

## EMC QUALIFICATION TEST REPORT

**RFID, INC.**

**RFID ACTIVE TAG**

TESTED TO CONFORM WITH:

**EMISSIONS STANDARDS**     **IMMUNITY STANDARDS**

FOR

**INDUSTRIAL, SCIENTIFIC AND MEDICAL (ISM)**

Test Report Number: 100618-1585

Date of Test Completion: July 20, 2010

Manufacturer's Address: 14100 E. Jewell Ave, Suite 12  
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Approved by:



Laboratory Director

#### DOCUMENT REVISION HISTORY

REVISION #	REPORT NUMBER	DESCRIPTION OF REVISION	DATE OF REVISION
0	100618-1585	ORIGINAL REPORT	2010-09-15

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The client is aware that Criterion Technology has performed testing in accordance with the applicable standard(s). Test data is accurate within ANSI parameters for Emissions testing, unless a specific level of accuracy has been defined in writing prior to testing, by Criterion Technology and the client.

Criterion Technology reports apply only to the specific Equipment Under Test (EUT) sample(s) tested under the test conditions described in this report. If the manufacturer intends to use this report as a document demonstrating compliance of this model, additional models of this product must have electrical and mechanical characteristics identical to the device tested for this report. Criterion Technology shall have no liability for any deductions, inferences, or generalizations drawn by the client or others from Criterion Technology issued reports.

Total liability is limited to the amount invoiced for the testing of this EUT and the contents of this report are not warranted.

Compliance with the appropriate governmental standards is the responsibility of the manufacturer.

Any questions regarding this report should be directed to:

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**All Criterion Technology instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 9002, ISO 17025, ANSI/NCSL Z540-I-1994 and are traceable to national standards.**

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## EMC QUALIFICATION TEST REPORT RFID ACTIVE TAG

### 1.0 EXECUTIVE SUMMARY

#### 1.1 PURPOSE

The purpose of this report is to present EMC test data and demonstrate conformity to the requirements of the prescribed standards for Emissions and/or Immunity.

#### 1.2 CONFORMITY

The test article was tested to the standards listed in Table I with the indicated conformity status. All test methods were performed in accordance to with the standards listed.

TABLE I. EMISSIONS CONFORMITY SUMMARY

TEST TYPE	COMPLIANCE STANDARD	TESTING TECHNIQUE	TEST DESCRIPTION	PRODUCT CLASSIFICATION	CONFORMITY STATUS
EMISSIONS	<u>FCC Part 15.109</u> <u>FCC Part 15.209</u> <u>FCC Part 15.240</u> <u>FCC Part 15.247</u> <u>CISPR 11</u> <u>ICES-001</u> <u>AS/NZ 4268</u>	<input checked="" type="checkbox"/> <u>ETSI 300 220</u>	Unentional Radiated Emissions	Class B	<b>PASSED</b>
	Intentional Radiated Emissions		<b>PASSED</b>		

TABLE II. IMMUNITY CONFORMITY SUMMARY

TEST TYPE	COMPLIANCE STANDARD	TESTING TECHNIQUE	TEST DESCRIPTION	MINIMUM PERFORMANCE CRITERIA	CONFORMITY STATUS
IMMUNITY	<u>EN 61326-1</u>	<input checked="" type="checkbox"/> 61000-4-2	Electrostatic Discharge	B	<b>PASSED</b>
		<input checked="" type="checkbox"/> 61000-4-3	Radiated, RF Electromagnetic Field Amplitude Modulated	A	<b>PASSED</b>
		<input checked="" type="checkbox"/> ENV 50204	Radiated, RF Electromagnetic Field Pulse Modulated		<b>PASSED</b>
		<input checked="" type="checkbox"/> 61000-4-8	Power Frequency Magnetic Field <sup>1</sup>	A	<b>PASSED</b>
		<input checked="" type="checkbox"/> 61000-4-11	Voltage Dips, Short Interruptions and Voltage Variations	B/C	<b>PASSED</b>

#### 1.3 EQUIPMENT UNDER TEST (EUT)

EUT NAME: ACTIVE RFID TAG

<sup>1</sup> The requirements of EN 61000-4-8 may be waived if the EUT does not contain magnetically-sensitive devices.

## 2.0 EMISSIONS TEST STANDARDS

FCC Part 15, Subpart B

Class B

### 2.1 RADIATED EMISSIONS – 30 MHZ TO 1000 MHZ

Measurements for *Radiated Emissions* were performed over the frequency range of 30 MHz to 1000 MHz in the horizontal and vertical antenna polarities to the requirements of:

FCC Part 15.109

Class B

#### Testing Conditions

Date of Test: July 6, 2010  
Temperature: 19° C  
Relative Humidity: 48 %  
Test Voltage: Battery powered  
Test Operator: SP

#### Test Location

**Criterion Technology Open Area Test Site**

#### Test Distance

Antenna Distance: **3 meter(s)**      **Final Measurement(s)**

#### Test Equipment

- Rohde and Schwarz Receiver, ESVS-30
- Mini Circuits Pre-Amp #2
- Chase BiLog Antenna, Model 1121

#### Test Results of Radiated Emissions

Test Status: **PASSED**Frequency Range: **30 MHz to 1000 MHz**Minimum Margin to Limit: **-14.47** dB at **616.7280** MHz

#### Under 1GHz @ 3 meters

Uncertainty Horizontal under 200 MHz: **4.55** dB  
Uncertainty Horizontal over 200 MHz: **3.92** dB  
Uncertainty Vertical under 200 MHz: **4.69** dB  
Uncertainty Vertical over 200 MHz: **4.32** dB

#### Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

**2.2**  **RADIATED EMISSIONS ABOVE 1GHZ**

Measurements for *Radiated Emissions* were performed over the frequency range of 1 GHz to 6 GHz in the horizontal and vertical antenna polarities to the requirements of:

**FCC Part 15.109****Class B**Testing Conditions

Date of Test: July 6, 2010  
Temperature: 19° C  
Relative Humidity: 48 %  
Test Voltage: Battery powered  
Test Operator: SP

Test Location**Criterion Technology Open Area Test Site**Test DistanceAntenna Distance: **3 meter(s)**      **Final Measurement(s)**Test Equipment Antenna Research, Horn Antenna, Model DRG118/ATest Results of Radiated EmissionsTest Status: **PASSED**      Frequency Range: **1 GHz to 6 GHz**Minimum Margin to Limit: **-26.34** dB at **1618.4354** MHzRemarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

**2.3**  **INTENTIONAL RADIATOR**

Measurements for *Intentional Radiated Emissions* were performed over the frequency range of 1 GHz to 6 GHz the horizontal and vertical antenna polarities to the requirements of:

**FCC Part 15.209**  
**FCC Part 15.247**

**Class A**  
**Class A**

Testing Conditions

Date of Test: July 2, 2010  
Temperature: 18° C  
Relative Humidity: 49 %  
Test Voltage: Battery powered  
Test Operator: SP

Test Location**Criterion Technology Open Area Test Site**Test Distance

Antenna Distance: **10 meter(s)** **Final Measurement(s)**

Test Equipment

- Veratech Pre-Amp #3
- Antenna Research, Horn Antenna, Model DRG118/A
- EMCO Active Loop, 6502

Test Accessories: Laptop

Test Results of Radiated Emissions

Test Status: **PASSED** Frequency Range: **1 GHz to 6 GHz**

Minimum Margin to Limit: **-17.96** dB at **867.5852** MHz

Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

## 2.4 CHANNEL BANDWIDTH

Measurements for bandwidth, band edges, number of channels were performed in accordance with the Operations to the Requirements of:

