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PHOTOMETRIC  
TEST REPORT

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|----------------------------------|---|
| <b>Report Number</b>             | GNC-19577                                     |
| <b>Customer</b>                  | Astro Lighting Limited                        |
| <b>Contact</b>                   | Ross Dickson                                  |
| <b>Product Type</b>              | LED Wall light                                |
| <b>Test Purpose</b>              | Generation of Photometric Data                |
| <b>Sales Order Ref</b>           | Q-LUX17-21659                                 |
| <b>Works Order Number</b>        | WO-10224                                      |
| <b>Test Item Reference</b>       | TI-13766                                      |
| <b>LAB Test Method Reference</b> | TES-102000                                    |
| <b>Test Standards</b>            | LM-79-08; (BS) EN 13032-4:2015; CIE S025:2015 |
| <b>Lab Location Reference</b>    | LUX-TSI                                       |
| <b>Tested by</b>                 | Mike Sewell                                   |
| <b>Date of Test</b>              | 23/06/2017                                    |
| <b>Reviewed by</b>               | Menno Schakel                                 |
| <b>Number of products tested</b> | 1   |

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Signed:



Date: 29/08/2017



7937 - Rio 210 LED

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## Nomenclature

Lamp Orientation described below relates to the position in which a lamp is designed to operate for maximum performance and safety, these include:

BD - Base Down (bulb is vertically positioned with the metal base at the bottom, glass up)

BU - Base Up (bulb is vertically positioned with the metal base at the top, glass hanging down)

HBD - Horizontal  $+15^{\circ}$  to Base Down

H45 - Horizontal to  $-45^{\circ}$  only

VBU - Vertical Base Up  $\pm 15^{\circ}$

VBD - Vertical Base Down  $\pm 15^{\circ}$

HBU - Base Up  $\pm 90^{\circ}$  (bulb can be operated in a base up or horizontal position)

HOR - Horizontal Burn (bulb is positioned with the metal base parallel to the ground)

H75 - Horizontal  $\pm 75^{\circ}$  (bulb should not be operated within  $15^{\circ}$  of vertical)

U - Universal Burn (burn can be operated in any position)

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## Test Conditions

Measurements were made with an ambient temperature of  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ . Measurements were taken only after sufficient time for thermal stabilisation has been allowed. Thermal stabilisation according to LM-79-08 was achieved before measurements are measured and reported.

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## Calibrations

The far field Type C Goniophotometer is calibrated using an intensity lamp calibrated by a NVLAP accredited calibration laboratory.

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## Test Equipment

UL LSI Custom Far-Field Type C Moving Mirror Goniophotometer measures intensity as a function of angle. On-axis spectral measurements taken using spectrometer, for which these measurements and outputs are not accredited.

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## Data Formats

IES (15 deg azimuth and 2.5 deg inclination) and LDT (15 deg C planes and 2.5 deg gamma angles)

Spectral Data file from which the calculation of chromaticity and CRI etc. have been performed and the derived results from the LightMtrX software are provided as a text file format.

All photometric data for LED products will be provided in ABSOLUTE photometric format and all non-LED data will be in relative photometric format with lamp lumens measured separately, where possible, for LOR estimation.

|                              |                            |
|------------------------------|----------------------------|
| <b>Product Name</b>          | 7937 - Rio 210 LED         |
| <b>Part/Serial Number</b>    | N/A                        |
| <b>Type of Product</b>       | LED Wall light             |
| <b>Base Type</b>             | Not Applicable - Luminaire |
| <b>Driver Type</b>           | Internal                   |
| <b>Test Time</b>             | 30 mins                    |
| <b>Operating Orientation</b> | Base Up                    |
| <b>Test Orientation</b>      | Base Up                    |
| <b>Ambient Temperature</b>   | 25.2°C                     |
| <b>Manufacturer</b>          | Astro Lighting Limited     |
| <b>Date of Manufacture</b>   | Not Available              |
| <b>Thermal Management</b>    | Passive                    |
| <b>Dimmable</b>              | No                         |
| <b>Pre-Burning Time</b>      | 0 hours                    |
| <b>Stabilisation Time</b>    | 45 mins                    |
| <b>Humidity</b>              | 58.1% RH                   |
| <b>Averaging Applied</b>     | NONE                       |

