

LM-79-08 TEST REPORT

for

Espen Technology Inc.

12257 Florence Ave. Santa Fe Springs, CA 90670

LED Tube

Model: L96T8(aa)/8XX/42G-AB

XX can be 30K, 35K, 40K, 41K, 45K, 50K for CCT.

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

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Report No.: HZ21020017a

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

Review by:



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Feb. 07, 2021



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Feb. 07, 2021

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

TEST SUMMARY

Tested Model	L96T8(aa)/830/42G-AB	L96T8(aa)/850/42G-AB
Luminous Efficacy (Lumens /Watt)	119.4	135.2
Total Luminous Flux (Lumens)	5983.9	7068.7
Power (Watts)/2	50.14	52.28
Power Factor	0.9981	0.9981
CCT (K)	2952	5041
CRI	82.9	83.1
Stabilization Time (Light & Power)	60 mins	60 mins
Note	3000K	5000K

Scaled data for family models based on tested models' data

Model	Flux(lm)	Power(W)	Efficacy(lm/W)
L96T8(aa)/830/42G-AB	5983.9	50.14	119.4
L96T8(aa)/835/42G-AB	6255.1	51.21	122.1
L96T8(aa)/840/42G-AB	6526.3	51.21	127.4
L96T8(aa)/841/42G-AB	6526.3	51.21	127.4
L96T8(aa)/845/42G-AB	6797.5	51.21	132.7
L96T8(aa)/850/42G-AB	7068.7	52.28	135.2

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Jan. 10, 2020
Date of Test	: Feb. 28, 2020
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

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SAMPLE PHOTO



Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: L96T8(aa)/830/42G-AB L96T8(aa)/850/42G-AB
Electrical Ratings	: 120-277V, 50/60Hz, 42W
Product Description	: UL Type A+B LED Tubes supplied by a high frequency fluorescent lamp ballast: B259IUNVHP-A

TEST RESULTS of Model L96T8(aa)/830/42G-AB

Test ambient temperature was 25.1 °C.

Base orientation was horizontal. 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)	0.837	0.358
Power Factor	0.9981	0.9893
Test Power (W)/2	50.14	48.98
THD A%	5.54	4.08
Luminous Efficacy (lm/W)	119.4	121.8
Total Luminous Flux (lm)	5983.9	5966.5
Color Rendering Index (CRI)	82.9	
R9	7.2	
Correlated Color Temperature (CCT)(K)	2952	
Chromaticity Chroma x	0.4385	
Chromaticity Chroma y	0.4016	
Chromaticity Chroma u	0.2526	
Chromaticity Chroma v	0.3471	
Duv	-0.0012	
Chromaticity Chroma u'	0.2526	
Chromaticity Chroma v'	0.5206	

Special Color Rendering Indices	
R1	81.6
R2	91.5
R3	95.9
R4	81.4
R5	82.2
R6	90.3
R7	82.1
R8	58.5
R9	7.2
R10	81.1
R11	81.5
R12	75.3
R13	84.1
R14	98.5

