

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: P859921

Luminaire Tested: **SPHB-15SE-N-L840-CD**

Issue Date: 7/11/2024



**Test Information**

Test Method: LM-79-08  
Report Number: P859921  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G3-2404-343-7)  
Test Lab: INNOVATION CENTER  
Issue Date: 7/11/2024  
Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)  
Product Line: METALUX  
Catalog Number: SPHB-15SE-N-L840-CD  
Description: 15000 Lumen Standard Efficacy Select Pro High Bay with Narrow Lens  
and, 4000K 80CRI LEDs  
Light Source: -  
Ballast/Driver: -

Luminaire Equipment: Sample No.   Condition   Description

**Summary**

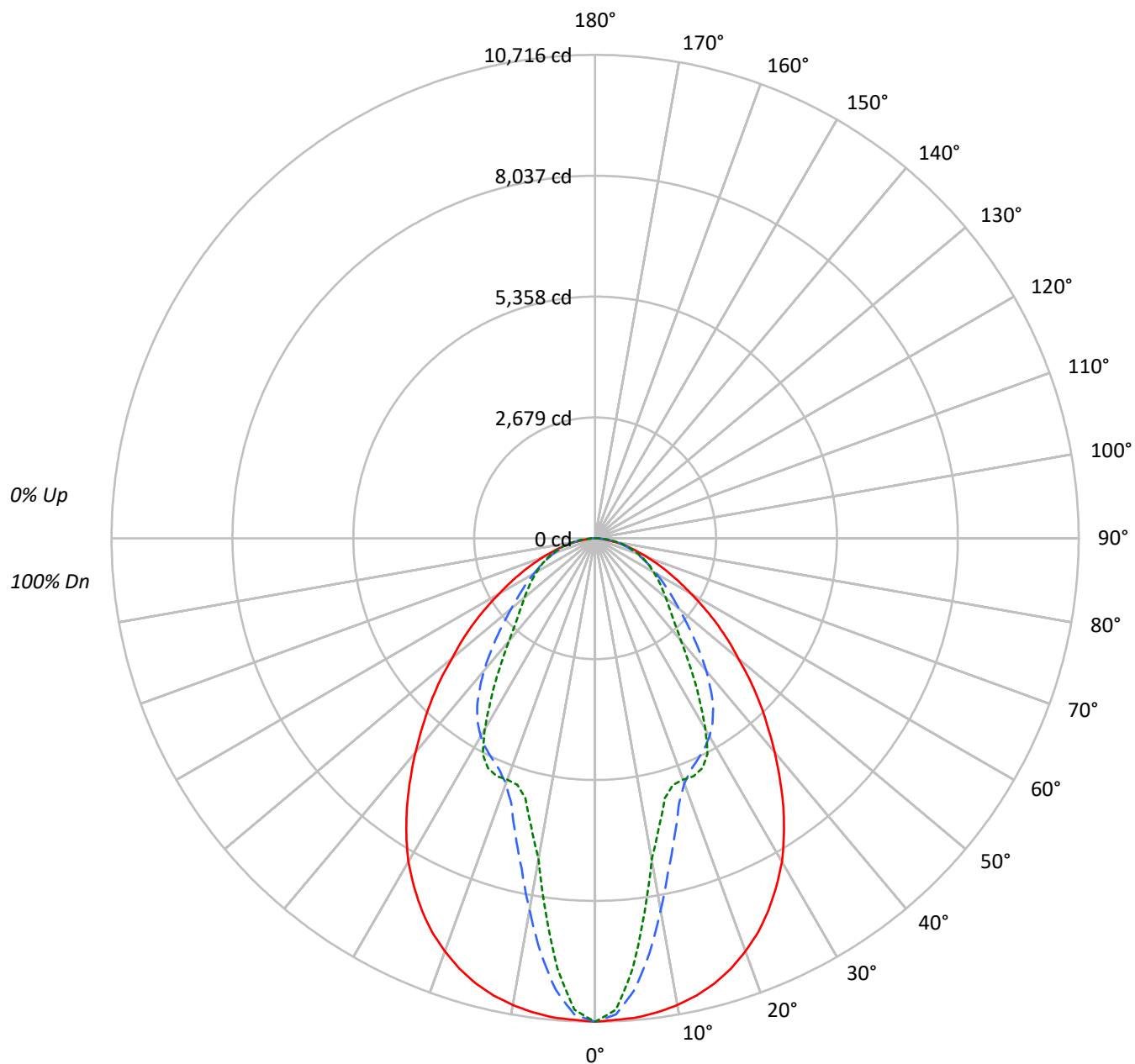
Lumens per Lamp: N/A  
Luminaire Lumens: 15706.0 lumens  
Efficiency: N/A  
Efficacy: 163.8 lumens/watt  
Spacing Criteria (0/90/45): 1.16 / 0.54 / 0.94  
Luminous Opening: Rectangular (W 1' x L: 1.38' x H: 0')  
CIE Type: Direct

Input Watts (W): 95.9  
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: P859921

