

## EMISSIONS TEST REPORT

Report Number: 3147251BOX-005d

Project Number: 3147251

Testing performed on the

Wireless Relay

Model: FA-03

To

CFR47 "Telecommunications"  
FCC Part 15 Subpart C "Unintentional Radiators" 15.225

For

Freelinc

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

Test Authorized by:  
Freelinc  
266 West Center Street  
Orem, UT 84057

Prepared by:



Nicholas Abbondante

Date: 07/09/2008

Reviewed by:



for:

Michael F. Murphy

Date: 07/10/08

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## 1.0 Job Description

### 1.1 Client Information

This EUT has been tested at the request of:

**Company:** Freelinc  
266 West Center Street  
Orem, UT 84057  
**Contact:** Mr. Michael Wheeler  
**Telephone:** 801-494-3995  
**Fax:** N/A  
**Email:** [mwheeler@freelinc.com](mailto:mwheeler@freelinc.com)

### 1.2 Equipment Under Test

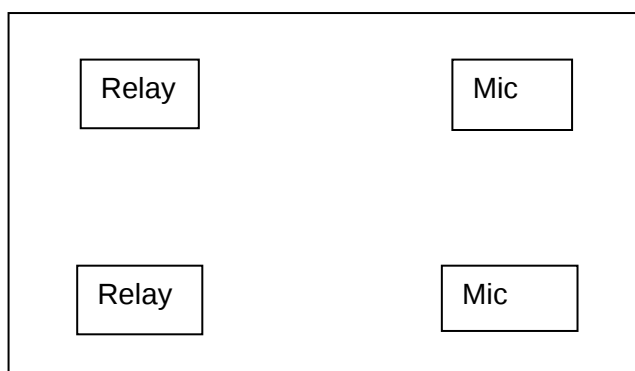
**Equipment Type:** Wireless Relay  
**Model Number(s):** FA-03  
**Serial number(s):** A, B  
**Manufacturer:** Freelinc  
**EUT receive date:** 03/07/2008  
**EUT received condition:** Prototypes in Good Condition  
**Test start date:** 04/11/2008  
**Test end date:** 07/09/2008

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

### 1.4 Test Configuration

#### 1.4.1 Block Diagram

The EUT set must be in the proximity of another EUT set in order to trigger transmission at 13.956 MHz in addition to the normal 13.56 MHz transmission. The Mic and Relay must be ~1.1 meters apart maximum, and the two systems must be ~0.5 meters apart.



Turntable

**1.4.2. Cables:**

| Cable | Shielding | Connector | Length (m) | Qty. |
|-------|-----------|-----------|------------|------|
| None  |           |           |            |      |

**1.4.3. Support Equipment:**

Name: Freemic  
Model No.: FMC-200  
Serial No.: A, B

**1.5 Mode(s) of Operation:**

The EUT was activated from a fresh, 9 Volt battery in transmit mode and was transmitting repetitively on both channels, 13.56 MHz and 13.956 MHz, throughout testing. In order for the EUT to operate at 13.956 MHz, two EUTs were placed in proximity with each other. The EUT software disables transmission while in charge mode, so this mode was not tested to the transmitter requirements. The EUT was manipulated in three orthogonal axes.

## 2.0 Test Summary

| TEST STANDARD                                                                                  | RESULTS                                                                                                                                                      |         |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| CFR47 Telecommunications<br>FCC Part 15 Subpart C 15.225                                       |                                                                                                                                                              |         |
| SUB-TEST                                                                                       | TEST PARAMETER                                                                                                                                               | COMMENT |
| Radiated Fundamental Field<br>Strength and Spurious<br>Emissions<br>FCC 15.205, 15.209, 15.225 | The field strength of emissions must not exceed the limits of 15.209 and 15.225.                                                                             | Pass    |
| Frequency Stability<br>FCC 15.225                                                              | The frequency tolerance of the 13.56 MHz fundamental must not deviate by more than 0.01% (100 ppm) over a temperature range from -20 to +50 degrees Celsius. | 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 $\mu$ V/m  
              RA = Receiver Amplitude (including preamplifier) in dB $\mu$ 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 $\mu$ 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 $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB $\mu$ V  
AF = 7.4 dB/m  
CF = 1.6 dB  
AG = 29.0 dB  
FS = 32 dB $\mu$ 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 $\mu$ V  
              RF = Reading from receiver in dB $\mu$ V  
              LF = LISN Correction Factor in dB  
              CF = Cable Correction Factor in dB  
              AF = Attenuator Loss Factor in dB

To convert from dB $\mu$ V to  $\mu$ 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:

$\pm 3.5$  dB at 10m,  $\pm 3.8$  dB at 3m

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

$\pm 2.6$  dB

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

$\pm 3.2$  for ISN and voltage probe measurements

$\pm 3.1$  for current probe measurements

### 3.2 Site Description

#### Test Site(s): 2 and Littleton

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.

