



## Photometric Test Report

### Relevant Standards

- ☒ IES LM-79-2008
- ☒ ANSI C82.77-2002
- ☒ UL1598-2008/ UL1993-2012

### Prepared For

## IKIO LED LIGHTING

8470 Allison Pointe Blvd, Suite 128,  
Indianapolis, IN 46250

### Test Laboratory & Address:

UL-CCIC Company Limited location 2,  
Chengwan Road,  
Suzhou Industrial Park, Suzhou 21522 China

### Catalog Number

IK-FP24-0036-DX-35-J, IK-FP24-0036-DX-40-J, IK-FP24-0036-DX-50-J

IK-FP24-0036-DX-35-J was selected as the representative model,  
all measurements are the same except CCT.

Project Number 4788160671

Report Number 4788160671\_12

Test Date 7/11/2017-9/25/2017

Issue Date 10/13/2017

Prepared By

Jonathan Xu

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

Requirement Category	Test Method	Requirements	Test value	Results (Fail/Pass)
Minimum Light Output (lm)	IES LM-79-2008	3000	4357.59	Pass
Minimum Lamp Output (lm)	IES LM-79-2008	N/A	N/A	N/A
Spacing Criteria (0-180°)	IES LM-79-2008	1.0-2.0	1.28	Pass
Spacing Criteria (90-270°)	IES LM-79-2008	1.0-2.0	1.46	Pass
Zonal Lumen Requirement (0°-60°)	IES LM-79-2008	75%	77.60%	Pass
Zonal Lumen Requirement 2	IES LM-79-2008	N/A	N/A	N/A
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	121.25lm/W	127.01	Pass
Minimum Lamp Efficacy (lm/ft)	IES LM-79-2008	N/A	N/A	N/A
Allowable CCTs* (K)	IES LM-79-2008	≤5000	4961	Pass
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥80	82.47	Pass
L70 Lumen maintenance (hours)	IES LM-80-2015 IES TM-21-2011	≥50000	≥50000	Pass
L90 Lumen maintenance (hours)	IES LM-80-2015 IES TM-21-2011	≥36000	≥36000	Pass
Power Factor	ANSI C82.77-2002	≥0.9	0.8979	Pass
Total Harmonic Distortion (A%)	ANSI C82.77-2002	≤20%	19.58%	Pass
In-Situ Temperature Measurement Test for LED (°C)	UL1598-2008/ UL1993-2012	≤105	37	Pass
In-Situ Temperature Measurement Test for Driver (°C)	UL1598-2008/ UL1993-2012	90	34	Pass
Minimum Luminaire Warranty (years)	N/A	5	5	Pass

\*Defined by ANSI C78.377-2011‡

‡ANSI C78.377-2015 also referred to for Duv and (x,y) chromaticity coordinates tolerances for indoor categories.



## 2.0 Test List

Test Item	Test	Test Date	Model Number	Tests Conducted By
1	Integrating Sphere Test for the Lower CCT	9/21/2017	IK-FP24-0036-DX-35-J	Gavin Yang
2	Integrating Sphere Test for the Higher CCT	7/11/2017	IK-FP24-0036-DX-50-J	Gavin Yang
3	Goniophotometer Test	9/21/2017	IK-FP24-0036-DX-35-J	Gavin Yang
4	THD and PF Test	9/21/2017	IK-FP24-0036-DX-35-J	Gavin Yang
5	In-Situ Temperature Measurement Test	9/25/2017	IK-FP24-0036-DX-35-J	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:** 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces

**Model Number:** IK-FP24-0036-DX-35-J

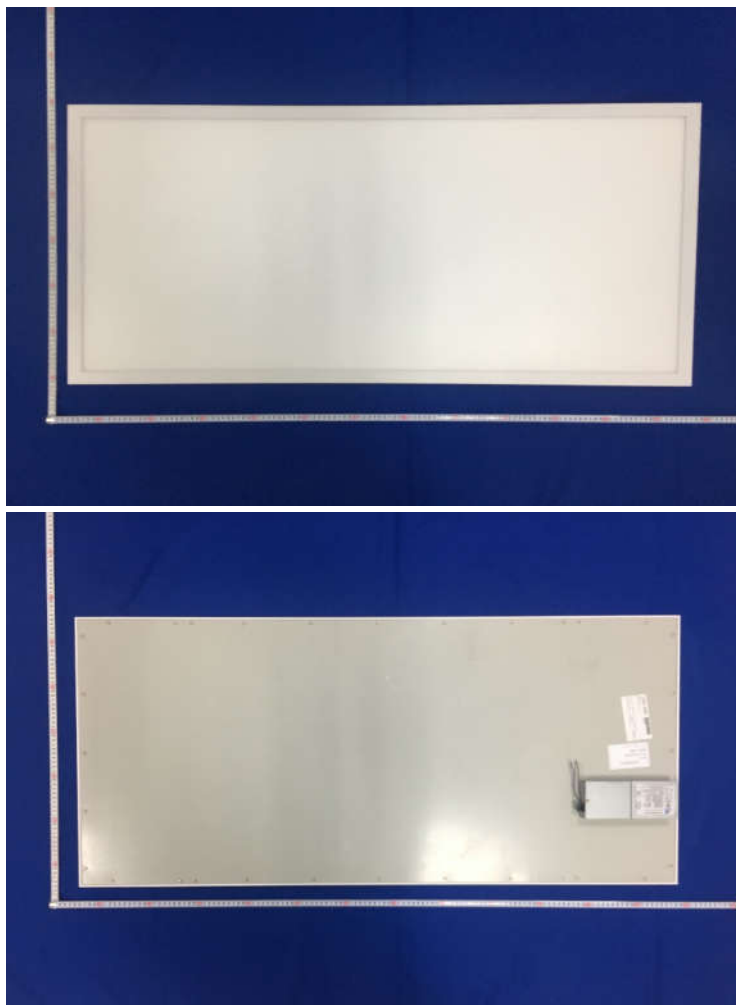
**Rated Voltage:** 120-277V **Frequency:** 50/60Hz

**LED Package:** SPMWH1228xxxxxxxxx

**Family Model and Variation:** IK-FP24-0036-DX-50-J

**Photos of Luminaire Characteristics**

Model Number	CCT	Light Output (lm)	Power (W)	Luminous efficacy (lm/W)
IK-FP24-0036-DX-35-J	3500K	4500	36	125
IK-FP24-0036-DX-40-J	4000K	4536	36	126
IK-FP24-0036-DX-50-J	5000K	4572	36	127





#### 4.0 LM-79 Measurement and Test Results

Model No.	IK-FP24-0036-DX-35-J		Sample ID.	1177137
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 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 omni-directional 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 was 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.

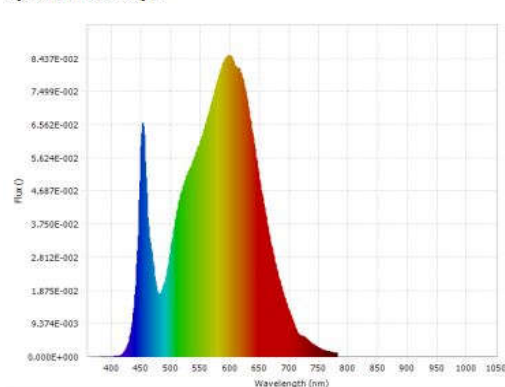
##### Integrating Sphere Test Conditions

Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD
25.2	120.02	60	0.2926	34.308	0.9813	9.43%

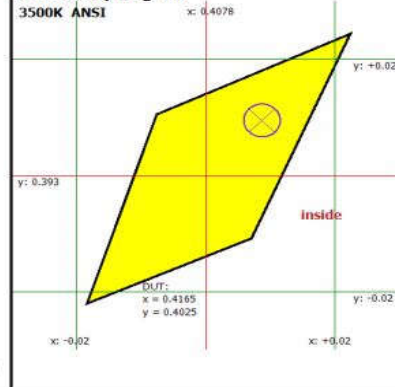
##### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
3360	82.47	0.0028	4357.59	127.01	N/A

