

LM-79-08 TEST REPORT

for

RAB Lighting INC

170 Ludlow Avenue, Northvale, New Jersey 07647 USA

LED Tube

Model: T5HE-13-48G-835-DIR

Laboratory: Leading Testing Laboratories

NVLAP CODE: 200960-0

3rd Floor, Bld. 2, NO. 96 Longchuanwu Rd Qianjiang Economy Dev. Zone, YuhangDist,
Hangzhou, Zhejiang Province, China 311100

Tel: +86571 86376106

www.ledtestlab.com

Report No.: HZ20090061ac

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

Review by:



Engineer: April Zou
Oct. 26, 2020

Approved by:



Manager: Jim Zhang
Oct. 26, 2020

TEST SUMMARY

Model	T5HE-13-48G-835-DIR
Luminous Efficacy (Lumens /Watt)	135.2
Total Luminous Flux (Lumens)	1984.4
Power (Watts)/2	14.68
Power Factor	0.9927
CCT (K)	3466
CRI	84.8
Stabilization Time (Light & Power)	60 mins
Note	3500K

Table 1: Executive Data Summary

Test specifications:

Date of Receipt	: Sep. 28, 2020
Date of Test	: Oct. 22, 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

TABLE OF CONTENT

LM-79-08 TEST REPORT	1
TEST SUMMARY	2
SAMPLE PHOTO	4
TEST RESULTS	5
Sphere-Spectroradiometer Method.....	5
Spectral Power Distribution - Sphere Spectroradiometer Method	6
Chromaticity Diagram - Sphere Spectroradiometer Method.....	7
Nominal CCT Quadrangles – Sphere Spectroradiometer Method	8
Color Rendition Report – Sphere Spectroradiometer Method	9
EQUIPMENT LIST	10
TEST METHODS	10
Seasoning of SSL Product.....	10
Sphere-Spectroradiometer Method- Photometric and Electrical Measurements.....	10

