



LM-79-08 Test Report

for

Signify North America Corporation

200 Franklin Square Drive, Somerset, NJ 08873, USA

LED Tube

Model: 9290019925

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18110028a

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

Review by:

April Zou

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Nov. 29, 2018

Approved by:



Jim Zhang

Manager: Jim Zhang
Nov. 29, 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: **9290019925**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
153.7	3800.0	24.73	0.9936
CCT (K)	CRI	Stabilization Time (Light & Power)	
3512	81.6	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 : Nov. 19, 2018

Date of Test : Nov. 22, 2018

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

TABLE OF CONTENT

LM-79-08 Test Report.....	1
Test Summary.....	2
Sample Photo.....	4
TEST RESULTS	5
Goniophotometer Method	6
Spectral Power Distribution - Sphere Spectroradiometer Method	7
Chromaticity Diagram - Sphere Spectroradiometer Method.....	8
Zonal Lumen Tabulation- Goniophotometer Method	10
Luminous Intensity Data- Goniophotometer Method.....	13
EQUIPMENT LIST	15
TEST METHODS	15
Seasoning of SSL Product.....	15
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	15
Goniophotometer Method	16
Photometric and Electrical Measurements.....	16
Color Characteristics Measurements.....	16
Color Spatial Uniformity	16

Sample Photo



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 9290019925
Electrical Ratings	: 120-277V, 60Hz
Product Description	: 25T5HO/COR/46-835/MF33/G 25/1
Manufacturer	: Signify North America Corporation
Address	: 200 Franklin Square Drive, Somerset, NJ 08873,USA

TEST RESULTS

Test ambient temperature was 25.0°C.

Base orientation was Light down. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60minutes, and the total operating time including stabilization was 65minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.207	0.090
Power Factor	0.9936	0.9668
Test Power (W)	24.73	24.01
THD A%	10.62	14.16
Luminous Efficacy (lm/W)	153.7	158.9
Total Luminous Flux (lm)	3800.0	3815.0
Color Rendering Index (CRI)	81.6	
R9	4.3	
Correlated Color Temperature (CCT)(K)	3512	
Chromaticity Chroma x	0.4052	
Chromaticity Chroma y	0.3924	
Chromaticity Chroma u	0.2350	
Chromaticity Chroma v	0.3413	
Duv	0.0006	
Chromaticity Chroma u'	0.2350	
Chromaticity Chroma v'	0.5119	

Special Color Rendering Indices	
R1	79.6
R2	89.3
R3	95.7
R4	78.8
R5	79.2
R6	85.1
R7	84.3
R8	60.6
R9	4.3
R10	74.1
R11	76.7
R12	60.8
R13	82
R14	97.9
Rf	81
Rg	94

Table 2: Test data per Sphere-Spectroradiometer Method

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

Goniophotometer Method

Test ambient temperature was 24.9°C.

The photometric distance is 30m.

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)	0.209
Power Factor	0.9927
Power (W)	24.84
Luminous Efficacy (lm/W)	151.0
Total Luminous Flux (lm)	3751.5
Beam Angle (°)	111.6 (0°-180°) / 185.6(90°-270°)
Center Beam Candle Power (cd)	721
Maximum Beam Candle Power (cd)	721.6 (At: C=70.0, Gamma=2.0)
Spacing Criteria	1.24 (0°-180°) /1.41 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	48.48%
Zonal Lumens in the 60 °-90 °Zone	27.49%
Zonal Lumens in the 90 °-120 °Zone	14.92%
Zonal Lumens in the 120 °-180 °Zone	9.11%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

