Limited Modular Approval Certification Application Report
FCC Part 15.247 & 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:	FBRV2420G/ 1859A-V2420G	**Test Report Date:**	April 7, 2011
Platform:	N/A	**RTL Work Order #:**	2010234
Model:	V2420G	**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:	DSS – Part 15 Spread Spectrum Transmitter		
FCC Rule Part(s)/Guidance:	FCC Rules Part 15.247: Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System (10-01-10), DA 00-705		
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	0.120	N/A	1M00FXD

** power is peak conducted*

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: April 7, 2011

Typed/Printed Name: Desmond A. Fraser Position: President

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 test report for Limited Modular Approval.

Applicable Standards:

- FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- Industry Canada RSS-210: Low Power License-Exempt Communications Devices

1.2 Description of EUT

Equipment Under Test	Gateway Transceiver
Model	V2420G
Power Supply	POE or 6 VDC AC adapter
Modulation Type	GFSK (250 Kbps and 1 Mbps rates)
Frequency Range	2401 – 2475 MHz
Antenna Connector Type	PCB Trace or external
Antenna Type	Internal or external

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: V2420G, FCC ID: FBRV2420G, IC: 1859A-V2420G.

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 low, mid and high 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 15.247)

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(b)	Maximum Peak Power Output	Pass
FCC 15.247(d)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	Band Edge Measurement	Pass
FCC 15.247(a)(1)	Carrier Frequency Separation	Pass
FCC 15.247(a)(1)(ii)	20 dB Bandwidth	Pass
FCC 15.247(a)(1)(iii)	Hopping Characteristics	Pass
FCC 15.247(a)(1)(iii)	Average Time of Occupancy	Pass

2.4 Test System Details

The test samples were received on March 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
Gateway Transceiver	Fleetwood Group, Inc.	V2420G	N/A	FBRV2420G	N/A	20068
Power Over Ethernet	Ault Inc.	PW130	RB4800F01	N/A	1.2m Unshielded Power; 9m unshielded Ethernet	20071
6V AC Adapter	GlobTek, Inc.	GT-41052-1506	N/A	N/A	1m unshielded with ferrite	20069
2.4 GHz Swivel Antenna	Nearson	131	N/A	N/A	N/A	20070

2.5 Configuration of Tested System

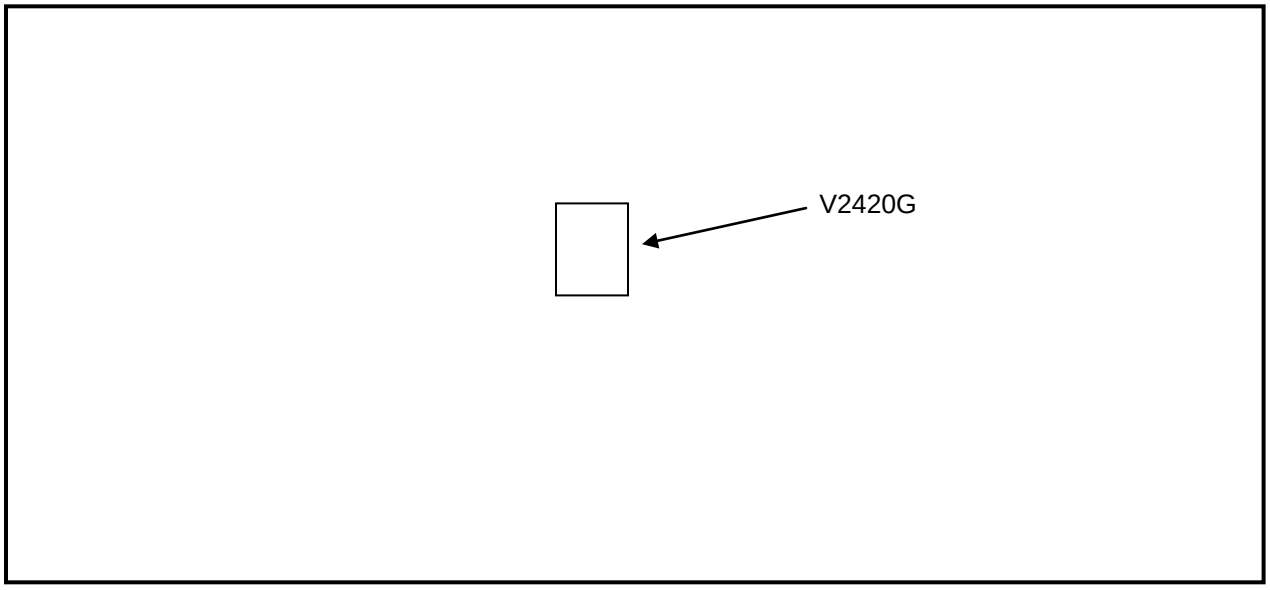


Figure 2-1: Configuration of System under Test

3 Peak Output Power – FCC §15.247(b)(1); RSS-210 §A8.4(2)

3.1 Power Output Test Procedure

A power measurement of the EUT was taken using an Agilent E9323A power meter.

Table 3-1: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	1/11/12
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	1/11/12

3.2 Power Output Test Data

Table 3-2: Power Output Test Data

Frequency (MHz)	Level Measured (dBm)
2401	20.8
2437	20.1
2475	18.8

Test Personnel:

Daniel W. Baltzell		March 28, 2011
EMC Test Engineer	Signature	Date of Test

4 Antenna Conducted Spurious Emissions – FCC §15.247(d); RSS-210 §A8.5

No spurious emissions were found within 20 dB of the limit, therefore no emissions are reported.

Table 4-1: Antenna Conducted Spurious Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz-12.8 GHz)	3826A00144	1/13/12

Test Personnel:

Daniel W. Baltzell		March 28, 2011
EMC Test Engineer	Signature	Date of Test

5 Band-Edge Compliance of RF Conducted Emissions – FCC §15.247(d); RSS-Gen

5.1 Band Edge Test Procedure

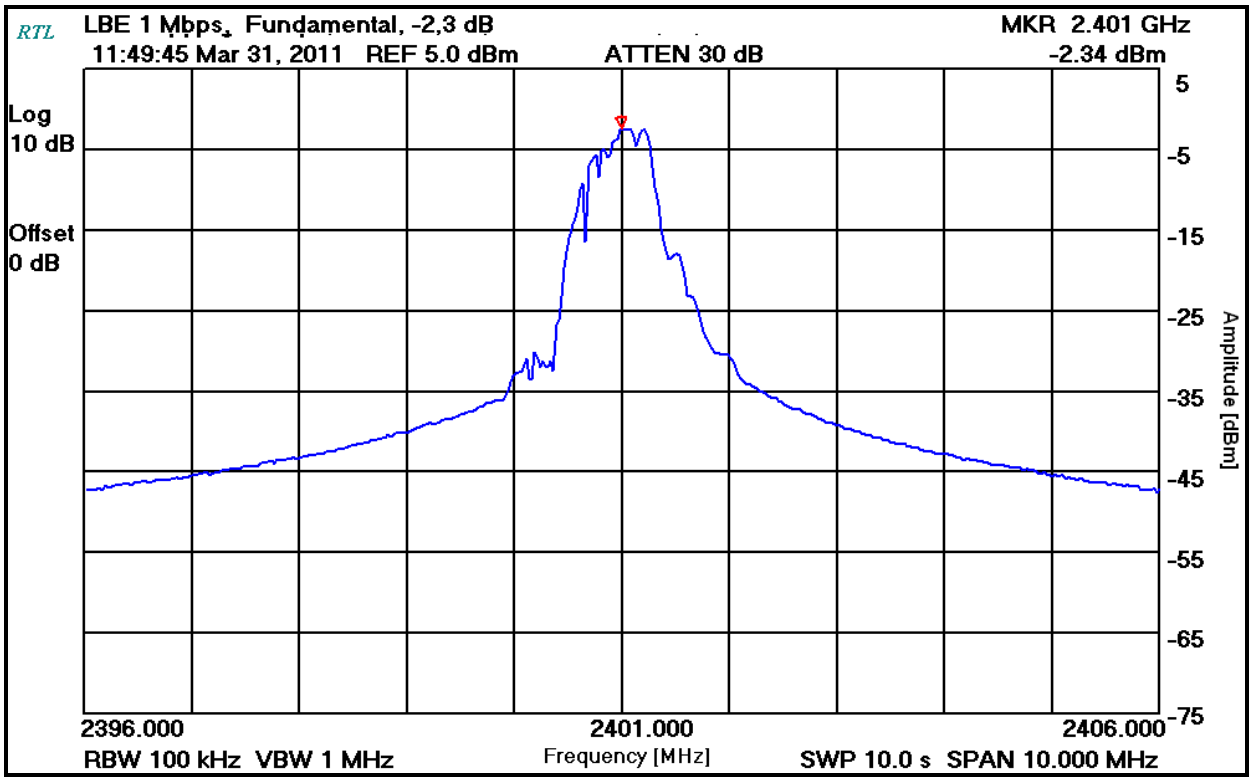
The EUT was connected to the spectrum analyzer through suitable attenuation. The span was set to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation. The spectrum analyzer was set to the following:

RBW = 1% of the span
VBW ≥ RBW
Sweep ≥ auto
Detector function = peak
Trace = max hold

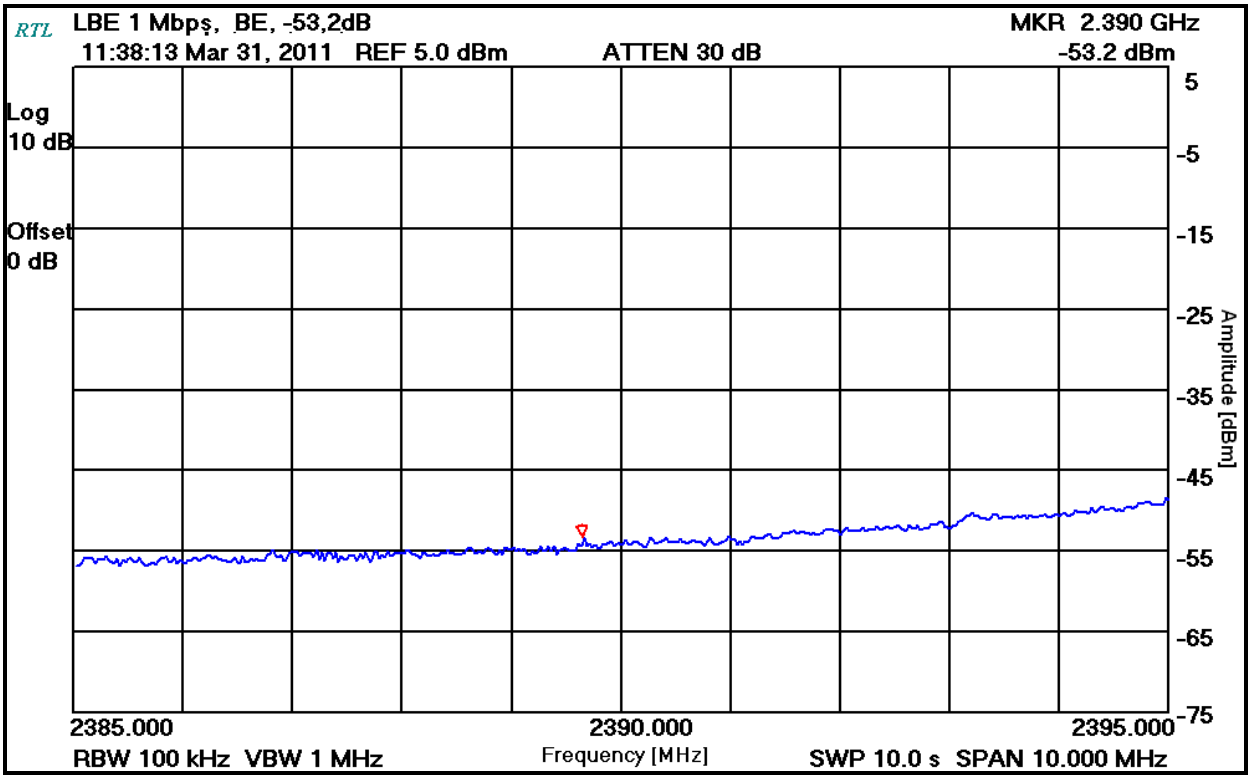
The trace was allowed to stabilize. The marker was set on the emission at the band edge. The marker-delta from two plots were used to show the delta between the maximum in-band emission and the emission at the band edge, and was compared to the 20 dBc requirement of 15.247(d) (when using peak emissions). This measurement was taken in both fixed frequency and hopping modes.

5.2 Test Results

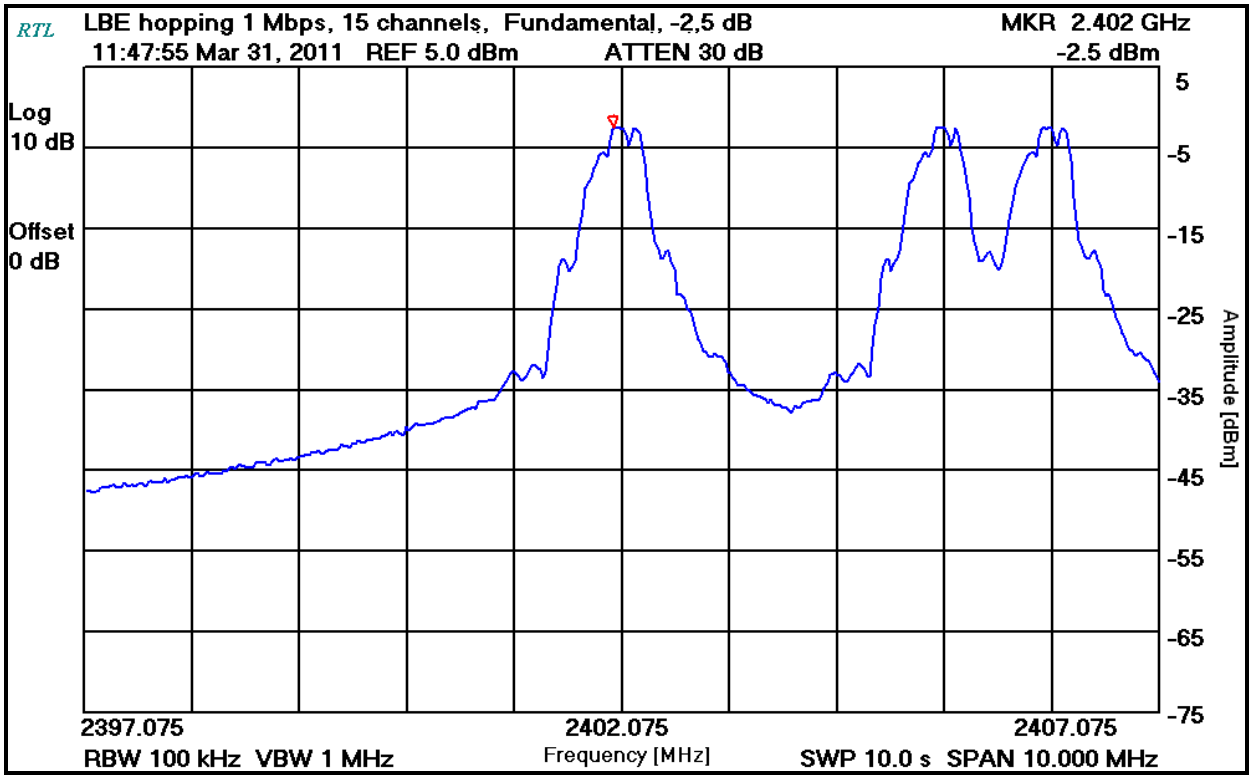
Plot 5-1: Lower Band Edge TX Frequency; 2401 MHz – Fixed Frequency (1 Mbps); Fundamental



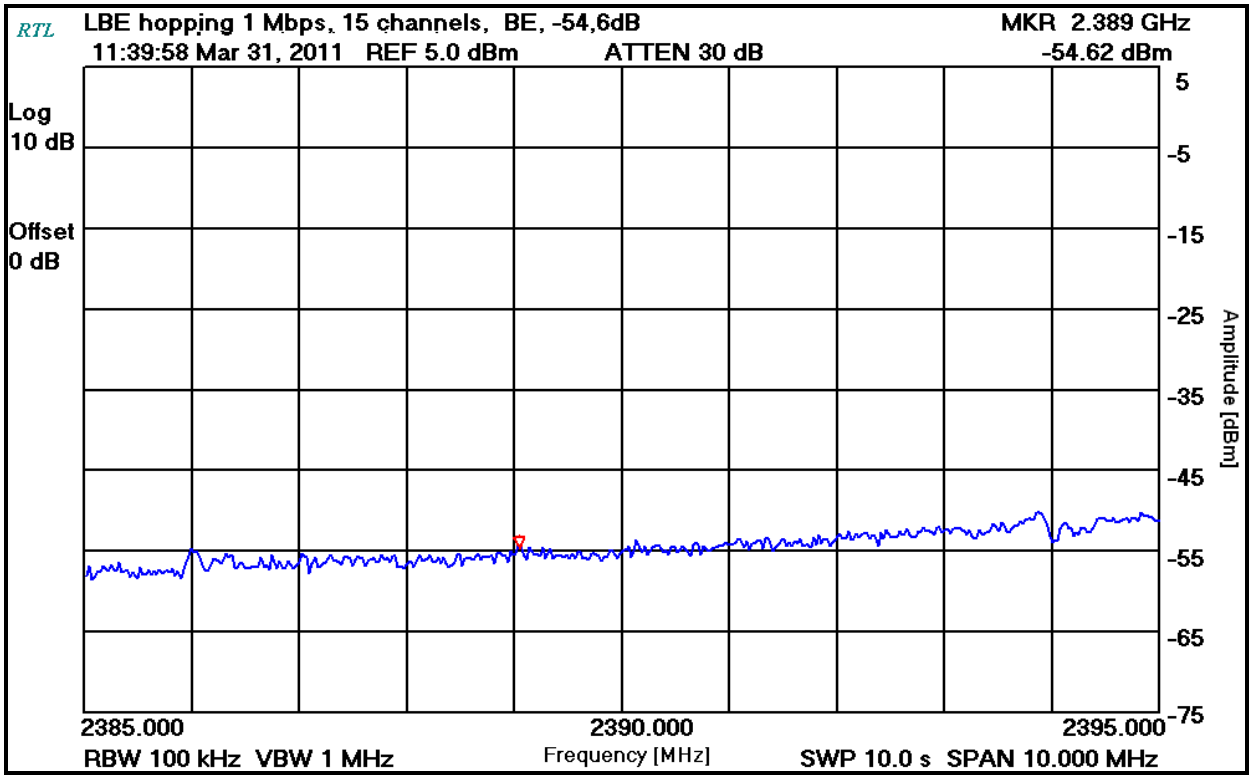
Plot 5-2: Lower Band Edge TX Frequency; 2401 MHz – Fixed Frequency (1 Mbps); Band Edge



