

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: P510427

Luminaire Tested: **CTN-CA10-210-740-U-T2**

Issue Date: 4/6/2021

**Test Information**

Test Method: LM-79-08  
Report Number: P510427  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G3-2102-151-10)  
Test Lab: COOPER LIGHTING SOLUTIONS  
Issue Date: 4/6/2021  
Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)  
Product Line: MCGRAW-EDISON  
Catalog Number: CTN-CA10-210-740-U-T2  
Description: CELESTEON HIGH MAST LUMINAIRE  
Light Source: (10) 4000K CCT, 70 CRI LEDS  
Ballast/Driver: ELECTRONIC DRIVER

**Summary**

Lumens per Lamp: N/A  
Luminaire Lumens: 34645 lumens  
Efficiency: N/A  
Efficacy: 162.7 lumens/watt  
Luminous Opening: Circular (Dia: 2.08' x H: 0')  
IES Classification: Type II - Short  
BUG Rating: B3 - U0 - G4

Input Watts (W): 212.9  
Input Voltage (V): 120  
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: 28.75 FT



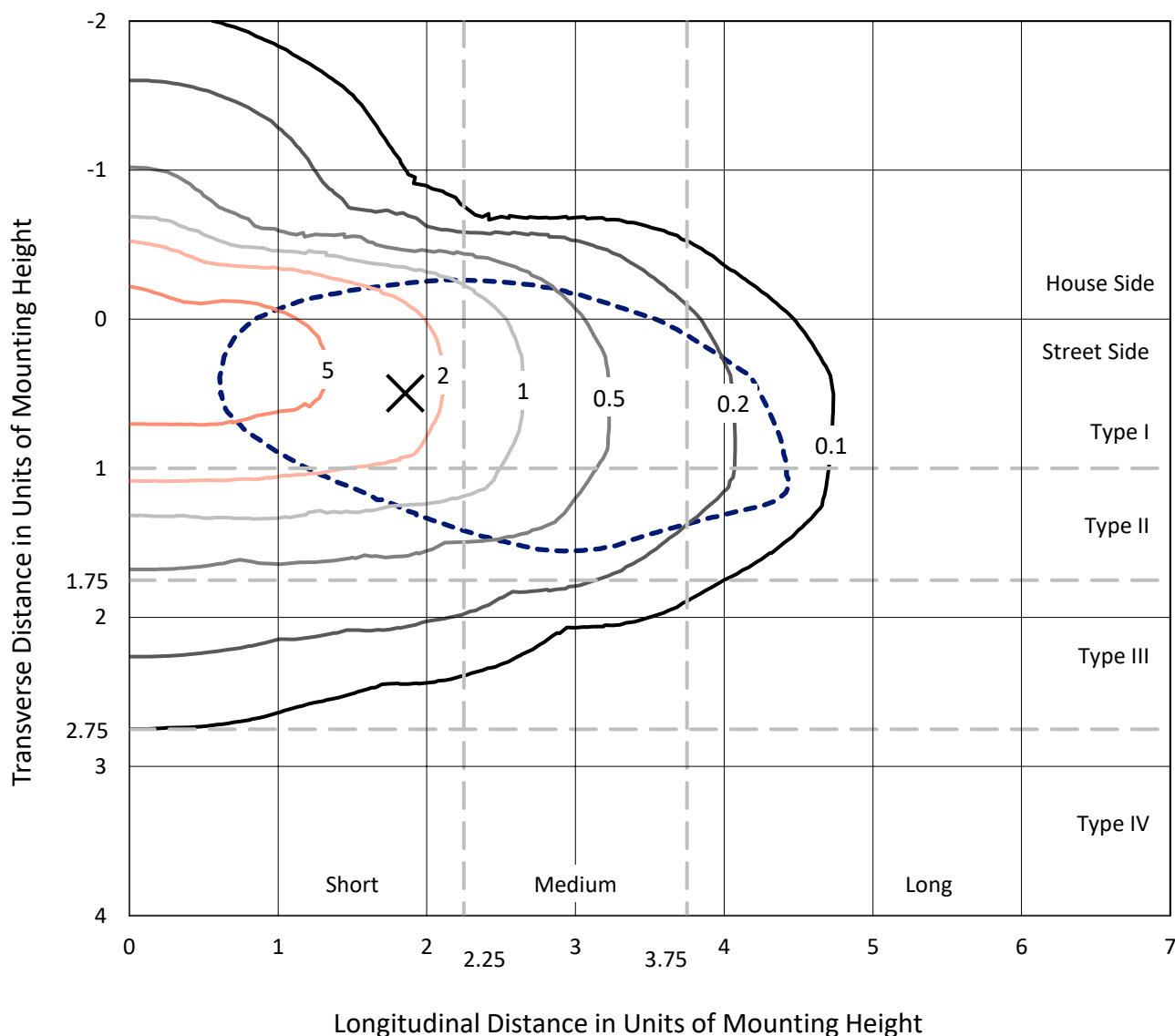
REPORT NUMBER: P510427

CATALOG NUMBER: CTN-CA10-210-740-U-T2

## Iso-Footcandle Lines of Horizontal Illumination

× Max cd

--- 1/2 Max cd

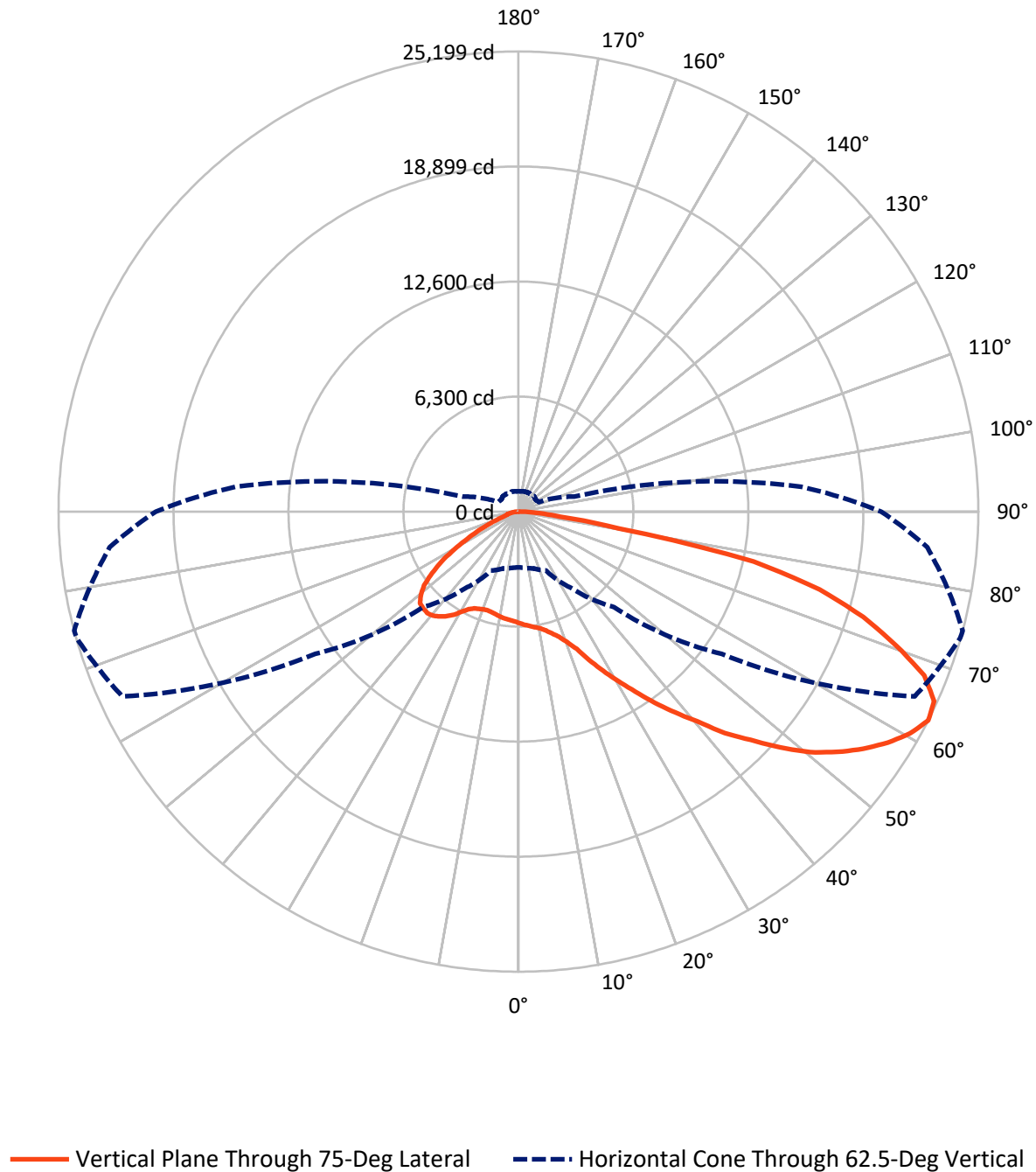


Based on 30 foot mounting height. Maximum calculated value = 8 fc

Type II - Short - N/A

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## Luminous Intensity Polar Plot



