

FCC Part 15C Measurement and Test Report

For

AsiaRF Ltd

**3F, 26, Lane 70, Wu Kong 3rd Road, Wu-Ku Industry,
Taipei County, Taiwei**

FCC ID: TKZAWBRG2415

Report Concerns: Original Report	Equipment Type: WiFi Router
Model:	<u>AWBRG2415</u>
Report No.:	<u>STR07128123I</u>
Test/Witness Engineer:	<u>Lahm Peng</u>
Test Date:	<u>2008-01-05 to 2008-01-16</u>
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Approved & Authorized By:	 <hr style="width: 80%; margin: 0 auto;"/> <p>Jandy So / PSQ Manager</p>

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by SEM.Test Compliance Service Co., Ltd.

TABLE OF CONTENTS

1. GENERAL INFORMATION.....4

1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....4

1.2 TEST STANDARDS4

1.3 RELATED SUBMITTAL(S)/GRANT(S).....4

1.4 TEST METHODOLOGY5

1.5 TEST FACILITY5

1.6 EUT EXERCISE SOFTWARE5

1.7 ACCESSORIES EQUIPMENT LIST AND DETAILS5

1.8 EUT CABLE LIST AND DETAILS5

2. SUMMARY OF TEST RESULTS6

3. §15.203 - ANTENNA REQUIREMENT.....7

3.1 STANDARD APPLICABLE7

3.2 TEST RESULT7

4. CONDUCTED EMISSIONS8

4.1 MEASUREMENT UNCERTAINTY8

4.2 TEST EQUIPMENT LIST AND DETAILS8

4.3 TEST PROCEDURE.....8

4.4 BASIC TEST SETUP BLOCK DIAGRAM.....8

4.5 ENVIRONMENTAL CONDITIONS9

4.6 SUMMARY OF TEST RESULTS/PLOTS.....9

4.7 CONDUCTED EMISSIONS TEST DATA.....9

5. POWER SPECTRAL DENSITY12

5.1 STANDARD APPLICABLE12

5.2 TEST EQUIPMENT LIST AND DETAILS12

5.3 TEST PROCEDURE.....12

5.4 ENVIRONMENTAL CONDITIONS12

5.5 SUMMARY OF TEST RESULTS/PLOTS13

6. 6-DB BANDWIDTH.....17

6.1 STANDARD APPLICABLE17

6.2 TEST EQUIPMENT LIST AND DETAILS17

6.3 TEST PROCEDURE.....17

6.4 ENVIRONMENTAL CONDITIONS17

6.5 SUMMARY OF TEST RESULTS/PLOTS17

FOR 802.11B18

7. POWER OUTPUT.....21

7.1 STANDARD APPLICABLE21

7.2 TEST EQUIPMENT LIST AND DETAILS21

7.3 TEST PROCEDURE.....21

7.4 ENVIRONMENTAL CONDITIONS21

7.5 SUMMARY OF TEST RESULTS/PLOTS21

FOR 802.11B22

FOR 802.11G23

8. FIELD STRENGTH OF SPURIOUS EMISSIONS25

8.1 MEASUREMENT UNCERTAINTY25

8.2 STANDARD APPLICABLE25

8.3 TEST EQUIPMENT LIST AND DETAILS26

8.4 TEST PROCEDURE.....26

8.5 CORRECTED AMPLITUDE & MARGIN CALCULATION27

8.6 ENVIRONMENTAL CONDITIONS27

8.7 SUMMARY OF TEST RESULTS/PLOTS27

9. OUT OF BAND EMISSIONS.....31

9.1 STANDARD APPLICABLE31

9.2 TEST EQUIPMENT LIST AND DETAILS31

9.3 TEST PROCEDURE.....31
9.4 ENVIRONMENTAL CONDITIONS.....31
9.5 SUMMARY OF TEST RESULTS/PLOTS.....32

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: AsiaRF Ltd
 Address of applicant: 3F, 26, Lane 70, Wu Kong 3rd Road, Wu-Ku Industry, Taipei County, Taiwei
 Manufacturer: AsiaRF Ltd
 Address of manufacturer: Room 606, Light Industry Forgeign Trade Building, No.1002, Aiguo Road, LuohuDistrict, 518000, Shenzhen City, China

General Description of E.U.T

Items	Description
EUT Description:	WiFi Router
Trade Name:	Asia RF
Model No.:	AWBRG2415
Rated Voltage:	DC 7.5V Adaptor
Max. Output Power	< 30dBm
Frequency range:	2412-2462MHz
Number of channels:	11
Size:	5MHz
Channel Separation:	Unique Antenna
Type of Antenna:	14.0x9.0x3.0cm

Note: The test data gathered are from a production sample with the adaptor, model PRS-C24US7. It is provided by the manufacturer.

1.2 Test Standards

The following report is prepared on behalf of AsiaRF Ltd in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Related Submittal(s)/Grant(s)

No Related Submittal(s).

1.4 Test Methodology

All measurements contained in this report were conducted 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.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted with Low Channel, Middle Channel and High Channel, accordingly in reference to the Operating Instructions.

1.5 Test Facility

The Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission.

The acceptance letter from the FCC is maintained in files which the Registration No.: 759397.

Measurement required was performed at laboratory of Solid Industrial Co., Ltd. at 333 Bulong Highway Buji Longgang, Shenzhen, Guangdong, China.

1.6 EUT Exercise Software

The EUT exercise program used during the testing was designed to exercise the system components.

