



Engineering and Testing for EMC and Safety Compliance

Limited Modular Approval Certification Application Report
FCC Part 15.231 & Industry Canada RSS-210

Test Lab:		Applicant:	
Rhein Tech Laboratories, Inc. Tel: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 E-Mail: atcbinfo@rheintech.com		Fleetwood Group, Inc. Tel: 616-820-8271 11832 James Street Fax: 616-820-8300 Holland, MI 49424 Contact: Will Buehler	
FCC ID/ IC:	FBRVL4B 1859A-VL4B	Test Report Date:	August 12, 2010
Platform:	N/A	RTL Work Order #:	2010155
Model:	VL4B	RTL Quote #:	QRTL10-165
American National Standard Institute:	ANSI C63.4-2003: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz		
FCC Classification:	DSC – Part 15 Security/Remote Control Transmitter		
FCC Rule Part(s)/Guidance:	FCC Rules Part 15.231: Periodic operation in the band 40.66–40.70 MHz and above 70 MHz (10-01-09)		
Industry Canada:	RSS-210 Issue 7: Low Power License-Exempt Communications Devices		
Digital Interface Information:	Digital Interface was found to be compliant		
Frequency Range (MHz)	Output Power* (W)	Frequency Tolerance	Emission Designator
433.9	N/A	N/A	143KM1D

* power is calculated radiated peak limit

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, Industry Canada RSS-210, and ANSI C63.4.

Signature: Desmond A. Fraser

Date: August 12, 2010

Typed/Printed Name: Desmond A. Fraser

Position: President

This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc. and Fleetwood Group, Inc. The test results relate only to the item(s) tested.

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACCLASS. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

This is an original Limited Modular Approval certification application test report.

Applicable Standards:

- FCC Rules Part 15.231: Periodic operation in the band 40.66–40.70 MHz and above 70 MHz (15.231(e) limits)
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices

1.2 Description of EUT

Model	VL4B
Power Supply	Internal 3 VDC Battery
Frequency Range	433.9 MHz
Antenna Type	Internal PCB Trace

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4-2003).

1.4 Related Submittal(s)/Grant(s)

This is an original application for Limited Modular Approval for Fleetwood Group, Inc., Model: VL4B, FCC ID: FBRVL4B, IC: 1859A-VL4B.

1.5 Modifications

The 150 ohm resistor was changed to 180 ohm at antenna to reduce transmitter fundamental to achieve passing results.

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2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band of one frequency, the following frequency was tested.

Table 2-1: Channels Tested

Frequency
433.9

2.2 Exercising the EUT

The EUT was supplied with test firmware programmed to transmit continuously, as well as in an original configuration for bandwidth and timing tests. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.231)

Standard	Test	Pass/Fail or N/A
FCC 15.209	Radiated Emissions	Pass
FCC 15.231(e)	Maximum Peak Power Output	Pass
FCC 15.231(c)	20 dB Bandwidth	Pass

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2.4 Test System Details

The test samples were received on August 7, 2010. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following table.

Table 2-3: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Transmitter (Continuous Transmission)	Fleetwood Group Inc.	VL4B	N/A	FBRVL4B	N/A	19843
Transmitter (Normal Modulation)	Fleetwood Group Inc.	VL4B	N/A	FBRVL4B	N/A	19844