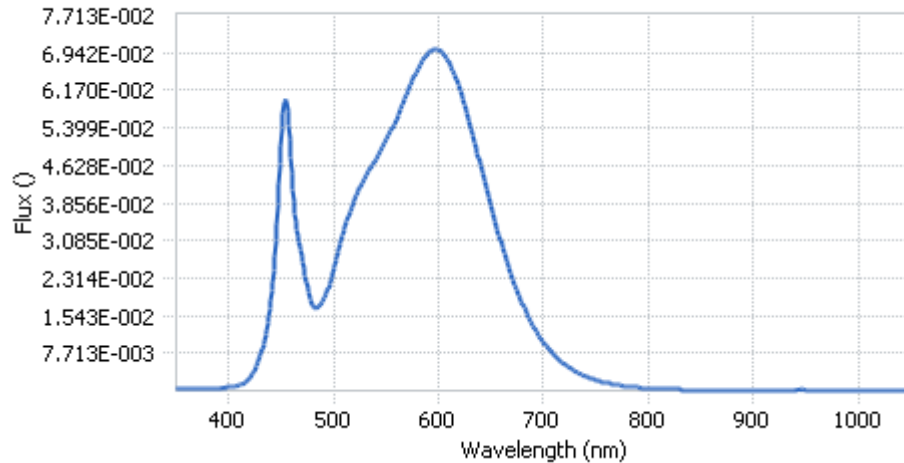
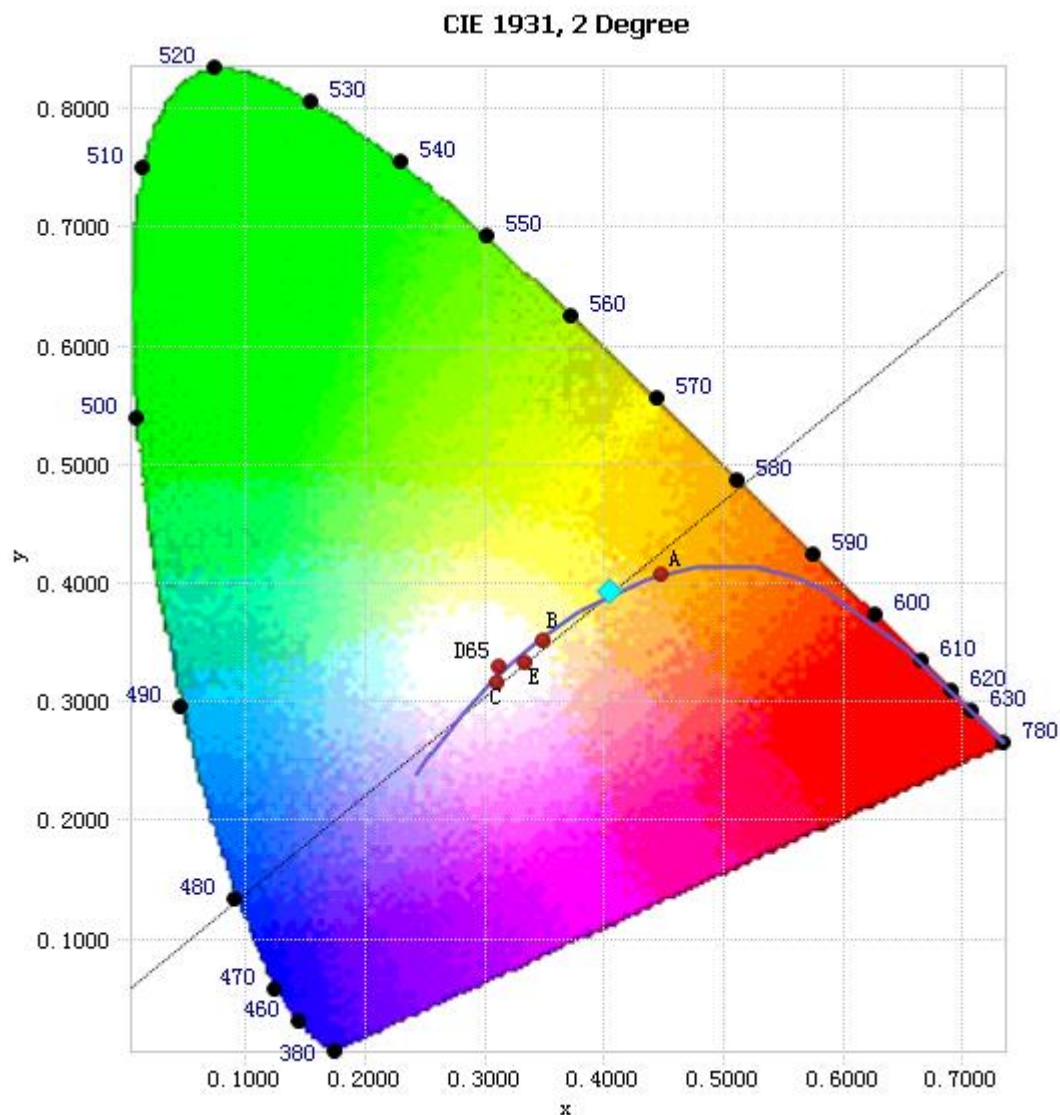


