

Cooper Lighting Solutions Photometric Lab  
1121 Highway 74 South  
Peachtree City, GA 30269



Scaled data based on original data using  
LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State  
Lighting Products

Test Report Prepared for

Cooper Lighting Solutions

(formerly Eaton)

Brand: METALUX

Report Number: P860200

Luminaire Tested: **SPHB-48SE-W-L840-CD**

Issue Date: 7/11/2024

This test was performed under the Supervised Manufacturer's Testing Program. The results of this test have not been influenced by sources from within Cooper Lighting Solutions or from external interests.



**Test Information**

Test Method: LM-79-08  
Report Number: P860200  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G3-2404-343-6)  
Test Lab: INNOVATION CENTER  
Issue Date: 7/11/2024  
Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)  
Product Line: METALUX  
Catalog Number: SPHB-48SE-W-L840-CD  
Description: 48000 Lumen Standard Efficacy Select Pro High Bay with Wide Lens  
and, 4000K 80CRI LEDs  
Light Source: -  
Ballast/Driver: -

Luminaire Equipment: Sample No.   Condition   Description

**Summary**

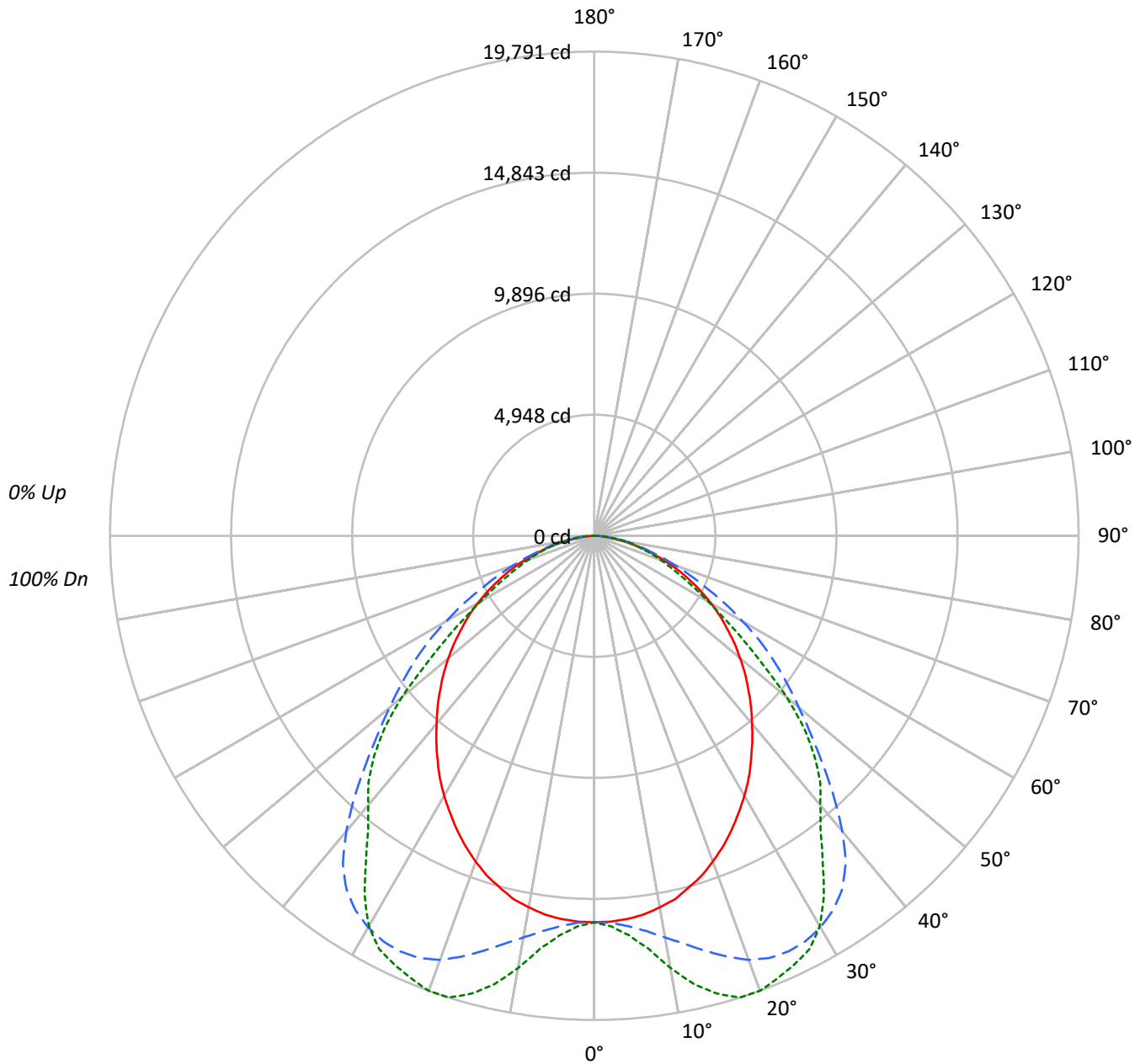
Lumens per Lamp: N/A  
Luminaire Lumens: 49710.0 lumens  
Efficiency: N/A  
Efficacy: 163.0 lumens/watt  
Spacing Criteria (0/90/45): 1.16 / 1.5 / 1.51  
Luminous Opening: Rectangular (W 1' x L: 3.38' x H: 0')  
CIE Type: Direct

Input Watts (W): 304.9  
Input Voltage (V): NR  
Input Current (Ain): NR  
Voltage Rise (V): NR  
Power Factor: NR  
Total Harmonic Distortion (THDi): NR  
Frequency (hertz): 60  
Stabilization Time: NR  
Operation Time: NR  
Ambient Temperature (°C): NR  
Test Distance: 25 FT

TEST NUMBER: P860200

CATALOG NUMBER: SPHB-48SE-W-L840-CD

### Luminous Intensity Polar Plot





TEST NUMBER: P860200

CATALOG NUMBER: SPHB-48SE-W-L840-CD

**COEFFICIENT OF UTILIZATION - ZONAL CAVITY METHOD:**

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|
| RF  | 20  |     |     |     | 20  |     |     |     |     | 20  |     |     |     |     | 20  |     |     |     |    | 20 |
| RC  | 80  |     |     |     | 70  |     |     |     |     | 50  |     |     |     |     | 30  |     |     |     |    | 10 |
| RW  | 70  | 50  | 30  | 10  | 70  | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30  | 10  | 50  | 30 | 10 |
| RCR |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |
| 0   | 119 | 119 | 119 | 119 | 116 | 116 | 116 | 116 | 111 | 111 | 111 | 106 | 106 | 106 | 102 | 102 | 102 | 100 |    |    |
| 1   | 110 | 105 | 101 | 98  | 107 | 103 | 99  | 96  | 99  | 96  | 93  | 95  | 92  | 90  | 91  | 89  | 87  | 85  |    |    |
| 2   | 100 | 92  | 86  | 81  | 98  | 91  | 85  | 80  | 87  | 82  | 78  | 84  | 80  | 76  | 81  | 77  | 74  | 72  |    |    |
| 3   | 92  | 82  | 74  | 68  | 89  | 80  | 73  | 67  | 77  | 71  | 66  | 74  | 69  | 65  | 72  | 67  | 64  | 62  |    |    |
| 4   | 84  | 73  | 64  | 58  | 82  | 71  | 63  | 57  | 69  | 62  | 57  | 66  | 61  | 56  | 64  | 59  | 55  | 53  |    |    |
| 5   | 77  | 65  | 56  | 50  | 75  | 64  | 56  | 50  | 62  | 55  | 49  | 60  | 54  | 49  | 58  | 52  | 48  | 46  |    |    |
| 6   | 72  | 59  | 50  | 44  | 70  | 58  | 49  | 43  | 56  | 49  | 43  | 54  | 48  | 43  | 53  | 47  | 42  | 40  |    |    |
| 7   | 66  | 53  | 45  | 39  | 65  | 52  | 44  | 38  | 51  | 43  | 38  | 49  | 43  | 38  | 48  | 42  | 38  | 36  |    |    |
| 8   | 62  | 48  | 40  | 34  | 60  | 48  | 40  | 34  | 46  | 39  | 34  | 45  | 39  | 34  | 44  | 38  | 34  | 32  |    |    |
| 9   | 58  | 44  | 36  | 31  | 56  | 44  | 36  | 31  | 43  | 36  | 31  | 42  | 35  | 30  | 41  | 35  | 30  | 29  |    |    |
| 10  | 54  | 41  | 33  | 28  | 53  | 40  | 33  | 28  | 39  | 33  | 28  | 39  | 32  | 28  | 38  | 32  | 28  | 26  |    |    |