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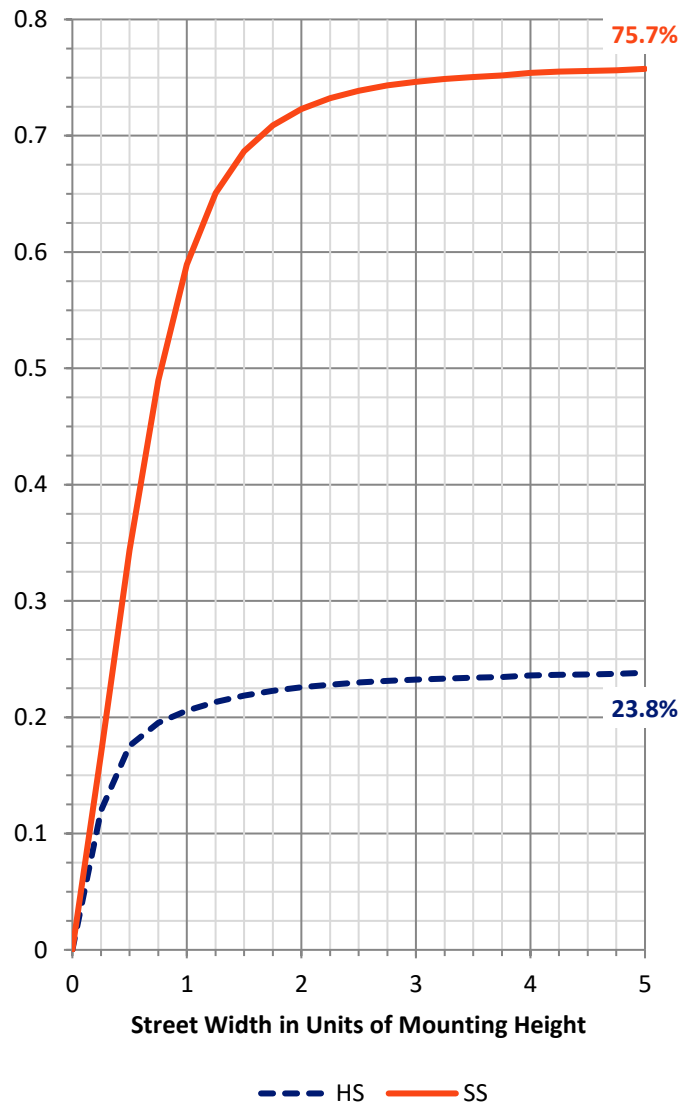
**FLUX DISTRIBUTION:**

|                    |           | Downward | Upward | Total   |
|--------------------|-----------|----------|--------|---------|
| <b>House Side</b>  | Lumens    | 8393.9   | 0.0    | 8393.9  |
|                    | % Fixture | 24.2     | 0.0    | 24.2    |
| <b>Street Side</b> | Lumens    | 26251.1  | 0.0    | 26251.1 |
|                    | % Fixture | 75.8     | 0.0    | 75.8    |
| <b>Total</b>       | Lumens    | 34645.0  | 0.0    | 34645.0 |
|                    | % Fixture | 100.0    | 0.0    | 100.0   |

**ZONAL LUMENS:**

| Zone      | Lumens  | % Fixture |
|-----------|---------|-----------|
| 0°-10°    | 587.5   | 1.7       |
| 10°-20°   | 1783.1  | 5.1       |
| 20°-30°   | 3075.4  | 8.9       |
| 30°-40°   | 4534.7  | 13.1      |
| 40°-50°   | 5977.8  | 17.3      |
| 50°-60°   | 7035.3  | 20.3      |
| 60°-70°   | 6999.4  | 20.2      |
| 70°-80°   | 4081.9  | 11.8      |
| 80°-90°   | 570.0   | 1.6       |
| 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°    | 34645.0 | 100.0     |
| 0°-180°   | 34645.0 | 100.0     |

**Coefficient of Utilization**



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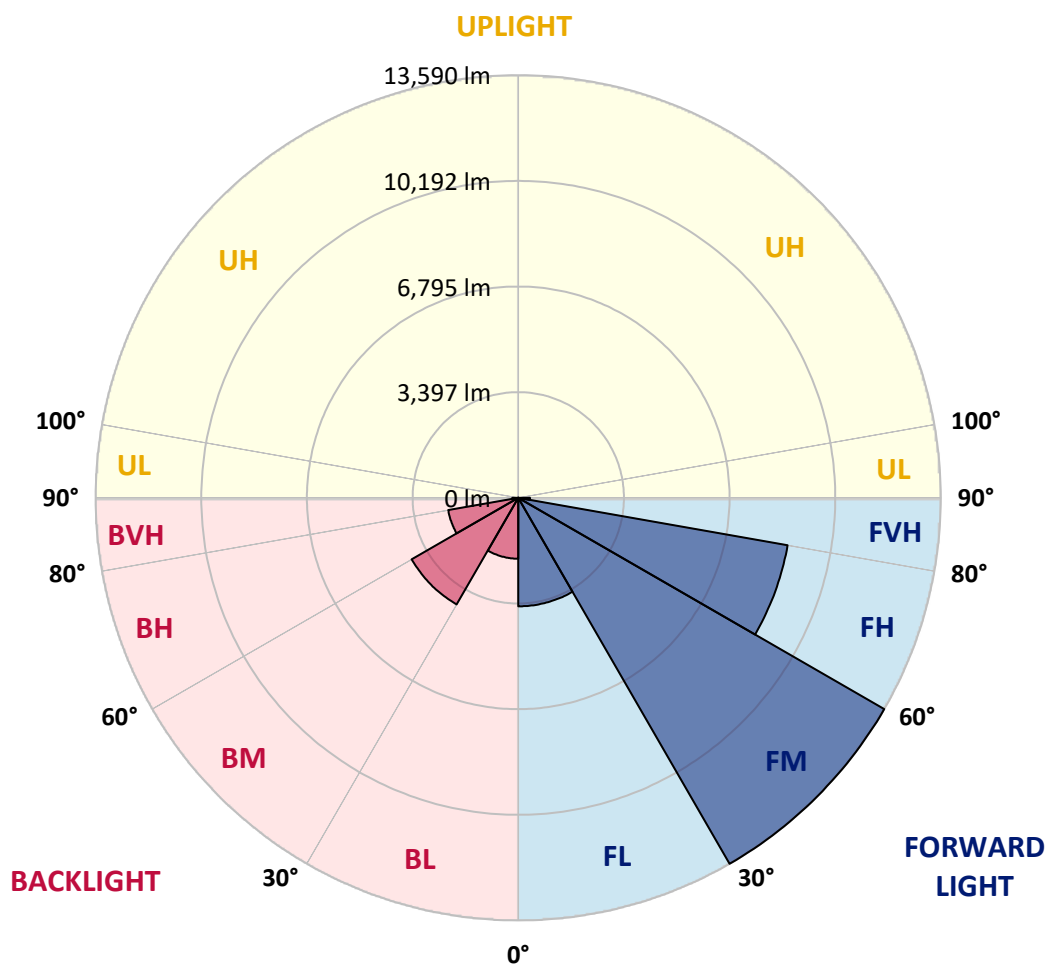
CATALOG NUMBER: CTN-CA10-210-740-U-T2

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

| Zone |             | Lumens  | % Fixture | Zone Rating/Lumen Limit |      |          |
|------|-------------|---------|-----------|-------------------------|------|----------|
|      |             |         |           | B                       | U    | G        |
| FL   | (0°-30°)    | 3488.6  | 10.1      |                         |      |          |
| FM   | (30°-60°)   | 13589.8 | 39.2      |                         |      |          |
| FH   | (60°-80°)   | 8794.5  | 25.4      |                         |      | G4/12000 |
| FVH  | (80°-90°)   | 378.2   | 1.1       |                         |      | G3/500   |
| BL   | (0°-30°)    | 1957.4  | 5.6       | B3/2500                 |      |          |
| BM   | (30°-60°)   | 3958.0  | 11.4      | B3/5000                 |      |          |
| BH   | (60°-80°)   | 2286.8  | 6.6       | B3/2500                 |      | G3/2500  |
| BVH  | (80°-90°)   | 191.7   | 0.6       |                         |      | G2/225   |
| UL   | (90°-100°)  | 0.0     | 0.0       |                         | U0/0 |          |
| UH   | (100°-180°) | 0.0     | 0.0       |                         | U0/0 |          |

**BUG Rating: B3-U0-G4**

Type II Short



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**CANDELA DISTRIBUTION (FULL):**

