

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: P1356774

Luminaire Tested: 1ASL4-5HE-2-35-UNV

Issue Date: 2/17/2026

**Test Information**

Test Method: LM-79-2019  
Report Number: P1356774  
TEST IS SCALED FROM IESNA LM-79-08 TEST DATA (G2-2511-597-7)  
Test Lab: INNOVATION CENTER  
Issue Date: 2/17/2026  
Manufacturer: COOPER LIGHTING SOLUTIONS  
Product Line: FAIL-SAFE  
Catalog Number: 1ASL4-5HE-2-35-UNV  
Description: 1FT 500 LUMEN PER FOOT 4ASL LED LUMINAIRE WITH OPL LENS AND 3500K LEDS 2 ROW  
Light Source: -  
Ballast/Driver: -

**Summary**

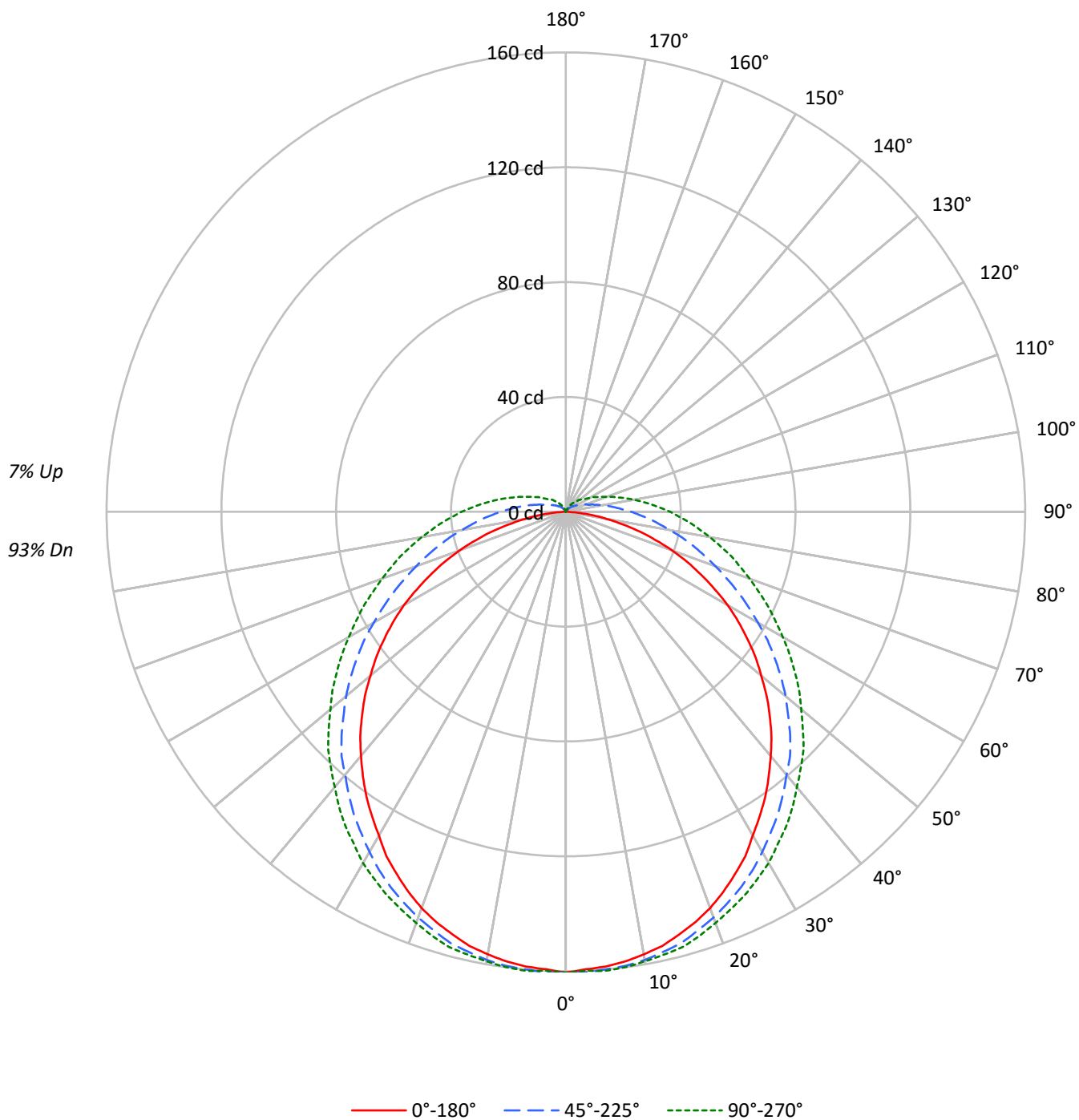
Lumens per Lamp: N/A  
Luminaire Lumens: 551.0 lumens  
Efficiency: N/A  
Efficacy: 128.1 lumens/watt  
Spacing Criteria (0/90/45): 1.21 / 1.3 / 1.4  
Luminous Opening: Rectangular w/ Sides (W: 0.33' x L: 0.98' x H: 0.1')  
CIE Type: Direct

Input Watts (W): 4.3  
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

TEST NUMBER: P1356774

CATALOG NUMBER: 1ASL4-5HE-2-35-UNV

### Luminous Intensity Polar Plot



TEST NUMBER: P1356774

CATALOG NUMBER: 1ASL4-5HE-2-35-UNV

**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 | 30 | 10 |
| RCR |     |     |     |     |  |     |     |     |     |  |     |     |     |  |     |     |     |  |    |    |    |
| 0   | 117 | 117 | 117 | 117 |  | 114 | 114 | 114 | 114 |  | 107 | 107 | 107 |  | 101 | 101 | 101 |  | 95 | 95 | 95 |
| 1   | 105 | 100 | 95  | 90  |  | 102 | 97  | 92  | 88  |  | 91  | 87  | 84  |  | 86  | 83  | 80  |  | 81 | 79 | 77 |
| 2   | 95  | 86  | 79  | 72  |  | 92  | 84  | 77  | 71  |  | 79  | 73  | 68  |  | 74  | 70  | 65  |  | 70 | 66 | 63 |
| 3   | 86  | 75  | 66  | 59  |  | 83  | 73  | 65  | 58  |  | 69  | 62  | 56  |  | 65  | 59  | 55  |  | 62 | 57 | 53 |
| 4   | 79  | 66  | 57  | 50  |  | 76  | 64  | 56  | 49  |  | 61  | 54  | 48  |  | 58  | 51  | 46  |  | 55 | 49 | 45 |
| 5   | 72  | 59  | 50  | 43  |  | 70  | 57  | 49  | 42  |  | 54  | 47  | 41  |  | 52  | 45  | 40  |  | 49 | 43 | 39 |
| 6   | 67  | 53  | 44  | 37  |  | 64  | 52  | 43  | 37  |  | 49  | 41  | 36  |  | 47  | 40  | 35  |  | 44 | 39 | 34 |
| 7   | 62  | 48  | 39  | 33  |  | 60  | 47  | 38  | 32  |  | 45  | 37  | 32  |  | 43  | 36  | 31  |  | 41 | 35 | 30 |
| 8   | 58  | 44  | 35  | 29  |  | 56  | 43  | 34  | 29  |  | 41  | 33  | 28  |  | 39  | 32  | 28  |  | 37 | 31 | 27 |
| 9   | 54  | 40  | 32  | 26  |  | 52  | 39  | 31  | 26  |  | 37  | 30  | 25  |  | 36  | 29  | 25  |  | 34 | 29 | 24 |
| 10  | 50  | 37  | 29  | 24  |  | 49  | 36  | 28  | 23  |  | 35  | 28  | 23  |  | 33  | 27  | 22  |  | 32 | 26 | 22 |

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

|     | 0°   | 45°  | 90°  |
|-----|------|------|------|
| 0°  | 5293 | 5293 | 5293 |
| 5°  | 5215 | 5163 | 5172 |
| 10° | 5144 | 5044 | 5046 |
| 15° | 5059 | 4919 | 4946 |
| 20° | 4963 | 4765 | 4802 |
| 25° | 4829 | 4614 | 4681 |
| 30° | 4671 | 4449 | 4558 |
| 35° | 4537 | 4291 | 4420 |
| 40° | 4387 | 4124 | 4270 |
| 45° | 4232 | 3976 | 4161 |
| 50° | 4043 | 3788 | 4000 |
| 55° | 3853 | 3588 | 3872 |
| 60° | 3626 | 3365 | 3736 |
| 65° | 3304 | 3154 | 3630 |
| 70° | 2940 | 2950 | 3533 |
| 75° | 2444 | 2778 | 3506 |
| 80° | 1729 | 2608 | 3494 |
| 85° | 854  | 2528 | 3592 |

