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## Certification Test Report

**FCC ID: HSW-2410G  
IC: 4492A-2410G**

**FCC Rule Part: 15.247  
IC Radio Standards Specification: RSS-210**

**ACS Report Number 09-0296-15C**

**Manufacturer: RFM / Cirronet Inc.  
Model(s): WIT2410G**

**Test Begin Date: September 3, 2009  
Test End Date: September 3, 2009**

**Report Issue Date: September 11, 2009**



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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## Additional Exhibits Included In Filing

RF Exposure

Test Setup Photographs

Manual

## 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 for a class II permissive change. The permissive change is to address the addition of a 17 dBi panel antenna to the approved antenna list.

### 1.2 Product Description

The WIT2410G radio transceiver provides reliable wireless connectivity for either point to point or multipoint applications. A simple serial interface supports asynchronous data up to 230400 bps. An on board 3 KB buffer and an error correcting over the air protocol provide smooth data flow and simplify the task of integration with existing applications.

Manufacturer Information:

RFM/Cirronet, Inc.  
3079 Premiere Parkway, Suite 140  
Duluth, GA 30097

Test Sample Serial Number(s):  
W2410mgb-F-439967

Test Sample Condition:

Test samples were provided in good working order with no visible defects.

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

### 1.3 Test Methodology and Considerations

This evaluation is to address the addition of a 17 dBi panel antenna to the approved antenna list therefore only radiated emissions and radiated band-edge characteristics were measured.

## 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/IEC 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 4175A-1

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:

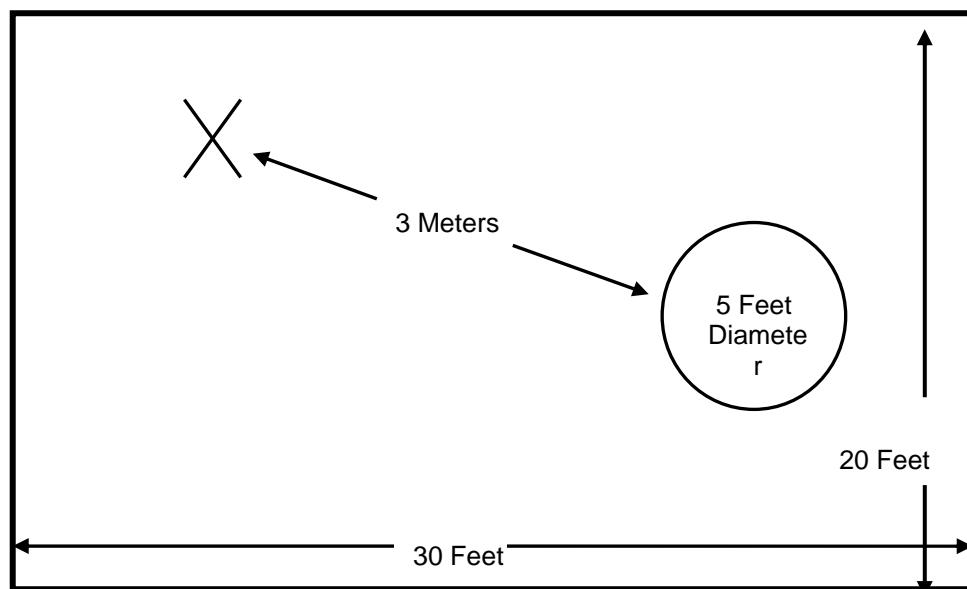


Figure 2.3-1: Semi-Anechoic Chamber Test Site

### 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:

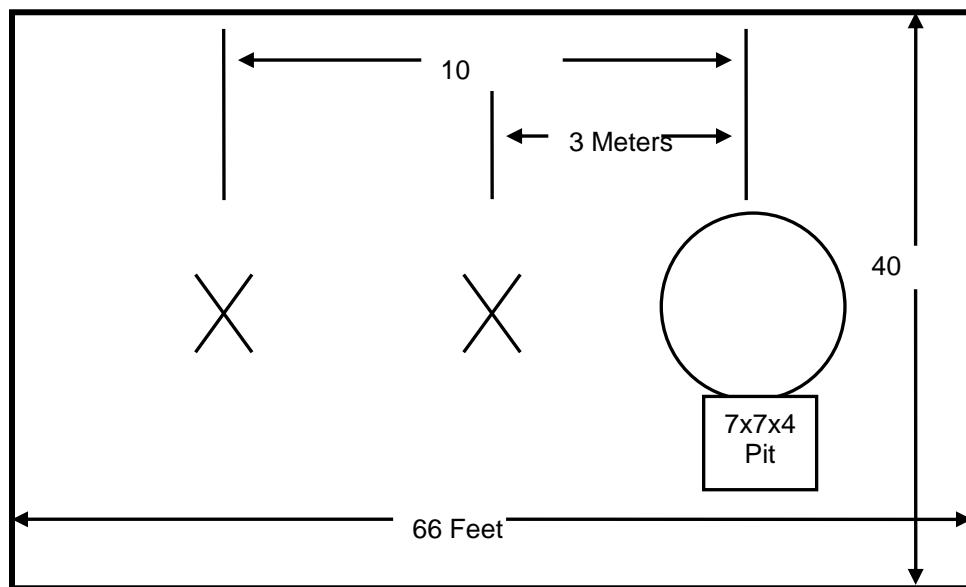


Figure 2.3-2: Open Area Test Site

## 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:

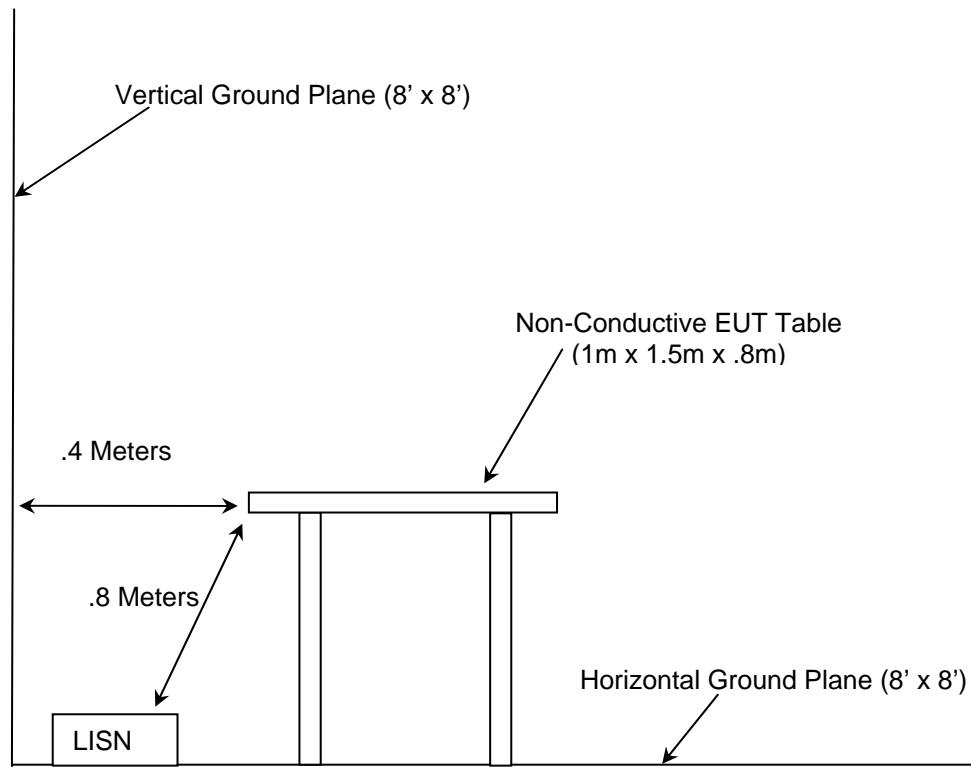


Figure 2.4-1: AC Mains Conducted EMI Site

## 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, 2009
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2009
- ❖ FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- ❖ Industry Canada Radio Standards Specification: RSS-210 - Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, Issue 7 June 2007
- ❖ Industry Canada Radio Standards Specification: RSS-GEN - General Requirements and Information for the Certification of Radiocommunication Equipment, Issue2, June 2007.

