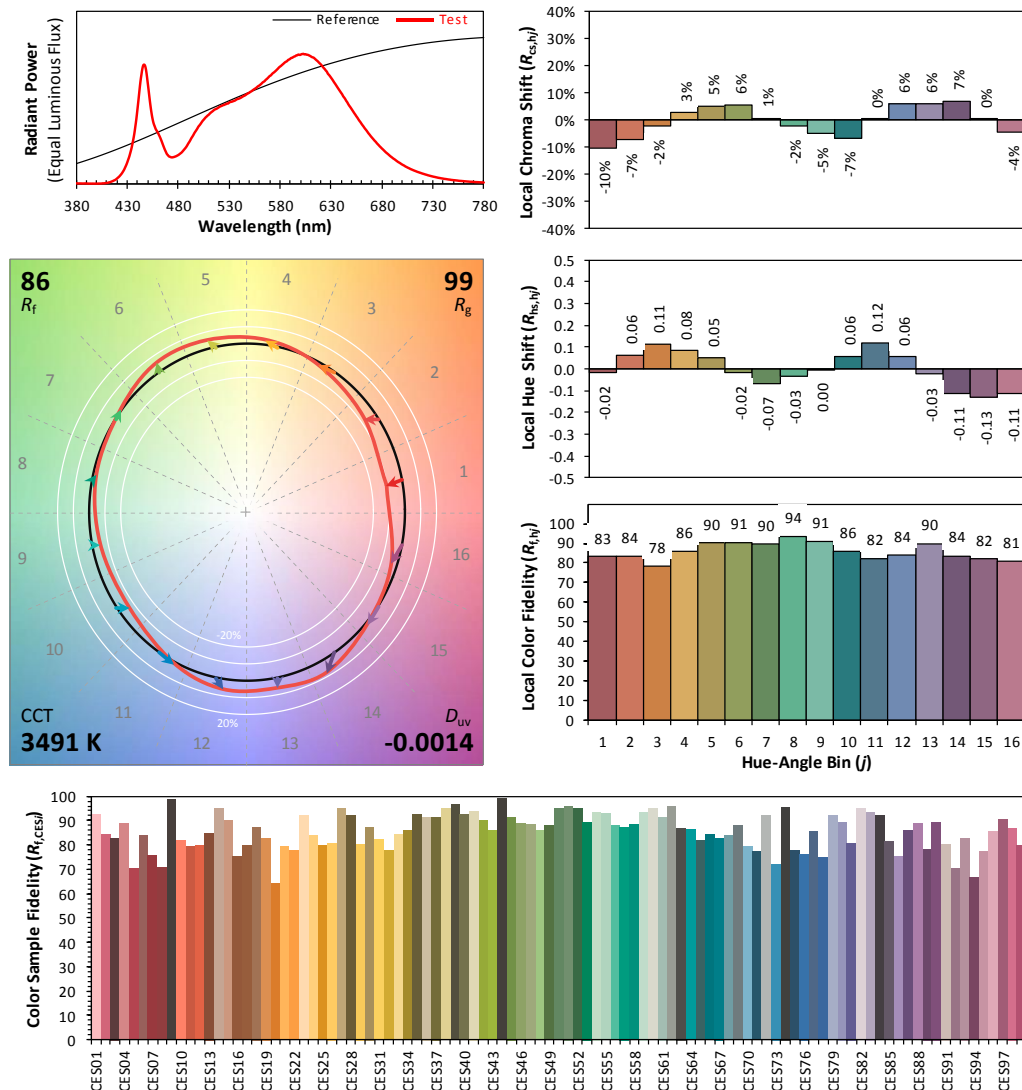
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: ESPEN TECHNOLOGY, INC.

Date: 2022/10/28

Model: LB31T8U/8T/13P-AB



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

x 0.4043
 y 0.3870
 u' 0.2366
 v' 0.5096

CIE 13.3-1995
(CRI)
 R_a 85
 R_9 19

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 25.0 °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)	0.041
Power Factor	0.9959
Power (W)/2	14.66
Luminous Efficacy (lm/W)	128.6
Total Luminous Flux (lm)	1885.3
Beam Angle (°)	107.8 (0°-180°) / 146.6 (90°-270°)
Center Beam Candle Power (cd)	414
Maximum Beam Candle Power (cd)	414.9 (At: C=240.0, Gamma=2.5)
Spacing Criteria	1.25 (0°-180°) / 1.42 (90°-270°)
Zonal Lumens in the 0°-60° Zone	54.35%
Zonal Lumens in the 60°-90° Zone	25.00%
Zonal Lumens in the 90°-120° Zone	11.34%
Zonal Lumens in the 120°-180° Zone	9.31%

Table 4: Test data per Goniophotometer Method

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	39.275	2.08%
10- 20	113.348	6.01%
20- 30	174.9	9.28%
30- 40	218.064	11.57%
40- 50	239.891	12.72%
50- 60	239.242	12.69%
60- 70	211.14	11.20%
70- 80	159.701	8.47%
80- 90	100.388	5.32%
90-100	70.985	3.77%
100-110	70.875	3.76%
110-120	71.961	3.82%
120-130	64.99	3.45%
130-140	49.59	2.63%
140-150	33.728	1.79%
150-160	19.195	1.02%
160-170	7.136	0.38%
170-180	0.842	0.04%
Total	1885.3	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1024.72	54.35%
60- 90	471.229	25.00%
0-90	1495.95	79.35%
90- 180	389.302	20.65%
0- 180	1885.3	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