|       | 0°     | 5°     | 15°    | 25°    | 35°     | 45°     | 55°     | 65°     | 74°     | 75°     | 85°     |
|-------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|
| 0°    | 6107.1 | 6107.1 | 6107.1 | 6107.1 | 6107.1  | 6107.1  | 6107.1  | 6107.1  | 6107.1  | 6107.1  | 6107.1  |
| 2.5°  | 6441.5 | 6415.2 | 6418.7 | 6400.2 | 6372.4  | 6351.7  | 6297.5  | 6239.0  | 6204.1  | 6201.2  | 6151.3  |
| 5°    | 6765.3 | 6773.8 | 6775.9 | 6716.8 | 6658.3  | 6592.0  | 6509.3  | 6396.6  | 6304.6  | 6290.4  | 6193.4  |
| 7.5°  | 7060.4 | 7059.7 | 7055.5 | 7022.7 | 6995.6  | 6897.2  | 6731.7  | 6554.9  | 6405.2  | 6391.6  | 6234.0  |
| 10°   | 7362.8 | 7360.6 | 7317.9 | 7262.9 | 7201.6  | 7111.1  | 6969.2  | 6757.4  | 6515.0  | 6497.2  | 6271.8  |
| 12.5° | 7692.2 | 7668.7 | 7641.6 | 7575.3 | 7502.5  | 7345.7  | 7196.6  | 6966.3  | 6713.2  | 6681.1  | 6338.9  |
| 15°   | 7963.9 | 7939.6 | 7901.8 | 7856.9 | 7780.6  | 7660.8  | 7502.5  | 7229.4  | 6957.8  | 6926.4  | 6489.3  |
| 17.5° | 8232.7 | 8221.3 | 8194.2 | 8146.4 | 8087.9  | 7984.5  | 7839.1  | 7607.3  | 7251.5  | 7213.0  | 6739.6  |
| 20°   | 8453.0 | 8425.9 | 8405.9 | 8428.0 | 8433.0  | 8356.7  | 8276.9  | 8082.2  | 7690.1  | 7630.9  | 7046.9  |
| 22.5° | 8578.5 | 8572.8 | 8681.9 | 8763.2 | 8796.0  | 8813.1  | 8788.1  | 8631.3  | 8276.2  | 8172.8  | 7474.7  |
| 25°   | 8697.6 | 8688.3 | 8836.6 | 9039.8 | 9233.1  | 9331.5  | 9397.8  | 9418.4  | 9092.6  | 8999.2  | 8162.8  |
| 27.5° | 8701.1 | 8726.8 | 8942.1 | 9283.0 | 9577.5  | 9877.6  | 10195.7 | 10232.0 | 9946.1  | 9871.9  | 8945.7  |
| 30°   | 8720.4 | 8731.8 | 8945.0 | 9336.4 | 9949.7  | 10431.0 | 10845.2 | 11049.9 | 10803.2 | 10768.9 | 9807.8  |
| 32.5° | 8475.8 | 8490.8 | 8822.3 | 9429.9 | 10230.6 | 11003.5 | 11553.3 | 11857.0 | 11795.7 | 11752.2 | 10727.6 |
| 35°   | 8221.3 | 8234.1 | 8619.1 | 9297.2 | 10439.5 | 11523.3 | 12192.9 | 12789.7 | 12901.6 | 12868.8 | 11753.6 |
| 37.5° | 7822.0 | 7864.7 | 8268.3 | 9138.9 | 10475.9 | 11905.5 | 12803.2 | 13718.7 | 14056.7 | 13958.3 | 12838.9 |
| 40°   | 7388.4 | 7419.8 | 7889.7 | 8807.4 | 10435.2 | 12156.5 | 13402.9 | 14746.9 | 15156.2 | 15103.5 | 13916.3 |
| 42.5° | 6840.8 | 6925.0 | 7395.6 | 8383.8 | 10226.3 | 12312.6 | 13957.6 | 15912.7 | 16507.4 | 16578.0 | 14905.9 |
| 45°   | 6379.5 | 6377.4 | 6814.5 | 7770.6 | 9847.7  | 12349.7 | 14468.1 | 17091.4 | 17961.3 | 17828.7 | 16214.4 |
| 47.5° | 5836.9 | 5859.0 | 6315.3 | 7160.3 | 9289.4  | 12232.1 | 14866.0 | 18484.7 | 19365.2 | 19293.2 | 17287.5 |
| 50°   | 4581.2 | 4740.2 | 5604.4 | 6635.5 | 8534.3  | 11904.1 | 15197.6 | 19841.6 | 20682.2 | 20715.0 | 18262.9 |
| 52.5° | 3949.5 | 4010.8 | 4487.8 | 6107.1 | 7864.0  | 11353.6 | 15561.2 | 21368.2 | 21955.0 | 21871.6 | 19370.2 |
| 55°   | 3696.4 | 3729.2 | 3958.0 | 5158.1 | 7215.9  | 10501.5 | 15735.9 | 22762.1 | 22947.5 | 22934.0 | 20281.5 |
| 57.5° | 3513.1 | 3538.1 | 3700.6 | 4304.6 | 6504.3  | 9407.7  | 15588.3 | 23669.1 | 23957.2 | 23868.8 | 21141.4 |
| 60°   | 3248.6 | 3268.5 | 3511.0 | 3878.9 | 5772.0  | 8303.3  | 14680.6 | 24080.5 | 24689.5 | 24656.7 | 21901.5 |
| 62.5° | 3049.6 | 3083.9 | 3219.3 | 3564.4 | 5146.7  | 7393.4  | 13599.0 | 23952.2 | 25170.0 | 25199.3 | 22481.9 |
| 65°   | 2839.3 | 2870.0 | 2984.8 | 3286.4 | 4579.8  | 6795.2  | 12432.4 | 23309.0 | 24949.0 | 25026.7 | 22576.0 |
| 67.5° | 2579.8 | 2603.3 | 2739.5 | 3000.4 | 3917.4  | 6197.0  | 11116.9 | 22171.7 | 23722.6 | 23972.9 | 21639.1 |
| 70°   | 2253.2 | 2261.7 | 2428.6 | 2606.1 | 3252.9  | 5295.0  | 8839.5  | 20310.0 | 21947.8 | 21952.8 | 19870.1 |
| 72.5° | 1793.3 | 1800.4 | 1844.6 | 1979.4 | 2443.6  | 4190.5  | 6497.2  | 16970.2 | 19790.2 | 19753.8 | 17659.7 |
| 75°   | 1219.3 | 1282.0 | 1435.3 | 1563.7 | 1762.6  | 2942.7  | 4040.8  | 11433.5 | 16767.0 | 17052.2 | 14505.9 |
| 77.5° | 963.3  | 969.0  | 1032.5 | 1150.1 | 1322.0  | 2198.3  | 2264.6  | 6326.0  | 12500.2 | 13178.3 | 11402.1 |
| 80°   | 671.7  | 681.7  | 647.4  | 676.0  | 922.0   | 1504.5  | 1323.4  | 2753.0  | 5213.0  | 5565.9  | 6845.8  |
| 82.5° | 320.2  | 331.6  | 380.8  | 353.7  | 458.5   | 639.6   | 698.8   | 1422.5  | 2251.8  | 2310.9  | 2665.3  |
| 85°   | 211.1  | 211.1  | 211.8  | 200.4  | 267.4   | 278.8   | 317.3   | 606.8   | 1099.5  | 1136.6  | 1130.2  |
| 87.5° | 67.7   | 74.9   | 72.7   | 84.9   | 102.7   | 92.7    | 97.0    | 190.4   | 377.2   | 373.6   | 312.3   |
| 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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**CANDELA DISTRIBUTION (continued):**

|       | 90°     | 95°     | 105°   | 115°   | 125°   | 135°   | 145°   | 155°   | 165°   | 175°   | 180°   |
|-------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0°    | 6107.1  | 6107.1  | 6107.1 | 6107.1 | 6107.1 | 6107.1 | 6107.1 | 6107.1 | 6107.1 | 6107.1 | 6107.1 |
| 2.5°  | 6115.7  | 6086.4  | 6018.0 | 5958.1 | 5898.9 | 5854.0 | 5815.5 | 5764.2 | 5739.9 | 5717.8 | 5764.2 |
| 5°    | 6133.5  | 6081.5  | 5958.8 | 5836.2 | 5723.5 | 5640.8 | 5590.2 | 5553.1 | 5519.6 | 5519.6 | 5535.3 |
| 7.5°  | 6154.2  | 6083.6  | 5908.2 | 5734.2 | 5565.2 | 5471.1 | 5399.1 | 5352.0 | 5324.9 | 5326.4 | 5359.9 |
| 10°   | 6167.7  | 6059.3  | 5850.4 | 5615.8 | 5431.9 | 5280.7 | 5210.1 | 5142.4 | 5091.1 | 5060.4 | 5094.6 |
| 12.5° | 6183.4  | 6051.5  | 5772.7 | 5508.2 | 5284.3 | 5113.2 | 4966.3 | 4915.6 | 4865.7 | 4827.2 | 4845.8 |
| 15°   | 6280.4  | 6081.5  | 5707.8 | 5371.3 | 5111.7 | 4898.5 | 4706.0 | 4613.3 | 4599.1 | 4572.7 | 4579.1 |
| 17.5° | 6438.7  | 6162.0  | 5665.8 | 5203.7 | 4904.2 | 4652.5 | 4408.7 | 4288.9 | 4260.4 | 4246.8 | 4254.0 |
| 20°   | 6674.7  | 6315.3  | 5678.6 | 5086.1 | 4670.4 | 4388.7 | 4073.6 | 3933.1 | 3838.3 | 3844.0 | 3871.8 |
| 22.5° | 7035.5  | 6562.8  | 5748.5 | 4957.0 | 4417.2 | 4047.9 | 3729.9 | 3538.8 | 3443.2 | 3422.6 | 3453.9 |
| 25°   | 7610.2  | 6961.3  | 5825.5 | 4833.6 | 4172.7 | 3680.0 | 3327.7 | 3120.9 | 2998.3 | 2990.5 | 3025.4 |
| 27.5° | 8346.8  | 7572.4  | 5993.0 | 4726.7 | 3868.9 | 3237.9 | 2887.8 | 2710.9 | 2580.5 | 2564.8 | 2553.4 |
| 30°   | 9100.4  | 8251.2  | 6296.1 | 4564.1 | 3514.5 | 2781.5 | 2477.1 | 2338.7 | 2192.6 | 2133.4 | 2146.2 |
| 32.5° | 9899.0  | 8883.7  | 6651.2 | 4450.0 | 3118.1 | 2380.1 | 2115.6 | 1983.7 | 1849.6 | 1764.0 | 1744.1 |
| 35°   | 10703.3 | 9512.6  | 6949.9 | 4279.6 | 2742.3 | 2061.4 | 1808.3 | 1672.1 | 1555.1 | 1485.2 | 1480.3 |
| 37.5° | 11644.5 | 10167.1 | 7189.5 | 4098.5 | 2352.3 | 1811.8 | 1507.4 | 1428.9 | 1372.6 | 1311.3 | 1317.7 |
| 40°   | 12587.2 | 10930.1 | 7381.3 | 3799.0 | 2028.6 | 1543.7 | 1282.7 | 1298.4 | 1310.6 | 1259.2 | 1254.9 |
| 42.5° | 13370.1 | 11571.1 | 7469.0 | 3411.1 | 1741.9 | 1310.6 | 1183.6 | 1254.9 | 1307.7 | 1274.2 | 1269.9 |
| 45°   | 14165.1 | 12110.9 | 7434.8 | 2929.9 | 1503.8 | 1199.3 | 1175.8 | 1248.5 | 1316.3 | 1308.4 | 1304.8 |
| 47.5° | 15029.3 | 12818.2 | 7375.6 | 2381.5 | 1333.4 | 1188.6 | 1192.9 | 1227.1 | 1312.7 | 1327.0 | 1321.2 |
| 50°   | 16086.0 | 13469.2 | 7025.5 | 1854.6 | 1250.7 | 1205.7 | 1231.4 | 1213.6 | 1286.3 | 1315.5 | 1320.5 |
| 52.5° | 17137.7 | 13970.4 | 6557.0 | 1607.2 | 1217.9 | 1222.1 | 1284.9 | 1224.3 | 1256.4 | 1282.0 | 1305.6 |
| 55°   | 17949.2 | 14481.0 | 5799.1 | 1458.2 | 1207.2 | 1230.0 | 1299.9 | 1247.1 | 1246.4 | 1246.4 | 1254.2 |
| 57.5° | 18779.8 | 15164.8 | 5041.1 | 1361.9 | 1188.6 | 1238.5 | 1282.0 | 1251.4 | 1241.4 | 1227.1 | 1217.9 |
| 60°   | 19358.1 | 15417.9 | 4067.1 | 1298.4 | 1169.4 | 1226.4 | 1232.1 | 1227.8 | 1197.2 | 1183.6 | 1172.9 |
| 62.5° | 19871.5 | 15555.5 | 3166.6 | 1225.7 | 1143.0 | 1197.9 | 1167.9 | 1158.7 | 1140.9 | 1108.1 | 1113.8 |
| 65°   | 19733.9 | 15260.3 | 2412.9 | 1143.7 | 1124.5 | 1163.7 | 1111.6 | 1089.5 | 1090.9 | 1056.7 | 1068.1 |
| 67.5° | 18848.3 | 13936.2 | 1732.7 | 1018.2 | 1073.8 | 1095.9 | 1047.4 | 1031.0 | 1006.8 | 989.7  | 1005.4 |
| 70°   | 17059.3 | 12354.0 | 1168.7 | 844.9  | 958.3  | 1006.1 | 974.0  | 945.5  | 907.7  | 896.3  | 913.4  |
| 72.5° | 14358.3 | 10312.6 | 806.4  | 679.5  | 827.1  | 889.2  | 877.0  | 847.8  | 820.7  | 848.5  | 882.0  |
| 75°   | 11795.7 | 7629.4  | 658.1  | 556.9  | 636.0  | 740.8  | 776.5  | 785.0  | 866.3  | 1137.3 | 1165.1 |
| 77.5° | 8490.8  | 4729.5  | 591.8  | 452.8  | 507.7  | 592.5  | 663.8  | 693.1  | 1058.1 | 1013.2 | 1011.1 |
| 80°   | 4950.6  | 2756.6  | 451.3  | 357.2  | 410.7  | 434.2  | 519.1  | 813.6  | 912.7  | 782.9  | 763.7  |
| 82.5° | 2258.9  | 1216.4  | 314.4  | 285.9  | 285.2  | 287.4  | 353.7  | 782.9  | 700.2  | 616.8  | 594.0  |
| 85°   | 830.7   | 427.8   | 191.1  | 165.4  | 189.7  | 164.7  | 231.7  | 574.0  | 405.7  | 399.3  | 333.0  |
| 87.5° | 204.6   | 87.7    | 64.9   | 54.2   | 44.2   | 42.1   | 70.6   | 189.0  | 99.1   | 90.6   | 87.0   |
| 90°   | 0.0     | 0.0     | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    | 0.0    |



