

TEST REPORT

Report Number: 3112645LEX-003

Project Number: 3112645

**Evaluation of the Wireless Hand Controller for Universal Procedure Table
Model Number: 9A408H**

**FCC ID: U399A408H
Industry Canada ID: 6978A-9A408H**

**FCC Part 15 Subpart B & FCC Part 15 Subpart C
ICES-003 & RSS-210 Issue 6**

For

Midmark Corporation

Test Performed by:

Intertek
731 Enterprise Drive
Lexington, KY 40510

Test Authorized by:

Midmark Corporation
PO Box 286
Versailles, OH 45380

Prepared By: Jason Centers Date: 3/16/2007

Jason Centers, Senior Project Engineer

Approved By: Bryan C. Taylor Date: 3/16/2007

Bryan C. Taylor, Team Leader

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Intertek

731 Enterprise Drive, Lexington, KY 40510

Telephone: 859-226-1000 Fax: 859-226-1040 Web: www.etlsemko.com

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1 JOB DESCRIPTION

1.1 Company Information

Company Information	
Manufacturer:	Midmark Corporation
Address:	PO Box 286 Versailles, OH 45380
Contact Name:	Bob Menke
Telephone Number:	(937) 526-8312
Email Address:	bmenke@midmark.com

1.2 Test Sample Information

The Wireless Hand Controller for Universal Procedure Table Model 9A408H is a wireless hand controller for a powered examination chair for medical use. This report pertains only to the Wireless Hand Controller for Universal Procedure Table Model 9A408H.

Test sample	
Model Number:	9A408H
Serial Number:	Not Labeled
FCC ID:	U399A408H
Device Category:	Mobile
RF Exposure Category:	General Population/Uncontrolled Environment
Transmission:	Zigbee, 0-QPSK Modulation
Frequency Range (MHz)	2405-2480
Antenna Type:	PCB Antenna (Gain = 2.1dBi)
Antenna Location:	Internal

1.3 System Support Equipment

No support equipment was necessary for evaluation.

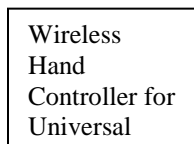
1.4 Cables Used During Testing

No cables were necessary for the evaluation.

1.5 System Block Diagram(s)

The diagrams below detail the interconnection of the EUT and its accessories during the testing.

Figure 1-1: Test Configuration



1.6 Mode(s) of operation / Engineering Judgments

The Wireless Hand Controller for Universal Procedure Table was powered by two AA batteries. Midmark Corporation provided a sample with special firmware that allowed constant transmission at the maximum duty cycle that will be used in normal operation. Tests were performed on the high, middle, and lowest channels at maximum output power.

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2 EXECUTIVE SUMMARY

Testing performed for: Midmark Corporation

Equipment Under Test: 9A408H

Receipt of Test Sample: 1/29/2007

Test Start Date: 1/29/2007

Test End Date: 3/15/2007

FCC RULE	IC RULE	DESCRIPTION OF TEST	RESULT	PAGE
§15.249, 15.209	RSS-210:2.6, RSS-210:A2.9	Field Strength of Spurious Radiation	Compliant	7
§15.109	ICES-003, RSS-Gen 6a	Radiated Receiver Emissions	Compliant	13
§15.207	ICES-003, RSS-Gen 7.2.2	Conducted Voltage Emissions	NA¹	-

2.1 Modifications required for compliance

No modifications were implemented by Intertek. All results in this report pertain to the un-modified sample provided to Intertek.

¹ The EUT was not AC powered.

3 TEST FACILITY

All testing was completed at the INTERTEK-Lexington location at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

For radiated immunity testing, removable ferrite tiles are positioned between the transmitting antenna and the area occupied by the equipment under test. The remaining tests typically are performed outside the chamber on the conducting ground reference plane.



The Industry Canada filing number for this site is 2055. The FCC registration number is 485103. The VCCI registration numbers are R-2056, C-2214, and T-195.