| Driver Details |         |     |
|----------------|---------|-----|
| Manufacturer   |         | N/A |
| Model          |         | N/A |
| Part/Serial #  |         | N/A |
| Rated Voltage  |         | N/A |
| Output         | Current | N/A |
|                | Voltage | N/A |

| Photometric Measurements |         |
|--------------------------|---------|
| Luminous Flux            | 277 lm  |
| Luminous Efficacy        | 50 lm/W |

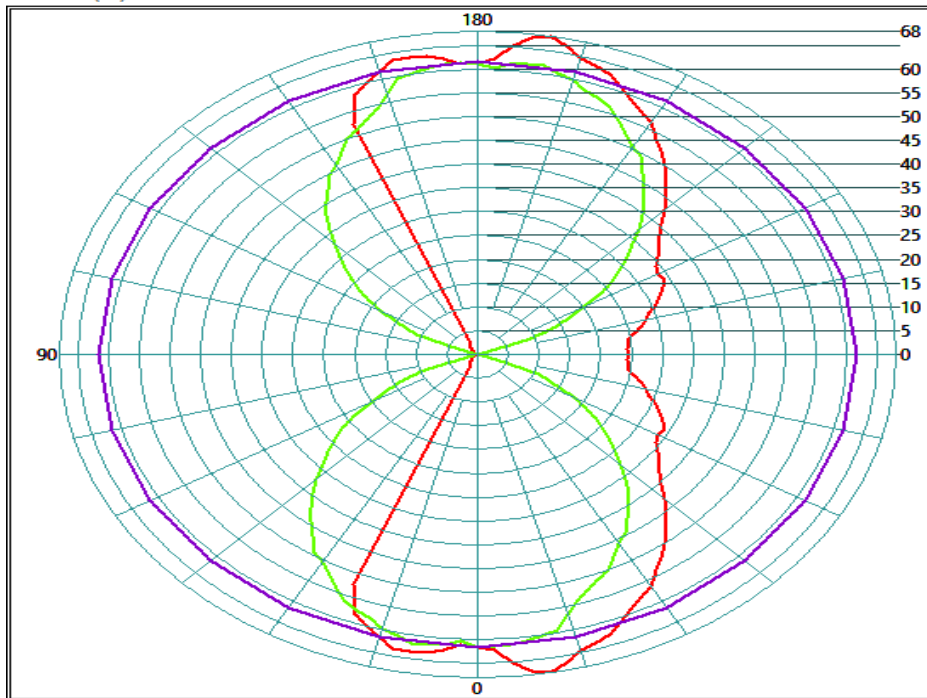
| Dimension      | Sample | Luminous Opening |
|----------------|--------|------------------|
| Diameter/Width | 210 mm | 190 mm           |
| Length         | 55 mm  | 45 mm            |
| Height/Depth   | 125 mm | 125 mm           |

| Electrical Measurements |           |
|-------------------------|-----------|
| Frequency               | 50 Hz     |
| Voltage                 | 229.160 V |
| Current                 | 0.026 A   |
| Power                   | 5.5 W     |
| Power Factor            | 0.914     |
| Apparent Power          | 6.0 VA    |

### Goniophotometric Measurements

|                   |            |       |
|-------------------|------------|-------|
| Beam Angle        | Horizontal | 95°   |
|                   | Vertical   | 86°   |
| On-axis Intensity |            | 62 cd |
| Peak Intensity    |            | 68 cd |
| Peak Direction    | Horizontal | 180°  |
|                   | Vertical   | 10°   |

Polar Plot (cd)