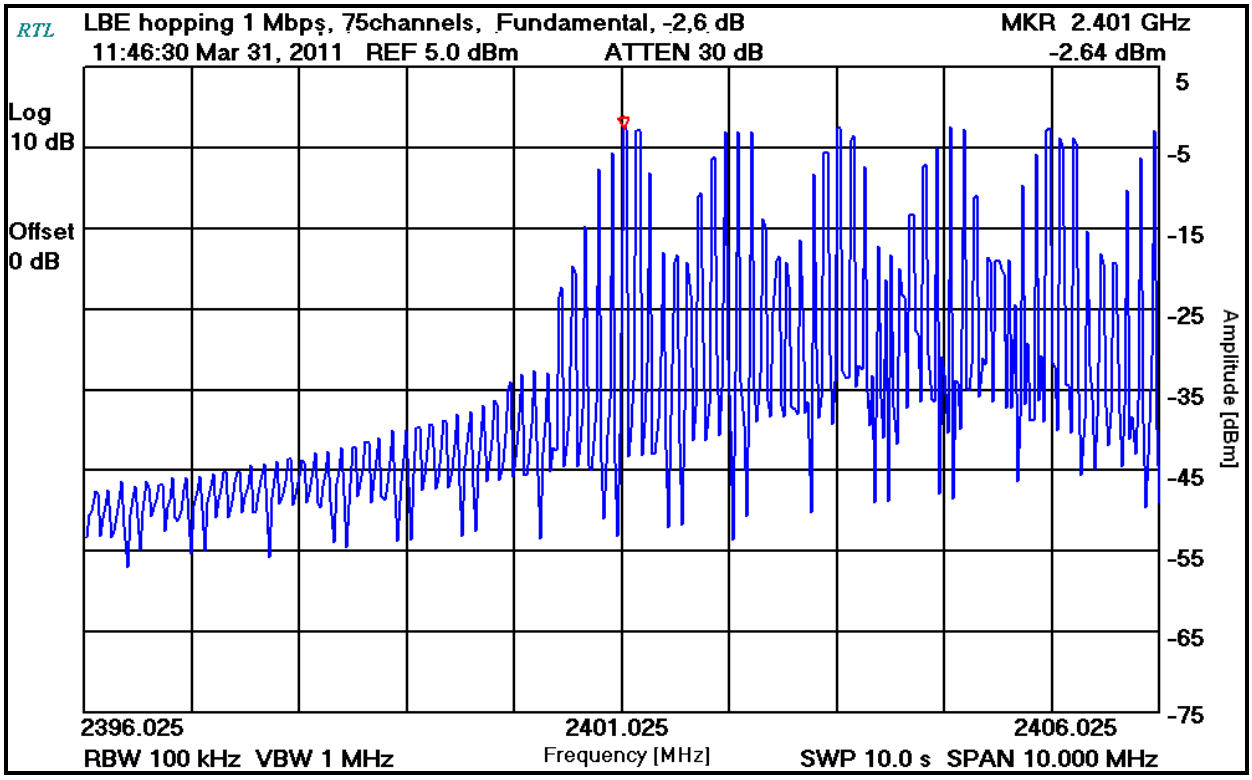
Plot 5-3: Lower Band Edge TX Frequency; 2401 MHz – Hopping (1 Mbps); 15 Channels; Fundamental



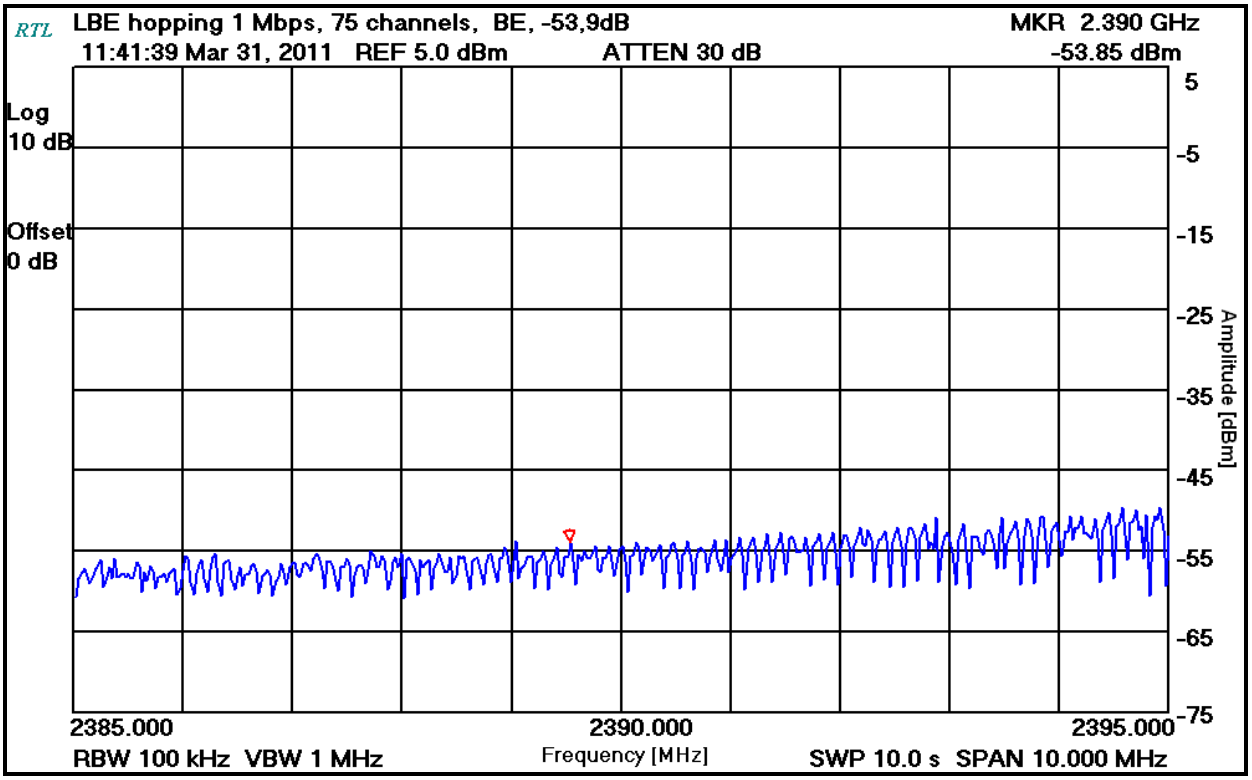
Plot 5-4: Lower Band Edge TX Frequency; 2401 MHz – Hopping (1 Mbps); 15 Channels; Band Edge



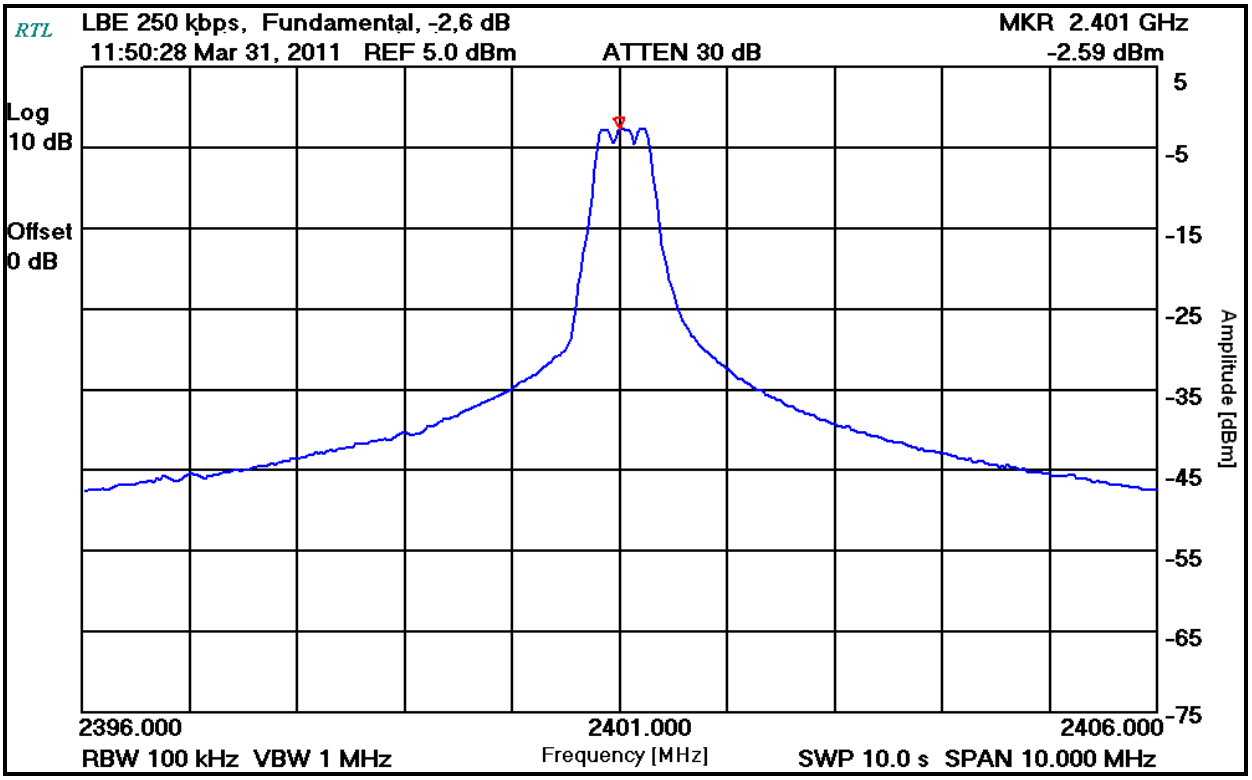
Plot 5-5: Lower Band Edge TX Frequency; 2401 MHz – Hopping (1 Mbps); 75 Channels; Fundamental



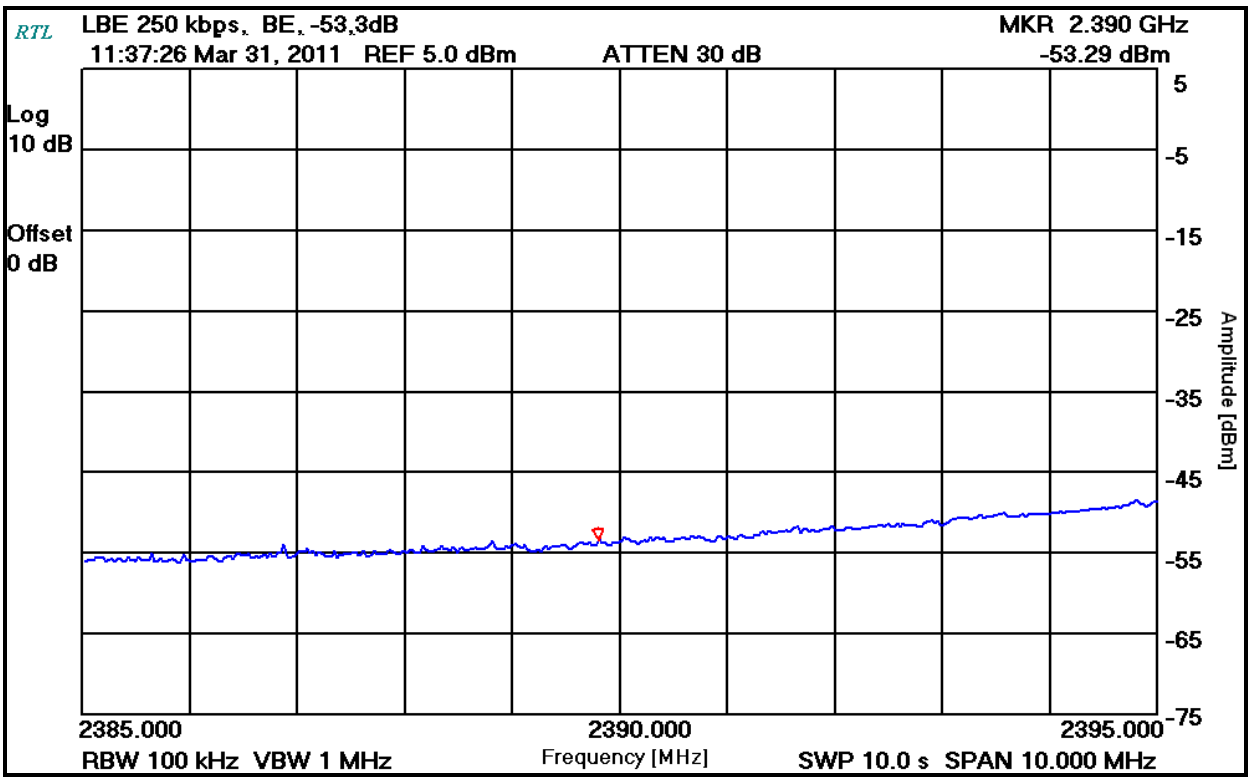
Plot 5-6: Lower Band Edge TX Frequency; 2401 MHz – Hopping (1 Mbps); 75 Channels; Band Edge



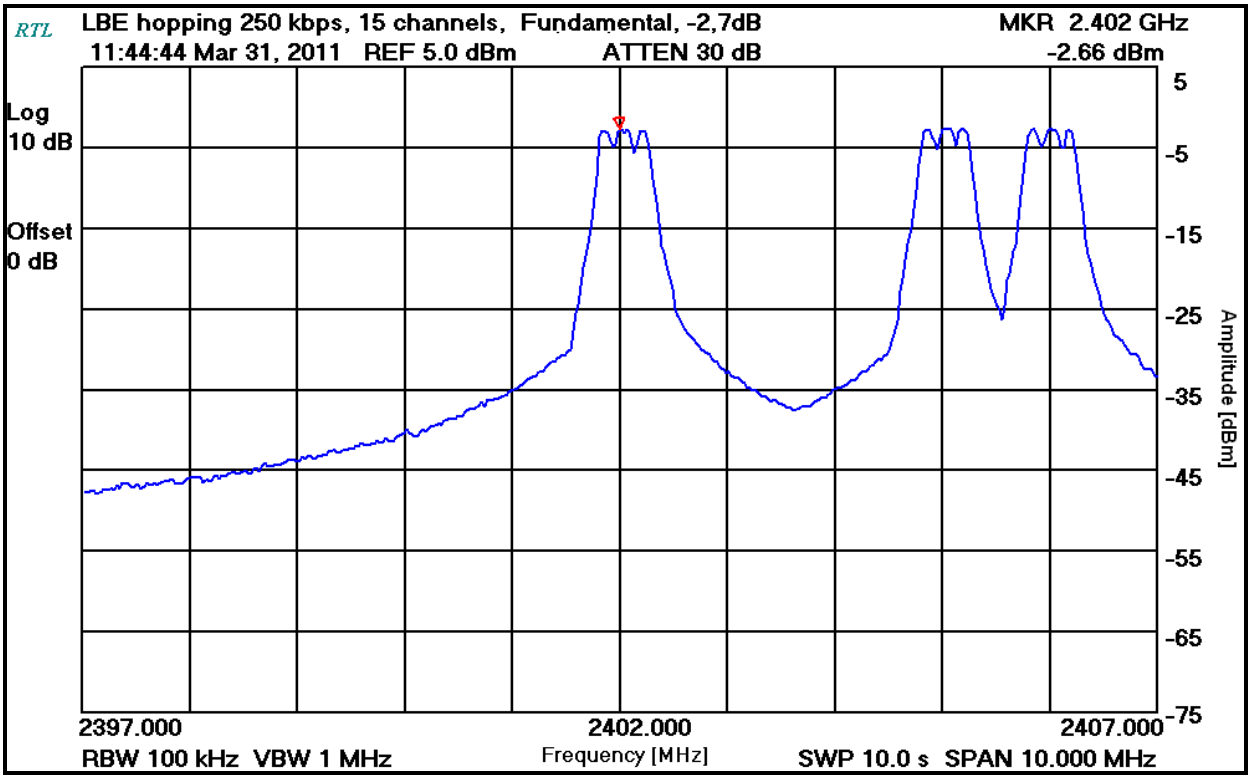
Plot 5-7: Lower Band Edge TX Frequency; 2401 MHz – Fixed Frequency (250 kbps); Fundamental



