Lab Code: 200167-0

FCC PART 15.247

INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

MEASUREMENT AND TEST REPORT

For

Monster, LLC

7251 West Lake Mead Blvd, suite 342

Las Vegas, NV 89128, USA

Model: 190070-00
FCC ID: RJE190070-00
IC ID: 5153A-19007000

Report Type:	**Product Type:**
☒ Original Report	2.4 GHz Transceiver

Test Engineer(s):	Xiao Ming Hu
Report Number:	R0710242
Report Date:	2007-11-28
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1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Monster LLC* product *model: 190070-00* or the "EUT" as referred to in this report, is a 2.4 GHz transceiver. EUT is a 2.4GHz audio bridge transmitter based on the Nordic nRF24Z1 chip. All RF functions are implemented by the chip including the frequency hopping, digital modulation, and half duplex handshaking with the target receiver.

The transceiver uses 38 channels for frequency hopping in the 2404 to 2478 MHz band with GFSK modulation. The lowest channel is centered at 2404 MHz. The highest channel is centered at 2476 MHz.

1.2 Mechanical Description of EUT

The *Monster, LLC model: 190070-00, is* a 2.4 GHz Transceiver and measures approximately 48.5 mm **(L)** x 40 mm **(W)** x 7 mm **(H)**, weighing approximately *16.0 g*.

1.3 Antenna Description

Item Number	Model/Type	
Antenna	Model number:	nRF24Z1
	Antenna Manufacturer:	Nordic
	Frequency :	2.4 GHz
	Maximum Gain	1 dBi
	Antenna Type/ Pattern:	Quarterwave/ Monopole
	Connection Type:	Solder
	Measurement:	Length: 26 mm (L) x 15 mm (W) x 0.1 mm (H)

1.4 EUT Photo

Please refer to Exhibit C for addition EUT photographs.

1.5 Objective

This report is prepared on behalf of *Monster LLC.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules and Industry Canada RSS-210 Issue 7, June 2007 standard.

The objective is to determine compliance with FCC and IC standards, rules and limits for this device including:

- RF Exposure
- Antenna Requirement
- Conducted Emissions*
- Spurious Emissions at Antenna Port
- Radiated Spurious Emissions
- Restricted Band
- Receiver Spurious Emissions
- Hopping Channel Separation
- 20 dB Bandwidth & 99% Bandwidth
- Number of Hopping Frequencies Used
- Dwell Time of Each Frequency
- Maximum Peak Output Power
- 100 kHz Bandwidth of Frequency Band Edge

  Note: * = NA

1.6 Related Submittal(s)/Grant(s)

No related submittals.

1.7 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.8 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from +2.0 for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.9 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The host system was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The EUT is programmed with the following data rate settings that were used during testing:

Channel	Low	Middle	High
Frequency (MHz)	2404	2438	2476

IPod, speakers and receiver are provided by manufacture in order to exercise the unit.

2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

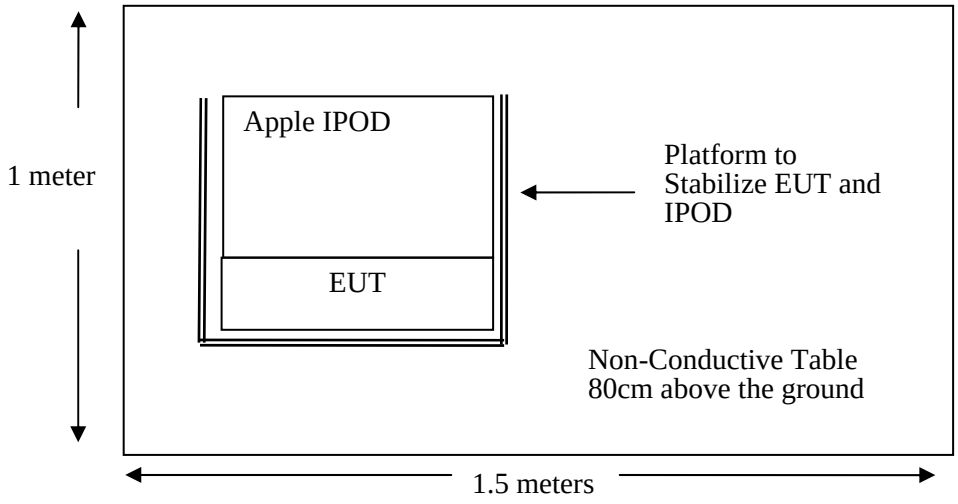
No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

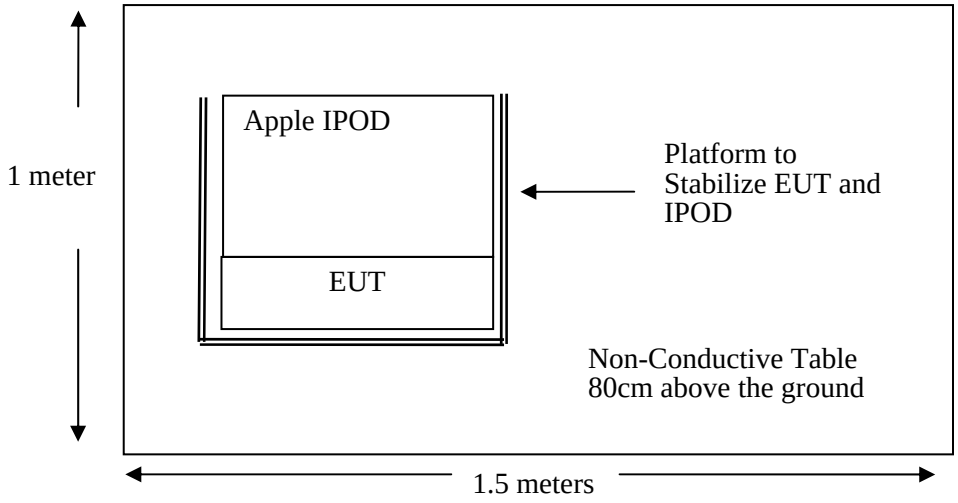
Manufacturer	Description	Model	Serial Number
Apple	2G IPod Nano	MA477LL	5U635JAMVQ5
Monster, LLC	Audio Bridge Receiver	190069-00	-
-	Generic DC battery-power speakers	-	-

2.6 Test Setup Block Diagrams

Receiver Radiated Emissions



Transmitter Radiated Emission



3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC 15C / RSS-210 Rules	Description of Test	Result	Note
FCC §15.247 (i) and §2.1091, IC RSS-Gen 5.5 & RSS-102	RF Exposure	Compliant	-
FCC §15.203, IC RSS-Gen §7.1.4	Antenna Requirement	Compliant	-
FCC §15.207 (a), IC RSS-Gen §7.2.2	Conducted Emissions	NA	*See note 1*
FCC §15.205, §15.209 & IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant	-
FCC §15.205, RSS-210 §A8.5	Restricted Band	Compliant	-
§15.109(a) & §15.247(d), RSS-Gen §6(a)	Receiver Spurious Emissions	Compliant	-
§15.247 (a)(1), RSS-210 §A8.1	20 dB Bandwidth & 99% Bandwidth	Compliant	-
§15.247 (a)(1), RSS-210 §A8.1	Hopping Channel Separation	Compliant	-
§15.247 (a)(1)(iii), RSS-210 §A8.1(d)	Number of Hopping Frequencies Channel Used	Compliant	-
§15.247 (a)(1)(iii), RSS-210 §A8.1(d)	Dwell Time	Compliant	-
§15.247 (b)(3), RSS210 § A8.4	Maximum Peak Output Power	Compliant	-
§ 15.247 (d), RSS210 § A8.5	100 kHz Bandwidth of Frequency Band Edge	Compliant	-

Note 1: The Apple Ipod can not be connected to a charger while interfacing with the EUT.