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	5.70E-04	485	1.73E-02	590	6.93E-02	695	1.16E-02
385	5.49E-04	490	1.86E-02	595	7.01E-02	700	1.00E-02
390	6.20E-04	495	2.12E-02	600	7.00E-02	705	8.59E-03
395	6.43E-04	500	2.51E-02	605	6.90E-02	710	7.42E-03
400	7.32E-04	505	2.93E-02	610	6.75E-02	715	6.36E-03
405	8.55E-04	510	3.32E-02	615	6.51E-02	720	5.48E-03
410	1.15E-03	515	3.66E-02	620	6.20E-02	725	4.74E-03
415	1.67E-03	520	3.95E-02	625	5.85E-02	730	4.04E-03
420	2.64E-03	525	4.18E-02	630	5.46E-02	735	3.46E-03
425	4.33E-03	530	4.39E-02	635	5.06E-02	740	2.97E-03
430	7.12E-03	535	4.57E-02	640	4.63E-02	745	2.54E-03
435	1.15E-02	540	4.75E-02	645	4.20E-02	750	2.18E-03
440	1.85E-02	545	4.94E-02	650	3.79E-02	755	1.88E-03
445	3.09E-02	550	5.14E-02	655	3.38E-02	760	1.63E-03
450	5.06E-02	555	5.35E-02	660	3.00E-02	765	1.42E-03
455	5.95E-02	560	5.59E-02	665	2.65E-02	770	1.21E-03
460	4.44E-02	565	5.85E-02	670	2.33E-02	775	1.05E-03
465	3.31E-02	570	6.12E-02	675	2.05E-02	780	9.12E-04
470	2.75E-02	575	6.37E-02	680	1.78E-02		
475	2.12E-02	580	6.62E-02	685	1.55E-02		
480	1.74E-02	585	6.81E-02	690	1.34E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y):(0.4052, 0.3924)

