



## LM-79-08 TEST REPORT

for

**P.Q.L., Inc.**

2285 Ward Avenue / Simi Valley, CA 93065

**AREA LIGHT**

**Model: 83436**

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ20040020h/R2

This report is replaced the old report No. HZ20040020h/R1 dated Jul. 14, 2020.

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

Review by:

Engineer: April Zou  
Aug. 10, 2020

Approved by:



Manager: Jim Zhang  
Aug. 10, 2020

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

## TEST SUMMARY

Sample Tested: **83436**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
126.4	4640.7	36.72	0.9974
CCT (K)	CRI	Stabilization Time (Light & Power)	
4981	72.7	60	

Table 1: Executive Data Summary

### Test specifications:

<b>Date of Receipt</b>	: Apr. 15, 2020
<b>Date of Test</b>	: Apr. 20, 2020
<b>Test item</b>	: Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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## SAMPLE PHOTO



Figure 1- Overview of the sample

### Equipment Under Test(EUT)

<b>Name</b>	: AREA LIGHT
<b>Model</b>	: 83436
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz, 40W
<b>Product Description</b>	: 5000K
<b>Manufacturer</b>	: P.Q.L., Inc.
<b>Address</b>	: 2285 Ward Avenue / Simi Valley, CA 93065

## TEST RESULTS

Test ambient temperature was 25.0°C.

Test orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 70 minutes, and the total operating time including stabilization was 90 minutes.

The photometric distance is 2.47 m.

Luminous data was taken at 0.5°vertical intervals and 10°horizontal intervals.

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.307	0.141
Power Factor	0.9974	0.9401
Test Power (W)	36.72	36.69
THD A%	3.37	11.86
Luminous Efficacy (lm/W)	126.4	126.7
Total Luminous Flux (lm)	4640.7	4649.1
Color Rendering Index (CRI)	72.7	
R9	-22	
Correlated Color Temperature (CCT) (K)	4981	
Chromaticity (Chroma x, Chroma y)	(0.3459, 0.3552)	
Chromaticity (Chroma u, Chroma v)	(0.2106, 0.3243)	
Chromaticity (Chroma u', Chroma v')	(0.2106, 0.4865)	
Duv	0.0015	
Average Beam Angle (°)	141.1	
Center Beam Candle Power (cd)	759	
Spacing Criteria	2.00 (0°-180°)/ 1.85 (90°-270°)	
Zonal Lumens in the 0°-60°Zone	80.52%	
Zonal Lumens in the 60°-90°Zone	19.18%	
Zonal Lumens in the 90°-120°Zone	0.20%	
Zonal Lumens in the 120°-180°Zone	0.10%	

Special Color Rendering Indices	
R1	71
R2	77
R3	81
R4	73
R5	70
R6	68
R7	83
R8	59
R9	-22
R10	45
R11	69
R12	38
R13	72
R14	89

