



Testing Cert #1007.01

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# Atlas Compliance & Engineering, Inc.

## FCC Test Report

### FCC CFR 47 Part 15.207 and 15.209 COMPLIANCE

• • • • • • • • •  
*Vector Wireless  
P.O. Box 5931  
Santa Clara, California 95056 USA*

*Product:  
Proximity Reader  
Model:  
Wireless Whiskers*

Test Report Number: 1020VWLwwskr\_subc  
Date of Report: May 24, 2010

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## General Information

Test Report Number: 1020VWLwwskr\_subc  
Date Product Tested: May 14-18, 2010  
Date of Report: May 24, 2010  
Applicant: Vector Wireless  
P.O. Box 5931  
Santa Clara, California 95056 USA  
Contact Person: Steve Whelan  
Equipment Tested: Proximity Reader  
Model: Wireless Whiskers  
Frequency: 125 KHz  
Purpose of Test: To demonstrate the compliance of the Proximity Reader, Wireless Whiskers, with the requirements of FCC CFR 47 Part 15 Rules and Regulations to the limits of Subpart C 15.207 and 15.209 using the procedure stated in ANSI C63.4-2003.  
Frequency Range Investigated: 9 kHz to 1000 MHz  
Test Site Locations: FCC measurement facility registration number 90452,  
Industry Canada test site file number IC 4929,  
Field Strength Measurement Facility:  
Atlas Compliance & Engineering, Inc.  
726 Hidden Valley Road  
Royal Oaks, California 95076  
Conducted Interference Measurement Facility:  
Atlas Compliance & Engineering, Inc.  
1792 Little Orchard Street  
San Jose, California 95125  
Test Personnel: Bruce Smith  
EMC Engineer



## Test Equipment

**The following list contains the test equipment that was utilized in making the measurements in this report.**

Description _ Model	Serial	Manufacturer	Calibration Due
BiLog Antenna _ CBL6112B	2783	Chase Electronics Ltd.	11/9/11
Active Loop Antenna _ 6502	9108-2669	EMCO	5/1/11
LISN _ 4825/2	9808-1088	EMCO	11/20/11
OATS – RG8 Cable 75 ft.	0004	Belden	10/16/11
Pre amp 9kHz-2GHz _ CPA9231A	3259	Schaffner	11/20/11
EMI Receiver 9kHz – 6.5 GHz _ 8546A	3650A00196	HP	11/5/11
4.8kVA AC Power Source _ 4801L	HK511991	California Instruments	2/1/11
Temperature and humidity probe _ RH-20F	200-97-082591	Omega Engineering	2/1/11



## EUT Technical Description

The product is an automated pet feeder that uses RFID technology to identify the presence of the pet that is wearing an ID tag. From this identification the device will allow access to the feed dish by opening the cover.

The product uses a mixed signal controller operating at 24 MHz and an AC power adapter. The product also has battery power in the event of power outage. The RF section operates at 125 kHz.



## Test Configuration

Customer: Vector Wireless  
Test Date: May 14-18, 2010  
Specification: FCC CRF 47 Part 15.209 Limits,  
ANSI C63.4-1992 Methods

### EUT Description / Note:

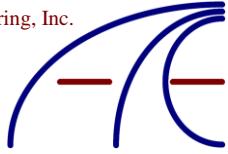
The EUT, Wireless Whiskers, a Proximity Reader, was tested connected to an AC power adapter and also with new batteries. The AC power adapter tested was MLF AC Adapter model MLF-005W0750666-C, Input 100-240VAC 50/60Hz 0.3A max Output 7.5VDC 500mA. Also tested for compliance was the Bolic Power Supply model BLC000750500WU, Input 100-240VAC 50/60Hz 0.15A max Output 7.5VDC 500mA. The EUT was set on the test table as it would be in a normal use on the floor.

### EUT Support Program

The Wireless Whiskers reader was placed in a constantly transmit operating mode waiting for a valid ID tag. It was also tested in a normal operating mode where the transmitter is turned on and off at intervals looking for a valid RFID tag.

### EUT Modifications for Compliance

There were no modifications performed on the EUT. The test results state the emission levels of the EUT in the condition as it was received on May 14, 2010.



## EUT Support Devices

*Table 1 - Support Equipment Used For Test*

Model:	Description:	S/N	FCC ID#
N/A	N/A	N/A	N/A

## I/O Ports and Cables

*Table 2 - EUT Port Termination's*

I/O Port	Cable Type	Length	Connector	Termination
DC IN	Non shielded	6 FT	DC Jack	Power Mains

*Table 3 - Host Port Termination's*

I/O Port	Cable Type	Length	Connector	Termination
Not Applicable				



## Equipment Under Test

The photographs below show the condition of the EUT for test.

Front view



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Back view



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MLF Power Adapter.



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AC adapter label



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Bolic Power Adapter.



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AC adapter label



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Front panel



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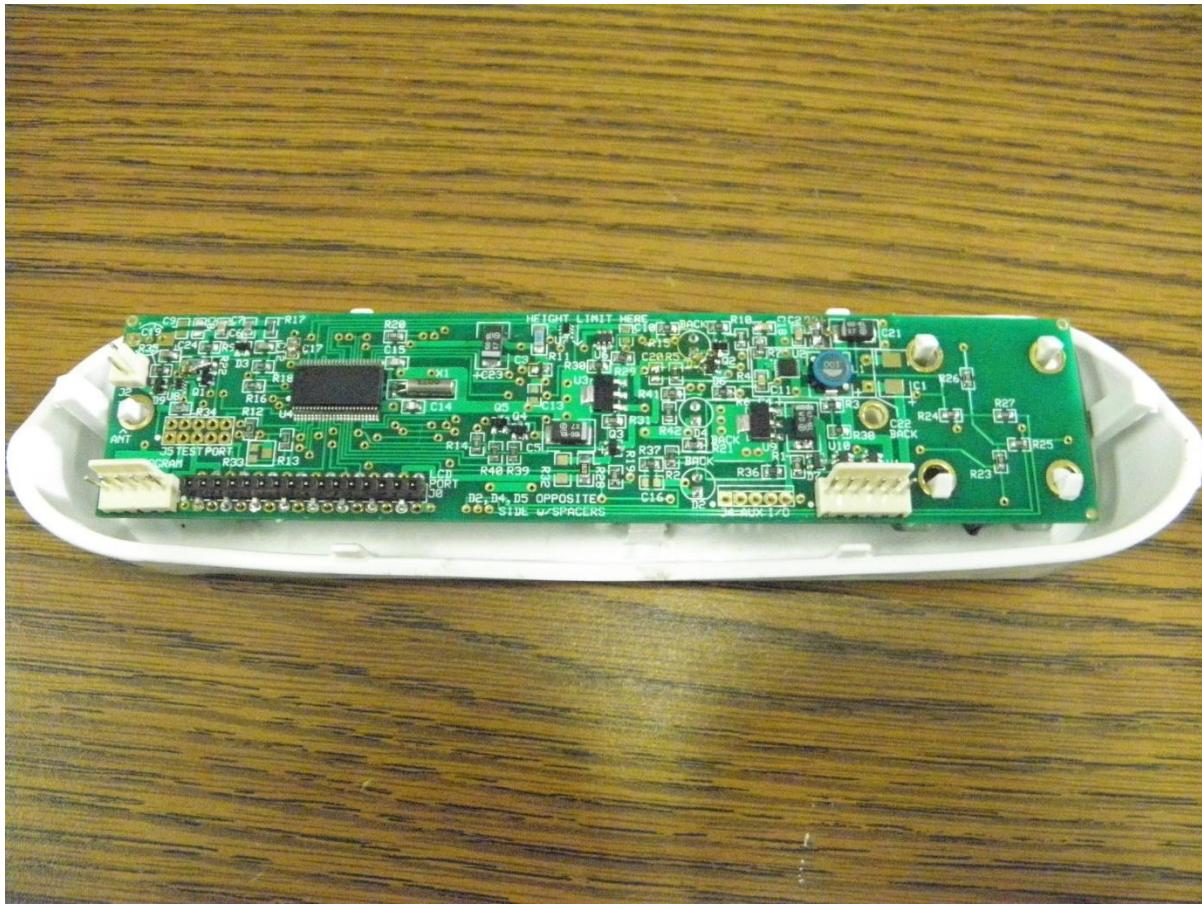
Main PCB installed