**AVERAGE LUMINANCE (cd/sqm):**

|     | 0°    | 45°   | 90°   |
|-----|-------|-------|-------|
| 0°  | 50312 | 50312 | 50312 |
| 5°  | 50258 | 51206 | 52420 |
| 10° | 49860 | 53908 | 57994 |
| 15° | 49081 | 57922 | 63881 |
| 20° | 48019 | 62528 | 67072 |
| 25° | 46633 | 65901 | 67951 |
| 30° | 45115 | 67963 | 67767 |
| 35° | 43422 | 68646 | 63234 |
| 40° | 41672 | 65546 | 59725 |
| 45° | 40096 | 59414 | 57303 |
| 50° | 38533 | 54023 | 50800 |
| 55° | 36771 | 49913 | 41338 |
| 60° | 34952 | 44500 | 34045 |
| 65° | 32545 | 38238 | 29520 |
| 70° | 29608 | 32647 | 26699 |
| 75° | 25427 | 27398 | 24478 |
| 80° | 19874 | 23500 | 22702 |
| 85° | 13439 | 19943 | 18715 |



TEST NUMBER: P860200

CATALOG NUMBER: SPHB-48SE-W-L840-CD

**ZONAL LUMENS:**

| Zone      | Lumens  | % Fixture |
|-----------|---------|-----------|
| 0°-10°    | 1551.1  | 3.1       |
| 10°-20°   | 4918.5  | 9.9       |
| 20°-30°   | 8049.5  | 16.2      |
| 30°-40°   | 9819.7  | 19.8      |
| 40°-50°   | 9725.4  | 19.6      |
| 50°-60°   | 7777.1  | 15.6      |
| 60°-70°   | 4851.7  | 9.8       |
| 70°-80°   | 2377.1  | 4.8       |
| 80°-90°   | 623.4   | 1.3       |
| 90°-100°  | 16.4    | 0.0       |
| 100°-110° | 0.0     | 0.0       |
| 110°-120° | 0.0     | 0.0       |
| 120°-130° | 0.0     | 0.0       |
| 130°-140° | 0.0     | 0.0       |
| 140°-150° | 0.0     | 0.0       |
| 150°-160° | 0.0     | 0.0       |
| 160°-170° | 0.0     | 0.0       |
| 170°-180° | 0.0     | 0.0       |
| 0°-30°    | 14519.1 | 29.2      |
| 0°-40°    | 24338.9 | 49.0      |
| 0°-60°    | 41841.4 | 84.2      |
| 0°-90°    | 49693.6 | 100.0     |
| 90°-120°  | 16.4    | 0.0       |
| 90°-150°  | 16.4    | 0.0       |
| 90°-180°  | 16.0    | 0.0       |
| 0°-180°   | 49710.0 | 100.0     |

**CANDELA DISTRIBUTION:**

|      | 0°    | 22.5° | 45°   | 67.5° | 90°   | Flux |
|------|-------|-------|-------|-------|-------|------|
| 0°   | 15799 | 15799 | 15799 | 15799 | 15799 |      |
| 5°   | 15722 | 15791 | 16018 | 16297 | 16398 | ###  |
| 15°  | 14887 | 15753 | 17568 | 18967 | 19376 | 4197 |
| 25°  | 13271 | 15518 | 18755 | 19299 | 19338 | 6107 |
| 35°  | 11169 | 14924 | 17658 | 16714 | 16265 | 6986 |
| 45°  | 8903  | 13831 | 13192 | 12749 | 12724 | 6876 |
| 55°  | 6623  | 10619 | 8990  | 8122  | 7445  | 5934 |
| 65°  | 4319  | 5958  | 5074  | 4208  | 3918  | 4283 |
| 75°  | 2066  | 2531  | 2227  | 2039  | 1989  | 2194 |
| 85°  | 368   | 522   | 546   | 518   | 512   | 456  |
| 90°  | 2     | 53    | 97    | 123   | 127   | 21   |
| 95°  | 2     | 8     | 8     | 6     | 4     | 1    |
| 105° | 0     | 0     | 0     | 0     | 0     | 0    |
| 115° | 0     | 0     | 0     | 0     | 0     | 0    |
| 125° | 0     | 0     | 0     | 0     | 0     | 0    |
| 135° | 0     | 0     | 0     | 0     | 0     | 0    |
| 145° | 0     | 0     | 0     | 0     | 0     | 0    |
| 155° | 0     | 0     | 0     | 0     | 0     | 0    |
| 165° | 0     | 0     | 0     | 0     | 0     | 0    |
| 175° | 0     | 0     | 0     | 0     | 0     | 0    |
| 180° | 0     | 0     | 0     | 0     | 0     |      |



TEST NUMBER: P860200

CATALOG NUMBER: SPHB-48SE-W-L840-CD

**CANDELA DISTRIBUTION (FULL):**

|        | 0°      | 22.5°   | 45°     | 67.5°   | 90°     |
|--------|---------|---------|---------|---------|---------|
| 0°     | 15798.6 | 15798.6 | 15798.6 | 15798.6 | 15798.6 |
| 2.5°   | 15782.8 | 15776.8 | 15834.2 | 15939.0 | 15986.4 |
| 5°     | 15721.5 | 15790.7 | 16018.1 | 16296.9 | 16397.8 |
| 7.5°   | 15610.7 | 15796.6 | 16298.9 | 16811.1 | 17028.6 |
| 10°    | 15418.9 | 15800.6 | 16670.7 | 17574.4 | 17934.3 |
| 12.5°  | 15221.1 | 15786.7 | 17084.0 | 18363.5 | 18757.0 |
| 15°    | 14886.9 | 15753.1 | 17568.5 | 18966.6 | 19376.0 |
| 17.5°  | 14576.5 | 15713.5 | 18035.2 | 19478.8 | 19789.3 |
| 20°    | 14169.1 | 15656.2 | 18450.5 | 19635.0 | 19791.2 |
| 22.5°  | 13741.9 | 15610.7 | 18679.9 | 19530.2 | 19577.7 |
| 25°    | 13271.3 | 15517.8 | 18755.0 | 19298.8 | 19338.4 |
| 27.5°  | 12769.0 | 15434.7 | 18683.8 | 19012.1 | 19045.7 |
| 30°    | 12268.7 | 15284.4 | 18482.1 | 18565.2 | 18428.7 |
| 32.5°  | 11744.6 | 15134.1 | 18155.8 | 17782.1 | 17463.7 |
| 35°    | 11169.2 | 14924.5 | 17657.5 | 16714.2 | 16265.3 |
| 37.5°  | 10601.6 | 14722.8 | 16880.3 | 15519.7 | 15181.6 |
| 40°    | 10024.2 | 14473.6 | 15766.9 | 14404.4 | 14366.8 |
| 42.5°  | 9478.4  | 14204.7 | 14507.2 | 13536.3 | 13662.8 |
| 45°    | 8902.9  | 13830.9 | 13192.2 | 12749.2 | 12723.5 |
| 47.5°  | 8357.1  | 13314.8 | 11995.8 | 11879.1 | 11616.1 |
| 50°    | 7777.7  | 12602.9 | 10904.2 | 10793.4 | 10253.6 |
| 52.5°  | 7210.1  | 11695.2 | 9929.2  | 9514.0  | 8726.9  |
| 55°    | 6622.8  | 10619.4 | 8989.9  | 8121.8  | 7445.4  |
| 57.5°  | 6077.0  | 9436.8  | 8034.8  | 6909.5  | 6302.4  |
| 60°    | 5487.7  | 8238.4  | 6986.7  | 5845.6  | 5345.3  |
| 62.5°  | 4910.2  | 7057.8  | 6037.4  | 4939.9  | 4607.7  |
| 65°    | 4319.0  | 5958.3  | 5074.4  | 4208.2  | 3917.5  |
| 67.5°  | 3753.4  | 5007.1  | 4241.8  | 3547.7  | 3353.9  |
| 70°    | 3179.9  | 4061.9  | 3506.2  | 2980.2  | 2867.4  |
| 72.5°  | 2588.6  | 3245.1  | 2835.8  | 2515.4  | 2430.4  |
| 75°    | 2066.5  | 2531.3  | 2226.7  | 2038.8  | 1989.4  |
| 77.5°  | 1538.5  | 1882.6  | 1740.2  | 1629.5  | 1615.7  |
| 80°    | 1083.7  | 1358.6  | 1281.4  | 1259.7  | 1237.9  |
| 82.5°  | 692.1   | 887.9   | 911.6   | 897.8   | 882.0   |
| 85°    | 367.8   | 522.1   | 545.8   | 518.1   | 512.2   |
| 87.5°  | 148.3   | 227.4   | 245.2   | 270.9   | 278.8   |
| 90°    | 2.0     | 53.4    | 96.9    | 122.6   | 126.6   |
| 92.5°  | 2.0     | 11.9    | 13.8    | 13.8    | 11.9    |
| 95°    | 2.0     | 7.9     | 7.9     | 5.9     | 4.0     |
| 97.5°  | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |
| 100°   | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |
| 102.5° | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |
| 105°   | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |



TEST NUMBER: P860200

CATALOG NUMBER: SPHB-48SE-W-L840-CD

**CANDELA DISTRIBUTION (continued):**

|        | 0°  | 22.5° | 45° | 67.5° | 90° |
|--------|-----|-------|-----|-------|-----|
| 112.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 115°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 117.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 120°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 122.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 125°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 127.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 130°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 132.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 135°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 137.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 140°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 142.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 145°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 147.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 150°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 152.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 155°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 157.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 160°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 162.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 165°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 167.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 170°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 172.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 175°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 177.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |
| 180°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0 |



Report Generated By 670246072 / DESKTOP-50001EG







— 0°-180°    - - 45°-225°    - - - 90°-270°







|        |     |     |     |     |     |
|--------|-----|-----|-----|-----|-----|
| 107.5° | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 110°   | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |



LM-79-2019: Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

Report Prepared for

Cooper Lighting Solutions

METALUX

Report Number: SP1-2309-187-7

Test Date: 10/09/2023

Luminaire Tested: SPHB-1224SE-M-UNV-L84050-CD-U (24K LUMEN 4000K)

Data in this report applies to families of products including SPHB-1224SE-M-UNV-L84050-CD-U (24K LUMEN 4000K).

### Test Information

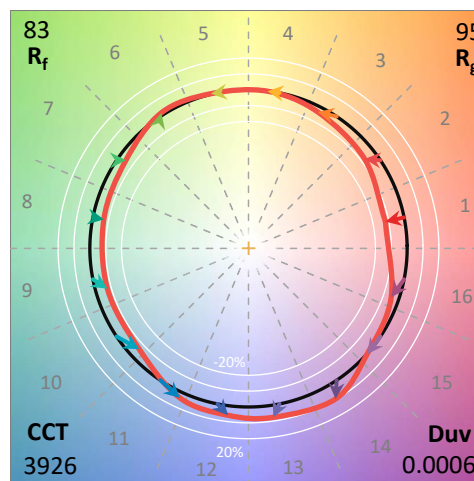
Test Method: LM-79-2019  
 Report Number: SP1-2309-187-7  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry:  $4\pi$   
 Issue Date: 10/09/2023  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: METALUX  
 Catalog Number: **SPHB-1224SE-M-UNV-L84050-CD-U (24K LUMEN 4000K)**  
 Description: SPHB SELECT, MEDIUM LENS, 24K LUMENS, 4000K

### Spectral Parameters

CCT (K): 3926  
 CIE u': 0.2261  
 CIE v': 0.5037  
 Duv: 0.0006  
 CIE x: 0.3841  
 CIE y: 0.3802  
 CIE z: 0.2357  
 Peak Wavelength (nm): 454  
 Dominant Wavelength (nm): 579  
 Purity: 29.5  
 Rf: 82.9  
 Rg: 95

CRI (Ra): 82.0  
 R1: 80.3  
 R2: 88.4  
 R3: 93.9  
 R4: 80.2  
 R5: 79.7  
 R6: 83.3  
 R7: 86.1  
 R8: 64.3

R9: 8.2  
 R10: 71.6  
 R11: 78.1  
 R12: 57.5  
 R13: 82.3  
 R14: 96.6



### Test Conditions

Stabilization Time: 23M  
 Operation Time: 12H  
 Room Temperature (°C) / RH%: 25.5/33%  
 Sphere Temperature (°C): 24.2

