



## LM-79-08 Test Report

for

### REVOLUTION LIGHTING TECHNOLOGIES, INC

2280 Ward Ave Simi Valley, CA 93065

### Canopy Luminaires

Model: 111012-3X2

### Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18030017e

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

Reviewed by:

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Mar. 12, 2018

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Mar. 12, 2018

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: **111012-3X2**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
114.9	4670.1	40.63	0.9971
CCT (K)	CRI	Stabilization Time (Light & Power)	
4000	76.0	60	

Table 1: Executive Data Summary

### Test specifications:

**Date of Receipt** : Feb. 13, 2017

**Date of Test** : Feb. 24, 2017

**Test item** : Total Luminous Flux, Luminous Distribution Intensity, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

**Reference Standard** : IESNA LM-79-2008 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>	: Canopy Luminaires
<b>Model</b>	: 111012-3X2
<b>Electrical Ratings</b>	: 100~277V, 60Hz, 40W
<b>Product Description</b>	: 4000K Manufacturer of the LED light source: Nichia Corporation Model of the LED light source: NF2L757GRT-V1
<b>Manufacturer</b>	: REVOLUTION LIGHTING TECHNOLOGIES, INC
<b>Address</b>	: 2280 Ward Ave Simi Valley, CA 93065

## TEST RESULTS

Test ambient temperature was 24.6°C.

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

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 85 minutes.

The photometric distance of Goniophotometer is 2.47 m.

Luminous data was taken at 0.5° vertical intervals and 10.0° horizontal intervals.

Parameter	Result			Special Color Rendering Indices	
Test Voltage (V)	120.0	100.0	277.0	R1	73
Voltage frequency (Hz)	60	60	60	R2	85
Test Current (A)	0.340	0.423	0.158	R3	93
Power Factor	0.9971	0.9784	0.9110	R4	72
Test Power (W)	40.63	41.38	39.98	R5	73
THD A%	3.94	4.96	11.97	R6	78
Luminous Efficacy (lm/W)	114.9	112.8	117.0	R7	81
Total Luminous Flux (lm)	4670.1	4664.8	4678.7	R8	52
Color Rendering Index (CRI)	76.0			R9	-24
R9	-24			R10	65
Correlated Color Temperature (CCT) (K)	4000			R11	69
Chromaticity (Chroma x, Chroma y)	(0.3796, 0.3737)			R12	51
Chromaticity (Chroma u, Chroma v)	(0.2258, 0.3334)			R13	76
Chromaticity (Chroma u', Chroma v')	(0.2258, 0.5001)			R14	96
Duv	0.0012				
Average Beam Angle (°)	159.9				
Center Beam Candle Power (cd)	1089				
Spacing Criteria	1.36 (0°-180°)/ 1.34 (90°-270°)				
Zonal Lumens in the 0°-60°Zone	58.79%				
Zonal Lumens in the 60°-90°Zone	37.39%				
Zonal Lumens in the 90°-120°Zone	3.71%				
Zonal Lumens in the 120°-180°Zone	0.11%				

Table 2: Test data per Goniophotometer 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

