dBi Corporation

FCC Certification Test Report
Point Six MOT-HM Wireless Sensor
Report Number 07dBi012

Testing Certificate #1985.01

ADMINISTRATIVE INFORMATION

Historical record:
Because dBi Corporation is a testing entity, and not a manufacturer, this original test report of the MOT-HM `wireless sensor` is being transmitted to the manufacturer, Point Six. dBi will keep a copy for its historical records and to satisfy A2LA-audit requirements. We strongly recommend archiving the unit that we tested, to facilitate answering future inquiries regarding this product.

Retention of records:
The FCC requires the records for a Class A or Class B product to be retained by the responsible party for at least two years after the manufacture of said product has been permanently discontinued. These records should include the original certification or verification test report, quality audit data, and the test procedures used.

The European Union requires the Declaration of Conformity (DoC) and all supporting data for a product bearing the CE Marking to be retained, and available for inspection by enforcement authorities, for 10 years after placing the product on the market.

Australia and New Zealand require the Declaration of Conformity, test reports, a description of the product, documentation that clearly identifies the product, and paperwork showing the product's brand name, model number, etc. to be kept for at least five years after the product ceases to be supplied to Australia or New Zealand.

Measurement uncertainties:
The Lexmark Electromagnetic Compatibility Laboratory (EMC Lab) has a documented calculation of the measurement uncertainties associated with tests performed at the Lexmark site.

Ongoing compliance:
This report applies only to the sample tested. The manufacturer is responsibility for ensuring that the production models of this wireless sensor comply with the FCC and CE Marking requirements, and continue to comply throughout their manufacturing life. The manufacturer should check any changes to the product that could change its interference profile.

A2LA approval:
dBi Corporation has been accredited by the American Association for Laboratory Accreditation (A2LA) for Radiated Emissions and Conducted Emissions, Electromagnetic Interference, and Electrostatic Discharge testing. Copies of our Accreditation Certificate and Scope of Accreditation follow.

The Federal Communications Commission (FCC) recognized the Lexmark site as meeting the requirements of section 2.948 of the FCC Rules in a letter dated December 10, 2001. This information is on file with the FCC under Registration No. 949691.

Please note: This report may be copied as needed, as long as it is copied in its entirety.

THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

DBI CORPORATION

Lexington, KY

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005*).

Presented this 30th day of October 2006.

President
For the Accreditation Council
Certificate Number 1985.01
Valid to September 30, 2008

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

dBi CORPORATION[1]
216 Hillsboro Avenue
Lexington, KY 40511-2105
John R. Barnes Phone: 859 253 1178

ELECTRICAL (EMC)

Valid To: September 30, 2008 Certificate Number: 1985.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Test Technology	Test Method(s)
Radiated Emissions	CFR 47, FCC Method Part 15, Class A and B (using ANSIC63.4:2003) AS/NZS 3548:1995, AS/NZS CISPR 22:2004, 2002 CISPR 22:2003, 1997, 1993 EN 55022:1994, 1998 VCCI 2002, 2006
Conducted Emissions	CFR 47, FCC Method Part 15, Class A and B (using ANSI C63.4:2003) AS/NZS 3548:1995; AS/NZS CISPR 22:2004, 2002; CISPR 22:2003, 1997, 1993 EN 55022:1994, 1998 VCCI 2002, 2006
Harmonics	IEC 61000-3-2:2000, EN 61000-3-2:2000
Flicker	IEC 61000-3-3:1994, 2002; EN 61000-3-3:1995
Immunity	
Electrostatic Discharge (ESD)	IEC 61000-4-2:1995 EN 61000-4-2:1995
Radiated Immunity	IEC 61000-4-3:1995, 2002 EN 61000-4-3:1996
Electrical Fast Transient/Burst	IEC 61000-4-4:1995 EN 61000-4-4:1995

(A2LA Cert. No. 1985.01) 10/30/06

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5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • Fax: 301-662 2974

Test Technology	Test Method(s)
Surge Immunity	IEC 61000-4-5:1995 EN 61000-4-5:1995
Conducted Immunity	IEC 61000-4-6:1996 EN 61000-4-6:1996
Magnetic Field Immunity	IEC 61000-4-8:1993, 2001 EN 61000-4-8:1993
Voltage Dips/!nterruption Immunity	IEC 61000-4-11:1994, 2001 EN 61000-4-11:1994
ITE Product Family	CISPR 24:1997 EN 55024:1998
Generic Devices for Residential, Commercial, and Light Industrial Use	EN 61000-6-1:2001; EN 61000-6-3:2001; AS/NZS 4251.1-1999
Generic Devices for Industrial Use	EN 61000-6-2:1999, 2001
Electrical Equipment for Measurement, Control, and Laboratory Use	IEC 61326:1997, 2002 EN 61326:1997

On materials and products related to the following:

Information Technology Equipment - Computers, Printers, Peripheral Devices;
Generic Devices for residential, commercial, and light industrial use;
Generic Devices for industrial use;
Electrical equipment for measurement, control and laboratory use

[1] NOTE: Testing is performed using the equipment and facilities at Lexmark International EMC Laboratory (A2LA Accreditation Certificate 0872.01)

(A2LA Cert. No. 1985.01) 10/30/06

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ADMINISTRATIVE DATA

Manufacturer: Point Six, Inc.
2333 Alumni Park Plaza, Suite 305
Lexington, KY 40517

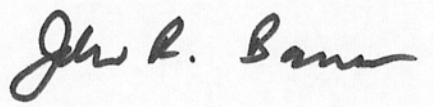
Appliance/Product: vibration/motion sensor
Model/Type Number: MOT-HM
FCC ID: VJC-ADHOC-MOT-HM
Rating: 3.6Vdc (Lithium battery)

Suppression Components: see attached sheet
Measurement Equipment used: see attached sheet.
Measurements According to, and Sample Unit Complies with: FCC 47 CFR Part 15-2006
Report Prepared By: John R. Barnes KS4GL, PE, NCE, NCT, ESDC Eng, ESDC Tech, PSE, SM IEEE

Testing Performed by:
dBi Corporation
216 Hillsboro Avenue
Lexington, KY 40511-2105, USA

Testing Performed on: July 29 & 31, 2007 **at:**
Lexmark International, Inc.
Development Lab.
Lexington, KY 40550, USA

Reviewed and Approved by: John R. Barnes KS4GL, PE, NCE, NCT, ESDC Eng, ESDC Tech, PSE, SM IEEE



SIGNED_____DATE__August 9, 2007__
John R. Barnes, PRESIDENT dBi Corp.

