# EMISSIONS TEST REPORT

**Report Number: 3079725.EMI**
**Project Number: 3079725**

**Testing performed on the**
**Model: Freelinc Wireless Headset System**

**to**

**FCC Part 15 Subpart C 15.225**

**For**

**Radeum**

| Test Performed by: | Test Authorized by: |
|---|---|
| Intertek – ETL SEMKO | Radeum |
| 70 Codman Hill Road | 2144 S. Highland Drive Suite #160 |
| Boxborough, MA 01719 | Salt Lake City, UT, 84106 |

Prepared by: _____ Date: 10/10/05
Nicholas Abbondante

Reviewed by: _____ Date: 10/10/05
Michael F. Murphy

## 1.0 Job Description

### 1.1 Client Information

This EUT has been tested at the request of

| | |
|---|---|
| **Company**: | Radeum<br>2144 S. Highland Drive Suite #160<br>Salt Lake City, UT, 84106 |
| **Contact:** | John Lair |
| **Telephone:** | 801-467-1199 |
| **Fax:** | 801-467-6099 |

### 1.2 Equipment Under Test

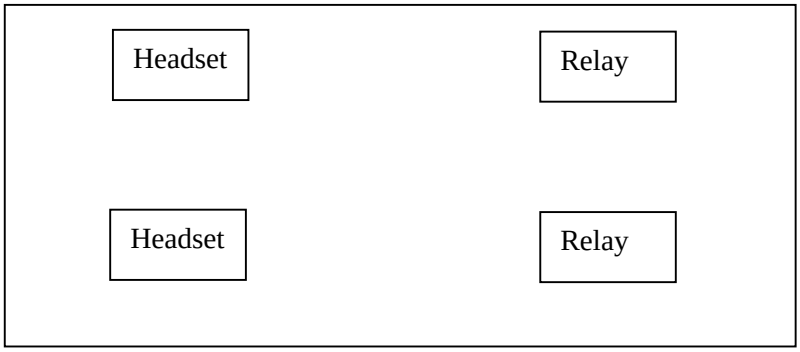
| | |
|---|---|
| **Equipment Type:** | Wireless Headset System |
| **Model Number(s):** | Freelinc Wireless Headset System |
| **Serial number(s):** | BOX0507271156-(001, 003, 005, 007) (ITS assigned)<br>-001 and –005 are Headsets, –003 and –007 are Relays |
| **Manufacturer:** | Radeum |
| **EUT receive date:** | 07/27/2005 |
| **EUT received condition:** | Good |
| **Test start date:** | 07/28/2005 |
| **Test end date:** | 08/12/2005 |

**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

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 Headset and Relay must be ~1.1 meters apart maximum, and the two systems must be ~0.5 meters apart.



### 1.4.2 Cable List:

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

### 1.4.3 Support Equipment:

Name: None
Model No.:
Serial No.:

### 1.5 Mode of Operation:

The EUT was activated from a fresh, charged battery in transmit mode. The EUT software disables transmission while in charge mode, so this mode was not tested to the transmitter requirements.

## 2.0 Test Summary

| TEST STANDARD | RESULTS | |
|---|---|---|
| **FCC Part 15 Subpart C 15.225** | | |
| **SUB-TEST** | **TEST PARAMETER** | **COMMENT** |
| FCC Parts 15.205, 15.209, 15.215, 15.225 RF Output Power and Radiated and Restricted Band Emissions | Emissions below specified limits | Pass |
| FCC Part 15.207 Line-Conducted Emissions | Emissions below specified limits | Pass |
| FCC Parts 15.225 Frequency Stability | Frequency drift must not exceed ±0.01% | Pass |
| FCC Parts 15.205 Occupied Bandwidth and Restricted Bands | The 20dB bandwidth must not extend into or drift into the restricted bands | Pass |

## 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 dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
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 dBμV 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 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

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

Level in μV/m = [10( 32 dBμV/m)/20] = 39.8 μV/m

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

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV

**Example:**

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(48.1\ dB\mu V / 20)}$ = 254 μV/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):** 2, Field Behind Site 2

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 Parts 15.205, 15.209, 15.225

**Test:** RF Output Power and Radiated and Restricted Band Emissions

**Performance Criterion:** RF Output Power is subject to the limits set forth in FCC Part 15.225, Spurious Emissions up to the tenth harmonic and in restricted bands are subject to the limits set forth in FCC Part 15.209. Spurious emissions must not exceed the fundamental field strength.