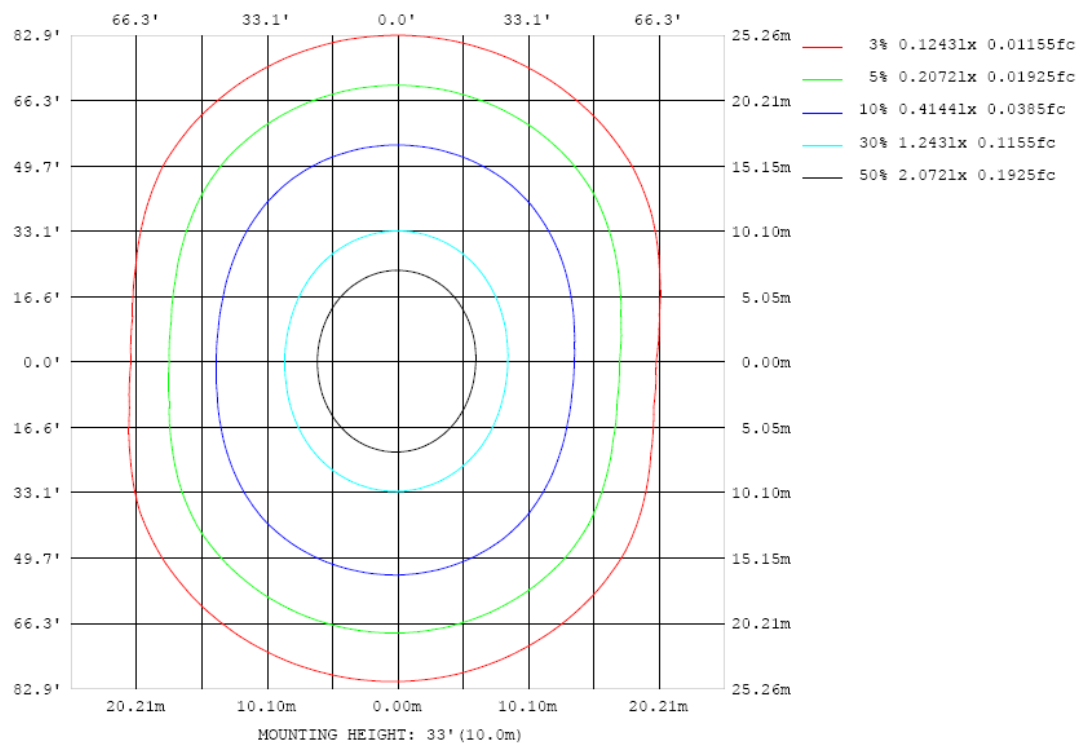


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

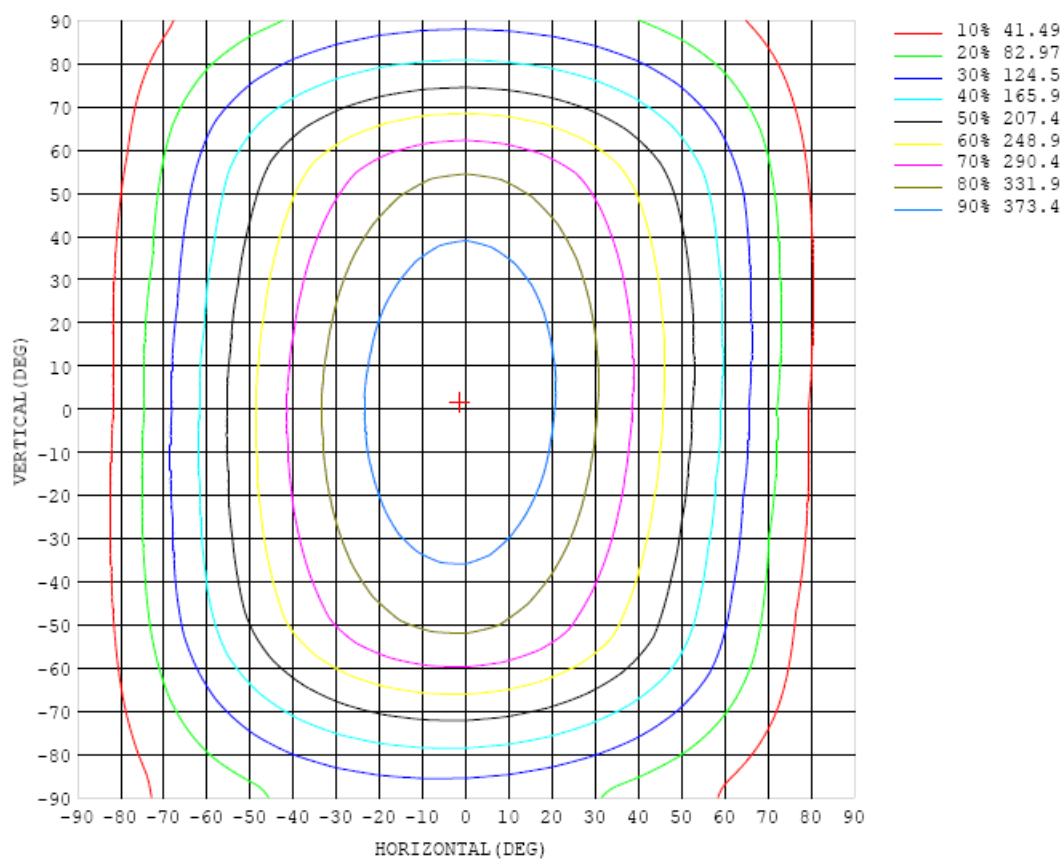


Chart 6: Isocandela Plot

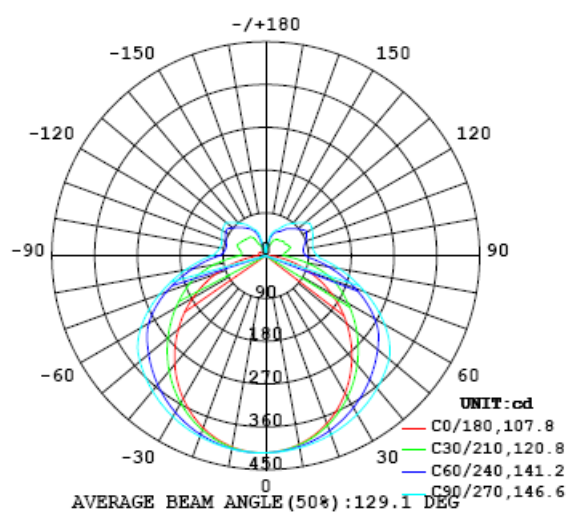


Chart 7: Polar Candela Distribution

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	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414
5	411	411	411	411	411	412	412	412	413	413	413	413	413	413	413	413	413	413	414
10	403	403	403	404	405	406	407	409	410	410	411	411	410	410	409	409	408	408	408
15	391	391	392	394	396	398	401	403	405	406	406	406	405	404	402	401	399	398	399
20	375	375	377	380	383	387	392	395	398	400	401	400	398	395	392	389	387	385	385
25	356	356	359	363	369	375	381	387	391	393	394	392	389	385	380	375	371	368	368
30	334	334	338	344	352	360	369	376	382	385	385	383	379	373	366	359	353	348	347
35	309	309	314	322	333	344	355	364	371	375	376	373	367	359	350	340	332	326	324
40	282	282	289	299	313	327	340	351	360	364	365	361	354	344	332	319	308	301	298
45	253	254	262	275	291	308	324	337	347	352	352	348	339	327	313	298	284	274	270
50	223	224	234	250	269	289	307	322	333	339	339	334	324	310	293	275	258	245	240
55	191	193	206	225	247	269	290	304	313	317	318	314	306	292	272	252	232	215	209
60	160	162	177	200	225	248	265	276	284	289	289	287	280	269	252	228	205	185	177
65	128	131	149	175	202	220	234	244	252	256	257	254	249	239	226	205	178	155	144
70	96.0	100	122	151	172	187	200	210	217	222	222	220	215	206	194	178	153	126	112
75	65.6	71.0	97.3	121	139	154	166	177	184	188	189	187	181	172	160	145	126	97.7	79.8
80	38.6	45.5	70.3	88.9	106	121	134	145	152	157	158	155	149	140	128	113	94.8	72.4	50.2
85	16.8	24.2	40.8	58.6	75.4	90.7	104	115	123	127	128	125	119	109	97.1	82.2	65.0	46.4	27.1
90	2.61	5.49	20.6	38.7	56.2	71.3	85.0	96.0	104	108	109	106	99.9	90.1	77.5	62.6	46.4	29.1	16.6
95	1.21	7.80	21.1	37.2	53.3	67.5	80.3	90.6	98.1	102	103	100	94.4	85.3	73.6	60.4	45.0	29.6	15.8
100	1.70	8.27	28.3	42.5	56.3	68.7	80.1	89.6	96.4	100	101	98.8	93.2	85.1	74.6	63.0	49.7	32.4	15.4
105	2.43	11.0	30.9	50.3	63.1	73.7	83.7	92.0	98.2	102	102	100	95.3	88.2	79.1	68.9	55.1	32.0	15.2
110	3.22	11.3	29.9	54.1	70.2	80.2	89.2	96.6	102	105	106	104	99.5	93.2	84.6	74.4	53.5	32.4	15.4
115	2.45	13.9	31.3	51.9	73.9	86.1	94.6	101	106	109	110	108	104	97.8	89.4	72.8	51.7	33.4	15.7
120	1.83	13.0	30.9	49.1	69.6	87.3	99.1	105	110	112	113	111	107	101	86.2	68.8	50.6	34.6	14.4
125	3.07	12.9	33.0	48.7	65.6	81.1	95.2	106	112	115	115	113	106	94.6	80.4	65.5	50.0	34.5	9.53
130	5.25	11.1	33.6	47.3	60.7	75.5	87.6	97.4	104	108	108	104	97.1	87.4	75.4	62.8	49.7	32.7	8.51
135	4.50	10.8	33.8	44.6	57.7	69.4	80.7	89.0	94.9	98.0	97.9	94.9	89.1	81.0	71.0	60.7	49.6	34.4	8.31
140	2.74	10.7	30.1	43.0	51.5	64.4	74.0	81.3	86.3	89.0	89.0	86.6	81.9	75.3	67.3	59.0	48.1	31.4	7.69
145	2.20	7.92	23.7	41.4	50.6	57.9	66.4	74.4	78.7	80.9	81.0	79.1	75.1	70.4	64.1	57.3	47.0	26.3	6.70
150	2.65	6.44	21.1	38.5	48.8	54.8	59.2	64.7	68.5	70.6	70.8	69.3	66.9	64.2	60.2	53.1	41.9	21.7	5.19
155	4.19	10.1	18.3	33.9	45.6	51.4	55.4	58.4	59.9	61.1	61.7	61.2	60.0	58.2	53.1	46.1	33.5	18.5	3.25
160	6.84	8.41	15.4	23.4	38.7	45.6	51.1	53.5	55.0	56.2	56.7	55.9	53.5	51.5	46.5	38.5	23.6	15.2	2.76
165	9.24	4.05	8.17	19.1	23.5	31.0	41.1	44.5	46.0	47.9	48.2	47.1	45.7	41.8	32.8	24.4	17.3	9.33	2.20
