

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: P363168

Luminaire Tested: NVN-SA2D-727-U-T4FT-HSS

Issue Date: 3/3/2020

**Test Information**

Test Method: LM-79-2019  
Report Number: P363168  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G2-1903-205-17)  
Test Lab: INNOVATION CENTER  
Issue Date: 3/3/2020  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: STREETWORKS  
Catalog Number: NVN-SA2D-727-U-T4FT-HSS  
Description: NAVION ROADWAY AND AREA LUMINAIRE  
(2) 70 CRI, 2700K, 1200mA LIGHTSQUARES WITH 16 LEDS EACH AND TYPE IV  
FORWARD THROW OPTICS WITH HOUSE SIDE SHIELD  
Light Source: -  
Ballast/Driver: ELECTRONIC DRIVER

**Summary**

Lumens per Lamp: N/A  
Luminaire Lumens: 9448 lumens  
Efficiency: N/A  
Efficacy: 73.2 lumens/watt  
Luminous Opening: Rectangular (W 0.5' x L: 1' x H: 0')  
IES Classification: Type IV - Short  
BUG Rating: B1 - U0 - G2

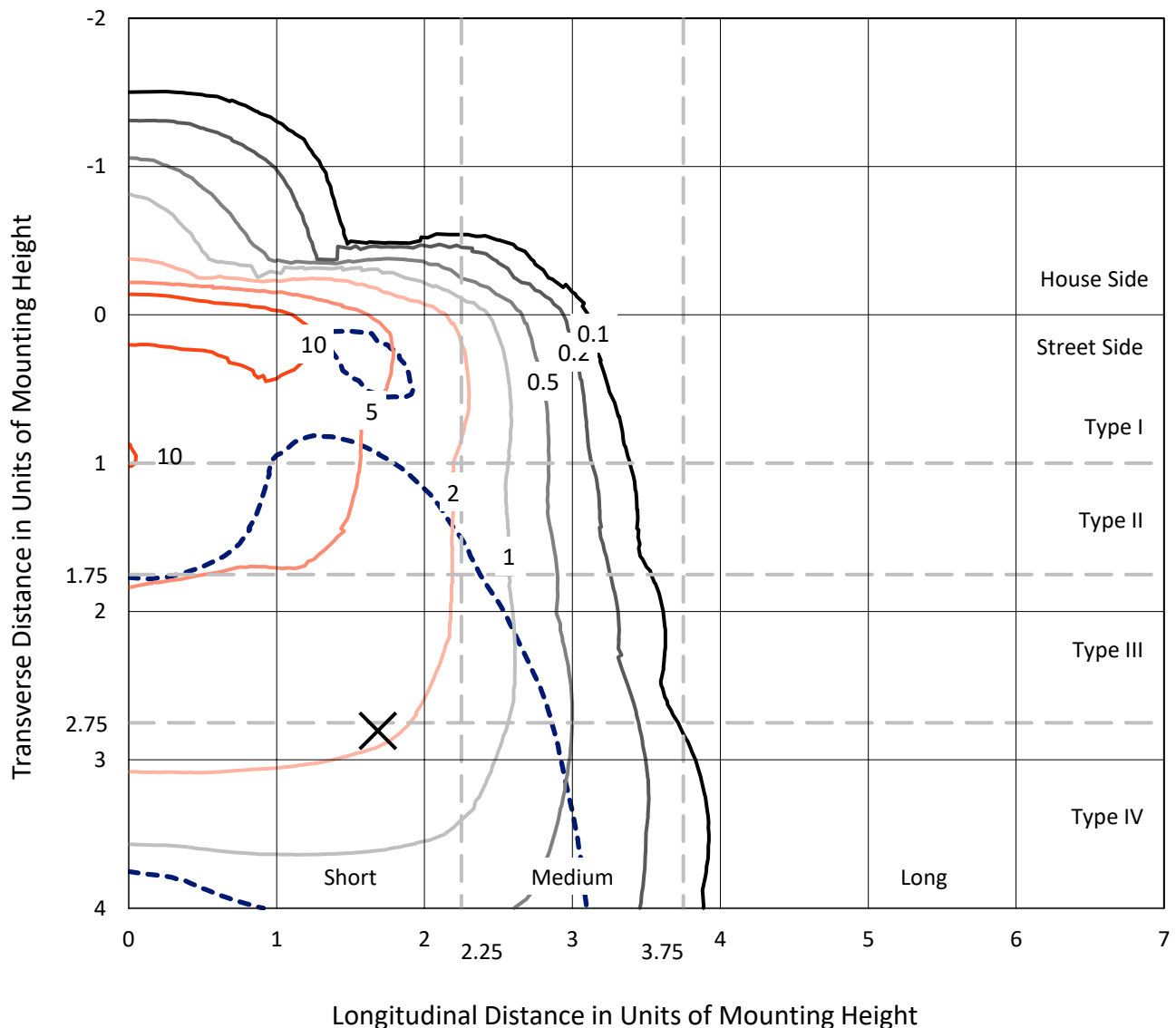
Input Watts (W): 129  
Input Voltage (V): NR  
Input Current (Ain): NR  
Voltage Rise (V): NR  
Power Factor: NR  
Total Harmonic Distortion (THDi): NR  
Frequency (hertz): 60  
Stabilization Time: NR  
Operation Time: NR  
Ambient Temperature (°C): NR  
Test Distance: 28.75 FT



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 CATALOG NUMBER: NVN-SA2D-727-U-T4FT-HSS

