Lab Code: 200167-0

FCC PART 15 SUBPART C
TEST AND MEASUREMENT REPORT

For

SecureALL Corporation

695 Woburn Court,

Mountain View, CA 94040, USA

FCC ID: Y29SA-DR-1000
Model: SA-DR-1000

Report Type:	**Product Type:**
Original Report	Door Reader with DSSS & FSSS Transceiver

Test Engineers:	Jerry Huang
Report Number:	R1012013-247
Report Date:	2010-12-20
Reviewed By:	Victor Zhang RF Lead
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1012013-247	Original Report	2010-12-20

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *SecureAll Corporation* and their product, *model: SA-DR-1000, FCC ID: Y29SA-DR-1000,* which will be henceforth in this report referred to as the EUT (Equipment under Test). The EUT is a Door Reader with DSSS and FHSS transceiver. The Door Reader powered by 4 AA dry cells, alternative powered by DC Power Adaptor. EUT communicates with a mobile Ukey device and a stationary Router device. Its Operating frequency range from 2400 MHz to 2483.5 MHz, 75 channels with 1 MHz opterating bandwidth for FHSS mode.

1.2 Mechanical Description of EUT

The EUT measures approximately 80 mm **(L)** x 49 mm **(W)** x 270 mm **(H)** for the front part, 82 mm **(L)** x 33 mm **(W)** x 345 mm **(H)** for the back part, and weighs approximately 3623g.

The data gathered are from a production sample provided by the manufacturer, serial number: 10.

1.3 Objective

This report is prepared on behalf of *SecureAll Corporation, Proprietary* in accordance with Part 2, Subpart J, and Part 15, Subparts 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.

1.4 Related Submittal(s)/Grant(s)

No Related Submittals.

1.5 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.

1.6 Measurement Uncertainty

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

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

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

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

1.7 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: R-2463 and C-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 was 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 software to exercise the unit was provided by the client.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Special Accessories

N/A

2.5 EUT Internal Configuration Details

Manufacturers	Descriptions	Models	Serial Numbers
SecureALL Corp.	PCB Assembly Main Board	810-000101	88450005
SecureALL Corp.	PCB Assembly Bottom Antenna Board	710-000105	-
SecureALL Corp.	PCB Assembly Back Antenna Board	710-000107	-

2.6 Power Supply and Line Filters

Manufacturers	Descriptions	Models	Serial Numbers
OEM	DC Power Adaptor	ADS0051-W050100	-

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
FCC §15.247(i)	RF Exposure	Compliant
FCC §15.203	Antenna Requirement	Compliant
FCC §15.207(a)	AC Line Conducted Emissions	Compliant
FCC §15.247(d)	Spurious Emissions at Antenna Port	Compliant
FCC §15.205	Restricted Bands	Compliant
FCC §15.209(a), §15.247(d)	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(1)	Dwell Time	Compliant
FCC §15.247(a)(1)	Hopping Channel Separation	Compliant
FCC §15.247(a)(1)	20 dB Bandwidth	Compliant
FCC §15.247(a)(2)	6 dB Bandwidth	Compliant
FCC §15.247(b)(1)	Number of Hopping Frequency Used	Compliant
FCC §15.247(b)(3)	Maximum Peak Output Power	Compliant
FCC §15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e)	Power Spectral Density	Compliant

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

4.1 Applicable Standard

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

Limits for General Population/Uncontrolled Exposure

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

4.3 MPE Results

DSSS:

Main Antenna

Maximum peak output power at antenna input terminal (dBm):	4.35
Maximum peak output power at antenna input terminal (mW):	2.723
Prediction distance (cm):	20
Prediction frequency (MHz):	2475
Maximum Antenna Gain, typical (dBi):	5
Maximum Antenna Gain (numeric):	3.162
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00171
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00171mW/cm^2 .Limit is $1mW/cm^2$.

Bottom Antenna

Maximum peak output power at antenna input terminal (dBm):	4.35
Maximum peak output power at antenna input terminal (mW):	2.723
Prediction distance (cm):	20
Prediction frequency (MHz):	2475
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.585
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00086
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00086mW/cm^2 .Limit is $1mW/cm^{2.}$

Back Antenna at Vertical Polarity

Maximum peak output power at antenna input terminal (dBm):	4.35
Maximum peak output power at antenna input terminal (mW):	2.723
Prediction distance (cm):	20
Prediction frequency (MHz):	2475
Maximum Antenna Gain, typical (dBi):	3
Maximum Antenna Gain (numeric):	1.995
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00108
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00108mW/cm^2.Limit is $1mW/cm^{2.}$

Back Antenna at Horizontal Polarity

Maximum peak output power at antenna input terminal (dBm):	4.35
Maximum peak output power at antenna input terminal (mW):	2.723
Prediction distance (cm):	20
Prediction frequency (MHz):	2475
Maximum Antenna Gain, typical (dBi):	3
Maximum Antenna Gain (numeric):	1.995
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00108
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00108mW/cm^2 .Limit is $1mW/cm^2$

FHSS Mode:

Main Antenna

Maximum peak output power at antenna input terminal (dBm):	0.32
Maximum peak output power at antenna input terminal (mW):	1.076
Prediction distance (cm):	20
Prediction frequency (MHz):	2479
Maximum Antenna Gain, typical (dBi):	5
Maximum Antenna Gain (numeric):	3.162
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00068
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.00068mW/cm^2.Limit is $1mW/cm^{2.}$

Bottom Antenna

Maximum peak output power at antenna input terminal (dBm):	0.32
Maximum peak output power at antenna input terminal (mW):	1.076
Prediction distance (cm):	20
Prediction frequency (MHz):	2479
Maximum Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.585
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.00034
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is0.00034mW/cm^2 .Limit is $1mW/cm^{2.}$

5 FCC §15.203 – Antenna Requirements

5.1 Applicable Standard

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

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

5.2 Antenna Connector Construction

EUT has two Main Antennas which are integrated on the main PCB board with each max gain 5dBi; two Bottom patch Antennas for each has a max gain of 2 dBi; on the back side, there is one slot antenna in vertical polarity with max gain 3 dBi and another patch antenna in horizontal polarity with max gain 3dBi. All the antennas of EUT fulfill the requirements of FCC§15.203.

Frequency Band	Name	Type	Antenna Gain (dBi)
2.4 GHz	Main Antenna – V Polarity	Patch	5.0
2.4 GHz	Main Antenna – H Polarity	Patch	5.0
2.4 GHz	Bottom Antenna –V Polarity	Patch	2.0
2.4 GHz	Bottom Antenna –H Polarity	Patch	2.0
2.4 GHz	Back Antenna –V Polarity	Slot	3.0
2.4 GHz	Back Antenna –V Polarity	Patch	3.0

Note: The EUT can only transmit with one antenna or the other by using the internal auto switch to choosing the MAX performance antenna.

The radio transceiver can at a given time only transmit either FHSS or DSSS and cannot transmit both modulations at the same time.

6 FCC §15.207 – AC Line Conducted Emissions

6.1 Applicable Standards

As per FCC §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 [1]	56 to 46 [1]
0.5-5	56	46
5-30	60	50

[1] *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 AC/DC power adapter of the Supporting Laptop which connects the EUT 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-R-24-BNC	511213	2010-06-28
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24

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

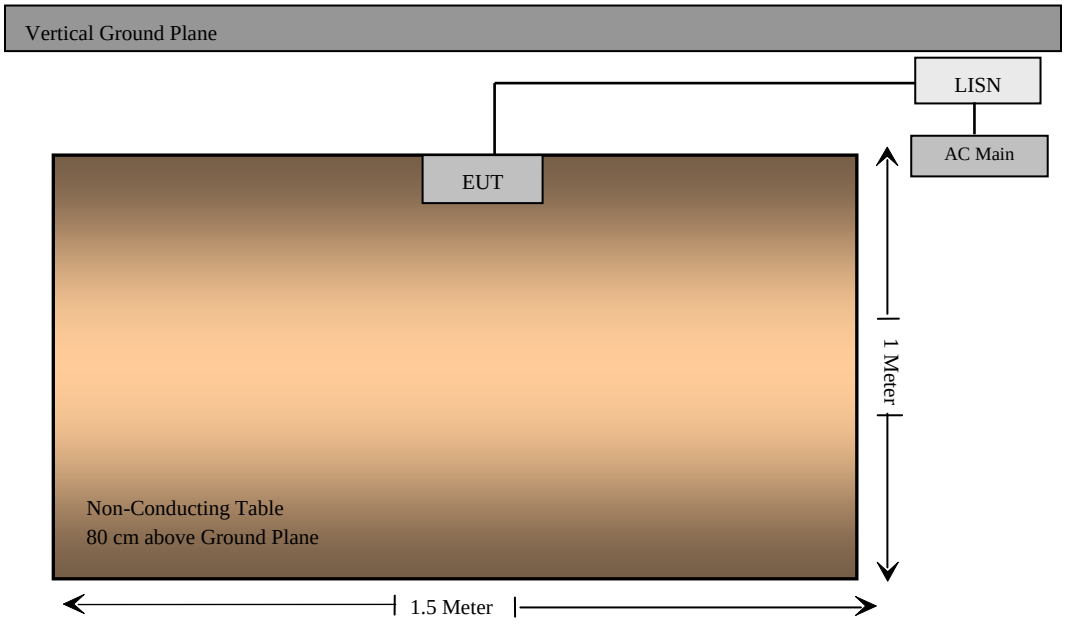
6.4 Test Procedure

During the conducted emissions test, the power cord of the EUT host system 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".

6.5 Test Setup Block Diagram



6.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10 dB)

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

Margin = Corrected Amplitude - Limit

6.7 Test Environmental Conditions

Temperature:	16~20 °C
Relative Humidity:	31~40 %
ATM Pressure:	101.2-102.4kPa

The testing was performed by Jerry Huang on 2010-12-1 ~ 2010-12-2 in 5 meter chamber 3.

6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits, with the EUT working in the worst channel and margin reading of:

Worst case: DSSS High Channel, Transmitting Mode

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-13.44	0.356133	Line	0.15 to 30

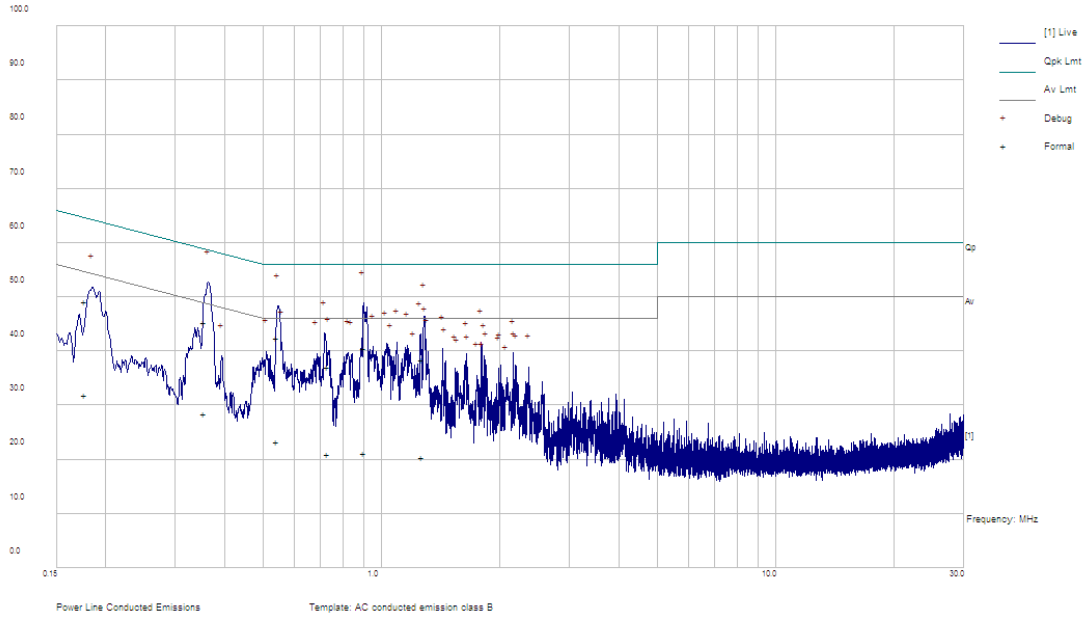
Worst Case: FHSS Middle Channel Transmitting Mode

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor (Line/Neutral)**	**Range (MHz)**
-15.62	0.181377	Neutral	0.15 to 30

6.9 Conducted Emissions Test Plots and Data

DSSS:

120 V, 60 Hz – Line



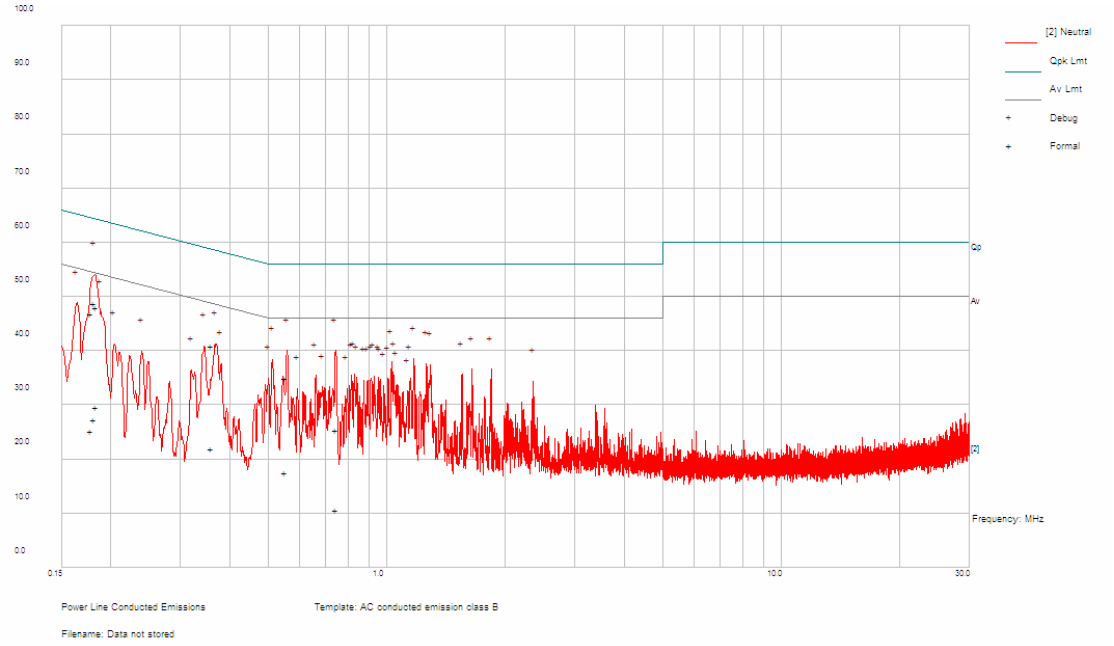
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.177555	49.08	Line	64.6	-15.52
0.356133	45.37	Line	58.82	-13.44
0.542886	42.41	Line	56.00	-13.59
0.733119	37.15	Line	56.00	-18.85
0.901176	40.59	Line	56.00	-15.41
1.267680	38.51	Line	56.00	-17.49

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.177555	31.88	Line	54.60	-22.72
0.356133	28.54	Line	48.82	-20.28
0.542886	23.26	Line	46.00	-22.74
0.733119	21.01	Line	46.00	-24.99
0.901176	21.14	Line	46.00	-24.86
1.267680	20.50	Line	46.00	-25.50

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

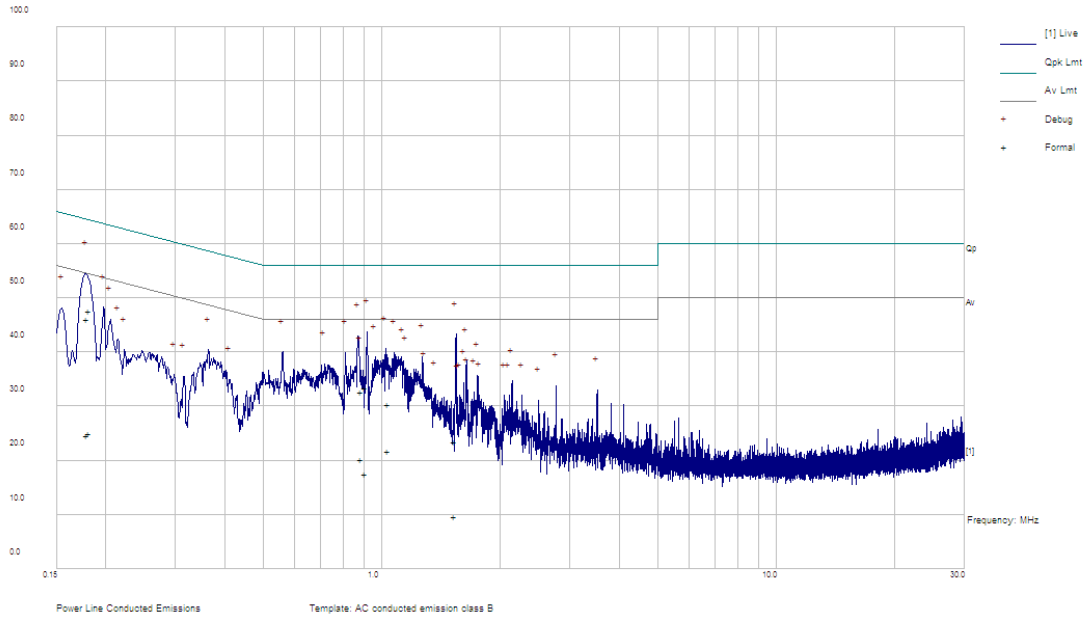
Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.182028	41.07	Neutral	64.39	-23.32
0.741795	25.68	Neutral	56.00	-30.32
0.891201	27.71	Neutral	56.00	-28.29
0.895524	27.10	Neutral	56.00	-28.90
1.083093	26.16	Neutral	56.00	-29.84
1.611129	20.15	Neutral	56.00	-35.85

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.182028	17.85	Neutral	54.39	-36.54
0.741795	14.59	Neutral	46.00	-31.41
0.891201	12.77	Neutral	46.00	-33.23
0.895524	12.59	Neutral	46.00	-33.41
1.083093	15.58	Neutral	46.00	-30.42
1.611129	6.48	Neutral	46.00	-39.52

FHSS:

120 V, 60 Hz – Line



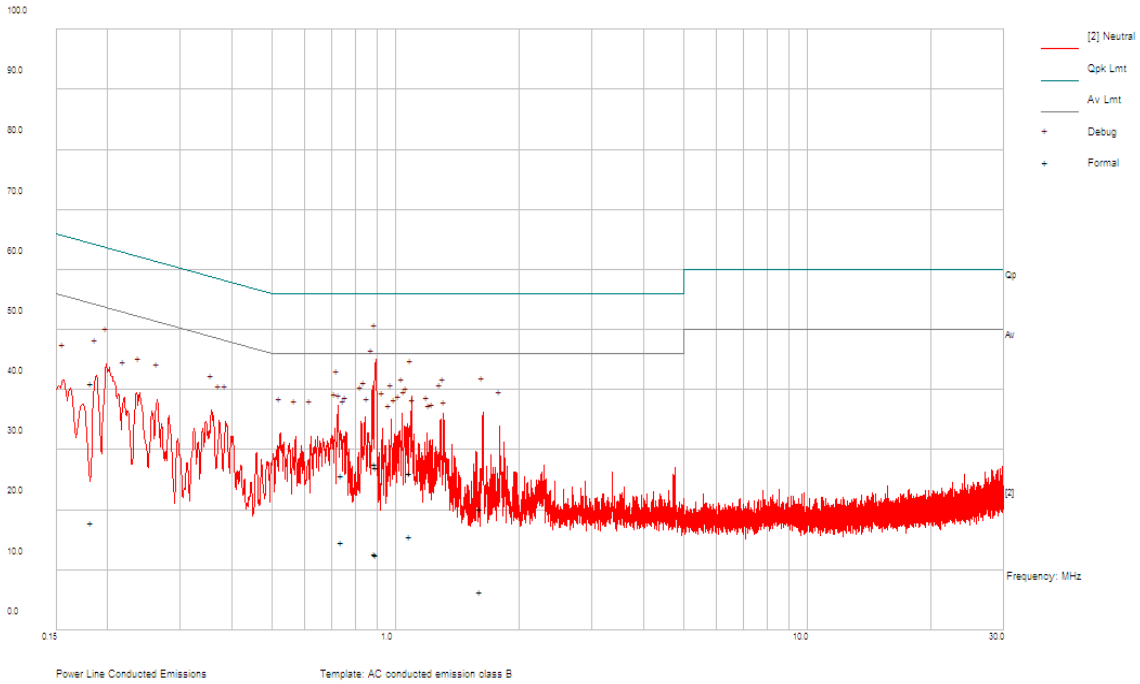
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.178800	46.04	Line	64.54	-18.50
0.181563	47.52	Line	64.41	-16.89
0.886011	32.66	Line	56.00	-23.34
0.911361	33.42	Line	56.00	-22.58
1.036251	30.39	Line	56.00	-25.61
1.530855	23.48	Line	56.00	-32.52

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.178800	24.64	Line	54.54	-29.90
0.181563	25.01	Line	54.41	-29.41
0.886011	20.16	Line	46.00	-25.84
0.911361	17.50	Line	46.00	-28.5
1.036251	21.77	Line	46.00	-24.23
1.530855	9.59	Line	46.00	-36.41

120 V, 60 Hz – Neutral



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.178269	46.94	Neutral	64.57	-17.62
0.181377	48.80	Neutral	64.42	-15.62
0.183720	47.98	Neutral	64.32	-16.33
0.359751	40.82	Neutral	58.73	-17.91
0.554352	34.99	Neutral	56.00	-21.01
0.745071	25.43	Neutral	56.00	-30.57

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)
0.178269	25.29	Neutral	54.57	-29.28
0.181377	27.39	Neutral	54.42	-27.03
0.183720	29.60	Neutral	54.32	-24.71
0.359751	21.88	Neutral	48.73	-26.85
0.554352	17.59	Neutral	46.00	-28.41
0.745071	10.65	Neutral	46.00	-35.35

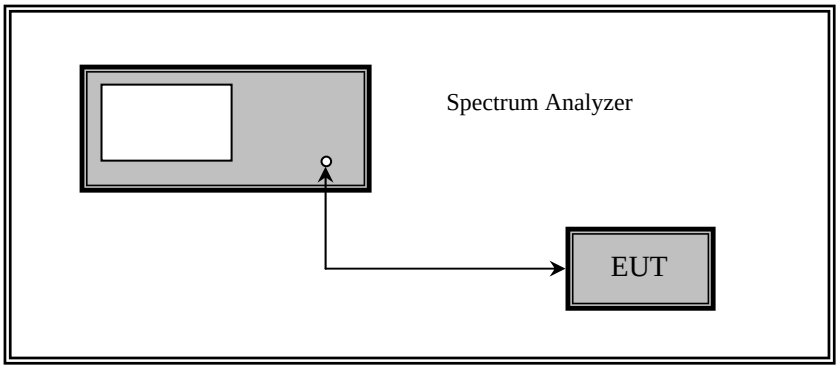
7 FCC §15.247(a)(1) - Hopping Channel Separation

7.1 Applicable Standard

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

7.2 Measurement Procedure

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



7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

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:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

The testing was performed by Jerry Huang on 2010-12-3 in RF site.

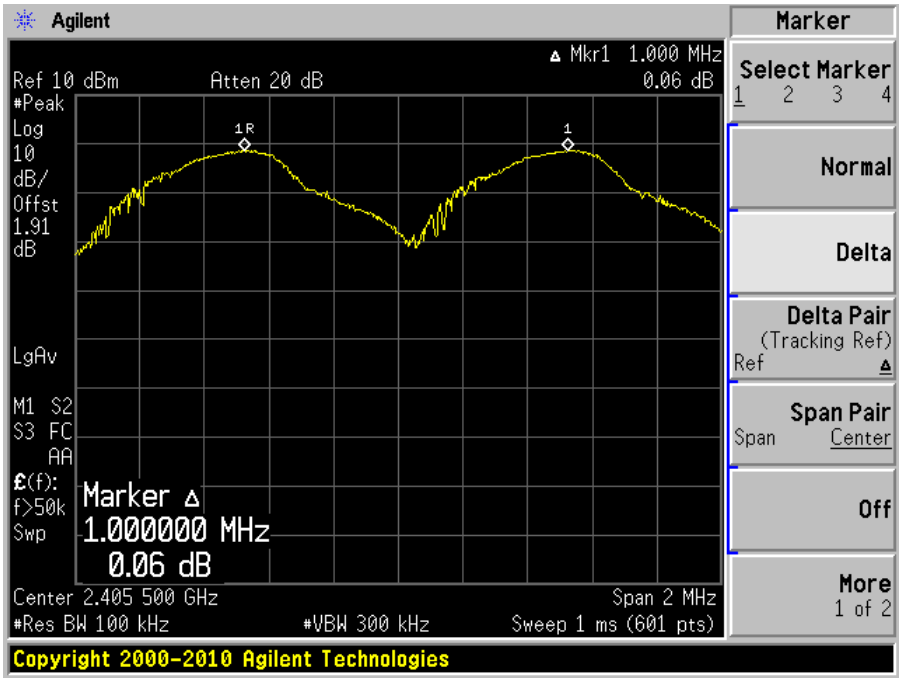
7.5 Measurement Results

FHSS modulation

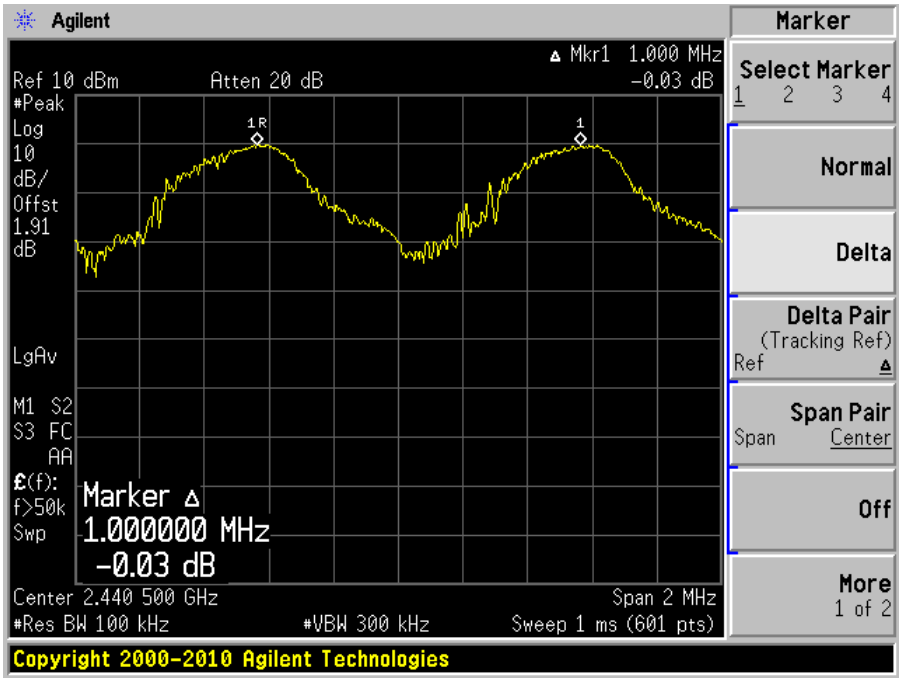
Channel	Frequency (MHz)	Channel Separation (kHz)	Limit > 2/3 20 dB OBW (kHz)
Low	2405	1000	611.4278
Mid	2440	1000	566.8826
High	2479	1000	555.0227

Please refer to the following plots.