170	11.2	3.88	10.0	8.19	15.3	20.9	23.2	24.6	27.0	28.5	28.7	27.7	25.3	22.3	16.5	14.1	9.78	6.86	2.00
175	11.1	6.91	3.10	6.29	9.58	8.54	8.84	11.3	12.9	13.3	14.0	12.5	9.24	7.75	6.73	5.96	5.28	5.53	1.78
180	6.72	7.12	7.51	7.75	7.04	3.76	0.00	0.00	0.00	0.00	0.00	0.00	2.76	4.45	5.01	3.16	2.59	3.39	6.96

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414	414		
5	414	414	414	414	414	415	415	415	414	414	414	413	413	412	412	412	411		
10	409	409	410	411	411	412	412	413	413	412	411	410	409	407	406	405	404		
15	399	400	402	404	405	407	408	409	409	408	407	405	402	399	397	394	393		
20	386	388	390	393	397	400	403	404	405	404	401	398	393	389	384	380	377		
25	369	371	375	381	386	391	395	398	399	397	394	389	382	376	369	363	359		
30	349	352	358	365	373	381	386	390	391	389	385	378	370	360	351	343	338		
35	325	330	338	348	359	368	376	380	382	380	374	366	355	343	331	321	314		
40	300	306	316	329	342	354	363	369	371	369	362	352	339	325	310	297	287		
45	272	280	293	309	324	338	350	357	359	356	349	337	322	305	287	272	260		
50	243	253	269	287	306	322	335	343	346	343	334	321	304	285	264	245	231		
55	212	225	244	265	286	305	319	327	329	326	318	305	286	264	241	219	201		
60	181	196	219	243	267	284	296	302	304	301	294	283	266	243	217	192	171		
65	149	168	194	221	242	256	265	271	272	270	264	254	240	221	194	166	142		
70	118	140	170	194	210	223	232	237	238	236	230	221	208	191	170	141	114		
75	87.5	115	142	162	177	189	197	202	204	201	196	186	174	159	141	118	86.8		
80	60.0	89.0	111	129	144	156	165	170	171	169	163	154	141	127	109	88.6	62.8		
85	37.8	59.8	80.2	98.3	114	126	134	139	141	139	133	124	111	95.6	77.7	57.7	37.3		
90	21.5	37.5	55.2	71.8	86.4	98.2	107	112	114	111	105	95.8	83.2	67.9	50.5	31.9	13.9		
95	21.6	35.7	51.0	65.7	78.6	89.3	97.1	102	103	101	94.8	86.0	74.4	60.5	45.1	28.8	13.6		
100	21.8	40.7	53.1	65.4	76.6	86.0	92.9	97.1	98.2	95.9	90.6	82.6	72.3	60.1	46.8	33.4	19.5		
105	22.2	44.2	58.9	69.1	78.4	86.3	92.2	95.8	96.7	94.7	90.0	83.1	74.3	64.1	53.3	41.0	20.7		
110	22.8	42.9	64.2	74.5	82.8	89.4	94.4	97.6	98.5	96.7	92.6	86.7	79.3	70.7	60.6	43.7	22.1		
115	20.0	42.3	62.0	79.3	87.3	93.6	98.2	101	102	100	96.9	91.7	85.1	77.1	65.0	42.9	22.7		
120	14.6	41.2	59.1	76.8	91.1	97.0	101	104	105	104	101	96.2	90.2	80.7	61.8	42.7	24.6		
125	9.11	40.8	56.6	72.0	86.6	98.8	104	107	108	107	104	99.8	90.3	75.6	59.3	42.6	25.4		
130	2.72	40.0	54.3	67.9	80.3	91.1	100	106	108	107	102	94.2	83.6	71.1	57.2	42.3	17.4		
135	1.95	34.2	52.5	64.0	74.9	83.8	91.4	96.6	98.7	97.6	93.4	86.5	77.6	67.2	52.9	40.2	15.4		
140	4.02	24.0	51.5	60.5	69.7	77.3	83.7	88.0	89.8	88.9	85.4	79.7	72.4	61.4	49.4	36.6	13.5		
145	4.42	22.1	46.7	58.0	65.1	71.2	76.5	80.2	81.8	81.2	78.3	73.6	65.0	56.2	48.4	22.6	6.50		
150	3.18	12.5	27.9	51.7	61.2	65.3	68.8	70.7	72.4	71.7	68.8	64.9	58.8	53.2	43.3	20.4	6.79		
155	1.89	5.07	24.8	29.4	50.1	57.6	59.5	61.3	62.2	61.9	60.5	58.1	55.1	47.2	25.6	16.7	4.70		
160	4.00	5.96	8.33	25.3	26.2	40.7	49.8	52.8	55.0	55.4	52.9	50.4	41.8	27.2	26.0	9.07	10.2		
165	4.16	1.78	3.79	6.86	17.5	25.2	24.8	27.7	28.7	28.8	28.5	26.7	25.3	25.0	12.1	7.12	14.0		
170	2.39	3.94	2.10	7.05	2.53	5.65	9.53	14.5	17.0	18.9	17.7	15.8	11.0	9.63	5.52	11.9	4.96		
175	1.81	3.59	4.02	1.99	1.58	2.20	4.48	5.92	7.65	8.37	8.92	10.7	10.7	7.72	3.76	2.56	5.97		
180	6.90	6.99	6.86	6.53	5.63	4.92	3.87	2.50	1.26	1.05	1.08	1.70	2.75	3.16	4.04	4.07	4.18		

