



## Photometric Test Report

### Relevant Standards

- IES LM-79-2008
- ANSI C82.77-10-2014
- UL1598-2008

### Prepared For

## Revolution Lighting Technologies, Inc

2280 Ward Ave. Simi Valley, CA. 93065

Roman Sukharev, (877) 578-2536, roman.sukharev@rvlti.com

Test Laboratory: UL-CCIC Company Limited

Test Laboratory Address: 2, Chengwan Road, Suzhou Industrial Park, Suzhou 21522 China

### Catalog Number

**15A511-102**

### Project Number

**4788381111**

### Report Number

**4788381111\_11**

### Test Date

**3/6/2018-3/14/2018**

### Issue Date

**3/16/2018**

### Revision Date

Prepared By

*Jonathan Xu*

Approved By

*Duff Yang*

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

This report shall not be reproduced, except in full, without written approval of Underwriters Laboratories.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.



## 1.0 Test Summary

DLC Technical Requirements v4.2- issued 2017-04-28

Requirement Category	Test Method	Requirements	Test value	Results (Fail/Pass)
Minimum Light Output (lm)	IES LM-79-2008	375lm/ft	681.01	Pass
Minimum Bare Lamp Output (lm)	IES LM-79-2008	N/A	N/A	N/A
Spacing Criteria (0-180°)	IES LM-79-2008	N/A	N/A	N/A
Spacing Criteria (90-270°)	IES LM-79-2008	N/A	N/A	N/A
Zonal Lumen Requirement 1 (20°-60°)	IES LM-79-2008	40%	68.7%	Pass
Zonal Lumen Requirement 2	IES LM-79-2008	N/A	N/A	N/A
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	126.1	129.92	Pass
Minimum Bare Lamp Efficacy (lm/W)	IES LM-79-2008	N/A	N/A	N/A
Allowable CCTs* (K)	IES LM-79-2008 ANSI C78.377-2015	5029±283	4975	Pass
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥70	82.18	Pass
L70 Lumen maintenance (hours)	IES TM-21-2011	≥50000	≥50000	Pass
L90 Lumen maintenance (hours)	IES TM-21-2011	≥36000	≥36000	Pass
Power Factor	ANSI C82.77-10-2014	≥0.9	0.9288	Pass
Total Harmonic Distortion (A%)	ANSI C82.77-10-2014	≤20%	9.34%	Pass
In-Situ Temperature Measurement Test for LED (°C)	UL1598-2008	≤85	36.1	Pass
In-Situ Temperature Measurement Test for Driver (°C)	UL1598-2008	≤90	44.9	Pass
Minimum Luminaire Warranty (years)	N/A	5	5	Pass



## 2.0 Test List

Test Item	Test	Test Date	Model Number	Tests Conducted By
1	Integrating Sphere Test for the Lower CCT	3/12/2018	15A511-102	Gavin Yang
2	Integrating Sphere Test for the Higher CCT	3/12/2018	15A511-105	Gavin Yang
3	Goniophotometer Test	3/6/2018	15A511-102	Gavin Yang
4	THD and PF Test	3/14/2018	15A511-102	Gavin Yang
5	In-Situ Temperature Measurement Test	3/14/2018	15A511-102	Gavin Yang

### Remark (if any)

1. UL test equipment information is recorded on Meter Use in UL's Aurora database.



### 3.0 Production Description

**Luminaire Description:** Direct Linear Ambient Luminaires

**Model Number:** 15A511-102

**Rated Voltage:** 120-277V

**Frequency:** 50/60Hz

**LED Package:** STWxA2PD-xx

**Family Model and Variation:** 15A511-105

**Remark:**

Photos of Luminaire Characteristics

Model Number	CCT (K)	Light Output (lm)	Power (W)	Luminous Efficacy (lm/W)
15A511-102	3500	2838	22	129
15A511-103	4000	2860	22	130
15A511-105	5000	2882	22	131





## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test for the lower CCT

Model No.	15A511-102	Sample ID.	1455409-001
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

1. The sample was tested according to the IES LM-79-2008.

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 2.6A omnidirectional incandescent lamp and was calibrated by China Seprei Laboratory.

