



Photometric Test Report

Relevant Standards

UL1598-2008

ANSI C82.77-10-2014

IES LM-79-2008

Prepared For

P.Q.L., Inc.

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Test Laboratory:

UL-CCIC Company Limited

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Catalog Number

55610

Project Number

4789044943

Report Number

4789044943_14R01

Test Date

2019-06-10~2019-07-02

Issue Date

2019-07-31

Revision Date

2019-07-31

Prepared By

Jonathan Xu

Xu, Jonathan

Approved By

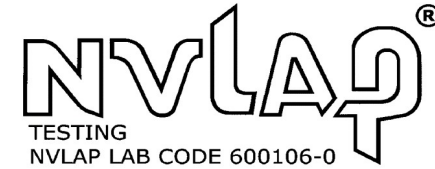
Duff Yang

Yang, Duff

The results contained in this report pertain only to the tested sample.

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Test Summary

DLC Technical Requirements v4.4- issued 2018-10-18

Requirement Category	Test Method	Requirements	Tolerance	Test Result
Minimum Light Output (lm/ft)-Luminaires	IES LM-79-2008	≥375	-10%	997.82
Zonal Lumen Requirement 1(0°-60°)	IES LM-79-2008	≥40%	N/A	61.10%
Minimum Luminaire Efficacy (lm/W)-Luminaires	IES LM-79-2008	≥130	-3%	130.87
Allowable CCT (3500K)	IES LM-79-2008/ANSI C78.377-2015	3465±245	N/A	3451.0
Allowable CCT (3500K)	IES LM-79-2008/ANSI C78.377-2015	3465±245	N/A	3479.0
Allowable CCT (3500K)	IES LM-79-2008/ANSI C78.377-2015	3465±245	N/A	3598.0
Allowable CCT (4000K)	IES LM-79-2008/ANSI C78.377-2015	3985±275	N/A	4160.0
Allowable CCT (5000K)	IES LM-79-2008/ANSI C78.377-2015	5029±283	N/A	4998.0
Minimum CRI	IES LM-79-2008/CIE 13.3-1995	≥80	-2	82.27
L70 Lumen maintenance (Hours)	N/A	≥50000	N/A	≥50000
L90 Lumen maintenance (Hours)	N/A	≥36000	N/A	≥36000
Power Factor	ANSI C82.77-10-2014	≥0.9	-0.03	0.9273
Total Harmonic Distortion (A%)	ANSI C82.77-10-2014	≤20%	5%	6.41%
In-Situ Temperature Measurement Test for LED 1 (°C)	UL1598-2008	≤105	N/A	41.7
In-Situ Temperature Measurement Test for Driver 1 (°C)	UL1598-2008	≤90	N/A	43.7
Minimum Luminaire Warranty (Years)	N/A	≥5	N/A	≥5



Test List

Sample Received Date: 2019-06-06

Test Item	Test Date	Model Number	Tests Conducted By
Integrating Sphere Test	2019-06-12	55610	Xiong, Blaire
Integrating Sphere Test	2019-06-12	55610	Xiong, Blaire
Integrating Sphere Test	2019-07-02	55610	Xiong, Blaire
Integrating Sphere Test	2019-06-12	55610	Xiong, Blaire
Goniophotometer Test	2019-06-12	55610	Xiong, Blaire
THD and PF Test	2019-06-10	55610	Xiong, Blaire
In-Situ Temperature Measurement Test	2019-06-25	55610	Xiong, Blaire

Remark (if any)

1. UL test equipment information is recorded on Meter Use in UL 's Aurora database.
2. This report replace 4789044943_14, the report 4789044943_14 is terminated.



