FCC PART 15.247

INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007 MEASUREMENT AND TEST REPORT

For

Trimble Navigation New Zealand

11 Birmingham Drive
P.O. Box 8729
Riccarton, Christchurch, New Zealand

FCC ID: JUP614
IC : 1756A-614

Report Type:	**Product Type:**
☒ Original Report (rev.1)	Bluetooth, GPS Receiver and 802.11b/g Device

Test Engineer(s):	Steve Xue
Report Number:	R0803171-a (BT)
Test Date(s)	2008-03-20 through 2008-04-08
Report Date:	2008-04-23
Reviewed By:	Sr. RF Test Engineer, Boni Baniqued
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TABLE OF CONTENTS

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

The *Trimble Navigation New Zealand* product, FCC ID: JUP614 or the “EUT” as referred to in this report, is a wireless Bluetooth, GPS Receiver and 802.11 b/g device.

1.2 Mechanical Description of EUT

The *Trimble Navigation New Zealand* product, FCC ID: JUP614 *is* a portable device that measures approximately 21.5 cm **(L)** x 9.9 cm **(W)** x 7.7 cm **(H)**, weighing approximately *0.78 kg*.

1.3 Antenna Description

Item Number	Model/Type	
Antenna 1 (Bluetooth)	Model number:	3030A5645-01
	Antenna Manufacturer:	Trimble Navigation
	Frequency :	2.4-2.5 GHz
	Maximum Gain	1.2 dBi
	Antenna Type/ Polarization:	SMD/ Linear
	Impedance:	50 ohm
	Measurement:	Length: 25.5 mm (L) x 3.6 mm (W) x 3.3 mm (H)

1.4 Objective

This Modular Approval report is prepared on behalf of *Trimble Navigation New Zealand* 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
- 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

1.5 Related Submittal(s)/Grant(s)

Please see BACL report prepared on behalf of Trimble R0803171 (WI) for measurement and testing required for the WiFi portion of this device.

1.6 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.

1.7 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.

1.8 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 software is provided by customer. The EUT exercise program used during the conducted and radiated testing was designed to exercise the system components.

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

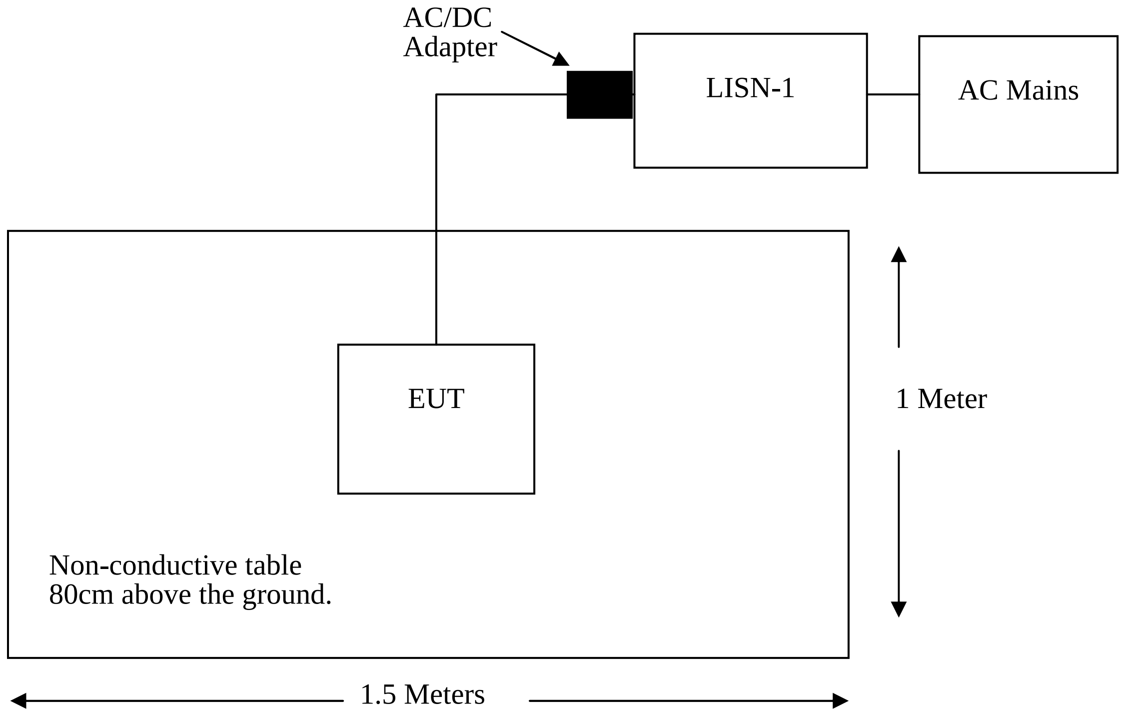
No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

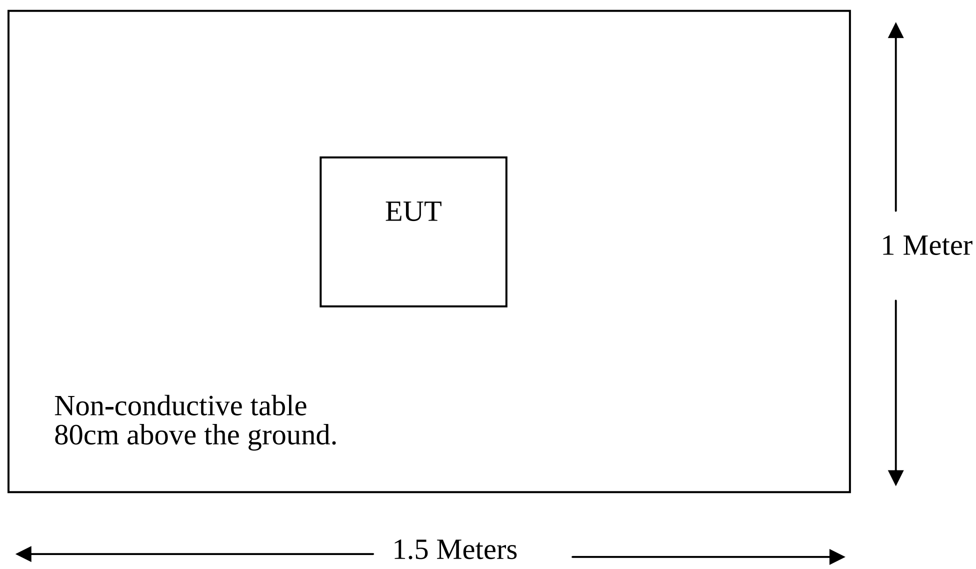
N/A

2.6 Test Setup Block Diagrams

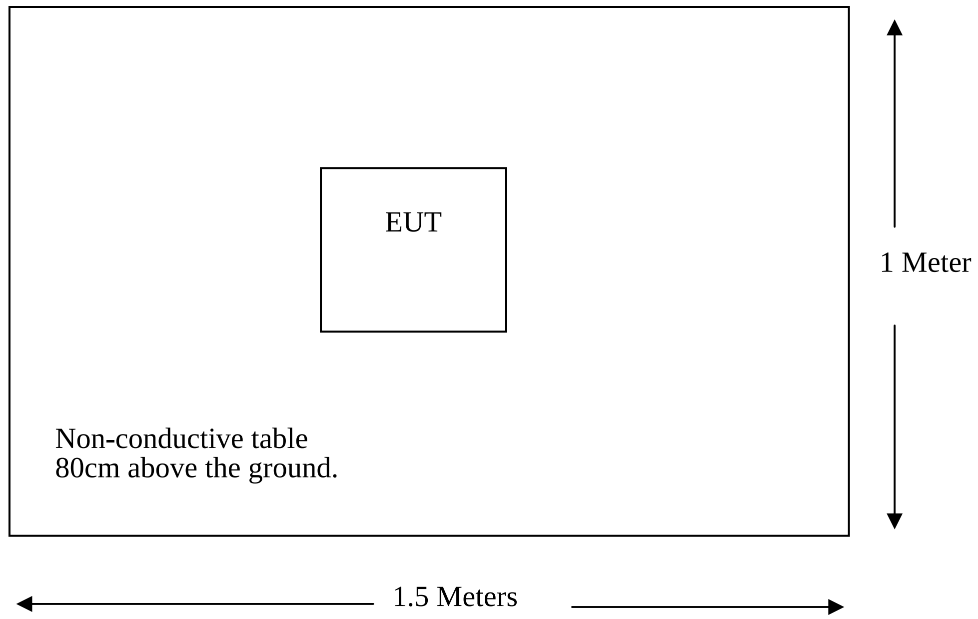
Conducted Emissions



Receiver Radiated Emissions



Transmitter Radiated Emission



3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC Part15C & RSS-210 Rules	Description of Test	Result	Note
FCC §15.247 (i) and §2.1093, 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	Compliant	-
FCC §15.247(d), RSS210 § A8.5 § RSS-Gen §7.2	Spurious Emissions at Antenna Port	Compliant	-
FCC §15.205, §15.209 & §15.247(c), IC RSS-210 §A8.5	Radiated Spurious Emissions	Compliant	-
FCC §15.205, RSS-210 §A8.5	Restricted Band	Compliant	-
§15.109 & RSS-Gen §6(a)	Receiver Spurious Emissions	Compliant	-
§15.247 (a)(1), RSS-210 §A8.1 (a)	20 dB Bandwidth & 99% Bandwidth	Compliant	-
§15.247 (a)(1), RSS-210 §A8.1(2)	Hopping Channel Separation	Compliant	-
§15.247 (a)(1)(iii), RSS-210 §A8.1(4)	Number of Hopping Frequencies Channel Used	Compliant	-
§15.247 (a)(1)(iii), RSS-210 §A8.1(4)	Dwell Time	Compliant	-
§15.247 (b)(3), RSS210 § A8.4	Maximum Peak Output Power	Compliant	-
§ 15.247 (d), RSS210 § A8.5	Band Edge	Compliant	-

4 FCC §15.247 (i) and §2.1093, 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.

Limits for General Population/Uncontrolled Exposure

According to FCC Exclusion list, In the following table, fGHz is mid-band frequency in GHz, and d is the distance to a person'sbody, excluding hands, wrists, feet, and ankles.

Exposure category	low threshold	high threshold
general population	$(60/f_{GHz})$ mW, $d < 2.5$ cm $(120/f_{GHz})$ mW, $d \geq 2.5$ cm	$(900/f_{GHz})$ mW, $d < 20$ cm
occupational	$(375/f_{GHz})$ mW, $d < 2.5$ cm $(900/f_{GHz})$ mW, $d \geq 2.5$ cm	$(2250/f_{GHz})$ mW, $d < 20$ cm

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

According to RSS-102 Issue 2, November 2005 §2.5.1 Exemption from Routine Evaluation Limits – SAR Evaluation

SAR evaluation is required if the separation distance between the user and the device is less than or equal to 20 cm, except when the device operates:

- above 2.2 GHz up to 3 GHz inclusively and its output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based time-averaged output power) is less than, or equal to 20 mW for General Public Use and 100 mW for Controlled Use;

4.2 Result:

This is a portable device and the Max peak output power is 1.43 mW (Bluetooth) < 24.59 = (60/2.44GHz) mW The SAR measurement is exempt.

According to RSS-102 section 2.5.1, this device exempts the RF exposure evaluation.

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 used is a SMD type antenna with a gain of 1.2 dBi. Refer to antenna description in section 1.4 of this report.

☒ **Compliant** ☐ **N/A**

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

6.1 Applicable Standard

According to FCC §15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

**Decreases with the logarithm of the frequency*

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

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

The EUT was powered via connection to AC/DC adapter, which was plugged into the LISN.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100338	2007-04-05
Solar Electronics CO	Artificial-Mains Network	9252-50-R-24-N	0511213	2007-07-30

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

6.4 Test Procedure

During the conducted emissions test, the power cord of the system was connected to the main outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP”. Average readings are distinguished with an “Ave”.

