

EMISSIONS TEST REPORT

Report Number: 3137303BOX-001

Project Number: 3137303

Testing performed on the

SenseWear Armband

Model: FF 2.4 Armband

To

FCC Part 15 Subpart B

For

BodyMedia, Inc.

Test Performed by:
Intertek – ETL SEMKO
70 Codman Hill Road
Boxborough, MA 01719

Test Authorized by:
BodyMedia, Inc.
4 Smithfield Street Suite 1200
Pittsburgh, PA 15222

Prepared by: Vathana Ven
Vathana Ven

Date: 11/19/2007

Reviewed by: Jeff Goulet
Jeff Goulet

Date: 11-19-07

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company: BodyMedia, Inc.
4 Smithfield Street Suite
1200
Pittsburgh, PA 15222
Contact: Mr. Scott Boehmke
Telephone: 412-288-9901 x1041
Fax: 412-288-9902
Email: skb@bodymedia.com

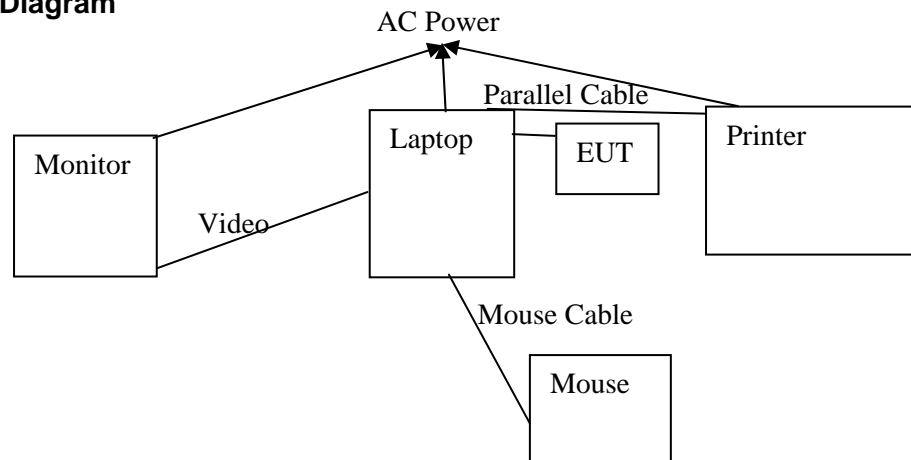
1.2 Equipment Under Test

Equipment Type: SenseWear Armband
Model Number(s): FF 2.4 Armband
Serial number(s): BOX0709251031-001
Manufacturer: BodyMedia, Inc.
EUT receive date: 09/25/2007
EUT received condition: Prototype in Good Condition
Test start date: 11/15/2007
Test end date: 11/15/2007

1.3 Test Plan Reference: Tested according to the standards listed and ANSI C63.4:2003.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2. Cables:

| Cable Length (m) Qty. | Shielding | Connector | | |
|--------------------------|-----------|----------------|-----|---|
| Laptop DC Mains | Braid | Metal/360 Jack | 1.8 | 1 |
| Laptop AC Mains | None | Plastic | 0.3 | 1 |
| Printer Parallel | Braid | Metal/360 DB25 | 1.7 | 1 |
| Video | Braid | Metal/360 DB15 | 1.5 | 1 |
| Mouse RS-232 | Foil | Metal/360 DB9 | 2.4 | 1 |
| Monitor AC Mains | None | Plastic | 1.8 | 1 |
| Printer AC Mains | None | Plastic | 1.9 | 1 |
| Armband USB | Braid | Metal/360 USB | 1.8 | 1 |

1.4.3. Support Equipment:

Name: Compaq laptop
Model No.: J07M040.00
Serial No.: Not labeled

Name: Dell monitor
Model No.: Vi1439U
Serial No.: 73536AAKCK24

Name: Compaq ac adapter
Model No.: PPP005L
Serial No.: Not labeled

Name: Epson Stylus Printer
Model No.: P930A
Serial No.: AZN1057576

Name: Microsoft Mouse
Model No.: Serial – PS/2 Compatible Mouse
Serial No.: 0021122

1.5 Mode(s) of Operation:

The EUT was connected to the Compaq laptop host laptop and was powered normally from the USB port. The EUT was not transmitting during testing.