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

**Test Results:** Pass

**Test Standard:** FCC Part 15 Subpart C

**Test:** Radiated Fundamental Field Strength and Spurious Emissions

**Performance Criterion:** The field strength of any emissions must not exceed the limits of 15.209 and 15.225:

| Frequency Range (MHz)           | Field Strength at 30m (dBuV/m) | Field Strength at 3m (dBuV/m) |
|---------------------------------|--------------------------------|-------------------------------|
| 13.553-13.567                   | 84                             | 124                           |
| 13.410-13.553 and 13.567-13.710 | 50.5                           | 90.5                          |
| 13.110-13.410 and 13.710-14.010 | 40.5                           | 80.5                          |
| 1.705-30                        | 29.5                           | 69.5                          |
| 30-88                           | -                              | 40                            |
| 88-216                          | -                              | 43.5                          |
| 216-960                         | -                              | 46                            |
| Above 960                       | -                              | 54                            |

**Test Environment:**

|                                          |                     |    |                       |    |                 |      |
|------------------------------------------|---------------------|----|-----------------------|----|-----------------|------|
| Environmental Conditions During Testing: | Ambient (°C):       | 19 | Humidity (%):         | 39 | Pressure (hPa): | 1050 |
| Pretest Verification Performed           | Yes                 |    | Equipment under Test: |    | Wireless Relay  |      |
| Test Engineer(s):                        | Nicholas Abbondante |    | EUT Serial Number:    |    | A, B            |      |

**Test Equipment Used:**

| TEST EQUIPMENT LIST |                                   |                  |                   |            |               |
|---------------------|-----------------------------------|------------------|-------------------|------------|---------------|
| Item                | Equipment Type                    | Make             | Model No.         | Serial No. | Next Cal. Due |
| 1                   | Digital 4 Line Barometer          | Mannix           | 0ABA116           | BAR2       | 05/20/2008    |
| 2                   | 9kHz to 3GHz EMI Test Receiver    | Rohde & Schwartz | ESCI 1166.5950K03 | 100067     | 01/25/2009    |
| 3                   | ANTENNA                           | EMCO             | 3142              | 9711-1225  | 06/05/2008    |
| 4                   | 3 Meter In floor cable for site 2 | ITS              | RG214B/U          | S2 3M FLR  | 09/17/2008    |
| 5                   | LOOP ANTENNA                      | Empire           | LP-105            | 905        | 09/21/2008    |

**Software Utilized:**

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

# Test Results:

## Special Radiated Emissions

Company: Freelinc  
 Model #: FA-03  
 Serial #: A, B  
 Engineers: Nicholas Abbondante  
 Project #: 3147251  
 Standard: FCC Part 15 Subpart C 15.225  
 Receiver: R&S ESCI (ROS002)  
 PreAmp: NONE.  
 PreAmp Used? (Y or N): N  
 Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)  
 Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Antenna & Cables: LF Bands: N, LF, HF, SHF  
 Antenna: Loop2\_E-Field\_09-21-08.txt Loop2\_H-Field\_09-21-08.txt  
 Cable(s): S2 3M FLR 9-17-08.txt NONE.  
 Barometer: BAR2

Location: Site 2  
 Date(s): 04/11/08  
 Temp/Humidity/Pressure: 19c 39% 1050mB

Limit Distance (m): 3  
 Test Distance (m): 3  
 Voltage/Frequency: Fresh 9V Battery Frequency Range: 13.56 - 30 MHz

