



## LM-79-08 TEST REPORT

for

### RAB Lighting Inc

170 Ludlow Avenue, Northvale, New Jersey 07647 USA

### LED Tube

**Model: T8-14-48GC-840-HYB**

### Laboratory: Leading Testing Laboratories

**NVLAP CODE: 200960-0**

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Report No.: HZ21060026p

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

Review by:

Engineer: April Zou  
Jul. 16, 2021

Approved by:



Manager: Jim Zhang  
Jul. 16, 2021

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: **T8-14-48GC-840-HYB**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)/2	Power Factor
143.3	2155.2	15.04	0.9956
CCT (K)	CRI	Stabilization Time (Light & Power)	
4044	83.4	60	

Table 1: Executive Data Summary

Note: The above results are recorded/ derived from measurements made using an Integrating Sphere.

### Test specifications:

**Date of Receipt** : Jun. 23, 2021

**Date of Test** : Jul. 14, 2021

**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  
ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

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**SAMPLE PHOTO**

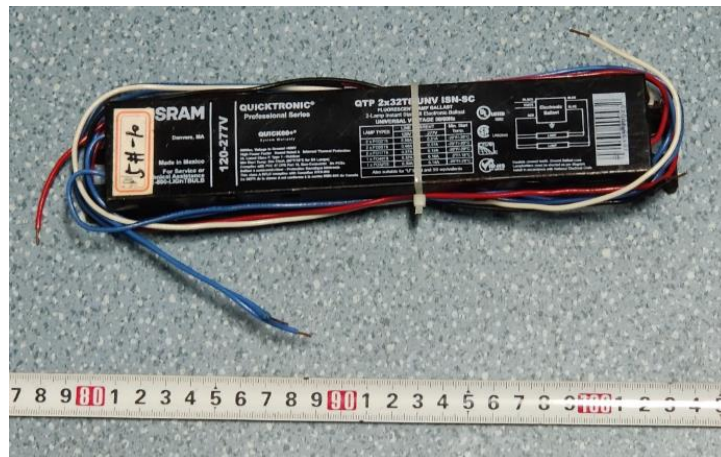
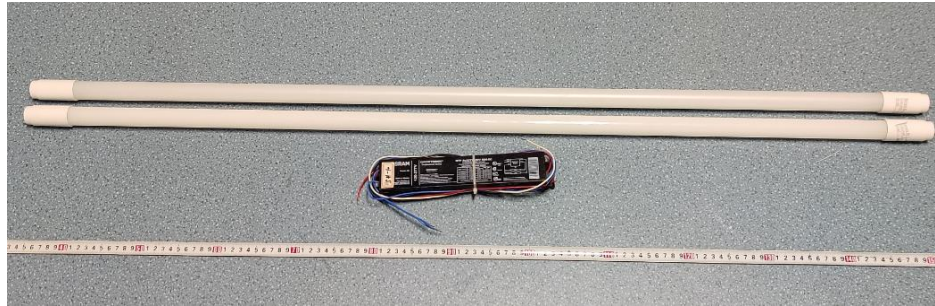


Figure 1- Overview of the sample

**Equipment Under Test(EUT)**

<b>Name</b>	: LED Tube
<b>Model</b>	: T8-14-48GC-840-HYB
<b>Electrical Ratings</b>	: 120-277V, 50/60Hz
<b>Product Description</b>	: 4000K LED Tubes supplied by a high frequency fluorescent lamp ballast: QTP 2x32T8/UNV ISN-SC

## TEST RESULTS

Test ambient temperature was 26.0 °C.

Base orientation was horizontal. 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	
	Test Voltage (V)	120.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.252	0.115
Power Factor	0.9956	0.9564
Test Power (W)/2	15.04	15.17
THD A%	5.70	13.97
Luminous Efficacy (lm/W)	143.3	142.1
Total Luminous Flux (lm)	2155.2	2155.4
Color Rendering Index (CRI)	83.4	
R9	12.3	
Correlated Color Temperature (CCT)(K)	4044	
Chromaticity Chroma x	0.3797	
Chromaticity Chroma y	0.3804	
Chromaticity Chroma u	0.2232	
Chromaticity Chroma v	0.3354	
Duv	0.0019	
Chromaticity Chroma u'	0.2232	
Chromaticity Chroma v'	0.5031	

Special Color Rendering Indices	
R1	81.6
R2	88.1
R3	93.7
R4	83.6
R5	81.8
R6	83.9
R7	87.3
R8	66.9
R9	12.3
R10	72.3
R11	83.1
R12	62.5
R13	83
R14	96.6

