Excellence in Compliance Testing

Certification Test Report

FCC ID: HSW-XDM2140
IC: 4492A-XDM2140

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

ACS Report Number: 08-0352 - 15C

Manufacturer: RFM / Cirronet Inc.
Model: XDM2140

Test Begin Date: August 29, 2008
Test End Date: September 3, 2008

Report Issue Date: September 25, 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: _____
Jeff Woods
Wireless Certifications Engineer
ACS, Inc.

Reviewed by: _____
J. Kirby Munroe
Director Wireless Certifications
ACS, Inc.

This report contains 26 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 RFM / Cirronet XDM2140 is a 2.4 GHz ultra low power mesh RF transceiver module utilizing digital transmission technology. Based on DUST Networks' SmartMesh-XD™ technology, RFM's / Cirronet's XDM2140 module is designed to provide excellent communications reliability and long battery life in a wide range of sensor network applications.

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

Test Sample Serial Number(s):
N/A

Test Sample Condition:
The test samples were provided in good working order with no visible defects.

1.2.2 Intended Use

The XDM2140 module is intended to provide excellent communications reliability and long battery life in a wide range of sensor network applications

1.3 Test Methodology and Considerations

The XDM2140 device can use two different antenna types; a patch antenna with a gain of 12 dBi and a monopole antenna with a gain of 9 dBi. Both antennas where evaluated where applicable.

The test setup included the use of a support PCB to provide power and communications for programming test modes.

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:

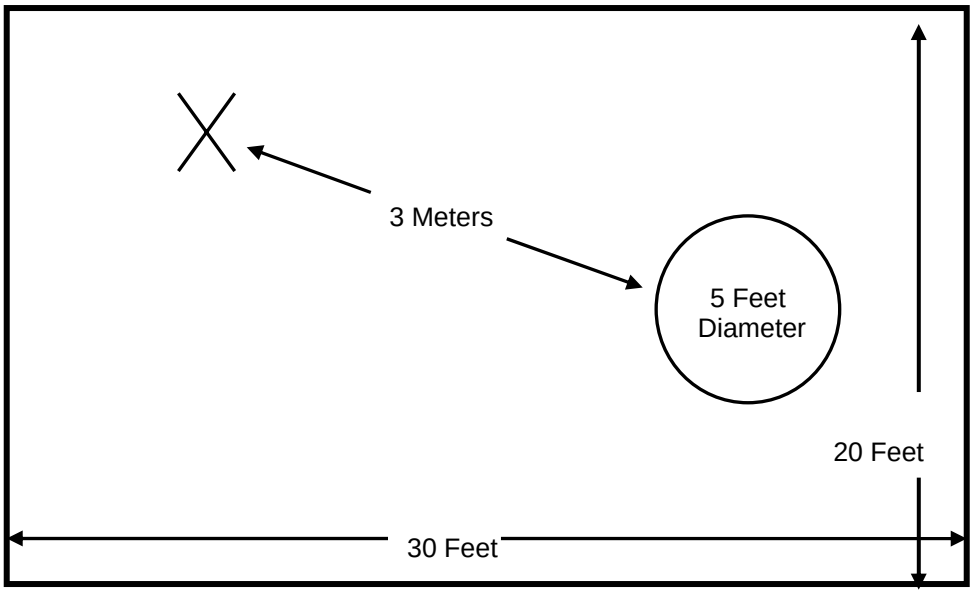

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

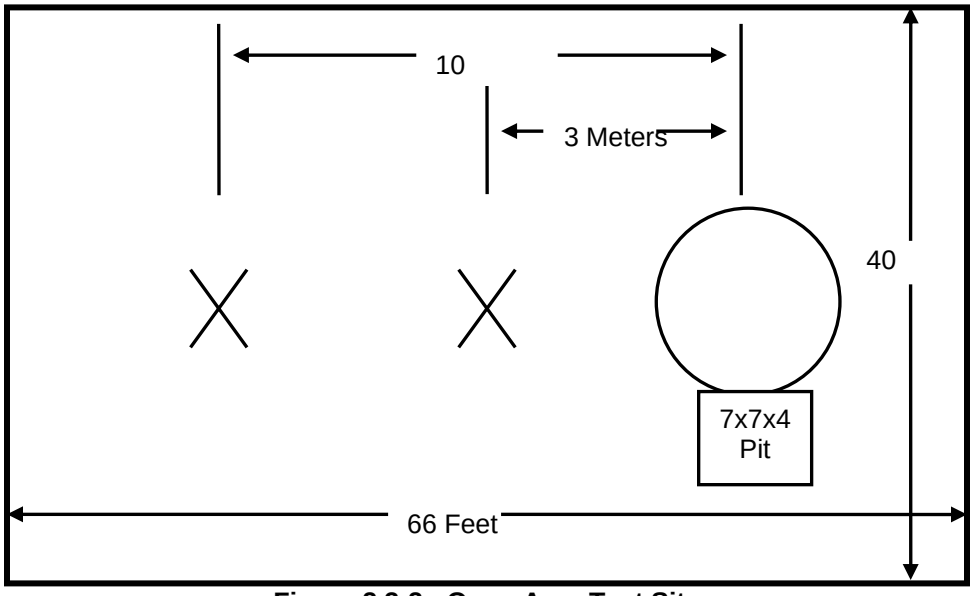

Figure 2.3-2: Open Area Test Site

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:

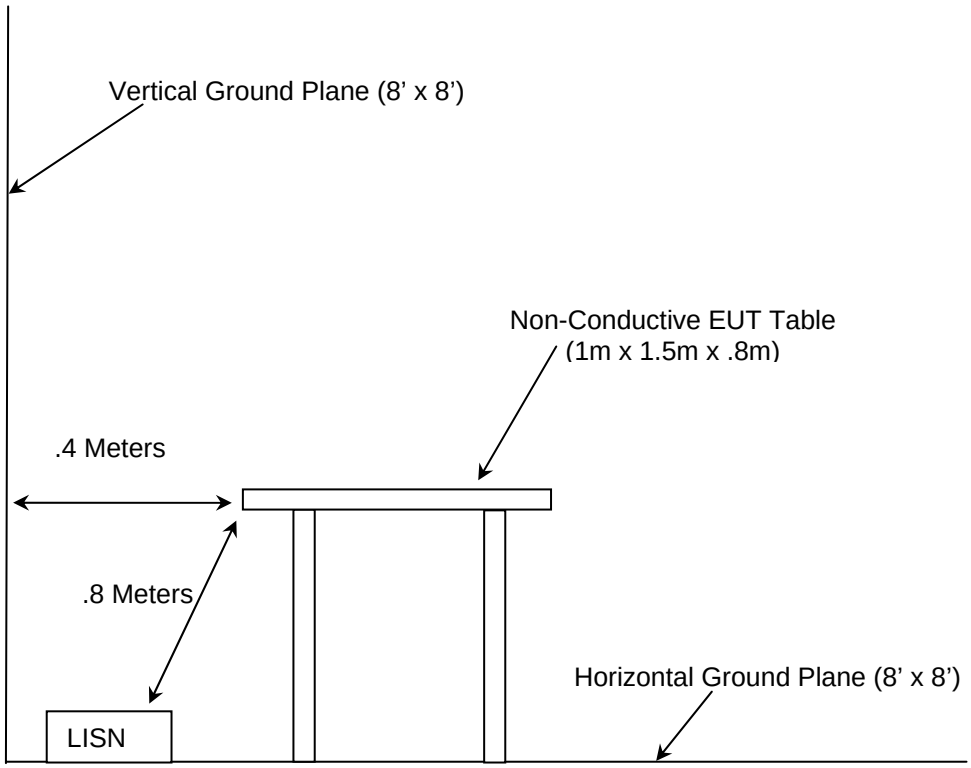

Figure 2.4-1: AC Mains Conducted EMI Site

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, 2008
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2008
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, 2001
- FCC KDB Publication No. 558074 - Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), March 2005
- 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

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

Table 4.0-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
331	Microwave Circuits	Filter	H1G513G1	31417	07/28/09
22	Agilent	Amplifier	8449B	3008A00526	10/25/08
30	Spectrum Technologies	Antenna	DRH-0118	970102	05/07/09
3	Rohde & Schwarz	Spectrum Analyzers	ESMI – Display	839379/011	10/26/08
4	Rohde & Schwarz	Spectrum Analyzers	ESMI - Receiver	833827/003	10/26/08
25	Chase	Antenna	CBL6111	1043	08/22/09
73	Agilent	Pre-Amplifier	8447D	2727A05624	12/19/08
167	ACS	Cable Set	Chamber EMI Cable Set	167	01/04/09
343	Florida RF Cables	Cables	SMRE-200W-12.0-SMRE	343	11/21/08
430	Florida RF Cables	Cables	SMS-290AW-480-SMS	430	06/09/09
283	Rohde & Schwarz	Spectrum Analyzer	FSP40	1000033	11/09/08

5.0 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item#	Mfg.	Eq. type	Model	S/N
1	RFM / Cirronet	EUT	XDM2140	NA
2	RFM / Cirronet	Support PCB	NA	NA
3	Volgen	Power Supply	SPU10R-2	NA

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

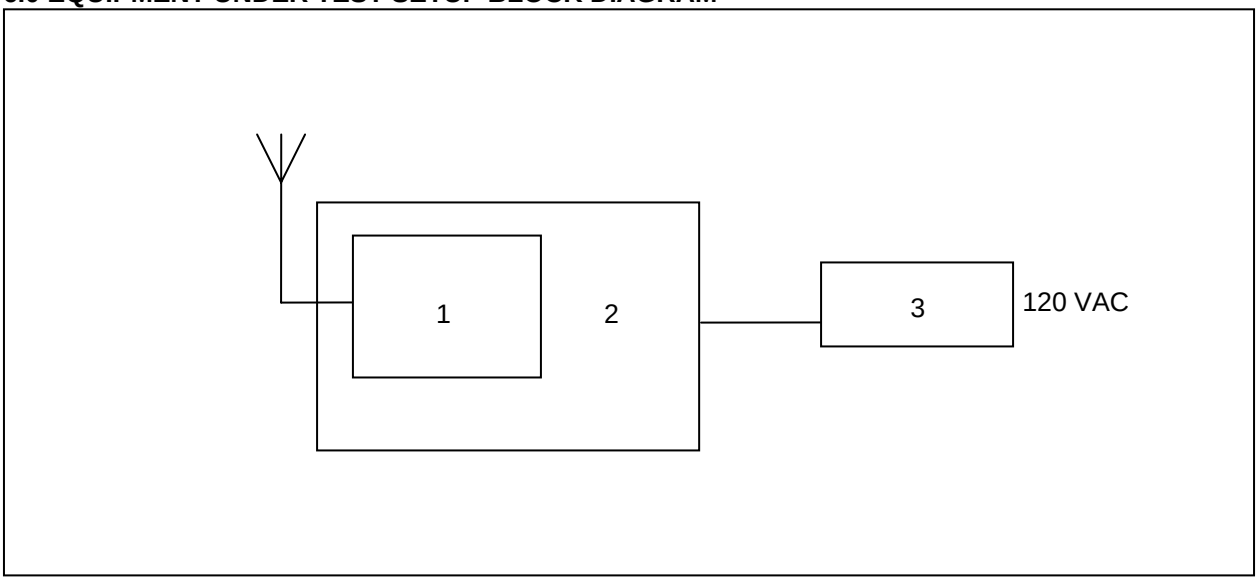

Figure 6-1: EUT Test Setup

*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 – FCC: Section 15.203

The XDM2140 module's RF output is through a U.FL coaxial connector which is considered unique in design.

7.2 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 7.2.2

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:

Testing was done with both the dipole and patch antennas

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 Tables 7.2-1 through 7.2-2.

Table 7.2-1: Conducted EMI Results – Patch Antenna

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										
0.21	30.7	24.9	9.80	40.50	34.70	63.21	53.21	22.7	18.5	FLO
0.31	24.1	20.5	9.80	33.90	30.30	59.97	49.97	26.1	19.7	FLO
0.62	22.3	22.1	9.80	32.10	31.90	56.00	46.00	23.9	14.1	FLO
0.72	23.8	23.6	9.80	33.60	33.40	56.00	46.00	22.4	12.6	FLO
10.39	20.3	18.8	10.00	30.30	28.80	60.00	50.00	29.7	21.2	FLO
27.66	26.1	25	10.21	36.31	35.21	60.00	50.00	23.7	14.8	FLO
Line 2										
0.21	31.1	25.1	9.80	40.90	34.90	63.21	53.21	22.3	18.3	FLO
0.31	26.2	23.9	9.80	36.00	33.70	59.97	49.97	24.0	16.3	FLO
0.62	25.9	25.6	9.80	35.70	35.40	56.00	46.00	20.3	10.6	FLO
0.72	20.7	20.6	9.80	30.50	30.40	56.00	46.00	25.5	15.6	FLO
9.25	23.2	21.8	9.91	33.11	31.71	60.00	50.00	26.9	18.3	FLO
27.64	25.6	23.4	10.21	35.81	33.61	60.00	50.00	24.2	16.4	FLO

