Lab Code: 200167-0

FCC PART 15.247
INDUSTRY CANADA RSS-210, ISSUE 7, JUNE 2007

TEST AND MEASUREMENT REPORT

For

Movea, Inc.

680 N. McCarty Blvd., Milpitas, CA 95035, USA

FCC ID: JJ4-G2M1
IC: 5689A-G2M1

Report Type:	**Product Type:**
Original Report	In-air Wireless Laser Computer Mouse

Test Engineer:	Jack Liu
Report Number:	R0906093-247
Report Date:	2009-08-04
Reviewed By:	Boni Baniqued Sr. RF Engineer
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TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0906093-247	Original Report	2009-08-04

1 General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Movea, Inc.* product, *FCC ID: JJ4-G2M1, IC: 5689A-G2M1,*or the "EUT" as referred to this report. The EUT is a computer mouse with a USB transceiver, the mouse works on the desk and also in the air to control computer cursor functions and some special functions. Normal operating conditions: to be used with dongle connected to laptop or desk PC; used as normal mouse and in the air. No special software is need; the computer recognizes it as a normal mouse.

1.2 Mechanical Description of EUT

The *EUT* measures approximately 127mm **(L)** x 60 mm **(W)** x 40 mm **(H)**, weighing approximately 92 g.

**The data gathered are from a typical production sample (sample ID: EMI2 Rev2.) provided by the manufacturer with serial number: R0906093-2 assigned by BACL.*

1.3 EUT Photo

Please refer to Exhibit C for addition EUT photographs.

1.4 Objective

This report is prepared on behalf of *Movea, Inc.* 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.

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
- 6 dB Bandwidth & 99% Bandwidth
- Maximum Peak Output Power
- 100 kHz Bandwidth of Frequency Band Edge
- Power Spectral Density

1.5 Related Submittal(s)/Grant(s)

No related submittals.

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 $\pm$2.0 for Conducted Emissions tests and $\pm$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

N/A

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 EUT Internal Configuration and Details

Manufacturers	Descriptions	Models	Serial Numbers
Movea Inc	PCB Assembly	GO2 Upper Board	AC03690-001
Movea Inc	PCB Assembly	GO2 Dower Board	P000354-001

2.6 Interface Ports and Cabling

N/A

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Part 15C & IC RSS-210/RSS-Gen Rules	Description of Test	Result
FCC §15.203 IC RSS-Gen §7.1.4	Antenna Requirement	Compliant
FCC § 15.207 (a) IC RSS-Gen §7.2.2	Conducted Emissions	N/A *
FCC §15.247 (a)(2) IC RSS-210 §A8.2 (a)	6 dB Bandwidth & 99% Bandwidth	Compliant
FCC §15.247 (b)(3) IC RSS-210 § A8.4	Maximum Peak Output Power	Compliant
FCC § 15.247 (d) IC RSS-210 § A8.5	Band Edge/Out of Band Emissions	Compliant
FCC §15.247 (e) IC RSS-210 §A8.2 (b)	Power Spectral Density	Compliant
FCC §15.205, §15.209 & §15.247(c) IC RSS-Gen §4.9	Radiated Spurious Emissions	Compliant
FCC §15.205 IC RSS-210 § 2.6	Restricted Band	Compliant
IC RSS-210 § 2.6 IC RSS-Gen § 6	Receiver Spurious Emissions	Compliant
FCC§15.247 (i), §2.1091 IC RSS-102	RF Exposure	Compliant

Note: * EUT is powered by Battery.

4 FCC §15.203 & IC RSS-GEN § 7.1.4 - Antenna Requirement

4.1 Applicable Standard

For intentional device, according to FCC Part §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used.

Per IC RSS-Gen §7.1.4, A transmitter can only be sold or operated with antennas with which it was certified. A transmitter maybe 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.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in IC RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to IC RSS-210 Annex 8 or RSS-210 Annex 9, the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to IC RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

4.2 Results

The EUT has integral antenna with a maximum gain of 2 dBi antenna, which in accordance to sections FCC Part 15.203 and IC RSS-Gen §7.1.4, is considered sufficient to comply with the provisions of these sections.

5 FCC §15.207 & IC RSS-GEN § 7.2.2- Conducted Emissions

5.1 Applicable Standard

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 (dBuV)	
	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.*

5.2 Test Results

This test is not applicable (N/A) as the device is powered by Battery.

6 FCC §15.247(a) (2) & IC RSS-210 § A8.2 (a) – 6 dB Occupied Bandwidth

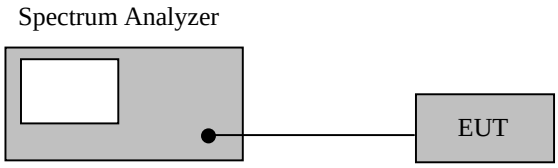
6.1 Applicable Standard

According to §15.247(a)(2) and RSS-210 A8.2 (a), systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

6.2 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.

6.3 Test Setup Block Diagram



6.4 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-03-25

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

6.5 Test Environmental Conditions

Temperature:	22°C~25°C
Relative Humidity:	31 %~33 %
ATM Pressure:	101.1~101.4 kPa

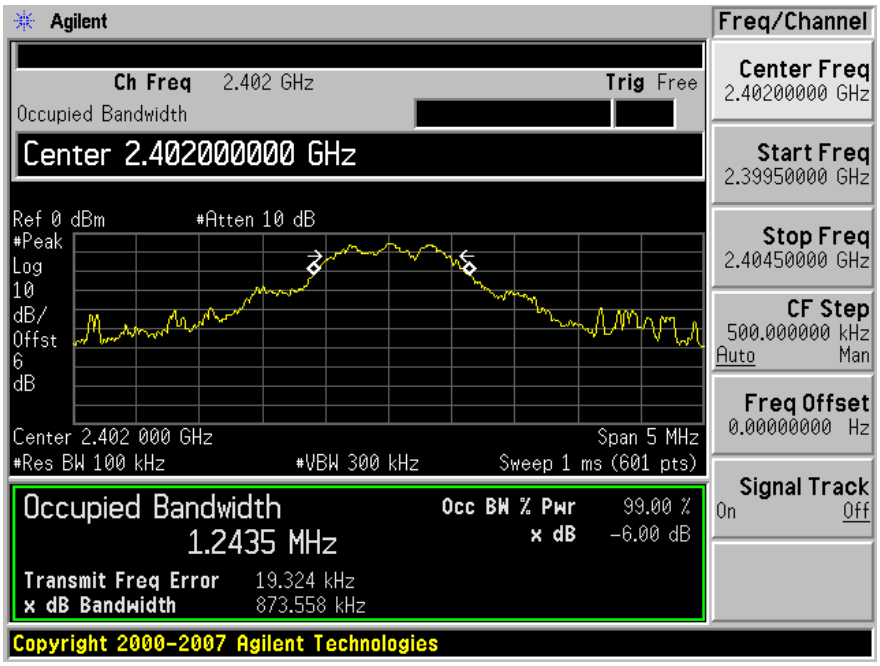
**The testing was performed by Jack Liu on 2009-06-16 ~ 2009-06-25.*

6.6 Test Results

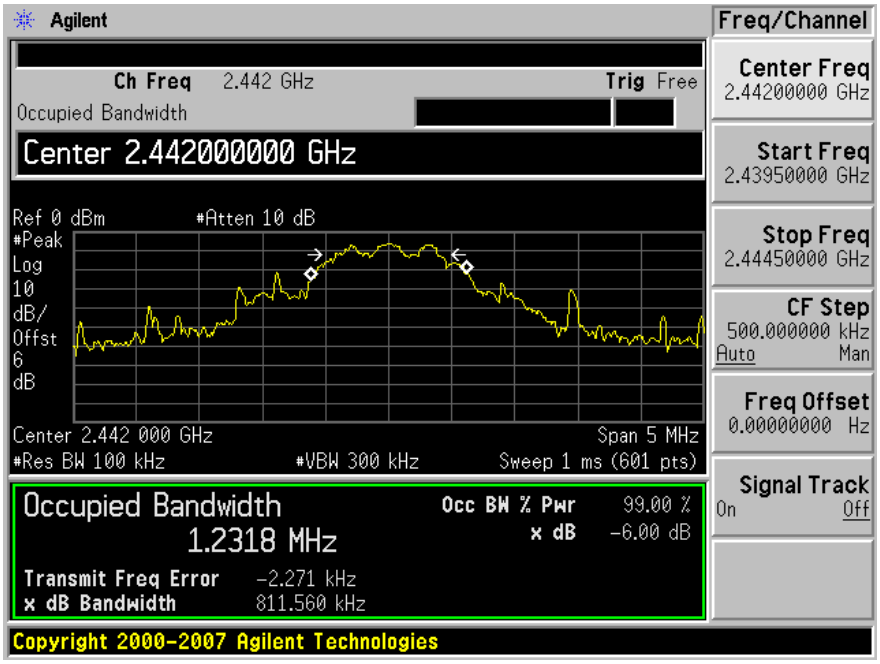
Channel	Frequency (MHz)	6 dB OBW (kHz)	99% OBW (kHz)	Limit (kHz)
Low	2402	873.558	1243.5	> 500
Middle	2442	811.560	1231.8	> 500
High	2479	941.246	1167.6	> 500

Please refer to the following plots for detailed test results

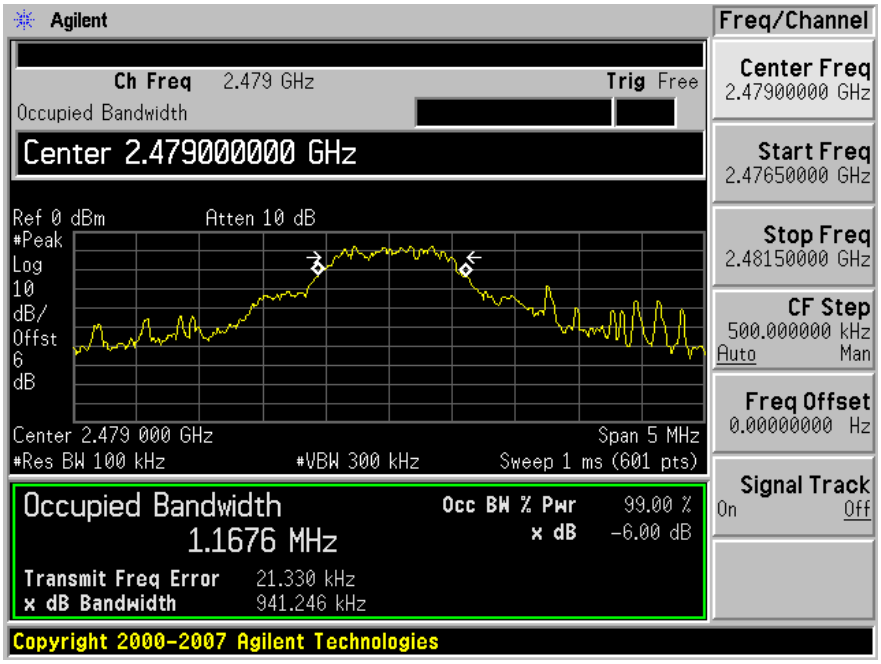
Low Channel



Middle Channel



High Channel



7 FCC §15.247(b) & IC RSS-210 § A8.4 - Peak Output Power

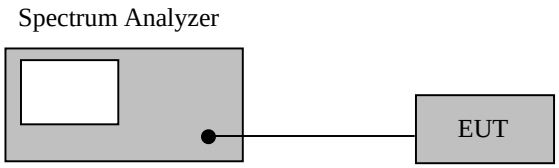
7.1 Applicable Standard

According to §15.247(b) (3) and RSS210 § A8.4 (4) for systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed 1 Watt.

