

## LM-79-08 Test Report

For

### ESPEN TECHNOLOGY INC

12257 FLORENCE AVE SANTA FE SPRINGS, CA 90670 USA

### LED Tube

Model Name(s):

L24T8/8XX/9P-ID DE RF

Representative (Tested) Model:

L24T8/850/9P-ID DE RF

#### Model Difference:

1. XX represents CCT, can be 30 for 3000K, 35 for 3500K, 40 for 4000K and 50 for 5000K;
2. All is the same construction, except CCT.

Prepare by:



Engineer: Alan Wang

Date: 2021-02-02

Review by:



Technical Lead: Vincent Yuan

Issue Date: 2021-04-29

Revised Date: N/A

Note:

1. The results contained in this report pertain only to the tested samples.
2. This report shall not be reproduced, no limited part or full, without approval of Dongguan New Testing Centre Co., Ltd
3. This report does not imply product certification, approval, or endorsement by NVLAP, or any agency of the Federal Government.

**Client Information:**

|                 |                      |
|-----------------|----------------------|
| Applicant Name: | ESPEN TECHNOLOGY INC |
| Brand Name:     | ESPEN                |

**Product Information:**

|                        |                                                            |
|------------------------|------------------------------------------------------------|
| Model Number:          | L24T8/850/9P-ID DE RF                                      |
| Product Type:          | 2' T8 Lamp, Internal Driver/Line Voltage (UL Type B) Lamps |
| Rating Input:          | 100-277Vac, 50/60Hz, 9W                                    |
| Declared CCT:          | 5000K                                                      |
| Declared Light Output: | 1000 lm                                                    |
| Declared Beam Angle:   | 180°                                                       |
| LED Manufacturer:      | Shenzhen JuFei Optoelectronics Co., Ltd.                   |
| LED Model:             | 2835 3V 0.5W WhiteSMD LED                                  |
| LED Quantity:          | 60 pcs                                                     |

**Test Information:**

|                              |                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Standard Lamp:               | Total Spectral Radiant Flux Standard Lamp, trace to NIST.<br>1. D908S for Gonio<br>2. D215S for Integrating Sphere |
| Date of Receipt Samples:     | 2020-12-12                                                                                                         |
| Quantity of Receipt Samples: | 1 pc                                                                                                               |
| Sample Number:               | 201212004-S1                                                                                                       |

**Laboratory Information:**

|                            |                                                                                                                        |
|----------------------------|------------------------------------------------------------------------------------------------------------------------|
| Test Laboratory:           | Dongguan New Testing Centre Co., Ltd                                                                                   |
| Laboratory Address:        | 3F, No. 1 the 1 <sup>st</sup> North Industry Road, Songshan Lake Science & Technology Park, Dongguan, Guangdong, China |
| Laboratory Contact Name:   | Neil Zhong                                                                                                             |
| Laboratory Contact E-mail: | <a href="mailto:Neil_zhong@ntc-cert.com">Neil_zhong@ntc-cert.com</a>                                                   |

**Report Information:**

|                              |               |
|------------------------------|---------------|
| Issued Date of Test Report:  | 2021-04-29    |
| Revised Date of Test Report: | N/A           |
| Test Report No.:             | NTCLR21010180 |
| Remark (If applicable):      | N/A           |

| <b>Test Specification:</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date of Test               | 2020-12-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Test Item                  | 1. Total Luminous Flux<br>2. Luminous Distribution Intensity<br>3. Luminous Efficacy<br>4. Correlated Color Temperature<br>5. Color Rendering Index<br>6. Chromaticity Coordinate<br>7. Fidelity Index<br>8. Gamut Index<br>9. Local Chroma Shift<br>10. THD and PF                                                                                                                                                                                                                            |
| Reference Standard         | IES LM-79-2008 Electrical and Photometric Measurements of Solid-State Lighting Products<br>ANSI C78.377-2017 Specifications for the Chromaticity of Solid State Lighting Products<br>CIE 13.3-1995 Method of Measuring and Specifying Color Rendering Properties of Light Sources<br>CIE 15-2004 Technical Report Colorimetry<br>ANSI IES TM-30-18 IES Method for Evaluating Light Source Color Rendition<br>ANSI C78.77-10-2014 Harmonic Emission Limits – Related Power Quality Requirements |

| <b>Test Methods:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>1. Photometric and Electrical Measurements – Light Distribution Method:</b></p> <p>Photometric parameters were measured using the goniophotometer and software. The ambient temperature shall be maintained at 25 °C ± 1°C, measured at a point not more than 1 m from the sample and at the same height as the sample. The sample was operated at required Voltage and Frequency. It was stabilized before measurement was made. Luminous Flux, Luminaire Efficacy and Zonal Lumen were calculated from the software taken at 1° vertical intervals and 15° horizontal intervals.</p>                                                                                                                                                                          |
| <p><b>2. Photometric and Electrical Measurements – Integrating Sphere Method:</b></p> <p>Photometric parameters were measured using an integrating sphere, as spectroradiometer and software. The ambient temperature condition inside the sphere was measured at 25 °C ± 1°C. The sample measurements were made using a spectroradiometer connected by a fiber optic cable and detector through the detector port of the integrating sphere. The sample was operated at require Voltage and Frequency. It was stabilized before measurement was made. Chromaticity Coordinates, Correlated Color Temperature and Color Rendering Index were calculated from the spectral radiant flux measurements taken at least 1 nm intervals over the rage of 380 to 780 nm.</p> |
| <p><b>3. THD and PF Measurements:</b></p> <p>The sample was tested according to the ANSI C82.77-10-2014, the sample was operated at requirement Voltage and Frequency, and was stabilized before measurement. The Total Harmonic Distortion was calculated from the Digital Power Meter.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### Integrating Sphere Test Results:

#### Test Condition:

| Test Ambient (°C) | Test Humidity (%) | Orientation | Stabilization Time (minute) | Test Time (minute) |
|-------------------|-------------------|-------------|-----------------------------|--------------------|
| 25.4              | 41.0              | Face Down   | 90                          | 10                 |