Table 2: Test data per Sphere-Spectroradiometer Method

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

### Goniophotometer Method

Test ambient temperature was 24.6 °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)	0.255
Power Factor	0.9951
Power (W)/2	15.23
Luminous Efficacy (lm/W)	139.7
Total Luminous Flux (lm)	2127.8
Beam Angle ( ° )	108.7 (0°-180°) / 177.7 (90°-270°)
Center Beam Candle Power (cd)	427
Maximum Beam Candle Power (cd)	426.9 (At: C=270.0, Gamma=2.0)
Spacing Criteria	1.24 (0°-180°) / 1.38 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	49.03%
Zonal Lumens in the 60 °-90 °Zone	27.13%
Zonal Lumens in the 90 °-120 °Zone	15.07%
Zonal Lumens in the 120 °-180 °Zone	8.77%

Table 3: Test data per Goniophotometer Method

**Spectral Power Distribution - Sphere Spectroradiometer Method**

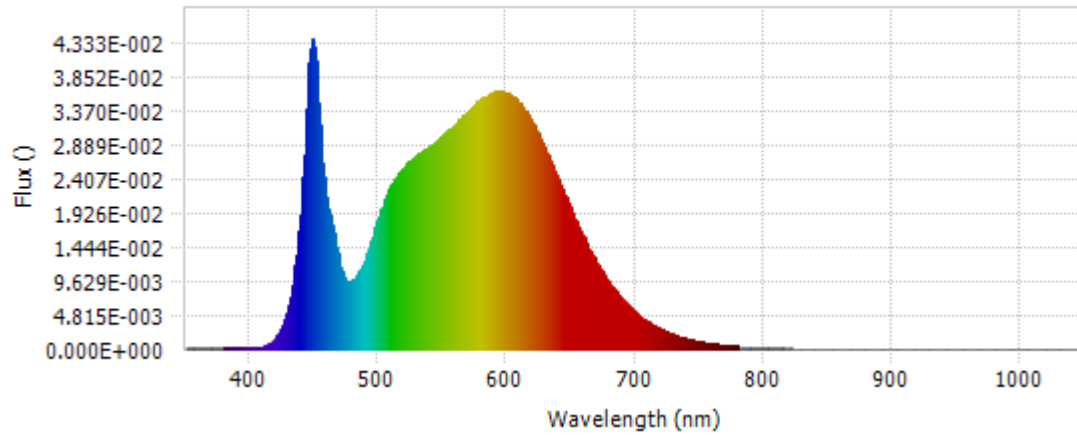
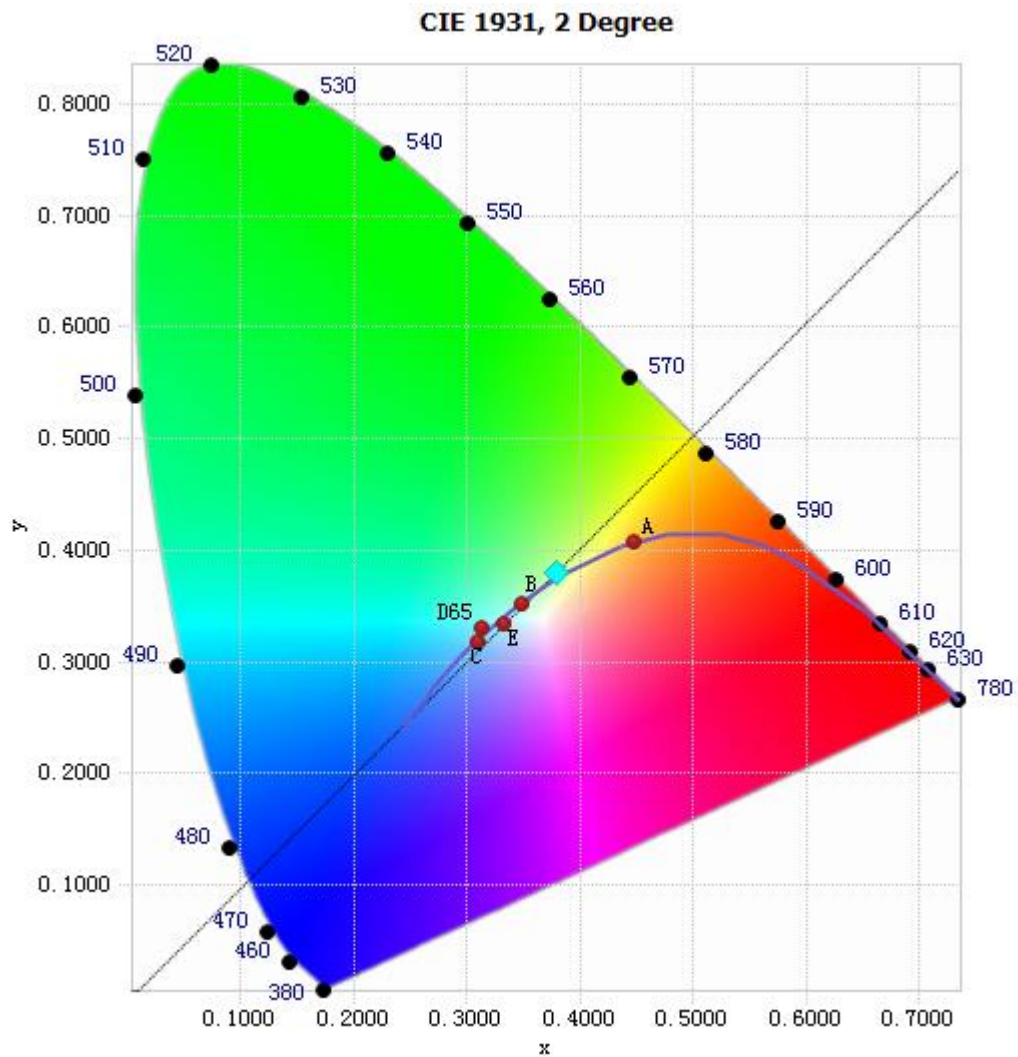