Product Description

Lamp/Luminaire Description: Direct Linear Ambient Luminaires

Model Number: 55610

Electrical Parameter: 120-277V, 50/60Hz, 18W/25W/30W

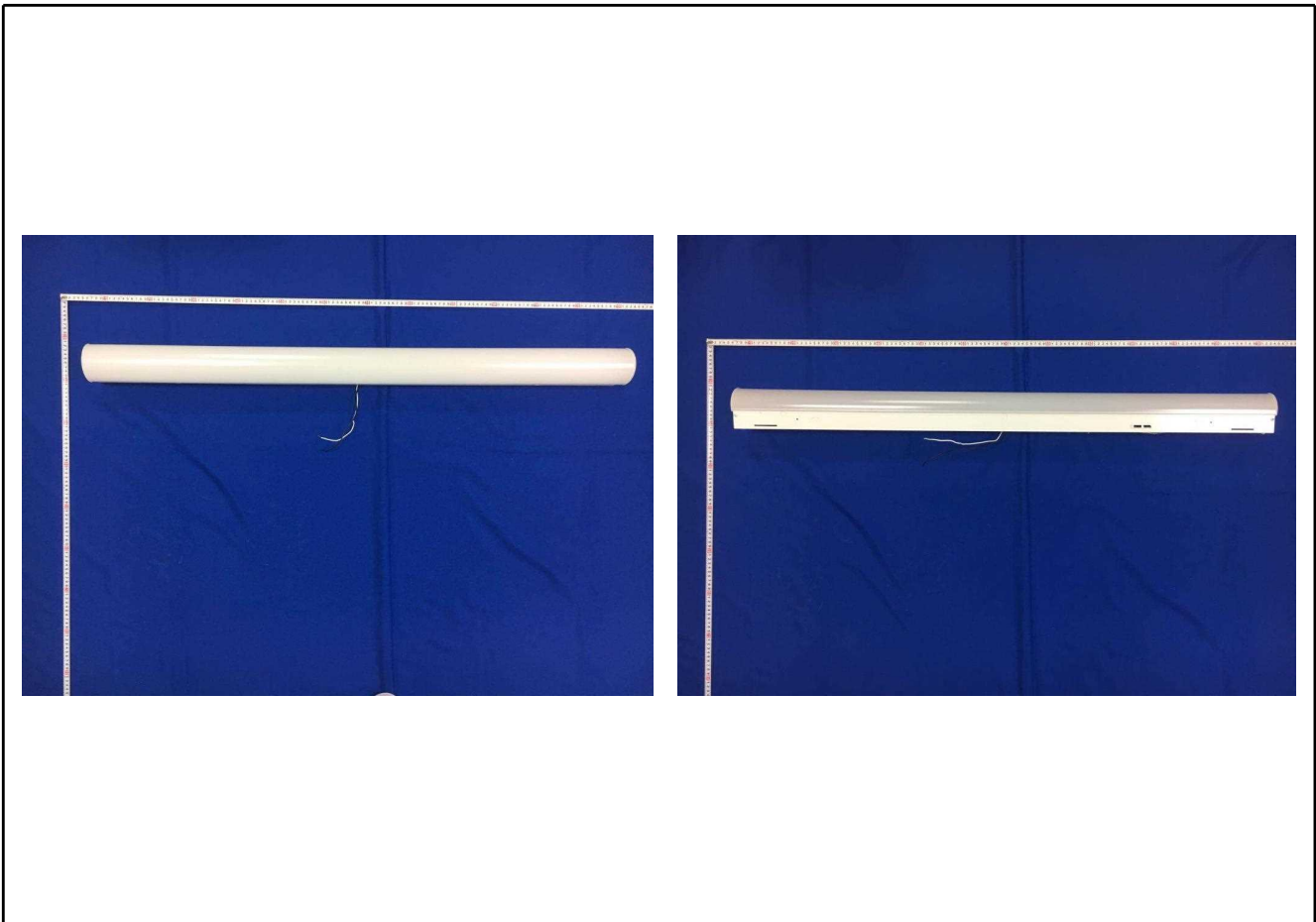
LED Package: STW8A2PD-XX

Family Model and Variation: 55610

Products Scaled Value

Model Number	CCT	Luminous Flux	Power	Luminous Efficacy
55610	3500	3900	30	130
55610	4000	3930	30	131
55610	5000	3960	30	132

Photos of Products Characteristics





Integrating Sphere Test

Model No.	55610	Sample ID.	2339758
Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