INFORMATION RELATING TO PRODUCT RF INTERFERENCE

Appliance/Product: vibration/motion sensor
Model/Type Number: MOT-HM
FCC ID: VJC-ADHOC-MOT-HM
Rating: 3.6Vdc (Lithium battery)

Suppression Components: none

Clock Frequencies: 8MHz and 418MHz

Cables: none.

Electronic Printed Circuit Boards:
Ad Hoc Motion Sensor P/N P2802

Size of Product: 64mm x 51mm x 25mm high

Weight of Product: 70g

Radiated Emissions 30-4,180 MHz

Radiated Emission Standards:

FCC 47 CFR Part 15-2006, using ANSI C63.4-2003; section 15.231(e) limits for 418MHz.

Appliance/Product: vibration/motion sensor
Model/Type Number: MOT-HM
FCC ID: VJC-ADHOC-MOT-HM
Rating: 3.6Vdc (Lithium battery)
Serial Number: 70767018

Host and Other Peripherals: None

Name of Test: Radiated Interference
Test Procedure: ANSI C63.4-2003
Test Location: 5m semianechoic chamber
Test Distance: 3m
Test Instrumentation: See attached sheets

Notes: Transmitting at 1 second intervals to speed up testing.

Based on our experiences testing previous FCC Part 15.231(e) products, we put a calibrated 20dB attenuator right after the bi-con antenna to prevent signal compression in the preamp/receiver chain,. for measurements from 30-1000MHz. We added its loss (20.194dB at 418MHz, 20.15dB at 836MHz) to the field strengths measured by the receiver in this band. We used a different antenna and preamp for measurements above 1GHz. The FCC Part 15.231(e) limits above 1GHz are lower than the FCC Class A limits above 1GHz, thus any linearity concerns had been addressed during equipment calibration.

Due to software limitations, we had to measure PK+, QP, and AVE for 418MHz and its harmonics in manual mode, as follows:

1. With the equipment-under-test (EUT) upright, measure 418MHz and 836MHz in QP mode with the bi-con antenna vertical and horizontal (Lexmark's EMC software records the azimuth and antenna elevation for the highest QP emissions).
2. Repeat step 1 with the EUT on its back.
3. Repeat step 1 with the EUT on its side.
4. Study the plots to determine which orientation of the EUT had the highest emissions in QP mode.
5. Return the EUT to this position. With the bi-con antenna vertical, go back to the azimuth and antenna elevation that maximized the QP emissions at a given frequency.
6. Using a 1 second sampling time, measure PK+ and QP, taking the maximum values seen on the receiver over 10-20 seconds. If we still suspected signal compression, we increased the attenuation of the receiver's front-end by 10dB. If the measurement stayed the same, we used the previous reading. If the value increased, we continued increasing the attenuation in 10dB steps until the measurement stayed the same, then reduced the attenuation 10dB for the official measurement.

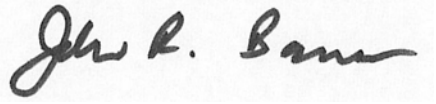
7. Using a 100 millisecond sampling time, measure AVE, taking taking the maximum value seen on the receiver over 10-20 seconds. (Since we could only catch the top 2 digits, we used 0.99dB as the fractional part to be conservative.)
8. In the calculations, add the attenuator's loss to the measured value to get the true field strength.
9. Repeat steps 5 to 8 with the bi-con antenna horizontal.
10. Put the EUT(s) on the table in the position(s) that mazimized 418MHz Radiated Emissions.
11. Measure 1254MHz, 1672MHz, …, 4180MHz in PK+ mode with the horn antenna vertical and horizontal (the software records the azimuth of the PK+ and AVE peaks, elevation was 1m).
12. With the horn antenna vertical, go to the azimuth that maximized each PK+ peak.
13. Using a 1 second sampling time, measure PK+, taking the maximum values seen on the receiver over 10-20 seconds.
14. Using a 100 millisecond sampling time, measure AVE, taking taking the maximum value seen on the receiver over 10-20 seconds. (Since we could only catch the top 2 digits, we used 0.99dB as the fractional part to be conservative.)
15. Repeat steps 12 to 14 with the horn antenna horizontal.

For measurements from 30MHz-1,000 MHz the 6dB resolution bandwidth (RBW) was 120kHz. Above 1,000MHz the 6dB RBW was 1MHz. All measurements were made in EMI Receiver mode, and according to the receiver specifications, video bandwidth (VBW) doesn't apply, the bandwidth error is under 10%, and the shape factor (B(60dB)/B(6dB)) is under 10.

