Engineering and Testing for EMC and Safety Compliance

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FCC Part 15.231 & IC Part RSS-210
Certification Application Report

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Tel: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 Web: www.rheintech.com Herndon, VA 20170 Email: atcbinfo@rheintech.com	RFind Systems, Inc. Tel: (250) 980-3912 Suite 102, 2076 Enterprise Way Kelowna, BC, V1Y 6H7 Contact: Marty Brooks

FCC ID / IC	UL3T400A / 6721A-T400A	**Test Report Date**	March 15, 2010
Platform	N/A	**RTL Work Order Number**	2010029
Model	T400	**RTL Quote Number**	QRTL09-495

FCC Classification	DSC – Part 15 Security/Remote Control Transmitter
FCC Rule Part(s)	Part 15.231: Periodic operation in the band 40.66 – 40.70 MHz and above 70 MHz (10-01-09)
IC Rule Part(s)	RSS-210: Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
Procedure or Other Guidance	ANSI C63.4-2003 Standard for Methods of Measurement of Radio-Noise Emissions
Digital Interface Information	Digital Interface was found to be compliant
Receiver Information	Receiver was found to be compliant

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
433.5 and 433.92	N/A	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. Modifications made to the equipment during testing in order to achieve compliance with these standards are listed in the report.

Furthermore, there was no deviation from, additions to, or exclusions from the applicable parts of FCC Part 2, FCC Part 15, IC RSS-210 and ANSI C63.4.

Signature: _____ Date: March 24, 2010

Typed/Printed Name: Desmond A. Fraser Position: President

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1 General Information

1.1 Scope

FCC Rules Part 15.231: Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.

Industry Canada RSS-210: Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

1.2 Modifications

N/A

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Rhein Tech Laboratories, Inc. (RTL), 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original certification application for RFind Systems, Inc. Model T400, FCC ID: UL3T400A, IC: 6721A-T400A.

2 Test Information

2.1 Test Justification

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT's frequencies were tested and investigated from 9 kHz to the 10th harmonic. The test results relate only to the item that was tested. The antenna transmits, receives, and is externally attached. The IF, LO, and up to the 2nd LO, were investigated and tested, and found to be compliant for unintentional emissions compliance.

2.2 Exercising the EUT

The EUT was adapted to continuously transmit for testing purposes. The carrier was also checked to verify that the information was being transmitted. The unit was reprogrammed for normal operation for the duty cycle plots and transmission requirement of 15.231(a)(2) and 15.231(e). There were no deviations from the test standard(s) and/or methods.

2.3 Test Result Summary

Table 2-1: Test Result Summary with FCC Rules and Regulations

Standard	Test	Pass/Fail Or N/A
FCC 15.207	AC Conducted Emissions	N/A
FCC 15.231(a)(2)	Transmitter Deactivation	Pass
FCC 15.231(e)	Transmitter Duration	Pass
FCC 15.231(b)	Radiated Emissions	Pass
FCC 15.231(c)	20 dB Bandwidth	Pass

2.4 Test System Details

The tag can be configured as an Asset Tag or Location Marker. The Asset Tag uses a lower power wakeup signal greater than 100 ms, and no duty cycle correction is required for that peak measurement to meet the average limits of 15.231(a). This wakeup signal is followed by a chirp of 6.167 ms and slightly higher power, meeting the requirements of 15.231(a) with a duty cycle reduction for the average limits at 433.5 MHz, and has been measured separately. A squawk signal at 433.92 MHz has also been measured with the same duty cycle reduction for the average limits of 15.231(e) requirements.

