

**Advanced  
Compliance Laboratory**

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## **ELECTROMAGNETIC EMISSION COMPLIANCE REPORT**

of

SAMPLE BOX SCANNER  
MODEL: BOXMAPPER II  
FCC ID: 2AMHY-BM02

July 12<sup>th</sup> , 2017

This report concerns (check one): Original grant ☒ Class II change \_\_\_\_\_  
Equipment type: Low Power Intentional Radiator

Deferred grant requested per 47 CF 0.457(d)(1)(ii)? yes \_\_\_\_\_ no ☒  
If yes, defer until: \_\_\_\_\_ (date)  
Company agrees to notify the Commission by \_\_\_\_\_ (date)  
of the intended date of announcement of the product so that the grant can be  
issued on that date.

Transition Rules Request per 15.37? yes \_\_\_\_\_ no ☒  
If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR  
[10-1-90 Edition] provision.

Report prepared for: BIOTILLION LLC.  
Report prepared by: Advanced Compliance Lab  
Report number: 0048-170607-01-FCC-LF



**Lab Code: 200101**

The test result in this report IS supported and covered by the NVLAP accreditation

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## 1. GENERAL INFORMATION

### 1.1 Verification of Compliance

EUT: SAMPLE BOX SCANNER

Model: BOXMAPPER II

Applicant: BIOTILLION LLC.

Test Type: FCC Part 15C CERTIFICATION

Result: PASS

Tested by: ADVANCED COMPLIANCE LABORATORY

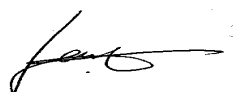
Test Date: June 07, 2017 ~ July 12, 2017

Report Number: 0048-170607-01-FCC-LF

The above equipment was tested by Compliance Laboratory, Advanced Technologies, Inc. for compliance with the requirement set forth in the FCC rules and regulations Part 15 subpart C. This said equipment in the configuration described in the report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

|                                 | Prob. Dist. | Uncertainty(dB) | Uncertainty(dB) | Uncertainty(dB) |
|---------------------------------|-------------|-----------------|-----------------|-----------------|
|                                 |             | 30-1000MHz      | 1-6.5GHz        | Conducted       |
| Combined Std. Uncertainty $u_c$ | norm.       | $\pm 2.36$      | $\pm 2.99$      | $\pm 1.83$      |



Wei Li  
Lab Manager  
Advanced Compliance Lab

Date: July 12, 2017

## **1.2 Equipment Modifications**

N/A

### 1.3 Product Information

#### System Configuration

| ITEM            | DESCRIPTION                                                              | FCC ID       | CABLE |
|-----------------|--------------------------------------------------------------------------|--------------|-------|
| Product         | SAMPLE BOX SCANNER<br>BOXMAPPER II (1)                                   | 2AMHY-BM02   |       |
| Housing         | Plastic w / metal bottom                                                 |              |       |
| Power Supply    | AC/DC Adaptor<br>Input:100-240V~/0.3A,<br>50-60Hz<br>Output: 6.0Vdc/2.0A |              |       |
| Operation Freq. | 13.56MHz                                                                 |              |       |
| Device Type     | Sec. 15.225 Operation                                                    |              |       |
| Receiver        | BOXMAPPER II(RX)                                                         | Verification |       |

(1) EUT submitted for grant.

### 1.4 Test Methodology

Radiated tests were performed according to the procedures in ANSI C63.4-2014 & ANSI C63.10-2013 at an antenna to EUT distance of 30 & 3 meters.

### 1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at Hillsborough, New Jersey. This site has been accepted by FCC to perform measurements under Part 15 or 18 in a letter dated May 19, 1997 (Refer to: 31040/PRV 1300F2). The NVLAP Lab code for accreditation of FCC EMC Test Method is: 200101-0.

### 1.6 Test Equipment

| Manufacture     | Model   |  | Serial No. | Description                      | Cal Due<br>dd/mm/yy |
|-----------------|---------|--|------------|----------------------------------|---------------------|
| Hewlett-Packard | HP8546A |  | 3448A00290 | EMI Receiver                     | 25/09/17            |
| Agilent         | E4440A  |  | US40420700 | 3Hz-26.5GHz Spectrum<br>Analyzer | 17/06/18            |
| R & S           | ESPI    |  | 100018     | 9KHz-7GHz EMI Receiver           | 25/08/17            |
| EMCO            | 3104C   |  | 9307-4396  | 20-300MHz Biconical Antenna      | 12/11/17            |
| EMCO            | 3146    |  | 9008-2860  | 200-1000MHz Log-Periodic         | 13/11/17            |

|                  |            |  |            |                                       |          |
|------------------|------------|--|------------|---------------------------------------|----------|
|                  |            |  |            | Antenna                               |          |
| ARA              | MWH-1826/B |  | 1013       | 18-26GHZ Horn Antena                  | 10/02/18 |
| EMCO             | 3115       |  | 49225      | Double Ridge Guide Horn Antenna       | 28/11/17 |
| Electro-Meterics | ALR-25M/30 |  | 289        | 10KHz-30MHz Active Loop Antenna       | 28/05/18 |
| ARA              | MWH-1826/B |  | 1013       | 18-26GHZ Horn Antena                  | 10/02/18 |
| COM-POWER        | L1215A     |  | 191994     | Line Impedance Stabilization Networks | 24/03/18 |
| Fischer Custom   | LISN-2     |  | 900-4-0009 | Line Impedance Stabilization Networks | 18/03/18 |

All Test Equipment Used are Calibrated Traceable to NIST Standards.

