



LM-79-08 Test Report

for

Signify North America Corporation

200 Franklin Square Drive, Somerset, NJ 08873, USA

LED Tube

Model: 9290019927

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ18110028c

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

Review by:

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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: **9290019927**

Luminous Efficacy (Lumens /Watt)	Total Luminous Flux (Lumens)	Power (Watts)	Power Factor
154.3	3774.0	24.46	0.9937
CCT (K)	CRI	Stabilization Time (Light & Power)	
5119	83.1	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. 28, 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

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Sample Photo



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: 9290019927
Electrical Ratings	: 120-277V, 60Hz
Product Description	: 25T5HO/COR/46-850/MF35/G 25/1
Manufacturer	: Signify North America Corporation
Address	: 200 Franklin Square Drive, Somerset, NJ 08873,USA

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 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)	0.205	0.089
Power Factor	0.9937	0.9677
Test Power (W)	24.46	23.80
THD A%	10.54	13.63
Luminous Efficacy (lm/W)	154.3	159.5
Total Luminous Flux (lm)	3774.0	3796.0
Color Rendering Index (CRI)	83.1	
R9	8.5	
Correlated Color Temperature (CCT)(K)	5119	
Chromaticity Chroma x	0.3419	
Chromaticity Chroma y	0.3514	
Chromaticity Chroma u	0.2093	
Chromaticity Chroma v	0.3227	
Duv	0.0006	
Chromaticity Chroma u'	0.2093	
Chromaticity Chroma v'	0.4841	

Special Color Rendering Indices	
R1	81.7
R2	90.1
R3	93.6
R4	80.7
R5	81.6
R6	84.4
R7	86.2
R8	66.6
R9	8.5
R10	74.7
R11	79
R12	59.5
R13	84.3
R14	96.8
Rf	80
Rg	93

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 25.0°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)	0.206
Power Factor	0.9929
Power (W)	24.57
Luminous Efficacy (lm/W)	153.2
Total Luminous Flux (lm)	3765.0
Beam Angle (°)	109.6 (0°-180°) / 165.9(90°-270°)
Center Beam Candle Power (cd)	788
Maximum Beam Candle Power (cd)	789.0 (At: C=90.0, Gamma=2.5)
Spacing Criteria	1.24 (0°-180°) /1.36 (90°-270°)
Zonal Lumens in the 0 °-60 °Zone	51.21%
Zonal Lumens in the 60 °-90 °Zone	26.97%
Zonal Lumens in the 90 °-120 °Zone	13.63%
Zonal Lumens in the 120 °-180 °Zone	8.19%