1.7 Accessories Equipment List and Details

Manufacturer	Description	Model	Serial Number
IBM	Notebook	R51e	LV14893
TP-LINK	Modem	TM-EC5658V	KT99CTQC-508
Lenovo	Printer	3110	OD65133711480

1.8 EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
DC Power Cabel	1.5	Unshielded	Without Core
RJ 45 Cable	3.0	Unshielded	Without Core

2. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§ 15.203; § 15.247(c)(1)(i)	Antenna Requirement	Compliant
§ 15.207	Conducted Emission	Compliant
§ 15.247(e)	Power Spectral Density	Compliant
§ 15.247(a)(2)	6 dB Bandwidth	Compliant
§ 15.247(b)(3)	Power Output	Compliant
§ 15.209(a)(d)	Radiated Emission	Compliant
§ 15.247(d)	Band edge	Compliant

3. §15.203 - ANTENNA REQUIREMENT

3.1 Standard Applicable

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.

3.2 Test Result

This product has an unique antenna with reverse SMA connector, fulfill the requirement of this section.

4. CONDUCTED EMISSIONS

4.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 0.5 dB.

4.2 Test Equipment List and Details

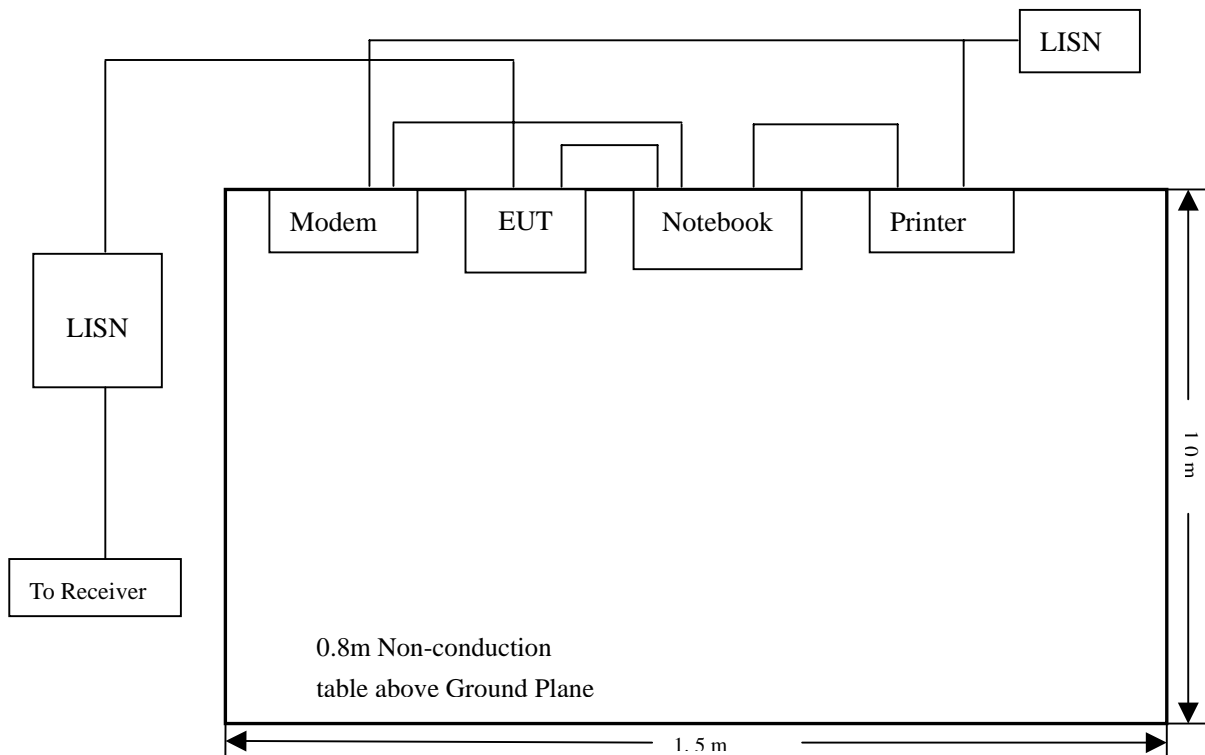
Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
EMI Test Receiver	Rohde & Schwarz	ESCS30	830245/009	2007-01-26	2008-01-25
AMN	Rohde & Schwarz	ESH2-Z5	100002	2007-01-26	2008-01-25
Limiter	Rohde & Schwarz	ESH3-Z2	357.8810.52	2007-01-26	2008-01-25
AMN	Rohde & Schwarz	ESH3-Z5	828304/014	2007-01-26	2008-01-25

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

4.3 Test Procedure

Test is conducting under the description of 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.

4.4 Basic Test Setup Block Diagram



4.5 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

4.6 Summary of Test Results/Plots

According to the data in section 4.7, the EUT complied with the FCC 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

-10.7 dBµV at 0.82 MHz in the Neutral, 0.15-30MHz

4.7 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC 15.207	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	dBµV	QP/Ave/Pk	Line/Neutral	dBµV	dB
0.82	45.35	PK	Neutral	56.00	-10.7
1.25	44.68	PK	Neutral	56.00	-11.3
0.47	44.77	PK	Line	56.51	-11.7
0.70	44.03	PK	Line	56.00	-12.0
1.18	43.72	PK	Line	56.00	-12.3
0.24	47.46	PK	Neutral	62.10	-14.6

