LM-79-08 TEST REPORT

for

RAB Lighting Inc

170 Ludlow Ave, PO BOX 970 Northvale, NJ 07647-2305 USA

LED Tube

Model: T8-24-96G-FA8-840-DE-BYP

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ21070016s

The laboratory that conducted the testing detailed in this report has been accredited for SSL by NVLAP.

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Jul. 22, 2021

Approved by:

Manager: Jim Zhang
Jul. 22, 2021

Note: This report does not imply product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

TEST SUMMARY

Model	T8-24-96G-FA8-840-DE-BYP
Luminous Efficacy (Lumens /Watt)	149.6
Total Luminous Flux (Lumens)	3539.6
Power (Watts)	23.66
Power Factor	0.9801
CCT (K)	4036
CRI	83.3
Stabilization Time (Light & Power)	60 mins
Note	4000K

Table 1: Executive Data Summary

Test specifications:

Date of Receipt : Jul. 08, 2021

Date of Test : Jul. 12, 2021

Test item : Total Luminous Flux, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters

Reference Standard : IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

ANSI/IES TM-30-18 IES Method for Evaluating Light Source Color Rendition

TABLE OF CONTENT

SAMPLE PHOTO

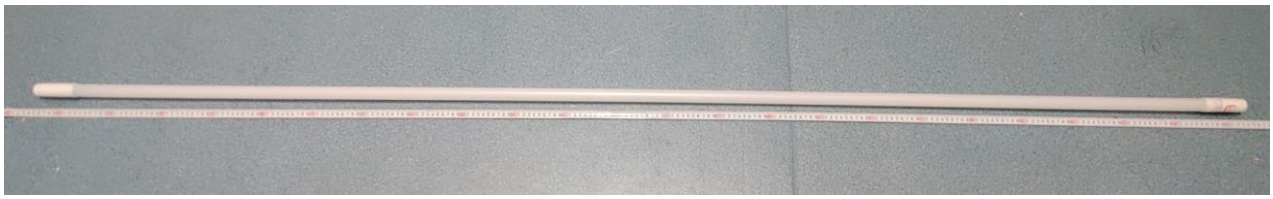


Figure 1- Overview of the sample

Equipment Under Test(EUT)	
Name	: LED Tube
Model	: T8-24-96G-FA8-840-DE-BYP
Electrical Ratings	: 120-277V, 50/60Hz, 24W
Product Description	: 4000K

TEST RESULTS

Test ambient temperature was 25.1 ℃.

Base orientation was base up. Test was conducted without a dimmer in the circuit.

The stabilization time of the sample was 60 minutes, and the total operating time including stabilization was 65 minutes.

Sphere-Spectroradiometer Method

Parameter	Result	
Test Voltage (V)	120.0	277.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.201	0.096
Power Factor	0.9801	0.9181
Test Power (W)	23.66	24.34
THD A%	18.44	19.62
Luminous Efficacy (lm/W)	149.6	147.1
Total Luminous Flux (lm)	3539.6	3579.6
Color Rendering Index (CRI)	83.3	
R9	7.5	
Correlated Color Temperature (CCT)(K)	4036	
Chromaticity Chroma x	0.3792	
Chromaticity Chroma y	0.3774	
Chromaticity Chroma u	0.2240	
Chromaticity Chroma v	0.3345	
Duv	0.0007	
Chromaticity Chroma u ’	0.2240	
Chromaticity Chroma v’	0.5017	

Special Color Rendering Indices	
R1	81.4
R2	89.4
R3	95.3
R4	82.5
R5	81.9
R6	85.6
R7	86
R8	64.3
R9	7.5
R10	75.1
R11	82
R12	65.2
R13	83.4
R14	97.7

Table 2: Test data per Sphere-Spectroradiometer Method

Note: According to CIE 1976 (u’,v’) diagram, u’ = u = 4x/(-2x+12y+3), v’ = 3v/2 = 9y/(-2x+12y+3).