Table 3: Test data per Goniophotometer Method

Spectral Power Distribution - Sphere Spectroradiometer Method

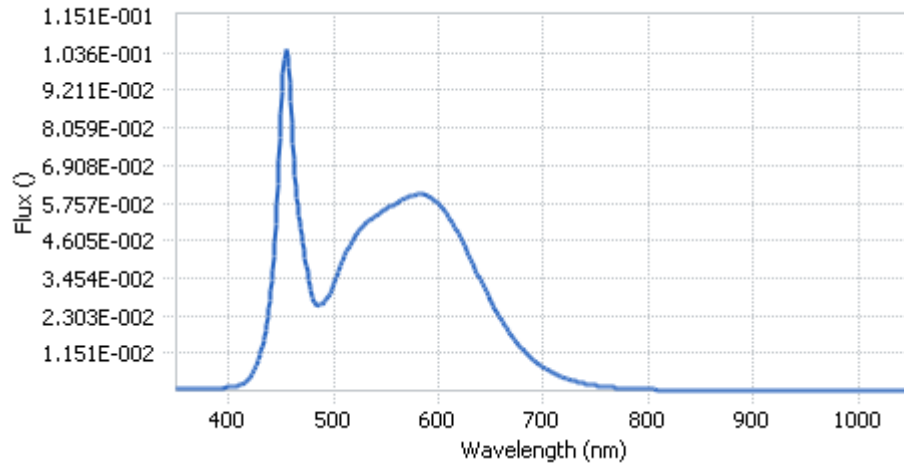
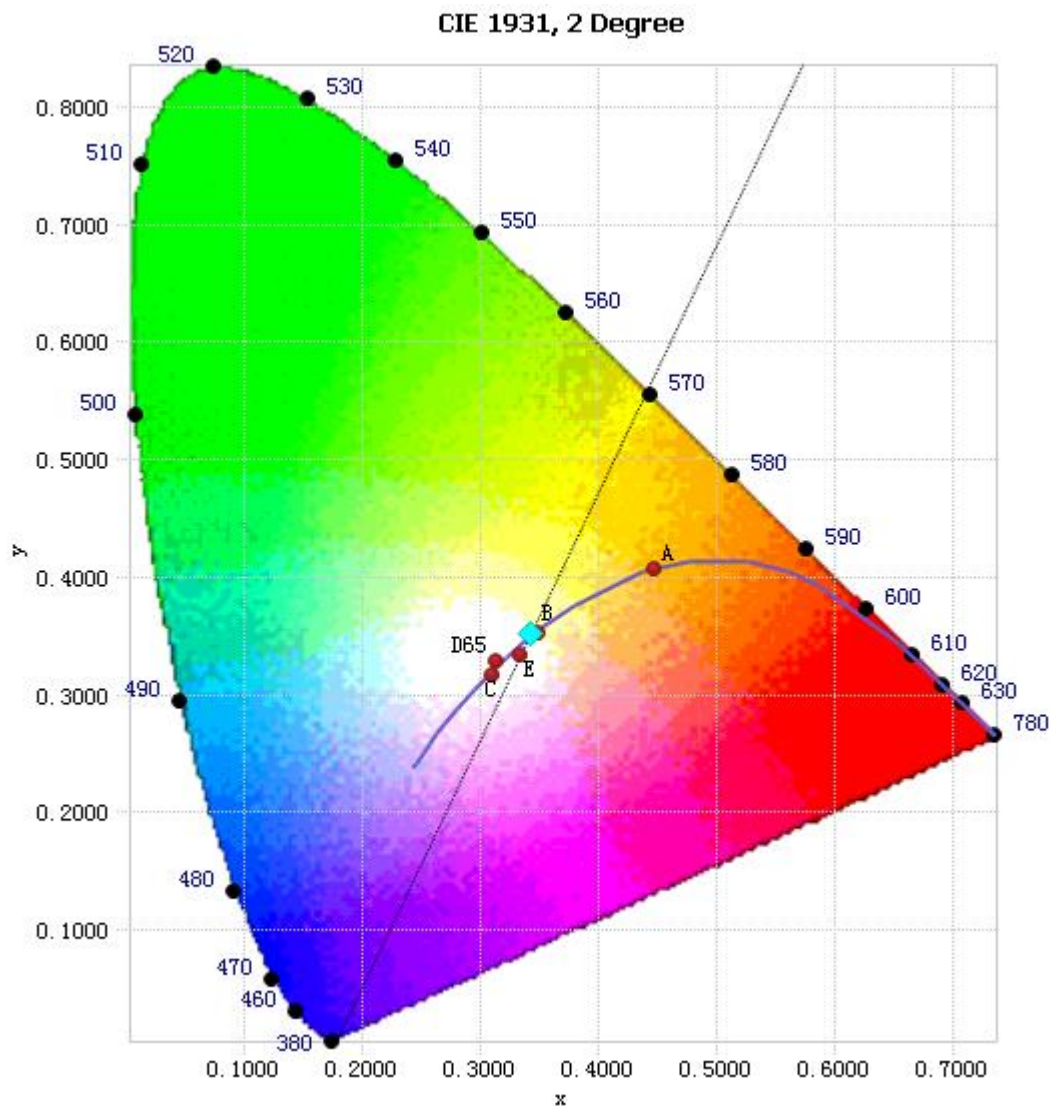


