



# Scientific Grade CCD Spectroradiometer & Integrating Sphere Test System LPCE-2(LMS-9500)

## Brochure

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**Leader in Lighting & Electrical Test Instruments**

Rev. 1/29/2022



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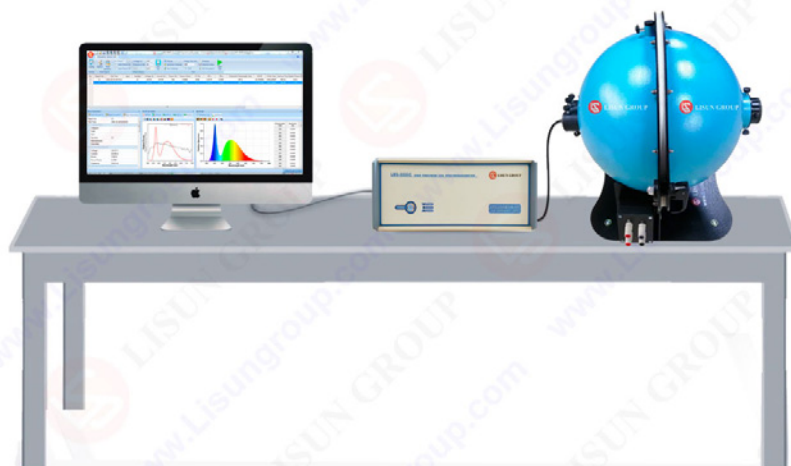
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**Note: 1. If you need to test the single LED or LED Chip, you should choose the items which marked by **Blue**.**

**2. Already include the upgradeable & free software which can run in Win7, 8, 10 and 11 (USB driver was register by Microsoft, it can install directly).**

## 1、 Scientific Grade CCD Spectroradiometer

LMS-9500 Scientific Grade High Accuracy CCD Array Color Spectroradiometer fully meets Energy Star IESNA LM-79 and GB/T24824 standards etc. It can test CFL, HID, Promise Light, Tungsten Halogen Lamps, which can reach the scientific grade measurement accuracy. LMS-9500 is composed of Concave Average Diffraction Grating and Scientific Grade CCD, and it uses unique stray light control technology, wide dynamic linear technology, precision CCD electronic drive technology and complex matrix software technology. The instrument is traceable to the Chinese National Institute of Metrology(NIM) and the USA NIST standards.



### Standard:

Fully meet GB/T-5702, GB/T-7922, GB/T-20145, GB/T-24824  
CIE 177, CIE84, CIE-13.3, IES LM-79-19 and IES LM-79-08

### Specification:

- CCD detector: Hamamatsu TE-cooled (Temp:  $-10^{\circ}\text{C} \pm 0.05^{\circ}\text{C}$ ) high sensitivity back-thinned detector
- Spectral wavelength accuracy:  $\pm 0.2\text{nm}$ , Resolution:  $\pm 0.1\text{nm}$ , Sample scanning steps:  $\pm 0.1\text{nm}$
- Accuracy of chromaticity coordinate ( $\Delta x$ ,  $\Delta y$ ):  $\pm 0.0015$  (Standard A Lamp)
- Correlated color temperature CCT: 1, 500K~100, 000K, CCT accuracy:  $\pm 0.2\%$
- Color rendering index range: 0~100.0, Accuracy:  $\pm(0.3\%rd \pm 0.3)$
- Photometric linear:  $\pm 0.2\%$ , Stray light  $< 0.015\%$ (600nm) and  $< 0.03\%$  (435nm)
- Integration time: 0.1ms-60s
- Flux testing method: spectrum, photometric and spectrum with photometric revision

LI SUN Model	LMS-9500C	LMS-9500CUV-VIS	LMS-9500CVIS-NIR
Wavelength	350-800nm	200-800nm	350-1050nm

P.S. If the UV Accuracy Test, please go here learn more: [LPCE-2\(LMS-9000CUV\)](#)

## 2、 Optical Fiber



The optical fiber is used to connect the integrating sphere with spectroradiometer.

LISUN Model	CFO-1.5M	CFS-1.5M
Products Name	1.5m Optical Fiber	1.5m Silica Optical Fiber
Work in Wavelength	350-1050nm	200-1050nm

P.S. The 2m or 3m length optical fiber can be design according to customers' request.

## 3、 Digital CC and CV DC Power Supply

The DC Series Power Supplies are with high stability and high accuracy. The voltage and current can be adjustable and simple operation. They are suitable to supply DC Power for the standard lamps.



### Specifications:

- Accuracy of Voltage and Current:  $\pm(0.02 \text{ Reading} + 0.01\% \text{ Range} + 1 \text{ Digit})$
- Stability of Output Voltage/Current:  $\pm 0.01\% \text{ Reading}/3\text{min}$
- Digital control for Constant Current output or Constant Voltage output
- Communicate with PC via software, the Voltage & Current set by the software and Power Output can be remote controlled.