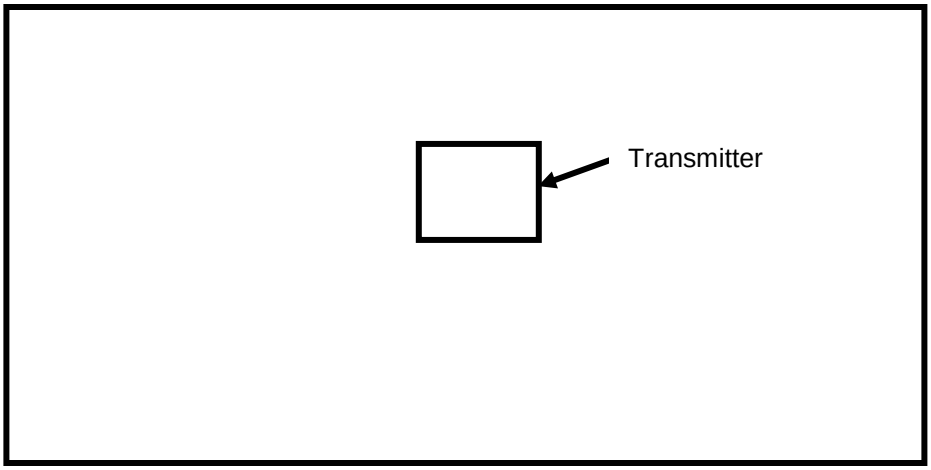
The test samples were received on February 19, 2010. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system, are shown in the following table.

Table 2-2: Equipment Under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Radio Frequency Identification Tag	RFind Systems, Inc.	T400	N/A	UL3T400A	N/A	19414
Radio Frequency Identification Tag	RFind Systems, Inc.	T400	N/A	UL3T400A	N/A	19416

