

# IES LM-79-08

## MEASUREMENT AND TEST REPORT

For

### GREEN CREATIVE LTD

756 North Zhongshan Rd., Unit B301 Zhabei District, Shanghai, China

**Test Model: SLFT9.5/80CCTS/DIM120V**

<b>Report Type:</b>	Electrical and Photometric tests including: Luminous Flux, Chromaticity, Luminous Intensity Distribution
<b>Test Engineer:</b>	George Yang <i>George Yang</i>
<b>Report Number:</b>	RKSB190117004-10-1
<b>Test Date:</b>	2019-01-19 to 2019-02-25
<b>Report Date:</b>	2019-02-26
<b>Reviewed By:</b>	Ray Gao/EE Engineer <i>Ry Gao</i>
<b>Prepared By:</b>	Bay Area Compliance Laboratories Corp. (Kunshan). No.248 Chenghu Road, Kunshan, Jiangsu province, China. Tel: +86-0512-86175000 Fax: +86-0512-88934268
<b>Test Facility:</b>	Test facility was located at No.248 Chenghu Road, Kunshan, Jiangsu province, China.
<b>Accreditation:</b>	The IAS Accreditation Number TL-749.

**Note:** The test data was only valid for the test sample(s). This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Kunshan). This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

## 1. Product Description

### General Information:

One sample was received on 2019-01-17 and used for testing.

Model Tested: SLFT9.5/80CCTS/DIM120V  
 Manufacturer: GREEN CREATIVE LTD  
 Brand Name: GREEN CREATIVE  
 Product Designation: LED Downlight  
 Dimming: Dimmable  
 Connectable: None  
 Color Tunable: White-tunable  
 CCT Range: 3000K/3500K/4000K  
 Aging Time Before Test: 0hour(For New Products)

### Rated Values:

Rated Voltage/Frequency: 120VAC, 60Hz  
 Nominal CCT: 3000K  
 Nominal Lumen Output: 3050/3200/3050lm

## 2. Standards Used

- IES LM-79-08: Approved Method: Electrical & Photometric Measurement of Solid-state Lighting Products
- ANSI C82.77-10-2014: Harmonic Emission Limits – Related Power Quality Requirements for Lighting Equipment
- IES TM-30-15: IES Method for Evaluating Light Source Color Rendition

## 3. Description of Test Equipment

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
Integrating Sphere	INVENTFINE	Dia 1.5m	JWWCV090112	2019-01-24	2020-01-24
Power Meter	INVENTFINE	WT500	GSJWQ20009	2019-01-25	2019-04-08
Spectral photometer	INVENTFINE	CMS-3S	GSGSE100017	2018-01-24	2020-01-24
AC Power Supply	INVENTFINE	CHP500	JWJSD010071	2018-04-08	2019-04-08
Standard Light Source	INVENTFINE	N/A	JWWCR020106	2019-01-24	2020-01-24
Thermal Meter	KEJIAN	TA298	N/A	2018-12-01	2019-12-01
DC Power Supply	INVENTFINE	WL3005	JWWCP020069	2018-04-08	2019-04-08
AC Power Supply	INVENTFINE	CHP-5KVA	900511765	2018-04-08	2019-04-08
DC Power Supply	INVENTFINE	WL3010	JWDMP030001	2018-04-08	2019-04-08
Power Meter	INVENTFINE	WT500	GSDSQ200007	2018-04-08	2019-04-08
Goniophotometer	INVENTFINE	GPM-1900	YWGCF120001	2019-01-24	2020-01-24
Wireless Weather Station	ZHONGXING	KG218	N/A	2018-12-01	2019-12-01

Device	Manufacture	Model No	Serial No	Calibration date	Calibration due date
Standard Light Source	INVENTFINE	N/A	JWBYR040008	2019-01-24	2020-01-24

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Kunshan) attested that all calibration has been performed using suitable standards traceable to National Primary Standards and International System of Units (SI).

## 4. Test Method

Product was tested with no seasoning. All stabilization and measurements were made in compliance with IES LM-79-08. The product was operated at rated voltage or at voltage required by manufacturer. The ambient temperature of the sample was maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$  during measurement. And relative humidity is less than 65%.

### Integrating Sphere System

The system includes AC power source, digital power meter, DC power supply, Spectroradiometer, and integrating sphere. The integrating sphere system is calibrated by standard spectrum light source before measurement.

$4\pi$  geometry was used during measurement. The product was operated in its intended orientation in application and was recorded in this report.

The uncertainty of the light output (luminous flux) measurements is  $U=2.6\%$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the correlated color temperature measurements is  $U=24\text{K}$  ( $K=2$ ), at the 95% confidence level. The uncertainty of the CRI is  $U=2.5(K=2)$ , at the 95% confidence level.

The uncertainty of power meter AC current  $U=0.16\%$  of rdg, AC Voltage  $U=0.18\%$  of rdg, Power  $U=0.14\%$  ( $K=2$ ), at the 95% confidence level.

### Goniophotometer System

The goniophotometer system is calibrated by standard light source before measurement.

Type C goniophotometer was used for measuring total luminous flux, luminous intensity distribution, and color spatial uniformity. The product was operated in its intended orientation in application and was recorded in this report. The vertical angle ( $\gamma$ ) test intervals were set no more than 1 degree while data for 5 degree intervals is reported. The horizontal angle (C plane) test intervals were set no more than 22.5 degree.

The uncertainty of the luminous flux is  $U=2.6\%$  ( $K=2$ ), at the 95% confidence level.

### Fidelity Index and Gamut Index Calculation

The  $R_i$ ,  $R_g$  was calculated according to IES TM-30-15 by using calculation tools. The calculation was based on the measured SPD from 380nm to 780nm with 1nm intervals. All the colors in this report is for reference only.

## 5. Test Result

### [Integrating Sphere System]

#### Test CCT Setting: 3000K

Total operating time for integrating sphere test: **1.0 hour**

Test orientation: **Downward**

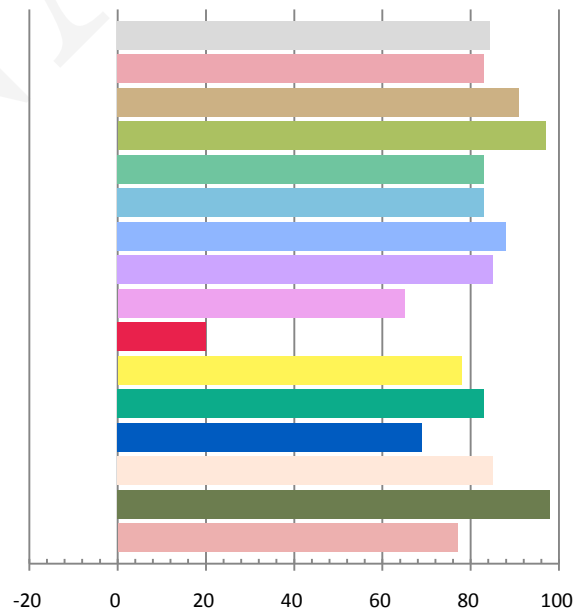
#### Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120	60	0.2503	30	0.9989	3064.37	102.14

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
9.540	3040	-0.00006	0.4341	0.4029	0.2492	0.5205

#### Color Rendering Index

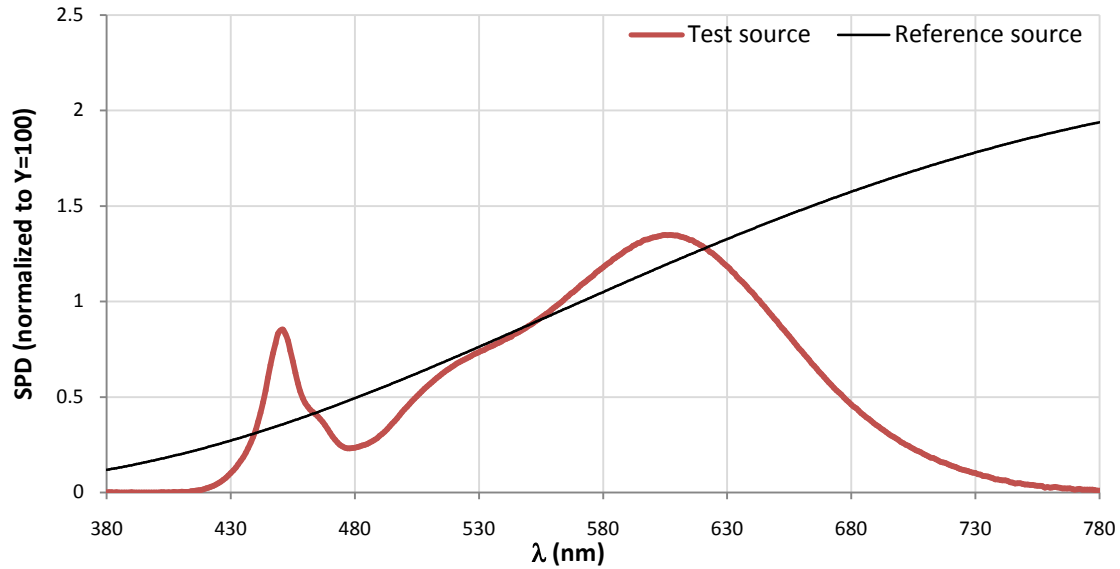
Ra			
84.4			
R1	R2	R3	R4
83	91	97	83
R5	R6	R7	R8
83	88	85	65
R9	R10	R11	R12
20	78	83	69
R13	R14	R15	
85	98	77	



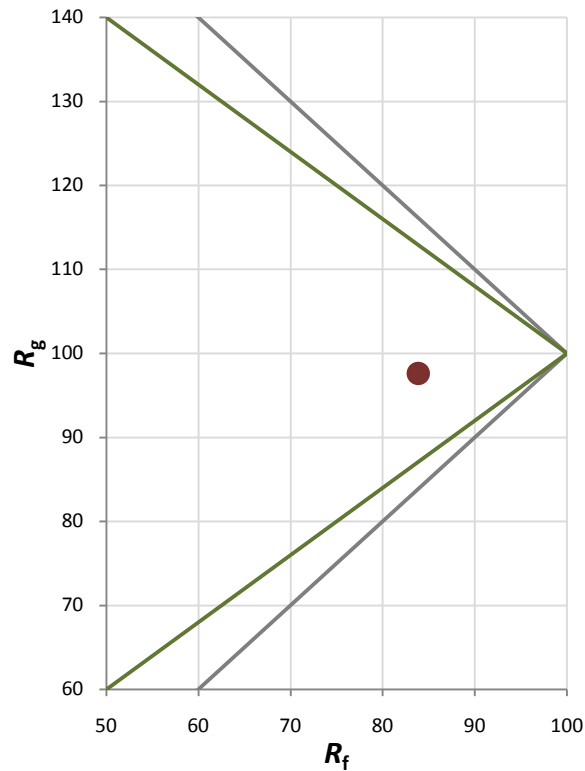
### Fidelity Index and Gamut Index

Fidelity Index $R_f$	84
Gamut Index $R_g$	98

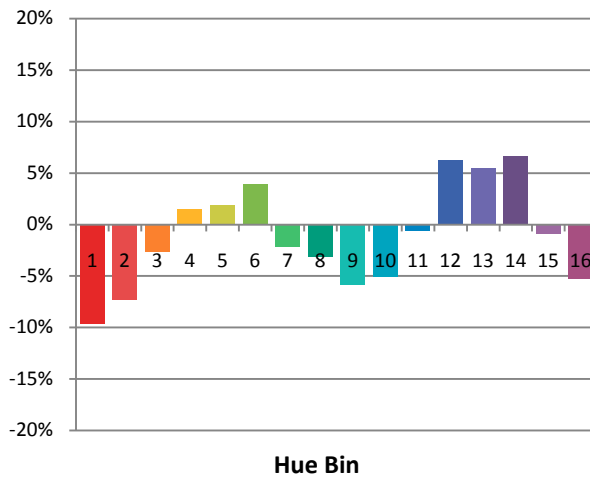
### Spectral Power Distribution Comparison