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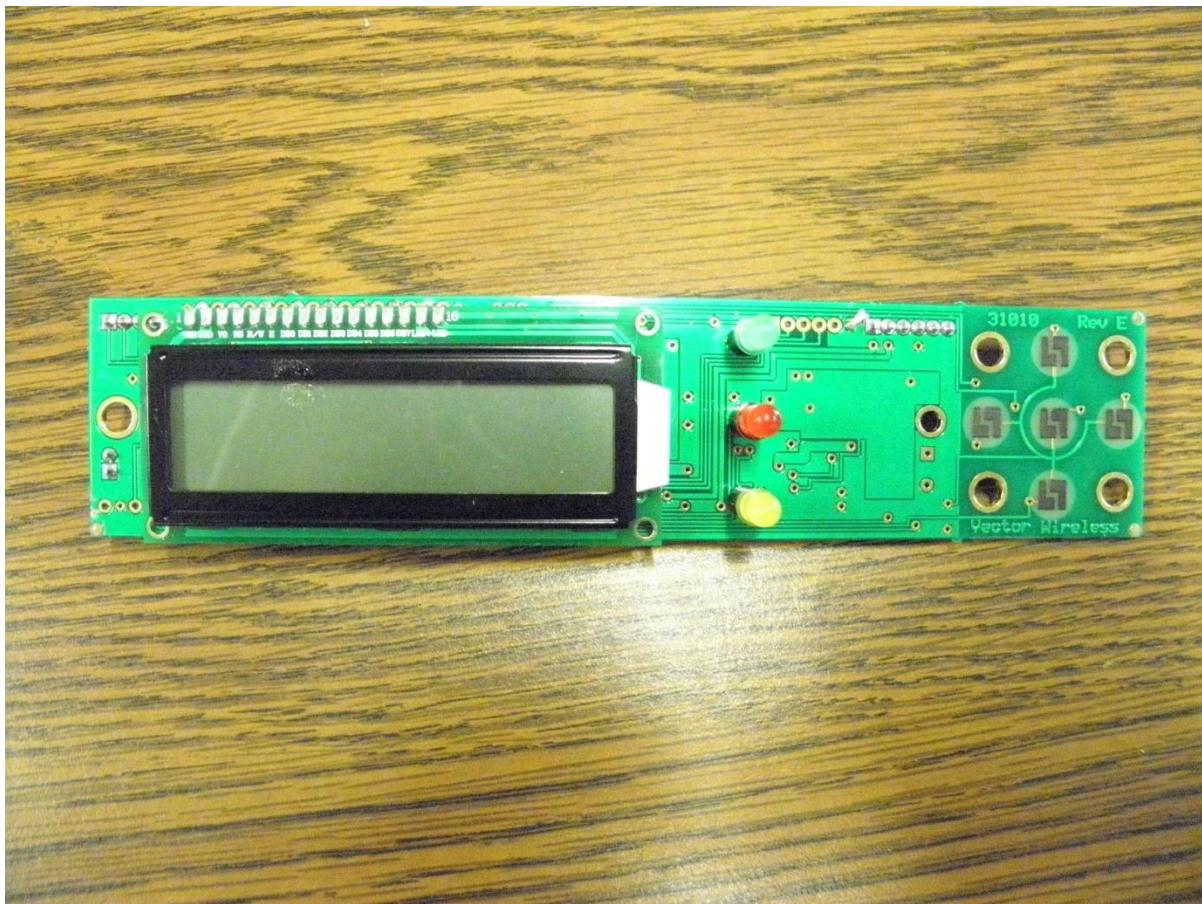
Main PCB assembled bottom view



