



Engineering and Testing for EMC and Safety Compliance

**Limited Modular Approval Certification Application Report
FCC Part 15.249 & Industry Canada RSS-210**

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FCC ID/IC:	FBRV240S/ 1859A-V240S	Test Report Date:	January 31, 2011
Platform:	N/A	RTL Work Order #:	2010235
Model:	V240S	RTL Quote #:	QRTL10-183B
American National Standard Institute:	ANSI C63.4: 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:	DXT – Part 15 Low Power Transceiver		
FCC Rule Part(s)/Guidance:	15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz, October 1, 2009		
Industry Canada:	RSS-210 Issue 8: License-Exempt Radio Apparatus (All Frequency Bands): Category I Equipment		
Digital Interface Information:	Digital Interface was found to be compliant		
Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
2401 – 2475	N/A	N/A	796KFXD

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 and ANSI C63.4.

Signature: 

Date: January 31, 2011

Typed/Printed Name: Desmond A. Fraser

Position: President

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

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1 General Information

1.1 Scope

This is an original certification application request for Limited Modular Approval.

Applicable Standards:

- FCC Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices

1.2 Description of EUT

Equipment Under Test	Sensor Transceiver
Model	V240S
Power Supply	3 Internal "D" size cells (1.5VDC) low voltage DC
Modulation Type	GFSK
Frequency Range	2401 – 2475 MHz
Antenna Connector Type	PCB Trace type
Antenna Type	Internal

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).

1.4 Related Submittal(s)/Grant(s)

This is an original application for Limited Modular Approval for Fleetwood Group, Inc., Model: V240S, FCC ID: FBRV240S, IC: 1859A-V240S.

1.5 Modifications

No modifications were made to the equipment during testing in order to achieve compliance with these standards.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

Table 2-1: Channels Tested

Channel	Frequency
Low	2401
Middle	2437
High	2475

2.2 Exercising the EUT

The EUT was supplied with test firmware programmed with a high, mid, and low channel for testing as well as a low, mid, and high power. The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. Four power levels were available for testing.

2.3 Test Result Summary

Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.249)

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	N/A
FCC 15.209	Radiated Emissions	Pass
FCC 15.249(a)	Field Strength of Fundamental and Harmonics	Pass
RSS-Gen	20 dB Bandwidth	Pass

2.4 Test System Details

The test samples were received on January 26, 2011. 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
Versus 2.4 Sensor Transceiver	Fleetwood Group Inc.	V240S	TX	FBRV240S	N/A	19984