### EN 300 220

#### Testing Conditions

Date of Test: July 7, 2010  
Temperature: 15° C  
Relative Humidity: 48 %  
Test Voltage: Battery powered  
Test Operator: LWS

#### Test Location

**Criterion Technology Open Area Test Site**

#### Test Equipment

Hewlett-Packard Spectrum Analyzer, HP 8566B  
Rohde and Schwarz Receiver, ESVS-30

#### Test Results of Occupied Bandwidth and 40 db Bandedges

Test Status: **PASSED**

-40 dB lower Bandedge:	433.53 <u>MHz</u>
-40 dB upper Bandedge:	434.36 <u>MHz</u>
-40 dB Occupied Channel Bandwidth:	0.83 <u>MHz</u>

#### Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status



## 2.5 FREQUENCY STABILITY

Measurements for Frequency Stability were performed in accordance with the Operations to the Requirements of:

**EN 300 220 paragraph 8.9.3**

### Testing Conditions

Date of Test: July 20, 2010  
Temperature: 25° C  
Relative Humidity: 36 %  
Test Voltage: Battery powered  
Test Operator: LWS

### Test Location

**Criterion Technology Open Area Test Site**

### Test Equipment

Hewlett-Packard Spectrum Analyzer, HP 8566B  
Rohde and Schwarz Receiver, ESVS-30

### Test Results of Occupied Bandwidth and 40 db Bandedges

Test Status: **PASSED**

Margin to limit:

<b>-36 dBm lower Bandedge:</b>	<b>0.0492MHz 55°C at 2.55 VDC</b>
<b>-36 dBm upper Bandedge:</b>	<b>0.1721MHz 10°C at 3.45 VDC</b>

### Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

## 2.6 FREQUENCY STABILITY

Measurements for Frequency Stability were performed in accordance with the Operations to the Requirements of:

### **FCC Part 15.240C**

#### Testing Conditions

Date of Test: July 20, 2010  
Relative Humidity: 36 %  
Test Voltage: Battery powered  
Test Operator: LWS

#### Test Location

#### **Criterion Technology Open Area Test Site**

#### Test Equipment

Hewlett-Packard Spectrum Analyzer, HP 8566B  
Rohde and Schwarz Receiver, ESVS-30

Test Status: **PASSED**

46 dBuV/m lower margin to bandedge .0492MHz 55 °C @ 2.55 VDC

46 dBuV/m upper margin to bandedge .1721MHz 10 °C @ 3.45 VDC

#### Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

**3.0 IMMUNITY STANDARDS**

EN 61326-1

**3.1 IMMUNITY TEST STANDARDS.**

TABLE II. IMMUNITY TESTS

BASIC STANDARDS	TESTED	ENVIRONMENTAL PHENOMENA	SPECIFICATIONS/UNITS	REQUIRED PERFORMANCE
EN 61000-4-2	<input checked="" type="checkbox"/>	Electrostatic Discharge	$\pm 8$ kV Air $\pm 4$ kV Contact	Performance Criterion B
EN 61000-4-3	<input checked="" type="checkbox"/>	Radiated, RF Electromagnetic Field - Amplitude Modulated	3 V/m (unmodulated, RMS) 80%, 1 kHz AM 80 MHz – 2.7 GHz	Performance Criterion A
ENV 50204	<input checked="" type="checkbox"/>	Radiated, RF Electromagnetic Field - Pulse Modulated	3 V/m (unmodulated, RMS) 50% duty cycle 900 $\pm$ 5 MHz	
EN 61000-4-8	<input checked="" type="checkbox"/>	Power Frequency Magnetic Field	50 Hz, 30.0 A <sub>RMS</sub> /m	

**3.2 PERFORMANCE CRITERIA****3.2.1 Performance Criterion A**

The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

**3.2.2 Performance Criterion B**

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

**3.2.3 Performance Criterion C**

Temporary loss of function is allowed, provided the loss of function is self recoverable or can be restored by the operation of the controls.

**3.3**  **ELECTROSTATIC DISCHARGE (ESD)**

Measurements of immunity against *ESD* were performed to the requirements of EN 61000-4-2.

Testing Conditions

Date of Test: July 7, 2010  
Temperature: 15° C  
Relative Humidity: 48 %  
Atmospheric Pressure: 567 Torr  
Test Voltage: Battery powered  
Test Operator: SP

Test Location**Criterion Technology Immunity Area**Test Equipment

Haefely Trench PESD, 1600

Test Setup

	<u>Air</u>	<u>Contact</u>
Discharge Type:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Discharge Voltages:	<b>±8 kV</b>	<b>±4 kV</b>
Discharge Polarity:	<b><u>Positive/Negative</u></b>	<b><u>Positive/Negative</u></b>
Discharge Factor:	<b><u>³1 second</u></b>	<b><u>³1 second</u></b>
Discharge Number:	<b><u>³10</u></b>	<b><u>³10</u></b>
Discharge Impedance:		<b><u>330 ohms/150 pF</u></b>
Discharge Locations:	<input checked="" type="checkbox"/> Human-Interface Accessible	
	<input checked="" type="checkbox"/> See Photographs <u>APPENDIX A</u>	

Test Results of ESD

Test Status: **PASSED** Performance Criterion **A**

Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

3.4  **RADIATED RF ELECTROMAGNETIC (EM) FIELD IMMUNITY**

Measurements of immunity against *Radiated RF EM Fields* were performed to the requirements of:

EN 61000-4-3       ENV 50204

Testing Conditions

Date of Test: July 7, 2010  
 Temperature: 14° C  
 Relative Humidity: 48 %  
 Atmospheric Pressure: 566.6 torr  
 Test Voltage: Battery powered  
 Test Operator: SP

Test Location**Criterion Technology Semi-Anechoic Chamber**Test Equipment

Amplifier Research Field-Strength Monitoring System, FM2000/FP2000  
 Amplifier Research Power Amplifier, 100W1000M1  
 Amplifier Research Log Periodic Antenna, Model AT1080  
 EMCO Double Rigeld Wave Guide horn, model 3115  
 HP Signal Generator, HP8648D       HP Spectrum Analyzer, HP8566B/85662A

Test Specifications

Frequency Range:  **80 MHz to 2.7 GHz**       **900 ± 5 MHz**  
 Field Strength:  **3 V/m**       Other: **3 V/m**  
 Modulation:  **AM - 1 kHz, 80% sinewave**  
 Step: **1%**      **3/30 second(s) sweep/spot**  
 Antenna Distance: **1.8 meter(s)**  
 Antenna Polarization:  **Horizontal**     **Vertical**  
 EUT Position:     Front       Left       Top  
                        Back       Right       Bottom

Test Results of Radiated RF EM Field Immunity

Test Status: **PASSED**      Performance Criterion **A**

Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

**3.5**  **POWER-FREQUENCY MAGNETIC FIELD (PFMF)**

Measurements of immunity against *PFMF* were performed to the requirements of EN 61000-4-8.