4 FCC §15.247 (i) and §2.1091, IC RSS-Gen 5.5 & RSS-102 - RF Exposure

4.1 Applicable Standard

According to §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

4.2 MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	-17.8
Maximum peak output power at antenna input terminal (mW):	0.016
Prediction distance (cm):	20
Prediction frequency (MHz):	2440
Maximum Antenna Gain, typical (dBi):	1.0
Maximum Antenna Gain (numeric):	1.26
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00132
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

4.3 Test Result

The power density level at 20 cm is 0.00132 mW/cm^2, which is below the uncontrolled exposure limit of 1.0mW/cm^2 at 2441MHz.

5 FCC §15.203, IC RSS-Gen §7.1.4 – Antenna Requirement

5.1 Applicable Standard

According to FCC §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

As per IC RSS-Gen §7.1.4: Transmitter Antenna, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

5.2 Result

The Antenna is a quarter wave monopole antenna with a gain of: 1 dBi.

Item Number	Model/Type	
RF Antenna	Model number:	nRF24Z1
	Antenna Manufacturer:	Nordic
	Frequency Range:	2.4 GHz
	Maximum Gain	1 dBi
	Antenna Type/ Pattern:	Quarterwave / monopole
	Connection Type:	solder
	Measurement:	Length: 26 mm (L) x 15 mm (W) x 0.1 mm (H)

Antenna Photo

☒ **Compliant** ☐ **N/A**

6 FCC §15.207 (a), IC RSS-Gen §7.2.2 - Conducted Emissions

Remarks: Not required, the Apple Ipod can not connect to a charger while interfacing with the EUT.

7 FCC §15.205, §15.209 & §15.247(c), IC RSS-210 §A8.5 - Spurious Radiated Emissions

7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247(c)(1)(i): Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

IC RSS-GEN §4.9 the measurement method shall be described in the test report. The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

7.2 Test Setup

The radiated emissions tests were performed in the 3-meter open area test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

7.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

7.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2007-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18

* **Statement of Traceability:** BACL attests that all calibrations have been performed per the NVLAP requirements, traceable to NIST.

7.5 Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meters away from the testing antenna, which is varied from 1-4 meters, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

7.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

7.7 Environmental Conditions

Temperature:	20 °C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

**The testing was performed by Xiao Ming Hu from 2007-11-06.*

7.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC and IC requirements, and had the worst margin readings of:

Tranmitting (2404-2476 MHz)			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-5.5	4808	Vertical	Low, 1 GHz – 25GHz
-4.6	4876	Horizontal	Middle, 1 GHz – 25GHz
-13.1	7428	Horizontal	High, 1 GHz – 25GHz

7.9 Radiated Spurious Emissions Test Data

2404 - 2476 MHz, Measured at 3 meters, 1 GHz – 25 GHz

Low channel: 2404 MHz

Freq. (MHz)	Reading (dBuV)	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBuV/m)	15.247 / RSS-210		Note
			Height (m)	Polar (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	
4808.0	67.0	334	1.0	V	32.5	3.8	34.8	68.5	74	-5.5	Peak
4808.0	63.3	168	1.3	H	32.5	3.8	34.8	64.9	74	-9.1	Peak
7212.0	34.2	334	1.6	H	36.7	4.8	34.9	40.7	54	-13.3	Ave
7212.0	33.3	339	1.0	V	36.7	4.8	34.9	39.9	54	-14.1	Ave
4808.0	36.7	334	1.0	V	32.5	3.8	34.8	38.2	54	-15.8	Ave
4808.0	36.2	168	1.3	H	32.5	3.8	34.8	37.7	54	-16.3	Ave
7212.0	49.7	334	1.6	H	36.7	4.8	34.9	56.2	74	-17.8	Peak
7212.0	44.7	339	1.0	V	36.7	4.8	34.9	51.2	74	-22.8	Peak

Middle channel: 2438 MHz

Freq. (MHz)	Reading (dBuV)	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBuV/m)	15.247 / RSS-210		Note
			Height (m)	Polar (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	
4876.0	67.8	93	1.7	H	32.5	3.8	34.8	69.4	74	-4.6	Peak
4876.0	62.5	285	1.5	V	32.5	3.8	34.8	64.0	74	-10.0	Peak
7314.0	33.8	273	1.0	V	36.7	4.8	35.1	40.2	54	-13.8	Ave
7314.0	33.7	95	1.0	H	36.7	4.8	35.1	40.0	54	-14.0	Ave
4876.0	36.8	93	1.7	H	32.5	3.8	34.8	38.4	54	-15.6	Ave
4876.0	36.0	285	1.5	V	32.5	3.8	34.8	37.5	54	-16.5	Ave
7314.0	46.0	273	1.0	V	36.7	4.8	35.1	52.4	74	-21.6	Peak
7314.0	46.0	95	1.0	H	36.7	4.8	35.1	52.4	74	-21.6	Peak

High channel: 2476 MHz

Freq. (MHz)	Reading (dBuV)	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBuV/m)	15.247 / RSS-210		Note
			Height (m)	Polar (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	
7428.0	35.0	306	1.4	H	36.7	4.8	35.6	40.9	54	-13.1	Ave
7428.0	53.8	306	1.4	H	36.7	4.8	35.6	59.7	74	-14.3	Peak
7428.0	33.3	0	1.0	V	36.7	4.8	35.6	39.2	54	-14.8	Ave
4952.0	55.3	98	2.0	V	32.5	3.9	35.0	56.7	74	-17.3	Peak
4952.0	54.8	243	1.4	H	32.5	3.9	35.0	56.2	74	-17.8	Peak
4952.0	34.3	98	2.0	V	32.5	3.9	35.0	35.7	54	-18.3	Ave
4952.0	34.2	243	1.4	H	32.5	3.9	35.0	35.6	54	-18.4	Ave
7428.0	46.5	0	1.0	V	36.7	4.8	35.6	52.4	74	-21.6	Peak

Restricted Band Edge

Low Channel (2310-2390 MHz)

Freq. (MHz)	Reading (dBuV)	Direction Degree	Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Amp. (dBuV/m)	15.205 / RSS-210		Note
			Height (m)	Polar (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	
2381.9	36.6	90	1.0	v	28.7	2.7	35.8	32.2	54	-21.8	Ave
2386.3	36.3	230	1.1	h	28.7	2.7	35.8	31.9	54	-22.1	Ave
2386.3	50.6	230	1.1	h	28.7	2.7	35.8	46.2	74	-27.8	Peak
2381.9	49.3	90	1.0	v	28.7	2.7	35.8	44.9	74	-29.1	Peak

High Channel (2483.5-2500 MHz)

Freq. (MHz)	Reading (dBuV)	Direction Degree	Antenna			Cable Loss dB	Pre-Amp. (dB)	Cord. Amp. (dBuV/m)	15.205 / RSS-210		Note
			Height (m)	Polar (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	
2483.6	57.4	271	1.3	v	28.7	2.7	35.8	53.0	74	-21.0	Peak
2483.5	37.2	280	1.4	v	28.7	2.7	35.8	32.8	54	-21.2	Ave
2483.6	36.8	271	1.3	h	28.7	2.7	35.8	32.4	54	-21.6	Ave
2483.5	55.4	280	1.4	h	28.7	2.7	35.8	51.0	74	-23.0	Peak

8 §15.109 (a) & RSS-GEN §6 (a): Receiver Spurious Radiated Emissions

8.1 Applicable Standards

FCC 15.109

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (microvolts/meter)
30–88	100
88–216	150
216–960	200
Above 960	500

RSS-GEN

6. The following receiver spurious emission limits shall be complied with
   (a) If a radiated measurement is made, all spurious emissions shall comply with the limit of table 1.