Spectral Flux Graph



Chromaticity Diagram



Spectral Result

Luminous Flux $\Phi(v)$	4357.59 (lm)	Chrom x	0.4165
Chrom y	0.4025	Chrom u	0.2381
Chrom v	0.3452	Duv	0.0028
Chrom u'	0.2381	Chrom v'	0.5177
CCT	3360.0 (K)	Luminous Efficacy $\eta$	127.01 (lm/W)
Ra	82.47	R1	80.4
R2	88.9	R3	96.1
R4	80.9	R5	79.9
R6	85.2	R7	85.7
R8	62.6	R9	9.0
R10	74.0	R11	79.5
R12	61.0	R13	82.3
R14	97.8	R15	73.6
Rf	82.5	Rg	95.1



## 4.0 LM-79 Measurement and Test Results

### 4.2 Integrating Sphere Test for the higher CCT

Model No.	IK-FP24-0036-DX-50-J	Sample ID.	1047714
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 omni-directional 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 was 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.

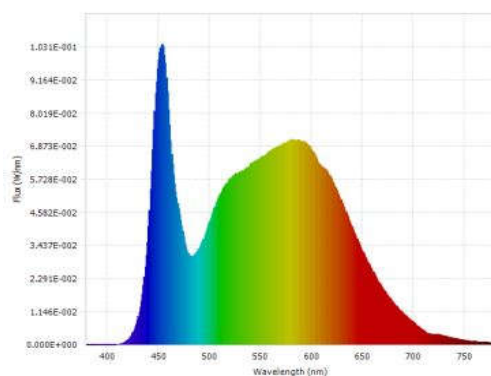
#### Integrating Sphere Test Conditions

Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Current THD
25.2	120.04	60	0.2919	34.636	0.9883	7.40%

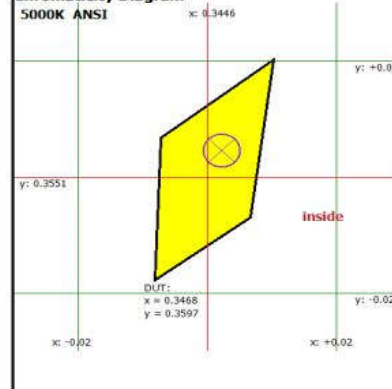
#### Test Results

CCT (K)	CRI (Ra)	Duv	Luminous Flux (lm)	Luminous Efficacy (lm/W)	Luminous Efficacy (lm/ft)
4961	83.23	0.0034	4447.41	128.40	N/A

Spectral Flux Graph



Chromaticity Diagram



Spectral Result

Luminous Flux $\Phi(v)$	4447.41 (lm)	Chrom x	0.3468
Chrom y	0.3597	Chrom u	0.2094
Chrom v	0.3259	Duv	0.0034
Chrom u'	0.2094	Chrom v'	0.4888
CCT	4961.0 (K)	Luminous Efficacy $\eta$	128.40 (lm/W)
Ra	83.23	R1	81.1
R2	89.7	R3	94.8
R4	80.5	R5	80.9
R6	84.7	R7	87.3
R8	66.8	R9	8.6
R10	75.1	R11	79.4
R12	56.0	R13	83.7
R14	97.5	R15	75.3
Rf	81.6	Rg	93.8



## 5.0 LM-79 Measurement and Test Results

Model No.	IK-FP24-0036-DX-35-J		Sample ID.	1177137	
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  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ , 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  $0.5^{\circ}$  vertical intervals and  $22.5^{\circ}$  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	Orientation
25.2	120.06	60	0.29183	34.38	0.9897	Horizontal

