

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: FAIL-SAFE

Report Number: P1357293

Luminaire Tested: 6ASL4-10-1-R63-UNV

Issue Date: 2/17/2026

**Test Information**

Test Method: LM-79-2019  
Report Number: P1357293  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G2-2511-597-6)  
Test Lab: INNOVATION CENTER  
Issue Date: 2/17/2026  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: FAIL-SAFE  
Catalog Number: 6ASL4-10-1-R63-UNV  
Description: 6FT 1000 LUMEN PER FOOT 4ASL LED LUMINAIRE WITH OPL LENS AND R63 LEDS 1 ROW  
Light Source: -  
Ballast/Driver: -

**Summary**

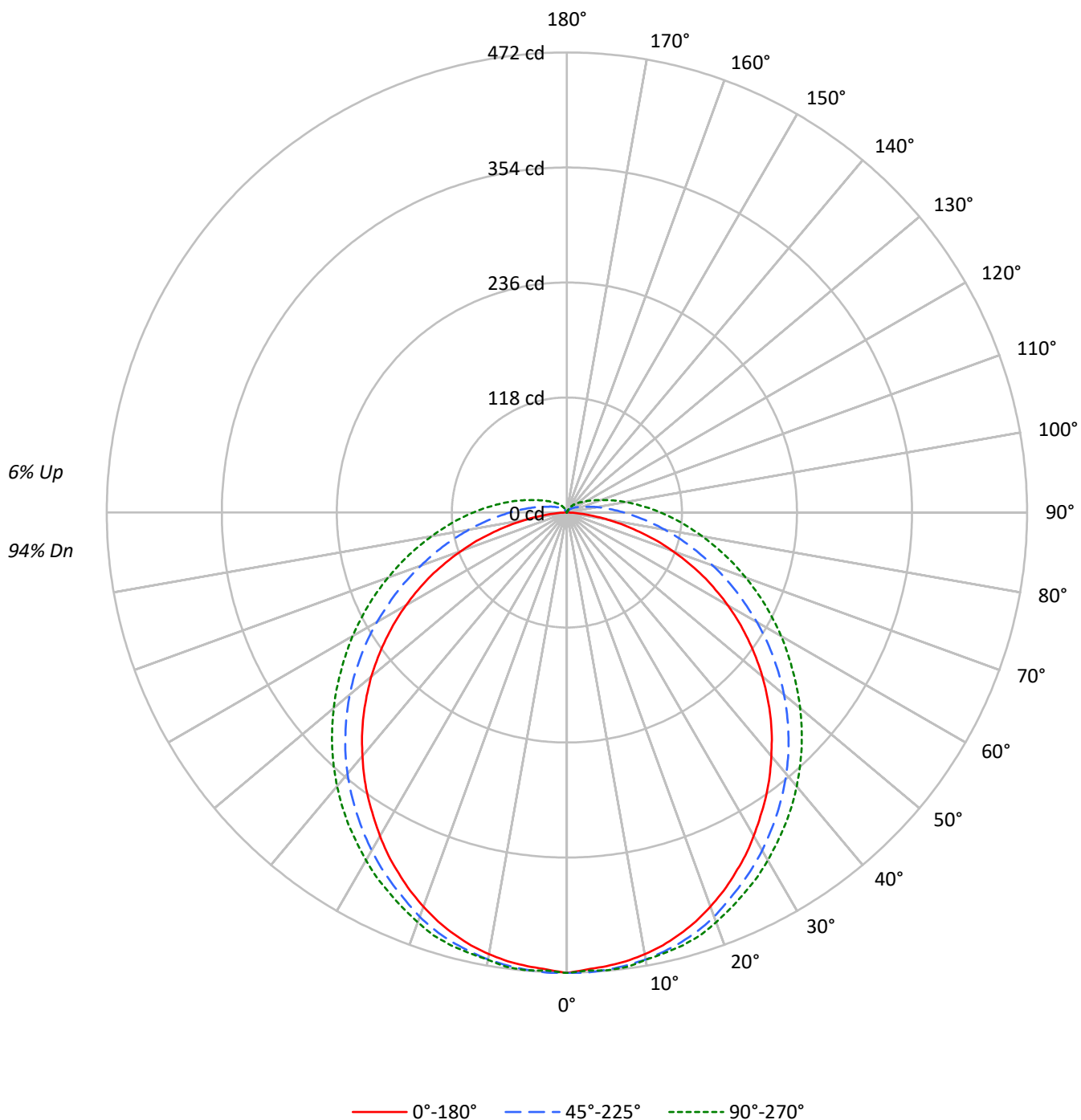
Lumens per Lamp: N/A  
Luminaire Lumens: 1582.0 lumens  
Efficiency: N/A  
Efficacy: 40.5 lumens/watt  
Spacing Criteria (0/90/45): 1.21 / 1.3 / 1.39  
Luminous Opening: Rectangular w/ Sides (W: 0.33' x L: 5.98' x H: 0.1')  
CIE Type: Direct

Input Watts (W): 39.1  
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: 24 FT

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### Luminous Intensity Polar Plot



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**COEFFICIENT OF UTILIZATION - ZONAL CAVITY METHOD:**

|     |     |     |     |     |     |     |     |     |     |     |     |  |     |     |     |  |    |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|-----|-----|-----|--|----|
| RF  | 20  |     |     |     | 20  |     |     |     | 20  |     |     |  | 20  |     |     |  | 20 |
| RC  | 80  |     |     |     | 70  |     |     |     | 50  |     |     |  | 30  |     |     |  | 10 |
| RW  | 70  | 50  | 30  | 10  | 70  | 50  | 30  | 10  | 50  | 30  | 10  |  | 50  | 30  | 10  |  | 50 |
| RCR |     |     |     |     |     |     |     |     |     |     |     |  |     |     |     |  |    |
| 0   | 118 | 118 | 118 | 118 | 114 | 114 | 114 | 114 | 108 | 108 | 108 |  | 102 | 102 | 102 |  | 96 |
| 1   | 106 | 100 | 95  | 91  | 102 | 97  | 93  | 89  | 92  | 88  | 85  |  | 87  | 84  | 81  |  | 82 |
| 2   | 95  | 86  | 79  | 73  | 92  | 84  | 77  | 71  | 79  | 74  | 69  |  | 75  | 70  | 66  |  | 71 |
| 3   | 87  | 76  | 67  | 60  | 84  | 73  | 65  | 59  | 69  | 63  | 57  |  | 66  | 60  | 55  |  | 62 |
| 4   | 79  | 67  | 57  | 50  | 76  | 65  | 56  | 50  | 62  | 54  | 48  |  | 58  | 52  | 47  |  | 56 |
| 5   | 73  | 59  | 50  | 43  | 70  | 58  | 49  | 43  | 55  | 47  | 42  |  | 52  | 46  | 41  |  | 50 |
| 6   | 67  | 53  | 44  | 38  | 65  | 52  | 43  | 37  | 50  | 42  | 36  |  | 47  | 41  | 35  |  | 45 |
| 7   | 62  | 48  | 39  | 33  | 60  | 47  | 39  | 33  | 45  | 37  | 32  |  | 43  | 36  | 31  |  | 41 |
| 8   | 58  | 44  | 35  | 29  | 56  | 43  | 35  | 29  | 41  | 34  | 29  |  | 39  | 33  | 28  |  | 38 |
| 9   | 54  | 40  | 32  | 26  | 52  | 39  | 32  | 26  | 38  | 31  | 26  |  | 36  | 30  | 25  |  | 35 |
| 10  | 51  | 37  | 29  | 24  | 49  | 36  | 29  | 24  | 35  | 28  | 23  |  | 34  | 27  | 23  |  | 32 |

**AVERAGE LUMINANCE (cd/sqm):**

|     | 0°   | 45°  | 90°  |
|-----|------|------|------|
| 0°  | 2552 | 2552 | 2552 |
| 5°  | 2529 | 2502 | 2488 |
| 10° | 2516 | 2453 | 2423 |
| 15° | 2493 | 2400 | 2372 |
| 20° | 2458 | 2339 | 2309 |
| 25° | 2414 | 2266 | 2241 |
| 30° | 2367 | 2201 | 2177 |
| 35° | 2319 | 2133 | 2113 |
| 40° | 2266 | 2064 | 2048 |
| 45° | 2215 | 1990 | 1981 |
| 50° | 2156 | 1912 | 1911 |
| 55° | 2082 | 1824 | 1841 |
| 60° | 2001 | 1731 | 1779 |
| 65° | 1896 | 1635 | 1718 |
| 70° | 1731 | 1533 | 1658 |
| 75° | 1518 | 1443 | 1612 |
| 80° | 1226 | 1367 | 1583 |
| 85° | 744  | 1318 | 1594 |

