Electromagnetic Compatibility Test Report

Tests Performed on a Mier Products, Inc.

Transmitter, Model DA-610

Radiometrics Document RP-5403B

ACCREDITED
Certification # 1495.01

Product Detail:
FCC ID: SGXMPIDA-610
Equipment type: 433.9 MHz Momentarily Operated Transmitter

Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C
FCC Part 15 CFR Title 47: 2004
Industry Canada RSS-210, Issue 5 as required for Category I Equipment

This report concerns: Original Grant for Certification
FCC Part 15.231
RSS-210 section 6.1

Tests Performed For:	*Test Facility:*
Mier Products, Inc. 1500 Ann St. Kokomo, IN 46901	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772 e-mail: info@radiomet.com

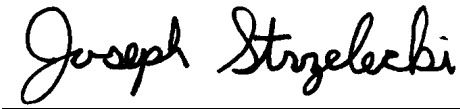
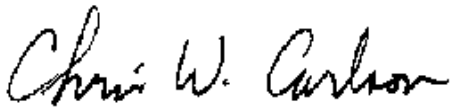
Test Date(s): (Month-Day-Year)
December 9 to 17 and January 21, 2004

Document RP-5403B Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	January 4, 2005			
1	January 23, 2005	All	Joseph Strzelecki	Joseph Strzelecki

Table of Contents

1 ADMINISTRATIVE DATA

Equipment Under Test: A Mier Products, Inc., Transmitter Model: DA-610 Serial Number: none This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) October 20, 2004	*Test Date(s): (Month-Day-Year)* December 9 to 17, 2004
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* The tests were not witnessed by Mier Products, Inc.
Radiometrics' Personnel Responsible for Test:  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*Test Report Approved By*  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Transmitter, Model DA-610, manufactured by Mier Products, Inc.. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30-4400 MHz	RSS-210 & FCC Part 15	Pass
Occupied Bandwidth Test	Fundamental Freq.	RSS-210 & FCC Part 15	Pass

2.1 RF Exposure Compliance Requirements

The power output is less than 10 mW; the EUT meets the FCC and Canada's RSS-210 requirements for RF exposure.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Transmitter, Model DA-610, manufactured by Mier Products, Inc. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-210 Section 5.5 Antenna Requirements

There are no power level adjustments and the antenna is permanently attached.

3.2 Related Submittals

The associated receiver is subject to the IC requirements pursuant to the Certification equipment authorization under RSS-210. The associated receiver is subject to the IC requirements pursuant to the Certification equipment authorization under RSS-210.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations.

The EUT was tested as a stand-alone device. Power was supplied with a new battery. There are no external cables connected to the EUT.

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2004	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2001	2001	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 5	2001	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)
IC RSS-212 Issue 1	1998	Test Methods For Radio Equipment

The test procedures used are in accordance with the Industry Canada RSS-212 and ANSI document C63.4-2001, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.net).

The following is a list of facilities used during the tests.

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles in the located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number 31040/SIT 1300F2. The FCC test site Registration Number is 90897. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/07/04
AMP-12	MITEQ	Pre-amplifier	AM-1431	530935	0.01-1000MHz	12 Mo.	12/29/04
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/07/04
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 mo	11/17/03

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
ANT-12	RMC	Dipole Antenna Set	HW1010	202	25-1000MHz	24 Mo.	07/12/04
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/13/04
ANT-42	EMCO	Bicon Antenna	3104C	9512-4713	25-300MHz	24 Mo.	12/02/03
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	06/15/04
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	08/17/04
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	11/11/04
SCP-02	Tektronix	Oscilloscope	TDS 3054B	B030068	DC- 500 MHz	12 Mo.	03/04/04
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 Mo.	01/28/04

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

10.1 Radiated RF Emissions

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 450 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz an Anritsu Spectrum analyzer and a MITEQ AM-1431 amplifier with a 10 dB attenuator connected to the input. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 4.4 GHz, an HP8566A spectrum analyzer was used with a Celeritek uWave amplifier. The fundamental emission, out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

Preliminary radiated emission tests were performed inside of an anechoic enclosure. The frequency range from 30 to 4400 MHz was scanned and plotted using the peak detector function. The test antennas were positioned 3 meters from the EUT. The results of the preliminary scans were only used to identify the frequencies being emitted from the EUT and were not used to determine compliance with the test specification. Radiated emission measurements are performed with linearly polarized broadband antennas.