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

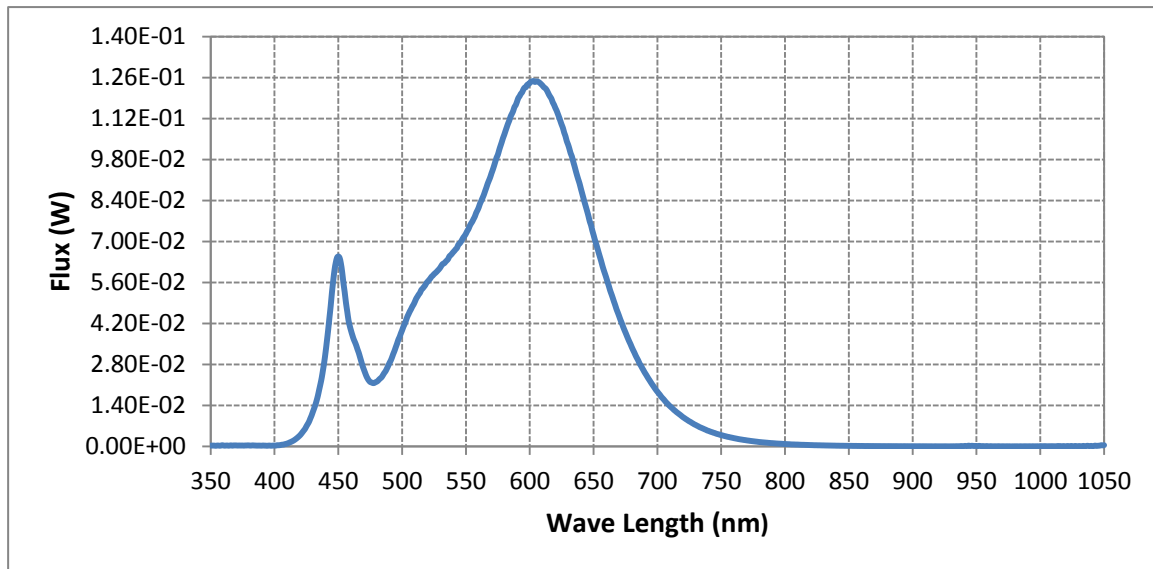
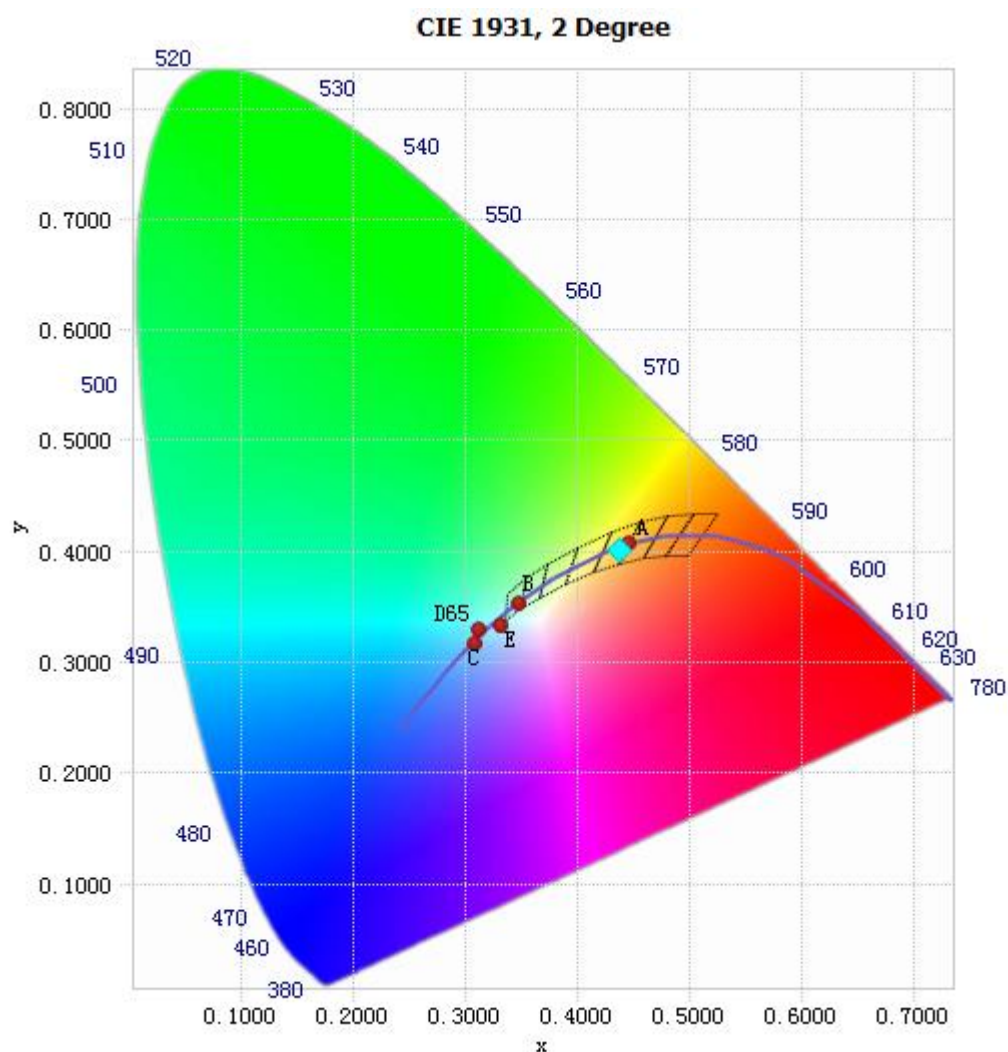