Model	DC3005	DC3010	DC6005	DC6010	DC12005
U Range	0.0005-30.000V	0.0005-30.000V	0.0005-60.000V	0.0005-60.000V	0.0001-120.00V
I Range	0.0005-5.0000A	0.0005-10.000A	0.0005-5.0000A	0.0005-10.000A	0.0005-5.0000A

### 4、 Digital Power Meter



LISUN Model	Measure	Remark
LS2012	U(AC&DC), I(AC&DC), P(AC&DC), Power Factor PF(AC)	Digital Tube display
LS2050B	U(AC&DC), I(AC&DC), P(AC&DC), Power Factor PF(AC), Displacement Factor DF(AC) and Total 0-50 Harmonic in IEC/CSA	Test Accuracy is Class 0.5 with LCD touch screen display, it has special Software can be run in Win7, Win8 or Win10
LS2050C	U(AC&DC), I(AC&DC), P(AC&DC), Power Factor PF(AC), Displacement Factor DF(AC) and Total 0-50 Harmonic in IEC/CSA	Test Accuracy is Class 0.2 with LCD touch screen display, it has special Software can be run in Win7, Win8 or Win10

P.S. The LS2050C is fully meet LM-79-19 requirements and the frequency Range: 0.5Hz-100kHz

### 5、 AC Power Source



- AC-DC-AC frequency conversion technology, Controlled & tested by 16 bits MCU
- Protection for over hot, thundering voltage and current
- Total voltage distortion:  $\leq 0.6\%$ ; Voltage stability:  $\leq 0.1\%/30\text{min}$
- Load adjust rate:  $\leq 0.1\%$ ; Frequency stability:  $\leq 0.05\%/30\text{min}$
- Output voltage range: AC 0.0~300.0V, Output Frequency Range: 45~70Hz, 100Hz, 200Hz and 400Hz
- Input Power: 220V and 50/60Hz



- Communicate with PC via software, the Voltage & Current set by the software and Power Output can be remote controlled.

P.S. LSP-500VARC and LSP-1KVARC are the update version with big LCD screen.

LISUN Model	Output Power	Specification
LSP-500VARC (with Trigger Function)	500VA	0~150V is 4.2A and 150~300V is 2.1A
LSP-500VARC-Pst (IEC-Pst AC Source Generator)		
LSP-1KVARC (with Trigger Function)	1KVA	0~150V is 8.4A and 150~300V is 4.2A
LSP-1KVARC-Pst (IEC-Pst AC Source Generator)		

The LSP-500VARC-Pst and LSP-1KVARC-Pst are according to IEC TR 61547-1:2020 IEC61000-3-3, IEC 61000-4-15 and IEEE 1453 Pst programmable function as below:

**Table 1 – Voltage fluctuations – Test specification of voltage fluctuations applied at input AC mains 120/230 V and 50/60 Hz**

Rectangular amplitude modulations with duty cycle of 50 % <sup>a c d f</sup>					
Voltage changes per minute cpm	Modulation frequency $f_m$ Hz	Relative voltage fluctuation			
		$d = \Delta U/U$ %			
		120 V 50 Hz	120 V 60 Hz	230 V 50 Hz	230 V 60 Hz
39	0,325 0	1,045	1,040	0,894	0,895
110	0,916 7	0,844	0,844	0,722	0,723
1 056	8,8	0,353 b	0,353 b	0,275 b	0,275 b
1 620	13,5	0,545	0,548	0,407	0,409
4 000	33 1/3 <sup>e</sup>	3,426	Test not required	2,343	Test not required
4 800	40,0 <sup>e</sup>	Test not required	4,837	Test not required	3,263

<sup>a</sup> See Table 5 of IEC 61000-4-15:2010 and Table D1 of IEC 61000-3-3:2013.

<sup>b</sup> See Tables 2a and 2b of IEC 61000-4-15:2010 for  $R_{inst} = 1$ ; the values of  $d = 0,252\%$  and  $d = 0,196\%$  are increased to respectively  $0,353\%$  and  $0,275\%$  to give  $I_{st}^{LM}(1) = 1$ .

<sup>c</sup> The duration of the voltage fluctuation and recording of the illuminance is recommended to be a minimum of 180 s (60 s for the transient response of the flickermeter's filters and 120 s for the duration of the statistical evaluation of the flicker level in block d, see A.2.5). First of all, the transient response of the light flickermeter's filters should be considered, which is dominated by the illuminance adapter (block a, see A.2.2). The time constant of this filter is set at 10 s, reaching the 90 % of the value corresponding to the steady state response at approximately 50 s. In addition, the evaluation period should contain an integer number of voltage fluctuation periods. For the set of test modulation frequencies given in this table, the minimum duration to achieve an integer number of voltage fluctuation periods in all the test cases is 120 s.

<sup>d</sup> Recommended absolute tolerance for the duty cycle is  $\pm 2$  pp, for the modulation frequency the recommended tolerance is  $\pm 1\%$  and for the relative voltage fluctuation the recommended tolerance is  $\pm 5\%$ .

<sup>e</sup> The 33 1/3 Hz and 40 Hz modulation frequencies should be synchronous with the supply frequency of respectively 50 Hz and 60 Hz with a fixed phase angle as defined by Equation (1).

<sup>f</sup> The light flicker specifications in this document are expanded such that it is aligned with the voltage flicker specifications given in IEC 61000-4-15, which is limited to 120 V and 230 V, 50 Hz and 60 Hz. No voltage fluctuation tests are available yet for 100 V, 200 V and 277 V. However, in practice the test specifications given in this table for 120 V and 230 V can be applied for 100 V and 200/277 V respectively for indicative purposes.