Under Section 15.231(e), the average limit for the fundamental is calculated by linear interpolation from 1500uV/m at 260MHz to 5000uV/m at 470MHz when measured at 3m. Average limit = ((5000uV/m-1500uV/m)*(418MHz-260MHz)/(470MHz-260MHz))+1500uV/m = 4133uV/m = 20*log(4133) dB(uV/m) = 72.33dB(uV/m). Section 15.35(b) sets the peak limit for the fundamental to 20 dB above the average limit, or 92.33dB(uV/m) at 3m. For spurious emissions, Section 15.231(e) sets the average limit to 20dB below the maximum permitted fundamental level, or 52.33dB(uV/m) at 3m, with the peak limit 20dB higher at 72.33dB(uV/m).

The maximum transmit time for these sensors is 8ms. Averaged over a 100ms sample time, the AVE measurement should be about 20*log(8ms/100ms) = -21.938dB from PK+ measurements. The measured difference may be less if the AVE signal level is under the noise floor of the receiver, artificially increasing its value. On a previous product we were told that for pulsed emissions we should calculate AVE emissions using a duty-cycle correction factor = 20*log(worst case ON-TIME (ms) in any 100ms window / 100 ms) from the peak value, with the duty-cycle correction factor limited to the range 0dB to 20dB. In this test report we show both the *measured* AVE values and the *calculated* AVE values for this sensor.

Test Results: Tables 1 through 4, and the Transmitted Bandwidth Data, show that this unit meets the radiated interference requirements of FCC Part 15 Section 15.231(e).



SIGNED_____DATE August 9, 2007

John R. Barnes, PRESIDENT dBi Corp.

Radiated Emissions Data 30-4,180MHz

TABLE 1 PEAK EMISSIONS

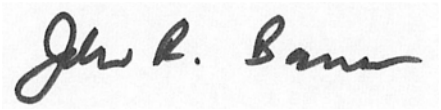
Receiver Meas. Freq. MHz	Receiver Reading Vert. dB(uV)*	Horiz. (dB(uV)*	Cable Correction Factor dB	Antenna Factor dB(/m)	Radiated Interference Field Strength Vert. dB(uV/m)	Horiz. dB(uV/m)	15.231(e) Peak Limit dB(uV/m)
418.07	72.133	90.963	-25.210	16.721	63.644	82.474	92.33
836.15	51.358	52.078	-23.631	23.243	50.970	51.690	72.33
1254.22	61.564	58.064	-29.787	23.563	55.340	51.840	72.33
1672.30	65.659	46.489	-28.236	24.817	62.240	43.070	72.33
2090.37	49.152	54.952	-27.522	26.180	47.810	53.610	72.33
2508.44	39.800	32.700	-27.197	29.937	42.540	35.440	72.33
2926.52	30.394	34.474	-26.447	29.623	33.570	37.650	72.33
3344.59	29.626	28.456	-25.881	30.345	34.090	32.920	72.33
3762.66	40.542	33.462	-25.025	30.763	46.280	39.200	72.33
4180.74	30.335	26.885	-24.719	31.524	37.140	33.690	72.33

Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) equals Radiated Interference Field Strength dB(uV/m).

TABLE 2 QUASIPEAK EMISSIONS

Receiver Meas. Freq. MHz	Receiver Reading Vert. dB(uV)*	Horiz. (dB(uV)*	Cable Correction Factor dB	Antenna Factor dB(/m)	Radiated Interference Field Strength Vert. dB(uV/m)	Horiz. dB(uV/m)	15.231(e) Quasipeak Limit dB(uV/m)
418.07	67.549	89.073	-25.210	16.721	59.060	80.584	
836.15	45.518	45.588	-23.631	23.243	45.130	45.200	

Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) equals Radiated Interference Field Strength dB(uV/m).



Signed_____**Date** August 9, 2007

John R. Barnes, PRESIDENT dBi Corporation

Radiated Emissions Data 30-4,180MHz (BA/WT-D-BB, cont.)

TABLE 3 MEASURED AVERAGE EMISSIONS

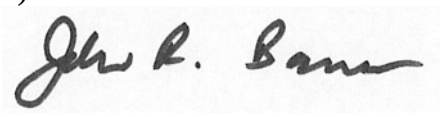
Receiver Meas. Freq.	Receiver Reading Vert.	Horiz.	Cable Correction Factor	Antenna Factor	Radiated Interference Field Strength Vert.	Horiz.	15.231(e) Average Limit
MHz	dB(uV)*	(dB(uV)*	dB	dB(/m)	dB(uV/m)	dB(uV/m)	dB(uV/m)
418.07	51.673	73.673	-25.210	16.721	43.184	65.184	72.33
836.15	39.528	39.528	-23.631	23.243	39.140	39.140	52.33
1254.22	43.215	41.215	-29.787	23.562	36.990	34.990	52.33
1672.30	38.409	26.409	-28.236	24.817	34.990	22.990	52.33
2090.37	32.333	37.333	-27.522	26.179	30.990	35.990	52.33
2508.44	25.252	20.252	-27.197	27.935	25.990	20.990	52.33
2926.52	16.705	19.705	-26.406	29.691	19.990	22.990	52.33
3344.59	15.527	14.527	-25.881	30.344	19.990	18.990	52.33
3762.66	23.253	17.253	-25.025	30.762	28.990	22.990	52.33
4180.74	15.185	13.185	-24.719	31.524	21.990	19.990	52.33

Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) equals Radiated Interference Field Strength dB(uV/m).

