

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



Scaled data based on original data using  
LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-  
State Lighting Products

Test Report Prepared for  
Cooper Lighting Solutions  
(formerly Eaton)

Brand: INVUE

Report Number: P472249

Luminaire Tested: **CCP-VA-1-840-U-T2**

Issue Date: 01/27/2021



**Test Information**

Test Method: LM-79-08  
Report Number: P472249  
Test Lab: INNOVATION CENTER(G3)  
Issue Date: 01/27/2021  
Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)  
Product Line: INVUE  
Catalog Number: CCP-VA-1-840-U-T2  
Description: INVUE CLEARCURVE POLE MOUNT Wave Stream LUMINAIRE WITH T2  
DISTRIBUTION LENS  
Light Source: 4000K CCT, 80 CRI LEDS  
Ballast/Driver: ELECTRONIC DRIVER

**Summary**

Lumens per Lamp: N/A  
Luminaire Lumens: 2672 lumens  
Efficiency: N/A  
Efficacy: 89.7 lumens/watt  
Luminous Opening: Rectangular (W 1' x L: 0.54' x H: 0')  
IES Classification: Type II - Short  
BUG Rating: B2 - U0 - G2

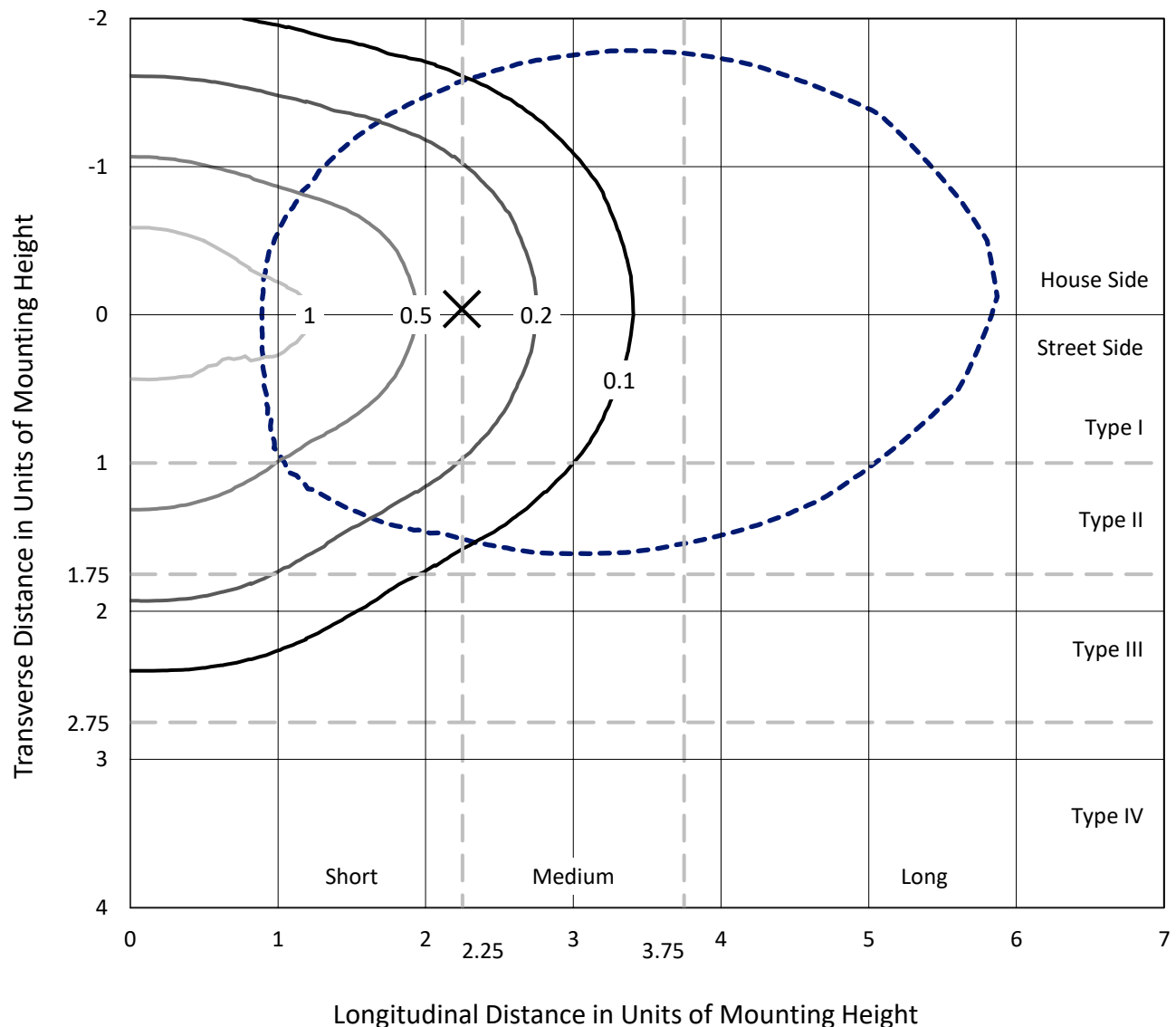
Input Watts (W): 29.8  
Input Voltage (V): 120  
Input Current (Ain): NR  
Voltage Rise (V): NR  
Power Factor: NR  
Total Harmonic Distortion (THDi): NR  
Frequency (hertz): 60  
Stabilization Time: NR  
Operation Time: NR  
Ambient Temperature (°C): NR  
Test Distance: 25 FT

REPORT NUMBER: P472249

CATALOG NUMBER: CCP-VA-1-840-U-T2

## Iso-Footcandle Lines of Horizontal Illumination

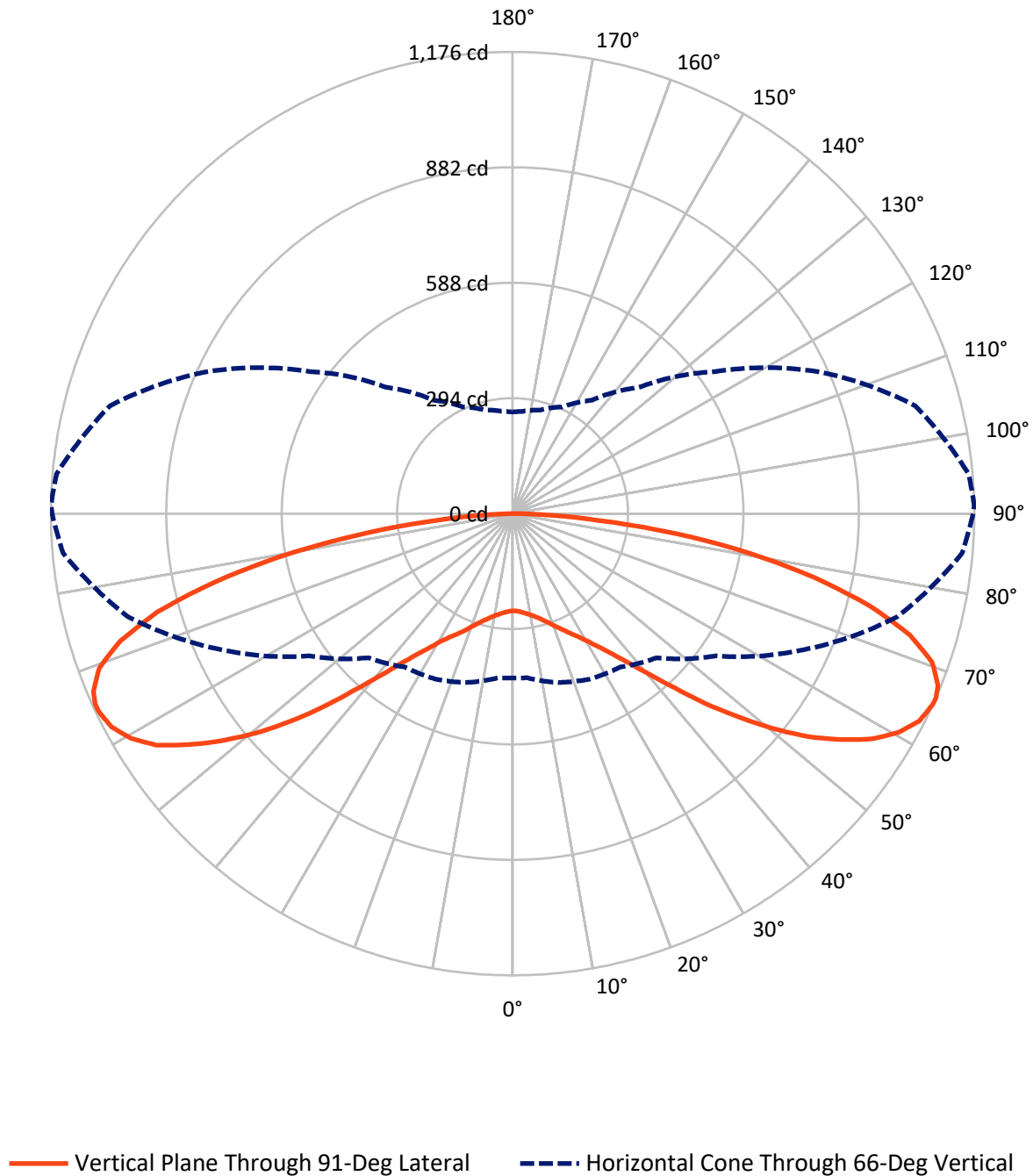
× Max cd  
 - - - 1/2 Max cd



Based on 15 foot mounting height. Maximum calculated value = 1.2 fc  
 Type II - Short - N/A

REPORT NUMBER: P472249  
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## Luminous Intensity Polar Plot