Table 2: Test data per Goniophotometer Method

**Spectral Power Distribution- Goniophotometer Method**

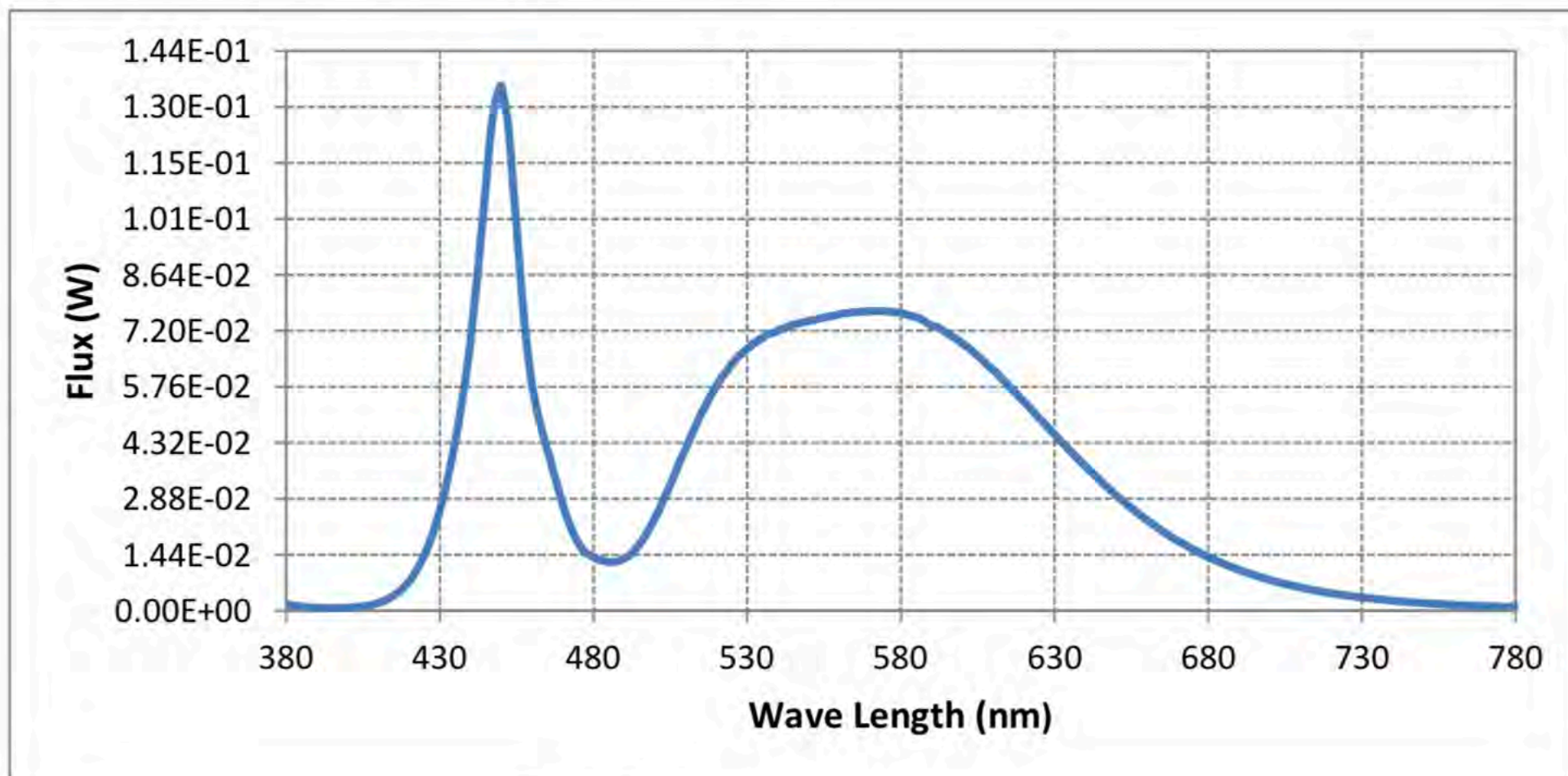
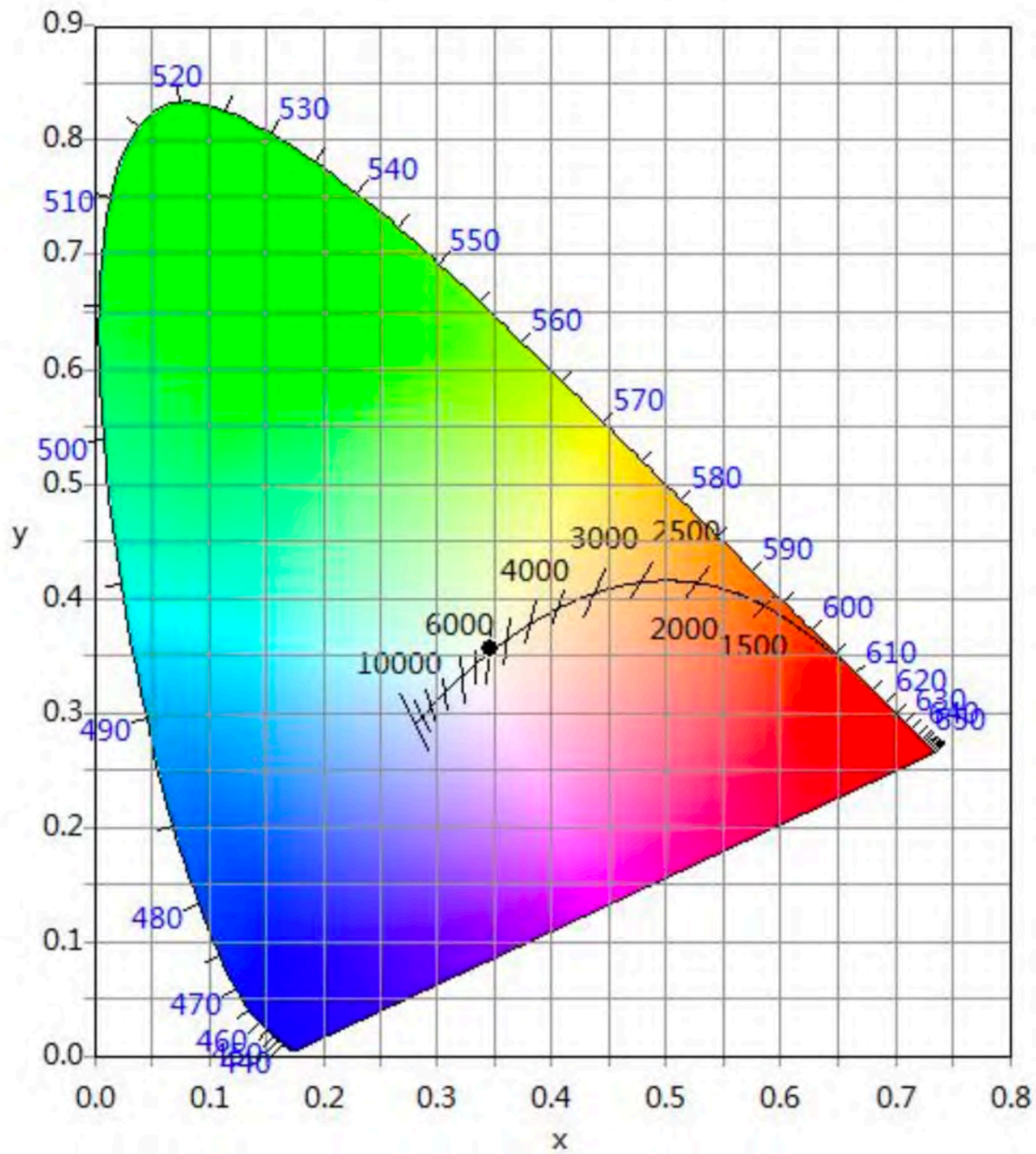


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.67E-03	485	1.25E-02	590	7.34E-02	695	9.13E-03
385	1.09E-03	490	1.34E-02	595	7.14E-02	700	7.96E-03
390	7.62E-04	495	1.72E-02	600	6.88E-02	705	6.92E-03
395	7.34E-04	500	2.40E-02	605	6.56E-02	710	6.01E-03
400	7.64E-04	505	3.25E-02	610	6.20E-02	715	5.16E-03
405	1.14E-03	510	4.18E-02	615	5.80E-02	720	4.49E-03
410	1.99E-03	515	5.06E-02	620	5.38E-02	725	3.93E-03
415	3.93E-03	520	5.78E-02	625	4.95E-02	730	3.42E-03
420	7.55E-03	525	6.36E-02	630	4.54E-02	735	2.98E-03
425	1.45E-02	530	6.75E-02	635	4.11E-02	740	2.62E-03
430	2.61E-02	535	7.01E-02	640	3.72E-02	745	2.25E-03
435	4.35E-02	540	7.21E-02	645	3.34E-02	750	1.97E-03
440	6.97E-02	545	7.37E-02	650	2.97E-02	755	1.72E-03
445	1.10E-01	550	7.45E-02	655	2.64E-02	760	1.50E-03
450	1.35E-01	555	7.54E-02	660	2.34E-02	765	1.33E-03
455	9.81E-02	560	7.63E-02	665	2.06E-02	770	1.19E-03
460	5.79E-02	565	7.68E-02	670	1.81E-02	775	1.04E-03
465	4.12E-02	570	7.70E-02	675	1.58E-02	780	1.18E-03
470	2.73E-02	575	7.70E-02	680	1.38E-02		
475	1.76E-02	580	7.66E-02	685	1.21E-02		
480	1.38E-02	585	7.55E-02	690	1.05E-02		

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

**Chromaticity Diagram - Goniophotometer Method**



Tristimulus values(x, y): (0.3459, 0.3552)