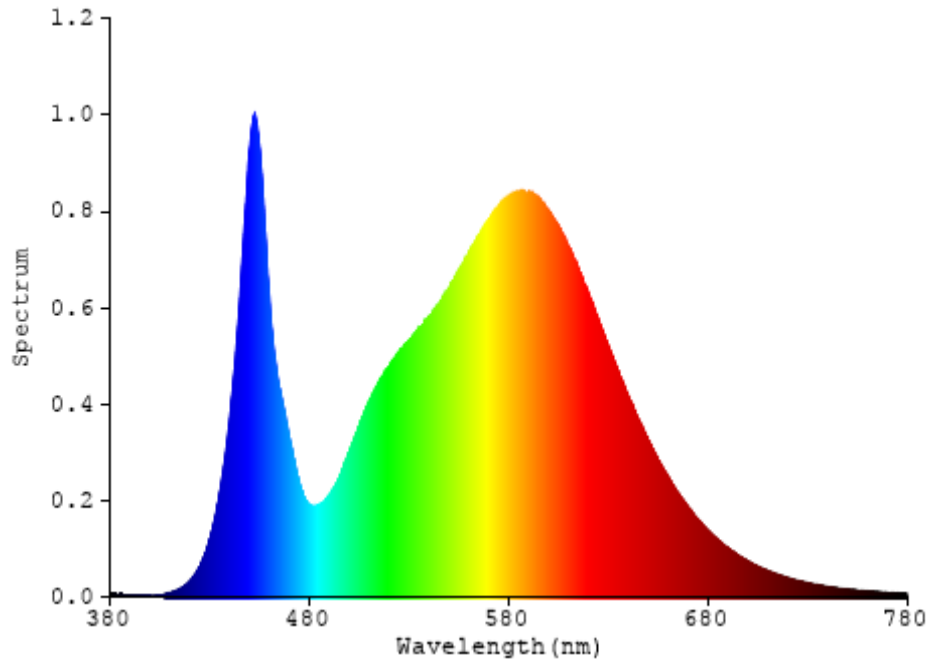


Chart 1: Spectral Power Distribution

### Zonal Lumen Tabulation

$\gamma(^{\circ})$	Lumens	% Total
0- 10	103.615	2.22%
10- 20	302.629	6.48%
20- 30	472.831	10.12%
30- 40	591.26	12.66%
40- 50	643.461	13.78%
50- 60	631.762	13.53%
60- 70	651.368	13.95%
70- 80	763.597	16.35%
80- 90	331.384	7.10%
90-100	133.769	2.86%
100-110	30.881	0.66%
110-120	8.647	0.19%
120-130	2.954	0.06%
130-140	0.706	0.02%
140-150	0.507	0.01%
150-160	0.397	0.01%
160-170	0.256	0.01%
170-180	0.089	0.00%
Total	4670.1	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	2745.558	58.79%
60- 90	1746.349	37.39%
0-90	4491.907	96.18%
90- 180	178.206	3.82%
0- 180	4670.1	100%