### **1.7 Statement for the Document Use**

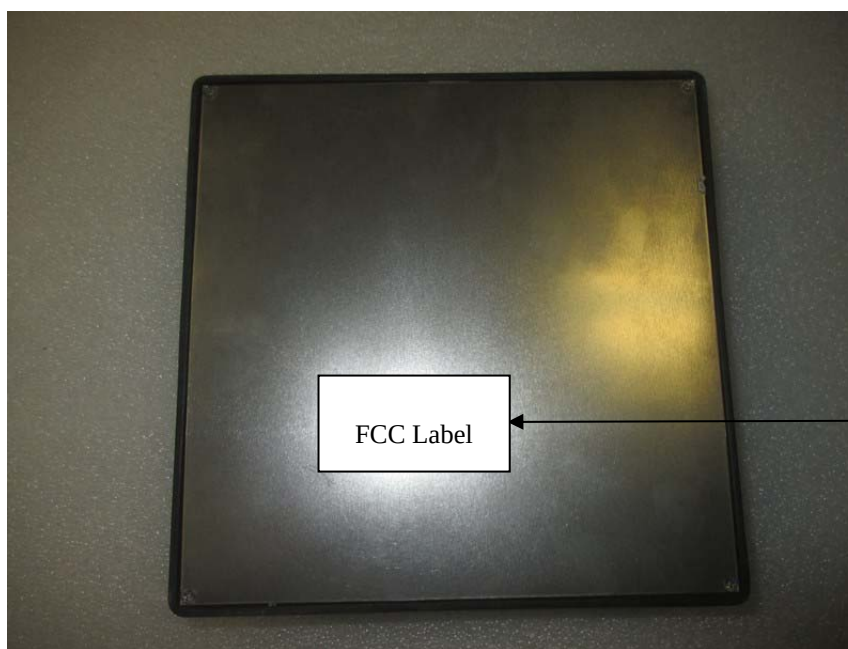
This report shall not be reproduced except in full, without the written approval of the laboratory. And this report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

## 2. PRODUCT LABELING

**BioTillion Sample Box Scanner**  
**Model No.: BoxMapper II**  
**FCC ID: 2AMHY-BM02**

**This device complies with part 15 of the FCC Rules. Operating is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

**Figure 2.1 FCC ID Label**



**Figure 2.2 FCC ID Label Location**

### **3. SYSTEM TEST CONFIGURATION**

#### **3.1 Justification**

The system was configured for testing in a typical fashion (as a customer would normally use it) . Testing was performed as EUT was operated continuously.

#### **3.2 Special Accessories**

N/A

#### **3.3 Configuration of Tested System**

Figure 3.1 to Figure 3.5 illustrate the system setup for testing. A notebook computer was used to excise the operation software and read/display the tag scanning results via standard RJ45 interface.



**Figure 3.1 Radiated Test Setup**



**Figure 3.2 Frequency Configuration Setup**



**Figure 3.3 Conducted Emission Test Setup**



**Figure 3.4 Frequency Tolerance Test Setup**

## **4. SYSTEM SCHEMATICS**

See Attachment.

**Figure 4.1 System Schematics**

## 5. CONDUCTED EMISSION DATA

### 5.1 Test Methods and Conditions

The EUT was under normal operational mode during the conducted emission test. EMI Receiver was scanned from 150KHz to 30MHz with maximum hold mode for maximum emission. Recorded data was sent to the plotter to generate output in linear format. At the input of the spectrum analyzer, a HP transient limiter is inserted for protective purpose. This limiter has a 10 dB attenuation in the range of 150KHz to 30MHz. That factor was automatically compensated by the receiver, so the readings are the corrected readings. The reference of the plot is the CISPR 22 Class B limit in Figure 5.1 through Figure 5.2.

| Conducted Emission Technical Requirements |                    |                 |                    |                 |
|-------------------------------------------|--------------------|-----------------|--------------------|-----------------|
| Frequency Range                           | Class A            |                 | Class B            |                 |
|                                           | Quasi-Peak<br>dBuV | Average<br>dBuV | Quasi-Peak<br>DBuV | Average<br>dBuV |
| 150kHz –0.5MHz                            | 79 (8912uV)        | 66 (1995uV)     | 66-56              | 56-46           |
| 0.5MHz-30MHz                              | 73 (4467uV)        | 60 (1000uV)     | ---                | ---             |
| 0.5MHz- 5MHz                              | ---                | ---             | 56                 | 46 (250uV)      |
| 5MHz-30MHz                                | ---                | ---             | 60                 | 50              |

Emissions that have peak values close to the specification limit (if any) may be also measured in the quasi-peak mode to determine compliance.