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

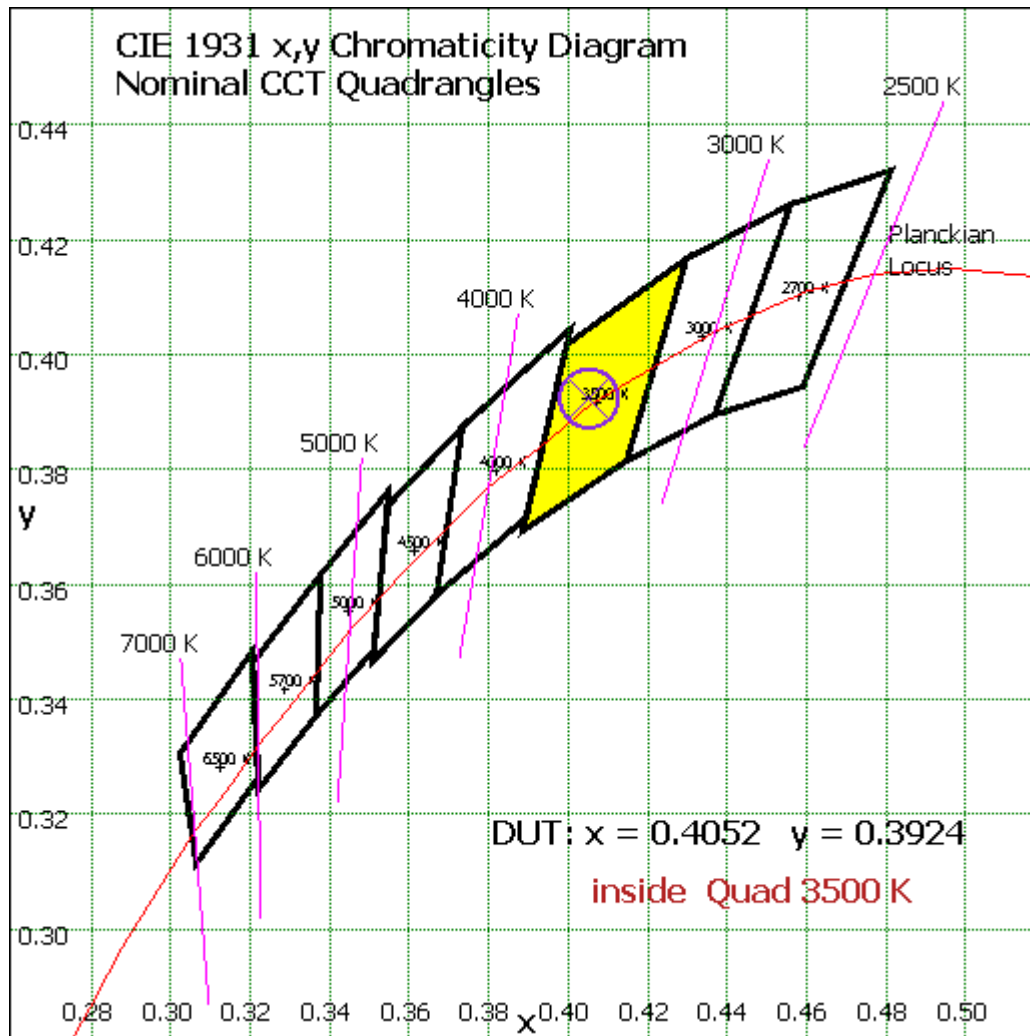


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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

Zonal Lumen Tabulation- Goniophotometer Method

$\gamma(^{\circ})$	Lumens	% Total
0- 10	68.424	1.82%
10- 20	198.168	5.28%
20- 30	307.588	8.20%
30- 40	386.171	10.29%
40- 50	427.627	11.40%
50- 60	430.905	11.49%
60- 70	400.415	10.67%
70- 80	346.27	9.23%
80- 90	284.5	7.58%
90-100	230.786	6.15%
100-110	183.734	4.90%
110-120	145.22	3.87%
120-130	114.606	3.05%
130-140	88.526	2.36%
140-150	65.175	1.74%
150-160	43.682	1.16%
160-170	23.111	0.62%
170-180	6.579	0.18%
Total	3751.5	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1818.883	48.48%
60- 90	1031.185	27.49%
0-90	2850.068	75.97%
90- 180	901.419	24.03%
0- 180	3751.5	100%

