Lab Code: 200167-0

FCC PART 15.247

TEST AND MEASUREMENT REPORT

For

Everex Communications, Inc.

1045 Mission Court,

Fremont, CA 94539, USA

FCC ID: TF7WR-23-1000
Model: WR-23XX

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

Test Engineers:	Dennis Huang
Report Number:	R0908134-247
Report Date:	2009-09-28
Reviewed By:	Boni Baniqued Senior RF Engineer
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0908134-247	Original Report	2009-09-28

1 General Information

1.1 Product Description for Equipment under Test (EUT)

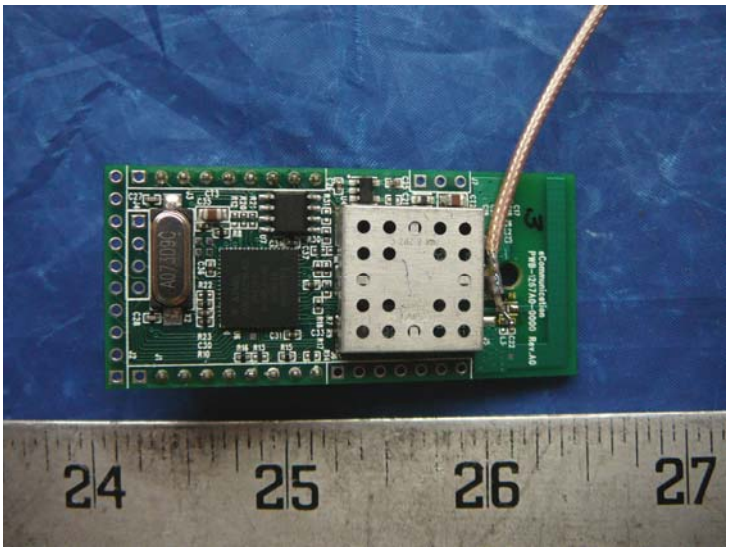
This test and measurement report was prepared on behalf of *Everex Communications,* Inc and their product *model: WR-23XX, FCC ID: TF7WR-23-1000* or the "EUT" as referred to in this report. The EUT is a mesh networking capable transceiver module operating in 2.4 GHz unlicensed ISM frequency. It is designed to be used in, but not limited to, building control, industrial control, residential and commercial automation, HVAC, energy management and wireless sensor network applications. It can be easily integrated into devices, such as thermostat, sensors, electric/water/gas meters, home appliances, which require wireless connectivity. WR-23XX can be configured as an end point device transceiver or as a pan coordinator which coordinates data traffic among end point devices.

1.2 Mechanical Description of EUT

The *Everex Communications, Inc.* EUT measures approximately *57 mm L x 26 mm W x 14 mm H,* and weighs approximately 9g.

** The test data gathered are from typical production sample, serial number: R0908134-1, assigned by BACL.*

1.3 EUT Photo



Please refer to Exhibit C for addition EUT photographs.

1.4 Objective

This original measurement and test report is prepared on behalf of Everex Communications, Inc. in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for Output Power, Antenna Requirements, 6 dB Bandwidth, and power spectral density, 100 kHz Bandwidth of Band Edges Measurement, Spurious Emissions, Conducted and Radiated Spurious Emissions.

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 EUT and its host were configured for testing according to ANSI C63.4-2003.

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

2.2 EUT Exercise Software

The EUT had been tested with the following Channel settings:

Channel No.	Frequency (MHz)
11	2405
18	2440
25	2475

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Power Supply Information

Manufacturer	Description	Model	Serial Number
PhiHong	AC/DC Power Adapter	PSA05W-105P	M82431185A2

2.5 EUT Internal Configuration Details

Manufacturer	Description	Model / Rev. No.
Everex Communications	PCB Assembly	PWB-1267A0-0000 / Rev.A0
Everex Communications	PCB Assembly- Supporting Board 1	uLink X1
Everex Communications	PCB Assembly- Supporting Board 2	Modem Riser / Rev. B

2.6 Interface Ports and Cabling

Cable Description	Length (m)	From	To
RF Cable	< 1 m	Output/ EUT	Spectrum Analyzer

3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
§15.247 (i), §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	Conducted Emissions	Compliant
§2.1051, §15.247 (d)	Spurious Emissions at Antenna Port	Compliant
§15.205	Restricted Bands	Compliant
§15.209 (a), §15.247 (d)	Radiated Spurious Emissions	Compliant
§15.247 (a)(2)	6 dB Bandwidth	Compliant
§15.247 (b)(3)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247 (e)	Power Spectral Density	Compliant

4 FCC §15.247 (i) & § 2.1091 - RF Exposure

4.1 Applicable Standard

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

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

Limits for General Population/Uncontrolled Exposure

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

4.2 MPE Prediction

Predication of MPE limit at a given distance, equation from 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):	10.83
Maximum peak output power at antenna input terminal (mW):	12.1
Prediction distance (cm):	20
Prediction frequency (MHz):	2405
Maximum Antenna Gain, typical (dBi):	5.0
Maximum Antenna Gain (numeric):	3.16
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0076
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

4.3 Test Result

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0076 mW/cm^2. Limit is 1 mW/cm^2.

5 FCC §15.203 - Antenna Requirement

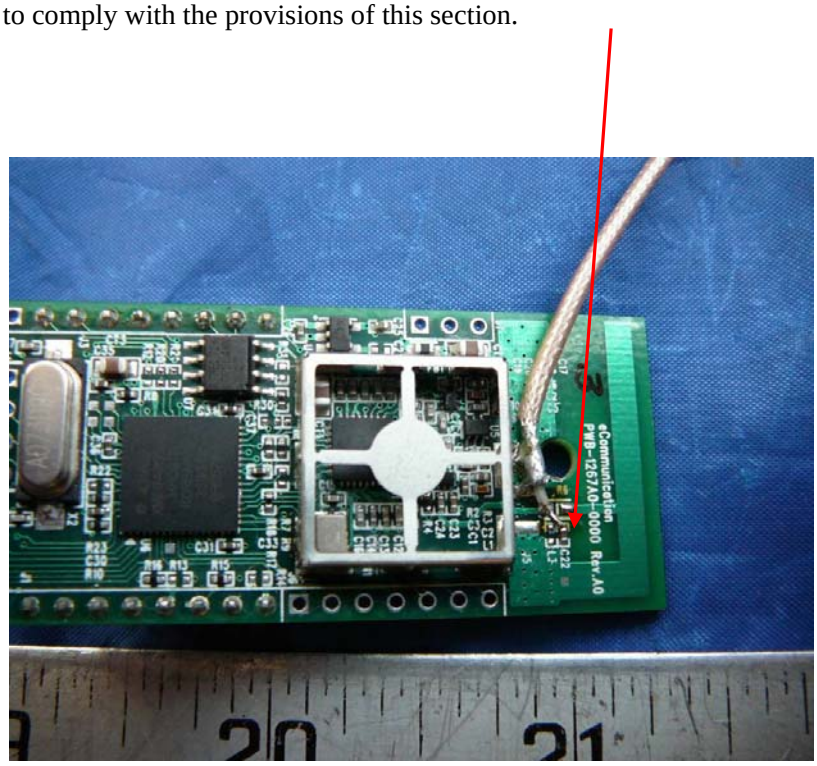
5.1 Applicable Standard

According to § 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 § 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.

5.2 Results

The EUT has a integral PCB antenna (3.5 dBi) or an external dipole antenna (5.0 dBi) via U.FL connector or via direct coaxial cable soldered to the transmitter PCB, which in accordance to sections FCC Part 15.203 is considered sufficient to comply with the provisions of this section.



6 FCC §15.207 - Conducted Emissions

6.1 Applicable Standard

Section 15.207 Conducted limits:

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.*

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 Part15.207 limits.

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

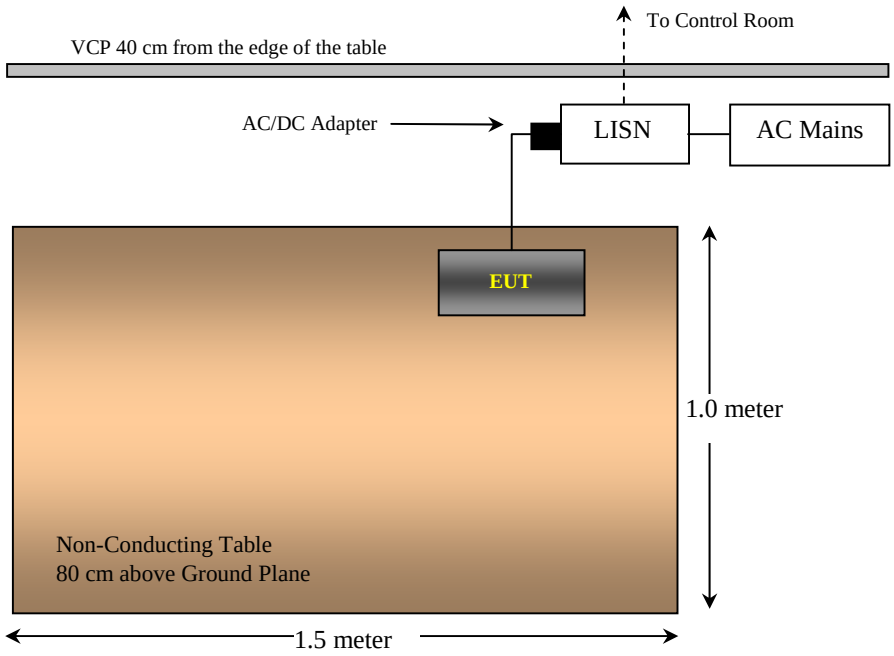
The EUT AC/DC power adapter was connected with LISN-1 which provided 120 V / 60 Hz AC power.

6.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Solar Electronics	LISN	9252-50-R-24-N	511205	2009-06-09
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100338	2009-02-28

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

6.4 Test Setup Block Diagram



6.5 Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-2.

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".

6.6 Test Environmental Conditions

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

**The testing was performed by Dennis Huang on 2009-8-18 in chamber 3.*

6.7 Summary of Test Results

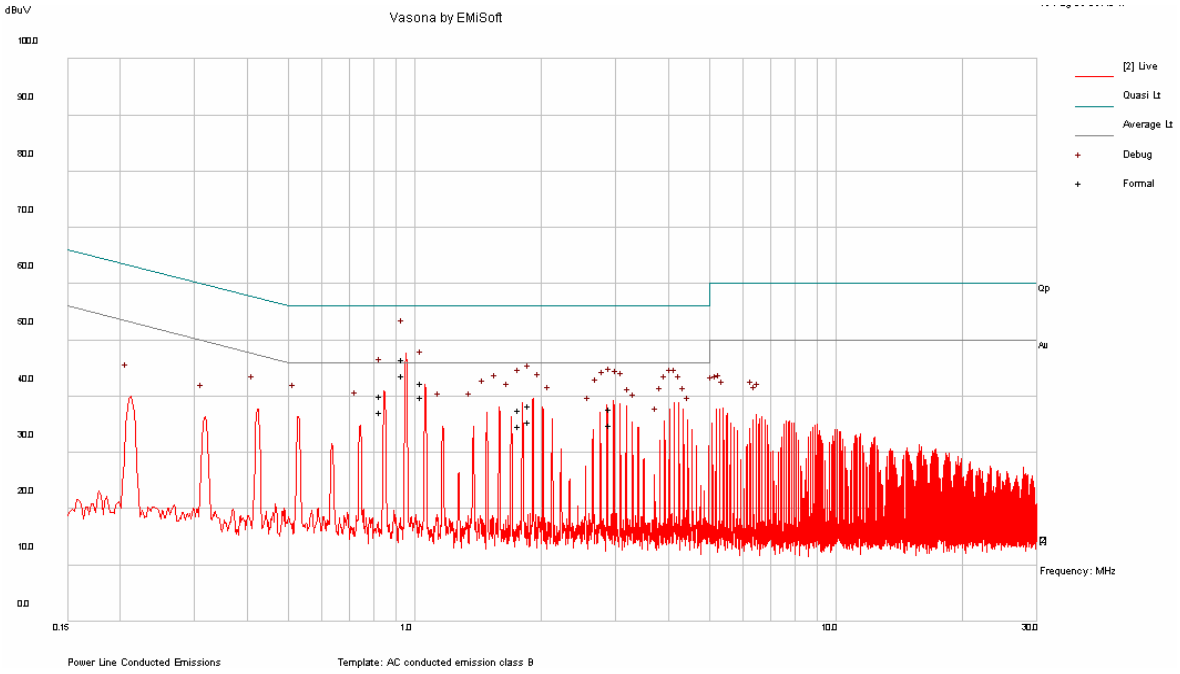
According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits for consumer devices, with the *worst* margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-2.22	0.952	Line	0.15 to 30
-2.46	0.948	Neutral	0.15 to 30

6.8 Conducted Emissions Test Plots and Data

Please refer to the following plots and tables for detailed results.