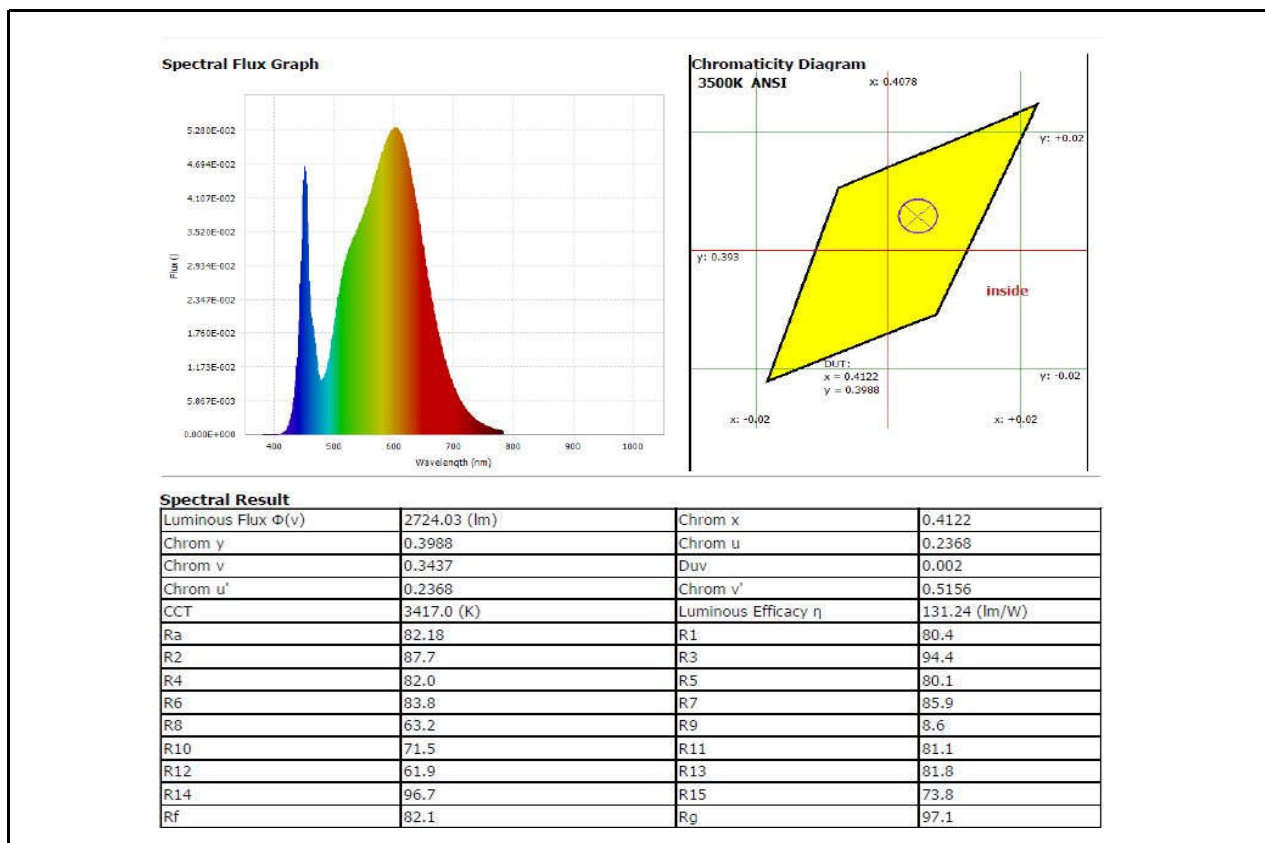
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using  $4\pi$  geometry. The self-absorption 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
25.2	119.98	60	0.1742	20.756	0.9929	8.90%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
3417	82.18	0.002	2724.03	131.24	681.01





## 4.0 LM-79 Measurement and Test Results

### 4.2 Integrating Sphere Test for the higher CCT

Model No.	15A511-105	Sample ID.	1455409-003
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

1. The sample was tested according to the IES LM-79-2008.

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 2.6A omnidirectional incandescent lamp and was calibrated by China Seprei Laboratory.