LM-79-08: Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

Report Prepared for

Cooper Lighting Solutions

(formerly Eaton)

STREETWORKS

Report Number: SP1-2104-215-1

Luminaire Tested: CST-CA6-230-740-U-T4

Test Date: 04/20/2021

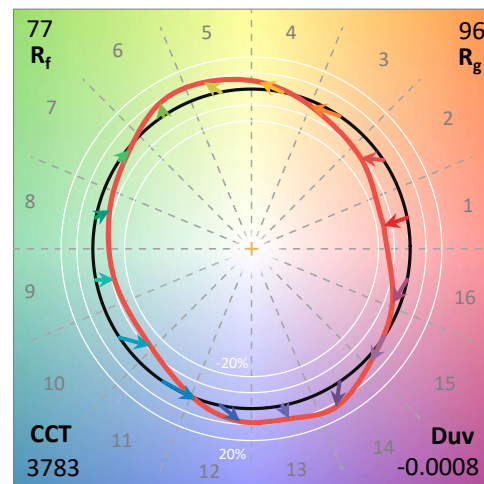
### Test Information

Test Method: LM-79-08  
 Report Number: SP1-2104-215-1  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1  
 Measurement Geometry:  $4\pi$   
 Issue Date: 04/20/2021  
 Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)  
 Product Line: STREETWORKS  
 Catalog Number: **CST-CA6-230-740-U-T4**  
 Description: STREETWORKS HIGH MAST LUMINAIRE

230W

### Spectral Parameters

|                           |         |           |      |      |       |
|---------------------------|---------|-----------|------|------|-------|
| CCT (K):                  | 3783    | CRI (Ra): | 75.1 |      |       |
| CIE u':                   | 0.2297  | R1:       | 72.8 | R9:  | -19.0 |
| CIE v':                   | 0.5046  | R2:       | 81.9 | R10: | 57.0  |
| Duv:                      | -0.0008 | R3:       | 89.0 | R11: | 70.7  |
| CIE x:                    | 0.3897  | R4:       | 74.1 | R12: | 48.2  |
| CIE y:                    | 0.3804  | R5:       | 72.3 | R13: | 74.4  |
| CIE z:                    | 0.2299  | R6:       | 74.5 | R14: | 93.7  |
| Peak Wavelength (nm):     | 450     | R7:       | 81.7 |      |       |
| Dominant Wavelength (nm): | 580     | R8:       | 54.6 |      |       |
| Purity:                   | 31.3    |           |      |      |       |
| Rf:                       | 76.5    |           |      |      |       |
| Rg:                       | 95.6    |           |      |      |       |



### Test Conditions

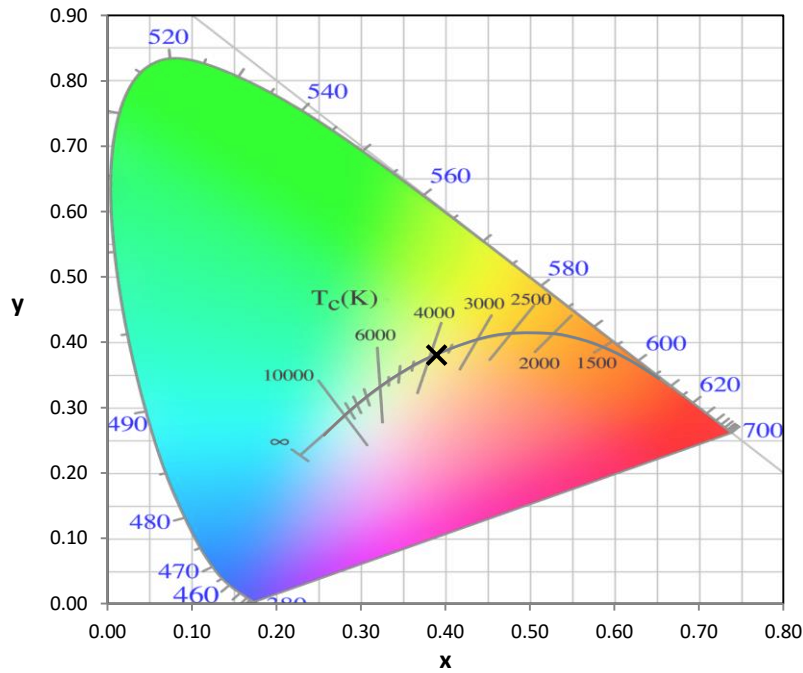
Stabilization Time: 47M  
 Operation Time: 12H  
 Room Temperature (°C) / RH%: 25.5/39%  
 Sphere Temperature (°C): 24.0

REPORT NUMBER: SP1-2104-215-1

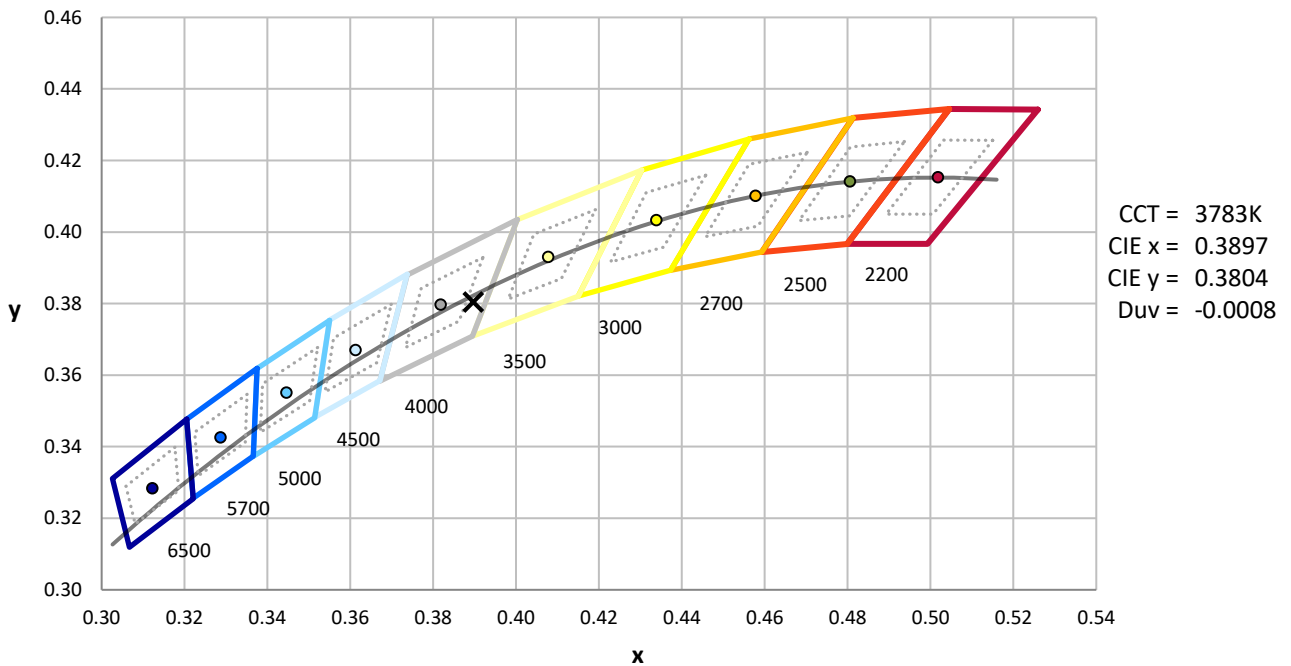
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | IN0058                | 1/31/2021        | 7/31/2021            |
| Power Meter                    | IN0071                | 12/1/2020        | 12/1/2021            |
| AC Power Source                | IN0063                | 12/1/2020        | 12/1/2021            |
| DC Power Source                | IN0208                | 12/1/2020        | 12/1/2021            |
| Sphere Thermometer             | IN0085                | 12/1/2020        | 12/1/2021            |
| Room Thermometer               | IN0046                | 12/1/2020        | 12/1/2021            |