Final radiated emissions measurements were performed in the open area test site at a test distance of 3 meters. Measurements were performed using the peak or quasi-peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The was device was rotated through three orthogonal axis as per 13.1.4.1 of ANSI C63.4 during the prescans and during final radiated tests.

The entire frequency range from 30 to 4400 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high in the preliminary emission scan. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

10.1.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG + PKA

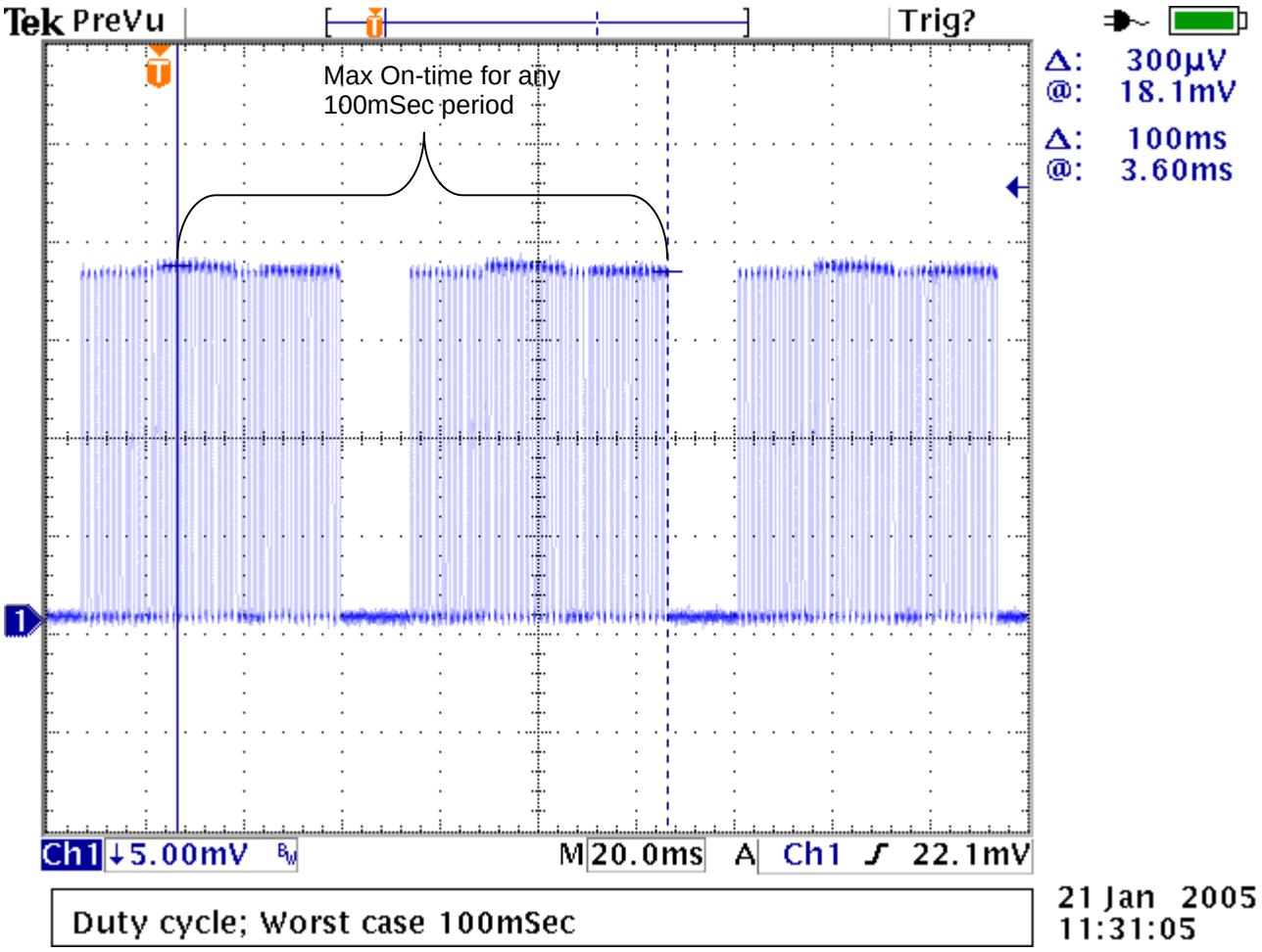
Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
PKA = Peak to Average Factor

The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is 20 * Log(Duty cycle/100).