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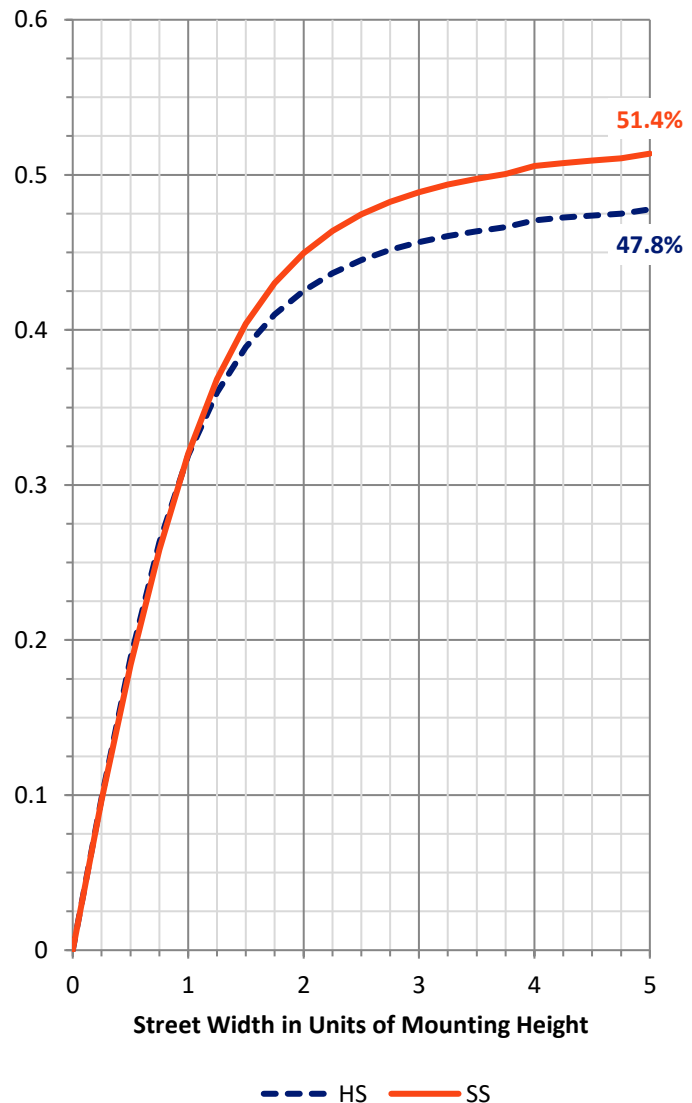
**FLUX DISTRIBUTION:**

|                    |           | Downward | Upward | Total  |
|--------------------|-----------|----------|--------|--------|
| <b>House Side</b>  | Lumens    | 1289.7   | 0.0    | 1289.7 |
|                    | % Fixture | 48.3     | 0.0    | 48.3   |
| <b>Street Side</b> | Lumens    | 1382.3   | 0.0    | 1382.3 |
|                    | % Fixture | 51.7     | 0.0    | 51.7   |
| <b>Total</b>       | Lumens    | 2672.0   | 0.0    | 2672.0 |
|                    | % Fixture | 100.0    | 0.0    | 100.0  |

**ZONAL LUMENS:**

| Zone      | Lumens | % Fixture |
|-----------|--------|-----------|
| 0°-10°    | 24.4   | 0.9       |
| 10°-20°   | 79.8   | 3.0       |
| 20°-30°   | 154.3  | 5.8       |
| 30°-40°   | 253.1  | 9.5       |
| 40°-50°   | 400.9  | 15.0      |
| 50°-60°   | 552.8  | 20.7      |
| 60°-70°   | 620.8  | 23.2      |
| 70°-80°   | 464.0  | 17.4      |
| 80°-90°   | 121.9  | 4.6       |
| 90°-100°  | 0.0    | 0.0       |
| 100°-110° | 0.0    | 0.0       |
| 110°-120° | 0.0    | 0.0       |
| 120°-130° | 0.0    | 0.0       |
| 130°-140° | 0.0    | 0.0       |
| 140°-150° | 0.0    | 0.0       |
| 150°-160° | 0.0    | 0.0       |
| 160°-170° | 0.0    | 0.0       |
| 170°-180° | 0.0    | 0.0       |
| 0°-90°    | 2672.0 | 100.0     |
| 0°-180°   | 2672.0 | 100.0     |

**Coefficient of Utilization**



REPORT NUMBER: P472249

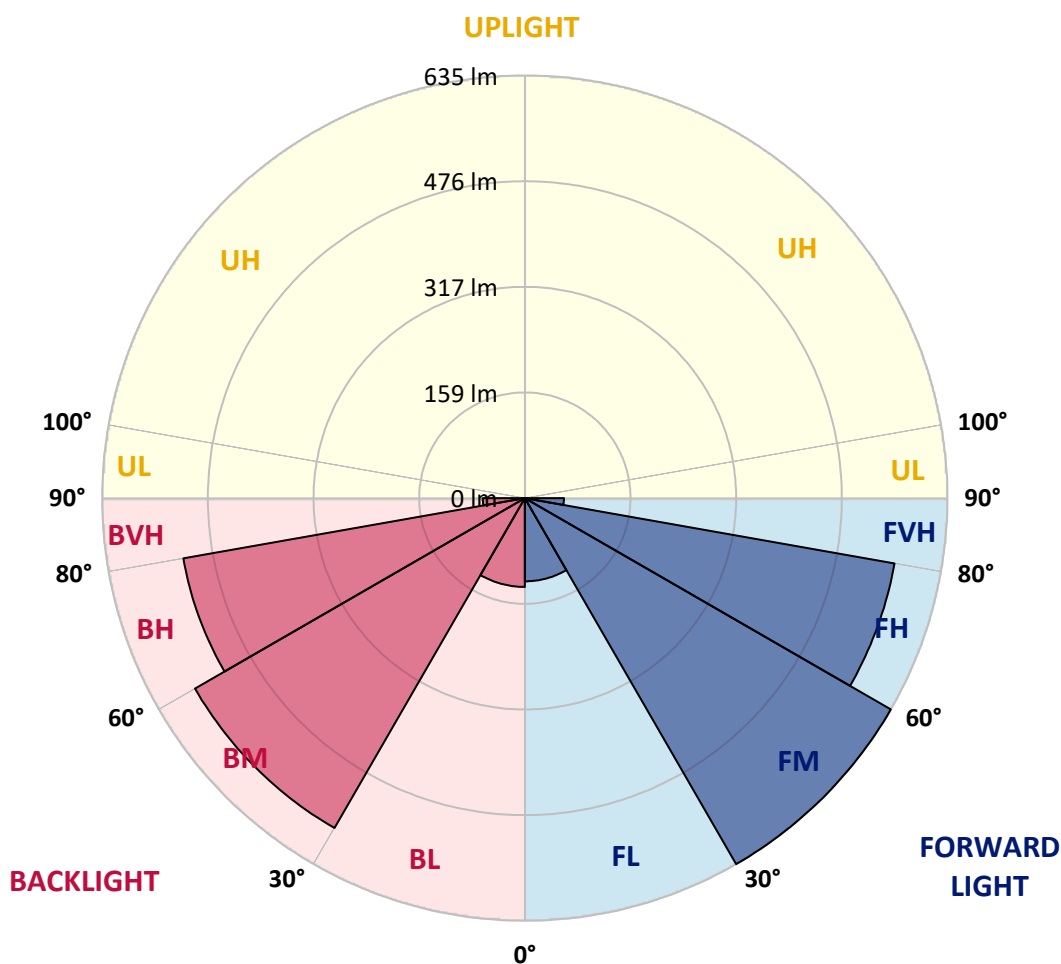
CATALOG NUMBER: CCP-VA-1-840-U-T2

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

| Zone |             | Lumens | % Fixture | Zone Rating/Lumen Limit |      |         |
|------|-------------|--------|-----------|-------------------------|------|---------|
|      |             |        |           | B                       | U    | G       |
| FL   | (0°-30°)    | 124.9  | 4.7       |                         |      |         |
| FM   | (30°-60°)   | 634.8  | 23.8      |                         |      |         |
| FH   | (60°-80°)   | 563.9  | 21.1      |                         |      | G0/660  |
| FVH  | (80°-90°)   | 58.7   | 2.2       |                         |      | G1/100  |
| BL   | (0°-30°)    | 133.5  | 5.0       | B1/500                  |      |         |
| BM   | (30°-60°)   | 572.1  | 21.4      | B1/1000                 |      |         |
| BH   | (60°-80°)   | 520.9  | 19.5      | B2/1000                 |      | G2/1000 |
| BVH  | (80°-90°)   | 63.2   | 2.4       |                         |      | G1/100  |
| UL   | (90°-100°)  | 0.0    | 0.0       |                         | U0/0 |         |
| UH   | (100°-180°) | 0.0    | 0.0       |                         | U0/0 |         |