**MAXIMUM LUMINANCE 45°-90°:**

Horizontal Angle: 0°  
Vertical Angle: 45°  
Luminance: 2215 cd/sqm

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**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 44.7   | 2.8       |
| 10°-20°   | 128.4  | 8.1       |
| 20°-30°   | 194.2  | 12.3      |
| 30°-40°   | 234.8  | 14.8      |
| 40°-50°   | 246.8  | 15.6      |
| 50°-60°   | 229.9  | 14.5      |
| 60°-70°   | 188.9  | 11.9      |
| 70°-80°   | 134.1  | 8.5       |
| 80°-90°   | 80.8   | 5.1       |
| 90°-100°  | 45.3   | 2.9       |
| 100°-110° | 25.1   | 1.6       |
| 110°-120° | 14.0   | 0.9       |
| 120°-130° | 8.1    | 0.5       |
| 130°-140° | 4.4    | 0.3       |
| 140°-150° | 1.9    | 0.1       |
| 150°-160° | 0.4    | 0.0       |
| 160°-170° | 0.0    | 0.0       |
| 170°-180° | 0.0    | 0.0       |
| <hr/>     |        |           |
| 0°-30°    | 367.4  | 23.2      |
| 0°-40°    | 602.2  | 38.1      |
| 0°-60°    | 1078.9 | 68.2      |
| 0°-90°    | 1482.8 | 93.7      |
| 90°-120°  | 84.3   | 5.3       |
| 90°-150°  | 98.7   | 6.2       |
| 90°-180°  | 99.0   | 6.3       |
| 0°-180°   | 1582.0 | 100.0     |

**CANDELA DISTRIBUTION:**

|      | 0°  | 22.5° | 45° | 67.5° | 90° | Flux |
|------|-----|-------|-----|-------|-----|------|
| 0°   | 472 | 472   | 472 | 472   | 472 |      |
| 5°   | 467 | 472   | 471 | 470   | 472 | 44   |
| 15°  | 448 | 454   | 456 | 458   | 460 | 126  |
| 25°  | 408 | 416   | 422 | 428   | 431 | 188  |
| 35°  | 356 | 365   | 376 | 386   | 391 | 223  |
| 45°  | 295 | 306   | 321 | 335   | 340 | 228  |
| 55°  | 227 | 240   | 258 | 275   | 283 | 203  |
| 65°  | 154 | 168   | 192 | 214   | 224 | 152  |
| 75°  | 78  | 97    | 129 | 156   | 167 | 83   |
| 85°  | 14  | 42    | 78  | 107   | 118 | 18   |
| 90°  | 0   | 25    | 58  | 86    | 96  | 1    |
| 95°  | 0   | 14    | 43  | 67    | 77  | 0    |
| 105° | 0   | 5     | 22  | 41    | 48  | 0    |
| 115° | 0   | 3     | 14  | 25    | 29  | 0    |
| 125° | 0   | 2     | 9   | 16    | 19  | 0    |
| 135° | 0   | 0     | 5   | 10    | 13  | 0    |
| 145° | 0   | 0     | 2   | 6     | 8   | 0    |
| 155° | 0   | 0     | 0   | 2     | 2   | 0    |
| 165° | 0   | 0     | 0   | 0     | 0   | 0    |
| 175° | 0   | 0     | 0   | 0     | 0   | 0    |
| 180° | 0   | 0     | 0   | 0     | 0   | 0    |

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**CANDELA DISTRIBUTION (FULL):**

|        | 0°    | 22.5° | 45°   | 67.5° | 90°   |
|--------|-------|-------|-------|-------|-------|
| 0°     | 472.5 | 472.5 | 472.5 | 472.5 | 472.5 |
| 2.5°   | 469.3 | 473.6 | 472.5 | 470.4 | 470.4 |
| 5°     | 467.2 | 471.5 | 470.9 | 470.4 | 471.5 |
| 7.5°   | 464.5 | 468.8 | 468.8 | 469.3 | 470.4 |
| 10°    | 460.2 | 465.6 | 465.6 | 465.6 | 466.1 |
| 12.5°  | 454.9 | 460.2 | 461.3 | 461.8 | 462.9 |
| 15°    | 447.9 | 453.8 | 456.0 | 458.1 | 459.7 |
| 17.5°  | 439.9 | 445.8 | 449.5 | 452.2 | 454.9 |
| 20°    | 430.3 | 436.7 | 441.5 | 444.7 | 447.4 |
| 22.5°  | 420.1 | 426.6 | 431.4 | 436.2 | 439.4 |
| 25°    | 408.4 | 415.9 | 421.7 | 427.6 | 430.8 |
| 27.5°  | 396.6 | 404.1 | 411.6 | 418.5 | 422.3 |
| 30°    | 383.3 | 391.8 | 400.4 | 408.4 | 412.1 |
| 32.5°  | 369.4 | 378.5 | 388.6 | 397.2 | 401.4 |
| 35°    | 356.0 | 365.1 | 376.3 | 385.9 | 390.7 |
| 37.5°  | 341.6 | 350.7 | 363.5 | 374.2 | 379.0 |
| 40°    | 326.1 | 336.2 | 350.1 | 361.3 | 366.7 |
| 42.5°  | 311.1 | 321.3 | 336.2 | 348.5 | 353.9 |
| 45°    | 295.1 | 305.8 | 321.3 | 334.6 | 340.5 |
| 47.5°  | 278.5 | 289.7 | 306.3 | 320.2 | 326.6 |
| 50°    | 261.9 | 273.7 | 290.8 | 305.8 | 312.2 |
| 52.5°  | 244.3 | 256.6 | 274.8 | 290.8 | 297.7 |
| 55°    | 226.6 | 239.5 | 258.2 | 275.3 | 282.8 |
| 57.5°  | 209.0 | 221.8 | 242.1 | 260.3 | 268.3 |
| 60°    | 190.8 | 204.2 | 225.0 | 244.8 | 253.9 |
| 62.5°  | 172.1 | 186.0 | 207.9 | 229.3 | 238.9 |
| 65°    | 153.9 | 167.8 | 191.9 | 214.3 | 224.5 |
| 67.5°  | 134.7 | 149.7 | 175.3 | 198.8 | 209.5 |
| 70°    | 114.9 | 132.0 | 159.3 | 184.4 | 195.1 |
| 72.5°  | 97.3  | 114.9 | 144.3 | 170.0 | 181.2 |
| 75°    | 77.5  | 97.3  | 129.4 | 156.1 | 167.3 |
| 77.5°  | 60.4  | 81.8  | 115.5 | 142.7 | 153.9 |
| 80°    | 43.3  | 66.8  | 102.1 | 129.9 | 141.1 |
| 82.5°  | 27.8  | 53.5  | 89.8  | 118.1 | 128.8 |
| 85°    | 14.4  | 41.7  | 78.0  | 106.9 | 117.6 |
| 87.5°  | 4.3   | 32.1  | 67.4  | 95.7  | 106.4 |
| 90°    | 0.0   | 24.6  | 58.3  | 85.5  | 95.7  |
| 92.5°  | 0.0   | 18.7  | 50.2  | 76.4  | 86.6  |
| 95°    | 0.0   | 14.4  | 42.8  | 67.4  | 77.0  |
| 97.5°  | 0.0   | 11.2  | 36.9  | 59.3  | 69.0  |
| 100°   | 0.0   | 9.1   | 31.5  | 52.4  | 61.5  |
| 102.5° | 0.0   | 7.5   | 27.3  | 46.5  | 54.5  |
| 105°   | 0.0   | 5.3   | 22.5  | 40.6  | 48.1  |
| 107.5° | 0.0   | 3.7   | 19.8  | 35.8  | 42.2  |
| 110°   | 0.0   | 3.2   | 17.6  | 31.0  | 37.4  |