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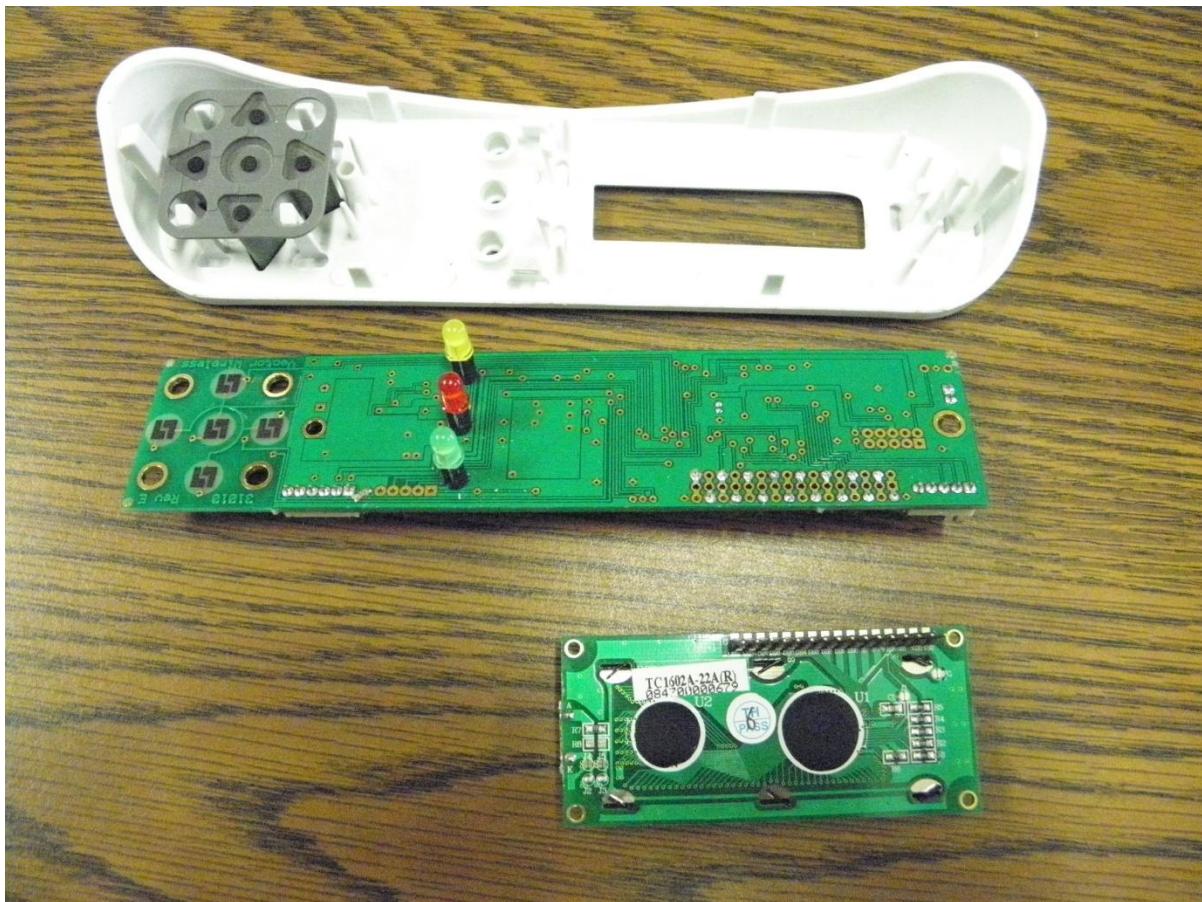
Main PCB and Display assembled top view



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Main PCB and display



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Antenna location top view



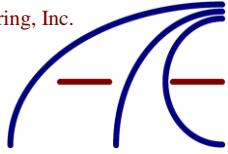
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Antenna location bottom view



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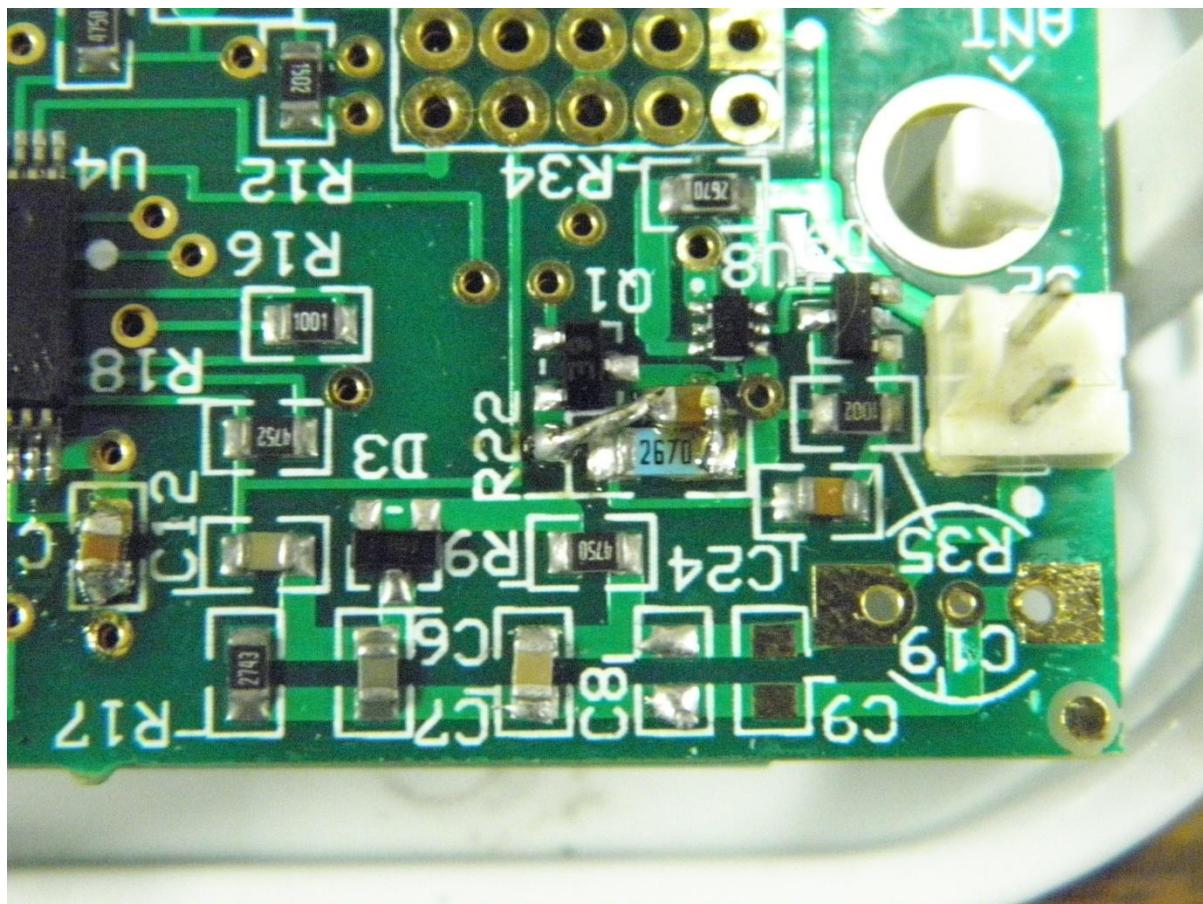
Antenna



