



# Photometric Test Report

## Relevant Standards

- IES LM-79-2008
- ANSI C82.77:2014

## Prepared For RAB LIGHTING INC

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2019/7/10

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## 1.0 Test Summary

DLC Technical Requirements v4.4

<b>Linear Replacement Lamps - Replacement Lamps ("Plug and Play") (UL Type C)</b>				
<b>Requirement Category</b>	<b>Test Method</b>	<b>Requirements</b>	<b>Test value</b>	<b>Results (Fail/Pass)</b>
<b>Bare Lamp (with 2 Tube driver)</b>				
Lamp Output for bare lamp (lm)	IES LM-79-2008	≥1600	1767	P
		≥1600	1810	P
Minimum Lamp Efficacy (lm/W)	IES LM-79-2008	≥110	135.1	P
		≥110	137.1	P
Allowable CCTs* (K)	IES LM-79-2008	3045±175	3047	P
		5029±283	5020	P
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥80	81.8	P
		≥80	83.9	P
Power Factor	ANSI C82.77:2014	≥0.9	0.997	P
		≥0.9	0.949	P
Total Harmonic Distortion (A%)	ANSI C82.77:2014	≤25%	4.79%	P
		≤25%	7.48%	P
<b>Bare Lamp (with 3 Tube driver)</b>				
Lamp Output for bare lamp (lm)	IES LM-79-2008	≥1600	1684	P
		≥1600	1743	P
Minimum Lamp Efficacy (lm/W)	IES LM-79-2008	≥110	131.5	P
		≥110	135.3	P
Allowable CCTs* (K)	IES LM-79-2008	3045±175	3041	P
		5029±283	5009	P
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥80	81.8	P
		≥80	83.9	P
Power Factor	ANSI C82.77:2014	≥0.9	0.995	P
		≥0.9	0.920	P
Total Harmonic Distortion (A%)	ANSI C82.77:2014	≤25%	12.81%	P
		≤25%	12.66%	P
<b>Bare Lamp (with 4 Tube driver)</b>				
Lamp Output for bare lamp (lm)	IES LM-79-2008	≥1600	1680	P
		≥1600	1745	P
Minimum Lamp Efficacy (lm/W)	IES LM-79-2008	≥110	131.0	P
		≥110	134.6	P
Allowable CCTs* (K)	IES LM-79-2008	3045±175	3041	P
		5029±283	5011	P
Minimum CRI	IES LM-79-2008 CIE 13.3-1995	≥80	81.7	P
		≥80	83.9	P
Power Factor	ANSI C82.77:2014	≥0.9	0.996	P
		≥0.9	0.947	P
Total Harmonic Distortion (A%)	ANSI C82.77:2014	≤25%	5.81%	P
		≤25%	8.96%	P

in Fixture (2 tube)				
Lamp Output (lm)	IES LM-79-2008	≥2700	2887	P
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	≥100	110.3	P
Zonal Lumen Requirement(0°-60°)	IES LM-79-2008	≥75%	81.13%	P
SC (0°-180°)	IES LM-79-2008	1.0-2.0	1.24	P
SC (90°-270°)	IES LM-79-2008	1.0-2.0	1.30	P
in Fixture (3 tube)				
Lamp Output (lm)	IES LM-79-2008	≥4050	4125	P
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	≥100	107.2	P
Zonal Lumen Requirement(0°-60°)	IES LM-79-2008	≥75%	80.93%	P
SC (0°-180°)	IES LM-79-2008	1.0-2.0	1.24	P
SC (90°-270°)	IES LM-79-2008	1.0-2.0	1.30	P
in Fixture (4 tube)				
Lamp Output (lm)	IES LM-79-2008	≥5400	5488	P
Minimum Luminaire Efficacy (lm/W)	IES LM-79-2008	≥100	106.8	P
Zonal Lumen Requirement(0°-60°)	IES LM-79-2008	≥75%	80.87%	P
SC (0°-180°)	IES LM-79-2008	1.0-2.0	1.23	P
SC (90°-270°)	IES LM-79-2008	1.0-2.0	1.31	P

## 2.0 Test List

Test Item	Test	Test Date	Model Number	Sample No.
1	Integrating Sphere Test	2019/7/9	T8-11-48G-830-EXT	F1-F4
			T8-11-48G-850-EXT	F5-F8
2	Goniophotometer Test	2019/7/9	T8-11-48G-830-EXT	F1-F4
3	THD and PF Test	2019/7/9	T8-11-48G-830-EXT	F1-F4

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### 3.0 Production Description

**Luminaire Description:** T8-11-48G-830-EXT / T8-11-48G-850-EXT

**Electrical Specification:** 120V-277V,60HZ

**Test in fixture:** Lithonia 2GT8 lensed 2x4

**LED Driver for 2 tube:** DRI-24T8-4L-DIM

**LED Driver for 3 tube:** DRI-36/48T8-4L-DIM

**LED Driver for 4 tube:** DRI-36/48T8-4L-DIM

#### Photos of Luminaire Characteristics



## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test (with 2 Tube driver)

Model No.	T8-11-48G-830-EXT	Sample ID.	F1-F2
Model No.	T8-11-48G-850-EXT	Sample ID.	F5-F6
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

The samples were tested according to the IES LM-79-2008.

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 sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere.

The voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

The sample was measured using  $4\pi$  geometry and 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.