### 5.2 Test Data

Figure 5.1-5.2 show the neutral and line conducted emissions for the standard operation with antenna output attenuated.

| Highest Data for AC Line Conducted Emissions, 120Vac Battery Charging Mode |                 |                 |                 |                    |                    |                    |
|----------------------------------------------------------------------------|-----------------|-----------------|-----------------|--------------------|--------------------|--------------------|
| Frequency (MHz)                                                            | 0.380<br>(Line) | 0.450<br>(Line) | 13.56<br>(Line) | 0.370<br>(Neutral) | 0.450<br>(Neutral) | 13.56<br>(Neutral) |
| Peak/QP Reading<br>(dBuV)*                                                 | 46.13           | 52.71           | 53.99           | 45.50              | 50.23              | 51.28              |
| Average Reading<br>(dBuV)*                                                 |                 | 29.59           | 46.99           |                    | 21.49              | 43.86              |
| Under FCC Part 15<br>Limit                                                 | Yes             | Yes             | Yes             | Yes                | Yes                | Yes                |

Test Personnel:

Tester Signature: David Tu

Date: July 12, 2017

Typed/Printed Name: David Tu

## Line Conducted Emission 150kHz-30MHz



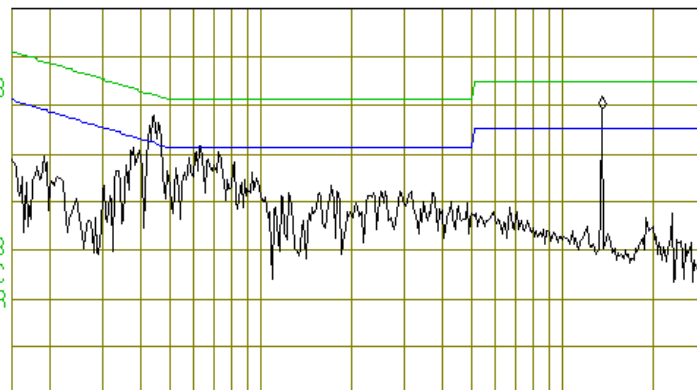
MARKER  
13.53 MHz  
53.99 dBμV

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 13.53 MHz  
53.99 dBμV

LOG REF 75.0 dBμV

10  
dB/  
ATN  
10 dB

DL  
75.0  
dBμV  
VA SB  
SC FC  
ACORR



START 150 kHz STOP 30.00 MHz  
#IF BW 9.0 kHz AVG BW 30 kHz SWP 2.49 sec

## Line Conducted Emission 400 kHz (Average)



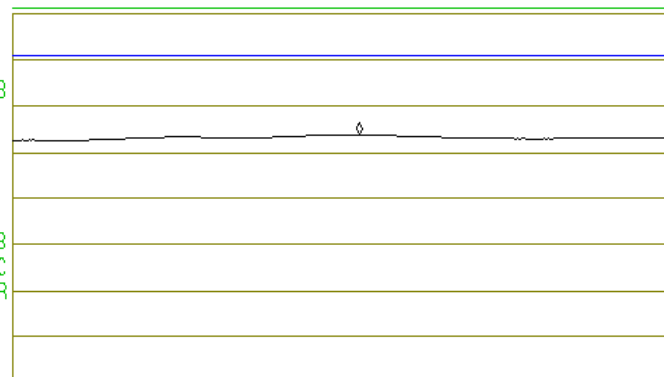
MARKER  
365.75 msec  
29.59 dBμV

ACTV DET: AVG  
MEAS DET: PEAK QP AVG  
MKR 365.75 msec  
29.59 dBμV

LOG REF 56.0 dBμV

10  
dB/  
ATN  
10 dB

VA SB  
SC FC  
