



LM-79-08 Test Report

for

Elec-Tech International Co., Ltd

NO.1 JINFENG ROAD, TANGJIAWAN TOWN, XIANGZHOU DISTRICT, ZHUHAI
CITY, GUANGDONG PROVINCE

U-Bent LED TUBE

Model: 542931XX (41-50)

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ14090031e

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

Reviewed by:

Engineer: April Zou
Sep. 29, 2014

Approved:



Manager: Jim Zhang
Sep. 29, 2014

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

Test Summary

Model	542931XX (41-50)
Luminous Efficacy (Lumens /Watt)	125.6
Total Luminous Flux (Lumens)	1858.0
Power (Watts)	14.79
Power Factor	0.9882
Stabilization Time (Light & Power)	60 mins

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Sep. 19, 2014
Date of Test	: Sep. 24, 2014
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 Photos



Sample view

Equipment Under Test (EUT)

Name	: U-Bent LED TUBE
Model	: 542931XX (41-50)
Electrical Ratings	: AC100-277V, 50/60Hz, 15W
Product Description	: 4000 K, G13 base, U bent tube, 2 foot long, frosted lens
Manufacturer	: Elec-Tech International Co.,Ltd
Address	: No.18-1, Keji 6th Road, Gangwan Avenue, Tangjiawan Town, Xiangzhou District, Zhuhai City, Guangdong Province, P.R.China
Alternative Manufacturer	: Wuhu 3E Lighting Co., Ltd
Address	: No11.wei erci Rd.East Zone of wuhu Economic and Technical Development Zone, Anhui province China

Model discrepancy: For Model 542931XX (41-50) "XX" could be 41-50, indicate for different packages, different customer No.

TEST RESULTS

Test ambient temperature was 24.3°C.

Test orientation was Light down. 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 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result			Special Color Rendering Indices	
Test Voltage (V)	120.0	100.0	277.0	R1	84.3
Voltage frequency (Hz)	60	60	60	R2	92
Test Current (A)	0.125	0.155	0.059	R3	95.4
Power Factor	0.9882	0.9831	0.9182	R4	82.2
Test Power (W)	14.79	15.21	15.10	R5	83.5
THD A%	13.75	17.77	20.77	R6	87.1
Luminous Efficacy (lm/W)	125.6			R7	87.4
Total Luminous Flux (lm)	1858.0			R8	70.2
Color Rendering Index (CRI)	85.3			R9	26.3
R9	26.3			R10	79.4
Correlated Color Temperature (CCT) (K)	3995			R11	80
Chromaticity (Chroma x, Chroma y)	(0.3795, 0.3729)			R12	62.1
Chromaticity (Chroma u, Chroma v)	(0.2260, 0.3331)			R13	86.5
Chromaticity (Chroma u', Chroma v')	(0.2260, 0.4997)			R14	97.7
Duv	0.0015				

Table: Test data per Goniophotometer Method

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

Goniophotometer Method

Test ambient temperature was 24.9°C.

The photometric distance is 2.475m.

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)	0.125
Power Factor	0.9878
Test Power (W)	14.76
Luminous Efficacy (lm/W)	128.1
Total Luminous Flux (lm)	1890.3
Beam Angle (°)	143.4
Center Beam Candle Power (cd)	391
Spacing Criteria	1.26 (0°-180°)/ 1.40 (90°-270°)