#### Electrical Data:

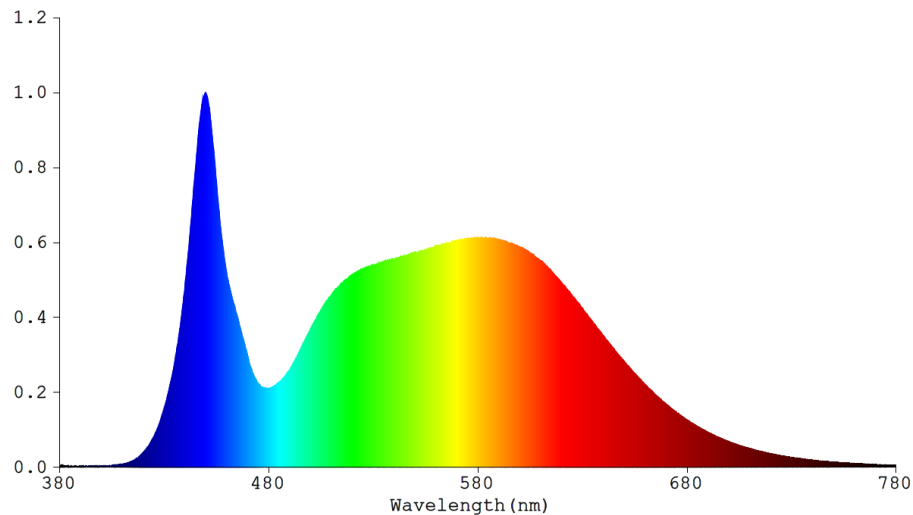
| Voltage (V) | Frequency (Hz) | Current (A) | Wattage (W) | Power Factor |
|-------------|----------------|-------------|-------------|--------------|
| 120.0       | 60             | 0.0728      | 8.560       | 0.9757       |

#### Color Data:

| Parameter              | Result           |
|------------------------|------------------|
| CCT(K)                 | 4969             |
| R <sub>a</sub>         | 82.0             |
| R <sub>f</sub>         | 83               |
| R <sub>g</sub>         | 97               |
| R <sub>cs, hl</sub>    | -12%             |
| Chromaticity, (x, y)   | (0.3468, 0.3596) |
| Chromaticity, (u', v') | (0.2095, 0.4888) |
| Duv                    | 0.0033           |

| Special Color Rendering |    |     |    |
|-------------------------|----|-----|----|
| R1                      | 80 | R9  | 5  |
| R2                      | 86 | R10 | 68 |
| R3                      | 91 | R11 | 81 |
| R4                      | 82 | R12 | 56 |
| R5                      | 80 | R13 | 81 |
| R6                      | 81 | R14 | 95 |
| R7                      | 88 | R15 | 74 |
| R8                      | 67 | -   | -  |

### Spectrum Diagram:



# IES TM-30-18 Color Rendition Result:

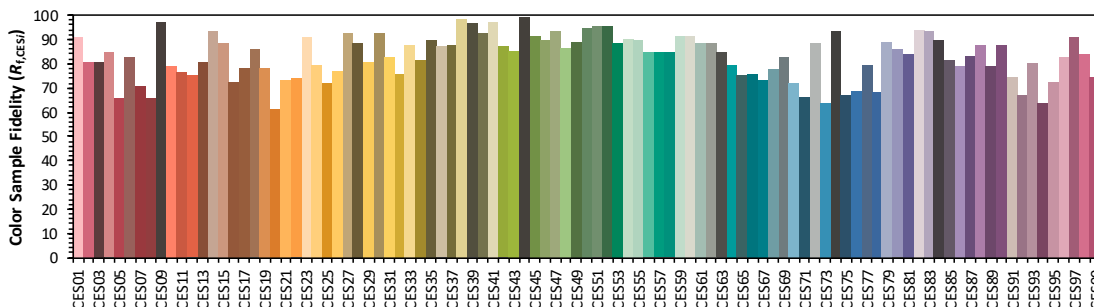
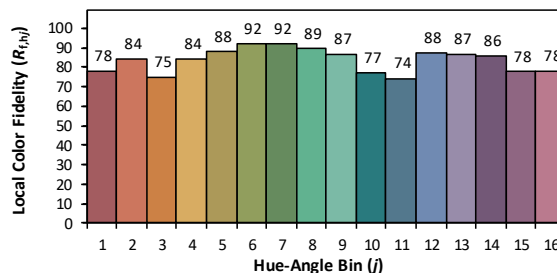
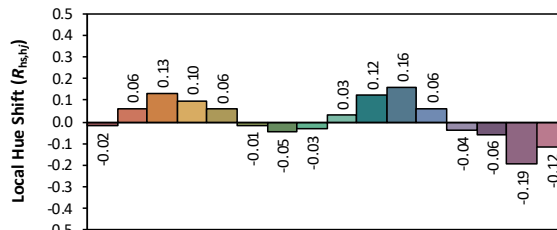
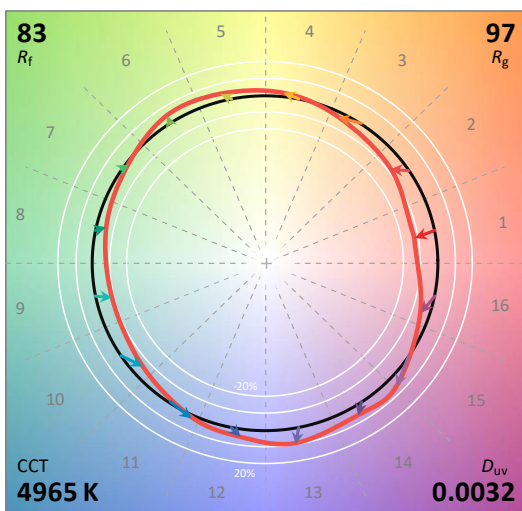
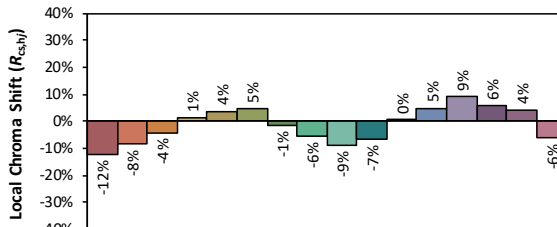
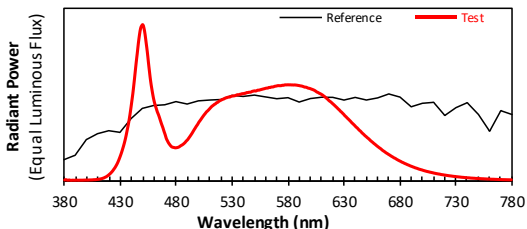
## ANSI/IES TM-30-18 Color Rendition Report