Spectral Power Distribution - Sphere Spectroradiometer Method

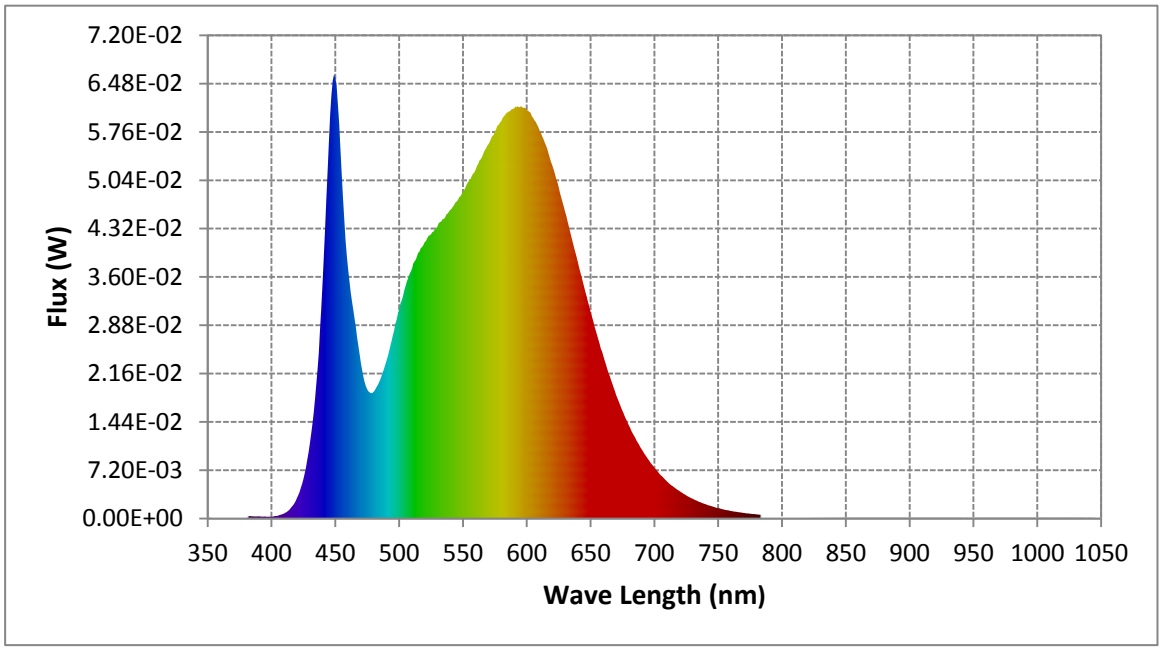
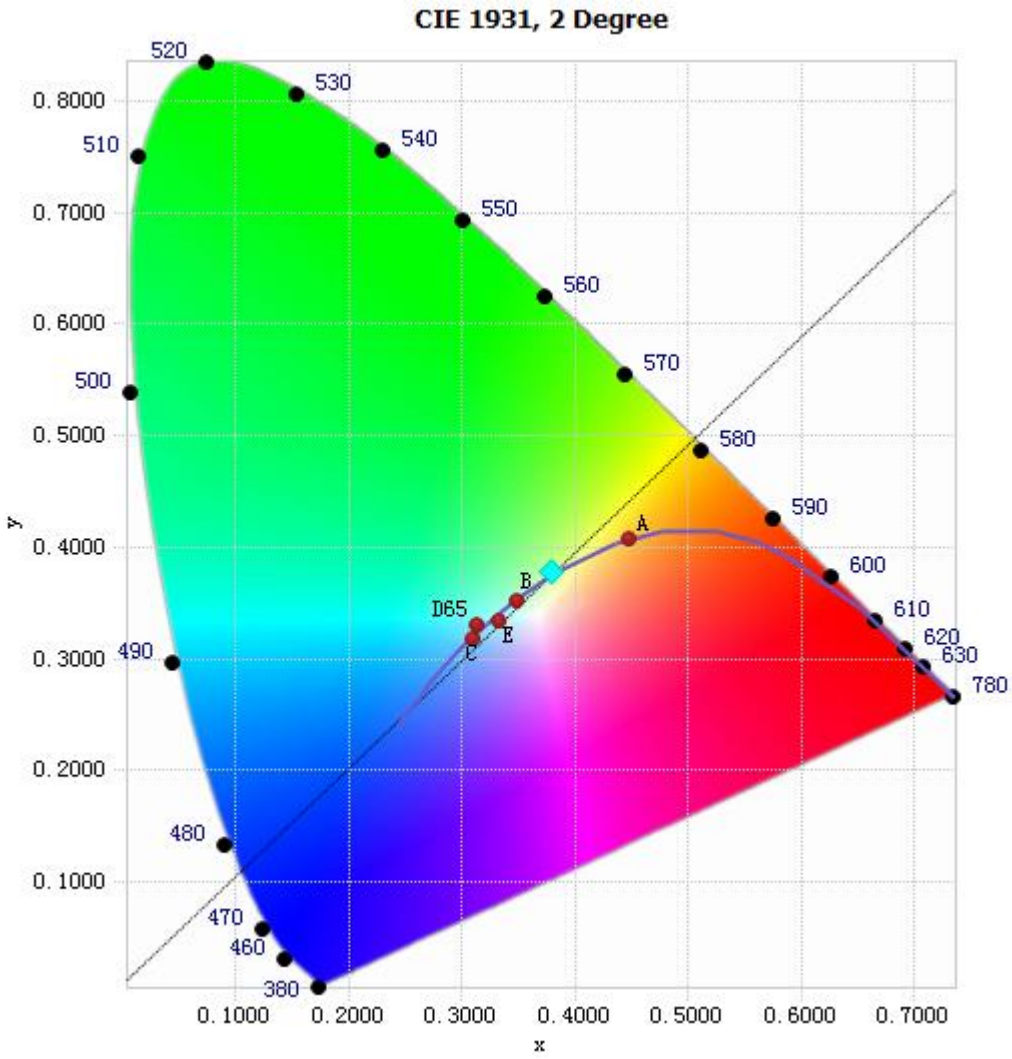