Table 3: Zonal Lumen Data

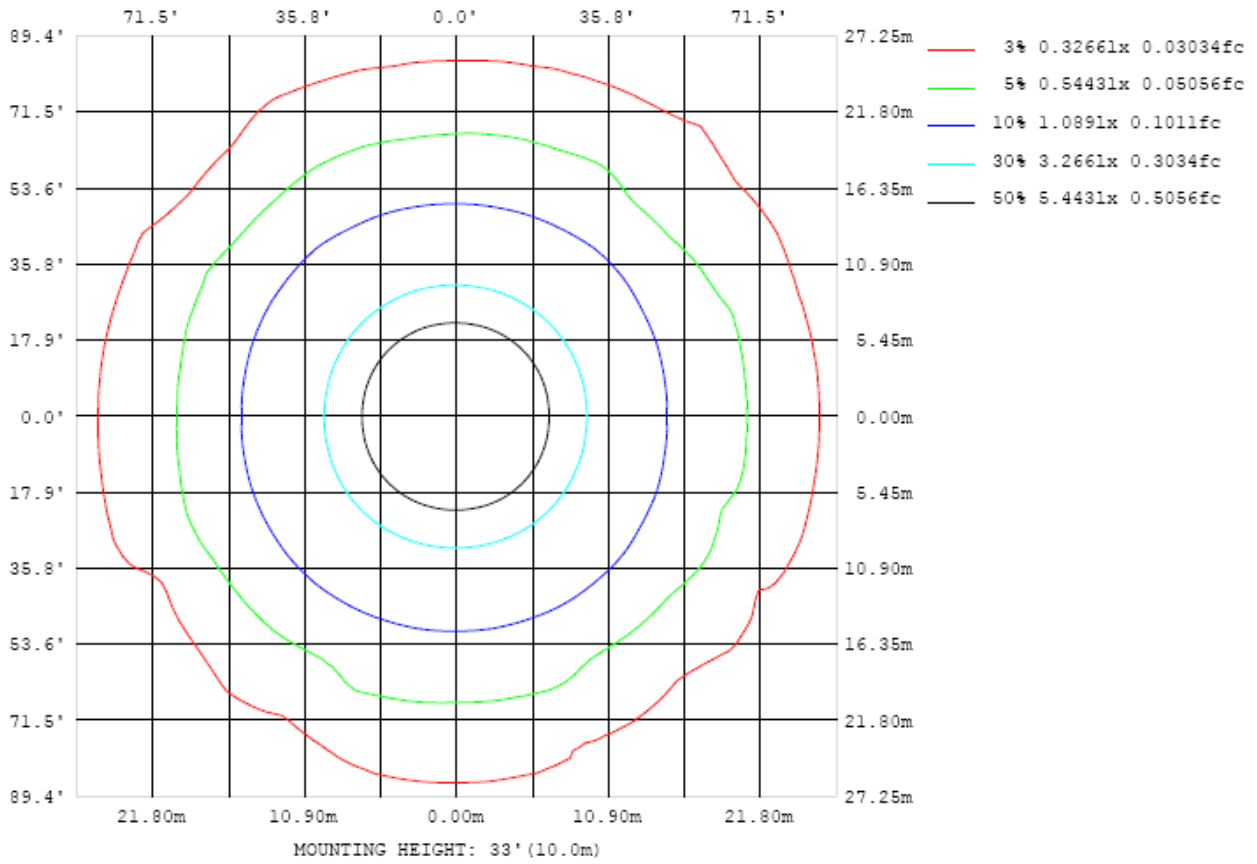


Chart 2: Illuminance Plot (Footcandles)