Table 7.2-1: Conducted EMI Results – Monopole Antenna

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										
0.2	30.7	24.9	9.80	40.50	34.70	63.61	53.61	23.1	18.9	FLO
0.31	24.2	20.8	9.80	34.00	30.60	59.97	49.97	26.0	19.4	FLO
0.72	23.7	22.7	9.80	33.50	32.50	56.00	46.00	22.5	13.5	FLO
2.38	19.2	14.6	9.80	29.00	24.40	56.00	46.00	27.0	21.6	FLO
9.25	21.9	20.1	9.91	31.81	30.01	60.00	50.00	28.2	20.0	FLO
27.75	26.1	24.8	10.21	36.31	35.01	60.00	50.00	23.7	15.0	FLO
Line 2										
0.21	31	25.1	9.80	40.80	34.90	63.21	53.21	22.4	18.3	FLO
0.31	26.4	23.9	9.80	36.20	33.70	59.97	49.97	23.8	16.3	FLO
0.62	25	25.6	9.80	34.80	35.40	56.00	46.00	21.2	10.6	FLO
0.72	21.3	20.9	9.80	31.10	30.70	56.00	46.00	24.9	15.3	FLO
10.29	23.7	23	10.00	33.70	33.00	60.00	50.00	26.3	17.0	FLO
27.7	25.6	24.1	10.21	35.81	34.31	60.00	50.00	24.2	15.7	FLO

7.3 Radiated Emissions – FCC: Section 15.109(Unintentional Radiation) IC: RSS-210 2.6

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 12.5 GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The 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.

7.3.2 Test Results

Results of the test are given in Table 7.3-1 below:

Table 7.3-1: Radiated Emissions Tabulated Data

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
30		38.37	V	-10.40	---------	27.97	--------	40.0	---------	12.03
32.23		43.58	V	-11.74	---------	31.84	--------	40.0	---------	8.16
114.06		40.26	V	-16.81	---------	23.45	--------	43.5	---------	20.05
171.18		34.45	V	-15.35	---------	19.10	--------	43.5	---------	24.40
183.04		35.33	V	-14.88	---------	20.45	--------	43.5	---------	23.05
477.27		24.95	V	-5.74	---------	19.21	--------	46.0	---------	26.79

* Note: All emissions above 477.27 MHz were attenuated below the permissible limit.

7.4 6dB / 99% Bandwidth – FCC: Section 15.247(a)(2) IC: RSS-210 A8.2(a)

7.4.1 Test Methodology

The 6dB bandwidth was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the entire emissions and >> RBW.

7.4.2 Test Results

Results are shown below in table 7.4.2-1 and figure 7.4.2-1 to 7.4.2-6:

Table 7.4.2-1: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth [MHz]
2405	1.46	2.24
2435	1.56	2.24
2480	1.52	2.30