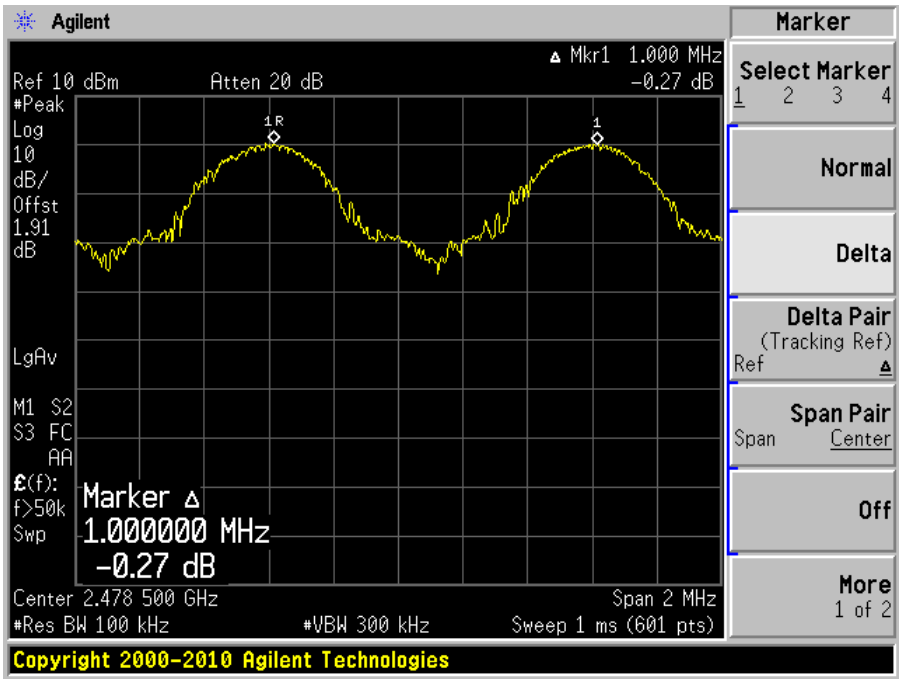
Low Channel



Middle Channel



High Channel



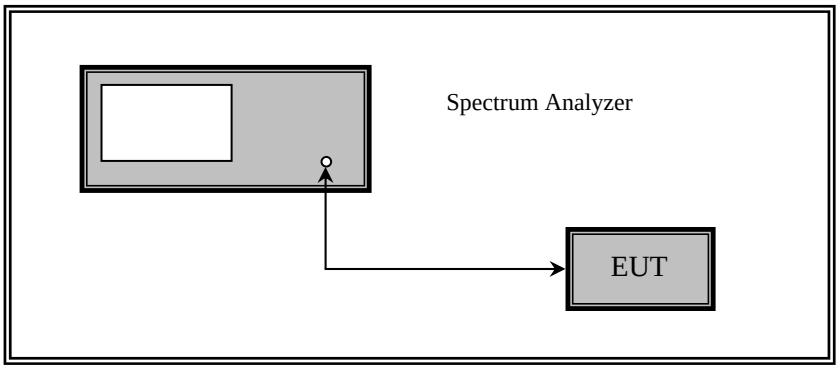
8 FCC §15.247(a)(1)(iii) – Number of Hopping Frequencies Used

8.1 Applicable Standard

According to FCC §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

8.2 Measurement Procedure

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



8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

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

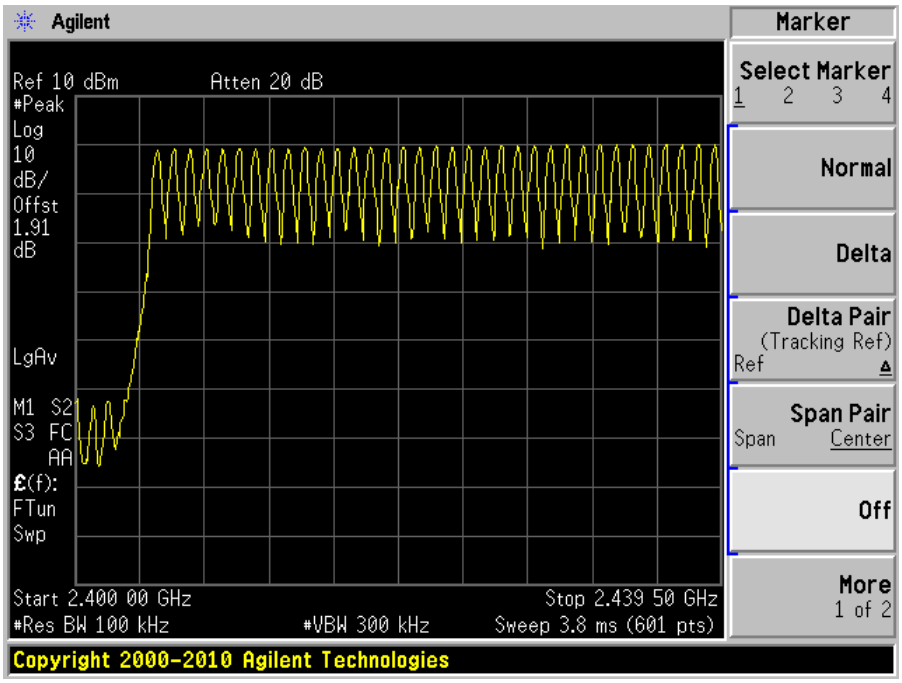
Temperature:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

The testing was performed by Jerry Huang on 2010-12-3 in RF site.

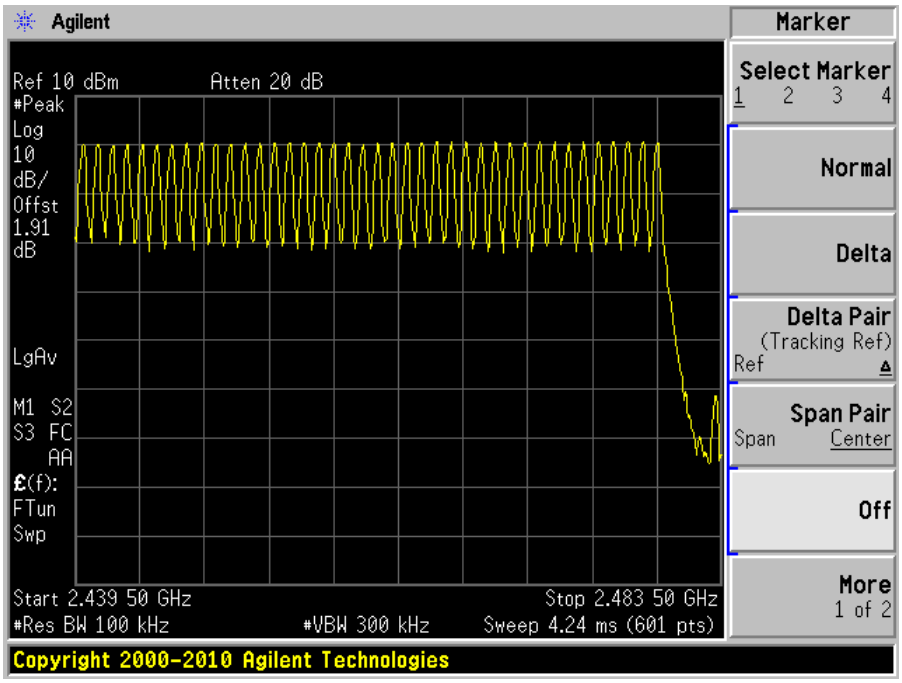
8.5 Measurement Result

75 channels please refer to the following plots.

Hopping Channel Number



35 Channels between 2400 to 2439.5 MHz



40 Channels between 2440 to 2483.5 MHz

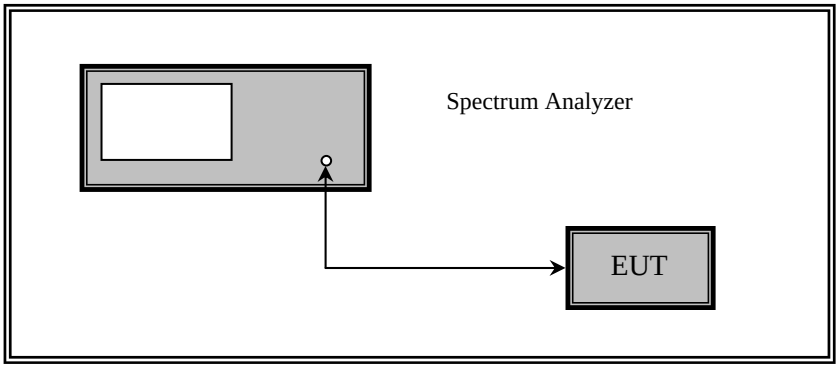
9 FCC §15.247(a)(1)(iii) - Dwell Time

9.1 Applicable Standard

According to FCC §15.247 (a)(1)(iii), the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

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. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.



9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

*** 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:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

The testing was performed by Jerry Huang on 2010-12-3 in RF site.

9.5 Measurement Results

Channel	Frequency (MHz)	Pulse Width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Results
Low	2405	1.68	0.0212	0.4	Compliant
Mid	2440	1.68	0.0212	0.4	Compliant
High	2479	1.69	0.0214	0.4	Compliant

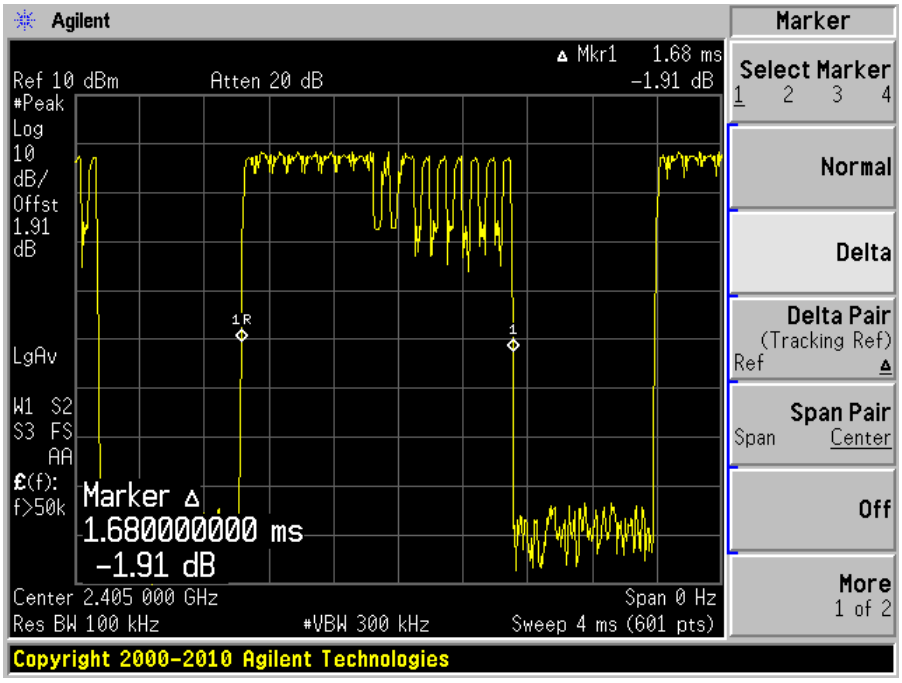
Note:

Dwell time = Pulse time*(hop rate/2/number of channels)*31.6 sec

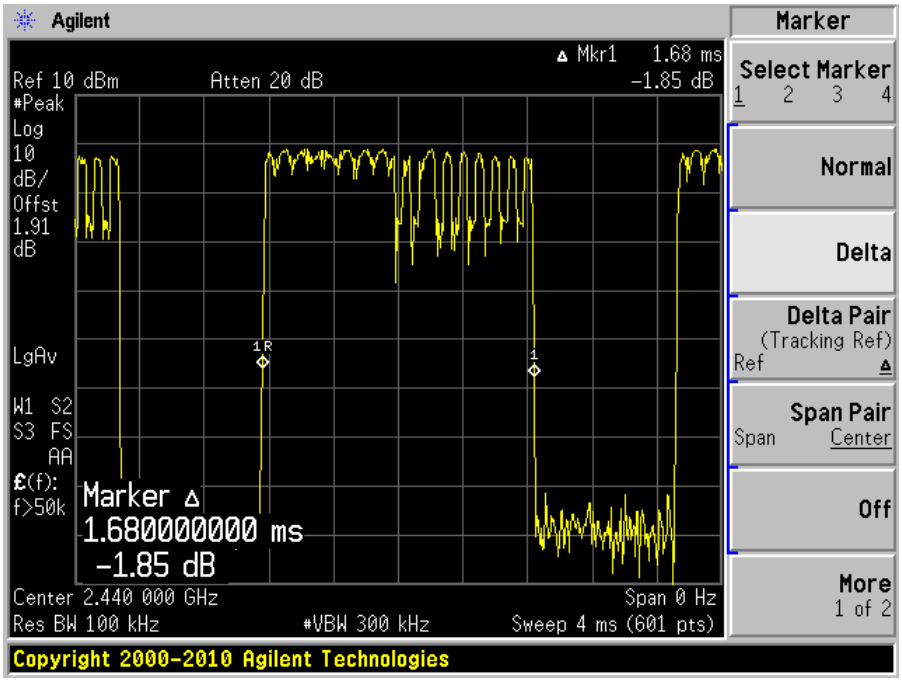
• Hop Rate = 60
• Number of Channels = 75

Please refer the following plots.

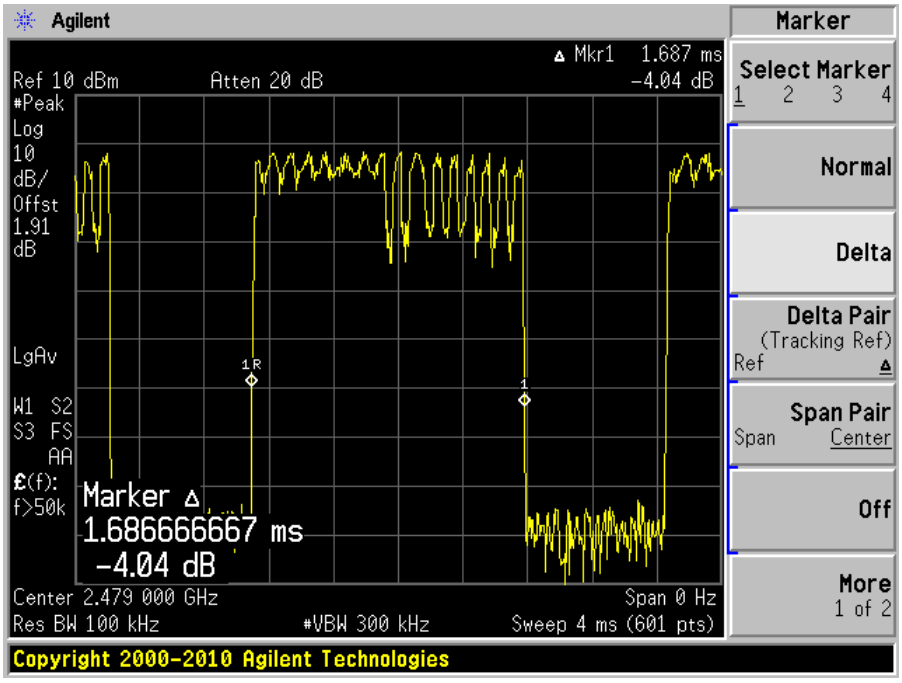
Low Channel



Middle Channel



High Channel



10 FCC §15.247(a) (2) – Channel Bandwidth

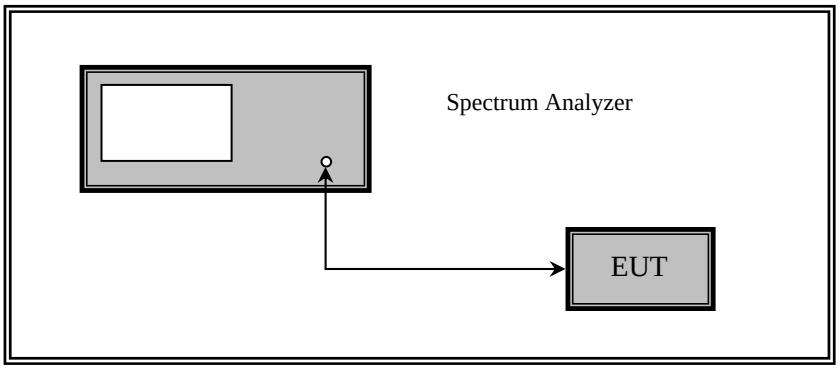
10.1 Applicable Standard

According to FCC §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

According to FCC §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

10.2 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.
4. Repeat above procedures until all frequencies measured were complete.



10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

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:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

The testing was performed by Jerry Huang on 2010-12-3 in RF site.

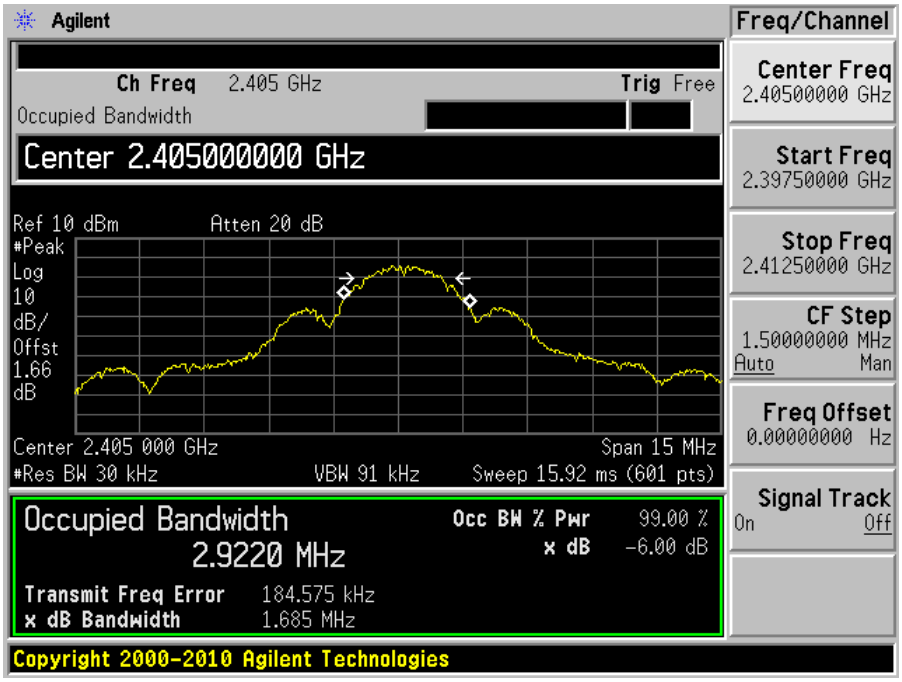
10.5 Summary of Test Results

DSSS:

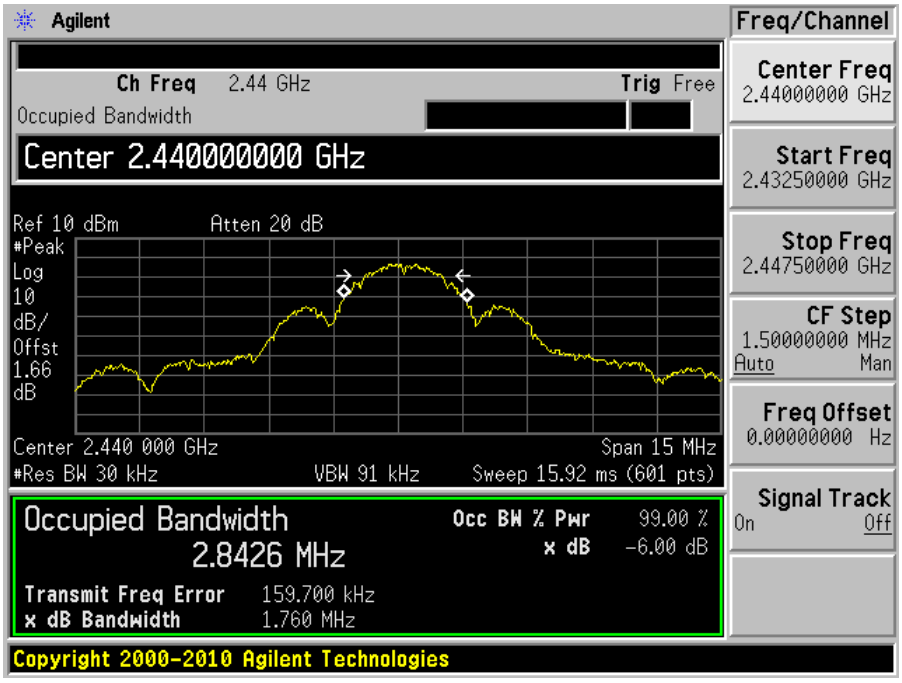
Channel	Frequency (MHz)	6 dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Limit (MHz)	Results
Low	2405	2.9220	1.685	> 0.5	Compliant
Middle	2440	2.8426	1.760	> 0.5	Compliant
High	2475	2.9338	1.630	> 0.5	Compliant

Please refer to the following plots for detailed test results:

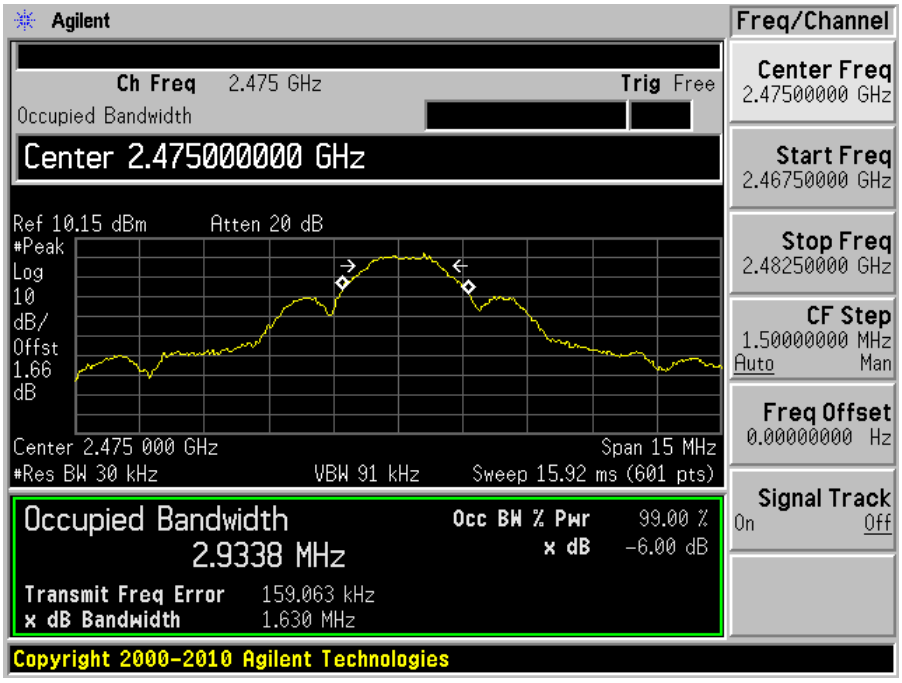
Low Channel: 2405 MHz



Middle Channel: 2440 MHz



High Channel: 2475 MHz

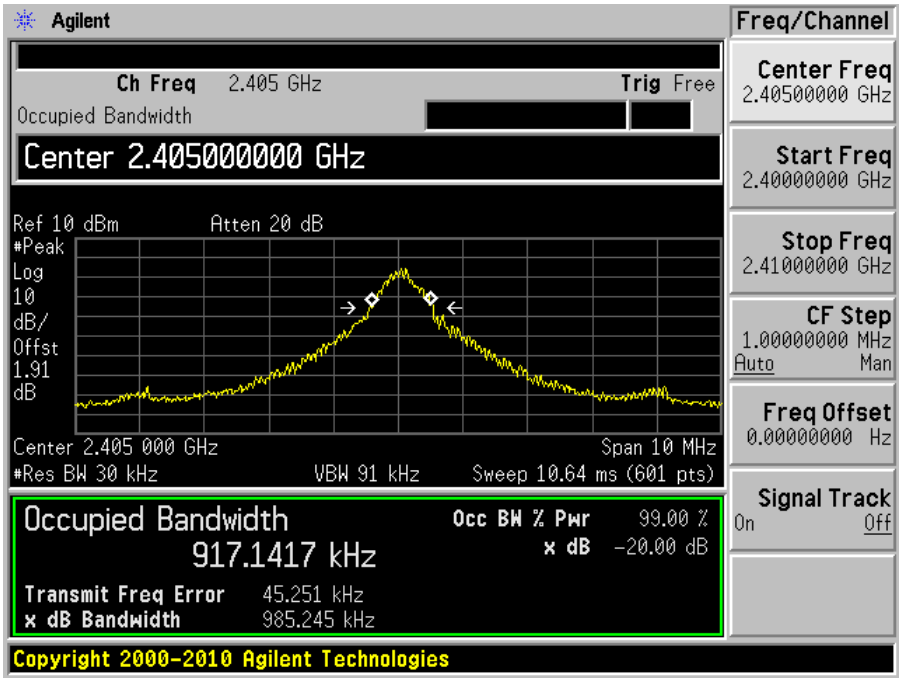


FHSS:

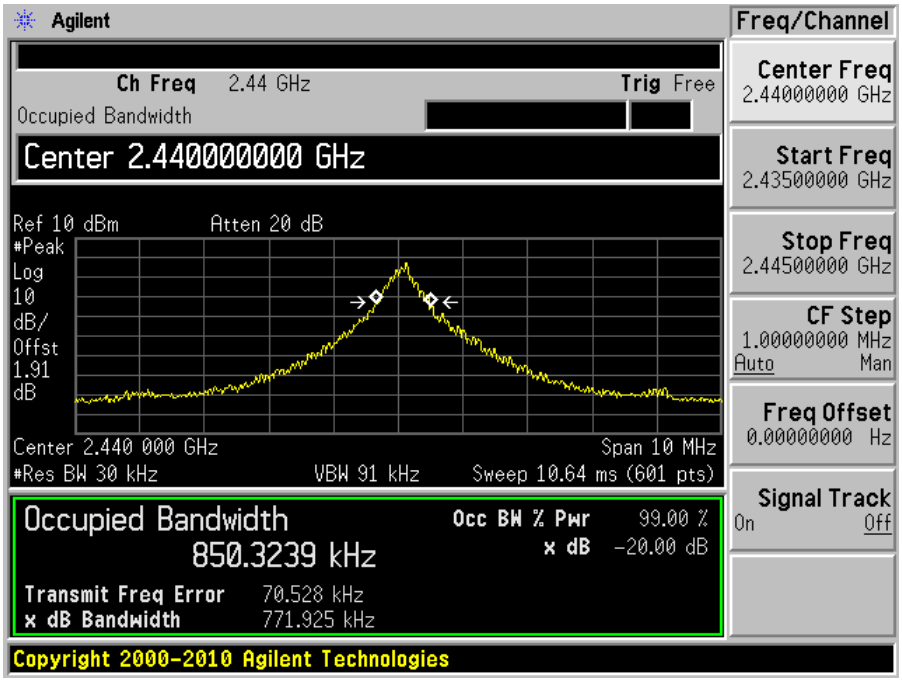
Channel	Frequency (MHz)	20 dB Emission Bandwidth (kHz)	99% Emission Bandwidth (kHz)	Limit (MHz)	Results
Low	2405	917.1417	985.245	> 0.5	Compliant
Middle	2440	850.3239	771.925	> 0.5	Compliant
High	2479	832.5341	679.135	> 0.5	Compliant

Please refer to the following plots for detailed test results:

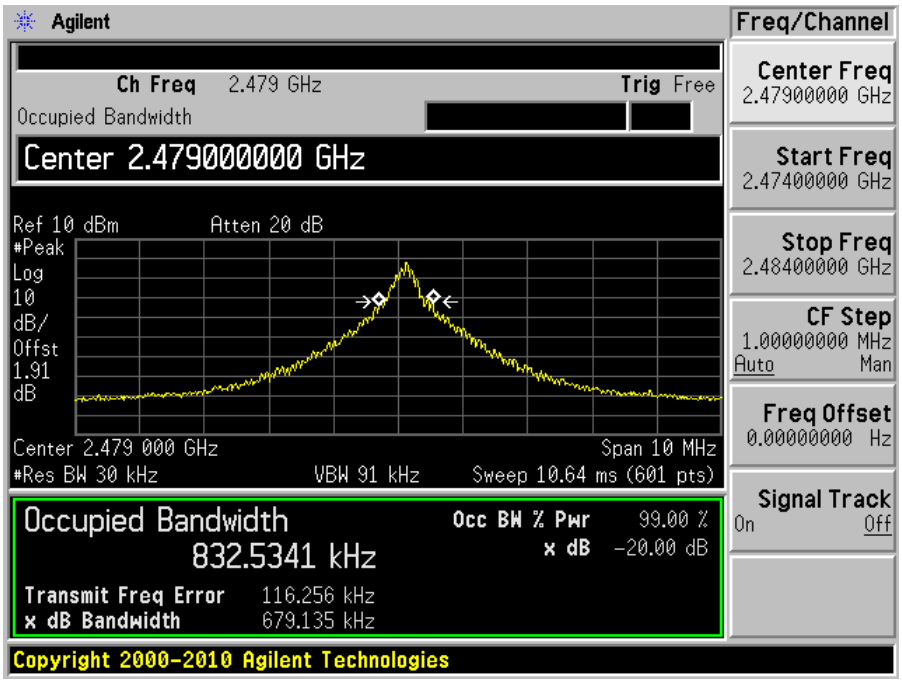
Low Channel: 2405 MHz



Middle Channel: 2440 MHz



High Channel: 2479 MHz



11 FCC §15.247(b)(1)(3) - Peak Output Power Measurement

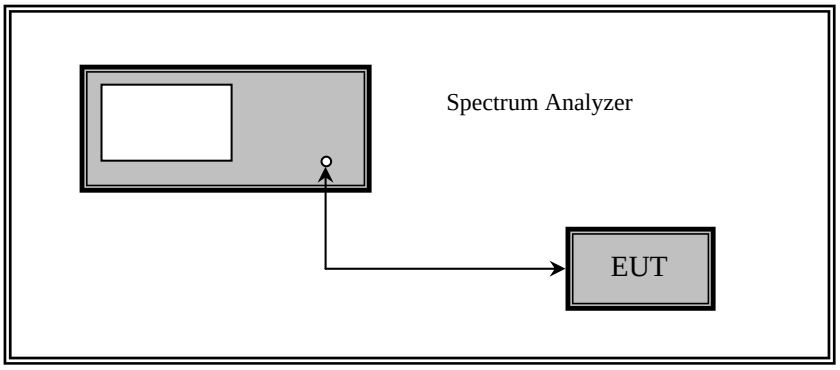
11.1 Applicable Standard

According to FCC §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.

According to FCC §15.247(b)(1) for frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

11.2 Measurement Procedure

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



11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

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:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

The testing was performed by Jerry Huang on 2010-12-3 in RF site.

11.5 Test Results

DSSS:

Channel	Frequency (MHz)	Conducted Output Power (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2405	3.25	30	-26.75
Middle	2440	4.01	30	-25.99
High	2475	4.35	30	-25.65

FHSS:

Channel	Frequency (MHz)	Conducted Output Power (dBm)	FCC Limit (dBm)	Margin (dB)
Low	2405	-1.35	21	-22.35
Middle	2440	-0.23	21	-21.23
High	2479	0.32	21	-20.68

12 FCC §15.247(d) - Spurious Emissions at Antenna Terminals

12.1 Applicable Standard

For 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.