| 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               | 13.559        | 11.5           | 41.1                   | 0.4           | 0.0               | 0.0                | 53.0         | 124.0          | -71.0     | 9/30 kHz  | FCC |
| QP            | V               | 13.552        | 7.2            | 41.1                   | 0.4           | 0.0               | 0.0                | 48.7         | 90.5           | -41.8     | 9/30 kHz  |     |
| QP            | V               | 13.568        | 2.5            | 41.1                   | 0.4           | 0.0               | 0.0                | 44.0         | 90.5           | -46.5     | 9/30 kHz  |     |
| QP            | V               | 13.509        | 8.6            | 41.1                   | 0.4           | 0.0               | 0.0                | 50.1         | 90.5           | -40.4     | 9/30 kHz  |     |
| QP            | V               | 13.610        | 11.7           | 41.1                   | 0.4           | 0.0               | 0.0                | 53.2         | 90.5           | -37.3     | 9/30 kHz  |     |
| QP            | V               | 13.458        | -5.0           | 41.1                   | 0.4           | 0.0               | 0.0                | 36.5         | 90.5           | -54.0     | 9/30 kHz  |     |
| QP            | V               | 13.662        | 0.2            | 41.1                   | 0.4           | 0.0               | 0.0                | 41.7         | 90.5           | -48.8     | 9/30 kHz  |     |
| QP            | V               | 13.409        | -17.4          | 41.1                   | 0.4           | 0.0               | 0.0                | 24.1         | 80.5           | -56.4     | 9/30 kHz  | RB  |
| QP            | V               | 13.711        | -15.4          | 41.1                   | 0.4           | 0.0               | 0.0                | 26.1         | 80.5           | -54.4     | 9/30 kHz  |     |
| QP            | V               | 27.120        | -16.0          | 39.6                   | 0.6           | 0.0               | 0.0                | 24.2         | 69.5           | -45.3     | 9/30 kHz  |     |
| QP            | V               | 13.908        | 14.0           | 41.1                   | 0.4           | 0.0               | 0.0                | 55.5         | 80.5           | -25.0     | 9/30 kHz  |     |
| QP            | V               | 13.956        | 13.6           | 41.1                   | 0.4           | 0.0               | 0.0                | 55.1         | 80.5           | -25.4     | 9/30 kHz  |     |
| QP            | V               | 14.011        | 10.3           | 41.1                   | 0.4           | 0.0               | 0.0                | 51.8         | 69.5           | -17.7     | 9/30 kHz  |     |
| QP            | V               | 27.912        | -16.0          | 39.4                   | 0.6           | 0.0               | 0.0                | 24.0         | 69.5           | -45.5     | 9/30 kHz  |     |

## Special Radiated Emissions

Company: Freelinec  
 Model #: FA-03  
 Serial #: A, B  
 Engineers: Nicholas Abbondante  
 Project #: 3147251  
 Standard: FCC Part 15 Subpart C 15.225  
 Receiver: R&S ESCI (ROS002)  
 PreAmp: NONE.

Antenna & Cables: N Bands: N, LF, HF, SHF  
 Antenna: LOG4 06-05-08 V3.txt LOG4 06-05-08 H3.txt  
 Cable(s): S2 3M FLR 9-17-08.txt NONE.  
 Barometer: BAR2

Location: Site 2  
 Date(s): 04/11/08  
 Temp/Humidity/Pressure: 19c 39% 1050mB

Limit Distance (m): 3  
 Test Distance (m): 3  
 Voltage/Frequency: Fresh 9V Battery  
 Frequency Range: 30-1000 MHz

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)

