

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: P361856

Luminaire Tested: NVN-SA4A-727-U-SL3

Issue Date: 3/3/2020

**Test Information**

Test Method: LM-79-2019  
Report Number: P361856  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G2-1903-205-22)  
Test Lab: INNOVATION CENTER  
Issue Date: 3/3/2020  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: STREETWORKS  
Catalog Number: NVN-SA4A-727-U-SL3  
Description: NAVION ROADWAY AND AREA LUMINAIRE  
(4) 70 CRI, 2700K, 615mA LIGHTSQUARES WITH 16 LEDS EACH AND TYPE III  
SPILL LIGHT ELIMINATOR OPTICS  
Light Source: -  
Ballast/Driver: ELECTRONIC DRIVER

**Summary**

Lumens per Lamp: N/A  
Luminaire Lumens: 15952 lumens  
Efficiency: N/A  
Efficacy: 123.7 lumens/watt  
Luminous Opening: Rectangular (W 1' x L: 1.5' x H: 0')  
IES Classification: Type III - Medium  
BUG Rating: B2 - U0 - G3

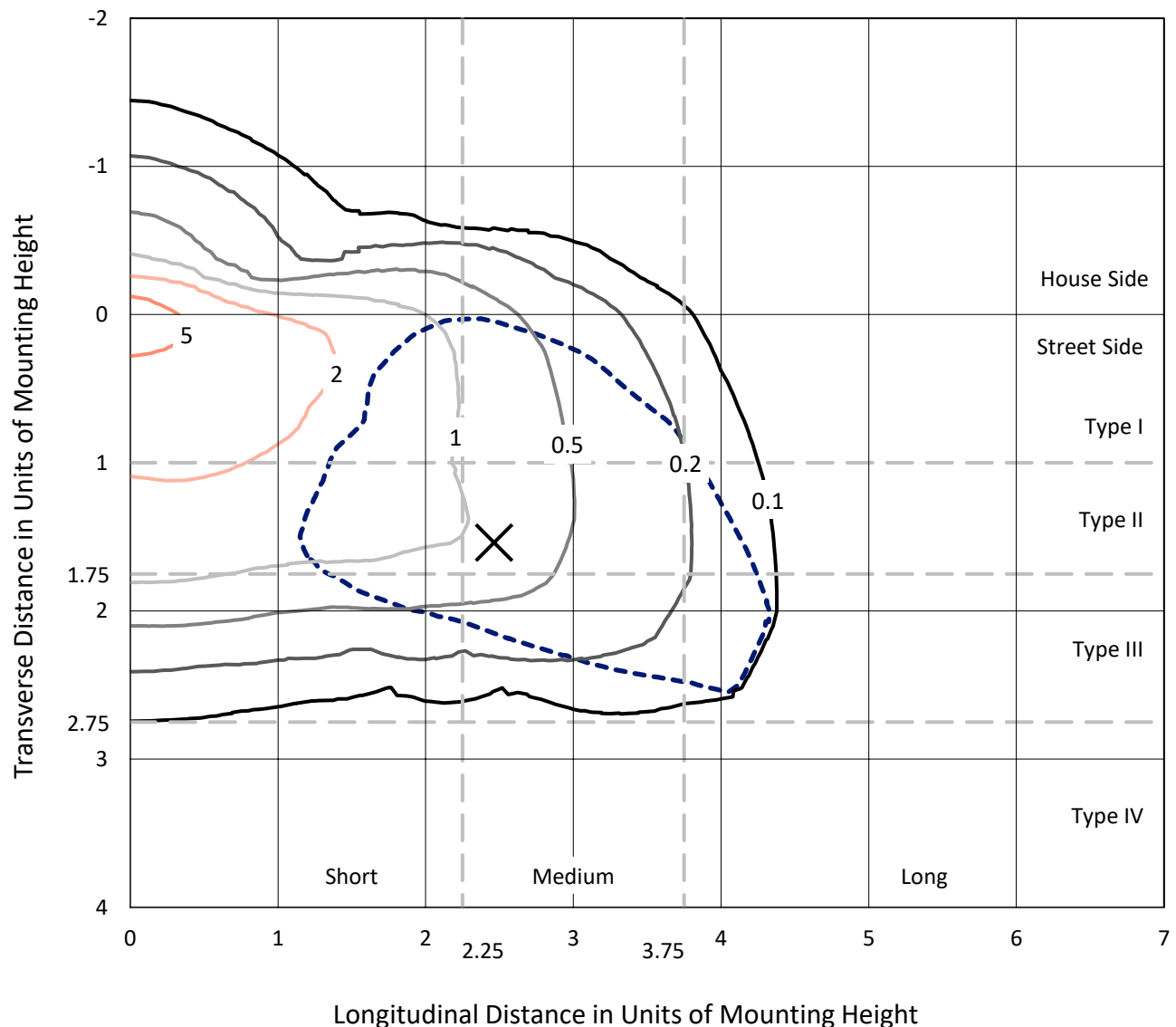
Input Watts (W): 129  
Input Voltage (V): NR  
Input Current (Ain): NR  
Voltage Rise (V): NR  
Power Factor: NR  
Total Harmonic Distortion (THDi): NR  
Frequency (hertz): 60  
Stabilization Time: NR  
Operation Time: NR  
Ambient Temperature (°C): NR  
Test Distance: 28.75 FT



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## Iso-Footcandle Lines of Horizontal Illumination

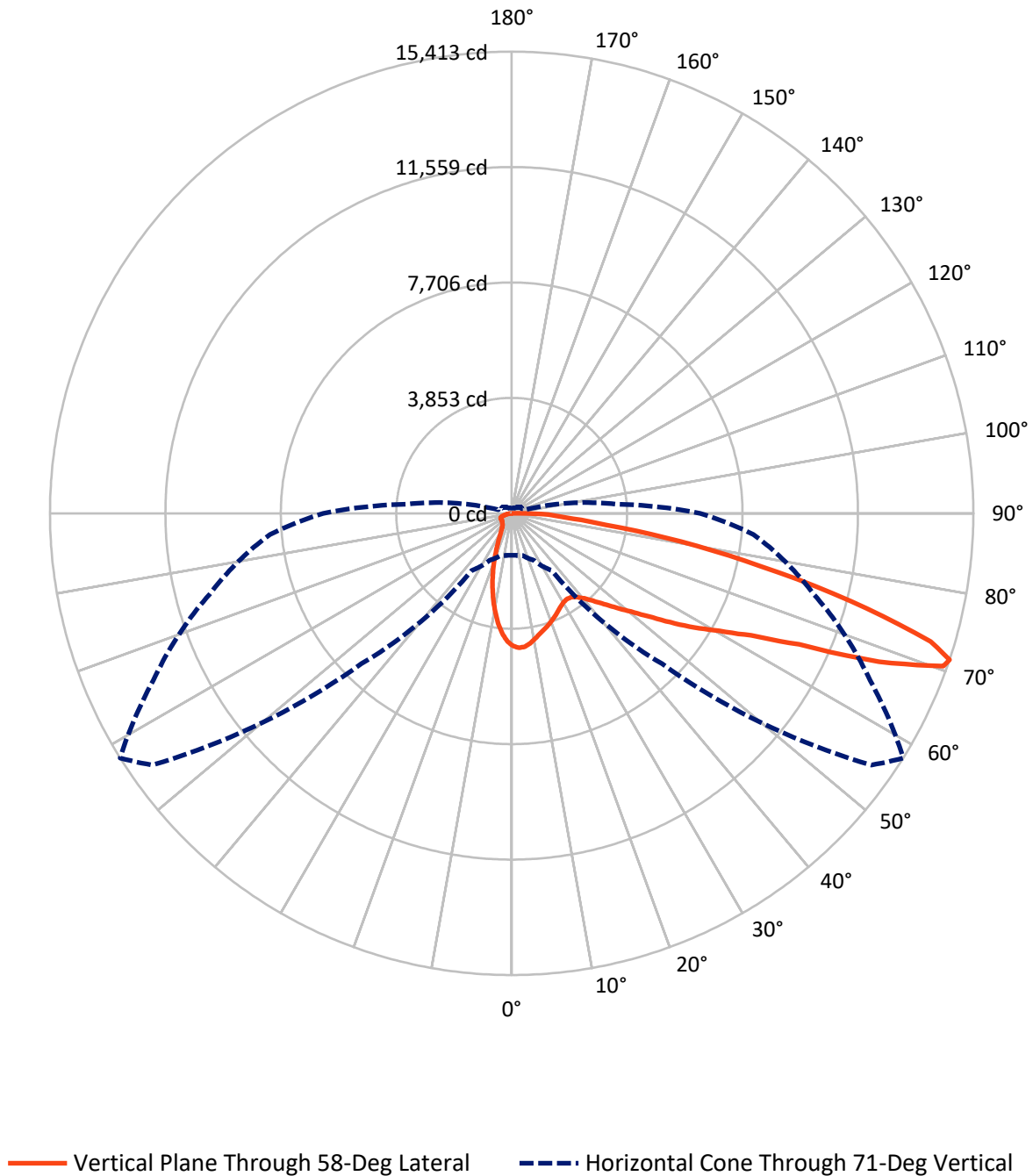
✕ Max cd  
 - - - 1/2 Max cd



Based on 25 foot mounting height. Maximum calculated value = 7.1 fc  
 Type III - Medium - N/A

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## Luminous Intensity Polar Plot