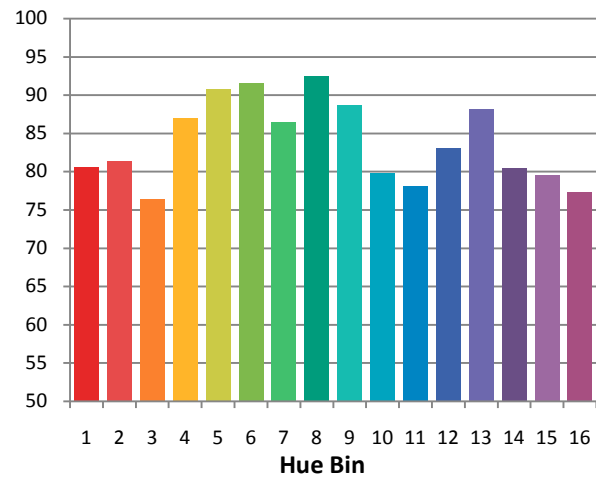
### Plot of $R_g$ versus $R_f$



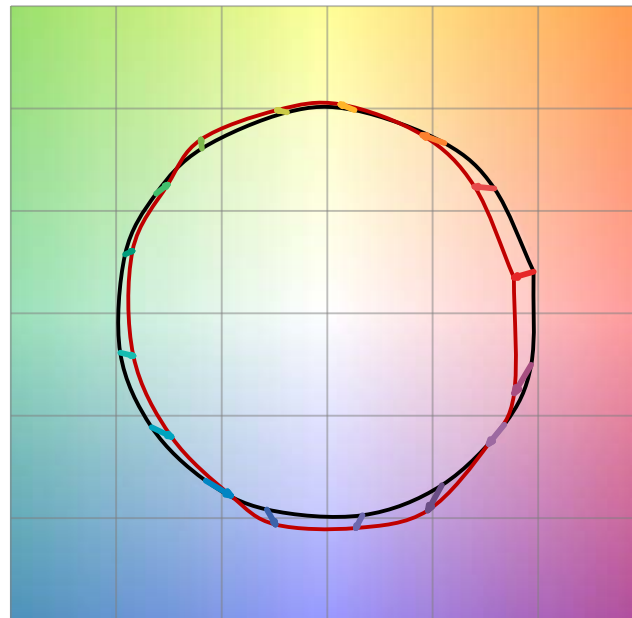
Chroma Shift by Hue



$R_t$  by Hue

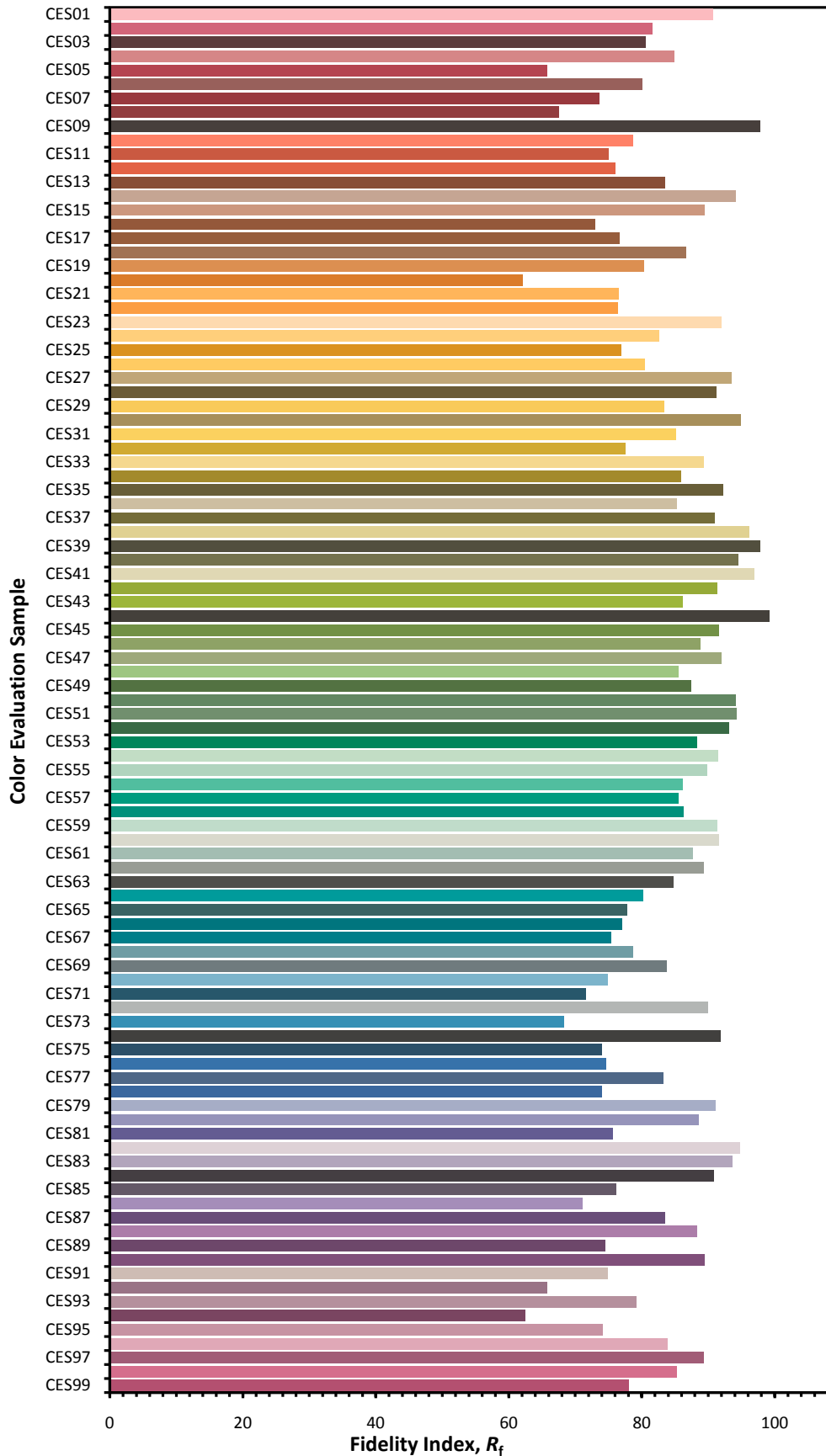


Color Vector Graphic

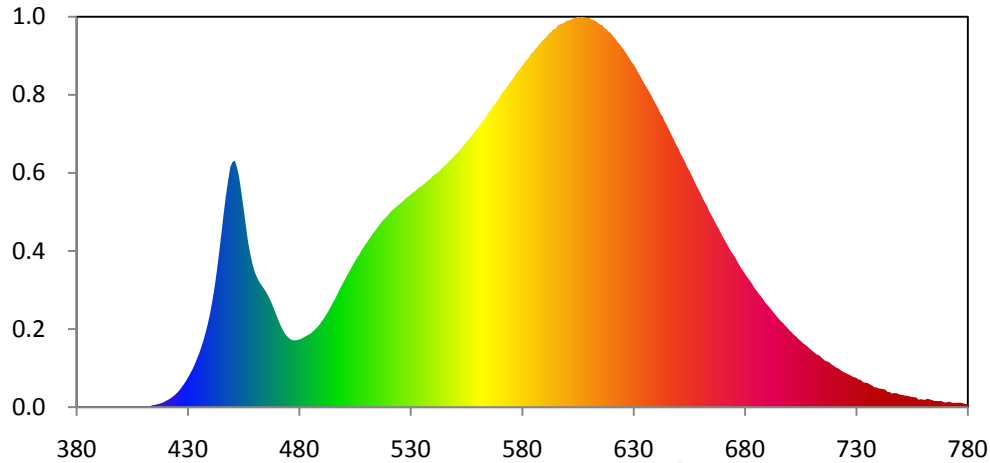


— Reference Illuminant — Test Source

### Color Fidelity by CES Sample



### Relative Spectral Power Distribution

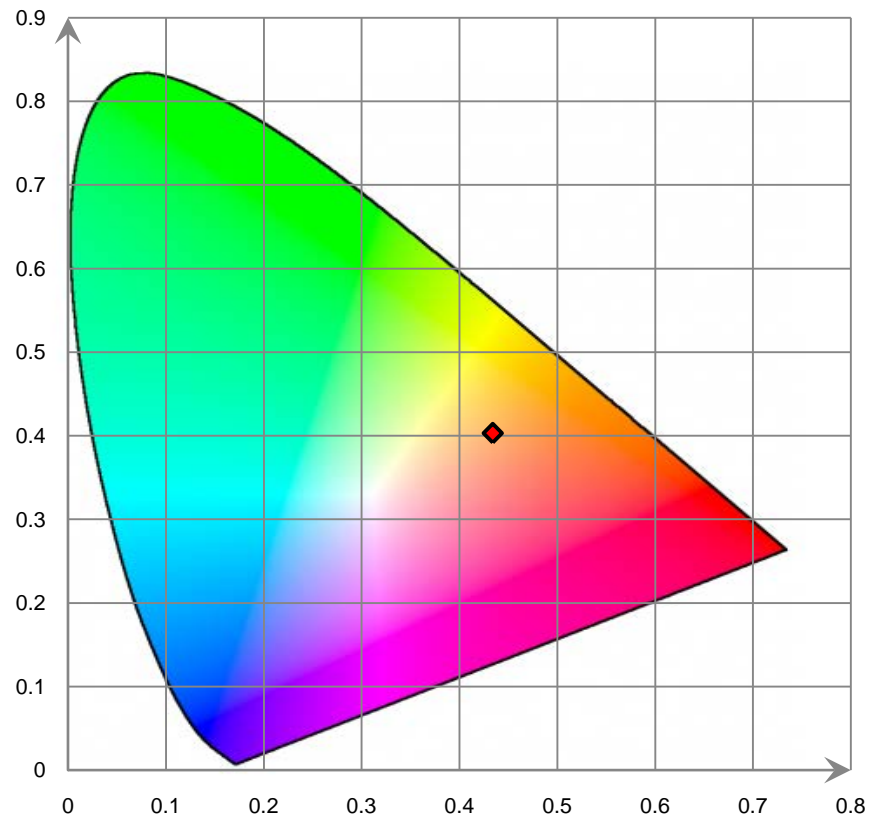


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	3.910E-02	421	1.124E+00	462	1.943E+01	503	2.140E+01	544	3.709E+01
381	7.120E-02	422	1.326E+00	463	1.895E+01	504	2.202E+01	545	3.737E+01
382	5.940E-02	423	1.569E+00	464	1.843E+01	505	2.264E+01	546	3.765E+01
383	1.600E-02	424	1.852E+00	465	1.790E+01	506	2.320E+01	547	3.807E+01
384	5.990E-02	425	2.189E+00	466	1.729E+01	507	2.372E+01	548	3.836E+01
385	2.220E-02	426	2.535E+00	467	1.657E+01	508	2.434E+01	549	3.873E+01
386	6.300E-03	427	3.002E+00	468	1.579E+01	509	2.489E+01	550	3.916E+01
387	2.160E-02	428	3.485E+00	469	1.489E+01	510	2.539E+01	551	3.944E+01
388	2.550E-02	429	3.989E+00	470	1.402E+01	511	2.588E+01	552	3.987E+01
389	1.850E-02	430	4.581E+00	471	1.317E+01	512	2.637E+01	553	4.025E+01
390	4.530E-02	431	5.196E+00	472	1.238E+01	513	2.691E+01	554	4.068E+01
391	1.830E-02	432	5.844E+00	473	1.173E+01	514	2.733E+01	555	4.112E+01
392	1.500E-03	433	6.601E+00	474	1.119E+01	515	2.782E+01	556	4.151E+01
393	2.400E-02	434	7.458E+00	475	1.083E+01	516	2.828E+01	557	4.195E+01
394	1.160E-02	435	8.287E+00	476	1.054E+01	517	2.874E+01	558	4.234E+01
395	1.030E-02	436	9.312E+00	477	1.040E+01	518	2.911E+01	559	4.286E+01
396	1.960E-02	437	1.040E+01	478	1.035E+01	519	2.947E+01	560	4.330E+01
397	2.330E-02	438	1.163E+01	479	1.041E+01	520	2.985E+01	561	4.374E+01
398	9.800E-03	439	1.304E+01	480	1.049E+01	521	3.028E+01	562	4.421E+01
399	5.000E-04	440	1.463E+01	481	1.064E+01	522	3.060E+01	563	4.468E+01
400	2.000E-03	441	1.654E+01	482	1.082E+01	523	3.091E+01	564	4.513E+01
401	1.970E-02	442	1.870E+01	483	1.102E+01	524	3.121E+01	565	4.568E+01
402	5.470E-02	443	2.117E+01	484	1.122E+01	525	3.150E+01	566	4.616E+01
403	3.270E-02	444	2.394E+01	485	1.142E+01	526	3.179E+01	567	4.675E+01
404	2.190E-02	445	2.687E+01	486	1.171E+01	527	3.209E+01	568	4.707E+01
405	4.680E-02	446	2.988E+01	487	1.205E+01	528	3.245E+01	569	4.757E+01
406	1.550E-02	447	3.269E+01	488	1.239E+01	529	3.269E+01	570	4.812E+01
407	1.257E-01	448	3.504E+01	489	1.277E+01	530	3.299E+01	571	4.872E+01
408	5.720E-02	449	3.721E+01	490	1.329E+01	531	3.328E+01	572	4.912E+01
409	1.038E-01	450	3.801E+01	491	1.374E+01	532	3.347E+01	573	4.953E+01
410	1.803E-01	451	3.824E+01	492	1.431E+01	533	3.386E+01	574	5.006E+01
411	1.558E-01	452	3.722E+01	493	1.485E+01	534	3.412E+01	575	5.053E+01
412	1.670E-01	453	3.562E+01	494	1.553E+01	535	3.433E+01	576	5.098E+01
413	1.659E-01	454	3.328E+01	495	1.617E+01	536	3.461E+01	577	5.159E+01
414	2.974E-01	455	3.079E+01	496	1.678E+01	537	3.493E+01	578	5.202E+01
415	3.361E-01	456	2.814E+01	497	1.745E+01	538	3.520E+01	579	5.244E+01
416	4.278E-01	457	2.562E+01	498	1.820E+01	539	3.546E+01	580	5.290E+01
417	5.111E-01	458	2.374E+01	499	1.884E+01	540	3.589E+01	581	5.337E+01
418	6.091E-01	459	2.217E+01	500	1.950E+01	541	3.611E+01	582	5.383E+01
419	7.612E-01	460	2.097E+01	501	2.015E+01	542	3.639E+01	583	5.419E+01
420	9.491E-01	461	2.013E+01	502	2.078E+01	543	3.664E+01	584	5.478E+01