## Iso-Footcandle Lines of Horizontal Illumination

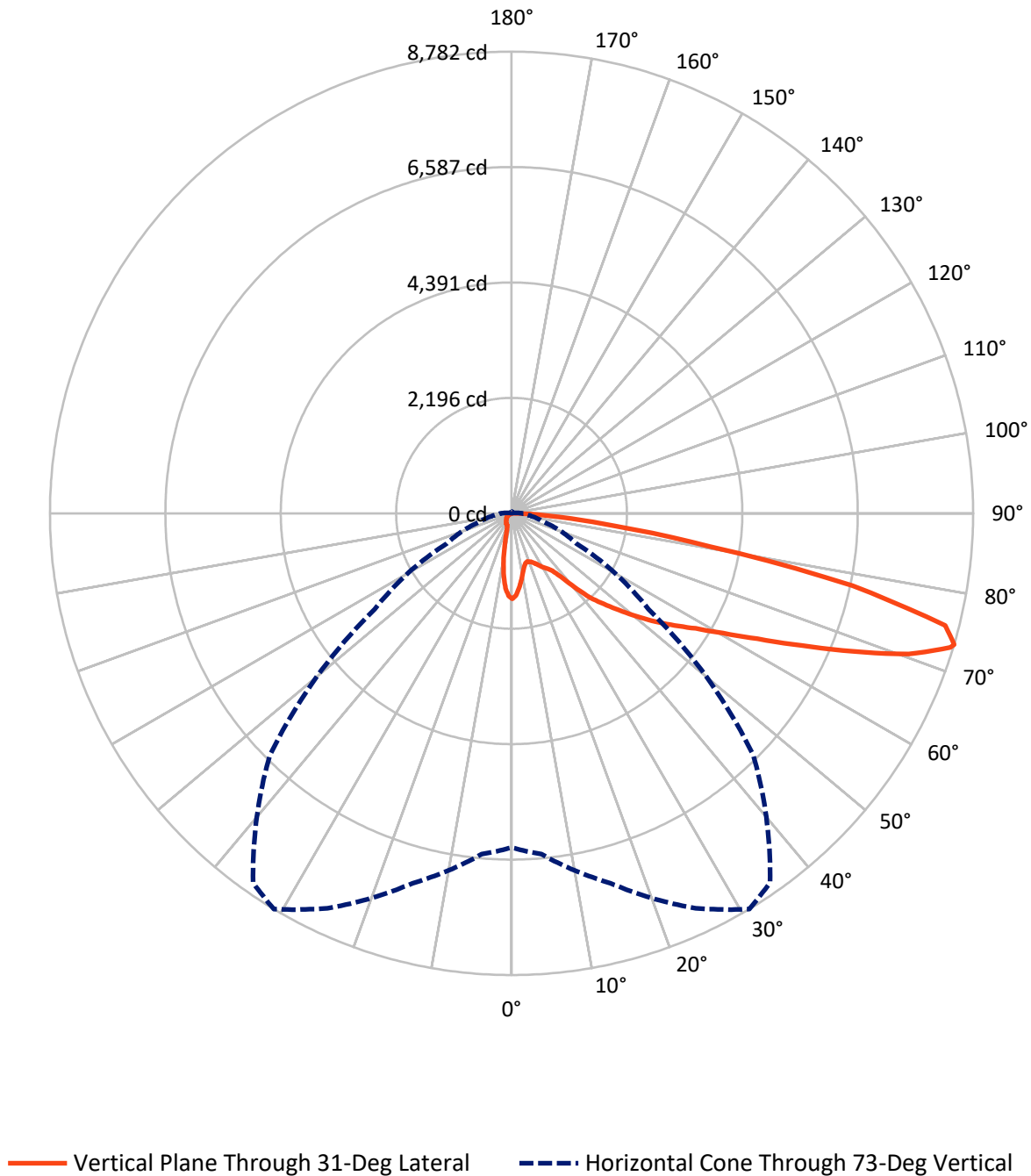
× Max cd  
 - - - 1/2 Max cd



Based on 10 foot mounting height. Maximum calculated value = 16.3 fc  
 Type IV - Short - N/A

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## Luminous Intensity Polar Plot



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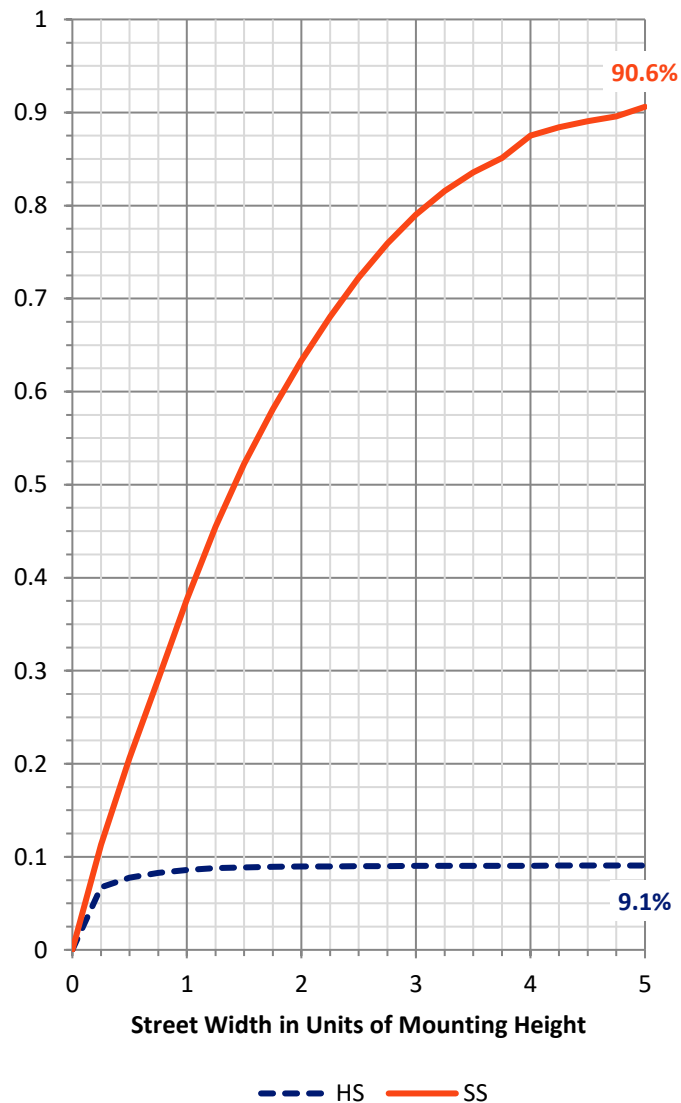
**FLUX DISTRIBUTION:**

|                    |           | Downward | Upward | Total  |
|--------------------|-----------|----------|--------|--------|
| <b>House Side</b>  | Lumens    | 861.2    | 0.0    | 861.2  |
|                    | % Fixture | 9.1      | 0.0    | 9.1    |
| <b>Street Side</b> | Lumens    | 8586.8   | 0.0    | 8586.8 |
|                    | % Fixture | 90.9     | 0.0    | 90.9   |
| <b>Total</b>       | Lumens    | 9448.0   | 0.0    | 9448.0 |
|                    | % Fixture | 100.0    | 0.0    | 100.0  |

**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 134.8  | 1.4       |
| 10°-20°   | 292.6  | 3.1       |
| 20°-30°   | 438.5  | 4.6       |
| 30°-40°   | 697.6  | 7.4       |
| 40°-50°   | 1245.7 | 13.2      |
| 50°-60°   | 1933.0 | 20.5      |
| 60°-70°   | 2569.7 | 27.2      |
| 70°-80°   | 1932.9 | 20.5      |
| 80°-90°   | 203.1  | 2.1       |
| 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°    | 9448.0 | 100.0     |
| 0°-180°   | 9448.0 | 100.0     |

**Coefficient of Utilization**



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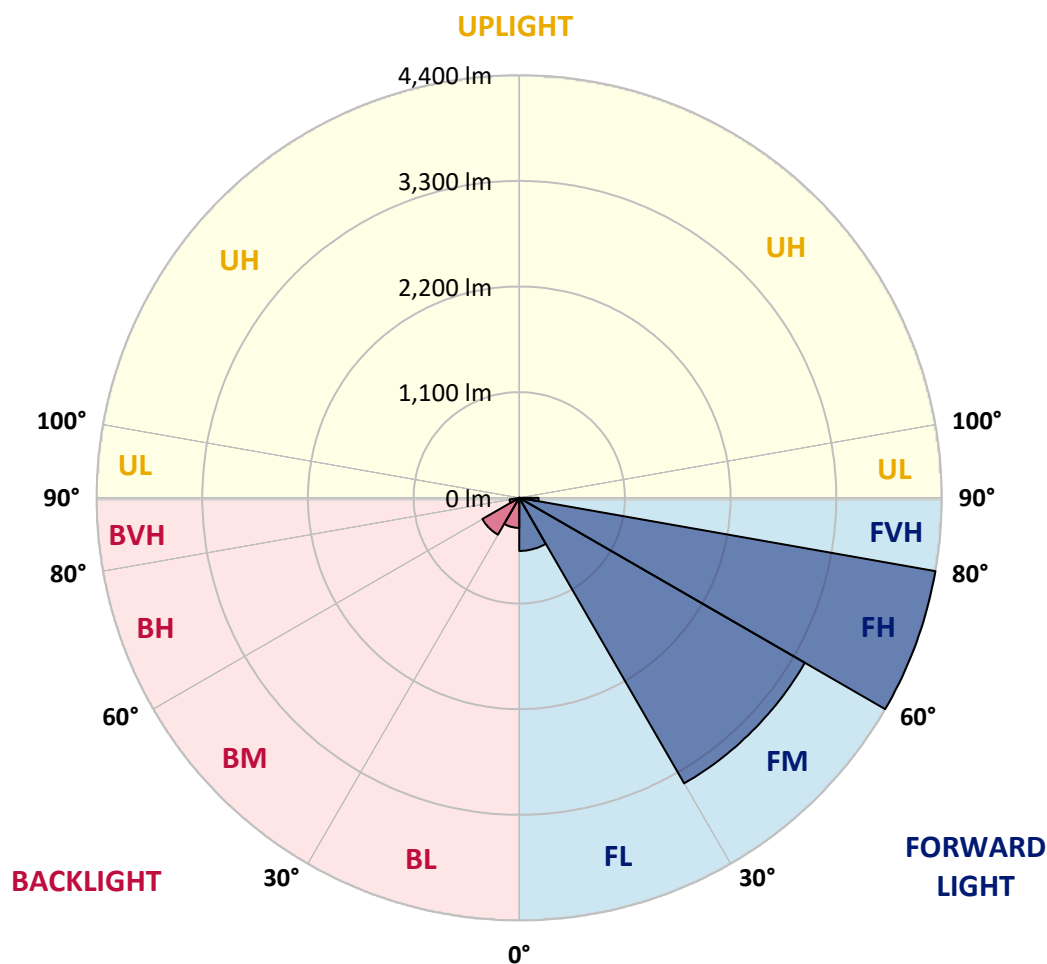
CATALOG NUMBER: NVN-SA2D-727-U-T4FT-HSS