6.5 Environmental Conditions

Temperature:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Steve Xue on 2008-04-01.*

6.6 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC & IC standard’s conducted emissions limits with the *worst* margin reading of:

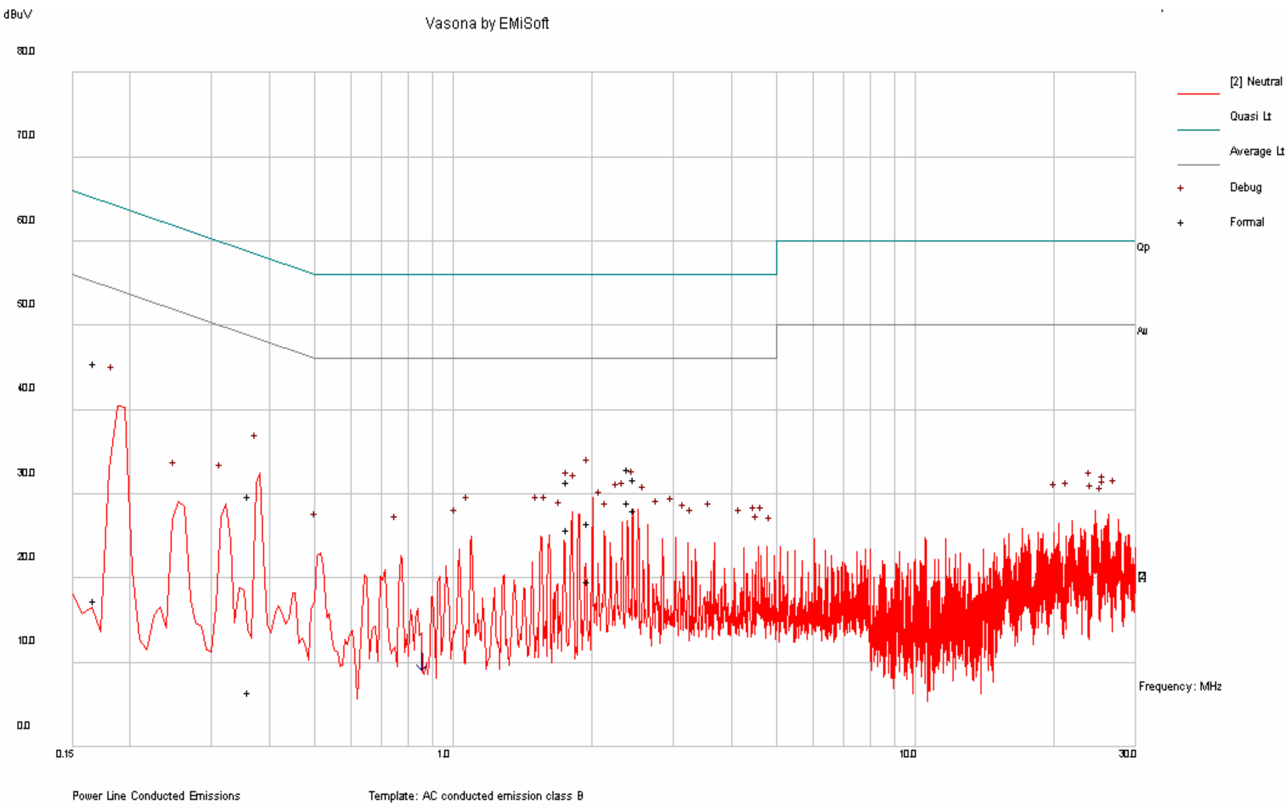
6.7 Summary of Test Results

According to the recorded data in following table, the EUT complied with the applicable FCC Rules and IC Standards, conducted emissions limits with the *worst* margin reading of:

Mode: 120V/ 60 Hz			
Margin (dB)	**Frequency (MHz)**	**Conductor (Hot/Neutral)**	**Range (MHz)**
-21.47	2.514	Hot	0.15 to 30

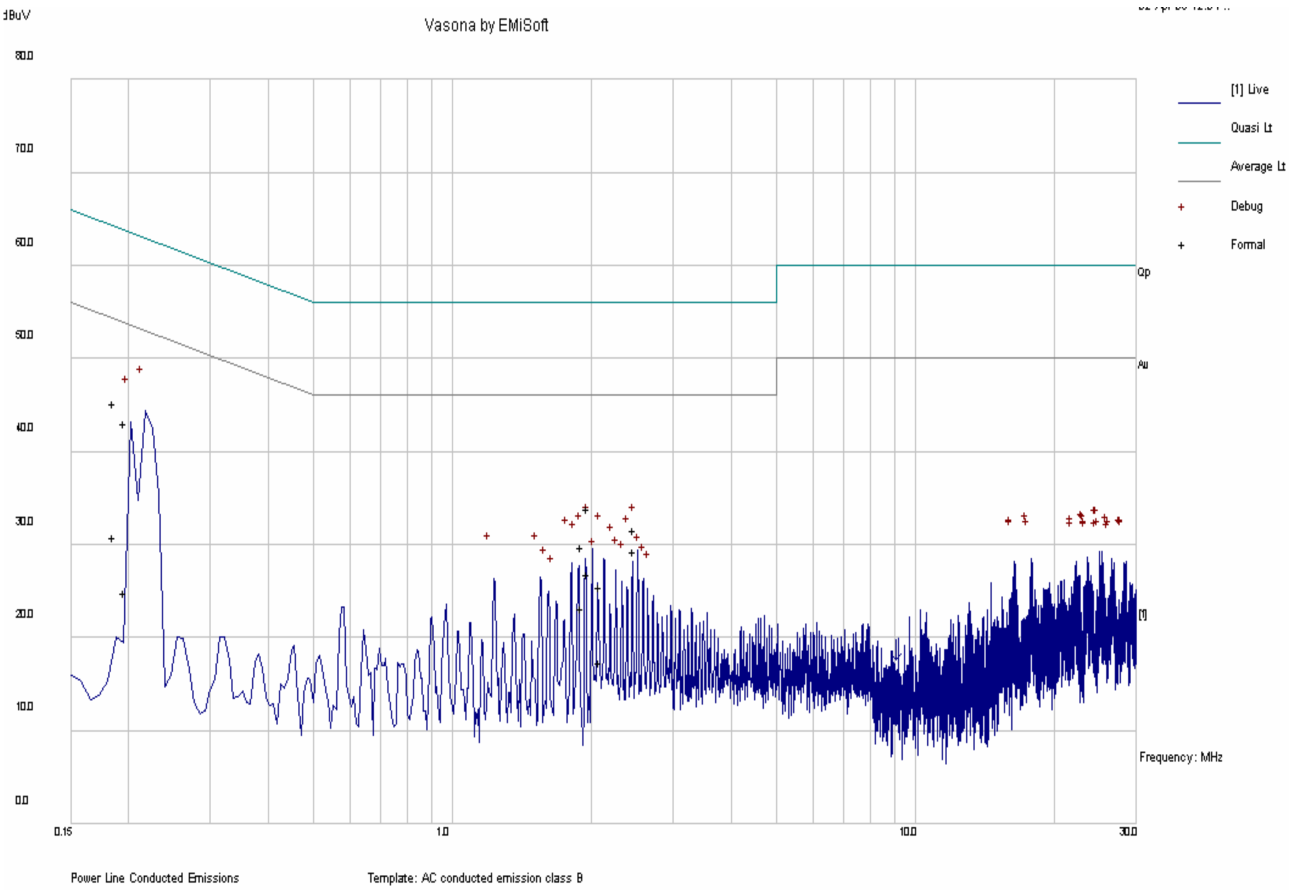
Please refer to the following plots and tables for complete test results

120V / 60 Hz Neutral:



Frequency (MHz)	Amplitude (dBµV)	Detector (QP/AV)	Conductor (Hot/Neutral)	Limit (dBµV)	Margin (dB)
2.447	24.27	AV	Neutral	46.00	-21.73
2.513	23.38	AV	Neutral	46.00	-22.62
0.171	40.77	QP	Neutral	64.92	-24.16
1.805	21.09	AV	Neutral	46.00	-24.91
2.447	28.14	QP	Neutral	56.00	-27.86
2.513	26.92	QP	Neutral	56.00	-29.08
1.805	26.68	QP	Neutral	56.00	-29.32
1.994	14.85	AV	Neutral	46.00	-31.15
0.369	25.01	QP	Neutral	58.51	-33.51
1.994	21.85	QP	Neutral	56.00	-34.15
0.171	12.66	AV	Neutral	54.92	-42.27
0.369	1.67	AV	Neutral	48.51	-46.84

120V / 60 Hz Hot:



Frequency (MHz)	Quasi-Peak (dBµV)	Detector (QP/AV)	Conductor (Live/Neutral)	Limit (dBµV)	Margin (dB)
2.514	24.53	AV	Hot	46.00	-21.47
0.190	40.50	QP	Hot	64.05	-23.55
1.997	22.04	AV	Hot	46.00	-23.96
0.200	38.30	QP	Hot	63.63	-25.33
1.997	29.20	QP	Hot	56.00	-26.80
1.934	18.46	AV	Hot	46.00	-27.54
0.190	26.06	AV	Hot	54.05	-27.98
2.514	26.80	QP	Hot	56.00	-29.20
1.934	25.00	QP	Hot	56.00	-31.00
2.122	12.63	AV	Hot	46.00	-33.37
0.200	20.08	AV	Hot	53.63	-33.55
2.122	20.77	QP	Hot	56.00	-35.23

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

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
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2007-08-21
Sunol Science Corp	Combination Antenna	JB1 Antenna	A020106-1	2007-05-21
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

* **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:	27 °C
Relative Humidity:	40 %
ATM Pressure:	102.0 kPa

**The testing was performed by Steve Xue on 2008-04-02.*

7.8 Summary of Test Results

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

Radiated Spurious Emissions:

Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range (GHz)**
-15.44	4804.00	Horizontal	Low, 1 GHz – 25GHz
-14.88	4882.00	Horizontal	Middle, 1 GHz – 25GHz
-15.70	4960.00	Horizontal	High, 1 GHz – 25GHz

7.9 Radiated Spurious Emissions Test Data

Low Channel: 2402 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
4804.00	45.11	90	1.5	V	32.81	7.87	40.52	45.27	74	-28.73	Peak
4804.00	49.34	260	1.5	H	32.81	7.87	40.52	49.50	74	-24.50	Peak
4804.00	35.87	90	1.5	V	32.81	7.87	40.52	36.03	54	-17.97	Average
4804.00	38.40	260	1.5	H	32.81	7.87	40.52	38.56	54	-15.44	Average

Middle Channel: 2441 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
4882.00	46.47	270	1.0	V	32.81	8.31	40.35	47.24	74	-26.76	Peak
4882.00	49.59	330	1.5	H	32.81	8.31	40.35	50.36	74	-23.64	Peak
4882.00	36.67	270	1.0	V	32.81	8.31	40.35	37.44	54	-16.56	Average
4882.00	38.35	330	1.5	H	32.81	8.31	40.35	39.12	54	-14.88	Average