7.2 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.

7.3 Test Setup Block Diagram



7.4 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-03-25

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

7.5 Test Environmental Conditions

Temperature:	22°C~25°C
Relative Humidity:	31 %~33 %
ATM Pressure:	101.1~101.4 kPa

**The testing was performed by Jack Liu on 2009-06-16 ~ 2009-06-25.*

7.6 Test Results

Channel	Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
Low	2402	-5.70	0.27	1000	Compliant
Mid	2442	-5.64	0.26	1000	Compliant
High	2479	-6.26	0.24	1000	Compliant

8 FCC §15.247(d) & IC RSS-210 § A8.5 – Out of Band Emissions

8.1 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)).

RSS-210§ 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.

8.2 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.

8.3 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-03-25

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

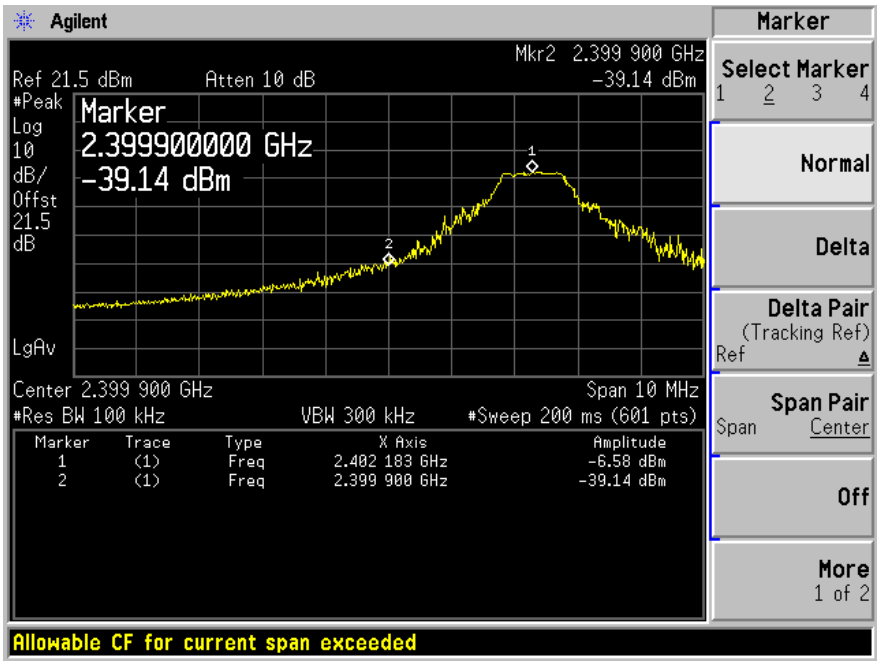
8.4 Test Environmental Conditions

Temperature:	22°C~25°C
Relative Humidity:	31 %~33 %
ATM Pressure:	101.1~101.4kPa

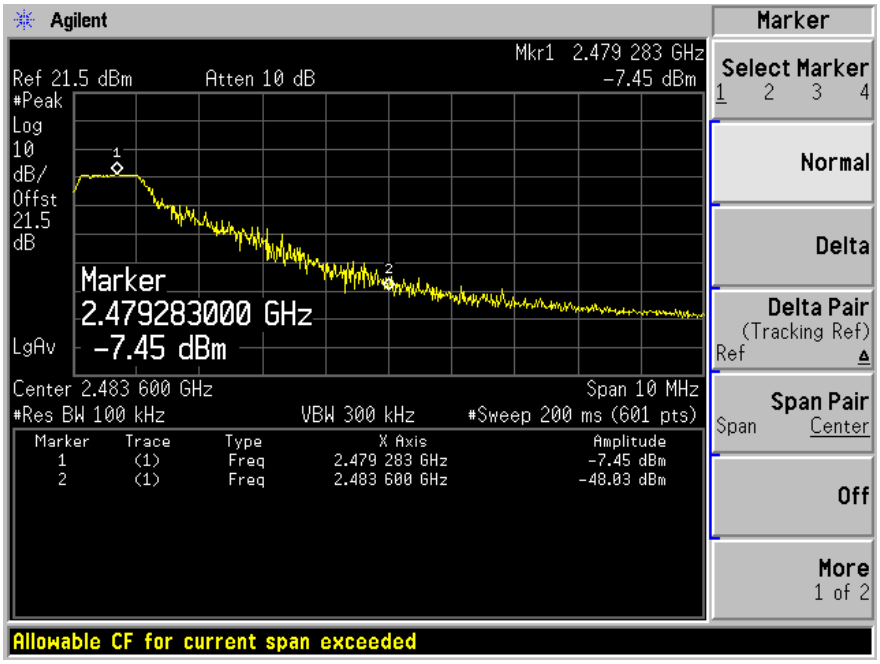
**The testing was performed by Jack Liu on 2009-06-16 ~ 2009-06-25.*