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

| Zone |             | Lumens | % Fixture | Zone Rating/Lumen Limit |      |         |
|------|-------------|--------|-----------|-------------------------|------|---------|
|      |             |        |           | B                       | U    | G       |
| FL   | (0°-30°)    | 552.7  | 5.9       |                         |      |         |
| FM   | (30°-60°)   | 3433.1 | 36.3      |                         |      |         |
| FH   | (60°-80°)   | 4399.6 | 46.6      |                         |      | G2/5000 |
| FVH  | (80°-90°)   | 201.4  | 2.1       |                         |      | G2/225  |
| BL   | (0°-30°)    | 313.2  | 3.3       | B1/500                  |      |         |
| BM   | (30°-60°)   | 443.3  | 4.7       | B1/1000                 |      |         |
| BH   | (60°-80°)   | 103.0  | 1.1       | B0/110                  |      | G0/110  |
| BVH  | (80°-90°)   | 1.7    | 0.0       |                         |      | G0/10   |
| UL   | (90°-100°)  | 0.0    | 0.0       |                         | U0/0 |         |
| UH   | (100°-180°) | 0.0    | 0.0       |                         | U0/0 |         |

**BUG Rating: B1-U0-G2**

Type IV Short





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**CANDELA DISTRIBUTION (FULL):**

|       | 0°     | 5°     | 15°    | 25°    | 31°    | 35°    | 45°    | 55°    | 65°    | 75°    | 85°    |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0°    | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 |
| 2.5°  | 1540.5 | 1547.0 | 1553.9 | 1555.3 | 1566.8 | 1567.3 | 1583.9 | 1596.4 | 1608.9 | 1620.9 | 1625.1 |
| 5°    | 1382.4 | 1393.0 | 1405.5 | 1418.0 | 1442.5 | 1452.2 | 1492.9 | 1534.5 | 1574.2 | 1612.1 | 1630.6 |
| 7.5°  | 1213.6 | 1225.6 | 1243.2 | 1274.2 | 1301.5 | 1320.4 | 1384.7 | 1458.6 | 1532.6 | 1602.4 | 1642.7 |
| 10°   | 1059.7 | 1070.8 | 1089.2 | 1122.1 | 1164.1 | 1190.0 | 1276.5 | 1379.1 | 1487.8 | 1593.6 | 1660.7 |
| 12.5° | 961.6  | 967.7  | 977.8  | 1013.0 | 1050.9 | 1080.0 | 1181.7 | 1308.9 | 1450.8 | 1593.2 | 1689.8 |
| 15°   | 943.6  | 945.5  | 937.1  | 952.9  | 982.4  | 1010.7 | 1113.7 | 1252.0 | 1422.6 | 1600.6 | 1727.7 |
| 17.5° | 972.3  | 971.4  | 943.6  | 941.8  | 965.3  | 988.5  | 1080.5 | 1212.7 | 1402.7 | 1617.7 | 1776.7 |
| 20°   | 1015.7 | 1012.5 | 964.4  | 955.6  | 980.6  | 1002.3 | 1078.2 | 1197.9 | 1395.3 | 1646.4 | 1836.4 |
| 22.5° | 1073.5 | 1068.0 | 992.6  | 983.4  | 1010.2 | 1032.8 | 1106.8 | 1212.2 | 1401.8 | 1684.7 | 1905.7 |
| 25°   | 1145.2 | 1136.9 | 1041.2 | 1031.0 | 1058.3 | 1080.9 | 1158.1 | 1253.4 | 1421.2 | 1731.4 | 1993.6 |
| 27.5° | 1226.1 | 1214.1 | 1118.8 | 1092.5 | 1123.5 | 1147.0 | 1226.6 | 1316.2 | 1451.7 | 1780.9 | 2101.3 |
| 30°   | 1302.4 | 1286.7 | 1200.7 | 1157.2 | 1195.1 | 1221.5 | 1300.5 | 1391.1 | 1500.7 | 1857.2 | 2248.8 |
| 32.5° | 1379.1 | 1361.6 | 1273.7 | 1221.9 | 1256.1 | 1284.8 | 1376.8 | 1494.2 | 1592.7 | 1973.7 | 2444.8 |
| 35°   | 1555.7 | 1537.2 | 1429.5 | 1344.0 | 1343.5 | 1359.7 | 1483.6 | 1635.3 | 1714.3 | 2136.0 | 2678.7 |
| 37.5° | 1853.0 | 1842.4 | 1739.7 | 1577.5 | 1534.0 | 1516.0 | 1629.2 | 1803.5 | 1889.1 | 2359.3 | 2942.7 |
| 40°   | 2178.5 | 2169.2 | 2054.1 | 1907.1 | 1841.0 | 1796.6 | 1838.2 | 2037.9 | 2136.0 | 2632.0 | 3212.3 |
| 42.5° | 2546.0 | 2502.1 | 2296.8 | 2252.9 | 2193.7 | 2160.0 | 2122.6 | 2326.9 | 2439.2 | 2928.9 | 3479.5 |
| 45°   | 2879.8 | 2805.9 | 2539.6 | 2473.0 | 2459.6 | 2467.9 | 2488.7 | 2715.3 | 2780.4 | 3281.6 | 3745.8 |
| 47.5° | 3078.6 | 3020.4 | 2816.0 | 2752.2 | 2748.5 | 2803.6 | 2960.8 | 3154.0 | 3120.3 | 3589.1 | 3980.2 |
| 50°   | 3267.7 | 3215.0 | 3045.4 | 3061.1 | 3078.2 | 3153.1 | 3496.6 | 3605.2 | 3430.5 | 3867.8 | 4195.2 |
| 52.5° | 3420.8 | 3340.3 | 3251.6 | 3339.9 | 3424.0 | 3544.7 | 4049.5 | 4010.2 | 3650.5 | 4089.8 | 4379.2 |
| 55°   | 3509.1 | 3472.6 | 3515.5 | 3604.3 | 3762.4 | 3958.5 | 4571.5 | 4347.3 | 3811.4 | 4292.3 | 4501.7 |
| 57.5° | 3832.7 | 3761.0 | 3846.6 | 3923.3 | 4129.5 | 4403.7 | 5018.6 | 4598.3 | 3927.5 | 4417.6 | 4529.9 |
| 60°   | 4224.3 | 4166.5 | 4216.9 | 4344.5 | 4622.8 | 4945.1 | 5436.5 | 4803.1 | 3988.0 | 4498.0 | 4456.8 |
| 62.5° | 4847.5 | 4771.2 | 4739.8 | 4882.7 | 5251.6 | 5603.4 | 5753.7 | 4945.1 | 3974.6 | 4462.4 | 4206.3 |
| 65°   | 5682.5 | 5603.4 | 5462.9 | 5592.3 | 6061.6 | 6309.9 | 6108.3 | 4975.1 | 3882.2 | 4174.4 | 3572.9 |
| 67.5° | 6537.8 | 6480.5 | 6360.3 | 6578.5 | 7002.0 | 7082.0 | 6483.2 | 4902.1 | 3584.4 | 3384.7 | 2524.3 |
| 70°   | 7102.8 | 7078.3 | 7156.4 | 7639.1 | 8016.8 | 7993.7 | 6827.2 | 4509.6 | 2793.9 | 2081.4 | 1248.7 |
| 72.5° | 6695.4 | 6812.9 | 7389.9 | 8265.1 | 8726.5 | 8537.8 | 6650.6 | 3462.8 | 1596.9 | 800.8  | 361.1  |
| 73°   | 6357.9 | 6508.2 | 7284.9 | 8288.6 | 8782.4 | 8575.7 | 6502.2 | 3178.5 | 1361.1 | 632.0  | 273.7  |
| 75°   | 4423.1 | 4607.6 | 6031.1 | 7719.5 | 8520.7 | 8170.7 | 5419.9 | 1945.5 | 630.6  | 280.2  | 110.5  |
| 77.5° | 2147.5 | 2283.9 | 3320.9 | 5577.5 | 6626.6 | 6383.8 | 3374.1 | 724.9  | 284.8  | 175.2  | 50.9   |
| 80°   | 801.7  | 891.4  | 1441.5 | 2838.7 | 3829.5 | 3929.8 | 1484.1 | 274.2  | 189.6  | 141.0  | 25.9   |
| 82.5° | 209.9  | 233.9  | 531.7  | 1265.9 | 1962.6 | 2054.1 | 467.9  | 138.2  | 138.7  | 116.0  | 15.7   |
| 85°   | 67.0   | 76.7   | 166.0  | 568.2  | 924.7  | 811.8  | 122.1  | 67.0   | 100.8  | 86.5   | 8.8    |
| 87.5° | 8.3    | 10.6   | 52.7   | 133.6  | 203.9  | 113.3  | 19.0   | 19.9   | 43.0   | 48.1   | 5.1    |
| 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: P363168

