Classified

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: io LED

Report Number: P895870

Luminaire Tested: **GRZ-10L-935-50x60-X-UNV-STD-1F**

Issue Date: 11/20/2024

Report Generated By 670245763 / DESKTOP-DVLU35A

Cooper Lighting Solutions Photometric Lab
1121 Highway 74 South
Peachtree City, GA 30269

Scaled Data Report

**Test Information**

| | |
|---|---|
| Test Method: | LM-79-08 |
| Report Number: | P895870 |
| Test Lab: | INNOVATION CENTER(G3) |
| Issue Date: | 11/20/2024 |
| Manufacturer: | COOPER LIGHTING SOLUTIONS (FORMERLY EATON) |
| Product Line: | io LED |
| Catalog Number: | GRZ-10L-935-50x60-X-UNV-STD-1F |
| Description: | iO LED 90CRI 3500K GRAZER 1000 lumens per ft WITH 50 deg x 60 deg OPTIC |
| Light Source: | 3500K CCT, 90 CRI LEDS |
| Ballast/Driver: | ELECTRONIC DRIVER |

**Summary**

| | |
|---|---|
| Lumens per Lamp: | N/A |
| Luminaire Lumens: | 820.3 lumens |
| Efficiency: | N/A |
| Efficacy: | 82.0 lumens/watt |
| Spacing Criteria (0/90/45): | 0.87 / 0.95 / 0.87 |
| Luminous Opening: | Rectangular (W 1' x L: 0.17' x H: 0') |
| CIE Type: | Direct |

| | |
|---|---|
| Input Watts (W): | 10 |
| 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 |

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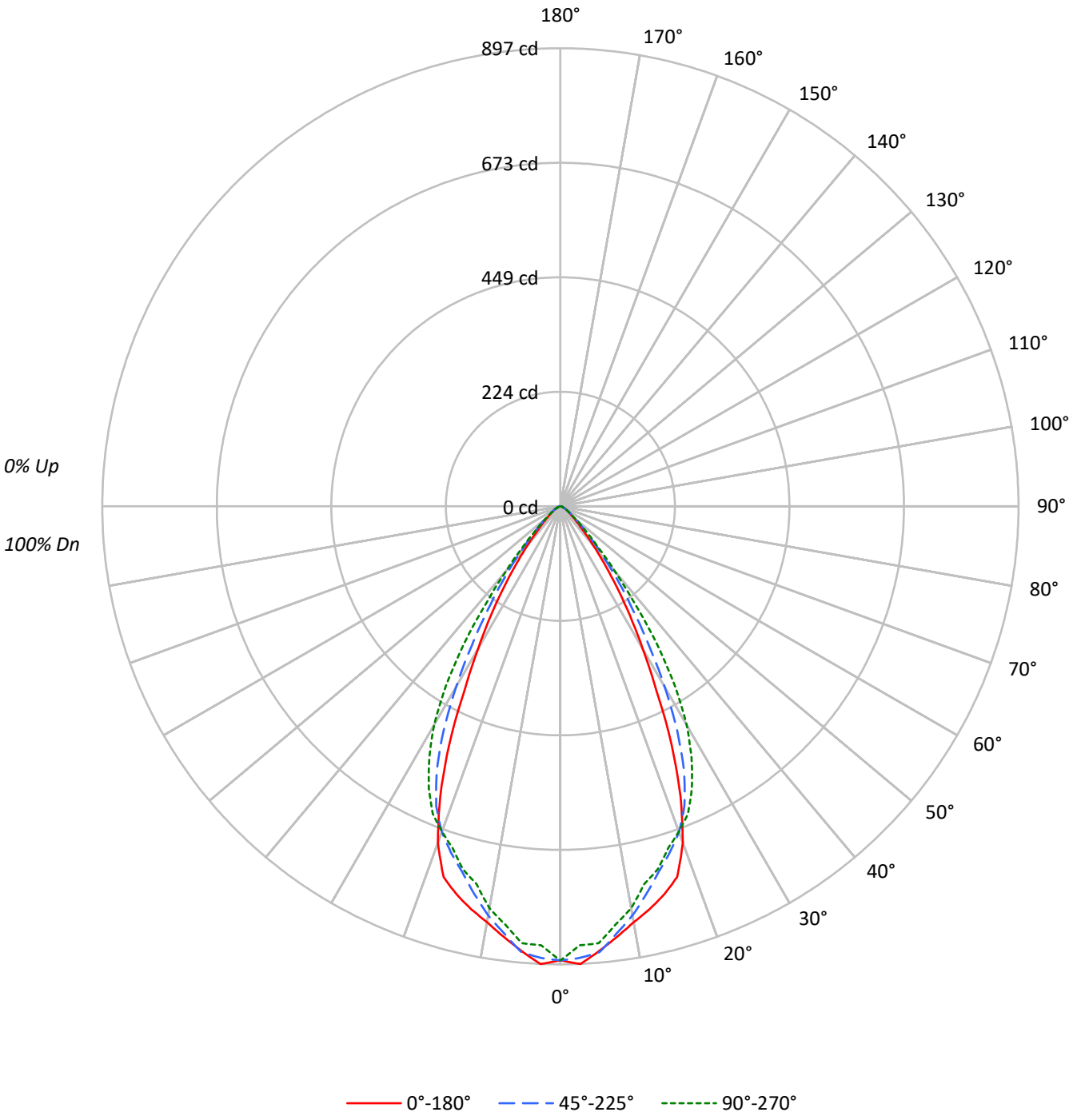
Scaled Data Report

TEST NUMBER: P895870
CATALOG NUMBER: GRZ-10L-935-50x60-X-UNV-STD-1F

## Luminous Intensity Polar Plot



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TEST NUMBER: P895870
CATALOG NUMBER: GRZ-10L-935-50x60-X-UNV-STD-1F

## COEFFICIENT OF UTILIZATION - ZONAL CAVITY METHOD:

| RF | 20 | | | | 20 | | | | 20 | | | 20 | | | 20 | | | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RC | 80 | | | | 70 | | | | 50 | | | 30 | | | 10 | | | 0 |
| RW | 70 | 50 | 30 | 10 | 70 | 50 | 30 | 10 | 50 | 30 | 10 | 50 | 30 | 10 | 50 | 30 | 10 | 0 |
| RCR | | | | | | | | | | | | | | | | | | |
| 0 | 119 | 119 | 119 | 119 | 116 | 116 | 116 | 116 | 111 | 111 | 111 | 106 | 106 | 106 | 102 | 102 | 102 | 100 |
| 1 | 113 | 110 | 108 | 105 | 111 | 108 | 106 | 104 | 104 | 102 | 100 | 100 | 99 | 97 | 97 | 96 | 95 | 93 |
| 2 | 107 | 102 | 98 | 94 | 105 | 100 | 96 | 93 | 97 | 94 | 91 | 94 | 91 | 89 | 91 | 89 | 87 | 86 |
| 3 | 101 | 95 | 89 | 85 | 99 | 93 | 88 | 85 | 91 | 87 | 83 | 88 | 85 | 82 | 86 | 83 | 81 | 79 |
| 4 | 96 | 88 | 82 | 78 | 94 | 87 | 81 | 77 | 85 | 80 | 76 | 83 | 79 | 75 | 81 | 77 | 75 | 73 |
| 5 | 91 | 82 | 76 | 71 | 89 | 81 | 75 | 71 | 79 | 74 | 70 | 78 | 73 | 70 | 76 | 72 | 69 | 68 |
| 6 | 86 | 77 | 70 | 66 | 84 | 76 | 70 | 66 | 74 | 69 | 65 | 73 | 68 | 65 | 72 | 68 | 64 | 63 |
| 7 | 82 | 72 | 66 | 61 | 80 | 71 | 65 | 61 | 70 | 65 | 61 | 69 | 64 | 60 | 67 | 63 | 60 | 59 |
| 8 | 77 | 67 | 61 | 57 | 76 | 67 | 61 | 57 | 66 | 60 | 57 | 65 | 60 | 56 | 64 | 59 | 56 | 55 |
| 9 | 74 | 64 | 57 | 53 | 72 | 63 | 57 | 53 | 62 | 57 | 53 | 61 | 56 | 53 | 60 | 56 | 53 | 51 |
| 10 | 70 | 60 | 54 | 50 | 69 | 60 | 54 | 50 | 59 | 53 | 50 | 58 | 53 | 50 | 57 | 53 | 49 | 48 |