Testing Conditions

Date of Test: July 7, 2010  
Temperature: 14° C  
Relative Humidity: 48 %  
Atmospheric Pressure: 566.6 torr  
Test Voltage: Battery powered  
Test Operator: SP

Test Location**Criterion Technology Immunity Area**Test Equipment

Haefely Trench Magnetic Loop Antenna

Test Specifications

Power Frequency: **60 Hz**  
Field Strength: **30 A/m**

Test Results of PFMF

Test Status: **PASSED** Performance Criterion **A**

Remarks

See: **APPENDIX A** for EUT Photographs  
**APPENDIX B** for Data Sheets  
**APPENDIX D** for Test Equipment Calibration Status

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## 4.0 APPENDIX A: EUT PHOTOGRAPHS

### 4.1 RADIATED EMISSIONS – FRONT VIEW



4.2 ELECTROSTATIC DISCHARGE

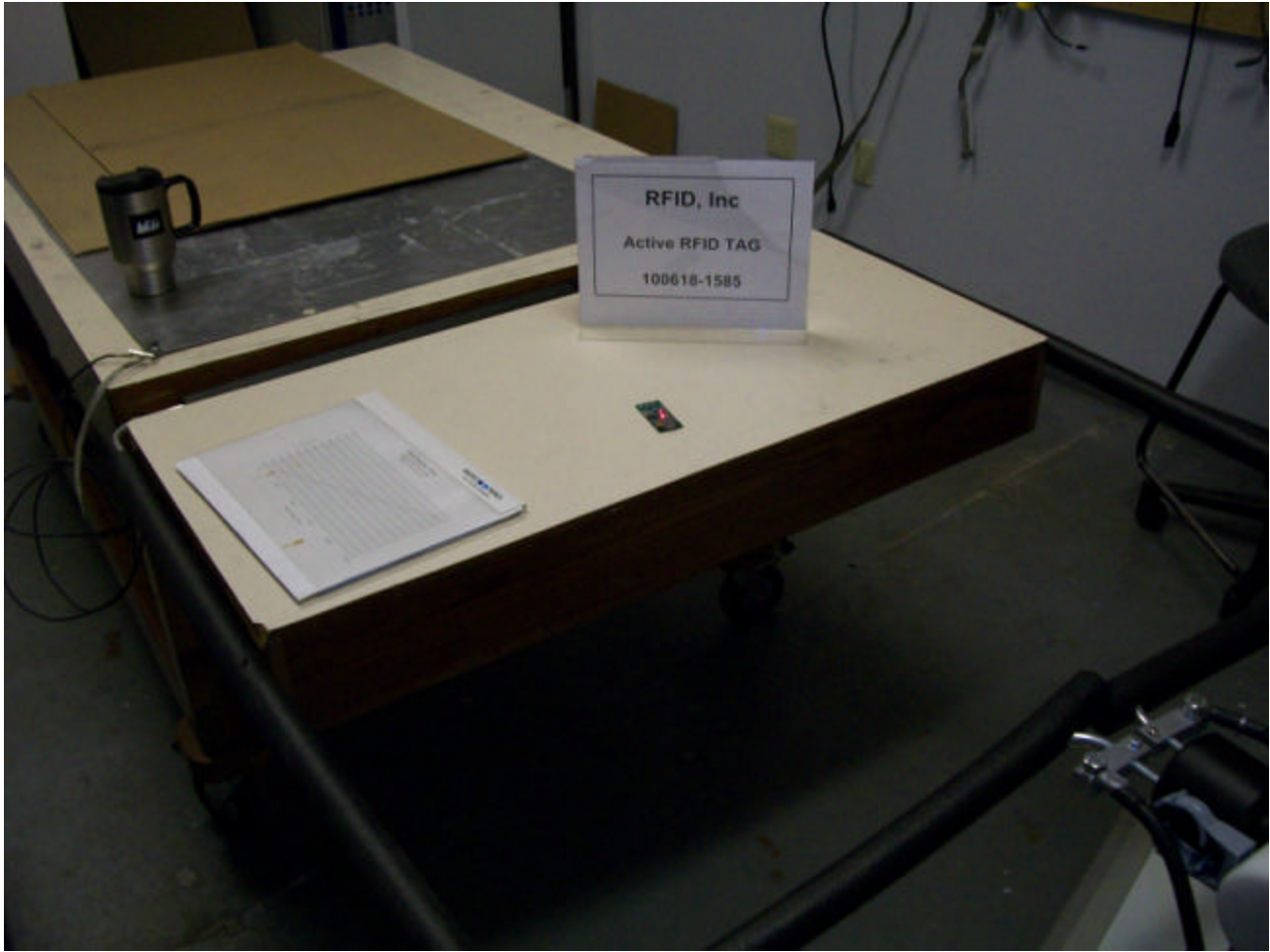




4.3 RADIATED RF ELECTROMAGNETIC FIELD IMMUNITY



4.4 POWER FREQUENCY MAGNETIC FIELD (PFMF)

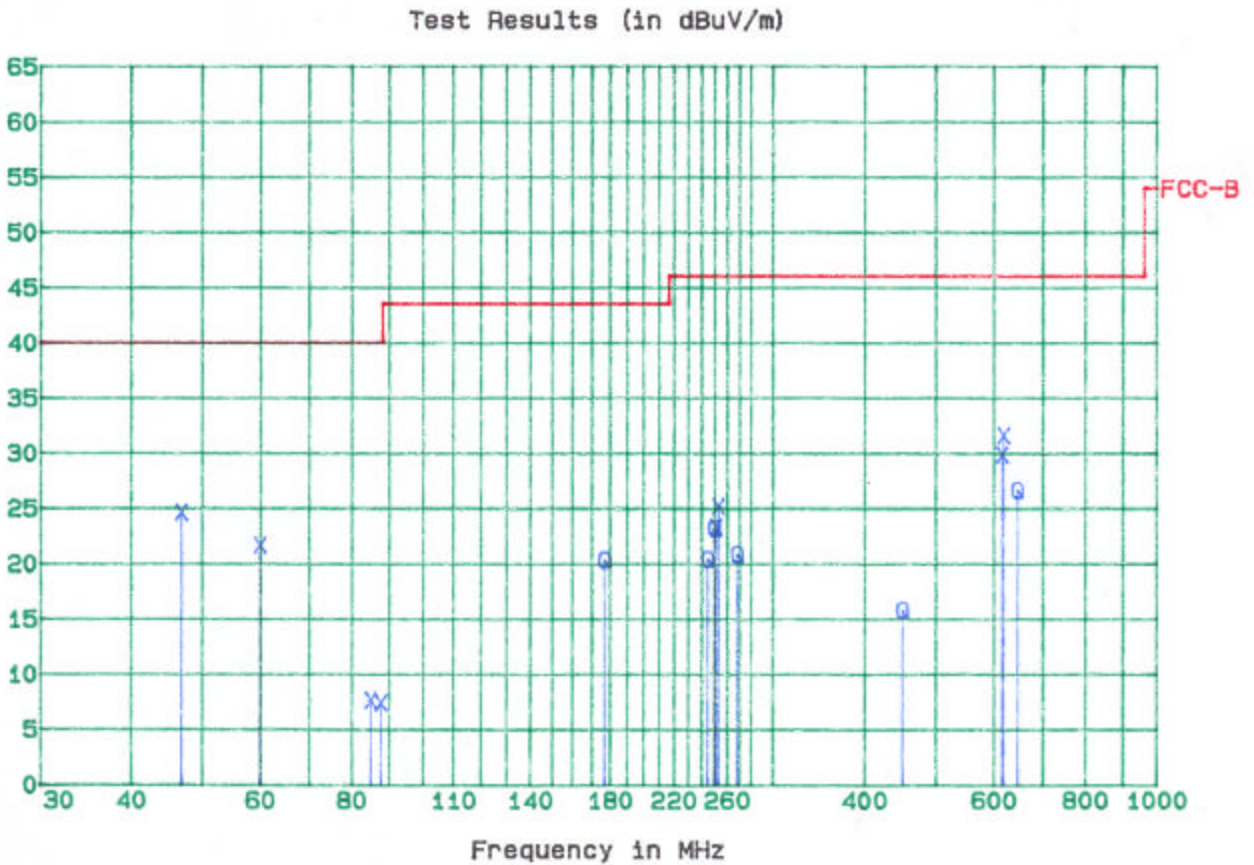


5.0 APPENDIX B: DATA SHEETS

5.1 RADIATED EMISSIONS PLOT – 30 MHZ TO 1 GHZ

Criterion Technology  
EUT: Active RFID Tag  
Manufacturer: RFID, Inc.  
Tester: SP  
EUT Level: production unit  
EUT Information: table top, battery powered  
Test Information: Normal ops, 3 meters, FCC Part 15.109 Class B  
Test Cond: Temp: 19 °C

Date: July 6, 2010  
SpiD: 100618-1585  
Humidity: 48 %



**5.2 RADIATED EMISSIONS TABLE – 30 MHZ TO 1 GHZ**

$$F_{val} = I_{val} + AF + Cable + Pads - Amp$$

Where:

$F_{val}$  is the final electric field in dbuv/m

$I_{val}$  is the initial reading from the EMC receiver or spec an in dbuv.

