

Signify Classified - Internal  
Cooper Lighting Solutions Photometric Lab  
1121 Highway 74 South  
Peachtree City, GA 30269



Scaled data based on original data using  
LM-79-2019 Approved Method: Electrical and Photometric Measurements of Solid-  
State Lighting Products

Test Report Prepared for  
Cooper Lighting Solutions

Brand: STREETWORKS

Report Number: P363332

Luminaire Tested: NVN-SA4C-750-U-T4W-HSS

Issue Date: 3/3/2020

**Test Information**

Test Method: LM-79-2019  
Report Number: P363332  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G2-1903-205-19)  
Test Lab: INNOVATION CENTER  
Issue Date: 3/3/2020  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: STREETWORKS  
Catalog Number: NVN-SA4C-750-U-T4W-HSS  
Description: NAVION ROADWAY AND AREA LUMINAIRE  
(4) 70 CRI, 5000K, 1050mA LIGHTSQUARES WITH 16 LEDS EACH AND TYPE IV WIDE OPTICS WITH HOUSE SIDE SHIELD  
Light Source: -  
Ballast/Driver: ELECTRONIC DRIVER

**Summary**

Lumens per Lamp: N/A  
Luminaire Lumens: 20910 lumens  
Efficiency: N/A  
Efficacy: 92.9 lumens/watt  
Luminous Opening: Rectangular (W 1' x L: 1.5' x H: 0')  
IES Classification: Type IV - Short  
BUG Rating: B2 - U0 - G4

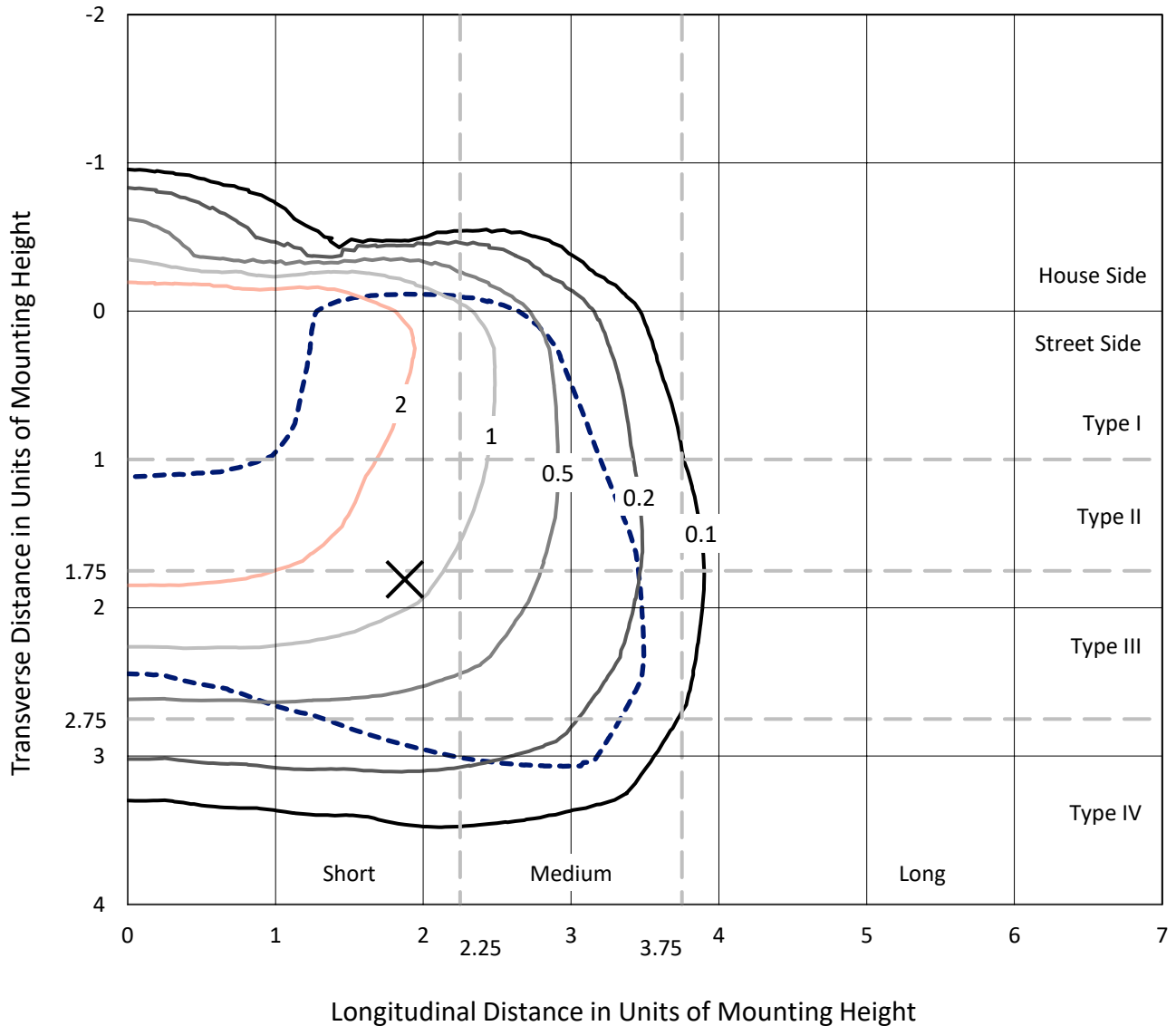
Input Watts (W): 225  
Input Voltage (V): NR  
Input Current (Ain): NR  
Voltage Rise (V): NR  
Power Factor: NR  
Total Harmonic Distortion (THDi): NR  
Frequency (hertz): 60  
Stabilization Time: NR  
Operation Time: NR  
Ambient Temperature (°C): NR  
Test Distance: 28.75 FT



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### Iso-Footcandle Lines of Horizontal Illumination

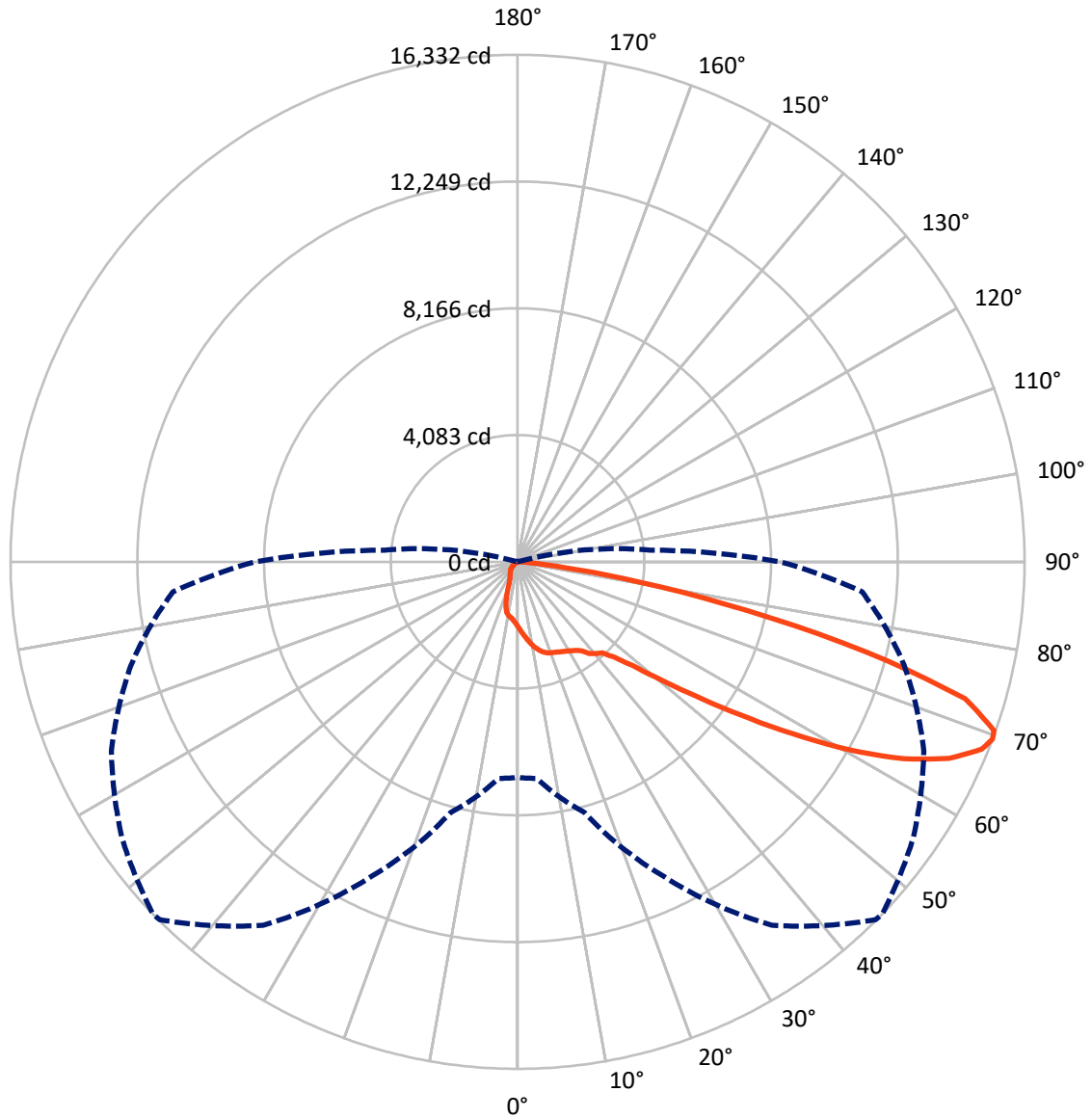
✕ Max cd  
 - - - 1/2 Max cd



Based on 25 foot mounting height. Maximum calculated value = 4.9 fc  
 Type IV - Short - N/A

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### Luminous Intensity Polar Plot



— Vertical Plane Through 46-Deg Lateral      - - - Horizontal Cone Through 69-Deg Vertical