10.1.2 Peak to average Correction

The EUT has at least one 14.5 mSec blank period every 100 mSec. The rest of the transmission is an equal number of ones and zeroes. Therefore the maximum total on time for any 100 mSec time period is 42.8 mSec. The peak to average factor is 20*Log(42.8/100) = 7.4 dB

Figure 1. Duty cycle plots

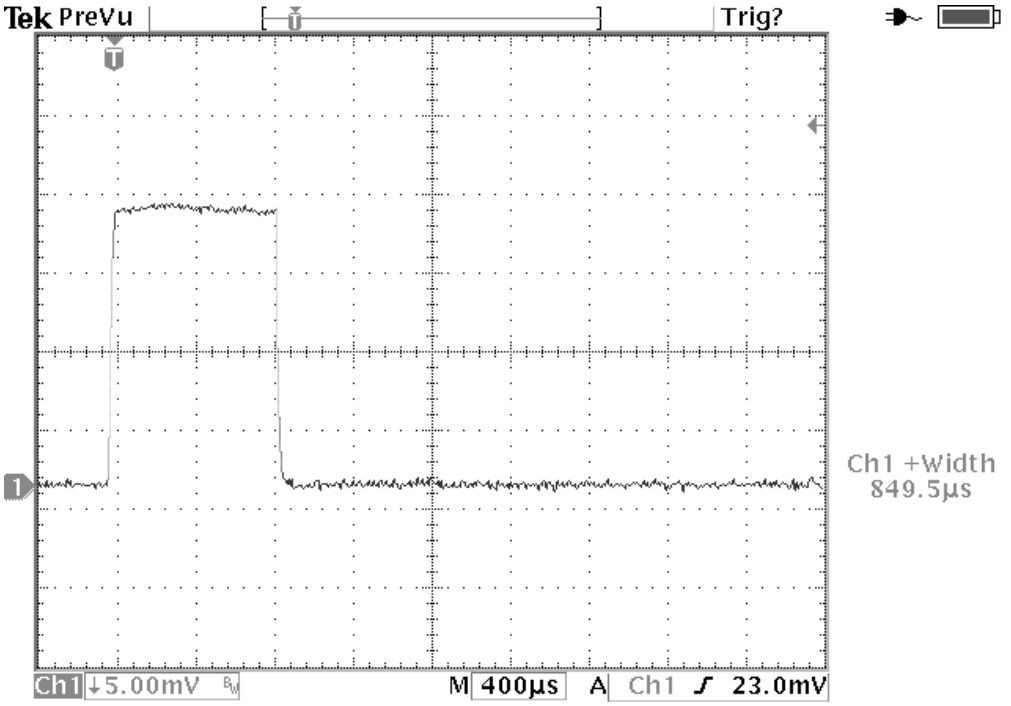


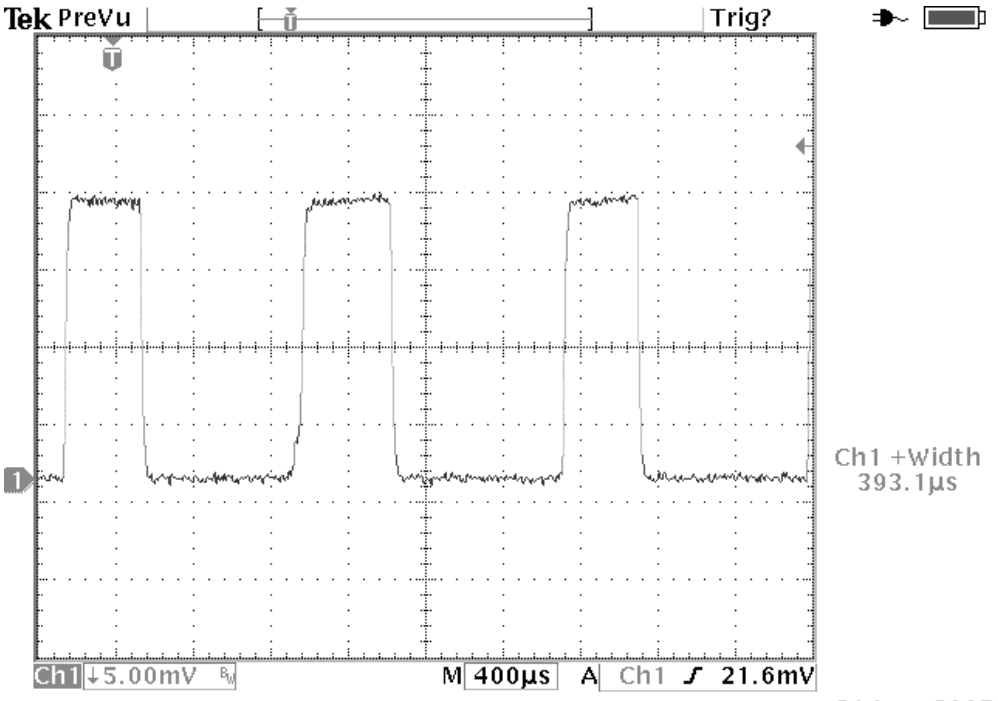
This trace shows three complete pulse trains. The highlighted area shows the 100 mSec window with the highest duty cycle and the greatest number of long pulses.

Within this window, there are 44 pulses that are 850 uS and 20 pulses that are 393 uS in duration. As seen below this corresponds to a 45.3 mSec on time.

44*850uS + 20*393uS = 45.3 mSec

20 Log*(45.3mSec/100mSec) = -6.9 dB Peak to average Correction factor.


Tek PreVu
Trig?
Ch1 +Width
849.5µs
Ch1 ↓5.00mV
M 400µs
A Ch1 23.0mV
Duty cycle; Long pulse
21 Jan 2005
13:54:20


Tek PreVu
Trig?
Ch1 +Width
393.1µs
Ch1 ↓5.00mV
M 400µs
A Ch1 21.6mV
Duty cycle; short pulse
21 Jan 2005
14:17:06