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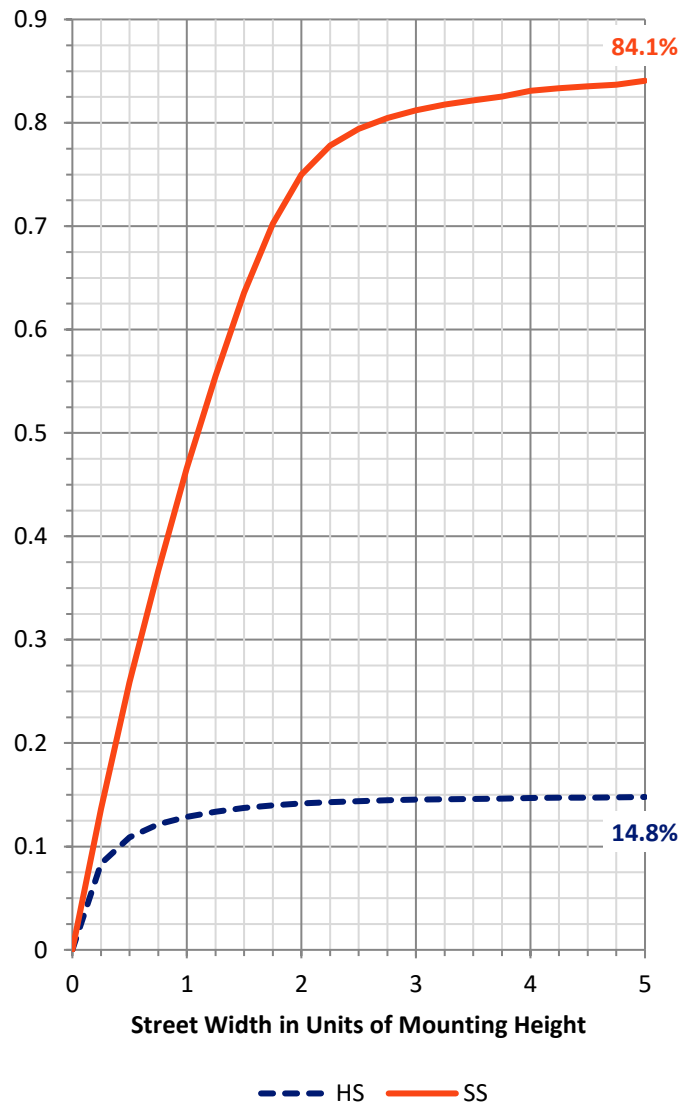
**FLUX DISTRIBUTION:**

|                    |           | Downward | Upward | Total   |
|--------------------|-----------|----------|--------|---------|
| <b>House Side</b>  | Lumens    | 2384.9   | 0.0    | 2384.9  |
|                    | % Fixture | 15.0     | 0.0    | 15.0    |
| <b>Street Side</b> | Lumens    | 13567.1  | 0.0    | 13567.1 |
|                    | % Fixture | 85.0     | 0.0    | 85.0    |
| <b>Total</b>       | Lumens    | 15952.0  | 0.0    | 15952.0 |
|                    | % Fixture | 100.0    | 0.0    | 100.0   |

**ZONAL LUMENS:**

| Zone      | Lumens  | % Fixture |
|-----------|---------|-----------|
| 0°-10°    | 381.3   | 2.4       |
| 10°-20°   | 847.8   | 5.3       |
| 20°-30°   | 1077.5  | 6.8       |
| 30°-40°   | 1372.6  | 8.6       |
| 40°-50°   | 1946.4  | 12.2      |
| 50°-60°   | 3012.1  | 18.9      |
| 60°-70°   | 4100.5  | 25.7      |
| 70°-80°   | 2735.5  | 17.1      |
| 80°-90°   | 478.3   | 3.0       |
| 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°    | 15952.0 | 100.0     |
| 0°-180°   | 15952.0 | 100.0     |

**Coefficient of Utilization**



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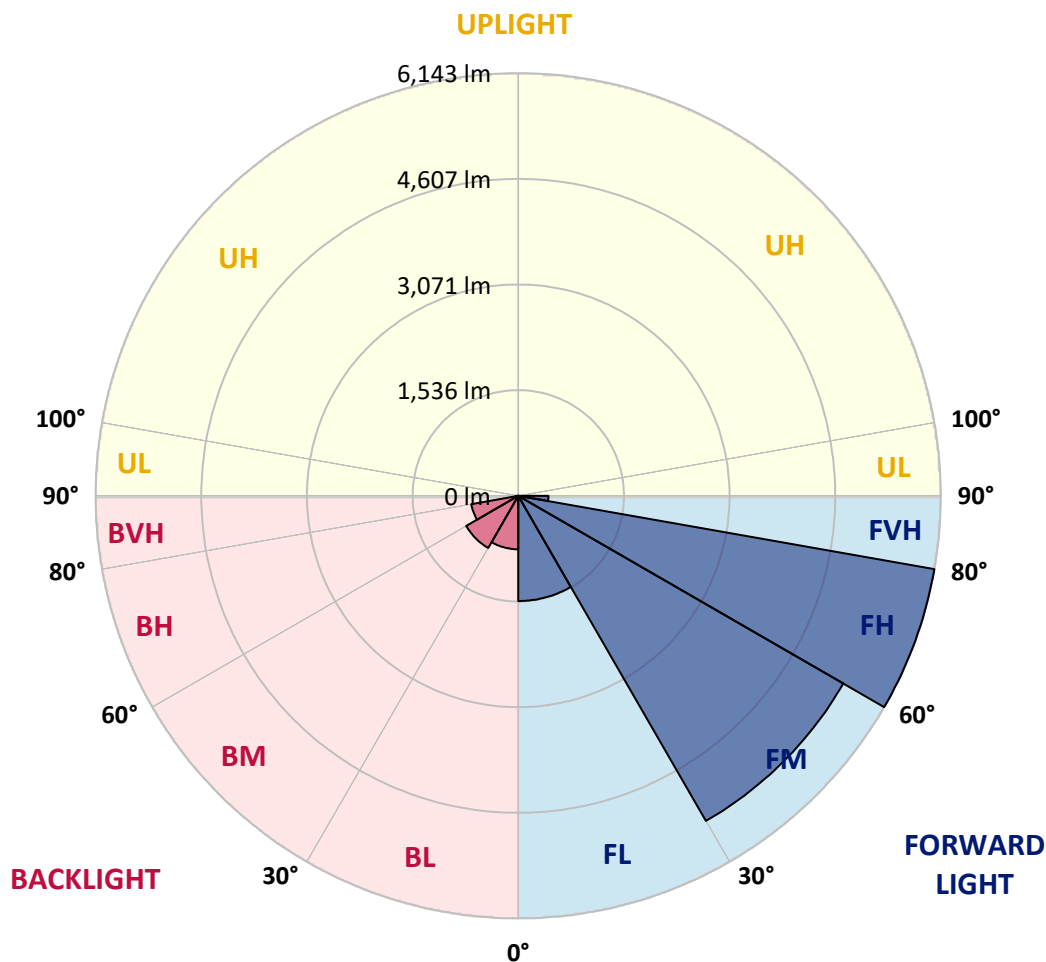
CATALOG NUMBER: NVN-SA4A-727-U-SL3

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

| Zone |             | Lumens | % Fixture | Zone Rating/Lumen Limit |      |         |
|------|-------------|--------|-----------|-------------------------|------|---------|
|      |             |        |           | B                       | U    | G       |
| FL   | (0°-30°)    | 1529.3 | 9.6       |                         |      |         |
| FM   | (30°-60°)   | 5456.4 | 34.2      |                         |      |         |
| FH   | (60°-80°)   | 6142.9 | 38.5      |                         |      | G3/7500 |
| FVH  | (80°-90°)   | 438.5  | 2.7       |                         |      | G3/500  |
| BL   | (0°-30°)    | 777.4  | 4.9       | B2/1000                 |      |         |
| BM   | (30°-60°)   | 874.6  | 5.5       | B1/1000                 |      |         |
| BH   | (60°-80°)   | 693.2  | 4.3       | B2/1000                 |      | G2/1000 |
| BVH  | (80°-90°)   | 39.7   | 0.2       |                         |      | G1/100  |
| UL   | (90°-100°)  | 0.0    | 0.0       |                         | U0/0 |         |
| UH   | (100°-180°) | 0.0    | 0.0       |                         | U0/0 |         |

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

Type III Medium



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**CANDELA DISTRIBUTION (FULL):**