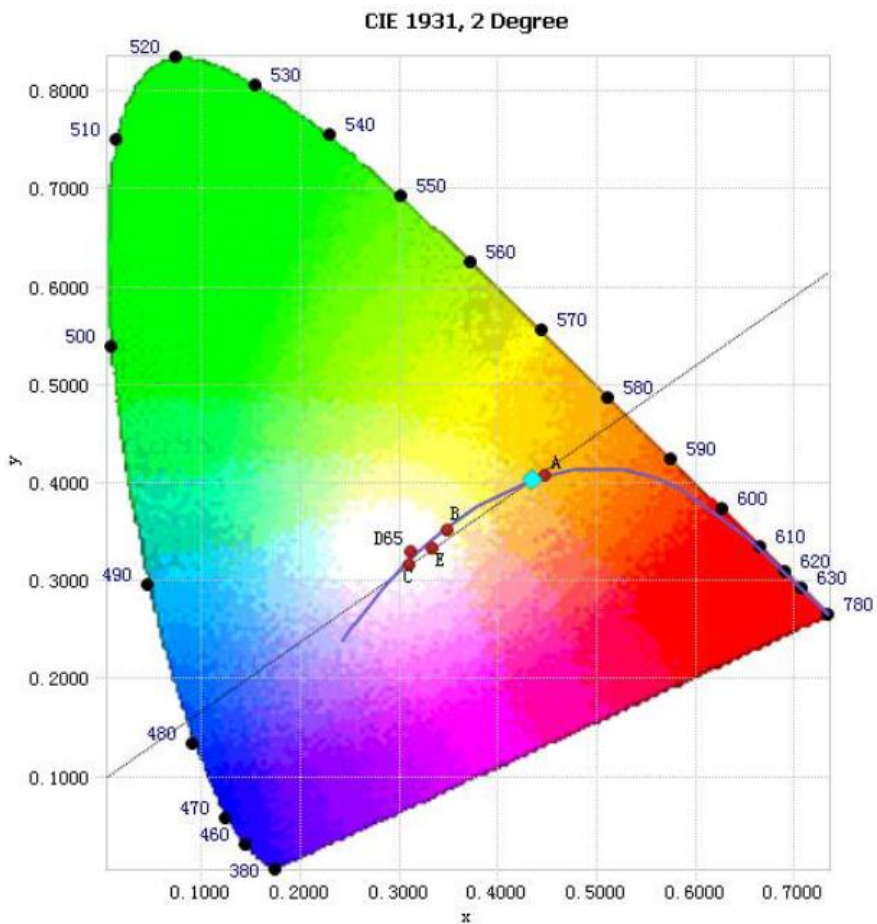
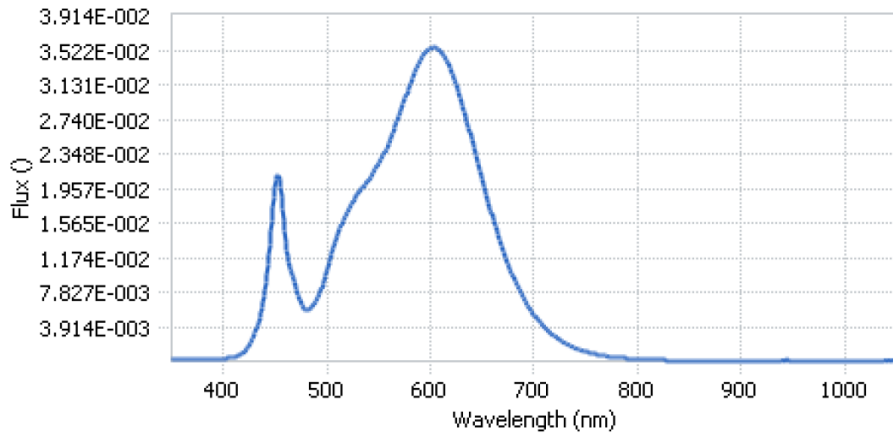
#### Test Conditions

Model No.	Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
T8-11-48G-830-EXT	25.1	120.00	60	0.109	13.08	0.997
T8-11-48G-850-EXT	25.1	120.00	60	0.110	13.20	0.997