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 –Goniophotometer Method

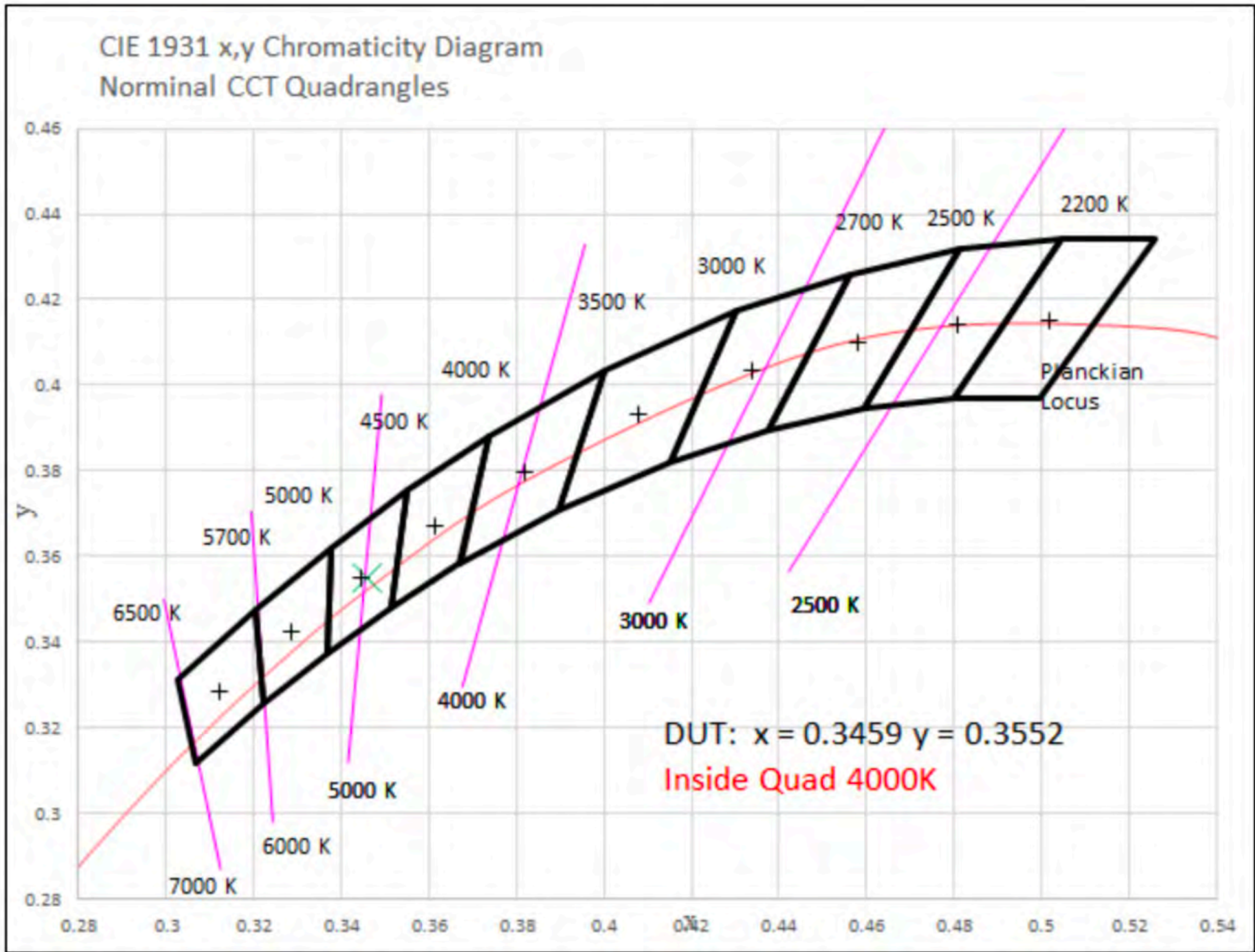


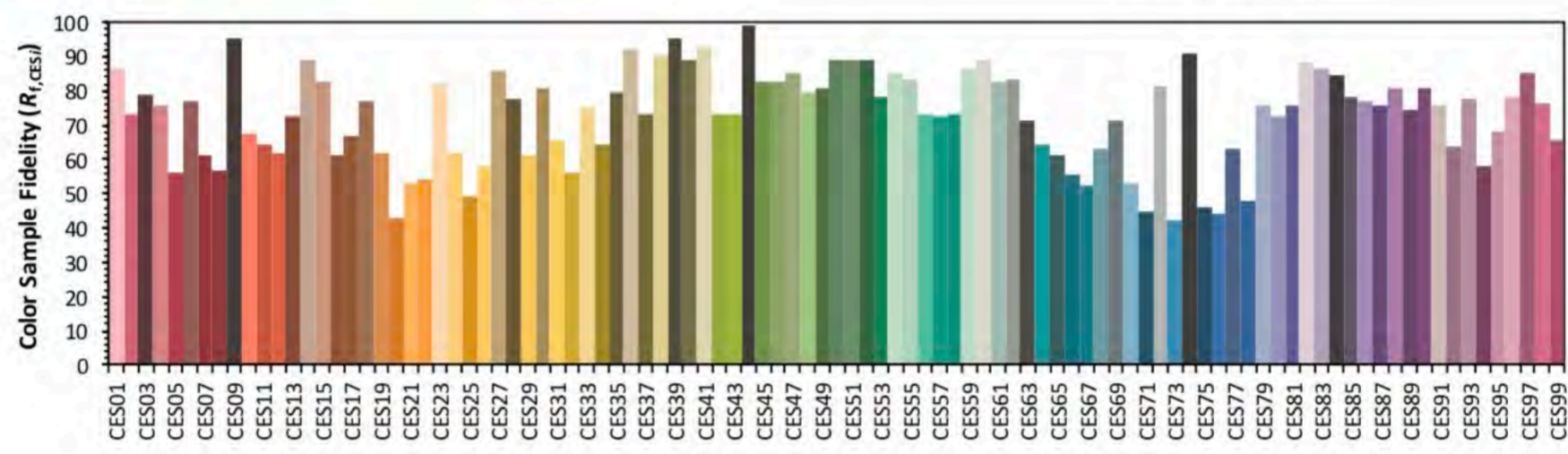
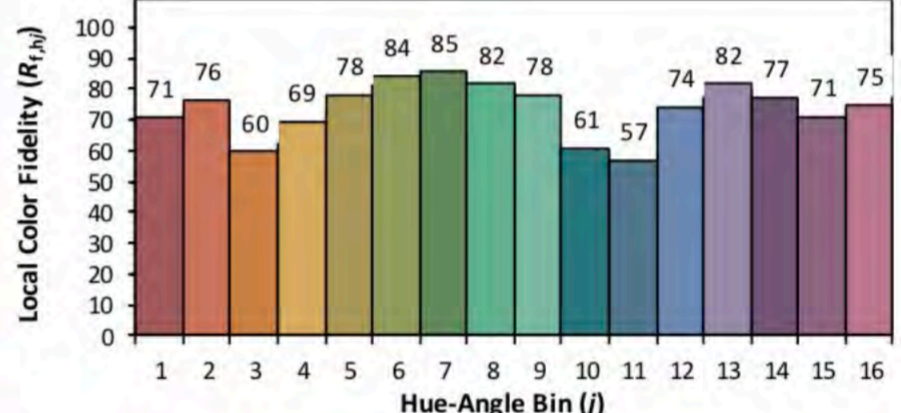
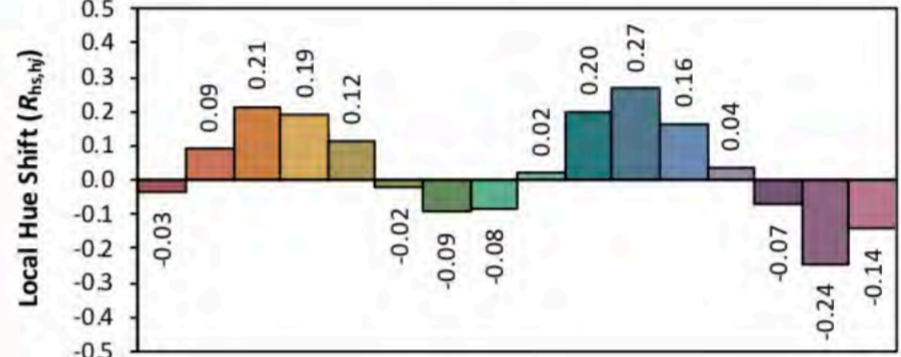
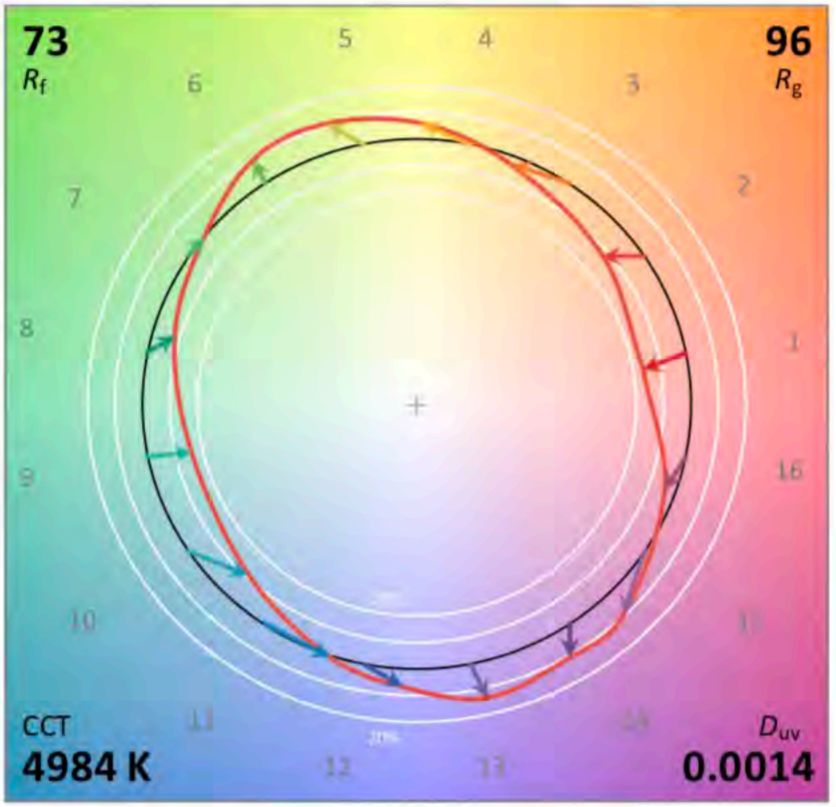
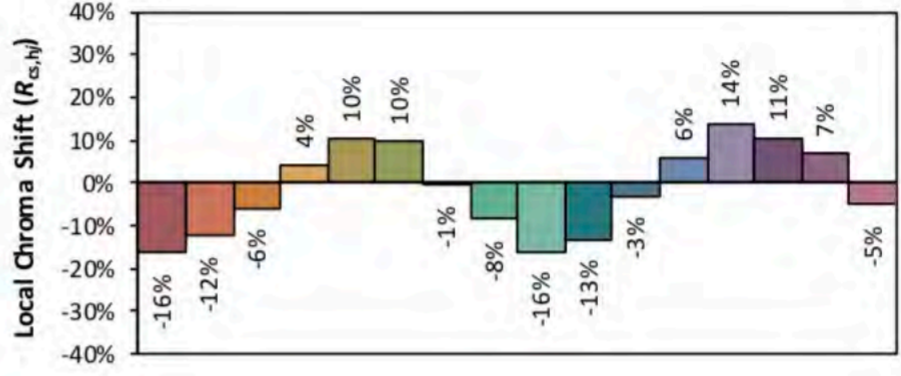
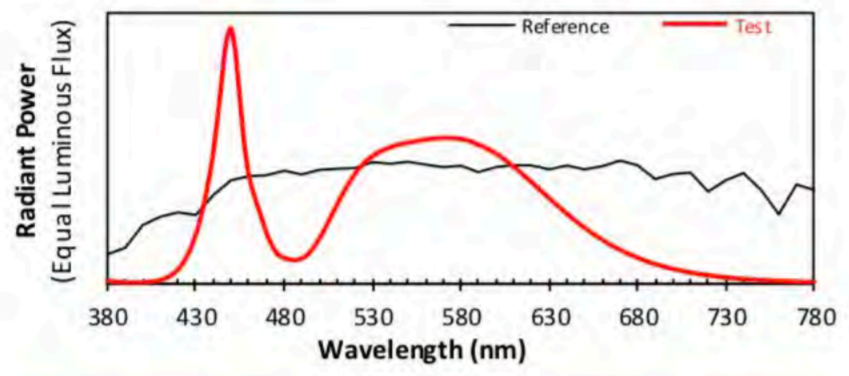
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



**Color Rendition Report –Goniophotometer Method**

**ANSI/IES TM-30-18 Color Rendition Report**

Source: LED  
 Date: 2020/4/20  
 Manufacturer: P.Q.L., Inc.  
 Model: 83436



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

$x$	0.3458	CIE 13.3-1995 (CRI)
$y$	0.3550	
$u'$	0.2106	
$v'$	0.4864	

$R_a$  73  
 $R_g$  -22

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

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

**Zonal Lumen Tabulation- Goniophotometer Method**

$\gamma(^{\circ})$	Lumens	% Total
0- 10	99.139	2.14%
10- 20	404.817	8.72%
20- 30	686.371	14.79%
30- 40	856.759	18.46%
40- 50	900.912	19.41%
50- 60	788.785	17.00%
60- 70	556.31	11.99%
70- 80	273.87	5.90%
80- 90	59.831	1.29%
90-100	4.879	0.11%
100-110	3.095	0.07%
110-120	1.32	0.03%
120-130	0.978	0.02%
130-140	1.042	0.02%
140-150	1.054	0.02%
150-160	0.824	0.02%
160-170	0.503	0.01%
170-180	0.163	0.00%
Total	4640.7	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	3736.783	80.52%
60- 90	890.011	19.18%
0-90	4626.794	99.70%
90- 180	13.858	0.30%
0- 180	4640.7	100%