2.5 Configuration of Tested System

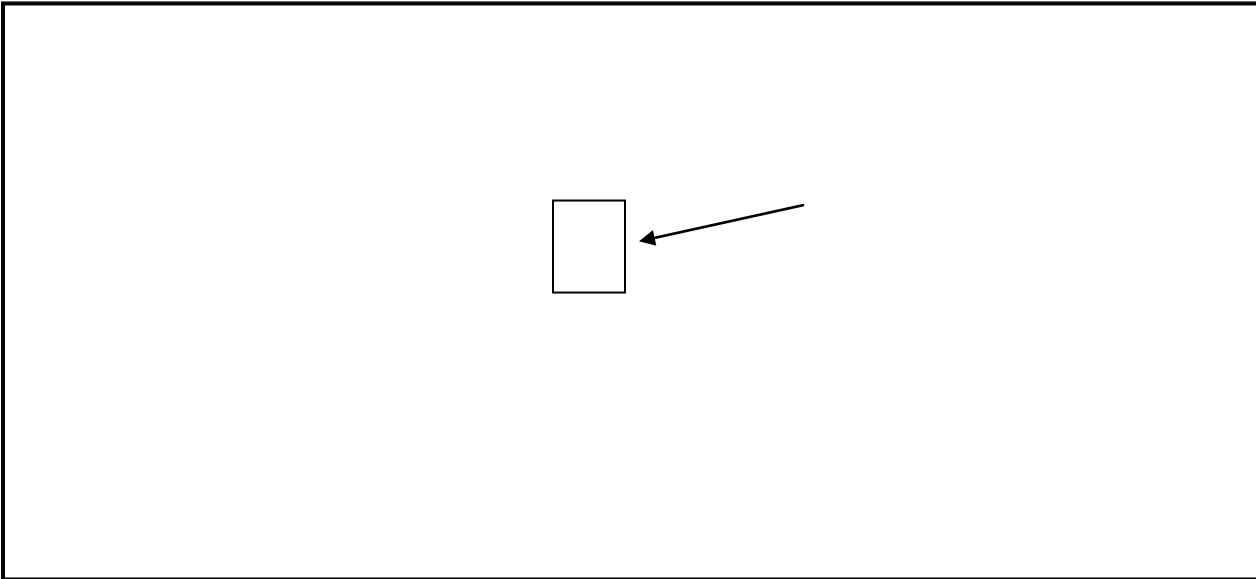


Figure 2-1: Configuration of System Under Test

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3 20 dB Bandwidth – FCC §15.231(c); IC RSS-210 A1.1.3

3.1 20 dB Bandwidth Test Procedure

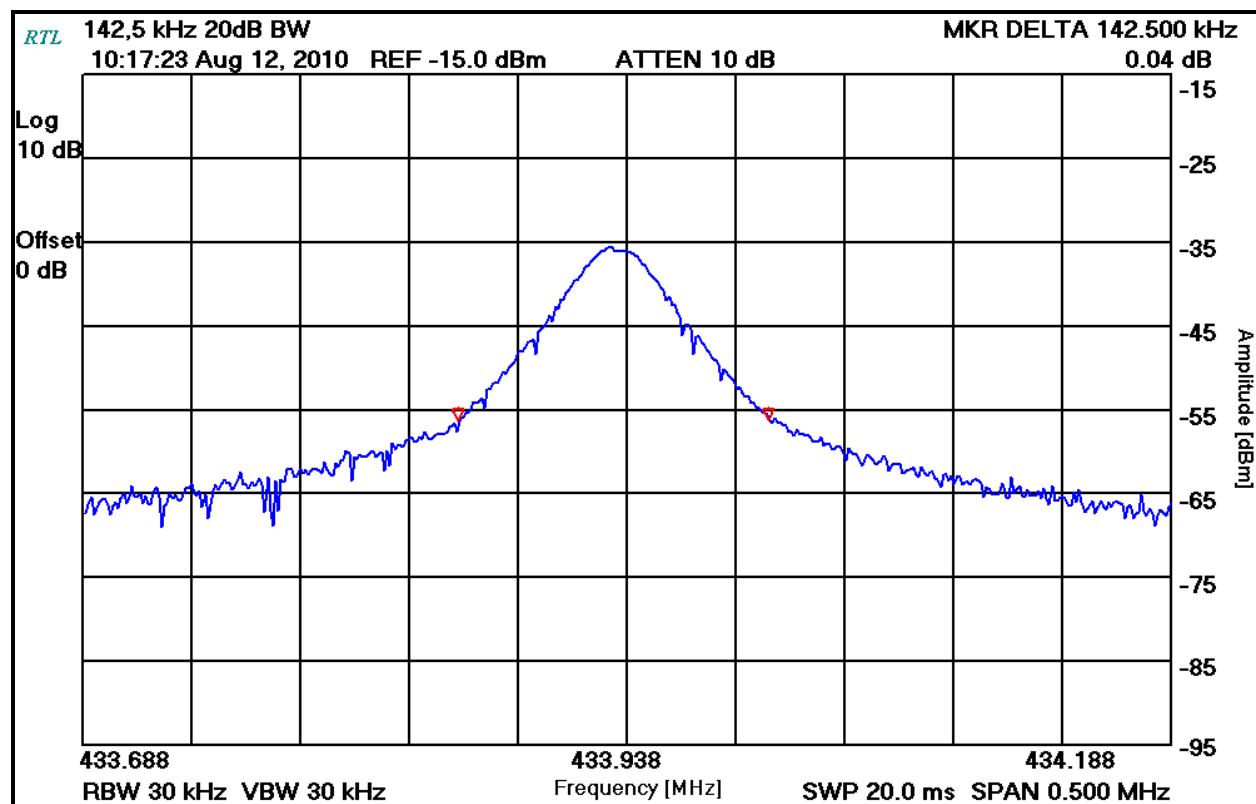
The minimum 20 dB bandwidths were measured using a 50 ohm spectrum analyzer. The carrier was adjusted on the analyzer so that it was displayed entirely on the spectrum analyzer. The sweep time was set to 1 second and allowed through several sweeps with the max hold function used in peak detector mode. The resolution bandwidth was set to 30 kHz, and the video bandwidth set at 30 kHz. The minimum 20 dB bandwidths were measured using the spectrum analyzer delta marker set 20 dB down from the peak of the carrier. The table below contains the bandwidth measurement results.