TABLE 4 CALCULATED AVERAGE EMISSIONS

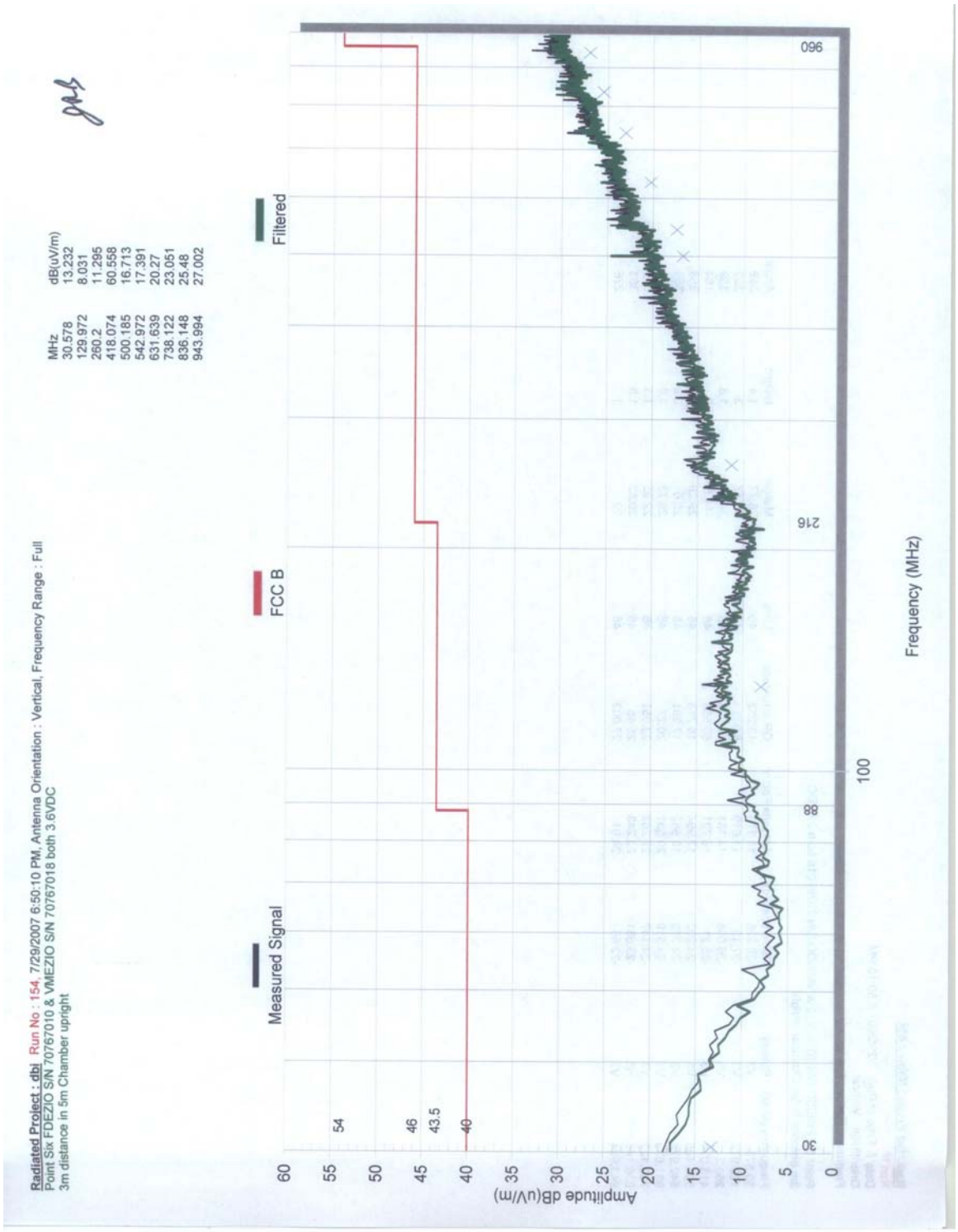
Receiver Meas. Freq.	Receiver Reading Vert.	Horiz.	Cable Corr. Factor	Antenna Factor	Duty-cyc. Corr. Factor	Radiated Interf. Field Strength Vert.	Horiz.	15.231e Average Limit
MHz	dB(uV)*	(dB(uV)*	dB	dB(/m)	dB**	dB(uV/m)	dB(uV/m)	dB(uV/m)
418.07	72.133	90.963	-25.210	16.721	-20.000	43.644	62.474	72.33
836.15	51.358	52.078	-23.631	23.243	-20.000	30.970	31.690	52.33
1254.22	61.564	58.064	-29.787	23.563	-20.000	35.340	31.840	52.33
1672.30	65.659	46.489	-28.236	24.817	-20.000	42.240	23.070	52.33
2090.37	49.152	54.952	-27.522	26.180	-20.000	27.810	33.610	52.33
2508.44	39.800	32.700	-27.197	29.937	-20.000	22.540	15.440	52.33
2926.52	30.394	34.474	-26.447	29.623	-20.000	13.570	17.650	52.33
3344.59	29.626	28.456	-25.881	30.345	-20.000	14.090	12.920	52.33
3762.66	40.542	33.462	-25.025	30.763	-20.000	26.280	19.200	52.33
4180.74	30.335	26.885	-24.719	31.524	-20.000	17.140	13.690	52.33