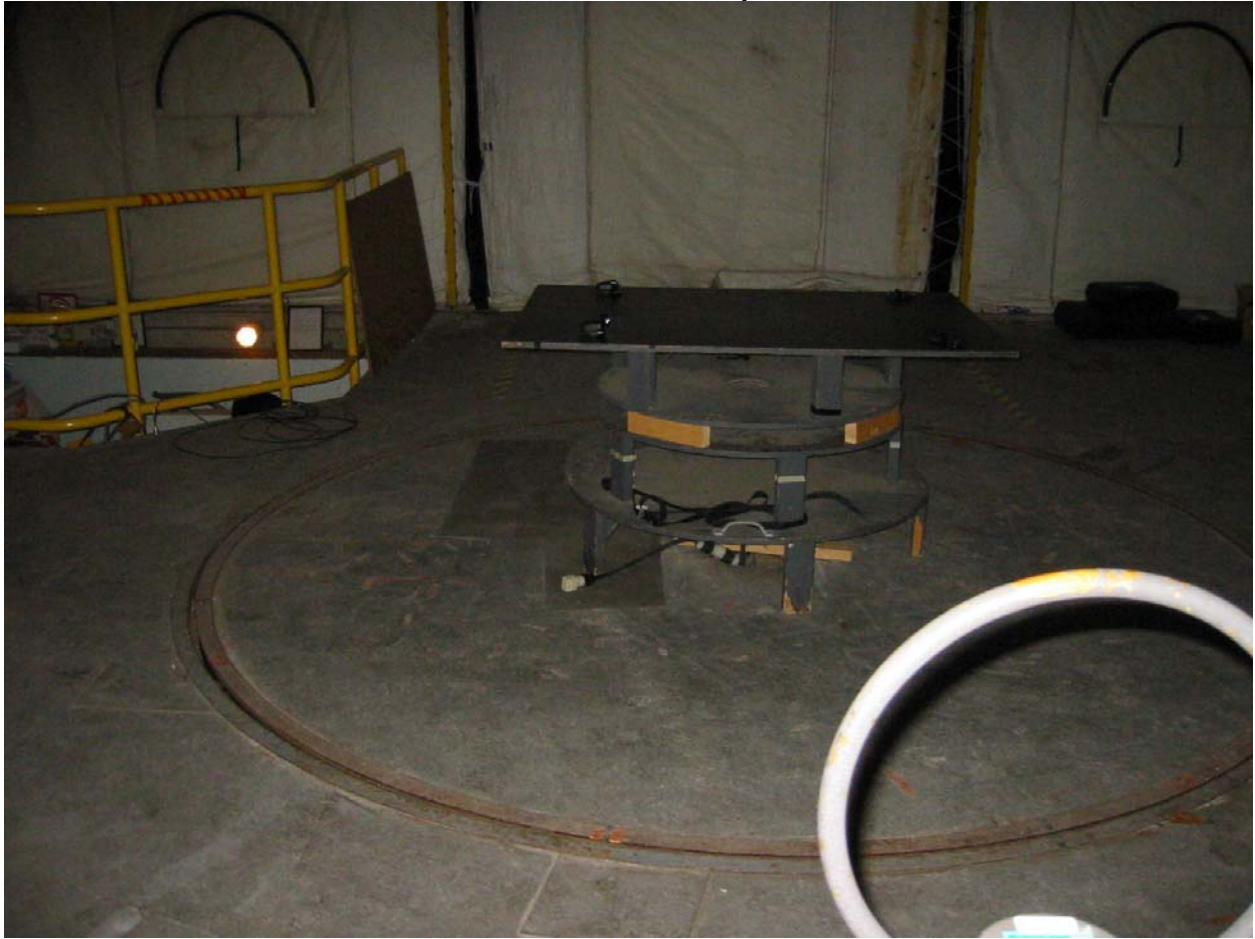
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