Plot of Conducted Emissions Test Data

Conducted Disturbance

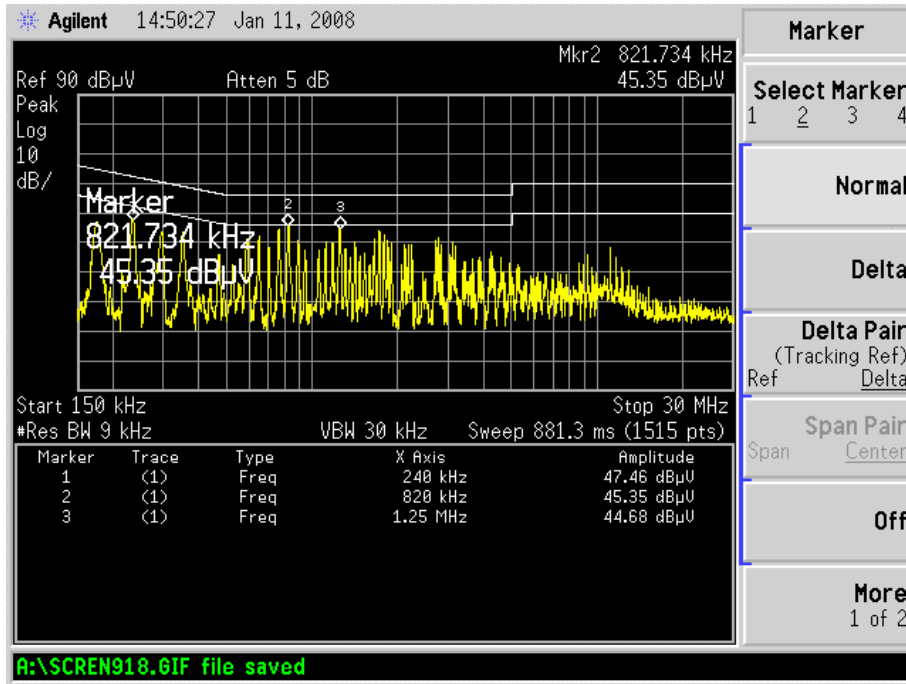
EUT: WiFi Router

M/N: AWBRG2415

Operating Condition: Running

Test Specification: N

Comment: AC120V/60Hz



Plot of Conducted Emissions Test Data

Conducted Disturbance

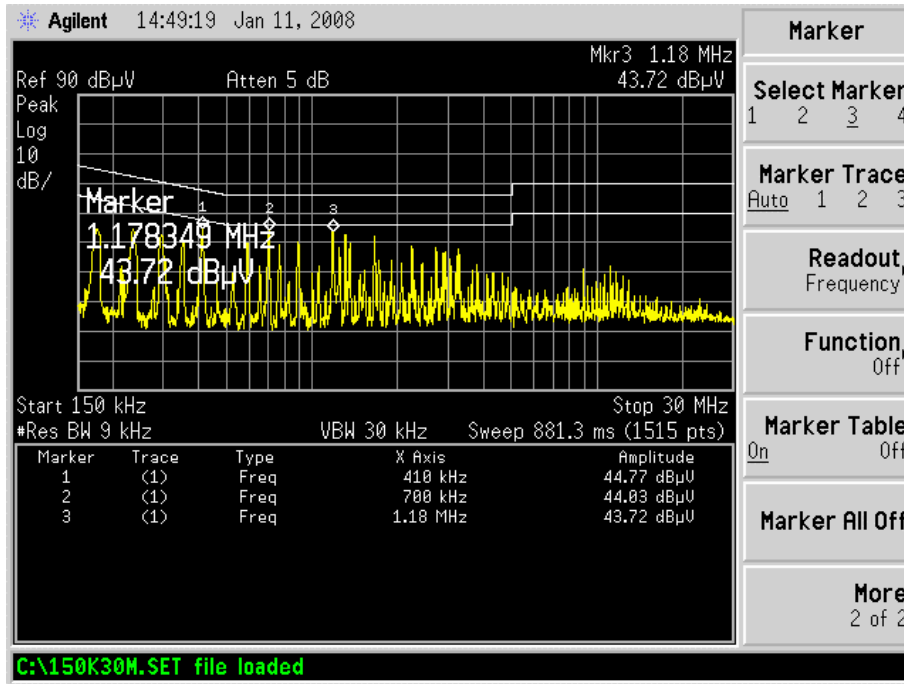
EUT: WiFi Router

M/N: AWBRG2415

Operating Condition: Running

Test Specification: L

Comment: AC120V/60Hz



5. POWER SPECTRAL DENSITY

5.1 Standard Applicable

According to 15.247(a)(1)(iii), 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.

5.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2007-06-30	2008-06-29
ETS	50 ohm Coaxial Cable	SUCOFLEX 104	25498514	2007-01-26	2008-01-25

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

5.3 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW,VBW=3KHz, Span = 20MHz.
4. Repeat above procedures until all frequency measured was complete.

