



## LM-79-08 Test Report

for

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

2285 Ward Avenue Simi Valley, CA 93065

### LED TUBE

**Model: 90448\_35K, 90450\_50K**

90448 was selected as the representative model for all the measurements.

90450 is the same except CCT.

**Laboratory: Leading Testing Laboratories**

**NVLAP CODE: 200960-0**

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Report No.: HZ17090019o/R1

This report is replaced the old report No. HZ17090019o dated Oct. 13, 2017.

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

Review by:

Engineer: April Zou  
Oct. 14, 2017

Approved by:



Manager: Jim Zhang  
Oct. 14, 2017

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

## Test Summary

<b>Model</b>	<b>90448_35K</b>
<b>Luminous Efficacy (Lumens /Watt)</b>	123.0
<b>Total Luminous Flux (Lumens)</b>	3605.0
<b>Power (Watts)/4</b>	29.30
<b>Power Factor</b>	0.9974
<b>CCT (K)</b>	5084
<b>CRI</b>	83.8
<b>Stabilization Time (Light &amp; Power)</b>	60 mins
<b>Note</b>	5000K

Table 1: Executive Data Summary

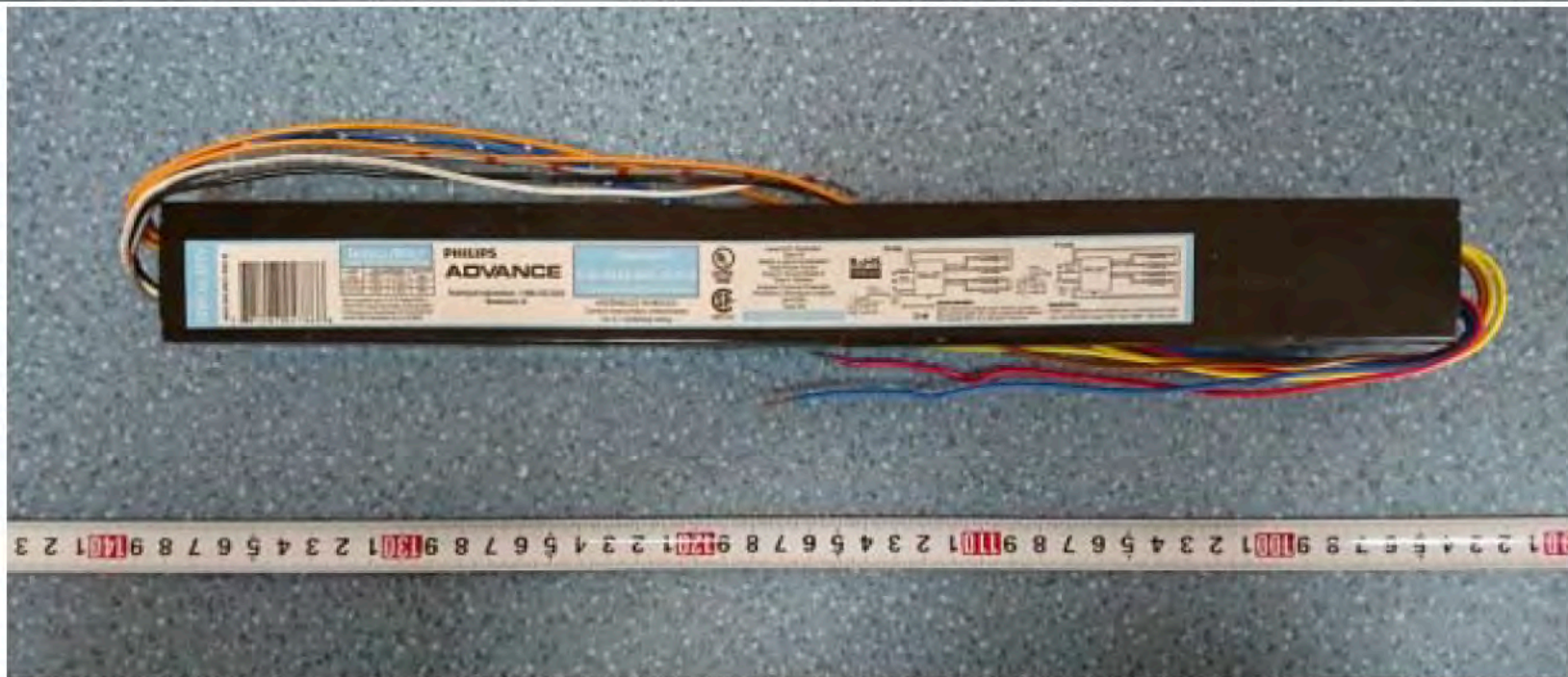
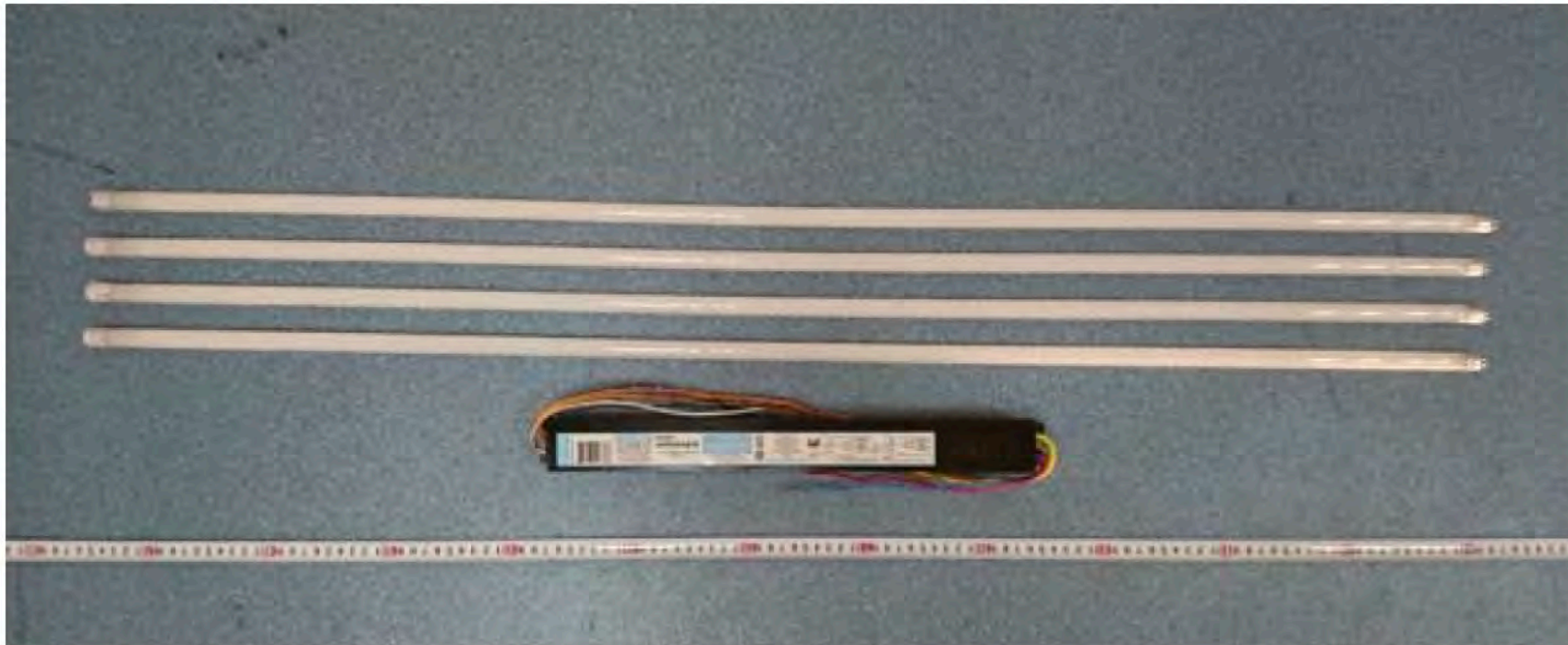
### Test specifications:

<b>Date of Receipt</b>	: Sep. 20, 2017
<b>Date of Test</b>	: Oct. 13, 2017
<b>Test item</b>	: Total Luminous Flux, Luminous Efficacy, Correlated Color Temperature, Color Rendering Index, Chromaticity Coordinate, Electrical parameters
<b>Reference Standard</b>	: IESNA LM-79-2008 Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products

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**Sample Photo**



Sample view

**Equipment Under Test (EUT)**

<b>Name</b>	: LED TUBE
<b>Model</b>	: 90448
<b>Electrical Ratings</b>	: 120-277VAC, 50/60Hz
<b>Product Description</b>	: 5000K LED Tubes supplied by a high frequency fluorescent lamp ballast: ICN-4S54-90C-2LS-G
<b>Manufacturer</b>	: P.Q.L., Inc.
<b>Address</b>	: 2285 Ward Avenue Simi Valley, CA

## TEST RESULTS

Test ambient temperature was 24.9°C.

Test orientation was Light down. Test was conducted without a dimmer in the circuit.

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

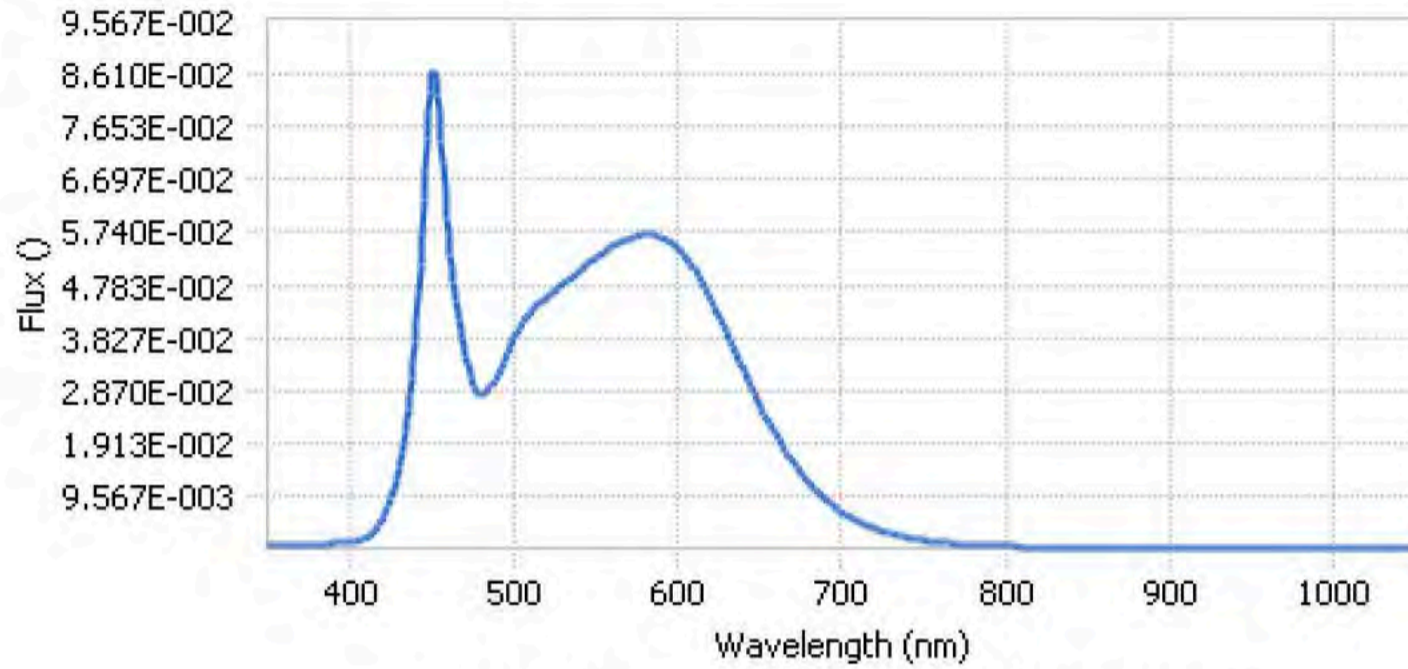
Parameter	Result	
	Test Voltage (V)	120.0
Voltage frequency (Hz)	60	60
Test Current (A)	0.979	0.433
Power Factor	0.9974	0.9778
Test Power (W)/4	29.30	29.33
THD A%	4.79	5.74
Luminous Efficacy (lm/W)	123.0	123.9
Total Luminous Flux (lm)	3605.0	3635.0
Color Rendering Index (CRI)	83.8	
R9	7.4	
Correlated Color Temperature (CCT)(K)	5084	
Chromaticity Chroma x	0.3432	
Chromaticity Chroma y	0.3561	
Chromaticity Chroma u	0.2084	
Chromaticity Chroma v	0.3244	
Duv	0.0023	
Chromaticity Chroma u'	0.2084	
Chromaticity Chroma v'	0.4865	