2.0 Test Summary

| TEST STANDARD | RESULTS | |
|-----------------------------|--|---------|
| FCC Part 15 Subpart B | | |
| SUB-TEST | TEST PARAMETER | COMMENT |
| Radiated Emissions | Emissions must be below Class B limits | Pass |
| AC Line-Conducted Emissions | Emissions must be below Class B limits | Pass |

REVISION SUMMARY – The following changes have been made to this Report:

| | | | | | |
|-------------|----------------|----------------|----------------|-------------|------------------------------|
| <u>Date</u> | <u>Project</u> | <u>Project</u> | <u>Page(s)</u> | <u>Item</u> | <u>Description of Change</u> |
| | <u>No.</u> | <u>Handler</u> | | | |

3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V
 AF = 7.4 dB/m
 CF = 1.6 dB
 AG = 29.0 dB
 FS = 32 dB μ V/m

$$\text{Level in } \mu\text{V/m} = [10(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

The following is how net line-conducted readings were determined:

$$NF = RF + LF + CF + AF$$

Where

- NF = Net Reading in dB μ V
- RF = Reading from receiver in dB μ V
- LF = LISN Correction Factor in dB
- CF = Cable Correction Factor in dB
- AF = Attenuator Loss Factor in dB

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where UF = Net Reading in } \mu\text{V}$$

Example:

$$NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 \text{ dB}\mu\text{V}$$

$$UF = 10^{(49.1 \text{ dB}\mu\text{V} / 20)} = 254 \mu\text{V/m}$$

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.

The expanded uncertainty ($k = 2$) for radiated emissions from 30 to 1000 MHz has been determined to be:
 ± 3.5 dB at 10m, ± 3.8 dB at 3m

The expanded uncertainty ($k = 2$) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 2.6 dB

The expanded uncertainty ($k = 2$) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:

± 3.2 for ISN and voltage probe measurements

± 3.1 for current probe measurements

3.2 Site Description

Test Site(s): 3

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

Test Results: Pass

Test Standard: FCC Part 15 Subpart B

Test: Radiated Emissions

Performance Criterion: Emissions must be below Class B limits

Test Environment:

| | | | | | | |
|--|---------------|----|-----------------------|-------------------|-----------------|-----|
| Environmental Conditions During Testing: | Ambient (°C): | 21 | Humidity (%): | 50 | Pressure (hPa): | 985 |
| Pretest Verification Performed | Yes | | Equipment under Test: | FF 2.4 Armband | | |
| Test Engineer(s): | Vathana Ven | | EUT Serial Number: | BOX0709251031-001 | | |

Test Equipment Used:

| TEST EQUIPMENT LIST | | | | | |
|---------------------|------------------------------------|------------------|-------------------|------------|---------------|
| Item | Equipment Type | Make | Model No. | Serial No. | Next Cal. Due |
| 1 | Digital 4 Line Barometer | Mannix | 0ABA116 | BAR3 | 05/20/2008 |
| 2 | 9kHz to 3GHz EMI Test Receiver | Rohde & Schwartz | ESCI 1166.5950K03 | 100067 | 12/19/2007 |
| 3 | 10 Meter in floor cable for site 3 | ITS | RG214B/U | S3 10M FLR | 09/17/2008 |
| 4 | Spectrum Analyzer | Agilent | E7405A | US40240205 | 08/09/2008 |
| 5 | High Frequency Cable 40GHz | Megaphase | TM40 K1K1 197 | CBL028 | 12/04/2007 |
| 6 | High Frequency Cable 40GHz | Megaphase | TM40 K1K1 80 | CBL030 | 12/04/2007 |
| 7 | ANTENNA | EMCO | 3142 | PRE9 | 02/06/2008 |
| 8 | HORN ANTENNA | EMCO | 3115 | 9610-4980 | 06/18/2008 |
| 9 | ANTENNA, RIDGED GUIDE, 18-40 GHZ | EMCO | 3116 | 2090 | 12/13/2007 |

Software Utilized:

| Name | Manufacturer | Version |
|----------------|-----------------------|------------------|
| EXCEL 2000 | Microsoft Corporation | 9.0.6926 SP-3 |
| EMI BOXBOROUGH | Intertek | 3/07/07 Revision |

Test Results:

Radiated Emissions

Company: BodyMedia
 Model #: FF 2.4 Armband
 Serial #: BOX0709251031-001
 Engineers: Vathana Ven
 Project #: 3137303
 Standard: FCC Part 15 Subpart B Class B
 Receiver: R&S ESCI (ROS002)
 PreAmp: PRE9 3-25-08.txt
 Barometer: BAR2
 Temp/Humidity/Pressure: 21 deg. C 50% 985 mB
 PreAmp Used? (Y or N): N
 Voltage/Frequency: 120 Vac/60 Hz
 Frequency Range: 30 MHz - 1 GHz
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Antenna & Cables: N Bands: N, LF, HF, SHF
 LF Antenna: NONE.
 N Antenna: LOG4 06-05-08 V10.txt LOG4 06-05-08 H10.txt
 HF Antenna: HORN3 V1m 6-18-08.txt HORN3 H1m 6-18-08.txt
 SHF Antenna: NONE.
 LF Cable(s): NONE.
 N Cable(s): S3 10M FLR 9-17-08.txt
 HF Cable(s): CBL028 12-04-2007.txt CBL030 12-04-2007.txt
 SHF Cable(s): NONE.

