



## Photometric Test Report

### Relevant Standards

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

### Prepared For

**P.Q.L., Inc.**

2285 Ward Avenue

Simi Valley, CA 93065

Test Laboratory: UL-CCIC Company Limited

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

### Catalog Number

91141, 91142, 91143

91141 and 91143 were selected as the representative models.

All measurements are the same except CCT.

### Project Number

4788382593

### Report Number

4788382593\_2

### Test Date

3/13/2018-3/22/2018

### Issue Date

3/23/2018

Prepared By

*Jonathan Xu*

Revision Date

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 v4.3- issued 2018-03-26

Requirement Category	Test Method	Requirements	Test value	Results (Fail/Pass)
Minimum Light Output (lm)	IES LM-79-2008	2700	3233.10	Pass
Minimum Bare Lamp Output (lm)	IES LM-79-2008	1600	2119.99	Pass
Spacing Criteria (0-180°)	IES LM-79-2008	1.0-2.0	1.34	Pass
Spacing Criteria (90-270°)	IES LM-79-2008	1.0-2.0	1.24	Pass
Zonal Lumen Requirement 1 (0°-60°)	IES LM-79-2008	75%	84.6%	Pass
Zonal Lumen Requirement 2	IES LM-79-2008	N/A	N/A	N/A
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	100	102.25	Pass
Minimum Bare Lamp Efficacy (lm/W)	IES LM-79-2008	110	133.63	Pass
Allowable CCTs* (K)	IES LM-79-2008 ANSI C78.377-2015	5029±283	5125	Pass
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥80	81.56	Pass
L70 Lumen maintenance (hours)	IES TM-21-2011	≥50000	≥50000	Pass
L90 Lumen maintenance (hours)	IES TM-21-2011	N/A	N/A	N/A
Power Factor	ANSI C82.77-10-2014	≥0.9	0.9103	Pass
Total Harmonic Distortion (A%)	ANSI C82.77-10-2014	≤25%	23.86%	Pass
In-Situ Temperature Measurement Test for LED (°C)	UL1598-2008	≤85	57.9	Pass
In-Situ Temperature Measurement Test for Driver (°C)	UL1598-2008	N/A	N/A	N/A
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	3/13/2018	91141	Yakima Yuan
2	Integrating Sphere Test for the Higher CCT	3/13/2018	91143	Yakima Yuan
3	Goniophotometer Test	3/14/2018	91141	Yakima Yuan
4	THD and PF Test	3/13/2018	91141	Yakima Yuan
5	In-Situ Temperature Measurement Test	3/22/2018	91141	Yakima Yuan

### Remark (if any)

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



### 3.0 Production Description

**Luminaire Description:** Four-Foot Linear Replacement Lamps

**Model Number:** 91141

**Rated Voltage:** 120-277V

**Frequency:** 50/60Hz

**LED Package:** SL-35B2835FTA-11CAGJ3C-APH001

**Family Model and Variation:** 91142, 91143

**Remark:**

#### Photos of Luminaire Characteristics





## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test for the lower CCT

Model No.	91141	Sample ID.	1459933-001
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.