SAMPLE PHOTO

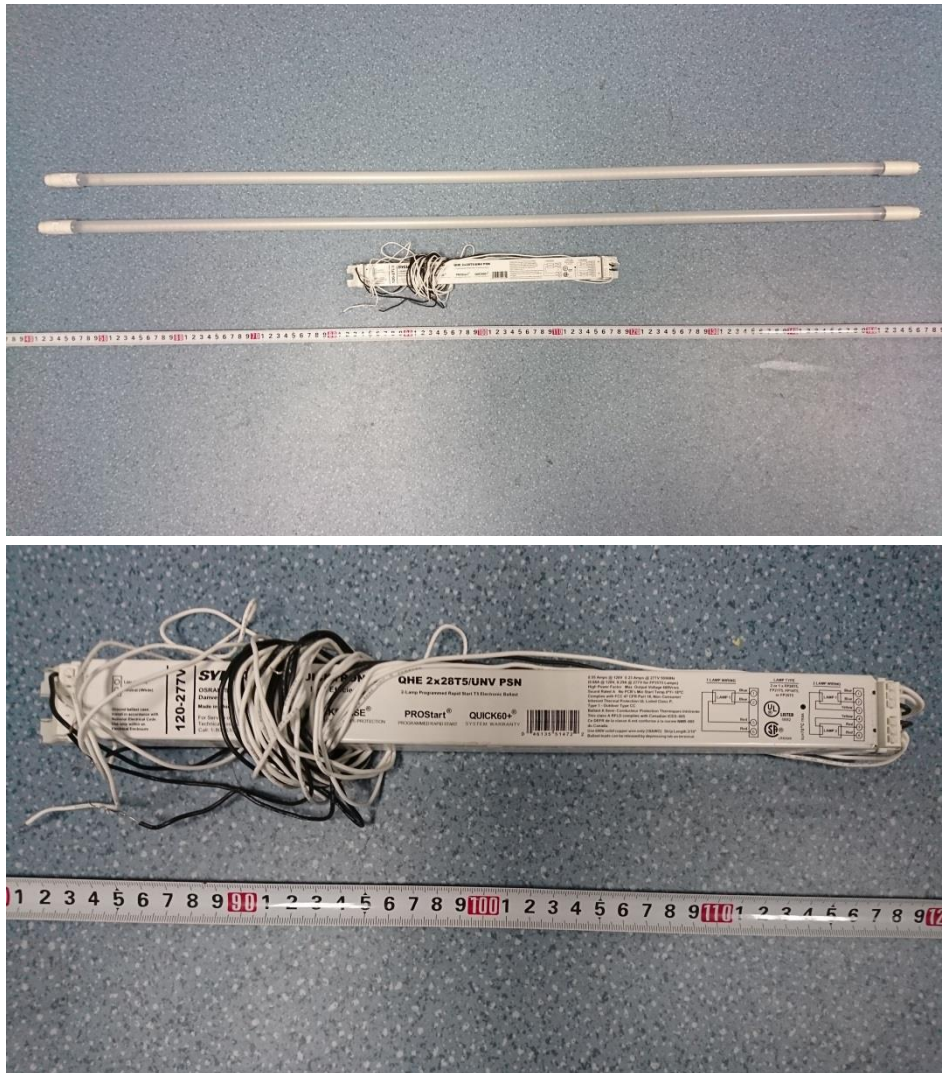


Figure 1- Overview of the sample

Equipment Under Test(EUT)

Name	: LED Tube
Model	: T5HE-13-48G-835-DIR
Electrical Ratings	: 120-277V, 50/60Hz
Product Description	: G5 base, 3500K LED Tubes supplied by a high frequency fluorescent lamp ballast: QHE 2x28T5/UNV PSN

TEST RESULTS

Test ambient temperature was 25.2 °C.

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
Voltage frequency (Hz)	60	60
Test Current (A)	0.246	0.114
Power Factor	0.9927	0.9290
Test Power (W)/2	14.68	14.69
THD A%	3.90	9.05
Luminous Efficacy (lm/W)	135.2	135.4
Total Luminous Flux (lm)	1984.4	1988.6
Color Rendering Index (CRI)	84.8	
R9	13.8	
Correlated Color Temperature (CCT)(K)	3466	
Chromaticity Chroma x	0.4058	
Chromaticity Chroma y	0.3882	
Chromaticity Chroma u	0.2371	
Chromaticity Chroma v	0.3402	
Duv	-0.0012	
Chromaticity Chroma u'	0.2371	
Chromaticity Chroma v'	0.5103	

Special Color Rendering Indices	
R1	83.9
R2	93.2
R3	95.6
R4	82.9
R5	84.4
R6	91
R7	83.9
R8	63.2
R9	13.8
R10	84
R11	82.9
R12	71.9
R13	86.5
R14	98.3