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**CANDELA DISTRIBUTION (continued):**

|        | 0°  | 22.5° | 45°  | 67.5° | 90°  |
|--------|-----|-------|------|-------|------|
| 112.5° | 0.0 | 2.7   | 15.5 | 27.8  | 33.1 |
| 115°   | 0.0 | 2.7   | 13.9 | 24.6  | 29.4 |
| 117.5° | 0.0 | 2.1   | 11.8 | 21.9  | 26.2 |
| 120°   | 0.0 | 2.1   | 10.7 | 19.8  | 23.5 |
| 122.5° | 0.0 | 1.6   | 9.6  | 17.6  | 21.4 |
| 125°   | 0.0 | 1.6   | 8.6  | 16.0  | 18.7 |
| 127.5° | 0.0 | 1.1   | 7.5  | 14.4  | 17.1 |
| 130°   | 0.0 | 1.1   | 6.9  | 12.8  | 15.5 |
| 132.5° | 0.0 | 0.5   | 6.4  | 11.8  | 13.9 |
| 135°   | 0.0 | 0.5   | 5.3  | 10.2  | 12.8 |
| 137.5° | 0.0 | 0.0   | 4.8  | 9.1   | 11.2 |
| 140°   | 0.0 | 0.0   | 3.7  | 8.0   | 10.2 |
| 142.5° | 0.5 | 0.0   | 3.2  | 6.9   | 8.6  |
| 145°   | 0.5 | 0.0   | 2.1  | 5.9   | 7.5  |
| 147.5° | 0.5 | 0.5   | 1.6  | 4.8   | 5.9  |
| 150°   | 0.5 | 0.5   | 1.1  | 3.2   | 4.8  |
| 152.5° | 0.5 | 0.5   | 0.5  | 2.1   | 3.2  |
| 155°   | 0.5 | 0.5   | 0.0  | 1.6   | 2.1  |
| 157.5° | 0.5 | 0.5   | 0.0  | 0.5   | 1.1  |
| 160°   | 0.5 | 0.5   | 0.0  | 0.0   | 0.5  |
| 162.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 165°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 167.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 170°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 172.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 175°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 177.5° | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |
| 180°   | 0.0 | 0.0   | 0.0  | 0.0   | 0.0  |

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**CIE UGR TABLE:**

| Reflectances:   |      |                  |       |       |       |       |                |       |       |       |       |
|-----------------|------|------------------|-------|-------|-------|-------|----------------|-------|-------|-------|-------|
| Ceiling         |      | 0.7              | 0.7   | 0.5   | 0.5   | 0.3   | 0.7            | 0.7   | 0.5   | 0.5   | 0.3   |
| Wall            |      | 0.5              | 0.3   | 0.5   | 0.3   | 0.3   | 0.5            | 0.3   | 0.5   | 0.3   | 0.3   |
| Reference plane |      | 0.2              | 0.2   | 0.2   | 0.2   | 0.2   | 0.2            | 0.2   | 0.2   | 0.2   | 0.2   |
| Room dimensions |      | Viewed crosswise |       |       |       |       | Viewed endwise |       |       |       |       |
| X=2H            | Y=2H | 12.67            | 14.22 | 13.13 | 14.66 | 15.13 | 14.68          | 16.23 | 15.14 | 16.67 | 17.14 |
|                 | 3H   | 14.16            | 15.58 | 14.63 | 16.03 | 16.54 | 17.10          | 18.52 | 17.57 | 18.97 | 19.48 |
|                 | 4H   | 14.64            | 15.98 | 15.13 | 16.45 | 16.97 | 18.28          | 19.62 | 18.77 | 20.09 | 20.61 |
|                 | 6H   | 14.91            | 16.16 | 15.42 | 16.65 | 17.18 | 19.50          | 20.75 | 20.01 | 21.24 | 21.78 |
|                 | 8H   | 14.97            | 16.16 | 15.48 | 16.67 | 17.21 | 20.14          | 21.34 | 20.66 | 21.84 | 22.39 |
|                 | 12H  | 14.98            | 16.13 | 15.50 | 16.63 | 17.20 | 20.85          | 21.99 | 21.37 | 22.49 | 23.07 |
| 4H              | 2H   | 13.54            | 14.88 | 14.03 | 15.35 | 15.87 | 15.11          | 16.45 | 15.61 | 16.92 | 17.45 |
|                 | 3H   | 15.27            | 16.41 | 15.77 | 16.92 | 17.47 | 17.76          | 18.90 | 18.26 | 19.41 | 19.96 |
|                 | 4H   | 15.87            | 16.91 | 16.39 | 17.44 | 18.01 | 19.10          | 20.15 | 19.63 | 20.67 | 21.25 |
|                 | 6H   | 16.26            | 17.18 | 16.81 | 17.74 | 18.33 | 20.52          | 21.44 | 21.06 | 21.99 | 22.58 |
|                 | 8H   | 16.36            | 17.22 | 16.91 | 17.77 | 18.38 | 21.26          | 22.12 | 21.81 | 22.67 | 23.28 |
|                 | 12H  | 16.40            | 17.19 | 16.97 | 17.77 | 18.37 | 22.09          | 22.87 | 22.66 | 23.45 | 24.06 |
| 8H              | 4H   | 16.52            | 17.39 | 17.08 | 17.94 | 18.55 | 19.32          | 20.18 | 19.87 | 20.73 | 21.34 |
|                 | 6H   | 17.09            | 17.83 | 17.68 | 18.42 | 19.03 | 20.89          | 21.63 | 21.48 | 22.22 | 22.83 |
|                 | 8H   | 17.27            | 17.93 | 17.87 | 18.54 | 19.16 | 21.77          | 22.43 | 22.37 | 23.04 | 23.66 |
|                 | 12H  | 17.38            | 17.97 | 17.98 | 18.56 | 19.25 | 22.78          | 23.38 | 23.38 | 23.97 | 24.66 |
| 12H             | 4H   | 16.71            | 17.49 | 17.28 | 18.07 | 18.68 | 19.32          | 20.11 | 19.90 | 20.69 | 21.30 |
|                 | 6H   | 17.37            | 18.03 | 17.97 | 18.64 | 19.26 | 20.93          | 21.59 | 21.52 | 22.20 | 22.82 |
|                 | 8H   | 17.64            | 18.23 | 18.24 | 18.83 | 19.52 | 21.87          | 22.47 | 22.47 | 23.06 | 23.75 |

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

Report Prepared for

Cooper Lighting Solutions

Fail-Safe

Report Number: SP1-2511-597-7

Test Date: 01/21/2026

Luminaire Tested: 4ASL-2-R630-UNV-OPL-1\_600mA

Data in this report applies to families of products including 4ASL

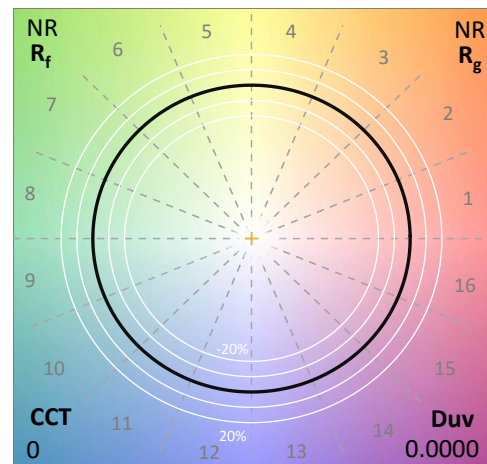
### Test Information

Test Method: LM-79-2019  
 Report Number: SP1-2511-597-7  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry:  $4\pi$   
 Issue Date: 01/29/2026  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: Fail-Safe  
 Catalog Number: **4ASL-2-R630-UNV-OPL-1\_600mA**  
 Description: 2foot 4ASL LED LUMINAIRE WITH OPL LENS AND RED 630NM LEDS with 1 rows at 600mA

### Spectral Parameters

CCT (K): 0  
 CIE  $u'$ : 0.5395  
 CIE  $v'$ : 0.5190  
 Duv: 0.0000  
 CIE x: 0.7004  
 CIE y: 0.2995  
 CIE z: 0.0001  
 Peak Wavelength (nm): 638  
 Dominant Wavelength (nm): 624  
 Purity: 99.9862  
 R<sub>f</sub>: NR  
 R<sub>g</sub>: NR

CRI (Ra): 0.0  
 R1: 0.0  
 R2: 0.0  
 R3: 0.0  
 R4: 0.0  
 R5: 0.0  
 R6: 0.0  
 R7: 0.0  
 R8: 0.0  
 R9: 0.0  
 R10: 0.0  
 R11: 0.0  
 R12: 0.0  
 R13: 0.0  
 R14: 0.0  
 R15: 0.0