AF is the antenna factor, a + value is loss

Cable is the cable attenuation in db, a + value is loss

Pads is the total attenuator loss in db, a + value is loss

Amp is the preamplifier gain in db, a + value is amplifier gain

A Sample calculation with  $I_{val}$ , AF, Cable, Pads, & Amp values of 50 dbuv, 18, 4, 3, 32 respectively is:

$$F_{val} = 50 + 18 + 4 + 3 - 32 = 43 \text{ dbuv/m}$$

Minimum Margin to Limit: **-14.47** dB at **616.7280** MHz

Criterion Technology Tue Jul 06 12:04:25 2010

EUT: Active RFID Tag

Manufacturer: RFID, In.

Tester: sp

Special ID: 100618-1585

EUT Level: production unit

EUT Information: Table top, battery powered

Test information: Normal ops, 3 meters, FCC Part 15.109 Class B

**Table 1: Scan List, sorted by margin to limit FCC-B, -40.0dB filter**

<u>Freq, MHz</u>	<u>Value dBuV/m</u>	<u>Sts</u>	<u>Margin to FCC-B limits (dB)</u>	<u>TT</u>	<u>Hght</u>	<u>Az</u>	<u>Comment</u>
616.7280	31.55	m	-14.47	215	100	V	.
46.6200	24.58	m	-15.42	219	100	V	.
614.2980	29.84	m	-16.18	270	151	H	.
59.7600	21.61	m	-18.39	1	238	H	noise floor
644.7482	26.63	q	-19.39	90	100	V	.
252.1300	25.17	m	-20.85	180	351	H	.
250.0900	23.27	m	-22.75	180	351	H	.
248.8980	23.18	q	-22.84	180	351	H	.
176.4181	20.29	q	-23.23	180	351	H	.
267.5581	20.83	q	-25.19	180	351	H	.
243.8200	20.37	q	-25.65	180	351	H	.
449.2300	15.77	q	-30.25	180	100	V	.
84.7195	7.63	m	-32.37	270	100	V	Noise floor
87.4491	7.37	m	-32.63	1	238	H	.

**Table 2: Scan List for FCC-B, sorted by Frequency, -40.0dB filter**

<u>Freq. MHz</u>	<u>Final Value dBuV/m</u>	<u>Sts</u>	<u>Margin to FCC-B limits (dB)</u>	<u>TT</u>	<u>Hght</u>	<u>Az</u>	<u>Comment</u>
46.6200	24.58	m	-15.42	219	100	V	.
59.7600	21.61	m	-18.39	1	238	H	noise floor
84.7195	7.63	m	-32.37	270	100	V	Noise floor
87.4491	7.37	m	-32.63	1	238	H	.
176.4181	20.29	q	-23.23	180	351	H	.
243.8200	20.37	q	-25.65	180	351	H	.
248.8980	23.18	q	-22.84	180	351	H	.
250.0900	23.27	m	-22.75	180	351	H	.
252.1300	25.17	m	-20.85	180	351	H	.
267.5581	20.83	q	-25.19	180	351	H	.
449.2300	15.77	q	-30.25	180	100	V	.
614.2980	29.84	m	-16.18	270	151	H	.
616.7280	31.55	m	-14.47	215	100	V	.
644.7482	26.63	q	-19.39	90	100	V	.

**Table 3: Complete Scan List Sorted by Frequency**

<u>Freq. MHz</u>	<u>I-val before xducr factors dBuV</u>	<u>Final Value dBuV/m</u>	<u>Sts</u>	<u>TT</u>	<u>Hght</u>	<u>Az</u>	<u>Time</u>	<u>Comment</u>
46.6200	37.07	24.58	m	219	100	V	Tue Jul 06 11:13:32 2010	.
59.7600	37.74	21.61	m	1	238	H	Tue Jul 06 11:40:12 2010	noise floor
84.7195	21.49	7.63	m	270	100	V	Tue Jul 06 11:06:35 2010	Noise floor
87.4491	20.94	7.37	m	1	238	H	Tue Jul 06 11:43:31 2010	.
176.4181	32.49	20.29	q	180	351	H	Tue Jul 06 10:47:20 2010	.
243.8200	29.58	20.37	q	180	351	H	Tue Jul 06 10:47:23 2010	.
248.8980	31.82	23.18	q	180	351	H	Tue Jul 06 10:47:25 2010	.
250.0900	31.77	23.27	m	180	351	H	Tue Jul 06 10:47:28 2010	.
252.1300	33.43	25.17	m	180	351	H	Tue Jul 06 10:47:30 2010	.
267.5581	29.29	20.83	q	180	351	H	Tue Jul 06 10:47:33 2010	.
449.2300	19.21	15.77	q	180	100	V	Tue Jul 06 10:39:23 2010	.
614.2980	30.06	29.84	m	270	151	H	Tue Jul 06 10:54:53 2010	.
616.7280	31.63	31.55	m	215	100	V	Tue Jul 06 11:26:01 2010	.
644.7482	26.11	26.63	q	90	100	V	Tue Jul 06 10:36:26 2010	.

5.3 RADIATED EMISSIONS PLOT – ABOVE 1 GHZ

Criterion Technology

Date: July 6, 2010

EUT: Active RFID Tag

Manufacturer: RFID, Inc.