**MAXIMUM LUMINANCE 45°-90°:**

Horizontal Angle: 0°

Vertical Angle: 45°

Luminance: 4232 cd/sqm

TEST NUMBER: P1356774

CATALOG NUMBER: 1ASL4-5HE-2-35-UNV

**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 15.2   | 2.8       |
| 10°-20°   | 43.8   | 7.9       |
| 20°-30°   | 66.3   | 12.0      |
| 30°-40°   | 80.2   | 14.6      |
| 40°-50°   | 84.5   | 15.3      |
| 50°-60°   | 78.9   | 14.3      |
| 60°-70°   | 65.1   | 11.8      |
| 70°-80°   | 47.3   | 8.6       |
| 80°-90°   | 29.8   | 5.4       |
| 90°-100°  | 17.8   | 3.2       |
| 100°-110° | 10.2   | 1.9       |
| 110°-120° | 5.8    | 1.1       |
| 120°-130° | 3.3    | 0.6       |
| 130°-140° | 1.8    | 0.3       |
| 140°-150° | 0.8    | 0.1       |
| 150°-160° | 0.1    | 0.0       |
| 160°-170° | 0.0    | 0.0       |
| 170°-180° | 0.0    | 0.0       |
| <hr/>     |        |           |
| 0°-30°    | 125.3  | 22.7      |
| 0°-40°    | 205.5  | 37.3      |
| 0°-60°    | 368.9  | 67.0      |
| 0°-90°    | 511.1  | 92.8      |
| 90°-120°  | 33.8   | 6.1       |
| 90°-150°  | 39.7   | 7.2       |
| 90°-180°  | 40.0   | 7.3       |
| 0°-180°   | 551.0  | 100.0     |

**CANDELA DISTRIBUTION:**

|      | 0°  | 22.5° | 45° | 67.5° | 90° | Flux |
|------|-----|-------|-----|-------|-----|------|
| 0°   | 160 | 160   | 160 | 160   | 160 |      |
| 5°   | 159 | 160   | 160 | 160   | 160 | 15   |
| 15°  | 152 | 154   | 156 | 156   | 157 | 43   |
| 25°  | 139 | 141   | 144 | 146   | 147 | 64   |
| 35°  | 121 | 124   | 129 | 132   | 134 | 76   |
| 45°  | 100 | 104   | 110 | 115   | 117 | 77   |
| 55°  | 77  | 82    | 89  | 95    | 97  | 69   |
| 65°  | 52  | 58    | 66  | 74    | 78  | 52   |
| 75°  | 27  | 34    | 46  | 56    | 60  | 28   |
| 85°  | 5   | 16    | 29  | 39    | 43  | 6    |
| 90°  | 0   | 10    | 23  | 32    | 36  | 0    |
| 95°  | 0   | 6     | 17  | 26    | 30  | 0    |
| 105° | 0   | 2     | 10  | 17    | 19  | 0    |
| 115° | 0   | 1     | 6   | 10    | 12  | 0    |
| 125° | 0   | 0     | 4   | 7     | 8   | 0    |
| 135° | 0   | 0     | 2   | 4     | 5   | 0    |
| 145° | 0   | 0     | 1   | 2     | 3   | 0    |
| 155° | 0   | 0     | 0   | 0     | 1   | 0    |
| 165° | 0   | 0     | 0   | 0     | 0   | 0    |
| 175° | 0   | 0     | 0   | 0     | 0   | 0    |
| 180° | 0   | 0     | 0   | 0     | 0   | 0    |

TEST NUMBER: P1356774

CATALOG NUMBER: 1ASL4-5HE-2-35-UNV

**CANDELA DISTRIBUTION (FULL):**

|        | 0°    | 22.5° | 45°   | 67.5° | 90°   |
|--------|-------|-------|-------|-------|-------|
| 0°     | 160.5 | 160.5 | 160.5 | 160.5 | 160.5 |
| 2.5°   | 159.5 | 161.0 | 160.5 | 160.0 | 160.0 |
| 5°     | 159.0 | 160.5 | 160.0 | 160.0 | 160.5 |
| 7.5°   | 158.0 | 159.5 | 159.5 | 159.5 | 160.0 |
| 10°    | 156.5 | 158.5 | 158.5 | 158.5 | 159.0 |
| 12.5°  | 154.9 | 156.5 | 157.0 | 157.5 | 158.0 |
| 15°    | 152.4 | 154.4 | 155.5 | 156.0 | 157.0 |
| 17.5°  | 149.9 | 151.4 | 152.9 | 154.4 | 154.9 |
| 20°    | 146.9 | 148.9 | 150.4 | 151.9 | 152.4 |
| 22.5°  | 143.3 | 145.4 | 147.4 | 148.9 | 149.9 |
| 25°    | 139.3 | 141.3 | 144.3 | 146.4 | 147.4 |
| 27.5°  | 135.3 | 137.3 | 140.8 | 143.3 | 144.3 |
| 30°    | 130.2 | 133.2 | 136.8 | 139.8 | 141.3 |
| 32.5°  | 125.7 | 128.7 | 132.7 | 136.3 | 137.3 |
| 35°    | 121.1 | 124.2 | 128.7 | 132.2 | 133.8 |
| 37.5°  | 116.1 | 119.6 | 124.2 | 128.2 | 129.7 |
| 40°    | 111.0 | 114.6 | 119.6 | 124.2 | 125.2 |
| 42.5°  | 106.0 | 109.5 | 115.6 | 119.6 | 121.1 |
| 45°    | 100.4 | 104.5 | 110.5 | 115.1 | 117.1 |
| 47.5°  | 94.9  | 98.9  | 105.0 | 110.0 | 112.0 |
| 50°    | 88.8  | 93.4  | 99.9  | 105.0 | 107.0 |
| 52.5°  | 83.3  | 87.8  | 94.4  | 99.9  | 102.5 |
| 55°    | 77.2  | 81.8  | 88.8  | 94.9  | 97.4  |
| 57.5°  | 71.2  | 75.7  | 83.3  | 89.8  | 92.4  |
| 60°    | 65.1  | 69.7  | 77.2  | 84.8  | 87.3  |
| 62.5°  | 58.5  | 63.6  | 71.7  | 79.2  | 82.3  |
| 65°    | 52.0  | 57.5  | 66.1  | 74.2  | 77.7  |
| 67.5°  | 45.9  | 51.5  | 60.6  | 69.7  | 72.7  |
| 70°    | 39.4  | 45.4  | 55.5  | 64.6  | 68.1  |
| 72.5°  | 32.8  | 39.4  | 50.5  | 60.1  | 63.6  |
| 75°    | 26.8  | 33.8  | 45.9  | 55.5  | 59.6  |
| 77.5°  | 20.2  | 28.8  | 41.4  | 51.5  | 55.0  |
| 80°    | 14.6  | 23.7  | 36.8  | 47.4  | 51.0  |
| 82.5°  | 9.6   | 19.2  | 32.8  | 43.4  | 46.9  |
| 85°    | 5.0   | 15.6  | 29.3  | 39.4  | 43.4  |
| 87.5°  | 1.5   | 12.1  | 25.7  | 35.8  | 39.4  |
| 90°    | 0.0   | 9.6   | 22.7  | 32.3  | 36.3  |
| 92.5°  | 0.0   | 7.6   | 19.7  | 29.3  | 32.8  |
| 95°    | 0.0   | 6.1   | 17.2  | 26.2  | 29.8  |
| 97.5°  | 0.0   | 5.0   | 15.1  | 23.7  | 26.8  |
| 100°   | 0.0   | 4.0   | 13.1  | 21.2  | 24.2  |
| 102.5° | 0.0   | 3.0   | 11.1  | 18.7  | 21.7  |
| 105°   | 0.0   | 2.0   | 9.6   | 16.7  | 19.2  |
| 107.5° | 0.0   | 1.5   | 8.1   | 14.6  | 17.2  |
| 110°   | 0.0   | 1.5   | 7.6   | 12.6  | 15.1  |