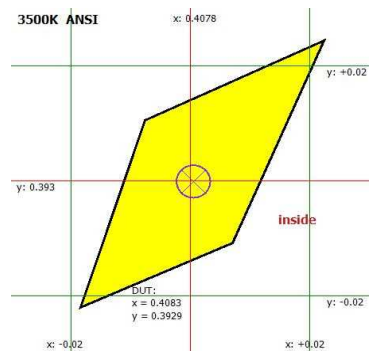
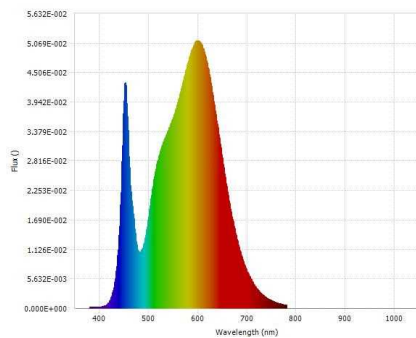
1. The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning.
 2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. The reference standard lamp is rated current 2.679A omni-directional Incandescent lamp and was calibrated by Labsphere, Inc., Optical Calibration Laboratory.
 3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions was using 4π geometry. The self-absorption factor is applied in the final test result. The sample was operated at rated voltage and was stabilized before measurement. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 1 nm intervals over the range of 380 to 780 nm.

Integrating Sphere Test Conditions

Temperature ($^{\circ}\text{C}$)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.5	119.96	60	0.1586	18.846	0.9907	N/A	Horizontal

Test Results

CCT (K)	CRI (Ra)	Duv	Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
3451.0	82.27	0.0004	2632.53	139.69	658.13



Luminous Flux (lm)	2632.53	Chrom x	0.4083
Chrom y	0.3929	Chrom u	0.2367
Chrom v	0.3417	Duv	0.0004
Chrom u'	0.2367	Chrom v'	0.5126
CCT (K)	3451.0	Luminous Efficacy (lm/W)	139.69
Ra	82.27	R1	80.6
R2	89.1	R3	95.4
R4	80.8	R5	80.3
R6	85.1	R7	84.9
R8	61.9	R9	7.2
R10	73.9	R11	79.5
R12	62.0	R13	82.6
R14	97.5	R15	74.2
Rf	81.7	Rg	95.7



Integrating Sphere Test

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Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

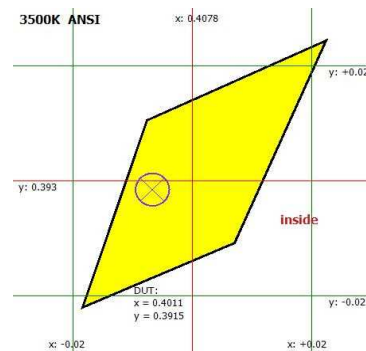
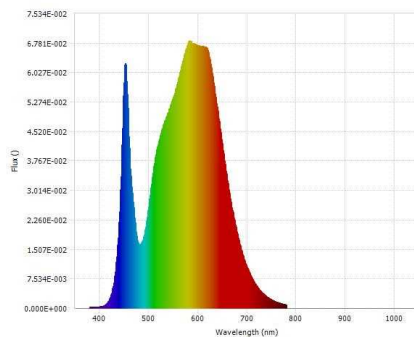
1. The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning.
 2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. The reference standard lamp is rated current 2.679A omni-directional Incandescent lamp and was calibrated by Labsphere, Inc., Optical Calibration Laboratory.
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Integrating Sphere Test Conditions

Temperature ($^{\circ}\text{C}$)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.5	119.98	60	0.2479	29.593	0.9951	N/A	Horizontal

Test Results

CCT (K)	CRI (Ra)	Duv	Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
3598.0	82.92	0.0013	3904.38	131.94	976.10



Luminous Flux (lm)	3904.38	Chrom x	0.4011
Chrom y	0.3915	Chrom u	0.2326
Chrom v	0.3406	Duv	0.0013
Chrom u'	0.2326	Chrom v'	0.5109
CCT (K)	3598.0	Luminous Efficacy (lm/W)	131.94
Ra	82.92	R1	81.1
R2	88.4	R3	94.1
R4	81.5	R5	80.5
R6	83.8	R7	87.2
R8	66.8	R9	16.8
R10	72.3	R11	79.5
R12	60.1	R13	82.5
R14	96.6	R15	76.0
Rf	82.3	Rg	96.0