| Detector Type | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB | Bandwidth |
|---------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|--------------|----------------|-----------|-------------|
| QP | V | 39.420 | 7.0 | 11.6 | 0.9 | 0.0 | -10.5 | 30.0 | 40.0 | -10.0 | 120/300 kHz |
| QP | V | 74.224 | 15.0 | 6.4 | 1.3 | 0.0 | -10.5 | 33.2 | 40.0 | -6.8 | 120/300 kHz |
| QP | V | 124.944 | 7.0 | 6.8 | 1.7 | 0.0 | -10.5 | 25.9 | 43.5 | -17.6 | 120/300 kHz |
| QP | V | 265.800 | 7.0 | 12.8 | 2.5 | 0.0 | -10.5 | 32.8 | 46.0 | -13.2 | 120/300 kHz |
| QP | H | 299.204 | 5.0 | 13.2 | 2.7 | 0.0 | -10.5 | 31.4 | 46.0 | -14.6 | 120/300 kHz |
| QP | H | 465.104 | 4.0 | 17.9 | 3.5 | 0.0 | -10.5 | 35.8 | 46.0 | -10.2 | 120/300 kHz |

Radiated Emissions

Company: BodyMedia
 Model #: FF 2.4 Armband
 Serial #: BOX0709251031-001
 Engineers: Vathana Ven
 Project #: 3137303
 Standard: FCC Part 15 Subpart B Class B
 Receiver: Agilent E7405A (AGL001)
 PreAmp: PRE9 3-25-08.txt
 Barometer: BAR2
 Temp/Humidity/Pressure: 21 deg. C 50% 985 mB
 PreAmp Used? (Y or N): Y
 Voltage/Frequency: Battery power
 Frequency Range: 1 - 25 GHz
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Antenna & Cables: HF Bands: N, LF, HF, SHF
 LF Antenna: NONE.
 N Antenna: LOG4 06-05-08 V10.txt LOG4 06-05-08 H10.txt
 HF Antenna: HORN3 V1m 6-18-08.txt HORN3 H1m 6-18-08.txt
 SHF Antenna: NONE.
 LF Cable(s): NONE.
 N Cable(s): S3 10M FLR 9-17-08.txt
 HF Cable(s): CBL028 12-04-2007.txt CBL030 12-04-2007.txt
 SHF Cable(s): NONE.

| Detector Type | Ant. Pol. (V/H) | Frequency MHz | Reading dB(uV) | Antenna Factor dB(1/m) | Cable Loss dB | Pre-amp Factor dB | Distance Factor dB | Net dB(uV/m) | Limit dB(uV/m) | Margin dB | Bandwidth | |
|---------------|-----------------|---------------|----------------|------------------------|---------------|-------------------|--------------------|--------------|----------------|-----------|-----------|-----|
| QP | H | 1008.184 | 34.0 | 24.3 | 2.7 | 28.8 | 0.0 | 32.3 | 54.0 | -21.7 | 1/3 MHz | FCC |
| QP | H | 1063.184 | 29.0 | 24.5 | 2.8 | 28.8 | 0.0 | 27.5 | 54.0 | -26.5 | 1/3 MHz | RB |
| QP | H | 1195.884 | 29.0 | 25.0 | 3.0 | 28.8 | 0.0 | 28.2 | 54.0 | -25.8 | 1/3 MHz | RB |
| QP | H | 1463.884 | 26.0 | 26.0 | 3.3 | 28.8 | 0.0 | 26.5 | 54.0 | -27.5 | 1/3 MHz | RB |
| QP | H | 1593.884 | 25.0 | 26.5 | 3.5 | 28.7 | 0.0 | 26.3 | 54.0 | -27.7 | 1/3 MHz | RB |

FCC Part 15 Subpart B Radiated Emissions Setup Photos



FCC Part 15 Subpart B Radiated Emissions Setup Photos continue



Test Results: Pass

Test Standard: FCC Part 15 Subpart B

Test: AC Line-Conducted Emissions

Performance Criterion: Emissions must be below Class B limits

Test Environment:

| | | | | | | |
|--|---------------|----|-----------------------|-------------------|-----------------|-----|
| Environmental Conditions During Testing: | Ambient (°C): | 21 | Humidity (%): | 55 | Pressure (hPa): | 983 |
| Pretest Verification Performed | Yes | | Equipment under Test: | FF 2.4 Armband | | |
| Test Engineer(s): | Vathana Ven | | EUT Serial Number: | BOX0709251031-001 | | |