LSP-500VARC-Pst or LSP-1KVARC-Pst can work with LISUN LSRF-3 to do Flicker dynamic Pst LM(I) test in IEC TR 61547-1:2020

## 6、 New Design Integrating Sphere

Due to the LED luminaires such as LED street luminaires developed, to do 4π geometry testing, it is hard to be hold in the traditional integrating sphere design. To solve this problem, LISUN design a new kind of sphere.



### A Molding Integrating Sphere VS the traditional Integrating Sphere

LISUN new Integrating sphere has the following advantages:

- The hold base can bear max 20kg, it can test all kinds of luminaires and light source such as E27/E40, all tubes such as T5/T8/T12 and all kinds of luminaires
- The hold base can be installed in the ceiling or down, height can be adjustable
- The test hold base has four power cables connect to the outside Power Supply and max is 5KW
- Build-in Cross laser system which help to install the standard lamp and testing lamp in the centre of the integrating sphere



### Build-in Cross Laser System

#### Specification:

- Diameter: 0.3m, 0.5m, 1.0m, 1.5m, 1.75m, 2.0m, 2.5m and 3.0m
- The painting of integrating spheres is according to CIE Pub.No.84(1989)
- BaSO<sub>4</sub> coating:  $\rho(\lambda) \geq 0.96(450\text{nm} \sim 800\text{nm})$  and  $\rho(\lambda) \geq 0.92(380\text{nm} \sim 450\text{nm})$
- Fine diffuse reflection: Reflectance  $\rho \approx 0.8$  and accuracy of  $\rho(\lambda) < 1.5\%$

**Order Number:**

<b>Sphere Diameter</b>	1.0m	1.5m	1.75m	2m
<b>LISUN Model</b>	IS-1.0MA	IS-1.5MA	IS-1.75MA	IS-2.0MA
<b>Cycle side opening</b>	IS-1.0MA33C	IS-1.5MA55C	IS-1.75MA66C	IS-2.0MA77C

**Remark:**

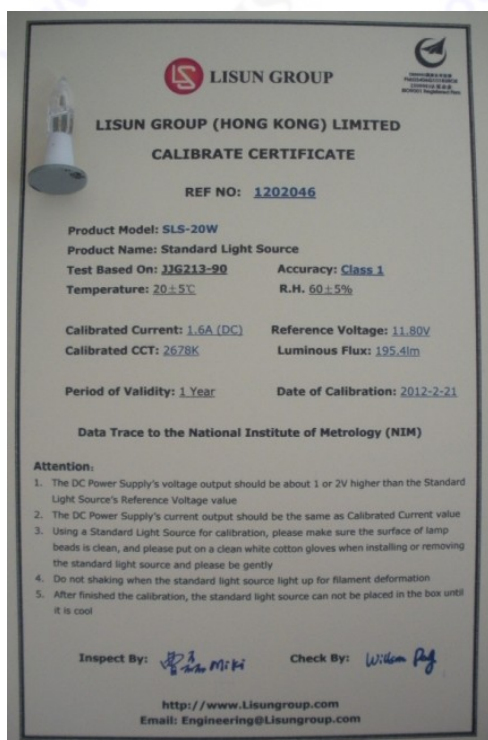
The code 55C in IS-1.5MA55C means the side opening is diameter=50cm cycle size

## 7、 Auxiliary Lamp (RLS-50W)

Due to the luminaires material has self-absorption, the test flux will be a bit difference than the original flux when test the luminaires in the integrating sphere and LISUN 350-1050nm Spectroradiometer Test System, according to CIE request, it is necessary use an Auxiliary lamp to do flux self-absorption revise.

<b>Integrating Sphere Size</b>	<b>Auxiliary Lamp (350-1050nm)</b>
1m/1.5m/1.75m	RLS-50W
2m/2.5m/3m	RLS-100W

## 8、 Standard Light Source



The **Standard Light Source** is used to calibrate LISUN LPCE-2 Scientific Grade Spectroradiometer Integrating Sphere System or LPCE-3 CCD Spectroradiometer Integrating Sphere Compact System. The Standard Light Source Calibrate Certificate can be traced to NIM and NIST. The different size of Integrating Sphere should choose the right power of standard lamp source.

<b>Integrating Sphere Size</b>	<b>Standard Light Source (350-800nm)</b>	<b>Standard Light Source (350-1050nm)</b>
0.3m/0.5m	SLS-10W	SLS-10WIR
1m/1.5m/1.75m	SLS-50W	SLS-50WIR
2m/2.5m/3m	SLS-100W	SLS-100WIR



## 9、 Multi-function LED Clamps Set

The whole sets includes three good thermal conductivity clamps and an extended converter : for through hole LED, for COB LED for multi-functions SMD LED, they can work with 0.3m or 0.5m integrating sphere



## 10、 19Inch Cabinet (CASE-19IN)

Combine all of the test instruments in a 19 inch standard Cabinet, makes the whole systems looks nice and is simple to use