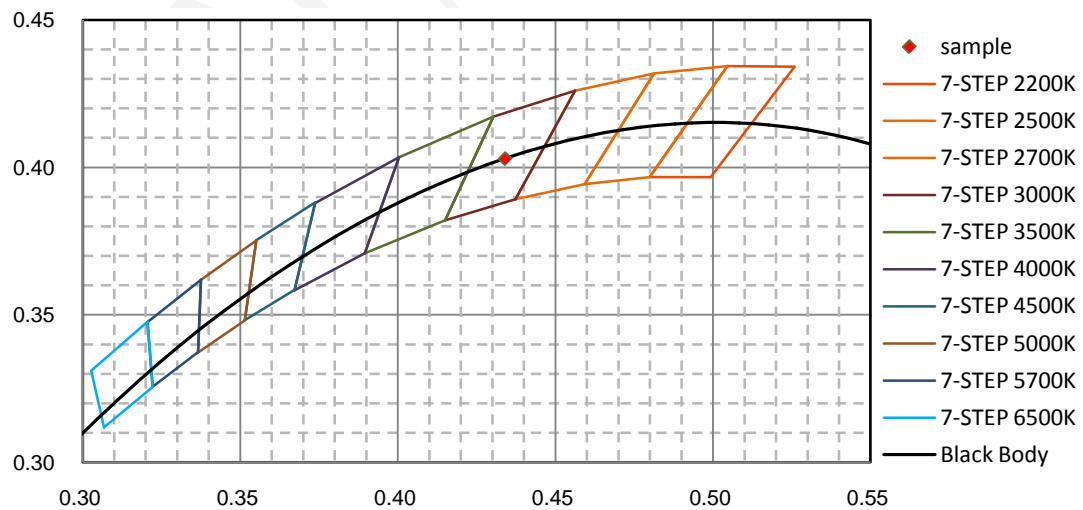


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	5.512E+01	626	5.523E+01	667	2.841E+01	708	9.440E+00	749	2.036E+00
586	5.555E+01	627	5.472E+01	668	2.783E+01	709	9.091E+00	750	1.907E+00
587	5.593E+01	628	5.414E+01	669	2.714E+01	710	8.806E+00	751	1.879E+00
588	5.634E+01	629	5.359E+01	670	2.646E+01	711	8.510E+00	752	1.767E+00
589	5.682E+01	630	5.316E+01	671	2.587E+01	712	8.221E+00	753	1.768E+00
590	5.710E+01	631	5.259E+01	672	2.526E+01	713	8.096E+00	754	1.660E+00
591	5.745E+01	632	5.188E+01	673	2.459E+01	714	7.827E+00	755	1.573E+00
592	5.791E+01	633	5.138E+01	674	2.400E+01	715	7.486E+00	756	1.554E+00
593	5.817E+01	634	5.068E+01	675	2.354E+01	716	7.203E+00	757	1.490E+00
594	5.856E+01	635	5.007E+01	676	2.298E+01	717	7.070E+00	758	1.142E+00
595	5.866E+01	636	4.950E+01	677	2.233E+01	718	6.925E+00	759	1.252E+00
596	5.919E+01	637	4.893E+01	678	2.171E+01	719	6.592E+00	760	1.147E+00
597	5.936E+01	638	4.830E+01	679	2.124E+01	720	6.390E+00	761	1.164E+00
598	5.947E+01	639	4.760E+01	680	2.069E+01	721	6.130E+00	762	1.310E+00
599	5.967E+01	640	4.701E+01	681	2.018E+01	722	5.995E+00	763	1.206E+00
600	5.991E+01	641	4.636E+01	682	1.973E+01	723	5.723E+00	764	1.110E+00
601	5.995E+01	642	4.562E+01	683	1.924E+01	724	5.487E+00	765	9.553E-01
602	6.011E+01	643	4.508E+01	684	1.862E+01	725	5.342E+00	766	9.831E-01
603	6.028E+01	644	4.430E+01	685	1.818E+01	726	5.165E+00	767	9.350E-01
604	6.040E+01	645	4.367E+01	686	1.767E+01	727	5.017E+00	768	9.863E-01
605	6.051E+01	646	4.297E+01	687	1.726E+01	728	4.788E+00	769	8.222E-01
606	6.044E+01	647	4.224E+01	688	1.682E+01	729	4.639E+00	770	7.064E-01
607	6.054E+01	648	4.155E+01	689	1.630E+01	730	4.550E+00	771	7.806E-01
608	6.043E+01	649	4.078E+01	690	1.586E+01	731	4.296E+00	772	8.466E-01
609	6.036E+01	650	4.021E+01	691	1.550E+01	732	4.223E+00	773	6.782E-01
610	6.036E+01	651	3.942E+01	692	1.506E+01	733	3.889E+00	774	6.777E-01
611	6.015E+01	652	3.874E+01	693	1.463E+01	734	3.795E+00	775	6.693E-01
612	6.000E+01	653	3.811E+01	694	1.419E+01	735	3.752E+00	776	6.938E-01
613	5.985E+01	654	3.734E+01	695	1.378E+01	736	3.560E+00	777	6.917E-01
614	5.958E+01	655	3.672E+01	696	1.338E+01	737	3.377E+00	778	6.098E-01
615	5.930E+01	656	3.598E+01	697	1.308E+01	738	3.102E+00	779	4.788E-01
616	5.921E+01	657	3.528E+01	698	1.267E+01	739	3.063E+00	780	4.800E-01
617	5.877E+01	658	3.452E+01	699	1.233E+01	740	2.907E+00		
618	5.853E+01	659	3.384E+01	700	1.191E+01	741	2.863E+00		
619	5.820E+01	660	3.320E+01	701	1.159E+01	742	2.814E+00		
620	5.791E+01	661	3.244E+01	702	1.122E+01	743	2.718E+00		
621	5.743E+01	662	3.176E+01	703	1.096E+01	744	2.378E+00		
622	5.709E+01	663	3.120E+01	704	1.057E+01	745	2.344E+00		
623	5.654E+01	664	3.035E+01	705	1.027E+01	746	2.104E+00		
624	5.618E+01	665	2.975E+01	706	9.940E+00	747	2.190E+00		
625	5.568E+01	666	2.911E+01	707	9.691E+00	748	2.183E+00		

### CIE 1931 x y Chromaticity Diagram



### 7-Step Chromaticity Quadrangles



## Test CCT Setting: 3500K

Total operating time for integrating sphere test: **1.0 hour**

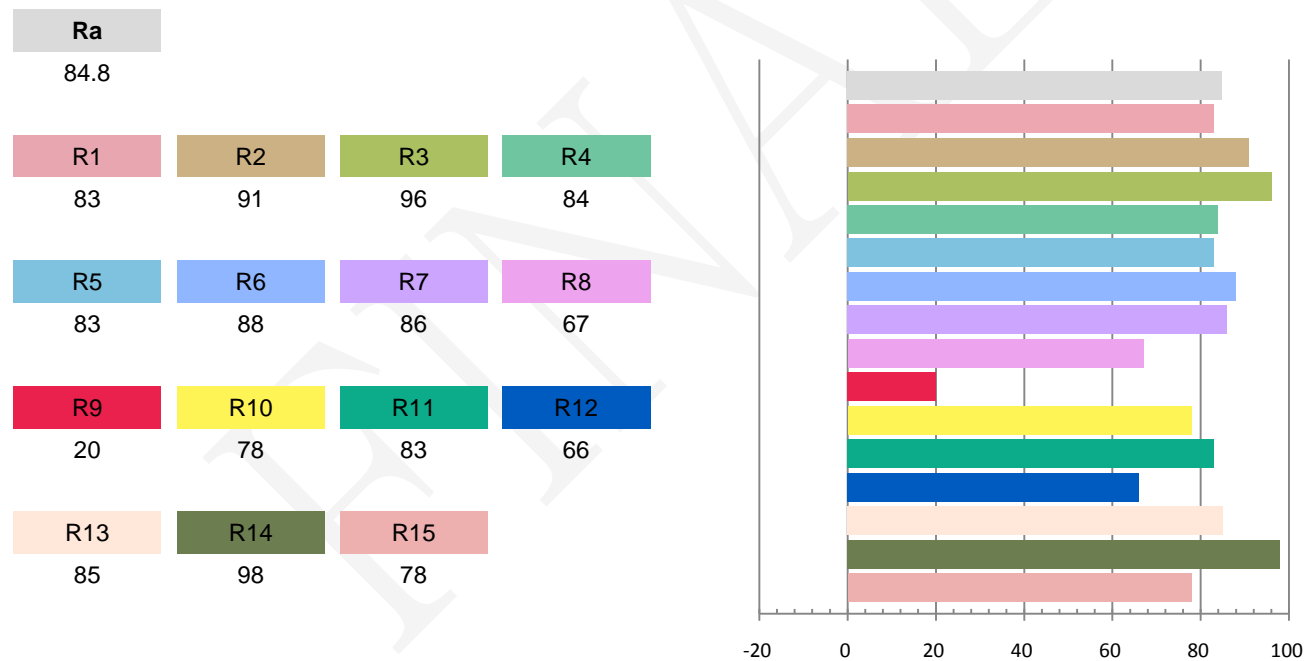
Test orientation: **Downward**

## Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120	60	0.2433	29.16	0.9988	3216.77	110.3

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
9.884	3477	-0.00019	0.4064	0.3909	0.2364	0.5115