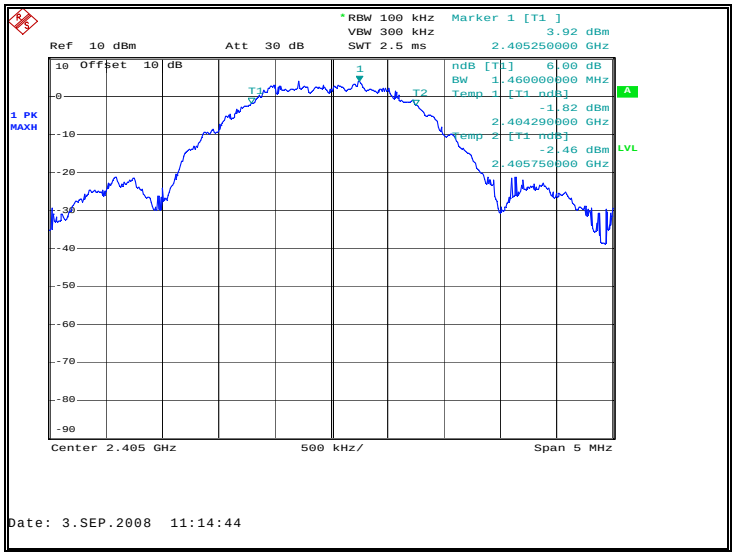

Figure 7.4.2-1: 6dB Bandwidth Plot – Low Channel

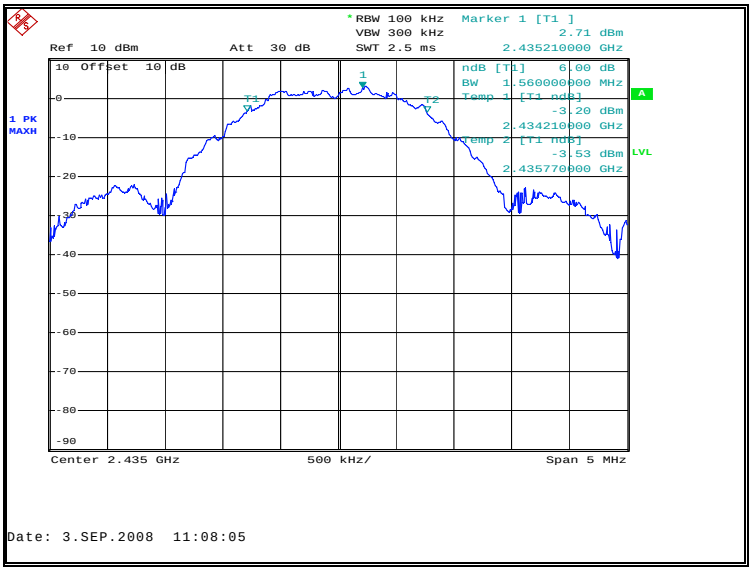

Figure 7.4.2-2: 6dB Bandwidth Plot – Mid Channel

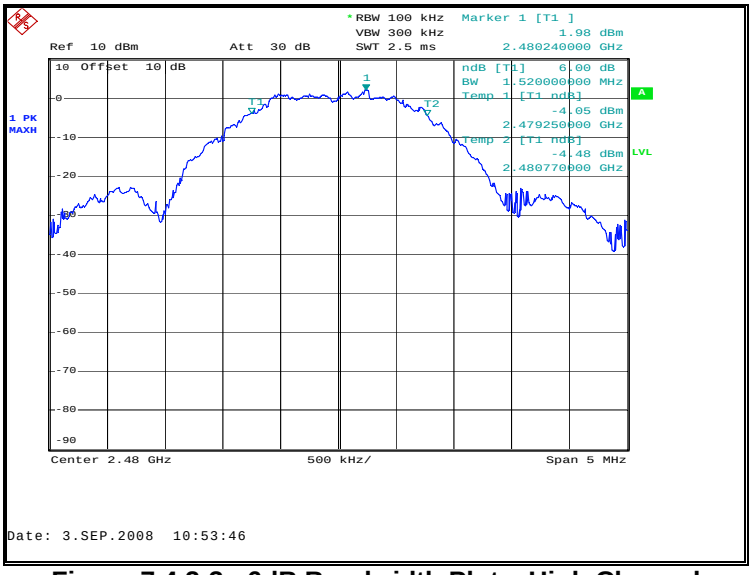

Figure 7.4.2-3: 6dB Bandwidth Plot – High Channel

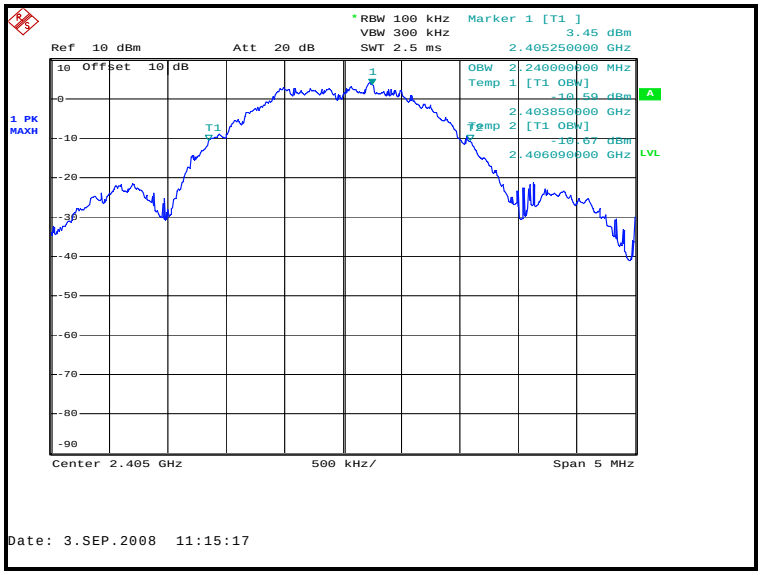

Figure 7.4.2-4: 99% Bandwidth Plot – Low Channel

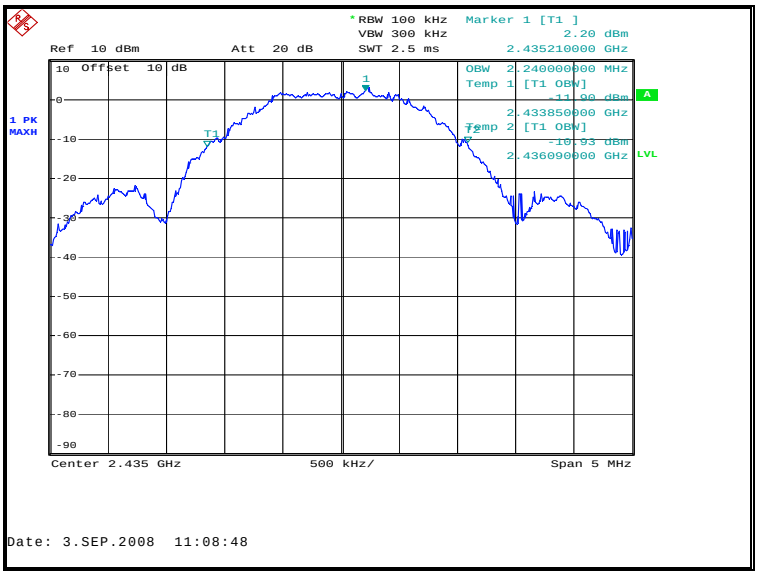

Figure 7.4.2-5: 99% Bandwidth Plot – Mid Channel

Figure 7.4.2-6: 99% Bandwidth Plot – High Channel

7.5 Peak Output Power Requirement - FCC Section 15.247(b)(3) IC: RSS-210 A8.4(4)

7.5.1 Test Methodology

The Peak Output Power was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)" Power Option 1. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer using a RBW >>> EBW.

Data was collected with the EUT operating at maximum power.

7.5.2 Test Results

Results are shown below in Table 7.5.2-1 and Figures 7.5.2-1 to 7.5.2-3.