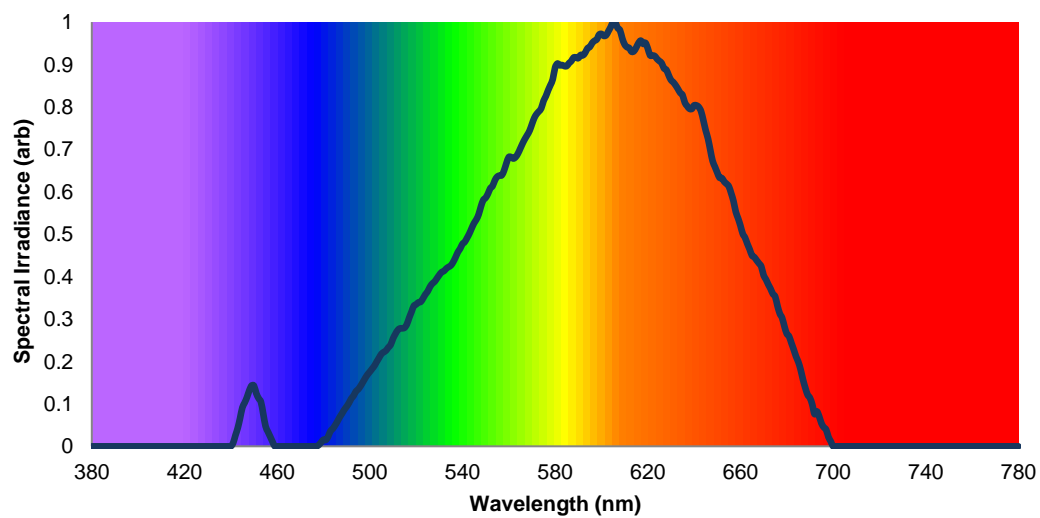


## Appendices

### *On-axis Spectral Measurement*

The following data was determined from an on-axis spectral measurement using a SP1000 spectrometer at a distance of 500mm, for which these measurements and outputs are not accredited.