ACORR



CENTER 450.000 kHz SPAN 0 Hz  
#IF BW 9.0 kHz AVG BW 1.0 Hz SWP 700 msec

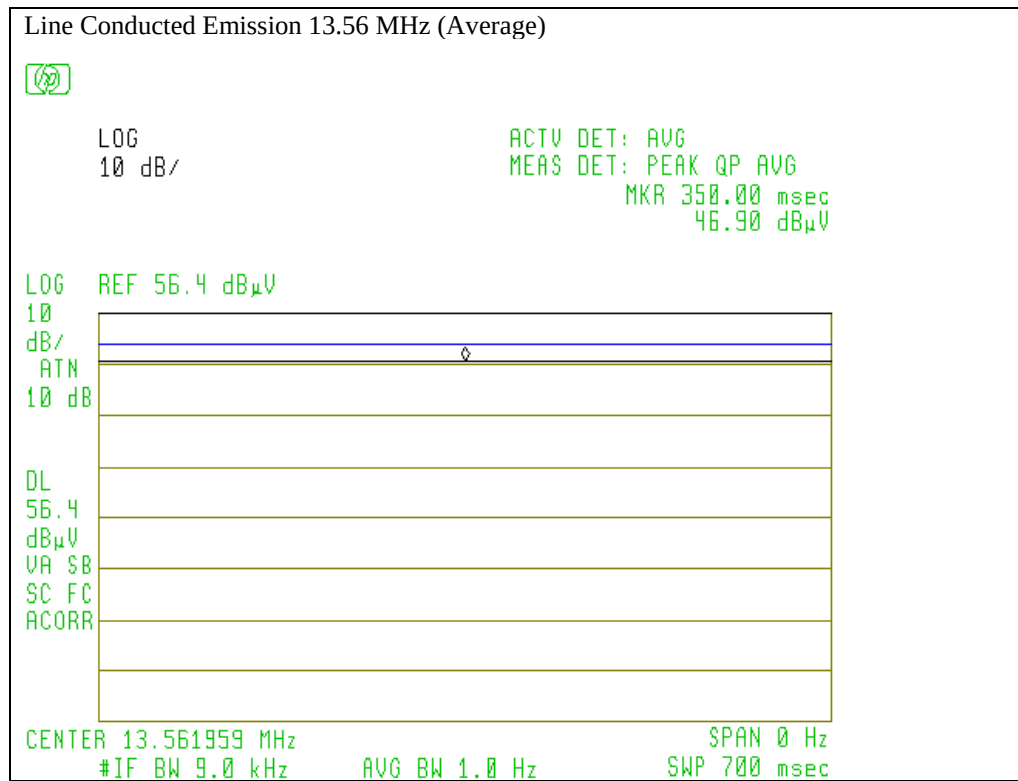


Fig. 5.1 Conducted Emission-Line

## Neutral Conducted Emission 150kHz-30MHz



MARKER  
13.53 MHz  
51.28 dBμV

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKR 13.53 MHz  
51.28 dBμV

LOG REF 75.0 dBμV

10

dB/

ATN

10 dB

VA SB

SC FC

ACORR

10 dB

VA SB

SC FC

ACORR

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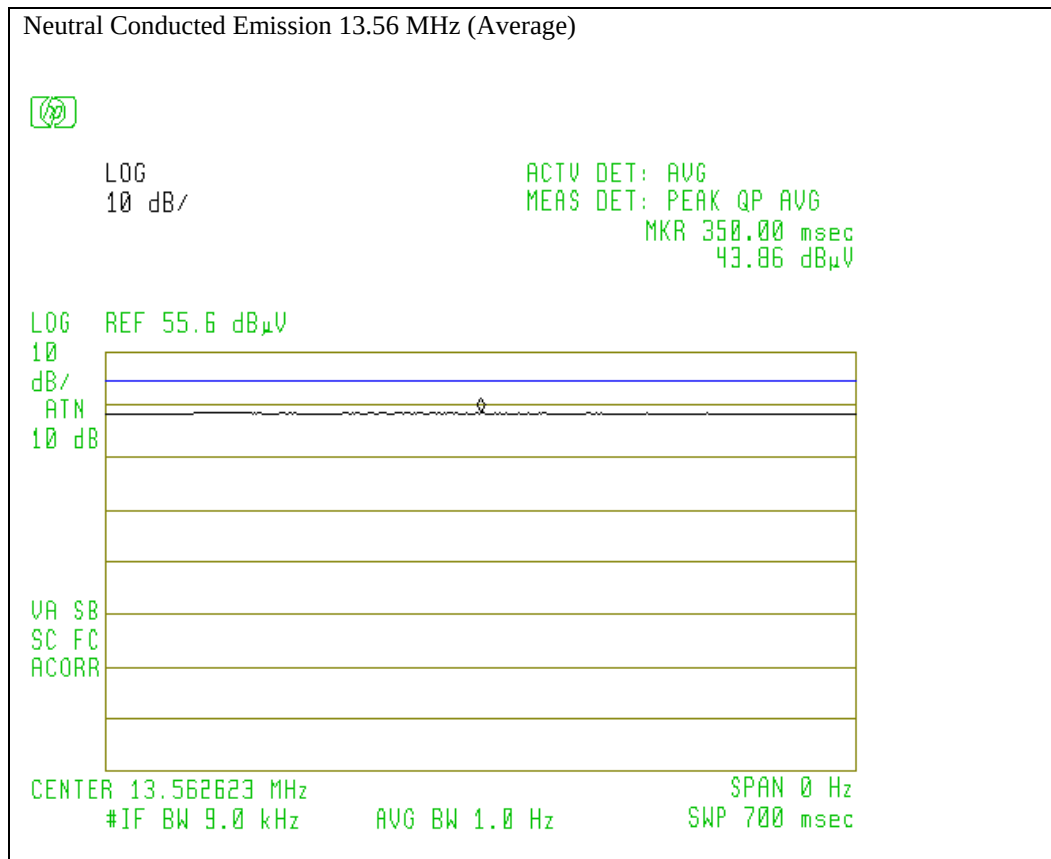


Fig. 5.2 Conducted Emission- Neutral

## 6. RADIATED EMISSION DATA

### 6.1 Field Strength Calculation

The corrected field strength is automatically calculated by EMI Receiver using following:

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

where FS: Corrected Field Strength in dB $\mu$ V/m

RA: Amplitude of EMI Receiver before correction in dB $\mu$ V

AF: Antenna Factor in dB/m

CF: Cable Attenuation Factor in dB

AG: Built-in Preamplifier Gain in dB (Stored in receiver as part of the calibration data)

### 6.2 Test Methods and Conditions

The initial step in collecting radiated data is a EMI Receiver scan of the measurement range below 30MHz using peak/quasi-peak detector and 9KHz IF bandwidth / 30KHz video bandwidth with loop antenna. For the range 30MHz - 1GHz, 120KHz IF bandwidth / 120KHz video bandwidth are used. Both bandwidths are 1MHz for above 1GHz measurement. Frequency range from EUT's lowest crystal frequency to 10th harmonics of fundamental was investigated.

EUT was rotated all around and cables and equipment were placed and moved within the range of positions likely to find their maximum emissions. Antenna must be rotated about its Horizontal and Vertical positions to maximize emissions.

### 6.3 Test Data

The following data lists the significant emission frequencies, polarity and position, peak reading of the EMI Receiver, the FCC limit, and the difference between the peak reading and the limit. Explanation of the correction and calculation are given in section 6.1.