12.2 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 10th harmonic.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

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:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

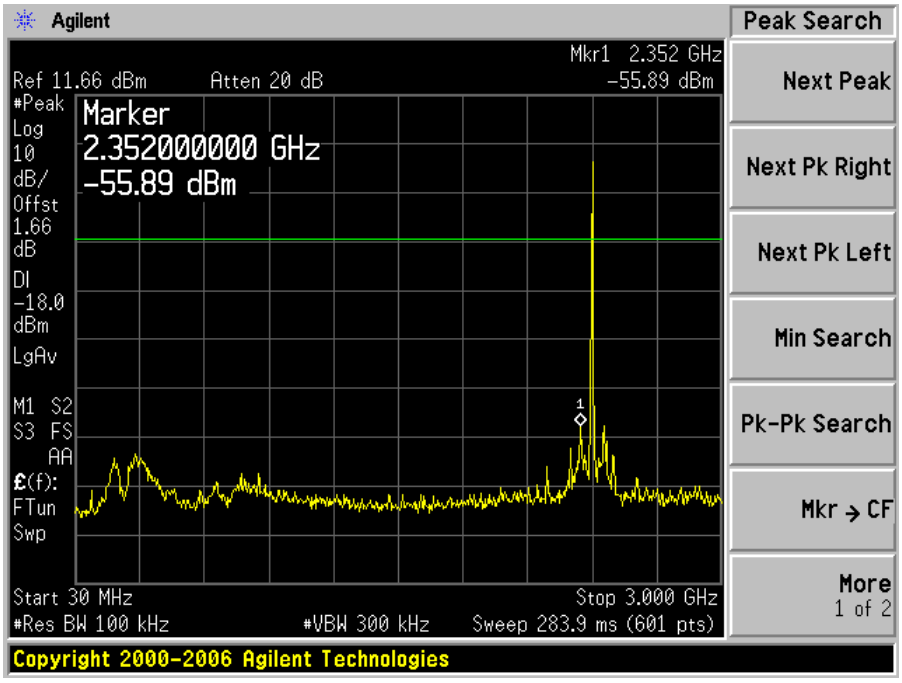
The testing was performed by Jerry Huang on 2010-12-3 in RF site.

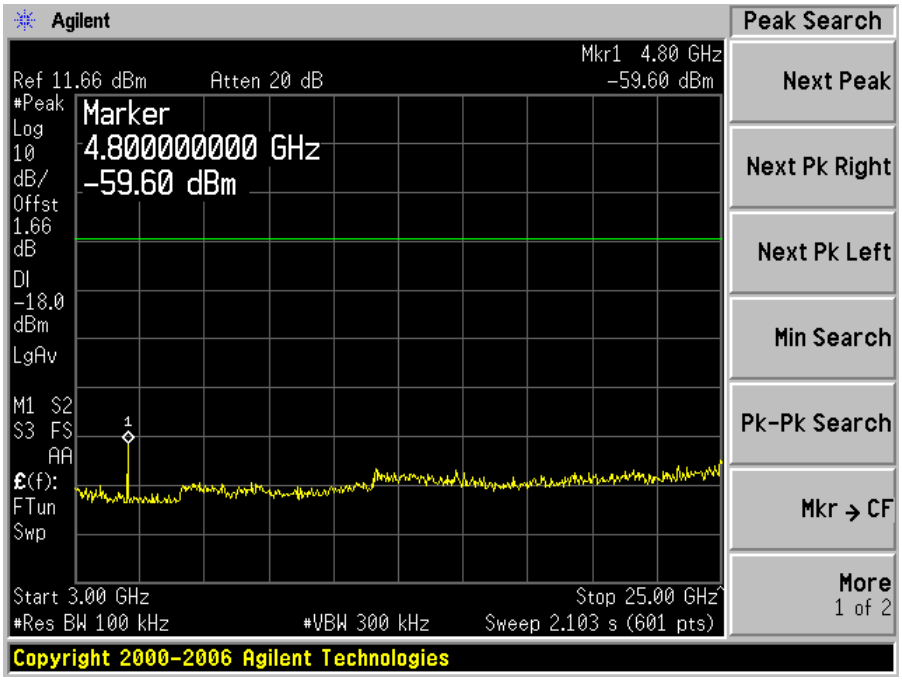
12.5 Measurement Result:

Please refer to following plots of spurious emissions.

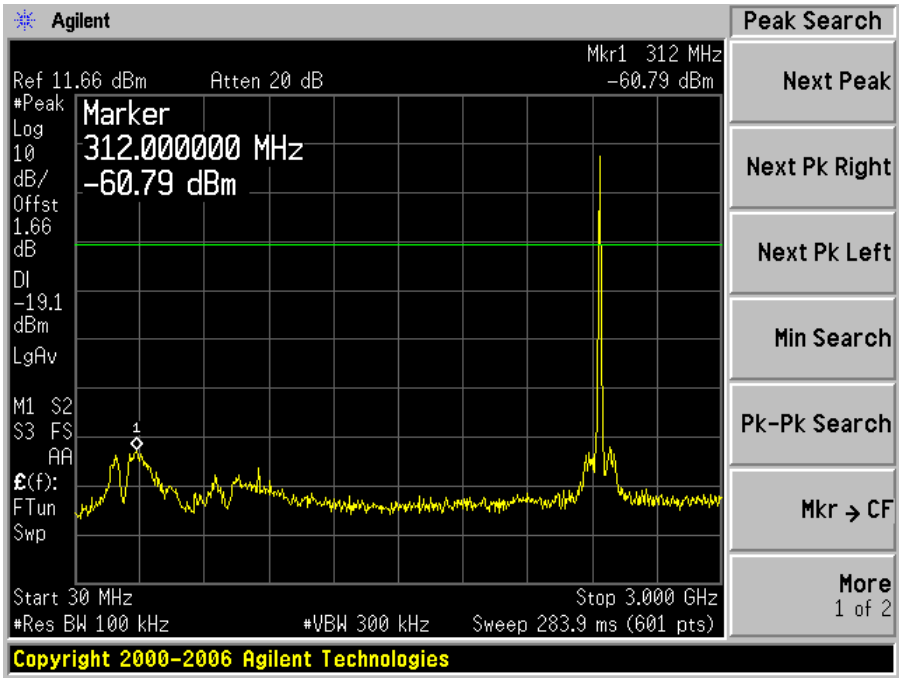
DSSS:

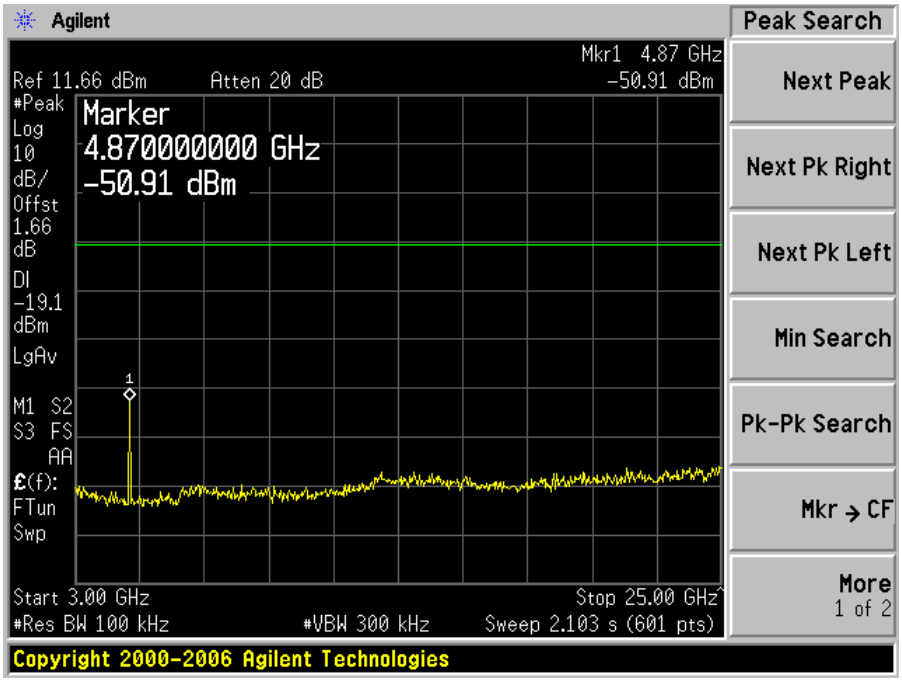
Low Channel: 2405 MHz



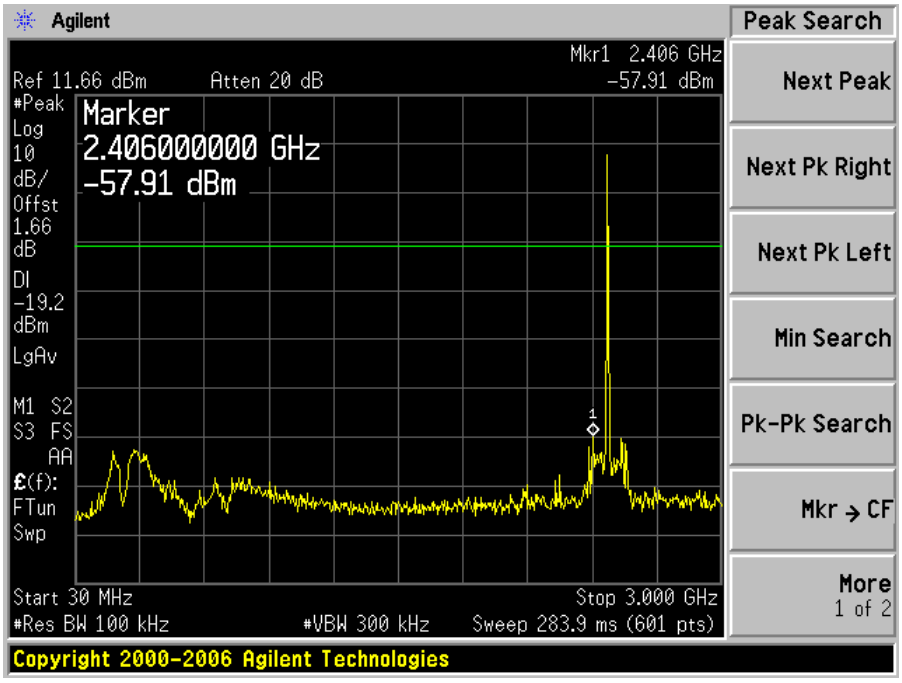


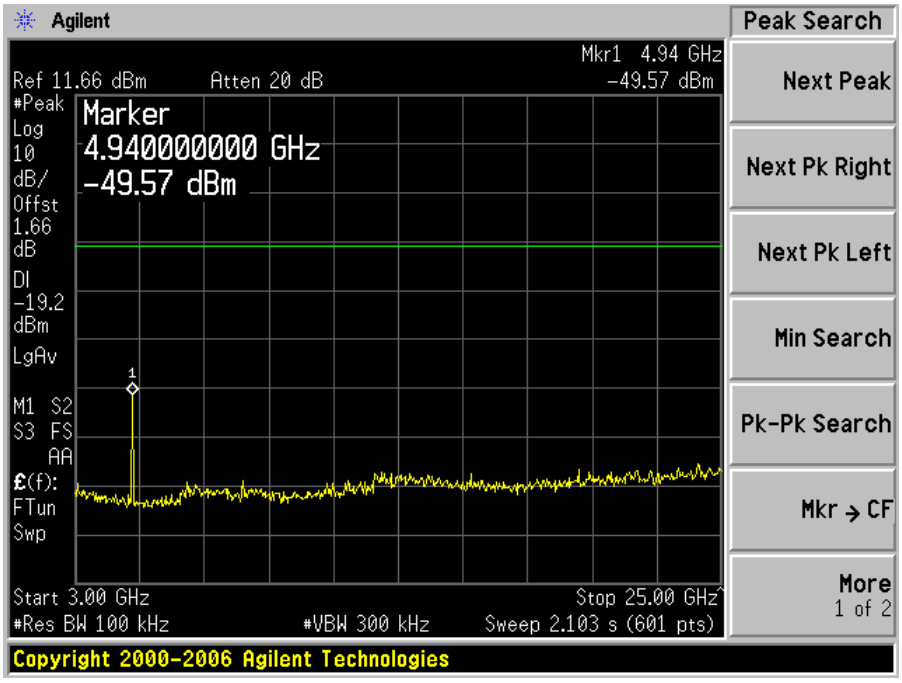
Middle Channel: 2440 MHz





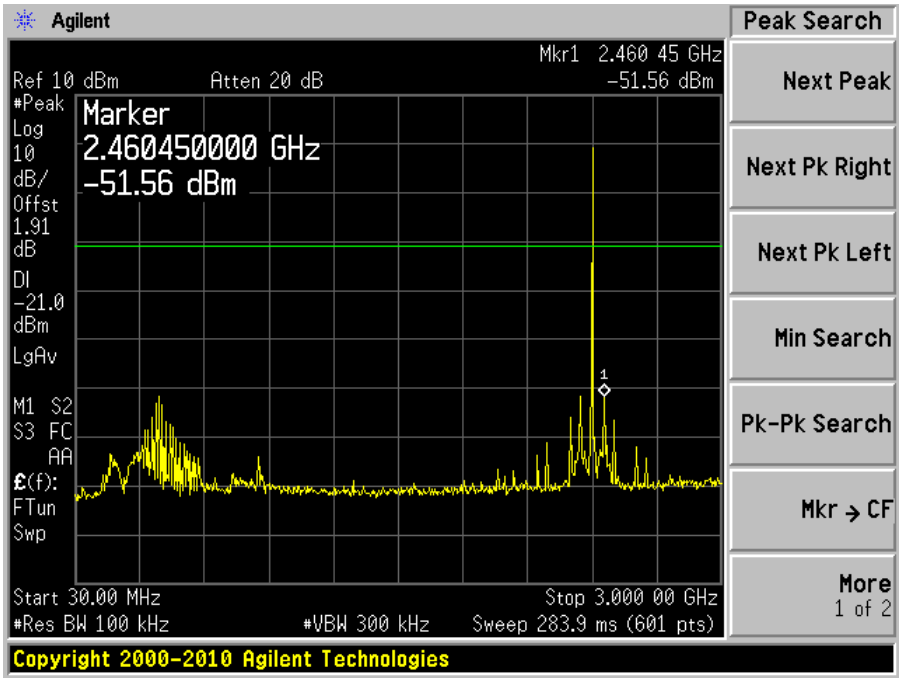
High Channel: 2475 MHz

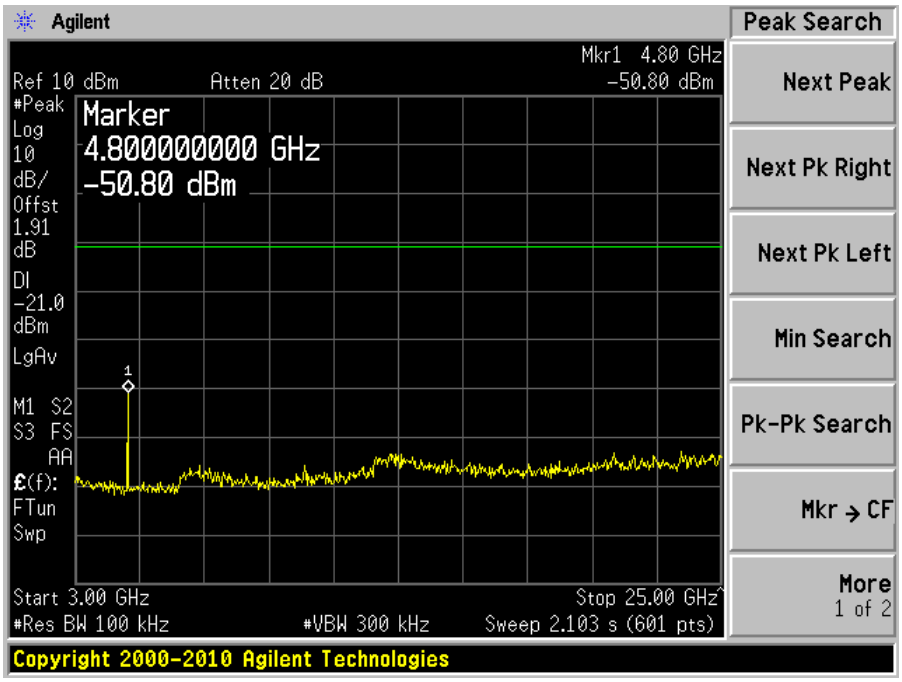




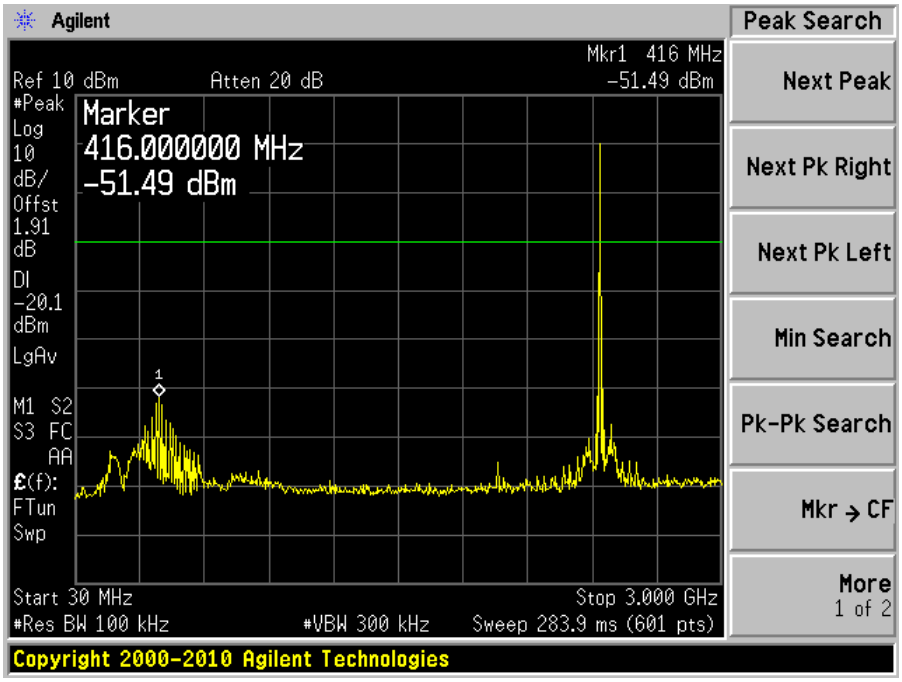
FHSS:

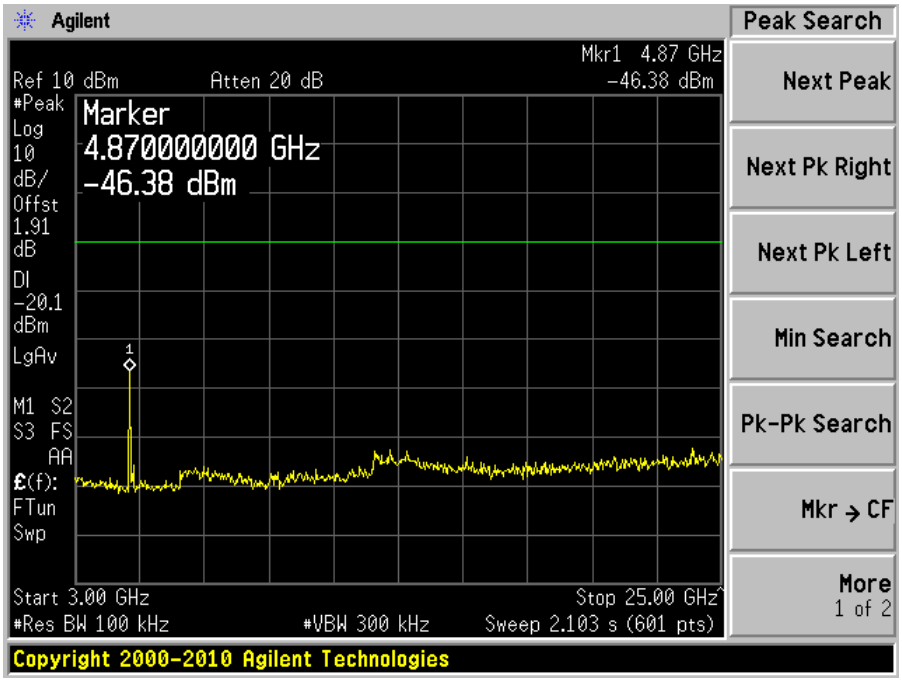
Low Channel: 2405 MHz



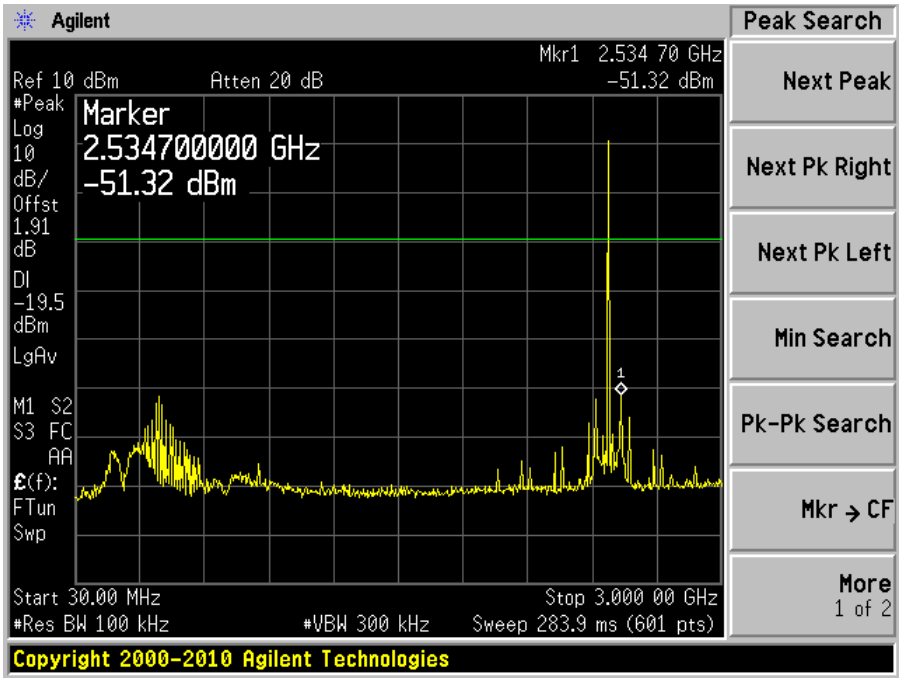


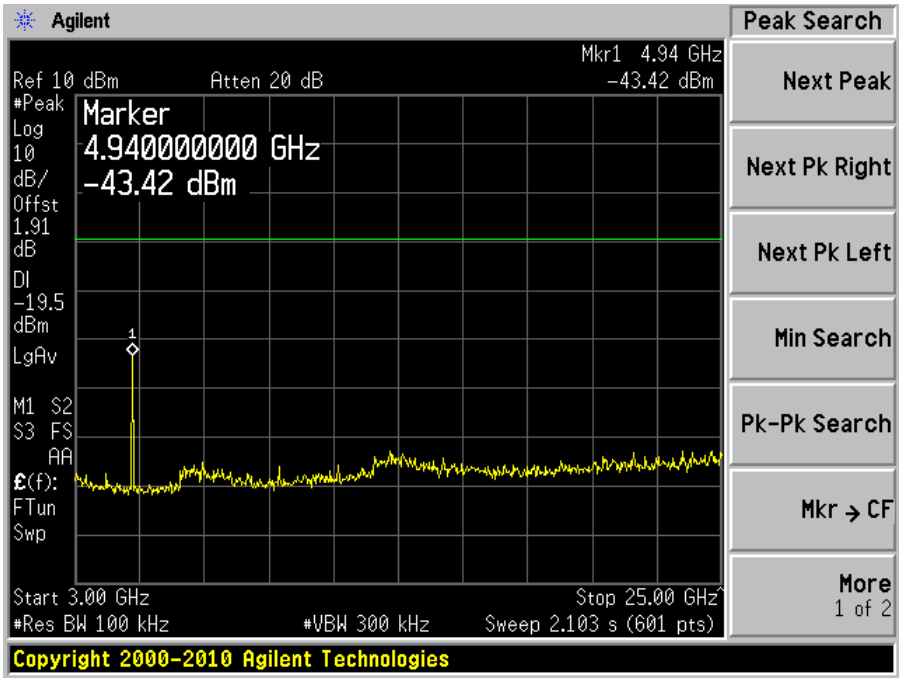
Middle Channel: 2440 MHz





High Channel: 2475 MHz





13 FCC §15.205, §15.209, §15.247(d) §4.9 – Spurious Radiated Emissions

13.1 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. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, *e.g.* , see §§15.250, 15.252, 15.255, and 15.509–15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

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:

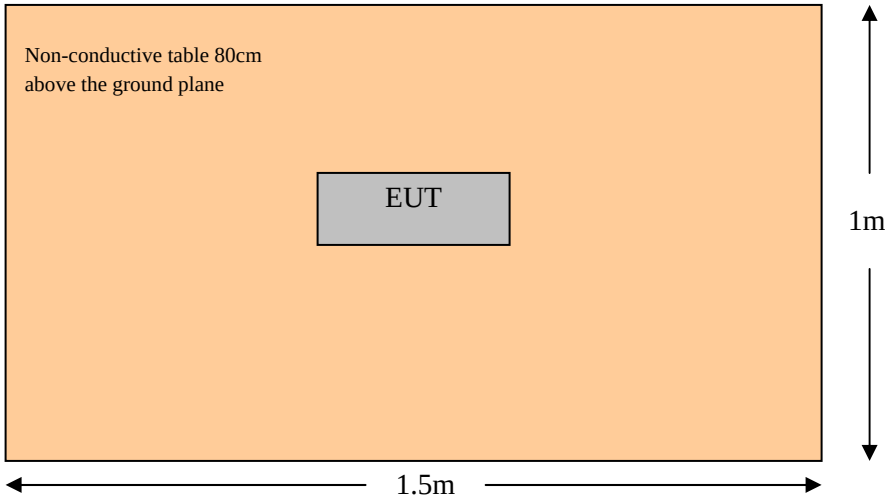
MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 –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

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

13.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15C limits.

13.3 Test Setup Block Diagram



13.4 EUT Setup

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

The spacing between the peripherals was 10 centimeters.

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

13.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Mini-Circuits	Pre amplifier	ZVA-183-S	570400946	2010-05-10
Sunol Science Corp	Combination Antenna	JB1	A020106-1	2010-05-28
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
EMCO	Antenna, Horn	3115	9511-4627	2010-08-09
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09
Agilent	Pre Amplifier	8449B	3008A01978	2010-01-29

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

13.6 Test Procedure

For the radiated emissions test, the EUT host, 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 meter away from the testing antenna, which is varied from 1-4 meter, 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

13.7 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10dB)

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

Margin = Corrected Amplitude - Limit

13.8 Test Environmental Conditions

Temperature:	16~20 °C
Relative Humidity:	31~40 %
ATM Pressure:	101.2-102.4kPa

The testing was performed by Jerry Huang on 2010-12-1 ~ 2010-12-2 in 5 meter chamber 3.

13.9 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247 standard's radiated emissions limits, and had the worst margin of:

DSSS:

30-1000 MHz:

Mode: Transmitting – Main Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-21.57	31.00325	Horizontal	30 MHz – 1GHz

Mode: Transmitting – Bottom Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-20.26	946.7113	Vertical	30 MHz – 1GHz

Mode: Transmitting – Back Antenna in Vertical Polarity			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-21.39	30.8285	Horizontal	30 MHz – 1GHz

Mode: Transmitting – Main Antenna in Horizontal Polarity			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-20.77	30.01465	Horizontal	30 MHz – 1GHz

Above 1 GHz:

Mode: Transmitting – Main Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-6.758	4950	Horizontal	1GHz– 25GHz

Mode: Transmitting – Bottom Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-7.711	4880	Vertical	1GHz– 25GHz

Mode: Transmitting – Back Antenna in Vertical Polarity			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-14.021	4880	Horizontal	1GHz– 25GHz

Mode: Transmitting – Main Antenna in Horizontal Polarity			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-10.861	4810	Horizontal	1GHz– 25GHz

FHSS:

30-1000 MHz:

Mode: Transmitting – Main Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-9	512.0315	Vertical	30 MHz – 1GHz

Mode: Transmitting – Bottom Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-8.86	448.0183	Vertical	30 MHz – 1GHz

Above 1 GHz:

Mode: Transmitting – Main Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-10.028	4950	Vertical	1GHz– 25GHz

Mode: Transmitting – Bottom Antenna			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range**
-10.26	4950	Vertical	1GHz– 25GHz

The EUT can only transmit with one antenna or the other by using the internal auto switch to choosing the MAX performance antenna.

The radio transceiver can at a given time only transmit either FHSS or DSSS and cannot transmit both modulations at the same time.