Integrating Sphere Test

Model No.	55610	Sample ID.	2339758
Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

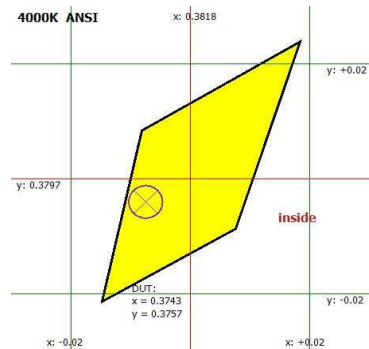
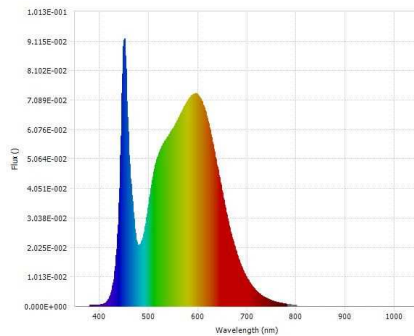
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 2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. The reference standard lamp is rated current 2.679A omni-directional Incandescent lamp and was calibrated by Labsphere, Inc., Optical Calibration Laboratory.
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Integrating Sphere Test Conditions

Temperature ($^{\circ}\text{C}$)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.5	119.79	60	0.2413	28.752	0.9947	N/A	Horizontal

Test Results

CCT (K)	CRI (Ra)	Duv	Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
4160.0	83.15	0.0013	4202.91	146.18	N/A



Luminous Flux (lm)	4202.91	Chrom x	0.3743
Chrom y	0.3757	Chrom u	0.2215
Chrom v	0.3335	Duv	0.0013
Chrom u'	0.2215	Chrom v'	0.5002
CCT (K)	4160.0	Luminous Efficacy (lm/W)	146.18
Ra	83.15	R1	81.6
R2	88.2	R3	93.3
R4	83.0	R5	81.5
R6	83.6	R7	87.2
R8	66.7	R9	11.2
R10	72.0	R11	82.1
R12	60.1	R13	83.1
R14	96.3	R15	75.8
Rf	82.3	Rg	96.1



Integrating Sphere Test

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Test Method

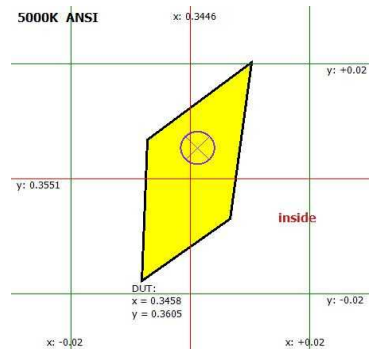
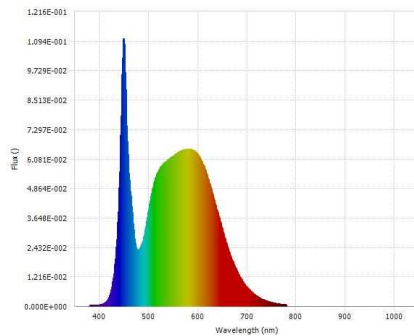
1. The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning.
 2. Photometric parameters were measured using an integrating sphere, a spectroradiometer and software. The ambient temperature condition inside the sphere was maintained at 25° C ± 1° C. The reference standard lamp is rated current 2.679A omni-directional Incandescent lamp and was calibrated by Labsphere, Inc., Optical Calibration Laboratory.
 3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions was using 4π geometry. The self-absorption factor is applied in the final test result. The sample was operated at rated voltage and was stabilized before measurement. Chromaticity coordinates, correlated color temperature and color rendering index were calculated from the spectral radiant flux measurements taken at 1 nm intervals over the range of 380 to 780 nm.