5.4 Environmental Conditions

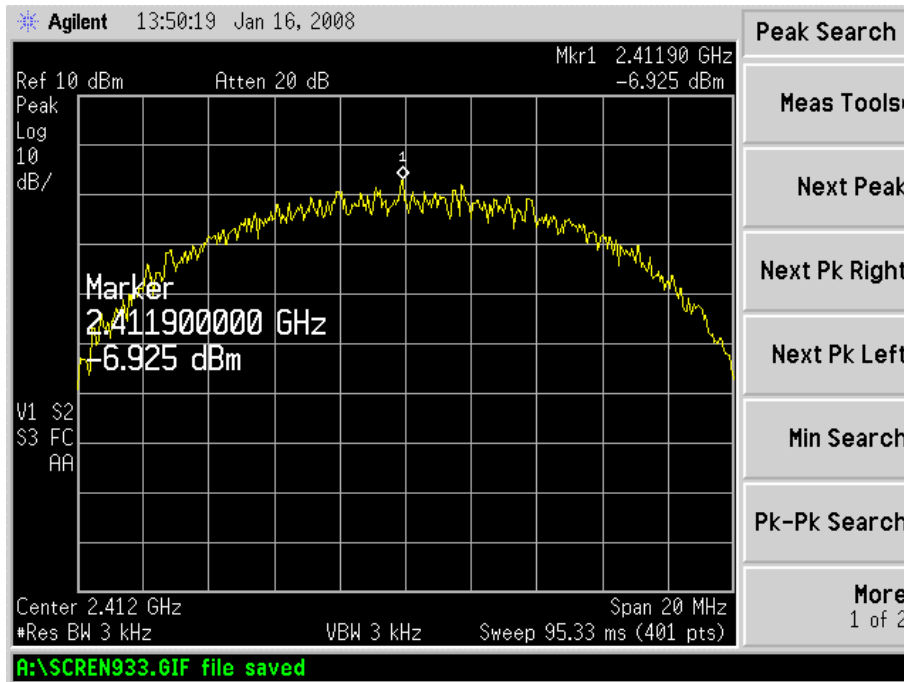
Temperature:	20° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.5 Summary of Test Results/Plots

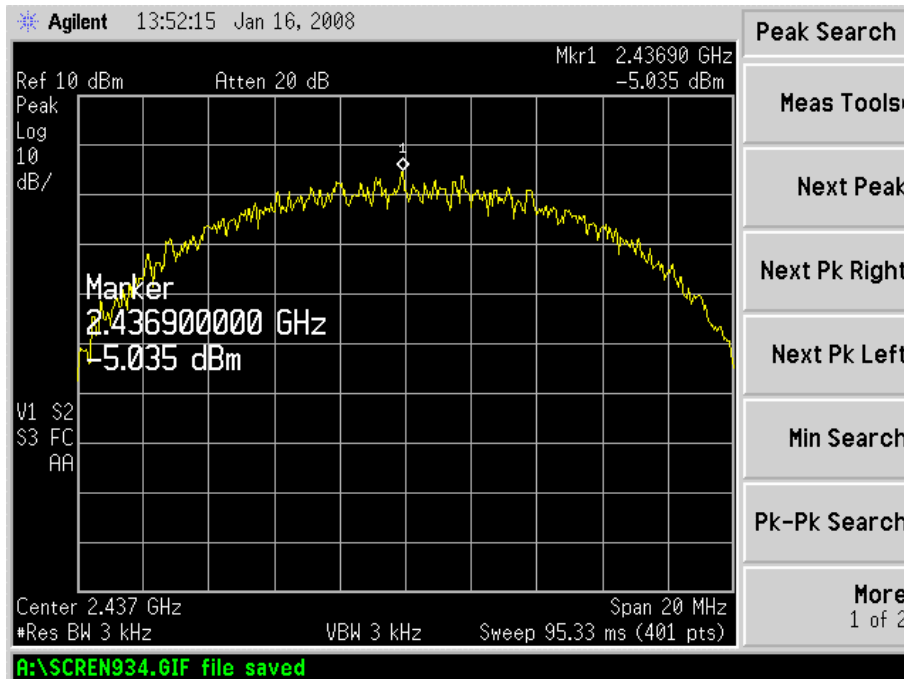
Test mode	Test channel	Reading dBm/3kHz	Limit dBm/3kHz
802.11b	Low channel (2412MHz)	-6.925	8
	Middle channel (2437MHz)	-5.035	8
	High channel (2462MHz)	-7.996	8
802.11g	Low channel (2412MHz)	-17.50	8
	Middle channel (2437MHz)	-8.180	8
	High channel (2462MHz)	-18.39	8

For 802.11b

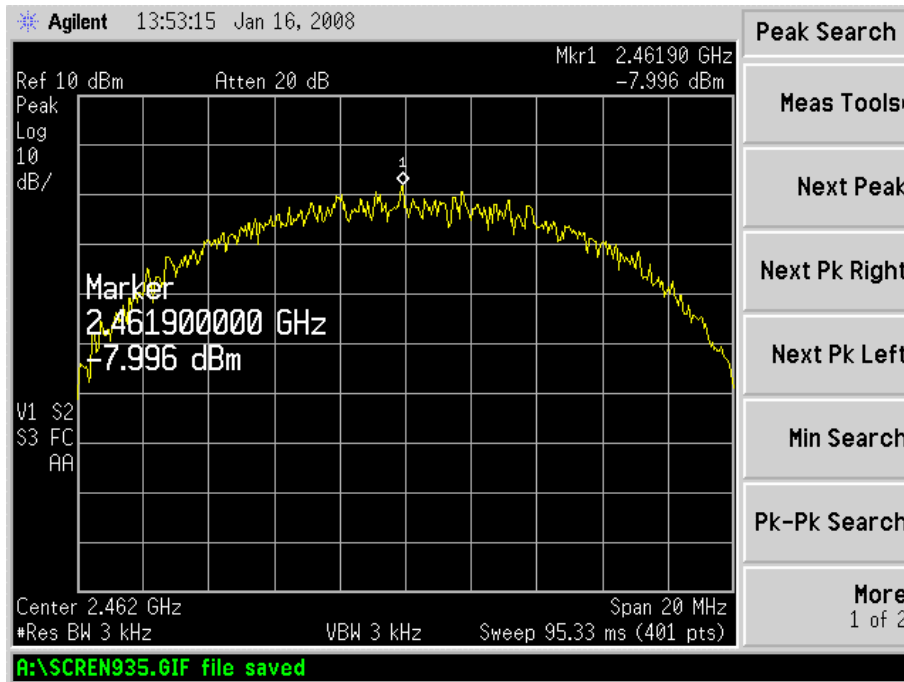
Low Channel:



Middle Channel:

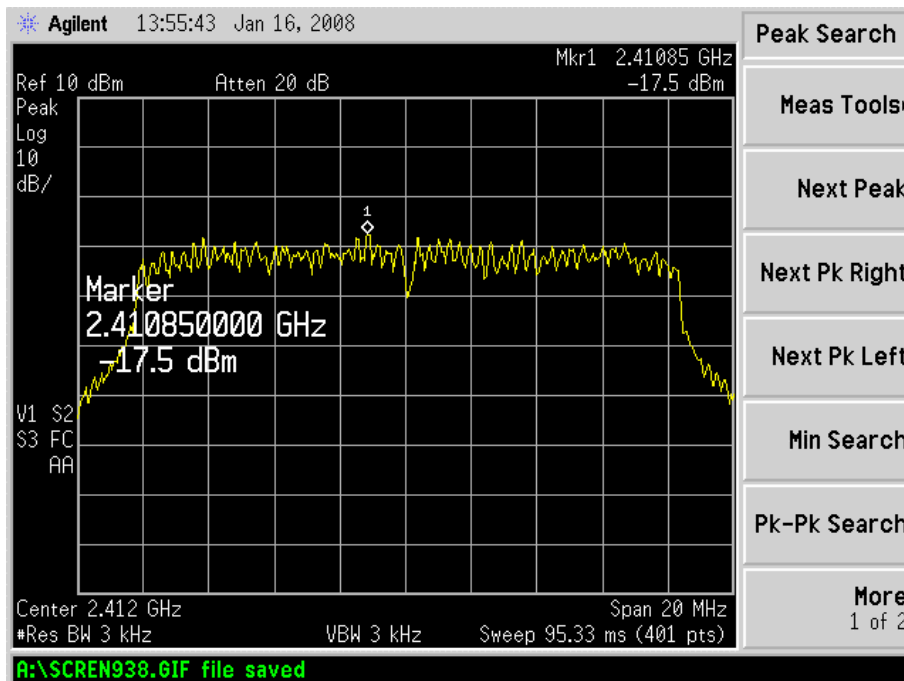


High Channel:

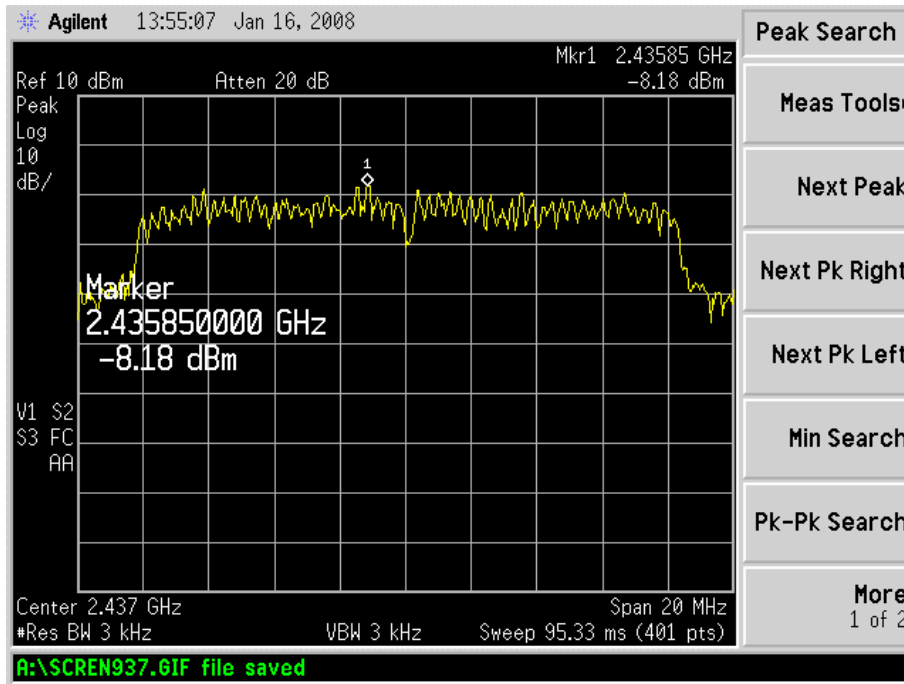


For 802.11g

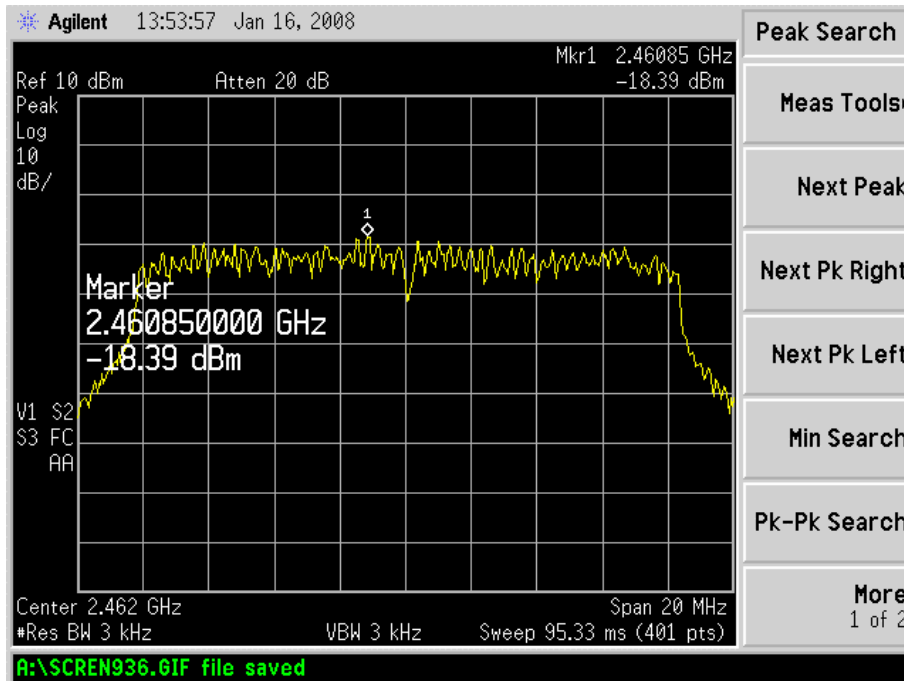
Low Channel:



Middle Channel:



High Channel:



6. 6-dB BANDWIDTH

6.1 Standard Applicable

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.

6.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2007-06-30	2008-06-29
ETS	50 ohm Coaxial Cable	SUCOFLEX 104	25498514	2007-01-26	2008-01-25

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

6.3 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. The spectrum analyzer as RBW=300KHz (1 % of Bandwidth.), Sweep=auto
4. Mark the peak frequency and –6dB (upper and lower) frequency.

6.4 Environmental Conditions

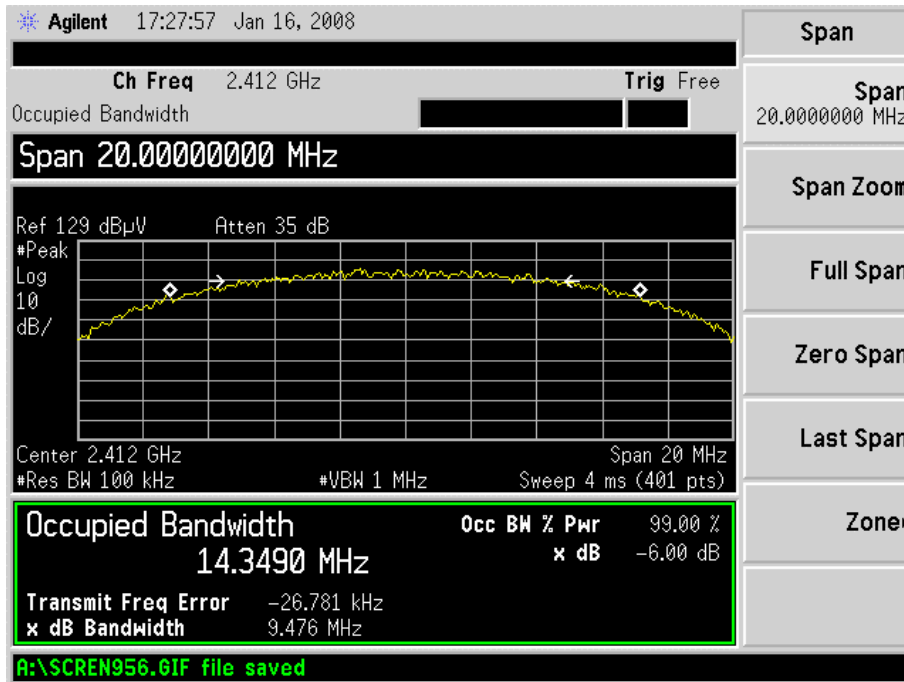
Temperature:	24° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.5 Summary of Test Results/Plots

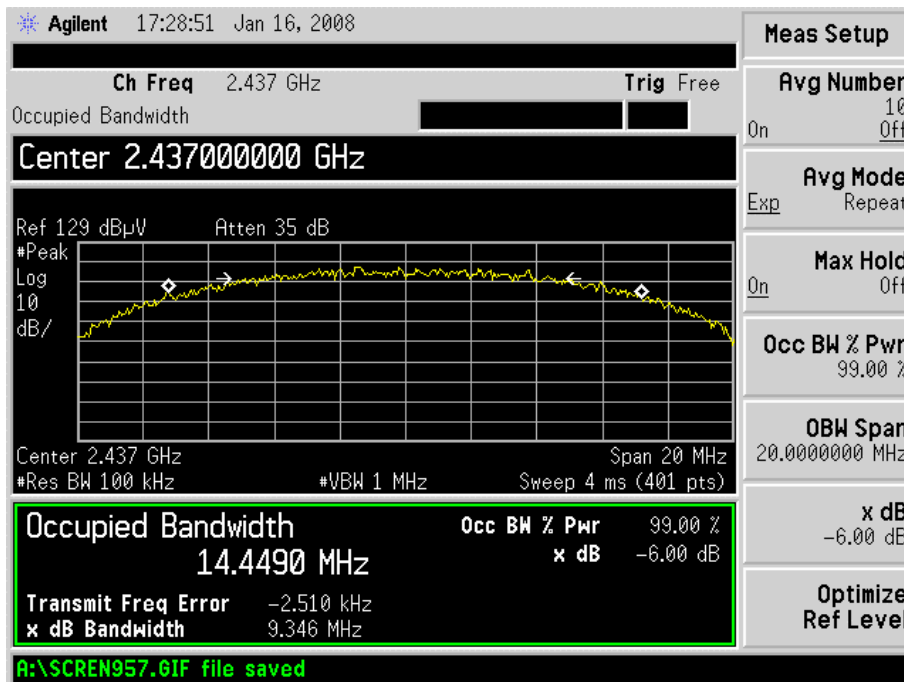
Test mode	Frequency MHz	6 dB Bandwidth kHz	Limit kHz
802.11b	2412	9476	500
	2437	9346	500
	2462	9471	500
802.11g	2412	15386	500
	2437	14758	500
	2462	15609	500