Table-1 Spurious Emission Limits for Receivers

Spurious Frequency (MHz)	Field Strength (microvolt at 3 meters)
30 - 88	100
88 – 216	150
216 – 960	200
Above 960	500

8.2 Test Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2003.

8.3 Equipment Lists and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26
Sonoma Instrument	Amplifier Broadband (10 kHz - 2500 MHz)	317	260407	2007-04-26
Sunol Science Corp.	30MHz ~ 3 GHz Antenna	JB3	A020106-3/S006628	2007-03-05

***Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

8.4 Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

**The testing was performed by Xiao Ming Hu on 2007-11-09.*

8.5 Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

8.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emissions are 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Class B Limit

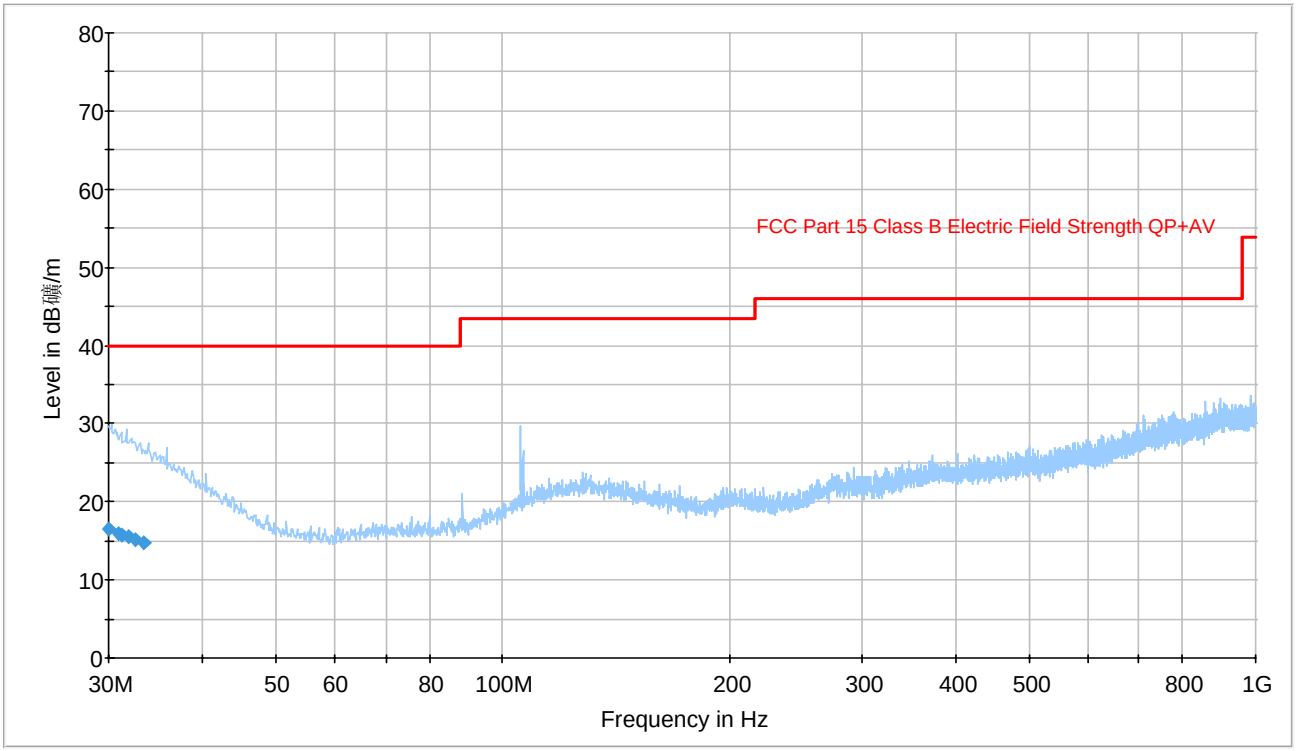
8.7 Summary of Test Results

According to the test data,, the EUT complied with the with the RSS-210, with the closest margins from the limit listed below:

Radiated Emissions Test Data @ 3meter

-23.5 dB at **30.040000 MHz** in the **Horizontal** polarization

8.8 Receiver Spurious Radiated Emissions Test Plot and Data



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (degrees)	Limit (dBµV/m)	Margin (dB)
30.040000	16.5	207.0	H	202.0	40.0	-23.5
30.928750	16.0	148.0	H	0.0	40.0	-24.0
31.257500	15.8	260.0	H	143.0	40.0	-24.2
31.902500	15.5	398.0	H	306.0	40.0	-24.5
32.511250	15.2	204.0	V	28.0	40.0	-24.8
33.440000	14.7	280.0	V	149.0	40.0	-25.3

9 FCC §15.247(a) (1), RSS-210 § A8.1 – 20 dB Bandwidth & 99% Bandwidth

9.1 Applicable Standard

According to §15.247(a)(1) & RSS-210§ A8.1 : 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. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emissions bandwidth. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

9.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

9.4 Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

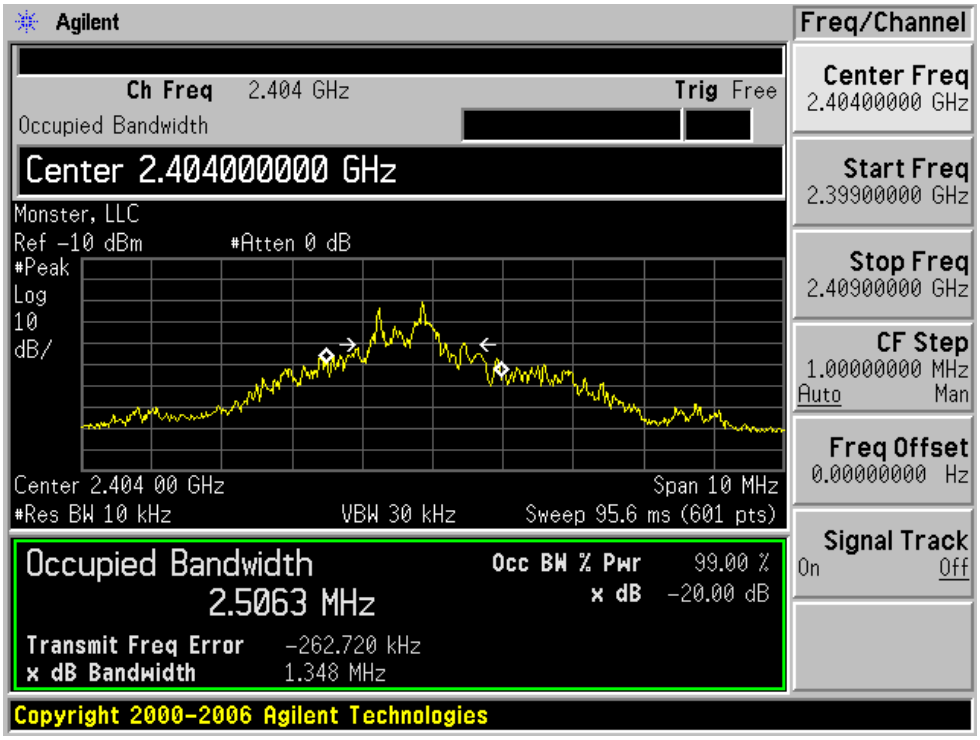
**The testing was performed by Xiao Ming Hu from 2007-11-09.*

