

Signify Classified - Internal  
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: McGRAW-EDISON

Report Number: P821133

Luminaire Tested: **TT-D2-830-24VDC-T4-PM**

Issue Date: 5/19/2020

**Test Information**

Test Method: LM-79-08  
Report Number: P821133  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G3-1908-473-26)  
Test Lab: INNOVATION CENTER  
Issue Date: 5/19/2020  
Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)  
Product Line: MCGRAW-EDISON  
Catalog Number: TT-D2-830-24VDC-T4-PM  
Description: TOPTIER LED SITE LUMINAIRE  
3000K, 80 CRI LEDS AND DRIVE LANE DISTRIBUTION  
Light Source: -  
Ballast/Driver: ELECTRONIC DRIVER

**Summary**

Lumens per Lamp: N/A  
Luminaire Lumens: 3985 lumens  
Efficiency: N/A  
Efficacy: 104.9 lumens/watt  
Luminous Opening: Circular (Dia: 1.12' x H: 0')  
IES Classification: Type IV - Short  
BUG Rating: B2 - U0 - G3

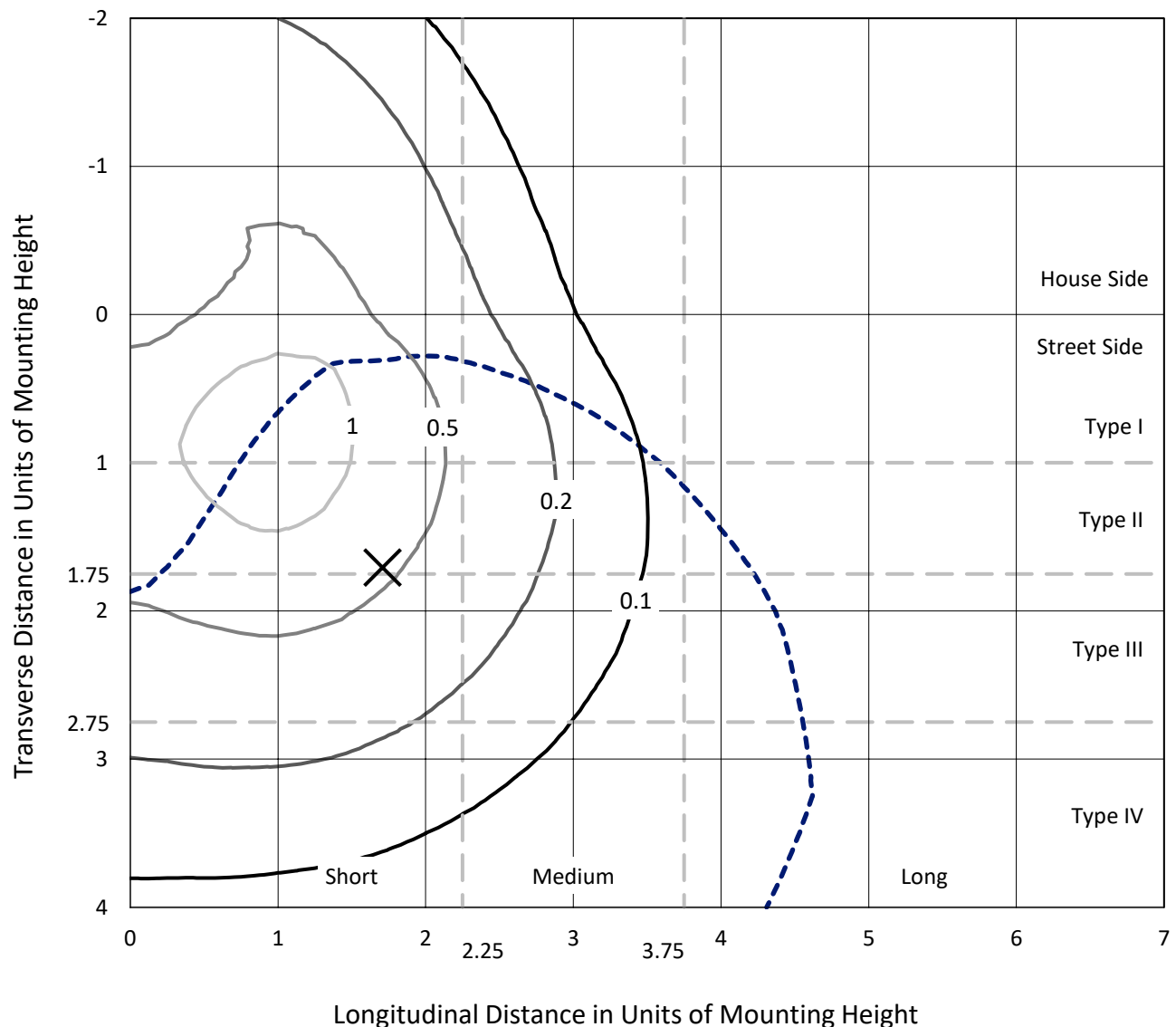
Input Watts (W): 38  
Input Voltage (V): NR  
Input Current (Ain): NR  
Voltage Rise (V): NR  
Power Factor: NR  
Total Harmonic Distortion (THDi): NR  
Frequency (hertz): 60  
Stabilization Time: NR  
Operation Time: NR  
Ambient Temperature (°C): NR  
Test Distance: 25 FT

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## Iso-Footcandle Lines of Horizontal Illumination

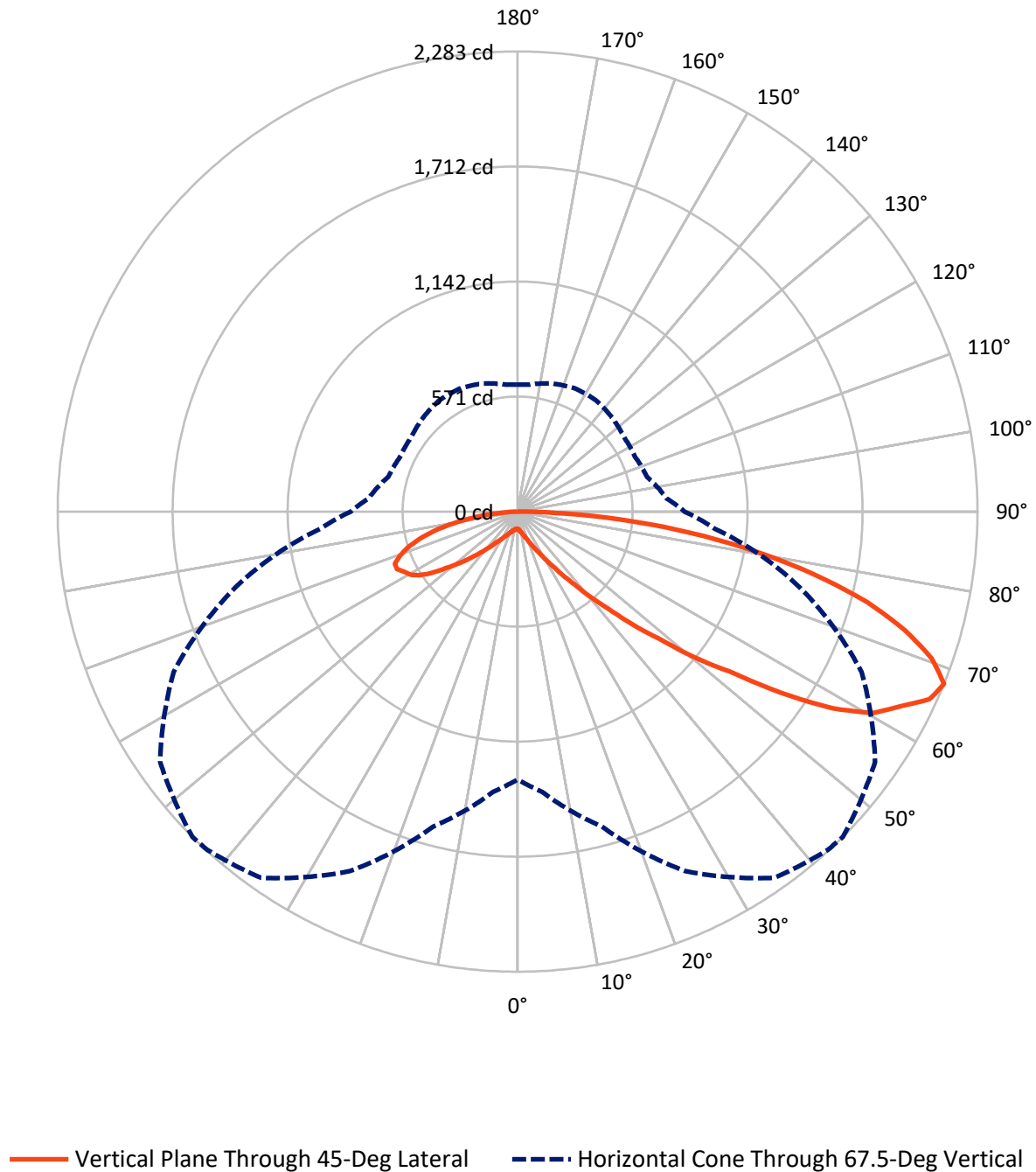
✕ Max cd  
 - - - 1/2 Max cd



Based on 15 foot mounting height. Maximum calculated value = 1.4 fc  
 Type IV - Short - N/A

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## Luminous Intensity Polar Plot



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CATALOG NUMBER: TT-D2-830-24VDC-T4-PM