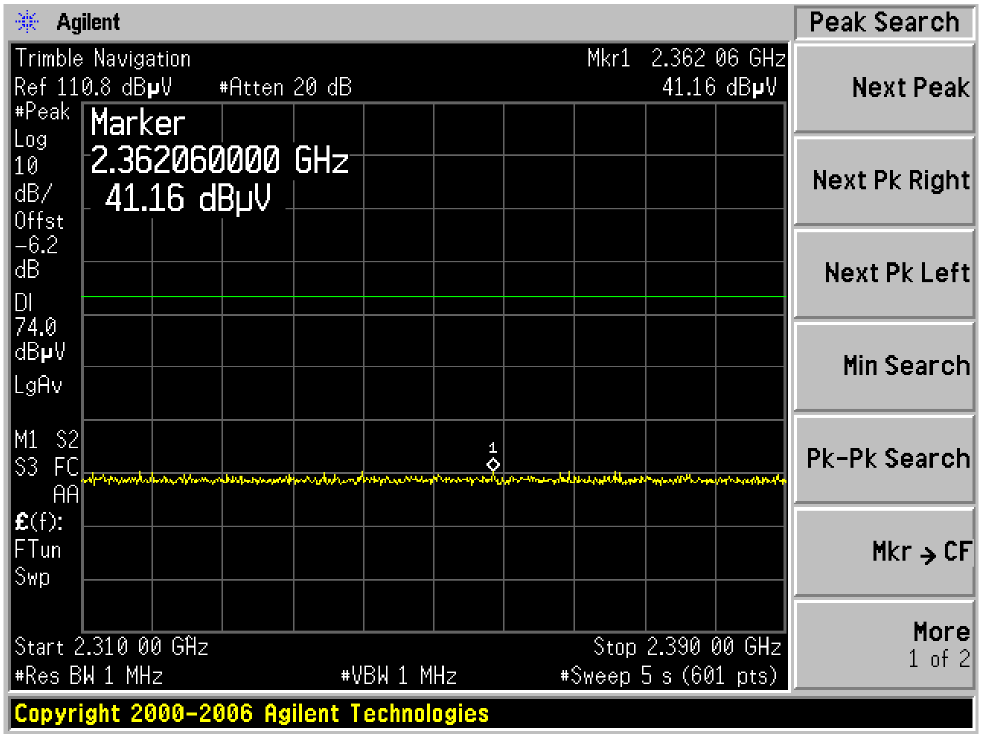
High Channel: 2480 MHz

Frequency (MHz)	Reading (dBuV)	Azimuth (Degrees)	Ant. Height (m)	Ant. Polarity (H/V)	Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
4960.00	46.13	320	1.0	V	32.81	8.31	40.18	47.07	74	-26.93	Peak
4960.00	48.30	330	1.5	H	32.81	8.31	40.18	49.24	74	-24.76	Peak
4960.00	36.03	320	1.0	V	32.81	8.31	40.18	36.97	54	-17.03	Average
4960.00	37.36	330	1.5	H	32.81	8.31	40.18	38.30	54	-15.70	Average