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.07E-04	485	2.06E-02	590	6.11E-02	695	8.85E-03
385	3.23E-04	490	2.34E-02	595	6.14E-02	700	7.56E-03
390	3.27E-04	495	2.72E-02	600	6.08E-02	705	6.43E-03
395	2.94E-04	500	3.12E-02	605	5.97E-02	710	5.51E-03
400	2.62E-04	505	3.46E-02	610	5.79E-02	715	4.72E-03
405	3.88E-04	510	3.72E-02	615	5.56E-02	720	4.04E-03
410	7.47E-04	515	3.96E-02	620	5.26E-02	725	3.44E-03
415	1.55E-03	520	4.12E-02	625	4.94E-02	730	2.94E-03
420	3.10E-03	525	4.24E-02	630	4.57E-02	735	2.48E-03
425	5.91E-03	530	4.35E-02	635	4.20E-02	740	2.13E-03
430	1.12E-02	535	4.46E-02	640	3.83E-02	745	1.80E-03
435	2.00E-02	540	4.60E-02	645	3.45E-02	750	1.54E-03
440	3.50E-02	545	4.72E-02	650	3.08E-02	755	1.30E-03
445	5.61E-02	550	4.88E-02	655	2.74E-02	760	1.12E-03
450	6.57E-02	555	5.04E-02	660	2.42E-02	765	9.66E-04
455	5.14E-02	560	5.20E-02	665	2.12E-02	770	8.20E-04
460	3.72E-02	565	5.39E-02	670	1.84E-02	775	7.03E-04
465	2.98E-02	570	5.58E-02	675	1.60E-02	780	6.08E-04
470	2.31E-02	575	5.76E-02	680	1.39E-02		
475	1.92E-02	580	5.92E-02	685	1.20E-02		
480	1.89E-02	585	6.05E-02	690	1.03E-02		

Table 3: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3792, 0.3774)

Chart 2: Chromaticity Diagram per Sphere - Spectroradiometer Method

Note: The location on the diagram of the tristimulus coordinates are indicated by the blue diamond.

