# IESNA LM-79: 2008

## Measurement and Test Report

## For

## Verbatim Americas LLC

1200 W.T.Harris Boulevard,Charlotte,NC

Aug 23, 2016

| | |
|---|---|
| **Product Name:** | LED |
| **Model No:** | 99563 |
| **Test Engineer:** | David Zhang |
| **Report No.:** | BTR66.181.16.0003.11 |
| **Sample Received Date:** | April 28, 2015 |
| **Test Performed Date:** | April 28, 2015 to May 05, 2015 |
| **Reviewed By:** | Steven Huo |
| **Prepared By:** | **BEST Test Service Shenzhen Co., Ltd.**<br>1st Floor, 1st Building, Weitai Industrial Park, Yingrenshi, Shiyan, Baoan, Shenzhen, China<br>TEL: +86-755-28236006<br>FAX: +86-755-23467087-811<br>Email: certification@bestcert.cn |

NVLAP LAB CODE 200770-0

Efficient Lighting Initiative

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# 1 - GENERAL INFORMATION

## 1.1 Product Description for Equipment under Test (EUT)

| | | |
|---|---|---|
| Applicant | : | Verbatim Americas LLC |
| Product Name | : | LED |
| Model No | : | 99563 |
| Brand | : | Verbatim |
| Nominal Operation Voltage | : | AC 120V |
| Nominal Power | : | 11W |
| Nominal CCT | : | 3000K |
| Nominal CRI | : | 90 |
| Nominal Lumen Output | : | 800Lumens |
| Nominal Life Time | : | 25000Hours |
| Number of hours operated prior to measurement for new sample | : | 0 Hours |
| Stabilization Time | : | 1.5 Hours |
| Total operating time for measurement include stabilization time | : | 3.5 Hours |
| Nominal Shape of Bulb(Designation) | : | ☒Standard ☐Non Standard<br>☐Omnidirectional A, BT, P, PS, S, T<br>☐Decorative B, BA, C, CA, DC, F, G<br>☒Directional PAR, MR, R, BR |
| Date of Receiving Sample | : | April 28, 2015 |
| Date of Measurement performed | : | April 28, 2015 to May 05, 2015 |
| Measurement quantities measured | : | 1 pcs |
| Orientation During Testing | : | Base Up |
| Test Requested | : | 1. Electrical and Photometric Test<br>2. Luminous Intensity Distribution Test |

## 1.2 Objective

The following test report is prepared on behalf of Verbatim Americas LLC in accordance with IESNA LM-79-08, used the following American National Standards or illumination Engineering Society of North America test guides:

ANSI C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products;
ANSI C79.1– 2002: American National Standard for Electric Lamps – Nomenclature for Glass Bulbs Intended for Use with Electric Lamps;
ANSI C78.20 – 2003: American National Standard for Electric Lamps – A, G, PS, and Similar Shapes with E26 Medium Screw Bases;
ANSI C78.21 – 2011: American National Standard for Incandescent lamps – PAR and R Shapes;
ANSI C78.24 – 2001: American National Standard for Electric Lamps – Two-inch (51 mm);
Integral-reflector Lamps with Front Covers and GU5.3 or GX 5.3 Bases;
ANSI/IEC C81.61-2003: American National Standard for Electric Lamp Bases;
ANSI/IEEE C62.41 – 1991 (01-May-1991): Surge Voltages in Low-Voltage AC Power Circuits, Recommended Practice for;
CIE Publication No. 13.3 – 1995: Method of Measuring and Specifying Color Rendering of Light Sources;
CIE Publication No. 18.2 – 1983: The Basis of Physical Photometry;
IESNA LM-16-1993: Practical Guide to Colorimetry of Light Sources;
IESNA LM-28-89: Guide for the Selection, Care, and Use of Electrical Instruments in the Photometric Laboratory;

IESNA LM-79-08 Electrical and Photometric Measurement of Solid State Lighting Products
UL 1993 – 1999: Standard for Self-Ballasted Lamps and Lamp Adapters;
UL 8750 – 2009: Light Emitting Diode (LED) Equipment for Use in Lighting Products.

