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FCC Part 15.209
Transmitter Certification

Test Report

FCC ID: VC3-RF5X10

FCC Rule Part: 15.209

ACS Report Number: 07-0074-15C

Manufacturer: Hanchett Entry Systems, Inc.
Model(s): RF5010-IA, RF5010-EA, RF5210-IA, RF5210-EA

Test Begin Date: March 8, 2007
Test End Date: March 9, 2007

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FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

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This report contains 13 pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General

The HES HYBRID ELECTRIC STRIKE Series is an electronic door security monitor and locking system which consists of 4 models each containing a Reader module and Antenna module which operates at 125kHz. The model designations are as follows:

RF5010-IA: 5000 Series & Attached Reader Module
RF5010-EA: 5000 Series & Separated Reader Module
RF5210-IA: 5200 Series & Attached Reader Module
RF5210-EA: 5200 Series & Separated Reader Module

The difference between the RF5010 and RF5210 is that the reader is used with a different Electric Strike Model. The RF5010 is used with the 5000 Series. The RF5210 is used with the 5200 Series. The difference between the 5000 Series and the 5200 Series are the locksets they are design for. The 5000 Series was design for cylindrical locksets with a latch bolt length from 1/2" to 5/8". The 5200 Series was design for cylindrical locksets with a latch bolt length from 5/8" to 3/4".

There are 2 configurations of the Reader module. Configuration IA has the Antenna Module attached to the electric strike. Configuration EA has the Antenna Module as a separate piece which is connected to the Reader Module via a 24" cable.

Manufacturer Information:
Company name: Hanchett Entry Systems, Inc.
Address: 22630N 17th Ave, Phoenix, AZ 85027

Detailed photographs of the EUT are filed separately with this filing.

1.2.2 Intended Use

The HES HYBRID ELECTRIC STRIKE Series is an electronic door security monitor and locking system.

1.3 Test Methodology and Considerations

The difference in models as described above are in the locksets used and the antenna configuration. The Reader module which contains all the RF components is identical for all models. Both the IA (Antenna Module attached to the electric strike) and EA (Antenna Module as a separate piece) where evaluated for compliance. These products can be used with multiple door types and frames so the samples where tested standalone to provide a worst case test environment. The EUT's where positioned to provide worst case data for each configuration and where excited and tested with a reader card (badge) present. See test setup photographs for more detail.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 89450
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