**BUG Rating: B2-U0-G2**

Type II Short



REPORT NUMBER: P472249

CATALOG NUMBER: CCP-VA-1-840-U-T2

**CANDELA DISTRIBUTION (FULL):**

|       | 0°    | 5°    | 15°   | 25°   | 35°   | 45°   | 55°   | 65°   | 75°    | 85°    | 90°    |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| 0°    | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 | 247.6  | 247.6  | 247.6  |
| 2.5°  | 248.5 | 248.5 | 248.5 | 248.5 | 249.5 | 249.5 | 249.5 | 249.5 | 249.5  | 248.5  | 248.5  |
| 5°    | 250.4 | 250.4 | 250.4 | 250.4 | 251.4 | 251.4 | 251.4 | 251.4 | 252.3  | 252.3  | 252.3  |
| 7.5°  | 252.3 | 252.3 | 253.3 | 253.3 | 254.2 | 254.2 | 255.2 | 255.2 | 256.1  | 257.0  | 257.0  |
| 10°   | 256.1 | 256.1 | 257.0 | 257.0 | 258.9 | 259.9 | 260.8 | 260.8 | 262.7  | 262.7  | 262.7  |
| 12.5° | 260.8 | 261.8 | 262.7 | 263.7 | 265.5 | 266.5 | 267.4 | 268.4 | 269.3  | 270.3  | 270.3  |
| 15°   | 268.4 | 267.4 | 269.3 | 271.2 | 272.2 | 274.1 | 275.0 | 275.9 | 277.8  | 279.7  | 279.7  |
| 17.5° | 274.1 | 275.0 | 275.9 | 277.8 | 279.7 | 282.6 | 284.4 | 286.3 | 288.2  | 290.1  | 290.1  |
| 20°   | 281.6 | 280.7 | 284.4 | 287.3 | 289.2 | 293.0 | 295.8 | 299.6 | 301.5  | 303.3  | 304.3  |
| 22.5° | 288.2 | 289.2 | 291.1 | 294.8 | 298.6 | 304.3 | 310.0 | 312.8 | 315.6  | 317.5  | 320.4  |
| 25°   | 296.7 | 297.7 | 300.5 | 304.3 | 310.0 | 316.6 | 323.2 | 327.0 | 329.8  | 333.6  | 336.4  |
| 27.5° | 305.2 | 305.2 | 310.0 | 315.6 | 322.2 | 330.8 | 338.3 | 342.1 | 346.8  | 351.5  | 353.4  |
| 30°   | 314.7 | 314.7 | 319.4 | 327.0 | 336.4 | 345.9 | 352.5 | 360.0 | 366.7  | 371.4  | 375.2  |
| 32.5° | 328.9 | 328.9 | 334.5 | 342.1 | 352.5 | 363.8 | 373.3 | 380.8 | 389.3  | 397.8  | 405.4  |
| 35°   | 344.9 | 345.9 | 353.4 | 362.9 | 375.2 | 389.3 | 397.8 | 408.2 | 417.7  | 431.9  | 439.4  |
| 37.5° | 370.4 | 371.4 | 379.9 | 392.2 | 404.5 | 419.6 | 433.8 | 446.0 | 460.2  | 476.3  | 482.0  |
| 40°   | 408.2 | 411.1 | 419.6 | 425.3 | 436.6 | 447.9 | 468.7 | 489.5 | 514.1  | 535.8  | 539.6  |
| 42.5° | 476.3 | 473.4 | 467.8 | 465.9 | 468.7 | 481.0 | 503.7 | 535.8 | 579.3  | 606.7  | 606.7  |
| 45°   | 502.7 | 502.7 | 503.7 | 501.8 | 499.9 | 508.4 | 534.9 | 585.9 | 647.3  | 685.1  | 692.7  |
| 47.5° | 507.5 | 508.4 | 516.9 | 524.5 | 526.4 | 535.8 | 567.9 | 635.0 | 717.3  | 773.0  | 777.7  |
| 50°   | 507.5 | 509.4 | 520.7 | 533.9 | 543.4 | 556.6 | 596.3 | 678.5 | 786.2  | 850.5  | 862.8  |
| 52.5° | 505.6 | 507.5 | 519.8 | 535.8 | 550.9 | 569.8 | 620.9 | 723.9 | 847.7  | 934.6  | 940.3  |
| 55°   | 500.9 | 502.7 | 517.9 | 534.9 | 551.9 | 577.4 | 640.7 | 762.6 | 907.2  | 1004.5 | 1014.9 |
| 57.5° | 495.2 | 498.0 | 514.1 | 532.0 | 548.1 | 579.3 | 653.9 | 792.9 | 955.4  | 1066.9 | 1085.8 |
| 60°   | 483.8 | 488.6 | 506.5 | 524.5 | 539.6 | 572.7 | 660.6 | 816.5 | 991.3  | 1112.3 | 1131.2 |
| 62.5° | 461.2 | 465.9 | 485.7 | 505.6 | 520.7 | 556.6 | 656.8 | 827.8 | 1012.1 | 1140.6 | 1160.5 |
| 65°   | 432.8 | 434.7 | 456.4 | 477.2 | 492.3 | 530.1 | 640.7 | 825.9 | 1016.8 | 1150.1 | 1172.7 |
| 66°   | 418.6 | 419.6 | 445.1 | 464.9 | 477.2 | 518.8 | 631.3 | 819.3 | 1014.0 | 1149.1 | 1172.7 |
| 67.5° | 393.1 | 397.8 | 419.6 | 440.4 | 454.5 | 493.3 | 608.6 | 804.2 | 1002.6 | 1139.7 | 1164.2 |
| 70°   | 348.7 | 352.5 | 370.4 | 391.2 | 406.4 | 443.2 | 559.4 | 759.8 | 961.1  | 1100.9 | 1129.3 |
| 72.5° | 300.5 | 303.3 | 322.2 | 337.4 | 346.8 | 386.5 | 499.9 | 687.0 | 888.3  | 1028.2 | 1055.6 |
| 75°   | 249.5 | 251.4 | 268.4 | 278.8 | 287.3 | 322.2 | 420.5 | 593.5 | 774.0  | 910.0  | 945.9  |
| 77.5° | 196.6 | 197.5 | 211.7 | 221.1 | 221.1 | 251.4 | 333.6 | 481.0 | 635.0  | 760.7  | 787.2  |
| 80°   | 144.6 | 143.6 | 152.1 | 156.9 | 159.7 | 179.6 | 240.0 | 353.4 | 483.8  | 582.1  | 607.6  |
| 82.5° | 94.5  | 93.6  | 99.2  | 101.1 | 101.1 | 113.4 | 151.2 | 224.0 | 317.5  | 395.0  | 410.1  |
| 85°   | 50.1  | 52.0  | 51.0  | 51.0  | 51.0  | 55.8  | 75.6  | 117.2 | 169.2  | 211.7  | 222.1  |
| 87.5° | 8.5   | 8.5   | 8.5   | 9.5   | 11.3  | 15.1  | 19.8  | 33.1  | 48.2   | 65.2   | 73.7   |
| 90°   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0    | 0.0    | 0.0    |

REPORT NUMBER: P472249

CATALOG NUMBER: CCP-VA-1-840-U-T2

**CANDELA DISTRIBUTION (continued):**

|       | 91°    | 95°    | 105°   | 115°  | 125°  | 135°  | 145°  | 155°  | 165°  | 175°  | 180°  |
|-------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0°    | 247.6  | 247.6  | 247.6  | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 | 247.6 |
| 2.5°  | 248.5  | 249.5  | 249.5  | 249.5 | 249.5 | 249.5 | 249.5 | 249.5 | 249.5 | 249.5 | 249.5 |
| 5°    | 252.3  | 252.3  | 252.3  | 253.3 | 253.3 | 253.3 | 253.3 | 253.3 | 253.3 | 253.3 | 253.3 |
| 7.5°  | 257.0  | 257.0  | 258.0  | 258.0 | 258.0 | 258.9 | 258.9 | 258.0 | 258.0 | 258.0 | 258.0 |
| 10°   | 262.7  | 262.7  | 263.7  | 264.6 | 264.6 | 265.5 | 265.5 | 264.6 | 264.6 | 263.7 | 263.7 |
| 12.5° | 270.3  | 271.2  | 272.2  | 273.1 | 274.1 | 274.1 | 273.1 | 272.2 | 271.2 | 270.3 | 270.3 |
| 15°   | 279.7  | 280.7  | 281.6  | 283.5 | 283.5 | 283.5 | 282.6 | 281.6 | 279.7 | 278.8 | 279.7 |
| 17.5° | 291.1  | 292.0  | 293.9  | 294.8 | 295.8 | 294.8 | 294.8 | 293.9 | 293.9 | 293.0 | 293.0 |
| 20°   | 305.2  | 306.2  | 309.0  | 310.0 | 310.0 | 310.9 | 313.7 | 315.6 | 318.5 | 319.4 | 319.4 |
| 22.5° | 319.4  | 321.3  | 324.1  | 327.9 | 329.8 | 333.6 | 334.5 | 336.4 | 335.5 | 332.6 | 332.6 |
| 25°   | 336.4  | 338.3  | 344.0  | 348.7 | 352.5 | 354.4 | 352.5 | 349.7 | 344.9 | 341.1 | 340.2 |
| 27.5° | 354.4  | 357.2  | 365.7  | 372.3 | 374.2 | 372.3 | 364.8 | 358.2 | 352.5 | 347.8 | 345.9 |
| 30°   | 377.1  | 381.8  | 391.2  | 395.0 | 394.1 | 386.5 | 375.2 | 366.7 | 358.2 | 352.5 | 351.5 |
| 32.5° | 405.4  | 410.1  | 418.6  | 419.6 | 413.9 | 399.7 | 384.6 | 373.3 | 362.9 | 356.3 | 355.3 |
| 35°   | 439.4  | 444.2  | 448.9  | 446.0 | 430.0 | 412.0 | 393.1 | 377.1 | 366.7 | 359.1 | 359.1 |
| 37.5° | 482.9  | 485.7  | 485.7  | 471.6 | 447.0 | 423.4 | 399.7 | 380.8 | 369.5 | 361.9 | 361.0 |
| 40°   | 539.6  | 538.7  | 525.4  | 498.0 | 465.9 | 433.8 | 404.5 | 384.6 | 370.4 | 362.9 | 361.9 |
| 42.5° | 607.6  | 601.0  | 572.7  | 528.3 | 483.8 | 443.2 | 410.1 | 385.6 | 369.5 | 361.9 | 361.0 |
| 45°   | 690.8  | 679.5  | 628.4  | 563.2 | 502.7 | 451.7 | 413.0 | 384.6 | 366.7 | 358.2 | 357.2 |
| 47.5° | 773.0  | 766.4  | 696.5  | 600.1 | 521.6 | 461.2 | 414.9 | 381.8 | 361.0 | 348.7 | 348.7 |
| 50°   | 860.0  | 843.9  | 764.5  | 644.5 | 541.5 | 467.8 | 414.9 | 377.1 | 351.5 | 338.3 | 336.4 |
| 52.5° | 944.1  | 928.0  | 833.5  | 688.9 | 563.2 | 474.4 | 413.0 | 370.4 | 343.0 | 328.9 | 327.0 |
| 55°   | 1015.9 | 1002.6 | 900.6  | 739.0 | 585.9 | 479.1 | 410.1 | 362.9 | 334.5 | 321.3 | 319.4 |
| 57.5° | 1082.0 | 1068.8 | 959.2  | 781.5 | 607.6 | 482.0 | 403.5 | 353.4 | 324.1 | 310.9 | 310.0 |
| 60°   | 1130.2 | 1119.8 | 1009.3 | 821.2 | 625.6 | 482.0 | 394.1 | 342.1 | 312.8 | 299.6 | 298.6 |
| 62.5° | 1162.4 | 1152.0 | 1045.2 | 847.7 | 636.9 | 475.3 | 379.9 | 327.0 | 298.6 | 286.3 | 283.5 |
| 65°   | 1174.6 | 1165.2 | 1061.2 | 858.1 | 635.0 | 462.1 | 361.0 | 308.1 | 280.7 | 268.4 | 266.5 |
| 66°   | 1175.6 | 1165.2 | 1061.2 | 856.2 | 630.3 | 454.5 | 352.5 | 299.6 | 273.1 | 260.8 | 258.9 |
| 67.5° | 1168.0 | 1158.6 | 1054.6 | 846.7 | 617.1 | 440.4 | 335.5 | 285.4 | 258.9 | 246.6 | 245.7 |
| 70°   | 1133.1 | 1125.5 | 1018.7 | 810.8 | 585.9 | 409.2 | 307.1 | 258.0 | 232.5 | 224.0 | 221.1 |
| 72.5° | 1057.5 | 1049.0 | 946.9  | 743.7 | 534.9 | 366.7 | 271.2 | 225.9 | 205.1 | 194.7 | 193.7 |
| 75°   | 940.3  | 936.5  | 837.3  | 654.9 | 461.2 | 315.6 | 229.6 | 190.9 | 173.9 | 166.3 | 166.3 |
| 77.5° | 787.2  | 779.6  | 695.5  | 541.5 | 378.9 | 255.2 | 184.3 | 155.0 | 141.8 | 135.1 | 136.1 |
| 80°   | 612.4  | 606.7  | 535.8  | 406.4 | 286.3 | 191.8 | 138.0 | 118.1 | 108.7 | 104.9 | 103.0 |
| 82.5° | 419.6  | 404.5  | 357.2  | 269.3 | 186.2 | 129.5 | 95.4  | 82.2  | 77.5  | 76.5  | 75.6  |
| 85°   | 218.3  | 224.0  | 188.1  | 142.7 | 101.1 | 71.8  | 57.6  | 52.9  | 51.0  | 52.0  | 52.0  |
| 87.5° | 71.8   | 73.7   | 56.7   | 43.5  | 33.1  | 25.5  | 21.7  | 20.8  | 18.0  | 19.8  | 20.8  |
| 90°   | 0.0    | 0.0    | 0.0    | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |



Report Prepared for

Cooper Lighting Solutions

(formerly Eaton)

INVUE

Report Number: SP1-2009-972-1-R2

Luminaire Tested: CCW-VA4-840-U-T4W

Test Date: 11/10/2020

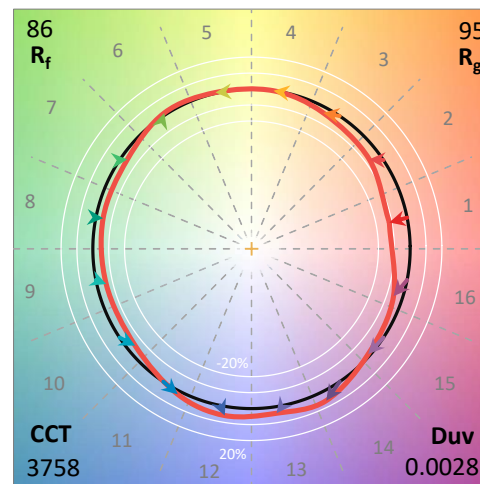
### Test Information

Test Method: LM-79-08  
 Report Number: SP1-2009-972-1-R2  
 Test Lab: COOPER LIGHTING SOLUTIONS  
 Photometer: SP1  
 Measurement Geometry:  $4\pi$   
 Issue Date: 11/10/2020  
 Manufacturer: COOPER LIGHTING SOLUTIONS (FORMERLY EATON)  
 Product Line: INVUE  
 Catalog Number: **CCW-VA4-840-U-T4W**  
 Description: INVUE WALL PACK WAVEGUIDE VERSION

\*\*\*THIS IS A REVISION OF SP1-2009-972-1. TO UPDATE THE CATALOG INFORMATION.\*\*\*TESTED  
 IN SITU. INVUE WALL PACK WAVEGUIDE 6000LM 120V T4W (4 LED BOARDS)

### Spectral Parameters

|                           |        |           |      |      |      |
|---------------------------|--------|-----------|------|------|------|
| CCT (K):                  | 3758   | CRI (Ra): | 83.7 |      |      |
| CIE u':                   | 0.2283 | R1:       | 81.4 | R9:  | 8.1  |
| CIE v':                   | 0.5097 | R2:       | 89.8 | R10: | 77.1 |
| Duv:                      | 0.0028 | R3:       | 96.8 | R11: | 82.8 |
| CIE x:                    | 0.3941 | R4:       | 83.0 | R12: | 68.3 |
| CIE y:                    | 0.3910 | R5:       | 82.1 | R13: | 83.4 |
| CIE z:                    | 0.2150 | R6:       | 87.1 | R14: | 98.5 |
| Peak Wavelength (nm):     | 598    | R7:       | 86.1 |      |      |
| Dominant Wavelength (nm): | 578    | R8:       | 63.6 |      |      |
| Purity:                   | 35.8   |           |      |      |      |
| Rf:                       | 86.1   |           |      |      |      |
| Rg:                       | 95.3   |           |      |      |      |



### Test Conditions

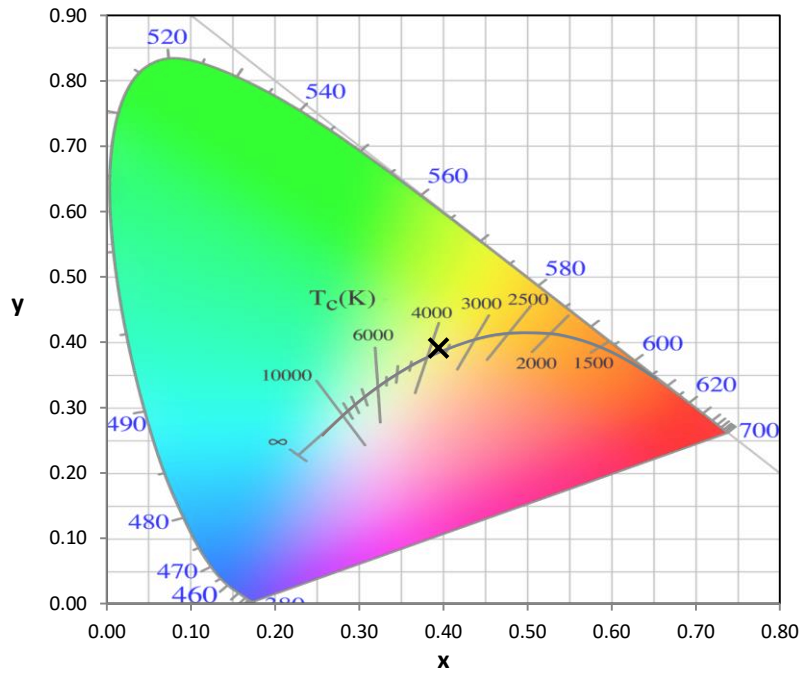
Stabilization Time: 134M  
 Operation Time: 12H  
 Room Temperature (°C) / RH%: 24.9/45%  
 Sphere Temperature (°C): 24.5

REPORT NUMBER: SP1-2009-972-1-R2

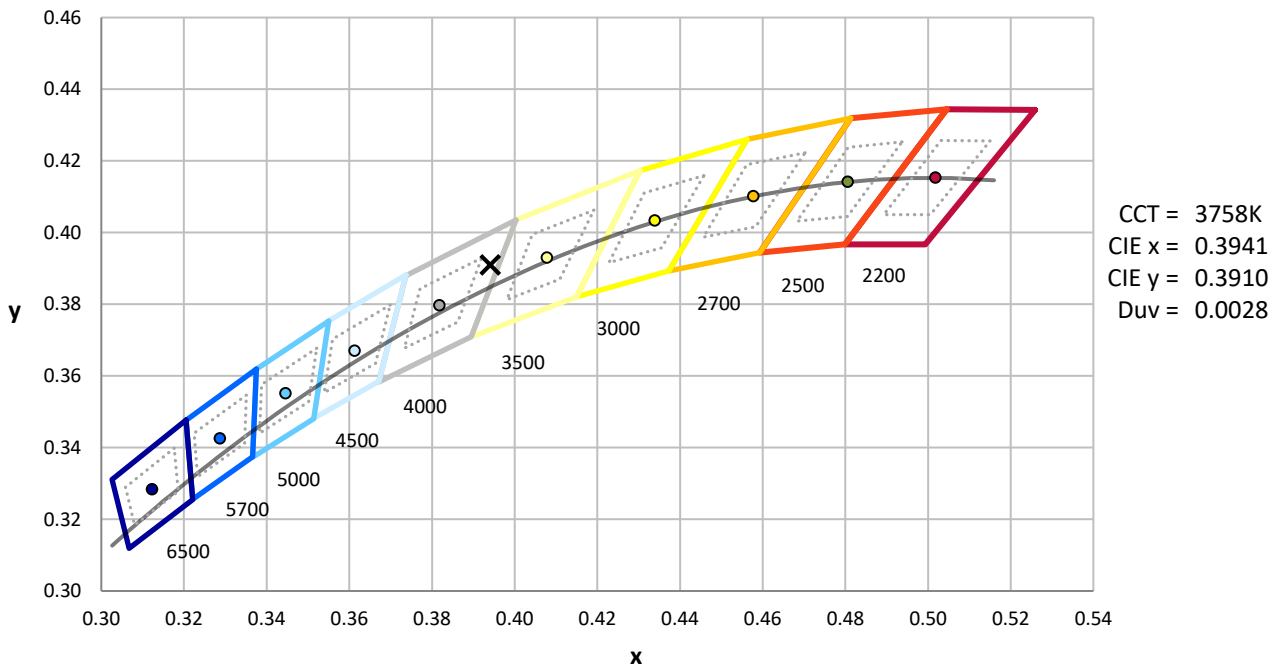
| Measurement and Test Equipment |                       |                  |                      |
|--------------------------------|-----------------------|------------------|----------------------|
| Instrument                     | Identification Number | Calibration Date | Calibration Due Date |
| Photometer                     | IN0058                | 7/29/2020        | 1/29/2021            |
| Power Meter                    | IN0071                | 12/3/2019        | 12/3/2020            |
| AC Power Source                | IN0063                | 12/3/2019        | 12/3/2020            |
| DC Power Source                | IN0208                | 12/3/2019        | 12/3/2020            |
| Sphere Thermometer             | IN0085                | 12/3/2019        | 12/3/2020            |
| Room Thermometer               | IN0046                | 12/3/2019        | 12/3/2020            |