Table 7.5.2-1: Peak Output Power

Frequency (MHz)	Output Power (dBm)
2405	7.17
2435	6.41
2480	5.40

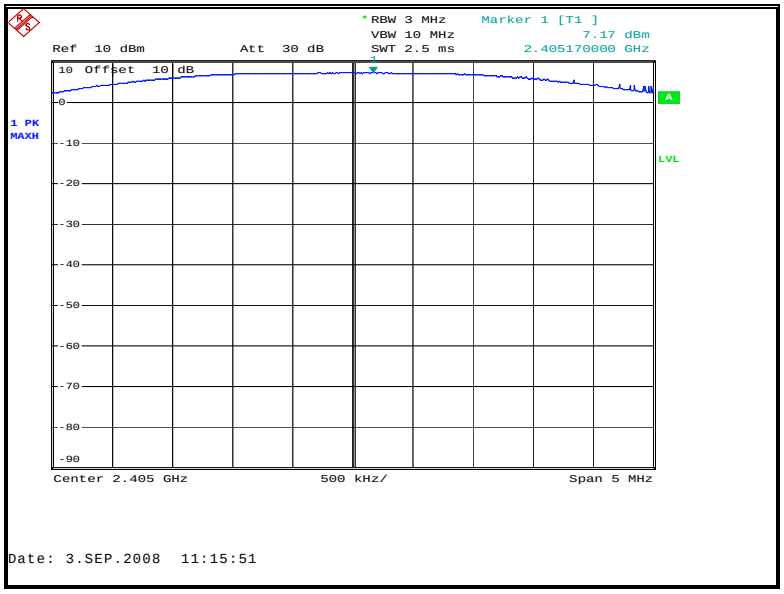

Figure 7.5.2-1: Output power – Low Channel

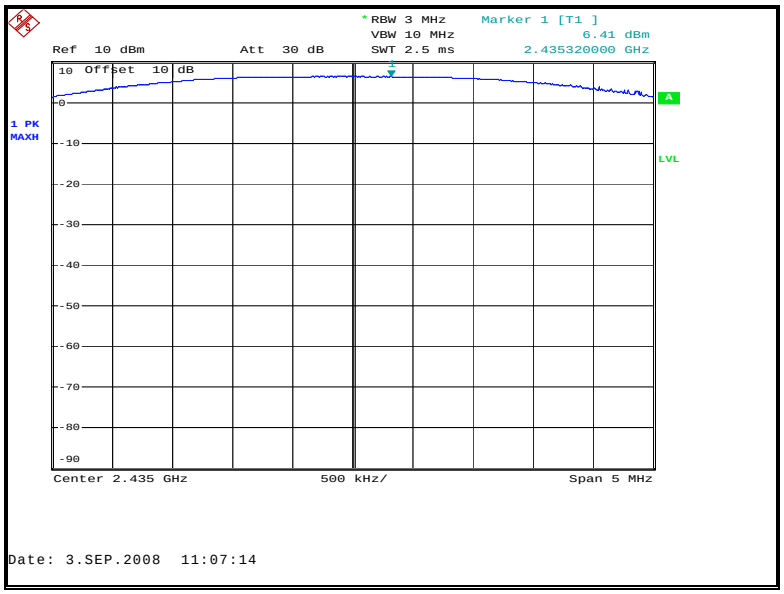

Figure 7.5.2-2: Output power – Mid Channel

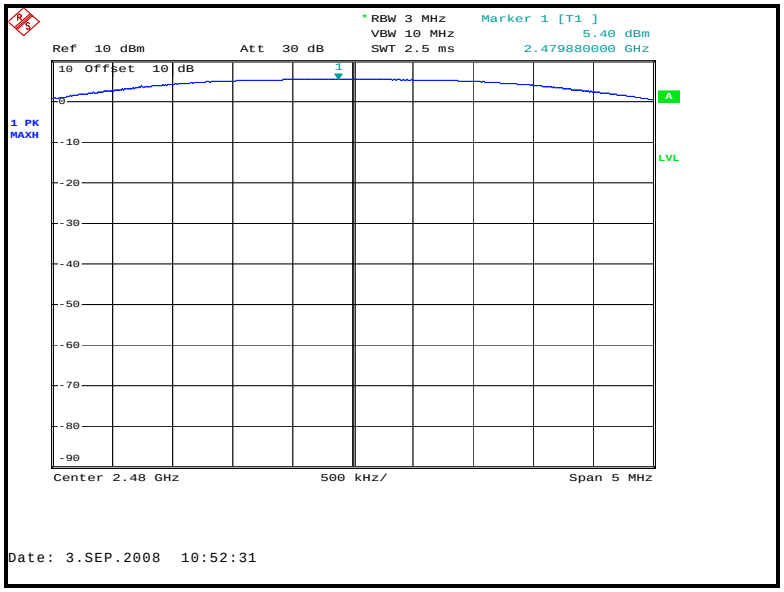

Figure 7.5.2-3: Output power – High Channel

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

7.6.1 Band-Edge Compliance of RF Emissions

7.6.1.1 Test Methodology

The EUT was investigated at the low and high channels of operation to determine band-edge compliance. All antenna types were evaluated. 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.

The lower band-edge compliance was determined using the marker-delta method in which the radio frequency power that is produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

7.6.1.2 Test Results

Band-edge compliance is displayed in Table 7.6.1.2-1 to Table 7.6.1.2-2 and Figure 7.6.1.2-1 to 7.6.1.2-3.

Table 7.6.1.2-1: Upper Band-edge Marker Delta Method - Patch Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74 / 54	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	110.21	110.21	V	-0.71	109.50	83.12	40.6	68.90	42.52	5.10	11.48

Table 7.6.1.2-2 Upper Band-edge Marker Delta Method - Monopole Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74 / 54	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	109.25	109.25	V	-0.71	108.54	82.16	39.39	69.15	42.77	4.85	11.23

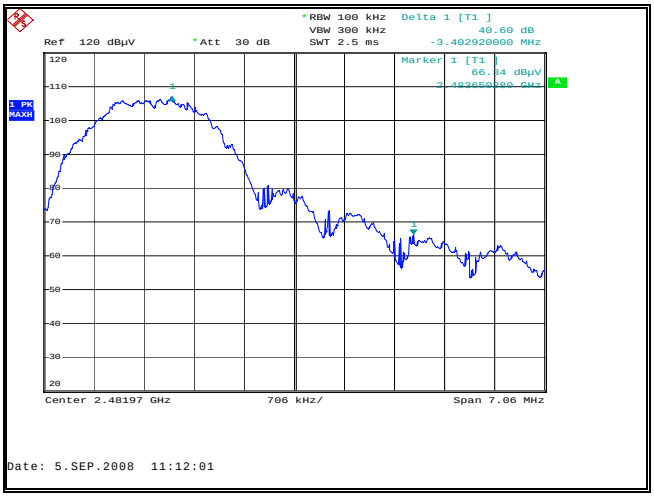

Figure 7.6.1.2-1: Upper Band-edge (Radiated) – Patch Antenna

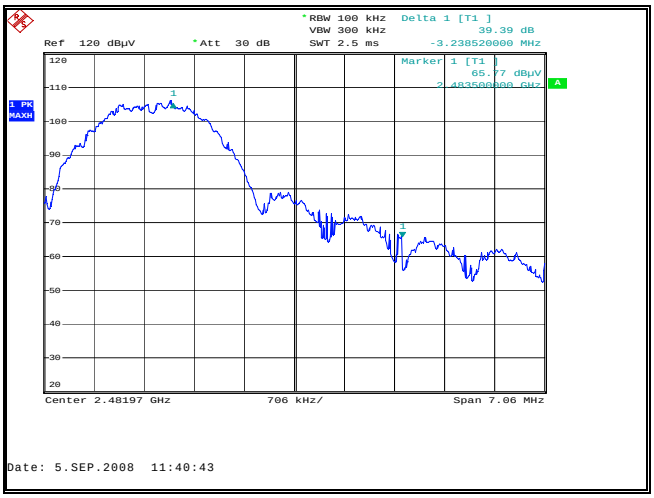

Figure 7.6.1.2-2: Upper Band-edge (Radiated) – Monopole Antenna

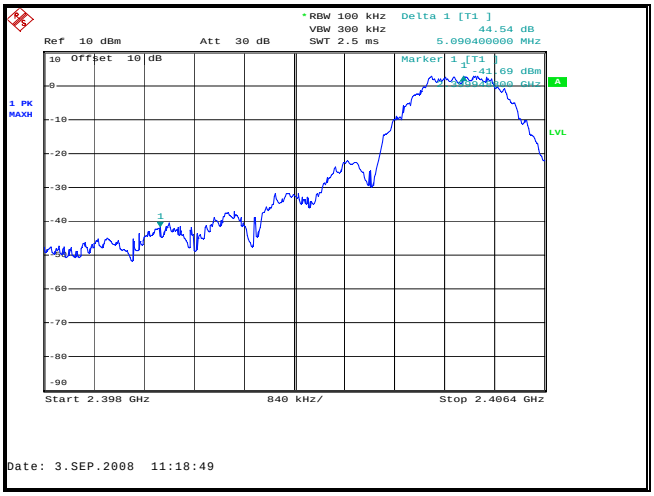

Figure 7.6.1.2-3: Lower Band-edge (Conducted)