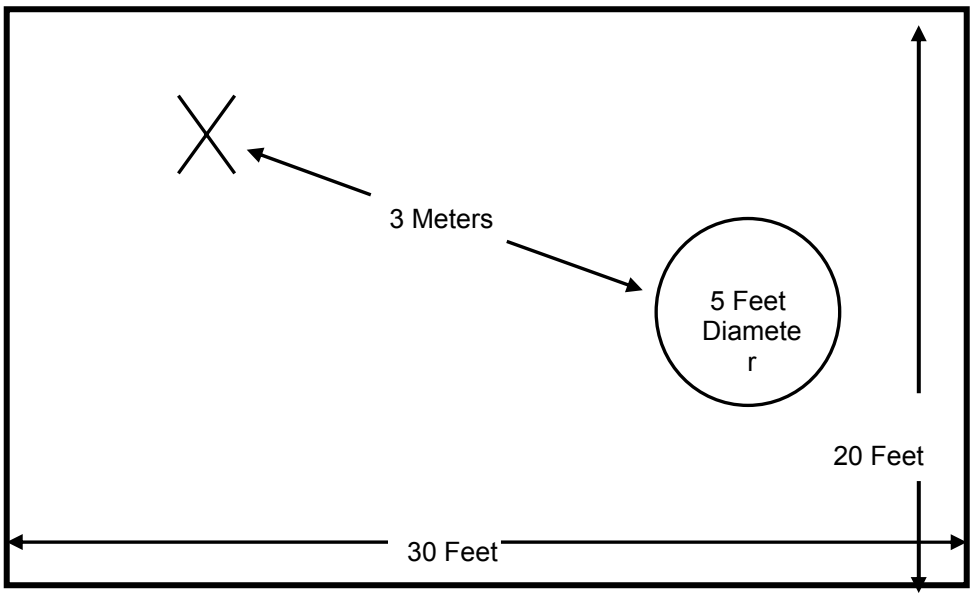

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

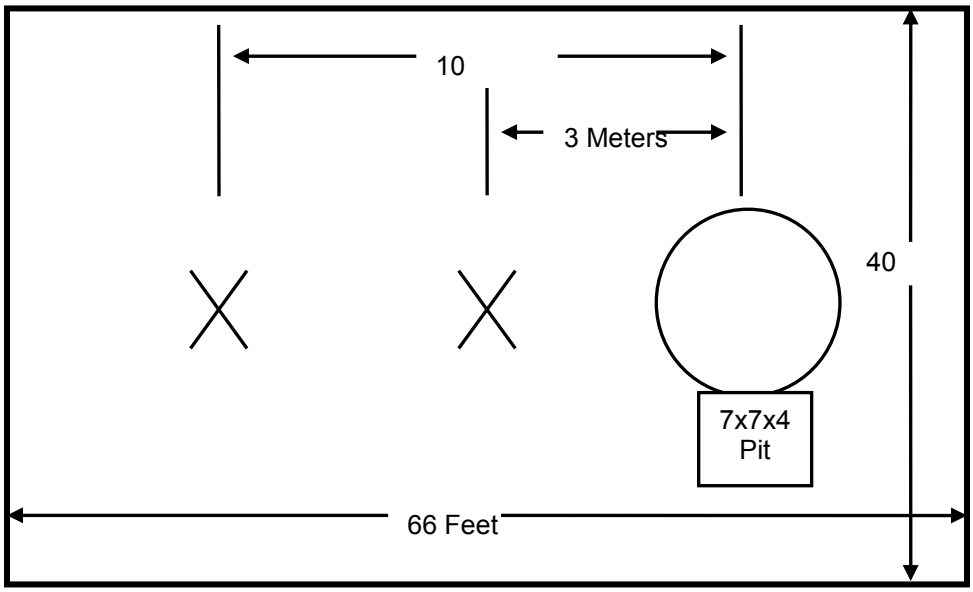

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

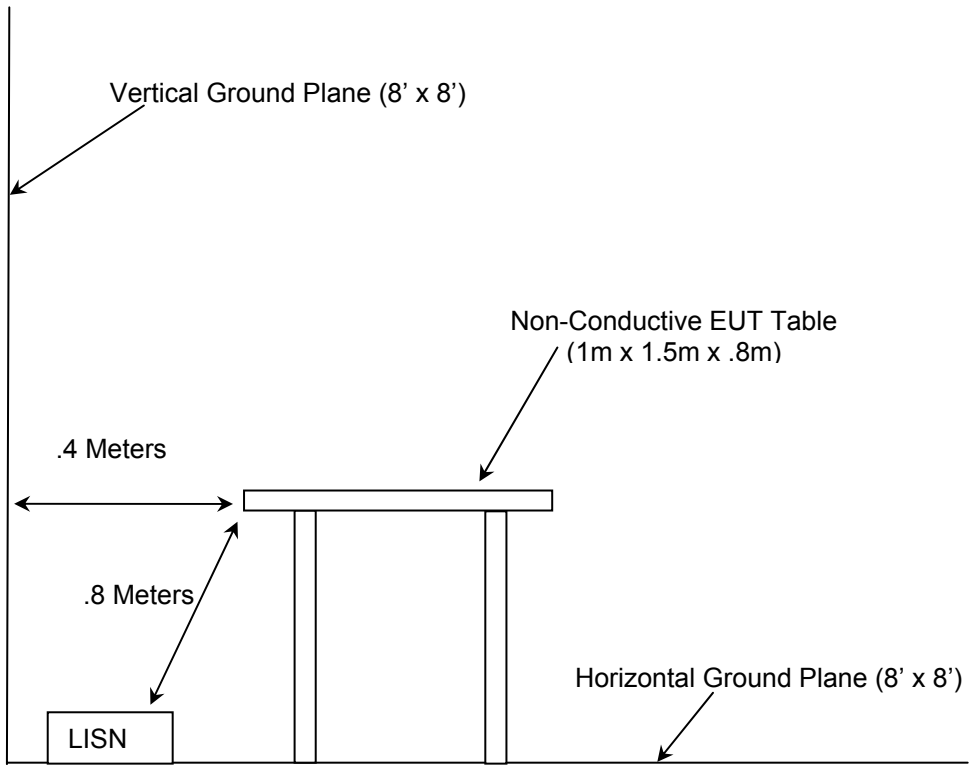

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4.0-1: Test Equipment

Equipment Calibration Information					
AssetID	Manufacturer	ModelNumber	Serial Number	Equipment Type	Cal Due
168	Hewlett Packard	11947A	44829	Attenuators	03/13/08
16	ACS	Cable	16	Cables	05/21/08
153	EMCO	3825/2	9411-2268	LISN	11/16/07
152	EMCO	3825/2	9111-1905	LISN	02/20/08
70	Rohde & Schwarz	ESH-3	879676/050	Spectrum Analyzers	08/09/07
73	Agilent	8447D	2727A05624	Amplifiers	05/10/07