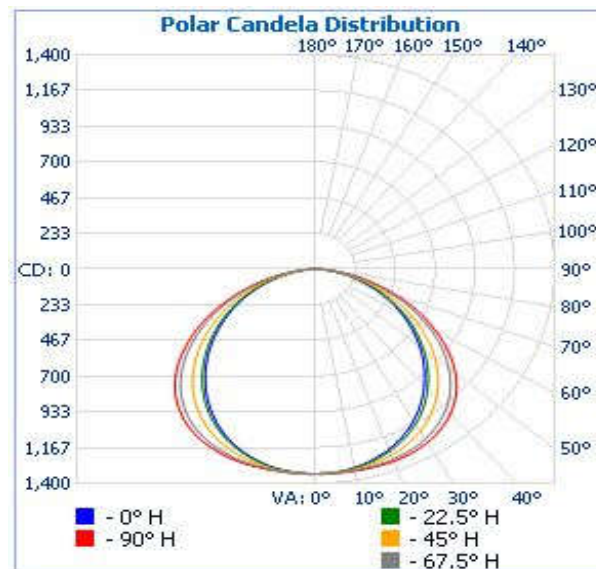
### Test Result

Flux (lm)	Zonal Lumen Requirement (0°-60°)	Field Angle (10%)		Beam Angle (50%)		Luminous Efficacy (lm/W)
		Horizontal Spread	Vertical Spread	Horizontal Spread	Vertical Spread	
4298.7	77.6%	165.8	162.1	129.8	112.7	125.03
SC	SC					
0°~180°	90°~270°					
1.28	1.46					

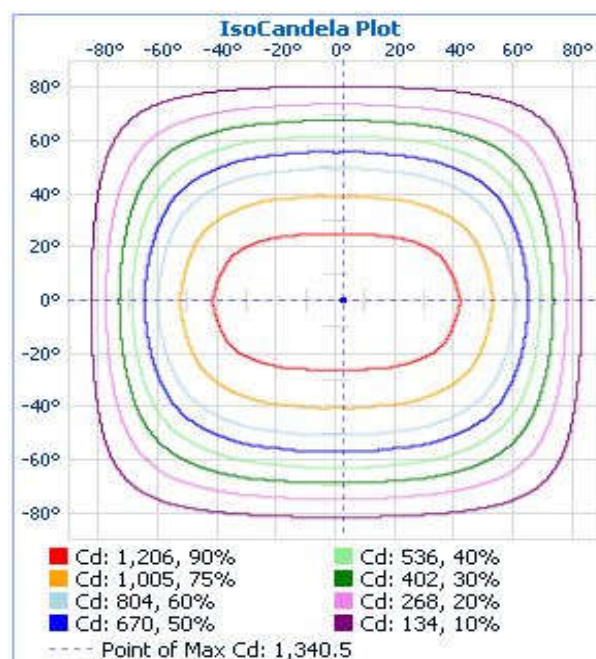


## 5.2 Goniophotometer Test (Cont'd)

### Light Distribution Curve



### IsoCandela Plot





## 5.2 Goniophotometer Test (Cont'd)

### Zonal Lumen Summary

Zonal Lumen Summary		
Zone	Lumens	% Luminaire
0-30	1,084.5	25.2%
0-40	1,819.7	42.3%
0-60	3,335.4	77.6%
60-90	952.2	22.2%
70-100	401.3	9.3%
90-120	3.7	0.1%
0-90	4,287.5	99.7%
90-180	10.8	0.3%
0-180	4,298.3	100%

### Lumens Per Zone

Lumens Per Zone					
Zone	Lumens	% Total	Zone	Lumens	% Total
0-5	32.0	0.7%	90-95	1.0	0%
5-10	95.3	2.2%	95-100	0.6	0%
10-15	156.9	3.6%	100-105	0.6	0%
15-20	215.3	5.0%	105-110	0.5	0%
20-25	269.0	6.3%	110-115	0.5	0%
25-30	316.0	7.4%	115-120	0.5	0%
30-35	354.1	8.2%	120-125	0.6	0%
35-40	381.1	8.9%	125-130	0.7	0%
40-45	395.2	9.2%	130-135	0.7	0%
45-50	394.5	9.2%	135-140	0.7	0%
50-55	378.5	8.8%	140-145	0.7	0%
55-60	347.5	8.1%	145-150	0.7	0%
60-65	303.4	7.1%	150-155	0.7	0%
65-70	249.1	5.8%	155-160	0.7	0%
70-75	188.3	4.4%	160-165	0.6	0%
75-80	125.7	2.9%	165-170	0.5	0%
80-85	67.1	1.6%	170-175	0.3	0%
85-90	18.6	0.4%	175-180	0.1	0%