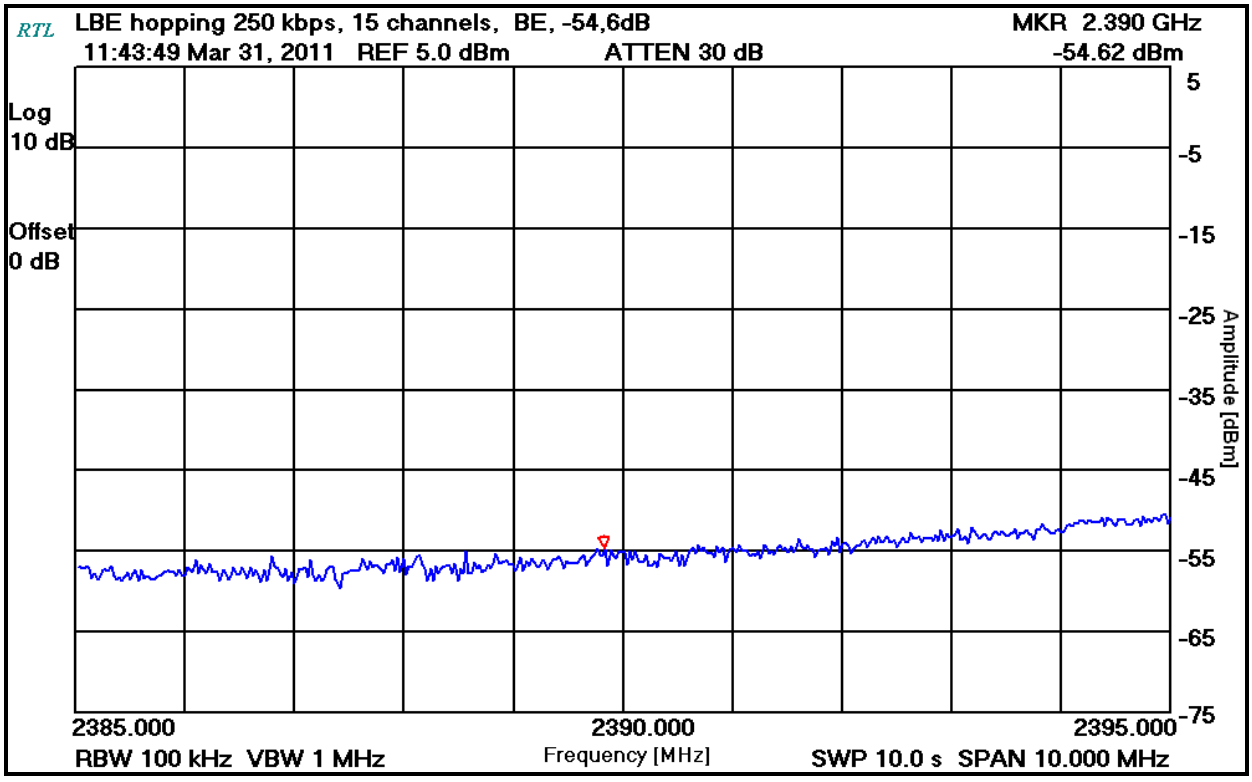
Plot 5-8: Lower Band Edge TX Frequency; 2401 MHz – Fixed Frequency (250 kbps); Band Edge



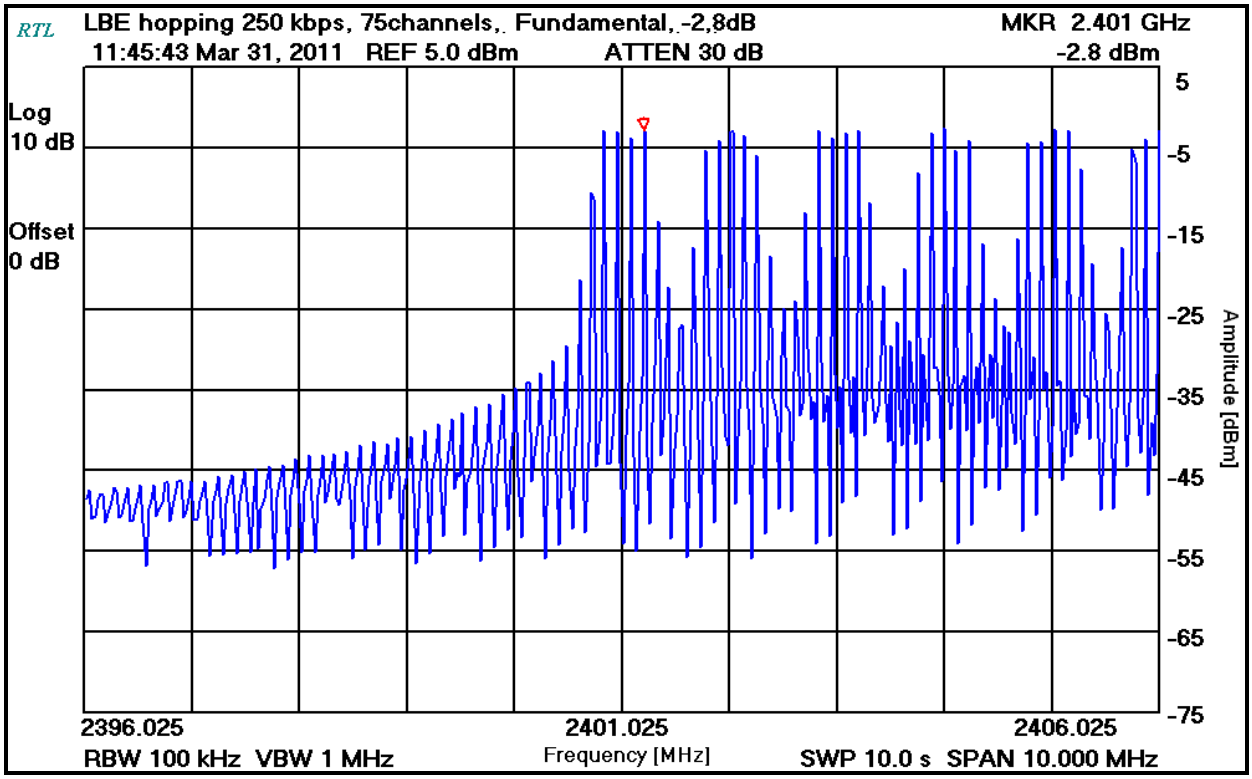
Plot 5-9: Lower Band Edge TX Frequency; 2401 MHz – Hopping (250 kbps); 15 Channels; Fundamental



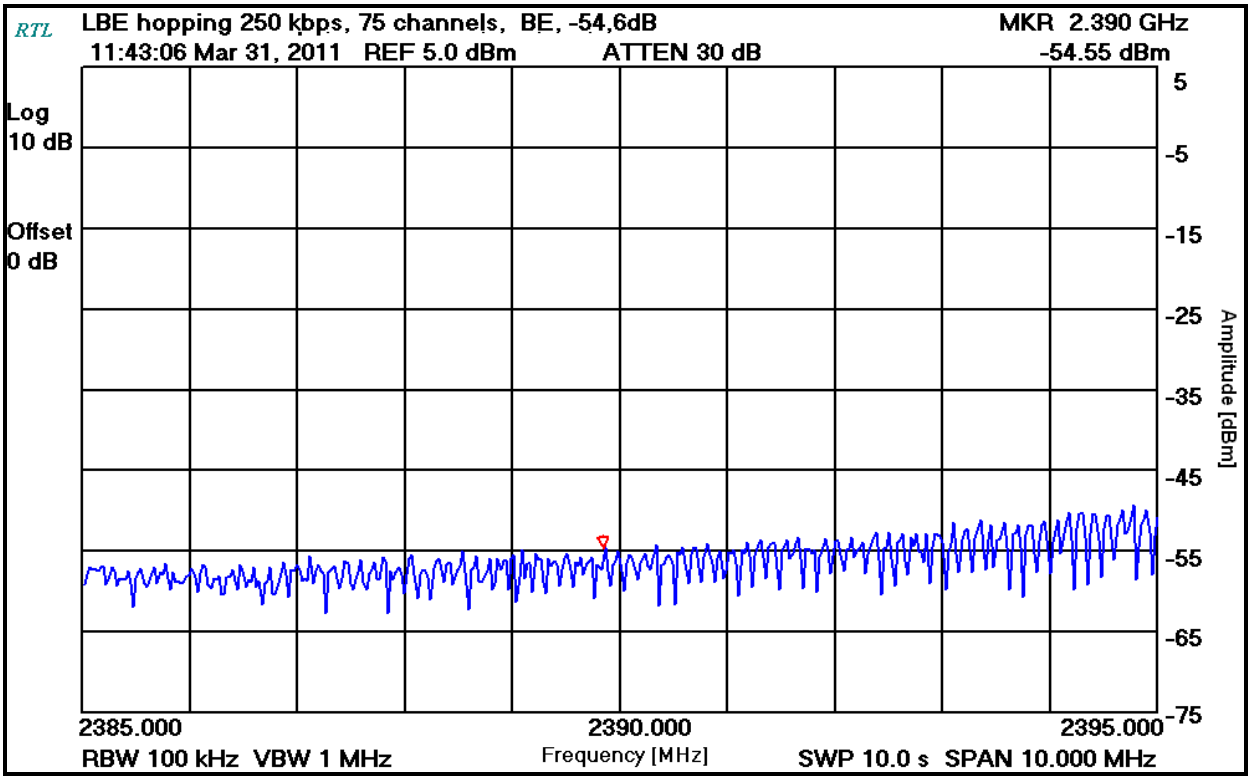
Plot 5-10: Lower Band Edge TX Frequency; 2401 MHz – Hopping (250 kbps); 15 Channels; Band Edge



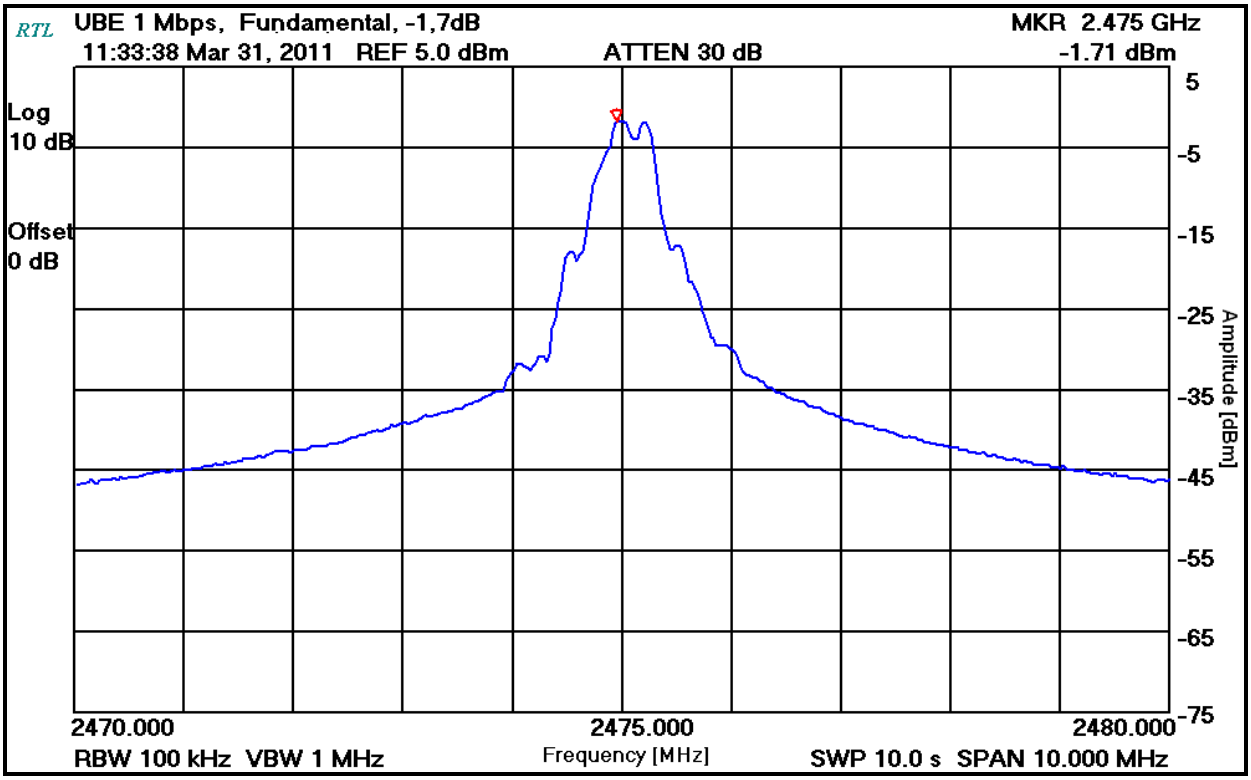
Plot 5-11: Lower Band Edge TX Frequency; 2401 MHz – Hopping (250 kbps); 75 Channels; Fundamental



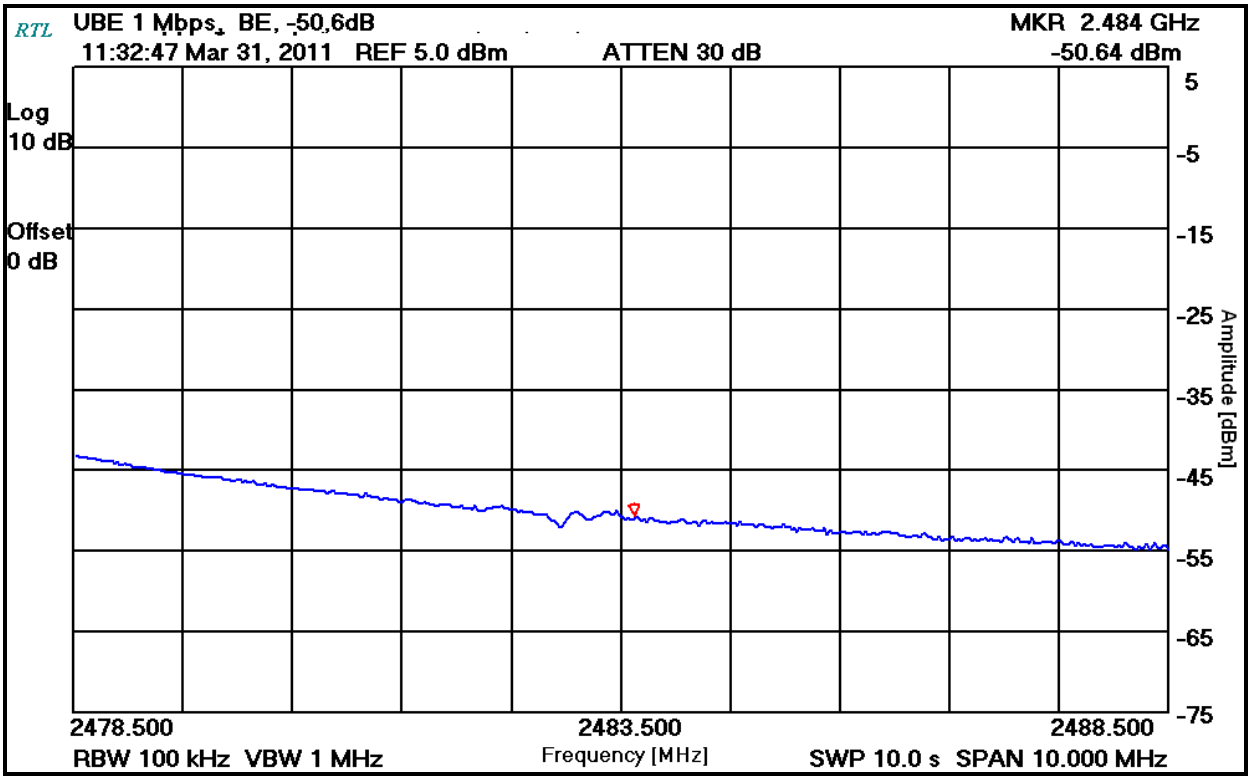
Plot 5-12: Lower Band Edge TX Frequency; 2401 MHz – Hopping (250 kbps); 75 Channels; Band Edge



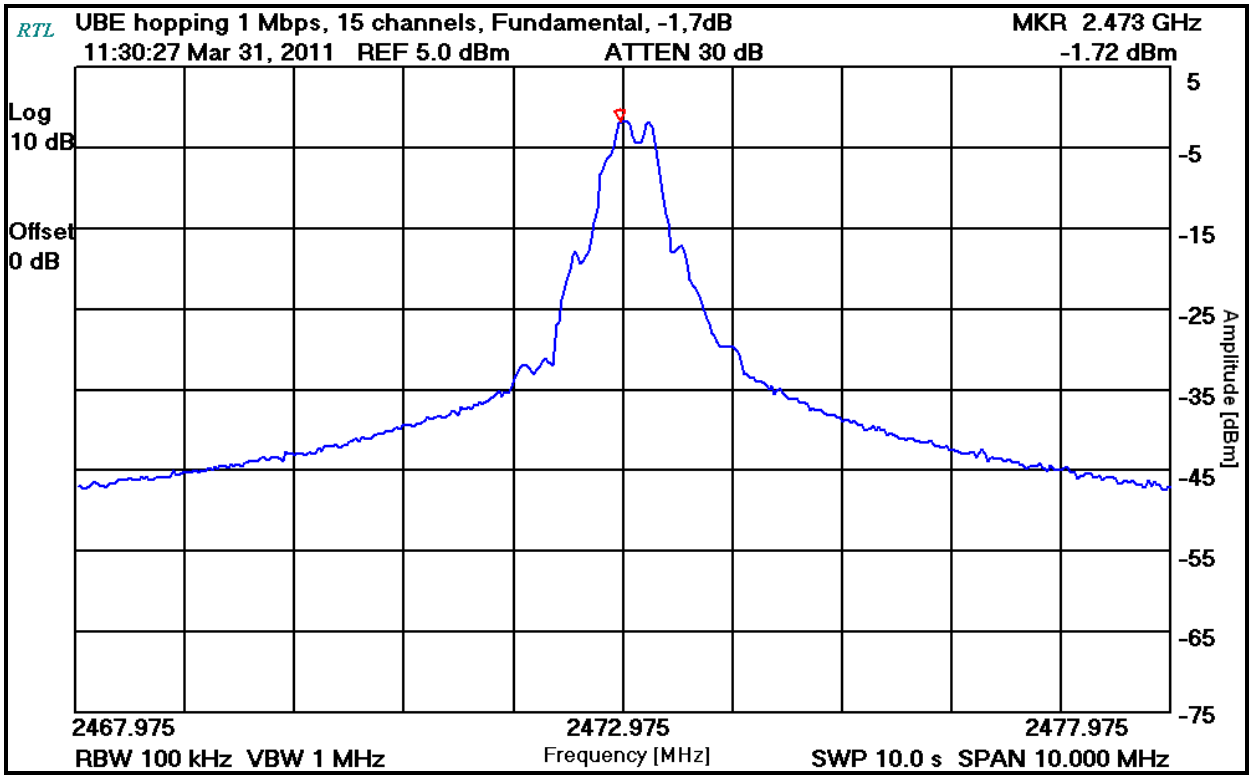
Plot 5-13: Upper Band Edge TX Frequency; 2475 MHz – Fixed Frequency (1 Mbps); Fundamental