Table 5: Zonal Lumen

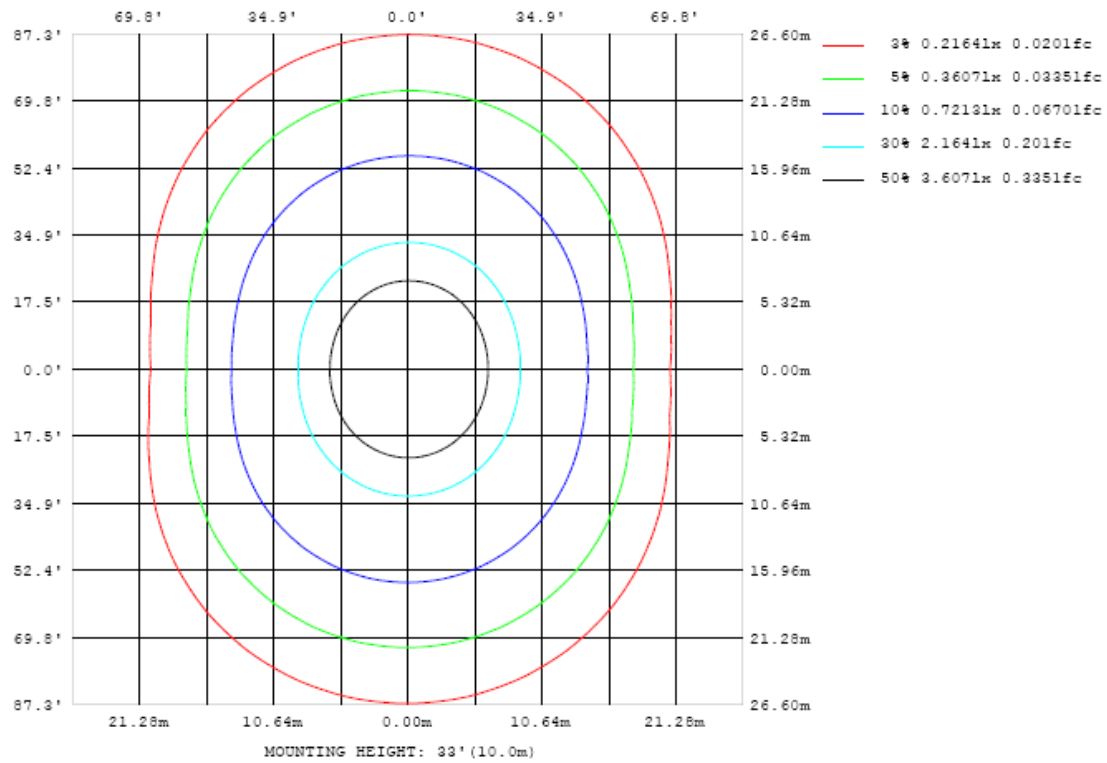


Chart 4: Beam Angle

Luminous Intensity Distribution