



## Photometric Test Report

### Relevant Standards

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

### Prepared For

## Revolution Lighting Technologies, Inc

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### Catalog Number

15A512

### Project Number

4788381111

### Report Number

4788381111\_5

### Test Date

1/18/2018-1/24/2018

### Issue Date

3/6/2018

### Revision Date

Prepared By

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Approved By

*Duff Yang*

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

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## 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	946.89	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%	69.1%	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	133.13	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	4958	Pass
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥70	82.16	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	0.9531	Pass
Total Harmonic Distortion (A%)	ANSI C82.77-10-2014	≤20%	4.75%	Pass
In-Situ Temperature Measurement Test for LED (°C)	UL1598-2008	≤85	39.8	Pass
In-Situ Temperature Measurement Test for Driver (°C)	UL1598-2008	≤90	51.3	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	1/22/2018	15A512-102	Gavin Yang
2	Integrating Sphere Test for the Higher CCT	1/22/2018	15A512-105	Gavin Yang
3	Goniophotometer Test	1/18/2018	15A512-102	Gavin Yang
4	THD and PF Test	1/24/2018	15A512-102	Gavin Yang
5	In-Situ Temperature Measurement Test	1/24/2018	15A512-102	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:** 15A512-102

**Rated Voltage:** 120-277V

**Frequency:** 50/60Hz

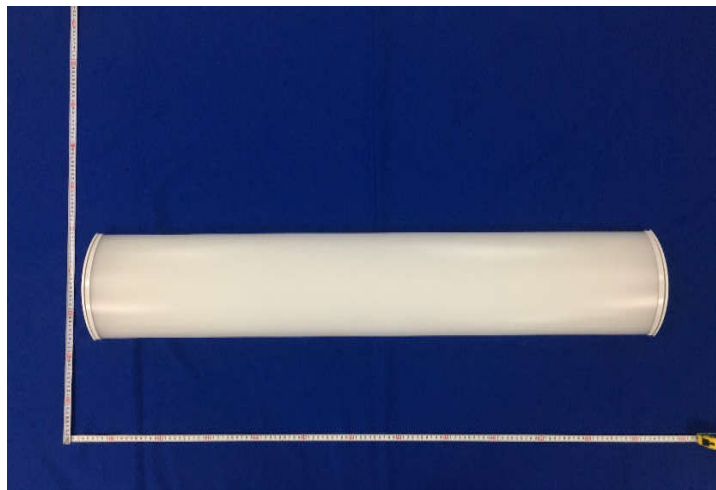
**LED Package:** STWxA2PD-xx

**Family Model and Variation:** 15A512-105

**Remark:**

Photos of Luminaire Characteristics

Model Number	CCT (K)	Light Output (lm)	Power (W)	Luminous Efficacy (lm/W)
15A512-102	3500	3990	30	133
15A512-103	4000	4020	30	134
15A512-105	5000	4050	30	135





## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test for the lower CCT

Model No.	15A512-102	Sample ID.	1362798-001
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.