2.5 Configuration of Tested System

Figure 2-1: Worst Case Configuration of System under Test

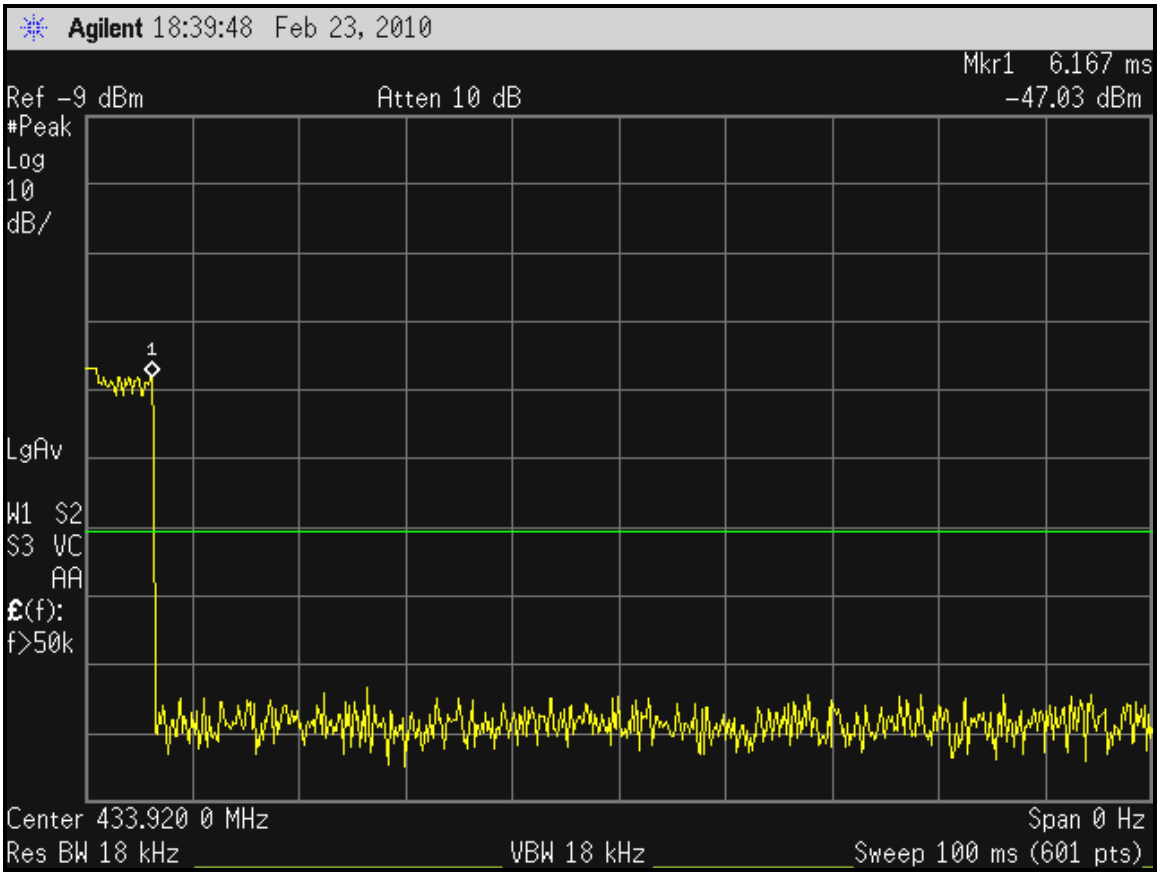


3 Duty Cycle Calculation - FCC §15.35(c)

A standard transmission consists of firmware limiting the timing to a 6.167 ms pulse within a 100 ms timeframe.

20 log (6.167/100) = -24.2 dB

Plot 3-1: Total Pulse Train Length – 6.167 ms – 433.92 MHz Squawk Signal



Plot 3-2: Total Pulse Train Length – 6.167 ms – 433.5 MHz Chirp Signal

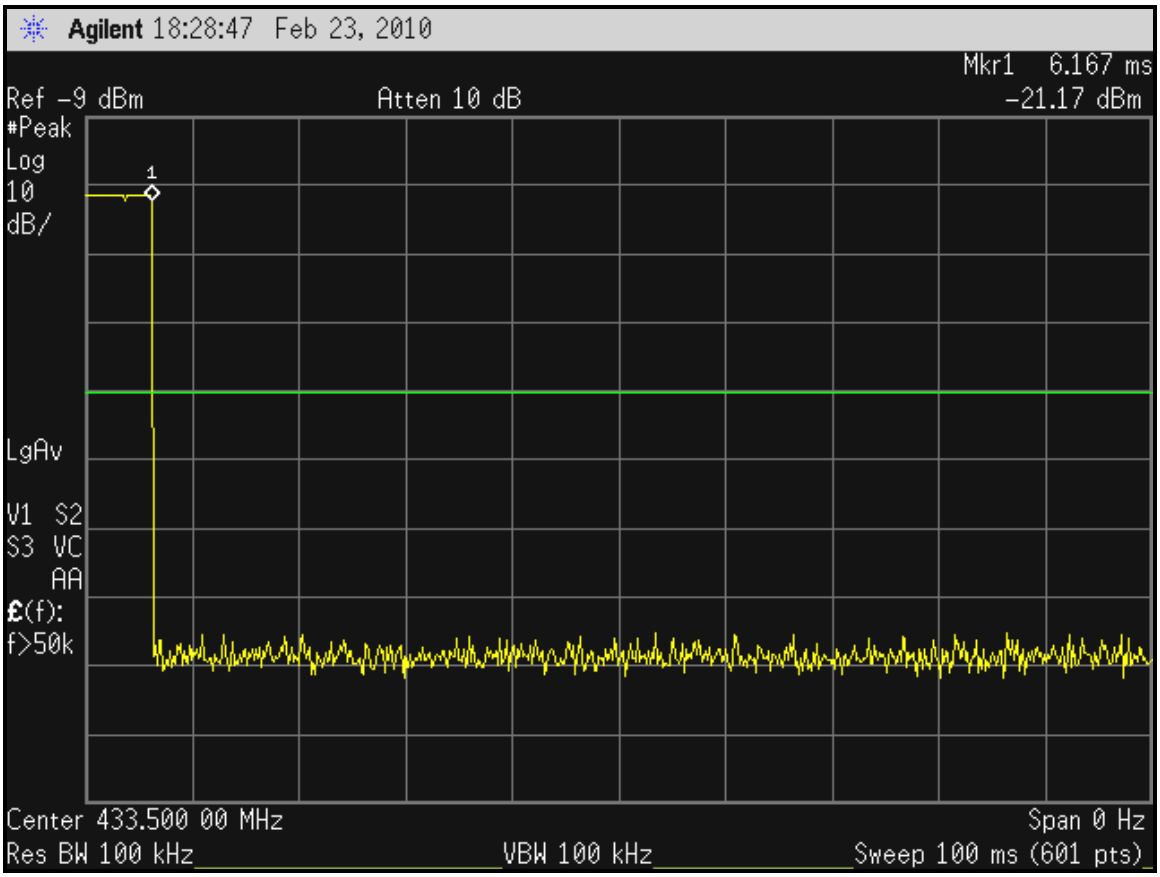


Table 3-1: Duty Cycle Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/10/10

Test Personnel:

Daniel Baltzell		February 23, 2010
Test Engineer	Signature	Date of Test

4 Transmitter Deactivation – FCC §15.231(a)(2); RSS-210 2.5

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Plot 4-1: Transmitter Deactivation

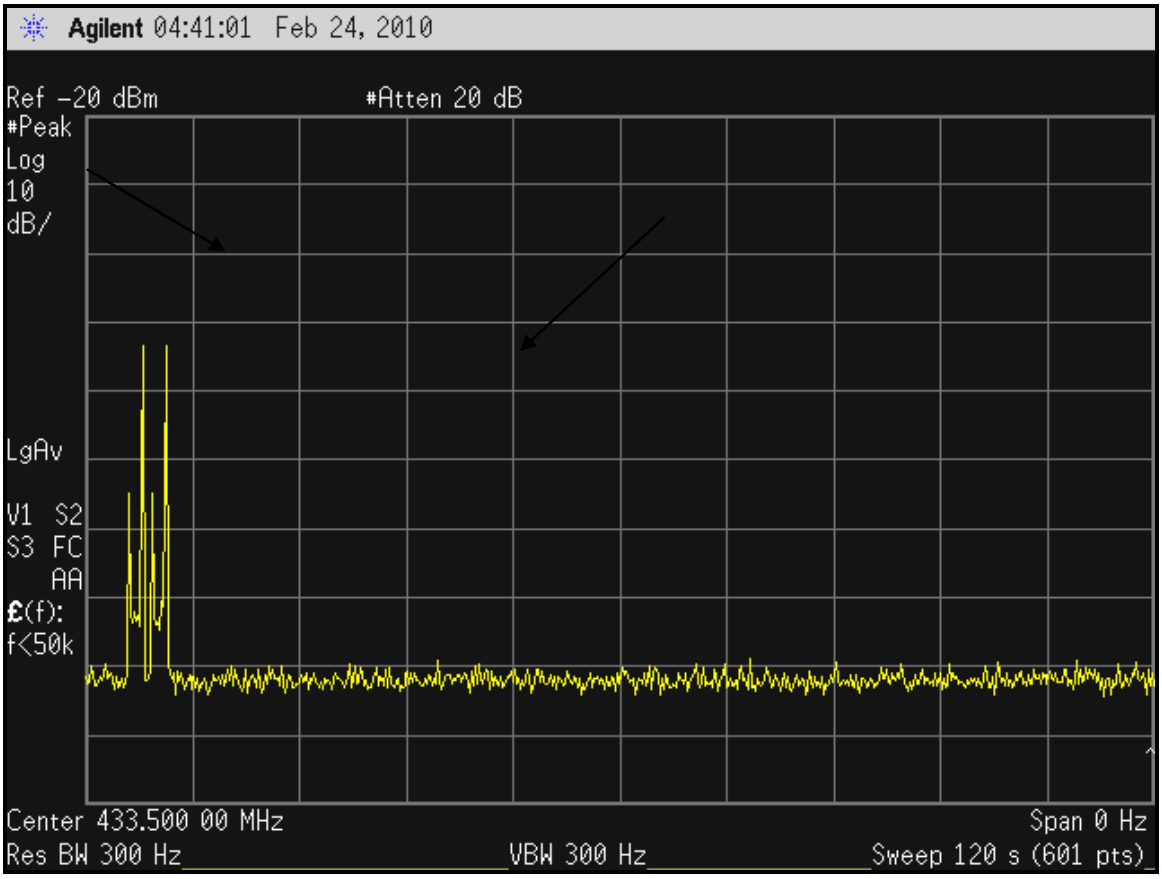


Table 4-1: Transmitter Deactivation Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/10/10

Test Personnel:

Daniel Baltzell		February 24, 2010
Test Engineer	Signature	Date of Test

5 Modulated Bandwidth – FCC §15.231(c); RSS-Gen

5.1 Modulated Bandwidth Test Procedure

The minimum 20 dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 1 MHz. The spectrum analyzer's display line was set to -20 dB using max hold until the spectrum was filled and a plot taken.