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology

The RF Conducted Spurious Emissions were measured in accordance with the FCC KDB Publication No. 558074 “Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)”. The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency. For each measurement, the spectrum analyzer’s RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak detector and Max Hold function of the analyzer were utilized.

7.6.2.2 Test Results

In a 100 kHz bandwidth, the radio frequency power that was produced by the EUT emissions is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. RF Conducted Emissions are displayed in Figures 7.6.2.2-1 through 7.6.2.2-9.

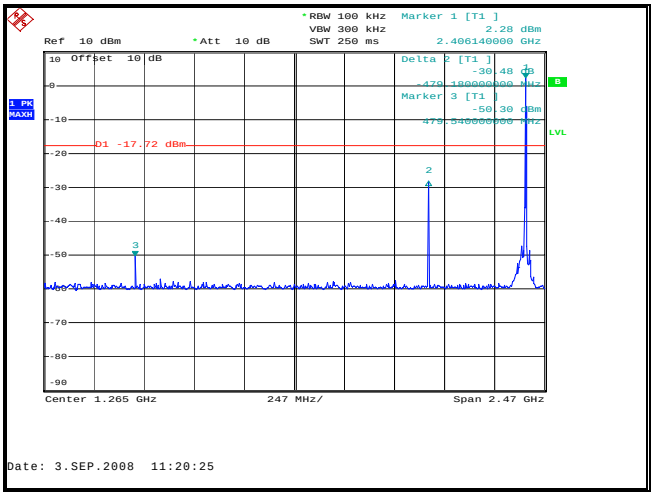

Figure 7.6.2.2-1: 30 MHz – 2.5 GHz – Low Channel

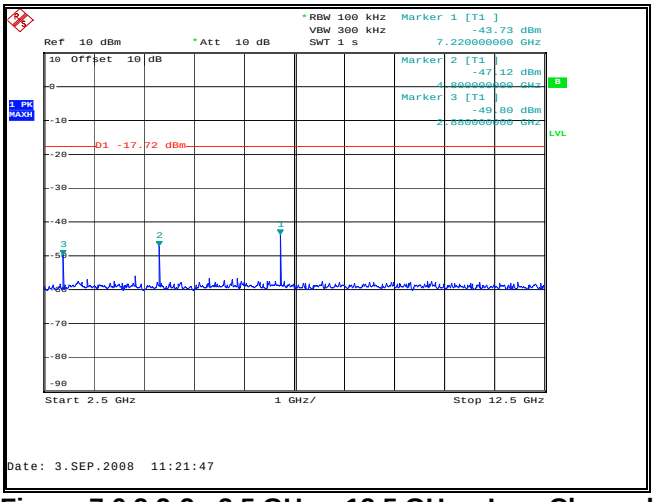

Figure 7.6.2.2-2: 2.5 GHz – 12.5 GHz – Low Channel

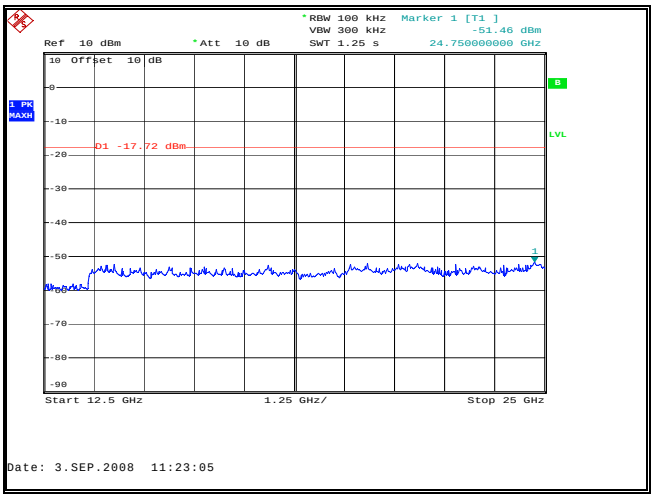

Figure 7.6.2.2-3: 12.5 GHz – 25 GHz – Low Channel

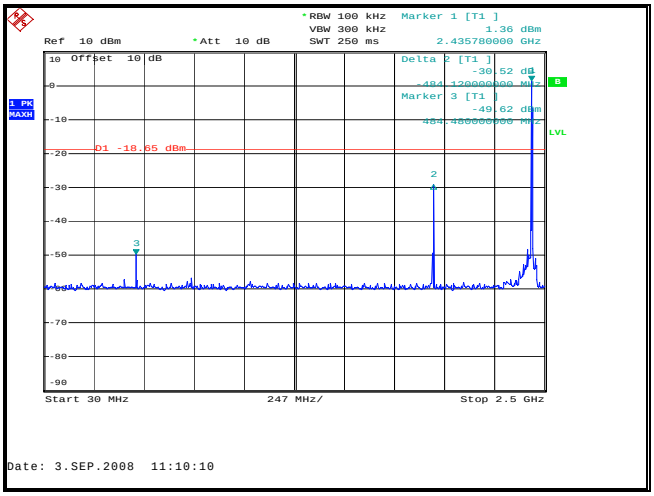