CATALOG NUMBER: SPHB-15SE-N-L840-CD

### Luminous Intensity Polar Plot





TEST NUMBER: P859921

CATALOG NUMBER: SPHB-15SE-N-L840-CD

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

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|
| RF  | 20  |     |     |     | 20  |     |     |     |     | 20  |     |     |     |     | 20  |     |     |     |    | 20 |
| RC  | 80  |     |     |     | 70  |     |     |     |     | 50  |     |     |     |     | 30  |     |     |     |    | 0  |
| 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 | 106 | 102 | 98  | 107 | 103 | 100 | 97  | 99  | 96  | 94  | 95  | 93  | 91  | 92  | 90  | 88  | 86  |    |    |
| 2   | 101 | 94  | 88  | 83  | 99  | 92  | 86  | 82  | 88  | 84  | 80  | 85  | 81  | 78  | 82  | 79  | 76  | 74  |    |    |
| 3   | 93  | 84  | 76  | 71  | 91  | 82  | 75  | 70  | 79  | 73  | 69  | 77  | 72  | 68  | 74  | 70  | 66  | 64  |    |    |
| 4   | 86  | 75  | 67  | 61  | 84  | 74  | 67  | 61  | 72  | 65  | 60  | 69  | 64  | 59  | 67  | 62  | 58  | 56  |    |    |
| 5   | 80  | 68  | 60  | 54  | 78  | 67  | 59  | 54  | 65  | 58  | 53  | 63  | 57  | 53  | 61  | 56  | 52  | 50  |    |    |
| 6   | 74  | 62  | 54  | 48  | 73  | 61  | 54  | 48  | 60  | 53  | 47  | 58  | 52  | 47  | 56  | 51  | 47  | 45  |    |    |
| 7   | 70  | 57  | 49  | 43  | 68  | 56  | 49  | 43  | 55  | 48  | 43  | 53  | 47  | 43  | 52  | 46  | 42  | 40  |    |    |
| 8   | 65  | 53  | 45  | 39  | 64  | 52  | 44  | 39  | 51  | 44  | 39  | 49  | 43  | 39  | 48  | 43  | 38  | 37  |    |    |
| 9   | 61  | 49  | 41  | 36  | 60  | 48  | 41  | 36  | 47  | 40  | 36  | 46  | 40  | 35  | 45  | 39  | 35  | 34  |    |    |
| 10  | 58  | 45  | 38  | 33  | 56  | 45  | 38  | 33  | 44  | 37  | 33  | 43  | 37  | 33  | 42  | 37  | 33  | 31  |    |    |

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

|     | 0°    | 45°   | 90°   |
|-----|-------|-------|-------|
| 0°  | 83588 | 83588 | 83588 |
| 5°  | 83491 | 78648 | 74927 |
| 10° | 83206 | 66293 | 57151 |
| 15° | 82513 | 55031 | 48161 |
| 20° | 80851 | 47970 | 47277 |
| 25° | 78253 | 46414 | 48385 |
| 30° | 74554 | 45670 | 44033 |
| 35° | 69223 | 43398 | 36488 |
| 40° | 63034 | 38960 | 30130 |
| 45° | 56899 | 33806 | 26451 |
| 50° | 50213 | 29395 | 24769 |
| 55° | 44556 | 26512 | 23841 |
| 60° | 38185 | 24517 | 23355 |
| 65° | 33053 | 23041 | 23238 |
| 70° | 28286 | 22165 | 23209 |
| 75° | 23742 | 21524 | 23003 |
| 80° | 18115 | 20802 | 22526 |
| 85° | 11858 | 18454 | 17353 |



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**ZONAL LUMENS:**

| Zone      | Lumens  | % Fixture |
|-----------|---------|-----------|
| 0°-10°    | 913.7   | 5.8       |
| 10°-20°   | 2097.9  | 13.4      |
| 20°-30°   | 2835.2  | 18.1      |
| 30°-40°   | 2983.9  | 19.0      |
| 40°-50°   | 2532.0  | 16.1      |
| 50°-60°   | 1961.4  | 12.5      |
| 60°-70°   | 1366.0  | 8.7       |
| 70°-80°   | 782.2   | 5.0       |
| 80°-90°   | 227.6   | 1.4       |
| 90°-100°  | 6.1     | 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°    | 5846.8  | 37.2      |
| 0°-40°    | 8830.7  | 56.2      |
| 0°-60°    | 13324.1 | 84.8      |
| 0°-90°    | 15699.9 | 100.0     |
| 90°-120°  | 6.1     | 0.0       |
| 90°-150°  | 6.1     | 0.0       |
| 90°-180°  | 6.0     | 0.0       |
| 0°-180°   | 15706.0 | 100.0     |

**CANDELA DISTRIBUTION:**

|      | 0°    | 22.5° | 45°   | 67.5° | 90°   | Flux |
|------|-------|-------|-------|-------|-------|------|
| 0°   | 10716 | 10716 | 10716 | 10716 | 10716 |      |
| 5°   | 10663 | 10468 | 10045 | 9660  | 9570  | ###  |
| 15°  | 10218 | 8673  | 6815  | 6134  | 5964  | 2875 |
| 25°  | 9092  | 6423  | 5393  | 5549  | 5622  | 4174 |
| 35°  | 7270  | 4940  | 4558  | 4117  | 3832  | 4532 |
| 45°  | 5158  | 3709  | 3065  | 2518  | 2398  | 3973 |
| 55°  | 3276  | 2498  | 1950  | 1772  | 1753  | 2929 |
| 65°  | 1791  | 1466  | 1248  | 1248  | 1259  | 1789 |
| 75°  | 788   | 700   | 714   | 759   | 763   | 840  |
| 85°  | 132   | 172   | 206   | 194   | 194   | 168  |
| 90°  | 1     | 16    | 30    | 38    | 40    | 7    |
| 95°  | 1     | 2     | 5     | 5     | 4     | 0    |
| 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: P859921

