LM-79-19 TEST REPORT

for

P.Q.L., Inc.

2285 Ward Avenue / Simi Valley, CA 93065

LED Tube

91474, 91475, 91476

All measurements are the same except CCT.

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ22100009a

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

Review by:

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Nov. 14, 2022

Approved by:

Manager: Jim Zhang
Nov. 14, 2022

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	91459	91474	91475	91476
Luminous Efficacy (Lumens /Watt)	141.1	144.8	149.1	150.5
Total Luminous Flux (Lumens)	1700.8	1812.6	1820.2	1878.7
Power (Watts)	12.05	12.52	12.21	12.48
Power Factor	0.9792	0.9785	0.9785	0.9794
CCT (K)	3068	3519	4000	5141
CRI	82.0	82.0	81.1	84.3
Stabilization Time (Light & Power)	50 mins	50 mins	50 mins	50 mins
Note	3000K	3500K	4000K	5000K

Table 1: Executive Data Summary

Test specifications:

Date of Receipt : Oct. 17, 2022

Date of Test : Oct. 20, 2022 & Nov. 09, 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

ANSI/UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products

UL 1993 Self-Ballasted Lamps and Lamp Adapters

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SAMPLE PHOTO

Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: 91459 - 3000K 91474 - 3500K 91475 - 4000K 91476 - 5000K
Electrical Ratings	: 120-277V, 50/60Hz, 12W
Product Description	: Manufacturer of light source: Bridgelux Inc. Model of LED light source: BXVN-30E-11L-3EJ-000-00-00-0 (3000K) BXVN-35E-11L-3EJ-000-00-00-0 (3500K) BXVN-40E-11L-3EJ-000-00-00-0 (4000K) BXVN-50E-11L-3EJ-000-00-00-0 (5000K)
Manufacturer	: P.Q.L., Inc.
Address	: 2285 Ward Avenue / Simi Valley, CA 93065

TEST RESULTS of 91459

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)	0.103	0.049
Power Factor	0.9792	0.9112
Test Power (W)	12.05	12.43
THD A%	18.08	19.32
Luminous Efficacy (lm/W)	141.1	138.6
Total Luminous Flux (lm)	1700.8	1722.7
Color Rendering Index (CRI)	82.0	
R9	4.1	
Correlated Color Temperature (CCT)(K)	3068	
Chromaticity Chroma x	0.4316	
Chromaticity Chroma y	0.4014	
Chromaticity Chroma u	0.2483	
Chromaticity Chroma v	0.3464	
Duv	-0.0003	
Chromaticity Chroma u '	0.2483	
Chromaticity Chroma v'	0.5195	

Special Color Rendering Indices	
R1	80.8
R2	91.9
R3	94.9
R4	79.1
R5	81
R6	90
R7	81.4
R8	57.3
R9	4.1
R10	81.4
R11	78.4
R12	69.1
R13	83.6
R14	97.9

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

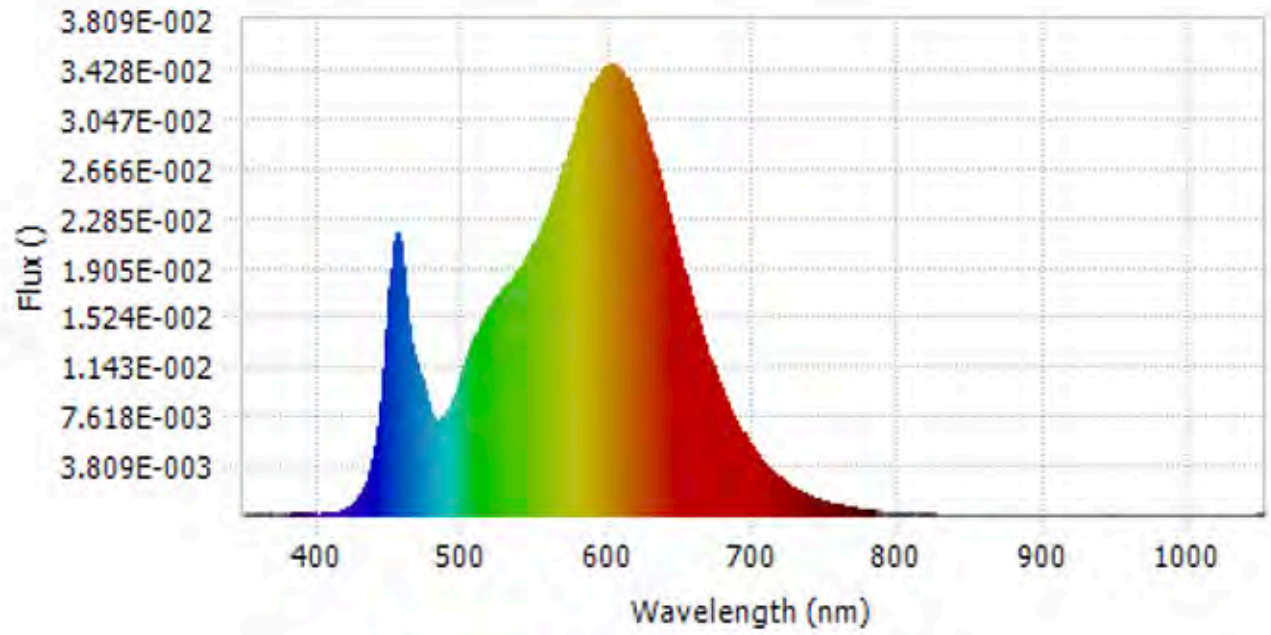
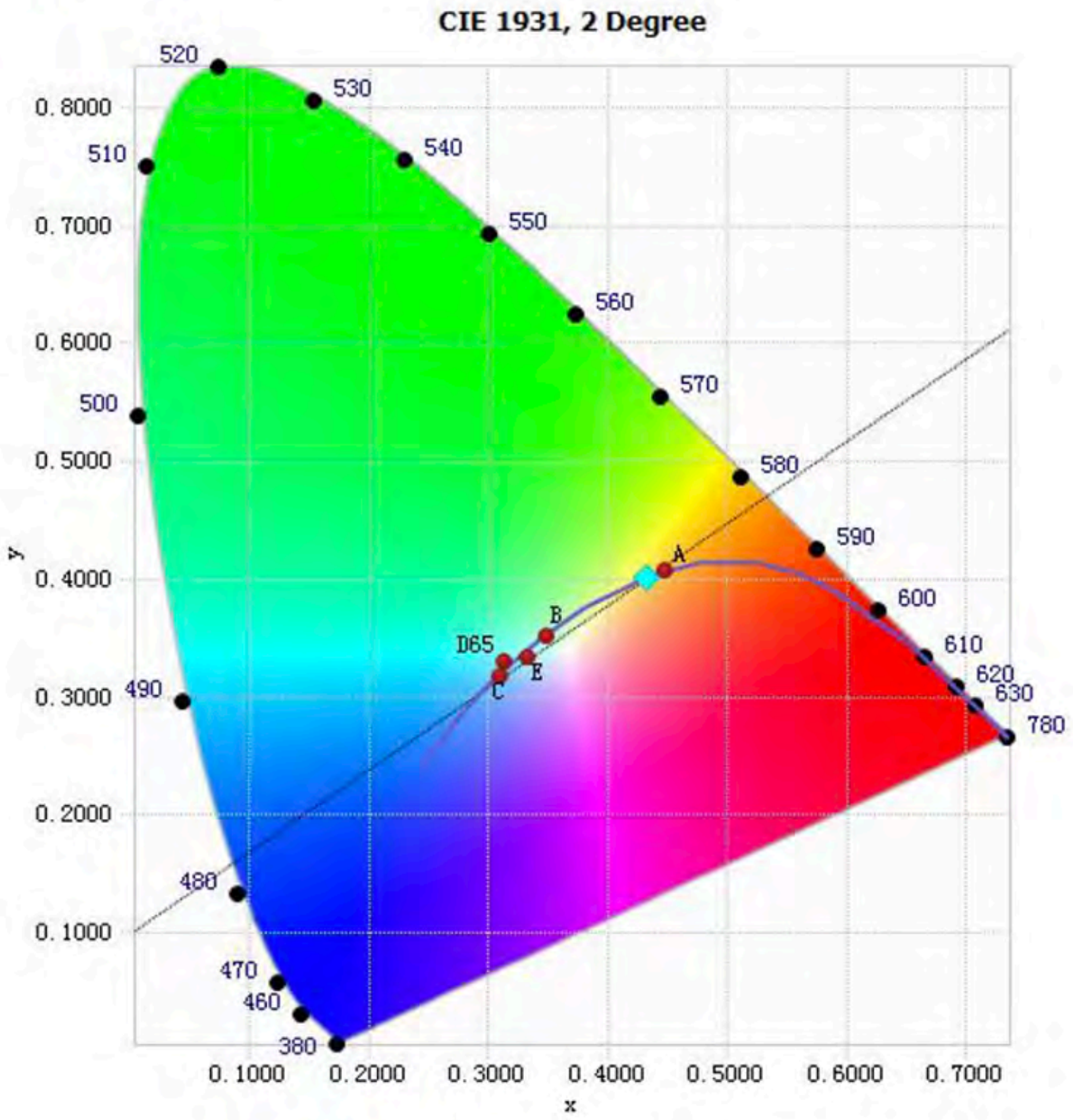


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.09E-04	485	7.42E-03	590	3.33E-02	695	5.73E-03
385	1.09E-04	490	8.15E-03	595	3.42E-02	700	4.91E-03
390	1.23E-04	495	9.45E-03	600	3.45E-02	705	4.19E-03
395	1.08E-04	500	1.11E-02	605	3.45E-02	710	3.57E-03
400	9.70E-05	505	1.28E-02	610	3.39E-02	715	3.05E-03
405	1.06E-04	510	1.41E-02	615	3.29E-02	720	2.63E-03
410	1.74E-04	515	1.53E-02	620	3.15E-02	725	2.24E-03
415	2.81E-04	520	1.62E-02	625	2.98E-02	730	1.91E-03
420	4.67E-04	525	1.70E-02	630	2.78E-02	735	1.62E-03
425	8.89E-04	530	1.76E-02	635	2.58E-02	740	1.35E-03
430	1.62E-03	535	1.83E-02	640	2.36E-02	745	1.17E-03
435	2.97E-03	540	1.90E-02	645	2.15E-02	750	1.00E-03
440	5.36E-03	545	1.99E-02	650	1.93E-02	755	8.50E-04
445	9.96E-03	550	2.10E-02	655	1.73E-02	760	7.38E-04
450	1.74E-02	555	2.23E-02	660	1.53E-02	765	6.17E-04
455	2.16E-02	560	2.36E-02	665	1.35E-02	770	5.35E-04
460	1.69E-02	565	2.53E-02	670	1.18E-02	775	4.64E-04
465	1.27E-02	570	2.70E-02	675	1.03E-02	780	3.91E-04
470	1.10E-02	575	2.87E-02	680	8.97E-03		
475	8.64E-03	580	3.05E-02	685	7.75E-03		
480	7.24E-03	585	3.21E-02	690	6.67E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4316, 0.4014)

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

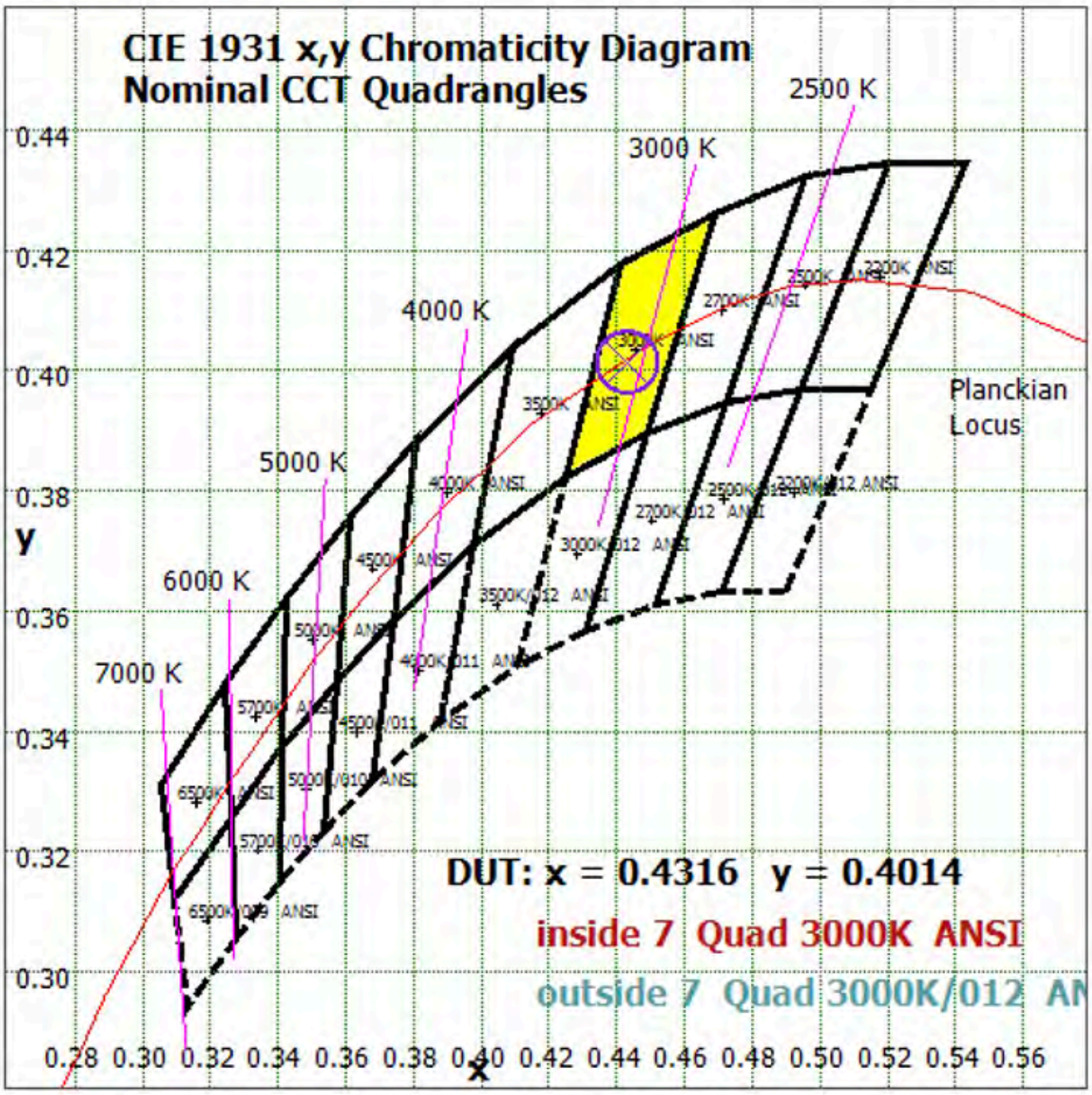


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Quality Assured

Color Rendition Report – Sphere Spectroradiometer Method

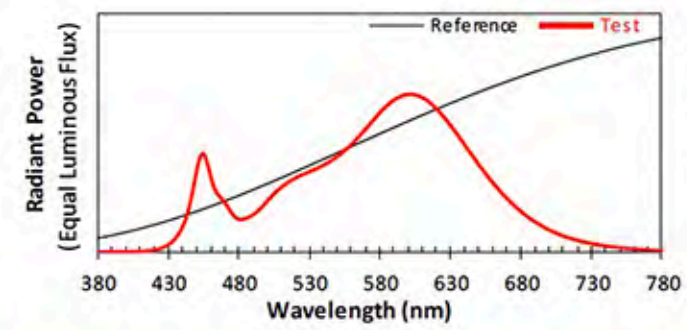
ANSI/IES TM-30-18 Color Rendition Report

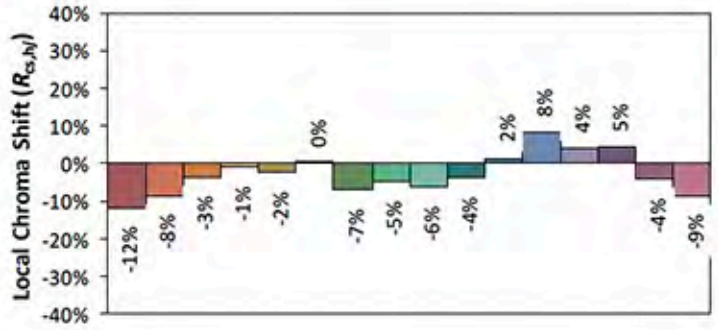
Source: LED

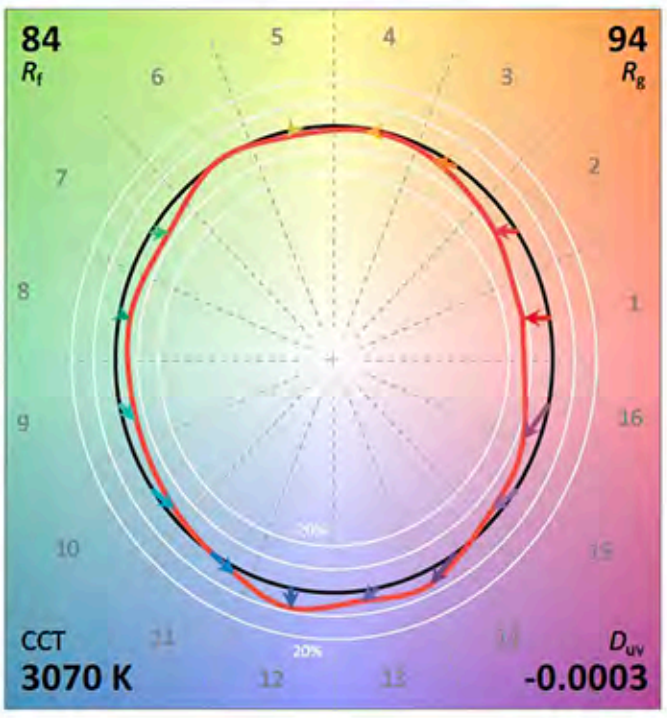
Manufacturer: P.Q.L., Inc.