Please refer to the following table and plots for specific test result details

13.10 Radiated Spurious Emissions Test Data and Plots

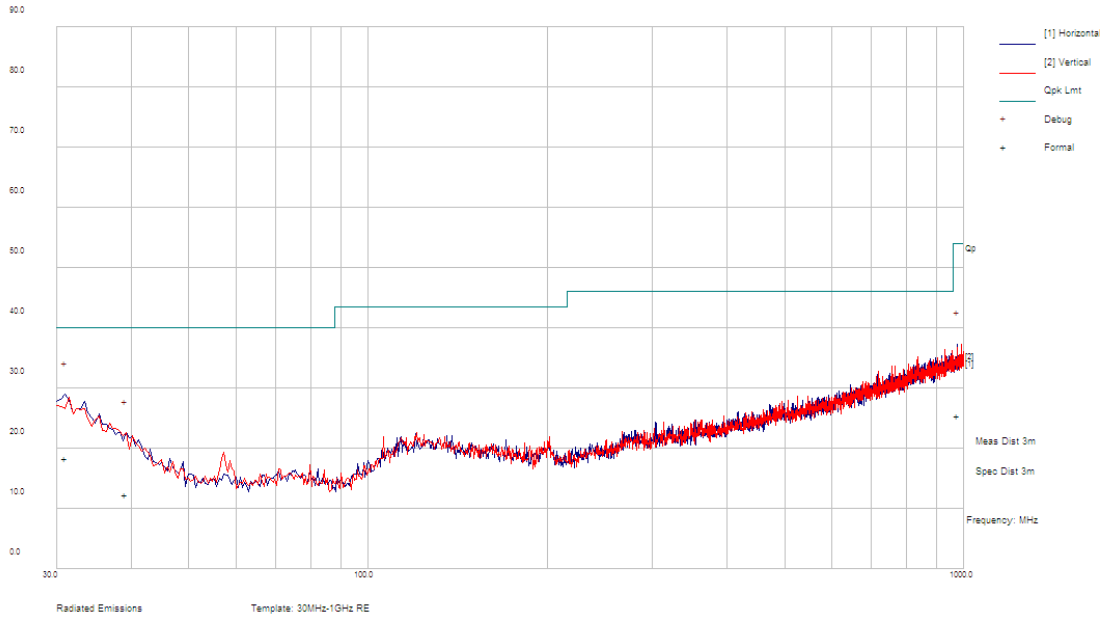
DSSS:

3 0 MHz – 1 GHz:

Main Antenna in Vertical Polarity @ 3 meters

EUT worked on worst channel.

High Channel (2475 MHz)



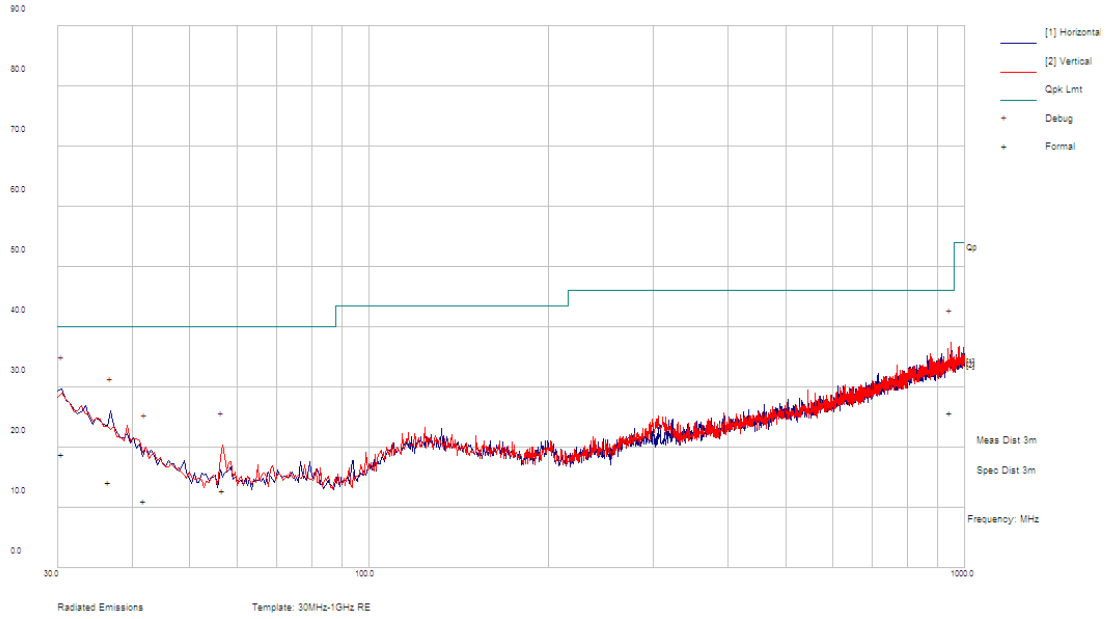
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
31.00325	18.43	H	160	25	40	-21.57
39.17775	12.32	H	246	173	40	-27.68
974.6378	25.37	H	150	72	54	-28.63

Bottom Antenna in Vertical Polarity @ 3 meters

EUT worked on worst channel.

High Channel (2475 MHz)



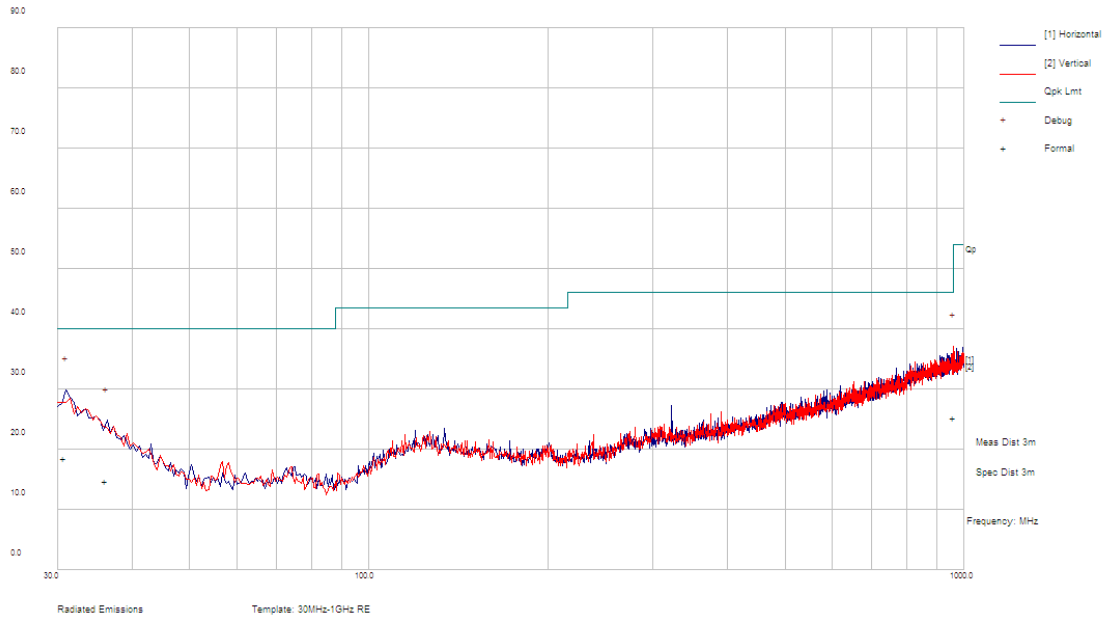
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
946.7113	25.74	V	187	242	46	-20.26
30.49775	18.82	H	246	125	40	-21.18
36.55175	14.22	H	286	117	40	-25.78
56.84225	12.80	V	195	53	40	-27.20
41.90900	11.17	H	374	6	40	-28.83

Back Antenna in Vertical Polarity @ 3 meters

EUT worked on worst channel.

High Channel (2475 MHz)



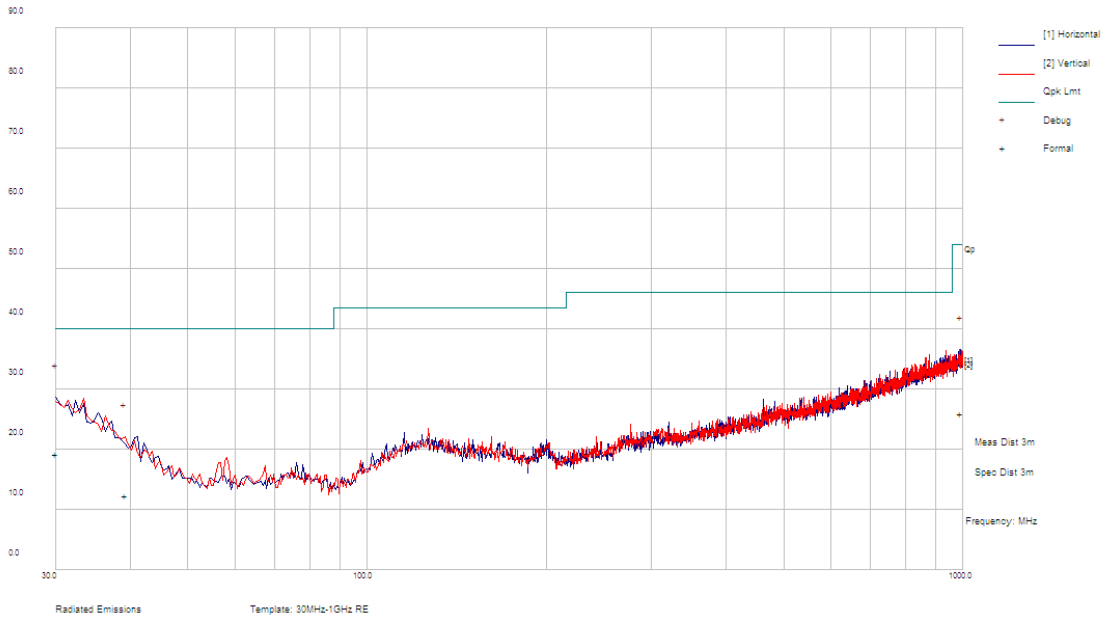
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30.82850	18.61	H	164	344	40	-21.39
36.10625	14.72	H	238	105	40	-25.28
960.9343	25.29	V	141	31	54	-28.71

Back Antenna in Horizontal Polarity @ 3 meters

EUT worked on worst channel.

High Channel (2475 MHz)



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30.01465	19.23	H	175	62	40	-20.77
990.40980	25.96	H	161	9	54	-28.04
39.27925	12.32	V	192	96	40	-27.68

1 GHz – 25 GHz:

1) Main Antenna in Vertical Polarity, Measured at 3 meters

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	Comment
Low Channel: 2405 MHz											
4810	42.26	19	152	H	32.789	4.56	27.5	52.109	74	-21.891	Peak
4810	41.37	334	103	V	32.789	4.56	27.5	51.219	74	-22.781	Peak
4810	31.96	19	152	H	32.789	4.56	27.5	41.809	54	-12.191	Ave
4810	30.95	334	103	V	32.789	4.56	27.5	40.799	54	-13.201	Ave
Middle Channel: 2440 MHz											
4880	42.18	254	159	H	33.615	4.02	27.4	52.415	74	-21.585	Peak
4880	40.7	222	142	V	33.615	4.02	27.4	50.935	74	-23.065	Peak
4880	31.6	254	159	H	33.615	4.02	27.4	41.835	54	-12.165	Ave
4880	30.42	222	142	V	33.615	4.02	27.4	40.655	54	-13.345	Ave
High Channel: 2475 MHz											
4950	46.3	291	115	H	32.942	4.52	27.4	56.362	74	-17.638	Peak
4950	45.16	236	100	V	32.942	4.52	27.4	55.222	74	-18.778	Peak
4950	37.18	291	115	H	32.942	4.52	27.4	47.242	54	-6.758	Ave
4950	34.39	236	100	V	32.942	4.52	27.4	44.452	54	-9.548	Ave

2) Bottom Antenna in Vertical Polarity, Measured at 3 meters

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	Comment
Low Channel: 2405 MHz											
4810	41.92	21	107	H	32.789	4.56	27.5	51.769	74	-22.231	Peak
4810	42.42	331	100	V	32.789	4.56	27.5	52.269	74	-21.731	Peak
4810	31.55	21	107	H	32.789	4.56	27.5	41.399	54	-12.601	Ave
4810	31.4	331	100	V	32.789	4.56	27.5	41.249	54	-12.751	Ave
Middle Channel: 2440 MHz											
4880	43.86	18	110	H	32.789	4.54	27.4	53.789	74	-20.211	Peak
4880	45.8	28	228	V	32.789	4.54	27.4	55.729	74	-18.271	Peak
4880	34.51	18	110	H	32.789	4.54	27.4	44.439	54	-9.561	Ave
4880	36.36	28	228	V	32.789	4.54	27.4	46.289	54	-7.711	Ave
High Channel: 2475 MHz											
4950	45.31	16	107	H	32.942	4.52	27.4	55.372	74	-18.628	Peak
4950	44.41	339	273	V	32.942	4.52	27.4	54.472	74	-19.528	Peak
4950	36.04	16	107	H	32.942	4.52	27.4	46.102	54	-7.898	Ave
4950	34.72	339	273	V	32.942	4.52	27.4	44.782	54	-9.218	Ave

3) Back Antenna in Vertical Polarity, Measured at 3 meters

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	Comment
Low Channel: 2405 MHz											
4810	41.53	305	119	H	32.789	4.56	27.5	51.379	74	-22.621	Peak
4810	40.25	146	100	V	32.789	4.56	27.5	50.099	74	-23.901	Peak
4810	31.6	305	119	H	32.789	4.56	27.5	41.449	54	-12.551	Ave
4810	27.99	146	100	V	32.789	4.56	27.5	37.839	54	-16.161	Ave
Middle Channel: 2440 MHz											
4880	41.05	310	114	H	32.789	4.54	27.4	50.979	74	-23.021	Peak
4880	40.04	145	100	V	32.789	4.54	27.4	49.969	74	-24.031	Peak
4880	30.05	310	114	H	32.789	4.54	27.4	39.979	54	-14.021	Ave
4880	28.4	145	100	V	32.789	4.54	27.4	38.329	54	-15.671	Ave
High Channel: 2475 MHz											
4950	40.17	306	104	H	32.942	4.52	27.4	50.232	74	-23.768	Peak
4950	38.63	229	111	V	32.942	4.52	27.4	48.692	74	-25.308	Peak
4950	28.84	306	104	H	32.942	4.52	27.4	38.902	54	-15.098	Ave
4950	26.29	229	111	V	32.942	4.52	27.4	36.352	54	-17.648	Ave

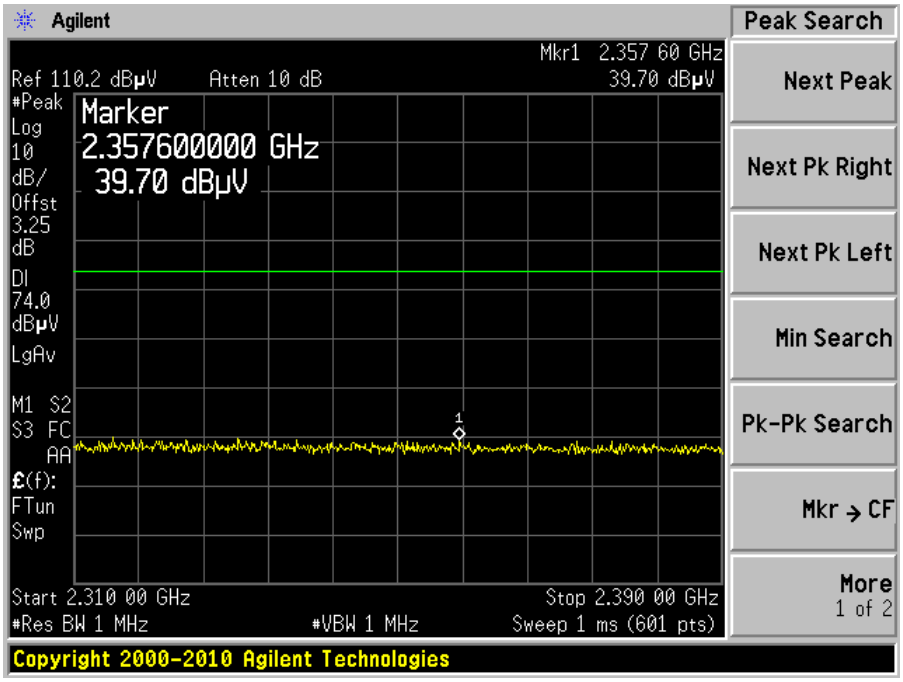
4) Back Antenna in Horizontal Polarity, Measured at 3 meters

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)				Limit (dBuV/m)	Margin (dB)	Comment
Low Channel: 2405 MHz											
4810	42.33	306	100	H	32.789	4.56	27.5	52.179	74	-21.821	Peak
4810	40.97	156	100	V	32.789	4.56	27.5	50.819	74	-23.181	Peak
4810	33.29	306	100	H	32.789	4.56	27.5	43.139	54	-10.861	Ave
4810	29.35	156	100	V	32.789	4.56	27.5	39.199	54	-14.801	Ave
Middle Channel: 2440 MHz											
4880	41	249	113	H	32.789	4.54	27.4	50.929	74	-23.071	Peak
4880	41.61	143	100	V	32.789	4.54	27.4	51.539	74	-22.461	Peak
4880	29.31	249	113	H	32.789	4.54	27.4	39.239	54	-14.761	Ave
4880	30.91	143	100	V	32.789	4.54	27.4	40.839	54	-13.161	Ave
High Channel: 2475 MHz											
4950	40.12	145	134	H	32.942	4.52	27.4	50.182	74	-23.818	Peak
4950	39.63	144	100	V	32.942	4.52	27.4	49.692	74	-24.308	Peak
4950	28.6	145	134	H	32.942	4.52	27.4	38.662	54	-15.338	Ave
4950	26.83	144	100	V	32.942	4.52	27.4	36.892	54	-17.108	Ave

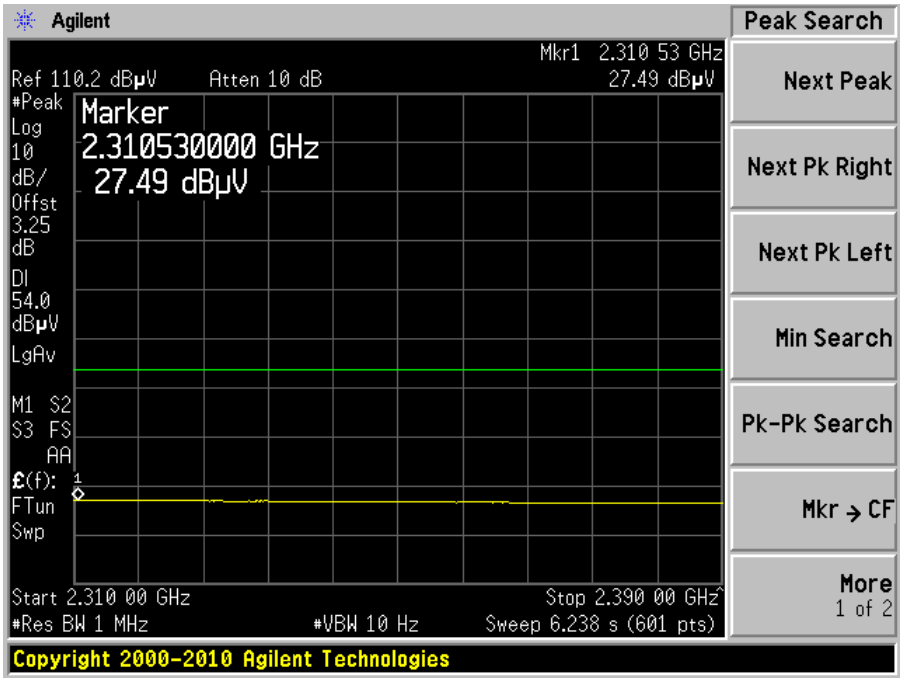
Restricted Band Emissions:

Main Antenna in Vertical Polarity

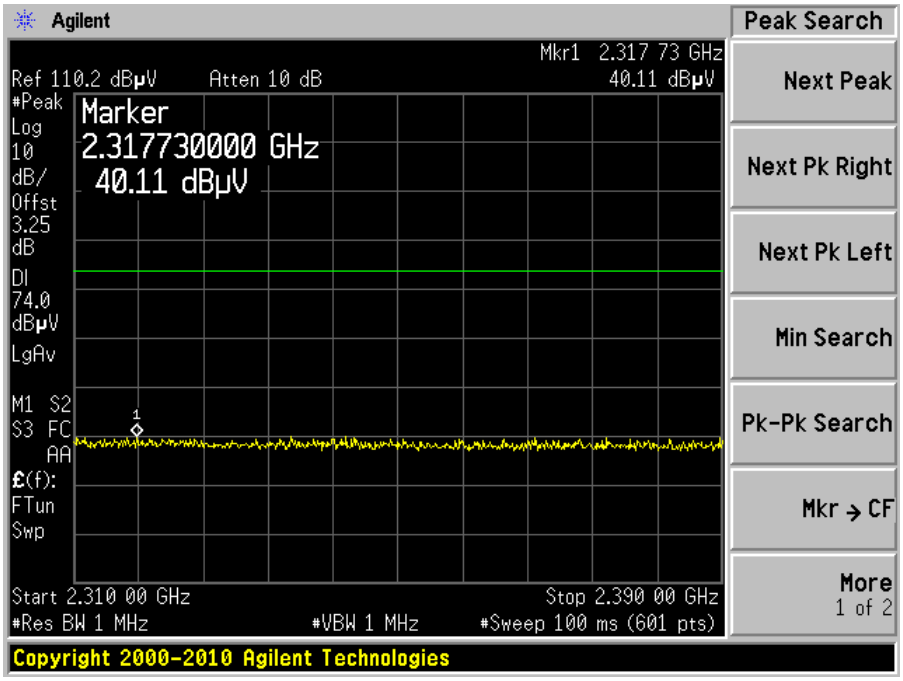
Main Antenna- Lowest Channel at Horizontal, Peak



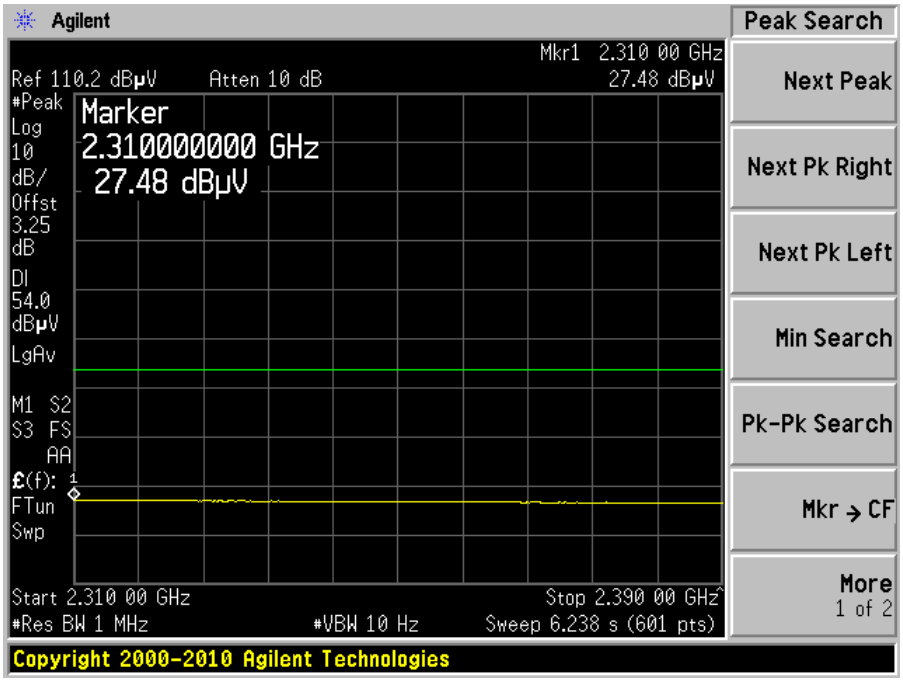
Main Antenna-Lowest Channel at Horizontal, Average



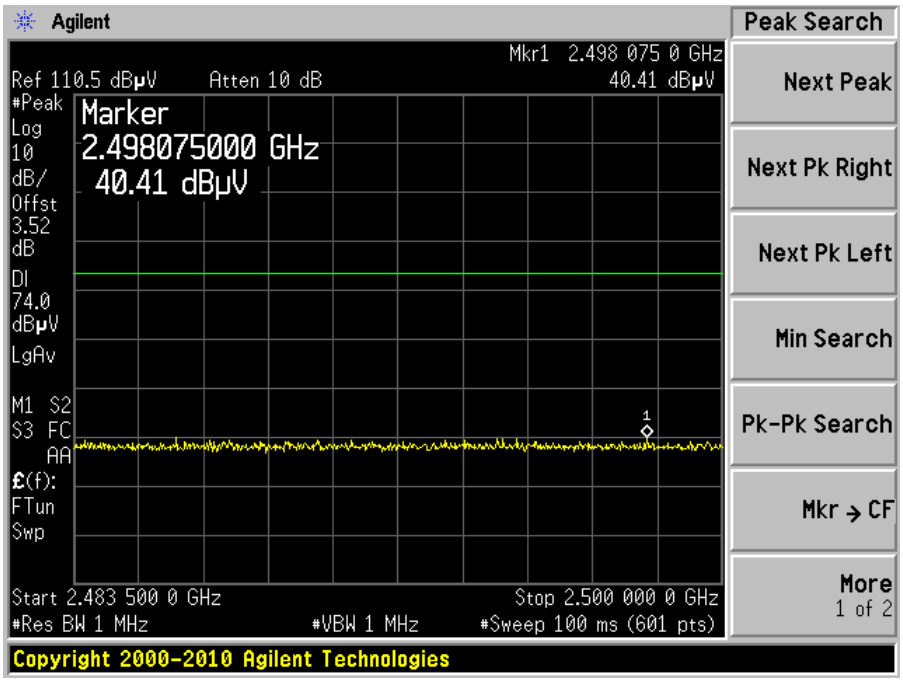
Main Antenna-Lowest Channel at Vertical, Peak



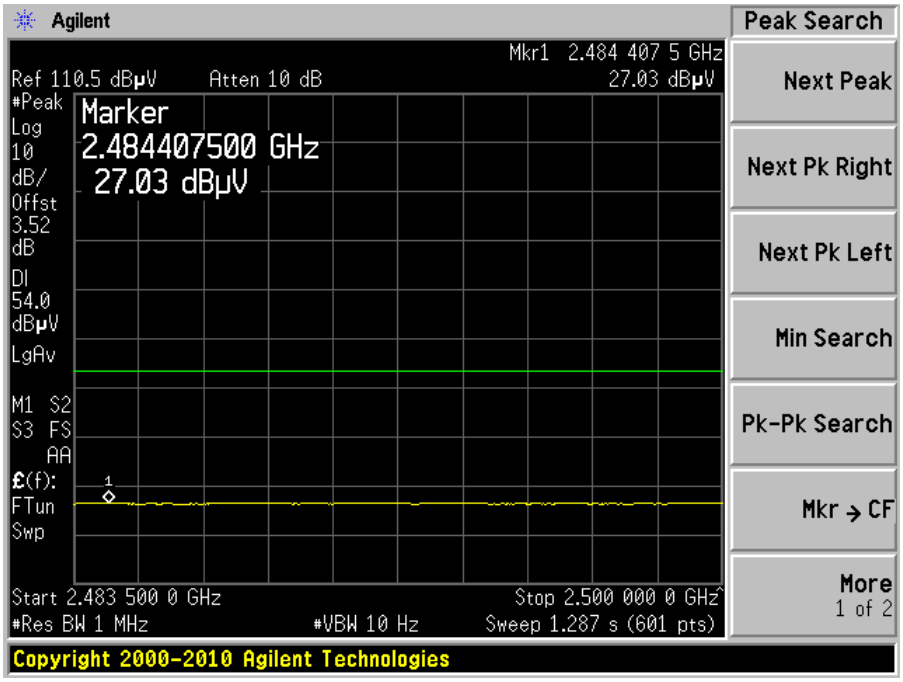
Main Antenna-Lowest Channel at Vertical, Average



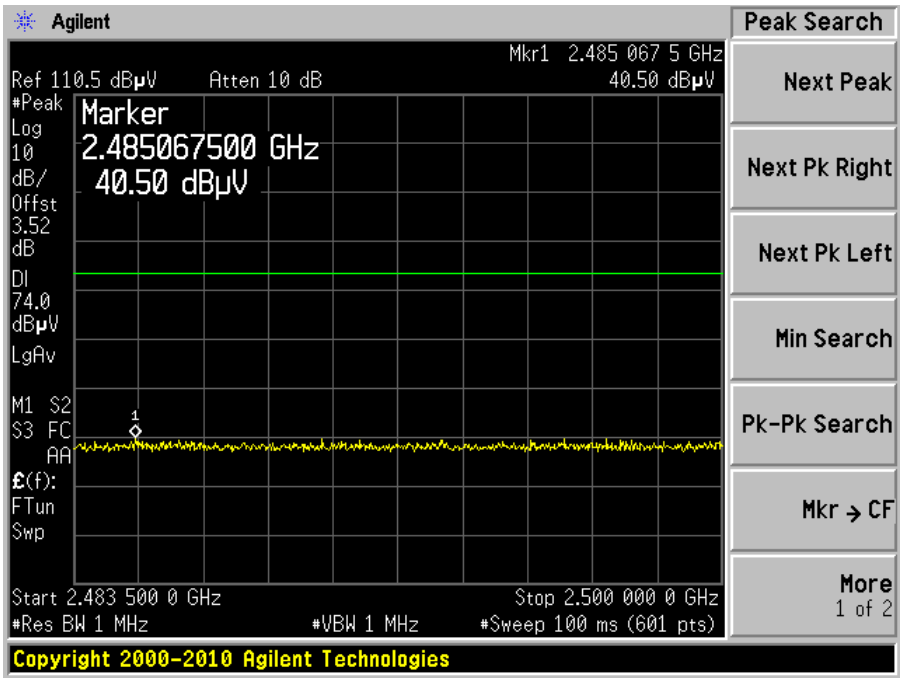
Main Antenna-Highest Channel at Horizontal, Peak