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**CIE 1931 Chromaticity Diagram**



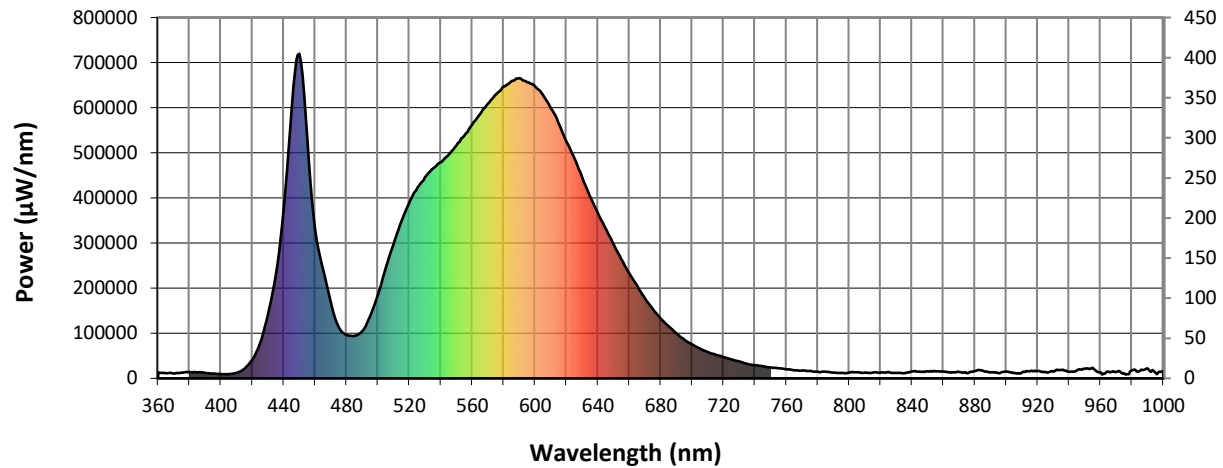
**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



Point lies inside the ANSI 4000K 7-step quadrangle

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### Photopic Flux vs. Wavelength

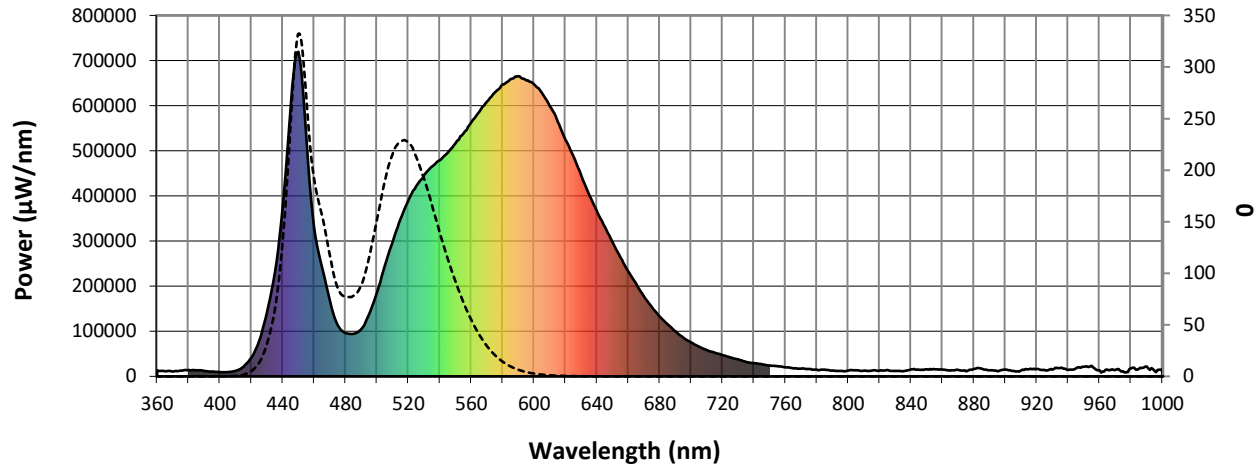


#####

| 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       | 13329            | 0.0              | 490       | 105235           | 15.0             | 620       | 524343           | 136.4            | 750       | 24224            | 0.0              | 880       | 16135            | 0.0              |
| 365       | 11697            | 0.0              | 495       | 137678           | 25.0             | 625       | 488932           | 107.9            | 755       | 22376            | 0.0              | 885       | 16876            | 0.0              |
| 370       | 10917            | 0.0              | 500       | 186689           | 41.2             | 630       | 445400           | 80.6             | 760       | 20109            | 0.0              | 890       | 13554            | 0.0              |
| 375       | 12548            | 0.0              | 505       | 244611           | 68.4             | 635       | 403534           | 60.6             | 765       | 18097            | 0.0              | 895       | 11525            | 0.0              |
| 380       | 13932            | 0.0              | 510       | 298987           | 102.7            | 640       | 366414           | 43.8             | 770       | 17366            | 0.0              | 900       | 14656            | 0.0              |
| 385       | 13265            | 0.0              | 515       | 348170           | 144.2            | 645       | 331272           | 31.9             | 775       | 16226            | 0.0              | 905       | 11999            | 0.0              |
| 390       | 11808            | 0.0              | 520       | 390427           | 189.3            | 650       | 297360           | 21.7             | 780       | 14803            | 0.0              | 910       | 12965            | 0.0              |
| 395       | 10395            | 0.0              | 525       | 421211           | 226.1            | 655       | 263291           | 15.1             | 785       | 15199            | 0.0              | 915       | 15939            | 0.0              |
| 400       | 9348             | 0.0              | 530       | 446063           | 262.6            | 660       | 232931           | 9.7              | 790       | 12989            | 0.0              | 920       | 16238            | 0.0              |
| 405       | 9479             | 0.0              | 535       | 465110           | 288.4            | 665       | 204719           | 6.5              | 795       | 12106            | 0.0              | 925       | 14419            | 0.0              |
| 410       | 12414            | 0.0              | 540       | 479189           | 312.2            | 670       | 177096           | 3.9              | 800       | 12942            | 0.0              | 930       | 14788            | 0.0              |
| 415       | 21574            | 0.0              | 545       | 495864           | 330.0            | 675       | 153254           | 2.6              | 805       | 13253            | 0.0              | 935       | 18619            | 0.0              |
| 420       | 41448            | 0.1              | 550       | 516625           | 351.1            | 680       | 132874           | 1.5              | 810       | 12808            | 0.0              | 940       | 13995            | 0.0              |
| 425       | 79385            | 0.4              | 555       | 538555           | 367.8            | 685       | 115378           | 1.0              | 815       | 12903            | 0.0              | 945       | 18047            | 0.0              |
| 430       | 141845           | 1.1              | 560       | 562412           | 382.2            | 690       | 100157           | 0.6              | 820       | 12621            | 0.0              | 950       | 21418            | 0.0              |
| 435       | 231290           | 2.7              | 565       | 585835           | 389.5            | 695       | 85561            | 0.4              | 825       | 13903            | 0.0              | 955       | 23138            | 0.0              |
| 440       | 374482           | 5.9              | 570       | 608681           | 395.8            | 700       | 75396            | 0.2              | 830       | 11870            | 0.0              | 960       | 13665            | 0.0              |
| 445       | 596715           | 12.4             | 575       | 629563           | 391.7            | 705       | 65658            | 0.1              | 835       | 11069            | 0.0              | 965       | 14793            | 0.0              |
| 450       | 719656           | 18.7             | 580       | 646820           | 384.3            | 710       | 58172            | 0.1              | 840       | 15291            | 0.0              | 970       | 14396            | 0.0              |
| 455       | 530438           | 17.8             | 585       | 659231           | 366.3            | 715       | 52563            | 0.1              | 845       | 15125            | 0.0              | 975       | 11155            | 0.0              |
| 460       | 330446           | 13.5             | 590       | 665630           | 344.2            | 720       | 47085            | 0.0              | 850       | 15336            | 0.0              | 980       | 17987            | 0.0              |
| 465       | 241999           | 12.5             | 595       | 656228           | 311.1            | 725       | 41741            | 0.0              | 855       | 15791            | 0.0              | 985       | 16185            | 0.0              |
| 470       | 167096           | 10.4             | 600       | 646946           | 278.8            | 730       | 37415            | 0.0              | 860       | 14660            | 0.0              | 990       | 22120            | 0.0              |
| 475       | 113791           | 8.9              | 605       | 628643           | 243.4            | 735       | 32125            | 0.0              | 865       | 12528            | 0.0              | 995       | 11943            | 0.0              |
| 480       | 96126            | 9.1              | 610       | 599057           | 205.8            | 740       | 29322            | 0.0              | 870       | 14089            | 0.0              | 1000      | 16020            | 0.0              |
| 485       | 94467            | 11.2             | 615       | 565669           | 170.8            | 745       | 26862            | 0.0              | 875       | 11732            | 0.0              |           |                  |                  |