Source: 1 CIE F1

Date: 2021/2/2

Manufacturer: ESPEN TECHNOLOGY INC

Model: L24T8/850/9P-ID DE RF



Notes: This is a recommended method for displaying ANSI/IES TM-30-18 information.

$x$  0.3468  
 $y$  0.3594  
 $u'$  0.2095  
 $v'$  0.4887

CIE 13.3-1995  
(CRI)  
 $R_a$  82  
 $R_9$  5

Colors are for visual orientation purposes only. Created with the ANSI/IES TM-30-18 Calculator Version 2.00.

### Spectrum Data:

| nm  | mW     | nm  | mW     | nm  | mW     | nm  | mW     | nm  | mW     | nm  | mW     |
|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|
| 380 | 0.0044 | 447 | 0.9333 | 514 | 0.4877 | 581 | 0.6130 | 648 | 0.2954 | 715 | 0.0429 |
| 381 | 0.0069 | 448 | 0.9744 | 515 | 0.4914 | 582 | 0.6134 | 649 | 0.2879 | 716 | 0.0419 |
| 382 | 0.0045 | 449 | 0.9913 | 516 | 0.4982 | 583 | 0.6126 | 650 | 0.2824 | 717 | 0.0400 |
| 383 | 0.0033 | 450 | 0.9974 | 517 | 0.5014 | 584 | 0.6127 | 651 | 0.2755 | 718 | 0.0388 |
| 384 | 0.0047 | 451 | 0.9763 | 518 | 0.5071 | 585 | 0.6120 | 652 | 0.2701 | 719 | 0.0379 |
| 385 | 0.0031 | 452 | 0.9358 | 519 | 0.5119 | 586 | 0.6127 | 653 | 0.2634 | 720 | 0.0365 |
| 386 | 0.0026 | 453 | 0.8800 | 520 | 0.5152 | 587 | 0.6118 | 654 | 0.2563 | 721 | 0.0356 |
| 387 | 0.0034 | 454 | 0.8244 | 521 | 0.5189 | 588 | 0.6110 | 655 | 0.2504 | 722 | 0.0344 |
| 388 | 0.0032 | 455 | 0.7573 | 522 | 0.5218 | 589 | 0.6096 | 656 | 0.2446 | 723 | 0.0333 |
| 389 | 0.0032 | 456 | 0.6945 | 523 | 0.5244 | 590 | 0.6085 | 657 | 0.2381 | 724 | 0.0322 |
| 390 | 0.0031 | 457 | 0.6358 | 524 | 0.5291 | 591 | 0.6067 | 658 | 0.2328 | 725 | 0.0312 |
| 391 | 0.0040 | 458 | 0.5900 | 525 | 0.5306 | 592 | 0.6058 | 659 | 0.2266 | 726 | 0.0304 |
| 392 | 0.0031 | 459 | 0.5478 | 526 | 0.5334 | 593 | 0.6039 | 660 | 0.2208 | 727 | 0.0293 |
| 393 | 0.0032 | 460 | 0.5123 | 527 | 0.5348 | 594 | 0.6013 | 661 | 0.2153 | 728 | 0.0283 |
| 394 | 0.0035 | 461 | 0.4854 | 528 | 0.5357 | 595 | 0.5986 | 662 | 0.2098 | 729 | 0.0274 |
| 395 | 0.0035 | 462 | 0.4626 | 529 | 0.5393 | 596 | 0.5984 | 663 | 0.2050 | 730 | 0.0270 |
| 396 | 0.0034 | 463 | 0.4400 | 530 | 0.5413 | 597 | 0.5958 | 664 | 0.1987 | 731 | 0.0257 |
| 397 | 0.0039 | 464 | 0.4225 | 531 | 0.5421 | 598 | 0.5924 | 665 | 0.1928 | 732 | 0.0252 |
| 398 | 0.0041 | 465 | 0.4015 | 532 | 0.5431 | 599 | 0.5910 | 666 | 0.1883 | 733 | 0.0242 |
| 399 | 0.0044 | 466 | 0.3788 | 533 | 0.5450 | 600 | 0.5888 | 667 | 0.1831 | 734 | 0.0236 |
| 400 | 0.0042 | 467 | 0.3577 | 534 | 0.5483 | 601 | 0.5859 | 668 | 0.1778 | 735 | 0.0226 |
| 401 | 0.0042 | 468 | 0.3383 | 535 | 0.5503 | 602 | 0.5834 | 669 | 0.1736 | 736 | 0.0219 |
| 402 | 0.0049 | 469 | 0.3151 | 536 | 0.5490 | 603 | 0.5804 | 670 | 0.1687 | 737 | 0.0214 |
| 403 | 0.0050 | 470 | 0.2949 | 537 | 0.5529 | 604 | 0.5768 | 671 | 0.1645 | 738 | 0.0206 |
| 404 | 0.0052 | 471 | 0.2707 | 538 | 0.5538 | 605 | 0.5718 | 672 | 0.1597 | 739 | 0.0197 |
| 405 | 0.0056 | 472 | 0.2558 | 539 | 0.5567 | 606 | 0.5668 | 673 | 0.1551 | 740 | 0.0194 |
| 406 | 0.0064 | 473 | 0.2421 | 540 | 0.5564 | 607 | 0.5639 | 674 | 0.1511 | 741 | 0.0186 |
| 407 | 0.0066 | 474 | 0.2319 | 541 | 0.5588 | 608 | 0.5593 | 675 | 0.1462 | 742 | 0.0185 |
| 408 | 0.0072 | 475 | 0.2226 | 542 | 0.5594 | 609 | 0.5563 | 676 | 0.1434 | 743 | 0.0177 |
| 409 | 0.0082 | 476 | 0.2164 | 543 | 0.5637 | 610 | 0.5520 | 677 | 0.1385 | 744 | 0.0168 |