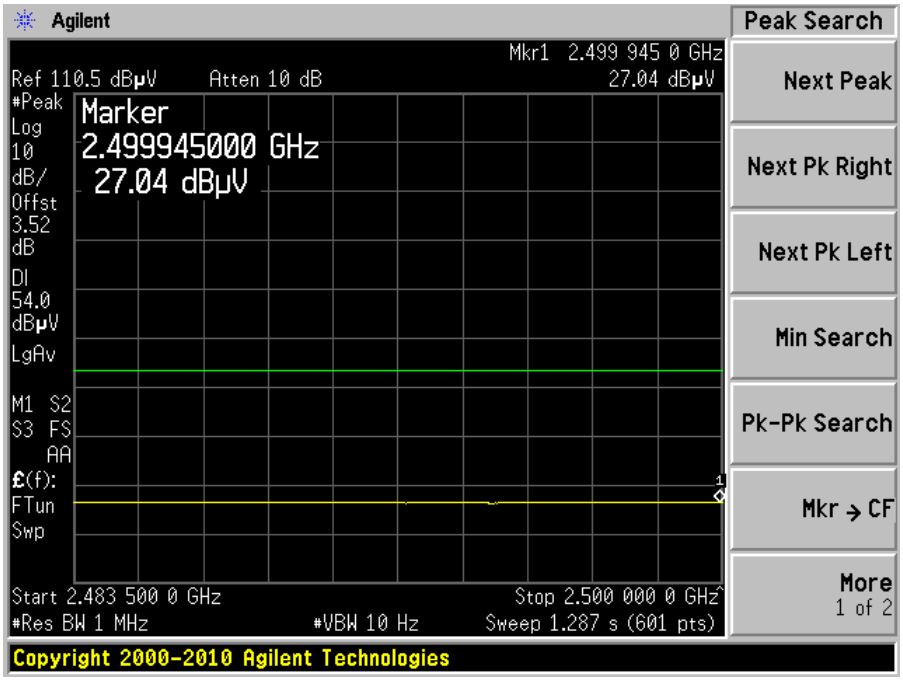
Main Antenna-Highest Channel at Horizontal, Average



Main Antenna-Highest Channel at Vertical, Peak

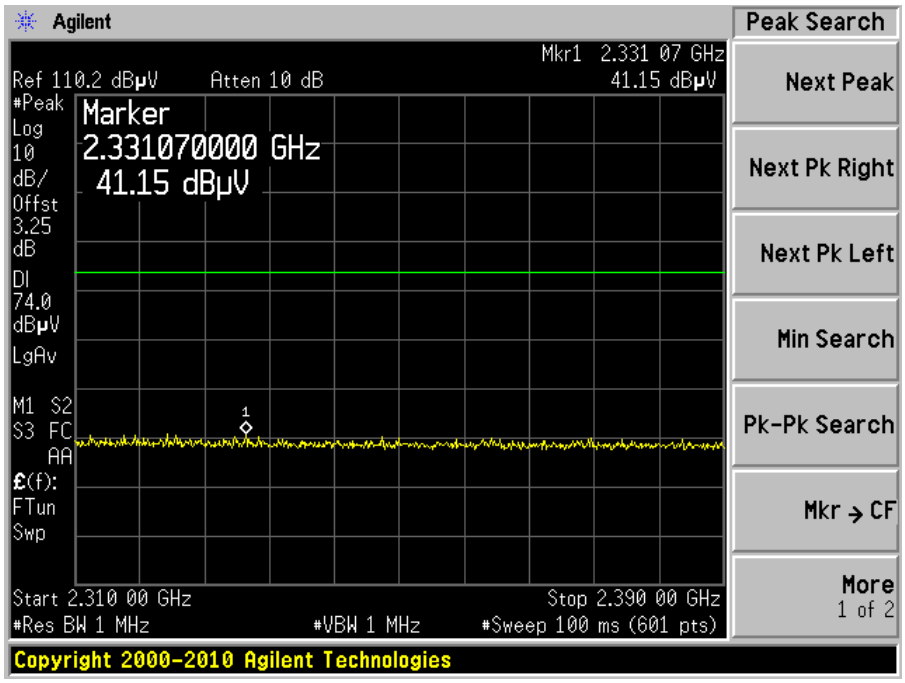


Main Antenna-Highest Channel at Vertical, Average

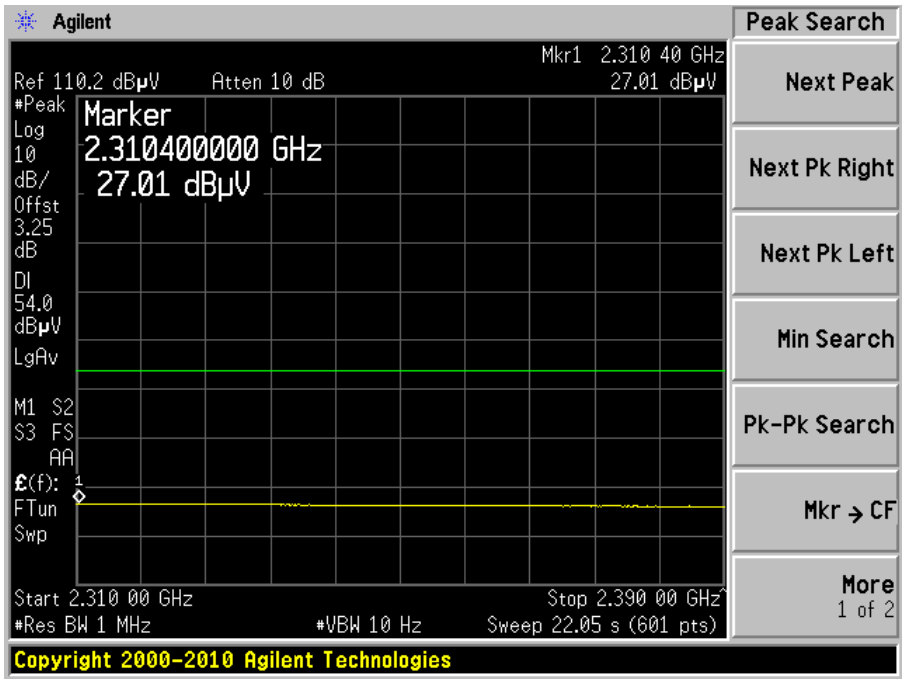


Bottom Antenna in Vertical Polarity

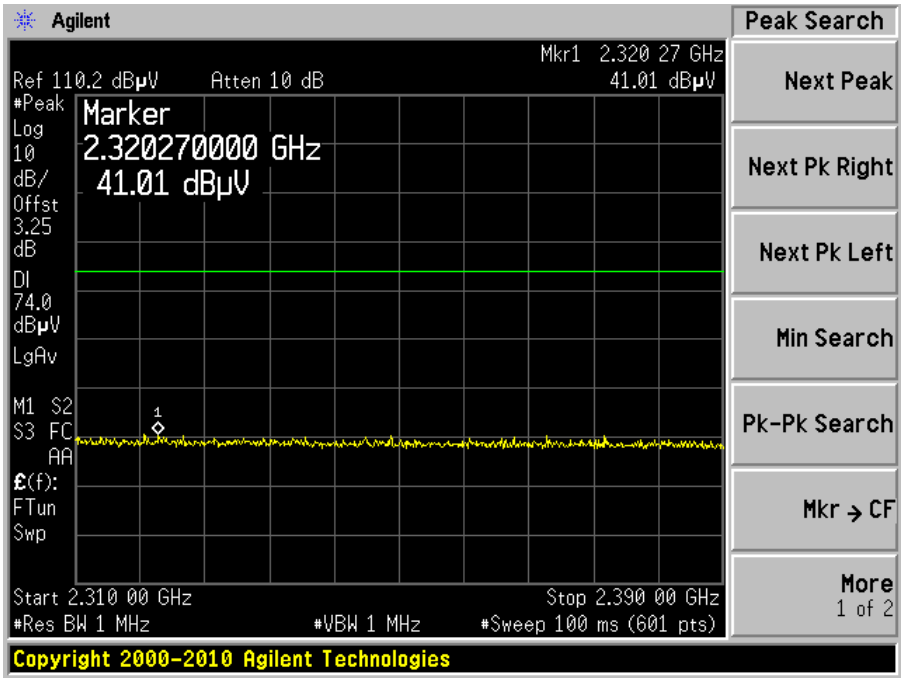
Bottom Antenna- Lowest Channel at Horizontal, Peak



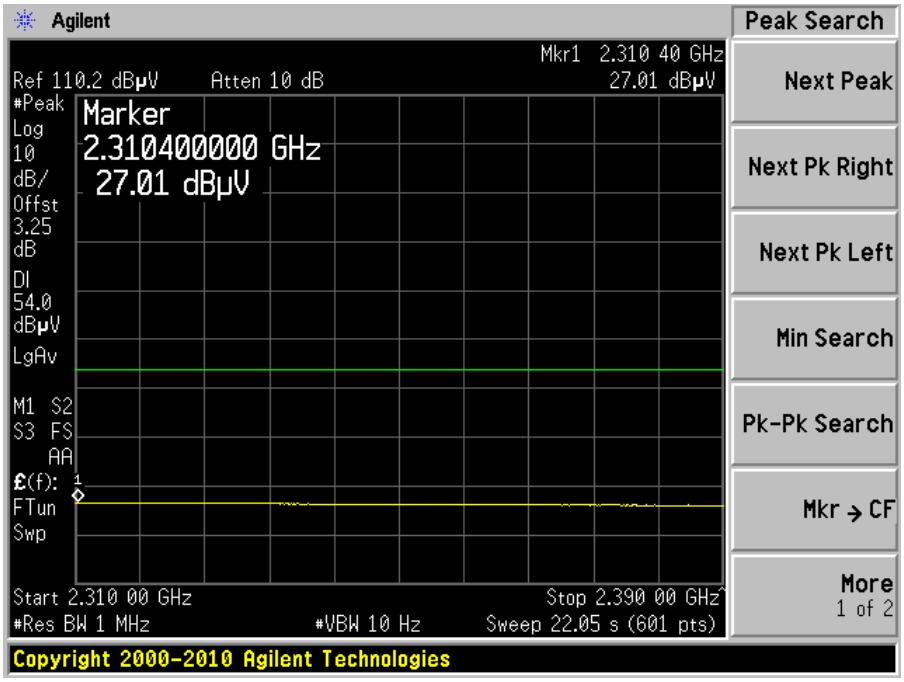
Bottom Antenna-Lowest Channel at Horizontal, Average



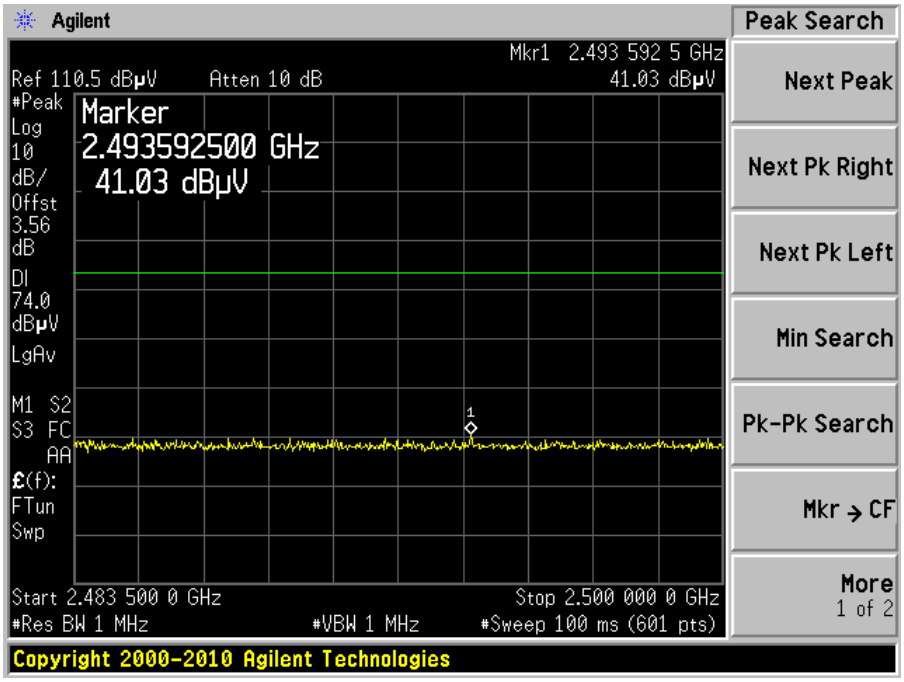
Bottom Antenna-Lowest Channel at Vertical, Peak



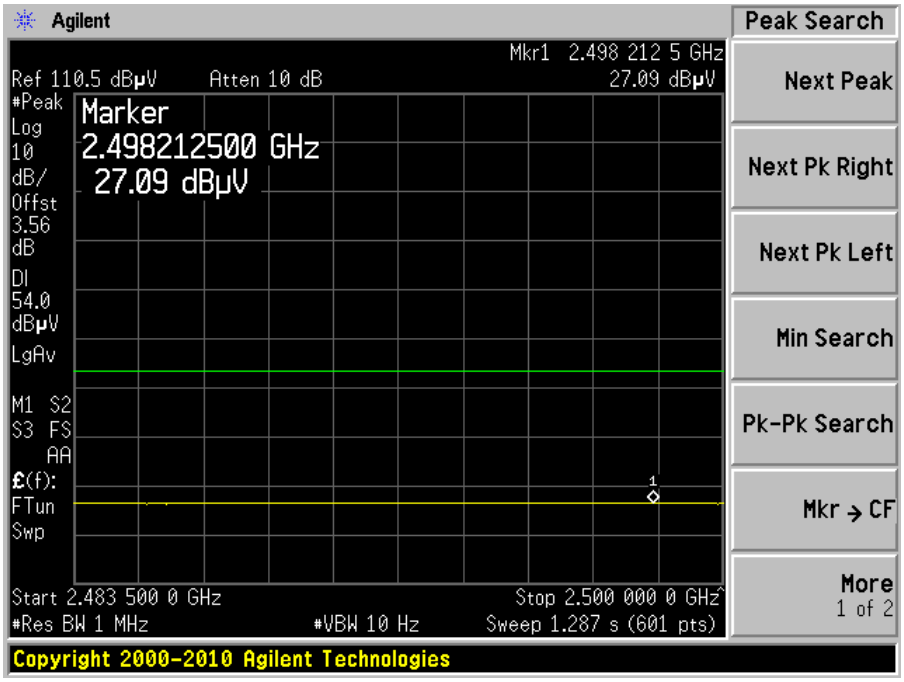
Bottom Antenna-Lowest Channel at Vertical, Average



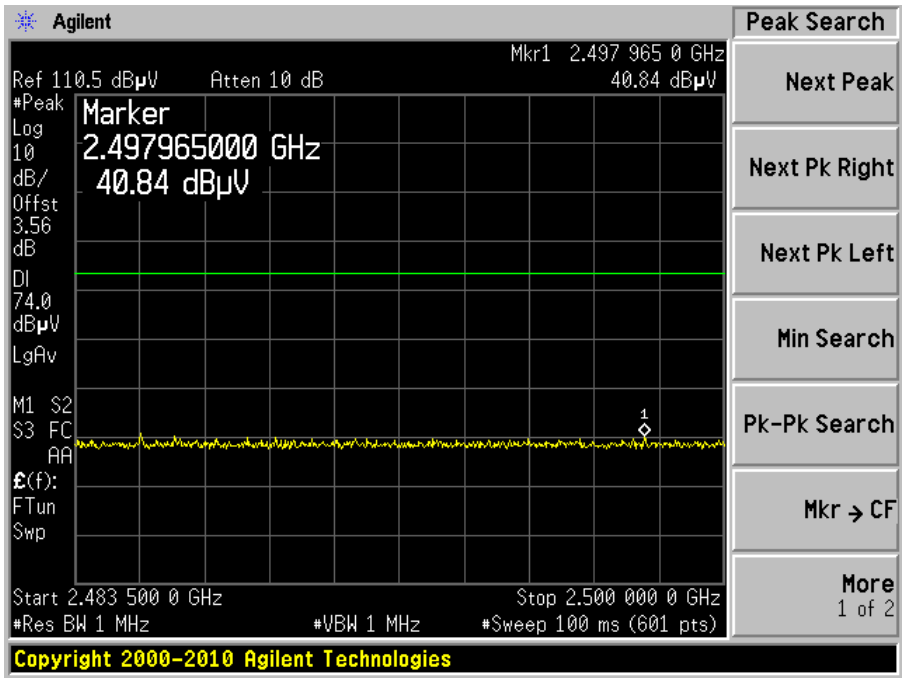
Bottom Antenna-Highest Channel at Horizontal, Peak



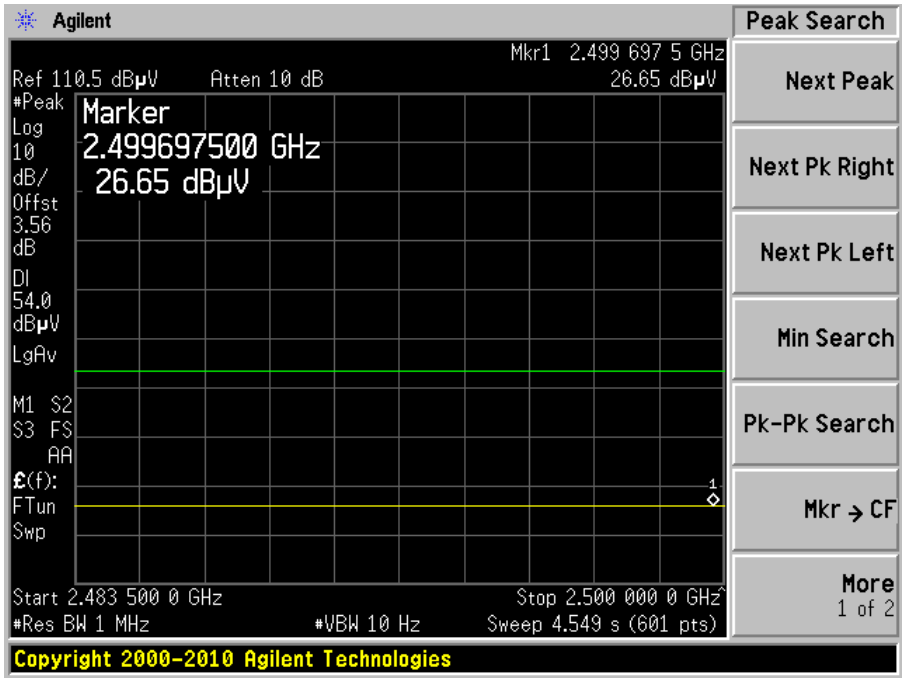
Bottom Antenna-Highest Channel at Horizontal, Average



Bottom Antenna-Highest Channel at Vertical, Peak

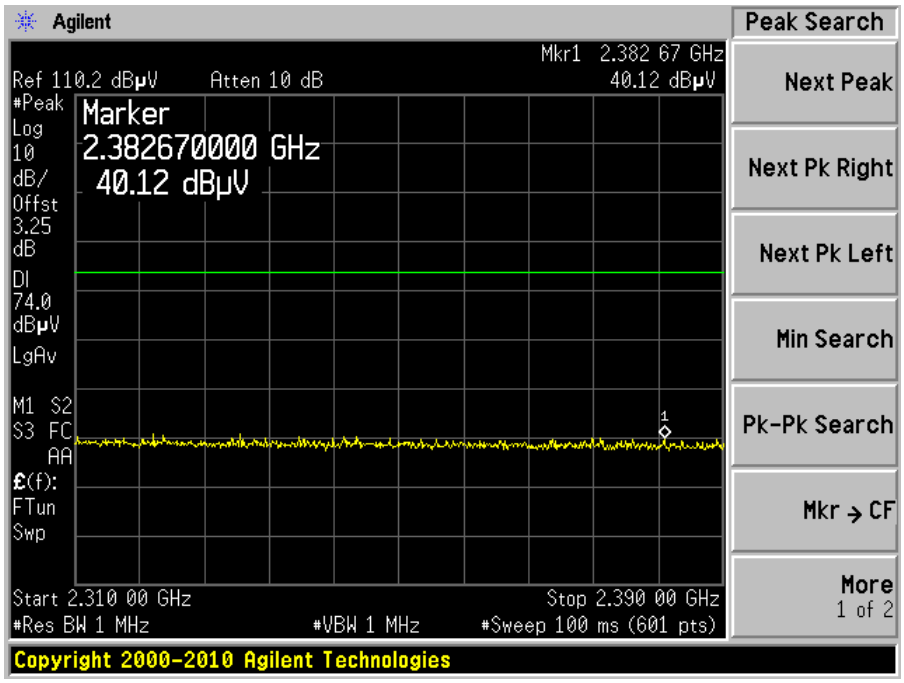


Bottom Antenna-Highest Channel at Vertical, Average

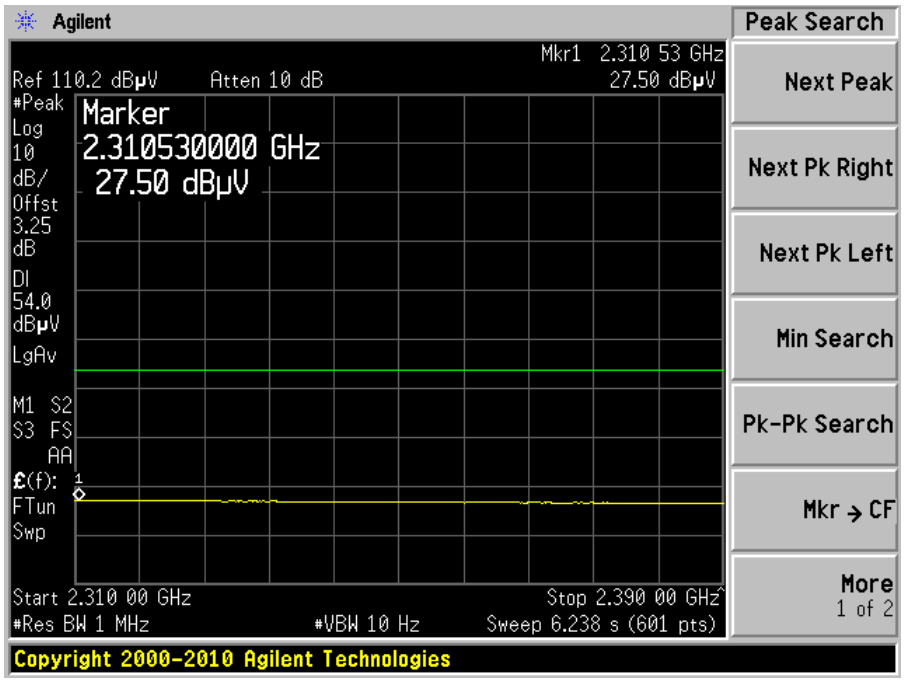


Back Antenna in Vertical Polarity

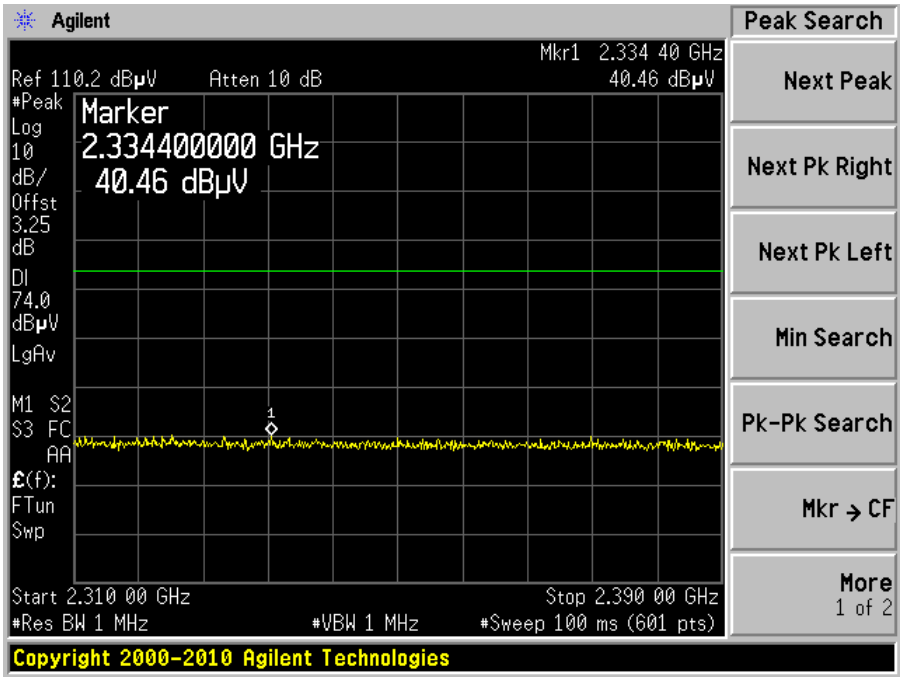
Back Antenna- Lowest Channel at Horizontal, Peak



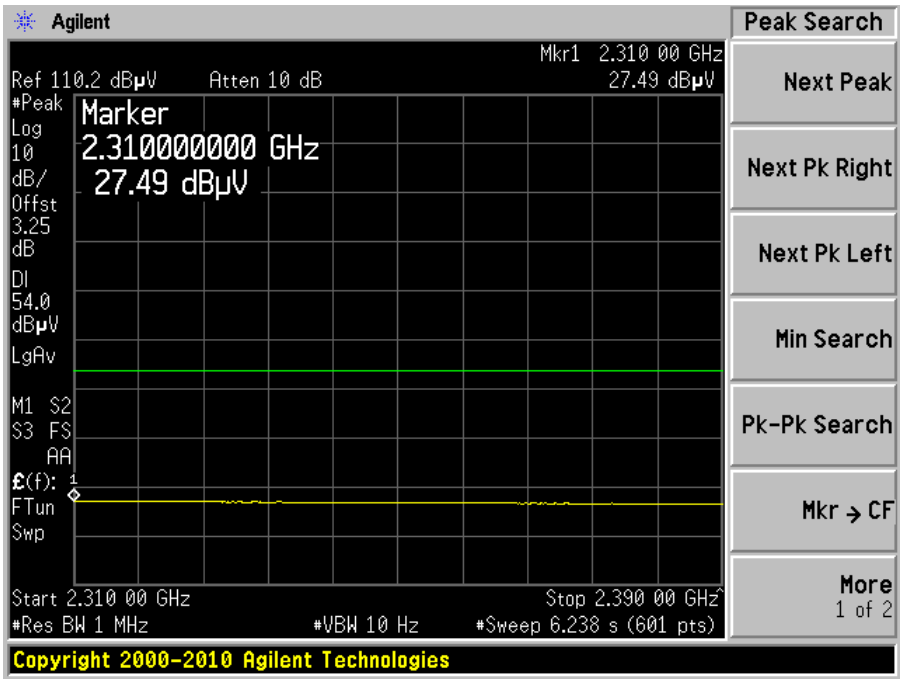
Back Antenna-Lowest Channel at Horizontal, Average



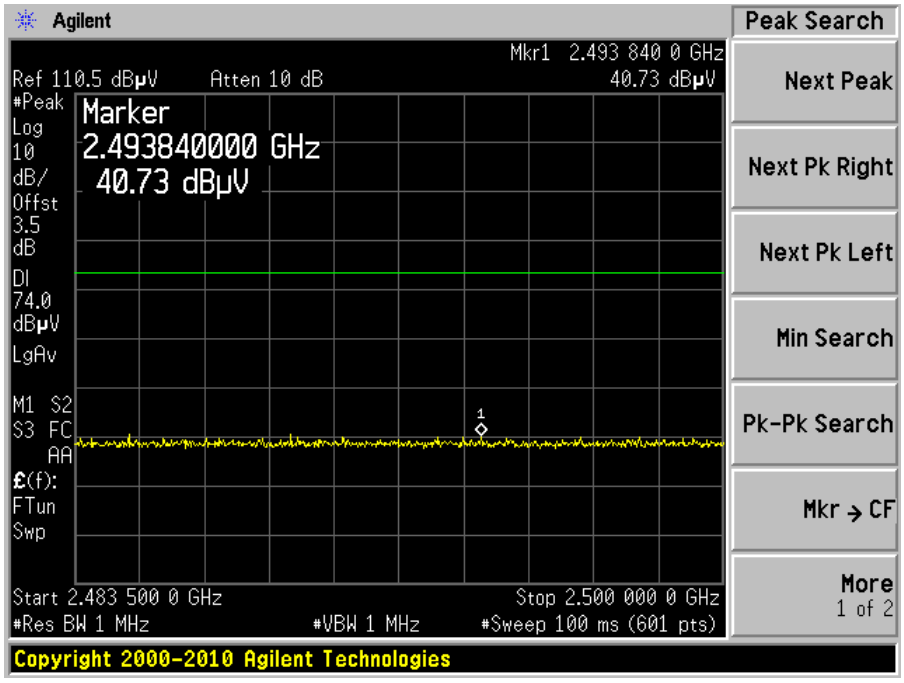
Back Antenna-Lowest Channel at Vertical, Peak