25	Chase	CBL6111	1043	Antennas	05/30/07
167	ACS	Chamber EMI Cable Set	167	Cables	01/05/08
78	EMCO	6502	9104-2608	Antennas	01/15/08
1	Rohde & Schwarz	ESMI - Display	833771/007	Spectrum Analyzers	03/05/08
2	Rohde & Schwarz	ESMI-Receiver	839587/003	Spectrum Analyzers	03/05/08
283	Rohde & Schwarz	FSP40	1000033	Spectrum Analyzers	11/09/08

5.0 SUPPORT EQUIPMENT

Table 5-3: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
OK Industries	DC Power Supply	PS73C	36095	NA
Hewlett Packard	DC Power Supply	E3611A	KR4060603	NA

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

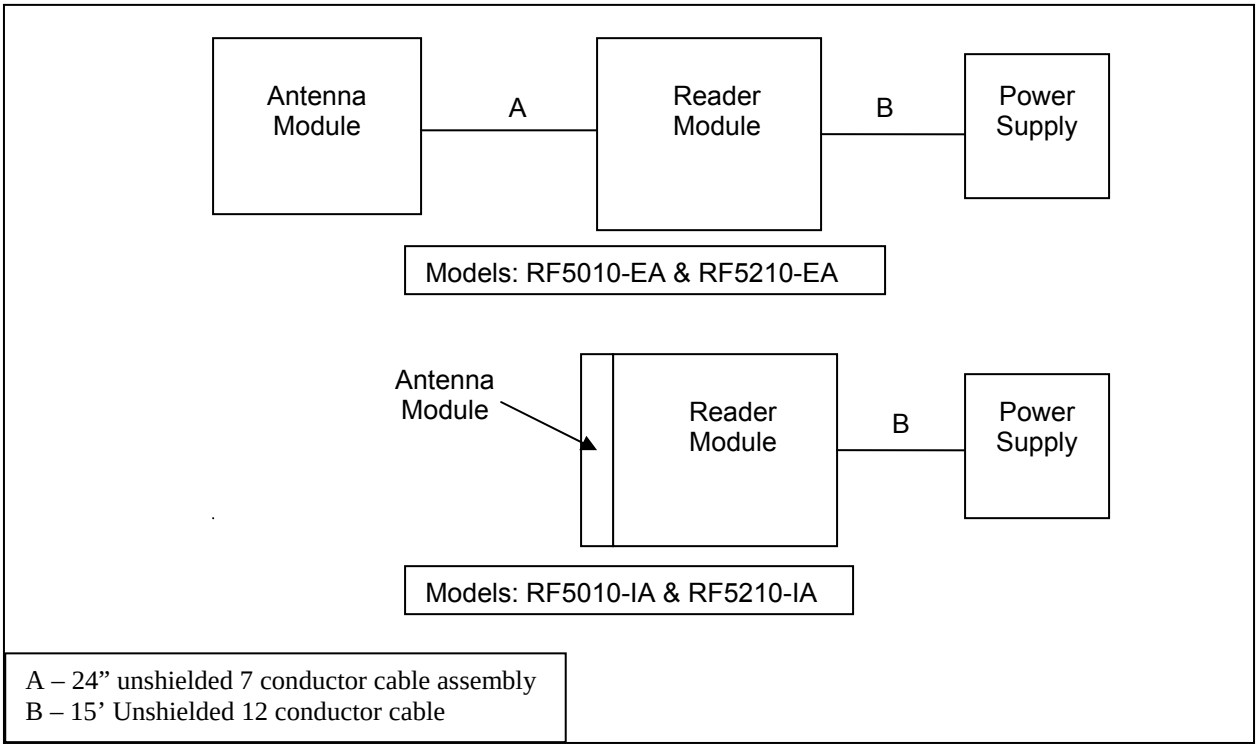

Figure 6-1: EUT Test Setup

*See Test Setup photographs for additional detail.