**Spectral Irradiance versus Wavelength**

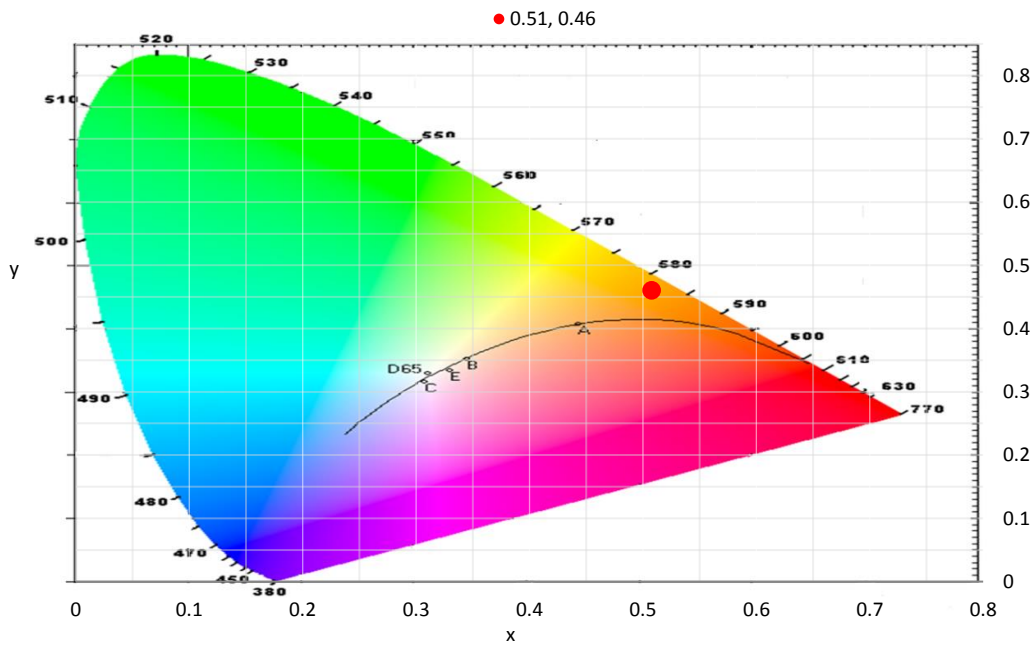


| Colour Rendering Index Detail |    |     |     |
|-------------------------------|----|-----|-----|
| R1                            | 69 | R8  | 51  |
| R2                            | 80 | R9  | -14 |
| R3                            | 90 | R10 | 55  |
| R4                            | 69 | R11 | 61  |
| R5                            | 66 | R12 | 42  |
| R6                            | 73 | R13 | 70  |
| R7                            | 85 | R14 | 94  |

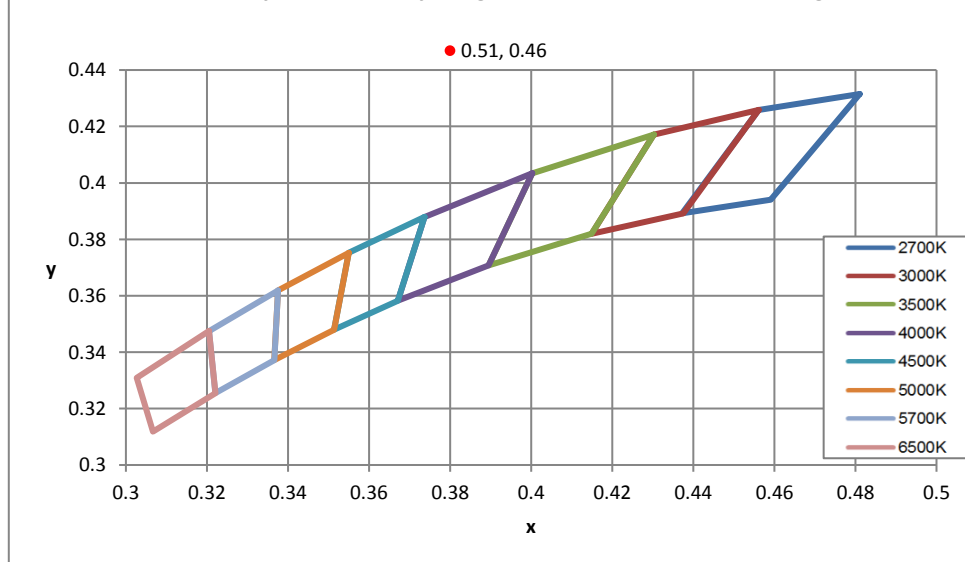
| Colorimetric Details |       |
|----------------------|-------|
| CCT                  | 2475K |
| CRI (Ra)             | 73    |

| Chromaticity Coordinates |    |        |
|--------------------------|----|--------|
| CIE 1931                 | x  | 0.5077 |
|                          | y  | 0.4605 |
| CIE 1960                 | u  | 0.2704 |
|                          | v  | 0.3679 |
| CIE 1976                 | u' | 0.2704 |
|                          | v' | 0.5518 |
| Duv                      |    | 0.0138 |

CIE 1931 Colour Chart



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles



### Spectral Power Distribution

| $\lambda$ (nm) | Arb units | $\lambda$ (nm) | Arb units | $\lambda$ (nm) | Arb units | $\lambda$ (nm) | Arb units |
|----------------|-----------|----------------|-----------|----------------|-----------|----------------|-----------|
| 380            | 0.00E+00  | 430            | 0.00E+00  | 480            | 1.58E-02  | 530            | 4.04E-01  |
| 381            | 0.00E+00  | 431            | 0.00E+00  | 481            | 1.51E-02  | 531            | 4.11E-01  |
| 382            | 0.00E+00  | 432            | 0.00E+00  | 482            | 2.29E-02  | 532            | 4.13E-01  |
| 383            | 0.00E+00  | 433            | 0.00E+00  | 483            | 3.59E-02  | 533            | 4.19E-01  |
| 384            | 0.00E+00  | 434            | 0.00E+00  | 484            | 4.15E-02  | 534            | 4.23E-01  |
| 385            | 0.00E+00  | 435            | 0.00E+00  | 485            | 4.95E-02  | 535            | 4.27E-01  |
| 386            | 0.00E+00  | 436            | 0.00E+00  | 486            | 5.86E-02  | 536            | 4.35E-01  |
| 387            | 0.00E+00  | 437            | 0.00E+00  | 487            | 6.87E-02  | 537            | 4.46E-01  |
| 388            | 0.00E+00  | 438            | 0.00E+00  | 488            | 7.73E-02  | 538            | 4.58E-01  |
| 389            | 0.00E+00  | 439            | 0.00E+00  | 489            | 8.64E-02  | 539            | 4.66E-01  |
| 390            | 0.00E+00  | 440            | 0.00E+00  | 490            | 9.38E-02  | 540            | 4.77E-01  |
| 391            | 0.00E+00  | 441            | 7.79E-03  | 491            | 1.02E-01  | 541            | 4.82E-01  |
| 392            | 0.00E+00  | 442            | 2.60E-02  | 492            | 1.13E-01  | 542            | 4.92E-01  |
| 393            | 0.00E+00  | 443            | 4.33E-02  | 493            | 1.19E-01  | 543            | 5.02E-01  |
| 394            | 0.00E+00  | 444            | 6.66E-02  | 494            | 1.30E-01  | 544            | 5.15E-01  |
| 395            | 0.00E+00  | 445            | 9.14E-02  | 495            | 1.34E-01  | 545            | 5.26E-01  |
| 396            | 0.00E+00  | 446            | 1.03E-01  | 496            | 1.42E-01  | 546            | 5.35E-01  |
| 397            | 0.00E+00  | 447            | 1.16E-01  | 497            | 1.51E-01  | 547            | 5.47E-01  |
| 398            | 0.00E+00  | 448            | 1.32E-01  | 498            | 1.61E-01  | 548            | 5.66E-01  |
| 399            | 0.00E+00  | 449            | 1.43E-01  | 499            | 1.69E-01  | 549            | 5.81E-01  |
| 400            | 0.00E+00  | 450            | 1.43E-01  | 500            | 1.76E-01  | 550            | 5.86E-01  |
| 401            | 0.00E+00  | 451            | 1.25E-01  | 501            | 1.83E-01  | 551            | 5.96E-01  |
| 402            | 0.00E+00  | 452            | 1.13E-01  | 502            | 1.90E-01  | 552            | 6.08E-01  |
| 403            | 0.00E+00  | 453            | 1.05E-01  | 503            | 2.00E-01  | 553            | 6.14E-01  |
| 404            | 0.00E+00  | 454            | 7.68E-02  | 504            | 2.09E-01  | 554            | 6.27E-01  |
| 405            | 0.00E+00  | 455            | 4.76E-02  | 505            | 2.18E-01  | 555            | 6.36E-01  |
| 406            | 0.00E+00  | 456            | 3.49E-02  | 506            | 2.22E-01  | 556            | 6.38E-01  |
| 407            | 0.00E+00  | 457            | 2.31E-02  | 507            | 2.26E-01  | 557            | 6.40E-01  |
| 408            | 0.00E+00  | 458            | 1.10E-02  | 508            | 2.33E-01  | 558            | 6.51E-01  |
| 409            | 0.00E+00  | 459            | 0.00E+00  | 509            | 2.40E-01  | 559            | 6.68E-01  |
| 410            | 0.00E+00  | 460            | 0.00E+00  | 510            | 2.54E-01  | 560            | 6.82E-01  |
| 411            | 0.00E+00  | 461            | 0.00E+00  | 511            | 2.64E-01  | 561            | 6.82E-01  |
| 412            | 0.00E+00  | 462            | 0.00E+00  | 512            | 2.74E-01  | 562            | 6.79E-01  |
| 413            | 0.00E+00  | 463            | 0.00E+00  | 513            | 2.78E-01  | 563            | 6.82E-01  |
| 414            | 0.00E+00  | 464            | 0.00E+00  | 514            | 2.78E-01  | 564            | 6.91E-01  |
| 415            | 0.00E+00  | 465            | 0.00E+00  | 515            | 2.80E-01  | 565            | 7.03E-01  |
| 416            | 0.00E+00  | 466            | 0.00E+00  | 516            | 2.88E-01  | 566            | 7.15E-01  |
| 417            | 0.00E+00  | 467            | 0.00E+00  | 517            | 3.03E-01  | 567            | 7.25E-01  |
| 418            | 0.00E+00  | 468            | 0.00E+00  | 518            | 3.17E-01  | 568            | 7.34E-01  |
| 419            | 0.00E+00  | 469            | 0.00E+00  | 519            | 3.31E-01  | 569            | 7.45E-01  |
| 420            | 0.00E+00  | 470            | 0.00E+00  | 520            | 3.35E-01  | 570            | 7.60E-01  |
| 421            | 0.00E+00  | 471            | 0.00E+00  | 521            | 3.39E-01  | 571            | 7.74E-01  |
| 422            | 0.00E+00  | 472            | 0.00E+00  | 522            | 3.41E-01  | 572            | 7.84E-01  |
| 423            | 0.00E+00  | 473            | 0.00E+00  | 523            | 3.49E-01  | 573            | 7.90E-01  |
| 424            | 0.00E+00  | 474            | 0.00E+00  | 524            | 3.58E-01  | 574            | 7.97E-01  |
| 425            | 0.00E+00  | 475            | 0.00E+00  | 525            | 3.66E-01  | 575            | 8.14E-01  |
| 426            | 0.00E+00  | 476            | 0.00E+00  | 526            | 3.76E-01  | 576            | 8.26E-01  |
| 427            | 0.00E+00  | 477            | 0.00E+00  | 527            | 3.84E-01  | 577            | 8.40E-01  |
| 428            | 0.00E+00  | 478            | 3.44E-03  | 528            | 3.89E-01  | 578            | 8.52E-01  |
| 429            | 0.00E+00  | 479            | 9.58E-03  | 529            | 3.96E-01  | 579            | 8.66E-01  |
|                |           |                |           |                |           | 580            | 8.93E-01  |



### Spectral Power Distribution

| $\lambda$ (nm) | Arb units | $\lambda$ (nm) | Arb units | $\lambda$ (nm) | Arb units | $\lambda$ (nm) | Arb units |
|----------------|-----------|----------------|-----------|----------------|-----------|----------------|-----------|
| 581            | 9.03E-01  | 631            | 8.59E-01  | 681            | 2.59E-01  | 731            | 0.00E+00  |
| 582            | 8.98E-01  | 632            | 8.52E-01  | 682            | 2.44E-01  | 732            | 0.00E+00  |
| 583            | 8.99E-01  | 633            | 8.43E-01  | 683            | 2.29E-01  | 733            | 0.00E+00  |
| 584            | 8.97E-01  | 634            | 8.34E-01  | 684            | 2.12E-01  | 734            | 0.00E+00  |
| 585            | 8.97E-01  | 635            | 8.28E-01  | 685            | 1.99E-01  | 735            | 0.00E+00  |
| 586            | 9.04E-01  | 636            | 8.11E-01  | 686            | 1.81E-01  | 736            | 0.00E+00  |
| 587            | 9.09E-01  | 637            | 8.03E-01  | 687            | 1.58E-01  | 737            | 0.00E+00  |
| 588            | 9.17E-01  | 638            | 7.96E-01  | 688            | 1.38E-01  | 738            | 0.00E+00  |
| 589            | 9.17E-01  | 639            | 7.96E-01  | 689            | 1.22E-01  | 739            | 0.00E+00  |
| 590            | 9.15E-01  | 640            | 8.04E-01  | 690            | 1.14E-01  | 740            | 0.00E+00  |
| 591            | 9.23E-01  | 641            | 8.04E-01  | 691            | 9.89E-02  | 741            | 0.00E+00  |
| 592            | 9.22E-01  | 642            | 8.00E-01  | 692            | 7.62E-02  | 742            | 0.00E+00  |
| 593            | 9.29E-01  | 643            | 7.90E-01  | 693            | 8.25E-02  | 743            | 0.00E+00  |
| 594            | 9.39E-01  | 644            | 7.69E-01  | 694            | 7.05E-02  | 744            | 0.00E+00  |
| 595            | 9.42E-01  | 645            | 7.45E-01  | 695            | 5.40E-02  | 745            | 0.00E+00  |
| 596            | 9.51E-01  | 646            | 7.26E-01  | 696            | 4.50E-02  | 746            | 0.00E+00  |
| 597            | 9.56E-01  | 647            | 6.99E-01  | 697            | 3.94E-02  | 747            | 0.00E+00  |
| 598            | 9.60E-01  | 648            | 6.73E-01  | 698            | 2.20E-02  | 748            | 0.00E+00  |
| 599            | 9.71E-01  | 649            | 6.59E-01  | 699            | 1.17E-02  | 749            | 0.00E+00  |
| 600            | 9.72E-01  | 650            | 6.46E-01  | 700            | 0.00E+00  | 750            | 0.00E+00  |
| 601            | 9.68E-01  | 651            | 6.33E-01  | 701            | 0.00E+00  | 751            | 0.00E+00  |
| 602            | 9.69E-01  | 652            | 6.33E-01  | 702            | 0.00E+00  | 752            | 0.00E+00  |
| 603            | 9.79E-01  | 653            | 6.24E-01  | 703            | 0.00E+00  | 753            | 0.00E+00  |
| 604            | 9.89E-01  | 654            | 6.19E-01  | 704            | 0.00E+00  | 754            | 0.00E+00  |
| 605            | 1.00E+00  | 655            | 6.13E-01  | 705            | 0.00E+00  | 755            | 0.00E+00  |
| 606            | 9.99E-01  | 656            | 5.97E-01  | 706            | 0.00E+00  | 756            | 0.00E+00  |
| 607            | 9.87E-01  | 657            | 5.78E-01  | 707            | 0.00E+00  | 757            | 0.00E+00  |
| 608            | 9.81E-01  | 658            | 5.53E-01  | 708            | 0.00E+00  | 758            | 0.00E+00  |
| 609            | 9.62E-01  | 659            | 5.38E-01  | 709            | 0.00E+00  | 759            | 0.00E+00  |
| 610            | 9.48E-01  | 660            | 5.21E-01  | 710            | 0.00E+00  | 760            | 0.00E+00  |
| 611            | 9.42E-01  | 661            | 5.01E-01  | 711            | 0.00E+00  | 761            | 0.00E+00  |
| 612            | 9.39E-01  | 662            | 4.92E-01  | 712            | 0.00E+00  | 762            | 0.00E+00  |
| 613            | 9.31E-01  | 663            | 4.77E-01  | 713            | 0.00E+00  | 763            | 0.00E+00  |
| 614            | 9.32E-01  | 664            | 4.64E-01  | 714            | 0.00E+00  | 764            | 0.00E+00  |
| 615            | 9.40E-01  | 665            | 4.50E-01  | 715            | 0.00E+00  | 765            | 0.00E+00  |
| 616            | 9.51E-01  | 666            | 4.46E-01  | 716            | 0.00E+00  | 766            | 0.00E+00  |
| 617            | 9.57E-01  | 667            | 4.39E-01  | 717            | 0.00E+00  | 767            | 0.00E+00  |
| 618            | 9.49E-01  | 668            | 4.32E-01  | 718            | 0.00E+00  | 768            | 0.00E+00  |
| 619            | 9.51E-01  | 669            | 4.24E-01  | 719            | 0.00E+00  | 769            | 0.00E+00  |
| 620            | 9.39E-01  | 670            | 4.04E-01  | 720            | 0.00E+00  | 770            | 0.00E+00  |
| 621            | 9.22E-01  | 671            | 3.94E-01  | 721            | 0.00E+00  | 771            | 0.00E+00  |
| 622            | 9.22E-01  | 672            | 3.82E-01  | 722            | 0.00E+00  | 772            | 0.00E+00  |
| 623            | 9.20E-01  | 673            | 3.72E-01  | 723            | 0.00E+00  | 773            | 0.00E+00  |
| 624            | 9.14E-01  | 674            | 3.60E-01  | 724            | 0.00E+00  | 774            | 0.00E+00  |
| 625            | 9.09E-01  | 675            | 3.53E-01  | 725            | 0.00E+00  | 775            | 0.00E+00  |
| 626            | 9.04E-01  | 676            | 3.31E-01  | 726            | 0.00E+00  | 776            | 0.00E+00  |
| 627            | 8.91E-01  | 677            | 3.13E-01  | 727            | 0.00E+00  | 777            | 0.00E+00  |
| 628            | 8.88E-01  | 678            | 3.03E-01  | 728            | 0.00E+00  | 778            | 0.00E+00  |
| 629            | 8.75E-01  | 679            | 2.83E-01  | 729            | 0.00E+00  | 779            | 0.00E+00  |
| 630            | 8.64E-01  | 680            | 2.66E-01  | 730            | 0.00E+00  | 780            | 0.00E+00  |

## Measurement Uncertainty

The following is the reported expanded uncertainty of the UL 6440T Type C Mirror Goniophotometer.

| Parameter                      | Uncertainty  |
|--------------------------------|--------------|
| Total Luminous Flux (%)        | $\pm 4.9$    |
| Luminous Intensity (%)         | $\pm 4.9$    |
| Temperature (°C)               | $\pm 1.0$    |
| Voltage DC TY720 (%)           | $\pm 0.02$   |
| Current DC TY720 (%)           | $\pm 0.10$   |
| Voltage AC WT210 (%)           | $\pm 0.0585$ |
| Current AC WT210 (%)           | $\pm 0.0251$ |
| Power AC WT210 (%)             | $\pm 0.2261$ |
| Frequency (50/60 Hz) WT210 (%) | $\pm 0.0040$ |
| Power Factor WT210 (%)         | $\pm 0.0601$ |

The reported expanded uncertainty is based on the combined standard uncertainty multiplied by a coverage factor of  $k = 2$ . This value of  $k$  gives a coverage probability of approximately 95%, assuming a normal distribution. This determination of the measurement uncertainty has been done in accordance with international requirements including UKAS, BIPM Guide to the Expression of Uncertainty in Measurement and CIE 198:2011 and CIE S 025/E:2015.

Electrical measurement equipment used for the determination of results for this report, are compliant and meet the performance requirements of the measurement standards used.

## Appendix - LED Upgrade Scaling

The photometric and electrical data within this report and the corresponding IES and LDT files have been scaled based on comparison measurements between "Luxeon Rebel Plus LX18-P127-3" and "Luxeon TX L1T2-27803 (2W)" based products. The results in the above report correspond to the luminaire using "Luxeon TX L1T2-27803 (2W)" LEDs.

The Colorimetric data on pages 5-8 of this report have not been changed from the "Luxeon Rebel Plus LX18-P127-3" to the "Luxeon TX L1T2-27803 (2W)" LEDs as no significant changes were measured.

Please refer to "GNC-19568 7607 - Pienza LED 2700K" for the comparison data.

### Original data based on "Luxeon Rebel Plus LX18-P127-3" LED

|                  |        |
|------------------|--------|
| Luminous Flux    | 281 lm |
| Electrical Power | 5.7 W  |

----- END OF REPORT -----