REPORT NUMBER: SP1-2009-972-1-R2

**CIE 1931 Chromaticity Diagram**



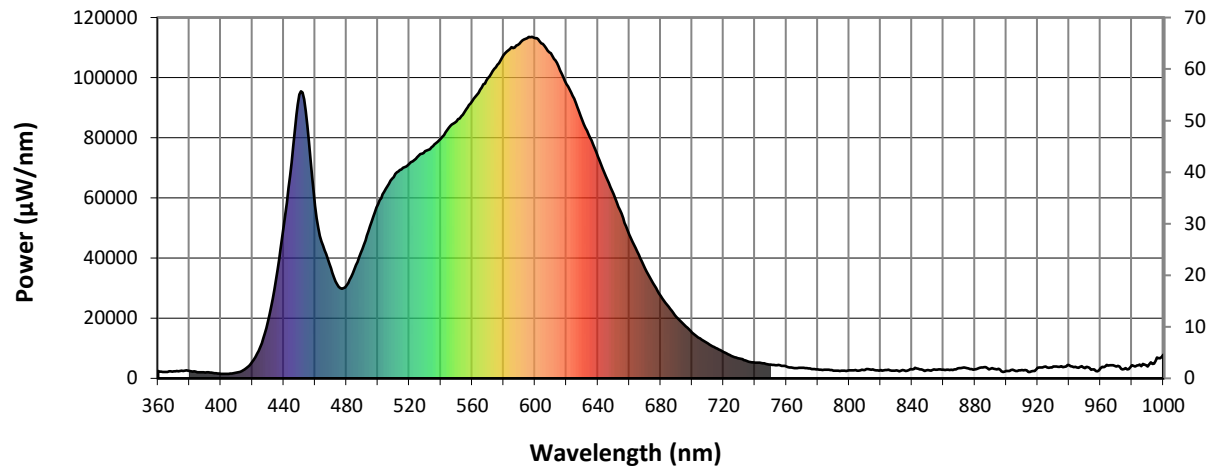
**CIE 1931 Chromaticity Diagram with 2017 ANSI 7-Step and 4-Step Quadrangles**



Point lies inside the ANSI 4000K 7-step quadrangle

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### Photopic Flux vs. Wavelength

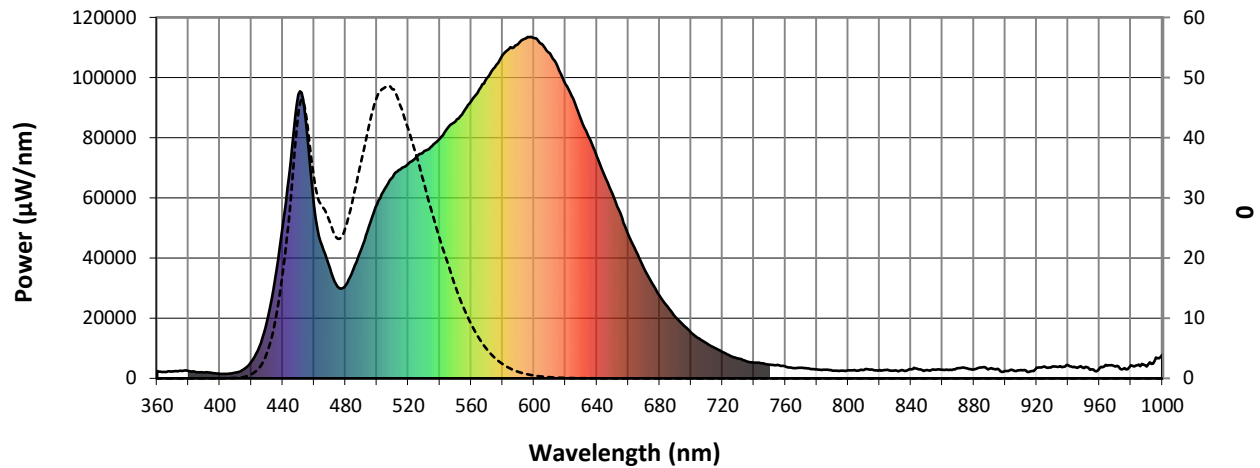


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| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 360       | 2470             | 0.0              | 490       | 43022            | 6.1              | 620       | 97795            | 25.4             | 750       | 4583             | 0.0              | 880       | 2980             | 0.0              |
| 365       | 2119             | 0.0              | 495       | 50645            | 9.2              | 625       | 92963            | 20.5             | 755       | 4424             | 0.0              | 885       | 3638             | 0.0              |
| 370       | 2296             | 0.0              | 500       | 57941            | 12.8             | 630       | 85922            | 15.6             | 760       | 3924             | 0.0              | 890       | 3210             | 0.0              |
| 375       | 2538             | 0.0              | 505       | 62961            | 17.6             | 635       | 80139            | 12.0             | 765       | 3412             | 0.0              | 895       | 3195             | 0.0              |
| 380       | 2460             | 0.0              | 510       | 66978            | 23.0             | 640       | 73764            | 8.8              | 770       | 3550             | 0.0              | 900       | 2403             | 0.0              |
| 385       | 2060             | 0.0              | 515       | 69458            | 28.8             | 645       | 67130            | 6.5              | 775       | 3301             | 0.0              | 905       | 2672             | 0.0              |
| 390       | 1910             | 0.0              | 520       | 71406            | 34.6             | 650       | 61251            | 4.5              | 780       | 2938             | 0.0              | 910       | 2746             | 0.0              |
| 395       | 1833             | 0.0              | 525       | 73554            | 39.5             | 655       | 54757            | 3.1              | 785       | 2901             | 0.0              | 915       | 2093             | 0.0              |
| 400       | 1499             | 0.0              | 530       | 75559            | 44.5             | 660       | 47806            | 2.0              | 790       | 2596             | 0.0              | 920       | 3502             | 0.0              |
| 405       | 1535             | 0.0              | 535       | 77242            | 47.9             | 665       | 42159            | 1.3              | 795       | 2512             | 0.0              | 925       | 3893             | 0.0              |
| 410       | 1918             | 0.0              | 540       | 79724            | 51.9             | 670       | 36632            | 0.8              | 800       | 2612             | 0.0              | 930       | 3909             | 0.0              |
| 415       | 2937             | 0.0              | 545       | 83331            | 55.5             | 675       | 31705            | 0.5              | 805       | 2583             | 0.0              | 935       | 4024             | 0.0              |
| 420       | 5537             | 0.0              | 550       | 85438            | 58.1             | 680       | 27443            | 0.3              | 810       | 2787             | 0.0              | 940       | 4351             | 0.0              |
| 425       | 10459            | 0.1              | 555       | 88580            | 60.5             | 685       | 23866            | 0.2              | 815       | 2970             | 0.0              | 945       | 3575             | 0.0              |
| 430       | 18944            | 0.2              | 560       | 92201            | 62.7             | 690       | 20482            | 0.1              | 820       | 2759             | 0.0              | 950       | 3451             | 0.0              |
| 435       | 32809            | 0.4              | 565       | 95983            | 63.8             | 695       | 17805            | 0.1              | 825       | 2924             | 0.0              | 955       | 2965             | 0.0              |
| 440       | 50593            | 0.8              | 570       | 99840            | 64.9             | 700       | 15274            | 0.0              | 830       | 2665             | 0.0              | 960       | 3360             | 0.0              |
| 445       | 71865            | 1.5              | 575       | 103421           | 64.4             | 705       | 13257            | 0.0              | 835       | 2711             | 0.0              | 965       | 4213             | 0.0              |
| 450       | 94356            | 2.4              | 580       | 107508           | 63.9             | 710       | 11582            | 0.0              | 840       | 2995             | 0.0              | 970       | 3908             | 0.0              |
| 455       | 84106            | 2.8              | 585       | 110098           | 61.2             | 715       | 10160            | 0.0              | 845       | 3015             | 0.0              | 975       | 3041             | 0.0              |
| 460       | 57367            | 2.4              | 590       | 111337           | 57.6             | 720       | 8764             | 0.0              | 850       | 2730             | 0.0              | 980       | 4418             | 0.0              |
| 465       | 44149            | 2.3              | 595       | 113111           | 53.6             | 725       | 7477             | 0.0              | 855       | 2854             | 0.0              | 985       | 4563             | 0.0              |
| 470       | 36600            | 2.3              | 600       | 113155           | 48.8             | 730       | 6579             | 0.0              | 860       | 2845             | 0.0              | 990       | 3924             | 0.0              |
| 475       | 30491            | 2.4              | 605       | 111204           | 43.1             | 735       | 5754             | 0.0              | 865       | 2927             | 0.0              | 995       | 5812             | 0.0              |
| 480       | 30970            | 2.9              | 610       | 108150           | 37.2             | 740       | 5243             | 0.0              | 870       | 3427             | 0.0              | 1000      | 7877             | 0.0              |
| 485       | 36255            | 4.3              | 615       | 103709           | 31.3             | 745       | 5025             | 0.0              | 875       | 3419             | 0.0              |           |                  |                  |