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement - FCC Section 15.203

This product design incorporates an integrated 125kHz loop antenna.

7.2 Power Line Conducted Emissions - FCC Section 15.207

7.2.1 Test Methodology

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Test Results

Results of the test are shown below in and Tables 7.2-1 through 7.2-2.

Table 7.2-1: Conducted EMI Results – IA Models (Antenna Module attached to strike)

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)		Line
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
Line 1										
0.18	39.6	12.8	9.80	49.40	22.60	64.49	54.49	15.1	31.9	GND
0.23	35.1	10.8	9.80	44.90	20.60	62.45	52.45	17.5	31.8	GND
0.27	33.8	8.2	9.80	43.60	18.00	61.12	51.12	17.5	33.1	GND
0.3	33.2	8.3	9.80	43.00	18.10	60.24	50.24	17.2	32.1	GND
0.33	30.3	7.2	9.80	40.10	17.00	59.45	49.45	19.4	32.5	GND
0.36	30.5	7.4	9.80	40.30	17.20	58.73	48.73	18.4	31.5	GND
Line 2										
0.18	39.5	10.5	9.80	49.30	20.30	64.49	54.49	15.2	34.2	GND
0.22	35.6	9.8	9.80	45.40	19.60	62.82	52.82	17.4	33.2	GND
0.26	33.9	8.2	9.80	43.70	18.00	61.43	51.43	17.7	33.4	GND
0.3	30.8	7.4	9.80	40.60	17.20	60.24	50.24	19.6	33.0	GND
0.37	29.9	7.8	9.80	39.70	17.60	58.50	48.50	18.8	30.9	GND
0.45	26.4	6.8	9.80	36.20	16.60	56.88	46.88	20.7	30.3	GND

Table 7.2-2: Conducted EMI Results – EA Models (Antenna Module as a separate piece)

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)		Line
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	
Line 1										
0.18	40.1	35.3	9.80	49.90	45.10	64.49	54.49	14.6	9.4	GND
0.2	37.1	10.7	9.80	46.90	20.50	63.61	53.61	16.7	33.1	GND
0.24	32.6	28.9	9.80	42.40	38.70	62.10	52.10	19.7	13.4	GND
0.31	28.4	8.7	9.80	38.20	18.50	59.97	49.97	21.8	31.5	GND
0.36	27	15.5	9.80	36.80	25.30	58.73	48.73	21.9	23.4	GND
16.25	25.4	16.8	10.00	35.40	26.80	60.00	50.00	24.6	23.2	GND
Line 2										
0.17	39.5	28.1	9.80	49.30	37.90	64.96	54.96	15.7	17.1	GND
0.19	37.5	10.6	9.80	47.30	20.40	64.04	54.04	16.7	33.6	GND
0.22	33.7	21.4	9.80	43.50	31.20	62.82	52.82	19.3	21.6	GND
0.24	32.4	20.4	9.80	42.20	30.20	62.10	52.10	19.9	21.9	GND
0.3	28.8	15.6	9.80	38.60	25.40	60.24	50.24	21.6	24.8	GND
16.25	25.8	17.2	10.00	35.80	27.20	60.00	50.00	24.2	22.8	GND

7.3 Radiated Emissions - FCC Section 15.109(Unintentional Radiation)

7.3.1 Test Methodology

Section 15.33(a)(4) specifies, if the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to frequency specified in 15.33(b)(1) for unintentional radiators. The upper frequency range for the digital device is 1000MHz which greater than the 10th harmonic of the fundamental frequency. The upper frequency range measured was 1000MHz.

The EUT was evaluated while excited by a proximity ID card and data provided in section 7.5 for spurious emissions from the intentional radiator.

7.3.2 Test Results

Included in section 7.5.