Table 3-1: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	8/02/11

3.2 20 dB Modulated Bandwidth Test Data

Plot 3-1: 20 dB Bandwidth – 433.9 MHz



Test Personnel:

Dan Baltzell
 EMC Test Engineer

Signature

August 12, 2010
 Date of Test

4 Duty Cycle

The following maximum case information was supplied by Fleetwood Group, Inc.:

An encoded transmission consists of defined train of forty-six 225 ms pulses.

The encoding of the logical 1's and 0's is determined by the space (off time) between the pulses.

The off time of approximately 1.2 ms determines the logical "0"(zero).

The off time of approximately 1.9 ms determines the logical "1"(one).

The pulse train consists of:

1. Four preamble pulses separated by approximately 1.24 ms off time
2. An off time of approximately 6.75 ms.
3. Forty-two pulses separated by off time of either 1.24 ms or 1.91 ms.

If all forty-two encoding pulses are separated by 1.24 ms, then the maximum value of the emission is calculated as follows:

Pulse on time:

Total on time $46 \times 0.225 \text{ ms}$ 10.35 ms

Pulse word period:

1. Preamble on time $4 \times 0.225 \text{ ms}$	0.90 ms
2. Preamble off time $3 \times 1.24 \text{ ms}$	3.72 ms
3. Preamble space time 6.75 ms	6.75 ms
4. Encoded pulses $42 \times 0.225 \text{ ms}$	9.45 ms
5. Encoded off time $41 \times 1.24 \text{ ms}$	50.84 ms

TOTAL pulse word period 71.66 ms

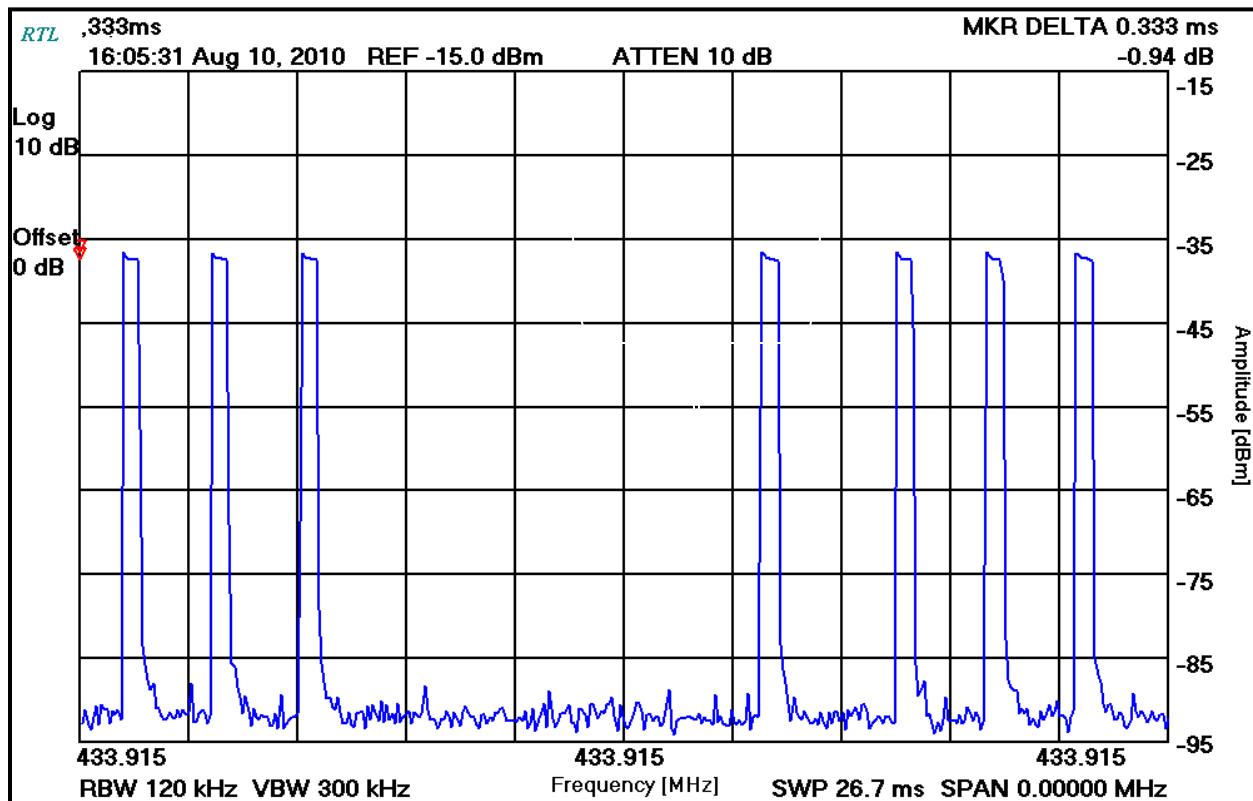
Duty cycle factor (maximum time on) is:

1. Numeric factor: $(10.35 \text{ ms} / 71.66 \text{ ms}) = 0.144$
2. dB factor: $20 * \text{LOG}(0.144) = -16.88 \text{ dB}$

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Plot 4-1: Pulse Width



Test Personnel:

Dan Baltzell
EMC Test Engineer

Signature

August 10, 2010

Date of Test

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Measured number of pulses in 100 ms = 43 X Pulse width = 0.333 ms = 14.319 %

Duty cycle correction = 20 Log (0.14319) = - 16.88 dB

Plot 4-2: Number of Pulses in 100 ms

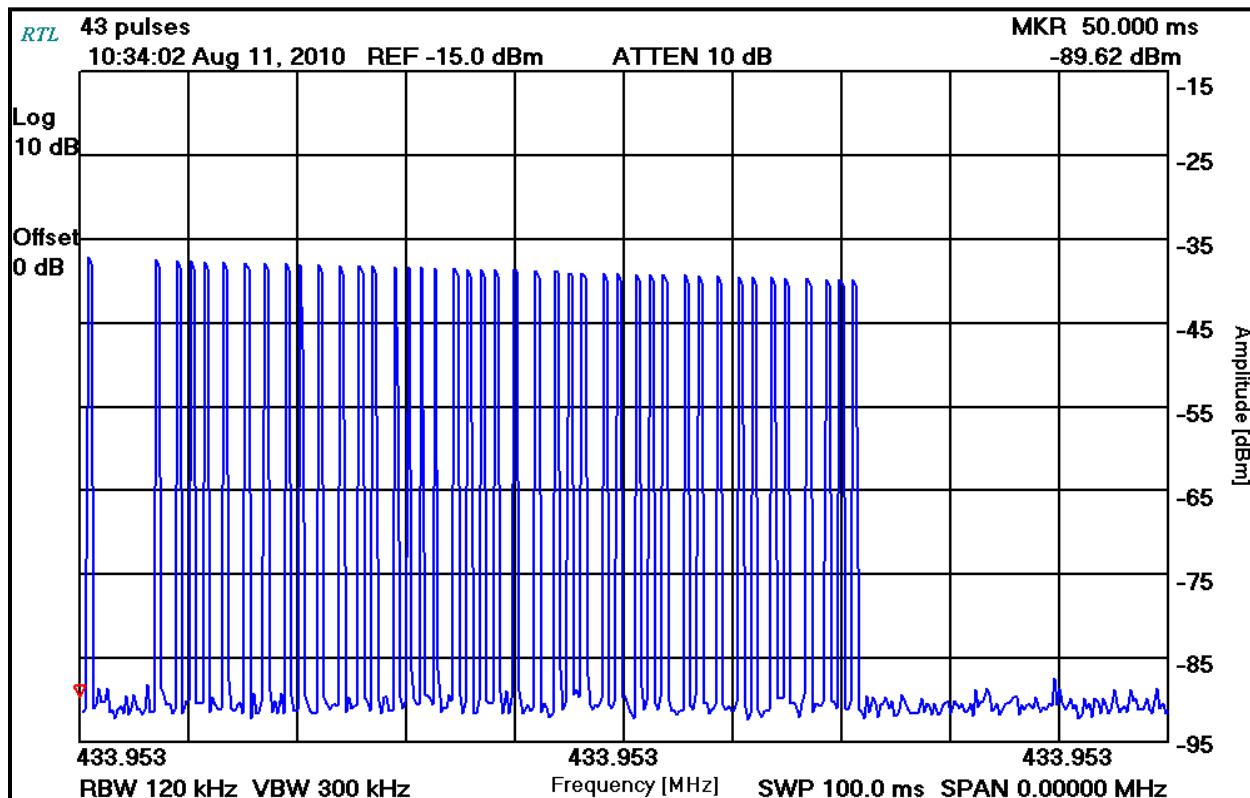


Table 4-1: Duty Cycle Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159	8/02/11

Test Personnel:

Dan Baltzell
 EMC Test Engineer



Signature

August 11, 2010

Date of Test

5 Radiated Emissions Test Results - FCC Rules and Regulations Part §15.231(e); IC RSS-210 A1.1.5

5.1 Limits of Radiated Emissions Measurement

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66– 40.70.	1,000	100
70–130	500	50
130–174	500 to 1,500 ¹	50 to 150 ¹
174–260	1,500	150
260–470	1,500 to 5,000 ¹	150 to 500 ¹
Above 470	5,000	500

¹ Linear interpolations.

5.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency (24.8 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

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Table 5-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901364	MITEQ	JS4-01002600-36-5P	Amplifier 0.1-26 GHz, 28 dB gain, power 5 dB	849863	2/22/11
900878	Rhein Tech Laboratories, Inc.	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901516	Insulated Wire, Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/17/10
901517	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/17/10
901242	Rhein Tech Laboratories, Inc.	WRT-000-0003	Wood rotating table	N/A	Not Required
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	11/23/10