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	3.55E-04	485	2.44E-02	590	1.18E-01	695	2.18E-02
385	3.14E-04	490	2.85E-02	595	1.22E-01	700	1.87E-02
390	2.69E-04	495	3.39E-02	600	1.24E-01	705	1.61E-02
395	2.75E-04	500	3.97E-02	605	1.25E-01	710	1.37E-02
400	3.22E-04	505	4.52E-02	610	1.23E-01	715	1.17E-02
405	5.18E-04	510	4.95E-02	615	1.20E-01	720	1.00E-02
410	1.02E-03	515	5.34E-02	620	1.16E-01	725	8.59E-03
415	2.05E-03	520	5.63E-02	625	1.10E-01	730	7.35E-03
420	3.82E-03	525	5.89E-02	630	1.03E-01	735	6.26E-03
425	6.89E-03	530	6.12E-02	635	9.59E-02	740	5.33E-03
430	1.17E-02	535	6.35E-02	640	8.82E-02	745	4.57E-03
435	1.94E-02	540	6.64E-02	645	8.03E-02	750	3.87E-03
440	3.22E-02	545	6.93E-02	650	7.23E-02	755	3.31E-03
445	5.26E-02	550	7.27E-02	655	6.47E-02	760	2.84E-03
450	6.49E-02	555	7.68E-02	660	5.76E-02	765	2.43E-03
455	5.27E-02	560	8.16E-02	665	5.08E-02	770	2.08E-03
460	3.95E-02	565	8.72E-02	670	4.46E-02	775	1.78E-03
465	3.32E-02	570	9.33E-02	675	3.90E-02	780	1.52E-03
470	2.63E-02	575	9.97E-02	680	3.39E-02		
475	2.20E-02	580	1.06E-01	685	2.94E-02		
480	2.21E-02	585	1.13E-01	690	2.53E-02		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4385, 0.4016)