TEST NUMBER: P1356774

CATALOG NUMBER: 1ASL4-5HE-2-35-UNV

**CANDELA DISTRIBUTION (continued):**

|        | 0°  | 22.5° | 45° | 67.5° | 90°  |
|--------|-----|-------|-----|-------|------|
| 112.5° | 0.0 | 1.0   | 6.6 | 11.6  | 13.6 |
| 115°   | 0.0 | 1.0   | 5.6 | 10.1  | 12.1 |
| 117.5° | 0.0 | 1.0   | 5.0 | 9.1   | 11.1 |
| 120°   | 0.0 | 1.0   | 4.5 | 8.1   | 9.6  |
| 122.5° | 0.0 | 0.5   | 4.0 | 7.1   | 8.6  |
| 125°   | 0.0 | 0.5   | 3.5 | 6.6   | 7.6  |
| 127.5° | 0.0 | 0.5   | 3.0 | 6.1   | 7.1  |
| 130°   | 0.0 | 0.5   | 3.0 | 5.6   | 6.6  |
| 132.5° | 0.0 | 0.0   | 2.5 | 5.0   | 6.1  |
| 135°   | 0.0 | 0.0   | 2.0 | 4.0   | 5.0  |
| 137.5° | 0.0 | 0.0   | 2.0 | 3.5   | 4.5  |
| 140°   | 0.0 | 0.0   | 1.5 | 3.5   | 4.0  |
| 142.5° | 0.0 | 0.0   | 1.0 | 3.0   | 3.5  |
| 145°   | 0.0 | 0.0   | 1.0 | 2.5   | 3.0  |
| 147.5° | 0.0 | 0.0   | 0.5 | 2.0   | 2.5  |
| 150°   | 0.0 | 0.0   | 0.5 | 1.5   | 2.0  |
| 152.5° | 0.0 | 0.0   | 0.0 | 1.0   | 1.5  |
| 155°   | 0.0 | 0.0   | 0.0 | 0.5   | 1.0  |
| 157.5° | 0.0 | 0.0   | 0.0 | 0.0   | 0.5  |
| 160°   | 0.0 | 0.0   | 0.0 | 0.0   | 0.0  |
| 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  |

TEST NUMBER: P1356774

CATALOG NUMBER: 1ASL4-5HE-2-35-UNV

**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 | 15.01            | 16.54 | 15.48 | 17.01 | 17.50 | 16.83          | 18.36 | 17.30 | 18.82 | 19.31 |
|                 | 3H   | 16.52            | 17.92 | 17.00 | 18.39 | 18.92 | 19.18          | 20.58 | 19.66 | 21.05 | 21.58 |
|                 | 4H   | 17.00            | 18.33 | 17.51 | 18.82 | 19.36 | 20.31          | 21.63 | 20.81 | 22.12 | 22.67 |
|                 | 6H   | 17.28            | 18.52 | 17.80 | 19.02 | 19.58 | 21.45          | 22.69 | 21.97 | 23.19 | 23.75 |
|                 | 8H   | 17.33            | 18.52 | 17.87 | 19.04 | 19.61 | 22.01          | 23.20 | 22.54 | 23.72 | 24.29 |
|                 | 12H  | 17.35            | 18.49 | 17.89 | 19.00 | 19.60 | 22.60          | 23.74 | 23.14 | 24.25 | 24.85 |
| 4H              | 2H   | 15.84            | 17.17 | 16.35 | 17.66 | 18.20 | 17.27          | 18.60 | 17.78 | 19.08 | 19.63 |
|                 | 3H   | 17.59            | 18.72 | 18.11 | 19.25 | 19.82 | 19.85          | 20.99 | 20.37 | 21.52 | 22.08 |
|                 | 4H   | 18.20            | 19.24 | 18.74 | 19.78 | 20.38 | 21.16          | 22.19 | 21.70 | 22.73 | 23.33 |
|                 | 6H   | 18.60            | 19.52 | 19.16 | 20.09 | 20.70 | 22.50          | 23.41 | 23.06 | 23.98 | 24.59 |
|                 | 8H   | 18.70            | 19.56 | 19.27 | 20.13 | 20.76 | 23.17          | 24.03 | 23.73 | 24.59 | 25.22 |
|                 | 12H  | 18.75            | 19.53 | 19.34 | 20.13 | 20.76 | 23.87          | 24.66 | 24.46 | 25.25 | 25.88 |
| 8H              | 4H   | 18.84            | 19.70 | 19.41 | 20.27 | 20.89 | 21.39          | 22.25 | 21.95 | 22.81 | 23.44 |
|                 | 6H   | 19.43            | 20.16 | 20.02 | 20.77 | 21.40 | 22.90          | 23.64 | 23.50 | 24.24 | 24.88 |
|                 | 8H   | 19.61            | 20.27 | 20.22 | 20.89 | 21.54 | 23.72          | 24.38 | 24.33 | 25.00 | 25.64 |
|                 | 12H  | 19.74            | 20.33 | 20.35 | 20.93 | 21.64 | 24.61          | 25.20 | 25.22 | 25.81 | 26.52 |
| 12H             | 4H   | 19.02            | 19.80 | 19.60 | 20.39 | 21.02 | 21.40          | 22.18 | 21.98 | 22.77 | 23.41 |
|                 | 6H   | 19.70            | 20.36 | 20.30 | 20.98 | 21.62 | 22.95          | 23.61 | 23.56 | 24.23 | 24.87 |
|                 | 8H   | 19.98            | 20.57 | 20.59 | 21.18 | 21.89 | 23.83          | 24.42 | 24.44 | 25.03 | 25.74 |

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

Report Prepared for

Cooper Lighting Solutions

Fail-Safe

Report Number: SP1-2511-597-1

Test Date: 11/17/2025

Luminaire Tested: 4ASL-2-35-UNV-OPL-1\_600mA

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

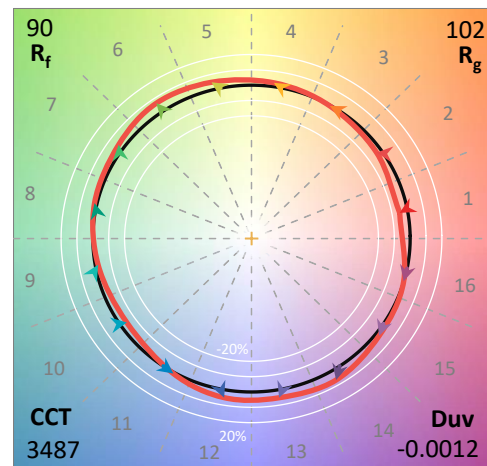
### Test Information

Test Method: LM-79-2019  
 Report Number: SP1-2511-597-1  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1 - 76IN SPHERE  
 Measurement Geometry:  $4\pi$   
 Issue Date: 11/18/2025  
 Manufacturer: COOPER LIGHTING SOLUTIONS  
 Product Line: Fail-Safe  
 Catalog Number: **4ASL-2-35-UNV-OPL-1\_600mA**  
 Description: 2foot 4ASL LED LUMINAIRE WITH OPL LENS AND 3500K LEDS with 1 rows at 600mA

### Spectral Parameters

CCT (K): 3487  
 CIE  $u'$ : 0.2366  
 CIE  $v'$ : 0.5099  
 Duv: -0.0012  
 CIE x: 0.4047  
 CIE y: 0.3876  
 CIE z: 0.2077  
 Peak Wavelength (nm): 630  
 Dominant Wavelength (nm): 581  
 Purity: 37.79273  
 R<sub>f</sub>: 90  
 R<sub>g</sub>: 102.4

CRI (Ra): 92.5  
 R1: 94.7  
 R2: 94.3  
 R3: 92.9  
 R4: 93.3  
 R5: 93.9  
 R6: 93.4  
 R7: 92.5  
 R8: 85.2  
 R9: 61.3  
 R10: 85.5  
 R11: 93.7  
 R12: 80.8  
 R13: 94.3  
 R14: 95.1  
 R15: 90.9