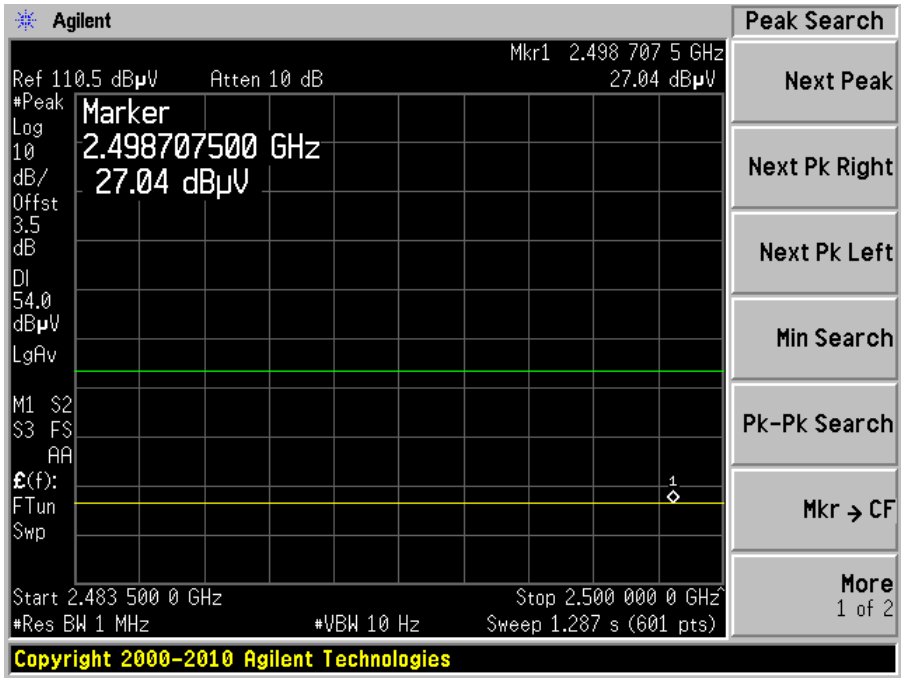
Back Antenna-Lowest Channel at Vertical, Average



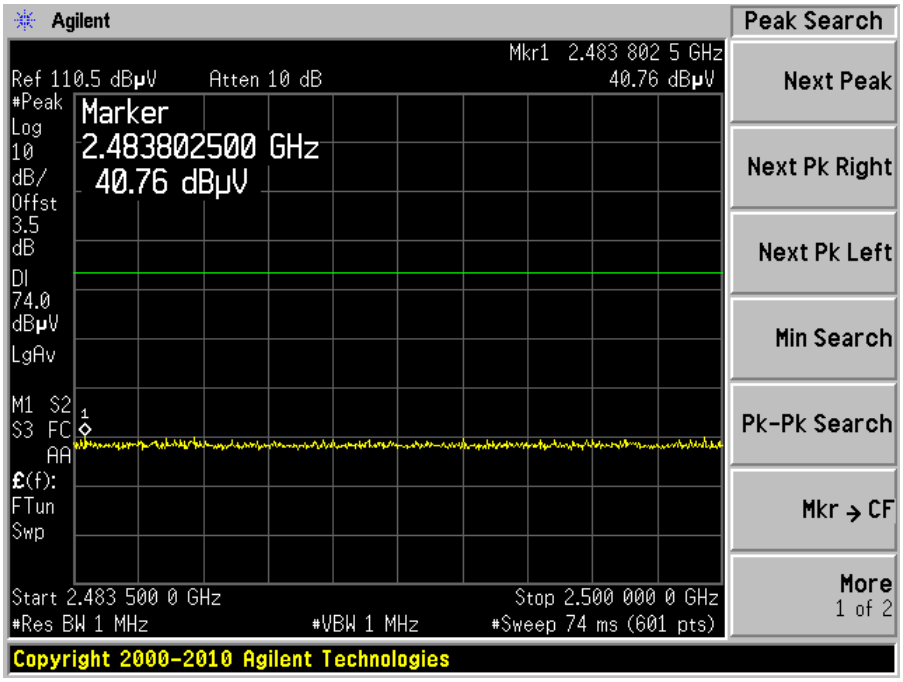
Back Antenna-Highest Channel at Horizontal, Peak



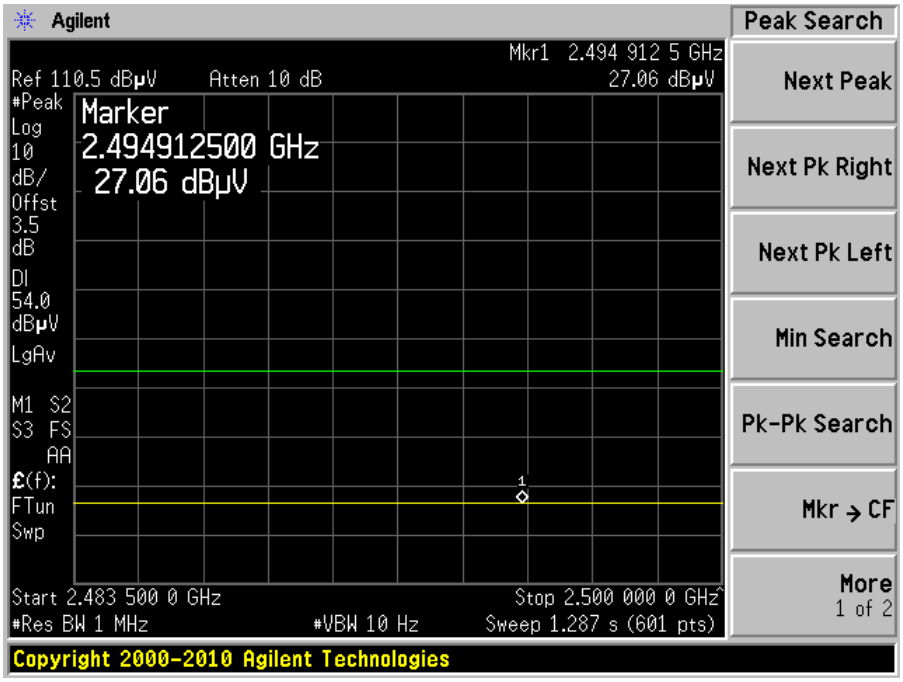
Back Antenna-Highest Channel at Horizontal, Average



Back Antenna-Highest Channel at Vertical, Peak

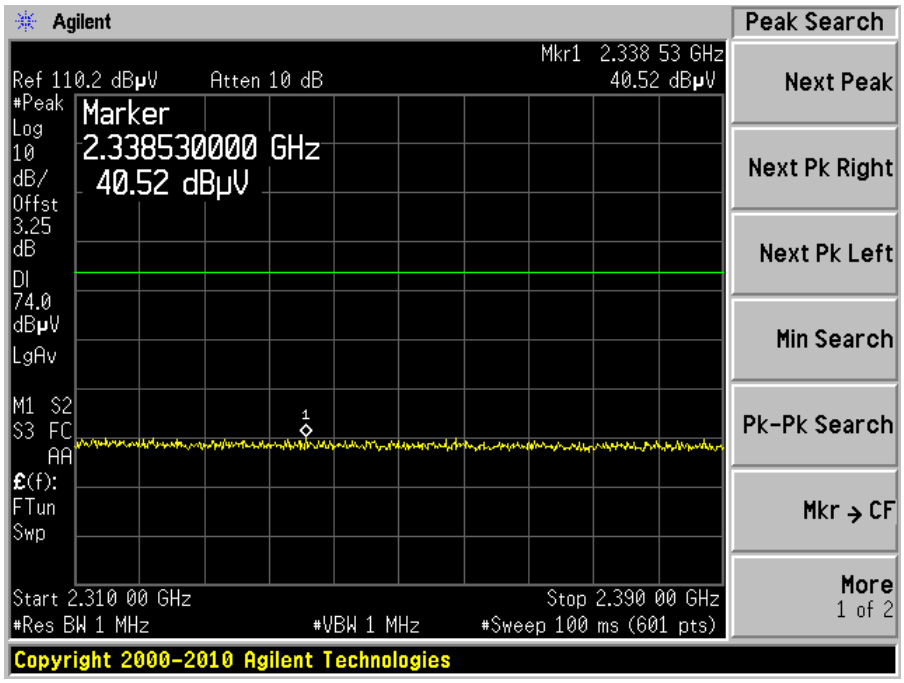


Back Antenna-Highest Channel at Vertical, Average

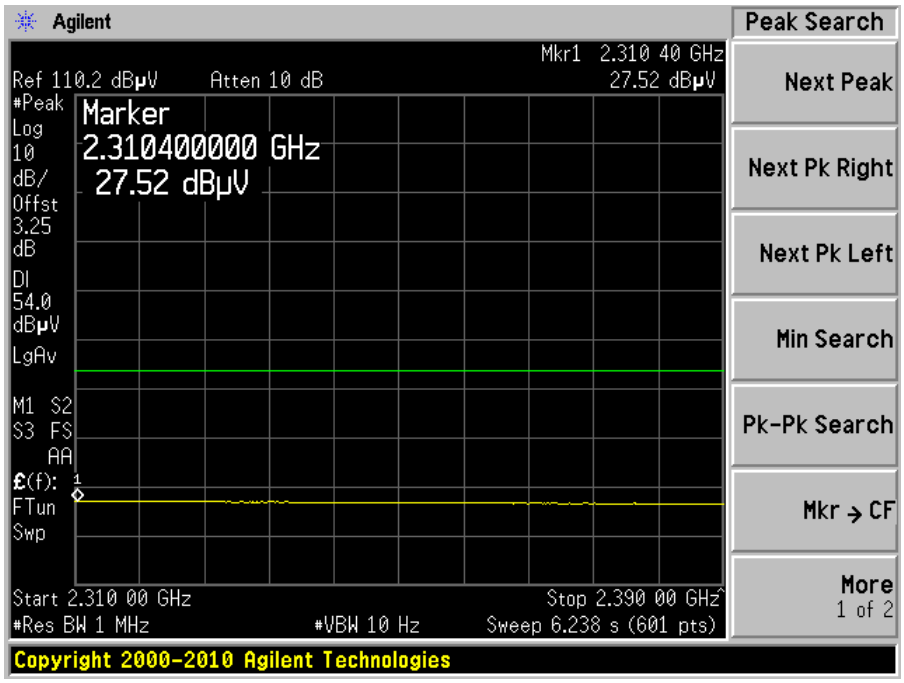


Back Antenna in Horizontal Polarity

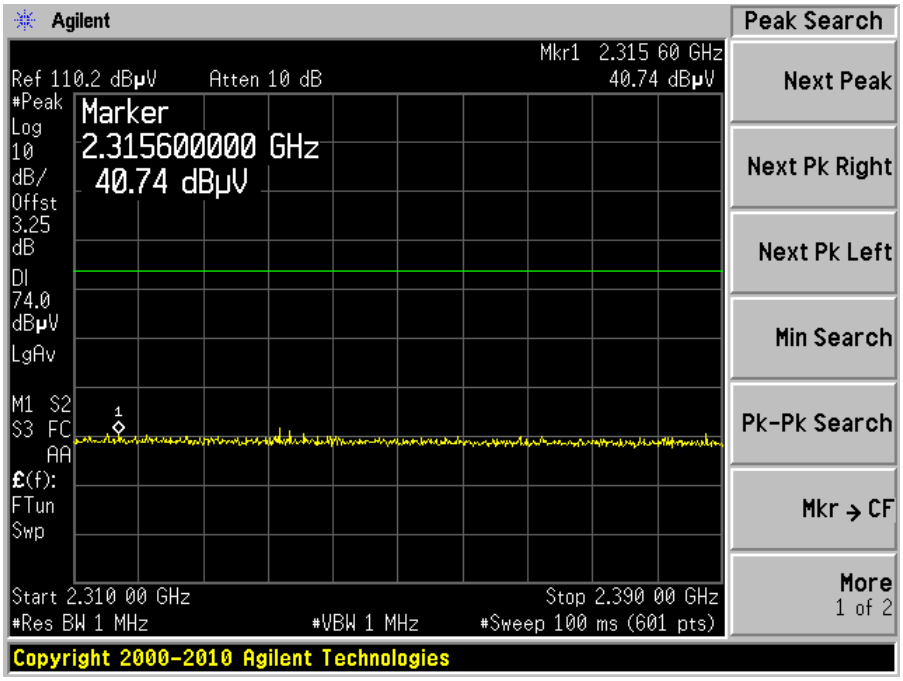
Back Antenna- Lowest Channel at Horizontal, Peak



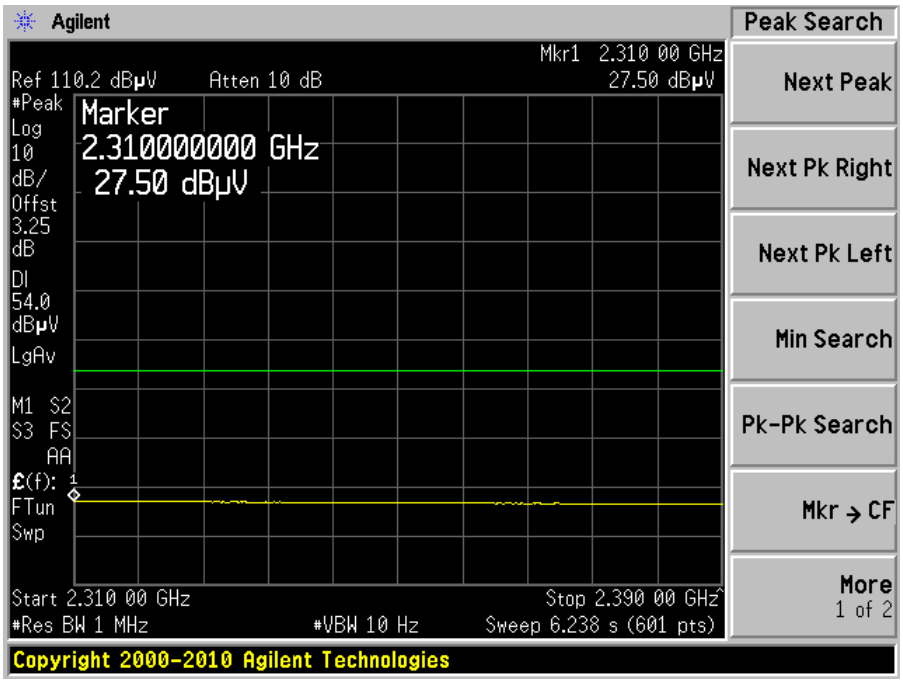
Back Antenna-Lowest Channel at Horizontal, Average



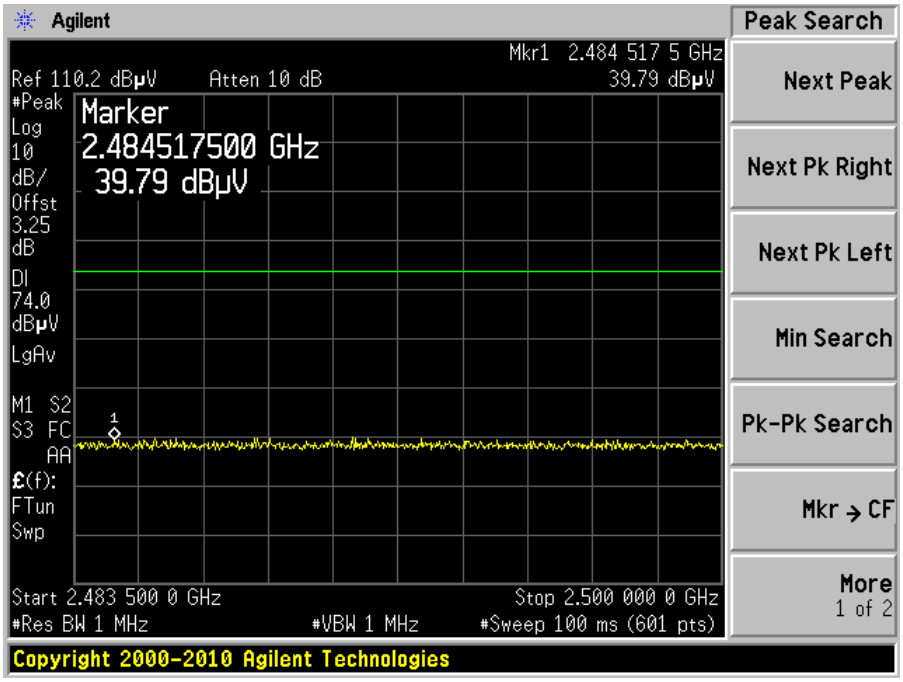
Back Antenna-Lowest Channel at Vertical, Peak



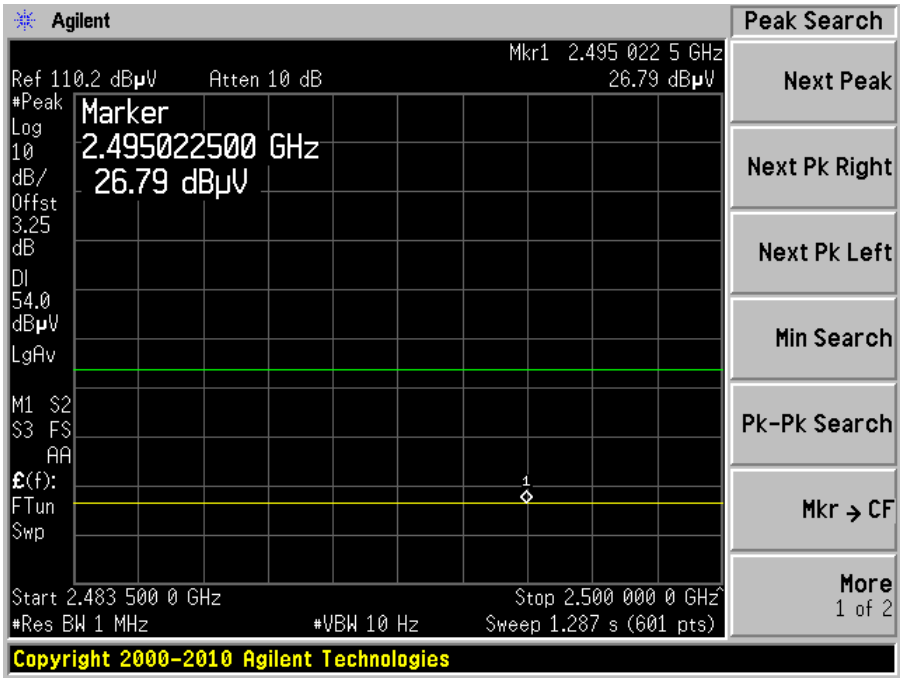
Back Antenna-Lowest Channel at Vertical, Average



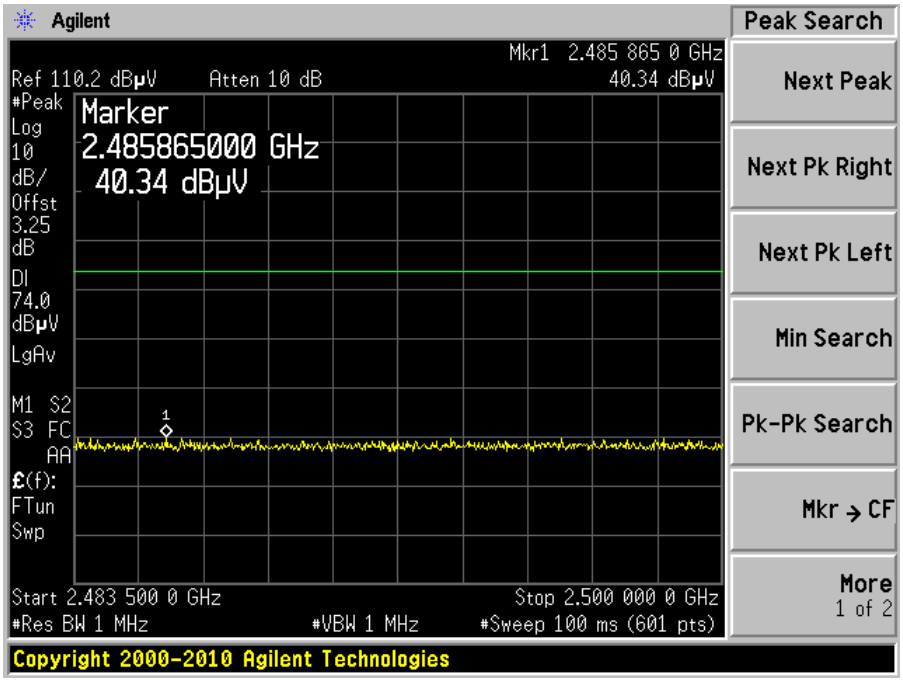
Back Antenna-Highest Channel at Horizontal, Peak



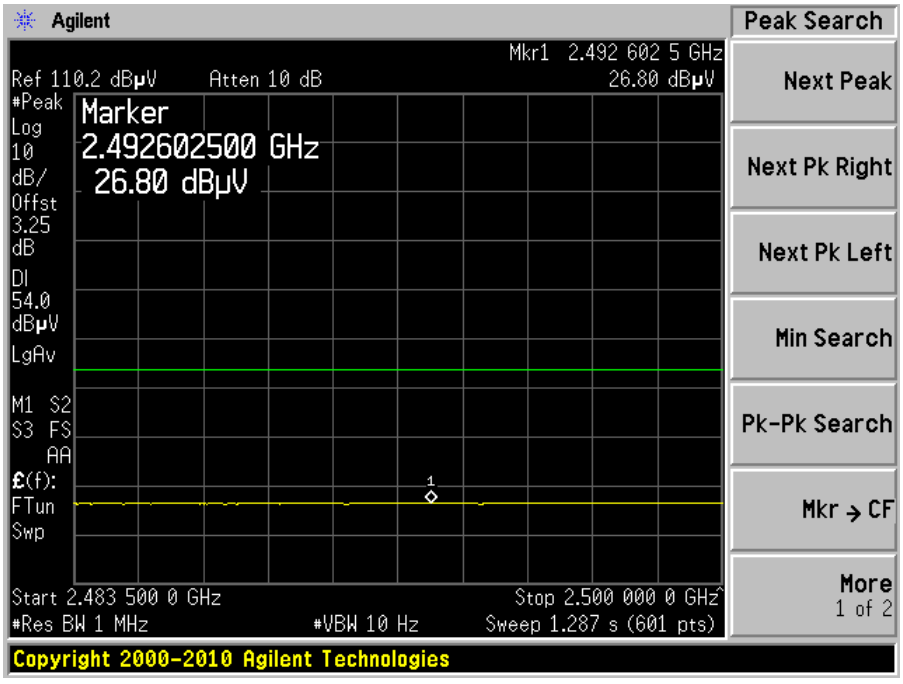
Back Antenna-Highest Channel at Horizontal, Average



Back Antenna-Highest Channel at Vertical, Peak



Back Antenna-Highest Channel at Vertical, Average



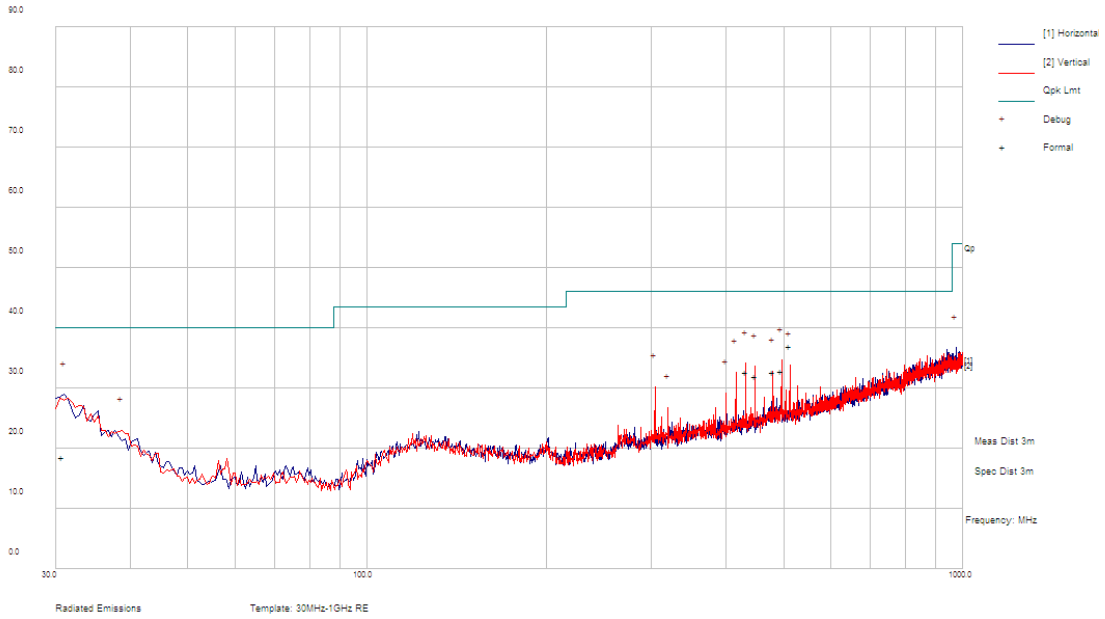
FHSS:

3 0 MHz – 1 GHz:

Main Antenna in Vertical Polarity @ 3 meters

EUT worked on worst channel.

High Channel (2479 MHz)



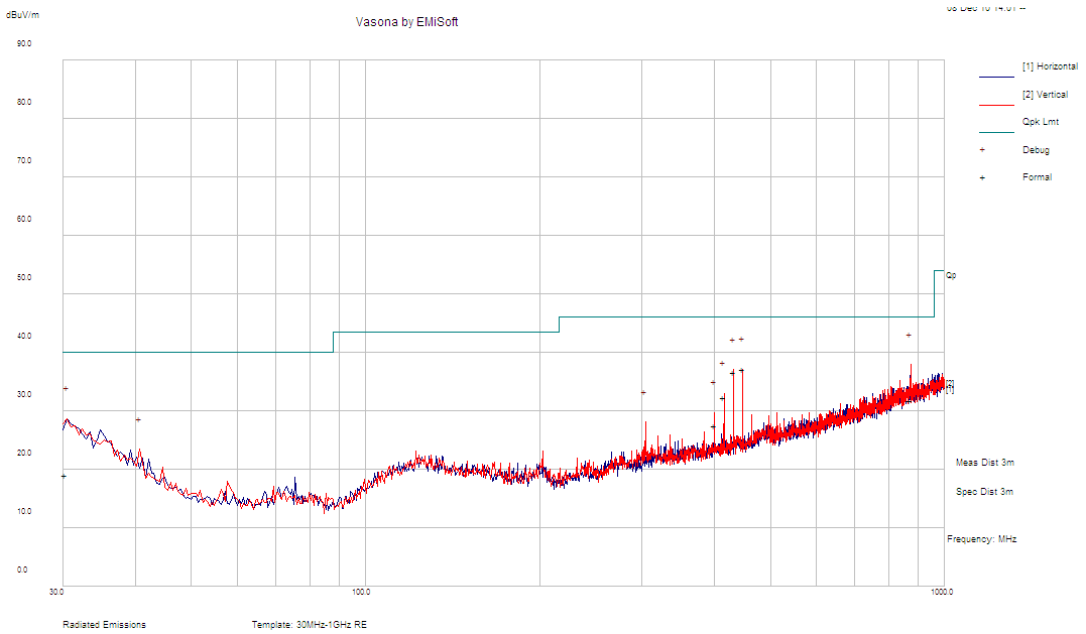
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
30.7855	18.59	H	401	159	40	-21.41
496.0208	32.91	V	97	177	46	-13.09
432.0313	32.67	V	92	359	46	-13.33
512.0315	37.00	V	98	185	46	-9.00
448.0333	32.04	V	98	358	46	-13.96
480.0355	32.61	V	91	0	46	-13.39

Bottom Antenna in Vertical Polarity @ 3 meters

EUT worked on worst channel.