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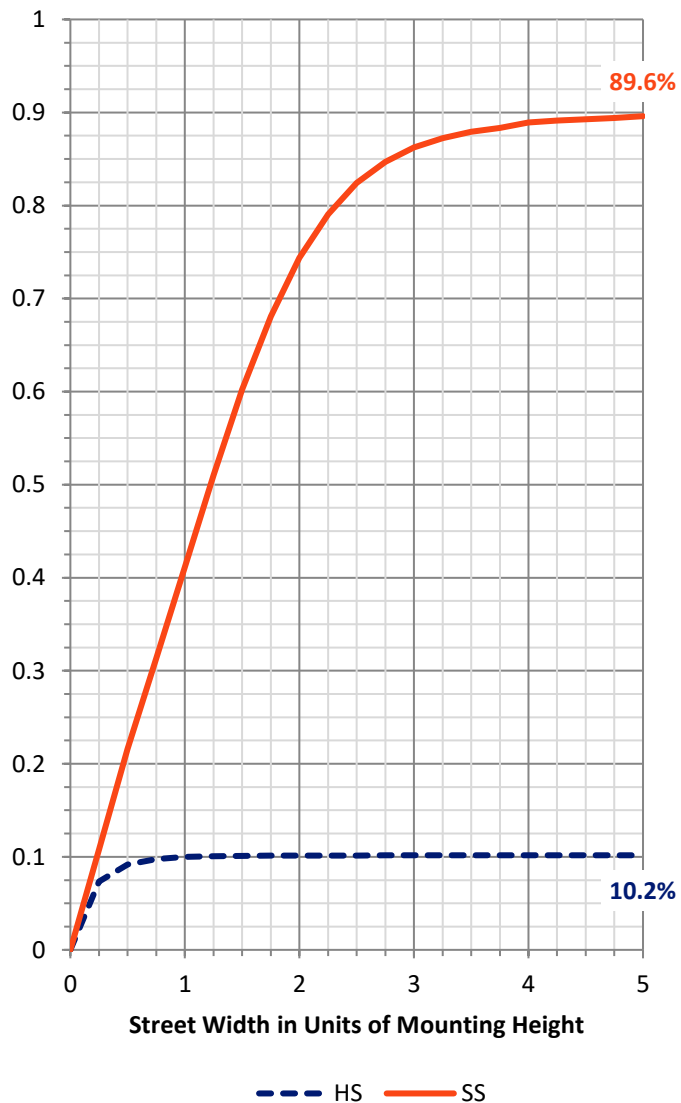
**FLUX DISTRIBUTION:**

|                    |           | Downward | Upward | Total   |
|--------------------|-----------|----------|--------|---------|
| <b>House Side</b>  | Lumens    | 2145.9   | 0.0    | 2145.9  |
|                    | % Fixture | 10.3     | 0.0    | 10.3    |
| <b>Street Side</b> | Lumens    | 18764.1  | 0.0    | 18764.1 |
|                    | % Fixture | 89.7     | 0.0    | 89.7    |
| <b>Total</b>       | Lumens    | 20910.0  | 0.0    | 20910.0 |
|                    | % Fixture | 100.0    | 0.0    | 100.0   |

**ZONAL LUMENS:**

| Zone      | Lumens  | % Fixture |
|-----------|---------|-----------|
| 0°-10°    | 208.5   | 1.0       |
| 10°-20°   | 632.6   | 3.0       |
| 20°-30°   | 994.9   | 4.8       |
| 30°-40°   | 1426.8  | 6.8       |
| 40°-50°   | 2466.0  | 11.8      |
| 50°-60°   | 4871.7  | 23.3      |
| 60°-70°   | 6808.7  | 32.6      |
| 70°-80°   | 3289.3  | 15.7      |
| 80°-90°   | 211.4   | 1.0       |
| 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°    | 20910.0 | 100.0     |
| 0°-180°   | 20910.0 | 100.0     |

**Coefficient of Utilization**



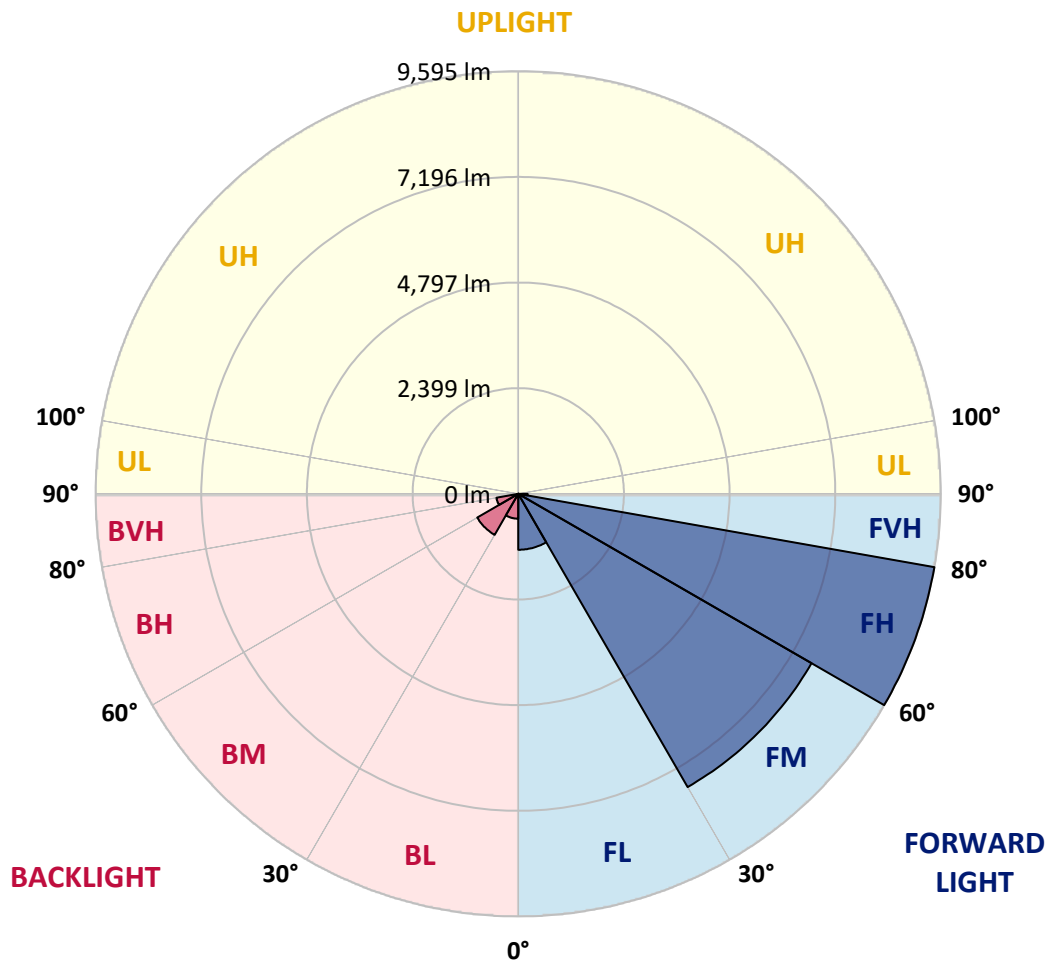
REPORT NUMBER: P363332  
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**LUMINAIRE CLASSIFICATION SYSTEM LUMEN TABLE AND BUG RATING:**

| Zone           | Lumens | % Fixture | Zone Rating/Lumen Limit |      |          |
|----------------|--------|-----------|-------------------------|------|----------|
|                |        |           | B                       | U    | G        |
| FL (0°-30°)    | 1270.5 | 6.1       |                         |      |          |
| FM (30°-60°)   | 7689.1 | 36.8      |                         |      |          |
| FH (60°-80°)   | 9594.8 | 45.9      |                         |      | G4/12000 |
| FVH (80°-90°)  | 209.6  | 1.0       |                         |      | G2/225   |
| BL (0°-30°)    | 565.6  | 2.7       | B2/1000                 |      |          |
| BM (30°-60°)   | 1075.4 | 5.1       | B2/2500                 |      |          |
| BH (60°-80°)   | 503.2  | 2.4       | B2/1000                 |      | G2/1000  |
| BVH (80°-90°)  | 1.8    | 0.0       |                         |      | G0/10    |
| UL (90°-100°)  | 0.0    | 0.0       |                         | U0/0 |          |
| UH (100°-180°) | 0.0    | 0.0       |                         | U0/0 |          |

**BUG Rating: B2-U0-G4**

Type IV Short





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**CANDELA DISTRIBUTION (FULL):**