**FLUX DISTRIBUTION:**

|                    |           | Downward | Upward | Total  |
|--------------------|-----------|----------|--------|--------|
| <b>House Side</b>  | Lumens    | 1161.2   | 0.0    | 1161.2 |
|                    | % Fixture | 29.1     | 0.0    | 29.1   |
| <b>Street Side</b> | Lumens    | 2823.8   | 0.0    | 2823.8 |
|                    | % Fixture | 70.9     | 0.0    | 70.9   |
| <b>Total</b>       | Lumens    | 3985.0   | 0.0    | 3985.0 |
|                    | % Fixture | 100.0    | 0.0    | 100.0  |

**Coefficient of Utilization**

**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 8.9    | 0.2       |
| 10°-20°   | 33.1   | 0.8       |
| 20°-30°   | 78.2   | 2.0       |
| 30°-40°   | 176.9  | 4.4       |
| 40°-50°   | 394.4  | 9.9       |
| 50°-60°   | 793.0  | 19.9      |
| 60°-70°   | 1164.6 | 29.2      |
| 70°-80°   | 1024.1 | 25.7      |
| 80°-90°   | 311.8  | 7.8       |
| 90°-100°  | 0.0    | 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°-90°    | 3985.0 | 100.0     |
| 0°-180°   | 3985.0 | 100.0     |



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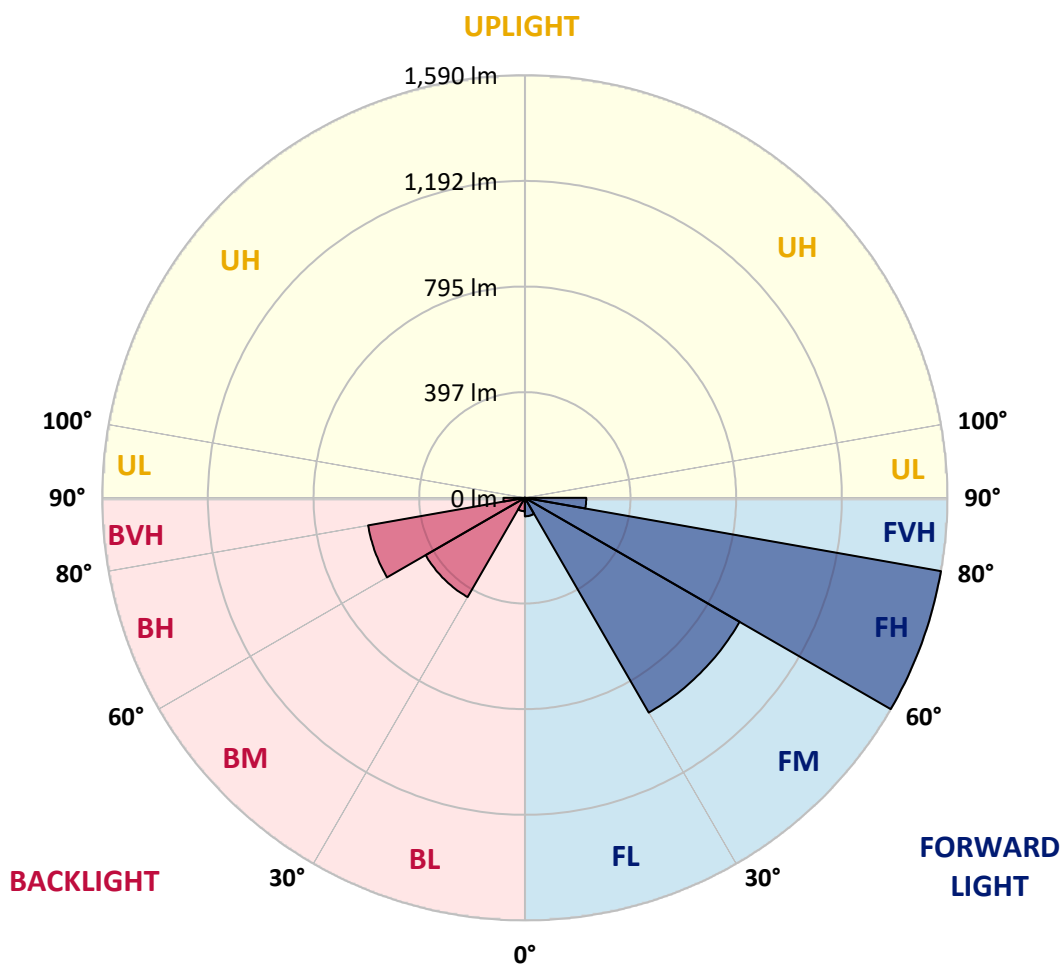
CATALOG NUMBER: TT-D2-830-24VDC-T4-PM

**LUMINAIRE CLASSIFICATION SYSTEM LUMEN TABLE AND BUG RATING:**

| Zone |             | Lumens | % Fixture | Zone Rating/Lumen Limit |      |         |
|------|-------------|--------|-----------|-------------------------|------|---------|
|      |             |        |           | B                       | U    | G       |
| FL   | (0°-30°)    | 69.6   | 1.7       |                         |      |         |
| FM   | (30°-60°)   | 933.2  | 23.4      |                         |      |         |
| FH   | (60°-80°)   | 1589.9 | 39.9      |                         |      | G1/1800 |
| FVH  | (80°-90°)   | 231.0  | 5.8       |                         |      | G3/500  |
| BL   | (0°-30°)    | 50.5   | 1.3       | B0/110                  |      |         |
| BM   | (30°-60°)   | 431.1  | 10.8      | B1/1000                 |      |         |
| BH   | (60°-80°)   | 598.8  | 15.0      | B2/1000                 |      | G2/1000 |
| BVH  | (80°-90°)   | 80.8   | 2.0       |                         |      | G1/100  |
| UL   | (90°-100°)  | 0.0    | 0.0       |                         | U0/0 |         |
| UH   | (100°-180°) | 0.0    | 0.0       |                         | U0/0 |         |

**BUG Rating: B2-U0-G3**

Type IV Short





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**CANDELA DISTRIBUTION (FULL):**