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	2.08E-04	485	1.09E-02	590	3.63E-02	695	6.10E-03
385	1.72E-04	490	1.30E-02	595	3.64E-02	700	5.26E-03
390	1.95E-04	495	1.59E-02	600	3.63E-02	705	4.50E-03
395	1.58E-04	500	1.88E-02	605	3.56E-02	710	3.87E-03
400	1.57E-04	505	2.13E-02	610	3.47E-02	715	3.30E-03
405	2.06E-04	510	2.32E-02	615	3.36E-02	720	2.84E-03
410	4.06E-04	515	2.48E-02	620	3.19E-02	725	2.43E-03
415	8.32E-04	520	2.59E-02	625	3.01E-02	730	2.07E-03
420	1.68E-03	525	2.67E-02	630	2.82E-02	735	1.76E-03
425	3.28E-03	530	2.73E-02	635	2.61E-02	740	1.49E-03
430	6.35E-03	535	2.80E-02	640	2.40E-02	745	1.28E-03
435	1.18E-02	540	2.86E-02	645	2.18E-02	750	1.09E-03
440	2.15E-02	545	2.95E-02	650	1.97E-02	755	9.24E-04
445	3.75E-02	550	3.02E-02	655	1.77E-02	760	8.01E-04
450	4.27E-02	555	3.10E-02	660	1.58E-02	765	6.73E-04
455	2.89E-02	560	3.18E-02	665	1.40E-02	770	5.71E-04
460	2.08E-02	565	3.28E-02	670	1.23E-02	775	4.88E-04
465	1.65E-02	570	3.37E-02	675	1.08E-02	780	4.19E-04
470	1.17E-02	575	3.45E-02	680	9.38E-03		
475	9.63E-03	580	3.54E-02	685	8.14E-03		
480	9.78E-03	585	3.60E-02	690	7.09E-03		

Table 4: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

**Chromaticity Diagram - Sphere Spectroradiometer Method**



Tristimulus values(x, y): (0.3797, 0.3804)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