|       | 0°      | 5°      | 15°     | 25°     | 35°     | 45°     | 46°     | 55°     | 65°     | 75°     | 85°     |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0°    | 2095.1  | 2095.1  | 2095.1  | 2095.1  | 2095.1  | 2095.1  | 2095.1  | 2095.1  | 2095.1  | 2095.1  | 2095.1  |
| 2.5°  | 2327.5  | 2324.5  | 2310.8  | 2304.9  | 2271.6  | 2252.0  | 2244.1  | 2219.6  | 2184.3  | 2149.0  | 2109.8  |
| 5°    | 2592.2  | 2591.2  | 2565.7  | 2541.2  | 2478.4  | 2419.6  | 2408.8  | 2352.0  | 2272.6  | 2198.0  | 2123.5  |
| 7.5°  | 2862.8  | 2850.0  | 2824.5  | 2777.5  | 2686.3  | 2592.2  | 2583.3  | 2502.9  | 2390.2  | 2282.4  | 2175.5  |
| 10°   | 3092.2  | 3084.3  | 3051.0  | 2979.4  | 2872.6  | 2765.7  | 2754.9  | 2655.9  | 2528.4  | 2396.1  | 2259.8  |
| 12.5° | 3270.6  | 3264.7  | 3220.6  | 3131.4  | 3017.7  | 2906.9  | 2892.2  | 2803.9  | 2667.7  | 2519.6  | 2358.8  |
| 15°   | 3379.4  | 3376.5  | 3322.6  | 3227.5  | 3115.7  | 3019.6  | 3006.9  | 2929.4  | 2802.9  | 2648.0  | 2466.7  |
| 17.5° | 3404.9  | 3405.9  | 3350.0  | 3253.9  | 3161.8  | 3093.1  | 3083.3  | 3024.5  | 2918.6  | 2764.7  | 2574.5  |
| 20°   | 3348.0  | 3359.8  | 3309.8  | 3226.5  | 3169.6  | 3133.3  | 3125.5  | 3090.2  | 3001.0  | 2855.9  | 2660.8  |
| 22.5° | 3267.7  | 3273.5  | 3239.2  | 3183.3  | 3159.8  | 3166.7  | 3162.8  | 3143.1  | 3067.7  | 2934.3  | 2746.1  |
| 25°   | 3218.6  | 3218.6  | 3198.0  | 3151.0  | 3166.7  | 3208.8  | 3209.8  | 3205.9  | 3146.1  | 3030.4  | 2850.0  |
| 27.5° | 3216.7  | 3210.8  | 3187.3  | 3152.0  | 3195.1  | 3259.8  | 3263.7  | 3290.2  | 3253.0  | 3147.1  | 2979.4  |
| 30°   | 3295.1  | 3288.2  | 3238.2  | 3192.2  | 3247.1  | 3316.7  | 3326.5  | 3384.3  | 3365.7  | 3273.5  | 3123.5  |
| 32.5° | 3478.4  | 3453.9  | 3343.1  | 3267.7  | 3308.8  | 3392.2  | 3404.9  | 3497.1  | 3526.5  | 3429.4  | 3262.8  |
| 35°   | 3729.4  | 3652.0  | 3492.2  | 3410.8  | 3414.7  | 3502.0  | 3513.7  | 3649.0  | 3736.3  | 3572.6  | 3370.6  |
| 37.5° | 4075.5  | 4037.3  | 3777.5  | 3559.8  | 3577.5  | 3709.8  | 3744.1  | 3891.2  | 3866.7  | 3651.0  | 3493.1  |
| 40°   | 4834.3  | 4774.5  | 4498.1  | 3977.5  | 3733.3  | 3878.4  | 3889.2  | 3967.7  | 3969.6  | 3828.4  | 3748.0  |
| 42.5° | 5867.7  | 5843.2  | 5552.0  | 4735.3  | 4040.2  | 3991.2  | 4010.8  | 4143.1  | 4291.2  | 4203.0  | 4199.0  |
| 45°   | 7011.8  | 6999.0  | 6690.2  | 5741.2  | 4660.8  | 4360.8  | 4385.3  | 4562.8  | 4846.1  | 4865.7  | 4990.2  |
| 47.5° | 7932.4  | 7926.5  | 7749.0  | 6863.7  | 5610.8  | 4987.3  | 4995.1  | 5183.3  | 5681.4  | 5927.5  | 6126.5  |
| 50°   | 8771.6  | 8800.0  | 8659.8  | 8078.5  | 6904.9  | 5968.6  | 5950.0  | 6075.5  | 6875.5  | 7278.5  | 7525.5  |
| 52.5° | 9938.3  | 9978.5  | 9585.3  | 9211.8  | 8262.8  | 7186.3  | 7171.6  | 7303.0  | 8310.8  | 8612.8  | 8656.9  |
| 55°   | 10968.7 | 10900.0 | 10589.2 | 10481.4 | 9918.7  | 8690.2  | 8686.3  | 8802.0  | 9699.0  | 9827.5  | 9908.9  |
| 57.5° | 11423.6 | 11397.1 | 11547.1 | 11794.2 | 11653.0 | 10467.7 | 10458.9 | 10370.6 | 10941.2 | 10954.9 | 11204.9 |
| 60°   | 11710.8 | 11743.2 | 12203.0 | 12964.7 | 13316.7 | 12380.4 | 12323.6 | 11785.3 | 12127.5 | 12097.1 | 12364.7 |
| 62.5° | 11495.1 | 11558.9 | 12386.3 | 13655.9 | 14561.8 | 14050.0 | 13969.6 | 13081.4 | 13141.2 | 13036.3 | 13285.3 |
| 65°   | 10350.0 | 10449.0 | 11804.9 | 13525.5 | 15179.5 | 15354.9 | 15273.6 | 14225.5 | 13946.1 | 13773.6 | 13635.3 |
| 67.5° | 8403.9  | 8462.8  | 9878.5  | 12391.2 | 14901.0 | 16133.4 | 16116.7 | 15228.5 | 14554.0 | 13649.1 | 12576.5 |
| 69°   | 6945.1  | 7003.0  | 8365.7  | 11197.1 | 14288.3 | 16300.0 | 16332.4 | 15550.0 | 14438.3 | 12892.2 | 11143.2 |
| 70°   | 5882.4  | 5944.1  | 7213.7  | 10173.6 | 13577.5 | 16222.6 | 16280.4 | 15519.7 | 14106.9 | 12015.7 | 9885.3  |
| 72.5° | 3085.3  | 3138.2  | 4441.2  | 7008.8  | 11068.7 | 14896.1 | 15071.6 | 14207.9 | 11957.9 | 8726.5  | 5845.1  |
| 75°   | 969.6   | 1000.0  | 1734.3  | 3663.7  | 7578.5  | 11582.4 | 11622.6 | 11145.1 | 8491.2  | 4800.0  | 2434.3  |
| 77.5° | 369.6   | 360.8   | 577.5   | 1350.0  | 3831.4  | 7293.2  | 7539.2  | 6964.7  | 4455.9  | 1697.1  | 561.8   |
| 80°   | 199.0   | 200.0   | 300.0   | 558.8   | 1639.2  | 3748.0  | 3955.9  | 3375.5  | 1583.3  | 529.4   | 129.4   |
| 82.5° | 86.3    | 90.2    | 168.6   | 296.1   | 752.9   | 1382.4  | 1486.3  | 1237.3  | 604.9   | 355.9   | 48.0    |
| 85°   | 18.6    | 20.6    | 81.4    | 160.8   | 306.9   | 388.2   | 406.9   | 401.0   | 385.3   | 276.5   | 18.6    |
| 87.5° | 0.0     | 0.0     | 36.3    | 57.8    | 77.5    | 88.2    | 77.5    | 101.0   | 212.7   | 186.3   | 9.8     |
| 90°   | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |



REPORT NUMBER: P363332

CATALOG NUMBER: NVN-SA4C-750-U-T4W-HSS

**CANDELA DISTRIBUTION (continued):**

|       | 90°     | 95°    | 105°   | 115°   | 125°   | 135°   | 145°   | 155°   | 165°   | 175°   | 180°   |
|-------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0°    | 2095.1  | 2095.1 | 2095.1 | 2095.1 | 2095.1 | 2095.1 | 2095.1 | 2095.1 | 2095.1 | 2095.1 | 2095.1 |
| 2.5°  | 2097.1  | 2079.4 | 2049.0 | 2015.7 | 1992.2 | 1967.7 | 1948.0 | 1939.2 | 1929.4 | 1922.6 | 1931.4 |
| 5°    | 2093.1  | 2058.8 | 2000.0 | 1943.1 | 1902.0 | 1868.6 | 1841.2 | 1830.4 | 1819.6 | 1811.8 | 1810.8 |
| 7.5°  | 2127.5  | 2079.4 | 1989.2 | 1905.9 | 1842.2 | 1797.1 | 1759.8 | 1744.1 | 1731.4 | 1725.5 | 1720.6 |
| 10°   | 2193.1  | 2131.4 | 2010.8 | 1902.0 | 1819.6 | 1743.1 | 1662.7 | 1601.0 | 1560.8 | 1542.2 | 1535.3 |
| 12.5° | 2278.4  | 2201.0 | 2052.0 | 1922.6 | 1802.9 | 1655.9 | 1485.3 | 1338.2 | 1243.1 | 1211.8 | 1193.1 |
| 15°   | 2378.4  | 2282.4 | 2105.9 | 1949.0 | 1742.2 | 1473.5 | 1184.3 | 992.2  | 903.9  | 886.3  | 866.7  |
| 17.5° | 2474.5  | 2368.6 | 2170.6 | 1953.9 | 1608.8 | 1177.5 | 867.6  | 737.3  | 702.9  | 714.7  | 717.6  |
| 20°   | 2558.8  | 2453.9 | 2234.3 | 1910.8 | 1366.7 | 883.3  | 671.6  | 639.2  | 652.0  | 674.5  | 678.4  |
| 22.5° | 2644.1  | 2536.3 | 2293.1 | 1797.1 | 1056.9 | 670.6  | 604.9  | 612.7  | 625.5  | 648.0  | 652.0  |
| 25°   | 2748.0  | 2636.3 | 2348.0 | 1588.2 | 793.1  | 570.6  | 574.5  | 586.3  | 599.0  | 619.6  | 621.6  |
| 27.5° | 2867.7  | 2762.8 | 2384.3 | 1316.7 | 588.2  | 524.5  | 537.3  | 554.9  | 567.6  | 587.3  | 591.2  |
| 30°   | 3026.5  | 2929.4 | 2396.1 | 1035.3 | 493.1  | 483.3  | 489.2  | 510.8  | 529.4  | 547.1  | 550.0  |
| 32.5° | 3175.5  | 3094.1 | 2356.9 | 781.4  | 456.9  | 445.1  | 445.1  | 457.8  | 479.4  | 496.1  | 500.0  |
| 35°   | 3312.8  | 3259.8 | 2231.4 | 571.6  | 429.4  | 409.8  | 400.0  | 400.0  | 413.7  | 427.5  | 431.4  |
| 37.5° | 3494.1  | 3492.2 | 2028.4 | 455.9  | 402.9  | 380.4  | 359.8  | 344.1  | 339.2  | 342.2  | 344.1  |
| 40°   | 3804.9  | 3807.9 | 1763.7 | 408.8  | 380.4  | 350.0  | 318.6  | 290.2  | 263.7  | 254.9  | 253.9  |
| 42.5° | 4290.2  | 4246.1 | 1486.3 | 386.3  | 360.8  | 318.6  | 271.6  | 233.3  | 192.2  | 179.4  | 178.4  |
| 45°   | 5060.8  | 4799.0 | 1192.2 | 365.7  | 340.2  | 283.3  | 224.5  | 172.5  | 139.2  | 129.4  | 129.4  |
| 47.5° | 6183.4  | 5525.5 | 923.5  | 343.1  | 312.7  | 243.1  | 169.6  | 124.5  | 102.0  | 97.1   | 98.0   |
| 50°   | 7344.1  | 6237.3 | 707.8  | 314.7  | 279.4  | 201.0  | 125.5  | 90.2   | 77.5   | 77.5   | 78.4   |
| 52.5° | 8373.6  | 6758.8 | 552.0  | 284.3  | 238.2  | 157.8  | 95.1   | 70.6   | 64.7   | 63.7   | 64.7   |
| 55°   | 9337.3  | 7095.1 | 422.6  | 249.0  | 189.2  | 117.6  | 72.5   | 57.8   | 53.9   | 52.0   | 51.0   |
| 57.5° | 10266.7 | 7261.8 | 316.7  | 201.0  | 137.3  | 85.3   | 57.8   | 49.0   | 45.1   | 42.2   | 41.2   |
| 60°   | 10885.3 | 7126.5 | 217.6  | 148.0  | 95.1   | 61.8   | 48.0   | 42.2   | 37.3   | 34.3   | 33.3   |
| 62.5° | 11234.3 | 6756.9 | 140.2  | 106.9  | 67.6   | 46.1   | 38.2   | 35.3   | 28.4   | 25.5   | 25.5   |
| 65°   | 11093.2 | 6147.1 | 98.0   | 76.5   | 49.0   | 34.3   | 28.4   | 28.4   | 20.6   | 16.7   | 15.7   |
| 67.5° | 9830.4  | 5193.2 | 74.5   | 56.9   | 35.3   | 25.5   | 21.6   | 24.5   | 12.7   | 7.8    | 7.8    |
| 69°   | 8457.9  | 4303.9 | 63.7   | 47.1   | 29.4   | 20.6   | 18.6   | 22.5   | 8.8    | 5.9    | 4.9    |
| 70°   | 7351.0  | 3712.8 | 57.8   | 41.2   | 24.5   | 17.6   | 16.7   | 21.6   | 8.8    | 4.9    | 3.9    |
| 72.5° | 4398.1  | 2070.6 | 44.1   | 29.4   | 15.7   | 13.7   | 13.7   | 24.5   | 8.8    | 4.9    | 3.9    |
| 75°   | 1777.5  | 729.4  | 32.4   | 20.6   | 11.8   | 11.8   | 16.7   | 31.4   | 7.8    | 3.9    | 2.9    |
| 77.5° | 402.9   | 159.8  | 18.6   | 12.7   | 7.8    | 11.8   | 19.6   | 24.5   | 4.9    | 2.0    | 0.0    |
| 80°   | 98.0    | 39.2   | 11.8   | 7.8    | 4.9    | 8.8    | 14.7   | 13.7   | 1.0    | 0.0    | 0.0    |
| 82.5° | 32.4    | 13.7   | 4.9    | 3.9    | 1.0    | 2.9    | 6.9    | 3.9    | 0.0    | 0.0    | 0.0    |
| 85°   | 13.7    | 7.8    | 2.0    | 1.0    | 0.0    | 0.0    | 1.0    | 0.0    | 0.0    | 0.0    | 0.0    |
| 87.5° | 8.8     | 2.9    | 0.0    | 0.0    | 0.0    | 0.0    | 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    |