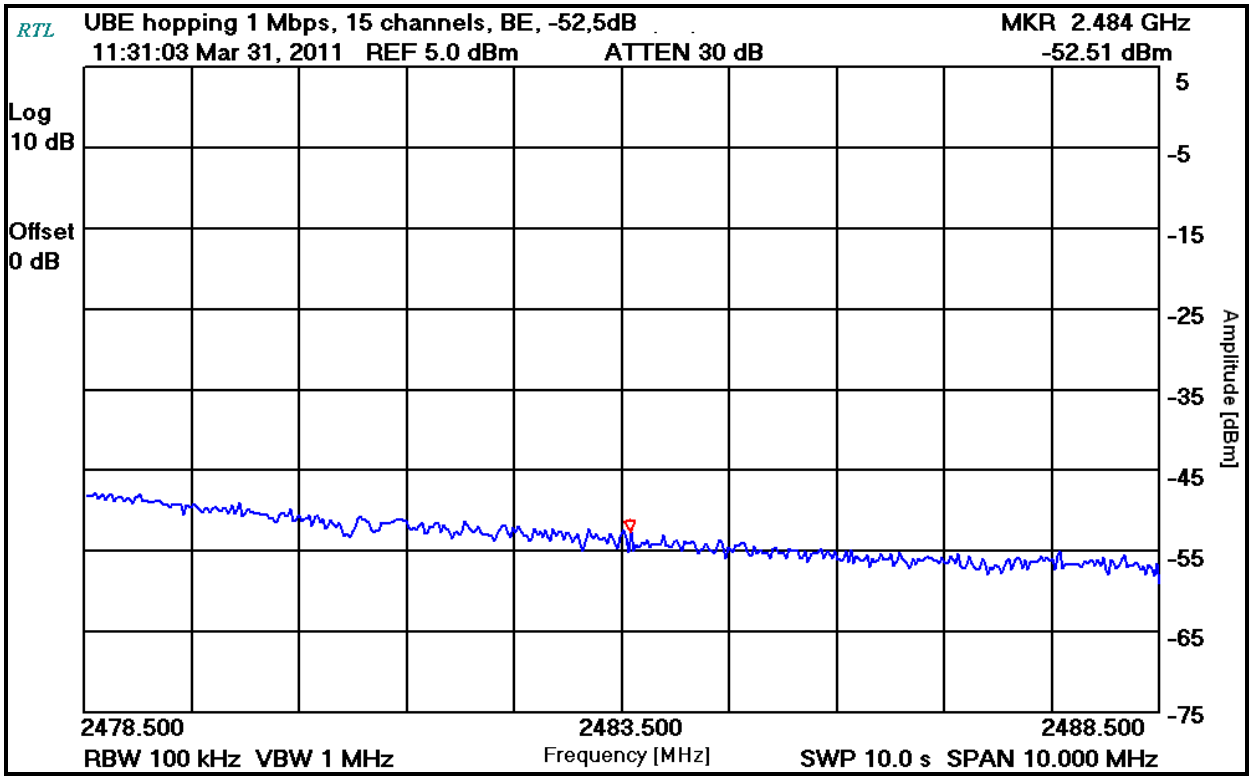
Plot 5-14: Upper Band Edge TX Frequency; 2475 MHz – Fixed Frequency (1 Mbps); Band Edge



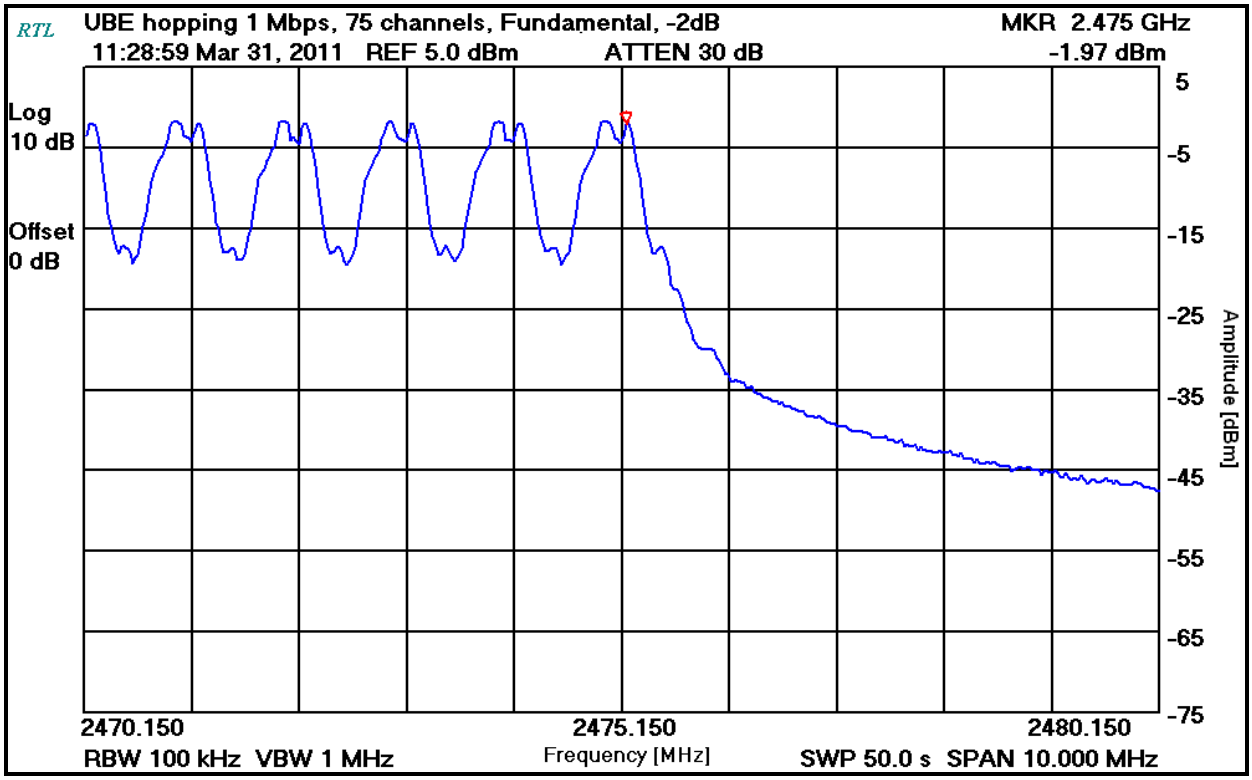
Plot 5-15: Upper Band Edge TX Frequency; 2475 MHz – Hopping (1 Mbps); 15 Channels; Fundamental



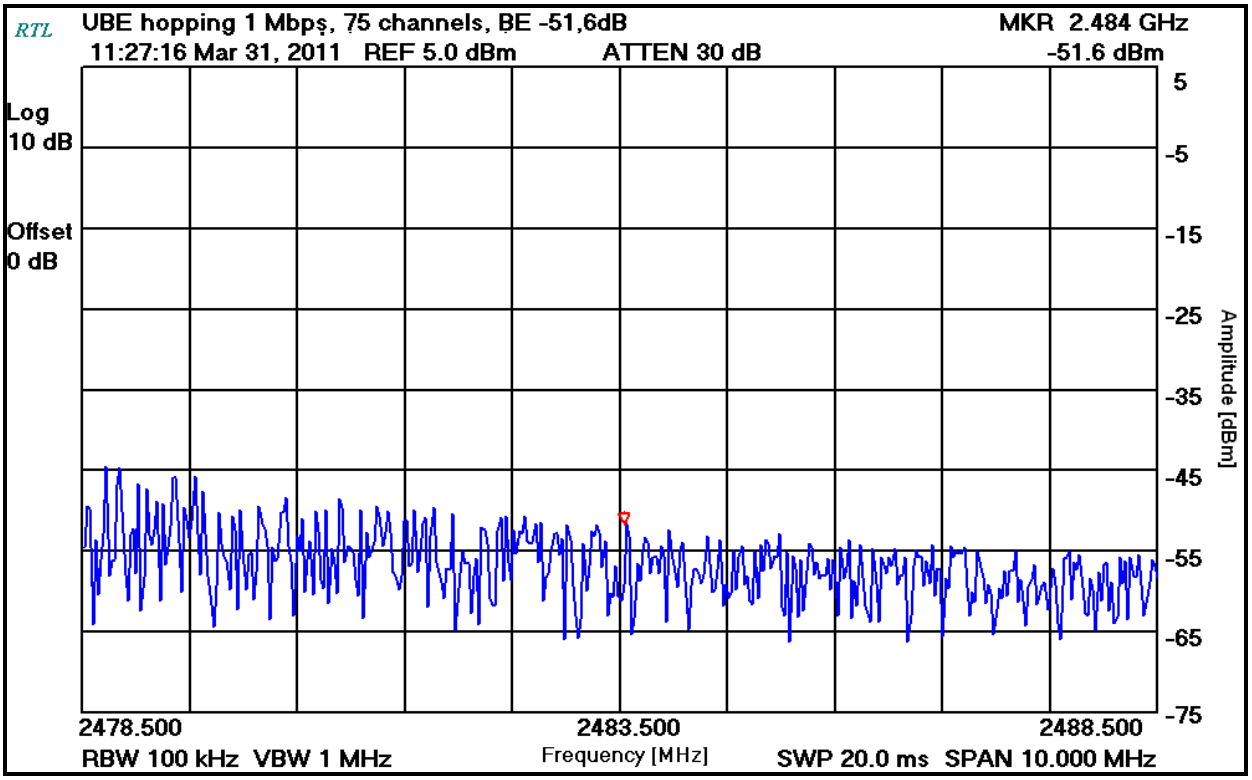
Plot 5-16: Upper Band Edge TX Frequency; 2475 MHz – Hopping (1 Mbps); 15 Channels; Band Edge



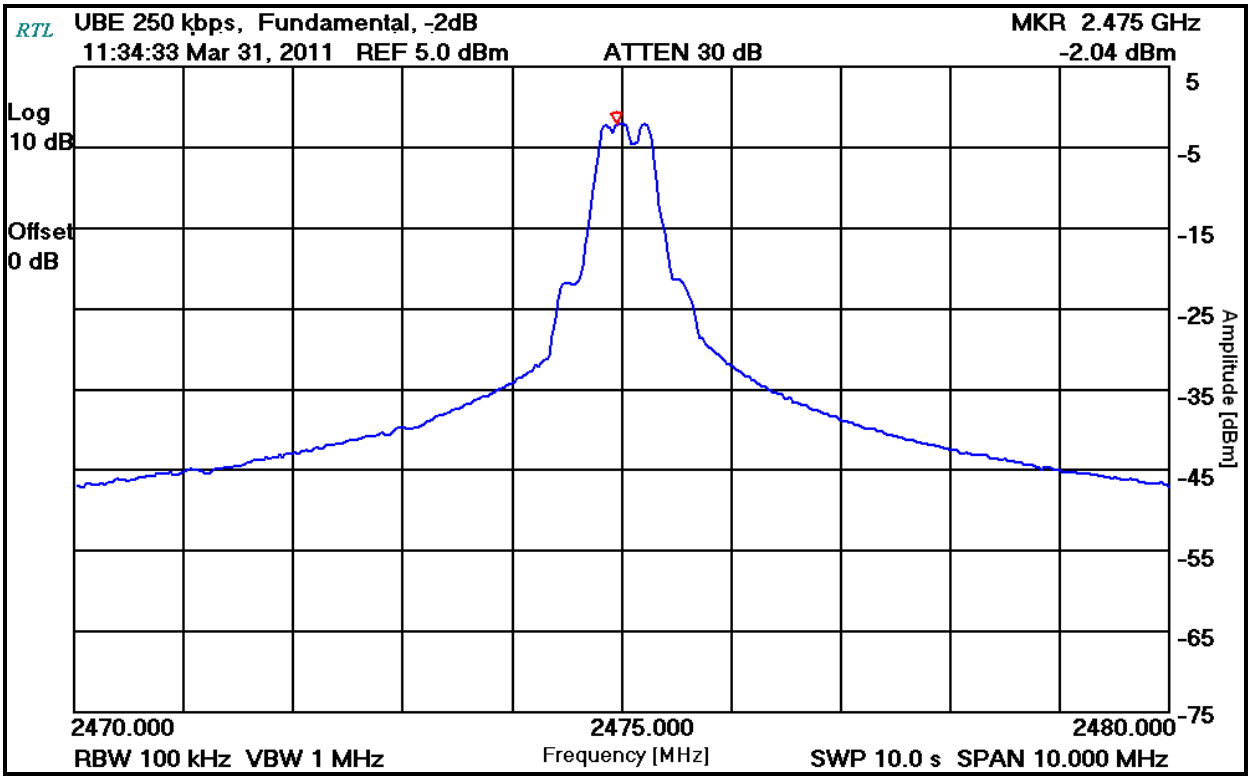
Plot 5-17: Upper Band Edge TX Frequency; 2475 MHz – Hopping (1 Mbps); 75 Channels; Fundamental



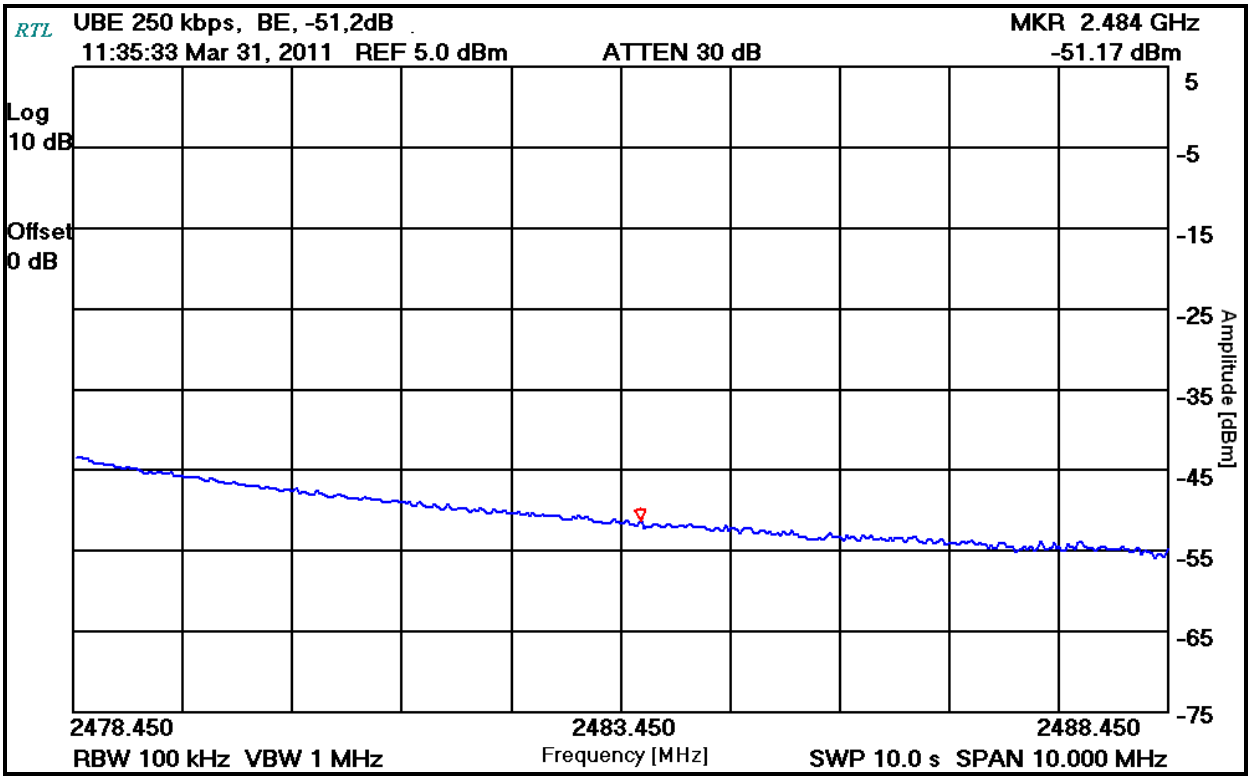
Plot 5-18: Upper Band Edge TX Frequency; 2475 MHz – Hopping (1 Mbps); 75 Channels; Band Edge