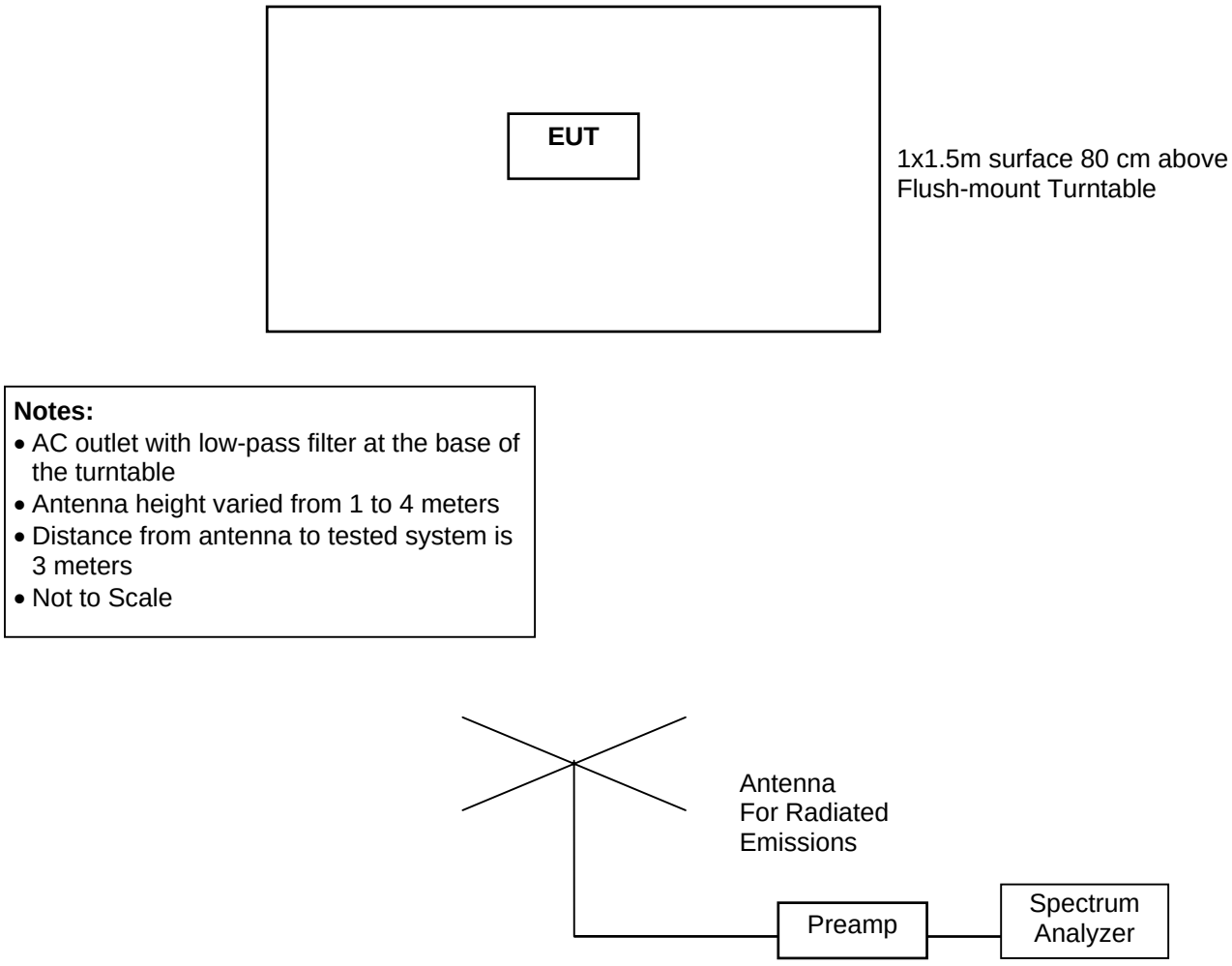
10.1.3 Radiated Emissions Test Results

Test Date	12/17/2004
Test Distance	3 Meters
Specification	FCC Part 15 Subpart C & RSS-210
Notes	Peak to Average factor is –6.9 dB; Correction factors are preamp and cable loss
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-42); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP
Configuration	

Freq. MHz	Peak Meter Reading dBuV	Antenna		Corr. Factors dB	Peak to Average factor dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Number			EUT	Limit	
433.9	85.1	16.4	V/06	-14.3	-6.9	80.3	80.8	0.5
867.7	35.8	21.4	V/06	-10.9	-6.9	39.4	60.8	21.4
1301.6	41.7	24.8	V/13	-38.8	-6.9	20.8	54.0	33.2
1735.4	42.2	26.3	V/13	-38.6	-6.9	23.0	54.0	31.0