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.57E-04	485	2.63E-02	590	5.96E-02	695	8.29E-03
385	7.52E-04	490	2.68E-02	595	5.88E-02	700	7.14E-03
390	8.57E-04	495	2.90E-02	600	5.73E-02	705	6.18E-03
395	9.43E-04	500	3.29E-02	605	5.55E-02	710	5.29E-03
400	1.06E-03	505	3.71E-02	610	5.31E-02	715	4.58E-03
405	1.26E-03	510	4.12E-02	615	5.05E-02	720	3.95E-03
410	1.69E-03	515	4.46E-02	620	4.73E-02	725	3.41E-03
415	2.48E-03	520	4.74E-02	625	4.41E-02	730	2.95E-03
420	3.94E-03	525	4.94E-02	630	4.07E-02	735	2.51E-03
425	6.66E-03	530	5.12E-02	635	3.73E-02	740	2.18E-03
430	1.12E-02	535	5.24E-02	640	3.39E-02	745	1.87E-03
435	1.86E-02	540	5.36E-02	645	3.05E-02	750	1.63E-03
440	3.05E-02	545	5.47E-02	650	2.74E-02	755	1.40E-03
445	5.13E-02	550	5.57E-02	655	2.44E-02	760	1.22E-03
450	8.48E-02	555	5.66E-02	660	2.16E-02	765	1.05E-03
455	1.05E-01	560	5.75E-02	665	1.90E-02	770	9.15E-04
460	8.22E-02	565	5.86E-02	670	1.66E-02	775	7.95E-04
465	5.89E-02	570	5.94E-02	675	1.46E-02	780	6.86E-04
470	4.74E-02	575	5.99E-02	680	1.27E-02		
475	3.62E-02	580	6.03E-02	685	1.11E-02		
480	2.81E-02	585	6.03E-02	690	9.55E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y):(0.3419, 0.3514)