Plots of 100 kHz Band Edge

Lowest Channel

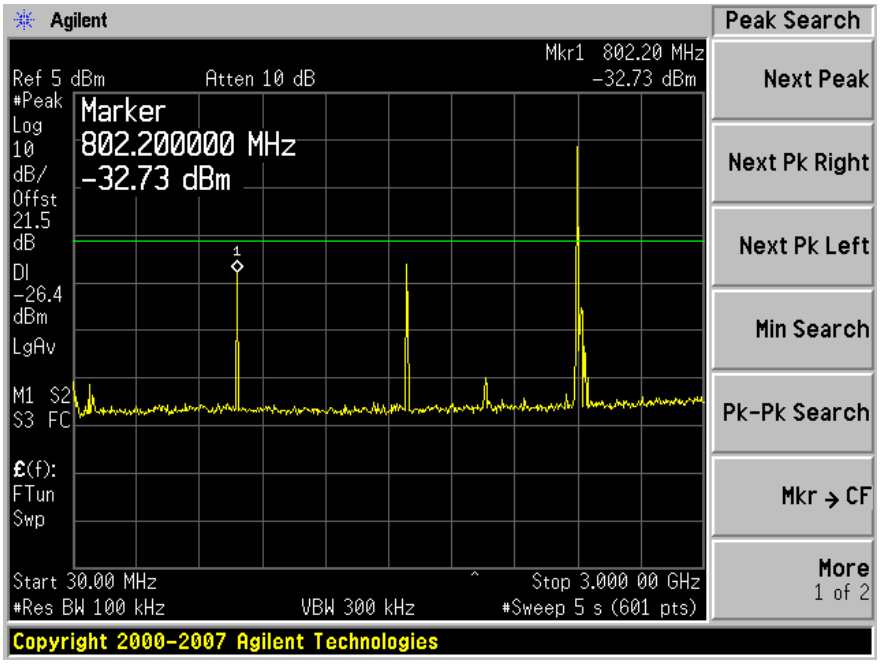


Highest Channel

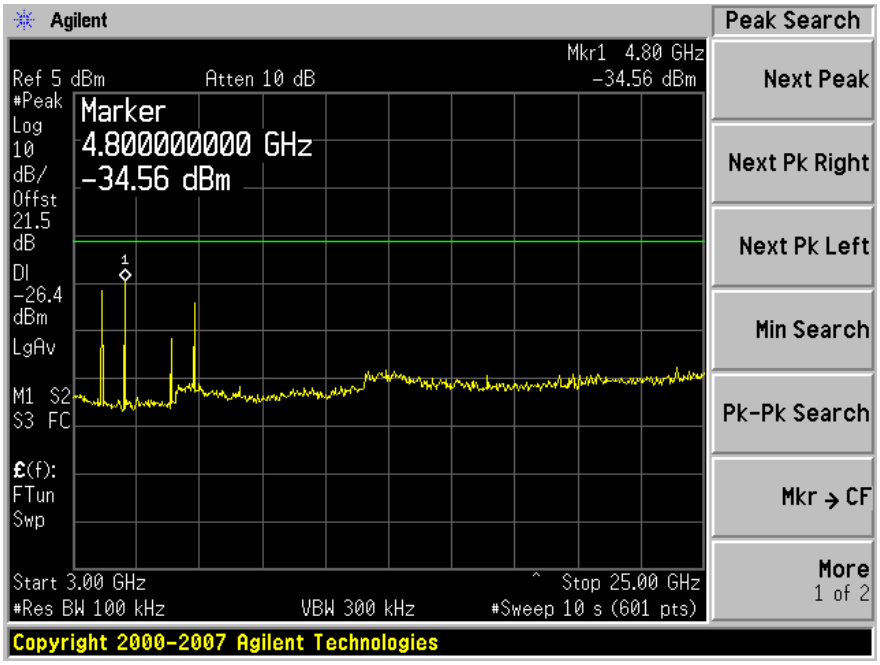


Plots of spurious emission at antenna port

Low Channel

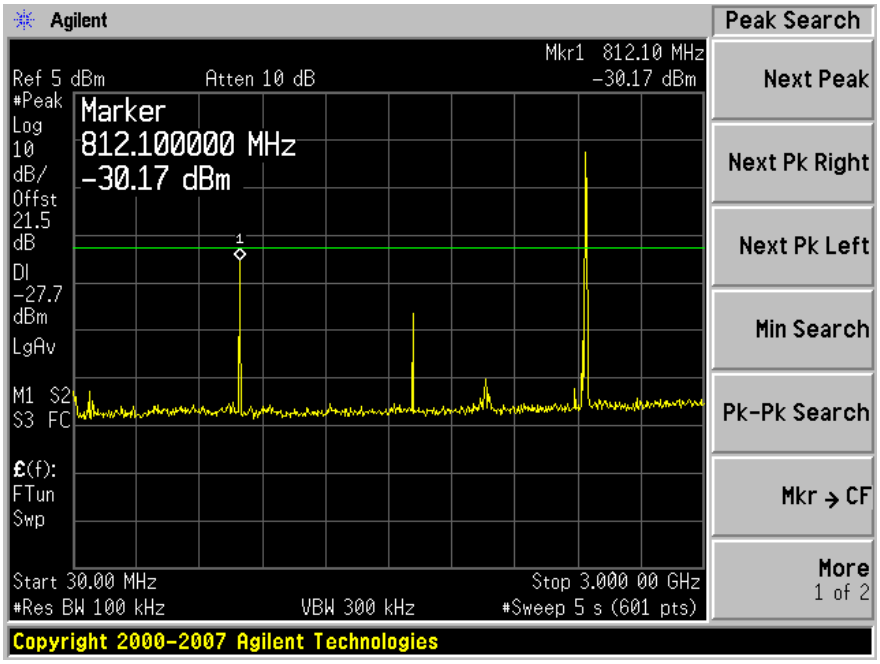


Plot 1: 30 MHz~3 GHz

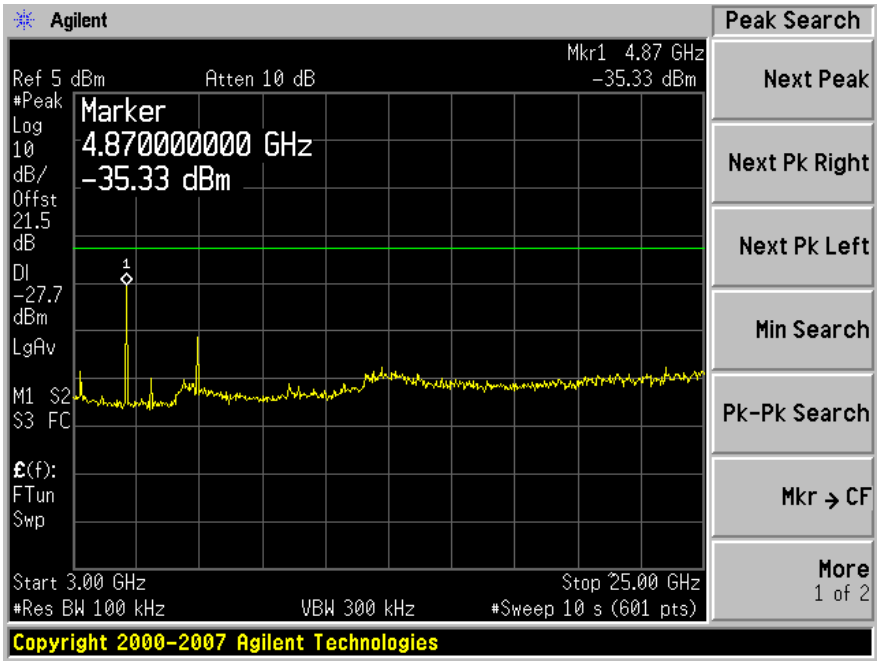


Plot 2: 3 ~25 GHz

Middle Channel

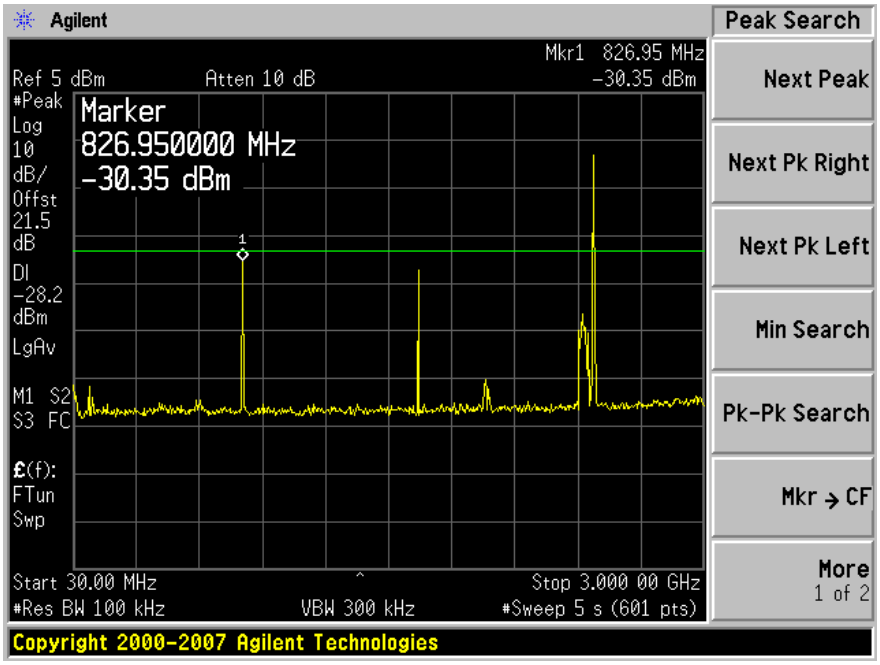


Plot 1: 30 MHz~3 GHz

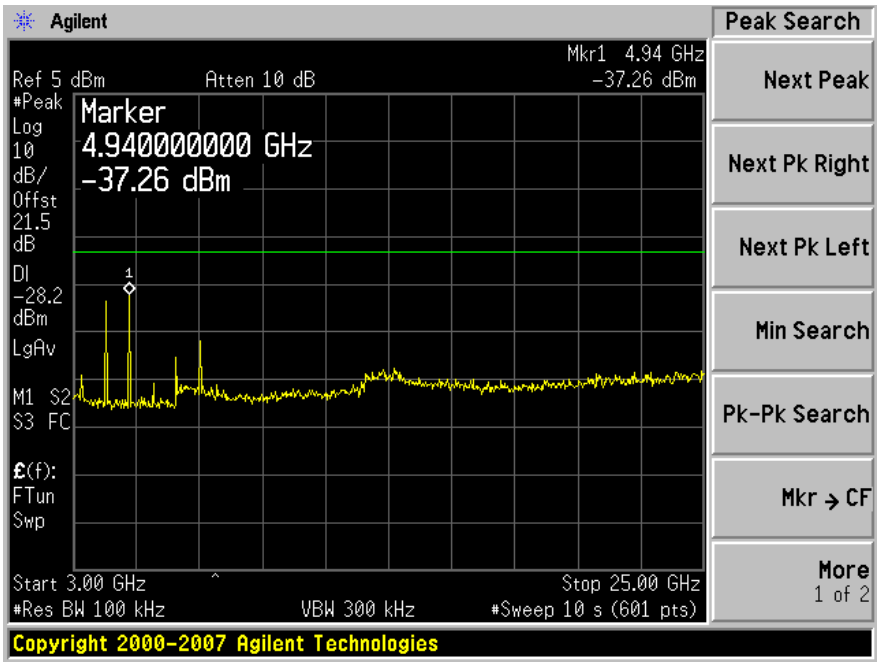


Plot 2: 3 ~ 25 GHz

High Channel



Plot 1: 30 MHz~3 GHz



Plot 2: 3 ~ 25 GHz

9 FCC §15.247(e) & IC RSS-210 § A8.2 (b) - Power Spectral Density

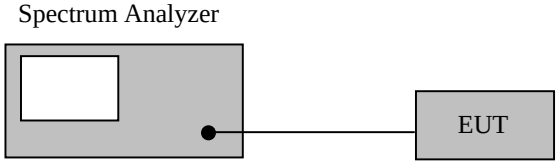
9.1 Applicable Standard

According to §15.247 (e) and RSS-210 § A8.2 (b) , for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

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 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. Measure the power spectral density as follows:
   A. Tune the analyzer to the highest point of the maximized fundamental emission. Reset the analyzer to a RBW = 3 kHz, VBW > RBW, span = 99% OBW, sweep = (span/3kHz) second.
   B. From the peak level obtained in (A), derive the field strength, E, by applying the appropriate antenna factor, cable loss, pre-amp gain, etc.
4. P = (E x d) squared / (30 x G)
   G = the numeric gain of the transmitting antenna over an isotropic radiator.
   d = the distance in meters from which the field strength was measured.
   P = the power in watts for which you are solving:
5. Using the equation listed in (4), calculate a power level for comparison to the + 8 dBm limit.

9.3 Test Setup Block Diagram



9.4 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-03-25

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

9.5 Test Environmental Conditions

Temperature:	22°C~25°C
Relative Humidity:	31 %~33 %
ATM Pressure:	101.1~101.4kPa

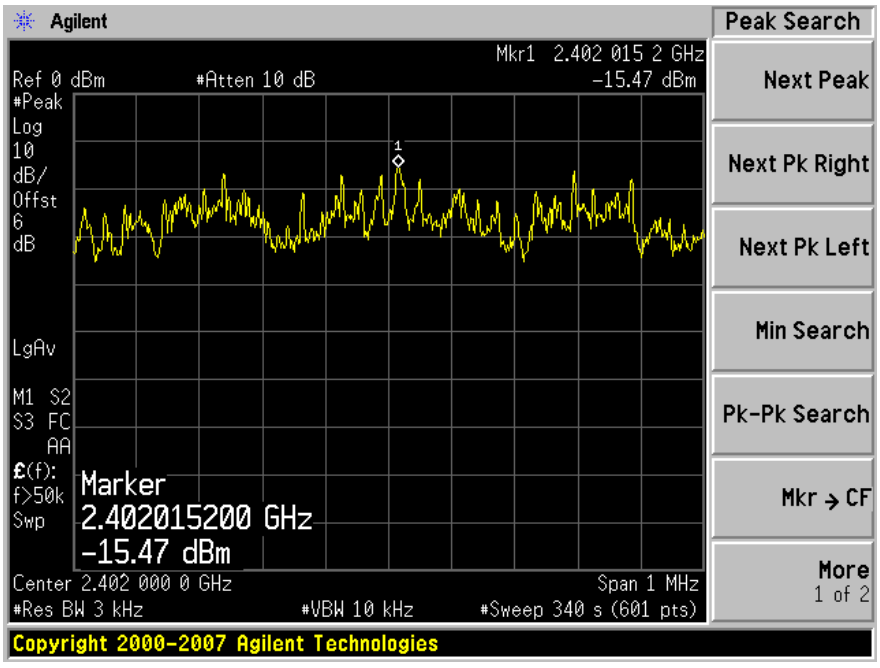
**The testing was performed by Jack Liu on 2009-06-16 ~ 2009-06-25.*