2169.3	45.0	27.9	V/13	-38.8	-6.9	27.2	54.0	26.8
2603.2	43.0	28.9	V/13	-38.1	-6.9	26.9	54.0	27.1
3037.0	38.8	30.1	V/13	-37.8	-6.9	24.2	54.0	29.8
3470.9	37.6	31.1	V/13	-37.5	-6.9	24.3	54.0	29.7
3904.7	39.0	32.5	V/13	-37.4	-6.9	27.2	54.0	26.8
4338.6	38.0	33.1	V/13	-37.5	-6.9	26.7	54.0	27.3
433.9	78.5	16.9	H/06	-14.3	-6.9	74.2	80.8	6.6
867.7	33.0	22.5	H/06	-10.9	-6.9	37.7	60.8	23.1
1301.6	50.0	24.8	H/13	-38.8	-6.9	29.1	54.0	24.9
1735.4	43.2	26.3	H/13	-38.6	-6.9	24.0	54.0	30.0
2169.3	44.1	27.9	H/13	-38.8	-6.9	26.3	54.0	27.7
2603.2	41.9	28.9	H/13	-38.1	-6.9	25.8	54.0	28.2
3037.0	39.0	30.1	H/13	-37.8	-6.9	24.4	54.0	29.6
3470.9	38.1	31.1	H/13	-37.5	-6.9	24.8	54.0	29.2
3904.7	39.1	32.5	H/13	-37.4	-6.9	27.3	54.0	26.7
4338.6	36.9	33.1	H/13	-37.5	-6.9	25.6	54.0	28.4