2.5 Configuration of Tested System

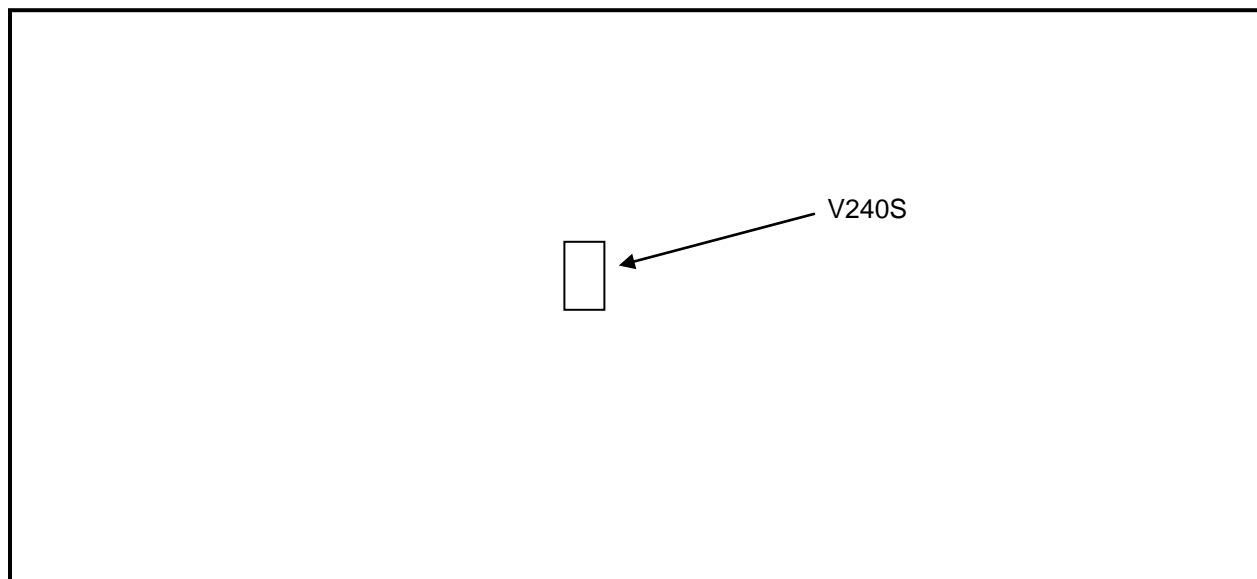


Figure 2-1: Configuration of System Under Test

3 Duty Cycle Calculation - FCC §15.35(c), RSS-Gen §4.3

A standard transmission consists of an 859 μ s data packet with a 37.5 ms transmission period. Therefore, the maximum aggregate on time within a transmission period of 100 ms is $859 \times (100/37.5)$, or $20\text{Log}(2.3/100) = 32.8\text{dB}$.

The duty cycle correction is 32.8 dB.

4 Radiated Emissions – FCC §15.209, §15.249(a); RSS-210 §A2.9; RSS-Gen

4.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any circumstances of modulation.

4.2 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 at three meters distance. 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.

Table 4-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	10/1/12
901364	MITEQ	JS4-01002600-36-5P	Amplifier 0.1-26 GHz, 28 dB gain, power 5 dB	849863	2/22/11
900905	Rhein Tech Laboratories	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	4/10/11
900878	Rhein Tech Laboratories	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	10/19/11
901517	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/19/11
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	Not Required
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz – 6.5 GHz)	3325A00159	8/2/11
900914	Hewlett Packard	85460A	RF Filter Section (100 kHz - 6.5 GHz)	3330A00107	8/2/11
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	06/14/11
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	06/14/11
900323	EMCO	3160-07	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	06/14/11
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	06/14/11
900325	EMCO	3160-9	Horn Antenna (18 - 26.5 GHz)	9605-1051	06/14/11
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/11/11
900724	Antenna Research Associates, Inc.	LPB-2520	LOG/Biconical Antenna (25 – 1000 MHz)	1037	7/17/11

4.3 Radiated Emissions Test Results

Table 4-2: Radiated Emissions Test Data

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV/m) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Calculated Average (dBuV/m) (-32.8 dB)	Average Limit (dBuV/m)	Average Margin (dB)
2401.0	75.2	24.9	100.1	114.0	-13.9	67.3	94.0	-26.7
2437.0	75.1	24.9	100.0	114.0	-14.0	67.2	94.0	-26.8
2475.0	75.7	38.3	100.8	114.0	-13.3	68.0	94.0	-26.1

4.4 Radiated Emissions Harmonics/Spurious Test Data

Table 4-3: Radiated Emissions Harmonics/Spurious - 2401 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV/m) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Calculated Average (dBuV/m) (-32.8 dB)	Average Limit (dBuV/m)	Average Margin (dB)
4802.0	35.1	2.3	37.4	74.0	-36.6	4.6	54.0	-49.4
7203.0	26.7	5.4	32.1	74.0	-41.9	-0.7	54.0	-54.7
9604.0	24.3	12.6	36.9	74.0	-37.1	4.1	54.0	-49.9
12005.0	22.3	13.7	36.0	74.0	-38.0	3.2	54.0	-50.8

Table 4-4: Radiated Emissions Harmonics/Spurious - 2437 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV/m) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Calculated Average (dBuV/m) (-32.8 dB)	Average Limit (dBuV/m)	Average Margin (dB)
4874.0	34.7	2.4	37.1	74.0	-36.9	4.3	54.0	-49.7
7311.0	26.0	5.6	31.6	74.0	-42.4	-1.2	54.0	-55.2
9748.0	24.5	12.8	37.3	74.0	-36.7	4.5	54.0	-49.5
12185.0	22.1	14.2	36.3	74.0	-37.7	3.5	54.0	-50.5