|       | 0°     | 5°     | 15°    | 25°    | 35°    | 45°     | 55°     | 58°     | 65°     | 75°     | 85°    |
|-------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|--------|
| 0°    | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8  | 4419.8  | 4419.8  | 4419.8  | 4419.8  | 4419.8 |
| 2.5°  | 4537.0 | 4530.9 | 4533.1 | 4528.7 | 4518.1 | 4507.6  | 4492.0  | 4494.8  | 4473.1  | 4440.9  | 4400.9 |
| 5°    | 4451.4 | 4449.2 | 4465.9 | 4475.3 | 4483.1 | 4477.0  | 4472.6  | 4478.1  | 4446.4  | 4402.0  | 4332.5 |
| 7.5°  | 4272.0 | 4247.5 | 4268.6 | 4300.3 | 4330.3 | 4353.1  | 4383.1  | 4387.0  | 4367.0  | 4320.3  | 4229.2 |
| 10°   | 4016.9 | 3993.6 | 4024.7 | 4074.1 | 4134.2 | 4188.6  | 4249.2  | 4260.3  | 4264.2  | 4222.0  | 4111.4 |
| 12.5° | 3752.4 | 3734.6 | 3765.8 | 3835.2 | 3934.7 | 4018.6  | 4115.3  | 4131.9  | 4166.4  | 4138.0  | 4002.5 |
| 15°   | 3515.7 | 3509.0 | 3546.8 | 3615.2 | 3729.6 | 3858.0  | 3997.5  | 4028.0  | 4086.4  | 4076.9  | 3917.4 |
| 17.5° | 3311.2 | 3309.5 | 3338.4 | 3410.1 | 3536.8 | 3699.1  | 3880.2  | 3931.9  | 4018.6  | 4029.7  | 3847.4 |
| 20°   | 3159.0 | 3155.6 | 3175.6 | 3228.4 | 3359.0 | 3542.9  | 3753.5  | 3824.7  | 3949.7  | 3988.6  | 3775.2 |
| 22.5° | 3077.3 | 3076.7 | 3077.3 | 3102.3 | 3209.0 | 3380.1  | 3630.2  | 3716.9  | 3882.4  | 3955.8  | 3695.2 |
| 25°   | 3063.4 | 3061.7 | 3049.5 | 3046.7 | 3107.3 | 3244.0  | 3507.9  | 3603.5  | 3818.5  | 3933.0  | 3619.1 |
| 27.5° | 3099.5 | 3101.7 | 3085.6 | 3059.5 | 3071.7 | 3154.5  | 3401.8  | 3504.0  | 3767.4  | 3928.6  | 3566.3 |
| 30°   | 3174.5 | 3173.4 | 3159.5 | 3132.3 | 3108.4 | 3121.2  | 3326.2  | 3428.5  | 3733.0  | 3948.0  | 3530.1 |
| 32.5° | 3257.3 | 3263.4 | 3260.7 | 3245.6 | 3210.1 | 3159.0  | 3303.4  | 3403.5  | 3723.0  | 3994.7  | 3514.6 |
| 35°   | 3356.8 | 3363.4 | 3383.5 | 3395.1 | 3353.4 | 3271.2  | 3352.3  | 3439.0  | 3751.9  | 4082.5  | 3539.6 |
| 37.5° | 3451.2 | 3468.5 | 3524.6 | 3574.0 | 3538.5 | 3446.8  | 3482.4  | 3544.0  | 3841.3  | 4220.8  | 3606.8 |
| 40°   | 3560.2 | 3575.2 | 3666.8 | 3771.9 | 3766.3 | 3671.3  | 3691.8  | 3733.0  | 3999.1  | 4419.2  | 3728.5 |
| 42.5° | 3667.4 | 3697.4 | 3830.2 | 3979.1 | 4021.9 | 3938.0  | 3970.8  | 3992.5  | 4221.4  | 4682.0  | 3940.8 |
| 45°   | 3810.2 | 3842.4 | 4026.9 | 4206.4 | 4306.4 | 4259.2  | 4311.4  | 4319.8  | 4500.9  | 5039.9  | 4249.2 |
| 47.5° | 4026.4 | 4063.0 | 4278.1 | 4466.4 | 4619.3 | 4624.3  | 4710.4  | 4707.0  | 4849.9  | 5449.4  | 4637.6 |
| 50°   | 4363.1 | 4415.9 | 4592.0 | 4768.2 | 4953.8 | 5057.1  | 5172.1  | 5156.0  | 5268.3  | 5885.6  | 5084.9 |
| 52.5° | 4804.3 | 4828.7 | 4959.3 | 5089.3 | 5319.9 | 5551.7  | 5716.7  | 5702.2  | 5742.8  | 6334.0  | 5592.8 |
| 55°   | 5261.6 | 5279.9 | 5333.8 | 5405.0 | 5715.0 | 6092.9  | 6441.8  | 6419.1  | 6316.3  | 6799.7  | 6094.5 |
| 57.5° | 5672.8 | 5710.0 | 5747.3 | 5776.7 | 6112.9 | 6658.6  | 7183.7  | 7185.3  | 6938.6  | 7302.0  | 6613.0 |
| 60°   | 5736.7 | 5769.5 | 6015.6 | 6247.9 | 6793.6 | 7413.1  | 7977.7  | 7961.0  | 7582.6  | 7847.1  | 7190.9 |
| 62.5° | 5071.0 | 5144.9 | 5556.1 | 6174.0 | 7449.3 | 8793.4  | 8990.7  | 8970.1  | 8352.8  | 8518.9  | 7863.8 |
| 65°   | 3634.1 | 3718.0 | 4214.2 | 5142.7 | 7131.4 | 10314.3 | 10818.8 | 10542.1 | 9403.0  | 9345.2  | 8651.7 |
| 67.5° | 2096.5 | 2116.5 | 2331.6 | 3077.3 | 5430.0 | 10393.7 | 13607.7 | 13220.4 | 11033.9 | 10282.6 | 9037.4 |
| 70°   | 1550.3 | 1549.8 | 1600.9 | 1893.7 | 2938.4 | 8482.8  | 14934.1 | 15281.4 | 12750.9 | 10591.0 | 8492.2 |
| 71°   | 1401.9 | 1403.6 | 1460.8 | 1723.7 | 2327.1 | 7100.3  | 14652.4 | 15412.5 | 13203.2 | 10438.7 | 8097.7 |
| 72.5° | 1199.1 | 1204.7 | 1284.1 | 1545.9 | 1957.6 | 4896.5  | 13438.8 | 14625.7 | 13417.7 | 10063.1 | 7480.4 |
| 75°   | 909.6  | 922.4  | 1032.4 | 1303.0 | 1789.2 | 2483.3  | 9863.1  | 11679.0 | 11919.6 | 8879.5  | 5558.3 |
| 77.5° | 649.0  | 663.5  | 787.9  | 1095.8 | 1700.9 | 1871.5  | 6605.2  | 8518.9  | 8771.7  | 5690.6  | 2507.2 |
| 80°   | 410.1  | 427.3  | 521.2  | 871.8  | 1598.1 | 1777.0  | 4150.8  | 5726.1  | 4783.2  | 1820.9  | 637.9  |
| 82.5° | 240.6  | 253.9  | 323.4  | 569.6  | 1305.3 | 1711.5  | 2442.2  | 3174.0  | 1861.5  | 550.1   | 290.1  |
| 85°   | 139.5  | 145.6  | 201.7  | 362.9  | 948.0  | 1615.3  | 1794.2  | 1774.2  | 807.9   | 268.9   | 137.2  |
| 87.5° | 65.0   | 72.2   | 119.5  | 189.5  | 526.2  | 1170.8  | 1418.1  | 1225.2  | 502.3   | 126.1   | 64.5   |
| 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: P361856

CATALOG NUMBER: NVN-SA4A-727-U-SL3

**CANDELA DISTRIBUTION (continued):**

|       | 90°    | 95°    | 105°   | 115°   | 125°   | 135°   | 145°   | 155°   | 165°   | 175°   | 180°   |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0°    | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 | 4419.8 |
| 2.5°  | 4381.4 | 4372.0 | 4332.5 | 4297.5 | 4260.8 | 4213.1 | 4160.3 | 4153.6 | 4121.4 | 4127.5 | 4116.4 |
| 5°    | 4294.7 | 4270.9 | 4175.8 | 4089.7 | 3988.0 | 3896.9 | 3798.0 | 3752.4 | 3686.8 | 3682.4 | 3665.7 |
| 7.5°  | 4170.8 | 4126.4 | 3979.1 | 3815.8 | 3652.4 | 3496.8 | 3342.9 | 3241.8 | 3138.4 | 3094.5 | 3090.6 |
| 10°   | 4031.4 | 3955.8 | 3739.1 | 3497.4 | 3261.8 | 3034.5 | 2814.5 | 2651.6 | 2504.9 | 2435.5 | 2432.7 |
| 12.5° | 3899.1 | 3787.4 | 3490.1 | 3161.2 | 2838.9 | 2544.4 | 2242.7 | 2028.7 | 1844.8 | 1783.1 | 1757.0 |
| 15°   | 3786.9 | 3629.6 | 3247.9 | 2827.2 | 2436.0 | 2027.1 | 1683.7 | 1458.6 | 1288.6 | 1229.7 | 1218.6 |
| 17.5° | 3678.0 | 3475.7 | 2999.5 | 2489.9 | 2017.1 | 1567.5 | 1223.6 | 1056.3 | 965.7  | 941.9  | 941.3  |
| 20°   | 3569.6 | 3317.3 | 2740.0 | 2144.9 | 1612.0 | 1172.5 | 940.7  | 865.7  | 835.2  | 832.4  | 827.9  |
| 22.5° | 3446.8 | 3149.5 | 2467.2 | 1798.7 | 1258.0 | 921.9  | 799.6  | 769.6  | 765.7  | 775.7  | 775.7  |
| 25°   | 3331.8 | 2982.8 | 2190.4 | 1459.7 | 978.5  | 769.0  | 714.0  | 707.9  | 718.5  | 736.3  | 737.9  |
| 27.5° | 3224.5 | 2822.2 | 1920.4 | 1158.6 | 784.0  | 677.4  | 654.6  | 661.8  | 680.7  | 701.3  | 701.8  |
| 30°   | 3136.2 | 2670.5 | 1658.1 | 913.0  | 662.4  | 609.0  | 605.1  | 619.6  | 640.1  | 656.2  | 660.1  |
| 32.5° | 3067.8 | 2541.1 | 1404.7 | 734.0  | 582.9  | 557.9  | 561.2  | 573.4  | 586.2  | 595.1  | 601.2  |
| 35°   | 3036.2 | 2429.9 | 1170.8 | 619.0  | 532.3  | 518.4  | 522.9  | 529.6  | 535.1  | 541.8  | 546.8  |
| 37.5° | 3041.7 | 2343.8 | 961.9  | 547.3  | 498.4  | 491.2  | 491.2  | 491.2  | 491.2  | 494.5  | 495.1  |
| 40°   | 3093.4 | 2294.3 | 791.8  | 501.8  | 475.7  | 467.9  | 461.8  | 456.2  | 451.8  | 454.0  | 452.9  |
| 42.5° | 3225.6 | 2289.9 | 667.4  | 472.9  | 457.3  | 444.5  | 432.3  | 424.5  | 419.0  | 421.2  | 422.3  |
| 45°   | 3450.1 | 2345.5 | 583.4  | 452.3  | 440.1  | 420.6  | 405.1  | 396.7  | 392.9  | 400.1  | 401.2  |
| 47.5° | 3740.7 | 2466.6 | 532.3  | 437.3  | 424.0  | 398.4  | 381.7  | 374.0  | 375.1  | 385.6  | 388.4  |
| 50°   | 4115.3 | 2663.3 | 507.9  | 427.9  | 412.9  | 379.5  | 362.3  | 355.6  | 359.0  | 374.0  | 377.3  |
| 52.5° | 4526.5 | 2946.7 | 510.7  | 425.1  | 405.6  | 365.6  | 347.3  | 339.5  | 345.1  | 359.0  | 361.7  |
| 55°   | 5001.0 | 3287.3 | 556.8  | 429.0  | 395.1  | 356.7  | 335.1  | 321.7  | 326.2  | 339.0  | 341.2  |
| 57.5° | 5528.3 | 3677.4 | 649.6  | 427.9  | 381.7  | 348.4  | 322.3  | 302.3  | 305.6  | 313.4  | 315.6  |
| 60°   | 6077.3 | 4148.6 | 793.5  | 431.2  | 375.6  | 338.4  | 305.1  | 280.1  | 278.9  | 285.6  | 286.7  |
| 62.5° | 6736.3 | 4693.7 | 958.0  | 433.4  | 379.5  | 325.6  | 282.3  | 257.8  | 254.5  | 256.2  | 257.3  |
| 65°   | 7415.4 | 5088.2 | 896.3  | 424.5  | 391.7  | 315.1  | 262.3  | 236.2  | 230.0  | 228.9  | 229.5  |
| 67.5° | 7436.5 | 4665.4 | 628.5  | 406.7  | 396.7  | 309.5  | 247.3  | 217.8  | 207.8  | 203.9  | 203.4  |
| 70°   | 6669.1 | 3790.2 | 489.5  | 387.9  | 376.7  | 300.6  | 233.4  | 202.8  | 187.8  | 181.7  | 181.1  |
| 71°   | 6294.6 | 3489.0 | 464.0  | 378.4  | 361.7  | 291.7  | 227.3  | 196.2  | 180.6  | 173.9  | 172.8  |
| 72.5° | 5707.2 | 3127.8 | 432.9  | 363.4  | 332.8  | 268.9  | 215.6  | 186.7  | 170.6  | 162.8  | 161.1  |
| 75°   | 4095.8 | 2045.4 | 371.7  | 324.0  | 275.6  | 214.5  | 188.9  | 167.8  | 153.9  | 144.5  | 143.4  |
| 77.5° | 1578.1 | 814.1  | 281.2  | 269.5  | 211.2  | 167.8  | 155.6  | 145.0  | 135.0  | 125.6  | 125.0  |
| 80°   | 487.9  | 364.0  | 205.0  | 202.8  | 152.8  | 125.0  | 121.1  | 118.4  | 114.5  | 104.5  | 102.2  |
| 82.5° | 260.6  | 208.9  | 141.1  | 131.1  | 100.0  | 83.3   | 87.8   | 88.9   | 89.5   | 78.9   | 77.8   |
| 85°   | 124.5  | 110.6  | 79.5   | 74.5   | 58.3   | 46.7   | 53.9   | 58.3   | 58.9   | 48.3   | 45.0   |
| 87.5° | 59.5   | 57.8   | 37.2   | 28.3   | 21.7   | 15.6   | 18.9   | 23.3   | 25.6   | 18.3   | 16.1   |
| 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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LM-79-2008: Approved Method: Electrical and Photometric Measurements of Solid-  
State Lighting Products