Table 4: Zonal Lumen Data

**Illuminance Plots- Goniophotometer Method**

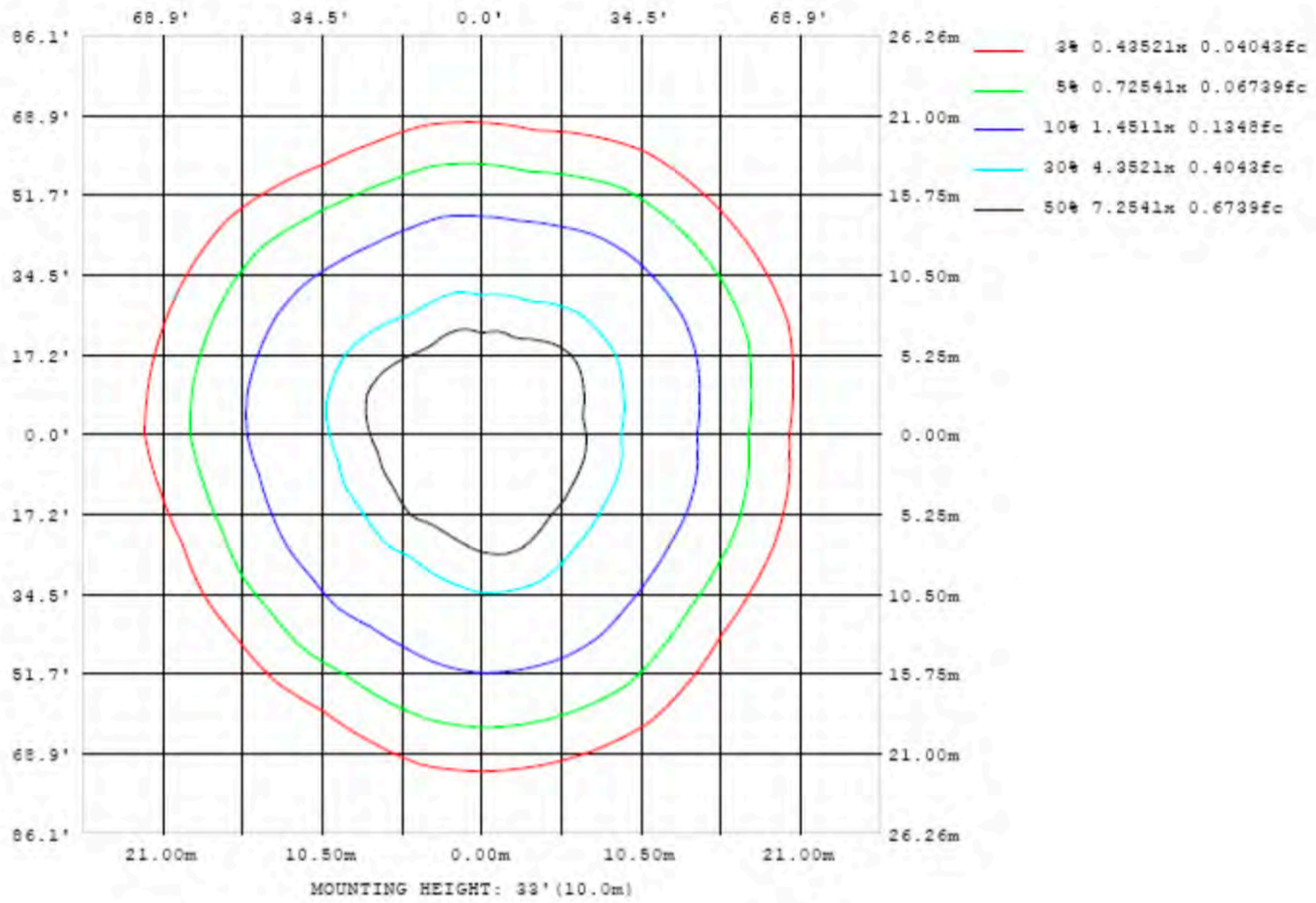


Chart 5: Illuminance Plot (Footcandles)