### Luminous Intensity Distribution Plots

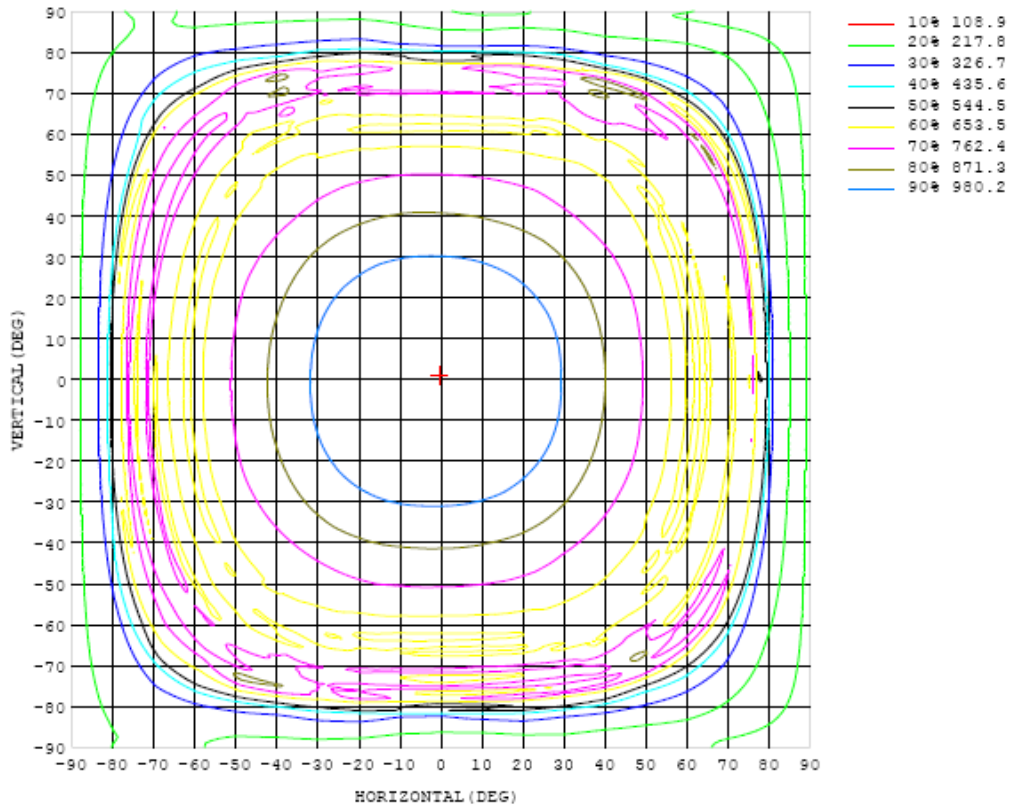


Chart 3: Isocandela Plot

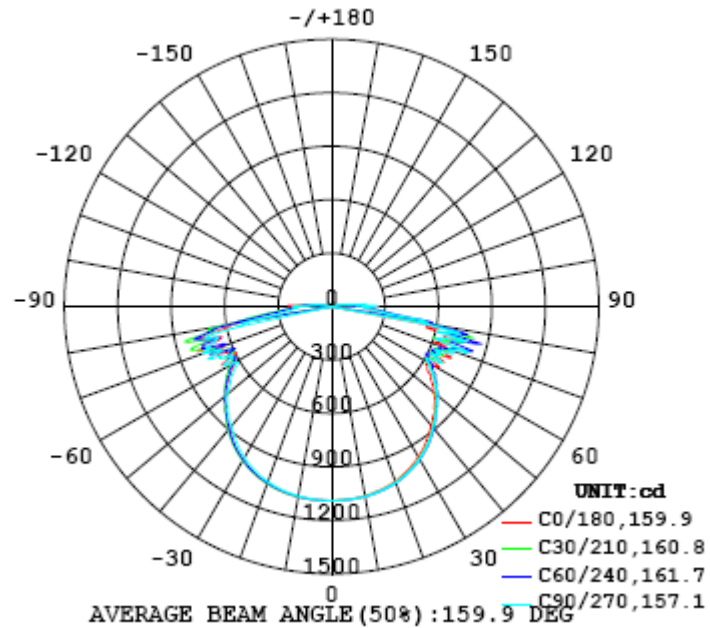


Chart 4: Polar Candela Distribution

### Luminous Intensity Data

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	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089
5	1086	1087	1087	1087	1087	1087	1087	1087	1087	1087	1087	1087	1088	1088	1088	1088	1089	1088	1088
10	1078	1078	1080	1081	1082	1082	1084	1083	1082	1083	1082	1083	1085	1084	1085	1086	1085	1084	1083
15	1065	1065	1067	1068	1069	1070	1072	1071	1071	1071	1071	1073	1075	1075	1076	1076	1075	1074	1074
20	1044	1045	1047	1050	1051	1052	1053	1053	1052	1052	1053	1055	1058	1059	1060	1061	1060	1057	1056
25	1013	1015	1018	1021	1024	1025	1026	1025	1025	1024	1026	1030	1033	1036	1037	1037	1035	1032	1030
30	975	977	981	986	988	990	991	990	989	989	992	996	1001	1003	1005	1005	1001	999	996
35	926	928	935	939	943	945	947	945	943	944	947	953	958	961	964	962	959	954	950
40	871	873	878	885	892	893	894	890	888	887	891	899	906	912	914	911	905	899	895
45	815	824	821	828	829	833	832	833	831	830	834	843	846	853	854	851	848	841	839
50	749	755	762	763	765	766	777	771	777	778	779	780	788	786	790	794	785	787	781
55	683	684	686	708	714	705	711	712	697	699	702	720	725	728	728	724	726	711	709
60	673	641	619	627	650	648	652	627	629	623	633	636	660	669	679	664	640	640	627
65	638	653	704	613	619	584	654	632	626	633	627	659	627	608	618	661	597	604	623
70	726	737	740	698	661	646	697	710	697	700	702	723	674	636	634	718	669	636	653
75	651	657	752	763	897	729	743	787	789	756	738	716	683	817	820	713	668	644	661
80	398	448	539	576	584	600	565	564	516	500	555	639	629	725	776	678	729	665	623
