PLASMA AIR INTERNATIONAL
360 Connecticut Ave
Suite 103
Norwalk, CT 06954
Attn: Larry Sunshine

Air Purifier Test Report
(Brand: "Plasma Air" Bipolar Ionization Air Purifier - Model: 102C)
Our Reference No.: 08/1253/RL/RC/001

Prepared by:

LAWN ENVIRONMENTAL PROTECTION LTD.
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Richard L.T. Liu

Technical Manager
Date: 27. November 2008
A. INTRODUCTION

This report details the findings of the measurement and laboratory test for the air purifier (Brand “Plasma Air” Bipolar Ionization Air Purifier - Model: 102C) in a controlled room size of 1,000 ft³, which was performed by LAWN Environmental Protection Ltd (Indoor Air Quality Certificate – Certifies Certificate Issue Body (CIB))

The test was carried out on 31 October 2008 and was to investigate the removal efficiency of the air purifier in regards to Total Volatile Organic Compounds (TVOC), Formaldehyde (HCHO), Airborne Bacteria and Cigarette Smoke Particulates.

B. MEASUREMENT METHOD

B.1 TVOC and HCHO measurement was conducted per the following steps:

Step 1: After preparation of a regular amount of VOC and before the air purifier was in operation, the TVOC and HCHO levels were recorded for 30 minutes.

Step 2: After the air purifier was turned on, the TVOC and HCHO levels were recorded at 15 minute intervals.

B.2 Airborne Bacteria measurement was conducted per the following steps:

Step 1: Before the air purifier was in operation, the Airborne Bacteria were sampled for 4 minutes and sent to a laboratory for analysis.

Step 2: After the air purifier was in operation for 30 minutes, the Airborne Bacteria were sampled for 4 minutes and sent to a laboratory for analysis.

B.3 Cigarette Smoke Particulate measurement was conducted per the following steps:

Step 1: Before the air purifier was in operation, the level of Cigarette Smoke Particulate for different sizes was recorded. One cigarette was burned for particulate generation, recorded after the cigarette was totally burned out.

Step 2: Air purifier was turned on immediately after the cigarette was totally burned out. After the air purifier was turned on, the level of Cigarette Smoke Particulate for different size was recorded at 15 minute intervals.
C. MEASUREMENT RESULTS

The measurement results of the removal efficiency of the air purifier (Brand "Plasma Air" Bipolar Ionization Air Purifier - Model: 102C) are shown in the following tables.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>HCHO</th>
<th>TVOC</th>
<th>Airborne Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td>µg/m³</td>
<td>µg/m³</td>
<td>CFU/m³</td>
</tr>
<tr>
<td>Sampling description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>31/10/08</td>
<td>86</td>
<td>40,400</td>
</tr>
<tr>
<td>Step 2 (after 15 min)</td>
<td>31/10/08</td>
<td>11</td>
<td>7,901</td>
</tr>
<tr>
<td>Removal rate at 15 min (%)</td>
<td>87.2%</td>
<td>80.4%</td>
<td>-</td>
</tr>
<tr>
<td>Step 2 (after 30 min)</td>
<td>31/10/08</td>
<td>8</td>
<td>3,002</td>
</tr>
<tr>
<td>Removal rate at 30 min (%)</td>
<td>90.7%</td>
<td>92.6%</td>
<td>95.3%</td>
</tr>
<tr>
<td>Step 2 (after 45 min)</td>
<td>31/10/08</td>
<td>6</td>
<td>2,514</td>
</tr>
<tr>
<td>Removal rate at 45 min (%)</td>
<td>93.0%</td>
<td>93.8%</td>
<td>-</td>
</tr>
<tr>
<td>Step 2 (after 1 hour)</td>
<td>31/10/08</td>
<td>4</td>
<td>580</td>
</tr>
<tr>
<td>Removal rate at 1 hour (%)</td>
<td>95.3%</td>
<td>98.6%</td>
<td>95.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Cigarette Smoke Particulates / Liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size: µm</td>
<td>0.3µ</td>
</tr>
<tr>
<td>Unit</td>
<td>No.</td>
</tr>
<tr>
<td>Sampling description</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td>31/10/08</td>
</tr>
<tr>
<td>Step 2 (after 15 min)</td>
<td>31/10/08</td>
</tr>
<tr>
<td>Removal rate at 15 min (%)</td>
<td>2.80%</td>
</tr>
<tr>
<td>Step 2 (after 30 min)</td>
<td>31/10/08</td>
</tr>
<tr>
<td>Removal rate at 30 min (%)</td>
<td>22.0%</td>
</tr>
<tr>
<td>Step 2 (after 45 min)</td>
<td>31/10/08</td>
</tr>
<tr>
<td>Removal rate at 45 min (%)</td>
<td>55.5%</td>
</tr>
<tr>
<td>Step 2 (after 1 hour)</td>
<td>31/10/08</td>
</tr>
<tr>
<td>Removal rate at 1 hour (%)</td>
<td>73.0%</td>
</tr>
</tbody>
</table>

D. CONCLUSION

D.1 Written Conclusion

1. From the measurement results, it can be observed that the air purifier can reduce over **70%** of Volatile Organic Compounds, Formaldehyde, Airborne Bacteria and Cigarette Smoke Particulate (0.5µ – 5.0µ) within **15 Minutes**.
2. From the measurement results, it can be observed that the air purifier can reduce over **80%** of Volatile Organic Compounds, Formaldehyde, Airborne Bacteria and Cigarette Smoke Particulate (0.5µ – 5.0µ) within **30 Minutes**.
3. From the measurement results, it can be observed that the air purifier can reduce over **90%** of Volatile Organic Compounds, Formaldehyde, Airborne Bacteria and Cigarette Smoke Particulate (0.5µ – 5.0µ) within **45 Minutes**.
4. From the measurement results, it can be observed that the air purifier can reduce over **95%** of Volatile Organic Compounds, Formaldehyde, Airborne Bacteria and Cigarette Smoke Particulate (0.5µ – 5.0µ) within **60 Minutes**.
D.2  Graphical Conclusion

**HCHO Removal Efficiency**

- Graph showing the removal efficiency of HCHO in parts per million (ug/m³) over time (minutes) with two lines representing Plasma Air Decay Rate and Natural Decay Rate.

**TVOC Removal Efficiency**

- Graph showing the removal efficiency of TVOC in parts per million (ug/m³) over time (minutes) with two lines representing Plasma Air Decay Rate and Natural Decay Rate.

**Total Bacteria Count Removal Efficiency**

- Graph showing the removal efficiency of Total Bacteria Count (TBC) in colony forming units per cubic meter (CFU/m³) over time (minutes) with two lines representing Plasma Air Decay Rate and Natural Decay Rate.

**Cigarette Smoke Particulate Removal Efficiency - 0.3u**

- Graph showing the removal efficiency of Cigarette Smoke Particulate (No. / Liter) over time (minutes) with two lines representing Plasma Air Decay Rate and Natural Decay Rate.
E. APPENDIX

E.1 APPENDIX A: Equipment method statement

1. Formaldehyde HCHO

   Equipment:          Interscan 4160-DSP
   Sensor type:       Electrochemical
   Detectable range:  0-500 ppb
   Accuracy:          ± 2%

   Procedure
   ● Set the FUNCTION switch to SAMPLE position to turn on the Interscan. Connect the C-12 zero filter. Adjust the meter to “0” with the ZERO control knob. Remove the filter to start the measurement. Turn on the logger if there is a switch.
   ● Set the FUNCTION switch to stop the measurement or turn off the logger.

2. Total Volatile Organic Compounds TVOC

   Equipment:          RAE ppbRAE plus
   Sensor type:       Photo-ionization sensor with super bright 10.6 eV
   Detectable range:  0-2000 ppm
   Resolution:        1 ppb
   Calibration gas:   Isobutylene
   Accuracy:          ± 20 ppb or ± 10% of reading

   Procedure
   ● Press the MODE key for one second and release.
   ● Press the Y/+ key to start the measurement.
   ● Press the MODE key and the display shows STOP.
   ● Press the Y/+ key to stop the measurement.
   ● Press the MODE key once and the display shows AVG READING.
   ● Press and hold the MODE key for 5 seconds and release to turn off the equipment.

3. Airborne Bacteria

   Equipment:          Biotest HYCON Standard RCS Air Sampler
   Reference:          Field Guide for the Determination of Biological Contaminants in Environmental Samples

   Procedure
   ● Clean the head and impellers with alcohol.
   ● Wait until all alcohol residues vaporized by turning on the RCS Air Sampler using the ON/OFF key.
   ● Unseal the package containing the agar strip and pull back the package top. Touching the side of the strip, insert the strip in the drum, agar side in.
   ● Use the ON/OFF key to turn on the RCS Air Sampler.
   ● Select the 4 minute of 5 permanently programmed sampling times.
   ● Press the ON/OFF key again to start the 4 minute sampling.
   ● Remove the agar strip and replace the strip in its package and immediately seal the broken parts of the top package with tape.
   ● Label the strip with appropriate information.
E.2 APPENDIX B: Calibration certificates
The calibration certificates of the equipment are attached in the following pages.

1. RAE ppbRAE


说明

DIRECTIONS

1. 本中心是国家质量监督检验检疫总局在华南地区设立的国家法定计量检定机构，计量授权证书号是：
   This laboratory is the National Legal Metrological Verification Institution in southern China set up by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ) under authorization certificates No.(2007)01043 & (2007)01032.

2. 本中心所出具的数据均可溯源至保存在中国计量科学研究院的国家计量基准和国际单位制(SI)。中国计量科学研究院于1999年代表中国签署了“国家计量基准及国家计量研究院出具的检定和测量证书相互承认协议”。
   All data issued by this laboratory are traceable to national primary standards maintained in National Institute of Metrology (NIM) and International System of Units (SI). NIM is the signatory to the Mutual Recognition Arrangement (MRA) for national measurement standards and for calibration and measurement certificates issued by national metrology institutes.

3. 本次校准的技术依据：
   Reference documents for the calibration:
   JJF1172-2007 挥发性有机化合物光离子化检测仪校准规范 C.S. for Volatile Organic Compounds Photo Ionization Detectors

4. 本次校准所使用的主要计量标准器：
   Major standards of measurement used in the calibration:
<table>
<thead>
<tr>
<th>设备名称/型号</th>
<th>硅号</th>
<th>证书号/有效期</th>
<th>计量特性</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Equipment</td>
<td>Serial No.</td>
<td>Certificate No.</td>
<td>Due Date</td>
</tr>
<tr>
<td>异丁烯气标物</td>
<td>000067</td>
<td></td>
<td>/2009-02-27</td>
</tr>
<tr>
<td>n-Butane in Air</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.04</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

5. 校准地点、环境条件：
   Place and environmental conditions of the calibration:
   地点：本中心理化实验室
   Temperature (25±1) °C
   相对湿度 (58±5) %
   RH

6. 校准仪器限制使用条件：
   Limiting condition of the instrument calibrated:

注：1. 本证书校准结果仅与受校准仪器有关。
   Note: The results relate only to the items calibrated.

2. 未经本中心书面批准，不得复制此证书。
   2. This certificate shall not be reproduced except in full, without the written approval of our laboratory.
校准结果
RESULTS OF CALIBRATION

证书编号: HYQ20082595
Certificate No.

原始记录号: 020080404
Record No.

第 3 页，共 3 页
Page 3 of

1. 外观: 合格。
(Exterior: Pass)

2. 示值误差:
(Error of indication)

<table>
<thead>
<tr>
<th>标准值</th>
<th>测量值</th>
<th>误差</th>
</tr>
</thead>
<tbody>
<tr>
<td>2×10^6</td>
<td>2.0×10^6</td>
<td>0.0%FS</td>
</tr>
<tr>
<td>5×10^6</td>
<td>5.3×10^6</td>
<td>+3.0%FS</td>
</tr>
<tr>
<td>10.1×10^6</td>
<td>9.7×10^6</td>
<td>-4.0%FS</td>
</tr>
</tbody>
</table>

[技术要求 (Technical characteristic): ±10%FS]

3. 重复性: 0.0%
(Repeatability)
[技术要求 (Technical characteristic): ≤3%]

4. 响应时间: 5 s
(Response time)
[技术要求 (Technical characteristic): ≤20 s]

5. 零点漂移: 0.0%FS
(Zero drift)
[技术要求 (Technical characteristic): 不超出允许误差的二分之一]

6. 示值漂移: 0.0%FS
(Indication drift)
[技术要求 (Technical characteristic): 不超出允许误差的二分之一]

说明:
(Note)

1. 结论: 被校准仪器校准结果符合技术要求。
(Conclusion: The data of instrument calibrated compliance with the technical characteristics)

2. 示值误差测量结果的扩展不确定性: ±2.4 k=2
(The expanded uncertainty of error of indication)

3. 计算测量结果不确定度的依据: JJG1059-1999 测量不确定度评定与表示
(The calculation of uncertainty in measurement according to JJG1059-1999 Evaluation and Expression of Uncertainty in Measurement.)

4. 建议校准周期为两年。
Advised the calibration period is one year.
2. **Interscan 4160-500b**

![Test Certificate Image]

- **Instrument**: Formaldehyde Gas Detector
- **Type/Model**: 4160-500b
- **Manufacturer**: INTERSCAN
- **Serial No.**: 21139
- **Name of Client**: LAWN Environmental Protection Ltd
- **Address of Client**: RoomA, 2/F, Wah Ha Factory Building, 8 Shipyard Lane, Quarry Bay, HK
- **Test Date**: 2007-07-26

**Approved by** [Signature]
# 测试环境条件及地点

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>地点</td>
<td>Location: NIM</td>
<td></td>
</tr>
<tr>
<td>气压</td>
<td>Pressure: 100.1 kPa</td>
<td></td>
</tr>
<tr>
<td>温度</td>
<td>Temperature: 28.9°C</td>
<td></td>
</tr>
<tr>
<td>湿度</td>
<td>Humidity: 58%(RH)</td>
<td></td>
</tr>
</tbody>
</table>

# 测试所使用的计量器具

<table>
<thead>
<tr>
<th>名称</th>
<th>Type/Model</th>
<th>不确定度/准确度</th>
<th>证书编号</th>
</tr>
</thead>
<tbody>
<tr>
<td>动态配气装置 (Dynamic Distributing Device)</td>
<td>DP-II</td>
<td>3%</td>
<td>赣产证第 2006-0421</td>
</tr>
<tr>
<td>秒表 (Stopwatch)</td>
<td>TS2102-2</td>
<td>0.1s/24h</td>
<td>XDsp2006-0421</td>
</tr>
</tbody>
</table>

**注:**
1. 我方仅对加盖“中国计量科学研究院测试专用章”完整证书负责
2. NIM is responsible for the whole of certificate only with test stamp of NIM
3. 本证书的测试结果仅对所测试的计量器具有效
4. The test results would be valid only for the items test
5. 本证书中英文两种语言表达，准确含义以中文为准
6. The certificate is written by Chinese and English. Exact meaning should be explained only on Chinese version

2006-04-02
测试结果

1. 外观及通电检查：良好；
Appearance and Electricity test: passed

2. 测试结果 Below the testing results

<table>
<thead>
<tr>
<th>标准值</th>
<th>仪器示值</th>
</tr>
</thead>
<tbody>
<tr>
<td>concentration of calibration gas</td>
<td>indicating Value</td>
</tr>
<tr>
<td>0.50×10⁻⁶ mol/mol</td>
<td>508×10⁻⁶ mol/mol</td>
</tr>
<tr>
<td>0.22×10⁻⁶ mol/mol</td>
<td>228×10⁻⁶ mol/mol</td>
</tr>
<tr>
<td>0.13×10⁻⁶ mol/mol</td>
<td>119×10⁻⁶ mol/mol</td>
</tr>
</tbody>
</table>

3. 重复性：＜1%；
Repeatability: ＜1%;

4. 响应时间：10min；
Response time: 10min；

以下空白

 Tested by: 曹志刚
Checked by: 刘艺锋

2006-05-04
3. Biotest HYCON Standard RCS Air Sampler
说明

Certificate No. XG120080201

1. 本中心是国家质量监督检验检疫总局在华南地区设立的国家法定计量检定机构，授权证书号为：（国）法计（2007）01043号、（国）法计（2007）01032号。
   This laboratory is the National Legal Metrological Verification Institution in southern China set up by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSiQ) under authorization certificates No.(2007)01043 & (2007)01032.

2. 本中心所出具的数据均可溯源至保存在中国计量科学研究院的国家计量基准和国际单位制(SI)。中国计量科学研究院于1999年代表中国签署了“国家计量基准及国家计量检定机构的校准和测量证书相互承认协议”。
   All data issued by this laboratory are traceable to national primary standards maintained in National Institute of Metrology (NIM) and International System of Units(SI). NIM is the signatory to the Mutual Recognition Arrangement(MRA) for national measurement standards and for calibration and measurement certificates issued by national metrology institutes.

3. 本次校准的技术依据:
   Reference documents for the calibration:
   JIG 956-2000 大气采样器检定规程 V.R.of Air Sampler

4. 本次校准所使用的主要计量标准器具:
   Major standards of measurement used in the calibration:

<table>
<thead>
<tr>
<th>设备名称/型号</th>
<th>编号</th>
<th>证书号/有效期</th>
<th>计量特性</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Equipment</td>
<td>Serial No.</td>
<td>Certificate No.</td>
<td>Metrological Characteristic</td>
</tr>
<tr>
<td>Digital Stopwatch</td>
<td>30</td>
<td>WSP20071490 /2008-09-17</td>
<td>0.01 s</td>
</tr>
<tr>
<td>Electronic Counting Tachometer</td>
<td>L813626</td>
<td>NSS200802028 /2009-01-29</td>
<td>0.1级</td>
</tr>
</tbody>
</table>

5. 校准地点、环境条件:
   Place and environmental conditions of the calibration:

   地点 本中心实验室(Lab. of SUM) 温度 (20.0±1.0) ℃ 相对湿度 ≤60% RH

6. 被校准仪器限制使用条件:
   Limiting condition of the instrument calibrated:
   ——

注: 1. 本证书校准结果只与受校准仪器有关。
   2. 未经本中心书面批准，不得部分复制此证书。
Note: 1. The results relate only to the items calibrated.
   2. This certificate shall not be reproduced except in full, without the written approval of our laboratory.
## RESULTS OF CALIBRATION

<table>
<thead>
<tr>
<th>Certification No.</th>
<th>Record No.</th>
<th>Page of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 一. 外观检查 (Appearance: pass)

### 二. 转速测量 (Tachometer):

<table>
<thead>
<tr>
<th>要素值 (BPM)</th>
<th>实测值 (RPM)</th>
<th>技术要求</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Value</td>
<td>Measured Value</td>
<td>MPE</td>
</tr>
<tr>
<td>4096</td>
<td>4082</td>
<td>±2%</td>
</tr>
</tbody>
</table>

### 三. 测量时间 (Time):

<table>
<thead>
<tr>
<th>要素值 (min)</th>
<th>实测值 (s)</th>
<th>技术要求</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Value</td>
<td>Measured Value</td>
<td>MPE</td>
</tr>
<tr>
<td>0.5</td>
<td>30.42</td>
<td>±2%</td>
</tr>
<tr>
<td>1</td>
<td>60.40</td>
<td>±2%</td>
</tr>
<tr>
<td>2</td>
<td>121.10</td>
<td>±2%</td>
</tr>
<tr>
<td>4</td>
<td>241.45</td>
<td>±2%</td>
</tr>
<tr>
<td>8</td>
<td>483.24</td>
<td>±2%</td>
</tr>
</tbody>
</table>

### 说明:

(Note)

1. 测量结果的相对扩展不确定度 (The expanded uncertainty of sampling quantity):
   - 转速 (Tachometer): $u_T = 2 \text{ BPM}$, $k = 2$;
   - 时间 (Time): $u_T = 0.29 \text{ s}$, $k = 2$;

2. 计算不确定度的依据: JJJ1059-1999测量不确定度评定与表示。
   (According to JJJ1059-1999 Evaluation and Expression of Uncertainty in Measurement.)

3. 建议校准周期不超过1年。
   The period of calibration advised within one year.