### Test Conditions

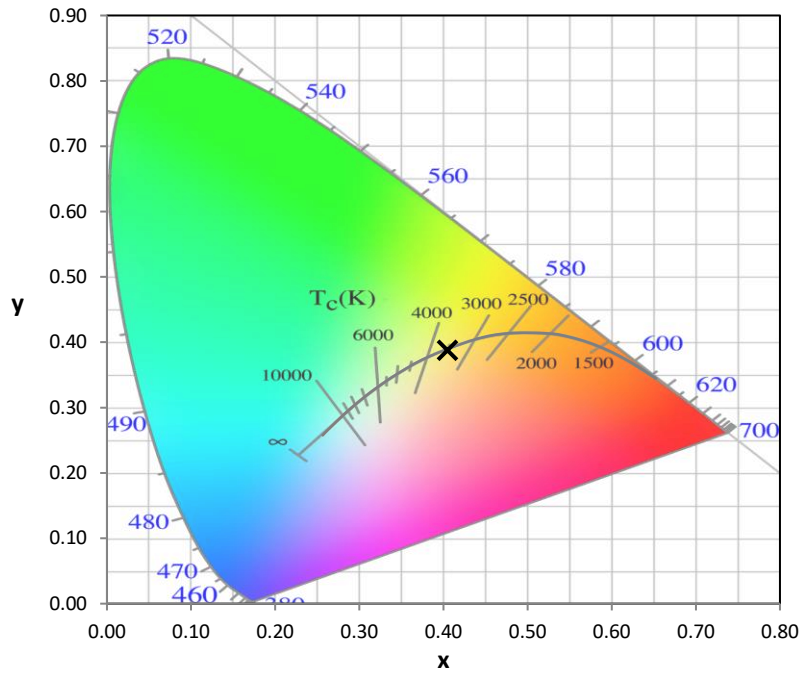
Stabilization Time: 31M  
 Operation Time: 1H 31M  
 Sphere Temperature (°C): 24.1

REPORT NUMBER: SP1-2511-597-1

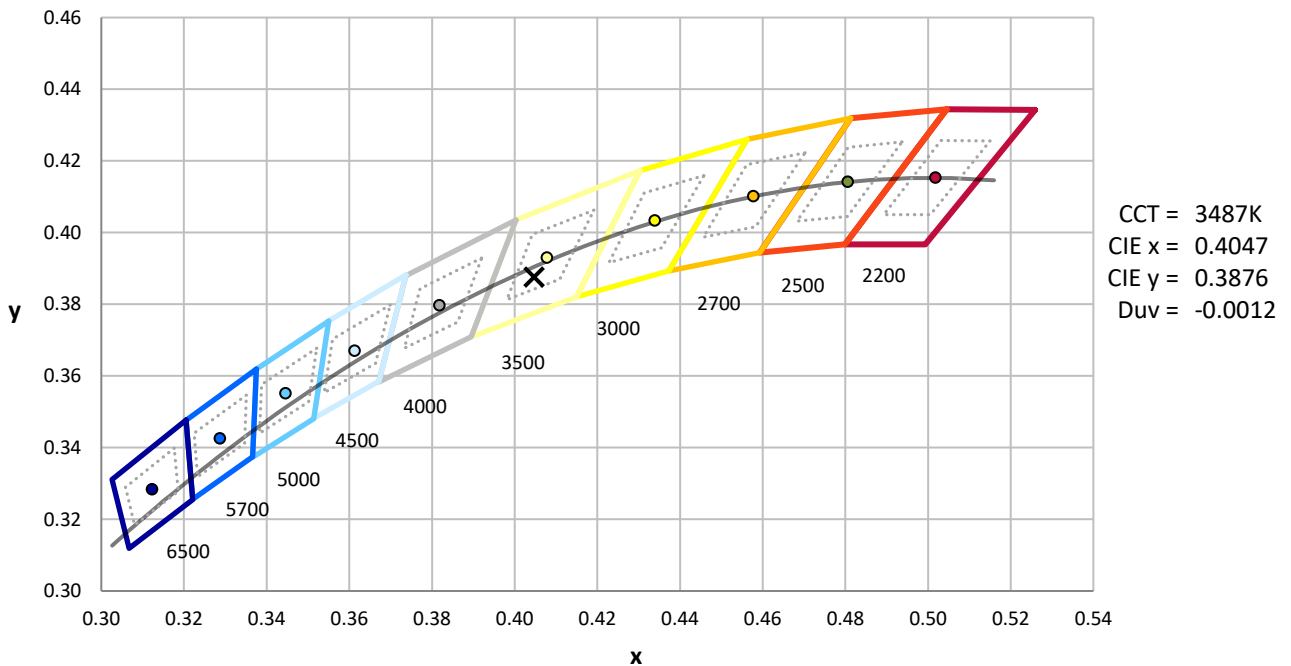
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | 76INCH SPHERE IN0058  | 6/16/2025        | 12/16/2025           |
| 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           |

REPORT NUMBER: SP1-2511-597-1

**CIE 1931 Chromaticity Diagram**



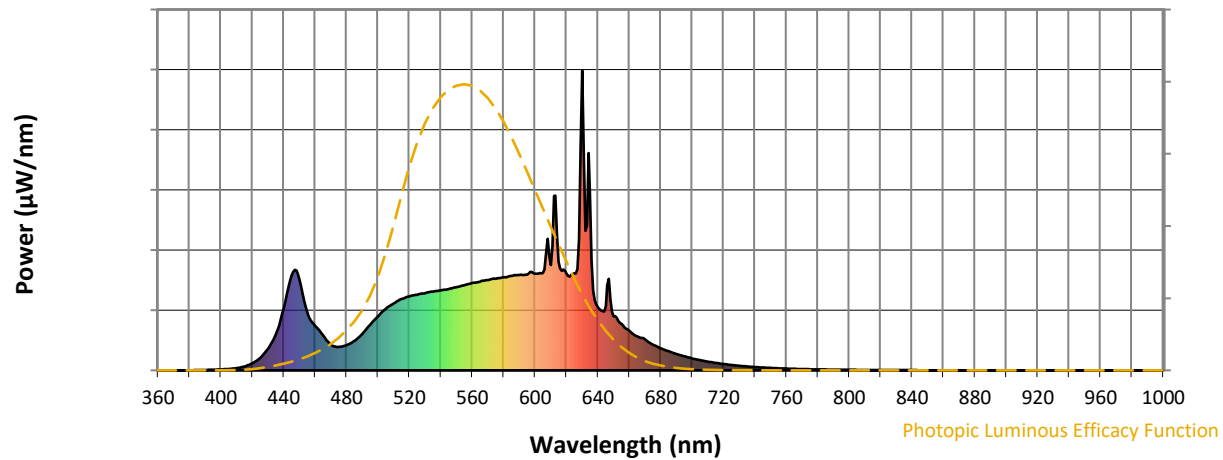
**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