85	217	226	255	273	260	270	280	292	248	237	251	293	303	289	293	310	321	291	271
90	251	255	236	192	166	168	186	198	194	196	195	199	205	207	199	224	232	219	200
95	106	109	110	94.1	82.6	93.9	93.6	124	136	149	157	154	117	106	110	132	168	179	140
100	64.1	63.1	62.0	51.4	39.5	40.7	52.3	68.5	73.5	75.3	77.3	77.9	64.9	52.3	56.6	65.8	87.4	89.1	83.5
105	28.1	26.6	22.6	17.4	11.8	11.9	19.1	30.3	35.0	35.8	35.9	33.3	26.0	17.7	16.2	27.0	38.4	41.4	40.0
110	11.9	11.4	10.3	9.20	8.46	8.59	9.46	11.3	12.7	13.6	13.1	12.2	11.6	11.9	12.3	12.2	12.4	12.9	14.5
115	9.71	9.25	8.49	6.62	5.38	5.68	6.95	9.34	10.8	11.4	11.1	10.2	8.54	8.38	8.64	9.10	10.7	11.4	11.3
120	6.42	6.13	5.13	3.86	2.64	3.00	4.41	6.37	7.59	8.16	8.17	7.45	5.72	4.50	4.65	6.36	8.69	9.56	8.91
125	4.06	3.80	3.21	2.13	0.95	1.33	2.63	3.74	4.50	4.88	4.79	4.21	3.16	1.61	1.79	3.37	4.46	4.95	4.97
130	2.12	1.98	1.49	0.78	0.60	0.60	1.16	1.98	2.57	2.83	2.71	2.17	1.31	0.60	0.61	1.32	2.24	2.72	2.81
135	0.67	0.63	0.62	0.62	0.62	0.62	0.62	0.64	1.00	1.15	1.04	0.70	0.62	0.62	0.62	0.62	0.63	0.88	1.10
140	0.67	0.67	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.85
145	0.70	0.70	0.70	0.70	0.70	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.93
150	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.70	0.98
155	0.71	0.71	0.71	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	1.00
160	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	1.02
165	0.76	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	1.03
170	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.83	0.83	0.82	0.83	0.83	1.03
175	0.90	0.90	0.90	0.90	0.91	0.91	0.91	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	1.02
180	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94