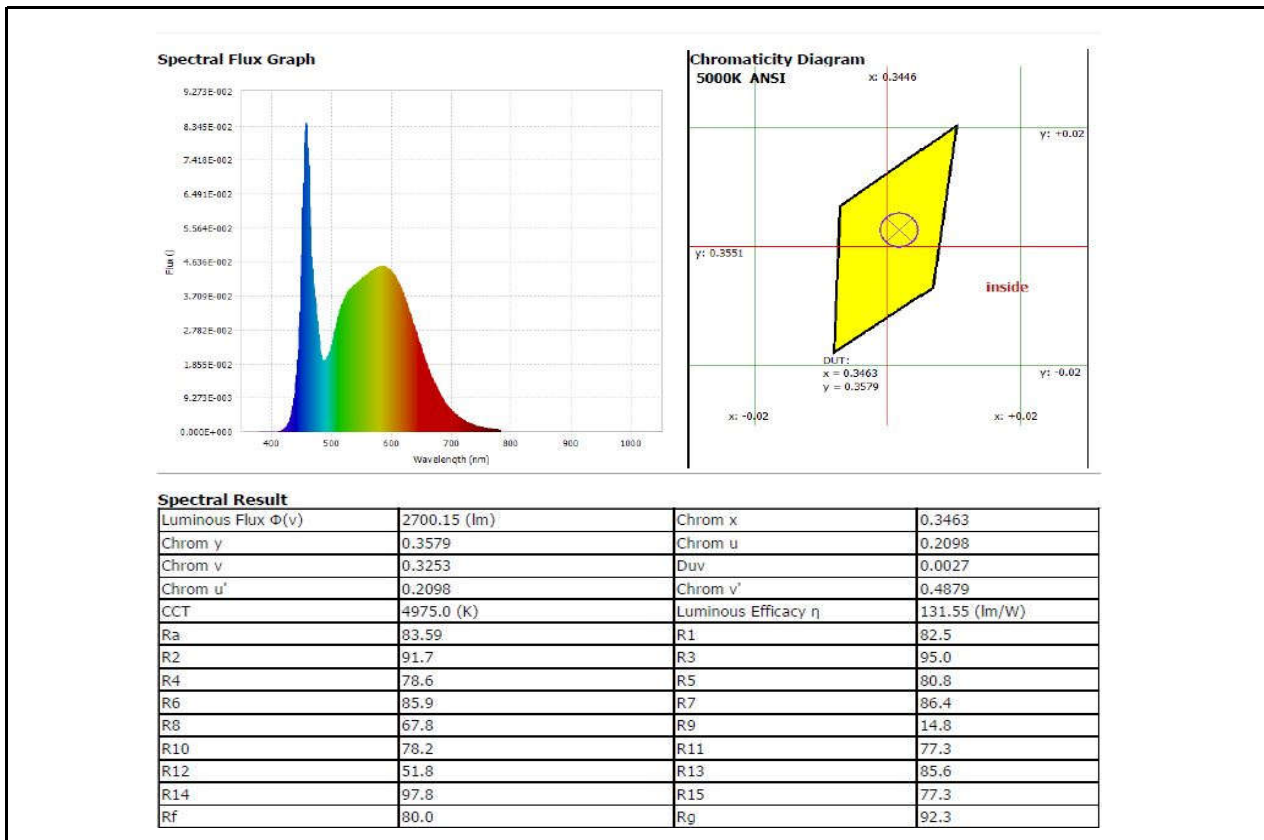
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using  $4\pi$  geometry. The self-absorption 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
25.2	120.04	60	0.1722	20.526	0.9928	9.00%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
4975	83.59	0.0027	2700.15	131.55	675.04