Report Prepared for

Cooper Lighting Solutions

McGRAW-EDISON

Report Number: SP1-1908-441-1-R4

Test Date: 08/20/2019

Luminaire Tested: SA1C-727-U-5WQ

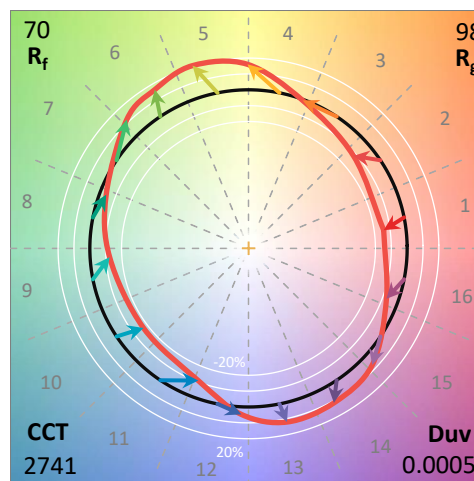
### Test Information

Test Method: LM-79-2008  
 Report Number: SP1-1908-441-1-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-727-U-5WQ**  
 Description: MCGRAW EDISON ROADWAY AND AREA LUMINAIRE

\*\*\*THIS IS A REVISION OF SP1-1908-441-1-R3. TO UPDATE THE CATALOG NUMBER.\*\*\*TESTED IN SITU. (1) 70 CRI, 2700K, 1050MA LIGHTSQUARE WITH 16 LEDS AND TYPE V WIDE OPTICS.

### Spectral Parameters

|                           |        |           |      |      |       |
|---------------------------|--------|-----------|------|------|-------|
| CCT (K):                  | 2741   | CRI (Ra): | 71.5 |      |       |
| CIE u':                   | 0.2605 | R1:       | 69.2 | R9:  | -16.1 |
| CIE v':                   | 0.5272 | R2:       | 79.4 | R10: | 51.4  |
| Duv:                      | 0.0005 | R3:       | 87.8 | R11: | 63.1  |
| CIE x:                    | 0.4573 | R4:       | 69.4 | R12: | 42.0  |
| CIE y:                    | 0.4113 | R5:       | 66.4 | R13: | 70.2  |
| CIE z:                    | 0.1313 | R6:       | 69.8 | R14: | 92.4  |
| Peak Wavelength (nm):     | 602    | R7:       | 79.8 |      |       |
| Dominant Wavelength (nm): | 583    | R8:       | 50.1 |      |       |
| Purity:                   | 61.2   |           |      |      |       |
| Rf:                       | 69.9   |           |      |      |       |
| Rg:                       | 98.3   |           |      |      |       |



### Test Conditions

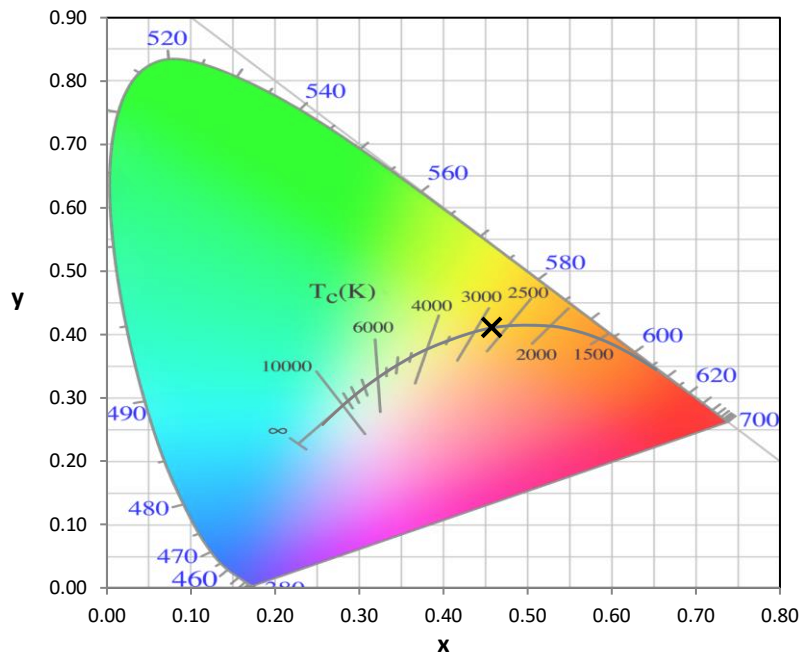
Stabilization Time: 56M  
 Operation Time: 12H  
 Room Temperature (°C) / RH%: 25.3./42%  
 Sphere Temperature (°C): 25.7

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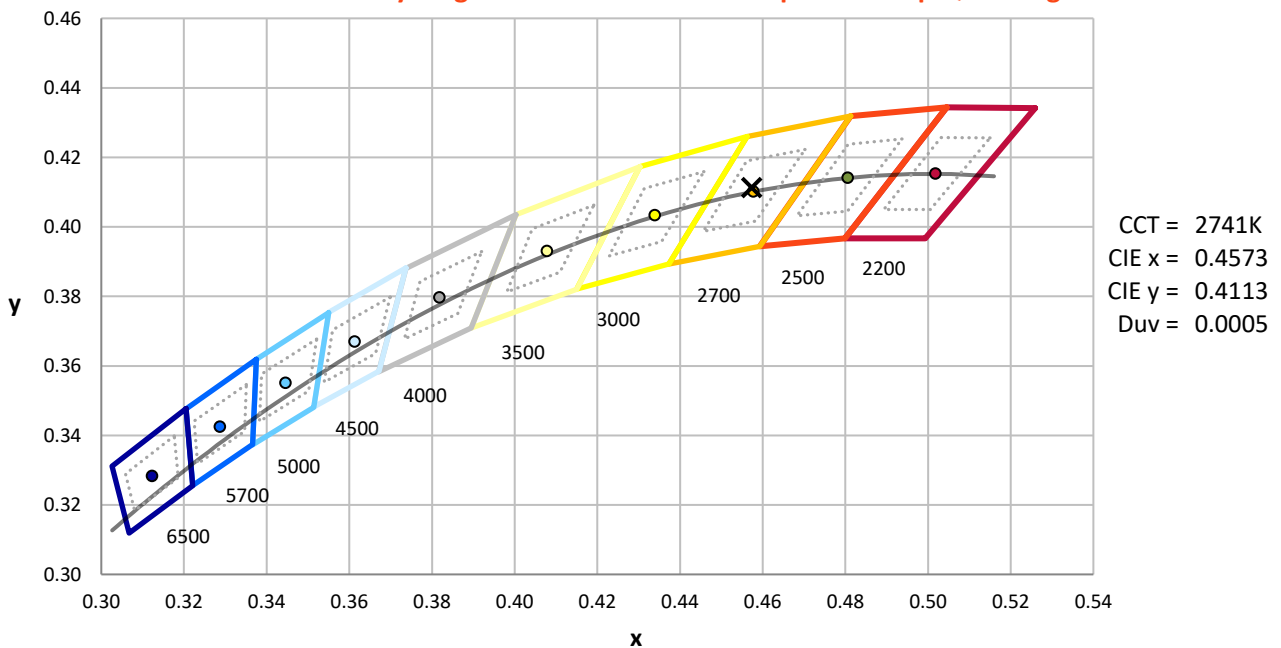
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date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