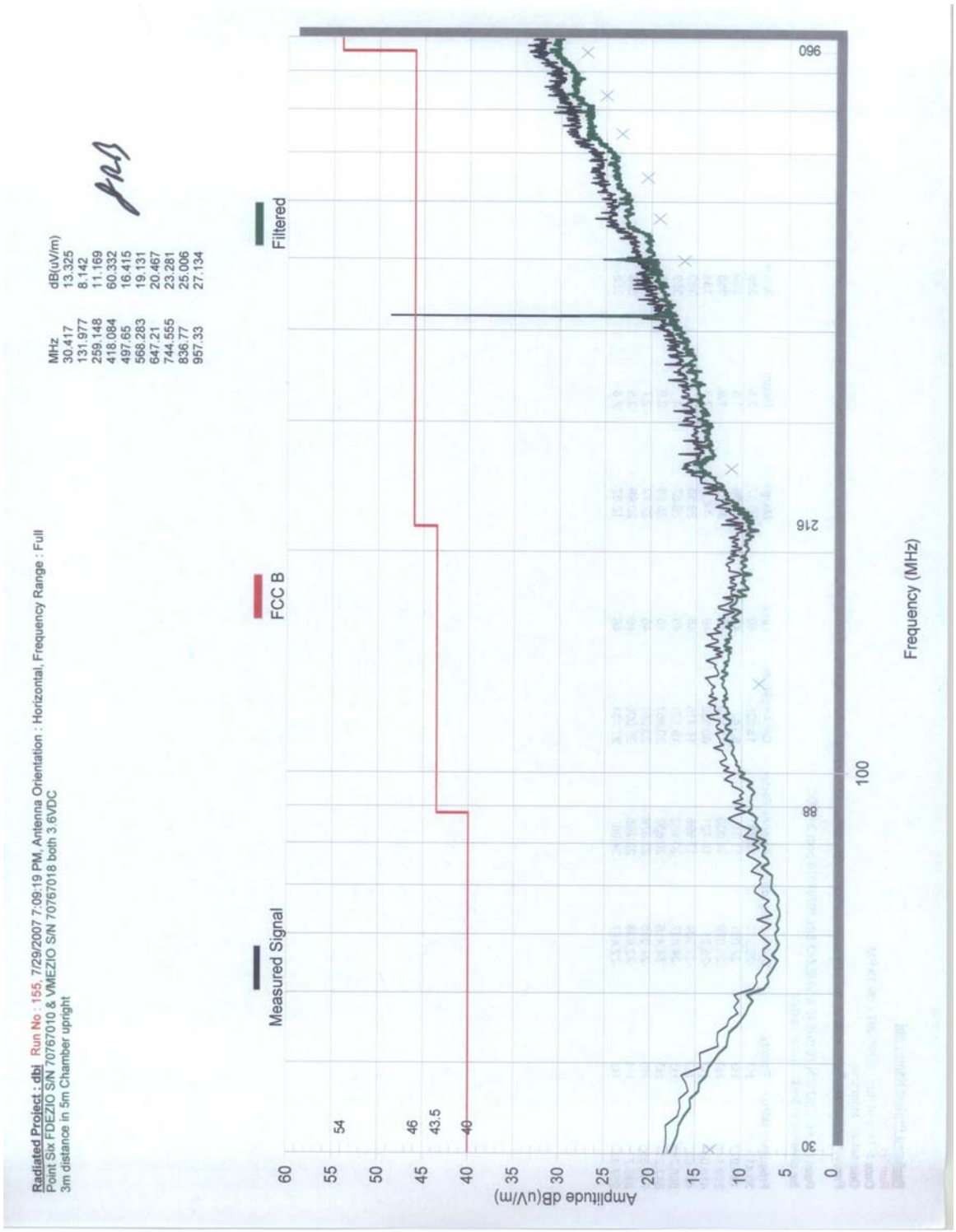
Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) plus duty-cycle correction factor equals Radiated Interference Field Strength dB(uV/m).