9.6 Test Results

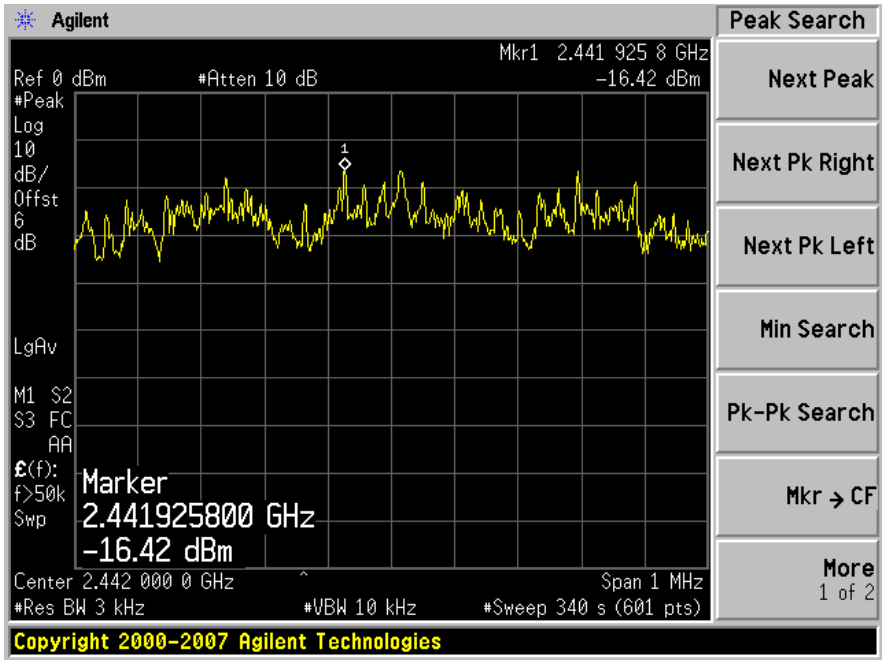
Frequency (MHz)	PPSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2402	-15.47	8	Compliant
2442	-16.42	8	Compliant
2479	-17.00	8	Compliant

Please refer to the following plots for detailed test results

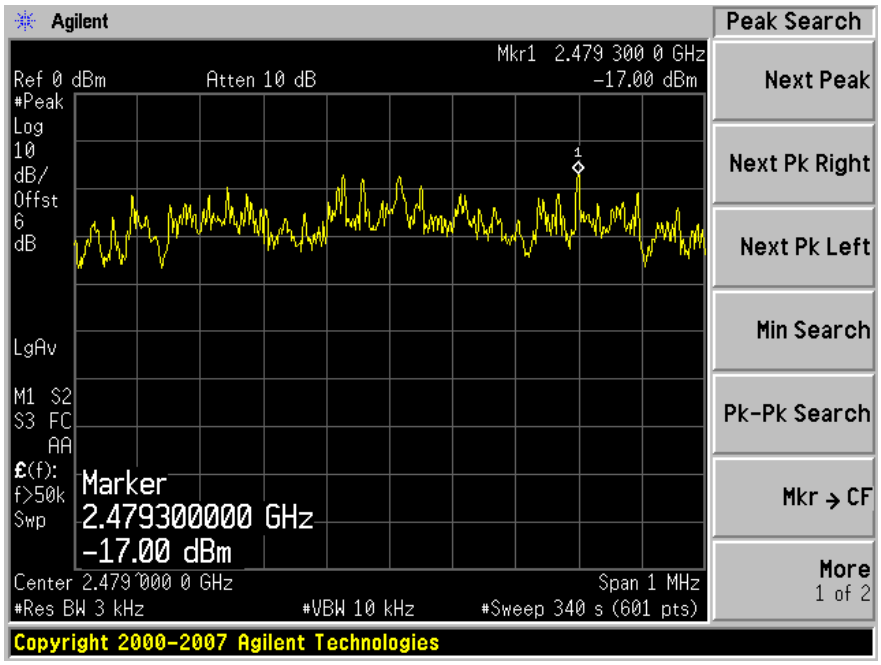
Low Channel



Middle Channel



High Channel



10 FCC §15.205, §15.209, §15.247(c) & IC RSS-Gen §4.9 - Spurious Radiated Emissions

10.1 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 §15.205(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.

10.2 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 and RSS-210 limits.

10.3 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 and RSS-210 limits.

The spacing between the peripherals was 3 centimeters.

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

10.4 Test Procedure

For the radiated emissions test, the EUT was connected to the DC power source, 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 1000 MHz:

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

Above 1000 MHz:

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

10.5 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:

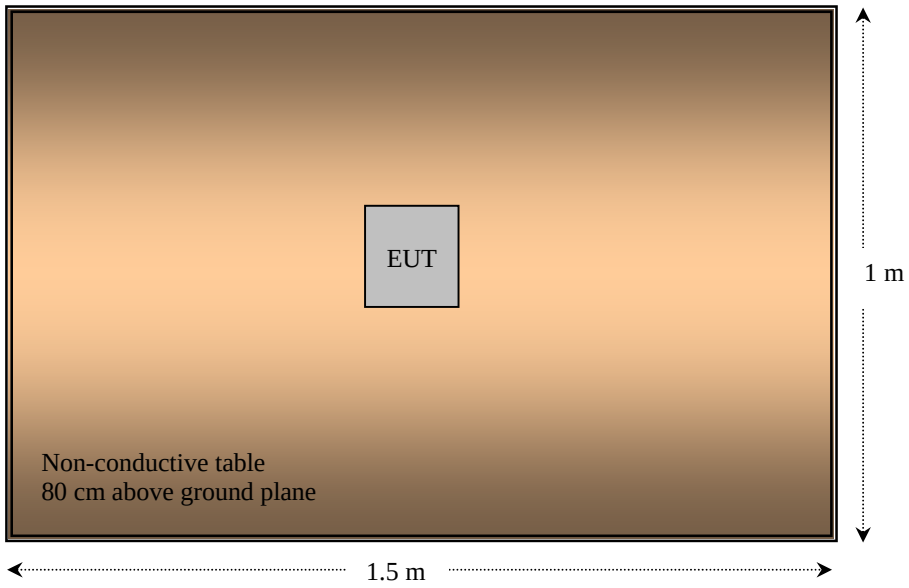
Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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 emission is 7dB below the maximum limit.
The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

10.6 Test Setup Block Diagrams

Radiated Emission



10.7 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
Agilent	Spectrum Analyzer	E4440A	US44303352	2009-04-27
Sunol Sciences	Antenna	JB1	A020106-1	2009-04-17
A.R.A	Horn Antenna	DRG-118/A	1132	2008-07-28
Ducommun	Pre-Amplifier	ALN-09173030-01	990297-01R	2009-03-04
HP	Pre-Amplifier	8447D	2944A06639	2009-06-05

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

10.8 Test Environmental Conditions

Temperature:	22°C~25°C
Relative Humidity:	31 %~33 %
ATM Pressure:	101.1~101.4kPa

**The testing was performed by Jack Liu on 2009-06-16 ~ 2009-06-25.*

10.9 Test Results

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

Low Channel: 2402 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-5.63	800.7129	Horizontal	30 to 1000 MHz
-8.29	4804	Horizontal	Above 1 GHz

Middle Channel: 2442 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-16.90	813.7086	Horizontal	30 to 1000 MHz
-5.24	4884	Vertical	Above 1 GHz

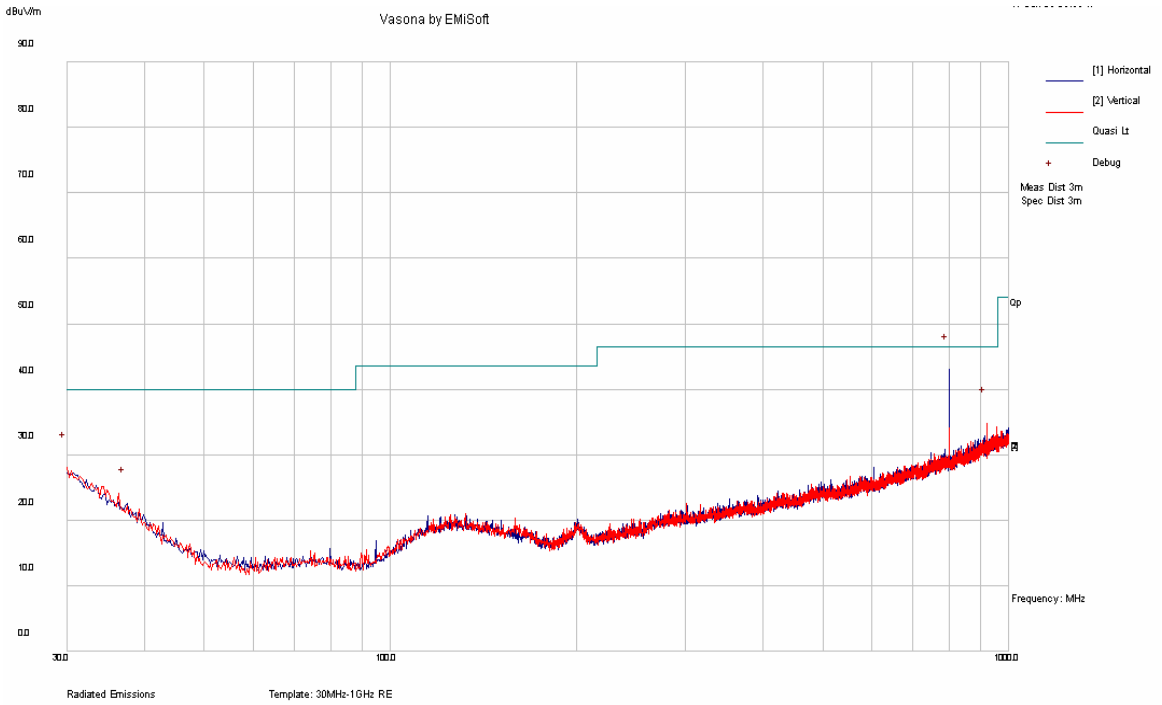
High Channel: 2479 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-3.72	826.3854	Horizontal	30 to 1000 MHz
-5.57	4958	Vertical	Above 1 GHz