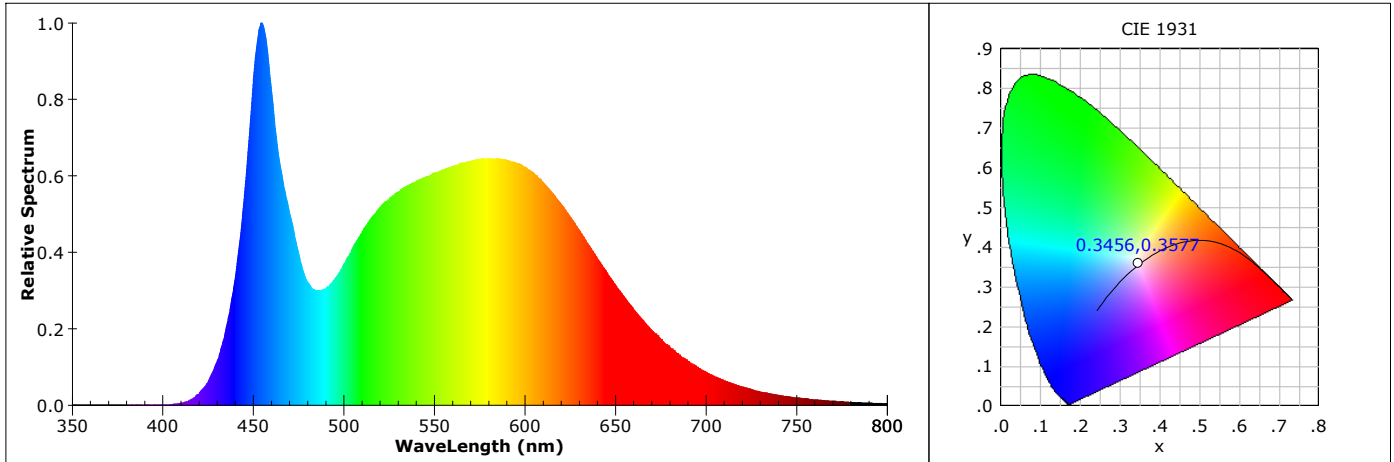
**The next pages are LPCE-2 (LMS-9500) Test Report.**

## Lightsource Test Report

**Report No:** 27

**Test Time:** 2022-11-25 17:12:31

 Category:  
 Spec: LED Bulb  
 Manufacturer: Philips Lighting B.V.

 Type:  
 Number: 27  
 Submitter:

**CIE Colorimetric Parameters**

CIE(x,y): 0.3456,0.3577	CIE(u,v): 0.2094,0.3251	CIE(u',v'): 0.2094,0.4877
CCT: 5002 K (Duv=0.002843 )	Dominant Wavelength: 570.1 nm	Color Purity: 0.111
Peak Wavelength: 454.5 nm	Half Width: 26.3 nm	Color Ratio: R:0.158, G:0.794, B:0.049

Color Render Index: Ra:83.8 , avgR(1~14):77.2 , avgR(1~15):77.2

R1: 82	R2: 90	R3: 94	R4: 81	R5: 82	R6: 85	R7: 87	R8: 68
R9: 12	R10: 76	R11: 80	R12: 61	R13: 85	R14: 97	R15: 77	

Color Quality Scale: Qa:81.8 , Qf:82.1 , Qp:81.3 , Qg:91.7 ,

Q1: 83	Q2: 98	Q3: 79	Q4: 73	Q5: 78	Q6: 81	Q7: 85	Q8: 89
Q9: 97	Q10: 88	Q11: 84	Q12: 83	Q13: 82	Q14: 73	Q15: 77	

TM-30-18: Rf:83 , Rg:94

Gamut Area Index (GAI): GAI\_EES:80.3 , GAI\_BB\_8:91.3 , GAI\_BB\_15:97.4

**Photometric Parameters**

Luminous Flux: 4206.31 lm	Radiant Power: 13.181 W	Efficiency: 115.34 lm/W
Energy Efficiency Class:E (EU 2019/2015 $\eta$ TM:115.34lm/W)		S/P: 1.982
M/P Ratio (WELL): 0.840	Kmel,v: 1.009 mW/lm	Kmel,v(D65): 0.761

Pupil Flux: 7172.60 Plm (Kp=1.705)

Pupil Lumens per Watt: 196.67 Plm/W

Cirtopic Flux: 16691.59 lm

Mesopic Flux (CIE R.): 5486.01 lm (Lp=0.100)

Mesopic Flux (USP): 6434.55 lm (Lp=0.100)

Mesopic Flux (MOVE): 5702.08 lm (Lp=0.100)

**Electric Parameters**

Voltage: 220.166 V	Current: 0.1731 A	Power: 36.469 W
Power Factor: 0.9568	Frequency: 50.00 Hz	Displacement Factor: 0.9655

**TMP Temperature Data**

Solder legT1: 24.4°C	Aluminum plate T2: 78.1°C	Upper lamp T3: 23.2°C	Middle lampT4: 63.9°C
Lowerr lampT5: 23.2°C	lamp holder T6: 23.1°C		

 Geometry: 4 $\pi$ , 1.5m  
 Warmup Time: 2 Minutes  
 Spectroradiometer: LMS-9500C

 Self-absorption Factor: 1.000  
 Integration Time: 66 ms  
 Digital Power Meter: LS2050C

 Photometric Method: sphere-spectroradiometer  
 Peak of Signal: 47743  
 Power Source: LSP Series