Table 2: Test data per Sphere-Spectroradiometer Method

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

Spectral Power Distribution - Sphere Spectroradiometer Method

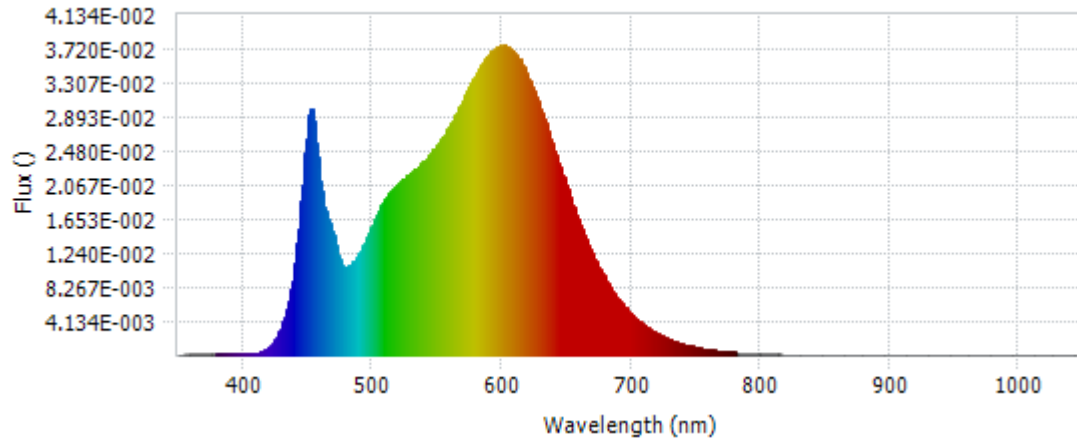
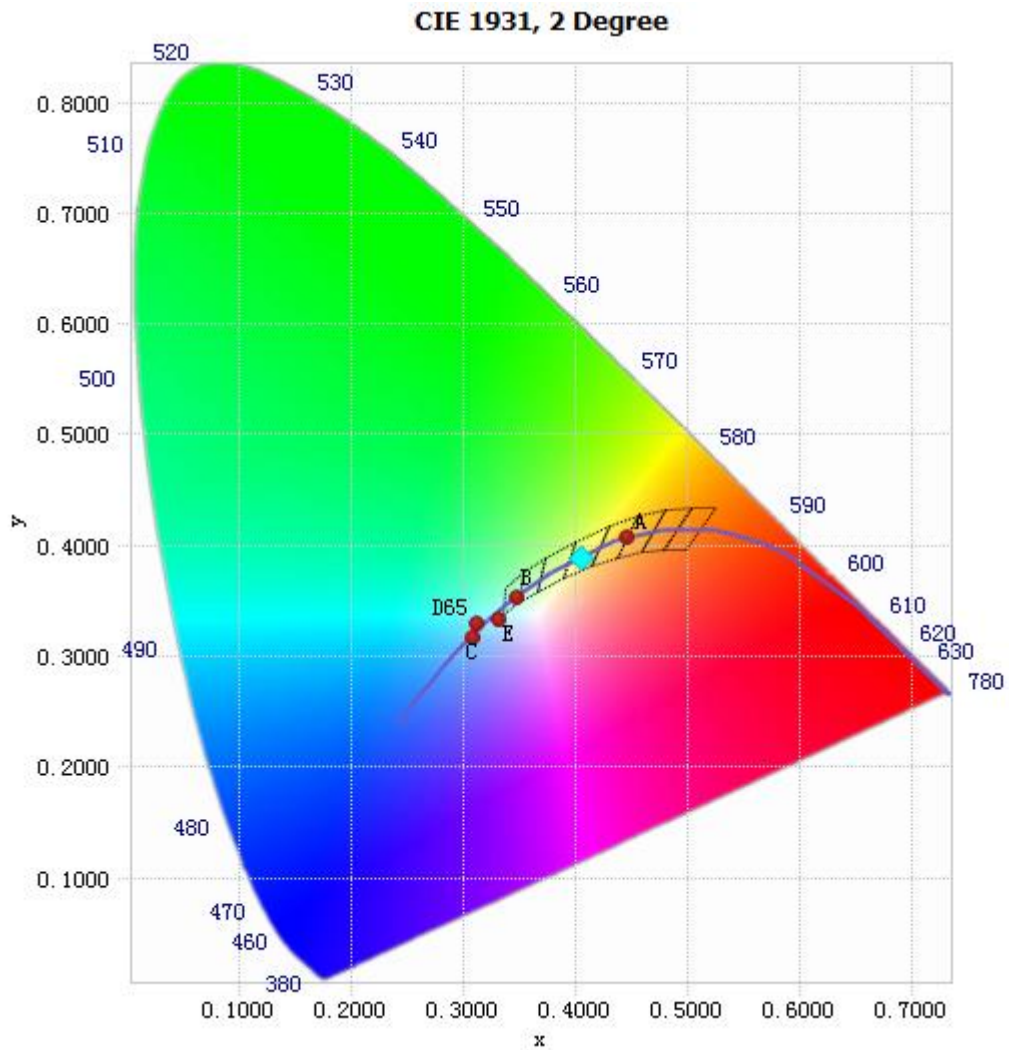


Chart 1: Spectral Power Distribution

Spectral Distribution over Visible Wavelength							
WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)	WL(nm)	Radiant(Watts)
380	1.68E-04	485	1.13E-02	590	3.65E-02	695	5.93E-03
385	1.60E-04	490	1.25E-02	595	3.72E-02	700	5.06E-03
390	1.60E-04	495	1.41E-02	600	3.76E-02	705	4.30E-03
395	1.48E-04	500	1.59E-02	605	3.74E-02	710	3.66E-03
400	1.44E-04	505	1.76E-02	610	3.67E-02	715	3.13E-03
405	1.72E-04	510	1.89E-02	615	3.56E-02	720	2.66E-03
410	2.79E-04	515	2.00E-02	620	3.40E-02	725	2.26E-03
415	5.30E-04	520	2.09E-02	625	3.21E-02	730	1.92E-03
420	1.02E-03	525	2.15E-02	630	3.00E-02	735	1.63E-03
425	1.93E-03	530	2.22E-02	635	2.77E-02	740	1.38E-03
430	3.59E-03	535	2.29E-02	640	2.54E-02	745	1.17E-03
435	6.46E-03	540	2.36E-02	645	2.29E-02	750	9.92E-04
440	1.11E-02	545	2.44E-02	650	2.06E-02	755	8.46E-04
445	1.88E-02	550	2.55E-02	655	1.83E-02	760	7.20E-04
450	2.79E-02	555	2.66E-02	660	1.62E-02	765	6.10E-04
455	2.86E-02	560	2.79E-02	665	1.42E-02	770	5.20E-04
460	2.11E-02	565	2.94E-02	670	1.24E-02	775	4.50E-04
465	1.70E-02	570	3.10E-02	675	1.08E-02	780	3.80E-04
470	1.45E-02	575	3.26E-02	680	9.36E-03		
475	1.17E-02	580	3.41E-02	685	8.06E-03		
480	1.07E-02	585	3.56E-02	690	6.92E-03		