Table 7: Luminous Intensity Data

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)	0.245	0.112
Power Factor	0.9953	0.9548
Test Power (W)/2	14.62	14.77
THD A%	5.76	14.13
Luminous Efficacy (lm/W)	133.4	132.0
Total Luminous Flux (lm)	1949.9	1950.2
Color Rendering Index (CRI)	86.2	
R9	22.6	
Correlated Color Temperature (CCT)(K)	4121	
Chromaticity Chroma x	0.3743	
Chromaticity Chroma y	0.3701	
Chromaticity Chroma u	0.2237	
Chromaticity Chroma v	0.3318	
Duv	-0.0013	
Chromaticity Chroma u'	0.2237	
Chromaticity Chroma v'	0.4977	

Special Color Rendering Indices	
R1	85.4
R2	91.3
R3	95.3
R4	86.2
R5	85.7
R6	87.8
R7	87.7
R8	70.1
R9	22.6
R10	79.4
R11	86.4
R12	67.8
R13	87
R14	97.6

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

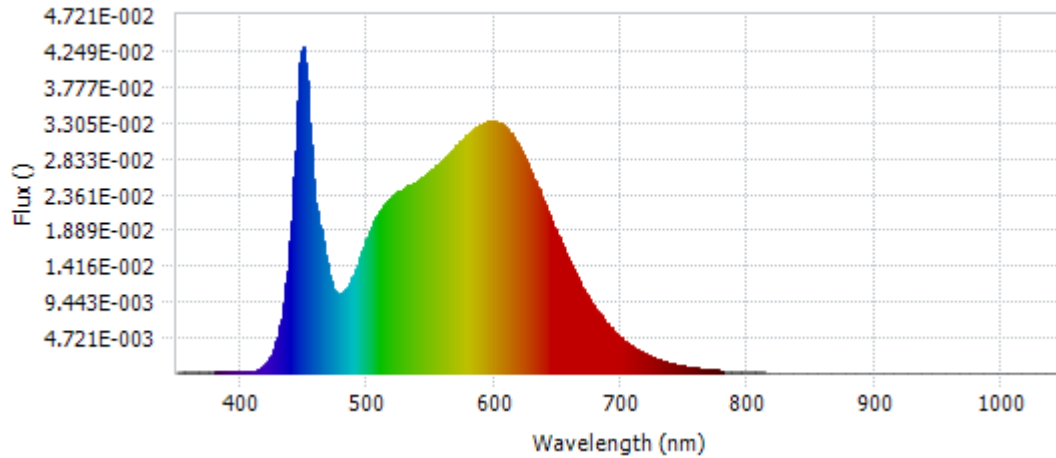
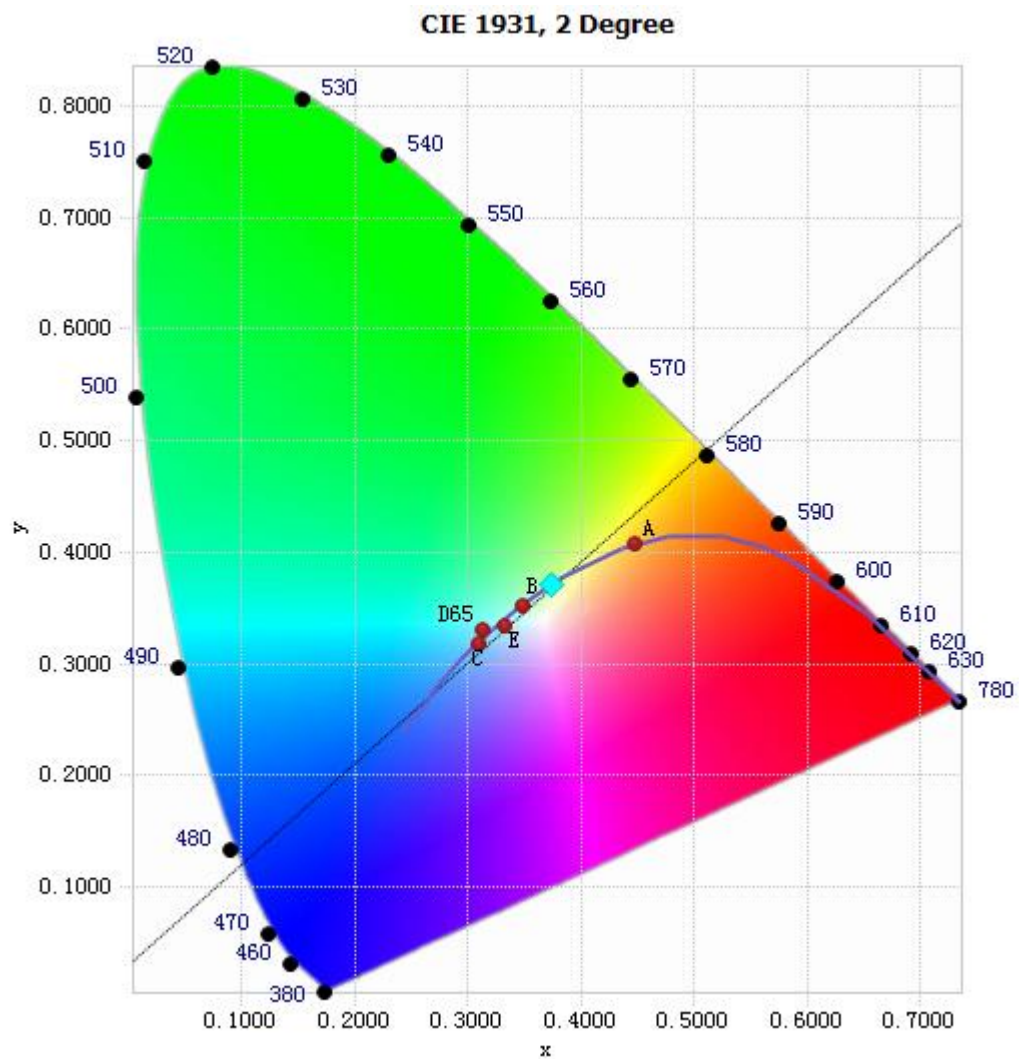