9.5 Summary of Test Results

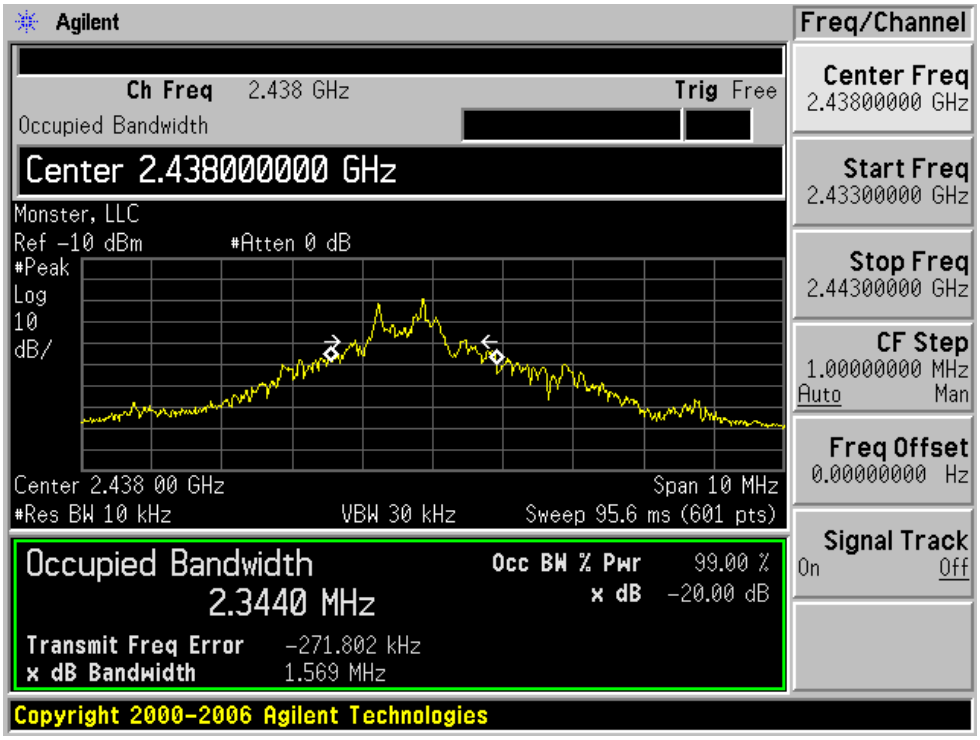
Channel	Frequency (MHz)	20 dB Channel Bandwidth (kHz)	99% Channel Bandwidth (kHz)
Low	2404	1348	2506.3
Middle	2438	1569	2344.0
High	2476	1376	2299.3

Please refer to the following plots for detailed test results

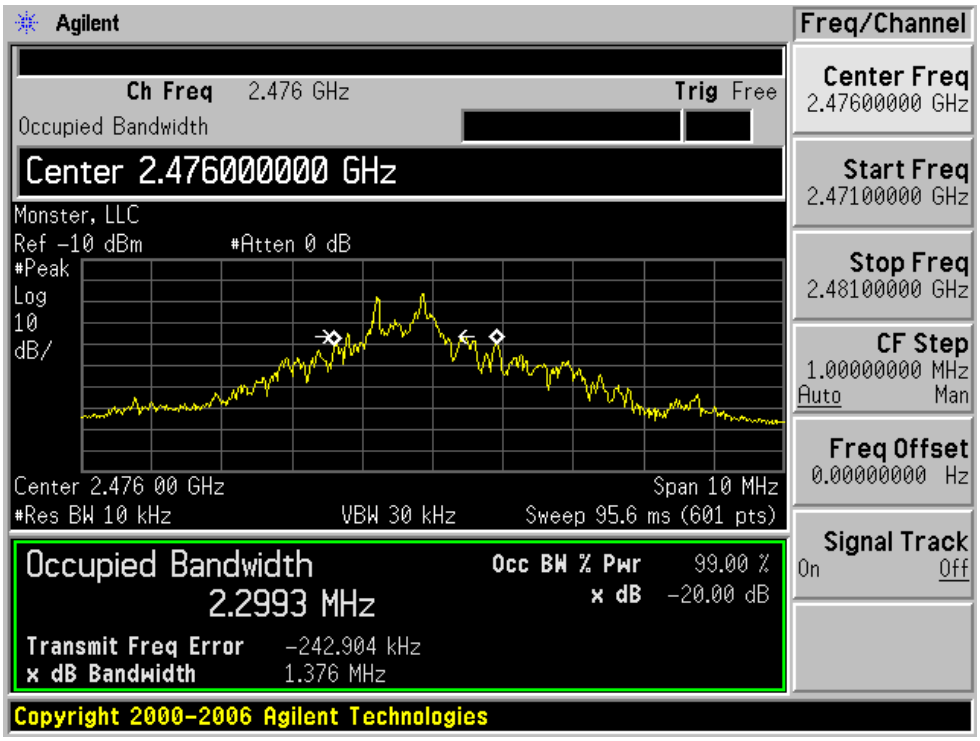
Low Channel



Middle Channel



High Channel



10 §15.247 (a) (1) & RSS-210 § A8.1 – Hopping Channel Separation

10.1 Applicable Standard

According to §15.247(a)(1) and RSS-210 §A8.1 : 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. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

10.2 Measurement Procedure

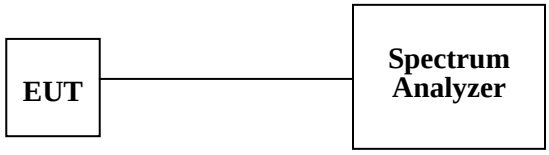
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the Max-Hold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

10.3 Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

10.4 Test Setup Diagram



10.5 Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

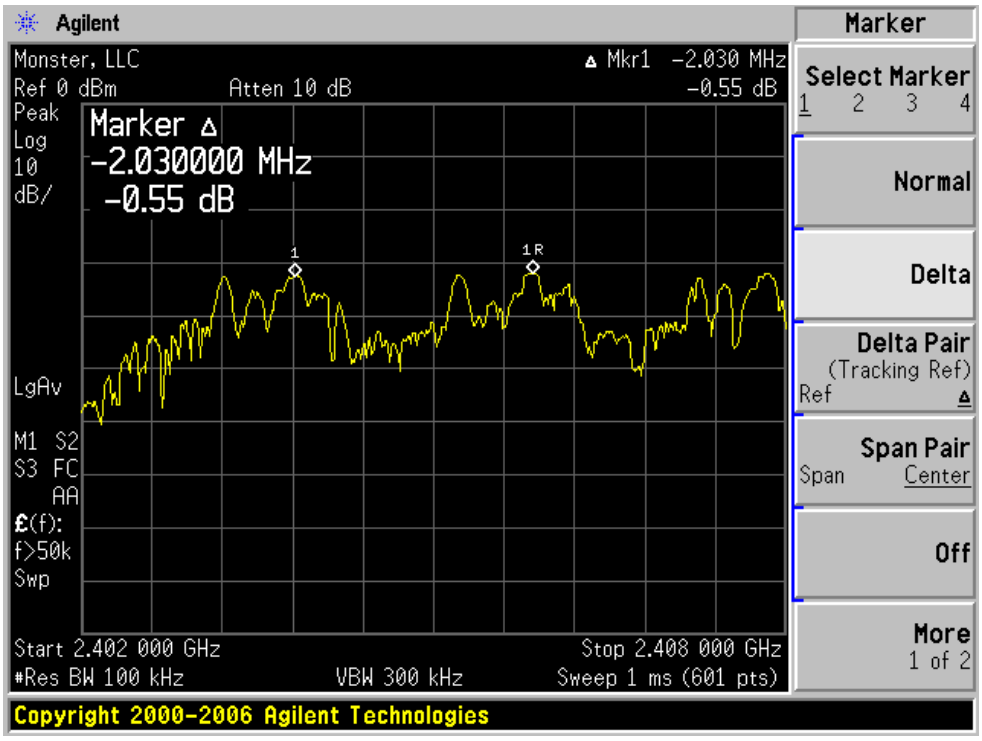
**The testing was performed by Xiao Ming Hu from 2007-11-09.*