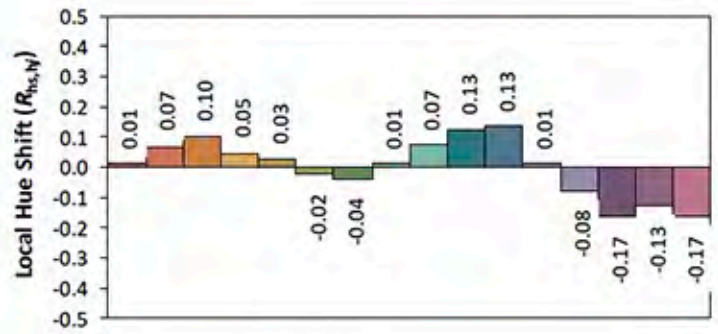
Date: 2022/10/20

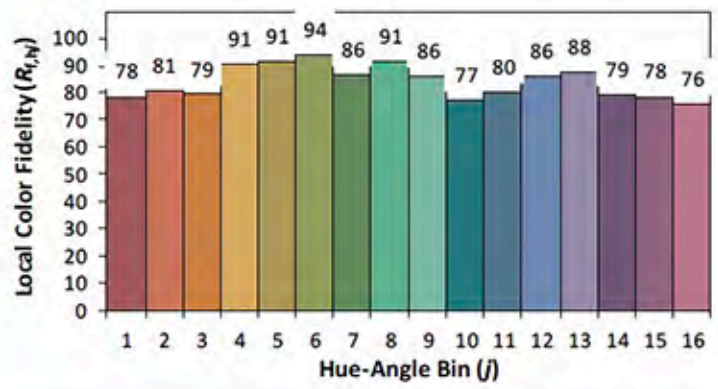
Model: 91459

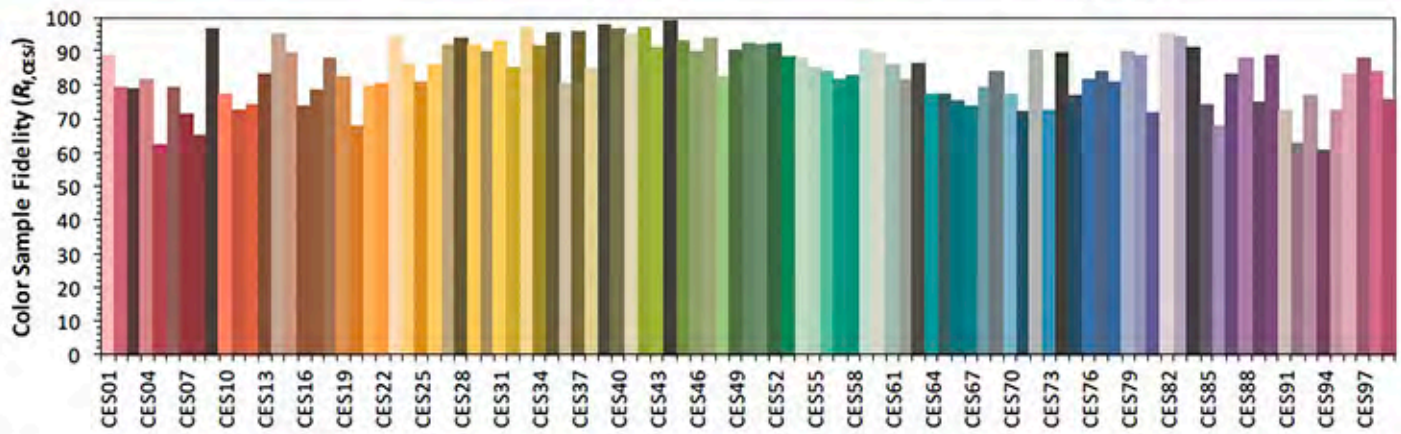












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.4316
y	0.4014
u'	0.2483
v'	0.5195

CIE 13.3-1995 (CRI)

R_a	82
R_9	4

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)	0.103
Power Factor	0.9793
Power (W)	12.10
Luminous Efficacy (lm/W)	141.4
Total Luminous Flux (lm)	1710.6
Beam Angle (°)	116.8 (0°-180°) / 257.4 (90°-270°)
Center Beam Candle Power (cd)	256
Maximum Beam Candle Power (cd)	258.2 (At: C=240.0, Gamma=10.5)
Spacing Criteria	1.35 (0°-180°) / 1.49 (90°-270°)
Zonal Lumens in the 0°-60°Zone	40.16%
Zonal Lumens in the 60°-90°Zone	26.96%
Zonal Lumens in the 90°-120°Zone	19.15%
Zonal Lumens in the 120°-180°Zone	13.73%

Table 4: Test data per Goniophotometer Method

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	24.318	1.42%
10- 20	71.009	4.15%
20- 30	111.839	6.54%
30- 40	143.646	8.40%
40- 50	164.045	9.59%
50- 60	172.084	10.06%
60- 70	168.21	9.83%
70- 80	155.091	9.07%
80- 90	137.911	8.06%
90-100	123.019	7.19%
100-110	109.181	6.38%
110-120	95.32	5.57%
120-130	80.712	4.72%
130-140	63.709	3.72%
140-150	46.739	2.73%
150-160	29.857	1.75%
160-170	12.652	0.74%
170-180	1.241	0.07%
Total	1710.6	100%

γ(°)	Lumens	% Total
0- 60	686.941	40.16%
60- 90	461.212	26.96%
0-90	1148.15	67.12%
90- 180	562.43	32.88%
0- 180	1710.6	100%

Table 5: Zonal Lumen

Illuminance Plots- Goniophotometer Method

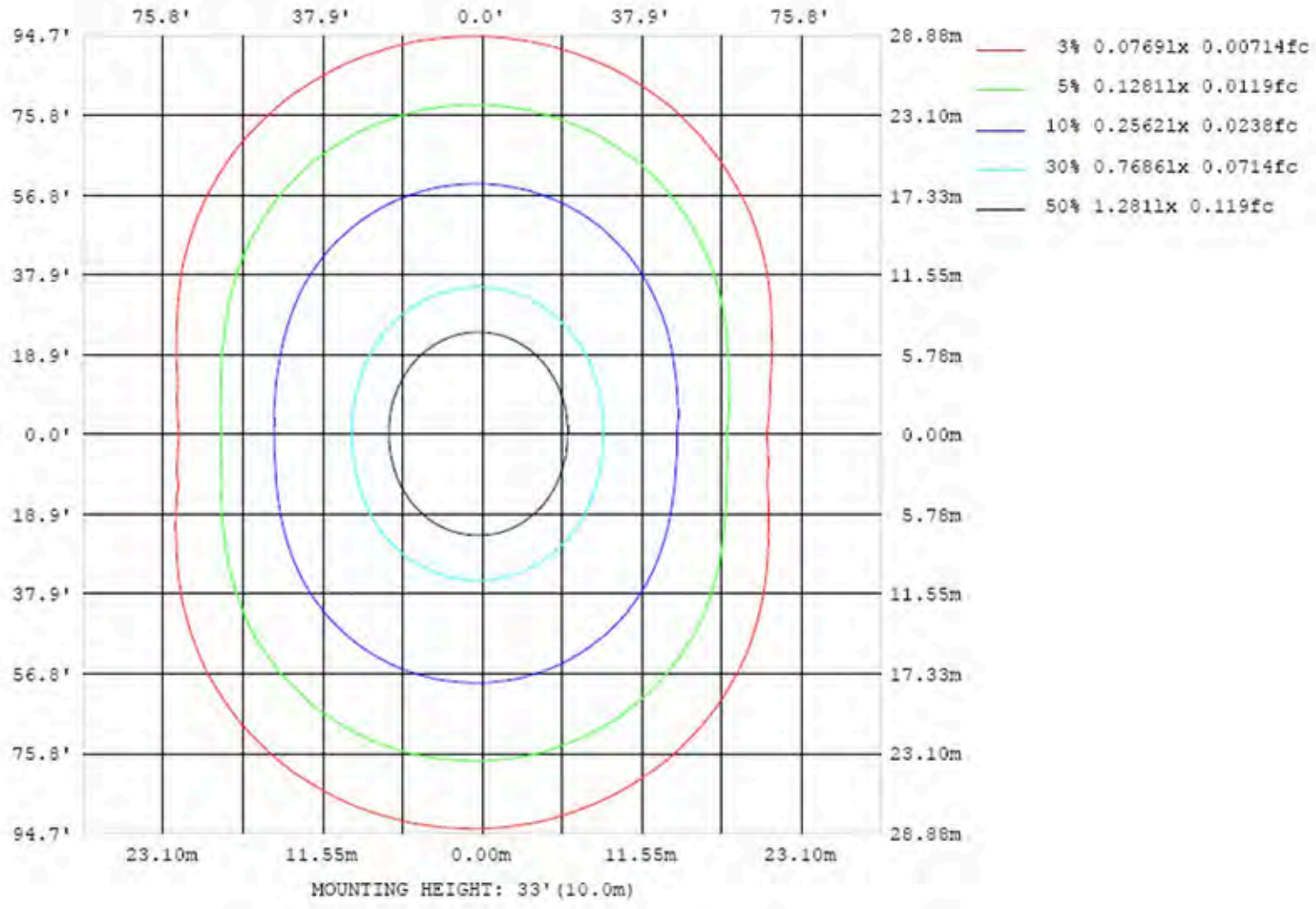


Chart 5: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

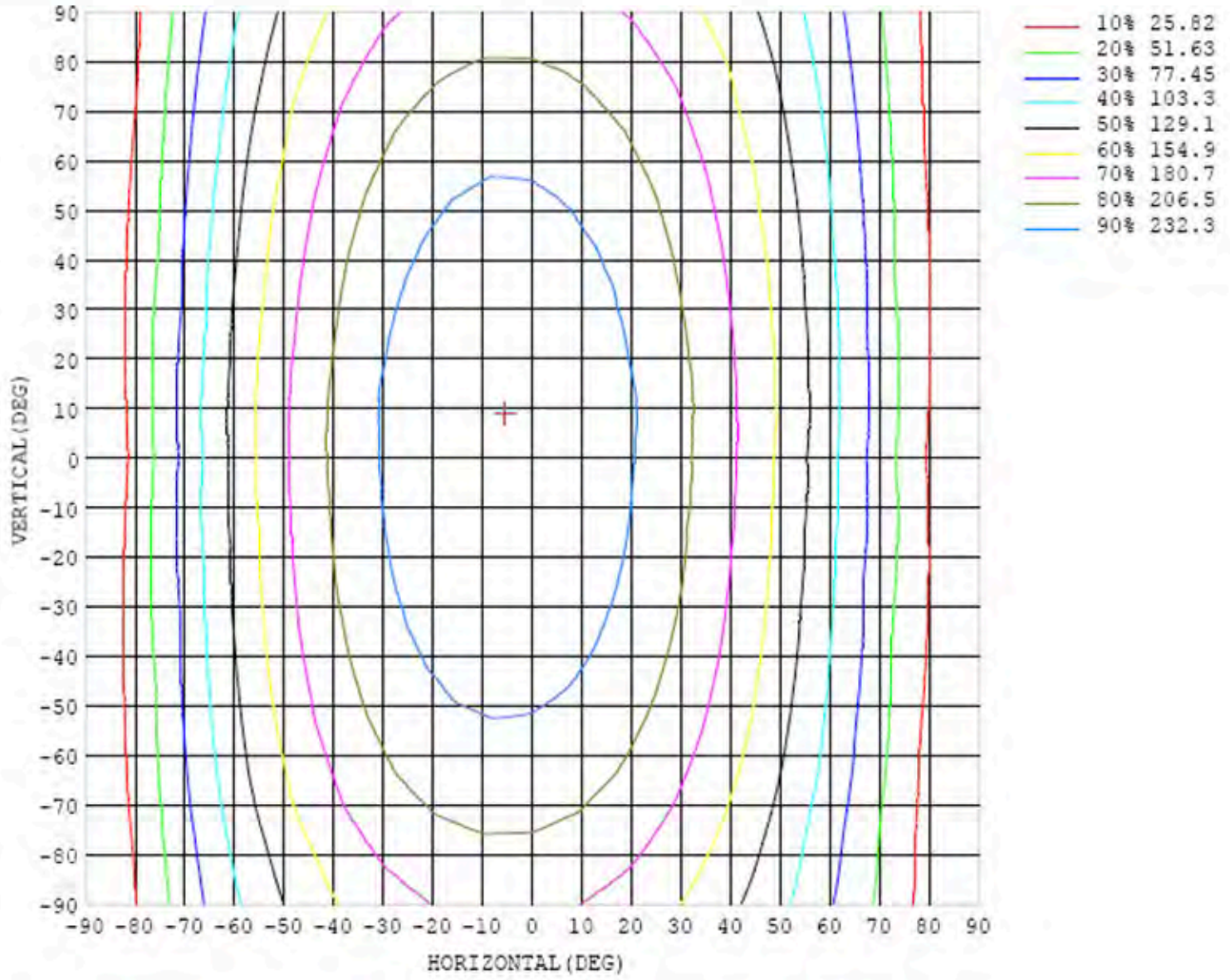


Chart 6: Isocandela Plot

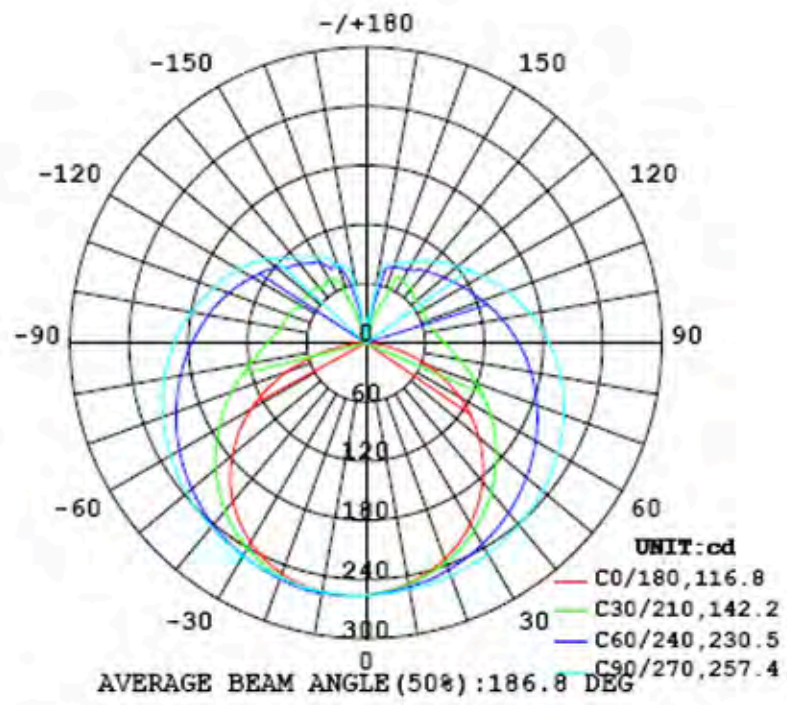


Chart 7: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256
5	253	253	253	253	253	254	254	254	255	255	255	256	256	256	256	257	257	257	257
10	248	248	249	249	250	251	252	253	254	254	255	255	256	256	256	256	256	256	256
15	242	242	242	243	245	247	249	251	252	253	254	255	255	254	254	254	254	254	254
20	233	233	234	237	239	242	245	248	250	251	252	253	253	252	251	250	249	249	249
25	224	224	226	229	232	236	240	244	247	250	251	251	251	249	247	245	243	243	242
30	212	213	216	220	225	230	236	241	245	247	248	249	248	245	242	239	236	234	234
35	199	200	203	209	216	223	231	237	241	245	246	246	243	240	235	230	227	223	223
40	184	185	190	198	207	216	225	232	238	242	243	242	239	234	228	221	215	211	210
45	168	170	176	186	197	208	219	227	234	238	239	238	234	227	219	211	202	196	194
50	150	152	161	173	187	200	212	222	230	234	235	233	228	220	210	199	187	179	177
55	130	134	145	160	176	192	206	217	225	229	231	228	222	213	200	186	171	160	157
60	110	114	128	146	165	183	199	211	220	224	225	223	216	205	190	172	154	139	134
65	88.1	93.7	111	132	155	175	192	205	214	219	220	217	209	196	179	158	136	117	110
70	66.2	73.1	94.0	119	144	166	185	198	209	214	214	211	202	188	169	145	118	94.4	84.5
75	44.3	53.9	78.6	107	134	157	177	192	202	207	208	204	194	179	158	131	101	71.9	58.0
80	23.4	36.1	65.5	95.4	124	150	170	185	196	201	201	197	186	170	147	120	85.6	51.9	32.4
85	6.97	22.4	53.6	86.7	117	142	163	178	188	194	194	188	178	161	138	108	72.2	35.6	10.8
90	0.42	15.8	47.8	79.8	109	134	155	170	181	186	186	181	170	153	129	99.1	63.7	25.3	0.57
95	0.33	14.3	43.4	73.9	103	127	147	163	173	178	178	173	162	145	121	91.8	57.8	22.5	0.53
100	0.31	16.1	41.5	70.3	96.7	120	140	155	165	170	170	164	154	137	114	86.0	54.4	23.2	0.50
105	0.33	20.1	41.8	67.4	91.7	114	133	147	156	161	161	156	146	129	108	81.7	53.3	26.4	0.51
110	0.47	25.2	43.7	66.0	87.8	108	126	139	148	153	153	148	138	123	103	78.8	54.0	31.1	0.67
115	1.08	30.9	46.6	65.7	84.8	103	119	132	140	144	144	139	130	116	98.1	77.1	55.9	36.5	2.16
120	1.49	37.0	49.5	66.2	82.7	99.2	114	125	133	136	136	132	123	110	94.5	76.4	58.7	42.1	4.64
125	1.69	41.6	52.7	67.3	81.2	95.4	108	118	125	128	128	124	116	105	91.8	76.3	61.8	47.6	7.03
130	1.97	30.3	56.4	66.8	80.1	92.4	103	112	118	121	121	117	111	101	89.5	76.8	65.1	52.5	8.28
135	2.43	19.8	59.6	67.9	79.3	89.8	98.9	106	111	114	114	111	105	97.3	87.9	74.7	66.1	35.6	9.32
140	2.97	12.8	63.0	70.4	76.4	87.2	95.2	101	106	108	108	105	101	94.1	83.6	76.1	68.0	27.6	10.1
145	3.89	7.28	65.6	71.9	77.2	82.8	90.3	96.6	100	102	102	100.0	95.8	88.2	82.4	76.8	70.3	15.4	10.7
150	5.12	17.6	39.5	73.4	77.2	81.5	85.9	89.5	92.3	93.9	93.6	92.0	89.1	86.0	81.5	76.2	57.5	6.12	10.9
155	6.40	9.82	21.2	70.5	77.6	80.6	83.7	86.3	88.0	89.1	89.0	88.2	86.8	84.0	79.3	72.0	36.8	14.3	10.7
160	7.54	8.57	7.39	39.5	75.2	78.8	81.9	83.7	85.0	85.6	85.6	85.2	84.2	80.3	72.4	39.8	18.0	15.3	10.3
165	8.57	4.17	16.3	11.6	33.3	51.5	77.9	81.2	82.4	82.9	82.9	82.6	76.3	53.8	35.2	15.8	8.42	10.4	9.60
170	10.4	11.8	9.63	17.5	9.48	14.9	24.2	32.7	43.1	45.2	45.0	36.4	23.6	16.1	8.10	10.1	14.0	5.22	9.56
175	12.2	22.9	12.5	7.77	9.92	12.4	15.5	18.7	21.4	26.2	16.8	9.71	12.7	15.3	11.0	10.7	5.83	8.86	11.3
180	12.4	12.3	12.9	13.5	19.3	20.7	0.00	0.00	0.00	6.16	18.1	3.37	0.00	0.00	2.71	11.4	23.6	23.1	12.4

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	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256	256		
5	257	257	257	257	257	257	257	257	256	255	255	255	254	253	253	253	253		
10	256	257	257	257	257	258	257	257	256	256	255	254	252	251	250	249	248		
15	254	255	256	256	257	257	257	256	255	254	253	252	249	247	245	243	242		
20	249	251	253	254	254	255	255	255	254	252	250	248	244	241	239	236	234		
25	243	245	247	249	251	252	253	253	252	249	247	243	238	234	231	228	225		
30	235	238	240	243	246	249	251	251	249	247	243	238	233	227	222	217	213		
35	224	228	232	237	242	246	248	249	248	244	239	233	226	218	211	206	201		
40	212	217	222	229	236	242	244	245	244	241	235	228	219	209	200	192	187		
45	197	203	211	221	229	236	241	242	241	237	231	222	211	199	188	178	171		
50	180	188	199	211	222	231	236	238	237	233	226	216	203	189	175	163	155		
55	162	171	186	201	214	225	231	234	233	228	221	209	195	179	163	148	137		
60	141	154	172	190	206	218	226	230	229	224	215	203	187	168	150	131	117		
65	117	136	158	179	198	212	220	225	224	218	209	196	179	159	137	115	96.9		
70	93.4	117	144	169	189	205	215	219	219	213	204	190	171	150	124	98.2	76.3		
75	69.8	98.8	131	159	181	198	208	214	214	208	198	183	163	140	112	83.1	56.6		
80	48.0	82.7	119	150	173	191	202	208	207	202	192	176	157	132	102	70.0	39.3		
85	30.9	70.1	108	141	165	184	195	201	201	196	185	170	150	124	93.7	59.9	26.4		
90	21.6	61.3	100	133	159	177	189	194	195	189	179	163	143	117	87.0	53.1	19.5		
95	19.1	56.2	93.6	126	152	169	181	187	187	182	172	158	137	112	81.7	49.0	16.9		
100	19.7	53.7	88.7	120	145	162	174	180	180	175	165	151	131	106	77.7	46.2	17.8		
105	23.0	53.2	85.3	114	138	155	166	172	172	168	159	145	125	101	74.2	45.0	21.3		
110	27.8	51.2	82.7	109	131	148	159	164	164	160	152	138	120	97.3	71.5	46.6	24.9		
115	32.9	53.8	80.5	105	125	141	151	157	157	153	144	131	114	93.0	71.1	48.5	29.1		
120	38.7	55.2	76.2	101	119	133	143	148	149	145	137	125	109	90.8	70.0	50.5	33.9		
125	43.6	59.5	77.1	93.1	113	127	135	140	141	137	130	119	105	87.5	70.3	52.2	35.3		
130	44.4	61.8	75.8	91.7	104	118	127	132	133	129	123	112	99.2	85.2	71.0	54.0	31.9		
135	35.8	64.0	76.6	89.3	101	109	116	121	122	119	113	105	95.1	83.8	71.1	57.3	24.1		
140	15.1	65.6	71.9	86.6	96.3	105	110	113	113	111	107	101	92.4	82.5	70.8	59.1	5.37		
145	10.8	68.0	72.6	82.4	93.2	98.4	104	106	107	105	102	96.8	89.2	79.1	70.6	60.6	8.82		
150	5.22	53.2	75.0	78.9	85.3	95.0	98.7	99.8	101	99.3	96.5	91.8	84.2	76.8	68.6	46.2	4.02		
155	17.1	28.2	70.7	74.7	82.2	82.9	89.3	92.6	93.9	92.3	89.3	85.5	78.9	75.3	70.2	29.3	12.4		
160	9.00	8.84	41.1	66.6	71.6	81.9	84.8	85.6	83.6	83.5	82.6	80.9	77.4	73.7	49.8	8.53	17.4		
165	3.43	15.3	9.94	28.1	45.8	63.5	76.1	80.0	80.1	80.3	79.6	75.7	70.4	49.0	20.9	7.00	16.2		
170	5.21	6.54	16.0	9.01	10.3	18.6	29.9	39.4	48.5	48.3	45.4	35.3	22.7	13.2	10.2	19.6	9.51		
175	10.8	3.38	7.22	10.6	12.0	9.86	8.86	7.62	6.56	12.8	13.8	11.2	15.8	16.7	12.4	8.44	5.14		
180	12.5	12.5	12.5	12.8	13.1	13.6	14.1	7.28	5.86	4.21	13.7	3.97	21.5	22.6	23.6	24.0	22.0		