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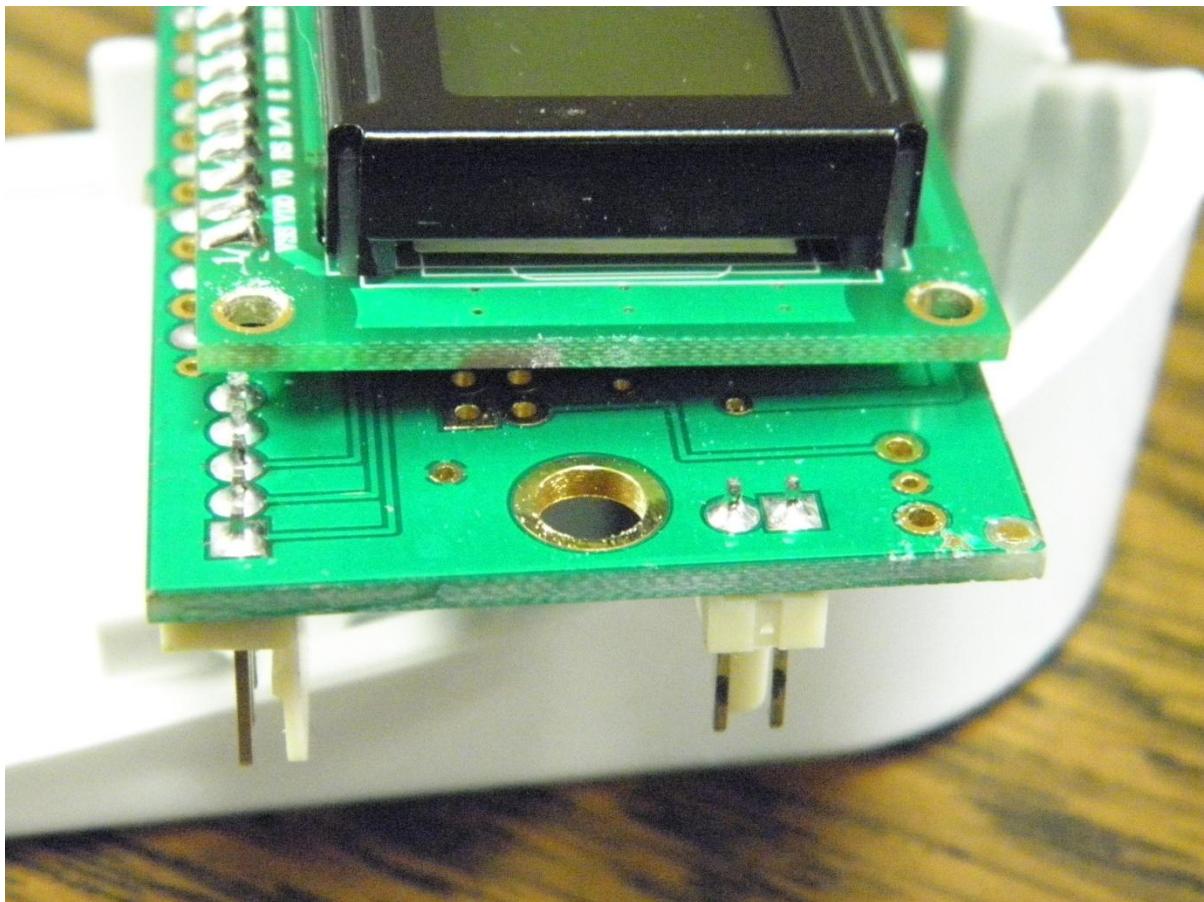
## Tx Rx circuit



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Antenna connection

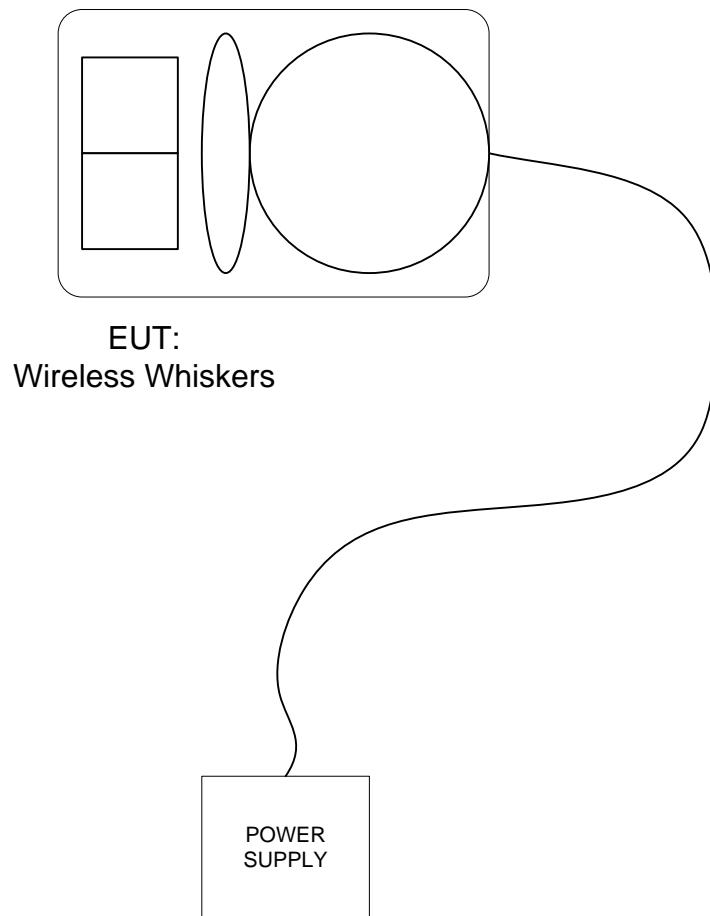




## Equipment Block Diagram

Following is the block diagram of the test setup. Refer to TEST CONFIGURATION pages for port connections and information.

*Figure 1 - Test Setup Diagram*





## Test Setup (Radiated Emissions)

The photographs below show worst case setup for radiated emission testing.



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10 Meter measurement for extrapolation calculation



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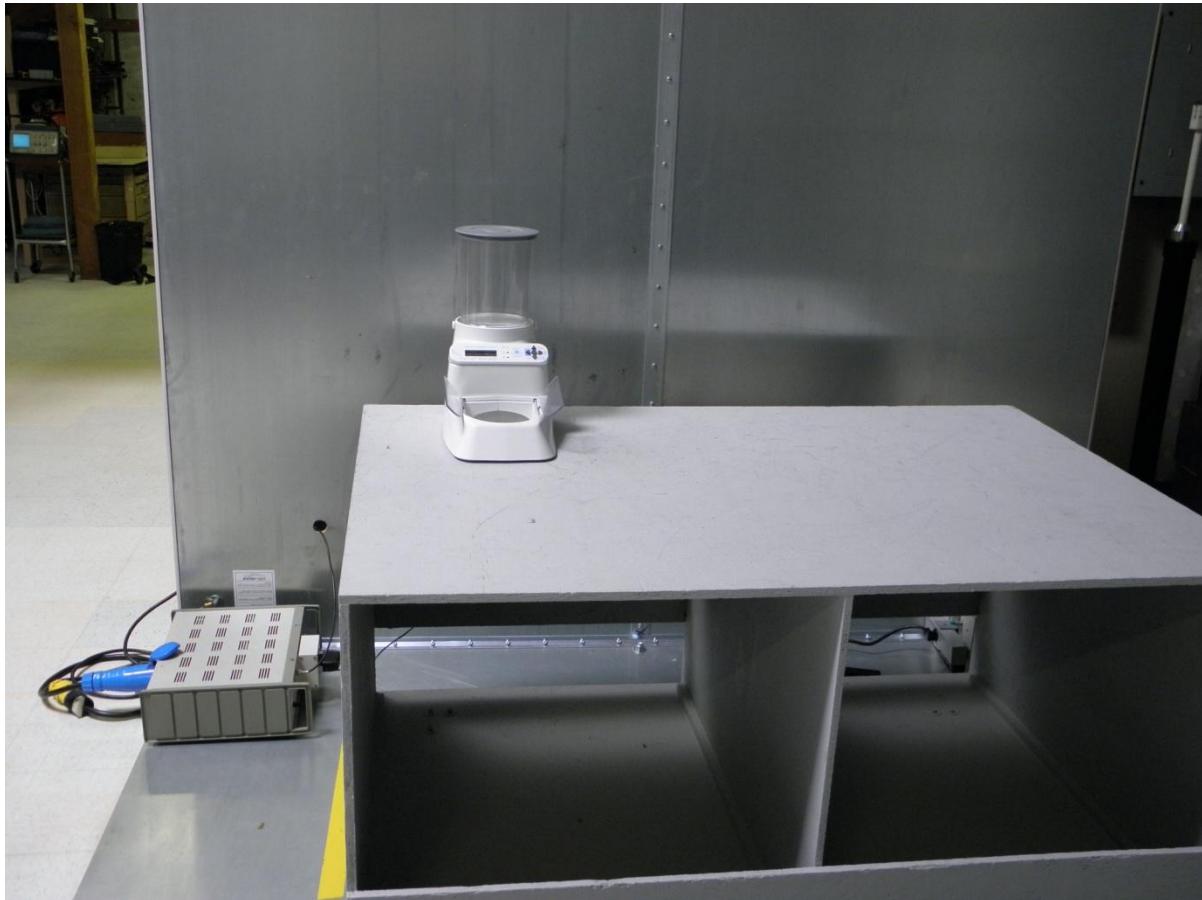
3 Meter measurement for extrapolation calculation