7.4 99% Occupied Bandwidth

7.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated bandwidth of the emission. The RBW was to ≥ 1% of the estimated bandwidth. The trace was set to max hold with a peak detector active. The 99% Occupied Bandwidth measurement function of the analyzer was utilized to determine the 99% bandwidth of the emission. The span and RBW were examined and re-adjusted if necessary to meet the requirements of 2 to 3 times the bandwidth for the span and ≥ 1% of the bandwidth for the RBW.

7.4.2 Test Results

The maximum 99% bandwidth was found to be approximately 1.17kHz. Results are shown below in Table 7.4.2-1 and Figure 7.4.2-1.

Table 7.4.2-1

Frequency (kHz)	99% Bandwidth (kHz)
125	1.17

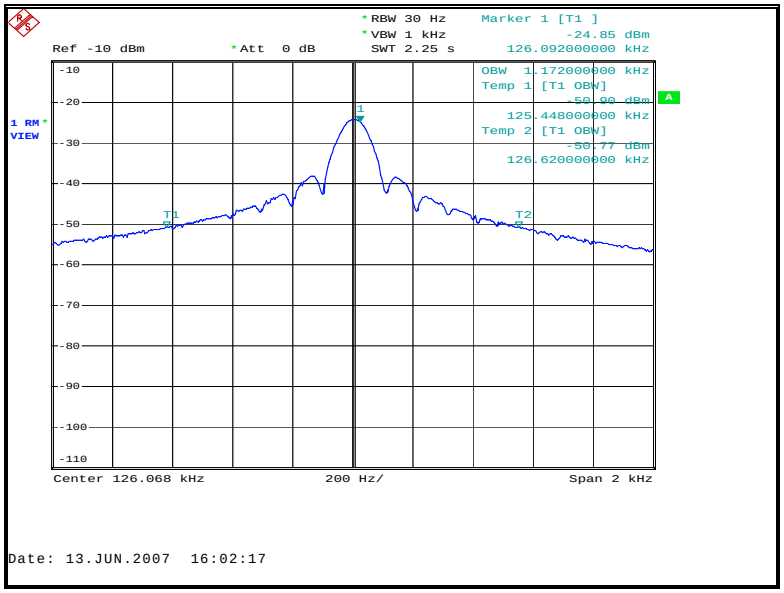

Figure 7.5.4-1: 99% Bandwidth

7.5 Spurious Emissions - FCC Section 15.209

7.5.1 Test Methodology

Measurements below 30MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated 360º and the loop antenna rotated about the vertical axis to maximize each emission. The magnetic loop receiving antenna was positioned with its center 1 meter above the ground.

The spectrum analyzer's resolution and video bandwidth was set to 100Hz and 300Hz respectively for frequencies below 150kHz and 9 kHz and 30 kHz respectively for frequencies above 150kHz and below 30MHz. For measurements in the frequency bands 9-90 kHz and 110-490 kHz, an average detector was used. When average measurements are specified, the peak emissions were also compared to a limit corresponding to 20 dB above the maximum permitted average limit according to Part 15.35. All other emissions were measured using a Quasi-peak detector. The final measurements were then corrected by a distance correction factor, antenna correction factors, and cable loss for comparison to the limits.

Measurements above 30MHz were performed in a semi-anechoic chamber with a 3 meter separation distance between the EUT and measurement antenna. The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, average measurements were made using an RBW of 1 MHz and a VBW of 10 Hz and peak measurements were made with RBW of 1 MHz and a VBW of 1 MHz.

7.5.2 Distance Correction for Measurements Below 30 MHz – Part 15.31

Radiated measurements were performed at a distance closer than the 300 and 30 meters as required according to Part 15.209. Therefore a correction factor was applied to account for propagation loss at the specified distance. The propagation loss was determined by using the square of an inverse linear distance extrapolation factor (40dB/decade) according to 15.31. A sample calculation of the distance correction factor is shown in section 7.5.4. for limits expressed at a 300m and 30m measurement distance is as follows:

Distance correction factor (300m Specified Test Distance) = 40*Log (Test Distance/300)
= 40*Log (3/300)
= - 80 dB

Distance correction factor (30m Specified Test Distance) = 40*Log (Test Distance/30)
= 40*Log (3/30)
= - 40 dB

7.5.3 Test Results

Radiated spurious emissions found are reported in Tables 7.5.3-1 through 7.5.3-2.