Table 7: Luminous Intensity Data

TEST RESULTS of 91474

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)	0.107	0.051
Power Factor	0.9785	0.9155
Test Power (W)	12.52	12.91
THD A%	18.47	19.02
Luminous Efficacy (lm/W)	144.8	142.3
Total Luminous Flux (lm)	1812.6	1837.1
Color Rendering Index (CRI)	82.0	
R9	4.9	
Correlated Color Temperature (CCT)(K)	3519	
Chromaticity Chroma x	0.4040	
Chromaticity Chroma y	0.3898	
Chromaticity Chroma u	0.2352	
Chromaticity Chroma v	0.3405	
Duv	-0.0001	
Chromaticity Chroma u '	0.2352	
Chromaticity Chroma v'	0.5107	

Special Color Rendering Indices	
R1	80.2
R2	88.9
R3	95.5
R4	80.7
R5	80.2
R6	85.1
R7	84.4
R8	61.2
R9	4.9
R10	74.1
R11	79.6
R12	63.3
R13	82.2
R14	97.7

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

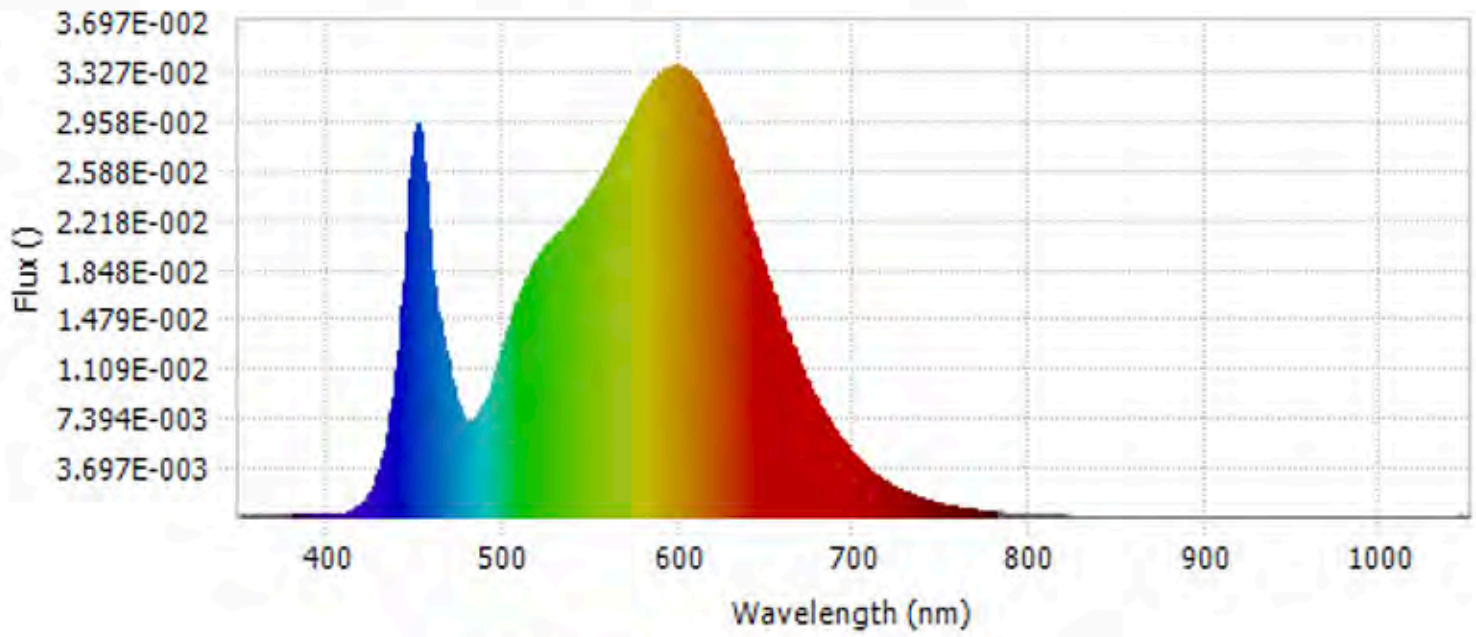
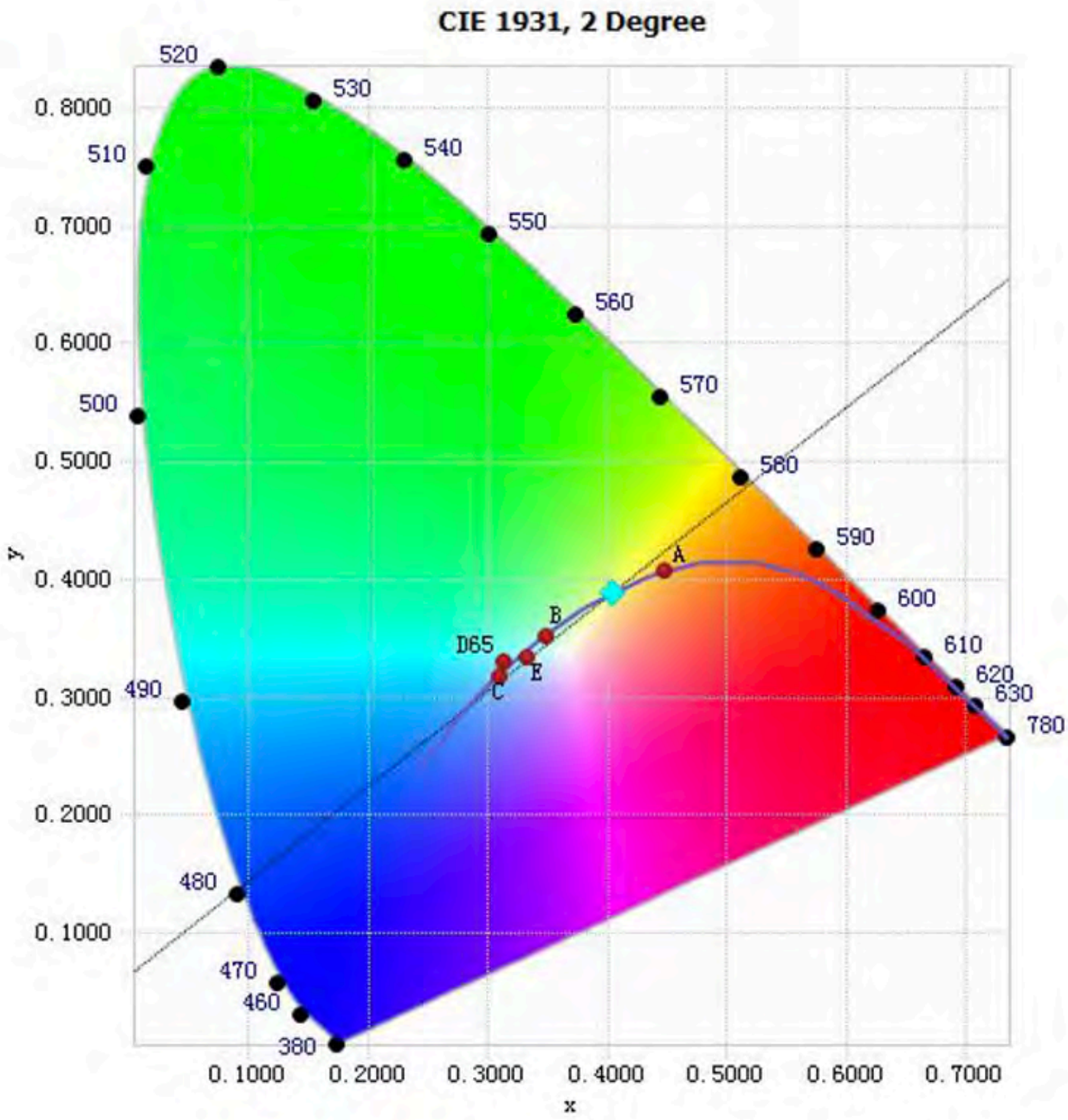


Chart 8: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.37E-04	485	7.57E-03	590	3.31E-02	695	5.30E-03
385	1.20E-04	490	8.74E-03	595	3.35E-02	700	4.54E-03
390	1.51E-04	495	1.07E-02	600	3.36E-02	705	3.87E-03
395	1.20E-04	500	1.29E-02	605	3.32E-02	710	3.31E-03
400	1.22E-04	505	1.51E-02	610	3.24E-02	715	2.81E-03
405	1.57E-04	510	1.68E-02	615	3.12E-02	720	2.42E-03
410	2.83E-04	515	1.84E-02	620	2.97E-02	725	2.07E-03
415	5.47E-04	520	1.94E-02	625	2.80E-02	730	1.77E-03
420	1.07E-03	525	2.03E-02	630	2.61E-02	735	1.49E-03
425	2.08E-03	530	2.10E-02	635	2.41E-02	740	1.27E-03
430	3.86E-03	535	2.16E-02	640	2.21E-02	745	1.09E-03
435	6.99E-03	540	2.24E-02	645	2.00E-02	750	9.17E-04
440	1.24E-02	545	2.32E-02	650	1.80E-02	755	7.90E-04
445	2.13E-02	550	2.42E-02	655	1.61E-02	760	6.62E-04
450	2.87E-02	555	2.52E-02	660	1.42E-02	765	5.74E-04
455	2.50E-02	560	2.63E-02	665	1.25E-02	770	4.83E-04
460	1.72E-02	565	2.77E-02	670	1.09E-02	775	4.19E-04
465	1.35E-02	570	2.90E-02	675	9.54E-03	780	3.58E-04
470	1.03E-02	575	3.02E-02	680	8.31E-03		
475	7.82E-03	580	3.14E-02	685	7.19E-03		
480	7.11E-03	585	3.24E-02	690	6.19E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4040, 0.3898)

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

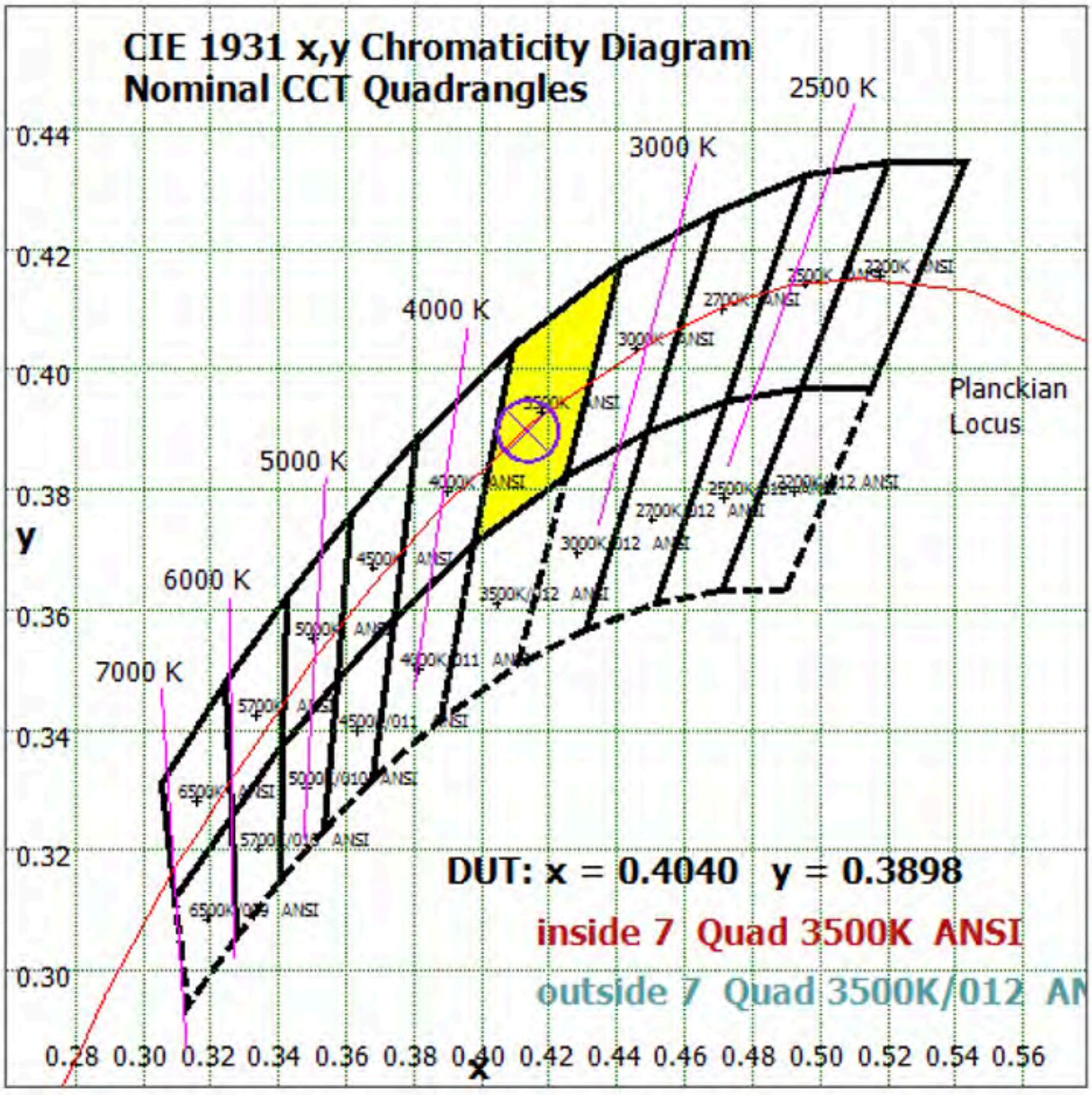


Chart 10: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Quality Assured

Color Rendition Report – Sphere Spectroradiometer Method

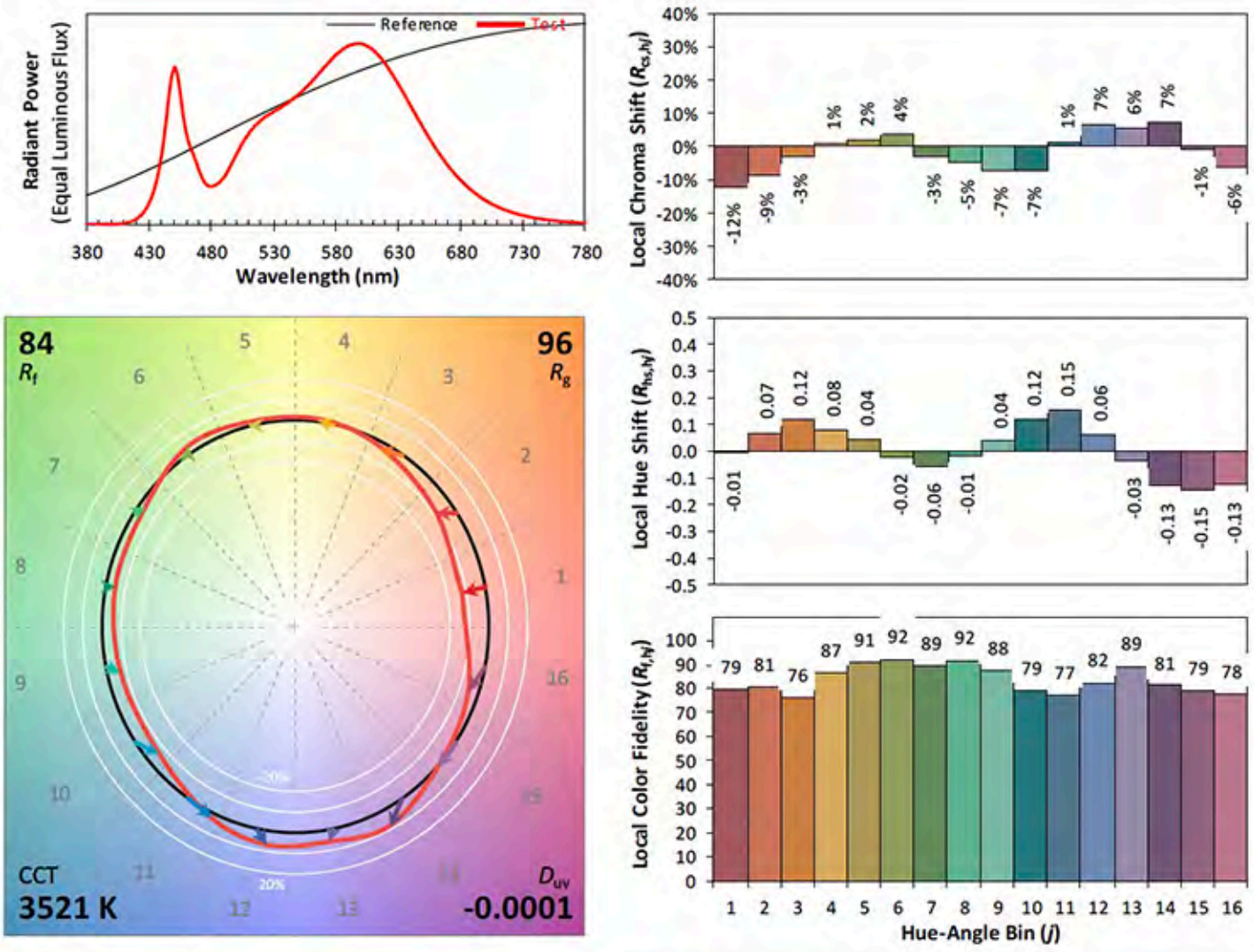
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: P.Q.L., Inc.

Date: 2022/10/20

Model: 91474



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

x	0.4040
y	0.3898
u'	0.2352
v'	0.5107

CIE 13.3-1995 (CRI)

R_a	82
R_9	5

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.