Signify Classified - Internal  
Cooper Lighting Solutions Photometric Lab  
1121 Highway 74 South  
Peachtree City, GA 30269



LM-79-2008: Approved Method: Electrical and Photometric Measurements of Solid-  
State Lighting Products

Report Prepared for

Cooper Lighting Solutions

McGRAW-EDISON

Report Number: SP1-1908-441-4-R4

Test Date: 10/02/2019

Luminaire Tested: SA1C-750-U-5WQ

Data in this report applies to families of products SA1C-760-U-5WQ .

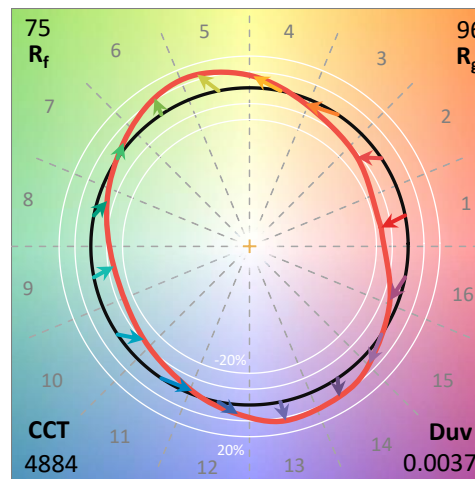
**Test Information**

Test Method: LM-79-2008  
 Report Number: SP1-1908-441-4-R4  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry: 4π  
 Issue Date: 10/28/2024  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: McGRAW-EDISON  
 Catalog Number: **SA1C-750-U-5WQ**  
 Description: McGRAW EDISON ROADWAY AND AREA LUMINAIRE

\*\*\*THIS IS A REVISION OF SP1-1908-441-4-R3. TO UPDATE THE CATALOG INFORMATION.\*\*\*TESTED IN SITU. ROADWAY AND AREA LUMINAIRE. (1) 70 CRI, 5000K, 1050MA LIGHTSQUARE WITH 16 LEDS AND TYPE V WIDE OPTICS.

**Spectral Parameters**

|                           |        |           |      |      |       |
|---------------------------|--------|-----------|------|------|-------|
| CCT (K):                  | 4884   | CRI (Ra): | 73.5 | R9:  | -28.4 |
| CIE u':                   | 0.2101 | R1:       | 70.5 | R10: | 48.6  |
| CIE v':                   | 0.4904 | R2:       | 77.7 | R11: | 73.2  |
| Duv:                      | 0.0037 | R3:       | 84.6 | R12: | 50.7  |
| CIE x:                    | 0.3493 | R4:       | 74.7 | R13: | 71.2  |
| CIE y:                    | 0.3624 | R5:       | 71.9 | R14: | 91.4  |
| CIE z:                    | 0.2884 | R6:       | 70.7 |      |       |
| Peak Wavelength (nm):     | 444    | R7:       | 81.2 |      |       |
| Dominant Wavelength (nm): | 571    | R8:       | 56.9 |      |       |
| Purity:                   | 13.7   |           |      |      |       |
| Rf:                       | 74.9   |           |      |      |       |
| Rg:                       | 96.3   |           |      |      |       |



**Test Conditions**

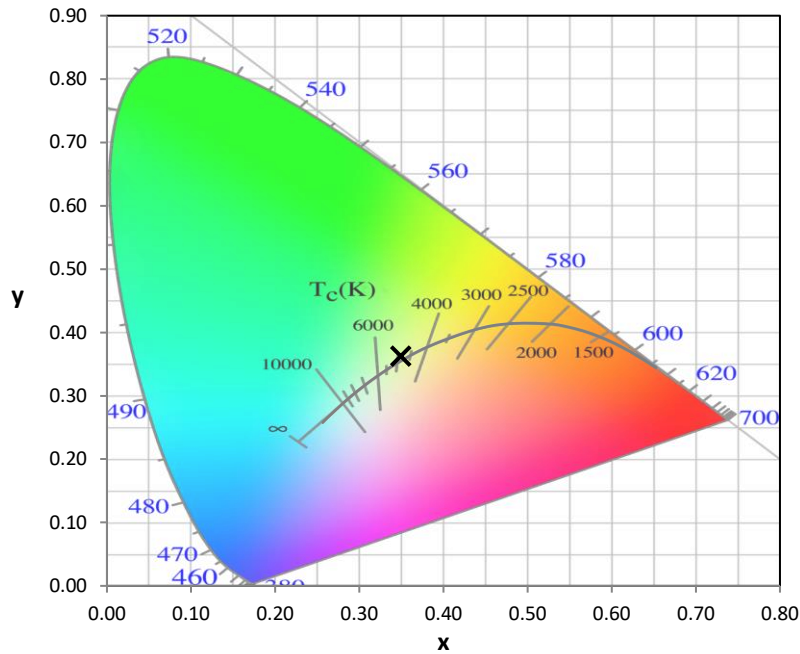
Stabilization Time: 240M  
 Operation Time: 12H  
 Room Temperature (°C) / RH%: 25.0./44%  
 Sphere Temperature (°C): 25.7

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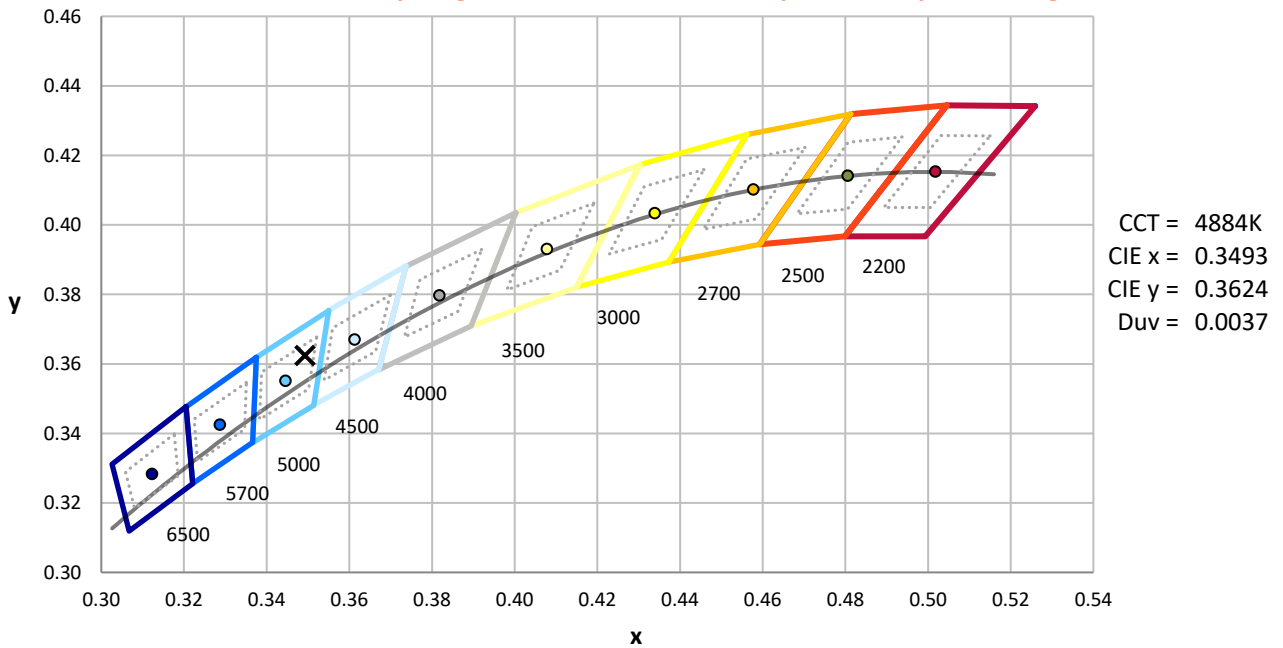
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | IN0058                | 6/28/2019        | 12/28/2019           |
| Power Meter                    | IN0071                | 12/5/2018        | 12/5/2019            |
| AC Power Source                | IN0063                | 12/5/2018        | 12/5/2019            |
| DC Power Source                | IN0208                | 12/5/2018        | 12/5/2019            |
| Sphere Thermometer             | IN0085                | 12/5/2018        | 12/5/2019            |
| Room Thermometer               | IN0046                | 12/5/2018        | 12/5/2019            |