## AVERAGE LUMINANCE (cd/sqm):

| | 0° | 45° | 90° |
|---|---|---|---|
| 0° | 57416 | 57416 | 57416 |
| 5° | 56657 | 56812 | 55672 |
| 10° | 54224 | 53338 | 52394 |
| 15° | 52570 | 49581 | 49207 |
| 20° | 48169 | 46637 | 46582 |
| 25° | 36706 | 40852 | 43410 |
| 30° | 24023 | 30443 | 36870 |
| 35° | 15024 | 19486 | 25965 |
| 40° | 8539 | 11556 | 13984 |
| 45° | 4730 | 6630 | 6913 |
| 50° | 3044 | 3847 | 3767 |
| 55° | 2240 | 2600 | 2330 |
| 60° | 1653 | 1860 | 1653 |
| 65° | 1345 | 1467 | 1222 |
| 70° | 906 | 1057 | 1057 |
| 75° | 599 | 798 | 798 |
| 80° | 595 | 595 | 595 |
| 85° | 593 | 593 | 593 |

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TEST NUMBER: P895870
CATALOG NUMBER: GRZ-10L-935-50x60-X-UNV-STD-1F

**ZONAL LUMENS:**

| Zone | Lumens | % Fixture |
|---|---|---|
| 0°-10° | 81.0 | 9.9 |
| 10°-20° | 209.7 | 25.6 |
| 20°-30° | 252.8 | 30.8 |
| 30°-40° | 172.6 | 21.0 |
| 40°-50° | 68.8 | 8.4 |
| 50°-60° | 22.3 | 2.7 |
| 60°-70° | 9.0 | 1.1 |
| 70°-80° | 3.5 | 0.4 |
| 80°-90° | 0.7 | 0.1 |
| 90°-100° | 0.0 | 0.0 |
| 100°-110° | 0.0 | 0.0 |
| 110°-120° | 0.0 | 0.0 |
| 120°-130° | 0.0 | 0.0 |
| 130°-140° | 0.0 | 0.0 |
| 140°-150° | 0.0 | 0.0 |
| 150°-160° | 0.0 | 0.0 |
| 160°-170° | 0.0 | 0.0 |
| 170°-180° | 0.0 | 0.0 |
| 0°-30° | 543.4 | 66.2 |
| 0°-40° | 716.0 | 87.3 |
| 0°-60° | 807.1 | 98.4 |
| 0°-90° | 820.3 | 100.0 |
| 90°-120° | 0.0 | 0.0 |
| 90°-150° | 0.0 | 0.0 |
| 90°-180° | 0.0 | 0.0 |
| 0°-180° | 820.3 | 100.0 |

**CANDELA DISTRIBUTION:**

| | 0° | 22.5° | 45° | 67.5° | 90° | Flux |
|---|---|---|---|---|---|---|
| 0° | 889 | 889 | 889 | 889 | 889 | |
| 5° | 874 | 873 | 876 | 861 | 859 | 82 |
| 15° | 786 | 759 | 742 | 730 | 736 | 219 |
| 25° | 515 | 512 | 573 | 592 | 609 | 232 |
| 35° | 191 | 240 | 247 | 352 | 329 | 122 |
| 45° | 52 | 100 | 73 | 98 | 76 | 44 |
| 55° | 20 | 27 | 23 | 22 | 21 | 18 |
| 65° | 9 | 9 | 10 | 9 | 8 | 8 |
| 75° | 2 | 3 | 3 | 3 | 3 | 3 |
| 85° | 1 | 1 | 1 | 1 | 1 | 1 |
| 90° | 0 | 0 | 0 | 0 | 0 | |

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TEST NUMBER: P895870
CATALOG NUMBER: GRZ-10L-935-50x60-X-UNV-STD-1F

**CANDELA DISTRIBUTION (FULL):**

| | 0° | 22.5° | 45° | 67.5° | 90° |
|---|---|---|---|---|---|
| 0° | *889.2* | 889.2 | 889.2 | 889.2 | 889.2 |
| 2.5° | *897.2* | *888.4* | *885.2* | *881.3* | *860.5* |
| 5° | *874.1* | 873.3 | 876.5 | 861.3 | 858.9 |
| 7.5° | *850.2* | 846.2 | 843.8 | 833.4 | 826.3 |
| 10° | *827.0* | 818.3 | 813.5 | 799.1 | 799.1 |
| 12.5° | *807.9* | 793.6 | 777.6 | 763.3 | 757.7 |
| 15° | *786.4* | 759.3 | 741.7 | 730.5 | 736.1 |
| 17.5° | *760.9* | 718.5 | 711.4 | 696.2 | 701.8 |
| 20° | *701.0* | 672.3 | 678.7 | 664.3 | 677.9 |
| 22.5° | *614.9* | 598.9 | 634.8 | 631.6 | 652.4 |
| 25° | *515.2* | 512.0 | 573.4 | 591.8 | 609.3 |
| 27.5° | *407.5* | 424.2 | 495.3 | 545.5 | 555.9 |
| 30° | *322.2* | 348.5 | 408.3 | 489.7 | 494.5 |
| 32.5° | *252.8* | 290.3 | 322.2 | 424.2 | 417.1 |
| 35° | *190.6* | 240.1 | 247.2 | 352.5 | 329.4 |
| 37.5° | *140.3* | 201.8 | 188.2 | 277.5 | 236.9 |
| 40° | *101.3* | 165.1 | 137.1 | 205.0 | 165.9 |
| 42.5° | *71.8* | 131.6 | 99.7 | 148.4 | 112.4 |
| 45° | *51.8* | 99.7 | 72.6 | 98.1 | 75.7 |
| 47.5° | *39.1* | 73.4 | 52.6 | 64.6 | 53.4 |
| 50° | *30.3* | 51.8 | 38.3 | 43.9 | 37.5 |
| 52.5° | *24.7* | 37.5 | 29.5 | 31.1 | 27.9 |
| 55° | *19.9* | 27.1 | 23.1 | 22.3 | 20.7 |
| 57.5° | *15.9* | 20.7 | 18.3 | 17.5 | 16.7 |
| 60° | *12.8* | 15.1 | 14.4 | 13.6 | 12.8 |
| 62.5° | *10.4* | 12.0 | 12.0 | 10.4 | 10.4 |
| 65° | *8.8* | 8.8 | 9.6 | 8.8 | 8.0 |
| 67.5° | *6.4* | 7.2 | 7.2 | 6.4 | 6.4 |
| 70° | *4.8* | 5.6 | 5.6 | 5.6 | 5.6 |
| 72.5° | *4.0* | 4.0 | 4.8 | 4.0 | 4.0 |
| 75° | *2.4* | 3.2 | 3.2 | 3.2 | 3.2 |
| 77.5° | *1.6* | 2.4 | 2.4 | 2.4 | 2.4 |
| 80° | *1.6* | 1.6 | 1.6 | 1.6 | 1.6 |
| 82.5° | *0.8* | 0.8 | 1.6 | 0.8 | 0.8 |
| 85° | *0.8* | 0.8 | 0.8 | 0.8 | 0.8 |
| 87.5° | *0.0* | 0.0 | 0.0 | 0.0 | 0.0 |
| 90° | *0.0* | 0.0 | 0.0 | 0.0 | 0.0 |

Cooper Lighting Solutions Photometric Lab
1121 Highway 74 South
Peachtree City, GA 30269