Goniophotometer Method

Test ambient temperature was 24.9°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)	0.107
Power Factor	0.9784
Power (W)	12.55
Luminous Efficacy (lm/W)	145.3
Total Luminous Flux (lm)	1823.6
Beam Angle (°)	116.5 (0°-180°) / 255.0 (90°-270°)
Center Beam Candle Power (cd)	274
Maximum Beam Candle Power (cd)	276.6 (At: C=230.0, Gamma=11.5)
Spacing Criteria	1.36 (0°-180°) / 1.49 (90°-270°)
Zonal Lumens in the 0°-60°Zone	40.30%
Zonal Lumens in the 60°-90°Zone	27.00%
Zonal Lumens in the 90°-120°Zone	19.09%
Zonal Lumens in the 120°-180°Zone	13.60%

Table 10: Test data per Goniophotometer Method

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	26.068	1.43%
10- 20	76.083	4.17%
20- 30	119.764	6.57%
30- 40	153.738	8.43%
40- 50	175.474	9.62%
50- 60	183.888	10.08%
60- 70	179.604	9.85%
70- 80	165.513	9.08%
80- 90	147.289	8.08%
90-100	131.101	7.19%
100-110	116.049	6.36%
110-120	100.991	5.54%
120-130	85.369	4.68%
130-140	67.435	3.70%
140-150	49.343	2.71%
150-160	31.415	1.72%
160-170	13.25	0.73%
170-180	1.266	0.07%
Total	1823.6	100%

γ(°)	Lumens	% Total
0- 60	735.015	40.30%
60- 90	492.406	27.00%
0-90	1227.42	67.31%
90- 180	596.219	32.69%
0- 180	1823.6	100%

Table 11: Zonal Lumen

Illuminance Plots- Goniophotometer Method

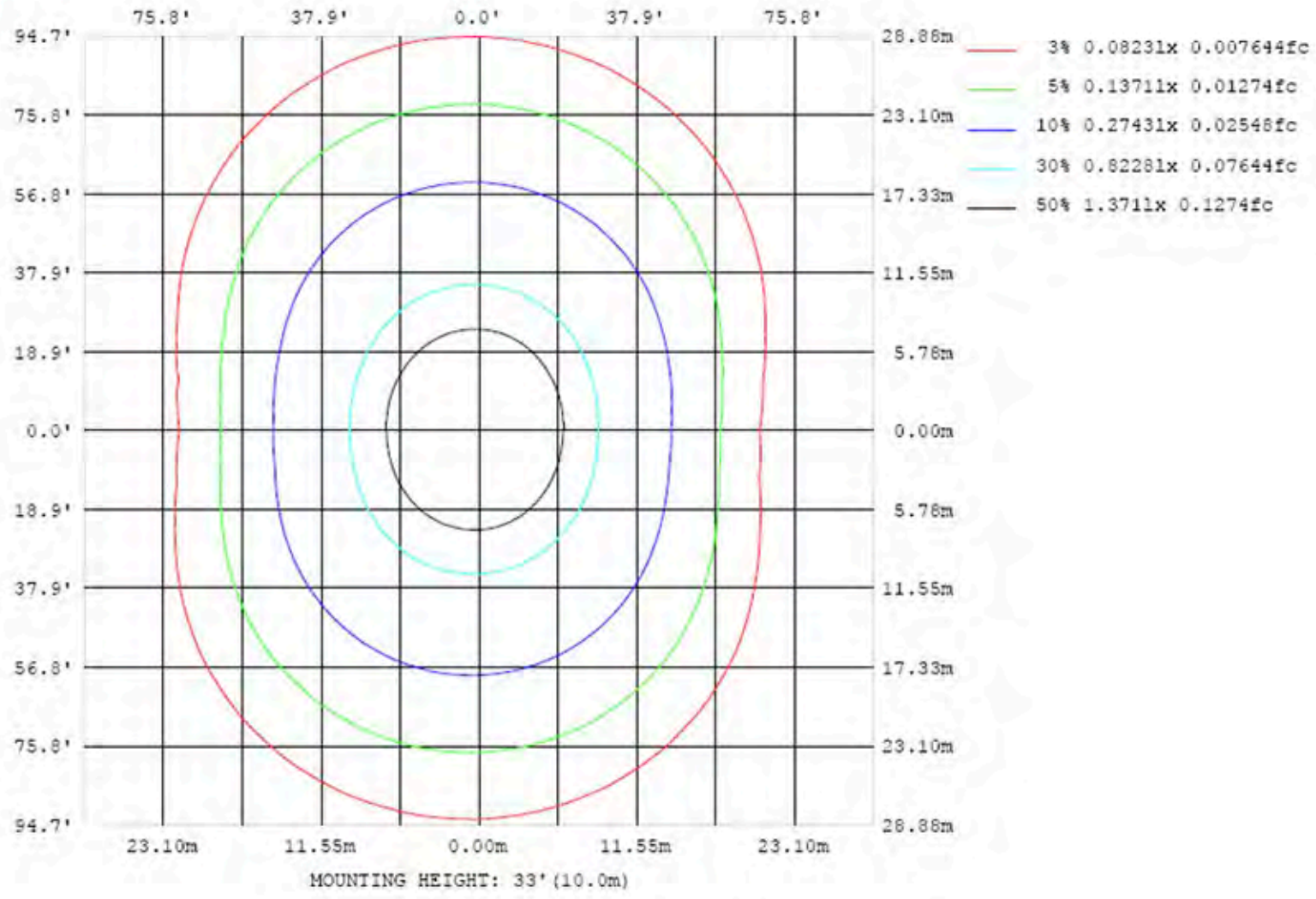


Chart 12: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

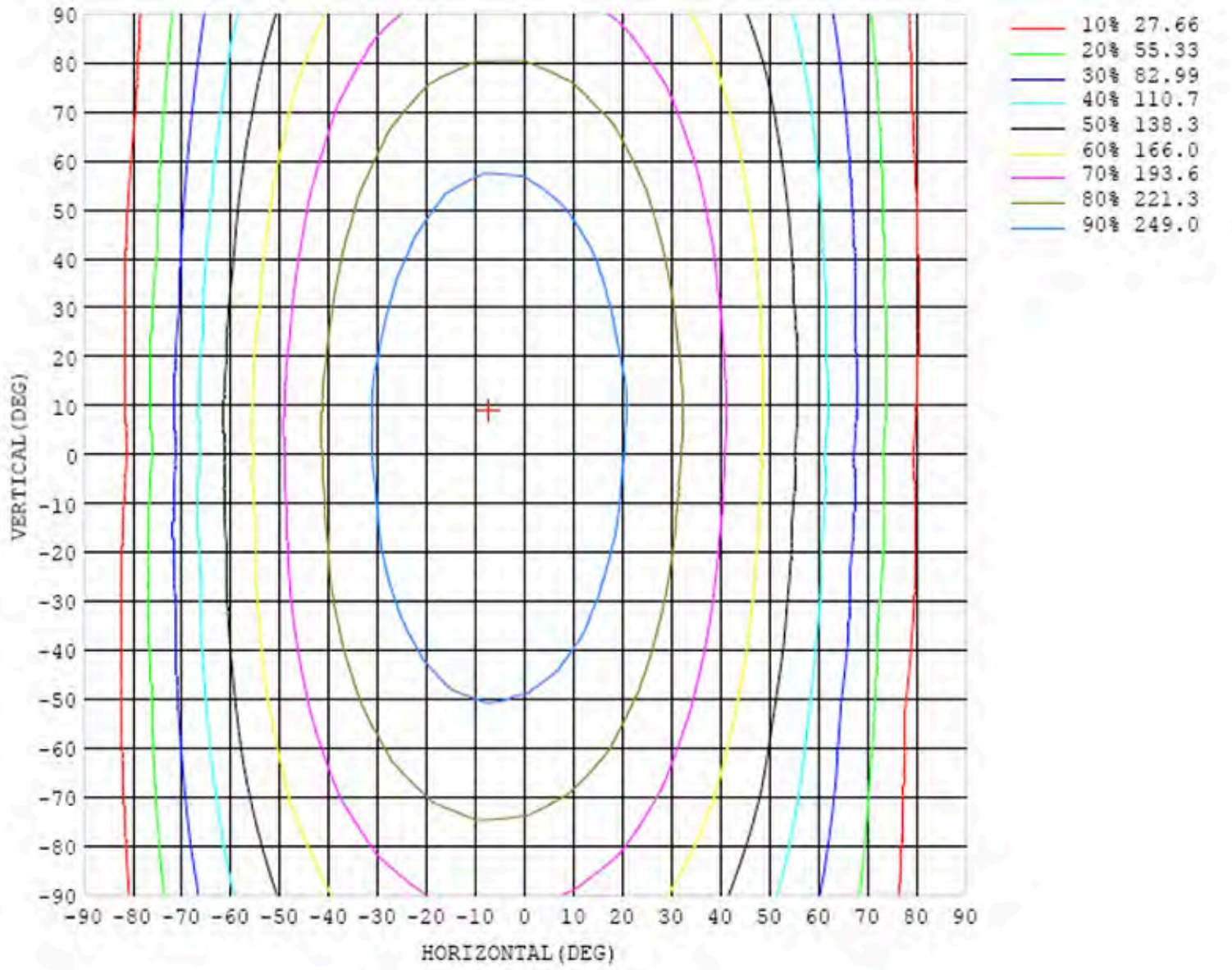


Chart 13: Isocandela Plot

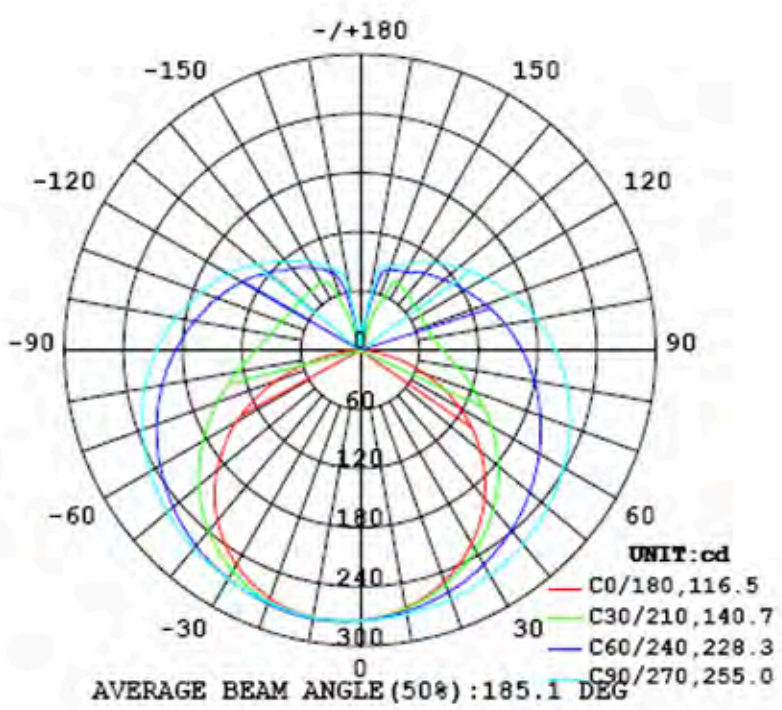


Chart 14: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274
5	271	271	271	271	271	272	272	273	273	273	274	274	274	275	275	275	275	275	276
10	265	265	266	267	267	268	269	270	271	272	273	273	274	275	275	274	274	275	275
15	259	258	259	261	262	264	265	267	269	271	272	272	273	273	273	272	272	272	273
20	250	249	251	253	255	258	261	264	267	269	270	271	271	270	270	268	268	267	268
25	239	239	241	244	248	252	257	261	264	267	268	268	268	267	265	263	261	260	261
30	226	227	229	234	239	245	251	256	260	264	266	266	265	262	260	256	253	251	251
35	212	213	216	223	230	238	245	252	257	261	262	262	260	257	253	247	243	240	239
40	196	197	202	210	220	230	239	247	253	257	259	258	255	251	245	237	231	226	225
45	179	180	187	197	209	221	232	241	248	253	254	253	250	244	235	226	217	210	209
50	159	162	170	183	198	212	225	235	243	248	250	249	244	236	225	213	202	192	190
55	139	141	153	168	186	202	217	229	238	244	245	243	237	228	215	200	185	171	168
60	116	120	135	154	174	193	210	223	232	239	240	237	230	219	204	185	166	149	145
65	93.4	98.5	116	138	162	184	202	217	226	233	234	231	223	210	192	170	147	127	118
70	69.9	76.5	98.2	124	151	175	195	210	220	227	228	224	215	201	181	156	128	103	90.2
75	46.9	56.0	80.1	112	141	167	187	203	214	220	221	217	207	192	170	142	110	78.7	61.5
80	24.9	36.9	67.4	101	132	158	180	196	207	213	214	210	199	182	159	129	93.4	57.6	33.8
85	7.42	22.1	56.8	91.4	123	150	172	189	200	206	206	202	191	174	149	118	80.2	40.4	11.3
90	0.65	15.7	49.6	84.0	116	143	165	181	192	199	199	194	183	165	140	108	70.5	30.0	1.04
95	0.35	14.6	45.6	78.4	109	136	157	173	184	190	191	185	174	156	132	100	64.2	26.0	0.61
100	0.34	16.8	44.2	74.3	104	129	150	166	176	182	182	177	165	148	124	94.2	60.4	26.1	0.58
105	0.34	21.2	44.8	72.2	98.6	123	143	158	168	173	173	168	157	140	118	89.3	58.7	28.8	0.62
110	0.40	26.7	46.9	71.1	94.7	117	135	150	159	164	164	159	149	133	112	85.9	58.8	33.3	0.75
115	0.79	32.9	50.0	70.7	91.5	112	129	142	151	156	155	151	141	126	107	83.7	60.3	38.6	1.82
120	1.88	39.2	53.1	71.3	89.2	107	122	135	142	147	147	142	133	120	103	82.3	62.7	44.1	4.66
125	3.35	37.9	56.5	72.4	87.5	103	117	128	135	139	139	134	126	114	99.2	81.9	65.7	49.6	7.74
130	3.96	32.0	60.2	71.5	86.4	99.6	111	121	127	130	130	127	119	109	96.3	82.0	68.9	54.5	8.72
135	3.97	17.3	63.5	73.1	85.1	96.6	107	115	120	123	123	120	113	105	94.4	79.6	69.7	39.8	8.77
140	3.73	8.15	67.0	75.2	81.8	93.6	102	109	113	116	116	113	108	101	89.6	80.8	71.6	25.4	8.34
145	3.45	16.0	61.3	76.6	82.2	88.6	96.3	104	107	109	109	107	103	94.4	87.9	81.5	73.2	14.5	7.63
150	3.20	15.3	43.8	77.9	82.4	87.3	91.8	95.7	98.5	101	100	98.6	95.1	91.8	86.9	80.3	56.5	5.77	7.16
155	3.05	8.33	18.9	65.9	82.4	85.9	89.3	92.1	93.9	95.2	95.2	94.2	92.3	89.5	84.6	75.2	34.9	20.7	5.91
160	3.02	4.75	10.7	36.3	71.2	83.6	86.9	89.1	90.4	91.3	91.5	90.8	89.2	85.5	75.6	43.7	13.7	13.6	4.99
165	3.30	4.70	15.4	8.53	31.8	57.1	75.4	85.7	87.2	87.9	88.1	87.6	81.0	57.4	37.2	16.5	14.3	7.64	4.10
170	4.27	17.9	5.95	16.2	17.7	8.00	22.5	32.1	38.2	45.7	44.5	32.7	20.3	14.8	6.60	15.4	11.4	3.64	4.02
175	5.34	18.5	19.3	7.23	7.24	10.7	13.4	16.9	20.1	25.3	15.1	7.68	14.9	12.6	10.4	8.34	5.24	15.5	5.19
180	5.41	5.03	4.67	4.46	5.06	5.67	15.4	0.00	0.00	5.07	18.1	0.00	0.00	27.9	5.91	8.78	27.7	24.2	5.61

Table 12: 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	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274		
5	276	276	276	276	276	275	275	275	275	274	274	273	273	272	271	272	271		
10	276	275	276	276	277	277	276	275	275	274	273	272	271	269	267	266	266		
15	273	273	275	276	276	275	276	275	274	273	271	269	267	265	262	260	259		
20	268	270	271	273	273	274	274	273	272	270	268	265	262	259	256	252	250		
25	262	264	266	268	269	271	272	271	270	268	264	260	256	251	247	243	240		
30	252	256	259	262	265	268	270	269	268	265	261	255	249	243	237	232	228		
35	241	246	250	255	260	264	266	266	265	262	257	250	242	234	226	220	215		
40	228	233	239	247	254	259	263	263	262	259	252	244	234	224	214	206	200		
45	212	218	227	237	247	254	259	260	260	254	248	238	227	214	201	190	183		
50	194	201	214	227	239	248	254	256	255	250	242	232	218	203	187	174	165		
55	173	184	200	216	230	241	249	251	251	246	237	225	210	193	174	158	146		
60	151	164	184	204	222	234	243	246	246	240	231	218	201	181	161	141	125		
65	126	145	169	193	212	227	237	241	241	235	225	211	192	170	147	123	103		
70	99.9	125	155	181	203	220	231	235	235	229	219	204	184	161	134	106	81.7		
75	74.2	105	140	170	194	212	224	229	229	223	212	196	175	151	121	89.7	61.2		
80	50.4	87.5	126	160	185	204	216	222	222	216	205	189	167	142	110	76.1	43.0		
85	31.8	73.5	115	150	176	196	208	214	215	209	198	181	161	133	101	65.3	29.5		
90	21.5	63.7	106	141	168	187	200	206	207	201	190	174	153	126	93.4	57.7	22.2		
95	18.8	57.8	98.3	133	160	179	192	198	199	193	182	166	146	119	87.4	52.9	18.8		
100	19.7	55.0	92.5	126	152	170	183	189	190	185	174	160	139	113	82.0	49.0	19.8		
105	23.4	54.4	88.4	119	144	162	174	180	181	176	166	152	132	106	77.5	48.7	23.0		
110	28.7	53.6	85.6	114	137	155	166	171	172	167	159	144	125	101	75.5	49.7	26.7		
115	33.7	55.3	82.1	109	130	147	158	162	163	160	150	137	118	97.5	74.7	51.0	31.4		
120	39.9	57.9	79.6	103	124	139	149	154	155	151	142	130	114	94.8	73.6	53.4	35.7		
125	46.4	60.4	79.5	98.7	116	131	141	145	146	142	135	123	109	91.6	73.2	55.3	37.3		
130	48.6	65.2	79.4	94.8	110	122	131	136	137	133	126	116	104	88.5	73.9	56.6	37.6		
135	37.5	67.7	78.4	93.0	104	114	122	126	127	124	118	110	98.7	87.1	74.0	59.7	29.2		
140	21.7	68.9	77.5	89.9	101	108	113	116	117	115	111	104	95.8	85.6	73.5	62.2	17.6		
145	11.0	71.1	78.6	85.5	95.8	103	108	110	110	109	105	100	92.6	82.3	73.3	63.4	8.19		
150	6.97	60.6	79.3	83.2	90.5	96.4	101	104	105	103	100	94.9	87.6	81.2	74.3	54.1	7.39		
155	12.5	37.2	73.6	79.5	83.3	91.3	94.1	95.4	96.0	94.8	93.2	90.1	84.7	80.2	72.3	40.5	5.16		
160	13.2	12.9	43.3	69.8	75.9	84.9	88.0	90.1	91.1	90.1	87.9	84.9	80.5	75.6	54.8	14.5	11.0		
165	6.21	12.8	11.2	36.2	51.2	67.1	79.0	81.2	81.2	81.6	80.6	77.9	73.7	52.2	33.4	12.6	17.8		
170	3.13	9.40	14.0	8.78	10.3	24.8	36.5	45.2	51.2	51.3	49.5	42.9	29.1	13.9	9.04	11.9	14.3		
175	4.88	5.79	9.33	13.8	15.2	13.7	7.69	3.97	3.52	5.77	6.92	10.5	15.7	21.2	17.2	11.6	6.87		
180	5.61	4.86	2.14	1.38	5.95	6.27	6.71	7.12	6.26	2.77	8.06	4.59	13.3	15.4	16.8	18.1	19.4		

Table 13: Luminous Intensity Data

TEST RESULTS of 91475

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)	0.104	0.050
Power Factor	0.9785	0.9120
Test Power (W)	12.21	12.55
THD A%	18.54	19.32
Luminous Efficacy (lm/W)	149.1	146.6
Total Luminous Flux (lm)	1820.2	1839.7
Color Rendering Index (CRI)	81.1	
R9	2	
Correlated Color Temperature (CCT)(K)	4000	
Chromaticity Chroma x	0.3808	
Chromaticity Chroma y	0.3786	
Chromaticity Chroma u	0.2246	
Chromaticity Chroma v	0.3350	
Duv	0.0008	
Chromaticity Chroma u '	0.2246	
Chromaticity Chroma v'	0.5025	