## 5.2 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	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338	1338
1	1337	1337	1338	1339	1340	1340	1339	1338	1337	1338	1339	1340	1340	1339	1338	1337	1337
2	1336	1336	1337	1337	1340	1340	1339	1337	1337	1337	1339	1340	1340	1337	1337	1336	1336
3	1336	1335	1336	1338	1340	1339	1339	1337	1339	1337	1339	1339	1340	1338	1336	1335	1336
4	1334	1334	1335	1337	1340	1340	1338	1337	1336	1337	1338	1340	1340	1337	1335	1334	1334
5	1333	1332	1334	1336	1340	1339	1340	1336	1335	1336	1340	1339	1340	1336	1334	1332	1333
6	1331	1330	1332	1336	1340	1339	1337	1334	1332	1334	1337	1339	1340	1336	1332	1330	1331
7	1329	1328	1332	1335	1339	1338	1336	1332	1331	1332	1336	1338	1339	1335	1332	1328	1329
8	1324	1326	1330	1335	1339	1338	1334	1330	1329	1330	1334	1338	1339	1335	1330	1326	1324
9	1320	1323	1328	1335	1338	1337	1332	1327	1326	1327	1332	1337	1338	1335	1328	1323	1320
10	1317	1319	1326	1334	1338	1336	1332	1325	1323	1325	1332	1336	1338	1334	1326	1319	1317
11	1313	1316	1325	1333	1338	1336	1328	1321	1320	1321	1328	1336	1338	1333	1325	1316	1313
12	1309	1313	1323	1332	1339	1334	1326	1317	1316	1317	1326	1334	1339	1332	1323	1313	1309
13	1302	1308	1319	1331	1338	1333	1324	1312	1309	1312	1324	1333	1338	1331	1319	1308	1302
14	1298	1303	1317	1331	1339	1333	1320	1308	1304	1308	1320	1333	1339	1331	1317	1303	1298
15	1291	1298	1314	1330	1337	1332	1317	1302	1299	1302	1317	1332	1337	1330	1314	1298	1291
16	1283	1293	1312	1329	1338	1330	1314	1296	1292	1296	1314	1330	1338	1329	1312	1293	1283
17	1275	1286	1307	1327	1338	1329	1312	1292	1286	1292	1312	1329	1338	1327	1307	1286	1275
18	1268	1281	1303	1327	1338	1328	1307	1285	1278	1285	1307	1328	1338	1327	1303	1281	1268
19	1263	1274	1298	1325	1336	1326	1301	1278	1272	1278	1301	1326	1336	1325	1298	1274	1263
20	1253	1266	1295	1323	1336	1324	1299	1272	1264	1272	1299	1324	1336	1323	1295	1266	1253
25	1206	1224	1265	1307	1326	1309	1269	1231	1219	1231	1269	1309	1326	1307	1265	1224	1206
30	1145	1169	1225	1283	1308	1286	1228	1177	1160	1177	1228	1286	1308	1283	1225	1169	1145
35	1073	1101	1170	1244	1278	1248	1175	1109	1088	1109	1175	1248	1278	1244	1170	1101	1073
40	990	1021	1099	1190	1230	1194	1106	1029	1005	1029	1106	1194	1230	1190	1099	1021	990
45	898	929	1014	1115	1162	1119	1020	938	911	938	1020	1119	1162	1115	1014	929	898
50	797	828	914	1020	1069	1022	918	837	811	837	918	1022	1069	1020	914	828	797
55	692	719	799	903	953	905	804	727	703	727	804	905	953	903	799	719	692
60	582	604	676	770	817	772	680	612	592	612	680	772	817	770	676	604	582
65	468	486	544	625	666	629	551	495	479	495	551	629	666	625	544	486	468
70	357	369	413	477	508	479	420	378	367	378	420	479	508	477	413	369	357
75	249	257	287	330	352	333	293	265	258	265	293	333	352	330	287	257	249
80	150	154	169	194	207	197	175	160	157	160	175	197	207	194	169	154	150
85	63	64	70	79	85	82	75	69	68	69	75	82	85	79	70	64	63
90	2	2	4	6	7	7	5	4	3	4	5	7	7	6	4	2	2
95	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
100	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
105	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
110	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
115	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
120	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
125	1	1	1	2	2	2	1	1	1	1	1	2	2	2	1	1	1
130	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
135	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
140	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
145	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
150	2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	2
155	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
160	3	3	3	3	3	4	3	3	3	3	3	4	3	3	3	3	3
165	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
170	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
175	5	5	5	5	4	4	4	4	5	4	4	4	4	5	5	5	5
180	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5