| 410 | 0.0087 | 477 | 0.2137 | 544 | 0.5635 | 611 | 0.5478 | 678 | 0.1343 | 745 | 0.0166 |
| 411 | 0.0101 | 478 | 0.2123 | 545 | 0.5658 | 612 | 0.5419 | 679 | 0.1305 | 746 | 0.0160 |
| 412 | 0.0115 | 479 | 0.2105 | 546 | 0.5660 | 613 | 0.5368 | 680 | 0.1266 | 747 | 0.0158 |
| 413 | 0.0130 | 480 | 0.2111 | 547 | 0.5677 | 614 | 0.5304 | 681 | 0.1234 | 748 | 0.0149 |
| 414 | 0.0155 | 481 | 0.2125 | 548 | 0.5716 | 615 | 0.5247 | 682 | 0.1190 | 749 | 0.0147 |
| 415 | 0.0177 | 482 | 0.2148 | 549 | 0.5729 | 616 | 0.5178 | 683 | 0.1162 | 750 | 0.0143 |
| 416 | 0.0214 | 483 | 0.2188 | 550 | 0.5748 | 617 | 0.5108 | 684 | 0.1125 | 751 | 0.0138 |
| 417 | 0.0246 | 484 | 0.2241 | 551 | 0.5736 | 618 | 0.5058 | 685 | 0.1091 | 752 | 0.0135 |
| 418 | 0.0293 | 485 | 0.2280 | 552 | 0.5760 | 619 | 0.4998 | 686 | 0.1063 | 753 | 0.0130 |
| 419 | 0.0345 | 486 | 0.2328 | 553 | 0.5792 | 620 | 0.4929 | 687 | 0.1025 | 754 | 0.0126 |
| 420 | 0.0407 | 487 | 0.2389 | 554 | 0.5790 | 621 | 0.4868 | 688 | 0.1001 | 755 | 0.0124 |
| 421 | 0.0470 | 488 | 0.2460 | 555 | 0.5813 | 622 | 0.4800 | 689 | 0.0965 | 756 | 0.0118 |
| 422 | 0.0548 | 489 | 0.2547 | 556 | 0.5832 | 623 | 0.4730 | 690 | 0.0936 | 757 | 0.0115 |
| 423 | 0.0631 | 490 | 0.2613 | 557 | 0.5852 | 624 | 0.4664 | 691 | 0.0911 | 758 | 0.0111 |
| 424 | 0.0733 | 491 | 0.2714 | 558 | 0.5871 | 625 | 0.4589 | 692 | 0.0881 | 759 | 0.0107 |
| 425 | 0.0832 | 492 | 0.2813 | 559 | 0.5888 | 626 | 0.4527 | 693 | 0.0856 | 760 | 0.0105 |
| 426 | 0.0954 | 493 | 0.2919 | 560 | 0.5911 | 627 | 0.4445 | 694 | 0.0825 | 761 | 0.0102 |
| 427 | 0.1086 | 494 | 0.3027 | 561 | 0.5924 | 628 | 0.4386 | 695 | 0.0805 | 762 | 0.0096 |
| 428 | 0.1243 | 495 | 0.3146 | 562 | 0.5928 | 629 | 0.4311 | 696 | 0.0781 | 763 | 0.0095 |
| 429 | 0.1422 | 496 | 0.3266 | 563 | 0.5967 | 630 | 0.4241 | 697 | 0.0751 | 764 | 0.0094 |
| 430 | 0.1613 | 497 | 0.3377 | 564 | 0.5960 | 631 | 0.4153 | 698 | 0.0731 | 765 | 0.0091 |
| 431 | 0.1820 | 498 | 0.3495 | 565 | 0.5991 | 632 | 0.4092 | 699 | 0.0708 | 766 | 0.0087 |
| 432 | 0.2051 | 499 | 0.3592 | 566 | 0.5995 | 633 | 0.4013 | 700 | 0.0691 | 767 | 0.0085 |
| 433 | 0.2294 | 500 | 0.3720 | 567 | 0.6004 | 634 | 0.3948 | 701 | 0.0664 | 768 | 0.0081 |
| 434 | 0.2568 | 501 | 0.3820 | 568 | 0.6036 | 635 | 0.3875 | 702 | 0.0644 | 769 | 0.0079 |
| 435 | 0.2883 | 502 | 0.3919 | 569 | 0.6048 | 636 | 0.3805 | 703 | 0.0623 | 770 | 0.0076 |
| 436 | 0.3240 | 503 | 0.4024 | 570 | 0.6063 | 637 | 0.3721 | 704 | 0.0603 | 771 | 0.0075 |
| 437 | 0.3591 | 504 | 0.4124 | 571 | 0.6081 | 638 | 0.3654 | 705 | 0.0586 | 772 | 0.0070 |
| 438 | 0.4013 | 505 | 0.4221 | 572 | 0.6079 | 639 | 0.3586 | 706 | 0.0570 | 773 | 0.0069 |
| 439 | 0.4486 | 506 | 0.4308 | 573 | 0.6077 | 640 | 0.3513 | 707 | 0.0551 | 774 | 0.0067 |
| 440 | 0.5012 | 507 | 0.4402 | 574 | 0.6082 | 641 | 0.3434 | 708 | 0.0536 | 775 | 0.0066 |
| 441 | 0.5551 | 508 | 0.4465 | 575 | 0.6106 | 642 | 0.3377 | 709 | 0.0519 | 776 | 0.0063 |
| 442 | 0.6173 | 509 | 0.4538 | 576 | 0.6102 | 643 | 0.3298 | 710 | 0.0504 | 777 | 0.0062 |
| 443 | 0.6845 | 510 | 0.4617 | 577 | 0.6126 | 644 | 0.3224 | 711 | 0.0484 | 778 | 0.0060 |
| 444 | 0.7527 | 511 | 0.4695 | 578 | 0.6131 | 645 | 0.3167 | 712 | 0.0471 | 779 | 0.0059 |
| 445 | 0.8144 | 512 | 0.4767 | 579 | 0.6129 | 646 | 0.3085 | 713 | 0.0455 | 780 | 0.0060 |
| 446 | 0.8791 | 513 | 0.4816 | 580 | 0.6136 | 647 | 0.3016 | 714 | 0.0442 | N/A | N/A    |