Test Personnel: David Tu

Typed/Printed Name: David Tu

Date: July 12, 2017

**Radiated Test Data**  
**Operation Mode: Typical**

| Frequency<br>(MHz) | Polarity<br>[H or V] | Height<br>(m) | Azimuth<br>(Degree) | Quasi-<br>Peak<br>Reading<br>(dB $\mu$ V/m) | FCC<br>30m & 3m<br>Limit<br>(dB $\mu$ V/m) | Difference<br>from limit<br>(dB) |
|--------------------|----------------------|---------------|---------------------|---------------------------------------------|--------------------------------------------|----------------------------------|
| 13.56              | H/V                  | 1.0           | 000                 | 68.0                                        | 84.0(1)                                    | -16                              |
| 27.12              | H/V                  | 1.0           | 000                 | 25.5(3)                                     | 29.5(2)                                    | -4.0                             |
| 56.4               | H                    | 1.8           | 010                 | 36.6                                        | 40.0                                       | -3.4                             |
| 67.0               | H                    | 1.8           | 010                 | 33.5                                        | 40.0                                       | -6.5                             |
| 111.6              | H                    | 1.8           | 045                 | 34.8                                        | 43.5                                       | -8.7                             |
| 123.5              | H                    | 1.8           | 045                 | 32.7                                        | 43.5                                       | -10.8                            |
| 173.2              | H                    | 1.8           | 000                 | 35.3                                        | 43.5                                       | -8.2                             |
| 466                | H                    | 1.1           | 010                 | 40.8                                        | 46.0                                       | -5.2                             |
| 43.8               | V                    | 1.3           | 010                 | 37.3                                        | 40.0                                       | -2.7                             |
| 56.4               | V                    | 1.3           | 270                 | 36.8                                        | 40.0                                       | -3.2                             |
| 67                 | V                    | 1.3           | 090                 | 36.6                                        | 40.0                                       | -3.4                             |
| 111.6              | V                    | 1.3           | 270                 | 38.7                                        | 43.5                                       | -4.8                             |
| 123.5              | V                    | 1.3           | 270                 | 38.3                                        | 43.5                                       | -5.2                             |
| 133.3              | V                    | 1.3           | 235                 | 38.1                                        | 43.5                                       | -5.4                             |
| 173.2              | V                    | 1.3           | 090                 | 37.4                                        | 43.5                                       | -6.1                             |
| 250                | V                    | 1.3           | 090                 | 40.7                                        | 46.0                                       | -5.3                             |

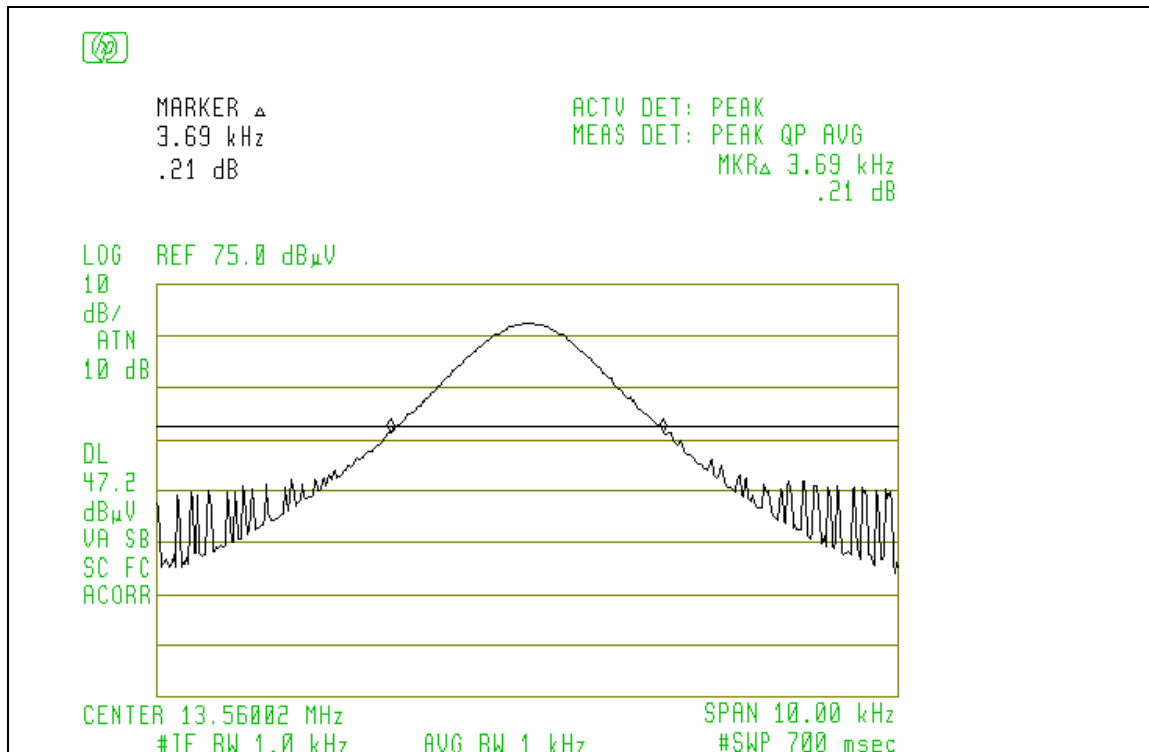
(1) Per 15.225(a): The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84dB $\mu$ V/m) at 30 meters.