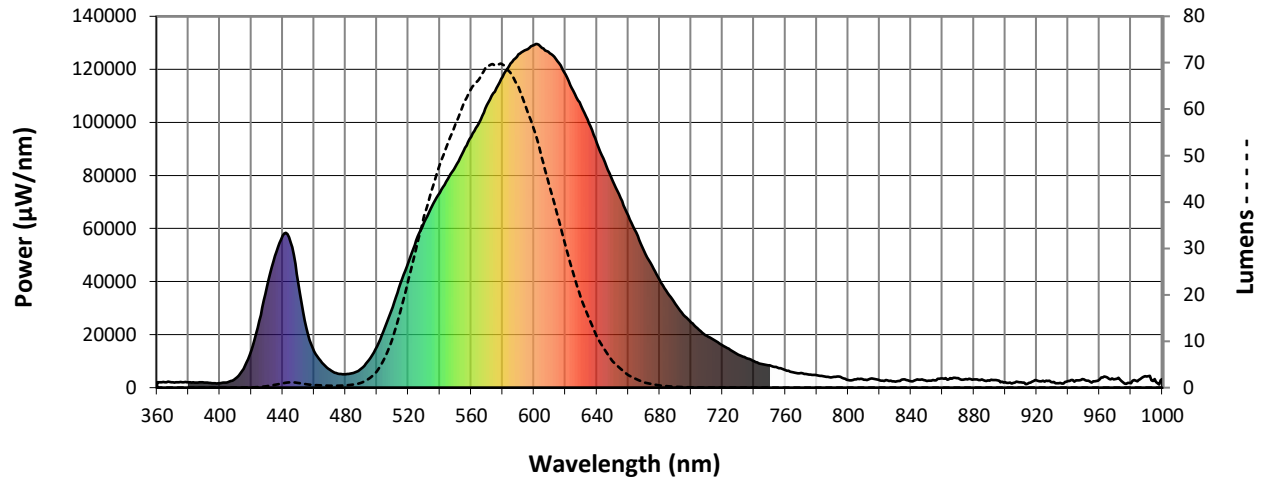
CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles



Point lies inside the ANSI 2700K 4-step quadrangle

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**Photopic Flux vs. Wavelength**

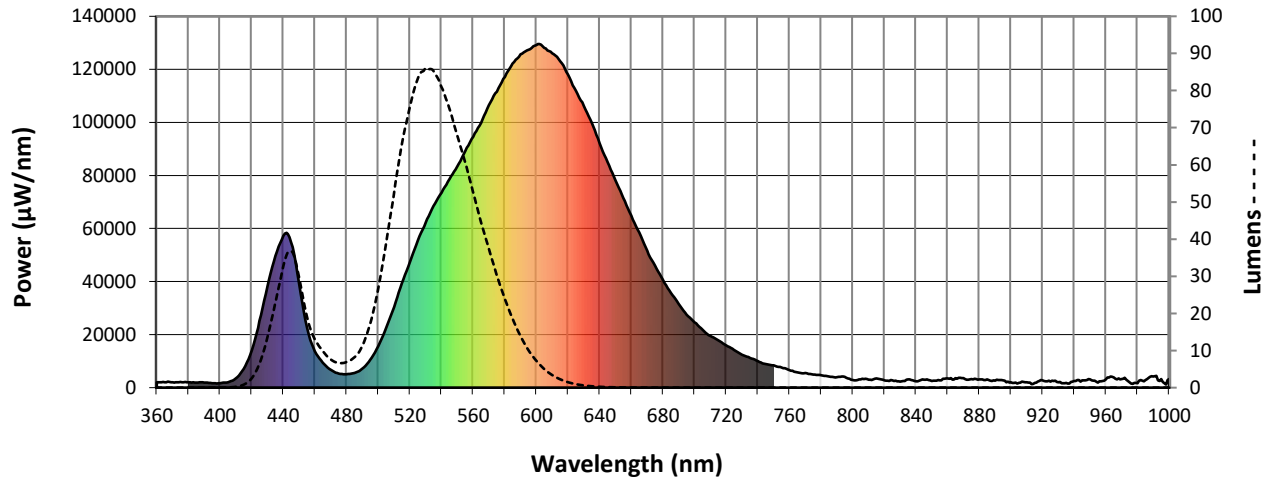


**Photopic Lumens: 6211.7**

| 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       | 2044             | 0.0              | 490       | 7179             | 1.0              | 620       | 118034           | 30.7             | 750       | 8362             | 0.0              | 880       | 3128             | 0.0              |
| 365       | 2016             | 0.0              | 495       | 10476            | 1.9              | 625       | 111884           | 24.7             | 755       | 7635             | 0.0              | 885       | 3110             | 0.0              |
| 370       | 2020             | 0.0              | 500       | 15549            | 3.4              | 630       | 106119           | 19.2             | 760       | 6582             | 0.0              | 890       | 2632             | 0.0              |
| 375       | 2137             | 0.0              | 505       | 22477            | 6.3              | 635       | 99706            | 15.0             | 765       | 5777             | 0.0              | 895       | 2709             | 0.0              |
| 380       | 2046             | 0.0              | 510       | 30417            | 10.4             | 640       | 92142            | 11.0             | 770       | 5474             | 0.0              | 900       | 2016             | 0.0              |
| 385       | 1925             | 0.0              | 515       | 39274            | 16.3             | 645       | 84987            | 8.2              | 775       | 4977             | 0.0              | 905       | 1748             | 0.0              |
| 390       | 1893             | 0.0              | 520       | 47282            | 22.9             | 650       | 78016            | 5.7              | 780       | 4723             | 0.0              | 910       | 2046             | 0.0              |
| 395       | 1695             | 0.0              | 525       | 55413            | 29.7             | 655       | 71541            | 4.1              | 785       | 4219             | 0.0              | 915       | 1844             | 0.0              |
| 400       | 1633             | 0.0              | 530       | 62377            | 36.7             | 660       | 64863            | 2.7              | 790       | 3969             | 0.0              | 920       | 2734             | 0.0              |
| 405       | 2065             | 0.0              | 535       | 68520            | 42.5             | 665       | 58485            | 1.9              | 795       | 4122             | 0.0              | 925       | 2307             | 0.0              |
| 410       | 3449             | 0.0              | 540       | 73435            | 47.8             | 670       | 51641            | 1.1              | 800       | 2864             | 0.0              | 930       | 2039             | 0.0              |
| 415       | 7117             | 0.0              | 545       | 78677            | 52.4             | 675       | 46030            | 0.8              | 805       | 3151             | 0.0              | 935       | 1784             | 0.0              |
| 420       | 13992            | 0.0              | 550       | 83331            | 56.6             | 680       | 40590            | 0.5              | 810       | 3022             | 0.0              | 940       | 2464             | 0.0              |
| 425       | 25176            | 0.1              | 555       | 89120            | 60.9             | 685       | 35691            | 0.3              | 815       | 3471             | 0.0              | 945       | 2794             | 0.0              |
| 430       | 38151            | 0.3              | 560       | 94613            | 64.3             | 690       | 31631            | 0.2              | 820       | 2749             | 0.0              | 950       | 3090             | 0.0              |
| 435       | 49673            | 0.6              | 565       | 99818            | 66.4             | 695       | 27437            | 0.1              | 825       | 2729             | 0.0              | 955       | 1866             | 0.0              |
| 440       | 57273            | 0.9              | 570       | 106526           | 69.3             | 700       | 24589            | 0.1              | 830       | 2282             | 0.0              | 960       | 3110             | 0.0              |
| 445       | 54802            | 1.1              | 575       | 111610           | 69.4             | 705       | 21832            | 0.0              | 835       | 3140             | 0.0              | 965       | 3880             | 0.0              |
| 450       | 39184            | 1.0              | 580       | 117163           | 69.6             | 710       | 19500            | 0.0              | 840       | 2365             | 0.0              | 970       | 3243             | 0.0              |
| 455       | 22506            | 0.8              | 585       | 122201           | 67.9             | 715       | 17870            | 0.0              | 845       | 3024             | 0.0              | 975       | 2014             | 0.0              |
| 460       | 13692            | 0.6              | 590       | 125662           | 65.0             | 720       | 15924            | 0.0              | 850       | 2510             | 0.0              | 980       | 1688             | 0.0              |
| 465       | 9446             | 0.5              | 595       | 127415           | 60.4             | 725       | 14268            | 0.0              | 855       | 2739             | 0.0              | 985       | 2827             | 0.0              |
| 470       | 6698             | 0.4              | 600       | 129155           | 55.7             | 730       | 12438            | 0.0              | 860       | 3515             | 0.0              | 990       | 4172             | 0.0              |
| 475       | 5328             | 0.4              | 605       | 128057           | 49.6             | 735       | 11255            | 0.0              | 865       | 3600             | 0.0              | 995       | 3177             | 0.0              |
| 480       | 5081             | 0.5              | 610       | 126031           | 43.3             | 740       | 9951             | 0.0              | 870       | 3609             | 0.0              | 1000      | 3241             | 0.0              |
| 485       | 5579             | 0.7              | 615       | 123059           | 37.1             | 745       | 8870             | 0.0              | 875       | 3208             | 0.0              |           |                  |                  |

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Scotopic Flux vs. Wavelength