3.1 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration due date
Horn Antenna	EMCO	3115	6556	7/28/2007
EMI Receiver	Rohde & Schwarz	ESI 26	1088.7490	9/6/2007
Bilog Antenna	EMCO	3142C	00051864	11/14/2007
Preamplifier	Miteq	AFS44-00102000-30-10P-44	987410	6/15/2007
LISN	Fischer Custom Communication	FCC-LISN-50-50-2M	1026	5/9/2007

4 FIELD STRENGTH OF SPURIOUS RADIATION

FCC §15.209, §15.249

RSS-210:2.6, RSS-210:A2.9

4.1 Test Procedure

- Measurements are made over the frequency range of 30 MHz to ten times the highest frequency operating within the device.
- The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.
- From 30 to 1000 MHz, a quasi-peak detector was used for measurement. Above 1000 MHz, average measurements were performed.
- The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.
- The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.
- The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.
- The EUT was placed on a wooden table 80 cm above the ground reference plane. Measurements were made with the device oriented in three orthogonal axes and the highest level measured is reported.
- Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4.
- The test was performed on the low, middle, and highest transmitting frequencies at maximum output power.
- For fundamental emissions near the restricted bands of §15.205, measurements were performed to show compliance with the limits in the restricted band. If the fundamental emission is within two standard bandwidths of the restricted band, the “marker delta-method” was performed. The EUT azimuth and antenna height were varied to obtain a maximum field-strength reading. The analyzer reading was corrected for cable loss, antenna factor, and pre-amp gain. Using bandwidths and detectors required by ANSI C63.4 an in-band measurement of the fundamental emission was performed. After obtaining a corrected reading for the fundamental emission, the spectrum analyzer was setup with a span large enough to capture the fundamental emission and the band-edge under investigation. A resolution bandwidth of 1% of the span (not less than 30kHz) was used. Several sweeps were performed in peak-hold mode. The amplitude delta between the peak of the fundamental emission and the peak emission at the restricted band edge was recorded. The amplitude delta is subtracted from the maximized field strength reading to determine compliance at the band-edge.
- If the fundamental emission is more two standard bandwidths from the restricted band, a spectrum analyzer was setup to sweep through the restricted band. The analyzer reading was corrected for cable loss, antenna factor, and pre-amp gain. The EUT azimuth and antenna height were varied to obtain a maximum field-strength reading. Several sweeps were performed in max-hold mode and the result was compared to the limits of §15.209.
- The readings obtained from the measurement receiver were corrected for antenna factor, cable loss, and pre-amp gain. An example calculation is shown below.

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Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculation are listed below.

Formula:

$$FS = RA + AF + CF$$

FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (Quasi-Peak) in dB μ V

AF = Antenna Factor in dB

CF = Cable Attenuation Factor in dB

Example Calculation:

$$RA = 19.48 \text{ dB}\mu\text{V}$$

$$AF = 18.52 \text{ dB}$$

$$CF = 0.78 \text{ dB}$$

$$FS = 19.48 + 18.52 + 0.78 = 38.78 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm} [(38.78 \text{ dB}\mu\text{V/m})/20] = 86.89 \mu\text{V/m}$$

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4.2 Test Results

The Wireless Hand Controller for Universal Procedure Table met the field strength requirements of FCC §15.249 for the fundamental, harmonics and spurious emissions. Measurements were made with the device oriented in three orthogonal axes and the highest level measured is reported below. See Table 4-1 and for the measured fundamental and spurious emissions. All other spurious emissions not shown below were greater than 20dB below the limit.

Table 4-1: Field Strength of Spurious Radiation

TX Channel	Frequency	Polarity	Corr. Peak Reading. (dBuV/m)	Corr. Avg Reading. (dBuV/m)	Peak Limit (dBuV/m)	Avg. Limit (dBuV/m)	Results	Comments
Low	2.405 GHz	H	94.381	81.12	114	94	Compliant	Fundamental
Low	2.4051 GHz	V	86.081	74.36	114	94	Compliant	Fundamental
Low	4.8091 GHz	H	63.197	49.35	74	54	Compliant	
Low	7.2136 GHz	H	65.527	52.23	74	54	Compliant	
Low	4.81 GHz	V	58.571	46.05	74	54	Compliant	
Low	7.214 GHz	V	62.716	49.97	74	54	Compliant	
Middle	2.445 GHz	V	87.31	74.57	114	94	Compliant	Fundamental
Middle	2.445 GHz	H	94.04	81.22	114	94	Compliant	Fundamental
Middle	4.8891 GHz	V	60.888	45.97	74	54	Compliant	
Middle	7.3367 GHz	V	68.162	49.88	74	54	Compliant	
Middle	4.8891 GHz	H	67.12	42.55	74	54	Compliant	
Middle	7.3337 GHz	H	61.689	49.74	74	54	Compliant	
High	2.48 GHz	V	85.075	72.54	114	94	Compliant	Fundamental
High	2.48 GHz	H	93.374	80.2	114	94	Compliant	Fundamental
High	4.9591 GHz	V	56.713	44.62	74	54	Compliant	
High	7.4385 GHz	V	57.508	47.36	74	54	Compliant	
High	4.9591 GHz	H	61.65	45.97	74	54	Compliant	
High	7.4418 GHz	H	60.205	48.87	74	54	Compliant	