**Luminous Intensity Distribution Plots- Goniophotometer Method**

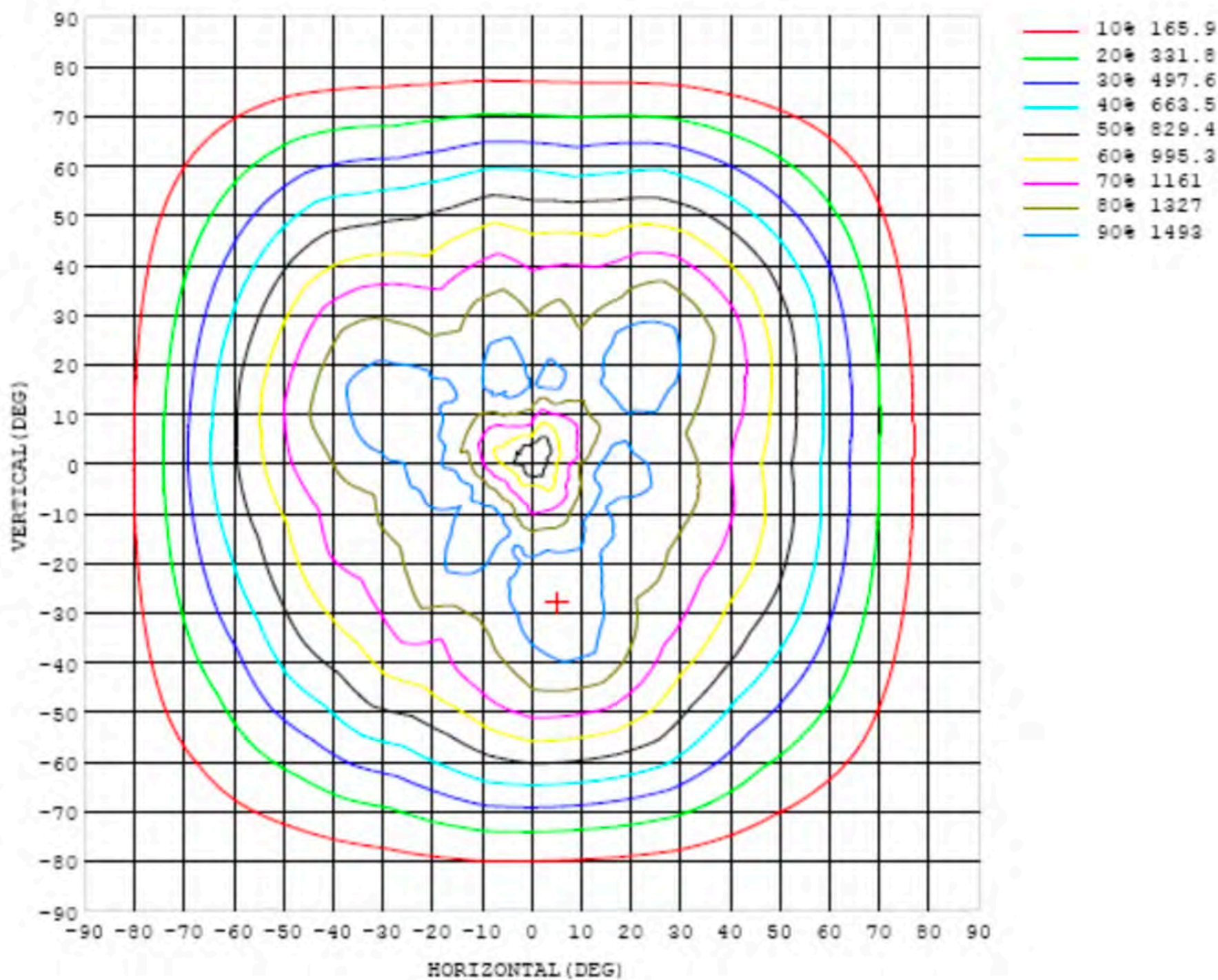


Chart 6: Isocandela Plot

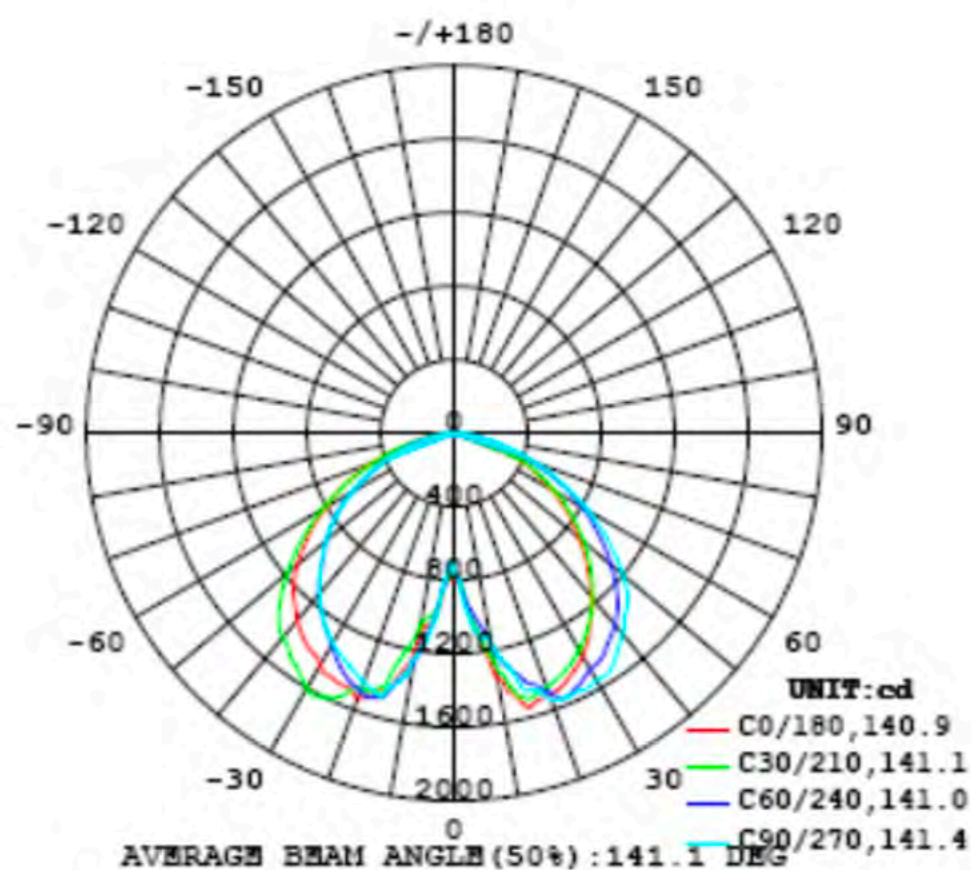


Chart 7: Polar Candela Distribution

**Luminous Intensity Data- Goniophotometer Method**

Table--1 UNIT: cd

C (DEG) y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759
5	999	1002	955	996	936	912	953	1003	1043	1035	1063	997	1036	1088	1057	1086	1042	1000	966
10	1357	1342	1306	1269	1193	1173	1170	1165	1178	1163	1241	1330	1394	1380	1380	1343	1320	1279	1192
15	1551	1576	1498	1494	1482	1459	1363	1380	1412	1444	1424	1510	1584	1618	1542	1501	1577	1497	1457
20	1516	1546	1487	1472	1516	1542	1499	1541	1538	1543	1472	1439	1565	1596	1506	1467	1539	1534	1531
25	1472	1484	1442	1427	1458	1440	1543	1608	1621	1561	1499	1430	1497	1534	1453	1414	1448	1491	1499
30	1400	1410	1373	1362	1402	1391	1483	1619	1647	1550	1462	1382	1388	1446	1383	1343	1365	1373	1457
35	1289	1305	1288	1276	1304	1313	1437	1549	1619	1519	1376	1288	1242	1349	1298	1258	1297	1298	1402
40	1163	1194	1187	1172	1201	1249	1362	1489	1501	1426	1314	1218	1148	1243	1198	1172	1240	1249	1328
45	1026	1077	1072	1053	1095	1139	1256	1353	1360	1332	1233	1150	1071	1123	1086	1084	1139	1128	1236
50	888	939	942	921	956	1006	1113	1192	1200	1199	1120	1019	968	996	961	981	998	1007	1117
55	754	790	799	781	803	858	960	1017	1024	1026	962	866	823	861	823	850	853	870	966
60	611	637	647	635	644	711	808	832	839	842	802	733	679	709	679	701	693	734	807
65	468	487	495	488	495	558	629	642	649	653	645	581	531	550	531	547	532	580	653
70	329	339	346	342	348	400	446	457	465	469	467	425	384	396	384	396	384	425	474
75	207	208	215	213	221	255	285	294	300	305	307	284	255	260	252	258	256	282	310
80	102	102	106	107	114	133	150	157	162	167	170	159	147	145	142	145	146	159	173
85	29.7	30.4	32.1	34.2	37.6	42.4	53.7	57.4	61.3	63.7	65.3	60.4	59.2	59.1	58.0	58.7	59.0	61.2	67.2