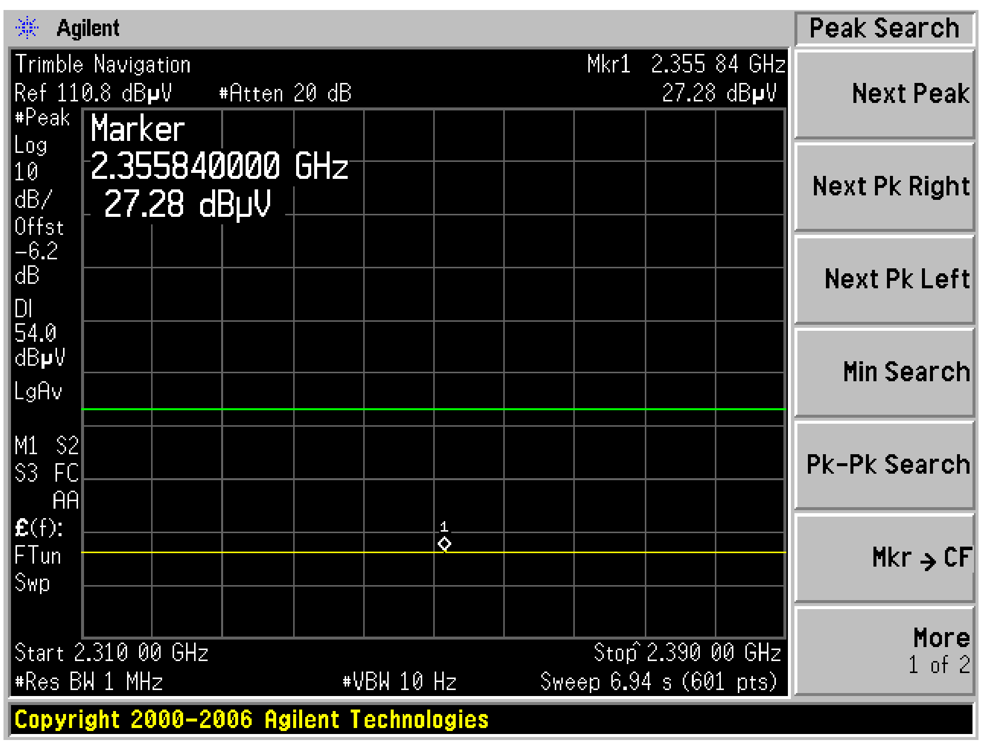
Restricted Band Edge

Low Channel

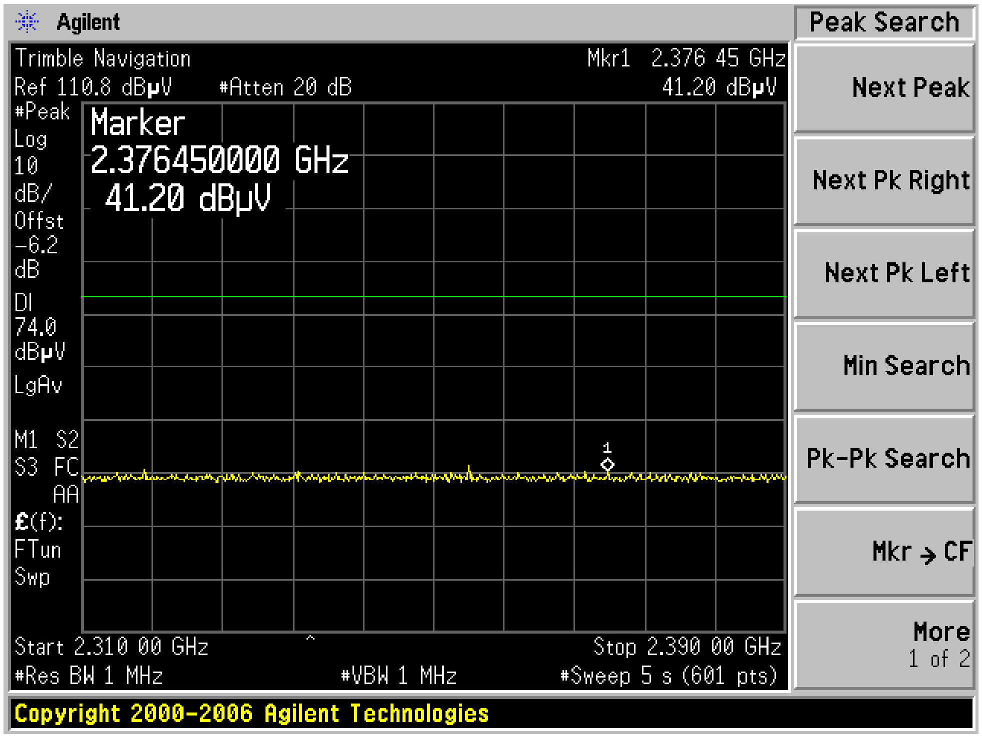
Peak, Horizontal



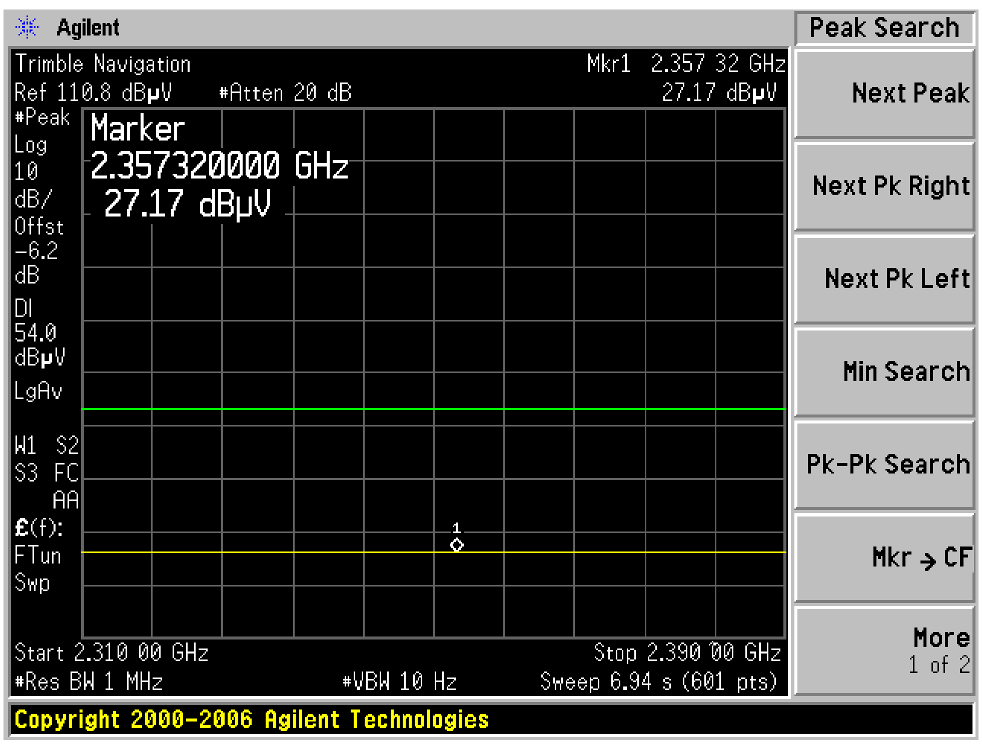
Average, Horizontal



Peak, Vertical

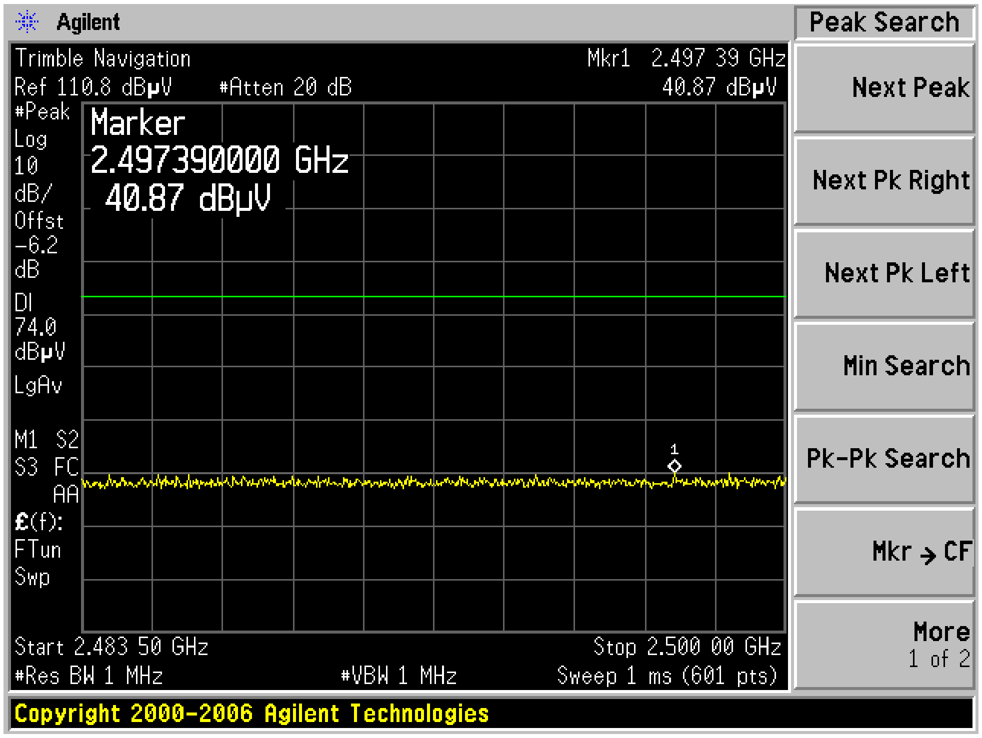


Average, Vertical

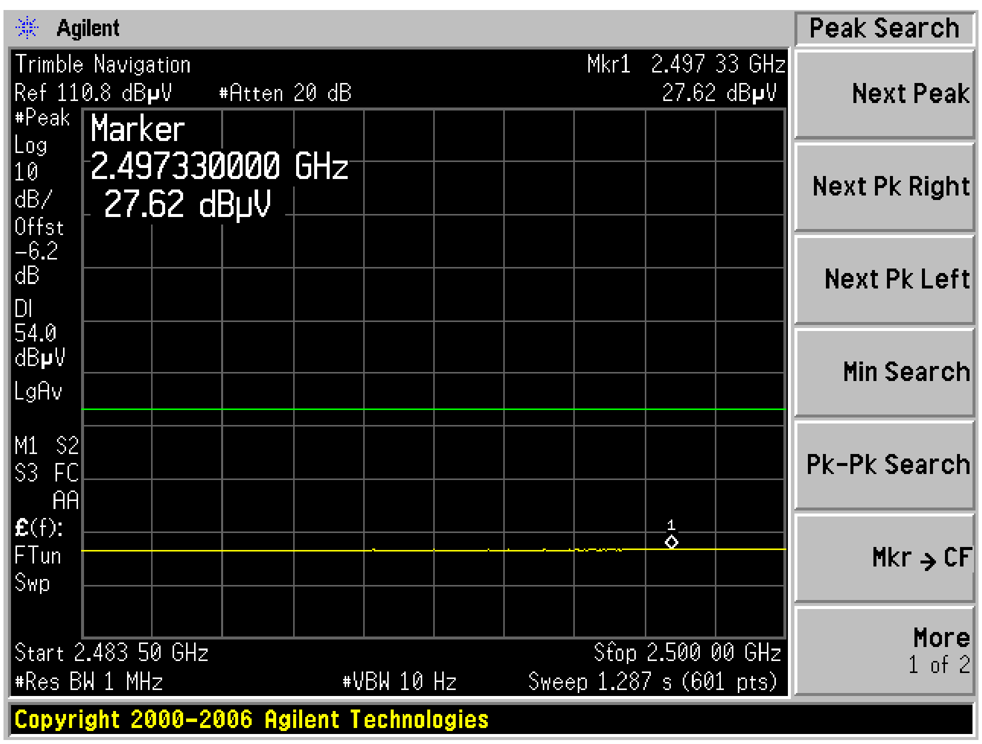


High Channel

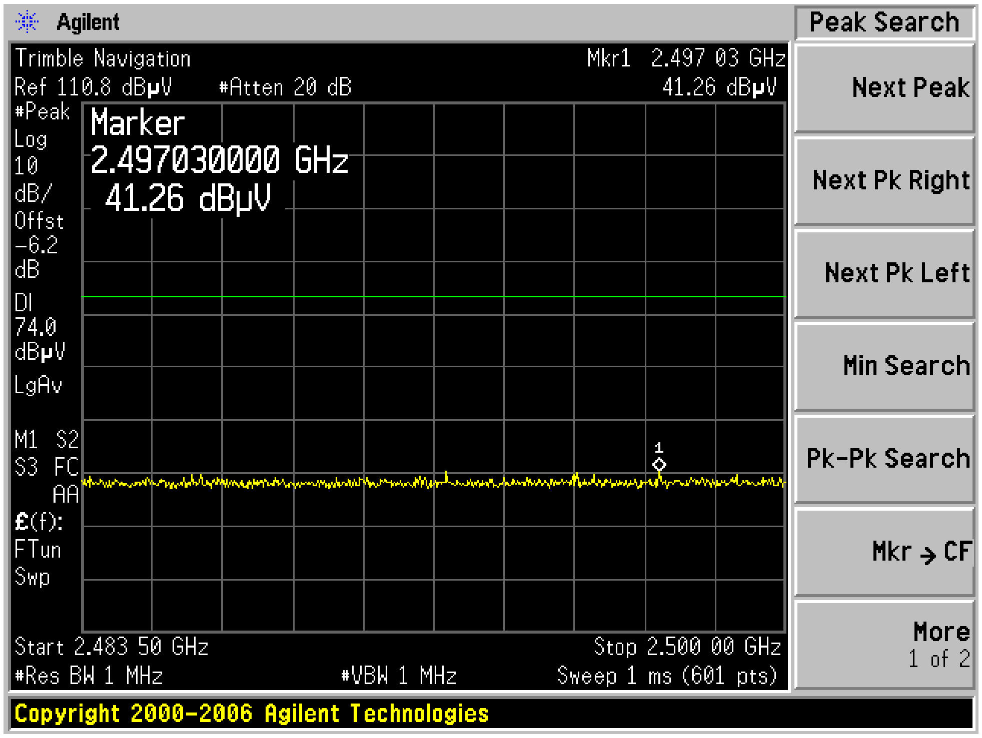
Peak, Horizontal



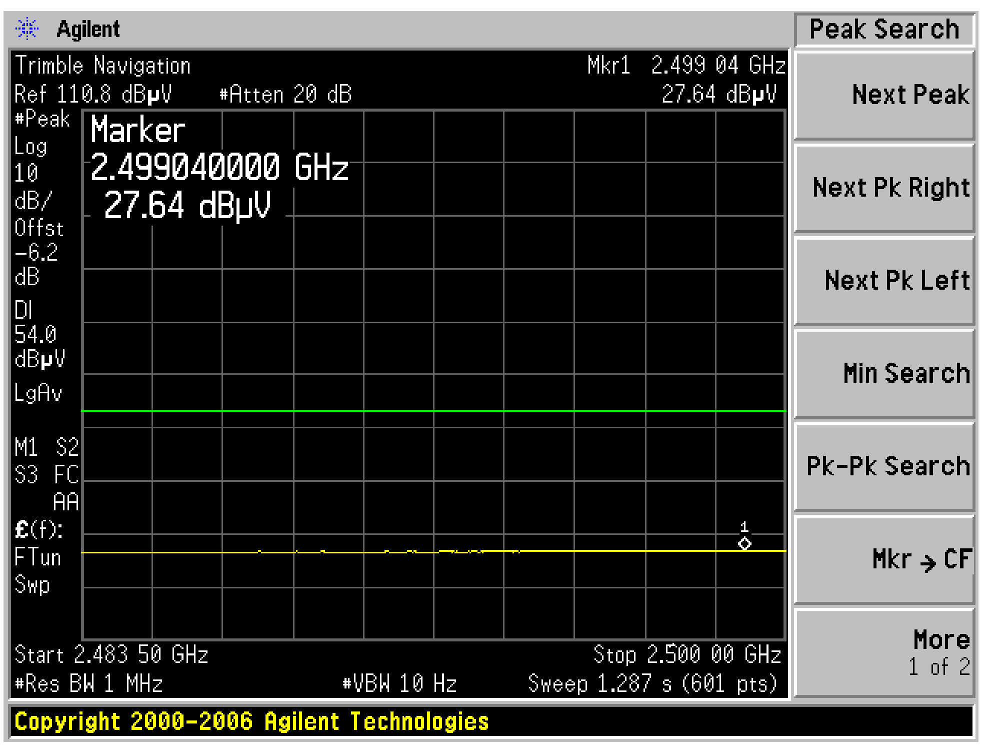
Average, Horizontal



Peak, Vertical



Average, Vertical



8 RSS-210 § 2.6 Receiver Spurious Radiated Emissions

8.1 Test Setup

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

8.2 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	JB1 Antenna	A020106-1	2007-05-21

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

8.3 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102..7 kPa

**The testing was performed by Steve Xue on 2008-04-08*

8.4 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.

8.5 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:

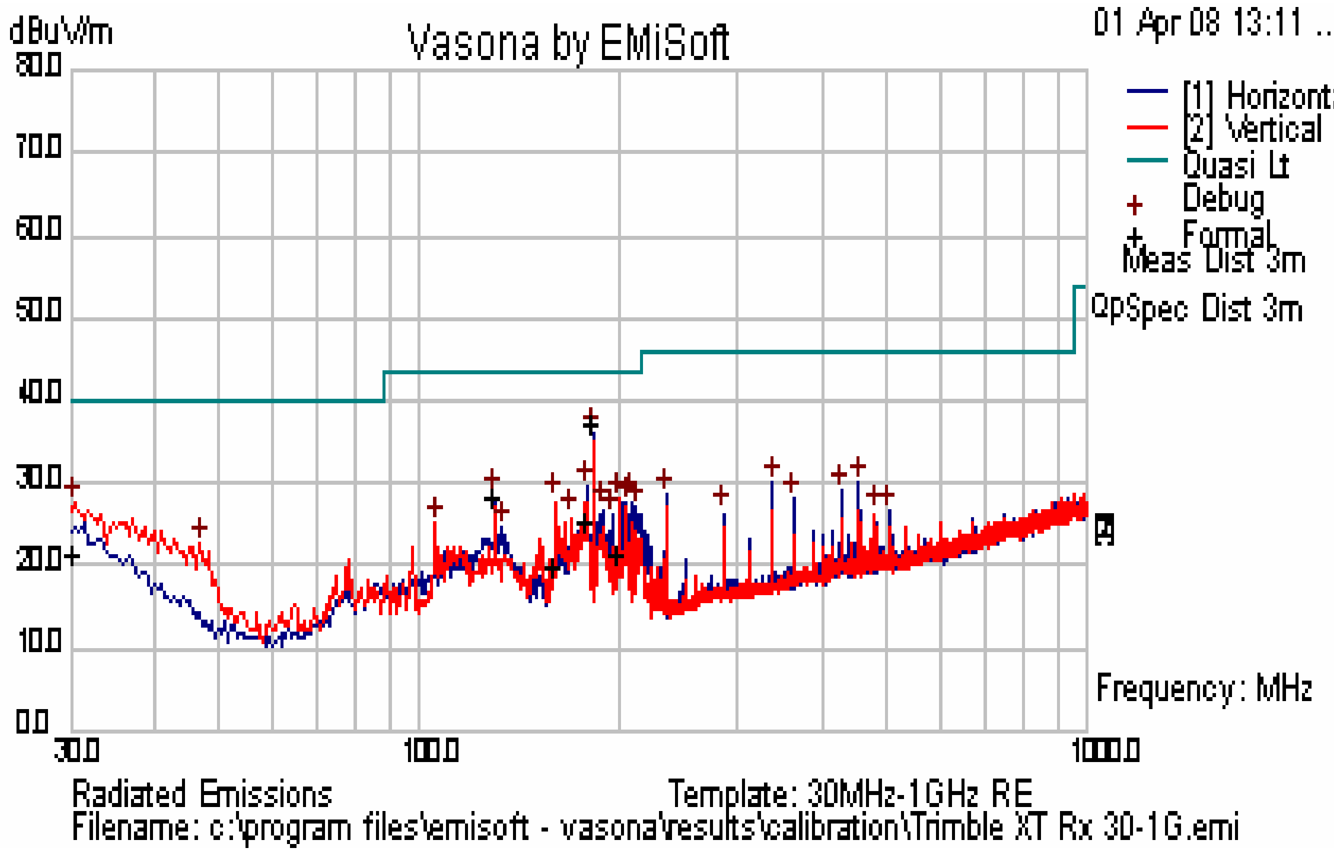
Margin = Corrected Amplitude - Class B Limit