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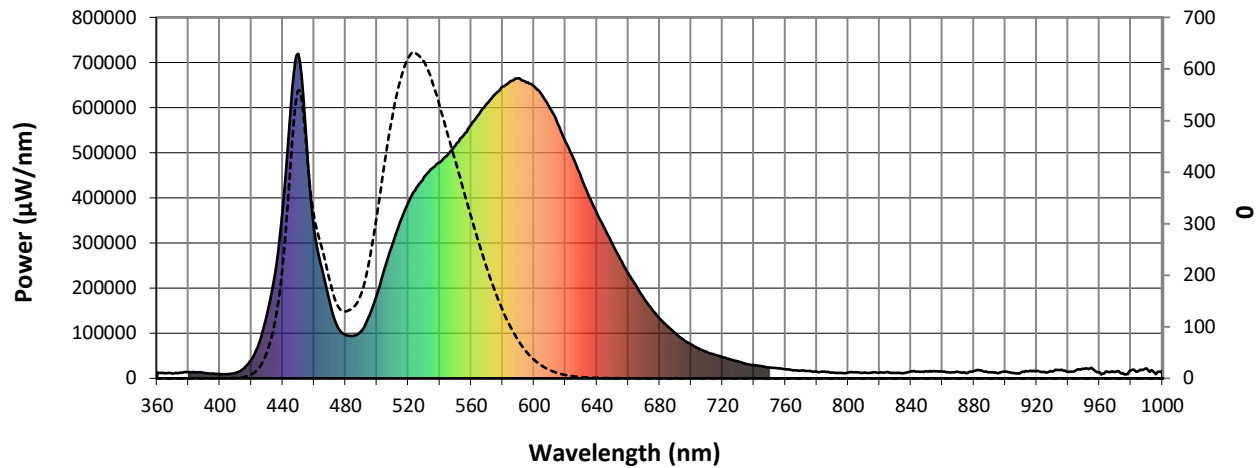
### Scotopic Flux vs. Wavelength


**Scotopic Lumens: 54268.8**
**S/P: 1.5**

| 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       | 13329            | 0.0              | 490       | 105235           | 162.0            | 620       | 524343           | 6.6              | 750       | 24224            | 0.0              | 880       | 16135            | 0.0              |
| 365       | 11697            | 0.0              | 495       | 137678           | 222.6            | 625       | 488932           | 4.1              | 755       | 22376            | 0.0              | 885       | 16876            | 0.0              |
| 370       | 10917            | 0.0              | 500       | 186689           | 312.3            | 630       | 445400           | 2.5              | 760       | 20109            | 0.0              | 890       | 13554            | 0.0              |
| 375       | 12548            | 0.0              | 505       | 244611           | 415.8            | 635       | 403534           | 1.5              | 765       | 18097            | 0.0              | 895       | 11525            | 0.0              |
| 380       | 13932            | 0.0              | 510       | 298987           | 506.8            | 640       | 366414           | 0.9              | 770       | 17366            | 0.0              | 900       | 14656            | 0.0              |
| 385       | 13265            | 0.0              | 515       | 348170           | 577.1            | 645       | 331272           | 0.6              | 775       | 16226            | 0.0              | 905       | 11999            | 0.0              |
| 390       | 11808            | 0.0              | 520       | 390427           | 620.6            | 650       | 297360           | 0.3              | 780       | 14803            | 0.0              | 910       | 12965            | 0.0              |
| 395       | 10395            | 0.1              | 525       | 421211           | 630.1            | 655       | 263291           | 0.2              | 785       | 15199            | 0.0              | 915       | 15939            | 0.0              |
| 400       | 9348             | 0.1              | 530       | 446063           | 615.0            | 660       | 232931           | 0.1              | 790       | 12989            | 0.0              | 920       | 16238            | 0.0              |
| 405       | 9479             | 0.3              | 535       | 465110           | 579.6            | 665       | 204719           | 0.1              | 795       | 12106            | 0.0              | 925       | 14419            | 0.0              |
| 410       | 12414            | 0.7              | 540       | 479189           | 529.5            | 670       | 177096           | 0.0              | 800       | 12942            | 0.0              | 930       | 14788            | 0.0              |
| 415       | 21574            | 2.2              | 545       | 495864           | 475.4            | 675       | 153254           | 0.0              | 805       | 13253            | 0.0              | 935       | 18619            | 0.0              |
| 420       | 41448            | 6.8              | 550       | 516625           | 422.4            | 680       | 132874           | 0.0              | 810       | 12808            | 0.0              | 940       | 13995            | 0.0              |
| 425       | 79385            | 19.4             | 555       | 538555           | 368.0            | 685       | 115378           | 0.0              | 815       | 12903            | 0.0              | 945       | 18047            | 0.0              |
| 430       | 141845           | 48.3             | 560       | 562412           | 314.4            | 690       | 100157           | 0.0              | 820       | 12621            | 0.0              | 950       | 21418            | 0.0              |
| 435       | 231290           | 103.4            | 565       | 585835           | 262.8            | 695       | 85561            | 0.0              | 825       | 13903            | 0.0              | 955       | 23138            | 0.0              |
| 440       | 374482           | 209.3            | 570       | 608681           | 214.8            | 700       | 75396            | 0.0              | 830       | 11870            | 0.0              | 960       | 13665            | 0.0              |
| 445       | 596715           | 399.6            | 575       | 629563           | 171.5            | 705       | 65658            | 0.0              | 835       | 11069            | 0.0              | 965       | 14793            | 0.0              |
| 450       | 719656           | 557.8            | 580       | 646820           | 133.3            | 710       | 58172            | 0.0              | 840       | 15291            | 0.0              | 970       | 14396            | 0.0              |
| 455       | 530438           | 463.5            | 585       | 659231           | 100.8            | 715       | 52563            | 0.0              | 845       | 15125            | 0.0              | 975       | 11155            | 0.0              |
| 460       | 330446           | 319.2            | 590       | 665630           | 74.1             | 720       | 47085            | 0.0              | 850       | 15336            | 0.0              | 980       | 17987            | 0.0              |
| 465       | 241999           | 255.6            | 595       | 656228           | 52.3             | 725       | 41741            | 0.0              | 855       | 15791            | 0.0              | 985       | 16185            | 0.0              |
| 470       | 167096           | 192.4            | 600       | 646946           | 36.5             | 730       | 37415            | 0.0              | 860       | 14660            | 0.0              | 990       | 22120            | 0.0              |
| 475       | 113791           | 142.3            | 605       | 628643           | 24.7             | 735       | 32125            | 0.0              | 865       | 12528            | 0.0              | 995       | 11943            | 0.0              |
| 480       | 96126            | 129.8            | 610       | 599057           | 16.2             | 740       | 29322            | 0.0              | 870       | 14089            | 0.0              | 1000      | 16020            | 0.0              |
| 485       | 94467            | 136.9            | 615       | 565669           | 10.5             | 745       | 26862            | 0.0              | 875       | 11732            | 0.0              |           |                  |                  |

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### Melanopic Flux vs. Wavelength



**Melanopic Lumens: 20938.3**      **M/P: 0.58**

| 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       | 13329            | 0.0              | 490       | 105235           | 87.6             | 620       | 524343           | 0.4              | 750       | 24224            | 0.0              | 880       | 16135            | 0.0              |
| 365       | 11697            | 0.0              | 495       | 137678           | 113.7            | 625       | 488932           | 0.3              | 755       | 22376            | 0.0              | 885       | 16876            | 0.0              |
| 370       | 10917            | 0.0              | 500       | 186689           | 150.1            | 630       | 445400           | 0.2              | 760       | 20109            | 0.0              | 890       | 13554            | 0.0              |
| 375       | 12548            | 0.0              | 505       | 244611           | 187.7            | 635       | 403534           | 0.1              | 765       | 18097            | 0.0              | 895       | 11525            | 0.0              |
| 380       | 13932            | 0.0              | 510       | 298987           | 214.7            | 640       | 366414           | 0.1              | 770       | 17366            | 0.0              | 900       | 14656            | 0.0              |
| 385       | 13265            | 0.0              | 515       | 348170           | 227.5            | 645       | 331272           | 0.0              | 775       | 16226            | 0.0              | 905       | 11999            | 0.0              |
| 390       | 11808            | 0.0              | 520       | 390427           | 227.3            | 650       | 297360           | 0.0              | 780       | 14803            | 0.0              | 910       | 12965            | 0.0              |
| 395       | 10395            | 0.1              | 525       | 421211           | 213.6            | 655       | 263291           | 0.0              | 785       | 15199            | 0.0              | 915       | 15939            | 0.0              |
| 400       | 9348             | 0.1              | 530       | 446063           | 192.8            | 660       | 232931           | 0.0              | 790       | 12989            | 0.0              | 920       | 16238            | 0.0              |
| 405       | 9479             | 0.2              | 535       | 465110           | 167.4            | 665       | 204719           | 0.0              | 795       | 12106            | 0.0              | 925       | 14419            | 0.0              |
| 410       | 12414            | 0.5              | 540       | 479189           | 140.2            | 670       | 177096           | 0.0              | 800       | 12942            | 0.0              | 930       | 14788            | 0.0              |
| 415       | 21574            | 1.4              | 545       | 495864           | 115.2            | 675       | 153254           | 0.0              | 805       | 13253            | 0.0              | 935       | 18619            | 0.0              |
| 420       | 41448            | 4.7              | 550       | 516625           | 92.7             | 680       | 132874           | 0.0              | 810       | 12808            | 0.0              | 940       | 13995            | 0.0              |
| 425       | 79385            | 12.4             | 555       | 538555           | 72.6             | 685       | 115378           | 0.0              | 815       | 12903            | 0.0              | 945       | 18047            | 0.0              |
| 430       | 141845           | 30.0             | 560       | 562412           | 55.5             | 690       | 100157           | 0.0              | 820       | 12621            | 0.0              | 950       | 21418            | 0.0              |
| 435       | 231290           | 61.7             | 565       | 585835           | 41.1             | 695       | 85561            | 0.0              | 825       | 13903            | 0.0              | 955       | 23138            | 0.0              |
| 440       | 374482           | 125.1            | 570       | 608681           | 29.7             | 700       | 75396            | 0.0              | 830       | 11870            | 0.0              | 960       | 13665            | 0.0              |
| 445       | 596715           | 235.4            | 575       | 629563           | 21.0             | 705       | 65658            | 0.0              | 835       | 11069            | 0.0              | 965       | 14793            | 0.0              |
| 450       | 719656           | 331.6            | 580       | 646820           | 14.5             | 710       | 58172            | 0.0              | 840       | 15291            | 0.0              | 970       | 14396            | 0.0              |
| 455       | 530438           | 277.9            | 585       | 659231           | 9.8              | 715       | 52563            | 0.0              | 845       | 15125            | 0.0              | 975       | 11155            | 0.0              |
| 460       | 330446           | 194.7            | 590       | 665630           | 6.5              | 720       | 47085            | 0.0              | 850       | 15336            | 0.0              | 980       | 17987            | 0.0              |
| 465       | 241999           | 158.1            | 595       | 656228           | 4.2              | 725       | 41741            | 0.0              | 855       | 15791            | 0.0              | 985       | 16185            | 0.0              |
| 470       | 167096           | 119.6            | 600       | 646946           | 2.7              | 730       | 37415            | 0.0              | 860       | 14660            | 0.0              | 990       | 22120            | 0.0              |
| 475       | 113791           | 86.9             | 605       | 628643           | 1.7              | 735       | 32125            | 0.0              | 865       | 12528            | 0.0              | 995       | 11943            | 0.0              |
| 480       | 96126            | 77.2             | 610       | 599057           | 1.1              | 740       | 29322            | 0.0              | 870       | 14089            | 0.0              | 1000      | 16020            | 0.0              |
| 485       | 94467            | 77.9             | 615       | 565669           | 0.7              | 745       | 26862            | 0.0              | 875       | 11732            | 0.0              |           |                  |                  |