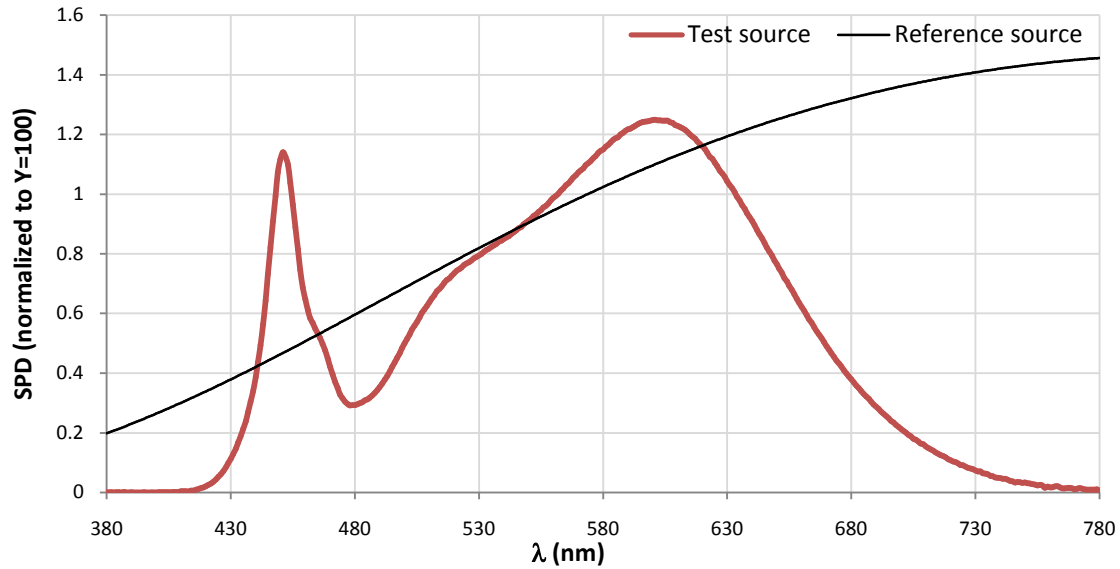
## Color Rendering Index



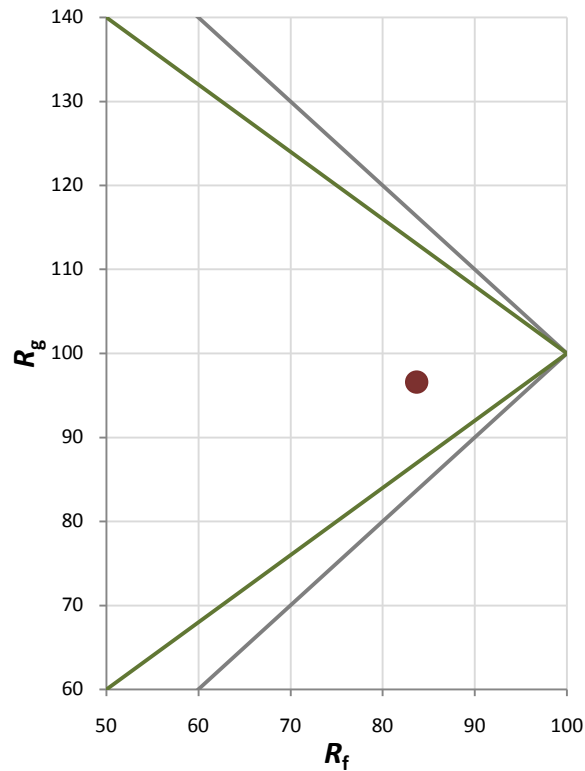
### Fidelity Index and Gamut Index

Fidelity Index $R_f$	84
Gamut Index $R_g$	97

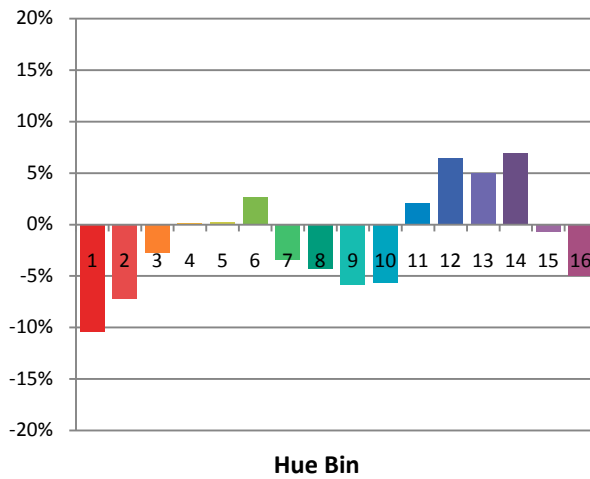
### Spectral Power Distribution Comparison