8.6 Summary of Test Results

According to the test data,, the EUT complied with the with the applicable FCC rules and IC Standards, with the closest margins from the limit listed below:

Radiated Emissions Test Data @ 3meter

-8.63 dB at **181.993 MHz** in the **Horizontal** polarization



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Ant. Polarity (H/V)	Turntable Position (degrees)	Limit (dBµV/m)	Margin (dB)
181.993	34.87	173	H	245	43.5	-8.63
130.002	25.94	144	H	235	43.5	-17.56
178.141	23.22	293	H	250	43.5	-20.28
30.396	19.19	98	V	231	40.0	-20.81
199.252	18.86	129	V	234	43.5	-24.64
159.837	17.53	121	V	205	43.5	-25.97

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

9.1 Applicable Standard

According to §15.247(a)(l)(i) and RSS-210 §A8.1 (c), The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

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:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102..7 kPa

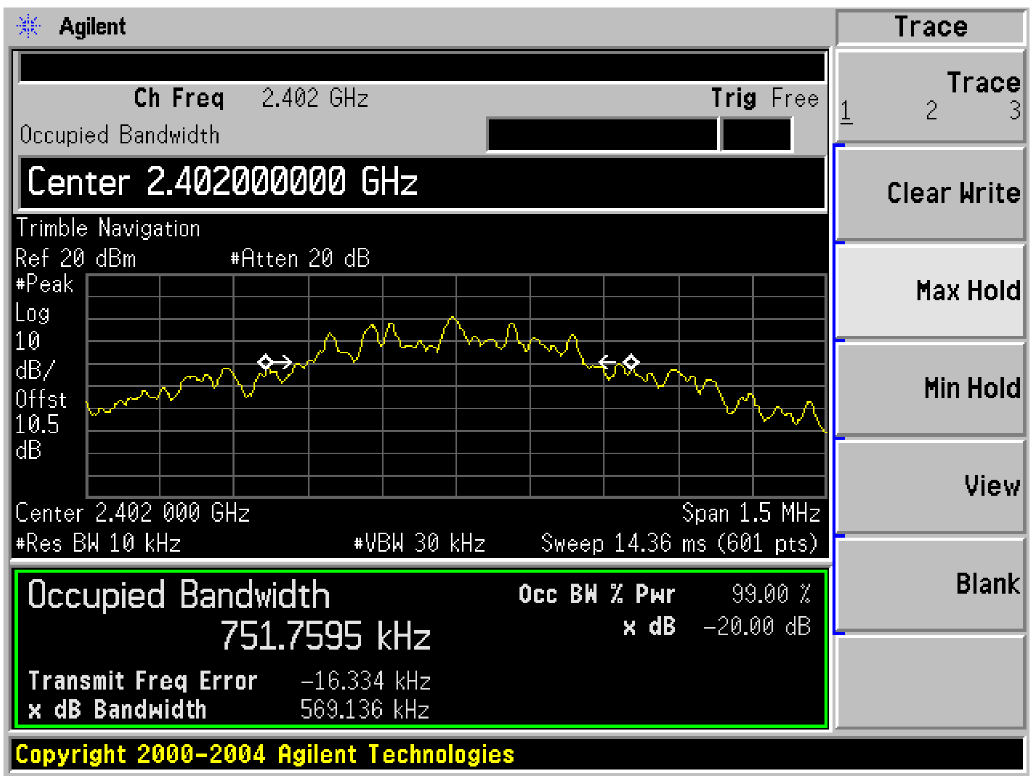
**The testing was performed by Steve Xue on 2008-04-07.*

9.5 Summary of Test Results

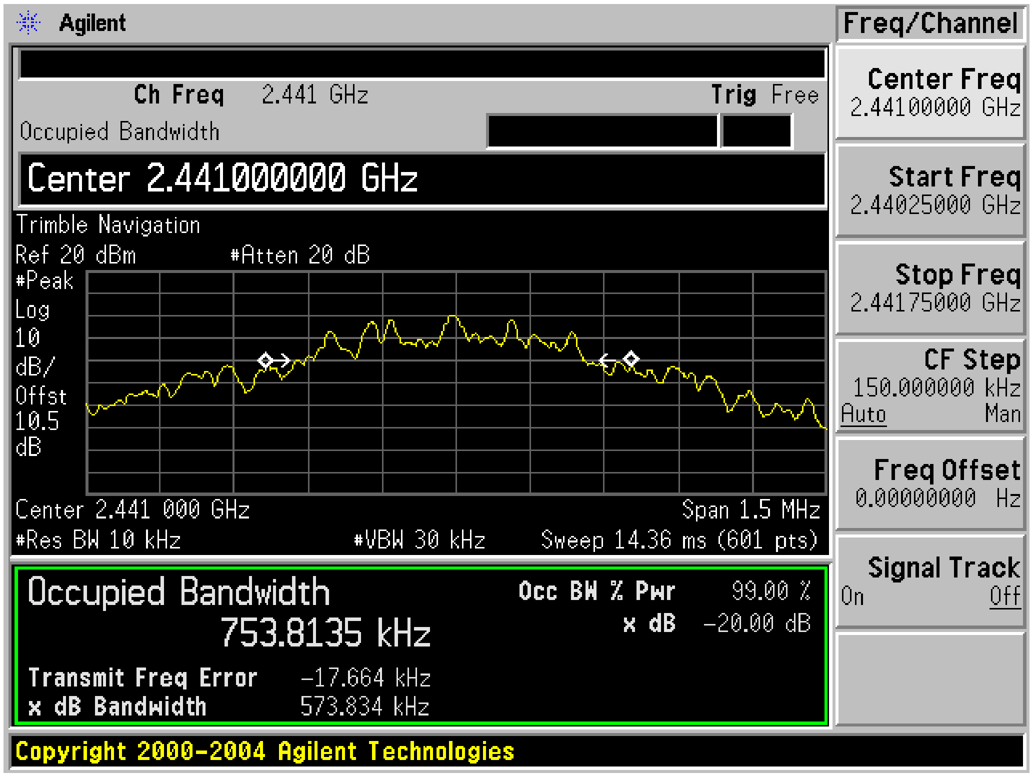
Channel	20 dB Channel Bandwidth (kHz)	99% Channel Bandwidth (kHz)
Low	569.136	751.7595
Middle	573.834	753.8135
High	573.875	753.6791

Please refer to the following plots for detailed test results

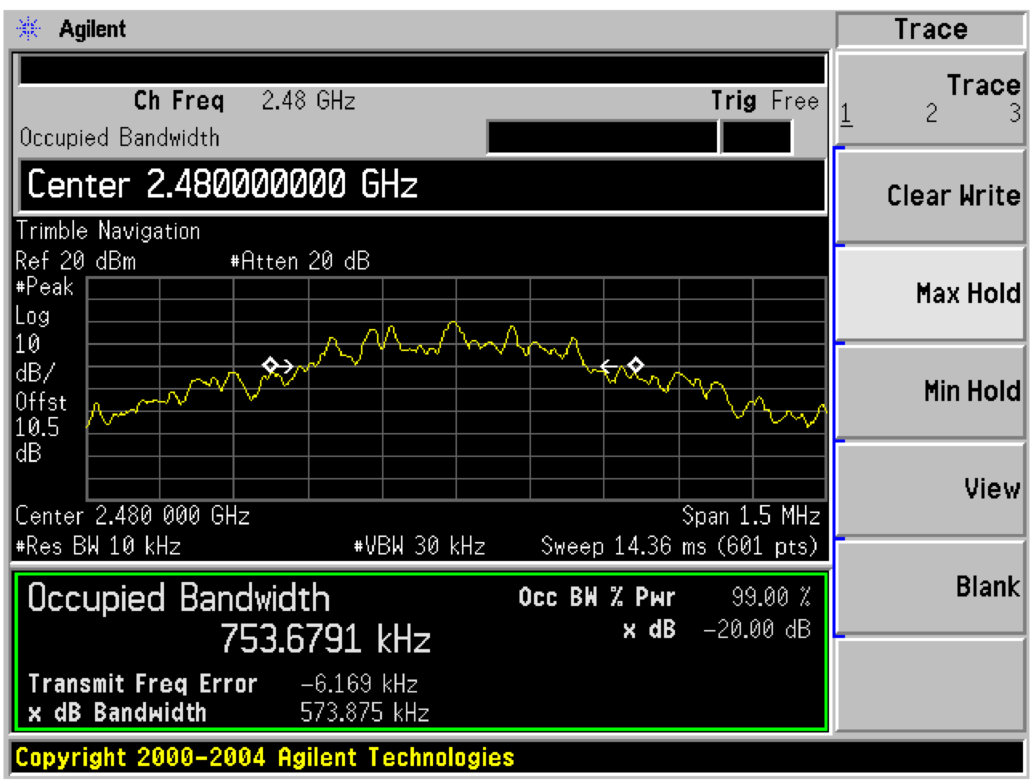
Low Channel



Middle Channel



High Channel



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

10.1 Applicable Standard

According to §15.247(a)(1) and RSS-210 §A8.1 (b), frequency hopping system 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

10.2 Measurement Procedure

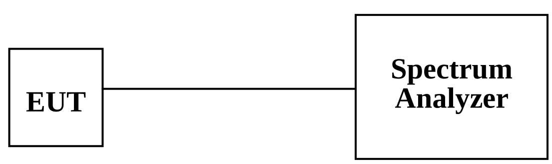
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient 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:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

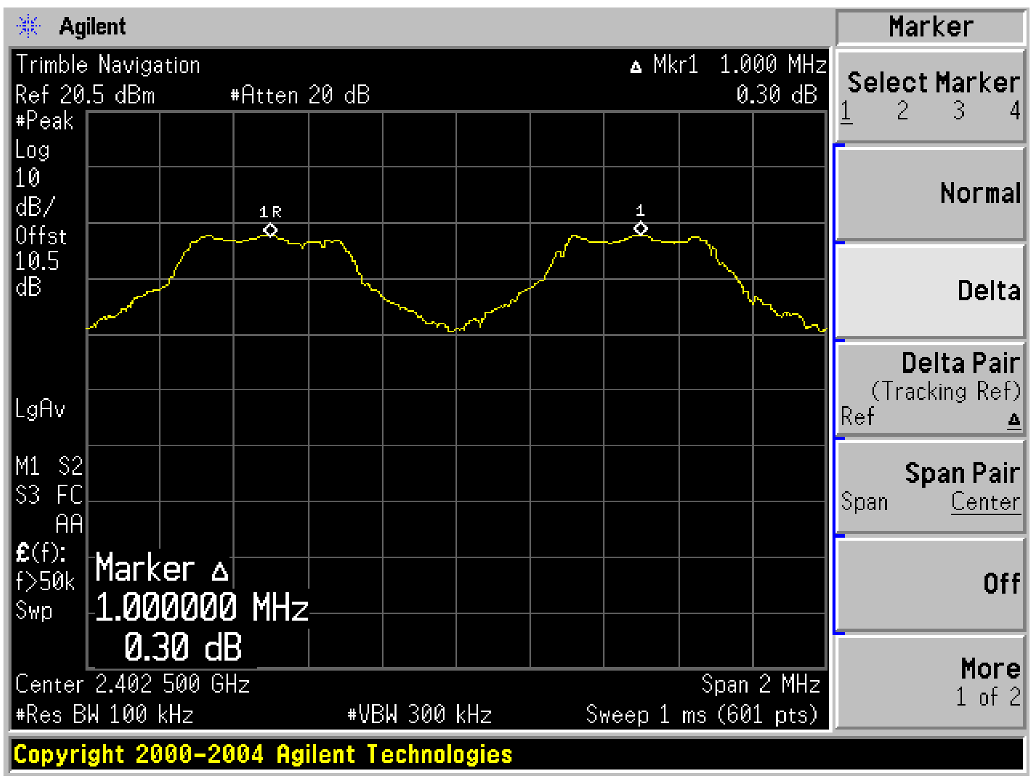
**The testing was performed by Steve Xue on 2008-03-20.*