Special Color Rendering Indices	
R1	79.1
R2	86.7
R3	92.9
R4	80.9
R5	79.4
R6	81.8
R7	85.4
R8	62.8
R9	2
R10	68.8
R11	79.9
R12	59.4
R13	80.7
R14	96.1

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

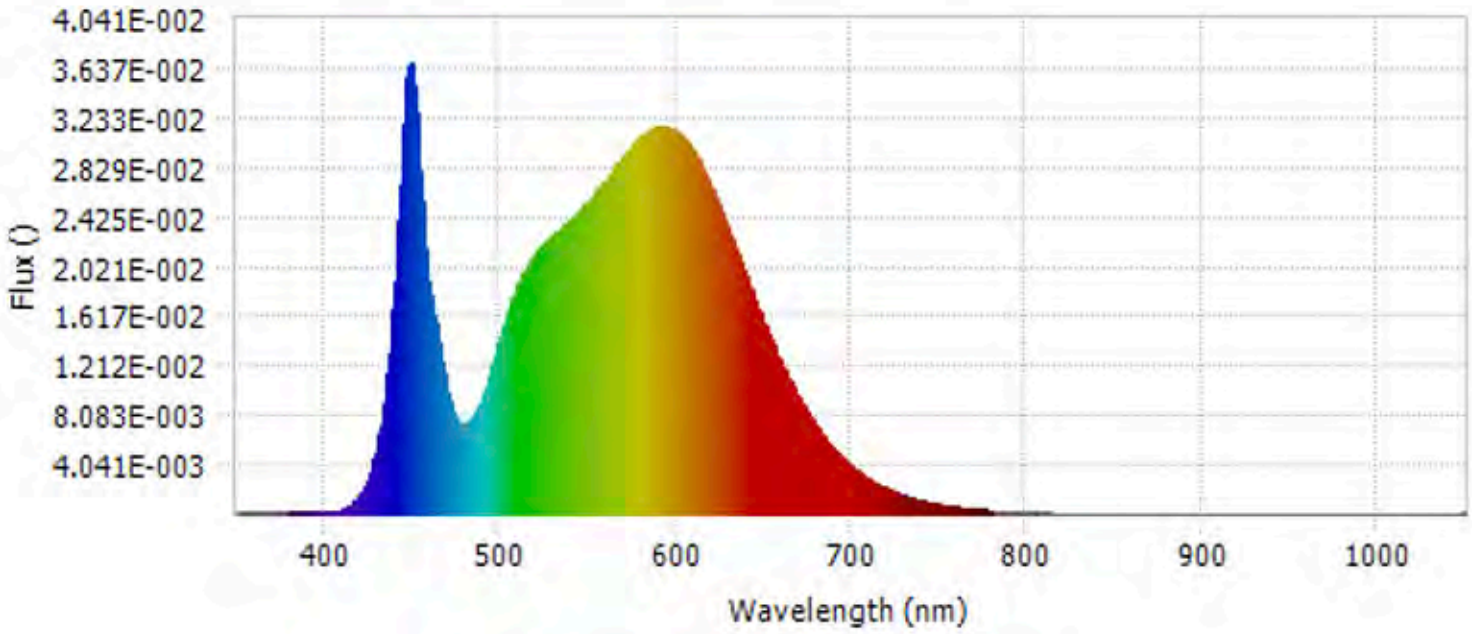
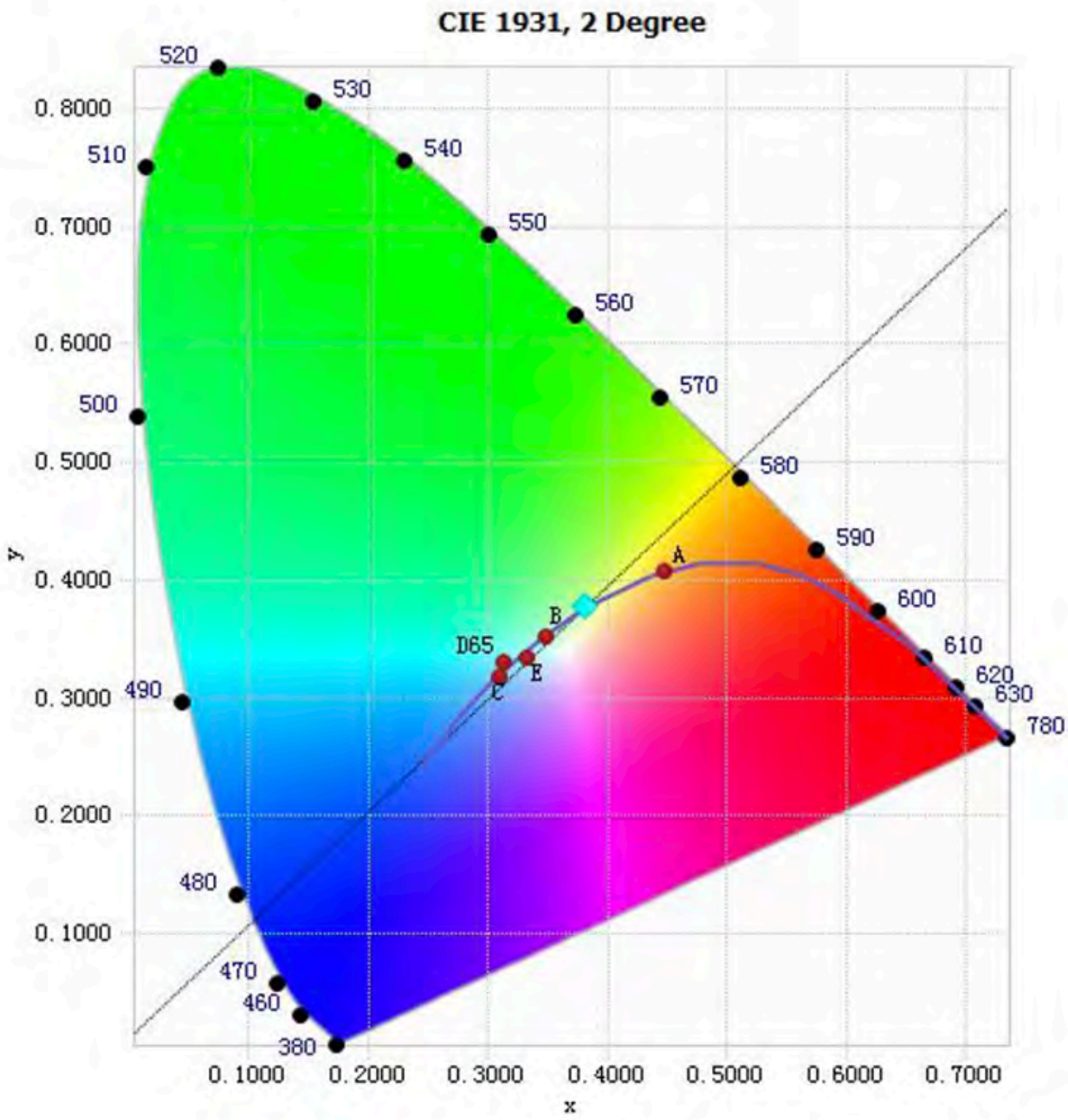


Chart 15: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.82E-04	485	8.04E-03	590	3.15E-02	695	4.57E-03
385	1.51E-04	490	9.47E-03	595	3.15E-02	700	3.89E-03
390	1.59E-04	495	1.18E-02	600	3.12E-02	705	3.31E-03
395	1.35E-04	500	1.44E-02	605	3.05E-02	710	2.83E-03
400	1.06E-04	505	1.67E-02	610	2.96E-02	715	2.43E-03
405	1.83E-04	510	1.86E-02	615	2.82E-02	720	2.08E-03
410	3.73E-04	515	2.02E-02	620	2.67E-02	725	1.78E-03
415	7.60E-04	520	2.12E-02	625	2.50E-02	730	1.52E-03
420	1.56E-03	525	2.21E-02	630	2.32E-02	735	1.27E-03
425	3.05E-03	530	2.28E-02	635	2.13E-02	740	1.09E-03
430	5.67E-03	535	2.34E-02	640	1.94E-02	745	9.27E-04
435	1.03E-02	540	2.40E-02	645	1.75E-02	750	7.93E-04
440	1.90E-02	545	2.47E-02	650	1.57E-02	755	6.74E-04
445	3.19E-02	550	2.55E-02	655	1.40E-02	760	5.84E-04
450	3.60E-02	555	2.63E-02	660	1.23E-02	765	4.99E-04
455	2.56E-02	560	2.72E-02	665	1.09E-02	770	4.33E-04
460	1.79E-02	565	2.82E-02	670	9.48E-03	775	3.63E-04
465	1.40E-02	570	2.91E-02	675	8.25E-03	780	3.19E-04
470	9.91E-03	575	3.00E-02	680	7.17E-03		
475	7.72E-03	580	3.07E-02	685	6.18E-03		
480	7.43E-03	585	3.13E-02	690	5.32E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3808, 0.3786)

Chart 16: 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

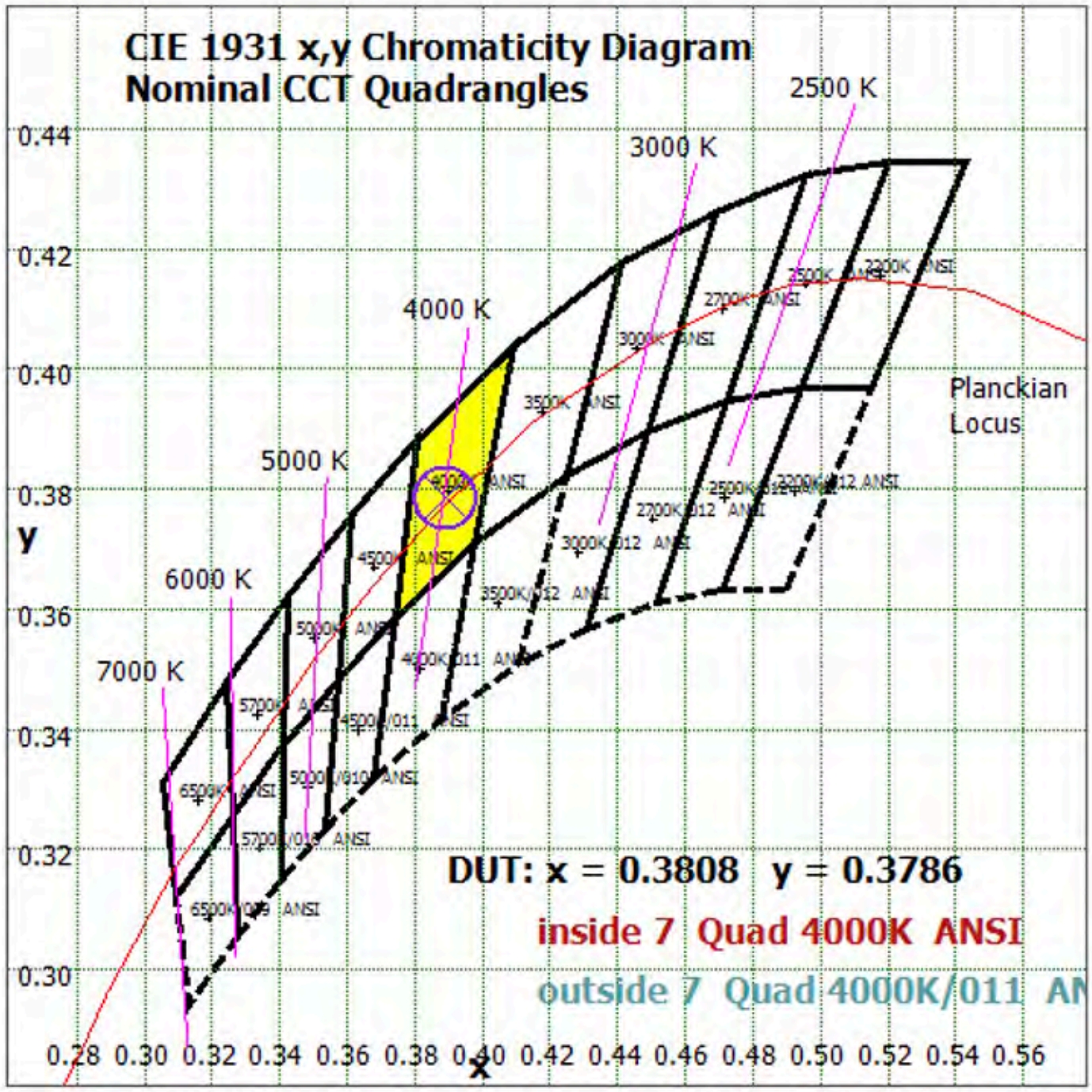


Chart17: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Quality Assured

Color Rendition Report – Sphere Spectroradiometer Method

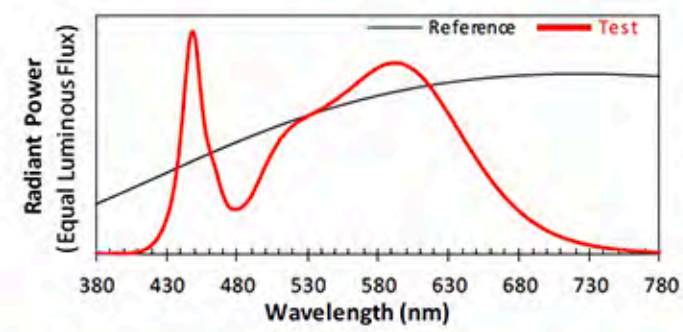
ANSI/IES TM-30-18 Color Rendition Report

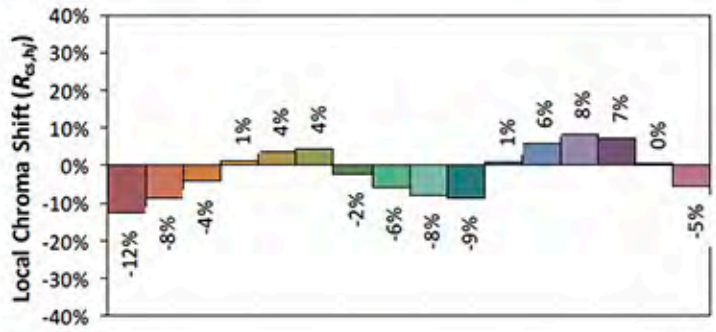
Source: LED

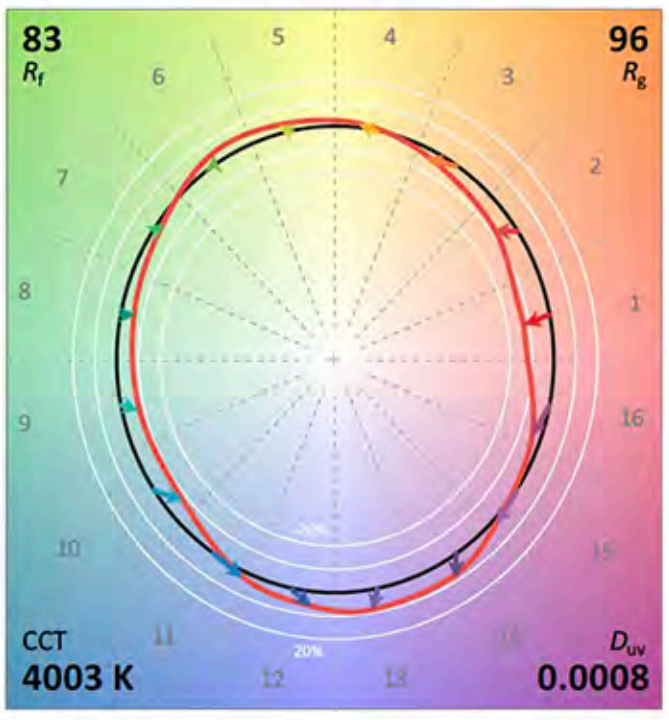
Manufacturer: P.Q.L., Inc.

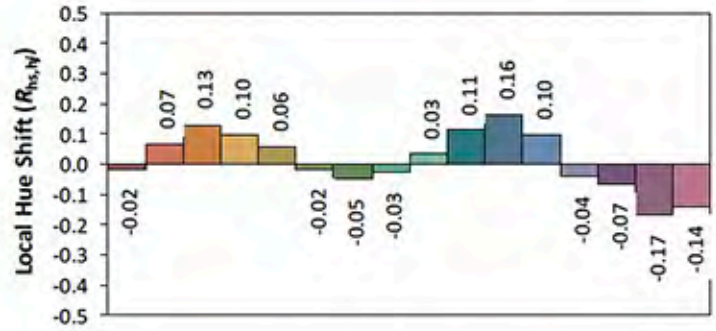
Date: 2022/10/20

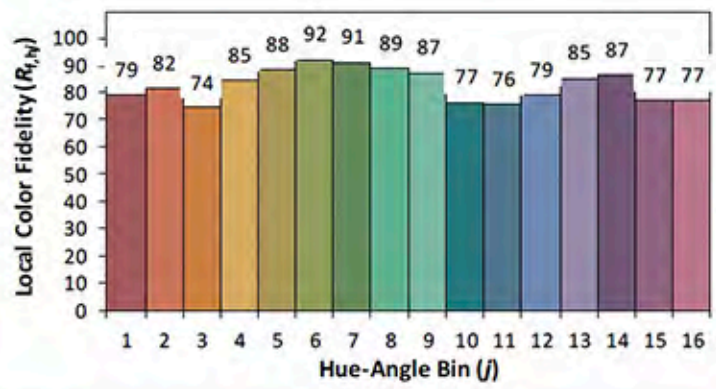
Model: 91475

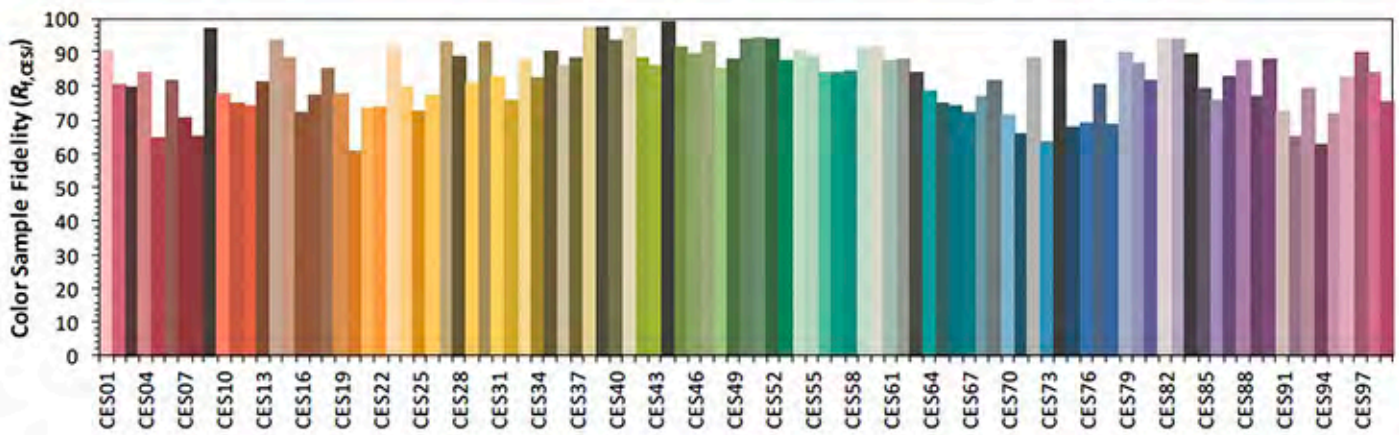












Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.3808
y	0.3786
u'	0.2246
v'	0.5025

CIE 13.3-1995 (CRI)

R_a	81
R_9	2

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

Chart 18: 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.