Special Color Rendering Indices	
R1	81.7
R2	89.8
R3	94.7
R4	82.7
R5	82.7
R6	85.6
R7	86.7
R8	66.7
R9	7.4
R10	75.7
R11	81.9
R12	66.1
R13	83.9
R14	97.4

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



s17090019b-06 T5L-IDDM14-3500-4ft-XCA-20.xml

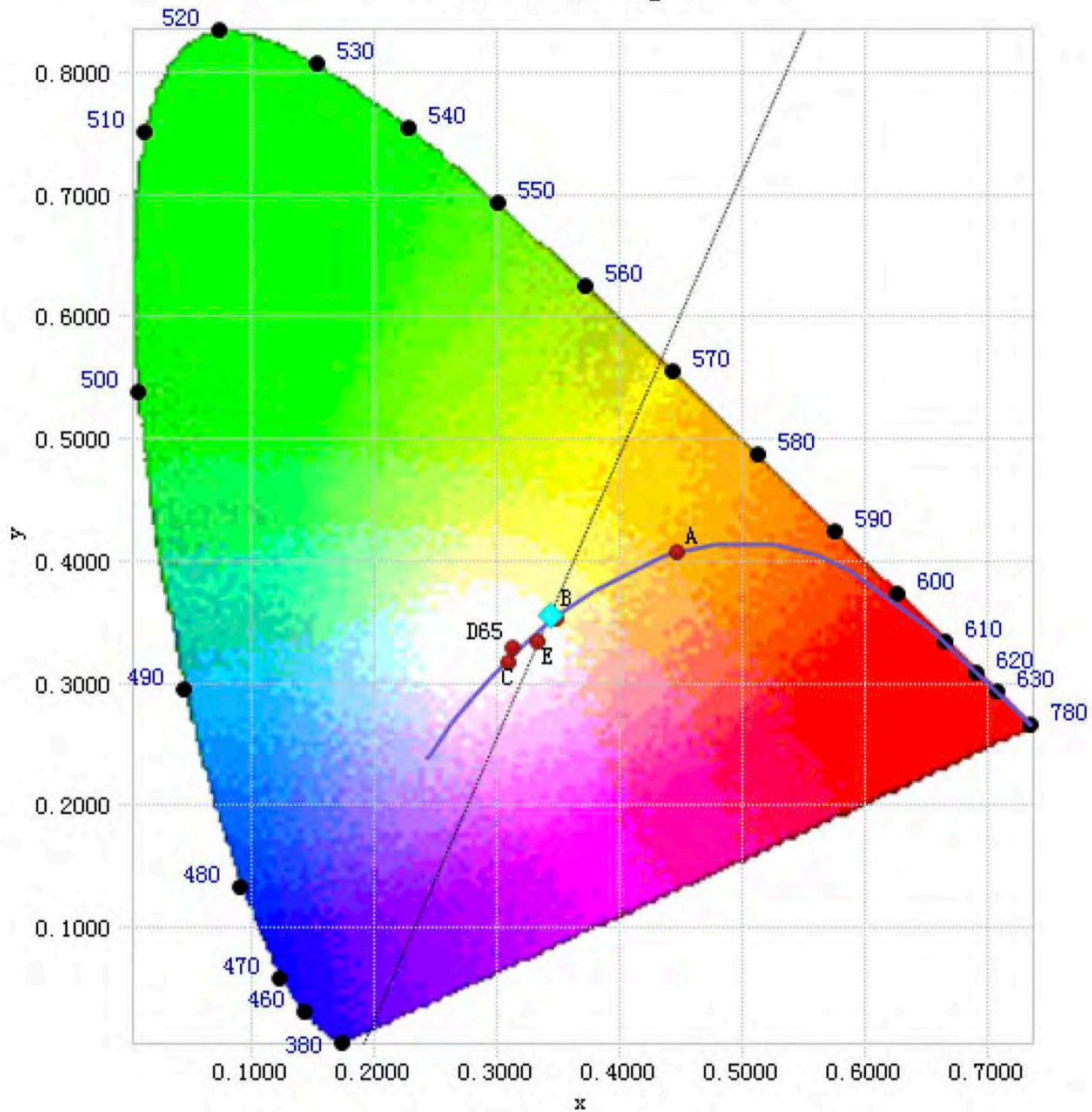
Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	8.53E-04	485	2.92E-02	590	5.64E-02	695	7.66E-03
385	8.38E-04	490	3.15E-02	595	5.56E-02	700	6.60E-03
390	8.81E-04	495	3.47E-02	600	5.46E-02	705	5.65E-03
395	9.70E-04	500	3.80E-02	605	5.29E-02	710	4.86E-03
400	1.09E-03	505	4.09E-02	610	5.07E-02	715	4.16E-03
405	1.39E-03	510	4.28E-02	615	4.82E-02	720	3.58E-03
410	1.95E-03	515	4.42E-02	620	4.52E-02	725	3.09E-03
415	3.18E-03	520	4.56E-02	625	4.22E-02	730	2.65E-03
420	5.26E-03	525	4.65E-02	630	3.90E-02	735	2.27E-03
425	8.86E-03	530	4.79E-02	635	3.56E-02	740	1.95E-03
430	1.46E-02	535	4.92E-02	640	3.24E-02	745	1.69E-03
435	2.33E-02	540	5.04E-02	645	2.91E-02	750	1.44E-03
440	3.76E-02	545	5.18E-02	650	2.61E-02	755	1.27E-03
445	6.30E-02	550	5.27E-02	655	2.31E-02	760	1.09E-03
450	8.62E-02	555	5.37E-02	660	2.04E-02	765	9.47E-04
455	7.87E-02	560	5.48E-02	665	1.80E-02	770	8.16E-04
460	5.69E-02	565	5.54E-02	670	1.57E-02	775	7.11E-04
465	4.45E-02	570	5.61E-02	675	1.36E-02	780	6.16E-04
470	3.63E-02	575	5.67E-02	680	1.19E-02		
475	2.97E-02	580	5.68E-02	685	1.03E-02		
480	2.78E-02	585	5.69E-02	690	8.91E-03		

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

### Chromaticity Diagram - Sphere Spectroradiometer Method

CIE 1931, 2 Degree



Tristimulus values(x, y) : (0.3432,0.3561)