Table 4-5: Radiated Emissions Harmonics/Spurious - 2475 MHz

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV/m) (1 MHz RBW/VBW)	Site Correction Factor (dB/m)	Peak Corrected (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Calculated Average (dBuV/m) (-32.8 dB)	Average Limit (dBuV/m)	Average Margin (dB)
4950.0	33.3	2.5	35.8	74.0	-38.2	3.0	54.0	-51.0
7425.0	26.2	5.8	32.0	74.0	-42.0	-0.8	54.0	-54.8
9900.0	24.6	12.9	37.5	74.0	-36.5	4.7	54.0	-49.3
12375.0	22.4	14.7	37.1	74.0	-36.9	4.3	54.0	-49.7


4.5 Radiated Emissions Digital Test Data

Table 4-6: Digital Radiated Emissions Test Data

Temperature: 28°F Humidity: 61%								
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
32.0	Qp	H	34.1	-13.8	20.3	40.0	-19.7	Pass
64.0	Qp	V	41.3	-22.2	19.1	40.0	-20.9	Pass
96.0	Qp	H	33.6	-21.8	11.8	43.5	-31.7	Pass
128.0	Qp	H	33.8	-19.0	14.8	43.5	-28.7	Pass
352.0	Qp	H	33.0	-13.6	19.4	46.0	-26.6	Pass
576.0	Qp	H	32.8	-7.9	24.9	46.0	-21.1	Pass
672.0	Qp	H	32.7	-6.2	26.5	46.0	-19.5	Pass
704.0	Qp	H	32.4	-5.0	27.4	46.0	-18.6	Pass
736.0	Qp	H	32.4	-4.7	27.7	46.0	-18.3	Pass
1200.6	Av	V	34.3	1.9	36.2	54.0	-17.8	Pass
1218.6	Av	H	34.0	2.1	36.1	54.0	-17.9	Pass
1237.6	Av	V	33.8	2.3	36.1	54.0	-17.9	Pass

Test Personnel:

Daniel W. Baltzell
Test Engineer



Signature

January 31, 2011
Date Of Test

5 AC Conducted Emissions - FCC §15.207; RSS-Gen §7.2.4: Conducted Limits; ANSI C63.4 Section 7

No AC conducted tests are required since the device is powered solely by a 3 1.5 VDC “D” size cells.

6 20 dB Bandwidth – IC RSS-Gen

6.1 20 dB Bandwidth Test Procedure

The minimum 20 dB bandwidths per RSS-Gen were measured using a 50-ohm spectrum analyzer. The modulated carrier was adjusted on the analyzer so that it was displayed entirely on the spectrum analyzer. The sweep time was auto and allowed through several sweeps with the max hold function used in peak detector mode. The resolution bandwidth was set to 100 kHz, and the video bandwidth set to 1 MHz. The table below contains the bandwidth measurement results.