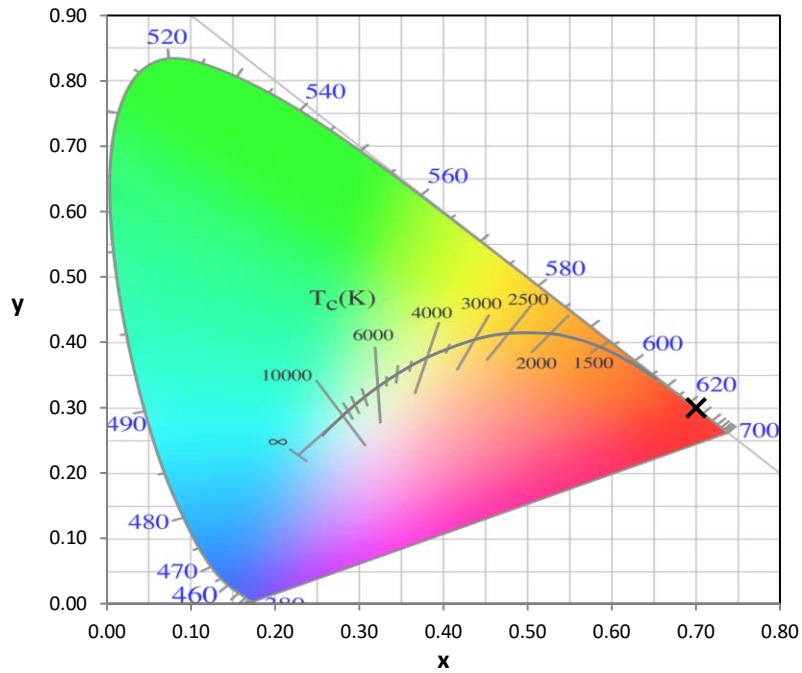


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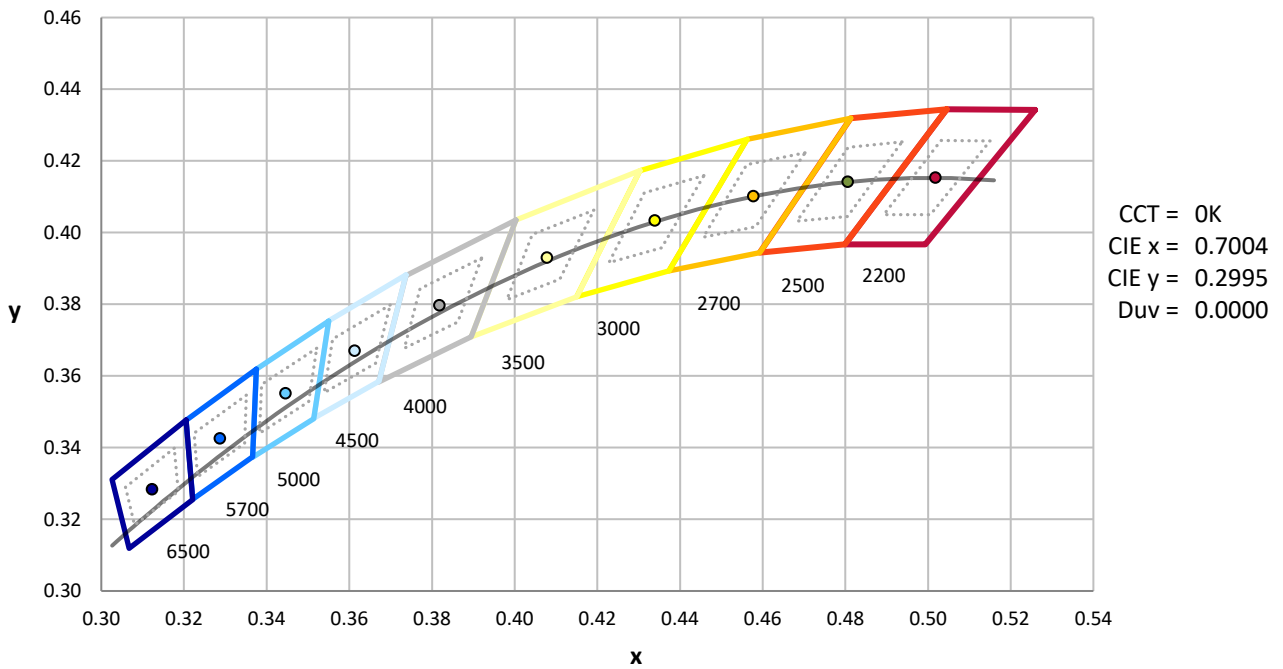
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | 76INCH SPHERE IN0058  | 12/16/2025       | 6/16/2026            |
| Power Meter                    | XITRON INXT2011004    | 10/21/2025       | 10/21/2026           |
| AC Power Source                | CHROMA 61603 IN0063   | 10/21/2025       | 10/21/2026           |
| DC Power Source                | AGILENT E3634A IN0208 | 10/21/2025       | 10/21/2026           |
| Sphere Thermometer             | ONSET IN0085          | 10/21/2025       | 10/21/2026           |
| Room Thermometer               | ONSET IN0046          | 10/21/2025       | 10/21/2026           |

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**CIE 1931 Chromaticity Diagram**



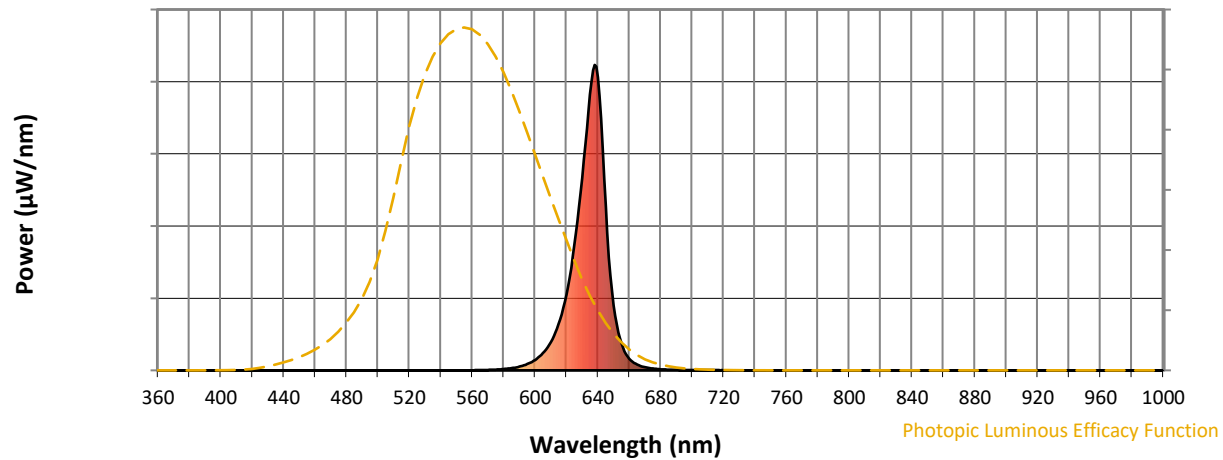
**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



CCT = 0K  
 CIE  $x$  = 0.7004  
 CIE  $y$  = 0.2995  
 Duv = 0.0000

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### Photopic Flux vs. Wavelength