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**

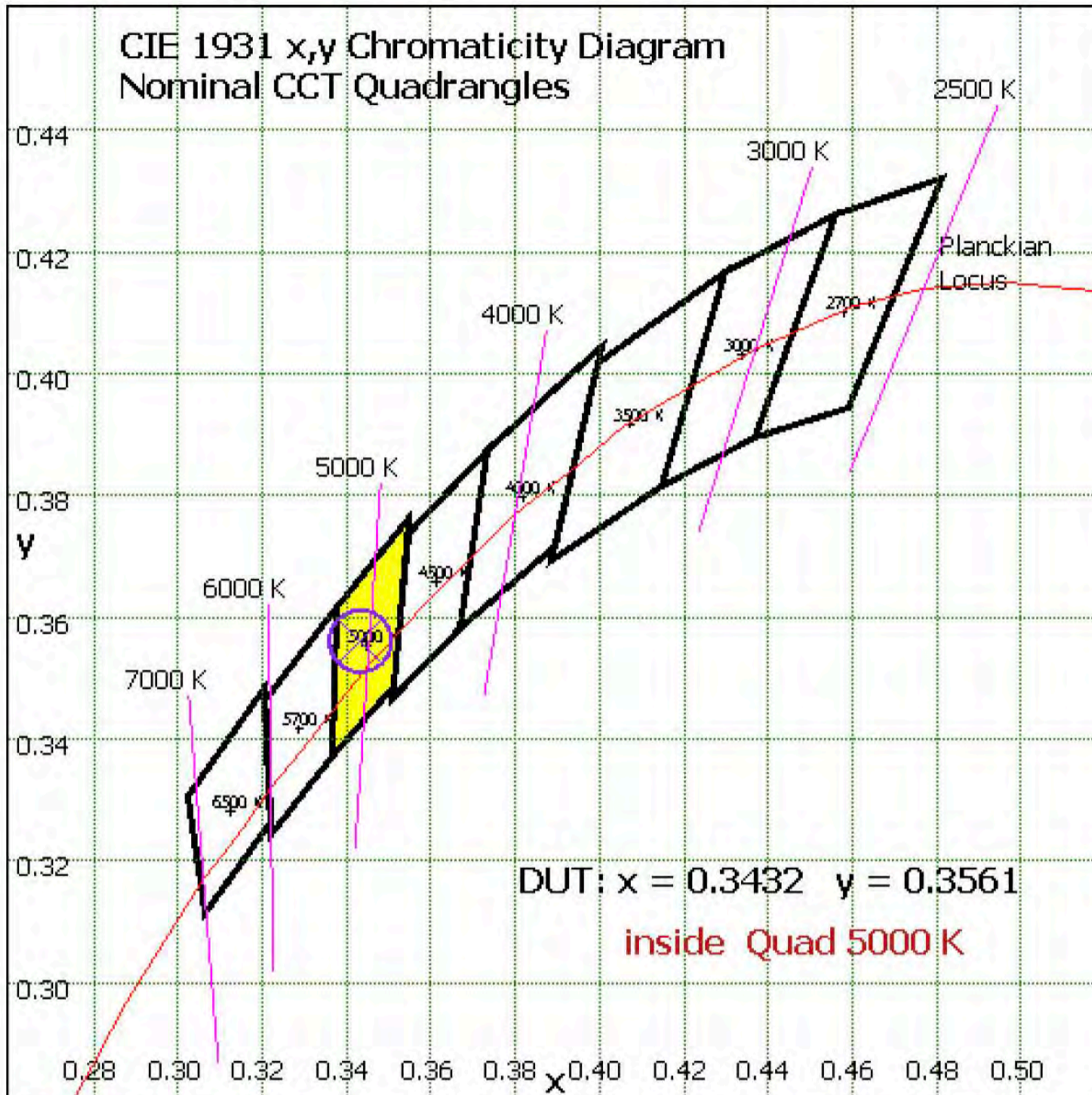


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram



## EQUIPMENT LIST

Test Equipment	Model	Equipment No.	Calibration Date	Calibration Due date
Integrate Sphere system	2M	HZTE015-01	Aug. 23, 2017	Aug. 22, 2018
Digital Power Meter	WT210	HZTE008-01	Aug. 10, 2017	Aug. 09, 2018
AC Power Supply	PCR 500L	HZTE001-07	Aug. 10, 2017	Aug. 09, 2018
DC Power Supply	IT6154	HZTE004-04	Aug. 10, 2017	Aug. 09, 2018
Temperature and humidity recorder	JR900	HZTE018-02	Aug. 16, 2017	Aug. 15, 2018
Standard source	SCL-1400	HZTE012-02	Aug. 20, 2017	Aug. 19, 2018
Temperature Meter	TES1310	HZTE017-01	Aug. 17, 2017	Aug. 16, 2018

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  $4\pi$ . 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 TUBEs) 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 expanded uncertainty is 2.1% with a coverage factor  $k=2$ .

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

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