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

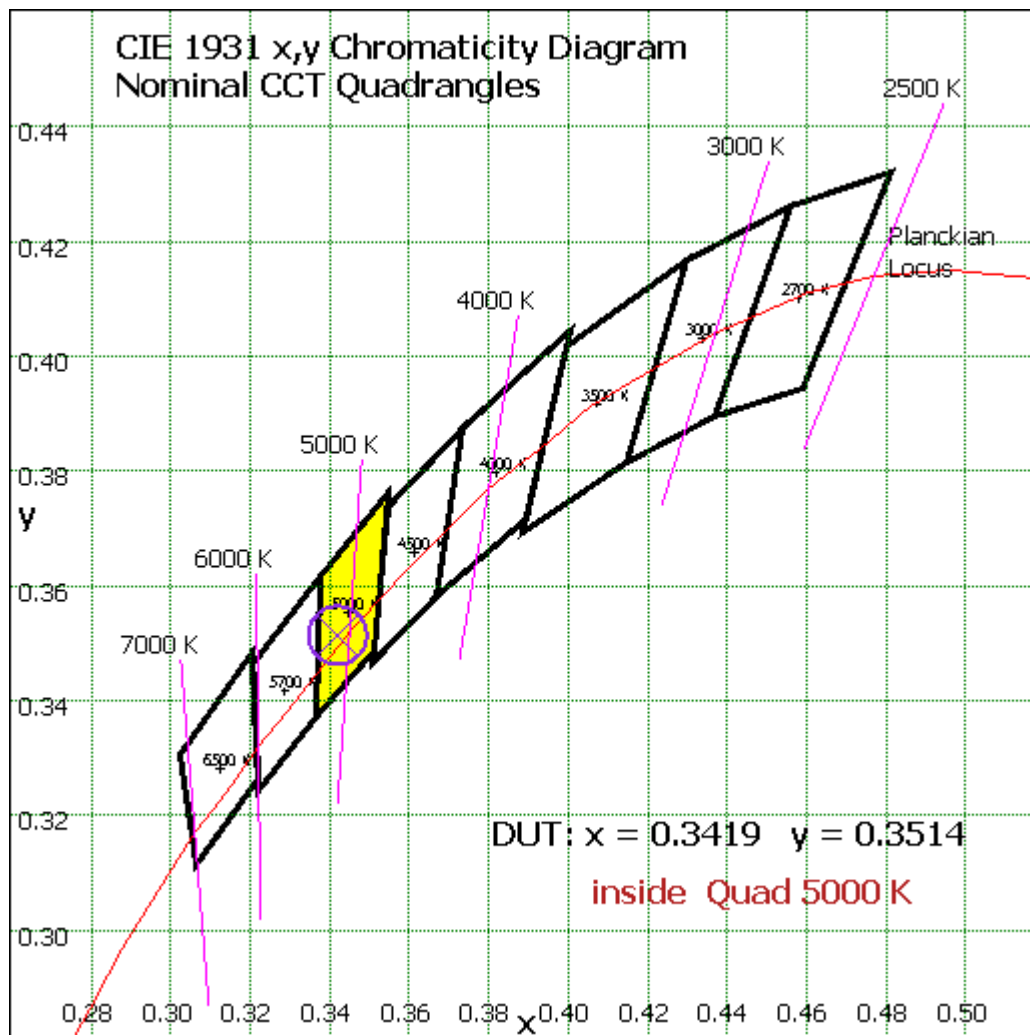


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

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	74.725	1.98%
10- 20	215.585	5.73%
20- 30	332.034	8.82%
30- 40	412.062	10.94%
40- 50	449.394	11.94%
50- 60	444.383	11.80%
60- 70	403.764	10.72%
70- 80	340.096	9.03%
80- 90	271.455	7.21%
90-100	213.414	5.67%
100-110	167.786	4.46%
110-120	131.911	3.50%
120-130	103.315	2.74%
130-140	79.668	2.12%
140-150	58.689	1.56%
150-160	39.313	1.04%
160-170	20.687	0.55%
170-180	6.688	0.18%
Total	3765.0	100%

$\gamma(^{\circ})$	Lumens	% Total
0- 60	1928.183	51.21%
60- 90	1015.315	26.97%
0-90	2943.498	78.18%
90- 180	821.471	21.82%
0- 180	3765.0	100%