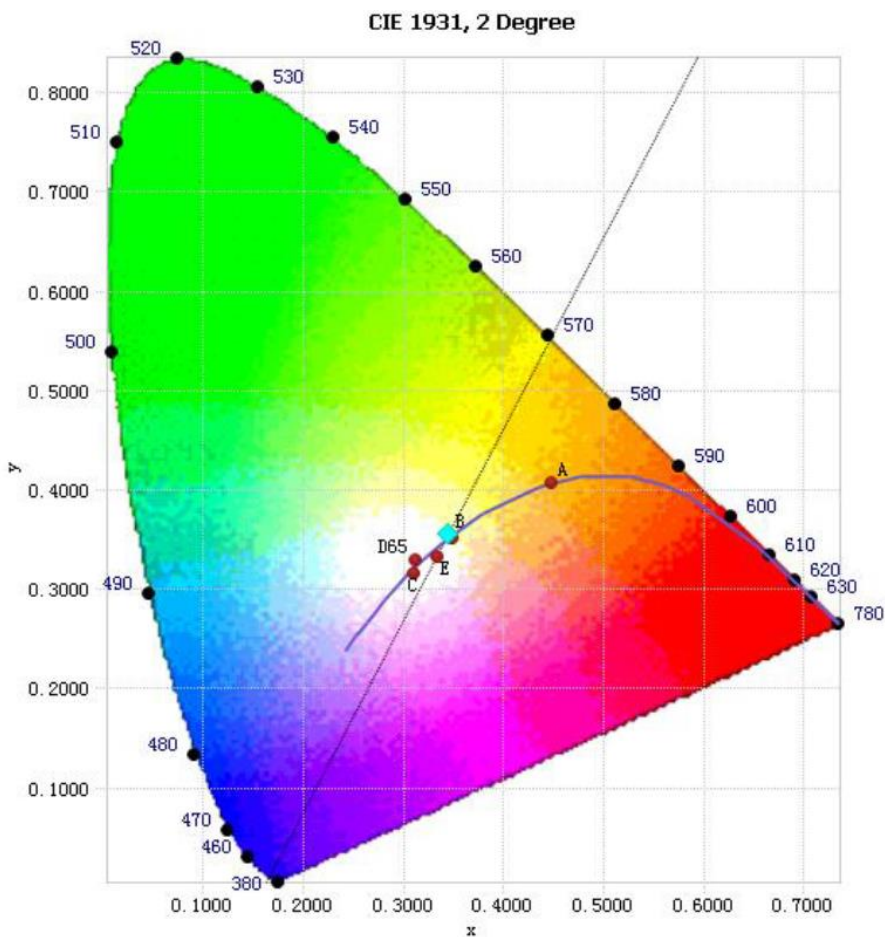
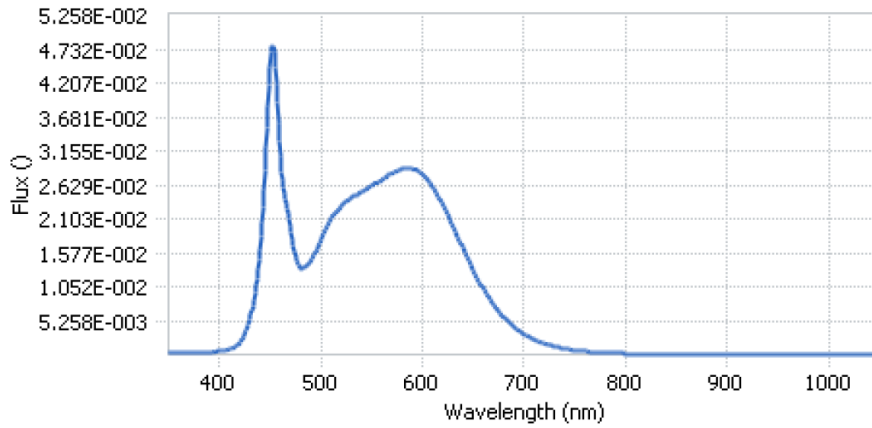
#### Test Result

Model No.	CCT (K)	CRI (Ra)	Light Output (lm)	Efficacy (lm/W)	Duv
T8-11-48G-830-EXT	3047	81.8	1767	135.1	2.0E-04
T8-11-48G-850-EXT	5020	83.9	1810	137.1	1.2E-03

**4.1 Integrating Sphere Test**  
 T8-11-48G-830-EXT



**4.1 Integrating Sphere Test**  
 T8-11-48G-850-EXT



## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test (with 3 Tube driver)

Model No.	T8-11-48G-830-EXT	Sample ID.	F1-F3
Model No.	T8-11-48G-850-EXT	Sample ID.	F5-F7
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

The samples were tested according to the IES LM-79-2008.

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 sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere.

The voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

The sample was measured using  $4\pi$  geometry and 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.

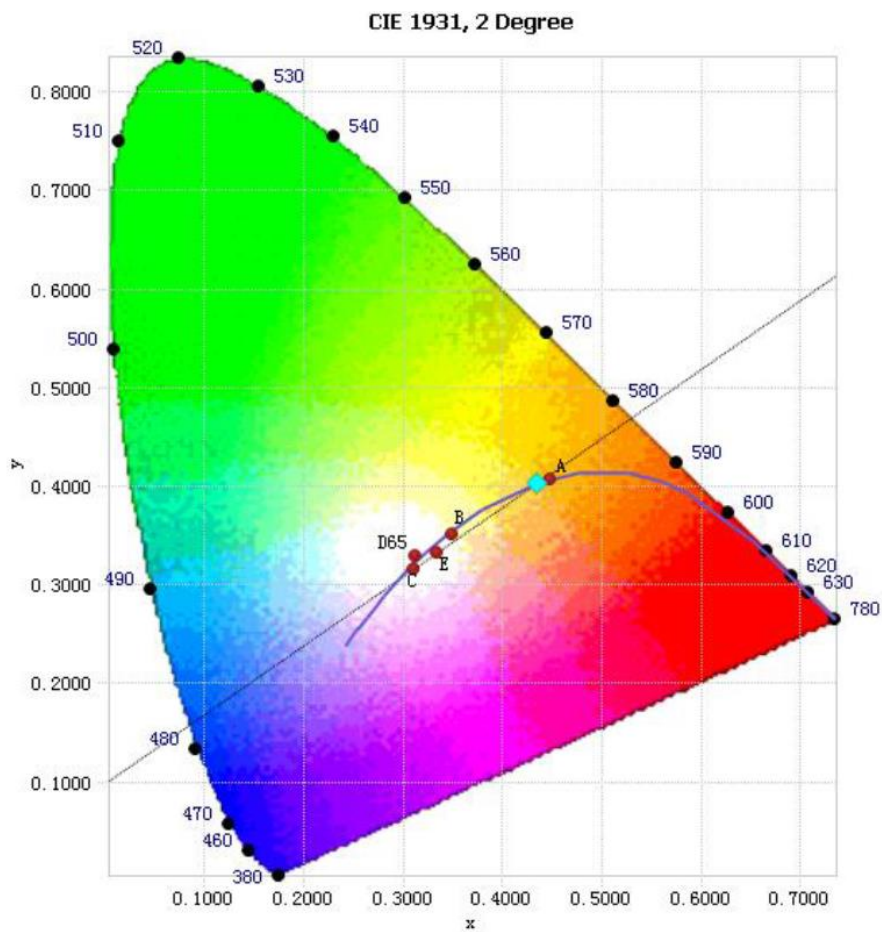
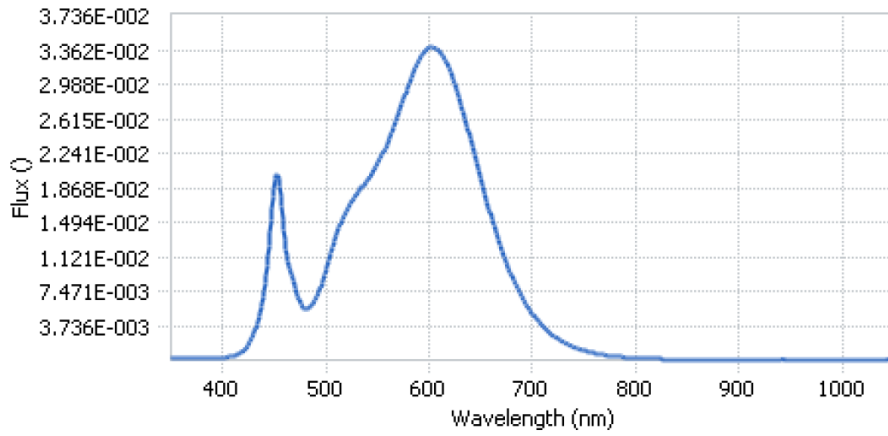
#### Test Conditions