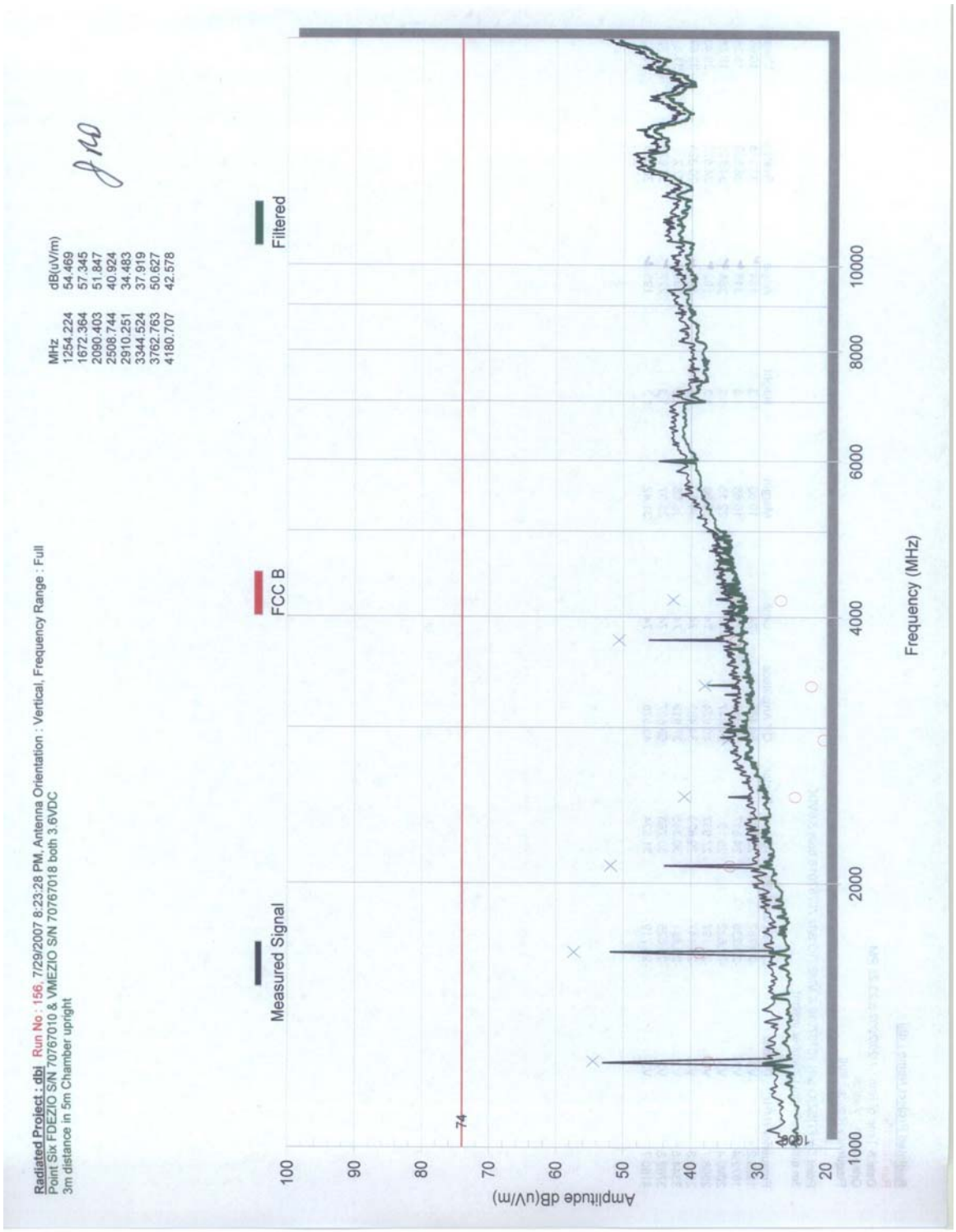


Signed_____**Date** August 9, 2007

John R. Barnes, PRESIDENT dBi Corporation


Radiated Project : dbi Run No : 154, 7/29/2007 6:50:10 PM, Antenna Orientation : Vertical, Frequency Range : Full
Point Six FDEZIO S/N 70767010 & VMEZIO S/N 70767018 both 3.6VDC
3m distance in 5m Chamber upright
MHz dB(uV/m)
30.578 13.232
129.972 8.031
260.2 11.295
418.074 60.558
500.185 16.713
542.972 17.391
631.639 20.27
738.122 23.051
836.148 25.48
943.994 27.002
Measured Signal
FCC B
Filtered
Amplitude dB(uV/m)
Frequency (MHz)
54
46
43.5
40
30
88
216
960
100