REPORT NUMBER: SP1-2009-972-1-R2

### Scotopic Flux vs. Wavelength



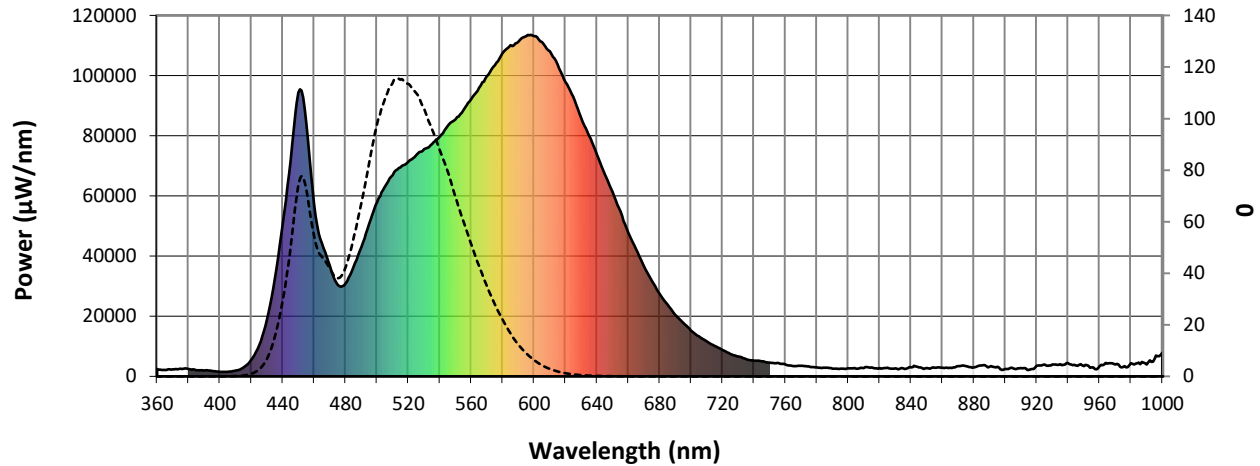
Scotopic Lumens: 4107.8

S/P: 0.65

| $\lambda$<br>(nm) | Power<br>( $\mu\text{W/nm}$ ) | Lumens<br>( $\Phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W/nm}$ ) | Lumens<br>( $\Phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W/nm}$ ) | Lumens<br>( $\Phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W/nm}$ ) | Lumens<br>( $\Phi/\text{nm}$ ) | $\lambda$<br>(nm) | Power<br>( $\mu\text{W/nm}$ ) | Lumens<br>( $\Phi/\text{nm}$ ) |
|-------------------|-------------------------------|--------------------------------|-------------------|-------------------------------|--------------------------------|-------------------|-------------------------------|--------------------------------|-------------------|-------------------------------|--------------------------------|-------------------|-------------------------------|--------------------------------|
| 360               | 2470                          | 0.0                            | 490               | 43022                         | 66.2                           | 620               | 97795                         | 1.2                            | 750               | 4583                          | 0.0                            | 880               | 2980                          | 0.0                            |
| 365               | 2119                          | 0.0                            | 495               | 50645                         | 81.9                           | 625               | 92963                         | 0.8                            | 755               | 4424                          | 0.0                            | 885               | 3638                          | 0.0                            |
| 370               | 2296                          | 0.0                            | 500               | 57941                         | 96.9                           | 630               | 85922                         | 0.5                            | 760               | 3924                          | 0.0                            | 890               | 3210                          | 0.0                            |
| 375               | 2538                          | 0.0                            | 505               | 62961                         | 107.0                          | 635               | 80139                         | 0.3                            | 765               | 3412                          | 0.0                            | 895               | 3195                          | 0.0                            |
| 380               | 2460                          | 0.0                            | 510               | 66978                         | 113.5                          | 640               | 73764                         | 0.2                            | 770               | 3550                          | 0.0                            | 900               | 2403                          | 0.0                            |
| 385               | 2060                          | 0.0                            | 515               | 69458                         | 115.1                          | 645               | 67130                         | 0.1                            | 775               | 3301                          | 0.0                            | 905               | 2672                          | 0.0                            |
| 390               | 1910                          | 0.0                            | 520               | 71406                         | 113.5                          | 650               | 61251                         | 0.1                            | 780               | 2938                          | 0.0                            | 910               | 2746                          | 0.0                            |
| 395               | 1833                          | 0.0                            | 525               | 73554                         | 110.0                          | 655               | 54757                         | 0.0                            | 785               | 2901                          | 0.0                            | 915               | 2093                          | 0.0                            |
| 400               | 1499                          | 0.0                            | 530               | 75559                         | 104.2                          | 660               | 47806                         | 0.0                            | 790               | 2596                          | 0.0                            | 920               | 3502                          | 0.0                            |
| 405               | 1535                          | 0.0                            | 535               | 77242                         | 96.3                           | 665               | 42159                         | 0.0                            | 795               | 2512                          | 0.0                            | 925               | 3893                          | 0.0                            |
| 410               | 1918                          | 0.1                            | 540               | 79724                         | 88.1                           | 670               | 36632                         | 0.0                            | 800               | 2612                          | 0.0                            | 930               | 3909                          | 0.0                            |
| 415               | 2937                          | 0.3                            | 545               | 83331                         | 79.9                           | 675               | 31705                         | 0.0                            | 805               | 2583                          | 0.0                            | 935               | 4024                          | 0.0                            |
| 420               | 5537                          | 0.9                            | 550               | 85438                         | 69.9                           | 680               | 27443                         | 0.0                            | 810               | 2787                          | 0.0                            | 940               | 4351                          | 0.0                            |
| 425               | 10459                         | 2.6                            | 555               | 88580                         | 60.5                           | 685               | 23866                         | 0.0                            | 815               | 2970                          | 0.0                            | 945               | 3575                          | 0.0                            |
| 430               | 18944                         | 6.4                            | 560               | 92201                         | 51.5                           | 690               | 20482                         | 0.0                            | 820               | 2759                          | 0.0                            | 950               | 3451                          | 0.0                            |
| 435               | 32809                         | 14.7                           | 565               | 95983                         | 43.1                           | 695               | 17805                         | 0.0                            | 825               | 2924                          | 0.0                            | 955               | 2965                          | 0.0                            |
| 440               | 50593                         | 28.3                           | 570               | 99840                         | 35.2                           | 700               | 15274                         | 0.0                            | 830               | 2665                          | 0.0                            | 960               | 3360                          | 0.0                            |
| 445               | 71865                         | 48.1                           | 575               | 103421                        | 28.2                           | 705               | 13257                         | 0.0                            | 835               | 2711                          | 0.0                            | 965               | 4213                          | 0.0                            |
| 450               | 94356                         | 73.1                           | 580               | 107508                        | 22.2                           | 710               | 11582                         | 0.0                            | 840               | 2995                          | 0.0                            | 970               | 3908                          | 0.0                            |
| 455               | 84106                         | 73.5                           | 585               | 110098                        | 16.8                           | 715               | 10160                         | 0.0                            | 845               | 3015                          | 0.0                            | 975               | 3041                          | 0.0                            |
| 460               | 57367                         | 55.4                           | 590               | 111337                        | 12.4                           | 720               | 8764                          | 0.0                            | 850               | 2730                          | 0.0                            | 980               | 4418                          | 0.0                            |
| 465               | 44149                         | 46.6                           | 595               | 113111                        | 9.0                            | 725               | 7477                          | 0.0                            | 855               | 2854                          | 0.0                            | 985               | 4563                          | 0.0                            |
| 470               | 36600                         | 42.1                           | 600               | 113155                        | 6.4                            | 730               | 6579                          | 0.0                            | 860               | 2845                          | 0.0                            | 990               | 3924                          | 0.0                            |
| 475               | 30491                         | 38.1                           | 605               | 111204                        | 4.4                            | 735               | 5754                          | 0.0                            | 865               | 2927                          | 0.0                            | 995               | 5812                          | 0.0                            |
| 480               | 30970                         | 41.8                           | 610               | 108150                        | 2.9                            | 740               | 5243                          | 0.0                            | 870               | 3427                          | 0.0                            | 1000              | 7877                          | 0.0                            |
| 485               | 36255                         | 52.6                           | 615               | 103709                        | 1.9                            | 745               | 5025                          | 0.0                            | 875               | 3419                          | 0.0                            |                   |                               |                                |

REPORT NUMBER: SP1-2009-972-1-R2

### Melanopic Flux vs. Wavelength



**Melanopic Lumens: 10325.3**    **S/P: 1.63**

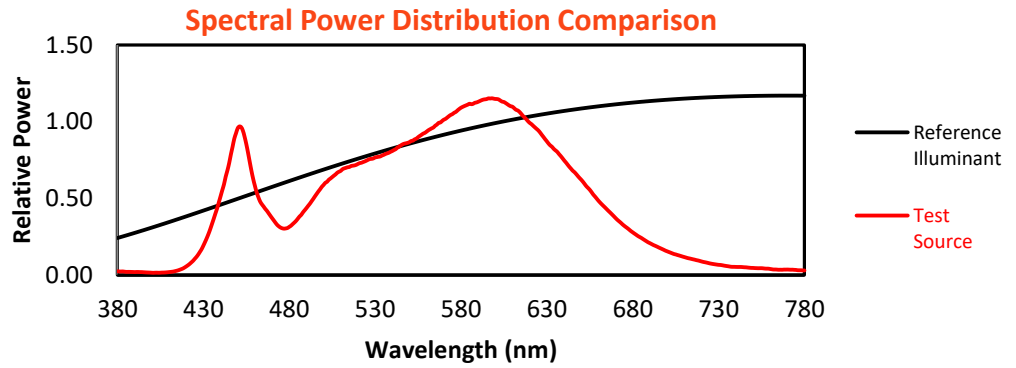
| λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) | λ<br>(nm) | Power<br>(μW/nm) | Lumens<br>(Φ/nm) |
|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|-----------|------------------|------------------|
| 360       | 2470             | 0.0              | 490       | 43022            | 35.8             | 620       | 97795            | 0.1              | 750       | 4583             | 0.0              | 880       | 2980             | 0.0              |
| 365       | 2119             | 0.0              | 495       | 50645            | 41.8             | 625       | 92963            | 0.0              | 755       | 4424             | 0.0              | 885       | 3638             | 0.0              |
| 370       | 2296             | 0.0              | 500       | 57941            | 46.6             | 630       | 85922            | 0.0              | 760       | 3924             | 0.0              | 890       | 3210             | 0.0              |
| 375       | 2538             | 0.0              | 505       | 62961            | 48.3             | 635       | 80139            | 0.0              | 765       | 3412             | 0.0              | 895       | 3195             | 0.0              |
| 380       | 2460             | 0.0              | 510       | 66978            | 48.1             | 640       | 73764            | 0.0              | 770       | 3550             | 0.0              | 900       | 2403             | 0.0              |
| 385       | 2060             | 0.0              | 515       | 69458            | 45.4             | 645       | 67130            | 0.0              | 775       | 3301             | 0.0              | 905       | 2672             | 0.0              |
| 390       | 1910             | 0.0              | 520       | 71406            | 41.6             | 650       | 61251            | 0.0              | 780       | 2938             | 0.0              | 910       | 2746             | 0.0              |
| 395       | 1833             | 0.0              | 525       | 73554            | 37.3             | 655       | 54757            | 0.0              | 785       | 2901             | 0.0              | 915       | 2093             | 0.0              |
| 400       | 1499             | 0.0              | 530       | 75559            | 32.7             | 660       | 47806            | 0.0              | 790       | 2596             | 0.0              | 920       | 3502             | 0.0              |
| 405       | 1535             | 0.0              | 535       | 77242            | 27.8             | 665       | 42159            | 0.0              | 795       | 2512             | 0.0              | 925       | 3893             | 0.0              |
| 410       | 1918             | 0.1              | 540       | 79724            | 23.3             | 670       | 36632            | 0.0              | 800       | 2612             | 0.0              | 930       | 3909             | 0.0              |
| 415       | 2937             | 0.2              | 545       | 83331            | 19.4             | 675       | 31705            | 0.0              | 805       | 2583             | 0.0              | 935       | 4024             | 0.0              |
| 420       | 5537             | 0.6              | 550       | 85438            | 15.3             | 680       | 27443            | 0.0              | 810       | 2787             | 0.0              | 940       | 4351             | 0.0              |
| 425       | 10459            | 1.6              | 555       | 88580            | 11.9             | 685       | 23866            | 0.0              | 815       | 2970             | 0.0              | 945       | 3575             | 0.0              |
| 430       | 18944            | 4.0              | 560       | 92201            | 9.1              | 690       | 20482            | 0.0              | 820       | 2759             | 0.0              | 950       | 3451             | 0.0              |
| 435       | 32809            | 8.8              | 565       | 95983            | 6.7              | 695       | 17805            | 0.0              | 825       | 2924             | 0.0              | 955       | 2965             | 0.0              |
| 440       | 50593            | 16.9             | 570       | 99840            | 4.9              | 700       | 15274            | 0.0              | 830       | 2665             | 0.0              | 960       | 3360             | 0.0              |
| 445       | 71865            | 28.3             | 575       | 103421           | 3.4              | 705       | 13257            | 0.0              | 835       | 2711             | 0.0              | 965       | 4213             | 0.0              |
| 450       | 94356            | 43.5             | 580       | 107508           | 2.4              | 710       | 11582            | 0.0              | 840       | 2995             | 0.0              | 970       | 3908             | 0.0              |
| 455       | 84106            | 44.1             | 585       | 110098           | 1.6              | 715       | 10160            | 0.0              | 845       | 3015             | 0.0              | 975       | 3041             | 0.0              |
| 460       | 57367            | 33.8             | 590       | 111337           | 1.1              | 720       | 8764             | 0.0              | 850       | 2730             | 0.0              | 980       | 4418             | 0.0              |
| 465       | 44149            | 28.8             | 595       | 113111           | 0.7              | 725       | 7477             | 0.0              | 855       | 2854             | 0.0              | 985       | 4563             | 0.0              |
| 470       | 36600            | 26.2             | 600       | 113155           | 0.5              | 730       | 6579             | 0.0              | 860       | 2845             | 0.0              | 990       | 3924             | 0.0              |
| 475       | 30491            | 23.3             | 605       | 111204           | 0.3              | 735       | 5754             | 0.0              | 865       | 2927             | 0.0              | 995       | 5812             | 0.0              |
| 480       | 30970            | 24.9             | 610       | 108150           | 0.2              | 740       | 5243             | 0.0              | 870       | 3427             | 0.0              | 1000      | 7877             | 0.0              |
| 485       | 36255            | 29.9             | 615       | 103709           | 0.1              | 745       | 5025             | 0.0              | 875       | 3419             | 0.0              |           |                  |                  |