Goniophotometer Method

Test ambient temperature was 24.9°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)	0.104
Power Factor	0.9785
Power (W)	12.24
Luminous Efficacy (lm/W)	149.6
Total Luminous Flux (lm)	1831.6
Beam Angle (°)	117.1 (0^{o}-180^{o}) / 254.1 (90^{o}-270^{o})
Center Beam Candle Power (cd)	276
Maximum Beam Candle Power (cd)	276.9 (At: C=270.0, Gamma=8.0)
Spacing Criteria	1.30 (0^{o}-180^{o}) / 1.49 (90^{o}-270^{o})
Zonal Lumens in the 0°-60°Zone	40.29%
Zonal Lumens in the 60°-90°Zone	27.03%
Zonal Lumens in the 90°-120°Zone	19.12%
Zonal Lumens in the 120°-180°Zone	13.55%

Table 16: Test data per Goniophotometer Method

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	26.187	1.43%
10- 20	76.412	4.17%
20- 30	120.265	6.57%
30- 40	154.353	8.43%
40- 50	176.18	9.62%
50- 60	184.633	10.08%
60- 70	180.412	9.85%
70- 80	166.435	9.09%
80- 90	148.296	8.10%
90-100	132.078	7.21%
100-110	116.798	6.38%
110-120	101.38	5.53%
120-130	85.391	4.66%
130-140	67.449	3.68%
140-150	49.426	2.70%
150-160	31.417	1.72%
160-170	13.182	0.72%
170-180	1.34	0.07%
Total	1831.6	100%

γ(°)	Lumens	% Total
0- 60	738.03	40.29%
60- 90	495.143	27.03%
0-90	1233.17	67.33%
90- 180	598.461	32.67%
0- 180	1831.6	100%

Table 17: Zonal Lumen

Illuminance Plots- Goniophotometer Method

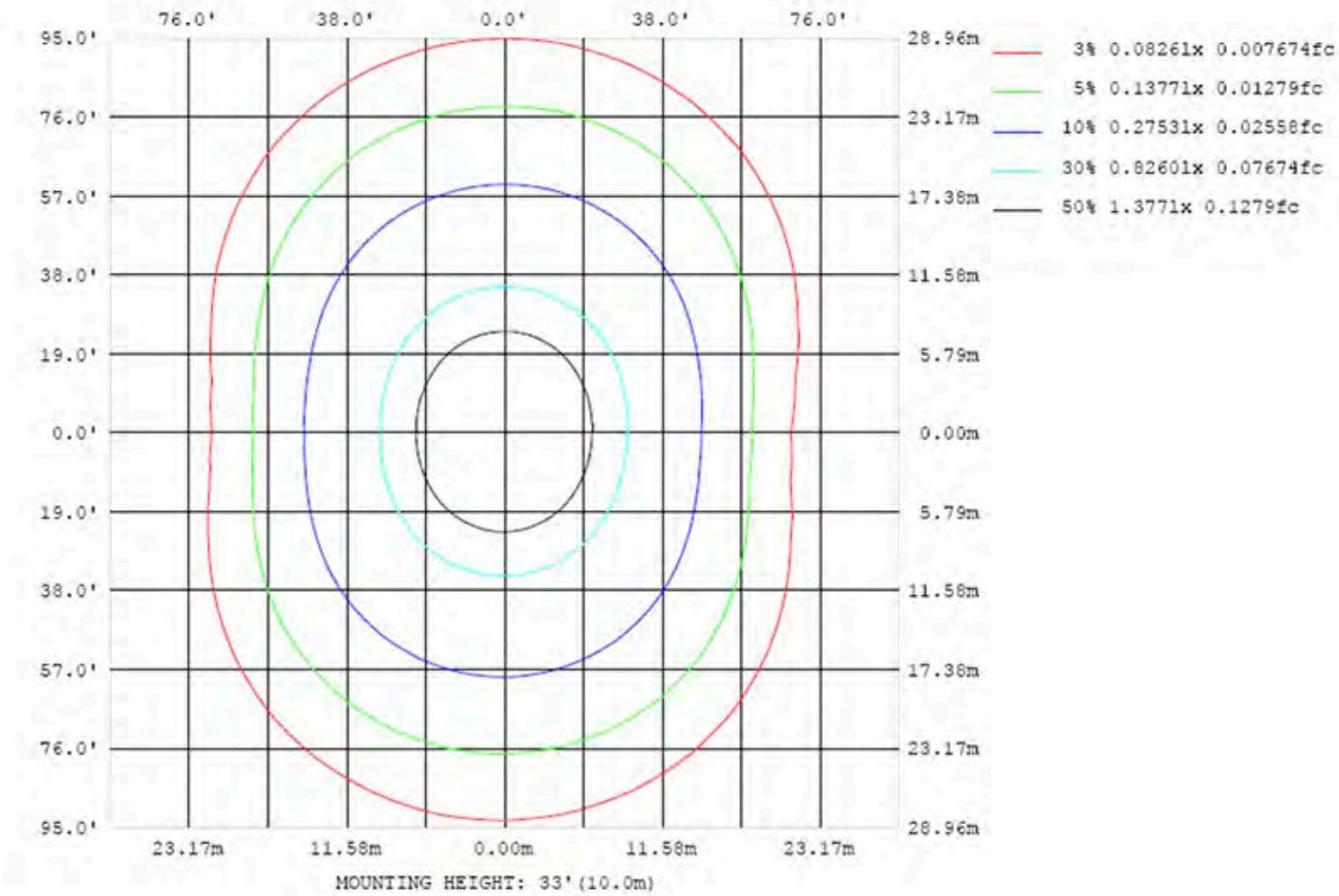


Chart 19: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

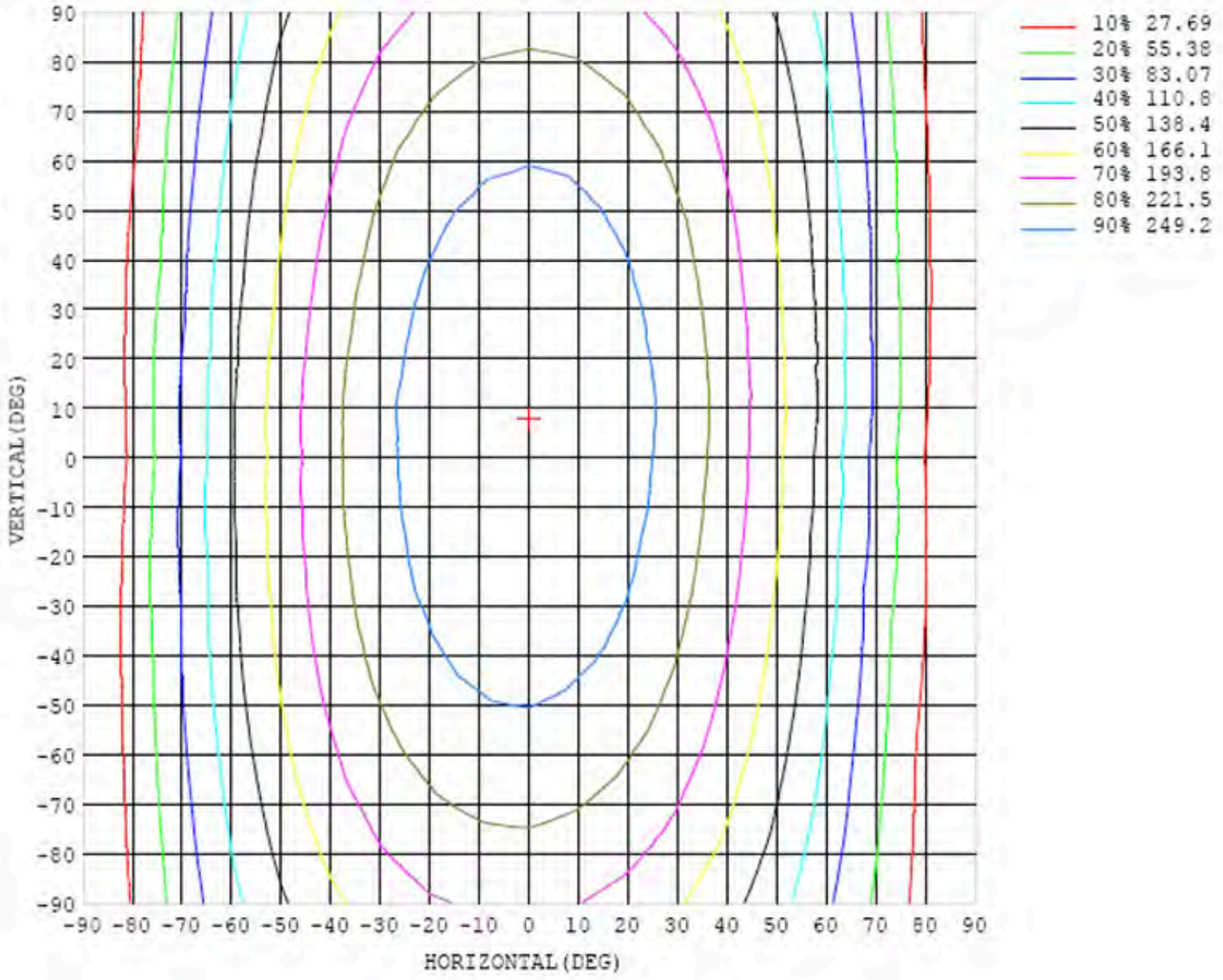


Chart 20: Isocandela Plot

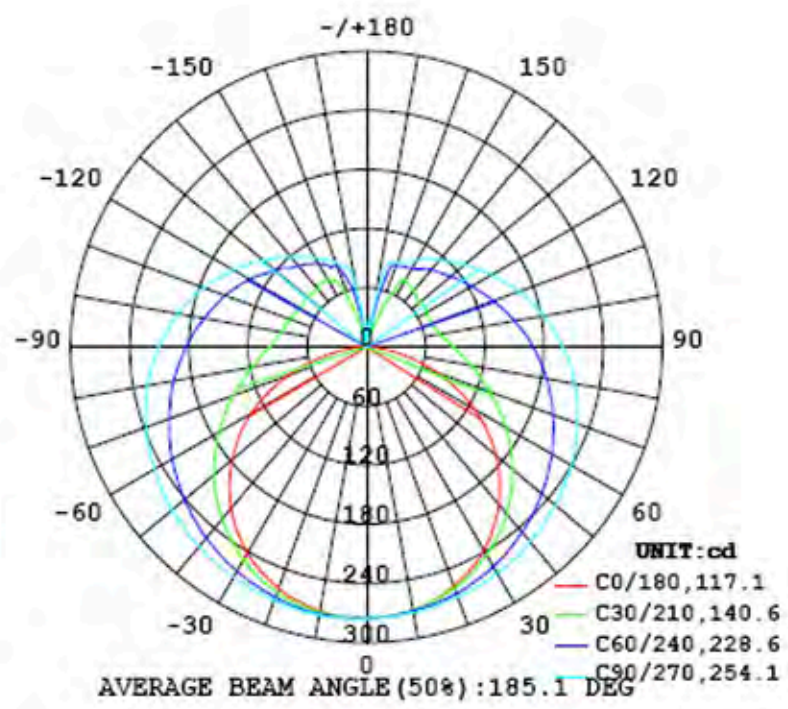


Chart 21: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276
5	275	274	275	274	274	274	274	274	274	275	274	275	275	274	275	274	274	275	274
10	271	271	271	271	271	272	272	272	273	274	273	273	274	273	272	272	272	272	272
15	266	266	266	266	267	269	270	270	272	272	272	271	271	270	269	268	267	268	267
20	259	258	259	260	262	265	266	268	270	270	270	269	269	266	264	263	261	261	261
25	249	249	251	253	256	259	262	264	267	268	267	266	265	262	258	256	254	252	252
30	238	238	240	244	248	253	257	260	264	265	264	263	260	257	252	248	244	242	241
35	224	224	228	233	239	247	251	256	260	262	261	259	256	250	245	238	233	230	229
40	209	209	214	221	230	238	246	252	256	258	257	255	251	243	236	228	220	216	214
45	191	192	198	208	219	230	239	246	252	254	253	250	245	236	226	216	206	200	197
50	172	173	181	194	208	221	232	240	247	250	248	245	238	228	216	203	190	181	178
55	150	152	163	179	196	212	225	235	242	244	244	239	232	219	206	190	174	162	157
60	126	130	144	163	184	202	217	228	236	240	238	233	225	211	194	175	156	141	135
65	102	107	125	148	172	193	209	222	230	234	232	227	217	202	183	161	138	118	110
70	76.0	82.9	105	133	160	183	201	215	224	228	226	221	210	193	172	147	120	95.9	84.4
75	51.3	60.6	87.6	119	149	174	193	208	217	221	220	214	202	185	162	134	103	73.6	58.0
80	27.0	39.7	71.9	107	139	165	186	200	210	215	213	206	195	176	152	122	87.3	54.5	32.8
85	8.00	24.1	60.5	96.6	129	156	177	193	203	207	205	199	187	168	143	112	75.4	37.8	11.7
90	0.82	16.1	52.0	88.1	121	148	169	185	195	199	197	191	179	160	135	104	67.3	28.9	1.32
95	0.56	14.1	46.7	81.1	113	140	161	176	186	191	189	182	171	152	127	96.5	61.7	25.6	0.47
100	0.55	15.7	44.2	75.9	106	132	152	168	177	182	180	174	162	144	120	91.0	58.7	26.2	0.41
105	0.58	19.8	44.0	72.5	100	125	145	159	169	173	172	166	154	136	114	86.7	57.7	29.5	0.45
110	0.67	24.9	45.5	70.3	96.0	119	137	151	160	164	163	157	146	130	108	83.9	58.4	34.3	0.56
115	1.42	30.2	48.5	70.4	92.1	113	130	142	151	155	154	149	138	123	104	82.1	60.4	39.7	1.67
120	1.96	35.8	52.2	70.4	89.5	108	123	135	143	147	145	140	131	117	100	81.5	63.2	45.5	4.40
125	3.01	30.1	54.2	71.7	87.5	104	117	128	135	138	137	133	124	112	97.4	81.4	66.4	51.2	6.17
130	4.36	20.3	58.2	70.6	86.4	99.9	111	121	127	130	129	125	118	108	95.1	81.5	69.0	54.6	5.65
135	5.33	13.8	61.3	71.7	84.7	97.1	107	114	120	122	122	119	112	103	93.3	79.3	71.0	38.3	4.54
140	5.64	9.77	64.6	74.7	81.6	93.8	102	109	114	116	115	112	107	100	89.1	81.2	73.3	17.6	3.58
145	5.43	18.0	48.0	76.2	82.4	89.0	96.1	104	108	110	109	107	102	94.1	87.9	81.9	74.3	12.3	2.76
150	4.98	9.80	31.1	77.2	83.0	88.2	91.8	96.2	99.1	101	100	98.5	95.3	91.6	87.0	79.5	49.9	10.8	2.68
155	4.57	8.42	13.2	54.4	82.8	87.1	90.0	92.4	94.3	95.2	95.0	94.4	92.7	89.6	83.6	73.3	24.3	18.7	2.75
160	4.28	4.38	16.3	27.1	64.2	85.6	87.5	89.7	91.4	92.1	91.7	91.2	89.5	82.6	71.7	39.1	7.27	9.30	2.96
165	4.08	9.81	10.8	9.86	24.9	49.2	66.9	85.9	87.7	88.4	87.9	87.1	71.4	49.2	26.1	11.3	19.7	3.96	3.28
170	5.50	19.5	6.56	12.2	23.1	7.99	17.5	25.5	30.8	34.0	33.3	23.8	15.9	8.93	4.24	18.3	8.91	10.1	4.67
175	6.45	12.7	21.3	13.3	11.7	8.44	11.0	12.4	14.0	17.3	9.41	9.19	11.6	10.2	7.60	8.40	11.9	17.9	5.72
180	6.21	5.00	5.08	4.57	2.57	2.50	14.5	0.00	7.60	18.4	6.99	0.00	0.00	0.00	9.62	15.9	19.7	17.7	6.26

Table 18: 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	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276		
5	275	275	275	276	276	276	275	276	276	275	276	276	275	275	275	274	275		
10	272	274	273	274	275	275	275	276	276	276	276	276	274	273	272	272	272		
15	268	269	270	272	273	273	274	275	275	274	275	274	272	270	269	267	266		
20	262	263	265	268	269	271	272	273	273	272	272	271	268	267	264	261	260		
25	253	256	258	261	265	267	269	271	272	271	270	267	263	260	257	253	251		
30	242	247	250	254	260	263	266	269	269	268	267	263	258	253	248	243	239		
35	231	235	239	246	253	258	263	266	267	265	264	259	252	245	238	232	227		
40	216	221	228	237	246	253	259	263	264	262	260	254	245	236	227	218	212		
45	200	206	216	227	238	247	254	259	261	259	256	248	237	226	214	203	195		
50	182	190	202	216	230	241	250	255	258	255	250	242	230	215	201	186	177		
55	162	172	188	205	222	234	244	251	254	251	245	236	221	205	186	169	157		
60	140	154	173	193	213	228	239	246	248	245	239	229	212	194	172	152	136		
65	116	135	158	182	204	221	233	240	243	241	233	222	204	183	158	134	113		
70	91.9	115	144	170	195	213	227	235	238	234	227	214	195	172	145	116	89.6		
75	67.9	96.8	130	160	186	206	220	229	232	229	221	207	187	162	132	98.5	67.3		
80	45.9	80.3	118	151	178	198	213	222	225	222	214	200	178	154	121	83.6	47.7		
85	28.5	67.2	107	142	169	191	206	215	219	215	207	192	171	144	111	72.1	33.0		
90	19.2	58.5	98.8	134	162	183	199	208	211	207	199	184	163	136	102	63.9	24.9		
95	17.6	53.9	92.3	127	155	175	190	199	203	199	191	176	156	128	95.5	58.0	20.9		
100	19.7	52.2	87.8	120	148	167	182	191	194	191	182	168	148	121	89.1	53.3	21.6		
105	24.1	51.9	84.7	115	141	160	173	182	185	182	174	159	140	114	83.4	52.2	24.5		
110	29.5	52.9	82.2	110	134	153	165	173	176	172	164	151	132	107	80.4	52.3	28.0		
115	35.2	55.2	80.4	106	128	145	157	164	166	162	155	142	124	103	78.4	52.8	32.9		
120	42.1	57.9	78.5	101	121	137	149	155	156	154	146	134	118	98.7	76.4	54.8	37.2		
125	48.8	60.1	78.8	97.3	115	129	139	146	147	144	138	127	112	94.6	75.0	56.3	38.4		
130	52.9	65.2	78.9	93.9	109	122	129	135	137	135	129	120	106	90.5	75.4	57.0	40.4		
135	41.1	67.6	77.4	92.3	104	114	122	127	129	127	121	112	100	88.6	75.2	59.8	32.7		
140	31.0	70.7	76.9	89.5	99.9	108	113	117	119	117	113	106	96.9	86.8	74.2	62.3	23.7		
145	14.1	73.2	79.9	86.2	95.8	103	108	111	112	110	107	101	93.6	83.0	74.0	63.5	8.38		
150	12.0	67.4	78.9	85.3	91.3	97.5	102	104	105	103	101	96.0	88.6	81.8	74.2	58.7	8.95		
155	7.52	41.3	73.4	78.0	88.2	90.8	95.3	97.6	97.7	96.8	94.6	91.0	85.8	79.9	72.5	44.4	4.85		
160	15.6	11.4	46.0	69.3	74.7	86.8	88.8	89.3	91.7	91.0	88.8	85.8	82.0	76.6	62.8	23.4	10.1		
165	7.75	7.53	13.6	39.8	58.4	66.9	78.7	83.8	83.9	82.6	82.4	81.3	77.3	60.6	40.0	12.9	15.3		
170	5.58	13.4	9.53	10.6	16.2	30.6	38.6	48.3	58.4	58.6	55.6	48.3	37.0	18.9	11.6	10.2	15.7		
175	5.71	8.06	12.6	15.6	13.7	10.1	7.19	6.00	6.23	9.27	7.93	10.2	13.5	18.7	17.5	13.9	9.28		
180	6.27	6.25	5.31	7.25	7.77	8.79	8.71	6.39	7.43	4.69	5.99	7.70	8.86	9.94	10.6	11.9	12.6		

Table 19: Luminous Intensity Data

TEST RESULTS of 91476

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)	0.106	0.050
Power Factor	0.9794	0.9149
Test Power (W)	12.48	12.77
THD A%	18.15	20.03
Luminous Efficacy (lm/W)	150.5	148.4
Total Luminous Flux (lm)	1878.7	1895.0
Color Rendering Index (CRI)	84.3	
R9	17.3	
Correlated Color Temperature (CCT)(K)	5141	
Chromaticity Chroma x	0.3412	
Chromaticity Chroma y	0.3497	
Chromaticity Chroma u	0.2096	
Chromaticity Chroma v	0.3221	
Duv	0.0006	
Chromaticity Chroma u '	0.2096	
Chromaticity Chroma v'	0.4832	