Point lies inside the ANSI 3500K 4-step quadrangle

REPORT NUMBER: SP1-2511-597-1

### Photopic Flux vs. Wavelength

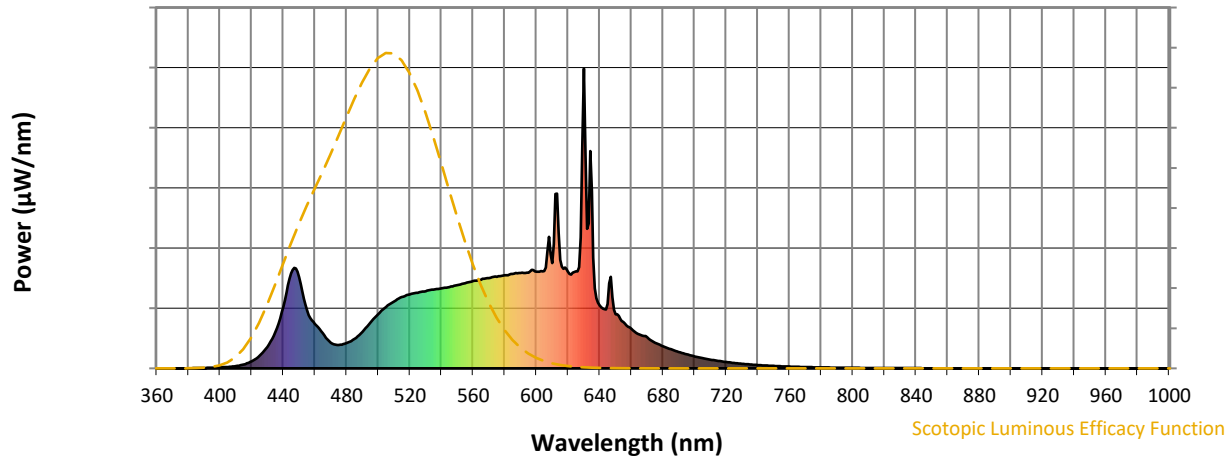


### Photopic Lumens: NR

| 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       | 122                         | NR               | 620       | 322                         | NR               | 750       | 8                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 152                         | NR               | 625       | 323                         | NR               | 755       | 7                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 180                         | NR               | 630       | 1000                        | NR               | 760       | 6                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 205                         | NR               | 635       | 589                         | NR               | 765       | 5                           | NR               | 895       | 0                           | NR               |
| 380       | 0                           | NR               | 510       | 223                         | NR               | 640       | 210                         | NR               | 770       | 4                           | NR               | 900       | 0                           | NR               |
| 385       | 1                           | NR               | 515       | 238                         | NR               | 645       | 214                         | NR               | 775       | 4                           | NR               | 905       | 0                           | NR               |
| 390       | 1                           | NR               | 520       | 247                         | NR               | 650       | 181                         | NR               | 780       | 3                           | NR               | 910       | 0                           | NR               |
| 395       | 2                           | NR               | 525       | 252                         | NR               | 655       | 155                         | NR               | 785       | 3                           | NR               | 915       | 0                           | NR               |
| 400       | 3                           | NR               | 530       | 258                         | NR               | 660       | 133                         | NR               | 790       | 2                           | NR               | 920       | 0                           | NR               |
| 405       | 5                           | NR               | 535       | 262                         | NR               | 665       | 113                         | NR               | 795       | 2                           | NR               | 925       | 0                           | NR               |
| 410       | 7                           | NR               | 540       | 267                         | NR               | 670       | 104                         | NR               | 800       | 2                           | NR               | 930       | 0                           | NR               |
| 415       | 13                          | NR               | 545       | 271                         | NR               | 675       | 86                          | NR               | 805       | 2                           | NR               | 935       | 0                           | NR               |
| 420       | 24                          | NR               | 550       | 277                         | NR               | 680       | 74                          | NR               | 810       | 1                           | NR               | 940       | 0                           | NR               |
| 425       | 42                          | NR               | 555       | 284                         | NR               | 685       | 64                          | NR               | 815       | 1                           | NR               | 945       | 0                           | NR               |
| 430       | 72                          | NR               | 560       | 291                         | NR               | 690       | 55                          | NR               | 820       | 1                           | NR               | 950       | 0                           | NR               |
| 435       | 122                         | NR               | 565       | 296                         | NR               | 695       | 47                          | NR               | 825       | 1                           | NR               | 955       | 0                           | NR               |
| 440       | 207                         | NR               | 570       | 301                         | NR               | 700       | 40                          | NR               | 830       | 1                           | NR               | 960       | 0                           | NR               |
| 445       | 317                         | NR               | 575       | 306                         | NR               | 705       | 34                          | NR               | 835       | 1                           | NR               | 965       | 0                           | NR               |
| 450       | 304                         | NR               | 580       | 310                         | NR               | 710       | 29                          | NR               | 840       | 1                           | NR               | 970       | 0                           | NR               |
| 455       | 193                         | NR               | 585       | 315                         | NR               | 715       | 25                          | NR               | 845       | 1                           | NR               | 975       | 0                           | NR               |
| 460       | 149                         | NR               | 590       | 318                         | NR               | 720       | 21                          | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 117                         | NR               | 595       | 320                         | NR               | 725       | 18                          | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 85                          | NR               | 600       | 322                         | NR               | 730       | 15                          | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 78                          | NR               | 605       | 325                         | NR               | 735       | 13                          | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 84                          | NR               | 610       | 351                         | NR               | 740       | 11                          | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 98                          | NR               | 615       | 362                         | NR               | 745       | 10                          | NR               | 875       | 0                           | NR               |           |                             |                  |

REPORT NUMBER: SP1-2511-597-1

### Scotopic Flux vs. Wavelength



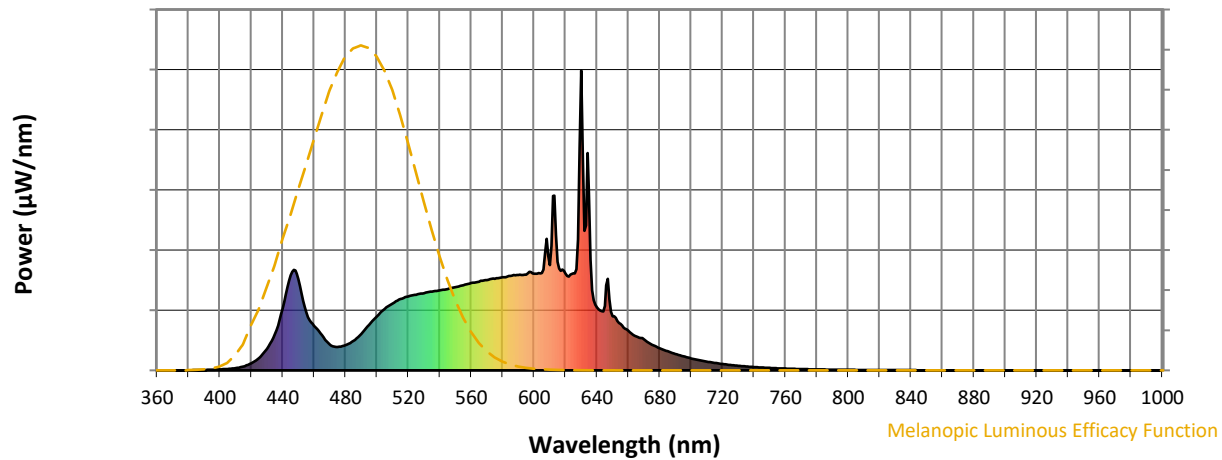
Scotopic Lumens: NR

S/P: 1.58

| λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) | λ<br>(nm) | Power<br>W <sup>^</sup> /nm | Lumens<br>(φ/nm) |
|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|-----------|-----------------------------|------------------|
| 360       | 0                           | NR               | 490       | 122                         | NR               | 620       | 322                         | NR               | 750       | 8                           | NR               | 880       | 0                           | NR               |
| 365       | 0                           | NR               | 495       | 152                         | NR               | 625       | 323                         | NR               | 755       | 7                           | NR               | 885       | 0                           | NR               |
| 370       | 0                           | NR               | 500       | 180                         | NR               | 630       | 1000                        | NR               | 760       | 6                           | NR               | 890       | 0                           | NR               |
| 375       | 0                           | NR               | 505       | 205                         | NR               | 635       | 589                         | NR               | 765       | 5                           | NR               | 895       | 0                           | NR               |
| 380       | 0                           | NR               | 510       | 223                         | NR               | 640       | 210                         | NR               | 770       | 4                           | NR               | 900       | 0                           | NR               |
| 385       | 1                           | NR               | 515       | 238                         | NR               | 645       | 214                         | NR               | 775       | 4                           | NR               | 905       | 0                           | NR               |
| 390       | 1                           | NR               | 520       | 247                         | NR               | 650       | 181                         | NR               | 780       | 3                           | NR               | 910       | 0                           | NR               |
| 395       | 2                           | NR               | 525       | 252                         | NR               | 655       | 155                         | NR               | 785       | 3                           | NR               | 915       | 0                           | NR               |
| 400       | 3                           | NR               | 530       | 258                         | NR               | 660       | 133                         | NR               | 790       | 2                           | NR               | 920       | 0                           | NR               |
| 405       | 5                           | NR               | 535       | 262                         | NR               | 665       | 113                         | NR               | 795       | 2                           | NR               | 925       | 0                           | NR               |
| 410       | 7                           | NR               | 540       | 267                         | NR               | 670       | 104                         | NR               | 800       | 2                           | NR               | 930       | 0                           | NR               |
| 415       | 13                          | NR               | 545       | 271                         | NR               | 675       | 86                          | NR               | 805       | 2                           | NR               | 935       | 0                           | NR               |
| 420       | 24                          | NR               | 550       | 277                         | NR               | 680       | 74                          | NR               | 810       | 1                           | NR               | 940       | 0                           | NR               |
| 425       | 42                          | NR               | 555       | 284                         | NR               | 685       | 64                          | NR               | 815       | 1                           | NR               | 945       | 0                           | NR               |
| 430       | 72                          | NR               | 560       | 291                         | NR               | 690       | 55                          | NR               | 820       | 1                           | NR               | 950       | 0                           | NR               |
| 435       | 122                         | NR               | 565       | 296                         | NR               | 695       | 47                          | NR               | 825       | 1                           | NR               | 955       | 0                           | NR               |
| 440       | 207                         | NR               | 570       | 301                         | NR               | 700       | 40                          | NR               | 830       | 1                           | NR               | 960       | 0                           | NR               |
| 445       | 317                         | NR               | 575       | 306                         | NR               | 705       | 34                          | NR               | 835       | 1                           | NR               | 965       | 0                           | NR               |
| 450       | 304                         | NR               | 580       | 310                         | NR               | 710       | 29                          | NR               | 840       | 1                           | NR               | 970       | 0                           | NR               |
| 455       | 193                         | NR               | 585       | 315                         | NR               | 715       | 25                          | NR               | 845       | 1                           | NR               | 975       | 0                           | NR               |
| 460       | 149                         | NR               | 590       | 318                         | NR               | 720       | 21                          | NR               | 850       | 0                           | NR               | 980       | 0                           | NR               |
| 465       | 117                         | NR               | 595       | 320                         | NR               | 725       | 18                          | NR               | 855       | 0                           | NR               | 985       | 0                           | NR               |
| 470       | 85                          | NR               | 600       | 322                         | NR               | 730       | 15                          | NR               | 860       | 0                           | NR               | 990       | 0                           | NR               |
| 475       | 78                          | NR               | 605       | 325                         | NR               | 735       | 13                          | NR               | 865       | 0                           | NR               | 995       | 0                           | NR               |
| 480       | 84                          | NR               | 610       | 351                         | NR               | 740       | 11                          | NR               | 870       | 0                           | NR               | 1000      | 0                           | NR               |
| 485       | 98                          | NR               | 615       | 362                         | NR               | 745       | 10                          | NR               | 875       | 0                           | NR               |           |                             |                  |