Integrating Sphere Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.5	119.98	60	0.2465	29.426	0.9950	N/A	Horizontal

Test Results

CCT (K)	CRI (Ra)	Duv	Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
4998.0	82.42	0.0041	3991.29	135.64	997.82



Luminous Flux (lm)	3991.29	Chrom x	0.3458
Chrom y	0.3605	Chrom u	0.2085
Chrom v	0.3260	Duv	0.0041
Chrom u'	0.2085	Chrom v'	0.4890
CCT (K)	4998.0	Luminous Efficacy (lm/W)	135.64
Ra	82.42	R1	80.3
R2	86.3	R3	91.3
R4	82.7	R5	80.6
R6	81.3	R7	88.3
R8	68.5	R9	8.3
R10	67.9	R11	81.7
R12	57.2	R13	81.6
R14	95.3	R15	74.7
Rf	82.0	Rg	96.3



Goniophotometer Test

Model No.	55610	Sample ID.	2339758
Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

- 1.The sample was tested according to the IES LM-79-2008, and the product is assume to be brand new without seasoning.
- 2.Photometric parameters were measured using a type C goniophotometer and software.
- 3.The ambient temperature shall be maintained at 25° C ± 1° C, measured at a point not more than 1 m from the sample and at the same height as the sample. The reference standard lamp is rated current 3.8631A, 3.875A, 3.884A omni-directional Incandescent lamp and was calibrated by National Institute of Metrology, China.
- 4.The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonallumen were calculated from the software taken at 1° vertical intervals and 22.5° horizontal intervals. Photometric distance was more than five times of the largest dimension of the test SSL product.

Goniophotometer Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.2	120.03	60	0.2476	29.610	0.9965	4.10%	Horizontal

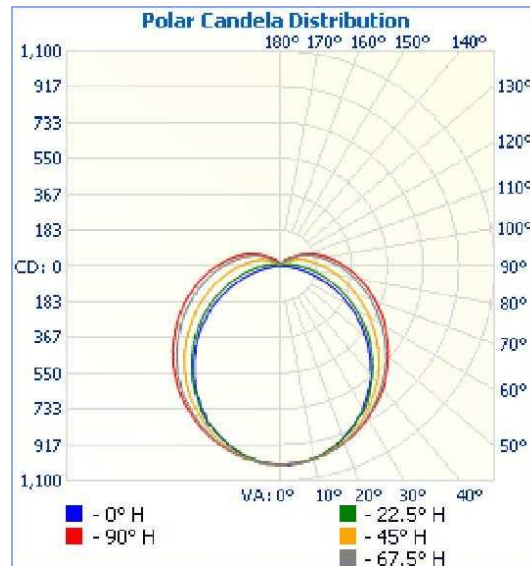
Test Results

Luminous Flux (lm)	Zonal Lumen Requirement 1	Zonal Lumen Requirement 2	Beam Angle (50%)		Luminous Efficacy (lm/W)	Spacing Criteria (0-180°)	Spacing Criteria (90°-270°)
	0°-60°	N/A	Horizontal Spread	Vertical Spread			
3875.0	61.10%	N/A	141.3	106.7	130.87	N/A	N/A

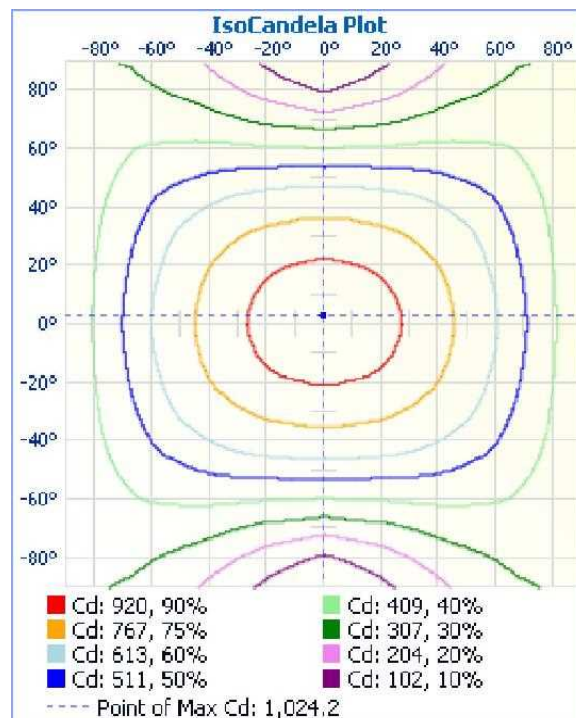


Goniophotometer Test (Cont'd)