CATALOG NUMBER: SPHB-15SE-N-L840-CD

**CANDELA DISTRIBUTION (FULL):**

|        | 0°      | 22.5°   | 45°     | 67.5°   | 90°     |
|--------|---------|---------|---------|---------|---------|
| 0°     | 10716.5 | 10716.5 | 10716.5 | 10716.5 | 10716.5 |
| 2.5°   | 10685.4 | 10650.2 | 10564.3 | 10508.7 | 10465.3 |
| 5°     | 10663.3 | 10467.8 | 10044.8 | 9659.5  | 9569.5  |
| 7.5°   | 10597.0 | 10167.5 | 9263.5  | 8550.9  | 8370.9  |
| 10°    | 10505.4 | 9736.4  | 8370.1  | 7477.6  | 7215.8  |
| 12.5°  | 10383.5 | 9275.8  | 7514.4  | 6673.4  | 6544.9  |
| 15°    | 10218.2 | 8672.8  | 6814.9  | 6134.2  | 5964.1  |
| 17.5°  | 10003.9 | 8049.4  | 6169.4  | 5775.9  | 5728.4  |
| 20°    | 9740.5  | 7477.6  | 5779.2  | 5645.0  | 5695.7  |
| 22.5°  | 9444.3  | 6922.1  | 5552.5  | 5609.0  | 5703.9  |
| 25°    | 9092.5  | 6423.0  | 5393.0  | 5549.3  | 5622.1  |
| 27.5°  | 8697.4  | 5972.2  | 5246.6  | 5389.7  | 5389.7  |
| 30°    | 8277.7  | 5596.7  | 5070.7  | 5057.6  | 4889.0  |
| 32.5°  | 7787.6  | 5277.7  | 4840.8  | 4581.4  | 4331.1  |
| 35°    | 7269.8  | 4939.8  | 4557.7  | 4116.7  | 3832.0  |
| 37.5°  | 6726.5  | 4625.6  | 4199.4  | 3617.7  | 3352.6  |
| 40°    | 6190.7  | 4315.6  | 3826.3  | 3169.4  | 2959.1  |
| 42.5°  | 5657.3  | 3999.8  | 3437.7  | 2806.1  | 2640.1  |
| 45°    | 5158.2  | 3709.3  | 3064.7  | 2518.2  | 2397.9  |
| 47.5°  | 4651.0  | 3400.9  | 2720.2  | 2286.6  | 2203.2  |
| 50°    | 4138.0  | 3088.4  | 2422.4  | 2102.6  | 2041.2  |
| 52.5°  | 3706.1  | 2797.1  | 2169.6  | 1928.3  | 1891.5  |
| 55°    | 3276.5  | 2498.5  | 1949.6  | 1772.0  | 1753.2  |
| 57.5°  | 2850.3  | 2220.4  | 1748.3  | 1628.9  | 1624.8  |
| 60°    | 2447.8  | 1960.2  | 1571.6  | 1506.1  | 1497.1  |
| 62.5°  | 2105.0  | 1701.7  | 1403.9  | 1372.8  | 1376.9  |
| 65°    | 1790.9  | 1466.1  | 1248.4  | 1248.4  | 1259.1  |
| 67.5°  | 1499.6  | 1249.3  | 1106.1  | 1124.9  | 1139.6  |
| 70°    | 1240.3  | 1052.9  | 971.9   | 1004.6  | 1017.7  |
| 72.5°  | 994.8   | 870.5   | 843.5   | 879.5   | 890.1   |
| 75°    | 787.8   | 700.3   | 714.2   | 759.2   | 763.3   |
| 77.5°  | 584.1   | 551.4   | 587.4   | 636.5   | 645.5   |
| 80°    | 403.3   | 406.6   | 463.1   | 497.4   | 501.5   |
| 82.5°  | 260.2   | 283.9   | 346.9   | 364.9   | 358.3   |
| 85°    | 132.5   | 171.8   | 206.2   | 193.9   | 193.9   |
| 87.5°  | 50.7    | 74.4    | 87.5    | 103.1   | 108.8   |
| 90°    | 0.8     | 15.5    | 30.3    | 38.5    | 40.1    |
| 92.5°  | 0.8     | 4.1     | 6.5     | 7.4     | 6.5     |
| 95°    | 0.8     | 2.5     | 4.9     | 4.9     | 4.1     |
| 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     |



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**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

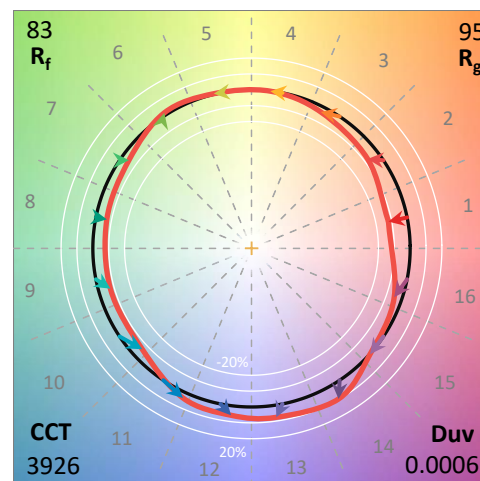
Test Method: LM-79-2019  
 Report Number: SP1-2309-187-7  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry:  $4\pi$   
 Issue Date: 10/09/2023  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: METALUX  
 Catalog Number: **SPHB-1224SE-M-UNV-L84050-CD-U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