10.6 Measurement Results

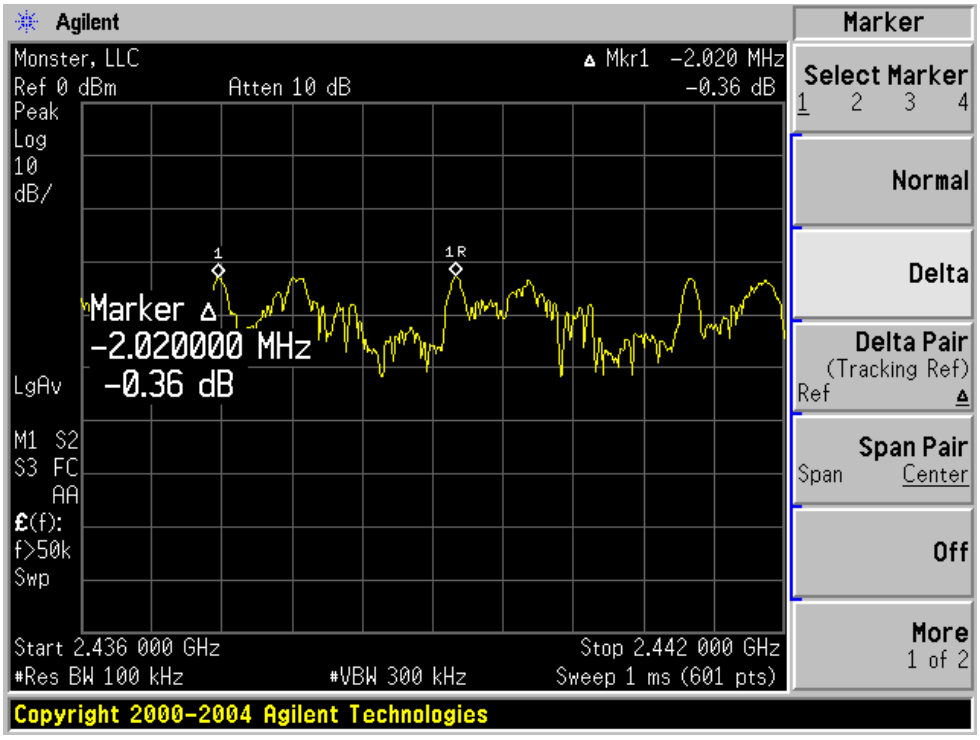
Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 20 dB BW >(kHz)	Result
Low	2404	2030	1348	Compliant
Middle	2438	2020	1569	Compliant
High	2476	2010	1376	Compliant

Please refer to the following plots:

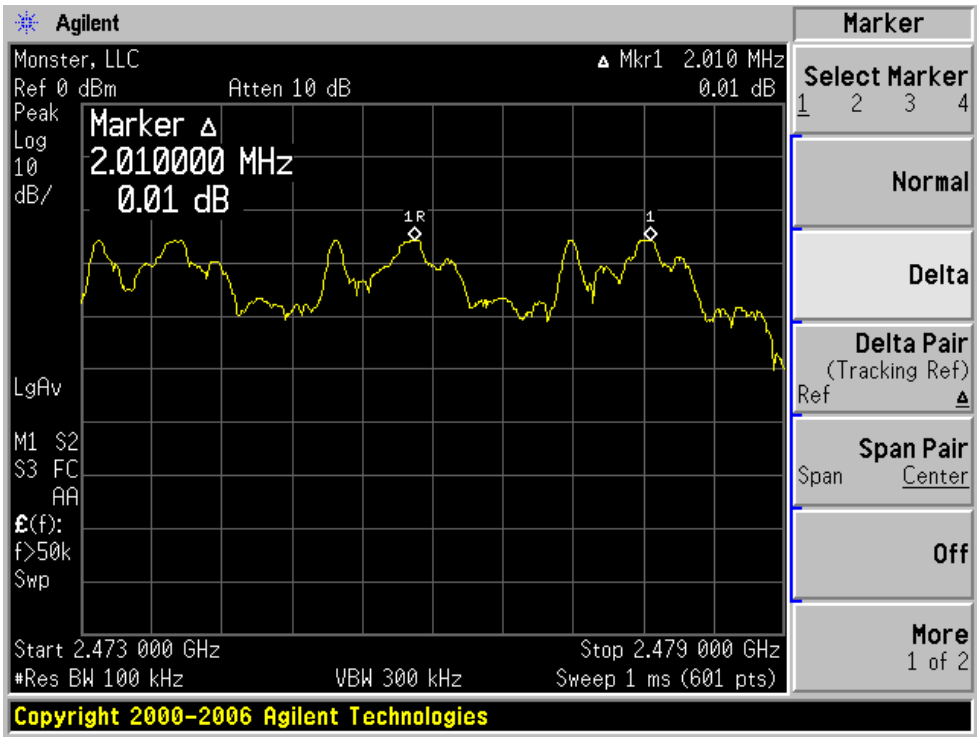
Low Channel



Middle Channel



High Channel



11 FCC §15.247(b) (1), RSS210 § A8.4 - Peak Output Power Measurement

11.1 Applicable Standard

§15.247(b) the maximum peak output power of the intentional radiator shall not exceed the following:

§15.247(b) (1) and RSS210 § A8.4 (2) for all other frequency hopping systems in the 2400–2483.5 MHz bands: 0.125 Watt.

§15.247(b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

11.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Max the emission readings from the EUT by turning the table and varying the antenna height.
3. If antenna conducted tests cannot be performed on this device, radiated tests to show compliance with the peak output power limit specified in Section 15.247(b) and the spurious RF conducted emission limit specified in Section 15.247(c) are acceptable. As stated previously, a pre-amp, and, in the latter case, a high pass filter, are required for the following measurements.

Calculate the transmitter's peak power using the following equation:

$$E = \frac{\sqrt{30PG}}{d}$$

$$P = \frac{(E*d)^2}{30G}$$

Where: E is the measured maximum fundamental field strength in V/m, utilizing a RBW ≥ the 20 dB bandwidth of the emission, VBW > RBW, peak detector function. Follow the procedures in C63.4-1992 with respect to maximizing the emission.

G is the numeric gain of the transmitting antenna with reference to an isotropic radiator.

d is the distance in meters from which the field strength was measured.

P is the power in watts for which you are solving

4. To demonstrate compliance with the spurious RF conducted emission requirement of Section 15.247(c), use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Measure the field strength of both the fundamental emission and all spurious emissions with these settings. Follow the procedures in C63.4-1992 with respect to maximizing the emissions. The measured field strength of all spurious emissions must be below the measured field strength of the fundamental emission by the amount specified in Section 15.247(c). Note that if the emission falls in a Restricted Band, as defined in Section 15.205, the procedure for measuring spurious radiated emissions, listed above, must be followed.

11.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

11.4 Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

**The testing was performed by Xiao Ming Hu from 2007-11-09.*

11.5 Measurement Result

Channel	Frequency (MHz)	Peak Output Power (mW)	Limit (mW)	Result
Low	2404	0.125	1000	Compliant
Mid	2438	0.222	1000	Compliant
High	2476	0.250	1000	Compliant

12 §15.247 (a) (1) (iii) RSS-210 § A8.1 (d) - Number of Hopping Frequencies Used

12.1 Standard Applicable

According to §15.247(a)(1)(iii) & RSS-210 §8.1(d): 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.