**4.0 LIST OF TEST EQUIPMENT**

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

**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	09-19-2009
2	Rohde & Schwarz	Spectrum Analyzers	ESMI-Receiver	839587/003	09-19-2009
30	Spectrum Technologies	Antennas	DRH-0118	970102	05-08-2010
291	Florida RF Labs	Cables	SMRE-200W-12.0-SMRE	None	11-24-2009 (See Note1)
292	Florida RF Labs	Cables	SMR-290AW-480.0-SMR	None	11-24-2009 (See Note1)
338	Hewlett Packard	Amplifiers	8449B	3008A01111	10-22-2009
422	Florida RF Labs	Cables	SMS-200AW-72.0-SMR	805	02-05-2010 (See Note1)
432	Microwave Circuits	Filters	H3G020G4	264066	07-17-2010 (See Note1)

**Note1:** Items characterized on an annual cycle. The date shown indicates the next characterization due date.

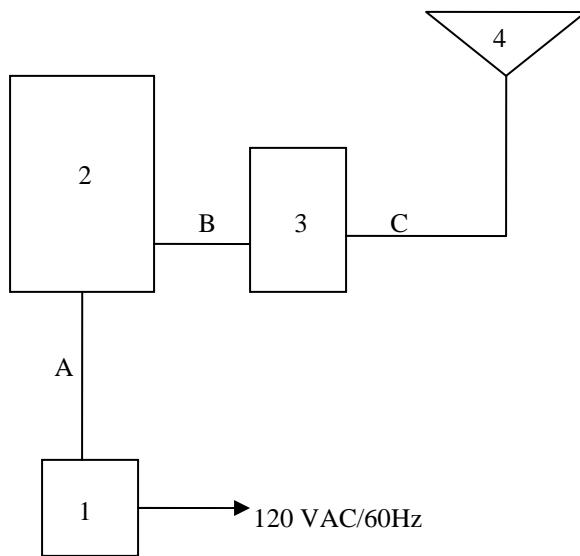
**Note2:** Items verified on an annual cycle. The date shown indicates the next verification due date.

## 5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	AC Adapter	Volgen	NP12-US0520	N/A
2	Data Modem	Cirronet	HN-591	18605090005
3	EUT	Cirronet	WIT2410G	W2410mgb-F-439967
4	Antenna	MTI Wireless Edge	MT-344041/S/E	00607

## 6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



Cable A – 2 Conductor DC, 64”

Cable B – Ribbon, 8”

Cable C – SAM Coax, 36”

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

The WIT2410G utilizes a MMCX connector soldered directly to the PCB board.

### 7.2 Band-Edge Compliance and Spurious Emissions - FCC Section 15.247(d) IC: RSS-210 2.6, A8.5

#### 7.2.1 Band-Edge Compliance - FCC Section 15.247(d) IC: RSS-210 2.6, A8.5

##### 7.2.1.1 Test Methodology

The EUT was investigated at the high channel of operation to determine band-edge compliance. Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in FCC DA 00-705. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions.

For band-edge measurements data was collected with the hopping function disabled and enabled.

##### 7.2.1.2 Test Results

Band-edge compliance is displayed in Table 7.2.1.2-1 to 7.2.1.2-2 and Figure 7.2.1.2-1 – 7.2.1.2-4.

Table 7.2.1.2-1: Upper Band-edge

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Fundamental Level (dBuV/m)		Marker-Delta (dB)	Band-Edge Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2469.888	112.94	111.84	H	-4.24	108.70	82.50	61.14	47.56	21.36	74.0	54.0	26.44	32.64
2469.888	129.33	128.08	V	-4.24	125.09	98.74	60.36	64.73	38.38	74.0	54.0	9.27	15.62

Table 7.2.1.2-2: Upper Band-edge (Hopping)