Table 2: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

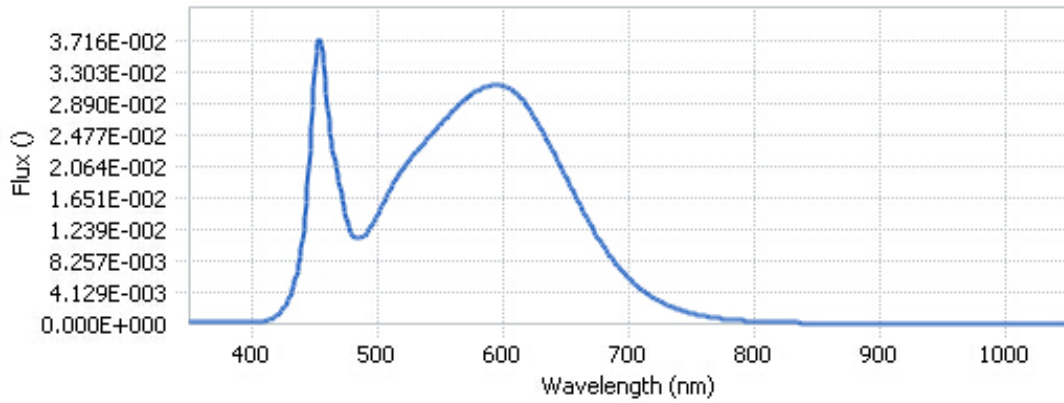
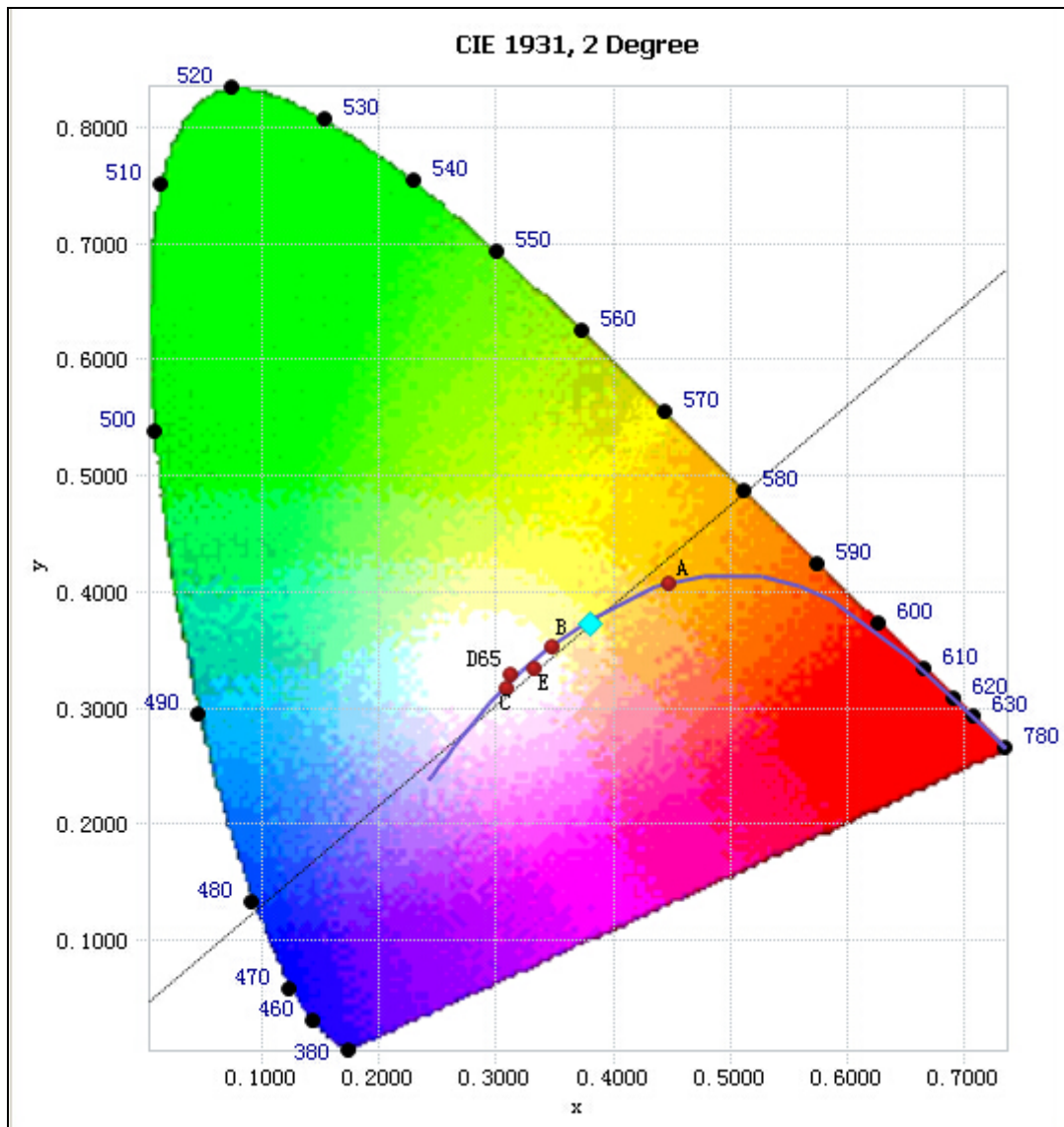


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.39E-04	485	1.13E-02	590	3.12E-02	695	6.85E-03
385	2.44E-04	490	1.17E-02	595	3.13E-02	700	5.96E-03
390	2.33E-04	495	1.28E-02	600	3.12E-02	705	5.16E-03
395	2.57E-04	500	1.44E-02	605	3.09E-02	710	4.49E-03
400	2.46E-04	505	1.61E-02	610	3.03E-02	715	3.88E-03
405	3.01E-04	510	1.77E-02	615	2.94E-02	720	3.36E-03
410	3.88E-04	515	1.91E-02	620	2.83E-02	725	2.91E-03
415	6.37E-04	520	2.04E-02	625	2.70E-02	730	2.50E-03
420	1.13E-03	525	2.15E-02	630	2.56E-02	735	2.15E-03
425	2.07E-03	530	2.25E-02	635	2.40E-02	740	1.84E-03
430	3.58E-03	535	2.34E-02	640	2.25E-02	745	1.59E-03
435	6.31E-03	540	2.44E-02	645	2.09E-02	750	1.36E-03
440	1.11E-02	545	2.52E-02	650	1.92E-02	755	1.17E-03
445	2.05E-02	550	2.61E-02	655	1.75E-02	760	1.01E-03
450	3.37E-02	555	2.71E-02	660	1.59E-02	765	8.67E-04
455	3.67E-02	560	2.80E-02	665	1.43E-02	770	7.43E-04
460	2.82E-02	565	2.88E-02	670	1.28E-02	775	6.36E-04
465	2.19E-02	570	2.95E-02	675	1.14E-02	780	5.53E-04
470	1.79E-02	575	3.01E-02	680	1.01E-02		
475	1.39E-02	580	3.07E-02	685	8.88E-03		
480	1.16E-02	585	3.11E-02	690	7.81E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y) : (0.3795, 0.3729)