Special Color Rendering Indices	
R1	83.5
R2	88.5
R3	91.4
R4	85
R5	84
R6	83.4
R7	87.7
R8	71
R9	17.3
R10	72.2
R11	84.8
R12	62.2
R13	84.7
R14	95.3

Table 20: 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

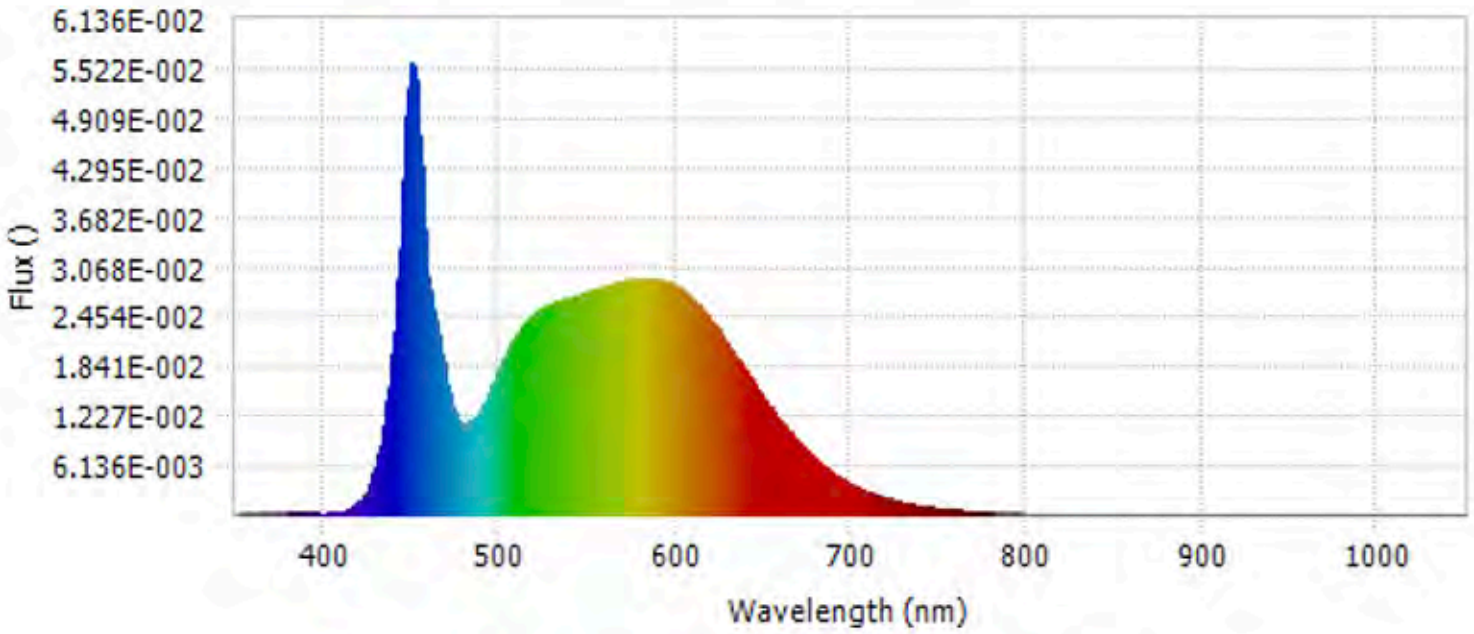
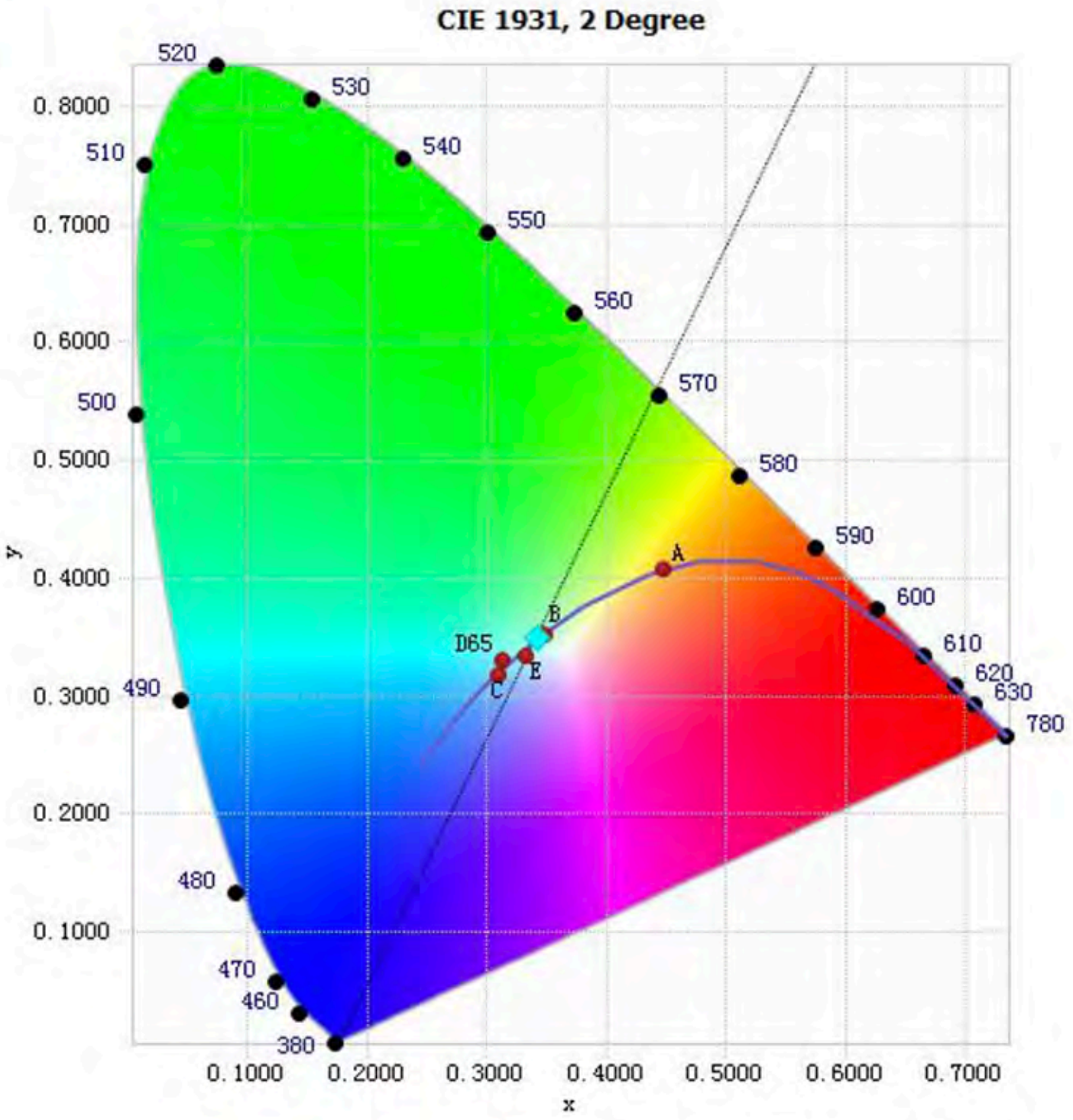


Chart 22: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.36E-04	485	1.18E-02	590	2.90E-02	695	4.36E-03
385	2.26E-04	490	1.32E-02	595	2.87E-02	700	3.73E-03
390	2.13E-04	495	1.56E-02	600	2.82E-02	705	3.20E-03
395	1.99E-04	500	1.82E-02	605	2.75E-02	710	2.73E-03
400	1.74E-04	505	2.06E-02	610	2.66E-02	715	2.35E-03
405	2.16E-04	510	2.23E-02	615	2.54E-02	720	2.01E-03
410	3.66E-04	515	2.39E-02	620	2.40E-02	725	1.73E-03
415	7.95E-04	520	2.49E-02	625	2.26E-02	730	1.47E-03
420	1.64E-03	525	2.56E-02	630	2.10E-02	735	1.26E-03
425	3.33E-03	530	2.61E-02	635	1.94E-02	740	1.07E-03
430	6.56E-03	535	2.64E-02	640	1.77E-02	745	9.13E-04
435	1.24E-02	540	2.68E-02	645	1.61E-02	750	7.81E-04
440	2.28E-02	545	2.72E-02	650	1.44E-02	755	6.60E-04
445	4.13E-02	550	2.75E-02	655	1.29E-02	760	5.67E-04
450	5.58E-02	555	2.79E-02	660	1.15E-02	765	4.98E-04
455	4.31E-02	560	2.82E-02	665	1.01E-02	770	4.25E-04
460	2.79E-02	565	2.85E-02	670	8.88E-03	775	3.61E-04
465	2.22E-02	570	2.88E-02	675	7.77E-03	780	3.10E-04
470	1.62E-02	575	2.90E-02	680	6.75E-03		
475	1.20E-02	580	2.91E-02	685	5.84E-03		
480	1.13E-02	585	2.92E-02	690	5.07E-03		

Table 21: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3412, 0.3497)

Chart 23: 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

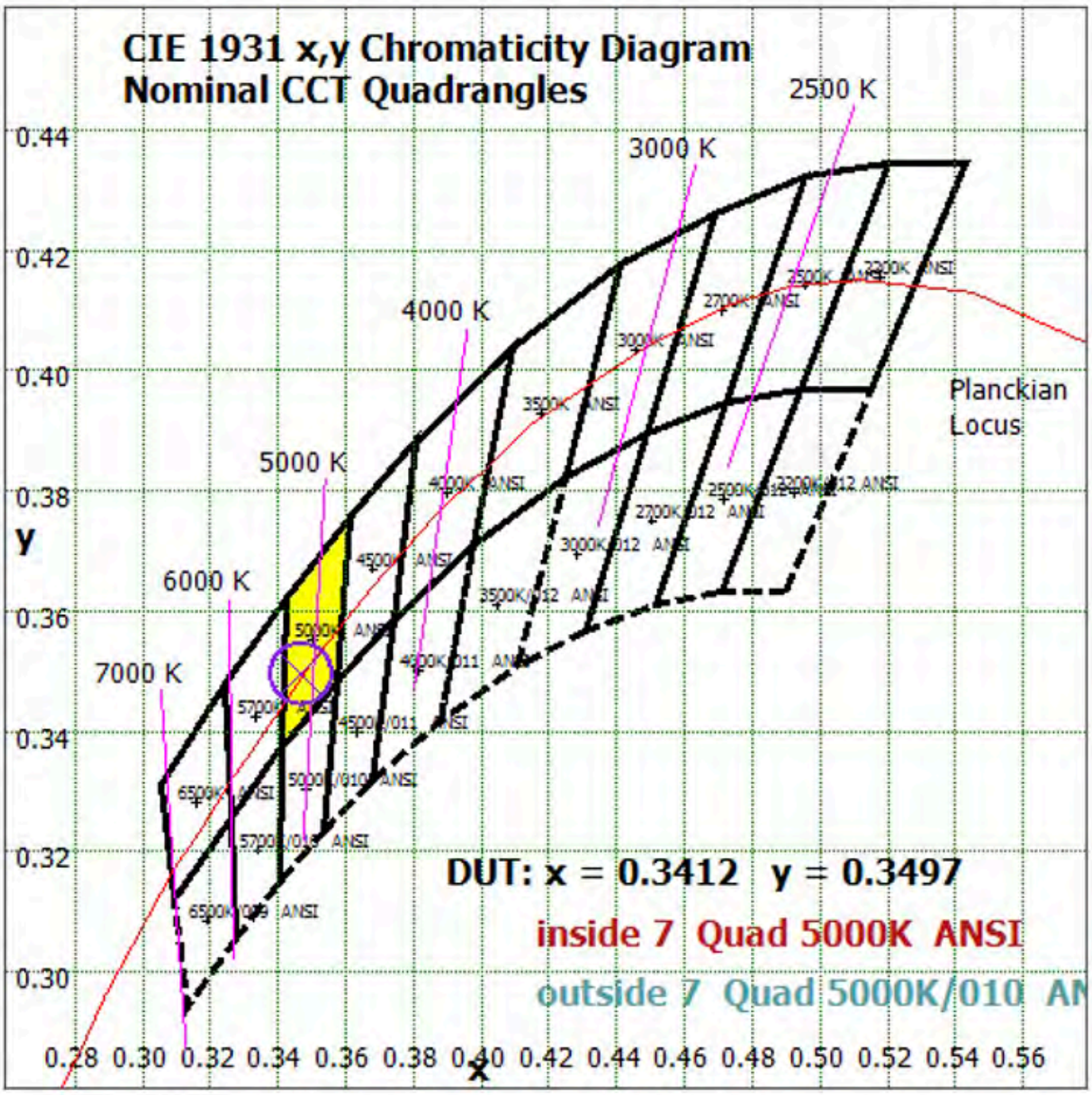


Chart 24: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Quality Assured

Color Rendition Report – Sphere Spectroradiometer Method

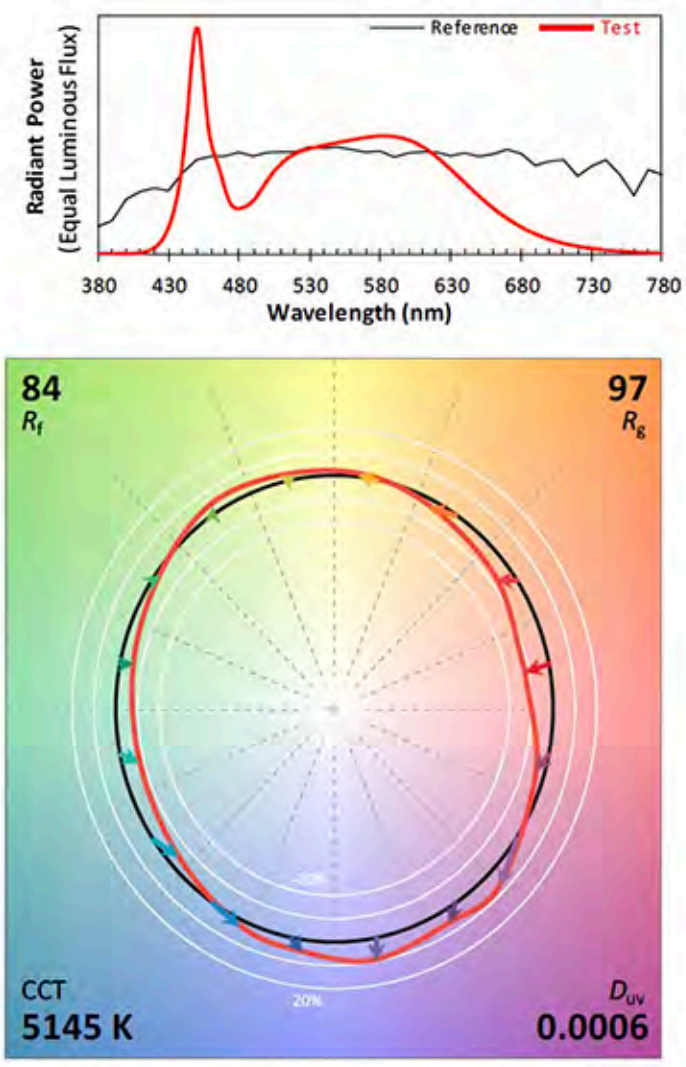
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: P.Q.L., Inc.

Date: 2022/11/09

Model: 91476



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

x	0.3412
y	0.3497
u'	0.2096
v'	0.4832

CIE 13.3-1995 (CRI)

R_a	84
R_9	17

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

Chart 25: 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 20 due to rounding.

Goniophotometer Method

Test ambient temperature was 25.8°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)	0.106
Power Factor	0.9793
Power (W)	12.50
Luminous Efficacy (lm/W)	150.8
Total Luminous Flux (lm)	1885.1
Beam Angle (°)	116.2 (0^{o}-180^{o}) / 246.4 (90^{o}-270^{o})
Center Beam Candle Power (cd)	292
Maximum Beam Candle Power (cd)	293.3 (At: C=110.0, Gamma=7.5)
Spacing Criteria	1.31 (0^{o}-180^{o}) / 1.45 (90^{o}-270^{o})
Zonal Lumens in the 0°-60°Zone	41.16%
Zonal Lumens in the 60°-90°Zone	27.11%
Zonal Lumens in the 90°-120°Zone	18.82%
Zonal Lumens in the 120°-180°Zone	12.91%

Table 22: Test data per Goniophotometer Method

Zonal Lumen Tabulation- Goniophotometer Method

γ(°)	Lumens	% Total
0- 10	27.73	1.47%
10- 20	80.814	4.29%
20- 30	127.057	6.74%
30- 40	162.622	8.63%
40- 50	184.919	9.81%
50- 60	192.814	10.23%
60- 70	187.293	9.94%
70- 80	171.659	9.11%
80- 90	152.133	8.07%
90-100	134.396	7.13%
100-110	118.152	6.27%
110-120	102.174	5.42%
120-130	84.37	4.48%
130-140	65.776	3.49%
140-150	45.344	2.41%
150-160	25.991	1.38%
160-170	15.636	0.83%
170-180	6.196	0.33%
Total	1885.1	100%

γ(°)	Lumens	% Total
0- 60	775.956	41.16%
60- 90	511.085	27.11%
0-90	1287.04	68.28%
90- 180	598.035	31.72%
0- 180	1885.1	100%