Plots- Goniophotometer Method

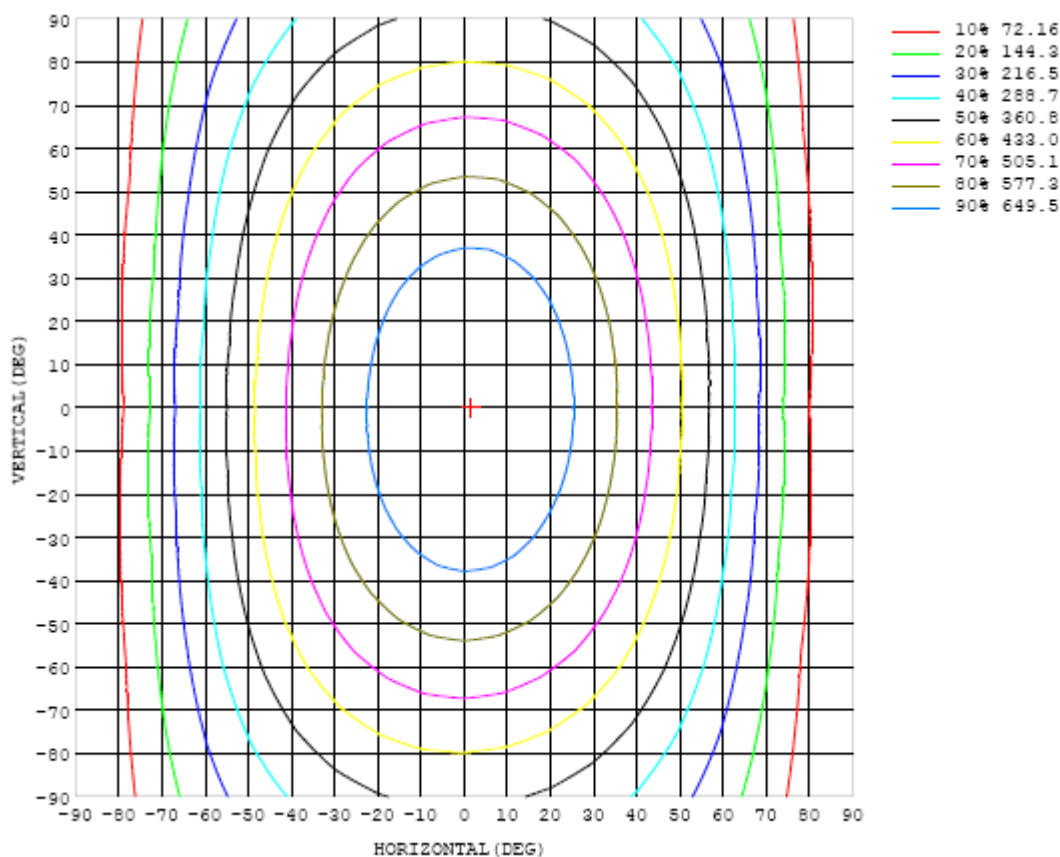


Chart 5: Illuminance Plot (Footcandles)