CATALOG NUMBER: NVN-SA2D-727-U-T4FT-HSS

**CANDELA DISTRIBUTION (continued):**

|       | 90°    | 95°    | 105°   | 115°   | 125°   | 135°   | 145°   | 155°   | 165°   | 175°   | 180°   |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0°    | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 | 1625.5 |
| 2.5°  | 1629.2 | 1626.9 | 1627.4 | 1615.4 | 1607.5 | 1591.8 | 1575.6 | 1568.2 | 1560.4 | 1557.1 | 1560.4 |
| 5°    | 1637.6 | 1633.4 | 1621.4 | 1584.4 | 1545.1 | 1494.2 | 1446.6 | 1410.6 | 1365.3 | 1352.8 | 1365.7 |
| 7.5°  | 1650.5 | 1642.2 | 1607.1 | 1531.7 | 1444.3 | 1347.2 | 1238.1 | 1158.6 | 1093.4 | 1051.3 | 1066.6 |
| 10°   | 1669.5 | 1653.7 | 1583.0 | 1454.9 | 1298.7 | 1126.7 | 971.8  | 851.1  | 765.6  | 730.5  | 729.1  |
| 12.5° | 1701.4 | 1671.8 | 1553.4 | 1355.1 | 1120.7 | 891.4  | 688.4  | 557.6  | 488.2  | 443.4  | 442.4  |
| 15°   | 1736.5 | 1693.0 | 1516.0 | 1235.3 | 913.6  | 638.5  | 443.4  | 344.0  | 299.1  | 284.8  | 282.9  |
| 17.5° | 1779.5 | 1717.6 | 1467.4 | 1087.9 | 696.7  | 423.0  | 289.4  | 260.8  | 258.9  | 257.5  | 257.5  |
| 20°   | 1833.6 | 1746.7 | 1405.0 | 919.1  | 494.2  | 282.5  | 246.0  | 247.8  | 248.7  | 246.9  | 247.3  |
| 22.5° | 1896.5 | 1776.3 | 1330.6 | 737.9  | 334.3  | 236.2  | 235.3  | 237.6  | 238.6  | 237.6  | 238.1  |
| 25°   | 1969.5 | 1810.5 | 1240.0 | 547.9  | 241.3  | 224.2  | 226.5  | 229.8  | 232.1  | 232.1  | 232.1  |
| 27.5° | 2060.1 | 1852.1 | 1130.9 | 382.3  | 208.5  | 211.7  | 218.2  | 224.2  | 227.5  | 228.4  | 228.4  |
| 30°   | 2178.0 | 1903.9 | 1000.0 | 262.1  | 189.6  | 195.1  | 207.1  | 218.7  | 224.7  | 225.6  | 226.1  |
| 32.5° | 2326.9 | 1962.1 | 848.4  | 193.7  | 173.4  | 177.5  | 190.5  | 209.9  | 221.5  | 223.3  | 223.3  |
| 35°   | 2497.5 | 2029.6 | 685.2  | 168.7  | 161.8  | 163.2  | 173.4  | 195.6  | 215.9  | 221.0  | 221.5  |
| 37.5° | 2684.3 | 2096.2 | 521.0  | 157.7  | 152.1  | 152.1  | 159.5  | 178.5  | 202.5  | 218.2  | 220.1  |
| 40°   | 2858.6 | 2136.4 | 365.2  | 148.9  | 143.3  | 143.3  | 149.8  | 163.7  | 186.3  | 209.9  | 215.0  |
| 42.5° | 3019.5 | 2150.3 | 254.3  | 140.5  | 135.0  | 136.4  | 141.9  | 153.0  | 170.1  | 193.7  | 198.3  |
| 45°   | 3185.0 | 2148.0 | 185.4  | 130.8  | 126.7  | 130.8  | 135.0  | 143.3  | 155.8  | 169.2  | 170.1  |
| 47.5° | 3309.8 | 2128.6 | 147.0  | 121.6  | 118.8  | 124.4  | 128.1  | 133.6  | 140.5  | 139.6  | 139.6  |
| 50°   | 3426.8 | 2081.4 | 118.4  | 109.1  | 111.0  | 117.4  | 119.3  | 121.1  | 121.6  | 112.8  | 111.9  |
| 52.5° | 3515.5 | 2007.9 | 94.8   | 95.7   | 103.1  | 109.6  | 107.7  | 104.9  | 100.3  | 89.7   | 87.8   |
| 55°   | 3545.1 | 1866.4 | 74.4   | 79.1   | 91.5   | 99.9   | 92.9   | 86.9   | 78.1   | 69.3   | 67.5   |
| 57.5° | 3491.5 | 1683.8 | 60.6   | 61.5   | 77.2   | 84.1   | 76.3   | 69.3   | 59.6   | 52.2   | 50.9   |
| 60°   | 3377.8 | 1480.8 | 49.9   | 46.2   | 59.6   | 65.7   | 60.6   | 53.6   | 44.8   | 39.3   | 38.8   |
| 62.5° | 3152.2 | 1264.5 | 41.1   | 36.1   | 45.3   | 50.4   | 47.2   | 42.1   | 34.7   | 31.0   | 30.5   |
| 65°   | 2677.8 | 1011.6 | 33.3   | 29.1   | 35.1   | 39.3   | 36.5   | 32.8   | 27.3   | 24.5   | 24.0   |
| 67.5° | 1869.2 | 683.8  | 27.3   | 24.0   | 27.7   | 31.0   | 28.7   | 26.8   | 21.7   | 21.3   | 21.7   |
| 70°   | 901.5  | 329.6  | 22.7   | 19.4   | 21.7   | 24.0   | 23.1   | 21.7   | 20.8   | 24.0   | 27.7   |
| 72.5° | 258.4  | 110.5  | 18.0   | 16.2   | 17.6   | 19.0   | 19.9   | 19.4   | 22.7   | 29.1   | 33.7   |
| 73°   | 198.8  | 89.2   | 17.1   | 15.3   | 16.6   | 18.5   | 19.4   | 19.0   | 23.1   | 29.6   | 33.7   |
| 75°   | 85.1   | 43.0   | 12.9   | 12.5   | 13.9   | 16.2   | 17.1   | 17.1   | 23.1   | 30.1   | 32.4   |
| 77.5° | 38.4   | 23.1   | 8.3    | 9.7    | 12.0   | 12.9   | 14.3   | 14.3   | 18.5   | 23.1   | 23.1   |
| 80°   | 21.7   | 12.5   | 6.5    | 7.4    | 8.8    | 8.8    | 8.8    | 7.9    | 8.3    | 9.2    | 10.2   |
| 82.5° | 13.9   | 8.3    | 5.1    | 6.0    | 5.5    | 4.6    | 3.7    | 3.7    | 3.2    | 3.7    | 4.6    |
| 85°   | 7.9    | 4.6    | 4.6    | 3.7    | 2.3    | 1.8    | 2.3    | 1.8    | 0.5    | 0.0    | 0.5    |
| 87.5° | 4.6    | 2.8    | 1.4    | 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: SP1-1908-441-1-R4