120 V/60 Hz Line



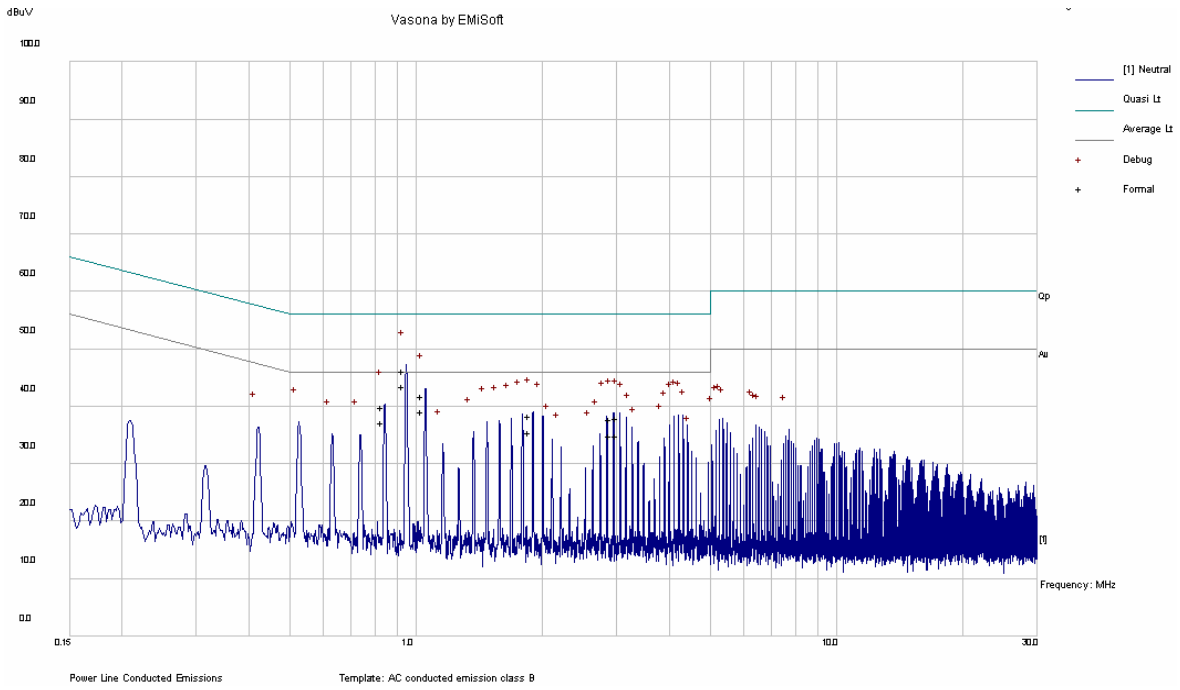
Quasi-Peak Measurements

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.952	46.62	Quasi-Peak	L	56	-9.38
1.057	42.35	Quasi-Peak	L	56	-13.65
0.846	40.03	Quasi-Peak	L	56	-15.97
1.904	38.36	Quasi-Peak	L	56	-17.64
2.962	37.77	Quasi-Peak	L	56	-18.23
1.799	37.66	Quasi-Peak	L	56	-18.34

Average Measurements

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.952	43.78	Average	L	46	-2.22
1.057	39.80	Average	L	46	-6.20
0.846	37.28	Average	L	46	-8.72
1.904	35.45	Average	L	46	-10.55
2.962	34.82	Average	L	46	-11.18
1.799	34.73	Average	L	46	-11.27

120V/60 Hz Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.948	46.19	Quasi-Peak	N	56	-9.81
1.053	41.74	Quasi-Peak	N	56	-14.26
0.843	39.86	Quasi-Peak	N	56	-16.14
1.898	38.24	Quasi-Peak	N	56	-17.76
3.058	37.88	Quasi-Peak	N	56	-18.12
2.953	37.68	Quasi-Peak	N	56	-18.32

Average Measurements

Frequency (MHz)	Corrected Reading (dBuV)	Measurement Type	Conductor (L/N)	Limit (dBuV)	Margin (dB)
0.948	43.54	Average	N	46	-2.46
1.053	39.08	Average	N	46	-6.92
0.843	37.26	Average	N	46	-8.74
1.898	35.40	Average	N	46	-10.60
3.058	34.96	Average	N	46	-11.04
2.953	34.86	Average	N	46	-11.14

7 FCC §2.1051 & §15.247(d) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

7.1 Applicable Standard

For §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.

Requirements: CFR 47, §2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in §2.1057.

7.2 Measurement Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

7.3 Test Equipment Lists and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

7.4 Test Environmental Conditions

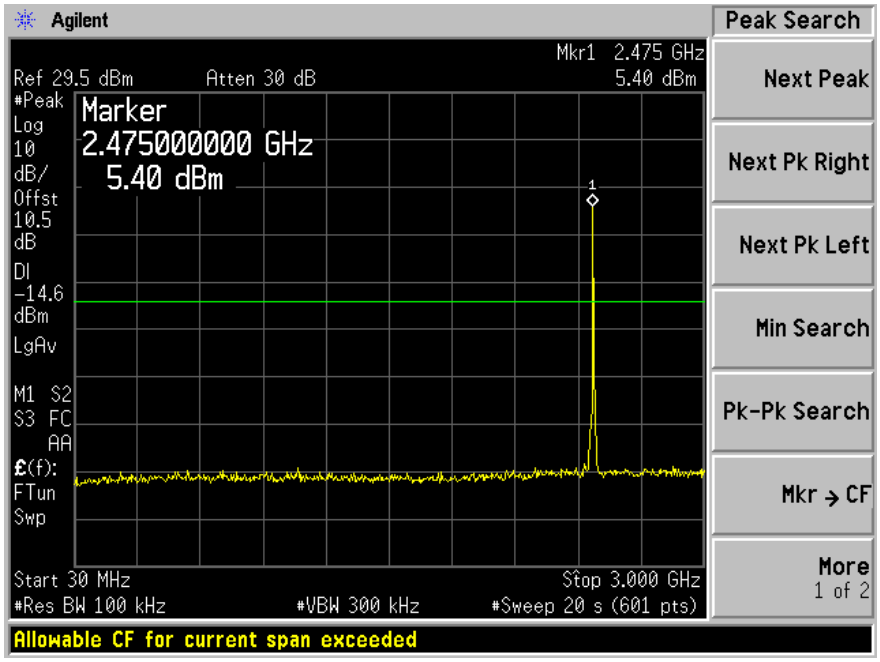
Temperature:	22°C~25°C
Relative Humidity:	31 %~33 %
ATM Pressure:	101.1~101.4kPa

**The testing was performed by Dennis Huang on 2009-08-14 in RF Site.*

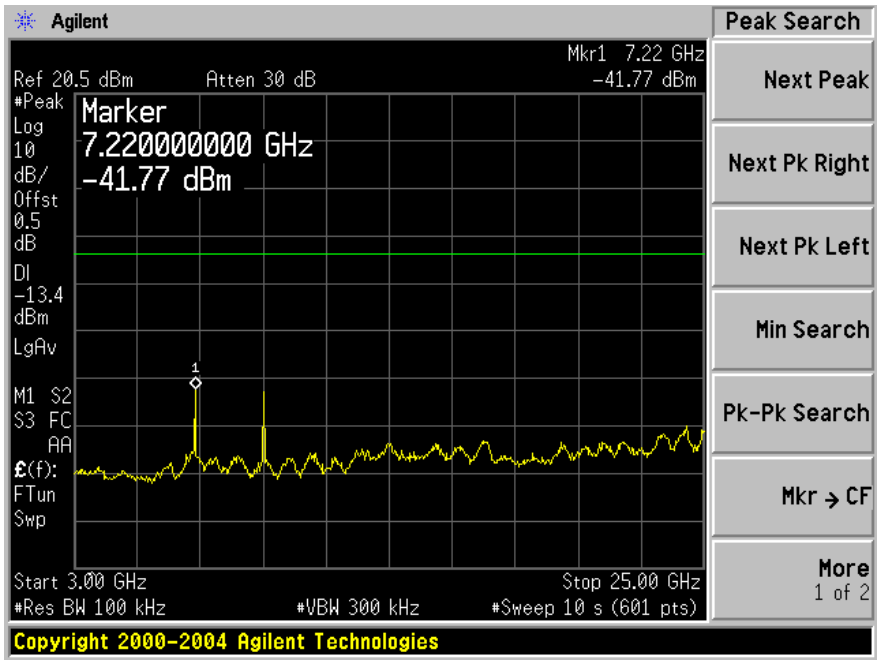
7.5 Measurement Result:

Please refer to the following plots for spurious emissions.