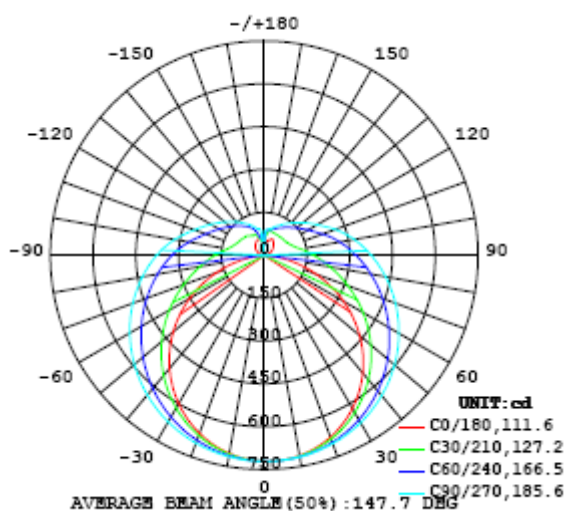


Chart 6: Polar Candela Distribution

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	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721
5	720	720	720	720	721	721	720	721	721	720	720	719	719	718	718	717	717	716	716
10	712	712	713	714	715	716	716	717	717	717	716	715	713	711	710	708	706	705	705
15	698	698	700	702	704	706	708	710	711	711	709	707	704	700	697	693	690	687	687
20	678	678	681	685	689	693	697	700	702	702	700	696	691	685	679	674	669	665	664
25	651	653	657	663	669	676	682	688	690	690	688	683	676	667	658	650	642	637	634
30	619	621	627	635	645	655	664	672	676	676	674	667	658	646	634	622	611	603	600
35	581	583	592	604	617	631	643	653	659	660	657	649	637	622	606	590	575	565	560
40	538	541	552	568	586	603	619	632	639	641	637	628	614	596	575	555	536	523	517
45	490	494	509	529	552	574	593	608	617	620	616	605	589	568	543	517	493	476	468
50	437	443	462	488	516	542	565	583	593	597	593	581	562	537	508	478	448	426	416
55	380	389	412	444	478	509	535	555	568	572	568	555	534	506	473	437	401	373	360
60	321	331	361	400	439	475	505	527	540	545	541	527	505	474	437	395	352	317	302
65	258	272	309	356	401	441	473	497	513	518	514	499	475	443	401	354	304	261	241
70	194	212	258	313	363	407	442	468	484	490	486	471	446	411	366	314	256	204	178
75	131	154	210	272	327	374	410	438	455	461	457	442	416	380	333	276	212	150	117
80	71.9	102	167	235	293	342	380	408	426	432	429	413	387	350	301	242	173	103	60.6
85	24.6	61.5	132	202	262	312	350	379	397	404	400	385	359	321	272	212	141	66.6	18.0
90	1.46	36.0	105	174	234	283	322	350	368	375	372	357	331	294	245	186	116	45.7	0.85
95	2.67	24.0	85.3	151	209	257	295	323	341	348	345	330	305	269	222	164	97.9	34.8	2.98
100	6.18	23.0	70.4	130	185	232	269	297	314	321	318	304	279	244	198	144	84.1	33.2	7.49
105	11.4	26.0	64.7	113	163	208	243	270	286	293	290	276	253	220	177	128	77.2	35.1	12.4
110	17.5	30.4	61.6	103	145	184	218	243	259	265	262	249	227	197	159	117	74.2	40.1	17.9
115	23.9	36.5	61.2	96.3	133	166	195	217	232	238	235	224	205	179	146	109	73.4	45.3	24.0
120	30.2	42.0	63.2	91.2	123	152	178	197	209	215	213	203	186	163	134	104	74.1	50.9	30.4
125	36.2	47.8	64.8	88.2	115	140	162	179	190	195	193	185	170	150	126	100	75.6	56.4	36.1
130	41.1	53.3	67.3	87.2	109	130	149	164	173	177	176	169	156	139	119	97.5	76.7	61.7	40.6
135	46.2	59.7	69.9	86.4	104	122	137	150	158	162	160	154	144	129	113	95.5	78.7	66.8	44.5
140	51.4	66.2	72.3	85.3	101	115	127	137	144	147	147	141	133	121	108	94.0	79.6	71.0	48.0
145	56.4	71.7	75.8	84.7	96.8	109	119	127	132	135	134	130	123	114	104	92.9	81.1	75.5	51.7
150	61.4	76.0	78.0	84.5	93.5	103	111	118	122	124	123	120	115	108	100	90.8	82.5	79.2	55.8
155	62.6	78.3	81.6	85.9	91.6	98.0	104	110	113	114	114	112	108	103	96.9	87.4	82.5	80.2	58.2
160	57.2	75.9	84.6	86.5	90.4	94.8	98.4	102	104	106	106	104	102	98.3	91.2	84.1	79.7	74.5	59.9
165	52.9	66.1	83.3	88.2	90.1	91.9	93.6	96.0	97.2	97.6	97.9	97.0	95.2	93.1	85.5	76.9	70.8	64.4	56.1
170	47.9	55.1	71.9	84.6	87.4	90.1	91.7	92.7	93.4	93.5	93.6	93.7	89.2	78.9	69.9	64.4	62.9	58.9	52.7
175	59.2	60.9	64.4	68.4	73.8	79.9	85.4	88.9	90.1	90.0	91.2	82.9	67.2	58.1	57.2	59.8	59.7	60.6	60.4
180	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6