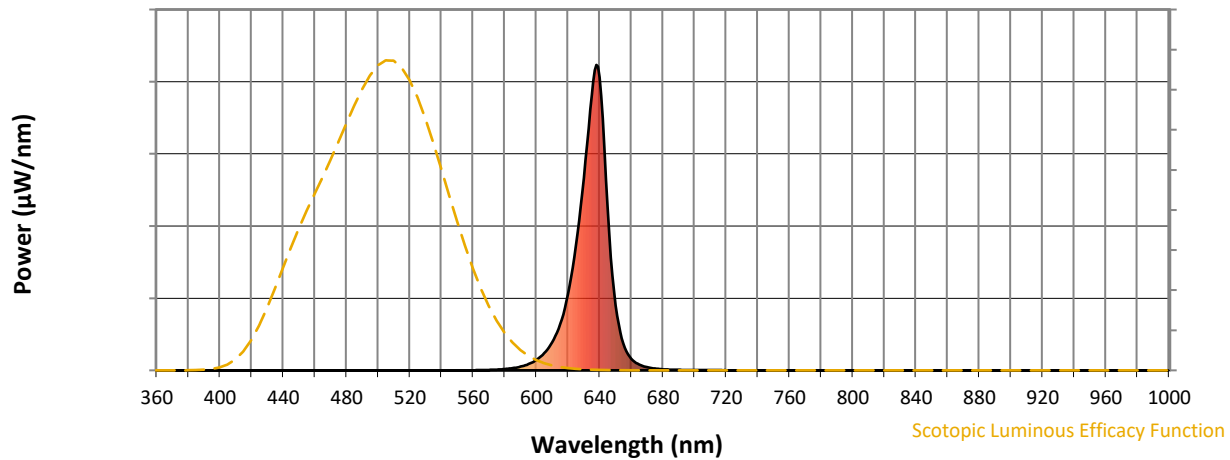


### Photopic Lumens: NR

| $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^{\wedge}/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) |
|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|-------------------|----------------------------------------|--------------------------------|
| 360               | 0                                      | NR                             | 490               | 0                                      | NR                             | 620               | 248                                    | NR                             | 750               | 0                                      | NR                             | 880               | 0                                      | NR                             |
| 365               | 0                                      | NR                             | 495               | 0                                      | NR                             | 625               | 409                                    | NR                             | 755               | 0                                      | NR                             | 885               | 0                                      | NR                             |
| 370               | 0                                      | NR                             | 500               | 0                                      | NR                             | 630               | 630                                    | NR                             | 760               | 0                                      | NR                             | 890               | 0                                      | NR                             |
| 375               | 0                                      | NR                             | 505               | 0                                      | NR                             | 635               | 903                                    | NR                             | 765               | 0                                      | NR                             | 895               | 0                                      | NR                             |
| 380               | 0                                      | NR                             | 510               | 0                                      | NR                             | 640               | 960                                    | NR                             | 770               | 0                                      | NR                             | 900               | 0                                      | NR                             |
| 385               | 0                                      | NR                             | 515               | 0                                      | NR                             | 645               | 535                                    | NR                             | 775               | 0                                      | NR                             | 905               | 0                                      | NR                             |
| 390               | 0                                      | NR                             | 520               | 0                                      | NR                             | 650               | 212                                    | NR                             | 780               | 0                                      | NR                             | 910               | 0                                      | NR                             |
| 395               | 0                                      | NR                             | 525               | 0                                      | NR                             | 655               | 88                                     | NR                             | 785               | 0                                      | NR                             | 915               | 0                                      | NR                             |
| 400               | 0                                      | NR                             | 530               | 0                                      | NR                             | 660               | 38                                     | NR                             | 790               | 0                                      | NR                             | 920               | 0                                      | NR                             |
| 405               | 0                                      | NR                             | 535               | 0                                      | NR                             | 665               | 19                                     | NR                             | 795               | 0                                      | NR                             | 925               | 0                                      | NR                             |
| 410               | 0                                      | NR                             | 540               | 0                                      | NR                             | 670               | 10                                     | NR                             | 800               | 0                                      | NR                             | 930               | 0                                      | NR                             |
| 415               | 0                                      | NR                             | 545               | 0                                      | NR                             | 675               | 6                                      | NR                             | 805               | 0                                      | NR                             | 935               | 0                                      | NR                             |
| 420               | 0                                      | NR                             | 550               | 0                                      | NR                             | 680               | 4                                      | NR                             | 810               | 0                                      | NR                             | 940               | 0                                      | NR                             |
| 425               | 0                                      | NR                             | 555               | 0                                      | NR                             | 685               | 2                                      | NR                             | 815               | 0                                      | NR                             | 945               | 0                                      | NR                             |
| 430               | 0                                      | NR                             | 560               | 0                                      | NR                             | 690               | 2                                      | NR                             | 820               | 0                                      | NR                             | 950               | 0                                      | NR                             |
| 435               | 0                                      | NR                             | 565               | 1                                      | NR                             | 695               | 1                                      | NR                             | 825               | 0                                      | NR                             | 955               | 0                                      | NR                             |
| 440               | 0                                      | NR                             | 570               | 2                                      | NR                             | 700               | 1                                      | NR                             | 830               | 0                                      | NR                             | 960               | 0                                      | NR                             |
| 445               | 0                                      | NR                             | 575               | 3                                      | NR                             | 705               | 1                                      | NR                             | 835               | 0                                      | NR                             | 965               | 0                                      | NR                             |
| 450               | 0                                      | NR                             | 580               | 4                                      | NR                             | 710               | 1                                      | NR                             | 840               | 0                                      | NR                             | 970               | 0                                      | NR                             |
| 455               | 0                                      | NR                             | 585               | 7                                      | NR                             | 715               | 1                                      | NR                             | 845               | 0                                      | NR                             | 975               | 0                                      | NR                             |
| 460               | 0                                      | NR                             | 590               | 12                                     | NR                             | 720               | 1                                      | NR                             | 850               | 0                                      | NR                             | 980               | 0                                      | NR                             |
| 465               | 0                                      | NR                             | 595               | 20                                     | NR                             | 725               | 0                                      | NR                             | 855               | 0                                      | NR                             | 985               | 0                                      | NR                             |
| 470               | 0                                      | NR                             | 600               | 34                                     | NR                             | 730               | 0                                      | NR                             | 860               | 0                                      | NR                             | 990               | 0                                      | NR                             |
| 475               | 0                                      | NR                             | 605               | 56                                     | NR                             | 735               | 0                                      | NR                             | 865               | 0                                      | NR                             | 995               | 0                                      | NR                             |
| 480               | 0                                      | NR                             | 610               | 92                                     | NR                             | 740               | 0                                      | NR                             | 870               | 0                                      | NR                             | 1000              | 0                                      | NR                             |
| 485               | 0                                      | NR                             | 615               | 152                                    | NR                             | 745               | 0                                      | NR                             | 875               | 0                                      | NR                             |                   |                                        |                                |

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### Scotopic Flux vs. Wavelength