Table 6-1: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/11/11

6.2 20 dB Modulated Bandwidth Test Data

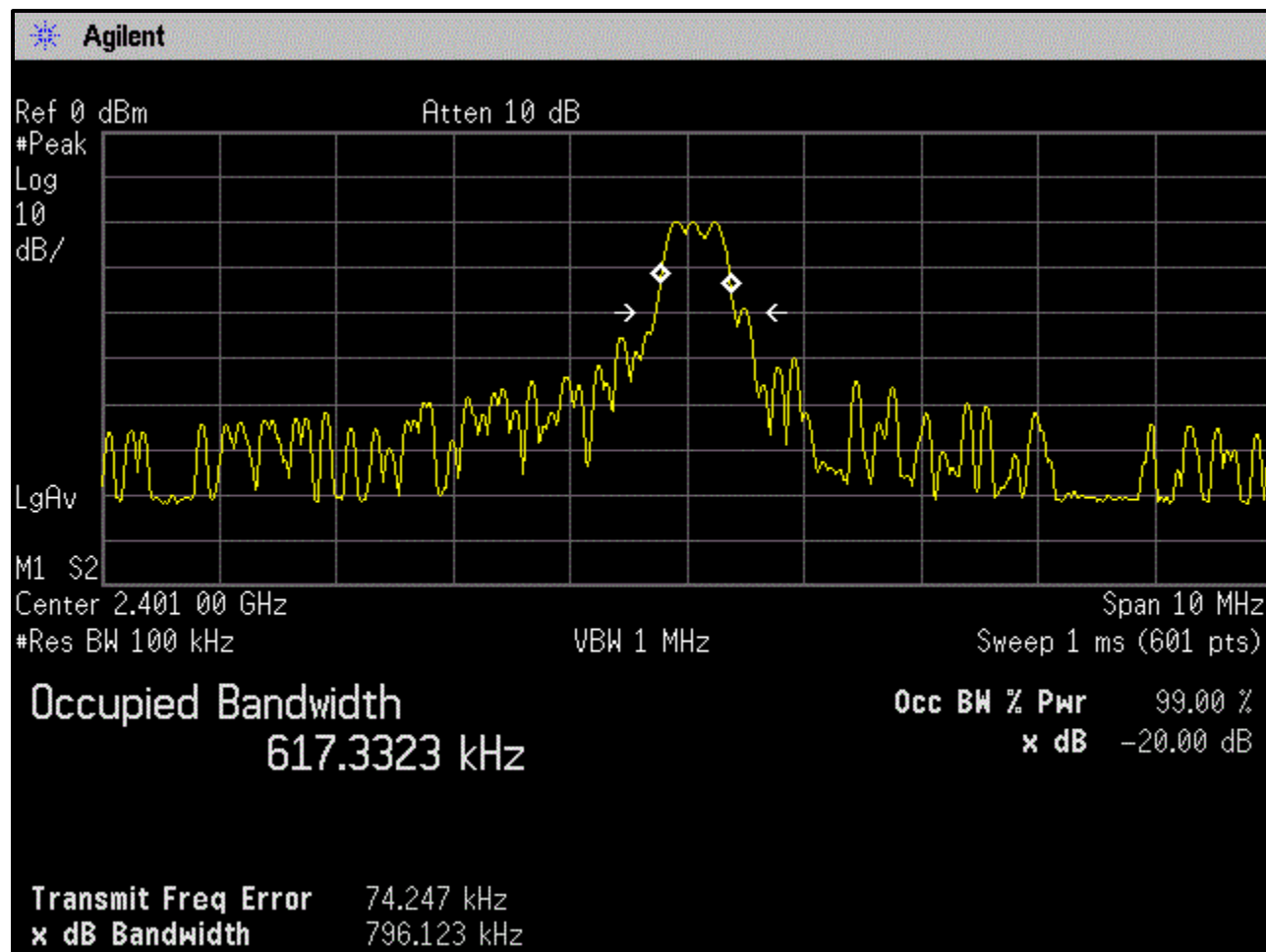
Table 6-2: 20 dB Modulated Bandwidth Test Data

Minimum 20 dB bandwidths	
Channel	20 dB Bandwidth (kHz)
1	796.1
37	707.6
75	706.7