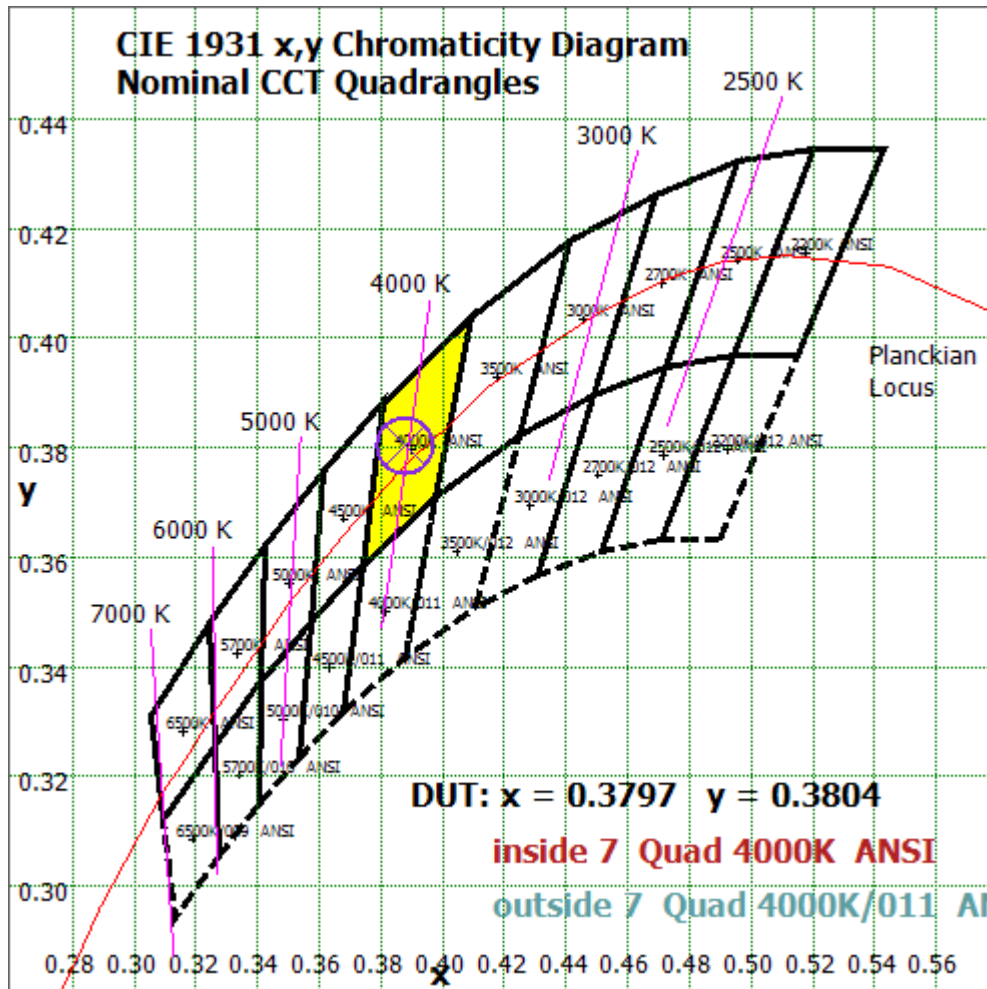


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

**Color Rendition Report – Sphere Spectroradiometer Method**

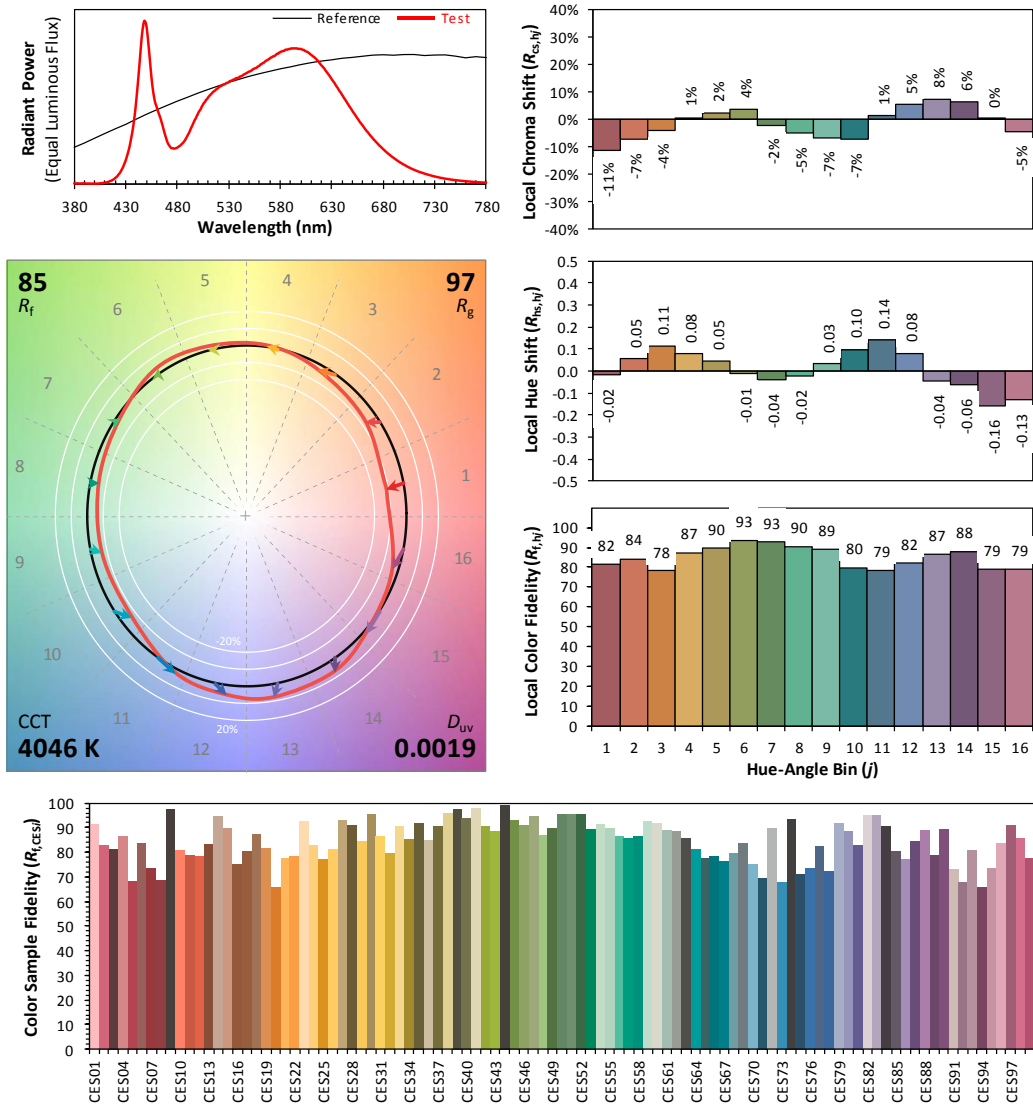
**ANSI/IES TM-30-18 Color Rendition Report**