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Band-Edge Compliance: 2310MHz – 2390MHz Restricted Band, Low Channel

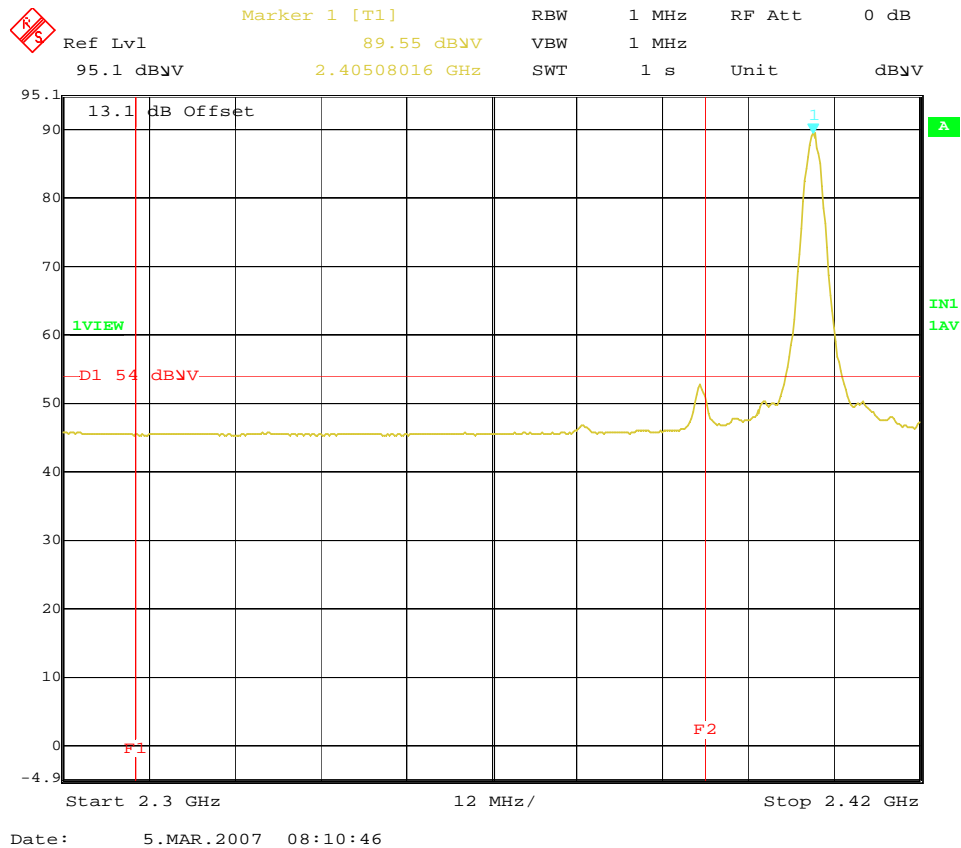


Exhibit 1

Evaluation For: Midmark Corporation
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Band-Edge Compliance (Marker-Delta Method): 2483.5MHz – 2500MHz Restricted Band, High Channel
Peak Detector