| 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               | 40.680        | 11.3           | 11.4                   | 0.7           | 0.0               | 0.0                | 23.4         | 40.0           | -16.6     | 120/300 kHz | FCC |
| QP            | V               | 41.868        | 10.2           | 11.0                   | 0.7           | 0.0               | 0.0                | 22.0         | 40.0           | -18.0     | 120/300 kHz |     |
| QP            | V               | 54.032        | 6.4            | 8.9                    | 0.9           | 0.0               | 0.0                | 16.2         | 40.0           | -23.8     | 120/300 kHz |     |
| QP            | V               | 108.500       | 4.1            | 8.1                    | 1.3           | 0.0               | 0.0                | 13.5         | 43.5           | -30.0     | 120/300 kHz | RB  |
| QP            | V               | 108.872       | 11.1           | 8.1                    | 1.3           | 0.0               | 0.0                | 20.5         | 43.5           | -23.0     | 120/300 kHz | RB  |
| QP            | V               | 111.273       | 15.1           | 7.9                    | 1.3           | 0.0               | 0.0                | 24.3         | 43.5           | -19.2     | 120/300 kHz | RB  |
| QP            | V               | 112.092       | 14.9           | 7.9                    | 1.3           | 0.0               | 0.0                | 24.0         | 43.5           | -19.5     | 120/300 kHz | RB  |
| QP            | V               | 121.580       | 16.6           | 6.9                    | 1.4           | 0.0               | 0.0                | 24.8         | 43.5           | -18.7     | 120/300 kHz | RB  |
| QP            | V               | 122.500       | 16.4           | 6.8                    | 1.4           | 0.0               | 0.0                | 24.6         | 43.5           | -18.9     | 120/300 kHz |     |
| QP            | V               | 125.176       | 12.3           | 6.7                    | 1.4           | 0.0               | 0.0                | 20.4         | 43.5           | -23.1     | 120/300 kHz | RB  |
| QP            | H               | 126.088       | 10.4           | 8.0                    | 1.4           | 0.0               | 0.0                | 19.9         | 43.5           | -23.6     | 120/300 kHz | RB  |
| QP            | H               | 135.084       | 17.0           | 8.2                    | 1.4           | 0.0               | 0.0                | 26.6         | 43.5           | -16.9     | 120/300 kHz | RB  |
| QP            | H               | 136.100       | 17.7           | 8.2                    | 1.4           | 0.0               | 0.0                | 27.4         | 43.5           | -16.1     | 120/300 kHz | RB  |
| QP            | H               | 139.092       | 20.9           | 8.4                    | 1.4           | 0.0               | 0.0                | 30.7         | 43.5           | -12.8     | 120/300 kHz |     |
| QP            | H               | 140.092       | 18.7           | 8.4                    | 1.4           | 0.0               | 0.0                | 28.6         | 43.5           | -14.9     | 120/300 kHz |     |
| QP            | H               | 148.576       | 19.1           | 9.1                    | 1.5           | 0.0               | 0.0                | 29.7         | 43.5           | -13.8     | 120/300 kHz |     |
| QP            | H               | 149.726       | 18.9           | 9.2                    | 1.5           | 0.0               | 0.0                | 29.6         | 43.5           | -13.9     | 120/300 kHz |     |
| QP            | V               | 152.990       | 20.0           | 8.3                    | 1.6           | 0.0               | 0.0                | 29.9         | 43.5           | -13.6     | 120/300 kHz |     |
| QP            | V               | 154.110       | 18.1           | 8.4                    | 1.6           | 0.0               | 0.0                | 28.0         | 43.5           | -15.5     | 120/300 kHz |     |
| QP            | H               | 166.890       | 26.5           | 9.4                    | 1.6           | 0.0               | 0.0                | 37.6         | 43.5           | -5.9      | 120/300 kHz | RB  |
| QP            | H               | 168.121       | 24.0           | 9.4                    | 1.6           | 0.0               | 0.0                | 35.0         | 43.5           | -8.5      | 120/300 kHz | RB  |
| QP            | V               | 180.810       | 17.6           | 9.0                    | 1.7           | 0.0               | 0.0                | 28.3         | 43.5           | -15.2     | 120/300 kHz |     |
| QP            | V               | 182.140       | 16.8           | 9.2                    | 1.7           | 0.0               | 0.0                | 27.6         | 43.5           | -15.9     | 120/300 kHz |     |