Judgment: Passed by 0.5 dB

Figure 2. Drawing of Radiated Emissions Setup



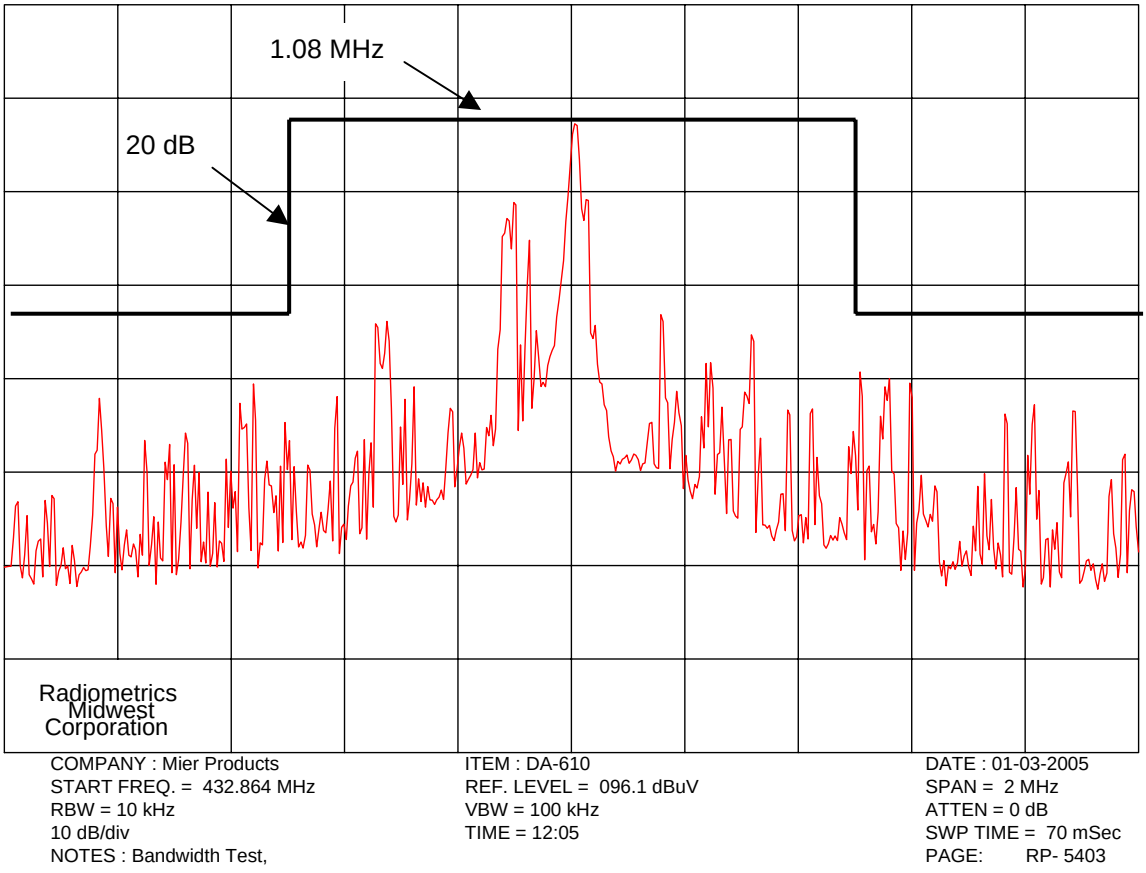
10.2 Occupied Bandwidth Data

The occupied bandwidth of the RF output was measured using a spectrum analyzer. The bandwidth was measured using the peak detector function and a narrow resolution bandwidth.

A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. A limit was drawn on the plots based on the level of the modulated carrier. The plots of the occupied bandwidth for the EUT are supplied on the following page.

Figure 3. Occupied Bandwidth Plot

The maximum 20 dB bandwidth allowed is 0.25% of 433.9 MHz = 1.08 MHz.



Judgment: Passed.