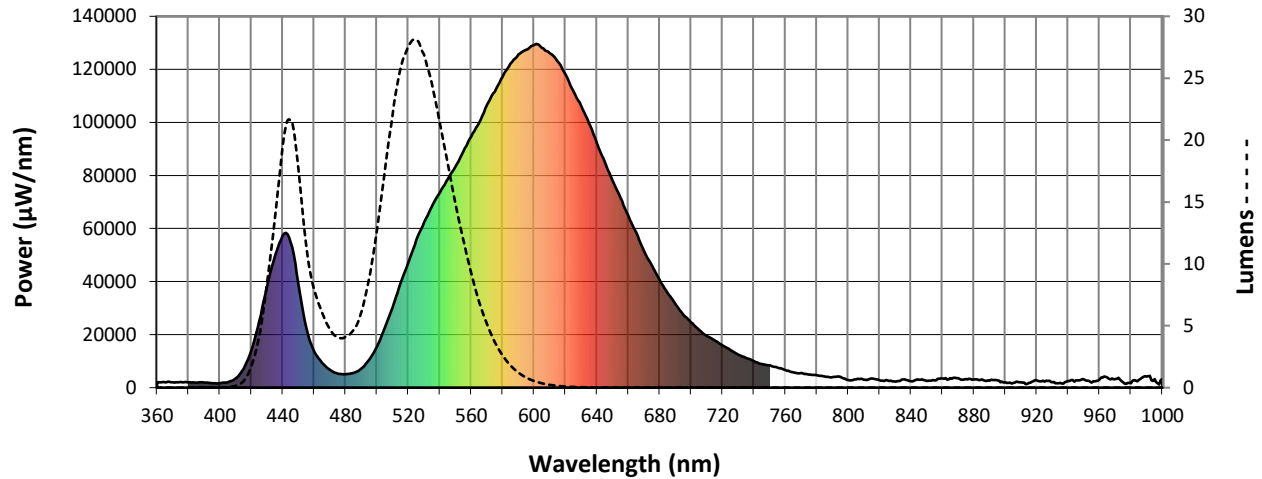
Scotopic Lumens: 6474.3

S/P: 1.04

| 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       | 2044             | 0.0              | 490       | 7179             | 6.0              | 620       | 118034           | 0.1              | 750       | 8362             | 0.0              | 880       | 3128             | 0.0              |
| 365       | 2016             | 0.0              | 495       | 10476            | 8.6              | 625       | 111884           | 0.1              | 755       | 7635             | 0.0              | 885       | 3110             | 0.0              |
| 370       | 2020             | 0.0              | 500       | 15549            | 12.5             | 630       | 106119           | 0.0              | 760       | 6582             | 0.0              | 890       | 2632             | 0.0              |
| 375       | 2137             | 0.0              | 505       | 22477            | 17.3             | 635       | 99706            | 0.0              | 765       | 5777             | 0.0              | 895       | 2709             | 0.0              |
| 380       | 2046             | 0.0              | 510       | 30417            | 21.8             | 640       | 92142            | 0.0              | 770       | 5474             | 0.0              | 900       | 2016             | 0.0              |
| 385       | 1925             | 0.0              | 515       | 39274            | 25.7             | 645       | 84987            | 0.0              | 775       | 4977             | 0.0              | 905       | 1748             | 0.0              |
| 390       | 1893             | 0.0              | 520       | 47282            | 27.5             | 650       | 78016            | 0.0              | 780       | 4723             | 0.0              | 910       | 2046             | 0.0              |
| 395       | 1695             | 0.0              | 525       | 55413            | 28.1             | 655       | 71541            | 0.0              | 785       | 4219             | 0.0              | 915       | 1844             | 0.0              |
| 400       | 1633             | 0.0              | 530       | 62377            | 27.0             | 660       | 64863            | 0.0              | 790       | 3969             | 0.0              | 920       | 2734             | 0.0              |
| 405       | 2065             | 0.0              | 535       | 68520            | 24.7             | 665       | 58485            | 0.0              | 795       | 4122             | 0.0              | 925       | 2307             | 0.0              |
| 410       | 3449             | 0.1              | 540       | 73435            | 21.5             | 670       | 51641            | 0.0              | 800       | 2864             | 0.0              | 930       | 2039             | 0.0              |
| 415       | 7117             | 0.5              | 545       | 78677            | 18.3             | 675       | 46030            | 0.0              | 805       | 3151             | 0.0              | 935       | 1784             | 0.0              |
| 420       | 13992            | 1.6              | 550       | 83331            | 15.0             | 680       | 40590            | 0.0              | 810       | 3022             | 0.0              | 940       | 2464             | 0.0              |
| 425       | 25176            | 3.9              | 555       | 89120            | 12.0             | 685       | 35691            | 0.0              | 815       | 3471             | 0.0              | 945       | 2794             | 0.0              |
| 430       | 38151            | 8.1              | 560       | 94613            | 9.3              | 690       | 31631            | 0.0              | 820       | 2749             | 0.0              | 950       | 3090             | 0.0              |
| 435       | 49673            | 13.3             | 565       | 99818            | 7.0              | 695       | 27437            | 0.0              | 825       | 2729             | 0.0              | 955       | 1866             | 0.0              |
| 440       | 57273            | 19.1             | 570       | 106526           | 5.2              | 700       | 24589            | 0.0              | 830       | 2282             | 0.0              | 960       | 3110             | 0.0              |
| 445       | 54802            | 21.6             | 575       | 111610           | 3.7              | 705       | 21832            | 0.0              | 835       | 3140             | 0.0              | 965       | 3880             | 0.0              |
| 450       | 39184            | 18.1             | 580       | 117163           | 2.6              | 710       | 19500            | 0.0              | 840       | 2365             | 0.0              | 970       | 3243             | 0.0              |
| 455       | 22506            | 11.8             | 585       | 122201           | 1.8              | 715       | 17870            | 0.0              | 845       | 3024             | 0.0              | 975       | 2014             | 0.0              |
| 460       | 13692            | 8.1              | 590       | 125662           | 1.2              | 720       | 15924            | 0.0              | 850       | 2510             | 0.0              | 980       | 1688             | 0.0              |
| 465       | 9446             | 6.2              | 595       | 127415           | 0.8              | 725       | 14268            | 0.0              | 855       | 2739             | 0.0              | 985       | 2827             | 0.0              |
| 470       | 6698             | 4.8              | 600       | 129155           | 0.5              | 730       | 12438            | 0.0              | 860       | 3515             | 0.0              | 990       | 4172             | 0.0              |
| 475       | 5328             | 4.1              | 605       | 128057           | 0.4              | 735       | 11255            | 0.0              | 865       | 3600             | 0.0              | 995       | 3177             | 0.0              |
| 480       | 5081             | 4.1              | 610       | 126031           | 0.2              | 740       | 9951             | 0.0              | 870       | 3609             | 0.0              | 1000      | 3241             | 0.0              |
| 485       | 5579             | 4.6              | 615       | 123059           | 0.1              | 745       | 8870             | 0.0              | 875       | 3208             | 0.0              |           |                  |                  |

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**Melanopic Flux vs. Wavelength**



