# Shanghai Nanhua Electronics Co Ltd.

# TEST REPORT

**SCOPE OF WORK**
ICAO Performance Testing - Low Intensity Type E

**REPORT NUMBER**
104011037CRT-001

**ORIGINAL ISSUE DATE**
July 30th, 2019

**REVISION DATE**
August 1st, 2019

**REVISION NOTE**
*Revised 8/1/2019: Deleted photo of flashhead sent for photometry (not used)*

**PAGES**
6

**DOCUMENT CONTROL NUMBER**
NA

| Test Report | | | |
|---|---|---|---|
| **Company Name** | Shanghai Nanhua Electronics Co Ltd. | **Test Location** | Intertek Testing Services NA |
| **Address** | Building #9 | **Address** | 3933 US Rt 11 |
| | 1755 Wenbei Road | | Cortland, NY 13045 |
| | Jiading, Shanghai 201802 | | USA |
| | China | | |
| **Client Contact** | Xu Zhixin | **Quote Number** | Qu-00988149 |
| **Phone** | +86 21 39126868 | **Test Start Date** | July 26th, 2019 |
| **Email** | xuzhixin@nanhua.com | **Completion Date** | July 29th, 2019 |

| Standard(s) |
|---|
| International Civil Aviation Organization (ICAO), Aerodromes, Annex 14, Volume 1, Eighth Edition, dated July 2018 |
| |

| Spec. | Test name | Clause | Result |
|---|---|---|---|
| ICAO | Photometry Low Intensity Type E (Red) | Table 6-1 & Table 6-2 | Pass |
| ICAO | Chromaticity ICAO App. 1 | 2.3.1 | Pass |
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| Results Key | |
|---|---|
| Pass | Compliant |
| Fail | Non-compliant |
| TBD | Compliance not determined |
| NT | Not tested in this project |
| NA | Test not applicable |

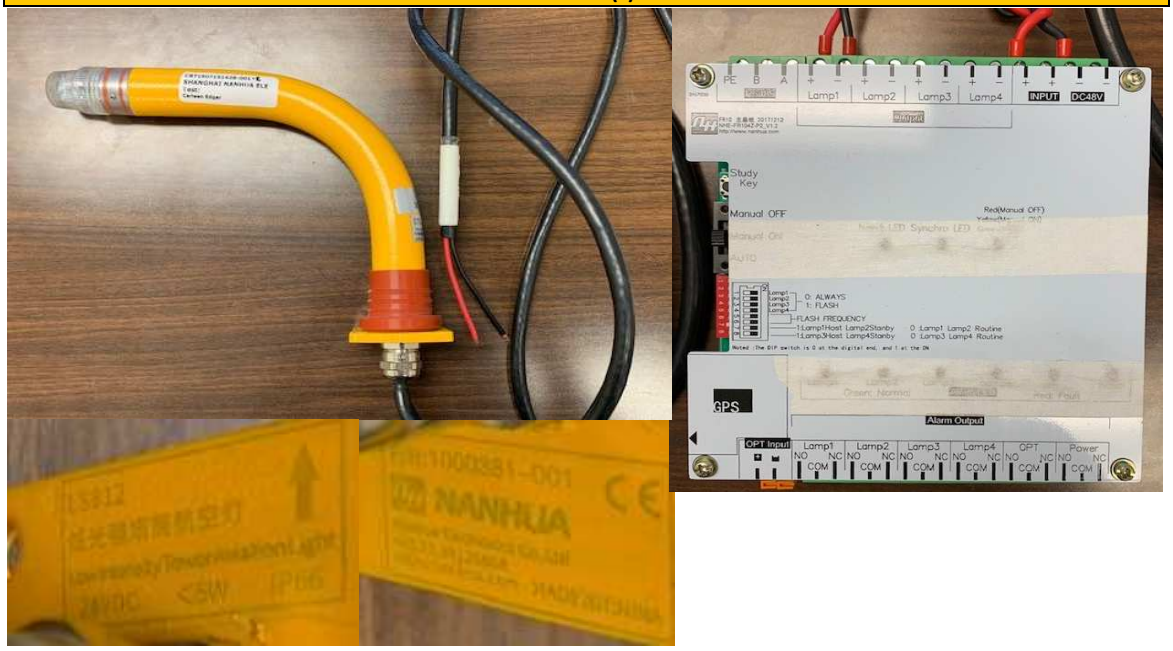
Lynette Smith
Engineer
Lighting

Christopher W. Metcalf
Engineering Supervisor
Lighting

| Sample Information | | | | |
|---|---|---|---|---|
| Date Rec. | Intertek ID | Description | Condition | Model No. |
| 7/15/19 | CRT1907151428-001-1 | Flash Head | Prototype | NA |
| 7/15/19 | CRT1907151428-001-2 | Low Intensity Flash Head | Production | LS812 |
| 7/15/19 | CRT1907151428-001-3 | Controller | Production | NHE-FR104Z-P2_V1.2 |
| | | | | |
| | | | | |
| | | | | |

| Further Sample Description | |
|---|---|
| Type: | Low Intensity Obstacle Light - Type E |
| Options: | NA |
| Light Source: | [4] Red LEDs, Osram, GA CSSPM1.23-KT-W |
| Lens: | PC(2180T), Shanghai NANHUA Electronics Co., Ltd. |
| Approx Size: | 210mm Height, 157mm Length |
| Electrical Input: | 24Vdc |
| LED Supply Location: | Power supply external to flash head |
| Cable: | [2] 1.5mm$^2$ Shanghai Yili Technology and Trade Co., Ltd |
| Casting Material: | Stainless Steel 316 |
| Mounting: | [4] Thru-holes for tower mounting with a mountng plate (PJ005) |

**Picture(s)**



## Photometry - Low Intensity Obstacle Light (Flashing)

Energize the light by the system power supply and control unit and test for compliance with the photometric requirements in Table 6-2. Vary the input voltage to the light ± 10% from nominal voltage and measure the effective intensity at the input extremes. Make the effective intensity measurements using an integrating photometer whose calibration is traceable to an NIST steady state source. The test distance is 100ft. The horizontal beam spread is 360 degrees.

**Results**

**ICAO Low-Intensity, Type E (Red Night)**

**Table 6-2 Requirements**

| Parameter | Requirement | Measured | | Result |
|---|---|---|---|---|
| Flash Rate (FPM) | 20-60 FPM | 20.0 | FPM | Pass |
| Minimum Intensity (cd) | 32cd between 2 and 10 degrees V | 43 | cd | Pass |
| Beam Spread | 10 degrees (>16cd) | 34 | cd | Pass |

| Sample | Voltage Variation | Voltage | Position | Measured | Factor | Result |
|---|---|---|---|---|---|---|
| CRT1907151428-001-2 | Input Voltage | 24.0 | 0,0 | 436 | NA | NA |
| | Input Voltage +10% | 26.4 | 0,0 | 436 | 100% | Pass |
| | Input Voltage -10% | 21.6 | 0,0 | 435 | 100% | Pass |

Cable Length (ft.): 5'
Flash Duration (sec): 0.670
Flash Period (sec.): 2.99

Calibration Factor: 2.45*10^-12
Neutral Density Filter: NA

Input: 24.0 Vdc

Effective Intensity (cd)

| Vertical Position (deg) | Horizontal Position (deg.) 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27U | -- | -- | -- | -- | -- | 14.9 | -- | 15.4 | 15.6 | -- | -- | -- |
| 26U | -- | -- | -- | -- | -- | 16.1 | -- | 20.0 | 22.1 | -- | -- | -- |
| 25U | -- | -- | -- | -- | 14.0 | 19.8 | -- | 26.9 | 26.9 | -- | -- | -- |
| 24U | -- | -- | -- | -- | 16.1 | 24.4 | -- | 30.6 | 33.3 | -- | -- | -- |
| 23U | -- | -- | -- | -- | 21.1 | 29.7 | -- | 36.6 | 38.2 | -- | -- | -- |
| 22U | -- | -- | 13.8 | -- | 26.4 | 35.6 | -- | 43.2 | 42.5 | -- | -- | -- |
| 21U | -- | -- | 20.2 | -- | 32.9 | 39.3 | 14.9 | 48.3 | 45.3 | -- | 15.4 | 15.6 |
| 20U | -- | 15.4 | 26.2 | -- | 39.3 | 44.6 | 19.3 | 52.0 | 48.3 | -- | 20.0 | 19.8 |
| 19U | -- | 20.2 | 32.0 | -- | 43.4 | 47.1 | 23.4 | 55.6 | 50.8 | 14.5 | 25.5 | 27.6 |
| 18U | -- | 26.9 | 37.9 | -- | 49.0 | 50.6 | 31.5 | 59.5 | 53.1 | 17.5 | 31.3 | 33.1 |
| 17U | -- | 32.9 | 41.4 | -- | 53.6 | 52.6 | 39.3 | 61.1 | 54.0 | 20.2 | 38.4 | 39.3 |
| 16U | -- | 40.2 | 44.4 | 15.9 | 55.4 | 54.9 | 47.8 | 63.0 | 55.9 | 22.8 | 41.8 | 43.2 |
| 15U | -- | 45.3 | 48.5 | 23.0 | 59.5 | 56.8 | 55.2 | 63.9 | 56.1 | 28.3 | 45.5 | 47.4 |
| 14U | -- | 49.7 | 52.9 | 31.0 | 62.8 | 57.7 | 63.9 | 65.5 | 56.1 | 32.9 | 49.0 | 49.4 |
| 13U | 15.2 | 54.3 | 55.9 | 40.2 | 64.6 | 58.6 | 71.7 | 63.4 | 53.8 | 40.2 | 52.0 | 51.3 |
| 12U | 23.2 | 57.5 | 58.2 | 48.5 | 67.4 | 56.8 | 78.4 | 59.3 | 51.5 | 48.5 | 54.7 | 53.3 |
| 11U | 33.3 | 60.5 | 59.5 | 56.6 | 66.9 | 56.3 | 85.5 | 55.6 | 50.1 | 57.0 | 56.8 | 54.9 |
| 10U | 42.8 | 63.7 | 60.9 | 64.8 | 65.1 | 54.5 | 91.7 | 52.9 | 50.1 | 64.6 | 59.1 | 56.6 |
| 9U | 52.9 | 67.4 | 61.4 | 73.6 | 62.5 | 54.9 | 95.6 | 52.9 | 48.7 | 71.3 | 61.8 | 59.1 |
| 8U | 62.1 | 68.3 | 60.0 | 80.5 | 59.8 | 58.4 | 99.1 | 51.7 | 49.7 | 77.7 | 64.6 | 59.8 |
| 7U | 71.5 | 69.7 | 59.3 | 86.4 | 59.1 | 64.1 | 99.5 | 50.8 | 49.9 | 83.4 | 66.0 | 60.2 |
| 6U | 80.0 | 66.4 | 58.6 | 89.9 | 55.9 | 67.8 | 98.4 | 50.8 | 52.2 | 87.8 | 63.9 | 60.2 |
| 5U | 86.7 | 63.0 | 60.9 | 91.7 | 53.3 | 69.7 | 96.8 | 50.1 | 58.4 | 90.6 | 61.8 | 59.3 |
| 4U | 91.3 | 61.6 | 64.6 | 91.5 | 53.3 | 71.0 | 94.3 | 49.7 | 64.4 | 92.0 | 59.1 | 61.1 |
| 3U | 93.8 | 58.4 | 69.0 | 90.3 | 53.1 | 72.9 | 93.6 | 50.1 | 66.4 | 92.4 | 56.8 | 68.5 |
| 2U | 95.6 | 56.3 | 71.5 | 88.3 | 52.9 | 83.4 | 92.9 | 48.3 | 67.1 | 92.0 | 56.1 | 71.3 |
| 1U | 97.0 | 53.8 | 74.0 | 85.7 | 52.2 | 73.8 | 89.7 | 49.7 | 67.4 | 90.6 | 55.4 | 73.1 |
| 0 | 95.6 | 54.0 | 76.3 | 84.4 | 51.5 | 74.7 | 87.1 | 49.2 | 69.7 | 89.7 | 55.6 | 75.9 |
| 1D | 94.9 | 54.5 | 77.7 | 82.3 | 51.5 | 73.3 | 86.0 | 49.0 | 83.2 | 87.4 | 54.7 | 77.2 |
| 2D | 93.1 | 53.6 | 79.1 | 80.2 | 52.4 | 72.6 | 86.7 | 48.3 | 72.2 | 85.3 | 54.7 | 79.1 |
| 3D | 90.1 | 52.6 | 77.9 | 78.9 | 53.6 | 67.8 | 84.1 | 47.8 | 72.6 | 83.0 | 54.0 | 79.1 |
| 4D | 87.4 | 53.1 | 77.0 | 76.6 | 54.3 | 63.4 | 89.0 | 48.0 | 71.5 | 80.9 | 53.1 | 79.8 |
| 5D | 85.7 | 54.5 | 73.1 | 76.8 | 55.6 | 61.4 | 84.4 | 49.2 | 69.0 | 77.9 | 52.2 | 77.5 |
| 6D | 85.3 | 55.9 | 70.3 | 76.8 | 56.3 | 59.1 | 85.1 | 51.5 | 66.9 | 75.9 | 52.4 | 74.5 |
| 7D | 85.3 | 56.1 | 66.0 | 77.0 | 56.3 | 56.8 | 84.1 | 52.0 | 65.1 | 75.6 | 51.7 | 70.1 |
| 8D | 86.7 | 58.4 | 62.8 | 77.7 | 57.9 | 56.6 | 83.4 | 53.6 | 61.4 | 77.5 | 52.9 | 64.6 |
| 9D | 88.3 | 58.9 | 62.3 | 77.0 | 57.2 | 54.0 | 80.7 | 54.7 | 60.0 | 79.3 | 54.0 | 60.0 |
| 10D | 89.4 | 59.8 | 61.1 | 74.3 | 59.3 | 52.9 | 76.8 | 55.6 | 58.2 | 80.2 | 54.7 | 56.3 |
| 11D | 88.5 | 61.6 | 59.1 | 69.2 | 58.9 | 54.0 | 70.8 | 57.9 | 55.6 | 80.2 | 57.0 | 53.8 |
| 12D | 86.2 | 62.5 | 58.9 | 62.3 | 61.8 | 54.7 | 64.6 | 59.1 | 54.7 | 77.9 | 56.8 | 52.4 |
| 13D | 80.9 | 65.1 | 57.5 | 53.6 | 63.7 | 55.4 | 57.9 | 61.8 | 54.7 | 73.3 | 57.9 | 50.1 |
| 14D | 75.4 | 71.3 | 58.6 | 44.8 | 65.1 | 56.6 | 47.8 | 65.1 | 54.9 | 69.7 | 58.6 | 50.3 |
| 15D | 67.1 | 57.7 | 59.5 | 38.4 | 63.9 | 56.8 | 38.9 | 66.7 | 56.3 | 61.8 | 61.1 | 50.8 |
| 16D | 59.3 | 74.0 | 61.4 | 32.2 | 59.3 | 55.4 | 30.6 | 66.2 | 56.6 | 53.6 | 64.8 | 50.8 |
| 17D | 49.2 | 74.9 | 62.8 | 25.7 | 52.6 | 55.2 | 24.8 | 63.9 | 56.3 | 44.8 | 68.3 | 53.6 |
| 18D | 39.1 | 70.3 | 60.5 | 21.4 | 44.6 | 46.9 | 20.9 | 58.2 | 54.9 | 36.1 | 71.5 | 55.6 |
| 19D | 31.0 | 63.0 | 53.6 | 17.7 | 37.5 | 40.9 | 17.9 | 51.5 | 52.0 | 30.1 | 71.3 | 56.8 |
| 20D | 24.8 | 51.0 | 44.4 | 15.2 | 32.0 | 34.5 | 15.9 | 43.7 | 46.4 | 24.4 | 66.0 | 56.1 |
| 21D | 19.5 | 41.8 | 38.2 | -- | 27.4 | 30.3 | -- | 38.2 | 41.1 | 18.6 | 58.9 | 52.2 |
| 22D | 16.6 | 36.8 | 32.9 | -- | 21.6 | 25.1 | -- | 31.3 | 36.3 | 15.4 | 50.6 | 47.4 |
| 23D | 13.1 | 27.1 | 26.0 | -- | 18.2 | 20.2 | -- | 23.4 | 30.8 | -- | 47.1 | 40.9 |
| 24D | -- | 19.5 | 13.8 | -- | 14.5 | 15.6 | -- | 17.5 | 24.4 | -- | 38.6 | 36.1 |
| 25D | -- | 14.9 | -- | -- | -- | -- | -- | 13.1 | 17.7 | -- | 30.1 | 30.1 |
| 26D | -- | -- | -- | -- | -- | -- | -- | -- | 12.9 | -- | 21.8 | 22.1 |
| 27D | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 15.4 | 15.6 |
| ICAO Annex 14 Requirements- Type A (Minimum Intensity: 10 cd) | | | | | | | | | | | | |
| Min (cd) | 42.8 | 56.3 | 58.6 | 64.8 | 52.9 | 54.5 | 91.7 | 48.3 | 48.7 | 64.6 | 56.1 | 56.6 |
| Upper(°) | 12 | 19 | 21 | 15 | 24 | 26 | 20 | 26 | 26 | 18 | 20 | 20 |
| Lower(°) | -22 | -24 | -23 | -19 | -23 | -23 | -19 | -24 | -25 | -21 | -26 | -26 |
| Spread(°) | 34 | 43 | 44 | 34 | 47 | 49 | 39 | 50 | 51 | 39 | 46 | 46 |

**Complies:** ☑ YES ☐ NO

| | | | | | |
|---|---|---|---|---|---|
| Tested By: | Lynette Smith | | | Signature or initials: | Lynette Smith |
| Reviewed By: | cwm | | | Signature or initials: | |
| Test Equipment Used: | 1,2,3,4,5,6,7 | | | Sample No: | CRT1907151428-001-2, 001-3 |
| Amb (ºC): | 24 | RH% | 45 | Completion Date: | 7/28/2019 |

## Chromaticity ICAO

Test the fixture with the lamp, filter and optical system for color of light emitted. Chromaticity Coordinates are to be calculated from a spectral distribution measured in 2nm increments for LEDs, and 5nm increments for incandescent. Measure the color after stabilization at rated input at the main beam center and beam extremes.

### Results - ICAO LED Red

| Sample | Color | Input | Location | x | y | z | (P/F) |
|---|---|---|---|---|---|---|---|
| CRT1907151428-001-2 | Red | 24Vdc | (0,6) | 0.678 | 0.319 | 0.003 | P |

The aviation red must be per ICAO Annex 14, Volume 1, Appendix 1, Colors for Aeronautical Ground Lights, within the following chromaticity boundaries

| Boundary | Line Equation | Calc. |
|---|---|---|
| Purple Boundary | y ≥ 0.980 - x | 0.302 |
| Yellow Boundary | y ≤ 0.335 | 0.319 |

**Complies:** ☑ YES ☐ NO

| | | | | | |
|---|---|---|---|---|---|
| Tested By: | Matthew Benninger | | | Signature or initials: | mb |
| Engineer: | Lynette Smith | | | Signature or initials: | Lynette Smith |
| Reviewed By: | cwm | | | Signature or initials: | cwm |
| Test Equipment Used: | 1,8,9 | | | Sample No: | CRT1907151428-001-2, 001-3 |
| Amb (ºC): | 22 | RH% | 44 | Completion Date: | 7/29/2017 |

| Equipment list | | | | |
|---|---|---|---|---|
| # | Intertek ID No. | Description | Manufacturer | Calibration Due |
| 1 | L178 | 100ft. Lab Goniophotometer | Labsphere | 08-May-2020 |
| 2 | E538 | Oscilloscope | Tektronix | 07-Sep-2019 |
| 3 | L061 | IL1700 Radiometer | International Light | 14-May-2020 |
| 4 | N1311 | Precision Bubble Level | Starrett | 10-Sep-2019 |
| 5 | M308 | Stopwatch | Traceable | 03-Nov-2019 |
| 6 | M135 | Multimeter | Fluke | 11-Jan-2020 |
| 7 | M310 | Hygro-Thermometer | Testo | 16-Nov-2019 |
| 8 | M292 | OL750S Spectroradiometer | Gooch & Housego | 01-Aug-2019 |
| 9 | L185 | Power Supply | Yokogawa | 05-Jun-2020 |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |
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| Note: For measurement uncertainty, refer to the calibration certificates for all the test equipment located in the equipment files | | | | |