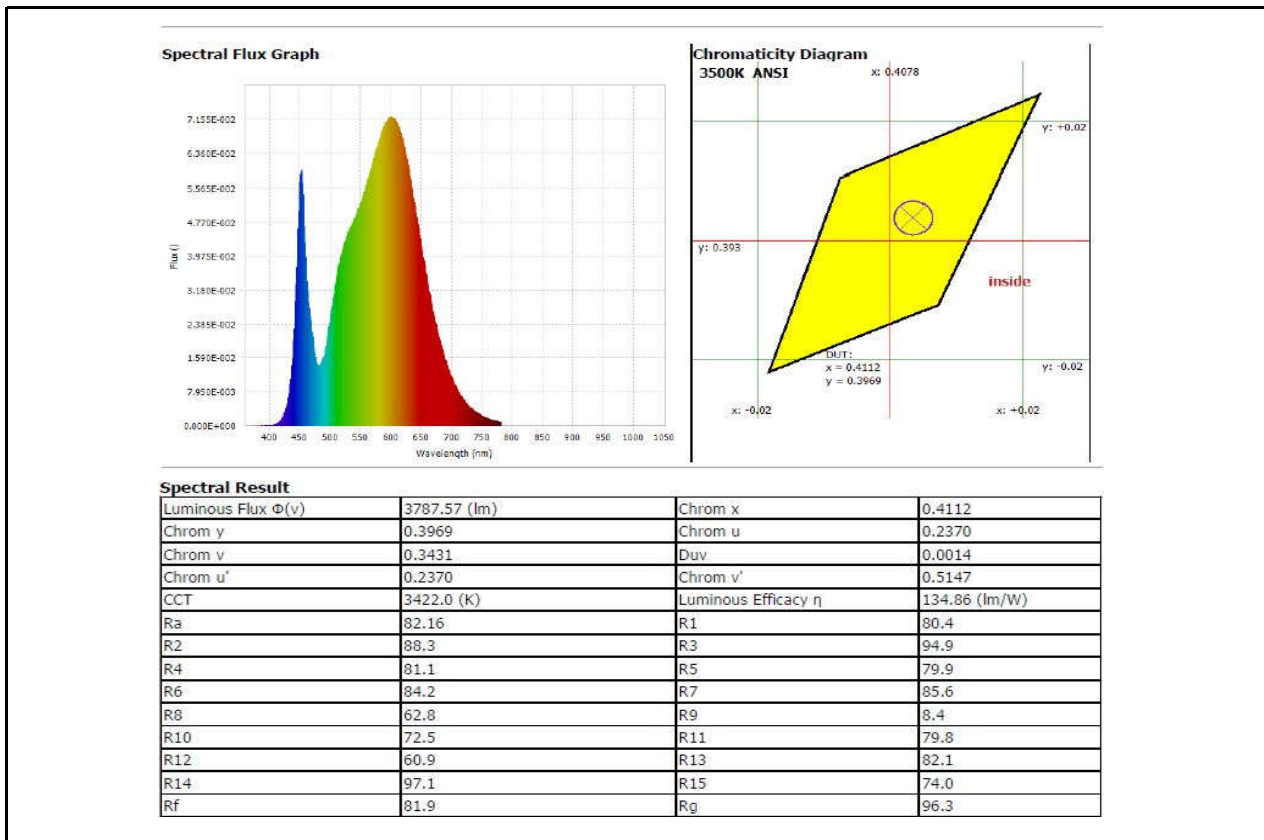
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using  $4\pi$  geometry. The self-absorption 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 (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD
25.1	120.04	60	0.2362	28.085	0.9952	5.64%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
3422	82.16	0.0014	3787.57	134.86	946.89





## 4.0 LM-79 Measurement and Test Results

### 4.2 Integrating Sphere Test for the higher CCT

Model No.	15A512-105	Sample ID.	1362798-003
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.