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

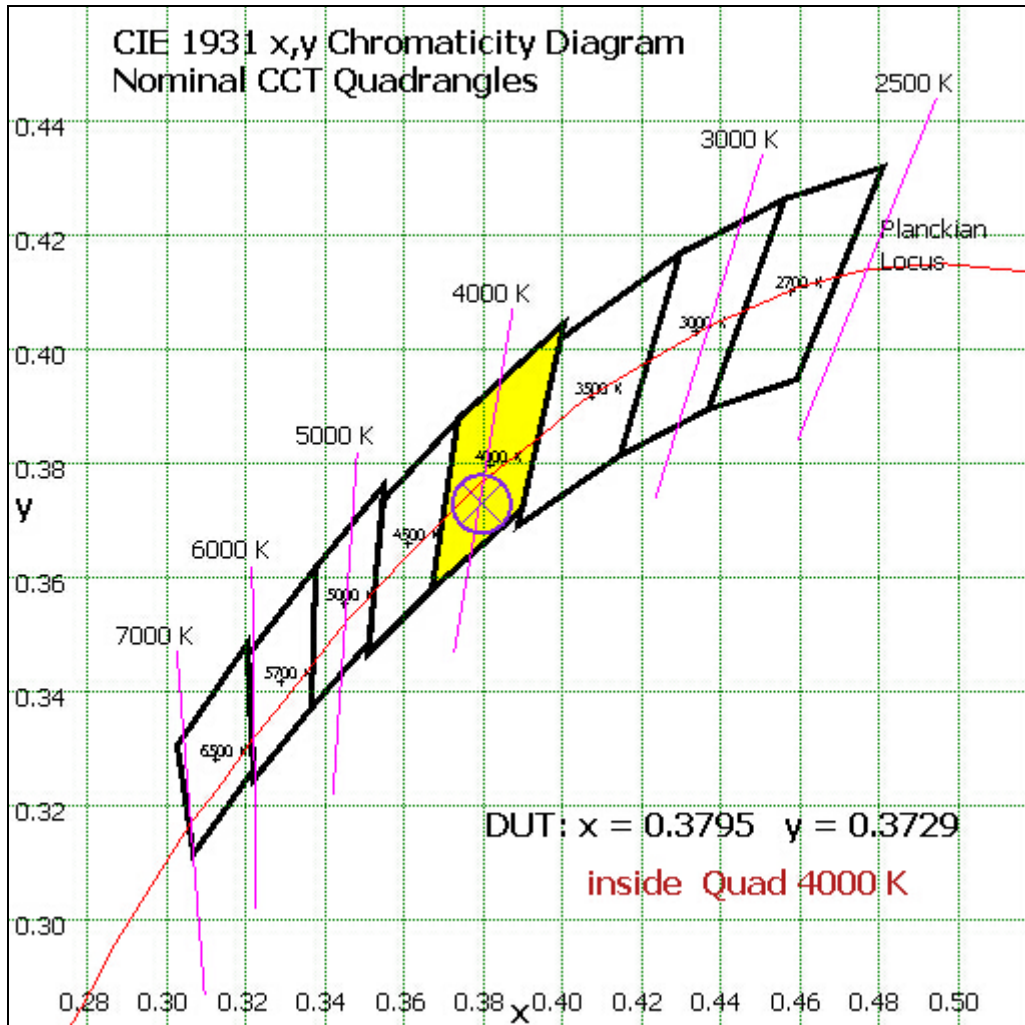


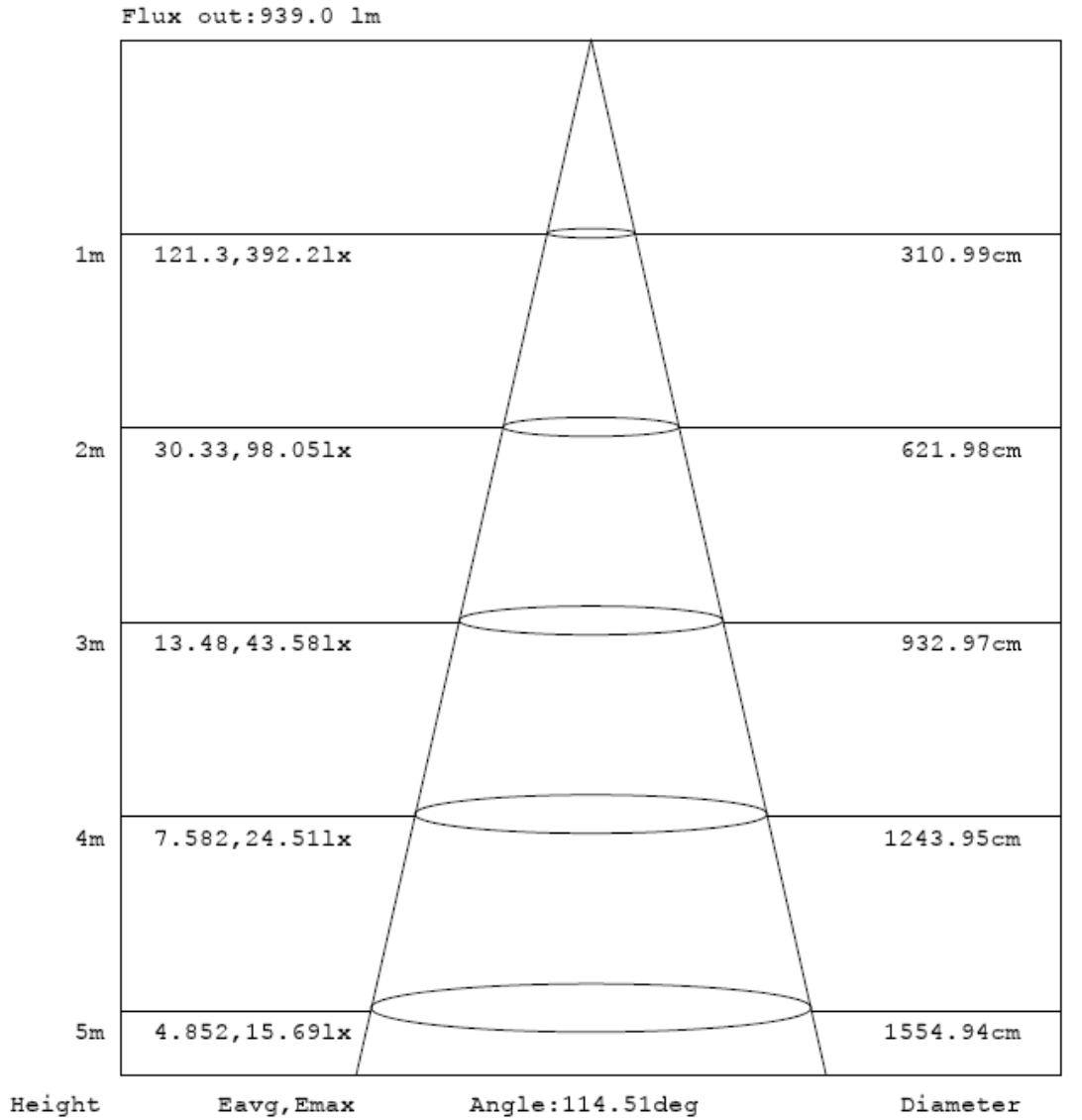
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	542931XX (41-50)	
	Lumens	% Total
0- 10	37.145	1.97%
10- 20	107.782	5.70%
20- 30	167.873	8.88%
30- 40	211.669	11.20%
40- 50	235.346	12.45%
50- 60	237.703	12.58%
60- 70	220.796	11.68%
70- 80	189.448	10.02%
80- 90	130.533	6.91%
90-100	83.496	4.42%
100-110	86.887	4.60%
110-120	65.231	3.45%
120-130	47.239	2.50%
130-140	32.353	1.71%
140-150	20.156	1.07%
150-160	11.013	0.58%
160-170	4.636	0.25%
170-180	0.967	0.05%
Total	1890.3	100%
$\gamma(^{\circ})$	Lumens	% Total
0- 60	997.518	52.77%
60- 90	540.777	28.61%
0-90	1538.295	81.38%
90- 180	351.978	18.62%
0- 180	1890.3	100%

Table 4: Zonal Lumen Data

Illuminance Plots- Goniophotometer Method



Note: The Curves indicate the illuminated area and the average illumination when the luminaire is at different distance.