### Goniophotometer Test Results:

#### Test Condition:

| Test Ambient (°C) | Test Humidity (%) | Orientation | Stabilization Time (minute) | Test Time (minute) |
|-------------------|-------------------|-------------|-----------------------------|--------------------|
| 24.6              | 49.0              | Face Down   | 90                          | 25                 |

#### Electrical Data:

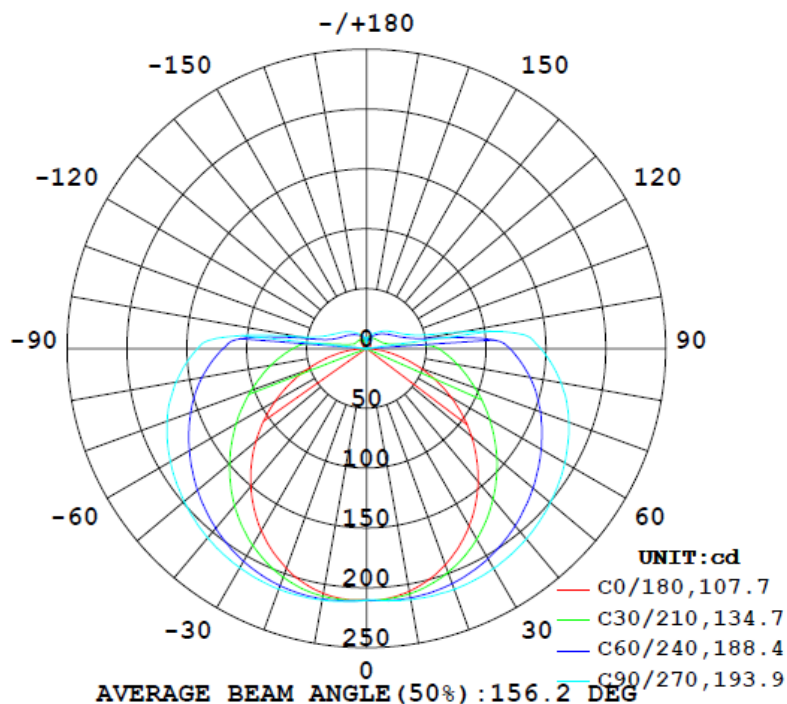
| Voltage (V) | Frequency (Hz) | Current (A) | Wattage (W) | Power Factor |
|-------------|----------------|-------------|-------------|--------------|
| 120.0       | 60             | 0.0728      | 8.560       | 0.9757       |

#### Goniophotometer Data:

| Parameter                         | Results |
|-----------------------------------|---------|
| Total Luminous (lm)               | 1067.0  |
| Luminous Efficacy (lm/w)          | 124.65  |
| Zonal Lumens Distribution (0-60°) | 52.4%   |
| Beam Angle (°)                    | 193.9   |

### Luminous Intensity Distribution Diagram:

#### LUMINOUS INTENSITY DISTRIBUTION DIAGRAM

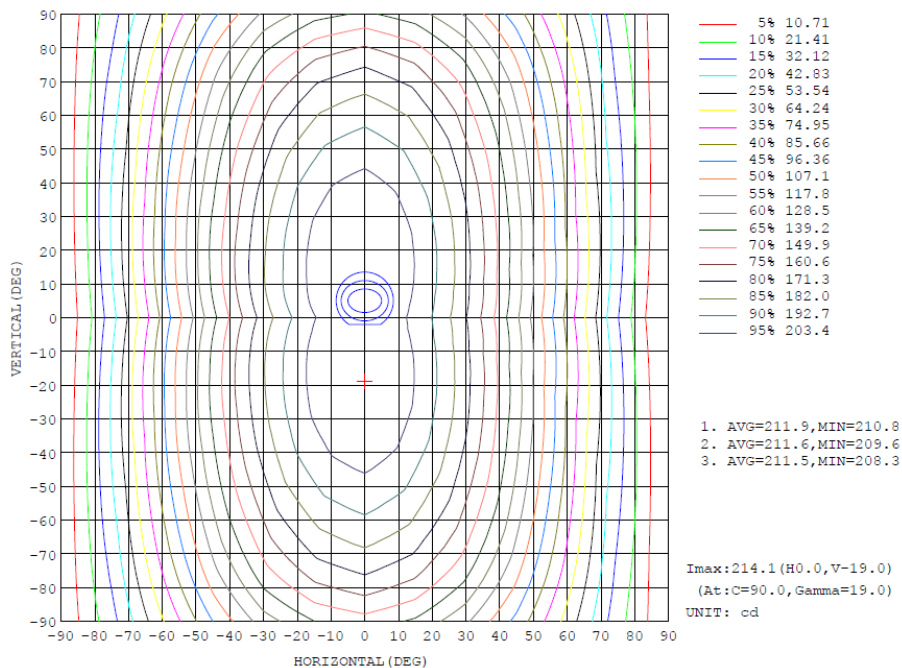


## Zonal Flux Diagram:

ZONAL FLUX DIAGRAM:

| γ   | C0                    | C45    | C90    | C135  | C180   | C225  | C270  | C315  | γ       | zone    | total | lum, lamp |
|-----|-----------------------|--------|--------|-------|--------|-------|-------|-------|---------|---------|-------|-----------|
| 10  | 206.0                 | 209.8  | 213.0  | 210.8 | 207.7  | 211.4 | 213.4 | 210.3 | 0- 10   | 20.11   | 20.11 | 1.89,1.89 |
| 20  | 192.3                 | 204.2  | 214.1  | 207.2 | 195.5  | 207.3 | 213.9 | 204.3 | 10- 20  | 58.95   | 79.06 | 7.41,7.41 |
| 30  | 171.5                 | 193.8  | 212.2  | 198.3 | 175.9  | 197.9 | 211.5 | 193.5 | 20- 30  | 92.60   | 171.7 | 16.1,16.1 |
| 40  | 145.0                 | 179.5  | 207.7  | 184.9 | 150.3  | 184.2 | 206.5 | 178.8 | 30- 40  | 117.8   | 289.5 | 27.1,27.1 |
| 50  | 114.7                 | 162.8  | 200.4  | 168.7 | 120.6  | 167.6 | 198.8 | 161.9 | 40- 50  | 132.8   | 422.2 | 39.6,39.6 |
| 60  | 81.89                 | 145.5  | 191.3  | 151.0 | 88.18  | 149.7 | 189.1 | 144.4 | 50- 60  | 137.3   | 559.5 | 52.4,52.4 |
| 70  | 48.45                 | 128.3  | 179.9  | 133.2 | 54.71  | 131.7 | 177.3 | 126.9 | 60- 70  | 132.6   | 692.1 | 64.9,64.9 |
| 80  | 18.46                 | 111.3  | 164.9  | 115.7 | 23.70  | 113.5 | 161.5 | 109.2 | 70- 80  | 120.3   | 812.4 | 76.1,76.1 |
| 90  | 0.5326                | 93.13  | 145.6  | 96.50 | 1.203  | 93.79 | 141.1 | 90.38 | 80- 90  | 102.8   | 915.2 | 85.8,85.8 |
| 100 | 1.474                 | 34.00  | 80.81  | 40.06 | 0.9862 | 31.19 | 57.34 | 30.19 | 90-100  | 70.10   | 985.3 | 92.3,92.3 |
| 110 | 2.539                 | 20.36  | 35.02  | 19.26 | 1.793  | 18.40 | 32.98 | 19.27 | 100-110 | 25.65   | 1011  | 94.7,94.7 |
| 120 | 3.727                 | 16.33  | 27.41  | 16.29 | 2.802  | 15.66 | 26.32 | 15.64 | 110-120 | 17.33   | 1028  | 96.4,96.4 |
| 130 | 4.534                 | 13.96  | 22.60  | 14.39 | 3.935  | 13.84 | 21.74 | 13.39 | 120-130 | 13.44   | 1042  | 97.6,97.6 |
| 140 | 5.379                 | 12.35  | 18.61  | 12.90 | 5.070  | 12.37 | 17.91 | 11.91 | 130-140 | 10.22   | 1052  | 98.6,98.6 |
| 150 | 5.347                 | 11.35  | 15.23  | 11.64 | 6.145  | 10.98 | 14.65 | 11.06 | 140-150 | 7.370   | 1059  | 99.3,99.3 |
| 160 | 5.679                 | 10.43  | 12.50  | 10.57 | 6.117  | 10.11 | 12.02 | 10.25 | 150-160 | 4.761   | 1064  | 99.7,99.7 |
| 170 | 4.570                 | 8.896  | 9.922  | 9.270 | 3.308  | 8.625 | 9.496 | 7.822 | 160-170 | 2.382   | 1066  | 99.9,99.9 |
| 180 | 0.0000                | 0.0000 | 0.0000 | 0     | 2.550  | 2.550 | 2.550 | 2.550 | 170-180 | 0.5827  | 1067  | 100,100   |
| DEG | LUMINOUS INTENSITY:cd |        |        |       |        |       |       |       |         | UNIT:lm |       |           |