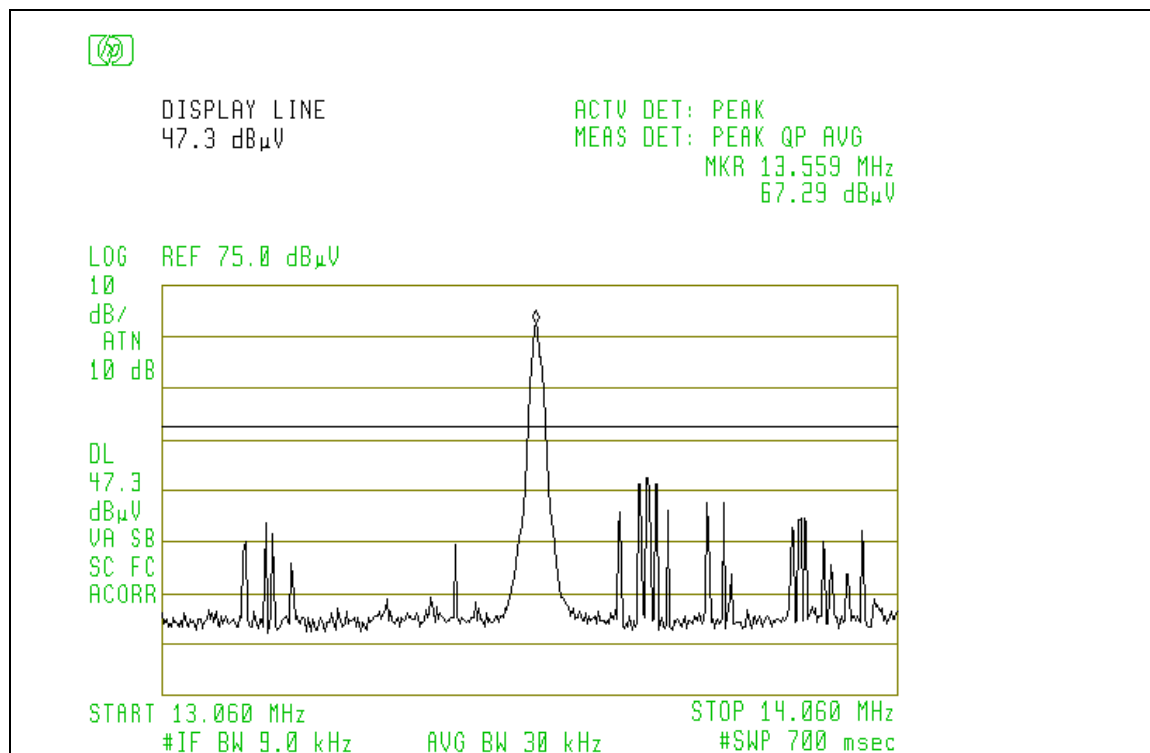
(2) Per 15.225(d): The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in 15.209.

(3) The distance factor 19.1dB was applied to the this testing value as the measurement was adjusted from 30m to 10m distance in order to obtain the significant reading.

## 6.4 Occupied Bandwidth

Bandwidth is determined at the points 20dB down from the modulated carrier. Figure 6.1 shows the occupied bandwidth plot.



**Figure 6.1 Occupied Bandwidth**

## 7. Frequency Tolerance

|                      |                            |                       |               |
|----------------------|----------------------------|-----------------------|---------------|
| <b>Name of Test:</b> | <i>Frequency Tolerance</i> | <b>Test Standard:</b> | <i>15.225</i> |
| <b>Tested By:</b>    | WEI LI                     | <b>Test Date:</b>     | 06/16/2017    |

---

**Minimum Standard:** Para 15.225(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

---

**Method of Measurement:** Frequency Stability With Voltage Variation:  
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. Set SA resolution bandwidth low enough (30Hz) to obtain the desired frequency resolution. (Using frequency counter method: The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10MHz ref, in of the signal generator). With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation:  
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied from -20 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

---

**Test Result:****Complies**

---

**Test Data:**

See Attached Table(s)

- temperature variation: -20°C to +50°C
- voltage variation: 97.75 Vac to 132.25 Vac
- frequency tolerance: +/- 1.356 kHz (+/- 0.01%)