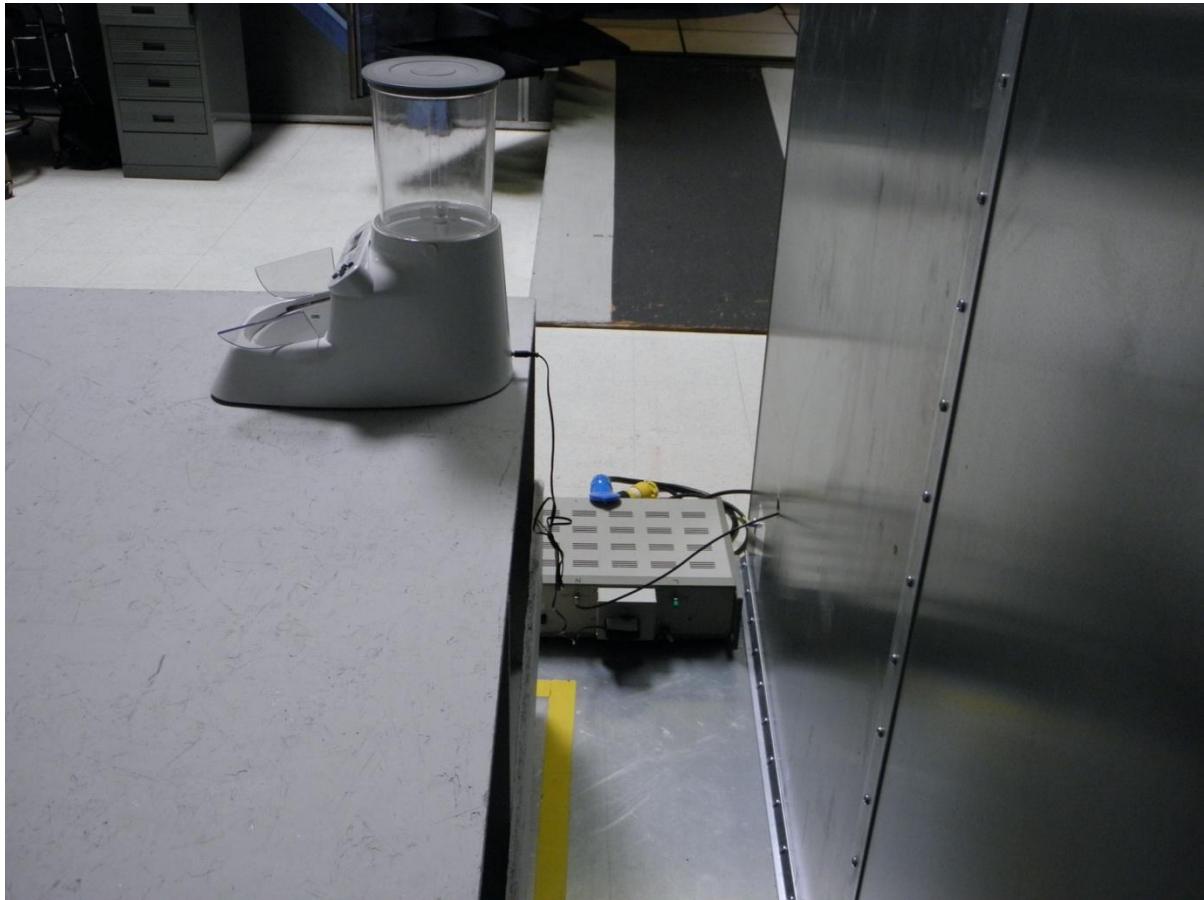


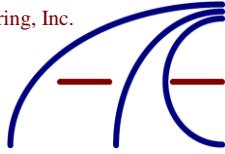
## Test Setup (Conducted Emissions)

The photograph below shows worst case setup for line conducted testing.



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## Test Methods for Emissions

The test procedure stated in ANSI C63.4-2003 was used to collect the test data. The radiated emission data of the EUT was taken with the Rohde & Schwarz EMI Test Receiver. Incorporating the application of correction factors programmed into the Test Receiver and verified for distance, antenna, cable loss, and amplifier gain, the data was reduced as shown in the Sample Calculations. These correction factors are available upon request. The corrected data was then compared to the emission limits to determine compliance.

During radiated emission testing, the EUT was placed on a nonconductive rotating table 0.8 meter above the conductive grid. The nonconductive table dimensions were 1 meter deep by 1.5 meters wide at 0.8 meter high. The EUT is centered on the tabletop and the measurement antenna was placed 3 or 10 meters from the EUT as noted in the test data.

For radiated emissions testing, scans in the frequency range of 9 kHz to 1000 MHz were made. Each frequency between 9 kHz and 150 kHz was measured at a bandwidth of 200 Hz, between 150 kHz and 30 MHz was measured at a bandwidth of 10 kHz and between 30 MHz and 1000 MHz was measured at a bandwidth of 120 kHz. Measurements were made employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz and 110-490 kHz, which employed an average detector. All readings within 10 dB of the limits were recorded, and those emissions were then measured using the appropriate detector and bandwidth for a 2-second measurement time.

Measurements were made at a distance of 10 meters and 3 meters and pursuant to section 15.31-(f) (2) the measurement results were extrapolated to the specified distance by making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor of 40dB/decade.