**Melanopic Lumens: 2145.7 M/P: 0.35**

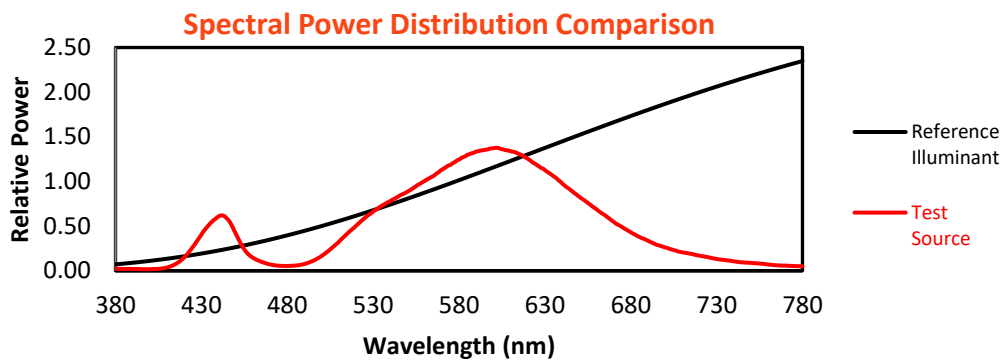
| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 360       | 2044             | 0.0              | 490       | 7179             | 11.1             | 620       | 118034           | 1.5              | 750       | 8362             | 0.0              | 880       | 3128             | 0.0              |
| 365       | 2016             | 0.0              | 495       | 10476            | 16.9             | 625       | 111884           | 0.9              | 755       | 7635             | 0.0              | 885       | 3110             | 0.0              |
| 370       | 2020             | 0.0              | 500       | 15549            | 26.0             | 630       | 106119           | 0.6              | 760       | 6582             | 0.0              | 890       | 2632             | 0.0              |
| 375       | 2137             | 0.0              | 505       | 22477            | 38.2             | 635       | 99706            | 0.4              | 765       | 5777             | 0.0              | 895       | 2709             | 0.0              |
| 380       | 2046             | 0.0              | 510       | 30417            | 51.6             | 640       | 92142            | 0.2              | 770       | 5474             | 0.0              | 900       | 2016             | 0.0              |
| 385       | 1925             | 0.0              | 515       | 39274            | 65.1             | 645       | 84987            | 0.1              | 775       | 4977             | 0.0              | 905       | 1748             | 0.0              |
| 390       | 1893             | 0.0              | 520       | 47282            | 75.2             | 650       | 78016            | 0.1              | 780       | 4723             | 0.0              | 910       | 2046             | 0.0              |
| 395       | 1695             | 0.0              | 525       | 55413            | 82.9             | 655       | 71541            | 0.1              | 785       | 4219             | 0.0              | 915       | 1844             | 0.0              |
| 400       | 1633             | 0.0              | 530       | 62377            | 86.0             | 660       | 64863            | 0.0              | 790       | 3969             | 0.0              | 920       | 2734             | 0.0              |
| 405       | 2065             | 0.1              | 535       | 68520            | 85.4             | 665       | 58485            | 0.0              | 795       | 4122             | 0.0              | 925       | 2307             | 0.0              |
| 410       | 3449             | 0.2              | 540       | 73435            | 81.1             | 670       | 51641            | 0.0              | 800       | 2864             | 0.0              | 930       | 2039             | 0.0              |
| 415       | 7117             | 0.7              | 545       | 78677            | 75.4             | 675       | 46030            | 0.0              | 805       | 3151             | 0.0              | 935       | 1784             | 0.0              |
| 420       | 13992            | 2.3              | 550       | 83331            | 68.1             | 680       | 40590            | 0.0              | 810       | 3022             | 0.0              | 940       | 2464             | 0.0              |
| 425       | 25176            | 6.2              | 555       | 89120            | 60.9             | 685       | 35691            | 0.0              | 815       | 3471             | 0.0              | 945       | 2794             | 0.0              |
| 430       | 38151            | 13.0             | 560       | 94613            | 52.9             | 690       | 31631            | 0.0              | 820       | 2749             | 0.0              | 950       | 3090             | 0.0              |
| 435       | 49673            | 22.2             | 565       | 99818            | 44.8             | 695       | 27437            | 0.0              | 825       | 2729             | 0.0              | 955       | 1866             | 0.0              |
| 440       | 57273            | 32.0             | 570       | 106526           | 37.6             | 700       | 24589            | 0.0              | 830       | 2282             | 0.0              | 960       | 3110             | 0.0              |
| 445       | 54802            | 36.7             | 575       | 111610           | 30.4             | 705       | 21832            | 0.0              | 835       | 3140             | 0.0              | 965       | 3880             | 0.0              |
| 450       | 39184            | 30.4             | 580       | 117163           | 24.1             | 710       | 19500            | 0.0              | 840       | 2365             | 0.0              | 970       | 3243             | 0.0              |
| 455       | 22506            | 19.7             | 585       | 122201           | 18.7             | 715       | 17870            | 0.0              | 845       | 3024             | 0.0              | 975       | 2014             | 0.0              |
| 460       | 13692            | 13.2             | 590       | 125662           | 14.0             | 720       | 15924            | 0.0              | 850       | 2510             | 0.0              | 980       | 1688             | 0.0              |
| 465       | 9446             | 10.0             | 595       | 127415           | 10.2             | 725       | 14268            | 0.0              | 855       | 2739             | 0.0              | 985       | 2827             | 0.0              |
| 470       | 6698             | 7.7              | 600       | 129155           | 7.3              | 730       | 12438            | 0.0              | 860       | 3515             | 0.0              | 990       | 4172             | 0.0              |
| 475       | 5328             | 6.7              | 605       | 128057           | 5.0              | 735       | 11255            | 0.0              | 865       | 3600             | 0.0              | 995       | 3177             | 0.0              |
| 480       | 5081             | 6.9              | 610       | 126031           | 3.4              | 740       | 9951             | 0.0              | 870       | 3609             | 0.0              | 1000      | 3241             | 0.0              |
| 485       | 5579             | 8.1              | 615       | 123059           | 2.3              | 745       | 8870             | 0.0              | 875       | 3208             | 0.0              |           |                  |                  |

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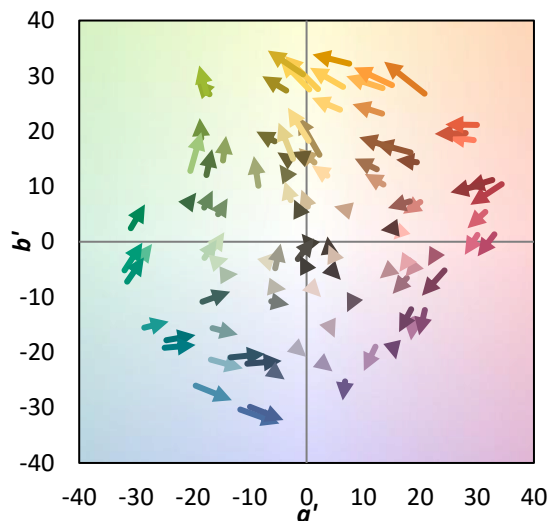
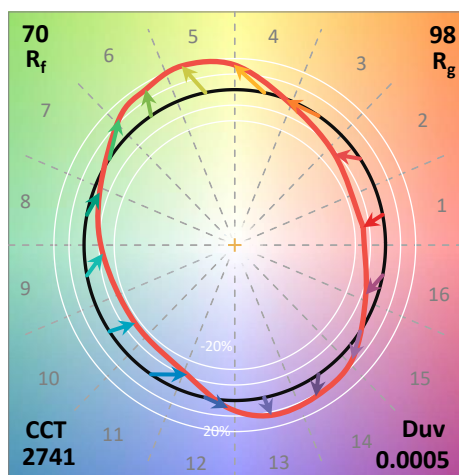
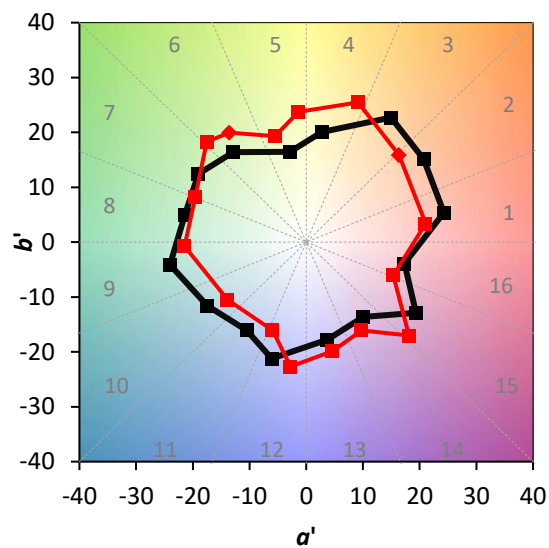
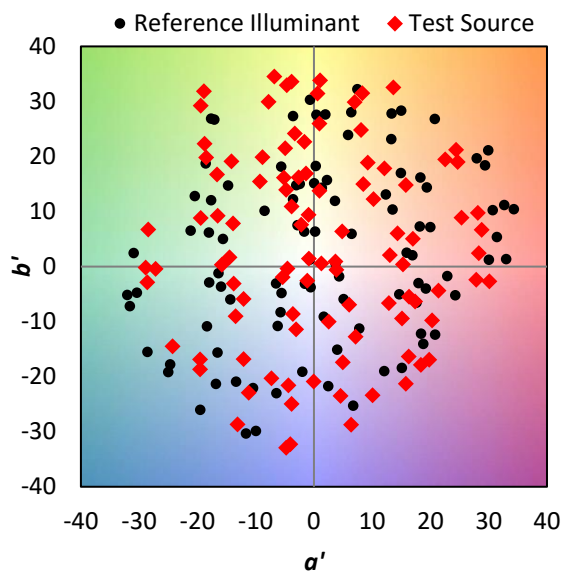
**TM-30-18**