**Source:** LED

**Manufacturer:** RAB Lighting Inc

**Date:** 2021/07/14

**Model:** T8-14-48GC-840-HYB



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

$x$  0.3797  
 $y$  0.3804  
 $u'$  0.2232  
 $v'$  0.5031

CIE 13.3-1995 (CRI)	
$R_a$	83
$R_g$	12

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	40.411	1.90%
10- 20	116.453	5.47%
20- 30	179.057	8.42%
30- 40	222.139	10.44%
40- 50	242.975	11.42%
50- 60	242.274	11.39%
60- 70	223.738	10.52%
70- 80	193.654	9.10%
80- 90	159.833	7.51%
90-100	130.203	6.12%
100-110	105.991	4.98%
110-120	84.489	3.97%
120-130	65.424	3.07%
130-140	48.838	2.30%
140-150	34.807	1.64%
150-160	22.162	1.04%
160-170	11.526	0.54%
170-180	3.821	0.18%
Total	2127.8	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1043.31	49.03%
60- 90	577.225	27.13%
0-90	1620.53	76.16%
90- 180	507.261	23.84%
0- 180	2127.8	100%

Table 5: Zonal Lumen

**Illuminance Plots- Goniophotometer Method**

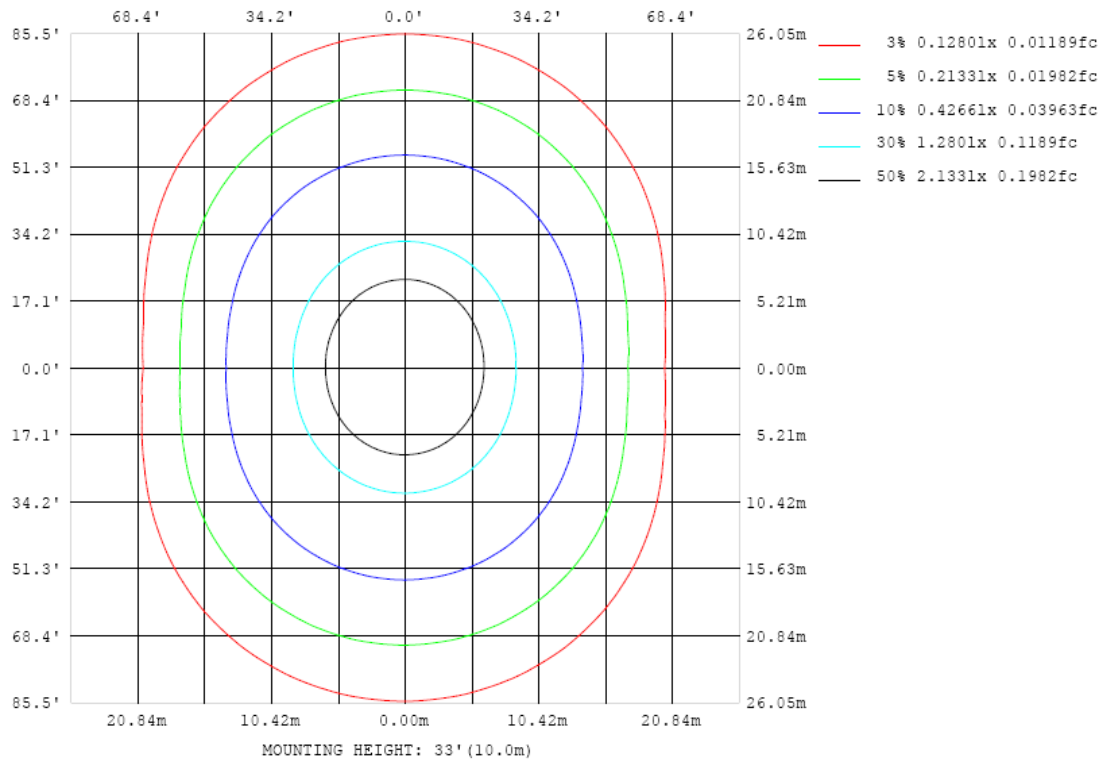


Chart 5: Illuminance Plot (Footcandles)

