Excellence in Compliance Testing

Certification Test Report

Test Report

FCC ID: JIAAWR1
IC: 6041A-AWR1

FCC Rule Part: 15.209
IC Radio Standards Specification: RSS-210

ACS Report Number 08-0085 - 15C

Manufacturer: **Mini Mitter Company, Inc.**
Model(s): **ActiReader**

Test Begin Date: March 5, 2008
Test End Date: March 14, 2008

Report Issue Date: March 17, 2008

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.

Prepared by: _____
J. Kirby Munroe
Manager Wireless Certifications
ACS, Inc.

Reviewed by: _____
R. Sam Wismer
Engineering Manager
ACS, Inc.

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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 and Industry Canada's Radio Standards Specification RSS-210.

1.2 Product Description

1.2.1 General

The ActiReader directs communication between your PC and any of the Actiwatch models. It is connected to the PC via an RS-232 serial cable, and communicates with Actiwatches using a short range telemetric link.

Manufacturer Information:
Mini Mitter Company, Inc.
A Respironics, Inc. Company
20300 Empire Avenue, Bldg B3
Bend, OR 97701 USA

Test Sample Condition:
The test sample was provided in good working condition with no visible defects.

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

1.2.2 Intended Use

ActiWatch and ActiReader provide a means for clinicians and researchers to measure and sleep quality in individuals suffering from sleep disorders, such as insomnia, PLM, sleep apnea and others. ActiWatch and ActiReader can also be used in many other applications.

1.3 Test Methodology and Considerations

The ActiWatch was included in the test configuration to offer full functionality to the system and simulate a data transfer.

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: 894540
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:

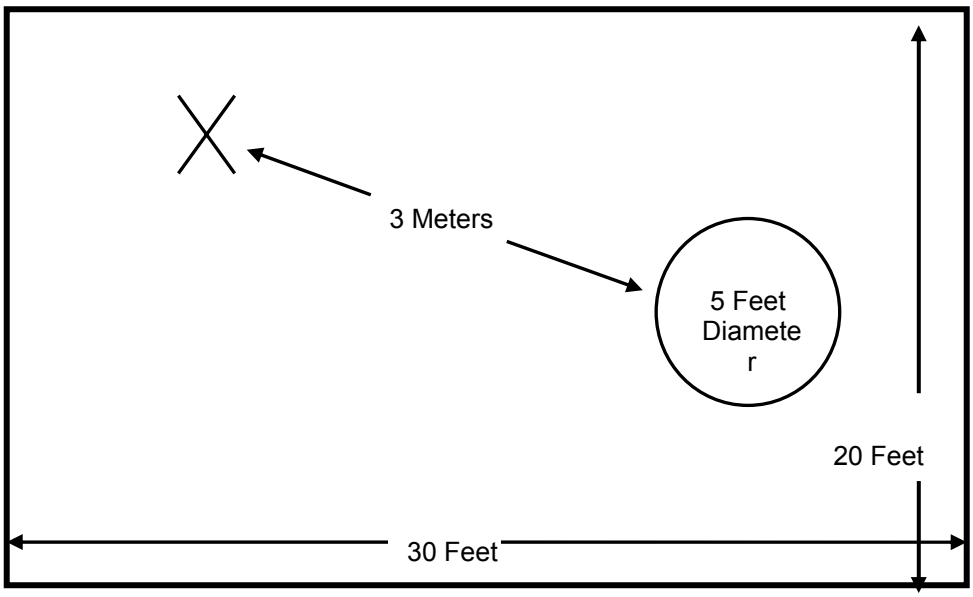

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

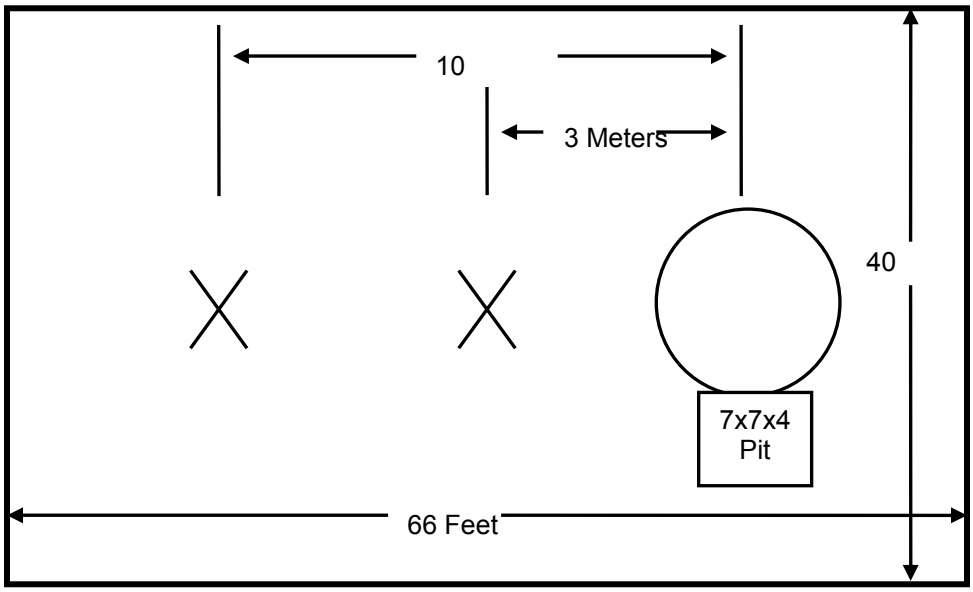

Figure 2.3-2: Open Area Test Site

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:

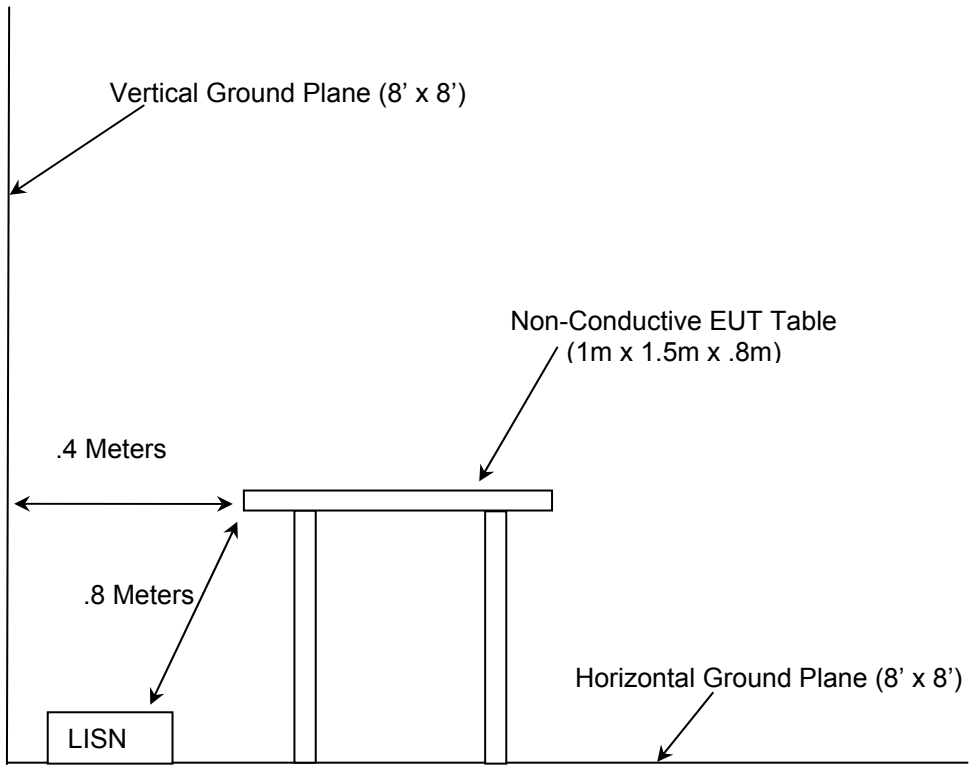

Figure 2.4-1: AC Mains Conducted EMI Site

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
- Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 7 June 2007