12.2 Measurement Procedure

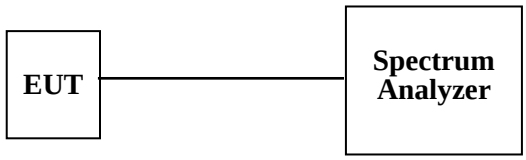
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

12.3 Test Equipment List and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

12.4 Test Setup Diagram



12.5 Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

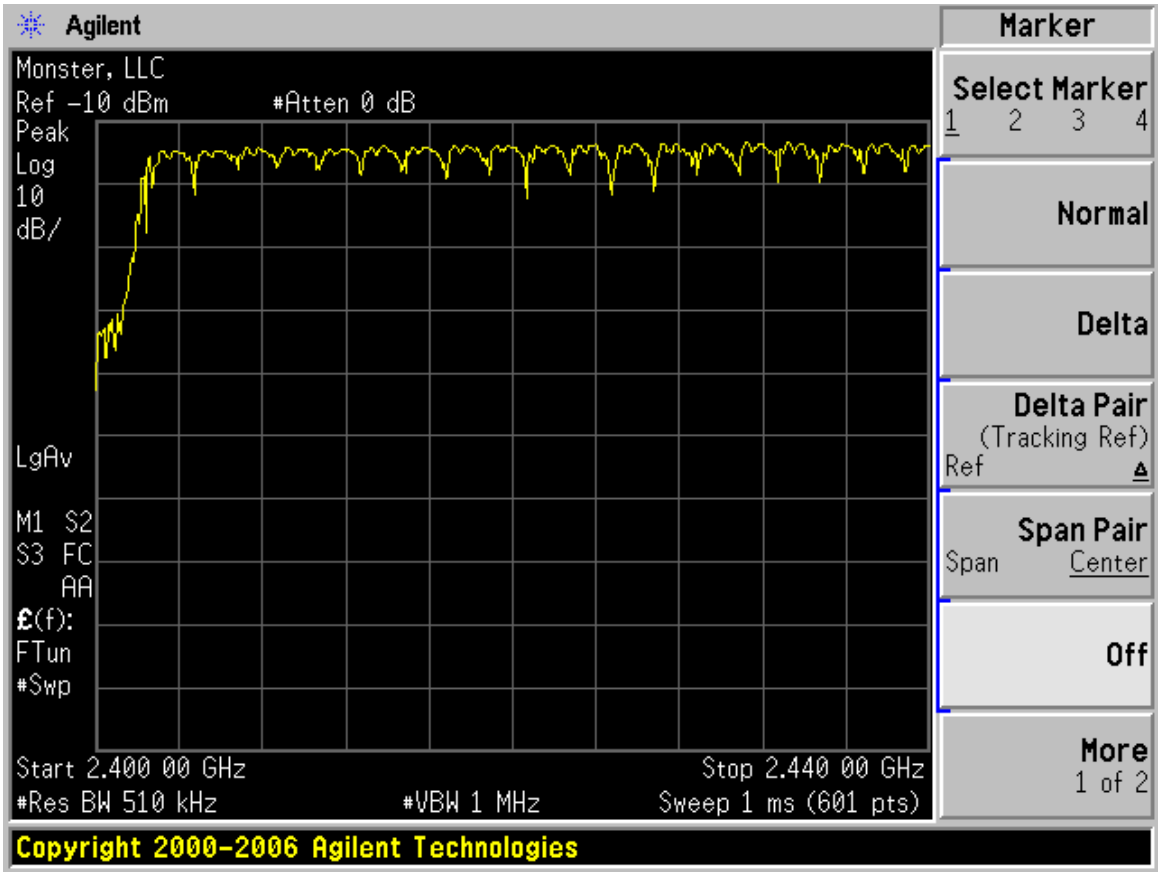
**The testing was performed by Xiao Ming Hu from 2007-11-09.*

12.6 Measurement Result

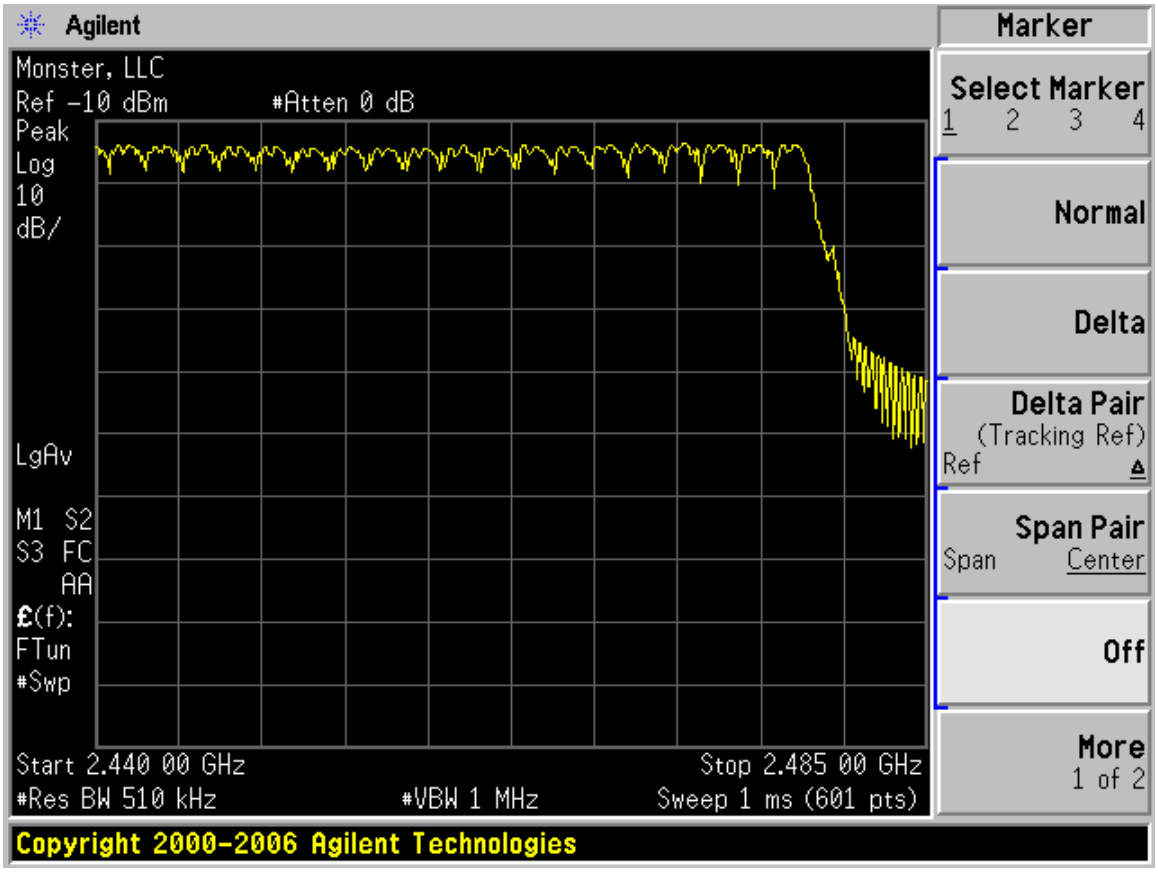
Frequency Range (MHz)	Number of Hopping Channels	Limit
2404-2480	38	>15

Please refer to the following plots:

Plot-1: Number of Channels 19



Plot-2: Number of Channels 19



13 §15.247(a) (1) (iii), RSS-210 §A8.1 (d) - Dwell Time

13.1 Applicable Standard

According to §15.247 (a)(1)(iii) & RSS-210 §8.1(d), For Frequency hopping systems in the 2400–2483.5 MHz band 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.