90	4.76	5.21	5.37	6.23	6.37	5.41	7.69	8.51	9.22	9.95	10.4	8.37	10.6	10.7	10.6	10.7	10.8	9.07	13.0
95	3.70	3.80	3.82	3.88	3.64	3.01	4.38	4.29	4.03	3.84	3.68	1.80	3.65	3.86	4.00	4.05	3.77	2.25	4.78
100	2.91	3.46	3.53	3.54	2.90	3.29	3.61	3.49	3.29	3.05	2.87	2.02	2.75	3.21	3.36	3.41	3.00	2.82	3.94
105	1.98	2.93	3.01	3.00	2.15	2.85	2.86	2.79	2.70	2.55	2.32	2.07	1.89	2.67	2.91	2.88	2.09	2.57	3.40
110	1.18	1.91	1.95	1.99	1.33	1.97	1.94	1.88	1.82	1.73	1.62	1.50	1.16	1.89	1.99	1.97	1.36	1.80	2.17
115	0.89	1.20	1.19	1.18	0.89	1.26	1.25	1.25	1.19	1.12	1.03	0.97	0.73	1.12	1.15	1.16	0.92	1.13	1.25
120	0.84	1.01	0.99	0.96	0.81	1.04	1.07	1.09	1.05	0.99	0.94	0.90	0.76	0.96	1.00	1.01	0.89	1.00	1.16
125	0.90	0.95	0.95	0.91	0.87	1.05	1.07	1.06	1.04	1.00	0.96	0.92	0.84	0.93	0.96	0.95	0.93	1.01	1.19
130	1.02	1.03	1.04	0.99	1.01	1.11	1.15	1.13	1.11	1.07	1.04	0.99	0.97	0.99	1.04	1.03	1.05	1.07	1.32
135	1.18	1.16	1.17	1.11	1.15	1.20	1.24	1.25	1.24	1.21	1.16	1.12	1.10	1.12	1.18	1.16	1.18	1.18	1.53
140	1.33	1.31	1.33	1.26	1.28	1.32	1.35	1.36	1.37	1.37	1.31	1.26	1.24	1.26	1.32	1.31	1.33	1.32	1.74
145	1.45	1.45	1.40	1.40	1.50	1.53	1.51	1.48	1.48	1.47	1.49	1.45	1.42	1.37	1.39	1.42	1.47	1.47	1.93
150	1.63	1.60	1.55	1.54	1.62	1.63	1.62	1.60	1.63	1.63	1.61	1.58	1.55	1.51	1.52	1.53	1.57	1.54	2.06
155	1.54	1.41	1.36	1.36	1.50	1.53	1.50	1.46	1.47	1.46	1.48	1.45	1.45	1.34	1.36	1.42	1.50	1.50	1.93
160	1.49	1.43	1.36	1.42	1.49	1.58	1.57	1.62	1.66	1.57	1.69	1.64	1.61	1.46	1.52	1.51	1.53	1.69	2.04
165	1.65	1.52	1.52	1.58	1.50	1.67	1.74	1.76	1.74	1.72	1.73	1.63	1.63	1.48	1.50	1.58	1.54	1.71	2.04
170	1.50	1.50	1.50	1.51	1.52	1.53	1.52	1.51	1.50	1.49	1.49	1.49	1.49	1.49	1.51	1.52	1.53	1.54	1.74
175	1.69	1.70	1.71	1.72	1.73	1.73	1.71	1.70	1.69	1.68	1.68	1.68	1.69	1.70	1.72	1.74	1.74	1.73	1.81
180	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77