## Isocandela Diagram:





### Luminous Distribution Intensity Data:

Table--1

UNIT: cd

| C (DEG) | 0    | 15   | 30   | 45   | 60   | 75   | 90   | 105  | 120  | 135  | 150  | 165  | 180  | 195  | 210  | 225  | 240  | 255  | 270  |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| y (DEG) | 0    | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  | 210  |
| 5       | 209  | 209  | 210  | 211  | 211  | 212  | 211  | 211  | 211  | 211  | 210  | 210  | 210  | 210  | 210  | 211  | 211  | 212  | 212  |
| 10      | 206  | 207  | 208  | 210  | 211  | 213  | 213  | 213  | 212  | 211  | 210  | 208  | 208  | 209  | 210  | 211  | 212  | 213  | 213  |
| 15      | 200  | 201  | 204  | 208  | 211  | 213  | 214  | 213  | 212  | 210  | 207  | 205  | 203  | 206  | 208  | 210  | 212  | 214  | 214  |
| 20      | 192  | 195  | 199  | 204  | 209  | 213  | 214  | 213  | 211  | 207  | 203  | 199  | 195  | 200  | 203  | 207  | 211  | 213  | 214  |
| 25      | 183  | 186  | 192  | 200  | 206  | 211  | 214  | 212  | 209  | 203  | 197  | 192  | 186  | 192  | 197  | 203  | 209  | 212  | 213  |
| 30      | 172  | 176  | 184  | 194  | 203  | 209  | 212  | 211  | 206  | 198  | 190  | 183  | 176  | 183  | 190  | 198  | 205  | 210  | 212  |
| 35      | 159  | 164  | 175  | 187  | 198  | 207  | 210  | 208  | 202  | 192  | 182  | 172  | 164  | 173  | 181  | 191  | 201  | 207  | 209  |
| 40      | 145  | 152  | 164  | 179  | 193  | 203  | 208  | 205  | 197  | 185  | 172  | 160  | 150  | 161  | 171  | 184  | 196  | 204  | 206  |
| 45      | 130  | 138  | 154  | 171  | 187  | 199  | 204  | 201  | 192  | 177  | 161  | 147  | 136  | 148  | 161  | 176  | 190  | 199  | 203  |
| 50      | 115  | 124  | 142  | 163  | 182  | 195  | 200  | 196  | 186  | 169  | 150  | 134  | 121  | 134  | 149  | 168  | 184  | 195  | 199  |
| 55      | 98.5 | 110  | 130  | 154  | 175  | 190  | 196  | 191  | 179  | 160  | 138  | 119  | 105  | 120  | 138  | 159  | 178  | 190  | 194  |
| 60      | 81.9 | 94.8 | 119  | 145  | 169  | 184  | 191  | 186  | 173  | 151  | 127  | 105  | 88.2 | 105  | 126  | 150  | 171  | 184  | 189  |
| 65      | 65.0 | 80.0 | 108  | 137  | 162  | 179  | 186  | 180  | 166  | 142  | 115  | 90.0 | 71.5 | 89.7 | 114  | 141  | 164  | 178  | 184  |
| 70      | 48.5 | 65.8 | 96.6 | 128  | 155  | 172  | 180  | 174  | 158  | 133  | 104  | 75.2 | 54.7 | 74.9 | 102  | 132  | 156  | 172  | 177  |
| 75      | 32.6 | 52.6 | 86.6 | 120  | 147  | 165  | 173  | 167  | 151  | 125  | 92.7 | 61.2 | 38.6 | 60.7 | 91.5 | 123  | 148  | 164  | 170  |
| 80      | 18.5 | 41.3 | 77.2 | 111  | 139  | 157  | 165  | 159  | 143  | 116  | 82.5 | 48.4 | 23.7 | 47.8 | 81.2 | 113  | 140  | 155  | 161  |
| 85      | 6.83 | 32.3 | 68.3 | 102  | 129  | 148  | 156  | 149  | 133  | 106  | 72.6 | 37.5 | 11.0 | 36.8 | 71.0 | 104  | 130  | 146  | 152  |
| 90      | 0.53 | 25.2 | 60.1 | 93.1 | 120  | 137  | 146  | 139  | 123  | 96.5 | 63.2 | 28.2 | 1.20 | 27.4 | 61.4 | 93.8 | 120  | 135  | 141  |
| 95      | 1.05 | 14.3 | 38.8 | 67.0 | 97.3 | 118  | 132  | 126  | 113  | 85.2 | 53.1 | 20.7 | 0.72 | 18.9 | 47.1 | 74.3 | 102  | 110  | 115  |
| 100     | 1.47 | 8.62 | 21.6 | 34.0 | 48.7 | 64.5 | 80.8 | 74.7 | 66.6 | 40.1 | 23.1 | 8.81 | 0.99 | 8.03 | 20.2 | 31.2 | 47.2 | 55.8 | 57.3 |
| 105     | 2.01 | 7.17 | 16.4 | 24.7 | 35.0 | 40.6 | 43.7 | 39.7 | 33.5 | 23.3 | 14.8 | 5.99 | 1.39 | 5.64 | 13.7 | 21.5 | 30.4 | 35.9 | 39.3 |
| 110     | 2.54 | 7.01 | 14.5 | 20.4 | 29.2 | 33.4 | 35.0 | 32.1 | 27.0 | 19.3 | 11.9 | 5.28 | 1.79 | 5.02 | 11.3 | 18.4 | 25.6 | 30.3 | 33.0 |
| 115     | 3.15 | 7.08 | 13.3 | 17.9 | 25.8 | 29.3 | 30.5 | 28.2 | 23.9 | 17.5 | 10.9 | 5.30 | 2.26 | 5.07 | 10.5 | 16.8 | 22.9 | 27.0 | 29.2 |
| 120     | 3.73 | 7.29 | 12.5 | 16.3 | 23.2 | 26.3 | 27.4 | 25.4 | 21.8 | 16.3 | 10.6 | 5.61 | 2.80 | 5.38 | 10.1 | 15.7 | 20.9 | 24.5 | 26.3 |
| 125     | 4.19 | 7.56 | 11.9 | 15.0 | 21.1 | 23.8 | 24.8 | 23.2 | 20.0 | 15.3 | 10.3 | 5.98 | 3.35 | 5.72 | 9.85 | 14.7 | 19.3 | 22.3 | 23.9 |
| 130     | 4.53 | 7.85 | 11.5 | 14.0 | 19.3 | 21.7 | 22.6 | 21.2 | 18.4 | 14.4 | 10.1 | 6.09 | 3.93 | 5.79 | 9.64 | 13.8 | 17.8 | 20.4 | 21.7 |
| 135     | 5.10 | 8.15 | 11.1 | 13.1 | 17.6 | 19.7 | 20.5 | 19.3 | 17.0 | 13.6 | 9.90 | 6.20 | 4.52 | 5.89 | 9.44 | 13.1 | 16.4 | 18.6 | 19.8 |
| 140     | 5.38 | 8.40 | 10.8 | 12.4 | 15.9 | 17.8 | 18.6 | 17.6 | 15.8 | 12.9 | 9.75 | 6.75 | 5.07 | 6.47 | 9.29 | 12.4 | 15.2 | 17.0 | 17.9 |
| 145     | 5.20 | 8.59 | 10.5 | 11.8 | 14.3 | 16.2 | 16.8 | 16.1 | 14.6 | 12.2 | 9.54 | 7.15 | 5.61 | 6.85 | 9.07 | 11.7 | 14.0 | 15.4 | 16.2 |
| 150     | 5.35 | 8.74 | 10.2 | 11.3 | 12.8 | 14.7 | 15.2 | 14.6 | 13.5 | 11.6 | 8.80 | 7.30 | 6.14 | 7.09 | 7.62 | 11.0 | 13.0 | 14.1 | 14.6 |
| 155     | 5.54 | 8.79 | 10.0 | 11.0 | 11.3 | 13.3 | 13.8 | 13.3 | 12.5 | 11.0 | 6.83 | 7.19 | 6.58 | 7.26 | 6.79 | 10.3 | 12.0 | 12.8 | 13.3 |
| 160     | 5.68 | 8.59 | 9.69 | 10.4 | 9.82 | 12.0 | 12.5 | 12.2 | 11.6 | 10.6 | 8.80 | 6.33 | 6.12 | 5.66 | 8.25 | 10.1 | 11.2 | 11.7 | 12.0 |
| 165     | 5.03 | 5.69 | 7.38 | 7.37 | 7.09 | 8.47 | 11.3 | 11.1 | 10.8 | 9.92 | 8.99 | 6.61 | 3.87 | 5.64 | 8.15 | 9.37 | 10.3 | 10.7 | 10.9 |
| 170     | 4.57 | 4.60 | 6.93 | 8.90 | 9.37 | 9.56 | 9.92 | 9.71 | 9.50 | 9.27 | 8.75 | 6.66 | 3.31 | 4.78 | 6.93 | 8.62 | 9.31 | 9.48 | 9.50 |
| 175     | 2.44 | 2.71 | 3.44 | 6.05 | 8.22 | 8.89 | 9.42 | 9.03 | 8.27 | 6.29 | 4.79 | 4.16 | 3.44 | 3.38 | 3.57 | 4.35 | 4.83 | 5.85 | 7.87 |
| 180     | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.55 | 2.55 | 2.55 | 2.55 | 2.55 | 2.55 | 2.55 |