Model No.	Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
T8-11-48G-830-EXT	25.1	120.00	60	0.107	12.81	0.995
T8-11-48G-850-EXT	25.1	120.00	60	0.108	12.88	0.996

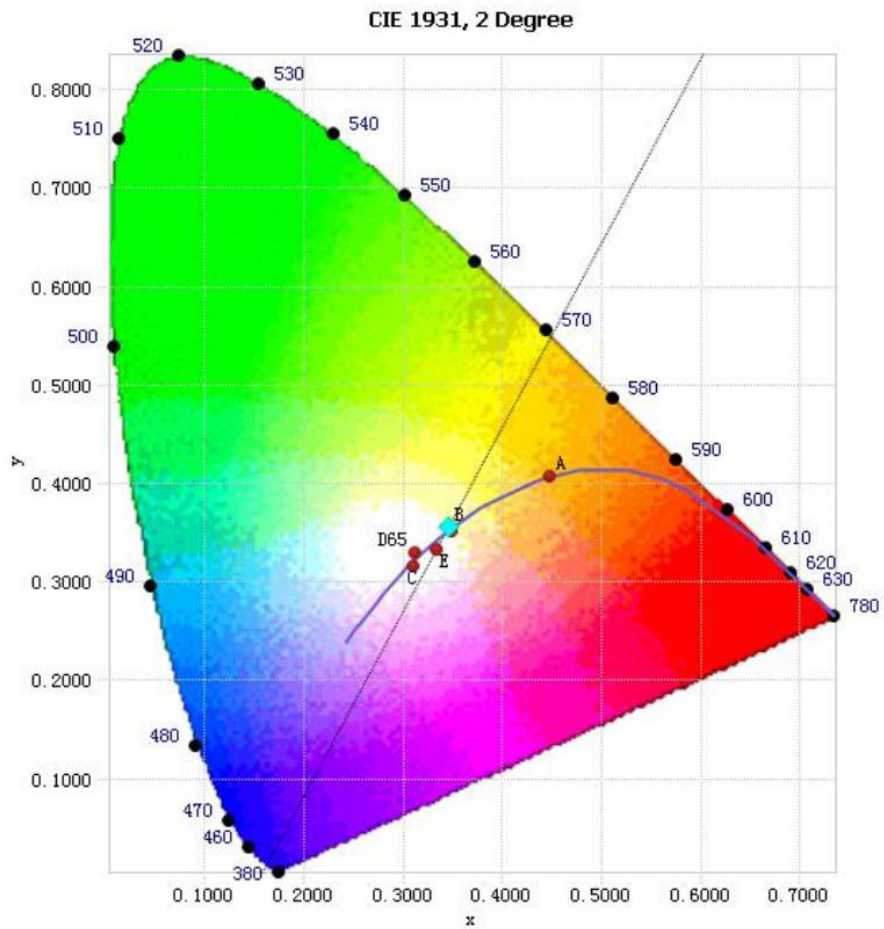
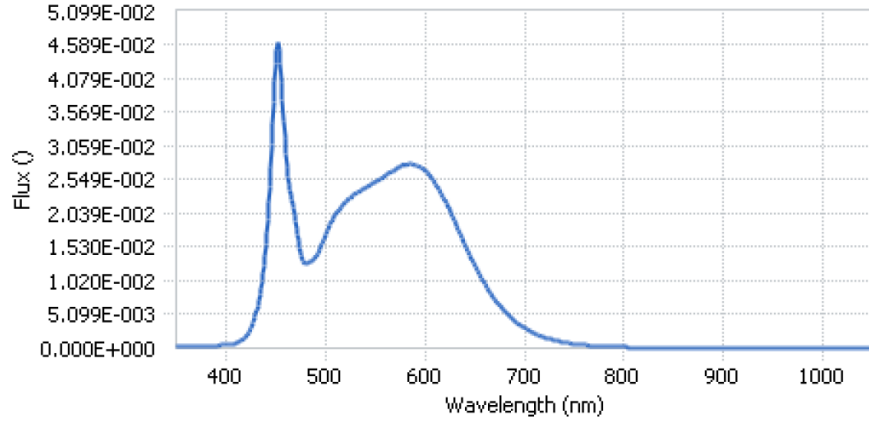
#### Test Result