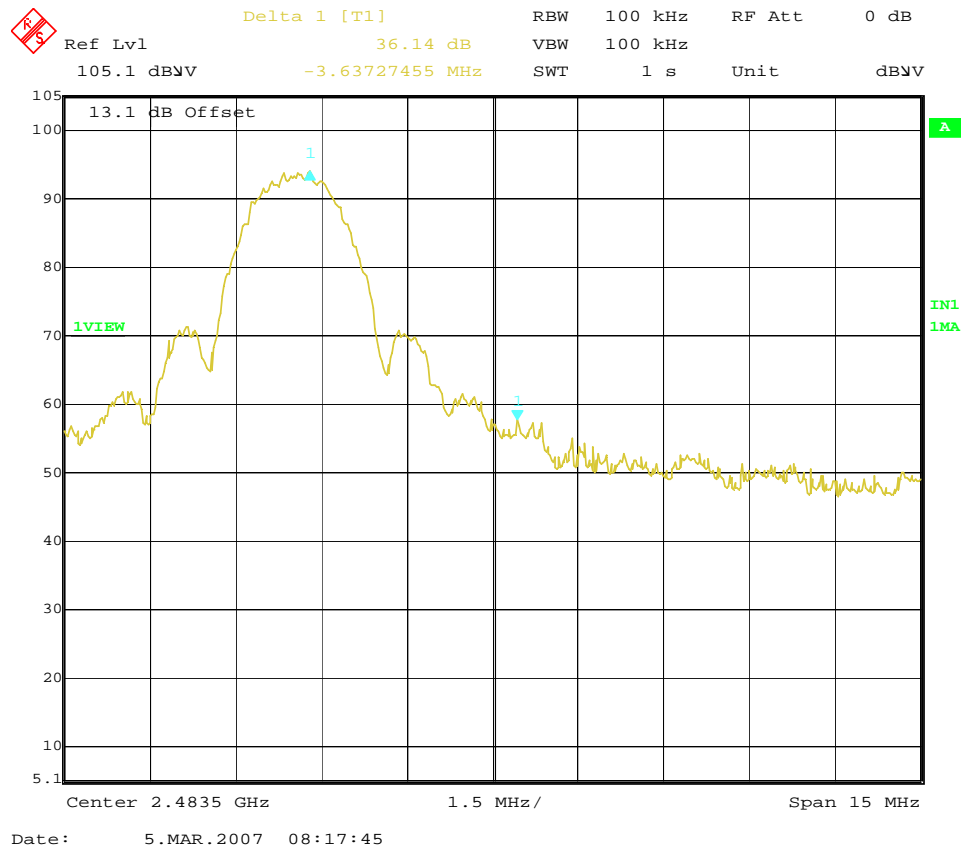


Exhibit 2

Peak Field Strength: 93.37 dBuV/m

Marker Delta Peak: 36.14 dB

Band-Edge Measurement = 93.37 dBuV/m – 36.14 dB = 57.23 dBuV/m

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Band-Edge Compliance (Marker-Delta Method): 2483.5MHz – 2500MHz Restricted Band, High Channel
Average Detector

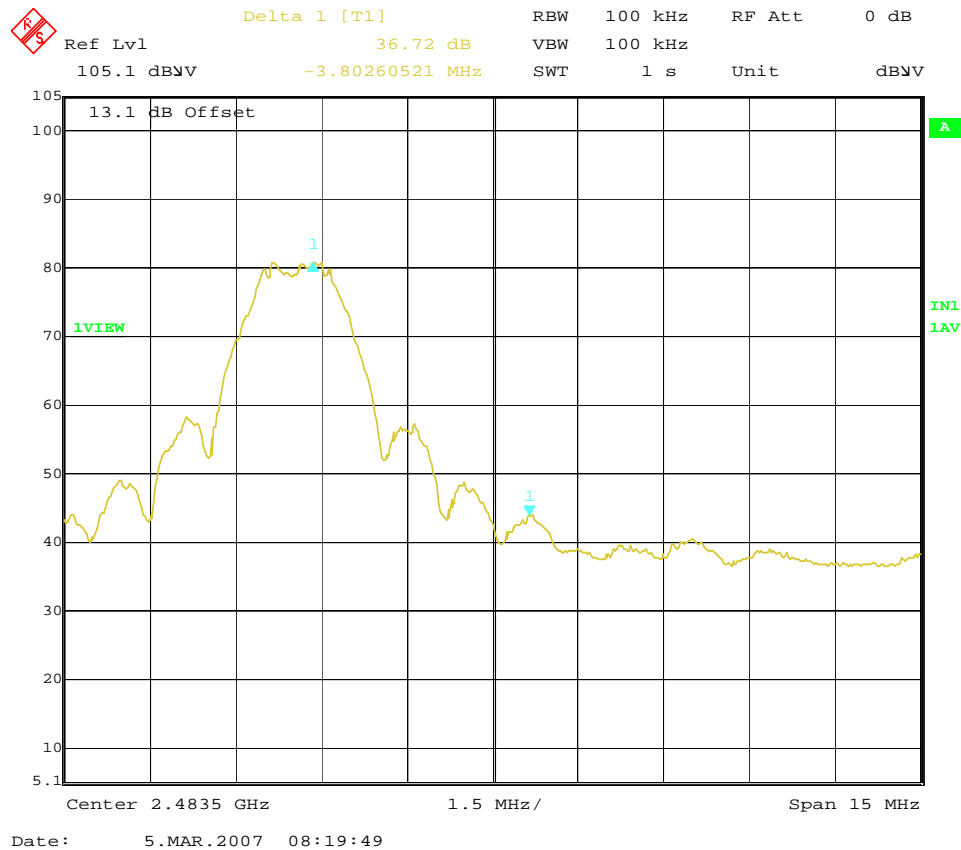


Exhibit 3

Average Field Strength: 80.2 dBuV/m

Marker Delta Average: 36.72 dB

Band-Edge Measurement = 80.2 dBuV/m - 36.72 dB = 43.48 dBuV/m

5 RADIATED RECEIVER EMISSIONS

FCC §15.109

ICES-003, RSS-Gen 6a

5.1 Test Procedure

- Measurements are made over the frequency range of 30 MHz to five times the highest frequency operating within the device.
- The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.
- From 30 to 1000 MHz, a quasi-peak detector was used for measurement. Above 1000 MHz, average measurements were performed.
- The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.
- The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.
- The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.
- The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.
- The test was performed on the device while in receive mode.
- Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4.
- The readings obtained from the measurement receiver were corrected for antenna factor, cable loss, and pre-amp gain. An example calculation is shown below.