10.10 Radiated Emissions Test Plot & Data

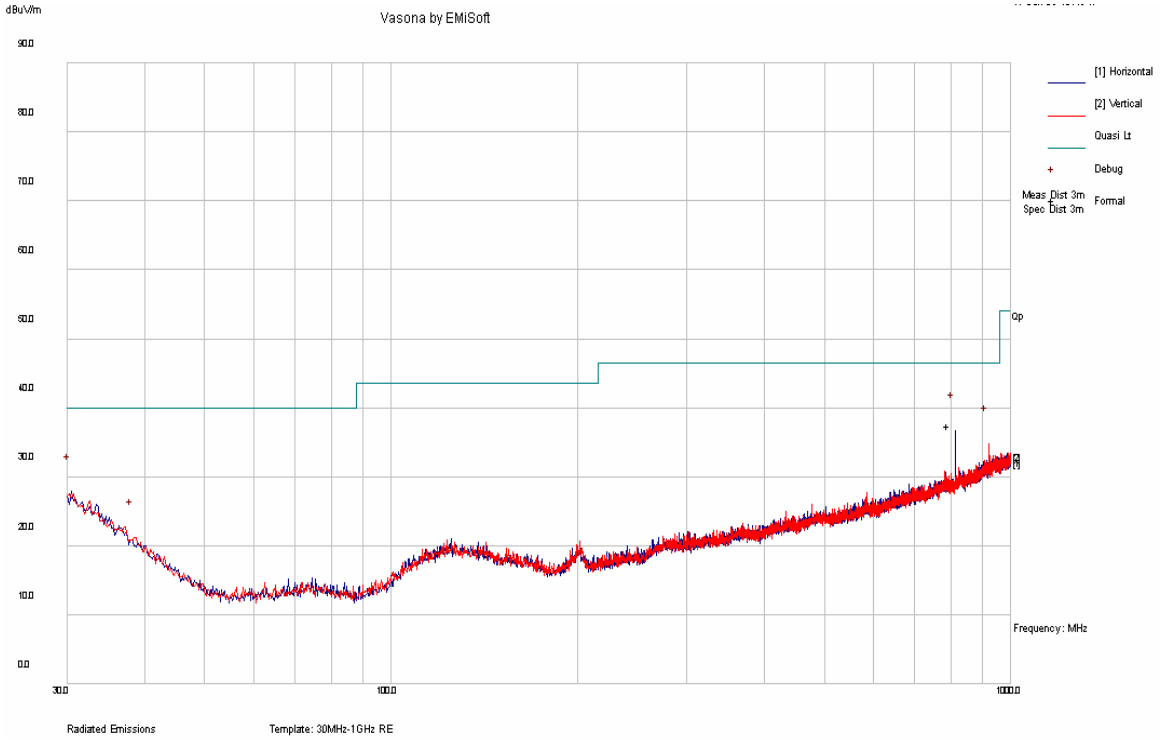
30 MHz – 1 GHz measured at 3 meters

Low Channel: 2402 MHz



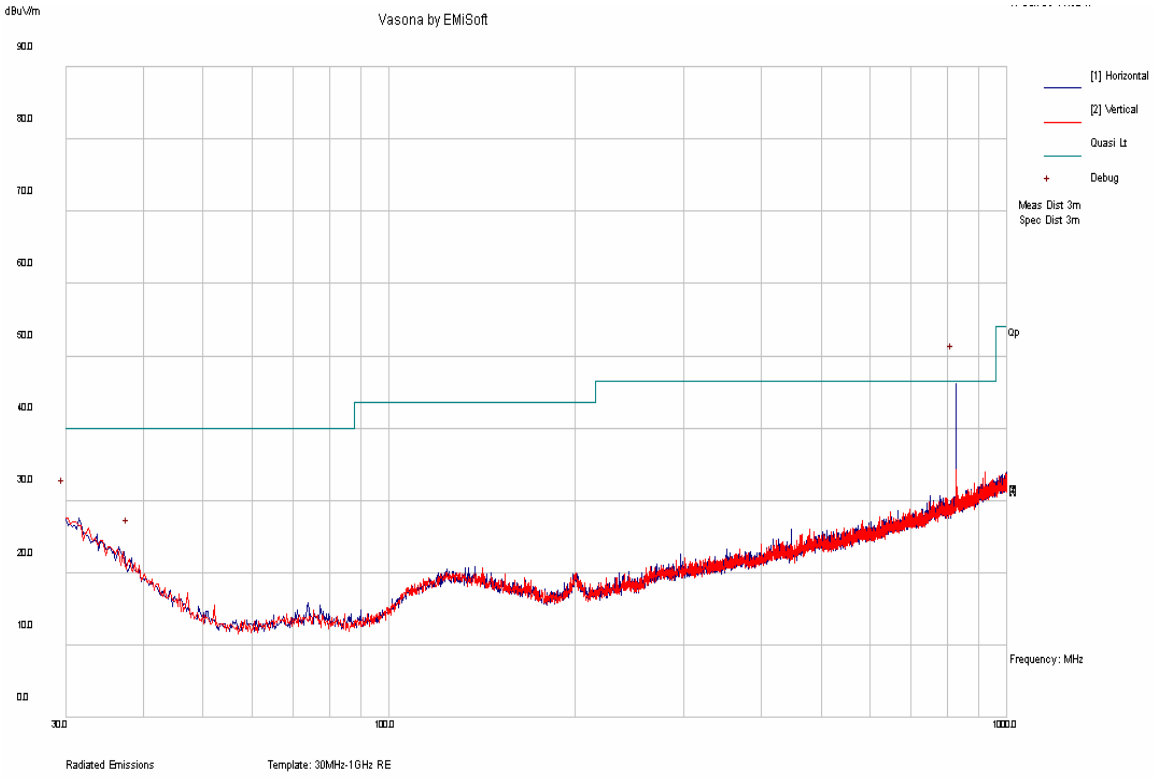
Frequency (MHz)	Corrected Quasi-Peak (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
800.7129	40.87	100	H	118	46.5	-5.63
922.1684	27.38	139	V	148	46.5	-19.12
30.0000	17.59	222	V	166	40.0	-22.41
37.5463	10.75	226	H	152	40.0	-29.25

Middle Channel: 2442 MHz



Frequency (MHz)	Corrected Quasi-Peak (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
813.70860	33.40	100	H	294	46.5	-16.90
921.88450	25.38	227	V	308	46.5	-21.12
30.26948	17.34	100	H	256	40.0	-22.66
38.65094	9.91	219	V	98	40.0	-30.09

High Channel: 2479 MHz



Frequency (MHz)	Corrected Quasi-Peak (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
826.38540	42.78	100	H	58	46.5	-3.72
30.00637	17.50	291	V	160	40.0	-22.50
38.13196	10.38	243	H	312	40.0	-29.62

Above 1 GHz:

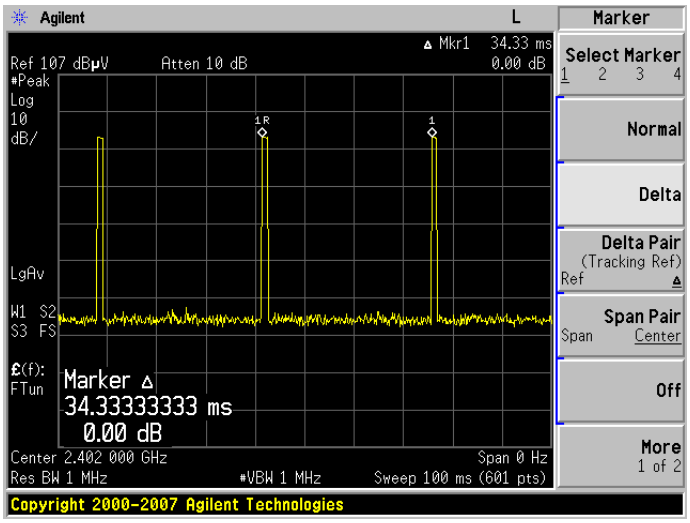
Low Channel: 2402 MHz

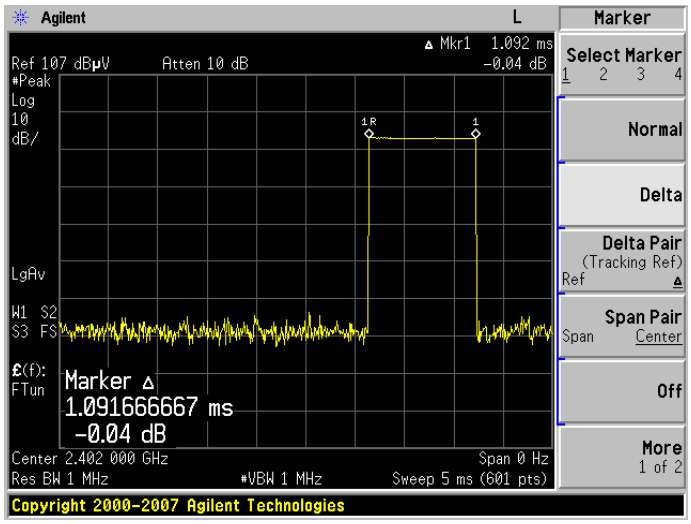
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

Freq. (MHz)	S.A. Reading (dBuV)	Detector (PK/AV)	Table Azimuth (Degree)	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle Factor (dB)	Cord. Amp. (dBuV/m)	FCC & IC	
				Height (cm)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
4804	63.27	PK	157	178	H	34.0	8.88	40.44	0	65.71	74	-8.29
4804	61.82	PK	171	100	V	34.0	8.88	40.44	0	64.26	74	-9.74
4804	63.27	-	157	178	H	34.0	8.88	40.44	-30.29	35.42*	54	-18.58
4804	61.82	-	171	100	V	34.0	8.88	40.44	-30.29	33.97*	54	-20.03
4003	54.61	PK	0	100	H	31.6	7.96	41.67	0	52.50	74	-21.50
1601	59.07	PK	145	100	H	25.4	4.66	39.22	0	49.91	74	-24.09
4003	49.42	PK	82	225	V	31.6	7.96	41.67	0	47.31	74	-26.69
1601	54.52	PK	122	100	V	25.4	4.66	39.22	0	45.36	74	-28.64
4003	54.61	-	0	100	H	31.6	7.96	41.67	-30.29	22.21*	54	-31.79
1601	59.07	-	145	100	H	25.4	4.66	39.22	-30.29	19.62*	54	-34.38
4003	49.42	-	82	225	V	31.6	7.96	41.67	-30.29	17.02*	54	-36.98
1601	54.52	-	122	100	V	25.4	4.66	39.22	-30.29	15.07*	54	-38.93

Note: • Average Value (*) is calculated based on Peak Reading + Duty Cycle Factor
• Duty Cycle Factor (DCF) = 20 $\log_{10}$ (Ton/Tp) = 20 $\log_{10}$ (3*1.01967ms/100ms) = -30.29 dB

Please refer to the following plot for the Duty cycle calculation:





Duty Cycle Plots

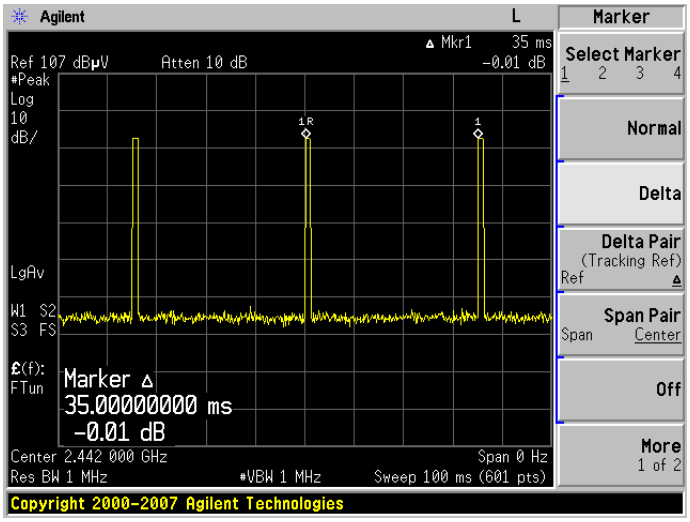
Middle Channel: 2442 MHz

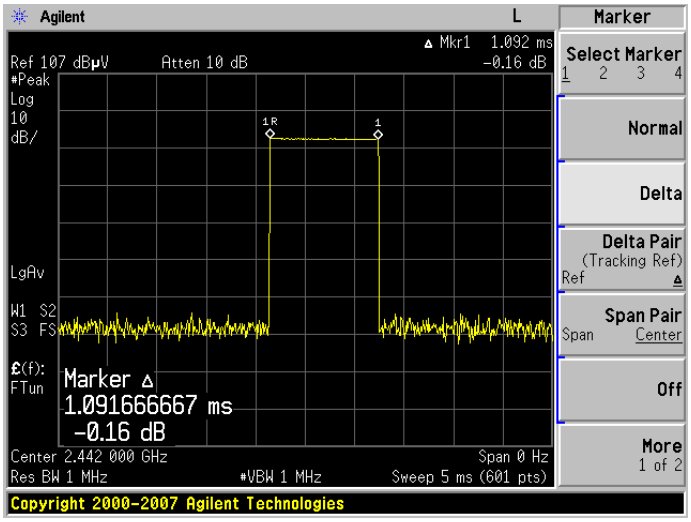
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