Model No.	CCT (K)	CRI (Ra)	Light Output (lm)	Efficacy (lm/W)	Duv
T8-11-48G-830-EXT	3041	81.8	1684	131.5	2.0E-04
T8-11-48G-850-EXT	5009	83.9	1743	135.3	1.1E-03

**4.1 Integrating Sphere Test**  
T8-11-48G-830-EXT



**4.1 Integrating Sphere Test**  
T8-11-48G-850-EXT



## 4.0 LM-79 Measurement and Test Results

### 4.1 Integrating Sphere Test (with 4 Tube driver)

Model No.	T8-11-48G-830-EXT	Sample ID.	F1-F4
Model No.	T8-11-48G-850-EXT	Sample ID.	F5-F8
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

The samples were tested according to the IES LM-79-2008.

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 sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere.

The voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

The sample was measured using  $4\pi$  geometry and 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.

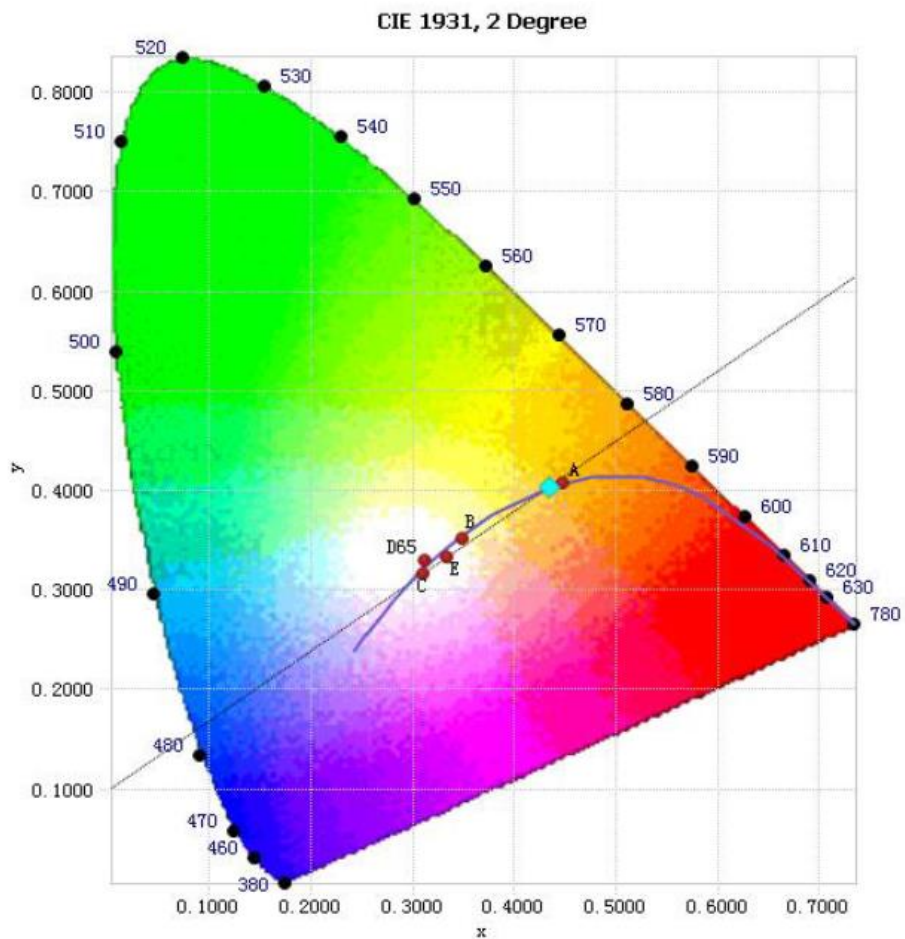
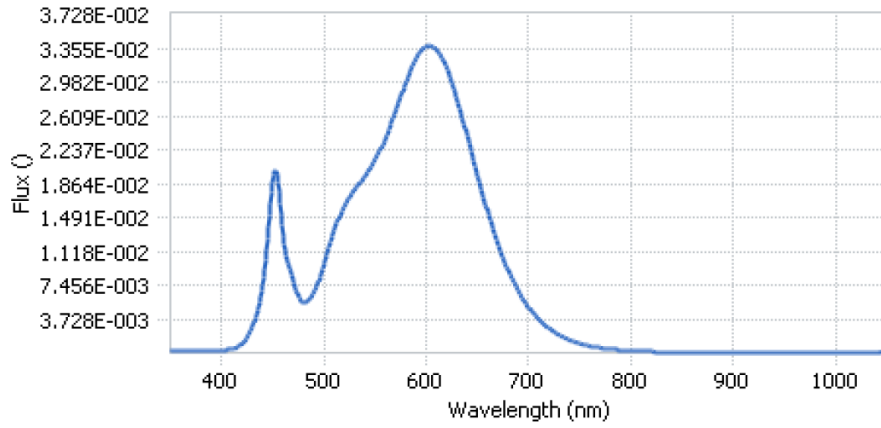
#### Test Conditions

Model No.	Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Current (A)	Power (W)	Power Factor
T8-11-48G-830-EXT	25.1	120.00	60	0.107	12.82	0.996
T8-11-48G-850-EXT	25.1	120.00	60	0.108	12.96	0.996

