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

Scaled data based on original data using

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

Test Report Prepared for

Cooper Lighting Solutions

Brand: McGRAW-EDISON

Report Number: P638410

Luminaire Tested: GWS-SA4E-827-U-AFL-W

Issue Date: 1/10/2023

Report Generated By 670246102 / DESKTOP-G35701P

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

Scaled Data Report

**Test Information**

| | |
|---|---|
| Test Method: | LM-79-2019 |
| Report Number: | P638410 |
| | TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G2-2209-782-45) |
| Test Lab: | COOPER LIGHTING SOLUTIONS |
| Issue Date: | 1/10/2023 |
| Manufacturer: | COOPER LIGHTING SOLUTIONS |
| Product Line: | McGRAW-EDISON |
| Catalog Number: | GWS-SA4E-827-U-AFL-W |
| Description: | GALLEON WALL SLIM LUMINAIRE. (4) LIGHTSQUARES WITH 16 LEDS EACH AND AUTOMOTIVE FRONTLINE OPTICS |
| Light Source: | (64) 2700K CCT, 80 CRI LEDS |
| Ballast/Driver: | - |

**Summary**

| | |
|---|---|
| Lumens per Lamp: | N/A |
| Luminaire Lumens: | 22908.5 lumens |
| Efficiency: | N/A |
| Efficacy: | 113.1 lumens/watt |
| Luminous Opening: | Rectangular (W 1' x L: 1' x H: 0') |
| IES Classification: | Type II - Short |
| BUG Rating: | B3 - U0 - G2 |

| | |
|---|---|
| Input Watts (W): | 202.6 |
| Input Voltage (V): | 120 |
| Input Current (Ain): | NR |
| Voltage Rise (V): | NR |
| Power Factor: | NR |
| Total Harmonic Distortion (THDi): | NR |
| Frequency (hertz): | 0 |
| Stabilization Time: | NR |
| Operation Time: | NR |
| Ambient Temperature (°C): | NR |
| Test Distance: | 28.75 FT |

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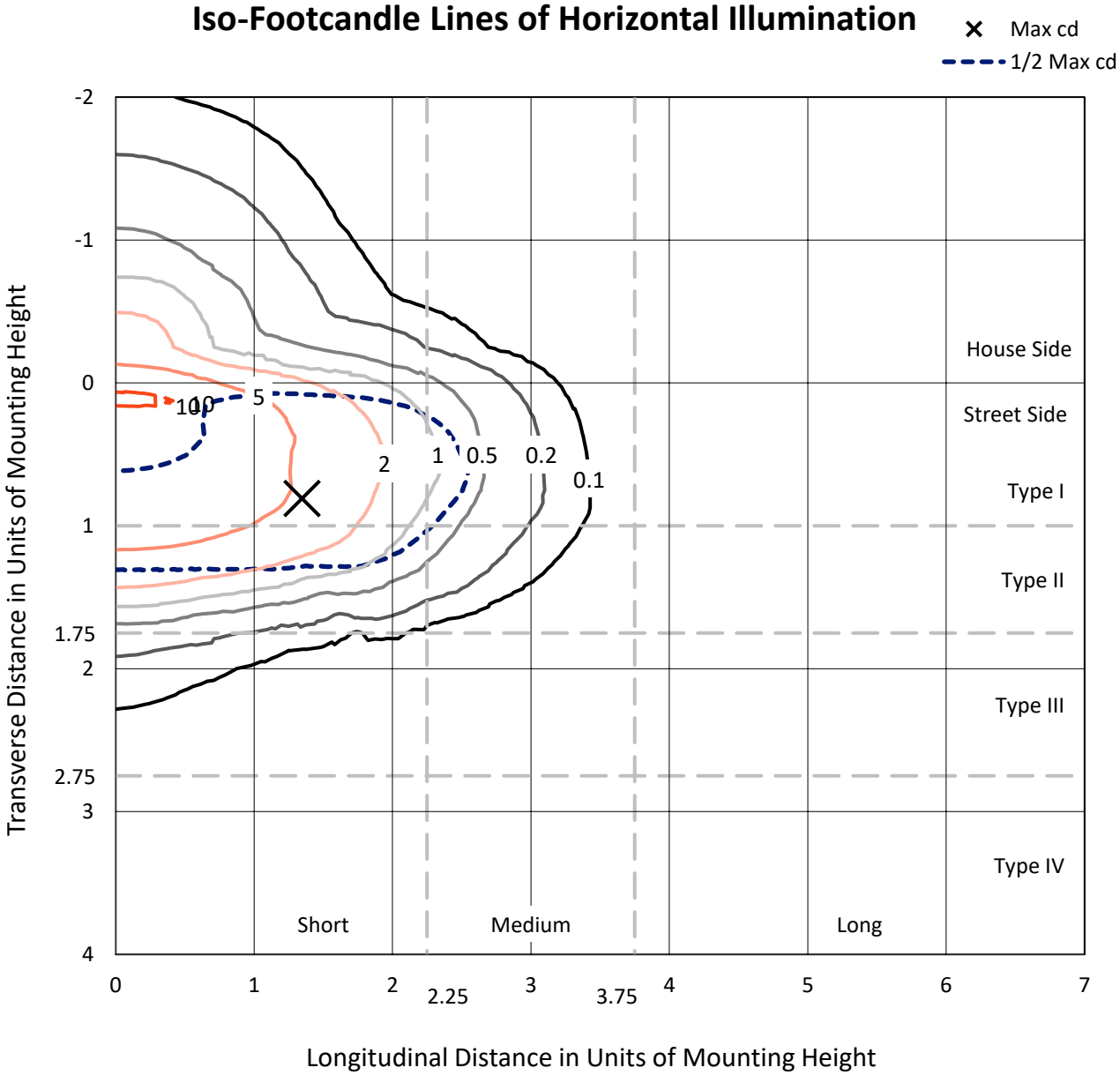
Scaled Data Report

REPORT NUMBER: P638410
CATALOG NUMBER: GWS-SA4E-827-U-AFL-W

## Iso-Footcandle Lines of Horizontal Illumination




Based on 25 foot mounting height. Maximum calculated value = 11 fc
Type II - Short - N/A

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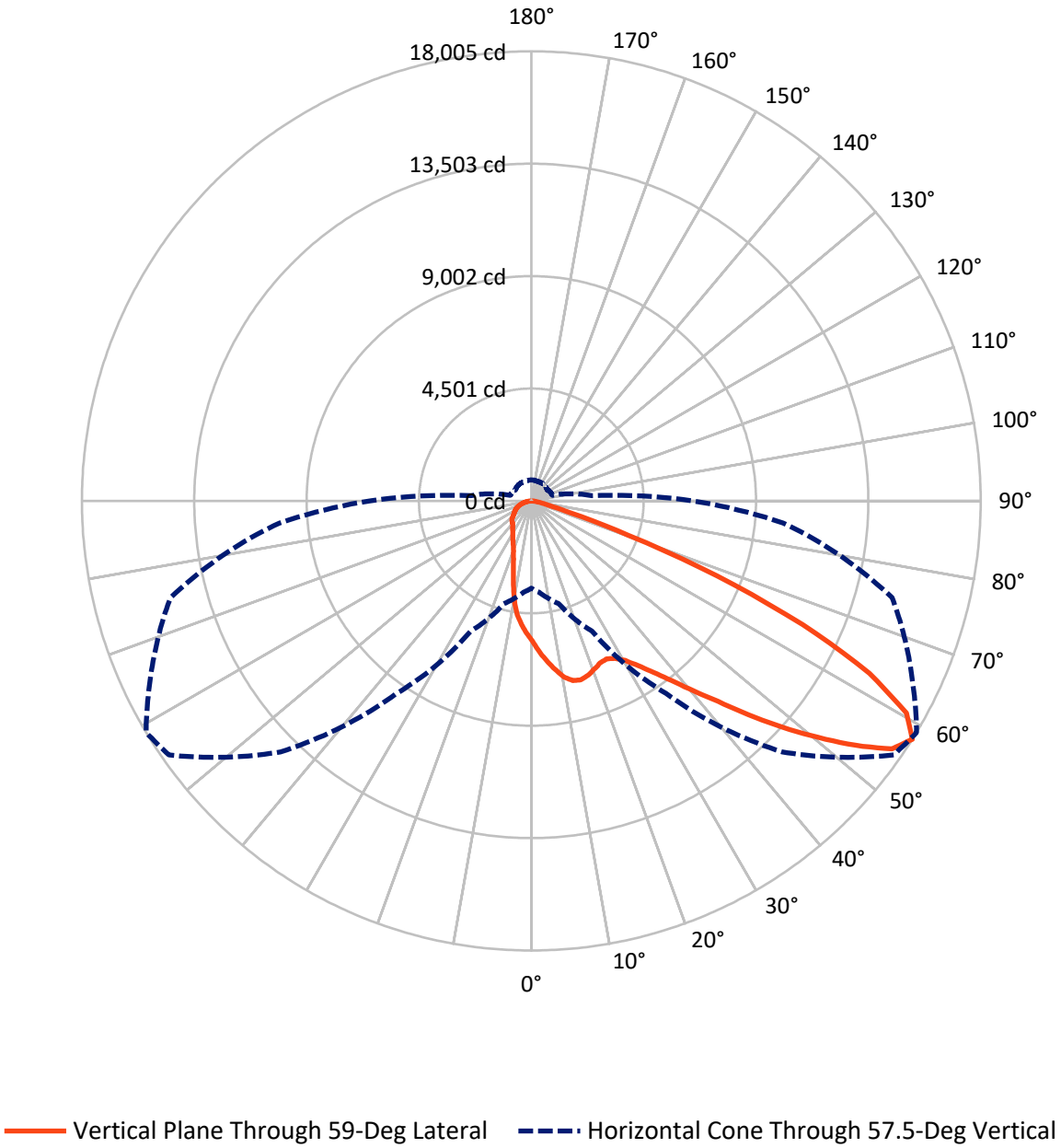
## Luminous Intensity Polar Plot