13.2 Measurement Procedure

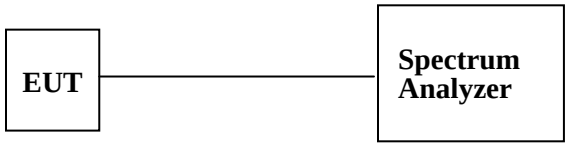
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

13.3 Test Equipment List and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100044	2007-02-19

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

13.4 Test Setup Diagram



13.5 Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

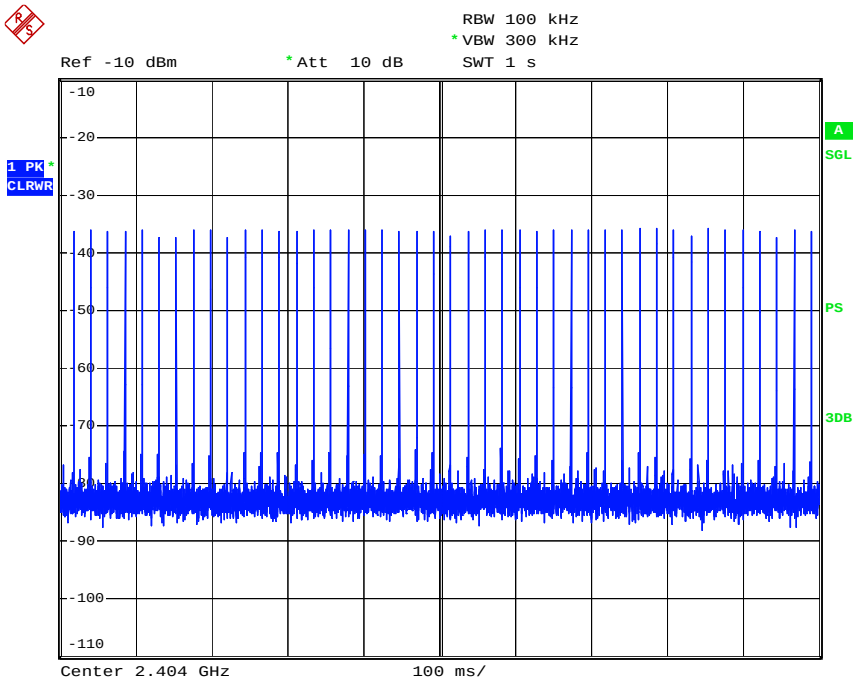
**The testing was performed by Xiao Ming Hu from 2007-11-26.*

13.6 Measurement Results

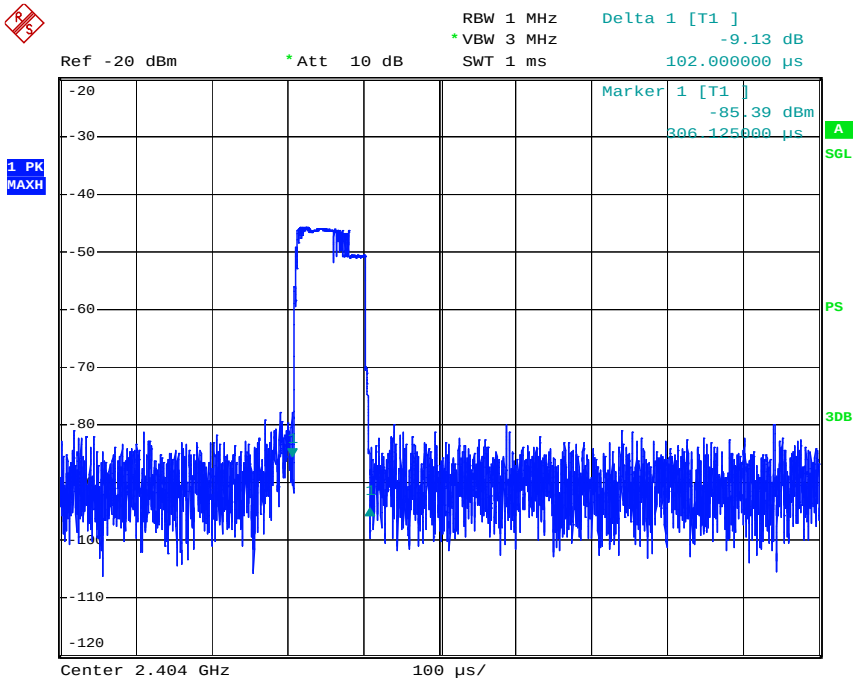
Channel	Frequency (MHz)	Pulse Width (us)	Pulse Quantity Per 2 Sec	Dwell Time (sec.)	Limit (Sec.)	Result
Low	2404	102	88	0.068	0.4	Compliant
Mid	2438	100	90	0.068	0.4	Compliant
High	2476	100	88	0.067	0.4	Compliant

Please refer the following plots.