6.3 20 dB Bandwidth Plots

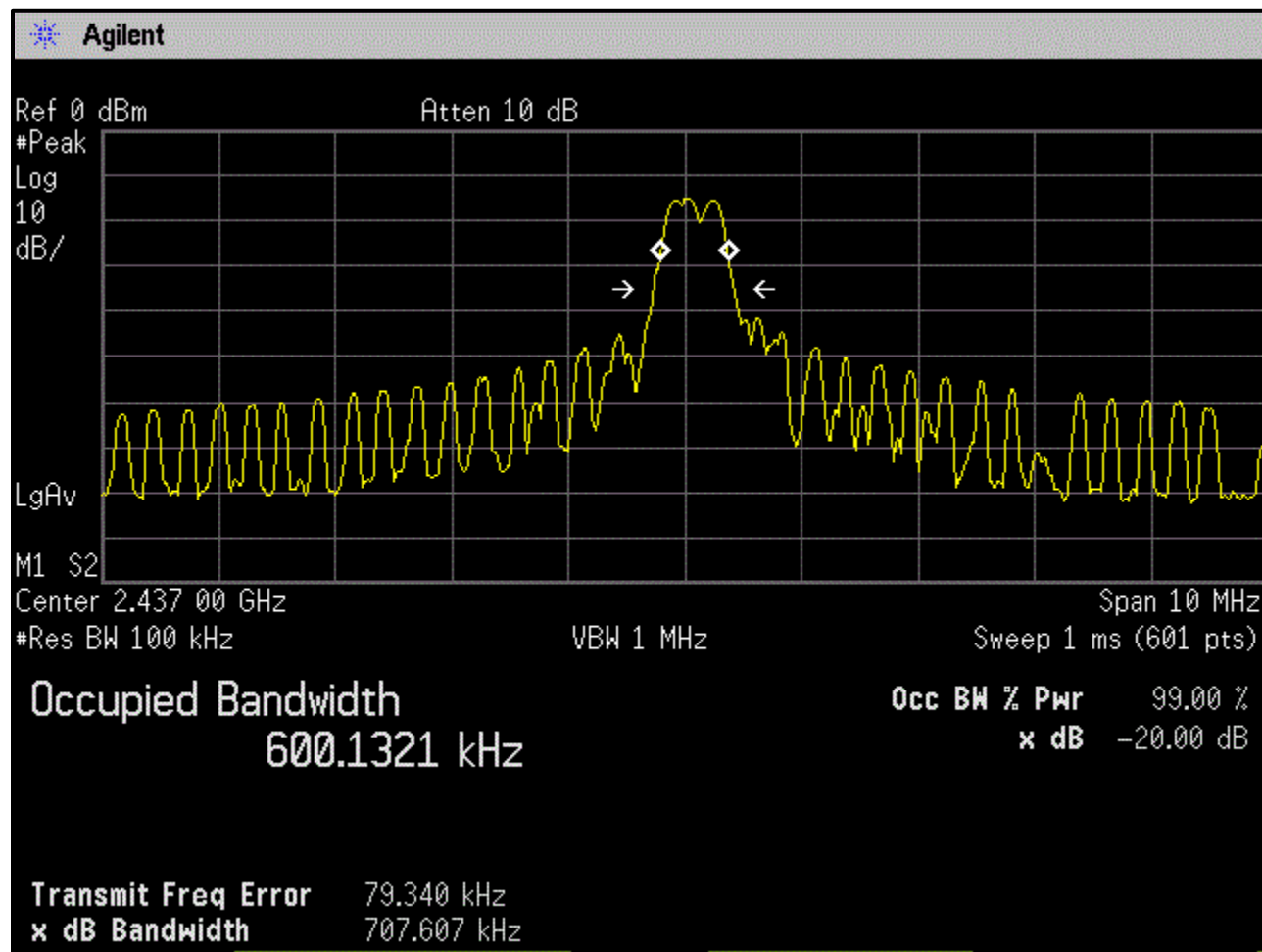
Channel: 1
 Channel Frequency (MHz): 2401
 Resolution Bandwidth (kHz): 100
 Video Bandwidth (MHz): 1
 Span (MHz): 10