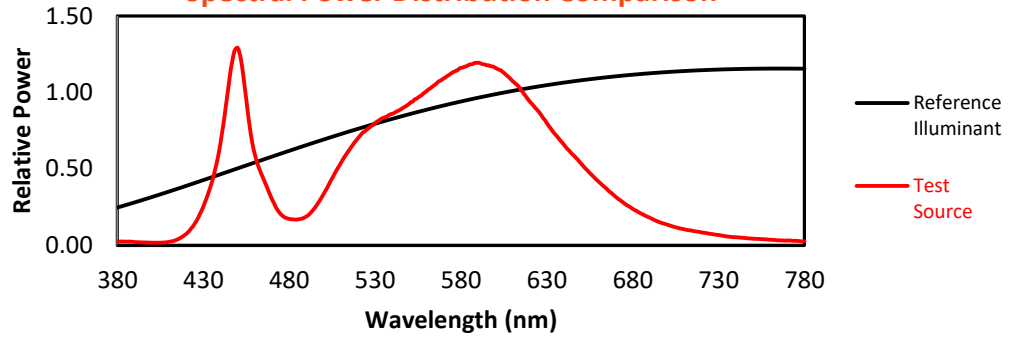
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TM-30-18

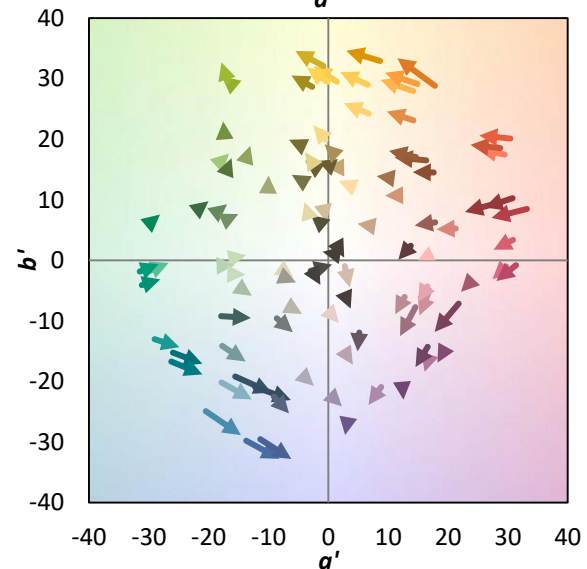
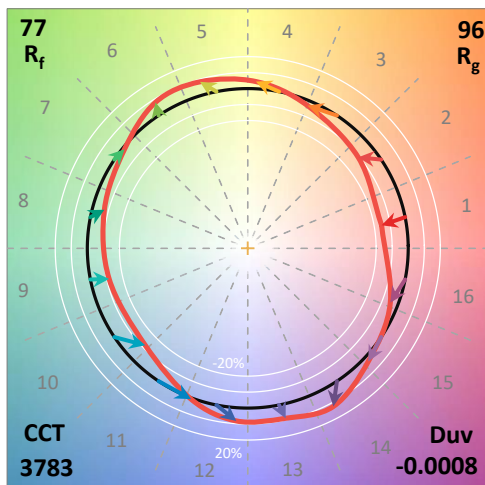
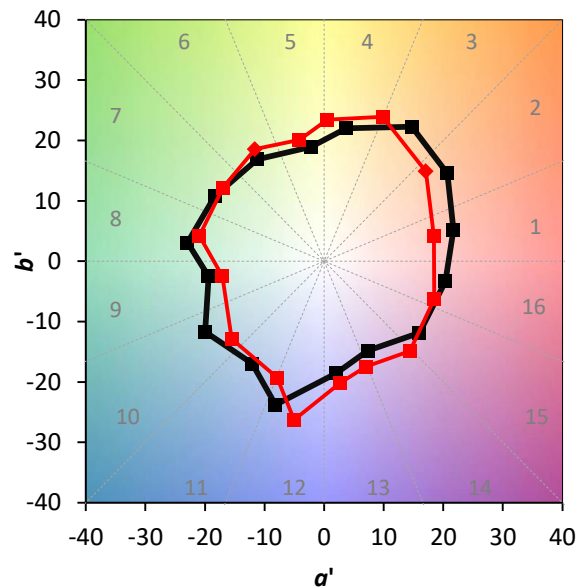
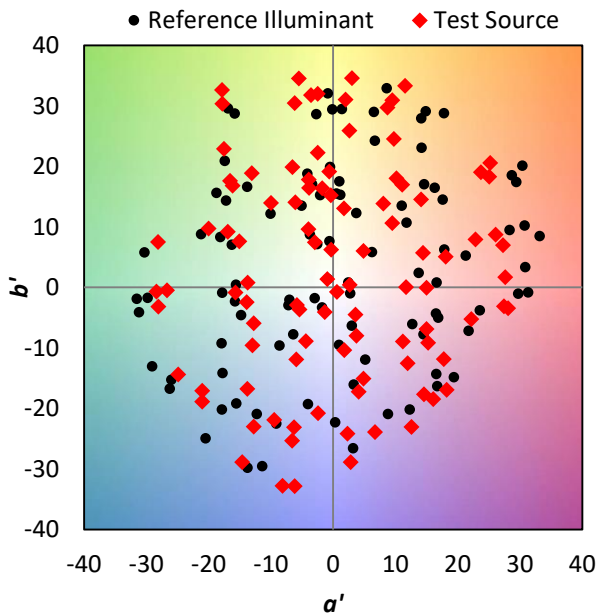
### Summary