Tester: SP

SpiD: 100618-1585

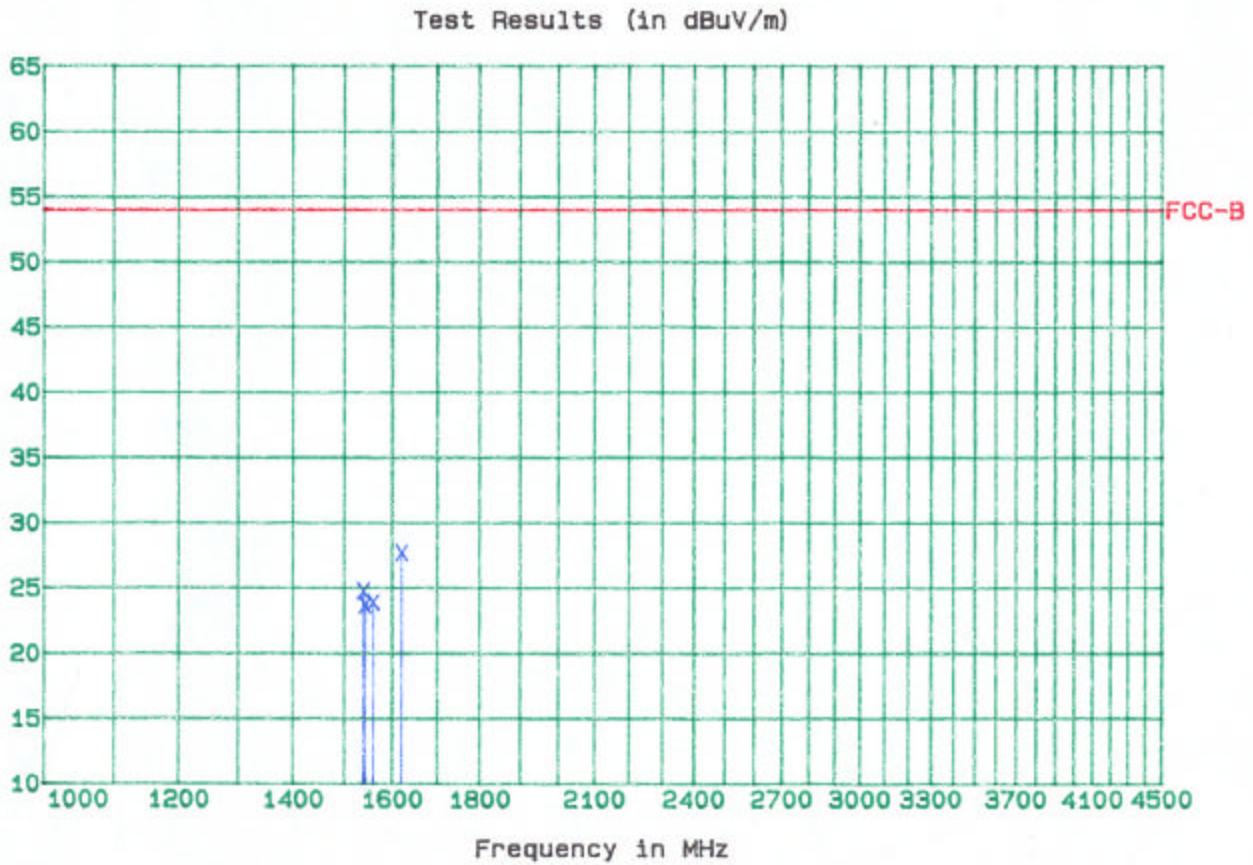
EUT Level: production unit

EUT Information: table top, battery powered

Test Information: Normal ops, 3 meters, FCC Part 15.109 Class B

Test Cond: Temp: 19 °C

Humidity: 48 %



**5.4 RADIATED EMISSIONS TABLE – ABOVE 1 GHZ**

$$F_{val} = I_{val} + AF + Cable + Pads - Amp$$

Where:

$F_{val}$  is the final electric field in dBuV/m

$I_{val}$  is the initial reading from the EMC receiver or spec in dBuV.

AF is the antenna factor, a + value is loss

Cable is the cable attenuation in db, a + value is loss

Pads is the total attenuator loss in db, a + value is loss

Amp is the preamplifier gain in db, a + value is amplifier gain

A Sample calculation with  $I_{val}$ , AF, Cable, Pads, & Amp values of 50 dBuV, 18, 4, 3, 32 respectively is:

$$F_{val} = 50 + 18 + 4 + 3 - 32 = 43 \text{ dBuV/m}$$

Minimum Margin to Limit: **-26.34** dB at **1618.4354** MHz

Criterion Technology Tue Jul 06 13:44:16 2010

EUT: Active RFID Tag

Manufacturer: RFID, In.

Tester: sp

Special ID: 100618-1585

EUT Level: production unit

EUT Information: Table top battery powered

Test information: Normal ops, 3 meters, FCC Part 15.109 Class B

**Table 1: Scan List, sorted by margin to limit FCC-B, -40.0dB filter**

<u>Freq. MHz</u>	<u>Value dBuV/m</u>	<u>Sts</u>	<u>Margin to FCC-B limits (dB)</u>	<u>TT</u>	<u>Hght</u>	<u>Az</u>	<u>Comment</u>
1618.4354	27.64	m	-26.34	1	100	V	.
1536.8950	24.70	m	-29.28	1	100	V	.
1557.6419	23.85	m	-30.13	363	100	H	.
1540.3060	23.64	m	-30.34	224	163	H	.

**Table 2: Scan List for FCC-B, sorted by Frequency, -40.0dB filter**

<u>Freq. MHz</u>	<u>Final Value dBuV/m</u>	<u>Sts</u>	<u>Margin to FCC-B limits (dB)</u>	<u>TT</u>	<u>Hght</u>	<u>Az</u>	<u>Comment</u>
1536.8950	24.70	m	-29.28	1	100	V	.
1540.3060	23.64	m	-30.34	224	163	H	.
1557.6419	23.85	m	-30.13	363	100	H	.
1618.4354	27.64	m	-26.34	1	100	V	.

**Table 3: Complete Scan List Sorted by Frequency**

<u>Freq. MHz</u>	<u>I-val before xducr factors dBuV</u>	<u>Final Value dBuV/m</u>	<u>Sts</u>	<u>TT</u>	<u>Hght</u>	<u>Az</u>	<u>Time</u>	<u>Comment</u>
1536.8950	37.54	24.70	m	1	100	V	Tue Jul 06 13:15:28 2010	.
1540.3060	36.44	23.64	m	224	163	H	Tue Jul 06 13:34:04 2010	.
1557.6419	36.48	23.85	m	363	100	H	Tue Jul 06 13:23:03 2010	.
1618.4354	39.74	27.64	m	1	100	V	Tue Jul 06 13:14:39 2010	.

5.5 INTENTIONAL RADIATED EMISSIONS TABLE

Criterion Technology  
EUT: Active RFID Tag  
Manufacturer: RFID, Inc.  
Tester: SP

Date: July 2, 2010

SpiD: 100618-1585

Fundamental Freq (MHz)	Fval before rcvr pads (dBuV)	Recv. Pads db	Pwr Out EIRP dBuV	Elev	AZ	Pol	Orientation	Conducted or Substitution CW Power to duplicate EIRP (dBuV)	Substitution antenna gain (dBil)	Equivalent CW Power (dBuV at 0 dBil)	Limit (dBuV)	Margin to Limit (dB)
433.7926	70.6	0	70.6	233.0	360.0	H	X	N/A	N/A	N/A	N/A	N/A
433.7926	69.56	0	69.56	225.0	327.0	H	Y	N/A	N/A	N/A	N/A	N/A
433.7926	70.79	0	70.79	100.0	299.0	V	Z	83.74	2.17	85.91	115.0	-29.1

Harmonic	Frequency (Bold => restricted band)	F val w/Duty cycle correction	FCC part 15 limit	Margin to Limit (db)	Elev	AZ	Pol	Comments	Antennas
2nd	867.5852	36.04	54	-17.96	100	227	V	Z orientation	DRG 118A
3rd	1301.3778	6.21	54	-47.79	100	229	V	Z orientation	DRG 118A
4th	1735.1704	18.18	54	-35.82	100	159	V	Z orientation	DRG 118A
5th	2168.963	22.2	54	-31.80	131	47	V	Z orientation	DRG 118A
6th	2602.7556	11.92	54	-42.08	163	35	V	Z orientation	DRG 118A
7th	3036.5482	22.61	54	-31.39	113	359	V	Z orientation	DRG 118A
8th	3470.3408	-0.01	54	-54.01	118	11	V	Z orientation	DRG 118A
9th	3904.1334	4.24	54	-49.76	103	9	V	Z orientation	DRG 118A
10th	4337.926	-7.99	54	-61.99	105.3	1	V	Z orientation	DRG 118A

Notes

System saturation is around 89 dBuV. EUT can be measured at fundamental barefoot (w/o pads)  
Data recorded into sheet from instruments and computer screen.