Polar Candela Distribution



IsoCandela Plot





Goniophotometer Test (Cont'd)
Zonal Lumen Summary

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	791.4	20.40%
0-40	1302.9	33.60%
0-60	2367.6	61.10%
60-90	1062.9	27.40%
70-100	789.2	20.40%
90-120	367.0	9.50%
0-90	3430.5	88.50%
90-180	444.4	11.50%
0-180	3875.0	100.00%

Lumens Per Zone

Lumens Per Zone					
Zone	Lumens	%Total	Zone	Lumens	%Total
0-5	24.3	0.60%	90-95	97.0	2.50%
5-10	71.9	1.90%	95-100	80.9	2.10%
10-15	117.2	3.00%	100-105	66.1	1.70%
15-20	158.5	4.10%	105-110	52.8	1.40%
20-25	194.7	5.00%	110-115	40.6	1.00%
25-30	224.9	5.80%	115-120	29.5	0.80%
30-35	247.7	6.40%	120-125	20.6	0.50%
35-40	263.7	6.80%	125-130	15.1	0.40%
40-45	271.9	7.00%	130-135	11.4	0.30%
45-50	272.6	7.00%	135-140	8.7	0.20%
50-55	266.4	6.90%	140-145	6.6	0.20%
55-60	253.9	6.60%	145-150	5.0	0.10%
60-65	236.5	6.10%	150-155	3.6	0.10%
65-70	215.2	5.60%	155-160	2.6	0.10%
70-75	190.7	4.90%	160-165	1.8	0.00%
75-80	164.8	4.30%	165-170	1.2	0.00%
80-85	139.4	3.60%	170-175	0.7	0.00%
85-90	116.3	3.00%	175-180	0.2	0.00%



Goniophotometer Test (Cont'd)
Intensity Data(cd)