|       | 0°     | 5°     | 15°    | 25°    | 35°    | 42.5°  | 45°    | 55°    | 65°    | 75°    | 85°    |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0°    | 86.4   | 86.4   | 86.4   | 86.4   | 86.4   | 86.4   | 86.4   | 86.4   | 86.4   | 86.4   | 86.4   |
| 2.5°  | 90.2   | 89.4   | 89.4   | 89.4   | 88.7   | 88.7   | 88.7   | 88.7   | 87.9   | 87.9   | 87.9   |
| 5°    | 95.4   | 94.6   | 95.4   | 93.9   | 93.1   | 93.1   | 92.4   | 92.4   | 91.7   | 90.9   | 90.2   |
| 7.5°  | 102.8  | 102.1  | 102.1  | 100.6  | 99.9   | 99.1   | 99.1   | 97.6   | 96.9   | 95.4   | 93.9   |
| 10°   | 111.0  | 111.0  | 110.3  | 109.5  | 108.0  | 106.6  | 106.6  | 104.3  | 103.6  | 101.3  | 99.1   |
| 12.5° | 120.7  | 120.7  | 120.7  | 119.2  | 117.7  | 117.0  | 115.5  | 114.0  | 111.8  | 108.0  | 105.8  |
| 15°   | 132.6  | 132.6  | 132.6  | 131.1  | 129.7  | 128.2  | 127.4  | 124.4  | 120.7  | 117.0  | 112.5  |
| 17.5° | 147.5  | 146.1  | 146.1  | 144.6  | 143.1  | 142.3  | 140.8  | 137.9  | 132.6  | 128.2  | 122.2  |
| 20°   | 163.9  | 163.2  | 162.4  | 162.4  | 161.0  | 159.5  | 158.7  | 154.2  | 148.3  | 140.1  | 132.6  |
| 22.5° | 182.6  | 181.8  | 181.8  | 183.3  | 182.6  | 180.3  | 180.3  | 173.6  | 165.4  | 155.7  | 144.6  |
| 25°   | 205.7  | 204.9  | 206.4  | 209.4  | 209.4  | 207.9  | 205.7  | 199.0  | 187.0  | 173.6  | 160.2  |
| 27.5° | 231.0  | 230.3  | 233.2  | 238.5  | 239.9  | 237.7  | 236.2  | 228.8  | 215.4  | 197.5  | 178.1  |
| 30°   | 261.6  | 262.3  | 270.5  | 276.5  | 280.2  | 278.7  | 277.9  | 269.7  | 248.1  | 227.3  | 201.9  |
| 32.5° | 298.8  | 296.6  | 307.0  | 316.7  | 323.4  | 327.1  | 324.9  | 315.2  | 296.6  | 263.8  | 231.7  |
| 35°   | 338.3  | 339.0  | 351.7  | 365.9  | 381.5  | 383.0  | 387.5  | 377.8  | 352.5  | 313.7  | 269.0  |
| 37.5° | 389.7  | 383.8  | 400.1  | 427.0  | 445.6  | 462.0  | 459.0  | 453.1  | 423.2  | 371.8  | 310.7  |
| 40°   | 435.9  | 434.4  | 457.5  | 494.8  | 529.1  | 552.9  | 555.9  | 548.4  | 508.9  | 435.9  | 355.4  |
| 42.5° | 488.8  | 493.3  | 525.3  | 576.8  | 628.9  | 663.2  | 655.0  | 651.3  | 605.1  | 511.9  | 416.5  |
| 45°   | 542.5  | 557.4  | 598.4  | 672.9  | 734.0  | 783.2  | 797.3  | 784.7  | 728.0  | 631.9  | 494.0  |
| 47.5° | 607.3  | 627.4  | 678.1  | 778.7  | 878.5  | 935.9  | 938.9  | 976.9  | 891.2  | 747.4  | 574.5  |
| 50°   | 693.0  | 701.9  | 772.7  | 895.7  | 1032.8 | 1113.3 | 1136.4 | 1137.1 | 1051.4 | 863.6  | 665.4  |
| 52.5° | 777.2  | 783.9  | 877.1  | 1035.8 | 1222.1 | 1313.7 | 1318.9 | 1348.0 | 1231.0 | 1051.4 | 795.8  |
| 55°   | 878.5  | 875.6  | 1003.7 | 1194.5 | 1414.3 | 1547.7 | 1586.4 | 1625.9 | 1476.9 | 1199.7 | 870.3  |
| 57.5° | 976.9  | 972.4  | 1126.7 | 1377.1 | 1677.4 | 1810.0 | 1842.0 | 1813.7 | 1592.4 | 1261.6 | 906.9  |
| 60°   | 1067.8 | 1083.5 | 1271.2 | 1579.0 | 1880.8 | 2007.5 | 2029.1 | 1952.3 | 1666.9 | 1309.2 | 930.0  |
| 62.5° | 1162.4 | 1193.7 | 1421.0 | 1747.4 | 2036.5 | 2127.4 | 2128.9 | 2038.8 | 1791.4 | 1401.6 | 1005.2 |
| 65°   | 1251.1 | 1301.0 | 1537.3 | 1891.2 | 2145.3 | 2236.2 | 2246.7 | 2165.4 | 1913.6 | 1482.1 | 1017.9 |
| 67.5° | 1329.4 | 1395.7 | 1617.7 | 1968.7 | 2219.1 | 2277.9 | 2283.2 | 2166.2 | 1884.5 | 1449.3 | 982.9  |
| 70°   | 1392.7 | 1446.4 | 1667.7 | 1970.2 | 2167.7 | 2184.1 | 2180.3 | 2055.9 | 1804.0 | 1384.5 | 924.0  |
| 72.5° | 1417.3 | 1461.3 | 1643.8 | 1877.8 | 2016.4 | 2012.7 | 2009.7 | 1894.9 | 1671.4 | 1276.5 | 839.0  |
| 75°   | 1382.3 | 1394.9 | 1513.4 | 1680.3 | 1768.3 | 1789.1 | 1792.1 | 1688.5 | 1466.5 | 1116.2 | 719.8  |
| 77.5° | 1237.7 | 1231.0 | 1321.9 | 1432.2 | 1498.5 | 1513.4 | 1510.4 | 1424.0 | 1229.5 | 927.7  | 603.6  |
| 80°   | 981.4  | 995.5  | 1052.2 | 1125.2 | 1191.5 | 1207.9 | 1197.5 | 1131.9 | 956.8  | 723.5  | 463.5  |
| 82.5° | 686.3  | 703.4  | 751.1  | 806.3  | 856.2  | 856.2  | 865.9  | 802.5  | 678.1  | 519.4  | 324.1  |
| 85°   | 370.3  | 360.7  | 412.8  | 475.4  | 511.2  | 517.9  | 521.6  | 500.7  | 419.5  | 313.7  | 192.3  |
| 87.5° | 61.1   | 65.6   | 81.2   | 124.4  | 141.6  | 163.9  | 174.4  | 136.4  | 82.7   | 52.9   | 38.7   |
| 90°   | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |

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CATALOG NUMBER: TT-D2-830-24VDC-T4-PM

**CANDELA DISTRIBUTION (continued):**

|       | 90°   | 95°   | 105°  | 115°  | 125°  | 135°  | 145°  | 155°  | 165°  | 175°  | 180°  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0°    | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  |
| 2.5°  | 87.9  | 87.2  | 86.4  | 85.7  | 85.7  | 84.9  | 84.9  | 84.9  | 85.7  | 85.7  | 85.7  |
| 5°    | 90.2  | 89.4  | 88.7  | 87.9  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  | 86.4  |
| 7.5°  | 93.9  | 92.4  | 91.7  | 90.2  | 88.7  | 88.7  | 87.9  | 87.9  | 87.9  | 88.7  | 87.9  |
| 10°   | 98.4  | 96.9  | 95.4  | 93.1  | 92.4  | 91.7  | 90.9  | 90.9  | 91.7  | 91.7  | 90.9  |
| 12.5° | 103.6 | 102.8 | 99.9  | 97.6  | 96.1  | 95.4  | 94.6  | 95.4  | 94.6  | 95.4  | 95.4  |
| 15°   | 111.0 | 108.8 | 105.1 | 102.8 | 100.6 | 99.9  | 99.1  | 99.9  | 99.9  | 100.6 | 99.9  |
| 17.5° | 119.2 | 116.2 | 112.5 | 108.8 | 105.8 | 105.1 | 105.1 | 105.1 | 105.8 | 106.6 | 105.8 |
| 20°   | 128.9 | 125.2 | 120.0 | 115.5 | 112.5 | 111.8 | 111.8 | 112.5 | 113.3 | 114.0 | 114.0 |
| 22.5° | 138.6 | 135.6 | 128.2 | 122.2 | 120.7 | 120.0 | 119.2 | 120.7 | 122.2 | 123.0 | 123.7 |
| 25°   | 153.5 | 147.5 | 138.6 | 131.9 | 128.9 | 128.9 | 129.7 | 131.1 | 131.9 | 133.4 | 132.6 |
| 27.5° | 169.2 | 162.4 | 151.3 | 142.3 | 140.1 | 139.3 | 140.8 | 142.3 | 145.3 | 145.3 | 144.6 |
| 30°   | 190.8 | 179.6 | 165.4 | 157.2 | 151.3 | 152.0 | 154.2 | 156.5 | 159.5 | 161.0 | 161.0 |
| 32.5° | 215.4 | 203.4 | 184.1 | 171.4 | 168.4 | 169.2 | 169.9 | 173.6 | 176.6 | 179.6 | 177.3 |
| 35°   | 247.4 | 232.5 | 208.6 | 194.5 | 187.0 | 186.3 | 189.3 | 193.7 | 196.7 | 198.2 | 198.2 |
| 37.5° | 282.4 | 263.0 | 233.2 | 221.3 | 212.4 | 211.6 | 212.4 | 216.1 | 219.8 | 221.3 | 224.3 |
| 40°   | 324.9 | 301.0 | 266.0 | 246.6 | 239.9 | 238.5 | 241.4 | 246.6 | 246.6 | 248.9 | 249.6 |
| 42.5° | 377.0 | 346.5 | 307.8 | 282.4 | 274.2 | 274.2 | 273.5 | 277.9 | 277.9 | 277.9 | 276.5 |
| 45°   | 443.4 | 409.1 | 358.4 | 332.3 | 318.2 | 310.7 | 313.0 | 310.0 | 309.2 | 311.5 | 304.8 |
| 47.5° | 507.5 | 464.2 | 404.6 | 376.3 | 362.1 | 357.7 | 349.5 | 347.2 | 343.5 | 343.5 | 333.8 |
| 50°   | 582.0 | 528.3 | 470.9 | 430.7 | 417.3 | 404.6 | 397.9 | 387.5 | 376.3 | 374.1 | 370.3 |
| 52.5° | 706.4 | 639.3 | 549.2 | 506.0 | 471.7 | 459.0 | 443.4 | 430.0 | 416.5 | 406.1 | 412.1 |
| 55°   | 757.1 | 688.5 | 602.8 | 561.1 | 537.3 | 525.3 | 496.3 | 478.4 | 458.3 | 443.4 | 451.6 |
| 57.5° | 782.4 | 707.9 | 628.2 | 596.9 | 590.2 | 579.0 | 557.4 | 526.8 | 503.7 | 485.1 | 486.6 |
| 60°   | 796.6 | 718.3 | 641.6 | 613.3 | 609.5 | 617.0 | 605.8 | 584.9 | 549.2 | 530.6 | 528.3 |
| 62.5° | 851.0 | 769.0 | 679.6 | 639.3 | 631.1 | 636.4 | 639.3 | 626.7 | 596.9 | 572.3 | 565.6 |
| 65°   | 862.1 | 775.0 | 687.0 | 661.0 | 661.7 | 663.2 | 665.4 | 652.0 | 637.1 | 606.6 | 600.6 |
| 67.5° | 828.6 | 742.9 | 664.7 | 643.1 | 644.6 | 661.7 | 675.1 | 674.4 | 658.0 | 631.9 | 629.7 |
| 70°   | 777.9 | 694.5 | 622.2 | 602.8 | 606.6 | 622.2 | 651.3 | 666.2 | 663.2 | 646.1 | 649.8 |
| 72.5° | 699.0 | 624.4 | 561.1 | 546.2 | 555.1 | 570.0 | 597.6 | 624.4 | 640.1 | 643.8 | 652.0 |
| 75°   | 606.6 | 546.9 | 487.3 | 478.4 | 485.1 | 502.2 | 527.6 | 558.9 | 593.1 | 611.8 | 617.0 |
| 77.5° | 500.7 | 446.3 | 402.4 | 396.4 | 406.1 | 421.8 | 447.1 | 471.7 | 510.4 | 543.2 | 550.7 |
| 80°   | 392.0 | 345.0 | 313.7 | 308.5 | 314.5 | 327.9 | 347.2 | 367.4 | 404.6 | 430.0 | 433.7 |
| 82.5° | 272.0 | 243.7 | 223.5 | 220.6 | 224.3 | 229.5 | 245.2 | 263.8 | 284.7 | 304.8 | 307.0 |
| 85°   | 158.0 | 140.1 | 134.9 | 130.4 | 138.6 | 138.6 | 142.3 | 152.8 | 163.2 | 164.7 | 169.2 |
| 87.5° | 29.1  | 27.6  | 28.3  | 20.9  | 26.1  | 18.6  | 18.6  | 23.8  | 17.9  | 20.9  | 17.1  |
| 90°   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 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