Plot 6-1: 20 dB Bandwidth Channel 1



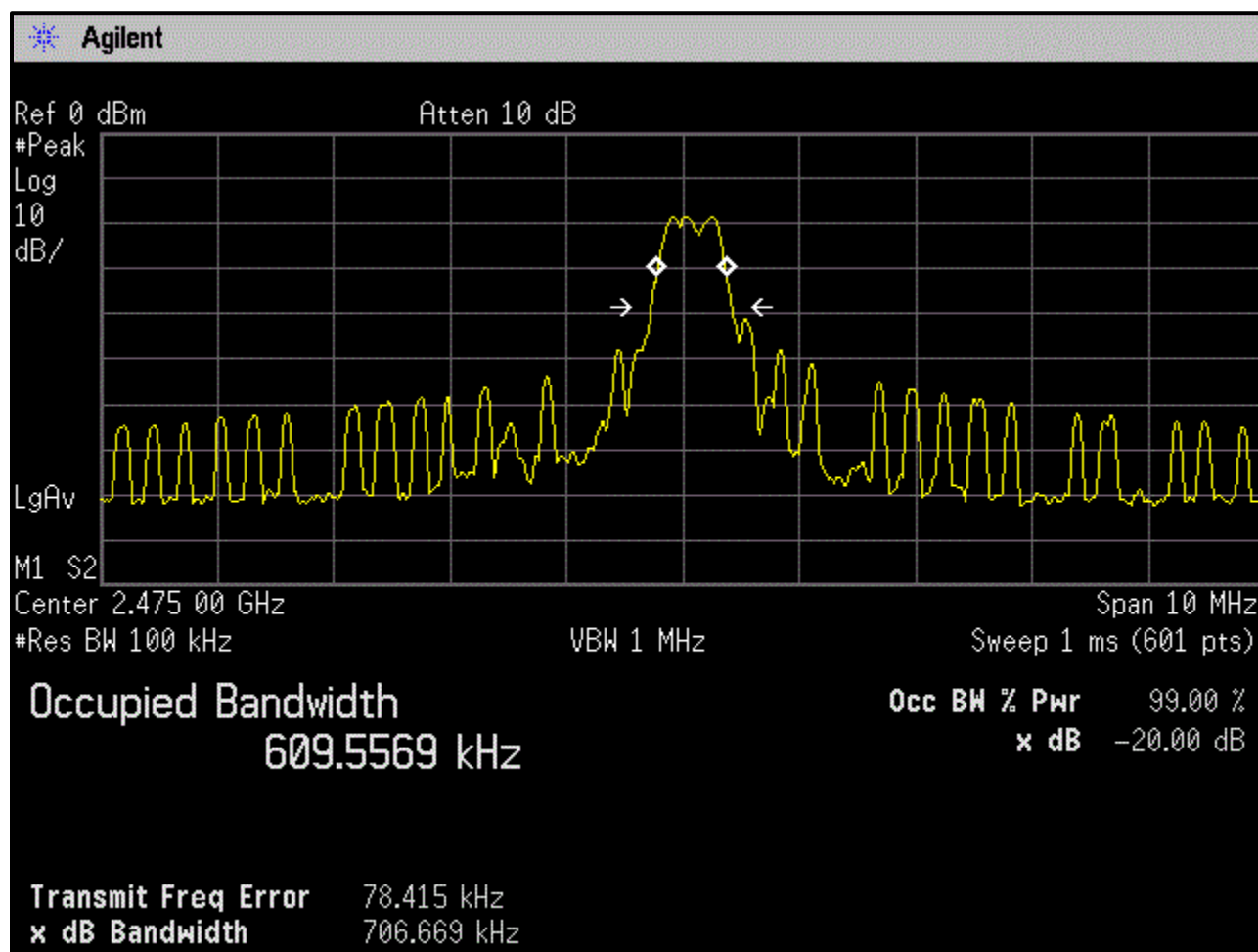
Channel: 37
Channel Frequency (MHz): 2437
Resolution Bandwidth (kHz): 100
Video Bandwidth (MHz): 1
Span (MHz): 10

Plot 6-2: 20 dB Bandwidth Channel 37



Channel: 75
Channel Frequency (MHz): 2475
Resolution Bandwidth (kHz): 100
Video Bandwidth (MHz): 1

Plot 6-3: 20 dB Bandwidth Channel 75



Test Personnel:

Daniel W. Baltzell
Test Engineer

Signature

January 28, 2011
Date Of Test

7 Conclusion

The data in this measurement report shows that the EUT as tested, Fleetwood Group, Inc., Model: V240S, FCC ID: FBRV240S, IC: 1859A-V240S, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations and IC RSS-210 and RSS-Gen for Limited Modular Approval.