### Summary

$R_f = 69.9$   
 $R_g = 98.3$   
 $CIE R_a = 71.5$   
 $R_g = -16.1$



### Color Vector Graphics



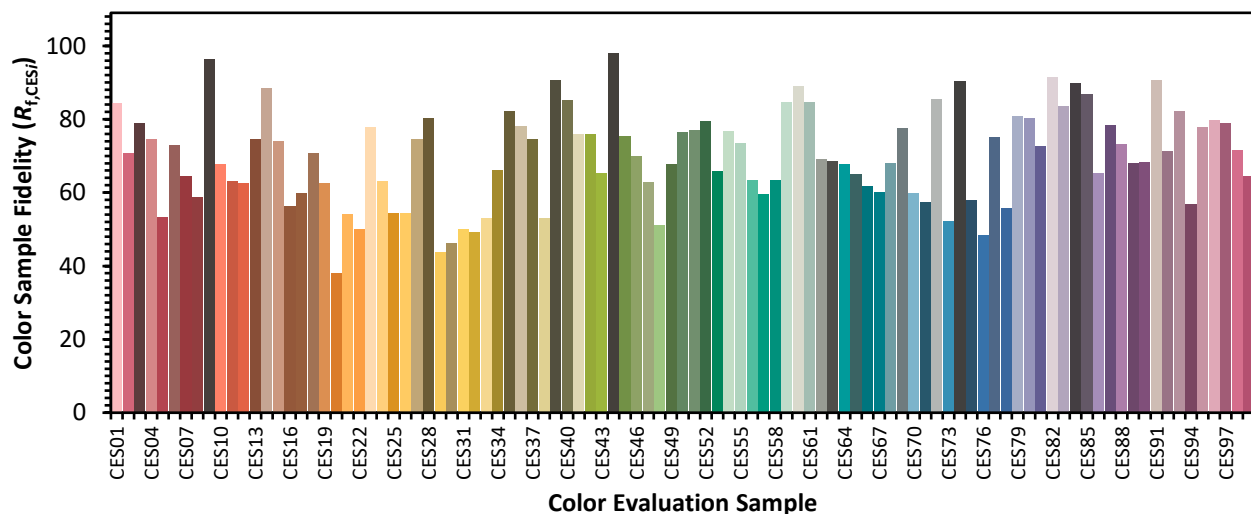


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**TM-30-18**

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

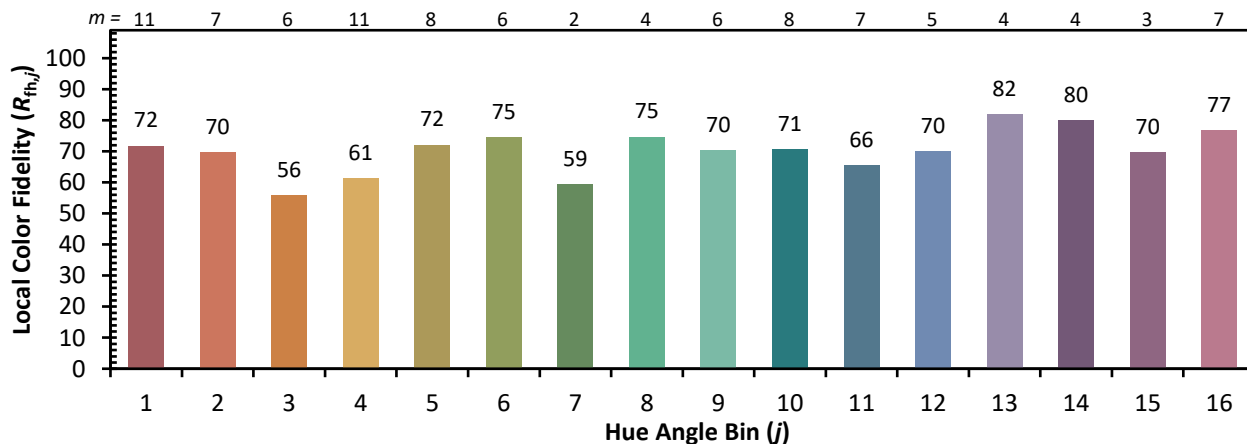
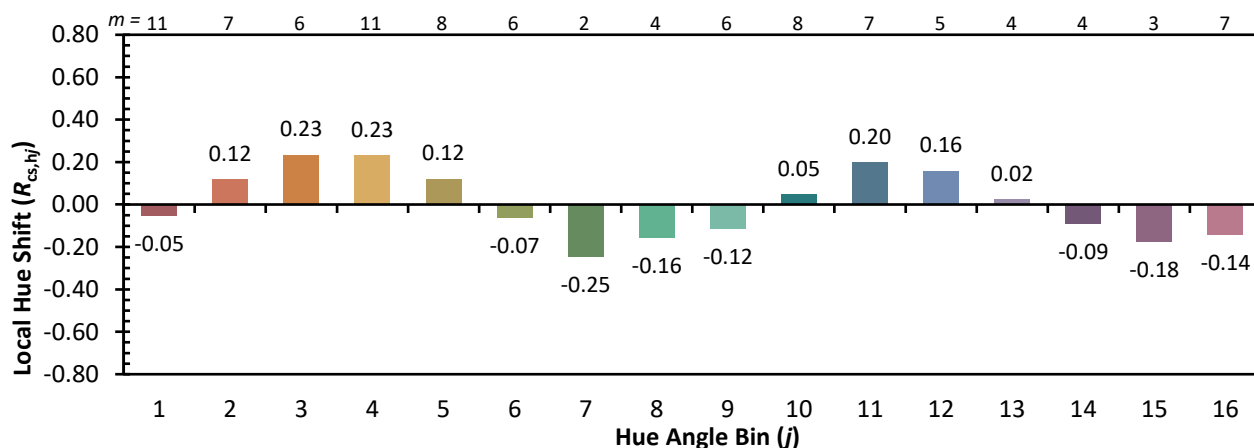
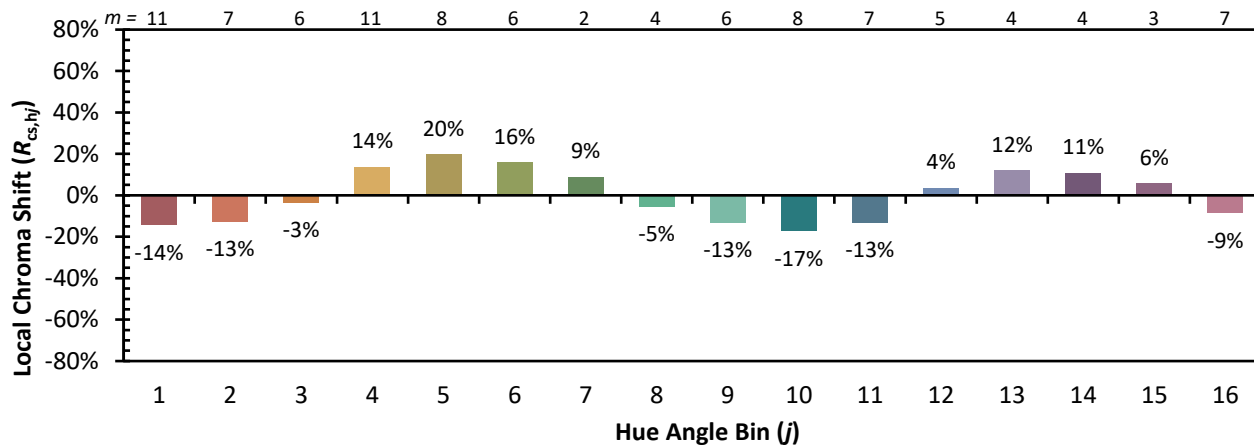
|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 54 | CES51 = 77 | CES76 = 48 |
| CES02 = 63 | CES27 = 74 | CES52 = 80 | CES77 = 75 |
| CES03 = 31 | CES28 = 80 | CES53 = 66 | CES78 = 56 |
| CES04 = 71 | CES29 = 44 | CES54 = 77 | CES79 = 81 |
| CES05 = 50 | CES30 = 46 | CES55 = 74 | CES80 = 80 |
| CES06 = 52 | CES31 = 50 | CES56 = 63 | CES81 = 73 |
| CES07 = 42 | CES32 = 49 | CES57 = 60 | CES82 = 91 |
| CES08 = 41 | CES33 = 53 | CES58 = 63 | CES83 = 84 |
| CES09 = 29 | CES34 = 66 | CES59 = 85 | CES84 = 90 |
| CES10 = 77 | CES35 = 82 | CES60 = 89 | CES85 = 87 |
| CES11 = 60 | CES36 = 78 | CES61 = 85 | CES86 = 65 |
| CES12 = 66 | CES37 = 75 | CES62 = 69 | CES87 = 78 |
| CES13 = 43 | CES38 = 53 | CES63 = 68 | CES88 = 73 |
| CES14 = 74 | CES39 = 91 | CES64 = 68 | CES89 = 68 |
| CES15 = 71 | CES40 = 85 | CES65 = 65 | CES90 = 68 |
| CES16 = 48 | CES41 = 76 | CES66 = 62 | CES91 = 91 |
| CES17 = 50 | CES42 = 76 | CES67 = 60 | CES92 = 71 |
| CES18 = 57 | CES43 = 65 | CES68 = 68 | CES93 = 82 |
| CES19 = 73 | CES44 = 98 | CES69 = 77 | CES94 = 57 |
| CES20 = 67 | CES45 = 75 | CES70 = 60 | CES95 = 78 |
| CES21 = 88 | CES46 = 70 | CES71 = 57 | CES96 = 80 |
| CES22 = 80 | CES47 = 63 | CES72 = 86 | CES97 = 79 |
| CES23 = 92 | CES48 = 51 | CES73 = 52 | CES98 = 71 |
| CES24 = 91 | CES49 = 68 | CES74 = 90 | CES99 = 64 |
| CES25 = 73 | CES50 = 77 | CES75 = 58 |            |



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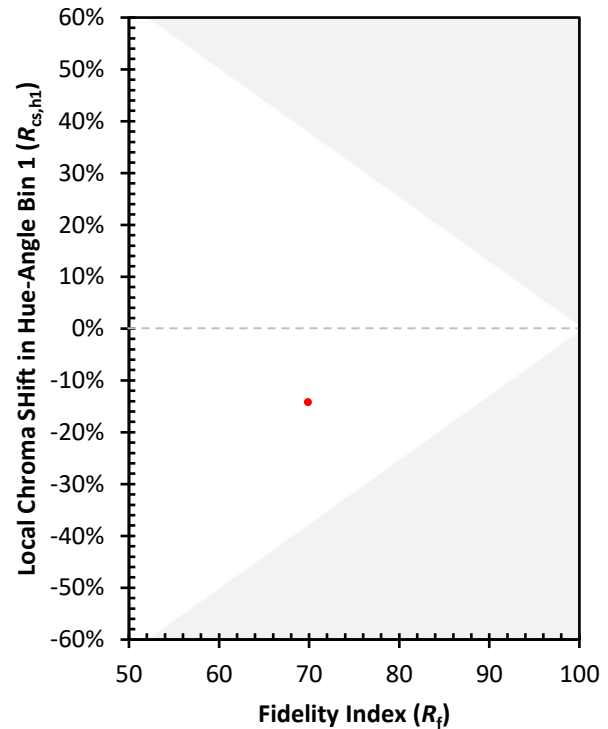
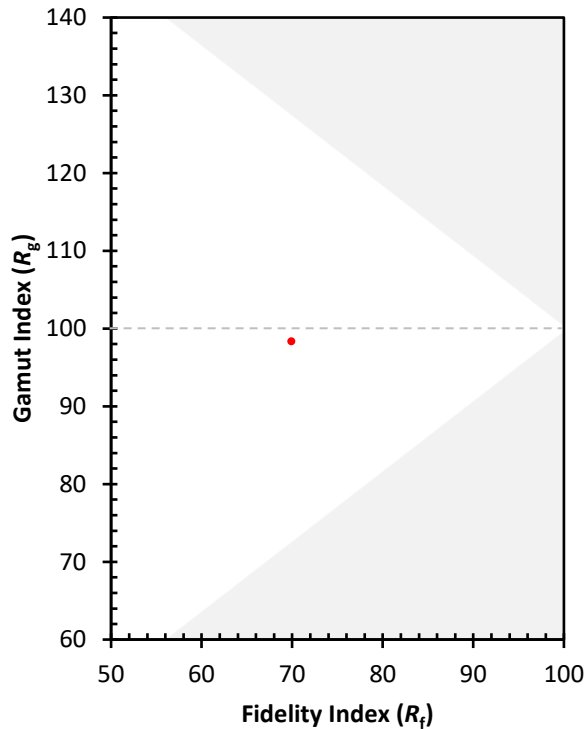
Color Rendition by Hue-Angle Bin



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**Measure Comparisons**



(END OF REPORT)