Radiated Project : dbi Run No : 155, 7/29/2007 7:09:19 PM, Antenna Orientation : Horizontal, Frequency Range : Full
Point Six FDEZIO S/N 70767010 & VMEZIO S/N 70767018 both 3 6VDC
3m distance in 5m Chamber upright
MHz dB(uV/m)
30.417 13.325
131.977 8.142
259.148 11.169
418.084 60.332
497.65 16.415
568.283 19.131
647.21 20.467
744.555 23.281
836.77 25.006
957.33 27.134
Measured Signal
FCC B
Filtered
Amplitude dB(uV/m)
Frequency (MHz)
60
55
50
45
40
35
30
25
20
15
10
5
0
54
46
43.5
40
30
88
100
216
960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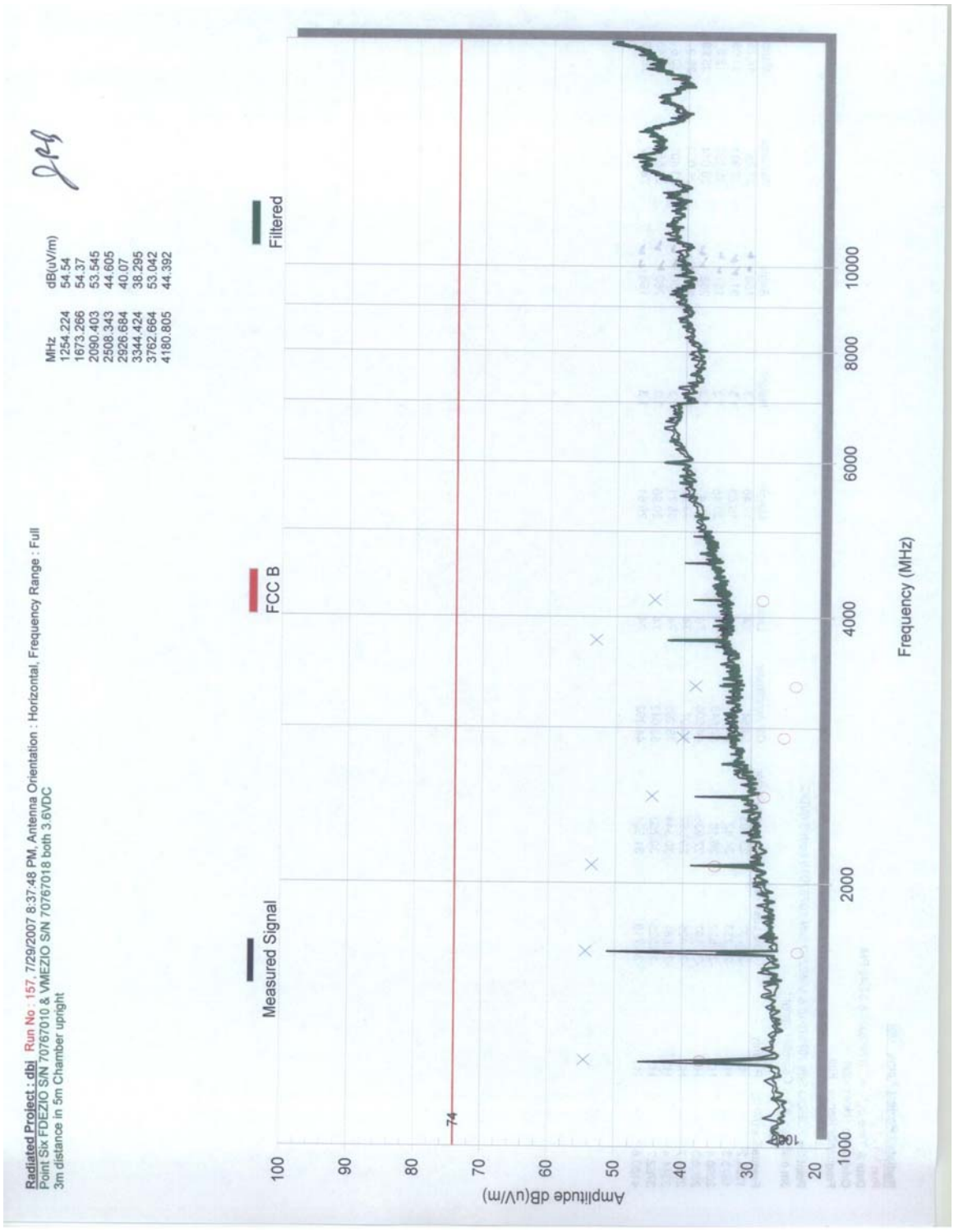
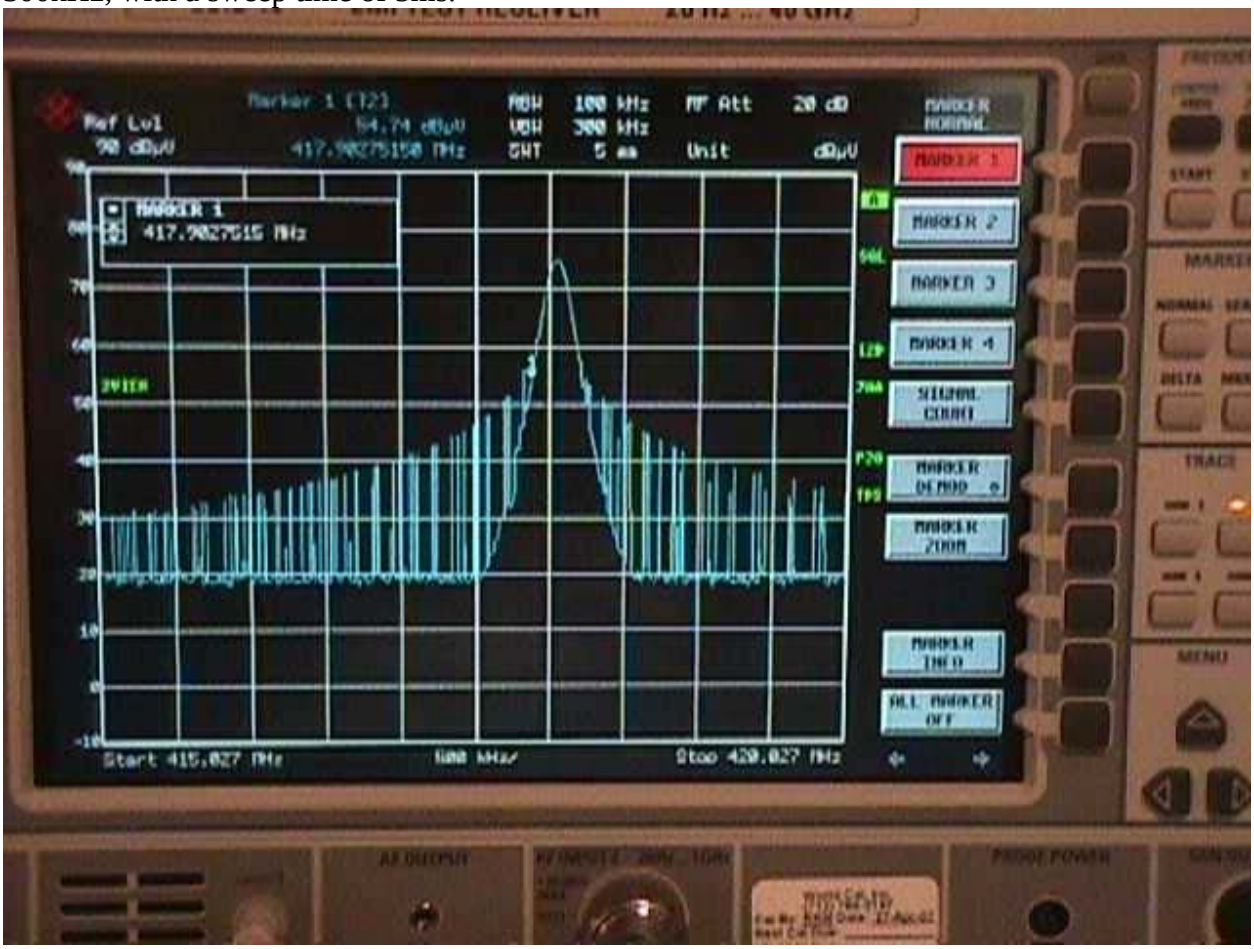
Point Six FDEZIO S/N 70767010 & VMEZIO S/N 70767018 both 3.6VDC
3m distance in 5m Chamber upright
MHz dB(uV/m)
1254.224 54.469
1672.364 57.345
2090.403 51.847
2508.744 40.924
2910.251 34.483
3344.524 37.919
3762.763 50.627
4180.707 42.578
Measured Signal
FCC B
Filtered
Amplitude dB(uV/m)
Frequency (MHz)
74
100
90
80
70
60
50
40
30
20
1000
2000
4000
6000
8000
10000


Radiated Project : dbi Run No : 157, 7/29/2007 8:37:48 PM, Antenna Orientation : Horizontal, Frequency Range : Full
Point Six FDEZIO S/N 70767010 & VMEZIO S/N 70767018 both 3.6VDC
3m distance in 5m Chamber upright
MHz dB(uV/m)
1254.224 54.54
1673.266 54.37
2090.403 53.545
2508.343 44.605
2926.684 40.07
3344.424 38.295
3762.664 53.042
4180.805 44.392
Measured Signal
FCC B
Filtered
Amplitude dB(uV/m)
Frequency (MHz)
74
100
90
80
70
60
50
40
30
20
1000
2000
4000
6000
8000
10000

Transmitted Bandwidth Data

Appliance/Product: vibration/motion sensor
Model/Type Number: MOT-HM
FCC ID: VJC-ADHOC-MOT-HM
Rating: 3.6Vdc (Lithium battery)
Serial Number: 70767018

Test Results: The 20dB transmitted bandwidth of the MOT-HM is 340kHz (417.903MHz to 418.243MHz), well within the 1045kHz (0.25% of 418MHz) maximum bandwidth permitted by FCC Part 15 Section 15.231(c). In the photo, each horizontal division is 500kHz, and each vertical division is 10dB. The RBW bandwidth was 100kHz, and the VBW bandwidth was 300kHz, with a sweep time of 5ms.