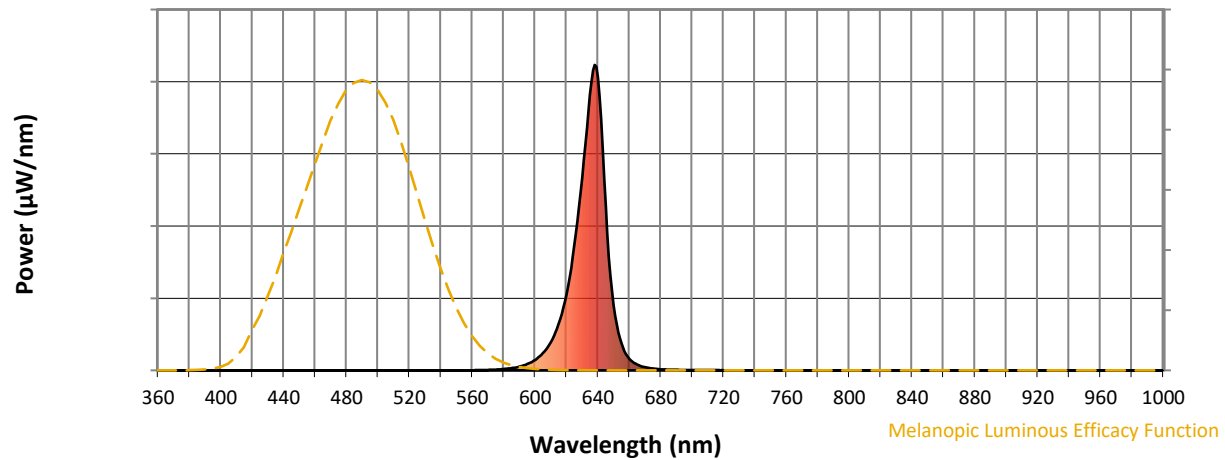
Scotopic Lumens: NR

S/P: 0.05

| $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>$\text{W}^\wedge/\text{nm}$ | Lumens<br>( $\phi/\text{nm}$ ) |
|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|-------------------|--------------------------------------|--------------------------------|
| 360               | 0                                    | NR                             | 490               | 0                                    | NR                             | 620               | 248                                  | NR                             | 750               | 0                                    | NR                             | 880               | 0                                    | NR                             |
| 365               | 0                                    | NR                             | 495               | 0                                    | NR                             | 625               | 409                                  | NR                             | 755               | 0                                    | NR                             | 885               | 0                                    | NR                             |
| 370               | 0                                    | NR                             | 500               | 0                                    | NR                             | 630               | 630                                  | NR                             | 760               | 0                                    | NR                             | 890               | 0                                    | NR                             |
| 375               | 0                                    | NR                             | 505               | 0                                    | NR                             | 635               | 903                                  | NR                             | 765               | 0                                    | NR                             | 895               | 0                                    | NR                             |
| 380               | 0                                    | NR                             | 510               | 0                                    | NR                             | 640               | 960                                  | NR                             | 770               | 0                                    | NR                             | 900               | 0                                    | NR                             |
| 385               | 0                                    | NR                             | 515               | 0                                    | NR                             | 645               | 535                                  | NR                             | 775               | 0                                    | NR                             | 905               | 0                                    | NR                             |
| 390               | 0                                    | NR                             | 520               | 0                                    | NR                             | 650               | 212                                  | NR                             | 780               | 0                                    | NR                             | 910               | 0                                    | NR                             |
| 395               | 0                                    | NR                             | 525               | 0                                    | NR                             | 655               | 88                                   | NR                             | 785               | 0                                    | NR                             | 915               | 0                                    | NR                             |
| 400               | 0                                    | NR                             | 530               | 0                                    | NR                             | 660               | 38                                   | NR                             | 790               | 0                                    | NR                             | 920               | 0                                    | NR                             |
| 405               | 0                                    | NR                             | 535               | 0                                    | NR                             | 665               | 19                                   | NR                             | 795               | 0                                    | NR                             | 925               | 0                                    | NR                             |
| 410               | 0                                    | NR                             | 540               | 0                                    | NR                             | 670               | 10                                   | NR                             | 800               | 0                                    | NR                             | 930               | 0                                    | NR                             |
| 415               | 0                                    | NR                             | 545               | 0                                    | NR                             | 675               | 6                                    | NR                             | 805               | 0                                    | NR                             | 935               | 0                                    | NR                             |
| 420               | 0                                    | NR                             | 550               | 0                                    | NR                             | 680               | 4                                    | NR                             | 810               | 0                                    | NR                             | 940               | 0                                    | NR                             |
| 425               | 0                                    | NR                             | 555               | 0                                    | NR                             | 685               | 2                                    | NR                             | 815               | 0                                    | NR                             | 945               | 0                                    | NR                             |
| 430               | 0                                    | NR                             | 560               | 0                                    | NR                             | 690               | 2                                    | NR                             | 820               | 0                                    | NR                             | 950               | 0                                    | NR                             |
| 435               | 0                                    | NR                             | 565               | 1                                    | NR                             | 695               | 1                                    | NR                             | 825               | 0                                    | NR                             | 955               | 0                                    | NR                             |
| 440               | 0                                    | NR                             | 570               | 2                                    | NR                             | 700               | 1                                    | NR                             | 830               | 0                                    | NR                             | 960               | 0                                    | NR                             |
| 445               | 0                                    | NR                             | 575               | 3                                    | NR                             | 705               | 1                                    | NR                             | 835               | 0                                    | NR                             | 965               | 0                                    | NR                             |
| 450               | 0                                    | NR                             | 580               | 4                                    | NR                             | 710               | 1                                    | NR                             | 840               | 0                                    | NR                             | 970               | 0                                    | NR                             |
| 455               | 0                                    | NR                             | 585               | 7                                    | NR                             | 715               | 1                                    | NR                             | 845               | 0                                    | NR                             | 975               | 0                                    | NR                             |
| 460               | 0                                    | NR                             | 590               | 12                                   | NR                             | 720               | 1                                    | NR                             | 850               | 0                                    | NR                             | 980               | 0                                    | NR                             |
| 465               | 0                                    | NR                             | 595               | 20                                   | NR                             | 725               | 0                                    | NR                             | 855               | 0                                    | NR                             | 985               | 0                                    | NR                             |
| 470               | 0                                    | NR                             | 600               | 34                                   | NR                             | 730               | 0                                    | NR                             | 860               | 0                                    | NR                             | 990               | 0                                    | NR                             |
| 475               | 0                                    | NR                             | 605               | 56                                   | NR                             | 735               | 0                                    | NR                             | 865               | 0                                    | NR                             | 995               | 0                                    | NR                             |
| 480               | 0                                    | NR                             | 610               | 92                                   | NR                             | 740               | 0                                    | NR                             | 870               | 0                                    | NR                             | 1000              | 0                                    | NR                             |
| 485               | 0                                    | NR                             | 615               | 152                                  | NR                             | 745               | 0                                    | NR                             | 875               | 0                                    | NR                             |                   |                                      |                                |

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### Melanopic Flux vs. Wavelength



Melanopic Lumens: NR

M/P: 0.02

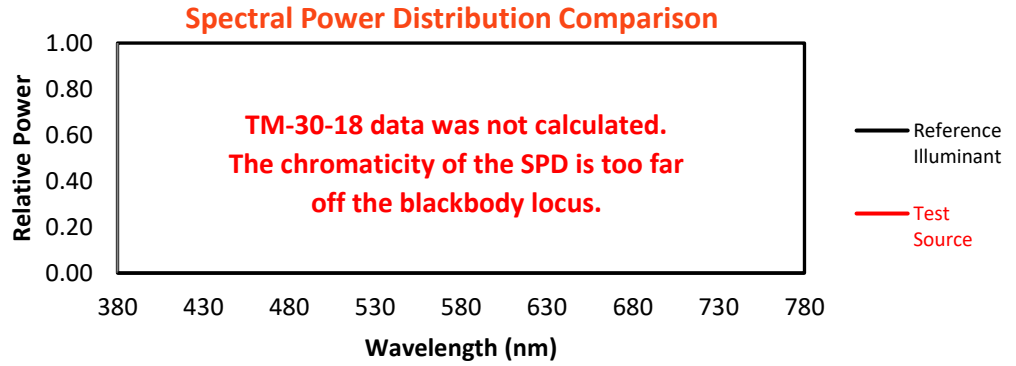
| λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>λ</sup> /nm | Lumens<br>(φ/nm) |
|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|
| 360       | 0                           | NR               | 490       | 0                           | NR               | 620       | 248                         | NR               | 750       | 0                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 0                           | NR               | 625       | 409                         | NR               | 755       | 0                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 0                           | NR               | 630       | 630                         | NR               | 760       | 0                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 0                           | NR               | 635       | 903                         | NR               | 765       | 0                           | NR               | 895       | 0                           | NR               |
| 380       | 0                           | NR               | 510       | 0                           | NR               | 640       | 960                         | NR               | 770       | 0                           | NR               | 900       | 0                           | NR               |
| 385       | 0                           | NR               | 515       | 0                           | NR               | 645       | 535                         | NR               | 775       | 0                           | NR               | 905       | 0                           | NR               |
| 390       | 0                           | NR               | 520       | 0                           | NR               | 650       | 212                         | NR               | 780       | 0                           | NR               | 910       | 0                           | NR               |
| 395       | 0                           | NR               | 525       | 0                           | NR               | 655       | 88                          | NR               | 785       | 0                           | NR               | 915       | 0                           | NR               |
| 400       | 0                           | NR               | 530       | 0                           | NR               | 660       | 38                          | NR               | 790       | 0                           | NR               | 920       | 0                           | NR               |
| 405       | 0                           | NR               | 535       | 0                           | NR               | 665       | 19                          | NR               | 795       | 0                           | NR               | 925       | 0                           | NR               |
| 410       | 0                           | NR               | 540       | 0                           | NR               | 670       | 10                          | NR               | 800       | 0                           | NR               | 930       | 0                           | NR               |
| 415       | 0                           | NR               | 545       | 0                           | NR               | 675       | 6                           | NR               | 805       | 0                           | NR               | 935       | 0                           | NR               |
| 420       | 0                           | NR               | 550       | 0                           | NR               | 680       | 4                           | NR               | 810       | 0                           | NR               | 940       | 0                           | NR               |
| 425       | 0                           | NR               | 555       | 0                           | NR               | 685       | 2                           | NR               | 815       | 0                           | NR               | 945       | 0                           | NR               |
| 430       | 0                           | NR               | 560       | 0                           | NR               | 690       | 2                           | NR               | 820       | 0                           | NR               | 950       | 0                           | NR               |
| 435       | 0                           | NR               | 565       | 1                           | NR               | 695       | 1                           | NR               | 825       | 0                           | NR               | 955       | 0                           | NR               |
| 440       | 0                           | NR               | 570       | 2                           | NR               | 700       | 1                           | NR               | 830       | 0                           | NR               | 960       | 0                           | NR               |
| 445       | 0                           | NR               | 575       | 3                           | NR               | 705       | 1                           | NR               | 835       | 0                           | NR               | 965       | 0                           | NR               |
| 450       | 0                           | NR               | 580       | 4                           | NR               | 710       | 1                           | NR               | 840       | 0                           | NR               | 970       | 0                           | NR               |
| 455       | 0                           | NR               | 585       | 7                           | NR               | 715       | 1                           | NR               | 845       | 0                           | NR               | 975       | 0                           | NR               |
| 460       | 0                           | NR               | 590       | 12                          | NR               | 720       | 1                           | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 0                           | NR               | 595       | 20                          | NR               | 725       | 0                           | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 0                           | NR               | 600       | 34                          | NR               | 730       | 0                           | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 0                           | NR               | 605       | 56                          | NR               | 735       | 0                           | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 0                           | NR               | 610       | 92                          | NR               | 740       | 0                           | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 0                           | NR               | 615       | 152                         | NR               | 745       | 0                           | NR               | 875       | 0                           | NR               |           |                             |                  |