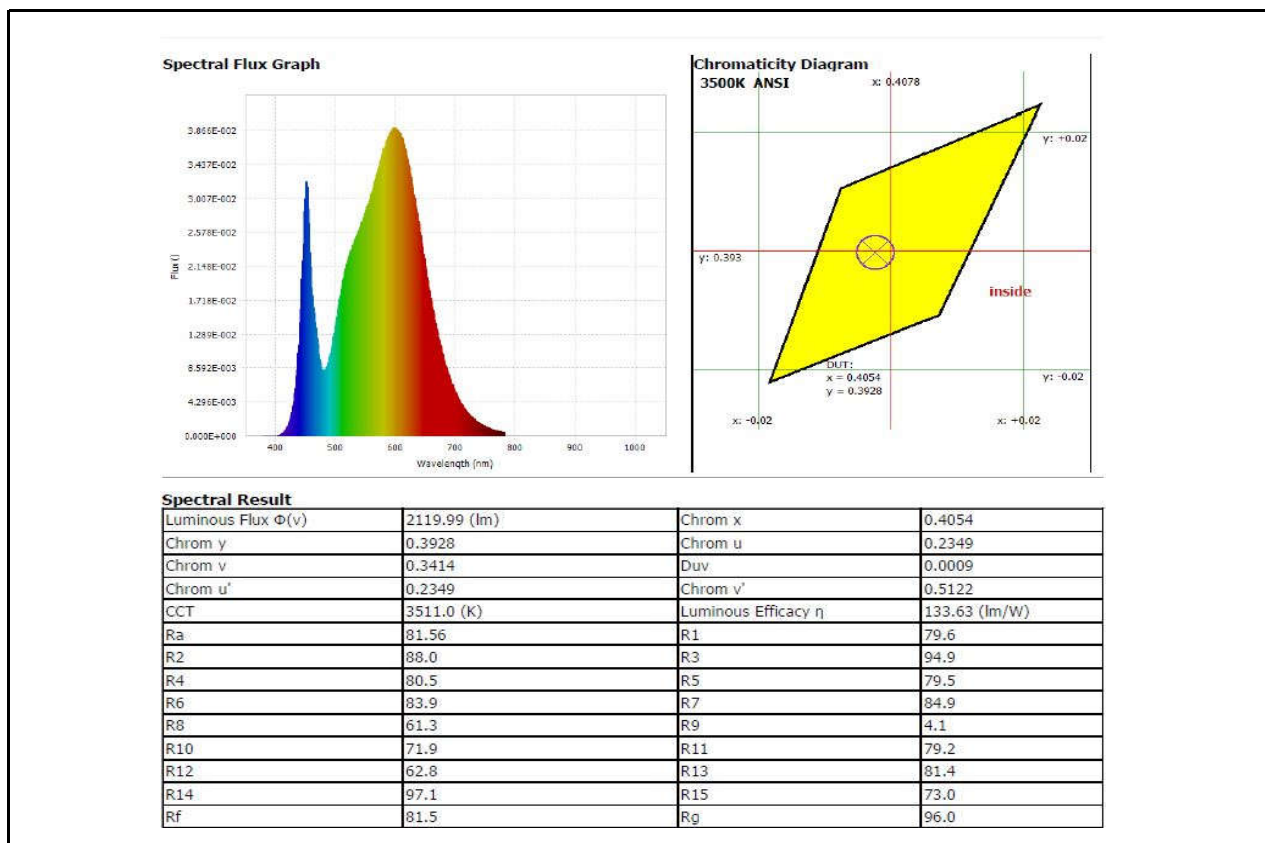
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using  $4\pi$  geometry. The self-absorption 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
25.2	119.96	60	0.1404	15.865	0.9421	22.80%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
3511	81.56	0.0009	2119.99	133.63	N/A





## 4.0 LM-79 Measurement and Test Results

### 4.2 Integrating Sphere Test for the higher CCT

Model No.	91143	Sample ID.	1459933-002
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.