High Channel (2479 MHz)



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
873.2270	31.74	V	169	196	46	-14.26
448.0183	37.14	V	97	5	46	-8.86
432.0193	36.66	V	100	6	46	-9.34
30.3205	19.00	V	97	310	40	-21.00
416.0215	32.37	V	102	0	46	-13.63

1 GHz – 25 GHz:

Main Antenna in Vertical Polarity, Measured at 3 meters

Low Channel: 2405 MHz

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle.	(dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
4810	51.96	302	100	H	32.789	4.56	27.5	0	61.809	74	-12.191	Peak
4810	51.65	16	260	V	32.789	4.56	27.5	0	61.499	74	-12.501	Peak
4810	37.03	302	100	H	32.789	4.56	27.5	-3.669	43.21	54	-10.79	Ave
4810	36.69	16	260	V	32.789	4.56	27.5	-3.669	42.87	54	-11.13	Ave

Middle Channel: 2440 MHz

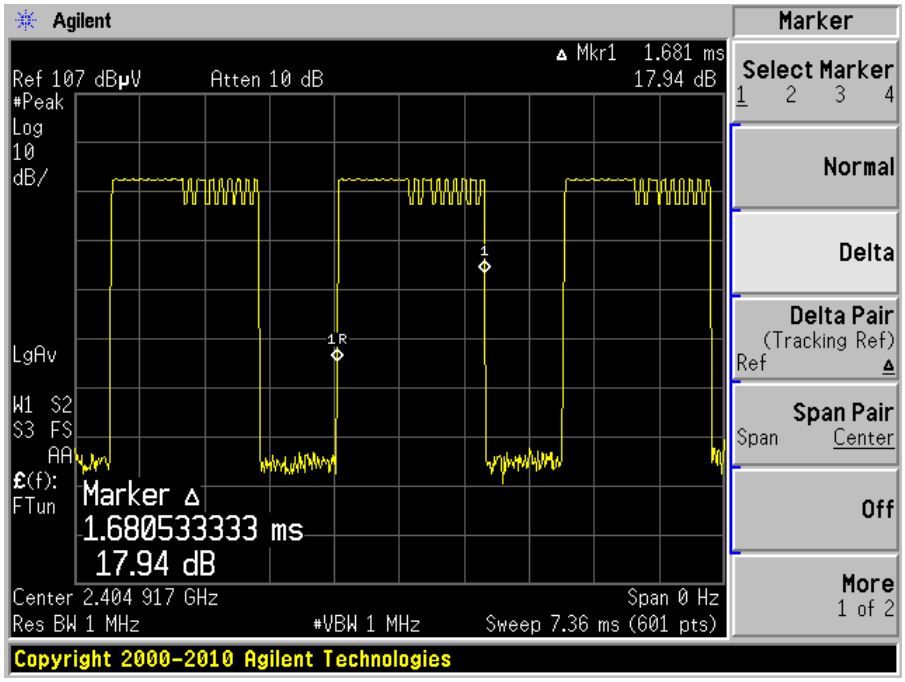
Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle.	(dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
4880	51.15	303	152	H	32.789	4.54	27.4	0	61.079	74	-12.921	Peak
4880	51.16	336	277	V	32.789	4.54	27.4	0	61.089	74	-12.911	Peak
4880	33.72	303	152	H	32.789	4.54	27.4	-3.669	39.98	54	-14.02	Ave
4880	36.97	336	277	V	32.789	4.54	27.4	-3.669	43.23	54	-10.77	Ave

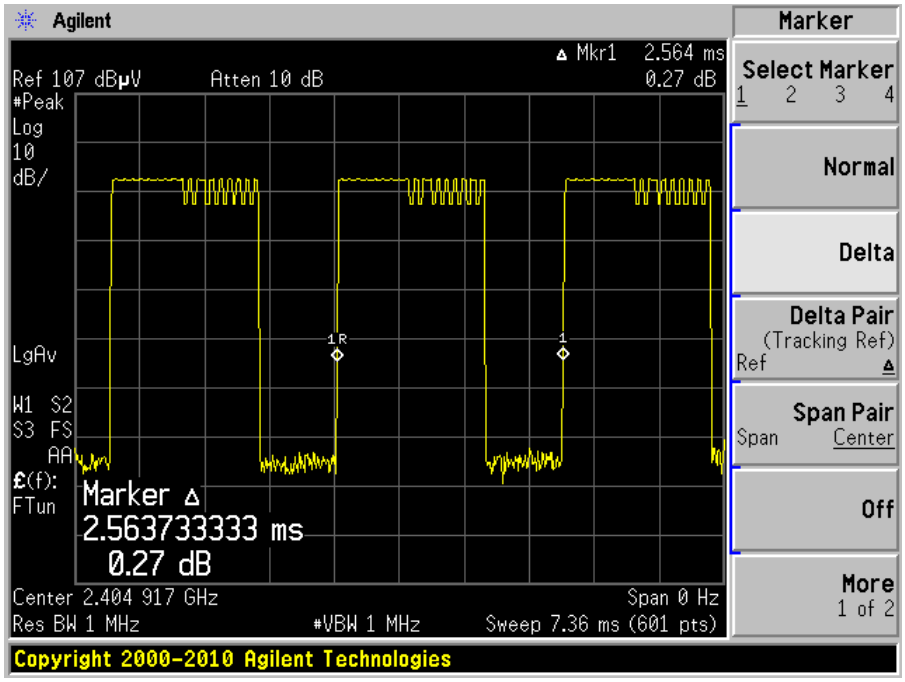
High Channel: 2479 MHz

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle.	(dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
4950	53.2	301	125	H	32.942	4.52	27.4	0	63.262	74	-10.738	Peak
4950	53.91	341	231	V	32.942	4.52	27.4	0	63.972	74	-10.028	Peak
4950	34.38	301	125	H	32.942	4.52	27.4	-3.669	40.773	54	-13.227	Ave
4950	38.11	341	231	V	32.942	4.52	27.4	-3.669	44.503	54	-9.497	Ave

Note: • Average Value (*) is calculated based on Peak Reading + Duty Cycle Factor
• Duty Cycle Factor (DCF) = 20 $\log_{10}$(Ton/Tp) = 20 $\log_{10}$(1.681/2.564ms) = -3.669dB

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





Bottom Antenna in Vertical Polarity, Measured at 3 meters

Low Channel: 2405 MHz

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle.	(dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
4810	48.31	309	100	H	32.789	4.56	27.5	0	58.159	74	-15.841	Peak
4810	47.9	331	100	V	32.789	4.56	27.5	0	57.749	74	-16.251	Peak
4810	35.09	309	100	H	32.789	4.56	27.5	-3.772	41.167	54	-12.833	Ave
4810	31.12	331	100	V	32.789	4.56	27.5	-3.772	37.197	54	-16.803	Ave

Middle Channel: 2440 MHz

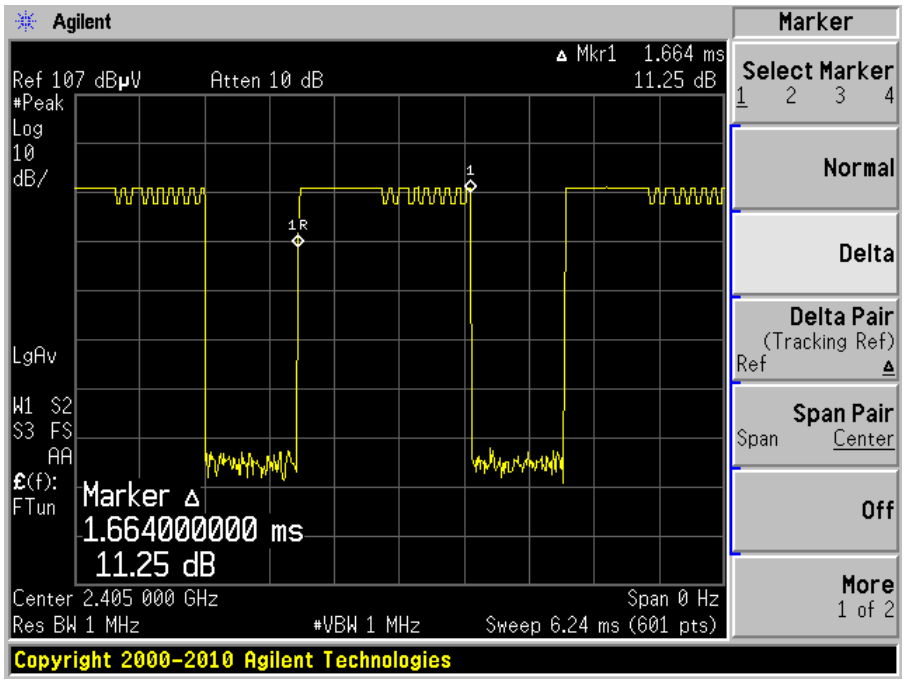
Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle.	(dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
4880	48.65	303	100	H	32.789	4.54	27.4	0	58.579	74	-15.421	Peak
4880	48.12	39	263	V	32.789	4.54	27.4	0	58.049	74	-15.951	Peak
4880	33.34	303	100	H	32.789	4.54	27.4	-3.772	39.497	54	-14.503	Ave
4880	33.95	39	263	V	32.789	4.54	27.4	-3.772	40.107	54	-13.893	Ave

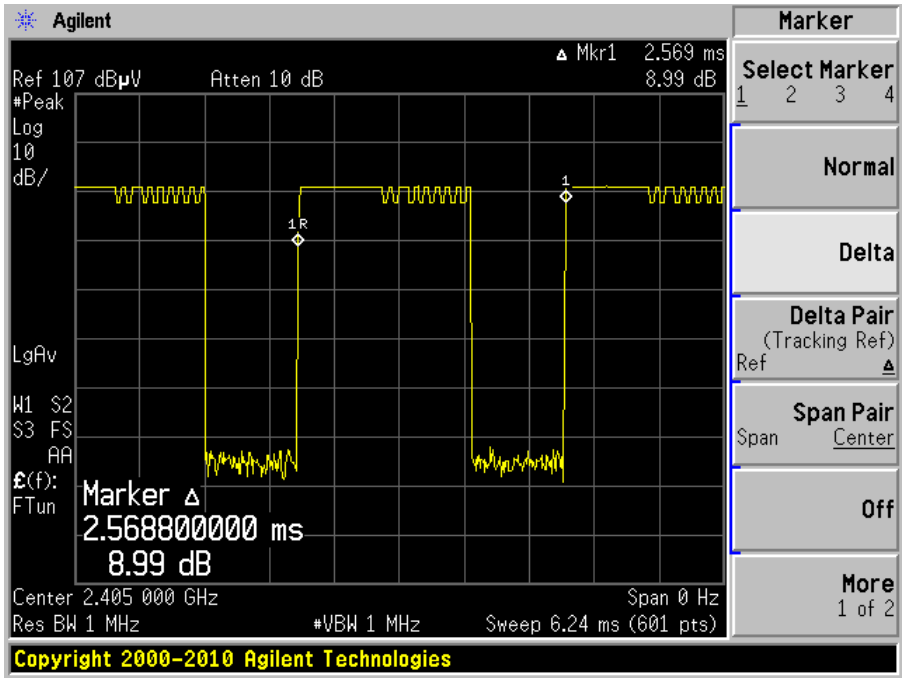
High Channel: 2479 MHz

Freq. (MHz)	S.A. Reading (dBuV)	Turntable Azimuth Degree	Test Antenna			Cable Loss (dB)	Pre-Amp. Gain (dB)	Duty Cycle.	(dBµV/m)	FCC Part 15.247/15.209		
			Height (cm)	Polar. (H/V)	Factor (dB/m)					Limit (dBuV/m)	Margin (dB)	Comment
4950	47.59	19	103	H	32.942	4.52	27.4	0	57.652	74	-16.348	Peak
4950	50.16	0	246	V	32.942	4.52	27.4	0	60.222	74	-13.778	Peak
4950	31.27	19	103	H	32.942	4.52	27.4	-3.772	37.56	54	-16.44	Ave
4950	37.45	0	246	V	32.942	4.52	27.4	-3.772	43.74	54	-10.26	Ave

Note: • Average Value (*) is calculated based on Peak Reading + Duty Cycle Factor
• Duty Cycle Factor (DCF) = 20 $\log_{10}$(Ton/Tp) = 20 $\log_{10}$(1.664/2.569ms) = -3.772 dB

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

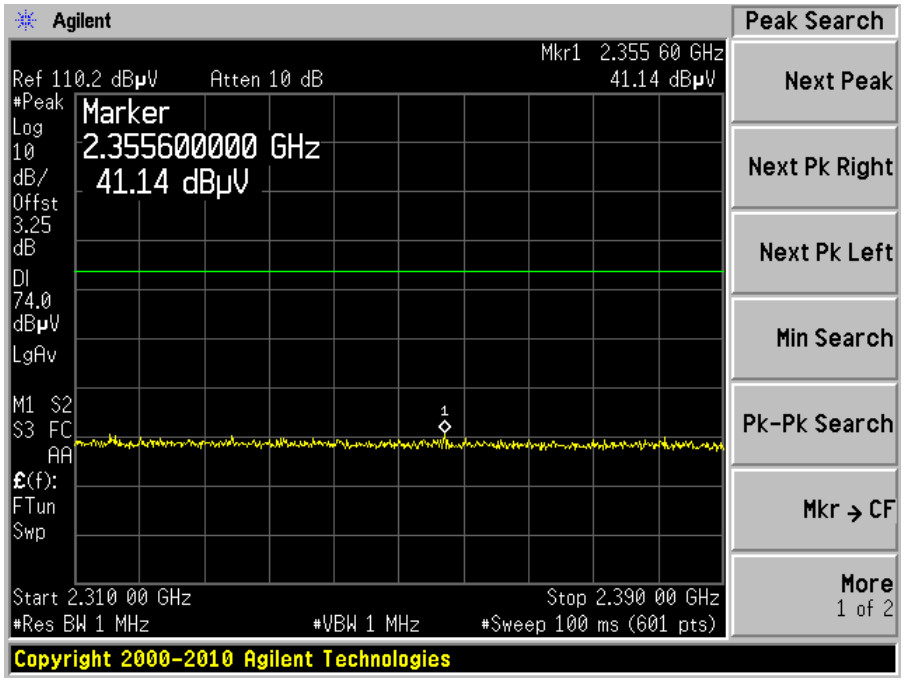




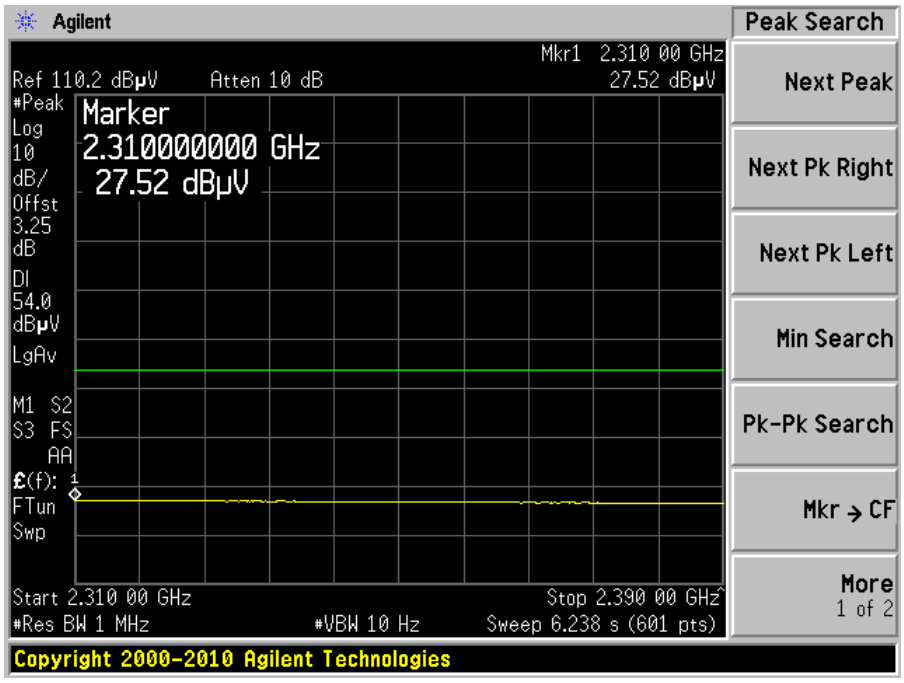
Restricted Band Emissions:

Main Antenna in Vertical Polarity

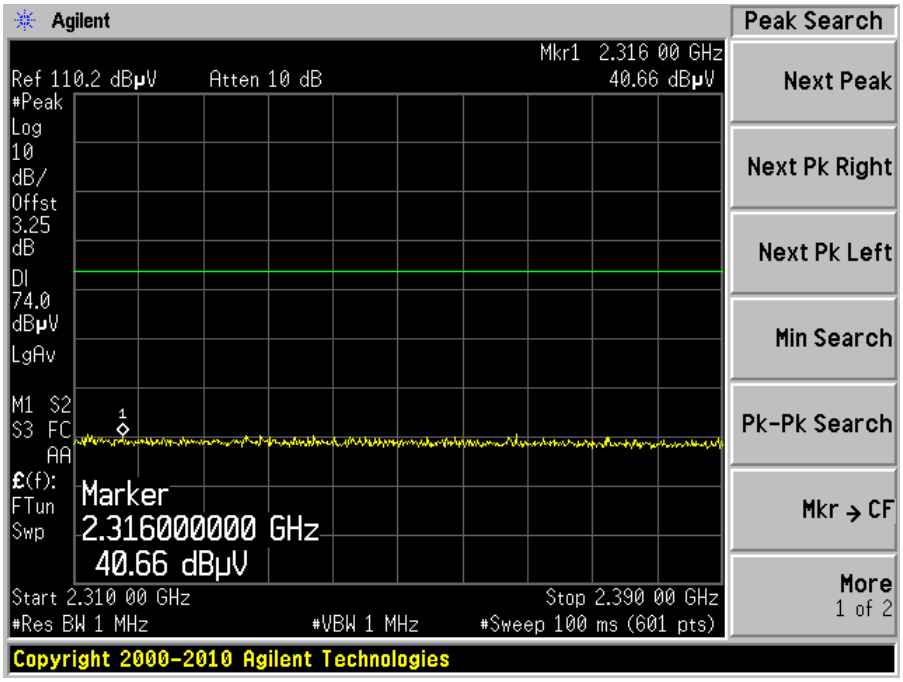
Main Antenna- Lowest Channel at Horizontal, Peak



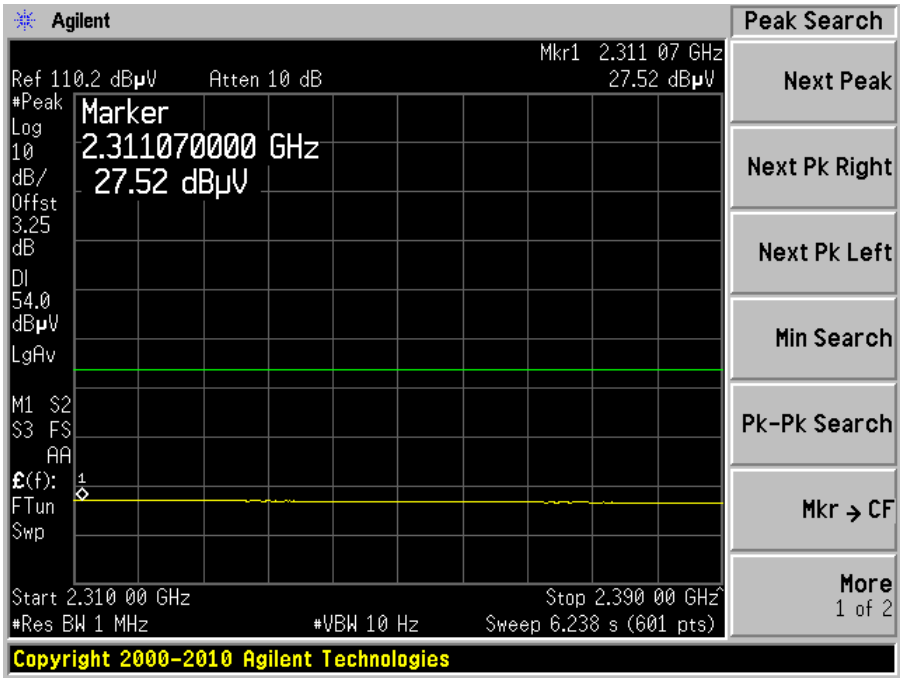
Main Antenna-Lowest Channel at Horizontal, Average



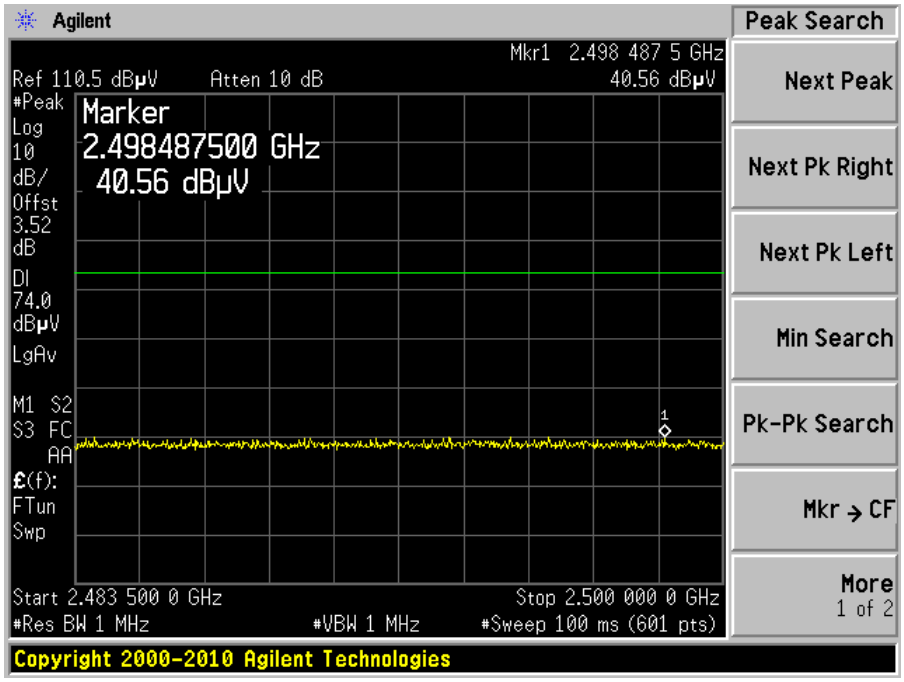
Main Antenna-Lowest Channel at Vertical, Peak



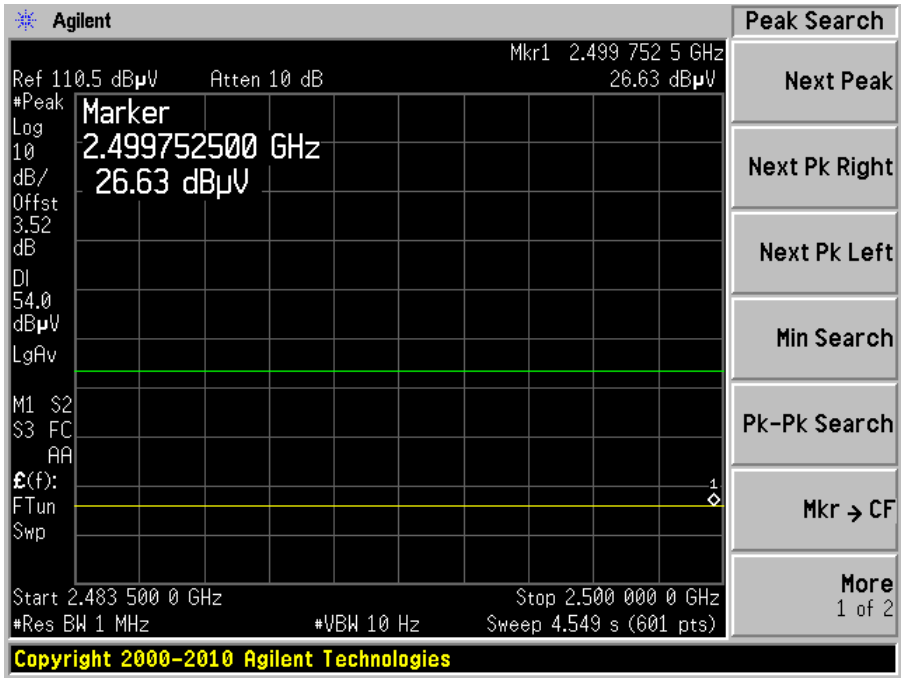
Main Antenna-Lowest Channel at Vertical, Average



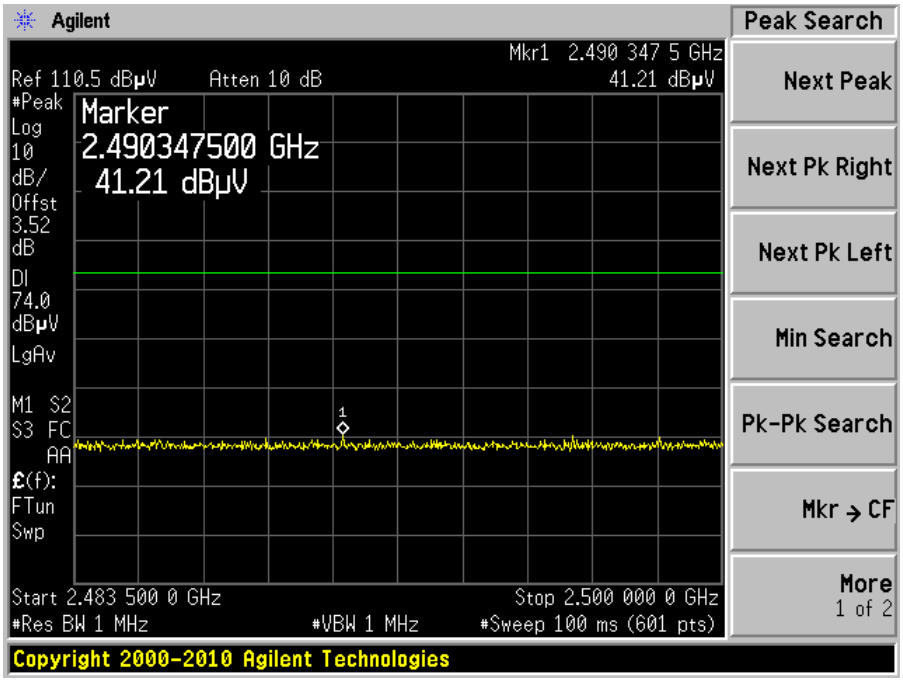
Main Antenna-Highest Channel at Horizontal, Peak



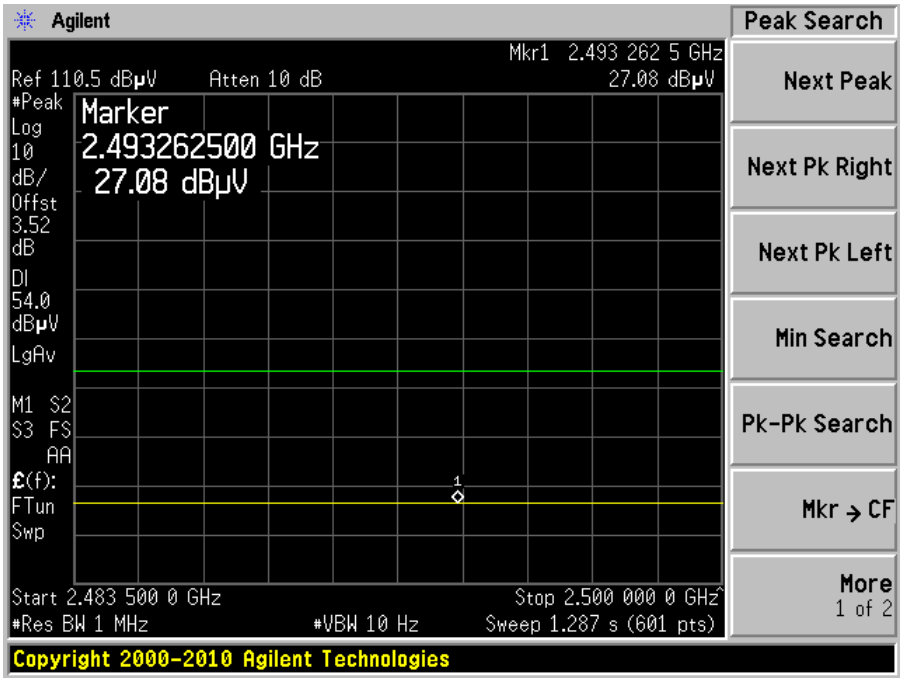
Main Antenna-Highest Channel at Horizontal, Average