### 5.0 LM-79 Measurement and Test Results

Model No.	15A511-102	Sample ID.	1455409-001
Opreate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

- 1.The sample was tested according to the IES LM-79-2008.
- 2.Photometric paramters 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 3.865A omni-directional Incandescent lamp and was calibrated by china seprei laboratory.
- 4.The samples were operated at rated voltage and was stabilized before measurement. Luminous flux, luminaire efficacy, zonal lumen 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

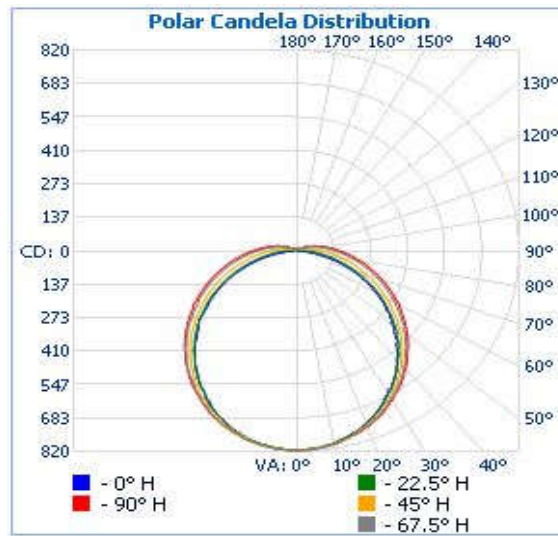
Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.1	119.94	60	0.17502	20.816	0.9917	9.42%	Horizontal

#### Test Result

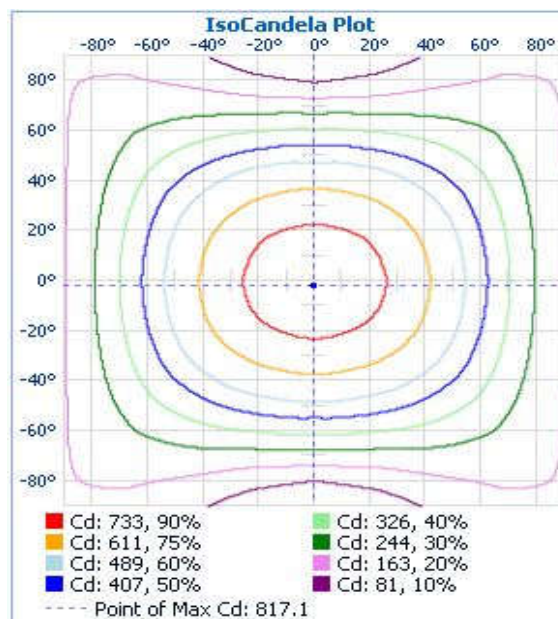
Flux (lm)	Zonal Lumen Requirement 1 (0°-60°)	Zonal Lumen Requirement 2	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
			Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
2704.4	68.7%	N/A	159.4	159.4	124.6	109.2	129.92
SC	SC						
0~180°	90~270°						
N/A	N/A						



5.0 Goniophotometer Test (Cont'd)  
Light Distribution Curve



IsoCandela Plot







**5.0 Goniophotometer Test (Cont'd)**  
**Zonal Lumen Summary**

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	632.8	23.4%
0-40	1,038.0	38.4%
0-60	1,857.8	68.7%
60-90	691.0	25.6%
70-100	441.6	16.3%
90-120	131.6	4.9%
0-90	2,548.9	94.3%
90-180	155.4	5.7%
0-180	2,704.2	100%