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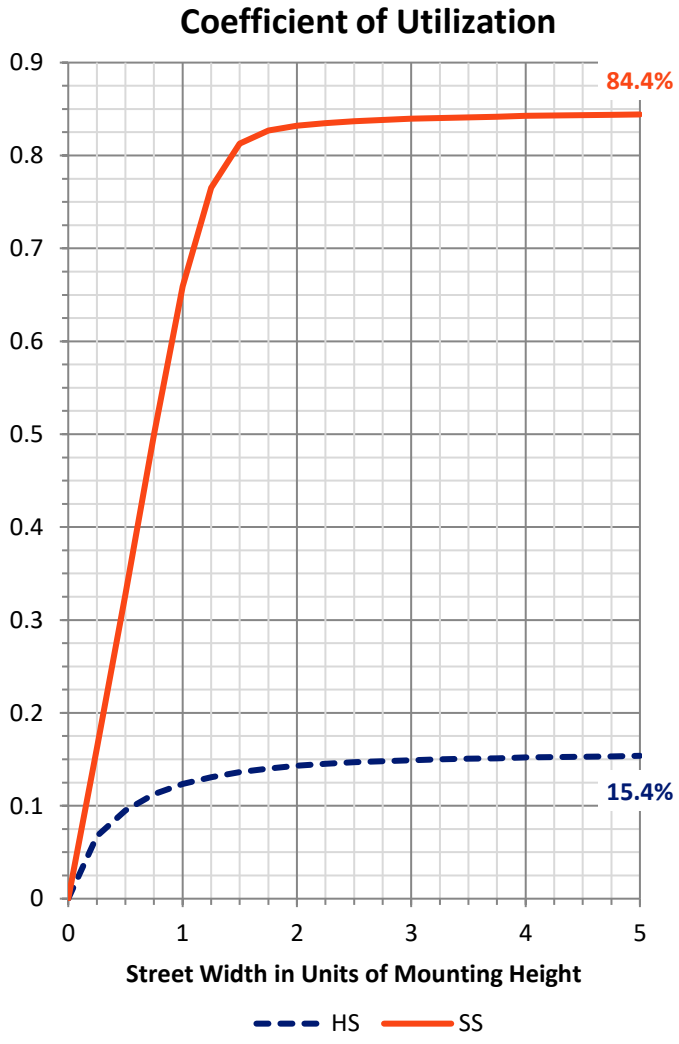
REPORT NUMBER: P638410
CATALOG NUMBER: GWS-SA4E-827-U-AFL-W

**FLUX DISTRIBUTION:**

| | | Downward | Upward | Total |
|---|---|---|---|---|
| **House Side** | Lumens | 3555.3 | 0.0 | 3555.3 |
| | % Fixture | 15.5 | 0.0 | 15.5 |
| **Street Side** | Lumens | 19353.2 | 0.0 | 19353.2 |
| | % Fixture | 84.5 | 0.0 | 84.5 |
| **Total** | Lumens | 22908.5 | 0.0 | 22908.5 |
| | % Fixture | 100.0 | 0.0 | 100.0 |

**ZONAL LUMENS:**

| Zone | Lumens | % Fixture |
|---|---|---|
| 0°-10° | 522.2 | 2.3 |
| 10°-20° | 1323.2 | 5.8 |
| 20°-30° | 2144.8 | 9.4 |
| 30°-40° | 3450.3 | 15.1 |
| 40°-50° | 5357.9 | 23.4 |
| 50°-60° | 5771.2 | 25.2 |
| 60°-70° | 3349.4 | 14.6 |
| 70°-80° | 874.4 | 3.8 |
| 80°-90° | 115.2 | 0.5 |
| 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° | 22908.5 | 100.0 |
| 0°-180° | 22908.5 | 100.0 |



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REPORT NUMBER: P638410
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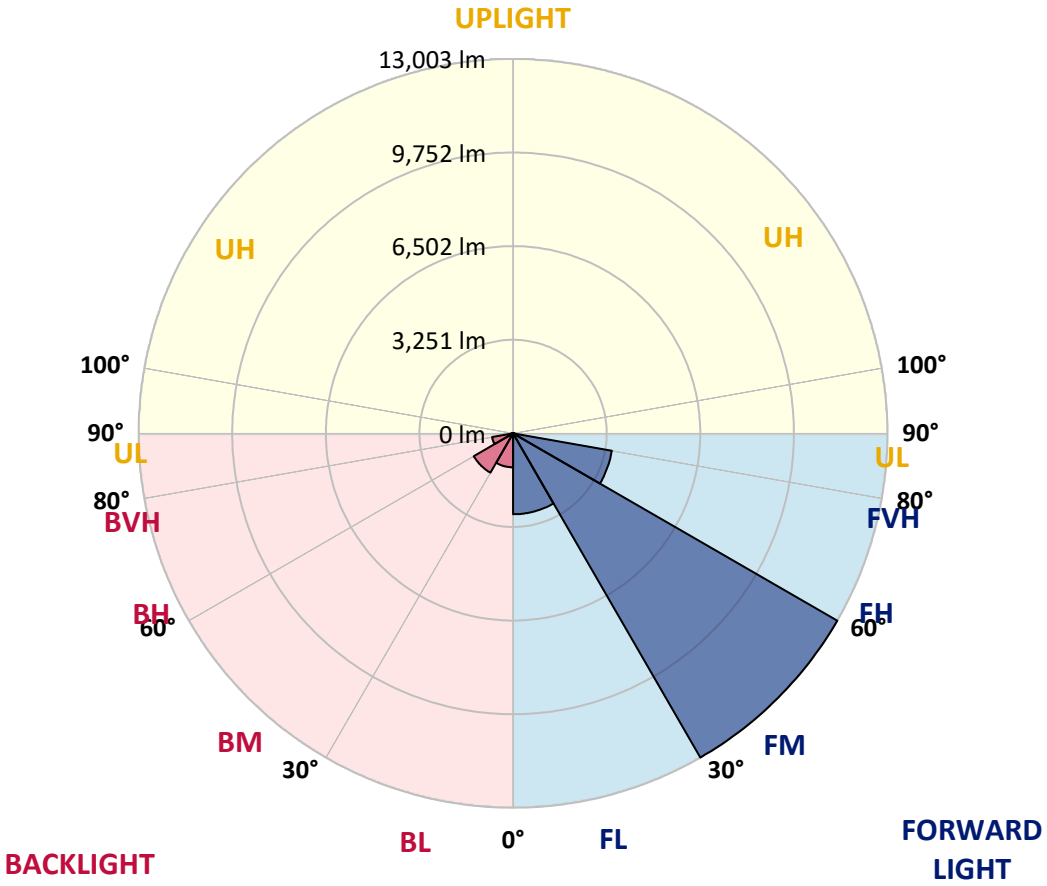
## LUMINAIRE CLASSIFICATION SYSTEM LUMEN TABLE AND BUG RATING:

| Zone | | Lumens | % Fixture | Zone Rating/Lumen Limit B | U | G |
|---|---|---|---|---|---|---|
| FL | (0°-30°) | 2810.7 | 12.3 | | | |
| FM | (30°-60°) | 13003.1 | 56.8 | | | |
| FH | (60°-80°) | 3484.3 | 15.2 | | | G2/5000 |
| FVH | (80°-90°) | 55.1 | 0.2 | | | G1/100 |
| BL | (0°-30°) | 1179.5 | 5.1 | B3/2500 | | |
| BM | (30°-60°) | 1576.3 | 6.9 | B2/2500 | | |
| BH | (60°-80°) | 739.5 | 3.2 | B2/1000 | | G2/1000 |
| BVH | (80°-90°) | 60.0 | 0.3 | | | G1/100 |
| UL | (90°-100°) | 0.0 | 0.0 | | U0/0 | |
| UH | (100°-180°) | 0.0 | 0.0 | | U0/0 | |

**BUG Rating: B3-U0-G2**
Type II Short



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REPORT NUMBER: P638410
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**CANDELA DISTRIBUTION (FULL):**