Table 5: Zonal Lumen

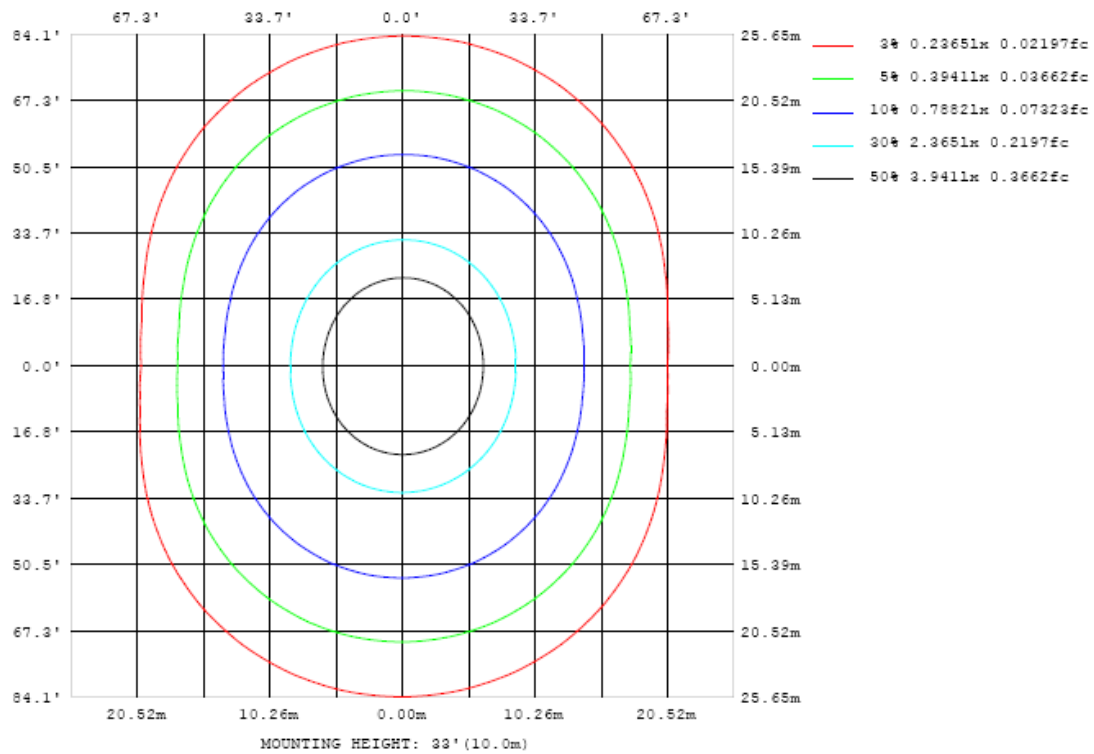


Chart 4: Beam Angle

Luminous Intensity Distribution Plots- Goniophotometer Method

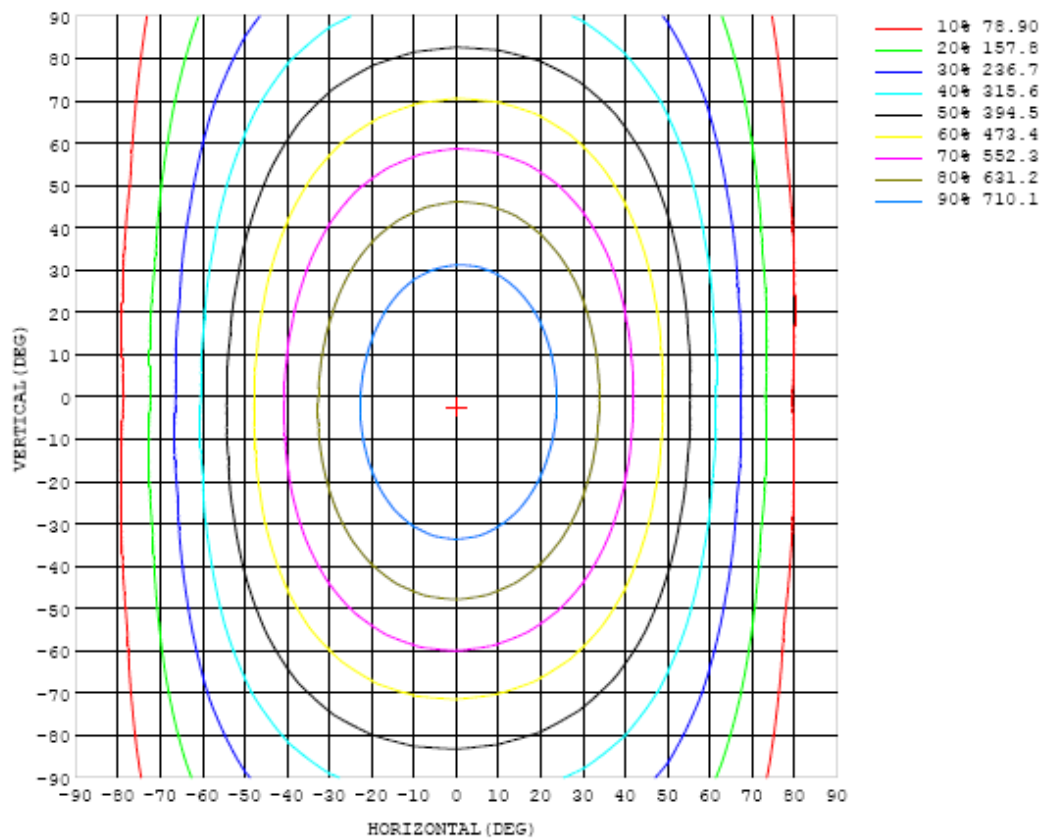


Chart 5: Illuminance Plot (Footcandles)