### Spectral Parameters

|                           |        |           |      |      |      |
|---------------------------|--------|-----------|------|------|------|
| CCT (K):                  | 3926   | CRI (Ra): | 82.0 |      |      |
| CIE u':                   | 0.2261 | R1:       | 80.3 | R9:  | 8.2  |
| CIE v':                   | 0.5037 | R2:       | 88.4 | R10: | 71.6 |
| Duv:                      | 0.0006 | R3:       | 93.9 | R11: | 78.1 |
| CIE x:                    | 0.3841 | R4:       | 80.2 | R12: | 57.5 |
| CIE y:                    | 0.3802 | R5:       | 79.7 | R13: | 82.3 |
| CIE z:                    | 0.2357 | R6:       | 83.3 | R14: | 96.6 |
| Peak Wavelength (nm):     | 454    | R7:       | 86.1 |      |      |
| Dominant Wavelength (nm): | 579    | R8:       | 64.3 |      |      |
| Purity:                   | 29.5   |           |      |      |      |
| Rf:                       | 82.9   |           |      |      |      |
| Rg:                       | 95     |           |      |      |      |

### Test Conditions

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



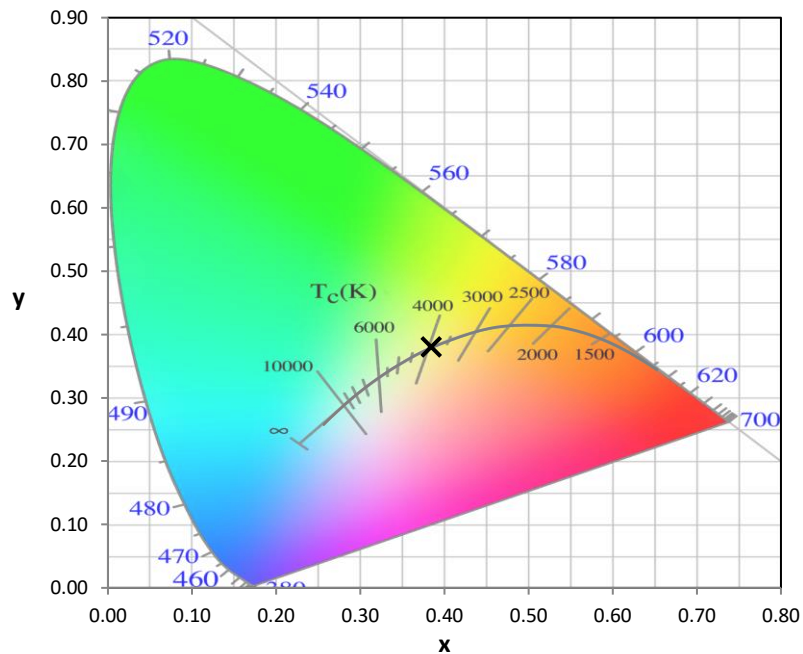


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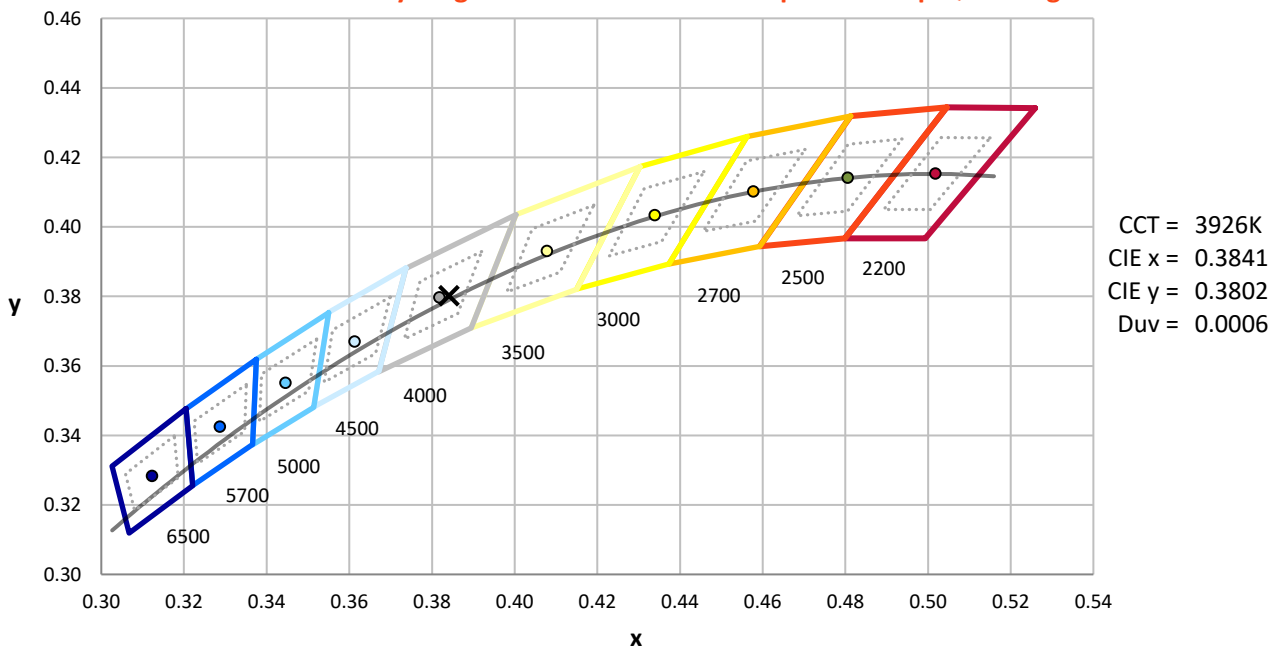
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| 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**