**Test Environment:**
See Data Tables

**Maximum Test Disturbance Parameters:** Emissions must not exceed specified limits.

**Software:**

| Name | Manufacturer | Version |
|---|---|---|
| EXCEL 2000 | Microsoft Corporation | 9.0.6926 SP-3 |
| EMI BOXBOROUGH | Intertek | 2/07/05 Revision |

**Test Date:** 07/29/2005 and 08/10/2005 **Engineer Initials:** NNA **Date:** 10/10/05
**Test Engineer:** Nicholas Abbondante **Reviewer Initials:** MFM **Date:** 10/10/05

**Test Equipment Used:**

| Intertek ID | Manufacturer | Model | Serial Number | Cal. Due |
|---|---|---|---|---|
| BAR2 | Mannix | 0ABA116 | BAR2 | 08/02/2006 |
| LOG2 | EMCO | 3142 | 9711-1223 | 12/13/2005 |
| - | Agilent | E7405A | US39150114 | 07/29/2005* |
| ROS002 | Rohde & Schwarz | ESCI | 100067 | 11/25/2005 |
| CBL022 | Belden | RG-58/U | CBL022 | 11/17/2005 |
| LOOP 145-019 | EMCO | 6502/1 | 9902-3267 | 01/26/2006 |
| S2, 10M FLR | ITS | RG-214B/U | S2, 10M FLR | 09/15/2005 |

* - used only for the 07/29/2005 testing

## Test Details:

**Radiated Emissions / Interference**

| | | | | | |
|---|---|---|---|---|---|
| Company: | Radeum | | Model #: | Freelinc Wireless Headset System | |
| Engineer: | Nicholas Abbondante | Barometer: BAR2 | Serial #: | BOX0507271156-(001, 003, 005, 007) (ITS assigned) | |
| Project #: | 3079725 | Pressure: 1004mB | Receiver: | R&S ESCI (ROS002) | |
| Date: | 08/10/05 | Temp: 27c | N Antenna: | LOG2 12-13-05 V10.txt | LOG2 12-13-05 H10.txt |
| Standard: | FCC Part 15.225 | Humidity: 60% | LF Antenna: | LOOP145-019-E 1-26-06.txt | LOOP145-019-H 1-26-06.txt |
| Class: | - | Group: - | HF Antenna: | NONE. | NONE. |
| Antenna Band: | LF | Bands: N, LF, HF, SHF | SHF Antenna: | NONE. | NONE. |
| PreAmp: | NONE. | | Cable(s): | CBL022 11-17-2005.cbl | NONE. |
| Limit Distance: | 30 meters | | Test Distance: | 3 meters | Location: Site 2 Field |
| Voltage/Frequency: | Fresh Battery | | Frequency Range: | 150 kHz - 30 MHz | |

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; 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 | 13.560 | 41.0 | 10.5 | 0.4 | 0.0 | 40.0 | 11.9 | 84.0 | -72.1 | 9/30 kHz |
| QP | V | 13.552 | 36.2 | 10.5 | 0.4 | 0.0 | 40.0 | 7.1 | 50.5 | -43.4 | 9/30 kHz |
| QP | V | 13.568 | 32.2 | 10.5 | 0.4 | 0.0 | 40.0 | 3.1 | 50.5 | -47.4 | 9/30 kHz |
| QP | V | 13.509 | 37.4 | 10.5 | 0.4 | 0.0 | 40.0 | 8.2 | 50.5 | -42.3 | 9/30 kHz |
| QP | V | 13.611 | 40.8 | 10.5 | 0.4 | 0.0 | 40.0 | 11.7 | 50.5 | -38.8 | 9/30 kHz |
| QP | V | 13.458 | 27.1 | 10.5 | 0.4 | 0.0 | 40.0 | -2.0 | 50.5 | -52.5 | 9/30 kHz |
| QP | V | 13.662 | 32.0 | 10.5 | 0.4 | 0.0 | 40.0 | 2.9 | 50.5 | -47.6 | 9/30 kHz |
| QP | V | 13.409 | 6.5 | 10.5 | 0.4 | 0.0 | 40.0 | -22.6 | 40.5 | -63.1 | 9/30 kHz |
| QP | V | 13.711 | 17.4 | 10.5 | 0.4 | 0.0 | 40.0 | -11.7 | 40.5 | -52.2 | 9/30 kHz |
| QP | V | 27.120 | 1.4 | 9.5 | 0.6 | 0.0 | 40.0 | -28.5 | 29.5 | -58.0 | 9/30 kHz |
| QP | V | 13.956 | 34.4 | 10.5 | 0.4 | 0.0 | 40.0 | 5.3 | 29.5 | -24.2 | 9/30 kHz |
| QP | V | 27.912 | 1.8 | 9.5 | 0.6 | 0.0 | 40.0 | -28.1 | 29.5 | -57.6 | 9/30 kHz |