Table 23: Zonal Lumen

Illuminance Plots- Goniophotometer Method

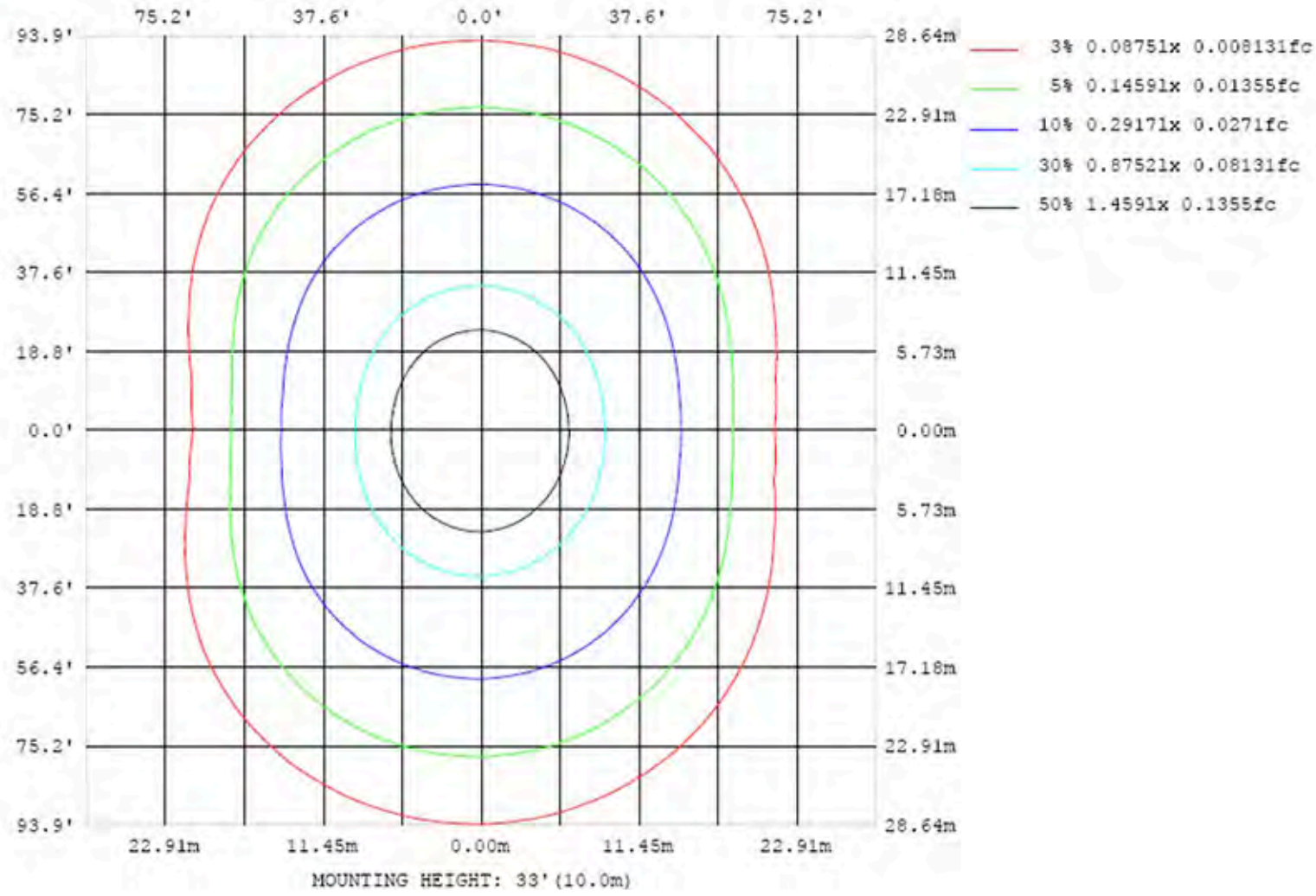


Chart 26: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

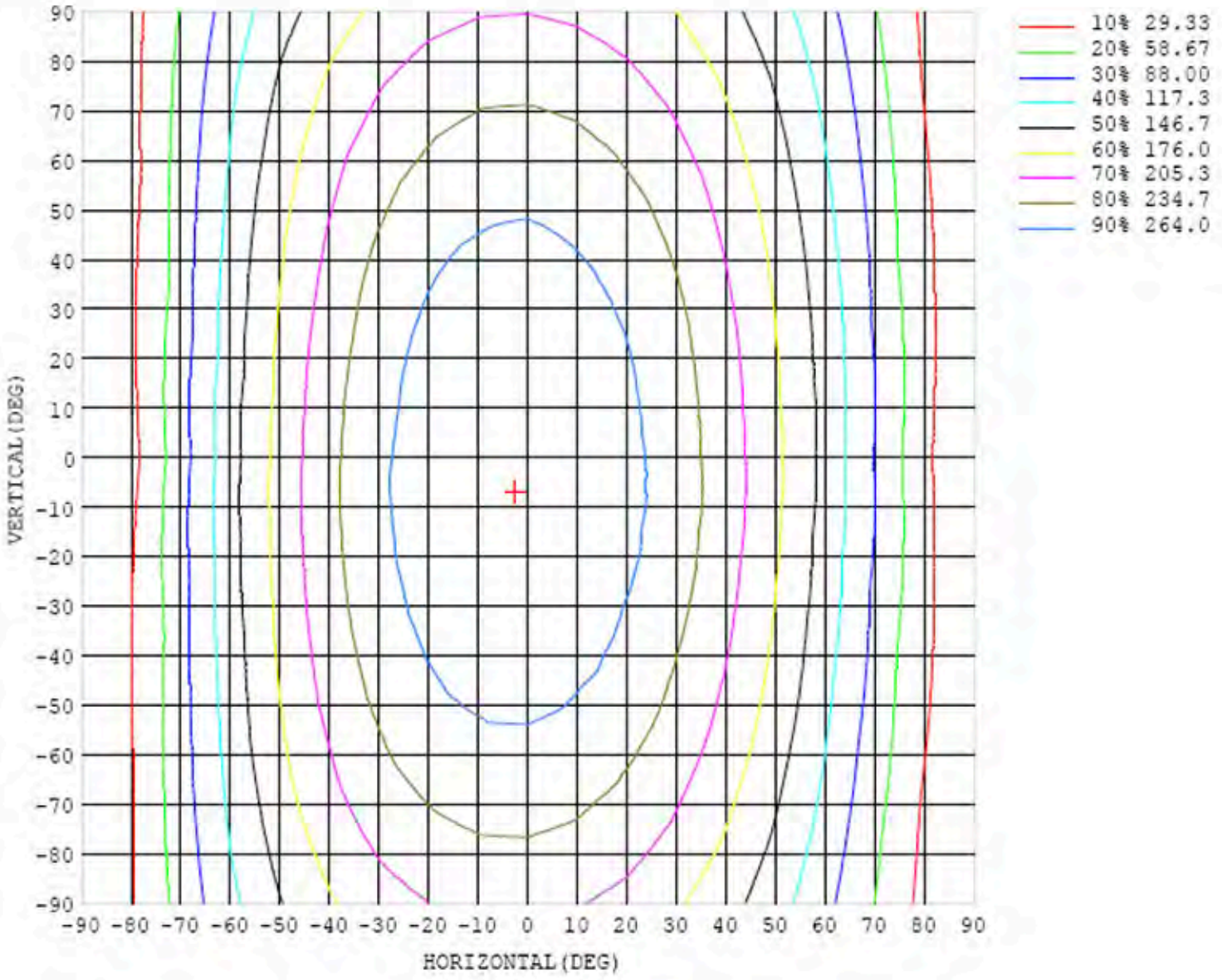


Chart 27: Isocandela Plot

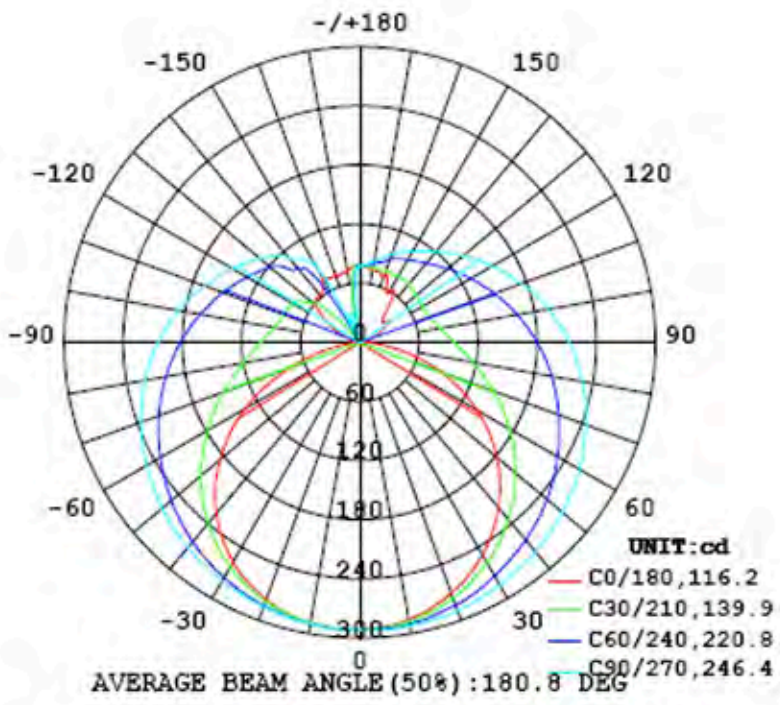


Chart 28: Polar Candela Distribution

Luminous Intensity Data- Goniophotometer Method

Table--1 UNIT: cd

γ (DEG) \ C(DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292
5	289	290	290	290	291	291	291	292	292	293	293	293	293	293	292	293	292	292	291
10	285	286	287	288	288	290	291	291	291	292	292	292	293	292	292	291	290	290	289
15	279	280	282	283	284	286	287	289	290	291	291	291	290	290	289	288	287	285	285
20	271	272	274	276	278	281	284	287	288	290	290	289	289	286	284	282	281	280	278
25	261	262	265	268	272	276	279	282	285	287	287	286	285	282	279	275	273	271	269
30	249	251	254	258	264	269	274	279	282	284	284	283	280	277	272	267	263	260	258
35	234	237	241	247	254	261	268	274	278	281	281	279	275	270	263	257	250	246	243
40	219	222	226	235	244	253	262	269	274	277	277	275	270	262	253	244	235	230	226
45	201	204	211	221	233	244	255	264	270	273	273	270	264	254	243	231	219	211	207
50	181	185	193	206	221	235	248	258	264	268	268	264	257	246	232	216	202	190	185
55	160	164	175	191	208	225	240	251	259	263	263	259	250	237	221	201	182	167	161
60	138	142	156	176	196	215	232	244	253	257	257	252	242	228	208	185	161	143	134
65	113	118	136	160	183	205	223	237	247	251	250	245	234	218	196	170	141	117	105
70	87.0	94.9	117	144	171	195	215	229	239	244	244	238	227	209	185	155	121	90.4	75.8
75	61.7	71.6	98.0	130	159	185	206	222	232	238	237	231	219	200	174	141	102	65.6	46.6
80	37.0	50.6	81.3	117	149	176	198	214	225	229	229	222	210	191	163	129	87.4	45.5	21.3
85	15.5	32.5	67.6	105	138	167	189	206	216	221	220	214	202	181	154	118	76.1	31.8	3.66
90	1.61	20.9	58.4	95.7	129	158	180	197	207	212	212	205	193	172	145	110	68.7	26.6	0.77
95	1.02	16.9	52.1	88.3	121	149	171	188	198	203	203	196	183	164	137	103	65.1	26.8	2.05
100	2.60	18.1	48.7	82.2	114	141	162	178	189	194	193	187	174	155	129	97.9	63.1	29.8	4.43
105	6.37	22.4	48.0	78.1	107	133	154	170	180	184	184	178	166	147	123	94.1	62.9	35.5	8.38
110	11.3	27.8	49.1	75.7	102	126	145	160	170	174	174	168	156	140	117	91.3	63.9	41.3	14.8
115	18.6	33.7	51.6	74.2	97.3	119	137	151	160	165	164	159	148	133	113	89.5	66.0	48.1	24.3
120	27.0	39.9	54.9	73.6	93.9	113	130	143	151	155	154	150	140	126	108	88.2	69.0	53.2	35.4
125	37.6	44.9	58.4	73.7	91.1	108	123	134	142	146	145	141	132	120	104	87.7	71.8	58.2	46.6
130	30.7	49.4	62.3	74.5	89.0	103	116	127	133	137	137	133	125	115	101	87.7	74.5	63.5	58.4
135	32.2	54.8	65.1	75.6	87.7	99.4	110	119	125	129	128	125	119	110	99.1	88.0	76.7	67.4	62.8
140	42.9	59.5	66.5	77.3	86.7	96.3	105	113	117	120	120	118	113	106	97.0	88.1	77.9	68.7	63.0
145	59.6	63.0	68.5	77.9	86.0	93.7	101	107	111	113	113	111	107	102	95.2	87.7	79.1	73.3	66.6
150	57.6	65.6	70.9	77.7	85.7	91.5	97.1	102	105	107	107	105	102	98.4	93.4	86.4	78.8	74.0	74.3
155	65.2	70.6	72.7	77.1	83.3	89.6	93.9	97.2	99.5	101	101	100	98.2	95.3	90.4	84.0	80.1	75.8	71.9
160	72.2	71.9	73.7	77.3	80.9	85.5	89.9	92.9	95.0	96.0	96.2	95.3	93.5	90.3	86.3	83.3	80.3	76.5	73.7
165	75.7	74.4	74.9	77.2	79.9	82.4	84.2	86.1	87.7	88.7	88.6	87.9	87.0	85.6	84.2	82.0	79.6	77.2	72.8
170	75.8	75.5	76.4	77.3	78.6	80.0	81.3	82.6	83.4	83.8	83.9	83.8	83.3	82.4	81.4	79.9	79.6	78.0	73.5
175	76.5	76.2	76.9	77.7	78.0	78.2	78.4	78.8	79.2	79.4	79.4	79.2	79.1	79.1	79.4	79.4	78.8	77.9	77.5
180	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0

Table 24: 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	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292		
5	292	291	291	291	291	291	291	291	291	290	290	290	290	289	289	289	289		
10	289	289	289	289	289	290	290	290	290	289	288	288	287	286	285	285	286		
15	284	285	285	286	287	288	288	288	288	287	286	285	283	282	281	280	279		
20	278	278	280	281	283	284	285	286	285	284	283	281	278	276	274	272	271		
25	268	270	273	275	278	280	282	283	283	281	279	276	273	269	265	262	261		
30	257	259	263	267	272	275	279	280	280	278	275	271	266	261	256	252	249		
35	243	247	252	259	265	270	274	276	276	274	270	264	258	252	245	239	236		
40	227	232	240	248	257	264	269	272	272	269	264	258	250	242	233	225	220		
45	208	216	226	237	248	257	263	266	267	264	258	251	242	230	219	209	203		
50	187	197	211	226	239	250	257	261	262	258	252	243	232	219	205	193	183		
55	164	177	195	213	230	242	251	255	256	253	246	235	222	206	190	175	164		
60	140	156	179	200	220	234	244	249	250	246	239	227	212	194	175	156	143		
65	113	136	163	188	209	226	236	242	243	239	231	219	202	182	160	138	120		
70	86.3	115	147	176	199	217	229	235	237	232	223	210	192	170	145	119	96.4		
75	60.8	96.4	133	165	190	209	221	228	229	225	216	202	183	159	132	101	73.2		
80	39.7	80.7	121	154	181	200	213	220	221	217	208	193	173	149	118	84.3	51.9		
85	26.2	68.8	110	145	171	191	205	212	213	209	199	184	164	139	107	71.0	34.9		
90	19.0	60.3	101	135	162	182	196	203	204	200	191	176	156	129	97.1	60.3	24.2		
95	16.7	54.9	93.6	127	154	173	187	194	196	191	181	167	148	121	87.8	50.5	15.3		
100	16.1	52.9	88.2	119	146	165	177	185	186	182	173	159	139	113	80.2	44.9	13.2		
105	15.0	52.6	84.6	113	138	156	168	175	177	173	164	151	131	106	75.5	43.1	13.3		
110	12.3	52.9	82.4	108	130	148	160	166	167	163	156	143	124	100	72.6	42.9	12.8		
115	10.0	53.0	81.4	104	123	140	151	157	159	155	147	135	118	96.0	70.4	42.6	11.2		
120	6.45	37.5	78.4	101	118	132	142	148	150	146	139	127	112	92.4	67.5	42.4	8.73		
125	7.82	6.69	73.4	94.3	113	125	134	139	141	137	131	120	107	89.1	60.6	32.7	9.08		
130	18.7	1.62	61.7	88.3	106	119	127	131	132	129	123	114	101	81.9	49.4	0.00	10.8		
135	31.0	7.54	42.9	83.0	95.1	108	119	124	124	122	117	106	91.5	76.4	37.6	1.55	7.58		
140	31.8	4.85	10.1	34.4	95.1	98.5	103	110	111	108	103	96.5	91.8	52.8	23.3	13.6	9.04		
145	31.6	8.43	4.72	4.80	49.7	84.6	97.6	99.8	102	101	98.1	93.6	72.6	4.12	6.22	12.1	14.6		
150	50.8	13.4	10.3	22.1	4.75	14.1	47.0	80.7	85.7	85.7	81.2	47.3	20.2	3.65	17.2	11.4	23.4		
155	59.4	21.5	8.24	11.1	15.6	5.22	18.0	12.3	7.03	8.19	12.0	26.1	17.8	13.6	16.1	10.7	30.4		
160	62.7	28.8	10.7	8.86	14.5	17.2	17.3	16.9	4.81	6.83	9.68	17.8	32.8	11.7	6.16	14.8	45.8		
165	66.0	43.0	20.7	14.0	9.04	12.2	12.1	25.0	30.7	38.3	29.0	16.0	13.4	10.4	17.6	30.4	62.4		
170	70.1	62.8	45.8	24.4	19.6	16.7	14.4	10.2	13.3	12.1	11.7	12.5	20.2	23.6	34.4	53.7	73.3		
175	78.4	78.2	76.3	70.0	61.9	55.5	50.5	46.7	44.5	44.5	46.7	49.8	55.1	62.4	71.6	77.2	77.5		
180	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0		

Table 25: Luminous Intensity Data

ISTMT Test Results

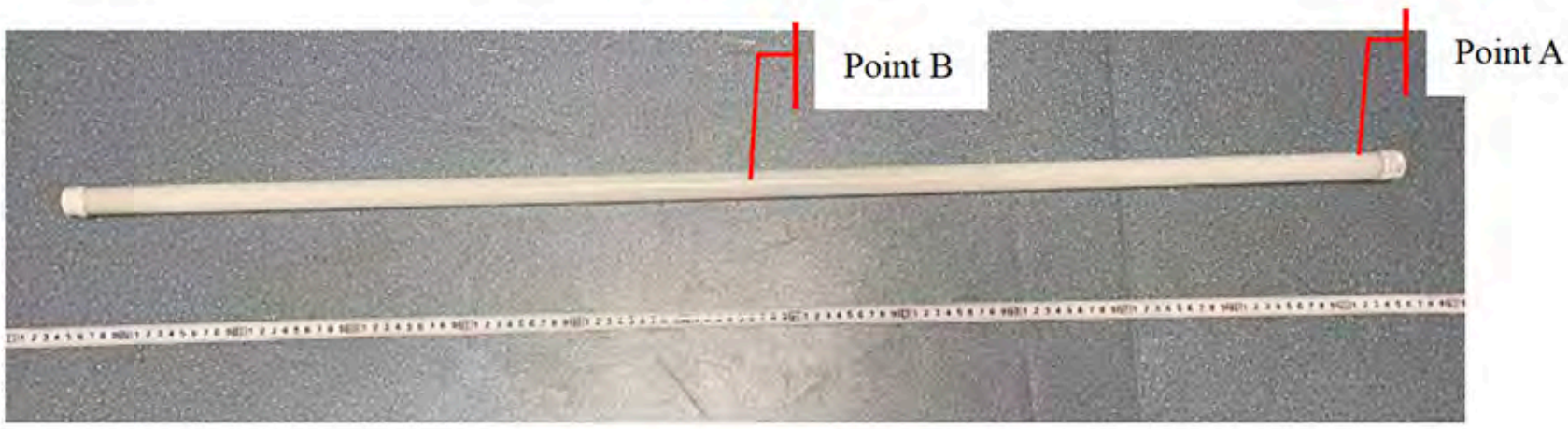
Test ambient temperature was 24.7°C.

Test orientation was light down.

Model of light source: BXVN-30E-11L-3EJ-000-00-00-0

The stabilization time of the sample was 7.5 hours.

View of In-Situ Point- Ts



Location of In-Situ Point from overall view

Input Voltage (V)	Input Power (W)	Tested LED source current (mA)	Measured In-Situ Maximum Temperature(Corrected to Ta=25℃)	
			Point A	Point B
120.0	12.12	48.7	39.2	42.2
277.0	12.43	48.8	39.0	42.0

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 26: 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.

ISTMT Measurements

The luminaire was installed to simulate intended usage, in accordance with the manufacturer's instructions.

Temperatures were measured after they stabilized, when the test was run for a minimum of 7.5 h.

The tests were conducted in an ambient temperature of 25 ± 5 °C. Ambient temperature variations above or

below 25°C were respectively subtracted from or added to temperatures recorded at points on the luminaire. Temperatures recorded at points on a luminaire were measured by means of thermocouples.

The thermocouples had conductors no larger than No. 24 AWG (0.21mm^2) and no smaller than No. 30 AWG (0.05mm^2). Thermocouples complied with the requirements specified in ASTM MNL 12 and thermocouples as listed in the table of the limits of error specified in NIST ITS 90, or ISA MC96.1.

The luminaire was installed in the test box in the configuration that resulted in the highest operating temperatures, considering different trim and maximum lamp wattage combinations, lamp holder adjustment heights, and the like.

The test box was constructed of 12mm thick plywood as described below:
The test box was rectangular and had four sides and a bottom.
The four sides of the test box for a ceiling-mounted luminaire were a minimum distance of 8.5 in (215mm) from the nearest part of the lamp housing or heat-producing parts. The top edge of the sides of the test box were a minimum of 8.5 in (215mm) above the highest point of any permanently attached part of the lamp housing.
Thermal insulation of the loose-fill type was poured into the test box through the open top, until level with the top, without applying any compacting procedure.
The thermal insulation was conditioned to the density specified by the insulation manufacturer to obtain a required rated thermal resistance of Rsi 0.56 to 0.678 (R3.2 to R3.85).
All spaces around the luminaire and between it and the sides of the box were filled with the thermal insulation.

*** End of Report ***