**Luminous Intensity Distribution Plots- Goniophotometer Method**

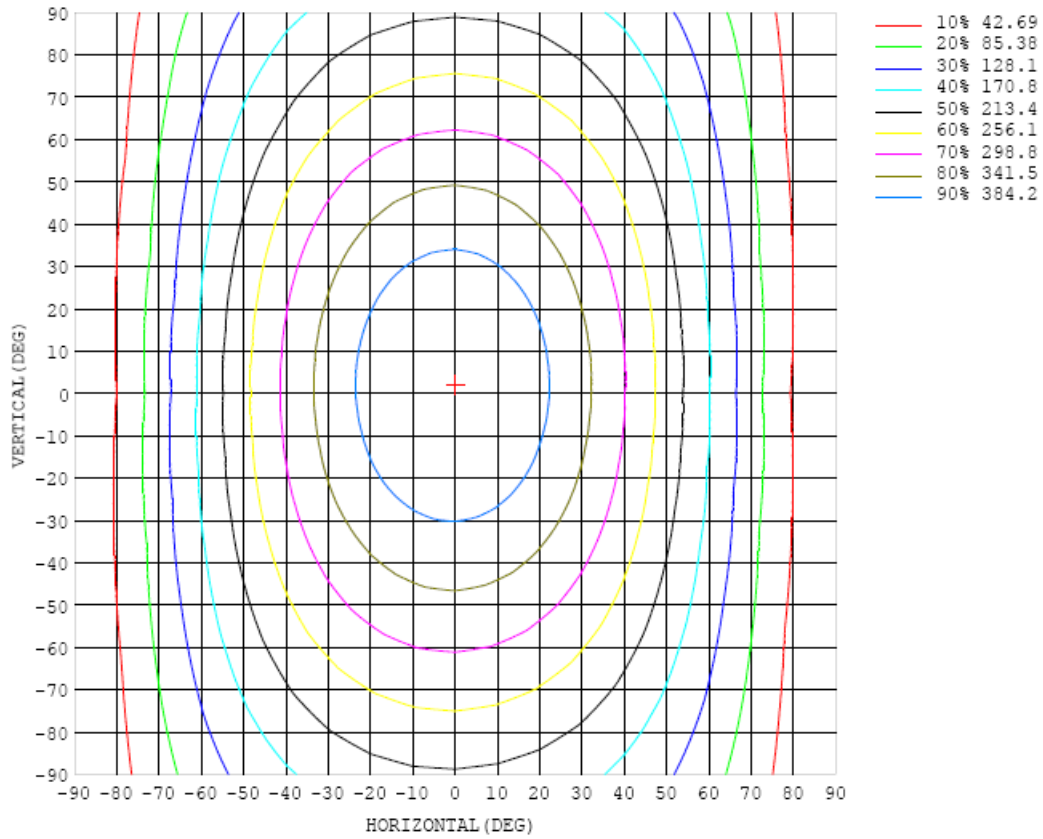


Chart 6: Isocandela Plot

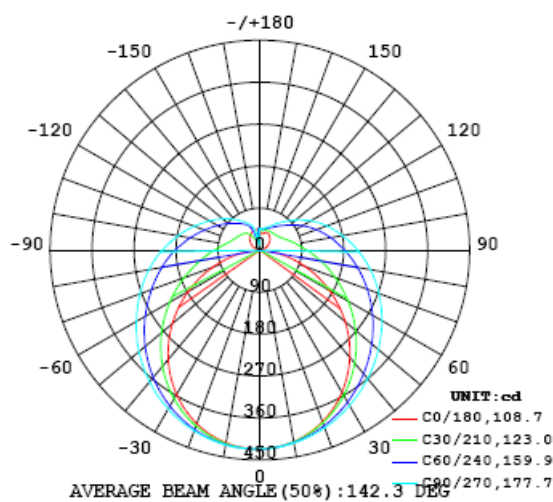


Chart 7: Polar Candela Distribution

**Luminous Intensity Data- Goniophotometer Method**

Table--1 UNIT: cd

C (DEG) \ y (DEG)	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
0	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427
5	424	424	424	424	424	424	424	424	424	424	424	425	425	425	425	425	425	425	425
10	417	417	417	417	418	418	419	420	420	420	420	420	420	420	419	419	419	419	419
15	406	406	407	407	408	410	411	412	413	414	414	414	413	412	411	410	409	409	410
20	392	392	393	394	397	399	401	403	405	406	405	405	403	402	400	398	396	396	396
25	374	374	375	378	382	386	390	393	395	396	396	394	392	389	386	382	380	378	378
30	352	352	355	360	365	371	376	381	383	385	384	382	379	374	370	365	360	358	357
35	327	328	332	339	347	355	362	367	371	372	372	369	365	358	351	344	338	334	333
40	300	301	307	316	327	337	346	353	358	360	359	355	349	341	332	322	314	308	306
45	270	273	281	293	306	319	330	338	344	346	345	340	333	323	311	299	288	279	277
50	239	242	253	268	284	300	313	323	329	332	331	325	317	305	290	275	260	249	245
55	206	210	224	243	263	281	296	307	314	317	316	310	300	286	269	250	232	218	212
60	172	178	196	218	242	262	279	292	299	302	301	294	283	267	248	226	203	186	178
65	138	146	168	194	221	244	262	275	284	287	285	278	266	249	227	202	175	154	143
70	103	114	142	172	201	226	245	259	268	272	270	262	249	231	207	179	149	122	108
75	69.7	84.0	116	152	182	208	229	244	253	256	254	246	233	214	188	158	124	91.9	74.1
80	38.5	57.2	94.4	132	165	191	213	228	237	241	239	231	217	197	171	139	102	65.0	43.1
85	12.2	36.2	76.4	115	149	176	197	212	221	225	223	215	201	181	155	122	83.1	43.0	15.6