## 1.3 Test Facility Description

The Energy Efficiency Lab used by BEST to collect energy efficiency measurement data is located in 1st Floor, 1st Building, Weitai Industrial Park, Yingrenshi, Shiyan, Baoan, Shenzhen, China. BEST Test Service Shenzhen Co., Ltd is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200770-0). BEST Test Service Shenzhen Co., Ltd is also an ELI accredited lab for lighting products (ELI Certificate No. ELI-L04-2010) and UL accredited lab for lighting products.

## 1.4 Test Equipment List

| Apparatus List | Device | Cal. Date | Cal Due Date |
|---|---|---|---|
| 1 | Integral Sphere+ Spectrophotometer System | Mar 10, 2015 | Mar 09, 2016 |
| 2 | Digital Power Meter | Oct 18, 2015 | Oct 17, 2016 |
| 3 | Goniophotometer+ Spectrophotometer System | Nov 20, 2014 | Nov 19, 2015 |
| 4 | Standard Light Source | Sep 17, 2015 | Sep 16, 2016 |
| 5 | Standard Light Source | Sep 17, 2015 | Sep 16, 2016 |
| 6 | Digital Storage Oscilloscope | Oct 18, 2015 | Oct 17, 2016 |
| 7 | Ultra Compact Simulator | Oct 20, 2015 | Oct 19, 2016 |
| 8 | Temperature Chamber | Oct 20, 2015 | Oct 19, 2016 |
| 9 | Digital Caliper | Nov 20, 2014 | Nov 19, 2015 |
| 10 | Digital CC&CV DC Power Supply(30V 5A) | N/A | N/A |
| 11 | 5 1/2 Digital Multimeter | Oct 18, 2015 | Oct 17, 2016 |
| 12 | Digital CC&CV DC Power Supply(120V 10A) | N/A | N/A |
| 13 | 6 1/2 Digital Multimeter | Oct 18, 2015 | Oct 17, 2016 |
| 14 | Digital Multimeter | Oct 18, 2015 | Oct 17, 2016 |
| 15 | Temperature Recorder+Thermocouple | Nov 20, 2014 | Nov 19, 2015 |
| 16 | Timer Controller | Nov 20, 2014 | Nov 19, 2015 |

***Statement of Traceability: BEST Test Service Shenzhen Co., Ltd.*** *certifies that all calibration has been performed using suitable standards traceable to the NIM China.*

# 2 - Test Method

## 2.1 Photometric and Electrical Measurement (Integrated Sphere Method)

Total light output (luminous flux) for the 25℃ ±1℃ ambient temperature conditions is measured using a 1.6m 4∏ geometry integrating sphere. Temperature is measured at a position inside the sphere. Spectral radiant flux measurements are made using Lab sphere to the detector port of the integrating sphere. Each lamp is operated at rated voltage in its designated orientation. Each lamp should be stable before measurements are made. The determining method of stable is as follows:

Step 1 Take 3 measurements of the lamp light output at 15 minute interval (total time=30mintues.)This time period is in addition to the recommended pre-burning time.

Step 2 Calculate the percent difference between the maximum measured value and the minimum measured value for the three consecutive measurements.

Step 3 if the value calculated in Step 2 does not exceed 0.5 percent, the lamp is considered stable.
Luminous flux, chromaticity coordinates, correlated color temperature and color rendering index for each lamp are calculated from the spectral radiant flux measurements taken at 2 nm intervals over the range 350 to 1050 nm. The calibration of the sphere photometer-spectrometer system is traceable to the NIST USA. Lamp efficacy (lumens per watts) for each lamp model is computed based on the revised luminous flux result. Electrical measurements including voltage, current, power and power factor are measured using the digital power Meter.

The total uncertainty of the light output measurements is estimated, at the 95% confidence level, not to exceed ±1.12% over the wavelength range 350-1050 nm.