Transmit Mode, 13.56 and 13.956 MHz fundamentals

**Radiated Emissions / Interference**

| | | | | | |
|---|---|---|---|---|---|
| Company: | Radeum | | | Model #: | Freelinc Wireless Headset System |
| Engineer: | Nicholas Abbondante | Barometer: | N/A | Serial #: | BOX0507271156-(001, 003, 005, 007) (ITS assigned) |
| Project #: | 3079725 | Pressure: | N/A | Receiver: | Agilent E7405A (S/N: US39150114) 7-29-05 |
| Date: | 07/28/05 | Temp: | N/A | N Antenna: | LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt |
| Standard: | FCC Part 15.209 | Humidity: | N/A | LF Antenna: | LOOP145-019-E 1-26-06.txt LOOP145-019-H 1-26-06.txt |
| Class: | - | Group: | - | HF Antenna: | NONE. NONE. |
| Antenna Band: | N | Bands: N, LF, HF, SHF | | SHF Antenna: | NONE. NONE. |
| PreAmp: | NONE. | | | Cable(s): | Site2, 10M Floor 9-15-05.cbl NONE. |
| Limit Distance: | 3 meters | | | Test Distance: | 3 meters Location: Site 2 |
| Voltage/Frequency: | Fresh Battery | | | Frequency Range: | 30 - 1000 MHz |

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; 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 | 0.6 | 11.3 | 1.0 | 0.0 | 0.0 | 12.9 | 40.0 | -27.1 | 120/300 kHz |
| QP | V | 108.480 | -1.7 | 7.6 | 1.6 | 0.0 | 0.0 | 7.5 | 43.5 | -36.0 | 120/300 kHz |
| QP | V | 122.040 | -0.7 | 6.8 | 1.7 | 0.0 | 0.0 | 7.8 | 43.5 | -35.7 | 120/300 kHz |
| QP | V | 135.600 | 0.1 | 7.1 | 1.8 | 0.0 | 0.0 | 9.0 | 43.5 | -34.5 | 120/300 kHz |
| QP | V | 41.868 | -0.2 | 10.9 | 1.0 | 0.0 | 0.0 | 11.7 | 40.0 | -28.3 | 120/300 kHz |
| QP | V | 83.736 | -0.3 | 7.2 | 1.4 | 0.0 | 0.0 | 8.4 | 40.0 | -31.6 | 120/300 kHz |
| QP | H | 111.200 | 1.8 | 7.5 | 1.6 | 0.0 | 0.0 | 10.9 | 43.5 | -32.6 | 120/300 kHz |
| QP | V | 125.900 | 12.7 | 6.7 | 1.7 | 0.0 | 0.0 | 21.2 | 43.5 | -22.3 | 120/300 kHz |
| QP | V | 140.400 | 5.2 | 7.5 | 1.9 | 0.0 | 0.0 | 14.6 | 43.5 | -28.9 | 120/300 kHz |
| QP | V | 326.700 | 9.3 | 14.5 | 3.0 | 0.0 | 0.0 | 26.7 | 46.0 | -19.3 | 120/300 kHz |
| QP | V | 336.300 | 19.7 | 14.8 | 3.1 | 0.0 | 0.0 | 37.6 | 46.0 | -8.4 | 120/300 kHz |
| QP | V | 340.300 | 15.8 | 15.0 | 3.1 | 0.0 | 0.0 | 33.8 | 46.0 | -12.2 | 120/300 kHz |
| QP | V | 347.700 | 12.9 | 15.2 | 3.1 | 0.0 | 0.0 | 31.2 | 46.0 | -14.8 | 120/300 kHz |
| QP | V | 361.600 | 8.3 | 15.6 | 3.2 | 0.0 | 0.0 | 27.1 | 46.0 | -18.9 | 120/300 kHz |
| QP | V | 378.300 | 5.1 | 16.2 | 3.3 | 0.0 | 0.0 | 24.6 | 46.0 | -21.4 | 120/300 kHz |
| QP | V | 394.700 | 9.9 | 17.1 | 3.3 | 0.0 | 0.0 | 30.3 | 46.0 | -15.7 | 120/300 kHz |
| QP | V | 408.300 | 13.0 | 17.2 | 3.4 | 0.0 | 0.0 | 33.6 | 46.0 | -12.4 | 120/300 kHz |
| QP | V | 421.800 | 15.6 | 16.8 | 3.5 | 0.0 | 0.0 | 35.8 | 46.0 | -10.2 | 120/300 kHz |
| QP | V | 435.500 | 17.3 | 17.1 | 3.5 | 0.0 | 0.0 | 37.9 | 46.0 | -8.1 | 120/300 kHz |
| QP | V | 449.100 | 16.1 | 17.7 | 3.6 | 0.0 | 0.0 | 37.3 | 46.0 | -8.7 | 120/300 kHz |
| QP | V | 459.300 | 8.4 | 17.8 | 3.6 | 0.0 | 0.0 | 29.8 | 46.0 | -16.2 | 120/300 kHz |
| QP | V | 462.700 | 10.8 | 17.9 | 3.6 | 0.0 | 0.0 | 32.3 | 46.0 | -13.7 | 120/300 kHz |
| QP | V | 476.400 | 12.6 | 18.0 | 3.7 | 0.0 | 0.0 | 34.3 | 46.0 | -11.7 | 120/300 kHz |
| QP | V | 490.000 | 11.0 | 18.0 | 3.8 | 0.0 | 0.0 | 32.8 | 46.0 | -13.2 | 120/300 kHz |