Chart 4: Beam Angle

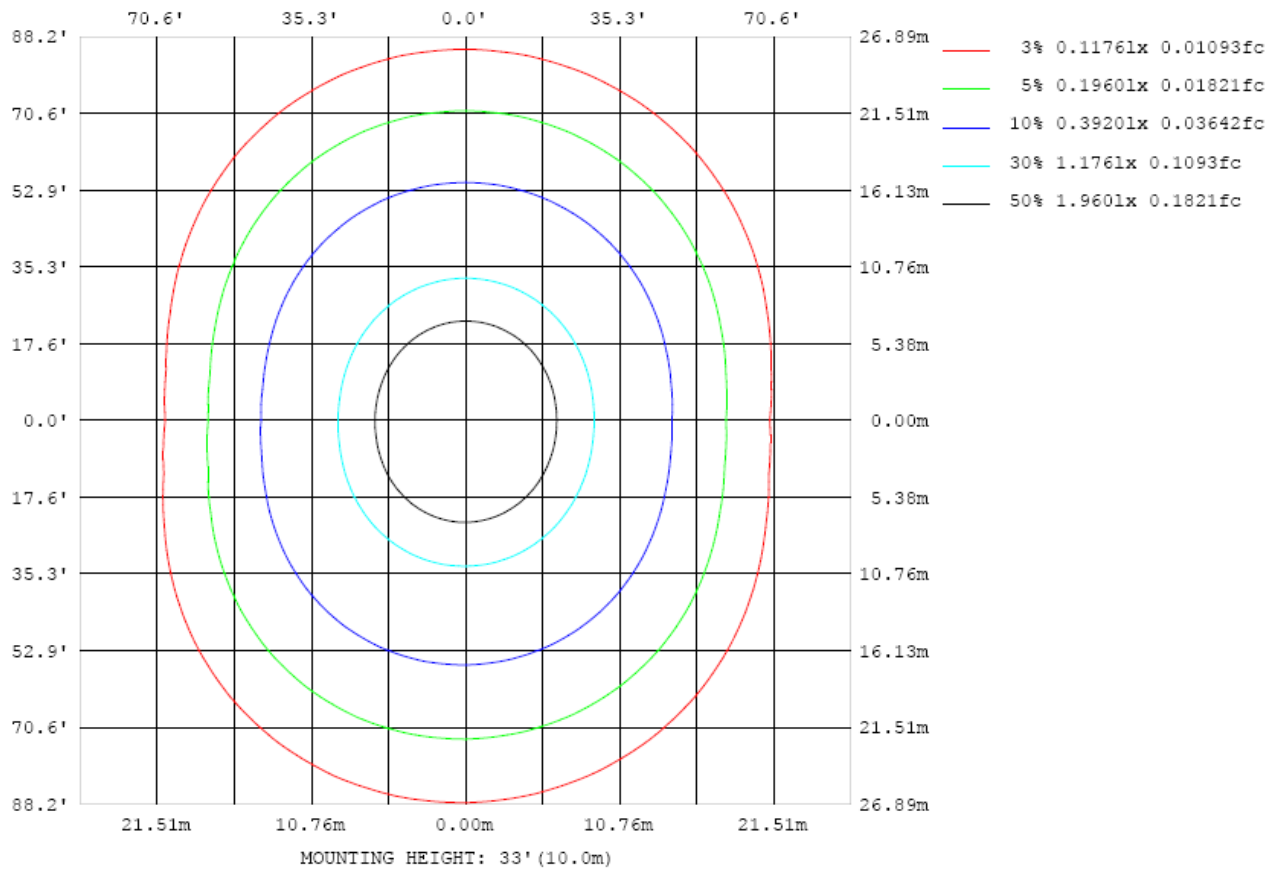


Chart 6: Illuminance Plot (Footcandles)