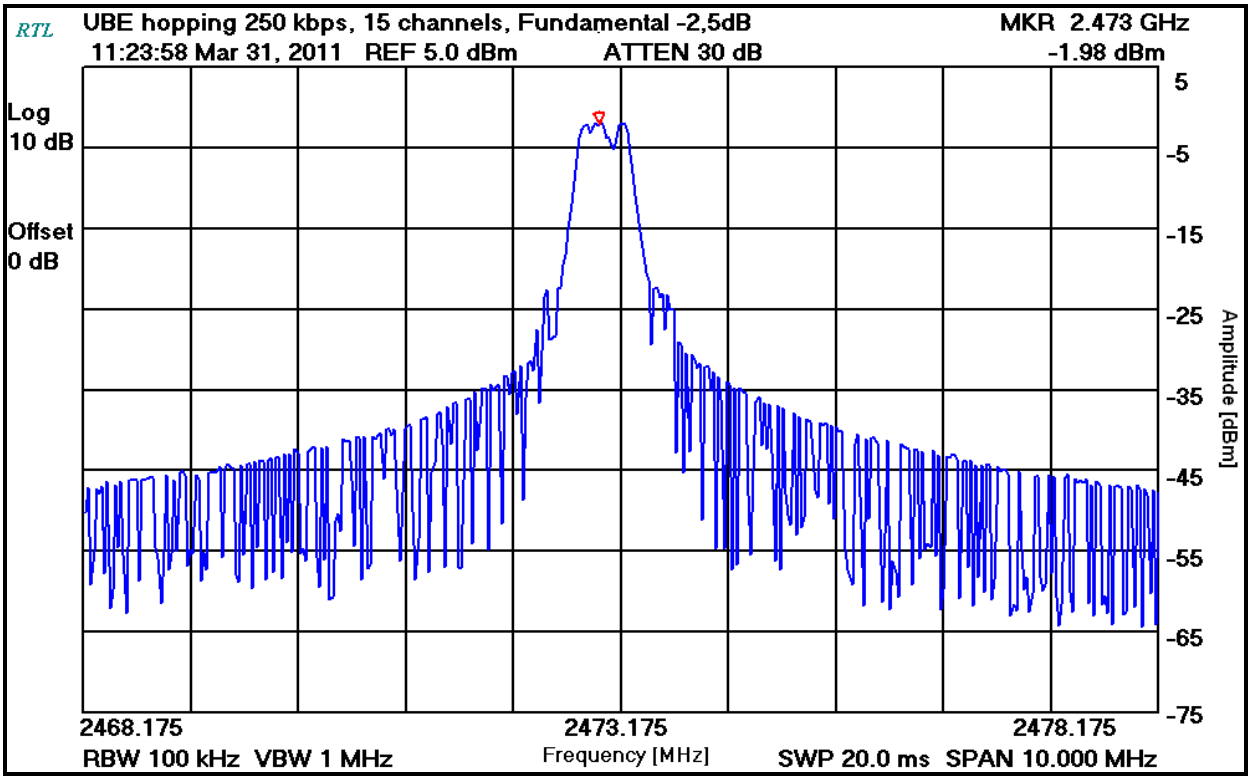
Plot 5-19: Upper Band Edge TX Frequency; 2475 MHz – Fixed Frequency (250 kbps); Fundamental



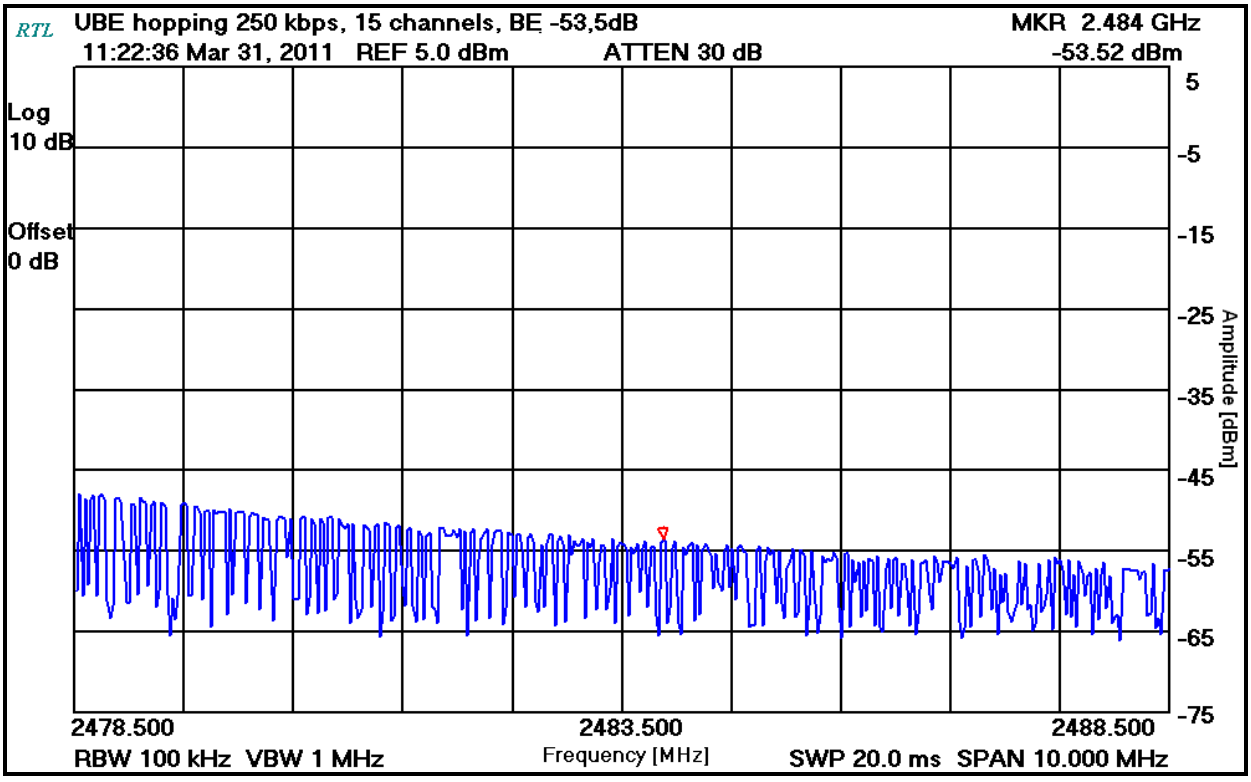
Plot 5-20: Upper Band Edge TX Frequency; 2475 MHz – Fixed Frequency (250 kbps); Band Edge



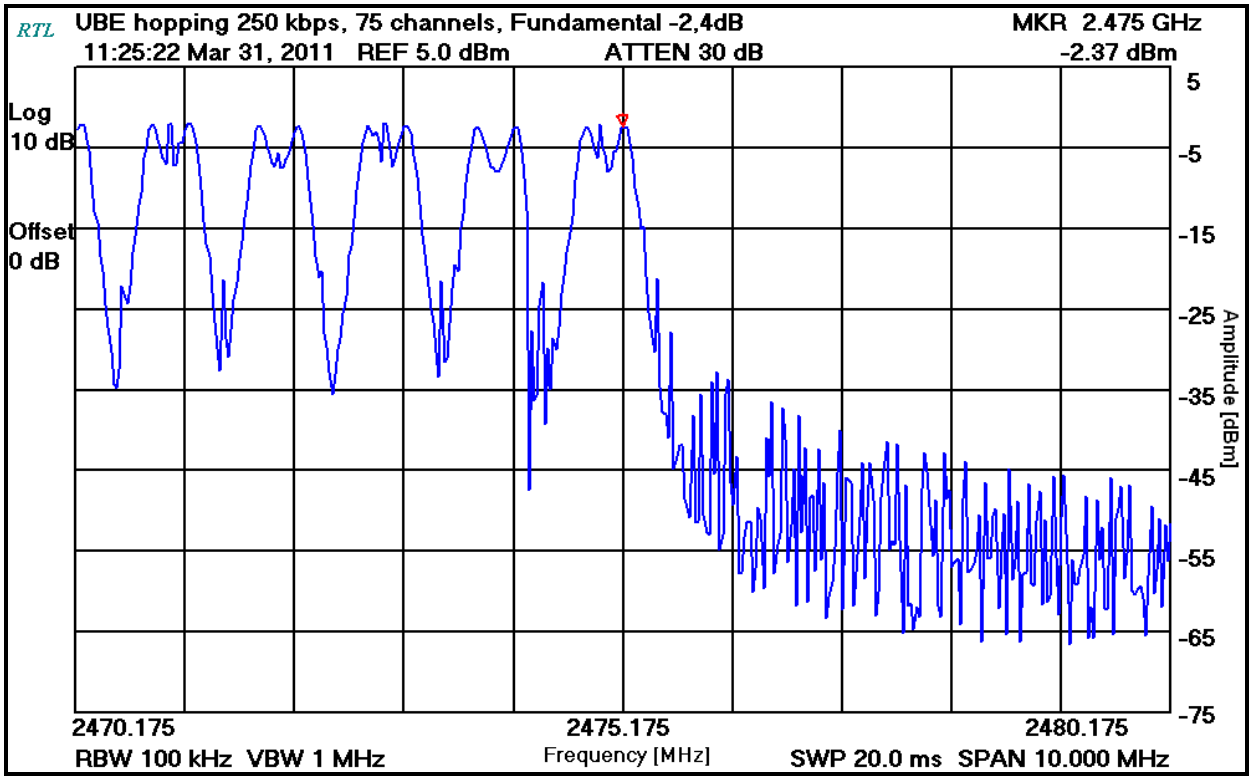
Plot 5-21: Upper Band Edge TX Frequency; 2475 MHz – Hopping (250 kbps); 15 Channels; Fundamental



Plot 5-22: Upper Band Edge TX Frequency; 2475 MHz – Hopping (250 kbps); 15 Channels; Band Edge



Plot 5-23: Upper Band Edge TX Frequency; 2475 MHz – Hopping (250 kbps); 75 Channels; Fundamental



Plot 5-24: Upper Band Edge TX Frequency; 2475 MHz – Hopping (250 kbps); 75 Channels; Band Edge

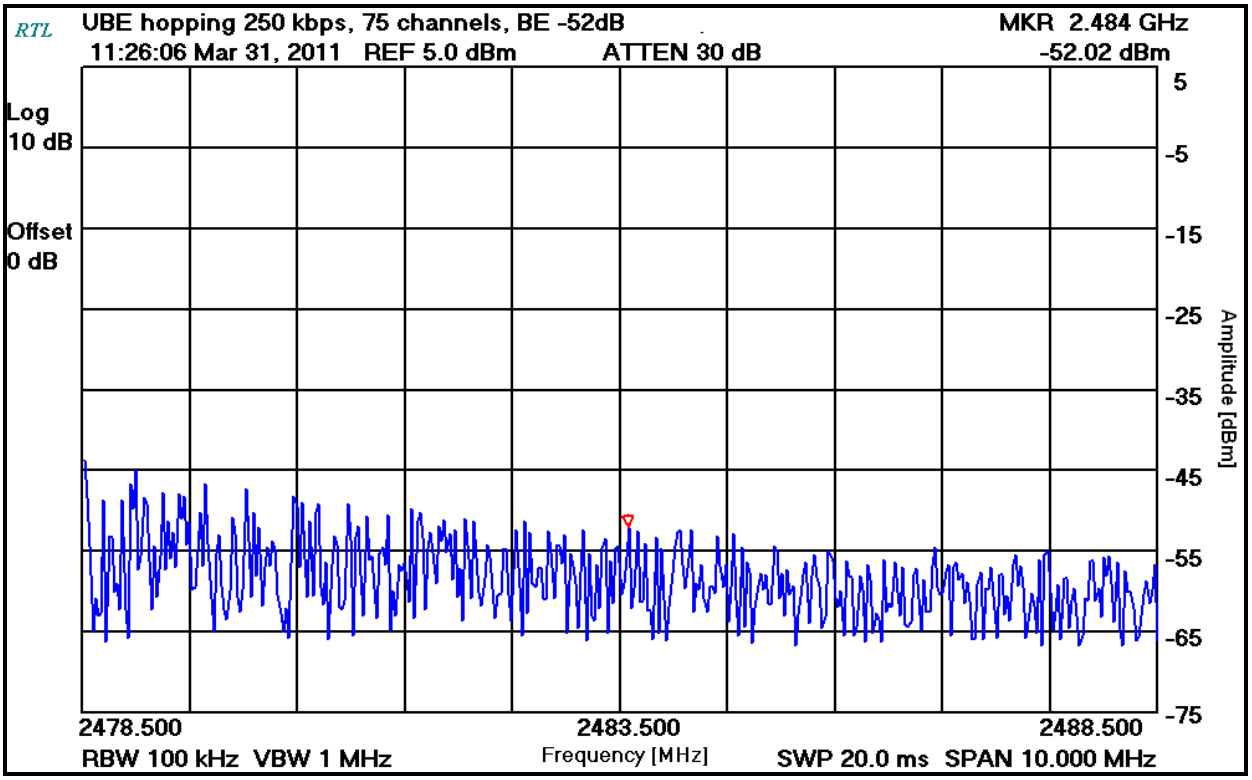


Table 5-1: Peak Radiated Band Edge Emissions Test Data (1 Mbps); Internal Antenna

Emission Frequency (MHz)	Corrected Peak (dBuV/m) (1 MHz RBW/VBW)	Delta (from above plots)	Peak Limit (dBuV/m)	Peak Margin (dB)
2401.0	120.8	50.9	74.0	-4.1
2475.0	118.8	48.9	74.0	-4.1

Table 5-2: Peak Radiated Band Edge Emissions Test Data (1 Mbps); External Antenna

Emission Frequency (MHz)	Corrected Peak (dBuV/m) (1 MHz RBW/VBW)	Delta (from above plots)	Peak Limit (dBuV/m)	Peak Margin (dB)
2401.0	120.6	50.9	74.0	-4.3
2475.0	118.7	48.9	74.0	-4.2

Table 5-3: Peak Radiated Band Edge Emissions Test Data (250 kbps); Internal Antenna

Emission Frequency (MHz)	Corrected Peak (dBuV/m) (1 MHz RBW/VBW)	Delta (from above plots)	Peak Limit (dBuV/m)	Peak Margin (dB)
2401.0	119.3	50.7	74.0	-5.4
2475.0	118.7	49.2	74.0	-4.5

Table 5-4: Peak Radiated Band Edge Emissions Test Data (250 kbps); External Antenna

Emission Frequency (MHz)	Corrected Peak (dBuV/m) (1 MHz RBW/VBW)	Delta (from above plots)	Peak Limit (dBuV/m)	Peak Margin (dB)
2401.0	120.5	50.7	74.0	-4.2
2475.0	118.4	49.2	74.0	-4.8

Table 5-5: Average Radiated Band Edge Emissions Test Data (1 Mbps); Internal Antenna

Emission Frequency (MHz)	Corrected Average (dBuV/m) (1 MHz RBW/10 Hz VBW, -20 dB duty cycle)	Delta (from above plots)	Average Limit (dBuV/m)	Average Margin (dB)
2401.0	49.3	50.9	54.0	-55.6
2475.0	48.9	48.9	54.0	-54.0

Table 5-6: Average Radiated Band Edge Emissions Test Data (1 Mbps); External Antenna

Emission Frequency (MHz)	Corrected Average (dBuV/m) (1 MHz RBW/10 Hz VBW, -25 dB duty cycle)	Delta (from above plots)	Average Limit (dBuV/m)	Average Margin (dB)
2401.0	44.0	50.9	54.0	-60.9
2475.0	64.0	48.9	54.0	-38.9

Table 5-7: Average Radiated Band Edge Emissions Test Data (250 kbps); Internal Antenna

Emission Frequency (MHz)	Corrected Average (dBuV/m) (1 MHz RBW/10 Hz VBW, -25 dB duty cycle)	Delta (from above plots)	Average Limit (dBuV/m)	Average Margin (dB)
2401.0	83.8	50.7	54.0	-20.9
2475.0	83.4	49.2	54.0	-19.8

Table 5-8: Average Radiated Band Edge Emissions Test Data (250 kbps); External Antenna

Emission Frequency (MHz)	Corrected Average (dBuV/m) (1 MHz RBW/10 Hz VBW, -25 dB duty cycle)	Delta (from above plots)	Average Limit (dBuV/m)	Average Margin (dB)
2401.0	84.8	50.7	54.0	-19.9
2475.0	83.0	49.2	54.0	-20.2

Table 5-9: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
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
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 26.5 GHz)	3008A00505	2/22/12
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/11/11
900772	EMCO	3161-02	Horn Antenna (2-4 GHz)	9804-1044	6/13/11

Test Personnel:

Daniel W. Baltzell		March 31, 2011
EMC Test Engineer	Signature	Date of Tests

6 20 dB Bandwidth – FCC §15.247(a)(1)(ii); IC RSS-210 §A8.1

6.1 20 dB Bandwidth Test Procedure

The minimum 20 dB bandwidths per RSS-210 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 auto 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 3 MHz. The minimum 20 dB bandwidths were measured using the spectrum analyzer automated -20 dB selection. 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
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz-12.8 GHz)	3826A00144	1/13/12