Chart 8: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.86E-04	485	1.17E-02	590	3.27E-02	695	5.41E-03
385	1.88E-04	490	1.34E-02	595	3.31E-02	700	4.64E-03
390	1.95E-04	495	1.57E-02	600	3.32E-02	705	3.97E-03
395	1.57E-04	500	1.81E-02	605	3.29E-02	710	3.37E-03
400	1.42E-04	505	2.00E-02	610	3.22E-02	715	2.88E-03
405	1.68E-04	510	2.14E-02	615	3.11E-02	720	2.47E-03
410	2.99E-04	515	2.27E-02	620	2.97E-02	725	2.11E-03
415	6.37E-04	520	2.34E-02	625	2.80E-02	730	1.77E-03
420	1.33E-03	525	2.39E-02	630	2.61E-02	735	1.52E-03
425	2.76E-03	530	2.45E-02	635	2.41E-02	740	1.30E-03
430	5.47E-03	535	2.49E-02	640	2.22E-02	745	1.10E-03
435	1.05E-02	540	2.53E-02	645	2.01E-02	750	9.34E-04
440	2.00E-02	545	2.60E-02	650	1.82E-02	755	8.00E-04
445	3.58E-02	550	2.66E-02	655	1.63E-02	760	6.88E-04
450	4.21E-02	555	2.74E-02	660	1.45E-02	765	5.81E-04
455	3.02E-02	560	2.82E-02	665	1.28E-02	770	4.95E-04
460	2.14E-02	565	2.91E-02	670	1.12E-02	775	4.28E-04
465	1.74E-02	570	3.00E-02	675	9.78E-03	780	3.60E-04
470	1.29E-02	575	3.08E-02	680	8.51E-03		
475	1.05E-02	580	3.16E-02	685	7.32E-03		
480	1.07E-02	585	3.23E-02	690	6.30E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3743, 0.3701)