| QP            | H               | 189.120       | 19.4           | 10.2                   | 1.7           | 0.0               | 0.0                | 31.4         | 43.5           | -12.1     | 120/300 kHz |     |
| QP            | H               | 190.548       | 18.8           | 10.3                   | 1.8           | 0.0               | 0.0                | 30.8         | 43.5           | -12.7     | 120/300 kHz |     |
| QP            | H               | 194.717       | 21.0           | 10.3                   | 1.8           | 0.0               | 0.0                | 33.0         | 43.5           | -10.5     | 120/300 kHz |     |
| QP            | H               | 196.144       | 19.8           | 10.3                   | 1.8           | 0.0               | 0.0                | 31.8         | 43.5           | -11.7     | 120/300 kHz |     |
| QP            | H               | 202.585       | 10.6           | 10.4                   | 1.9           | 0.0               | 0.0                | 22.8         | 43.5           | -20.7     | 120/300 kHz |     |
| QP            | H               | 204.160       | 12.1           | 10.5                   | 1.9           | 0.0               | 0.0                | 24.5         | 43.5           | -19.0     | 120/300 kHz |     |
| QP            | H               | 208.610       | 10.0           | 10.7                   | 1.9           | 0.0               | 0.0                | 22.5         | 43.5           | -21.0     | 120/300 kHz |     |
| QP            | H               | 216.120       | 11.8           | 11.0                   | 1.9           | 0.0               | 0.0                | 24.8         | 46.0           | -21.2     | 120/300 kHz |     |
| QP            | H               | 217.775       | 11.4           | 11.1                   | 1.9           | 0.0               | 0.0                | 24.5         | 46.0           | -21.5     | 120/300 kHz |     |
| QP            | H               | 222.529       | 12.5           | 11.4                   | 1.9           | 0.0               | 0.0                | 25.8         | 46.0           | -20.2     | 120/300 kHz |     |
| QP            | H               | 224.163       | 11.7           | 11.4                   | 1.9           | 0.0               | 0.0                | 25.0         | 46.0           | -21.0     | 120/300 kHz |     |
| QP            | H               | 236.416       | 3.1            | 11.9                   | 2.0           | 0.0               | 0.0                | 17.0         | 46.0           | -29.0     | 120/300 kHz |     |
| QP            | H               | 238.166       | 3.8            | 12.0                   | 2.0           | 0.0               | 0.0                | 17.7         | 46.0           | -28.3     | 120/300 kHz |     |
| QP            | H               | 243.130       | 5.6            | 12.2                   | 2.0           | 0.0               | 0.0                | 19.8         | 46.0           | -26.2     | 120/300 kHz | RB  |
| QP            | H               | 244.990       | 6.8            | 12.2                   | 2.0           | 0.0               | 0.0                | 21.0         | 46.0           | -25.0     | 120/300 kHz | RB  |
| QP            | H               | 250.300       | 10.3           | 12.4                   | 2.0           | 0.0               | 0.0                | 24.7         | 46.0           | -21.3     | 120/300 kHz | RB  |
| QP            | H               | 252.192       | 9.5            | 12.4                   | 2.0           | 0.0               | 0.0                | 24.0         | 46.0           | -22.0     | 120/300 kHz | RB  |
| QP            | H               | 258.600       | 5.3            | 12.6                   | 2.1           | 0.0               | 0.0                | 20.0         | 46.0           | -26.0     | 120/300 kHz | RB  |
| QP            | H               | 264.200       | 4.4            | 12.7                   | 2.1           | 0.0               | 0.0                | 19.2         | 46.0           | -26.8     | 120/300 kHz | RB  |
| QP            | H               | 266.200       | 3.9            | 12.7                   | 2.1           | 0.0               | 0.0                | 18.7         | 46.0           | -27.3     | 120/300 kHz | RB  |
| QP            | H               | 270.200       | 1.9            | 12.8                   | 2.1           | 0.0               | 0.0                | 16.8         | 46.0           | -29.2     | 120/300 kHz | RB  |
| QP            | H               | 272.200       | 1.9            | 12.8                   | 2.1           | 0.0               | 0.0                | 16.8         | 46.0           | -29.2     | 120/300 kHz | RB  |
| QP            | H               | 278.164       | 6.6            | 13.0                   | 2.2           | 0.0               | 0.0                | 21.7         | 46.0           | -24.3     | 120/300 kHz | RB  |