Report Prepared for

Cooper Lighting Solutions

(formerly Eaton)

iO LED

Report Number: SP1-2101-124-3

Luminaire Tested: GRZ-05L-935-10X10-X-UNV-STD-2F

Test Date: 02/10/2021

Report Generated By controller / USPTCWHP6086842

## Test Information

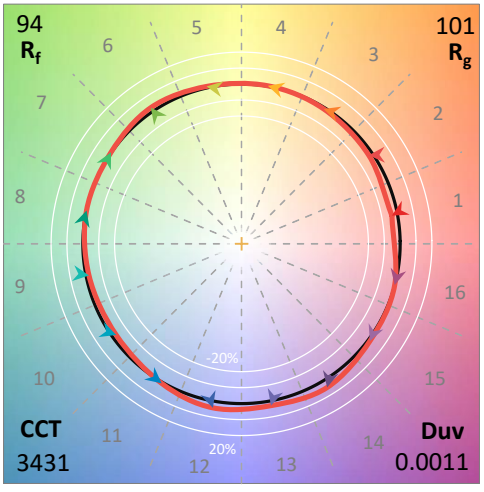
| | |
|---|---|
| Test Method: | LM-79-08 |
| Report Number: | SP1-2101-124-3 |
| Test Lab: | COOPER LIGHTING SOLUTIONS |
| Photometer: | SP1 |
| Measurement Geometry: | 4π |
| Issue Date: | 02/10/2021 |
| Manufacturer: | COOPER LIGHTING SOLUTIONS (FORMERLY EATON) |
| Product Line: | iO LED |
| Catalog Number: | **GRZ-05L-935-10X10-X-UNV-STD-2F** |
| Description: | IO LED Wall Grazer GRZ |

## Spectral Parameters

| | |
|---|---|
| CCT (K): | 3431 |
| CIE u': | 0.2369 |
| CIE v': | 0.5141 |
| Duv: | 0.0011 |
| CIE x: | 0.4104 |
| CIE y: | 0.3958 |
| CIE z: | 0.1938 |
| Peak Wavelength (nm): | 624 |
| Dominant Wavelength (nm): | 580 |
| Purity: | 42.2 |

| | |
|---|---|
| CRI (Ra): | 94.0 |
| R1: | 94.7 |
| R2: | 95.5 |
| R3: | 95.0 |
| R4: | 95.4 |
| R5: | 94.1 |
| R6: | 94.0 |
| R7: | 95.4 |
| R8: | 88.3 |
| R9: | 69.9 |
| R10: | 88.4 |
| R11: | 95.7 |
| R12: | 83.2 |
| R13: | 94.8 |
| R14: | 96.6 |

| | |
|---|---|
| Rf: | 93.6 |
| Rg: | 100.6 |




## Test Conditions

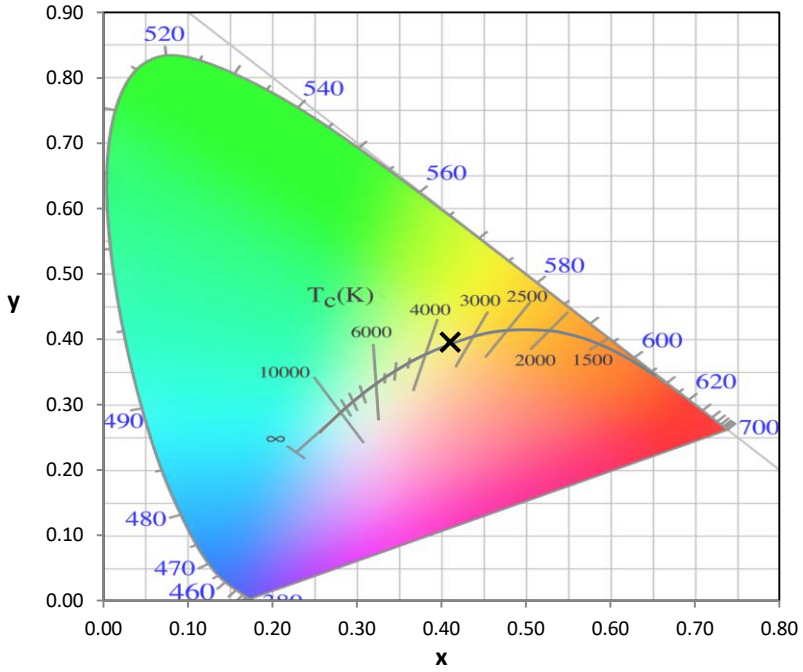
| | |
|---|---|
| Stabilization Time: | 57M |
| Operation Time: | 12H |
| Room Temperature (°C) / RH%: | 25.5/38% |
| Sphere Temperature (°C): | 24.4 |

REPORT NUMBER: SP1-2101-124-3

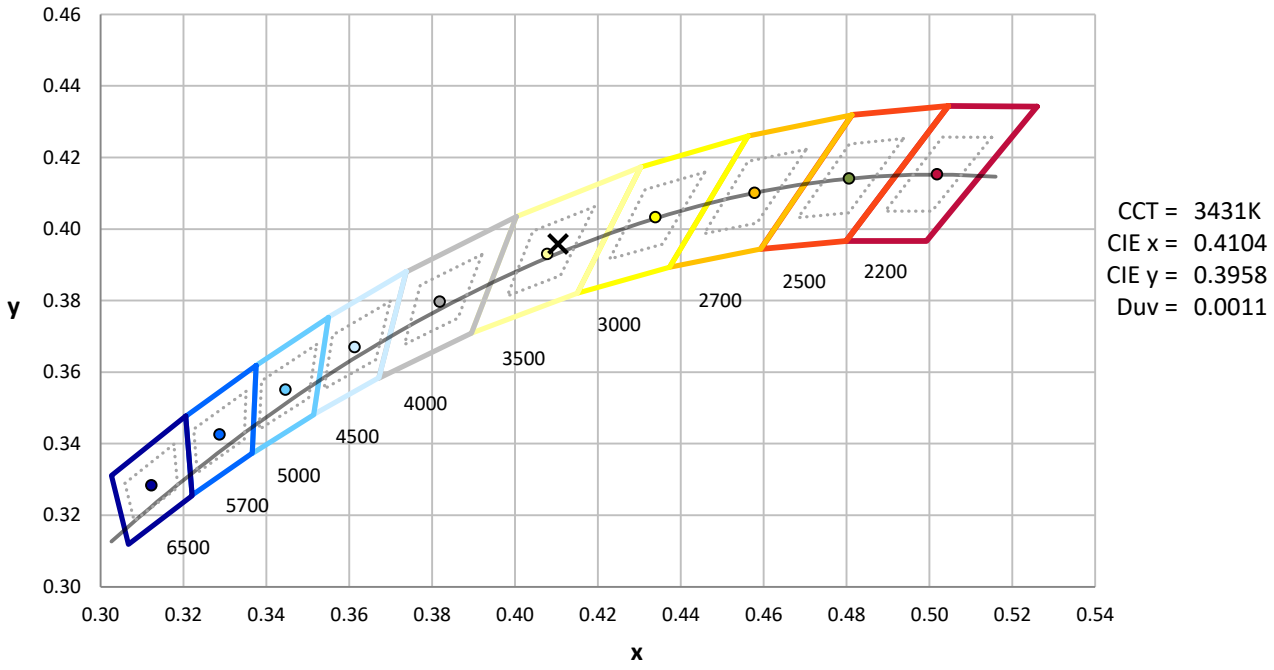
| Measurement and Test Equipment | | | |
|---|---|---|---|
| Instrument | Identification Number | Calibration Date | Calibration Due Date |
| Photometer | IN0058 | 1/31/2021 | 7/31/2021 |
| Power Meter | IN0071 | 12/1/2020 | 12/1/2021 |
| AC Power Source | IN0063 | 12/1/2020 | 12/1/2021 |
| DC Power Source | IN0208 | 12/1/2020 | 12/1/2021 |
| Sphere Thermometer | IN0085 | 12/1/2020 | 12/1/2021 |
| Room Thermometer | IN0046 | 12/1/2020 | 12/1/2021 |