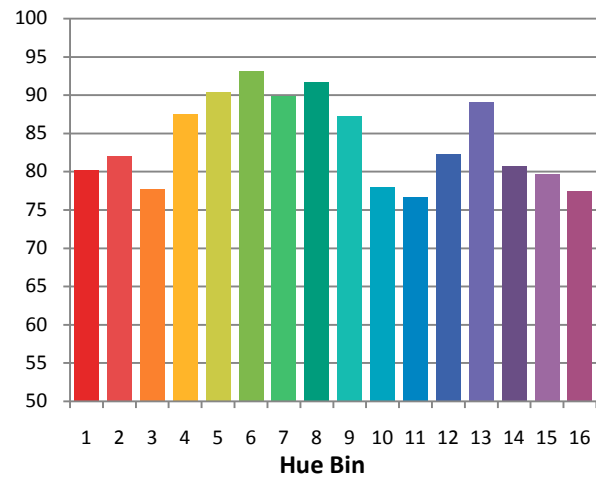
### Plot of $R_g$ versus $R_f$



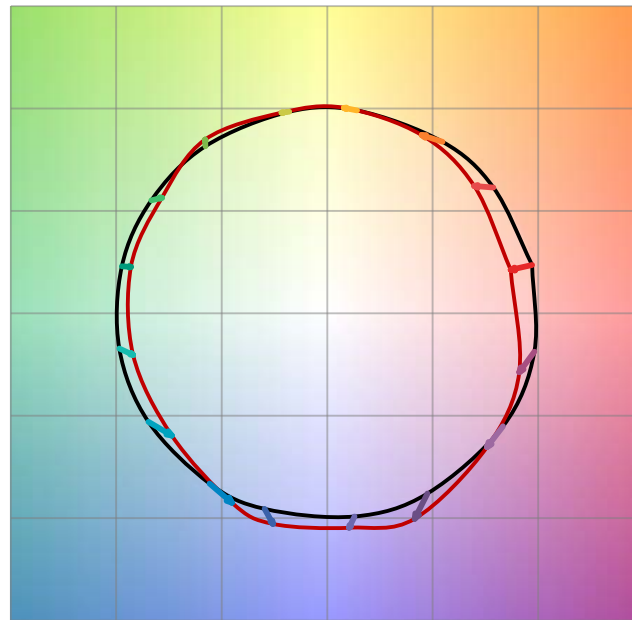
Chroma Shift by Hue



$R_t$  by Hue

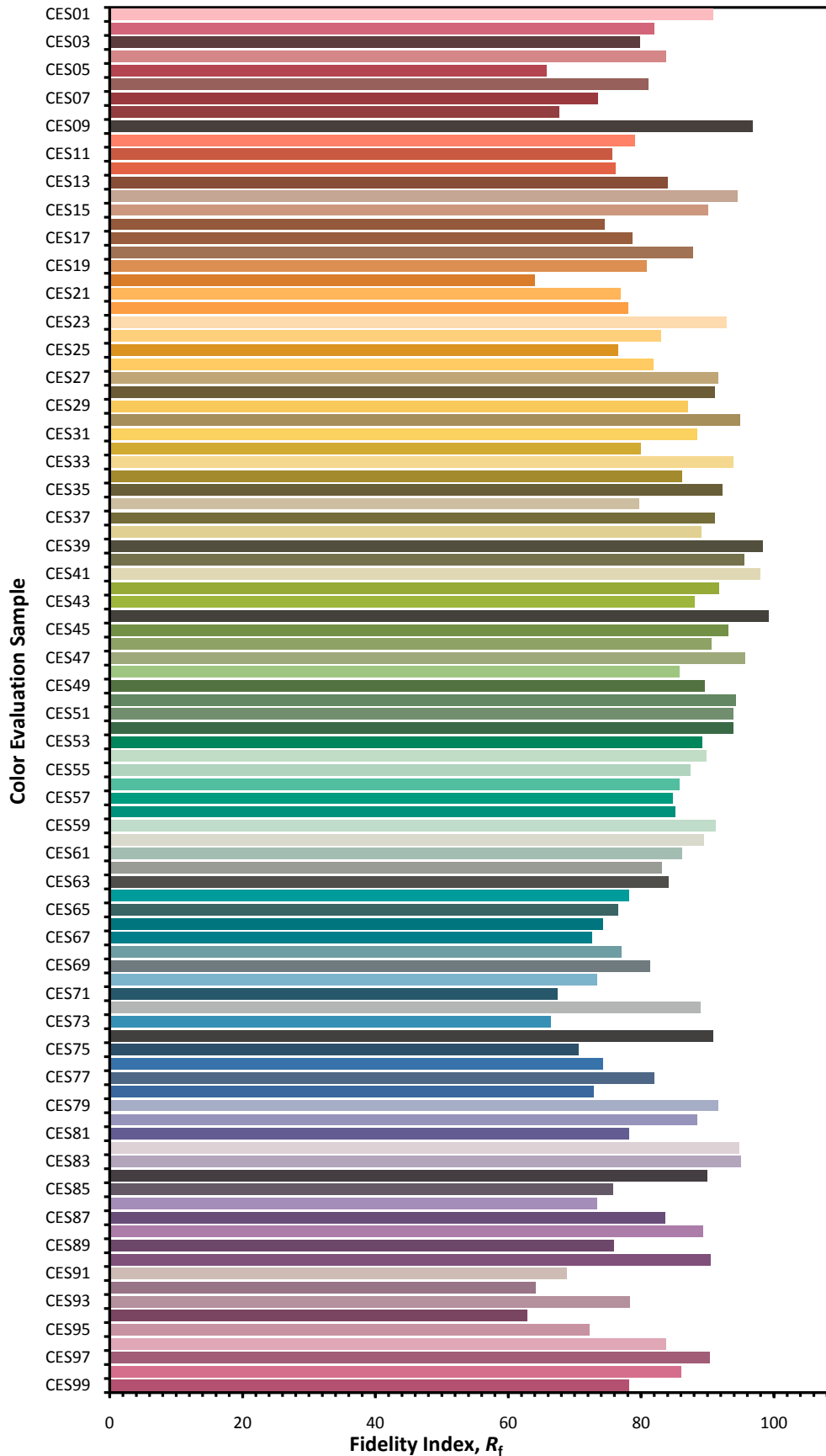


Color Vector Graphic

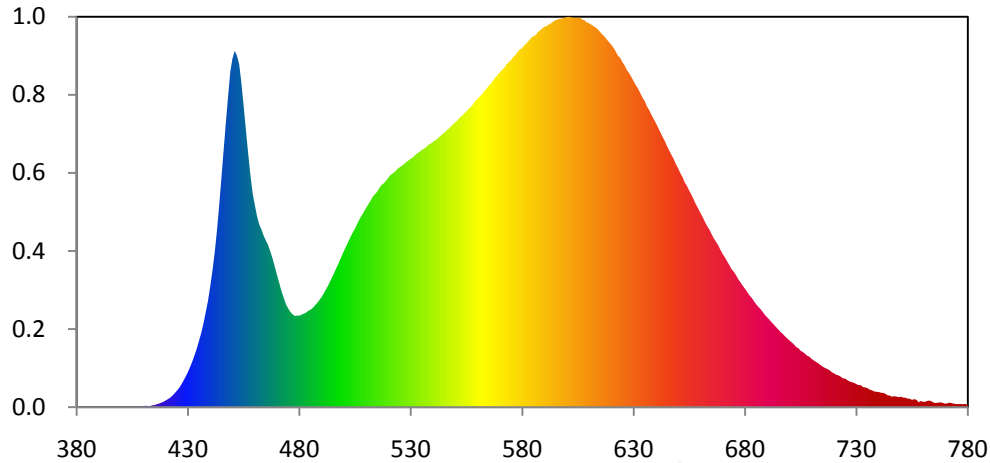


— Reference Illuminat — Test Source

### Color Fidelity by CES Sample



### Relative Spectral Power Distribution

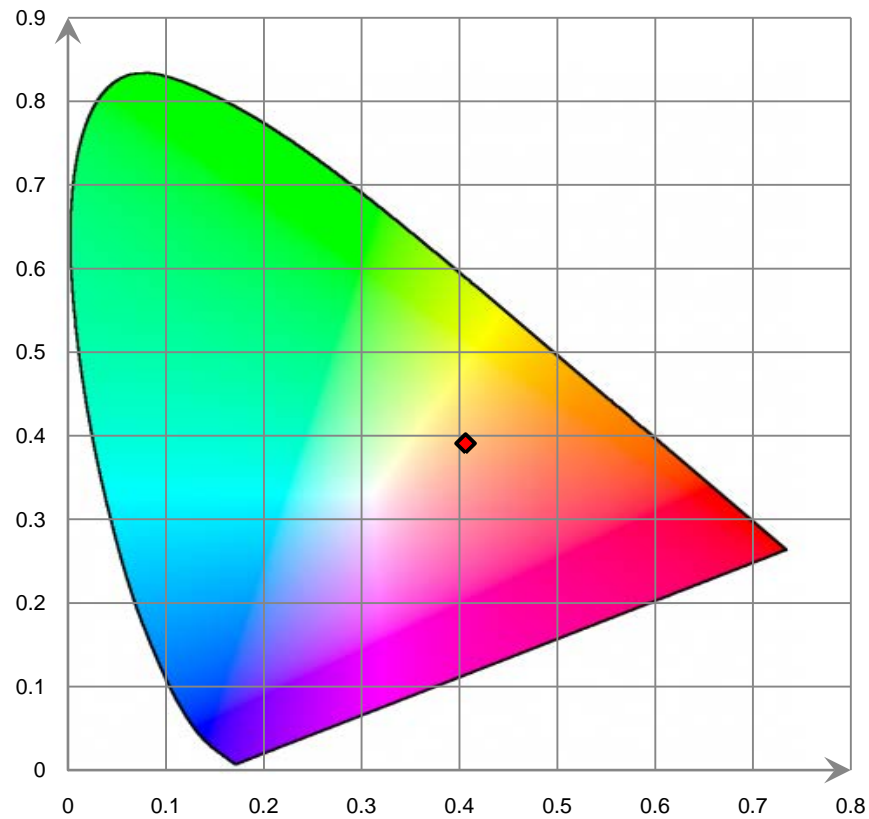


nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	3.580E-02	421	1.215E+00	462	2.754E+01	503	2.568E+01	544	4.108E+01
381	2.390E-02	422	1.425E+00	463	2.678E+01	504	2.633E+01	545	4.137E+01
382	5.220E-02	423	1.722E+00	464	2.584E+01	505	2.693E+01	546	4.169E+01
383	5.000E-03	424	2.081E+00	465	2.510E+01	506	2.764E+01	547	4.191E+01
384	3.990E-02	425	2.463E+00	466	2.441E+01	507	2.831E+01	548	4.229E+01
385	3.300E-02	426	2.871E+00	467	2.344E+01	508	2.889E+01	549	4.261E+01
386	1.600E-03	427	3.403E+00	468	2.239E+01	509	2.945E+01	550	4.294E+01
387	8.080E-02	428	3.991E+00	469	2.114E+01	510	3.006E+01	551	4.323E+01
388	7.400E-03	429	4.632E+00	470	1.989E+01	511	3.060E+01	552	4.364E+01
389	1.980E-02	430	5.289E+00	471	1.870E+01	512	3.112E+01	553	4.390E+01
390	6.530E-02	431	6.084E+00	472	1.747E+01	513	3.176E+01	554	4.428E+01
391	1.170E-02	432	6.916E+00	473	1.649E+01	514	3.212E+01	555	4.458E+01
392	7.200E-03	433	7.858E+00	474	1.550E+01	515	3.251E+01	556	4.498E+01
393	7.200E-03	434	8.867E+00	475	1.488E+01	516	3.306E+01	557	4.525E+01
394	9.100E-03	435	1.005E+01	476	1.436E+01	517	3.354E+01	558	4.565E+01
395	3.780E-02	436	1.121E+01	477	1.399E+01	518	3.376E+01	559	4.615E+01
396	2.800E-03	437	1.266E+01	478	1.375E+01	519	3.416E+01	560	4.648E+01
397	4.300E-03	438	1.433E+01	479	1.380E+01	520	3.461E+01	561	4.683E+01
398	1.970E-02	439	1.603E+01	480	1.380E+01	521	3.501E+01	562	4.718E+01
399	1.760E-02	440	1.818E+01	481	1.394E+01	522	3.524E+01	563	4.765E+01
400	4.200E-03	441	2.055E+01	482	1.409E+01	523	3.552E+01	564	4.798E+01
401	5.140E-02	442	2.325E+01	483	1.425E+01	524	3.590E+01	565	4.845E+01
402	3.580E-02	443	2.653E+01	484	1.452E+01	525	3.615E+01	566	4.877E+01
403	3.990E-02	444	3.031E+01	485	1.469E+01	526	3.637E+01	567	4.925E+01
404	3.380E-02	445	3.443E+01	486	1.494E+01	527	3.663E+01	568	4.971E+01
405	7.110E-02	446	3.861E+01	487	1.532E+01	528	3.696E+01	569	5.004E+01
406	2.710E-02	447	4.280E+01	488	1.570E+01	529	3.718E+01	570	5.048E+01
407	1.051E-01	448	4.674E+01	489	1.615E+01	530	3.743E+01	571	5.083E+01
408	5.660E-02	449	5.050E+01	490	1.660E+01	531	3.765E+01	572	5.114E+01
409	1.013E-01	450	5.256E+01	491	1.716E+01	532	3.799E+01	573	5.167E+01
410	1.738E-01	451	5.370E+01	492	1.777E+01	533	3.826E+01	574	5.196E+01
411	2.066E-01	452	5.297E+01	493	1.838E+01	534	3.850E+01	575	5.232E+01
412	1.805E-01	453	5.169E+01	494	1.911E+01	535	3.878E+01	576	5.279E+01
413	1.611E-01	454	4.886E+01	495	1.978E+01	536	3.896E+01	577	5.306E+01
414	2.829E-01	455	4.545E+01	496	2.051E+01	537	3.921E+01	578	5.357E+01
415	3.130E-01	456	4.185E+01	497	2.123E+01	538	3.957E+01	579	5.391E+01
416	4.540E-01	457	3.838E+01	498	2.198E+01	539	3.972E+01	580	5.412E+01
417	5.437E-01	458	3.512E+01	499	2.277E+01	540	4.000E+01	581	5.454E+01
418	6.838E-01	459	3.234E+01	500	2.353E+01	541	4.022E+01	582	5.484E+01
419	8.134E-01	460	3.051E+01	501	2.424E+01	542	4.046E+01	583	5.523E+01
420	1.006E+00	461	2.879E+01	502	2.496E+01	543	4.077E+01	584	5.565E+01

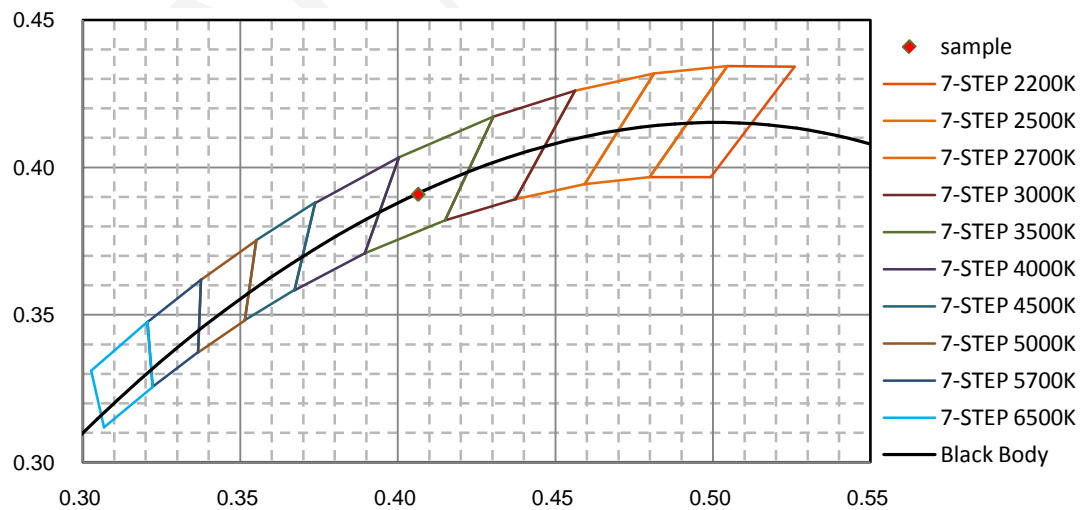
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	5.589E+01	626	5.151E+01	667	2.495E+01	708	7.737E+00	749	1.514E+00
586	5.605E+01	627	5.080E+01	668	2.441E+01	709	7.598E+00	750	1.578E+00
587	5.649E+01	628	5.036E+01	669	2.372E+01	710	7.247E+00	751	1.447E+00
588	5.678E+01	629	4.978E+01	670	2.308E+01	711	7.024E+00	752	1.429E+00
589	5.706E+01	630	4.915E+01	671	2.259E+01	712	6.803E+00	753	1.302E+00
590	5.734E+01	631	4.854E+01	672	2.199E+01	713	6.596E+00	754	1.263E+00
591	5.744E+01	632	4.803E+01	673	2.142E+01	714	6.330E+00	755	1.103E+00
592	5.768E+01	633	4.734E+01	674	2.081E+01	715	6.089E+00	756	1.212E+00
593	5.785E+01	634	4.667E+01	675	2.041E+01	716	5.901E+00	757	1.107E+00
594	5.813E+01	635	4.612E+01	676	1.990E+01	717	5.755E+00	758	7.445E-01
595	5.832E+01	636	4.535E+01	677	1.929E+01	718	5.562E+00	759	9.304E-01
596	5.845E+01	637	4.479E+01	678	1.881E+01	719	5.269E+00	760	8.026E-01
597	5.853E+01	638	4.408E+01	679	1.831E+01	720	5.100E+00	761	8.287E-01
598	5.858E+01	639	4.347E+01	680	1.786E+01	721	4.882E+00	762	9.626E-01
599	5.870E+01	640	4.285E+01	681	1.738E+01	722	4.788E+00	763	9.874E-01
600	5.877E+01	641	4.215E+01	682	1.686E+01	723	4.594E+00	764	8.236E-01
601	5.884E+01	642	4.147E+01	683	1.651E+01	724	4.345E+00	765	6.545E-01
602	5.874E+01	643	4.076E+01	684	1.600E+01	725	4.310E+00	766	6.549E-01
603	5.870E+01	644	4.013E+01	685	1.553E+01	726	4.071E+00	767	6.947E-01
604	5.867E+01	645	3.938E+01	686	1.513E+01	727	3.869E+00	768	7.243E-01
605	5.869E+01	646	3.868E+01	687	1.478E+01	728	3.759E+00	769	6.359E-01
606	5.870E+01	647	3.804E+01	688	1.435E+01	729	3.662E+00	770	5.063E-01
607	5.842E+01	648	3.743E+01	689	1.389E+01	730	3.478E+00	771	6.093E-01
608	5.831E+01	649	3.662E+01	690	1.354E+01	731	3.317E+00	772	6.907E-01
609	5.799E+01	650	3.601E+01	691	1.318E+01	732	3.334E+00	773	5.871E-01
610	5.786E+01	651	3.528E+01	692	1.278E+01	733	3.017E+00	774	5.124E-01
611	5.766E+01	652	3.468E+01	693	1.243E+01	734	2.980E+00	775	4.623E-01
612	5.744E+01	653	3.385E+01	694	1.206E+01	735	2.867E+00	776	4.623E-01
613	5.722E+01	654	3.333E+01	695	1.170E+01	736	2.643E+00	777	4.743E-01
614	5.693E+01	655	3.264E+01	696	1.133E+01	737	2.552E+00	778	4.547E-01
615	5.652E+01	656	3.202E+01	697	1.104E+01	738	2.378E+00	779	4.951E-01
616	5.616E+01	657	3.131E+01	698	1.068E+01	739	2.317E+00	780	3.146E-01
617	5.585E+01	658	3.057E+01	699	1.035E+01	740	2.293E+00		
618	5.541E+01	659	2.995E+01	700	1.006E+01	741	2.181E+00		
619	5.501E+01	660	2.930E+01	701	9.768E+00	742	2.145E+00		
620	5.463E+01	661	2.866E+01	702	9.459E+00	743	2.029E+00		
621	5.417E+01	662	2.797E+01	703	9.069E+00	744	1.808E+00		
622	5.361E+01	663	2.733E+01	704	8.882E+00	745	1.749E+00		
623	5.297E+01	664	2.679E+01	705	8.502E+00	746	1.584E+00		
624	5.264E+01	665	2.610E+01	706	8.315E+00	747	1.655E+00		
625	5.200E+01	666	2.546E+01	707	8.046E+00	748	1.598E+00		



CIE 1931 x y Chromaticity Diagram



7-Step Chromaticity Quadrangles



## Test CCT Setting: 4000K

Total operating time for integrating sphere test: **1.0 hour**

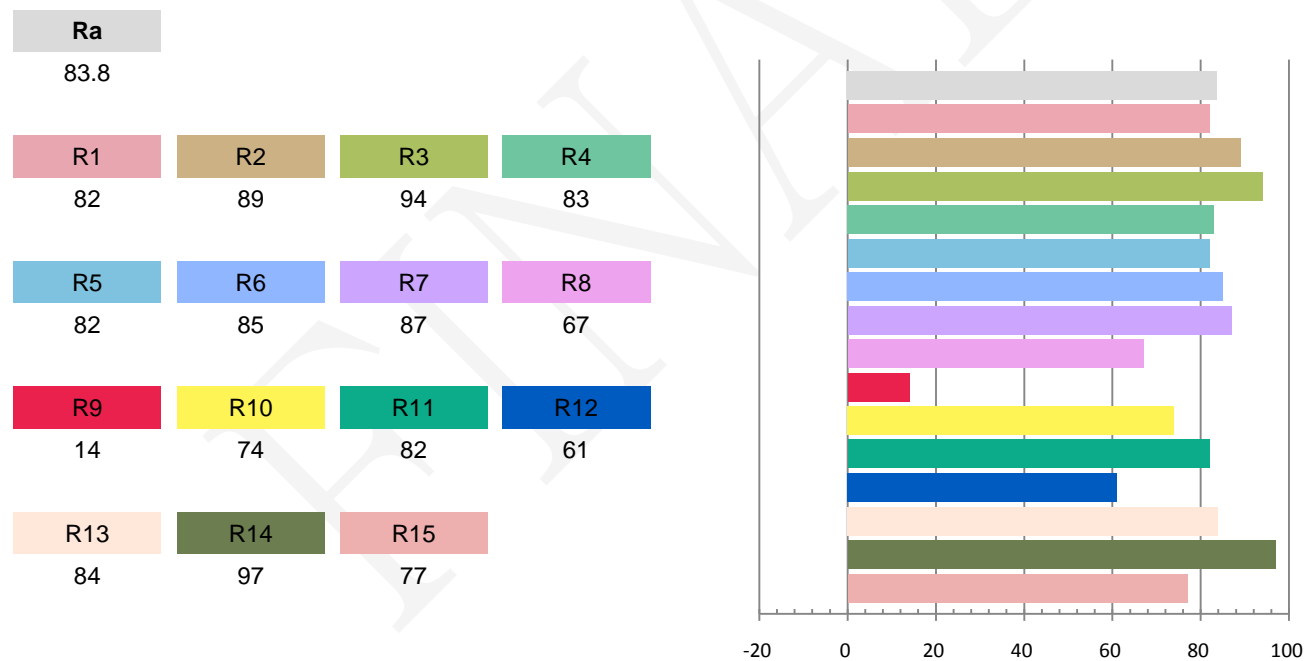
Test orientation: **Downward**

## Photometric and Electrical Measurement Result

Voltage (V)	Frequency (Hz)	Current (A)	Power (W)	Power Factor	Luminous Flux(lm)	Efficacy (lm/W)
120	60	0.2503	30	0.9988	3180.1	106