10.6 Measurement Results

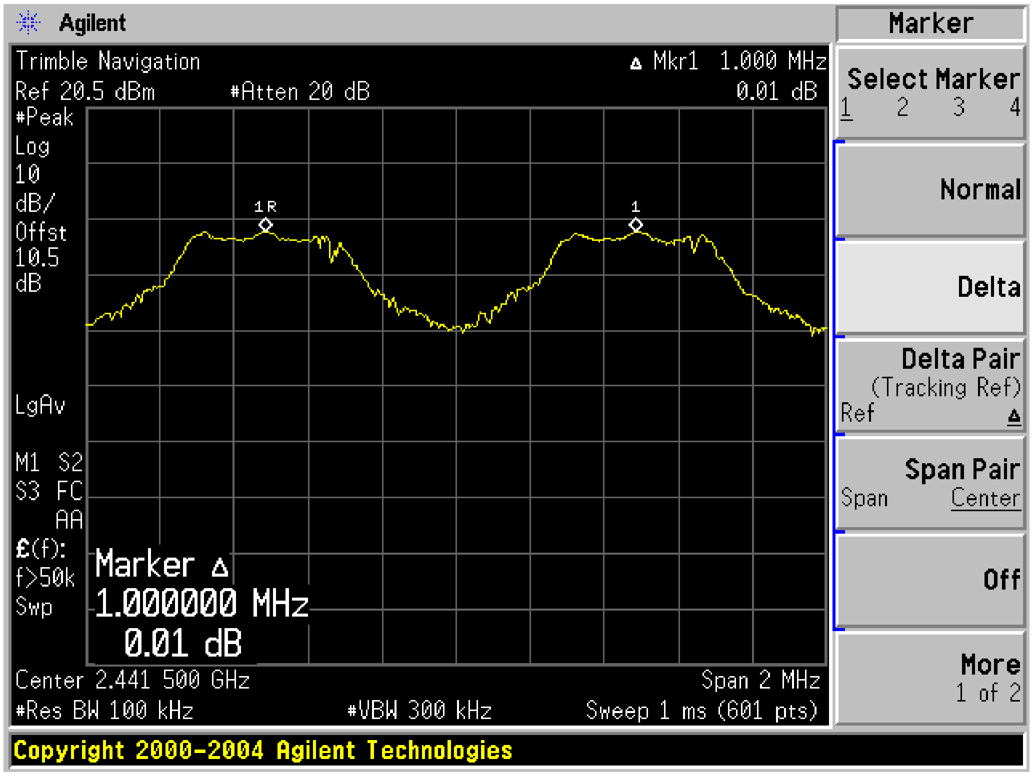
Channel	Channel Separation (MHz)	Limit > 20 dB Bandwidth (kHz)	Result
Low	1.0	569.136	Compliant
Middle	1.0	573.834	Compliant
High	1.0	573.875	Compliant

Please refer to the following plots:

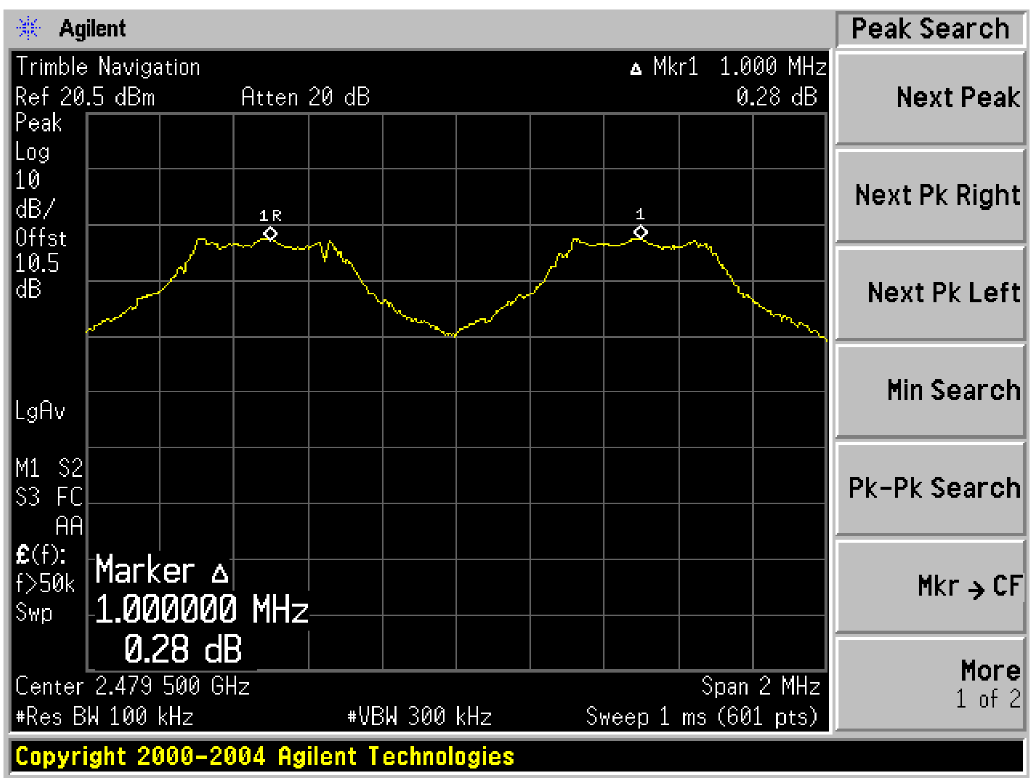
Low Channel



Middle Channel



High Channel



11 FCC §15.247(b) (1) (3), RSS210 § A8.4 - Peak Output Power Measurement

11.1 Applicable Standard

The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247(b) (1) (3)

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

(1) For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

RSS210 § A8.4

(2) For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4W.

(4) For systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power (see RSS-Gen).

11.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a spectrum analyzer.
3. Add a correction factor to the display.

4. Spectrum analyzer settings:

   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

   RBW > the 20 dB bandwidth of the emission being measured

   VBW ≥ RBW

   Sweep = auto

   Detector function = peak

   Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (see the NOTE above regarding external attenuation and cable loss). The limit is specified in one of the subparagraphs of this Section. Submit this plot. A peak responding power meter may be used instead of a spectrum analyzer.

11.3 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.

11.4 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

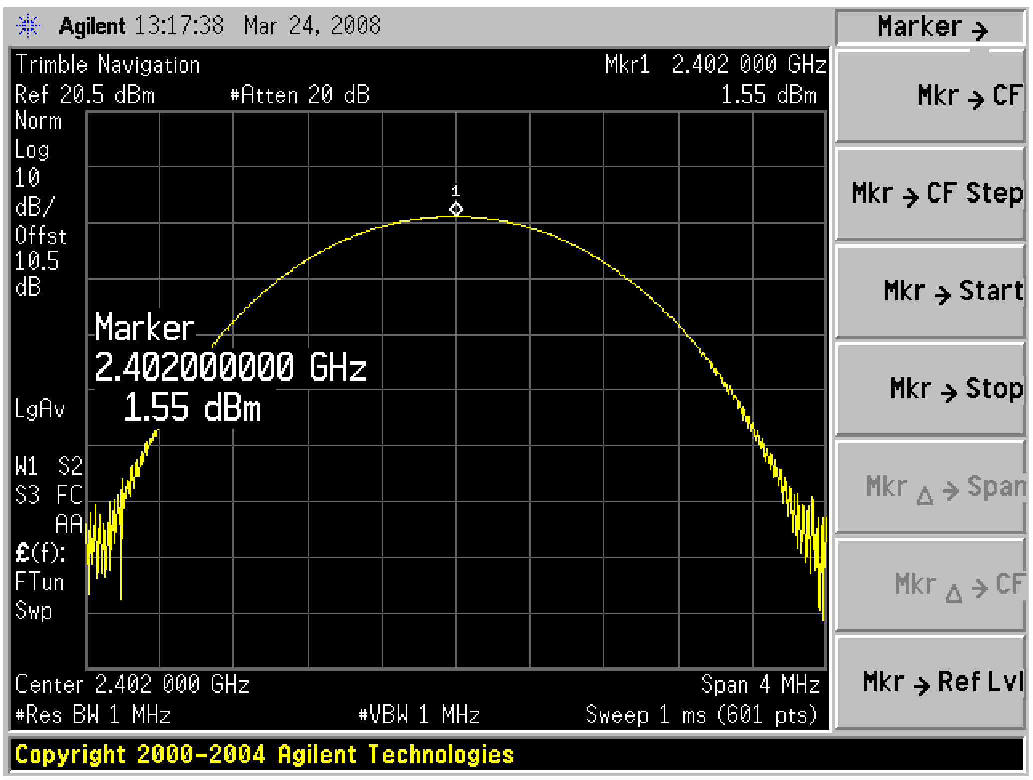
**The testing was performed by Steve Xue on 2008-03-24*

11.5 Measurement Result

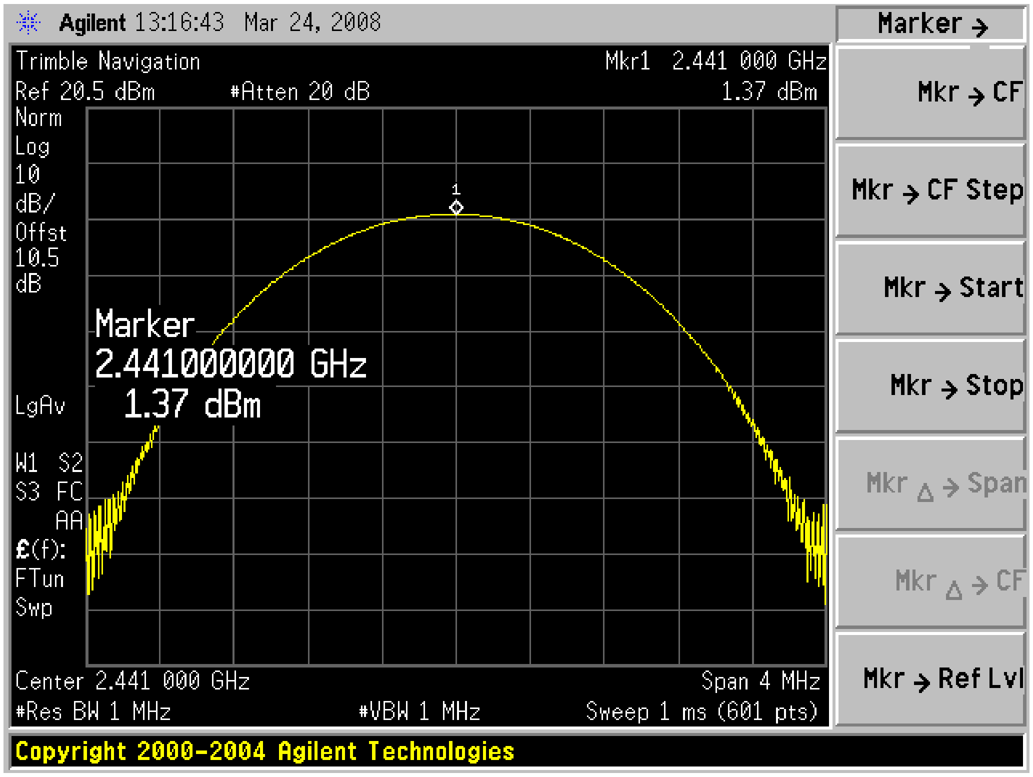
Channel	Max Peak Output Power		Limit (mW)	Result
	(dBm)	(mW)		
Low	1.55	1.43	1000	Compliant
Mid	1.37	1.37	1000	Compliant
High	1.13	1.30	1000	Compliant