Table 7.5.3-1: Radiated Spurious Emissions – IA Models (Antenna Module attached to strike)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Frequency										
0.126066	64.53	64.53	NA	10.20	74.73	74.73	125.6	105.6	50.86	30.86
Spurious Emissions										
0.378198	39.80	39.80	NA	10.20	50.00	50.00	116.0	96.0	66.05	46.05
0.504264	---------	31.52	NA	10.20	---------	41.72	--------	73.6	---------	31.83
229.3	---------	54.42	H	-12.97	---------	41.45	--------	46.0	---------	4.55
211	---------	41.5	H	-13.81	---------	27.69	--------	43.5	---------	15.81
245.5	---------	44.34	V	-12.03	---------	32.32	--------	46.0	---------	13.69
263.8	---------	39.36	H	-10.65	---------	28.71	--------	46.0	---------	17.29
229.3	---------	45.74	V	-12.76	---------	32.98	--------	46.0	---------	13.02
212.1	---------	37.89	V	-13.60	---------	24.29	--------	43.5	---------	19.21
189.5	---------	33.95	V	-15.00	---------	18.95	--------	43.5	---------	24.55
156	---------	30.35	H	-14.22	---------	16.13	--------	43.5	---------	27.37
129.1	---------	38.04	H	-13.48	---------	24.56	--------	43.5	---------	18.94
65.5	---------	38.35	V	20.61	---------	17.74	--------	40.0	---------	22.26

***** The magnitude of all emissions not reported were below the noise floor of the measurement system.

Table 7.5.3-2: Radiated Spurious Emissions - EA Models (Antenna Module as a separate piece)

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Fundamental Frequency										
0.1263	61.17	61.17	NA	10.20	71.37	71.37	125.6	105.6	54.21	34.21
Spurious Emissions										
0.3789	40.70	40.70	NA	10.20	50.90	50.90	116.0	96.0	65.13	45.13
52.75	---------	53.76	V	-18.34	---------	35.42	--------	40.0	---------	4.58
323.4	---------	44.79	H	-9.70	---------	35.09	--------	46.0	---------	10.91
228.3	---------	34.31	H	-13.07	---------	21.24	--------	46.0	---------	24.76
161.4	---------	39.56	H	-14.36	---------	25.20	--------	43.5	---------	18.30
166.8	---------	35.86	V	-14.30	---------	21.56	--------	43.5	---------	21.94
86	---------	38.34	V	-17.16	---------	21.18	--------	40.0	---------	18.82
121.6	---------	40.38	H	-13.67	---------	26.71	--------	43.5	---------	16.79
328.37	---------	34.13	V	-10.03	---------	24.10	--------	46.0	---------	21.90
369.5	---------	40.96	H	-8.38	---------	32.59	--------	46.0	---------	13.42
147.95	---------	33.96	V	-13.28	---------	20.68	--------	43.5	---------	22.82

***** The magnitude of all emissions not reported were below the noise floor of the measurement system.

7.5.4 Sample Calculation:

Example Calculation – Average/Quasi-Peak Limit < 30MHz

Measurement Distance 300m @ 126kHz

Limit (dBuV/m) = 20*Log(2400/F(kHz)) - Distance Correction Factor (Section 7.5.2)
Limit (dBuV/m) = 20*Log(2400/126) + 80
Limit (dBuV/m) = 105.6

Example Calculation - 126kHz Fundamental

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain

PEAK:
Corrected Level: 64.53 + 10.20 = 74.73dBuV
Margin: 105.6dBuV+ 20dB – 74.73dBuV = 50.86dB*

AVERAGE:
Corrected Level: 64.53 + 10.20 = 74.73dBuV
Margin: 105.6dBuV – 74.73dBuV = 38.87dB

* When average measurements are specified, the peak emissions were also compared to a limit corresponding to 20 dB above the maximum permitted average limit according to Part 15.35.

8.0 CONCLUSION
In the opinion of ACS, Inc. models RF5010-IA, RF5010-EA, RF5210-IA, RF5210-EA, manufactured by Hanchett Entry Systems, Inc. meet the requirements of FCC Part 15 subpart C.

END REPORT