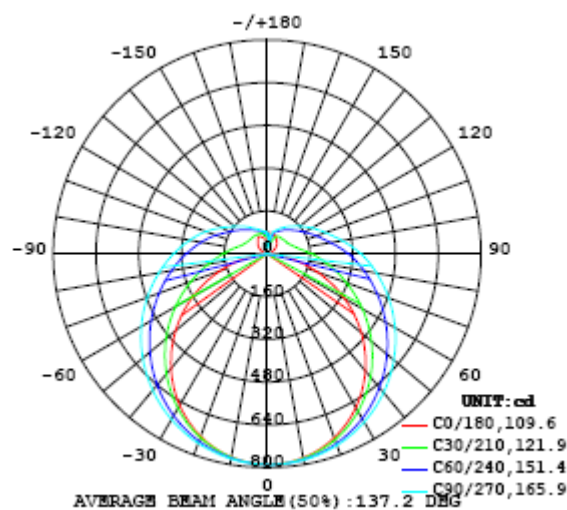


Chart 6: Polar Candela Distribution

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	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788
5	785	786	786	786	787	787	787	788	787	787	787	788	787	786	786	785	785	784	784
10	775	775	776	777	779	780	781	782	783	783	783	782	780	779	777	775	774	773	772
15	757	758	759	762	765	768	771	773	774	774	774	772	770	766	762	759	756	754	753
20	733	734	737	741	746	750	755	759	762	762	761	759	754	749	743	737	733	729	727
25	701	703	707	713	721	728	735	741	745	746	745	741	735	727	718	709	703	697	694
30	664	666	672	680	691	702	711	720	725	726	725	720	711	700	689	677	667	659	654
35	620	623	631	643	657	671	684	694	701	703	701	695	684	670	655	639	626	615	609
40	572	575	586	602	620	638	653	666	675	678	675	667	654	637	618	598	580	566	560
45	518	523	537	557	579	601	620	635	645	649	646	637	622	602	578	554	531	513	505
50	460	466	484	509	537	563	585	603	614	618	615	605	587	564	537	507	479	456	447
55	398	406	429	460	493	523	549	568	581	586	583	571	552	526	494	459	425	397	385
60	334	344	373	411	449	484	512	533	547	552	549	537	516	487	451	411	370	336	321
65	267	281	317	362	406	444	475	498	512	518	515	502	479	448	409	364	316	274	255
70	200	217	263	315	364	405	438	463	478	484	480	467	443	411	369	319	263	212	188
75	134	156	212	271	324	368	403	428	443	449	446	432	408	374	330	276	215	154	124
80	72.7	102	167	232	288	333	368	394	410	416	412	399	374	340	294	238	172	104	64.6
85	24.4	61.3	130	197	254	300	336	361	377	383	380	366	342	307	262	205	137	66.5	19.8
90	1.40	35.9	102	167	223	269	304	329	345	351	348	334	310	276	231	175	110	42.3	0.74
95	2.47	24.1	78.5	139	193	238	271	296	311	317	314	301	278	245	202	148	87.9	31.5	2.41
100	6.08	22.7	67.1	119	168	209	241	265	279	285	282	270	248	217	177	129	76.3	28.6	5.53
105	11.0	25.7	60.8	106	150	187	216	238	251	256	254	242	223	195	159	116	70.4	30.4	10.6
110	17.4	29.9	58.5	96.2	135	169	196	216	228	233	230	220	202	176	144	106	67.7	33.7	16.4
115	24.0	33.3	58.5	89.4	123	153	178	196	207	212	210	200	184	161	132	98.9	66.9	36.8	22.3
120	31.0	36.5	59.5	85.5	113	140	162	179	189	193	191	182	167	147	122	93.8	67.1	39.4	29.0
125	38.4	40.8	61.9	83.3	106	129	149	163	172	176	174	167	153	135	114	90.2	67.7	41.2	35.6
130	45.5	43.3	63.7	81.4	101	120	136	149	157	161	159	152	141	126	107	87.9	68.0	42.3	42.9
135	51.6	44.5	65.0	79.7	96.4	112	126	137	144	147	145	139	130	117	102	85.6	68.2	43.3	49.5
140	56.4	44.6	65.5	78.2	92.2	105	117	126	132	134	133	128	120	110	97.6	82.7	68.3	43.6	55.5
145	63.3	45.6	65.7	78.0	87.7	99.3	109	116	120	123	122	118	112	103	92.8	78.6	64.5	45.2	62.6
150	70.0	54.4	63.0	76.8	84.6	92.7	101	107	111	113	112	109	103	96.4	85.3	76.2	60.3	51.1	68.6
155	73.9	64.0	50.1	66.6	82.4	87.5	92.6	97.6	101	102	102	99.4	95.1	83.5	75.2	66.7	50.9	58.1	72.2
160	74.7	66.2	47.0	51.3	67.0	83.7	86.8	89.1	91.4	92.6	92.5	87.4	71.8	65.2	60.0	46.8	48.2	57.5	68.2
165	79.8	74.4	53.6	44.3	45.2	51.6	67.5	77.5	83.3	84.8	69.0	54.3	55.4	49.8	40.8	47.0	48.4	56.5	63.3
170	79.5	78.2	66.7	52.6	50.1	56.4	59.2	59.4	63.2	47.5	56.1	61.1	60.0	58.4	54.0	49.3	49.5	54.5	57.7
175	80.4	78.5	77.1	74.5	69.0	63.0	60.7	57.7	49.2	36.6	60.1	61.0	61.0	58.7	57.0	57.0	57.6	55.5	53.3
180	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5