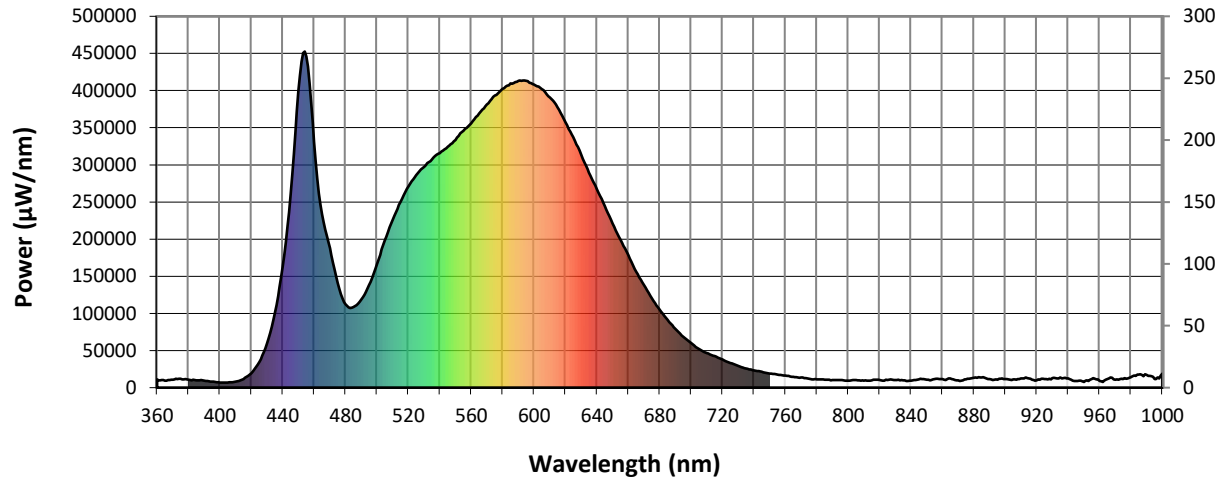
**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



Point lies inside the ANSI 4000K 4-step quadrangle

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**Photopic Flux vs. Wavelength**