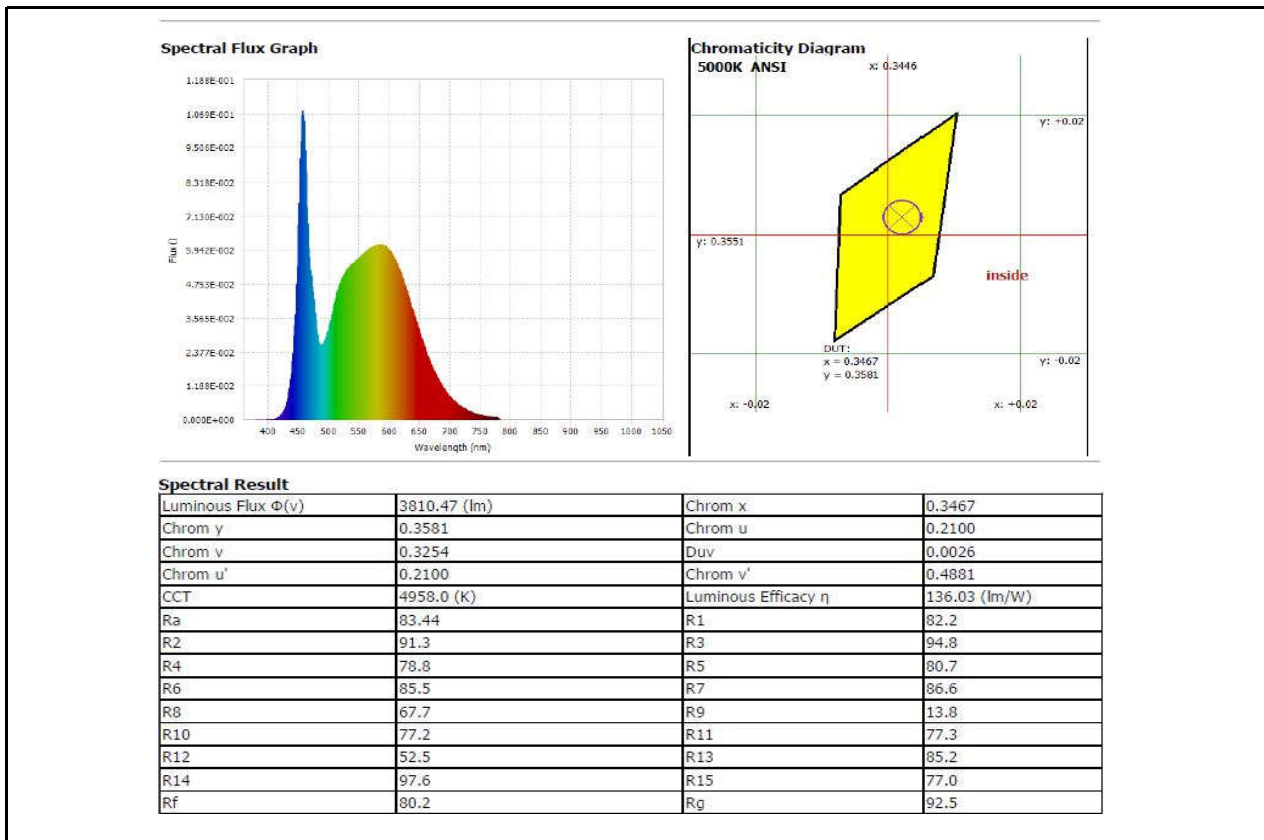
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using  $4\pi$  geometry. The self-absorption 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
25.1	119.93	60	0.2358	28.011	0.9953	5.49%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
4958	83.44	0.0026	3810.47	136.03	952.62





### 5.0 LM-79 Measurement and Test Results

Model No.	15A512-102		Sample ID.	1362798-001	
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

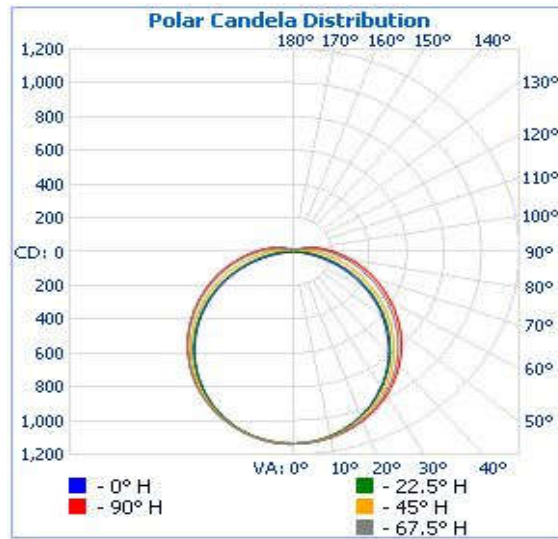
Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.1	120.05	60	0.23516	28.095	0.9952	5.64%	Horizontal