Please see the following plots:

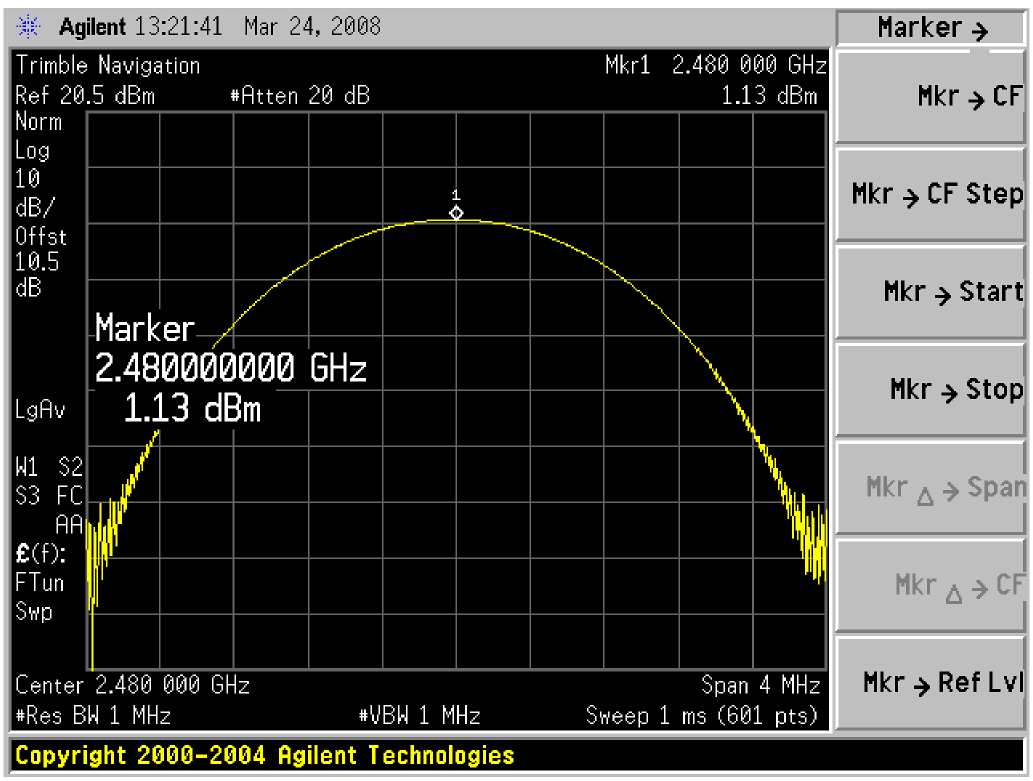
Low Channel



Middle Channel



High Channel



12 §15.247(a) (1) (i) & RSS-210 § A8.1 (c) - Number of Hopping Frequencies Used

12.1 Standard Applicable

According to §15.247(a)(1)(i) and RSS-210 §A8.1 (c), For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

12.2 Measurement Procedure

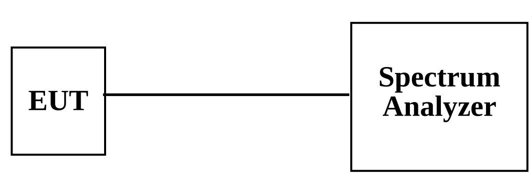
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low 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:	28 °C
Relative Humidity:	42 %
ATM Pressure:	102.0 kPa

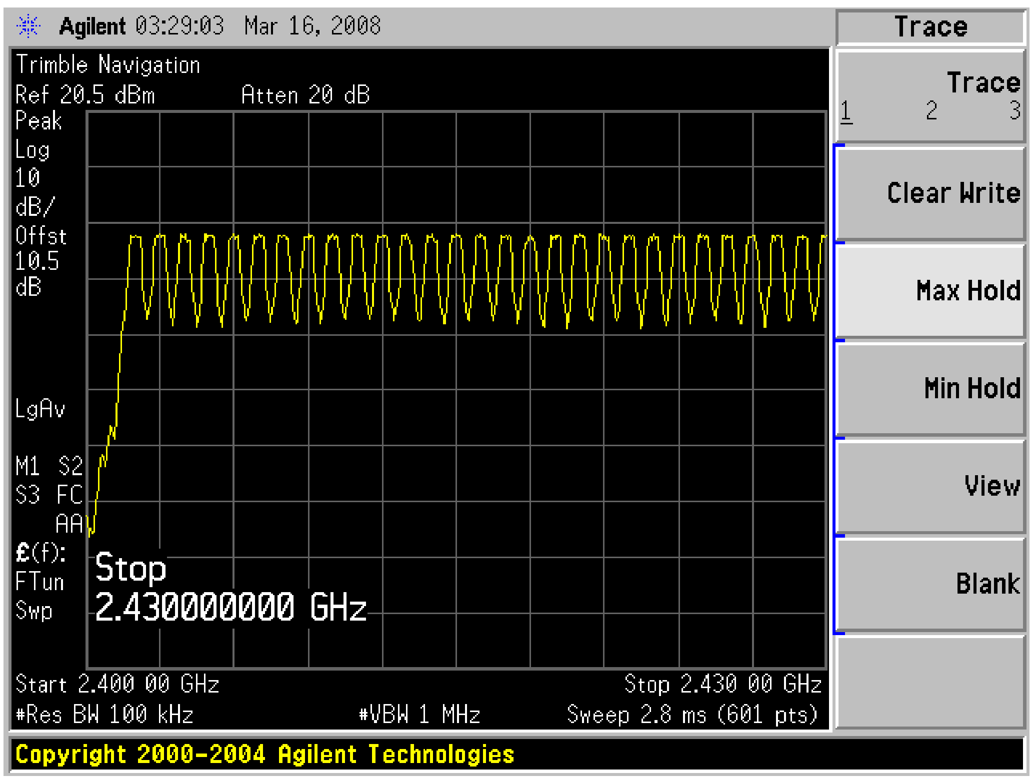
**The testing was performed by Steve Xue on 2008-03-20*

12.6 Measurement Result

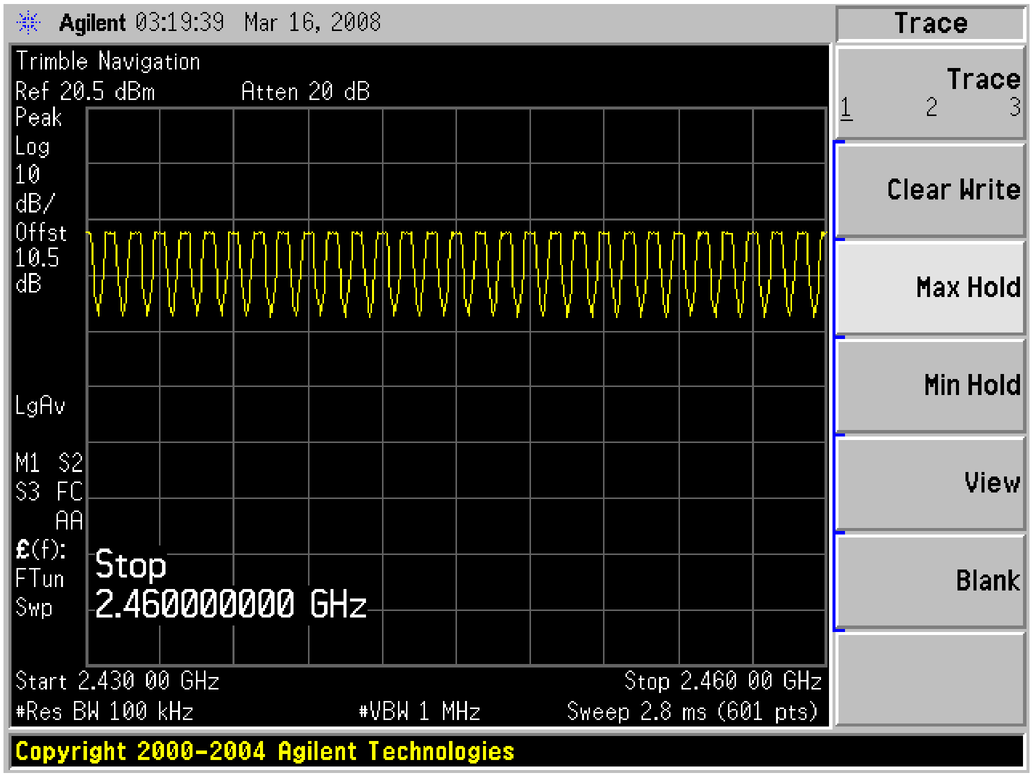
Frequency Range (MHz)	Number of Hopping Channels	Limit
2402-2480	79	>15

Please refer to the following plots:

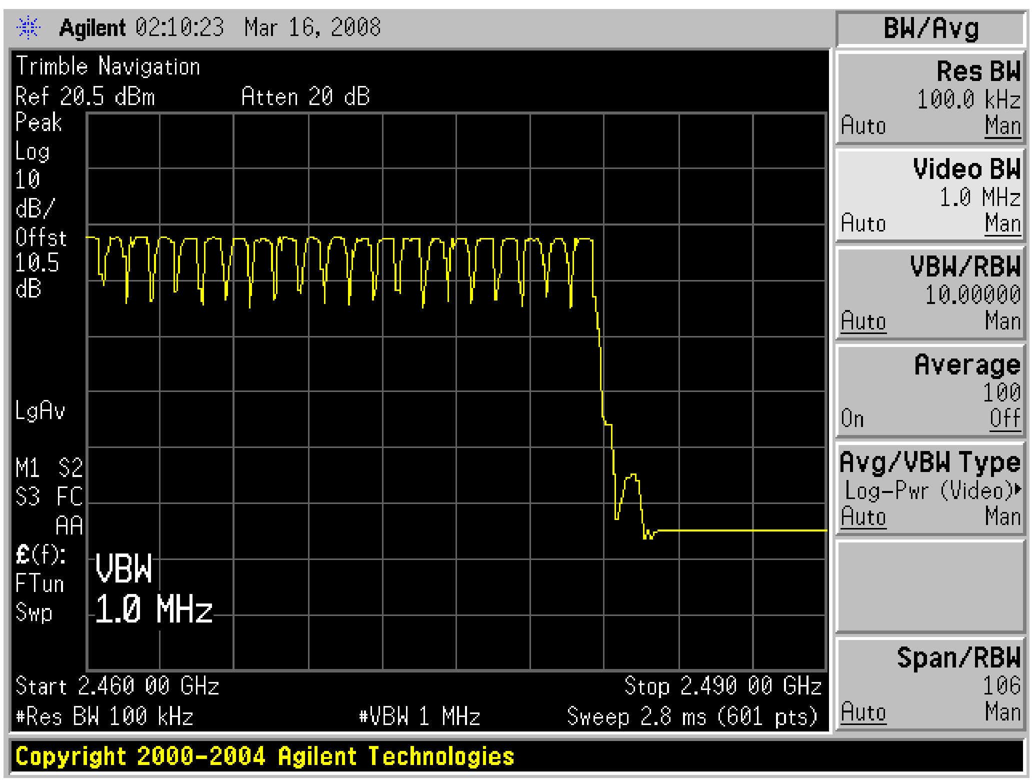
Plot-1: Number of Channels: 29



Plot-2: Number of Channels: 29



Plot-3: Number of Channels: 21



13 §15.247(a) (1) (i), RSS-210 §A8.1 (c) - Dwell Time

13.1 Applicable Standard

According to §15.247 (a)(1)(i) and RSS-210 §A8.1 (c), For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

13.2 Measurement Procedure

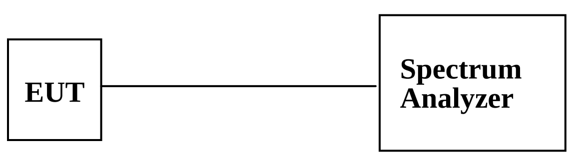
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. 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
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.