Radiant Flux (W)	CCT (K)	Duv	x	y	u'	v'
9.665	4002	0.00125	0.3812	0.3799	0.2244	0.5031

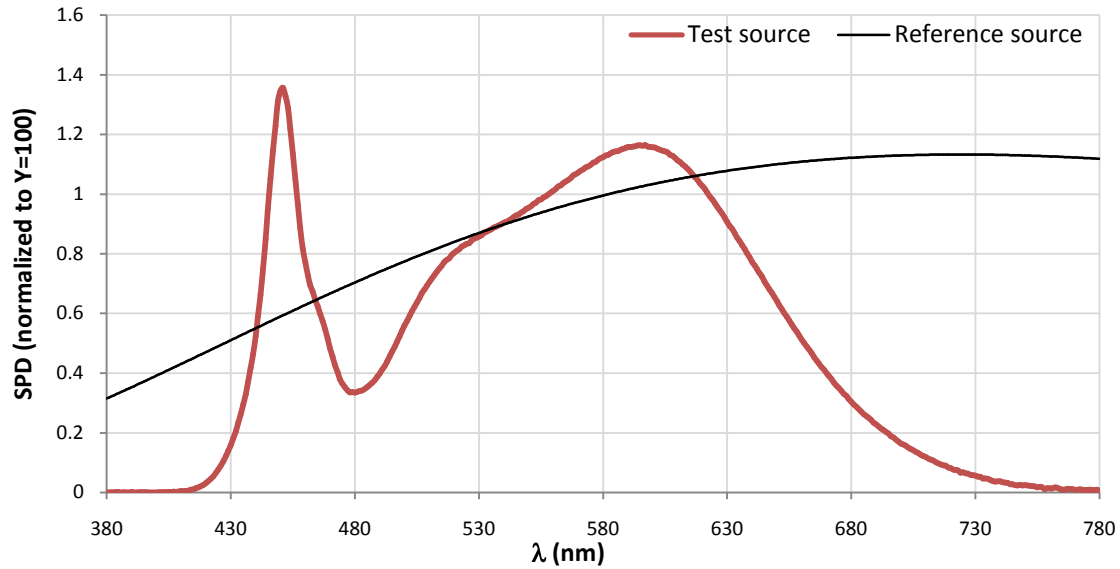
## Color Rendering Index



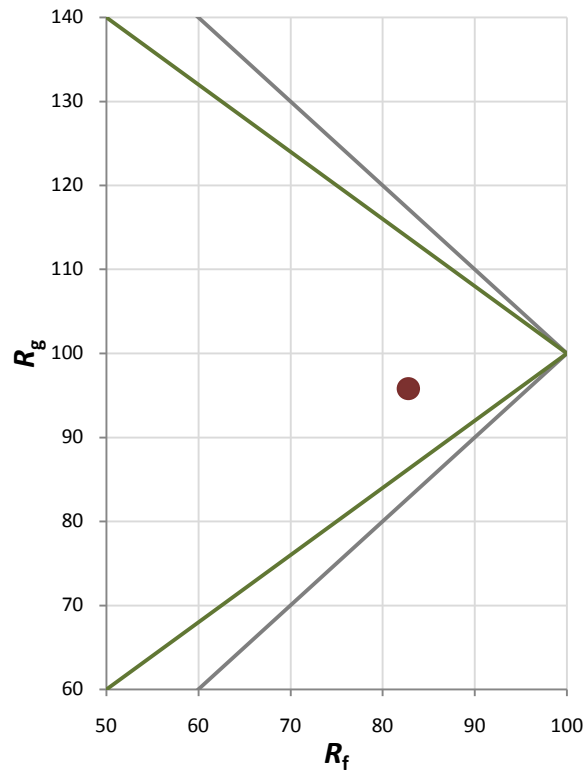
### Fidelity Index and Gamut Index

Fidelity Index $R_f$	83
Gamut Index $R_g$	96

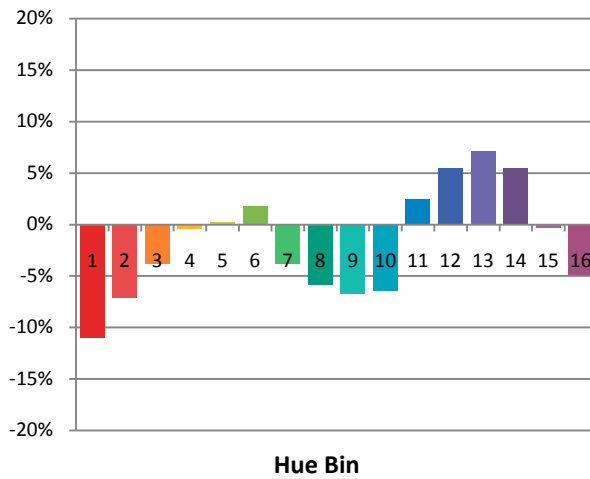
### Spectral Power Distribution Comparison