#### Test Result

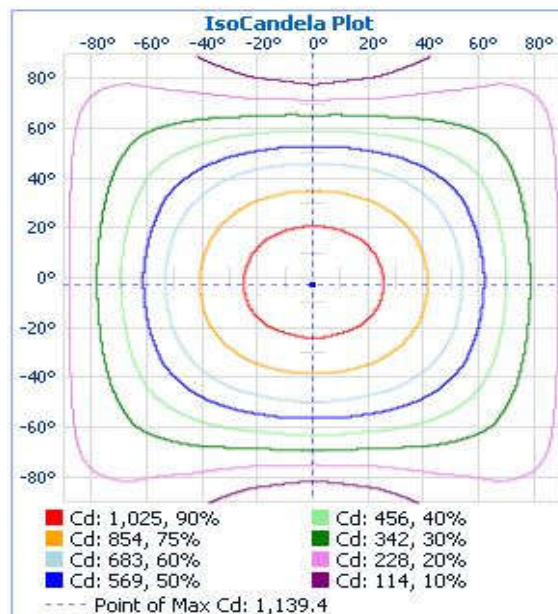
Flux (lm)	Zonal Lumen Requirement 1 (0°-60°)	Zonal Lumen Requirement 2	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
			Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
3740.4	69.1%	N/A	159.1	159.1	123.4	109.2	133.13
SC	SC						
0~180°	90°~270°						
N/A	N/A						



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	882.3	23.6%
0-40	1,447.1	38.7%
0-60	2,585.7	69.1%
60-90	942.3	25.2%
70-100	593.7	15.9%
90-120	171.9	4.6%
0-90	3,528.0	94.3%
90-180	212.2	5.7%
0-180	3,740.2	100%