Transmit Mode, 13.56 and 13.956 MHz fundamentals

**Radiated Emissions / Interference**

| | | | | | |
|---|---|---|---|---|---|
| Company: | Radeum | | | Model #: | Freelinc Wireless Headset System |
| Engineer: | Nicholas Abbondante | Barometer: | BAR2 | Serial #: | BOX0507271156-(001, 003, 005, 007) (ITS assigned) |
| Project #: | 3079725 | Pressure: | 1004mB | Receiver: | R&S ESCI (ROS002) |
| Date: | 08/10/05 | Temp: | 27c | N Antenna: | LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt |
| Standard: | FCC Part 15.215 | Humidity: | 60% | LF Antenna: | LOOP145-019-E 1-26-06.txt LOOP145-019-H 1-26-06.txt |
| Class: | - | Group: | - | HF Antenna: | NONE. NONE. |
| Antenna Band: | LF | Bands: | N, LF, HF, SHF | SHF Antenna: | NONE. NONE. |
| PreAmp: | NONE. | | | Cable(s): | CBL022 11-17-2005.cbl NONE. |
| Limit Distance: | - meters | | | Test Distance: | 3 meters Location: Site 2 Field |
| Voltage/Frequency: | Fresh Battery | | | Frequency Range: | 150 kHz - 30 MHz |

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; 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 | 13.560 | 41.0 | 10.5 | 0.4 | 0.0 | 0.0 | 51.9 | - | - | 9/30 kHz |
| QP | V | 13.552 | 36.2 | 10.5 | 0.4 | 0.0 | 0.0 | 47.1 | 51.9 | -4.7 | 9/30 kHz |
| QP | V | 13.568 | 32.2 | 10.5 | 0.4 | 0.0 | 0.0 | 43.1 | 51.9 | -8.7 | 9/30 kHz |
| QP | V | 13.509 | 37.4 | 10.5 | 0.4 | 0.0 | 0.0 | 48.2 | 51.9 | -3.6 | 9/30 kHz |
| QP | V | 13.611 | 40.8 | 10.5 | 0.4 | 0.0 | 0.0 | 51.7 | 51.9 | -0.2 | 9/30 kHz |
| QP | V | 13.458 | 27.1 | 10.5 | 0.4 | 0.0 | 0.0 | 38.0 | 51.9 | -13.9 | 9/30 kHz |
| QP | V | 13.662 | 32.0 | 10.5 | 0.4 | 0.0 | 0.0 | 42.9 | 51.9 | -9.0 | 9/30 kHz |
| QP | V | 13.409 | 6.5 | 10.5 | 0.4 | 0.0 | 0.0 | 17.4 | 51.9 | -34.5 | 9/30 kHz |
| QP | V | 13.711 | 17.4 | 10.5 | 0.4 | 0.0 | 0.0 | 28.3 | 51.9 | -23.6 | 9/30 kHz |
| QP | V | 27.120 | 1.4 | 9.5 | 0.6 | 0.0 | 0.0 | 11.5 | 51.9 | -40.3 | 9/30 kHz |
| QP | V | 13.956 | 34.4 | 10.5 | 0.4 | 0.0 | 0.0 | 45.3 | - | - | 9/30 kHz |
| QP | V | 27.912 | 1.8 | 9.5 | 0.6 | 0.0 | 0.0 | 11.9 | 45.3 | -33.4 | 9/30 kHz |

Transmit Mode, 13.56 and 13.956 MHz fundamentals. Field strength at 3m for comparison of spurious with fundamental field strength.