REPORT NUMBER: SP1-2101-124-3

## CIE 1931 Chromaticity Diagram




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

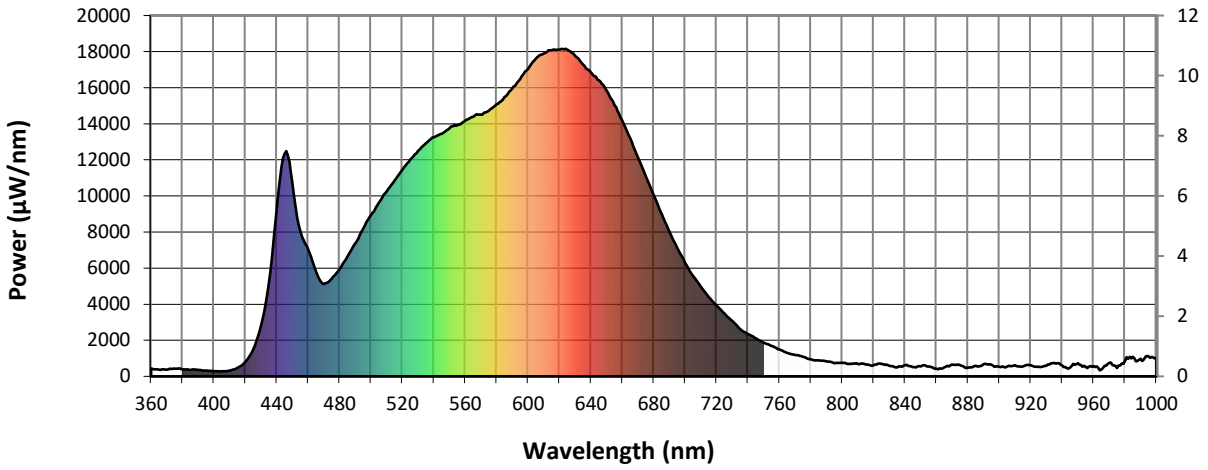



CCT = 3431K
CIE x = 0.4104
CIE y = 0.3958
Duv = 0.0011

Point lies inside the ANSI 3500K 4-step quadrangle

REPORT NUMBER: SP1-2101-124-3

## Photopic Flux vs. Wavelength

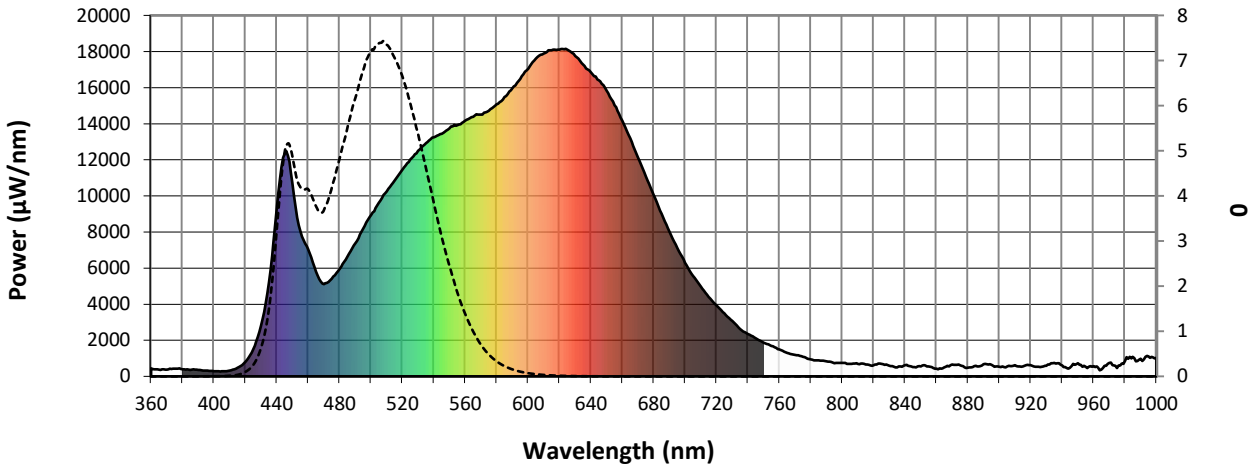



######

| λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 360 | 436 | 0.0 | 490 | 7373 | 1.0 | 620 | 18112 | 4.7 | 750 | 1864 | 0.0 | 880 | 485 | 0.0 |
| 365 | 370 | 0.0 | 495 | 8181 | 1.5 | 625 | 18107 | 4.0 | 755 | 1693 | 0.0 | 885 | 593 | 0.0 |
| 370 | 381 | 0.0 | 500 | 8943 | 2.0 | 630 | 17758 | 3.2 | 760 | 1498 | 0.0 | 890 | 677 | 0.0 |
| 375 | 432 | 0.0 | 505 | 9613 | 2.7 | 635 | 17291 | 2.6 | 765 | 1302 | 0.0 | 895 | 646 | 0.0 |
| 380 | 398 | 0.0 | 510 | 10245 | 3.5 | 640 | 16854 | 2.0 | 770 | 1180 | 0.0 | 900 | 526 | 0.0 |
| 385 | 359 | 0.0 | 515 | 10835 | 4.5 | 645 | 16410 | 1.6 | 775 | 1079 | 0.0 | 905 | 557 | 0.0 |
| 390 | 355 | 0.0 | 520 | 11465 | 5.6 | 650 | 15843 | 1.2 | 780 | 946 | 0.0 | 910 | 613 | 0.0 |
| 395 | 320 | 0.0 | 525 | 12004 | 6.4 | 655 | 15029 | 0.9 | 785 | 883 | 0.0 | 915 | 556 | 0.0 |
| 400 | 290 | 0.0 | 530 | 12512 | 7.4 | 660 | 14175 | 0.6 | 790 | 832 | 0.0 | 920 | 623 | 0.0 |
| 405 | 278 | 0.0 | 535 | 12925 | 8.0 | 665 | 13195 | 0.4 | 795 | 731 | 0.0 | 925 | 528 | 0.0 |
| 410 | 327 | 0.0 | 540 | 13254 | 8.6 | 670 | 12132 | 0.3 | 800 | 744 | 0.0 | 930 | 586 | 0.0 |
| 415 | 471 | 0.0 | 545 | 13437 | 8.9 | 675 | 11067 | 0.2 | 805 | 688 | 0.0 | 935 | 744 | 0.0 |
| 420 | 803 | 0.0 | 550 | 13744 | 9.3 | 680 | 10056 | 0.1 | 810 | 699 | 0.0 | 940 | 610 | 0.0 |
| 425 | 1501 | 0.0 | 555 | 13925 | 9.5 | 685 | 9011 | 0.1 | 815 | 651 | 0.0 | 945 | 486 | 0.0 |
| 430 | 2800 | 0.0 | 560 | 14164 | 9.6 | 690 | 8032 | 0.0 | 820 | 620 | 0.0 | 950 | 719 | 0.0 |
| 435 | 5221 | 0.1 | 565 | 14379 | 9.6 | 695 | 7112 | 0.0 | 825 | 686 | 0.0 | 955 | 527 | 0.0 |
| 440 | 9255 | 0.1 | 570 | 14511 | 9.4 | 700 | 6301 | 0.0 | 830 | 578 | 0.0 | 960 | 561 | 0.0 |
| 445 | 12350 | 0.3 | 575 | 14729 | 9.2 | 705 | 5570 | 0.0 | 835 | 502 | 0.0 | 965 | 364 | 0.0 |
| 450 | 10708 | 0.3 | 580 | 15069 | 9.0 | 710 | 4970 | 0.0 | 840 | 624 | 0.0 | 970 | 739 | 0.0 |
| 455 | 8053 | 0.3 | 585 | 15482 | 8.6 | 715 | 4396 | 0.0 | 845 | 523 | 0.0 | 975 | 457 | 0.0 |
| 460 | 7058 | 0.3 | 590 | 15975 | 8.3 | 720 | 3921 | 0.0 | 850 | 555 | 0.0 | 980 | 848 | 0.0 |
| 465 | 5809 | 0.3 | 595 | 16476 | 7.8 | 725 | 3489 | 0.0 | 855 | 553 | 0.0 | 985 | 1084 | 0.0 |
| 470 | 5111 | 0.3 | 600 | 17051 | 7.3 | 730 | 3068 | 0.0 | 860 | 424 | 0.0 | 990 | 980 | 0.0 |
| 475 | 5409 | 0.4 | 605 | 17607 | 6.8 | 735 | 2631 | 0.0 | 865 | 489 | 0.0 | 995 | 1093 | 0.0 |
| 480 | 5958 | 0.6 | 610 | 17893 | 6.1 | 740 | 2336 | 0.0 | 870 | 652 | 0.0 | 1000 | 1033 | 0.0 |
| 485 | 6631 | 0.8 | 615 | 18072 | 5.5 | 745 | 2108 | 0.0 | 875 | 622 | 0.0 | | | |