Figure 7.6.2.2-4: 30 MHz – 2.5 GHz –Mid Channel

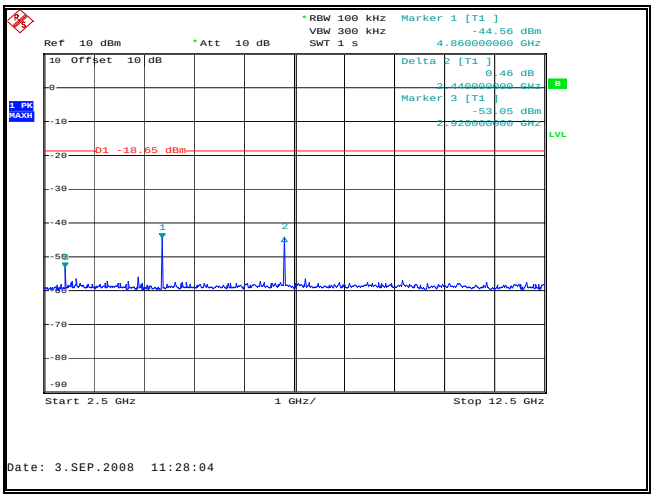

Figure 7.6.2.2-5: 2.5 GHz – 12.5 GHz – Mid Channel

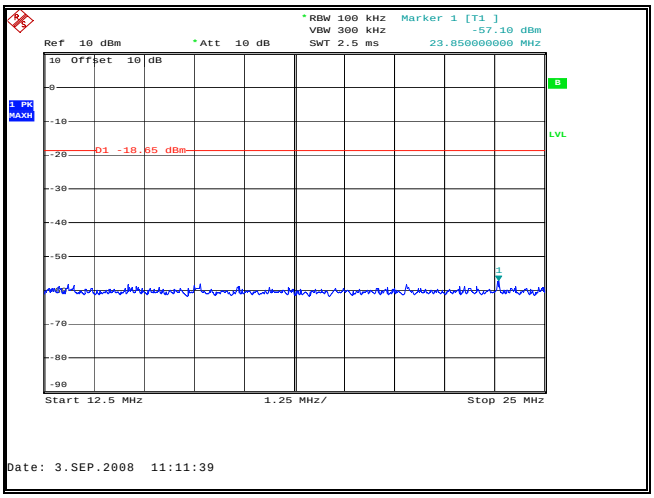

Figure 7.6.2.2-6: 12.5 GHz – 25 GHz – Mid Channel

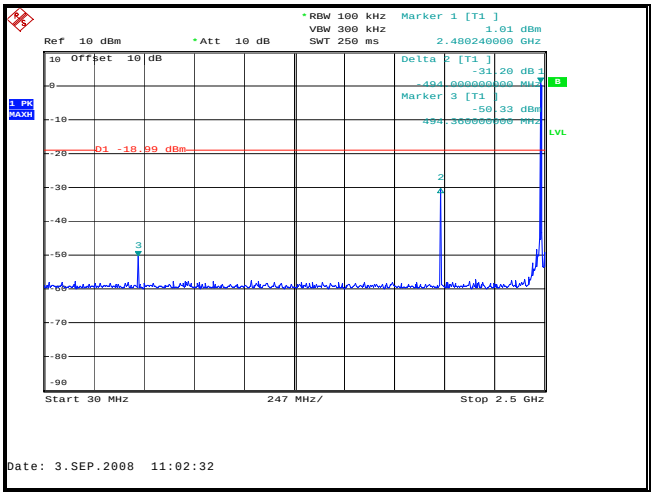

Figure 7.6.2.2-7: 30 MHz – 2.5 GHz – High Channel

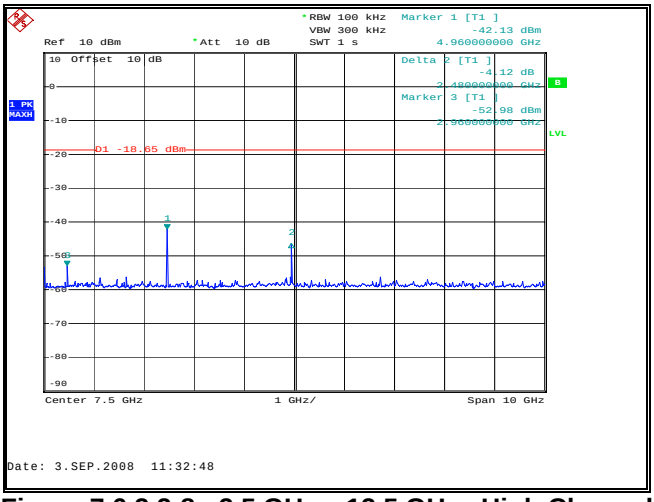

Figure 7.6.2.2-8: 2.5 GHz – 12.5 GHz –High Channel

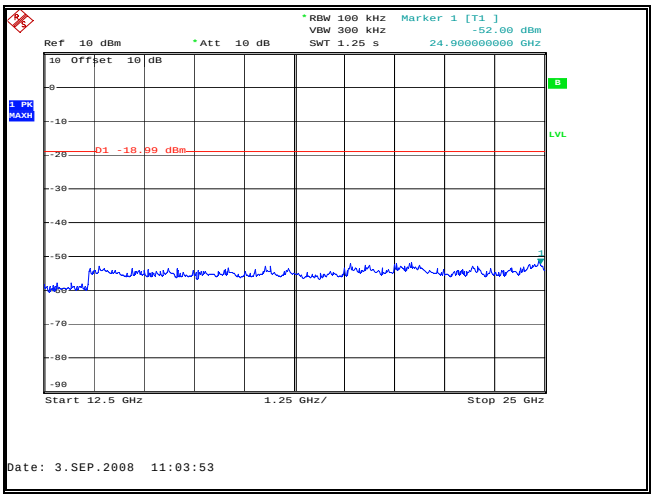

Figure 7.6.2.2-9: 12.5 GHz – 25 GHz –High Channel

7.6.3 Radiated Spurious Emissions (Restricted Bands) - FCC Section 15.205 IC: RSS-210 2.6

7.6.3.1 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. 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.

7.6.3.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 26.37dB to account for the duty cycle of the EUT. The packet transmissions length is 4.8ms. The duty cycle correction factor is determined using the formula: 20log (4.8/100) = -26.37dB.

A detailed analysis of the duty cycle timing is provided in the theory of operations.