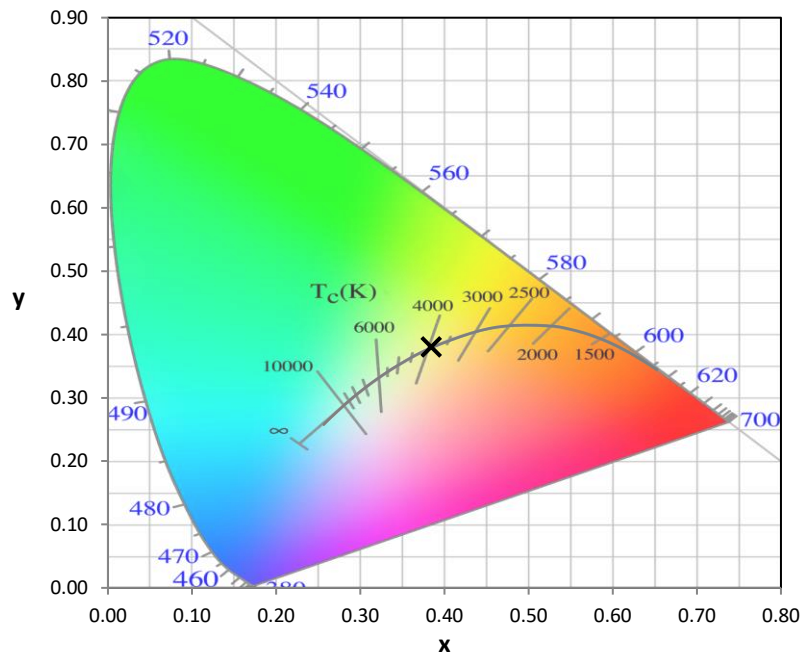


REPORT NUMBER: SP1-2309-187-7

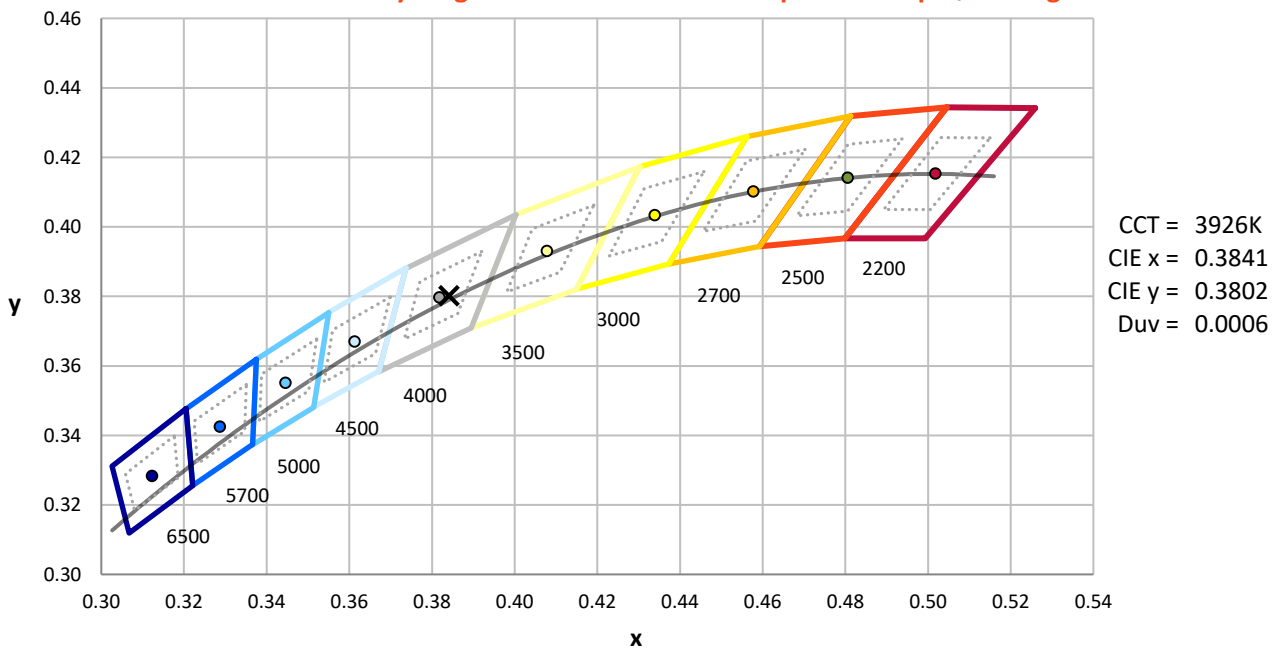
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | 76INCH SPHERE IN0058  | 8/9/2023         | 2/9/2024             |
| Power Meter                    | XITRON 2801 IN0071    | 11/29/2022       | 11/29/2023           |
| AC Power Source                | CHROMA 61603 IN0063   | 11/28/2022       | 11/28/2023           |
| DC Power Source                | AGILENT E3634A IN0208 | 11/28/2022       | 11/28/2023           |
| Sphere Thermometer             | ONSET IN0085          | 11/28/2022       | 11/28/2023           |
| Room Thermometer               | ONSET IN0046          | 11/28/2022       | 11/28/2023           |

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**CIE 1931 Chromaticity Diagram**



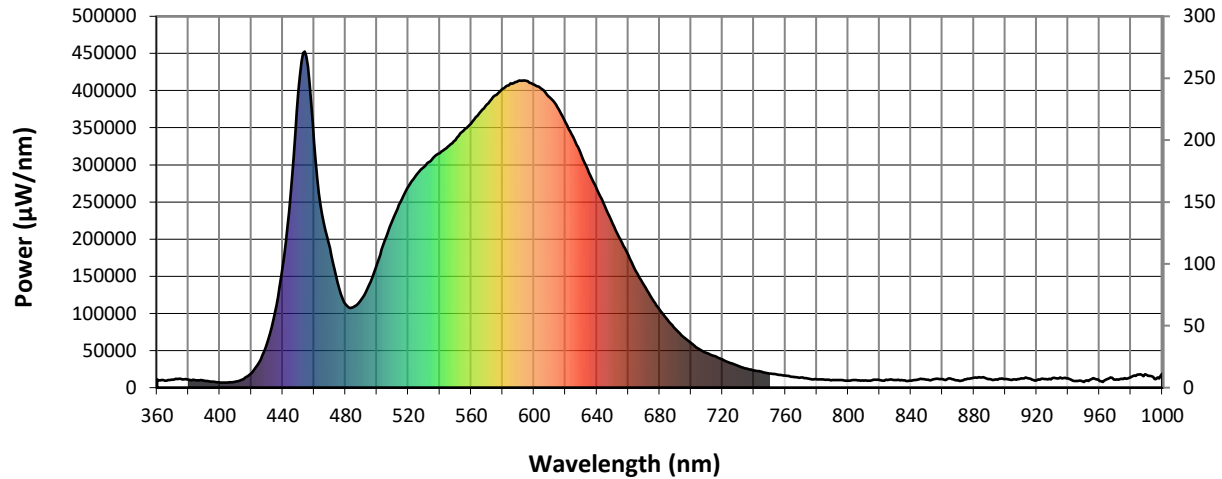
**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



Point lies inside the ANSI 4000K 4-step quadrangle

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**Photopic Flux vs. Wavelength**