**Lumens Per Zone**

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	27.1	0.7%	90-95	56.5	1.5%
5-10	80.4	2.1%	95-100	41.2	1.1%
10-15	130.9	3.5%	100-105	29.6	0.8%
15-20	176.9	4.7%	105-110	20.7	0.6%
20-25	217.1	5.8%	110-115	14.2	0.4%
25-30	249.9	6.7%	115-120	9.7	0.3%
30-35	274.5	7.3%	120-125	6.9	0.2%
35-40	290.3	7.8%	125-130	5.3	0.1%
40-45	296.9	7.9%	130-135	4.4	0.1%
45-50	294.4	7.9%	135-140	4.1	0.1%
50-55	283.2	7.6%	140-145	3.9	0.1%
55-60	264.1	7.1%	145-150	3.7	0.1%
60-65	238.5	6.4%	150-155	3.3	0.1%
65-70	207.9	5.6%	155-160	2.9	0.1%
70-75	173.9	4.6%	160-165	2.4	0.1%
75-80	138.9	3.7%	165-170	1.8	0%
80-85	105.7	2.8%	170-175	1.1	0%
85-90	77.5	2.1%	175-180	0.4	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	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136	1136
1	1138	1132	1137	1136	1135	1138	1137	1134	1139	1134	1137	1138	1135	1136	1137	1132	1138
2	1138	1132	1136	1136	1134	1136	1138	1136	1139	1136	1138	1136	1134	1136	1136	1132	1138
3	1135	1130	1136	1135	1133	1137	1136	1134	1139	1134	1136	1137	1133	1135	1136	1130	1135
4	1132	1128	1133	1133	1133	1136	1136	1133	1136	1133	1136	1136	1133	1133	1133	1128	1132
5	1131	1126	1131	1130	1132	1134	1134	1131	1136	1131	1134	1134	1132	1130	1131	1126	1131
6	1126	1123	1127	1129	1129	1132	1133	1129	1135	1129	1133	1132	1129	1129	1127	1123	1126
7	1122	1120	1124	1126	1127	1130	1130	1128	1131	1128	1130	1130	1127	1126	1124	1120	1122
8	1118	1115	1120	1122	1124	1127	1129	1125	1130	1125	1129	1127	1124	1122	1120	1115	1118
9	1115	1112	1118	1119	1121	1125	1125	1123	1126	1123	1125	1125	1121	1119	1118	1112	1115
10	1109	1106	1113	1116	1119	1122	1122	1117	1121	1117	1122	1122	1119	1116	1113	1106	1109
11	1103	1101	1108	1110	1114	1118	1118	1114	1118	1114	1118	1118	1114	1110	1108	1101	1103
12	1098	1095	1104	1107	1111	1114	1114	1110	1113	1110	1114	1114	1111	1107	1104	1095	1098
13	1091	1089	1099	1102	1106	1109	1110	1104	1107	1104	1110	1109	1106	1102	1099	1089	1091
14	1084	1082	1091	1098	1101	1105	1105	1098	1102	1098	1105	1105	1101	1098	1091	1082	1084
15	1076	1075	1086	1092	1097	1100	1099	1094	1097	1094	1099	1100	1097	1092	1086	1075	1076
16	1070	1068	1080	1086	1090	1094	1093	1086	1090	1086	1093	1094	1090	1086	1080	1068	1070
17	1062	1061	1071	1080	1085	1089	1087	1080	1083	1080	1087	1089	1085	1080	1071	1061	1062
18	1052	1054	1065	1073	1079	1082	1079	1073	1075	1073	1079	1082	1079	1073	1065	1054	1052
19	1044	1044	1055	1065	1072	1076	1074	1066	1068	1066	1074	1076	1072	1065	1055	1044	1044
20	1035	1036	1048	1058	1066	1069	1067	1058	1058	1058	1067	1069	1066	1058	1048	1036	1035
25	984	988	1003	1018	1028	1032	1025	1014	1014	1014	1025	1032	1028	1018	1003	988	984
30	925	930	950	968	981	986	975	960	959	960	975	986	981	968	950	930	925
35	858	865	889	913	929	933	918	900	896	900	918	933	929	913	889	865	858
40	785	794	822	851	872	871	852	833	827	833	852	871	872	851	822	794	785
45	704	720	748	784	809	806	782	759	752	759	782	806	809	784	748	720	704
50	622	635	671	713	739	736	707	680	673	680	707	736	739	713	671	635	622
55	536	551	591	640	667	662	629	598	587	598	629	662	667	640	591	551	536
60	444	463	510	564	595	586	549	510	500	510	549	586	595	564	510	463	444
65	352	374	431	491	523	512	469	425	409	425	469	512	523	491	431	374	352
70	258	287	355	420	454	440	391	335	315	335	391	440	454	420	355	287	258
75	166	206	284	353	386	370	317	251	222	251	317	370	386	353	284	206	166
80	82	135	220	290	322	306	248	173	133	173	248	306	322	290	220	135	82
85	20	80	165	233	264	247	189	109	56	109	189	247	264	233	165	80	20
90	3	43	120	184	212	196	139	62	9	62	139	196	212	184	120	43	3
95	3	22	85	142	168	152	99	33	3	33	99	152	168	142	85	22	3
100	4	13	59	109	131	116	69	17	4	17	69	116	131	109	59	13	4
105	4	8	40	80	100	86	46	9	4	9	46	86	100	80	40	8	4
110	5	7	26	58	74	60	30	6	4	6	30	60	74	58	26	7	5
115	6	7	18	40	52	42	17	5	6	5	17	42	52	40	18	7	6
120	7	8	13	27	35	28	11	6	6	6	11	28	35	27	13	8	7
125	8	9	11	19	24	18	8	6	8	6	8	18	24	19	11	9	8
130	9	10	12	15	17	12	8	8	9	8	8	12	17	15	12	10	9
135	11	12	12	13	14	9	8	9	10	9	8	9	14	13	12	12	11
140	12	12	13	13	12	9	9	10	11	10	9	9	12	13	13	12	12
145	13	14	14	14	13	10	10	11	12	11	10	10	13	14	14	14	13
150	14	15	15	14	13	10	12	12	13	12	12	10	13	14	15	15	14
155	15	15	15	14	13	10	13	14	15	14	13	10	13	14	15	15	15
160	16	16	16	14	13	11	14	14	16	14	14	11	13	14	16	16	16
165	17	17	16	14	13	12	14	16	16	16	14	12	13	14	16	17	17
170	17	17	17	15	13	13	15	16	17	16	15	13	13	15	17	17	17
175	17	18	17	15	15	14	16	17	18	17	16	14	15	15	17	18	17
180	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16



### 6.0 THD and PF Test

<b>Model No.</b>	15A512-102	<b>Sample ID.</b>	1362798-001
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#### 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	276.96	60	0.1065	28.119	0.9531	4.75%



## 7.0 In-Situ Temperature Measurement Test

Model No.	15A512-102	Sample ID.	1362798-001
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### 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
25.0	120.05	60	0.23516	28.095	0.9952	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	65	39.8	39.8	STWxA2PD-xx	300	85
Ambient Temperature	N/A	25.0	25.0			