90	0.56	23.6	62.6	101	134	162	182	197	206	210	208	200	186	166	140	107	68.6	28.6	0.90
95	2.34	17.9	52.8	88.6	121	147	167	182	191	195	193	185	171	153	126	94.4	58.1	21.7	1.97
100	5.14	16.2	45.9	78.8	109	134	154	168	176	180	178	170	158	139	114	84.2	50.7	18.9	4.58
105	8.67	17.0	40.8	70.5	98.4	122	141	155	163	166	164	158	145	127	103	75.4	45.0	19.1	7.69
110	12.2	19.5	38.0	63.3	88.7	111	129	142	150	153	151	144	132	115	93.3	67.7	41.3	20.9	11.4
115	15.9	22.3	36.7	57.4	79.9	100	117	129	136	139	138	131	120	104	84.0	61.2	39.4	23.4	15.5
120	19.5	25.3	36.6	53.3	72.0	90.0	105	116	123	126	124	118	108	93.4	75.6	56.4	38.6	25.9	19.6
125	23.2	28.3	37.0	50.3	65.6	80.8	94.0	104	110	113	111	106	96.5	83.8	68.7	53.0	38.7	28.8	23.7
130	26.4	31.0	37.8	48.3	60.6	72.9	84.0	92.6	98.2	100	99.1	94.3	86.1	75.5	63.3	50.5	39.0	31.6	27.1
135	30.4	33.8	39.0	46.9	56.7	66.4	75.3	82.6	87.1	89.0	87.9	83.9	77.4	68.8	58.9	48.7	39.8	34.3	30.7
140	33.5	35.7	40.2	46.1	53.6	61.3	68.5	74.3	77.9	79.4	78.6	75.4	70.0	63.2	55.3	47.3	41.0	36.6	34.5
145	36.1	37.6	41.4	45.8	51.1	57.0	62.0	66.5	70.0	71.1	70.4	67.9	63.7	58.4	52.4	46.7	42.1	38.9	37.5
150	38.5	38.7	42.1	45.6	49.4	53.4	57.2	60.6	63.1	64.0	63.5	61.6	58.4	54.5	50.4	46.4	43.2	40.7	39.2
155	40.6	40.2	43.1	45.7	48.2	50.9	53.3	55.5	57.2	58.0	57.6	56.3	54.2	51.6	49.0	46.4	44.1	42.2	41.8
160	41.2	40.5	42.0	45.4	47.3	49.0	50.6	51.4	52.5	53.4	53.3	52.5	51.2	49.7	47.9	46.3	44.8	43.4	43.4
165	38.3	39.7	41.4	44.8	46.5	47.6	48.4	49.0	49.7	50.3	50.2	49.8	49.1	48.2	47.2	46.2	45.1	44.5	44.8
170	36.2	38.4	40.3	43.9	45.5	46.1	46.8	47.2	47.5	47.6	47.7	47.8	47.6	47.1	46.4	45.7	45.4	45.2	45.8
175	35.1	36.5	39.4	41.7	43.8	45.1	45.2	45.2	45.0	45.0	45.2	45.5	45.7	45.7	45.7	45.5	45.6	45.7	46.1
180	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0