**Radiated Emissions / Interference**

| | | | | | |
|---|---|---|---|---|---|
| Company: | Radeum | | | Model #: | Freelinc Wireless Headset System |
| Engineer: | Nicholas Abbondante | Barometer: | N/A | Serial #: | BOX0507271156-(001, 003, 005, 007) (ITS assigned) |
| Project #: | 3079725 | Pressure: | N/A | Receiver: | Agilent E7405A (S/N: US39150114) 7-29-05 |
| Date: | 07/28/05 | Temp: | N/A | N Antenna: | LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt |
| Standard: | FCC Part 15.215 | Humidity: | N/A | LF Antenna: | LOOP145-019-E 1-26-06.txt LOOP145-019-H 1-26-06.txt |
| Class: | - | Group: | - | HF Antenna: | NONE. NONE. |
| Antenna Band: | N | Bands: | N, LF, HF, SHF | SHF Antenna: | NONE. NONE. |
| PreAmp: | NONE. | | | Cable(s): | Site2, 10M Floor 9-15-05.cbl NONE. |
| Limit Distance: | - meters | | | Test Distance: | 3 meters Location: Site 2 |
| Voltage/Frequency: | Fresh Battery | | | Frequency Range: | 30 - 1000 MHz |

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; 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 | 0.6 | 11.3 | 1.0 | 0.0 | 0.0 | 12.9 | 51.9 | -39.0 | 120/300 kHz |
| QP | V | 108.480 | -1.7 | 7.6 | 1.6 | 0.0 | 0.0 | 7.5 | 51.9 | -44.4 | 120/300 kHz |
| QP | V | 122.040 | -0.7 | 6.8 | 1.7 | 0.0 | 0.0 | 7.8 | 51.9 | -44.1 | 120/300 kHz |
| QP | V | 135.600 | 0.1 | 7.1 | 1.8 | 0.0 | 0.0 | 9.0 | 51.9 | -42.9 | 120/300 kHz |
| QP | V | 41.868 | -0.2 | 10.9 | 1.0 | 0.0 | 0.0 | 11.7 | 45.3 | -33.6 | 120/300 kHz |
| QP | V | 83.736 | -0.3 | 7.2 | 1.4 | 0.0 | 0.0 | 8.4 | 45.3 | -37.0 | 120/300 kHz |
| QP | H | 111.200 | 1.8 | 7.5 | 1.6 | 0.0 | 0.0 | 10.9 | 45.3 | -34.4 | 120/300 kHz |
| QP | V | 125.900 | 12.7 | 6.7 | 1.7 | 0.0 | 0.0 | 21.2 | 45.3 | -24.1 | 120/300 kHz |
| QP | V | 140.400 | 5.2 | 7.5 | 1.9 | 0.0 | 0.0 | 14.6 | 45.3 | -30.8 | 120/300 kHz |
| QP | V | 326.700 | 9.3 | 14.5 | 3.0 | 0.0 | 0.0 | 26.7 | 45.3 | -18.6 | 120/300 kHz |
| QP | V | 336.300 | 19.7 | 14.8 | 3.1 | 0.0 | 0.0 | 37.6 | 45.3 | -7.7 | 120/300 kHz |
| QP | V | 340.300 | 15.8 | 15.0 | 3.1 | 0.0 | 0.0 | 33.8 | 45.3 | -11.5 | 120/300 kHz |
| QP | V | 347.700 | 12.9 | 15.2 | 3.1 | 0.0 | 0.0 | 31.2 | 45.3 | -14.1 | 120/300 kHz |
| QP | V | 361.600 | 8.3 | 15.6 | 3.2 | 0.0 | 0.0 | 27.1 | 45.3 | -18.2 | 120/300 kHz |
| QP | V | 378.300 | 5.1 | 16.2 | 3.3 | 0.0 | 0.0 | 24.6 | 45.3 | -20.8 | 120/300 kHz |
| QP | V | 394.700 | 9.9 | 17.1 | 3.3 | 0.0 | 0.0 | 30.3 | 45.3 | -15.0 | 120/300 kHz |
| QP | V | 408.300 | 13.0 | 17.2 | 3.4 | 0.0 | 0.0 | 33.6 | 45.3 | -11.7 | 120/300 kHz |
| QP | V | 421.800 | 15.6 | 16.8 | 3.5 | 0.0 | 0.0 | 35.8 | 45.3 | -9.5 | 120/300 kHz |
| QP | V | 435.500 | 17.3 | 17.1 | 3.5 | 0.0 | 0.0 | 37.9 | 45.3 | -7.4 | 120/300 kHz |
| QP | V | 449.100 | 16.1 | 17.7 | 3.6 | 0.0 | 0.0 | 37.3 | 45.3 | -8.0 | 120/300 kHz |
| QP | V | 459.300 | 8.4 | 17.8 | 3.6 | 0.0 | 0.0 | 29.8 | 45.3 | -15.5 | 120/300 kHz |
| QP | V | 462.700 | 10.8 | 17.9 | 3.6 | 0.0 | 0.0 | 32.3 | 45.3 | -13.0 | 120/300 kHz |
| QP | V | 476.400 | 12.6 | 18.0 | 3.7 | 0.0 | 0.0 | 34.3 | 45.3 | -11.0 | 120/300 kHz |
| QP | V | 490.000 | 11.0 | 18.0 | 3.8 | 0.0 | 0.0 | 32.8 | 45.3 | -12.6 | 120/300 kHz |