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

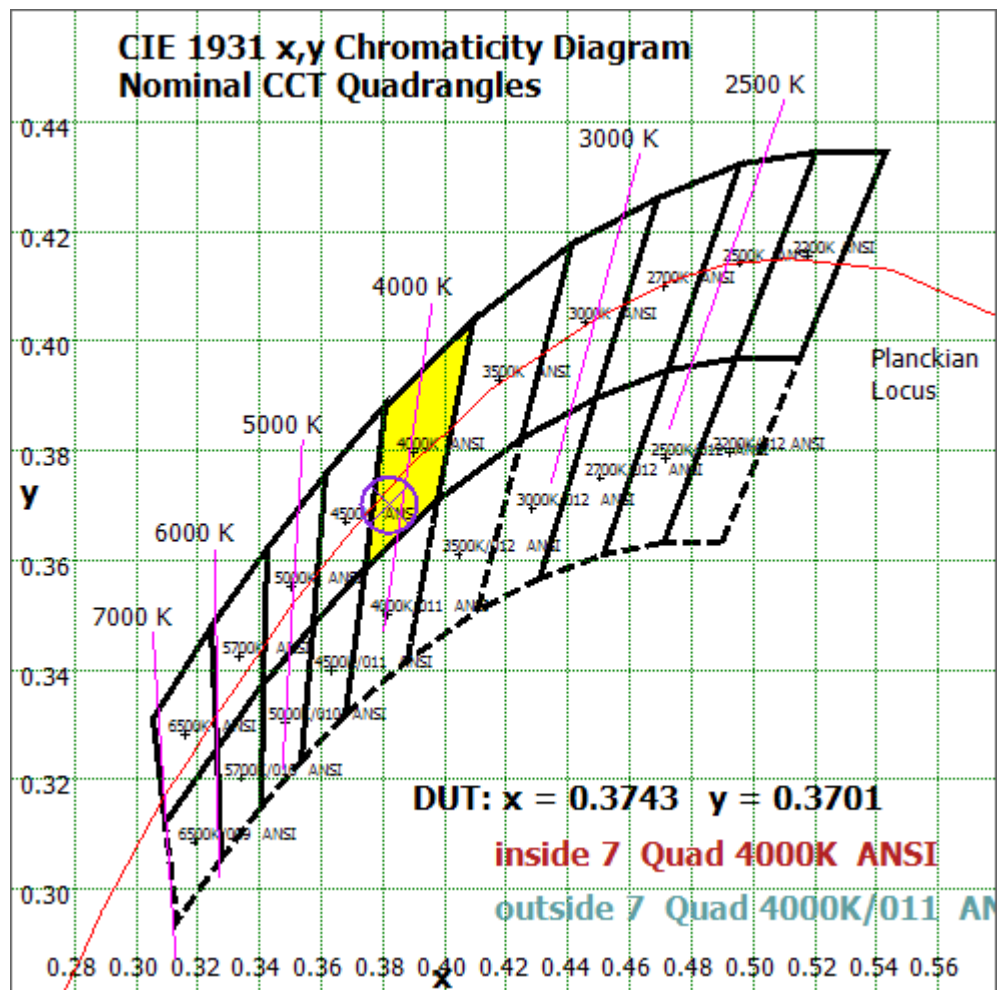


Chart 10: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

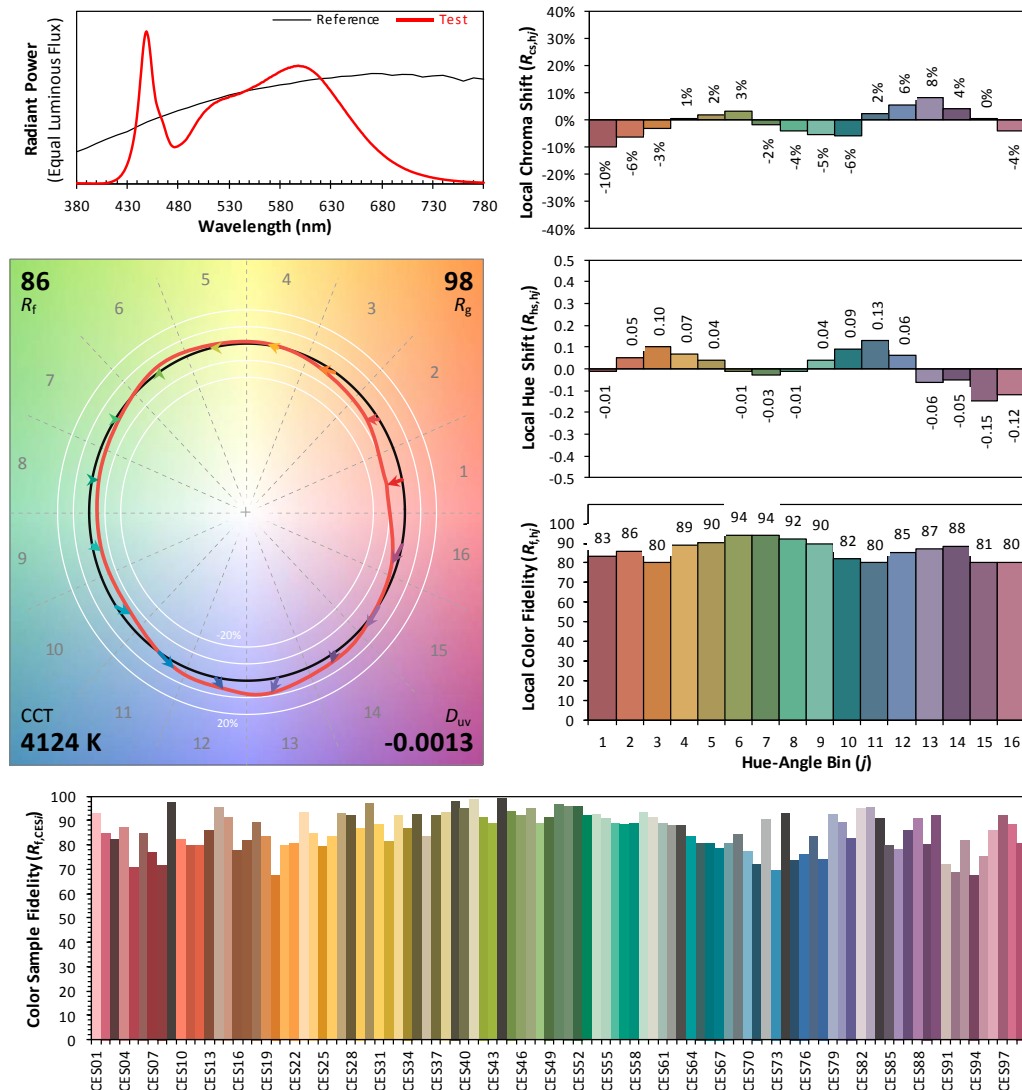
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: ESPEN TECHNOLOGY, INC.

Date: 2022/10/28

Model: LB31T8U/8T/13P-AB



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

x 0.3743
 y 0.3701
 u' 0.2237
 v' 0.4977

CIE 13.3-1995
(CRI)
 R_a 86
 R_g 23

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 (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)	0.252	0.115
Power Factor	0.9953	0.9570
Test Power (W)	15.07	15.21
THD A%	5.75	13.65
Luminous Efficacy (lm/W)	129.4	128.2
Total Luminous Flux (lm)	1950.4	1950.6
Color Rendering Index (CRI)	84.8	
R9	14.5	
Correlated Color Temperature (CCT)(K)	5116	
Chromaticity Chroma x	0.3421	
Chromaticity Chroma y	0.3528	
Chromaticity Chroma u	0.2089	
Chromaticity Chroma v	0.3232	
Duv	0.0018	
Chromaticity Chroma u'	0.2089	
Chromaticity Chroma v'	0.4848	

Special Color Rendering Indices	
R1	83.5
R2	89.4
R3	93.4
R4	85.3
R5	84.4
R6	85.1
R7	87.6
R8	69.8
R9	14.5
R10	74.9
R11	85.5
R12	65.6
R13	85.1
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