**Lumens Per Zone**

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	19.4	0.7%	90-95	43.1	1.6%
5-10	57.6	2.1%	95-100	31.7	1.2%
10-15	93.9	3.5%	100-105	22.9	0.8%
15-20	126.9	4.7%	105-110	15.9	0.6%
20-25	155.7	5.8%	110-115	10.8	0.4%
25-30	179.2	6.6%	115-120	7.1	0.3%
30-35	196.8	7.3%	120-125	4.7	0.2%
35-40	208.4	7.7%	125-130	3.2	0.1%
40-45	213.4	7.9%	130-135	2.6	0.1%
45-50	211.9	7.8%	135-140	2.3	0.1%
50-55	204.0	7.5%	140-145	2.2	0.1%
55-60	190.5	7.0%	145-150	2.1	0.1%
60-65	172.9	6.4%	150-155	1.9	0.1%
65-70	151.3	5.6%	155-160	1.6	0.1%
70-75	127.3	4.7%	160-165	1.4	0.1%
75-80	102.5	3.8%	165-170	1.0	0%
80-85	78.7	2.9%	170-175	0.6	0%
85-90	58.3	2.2%	175-180	0.2	0%



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

	0	22.5	45	67.5	90	113	135	158	180	203	225	247.5	270	293	315	338	360
0	814	814	814	814	814	814	814	814	814	814	814	814	814	814	814	814	814
1	817	814	815	814	813	815	815	814	817	814	815	815	813	814	815	814	817
2	814	813	815	814	814	815	816	814	816	814	816	815	814	814	815	813	814
3	814	811	815	814	813	813	814	812	813	812	814	813	813	814	815	811	814
4	815	810	813	814	810	815	813	809	814	809	813	815	810	814	813	810	815
5	811	809	811	810	810	814	812	809	813	809	812	814	810	810	811	809	811
6	810	807	809	809	810	809	811	807	811	807	811	809	810	809	809	807	810
7	809	805	808	808	807	808	810	806	807	806	810	808	807	808	808	805	809
8	806	802	809	806	806	807	807	802	806	802	807	807	806	806	809	802	806
9	803	802	804	805	802	805	803	800	804	800	803	805	802	805	804	802	803
10	797	798	803	800	802	803	804	797	803	797	804	803	802	800	803	798	797
11	796	793	796	801	800	799	800	796	795	796	800	799	800	801	796	793	796
12	788	788	794	797	796	796	795	791	792	791	795	796	796	797	794	788	788
13	787	786	791	791	792	794	793	788	792	788	793	794	792	791	791	786	787
14	784	781	789	788	788	793	786	784	784	784	786	793	788	788	789	781	784
15	777	780	785	784	785	787	783	779	780	779	783	787	785	784	785	780	777
16	771	774	777	781	781	779	776	772	774	772	776	779	781	781	777	774	771