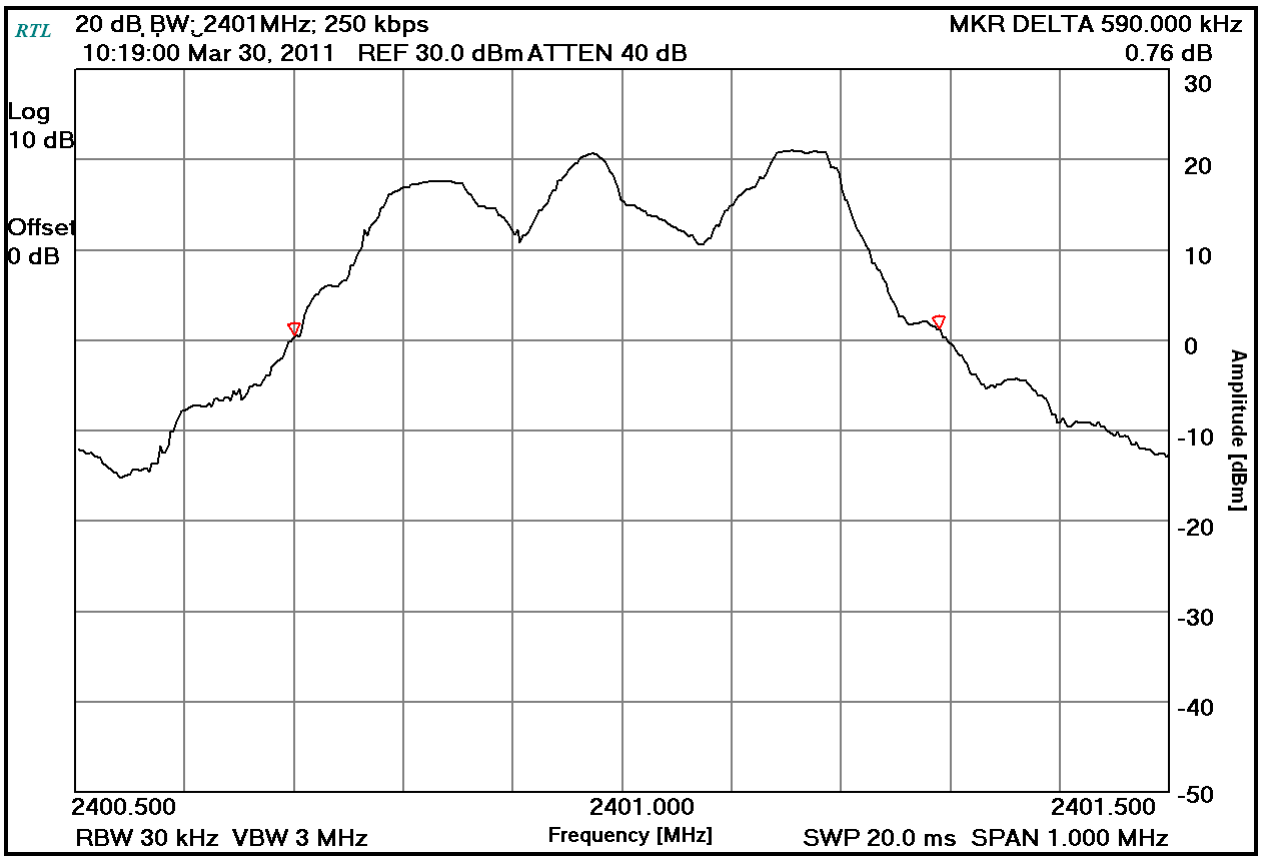
6.2 20 dB Modulated Bandwidth Test Data

Table 6-2: Minimum 20 dB Modulated Bandwidth Test Data

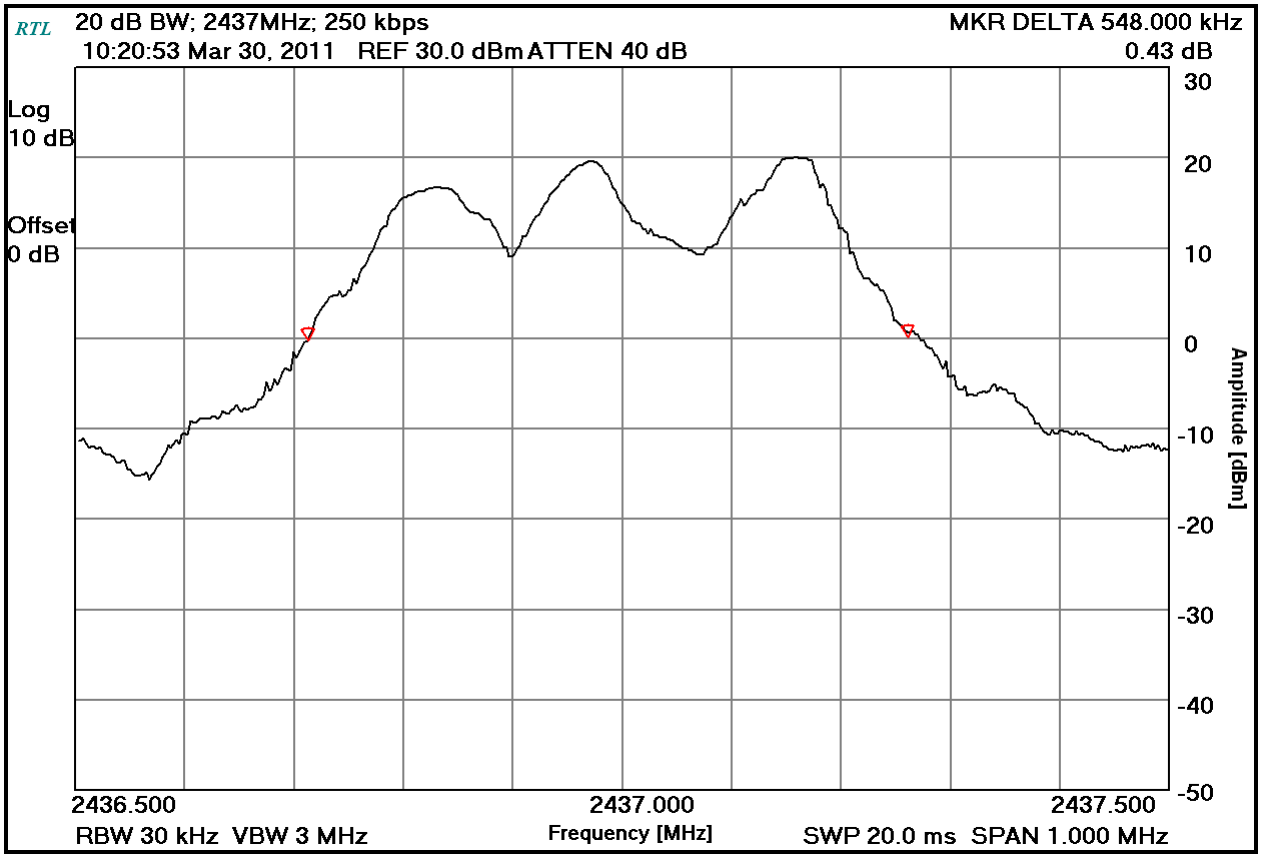
Frequency (MHz)	250 kbps - 20 dB Bandwidth (kHz)	1 Mbps - 20 dB Bandwidth (kHz)
2401	590	615
2437	548	608
2475	578	618

6.3 20 dB Bandwidth Plots

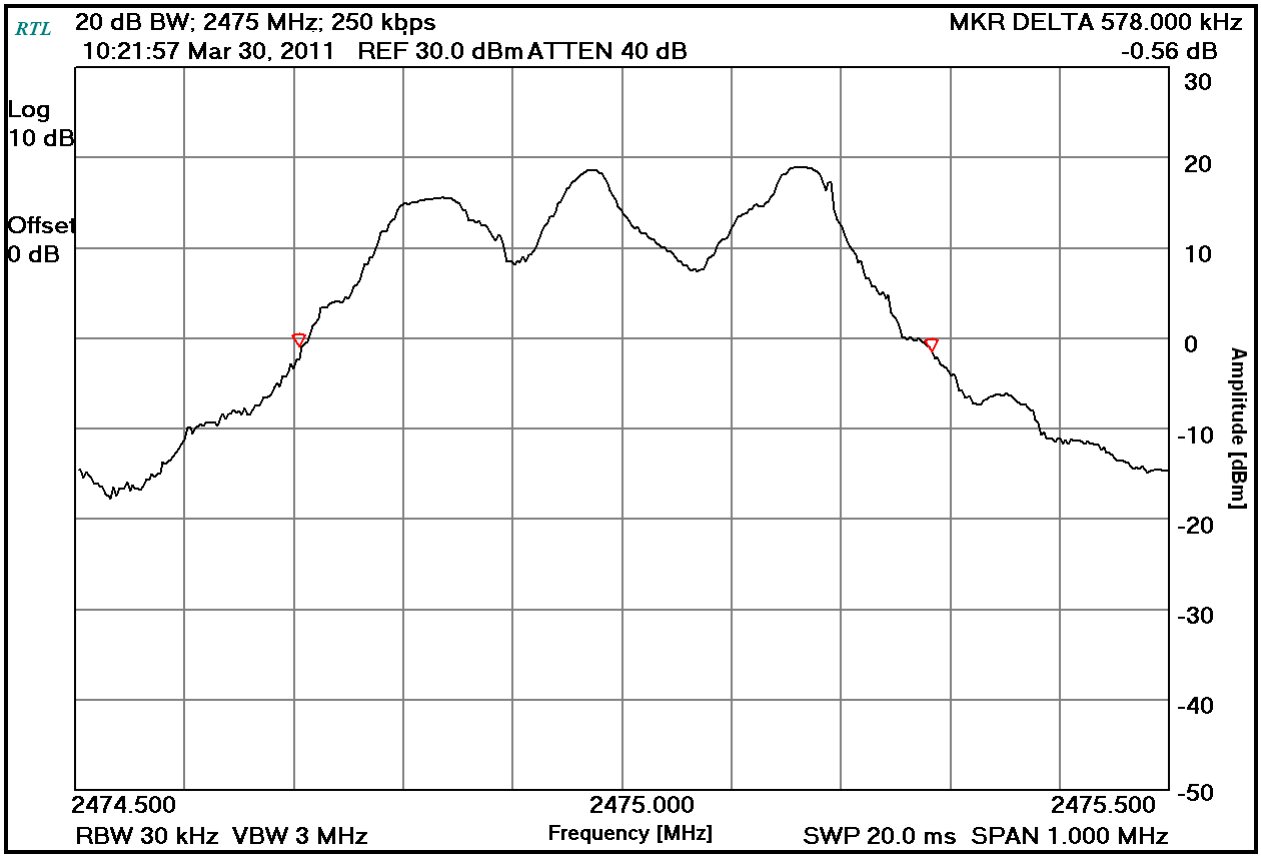
Plot 6-1: 20 dB Bandwidth - 2401 MHz – 250 kbps



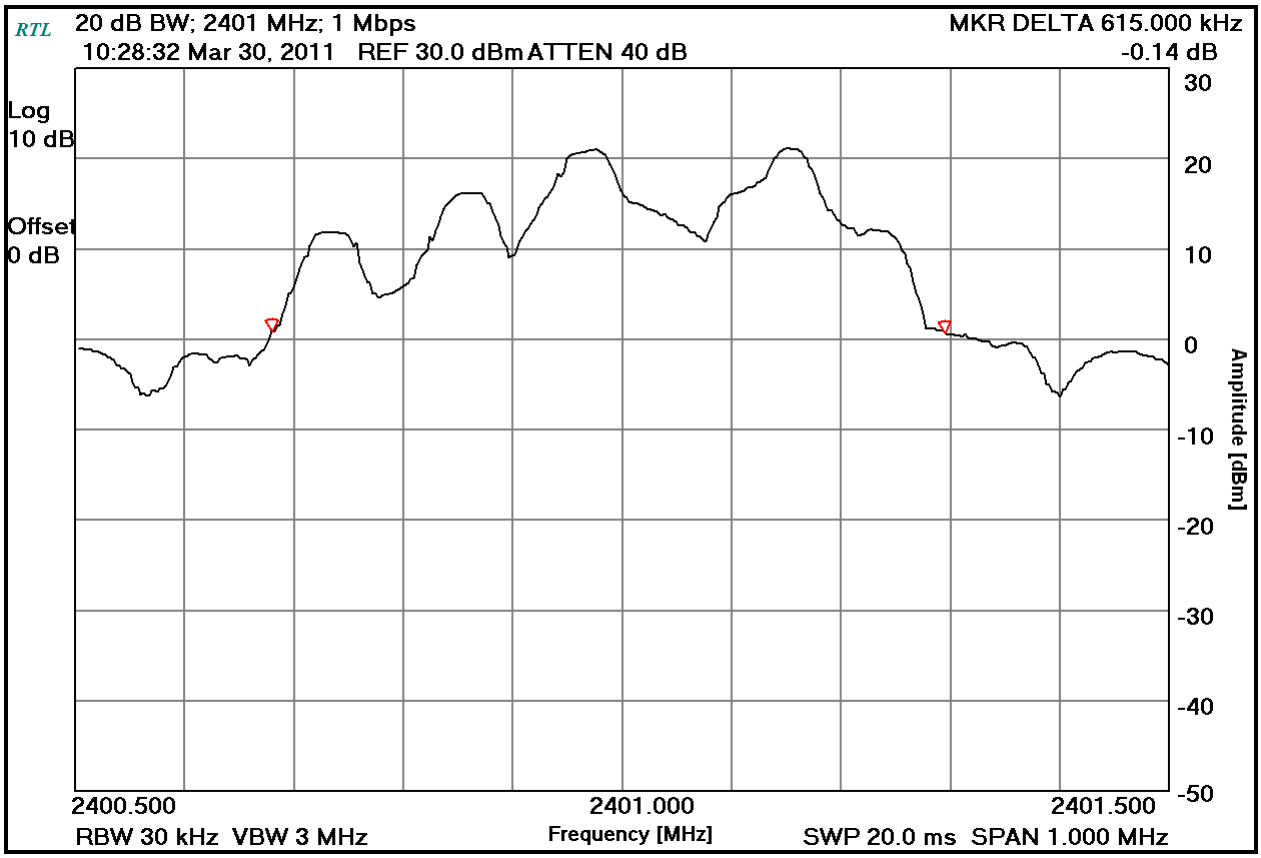
Plot 6-2: 20 dB Bandwidth - 2437 MHz – 250 kbps



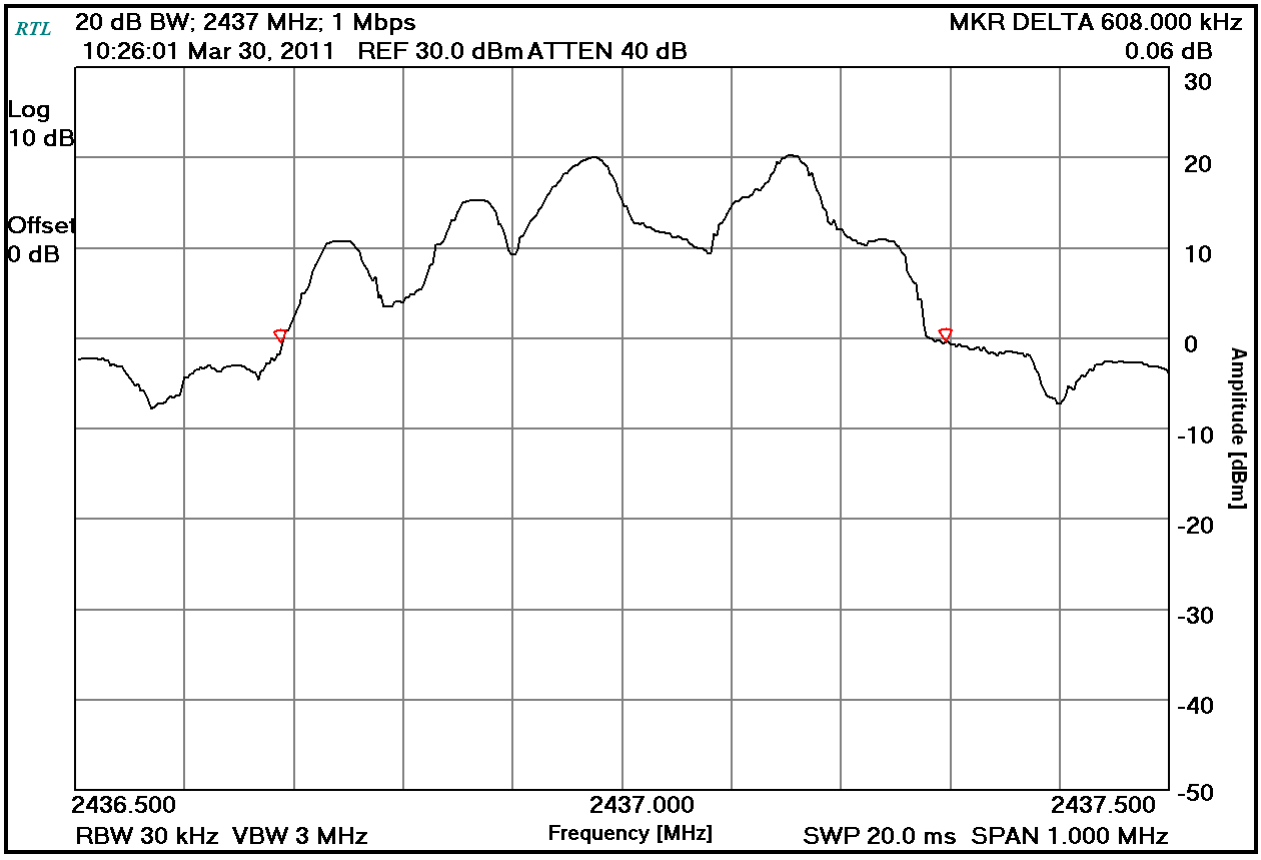
Plot 6-3: 20 dB Bandwidth - 2475 MHz – 250 kbps



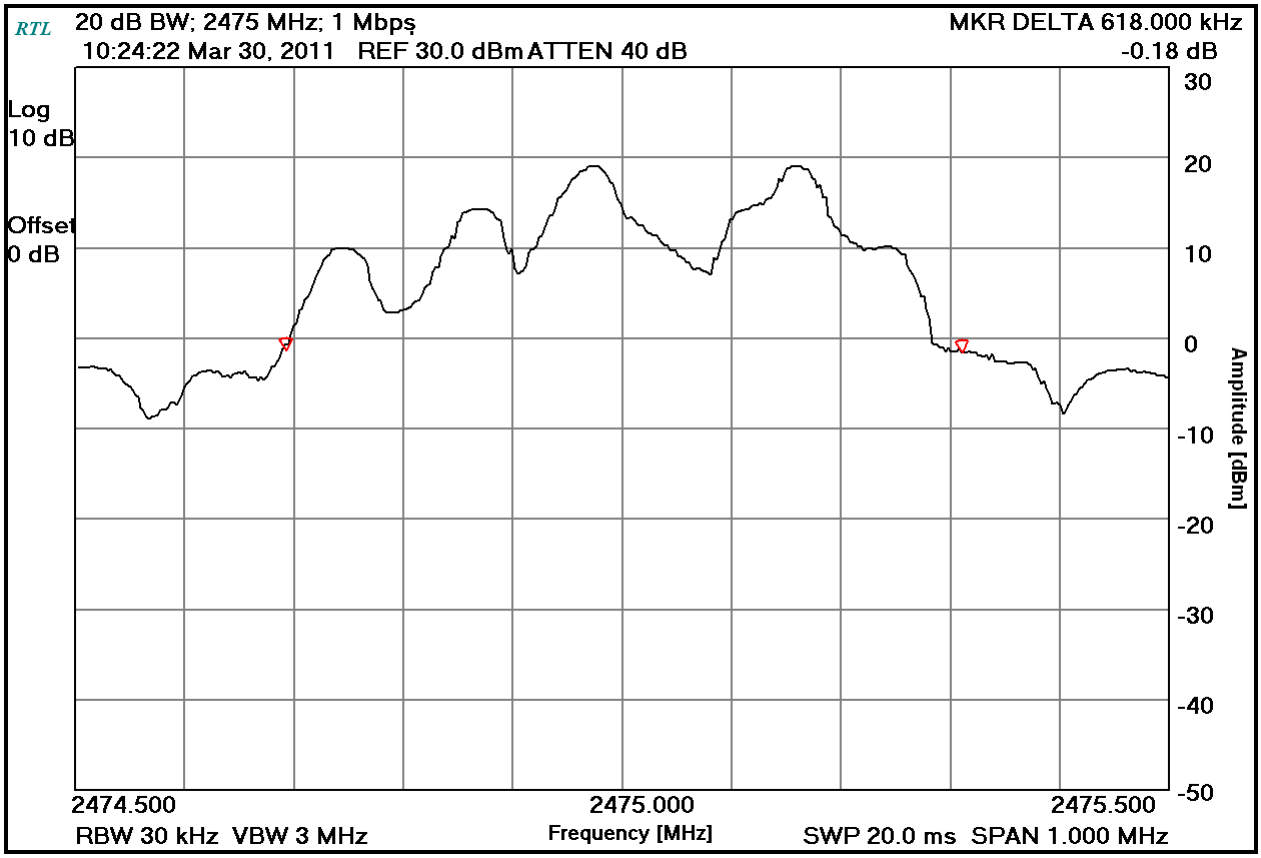
Plot 6-4: 20 dB Bandwidth - 2401 MHz – 1 Mbps