Test Date: 08/20/2019

Luminaire Tested: SA1C-727-U-5WQ

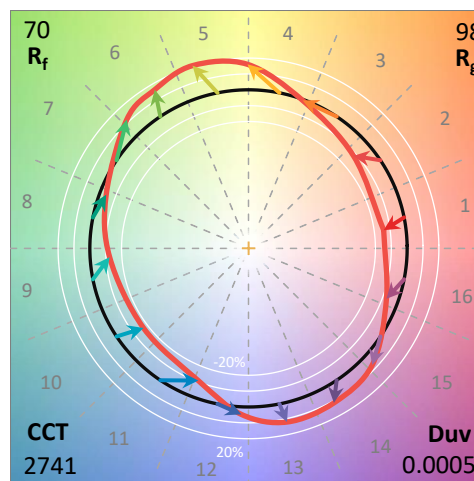
### Test Information

Test Method: LM-79-2008  
 Report Number: SP1-1908-441-1-R4  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry:  $4\pi$   
 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

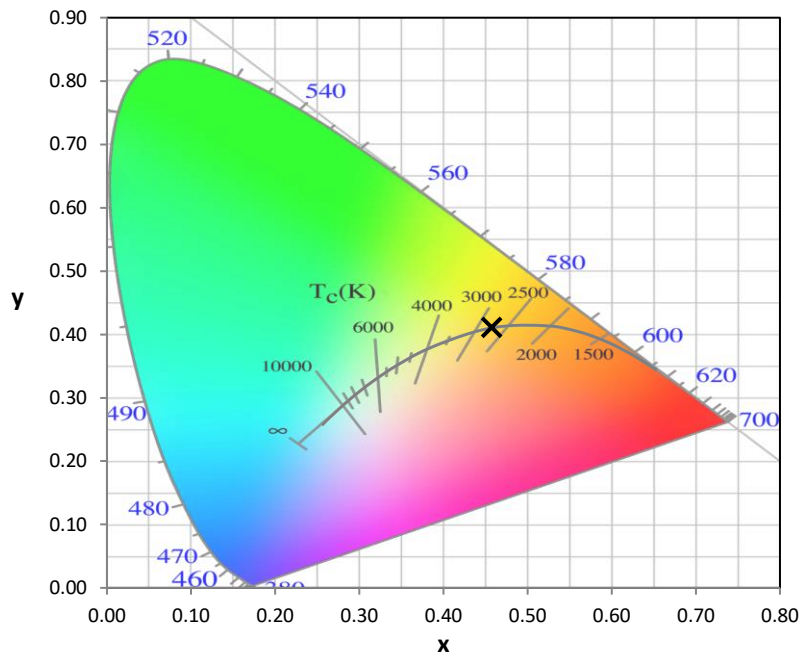
Stabilization Time: 56M  
 Operation Time: 12H  
 Room Temperature (°C) / RH%: 25.3./42%  
 Sphere Temperature (°C): 25.7

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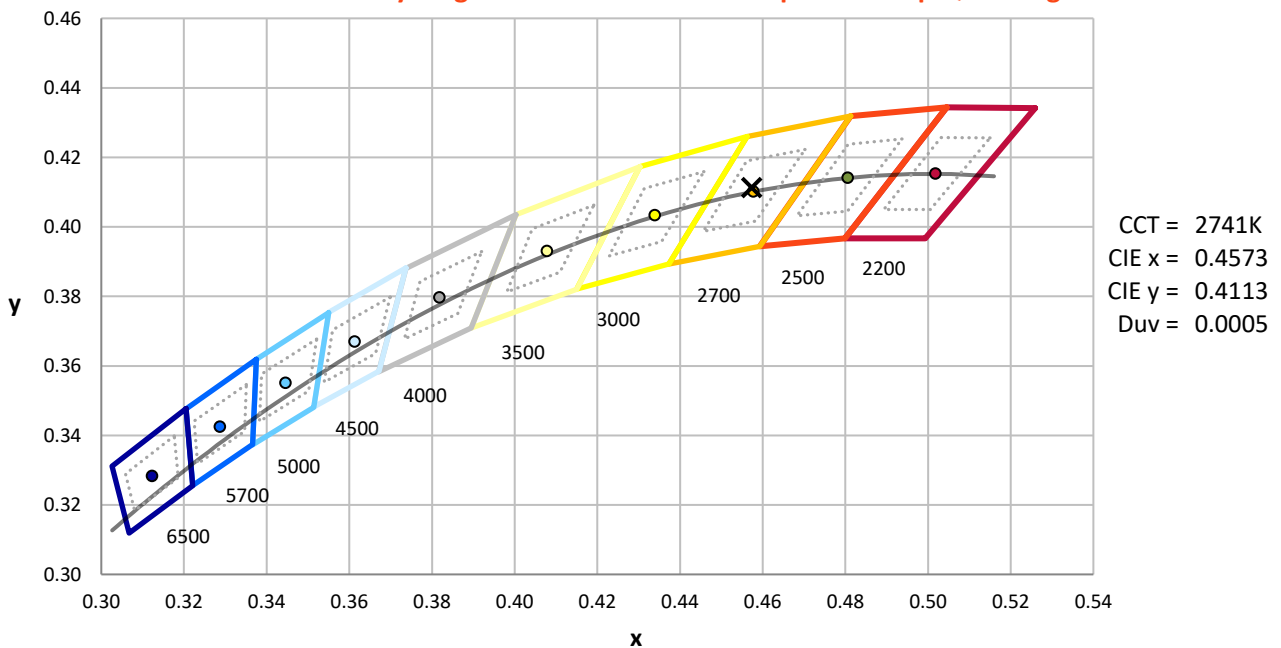
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date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