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

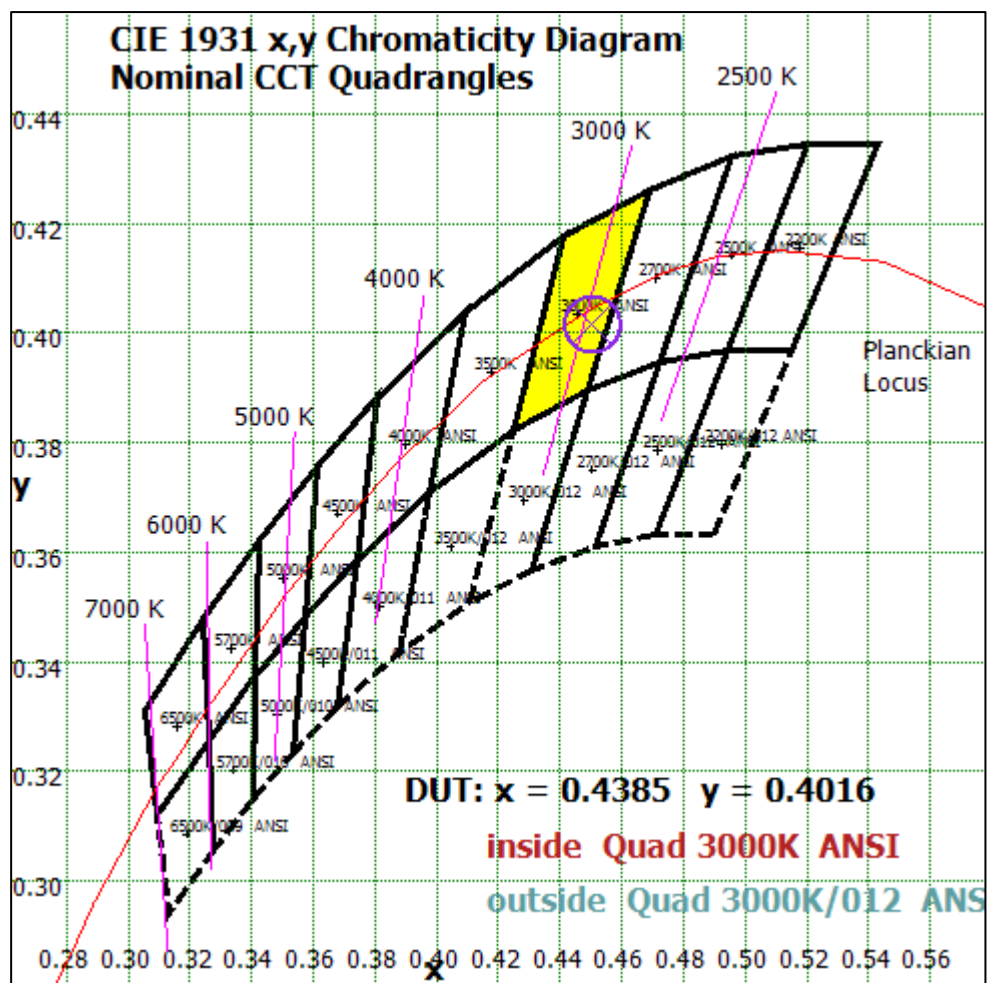
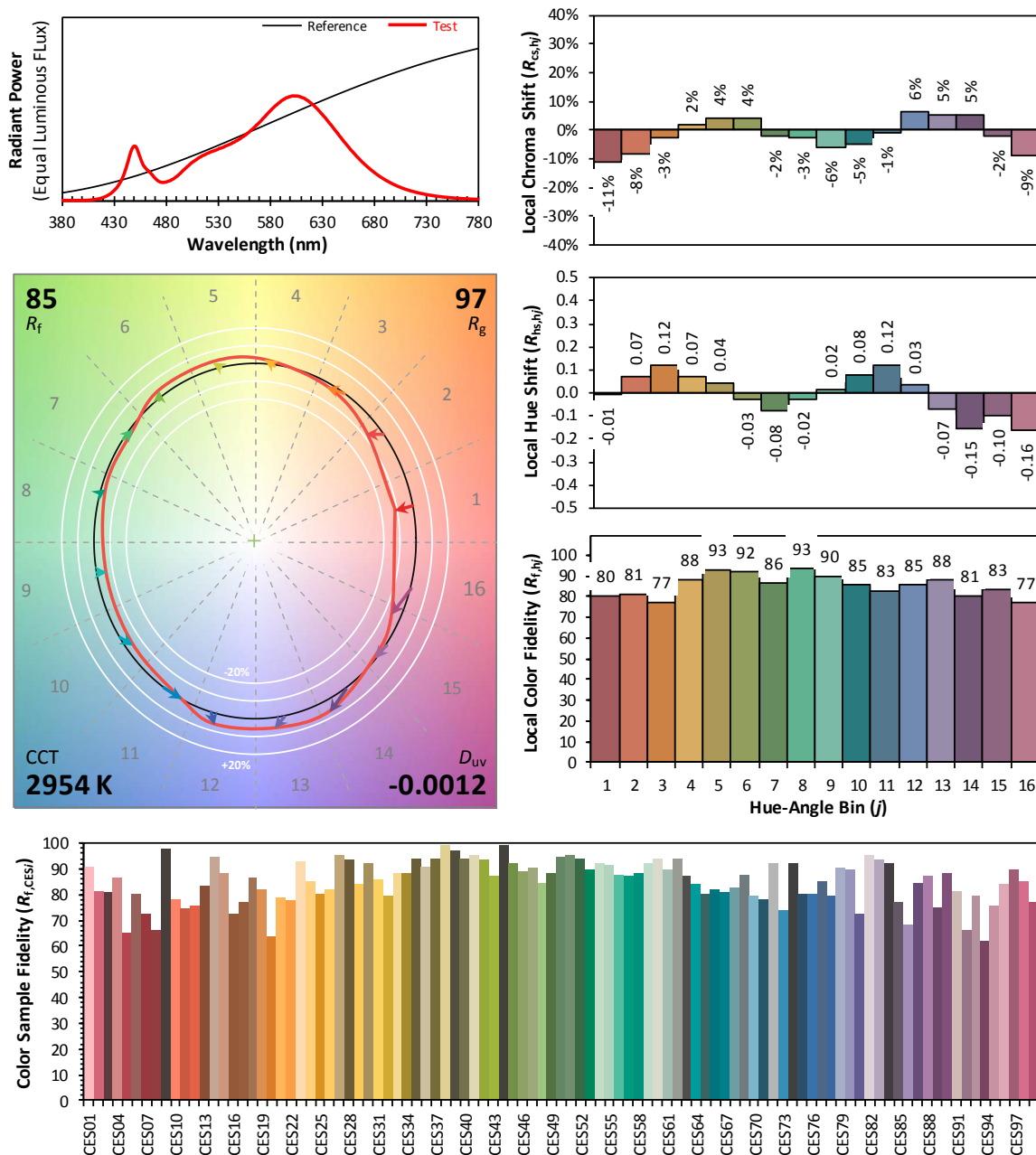


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.4385
 y 0.4016
 u' 0.2526
 v' 0.5206

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.