Table 6: Luminous Intensity Data

Table--2

UNIT: cd

C (DEG) γ (DEG)	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
0	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427		
5	425	425	426	426	426	426	426	426	426	426	426	426	426	425	425	424	424		
10	420	420	421	422	423	423	424	424	424	424	423	422	421	420	419	418	418		
15	410	411	413	415	416	418	419	419	419	419	418	416	414	412	410	409	407		
20	397	399	401	404	407	409	411	412	413	412	410	407	404	401	398	395	393		
25	380	383	386	391	395	399	402	403	404	403	400	396	392	387	382	378	375		
30	359	363	368	374	381	386	390	393	394	392	389	383	377	370	364	358	354		
35	336	341	348	356	365	372	377	381	382	380	376	369	361	352	343	335	330		
40	309	316	325	336	347	356	363	367	368	366	361	353	343	332	320	310	303		
45	280	289	301	315	328	339	348	353	354	352	346	336	324	311	296	284	274		
50	249	260	276	292	308	321	331	337	339	337	330	319	305	289	271	255	244		
55	217	231	249	269	288	303	314	321	323	320	313	301	285	266	246	227	212		
60	184	201	223	246	267	284	297	304	306	304	296	283	266	244	221	198	179		
65	150	171	198	224	247	265	279	287	290	287	278	265	246	223	196	169	147		
70	117	143	173	202	227	248	262	271	274	271	262	248	227	202	173	142	115		
75	85.6	116	150	182	209	230	246	255	258	255	246	231	210	183	151	117	85.2		
80	58.0	92.9	130	164	192	214	230	239	242	239	230	214	193	165	132	95.2	59.4		
85	35.8	74.8	113	147	176	198	213	223	226	223	214	199	177	149	116	77.9	38.9		
90	22.2	60.5	97.8	132	160	182	198	207	210	207	198	182	161	134	101	64.8	26.7		
95	16.6	50.1	85.2	117	145	166	182	191	193	190	181	167	146	120	88.7	54.7	20.9		
100	16.0	43.8	75.5	106	132	152	167	176	178	176	167	153	133	109	79.5	48.6	20.0		
105	17.3	40.6	68.0	95.4	119	139	153	161	164	162	154	140	122	98.6	72.3	45.5	20.6		
110	19.3	39.1	63.2	87.2	109	126	140	147	150	148	140	128	111	90.3	67.3	43.8	22.0		
115	20.6	38.6	59.2	80.3	99.4	115	127	134	137	135	128	117	102	83.7	63.6	42.8	23.1		
120	21.8	39.1	56.3	74.5	91.3	106	116	123	125	124	117	107	93.6	77.9	60.1	42.4	24.1		
125	21.8	39.3	54.1	69.7	84.2	97.0	107	112	115	113	107	98.2	86.5	72.8	57.5	42.5	24.6		
130	21.5	38.2	52.3	65.7	77.9	88.8	97.3	103	104	103	98.1	90.2	79.9	68.4	55.0	42.1	24.3		
135	23.5	35.6	50.1	62.1	72.9	81.3	88.7	93.4	95.0	93.6	89.0	82.7	74.6	64.4	52.7	39.8	25.0		
140	27.8	33.7	47.5	58.8	67.7	75.0	80.7	84.8	86.1	84.9	81.1	75.9	69.4	60.4	49.0	35.0	27.4		
145	32.9	28.8	42.7	54.9	62.5	69.4	74.1	76.9	77.9	76.8	74.3	70.6	63.7	56.8	47.2	31.3	30.7		
150	35.8	25.9	35.3	50.1	58.4	63.9	67.9	70.6	71.3	70.4	68.2	63.2	57.7	49.5	39.7	27.3	35.6		
155	38.5	29.6	26.7	38.7	51.1	58.0	61.9	63.0	62.6	61.6	58.3	51.6	44.7	37.5	29.9	29.2	37.5		
160	43.5	32.7	26.0	26.2	30.1	45.7	52.1	56.9	57.6	50.3	38.1	35.8	30.8	28.1	27.1	30.2	35.8		
165	43.7	39.0	31.2	24.7	27.1	29.6	29.6	36.7	46.8	31.0	34.9	33.4	29.0	26.8	27.8	30.5	34.5		
170	45.1	41.0	37.8	36.7	33.1	33.4	34.8	33.2	22.2	35.7	36.0	33.3	31.4	31.5	31.3	31.9	33.3		
175	46.5	46.8	47.1	46.1	44.3	44.6	43.3	38.7	27.5	24.8	26.0	27.1	28.3	29.7	30.6	31.8	33.7		
180	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0		

Table 7: Luminous Intensity Data

## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	PF2010A	HZTE028-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	DPS1060	HZTE001-06	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	WY12010	HZTE004-03	Aug. 05, 2020	Aug. 04, 2021
Temperature recorder	JM624U	HZTE018-08	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 05, 2020	Aug. 04, 2021
Standard source	D908	HZTE012-01	Aug. 05, 2020	Aug. 04, 2021
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

Table 8: 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  $4\pi$ . 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 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 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**

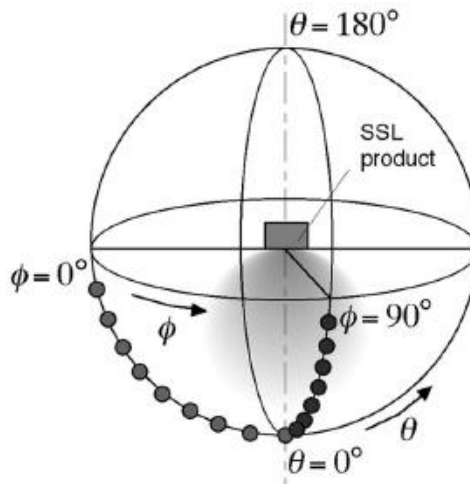
The color characteristics of SSL products include chromaticity coordinates, correlated color temperature, and color rendering index. These characteristics of SSL products may be spatially non-uniform, and thus, in order that they can be specified accurately, the color quantities shall be measured as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