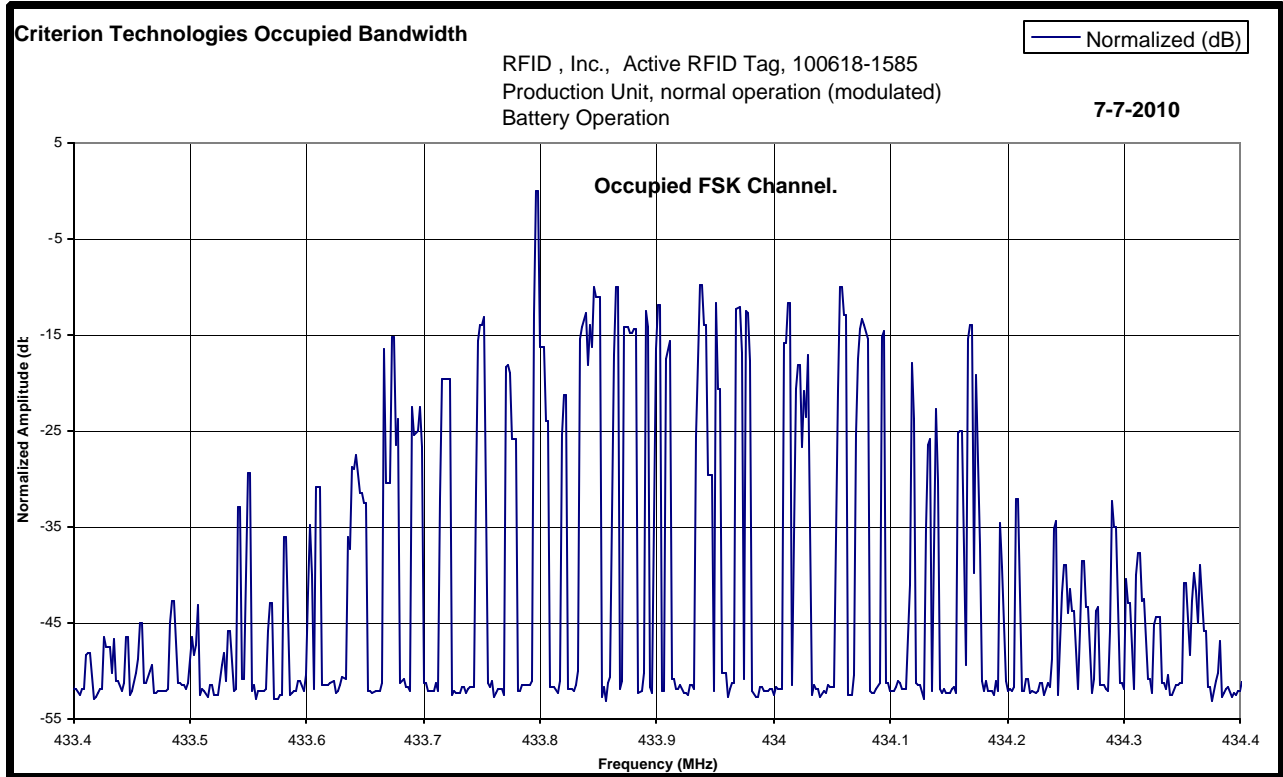


5.6 CHANNEL BANDWIDTH

Criterion Technology  
EUT: Active RFID Tag  
Manufacturer: RFID, Inc.  
Tester: SP

Date: July 7, 2010

SpiD: 100618-1585



**5.7 FREQUENCY STABILITY**

Criterion Technology  
EUT: Active RFID Tag  
Manufacturer: RFID, Inc.  
Tester: LWS

Date: July 20, 2010

SpiD: 100618-1585

**ETSI 300 220**

<u>TEMPERATURE</u>	<u>Time</u>	<u>Supply Voltage 2.55 volts Frequency (MHz)</u>	<u>Supply Voltage 3.45 volts Frequency (MHz)</u>
Room temp +25°	10:45	433.791880	434.045751
-20°	11:40	433.801899	433.801903
-5°	12:40	433.800717	433.800697
+10°	13:40	433.796330	434.050115
+40°	14:30	433.785707	434.039476
55°	15:45	433.780461	434.034310
Return to Room +25°	16:25	433.791891	434.0045730

## 5.8 FREQUENCY STABILITY

Criterion Technology  
EUT: Active RFID Tag  
Manufacturer: RFID, Inc.  
Tester: LWS

Date: July 20, 2010

SpiD: 100618-1585

## FCC Part 15.240

Occupied B.W. - margin to band edge with temperature and voltage

Lower Band Edge of 433.5 MHzO.B.W. lower edge@ 46 dbuV/M

<u>Temp &amp; supply voltage</u>	<u>(MHz)</u>	<u>Limit (MHz)</u>	<u>Margin to Limit (MHz)</u>	<u>pass/fail</u>
25C @ 3.0 VDC	433.667	433.5	0.167	pass
25C @ 2.55 VDC	433.56065	433.5	0.06065	pass
25C @ 3.45 VDC	433.7733451	433.5	0.2733451	pass
-20C @ 2.55 VDC	433.570669	433.5	0.070669	pass
-20C @ 3.45 VDC	433.570673	433.5	0.070673	pass
-5C @ 2.55 VDC	433.569487	433.5	0.069487	pass
-5C @ 3.45 VDC	433.569467	433.5	0.069467	pass
10C @ 2.55 VDC	433.5651	433.5	0.0651	pass
10C @ 3.45 VDC	433.818885	433.5	0.318885	pass
40C @ 2.55 VDC	433.554477	433.5	0.054477	pass
40C @ 3.45 VDC	433.808246	433.5	0.308246	pass
55C @ 2.55 VDC	433.549231	433.5	0.049231	pass
55C @ 3.45 VDC	433.80308	433.5	0.30308	pass
RTR 25C @ 2.55 VDC	433.560589	433.5	0.060589	pass
RTR 25C @ 3.45 VDC	433.7735	433.5	0.2735	pass

O.B.W. upper edge@ 46 dbuV/M

<u>Temp &amp; supply voltage</u>	<u>(MHz)</u>	<u>Limit (MHz)</u>	<u>Margin to Limit (MHz)</u>	<u>pass/fail</u>
25C @ 3.0 VDC	434.176	434.5	0.324	pass
25C @ 2.55 VDC	434.06965	434.5	0.43035	pass
25C @ 3.45 VDC	434.2823451	434.5	0.2176549	pass
-20C @ 2.55 VDC	434.079669	434.5	0.420331	pass
-20C @ 3.45 VDC	434.079673	434.5	0.420327	pass
-5C @ 2.55 VDC	434.078487	434.5	0.421513	pass
-5C @ 3.45 VDC	434.078467	434.5	0.421533	pass
10C @ 2.55 VDC	434.0741	434.5	0.4259	pass
10C @ 3.45 VDC	434.327885	434.5	0.172115	pass
40C @ 2.55 VDC	434.063477	434.5	0.436523	pass
40C @ 3.45 VDC	434.317246	434.5	0.182754	pass
55C @ 2.55 VDC	434.058231	434.5	0.441769	pass
55C @ 3.45 VDC	434.31208	434.5	0.18792	pass
RTR 25C @ 2.55 VDC	434.069589	434.5	0.430411	pass
RTR 25C @ 3.45 VDC	434.282343	434.5	0.217657	pass

## 5.9 ELECTROSTATIC DISRUPTION EN-61000-4-2

TEST NUMBER:	<u>100618-1585</u>	TEST ARTICLE:	<u>Active RFID Tag</u>
TEMPERATURE:	<u>14 °C</u>	HUMIDITY:	<u>48%</u>
ATMOSPHERIC PRESSURE:	<u>567 Torr</u>	TEST PERSONNEL:	<u>sp</u>
TEST RESULTS:	<u>Complies (x)</u>		<u>Does Not Comply ( )</u>
EUT OPERATING VOLTAGE:	<u>battery</u>	TEST DATE:	<u>7/7/2010</u>
DISCHARGE VOLTAGES NEEDED	<u>Air (A), A ±8 kV</u>		<u>Contact (C) C ±4 kV</u>