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	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788	788		
5	784	783	784	784	785	785	785	785	785	785	786	786	785	785	785	785	785		
10	772	772	773	774	775	776	777	778	778	779	779	778	777	777	775	775	775		
15	753	753	755	757	760	763	765	767	768	768	767	766	764	762	760	758	757		
20	726	728	732	735	741	746	750	752	754	754	752	749	747	742	738	735	733		
25	694	697	702	709	717	724	730	734	736	737	734	729	724	717	711	706	702		
30	655	660	668	678	689	699	707	713	715	715	712	705	697	688	678	670	665		
35	611	618	629	643	657	671	681	689	692	691	687	678	667	655	641	630	623		
40	562	571	587	605	623	640	653	662	666	665	659	648	634	618	601	585	575		
45	508	521	541	564	587	607	622	633	638	636	629	616	598	578	557	537	523		
50	452	469	494	522	549	572	590	602	607	606	597	582	561	537	510	485	467		
55	392	414	445	479	510	537	557	570	576	574	564	547	523	494	463	432	408		
60	330	359	397	435	471	501	523	537	544	541	530	511	484	451	414	377	347		
65	267	304	349	393	433	465	489	504	511	507	496	475	445	409	366	322	284		
70	206	251	303	353	396	430	455	471	477	474	461	439	408	368	320	268	222		
75	148	202	261	315	360	396	421	437	444	441	428	405	372	329	278	218	163		
80	95.7	159	223	280	327	363	389	405	412	408	395	371	337	294	239	174	110		
85	56.7	125	191	248	296	332	358	374	380	376	363	339	305	260	205	139	68.7		
90	34.5	99.7	164	220	267	303	328	344	350	346	333	309	276	231	176	111	42.6		
95	24.8	82.2	143	196	241	276	300	315	321	318	305	282	249	206	153	91.4	30.3		
100	24.1	69.1	125	175	218	251	275	289	295	291	278	256	225	183	134	76.6	26.8		
105	26.9	62.9	109	156	196	227	250	264	269	266	253	232	202	163	116	67.6	28.3		
110	32.2	60.5	98.8	138	175	204	226	239	244	240	229	209	180	144	104	63.4	32.5		
115	37.8	60.4	92.1	126	157	182	202	214	219	216	205	186	160	130	95.7	61.7	37.7		
120	43.5	61.9	87.9	116	143	164	181	191	195	192	183	167	145	119	90.0	62.2	43.1		
125	49.4	64.1	85.2	109	131	150	164	173	176	174	165	152	133	111	86.0	63.8	49.0		
130	54.9	66.7	83.6	103	122	138	150	157	160	158	151	139	123	104	83.8	66.3	54.6		
135	58.9	69.1	82.6	98.1	114	127	137	144	146	144	138	128	114	98.6	82.6	68.8	58.8		
140	63.4	71.9	82.5	94.5	107	118	126	132	133	132	127	118	107	94.7	82.3	71.7	63.7		
145	67.8	72.5	81.8	91.8	101	110	116	121	122	121	117	110	101	91.6	82.2	74.0	68.1		
150	71.8	74.9	82.6	89.5	96.5	103	108	111	112	111	108	103	96.3	89.3	82.3	76.0	72.1		
155	74.4	76.3	80.0	87.8	92.7	97.1	101	103	104	103	101	97.0	92.5	87.6	81.9	78.2	75.0		
160	75.1	78.0	80.0	84.8	89.5	92.3	94.7	96.3	96.9	96.3	94.8	92.4	89.3	85.7	82.5	80.4	78.4		
165	68.5	74.3	79.8	82.7	86.3	88.3	89.8	90.8	91.1	90.8	90.0	88.5	86.5	84.9	83.2	81.8	80.2		
170	61.1	67.0	74.7	80.8	81.9	83.6	85.9	86.5	86.6	86.6	86.3	85.7	85.1	84.3	83.5	82.8	81.6		
175	53.7	58.5	65.0	71.5	76.1	77.2	78.8	81.9	84.3	84.8	84.4	84.1	83.9	83.7	83.3	82.7	82.0		
180	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5		

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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