Low Channel

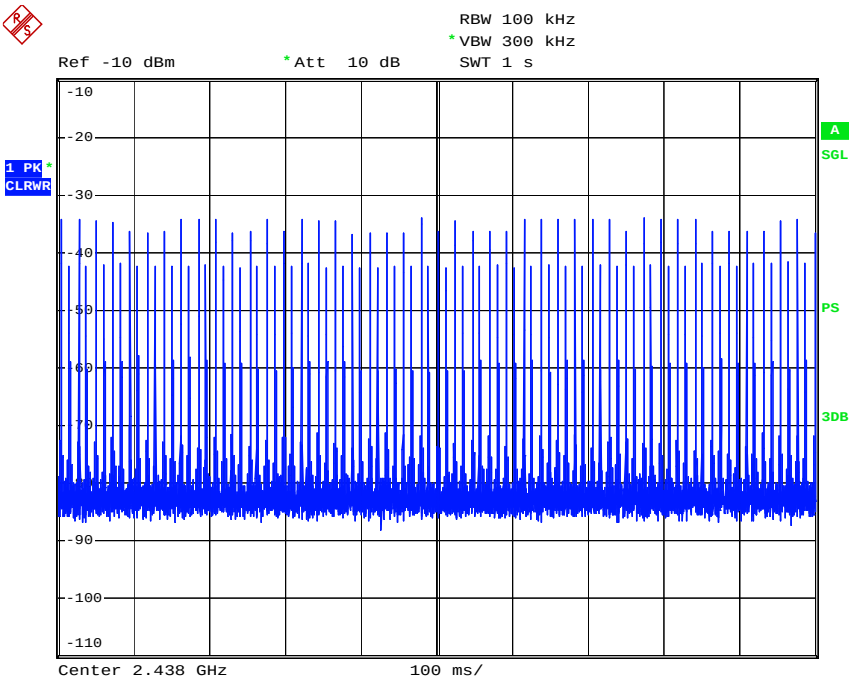


Date: 26.NOV.2007 14:50:58

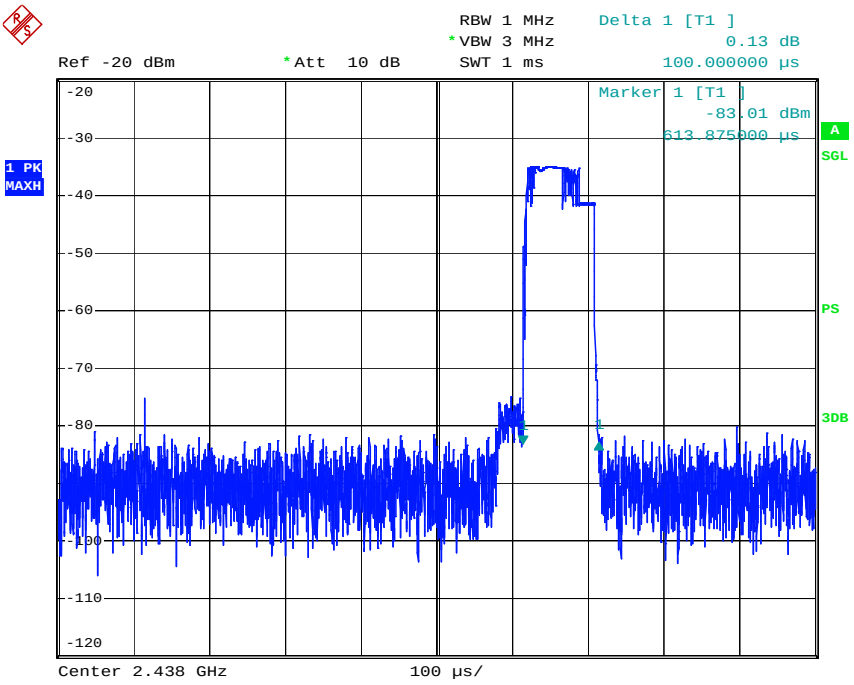


Date: 26.NOV.2007 14:01:10

Middle Channel

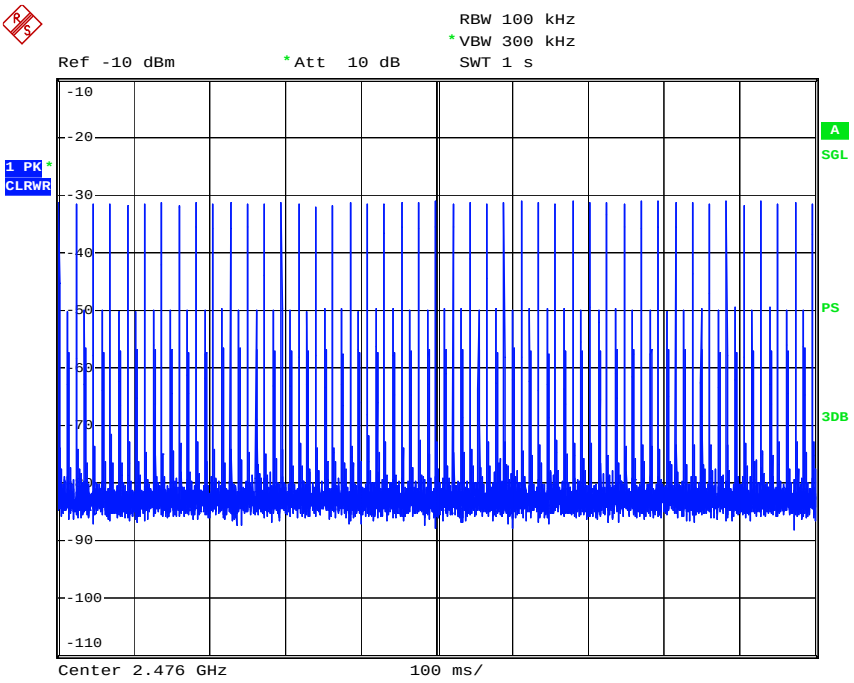


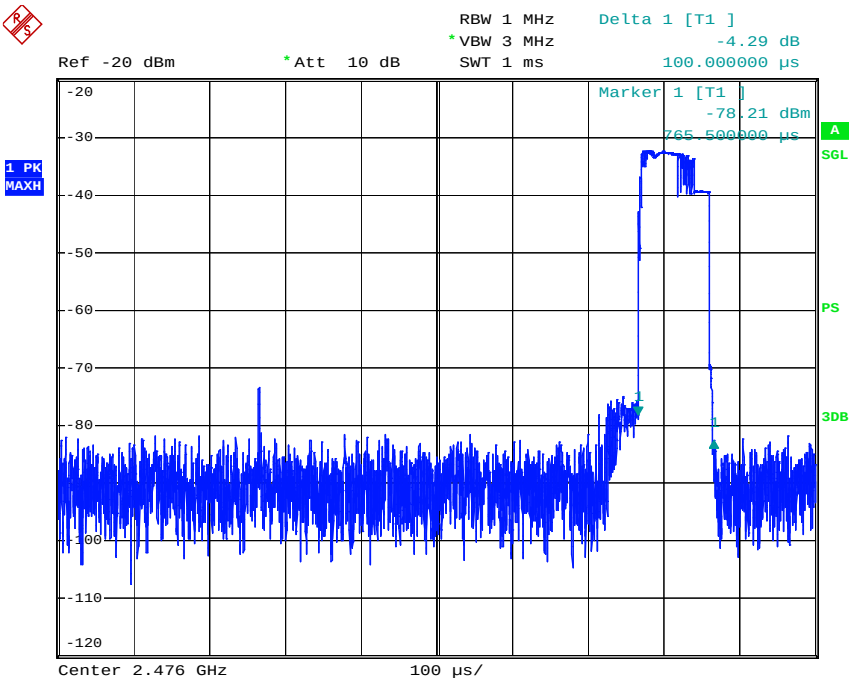
Date: 26.NOV.2007 14:49:41



Date: 26.NOV.2007 13:53:48

High Channel





Date: 26.NOV.2007 14:03:30

14 FCC §15.247(d), RSS-210 § A8.5 - 100 kHz Bandwidth of Band edge

14.1 Applicable Standard

According to §15.247(d), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c)).

RSS210§ A8.5: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emissions limits specified in Tables 2 and 3.

14.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

14.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

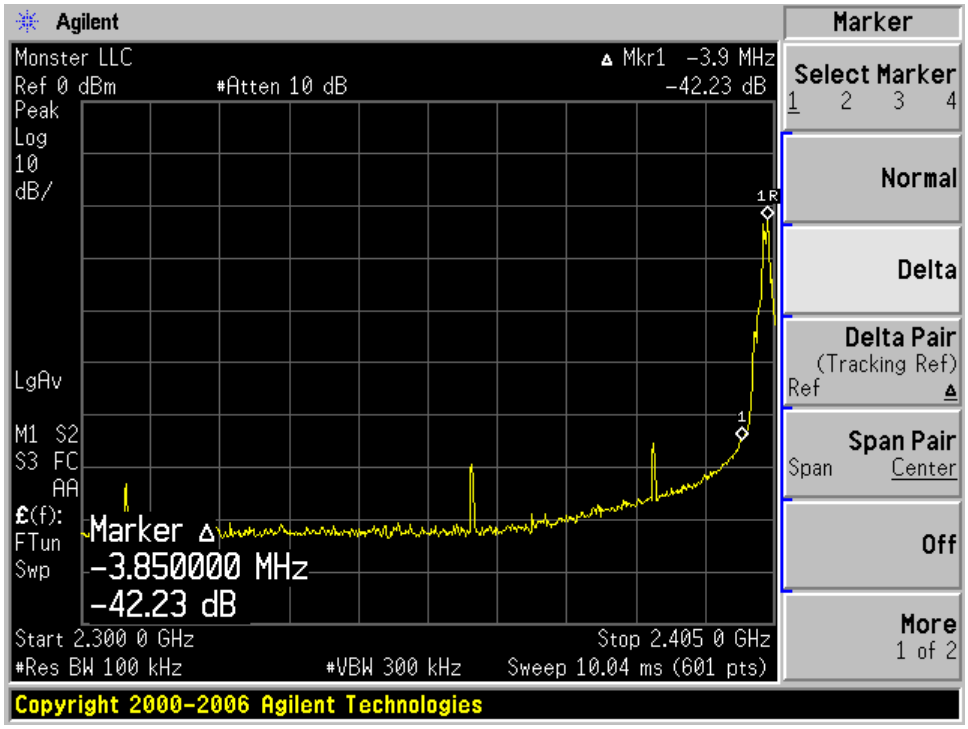
14.4 Environmental Conditions

Temperature:	18 °C
Relative Humidity:	40 %
ATM Pressure:	102.0kPa

**The testing was performed by Xiao Ming Hu from 2007-11-26.*

Please Refer to the Following Plots

Low Channel



High Channel