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	12/12/10
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	6/14/11
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/11

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5.2.1 Radiated Emissions Harmonics/Spurious Test Data

Table 5-2: Peak Radiated Emissions Harmonics

Emission Frequency (MHz)	Antenna Polarity (H/V)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
433.915	H	66.6	21.9	88.5	92.9	-4.4
867.850	V	54.7	-2.8	51.9	72.9	-21.0
1301.786	V	57.1	3.7	60.8	72.9	-12.1
1735.720	H	37.5	8.1	45.6	72.9	-27.3
2169.635	V	42.0	-2.9	39.1	72.9	-33.8
2603.550	H	38.0	-2.9	35.1	72.9	-37.8
3037.465	V	47.9	-3.0	44.9	72.9	-28.0
3471.380	V	40.7	-2.5	38.2	72.9	-34.7
3905.295	H	37.2	-1.6	35.6	72.9	-37.3
4339.210	V	28.6	4.0	32.6	72.9	-40.3

Table 5-3: Average Radiated Emissions Harmonics

Emission Frequency (MHz)	Antenna Polarity (H/V)	Peak Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Average Emission Level (-16.88 dB Duty Cycle Correction Factor) (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
433.915	H	66.6	21.9	71.6	72.9	-1.3
867.850	V	54.7	-2.8	35.0	52.9	-17.9
1301.786	V	57.1	3.7	43.9	52.9	-9.0
1735.720	H	37.5	8.1	28.7	52.9	-24.2
2169.635	V	42.0	-2.9	22.2	52.9	-30.7
2603.550	H	38.0	-2.9	18.2	52.9	-34.7
3037.465	V	47.9	-3.0	28.0	52.9	-24.9
3471.380	V	40.7	-2.5	21.3	52.9	-31.6
3905.295	H	37.2	-1.6	18.7	52.9	-34.2
4339.210	V	28.6	4.0	15.7	52.9	-37.2

Test Personnel:

Daniel W. Baltzell
 Test Engineer

Signature

August 10, 2010
 Date Of Test

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6 Conclusion

The data in this measurement report shows that the EUT as tested, Fleetwood Group, Inc., Model: VL4B, FCC ID: FBRVL4B, IC: 1859A-VL4B, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations, and Industry Canada RSS-210 and RSS-Gen for limited modular approval.