4.0 LIST OF TEST EQUIPMENT

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

Table 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
1	Rohde & Schwarz	Spectrum Analyzers	ESMI - Display	833771/007	10-26-2008
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	10-26-2008
16	ACS	Cables	Cable	16	05-21-2008
25	Chase	Antennas	CBL6111	1043	06-06-2008
70	Rohde & Schwarz	Spectrum Analyzers	ESH-3	879676/050	10-24-2008
78	EMCO	Antennas	6502	9104-2608	01-15-2009
144	Omega	Climate Monitoring Equipment	RH4111	H0103373	11-29-2008
152	EMCO	LISN	3825/2	9111-1905	No Cal Req.
153	EMCO	LISN	3825/2	9411-2268	11-27-2008
167	ACS	Cables	Chamber EMI Cable Set	167	01-04-2009
168	Hewlett Packard	Attenuators	11947A	44829	02-18-2009
193	ACS	Cable Set	OATS cable Set	193	01-04-2009
211	Eagle	Filters	C7RFM3NFNM	HLC-700	01-04-2009
283	Rohde & Schwarz	Spectrum Analyzers	FSP40	1000033	11-09-2008
321	Hewlett Packard	Amplifiers	HPC 8447D	1937A02809	07-17-2008

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	ActiWatch	Mini Mitter	Actiwatch	na
2	Reader (EUT)	Mini Mitter	Actireader	na
3	Laptop computer	Dell	Latitude D610	na
4	Power adapter	Dell	na	na
5	Power adapter for ActiReader	na	PSA30U-090	P73400775A1