 Test Lab: LISUN  
 Operator: Michael Asiami

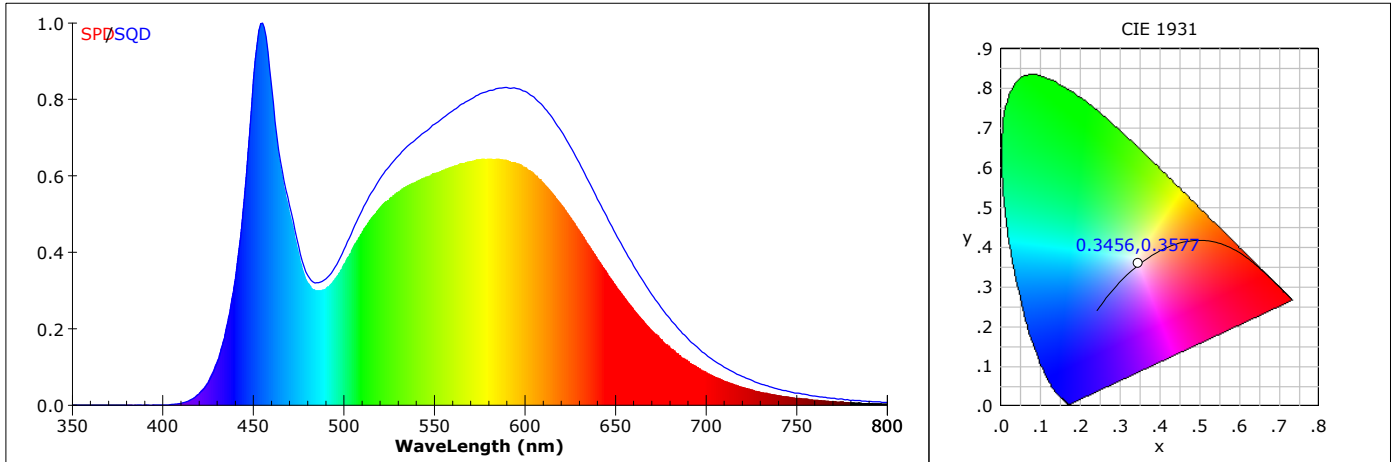
 Testing Environment: Ts:20.2°C, Ta:20.3°C,65%  
 Approver:

## Plant Growth Lamp Test Report

**Report No:** 27

**Test Time:** 2022-11-25 17:12:31

 Category:  
 Spec: LED Bulb  
 Manufacturer: Philips Lighting B.V.

 Type:  
 Number: 27  
 Submitter:


### CIE Colorimetric Parameters

CIE(x,y): 0.3456,0.3577	CIE(u,v): 0.2094,0.3251	CIE(u',v'): 0.2094,0.4877
CCT: 5002 K (Duv=0.002843 )	Dominant Wavelength: 570.1 nm	Color Purity: 0.111
Peak Wavelength: 454.5 nm	Half Width: 26.3 nm	Color Ratio: R:0.158, G:0.794, B:0.049

Color Render Index: Ra:83.8 , avgR(1~14):77.2 , avgR(1~15):77.2

R1: 82	R2: 90	R3: 94	R4: 81	R5: 82	R6: 85	R7: 87	R8: 68
R9: 12	R10: 76	R11: 80	R12: 61	R13: 85	R14: 97	R15: 77	

### Photometric Parameters

Luminous Flux: 4206.31 lm	Efficiency: 115.34 lm/W
Radiant Power: 13.181 W	Radiant Efficiency ( $\eta$ ): 0.361
Photosynthetic Photon Flux ( $\Phi_p$ ): 59.283 $\mu\text{mol/s}$	Photosynthetic Photon Efficacy ( $K_p$ ): 1.626 $\mu\text{mol/J}$
Photosynthetic Radiant Flux ( $\Phi_e$ ): 12.900 W	Photosynthetic Radiant Efficiency ( $\eta_e$ ): 0.354
Photon Flux (400~500nm): 13.704 $\mu\text{mol/s}$	Photon Flux (500~600nm): 27.284 $\mu\text{mol/s}$
Photon Flux (600~700nm): 18.295 $\mu\text{mol/s}$	Photon Flux (PFfr 700~800nm): 1.696 $\mu\text{mol/s}$
Photon Flux (PFuv 280~400nm): 0.007 $\mu\text{mol/s}$	Photon Flux (PF_PBAR): 60.985 $\mu\text{mol/s}$
Radiant Flux (400~500nm): 3.550 W	Radiant Flux (500~600nm): 5.903 W
Radiant Flux (600~700nm): 3.447 W	Radiant Flux (700~800nm): 0.279 W
Radiant Flux (280~400nm): 0.002 W	R/B: 1.0 R/FR: 12.4
YPF (320~780nm): 51.337 $\mu\text{mol/s}$	YPF (400~500nm): 9.897 $\mu\text{mol/s}$
YPF (500~600nm): 23.747 $\mu\text{mol/s}$	YPF (600~700nm): 17.342 $\mu\text{mol/s}$
YPF (700~780nm): 0.347 $\mu\text{mol/s}$	YPF (320~400nm): 0.004 $\mu\text{mol/s}$
Radiant Flux (Chl-A): 0.849 W	Radiant Flux (Chl-B): 2.092 W

### Electric Parameters

Voltage: 220.166 V	Current: 0.1731 A	Power: 36.469 W
Power Factor: 0.9568	Frequency: 50.00 Hz	Displacement Factor: 0.9655