Transmit Mode, 13.56 and 13.956 MHz fundamentals. Field strength at 3m for comparison of spurious with fundamental field strength. Note that the spurious emissions above the tenth harmonic were compared to the lower of the two fundamental field strengths.

**Setup Photos**

**Test Results:** Pass

**Test Standard:** FCC Part 15.207

**Test:** Line-conducted Emissions

**Performance Criterion:** N/A, EUT is battery powered

**Test Environment:**
See Data Table

**Maximum Test Disturbance Parameters:** Emissions must not exceed specified limits

**Software:**

| Name | Manufacturer | Version |
|---|---|---|
| EXCEL 2000 | Microsoft Corporation | 9.0.6926 SP-3 |
| EMI BOXBOROUGH | Intertek | 2/07/05 Revision |

**Test Date:** N/A
**Test Engineer:** N/A

**Engineer Initials:** NNA **Date:** 10/10/05
**Reviewer Initials:** MFM **Date:** 10/10/05

**Test Equipment Used:**

| Intertek ID | Manufacturer | Model | Serial Number | Cal. Due |
|---|---|---|---|---|
| Test not performed, EUT is battery powered | | | | |

**Test Details:**

Test not performed, EUT is battery powered

**Setup Photos**

Test not performed, EUT is battery powered

**Test Results:** Pass

**Test Standard:** FCC Parts 15.225

**Test:** Frequency Stability

**Performance Criterion:** The EUT must meet the requirements of FCC Part 15.225

**Test Environment:**
**Temp:** 22°C **Humidity:** 52%
**Pressure:** 1005 mbar

**Maximum Test Disturbance Parameters:** Frequency drift shall not exceed ±0.01%

**Software:**

| Description | Manufacturer | Version |
|---|---|---|
| EXCEL 2000 | Microsoft Corporation | 9.0.6926 SP-3 |

**Test Date:** 08/12/2005 **Engineer Initials:** NNA **Date:** 10/10/05
**Test Engineer:** Nicholas Abbondante **Reviewer Initials:** MFM **Date:** 10/10/05

**Test Equipment Used:**

| Intertek ID | Manufacturer | Model | Serial Number | Cal. Due |
|---|---|---|---|---|
| CBL022 | Belden | RG-58/U | CBL022 | 11/17/2005 |
| SAF312 | Mannix | 0ABA116 | SAF312 | 04/26/2006 |
| ROS002 | Rohde & Schwarz | ESCI | 100067 | 11/25/2005 |
| SAF187 | Bryant Manufacturing | TH-5S | 1207 | 04/06/2006 |
| MET2 | Meterman | 15XP | 050407779 | 07/28/2006 |
| LOOP 145-019 | EMCO | 6502/1 | 9902-3267 | 01/26/2006 |
| KEP2 | Kepco | MBT 75-5M | F 81015 | Verified |

**Test Details:**

| Channels | Freq MHz | Relay Voltage: | 9VDC |
|---|---|---|---|
| Channel 1 | 13.56 | Headset Voltage: | 4VDC |
| Channel 2 | 13.956 | (not tested) | |
| Passband: | 13.56 - 13.956 | MHz | |