Frequency (MHz)	S.A. Reading (dBuV)	Detector (PK/AV)	Table Azimuth (Degree)	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle Factor (dB)	Corrected Amplitude (dBuV/m)	FCC & IC	
				Height (cm)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
4884	66.32	PK	173	100	V	34.0	8.88	40.44	0	68.76	74	-5.24
4884	63.15	PK	206	100	H	34.0	8.88	40.44	0	65.59	74	-8.41
4884	66.32	-	173	100	V	34.0	8.88	40.44	-30.29	38.47*	54	-15.53
4884	63.15	-	206	100	H	34.0	8.88	40.44	-30.29	35.30*	54	-18.70
4070	55.83	PK	343	100	H	31.6	7.96	41.67	0	53.72	74	-20.28
1628	60.64	PK	128	100	H	25.4	4.66	39.22	0	51.48	74	-22.52
4070	49.95	PK	73	100	V	31.6	7.96	41.67	0	47.84	74	-26.16
1628	56.81	PK	271	100	V	25.4	4.66	39.22	0	47.65	74	-26.35
4070	55.83	-	343	100	H	31.6	7.96	41.67	-30.29	23.43*	54	-30.57
1628	60.64	-	128	100	H	25.4	4.66	39.22	-30.29	21.19*	54	-32.81
4070	49.95	-	73	100	V	31.6	7.96	41.67	-30.29	17.55*	54	-36.45
1628	56.81	-	271	100	V	25.4	4.66	39.22	-30.29	17.36*	54	-36.64

Note: • Average Value (*) is calculated based on Peak Reading + Duty Cycle Factor
• Duty Cycle Factor (DCF) = 20 $\log_{10}$ (Ton/Tp) = 20 $\log_{10}$ (3*1.01967ms/100ms) = -30.29 dB

Please refer to the following plot for the Duty cycle calculation:





Duty Cycle Plots

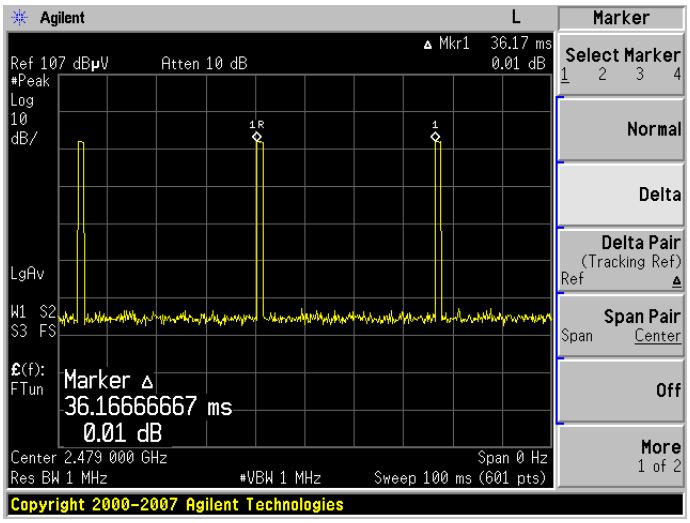
High Channel: 2479 MHz

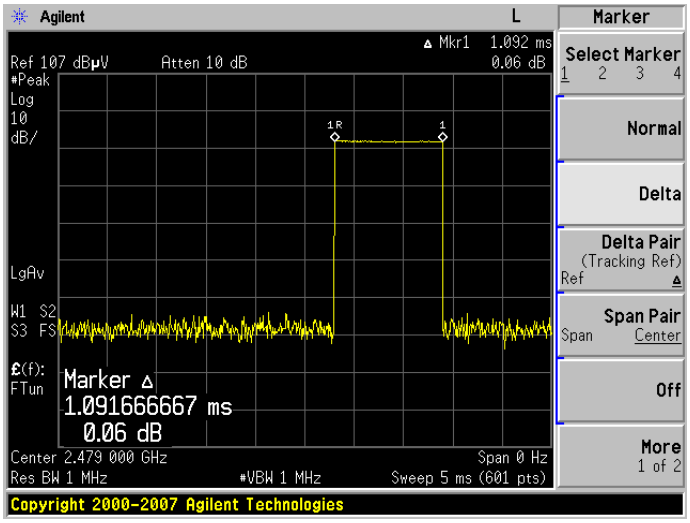
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

Frequency (MHz)	S.A. Reading (dBuV)	Detector (PK/AV)	Table Azimuth (Degree)	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle Factor (dB)	Corrected Amplitude (dBuV/m)	FCC & IC	
				Height (cm)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
4958	65.99	PK	183	100	V	34.0	8.88	40.44	0	68.43	74	-5.57
4958	64.66	PK	200	166	H	34.0	8.88	40.44	0	67.10	74	-6.90
4958	65.99	-	183	100	V	34.0	8.88	40.44	-30.29	38.14*	54	-15.86
4958	64.66	-	200	166	H	34.0	8.88	40.44	-30.29	36.81*	54	-17.19
4131	55.96	PK	0	100	H	31.6	7.96	41.67	0	53.85	74	-20.15
1652	60.35	PK	161	100	H	25.4	4.66	39.22	0	51.19	74	-22.81
1652	59.97	PK	141	100	V	25.4	4.66	39.22	0	50.81	74	-23.19
4131	51.93	PK	106	100	V	31.6	7.96	41.67	0	49.82	74	-24.18
4131	55.96	-	0	100	H	31.6	7.96	41.67	-30.29	23.56*	54	-30.44
1652	60.35	-	161	100	H	25.4	4.66	39.22	-30.29	20.90*	54	-33.10
1652	59.97	-	141	100	V	25.4	4.66	39.22	-30.29	20.52*	54	-33.48
4131	51.93	-	106	100	V	31.6	7.96	41.67	-30.29	19.53*	54	-34.47

Note: • Average Value (*) is calculated based on Peak Reading + Duty Cycle Factor
• Duty Cycle Factor (DCF) = 20 $\log_{10}$ (Ton/Tp) = 20 $\log_{10}$ (3*1.01967ms/100ms) = -30.29 dB

Please refer to the following plot for the Duty cycle calculation:

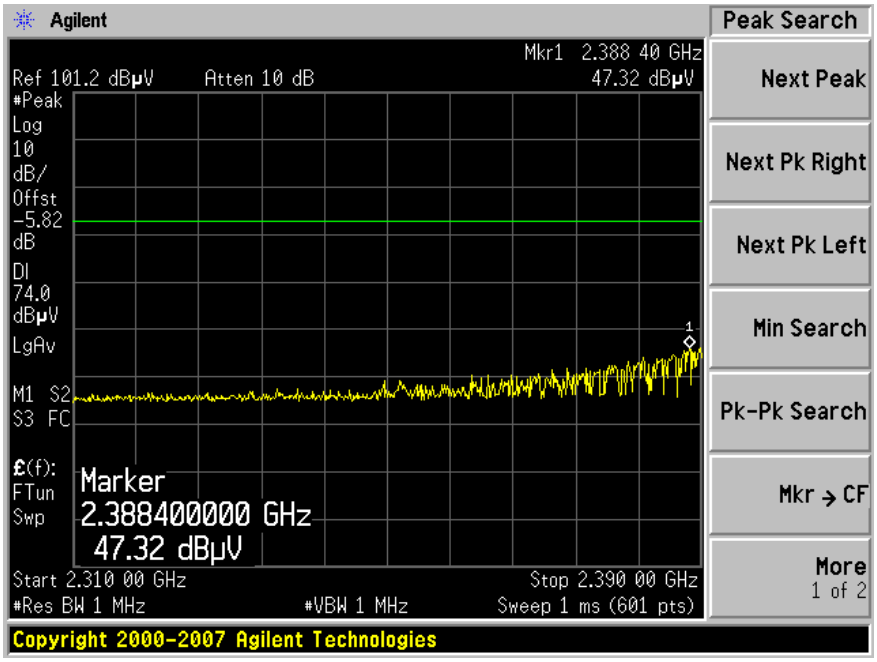




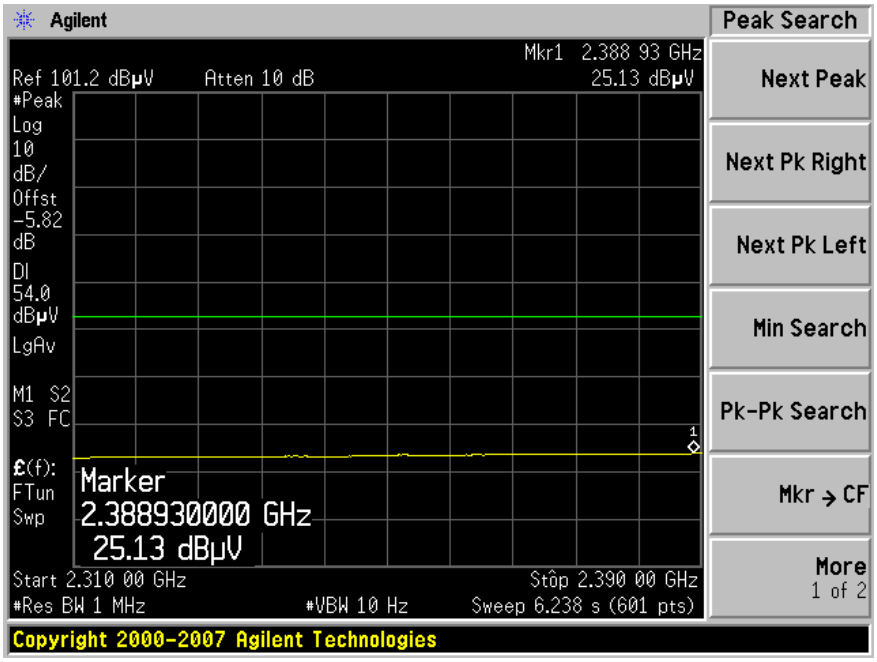
Duty Cycle Plots

Out of Band Emissions: Restricted band near band edge

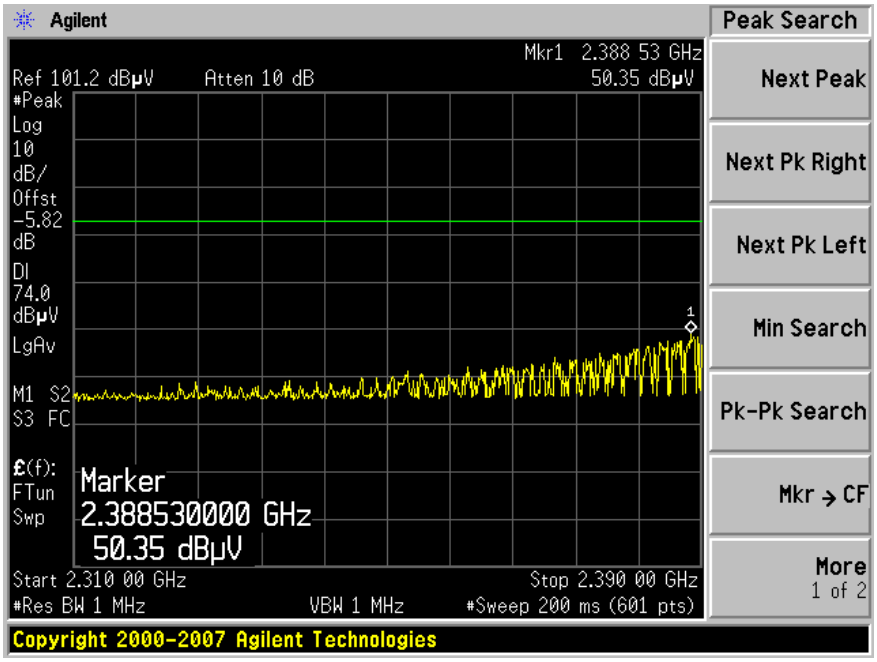
Lowest Channel: 2402 MHz



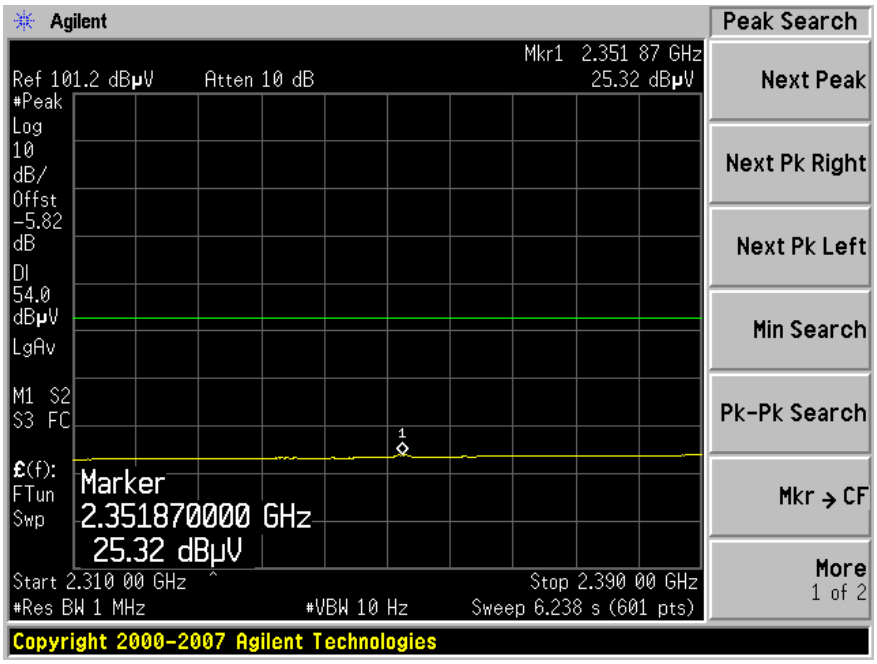
Vertical - Peak



Vertical - Average

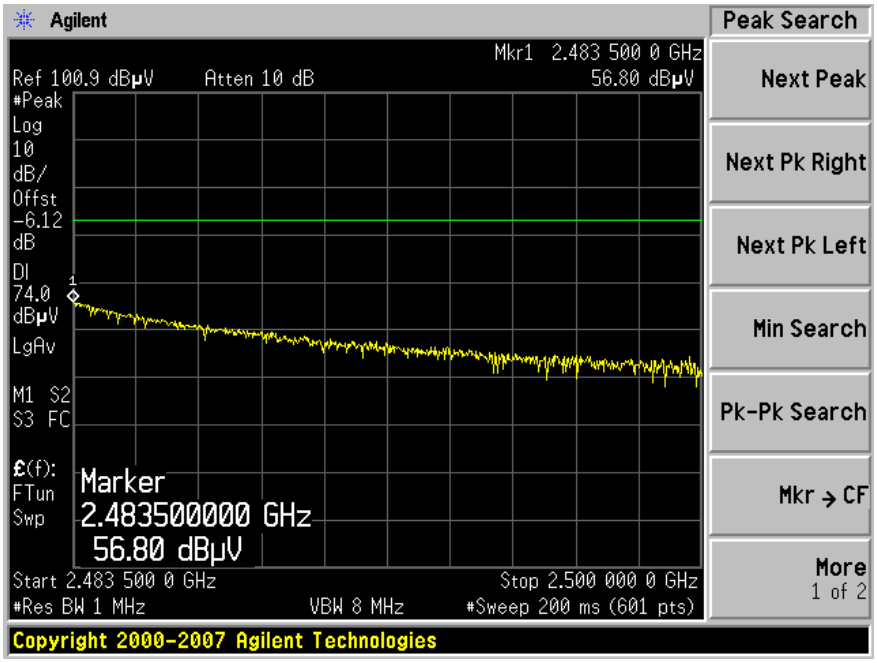


Horizontal – Peak

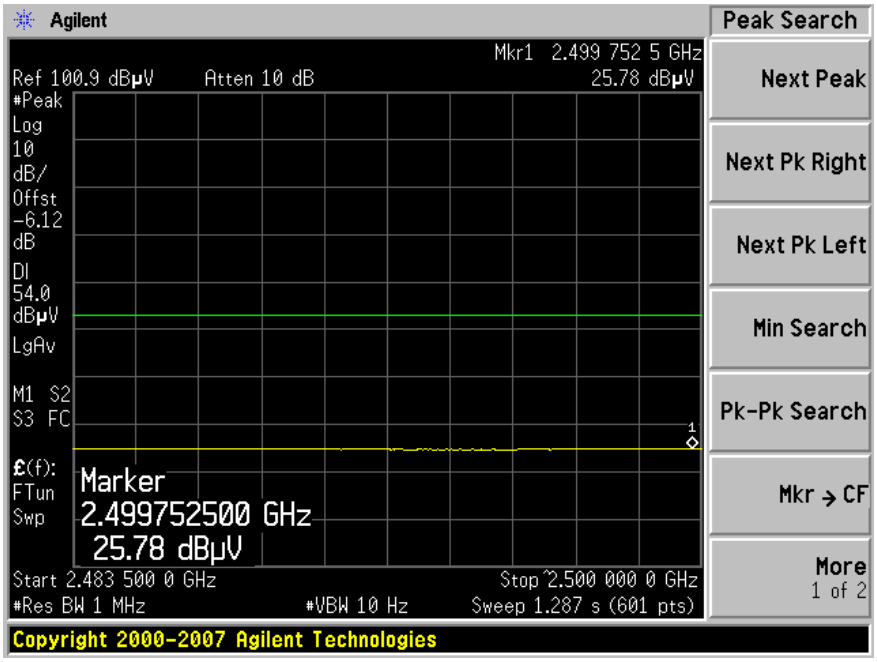


Horizontal - Average

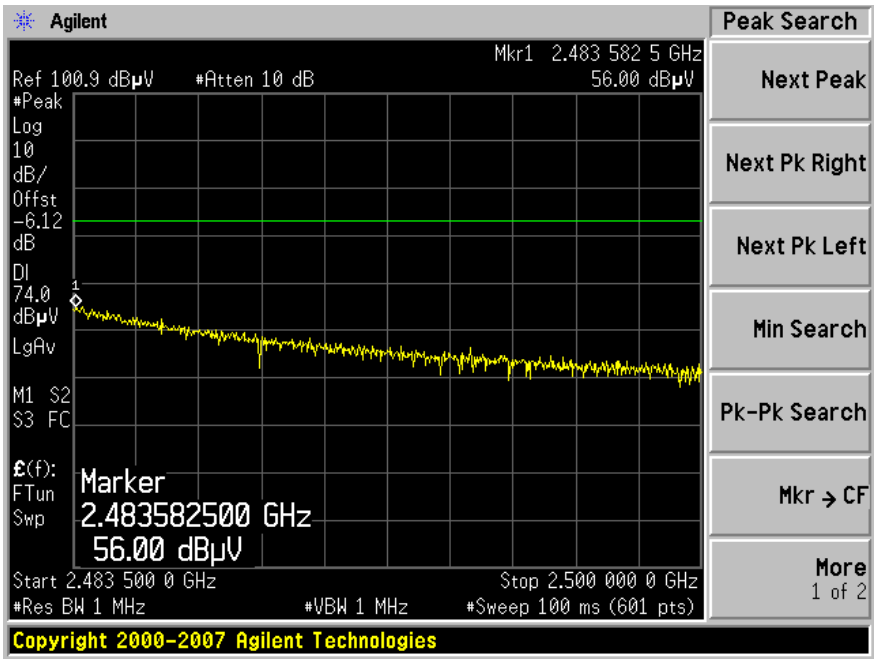
Highest Channel: 2479 MHz



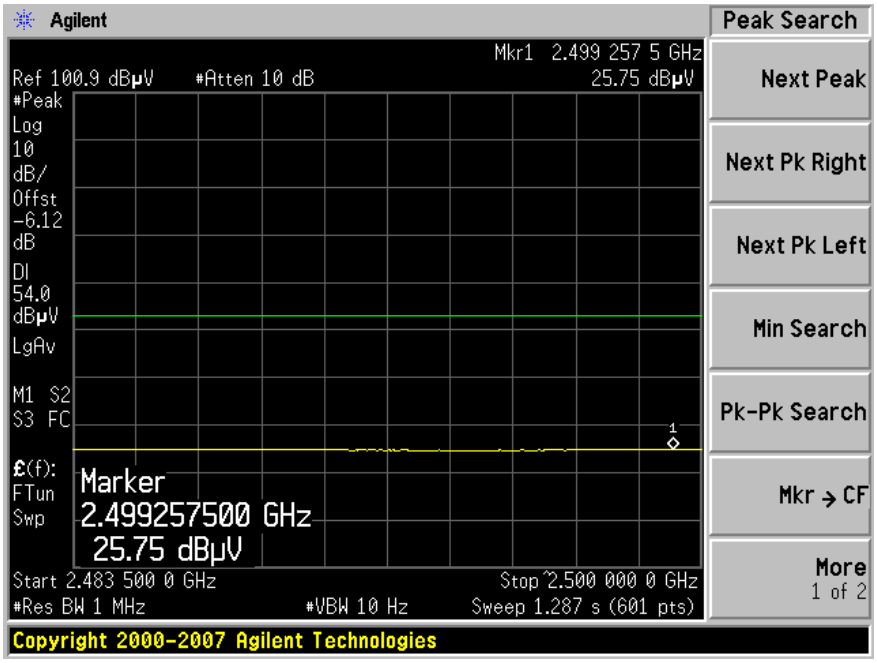
Vertical - Peak



Vertical - Average



Horizontal - Peak



Horizontal - Average

11 IC RSS-210 § 2.6 Receiver Spurious Emissions

11.1 Applicable Standard

As per RSS-210 § 2.6

Tables 2 and 3 show the general field strength limits of unwanted emissions, where applicable, for transmitters and receivers operating in accordance with the provisions specified in this RSS. Transmitters whose wanted emissions are also within the limits shown in Tables 2 and 3 may operate in any of the frequency bands of Tables 2 and 3, other than the restricted bands of Table 1 and the TV bands, and shall be certified under RSS-210. (Note: Devices operating below 490 kHz all of whose emissions are at least 40 dB below the limit given in Table 3 are Category II devices subject to RSS-310.) Unwanted emissions of transmitters and receivers are permitted to fall into Table 1 and TV frequencies but intentional emissions are prohibited. See the note of Table 2 for further details.

Table 2: General Field Strength Limits for Transmitters and Receivers at Frequencies above 30 MHz **(Note)**

Frequency (MHz)	Field Strength Microvolts/m at 3 meters (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

Note: Transmitting devices are not permitted in Table 1 bands or in TV bands (54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz, and 614-806 MHz). Prohibition of operation in TV bands does not apply to momentary devices, or to medical telemetry devices in the band 174-216 MHz, and to perimeter protection systems in the bands 54-72 and 76-88 MHz. The perimeter protection devices are to meet Table 3 field strengths limits.

Table 3: General Field Strength Limits for Transmitters at Frequencies below 30 MHz (Transmit)

Frequency (fundamental or spurious)	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average detector.

11.2 Test Setup

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

11.3 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.

11.4 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:

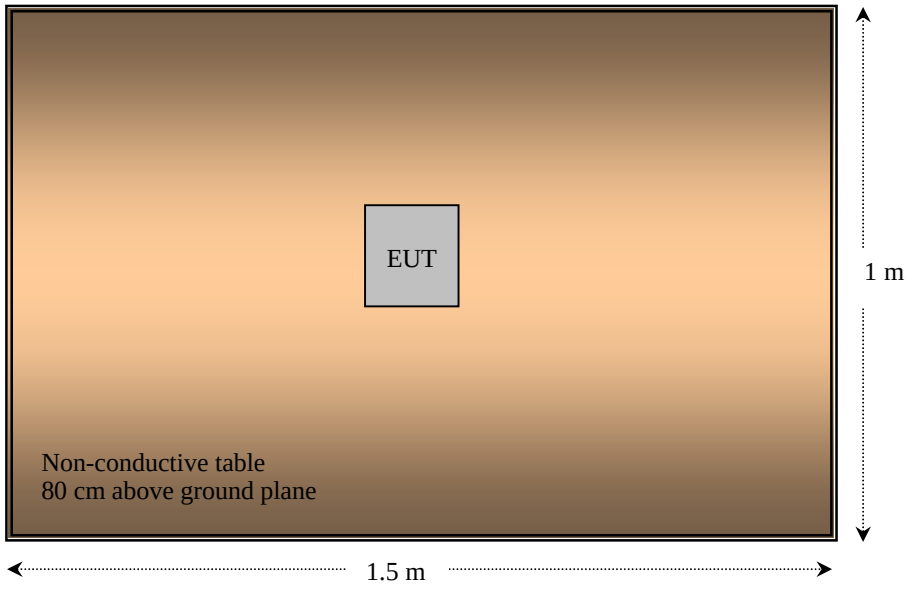
Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

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

11.5 Test Setup Block Diagrams

Radiated Emission



11.6 Test Equipment List and Details

Manufacturers	Description	Models	Serial Numbers	Calibration Dates
Agilent	Spectrum Analyzer	E4440A	US45303156	2009-03-25
Sunol Sciences	Antenna	JB1	A020106-1	2009-04-17
A.R.A	Horn Antenna	DRG-118/A	1132	2008-07-28
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2008-07-01
Ducommun	Pre-Amplifier	ALN-09173030-01	990297-01R	2009-03-04
HP	Pre-Amplifier	8447D	2944A06639	2009-06-05