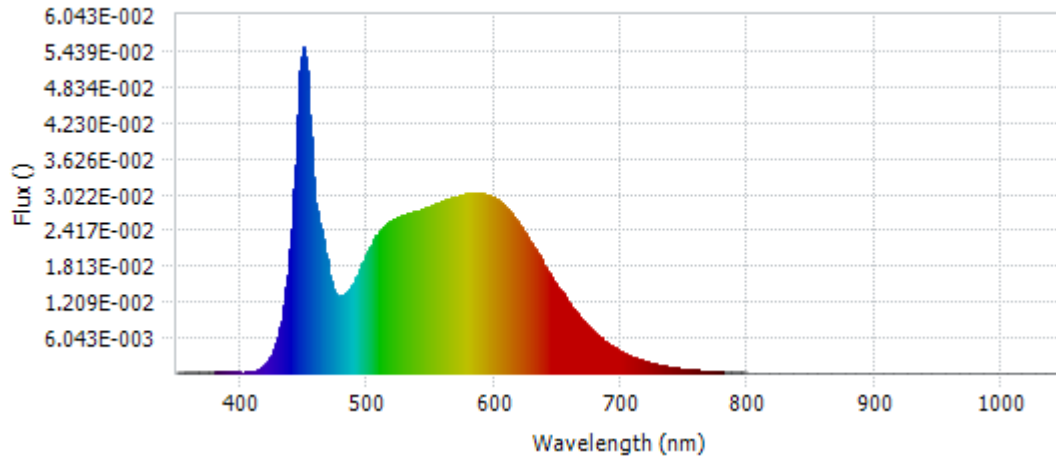
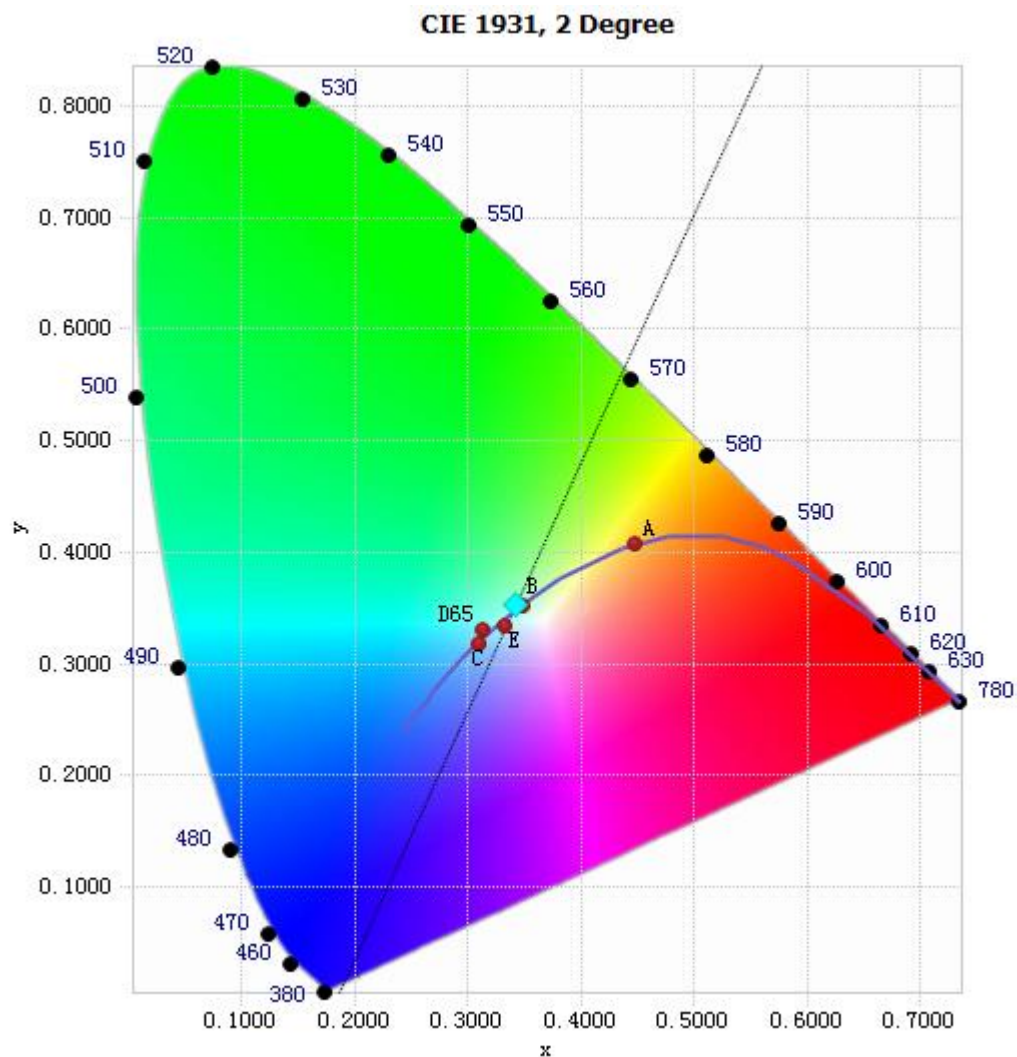


Chart 12: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.42E-04	485	1.40E-02	590	3.02E-02	695	4.28E-03
385	2.16E-04	490	1.56E-02	595	3.00E-02	700	3.64E-03
390	2.23E-04	495	1.80E-02	600	2.96E-02	705	3.09E-03
395	1.90E-04	500	2.05E-02	605	2.89E-02	710	2.64E-03
400	1.70E-04	505	2.25E-02	610	2.77E-02	715	2.27E-03
405	1.99E-04	510	2.40E-02	615	2.65E-02	720	1.94E-03
410	3.65E-04	515	2.52E-02	620	2.50E-02	725	1.65E-03
415	7.61E-04	520	2.59E-02	625	2.33E-02	730	1.40E-03
420	1.68E-03	525	2.63E-02	630	2.15E-02	735	1.20E-03
425	3.40E-03	530	2.67E-02	635	1.98E-02	740	1.03E-03
430	6.79E-03	535	2.71E-02	640	1.81E-02	745	8.59E-04
435	1.29E-02	540	2.74E-02	645	1.63E-02	750	7.48E-04
440	2.42E-02	545	2.78E-02	650	1.46E-02	755	6.37E-04
445	4.34E-02	550	2.82E-02	655	1.30E-02	760	5.50E-04
450	5.46E-02	555	2.87E-02	660	1.15E-02	765	4.62E-04
455	3.97E-02	560	2.90E-02	665	1.02E-02	770	3.93E-04
460	2.74E-02	565	2.94E-02	670	8.86E-03	775	3.42E-04
465	2.25E-02	570	2.98E-02	675	7.70E-03	780	2.95E-04
470	1.67E-02	575	3.01E-02	680	6.70E-03		
475	1.32E-02	580	3.03E-02	685	5.77E-03		
480	1.31E-02	585	3.04E-02	690	4.98E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3421, 0.3528)