REPORT NUMBER: SP1-2511-597-1

### Melanopic Flux vs. Wavelength



Melanopic Lumens: NR

M/P: 3.15

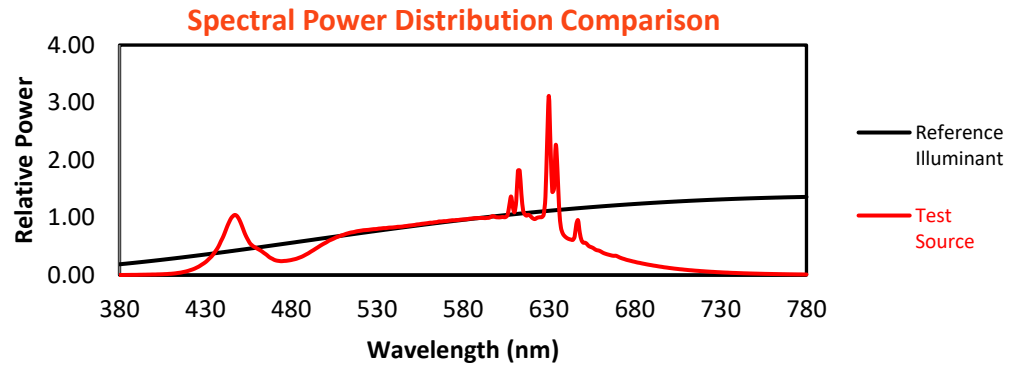
| λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) | λ (nm) | Power W <sup>λ</sup> /nm | Lumens (φ/nm) |
|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|--------|--------------------------|---------------|
| 360    | 0                        | NR            | 490    | 122                      | NR            | 620    | 322                      | NR            | 750    | 8                        | NR            | 880    | 0                        | NR            |
| 365    | 0                        | NR            | 495    | 152                      | NR            | 625    | 323                      | NR            | 755    | 7                        | NR            | 885    | 0                        | NR            |
| 370    | 0                        | NR            | 500    | 180                      | NR            | 630    | 1000                     | NR            | 760    | 6                        | NR            | 890    | 0                        | NR            |
| 375    | 0                        | NR            | 505    | 205                      | NR            | 635    | 589                      | NR            | 765    | 5                        | NR            | 895    | 0                        | NR            |
| 380    | 0                        | NR            | 510    | 223                      | NR            | 640    | 210                      | NR            | 770    | 4                        | NR            | 900    | 0                        | NR            |
| 385    | 1                        | NR            | 515    | 238                      | NR            | 645    | 214                      | NR            | 775    | 4                        | NR            | 905    | 0                        | NR            |
| 390    | 1                        | NR            | 520    | 247                      | NR            | 650    | 181                      | NR            | 780    | 3                        | NR            | 910    | 0                        | NR            |
| 395    | 2                        | NR            | 525    | 252                      | NR            | 655    | 155                      | NR            | 785    | 3                        | NR            | 915    | 0                        | NR            |
| 400    | 3                        | NR            | 530    | 258                      | NR            | 660    | 133                      | NR            | 790    | 2                        | NR            | 920    | 0                        | NR            |
| 405    | 5                        | NR            | 535    | 262                      | NR            | 665    | 113                      | NR            | 795    | 2                        | NR            | 925    | 0                        | NR            |
| 410    | 7                        | NR            | 540    | 267                      | NR            | 670    | 104                      | NR            | 800    | 2                        | NR            | 930    | 0                        | NR            |
| 415    | 13                       | NR            | 545    | 271                      | NR            | 675    | 86                       | NR            | 805    | 2                        | NR            | 935    | 0                        | NR            |
| 420    | 24                       | NR            | 550    | 277                      | NR            | 680    | 74                       | NR            | 810    | 1                        | NR            | 940    | 0                        | NR            |
| 425    | 42                       | NR            | 555    | 284                      | NR            | 685    | 64                       | NR            | 815    | 1                        | NR            | 945    | 0                        | NR            |
| 430    | 72                       | NR            | 560    | 291                      | NR            | 690    | 55                       | NR            | 820    | 1                        | NR            | 950    | 0                        | NR            |
| 435    | 122                      | NR            | 565    | 296                      | NR            | 695    | 47                       | NR            | 825    | 1                        | NR            | 955    | 0                        | NR            |
| 440    | 207                      | NR            | 570    | 301                      | NR            | 700    | 40                       | NR            | 830    | 1                        | NR            | 960    | 0                        | NR            |
| 445    | 317                      | NR            | 575    | 306                      | NR            | 705    | 34                       | NR            | 835    | 1                        | NR            | 965    | 0                        | NR            |
| 450    | 304                      | NR            | 580    | 310                      | NR            | 710    | 29                       | NR            | 840    | 1                        | NR            | 970    | 0                        | NR            |
| 455    | 193                      | NR            | 585    | 315                      | NR            | 715    | 25                       | NR            | 845    | 1                        | NR            | 975    | 0                        | NR            |
| 460    | 149                      | NR            | 590    | 318                      | NR            | 720    | 21                       | NR            | 850    | 0                        | NR            | 980    | 0                        | NR            |
| 465    | 117                      | NR            | 595    | 320                      | NR            | 725    | 18                       | NR            | 855    | 0                        | NR            | 985    | 0                        | NR            |
| 470    | 85                       | NR            | 600    | 322                      | NR            | 730    | 15                       | NR            | 860    | 0                        | NR            | 990    | 0                        | NR            |
| 475    | 78                       | NR            | 605    | 325                      | NR            | 735    | 13                       | NR            | 865    | 0                        | NR            | 995    | 0                        | NR            |
| 480    | 84                       | NR            | 610    | 351                      | NR            | 740    | 11                       | NR            | 870    | 0                        | NR            | 1000   | 0                        | NR            |
| 485    | 98                       | NR            | 615    | 362                      | NR            | 745    | 10                       | NR            | 875    | 0                        | NR            |        |                          |               |