## Conducted Emission Testing

For the conducted emissions testing, the EMCO LISN, Model No. 4825/2, was used for the EUT. During conducted emission testing the EUT was located on a wooden test bench measuring 0.8 meter high, 1 meter deep, and 1.5 meters in width. The vertical conducting surface was 0.4 meter from the back of the test bench. The LISNs were placed on the ground plane of the test area in accordance with ANSI C63.4-2003.

The metal plane used for conducted emission testing was grounded to the earth by a heavy gage braided wire attached to the plane. All other objects were kept a minimum of 1 meter away from the EUT during the conducted test.

For conducted emissions testing a scan of the frequency band 150 kHz to 30 MHz was made stepping every 5 kHz. Each frequency was measured at a bandwidth of 10 kHz for 20 msec. Due to the narrow specification of a 6 dB drop, the 10 kHz bandwidth meets the requirements of CISPR 16, band B (150 kHz to 30 MHz) and VDE 0876 as well as of various military standards that require tolerances of 10% for a 10 kHz



measurement bandwidth. All readings within 25 dB of the limits were recorded, and those emissions were then measured using the Average and CISPR quasi-peak detector at a bandwidth of 10 kHz for a 2 second measurement time. All emissions within 6 dB of the limit were examined with additional measurements to ensure compliance with the stated limits. The results of the conducted emissions test are shown in Tables 8 and 9 and Figures 3 and 4.

## Temperature and Humidity

The ambient temperature of the actual EUT was within the range of 10° to 40° C (50° to 104° F) unless the particular equipment requirements specify testing over a different temperature range. The humidity levels were within the range of 10% to 90% relative humidity unless the EUT operating requirements call for a different level.

## Sample Calculations

An example of how the EMI Test Receiver reading is converted using correction factors is given for the emissions recorded in Table 6. These correction factors are programmed into the EMI Test Receiver and verified. For radiated emissions in dB $\mu$ V/m, the EMI Test Receiver reading in dB $\mu$ V is corrected by using the following formula:

Meter Reading (dB $\mu$ V)  
+ Antenna Factor (dB)  
+ Cable Loss (dB)  
- Pre-amplifier Gain (dB)  
= Corrected Reading (dB $\mu$ V/m)

This reading is then compared to the applicable specification limits and the difference will determine compliance. For conducted emissions, the correction factors of insertion loss are added for the 50  $\mu$ H/50 Ohm LISN used. These correction factors are programmed into the EMI Test Receiver and verified.



## FCC Part 15 Subpart C 15.207 and 15.209 Limits

Table 4 - Radiated Emission Limits, General Requirements

Frequency MHz	Field Strength μV/m	Measurement Distance Meters
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

Table 5 - Conducted Limits

Frequency MHz	Limit Quasi-Peak dBμV	Limit Average dBμV
0.15-0.50	66-56*	56-46*
0.50-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

### NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closest point of any part of the device or system.
3. The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.
4. The emission limits shown are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.



## Report of Measurements Radiated Data $\leq 30\text{MHz}$

The following table reports the results of the radiated measurements for the Proximity Reader, Wireless Whiskers.

*Table 6 - Radiated Emission Level*

15.209 Limit dB $\mu$ V/m	Fundamental Frequency kHz	Level dB $\mu$ V/m	Detector	Test Distance	Corrected Level dB $\mu$ V/m	Margin dB	Antenna
25.67 @ 300 meters	125	81.84	AV	3	-20.28	45.95	Loop

15.209 Limit dB $\mu$ V/m	Unwanted Frequency kHz	Level dB $\mu$ V	Detector	Test Distance	Corrected Level dB $\mu$ V	Margin dB	Antenna
19.65 @ 300 meters	250	47.37	AV	3	54.75	74.40	Loop
16.12 @ 300 meters	375	40.13	AV	3	-61.99	78.11	Loop
33.62 @ 30 meters	500	38.60	QP	3	-7.38	41.00	Loop
31.69 @ 30 meters	625	65.07	QP	3	17.41	14.28	Loop
30.10 @ 30 meters	750	44.49	QP	3	-0.51	30.61	Loop
28.76 @ 30 meters	875	64.72	QP	3	16.51	12.25	Loop
27.60 @ 30 meters	1000	31.02	QP	3	-14.49	42.09	Loop
26.58 @ 30 meters	1125	56.39	QP	3	8.67	17.91	Loop
25.67 @ 30 meters	1250	37.81	QP	3	-4.80	30.47	Loop

Test Method: ANSI C63.4-1992

Spec Limit: FCC 15.209

No other emissions were observed.

Note: AV = Average

QP = Quasi Peak

COMMENTS: System continuously running. Tests were performed with the AC voltage varied from 85% to 115% of the nominal voltage. There were no changes in the measured levels from the device. The ambient temperature was 71°F and relative humidity of 53% during testing. Test distance of 3 meters was due to the presence of ambient radio noise. Corrected levels are extrapolated at 51.06dB/decade derived by taking measurements at two distances at one radial (see 15.31 (f)(2)). Measurements above 500 kHz were made with ambient radio noise present.

### Calculation of limit at 125 kHz:

Limit in microvolts/meter

$2400/125=19.2\mu\text{V}/\text{m}$  at 300 meters

Convert to dB $\mu$ V

$20 \log 19.2\mu\text{V}/\text{m} = 25.67\text{dB}\mu\text{V}/\text{m}$  at 300 meters



**Calculation of extrapolation factor at 125 kHz, 3 meter to 10 meter distance:**

The reading level in dB at 10 meter subtracted from the level in dB at 3 meter

$$81.90 - 55.20 = 26.70$$

Subtract the log of the two distances

$$\text{Log (10)-Log (3)} =$$

$$1-0.477121 = 0.522879$$

Divide the ratio of the readings by the ratio of the distance

$$26.70/0.522879 = 51.06$$

Actual Extrapolation Factor derived from measurements at 3 meters and 10 meters on fundamental frequency