## 2.2 Photometric and Electrical Measurement (GonioPhotometer Method)

A Goniometer was used to measure the intensity (candelas) at each angle of distribution for each sample; the photometric distance is 24m. Ambient temperature was measured equal to the height of the sample mounted on the Goniometer equipment. Each sample was operated at input rated voltage in its designated orientation. Each sample was allowed to be stable before measurement was made. Electrical measurements including voltage, current, power and power factor were measured using the Power Analyzer

Before each measurement, the method below should be used to determine the lamp is stable or not.

Step 1 Take 3 measurements of the lamp intensity at 15 minute interval (total time=30mintues.)This time period is in addition to the recommended pre-burning time.

Step 2 Calculate the percent difference between the maximum measured value and the minimum measured value for the three consecutive measurements.

Step 3 if the value calculated in Step 2 does not exceed 0.5 percent, the lamp is considered stable.

Some graphics were created with Photometric Plus software.

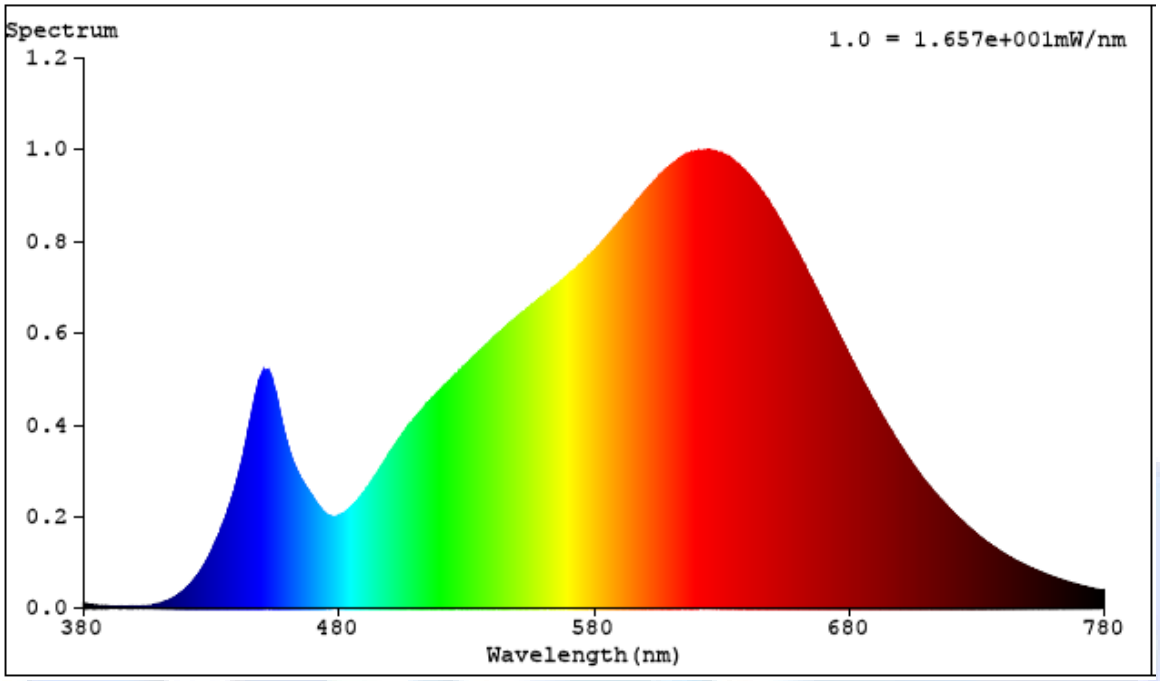
## 2.3 Deviation from standard operating procedure

None.