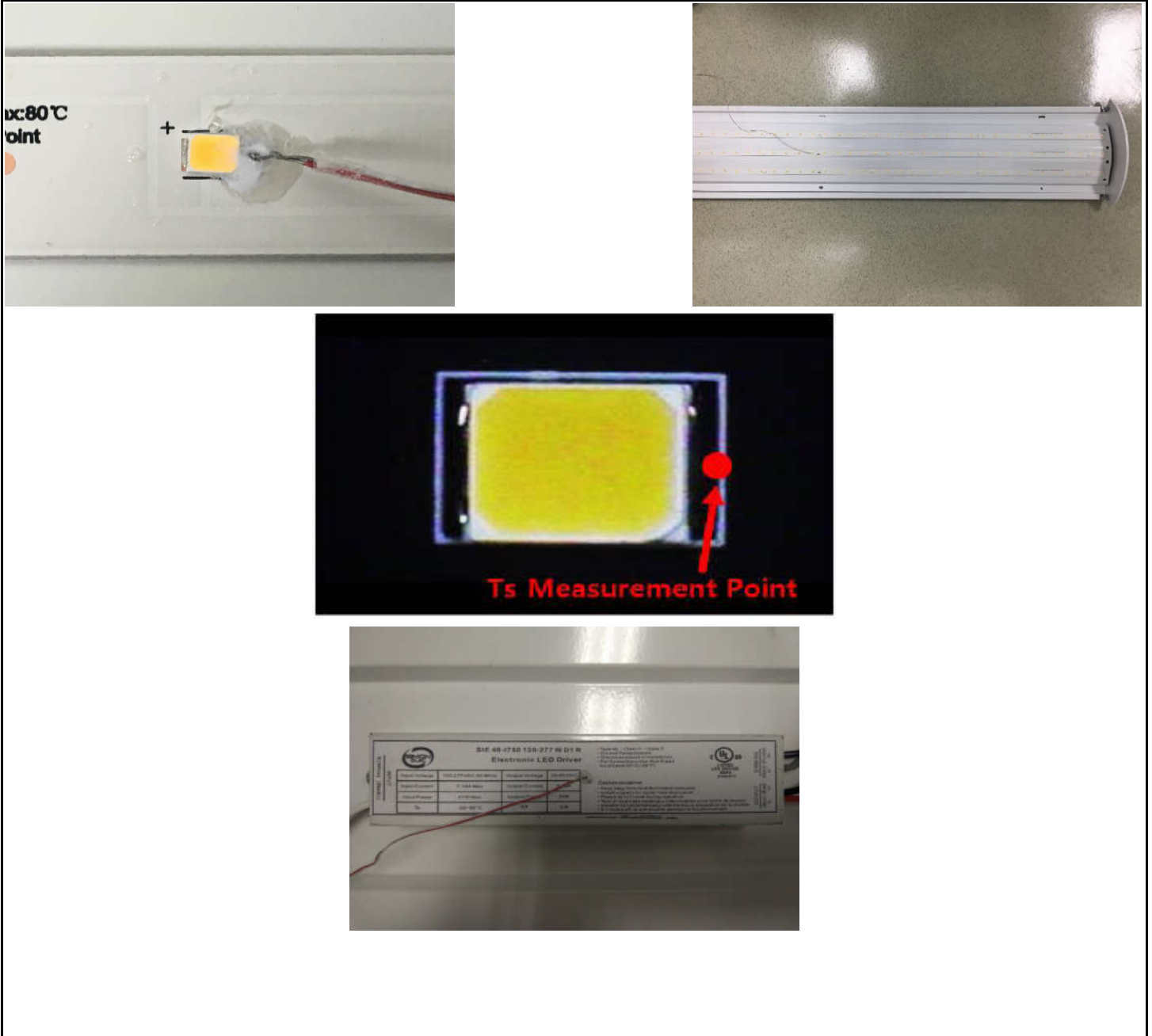
### Test Results(Driver)

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	51.3	51.3	SIE40-I750 120-277 W D1 R	90
Ambient Temperature	25.0	25.0		



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

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





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