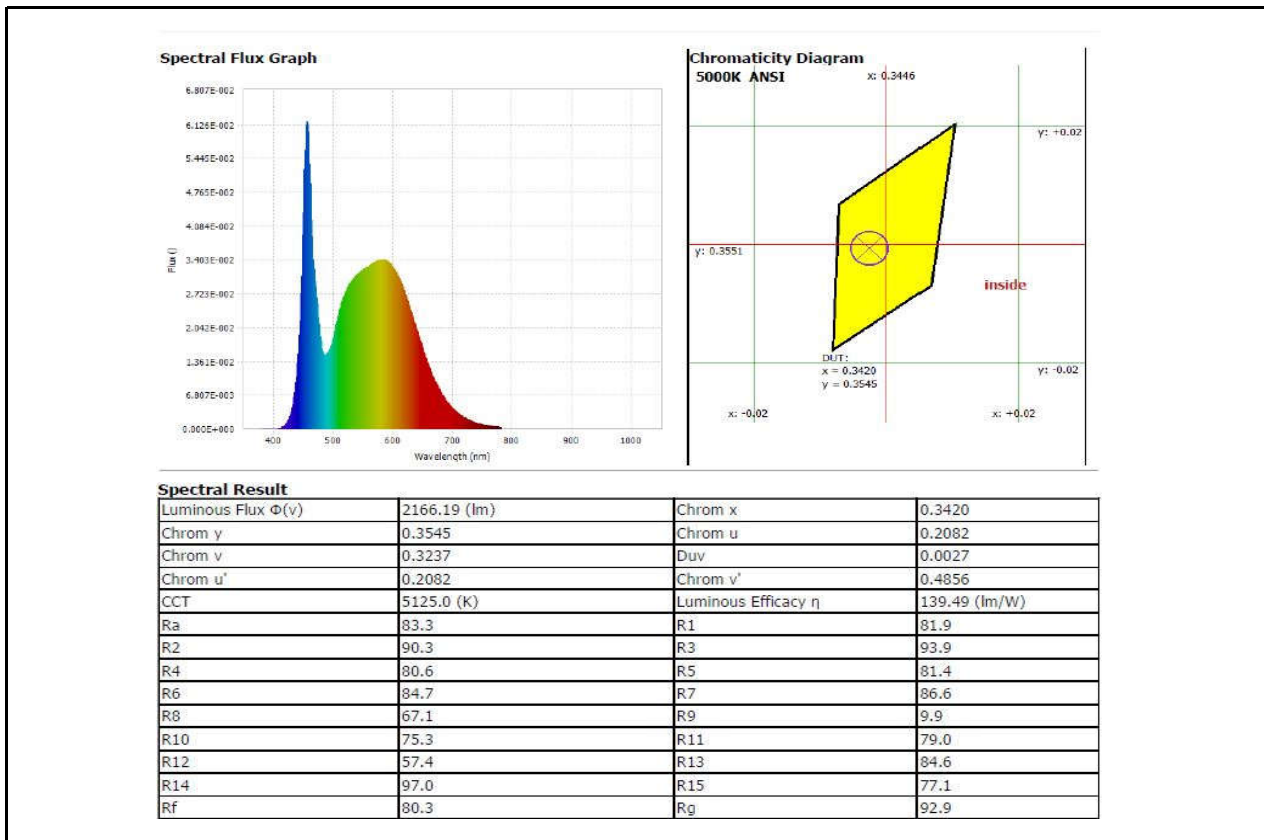
3. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. Coating reflectance of the integrating sphere was 90% to 98%. Photometric measurement conditions were using  $4\pi$  geometry. The self-absorption 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	120.05	60	0.1368	15.529	0.9459	23.00%

#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
5125	83.3	0.0027	2166.19	139.49	N/A





### 5.0 LM-79 Measurement and Test Results

Model No.	91141	Sample ID.	1459933-001, 1473114
Operate 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

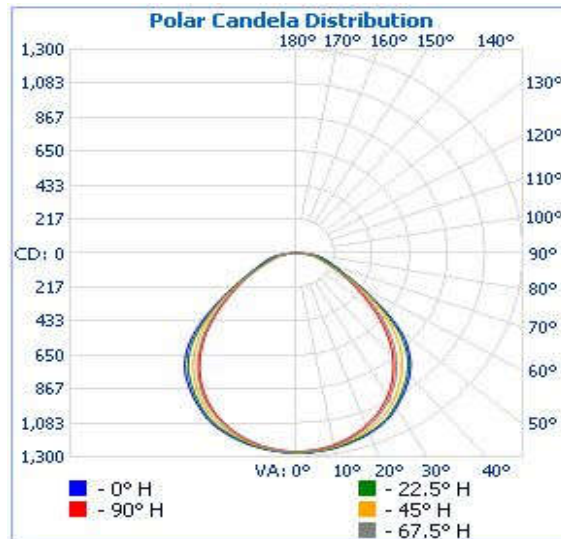
Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD	Orientation
25.1	120.03	60	0.27163	31.619	0.9697	21.02%	Horizontal