Plot 6-5: 20 dB Bandwidth - 2437 MHz – 1 Mbps



Plot 6-6: 20 dB Bandwidth - 2475 MHz – 1 Mbps



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	March 30, 2011
EMC Test Engineer	Signature	Date of Tests

7 Carrier Frequency Separation - §15.247(a)(1); IC RSS-210 §A8.1(d)

7.1 Carrier Frequency Separation Test Procedure

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

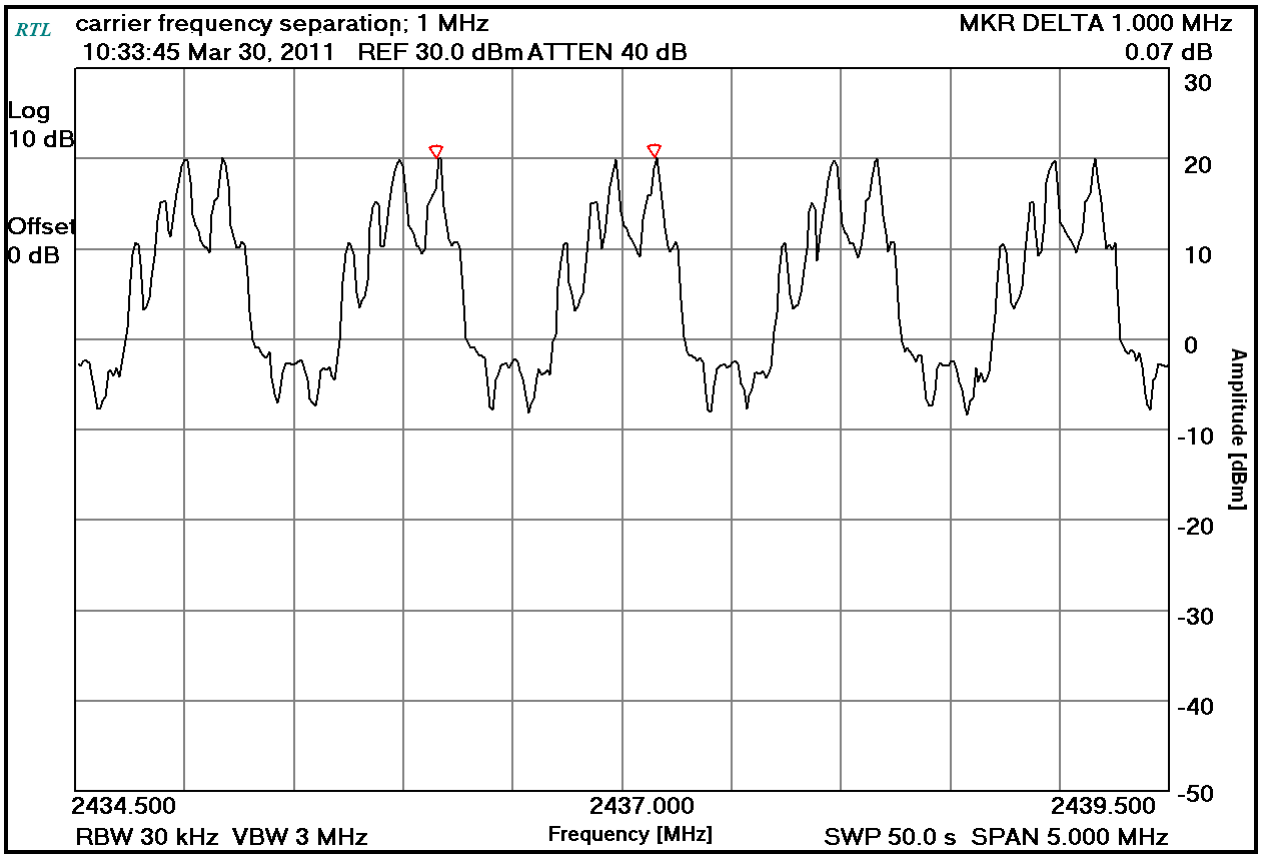
Measured frequency separation = 1.0 MHz

Table 7-1: Carrier Frequency Separation Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz-12.8 GHz)	3826A00144	1/13/12

7.2 Carrier Frequency Separation Test Data

Plot 7-1: Carrier Frequency Separation



Test Personnel:

Daniel W. Baltzell		March 30, 2011
EMC Test Engineer	Signature	Date of Test

8 Hopping Characteristics – FCC §15.247(a)(1)(iii); IC RSS-210 §A8.1(d)

8.1 Hopping Characteristics Test Procedure

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

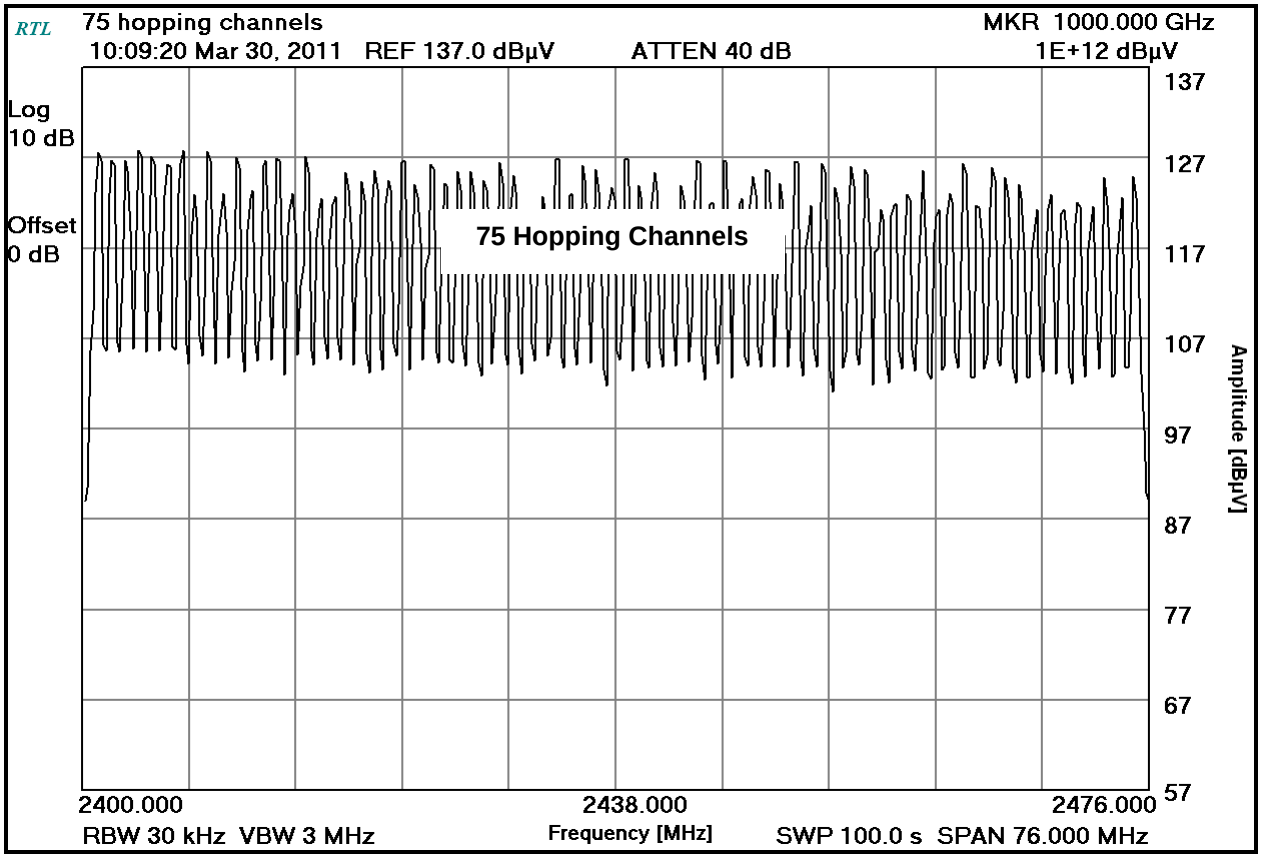
Table 8-1: Hopping Characteristics Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz-12.8 GHz)	3826A00144	1/13/12

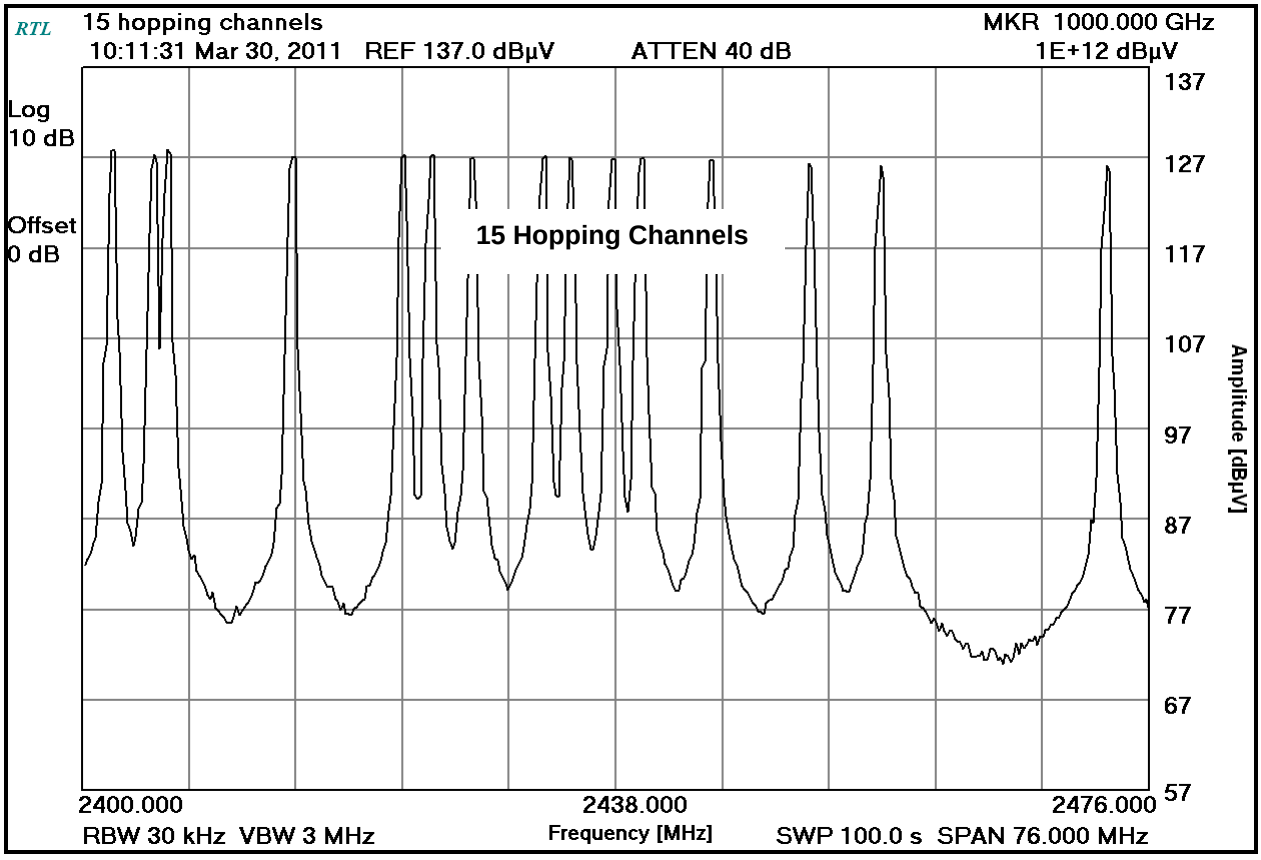
8.2 Number of Hopping Frequencies

Measured number of hopping frequencies = 15 and 75

Plot 8-1: Number of Hopping Frequencies (2401 - 2475 MHz) – 75 Hopping Channels



Plot 8-2: Number of Hopping Frequencies (2401 - 2475 MHz) – 15 Hopping Channels



Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	March 30, 2011
EMC Test Engineer	Signature	Date of Test

8.3 Average Time of Occupancy

The pulse width was measured to be 1.35 ms.

A plot was taken showing the number of pulses in a 5 second period for the 75 channel mode and 400 ms for the 15 channel mode, since it is not possible to discern the number of pulses within 0.4 seconds X 75 hopping channels (30 s) or x 15 hopping channels (6 s).

The number of pulses in 5 seconds was 41 pulses for 75 channel mode; this multiplied times 6 (30/5) gave 246 pulses in a 30 second period.

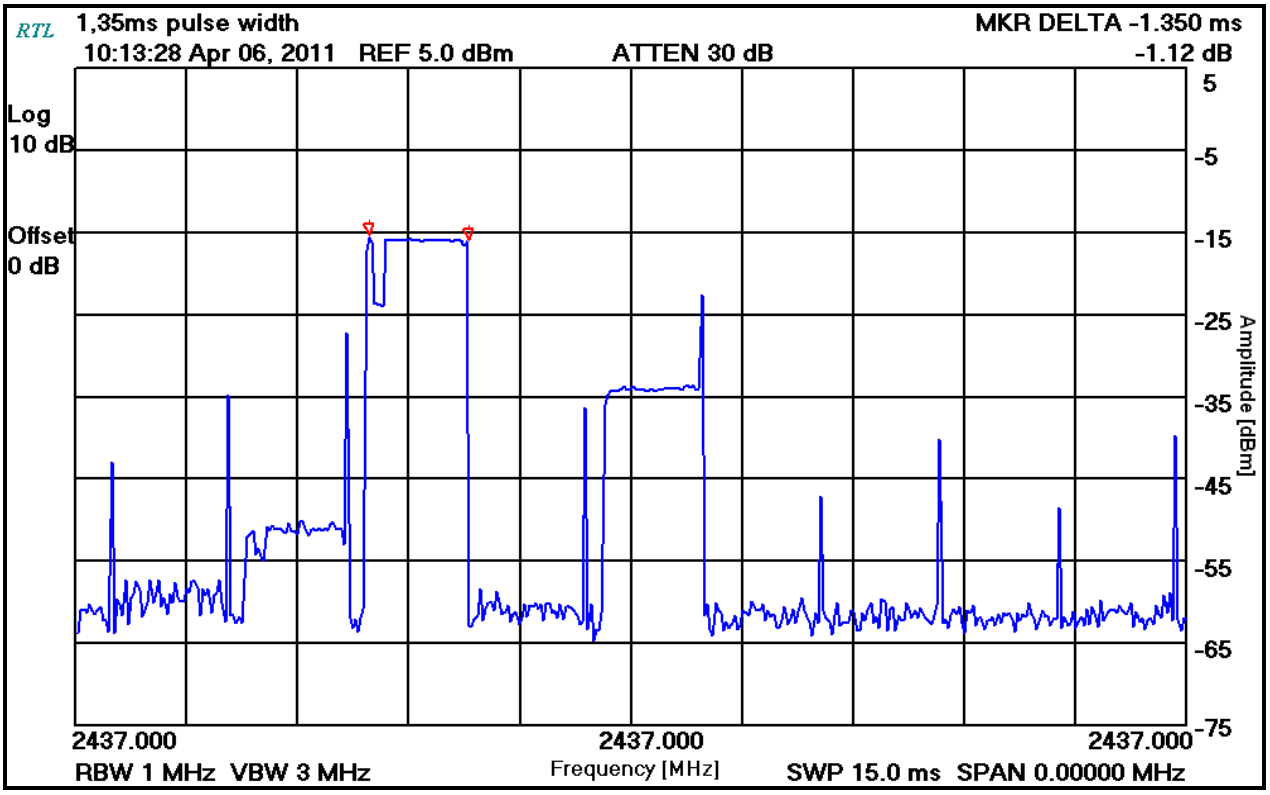
The number of pulses in 400 ms was 17 pulses for 15 channel mode; this multiplied times 15 (6/.4) gave 255 pulses in a 6 second period.

The worst case average time of occupancy in a 30 second period uses a setting of 250 kbps and 1.6 ms transmit interval, and is equal to 246 pulses (41/5 s) X 1.35 ms = 332 ms for 75 channels.