Since the device operates at two frequencies, the aggregate bandwidth must be considered. This was done by adding the two discrete bandwidths together and comparing against the more stringent of the two discrete calculated limits.

5.2 FCC §15.231(c) Limits

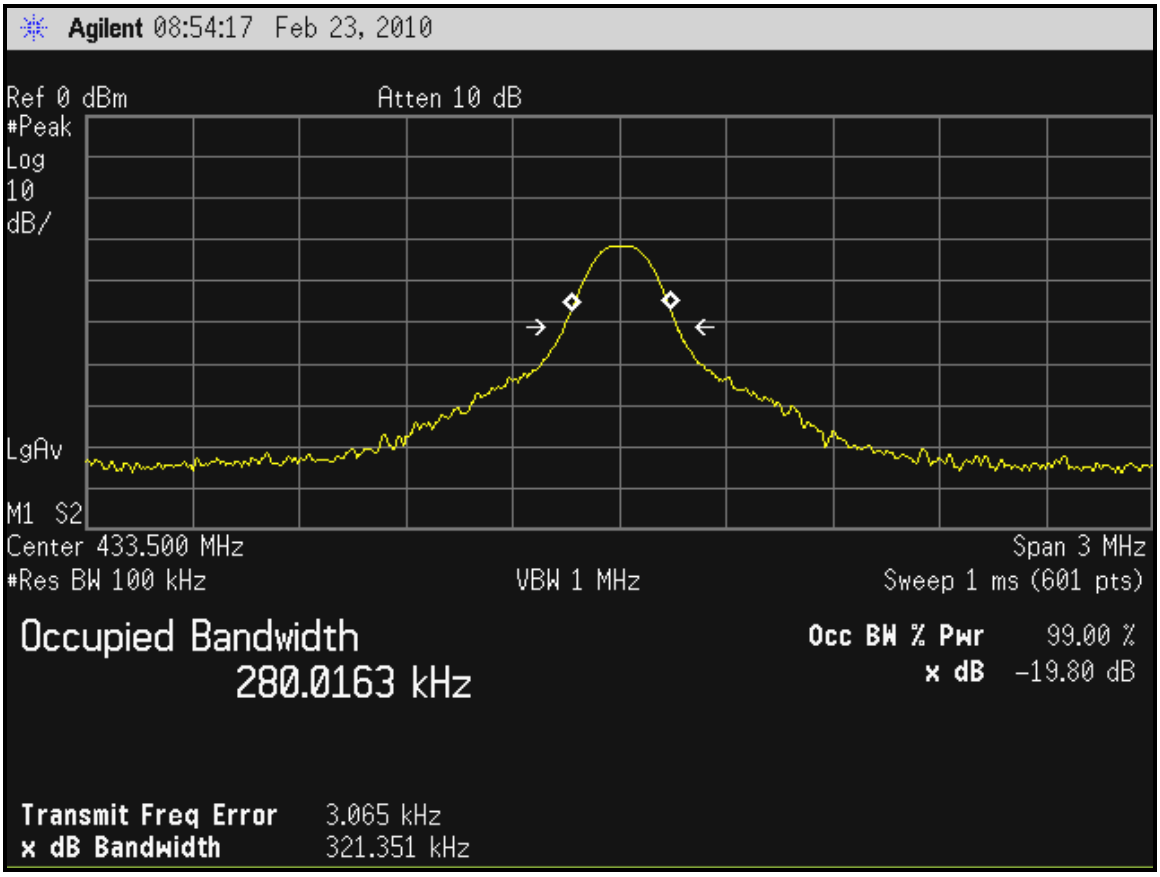
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3 Modulated Bandwidth Test Data