 Geometry: 4n, 1.5m  
 Warmup Time: 2 Minutes  
 Spectroradiometer: LMS-9500C

 Self-absorption Factor: 1.000  
 Integration Time: 66 ms  
 Digital Power Meter: LS2050C

 Photometric Method: sphere-spectroradiometer  
 Peak of Signal: 47743  
 Power Source: LSP Series

 Test Lab: LISUN  
 Operator: Michael Asiami

 Testing Environment: Ts:20.2°C, Ta:20.3°C,65%  
 Approver:

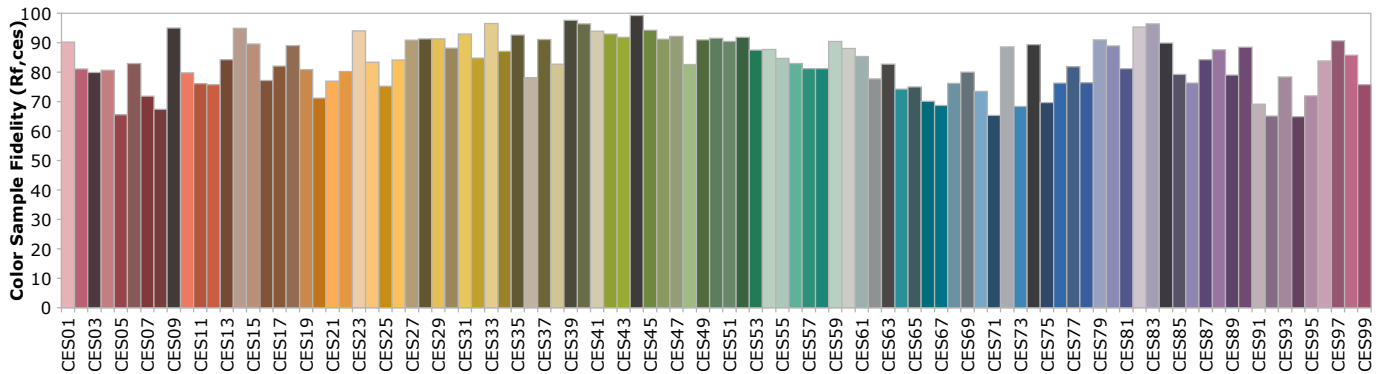
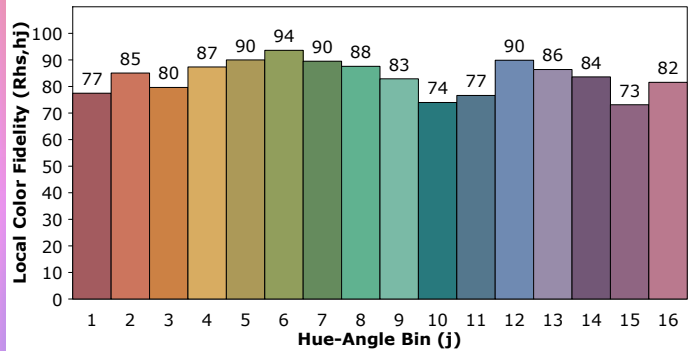
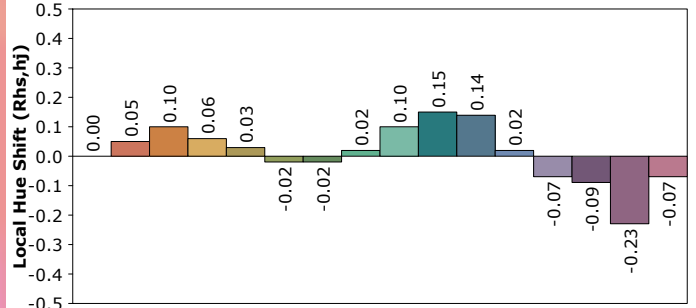
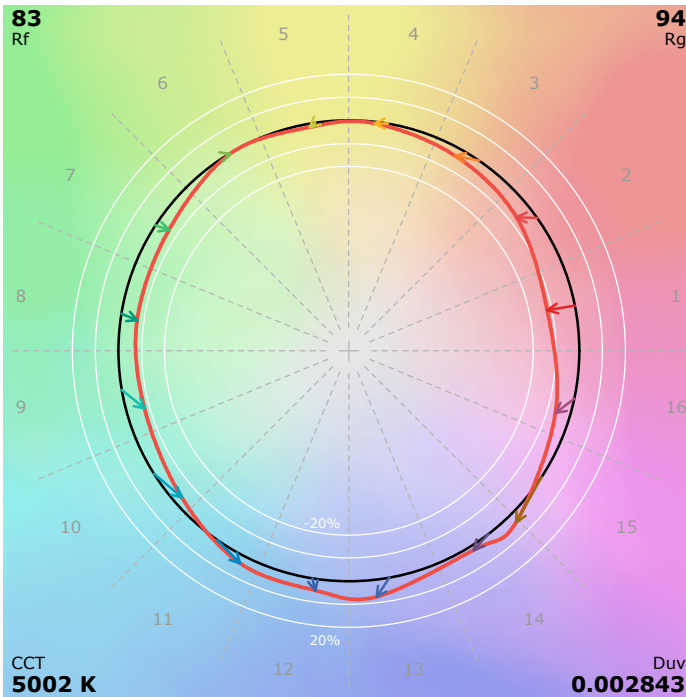
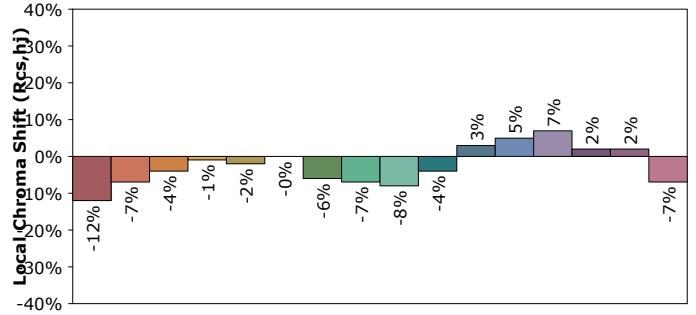
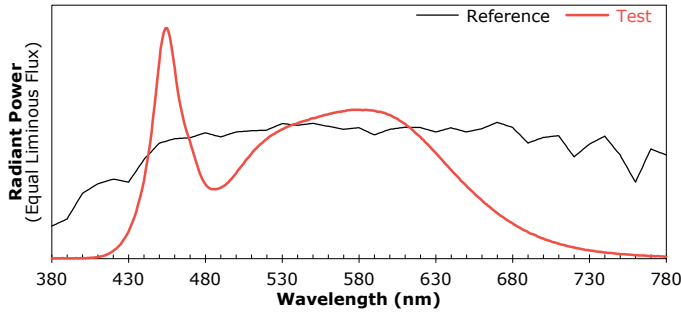
## IES TM-30-18 Color Rendition Report