| | 0° | 5° | 15° | 25° | 35° | 45° | 55° | 59° | 65° | 75° | 85° |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | *5623.6* | 5623.6 | 5623.6 | 5623.6 |
| 2.5° | 6378.3 | 6325.1 | 6362.2 | 6296.1 | 6268.7 | 6196.1 | 6102.6 | *6039.7* | 5942.9 | 5817.1 | 5707.4 |
| 5° | 7012.1 | 6975.0 | 6983.1 | 6912.1 | 6849.3 | 6728.3 | 6536.4 | *6429.9* | 6265.4 | 6012.2 | 5776.8 |
| 7.5° | 6992.8 | 7036.3 | 7060.5 | 7121.8 | 7139.5 | 7128.3 | 6955.7 | *6807.3* | 6626.7 | 6246.1 | 5891.3 |
| 10° | 6268.7 | 6350.9 | 6425.1 | 6634.8 | 6889.6 | 7212.1 | 7252.4 | *7163.7* | 6981.5 | 6544.4 | 6028.4 |
| 12.5° | 5480.0 | 5542.9 | 5609.1 | 5860.6 | 6250.9 | 6896.0 | 7333.1 | *7387.9* | 7315.3 | 6839.6 | 6183.2 |
| 15° | 5093.0 | 5122.0 | 5184.9 | 5351.0 | 5662.3 | 6378.3 | 7192.8 | *7433.1* | 7563.7 | 7152.4 | 6357.4 |
| 17.5° | 5076.9 | 5089.8 | 5120.4 | 5209.1 | 5425.2 | 5978.4 | 6939.6 | *7342.7* | 7758.8 | 7483.1 | 6560.6 |
| 20° | 5410.7 | 5376.8 | 5357.5 | 5355.9 | 5462.3 | 5844.5 | 6694.4 | *7197.6* | 7850.8 | 7821.7 | 6778.3 |
| 22.5° | 5873.6 | 5884.8 | 5842.9 | 5739.7 | 5726.8 | 5939.7 | 6571.9 | *7050.8* | 7878.2 | 8121.7 | 6979.9 |
| 25° | 6529.9 | 6586.4 | 6462.2 | 6265.4 | 6168.7 | 6215.4 | 6647.7 | *7005.7* | 7874.9 | 8371.7 | 7105.7 |
| 27.5° | 7296.0 | 7339.5 | 7213.7 | 6955.7 | 6755.7 | 6642.8 | 6873.4 | *7139.5* | 7902.4 | 8587.8 | 7181.5 |
| 30° | 8168.5 | 8183.0 | 8010.4 | 7739.5 | 7447.6 | 7205.7 | 7249.2 | *7415.3* | 8042.7 | 8871.6 | 7270.2 |
| 32.5° | 9234.5 | 9295.8 | 9034.5 | 8605.5 | 8197.5 | 7887.8 | 7754.0 | *7860.4* | 8345.9 | 9207.1 | 7407.3 |
| 35° | 10587.6 | 10608.5 | 10276.3 | 9661.8 | 9084.5 | 8655.5 | 8374.9 | *8431.3* | 8807.1 | 9676.4 | 7613.7 |
| 37.5° | 11863.2 | 11884.2 | 11531.0 | 10960.1 | 10134.4 | 9547.3 | 9140.9 | *9115.1* | 9397.4 | 10339.2 | 7950.7 |
| 40° | 12672.8 | 12732.5 | 12574.4 | 12216.4 | 11427.8 | 10635.9 | 10084.4 | *9995.7* | 10171.5 | 11150.4 | 8420.0 |
| 42.5° | 13108.2 | 13134.0 | 13130.8 | 13177.6 | 12708.3 | 11921.3 | 11148.8 | *10971.4* | 11089.1 | 12026.1 | 8894.2 |
| 45° | 13111.5 | 13176.0 | 13348.5 | 13798.5 | 13819.5 | 13329.2 | 12493.8 | *12216.4* | 12108.4 | 12908.3 | 9389.3 |
| 47.5° | 12524.4 | 12593.8 | 13067.9 | 13953.3 | 14606.5 | 14717.7 | 14104.9 | *13548.5* | 13093.7 | 13667.9 | 9795.7 |
| 50° | 10747.2 | 10921.4 | 11824.5 | 13390.5 | 14761.3 | 15830.5 | 15641.8 | *14887.1* | 13969.4 | 14254.9 | 10050.5 |
| 52.5° | 9203.8 | 9197.4 | 9753.8 | 11800.3 | 14114.6 | 16320.8 | 17128.8 | *16264.4* | 14835.5 | 14627.4 | 10115.0 |
| 55° | 6739.6 | 6776.7 | 7346.0 | 9024.8 | 12389.0 | 15846.7 | 17946.4 | *17532.0* | 15828.9 | 14825.8 | 10089.2 |
| 57.5° | *3494.8* | *3678.6* | *4262.4* | *5759.0* | *9413.5* | *14214.6* | *17728.7* | *18004.5* | *16838.5* | *14966.1* | *10123.1* |
| 60° | 1765.9 | 1730.5 | 1940.1 | 2749.7 | 5454.2 | 11102.0 | 16386.9 | *17265.9* | 17020.7 | 15075.8 | 10144.1 |
| 62.5° | 1178.9 | 1169.2 | 1111.2 | 1274.1 | 2228.8 | 6575.1 | 13969.4 | *15201.6* | 15754.7 | 14817.7 | 9876.3 |
| 65° | 1020.9 | 1001.5 | 895.1 | 888.6 | 1082.1 | 2727.1 | 10239.2 | *11950.3* | 13021.2 | 13671.1 | 9236.1 |
| 67.5° | 919.3 | 890.2 | 782.2 | 729.0 | 777.3 | 1198.3 | 5770.3 | *8015.3* | 9615.1 | 11561.6 | 7833.0 |
| 70° | 820.9 | 806.4 | 698.3 | 620.9 | 616.1 | 730.6 | 2125.6 | *4136.6* | 5883.2 | 7887.8 | 5726.8 |
| 72.5° | 735.4 | 709.6 | 617.7 | 543.5 | 506.4 | 517.7 | 922.5 | *1593.4* | 3044.8 | 4920.4 | 3425.4 |
| 75° | 637.0 | 617.7 | 537.0 | 462.9 | 417.7 | 379.0 | 562.8 | *737.0* | 1388.6 | 2338.5 | 1617.6 |
| 77.5° | 491.9 | 479.0 | 424.1 | 367.7 | 341.9 | 282.2 | 341.9 | *464.5* | 641.9 | 985.4 | 841.8 |
| 80° | 285.5 | 293.5 | 316.1 | 287.1 | 251.6 | 201.6 | 222.6 | *267.7* | 385.4 | 533.8 | 477.4 |
| 82.5° | 143.5 | 153.2 | 204.8 | 166.1 | 150.0 | 117.7 | 132.2 | *158.0* | 201.6 | 295.1 | 187.1 |
| 85° | 11.3 | 11.3 | 37.1 | 41.9 | 51.6 | 41.9 | 53.2 | *64.5* | 91.9 | 117.7 | 62.9 |
| 87.5° | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.8 | *8.1* | 14.5 | 27.4 | 17.7 |
| 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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Scaled Data Report

REPORT NUMBER: P638410
CATALOG NUMBER: GWS-SA4E-827-U-AFL-W

**CANDELA DISTRIBUTION (continued):**

| | 90° | 95° | 105° | 115° | 125° | 135° | 145° | 155° | 165° | 175° | 180° |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0° | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 | 5623.6 |
| 2.5° | 5633.3 | 5551.0 | 5452.6 | 5372.0 | 5247.8 | 5181.7 | 5097.8 | 4994.6 | 4952.7 | 4933.3 | 4922.0 |
| 5° | 5644.5 | 5499.4 | 5289.7 | 5096.2 | 4881.7 | 4712.4 | 4523.7 | 4326.9 | 4214.1 | 4186.6 | 4167.3 |
| 7.5° | 5686.5 | 5483.3 | 5149.4 | 4830.1 | 4431.8 | 4062.5 | 3702.8 | 3346.4 | 3164.2 | 3094.8 | 3088.4 |
| 10° | 5744.5 | 5476.8 | 5007.5 | 4476.9 | 3804.4 | 3220.6 | 2799.7 | 2520.7 | 2403.0 | 2364.3 | 2351.4 |
| 12.5° | 5817.1 | 5472.0 | 4820.4 | 3986.7 | 3080.3 | 2528.8 | 2288.5 | 2243.3 | 2259.4 | 2256.2 | 2256.2 |
| 15° | 5909.0 | 5478.4 | 4594.7 | 3431.9 | 2491.7 | 2194.9 | 2199.8 | 2253.0 | 2303.0 | 2311.0 | 2311.0 |
| 17.5° | 6009.0 | 5472.0 | 4267.3 | 2875.5 | 2138.5 | 2115.9 | 2190.1 | 2264.3 | 2309.4 | 2315.9 | 2315.9 |
| 20° | 6117.1 | 5441.3 | 3854.4 | 2351.4 | 1983.7 | 2065.9 | 2146.5 | 2204.6 | 2232.0 | 2238.5 | 2238.5 |
| 22.5° | 6181.6 | 5354.3 | 3406.1 | 1990.1 | 1885.3 | 1986.9 | 2040.1 | 2099.8 | 2103.0 | 2051.4 | 2049.8 |
| 25° | 6171.9 | 5191.4 | 2894.8 | 1757.9 | 1780.5 | 1869.2 | 1936.9 | 1895.0 | 1843.3 | 1814.3 | 1809.5 |
| 27.5° | 6110.6 | 4946.2 | 2373.9 | 1582.1 | 1656.3 | 1756.3 | 1735.3 | 1699.8 | 1686.9 | 1654.7 | 1651.4 |
| 30° | 6033.2 | 4644.7 | 1906.2 | 1445.0 | 1527.3 | 1619.2 | 1586.9 | 1583.7 | 1570.8 | 1535.3 | 1535.3 |
| 32.5° | 5959.0 | 4333.4 | 1553.1 | 1343.4 | 1445.0 | 1451.5 | 1496.6 | 1499.8 | 1493.4 | 1432.1 | 1425.7 |
| 35° | 5938.1 | 4022.1 | 1314.4 | 1262.8 | 1364.4 | 1361.1 | 1425.7 | 1424.0 | 1312.8 | 1227.3 | 1225.7 |
| 37.5° | 6001.0 | 3706.0 | 1172.5 | 1196.6 | 1253.1 | 1295.0 | 1346.6 | 1253.1 | 1216.0 | 1164.4 | 1161.2 |
| 40° | 6134.8 | 3414.1 | 1099.9 | 1157.9 | 1182.1 | 1243.4 | 1162.8 | 1169.2 | 1159.6 | 1120.8 | 1116.0 |
| 42.5° | 6312.2 | 3165.8 | 1059.6 | 1145.0 | 1141.8 | 1157.9 | 1069.2 | 1095.0 | 1109.6 | 1080.5 | 1075.7 |
| 45° | 6483.2 | 2949.7 | 1038.6 | 1096.7 | 1112.8 | 1019.2 | 1001.5 | 1025.7 | 1048.3 | 1037.0 | 1032.1 |
| 47.5° | 6609.0 | 2762.6 | 1027.3 | 1030.5 | 1075.7 | 972.5 | 943.4 | 954.7 | 982.2 | 987.0 | 985.4 |
| 50° | 6647.7 | 2602.9 | 1014.4 | 975.7 | 966.0 | 925.7 | 903.1 | 899.9 | 932.2 | 954.7 | 958.0 |
| 52.5° | 6573.5 | 2461.0 | 980.5 | 927.3 | 880.5 | 887.0 | 878.9 | 862.8 | 895.1 | 925.7 | 928.9 |
| 55° | 6463.8 | 2380.4 | 927.3 | 880.5 | 825.7 | 851.5 | 854.7 | 840.2 | 861.2 | 882.2 | 882.2 |
| 57.5° | *6471.9* | *2427.2* | *875.7* | *837.0* | *777.3* | *811.2* | *828.9* | *822.5* | *822.5* | *838.6* | *840.2* |
| 60° | 6525.1 | 2494.9 | 841.8 | 782.2 | 729.0 | 764.4 | 804.8 | 798.3 | 783.8 | 804.8 | 804.8 |
| 62.5° | 6371.9 | 2404.6 | 819.3 | 729.0 | 677.3 | 719.3 | 767.7 | 764.4 | 748.3 | 782.2 | 785.4 |
| 65° | 5920.3 | 2162.7 | 793.5 | 662.8 | 625.7 | 674.1 | 716.1 | 727.3 | 712.8 | 758.0 | 766.0 |
| 67.5° | 4962.4 | 1819.2 | 743.5 | 599.9 | 574.1 | 619.3 | 659.6 | 675.7 | 664.4 | 717.7 | 724.1 |
| 70° | 3699.6 | 1472.4 | 664.4 | 530.6 | 511.2 | 551.6 | 588.6 | 595.1 | 596.7 | 659.6 | 666.1 |
| 72.5° | 2359.4 | 1145.0 | 559.6 | 453.2 | 438.7 | 469.3 | 496.7 | 522.5 | 533.8 | 593.5 | 591.9 |
| 75° | 1316.0 | 851.5 | 450.0 | 383.8 | 358.0 | 382.2 | 414.5 | 445.1 | 477.4 | 564.5 | 574.1 |
| 77.5° | 758.0 | 598.3 | 356.4 | 308.0 | 277.4 | 303.2 | 330.6 | 374.2 | 470.9 | 546.7 | 537.0 |
| 80° | 427.4 | 388.7 | 269.3 | 225.8 | 206.4 | 225.8 | 246.7 | 329.0 | 370.9 | 403.2 | 408.0 |
| 82.5° | 200.0 | 217.7 | 183.9 | 138.7 | 138.7 | 151.6 | 170.9 | 254.8 | 280.6 | 229.0 | 200.0 |
| 85° | 72.6 | 98.4 | 90.3 | 71.0 | 62.9 | 61.3 | 106.4 | 145.1 | 90.3 | 80.6 | 69.3 |
| 87.5° | 19.4 | 27.4 | 25.8 | 17.7 | 9.7 | 8.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 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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Peachtree City, GA 30269