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CIE 1931 Chromaticity Diagram



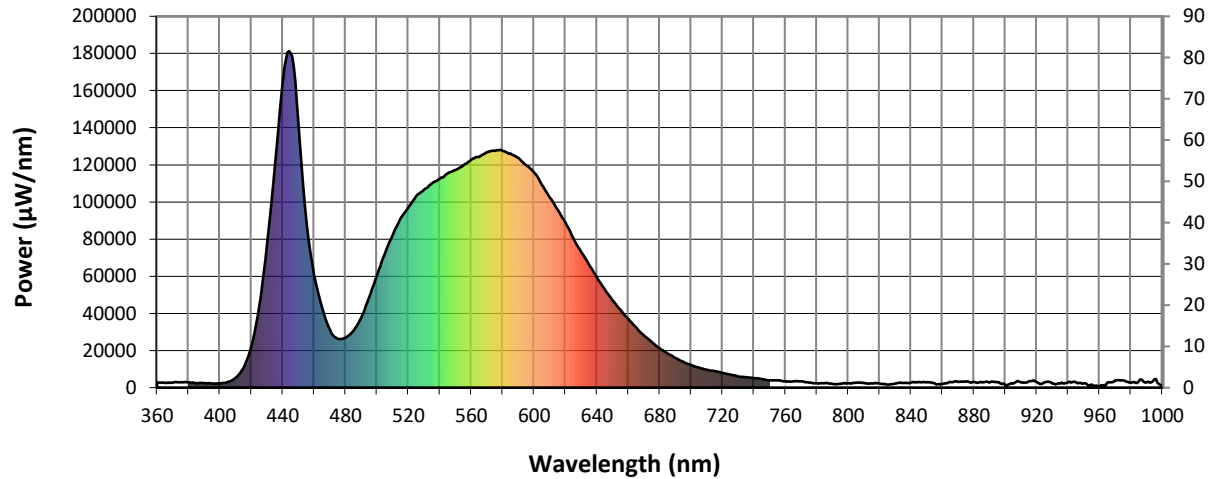
CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles



Point lies inside the ANSI 5000K 4-step quadrangle

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**Photopic Flux vs. Wavelength**

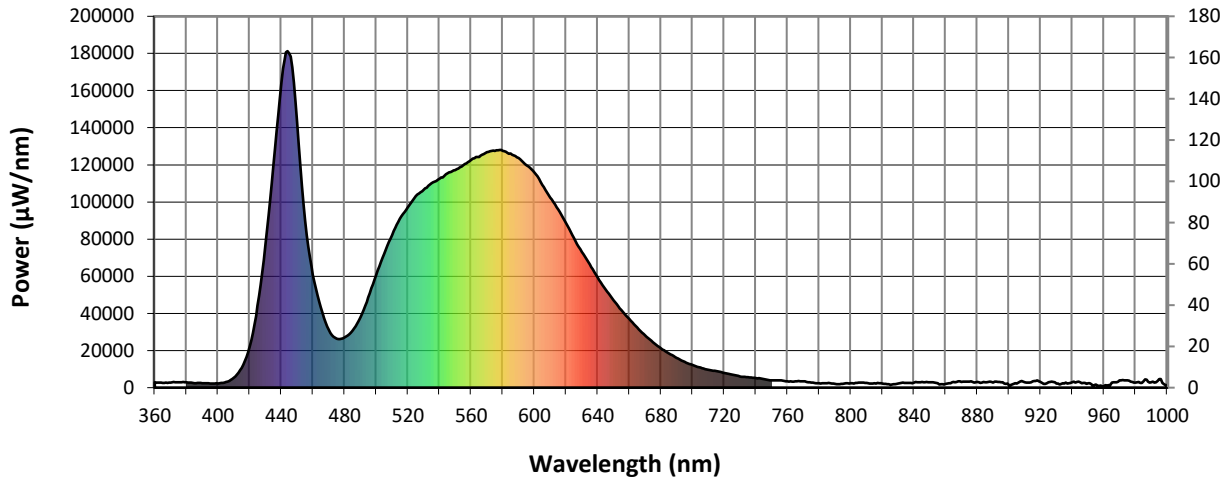


#####

| $\lambda$<br>(nm) | Power<br>( $\mu\text{W}/\text{nm}$ ) | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W}/\text{nm}$ ) | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W}/\text{nm}$ ) | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W}/\text{nm}$ ) | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W}/\text{nm}$ ) | Lumens<br>( $\phi/\text{nm}$ ) |
|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|
| 360               | 2945                                 | NR                             | 490               | 37941                                | NR                             | 620               | 88803                                | NR                             | 750               | 3908                                 | NR                             | 880               | 2997                                 | NR                             |
| 365               | 2596                                 | NR                             | 495               | 48525                                | NR                             | 625               | 80578                                | NR                             | 755               | 3988                                 | NR                             | 885               | 2927                                 | NR                             |
| 370               | 2732                                 | NR                             | 500               | 60609                                | NR                             | 630               | 73127                                | NR                             | 760               | 3335                                 | NR                             | 890               | 2649                                 | NR                             |
| 375               | 2894                                 | NR                             | 505               | 72036                                | NR                             | 635               | 66244                                | NR                             | 765               | 3438                                 | NR                             | 895               | 2828                                 | NR                             |
| 380               | 2822                                 | NR                             | 510               | 82168                                | NR                             | 640               | 59440                                | NR                             | 770               | 3427                                 | NR                             | 900               | 1407                                 | NR                             |
| 385               | 2394                                 | NR                             | 515               | 90898                                | NR                             | 645               | 52864                                | NR                             | 775               | 2759                                 | NR                             | 905               | 2224                                 | NR                             |
| 390               | 2370                                 | NR                             | 520               | 97142                                | NR                             | 650               | 47085                                | NR                             | 780               | 2340                                 | NR                             | 910               | 2905                                 | NR                             |
| 395               | 2267                                 | NR                             | 525               | 103255                               | NR                             | 655               | 41789                                | NR                             | 785               | 2412                                 | NR                             | 915               | 3350                                 | NR                             |
| 400               | 2262                                 | NR                             | 530               | 106697                               | NR                             | 660               | 37064                                | NR                             | 790               | 1999                                 | NR                             | 920               | 3114                                 | NR                             |
| 405               | 3000                                 | NR                             | 535               | 110081                               | NR                             | 665               | 32299                                | NR                             | 795               | 2054                                 | NR                             | 925               | 2834                                 | NR                             |
| 410               | 5324                                 | NR                             | 540               | 112494                               | NR                             | 670               | 28142                                | NR                             | 800               | 2331                                 | NR                             | 930               | 2271                                 | NR                             |
| 415               | 10725                                | NR                             | 545               | 115513                               | NR                             | 675               | 24505                                | NR                             | 805               | 2648                                 | NR                             | 935               | 2228                                 | NR                             |
| 420               | 22128                                | NR                             | 550               | 117203                               | NR                             | 680               | 21162                                | NR                             | 810               | 2485                                 | NR                             | 940               | 2833                                 | NR                             |
| 425               | 44095                                | NR                             | 555               | 119753                               | NR                             | 685               | 18400                                | NR                             | 815               | 2409                                 | NR                             | 945               | 2941                                 | NR                             |
| 430               | 77002                                | NR                             | 560               | 122602                               | NR                             | 690               | 16065                                | NR                             | 820               | 2221                                 | NR                             | 950               | 2323                                 | NR                             |
| 435               | 119881                               | NR                             | 565               | 124314                               | NR                             | 695               | 13860                                | NR                             | 825               | 1562                                 | NR                             | 955               | 1667                                 | NR                             |
| 440               | 164454                               | NR                             | 570               | 126775                               | NR                             | 700               | 12177                                | NR                             | 830               | 2249                                 | NR                             | 960               | 749                                  | NR                             |
| 445               | 179997                               | NR                             | 575               | 127511                               | NR                             | 705               | 10757                                | NR                             | 835               | 2573                                 | NR                             | 965               | 2669                                 | NR                             |
| 450               | 142822                               | NR                             | 580               | 127577                               | NR                             | 710               | 9601                                 | NR                             | 840               | 2764                                 | NR                             | 970               | 3968                                 | NR                             |
| 455               | 90008                                | NR                             | 585               | 126153                               | NR                             | 715               | 8944                                 | NR                             | 845               | 3109                                 | NR                             | 975               | 3886                                 | NR                             |
| 460               | 60557                                | NR                             | 590               | 123678                               | NR                             | 720               | 7947                                 | NR                             | 850               | 2963                                 | NR                             | 980               | 2788                                 | NR                             |
| 465               | 43305                                | NR                             | 595               | 119774                               | NR                             | 725               | 7062                                 | NR                             | 855               | 2336                                 | NR                             | 985               | 3496                                 | NR                             |
| 470               | 31089                                | NR                             | 600               | 115733                               | NR                             | 730               | 6004                                 | NR                             | 860               | 2118                                 | NR                             | 990               | 2913                                 | NR                             |
| 475               | 26278                                | NR                             | 605               | 109231                               | NR                             | 735               | 5594                                 | NR                             | 865               | 3144                                 | NR                             | 995               | 4659                                 | NR                             |
| 480               | 27060                                | NR                             | 610               | 102408                               | NR                             | 740               | 5165                                 | NR                             | 870               | 3069                                 | NR                             | 1000              | 1308                                 | NR                             |
| 485               | 30698                                | NR                             | 615               | 96015                                | NR                             | 745               | 4687                                 | NR                             | 875               | 3311                                 | NR                             |                   |                                      |                                |