$R_f = 76.5$   
 $R_g = 95.6$   
 CIE  $R_a = 75.1$   
 $R_g = -19.0$

### Spectral Power Distribution Comparison



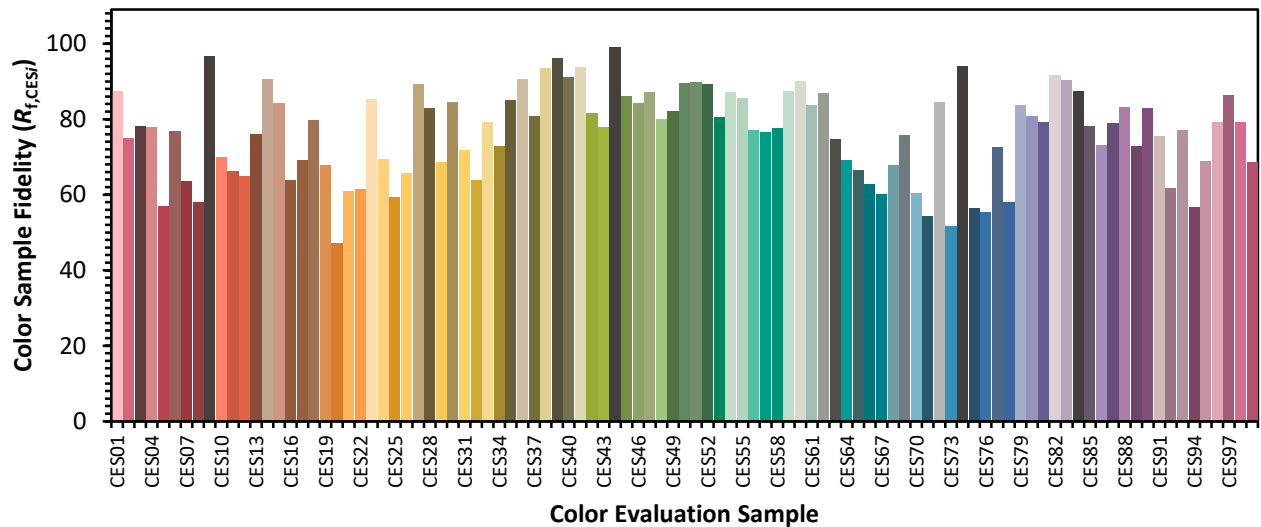
### Color Vector Graphics

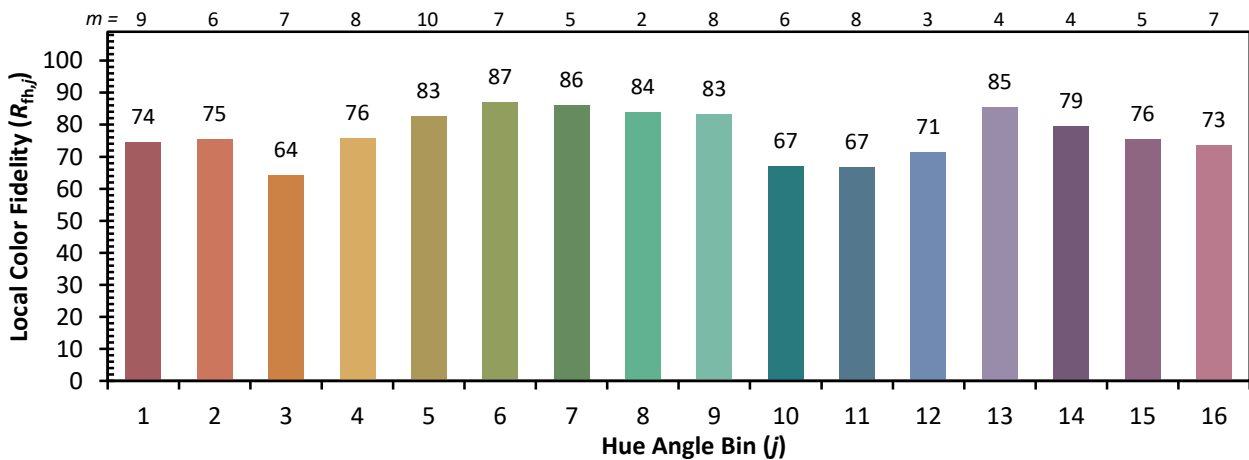
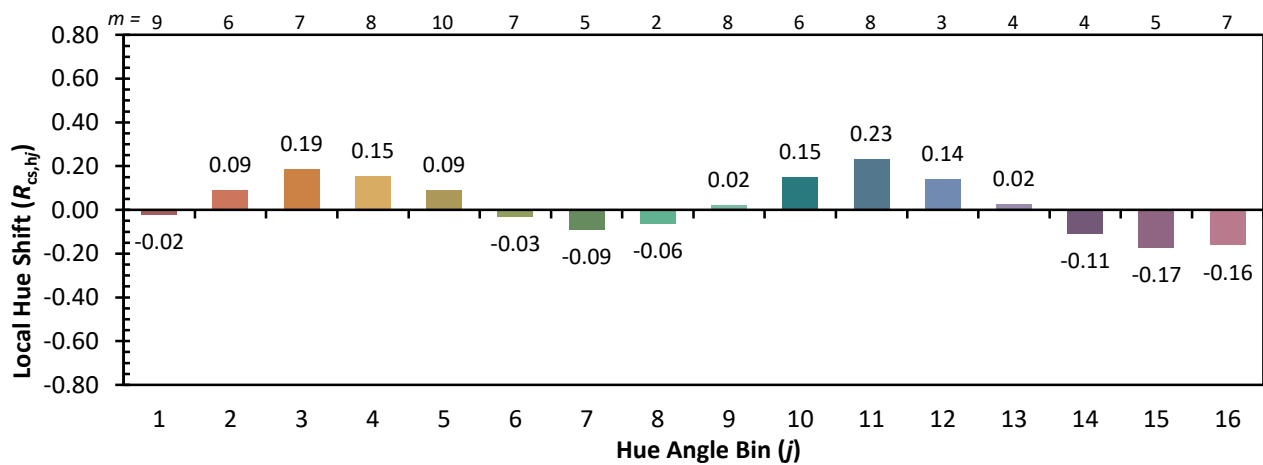
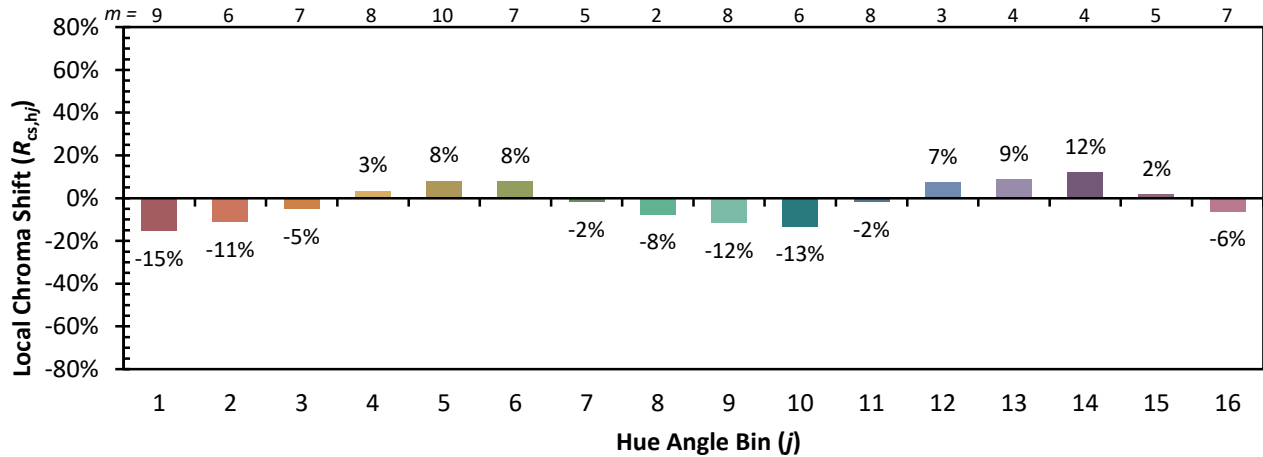




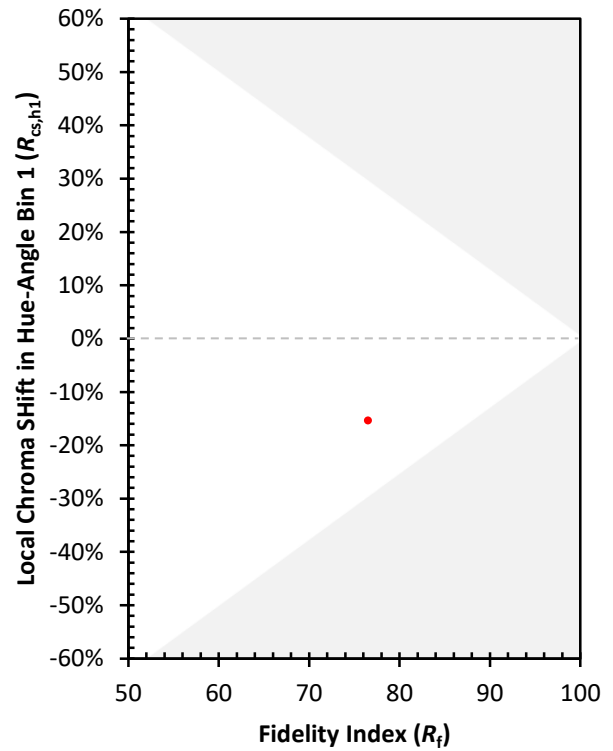
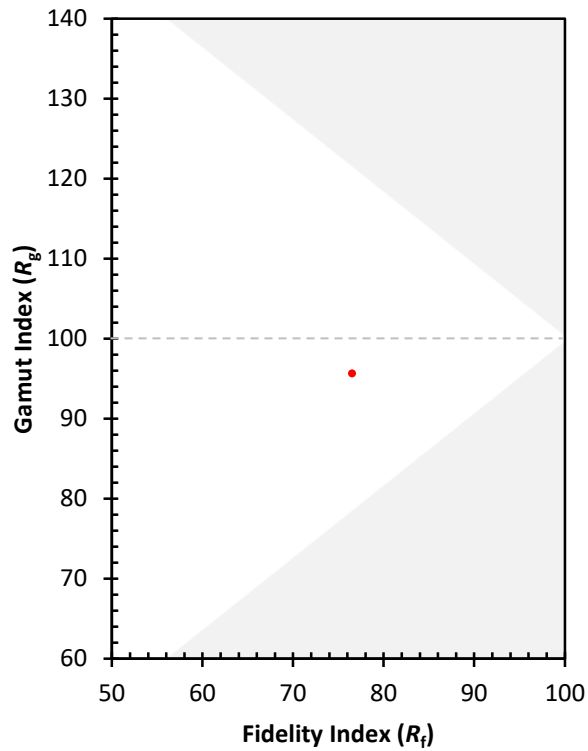
**Individual Sample Fidelity Index ( $R_{f,i}$ )**

|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 66 | CES51 = 90 | CES76 = 56 |
| CES02 = 61 | CES27 = 89 | CES52 = 89 | CES77 = 73 |
| CES03 = 31 | CES28 = 83 | CES53 = 81 | CES78 = 58 |
| CES04 = 70 | CES29 = 69 | CES54 = 87 | CES79 = 84 |
| CES05 = 48 | CES30 = 84 | CES55 = 86 | CES80 = 81 |
| CES06 = 51 | CES31 = 72 | CES56 = 77 | CES81 = 79 |
| CES07 = 40 | CES32 = 64 | CES57 = 77 | CES82 = 92 |
| CES08 = 39 | CES33 = 79 | CES58 = 77 | CES83 = 90 |
| CES09 = 29 | CES34 = 73 | CES59 = 87 | CES84 = 87 |
| CES10 = 74 | CES35 = 85 | CES60 = 90 | CES85 = 78 |
| CES11 = 57 | CES36 = 91 | CES61 = 84 | CES86 = 73 |
| CES12 = 63 | CES37 = 81 | CES62 = 87 | CES87 = 79 |
| CES13 = 42 | CES38 = 94 | CES63 = 75 | CES88 = 83 |
| CES14 = 74 | CES39 = 96 | CES64 = 69 | CES89 = 73 |
| CES15 = 71 | CES40 = 91 | CES65 = 66 | CES90 = 83 |
| CES16 = 47 | CES41 = 94 | CES66 = 63 | CES91 = 76 |
| CES17 = 49 | CES42 = 82 | CES67 = 60 | CES92 = 62 |
| CES18 = 56 | CES43 = 78 | CES68 = 68 | CES93 = 77 |
| CES19 = 72 | CES44 = 99 | CES69 = 76 | CES94 = 57 |
| CES20 = 65 | CES45 = 86 | CES70 = 60 | CES95 = 69 |
| CES21 = 86 | CES46 = 84 | CES71 = 54 | CES96 = 79 |
| CES22 = 78 | CES47 = 87 | CES72 = 85 | CES97 = 86 |
| CES23 = 92 | CES48 = 80 | CES73 = 52 | CES98 = 79 |
| CES24 = 91 | CES49 = 82 | CES74 = 94 | CES99 = 69 |
| CES25 = 72 | CES50 = 90 | CES75 = 56 |            |



**Color Rendition by Hue-Angle Bin**


**Measure Comparisons**



(END OF REPORT)