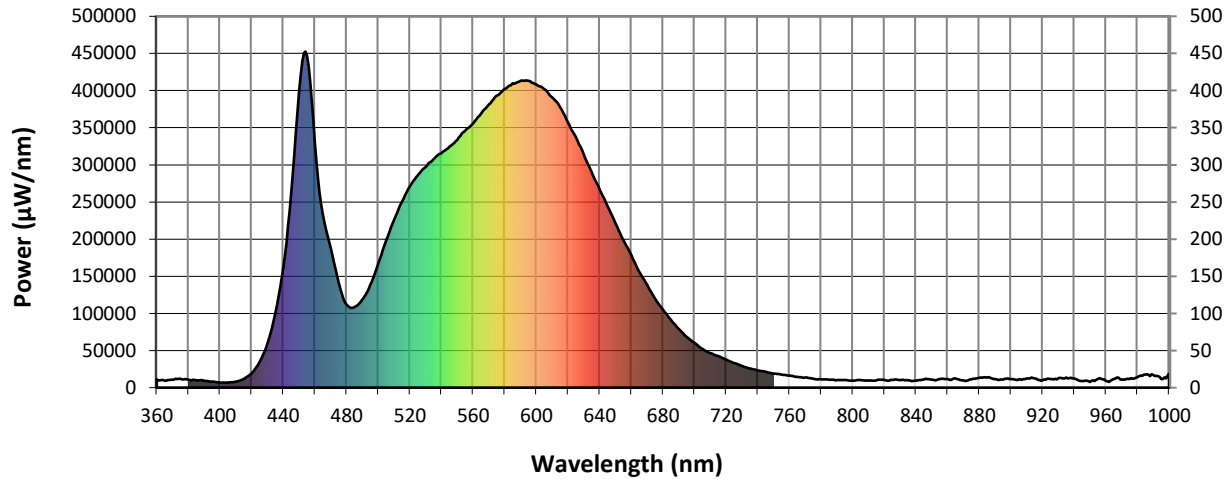


#####

| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 360       | 10992            | NR               | 490       | 118921           | NR               | 620       | 356922           | NR               | 750       | 19019            | NR               | 880       | 13091            | NR               |
| 365       | 9593             | NR               | 495       | 138088           | NR               | 625       | 337439           | NR               | 755       | 17413            | NR               | 885       | 13768            | NR               |
| 370       | 10476            | NR               | 500       | 166483           | NR               | 630       | 313667           | NR               | 760       | 16262            | NR               | 890       | 11509            | NR               |
| 375       | 11916            | NR               | 505       | 198126           | NR               | 635       | 289634           | NR               | 765       | 14555            | NR               | 895       | 10746            | NR               |
| 380       | 10857            | NR               | 510       | 225943           | NR               | 640       | 267120           | NR               | 770       | 13516            | NR               | 900       | 11526            | NR               |
| 385       | 9836             | NR               | 515       | 249652           | NR               | 645       | 244025           | NR               | 775       | 12156            | NR               | 905       | 11085            | NR               |
| 390       | 9329             | NR               | 520       | 270963           | NR               | 650       | 221090           | NR               | 780       | 11138            | NR               | 910       | 12484            | NR               |
| 395       | 8104             | NR               | 525       | 285863           | NR               | 655       | 198958           | NR               | 785       | 10805            | NR               | 915       | 12235            | NR               |
| 400       | 6858             | NR               | 530       | 297396           | NR               | 660       | 178676           | NR               | 790       | 10121            | NR               | 920       | 9666             | NR               |
| 405       | 6914             | NR               | 535       | 307535           | NR               | 665       | 155862           | NR               | 795       | 10392            | NR               | 925       | 11659            | NR               |
| 410       | 8077             | NR               | 540       | 315948           | NR               | 670       | 138150           | NR               | 800       | 9549             | NR               | 930       | 12967            | NR               |
| 415       | 11717            | NR               | 545       | 324499           | NR               | 675       | 120142           | NR               | 805       | 10057            | NR               | 935       | 13555            | NR               |
| 420       | 19513            | NR               | 550       | 333620           | NR               | 680       | 105107           | NR               | 810       | 9285             | NR               | 940       | 12553            | NR               |
| 425       | 34423            | NR               | 555       | 345725           | NR               | 685       | 91191            | NR               | 815       | 9751             | NR               | 945       | 9165             | NR               |
| 430       | 59393            | NR               | 560       | 355808           | NR               | 690       | 79275            | NR               | 820       | 10216            | NR               | 950       | 7624             | NR               |
| 435       | 101278           | NR               | 565       | 369262           | NR               | 695       | 68358            | NR               | 825       | 10410            | NR               | 955       | 11686            | NR               |
| 440       | 162827           | NR               | 570       | 381413           | NR               | 700       | 60050            | NR               | 830       | 10058            | NR               | 960       | 9106             | NR               |
| 445       | 260438           | NR               | 575       | 393089           | NR               | 705       | 51990            | NR               | 835       | 9982             | NR               | 965       | 11345            | NR               |
| 450       | 399252           | NR               | 580       | 402225           | NR               | 710       | 46653            | NR               | 840       | 9215             | NR               | 970       | 10672            | NR               |
| 455       | 445742           | NR               | 585       | 409494           | NR               | 715       | 42391            | NR               | 845       | 11311            | NR               | 975       | 11689            | NR               |
| 460       | 330661           | NR               | 590       | 413322           | NR               | 720       | 37628            | NR               | 850       | 10813            | NR               | 980       | 14054            | NR               |
| 465       | 233593           | NR               | 595       | 413160           | NR               | 725       | 33220            | NR               | 855       | 11652            | NR               | 985       | 17684            | NR               |
| 470       | 187643           | NR               | 600       | 408148           | NR               | 730       | 29243            | NR               | 860       | 11468            | NR               | 990       | 17244            | NR               |
| 475       | 140648           | NR               | 605       | 401766           | NR               | 735       | 25806            | NR               | 865       | 12591            | NR               | 995       | 11439            | NR               |
| 480       | 111871           | NR               | 610       | 390821           | NR               | 740       | 23374            | NR               | 870       | 9925             | NR               | 1000      | 19016            | NR               |
| 485       | 108472           | NR               | 615       | 377363           | NR               | 745       | 21294            | NR               | 875       | 11284            | NR               |           |                  |                  |

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**Scotopic Flux vs. Wavelength**



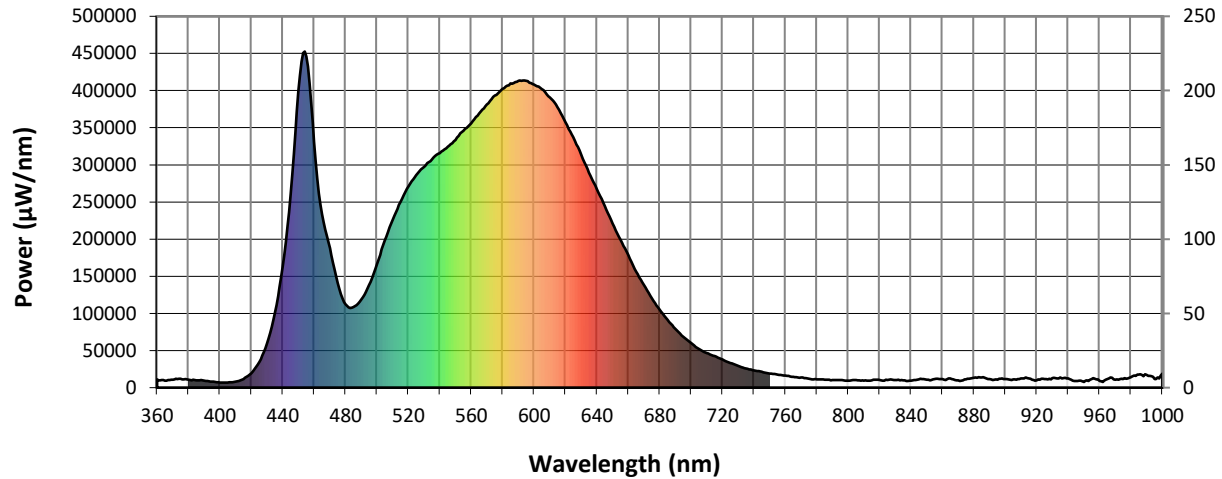
**Scotopic Lumens: 39237.7**

**S/P: 1.65**

| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 360       | 10992            | NR               | 490       | 118921           | NR               | 620       | 356922           | NR               | 750       | 19019            | NR               | 880       | 13091            | NR               |
| 365       | 9593             | NR               | 495       | 138088           | NR               | 625       | 337439           | NR               | 755       | 17413            | NR               | 885       | 13768            | NR               |
| 370       | 10476            | NR               | 500       | 166483           | NR               | 630       | 313667           | NR               | 760       | 16262            | NR               | 890       | 11509            | NR               |
| 375       | 11916            | NR               | 505       | 198126           | NR               | 635       | 289634           | NR               | 765       | 14555            | NR               | 895       | 10746            | NR               |
| 380       | 10857            | NR               | 510       | 225943           | NR               | 640       | 267120           | NR               | 770       | 13516            | NR               | 900       | 11526            | NR               |
| 385       | 9836             | NR               | 515       | 249652           | NR               | 645       | 244025           | NR               | 775       | 12156            | NR               | 905       | 11085            | NR               |
| 390       | 9329             | NR               | 520       | 270963           | NR               | 650       | 221090           | NR               | 780       | 11138            | NR               | 910       | 12484            | NR               |
| 395       | 8104             | NR               | 525       | 285863           | NR               | 655       | 198958           | NR               | 785       | 10805            | NR               | 915       | 12235            | NR               |
| 400       | 6858             | NR               | 530       | 297396           | NR               | 660       | 178676           | NR               | 790       | 10121            | NR               | 920       | 9666             | NR               |
| 405       | 6914             | NR               | 535       | 307535           | NR               | 665       | 155862           | NR               | 795       | 10392            | NR               | 925       | 11659            | NR               |
| 410       | 8077             | NR               | 540       | 315948           | NR               | 670       | 138150           | NR               | 800       | 9549             | NR               | 930       | 12967            | NR               |
| 415       | 11717            | NR               | 545       | 324499           | NR               | 675       | 120142           | NR               | 805       | 10057            | NR               | 935       | 13555            | NR               |
| 420       | 19513            | NR               | 550       | 333620           | NR               | 680       | 105107           | NR               | 810       | 9285             | NR               | 940       | 12553            | NR               |
| 425       | 34423            | NR               | 555       | 345725           | NR               | 685       | 91191            | NR               | 815       | 9751             | NR               | 945       | 9165             | NR               |
| 430       | 59393            | NR               | 560       | 355808           | NR               | 690       | 79275            | NR               | 820       | 10216            | NR               | 950       | 7624             | NR               |
| 435       | 101278           | NR               | 565       | 369262           | NR               | 695       | 68358            | NR               | 825       | 10410            | NR               | 955       | 11686            | NR               |
| 440       | 162827           | NR               | 570       | 381413           | NR               | 700       | 60050            | NR               | 830       | 10058            | NR               | 960       | 9106             | NR               |
| 445       | 260438           | NR               | 575       | 393089           | NR               | 705       | 51990            | NR               | 835       | 9982             | NR               | 965       | 11345            | NR               |
| 450       | 399252           | NR               | 580       | 402225           | NR               | 710       | 46653            | NR               | 840       | 9215             | NR               | 970       | 10672            | NR               |
| 455       | 445742           | NR               | 585       | 409494           | NR               | 715       | 42391            | NR               | 845       | 11311            | NR               | 975       | 11689            | NR               |
| 460       | 330661           | NR               | 590       | 413322           | NR               | 720       | 37628            | NR               | 850       | 10813            | NR               | 980       | 14054            | NR               |
| 465       | 233593           | NR               | 595       | 413160           | NR               | 725       | 33220            | NR               | 855       | 11652            | NR               | 985       | 17684            | NR               |
| 470       | 187643           | NR               | 600       | 408148           | NR               | 730       | 29243            | NR               | 860       | 11468            | NR               | 990       | 17244            | NR               |
| 475       | 140648           | NR               | 605       | 401766           | NR               | 735       | 25806            | NR               | 865       | 12591            | NR               | 995       | 11439            | NR               |
| 480       | 111871           | NR               | 610       | 390821           | NR               | 740       | 23374            | NR               | 870       | 9925             | NR               | 1000      | 19016            | NR               |
| 485       | 108472           | NR               | 615       | 377363           | NR               | 745       | 21294            | NR               | 875       | 11284            | NR               |           |                  |                  |