Low Channel

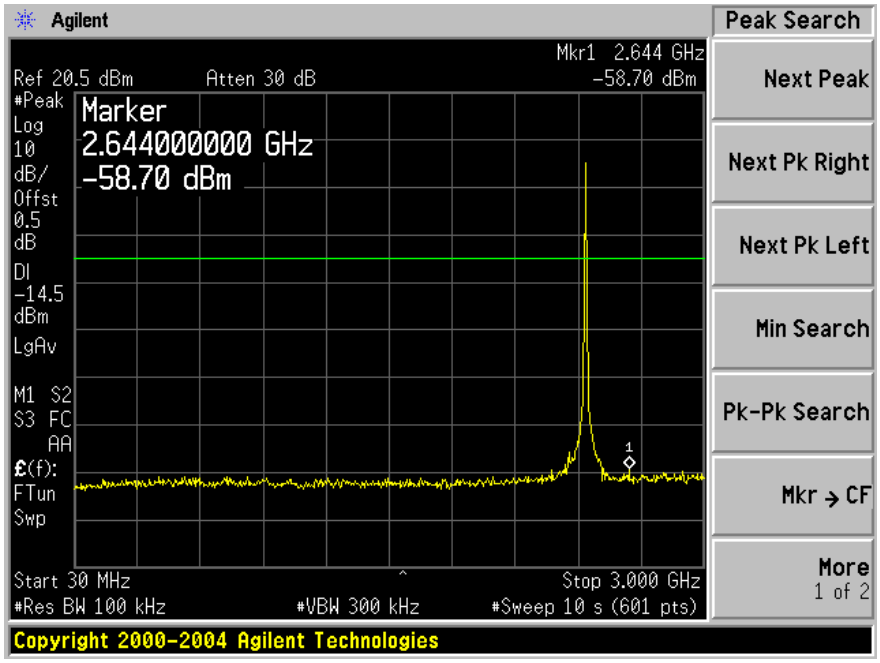


Plot 1: 30 MHz ~ 3 GHz

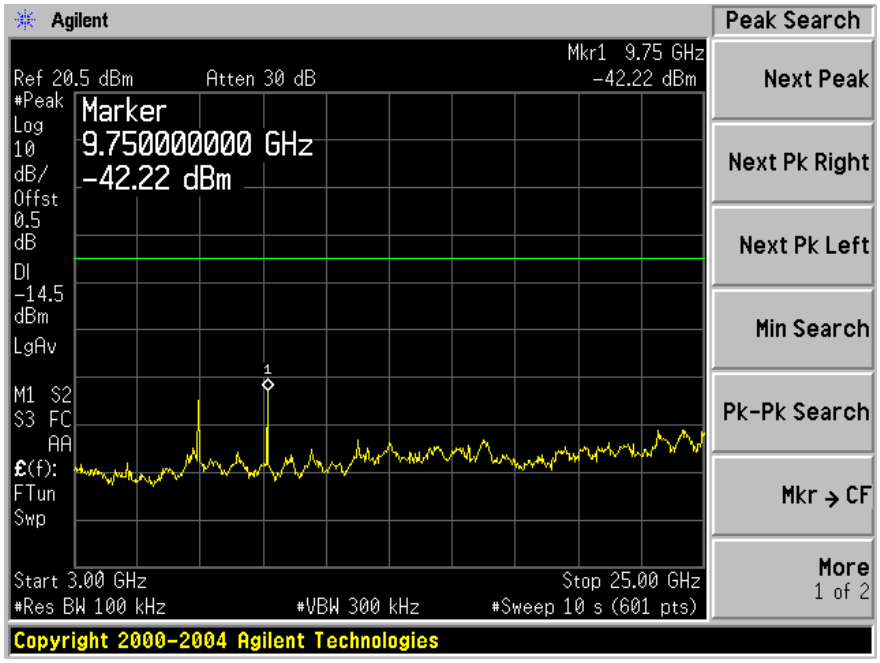


Plot 2: 3 ~ 25 GHz

Middle Channel

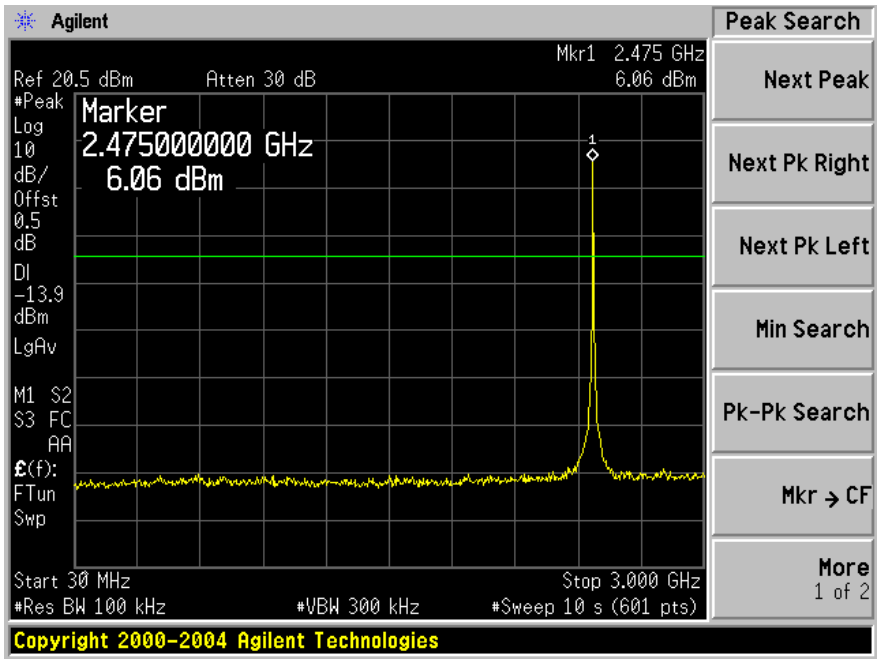


Plot 1: 30 MHz ~ 3 GHz

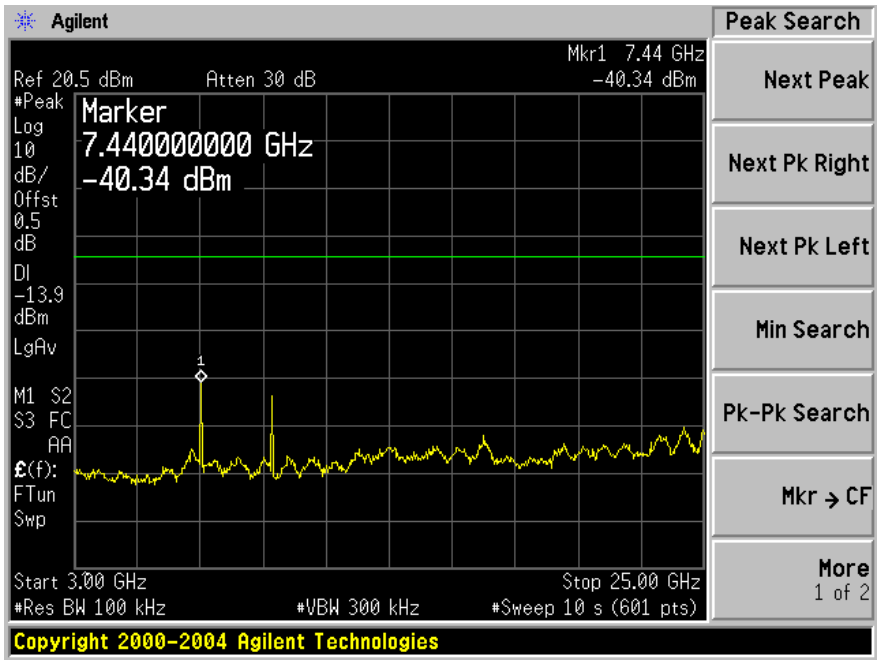


Plot 2: 3 ~ 25 GHz

High Channel



Plot 1: 30 MHz ~ 3 GHz



Plot 2: 3 ~ 25 GHz

8 FCC §15.205, §15.209 & §15.247(d) - Spurious Radiated Emissions

8.1 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)).

8.2 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.

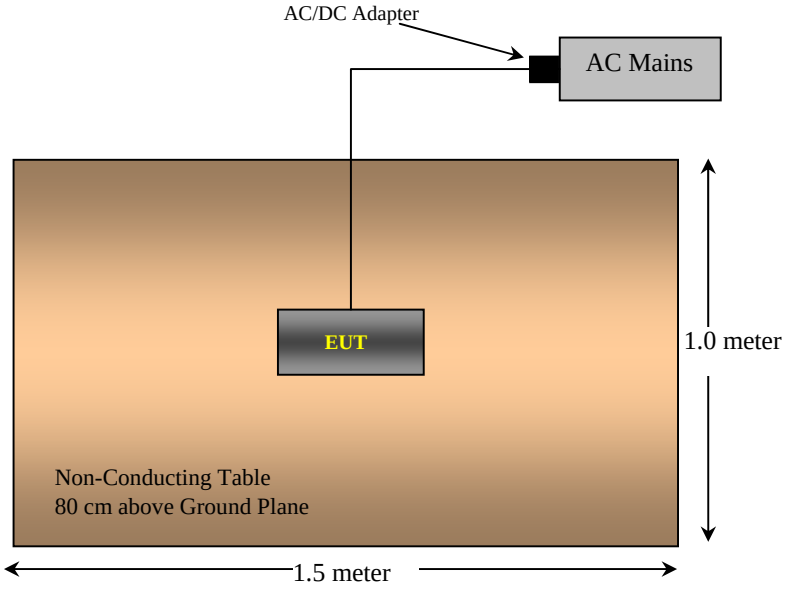
8.3 EUT Setup

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

8.4 Test Setup Block Diagram



8.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	E4440A	US44303352	2009-03-25
Sunol Sciences	Antenna	JB1	A020106-1	2009-04-17
A.R.A	Horn Antenna	DRG-118/A	1132	2009-07-28
Ducommun	Pre-Amplifier	ALN-09173030-01	99-297-01R	2009-03-04
HP	Pre-Amplifier	8447D	2944A06639	2009-03-06

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

8.6 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

8.7 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

8.8 Test Environmental Conditions

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

**The testing was performed by Dennis Huang on 2009-08-14.*

8.9 Summary of Test Results

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

EUT with External Antenna

Low Channel: 2405 MHz (Worst Case)

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-6.79	59.896	Vertical	30 to 1000 MHz
-0.17	7215.00	Vertical	Above 1 GHz

Middle Channel: 2440 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-0.73	7320.00	Vertical	Above 1 GHz

High Channel: 2475 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-0.86	7425.00	Vertical	Above 1 GHz

EUT with Integral Antenna

Low Channel: 2405 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-9.75	38.399	Vertical	30 to 1000 MHz
-6.13	7215	Horizontal	Above 1 GHz

Middle Channel: 2440 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-6.3	7320	Horizontal	Above 1 GHz

High Channel: 2475 MHz

Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Range (MHz)
-4.89	7425	Horizontal	Above 1 GHz

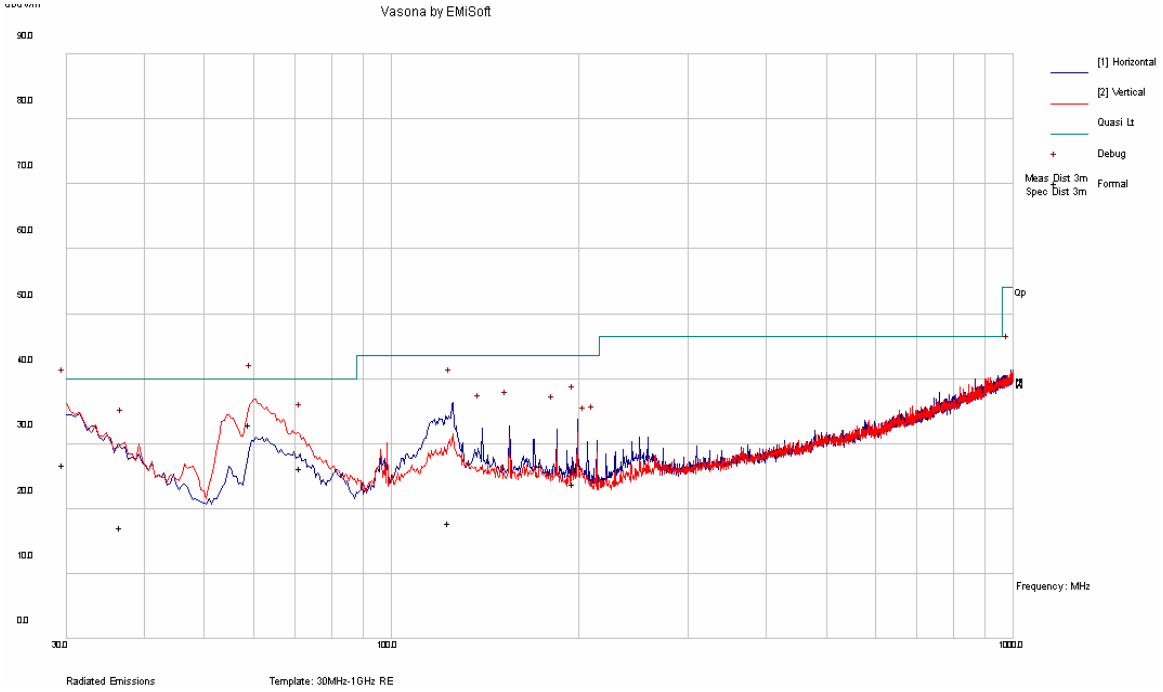
8.10 Radiated Emissions Test Plot & Data

Please refer to the following tables for detailed results.

External Antenna

30 MHz – 1 GHz measured at 3 meters

Low Channel 2405MHz (Worst Case)



Quasi-Peak Measurement:

Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (m)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
59.896	33.03	1.57	V	12	40.0	-6.97
30.012	26.76	1.66	V	9	40.0	-13.24
72.342	26.30	1.04	V	296	40.0	-13.70
199.013	23.88	1.60	H	217	43.5	-19.62
37.106	17.09	0.98	V	30	40.0	-22.91
125.353	17.81	2.31	H	0	43.5	-25.69

Above 1 GHz:

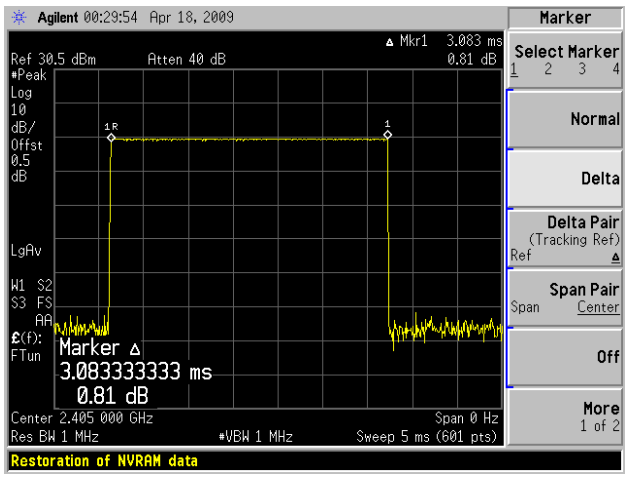
Low Channel: 2405 MHz

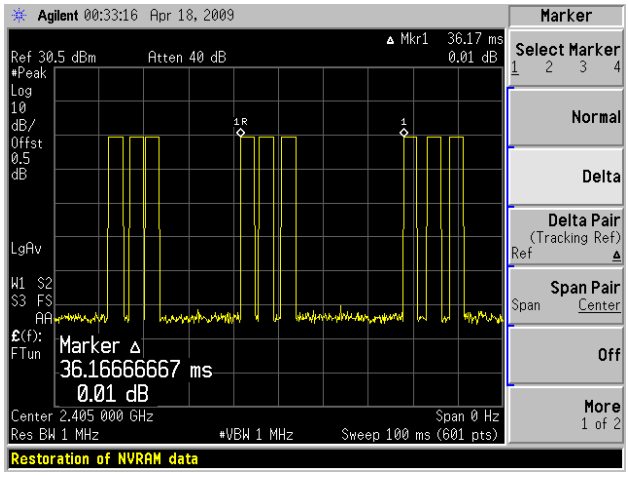
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

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)	Part 15.247/209	
				Height (m)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
7215	55.00	AV	60.00	1.0	V	36.50	10.12	35.95	-11.84	53.83*	54.00	-0.17
4804	60.44	AV	223.00	1.6	H	32.60	8.71	36.67	-11.84	53.24*	54.00	-0.76
4804	59.71	AV	107.00	1.0	V	32.60	8.71	36.67	-11.84	52.51*	54.00	-1.49
7215	49.01	AV	266.00	1.0	H	36.50	10.12	35.95	-11.84	47.84*	54.00	-6.16
7215	55.00	PK	60.00	1.0	V	36.50	10.12	35.95	0.00	65.67	74.00	-8.33
4810	60.44	PK	223.00	1.6	H	32.60	8.71	36.67	0.00	65.08	74.00	-8.92
4810	59.71	PK	107.00	1.0	V	32.60	8.71	36.67	0.00	64.35	74.00	-9.65
7215	49.01	PK	266.00	1.0	H	36.50	10.12	35.95	0.00	59.68	74.00	-14.32