Streetworks

Report Number: SP1-2407-176-7

Test Date: 09/27/2024

Luminaire Tested: MEM2-HTN-VA-30-830-U-WQ

Data in this report applies to families of products including MEM2-HTN-VA-30-830-U-WQ

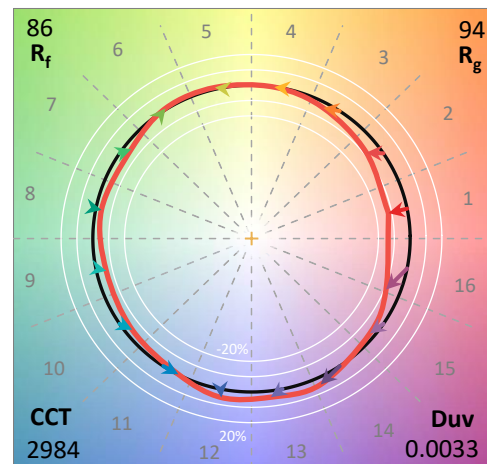
### Test Information

Test Method: LM-79-2019  
 Report Number: SP1-2407-176-7  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry:  $4\pi$   
 Issue Date: 09/27/2024  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: Streetworks  
 Catalog Number: **MEM2-HTN-VA-30-830-U-WQ**  
 Description: EPIC MODERN VISUAL COMFORT 30W WAVESTREAM WIDE

### Spectral Parameters

CCT (K): 2984  
 CIE  $u'$ : 0.2500  
 CIE  $v'$ : 0.5264  
 Duv: 0.0033  
 CIE x: 0.4431  
 CIE y: 0.4147  
 CIE z: 0.1422  
 Peak Wavelength (nm): 601  
 Dominant Wavelength (nm): 581  
 Purity: 57.4798  
 R<sub>f</sub>: 85.8  
 R<sub>g</sub>: 94.1

CRI (Ra): 81.8  
 R1: 79.4  
 R2: 89.9  
 R3: 96.6  
 R4: 80.6  
 R5: 80.1  
 R6: 88.9  
 R7: 82.6  
 R8: 56.0  
 R9: -1.1  
 R10: 78.4  
 R11: 80.8  
 R12: 72.8  
 R13: 81.7  
 R14: 98.5  
 R15: 70.2



### Test Conditions

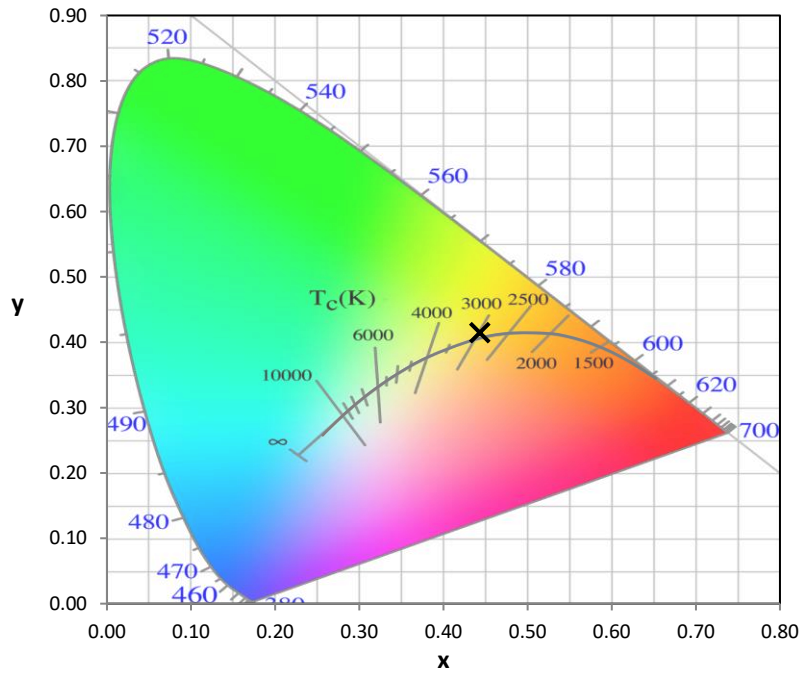
Stabilization Time: 29M  
 Operation Time: 1H 29M  
 Sphere Temperature (°C): 25.2

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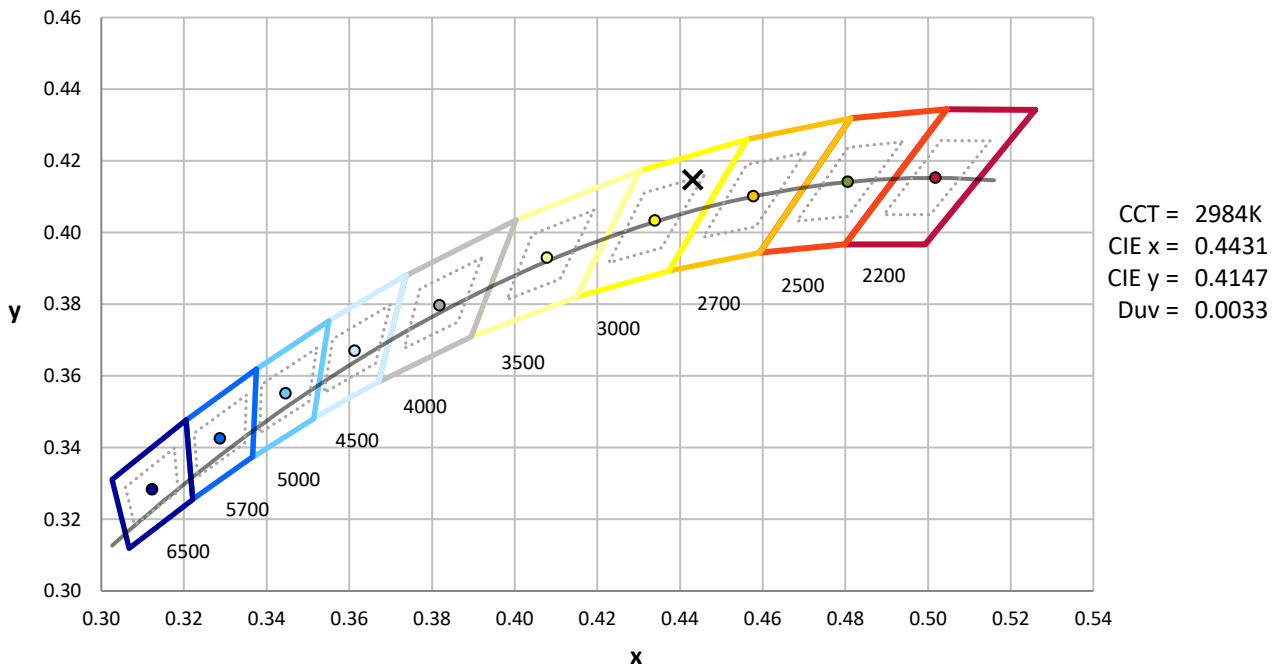
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | IN0058                | 6/18/2024        | 12/18/2024           |
| Power Meter                    | INXT2011004           | 2/8/2024         | 2/8/2025             |
| AC Power Source                | IN0063                | 10/24/2023       | 10/24/2024           |
| DC Power Source                | IN0208                | 10/24/2023       | 10/24/2024           |
| Sphere Thermometer             | IN0085                | 10/24/2023       | 10/24/2024           |
| Room Thermometer               | IN0046                | 10/24/2023       | 10/24/2024           |

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**CIE 1931 Chromaticity Diagram**



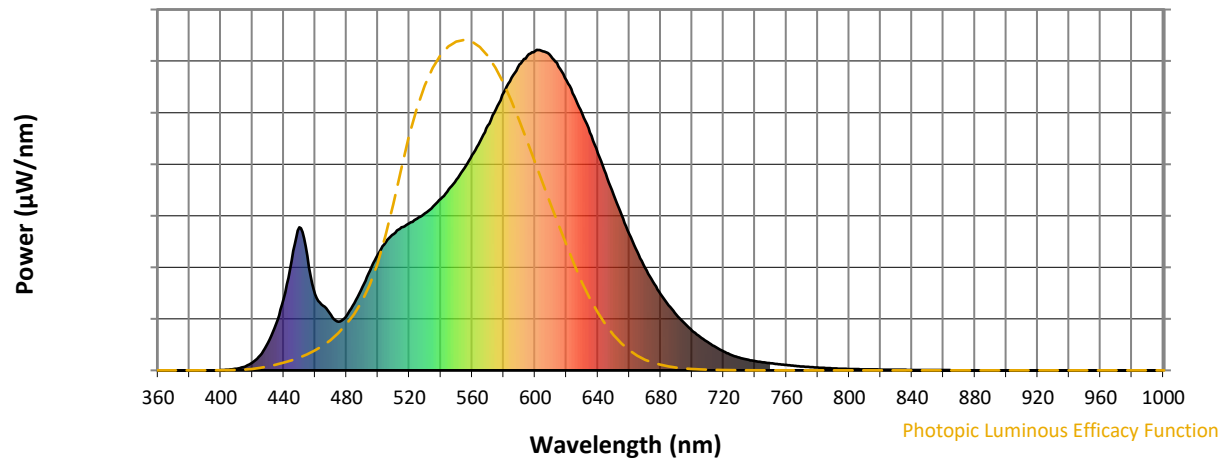
**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