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

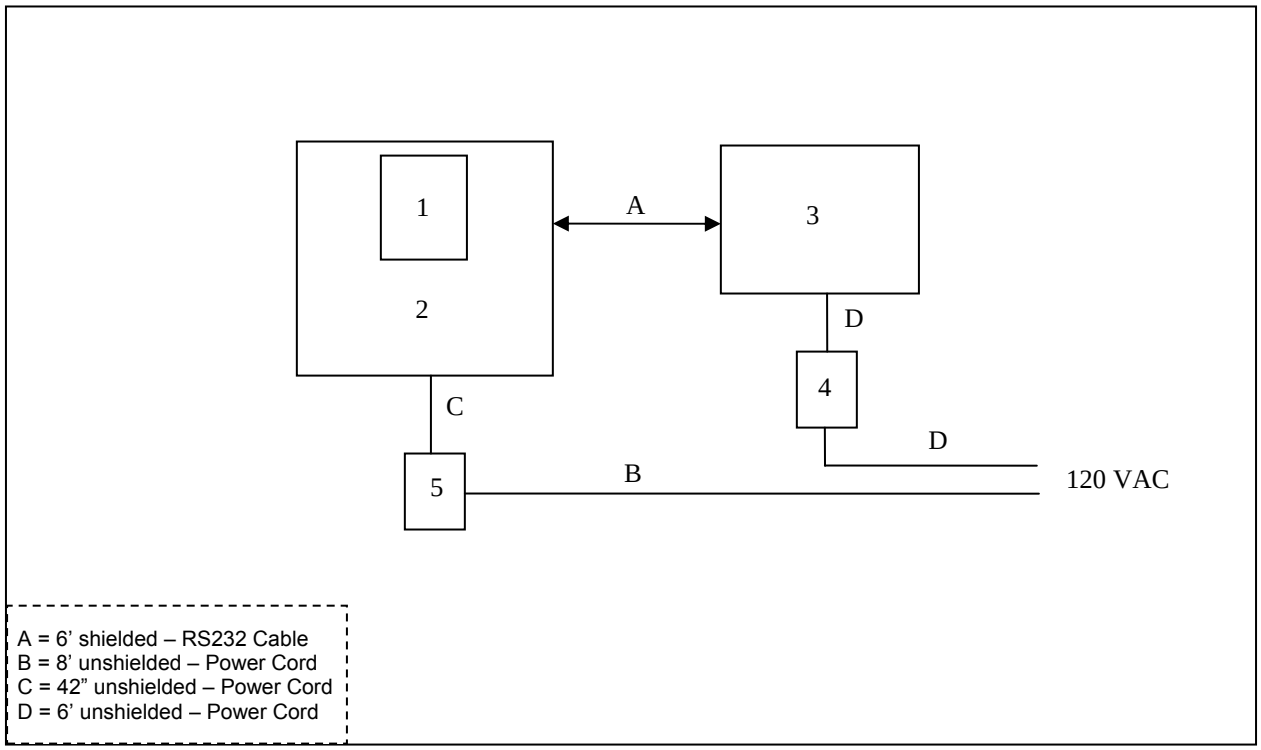

Figure 6-1: EUT Test Setup

*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

The ActiReader utilizes an integral antenna which can not be modified.

7.2 Power Line Conducted Emissions

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 Table 7.2-1.

Table 7.2-1: Conducted EMI Results

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										
0.53	30.7	28.1	9.80	40.50	37.90	56.00	46.00	15.5	8.1	GND
0.58	37.2	35.3	9.80	47.00	45.10	56.00	46.00	9.0	0.9	GND
0.62	31	29.3	9.80	40.80	39.10	56.00	46.00	15.2	6.9	GND
1.2	25.6	23.5	9.80	35.40	33.30	56.00	46.00	20.6	12.7	GND
2.36	27	24.4	9.80	36.80	34.20	56.00	46.00	19.2	11.8	GND
17.25	21.5	16.1	10.10	31.60	26.20	60.00	50.00	28.4	23.8	GND
Line 2										
0.53	30.8	28.2	9.80	40.60	38.00	56.00	46.00	15.4	8.0	GND
0.58	37.3	35.3	9.80	47.10	45.10	56.00	46.00	8.9	0.9	GND
0.62	31.3	29.7	9.80	41.10	39.50	56.00	46.00	14.9	6.5	GND
1.2	25.6	23.2	9.80	35.40	33.00	56.00	46.00	20.6	13.0	GND
2.36	26.7	24.1	9.80	36.50	33.90	56.00	46.00	19.5	12.1	GND
17.24	23.7	12.4	10.10	33.80	22.50	60.00	50.00	26.2	27.5	GND

7.3 Radiated Emissions - 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 10^{th} harmonic of the fundamental frequency. The upper frequency range measured was 1000MHz.

The device was placed in a continuous data transfer mode which exercised both unintentional and intentional radiators. Data for the unintentional radiated emissions is provided in section 7.5.

7.4 20dB and 99% Bandwidth

7.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated 20 dB bandwidth of the emission. The RBW was to ≥ 1% of the estimated 20 dB bandwidth. The trace was set to max hold with a peak detector active. The Delta function of the analyzer was utilized to determine the 20 dB bandwidth of the emission and bandwidth measurement function of the analyzer used for the 99% bandwidth. The span and RBW were examined and re-adjusted if necessary to meet the requirements of 2 to 3 times the 20 bandwidth for the span and ≥ 1% of the 20 dB bandwidth for the RBW.

7.4.2 Test Results

The maximum 20dB and 99% bandwidth was found to be approximately 880Hz. Results are shown below in Table 7.4-1 and Figures 7.4-1 through 7.4-2.