REPORT NUMBER: SP1-2101-124-3

## Scotopic Flux vs. Wavelength




**Scotopic Lumens: 1600.8** **S/P: 1.59**

| λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 360 | 436 | 0.0 | 490 | 7373 | 11.4 | 620 | 18112 | 0.2 | 750 | 1864 | 0.0 | 880 | 485 | 0.0 |
| 365 | 370 | 0.0 | 495 | 8181 | 13.2 | 625 | 18107 | 0.2 | 755 | 1693 | 0.0 | 885 | 593 | 0.0 |
| 370 | 381 | 0.0 | 500 | 8943 | 15.0 | 630 | 17758 | 0.1 | 760 | 1498 | 0.0 | 890 | 677 | 0.0 |
| 375 | 432 | 0.0 | 505 | 9613 | 16.3 | 635 | 17291 | 0.1 | 765 | 1302 | 0.0 | 895 | 646 | 0.0 |
| 380 | 398 | 0.0 | 510 | 10245 | 17.4 | 640 | 16854 | 0.0 | 770 | 1180 | 0.0 | 900 | 526 | 0.0 |
| 385 | 359 | 0.0 | 515 | 10835 | 18.0 | 645 | 16410 | 0.0 | 775 | 1079 | 0.0 | 905 | 557 | 0.0 |
| 390 | 355 | 0.0 | 520 | 11465 | 18.2 | 650 | 15843 | 0.0 | 780 | 946 | 0.0 | 910 | 613 | 0.0 |
| 395 | 320 | 0.0 | 525 | 12004 | 18.0 | 655 | 15029 | 0.0 | 785 | 883 | 0.0 | 915 | 556 | 0.0 |
| 400 | 290 | 0.0 | 530 | 12512 | 17.3 | 660 | 14175 | 0.0 | 790 | 832 | 0.0 | 920 | 623 | 0.0 |
| 405 | 278 | 0.0 | 535 | 12925 | 16.1 | 665 | 13195 | 0.0 | 795 | 731 | 0.0 | 925 | 528 | 0.0 |
| 410 | 327 | 0.0 | 540 | 13254 | 14.6 | 670 | 12132 | 0.0 | 800 | 744 | 0.0 | 930 | 586 | 0.0 |
| 415 | 471 | 0.0 | 545 | 13437 | 12.9 | 675 | 11067 | 0.0 | 805 | 688 | 0.0 | 935 | 744 | 0.0 |
| 420 | 803 | 0.1 | 550 | 13744 | 11.2 | 680 | 10056 | 0.0 | 810 | 699 | 0.0 | 940 | 610 | 0.0 |
| 425 | 1501 | 0.4 | 555 | 13925 | 9.5 | 685 | 9011 | 0.0 | 815 | 651 | 0.0 | 945 | 486 | 0.0 |
| 430 | 2800 | 1.0 | 560 | 14164 | 7.9 | 690 | 8032 | 0.0 | 820 | 620 | 0.0 | 950 | 719 | 0.0 |
| 435 | 5221 | 2.3 | 565 | 14379 | 6.5 | 695 | 7112 | 0.0 | 825 | 686 | 0.0 | 955 | 527 | 0.0 |
| 440 | 9255 | 5.2 | 570 | 14511 | 5.1 | 700 | 6301 | 0.0 | 830 | 578 | 0.0 | 960 | 561 | 0.0 |
| 445 | 12350 | 8.3 | 575 | 14729 | 4.0 | 705 | 5570 | 0.0 | 835 | 502 | 0.0 | 965 | 364 | 0.0 |
| 450 | 10708 | 8.3 | 580 | 15069 | 3.1 | 710 | 4970 | 0.0 | 840 | 624 | 0.0 | 970 | 739 | 0.0 |
| 455 | 8053 | 7.0 | 585 | 15482 | 2.4 | 715 | 4396 | 0.0 | 845 | 523 | 0.0 | 975 | 457 | 0.0 |
| 460 | 7058 | 6.8 | 590 | 15975 | 1.8 | 720 | 3921 | 0.0 | 850 | 555 | 0.0 | 980 | 848 | 0.0 |
| 465 | 5809 | 6.1 | 595 | 16476 | 1.3 | 725 | 3489 | 0.0 | 855 | 553 | 0.0 | 985 | 1084 | 0.0 |
| 470 | 5111 | 5.9 | 600 | 17051 | 1.0 | 730 | 3068 | 0.0 | 860 | 424 | 0.0 | 990 | 980 | 0.0 |
| 475 | 5409 | 6.8 | 605 | 17607 | 0.7 | 735 | 2631 | 0.0 | 865 | 489 | 0.0 | 995 | 1093 | 0.0 |
| 480 | 5958 | 8.0 | 610 | 17893 | 0.5 | 740 | 2336 | 0.0 | 870 | 652 | 0.0 | 1000 | 1033 | 0.0 |
| 485 | 6631 | 9.6 | 615 | 18072 | 0.3 | 745 | 2108 | 0.0 | 875 | 622 | 0.0 | | | |

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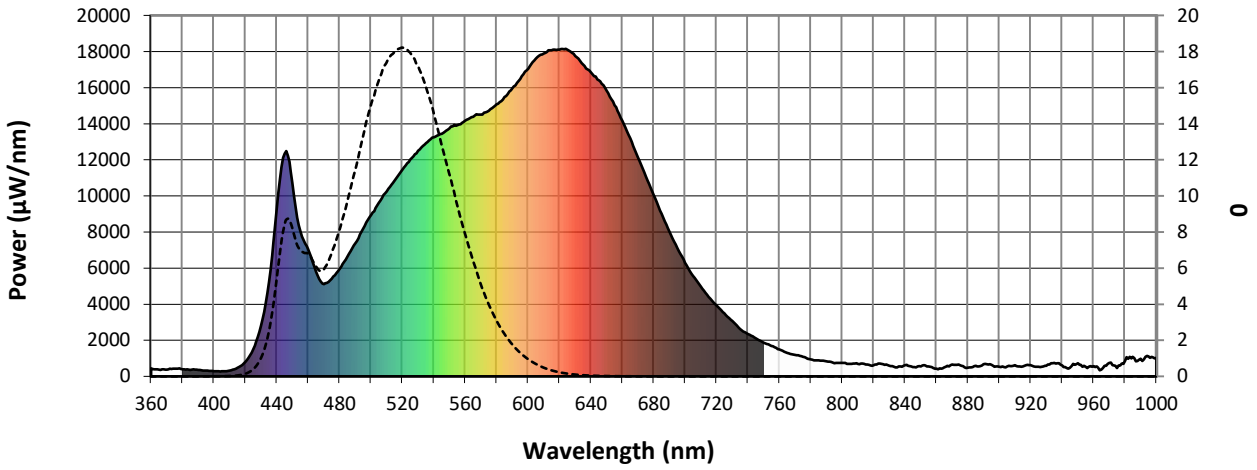
## Melanopic Flux vs. Wavelength