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

Report Prepared for

Cooper Lighting Solutions

Invue

Report Number: SP1-2407-157-9

Test Date: 10/03/2024

Luminaire Tested: EMM2-HTN-SA1A-827-U-5WQ

Data applicable to all product families utilizing light square engine

Report Generated By FNC07603 / LDUCLS01DT446
Version: v7.04

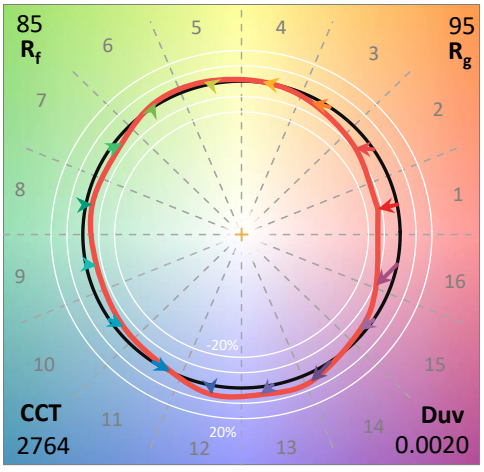
## Test Information

| | |
|---|---|
| Test Method: | LM-79-2019 |
| Report Number: | SP1-2407-157-9 |
| Test Lab: | COOPER LIGHTING SOLUTIONS |
| Photometer: | SP1 - 76IN SPHERE |
| Measurement Geometry: | 4π |
| Issue Date: | 10/03/2024 |
| Manufacturer: | COOPER LIGHTING SOLUTIONS |
| Product Line: | Invue |
| Catalog Number: | **EMM2-HTN-SA1A-827-U-5WQ** |
| Description: | Epic Modern Light Square 40W 5WQ Optic |

## Spectral Parameters

| | |
|---|---|
| CCT (K): | 2764 |
| CIE u': | 0.2591 |
| CIE v': | 0.5290 |
| Duv: | 0.0020 |
| CIE x: | 0.4581 |
| CIE y: | 0.4156 |
| CIE z: | 0.1263 |
| Peak Wavelength (nm): | 603 |
| Dominant Wavelength (nm): | 583 |
| Purity: | 62.2537 |
| Rf: | 84.7 |
| Rg: | 94.6 |

| | |
|---|---|
| CRI (Ra): | 80.9 |
| R1: | 78.8 |
| R2: | 89.9 |
| R3: | 96.2 |
| R4: | 79.1 |
| R5: | 79.1 |
| R6: | 88.8 |
| R7: | 81.3 |
| R8: | 54.3 |
| R9: | -1.5 |
| R10: | 77.9 |
| R11: | 78.9 |
| R12: | 71.6 |
| R13: | 81.2 |
| R14: | 98.5 |
| R15: | 69.9 |




## Test Conditions

| | |
|---|---|
| Stabilization Time: | 81M |
| Operation Time: | 2H 21M |
| Sphere Temperature (°C): | 25.2 |

REPORT NUMBER: SP1-2407-157-9

| 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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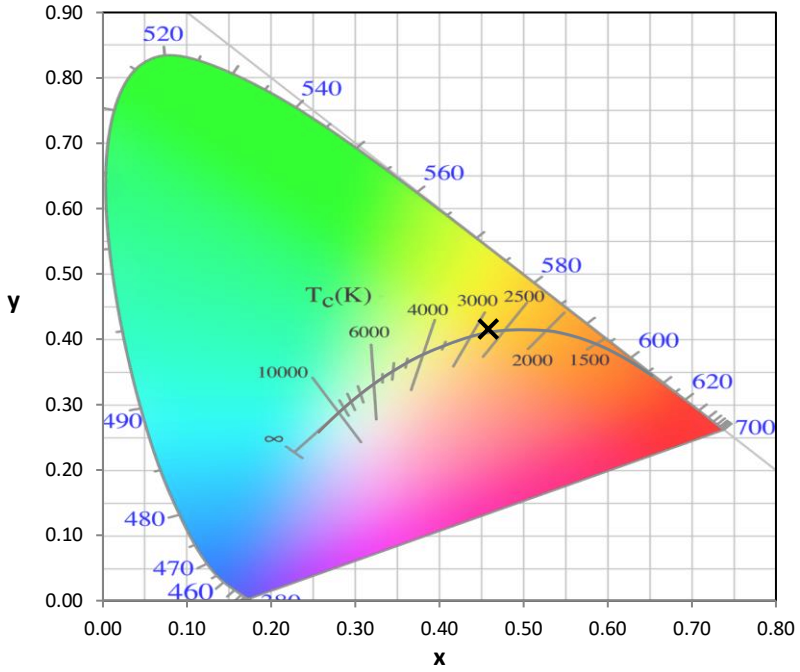
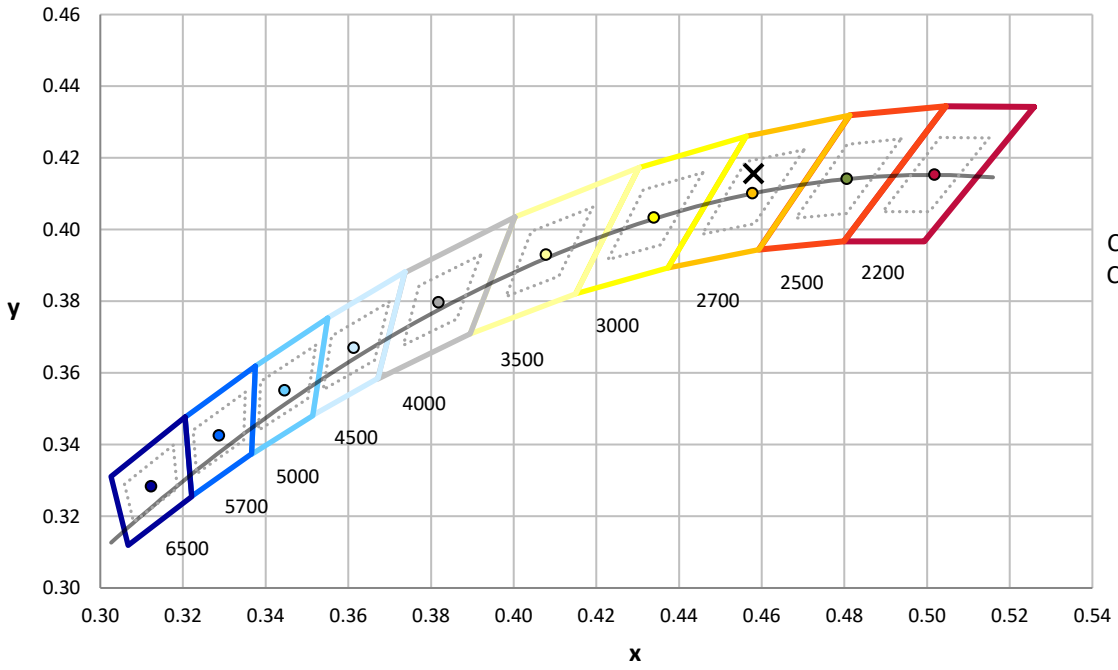
## CIE 1931 Chromaticity Diagram