Frequency (MHz)	Uncorrected Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Fundamental Level (dBuV/m)		Marker-Delta (dB)	Band-Edge Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg		pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
2469.888	112.94	111.84	H	-4.24	108.70	82.50	63.61	45.09	18.89	74.0	54.0	28.91	35.11
2469.888	129.33	128.08	V	-4.24	125.09	98.74	66.11	58.98	32.63	74.0	54.0	15.02	21.37

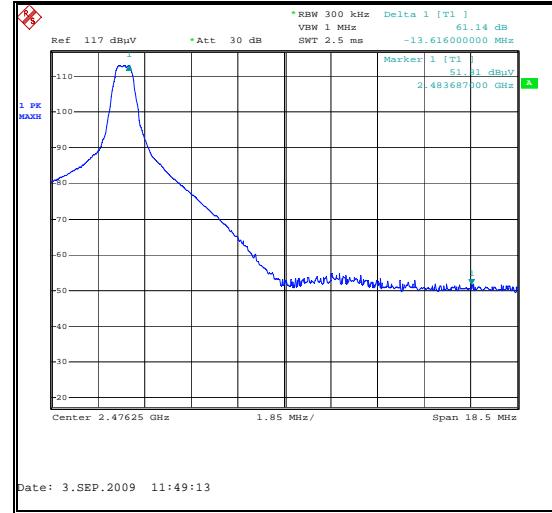


Figure 7.2.1.2-1: Upper Band-edge Hpol

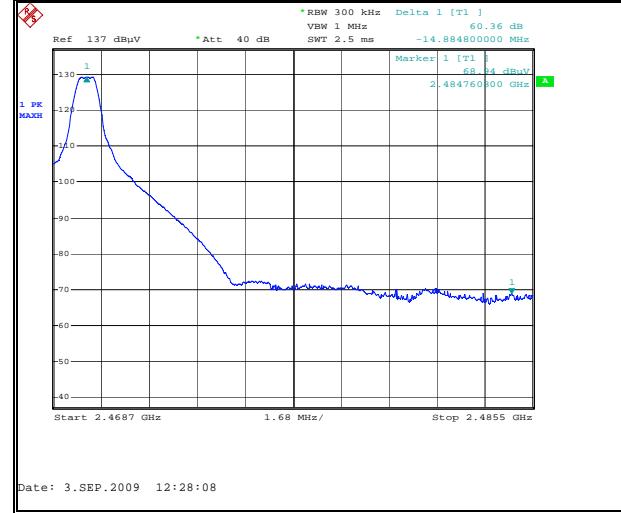
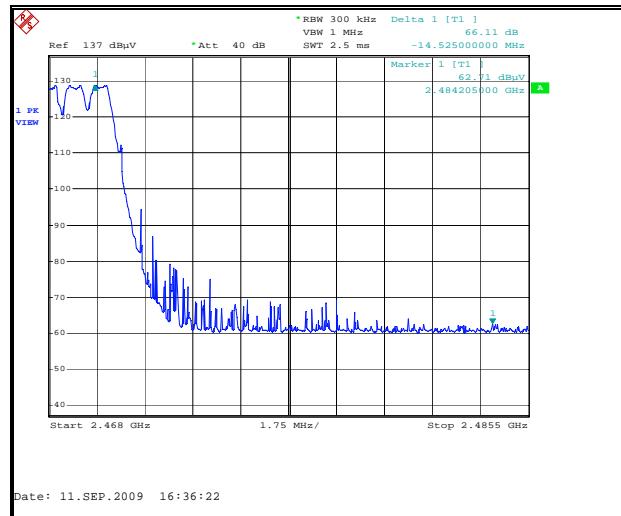
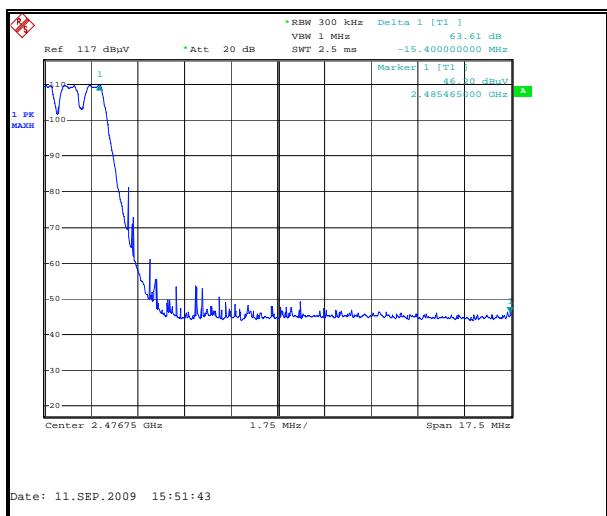