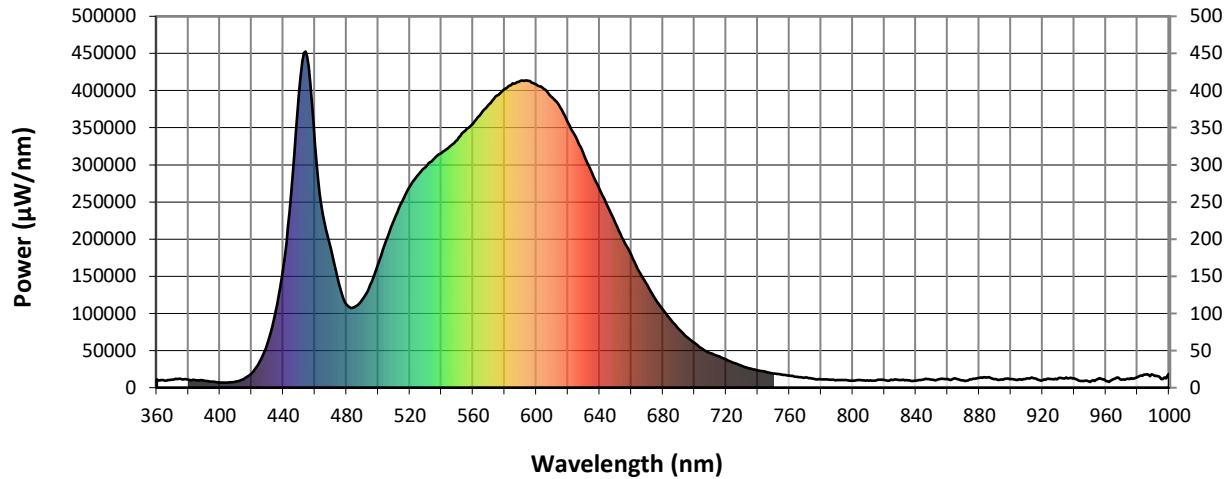


#####

| 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



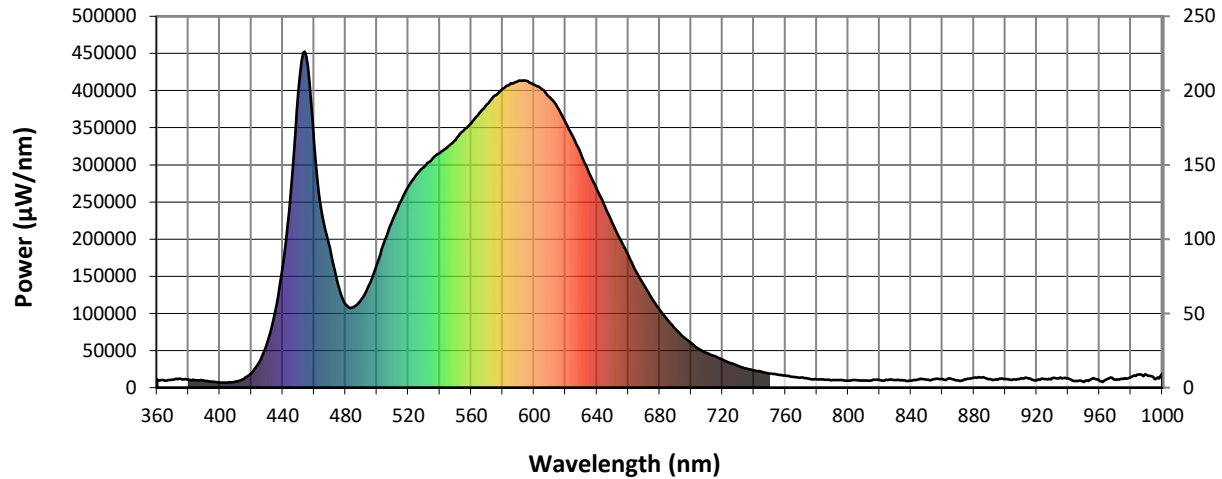
Scotopic Lumens: 39237.7

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**

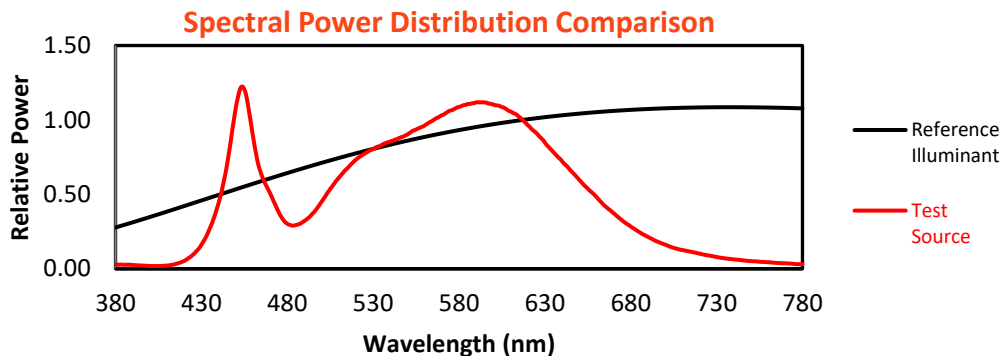
| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 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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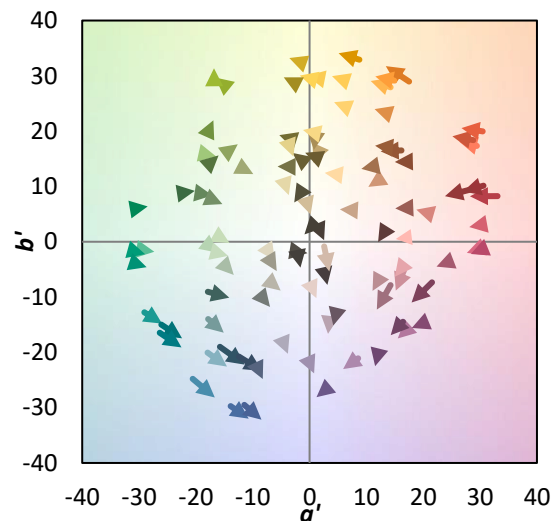
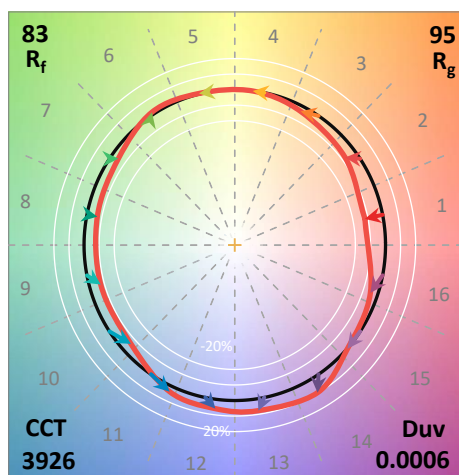
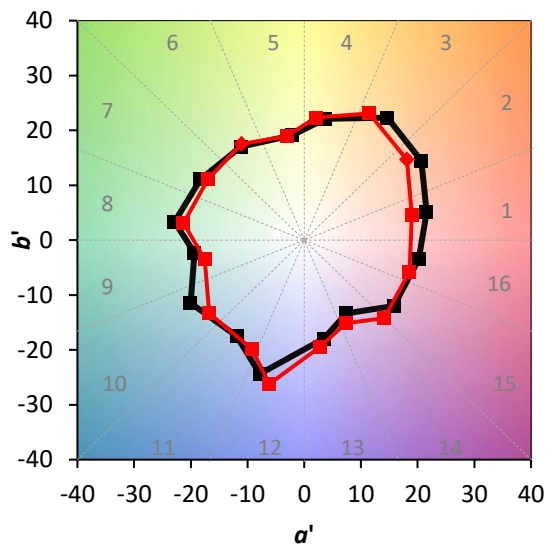
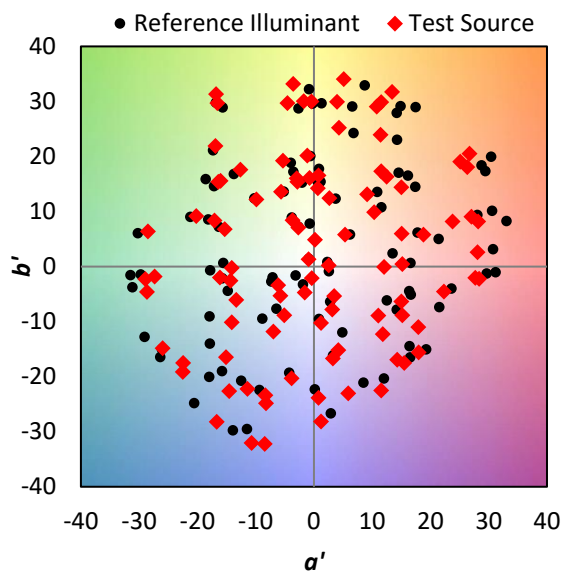
**TM-30-18**