Point lies inside the ANSI 3000K 4-step quadrangle

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### Photopic Flux vs. Wavelength

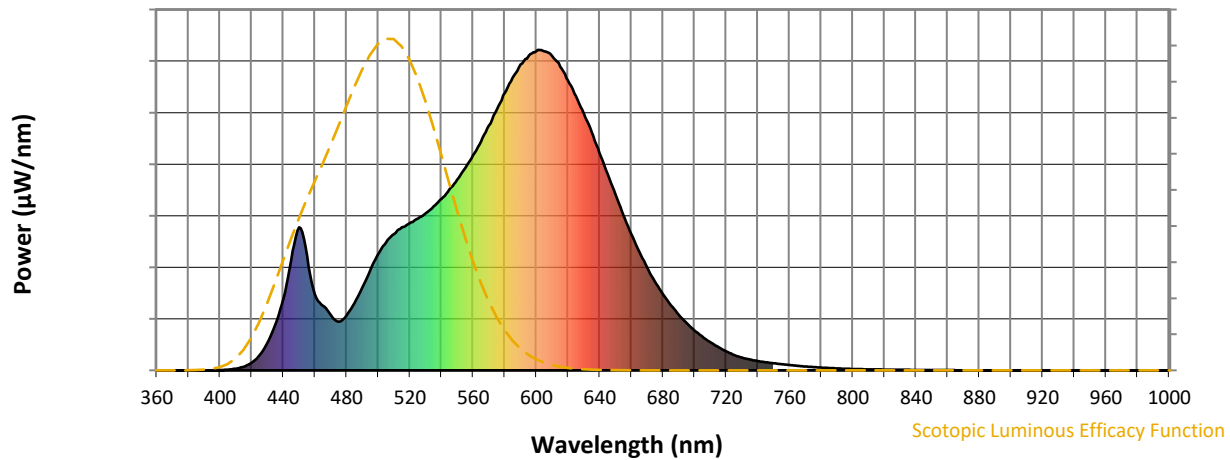


### Photopic Lumens: NR

| $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) |
|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|
| 360               | 0                                      | NR                             | 490               | 260                                    | NR                             | 620               | 905                                    | NR                             | 750               | 22                                     | NR                             | 880               | 0                                      | NR                             |
| 365               | 0                                      | NR                             | 495               | 312                                    | NR                             | 625               | 856                                    | NR                             | 755               | 19                                     | NR                             | 885               | 0                                      | NR                             |
| 370               | 0                                      | NR                             | 500               | 362                                    | NR                             | 630               | 801                                    | NR                             | 760               | 17                                     | NR                             | 890               | 0                                      | NR                             |
| 375               | 0                                      | NR                             | 505               | 399                                    | NR                             | 635               | 742                                    | NR                             | 765               | 14                                     | NR                             | 895               | 0                                      | NR                             |
| 380               | 0                                      | NR                             | 510               | 425                                    | NR                             | 640               | 677                                    | NR                             | 770               | 12                                     | NR                             | 900               | 0                                      | NR                             |
| 385               | 0                                      | NR                             | 515               | 446                                    | NR                             | 645               | 613                                    | NR                             | 775               | 10                                     | NR                             | 905               | 0                                      | NR                             |
| 390               | 0                                      | NR                             | 520               | 459                                    | NR                             | 650               | 549                                    | NR                             | 780               | 9                                      | NR                             | 910               | 0                                      | NR                             |
| 395               | 0                                      | NR                             | 525               | 473                                    | NR                             | 655               | 485                                    | NR                             | 785               | 7                                      | NR                             | 915               | 0                                      | NR                             |
| 400               | 1                                      | NR                             | 530               | 490                                    | NR                             | 660               | 425                                    | NR                             | 790               | 6                                      | NR                             | 920               | 0                                      | NR                             |
| 405               | 2                                      | NR                             | 535               | 511                                    | NR                             | 665               | 371                                    | NR                             | 795               | 5                                      | NR                             | 925               | 0                                      | NR                             |
| 410               | 5                                      | NR                             | 540               | 535                                    | NR                             | 670               | 321                                    | NR                             | 800               | 4                                      | NR                             | 930               | 0                                      | NR                             |
| 415               | 11                                     | NR                             | 545               | 565                                    | NR                             | 675               | 276                                    | NR                             | 805               | 4                                      | NR                             | 935               | 0                                      | NR                             |
| 420               | 24                                     | NR                             | 550               | 595                                    | NR                             | 680               | 238                                    | NR                             | 810               | 3                                      | NR                             | 940               | 0                                      | NR                             |
| 425               | 47                                     | NR                             | 555               | 631                                    | NR                             | 685               | 203                                    | NR                             | 815               | 3                                      | NR                             | 945               | 0                                      | NR                             |
| 430               | 86                                     | NR                             | 560               | 672                                    | NR                             | 690               | 174                                    | NR                             | 820               | 2                                      | NR                             | 950               | 0                                      | NR                             |
| 435               | 144                                    | NR                             | 565               | 715                                    | NR                             | 695               | 148                                    | NR                             | 825               | 2                                      | NR                             | 955               | 0                                      | NR                             |
| 440               | 224                                    | NR                             | 570               | 763                                    | NR                             | 700               | 124                                    | NR                             | 830               | 2                                      | NR                             | 960               | 0                                      | NR                             |
| 445               | 342                                    | NR                             | 575               | 814                                    | NR                             | 705               | 105                                    | NR                             | 835               | 2                                      | NR                             | 965               | 0                                      | NR                             |
| 450               | 446                                    | NR                             | 580               | 866                                    | NR                             | 710               | 88                                     | NR                             | 840               | 1                                      | NR                             | 970               | 0                                      | NR                             |
| 455               | 357                                    | NR                             | 585               | 912                                    | NR                             | 715               | 73                                     | NR                             | 845               | 1                                      | NR                             | 975               | 0                                      | NR                             |
| 460               | 237                                    | NR                             | 590               | 954                                    | NR                             | 720               | 59                                     | NR                             | 850               | 1                                      | NR                             | 980               | 0                                      | NR                             |
| 465               | 202                                    | NR                             | 595               | 981                                    | NR                             | 725               | 48                                     | NR                             | 855               | 1                                      | NR                             | 985               | 0                                      | NR                             |
| 470               | 172                                    | NR                             | 600               | 996                                    | NR                             | 730               | 40                                     | NR                             | 860               | 1                                      | NR                             | 990               | 0                                      | NR                             |
| 475               | 152                                    | NR                             | 605               | 996                                    | NR                             | 735               | 34                                     | NR                             | 865               | 1                                      | NR                             | 995               | 0                                      | NR                             |
| 480               | 171                                    | NR                             | 610               | 980                                    | NR                             | 740               | 29                                     | NR                             | 870               | 0                                      | NR                             | 1000              | 0                                      | NR                             |
| 485               | 210                                    | NR                             | 615               | 947                                    | NR                             | 745               | 25                                     | NR                             | 875               | 0                                      | NR                             |                   |                                        |                                |

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### Scotopic Flux vs. Wavelength