17	768	767	770	776	778	778	774	768	770	768	774	778	778	776	770	767	768
18	766	762	767	772	774	772	768	764	764	764	768	772	774	772	767	762	766
19	756	759	765	766	770	769	764	756	763	756	764	769	770	766	765	759	756
20	751	754	757	762	765	764	760	754	751	754	760	764	765	762	757	754	751
25	715	720	729	735	738	737	728	718	718	718	728	737	738	735	729	720	715
30	674	675	688	697	704	700	693	673	674	673	693	700	704	697	688	675	674
35	630	634	647	658	669	661	647	633	631	633	647	661	669	658	647	634	630
40	575	581	600	617	627	623	604	583	581	583	604	623	627	617	600	581	575
45	525	532	548	569	579	576	553	530	526	530	553	576	579	569	548	532	525
50	455	472	495	521	532	526	498	473	474	473	498	526	532	521	495	472	455
55	401	410	438	469	482	467	438	415	401	415	438	467	482	469	438	410	401
60	337	350	382	418	437	417	385	353	342	353	385	417	437	418	382	350	337
65	270	287	325	365	381	367	329	290	277	290	329	367	381	365	325	287	270
70	203	224	270	315	332	316	274	228	210	228	274	316	332	315	270	224	203
75	137	165	220	266	285	267	223	169	144	169	223	267	285	266	220	165	137
80	75	113	173	221	239	221	175	116	81	116	175	221	239	221	173	113	75
85	25	70	132	179	197	180	134	72	30	72	134	180	197	179	132	70	25
90	2	40	98	143	160	144	99	41	3	41	99	144	160	143	98	40	2
95	2	22	70	112	128	112	71	22	2	22	71	112	128	112	70	22	2
100	2	11	50	86	100	87	50	12	2	12	50	87	100	86	50	11	2
105	3	6	34	65	77	64	34	6	2	6	34	64	77	65	34	6	3
110	3	4	22	46	57	46	21	4	2	4	21	46	57	46	22	4	3
115	3	4	14	32	41	32	12	3	3	3	12	32	41	32	14	4	3
120	3	4	9	21	26	21	6	3	3	3	6	21	26	21	9	4	3
125	4	5	7	14	17	12	4	4	5	4	4	12	17	14	7	5	4
130	5	6	6	9	11	7	4	5	6	5	4	7	11	9	6	6	5
135	6	6	7	8	8	5	4	6	6	6	4	5	8	8	7	6	6
140	6	7	7	7	7	5	5	6	7	6	5	5	7	7	7	7	6
145	7	7	8	7	6	5	6	6	7	6	6	5	6	7	8	7	7
150	8	8	8	8	7	6	7	8	8	8	7	6	7	8	8	8	8
155	9	8	8	8	7	6	8	8	9	8	8	6	7	8	8	8	9
160	9	9	9	8	7	6	8	8	9	8	8	6	7	8	9	9	9
165	9	10	9	8	8	7	8	9	9	9	8	7	8	8	9	10	9
170	10	10	10	8	8	7	9	10	9	10	9	7	8	8	10	10	10
175	10	10	9	8	8	8	9	10	10	10	9	8	8	8	9	10	10
180	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9