Candela Table - Type C

	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5	360
0	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017
1	1021	1013	1018	1016	1014	1014	1019	1014	1024	1014	1019	1014	1014	1016	1018	1013	1021
2	1024	1014	1018	1015	1013	1014	1018	1016	1017	1016	1018	1014	1013	1015	1018	1014	1024
3	1020	1013	1016	1015	1012	1018	1018	1013	1018	1013	1018	1018	1012	1015	1016	1013	1020
4	1018	1014	1017	1015	1013	1013	1015	1009	1019	1009	1015	1013	1013	1015	1017	1014	1018
5	1018	1010	1016	1014	1010	1010	1013	1009	1013	1009	1013	1010	1010	1014	1016	1010	1018
6	1014	1008	1012	1012	1009	1012	1013	1007	1014	1007	1013	1012	1009	1012	1012	1008	1014
7	1012	1009	1012	1010	1010	1006	1009	1001	1006	1001	1009	1006	1010	1010	1012	1009	1012
8	1008	1004	1009	1007	1005	1006	1006	998	1006	998	1006	1006	1005	1007	1009	1004	1008
9	1007	1002	1006	1004	1002	1002	1002	995	998	995	1002	1002	1002	1004	1006	1002	1007
10	1003	997	1003	1002	1003	1002	998	989	994	989	998	1002	1003	1002	1003	997	1003
11	995	993	1001	1000	997	999	993	985	990	985	993	999	997	1000	1001	993	995
12	994	990	995	996	994	995	991	977	985	977	991	995	994	996	995	990	994
13	988	983	990	993	994	990	986	975	977	975	986	990	994	993	990	983	988
14	981	978	985	989	987	988	982	967	973	967	982	988	987	989	985	978	981
15	975	973	983	984	983	982	976	961	966	961	976	982	983	984	983	973	975
16	968	967	977	979	980	978	970	954	957	954	970	978	980	979	977	967	968
17	960	960	972	978	974	973	961	947	951	947	961	973	974	978	972	960	960
18	956	953	966	971	972	969	957	941	941	941	957	969	972	971	966	953	956
19	949	946	960	965	966	963	951	933	934	933	951	963	966	965	960	946	949
20	938	940	954	960	961	959	946	926	923	926	946	959	961	960	954	940	938
25	896	897	917	930	934	926	906	882	893	882	906	926	934	930	917	897	896
30	849	855	872	892	898	887	861	828	826	828	861	887	898	892	872	855	849
35	782	794	823	853	861	846	817	772	765	772	817	846	861	853	823	794	782
40	724	733	773	807	820	801	757	713	695	713	757	801	820	807	773	733	724
45	647	669	715	756	772	750	699	646	623	646	699	750	772	756	715	669	647
50	573	597	653	703	724	698	638	578	550	578	638	698	724	703	653	597	573
55	495	524	593	652	672	644	577	505	472	505	577	644	672	652	593	524	495
60	414	451	530	597	620	592	516	438	396	438	516	592	620	597	530	451	414
65	333	380	470	544	572	535	458	365	314	365	458	535	572	544	470	380	333
70	250	310	410	492	519	484	402	296	235	296	402	484	519	492	410	310	250
75	170	244	356	440	467	433	347	232	156	232	347	433	467	440	356	244	170
80	97	185	305	391	422	385	297	176	85	176	297	385	422	391	305	185	97
85	37	136	258	345	374	339	250	129	31	129	250	339	374	345	258	136	37
90	6	97	216	300	328	295	210	92	6	92	210	295	328	300	216	97	6
95	6	70	180	260	287	255	174	67	6	67	174	255	287	260	180	70	6
100	5	51	149	222	249	219	143	49	6	49	143	219	249	222	149	51	5
105	5	32	122	189	213	184	117	29	6	29	117	184	213	189	122	32	5
110	5	25	97	158	180	153	85	20	6	20	85	153	180	158	97	25	5
115	5	21	69	128	145	123	50	16	6	16	50	123	145	128	69	21	5
120	6	18	52	95	112	83	35	14	6	14	35	83	112	95	52	18	6
125	6	16	43	69	79	53	27	12	6	12	27	53	79	69	43	16	6
130	7	14	36	56	64	38	22	12	7	12	22	38	64	56	36	14	7
135	7	14	30	44	51	28	19	12	7	12	19	28	51	44	30	14	7
140	8	13	25	35	40	21	17	12	8	12	17	21	40	35	25	13	8
145	9	12	21	29	32	17	16	11	9	11	16	17	32	29	21	12	9
150	9	12	18	23	24	13	14	11	9	11	14	13	24	23	18	12	9
155	10	11	15	18	19	11	12	11	10	11	12	11	19	18	15	11	10
160	10	11	13	14	13	9	11	10	10	10	11	9	13	14	13	11	10
165	11	11	12	12	7	9	10	10	11	10	10	9	7	12	12	11	11
170	11	11	10	10	6	8	9	11	11	11	9	8	6	10	10	11	11
175	11	12	11	10	6	9	10	11	12	11	10	9	6	10	11	12	11
180	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10



THD and PF Test

Model No.	55610	Sample ID.	2339758
Operate time (Min.)	90	Stabilization time (Min.)	45

Test Method

1. The samples were tested according to the ANSI C82.77-10-2014.
 2. The ambient temperature condition was maintained at 25° C ± 1° C. The sample measurement was made using a digital power meter and power supply. The sample was operated at rated voltage and stabilized before measurement. The total harmonic distortion were calculated from the digital power meter.

Test Results

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.2	120.01	60	0.2487	29.750	0.9965	4.07%	Horizontal
25.5	276.94	60	0.1099	29.311	0.9633	4.50%	Horizontal



In-Situ Temperature Measurement Test

Model No.	55610	Sample ID.	2339758
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Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL 1598-2008, Section 14.
 2. The testing was conducted in a room with ambient temperature of 25°C ± 5°C. The apparatus construction followed those described in UL1598-2008 for normal temperature testing. Thermocouples were placed on the LED package in the locations indicated by LM-80 report. Thermocouples were placed on the LED driver case in the locations specified by the manufacture if necessary. The temperature was recorded after the lamp was operated by 7.5 hours.