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*3.0833ms/36.1667ms) = -11.84 dB

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





Duty Cycle Plots

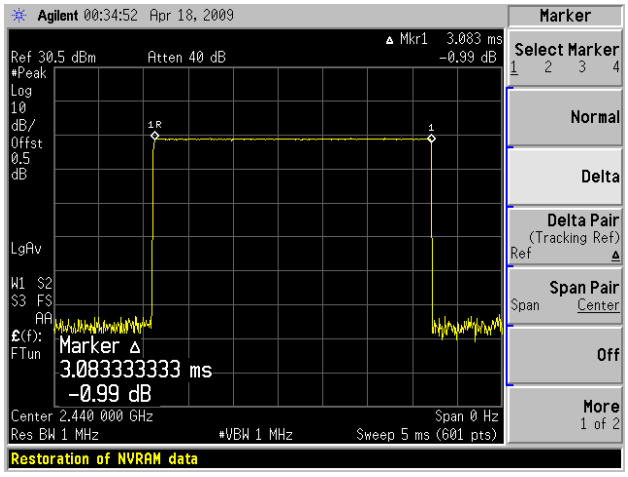
Middle Channel: 2440 MHz

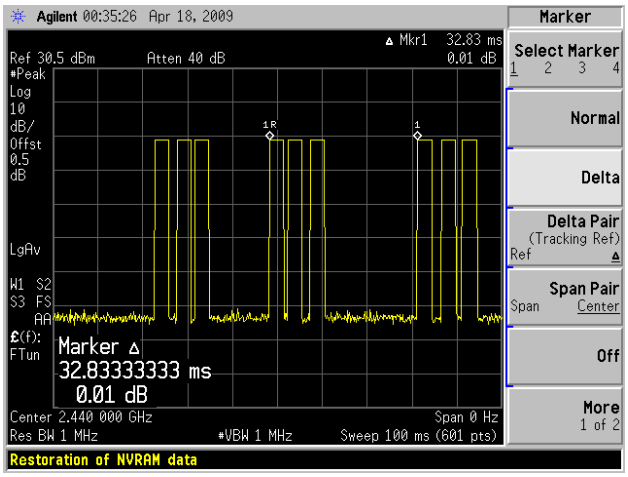
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

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)	Part 15.247/209	
				Height (m)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
7320	52.57	AV	106	1.0	V	37.8	10.58	36.67	-11.01	53.27*	54	-0.73
7320	44.11	AV	266	1.0	H	37.8	10.58	36.67	-11.01	44.81*	54	-9.19
7320	52.57	PK	106	1.0	V	37.8	10.58	36.67	0.00	64.28	74	-9.72
7320	44.11	PK	266	1.0	H	37.8	10.58	36.67	0.00	55.82	74	-18.18

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*3.0833ms/32.8333ms) = -11.01dB

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





Duty Cycle Plots

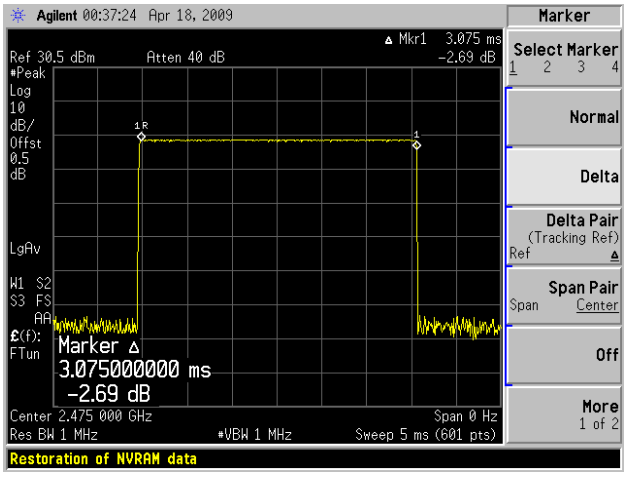
High Channel: 2475 MHz

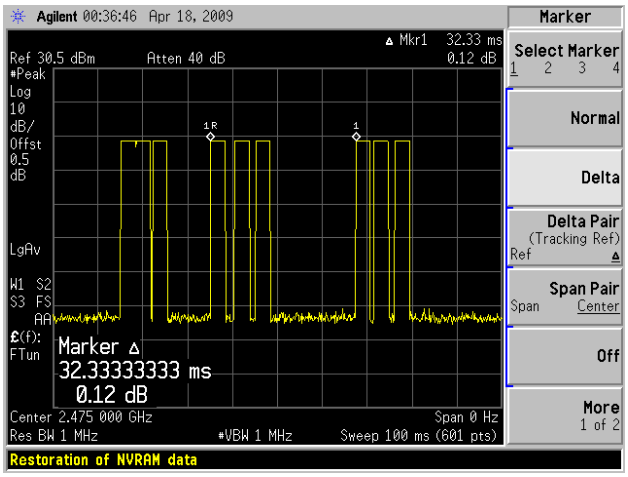
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

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)	Part 15.247/209	
				Height (m)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
7425	52.50	AV	93	2.0	V	36.5	10.58	35.55	-10.89	53.14*	54	-0.86
7425	52.50	PK	93	2.0	V	36.5	10.58	35.55	0.00	64.03	74	-9.97
7425	42.25	AV	273	1.0	H	36.5	10.58	35.55	-10.89	42.89*	54	-11.11
7425	42.25	PK	273	1.0	H	36.5	10.58	35.55	0.00	53.78	74	-20.22

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*3.075ms/32.333ms) = -10.89 dB

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

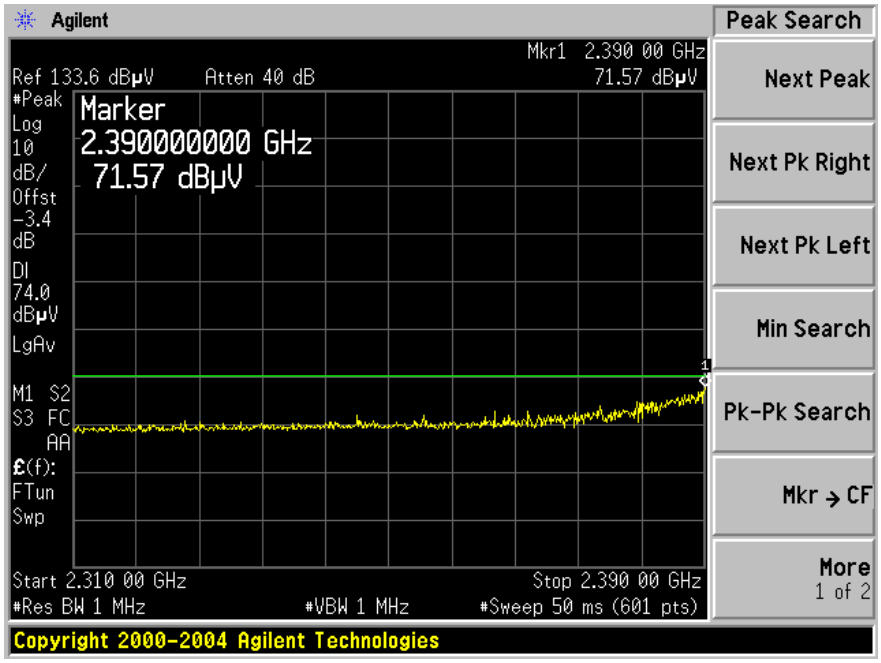




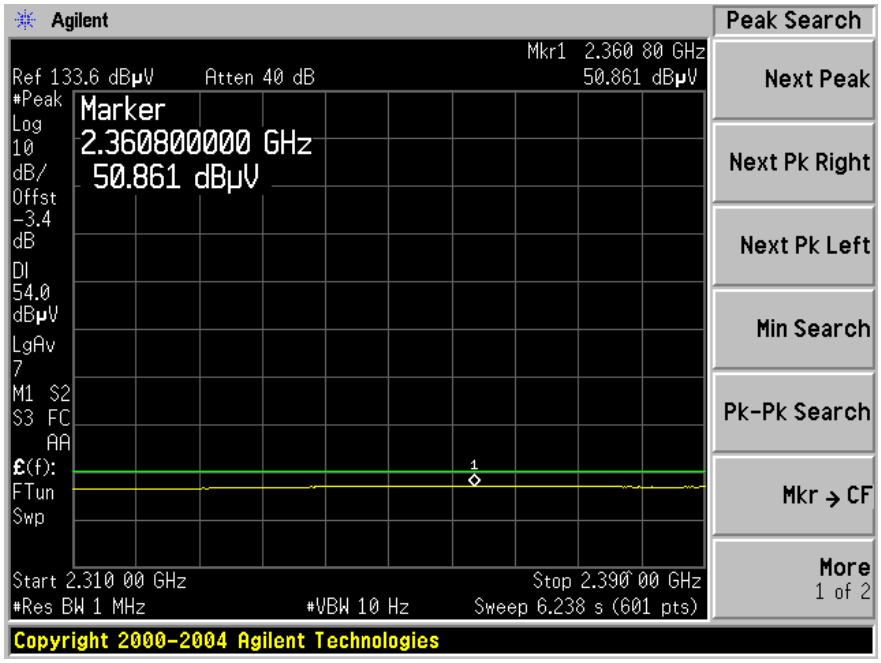
Duty Cycle Plots

Out of Band Emissions:

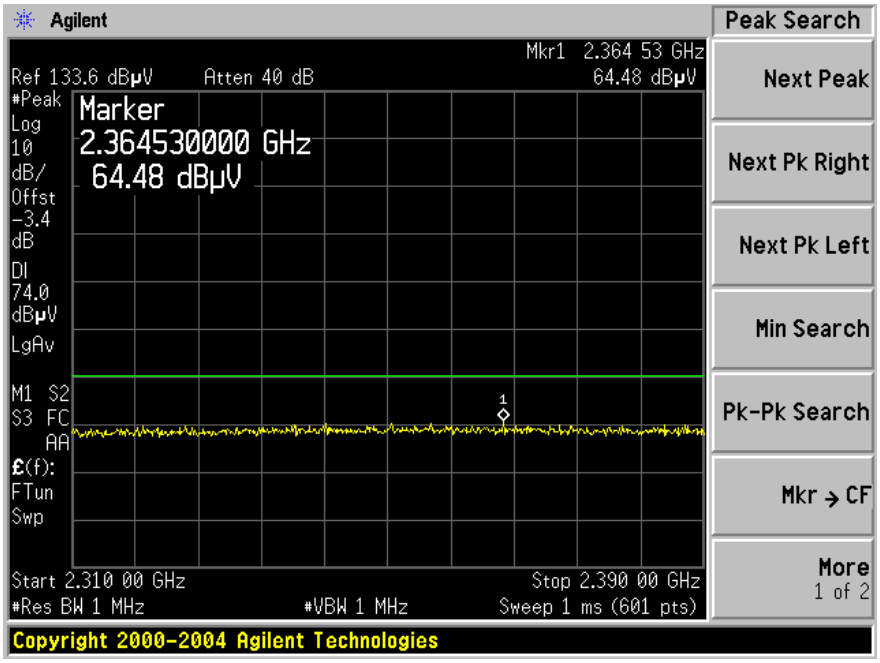
Lowest Channel: 2405 MHz



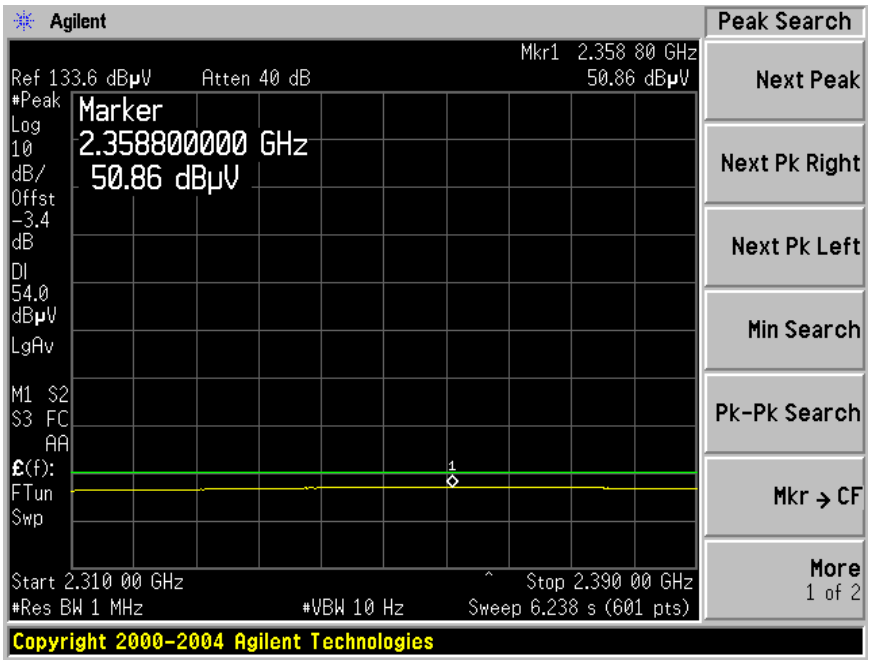
Vertical – Peak



Vertical – Average

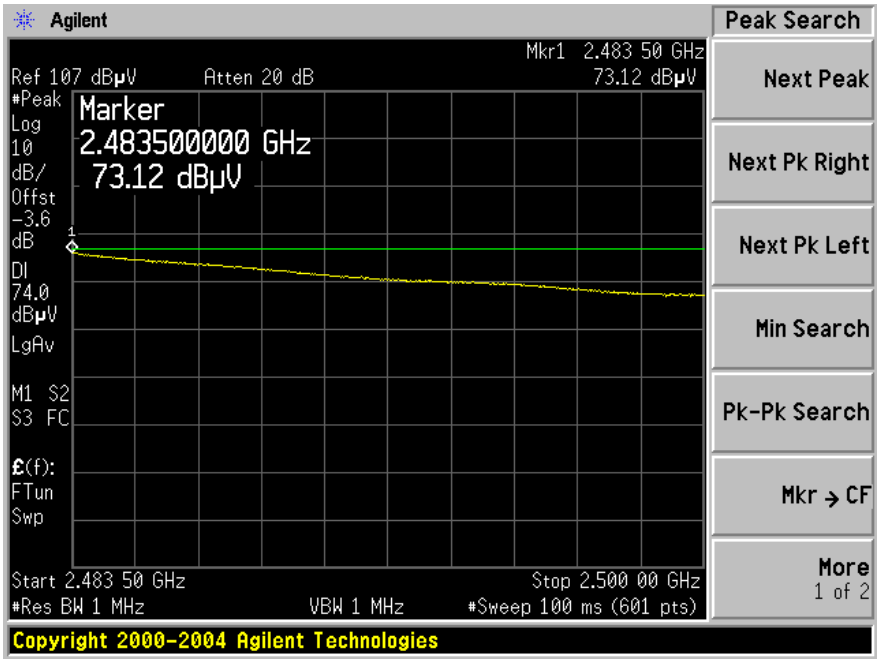


Horizontal – Peak

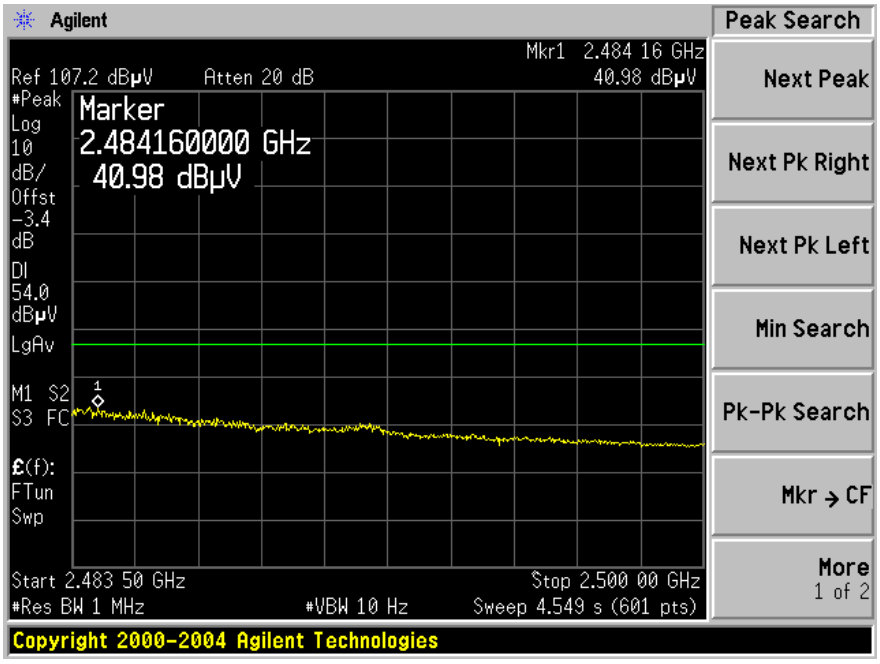


Horizontal - Average

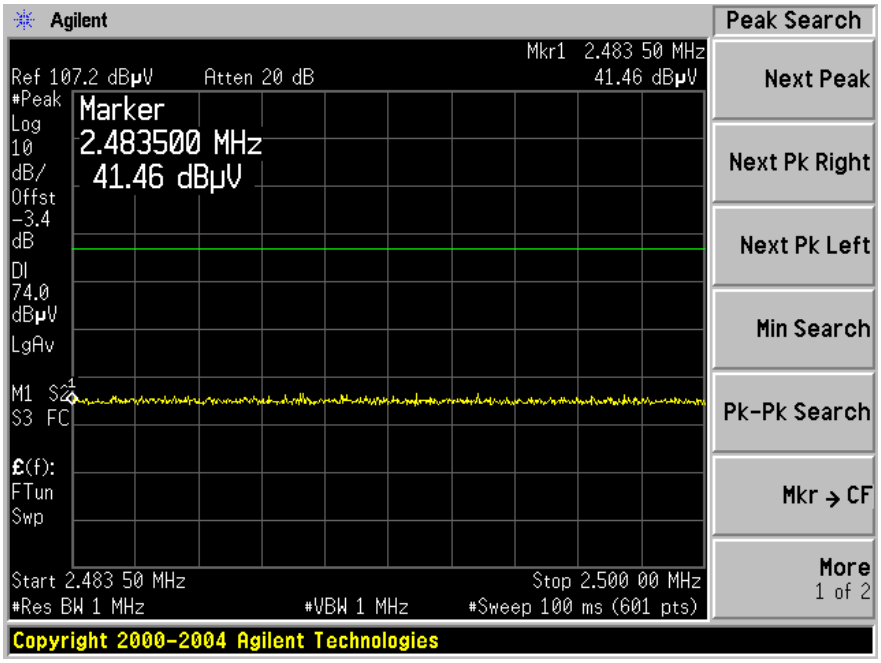
Highest Channel: 2475 MHz



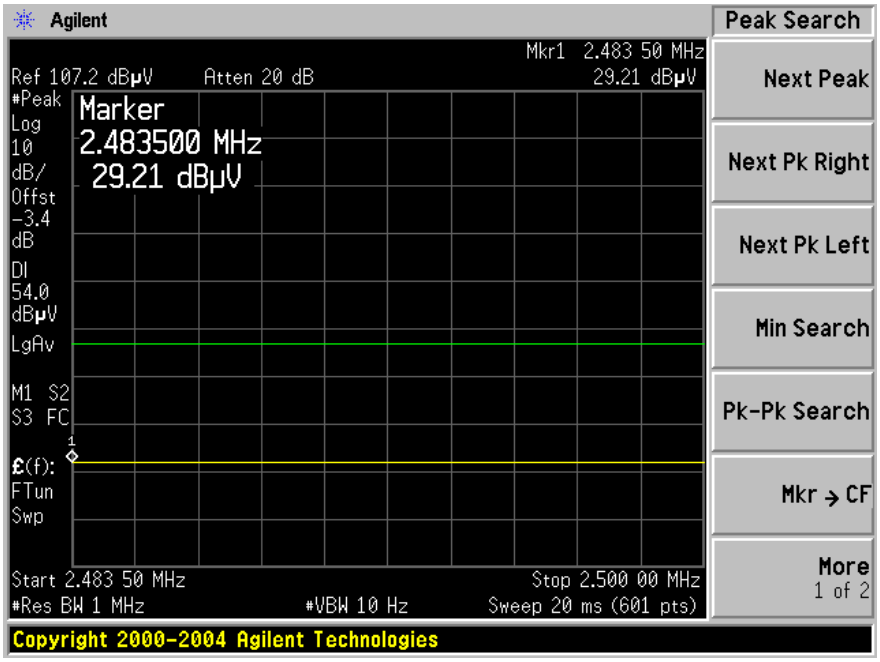
Vertical – Peak



Vertical - Average



Horizontal - Peak

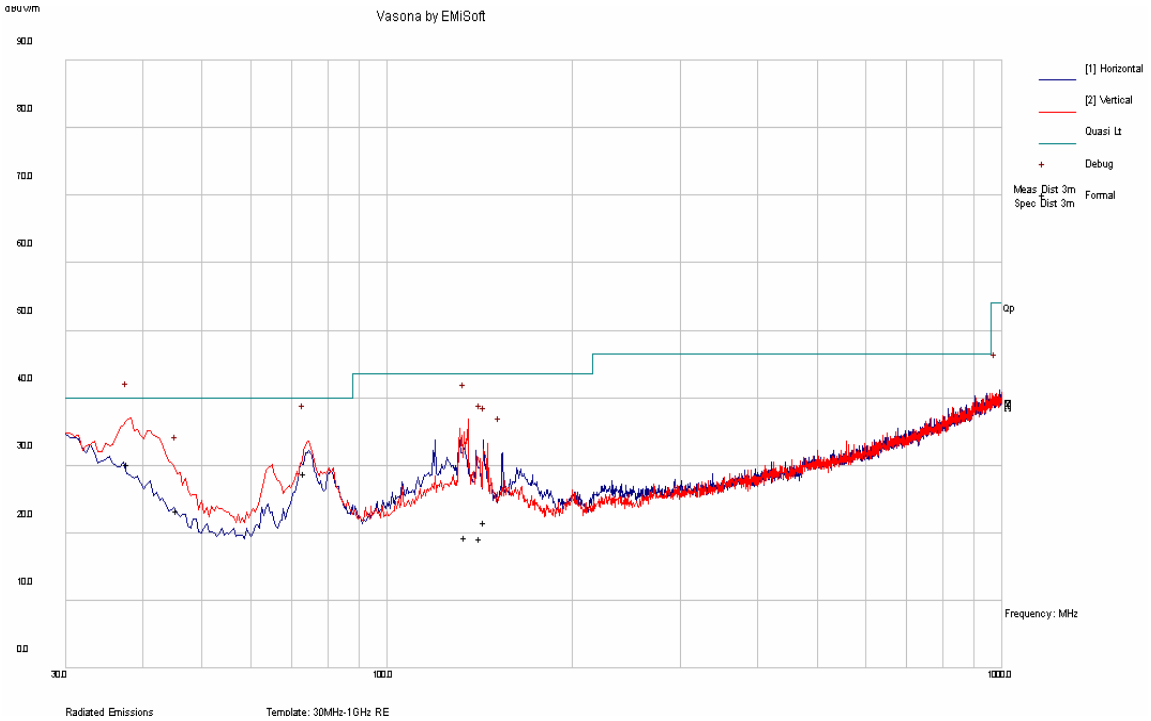


Horizontal - Average

EUT with Integral Antenna

30 MHz – 1 GHz measured at 3 meters

Low Channel 2405MHz (Worst Case)



Quasi-Peak Measurement:

Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (m)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
38.39956	30.25	1.33	V	206	40	-9.75
74.345	28.78	1.04	V	316	40	-11.22
135.4737	19.34	2.26	V	73	43.5	-24.16
143.712	19.2	1.38	H	14	43.5	-24.3
145.7948	21.6	0.98	V	235	43.5	-21.9
46.1778	23.33	1.18	V	95	40	-16.67

Above 1 GHz:

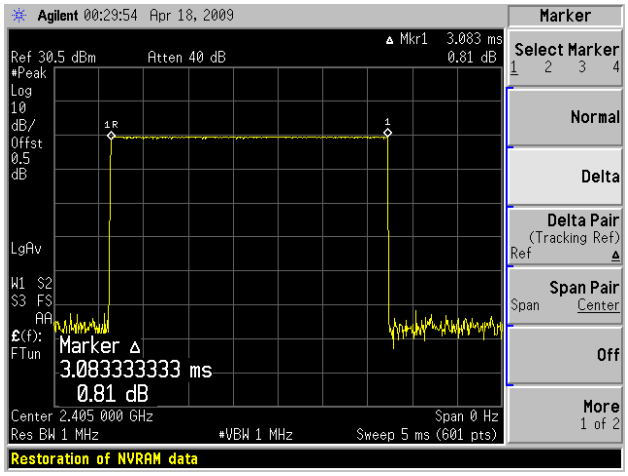
Low Channel: 2405 MHz

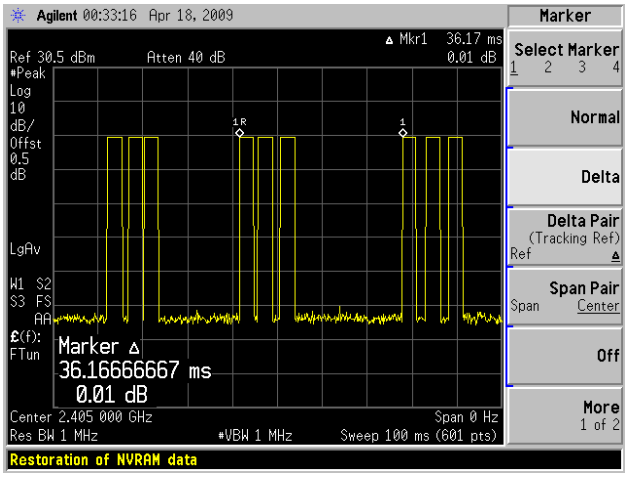
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