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




CCT = 2764K
CIE x = 0.4581
CIE y = 0.4156
Duv = 0.0020

Point lies inside the ANSI 2700K 4-step quadrangle

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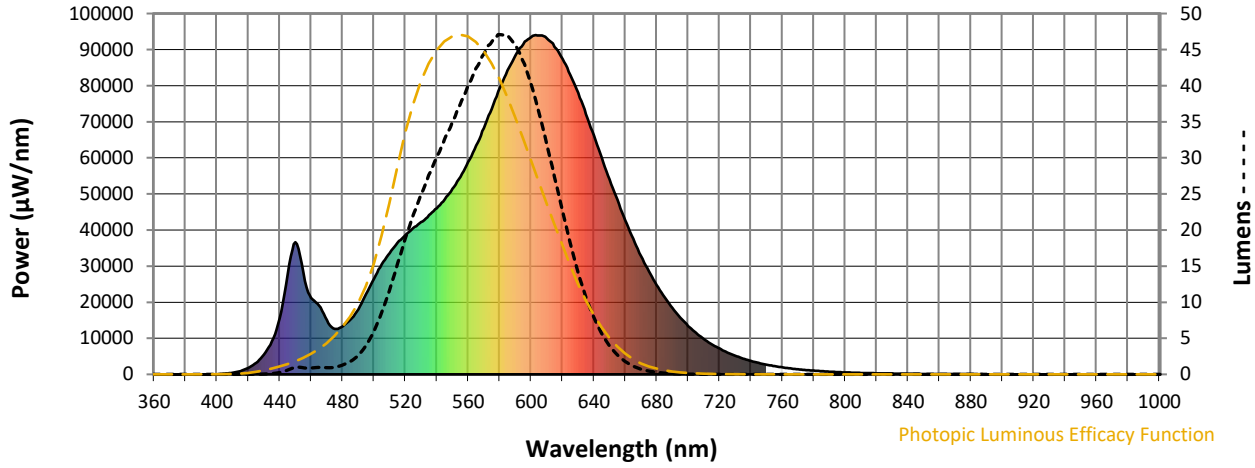
## Photopic Flux vs. Wavelength




**Photopic Lumens: 4337.9**

| λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 360 | 0 | 0.0 | 490 | 18018 | 2.6 | 620 | 87426 | 22.8 | 750 | 2680 | 0.0 | 880 | 58 | 0.0 |
| 365 | 0 | 0.0 | 495 | 22295 | 3.9 | 625 | 83013 | 18.2 | 755 | 2287 | 0.0 | 885 | 46 | 0.0 |
| 370 | 0 | 0.0 | 500 | 26478 | 5.8 | 630 | 78077 | 14.1 | 760 | 1944 | 0.0 | 890 | 45 | 0.0 |
| 375 | 0 | 0.0 | 505 | 30524 | 8.5 | 635 | 72080 | 10.7 | 765 | 1653 | 0.0 | 895 | 41 | 0.0 |
| 380 | 0 | 0.0 | 510 | 33611 | 11.5 | 640 | 66249 | 7.9 | 770 | 1413 | 0.0 | 900 | 38 | 0.0 |
| 385 | 0 | 0.0 | 515 | 36490 | 15.2 | 645 | 59973 | 5.7 | 775 | 1198 | 0.0 | 905 | 33 | 0.0 |
| 390 | 0 | 0.0 | 520 | 38610 | 18.7 | 650 | 53972 | 3.9 | 780 | 1025 | 0.0 | 910 | 30 | 0.0 |
| 395 | 0 | 0.0 | 525 | 40511 | 21.9 | 655 | 48369 | 2.7 | 785 | 874 | 0.0 | 915 | 23 | 0.0 |
| 400 | 48 | 0.0 | 530 | 42223 | 24.9 | 660 | 42641 | 1.8 | 790 | 747 | 0.0 | 920 | 24 | 0.0 |
| 405 | 201 | 0.0 | 535 | 44137 | 27.6 | 665 | 37602 | 1.1 | 795 | 639 | 0.0 | 925 | 22 | 0.0 |
| 410 | 457 | 0.0 | 540 | 46032 | 30.0 | 670 | 32798 | 0.7 | 800 | 547 | 0.0 | 930 | 22 | 0.0 |
| 415 | 925 | 0.0 | 545 | 48553 | 32.5 | 675 | 28558 | 0.5 | 805 | 473 | 0.0 | 935 | 17 | 0.0 |
| 420 | 1816 | 0.0 | 550 | 51408 | 34.9 | 680 | 24782 | 0.3 | 810 | 401 | 0.0 | 940 | 13 | 0.0 |
| 425 | 3217 | 0.0 | 555 | 54711 | 37.4 | 685 | 21386 | 0.2 | 815 | 351 | 0.0 | 945 | 6 | 0.0 |
| 430 | 5520 | 0.0 | 560 | 58847 | 40.0 | 690 | 18413 | 0.1 | 820 | 307 | 0.0 | 950 | 10 | 0.0 |
| 435 | 9225 | 0.1 | 565 | 63386 | 42.4 | 695 | 15721 | 0.1 | 825 | 261 | 0.0 | 955 | 11 | 0.0 |
| 440 | 15522 | 0.2 | 570 | 68196 | 44.3 | 700 | 13432 | 0.0 | 830 | 228 | 0.0 | 960 | 8 | 0.0 |
| 445 | 27642 | 0.6 | 575 | 73613 | 46.0 | 705 | 11513 | 0.0 | 835 | 193 | 0.0 | 965 | 12 | 0.0 |
| 450 | 36602 | 0.9 | 580 | 79207 | 47.1 | 710 | 9780 | 0.0 | 840 | 174 | 0.0 | 970 | 3 | 0.0 |
| 455 | 28292 | 0.9 | 585 | 84248 | 47.0 | 715 | 8356 | 0.0 | 845 | 151 | 0.0 | 975 | 8 | 0.0 |
| 460 | 21166 | 0.9 | 590 | 88397 | 45.7 | 720 | 7161 | 0.0 | 850 | 123 | 0.0 | 980 | 2 | 0.0 |
| 465 | 19092 | 1.0 | 595 | 91428 | 43.4 | 725 | 6067 | 0.0 | 855 | 106 | 0.0 | 985 | 13 | 0.0 |
| 470 | 14951 | 0.9 | 600 | 93452 | 40.3 | 730 | 5164 | 0.0 | 860 | 95 | 0.0 | 990 | 16 | 0.0 |
| 475 | 12606 | 1.0 | 605 | 93959 | 36.4 | 735 | 4393 | 0.0 | 865 | 82 | 0.0 | 995 | 20 | 0.0 |
| 480 | 13323 | 1.3 | 610 | 93079 | 32.0 | 740 | 3694 | 0.0 | 870 | 77 | 0.0 | 1000 | 0 | 0.0 |
| 485 | 15164 | 1.8 | 615 | 90707 | 27.3 | 745 | 3157 | 0.0 | 875 | 65 | 0.0 | | | |

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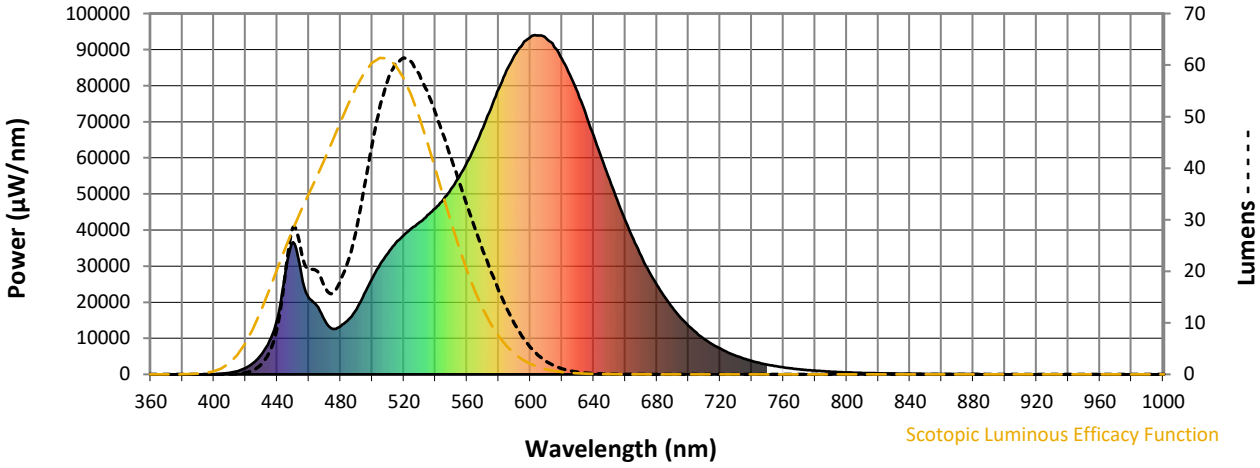
## Scotopic Flux vs. Wavelength