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**Melanopic Flux vs. Wavelength**



**Melanopic Lumens: 15753**

**M/P: 0.66**

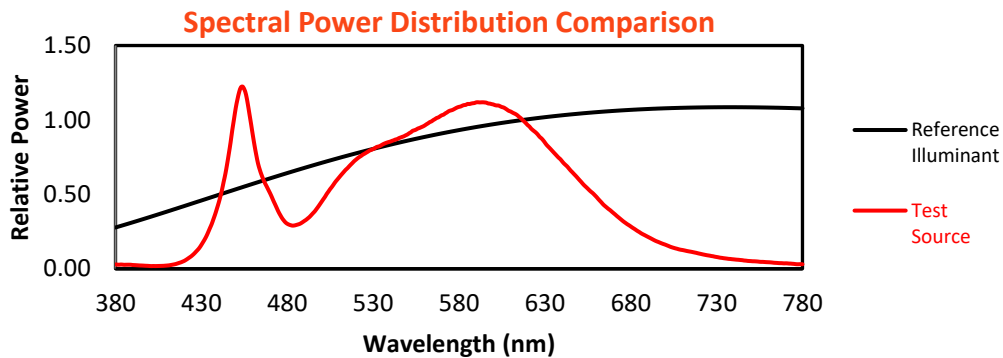
| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 360       | 10992            | NR               | 490       | 118921           | NR               | 620       | 356922           | NR               | 750       | 19019            | NR               | 880       | 13091            | NR               |
| 365       | 9593             | NR               | 495       | 138088           | NR               | 625       | 337439           | NR               | 755       | 17413            | NR               | 885       | 13768            | NR               |
| 370       | 10476            | NR               | 500       | 166483           | NR               | 630       | 313667           | NR               | 760       | 16262            | NR               | 890       | 11509            | NR               |
| 375       | 11916            | NR               | 505       | 198126           | NR               | 635       | 289634           | NR               | 765       | 14555            | NR               | 895       | 10746            | NR               |
| 380       | 10857            | NR               | 510       | 225943           | NR               | 640       | 267120           | NR               | 770       | 13516            | NR               | 900       | 11526            | NR               |
| 385       | 9836             | NR               | 515       | 249652           | NR               | 645       | 244025           | NR               | 775       | 12156            | NR               | 905       | 11085            | NR               |
| 390       | 9329             | NR               | 520       | 270963           | NR               | 650       | 221090           | NR               | 780       | 11138            | NR               | 910       | 12484            | NR               |
| 395       | 8104             | NR               | 525       | 285863           | NR               | 655       | 198958           | NR               | 785       | 10805            | NR               | 915       | 12235            | NR               |
| 400       | 6858             | NR               | 530       | 297396           | NR               | 660       | 178676           | NR               | 790       | 10121            | NR               | 920       | 9666             | NR               |
| 405       | 6914             | NR               | 535       | 307535           | NR               | 665       | 155862           | NR               | 795       | 10392            | NR               | 925       | 11659            | NR               |
| 410       | 8077             | NR               | 540       | 315948           | NR               | 670       | 138150           | NR               | 800       | 9549             | NR               | 930       | 12967            | NR               |
| 415       | 11717            | NR               | 545       | 324499           | NR               | 675       | 120142           | NR               | 805       | 10057            | NR               | 935       | 13555            | NR               |
| 420       | 19513            | NR               | 550       | 333620           | NR               | 680       | 105107           | NR               | 810       | 9285             | NR               | 940       | 12553            | NR               |
| 425       | 34423            | NR               | 555       | 345725           | NR               | 685       | 91191            | NR               | 815       | 9751             | NR               | 945       | 9165             | NR               |
| 430       | 59393            | NR               | 560       | 355808           | NR               | 690       | 79275            | NR               | 820       | 10216            | NR               | 950       | 7624             | NR               |
| 435       | 101278           | NR               | 565       | 369262           | NR               | 695       | 68358            | NR               | 825       | 10410            | NR               | 955       | 11686            | NR               |
| 440       | 162827           | NR               | 570       | 381413           | NR               | 700       | 60050            | NR               | 830       | 10058            | NR               | 960       | 9106             | NR               |
| 445       | 260438           | NR               | 575       | 393089           | NR               | 705       | 51990            | NR               | 835       | 9982             | NR               | 965       | 11345            | NR               |
| 450       | 399252           | NR               | 580       | 402225           | NR               | 710       | 46653            | NR               | 840       | 9215             | NR               | 970       | 10672            | NR               |
| 455       | 445742           | NR               | 585       | 409494           | NR               | 715       | 42391            | NR               | 845       | 11311            | NR               | 975       | 11689            | NR               |
| 460       | 330661           | NR               | 590       | 413322           | NR               | 720       | 37628            | NR               | 850       | 10813            | NR               | 980       | 14054            | NR               |
| 465       | 233593           | NR               | 595       | 413160           | NR               | 725       | 33220            | NR               | 855       | 11652            | NR               | 985       | 17684            | NR               |
| 470       | 187643           | NR               | 600       | 408148           | NR               | 730       | 29243            | NR               | 860       | 11468            | NR               | 990       | 17244            | NR               |
| 475       | 140648           | NR               | 605       | 401766           | NR               | 735       | 25806            | NR               | 865       | 12591            | NR               | 995       | 11439            | NR               |
| 480       | 111871           | NR               | 610       | 390821           | NR               | 740       | 23374            | NR               | 870       | 9925             | NR               | 1000      | 19016            | NR               |
| 485       | 108472           | NR               | 615       | 377363           | NR               | 745       | 21294            | NR               | 875       | 11284            | NR               |           |                  |                  |