Nominal CCT Quadrangles – Sphere Spectroradiometer Method

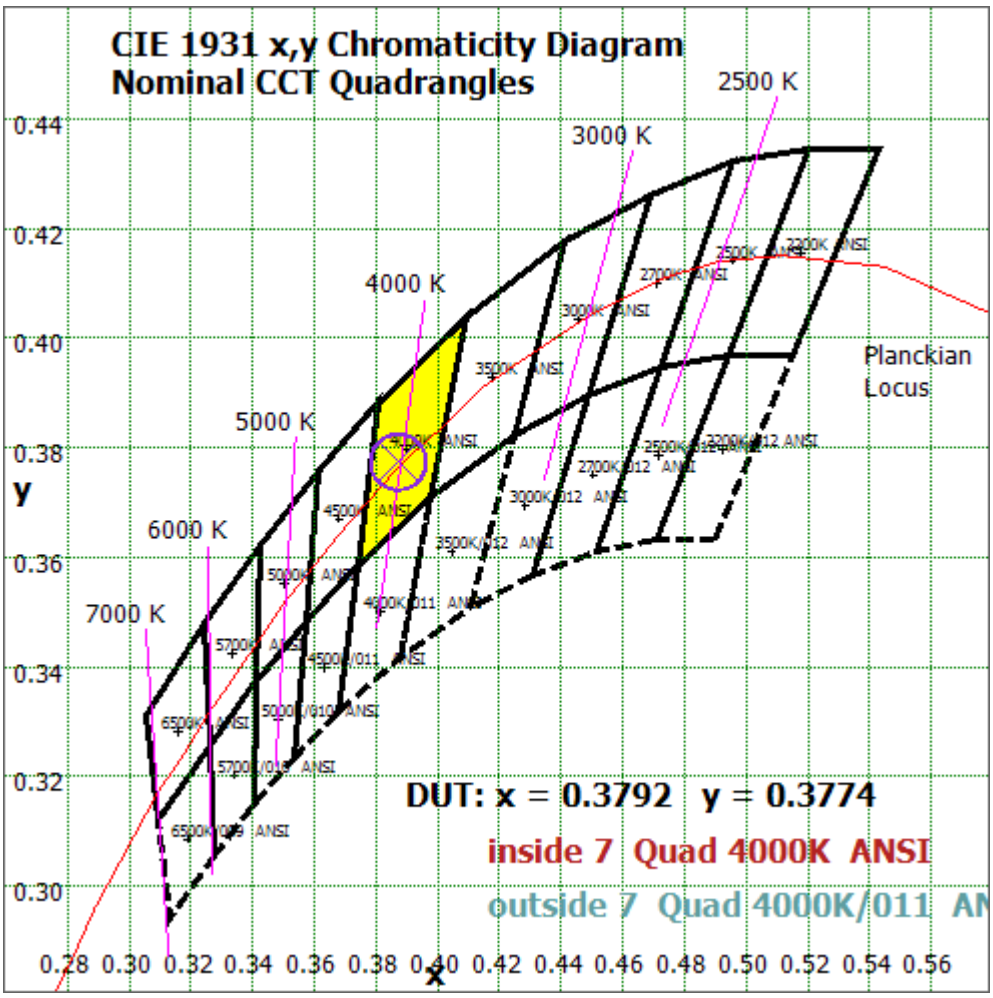


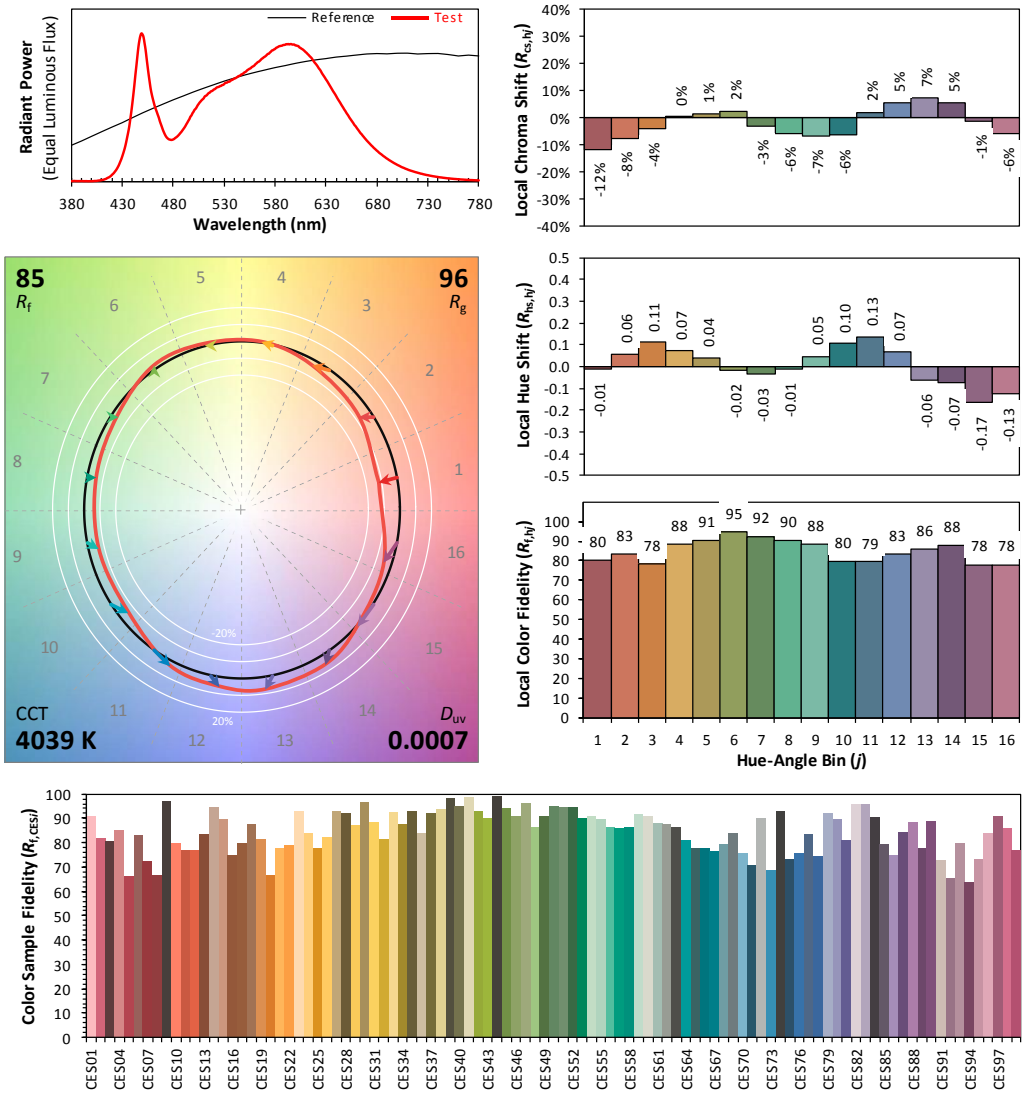
Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