TEST POINT DESCRIPTION	DISCHARGE VOLTAGES TESTED	DISCHARGE NOTE (1, 2 or 3)	REQUIRED TEST PERFORMANCE (A,B or C) *	ACTUAL TEST PERFORMANCE (A,B or C) *	PASS/ FAIL	OBSERVED RESPONSE OF THE EUT
(no contact points)						
Corners (4ea)	A ± 8 kV	1	B	A	Pass	ops norm
center seam	A ± 8 kV	1	B	A	Pass	ops norm
Horiz Coupling Plane						
EUT Front	C ± 4 kV	2	B	A	Pass	ops norm
EUT Right	C ± 4 kV	2	B	A	Pass	ops norm
EUT Rear	C ± 4 kV	2	B	A	Pass	ops norm
EUT Left	C ± 4 kV	2	B	A	Pass	ops norm
Vert. Coupling Plane						
EUT Front	C ± 4 kV	2	B	A	Pass	ops norm
EUT Right	C ± 4 kV	2	B	A	Pass	ops norm
EUT Rear	C ± 4 kV	2	B	A	Pass	ops norm
EUT Left	C ± 4 kV	2	B	A	Pass	ops norm

**\*NOTE:** Performance Criteria categories A, B, and C are as defined in EN 61326-1. The Performance Criterion for passing is as shown in Table II of this report. Refer to Setup Photos to see the test points.

**Discharge Notes:**

1. No perceived discharge, and no observed response in the EUT.
2. Discharge observed, but no observed response in the EUT.
3. Discharge observed, and the EUT was affected

5.10 ELECTROMAGNETIC SUSCEPTIBILITY EN-61000-4-3

TEST NUMBER: 100618-1585 TEST ARTICLE: Active RFID Tag  
 TEMPERATURE: 12 °C HUMIDITY: 48 %  
 ATMOSPHERIC PRESSURE: 566.6 Torr DWELL TIME: 3/30 SECONDS (SWEEP/SPOT)  
 TEST DATE: 7/7/2010 TEST PERSONNEL: sp  
 EUT OPERATING VOLTAGE: Battery

TEST FREQ. (MHz)	FIELD STRENGTH (V/m)	MODULATION FREQ. %	FIELD POLARITY	TESTED SIDE OF EUT	TEST PERFORMANCE (A,B or C) *	TEST PERFORMANCE (A,B or C) *	(PASS/ FAIL)	OBSERVED RESPONSE OF THE EUT
80 to 1000	3	1kHz 80%AM	Horizontal	Front (0)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Horizontal	Front (0)	A	A	Pass	ops norm
900	3	200 Hz pulse	Horizontal	Front (0)	A	A	Pass	ops norm
900	3	200 Hz pulse	Horizontal	Left (90)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Horizontal	Left (90)	A	A	Pass	ops norm
80 to 1000	3	1kHz 80%AM	Horizontal	Left (90)	A	A	Pass	ops norm
80 to 1000	3	1kHz 80%AM	Horizontal	Rear (180)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Horizontal	Rear (180)	A	A	Pass	ops norm
900	3	200 Hz pulse	Horizontal	Rear (180)	A	A	Pass	ops norm
900	3	200 Hz pulse	Horizontal	Right (270)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Horizontal	Right (270)	A	A	Pass	ops norm
80 to 1000	3	1kHz 80%AM	Horizontal	Right (270)	A	A	Pass	ops norm
80 to 1000	3	1kHz 80%AM	Vertical	Right (270)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Vertical	Right (270)	A	A	Pass	ops norm
900	3	200 Hz pulse	Vertical	Right (270)	A	A	Pass	ops norm
900	3	200 Hz pulse	Vertical	Rear (180)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Vertical	Rear (180)	A	A	Pass	ops norm
80 to 1000	3	1kHz 80%AM	Vertical	Rear (180)	A	A	Pass	ops norm
80 to 1000	3	1kHz 80%AM	Vertical	Left (90)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Vertical	Left (90)	A	A	Pass	ops norm
900	3	200 Hz pulse	Vertical	Left (90)	A	A	Pass	ops norm
900	3	200 Hz pulse	Vertical	Front (0)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Vertical	Front (0)	A	A	Pass	ops norm
80 to 1000	3	1kHz 80%AM	Vertical	Front (0)	A	A	Pass	ops norm

Clock/Spot Frequencies: 4, 8, 12, 16, 26, 52, 78, 104

TEST FREQ. (MHz)	FIELD STRENGTH (V/m)	MODULATION FREQ. %	FIELD POLARITY	TESTED SIDE OF EUT	TEST PERFORMANCE (A,B or C) *	TEST PERFORMANCE (A,B or C) *	(PASS/ FAIL)	OBSERVED RESPONSE OF THE EUT
1 - 2.7 GHz	3	1kHz 80%AM	Horizontal	Front (0)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Horizontal	Front (0)	N/A	N/A	N/A	N/A
SPOT	3	1kHz 80%AM	Horizontal	Left (90)	N/A	N/A	N/A	N/A
1 - 2.7 GHz	3	1kHz 80%AM	Horizontal	Left (90)	A	A	Pass	ops norm
1 - 2.7 GHz	3	1kHz 80%AM	Horizontal	Rear (180)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Horizontal	Rear (180)	N/A	N/A	N/A	N/A
SPOT	3	1kHz 80%AM	Horizontal	Right (270)	N/A	N/A	N/A	N/A
1 - 2.7 GHz	3	1kHz 80%AM	Horizontal	Right (270)	A	A	Pass	ops norm
1 - 2.7 GHz	3	1kHz 80%AM	Vertical	Right (270)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Vertical	Right (270)	N/A	N/A	N/A	N/A
SPOT	3	1kHz 80%AM	Vertical	Rear (180)	N/A	N/A	N/A	N/A
1 - 2.7 GHz	3	1kHz 80%AM	Vertical	Rear (180)	A	A	Pass	ops norm
1 - 2.7 GHz	3	1kHz 80%AM	Vertical	Left (90)	A	A	Pass	ops norm
SPOT	3	1kHz 80%AM	Vertical	Left (90)	N/A	N/A	N/A	N/A
SPOT	3	1kHz 80%AM	Vertical	Front (0)	N/A	N/A	N/A	N/A
1 - 2.7 GHz	3	1kHz 80%AM	Vertical	Front (0)	A	A	Pass	ops norm

no spot frequencies

\*NOTE: Performance Criteria categories A, B, and C are as defined in EN 61326-1. The Performance Criterion for passing is as shown in Table II of this report. Refer to Setup Photos to see the test points.

**5.11 MAGNETIC FIELDS IMMUNITY EN-61000-4-8**

**TEST NUMBER:** 100618-1585                      **TEST ARTICLE:** Active RFID Tag  
**TEMPERATURE:** 14°C                              **HUMIDITY:** 48%  
**ATMOSPHERIC PRESSURE:** 566.6Torr                      **METHOD:**  Immersion  Proximity  
**TEST DATE:** 7/7/2010                              **TEST PERSONNEL:** sp  
**TEST RESULTS:** Complies ( X )                              Does Not Comply ( )  
**EUT OPERATING VOLTAGE:** battery                              **DWELL TIME:** > 1 Minute

<u>MAGNETIC POWER FREQ. (Hz)</u>	<u>H-FIELD STRENGTH (A/m)</u>	<u>LOOP POSITION ON EUT</u>	<u>COUPLING DEVICE</u>	<u>REQUIRED PERFORMANCE (A,B or C) *</u>	<u>TEST PERFORMANCE (A,B or C) *</u>	<u>(PASS/ FAIL)</u>	<u>OBSERVED RESPONSE OF THE EUT</u>
60	30	X	Haefely loop	A	A	Pass	ops norm
60	30	Y	Haefely loop	A	A	Pass	ops norm
60	30	Z	Haefely loop	A	A	Pass	ops norm

**\*NOTE:** Performance Criteria categories A, B, and C are as defined in EN 61326-1. The Performance Criterion for passing is as shown in Table II of this report. Refer to Setup Photos to see the test points.