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

11.7 Test Environmental Conditions

Temperature:	22°C~25°C
Relative Humidity:	31 %~33 %
ATM Pressure:	101.1~101.4kPa

**The testing was performed by Jack Liu on 2009-06-16 ~ 2009-06-25.*

11.8 Test Results

According to the recorded data, the EUT complied with RSS-210 Standard, and had the worst margin reading of:

Receiving Mode:

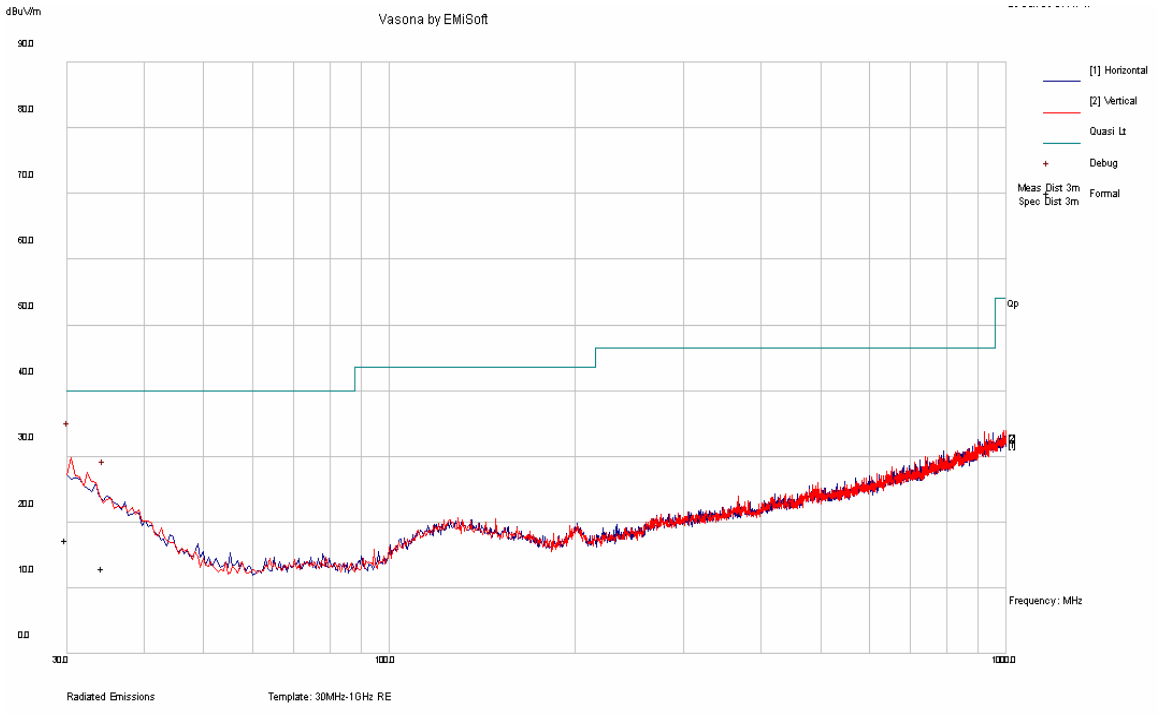
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range
-22.68	30.26252	Vertical	30 MHz to 1 GHz
-	-	-	Above 1 GHz*

***Note:** All above 1 GHz emission levels are at the noise floor and/or more then 20 dB below the limit.

Please refer to the following plot and data:

11.9 Radiated Emissions Test Plots and Data

30 MHz – 1 GHz (Middle Channel measured at 3 meters)



Frequency (MHz)	Corrected Quasi-Peak (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30.26252	17.32	209	V	314	40	-22.68
34.75448	12.94	126	H	198	40	-27.06

Above 1 GHz (Middle Channel measured at 3 meters)

Frequency (MHz)	Indicated Reading (dBµV)	Table Azimuth (degree)	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Corrected Reading (dBµV/m)	IC RSS-Gen		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
-	-	-	-	-	-	-	-	-	-	-	*
-	-	-	-	-	-	-	-	-	-	-	*

***Note:** All emission levels are at the noise floor and/or more then 20 dB below the limit.

12 FCC §15.247 (i), § 2.1091 & IC RSS-102 - RF Exposure

12.1 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

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
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

Before equipment certification is granted, the procedure of RSS-102 must be followed concerning the exposure of humans to RF fields.

According to RSS-102 Issue 2 section 4.1, RF limits used for general public will be applied to the EUT.

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m^2)	Time Averaging (min)
0.003 - 1	280	2.19	-	6
1 - 10	280 / f	2.19 / f	-	6
10 - 30	28	2.19 / f	-	6
30 – 300	28	0.073	2*	6
300 – 1 500	$1.585\ f^{0.5}$	$0.0042\ f^{0.5}$	f / 150	6
1 500 – 15 000	61.4	0.163	10	6
15 000 – 150 000	61.4	0.163	10	$616000 / f^{1.2}$
150 000- 300 000	$0.158\ f^{0.5}$	$4.21 \times 10\ -4\ f^{0.5}$	$6.67 \times 10^{-5}\ f$	$616000 / f^{1.2}$

Note: f is frequency in MHz
* Power density limit is applicable at frequencies greater than 100 MHz

12.2 MPE Prediction

Predication 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):	-5.7
Maximum peak output power at antenna input terminal (mW):	0.27
Prediction distance (cm):	20
Prediction frequency (MHz):	2402
Maximum Antenna Gain, typical (dBi):	2.0
Maximum Antenna Gain (numeric):	1.58
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.000084869
Power density of prediction frequency at 20.0 cm (W/m^2):	0.00084869
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0
MPE limit for uncontrolled exposure at prediction frequency (W/m^2):	10

12.3 Test Result

FCC: The power density level at 20 cm distance is 0.000084869mW/cm^2, which is below the uncontrolled exposure limit of 1.0 mW/cm^2.

IC: The power density level at 20 cm distance is 0.00084869 W/m^2, which is below the uncontrolled exposure limit of $10W/m^2$.