Luminous Intensity Distribution Plots- Goniophotometer Method

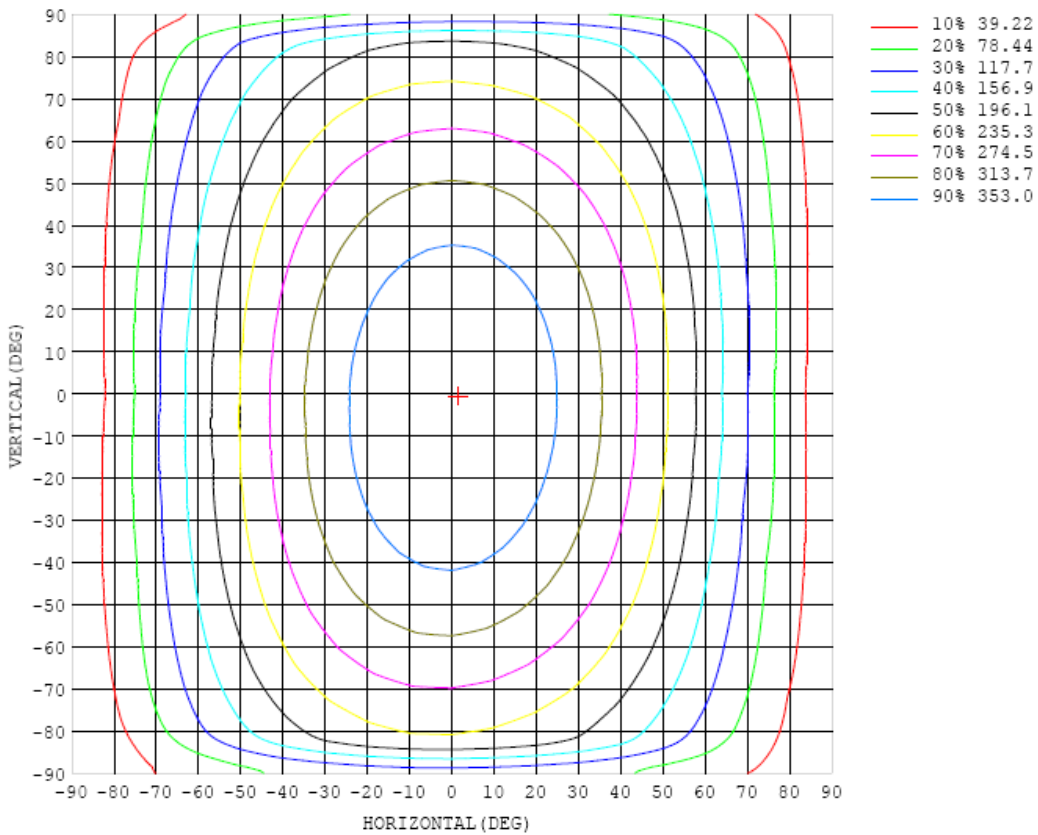


Chart 6: Isocandela Plot

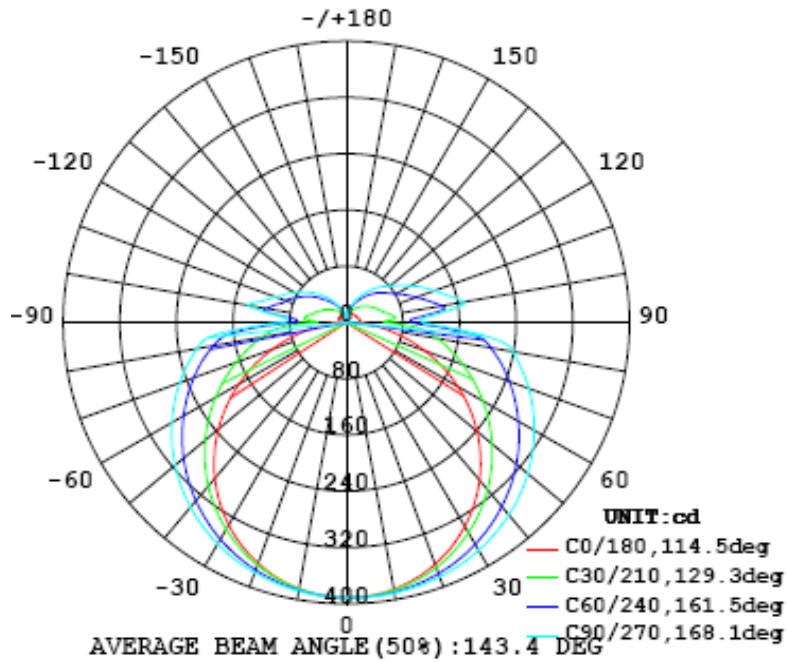


Chart 7: Polar Candela Distribution

Luminous Intensity Data

Table--1 UNIT: cd

C (DEG) \ γ (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391
5	390	390	390	391	391	391	391	391	392	392	391	391	391	391	391	390	390	390	389
10	385	385	386	387	388	388	389	390	390	391	390	390	389	388	387	386	385	385	384
15	377	378	379	380	382	384	385	387	388	388	388	387	386	384	382	380	378	377	376
20	366	367	368	371	374	377	380	382	384	385	384	383	380	377	374	371	368	365	365
25	352	353	355	359	364	369	373	377	379	380	379	377	374	369	364	359	355	351	350
30	335	336	340	345	351	358	364	369	373	374	373	370	366	359	353	345	339	334	332
35	315	317	322	329	337	346	354	360	364	366	365	362	356	348	339	329	321	314	312
40	293	295	301	310	321	332	342	350	355	357	356	352	345	335	323	312	300	292	289
45	268	271	279	290	303	317	328	338	344	347	346	341	332	321	307	292	278	268	264
50	241	244	254	269	284	300	313	324	331	334	334	328	319	305	289	271	254	241	236
55	212	216	229	246	264	282	297	309	317	321	320	314	304	288	270	249	229	213	207
60	182	187	202	222	244	264	280	294	302	306	306	299	288	271	250	227	203	184	176
65	150	156	175	199	223	245	263	277	286	291	290	284	271	253	230	204	177	154	144
70	118	126	148	175	202	226	245	260	269	274	274	267	254	234	210	181	151	124	111
75	86.1	95.7	122	153	181	206	227	242	251	256	256	249	236	216	190	159	127	95.1	79.0
80	57.6	68.5	98.5	131	160	186	207	224	234	239	238	231	216	195	168	138	104	69.6	49.7
85	33.9	46.1	75.0	106	134	154	167	176	182	185	185	180	171	158	139	112	80.1	48.1	26.2
90	21.0	25.3	39.4	58.8	69.8	82.8	93.3	101	106	108	107	102	93.4	83.8	71.7	60.1	39.8	19.1	9.06