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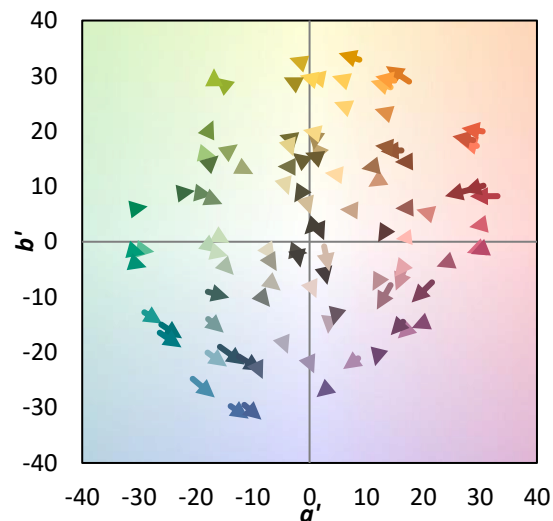
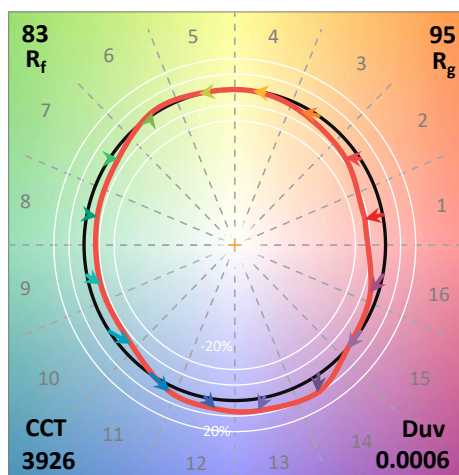
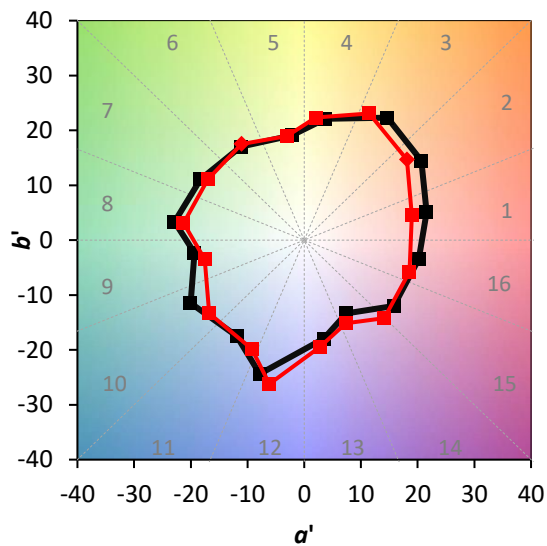
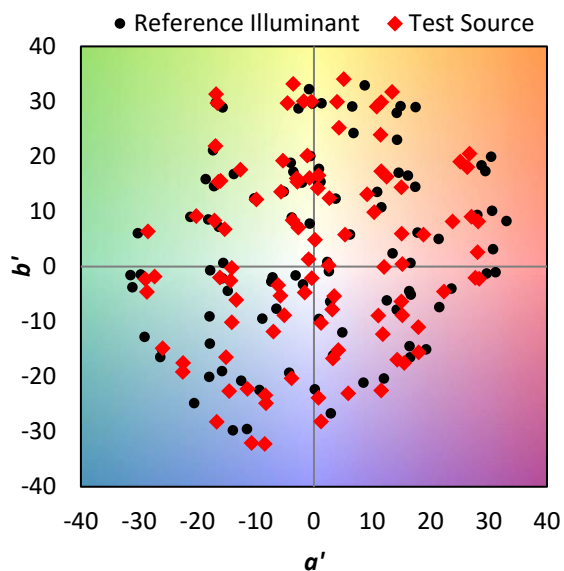
**TM-30-18**

**Summary**

$R_f = 82.9$   
 $R_g = 95$   
 $CIE R_a = 82.0$   
 $R_9 = 8.2$



**Color Vector Graphics**

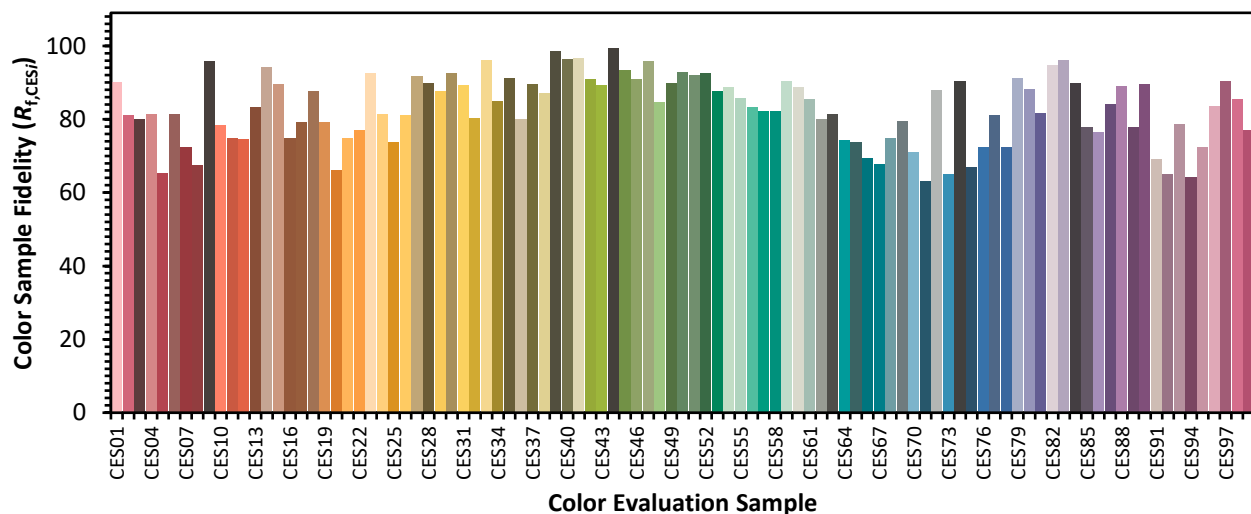


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**Individual Sample Fidelity Index ( $R_{f,i}$ )**