Table 6: 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	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721	721		
5	716	716	716	717	718	718	719	719	720	720	720	720	720	720	720	720	720		
10	705	706	707	708	710	712	714	715	716	716	716	716	715	714	714	713	712		
15	687	689	692	695	699	702	705	707	709	710	709	708	706	704	702	700	698		
20	664	667	671	677	683	689	694	698	700	700	699	696	693	689	684	681	679		
25	636	640	647	655	664	673	680	685	688	688	686	682	676	669	662	657	653		
30	602	608	617	629	642	654	663	670	674	674	670	664	656	646	636	627	621		
35	563	572	585	600	617	632	644	653	657	657	652	644	632	619	605	593	584		
40	520	532	549	569	589	608	623	633	638	638	632	621	606	588	570	554	542		
45	473	488	510	535	560	582	600	611	617	616	609	595	577	555	532	511	496		
50	422	442	469	499	529	555	575	588	594	593	584	568	546	520	492	465	445		
55	368	393	427	462	497	527	549	564	570	569	558	540	514	483	449	416	391		
60	312	343	384	426	464	497	522	538	545	542	531	510	481	446	406	366	335		
65	254	293	342	389	432	468	494	511	518	515	502	480	448	409	363	316	276		
70	197	245	301	354	400	438	466	483	490	487	473	450	416	372	322	266	218		
75	142	200	263	320	369	409	438	455	462	459	444	419	383	337	282	220	162		
80	92.7	160	229	289	339	380	409	427	434	430	415	389	352	304	246	178	111		
85	55.7	128	198	260	311	351	381	399	405	402	386	360	322	274	214	144	70.6		
90	34.9	104	173	233	284	324	353	371	377	374	358	332	294	246	186	117	45.6		
95	26.2	84.1	150	208	258	297	325	343	349	345	330	304	267	219	161	95.5	32.1		
100	25.8	74.0	131	184	231	269	296	313	319	315	300	275	239	193	139	80.9	29.7		
105	30.3	69.4	118	165	207	241	267	283	289	285	271	247	213	171	124	73.8	32.5		
110	35.4	67.9	110	152	188	219	241	255	260	256	244	222	192	156	114	70.0	37.4		
115	38.6	68.8	104	140	173	200	220	233	237	234	222	203	176	143	105	69.9	42.4		
120	41.0	69.6	100	131	159	184	202	213	217	214	203	185	161	132	100	71.0	44.6		
125	44.5	71.4	97.4	123	148	169	185	195	198	195	186	170	150	124	97.4	72.8	48.0		
130	49.9	72.1	94.8	117	138	156	169	178	181	179	170	157	139	117	95.5	74.5	53.3		
135	55.8	70.6	92.5	112	129	145	156	163	166	163	156	145	130	112	93.5	73.8	59.2		
140	60.0	69.3	88.6	107	122	134	144	150	152	150	144	134	122	108	91.6	76.0	63.7		
145	61.1	73.2	83.7	102	115	125	133	138	139	138	133	125	115	103	88.1	77.8	65.2		
150	59.6	77.5	78.1	90.3	107	116	122	126	128	126	123	117	108	96.7	87.4	79.3	64.1		
155	58.8	79.8	80.2	84.0	95.6	106	112	116	117	117	114	108	100	92.4	87.3	81.9	64.2		
160	51.8	67.3	72.0	76.4	83.2	92.7	101	105	106	106	105	100	95.2	90.7	88.8	78.1	57.2		
165	47.2	54.2	61.9	62.5	67.5	71.6	86.7	95.8	96.7	97.5	96.9	95.3	93.5	91.3	84.4	66.1	50.0		
170	48.2	48.2	51.7	59.1	58.8	62.2	60.2	69.9	94.2	94.4	93.6	87.3	82.4	73.5	60.2	50.9	48.2		
175	60.3	62.6	63.7	65.0	65.8	65.9	66.2	63.5	39.0	53.6	67.3	71.6	67.6	65.9	66.7	65.7	62.5		
180	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6		

Table 7: Luminous Intensity Data

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Goniophotometer system	GO-R5000	HZTE011-01	Aug. 14, 2018	Aug. 13, 2019
Digital Power Meter	PF2010A	HZTE028-01	Sep. 12, 2018	Sep. 11, 2019
AC Power Supply	DPS1060	HZTE001-06	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	WY12010	HZTE004-03	Aug. 09, 2018	Aug. 08, 2019
Temperature recorder	JM624U	HZTE018-08	Aug. 09, 2018	Aug. 08, 2019
Temperature and humidity recorder	JR900	HZTE018-01	Aug. 09, 2018	Aug. 08, 2019
Standard source	D908	HZTE012-01	Aug. 14, 2018	Aug. 13, 2019
Integrate Sphere system	2M	HZTE015-01	Aug. 16, 2018	Aug. 15, 2019
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2018	Aug. 01, 2019
AC Power Supply	PCR 500L	HZTE001-07	Aug. 09, 2018	Aug. 08, 2019
DC Power Supply	IT6154	HZTE004-04	Aug. 09, 2018	Aug. 08, 2019
Standard source	SCL-1400	HZTE012-02	Aug. 16, 2018	Aug. 15, 2019
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 09, 2018	Aug. 08, 2019
Temperature Meter	TES1310	HZTE017-01	Aug. 09, 2018	Aug. 08, 2019

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 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 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° 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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