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Scotopic Flux vs. Wavelength

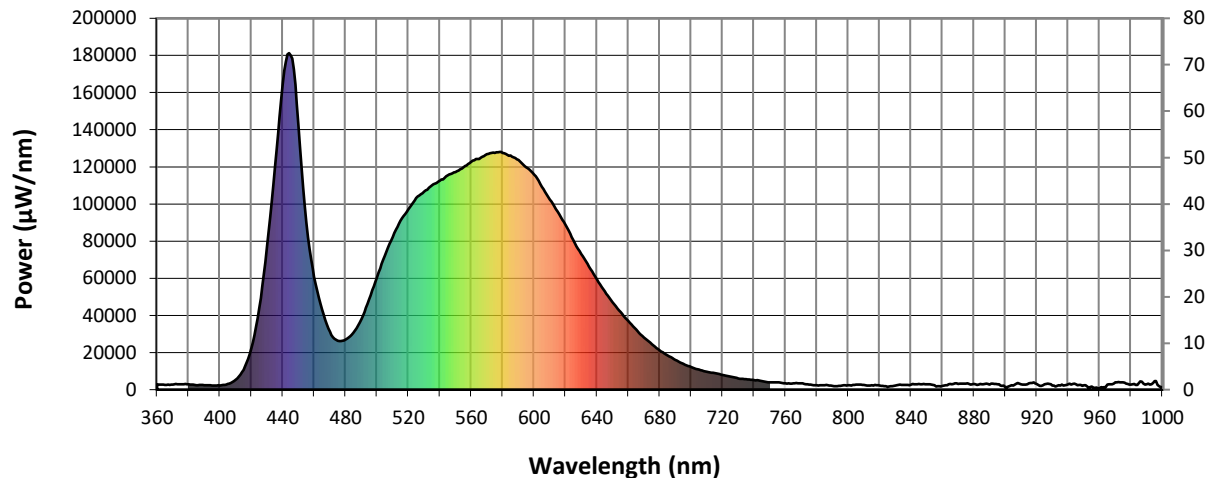


Scotopic Lumens: 13493.5 S/P: 1.77

| 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    | 2945          | NR            | 490    | 37941         | NR            | 620    | 88803         | NR            | 750    | 3908          | NR            | 880    | 2997          | NR            |
| 365    | 2596          | NR            | 495    | 48525         | NR            | 625    | 80578         | NR            | 755    | 3988          | NR            | 885    | 2927          | NR            |
| 370    | 2732          | NR            | 500    | 60609         | NR            | 630    | 73127         | NR            | 760    | 3335          | NR            | 890    | 2649          | NR            |
| 375    | 2894          | NR            | 505    | 72036         | NR            | 635    | 66244         | NR            | 765    | 3438          | NR            | 895    | 2828          | NR            |
| 380    | 2822          | NR            | 510    | 82168         | NR            | 640    | 59440         | NR            | 770    | 3427          | NR            | 900    | 1407          | NR            |
| 385    | 2394          | NR            | 515    | 90898         | NR            | 645    | 52864         | NR            | 775    | 2759          | NR            | 905    | 2224          | NR            |
| 390    | 2370          | NR            | 520    | 97142         | NR            | 650    | 47085         | NR            | 780    | 2340          | NR            | 910    | 2905          | NR            |
| 395    | 2267          | NR            | 525    | 103255        | NR            | 655    | 41789         | NR            | 785    | 2412          | NR            | 915    | 3350          | NR            |
| 400    | 2262          | NR            | 530    | 106697        | NR            | 660    | 37064         | NR            | 790    | 1999          | NR            | 920    | 3114          | NR            |
| 405    | 3000          | NR            | 535    | 110081        | NR            | 665    | 32299         | NR            | 795    | 2054          | NR            | 925    | 2834          | NR            |
| 410    | 5324          | NR            | 540    | 112494        | NR            | 670    | 28142         | NR            | 800    | 2331          | NR            | 930    | 2271          | NR            |
| 415    | 10725         | NR            | 545    | 115513        | NR            | 675    | 24505         | NR            | 805    | 2648          | NR            | 935    | 2228          | NR            |
| 420    | 22128         | NR            | 550    | 117203        | NR            | 680    | 21162         | NR            | 810    | 2485          | NR            | 940    | 2833          | NR            |
| 425    | 44095         | NR            | 555    | 119753        | NR            | 685    | 18400         | NR            | 815    | 2409          | NR            | 945    | 2941          | NR            |
| 430    | 77002         | NR            | 560    | 122602        | NR            | 690    | 16065         | NR            | 820    | 2221          | NR            | 950    | 2323          | NR            |
| 435    | 119881        | NR            | 565    | 124314        | NR            | 695    | 13860         | NR            | 825    | 1562          | NR            | 955    | 1667          | NR            |
| 440    | 164454        | NR            | 570    | 126775        | NR            | 700    | 12177         | NR            | 830    | 2249          | NR            | 960    | 749           | NR            |
| 445    | 179997        | NR            | 575    | 127511        | NR            | 705    | 10757         | NR            | 835    | 2573          | NR            | 965    | 2669          | NR            |
| 450    | 142822        | NR            | 580    | 127577        | NR            | 710    | 9601          | NR            | 840    | 2764          | NR            | 970    | 3968          | NR            |
| 455    | 90008         | NR            | 585    | 126153        | NR            | 715    | 8944          | NR            | 845    | 3109          | NR            | 975    | 3886          | NR            |
| 460    | 60557         | NR            | 590    | 123678        | NR            | 720    | 7947          | NR            | 850    | 2963          | NR            | 980    | 2788          | NR            |
| 465    | 43305         | NR            | 595    | 119774        | NR            | 725    | 7062          | NR            | 855    | 2336          | NR            | 985    | 3496          | NR            |
| 470    | 31089         | NR            | 600    | 115733        | NR            | 730    | 6004          | NR            | 860    | 2118          | NR            | 990    | 2913          | NR            |
| 475    | 26278         | NR            | 605    | 109231        | NR            | 735    | 5594          | NR            | 865    | 3144          | NR            | 995    | 4659          | NR            |
| 480    | 27060         | NR            | 610    | 102408        | NR            | 740    | 5165          | NR            | 870    | 3069          | NR            | 1000   | 1308          | NR            |
| 485    | 30698         | NR            | 615    | 96015         | NR            | 745    | 4687          | NR            | 875    | 3311          | NR            |        |               |               |

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**Melanopic Flux vs. Wavelength**