TEST RESULTS of Model L96T8(aa)/850/42G-AB

Test ambient temperature was 26.0 °C.

Base orientation was horizontal. 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)	0.874	0.374
Power Factor	0.9981	0.9899
Test Power (W)/2	52.28	51.32
THD A%	5.54	4.14
Luminous Efficacy (lm/W)	135.2	137.7
Total Luminous Flux (lm)	7068.7	7065.5
Color Rendering Index (CRI)	83.1	
R9	4.3	
Correlated Color Temperature (CCT)(K)	5041	
Chromaticity Chroma x	0.3445	
Chromaticity Chroma y	0.3583	
Chromaticity Chroma u	0.2084	
Chromaticity Chroma v	0.3252	
Duv	0.0036	
Chromaticity Chroma u'	0.2084	
Chromaticity Chroma v'	0.4878	

Special Color Rendering Indices	
R1	81.3
R2	90.7
R3	94.9
R4	80.4
R5	81.5
R6	86
R7	85.7
R8	64.7
R9	4.3
R10	77.1
R11	79.5
R12	61.3
R13	84.2
R14	97.7

Table 4: 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

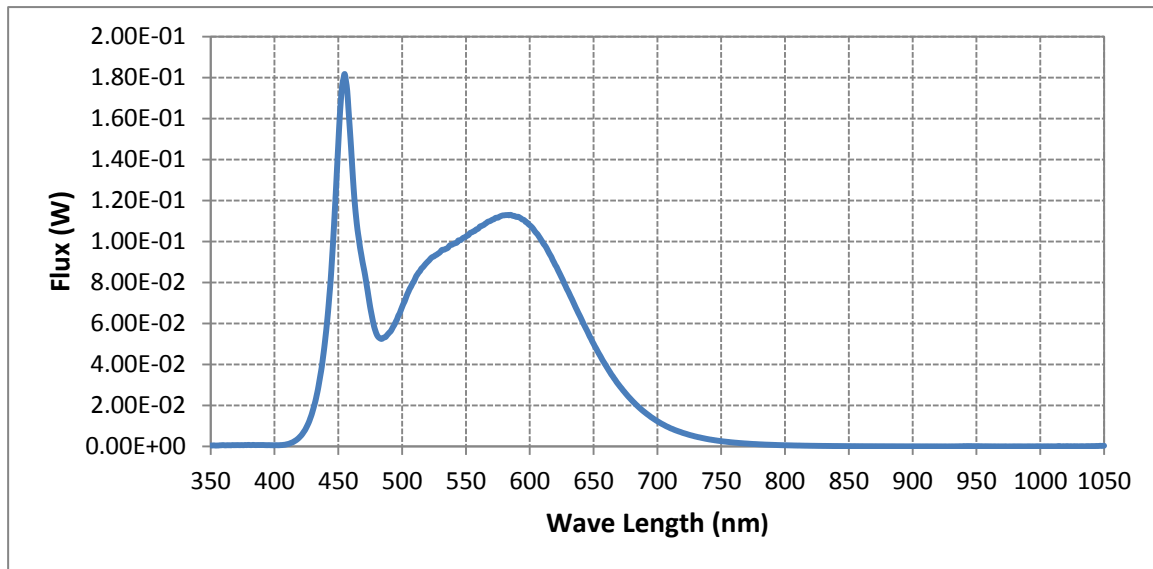
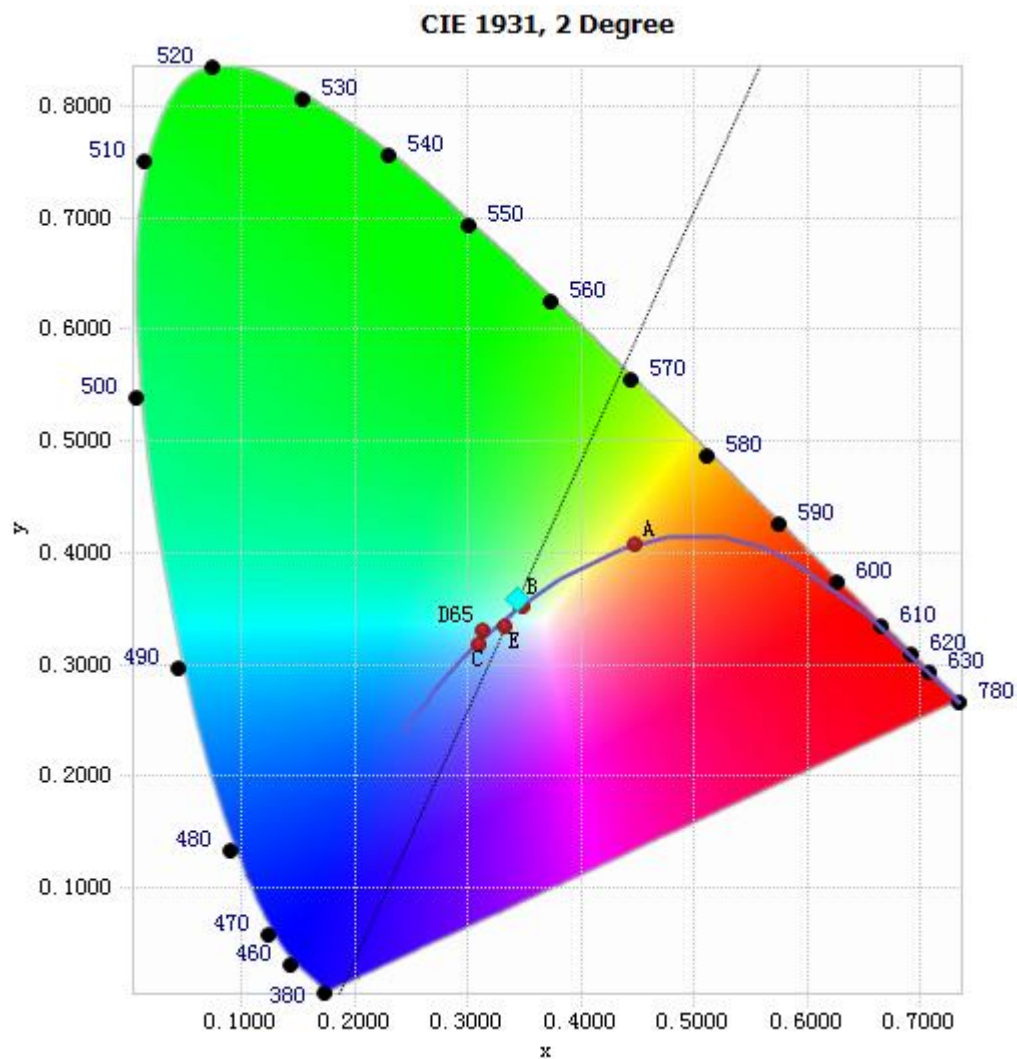


Chart 5: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	7.47E-04	485	5.29E-02	590	1.12E-01	695	1.44E-02