**Scotopic Lumens: 5286.7** **S/P: 1.22**

| λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 360 | 0 | 0.0 | 490 | 18018 | 75.9 | 620 | 87426 | 0.4 | 750 | 2680 | 0.0 | 880 | 58 | 0.0 |
| 365 | 0 | 0.0 | 495 | 22295 | 93.2 | 625 | 83013 | 0.2 | 755 | 2287 | 0.0 | 885 | 46 | 0.0 |
| 370 | 0 | 0.0 | 500 | 26478 | 107.8 | 630 | 78077 | 0.1 | 760 | 1944 | 0.0 | 890 | 45 | 0.0 |
| 375 | 0 | 0.0 | 505 | 30524 | 118.7 | 635 | 72080 | 0.1 | 765 | 1653 | 0.0 | 895 | 41 | 0.0 |
| 380 | 0 | 0.0 | 510 | 33611 | 122.2 | 640 | 66249 | 0.1 | 770 | 1413 | 0.0 | 900 | 38 | 0.0 |
| 385 | 0 | 0.0 | 515 | 36490 | 120.8 | 645 | 59973 | 0.0 | 775 | 1198 | 0.0 | 905 | 33 | 0.0 |
| 390 | 0 | 0.0 | 520 | 38610 | 113.9 | 650 | 53972 | 0.0 | 780 | 1025 | 0.0 | 910 | 30 | 0.0 |
| 395 | 0 | 0.0 | 525 | 40511 | 104.1 | 655 | 48369 | 0.0 | 785 | 874 | 0.0 | 915 | 23 | 0.0 |
| 400 | 48 | 0.0 | 530 | 42223 | 92.4 | 660 | 42641 | 0.0 | 790 | 747 | 0.0 | 920 | 24 | 0.0 |
| 405 | 201 | 0.0 | 535 | 44137 | 80.5 | 665 | 37602 | 0.0 | 795 | 639 | 0.0 | 925 | 22 | 0.0 |
| 410 | 457 | 0.1 | 540 | 46032 | 68.2 | 670 | 32798 | 0.0 | 800 | 547 | 0.0 | 930 | 22 | 0.0 |
| 415 | 925 | 0.3 | 545 | 48553 | 57.1 | 675 | 28558 | 0.0 | 805 | 473 | 0.0 | 935 | 17 | 0.0 |
| 420 | 1816 | 1.1 | 550 | 51408 | 46.7 | 680 | 24782 | 0.0 | 810 | 401 | 0.0 | 940 | 13 | 0.0 |
| 425 | 3217 | 2.5 | 555 | 54711 | 37.4 | 685 | 21386 | 0.0 | 815 | 351 | 0.0 | 945 | 6 | 0.0 |
| 430 | 5520 | 5.9 | 560 | 58847 | 29.4 | 690 | 18413 | 0.0 | 820 | 307 | 0.0 | 950 | 10 | 0.0 |
| 435 | 9225 | 12.5 | 565 | 63386 | 22.5 | 695 | 15721 | 0.0 | 825 | 261 | 0.0 | 955 | 11 | 0.0 |
| 440 | 15522 | 26.3 | 570 | 68196 | 16.9 | 700 | 13432 | 0.0 | 830 | 228 | 0.0 | 960 | 8 | 0.0 |
| 445 | 27642 | 55.2 | 575 | 73613 | 12.4 | 705 | 11513 | 0.0 | 835 | 193 | 0.0 | 965 | 12 | 0.0 |
| 450 | 36602 | 85.4 | 580 | 79207 | 9.0 | 710 | 9780 | 0.0 | 840 | 174 | 0.0 | 970 | 3 | 0.0 |
| 455 | 28292 | 75.1 | 585 | 84248 | 6.3 | 715 | 8356 | 0.0 | 845 | 151 | 0.0 | 975 | 8 | 0.0 |
| 460 | 21166 | 63.2 | 590 | 88397 | 4.4 | 720 | 7161 | 0.0 | 850 | 123 | 0.0 | 980 | 2 | 0.0 |
| 465 | 19092 | 63.2 | 595 | 91428 | 3.0 | 725 | 6067 | 0.0 | 855 | 106 | 0.0 | 985 | 13 | 0.0 |
| 470 | 14951 | 54.2 | 600 | 93452 | 2.0 | 730 | 5164 | 0.0 | 860 | 95 | 0.0 | 990 | 16 | 0.0 |
| 475 | 12606 | 48.8 | 605 | 93959 | 1.3 | 735 | 4393 | 0.0 | 865 | 82 | 0.0 | 995 | 20 | 0.0 |
| 480 | 13323 | 54.2 | 610 | 93079 | 0.9 | 740 | 3694 | 0.0 | 870 | 77 | 0.0 | 1000 | 0 | 0.0 |
| 485 | 15164 | 63.3 | 615 | 90707 | 0.5 | 745 | 3157 | 0.0 | 875 | 65 | 0.0 | | | |

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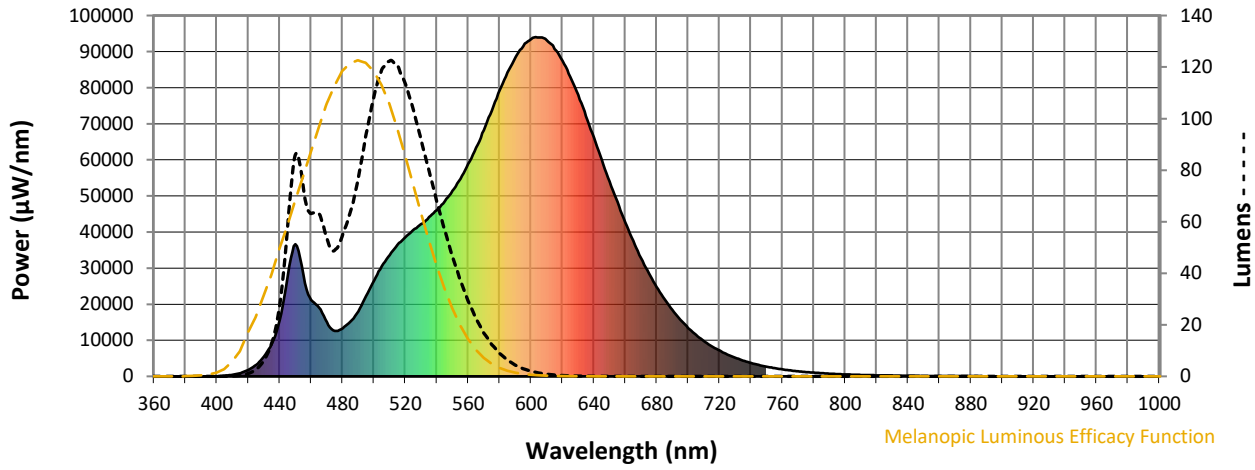
## Melanopic Flux vs. Wavelength




**Melanopic Lumens: 9797** **M/P: 2.26**

| λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 360 | 0 | 0.0 | 490 | 18018 | 27.7 | 620 | 87426 | 1.1 | 750 | 2680 | 0.0 | 880 | 58 | 0.0 |
| 365 | 0 | 0.0 | 495 | 22295 | 36.0 | 625 | 83013 | 0.7 | 755 | 2287 | 0.0 | 885 | 46 | 0.0 |
| 370 | 0 | 0.0 | 500 | 26478 | 44.2 | 630 | 78077 | 0.4 | 760 | 1944 | 0.0 | 890 | 45 | 0.0 |
| 375 | 0 | 0.0 | 505 | 30524 | 51.8 | 635 | 72080 | 0.3 | 765 | 1653 | 0.0 | 895 | 41 | 0.0 |
| 380 | 0 | 0.0 | 510 | 33611 | 57.0 | 640 | 66249 | 0.2 | 770 | 1413 | 0.0 | 900 | 38 | 0.0 |
| 385 | 0 | 0.0 | 515 | 36490 | 60.5 | 645 | 59973 | 0.1 | 775 | 1198 | 0.0 | 905 | 33 | 0.0 |
| 390 | 0 | 0.0 | 520 | 38610 | 61.4 | 650 | 53972 | 0.1 | 780 | 1025 | 0.0 | 910 | 30 | 0.0 |
| 395 | 0 | 0.0 | 525 | 40511 | 60.6 | 655 | 48369 | 0.0 | 785 | 874 | 0.0 | 915 | 23 | 0.0 |
| 400 | 48 | 0.0 | 530 | 42223 | 58.2 | 660 | 42641 | 0.0 | 790 | 747 | 0.0 | 920 | 24 | 0.0 |
| 405 | 201 | 0.0 | 535 | 44137 | 55.0 | 665 | 37602 | 0.0 | 795 | 639 | 0.0 | 925 | 22 | 0.0 |
| 410 | 457 | 0.0 | 540 | 46032 | 50.9 | 670 | 32798 | 0.0 | 800 | 547 | 0.0 | 930 | 22 | 0.0 |
| 415 | 925 | 0.1 | 545 | 48553 | 46.6 | 675 | 28558 | 0.0 | 805 | 473 | 0.0 | 935 | 17 | 0.0 |
| 420 | 1816 | 0.3 | 550 | 51408 | 42.0 | 680 | 24782 | 0.0 | 810 | 401 | 0.0 | 940 | 13 | 0.0 |
| 425 | 3217 | 0.8 | 555 | 54711 | 37.4 | 685 | 21386 | 0.0 | 815 | 351 | 0.0 | 945 | 6 | 0.0 |
| 430 | 5520 | 1.9 | 560 | 58847 | 32.9 | 690 | 18413 | 0.0 | 820 | 307 | 0.0 | 950 | 10 | 0.0 |
| 435 | 9225 | 4.1 | 565 | 63386 | 28.4 | 695 | 15721 | 0.0 | 825 | 261 | 0.0 | 955 | 11 | 0.0 |
| 440 | 15522 | 8.7 | 570 | 68196 | 24.1 | 700 | 13432 | 0.0 | 830 | 228 | 0.0 | 960 | 8 | 0.0 |
| 445 | 27642 | 18.5 | 575 | 73613 | 20.0 | 705 | 11513 | 0.0 | 835 | 193 | 0.0 | 965 | 12 | 0.0 |
| 450 | 36602 | 28.3 | 580 | 79207 | 16.3 | 710 | 9780 | 0.0 | 840 | 174 | 0.0 | 970 | 3 | 0.0 |
| 455 | 28292 | 24.7 | 585 | 84248 | 12.9 | 715 | 8356 | 0.0 | 845 | 151 | 0.0 | 975 | 8 | 0.0 |
| 460 | 21166 | 20.4 | 590 | 88397 | 9.8 | 720 | 7161 | 0.0 | 850 | 123 | 0.0 | 980 | 2 | 0.0 |
| 465 | 19092 | 20.1 | 595 | 91428 | 7.3 | 725 | 6067 | 0.0 | 855 | 106 | 0.0 | 985 | 13 | 0.0 |
| 470 | 14951 | 17.2 | 600 | 93452 | 5.3 | 730 | 5164 | 0.0 | 860 | 95 | 0.0 | 990 | 16 | 0.0 |
| 475 | 12606 | 15.7 | 605 | 93959 | 3.7 | 735 | 4393 | 0.0 | 865 | 82 | 0.0 | 995 | 20 | 0.0 |
| 480 | 13323 | 18.0 | 610 | 93079 | 2.5 | 740 | 3694 | 0.0 | 870 | 77 | 0.0 | 1000 | 0 | 0.0 |
| 485 | 15164 | 21.9 | 615 | 90707 | 1.7 | 745 | 3157 | 0.0 | 875 | 65 | 0.0 | | | |