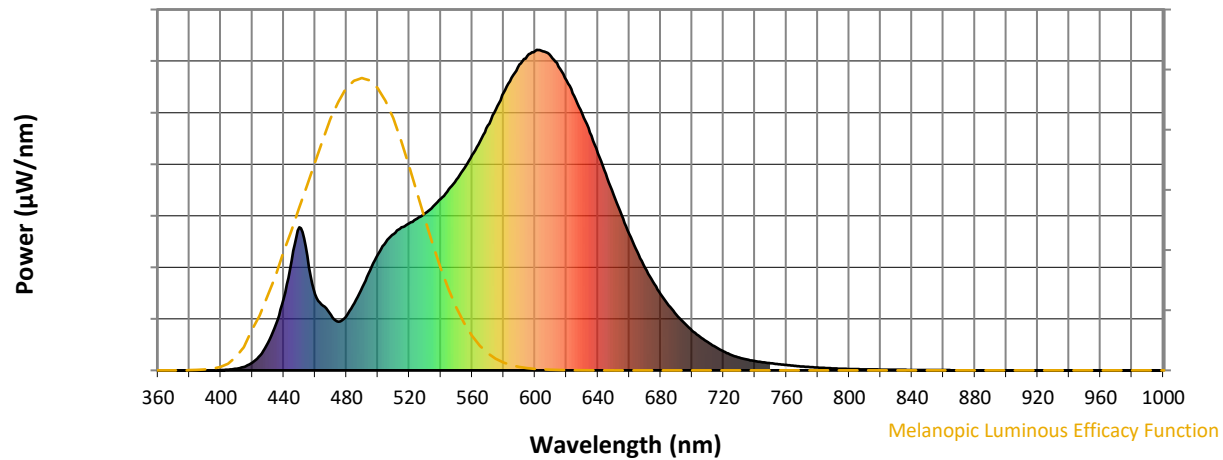
Scotopic Lumens: NR

S/P: 1.32

| λ (nm) | Power W <sup>^</sup> /nm | Lumens (Φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (Φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (Φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (Φ/nm) | λ (nm) | Power W <sup>^</sup> /nm | Lumens (Φ/nm) |
|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|
| 360    | 0                        | NR            | 490    | 260                      | NR            | 620    | 905                      | NR            | 750    | 22                       | NR            | 880    | 0                        | NR            |
| 365    | 0                        | NR            | 495    | 312                      | NR            | 625    | 856                      | NR            | 755    | 19                       | NR            | 885    | 0                        | NR            |
| 370    | 0                        | NR            | 500    | 362                      | NR            | 630    | 801                      | NR            | 760    | 17                       | NR            | 890    | 0                        | NR            |
| 375    | 0                        | NR            | 505    | 399                      | NR            | 635    | 742                      | NR            | 765    | 14                       | NR            | 895    | 0                        | NR            |
| 380    | 0                        | NR            | 510    | 425                      | NR            | 640    | 677                      | NR            | 770    | 12                       | NR            | 900    | 0                        | NR            |
| 385    | 0                        | NR            | 515    | 446                      | NR            | 645    | 613                      | NR            | 775    | 10                       | NR            | 905    | 0                        | NR            |
| 390    | 0                        | NR            | 520    | 459                      | NR            | 650    | 549                      | NR            | 780    | 9                        | NR            | 910    | 0                        | NR            |
| 395    | 0                        | NR            | 525    | 473                      | NR            | 655    | 485                      | NR            | 785    | 7                        | NR            | 915    | 0                        | NR            |
| 400    | 1                        | NR            | 530    | 490                      | NR            | 660    | 425                      | NR            | 790    | 6                        | NR            | 920    | 0                        | NR            |
| 405    | 2                        | NR            | 535    | 511                      | NR            | 665    | 371                      | NR            | 795    | 5                        | NR            | 925    | 0                        | NR            |
| 410    | 5                        | NR            | 540    | 535                      | NR            | 670    | 321                      | NR            | 800    | 4                        | NR            | 930    | 0                        | NR            |
| 415    | 11                       | NR            | 545    | 565                      | NR            | 675    | 276                      | NR            | 805    | 4                        | NR            | 935    | 0                        | NR            |
| 420    | 24                       | NR            | 550    | 595                      | NR            | 680    | 238                      | NR            | 810    | 3                        | NR            | 940    | 0                        | NR            |
| 425    | 47                       | NR            | 555    | 631                      | NR            | 685    | 203                      | NR            | 815    | 3                        | NR            | 945    | 0                        | NR            |
| 430    | 86                       | NR            | 560    | 672                      | NR            | 690    | 174                      | NR            | 820    | 2                        | NR            | 950    | 0                        | NR            |
| 435    | 144                      | NR            | 565    | 715                      | NR            | 695    | 148                      | NR            | 825    | 2                        | NR            | 955    | 0                        | NR            |
| 440    | 224                      | NR            | 570    | 763                      | NR            | 700    | 124                      | NR            | 830    | 2                        | NR            | 960    | 0                        | NR            |
| 445    | 342                      | NR            | 575    | 814                      | NR            | 705    | 105                      | NR            | 835    | 2                        | NR            | 965    | 0                        | NR            |
| 450    | 446                      | NR            | 580    | 866                      | NR            | 710    | 88                       | NR            | 840    | 1                        | NR            | 970    | 0                        | NR            |
| 455    | 357                      | NR            | 585    | 912                      | NR            | 715    | 73                       | NR            | 845    | 1                        | NR            | 975    | 0                        | NR            |
| 460    | 237                      | NR            | 590    | 954                      | NR            | 720    | 59                       | NR            | 850    | 1                        | NR            | 980    | 0                        | NR            |
| 465    | 202                      | NR            | 595    | 981                      | NR            | 725    | 48                       | NR            | 855    | 1                        | NR            | 985    | 0                        | NR            |
| 470    | 172                      | NR            | 600    | 996                      | NR            | 730    | 40                       | NR            | 860    | 1                        | NR            | 990    | 0                        | NR            |
| 475    | 152                      | NR            | 605    | 996                      | NR            | 735    | 34                       | NR            | 865    | 1                        | NR            | 995    | 0                        | NR            |
| 480    | 171                      | NR            | 610    | 980                      | NR            | 740    | 29                       | NR            | 870    | 0                        | NR            | 1000   | 0                        | NR            |
| 485    | 210                      | NR            | 615    | 947                      | NR            | 745    | 25                       | NR            | 875    | 0                        | NR            |        |                          |               |

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### Melanopic Flux vs. Wavelength



Melanopic Lumens: NR

M/P: 2.51

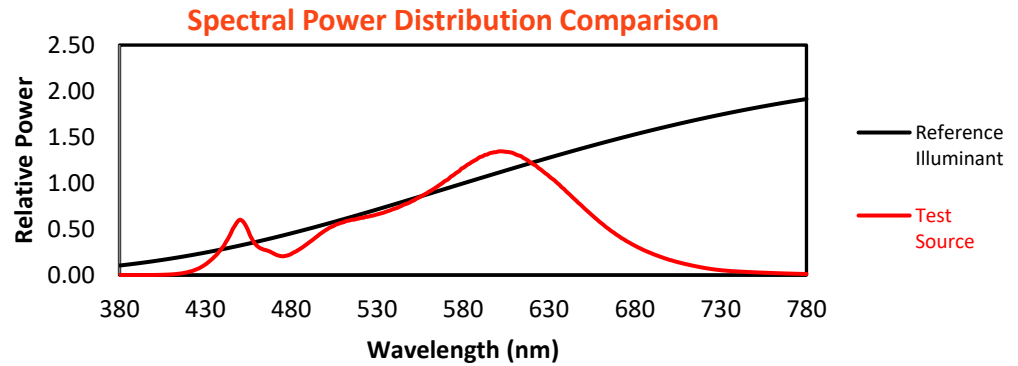
| $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) |
|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|
| 360               | 0                                      | NR                             | 490               | 260                                    | NR                             | 620               | 905                                    | NR                             | 750               | 22                                     | NR                             | 880               | 0                                      | NR                             |
| 365               | 0                                      | NR                             | 495               | 312                                    | NR                             | 625               | 856                                    | NR                             | 755               | 19                                     | NR                             | 885               | 0                                      | NR                             |
| 370               | 0                                      | NR                             | 500               | 362                                    | NR                             | 630               | 801                                    | NR                             | 760               | 17                                     | NR                             | 890               | 0                                      | NR                             |
| 375               | 0                                      | NR                             | 505               | 399                                    | NR                             | 635               | 742                                    | NR                             | 765               | 14                                     | NR                             | 895               | 0                                      | NR                             |
| 380               | 0                                      | NR                             | 510               | 425                                    | NR                             | 640               | 677                                    | NR                             | 770               | 12                                     | NR                             | 900               | 0                                      | NR                             |
| 385               | 0                                      | NR                             | 515               | 446                                    | NR                             | 645               | 613                                    | NR                             | 775               | 10                                     | NR                             | 905               | 0                                      | NR                             |
| 390               | 0                                      | NR                             | 520               | 459                                    | NR                             | 650               | 549                                    | NR                             | 780               | 9                                      | NR                             | 910               | 0                                      | NR                             |
| 395               | 0                                      | NR                             | 525               | 473                                    | NR                             | 655               | 485                                    | NR                             | 785               | 7                                      | NR                             | 915               | 0                                      | NR                             |
| 400               | 1                                      | NR                             | 530               | 490                                    | NR                             | 660               | 425                                    | NR                             | 790               | 6                                      | NR                             | 920               | 0                                      | NR                             |
| 405               | 2                                      | NR                             | 535               | 511                                    | NR                             | 665               | 371                                    | NR                             | 795               | 5                                      | NR                             | 925               | 0                                      | NR                             |
| 410               | 5                                      | NR                             | 540               | 535                                    | NR                             | 670               | 321                                    | NR                             | 800               | 4                                      | NR                             | 930               | 0                                      | NR                             |
| 415               | 11                                     | NR                             | 545               | 565                                    | NR                             | 675               | 276                                    | NR                             | 805               | 4                                      | NR                             | 935               | 0                                      | NR                             |
| 420               | 24                                     | NR                             | 550               | 595                                    | NR                             | 680               | 238                                    | NR                             | 810               | 3                                      | NR                             | 940               | 0                                      | NR                             |
| 425               | 47                                     | NR                             | 555               | 631                                    | NR                             | 685               | 203                                    | NR                             | 815               | 3                                      | NR                             | 945               | 0                                      | NR                             |
| 430               | 86                                     | NR                             | 560               | 672                                    | NR                             | 690               | 174                                    | NR                             | 820               | 2                                      | NR                             | 950               | 0                                      | NR                             |
| 435               | 144                                    | NR                             | 565               | 715                                    | NR                             | 695               | 148                                    | NR                             | 825               | 2                                      | NR                             | 955               | 0                                      | NR                             |
| 440               | 224                                    | NR                             | 570               | 763                                    | NR                             | 700               | 124                                    | NR                             | 830               | 2                                      | NR                             | 960               | 0                                      | NR                             |
| 445               | 342                                    | NR                             | 575               | 814                                    | NR                             | 705               | 105                                    | NR                             | 835               | 2                                      | NR                             | 965               | 0                                      | NR                             |
| 450               | 446                                    | NR                             | 580               | 866                                    | NR                             | 710               | 88                                     | NR                             | 840               | 1                                      | NR                             | 970               | 0                                      | NR                             |
| 455               | 357                                    | NR                             | 585               | 912                                    | NR                             | 715               | 73                                     | NR                             | 845               | 1                                      | NR                             | 975               | 0                                      | NR                             |
| 460               | 237                                    | NR                             | 590               | 954                                    | NR                             | 720               | 59                                     | NR                             | 850               | 1                                      | NR                             | 980               | 0                                      | NR                             |
| 465               | 202                                    | NR                             | 595               | 981                                    | NR                             | 725               | 48                                     | NR                             | 855               | 1                                      | NR                             | 985               | 0                                      | NR                             |
| 470               | 172                                    | NR                             | 600               | 996                                    | NR                             | 730               | 40                                     | NR                             | 860               | 1                                      | NR                             | 990               | 0                                      | NR                             |
| 475               | 152                                    | NR                             | 605               | 996                                    | NR                             | 735               | 34                                     | NR                             | 865               | 1                                      | NR                             | 995               | 0                                      | NR                             |
| 480               | 171                                    | NR                             | 610               | 980                                    | NR                             | 740               | 29                                     | NR                             | 870               | 0                                      | NR                             | 1000              | 0                                      | NR                             |
| 485               | 210                                    | NR                             | 615               | 947                                    | NR                             | 745               | 25                                     | NR                             | 875               | 0                                      | NR                             |                   |                                        |                                |