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)	Part 15.247/209	
				Height (m)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
7215	49.04	AV	360	1.85	H	36.5	10.12	35.95	-11.84	47.87	54	-6.13
4804	47.64	AV	278	1.47	H	32.6	8.71	36.67	-11.84	40.44	54	-13.56
7215	41.5	AV	360	1.0	V	36.5	10.12	35.95	-11.84	40.33	54	-13.67
7215	49.04	PK	360	1.85	H	36.5	10.12	35.95	0	59.71	74	-14.29
4804	41.04	AV	176	1.0	V	32.6	8.71	36.67	-11.84	33.84	54	-20.16
4810	47.64	PK	278	1.47	H	32.6	8.71	36.67	0	52.28	74	-21.72
7215	41.5	PK	360	1.0	V	36.5	10.12	35.95	0	52.17	74	-21.83
4810	41.04	PK	176	1.0	V	32.6	8.71	36.67	0	45.68	74	-28.32

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*3.0833ms/36.1667ms) = -11.84 dB

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





Duty Cycle Plots

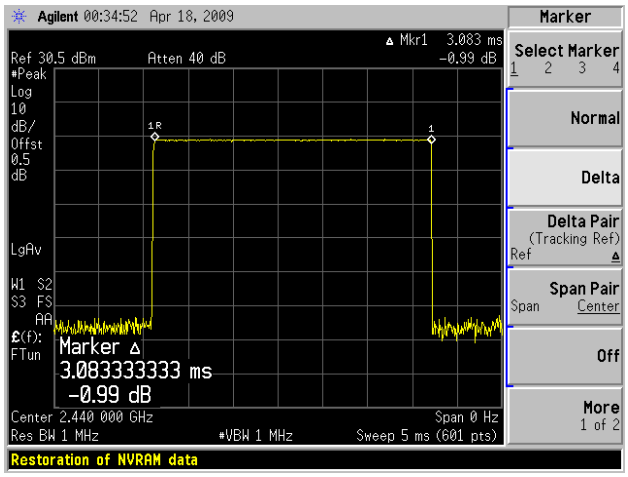
Middle Channel: 2440 MHz

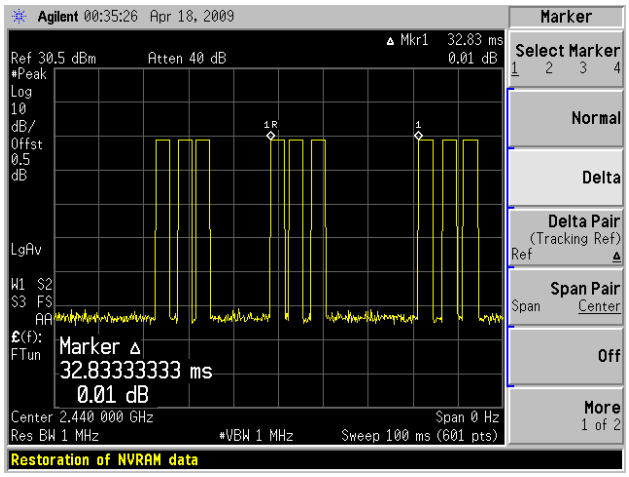
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

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)	Part 15.247/209	
				Height (m)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
7320	47	AV	15	1.79	H	37.8	10.58	36.67	-11.01	47.7	54	-6.3
7320	40.15	AV	360	1.0	V	37.8	10.58	36.67	-11.01	40.85	54	-13.15
7320	47	PK	15	1.79	H	37.8	10.58	36.67	0	58.71	74	-15.29
7320	40.15	PK	360	1.0	V	37.8	10.58	36.67	0	51.86	74	-22.14

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*3.0833ms/32.8333ms) = -11.01dB

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





Duty Cycle Plots

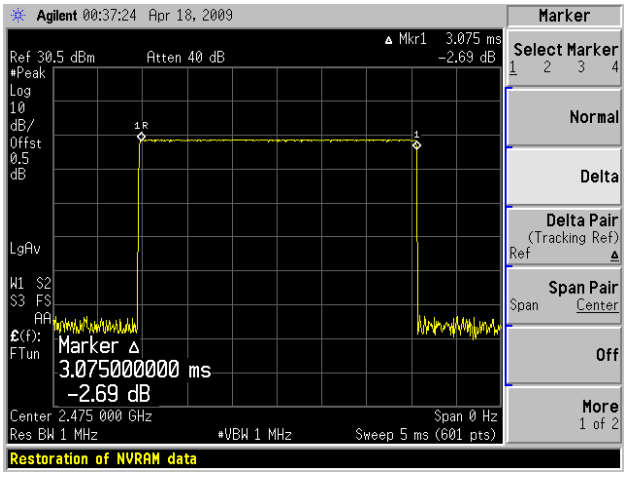
High Channel: 2475 MHz

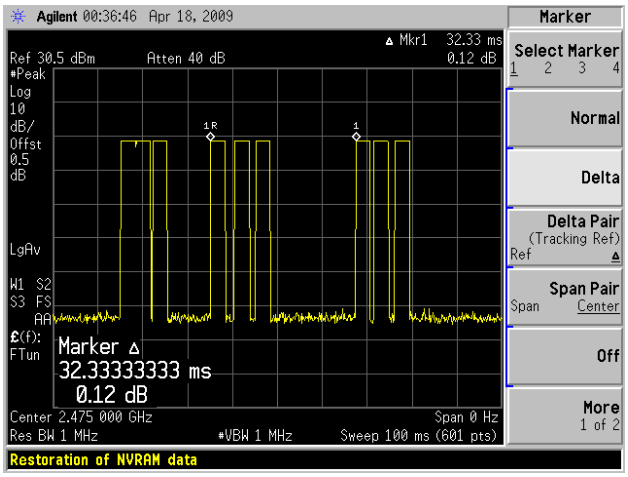
Spurious/Harmonics Emissions measured at 3 meters (Above 1 GHz)

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)	Part 15.247/209	
				Height (m)	Polarity (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)
7425	48.47	AV	18	1.47	H	36.5	10.58	35.55	-10.89	49.11	54	-4.89
7425	43.56	AV	153	1.7	V	36.5	10.58	35.55	-10.89	44.2	54	-9.8
7425	48.47	PK	18	1.47	H	36.5	10.58	35.55	0	60	74	-14
7425	43.56	PK	153	1.7	V	36.5	10.58	35.55	0	55.09	74	-18.91

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*3.075ms/32.333ms) = -10.89 dB

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

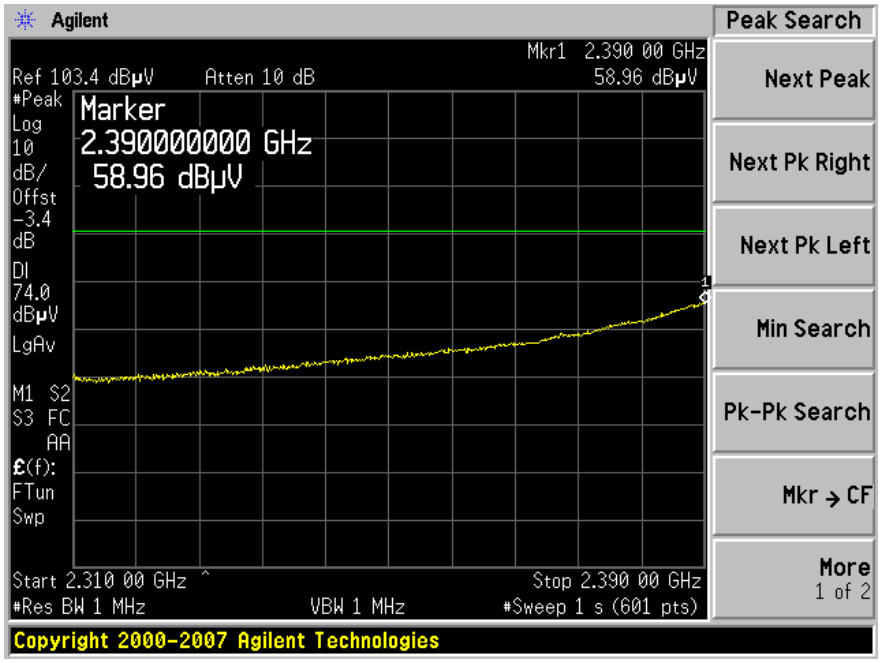




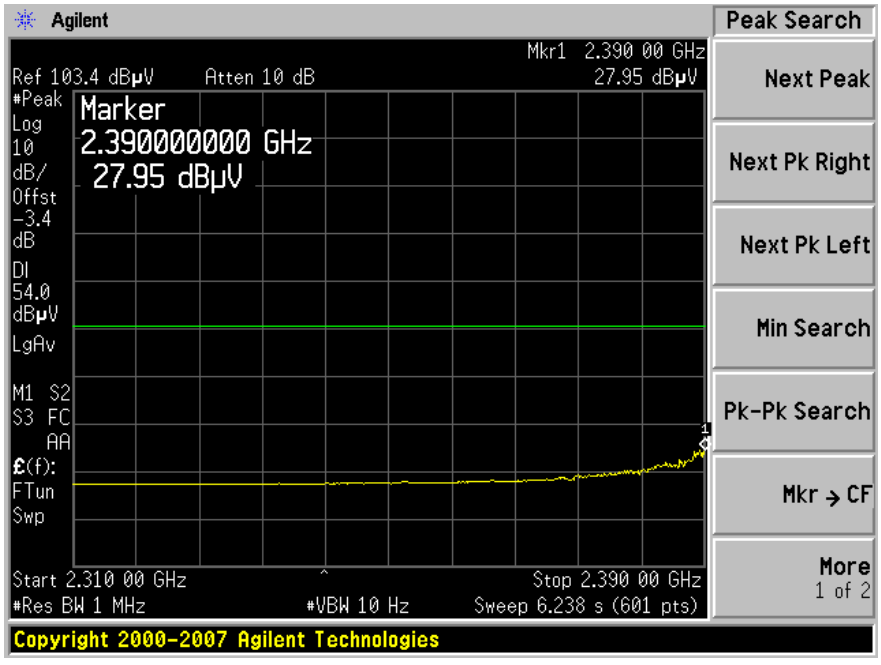
Duty Cycle Plots

Out of Band Emissions:

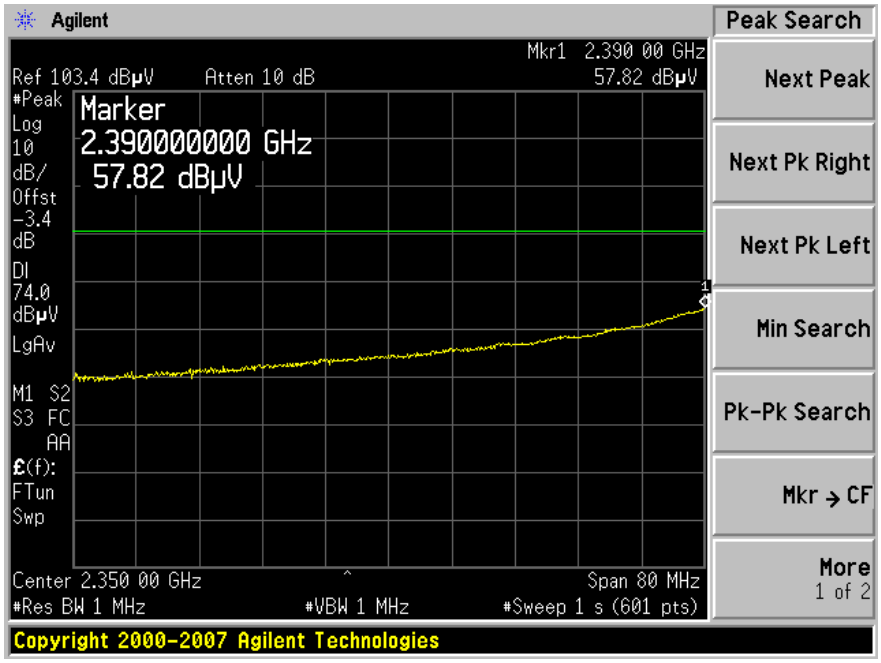
Lowest Channel: 2405 MHz



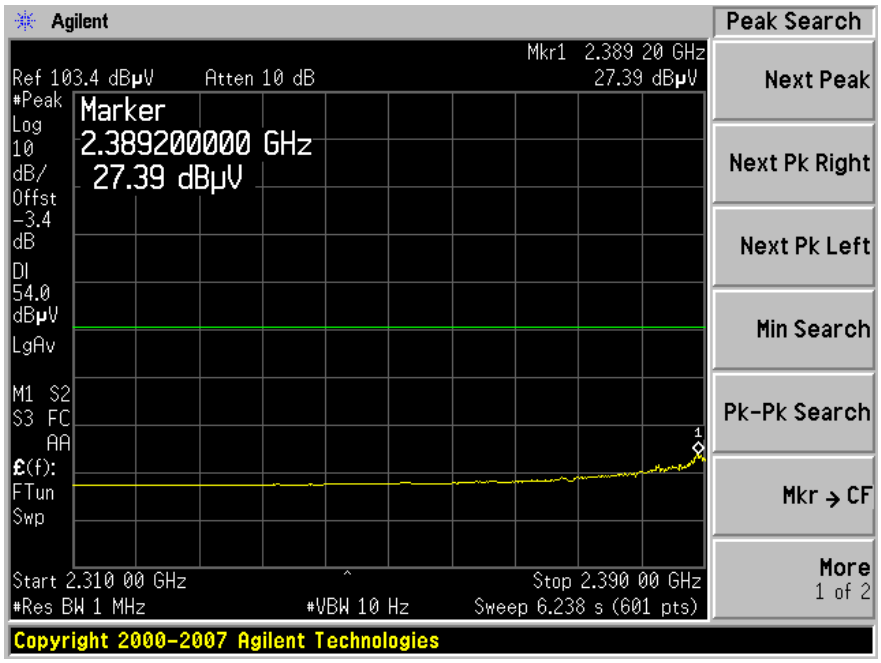
Vertical – Peak



Vertical – Average

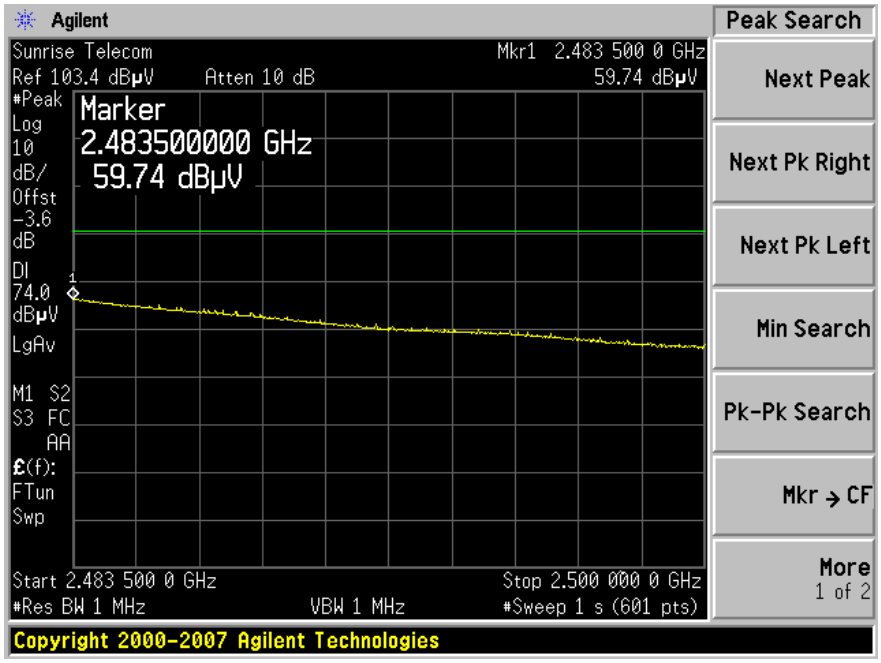


Horizontal – Peak

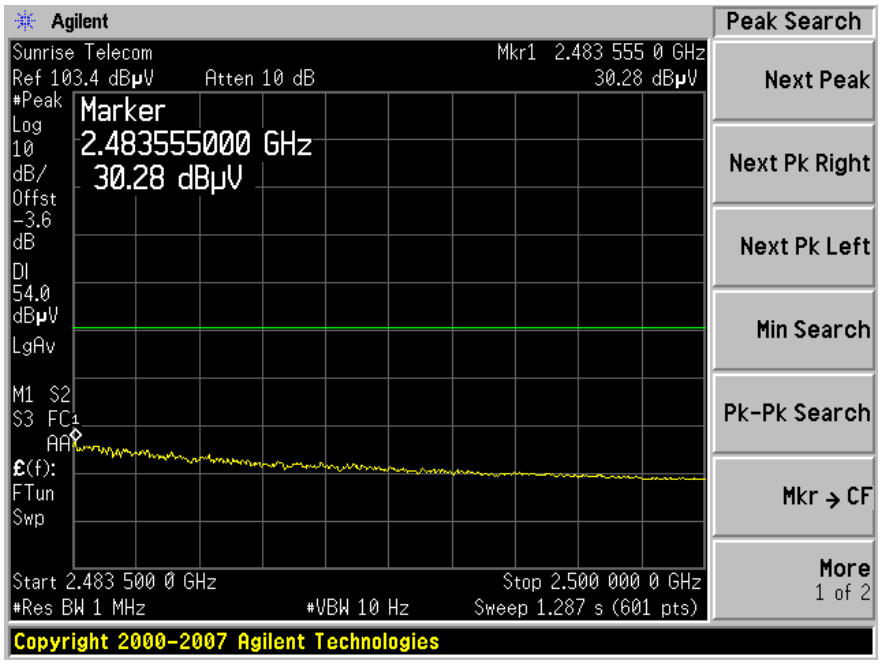


Horizontal - Average

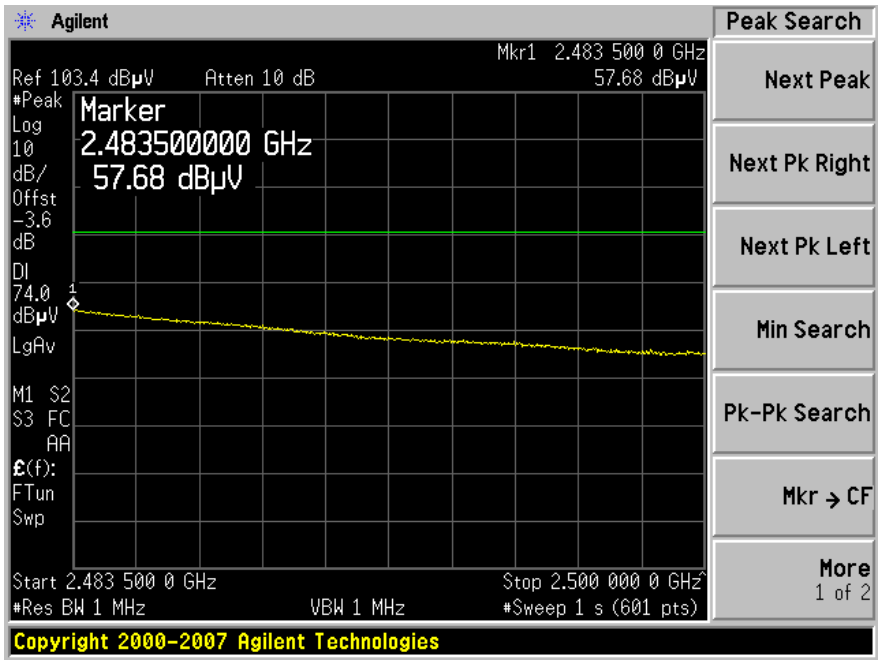
Highest Channel: 2475 MHz



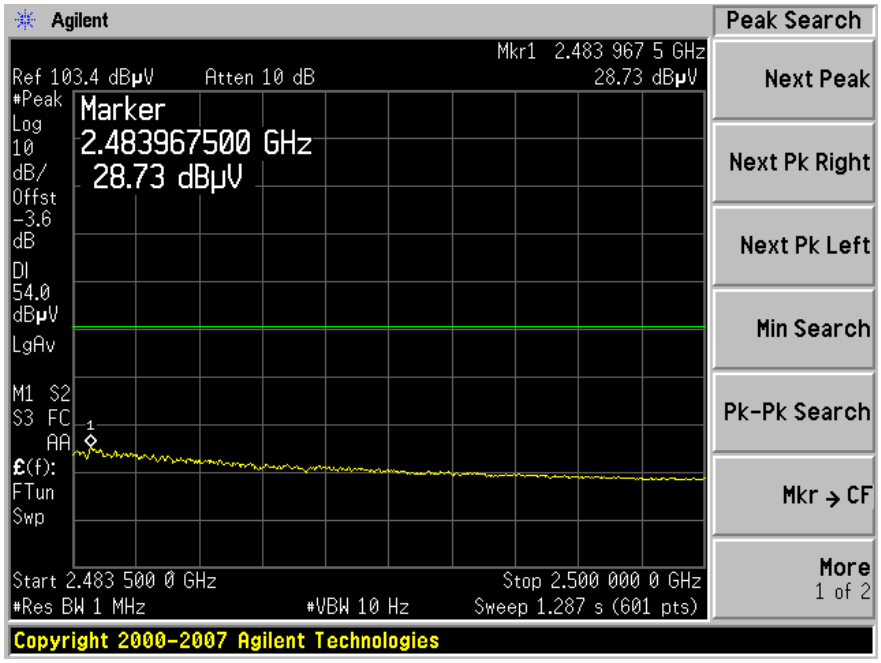
Vertical – Peak



Vertical - Average



Horizontal - Peak



Horizontal - Average

9 FCC §15.247(a) (2) – 6 dB & 99% Bandwidth

9.1 Applicable Standard

According to §15.247(a)(2), 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

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 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
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.

9.4 Test Environmental Conditions

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

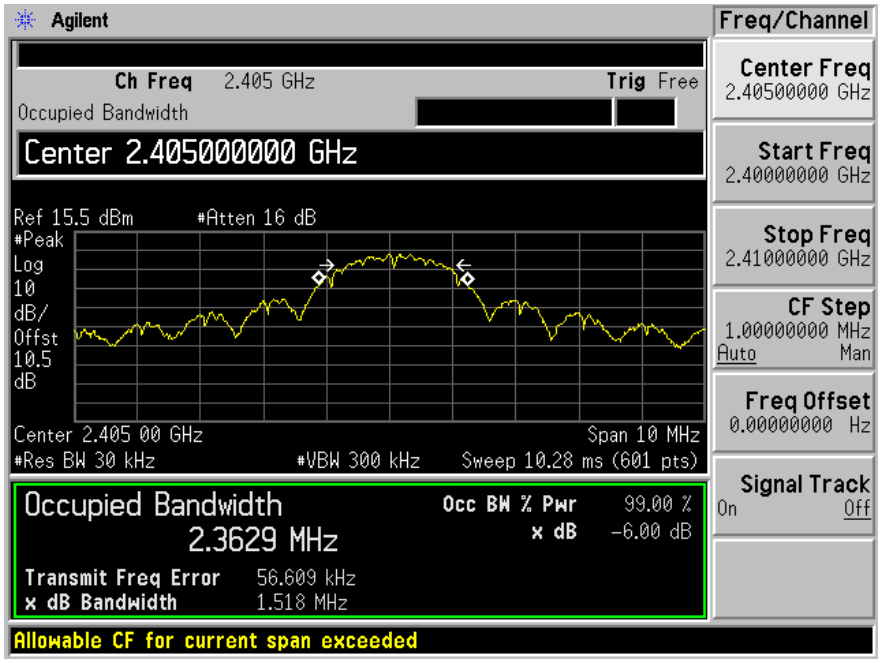
**The testing was performed by Dennis Huang on 2009-08-14.*