Table 7.4-1

Frequency (kHz)	20dB Bandwidth (Hz)	99% Bandwidth (Hz)
0.112	840	880

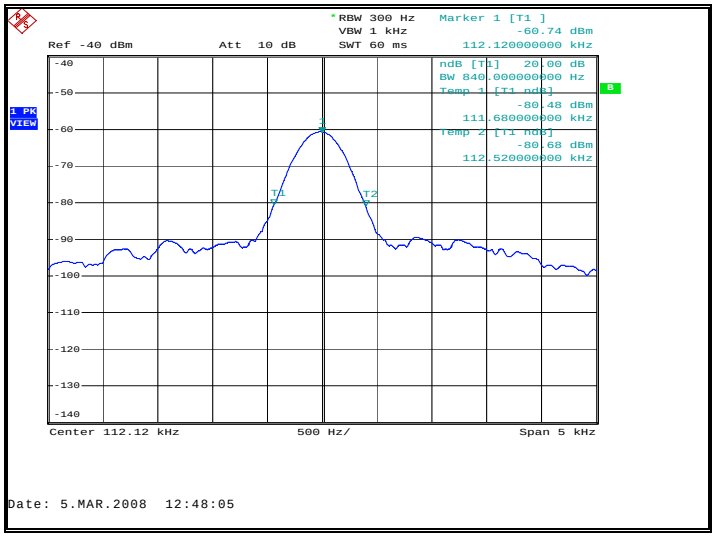

Figure 7.4-1: 20dB Bandwidth

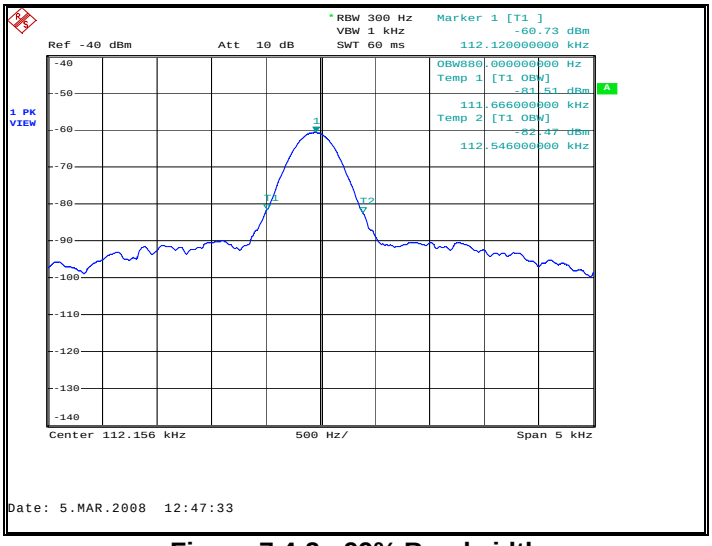

Figure 7.4-2: 99% Bandwidth

7.5 Radiated Spurious Emissions – Intentional Radiation – Part 15.209

7.5.1 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 10^{th} harmonic of the fundamental frequency. The upper frequency range measured was 1000MHz.

The device was placed in a continuous data transfer mode which exercised both unintentional and intentional radiators.

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.

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 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 Table 7.5-1.

Table 7.5-1: Radiated Spurious Emissions

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										
0.112	42.86	41.66	NA	10.86	53.72	52.52	126.6	106.6	72.90	54.10
Spurious Emissions										
41.85	---------	52.77	V	-14.89	---------	37.88	--------	40.0	---------	2.12
51.55	---------	55.95	V	-19.30	---------	36.65	--------	40.0	---------	3.35
62.33	---------	51.35	V	-20.99	---------	30.36	--------	40.0	---------	9.64
124.84	---------	50.32	H	-14.30	---------	36.02	--------	43.5	---------	7.48
200.28	---------	44.72	H	-15.40	---------	29.32	--------	43.5	---------	14.18
400.75	---------	44.04	H	-8.45	---------	35.59	--------	46.0	---------	10.41
798.45	---------	42.39	H	-1.40	---------	40.99	--------	46.0	---------	5.01
915.93	---------	37.82	H	0.32	---------	38.14	--------	46.0	---------	7.86

7.5.4 Sample Calculation:

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

Measurement Distance 300m @ 112kHz

Limit (dBuV/m) = 20*Log(2400/F(kHz)) - Distance Correction Factor (Section 7.5.2)
Limit (dBuV/m) = 20*Log(2400/112) + 80
Limit (dBuV/m) = 106.6

Example Calculation - 112kHz 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: 42.86 + 10.86 = 53.72dBuV
Margin: 106.6dBuV+ 20dB – 53.72dBuV = 72.90dB*

AVERAGE:
Corrected Level: 41.66 + 10.86 = 52.52dBuV
Margin: 106.6dBuV – 52.52dBuV = 54.10dB

* 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. the ActiReader, manufactured by Mini Mitter Company, Inc.meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

END REPORT