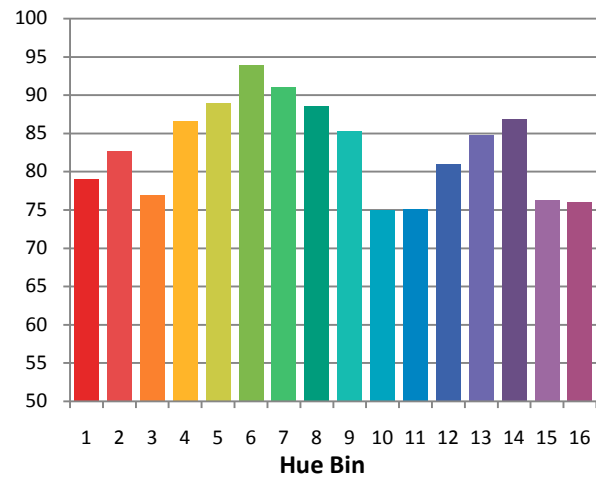
### Plot of $R_g$ versus $R_f$



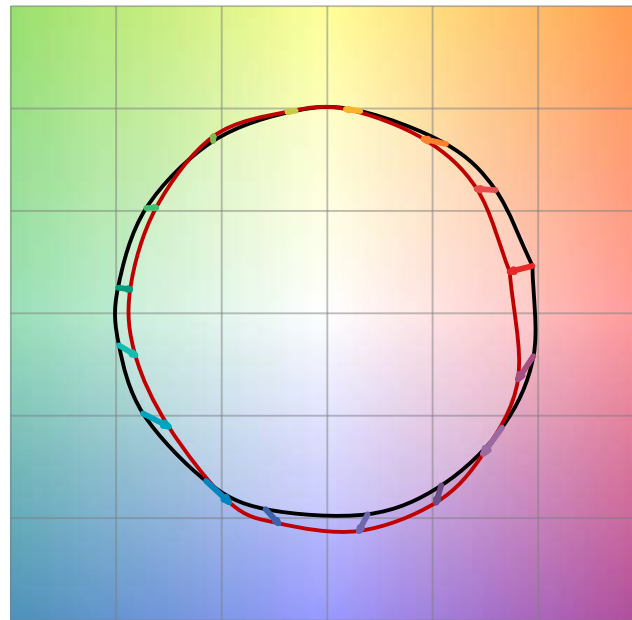
Chroma Shift by Hue



$R_t$  by Hue

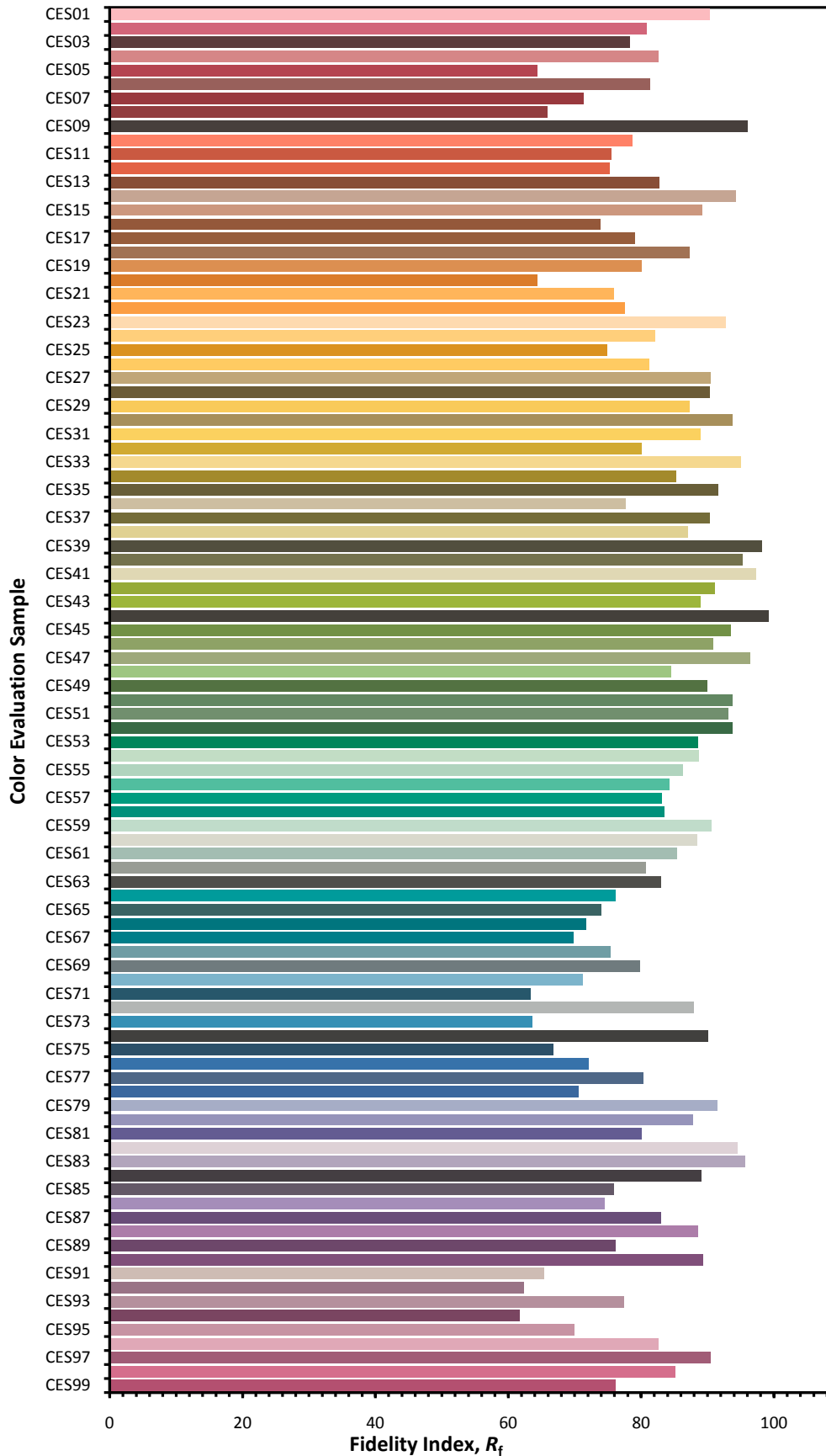


Color Vector Graphic

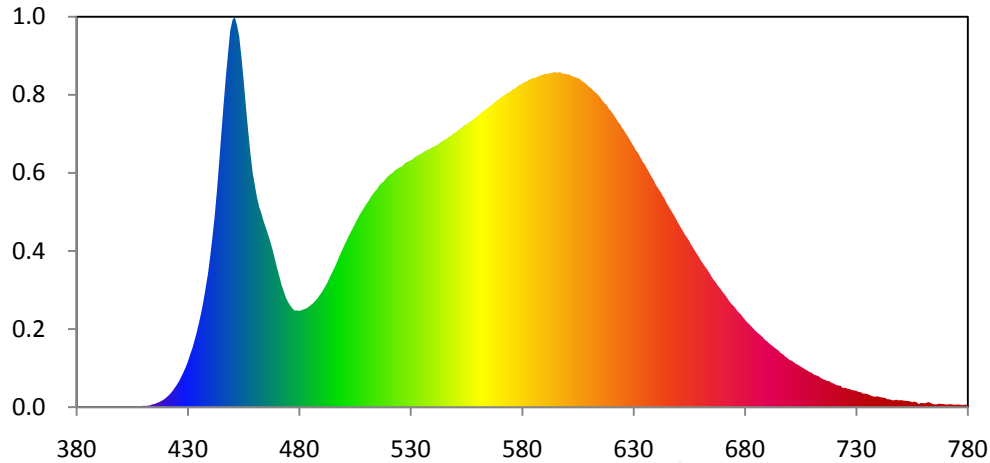


— Reference Illuminant — Test Source

### Color Fidelity by CES Sample



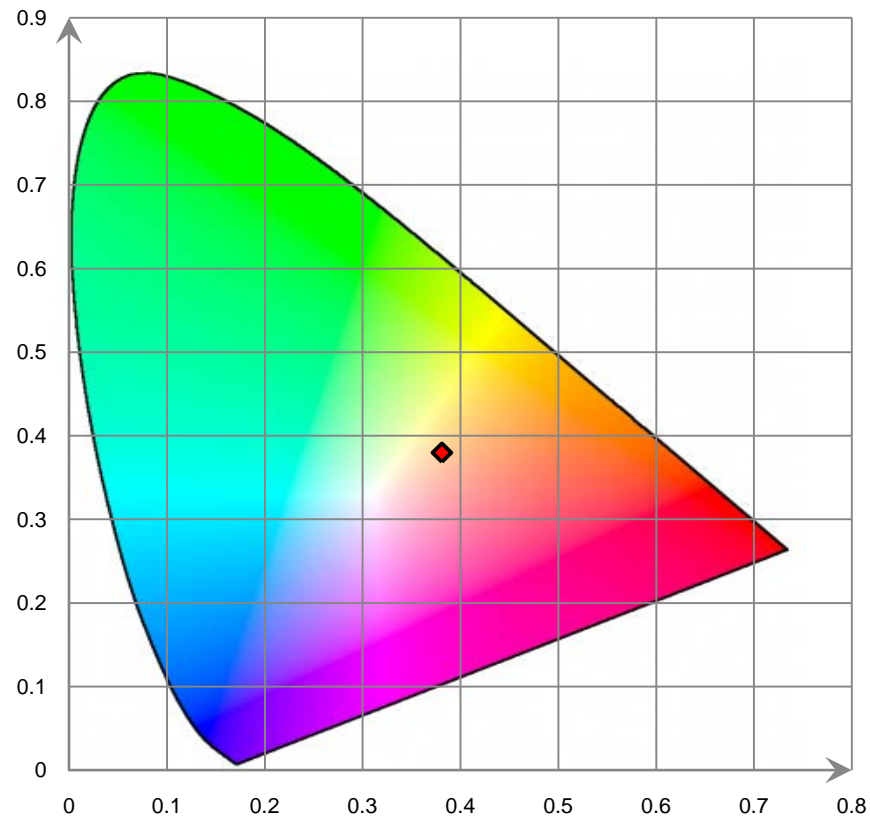
### Relative Spectral Power Distribution



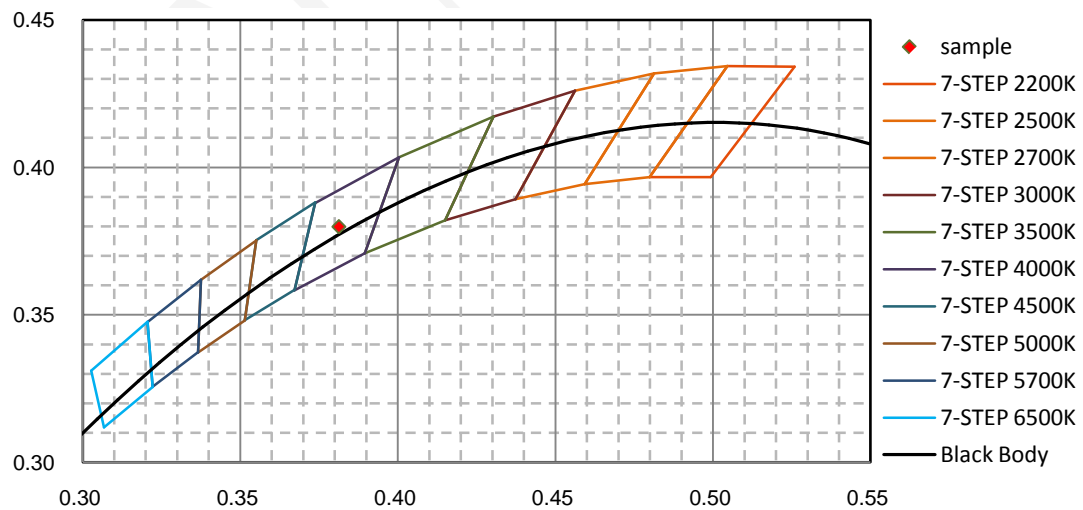
nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
380	2.820E-02	421	1.787E+00	462	3.237E+01	503	2.826E+01	544	4.297E+01
381	1.690E-02	422	2.145E+00	463	3.133E+01	504	2.894E+01	545	4.321E+01
382	2.830E-02	423	2.566E+00	464	3.003E+01	505	2.966E+01	546	4.339E+01
383	9.200E-03	424	3.091E+00	465	2.898E+01	506	3.037E+01	547	4.370E+01
384	9.270E-02	425	3.597E+00	466	2.792E+01	507	3.108E+01	548	4.388E+01
385	2.450E-02	426	4.180E+00	467	2.674E+01	508	3.163E+01	549	4.422E+01
386	1.000E-03	427	4.908E+00	468	2.544E+01	509	3.223E+01	550	4.441E+01
387	3.780E-02	428	5.669E+00	469	2.398E+01	510	3.283E+01	551	4.469E+01
388	1.130E-02	429	6.467E+00	470	2.253E+01	511	3.332E+01	552	4.501E+01
389	2.090E-02	430	7.407E+00	471	2.120E+01	512	3.392E+01	553	4.522E+01
390	1.023E-01	431	8.503E+00	472	1.980E+01	513	3.445E+01	554	4.561E+01
391	1.680E-02	432	9.547E+00	473	1.876E+01	514	3.493E+01	555	4.574E+01
392	6.000E-04	433	1.083E+01	474	1.769E+01	515	3.533E+01	556	4.604E+01
393	3.320E-02	434	1.217E+01	475	1.698E+01	516	3.592E+01	557	4.621E+01
394	3.090E-02	435	1.373E+01	476	1.641E+01	517	3.627E+01	558	4.653E+01
395	3.530E-02	436	1.533E+01	477	1.592E+01	518	3.653E+01	559	4.681E+01
396	4.730E-02	437	1.724E+01	478	1.562E+01	519	3.705E+01	560	4.710E+01
397	1.450E-02	438	1.940E+01	479	1.566E+01	520	3.741E+01	561	4.739E+01
398	6.000E-04	439	2.159E+01	480	1.557E+01	521	3.771E+01	562	4.775E+01
399	0.000E+00	440	2.439E+01	481	1.570E+01	522	3.793E+01	563	4.795E+01
400	0.000E+00	441	2.753E+01	482	1.582E+01	523	3.834E+01	564	4.829E+01
401	4.930E-02	442	3.086E+01	483	1.594E+01	524	3.855E+01	565	4.852E+01
402	4.300E-02	443	3.495E+01	484	1.617E+01	525	3.877E+01	566	4.875E+01
403	5.050E-02	444	3.949E+01	485	1.648E+01	526	3.891E+01	567	4.909E+01
404	2.990E-02	445	4.429E+01	486	1.676E+01	527	3.931E+01	568	4.945E+01
405	9.630E-02	446	4.891E+01	487	1.712E+01	528	3.958E+01	569	4.966E+01
406	3.510E-02	447	5.336E+01	488	1.752E+01	529	3.976E+01	570	4.993E+01
407	1.243E-01	448	5.723E+01	489	1.806E+01	530	3.991E+01	571	5.022E+01
408	7.250E-02	449	6.095E+01	490	1.853E+01	531	4.013E+01	572	5.041E+01
409	1.399E-01	450	6.261E+01	491	1.916E+01	532	4.048E+01	573	5.072E+01
410	2.320E-01	451	6.314E+01	492	1.974E+01	533	4.069E+01	574	5.089E+01
411	2.099E-01	452	6.184E+01	493	2.048E+01	534	4.089E+01	575	5.113E+01
412	2.474E-01	453	5.999E+01	494	2.126E+01	535	4.106E+01	576	5.148E+01
413	2.883E-01	454	5.672E+01	495	2.198E+01	536	4.132E+01	577	5.158E+01
414	4.505E-01	455	5.289E+01	496	2.272E+01	537	4.151E+01	578	5.191E+01
415	5.047E-01	456	4.875E+01	497	2.355E+01	538	4.169E+01	579	5.216E+01
416	6.755E-01	457	4.482E+01	498	2.442E+01	539	4.187E+01	580	5.234E+01
417	8.016E-01	458	4.124E+01	499	2.522E+01	540	4.211E+01	581	5.257E+01
418	9.910E-01	459	3.806E+01	500	2.603E+01	541	4.225E+01	582	5.269E+01
419	1.197E+00	460	3.594E+01	501	2.677E+01	542	4.243E+01	583	5.291E+01
420	1.473E+00	461	3.392E+01	502	2.754E+01	543	4.270E+01	584	5.313E+01

nm	mW	nm	mW	nm	mW	nm	mW	nm	mW
585	5.321E+01	626	4.460E+01	667	2.013E+01	708	5.910E+00	749	1.090E+00
586	5.327E+01	627	4.402E+01	668	1.957E+01	709	5.706E+00	750	1.153E+00
587	5.346E+01	628	4.348E+01	669	1.915E+01	710	5.552E+00	751	1.082E+00
588	5.361E+01	629	4.281E+01	670	1.863E+01	711	5.265E+00	752	1.034E+00
589	5.373E+01	630	4.222E+01	671	1.817E+01	712	5.137E+00	753	1.009E+00
590	5.389E+01	631	4.158E+01	672	1.769E+01	713	5.012E+00	754	9.590E-01
591	5.389E+01	632	4.112E+01	673	1.710E+01	714	4.731E+00	755	8.109E-01
592	5.397E+01	633	4.043E+01	674	1.668E+01	715	4.526E+00	756	9.015E-01
593	5.402E+01	634	3.978E+01	675	1.633E+01	716	4.409E+00	757	8.068E-01
594	5.414E+01	635	3.925E+01	676	1.587E+01	717	4.240E+00	758	5.035E-01
595	5.415E+01	636	3.861E+01	677	1.540E+01	718	4.181E+00	759	6.840E-01
596	5.409E+01	637	3.797E+01	678	1.507E+01	719	3.913E+00	760	6.522E-01
597	5.419E+01	638	3.732E+01	679	1.459E+01	720	3.816E+00	761	6.254E-01
598	5.397E+01	639	3.673E+01	680	1.416E+01	721	3.576E+00	762	7.961E-01
599	5.391E+01	640	3.597E+01	681	1.372E+01	722	3.507E+00	763	7.608E-01
600	5.384E+01	641	3.542E+01	682	1.340E+01	723	3.449E+00	764	5.510E-01
601	5.383E+01	642	3.489E+01	683	1.303E+01	724	3.089E+00	765	4.668E-01
602	5.362E+01	643	3.423E+01	684	1.262E+01	725	3.151E+00	766	4.467E-01
603	5.344E+01	644	3.367E+01	685	1.225E+01	726	2.991E+00	767	5.696E-01
604	5.334E+01	645	3.289E+01	686	1.193E+01	727	2.927E+00	768	5.220E-01
605	5.320E+01	646	3.232E+01	687	1.164E+01	728	2.766E+00	769	5.211E-01
606	5.306E+01	647	3.172E+01	688	1.131E+01	729	2.714E+00	770	4.483E-01
607	5.268E+01	648	3.114E+01	689	1.088E+01	730	2.645E+00	771	4.253E-01
608	5.250E+01	649	3.048E+01	690	1.063E+01	731	2.466E+00	772	5.007E-01
609	5.217E+01	650	2.983E+01	691	1.028E+01	732	2.423E+00	773	4.552E-01
610	5.182E+01	651	2.918E+01	692	9.996E+00	733	2.187E+00	774	3.843E-01
611	5.156E+01	652	2.858E+01	693	9.709E+00	734	2.195E+00	775	4.143E-01
612	5.118E+01	653	2.795E+01	694	9.428E+00	735	2.119E+00	776	4.269E-01
613	5.086E+01	654	2.743E+01	695	9.162E+00	736	1.957E+00	777	3.840E-01
614	5.054E+01	655	2.685E+01	696	8.775E+00	737	1.814E+00	778	3.463E-01
615	5.012E+01	656	2.621E+01	697	8.566E+00	738	1.685E+00	779	4.361E-01
616	4.960E+01	657	2.561E+01	698	8.218E+00	739	1.735E+00	780	2.596E-01
617	4.916E+01	658	2.503E+01	699	7.950E+00	740	1.724E+00		
618	4.884E+01	659	2.450E+01	700	7.646E+00	741	1.598E+00		
619	4.824E+01	660	2.385E+01	701	7.502E+00	742	1.556E+00		
620	4.783E+01	661	2.333E+01	702	7.267E+00	743	1.493E+00		
621	4.733E+01	662	2.278E+01	703	6.975E+00	744	1.279E+00		
622	4.677E+01	663	2.231E+01	704	6.811E+00	745	1.272E+00		
623	4.618E+01	664	2.175E+01	705	6.568E+00	746	1.129E+00		
624	4.572E+01	665	2.111E+01	706	6.352E+00	747	1.107E+00		
625	4.511E+01	666	2.058E+01	707	6.142E+00	748	1.208E+00		