ANSI/IES TM-30-18 Color Rendition Report

Source: LED **Manufacturer:** RAB Lighting Inc

Date: 2021/07/12 **Model:** T8-24-96G-FA8-840-DE-BYP



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

x	0.3792
y	0.3774
u'	0.2240
v'	0.5017

CIE 13.3-1995 (CRI)

R_a	83
R_9	8

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

Chart 4: Full Report Created with the IES TM-30 Calculator

Note: The values in this diagram might be a little different from the values in Table 2 due to rounding.

EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Integrate Sphere system	3M	HZTE015-04	Aug. 05, 2020	Aug. 04, 2021
Digital Power Meter	WT210	HZTE008-01	Aug. 05, 2020	Aug. 04, 2021
AC Power Supply	PCR 500L	HZTE001-07	Aug. 05, 2020	Aug. 04, 2021
DC Power Supply	IT6154	HZTE004-04	Aug. 05, 2020	Aug. 04, 2021
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 05, 2020	Aug. 04, 2021
Standard source	SCL-1400	HZTE012-02	Aug. 05, 2020	Aug. 04, 2021
Temperature Meter	TES1310	HZTE017-01	Aug. 05, 2020	Aug. 04, 2021

Table 4: Test Equipment List

TEST METHODS

Seasoning of SSL Product

For the purpose of rating new SSL products, SSL products shall be tested with no seasoning.
Therefore, no seasoning was performed.

Sphere-Spectroradiometer Method- Photometric and Electrical Measurements

A Labsphere Model CDS 2100 Spectroradiometer and Two Meter Sphere was used to measure correlated color temperature, chromaticity coordinates, and the color rendering index for each SSL unit. The coating reflectance of each sphere is 98%. The measure geometry is 4π. Self-absorption correction is conducted in testing. Bandwidth of spectroradiometer is 350nm-1050nm.
Ambient temperature was measured at a position inside the sphere. Each SSL unit was operated on the client provided driver at the rated input voltage in its designated orientation.
The stabilization time typically ranges from 30 min (small integrated LED lamps) to 2 or more hours for large SSL luminaires). It can be judged that stability is reached when the variation (maximum – minimum) of at least 3 readings of the light output and electrical power over a period of 30 min, taken 15 minutes apart, is less than 0.5 %.
Electrical measurements including voltage, current, and power were measured using the Yokogawa Power Analyzer.
The standard reference of the integrated sphere system is halogen incandescent lamp, the intensity distribution type is omni-directional, and is traceable to the National Institute of Standards and Technology.
The uncertainty of integrating sphere system reported in this document is expended uncertainty is 2.1% with a coverage factor k=2.

*** End of Report ***