95	20.0	25.3	44.5	69.8	88.7	101	111	118	122	124	124	120	114	107	97.7	81.5	51.6	21.1	4.56
100	19.7	24.8	40.6	64.1	89.8	115	136	153	163	168	167	160	146	126	101	74.1	47.9	20.9	8.03
105	18.8	24.3	37.8	56.2	78.2	101	120	134	144	149	148	142	129	112	90.2	66.1	41.5	21.2	10.7
110	18.1	23.2	34.7	50.8	68.7	87.9	105	119	128	133	132	127	116	100	79.8	58.2	38.4	22.6	11.4
115	17.3	22.1	32.7	47.2	62.1	78.2	92.8	105	114	119	119	113	103	88.6	70.9	52.7	36.3	22.7	12.2
120	16.7	21.1	30.5	43.4	56.5	69.6	82.0	92.8	101	104	105	100	91.4	79.0	64.3	49.2	34.0	21.4	12.3
125	16.3	20.3	28.0	39.6	52.4	63.5	73.0	81.9	88.6	91.6	91.5	88.7	81.8	70.9	58.7	44.9	31.5	19.7	12.9
130	15.9	19.4	25.8	36.2	47.1	57.8	65.3	72.8	78.4	81.1	81.1	78.6	73.1	64.0	52.8	41.0	29.1	19.0	12.1
135	15.6	18.2	23.7	32.4	42.3	51.4	59.6	65.2	69.8	72.2	72.3	69.5	64.6	56.9	46.7	36.4	26.8	18.8	11.6
140	15.4	17.6	21.7	29.1	37.2	45.3	52.1	57.8	62.0	64.3	64.1	61.2	56.4	49.2	42.3	32.6	24.6	18.5	13.9
145	15.3	16.9	20.1	25.7	32.7	39.2	45.2	49.6	53.1	54.8	54.3	52.0	48.5	43.3	36.4	28.5	23.0	18.4	14.2
150	15.2	16.3	18.0	22.3	28.0	33.8	38.4	42.2	45.0	46.4	46.3	44.5	41.2	37.1	30.8	25.5	21.2	18.5	15.0
155	15.1	15.9	16.8	20.6	23.8	27.9	32.4	35.4	37.3	38.3	38.1	37.1	34.8	30.7	25.7	22.8	19.5	17.7	15.2
160	14.1	15.0	15.7	16.8	20.8	23.1	25.7	28.0	29.4	30.3	30.1	29.1	27.7	25.1	22.5	19.6	15.5	13.8	12.9
165	12.4	13.4	14.3	15.2	15.9	19.0	21.6	22.2	23.3	24.0	24.1	23.5	21.6	19.1	16.5	14.3	13.2	12.6	11.5
170	10.4	10.6	12.2	13.3	13.7	14.2	15.7	16.7	17.4	18.3	15.6	14.7	14.1	13.2	12.6	11.2	10.7	10.5	9.71
175	8.52	8.59	8.96	9.57	10.0	10.9	11.1	9.98	10.0	10.1	9.84	9.88	9.52	8.95	9.15	9.39	9.15	9.24	9.21
180	9.29	9.22	9.06	8.73	8.63	8.12	7.45	5.98	5.16	2.82	4.24	7.44	6.91	8.00	8.05	8.57	9.00	9.41	9.29