REPORT NUMBER: SP1-2511-597-1

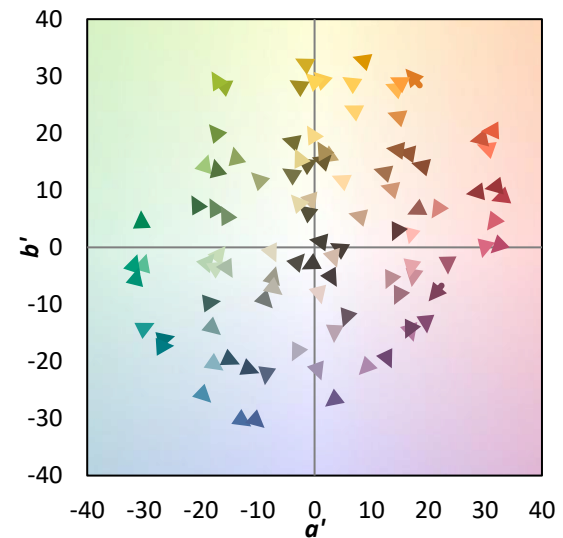
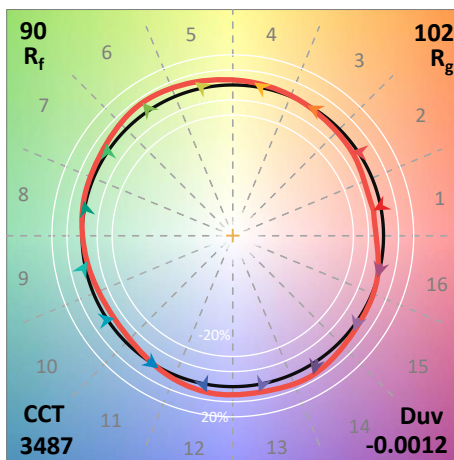
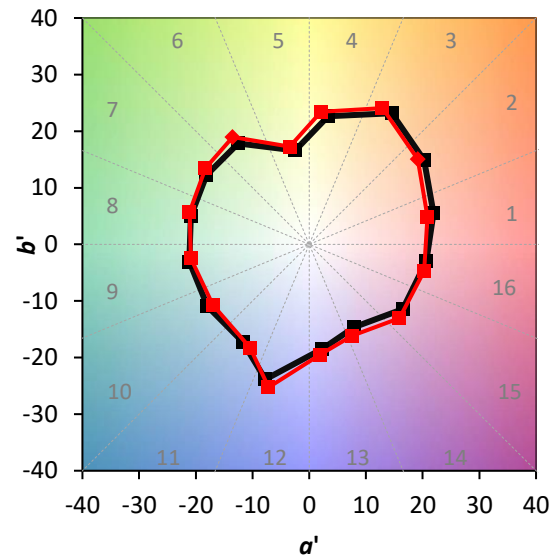
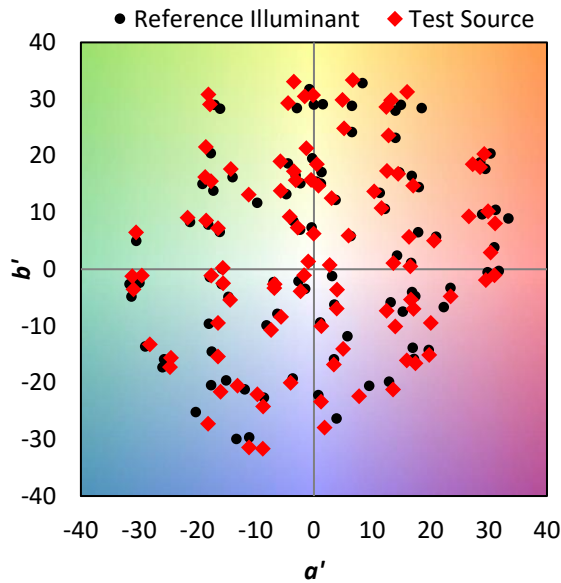
TM-30-18

### Summary

$R_f = 90$   
 $R_g = 102.4$   
 $CIE R_a = 92.5$   
 $R_9 = 61.3$

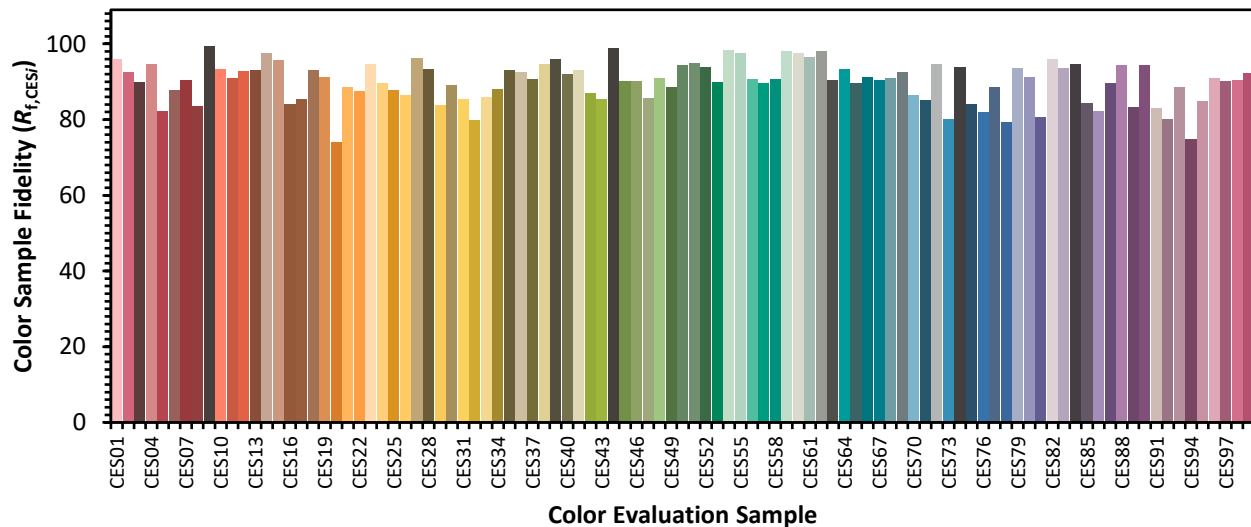


### Color Vector Graphics

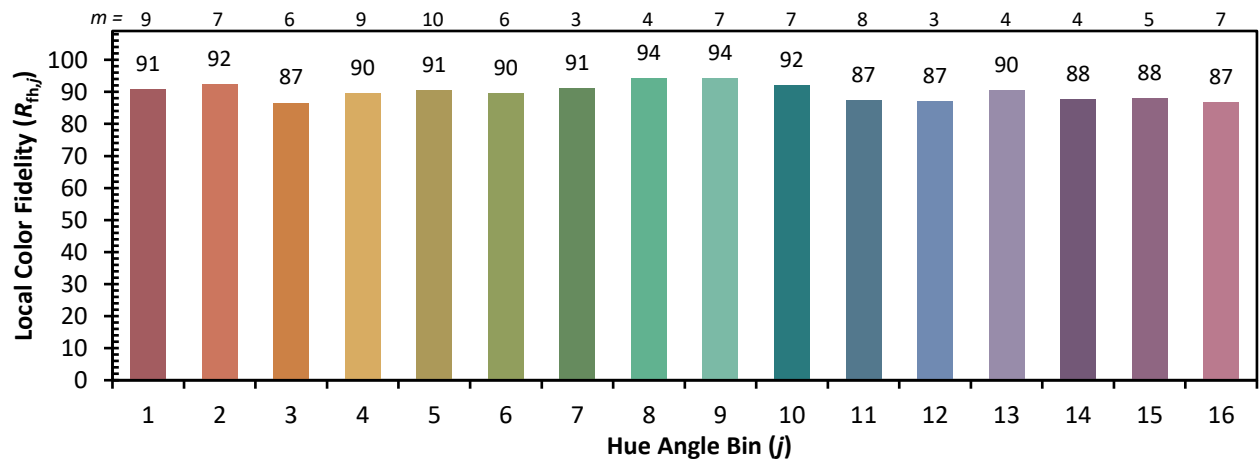
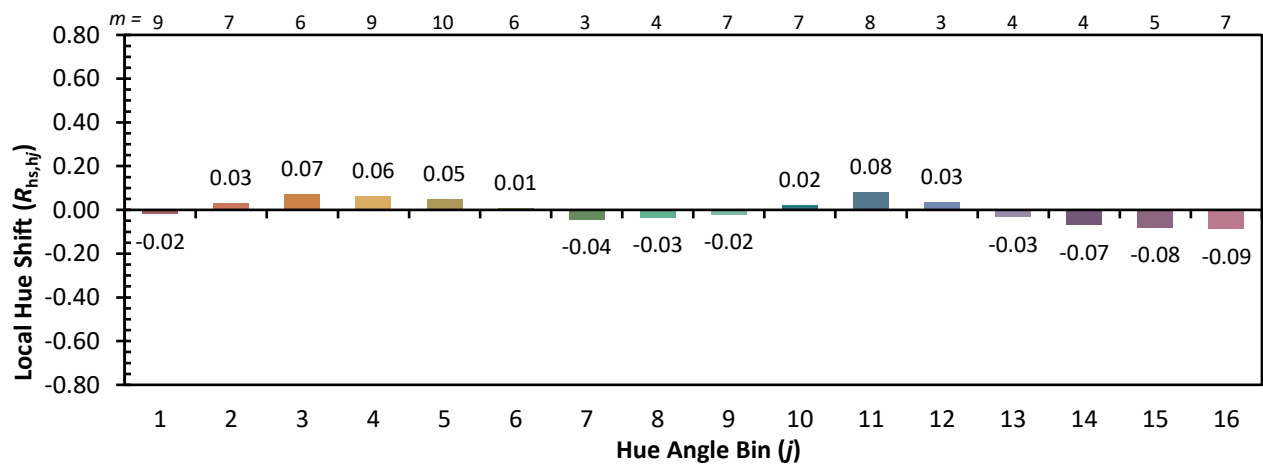
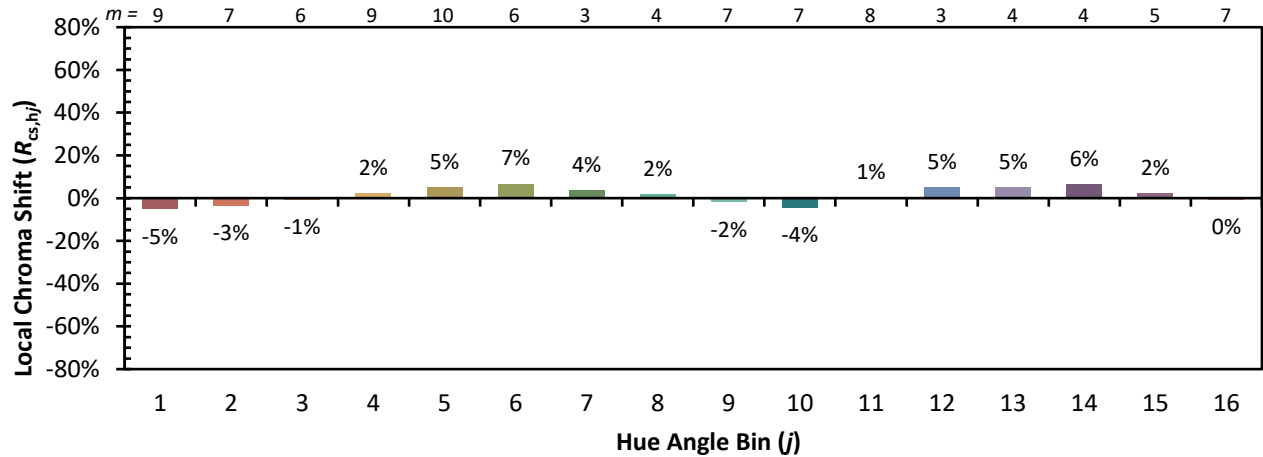