REPORT NUMBER: SP1-2407-176-7

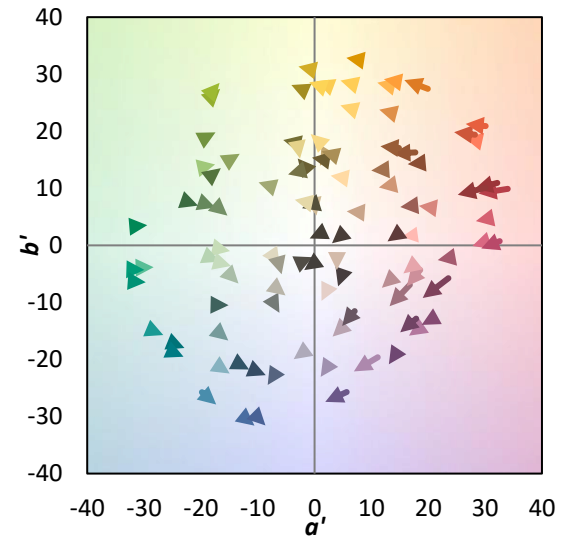
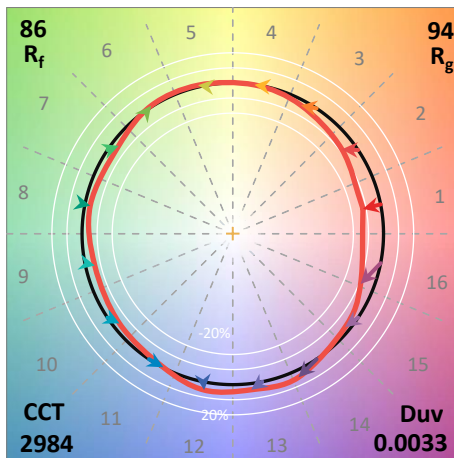
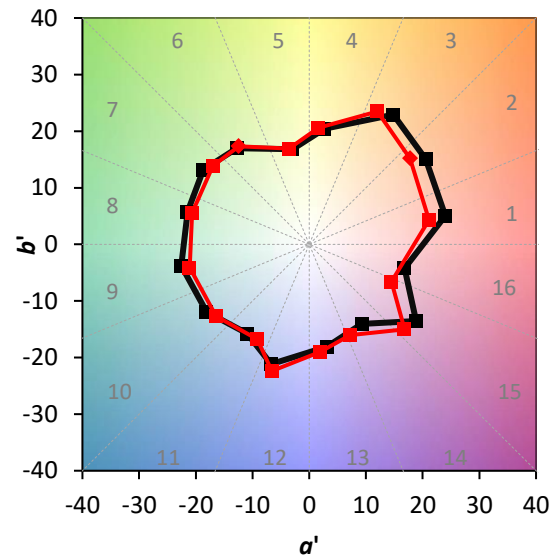
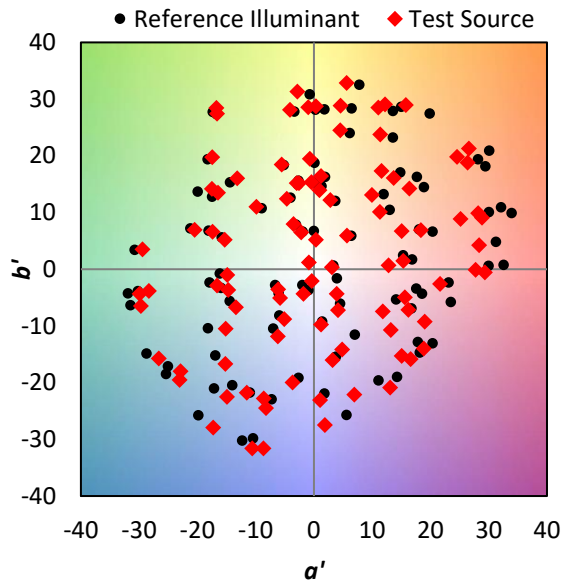
TM-30-18