Test Equipment Used:

| TEST EQUIPMENT LIST | | | | | |
|---------------------|------------------------------|-------------------|------------------|------------|---------------|
| Item | Equipment Type | Make | Model No. | Serial No. | Next Cal. Due |
| 1 | Digital 4 Line Barometer | Mannix | 0ABA116 | BAR3 | 05/20/2008 |
| 2 | Spectrum Analyzer | Agilent | E7405A | US40240205 | 08/09/2008 |
| 3 | 30 ft 50 ohm coax, BNC - BNC | ITT Pomona | RG 58 C/U | CBLBNC7 | 11/06/2008 |
| 4 | Attenuator, 20dB | Mini Circuits | 20dB, 50 ohm | DS24 | 09/18/2008 |
| 5 | LISN, 50uH, .01 - 50MHz, 24A | Solar Electronics | 9252-50-R-24-BNC | 955107 | 04/11/2008 |

Software Utilized:

| Name | Manufacturer | Version |
|----------------|-----------------------|------------------|
| EXCEL 2000 | Microsoft Corporation | 9.0.6926 SP-3 |
| EMI BOXBOROUGH | Intertek | 3/07/07 Revision |

Test Results:

Conducted Emissions

Company: BodyMedia
 Model #: FF 2.4 Armband
 Serial #: BOX0709251031-001
 Engineer(s): Vathana Ven
 Project #: 500052357
 Standard: FCC Part 15 Subpart B Class B
 Barometer: BAR3
 Temp/Humidity/Pressure: 21 deg. C 55% 983 mB
 Voltage/Frequency: 120 Vac/60 Hz
 Frequency Range: 0.150-30 MHz
 Receiver: Agilent E7405A (AGL001)
 Cable: CBLBNC7 11-06-08.txt
 LISN 1: LISN13 [1] 4-11-08.lsn
 LISN 2: LISN13 [2] 4-11-08.lsn
 LISN 3: NONE
 LISN 4: NONE
 Attenuator: DS24 9-18-08.txt
 Location: Site 3
 Date: 11/15/07
 Net is the sum of worst-case lsn, cable, & attenuator losses, and initial reading, factors are not shown
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor; Bandwidth denoted as RBW/VBW

| Detector Type | Frequency MHz | Reading Line 1 dB(uV) | Reading Line 2 dB(uV) | Reading Line 3 dB(uV) | Reading Line 4 dB(uV) | Net dB(uV) | QP Limit dB(uV) | Margin dB | Bandwidth |
|---------------|---------------|-----------------------|-----------------------|-----------------------|-----------------------|------------|-----------------|-----------|-----------|
| QP | 0.150 | 22.0 | 21.0 | | | 43.6 | 66.0 | -22.4 | 9/30 kHz |
| QP | 0.205 | 31.0 | 30.0 | | | 52.6 | 63.4 | -10.8 | 9/30 kHz |
| QP | 0.479 | 24.0 | 23.0 | | | 45.6 | 56.4 | -10.8 | 9/30 kHz |
| QP | 0.889 | 22.0 | 21.0 | | | 43.6 | 56.0 | -12.4 | 9/30 kHz |
| QP | 1.201 | 19.0 | 18.0 | | | 40.6 | 56.0 | -15.4 | 9/30 kHz |
| QP | 2.255 | 16.0 | 15.0 | | | 37.6 | 56.0 | -18.4 | 9/30 kHz |

| Detector Type | Frequency MHz | Reading Line 1 dB(uV) | Reading Line 2 dB(uV) | Reading Line 3 dB(uV) | Reading Line 4 dB(uV) | Net dB(uV) | Average Limit dB(uV) | Margin dB | Bandwidth |
|---------------|---------------|-----------------------|-----------------------|-----------------------|-----------------------|------------|----------------------|-----------|-----------|
| AVG | 0.150 | 15.0 | 15.0 | | | 36.6 | 56.0 | -19.4 | 9/30 kHz |
| AVG | 0.205 | 22.0 | 21.0 | | | 43.6 | 53.4 | -9.8 | 9/30 kHz |
| AVG | 0.479 | 21.0 | 21.0 | | | 42.6 | 46.4 | -3.8 | 9/30 kHz |
| AVG | 0.889 | 19.0 | 19.0 | | | 40.6 | 46.0 | -5.4 | 9/30 kHz |
| AVG | 1.201 | 16.0 | 4.0 | | | 37.6 | 46.0 | -8.4 | 9/30 kHz |
| AVG | 2.255 | 11.0 | 11.0 | | | 32.6 | 46.0 | -13.4 | 9/30 kHz |

FCC Part 15 Subpart B AC Line-Conducted Emissions Setup Photos



FCC Part 15 Subpart B AC Line-Conducted Emissions Setup Photos