385	6.72E-04	490	5.56E-02	595	1.11E-01	700	1.23E-02
390	6.99E-04	495	6.08E-02	600	1.08E-01	705	1.05E-02
395	6.43E-04	500	6.81E-02	605	1.04E-01	710	8.97E-03
400	6.09E-04	505	7.56E-02	610	9.97E-02	715	7.72E-03
405	6.74E-04	510	8.16E-02	615	9.46E-02	720	6.62E-03
410	1.11E-03	515	8.67E-02	620	8.85E-02	725	5.67E-03
415	2.32E-03	520	9.01E-02	625	8.24E-02	730	4.85E-03
420	4.77E-03	525	9.28E-02	630	7.58E-02	735	4.15E-03
425	9.31E-03	530	9.50E-02	635	6.92E-02	740	3.53E-03
430	1.75E-02	535	9.66E-02	640	6.27E-02	745	3.02E-03
435	3.13E-02	540	9.88E-02	645	5.64E-02	750	2.58E-03
440	5.38E-02	545	1.01E-01	650	5.01E-02	755	2.23E-03
445	9.08E-02	550	1.02E-01	655	4.45E-02	760	1.91E-03
450	1.48E-01	555	1.05E-01	660	3.91E-02	765	1.64E-03
455	1.82E-01	560	1.07E-01	665	3.43E-02	770	1.41E-03
460	1.46E-01	565	1.09E-01	670	2.99E-02	775	1.21E-03
465	1.06E-01	570	1.10E-01	675	2.60E-02	780	1.04E-03
470	8.68E-02	575	1.12E-01	680	2.25E-02		
475	6.79E-02	580	1.13E-01	685	1.94E-02		
480	5.49E-02	585	1.13E-01	690	1.67E-02		