REPORT NUMBER: SP1-2009-972-1-R2

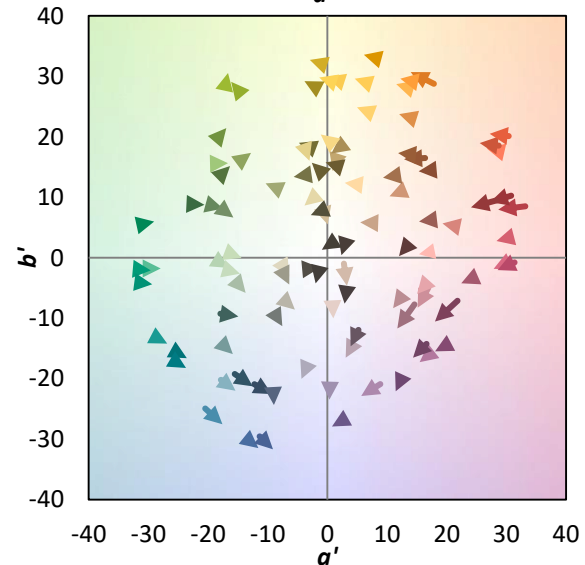
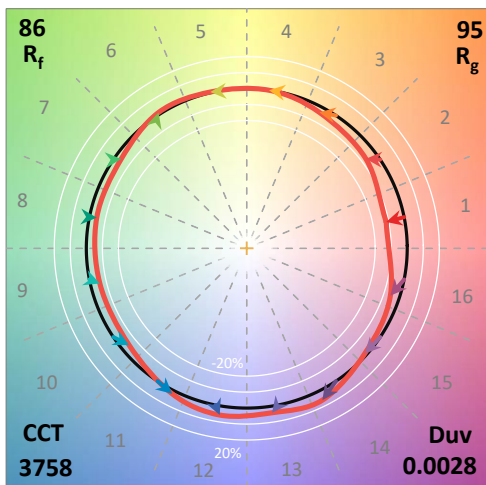
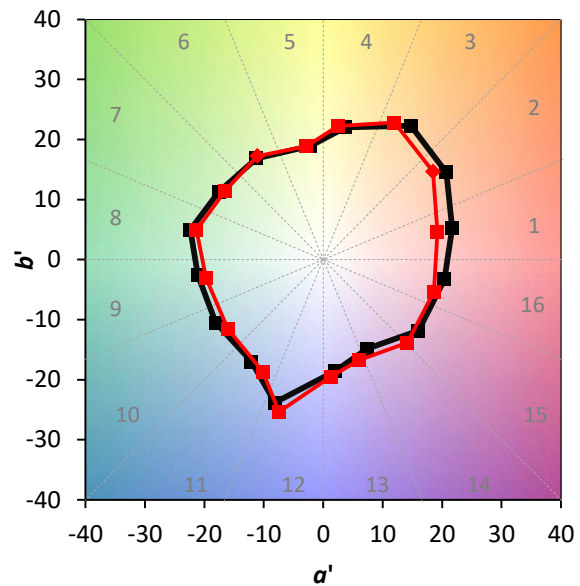
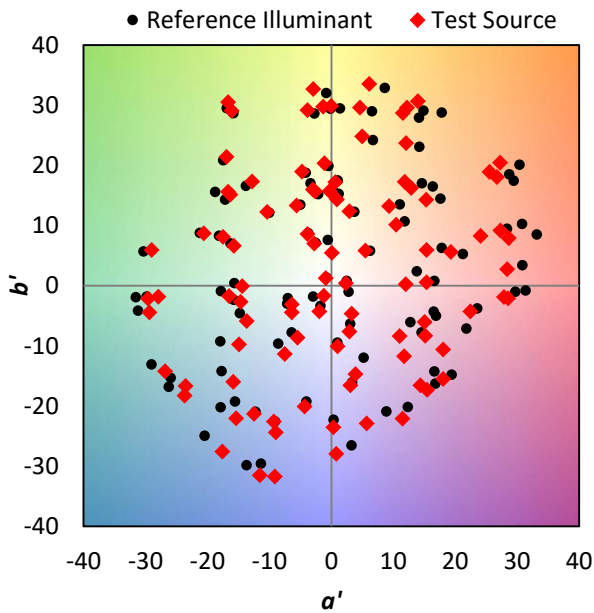
TM-30-18