**51.06 dB/decade**

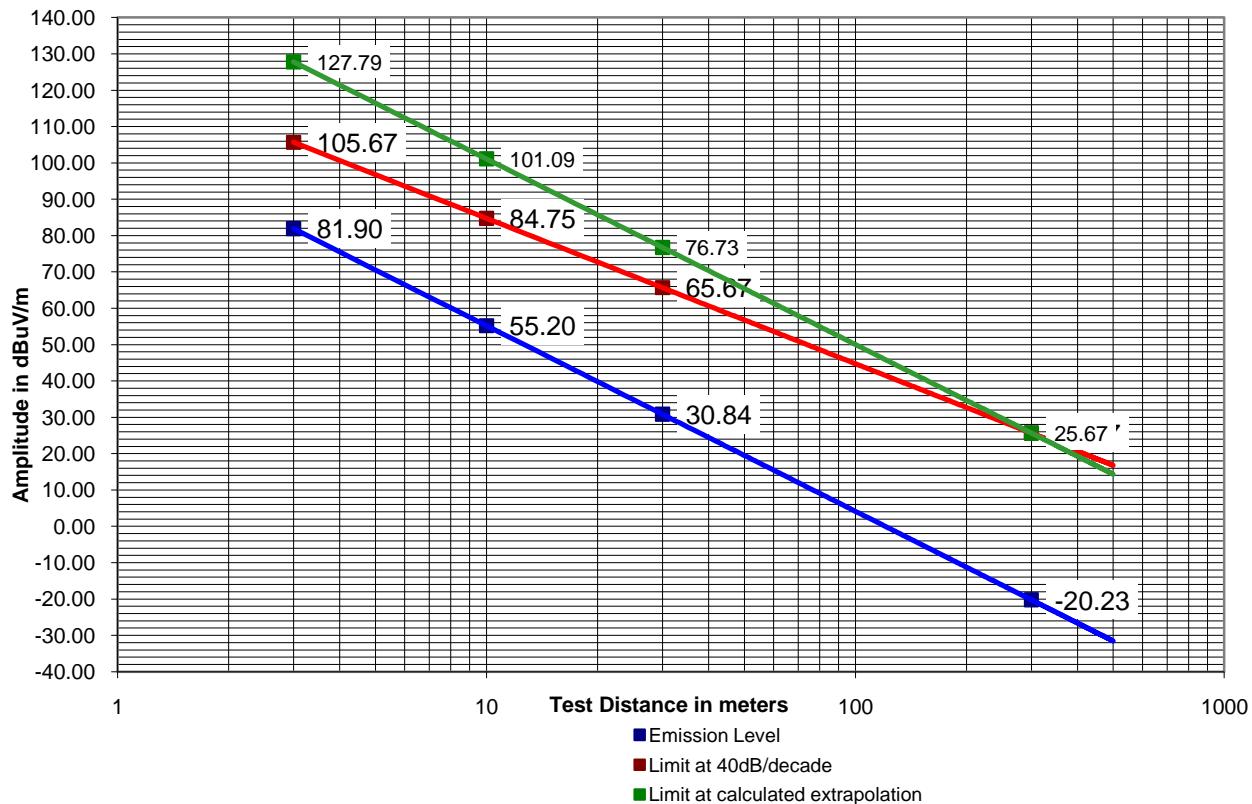
Levels at 3 and 10 meters were measured, levels at 30 and 300 meters are calculated.

*Table 7 – 123.1kHz Extrapolation Factor Data*

Distance in meters	3	10	30	300
Level dBuV/m	81.90	55.20	30.84	-20.23
Limit dBuV/m (40dB/decade)	105.67	84.75	65.67	25.67
Limit dBuV/m (51.06dB/decade)	127.79	101.09	76.73	25.67

*Figure 2 - Extrapolation Factor Plot*

**Extrapolation Plot of 125.0 kHz**





## Report of Measurements Radiated Data 30-1000 MHz

The following table reports the results of the radiated measurements for the Proximity Reader, Wireless Whiskers.

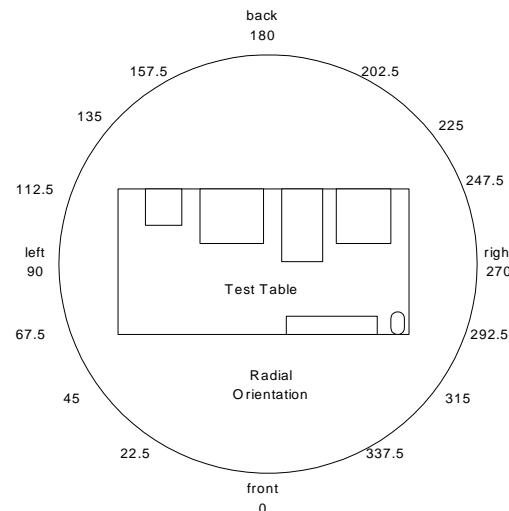
*Table 8 - Six Highest Radiated Emission Levels*

Frequency MHz	QP Level dB $\mu$ V/m	QP Limit dB $\mu$ V/m	Margin dB	Azimuth, Height	Antenna, Polarization
207.05	23.90	30.00	6.10	90, 3.5	BiLog, H
207.65	23.78	30.00	6.22	90, 3.5	BiLog, H
207.5	22.91	30.00	7.09	270, 1.1	BiLog, V
206.25	22.43	30.00	7.57	90, 3.5	BiLog, H
204.9	21.79	30.00	8.21	90, 3.5	BiLog, H
203.5	21.04	30.00	8.96	270, 1.1	BiLog, V

Test Method: ANSI C63.4-2003  
 Spec Limit: 15.109 (g) Class B at 10 meter distance

Note: Azimuth in degrees  
 Height in meters  
 V = vertical  
 H = horizontal

COMMENTS: System continuously running. Tests were performed with the AC voltage varied from 85% to 115% of the nominal voltage. There were no changes in the measured levels from the device. The ambient temperature was 71°F and relative humidity of 53% during testing. The ambient temperature of the actual EUT was within the range of 10° to 40° C (50° to 104° F) unless the particular equipment requirements specify testing over a different temperature range. The humidity levels were within the range of 10% to 90% relative humidity unless the EUT operating requirements call for a different level.





## Radiated Data for Class B at 10 Meters 30-1000 MHz

Vector Wireless  
 Product - Proximity Reader  
 Model - Wireless Whiskers

Pre-Scan Settings:

<u>Start Freq.</u>	<u>Stop Freq.</u>	<u>Step</u>	<u>IF BW</u>	<u>Detector</u>	<u>Scan-Time</u>	<u>Atten.</u>
30MHz	1000MHz	50kHz	120kHz	PK	10msec	0dB

Final Measurement: QP detector at 2 second measurement time.

*Table 9 - Radiated Data*

Frequency MHz	QP Level dB $\mu$ V/m	QP Limit dB $\mu$ V/m	Margin dB	Azimuth, Height	Antenna, Polarization
51.85	17.03	30.00	12.97	0, 4	BiLog, H
52.75	17.64	30.00	12.36	0, 4	BiLog, H
53.7	16.62	30.00	13.38	0, 4	BiLog, H
54.05	17.10	30.00	12.90	0, 4	BiLog, H
96.0	19.84	30.00	10.16	90, 4	BiLog, H
168.1	17.43	30.00	12.57	225, 4	BiLog, H
204.9	21.79	30.00	8.21	90, 3.5	BiLog, H
206.25	22.43	30.00	7.57	90, 3.5	BiLog, H
207.05	23.90	30.00	6.10	90, 3.5	BiLog, H
207.65	23.78	30.00	6.22	90, 3.5	BiLog, H
51.4	14.96	30.00	15.04	202, 1.3	BiLog, V
53.15	15.77	30.00	14.23	202, 1.3	BiLog, V
54.2	12.76	30.00	17.24	202, 1.3	BiLog, V
111.4	20.88	30.00	9.12	225, 1.1	BiLog, V
117.7	19.53	30.00	10.47	225, 1.1	BiLog, V
142.8	19.74	30.00	10.26	270, 1.1	BiLog, V
146.6	18.87	30.00	11.13	270, 1.1	BiLog, V
203.5	21.04	30.00	8.96	270, 1.1	BiLog, V
207.5	22.91	30.00	7.09	270, 1.1	BiLog, V