**Melanopic Lumens: 5378.9 M/P: 0.71**

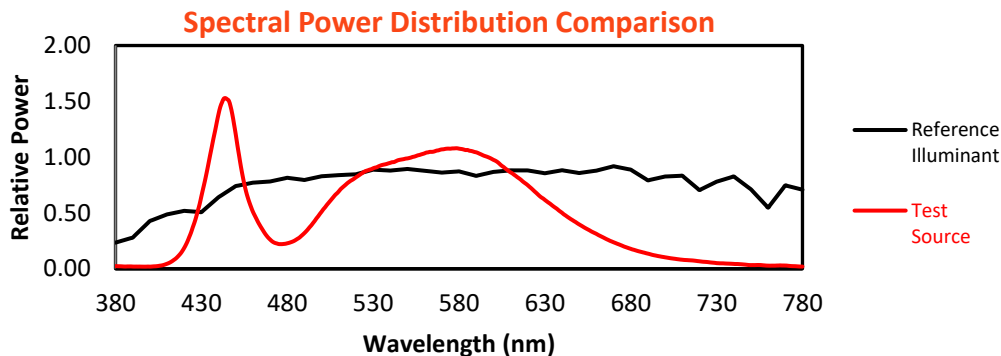
| λ (nm) | Power (µW/nm) | Lumens (φ/nm) | λ (nm) | Power (µW/nm) | Lumens (φ/nm) | λ (nm) | Power (µW/nm) | Lumens (φ/nm) | λ (nm) | Power (µW/nm) | Lumens (φ/nm) | λ (nm) | Power (µW/nm) | Lumens (φ/nm) |
|--------|---------------|---------------|--------|---------------|---------------|--------|---------------|---------------|--------|---------------|---------------|--------|---------------|---------------|
| 360    | 2945          | NR            | 490    | 37941         | NR            | 620    | 88803         | NR            | 750    | 3908          | NR            | 880    | 2997          | NR            |
| 365    | 2596          | NR            | 495    | 48525         | NR            | 625    | 80578         | NR            | 755    | 3988          | NR            | 885    | 2927          | NR            |
| 370    | 2732          | NR            | 500    | 60609         | NR            | 630    | 73127         | NR            | 760    | 3335          | NR            | 890    | 2649          | NR            |
| 375    | 2894          | NR            | 505    | 72036         | NR            | 635    | 66244         | NR            | 765    | 3438          | NR            | 895    | 2828          | NR            |
| 380    | 2822          | NR            | 510    | 82168         | NR            | 640    | 59440         | NR            | 770    | 3427          | NR            | 900    | 1407          | NR            |
| 385    | 2394          | NR            | 515    | 90898         | NR            | 645    | 52864         | NR            | 775    | 2759          | NR            | 905    | 2224          | NR            |
| 390    | 2370          | NR            | 520    | 97142         | NR            | 650    | 47085         | NR            | 780    | 2340          | NR            | 910    | 2905          | NR            |
| 395    | 2267          | NR            | 525    | 103255        | NR            | 655    | 41789         | NR            | 785    | 2412          | NR            | 915    | 3350          | NR            |
| 400    | 2262          | NR            | 530    | 106697        | NR            | 660    | 37064         | NR            | 790    | 1999          | NR            | 920    | 3114          | NR            |
| 405    | 3000          | NR            | 535    | 110081        | NR            | 665    | 32299         | NR            | 795    | 2054          | NR            | 925    | 2834          | NR            |
| 410    | 5324          | NR            | 540    | 112494        | NR            | 670    | 28142         | NR            | 800    | 2331          | NR            | 930    | 2271          | NR            |
| 415    | 10725         | NR            | 545    | 115513        | NR            | 675    | 24505         | NR            | 805    | 2648          | NR            | 935    | 2228          | NR            |
| 420    | 22128         | NR            | 550    | 117203        | NR            | 680    | 21162         | NR            | 810    | 2485          | NR            | 940    | 2833          | NR            |
| 425    | 44095         | NR            | 555    | 119753        | NR            | 685    | 18400         | NR            | 815    | 2409          | NR            | 945    | 2941          | NR            |
| 430    | 77002         | NR            | 560    | 122602        | NR            | 690    | 16065         | NR            | 820    | 2221          | NR            | 950    | 2323          | NR            |
| 435    | 119881        | NR            | 565    | 124314        | NR            | 695    | 13860         | NR            | 825    | 1562          | NR            | 955    | 1667          | NR            |
| 440    | 164454        | NR            | 570    | 126775        | NR            | 700    | 12177         | NR            | 830    | 2249          | NR            | 960    | 749           | NR            |
| 445    | 179997        | NR            | 575    | 127511        | NR            | 705    | 10757         | NR            | 835    | 2573          | NR            | 965    | 2669          | NR            |
| 450    | 142822        | NR            | 580    | 127577        | NR            | 710    | 9601          | NR            | 840    | 2764          | NR            | 970    | 3968          | NR            |
| 455    | 90008         | NR            | 585    | 126153        | NR            | 715    | 8944          | NR            | 845    | 3109          | NR            | 975    | 3886          | NR            |
| 460    | 60557         | NR            | 590    | 123678        | NR            | 720    | 7947          | NR            | 850    | 2963          | NR            | 980    | 2788          | NR            |
| 465    | 43305         | NR            | 595    | 119774        | NR            | 725    | 7062          | NR            | 855    | 2336          | NR            | 985    | 3496          | NR            |
| 470    | 31089         | NR            | 600    | 115733        | NR            | 730    | 6004          | NR            | 860    | 2118          | NR            | 990    | 2913          | NR            |
| 475    | 26278         | NR            | 605    | 109231        | NR            | 735    | 5594          | NR            | 865    | 3144          | NR            | 995    | 4659          | NR            |
| 480    | 27060         | NR            | 610    | 102408        | NR            | 740    | 5165          | NR            | 870    | 3069          | NR            | 1000   | 1308          | NR            |
| 485    | 30698         | NR            | 615    | 96015         | NR            | 745    | 4687          | NR            | 875    | 3311          | NR            |        |               |               |

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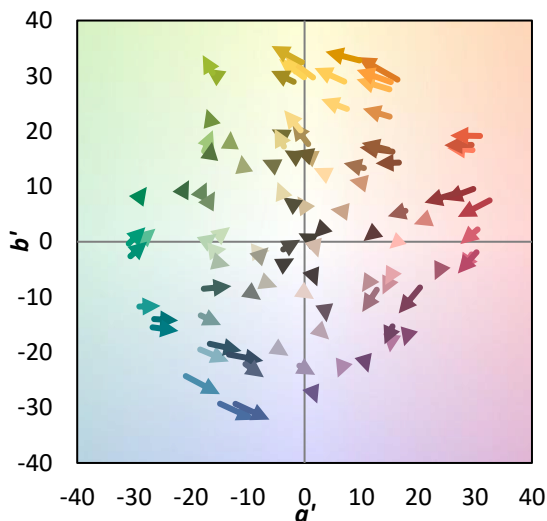
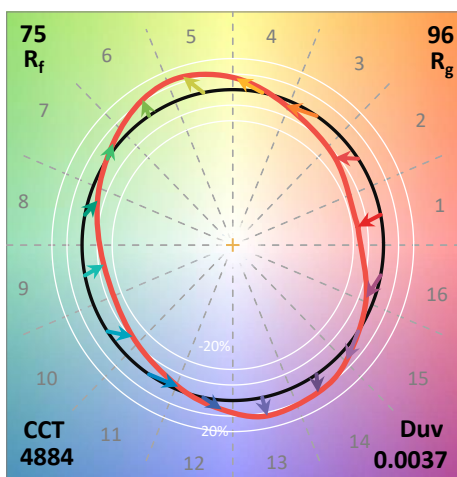
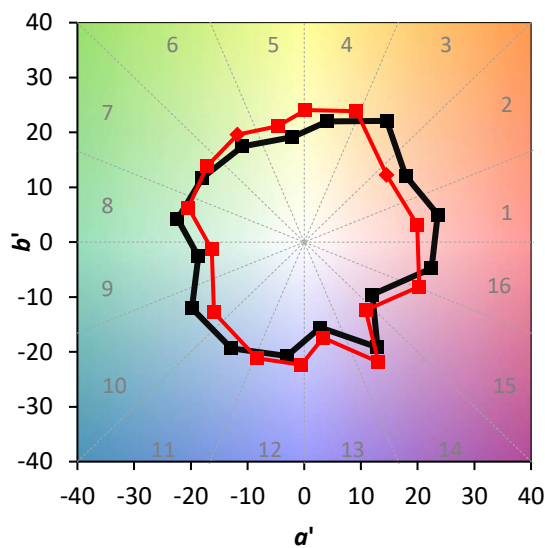
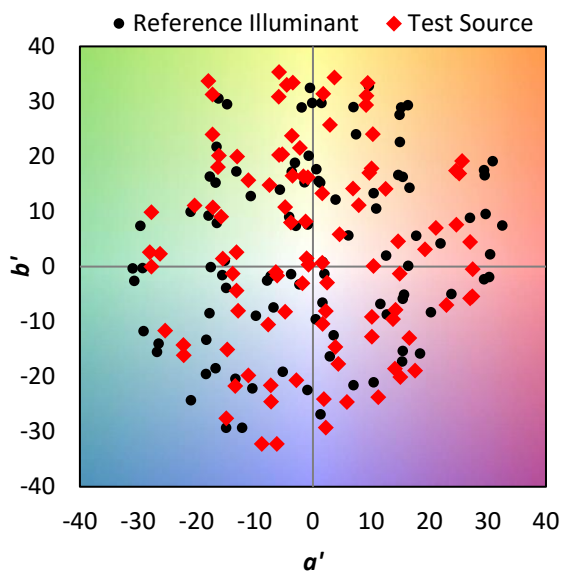
TM-30-18

**Summary**

$R_f = 74.9$   
 $R_g = 96.3$   
 CIE  $R_a = 73.5$   
 $R_g = -28.4$



**Color Vector Graphics**



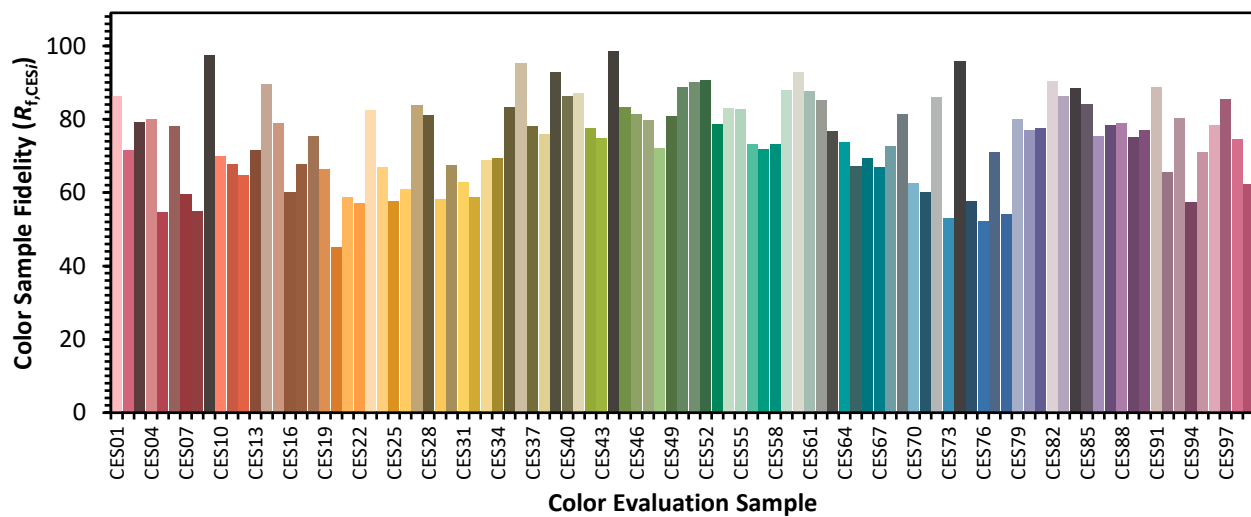


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**Individual Sample Fidelity Index ( $R_{f,i}$ )**