Table 4: 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	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089	1089		
5	1088	1088	1088	1088	1088	1088	1087	1086	1087	1086	1086	1087	1086	1086	1087	1087	1086		
10	1084	1084	1084	1084	1083	1083	1081	1079	1080	1079	1080	1079	1079	1080	1080	1080	1079		
15	1074	1074	1074	1073	1071	1072	1069	1067	1066	1066	1067	1067	1067	1067	1067	1067	1065		
20	1058	1058	1057	1057	1054	1054	1050	1047	1046	1045	1046	1047	1048	1047	1047	1046	1044		
25	1030	1031	1032	1032	1029	1027	1024	1019	1017	1016	1018	1018	1019	1019	1017	1016	1014		
30	997	997	999	998	996	993	988	984	980	980	981	982	983	983	982	979	976		
35	952	954	955	956	953	950	944	937	933	932	934	936	938	938	936	932	928		
40	897	900	903	905	900	896	890	884	877	877	877	880	884	885	881	877	872		
45	839	842	843	843	840	838	830	835	828	827	820	826	822	821	823	820	821		
50	784	781	787	778	774	776	776	768	763	761	764	766	759	757	762	759	752		
55	710	719	721	716	720	717	702	697	689	688	692	698	716	710	703	683	684		
60	633	648	653	665	668	634	618	622	632	625	607	630	651	653	629	612	658		
65	629	607	633	601	633	634	608	671	692	683	645	639	611	649	642	682	647		
70	675	693	699	659	765	665	686	779	773	777	724	703	805	734	726	714	733		
75	698	707	685	837	894	689	750	700	660	698	776	747	859	766	730	768	708		
80	661	695	640	645	608	586	582	495	458	483	529	510	428	438	466	465	419		
85	279	311	305	290	288	286	283	248	225	223	242	236	224	230	240	240	224		
90	212	232	206	190	190	205	218	211	210	240	226	181	158	175	208	268	269		
95	132	128	110	92.7	92.7	95.2	109	112	110	110	102	85.7	78.0	78.9	92.5	113	110		
100	81.0	74.3	54.3	41.7	41.5	48.8	68.9	67.6	64.7	63.4	59.3	42.7	33.8	34.1	47.0	59.4	62.4		
105	37.6	29.9	20.2	12.1	11.5	17.6	23.5	27.3	27.8	25.3	21.1	14.9	13.1	13.1	15.8	22.5	27.3		
110	12.7	12.3	10.9	10.4	10.1	10.4	11.4	11.8	11.9	11.4	10.9	9.50	9.26	9.04	9.75	11.5	12.0		
115	11.1	10.6	8.18	6.47	6.30	6.98	8.97	10.1	10.4	11.1	13.1	11.8	5.89	5.67	7.50	9.04	9.68		
120	8.21	6.86	4.93	3.02	2.76	4.60	5.97	6.96	7.19	6.37	5.48	3.99	2.15	2.63	4.41	5.58	6.31		
125	4.72	3.95	2.64	1.10	0.88	2.28	3.41	4.10	4.36	3.95	3.09	1.81	0.66	1.01	2.40	3.37	3.93		
130	2.57	1.89	0.94	0.68	0.68	0.71	1.50	2.04	2.19	1.88	1.23	0.68	0.68	0.68	0.84	1.56	2.03		
135	0.91	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.77	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77		
140	0.85	0.85	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86		
145	0.93	0.93	0.93	0.93	0.93	0.94	0.93	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94		
150	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99		
155	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01		
160	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03		
165	1.03	1.03	1.04	1.04	1.04	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.04	1.04	1.04		
170	1.03	1.03	1.04	1.04	1.04	1.04	1.03	1.03	1.03	1.02	1.03	1.03	1.03	1.03	1.03	1.03	1.03		
175	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02		
180	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94		

Table 5: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Jul. 27, 2016	Jul. 26, 2017
Digital Power Meter	PF2010A	HZTE028-01	Jul. 27, 2016	Jul. 26, 2017
AC Power Supply	PCR 500L	HZTE001-08	Jul. 27, 2016	Jul. 26, 2017
DC Power Supply	WY12010	HZTE004-03	Jul. 27, 2016	Jul. 26, 2017
Temperature Meter	TES1310	HZTE017-01	Jul. 27, 2016	Jul. 26, 2017
Standard Source	D908	HZTE012-01	Jul. 27, 2016	Jul. 26, 2017
Standard source	SCL-1400	HZTE012-02	Jul. 27, 2016	Jul. 26, 2017

Table 6: 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 1.94% with a coverage factor  $k=2$ .

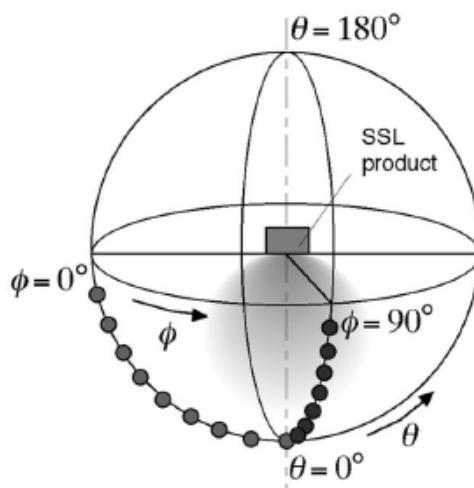
## Color Characteristics Measurements

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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