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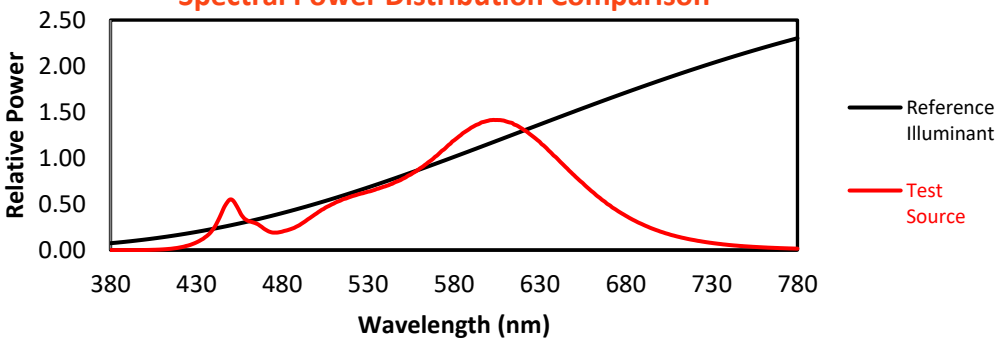
# TM-30-18

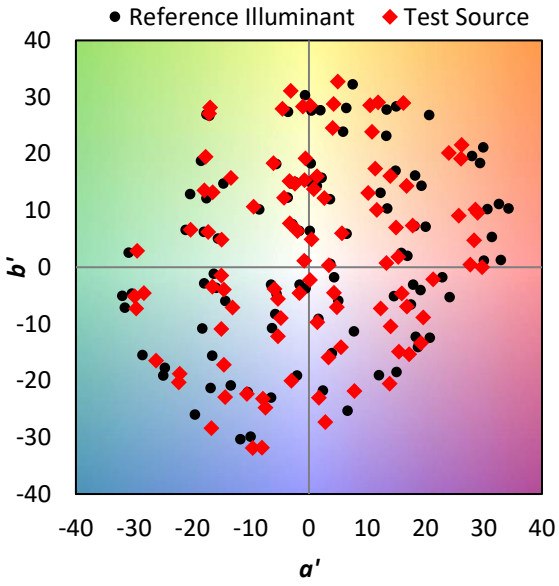
## Summary

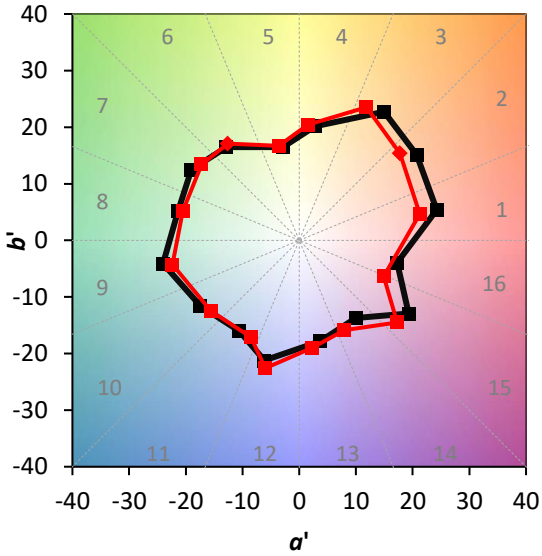
$R_f$ = 84.7
$R_g$ = 94.6
CIE $R_a$ = 80.9
$R_9$ = -1.5

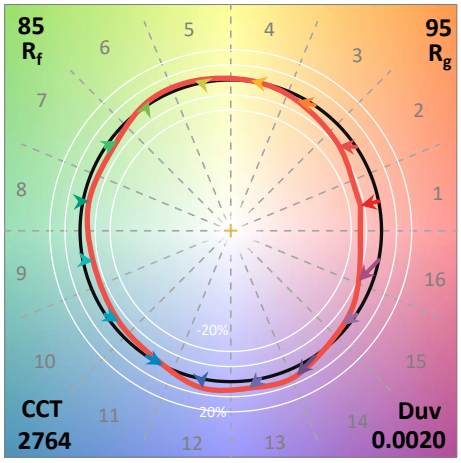
## Spectral Power Distribution Comparison

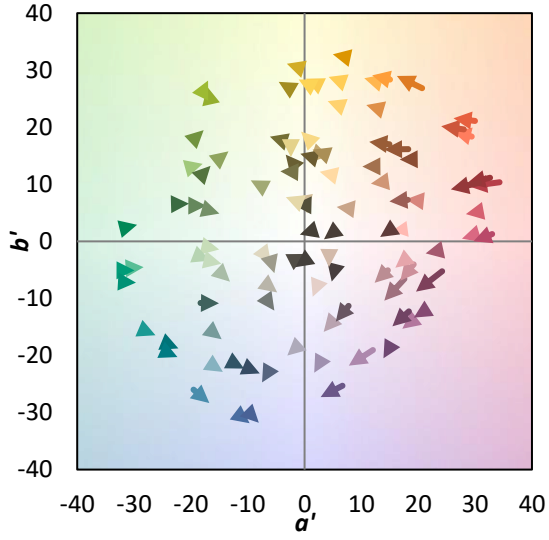



## Color Vector Graphics



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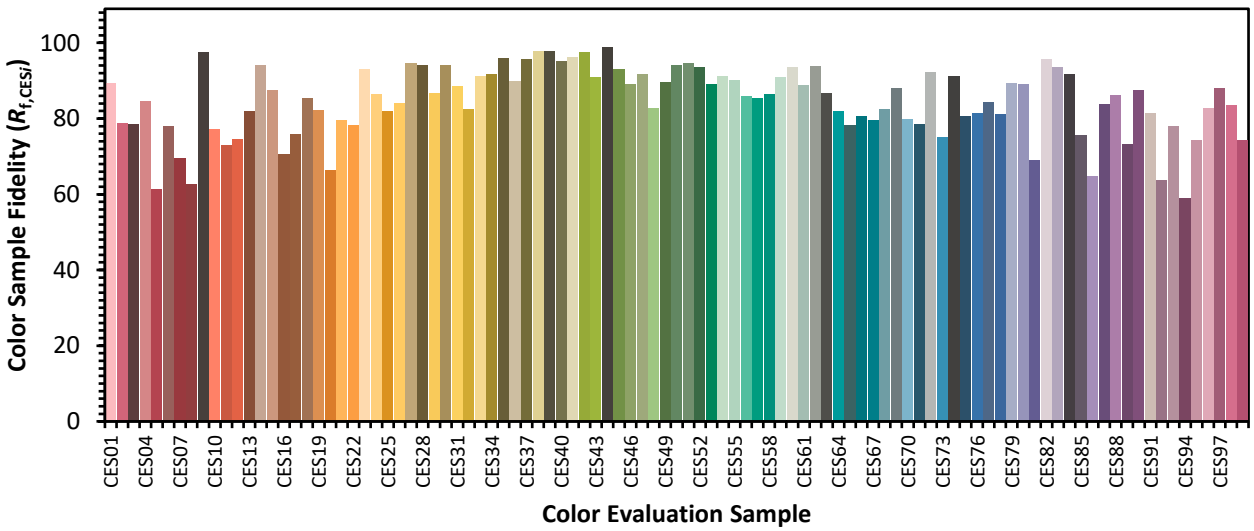
# TM-30-18

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

| | | | |
|---|---|---|---|
| CES01 = 86 | CES26 = 84 | CES51 = 95 | CES76 = 81 |
| CES02 = 63 | CES27 = 95 | CES52 = 94 | CES77 = 84 |
| CES03 = 31 | CES28 = 94 | CES53 = 89 | CES78 = 81 |
| CES04 = 71 | CES29 = 87 | CES54 = 91 | CES79 = 89 |
| CES05 = 50 | CES30 = 94 | CES55 = 90 | CES80 = 89 |
| CES06 = 52 | CES31 = 89 | CES56 = 86 | CES81 = 69 |
| CES07 = 43 | CES32 = 82 | CES57 = 85 | CES82 = 96 |
| CES08 = 41 | CES33 = 91 | CES58 = 86 | CES83 = 93 |
| CES09 = 29 | CES34 = 92 | CES59 = 91 | CES84 = 92 |
| CES10 = 77 | CES35 = 96 | CES60 = 94 | CES85 = 76 |
| CES11 = 60 | CES36 = 90 | CES61 = 89 | CES86 = 65 |
| CES12 = 66 | CES37 = 96 | CES62 = 94 | CES87 = 84 |
| CES13 = 44 | CES38 = 98 | CES63 = 87 | CES88 = 86 |
| CES14 = 74 | CES39 = 98 | CES64 = 82 | CES89 = 73 |
| CES15 = 72 | CES40 = 95 | CES65 = 78 | CES90 = 88 |
| CES16 = 48 | CES41 = 96 | CES66 = 81 | CES91 = 82 |
| CES17 = 50 | CES42 = 97 | CES67 = 80 | CES92 = 64 |
| CES18 = 57 | CES43 = 91 | CES68 = 83 | CES93 = 78 |
| CES19 = 73 | CES44 = 99 | CES69 = 88 | CES94 = 59 |
| CES20 = 67 | CES45 = 93 | CES70 = 80 | CES95 = 74 |
| CES21 = 87 | CES46 = 89 | CES71 = 79 | CES96 = 83 |
| CES22 = 79 | CES47 = 92 | CES72 = 92 | CES97 = 88 |
| CES23 = 92 | CES48 = 83 | CES73 = 75 | CES98 = 83 |
| CES24 = 91 | CES49 = 90 | CES74 = 91 | CES99 = 74 |
| CES25 = 72 | CES50 = 94 | CES75 = 81 | |