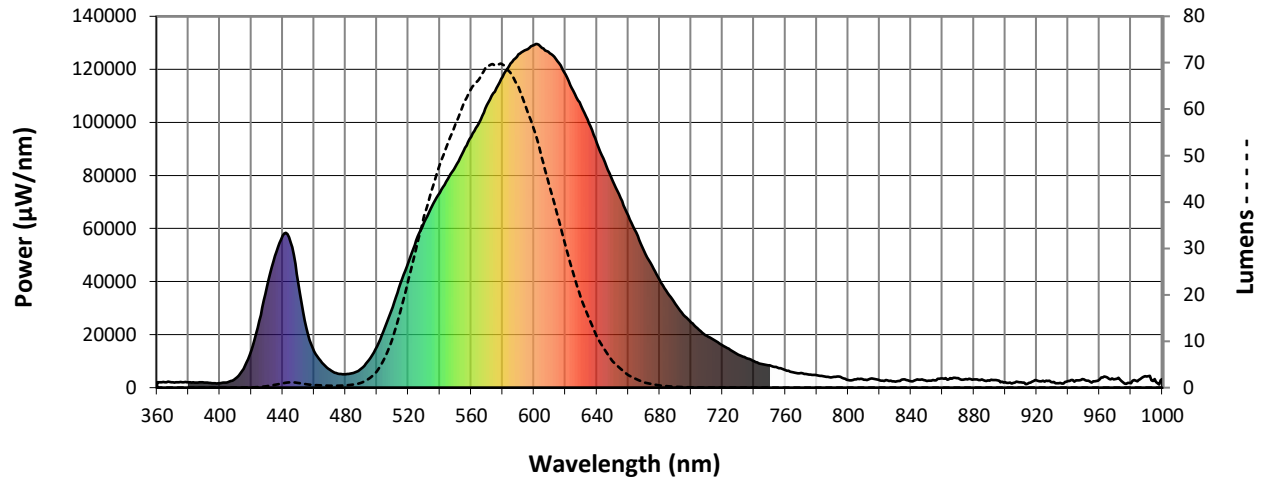
CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles



Point lies inside the ANSI 2700K 4-step quadrangle

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**Photopic Flux vs. Wavelength**