Table--2

UNIT: cd

| C (DEG) | 285  | 300  | 315  | 330  | 345  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---------|------|------|------|------|------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| y (DEG) | 0    | 210  | 210  | 210  | 210  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5       | 212  | 212  | 211  | 211  | 210  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10      | 213  | 212  | 210  | 209  | 207  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15      | 213  | 211  | 208  | 205  | 202  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20      | 212  | 209  | 204  | 199  | 195  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25      | 211  | 206  | 199  | 192  | 186  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30      | 209  | 202  | 194  | 184  | 176  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 35      | 206  | 198  | 187  | 175  | 165  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40      | 202  | 192  | 179  | 164  | 152  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 45      | 198  | 186  | 171  | 153  | 138  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50      | 193  | 180  | 162  | 142  | 124  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55      | 188  | 174  | 153  | 130  | 110  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60      | 183  | 167  | 144  | 118  | 94.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65      | 176  | 160  | 136  | 107  | 79.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70      | 170  | 153  | 127  | 95.8 | 65.5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 75      | 162  | 145  | 118  | 85.7 | 52.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 80      | 153  | 136  | 109  | 76.1 | 40.9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 85      | 144  | 126  | 99.8 | 66.9 | 31.9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 90      | 133  | 116  | 90.4 | 58.4 | 24.5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 95      | 98.0 | 79.2 | 53.6 | 32.9 | 13.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100     | 49.5 | 41.8 | 30.2 | 19.8 | 8.12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 105     | 37.1 | 32.4 | 23.0 | 15.6 | 6.87 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 110     | 31.6 | 27.7 | 19.3 | 13.9 | 6.72 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 115     | 28.1 | 24.6 | 17.1 | 12.8 | 6.79 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 120     | 25.3 | 22.3 | 15.6 | 12.1 | 6.99 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 125     | 22.9 | 20.2 | 14.4 | 11.5 | 7.24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 130     | 20.8 | 18.5 | 13.4 | 11.1 | 7.50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 135     | 18.9 | 16.8 | 12.5 | 10.8 | 7.78 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 140     | 17.1 | 15.2 | 11.9 | 10.5 | 7.99 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 145     | 15.5 | 13.6 | 11.4 | 10.2 | 8.10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 150     | 14.0 | 12.1 | 11.1 | 9.93 | 8.17 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 155     | 12.7 | 10.6 | 10.8 | 9.67 | 8.11 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 160     | 9.63 | 8.59 | 10.2 | 9.32 | 7.74 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 165     | 9.37 | 6.99 | 6.33 | 6.09 | 4.88 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 170     | 9.58 | 9.52 | 7.82 | 4.47 | 4.35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 175     | 6.02 | 3.77 | 2.39 | 2.15 | 1.70 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 180     | 2.55 | 2.55 | 2.55 | 2.55 | 2.55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

### THD and PF Measurement Test Results:

#### Electrical Measurement:

| Voltage (V) | Frequency (Hz) | Current (A) | Wattage (W) | Power Factor | iTHD (%) |
|-------------|----------------|-------------|-------------|--------------|----------|
| 277.0       | 60             | 0.0338      | 8.430       | 0.9001       | 17.67    |

**Photo of Sample:**



**Equipment List:**

| Equipment ID | Equipment Name               | Last Cal.  | Due Cal.   |
|--------------|------------------------------|------------|------------|
| NTC-F01-001  | Goniophotometer System       | 2020-11-12 | 2021-11-11 |
| NTC-F01-006  | 2.0 meter Integrating Sphere | 2020-11-12 | 2021-11-11 |
| NTC-F01-012  | Standard Lamp                | 2020-11-12 | 2021-11-11 |
| NTC-F01-013  | Standard Lamp                | 2020-11-12 | 2021-11-11 |
| NTC-F01-031  | Digital Power Meter          | 2020-08-22 | 2021-08-21 |
| NTC-F01-019  | Temperature & Humidity Meter | 2020-11-13 | 2021-11-12 |

\*\*\*\*\***End of Report**\*\*\*\*\*