## Frequency Stability versus Environmental Temperature

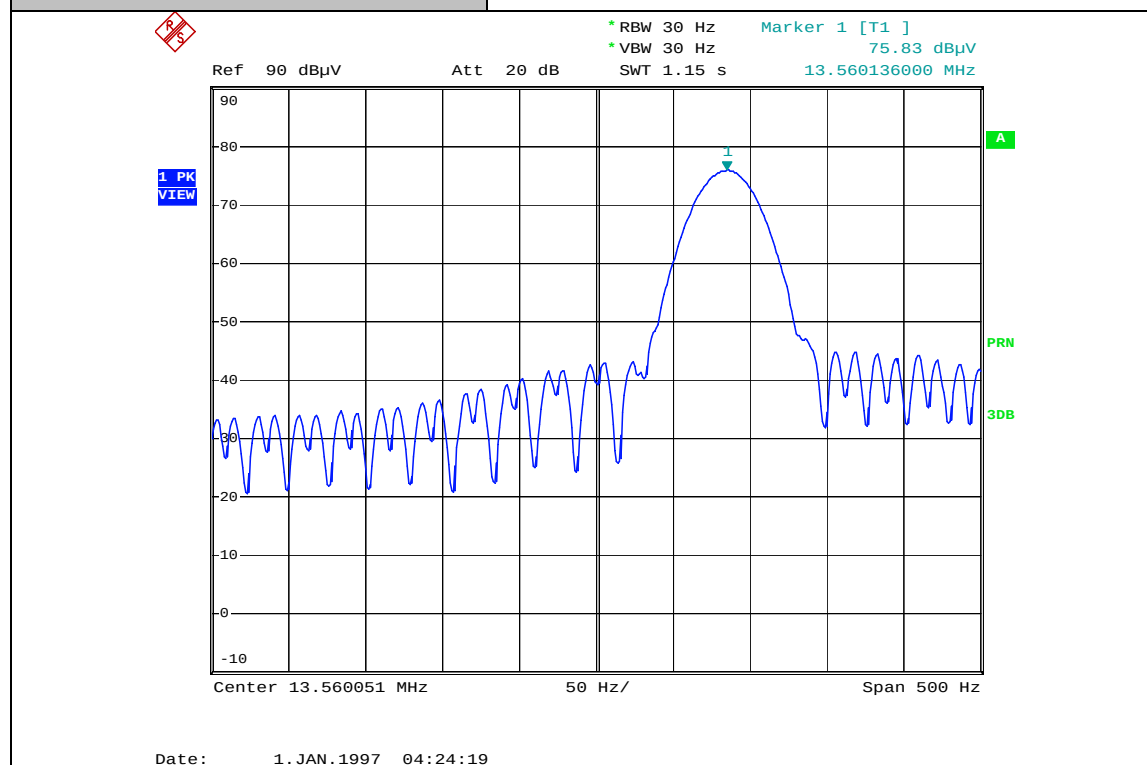
| Reference Frequency @ 115V & +20°C |                    |                   |
|------------------------------------|--------------------|-------------------|
| Temperature & Direction<br>(°C)    | Frequency<br>(MHz) | Deviation<br>(Hz) |
| -20                                | 13.560136          | +83               |
| +20                                | 13.560053          | -                 |
| +50                                | 13.560102          | +49               |

## Frequency Stability versus AC Voltage

| Reference Frequency @ 115VAC & +20°C |                    |                   |
|--------------------------------------|--------------------|-------------------|
| Voltage & Direction<br>(VAC)         | Frequency<br>(MHz) | Deviation<br>(Hz) |
| 97.75                                | 13.550052          | -1                |
| 115                                  | 13.560053          | -                 |
| 132.25                               | 13.560054          | +1                |

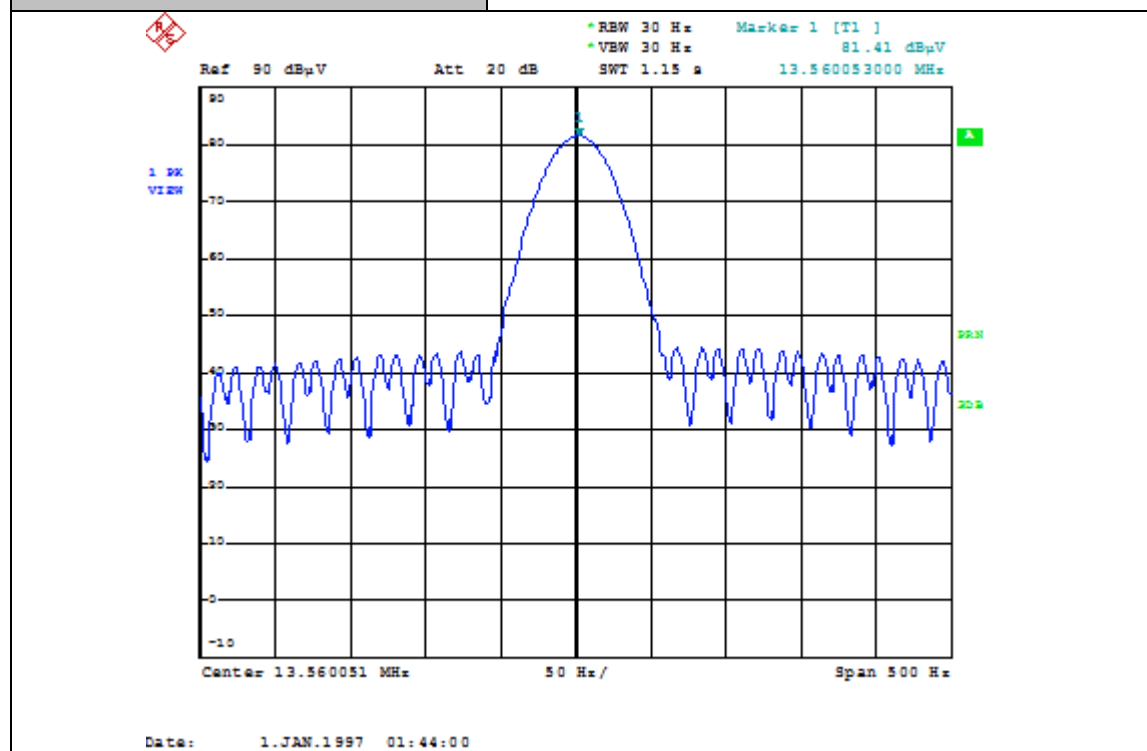
|                        |                       |
|------------------------|-----------------------|
| <b>Project Number:</b> | 0048-170607-01-FCC-LF |
| <b>EUT:</b>            | Avante                |
| <b>SN:</b>             | 003                   |
| <b>Tested By:</b>      | David Tu              |
| <b>Temperature:</b>    | 70°F                  |
| <b>Humidity:</b>       | 30%                   |

|                       |                                          |
|-----------------------|------------------------------------------|
| <b>Section:</b>       | <b>Frequency Tolerance</b>               |
| <b>Plot Name:</b>     | <b>Frequency Tolerance ~ Temperature</b> |
| <b>Configuration:</b> | 115Vac, -20°C                            |