**Melanopic Lumens: 631** **M/P: 0.63**

| λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) | λ (nm) | Power (µW/nm) | Lumens (ϕ/nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 360 | 436 | 0.0 | 490 | 7373 | 6.1 | 620 | 18112 | 0.0 | 750 | 1864 | 0.0 | 880 | 485 | 0.0 |
| 365 | 370 | 0.0 | 495 | 8181 | 6.8 | 625 | 18107 | 0.0 | 755 | 1693 | 0.0 | 885 | 593 | 0.0 |
| 370 | 381 | 0.0 | 500 | 8943 | 7.2 | 630 | 17758 | 0.0 | 760 | 1498 | 0.0 | 890 | 677 | 0.0 |
| 375 | 432 | 0.0 | 505 | 9613 | 7.4 | 635 | 17291 | 0.0 | 765 | 1302 | 0.0 | 895 | 646 | 0.0 |
| 380 | 398 | 0.0 | 510 | 10245 | 7.4 | 640 | 16854 | 0.0 | 770 | 1180 | 0.0 | 900 | 526 | 0.0 |
| 385 | 359 | 0.0 | 515 | 10835 | 7.1 | 645 | 16410 | 0.0 | 775 | 1079 | 0.0 | 905 | 557 | 0.0 |
| 390 | 355 | 0.0 | 520 | 11465 | 6.7 | 650 | 15843 | 0.0 | 780 | 946 | 0.0 | 910 | 613 | 0.0 |
| 395 | 320 | 0.0 | 525 | 12004 | 6.1 | 655 | 15029 | 0.0 | 785 | 883 | 0.0 | 915 | 556 | 0.0 |
| 400 | 290 | 0.0 | 530 | 12512 | 5.4 | 660 | 14175 | 0.0 | 790 | 832 | 0.0 | 920 | 623 | 0.0 |
| 405 | 278 | 0.0 | 535 | 12925 | 4.7 | 665 | 13195 | 0.0 | 795 | 731 | 0.0 | 925 | 528 | 0.0 |
| 410 | 327 | 0.0 | 540 | 13254 | 3.9 | 670 | 12132 | 0.0 | 800 | 744 | 0.0 | 930 | 586 | 0.0 |
| 415 | 471 | 0.0 | 545 | 13437 | 3.1 | 675 | 11067 | 0.0 | 805 | 688 | 0.0 | 935 | 744 | 0.0 |
| 420 | 803 | 0.1 | 550 | 13744 | 2.5 | 680 | 10056 | 0.0 | 810 | 699 | 0.0 | 940 | 610 | 0.0 |
| 425 | 1501 | 0.2 | 555 | 13925 | 1.9 | 685 | 9011 | 0.0 | 815 | 651 | 0.0 | 945 | 486 | 0.0 |
| 430 | 2800 | 0.6 | 560 | 14164 | 1.4 | 690 | 8032 | 0.0 | 820 | 620 | 0.0 | 950 | 719 | 0.0 |
| 435 | 5221 | 1.4 | 565 | 14379 | 1.0 | 695 | 7112 | 0.0 | 825 | 686 | 0.0 | 955 | 527 | 0.0 |
| 440 | 9255 | 3.1 | 570 | 14511 | 0.7 | 700 | 6301 | 0.0 | 830 | 578 | 0.0 | 960 | 561 | 0.0 |
| 445 | 12350 | 4.9 | 575 | 14729 | 0.5 | 705 | 5570 | 0.0 | 835 | 502 | 0.0 | 965 | 364 | 0.0 |
| 450 | 10708 | 4.9 | 580 | 15069 | 0.3 | 710 | 4970 | 0.0 | 840 | 624 | 0.0 | 970 | 739 | 0.0 |
| 455 | 8053 | 4.2 | 585 | 15482 | 0.2 | 715 | 4396 | 0.0 | 845 | 523 | 0.0 | 975 | 457 | 0.0 |
| 460 | 7058 | 4.2 | 590 | 15975 | 0.2 | 720 | 3921 | 0.0 | 850 | 555 | 0.0 | 980 | 848 | 0.0 |
| 465 | 5809 | 3.8 | 595 | 16476 | 0.1 | 725 | 3489 | 0.0 | 855 | 553 | 0.0 | 985 | 1084 | 0.0 |
| 470 | 5111 | 3.7 | 600 | 17051 | 0.1 | 730 | 3068 | 0.0 | 860 | 424 | 0.0 | 990 | 980 | 0.0 |
| 475 | 5409 | 4.1 | 605 | 17607 | 0.0 | 735 | 2631 | 0.0 | 865 | 489 | 0.0 | 995 | 1093 | 0.0 |
| 480 | 5958 | 4.8 | 610 | 17893 | 0.0 | 740 | 2336 | 0.0 | 870 | 652 | 0.0 | 1000 | 1033 | 0.0 |
| 485 | 6631 | 5.5 | 615 | 18072 | 0.0 | 745 | 2108 | 0.0 | 875 | 622 | 0.0 | | | |

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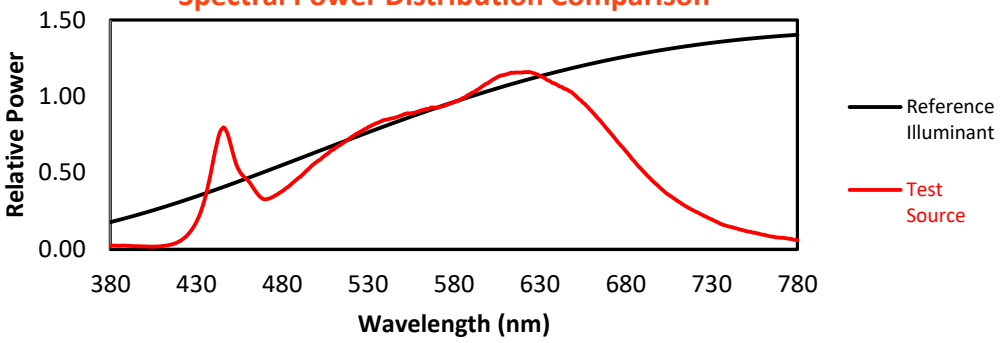
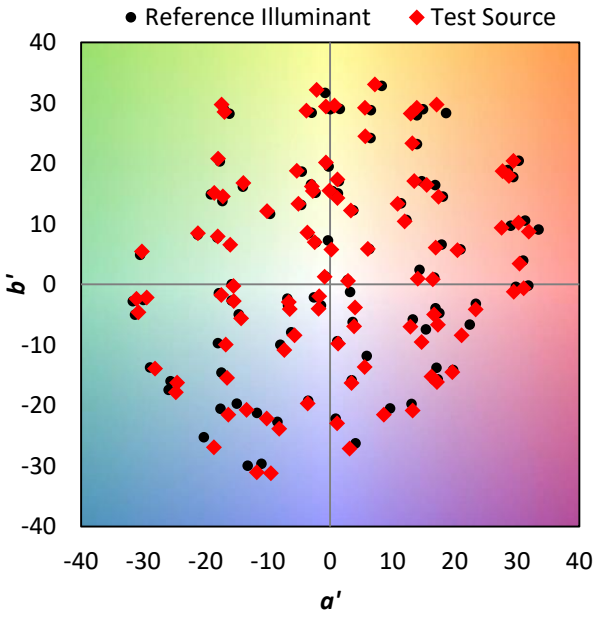
## Summary

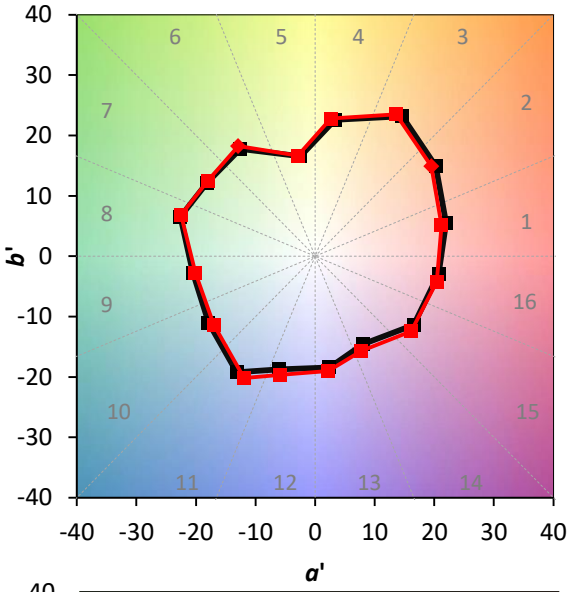
$R_f$ = 93.6
$R_g$ = 100.6
CIE $R_a$ = 94.0
$R_9$ = 69.9