## Conducted Data for FCC Part 15.207(a), Line

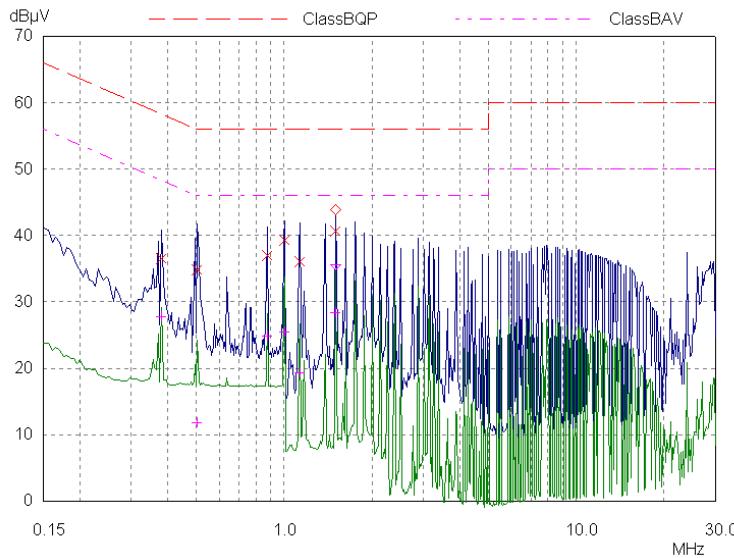


Figure 3 - Line Scan

Pre-Scan Settings:

Start Freq.	Stop Freq.	Step	IF BW	Detector	Scan-Time	Atten.
0.15MHz	30MHz	5kHz	10kHz	PK/AV	20msec	0dB

Blue Trace: Peak Measurement

Green Trace: Average Measurement

Final Measurement: **X** = QP / **+** = AV at 2 second measurement time.

Table 10 - Line Scan Data

Freq. MHz	Level dBμV	Detector	Limit dBμV	Margin dB	Phase	PE
0.38	36.48	QP	58.28	21.80	L1	gnd
0.505	34.80	QP	56.00	21.20	L1	gnd
0.875	36.90	QP	56.00	19.10	L1	gnd
1.00499	39.31	QP	56.00	16.69	L1	gnd
1.13	36.13	QP	56.00	19.87	L1	gnd
1.505	40.71	QP	56.00	15.29	L1	gnd
0.38	27.70	AV	48.28	20.58	L1	gnd
0.505	11.73	AV	46.00	34.27	L1	gnd
0.875	24.82	AV	46.00	21.18	L1	gnd
1.00499	25.53	AV	46.00	20.47	L1	gnd
1.13	19.31	AV	46.00	26.69	L1	gnd
1.505	28.33	AV	46.00	17.67	L1	gnd



## Conducted Data for FCC Part 15.207(a), Neutral

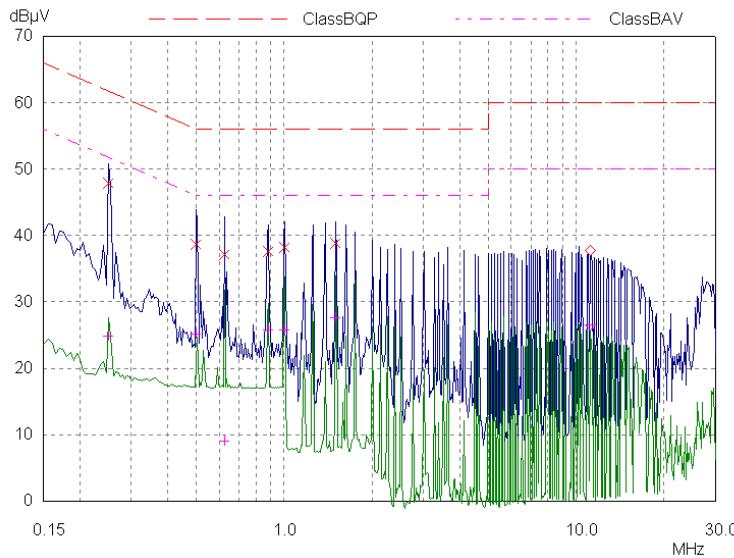


Figure 4 - Neutral Scan

Pre-Scan Settings:

Start Freq.	Stop Freq.	Step	IF BW	Detector	Scan-Time	Atten.
0.15MHz	30MHz	5kHz	10kHz	PK/AV	20msec	0dB

Blue Trace: Peak Measurement

Green Trace: Average Measurement

Final Measurement: **x** = QP / **+** = AV at 2 second measurement time.

Table 11 - Line Scan Data

Freq. MHz	Level dBµV	Detector	Limit dBµV	Margin dB	Phase	PE
0.25	47.93	QP	61.76	13.83	N	gnd
0.5	38.69	QP	56.00	17.31	N	gnd
0.625	37.18	QP	56.00	18.82	N	gnd
0.88	37.66	QP	56.00	18.34	N	gnd
1.00499	38.14	QP	56.00	17.86	N	gnd
1.505	38.79	QP	56.00	17.21	N	gnd
0.25	24.88	AV	51.76	26.88	N	gnd
0.5	25.17	AV	46.00	20.83	N	gnd
0.625	9.01	AV	46.00	36.99	N	gnd
0.88	25.79	AV	46.00	20.21	N	gnd
1.00499	25.72	AV	46.00	20.28	N	gnd
1.505	27.59	AV	46.00	18.41	N	gnd



Testing Cert #1007.01

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## COMPLIANCE VERIFICATION REPORT

# TEST CERTIFICATE

APPLICANT: Vector Wireless  
P.O. Box 5931  
Santa Clara, California 95056 USA

Trade Name: Proximity Reader

Model: Wireless Whiskers

### I HEREBY CERTIFY THAT:

The measurements shown in this report were made in accordance with the procedures indicated and that the energy emitted by this equipment, as received, was found to be within the FCC CFR 47 Part 15 Subpart C section 15.209 for Radiated emissions and FCC CFR 47 Part 15 Subpart C section 15.207 for Conducted emissions. Additionally, it should be noted that the results in this report apply only to the items tested, as identified herein.

### I FURTHER CERTIFY THAT:

On the basis of the measurements taken at the test site, the equipment tested is capable of operation in compliance with the requirements set forth in FCC CFR 47 Part 15.207 and 15.209 Rules and Regulations.

On this Date: May 24, 2010

Bruce Smith  
Atlas Compliance & Engineering, Inc.

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Printed Name

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Signature  
Vector Wireless Representative