Power measurements in this test are relative and do not represent actual power of EUT, the measurement was performed to show relative power drift only

| Frequency and Power Stability over Voltage & Temperature 8/12/05 performed by Nicholas Abbondante | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temp | Freq MHz | Deviation, Hz | Deviation, MHz | PPM | Limit, Hz | Power dBuV | Deviation, dB |
| -20 | 13.508418 | -62 | -0.000062 | -4.59 | 1350.85 | 62.70 | 2.80 |
| -10 | 13.509388 | 908 | 0.000908 | 67.21 | 1350.85 | 58.60 | -1.30 |
| 0 | 13.508420 | -60 | -0.000060 | -4.44 | 1350.85 | 60.70 | 0.80 |
| 10 | 13.508496 | 16 | 0.000016 | 1.18 | 1350.85 | 59.76 | -0.14 |
| 20 | 13.508480 | 0 | 0.000000 | 0.00 | 1350.85 | 59.90 | 0.00 |
| 30 | 13.508458 | -22 | -0.000022 | -1.63 | 1350.85 | 62.50 | 2.60 |
| 40 | 13.508740 | 260 | 0.000260 | 19.25 | 1350.85 | 60.20 | 0.30 |
| 50 | 13.509144 | 664 | 0.000664 | 49.15 | 1350.85 | 64.20 | 4.30 |
| Voltage | Freq MHz | Deviation, Hz | Deviation, MHz | PPM | Limit, Hz | Power dBuV | Deviation, dB |
| 3.6 & 8.1 VDC | 13.509390 | 910 | 0.000910 | 67.36 | 1350.85 | 60.60 | 0.70 |
| 4 & 9 VDC | 13.508480 | 0 | 0.000000 | 0.00 | 1350.85 | 59.90 | 0.00 |
| 3.4 & 7.65 VDC | 13.509550 | 1070 | 0.001070 | 79.20 | 1350.85 | 60.20 | 0.30 |

**Test Results:** Pass

**Test Standard:** FCC Parts 15.205

**Test:** Occupied Bandwidth and Restricted Bands

**Performance Criterion:** The 20dB bandwidth must not extend into or drift into the restricted bands

**Test Environment:**
N/A

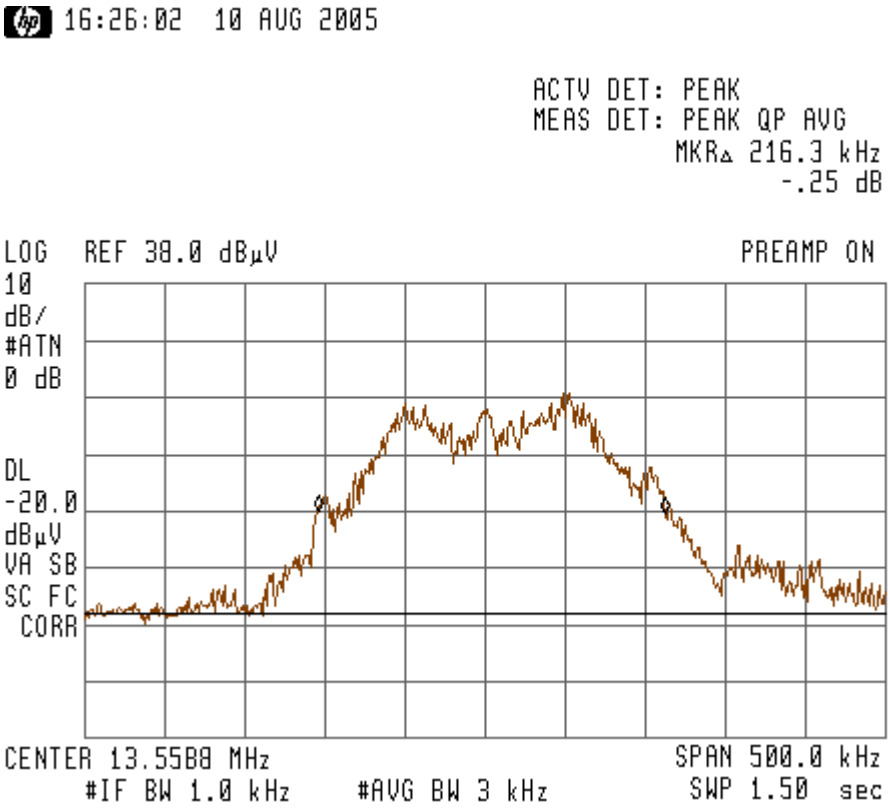
**Maximum Test Disturbance Parameters:** There is no limit on 20dB bandwidth