| QP            | H               | 280.200       | 5.4            | 13.0                   | 2.2           | 0.0               | 0.0                | 20.6         | 46.0           | -25.4     | 120/300 kHz | RB  |
| QP            | H               | 292.100       | 3.8            | 13.5                   | 2.2           | 0.0               | 0.0                | 19.5         | 46.0           | -26.5     | 120/300 kHz |     |
| QP            | H               | 294.200       | 3.6            | 13.5                   | 2.2           | 0.0               | 0.0                | 19.3         | 46.0           | -26.7     | 120/300 kHz |     |
| QP            | H               | 319.900       | 2.6            | 14.6                   | 2.3           | 0.0               | 0.0                | 19.6         | 46.0           | -26.4     | 120/300 kHz |     |
| QP            | H               | 378.194       | -1.4           | 16.3                   | 2.6           | 0.0               | 0.0                | 17.4         | 46.0           | -28.6     | 120/300 kHz |     |
| QP            | H               | 392.256       | 1.6            | 16.3                   | 2.6           | 0.0               | 0.0                | 20.5         | 46.0           | -25.5     | 120/300 kHz |     |
| QP            | H               | 394.800       | -3.3           | 16.4                   | 2.6           | 0.0               | 0.0                | 15.7         | 46.0           | -30.3     | 120/300 kHz |     |
| QP            | V               | 396.700       | 4.3            | 15.4                   | 2.6           | 0.0               | 0.0                | 22.3         | 46.0           | -23.7     | 120/300 kHz |     |
| QP            | V               | 400.734       | 5.0            | 15.4                   | 2.6           | 0.0               | 0.0                | 23.0         | 46.0           | -23.0     | 120/300 kHz | RB  |
| QP            | H               | 405.200       | 0.7            | 16.4                   | 2.6           | 0.0               | 0.0                | 19.7         | 46.0           | -26.3     | 120/300 kHz | RB  |
| QP            | H               | 408.300       | -2.4           | 16.4                   | 2.7           | 0.0               | 0.0                | 16.6         | 46.0           | -29.4     | 120/300 kHz | RB  |
| QP            | H               | 418.687       | -2.1           | 16.3                   | 2.7           | 0.0               | 0.0                | 17.0         | 46.0           | -29.0     | 120/300 kHz |     |
| QP            | H               | 421.900       | -2.4           | 16.3                   | 2.8           | 0.0               | 0.0                | 16.7         | 46.0           | -29.3     | 120/300 kHz |     |
| QP            | H               | 432.300       | -0.4           | 16.5                   | 2.8           | 0.0               | 0.0                | 19.0         | 46.0           | -27.0     | 120/300 kHz |     |
| QP            | H               | 435.600       | 2.4            | 16.7                   | 2.8           | 0.0               | 0.0                | 21.9         | 46.0           | -24.1     | 120/300 kHz |     |
| QP            | H               | 445.800       | 3.2            | 17.0                   | 2.9           | 0.0               | 0.0                | 23.1         | 46.0           | -22.9     | 120/300 kHz |     |
| QP            | H               | 449.200       | 3.9            | 17.2                   | 2.9           | 0.0               | 0.0                | 23.9         | 46.0           | -22.1     | 120/300 kHz |     |
| QP            | H               | 459.300       | 5.6            | 17.5                   | 2.9           | 0.0               | 0.0                | 25.9         | 46.0           | -20.1     | 120/300 kHz |     |
| QP            | H               | 462.700       | 4.7            | 17.6                   | 2.9           | 0.0               | 0.0                | 25.1         | 46.0           | -20.9     | 120/300 kHz |     |
| QP            | H               | 472.868       | 6.0            | 17.9                   | 2.9           | 0.0               | 0.0                | 26.8         | 46.0           | -19.2     | 120/300 kHz |     |
| QP            | H               | 476.348       | 5.0            | 18.0                   | 2.9           | 0.0               | 0.0                | 25.9         | 46.0           | -20.1     | 120/300 kHz |     |
| QP            | H               | 486.766       | 0.7            | 18.0                   | 3.0           | 0.0               | 0.0                | 21.6         | 46.0           | -24.4     | 120/300 kHz |     |
| QP            | H               | 490.362       | 5.2            | 18.0                   | 3.0           | 0.0               | 0.0                | 26.2         | 46.0           | -19.8     | 120/300 kHz |     |