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**6.0 APPENDIX C: PRODUCT INFORMATION FORM****General Information**Date June 17, 2010Company Name: RFID, IncCompany Address: 14100 E. Jewell Ave., Suite 12, Aurora, CO 80012Contacts: James Heurich or Dzung Pham Phone: 303-378-9500 or 303-366-1234 x 103email: james@rfidinc.com or dzung@rfidinc.com**Market Information (Check all that Apply)**USA  Canada  Euro.Union  Taiwan  Japan  New Zealand  Australia 

Other \_\_\_\_\_

**Product Information**Name Active RFID Tag, 433MHZ Model Number \_\_\_\_\_ Serial Number: N/A

Product Dimensions: \_\_\_\_\_ Weight: \_\_\_\_\_

**Product Power Source:**Battery:  No  YesVoltage 3.0VDC

AC Supply:

# of cords: NONEVoltage for each: NONE

I/O Cables:

# of cords under 10 meters: N/A# of cords over 10 meters: N/AList Support equipment if any: N/A

**Emissions Testing:**

Is this equipment to be used in a residence:  No (Class A)  Yes (Class B)

Does this have a transmitter or Transceiver:  No  Yes

Highest oscillator/Clock frequency (including internal clocks only to the microprocessor): 26.0000MHZ

To be compliant with C63.4-2003 test methodology, for the emissions testing, the equipment must be exercising all of the functionality within the capability of the Equipment under test. In addition, the equipment must be equipped in the configuration of maximum capability, which will be offered to customers. The test software installed in the Equipment Under Test (EUT) must exercise all of the modules in this maximum capability configuration.

Description of the maximum capability configuration: N/A

Name and revision # of the test software used for the emissions test: N/A

**Immunity Testing**

**(If equipment is to be sold in markets other than US/CA/TAIWAN you need Immunity testing)**

During the series of immunity tests the EUT is subjected to a series of potentially interfering signals and environments. It is important that for these tests to be valid, that the EUT be configured at its maximum capability and that the software or equipment exercising this EUT have demonstrable output that is easily observed, and preferably transmitted through a cable approximately 20 feet in length during the series of tests. Pass / Fail criteria must be clearly defined and correspond to the equipment specifications received by the customer.

Description of the maximum capability configuration: N/A

Name of revision # of the test software used for the immunity tests: N/A

Clearly defined definitive description of the pass / fail criteria: Will be read or not read by the reader

What is the minimum product performance required under adverse electrical conditions/ disturbances: None

How many interfacing cables are greater than 3 meter long? None

List each cable by name? \_\_\_\_\_

**EN 61000-4-2 (ESD)**

Number of Metallic test points touchable by equipment operator: None

Number of Non-Metallic test points touchable by equipment operator: None

Is the product enclosure completely plastic or conductive? PLASTIC

Is the product enclosure partly plastic or conductive? N/A

Are there any additional ESD voltages required for testing? If so, list herein: N/A



**7.0 APPENDIX D: TEST EQUIPMENT AND CALIBRATION STATUS**

Manufacturer	Name/Description	Model Number	Serial Number	Cal. Due Date
Amplifier Research	Power Amplifier	100W1000M1	20214	8/1/2010
Veratech	Preamplifier (AMP2)	unknown	N/A	9/18/2010
FCC	EM Clamp	F2031	309	10/2/2010
FCC	CDN	FCC-801-M3-25	9714	10/2/2010
Rohde/ Schwarz	VHF/UHF Receiver	ESVS-30	863342014	10/8/2010
Rohde/ Schwarz	LISN	ESH2-Z5	828739-001	10/8/2010
Rohde/ Schwarz	HF Receiver	ESHS-30	826003/011	10/8/2010
Solar Electronics	LISN	8012-50-R-24-BNC	892310	10/15/2010
Haefely Trench	Test Mag	Mag 100	80162	10/15/2010
Gigatronics	Power Sensor	80301A-410	1831996	10/15/2010
Gigatronics	Power Meter	8541C	1830945	10/15/2010
Hewlett Packard	Tracking Generator	HP85645A	3210A00124	10/21/2010
FCC	LISN	FCC-TLISN-T4-02	20252	11/24/2010
Califorina Instruments	AC Power Source Pacs-1	5001iX-CTS-411	55637/ 72242	3/24/2011
Haefely Trench	Surge Generator	PSURGE 6.1	083-906-07	5/26/2011
Haefely Trench	EFT Tester	PEFT Junior	583-333-51	5/26/2011
Haefely Trench	Surge Coupler	FP-Surge 32.1	083-925-05	5/26/2011
EMCO	Active Loop	6502	2626	5/28/2011
Amplifier Research	E-Field Probe	FP2080	20236	10/16/2011
Amplifier Research	E-Field Probe	FP2000	19682	10/19/2011
EMCO	Horn	3160-08	1147	1/19/2012
Hewlett Packard	Signal Generator	HP 8648D	3642000145	3/9/2012
Hewlett Packard	Quasi Peak Adapter	85652A	3014A18942	5/23/2012
Hewlett Packard	Spectrum Analyzer	HP 8566B	2240A01951	5/23/2012
Hewlett Packard	Spectrum Analyzer Display	HP 85662A	2403A07322	5/23/2012
Haefely Trench	ESD Gun	PESD 1600	H605100	6/23/2012

## 8.0 APPENDIX E: TEST DIRECTIVES, STANDARDS AND METHODS

### 8.1 EUROPEAN DIRECTIVES, STANDARDS AND METHODS

89/336/EEC: Council Directive of 03 May 1989 on the Approximation of the Laws of the Member States Relating to Electromagnetic Compatibility, OJEC No. L 139/19-26, Aug 1993.

EN 55011 (CENELEC): ISM Radio-Frequency Equipment Radio Disturbance Characteristics - Limits and Methods of Measurement, 2010.

EN 55022 (CENELEC): ITE - Radio-Frequency Equipment Radio Disturbance Characteristics - Limits and Methods of Measurement, 2008.

EN 55024 (CENELEC): ITE - Immunity Characteristics - Limits and Methods of Measurement, 2008.

EN 55103-2: Product Family standard for audio, video, audio - visual and entertainment lighting control apparatus for professional use. Part 2: Immunity, April 1997.

EN 60601-1-2 (CENELEC): Medical Electrical Equipment. Part 1. General Requirements for Safety - Section 1.2. Collateral Standard: Electromagnetic Compatibility - Requirements and Tests, 2007.

EN 61000-6-2: EMC- Part 6-2. Generic Standard-Immunity for Industrial Environments, 2005.

EN 61000-6-3: EMC- Part 6-3. Generic Standard-Emissions for residential, commercial and light-industrial Environments 2007.

EN61000-6-4 (CENELEC): EMC - Generic Emission Standard, Part 6-4: Industrial Environment, 2007.

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8.4 47 CFR FCC PART 24 PERSONAL COMMUNICATIONS SERVICES: OCT 2009

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