Table 5-1: 20 dB Modulated Bandwidths

Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)
433.5	321.4	0.25% of 433500 = 1083.75	-762.35
433.92	386.045	0.25% of 433920 = 1084.8	-698.755

Plot 5-1: Modulated Bandwidth – 433.5 MHz



Plot 5-2: Modulated Bandwidth – 433.92 MHz

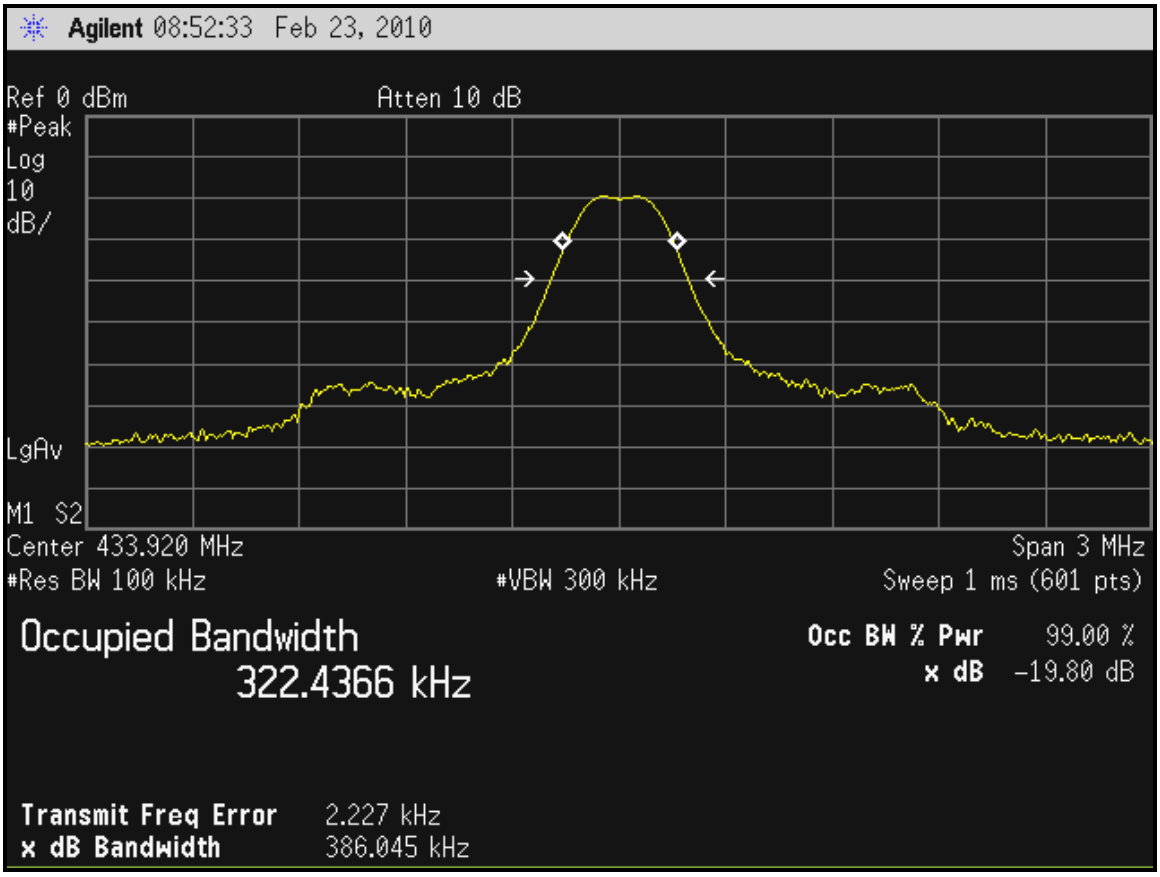


Table 5-2: Modulated Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	6/8/10

Test Personnel:

Daniel Baltzell		February 23, 2010
Test Engineer	Signature	Date of Test

6 Radiated Emissions – FCC §15.209, §15.231; IC RSS-210 Annex 5(b)

6.1 Radiated Fundamental Emissions Test Procedure

Radiated emissions of the fundamentals were tested at three meters, and meet the requirements of average mode, and 20 dB higher in peak mode. The limit is calculated from a linear interpolation between 3,750 and 12,500 uV/m, and from 260-470 MHz. The EUT was tested in all three orthogonal planes. Measurement was based on a peak detector and an average level was calculated. The average level was compared to the average limit as per 15.231(b) and the peak level was compared to the average limit +20 dB per 15.35(b).

6.1.1 Radiated Fundamental Emissions Limits Test Data

Table 6-1: Radiated Fundamental Emissions 15.231(a); Higher Power Chirp Signal from Asset Tag

Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
433.5	68.9	17.5	86.4	100.8	-14.4	-24.2	55.7	80.8	-25.1

Table 6-2: Radiated Fundamental Emissions 15.231(e); Squawk Signal

Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
433.92	74.0	18.2	92.2	92.9	-0.7	-24.2	68.0	72.9	-4.9

Table 6-3: Radiated Fundamental Emissions 15.231(a); Lower Power Wakeup Signal from Asset Tag

Frequency (MHz)	Analyzer Reading (dBuV)	Site Correction Factor (dBm)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Duty Cycle Correction (dB)	Calculated Average Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
433.5	62.4	17.5	79.9	100.8	-20.9	0	79.9	80.8	-0.9

6.2 Radiated Harmonics/Spurious Emissions – FCC §15.231

6.2.1 Radiated Emissions Harmonics/Spurious Test Procedure

Radiated emissions of the harmonics were tested at three meters. The EUT was tested in the three orthogonal planes with the receive antenna in both polarities. The emissions were maximized per ANSI C63.4:2003 8.3.1.2; that is, the measurement antenna height was varied between 1 and 4 m, and the EUT was rotated through 360° on a rotating turntable until the maximum emissions were found. Both horizontal and vertical measurement antenna polarizations were used. A resolution bandwidth of 100 kHz was used for frequencies less than 1000 MHz, and a resolution bandwidth of 1 MHz was used for frequencies greater than or equal to 1000 MHz.

Table 6-4: Radiated Spurious Harmonics; 433.5 MHz; 15.231(a); Higher Power Chirp Signal from Asset Tag

Peak Limit = 80.8 dBuV/m; Duty Cycle Correction = 24.2 dB; Average Limit = 60.8 dBuV/m

Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level Corrected With Duty Cycle (dBuV/m)	Average Limit (dBuV/m)	Peak Margin (dB)
867.0	73.3	-18.2	55.1	80.8	-25.7	30.9	60.8	-29.9
1300.5	78.3	-13.6	64.7	80.8	-16.1	40.5	60.8	-20.3
1734.0	40.9	-10.6	30.3	80.8	-50.5	6.1	60.8	-54.7
2167.5	50.6	3.8	54.4	80.8	-26.4	30.2	60.8	-30.6
2601.0	43.2	4.1	47.3	80.8	-33.5	23.1	60.8	-37.7
3034.5	49.8	4.0	53.8	80.8	-27.0	29.6	60.8	-31.2
3468.0	42.8	3.2	46.0	80.8	-34.8	21.8	60.8	-39.0
3901.5	48.8	3.3	52.1	80.8	-28.7	27.9	60.8	-32.9
4335.0	43.2	9.5	52.7	80.8	-28.1	28.5	60.8	-32.3

Table 6-5: Radiated Spurious Harmonics; 433.92 MHz; 15.231(e); Squawk Signal

Peak Limit = 72.9 dBuV/m; Duty Cycle Correction = 24.2 dB; Average Limit = 52.9 dBuV/m

Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level Corrected With Duty Cycle (dBuV/m)	Average Limit (dBuV/m)	Peak Margin (dB)
867.8	82.9	-18.1	64.8	72.9	-8.1	40.6	52.9	-12.3
1301.8	77.8	-13.6	64.2	72.9	-8.7	40.0	52.9	-12.9
1735.7	65.1	-10.6	54.5	72.9	-18.4	30.3	52.9	-22.6
2169.6	52.1	3.8	55.9	72.9	-17.0	31.7	52.9	-21.2
2603.5	44.6	4.1	48.7	72.9	-24.2	24.5	52.9	-28.4
3037.4	55.2	4.0	59.2	72.9	-13.7	35.0	52.9	-17.9
3471.4	50.9	3.2	54.1	72.9	-18.8	29.9	52.9	-23.0
3905.3	54.9	3.2	58.1	72.9	-14.8	33.9	52.9	-19.0
4339.2	45.4	9.4	54.8	72.9	-18.1	30.6	52.9	-22.3

Table 6-6: Radiated Spurious Harmonics; 433.5 MHz; 15.231(a); Low Power Wakeup Signal from Asset Tag

Peak Limit = 80.8 dBuV/m; Average Limit = 60.8 dBuV/m

Frequency (MHz)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Level Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Level Not Corrected With Duty Cycle (dBuV/m)	Average Limit (dBuV/m)	Peak Margin (dB)
867.0	58.9	-17.7	41.2	80.8	-39.6	41.2	60.8	-19.6
1300.5	61.8	-13.2	48.6	80.8	-32.2	48.6	60.8	-12.2
1734.0	49.7	-10.0	39.7	80.8	-41.1	39.7	60.8	-21.1
2167.5	42.0	3.8	45.8	80.8	-35.0	45.8	60.8	-15.0
2601.0	33.1	4.1	37.2	80.8	-43.6	37.2	60.8	-23.6
3034.5	37.2	4.0	41.2	80.8	-39.6	41.2	60.8	-19.6
3468.0	32.6	3.2	35.8	80.8	-45.0	35.8	60.8	-25.0
3901.5	39.2	3.3	42.5	80.8	-38.3	42.5	60.8	-18.3
4335.0	29.9	9.5	39.4	80.8	-41.4	39.4	60.8	-21.4

6.3 Unintentional/Receiver Emissions – FCC §15.209; RSS-Gen

Table 6-7: Unintentional/Receiver Emissions

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
216.000	Qp	H	0	1.0	30.3	-19.3	11.0	43.5	-32.5	Pass
243.000	Qp	H	0	1.0	30.3	-18.0	12.3	46.0	-33.7	Pass
270.000	Qp	V	0	1.0	30.6	-15.1	15.5	46.0	-30.5	Pass
324.000	Qp	V	0	1.0	31.2	-13.4	17.8	46.0	-28.2	Pass
351.000	Qp	V	0	1.0	31.5	-12.4	19.1	46.0	-26.9	Pass
378.000	Qp	V	0	1.0	32.1	-12.1	20.0	46.0	-26.0	Pass

Table 6-8: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	12/12/10
901364	MITEQ	JS4-01002600-36-5P	Amplifier (0.1 - 26 GHz)	849863	2/22/11
900811	Rhein Tech Laboratories	PR-1040	Amplifier	1003	4/10/10
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/10
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	6/14/10
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	11/23/10
901516	Insulated Wire, Inc.	KPS-1503-2400-KPS-09302008	RF cable, 20'	NA	10/19/10
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/19/10
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required

Test Personnel:

Daniel Baltzell		February 21, 2010
Test Engineer	Signature	Date of Tests

7 Conducted Emissions

7.1 Site and Test Description

The power line conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50 ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded. The limits for Class A and Class B are contained therein.

7.2 Test Limits

Class A Line-Conducted Emissions		
	Limit (dBµV)	
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	79	66
0.50 to 30.0	73	60

Class B Line-Conducted Emissions		
	Limit (dBµV)	
Frequency (MHz)	Quasi-Peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

7.3 Conducted Emissions Test Results

Testing is N/A – the EUT is battery powered.
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8 Conclusion

The data in this measurement report shows that the RFind Systems, Inc. Model T400, FCC ID: UL3T400A, IC: 6721A-T400A, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and IC RSS-210.