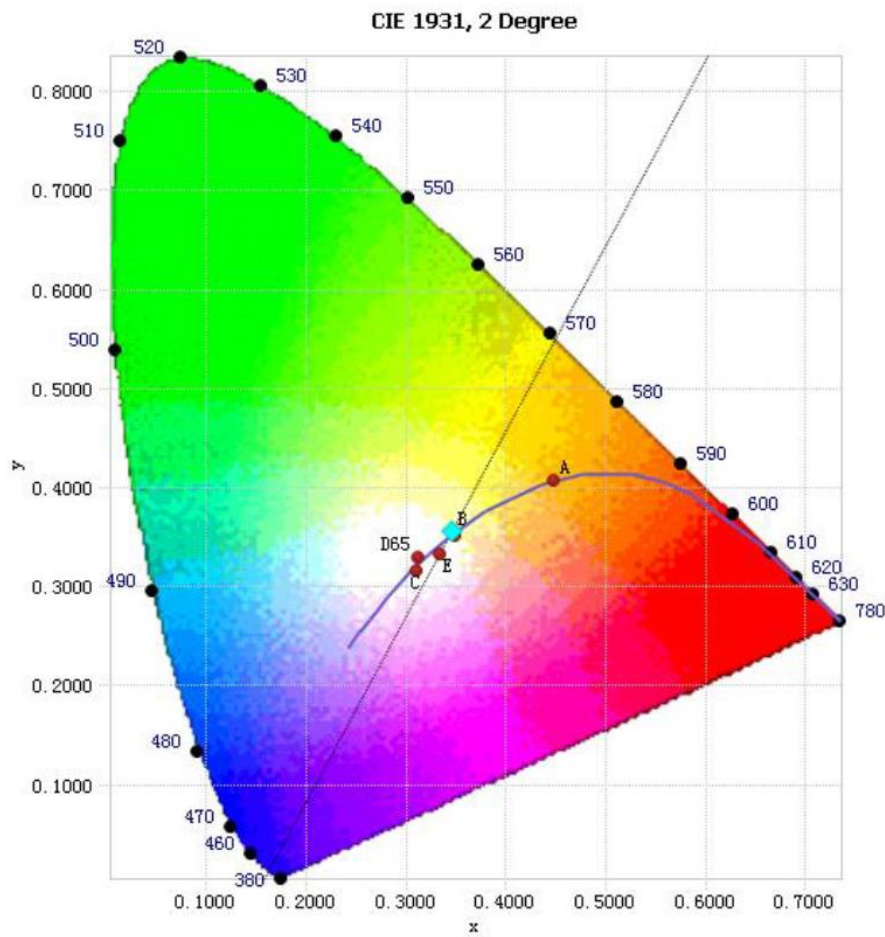
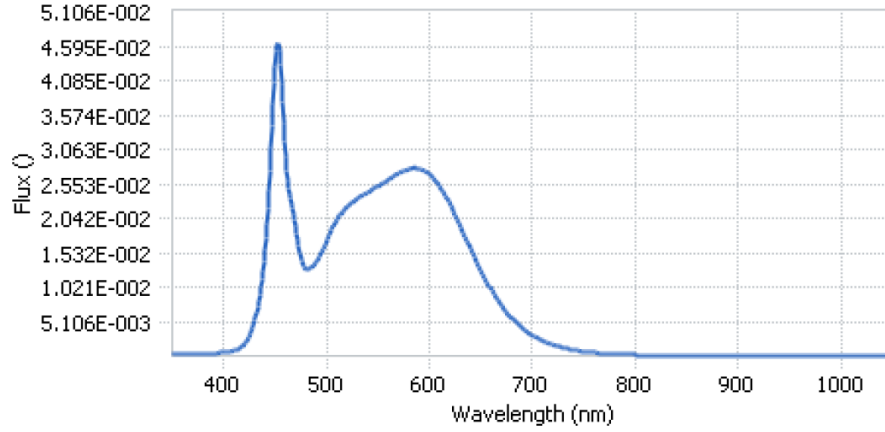
#### Test Result

Model No.	CCT (K)	CRI (Ra)	Light Output (lm)	Efficacy (lm/W)	Duv
T8-11-48G-830-EXT	3041	81.7	1680	131.0	2.0E-04
T8-11-48G-850-EXT	5011	83.9	1745	134.6	1.1E-03

**4.1 Integrating Sphere Test**  
 T8-11-48G-830-EXT



**4.1 Integrating Sphere Test**  
 T8-11-48G-850-EXT



## 4.0 LM-79 Measurement and Test Results

### 4.3 Goniophotometer Test

Model No.	T8-11-48G-830-EXT	Sample ID.	F1-F2
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

The samples were tested according to the IES LM-79-2008.

Photometric parameters were measured using a type C goniophotometer and software.

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 voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

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  $10^{\circ}$  horizontal intervals.