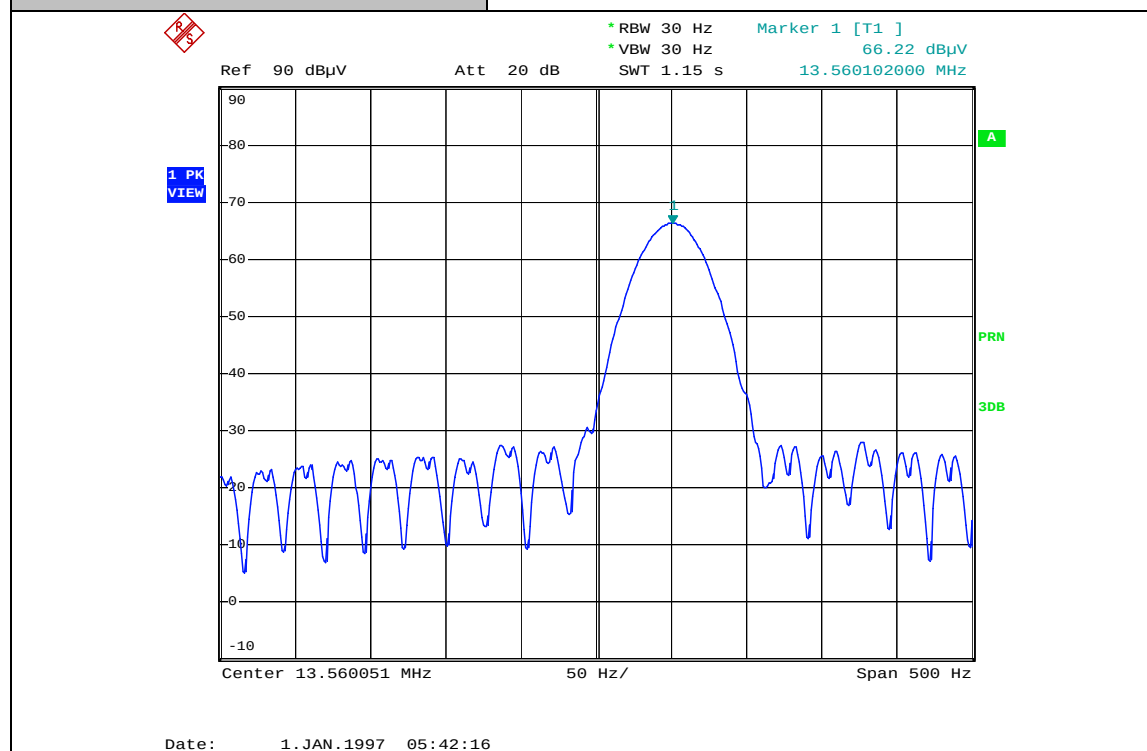
|                        |                       |
|------------------------|-----------------------|
| <b>Project Number:</b> | 0048-170607-01-FCC-LF |
| <b>EUT:</b>            | Avante BOXMAPPER II   |
| <b>SN:</b>             | 003                   |
| <b>Tested By:</b>      | David Tu              |
| <b>Temperature:</b>    | 70°F                  |
| <b>Humidity:</b>       | 30%                   |

|                       |                                          |
|-----------------------|------------------------------------------|
| <b>Section:</b>       | <b>Frequency Tolerance</b>               |
| <b>Plot Name:</b>     | <b>Frequency Tolerance ~ Temperature</b> |
| <b>Configuration:</b> | 115Vac, +20°C                            |



|                        |                       |
|------------------------|-----------------------|
| <b>Project Number:</b> | 0048-170607-01-FCC-LF |
| <b>EUT:</b>            | Avante BOXMAPPER II   |
| <b>SN:</b>             | 003                   |
| <b>Tested By:</b>      | David Tu              |
| <b>Temperature:</b>    | 70°F                  |
| <b>Humidity:</b>       | 30%                   |

|                       |                                          |
|-----------------------|------------------------------------------|
| <b>Section:</b>       | <b>Frequency Tolerance</b>               |
| <b>Plot Name:</b>     | <b>Frequency Tolerance ~ Temperature</b> |
| <b>Configuration:</b> | 115Vac, +50°C                            |



|                        |                       |
|------------------------|-----------------------|
| <b>Project Number:</b> | 0048-170607-01-FCC-LF |
| <b>EUT:</b>            | Avante BOXMAPPER II   |
| <b>SN:</b>             | 003                   |
| <b>Tested By:</b>      | David Tu              |
| <b>Temperature:</b>    | 70°F                  |
| <b>Humidity:</b>       | 30%                   |

|                       |                                      |
|-----------------------|--------------------------------------|
| <b>Section:</b>       | <b>Frequency Tolerance</b>           |
| <b>Plot Name:</b>     | <b>Frequency Tolerance ~ voltage</b> |
| <b>Configuration:</b> | 97.75Vac/115Vac/132.25Vac, +20°C     |