Table 5: Luminous Intensity Data

Table--2 UNIT: cd

C (DEG) y (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759	759		
5	946	944	926	924	936	910	930	933	938	854	800	704	786	842	874	943	968		
10	1109	1093	1072	1101	1145	1253	1295	1300	1246	1110	1060	1078	1071	1096	1138	1180	1199		
15	1356	1382	1395	1359	1382	1485	1504	1524	1463	1471	1449	1349	1268	1315	1294	1354	1456		
20	1498	1514	1481	1495	1446	1496	1555	1558	1440	1508	1491	1428	1457	1449	1479	1471	1491		
25	1592	1601	1593	1500	1440	1432	1501	1505	1379	1474	1412	1420	1539	1571	1538	1468	1385		
30	1569	1648	1601	1462	1361	1332	1422	1430	1320	1384	1306	1435	1561	1592	1544	1439	1352		
35	1519	1613	1524	1396	1301	1241	1316	1338	1240	1292	1248	1367	1498	1590	1492	1365	1254		
40	1428	1493	1451	1342	1223	1141	1190	1230	1139	1176	1189	1303	1407	1463	1395	1264	1190		
45	1345	1352	1343	1245	1127	1020	1063	1105	1026	1054	1054	1199	1307	1314	1303	1202	1112		
50	1192	1191	1184	1099	992	908	928	966	907	916	949	1067	1140	1146	1143	1067	965		
55	1020	1016	1010	948	849	788	782	815	780	767	822	913	960	964	963	903	818		
60	838	833	827	796	700	643	631	658	638	610	669	753	771	775	774	741	666		
65	656	649	643	628	557	494	485	504	490	474	527	584	588	590	590	582	520		
70	471	466	461	450	406	351	344	354	341	334	372	405	404	405	407	405	372		
75	308	303	299	292	260	226	216	220	211	209	228	247	247	248	249	248	230		
80	172	167	164	156	138	120	111	112	105	104	111	120	120	119	119	119	110		
85	65.7	63.2	60.4	55.8	44.1	41.1	36.5	35.0	32.6	31.1	30.1	33.9	33.7	33.4	33.3	33.1	28.8		
90	13.1	11.7	11.2	10.1	4.42	7.86	6.51	5.93	5.64	4.65	3.60	5.61	5.57	5.49	5.35	5.23	2.54		
95	5.28	5.87	6.32	6.24	2.95	5.99	5.41	5.07	4.81	3.55	3.78	4.35	4.23	4.11	4.15	4.17	2.57		
100	4.26	4.80	5.18	5.12	4.25	4.89	4.94	4.65	4.40	2.88	3.70	3.72	3.57	3.55	3.58	3.62	3.10		
105	3.70	3.94	4.12	4.12	4.27	3.45	4.31	4.01	3.73	2.20	3.04	2.88	2.81	2.81	2.82	2.85	2.79		
110	2.48	2.59	2.63	2.72	2.87	1.79	2.78	2.62	2.45	1.49	2.02	1.87	1.82	1.79	1.79	1.88	1.92		
115	1.25	1.28	1.34	1.39	1.41	1.09	1.46	1.43	1.43	1.15	1.41	1.37	1.34	1.31	1.27	1.33	1.33		
120	1.14	1.15	1.18	1.20	1.18	1.01	1.21	1.23	1.20	1.07	1.22	1.22	1.20	1.17	1.15	1.18	1.18		
125	1.19	1.19	1.20	1.23	1.22	1.08	1.13	1.18	1.15	1.13	1.22	1.21	1.21	1.20	1.19	1.22	1.22		
130	1.30	1.29	1.32	1.34	1.32	1.25	1.26	1.29	1.25	1.29	1.33	1.35	1.33	1.32	1.34	1.37	1.36		
135	1.52	1.52	1.52	1.53	1.51	1.48	1.47	1.48	1.47	1.49	1.52	1.56	1.57	1.58	1.58	1.60	1.57		
140	1.74	1.74	1.74	1.76	1.74	1.70	1.68	1.68	1.65	1.69	1.73	1.78	1.81	1.83	1.83	1.82	1.79		
145	1.90	1.92	1.97	1.98	1.96	1.91	1.89	1.88	1.83	1.89	1.93	1.97	2.00	2.03	2.02	2.01	2.01		
150	2.05	2.06	2.06	2.03	2.01	1.98	1.97	1.95	1.93	2.00	2.05	2.07	2.09	2.11	2.16	2.17	2.16		
155	1.95	1.98	1.98	1.97	1.89	1.86	1.81	1.74	1.79	1.84	1.91	1.96	2.01	2.04	2.05	2.07	2.01		
160	2.07	2.10	2.09	2.08	2.04	1.90	1.91	1.82	1.77	1.81	1.94	1.98	2.09	2.14	2.10	2.11	2.02		
165	2.03	2.05	2.05	2.07	1.96	1.94	1.86	1.85	1.90	1.79	1.82	1.95	2.06	2.10	2.14	2.14	2.11		
170	1.74	1.77	1.78	1.80	1.80	1.78	1.77	1.75	1.74	1.73	1.74	1.75	1.76	1.78	1.81	1.82	1.82		
175	1.81	1.81	1.82	1.84	1.85	1.84	1.84	1.82	1.81	1.80	1.80	1.80	1.80	1.82	1.83	1.85	1.86		
180	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77		

Table 6: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 02, 2019	Aug. 01, 2020
Digital Power Meter	PF2010A	HZTE028-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	DPS1060	HZTE001-06	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	WY12010	HZTE004-03	Aug. 02, 2019	Aug. 01, 2020
Standard Source	D908	HZTE012-01	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 02, 2019	Aug. 01, 2020
Temperature recorder	JM624U	HZTE018-08	Aug. 02, 2019	Aug. 01, 2020

Table 7: 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.

### Goniophotometer Method

#### Photometric and Electrical Measurements

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

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

The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Everfine Digital Power Meter.

Some graphics were created with Photometric Plus software.

The standard reference of the Goniophotometer system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Metrology P.R. China.

The uncertainty of goniophotometer system reported in this document is expanded uncertainty is 2.3% with a coverage factor  $k=2$ .

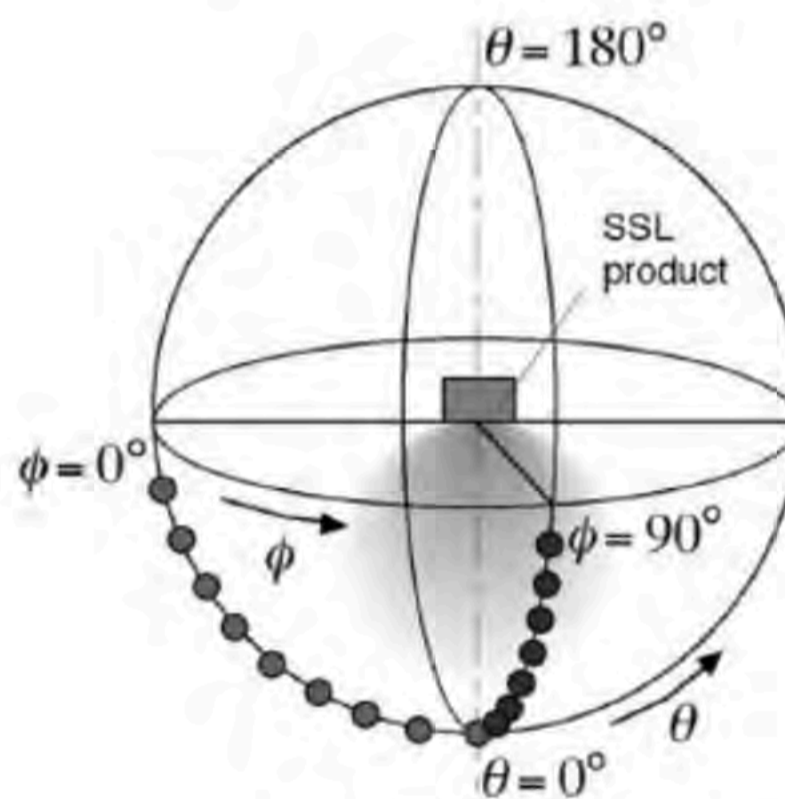
### Color Characteristics Measurements

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.

### Color Spatial Uniformity

The characteristics of SSL products may be spatially non-uniform, the chromaticity coordinate shall be measured at two vertical planes ( $C=0^\circ/180^\circ$  and  $C=90^\circ/270^\circ$ ) and at  $10^\circ$  or less intervals for vertical angle until the light output dropped to below 10% of the peak intensity. The averaged weighted chromaticity coordinate was calculated from these points. The data was then analyzed to check for delta color differences of the  $u'$ ,  $v'$  chromaticity coordinates. The spatial non-uniformity of chromaticity,  $\Delta u'v'$ , is determined as the maximum deviation (distance on the CIE ( $u'$ ,  $v'$ ) diagram) among all measured points from the spatially averaged chromaticity coordinate.

The geometry for the chromaticity measurement using gonio-spectroradiometer is shown as following.



\*\*\* End of Report \*\*\*

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