Example of Field Strength Calculation Method:

The measured field strength was calculated by summing the readings taken from the spectrum analyzer with the appropriate correction factors associated with the antenna losses and cable losses. The calculation formula and sample calculation are listed below.

Formula:

$$FS = RA + AF + CF$$

FS = Field Strength in dBμV/m

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5.2 Test Results

The Wireless Hand Controller for Universal Procedure Table was **compliant** with the radiated emissions requirements of FCC §15.109 of Class B limits. The maximized radiated emissions data can be found in Exhibit 4. Graphical results are shown in Exhibit 5.

Maximized Quasi Peak and Average Emissions (Sorted by Delta)

Test Engineer: Jason Centers

Test Start Date: 3/10/2007 **Test End Date:** 3/10/2007

Emission Limit Tested To: Class B **Test Distance (EUT to Antenna):** 3m

All radiated emissions from the device were greater than 10dB below the limit when measured with a peak detector.

Exhibit 4

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Graphical Peak Scan

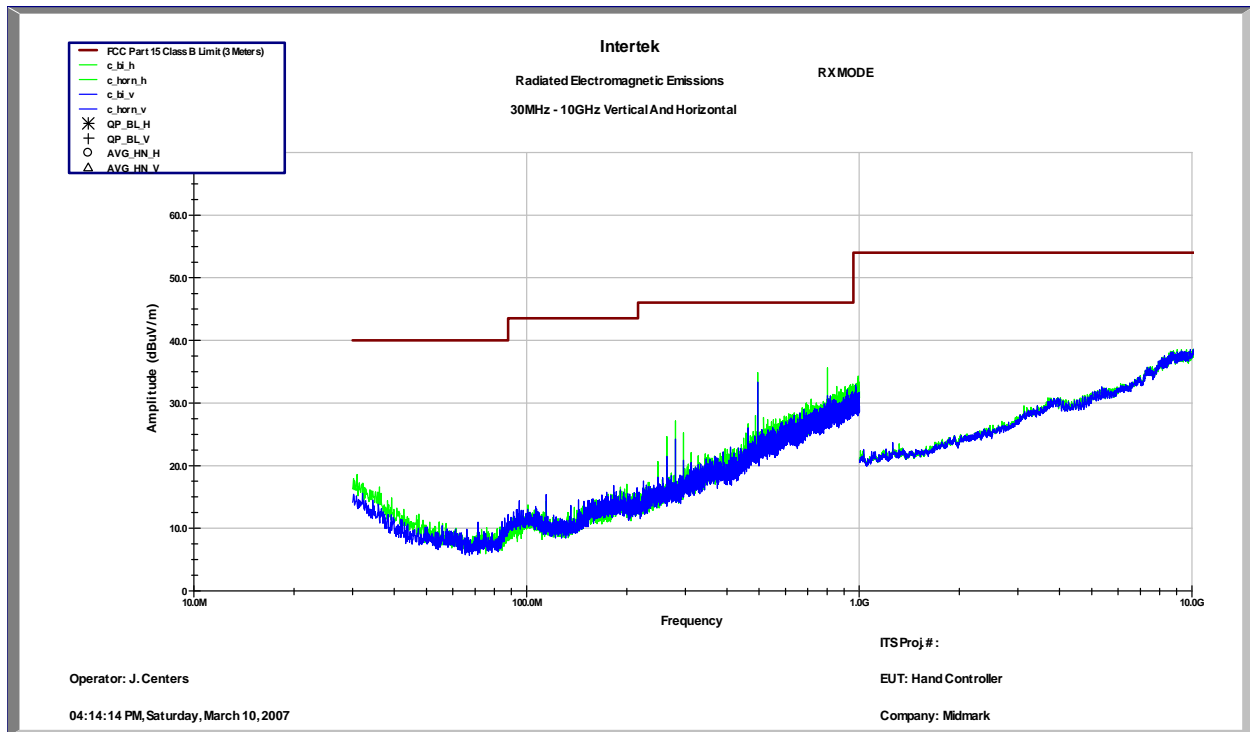


Exhibit 5