#### Test Conditions

Two tubes were placed in a reference housing during testing

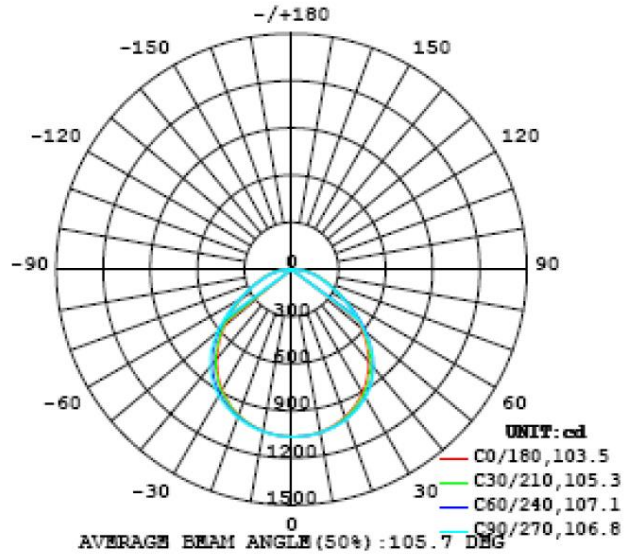
Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Power (W)	Orientation
25.10	120.00	60	26.18	Light Down

#### Test Result

Flux(lm)	Zonal Lumen Requirement( $0^{\circ}$ - $60^{\circ}$ )	SC ( $0^{\circ}$ - $180^{\circ}$ )	SC ( $90^{\circ}$ - $270^{\circ}$ )	Luminous Efficacy (lm/W)
2887	81.13%	1.24	1.30	110.3

### 4.3 Goniophotometer Test

#### Light Distrubtion Curve



#### Zonal Lumen Summary

$\gamma(^{\circ})$	<b>T8-11-48G-830-EXT</b>	
	<b>2 tubes in Lithonia 2GT8 lensed 2x4</b>	
	<b>Lumens</b>	<b>% Total</b>
0- 10	100.899	3.49%
10- 20	290.704	10.07%
20- 30	444.011	15.38%
30- 40	534.456	18.51%
40- 50	534.214	18.50%
50- 60	438.046	15.17%
60- 70	296.966	10.29%
70- 80	179.055	6.20%
80- 90	63.157	2.19%
90-100	0.713	0.02%
100-110	0.883	0.03%
110-120	0.77	0.03%
120-130	0.765	0.03%
130-140	0.734	0.03%
140-150	0.645	0.02%
150-160	0.493	0.02%
160-170	0.327	0.01%
170-180	0.12	0.00%
Total	2887.0	100%

## 4.0 LM-79 Measurement and Test Results

### 4.3 Goniophotometer Test

Model No.	T8-11-48G-830-EXT	Sample ID.	F1-F3
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

The samples were tested according to the IES LM-79-2008.

Photometric parameters were measured using a type C goniophotometer and software.

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 voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

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  $10^{\circ}$  horizontal intervals.

#### Test Conditions

Three tubes were placed in a reference housing during testing

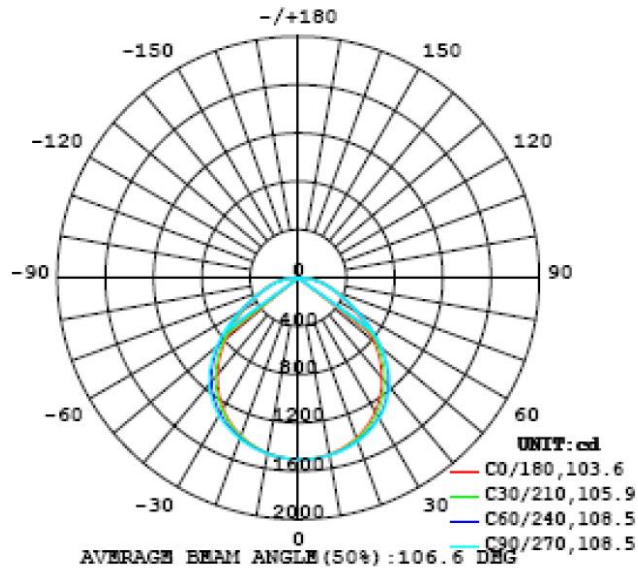
Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Power (W)	Orientation
25.10	120.00	60	38.47	Light Down

#### Test Result

Flux(lm)	Zonal Lumen Requirement( $0^{\circ}$ - $60^{\circ}$ )	SC ( $0^{\circ}$ - $180^{\circ}$ )	SC ( $90^{\circ}$ - $270^{\circ}$ )	Luminous Efficacy (lm/W)
4125	80.93%	1.24	1.30	107.2

### 4.3 Goniophotometer Test

#### Light Distribution Curve



#### Zonal Lumen Summary

$\gamma(^{\circ})$	<b>T8-11-48G-830-EXT</b>	
	<b>3 tubes in Lithonia 2GT8 lensed 2x4</b>	
	<b>Lumens</b>	<b>% Total</b>
0- 10	142.473	3.45%
10- 20	410.909	9.96%
20- 30	628.835	15.25%
30- 40	759.812	18.42%
40- 50	764.768	18.54%
50- 60	631.422	15.31%
60- 70	427.541	10.37%
70- 80	256.555	6.22%
80- 90	93.173	2.26%
90-100	1.049	0.03%
100-110	1.421	0.03%
110-120	1.612	0.04%
120-130	1.341	0.03%
130-140	1.152	0.03%
140-150	1.043	0.03%
150-160	0.801	0.02%
160-170	0.541	0.01%
170-180	0.183	0.00%
<b>Total</b>	<b>4124.6</b>	<b>100%</b>

## 4.0 LM-79 Measurement and Test Results

### 4.3 Goniophotometer Test

Model No.	T8-11-48G-830-EXT	Sample ID.	F1-F4
Operate time (Min.)	90	Stabilization time (Min.)	45

#### Test Method

The samples were tested according to the IES LM-79-2008.

Photometric parameters were measured using a type C goniophotometer and software.

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 voltage of an AC power supply (RMS voltage) or DC power supply (instantaneous voltage) applied to the device under test shall be regulated to within  $\pm 0.2$  percent under load.

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  $10^{\circ}$  horizontal intervals.