**Summary**

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



**Color Vector Graphics**

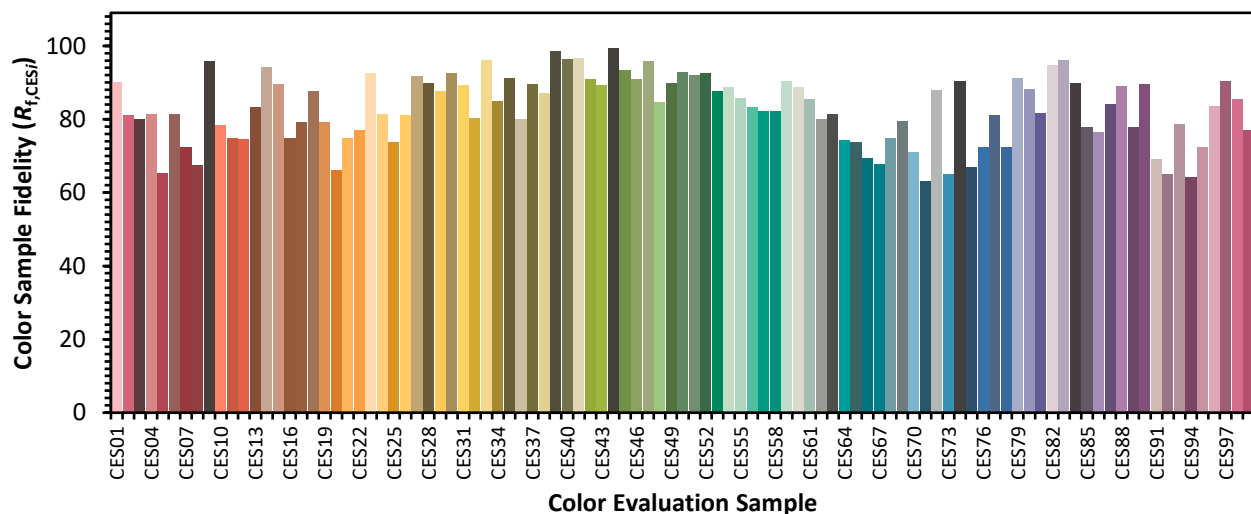


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**Individual Sample Fidelity Index ( $R_{f,i}$ )**

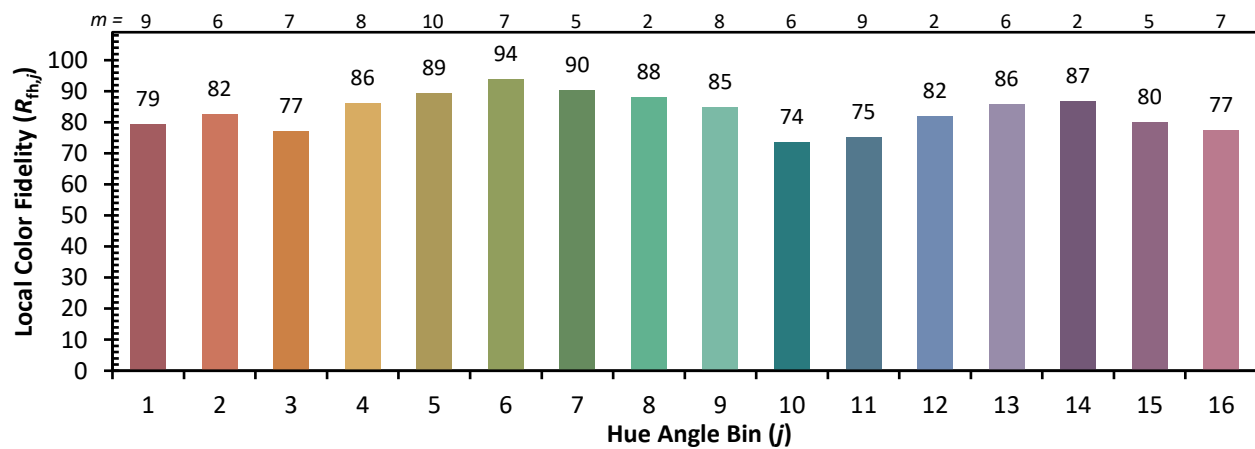
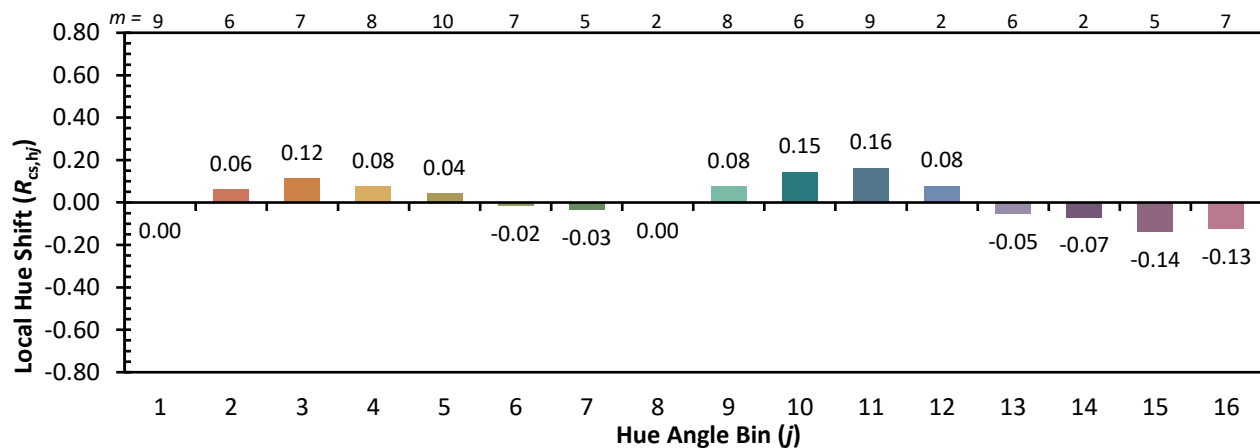
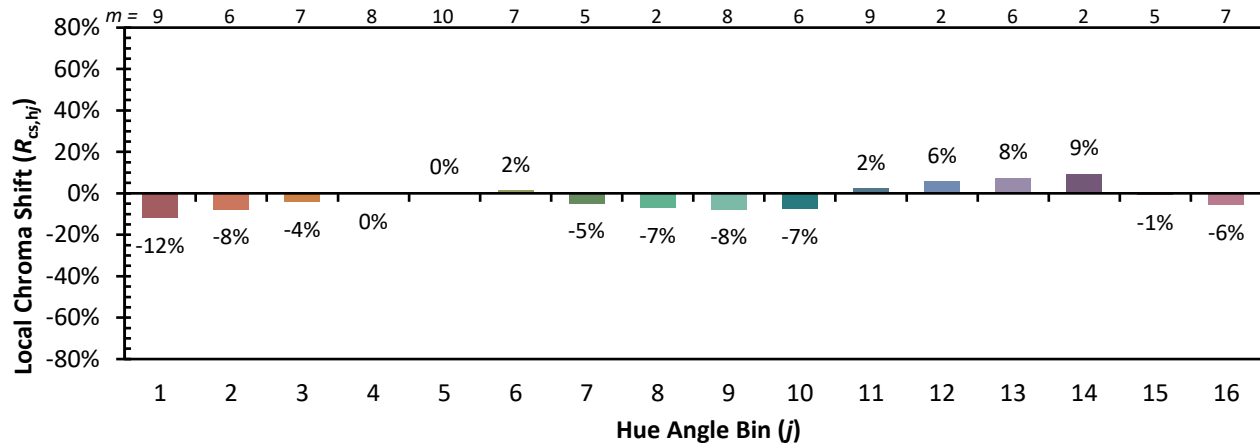
|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 81 | CES51 = 92 | CES76 = 73 |
| CES02 = 61 | CES27 = 92 | CES52 = 92 | CES77 = 81 |
| CES03 = 31 | CES28 = 90 | CES53 = 88 | CES78 = 72 |
| CES04 = 70 | CES29 = 88 | CES54 = 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