## 6.0 THD and PF Test

Model No.	IK-FP24-0036-DX-35-J	Sample ID.	1177137
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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
25.2	276.91	60	0.1397	34.744	0.8979	19.58%



## 7.0 In-Situ Temperature Measurement Test

Model No.	IK-FP24-0036-DX-35-J	Sample ID.	1177137
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### Test Method

1. In-Situ Temperature Measurement Test is conducted according to the UL1598-2008, Section 14 or UL1993-2012, Section 8.5.
2. The testing was conducted in a room with ambient temperature of  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ . 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
25.5	120.02	60	0.2926	34.31	0.9813	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 1	Test result (Correct to 25 °C)			
TMP of LEDs	45	37.5	37.0	SPMWH1228xxx xxxxxx	120	85
Ambient temperature	N/A	25.5	25.0			

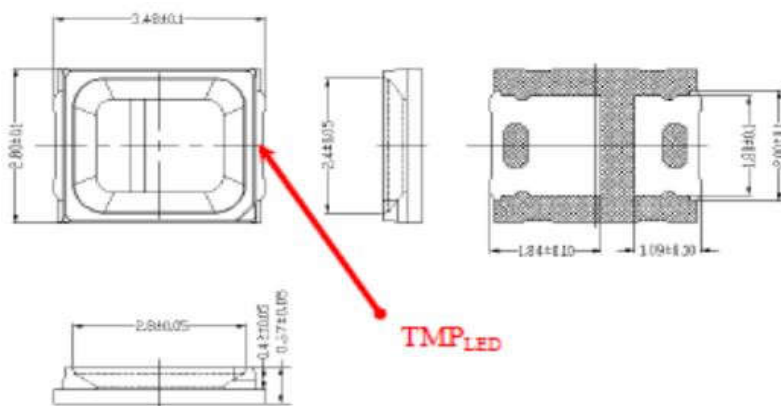
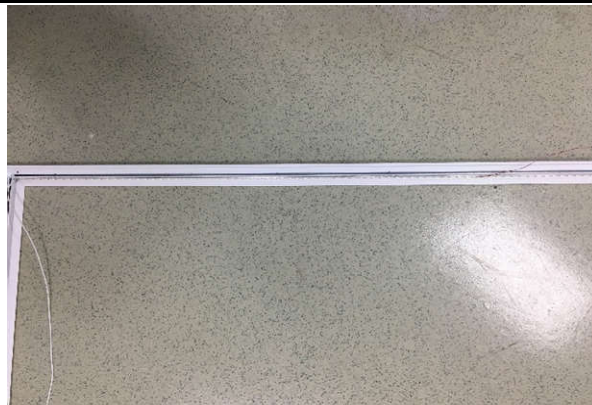
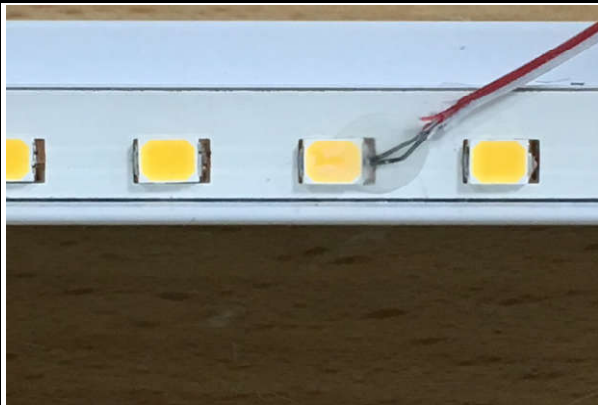
### Test Results(Driver)

Thermocouple Location	Temperature for Driver (°C)		Driver Model Number	Driver Limit Temp. (°C)
	Test result column 1	Test result (Correct to 25 °C)		
TMP of Driver	34.5	34.0	XZ-PK50B-420080-W	90
Ambient temperature	25.5	25.0		



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

Test Photos for Tc Point of LED Packages





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