7.6.3.3 Test Results

Using the procedures set forth in the FCC KDB Publication No. 558074 “Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)”, radiated spurious emissions found in the band of 30MHz to 25GHz are reported in Table 7.6.3.3-1 to 7.6.3.3-3. Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

Table 7.6.3.3-1: Radiated Spurious Emissions – Low Channel

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
Patch Antenna										
4810	49.69	49.69	H	6.96	56.65	30.27	74.0	54.0	17.35	23.73
4810	49.92	49.92	V	7.06	56.98	30.60	74.0	54.0	17.02	23.40
Monopole Antenna										
4810	47.07	47.07	H	6.96	54.03	27.65	74.0	54.0	19.97	26.35
4810	48.75	48.75	V	7.06	55.81	29.43	74.0	54.0	18.19	24.57

Table 7.6.3.3-2: Radiated Spurious Emissions – Mid Channel

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
Patch Antenna										
4870	48.47	48.47	H	7.14	55.61	29.24	74.0	54.0	18.39	24.76
4870	48.37	48.37	V	7.24	55.61	29.24	74.0	54.0	18.39	24.76
7305	50.00	50.00	H	11.96	61.96	35.58	74.0	54.0	12.04	18.42
7305	53.46	53.46	V	12.02	65.48	39.11	74.0	54.0	8.52	14.89
Monopole Antenna										
4872	45.24	45.24	H	7.15	52.39	26.02	74.0	54.0	21.61	27.98
4872	47.02	47.02	V	7.25	54.27	27.90	74.0	54.0	19.73	26.10
7308	47.30	47.30	H	11.96	59.26	32.89	74.0	54.0	14.74	21.11
7308	48.14	48.14	V	12.02	60.16	33.79	74.0	54.0	13.84	20.21

Table 7.6.3.3-3: Radiated Spurious Emissions – High Channel

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
Patch Antenna										
4960	49.20	49.20	H	7.42	56.62	30.25	74.0	54.0	17.38	23.75
4960	50.37	50.37	V	7.52	57.89	31.52	74.0	54.0	16.11	22.48
7440	47.38	47.38	H	12.11	59.49	33.12	74.0	54.0	14.51	20.88
7440	50.25	50.25	V	12.20	62.45	36.07	74.0	54.0	11.55	17.93
Monopole Antenna										
4960	45.40	45.40	H	7.42	52.82	26.45	74.0	54.0	21.18	27.55
4960	50.02	50.02	V	7.52	57.54	31.17	74.0	54.0	16.46	22.83
7440	45.70	45.70	H	12.11	57.81	31.44	74.0	54.0	16.19	22.56
7440	45.27	45.27	V	12.20	57.47	31.09	74.0	54.0	16.53	22.91

7.6.3.4 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: 49.69+ 6.96= 56.65dBuV/m
Margin: 74dBuV/m – 56.65dBuV/m = 17.35dB

Example Calculation: Average

Corrected Level: 49.69+ 6.96-26.37= 30.27dBuV
Margin: 54dBuV – 30.27dBuV = 23.73dB

7.7 Peak Power Spectral Density- FCC Section 15.247(d) IC: RSS-210 A8.2(b)

7.7.1 Test Methodology

The power spectral density was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The emission peaks within the pass band were located and zoomed in on. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 500 kHz and the sweep time was calculated to be 168s (Span/3 kHz).

7.7.2 Test Results

Results are shown below in table 7.7.2-1 and figures 7.7.2-1 – 7.7.2-3:

Table 7.7.2-1: Peak Power Spectral Density

Frequency (MHz)	PSD Level (dBm)
2405	-4.25
2435	-5.07
2480	-5.71

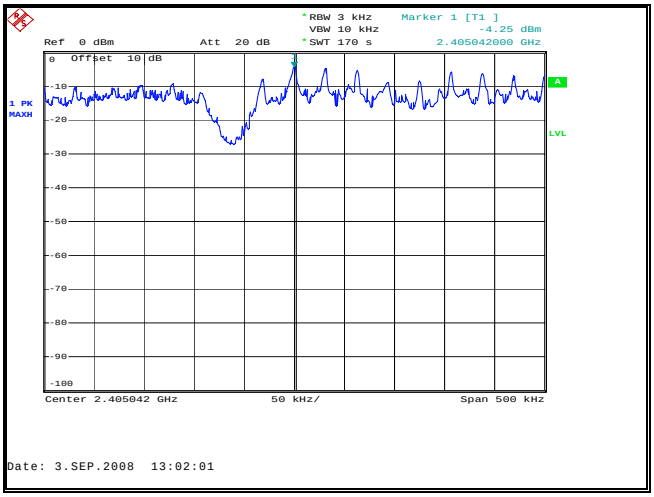

Figure 7.7.2-1: Power Spectral Density Plot – Low Channel

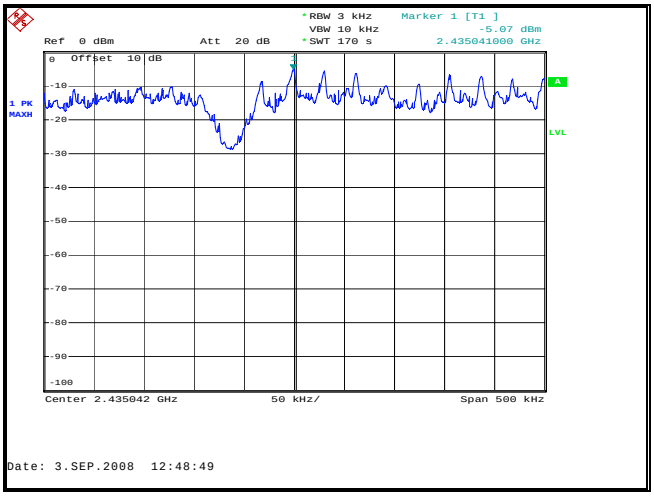

Figure 7.7.2-2: Power Spectral Density Plot – Mid Channel

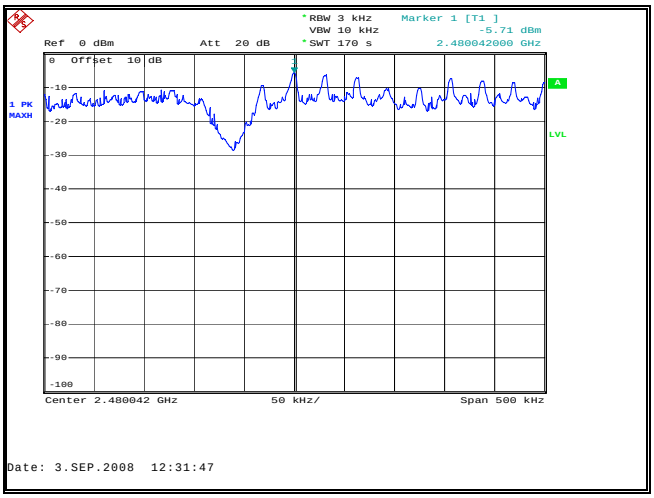

Figure 7.7.2-3: Power Spectral Density Plot – High Channel

8.0 CONCLUSION

In the opinion of ACS, Inc. the XDM2140, 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