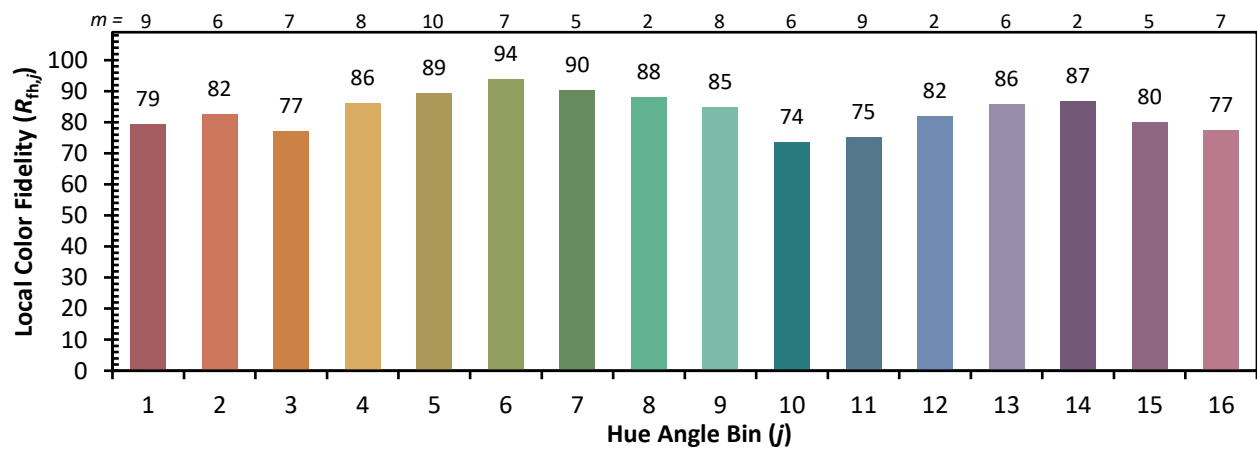
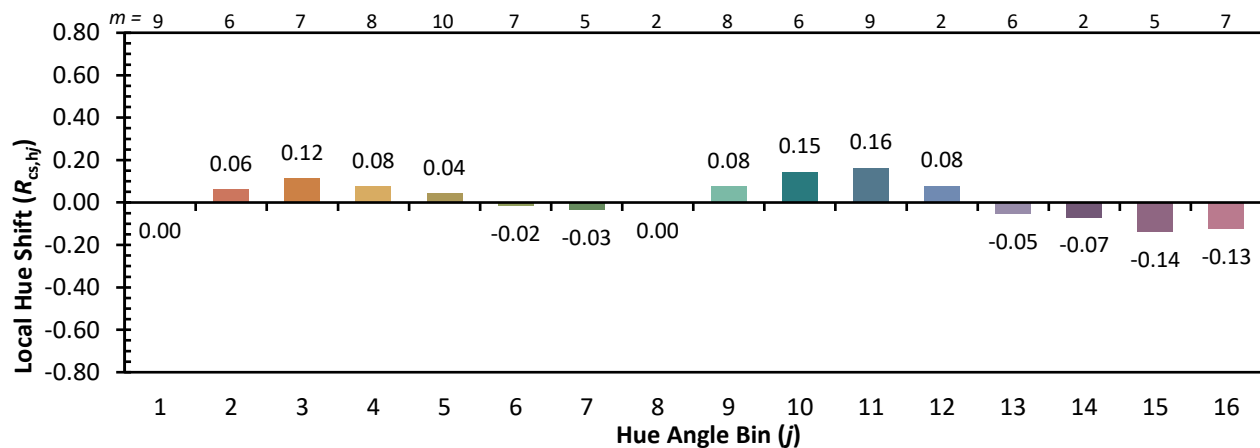
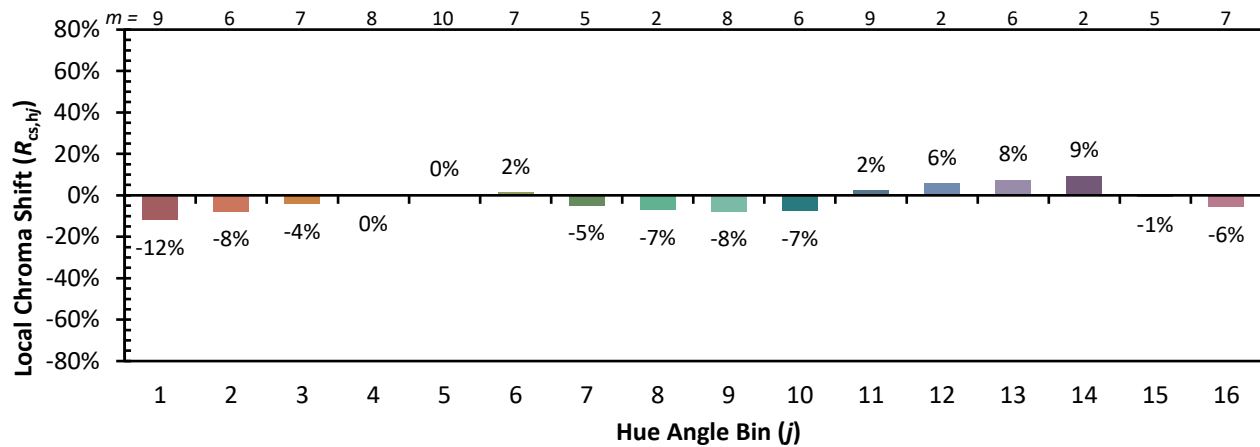
|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 81 | CES51 = 92 | CES76 = 73 |
| CES02 = 61 | CES27 = 92 | CES52 = 92 | CES77 = 81 |
| CES03 = 31 | CES28 = 90 | CES53 = 88 | CES78 = 72 |
| CES04 = 70 | CES29 = 88 | CES54 = 89 | CES79 = 91 |
| CES05 = 48 | CES30 = 92 | CES55 = 86 | CES80 = 88 |
| CES06 = 50 | CES31 = 89 | CES56 = 83 | CES81 = 82 |
| CES07 = 41 | CES32 = 80 | CES57 = 82 | CES82 = 95 |
| CES08 = 40 | CES33 = 96 | CES58 = 82 | CES83 = 96 |
| CES09 = 29 | CES34 = 85 | CES59 = 90 | CES84 = 90 |
| CES10 = 74 | CES35 = 91 | CES60 = 89 | CES85 = 78 |
| CES11 = 57 | CES36 = 80 | CES61 = 85 | CES86 = 76 |
| CES12 = 63 | CES37 = 90 | CES62 = 80 | CES87 = 84 |
| CES13 = 42 | CES38 = 87 | CES63 = 81 | CES88 = 89 |
| CES14 = 74 | CES39 = 98 | CES64 = 74 | CES89 = 78 |
| CES15 = 71 | CES40 = 96 | CES65 = 74 | CES90 = 90 |
| CES16 = 47 | CES41 = 97 | CES66 = 69 | CES91 = 69 |
| CES17 = 49 | CES42 = 91 | CES67 = 68 | CES92 = 65 |
| CES18 = 56 | CES43 = 89 | CES68 = 75 | CES93 = 79 |
| CES19 = 71 | CES44 = 99 | CES69 = 80 | CES94 = 64 |
| CES20 = 65 | CES45 = 93 | CES70 = 71 | CES95 = 72 |
| CES21 = 86 | CES46 = 91 | CES71 = 63 | CES96 = 84 |
| CES22 = 78 | CES47 = 96 | CES72 = 88 | CES97 = 90 |
| CES23 = 91 | CES48 = 85 | CES73 = 65 | CES98 = 85 |
| CES24 = 90 | CES49 = 90 | CES74 = 90 | CES99 = 77 |
| CES25 = 71 | CES50 = 93 | CES75 = 67 |            |



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Color Rendition by Hue-Angle Bin

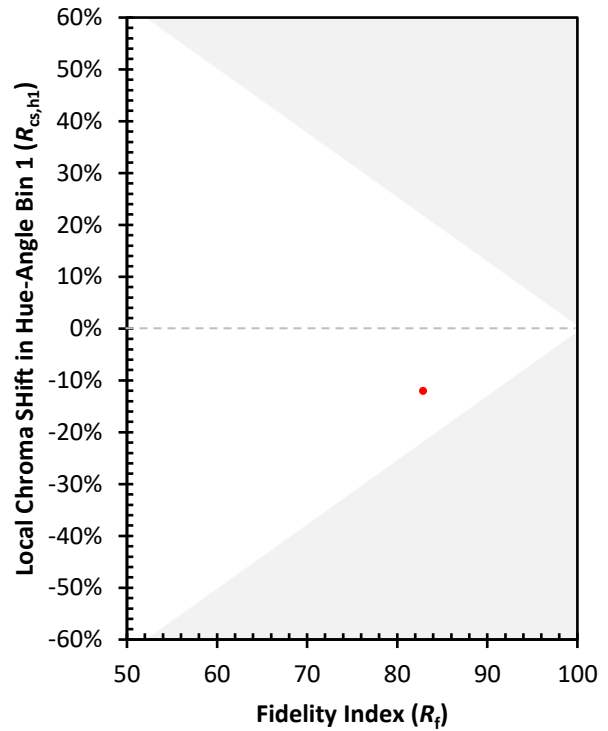
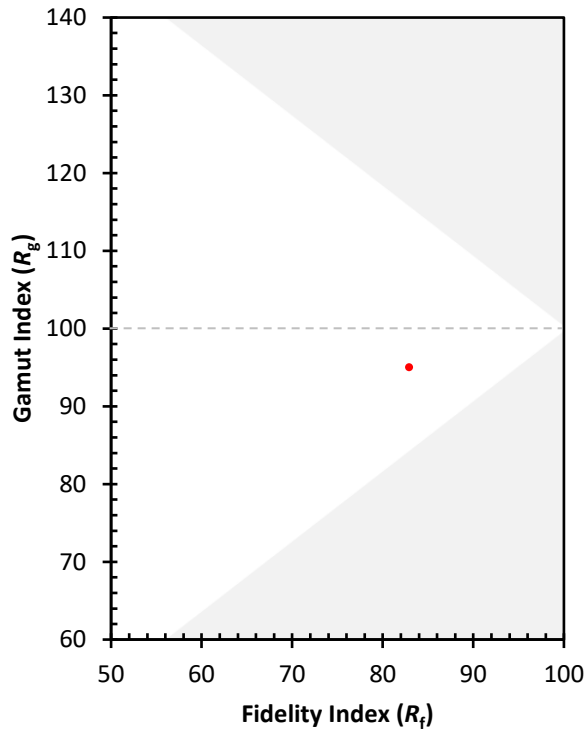




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**Measure Comparisons**



(END OF REPORT)