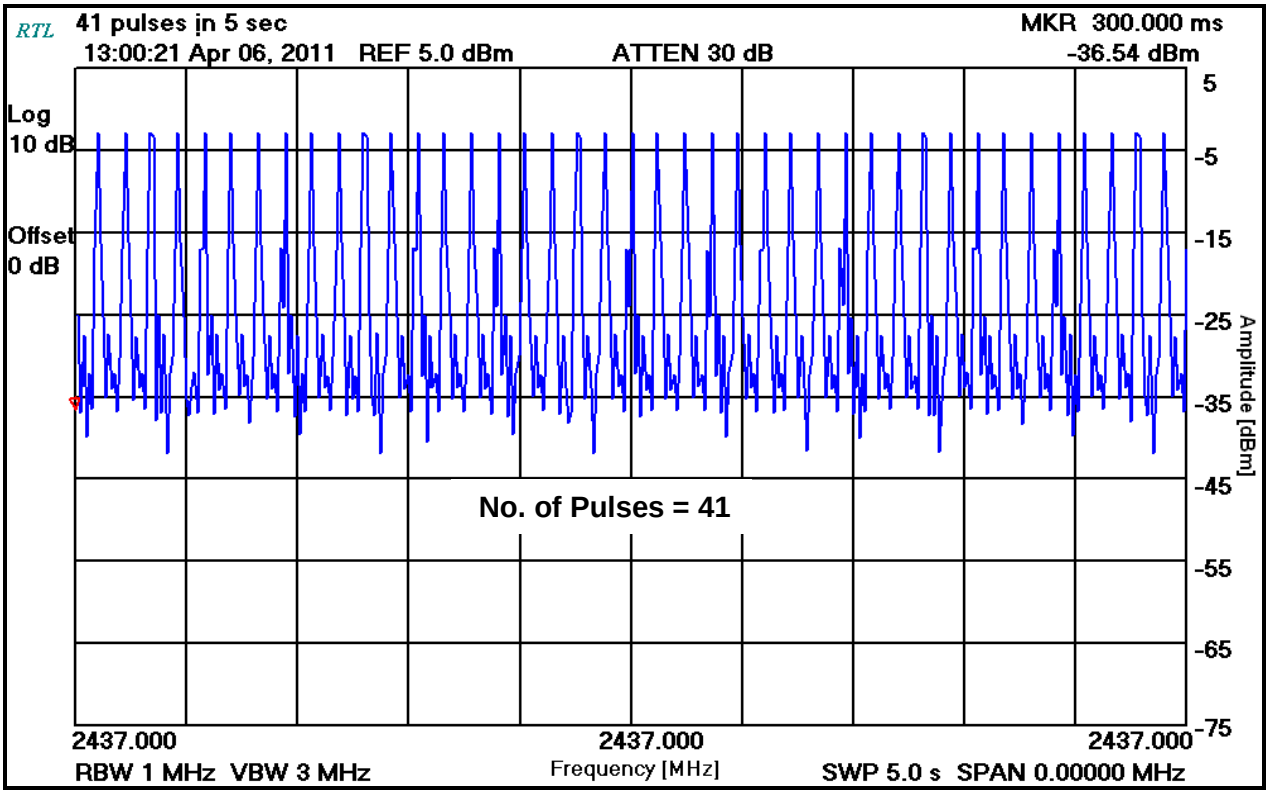
The worst case average time of occupancy in a 6 second period uses a setting of 250 kbps and 1.6 ms transmit interval, and is equal to 255 pulses (17/400 ms) X 1.35 ms = 344 ms for 15 channels.

These both meet the limit as defined by 15.247(a)(1)(iii) of 0.4 seconds.

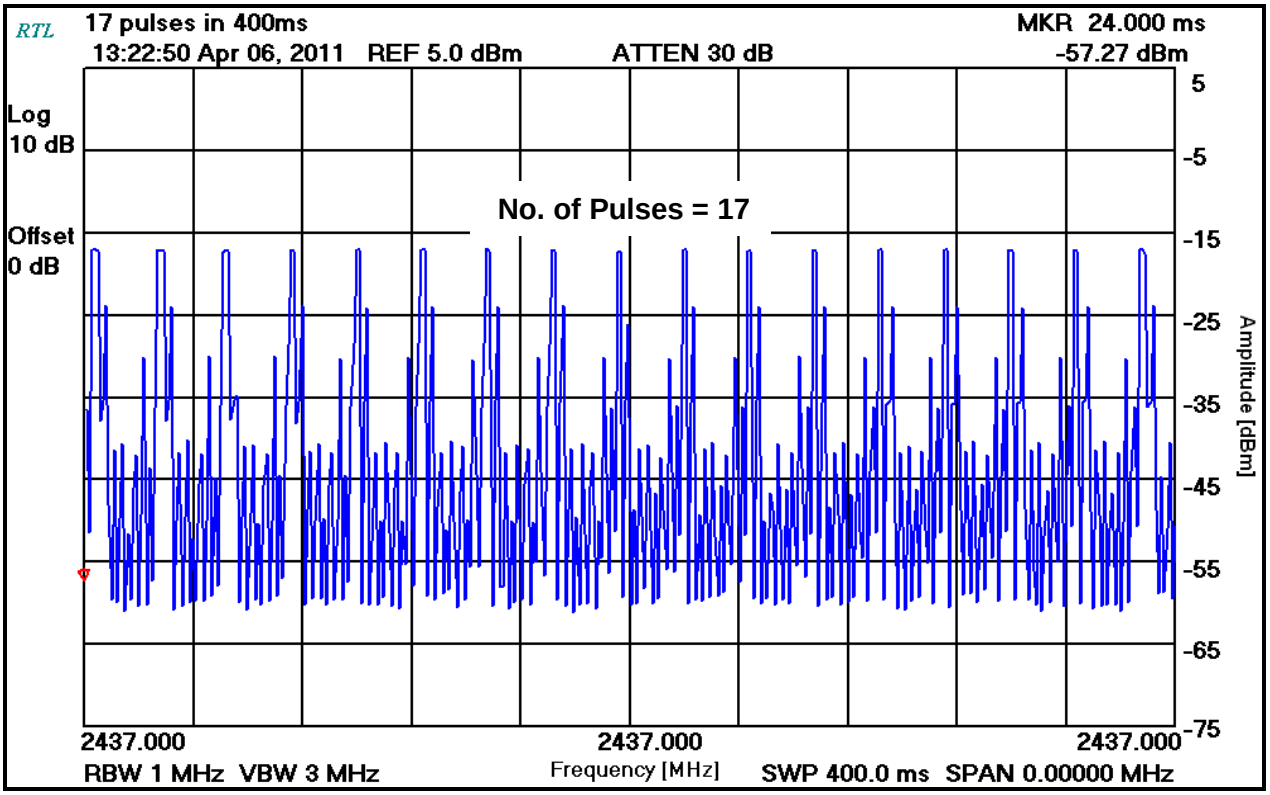
Plot 8-3: Pulse Width (1.35 ms)



Plot 8-4: Time of Occupancy (Dwell Time 5 Second Sweep) 75 channels



Plot 8-5: Time of Occupancy (Dwell Time 400 ms Sweep) 15 channels



Duty Cycle Correction

= 20 Log (on-off time/ on time)

On time = 1.35 ms (Plot 8.3)

On + off time = 24 ms (15 channels), 120 ms (75 channels)

Duty Cycle Correction = -25.1 (15 ch), -39.3 dB (75 ch)
-25 dB used as worst case

Table 8-2: Average Time of Occupancy 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	8/2/11
900914	Hewlett Packard	85460A	RF Filter Section (100 kHz-6.5 GHz)	3330A00107	8/2/11

Test Personnel:

Daniel W. Baltzell		April 6, 2011
EMC Test Engineer	Signature	Date of Tests

9 AC Conducted Emissions - FCC Rules and Regulations §15.207; IC RSS-Gen

9.1 Site and Test Description

The power line conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable).

The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded.

9.2 Test Limits

Line-Conducted Emissions		
	Limit (dBµV)	
Frequency (MHz)	**Quasi-Peak**	**Average**
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5.00	56	46
5.00 to 30.00	60	50

9.3 Conducted Emissions Test Data

Table 9-1: Conducted Emissions - Neutral Side – POE TX Mode

Temperature: 74°F Humidity: 25%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.150	Pk	49.1	0.1	49.2	66.0	-16.8	56.0	-6.8	Pass
0.276	Pk	37.9	0.1	38.0	60.9	-22.9	50.9	-12.9	Pass
0.400	Pk	34.3	0.2	34.5	57.9	-23.4	47.9	-13.4	Pass
1.210	Pk	33.6	0.4	34.0	56.0	-22.0	46.0	-12.0	Pass
5.720	Pk	31.4	1.2	32.6	60.0	-27.4	50.0	-17.4	Pass
23.220	Pk	40.1	2.5	42.6	60.0	-17.4	50.0	-7.4	Pass

Table 9-2: Conducted Emissions – Hot Side – POE TX Mode

Temperature: 74°F Humidity: 25%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.164	Qp	43.9	0.1	44.0	65.3	-21.3	55.3	-11.3	Pass
0.282	Qp	33.3	0.1	33.4	60.8	-27.4	50.8	-17.4	Pass
0.403	Qp	26.2	0.2	26.4	57.8	-31.4	47.8	-21.4	Pass
1.150	Pk	34.9	0.3	35.2	56.0	-20.8	46.0	-10.8	Pass
4.390	Qp	11.5	1.1	12.6	56.0	-43.4	46.0	-33.4	Pass
23.220	Pk	40.6	2.5	43.1	60.0	-16.9	50.0	-6.9	Pass

Table 9-3: Conducted Emissions - Neutral Side – 6 VDC AC Adapter; TX Mode

Temperature: 74°F Humidity: 25%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.154	Pk	52.0	0.1	52.1	65.8	-13.7	55.8	-3.7	Pass
0.281	Pk	39.6	0.1	39.7	60.8	-21.1	50.8	-11.1	Pass
0.398	Pk	33.6	0.2	33.8	57.9	-24.1	47.9	-14.1	Pass
0.500	Pk	31.6	0.2	31.8	56.0	-24.2	46.0	-14.2	Pass
18.320	Pk	28.3	2.3	30.6	60.0	-29.4	50.0	-19.4	Pass
23.240	Pk	28.0	2.5	30.5	60.0	-29.5	50.0	-19.5	Pass

Table 9-4: Conducted Emissions – Hot Side – 6 VDC AC Adapter; TX Mode

Temperature: 74°F Humidity: 25%									
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**QP Limit (dBuV)**	**QP Margin (dBuV)**	**AV Limit (dBuV)**	**AV Margin (dBuV)**	**Pass/ Fail**
0.161	Qp	44.9	0.1	45.0	65.4	-20.4	55.4	-10.4	Pass
0.293	Qp	31.8	0.1	31.9	60.4	-28.5	50.4	-18.5	Pass
0.403	Pk	43.1	0.2	43.3	57.8	-14.5	47.8	-4.5	Pass
1.770	Pk	36.5	0.5	37.0	56.0	-19.0	46.0	-9.0	Pass
18.380	Pk	26.7	2.3	29.0	60.0	-31.0	50.0	-21.0	Pass
23.240	Pk	27.7	2.5	30.2	60.0	-29.8	50.0	-19.8	Pass

Table 9-5: Conducted Emissions 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	8/2/11
901082	AFJ International	LS16	16A LISN	16010020082	4/13/11

Test Personnel:

Daniel W. Baltzell		March 30, 2011
EMC Test Engineer	Signature	Date of Tests

10 Radiated Emissions Test Results - FCC Rules and Regulations §15.247(d); IC RSS-210 §A8.5, RSS-Gen

10.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/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.

10.2 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 10^{th} 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.

As this is an LMA application, radiated testing was performed with the module in a stand-alone configuration and in a typical host. No significant discernible difference was observed in the emissions; the data that follows is representative of both configurations.

Table 10-1: 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	J54-00102600 36-5P	Preamplifier (1-26.5 GHz)	84986	2/22/12
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	10/19/11
901517	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/19/11
901242	Rhein Tech Laboratories, Inc.	WRT-000-0003	Wood rotating table	N/A	Not Required
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/11/11
900791	Chase	CBL6111B	Bilog Antenna (30 MHz–2000 MHz)	N/A	1/31/13
900321	EMCO	3161-03	Horn Antennas (4–8 GHz)	9508-1020	6/14/11
900323	EMCO	3160-07	Horn Antennas (8.2–12 GHz)	9605-1054	6/14/11
900356	EMCO	3160-08	Horn Antennas (12.4–18 GHz)	9607-1044	6/14/11
901218	EMCO	3160-09	Horn Antenna (18-26 GHz)	960281-003	6/14/11
900772	EMCO	3161-02	Horn Antenna (2-4 GHz)	9804-1044	6/14/11

10.2.1 Radiated Emissions Harmonics/Spurious Test Data

Table 10-2: Radiated Emissions Harmonics/Spurious - 2401 MHz (Peak)

Radiated Peak Emissions Harmonics - 2401 MHz					
Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/ VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m)	Peak Limit (dB)	Peak Margin (dB)
4802	70.7	-12.4	58.3	74.0	-15.7
12005	63.0	-0.5	62.5	74.0	-11.5
19208	38.4	21.4	59.8	74.0	-14.2

Table 10-3: Radiated Emissions Harmonics/Spurious - 2401 MHz (Average)

Radiated Average Emissions Harmonics - 2401 MHz					
Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m) (Less 25 dB 5.6% duty cycle)	Average Limit (dB)	Average Margin (dB)
4802	64.2	-12.4	26.8	54.0	-27.2
12005	52.6	-0.5	27.1	54.0	-26.9
19208	36.7	21.4	33.1	54.0	-20.9

Table 10-4: Radiated Emissions Harmonics/Spurious - 2437 MHz (Peak)

Radiated Peak Emissions Harmonics - 2437 MHz					
Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/ VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m)	Peak Limit (dB)	Peak Margin (dB)
4874	71.9	-12.8	59.1	74.0	-14.9
7311	75.5	-10.9	64.6	74.0	-9.4
12185	64.9	1.9	66.8	74.0	-7.2
19496	29.8	23.3	53.1	74.0	-20.9

Table 10-5: Radiated Emissions Harmonics/Spurious - 2437 MHz (Average)

Radiated Average Emissions Harmonics - 2437 MHz					
Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m) (Less 25 dB 5.6% duty cycle)	Average Limit (dB)	Average Margin (dB)
4874	65.1	-12.8	27.3	54.0	-26.7
7311	66.9	-10.9	31.0	54.0	-23.0
12185	54.4	1.9	31.3	54.0	-22.7
19496	19.0	23.3	17.3	54.0	-36.7

Table 10-6: Radiated Emissions Harmonics/Spurious - 2475 MHz (Peak)

Radiated Peak Emissions Harmonics - 2475 MHz					
Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/ VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m)	Peak Limit (dB)	Peak Margin (dB)
4950	72.7	-13.1	59.6	74.0	-14.4
7425	70.6	-10.4	60.2	74.0	-13.8
12375	64.1	2.9	67.0	74.0	-7.0
19800	27.9	31.4	59.3	74.0	-14.7

Table 10-7: Radiated Emissions Harmonics/Spurious - 2475 MHz (Average)

Radiated Average Emissions Harmonics - 2475 MHz					
Emission Frequency (MHz)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Corrected Average Emission Level (dBuV/m) (Less 25 dB 5.6% duty cycle)	Average Limit (dB)	Average Margin (dB)
4950	65.7	-13.1	27.6	54.0	-26.4
7425	62.3	-10.4	26.9	54.0	-27.1
12375	53.4	2.9	31.3	54.0	-22.7
19800	17.1	31.4	23.5	54.0	-30.5

Table 10-8: Radiated Emissions Harmonics/Spurious - Hopping Mode (250 kbps, Internal Antenna)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/ VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m -25 dB, 5.6% d.c.)	Average Limit (dB)	Average Margin (dB)
4913.70	75.5	-10.3	65.2	74.0	-8.8	6.5	54.0	-47.5
7298.30	77.4	-8.0	69.4	74.0	-4.6	8.5	54.0	-45.5
12365.00	71.2	0.1	71.3	74.0	-2.7	15.4	54.0	-38.6
14480.53	51.7	5.1	56.8	74.0	-17.2	19.3	54.0	-34.7

Table 10-9: Radiated Emissions Harmonics/Spurious - Hopping Mode (250 kbps, External Antenna)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/ VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m -25 dB, 5.6% d.c.)	Average Limit (dB)	Average Margin (dB)
4895.50	66.3	-10.4	55.9	74.0	-18.1	0.1	54.0	-53.9
7301.10	78.4	-8.0	70.4	74.0	-3.6	2.5	54.0	-51.5
12348.70	66.9	-0.1	66.8	74.0	-7.2	10.4	54.0	-43.6
14460.67	57.5	4.9	62.4	74.0	-11.6	15.4	54.0	-38.6

Table 10-10: Radiated Emissions Harmonics/Spurious - Hopping Mode (1 Mbps, Internal Antenna)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/ VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m -25 dB, 5.6% d.c.)	Average Limit (dB)	Average Margin (dB)
4806.60	69.5	-10.9	58.6	74.0	-15.4	2.4	54.0	-51.6
7261.90	81.4	-8.0	73.4	74.0	-0.6	5.8	54.0	-48.2
12363.90	72.0	0.1	72.1	74.0	-1.9	12.7	54.0	-41.3
14495.80	56.3	5.3	61.6	74.0	-12.4	19.5	54.0	-34.5

Table 10-11: Radiated Emissions Harmonics/Spurious - Hopping Mode (1 Mbps, External Antenna)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/ VBW)	Site Correction Factor (dB/m)	Corrected Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m -25 dB, 5.6% d.c.)	Average Limit (dB)	Average Margin (dB)
4811.90	64.6	-10.9	53.7	74.0	-20.3	1.7	54.0	-52.3
7251.40	78.4	-8.0	70.4	74.0	-3.6	6.0	54.0	-48.0
12363.90	67.6	0.1	67.7	74.0	-6.3	12.5	54.0	-41.5
14484.90	58.3	5.2	63.5	74.0	-10.5	19.6	54.0	-34.4

Test Personnel:

Daniel W. Baltzell		March 29-31, 2011
Test Engineer	Signature	Dates of Tests

11 Conclusion

The data in this measurement report shows that the EUT as tested, Fleetwood Group, Inc., Model: V2420G, FCC ID: FBRV2420G, IC: 1859A-V2420G, 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.