#### Test Conditions

Four tubes were placed in a reference housing during testing

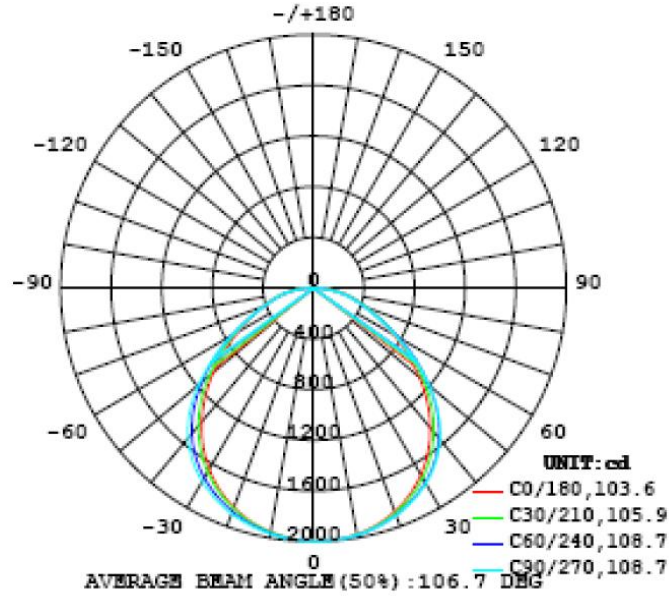
Temperature ( $^{\circ}\text{C}$ )	Voltage (Vac)	Frequency (Hz)	Power (W)	Orientation
25.10	120.00	60	51.37	Light Down

#### Test Result

Flux(lm)	Zonal Lumen Requirement( $0^{\circ}$ - $60^{\circ}$ )	SC ( $0^{\circ}$ - $180^{\circ}$ )	SC ( $90^{\circ}$ - $270^{\circ}$ )	Luminous Efficacy (lm/W)
5488	80.87%	1.23	1.31	106.8

### 4.3 Goniophotometer Test

#### Light Distribution Curve



#### Zonal Lumen Summary

$\gamma(^{\circ})$	<b>T8-11-48G-830-EXT</b>	
	<b>4 tubes in Lithonia 2GT8 lensed 2x4</b>	
	<b>Lumens</b>	<b>% Total</b>
0- 10	189.222	3.45%
10- 20	545.607	9.94%
20- 30	834.799	15.21%
30- 40	1009.115	18.39%
40- 50	1017.48	18.54%
50- 60	841.706	15.34%
60- 70	571.156	10.41%
70- 80	341.995	6.23%
80- 90	126.019	2.30%
90-100	1.4	0.03%
100-110	1.482	0.03%
110-120	1.531	0.03%
120-130	1.564	0.03%
130-140	1.525	0.03%
140-150	1.337	0.02%
150-160	0.977	0.02%
160-170	0.671	0.01%
170-180	0.234	0.00%
<b>Total</b>	<b>5487.8</b>	<b>100%</b>

## 5.0 THD and PF Test

Model No.	T8-11-48G-830-EXT	Sample ID.	F1-F4
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### Test Method

The samples were tested according to the ANSI C82.77:2002.

The total harmonic distortion shall be measured to the 40th order.

The ambient temperature condition was maintained at 25° C ± 1° C. The sample measurements were made using a digital power meter and power supply. The sample was operated at rated voltage and was stabilized before measurement. The total harmonic distortion were calculated.

#### Test Results (with 2 Tube driver)

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Power Factor	THD
25.1	120.00	60	0.997	4.79%
25.1	277.00	60	0.949	7.48%

#### Test Results (with 3 Tube driver)

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Power Factor	THD
25.1	120.00	60	0.995	12.81%
25.1	277.00	60	0.920	12.66%

#### Test Results (with 4 Tube driver)

Temperature (°C)	Voltage (Vac)	Frequency (Hz)	Power Factor	THD
25.1	120.00	60	0.996	5.81%
25.1	277.00	60	0.947	8.96%

## 6.0 Equipment Information

Test Equipment			
Equipment ID	Equipment Name	Last Calibration Date	Calibration Due Date
DLF107	Integrating Sphere System	2018/12/26	2019/12/25
DLF108	Auxiliary Lamp	2018/12/26	2019/12/25
DLF122	Measurement Standard Lamp Standard Lamp Type: 220 V, 0.4720 A, Tungsten, Omni-derectional	2018/12/26	2019/12/25
DLF116	AC Power Source	2018/12/26	2019/12/25
DLF113	Power Meter	2018/12/26	2019/12/25
DLF112	Temperature Recorder	2018/12/26	2019/12/25
DLF114	Temperature & Humidity Datalogger	2018/12/26	2019/12/25
DLF101	Goniophotometer	2018/12/26	2019/12/25
DLF125	Standard Lamp Standard Lamp Type: 76.58 V, 6.7875 A, Tungsten, Omni-derectional	2018/12/26	2019/12/25
DLF104	AC Power Source	2018/12/26	2019/12/25
DLF507	DC Power Source	2018/12/26	2019/12/25
DLF102	Power Meter	2018/12/26	2019/12/25
DLF111	Temperature & Humidity Datalogger	2018/12/26	2019/12/25
DLF119	Power Meter	2018/12/26	2019/12/25
DLF031	Temperature data logger	2018/12/26	2019/12/25
DLF022	Digital power meter	2018/12/26	2019/12/25
DLF003	Temperature & Humidity Datalogger	2018/12/26	2019/12/25

\*\*\*\*\* End of Test Report\*\*\*\*\*