In-Situ Temperature Measurement Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.5	120.03	60	0.2476	29.610	0.9965	4.10%	Horizontal

Test Results (LEDs)

Thermocouple Location	Declared Light Source Current (mA)	Temperature for Light Source (°C)		LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp (°C)
		Test Result	Test Result (Correct to 25 °C)			
Ambient TEMP	N/A	25.5	25.0			
TMP of Location 1	105	42.2	41.7	STW8A2PD-XX	200	105

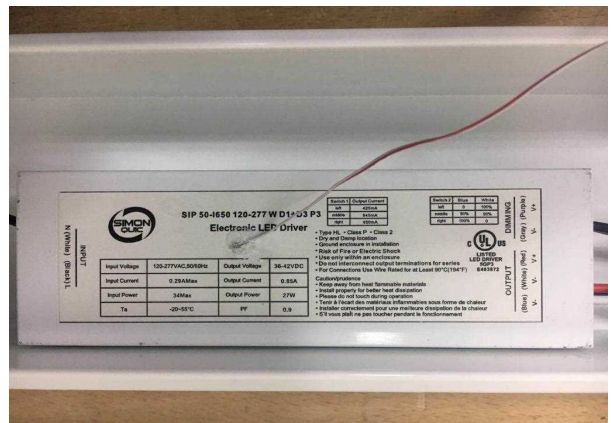
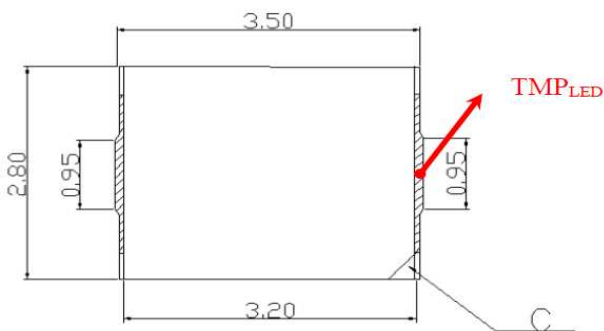
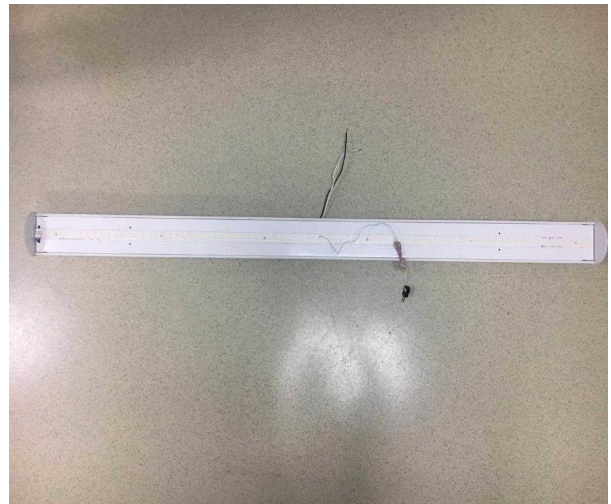
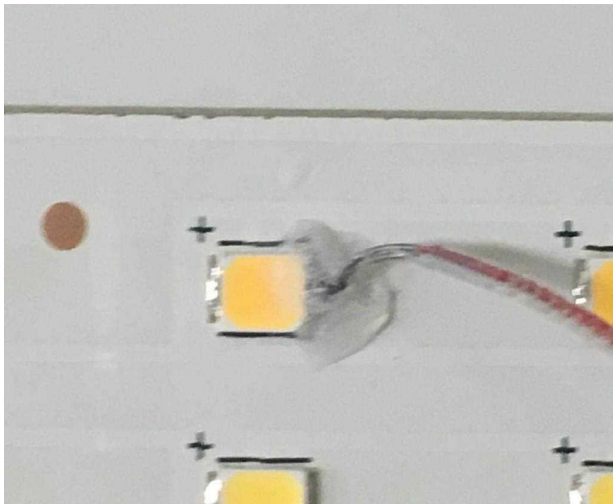
Test Results (Drivers)

Thermocouple Location	Temperature for Driver (°C)		Driver Model Number	Driver Limit Temp (°C)
	Test Result	Test Result (Correct to 25 °C)		
Ambient TEMP	25.5	25.0		
TMP of Location 1	44.2	43.7	SIP50-I650 120-277 W D1+D3 P3	90



In-Situ Temperature Measurement Test (Cont'd)

Test Photos for Ts Point of Light Sources & Tc Point of Drivers





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