13.4 Test Setup Diagram



13.5 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

**The testing was performed by Steve Xue on 2008-03-20*

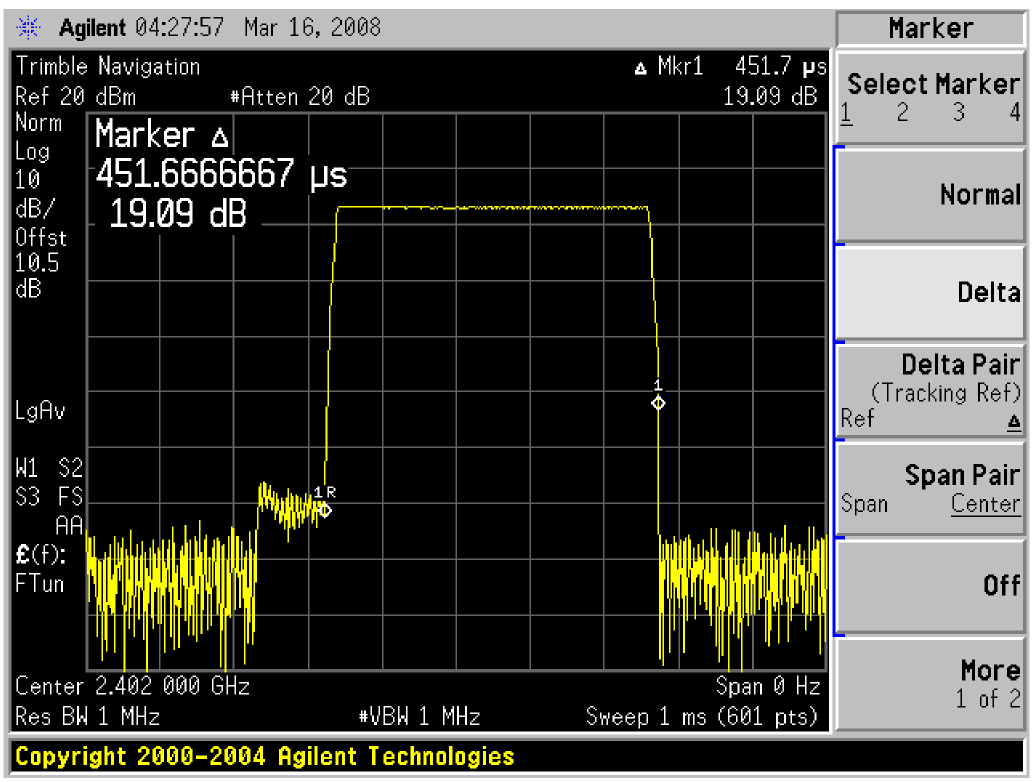
13.6 Measurement Results

Channel	Pulse Width (µs)	Dwell Time (sec.)	Limit (Sec.)	Result
Low	451.7	0.144544	0.4	Compliant
Mid	453.3	0.145056	0.4	Compliant
High	453.3	0.145056	0.4	Compliant

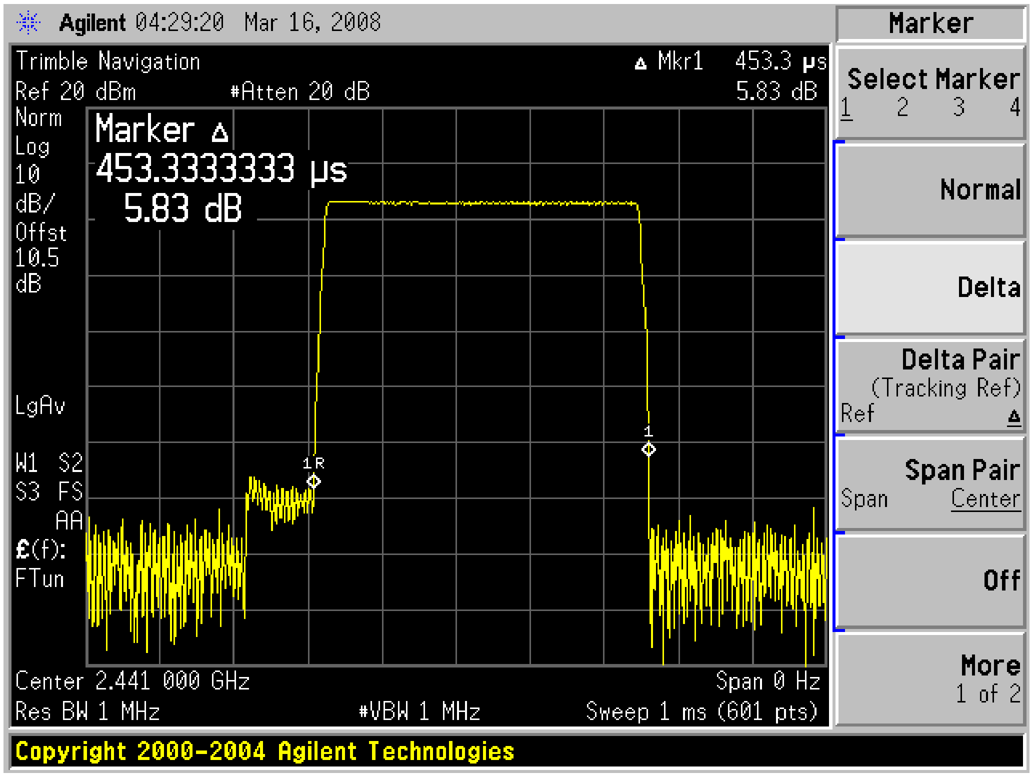
NOTE: Dwell time = Pulse time(1600/2/79)*31.6S*

Please refer the following plots.

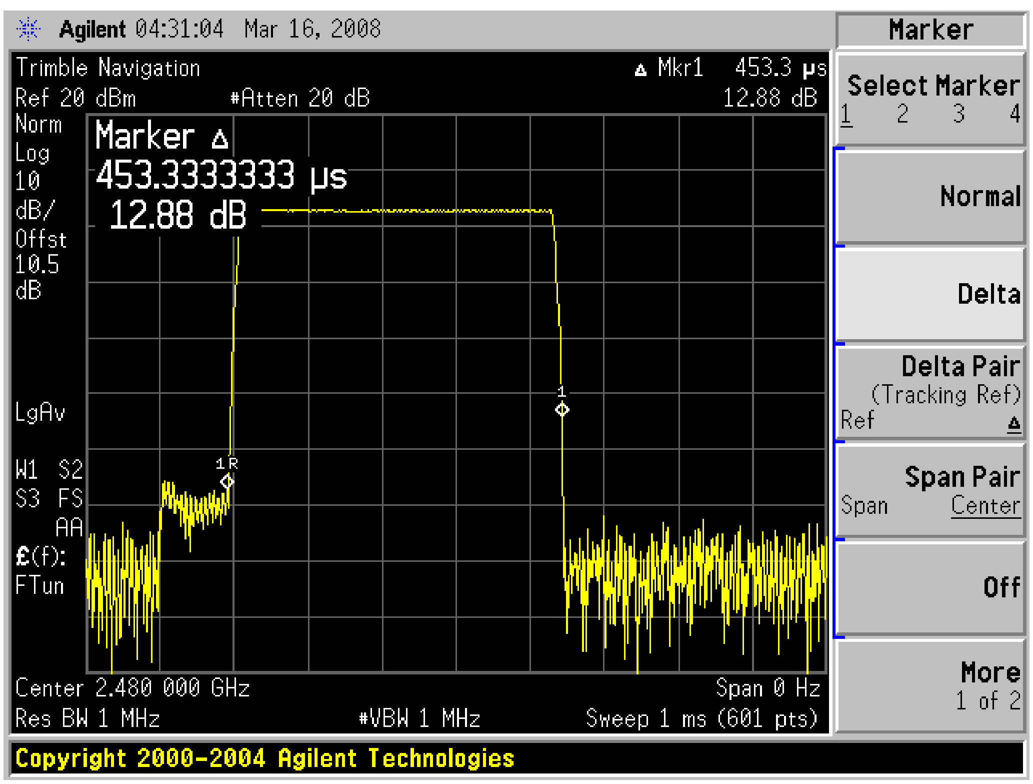
Low Channel



Middle Channel



High Channel



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

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.

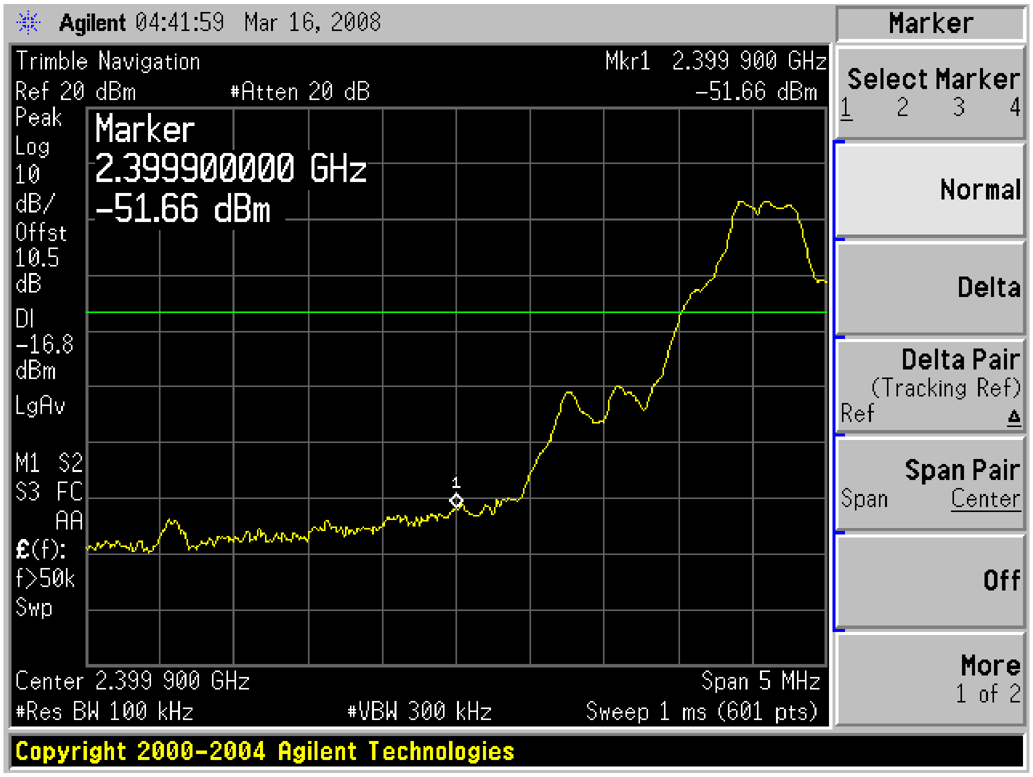
14.4 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

The testing was performed by Steve Xue on 2008-03-20

Please Refer to the Following Plots

Low Channel



High Channel