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

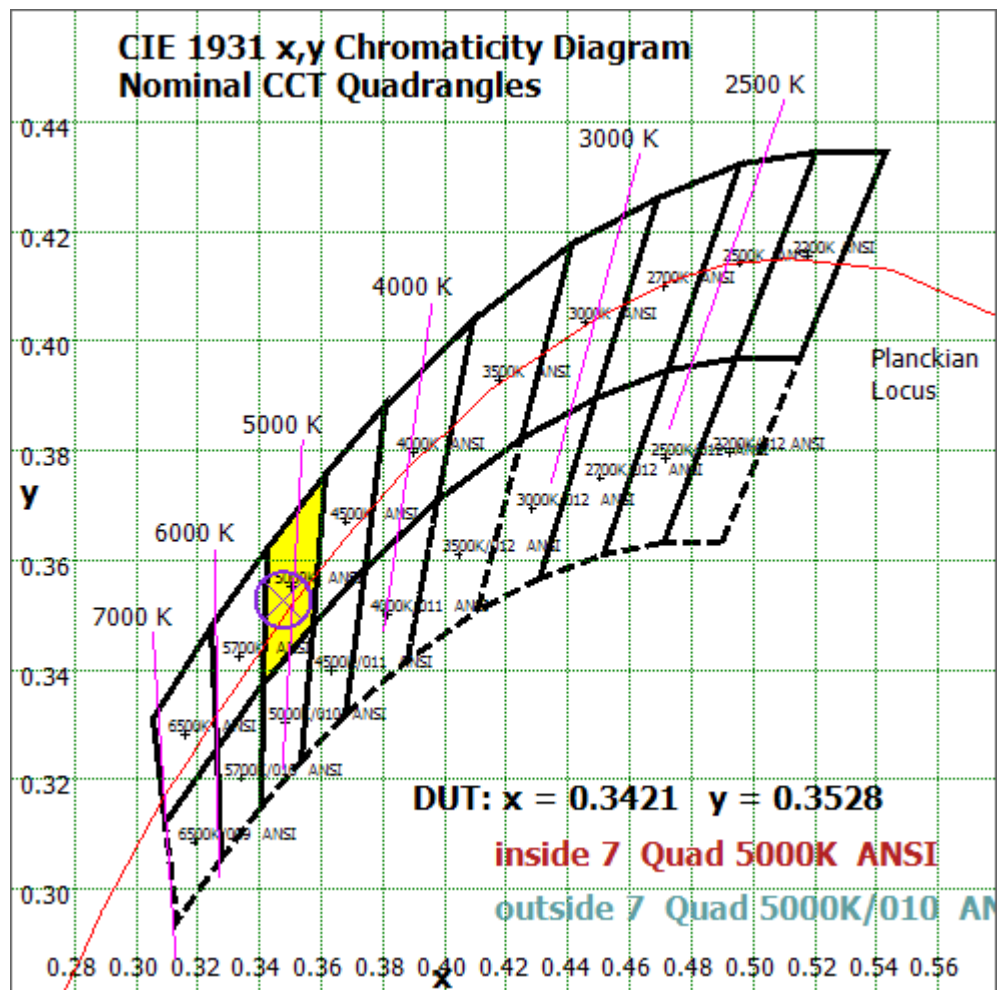


Chart 14: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

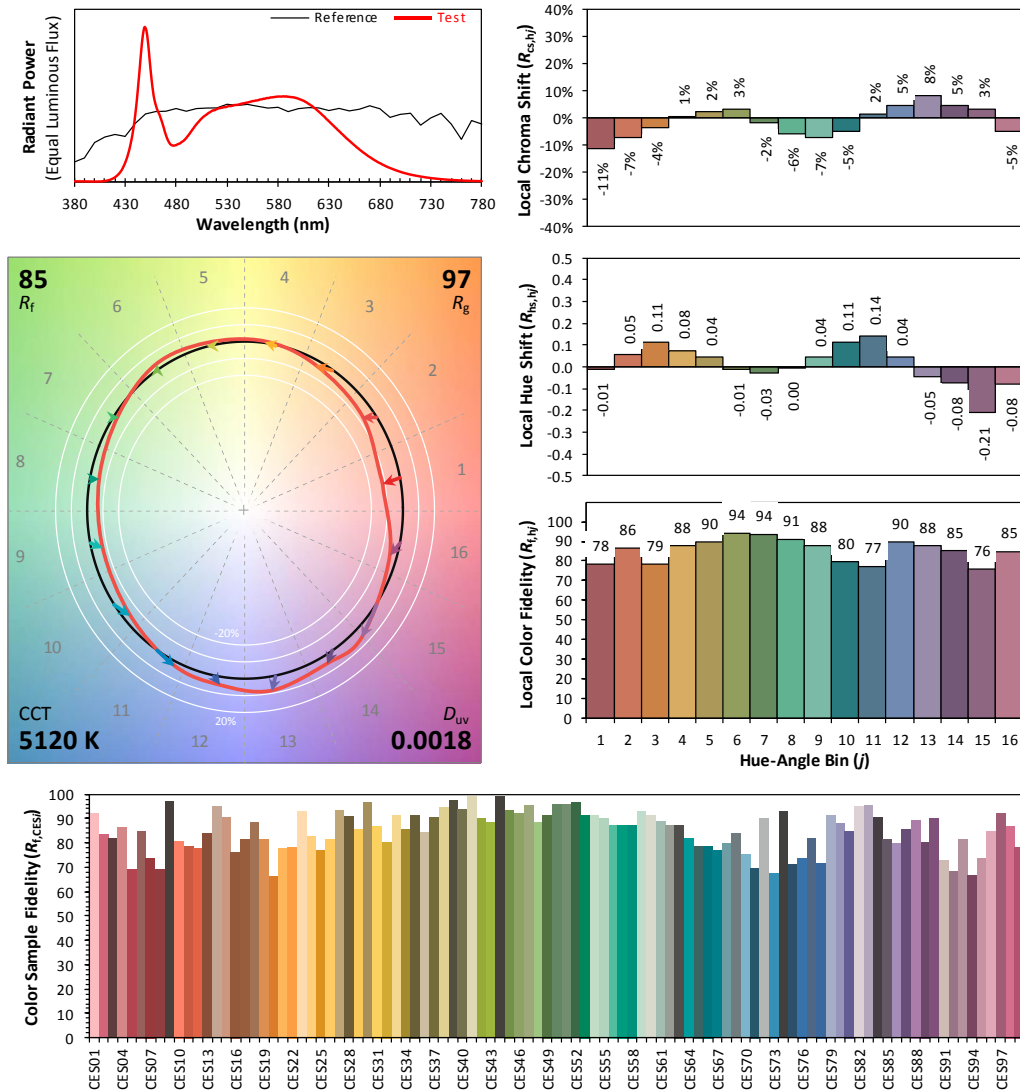
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: ESPEN TECHNOLOGY, INC.

Date: 2022/10/28

Model: LB31T8U/8T/13P-AB



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

x 0.3421
 y 0.3528
 u' 0.2089
 v' 0.4848

CIE 13.3-1995
(CRI)
 R_a 85
 R_g 14

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.

EQUIPMENT LIST

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

Table 12: 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 expanded uncertainty is 2.1% with a coverage factor $k=2$.

Goniophotometer Method

Photometric and Electrical Measurements

An EVERFINE Type C Model GO-R5000 Goniophotometer was used to measure the intensity at each angle of distribution for each sample. The photometric distance is 2.475m for near-field measurement or 30m for far-field measurement. Bandwidth of spectroradiometer is 380nm-780nm.

Ambient temperature was measured at the same height of the sample mounted on the Goniophotometer equipment. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 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 expanded uncertainty is 2.3% with a coverage factor $k=2$.

Color Characteristics Measurements

The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as values that are spatially average, weighted to intensity, over the angular range where light is intentionally emitted from the SSL product. The color characteristics measurements are using gonio-spectroradiometer.

*** End of Report ***

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