**Radiated Emissions Setup Photos**



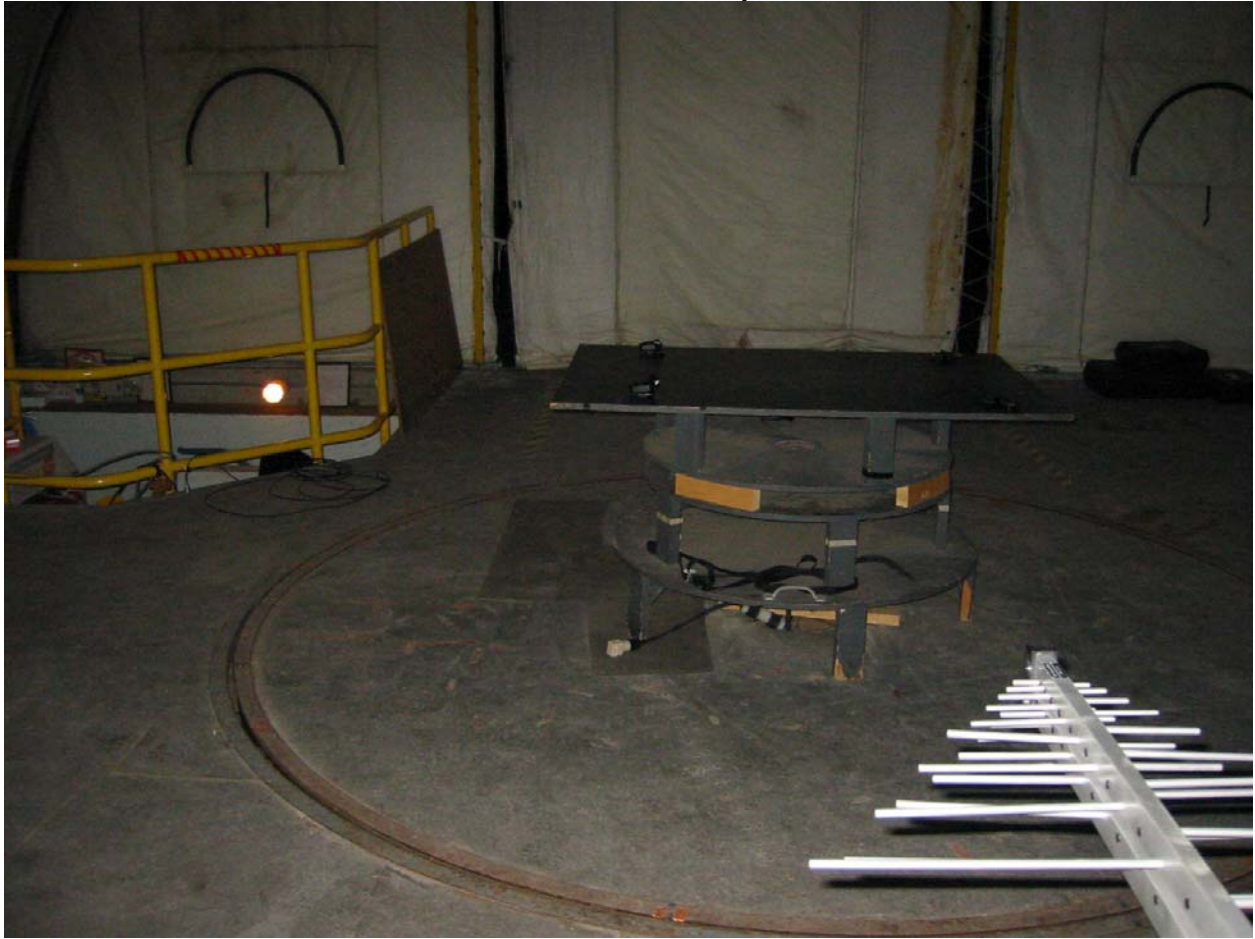
**Radiated Emissions Setup Photos**



**Radiated Emissions Setup Photos**



**Radiated Emissions Setup Photos**



**Test Results:** Pass

**Test Standard:** FCC Part 15 Subpart C 15.225

**Test:** Frequency Stability

**Performance Criterion:** The frequency tolerance of the 13.56 MHz fundamental must not deviate by more than 0.01% (100 ppm) over a temperature range from -20 to +50 degrees Celsius.

**Test Environment:**

|                                          |                     |     |                       |                |                 |     |
|------------------------------------------|---------------------|-----|-----------------------|----------------|-----------------|-----|
| Environmental Conditions During Testing: | Ambient (°C):       | N/A | Humidity (%):         | N/A            | Pressure (hPa): | N/A |
| Pretest Verification Performed           | Yes                 |     | Equipment under Test: | Wireless Relay |                 |     |
| Test Engineer(s):                        | Nicholas Abbondante |     | EUT Serial Number:    | A              |                 |     |

**Test Equipment Used:**

| TEST EQUIPMENT LIST |                       |                 |           |                    |               |
|---------------------|-----------------------|-----------------|-----------|--------------------|---------------|
| Item                | Equipment Type        | Make            | Model No. | Serial No.         | Next Cal. Due |
| 1                   | Spectrum Analyzer     | Hewlett Packard | 8591E     | 3308A01445         | 02/15/2009    |
| 2                   | LOOP ANTENNA          | Empire          | LP-105    | 905                | 09/21/2008    |
| 3                   | Temp/Humidity Chamber | Envirotronics   | SH27C     | 08015563S11<br>263 | 03/18/2009    |

**Software Utilized:**

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

## Test Details:

### Frequency Stability

Company: Freelinc

Model #: FA-03

Serial #: A

Engineer(s): Nicholas Abbondante

Project #: 3147251

Date(s): 07/09/08

Location: Littleton

Standard: FCC Part 15 Subpart C 15.225

Limit: 100 PPM

Nominal f: 13.56 MHz

Test Equipment Used:

SA0001 LOOP2 148012

Fresh  
Battery

Voltage: 9 VDC

| Temp<br>Celsius | Frequency<br>MHz | Deviation<br>kHz | Limit kHz |
|-----------------|------------------|------------------|-----------|
| -20             | 13.557750        | 0.5              | 1.36      |
| -10             | 13.557380        | 0.13             | 1.36      |
| 0               | 13.557500        | 0.25             | 1.36      |
| 10              | 13.556880        | -0.37            | 1.36      |
| 20              | 13.557250        | 0                | 1.36      |
| 30              | 13.557630        | 0.38             | 1.36      |
| 40              | 13.557380        | 0.13             | 1.36      |
| 50              | 13.557380        | 0.13             | 1.36      |