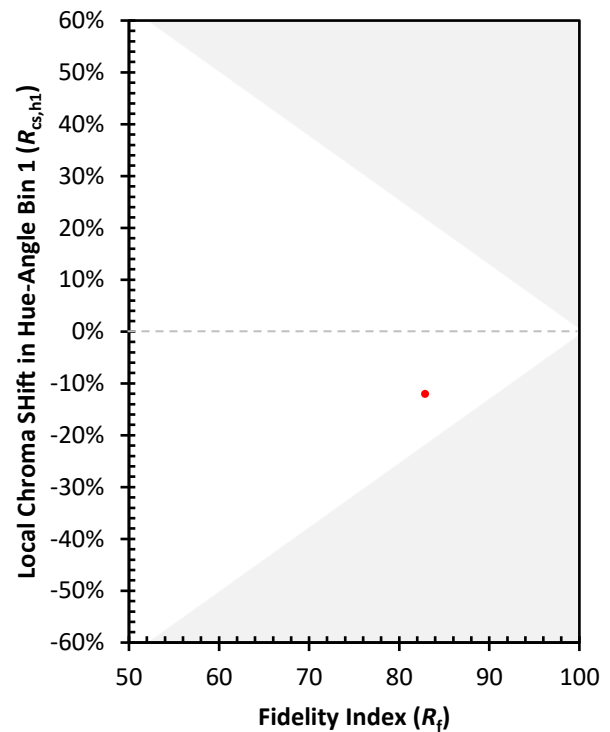
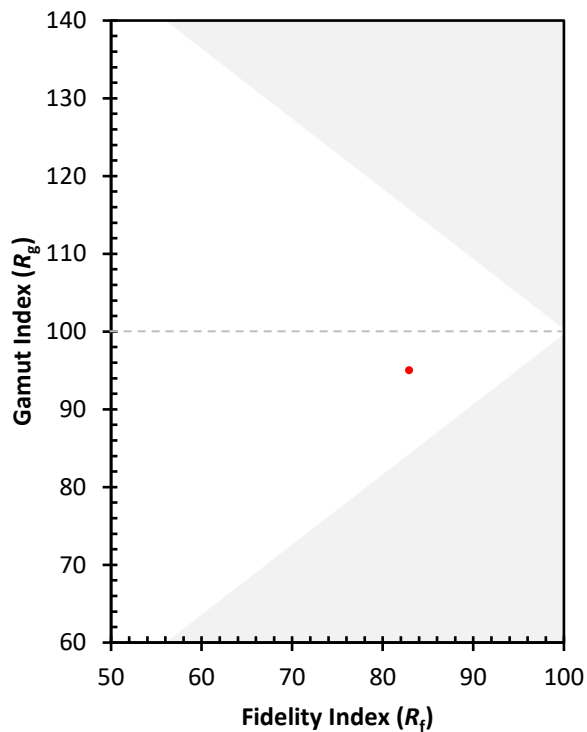




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**Measure Comparisons**



(END OF REPORT)