Table 5: 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	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391	391		
5	390	389	389	389	390	390	390	390	390	390	390	390	390	390	390	390	390		
10	384	384	385	385	386	386	387	387	388	387	387	387	386	386	386	385	385		
15	376	376	377	379	380	381	382	383	384	383	383	382	381	380	379	378	377		
20	365	366	367	370	372	375	377	378	379	378	377	376	374	371	369	368	366		
25	350	352	355	358	362	366	369	371	372	371	370	368	364	361	357	355	353		
30	333	335	340	345	351	356	360	363	364	363	361	358	353	348	343	339	336		
35	313	317	323	330	337	344	349	353	354	353	350	346	340	333	327	321	317		
40	290	295	304	313	323	331	337	341	343	342	338	333	325	317	308	301	295		
45	265	272	283	295	306	316	324	328	330	329	324	318	309	299	288	279	272		
50	238	247	260	275	289	300	309	314	316	314	310	302	292	280	267	255	246		
55	210	221	237	254	270	283	293	299	301	299	293	285	273	260	245	230	219		
60	180	194	213	233	251	266	276	283	285	282	277	267	254	239	221	204	190		
65	150	167	189	211	231	248	259	266	268	265	259	249	235	217	198	178	160		
70	119	140	165	190	212	229	242	249	251	248	241	231	216	197	175	152	131		
75	89.2	115	143	170	193	211	224	231	233	229	223	212	196	176	153	128	102		
80	62.4	91.4	122	149	172	191	205	213	214	211	204	193	176	156	132	104	76.1		
85	40.4	68.5	97.2	124	145	156	168	175	178	177	173	164	150	133	108	81.3	53.4		
90	12.9	29.1	43.5	55.8	65.9	74.2	81.7	87.6	89.9	89.6	87.6	83.5	76.6	67.1	55.2	41.8	28.1		
95	13.6	36.9	60.5	72.2	77.4	81.8	85.9	88.3	88.7	87.0	84.5	81.2	76.4	69.7	61.0	44.6	27.4		
100	17.0	35.5	56.3	77.5	97.1	115	130	140	142	139	133	121	103	82.5	60.8	40.7	25.8		
105	16.9	30.1	47.4	69.0	86.3	101	113	119	121	118	112	102	88.1	72.3	55.1	36.9	24.1		
110	15.6	27.2	45.2	61.6	78.2	91.1	97.9	105	107	105	99.9	91.5	80.1	65.6	48.3	32.9	22.0		
115	14.7	25.6	38.7	56.3	69.7	82.3	90.1	94.3	95.2	92.6	87.8	80.6	70.3	56.9	43.1	30.0	19.8		
120	14.5	23.2	36.5	49.0	62.7	73.3	81.3	84.6	85.6	83.8	79.7	71.9	62.0	50.2	37.9	26.3	18.8		
125	13.8	20.8	32.9	43.3	55.0	64.8	72.2	75.3	75.7	74.3	70.0	63.3	54.9	44.5	33.5	23.2	17.2		
130	13.2	19.4	28.9	38.7	46.0	56.6	63.2	66.2	66.6	65.4	61.6	55.7	48.1	38.9	28.9	20.7	16.0		
135	13.5	18.9	25.3	33.9	41.3	46.3	54.6	57.3	57.9	57.0	53.6	48.0	41.6	33.5	25.2	18.9	15.5		
140	14.3	17.3	22.5	29.2	35.4	40.8	45.1	48.8	49.2	48.2	45.6	41.1	35.6	28.5	22.2	16.8	15.5		
145	14.4	15.9	19.8	25.0	29.9	33.9	37.1	40.5	41.0	40.1	38.0	34.9	30.0	24.6	19.3	15.5	15.3		
150	14.8	15.5	17.6	21.0	25.1	28.0	30.9	31.5	33.5	33.0	31.7	29.0	25.0	20.9	16.9	14.5	15.0		
155	14.7	15.0	15.9	18.4	20.6	22.7	25.0	26.4	26.1	26.9	25.7	23.8	20.7	17.7	15.7	14.2	14.8		
160	12.3	12.1	13.1	15.6	17.7	18.6	19.8	20.6	20.7	20.3	20.2	19.2	17.5	16.1	14.4	13.7	14.2		
165	11.2	10.9	11.1	11.1	12.5	13.9	15.7	16.9	16.9	16.5	16.6	16.1	15.3	14.1	12.9	13.3	13.4		
170	9.65	9.47	9.24	9.19	9.68	9.82	9.91	10.5	11.3	13.4	12.6	12.9	12.2	12.0	12.0	12.1	10.9		
175	8.82	8.46	8.17	8.20	7.77	7.39	7.70	8.26	8.40	8.76	8.58	8.63	9.45	9.26	8.85	8.65	8.48		
180	9.30	9.24	9.03	8.87	8.58	8.28	7.76	6.40	4.44	2.76	5.38	5.83	7.34	7.73	8.14	8.67	9.04		

Table 6: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	PF2010A	HZTE028-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-08	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	WY12010	HZTE004-03	Sep. 18, 2014	Sep. 17, 2015
Temperature Meter	TES1310	HZTE017-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	D908	HZTE012-01	Sep. 18, 2014	Sep. 17, 2015
Integrate Sphere system	2M	HZTE015-01	Sep. 18, 2014	Sep. 17, 2015
Digital Power Meter	WT210	HZTE008-01	Sep. 18, 2014	Sep. 17, 2015
AC Power Supply	PCR 500L	HZTE001-07	Sep. 18, 2014	Sep. 17, 2015
DC Power Supply	6154	HZTE004-04	Sep. 18, 2014	Sep. 17, 2015
Temperature and humidity recorder	JR900	HZTE018-01	Sep. 18, 2014	Sep. 17, 2015
Standard source	SCL-1400	HZTE012-02	Sep. 18, 2014	Sep. 17, 2015

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.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two 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 30 min, taken 15 minutes apart, is less than 0.5 %.

Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.

The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.

The uncertainty of integrating sphere system reported in this document is expanded uncertainty is 1.06% 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 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

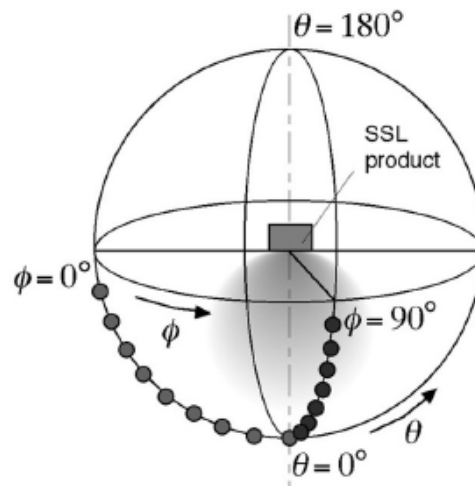
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as 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° 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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