### Summary

$R_f = 85.8$   
 $R_g = 94.1$   
 $CIE R_a = 81.8$   
 $R_g = -1.1$

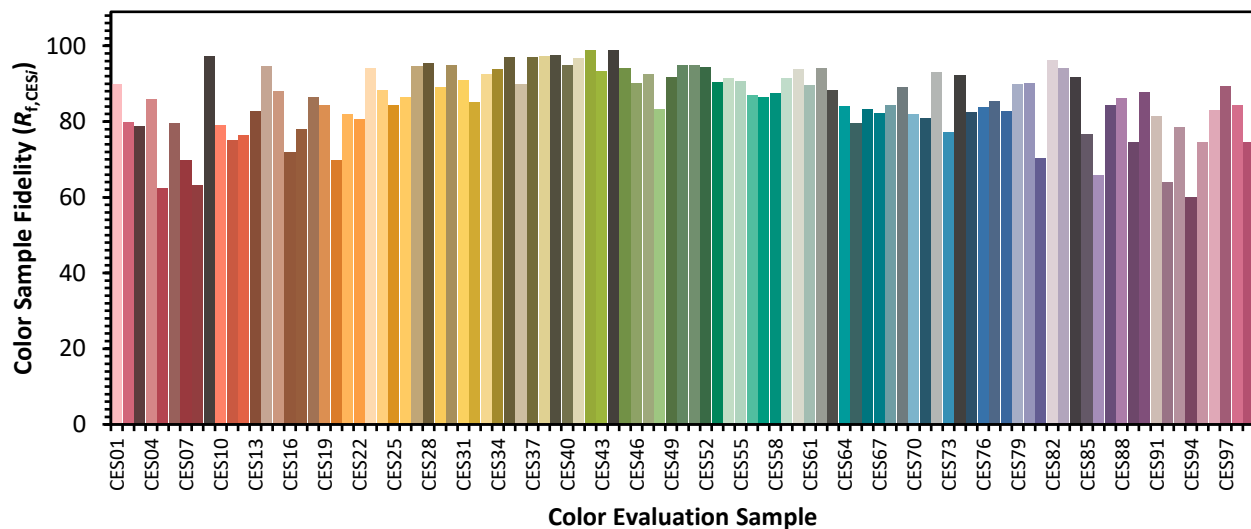


### Color Vector Graphics

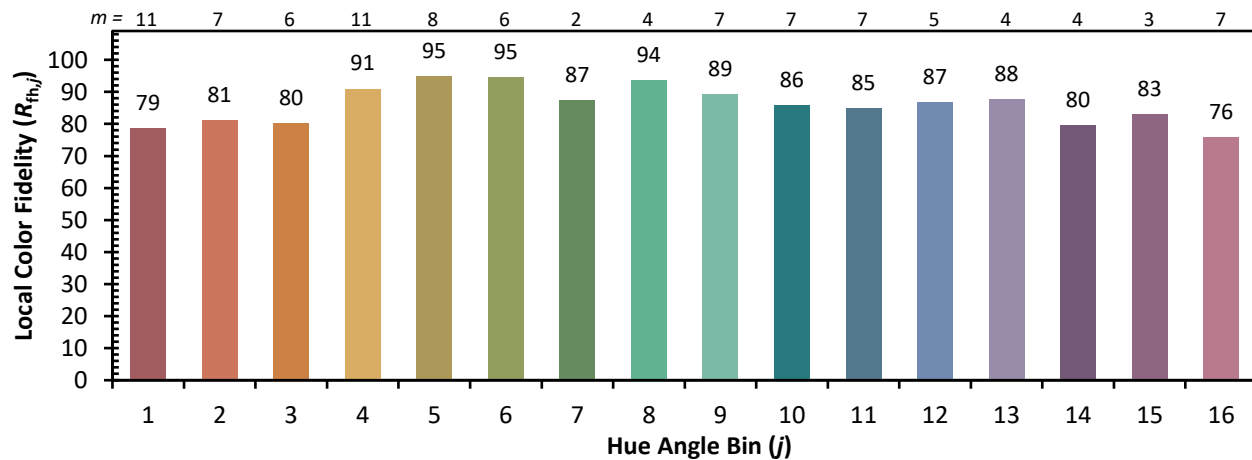
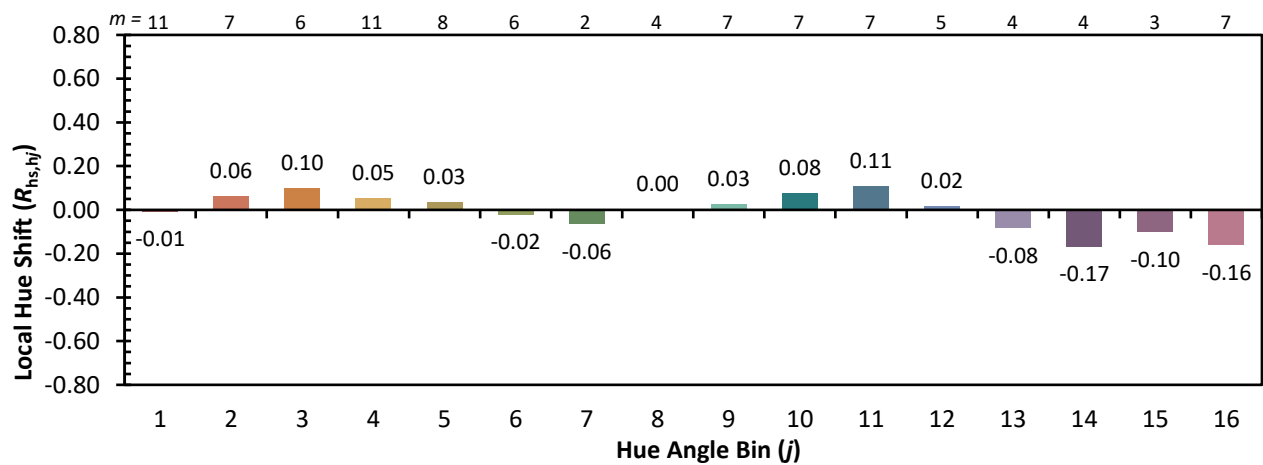
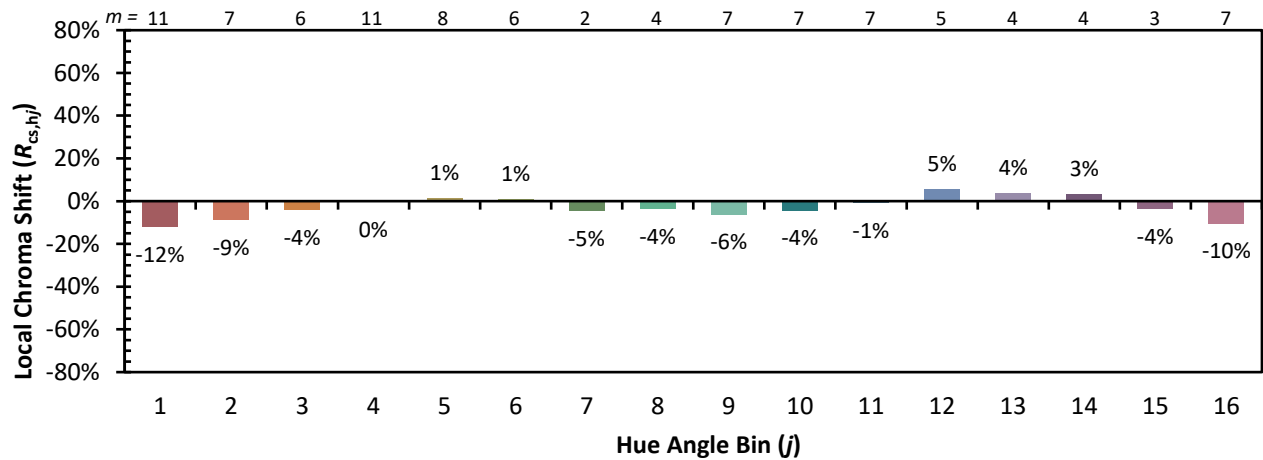


**Individual Sample Fidelity Index ( $R_{f,i}$ )**

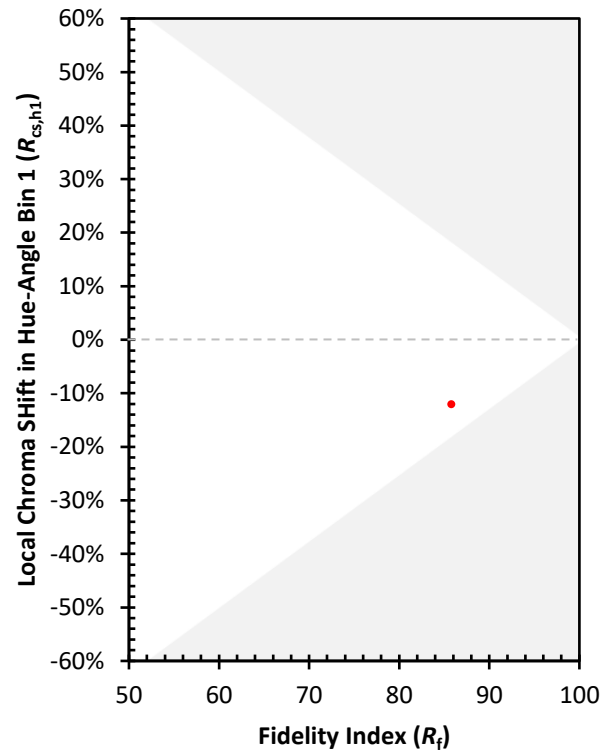
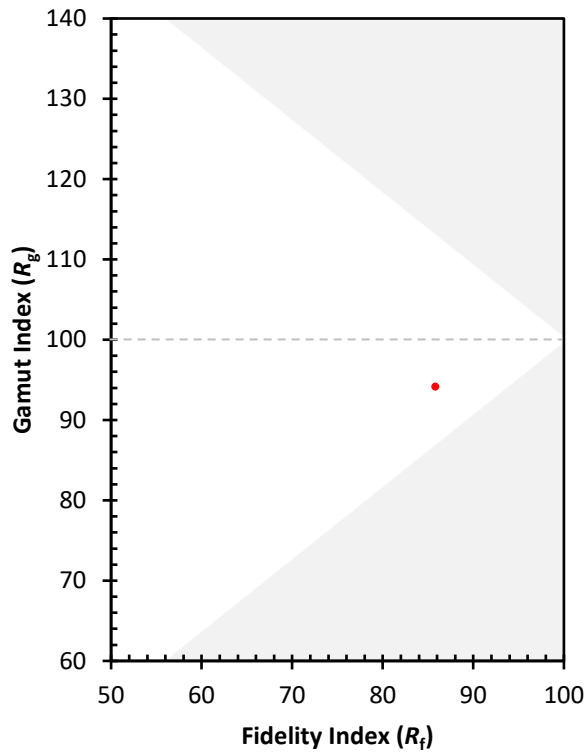
|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 86 | CES51 = 95 | CES76 = 84 |
| CES02 = 63 | CES27 = 95 | CES52 = 94 | CES77 = 86 |
| CES03 = 31 | CES28 = 95 | CES53 = 90 | CES78 = 83 |
| CES04 = 70 | CES29 = 89 | CES54 = 91 | CES79 = 90 |
| CES05 = 50 | CES30 = 95 | CES55 = 91 | CES80 = 90 |
| CES06 = 51 | CES31 = 91 | CES56 = 87 | CES81 = 70 |
| CES07 = 42 | CES32 = 85 | CES57 = 86 | CES82 = 96 |
| CES08 = 41 | CES33 = 93 | CES58 = 87 | CES83 = 94 |
| CES09 = 29 | CES34 = 94 | CES59 = 92 | CES84 = 92 |
| CES10 = 76 | CES35 = 97 | CES60 = 94 | CES85 = 77 |
| CES11 = 59 | CES36 = 90 | CES61 = 90 | CES86 = 66 |
| CES12 = 65 | CES37 = 97 | CES62 = 94 | CES87 = 84 |
| CES13 = 43 | CES38 = 97 | CES63 = 88 | CES88 = 86 |
| CES14 = 74 | CES39 = 98 | CES64 = 84 | CES89 = 75 |
| CES15 = 72 | CES40 = 95 | CES65 = 80 | CES90 = 88 |
| CES16 = 47 | CES41 = 97 | CES66 = 83 | CES91 = 81 |
| CES17 = 50 | CES42 = 99 | CES67 = 82 | CES92 = 64 |
| CES18 = 56 | CES43 = 93 | CES68 = 84 | CES93 = 79 |
| CES19 = 72 | CES44 = 99 | CES69 = 89 | CES94 = 60 |
| CES20 = 67 | CES45 = 94 | CES70 = 82 | CES95 = 74 |
| CES21 = 87 | CES46 = 90 | CES71 = 81 | CES96 = 83 |
| CES22 = 79 | CES47 = 93 | CES72 = 93 | CES97 = 89 |
| CES23 = 92 | CES48 = 83 | CES73 = 77 | CES98 = 84 |
| CES24 = 91 | CES49 = 92 | CES74 = 92 | CES99 = 75 |
| CES25 = 72 | CES50 = 95 | CES75 = 83 |            |



Color Rendition by Hue-Angle Bin



**Measure Comparisons**



(END OF REPORT)