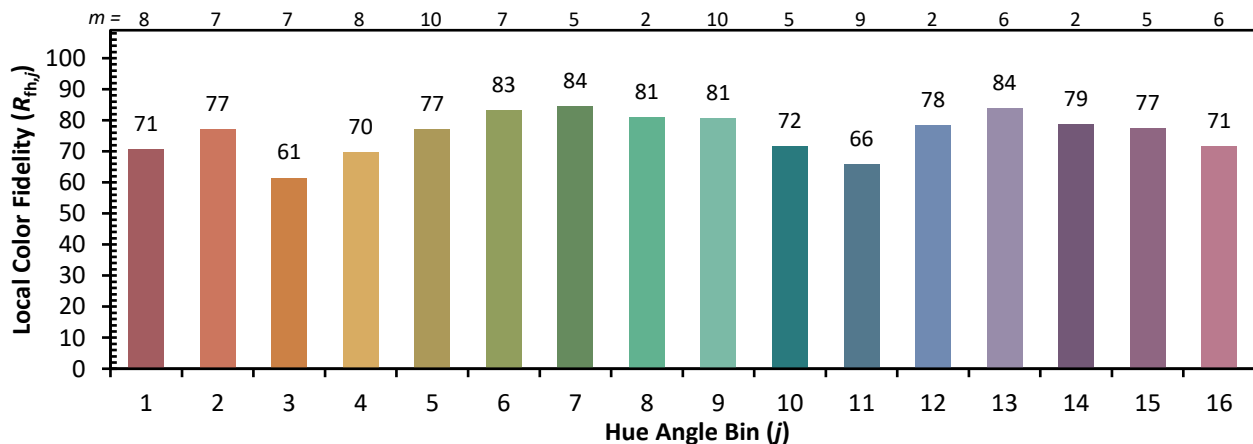
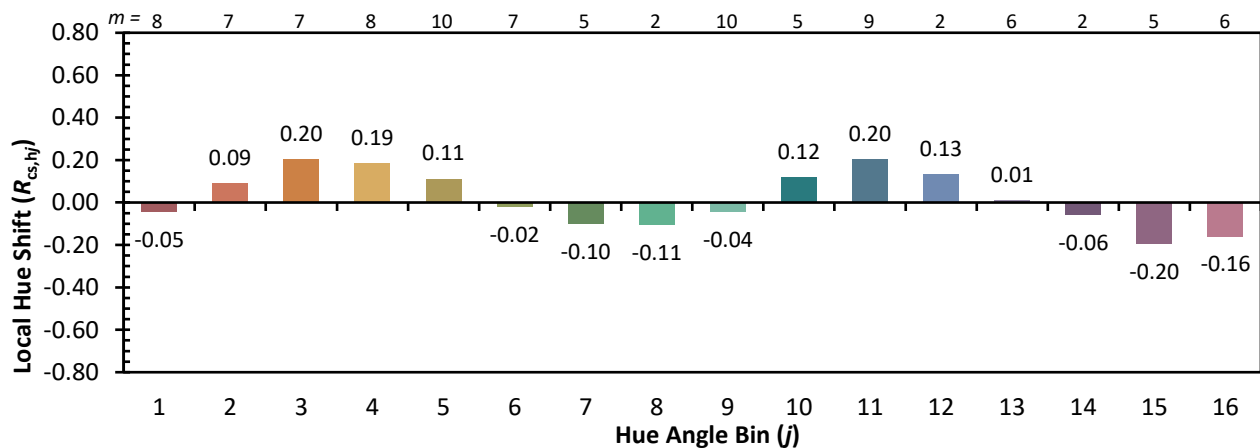
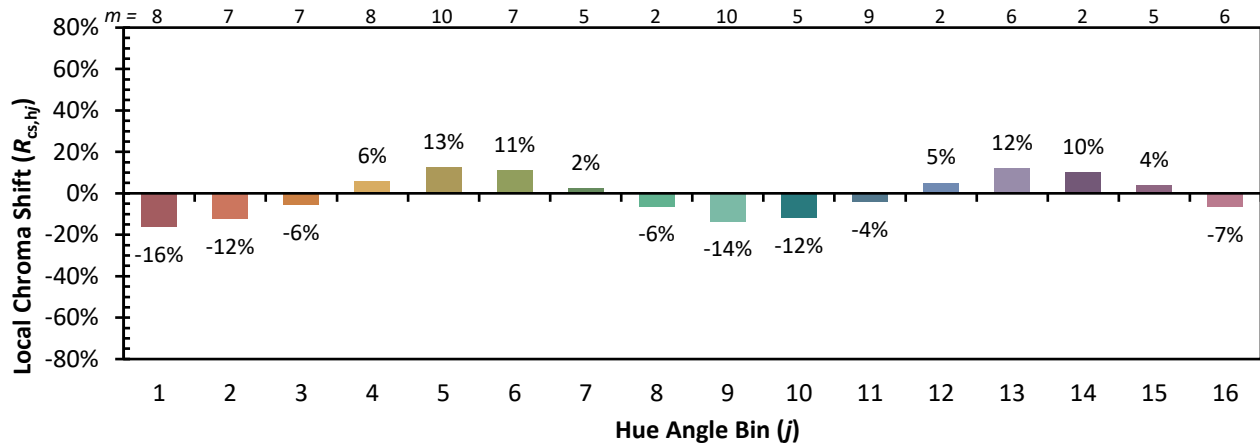
|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 85 | CES26 = 61 | CES51 = 90 | CES76 = 52 |
| CES02 = 60 | CES27 = 84 | CES52 = 91 | CES77 = 71 |
| CES03 = 30 | CES28 = 81 | CES53 = 79 | CES78 = 54 |
| CES04 = 69 | CES29 = 58 | CES54 = 83 | CES79 = 80 |
| CES05 = 46 | CES30 = 67 | CES55 = 83 | CES80 = 77 |
| CES06 = 50 | CES31 = 63 | CES56 = 73 | CES81 = 77 |
| CES07 = 39 | CES32 = 59 | CES57 = 72 | CES82 = 90 |
| CES08 = 38 | CES33 = 69 | CES58 = 73 | CES83 = 86 |
| CES09 = 29 | CES34 = 69 | CES59 = 88 | CES84 = 88 |
| CES10 = 73 | CES35 = 83 | CES60 = 93 | CES85 = 84 |
| CES11 = 56 | CES36 = 95 | CES61 = 88 | CES86 = 75 |
| CES12 = 61 | CES37 = 78 | CES62 = 85 | CES87 = 78 |
| CES13 = 41 | CES38 = 76 | CES63 = 77 | CES88 = 79 |
| CES14 = 74 | CES39 = 93 | CES64 = 74 | CES89 = 75 |
| CES15 = 70 | CES40 = 86 | CES65 = 67 | CES90 = 77 |
| CES16 = 46 | CES41 = 87 | CES66 = 69 | CES91 = 89 |
| CES17 = 49 | CES42 = 78 | CES67 = 67 | CES92 = 66 |
| CES18 = 55 | CES43 = 75 | CES68 = 73 | CES93 = 80 |
| CES19 = 71 | CES44 = 99 | CES69 = 81 | CES94 = 57 |
| CES20 = 64 | CES45 = 83 | CES70 = 63 | CES95 = 71 |
| CES21 = 85 | CES46 = 81 | CES71 = 60 | CES96 = 78 |
| CES22 = 77 | CES47 = 80 | CES72 = 86 | CES97 = 85 |
| CES23 = 91 | CES48 = 72 | CES73 = 53 | CES98 = 75 |
| CES24 = 90 | CES49 = 81 | CES74 = 96 | CES99 = 62 |
| CES25 = 71 | CES50 = 89 | CES75 = 58 |            |



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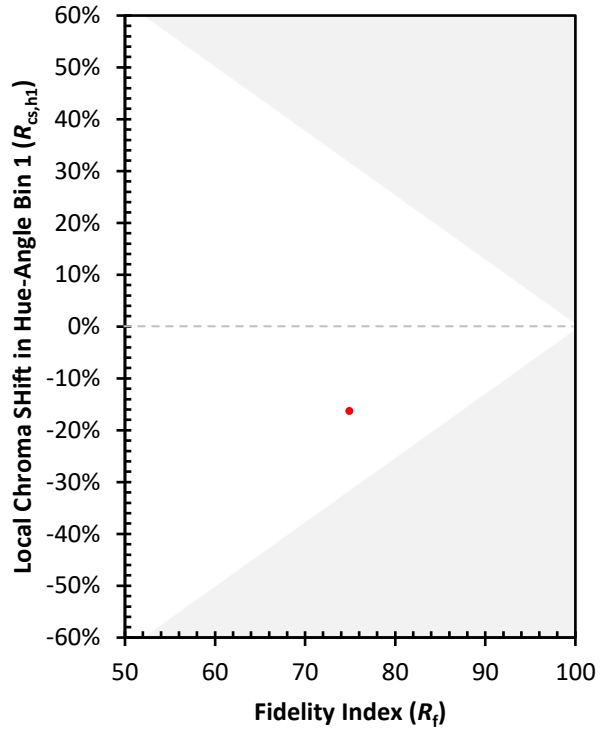
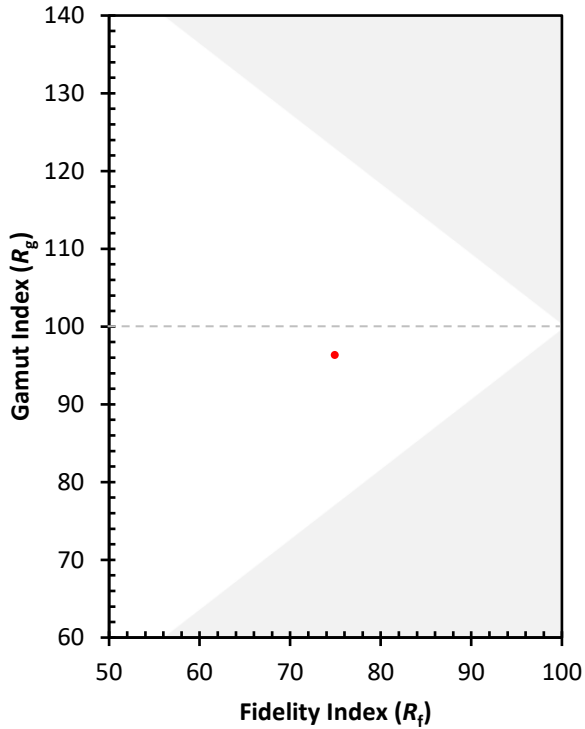
Color Rendition by Hue-Angle Bin



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Measure Comparisons



(END OF REPORT)