Table 5: Spectral Power Distribution Numerical Data per Sphere - Spectroradiometer Method

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.3445, 0.3583)

Chart 6: 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

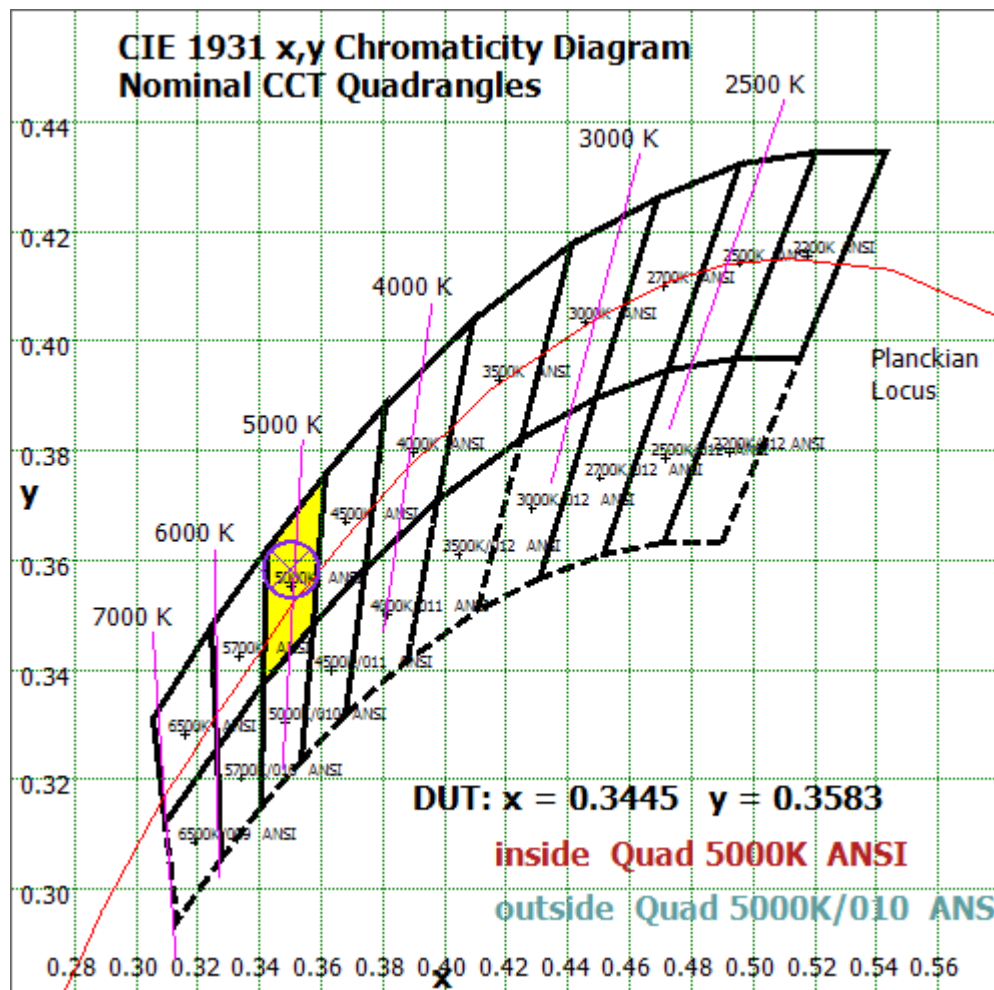
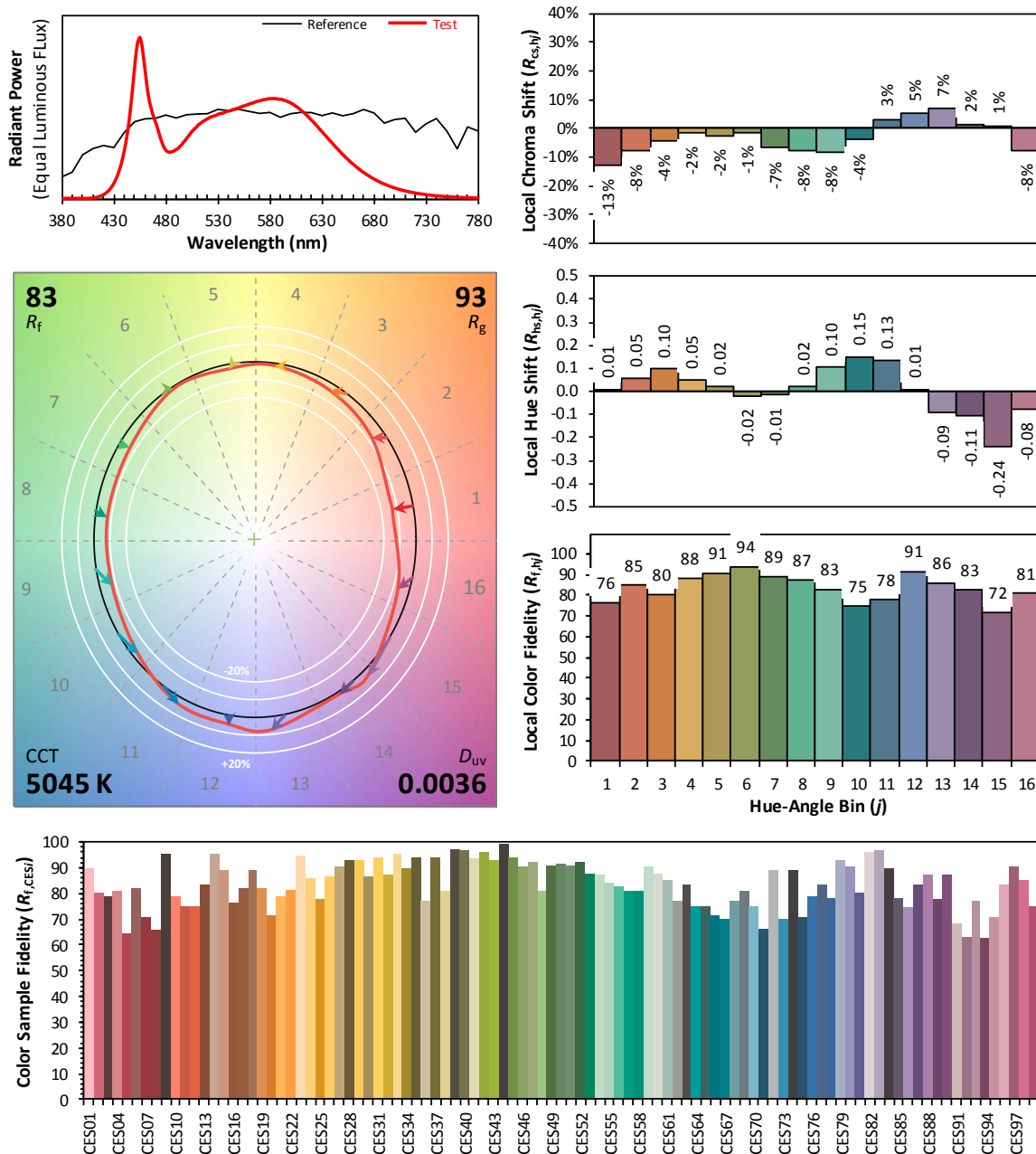


Chart 7: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method



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

x 0.3445
 y 0.3583
 u' 0.2084
 v' 0.4878

Chart 8: 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. 02, 2019	Aug. 01, 2020
Digital Power Meter	WT210	HZTE008-01	Aug. 02, 2019	Aug. 01, 2020
AC Power Supply	PCR 500L	HZTE001-07	Aug. 02, 2019	Aug. 01, 2020
DC Power Supply	IT6154	HZTE004-04	Aug. 02, 2019	Aug. 01, 2020
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 02, 2019	Aug. 01, 2020
Standard source	SCL-1400	HZTE012-02	Aug. 02, 2019	Aug. 01, 2020
Temperature Meter	TES1310	HZTE017-01	Aug. 02, 2019	Aug. 01, 2020

Table 6: 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 ***

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