### CIE 1931 x y Chromaticity Diagram



### 7-Step Chromaticity Quadrangles





## [Goniophotometer System]

Total operating time for luminous intensity distribution: **1.0 hours**

Test orientation: **Downward**

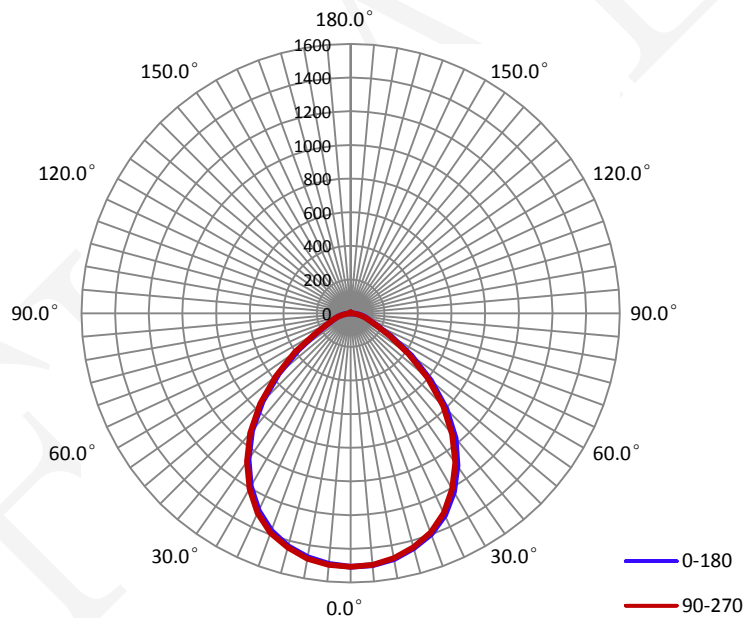
### Electrical Measurement

Input Voltage (V)	Frequency (Hz)	Input Current (A)	Power (W)	Power Factor
120.0	60	0.2510	30.06	0.9990

### Photometric Measurement

Luminous Flux (lm)	Efficacy (lm/W)	I <sub>max</sub> (cd)	S/MH (C0/180)	S/MH (C90/270)
3074.4	102.33	1506.9	1.19	1.19

### Luminous Intensity Distribution



	C0/180	C45/225	C90/270	C135/315	AVG.
Beam Angle (50% I <sub>max</sub> ):	91.0	90.9	90.9	90.9	90.9
Field Angle (10% I <sub>max</sub> ):	131.6	131.6	131.6	131.5	131.6

**Luminous Intensity (cd) Distribution Data**

C y	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°
0.0°	1507	1507	1507	1507	1507	1507	1507	1507
5.0°	1503	1505	1499	1498	1501	1500	1497	1496
10.0°	1484	1481	1476	1479	1478	1475	1472	1473
15.0°	1446	1446	1443	1440	1439	1437	1434	1432
20.0°	1397	1397	1389	1388	1388	1382	1381	1379
25.0°	1324	1325	1318	1315	1311	1305	1299	1297
30.0°	1226	1223	1220	1210	1206	1201	1195	1193
35.0°	1106	1105	1096	1088	1084	1077	1071	1066
40.0°	968	967	954	947	939	933	927	923
45.0°	804	800	792	784	777	767	758	757
50.0°	621	622	614	605	595	589	580	574
55.0°	440	442	438	430	421	414	404	397
60.0°	281	283	280	274	267	260	252	246
65.0°	171	171	171	166	163	157	155	152
70.0°	118	118	117	115	114	112	111	110
75.0°	90	90	89	87	85	84	83	82
80.0°	59	60	59	56	54	53	52	52
85.0°	26	27	26	24	22	21	20	19
90.0°	0	0	0	0	0	0	0	0
95.0°	0	0	0	0	0	0	0	0
100.0°	0	0	0	0	0	0	0	0
105.0°	0	0	0	0	0	0	0	0
110.0°	0	0	0	0	0	0	0	0
115.0°	0	0	0	0	0	0	0	0
120.0°	0	0	0	0	0	0	0	0
125.0°	0	0	0	0	0	0	0	0
130.0°	0	0	0	0	0	0	0	0
135.0°	0	0	0	0	0	0	0	0
140.0°	0	0	0	0	1	0	1	0
145.0°	1	1	2	1	2	1	1	2
150.0°	2	2	3	3	2	3	2	3
155.0°	3	3	3	3	3	2	3	3
160.0°	4	4	4	4	4	4	4	4
165.0°	4	4	4	4	4	4	4	4
170.0°	4	4	4	4	4	5	5	5
175.0°	5	5	6	5	5	5	5	5
180.0°	5	5	5	6	6	5	5	5

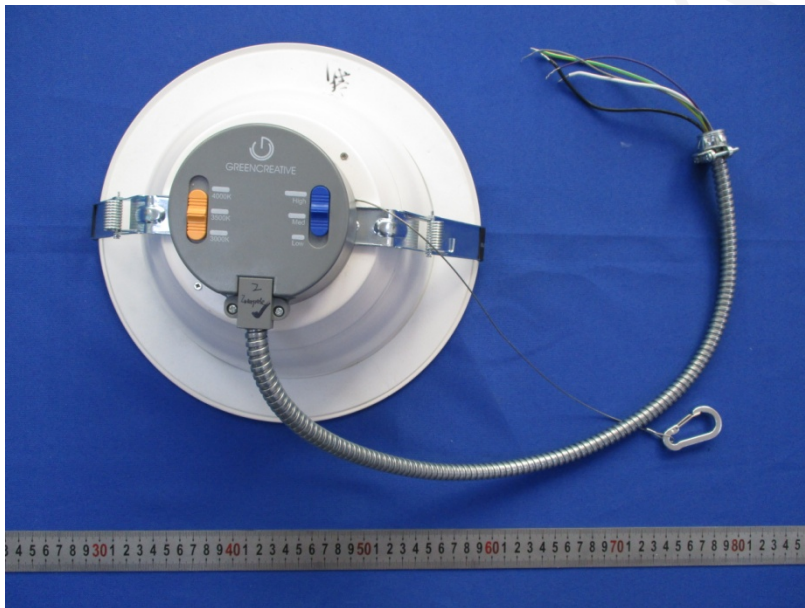
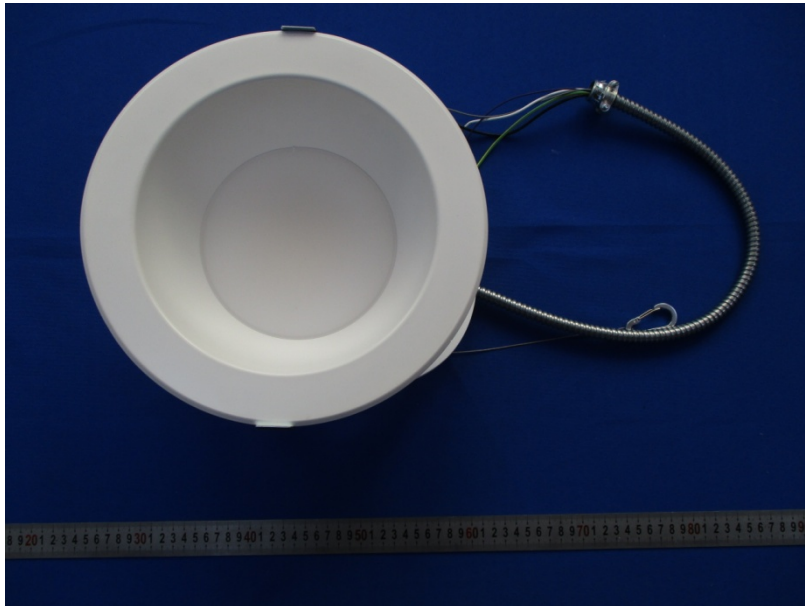
Luminous Intensity (cd) Distribution Data (cont.)

C γ	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°
0.0°	1507	1507	1507	1507	1507	1507	1507	1507
5.0°	1496	1499	1497	1498	1500	1503	1501	1503
10.0°	1472	1475	1474	1476	1482	1482	1484	1484
15.0°	1433	1434	1435	1436	1442	1446	1447	1447
20.0°	1377	1381	1383	1386	1391	1394	1395	1397
25.0°	1295	1295	1297	1303	1310	1314	1317	1321
30.0°	1188	1189	1191	1194	1204	1212	1217	1221
35.0°	1059	1060	1062	1069	1075	1087	1094	1099
40.0°	913	912	913	920	929	939	949	955
45.0°	741	743	746	750	761	773	780	789
50.0°	559	562	563	572	582	593	600	606
55.0°	382	386	389	397	406	414	420	427
60.0°	236	236	239	246	253	258	264	269
65.0°	145	145	147	150	154	156	160	163
70.0°	107	108	109	109	111	113	114	115
75.0°	78	79	79	80	82	84	85	86
80.0°	48	48	48	50	51	53	54	55
85.0°	14	14	16	18	19	20	22	23
90.0°	0	0	0	0	0	0	0	0
95.0°	0	0	0	0	0	0	0	0
100.0°	0	0	0	0	0	0	0	0
105.0°	0	0	0	0	0	0	0	0
110.0°	0	0	0	0	0	0	0	0
115.0°	0	0	0	0	0	0	0	0
120.0°	0	0	0	0	0	0	0	0
125.0°	0	0	0	0	0	0	0	0
130.0°	0	0	0	0	0	0	0	0
135.0°	0	0	0	0	0	0	0	0
140.0°	0	0	0	0	0	0	0	0
145.0°	1	0	1	1	1	1	1	1
150.0°	2	2	2	2	2	2	2	2
155.0°	2	2	3	3	3	3	3	3
160.0°	3	4	4	4	4	4	4	4
165.0°	4	4	4	4	4	5	4	4
170.0°	4	4	5	5	4	5	5	5
175.0°	4	5	4	5	5	6	6	5
180.0°	5	5	5	5	6	6	5	5

### Zonal Lumen Density Measurement

Deg	Flux (lm)	%	Deg	Flux (lm)	%
0-5	35.9	1.17	0-5	35.9	1.17
5-10	106.5	3.46	0-10	142.5	4.63
10-15	173.1	5.63	0-15	315.5	10.26
15-20	233.0	7.58	0-20	548.6	17.84
20-25	282.9	9.20	0-25	831.4	27.04
25-30	318.2	10.35	0-30	1149.6	37.39
30-35	336.7	10.95	0-35	1486.4	48.35
35-40	336.7	10.95	0-40	1823.0	59.30
40-45	316.0	10.28	0-45	2139.1	69.58
45-50	274.8	8.94	0-50	2413.8	78.51
50-55	218.0	7.09	0-55	2631.8	85.61
55-60	155.3	5.05	0-60	2787.2	90.66
60-65	101.4	3.30	0-65	2888.5	93.95
65-70	68.5	2.23	0-70	2957.0	96.18
70-75	51.3	1.67	0-75	3008.3	97.85
75-80	36.7	1.19	0-80	3045.0	99.04
80-85	20.1	0.65	0-85	3065.1	99.70
85-90	5.7	0.18	0-90	3070.8	99.88
90-95	0.0	0.00	0-95	3070.8	99.88
95-100	0.0	0.00	0-100	3070.8	99.88
100-105	0.0	0.00	0-105	3070.8	99.88
105-110	0.0	0.00	0-110	3070.8	99.88
110-115	0.0	0.00	0-115	3070.8	99.88
115-120	0.0	0.00	0-120	3070.8	99.88
120-125	0.0	0.00	0-125	3070.8	99.88
125-130	0.0	0.00	0-130	3070.8	99.88
130-135	0.0	0.00	0-135	3070.8	99.88
135-140	0.0	0.00	0-140	3070.8	99.88
140-145	0.2	0.01	0-145	3071.0	99.89
145-150	0.5	0.02	0-150	3071.5	99.91
150-155	0.6	0.02	0-155	3072.1	99.93
155-160	0.7	0.02	0-160	3072.8	99.95
160-165	0.6	0.02	0-165	3073.4	99.97
165-170	0.5	0.02	0-170	3073.9	99.98
170-175	0.3	0.01	0-175	3074.3	100.00
175-180	0.1	0.00	0-180	3074.4	100.00

## 6. Product Photo



\*\*\*\*\*END OF REPORT\*\*\*\*\*