Figure 7.2.1.2-2: Upper Band-edge Vpol



## 7.2.2 Radiated Spurious Emissions - FCC Section 15.205 IC: RSS-210 2.6

### 7.2.2.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

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, peak and average measurements made with RBW and VBW of 1 MHz and 3 MHz respectively. The average emissions were further corrected by applying the duty cycle correction of the EUT to the average measurements for comparison to the average limit.

### 7.2.2.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 25.1dB to account for the duty cycle of the EUT. Referencing the dwell time justification in section 7.5.3 above the worst case duty cycle within 100ms is 5.56% or 5.56ms. The duty cycle correction factor is determined using the formula:  $20 \log (0.0556) = -25.1\text{dB}$ . The duty cycle justification is detailed in the original application for certification.

### 7.2.2.3 Test Results

Radiated spurious emissions found in the band of 30MHz to 25GHz are reported in Table 7.2.2.3-1.

Table 7.2.2.3-1: Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
<b>Low Channel</b>										
4803.3792	66.06	49.76	H	3.17	69.23	27.83	74.0	54.0	4.77	26.17
4803.3792	64.31	49.00	V	3.17	67.48	27.07	74.0	54.0	6.52	26.93
12008.448	53.36	43.79	H	16.28	69.64	34.97	83.5	63.5	13.90	28.57
12008.448	56.46	47.50	V	16.28	72.74	38.68	83.5	63.5	10.80	24.86
<b>Middle Channel</b>										
4871.5776	63.80	48.36	H	3.42	67.22	26.69	74.0	54.0	6.78	27.31
4871.5776	65.15	50.39	V	3.42	68.57	28.72	74.0	54.0	5.43	25.28
7307.3664	63.42	56.87	H	8.30	71.72	40.07	74.0	54.0	2.28	13.93
7307.3664	63.44	56.56	V	8.30	71.74	39.76	74.0	54.0	2.26	14.24
12178.944	61.87	53.49	H	17.39	79.26	45.78	83.5	63.5	4.28	17.76
12178.944	62.71	54.15	V	17.39	80.10	46.44	83.5	63.5	3.44	17.10
<b>High Channel</b>										
4939.776	67.76	54.25	H	3.68	71.44	32.83	74.0	54.0	2.56	21.17
4939.776	63.36	49.07	V	3.68	67.04	27.65	74.0	54.0	6.96	26.35
7409.664	62.73	55.12	H	8.40	71.13	38.42	74.0	54.0	2.87	15.58
7409.664	60.62	52.83	V	8.40	69.02	36.13	74.0	54.0	4.98	17.87
12349.44	55.84	46.38	H	18.50	74.34	39.78	83.5	63.5	9.20	23.76

**7.2.2.4 Sample Calculation:**

$$R_C = R_U + CF_T$$

Where:

$CF_T$  = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)

$R_U$  = Uncorrected Reading

$R_C$  = Corrected Level

AF = Antenna Factor

CA = Cable Attenuation

AG = Amplifier Gain

DC = Duty Cycle Correction Factor

**Example Calculation: Peak**

Corrected Level:  $66.06 + 3.17 = 69.23\text{dBuV/m}$

Margin:  $74\text{dBuV/m} - 69.23\text{dBuV/m} = 4.77\text{dB}$

**Example Calculation: Average**

Corrected Level:  $49.76 + 3.17 - 25.1 = 27.83\text{dBuV}$

Margin:  $54\text{dBuV} - 27.83\text{dBuV} = 26.17\text{dB}$

**8.0 CONCLUSION**

In the opinion of ACS, Inc. the WIT2410G, manufactured by RFM/Cirronet Inc. meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-210.

**END REPORT**