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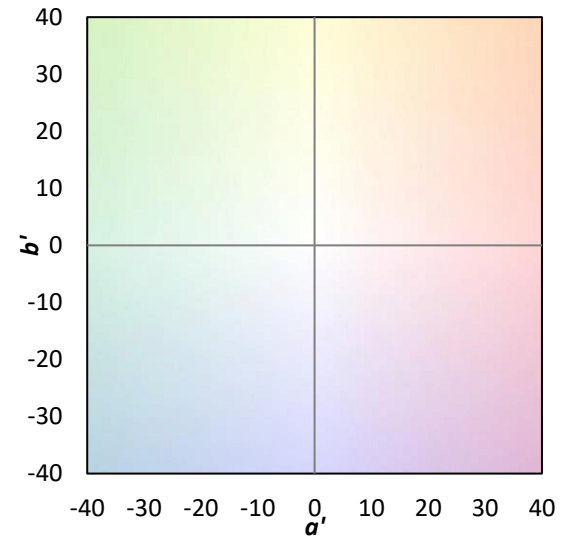
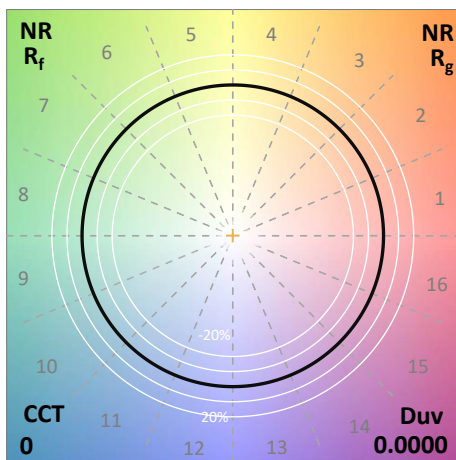
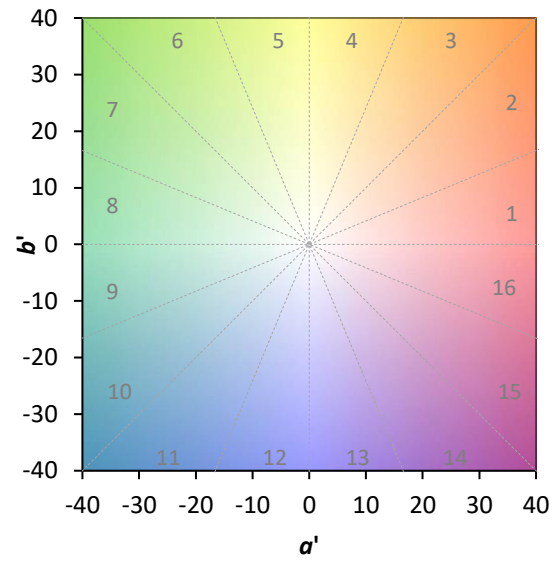
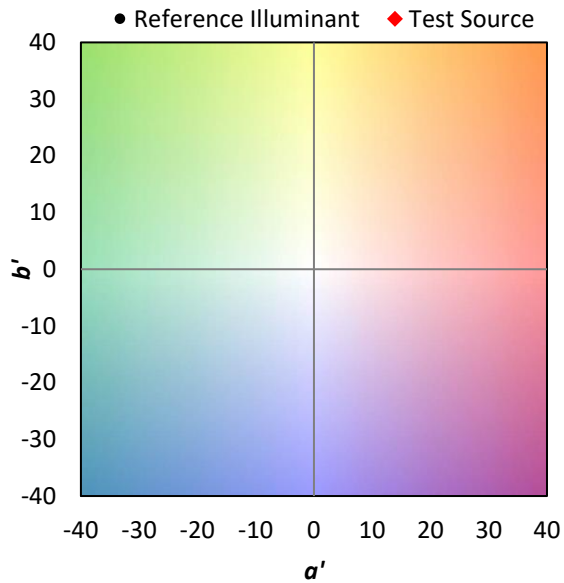
TM-30-18