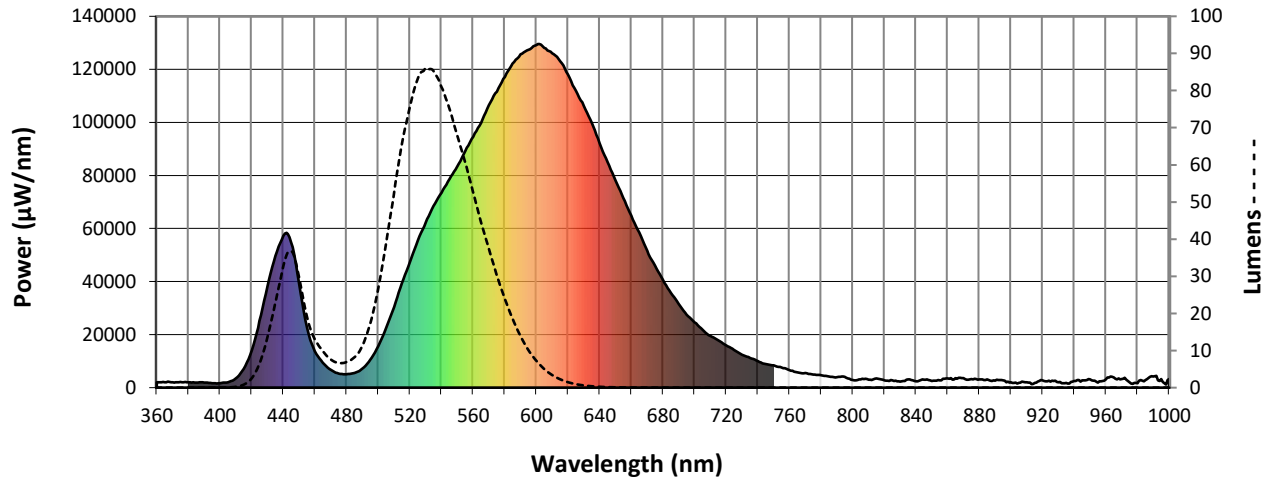


**Photopic Lumens: 6211.7**

| 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



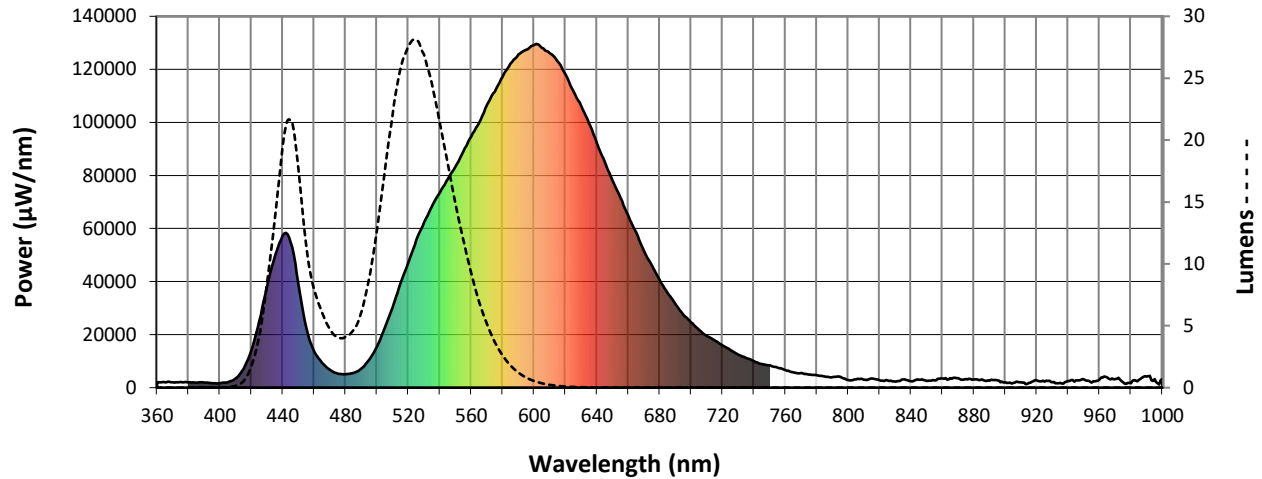
Scotopic Lumens: 6474.3

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**

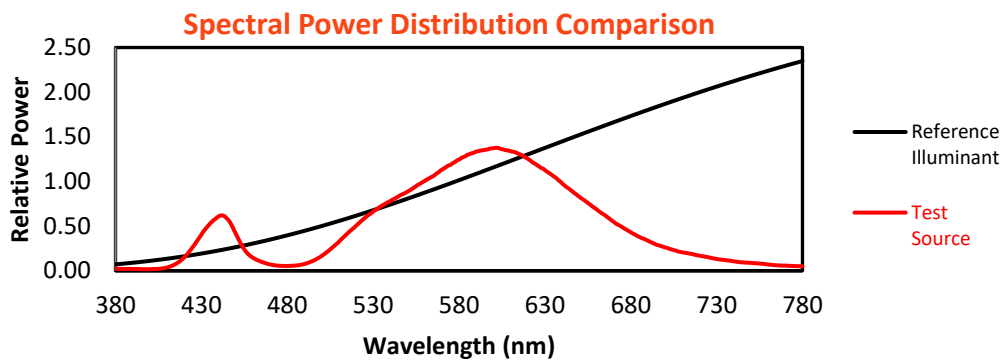
| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 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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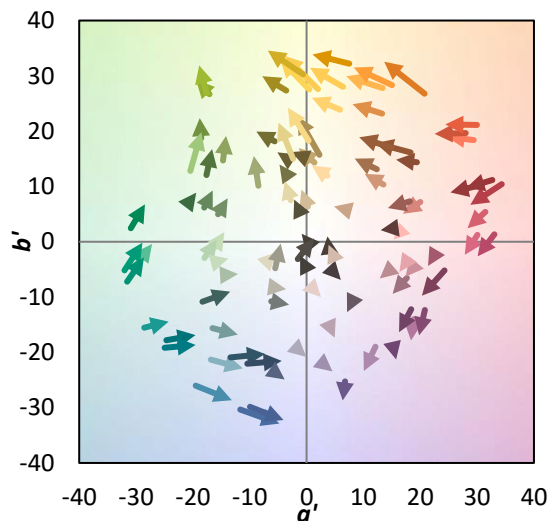
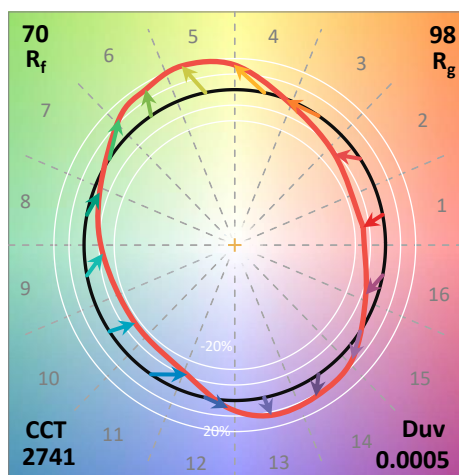
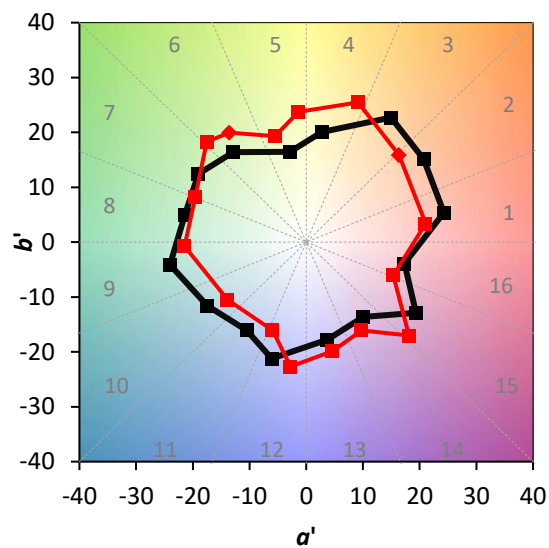
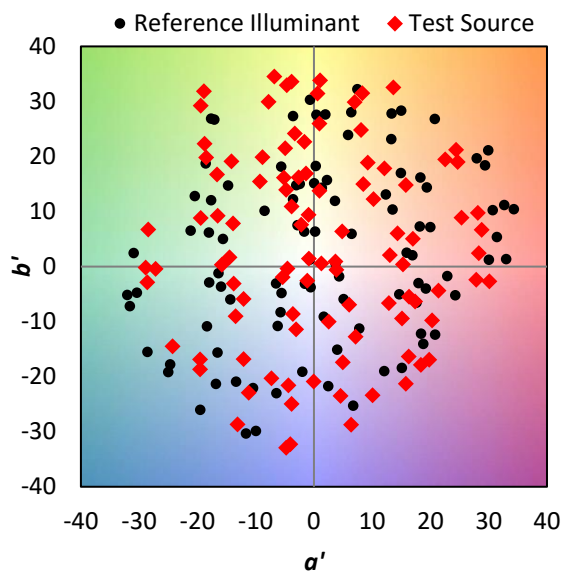
**TM-30-18**