**Report No:** 27

**Test Time:** 2022-11-25 17:12:31

Category:  
 Spec: LED Bulb  
 Manufacturer: Philips Lighting B.V.

Type:  
 Number: 27  
 Submitter:



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

x **0.3456**  
 y **0.3577**  
 u' **0.2094**  
 v' **0.4877**

CIE13.3-1995  
 (CRI)  
 Ra **84**  
 R9 **12**

Test Lab: LISUN  
 Operator: Michael Asiami

Testing Environment: Ts:20.2°C, Ta:20.3°C,65%  
 Approver:

## Spectral Power Distribution Data

**Report No:** 27

**Test Time:** 2022-11-25 17:12:31

 Category:  
 Spec: LED Bulb  
 Manufacturer: Philips Lighting B.V.

 Type:  
 Number: 27  
 Submitter:

WL(nm)	PL	PE(mW/nm)	WL(nm)	PL	PE(mW/nm)	WL(nm)	PL	PE(mW/nm)
350	0.0000	0.0000	505	0.4139	42.2867	660	0.2518	25.7223
355	0.0000	0.0000	510	0.4555	46.5305	665	0.2240	22.8873
360	0.0000	0.0000	515	0.4907	50.1329	670	0.1972	20.1428
365	0.0000	0.0000	520	0.5193	53.0531	675	0.1734	17.7124
370	0.0000	0.0000	525	0.5417	55.3394	680	0.1521	15.5379
375	0.0000	0.0000	530	0.5603	57.2434	685	0.1322	13.5074
380	0.0005	0.0556	535	0.5765	58.8947	690	0.1150	11.7462
385	0.0009	0.0920	540	0.5875	60.0145	695	0.1005	10.2666
390	0.0008	0.0799	545	0.5984	61.1309	700	0.0863	8.8156
395	0.0012	0.1241	550	0.6090	62.2129	705	0.0744	7.5986
400	0.0013	0.1359	555	0.6175	63.0844	710	0.0642	6.5582
405	0.0029	0.2912	560	0.6263	63.9810	715	0.0556	5.6752
410	0.0063	0.6408	565	0.6347	64.8372	720	0.0480	4.9079
415	0.0149	1.5255	570	0.6394	65.3240	725	0.0416	4.2456
420	0.0333	3.4066	575	0.6449	65.8779	730	0.0351	3.5828
425	0.0636	6.5013	580	0.6460	65.9919	735	0.0303	3.0983
430	0.1171	11.9578	585	0.6454	65.9295	740	0.0262	2.6755
435	0.2042	20.8595	590	0.6417	65.5570	745	0.0229	2.3360
440	0.3373	34.4552	595	0.6342	64.7900	750	0.0194	1.9769
445	0.5514	56.3329	600	0.6231	63.6595	755	0.0176	1.8023
450	0.8555	87.3944	605	0.6068	61.9857	760	0.0147	1.4990
455	1.0000	102.1581	610	0.5840	59.6640	765	0.0127	1.2929
460	0.8274	84.5222	615	0.5572	56.9242	770	0.0112	1.1434
465	0.6250	63.8438	620	0.5270	53.8364	775	0.0102	1.0392
470	0.5069	51.7864	625	0.4937	50.4398	780	0.0078	0.7928
475	0.3983	40.6899	630	0.4581	46.7955	785	0.0073	0.7497
480	0.3224	32.9342	635	0.4208	42.9903	790	0.0062	0.6286
485	0.3011	30.7549	640	0.3839	39.2223	795	0.0053	0.5423
490	0.3073	31.3959	645	0.3492	35.6704	800	0.0044	0.4505
495	0.3319	33.9065	650	0.3148	32.1564			
500	0.3709	37.8890	655	0.2825	28.8647			