# 3 – Summary of Test Result

| | Item | Test Result | | Accreditation |
|---|---|---|---|---|
| Required Fields | Lumen Output (Lumens) | 832.22 | | NVLAP/EPA |
| | Luminous Efficacy (lm/w) | 82.25 | | NVLAP/EPA |
| | Correlated Color Temperature (CCT) | 2939 | | NVLAP/EPA |
| | Color Rendering Index– CRI | 92.6 | | NVLAP/EPA |
| | Input Power (W) | 10.12 | | NVLAP/EPA |
| Optional Fields | Power Type | ☒AC | ☐DC | / |
| | Input Voltage (V) | 120.0 | | NVLAP/EPA |
| | Input Current (A) | 0.0908 | | NVLAP/EPA |
| | Power Factor | 0.9283 | | NVLAP/EPA |
| | x(CIE 1931) | 0.4370 | | NVLAP/EPA |
| | y(CIE 1931) | 0.3969 | | NVLAP/EPA |
| | u' (CIE 1976) | 0.2538 | | NVLAP/EPA |
| | v' (CIE 1976) | 0.5185 | | NVLAP/EPA |
| | Duv(CIE 1976) | -0.0029 | | NVLAP/EPA |
| | R9 | 64 | | NVLAP/EPA |
| | Beam Angle: (Degree) | 36.9 | | NVLAP/EPA |
| | Center beam candlepower: (cd) | 1438 | | NVLAP/EPA |
| | Zonal lumen density (0-60°): | 96.1% | | NVLAP/EPA |
| | Zonal lumen density (60-90°): | 3.9% | | NVLAP/EPA |
| | Zonal lumen density (90-120°): | 0.0% | | NVLAP/EPA |
| | Zonal lumen density (120-180°): | 0.0% | | NVLAP/EPA |

# 4 – Spectral Flux Plots



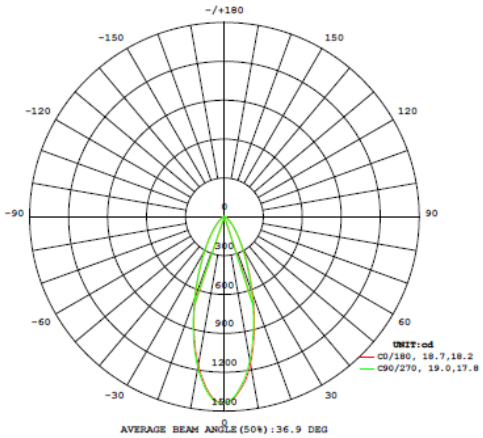
# 5 – EUT Photos

# 6 – Luminous Intensity Distribution Test Plots (CIE Chromaticity)

## LAMP PHOTOMETRIC REPORT

| | | |
|---|---|---|
| Electrical: Voltage:120.0V Current:0.0908A Power:10.12W Factor:0.9283 | | |
| MODEL: 99563 | | |
| POWER: 11W | VOLTAGE: 120.0V | WORKING VOLTAGE: 120.0V |
| MANUFACTURER: Verbatim | | Eff.: 82.25 lm/W |

TOTAL FLUX: 832.22 lm




| γ | C0 | C45 | C90 | C135 | C180 | C225 | C270 | C315 | γ | Φ zone | Φ total | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1163 | 1187 | 1182 | 1161 | 1152 | 1132 | 1126 | 1146 | 0- 10 | 123.0 | 123.0 | 14.8 |
| 20 | 661.7 | 673.9 | 672.7 | 648.5 | 632.8 | 611.4 | 615.9 | 638.5 | 10- 20 | 246.8 | 369.7 | 44.4 |
| 30 | 307.8 | 309.5 | 305.7 | 296.8 | 283.8 | 267.7 | 273.2 | 297.4 | 20- 30 | 203.1 | 572.8 | 68.8 |
| 40 | 140.9 | 134.5 | 133.9 | 129.6 | 124.1 | 112.3 | 117.7 | 135.9 | 30- 40 | 123.5 | 696.3 | 83.7 |
| 50 | 63.43 | 58.81 | 59.15 | 59.31 | 57.19 | 50.70 | 53.19 | 61.80 | 40- 50 | 67.93 | 764.2 | 91.8 |
| 60 | 28.51 | 25.82 | 27.30 | 27.66 | 27.68 | 24.07 | 25.02 | 27.86 | 50- 60 | 35.64 | 799.9 | 96.1 |
| 70 | 14.32 | 13.48 | 14.12 | 14.35 | 14.23 | 12.88 | 13.18 | 14.20 | 60- 70 | 19.32 | 819.2 | 98.4 |
| 80 | 5.962 | 5.901 | 6.156 | 6.022 | 5.843 | 5.348 | 5.416 | 5.851 | 70- 80 | 10.22 | 829.4 | 99.7 |
| 90 | 0.1337 | 0.2315 | 0.2490 | 0.1594 | 0.0906 | 0.0069 | 0.0033 | 0.0758 | 80- 90 | 2.790 | 832.2 | 100 |
| 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 90-100 | 0.0070 | 832.2 | 100 |
| 110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100-110 | 0 | 832.2 | 100 |
| 120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 110-120 | 0.0001 | 832.2 | 100 |
| 130 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 120-130 | 0 | 832.2 | 100 |
| 140 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 130-140 | 0 | 832.2 | 100 |
| 150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 140-150 | 0 | 832.2 | 100 |
| 160 | 0.0022 | 0.0014 | 0.0015 | 0.0020 | 0.0034 | 0.0049 | 0.0040 | 0.0034 | 150-160 | 0.0002 | 832.2 | 100 |
| 170 | 0.0110 | 0.0110 | 0.0103 | 0.0121 | 0.0128 | 0.0126 | 0.0130 | 0.0126 | 160-170 | 0.0020 | 832.2 | 100 |
| 180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 170-180 | 0.0010 | 832.2 | 100 |
| DEG | LUMINOUS INTENSITY:cd | | | | | | | | | UNIT:lm | | |

C Range: 0 - 360DEG
C Interval: 22.5DEG
Test Speed: HIGH
Temperature:25.6DEG
Operators:David

γ Range: 0 - 180DEG
γ Interval: 1.0DEG
Test System:EVERFINE GO-R5000_V2 SYSTEM V2.0.287
Humidity:67.1%
Test Distance:2.455m [K=1.0000]

# LUMINOUS DISTRIBUTION INTENSITY DATA

| | | |
|---|---|---|
| Electrical: Voltage:120.0V Current:0.0908A Power:10.12W Factor:0.9283 | | |
| MODEL: 99563 | | |
| POWER: 11W | VOLTAGE: 120.0V | WORKING VOLTAGE: 120.0V |
| MANUFACTURER: Verbatim | | Eff.: 82.25 lm/W |

Table--1 UNIT: cd

| γ (DEG) \ C (DEG) | 0 | 23 | 45 | 68 | 90 | 113 | 135 | 158 | 180 | 203 | 225 | 248 | 270 | 293 | 315 | 338 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1437 | 1437 | 1438 | 1438 | 1438 | 1438 | 1438 | 1437 | 1437 | 1437 | 1438 | 1438 | 1438 | 1438 | 1438 | 1437 | | | |
| 5 | 1365 | 1372 | 1378 | 1380 | 1379 | 1371 | 1360 | 1350 | 1346 | 1337 | 1330 | 1328 | 1331 | 1337 | 1347 | 1362 | | | |
| 10 | 1163 | 1178 | 1187 | 1188 | 1182 | 1176 | 1161 | 1149 | 1152 | 1140 | 1132 | 1127 | 1126 | 1134 | 1146 | 1161 | | | |
| 15 | 911 | 927 | 936 | 937 | 931 | 916 | 903 | 889 | 888 | 872 | 863 | 860 | 865 | 873 | 886 | 907 | | | |
| 20 | 662 | 671 | 674 | 675 | 673 | 663 | 649 | 640 | 633 | 621 | 611 | 611 | 616 | 624 | 638 | 657 | | | |
| 25 | 457 | 461 | 462 | 461 | 462 | 457 | 444 | 433 | 427 | 415 | 409 | 408 | 413 | 425 | 438 | 455 | | | |
| 30 | 308 | 309 | 310 | 309 | 306 | 303 | 297 | 287 | 284 | 272 | 268 | 268 | 273 | 284 | 297 | 307 | | | |
| 35 | 209 | 207 | 205 | 205 | 203 | 200 | 196 | 191 | 187 | 177 | 172 | 174 | 179 | 190 | 202 | 210 | | | |
| 40 | 141 | 138 | 135 | 135 | 134 | 133 | 130 | 127 | 124 | 117 | 112 | 114 | 118 | 127 | 136 | 144 | | | |
| 45 | 94.7 | 92.0 | 89.0 | 89.3 | 89.1 | 87.9 | 87.4 | 85.5 | 83.7 | 79.6 | 75.2 | 75.9 | 78.9 | 85.3 | 91.9 | 96.0 | | | |
| 50 | 63.4 | 60.8 | 58.8 | 58.5 | 59.2 | 59.4 | 59.3 | 58.6 | 57.2 | 54.1 | 50.7 | 50.3 | 53.2 | 57.4 | 61.8 | 64.1 | | | |
| 55 | 42.0 | 39.2 | 38.4 | 38.1 | 39.7 | 40.1 | 40.2 | 40.3 | 39.5 | 36.6 | 34.3 | 34.1 | 35.9 | 39.0 | 41.1 | 43.2 | | | |
| 60 | 28.5 | 26.4 | 25.8 | 26.2 | 27.3 | 27.9 | 27.7 | 28.3 | 27.7 | 25.5 | 24.1 | 24.1 | 25.0 | 27.1 | 27.9 | 29.5 | | | |
| 65 | 20.0 | 18.7 | 18.4 | 18.8 | 19.4 | 19.9 | 19.8 | 20.1 | 19.7 | 18.4 | 17.6 | 17.6 | 18.1 | 19.3 | 19.7 | 20.7 | | | |
| 70 | 14.3 | 13.6 | 13.5 | 13.7 | 14.1 | 14.5 | 14.3 | 14.3 | 14.2 | 13.4 | 12.9 | 12.9 | 13.2 | 13.9 | 14.2 | 14.8 | | | |
| 75 | 9.88 | 9.53 | 9.50 | 9.60 | 9.90 | 10.1 | 9.95 | 9.82 | 9.72 | 9.25 | 8.95 | 8.95 | 9.10 | 9.55 | 9.72 | 10.1 | | | |
| 80 | 5.96 | 5.85 | 5.90 | 5.97 | 6.16 | 6.25 | 6.02 | 5.82 | 5.84 | 5.56 | 5.35 | 5.34 | 5.42 | 5.69 | 5.85 | 6.15 | | | |
| 85 | 2.41 | 2.46 | 2.56 | 2.62 | 2.67 | 2.66 | 2.50 | 2.30 | 2.34 | 2.21 | 2.10 | 2.06 | 2.08 | 2.18 | 2.30 | 2.47 | | | |
| 90 | 0.13 | 0.19 | 0.23 | 0.25 | 0.25 | 0.22 | 0.16 | 0.10 | 0.09 | 0.04 | 0.01 | 0.00 | 0.00 | 0.03 | 0.08 | 0.14 | | | |
| 95 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 105 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 110 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 115 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 120 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 125 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 130 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 135 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 140 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 145 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 150 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 155 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 160 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 165 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | | | |
| 170 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | | | |
| 175 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | | | |
| 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 | 0.00 | 0.00 | 0.00 | 0.00 | | | |

C Range: 0 - 360DEG
C Interval: 22.5DEG
Test Speed: HIGH
Temperature:25.6DEG
Operators:David

γ Range: 0 - 180DEG
γ Interval: 1.0DEG
Test System:EVERFINE GO-R5000_V2 SYSTEM V2.0.287
Humidity:67.1%
Test Distance:2.455m [K=1.0000]