#### Test Result

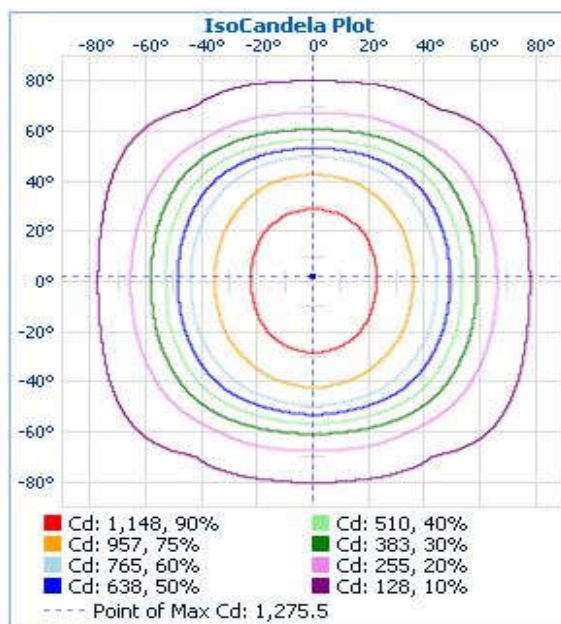
Flux (lm)	Zonal Lumen Requirement 1 (0°-60°)	Zonal Lumen Requirement 2	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
			Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
3233.1	84.6%	N/A	155.2	160.7	97.6	106.7	102.25
SC	SC						
0~180°	90°~270°						
1.34	1.24						



### 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	998.4	30.9%
0-40	1,635.5	50.6%
0-60	2,735.6	84.6%
60-90	496.9	15.4%
70-100	223.9	6.9%
90-120	0.2	0%
0-90	3,232.5	100%
90-180	0.2	0%
0-180	3,232.7	100%

**Lumens Per Zone**

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	30.3	0.9%	90-95	0.2	0%
5-10	90.0	2.8%	95-100	0	0%
10-15	147.1	4.6%	100-105	0	0%
15-20	199.8	6.2%	105-110	0	0%
20-25	246.5	7.6%	110-115	0	0%
25-30	284.6	8.8%	115-120	0	0%
30-35	311.3	9.6%	120-125	0	0%
35-40	325.8	10.1%	125-130	0	0%
40-45	325.6	10.1%	130-135	0	0%
45-50	305.0	9.4%	135-140	0	0%
50-55	262.2	8.1%	140-145	0	0%
55-60	207.3	6.4%	145-150	0	0%
60-65	156.0	4.8%	150-155	0	0%
65-70	117.2	3.6%	155-160	0	0%
70-75	90.1	2.8%	160-165	0	0%
75-80	70.0	2.2%	165-170	0	0%
80-85	47.3	1.5%	170-175	0	0%
85-90	16.3	0.5%	175-180	0	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	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	1269	
1	1273	1275	1271	1268	1265	1268	1268	1270	1272	1274	1272	1270	1268	1265	1268	1271	1275	1273
2	1276	1272	1269	1268	1264	1266	1268	1272	1275	1272	1268	1266	1264	1268	1269	1272	1276	
3	1276	1272	1269	1267	1263	1266	1269	1270	1275	1270	1269	1266	1263	1267	1269	1272	1276	
4	1275	1272	1269	1265	1261	1264	1266	1269	1270	1269	1266	1264	1261	1265	1269	1272	1275	
5	1272	1270	1267	1264	1259	1262	1263	1269	1269	1269	1263	1262	1259	1264	1267	1270	1272	
6	1268	1270	1264	1262	1256	1259	1261	1265	1267	1265	1261	1259	1256	1262	1264	1270	1268	
7	1268	1267	1262	1259	1253	1256	1259	1263	1266	1263	1259	1256	1253	1259	1262	1267	1268	
8	1268	1266	1260	1254	1250	1254	1256	1260	1264	1260	1256	1254	1250	1254	1260	1266	1268	
9	1266	1264	1257	1252	1247	1249	1252	1259	1261	1259	1252	1249	1247	1252	1257	1264	1266	
10	1262	1260	1253	1248	1241	1244	1248	1256	1259	1256	1248	1244	1241	1248	1253	1260	1262	
11	1260	1257	1251	1243	1236	1238	1246	1253	1255	1253	1246	1238	1236	1243	1251	1257	1260	
12	1257	1253	1246	1238	1231	1235	1241	1248	1253	1248	1241	1235	1231	1238	1246	1253	1257	
13	1255	1251	1242	1233	1225	1229	1236	1244	1248	1244	1236	1229	1225	1233	1242	1251	1255	
14	1250	1248	1236	1227	1218	1223	1230	1240	1246	1240	1230	1223	1218	1227	1236	1248	1250	
15	1245	1243	1230	1220	1212	1216	1225	1236	1241	1236	1225	1216	1212	1220	1230	1243	1245	
16	1241	1239	1225	1214	1205	1209	1219	1232	1237	1232	1219	1209	1205	1214	1225	1239	1241	
17	1238	1234	1220	1206	1196	1200	1214	1226	1232	1226	1214	1200	1196	1206	1220	1234	1238	
18	1235	1230	1215	1199	1189	1194	1206	1220	1228	1220	1206	1194	1189	1199	1215	1230	1235	
19	1230	1224	1207	1191	1180	1187	1199	1215	1222	1215	1199	1187	1180	1191	1207	1224	1230	
20	1224	1218	1201	1183	1169	1178	1192	1209	1217	1209	1192	1178	1169	1183	1201	1218	1224	
25	1192	1185	1158	1133	1118	1128	1148	1170	1180	1170	1148	1128	1118	1133	1158	1185	1192	
30	1143	1132	1102	1071	1048	1063	1088	1112	1126	1112	1088	1063	1048	1071	1102	1132	1143	
35	1080	1064	1029	989	964	981	1013	1044	1064	1044	1013	981	964	989	1029	1064	1080	
40	1013	993	943	888	863	882	923	969	994	969	923	882	863	888	943	993	1013	
45	920	897	838	774	740	761	807	862	894	862	807	761	740	774	838	897	920	
50	787	758	700	638	601	623	671	712	742	712	671	623	601	638	700	758	787	
55	592	575	548	495	464	479	523	535	556	535	523	479	464	495	548	575	592	
60	413	411	393	361	352	352	376	387	395	387	376	352	352	361	393	411	413	
65	298	296	263	255	269	252	252	282	286	282	252	252	269	255	263	296	298	
70	224	225	176	187	203	188	168	216	217	216	168	188	203	187	176	225	224	
75	179	173	130	141	149	141	127	164	174	164	127	141	149	141	130	173	179	
80	135	126	105	101	108	98	100	118	129	118	100	98	108	101	105	126	135	
85	73	75	60	56	56	52	53	63	67	63	53	52	56	60	75	73	73	
90	4	5	3	2	3	3	3	3	3	3	3	3	3	2	3	5	4	
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	