 Test Lab: LISUN  
 Operator: Michael Asiami

 Testing Environment: Ts:20.2°C, Ta:20.3°C,65%  
 Approver:

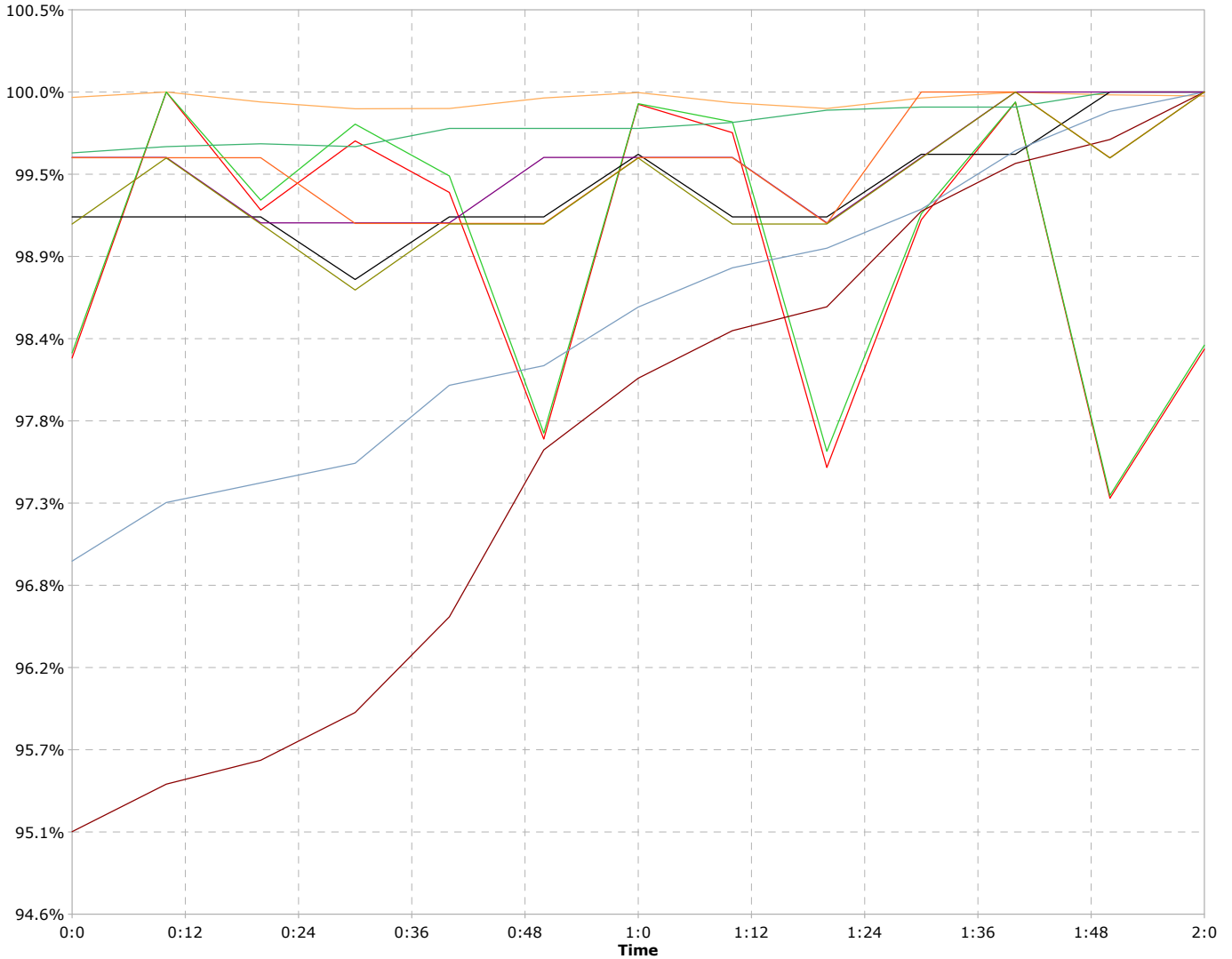


## Warmup Curve

**Report No:** 27

**Test Time:** 2022-11-25 17:12:31

 Category:  
 Spec: LED Bulb  
 Manufacturer: Philips Lighting B.V.

 Type:  
 Number: 27  
 Submitter:


Stable time: 2:0

Uptime: 0:0

Parameters	Maximum	Minimum	Change
Luminous Flux ,lm	4272.35	4158.51	113.84
Power ,W	36.481	36.440	0.041
Efficiency ,lm/W	117.11	114.01	3.10
CCT ,k	5002	4982	20
Solder legT1 ,°C	24.4	24.1	0.3
Aluminum plate T2 ,°C	78.0	75.6	2.4
Upper lamp T3 ,°C	23.3	23.1	0.2
Middle lamp T4 ,°C	63.9	60.8	3.1
Lowerr lamp T5 ,°C	23.2	23.0	0.2
lamp holder T6 ,°C	23.1	22.8	0.3

 Test Lab: LISUN  
 Operator: Michael Asiami

 Testing Environment: Ts:20.2°C, Ta:20.3°C,65%  
 Approver: