Report Administration

EQUIPMENT TESTED: Portable Oxygen Concentrator
MODEL/PART NO(S): Model 4000
SERIAL NO(S): Sample # 4
TEST DATE(S): Starting: August 30, 2013 Completing: August 30, 2013

Report Number: SC1308738 Revision Number: 0

CLIENT REQUESTER: Name: Lorenzo Subido Tel: 858-202-3161
E-mail: lorenzo.subido@chartindustries.com

TEST LOCATION: TÜV SÜD America
San Diego (Mira Mesa) Laboratory
10040 Mesa Rim Road
San Diego, CA 92121
Tel: 858 678 1400

Prepared By: Name: James E. Morris Tel: 858-673-1453
E-mail: jmorris@tuvam.com

The information presented in this report is, to the best of our knowledge, true and correct in all respects.

Tested By: Written By: Reviewed By:
Signature: James E Morris James E Morris David Gray
Name: James E Morris James E Morris David Gray
Title: Senior EMC Engineer Senior EMC Engineer EMC Engineer

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TÜV SÜD America, Inc. and its professional staff hold government and professional organization certifications for

AAMI, ACIL, AEA, ANSI, IEEE, A2LA, NIST and VCCI.
## VERSION HISTORY

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1.0 TEST STANDARDS / DOCUMENTS

1.1 The following documents were applicable to the preparation and performance of the EMC tests discussed:

RTCA/DO-160G: Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference

Other Documents: None

2.0 SUMMARY

2.1 Description of Equipment under Test:
Caire Model 4000 Portable Oxygen Concentrator.

2.2 Power Requirements:
The EUTs were designed to operate with internal battery for normal operational modes.
The EUT was not tested in charging mode as this is not a operational condition aboard aircraft.

2.3 Deviations from the Test Plan:
None

2.4 Recommendations:
None

2.5 TEST SPECIFICATION DEVIATIONS:
Additions To: None
Exclusions From: None

3.0 STATEMENT OF MEASUREMENT UNCERTAINTY
The data and results referenced in this document are accurate. The reader is cautioned that there is some measurement variability due to the tolerances of the test equipment that can contribute to a nominal product measurement uncertainty. Furthermore, component differences and manufacturing process variability of production units similar to that tested may result in additional product uncertainty. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests.

4.0 MODIFICATIONS REQUIRED TO PASS:
No modifications were implemented.
5.0 TEST CONFIGURATION AND GENERAL TEST PROCEDURES

5.1 Description of Test Site

The testing was performed at TÜV SÜD America, Inc., San Diego, California, within a Shielded Room, 20’ x 28’ x 16’, Metal, Semi-Anechoic Chamber.

5.2 Sequence of Testing

The test sequence was followed per the test engineer’s discretion.

5.3 Ambient Measurements

Ambient surveys were performed to establish background noise levels where needed. For each ambient survey, EMI test equipment configuration was as it would be for the test. Receiver sweep speed, bandwidth, etc. was the same during the ambient survey as during testing. The frequency range for each test method was swept and measured levels recorded. As a minimum, ambient levels were 6 dB below the applicable test limit.

5.4 Instrumentation

Calibration intervals and requirements of all measurement instrumentation used were in accordance with ANSI/NCSL Z540-1-1994. All instruments and model numbers used during testing are listed in each test section.

5.5 Table 1: Test Summaries and Results lists the EMI/EMC tests performed and the compliance results.

6.0 TEST SPECIFICATION DEVIATIONS:

Additions To: None
Exclusions From: None

7.0 STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are accurate. The reader is cautioned that there is some measurement variability due to the tolerances of the test equipment that can contribute to a nominal product measurement uncertainty. Furthermore, component differences and manufacturing process variability of production units similar to that tested may result in additional product uncertainty. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests.

8.0 MODIFICATIONS REQUIRED TO PASS:

Oscillator crystals were grounded.
9.0 GENERAL CONFIGURATION AND BONDING TEST PROCEDURES

9.1 Electrical Bonding

A ground plane, having physical and electrical characteristics as defined in RTCA/DO-160G, was used to electrically bond the test sample to the shielded enclosure. Bond resistance between the test sample and ground plane satisfied the resistance requirements for Class R bonds per ANSI-NCSL Z540-1-1994 (i.e., 2.5 mΩ or less). Each time the test sample was repositioned bond resistance was verified and recorded. No physical bonding to the EUT is possible.

9.2 Test Configuration

The general EMI/EMC test configuration was as shown in photographs for each setup.

<table>
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<th>RTCA/DO-160G</th>
<th>Description</th>
<th>Result</th>
<th>Appendix</th>
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<td>SECTION 21</td>
<td>RTCA/DO-160G, SECTION 21 RADIATED RF EMMISIONS, Radiated Emissions, Electric Field, 100 MHz to 6 GHz, Category M</td>
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</table>
SECTION 21 RADIATED RF EMMISSIONS Category M.
**Test Conditions: SECTION 21 RADIATED RF EMMISIONS** –
The *SECTION 21 RADIATED RF EMMISIONS* test was performed in the following test location at the San Diego Testing Facility:

SR4, Shielded Room, 20’ x 28’ x 16’, Metal, Semi-Anechoic Chamber

**Test Equipment Used:**

**Table 2: SECTION 21 RADIATED RF EMMISIONS Test Equipment List**

<table>
<thead>
<tr>
<th>Model No.:</th>
<th>Prop. No.:</th>
<th>Manufacturer:</th>
<th>Description:</th>
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<td>3115</td>
<td>SDGE06475</td>
<td>EMCO</td>
<td>DOUBLE RIDGE GUIDE ANT</td>
<td>9908-5927</td>
<td>19 Dec 13</td>
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<td>94455-1</td>
<td>SDGE06611</td>
<td>Eaton</td>
<td>Antenna, Biconical</td>
<td>0811</td>
<td>23 Aug 14</td>
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<tr>
<td>96000</td>
<td>SDGE06720</td>
<td>Eaton</td>
<td>Antenna, Double Ridge Horn</td>
<td>2278</td>
<td>17 Nov 13</td>
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<td>E4446A</td>
<td>SDGE06823</td>
<td>Agilent</td>
<td>SPECTRUM ANALYZER, PSA</td>
<td>US443300486</td>
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<td>ZFL-1000</td>
<td>SDGE06386</td>
<td>TÜV SÜD America</td>
<td>Pre-Amplifier</td>
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<td>SML03</td>
<td>SDGE07496</td>
<td>Rohde Schwarz</td>
<td>Signal Generator</td>
<td>100931</td>
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**Test Specification:**

- **Frequency:** 100 MHz – 6 GHz
- **Ambient:** Performed
- **Test Distance:** 1 meter
- **Antenna Polarization:** Vertical / Horizontal
- **Electrical Continuity Check:** Yes
- **Test Type:** Peak
- **Bandwidths:**
  - 10kHz (100 MHz – 400 MHz)
  - 100 kHz (400 MHz – .98 GHz)
  - 1 MHz (.98 – 6 GHz)

**Result:** Positive

**Remarks:** See Test Plan and RTCA/DO-160G for test procedures and limit.
Photograph of Test Setup:

SECTION 21 RADIATED RF EMMISIONS Radiated Emissions

Photograph 1: SECTION 21 RADIATED RF EMMISIONS 100 MHz to 200 MHz,
Biconical Antenna 1 m Setup
Photograph 2: SECTION 21 RADIATED RF EMMISIONS 200 MHz to 1 GHz, Double Ridge Guide 1m Setup
Photograph 3: SECTION 21 RADIATED RF EMMISIONS 1 GHz to 6 GHz, Double Ridge Guide Antenna
Appendix B.

Accreditations
SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

TUV SUD AMERICA INC.
10040 Mesa Rim Road
San Diego, CA 92121

Mr. Barry Quinlan  bquinlan@tuvam.com
Phone: 978-573-2528

Valid to: December 31, 2013  Certificate Number: 2955.13

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following EMC (electromagnetic compatibility) and Telecommunications tests.

Test Technology: Test Method(s):¹

**Emissions**²

| Generic (Commercial) | IEC/EN 61000-6-1; KN 61000-6-1; AS/NZS 61000.6.1; IEC/EN 61000-6-2; KN 61000-6-2; AS/NZS 61000.6.2; IEC/EN 61000-6-3; KN 61000-6-3; AS/NZS 61000.6.3; IEC/EN 61000-6-4; KN 61000-6-4; AS/NZS 61000.6.4; CISPR 13; EN 50121-3-2; EN 50155; EN 55013; KN 13; CISPR 20; KN 20 (only for audio/video equipment without tuner); CISPR 24; EN 55024; KN 24; CISPR 25; EN 50130-4; EN 55014; CISPR 14-1; KN 14-1; CISPR 14-2; KN 14-2; EN 55014-2; EN 55103-1; EN 55103-2; EN 61326-1; EN 61326-1-1; EN 61326-2-2; IEC 60601-1-2; EN 60601-1-2; EN 60601-2-2; EN 60601-2-2; EN 60601-2-2; EN 60601-2-2; EN 60601-2-2; EN 301 437; EN 300 386; EN 301 449 EN 301 511; EN 301 489-1 to -34; EN 301 908-1 to -22; ES 203 021; KN 301 489-01; KN 301 489-7; EN 301 489-17; KN 301 489-24; RTCA/DO-160 D, F¹ (section 21); RTCA/DO-160 E¹ (section 21)

**Radiated & Conducted**

Code of Federal Regulation (CFR) 47, FCC Part 18 (using FCC MP-5); EN 55011; KN 11; CISPR 11; AS/NZS CISPR 11; ICES-001; EN 55022; KN 22; CISPR 22; AS/NZS CISPR 22; ICES-003; CNS 13438 (up to 6 GHz); VCCI V.3 (up to 6 GHz); ICES-005; ICES-006; TEC/EMI/TEL-001/01/FEB-09; TCN 7189-2009 (CISPR 22:2006)

**Harmonics**

IEC 61000-3-2; EN 61000-3-2

**Voltage Flicker / Fluctuations**

IEC 61000-3-3; EN 61000-3-3

(A2LA Cert No. 2955.13) Revised 08/01/2013

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5301 Buckeystown Pike, Suite 350  |  Frederick, Maryland 21704-8373  |  Phone: 301 644 3248  |  Fax: 301 662 2974  |  www.A2LA.org

TÜV SÜD America Inc  10040 Mesa Rim Road  San Diego CA 92121  Tel: 858 673 1400  Fax: 858 546 0364  Form Rev. 0
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\(^{2}\) Immunity \(^{3}\) RTCA/DO-160
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MED (Cont'd)

Test Method(s):

EN 60601-1-8 (2006);  
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EN 60601-2-2 (2007, 2009+A1);  
EN 60601-2-4 2003, 2011);  
EN 60601-2-10 (2000+A1);  
EN 60601-2-12 (2006);  
EN 60601-2-19 (1996+A1, 2006+A11);  
EN 60601-2-20 (2009+A11);  
EN 60601-2-21 (1996+A1, 2009+A11);  
EN 60601-2-24 (1998);  
EN 60601-2-26 (1994, 2003);  
EN 60601-2-29 (1995+A1, 1999, 2008+A11);  
EN 60601-2-30 (1995, 2000);  
EN 60601-2-31 (1995+A1, 2006+A1);  
EN 60601-2-34 (2000);  
EN 60601-2-36 (1997);  
EN 60601-2-38 (1996+A1);  
EN 60601-2-40 (1998);  
EN 60601-2-41 (2000, 2009+A11);  
EN 60601-2-47 (2001);  
EN 60601-2-51 (2003);  
EN 62304 (2006);  
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UL 60601-1 (2003);  
CAN/CSA C22.2 No. 601.1-M90);  
CAN/CSA C22.2 No. 60601-1-08);  
CAN/CSA C22.2 No. 60601-1-1 (2002);  
CAN/CSA C22.2 No. 60601-1-4 (2002);  
CAN/CSA C22.2 No. 60601-1-6 (2008, 2011);  
CAN/CSA C22.2 No. 60601-1-8 (2005, 2008);  
CAN/CSA C22.2 No. 60601-1-11 (2011);  
CAN/CSA C22.2 No. 60601-2-2 (2008, 2009);  
CAN/CSA C22.2 No. 601.2.4 (1992);  
CAN/CSA C22.2 No. 60601-2-18 (2011);  
CAN/CSA C22.2 No. 60601-2-19 (2009);  
CAN/CSA C22.2 No. 60601-2-20 (2010);  
CAN/CSA C22.2 No. 60601-2-21 (2010);  
CAN/CSA C22.2 No. 60601-2-22 (2001, 2008);  
CAN/CSA C22.2 No. 60601-2-23 (2002, 2012);  
CAN/CSA C22.2 No. 60601-2-27 (2006, 2011);  
CAN/CSA C22.2 No. 60601.2.29 (2002, 2010);  
CAN/CSA C22.2 No. 60601.2-30 (2001, 2002);  
CAN/CSA C22.2 No. 60601.2-31 (2009);  
CAN/CSA C22.2 No. 60601.2-40 (2001);
### Test Technology: Test Method(s)

**Product Safety Tests (Cont’d)**

**MED (Cont’d)**

- CAN/CSA C22.2 No. 60601-2-41 (2002, 2011);
- CAN/CSA C22.2 No. 60601.2.49 (2004, 2011);
- ANSI/AAMI ES 60601-1 (2005);
- AAMI HA 60601-1-11 (2011);
- AAMI IEC 60601-2-2 (2006, 2009);
- AAMI IEC 60601-2-4 (2010);
- AAMI IEC 60601-2-19 (2009);
- AAMI IEC 60601-2-20 (2009);
- AAMI IEC 60601-2-21 (2000+A1, 2009);
- AAMI IEC 60601-2-25 (2011);
- AAMI IEC 60601-2-47 (2012);
- AAMI IEC 62304 (2006);
- AAMI IEC 62366 (2007);
- ISO 80601-2-12 (2011);
- EN ISO 80601-2-12 (2011);
- ISO 80601-2-55 (2011);
- EN ISO 80601-2-55 (2011);
- ISO 80601-2-61 (2011);
- EN ISO 80601-2-61 (2011);

**MISC**

- IEC 60823-1 (1993+A1+A2, 2007);
- IEC 60825-2 (2000, 2004+A1+A2);
- CAN/CSA-E60825-1-03 (R2012)

**OFF**

- IEC 60950 (1991+A1+A2+A3+A4, 1999);
- IEC 60950-1 (2001, 2005+A1);
- IEC 60950-22 (2005);
- IEC 62040-1-1 (2004);
- IEC 62040-1 (2008);
- CAN/CSA-C22.2 NO. 60950.1-07 (R2012);
- CAN/CSA-C22.2 NO. 60950-22-07 (R2012);
- UL 60950-22 Ed. 1 (2007);
- UL 60950-1 Ed. 1 (2003, 2007);

**TRON**

- IEC 60065 (2001+A1+A2);
- UL 60065 Ed. 7 (2003)

**SAFE**

- IEC 61558-1 (2005+A1);
- IEC 61558-2-6 (2009)
**Test Technology:**

**Radio Tests**

ANSI/TIA 603-C-2004; EN 300 220-1; EN 300 220-2;
EN 300 220-3; EN 300 330-1; EN 300 330-2; EN 300 440-1;
EN 300 440-2; EN 301 357-2; EN 300 328; EN 300 761-1;
EN 301 426; EN 301 427; EN 301 428; EN 301 444; EN 301 839;
EN 301 893; EN 302 501; EN 302 291-1; EN 302 291-2;
EN 302 208-1; EN 302 208-2; EN 300 761-2;
EN 301 908-1-22; EN 601 681;
AS/NZS 4268; NOM-121-SCFI-2009; LP0002;
QCVM 47:2011/BITTTT (2450 MHz to 10.5 GHz);
ANATEL Resolution 506; ARIB STD-T66 (v2.1);
RSS-GEN; RSS-102; RSS-111; RSS-112; RSS-117; RSS-119;
RSS-123; RSS-125; RSS-127; RSS-131; RSS-132; RSS-133;
RSS-134; RSS-135; RSS-137; RSS-138; RSS-139; RSS-141;
RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192;
RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210;
RSS-213; RSS-215; RSS-220; RSS-236; RSS-243; RSS-287;
RSS-288; RSS-310;
47 CFR (FCC Rules) Parts 2 and 11;
47 CFR (FCC Rules) Part 18 using FCC MP-5;
47 CFR (FCC Rules) Parts 22 (cellular and non-cellular), 24, 25,
27, 73, 74, 80, 87, 90, 95, 97 and 101 using Part 2 and ANSI/TIA
601-C-2004;
HKCA 1002 (issue 6); HKCA 1003 (issue 4);
HKCA 1007 (issue 5); HKCA 1008 (issue 3);
HKCA 1033 (issue 7); HKCA 1035 (issue 6); HKCA 1039 (issue 4);
HKCA 1042 (issue 2);
HKCA 1043 (issue 4); HKCA 1048 (issue 2);
HKCA 1049 (issue 1);
HKCA 1052 (issue 2); HKCA 1054 (issue 1);
HKCA 1057 (issue 1); HKCA 1061 (issue 1);
IDA TS LMR (Issue 1, Rev 4);
IDA TS WBA (Issue 1, Rev 2);
IDA TS GMPCS (Issue 1, Rev 4);
IDA TS SRD (Issue 1, Rev 7);
IDA TS CMT (Issue 1, 2011);
IDA TS UWB (Issue 1, Rev 1);
LP0002 (2011), ARIB STD-66;
QCVM 11:2010/BITTTT; QCVM 12:2010/BITTTT;
QCVM 13:2010/BITTTT; QCVM 15:2010/BITTTT;
QCVM 18:2010/BITTTT; QCVM 54:2011/BITTTT;
QCVM 55:2011/BITTTT;
NOM-121-SCFI-2009;
PLMN01 (2007); PLMN08 (2007); RTET01 (2007);
IEC 62209 - Part 1, Part 2; EN 62209 - Part 1, Part 2;
EN 50360, EN 50364; EN 50371; IEC 62311; EN 62311
Test Technology:  

**Military Emissions & Immunity**

**Emissions Tests:**
- MIL-STD-462 (methods RE01, RE02, RE03, CE01, CE02, CE03, CE04, CE06, CE07);
- MIL-STD-462 D (methods RE101, RE102, RE103, CE101, CE102, CE106);
- MIL-STD-461 E (methods RE101, RE102, RE103, CE101, CE102, CE106);
- MIL-STD-461 F (methods RE101, RE102, RE103, CE101, CE102, CE106)

**Immunity Tests:**
- MIL-STD-462 (methods RS01, RS02, RS03, CS03, CS04, CS05, CS07, CS12, CS13);
- MIL-STD-462 D (methods RS101, RS103, CS101, CS103, CS104, CS105, CS109, CS114, CS115, CS116);
- MIL-STD-461 E (methods CS101, CS103, CS104, CS105, CS109, CS114, CS115, CS116);

**Technical Regulations for the Republic of Korea**

**Technical Requirements for Electromagnetic Interference**
- (RRA Public Notification 2012-13, June 28, 2012);
- (RRA Public Notification 2012-14, June 28, 2012);
- Test Methods for Electromagnetic Interference (RRA Announce 2012-21, June 28, 2012);
- Test Methods for Electromagnetic Susceptibility (RRA Announce 2012-21, June 28, 2012);
- Notice on Conformity Assessment of Broadcasting and Communications Equipment (RRA Public Notification 2012-16, Sept 24, 2012)

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1 When the date, revision or edition of a test method standard is not identified on the scope of accreditation, the laboratory is required to be using the current version within one year of the date of publication, per part C., Section 1 of A2LA R101 - General Requirements - Accreditation of ISO-IEC 17025 Laboratories. If a specifier/regulator imposes a different transition period, this will supersede the A2LA one year implementation period.

2 This laboratory utilizes a 10m Semi-Anechoic Chamber (SAC) located at 16530 Via Espirito, San Diego, CA

3 Single stroke waveform only, 1, 2, 3, 4, 5B

4 Laboratory utilizes RADHAZ procedures for high level testing

(A2LA Cert. No. 2955.13) Revised 08/01/2013
Accredited Laboratory

American Association for Laboratory Accreditation

A2LA has accredited

TUV SUD AMERICA INC.
San Diego, CA
for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-IEC-ILAC-GIF Communiqué dated 8 January 2009).

Presented this 17th day of June 2013.

[Signature]

President & CEO
For the Accreditation Council
Certificate Number 2935.13
Valid to December 31, 2013
Revised July 24, 2013

For the tests or types of tests to which this accreditation applies, please refer to the laboratory’s Electrical Scope of Accreditation.