PROCEDURE: Test Performed Per ANSI 63.4 – 2003.

Signed_____**Date** __August 9, 2007__

John R. Barnes, PRESIDENT dBi Corporation

Conducted Emissions 150 kHz-30 MHz

Conducted Emission Standards:
FCC 47 CFR Part 15-2005, using ANSI C63.4-2003

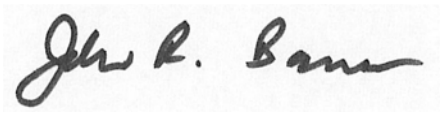
Appliance/Product: vibration/motion sensor
Model/Type Number: MOT-HM
FCC ID: VJC-ADHOC-MOT-HM
Rating: 3.6Vdc (Lithium battery)
Serial Number: 70767018

Host and Other Peripherals: None

Name of Test: Powerline Conducted Interference
Test Procedure: ANSI C63.4-2003
Test Location: All welded 18 ft x 18 ft shielded enclosure, Lexmark test facility, located in Lexington, Kentucky
Test Instrumentation: See attached sheets

Note: none

Test Results: This unit gets power from an internal battery, and has no connection to AC power lines. Therefore it meets the Class B conducted interference requirements of FCC Part 15 without testing.



SIGNED_____DATE August 9, 2007

John R. Barnes, PRESIDENT dBi Corp.

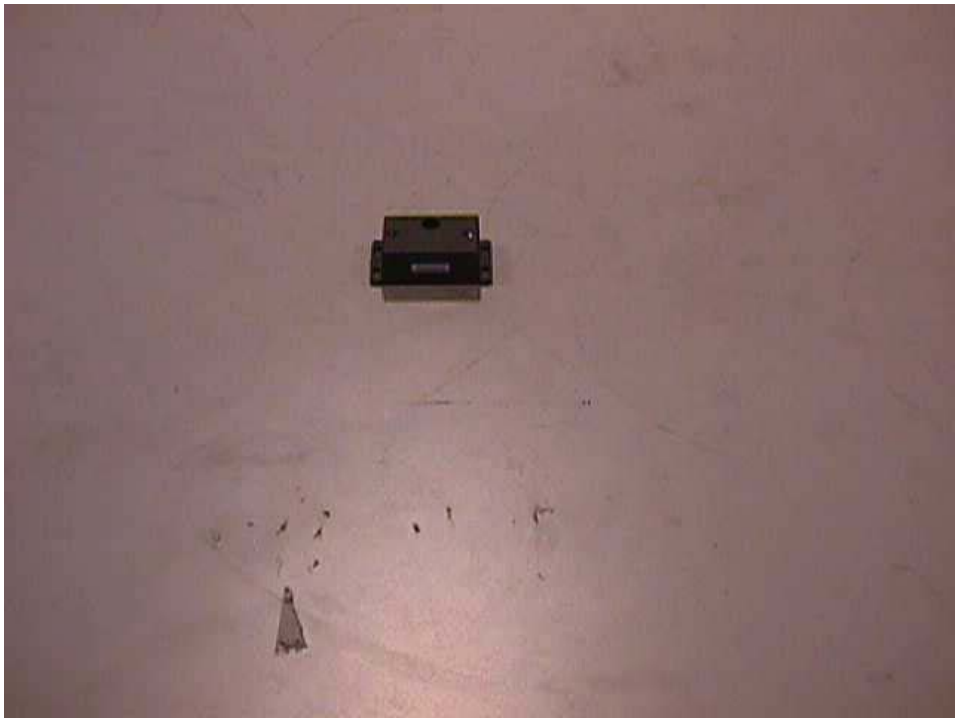
TESTING AND MEASURING EQUIPMENT USED AT LEXMARK

Radiated Interference and Bandwidth Measurements 30-4,180MHz:

Rohde & Schwarz	ESIB40, S/N 100148
EMI Test Receiver #0700	(Cal date: 4/27/07, Cal due date: 4/27/09)
Schaffner-Chase	CBL6111C, S/N 2460
BI-Log Antenna 30 to 1000 MHz #0507	(Cal date: 10/2/06, Cal due date: 10/2/08)
ARA	DRG-118/A, S/N 1091
Horn Antenna, 1GHz to 18GHz #0389	(Cal date: 12/1997, Cal due date: not needed)

Calibration: The measuring equipment used at Lexmark is calibrated according to the instruction manual once a day. Once a week the accuracy of the test system is checked. This includes the test equipment, associated cables, and antennas. This is accomplished with a calibrated radiating source for the radiated measurements, and a synthesized signal generator for the conducted measurements.

FCC RADIATED-EMISSIONS TEST CONFIGURATION
MOT-HM
5m SEMIANECHOIC CHAMBER
LEXMARK INTERNATIONAL, LEXINGTON KY.



FCC OCCUPIED BANDWIDTH TEST CONFIGURATION
MOT-HM
5m SEMIANECHOIC CHAMBER
LEXMARK INTERNATIONAL, LEXINGTON KY.