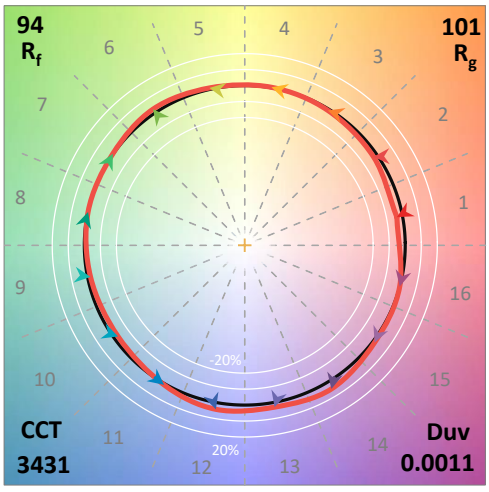
## Spectral Power Distribution Comparison

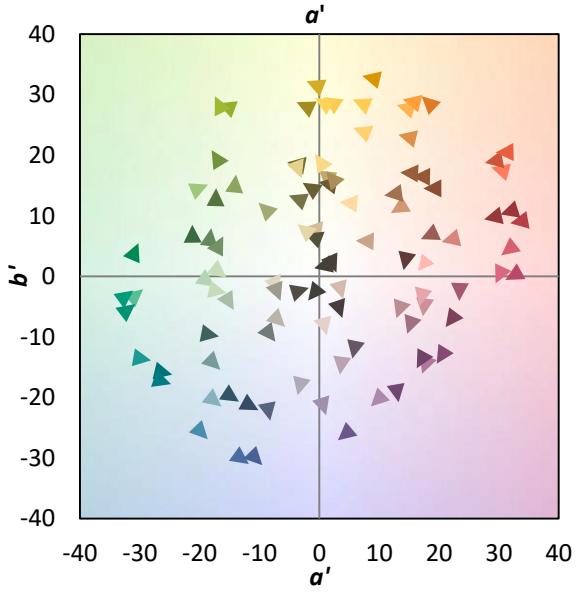



## Color Vector Graphics



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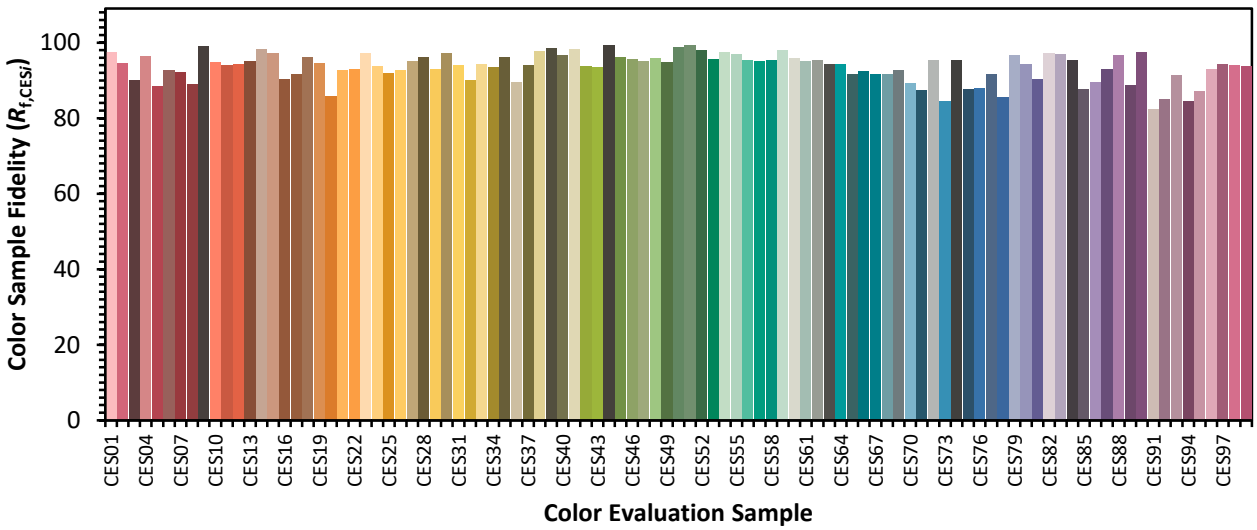
**Individual Sample Fidelity Index ($R_{f,i}$)**

| | | | |
|---|---|---|---|
| CES01 = 86 | CES26 = 93 | CES51 = 99 | CES76 = 88 |
| CES02 = 62 | CES27 = 95 | CES52 = 98 | CES77 = 92 |
| CES03 = 31 | CES28 = 96 | CES53 = 96 | CES78 = 86 |
| CES04 = 70 | CES29 = 93 | CES54 = 98 | CES79 = 97 |
| CES05 = 50 | CES30 = 97 | CES55 = 97 | CES80 = 94 |
| CES06 = 51 | CES31 = 94 | CES56 = 95 | CES81 = 90 |
| CES07 = 43 | CES32 = 90 | CES57 = 95 | CES82 = 97 |
| CES08 = 42 | CES33 = 94 | CES58 = 96 | CES83 = 97 |
| CES09 = 29 | CES34 = 93 | CES59 = 98 | CES84 = 95 |
| CES10 = 75 | CES35 = 96 | CES60 = 96 | CES85 = 88 |
| CES11 = 58 | CES36 = 90 | CES61 = 95 | CES86 = 90 |
| CES12 = 64 | CES37 = 94 | CES62 = 95 | CES87 = 93 |
| CES13 = 43 | CES38 = 98 | CES63 = 94 | CES88 = 97 |
| CES14 = 74 | CES39 = 99 | CES64 = 94 | CES89 = 89 |
| CES15 = 71 | CES40 = 97 | CES65 = 92 | CES90 = 97 |
| CES16 = 48 | CES41 = 98 | CES66 = 92 | CES91 = 82 |
| CES17 = 49 | CES42 = 94 | CES67 = 92 | CES92 = 85 |
| CES18 = 56 | CES43 = 94 | CES68 = 92 | CES93 = 91 |
| CES19 = 71 | CES44 = 99 | CES69 = 93 | CES94 = 84 |
| CES20 = 66 | CES45 = 96 | CES70 = 89 | CES95 = 87 |
| CES21 = 86 | CES46 = 96 | CES71 = 88 | CES96 = 93 |
| CES22 = 78 | CES47 = 95 | CES72 = 95 | CES97 = 94 |
| CES23 = 91 | CES48 = 96 | CES73 = 85 | CES98 = 94 |
| CES24 = 90 | CES49 = 95 | CES74 = 95 | CES99 = 94 |
| CES25 = 71 | CES50 = 99 | CES75 = 88 | |