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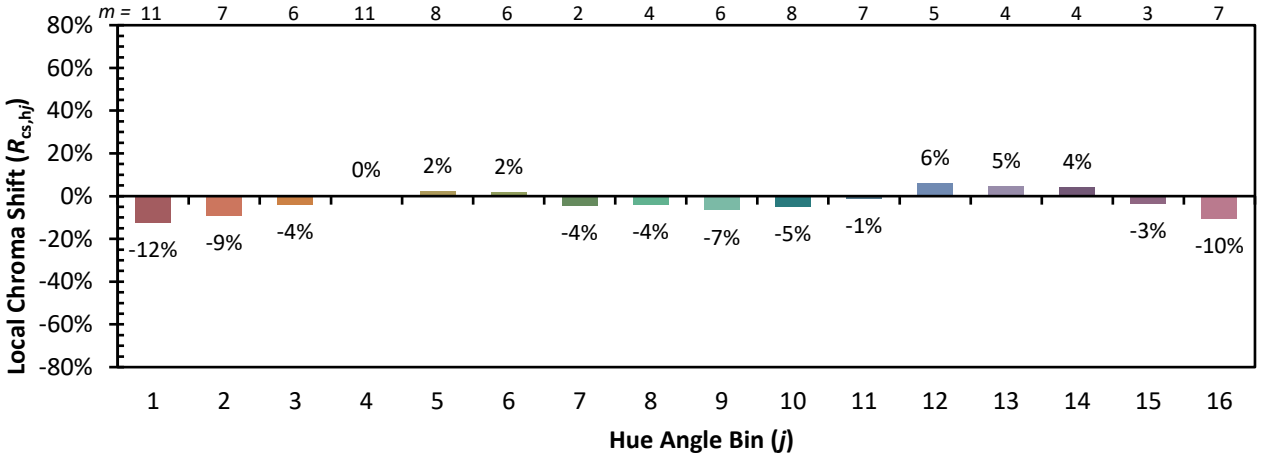
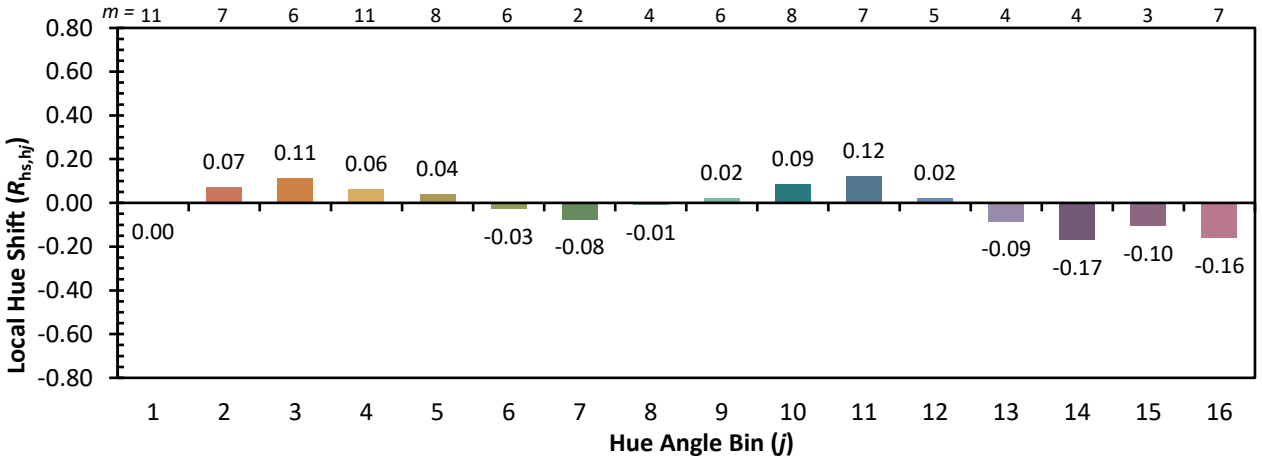
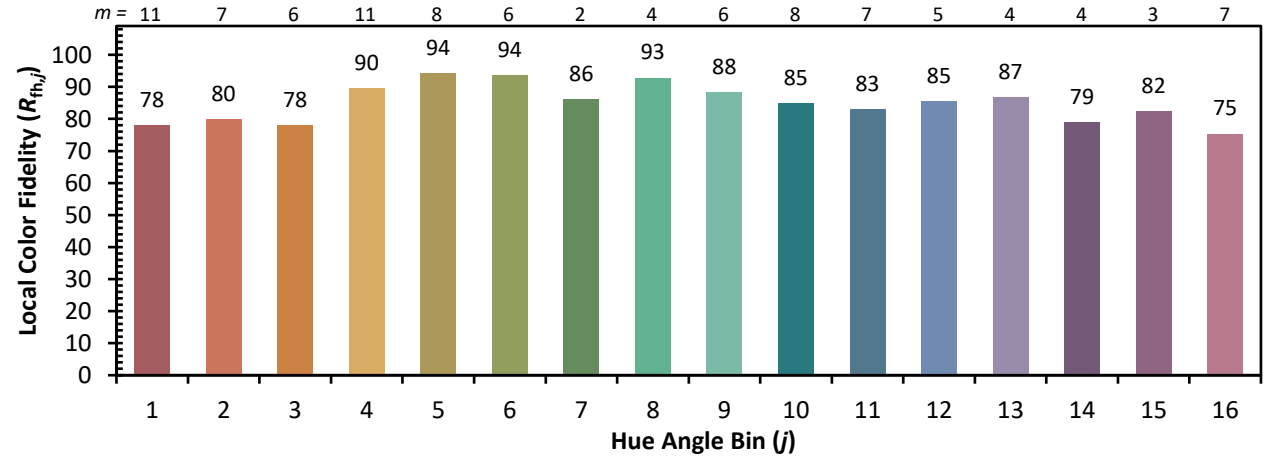
**TM-30-18**

## Color Rendition by Hue-Angle Bin



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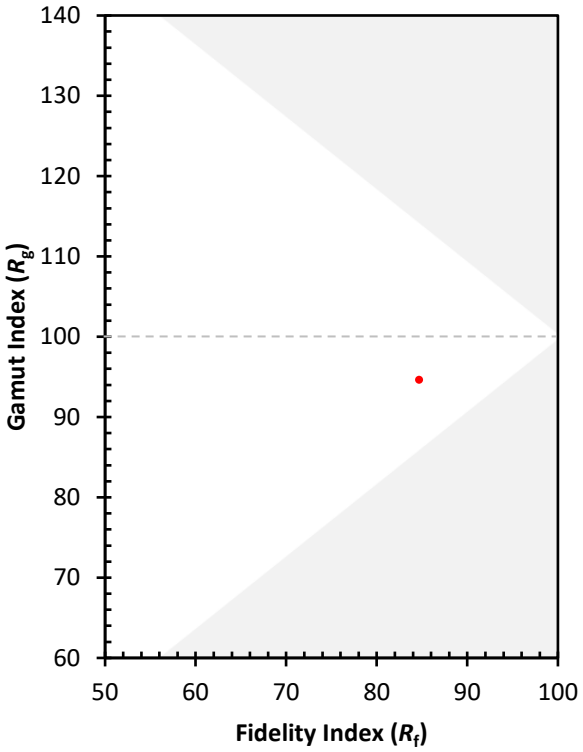
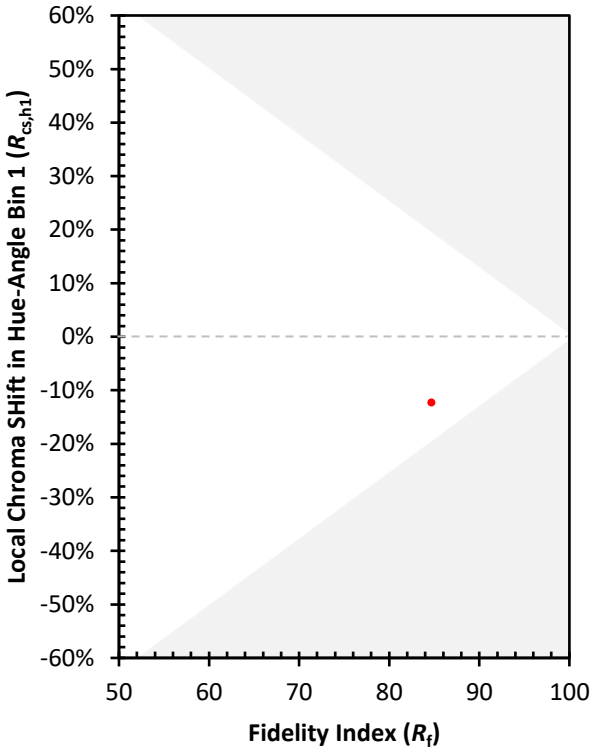
## Measure Comparisons




(END OF REPORT)