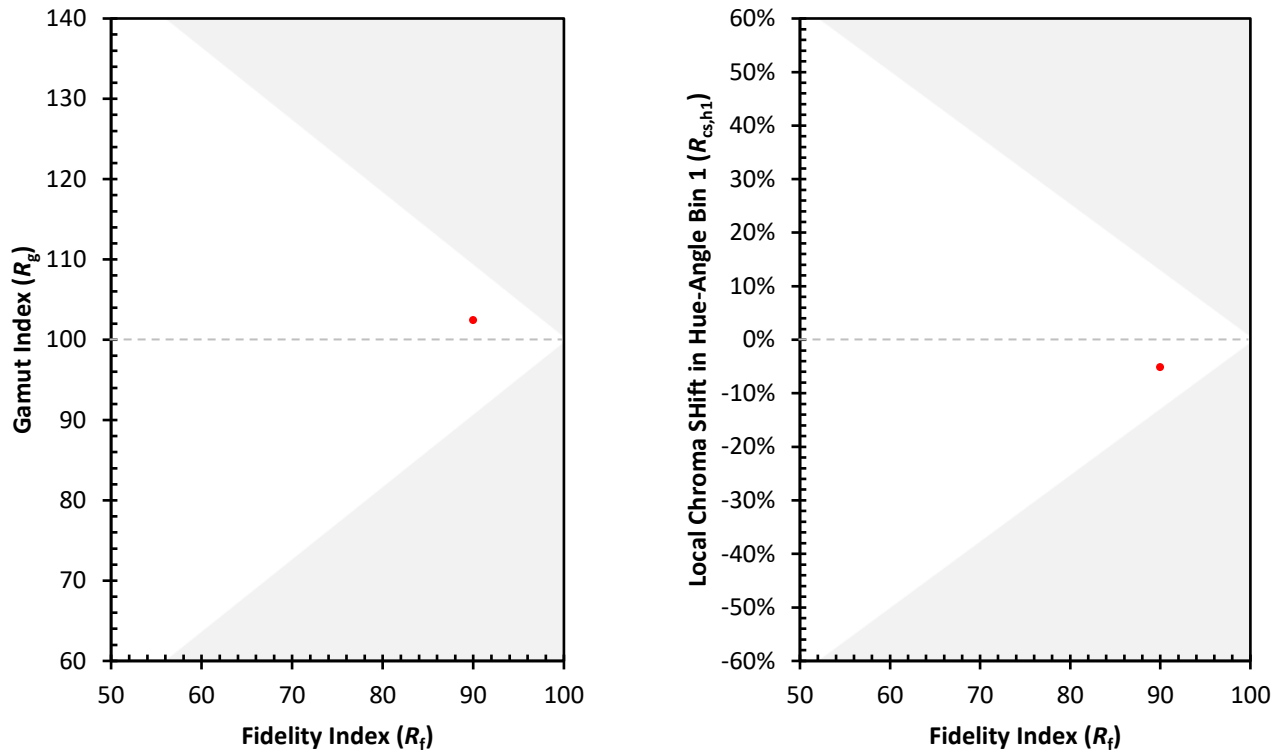
**Individual Sample Fidelity Index ( $R_{f,i}$ )**

|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 87 | CES51 = 95 | CES76 = 82 |
| CES02 = 62 | CES27 = 96 | CES52 = 94 | CES77 = 89 |
| CES03 = 31 | CES28 = 93 | CES53 = 90 | CES78 = 79 |
| CES04 = 70 | CES29 = 84 | CES54 = 98 | CES79 = 93 |
| CES05 = 50 | CES30 = 89 | CES55 = 97 | CES80 = 91 |
| CES06 = 51 | CES31 = 85 | CES56 = 91 | CES81 = 81 |
| CES07 = 43 | CES32 = 80 | CES57 = 90 | CES82 = 96 |
| CES08 = 41 | CES33 = 86 | CES58 = 91 | CES83 = 94 |
| CES09 = 29 | CES34 = 88 | CES59 = 98 | CES84 = 95 |
| CES10 = 75 | CES35 = 93 | CES60 = 97 | CES85 = 84 |
| CES11 = 58 | CES36 = 93 | CES61 = 96 | CES86 = 82 |
| CES12 = 64 | CES37 = 91 | CES62 = 98 | CES87 = 90 |
| CES13 = 43 | CES38 = 95 | CES63 = 91 | CES88 = 94 |
| CES14 = 74 | CES39 = 96 | CES64 = 93 | CES89 = 83 |
| CES15 = 71 | CES40 = 92 | CES65 = 90 | CES90 = 94 |
| CES16 = 47 | CES41 = 93 | CES66 = 91 | CES91 = 83 |
| CES17 = 49 | CES42 = 87 | CES67 = 91 | CES92 = 80 |
| CES18 = 56 | CES43 = 85 | CES68 = 91 | CES93 = 89 |
| CES19 = 71 | CES44 = 99 | CES69 = 93 | CES94 = 75 |
| CES20 = 66 | CES45 = 90 | CES70 = 87 | CES95 = 85 |
| CES21 = 86 | CES46 = 90 | CES71 = 85 | CES96 = 91 |
| CES22 = 78 | CES47 = 86 | CES72 = 95 | CES97 = 90 |
| CES23 = 91 | CES48 = 91 | CES73 = 80 | CES98 = 91 |
| CES24 = 90 | CES49 = 88 | CES74 = 94 | CES99 = 92 |
| CES25 = 71 | CES50 = 94 | CES75 = 84 |            |



Color Rendition by Hue-Angle Bin



**Measure Comparisons**


(END OF REPORT)