### Summary

$R_f = 86.1$   
 $R_g = 95.3$   
 $CIE R_a = 83.7$   
 $R_g = 8.1$



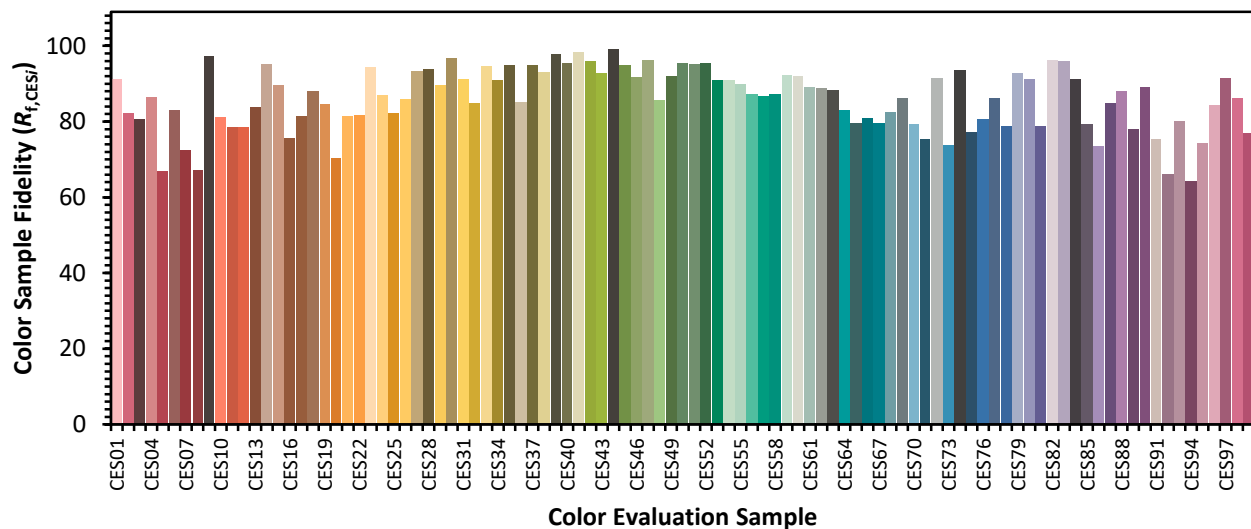
### Color Vector Graphics



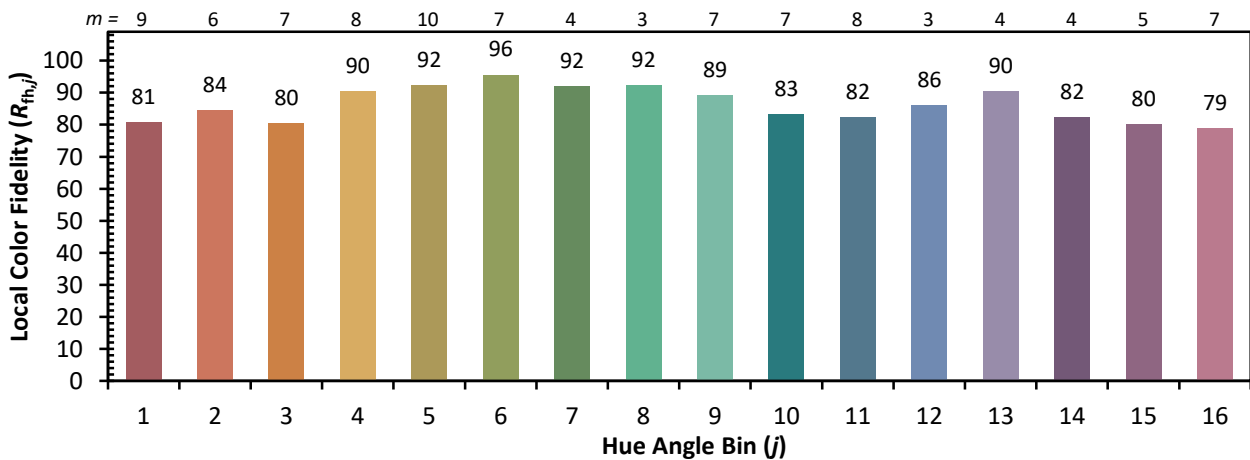
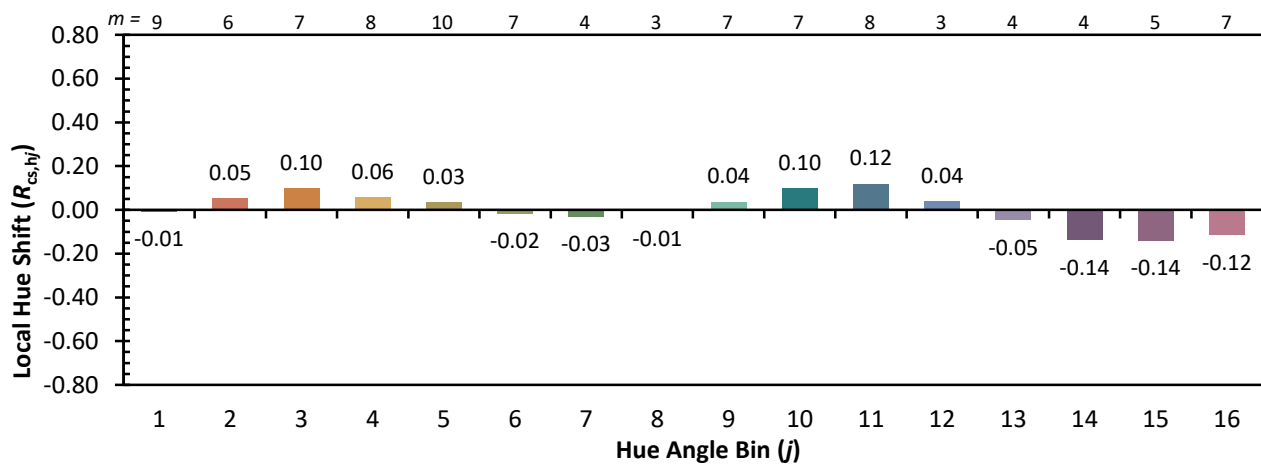
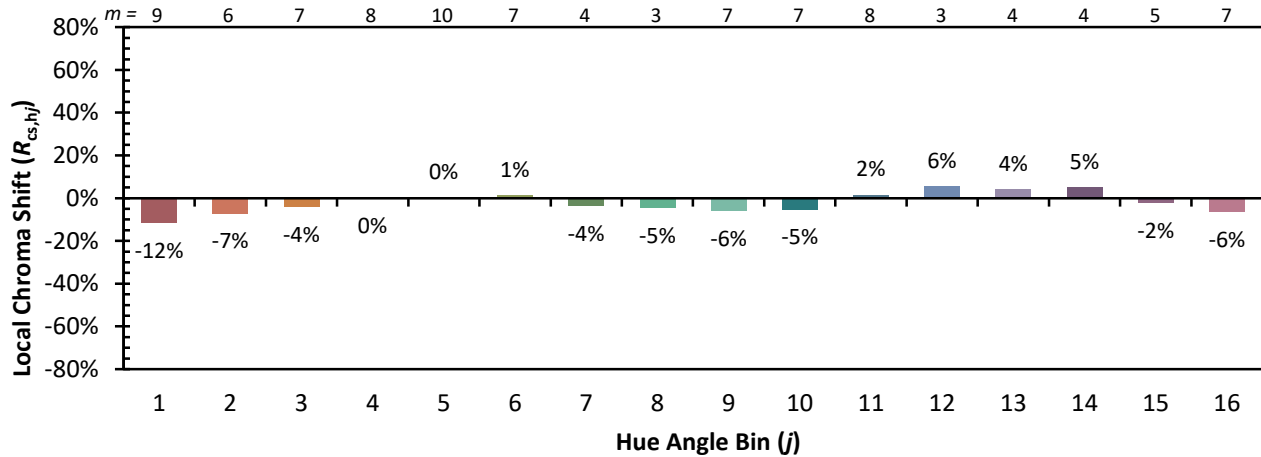


**Individual Sample Fidelity Index ( $R_{f,i}$ )**

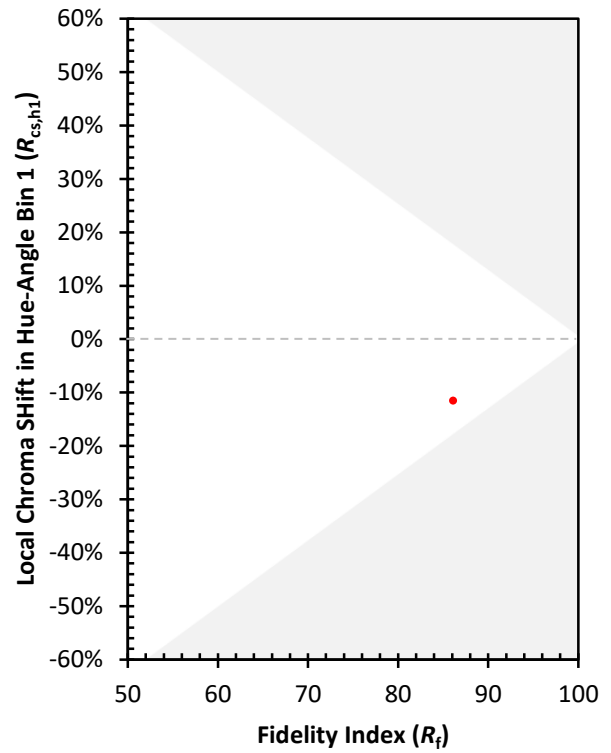
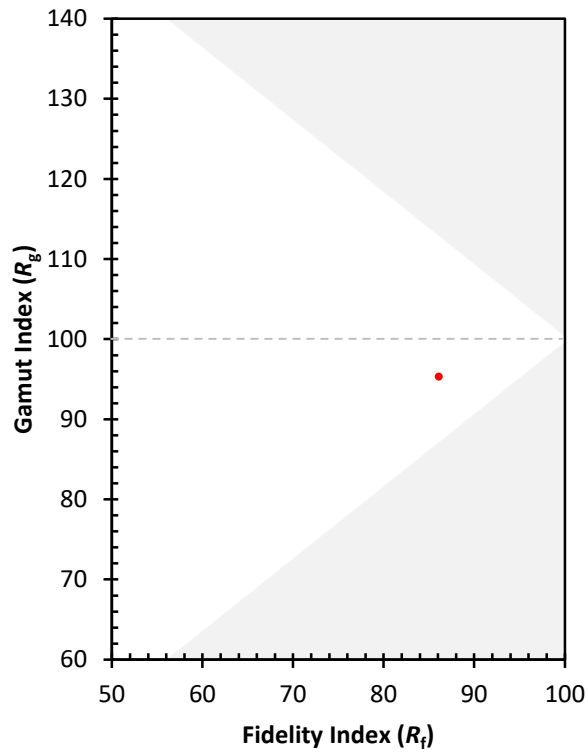
|            |            |            |            |
|------------|------------|------------|------------|
| CES01 = 86 | CES26 = 86 | CES51 = 95 | CES76 = 81 |
| CES02 = 61 | CES27 = 93 | CES52 = 95 | CES77 = 86 |
| CES03 = 31 | CES28 = 94 | CES53 = 91 | CES78 = 79 |
| CES04 = 70 | CES29 = 90 | CES54 = 91 | CES79 = 93 |
| CES05 = 48 | CES30 = 97 | CES55 = 90 | CES80 = 91 |
| CES06 = 51 | CES31 = 91 | CES56 = 87 | CES81 = 79 |
| CES07 = 41 | CES32 = 85 | CES57 = 87 | CES82 = 96 |
| CES08 = 40 | CES33 = 95 | CES58 = 87 | CES83 = 96 |
| CES09 = 29 | CES34 = 91 | CES59 = 92 | CES84 = 91 |
| CES10 = 74 | CES35 = 95 | CES60 = 92 | CES85 = 79 |
| CES11 = 57 | CES36 = 85 | CES61 = 89 | CES86 = 74 |
| CES12 = 63 | CES37 = 95 | CES62 = 89 | CES87 = 85 |
| CES13 = 43 | CES38 = 93 | CES63 = 88 | CES88 = 88 |
| CES14 = 74 | CES39 = 98 | CES64 = 83 | CES89 = 78 |
| CES15 = 71 | CES40 = 95 | CES65 = 80 | CES90 = 89 |
| CES16 = 47 | CES41 = 98 | CES66 = 81 | CES91 = 75 |
| CES17 = 49 | CES42 = 96 | CES67 = 80 | CES92 = 66 |
| CES18 = 56 | CES43 = 93 | CES68 = 82 | CES93 = 80 |
| CES19 = 71 | CES44 = 99 | CES69 = 86 | CES94 = 64 |
| CES20 = 65 | CES45 = 95 | CES70 = 79 | CES95 = 74 |
| CES21 = 86 | CES46 = 92 | CES71 = 75 | CES96 = 84 |
| CES22 = 78 | CES47 = 96 | CES72 = 92 | CES97 = 92 |
| CES23 = 91 | CES48 = 86 | CES73 = 74 | CES98 = 86 |
| CES24 = 90 | CES49 = 92 | CES74 = 94 | CES99 = 77 |
| CES25 = 71 | CES50 = 95 | CES75 = 77 |            |



Color Rendition by Hue-Angle Bin



**Measure Comparisons**



(END OF REPORT)