## 6.0 THD and PF Test

<b>Model No.</b>	91141	<b>Sample ID.</b>	1459933-001
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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	276.9	60	0.0627	15.808	0.9103	23.86%



### 7.0 In-Situ Temperature Measurement Test

<b>Model No.</b>	91141	<b>Sample ID.</b>	1459933-001, 1473114
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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
23.8	120.03	60	0.27163	31.619	0.9697	Horizontal

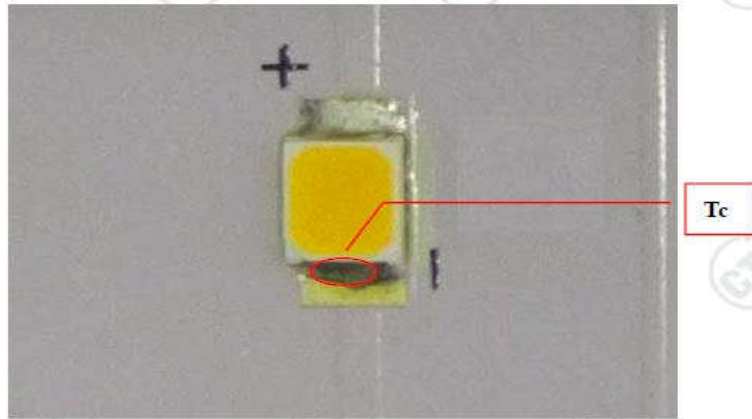
#### Test Results(LED)

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	Test Result (Correct to 25 °C)			
TMP of LEDs	60	56.7	57.9	SL-35B2835FTA-11CAGJ3C-APH001	60	85
Ambient Temperature	N/A	23.8	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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