9.5 Summary of Test Results

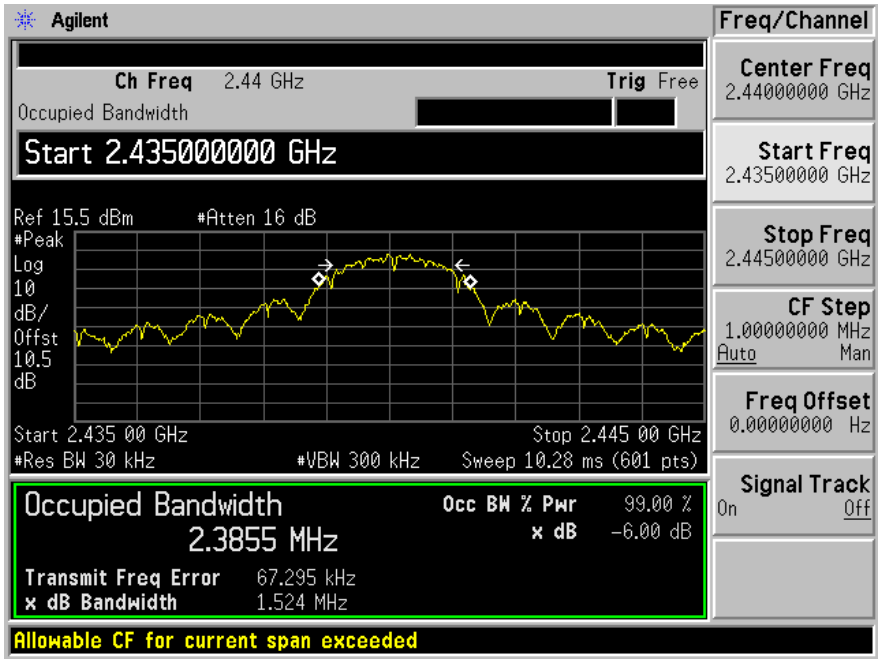
Channel	Frequency (MHz)	6 dB OBW (kHz)	99% OBW (kHz)	Limit (kHz)
Low	2405	1518	2362.9	> 500
Middle	2440	1524	2385.5	> 500
High	2475	1498	2420.7	> 500

Please refer to the following plots for detailed test results

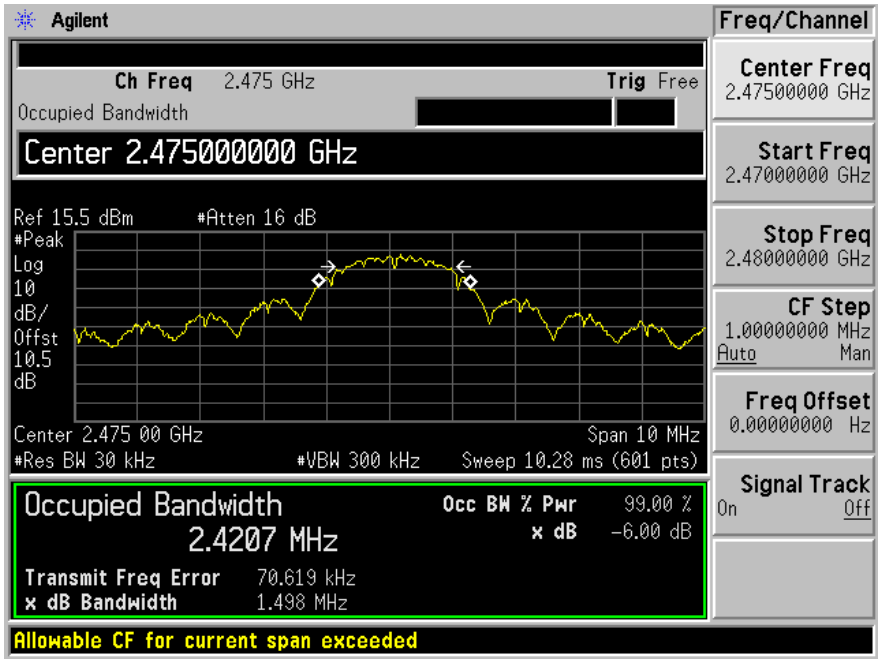
Low Channel



Middle Channel



High Channel



10 FCC §15.247(b) - Peak Output Power

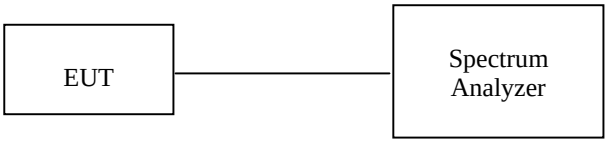
10.1 Applicable Standard

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

§15.247(b) (3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

10.2 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.



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
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.

10.4 Test Environmental Conditions

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

**The testing was performed by Dennis Huang on 2009-08-14.*

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10.5 Summary of Test Results

Channel	Frequency (MHz)	Max Power (dBm)	Max Power (mW)	Limit (mW)	Result
Low	2405	10.83	12.10	1000	Compliant
Mid	2440	10.50	11.22	1000	Compliant
High	2475	10.16	10.37	1000	Compliant

11 FCC §15.247(d) – 100 kHz Bandwidth Outside the Frequency Band

11.1 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)).

11.2 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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
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.

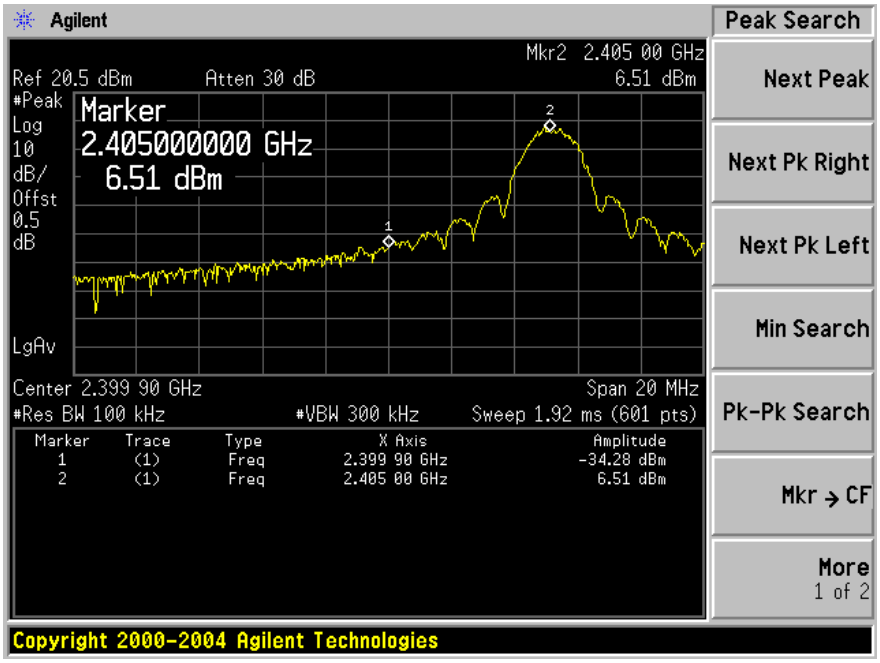
11.4 Test Environmental Conditions

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

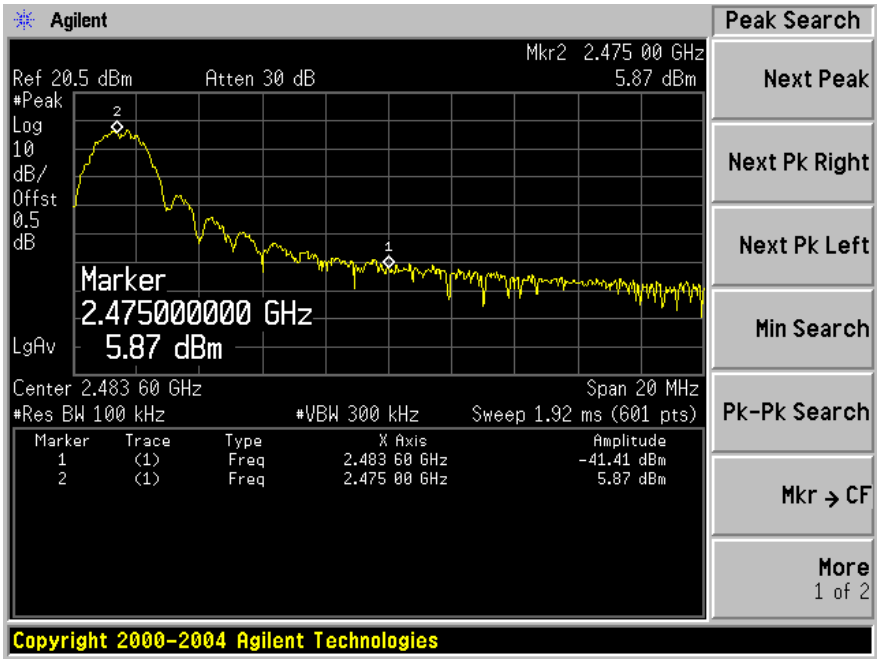
**The testing was performed by Dennis Huang on 2009-08-14.*

Please Refer to the Following Plots

Lowest Channel



Highest Channel



12 FCC §15.247(e) - Power Spectral Density

12.1 Applicable Standard

According to §15.247 (e), 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.

12.2 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 1.5MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
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.

12.4 Test Environmental Conditions

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

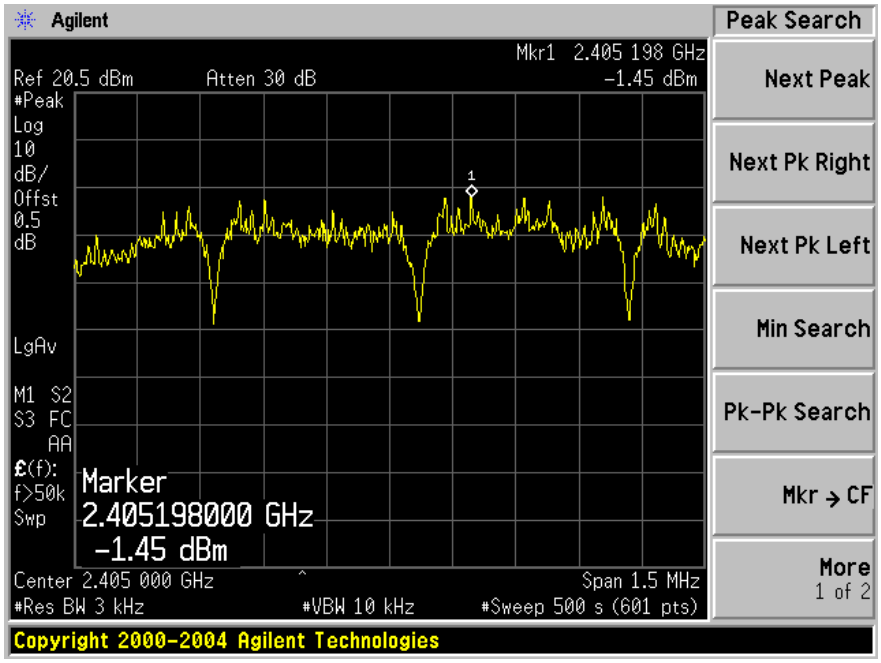
**The testing was performed by Dennis Huang on 2009-08-14.*

12.5 Summary of Test Results

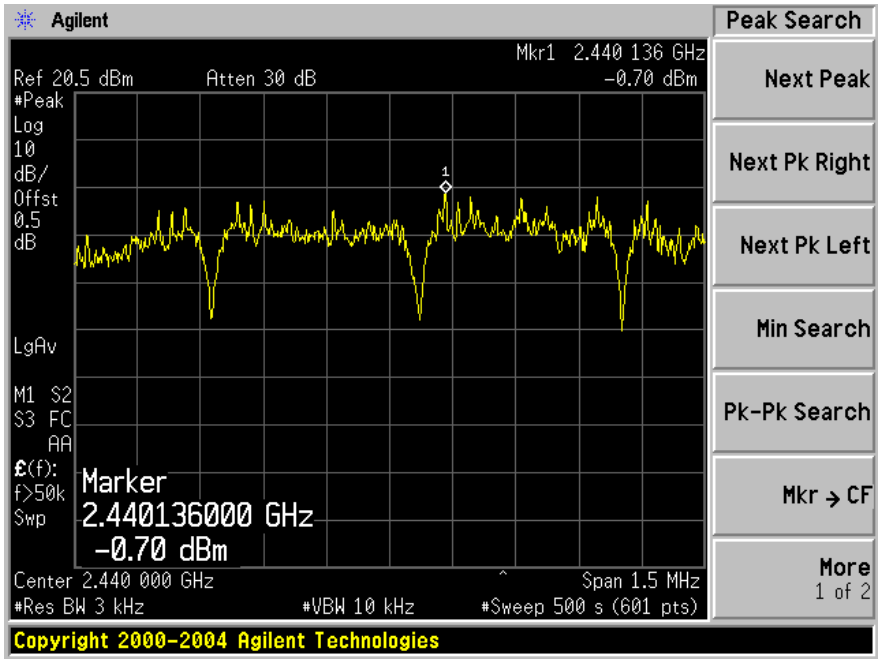
Frequency (MHz)	PPSD (dBm/3kHz)	Limit (dBm/3kHz)	Result
2405	-1.45	8	Compliant
2440	-0.70	8	Compliant
2475	-1.39	8	Compliant

Please refer to the following plots for detailed test results

Low Channel



Middle Channel



High Channel