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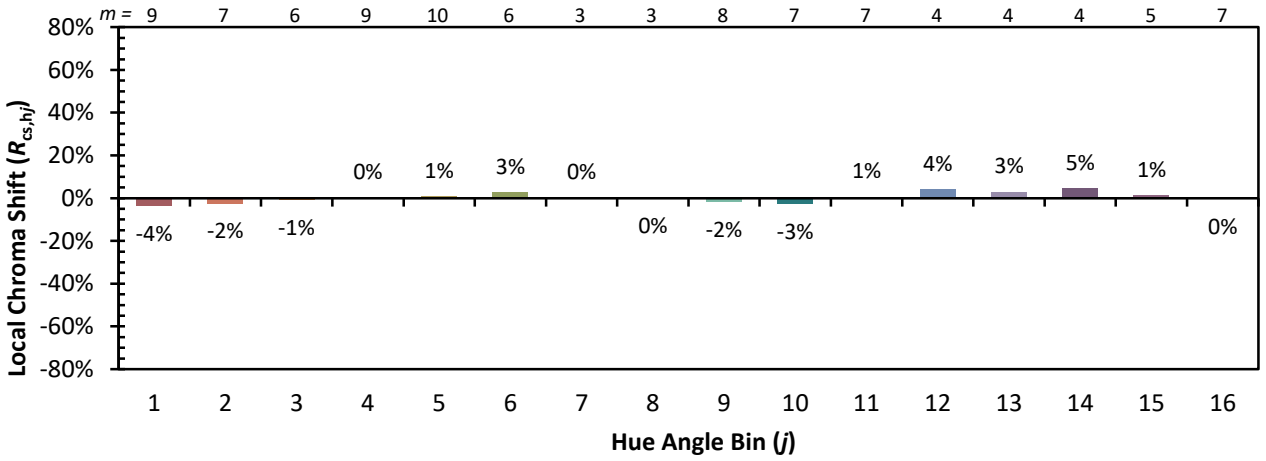
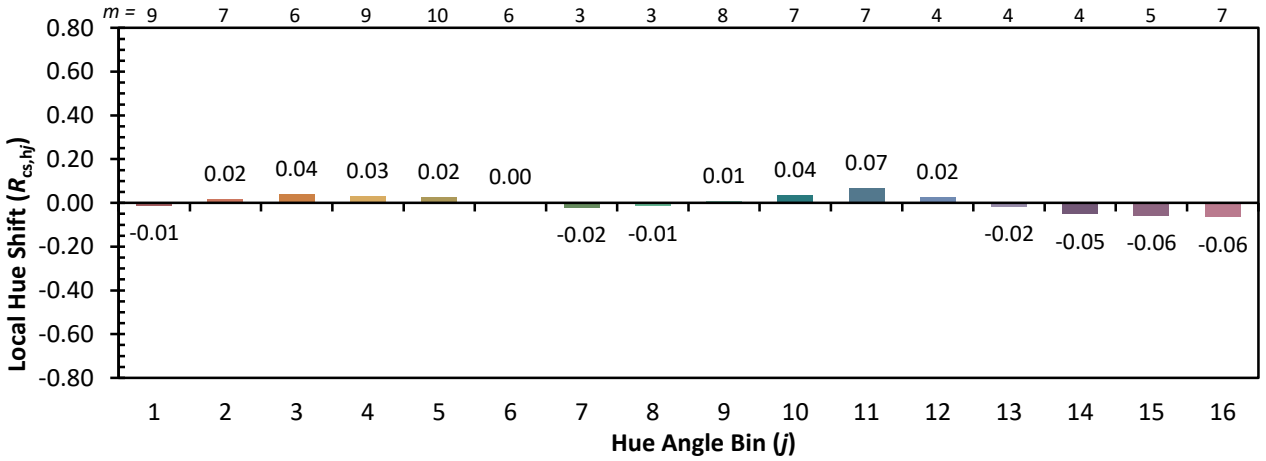
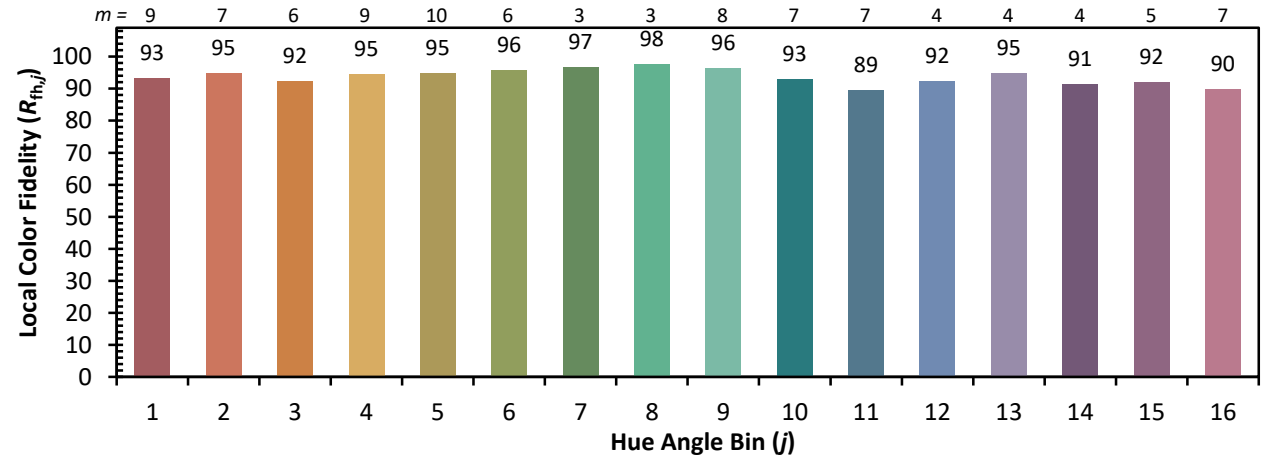
## Color Rendition by Hue-Angle Bin



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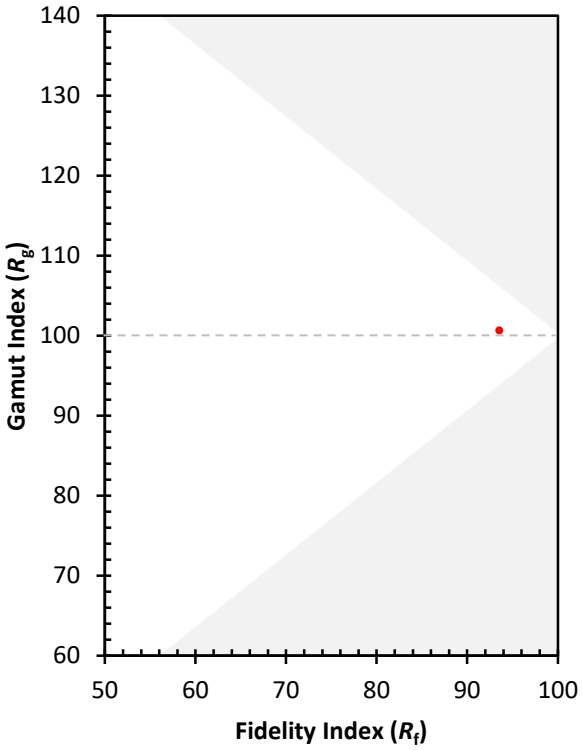
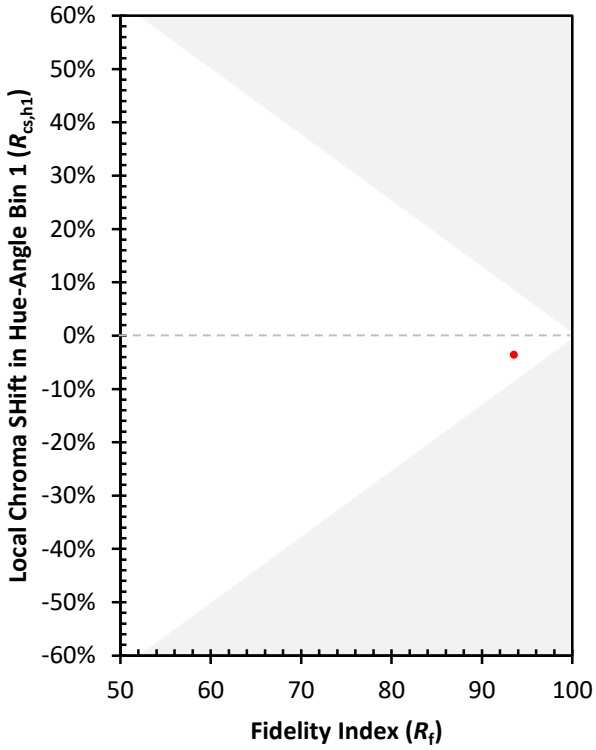
## Measure Comparisons

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