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

Chromaticity Diagram - Sphere Spectroradiometer Method



Tristimulus values(x, y): (0.4058, 0.3882)

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

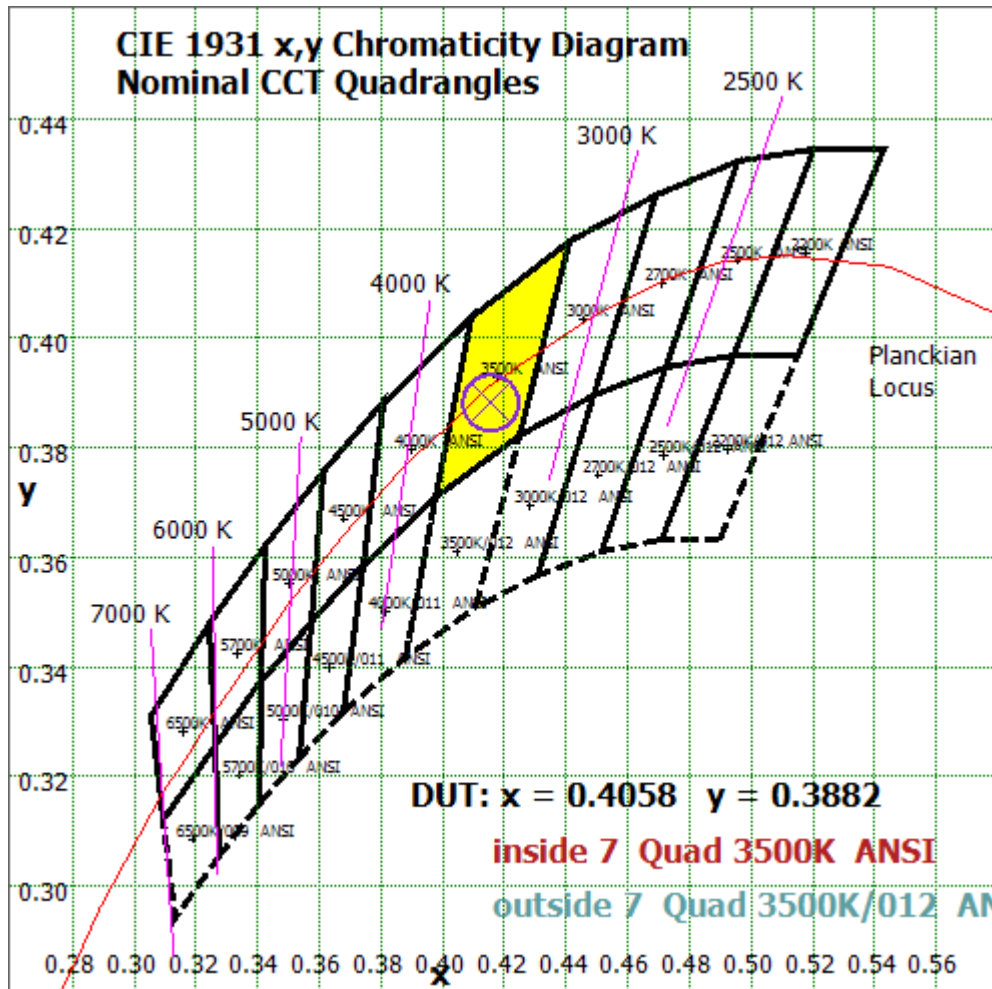


Chart 3: Plot of Lamp x/y coordinates on CIE 1931 Chromaticity Diagram

Color Rendition Report – Sphere Spectroradiometer Method

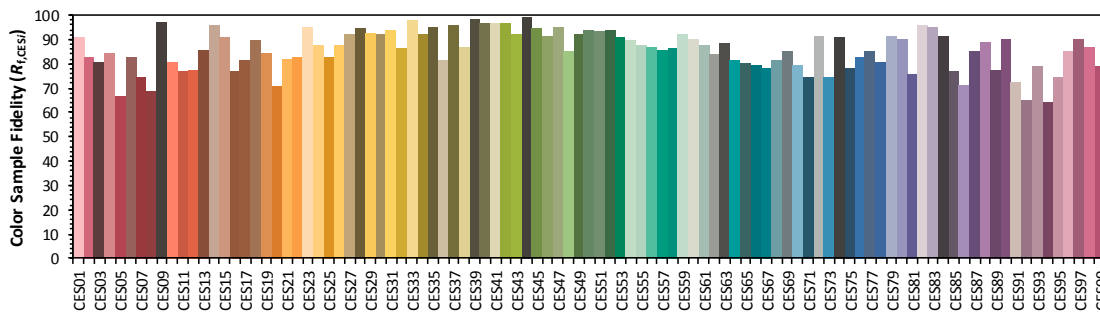
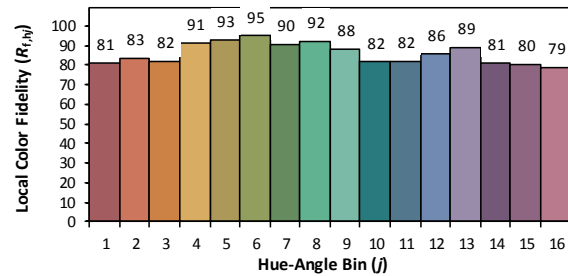
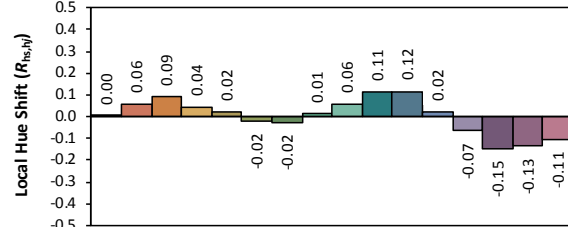
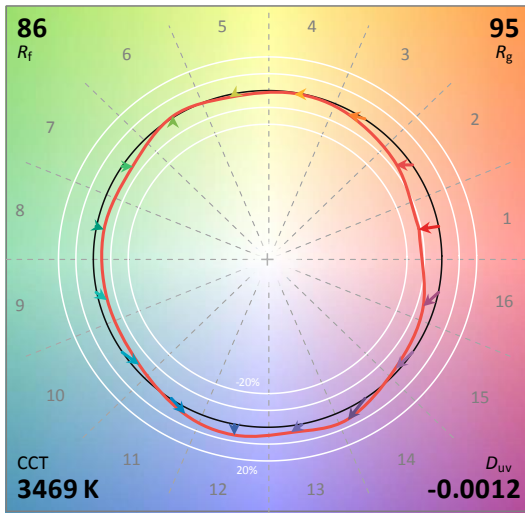
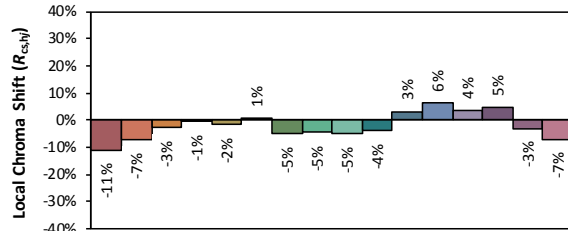
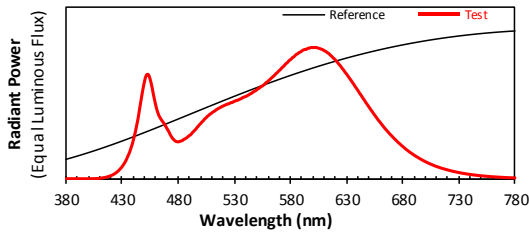
ANSI/IES TM-30-18 Color Rendition Report

Source: LED

Manufacturer: RAB Lighting INC

Date: 2020/10/22

Model: T5HE-13-48G-835-DIR



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

x 0.4058
 y 0.3882
 u' 0.2371
 v' 0.5103

CIE 13.3-1995 (CRI)	
R_a	85
R_g	14

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 expanded uncertainty is 2.1% with a coverage factor $k=2$.

*** End of Report ***

This report is considered invalidated without the Special Seal for Inspection of the LTL. This report shall not be altered, increased or deleted. The results shown in this test report refer only to the sample(s) tested. Without written approval of LTL, this test report shall not be copied except in full and published as advertisement.