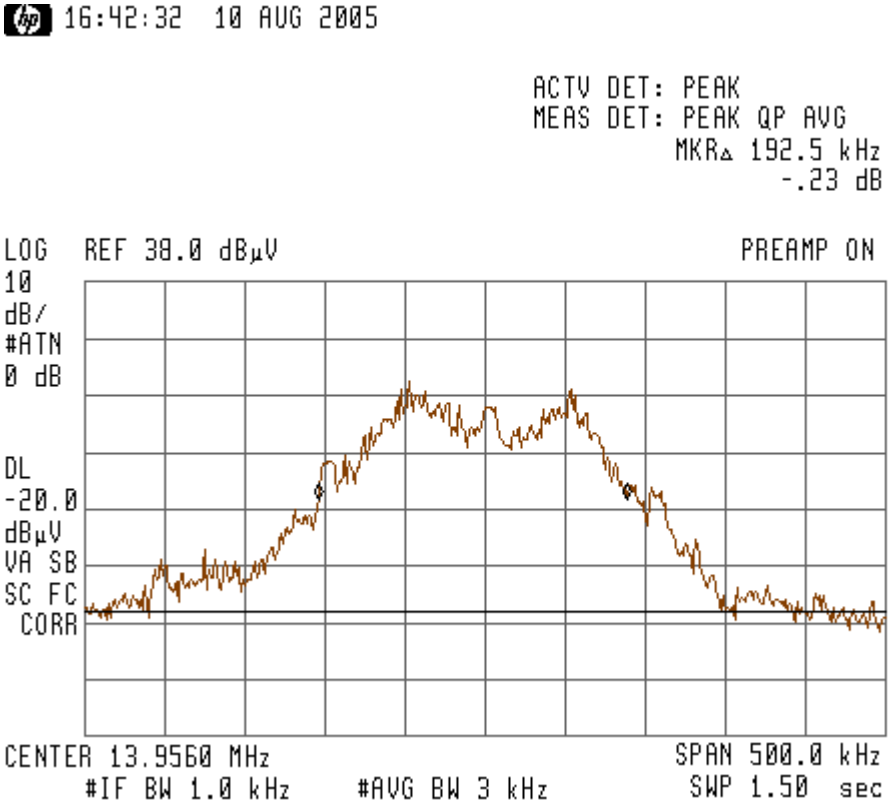
**Test Date:** 08/10/2005 **Engineer Initials:** NNA **Date:** 10/10/05
**Test Engineer:** Nicholas Abbondante **Reviewer Initials:** MFM **Date:** 10/11/05

**Test Equipment Used:**

| Intertek ID | Manufacturer | Model | Serial Number | Cal. Due |
|---|---|---|---|---|
| REC2 | Hewlett Packard | 8542E | 3520A00125 | 02/08/2006 |
| RECFL2 | Hewlett Packard | 85420E | 3427A00126 | 02/08/2006 |

**Test Details:**
The maximum 20dB bandwidth is 216.3 kHz, and the frequency drift measured is 908 Hz. The nearest restricted bands are located at 13.36-13.41 MHz and 16.42-16.423 MHz. Devices tested to FCC Part 15.225 are exempted from the restricted band requirements for the 13.36-13.41 MHz band, therefore the nearest restricted band below the fundamental frequency is 12.57675-12.57725 MHz. Since the fundamental at nominal temperature and voltage is centered at 13.508480 MHz for channel 1 and at 13.910640 MHz for channel 2, the fundamental will not ever extend beyond 13.399422-14.011698 MHz.


16:26:02 10 AUG 2005
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 216.3 kHz
-.25 dB
LOG REF 38.0 dBµV
PREAMP ON
10
dB/
#ATN
0 dB
DL
-20.0
dBµV
VA SB
SC FC
CORR
CENTER 13.5588 MHz
SPAN 500.0 kHz
#IF BW 1.0 kHz
#AVG BW 3 kHz
SWP 1.50 sec


16:42:32 10 AUG 2005
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 192.5 kHz
-.23 dB
LOG REF 38.0 dBµV
PREAMP ON
10
dB/
#ATN
0 dB
DL
-20.0
dBµV
VA SB
SC FC
CORR
CENTER 13.9560 MHz
SPAN 500.0 kHz
#IF BW 1.0 kHz
#AVG BW 3 kHz
SWP 1.50 sec