### Summary

$R_f = 0$   
 $R_g = 0$   
 $CIE R_a = 0.0$   
 $R_9 = 0.0$

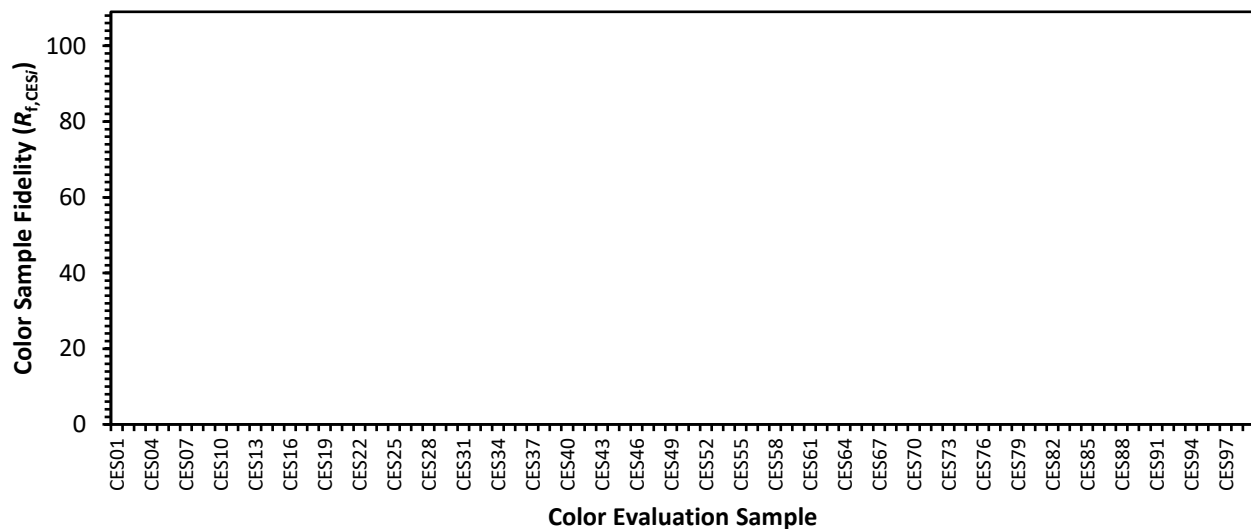


### Color Vector Graphics



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

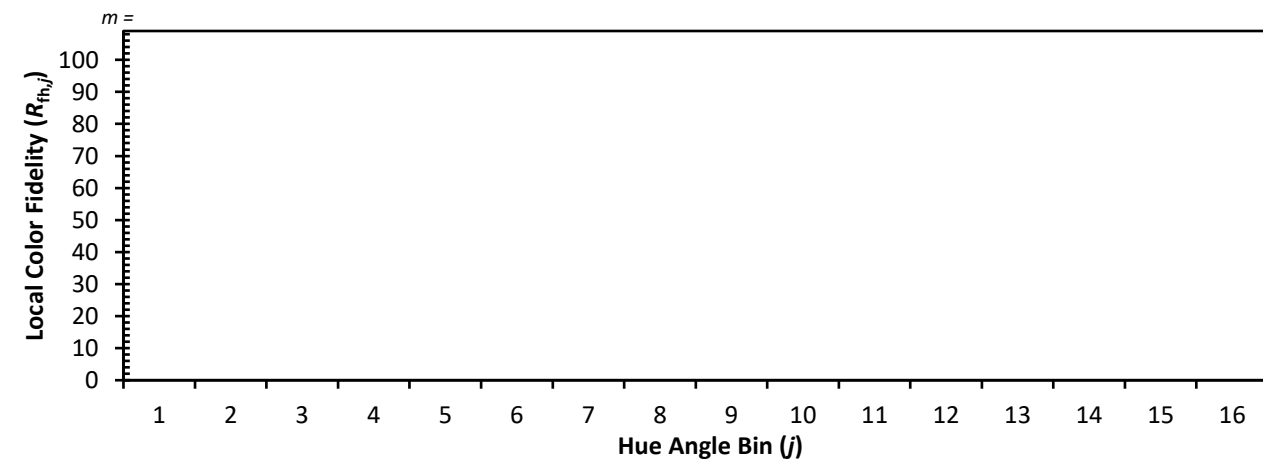
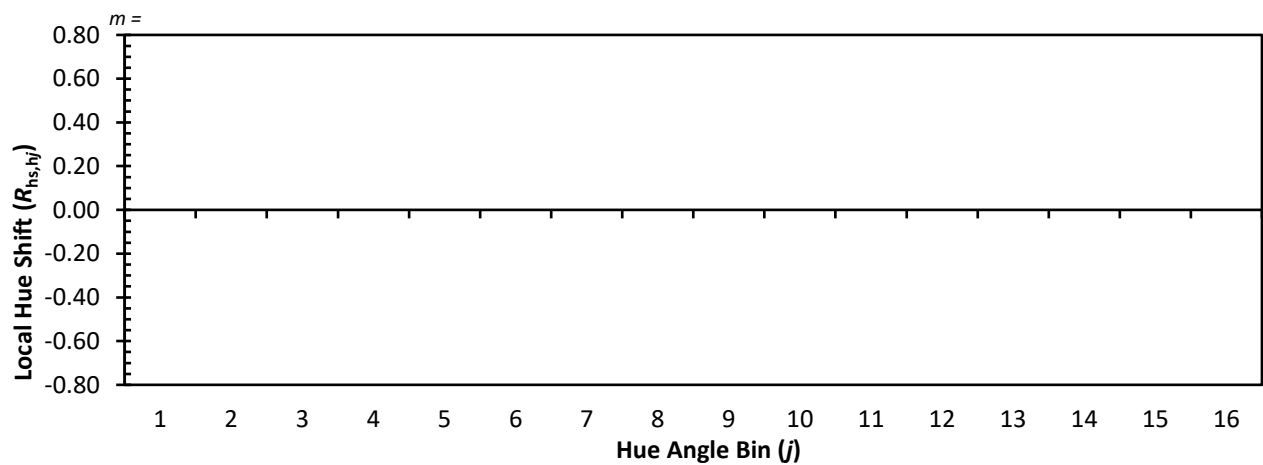
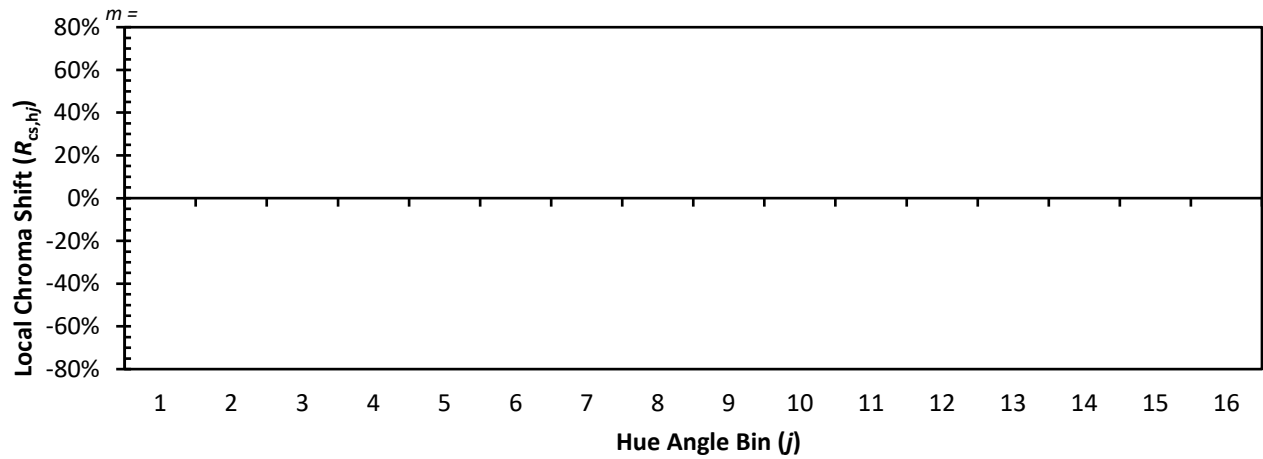
|           |           |           |           |
|-----------|-----------|-----------|-----------|
| CES01 = 0 | CES26 = 0 | CES51 = 0 | CES76 = 0 |
| CES02 = 0 | CES27 = 0 | CES52 = 0 | CES77 = 0 |
| CES03 = 0 | CES28 = 0 | CES53 = 0 | CES78 = 0 |
| CES04 = 0 | CES29 = 0 | CES54 = 0 | CES79 = 0 |
| CES05 = 0 | CES30 = 0 | CES55 = 0 | CES80 = 0 |
| CES06 = 0 | CES31 = 0 | CES56 = 0 | CES81 = 0 |
| CES07 = 0 | CES32 = 0 | CES57 = 0 | CES82 = 0 |
| CES08 = 0 | CES33 = 0 | CES58 = 0 | CES83 = 0 |
| CES09 = 0 | CES34 = 0 | CES59 = 0 | CES84 = 0 |
| CES10 = 0 | CES35 = 0 | CES60 = 0 | CES85 = 0 |
| CES11 = 0 | CES36 = 0 | CES61 = 0 | CES86 = 0 |
| CES12 = 0 | CES37 = 0 | CES62 = 0 | CES87 = 0 |
| CES13 = 0 | CES38 = 0 | CES63 = 0 | CES88 = 0 |
| CES14 = 0 | CES39 = 0 | CES64 = 0 | CES89 = 0 |
| CES15 = 0 | CES40 = 0 | CES65 = 0 | CES90 = 0 |
| CES16 = 0 | CES41 = 0 | CES66 = 0 | CES91 = 0 |
| CES17 = 0 | CES42 = 0 | CES67 = 0 | CES92 = 0 |
| CES18 = 0 | CES43 = 0 | CES68 = 0 | CES93 = 0 |
| CES19 = 0 | CES44 = 0 | CES69 = 0 | CES94 = 0 |
| CES20 = 0 | CES45 = 0 | CES70 = 0 | CES95 = 0 |
| CES21 = 0 | CES46 = 0 | CES71 = 0 | CES96 = 0 |
| CES22 = 0 | CES47 = 0 | CES72 = 0 | CES97 = 0 |
| CES23 = 0 | CES48 = 0 | CES73 = 0 | CES98 = 0 |
| CES24 = 0 | CES49 = 0 | CES74 = 0 | CES99 = 0 |
| CES25 = 0 | CES50 = 0 | CES75 = 0 |           |



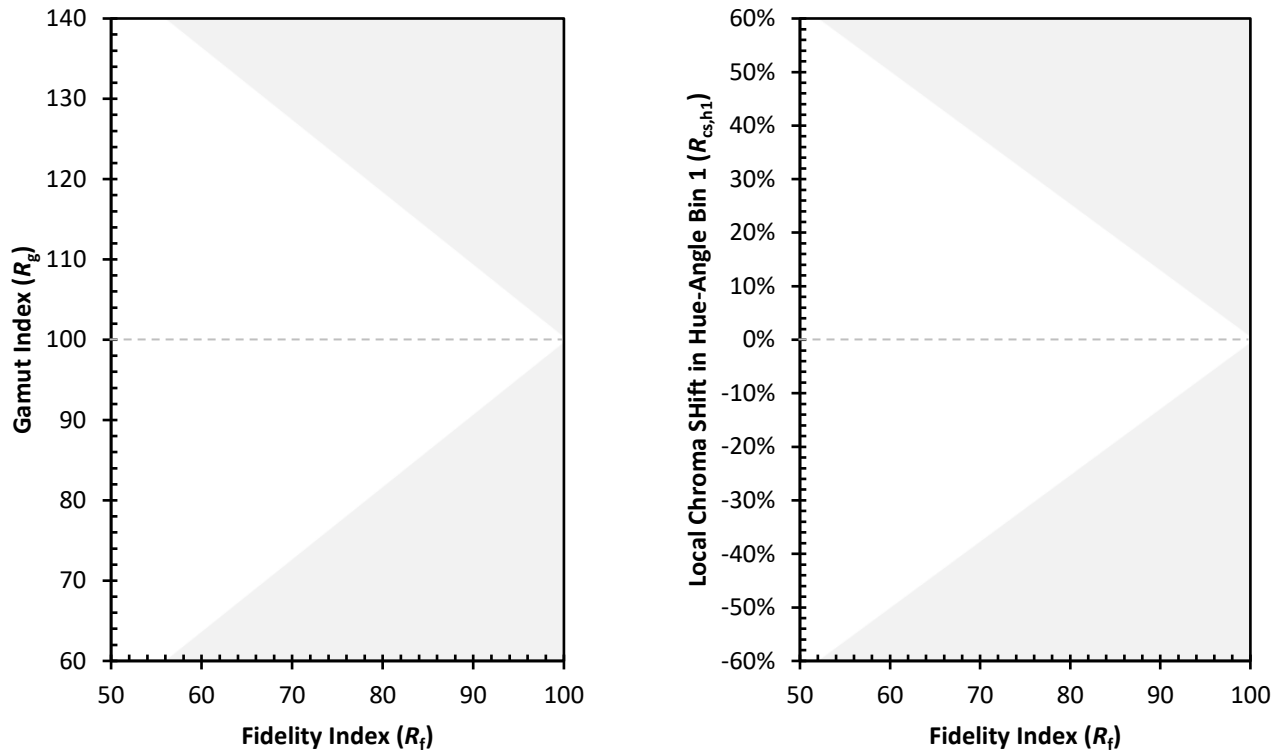
REPORT NUMBER: SP1-2511-597-7

**TM-30-18**

**Color Rendition by Hue-Angle Bin**



**Measure Comparisons**



(END OF REPORT)