Main Antenna-Highest Channel at Vertical, Peak

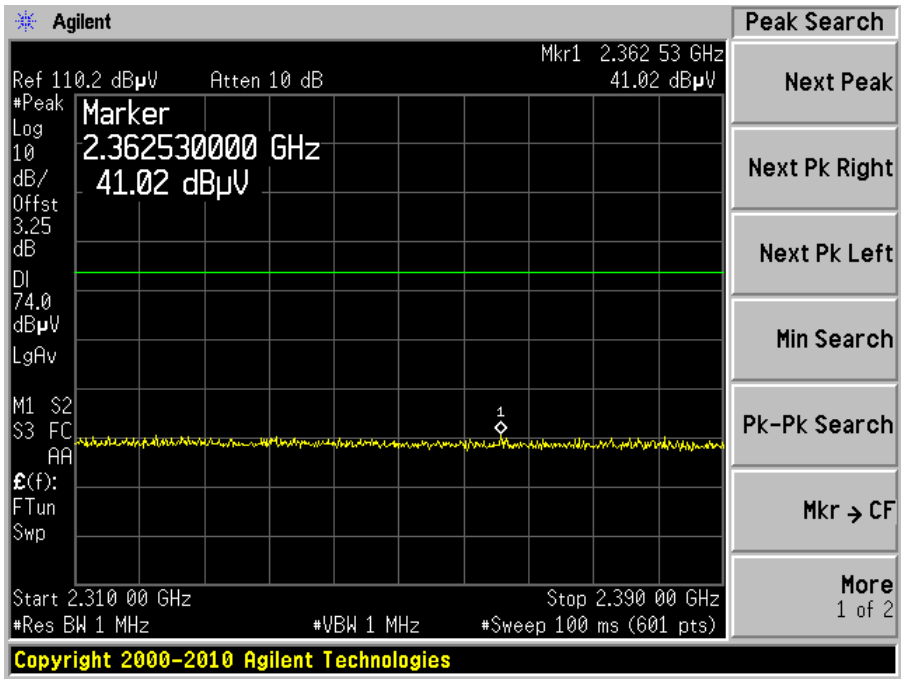


Main Antenna-Highest Channel at Vertical, Average

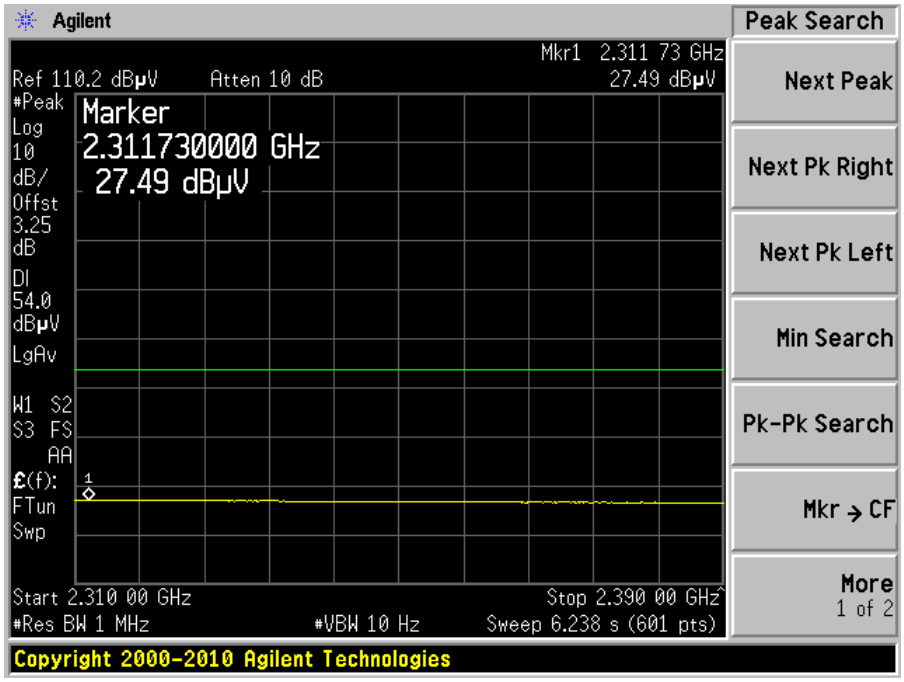


Bottom Antenna in Vertical Polarity

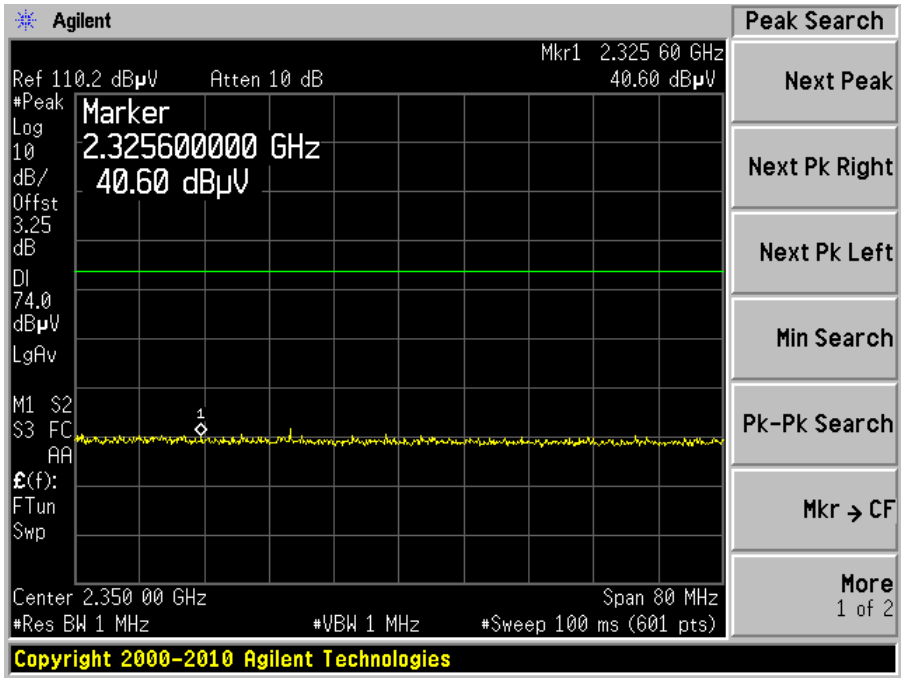
Bottom Antenna- Lowest Channel at Horizontal, Peak



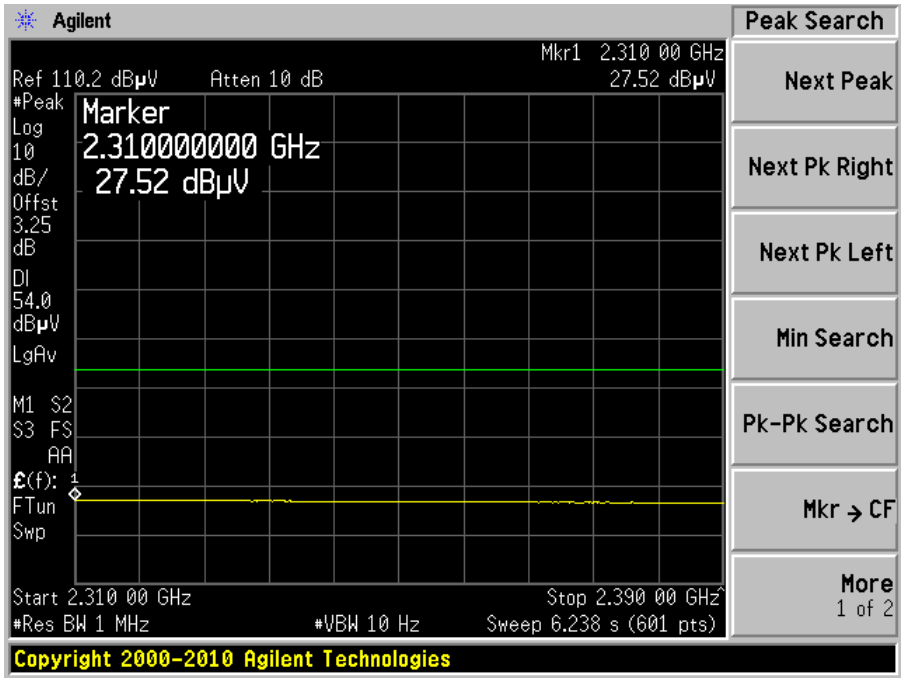
Bottom Antenna-Lowest Channel at Horizontal, Average



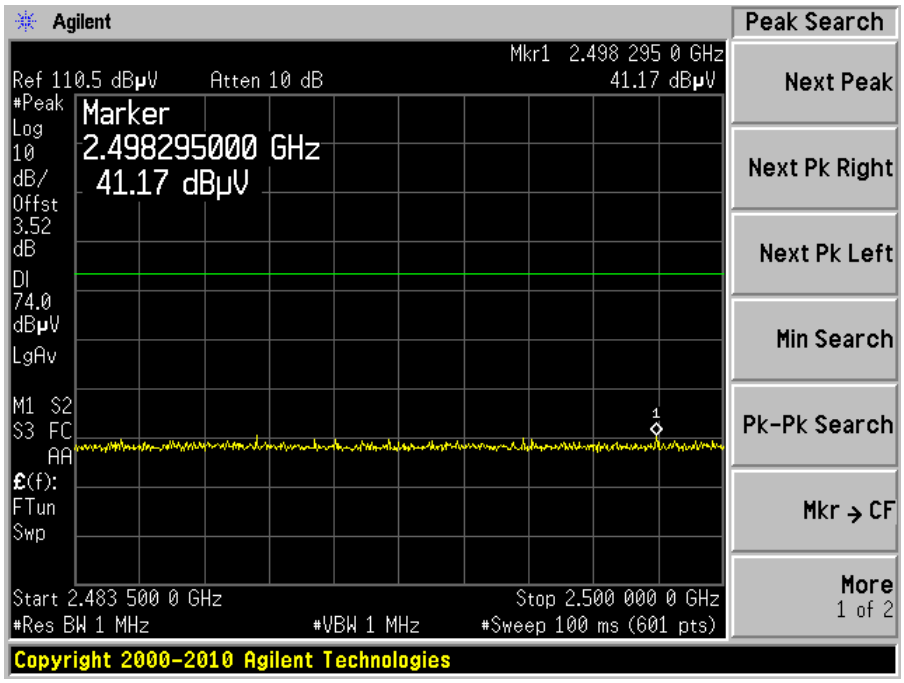
Bottom Antenna-Lowest Channel at Vertical, Peak



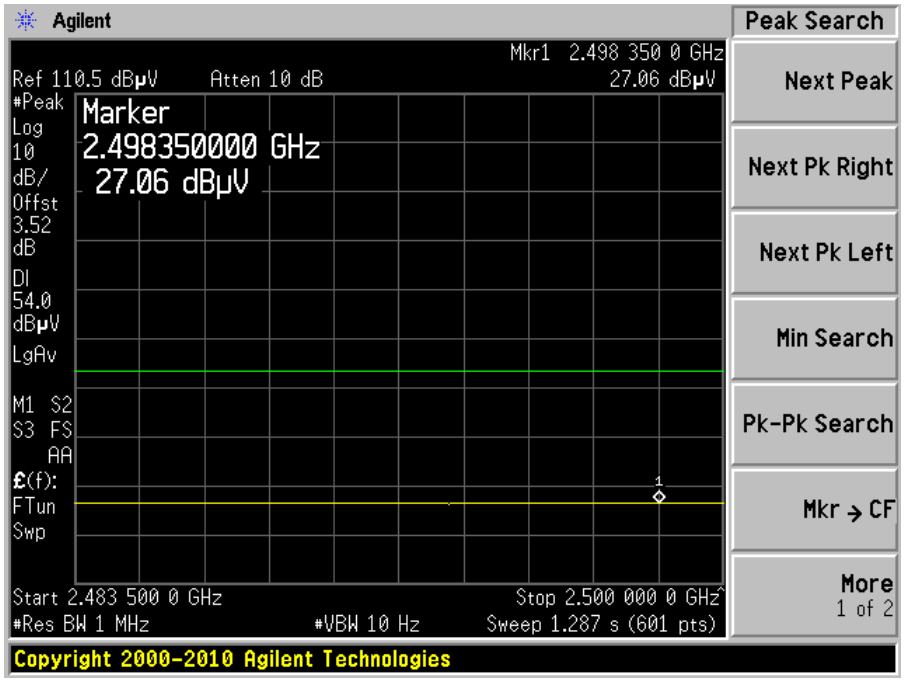
Bottom Antenna-Lowest Channel at Vertical, Average



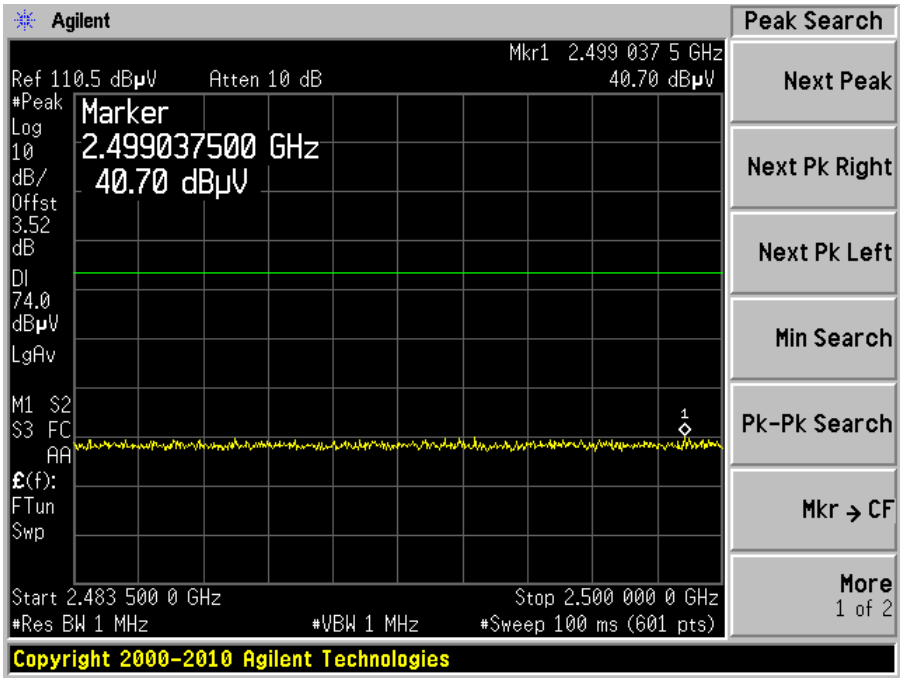
Bottom Antenna-Highest Channel at Horizontal, Peak



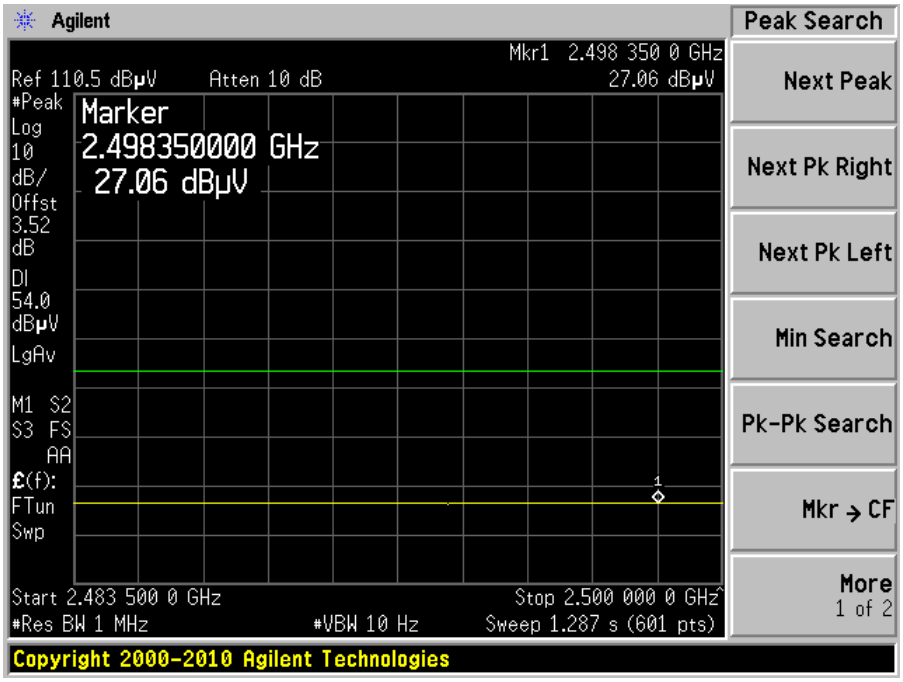
Bottom Antenna-Highest Channel at Horizontal, Average



Bottom Antenna-Highest Channel at Vertical, Peak



Bottom Antenna-Highest Channel at Vertical, Average



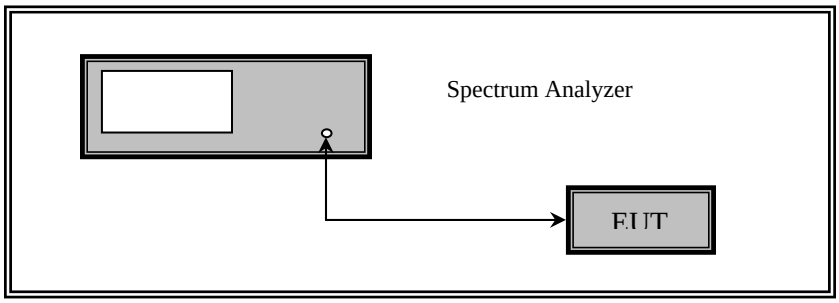
14 FCC §15.247(d) - 100 kHz Bandwidth Out-of-Band Emissions

14.1 Applicable Standard

According to FCC §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).

14.2 Measurement Procedure

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



14.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

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

14.4 Test Environmental Conditions

Temperature:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

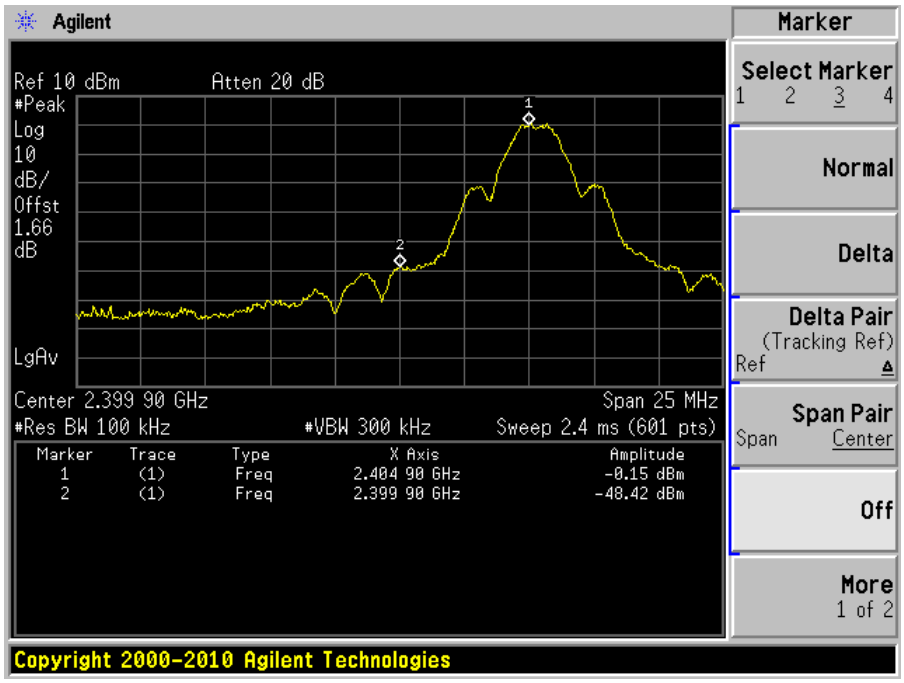
The testing was performed by Jerry Huang on 2010-12-3 in RF site.

14.5 Measurement Results

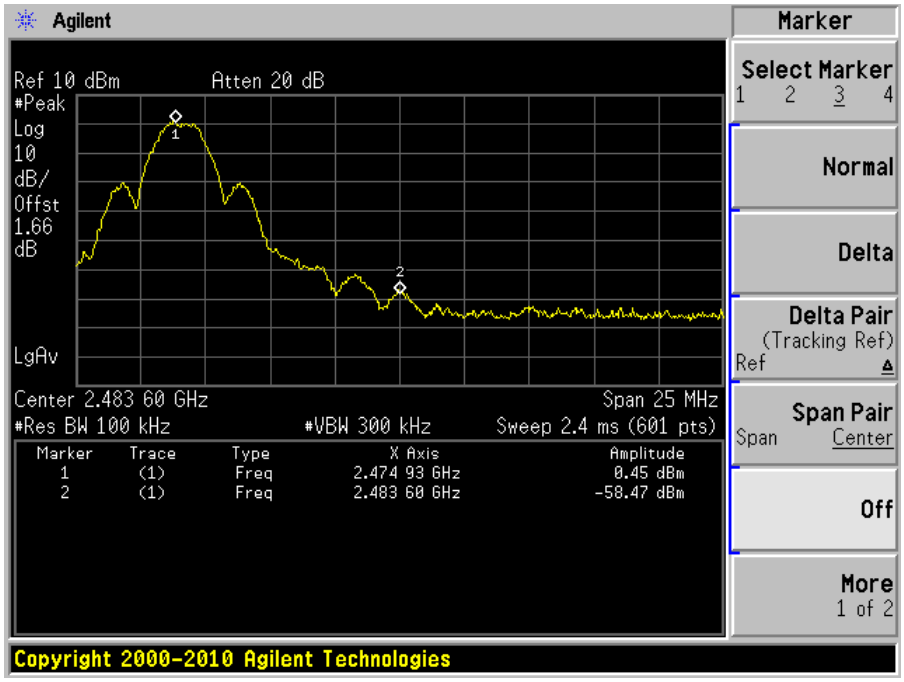
Please refer to following pages for plots of band edge.

DSSS:

Low Band Edge

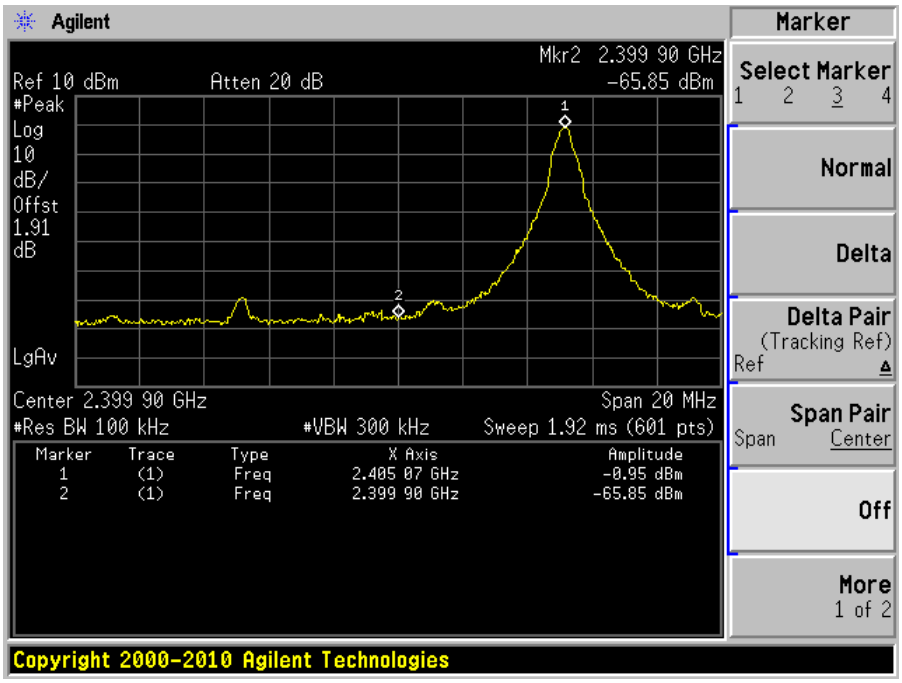


High Band Edge

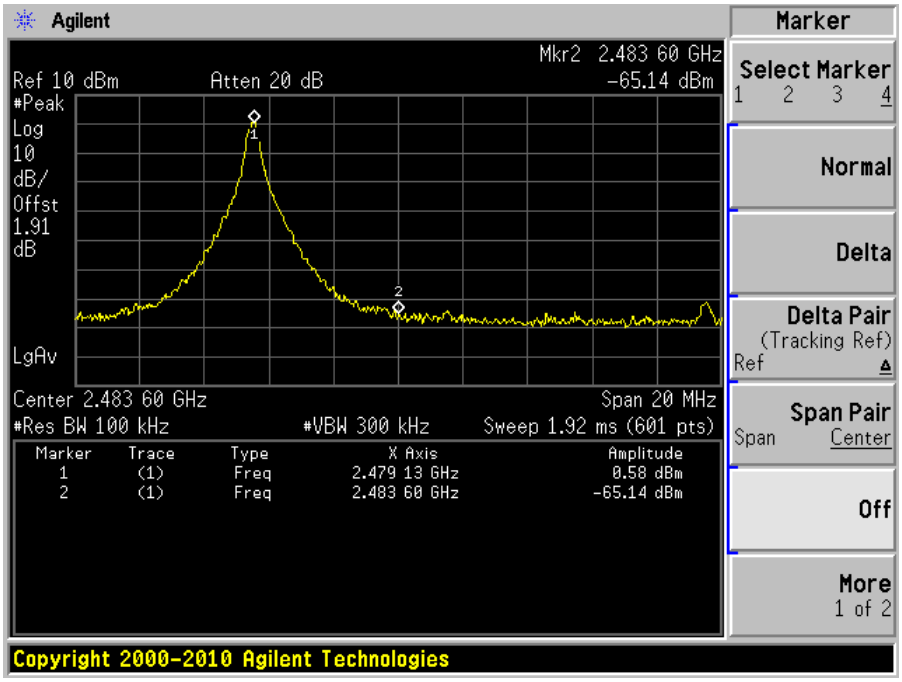


FHSS:

Low Band Edge



High Band Edge



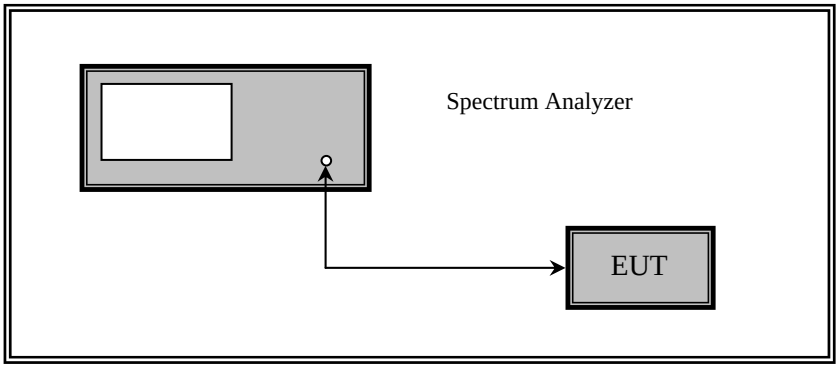
15 FCC §15.247(e) - Power Spectral Density

15.1 Applicable Standard

According to FCC §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.

15.2 Measurement Procedure

6. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
7. 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.
8. 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.
9. Repeat above procedures until all frequencies measured were complete.



15.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4440A	MY44303352	2010-05-09

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

15.4 Test Environmental Conditions

Temperature:	17~20 °C
Relative Humidity:	30~34 %
ATM Pressure:	101.2-103.2kPa

The testing was performed by Jerry Huang on 2010-12-3 in RF site.

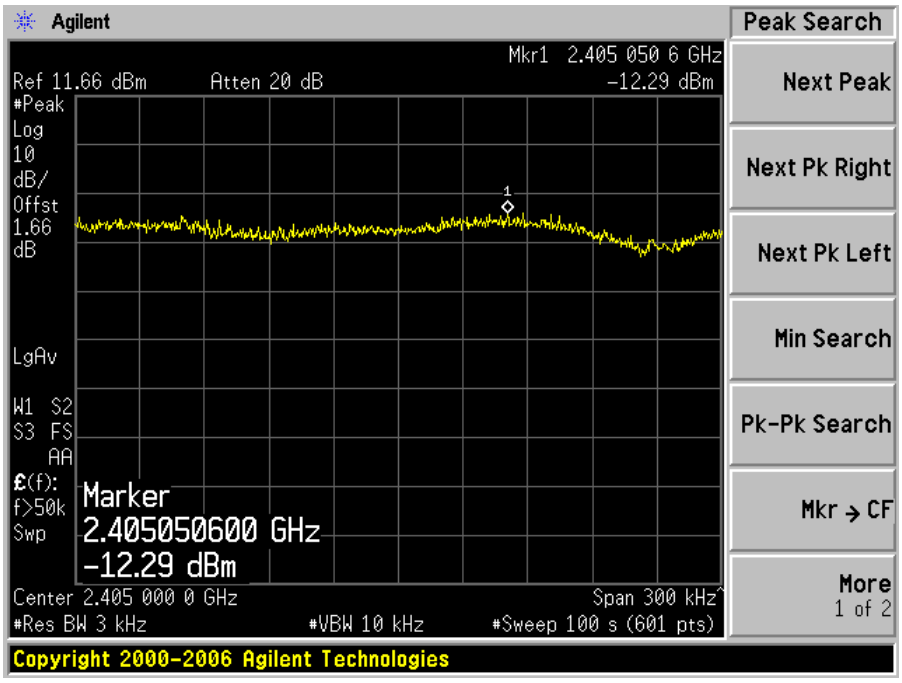
15.5 Summary of Test Results

DSSS:

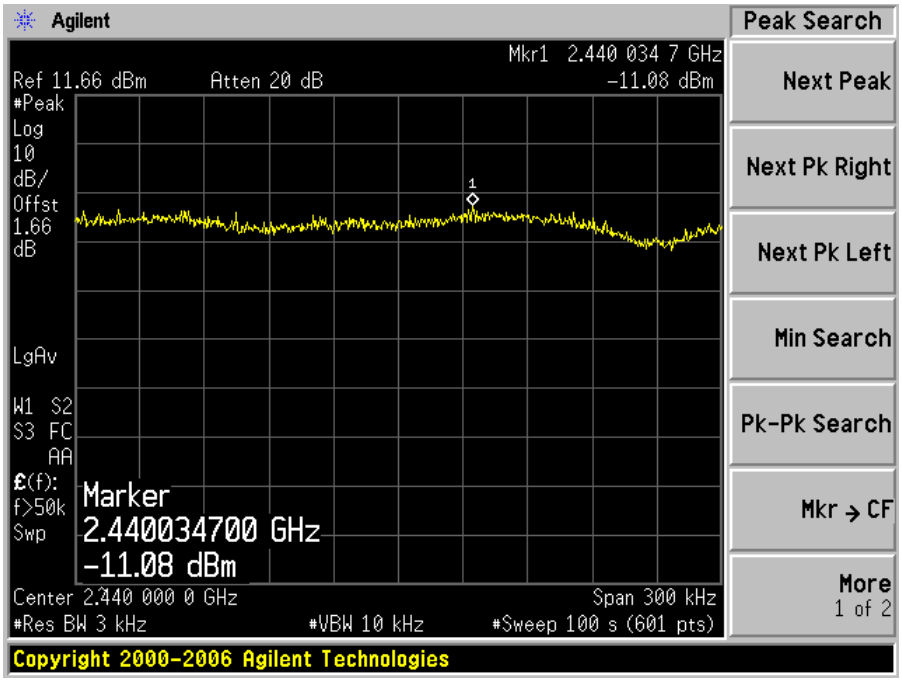
Channel	Frequency (MHz)	Power Spectral Density (dBm)	FCC Limit (dBm)	Result
Low	2405	-12.29	8	Compliant
Mid	2440	-11.08	8	Compliant
High	2475	-10.46	8	Compliant

Please refer to the following plots for detailed test results:

Low Channel: 2405 MHz



Middle Channel: 2440 MHz



High Channel: 2475 MHz