### 6.0 THD and PF Test

<b>Model No.</b>	15A511-102	<b>Sample ID.</b>	1455409-001
------------------	------------	-------------------	-------------

#### Test Method

1. The samples were tested according to the ANSI C82.77-2002.
2. The ambient temperature condition was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . 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
25.1	276.98	60	0.0804	20.678	0.9288	9.34%



## 7.0 In-Situ Temperature Measurement Test

<b>Model No.</b>	15A511-102	<b>Sample ID.</b>	1455409-001
------------------	------------	-------------------	-------------

### Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL1598-2008, 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. The temperature was recorded after the lamp was operated by 3.5 hours in stability or by 7.5 hours.

### In-Situ Temperature Measurement Test Conditions

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Orientation
25.6	119.94	60	0.17502	20.816	0.9917	Horizontal

### Test Results(LED)

Thermocouple Location	Manufacturer Declared Current (mA)	Temperature for Lighting source (°C)		LED Model Number	LM-80 Limit Current (mA)	LM-80 Limit Temp (°C)
		Test Result Column	Test Result (Correct to 25 °C)			
TMP of LEDs	45	36.7	36.1	STWxA2PD-xx	300	85
Ambient Temperature	N/A	25.6	25.0			

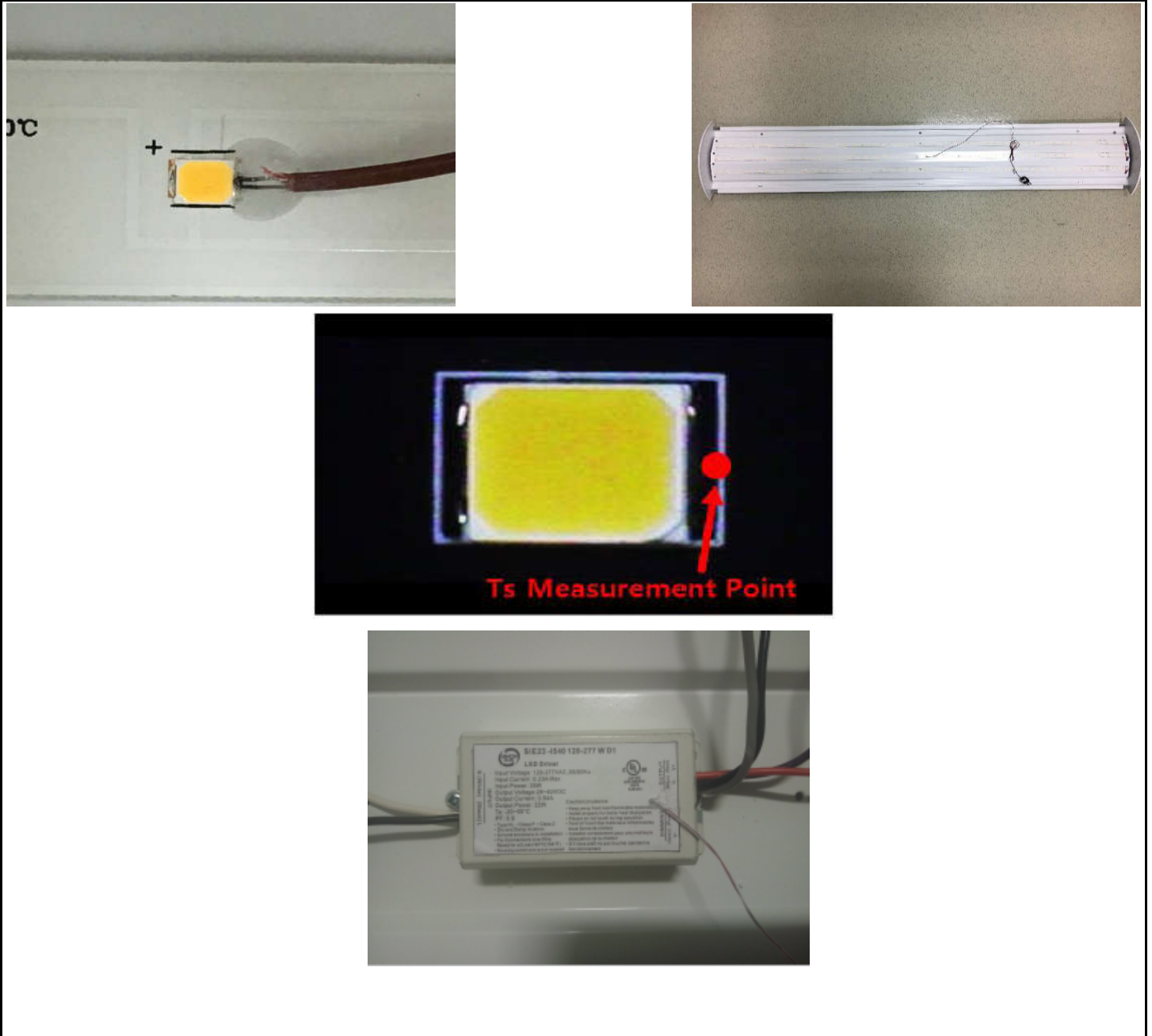
### Test Results(Driver)

Thermocouple Location	Temperature for Driver (°C)		Driver Model Number	Driver Limit Temp (°C)
	Test result Column	Test result (Correct to 25 °C)		
TMP of Driver	45.5	44.9	SIE23 -I540 120-277 W D1	90
Ambient Temperature	25.6	25.0		



## 7.0 In-Situ Temperature Measurement Test (Cont'd)

Test Photos for Ts Point of LED Packages & Tc Point of Driver





\*\*\*\*\* END OF REPORT. THIS PAGE INTENTIONALLY LEFT BLANK \*\*\*\*\*