**Summary**

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



**Color Vector Graphics**



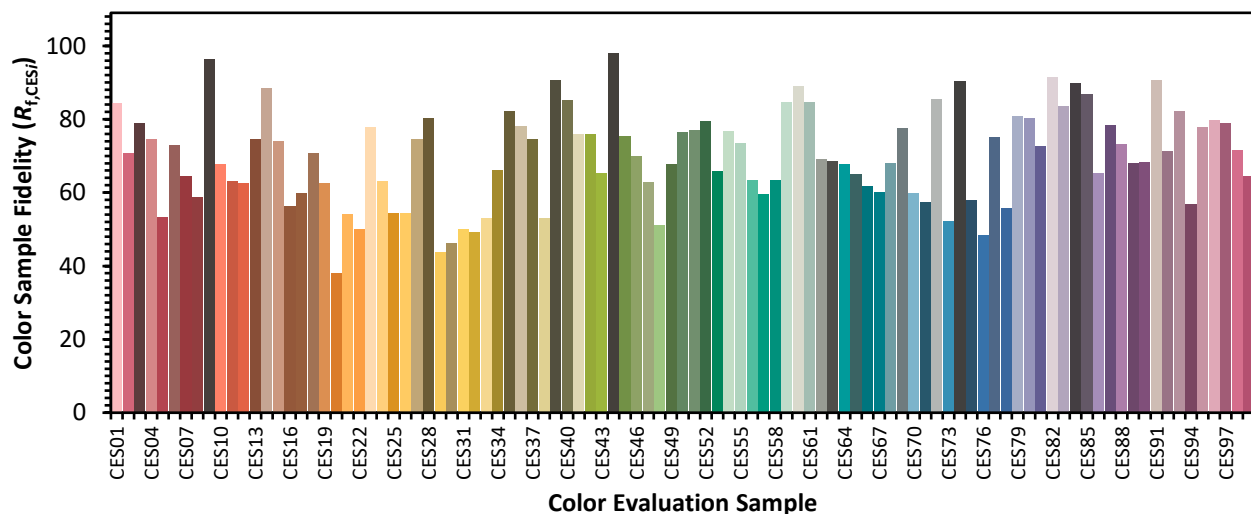


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**TM-30-18**

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

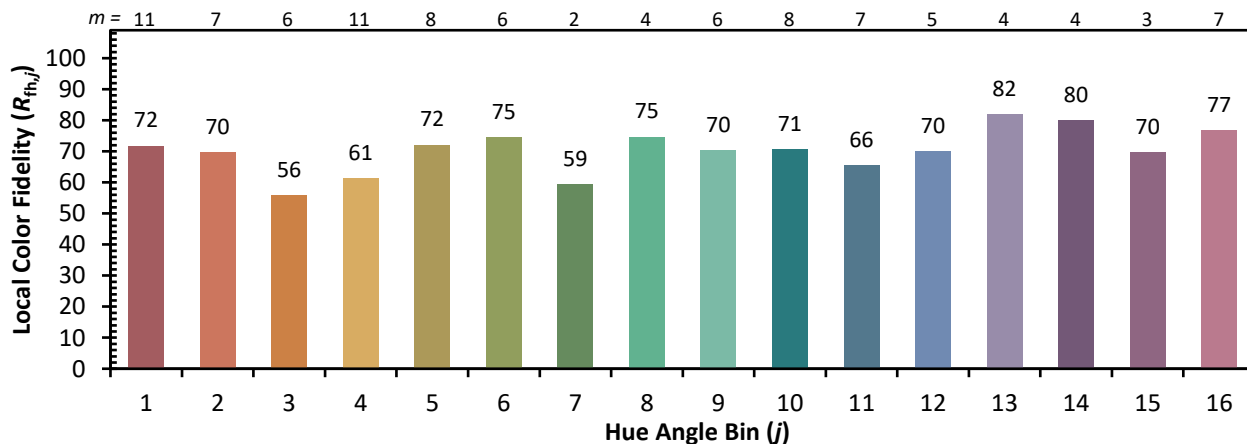
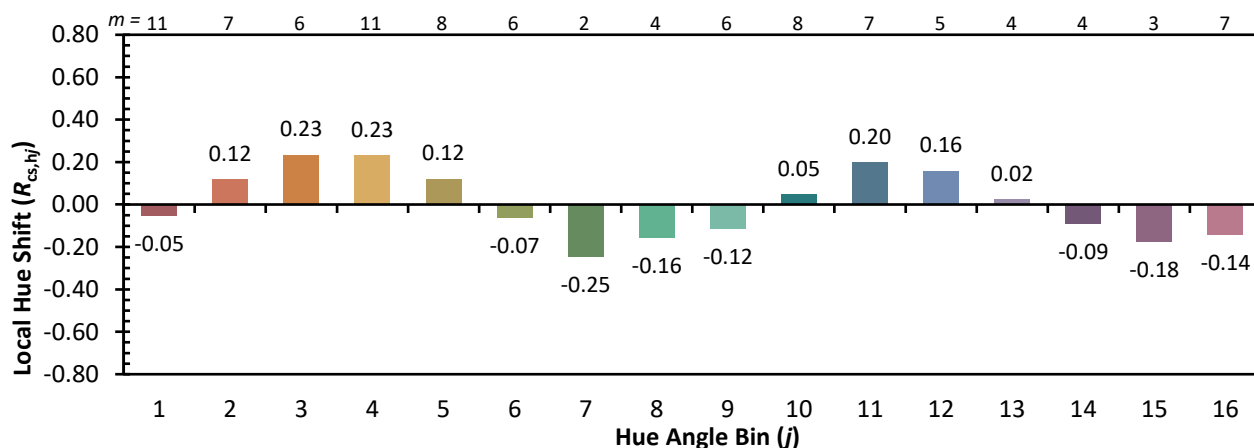
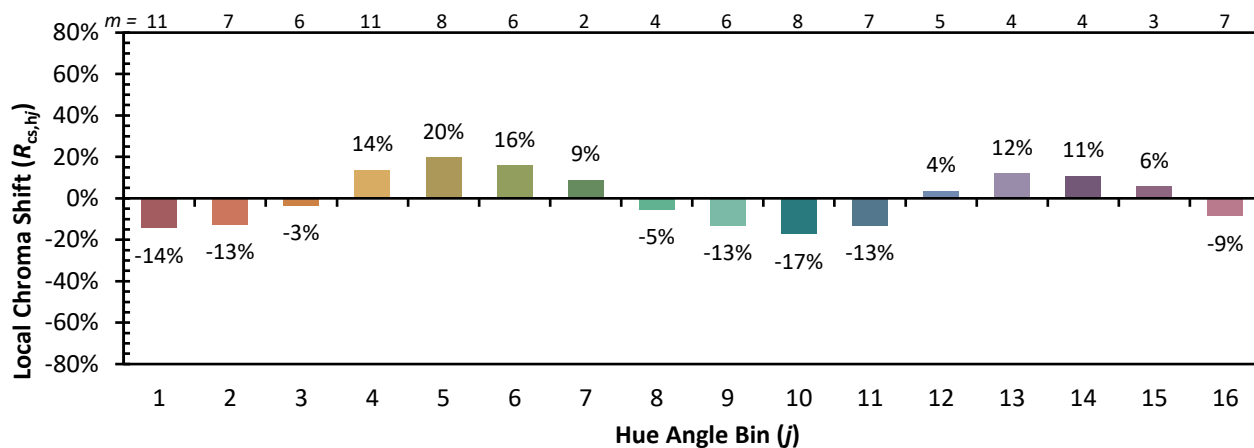
|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 54 | CES51 = 77 | CES76 = 48 |
| CES02 = 63 | CES27 = 74 | CES52 = 80 | CES77 = 75 |
| CES03 = 31 | CES28 = 80 | CES53 = 66 | CES78 = 56 |
| CES04 = 71 | CES29 = 44 | CES54 = 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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**TM-30-18**

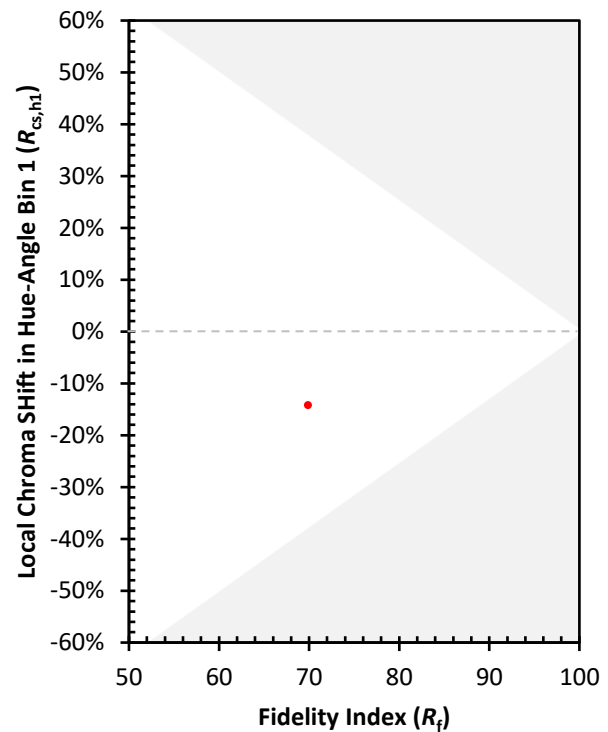
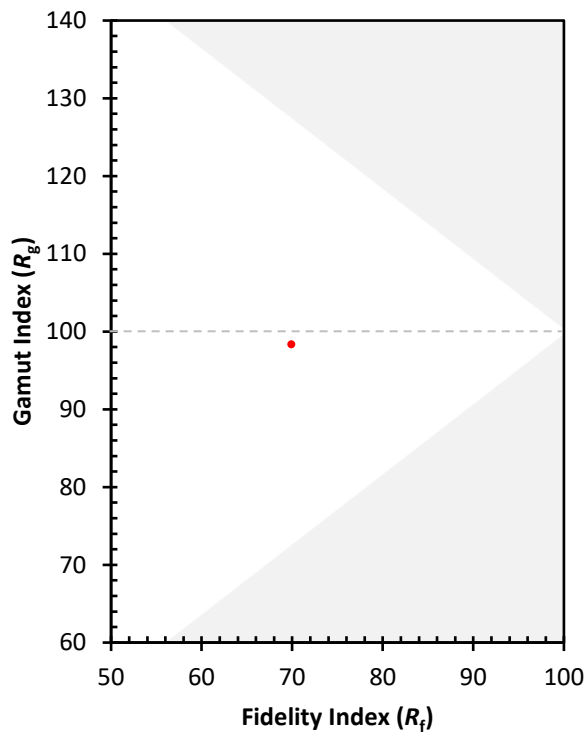
Color Rendition by Hue-Angle Bin



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**TM-30-18**

**Measure Comparisons**



(END OF REPORT)