For 802.11b

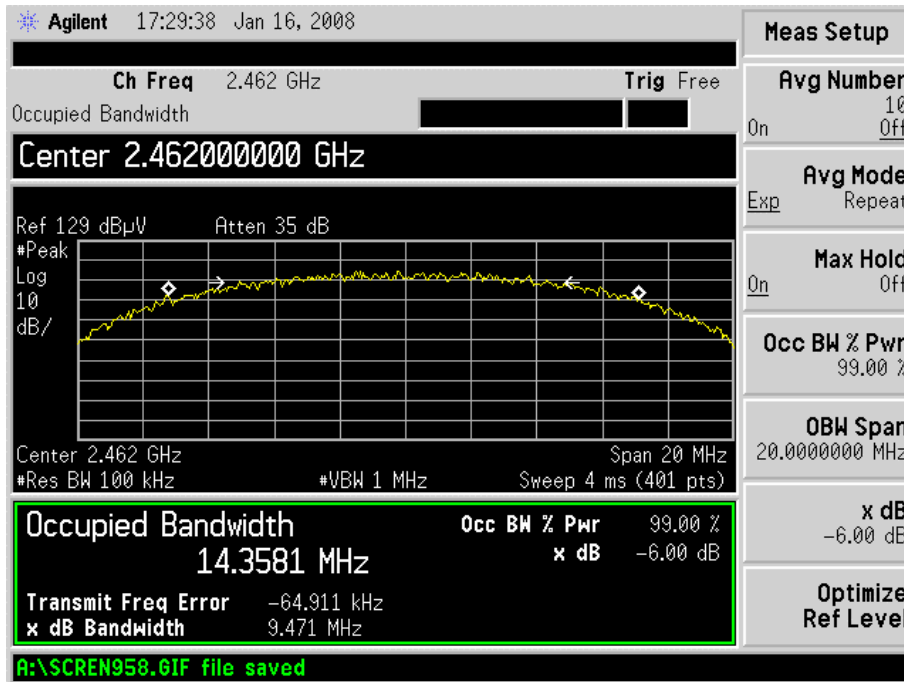
Low Channel:



Mid Channel:

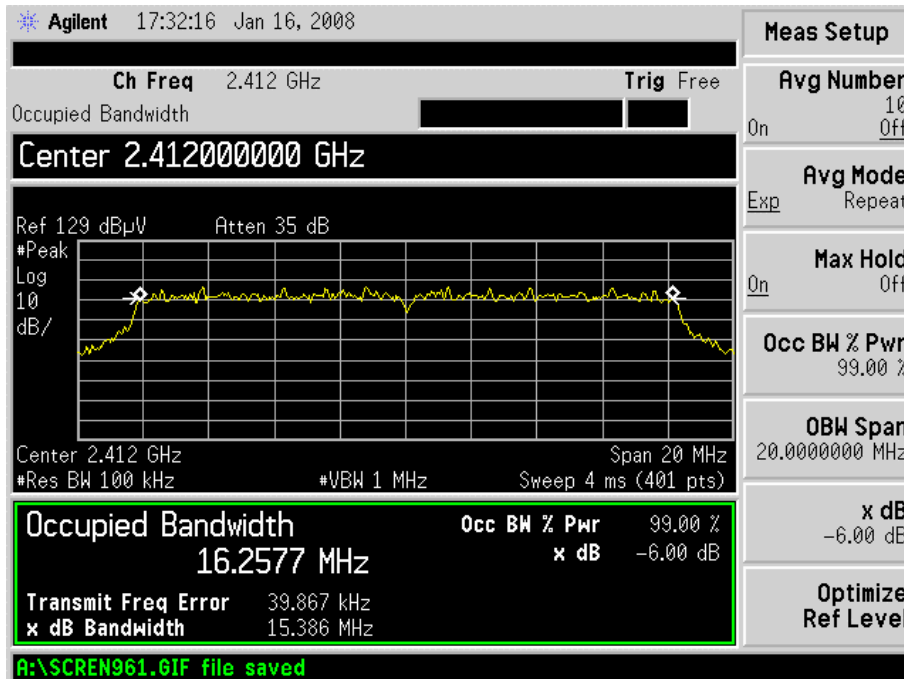


High Channel:

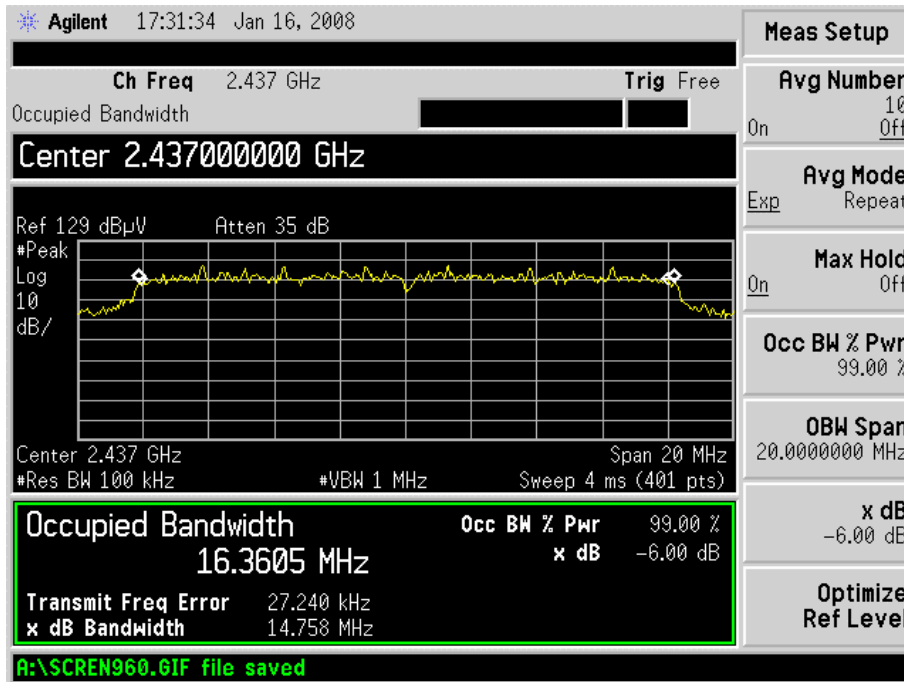


For 802.11g

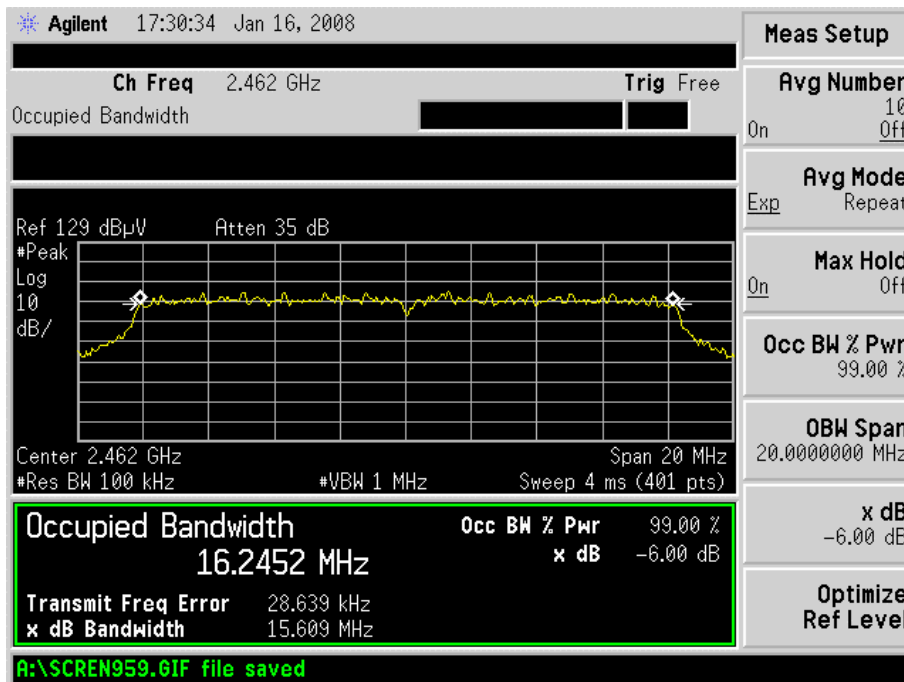
Low Channel:



Mid Channel:



High Channel:



7. POWER OUTPUT

7.1 Standard Applicable

According to 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.

7.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2007-06-30	2008-06-29
ETS	50 ohm Coaxial Cable	SUCOFLEX 104	25498514	2007-01-26	2008-01-25

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

7.3 Test Procedure

The device under test has an integral antenna and the power was measured on a radiated basis.

7.4 Environmental Conditions

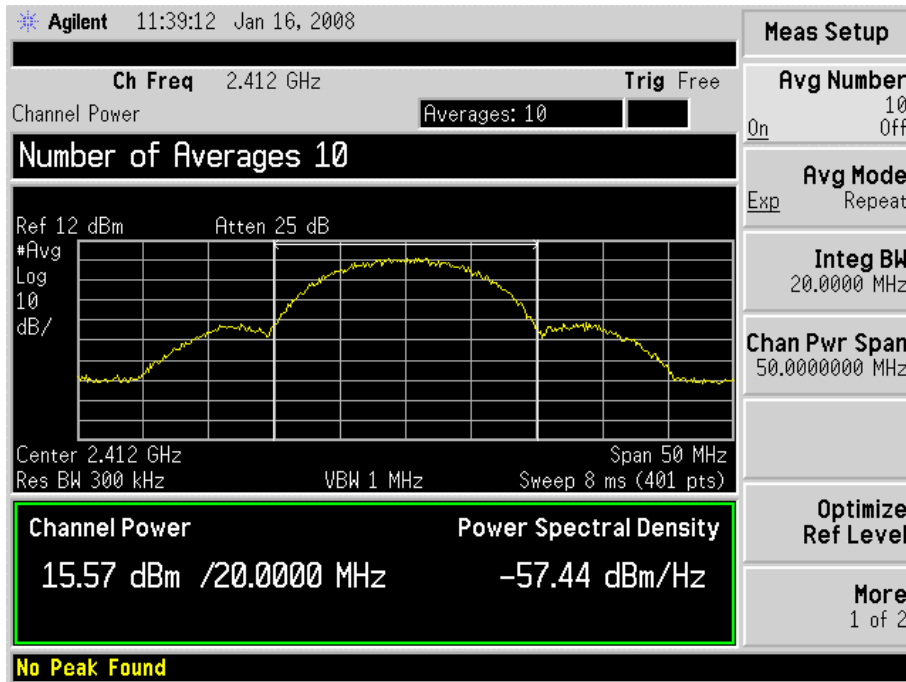
Temperature:	21° C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

7.5 Summary of Test Results/Plots

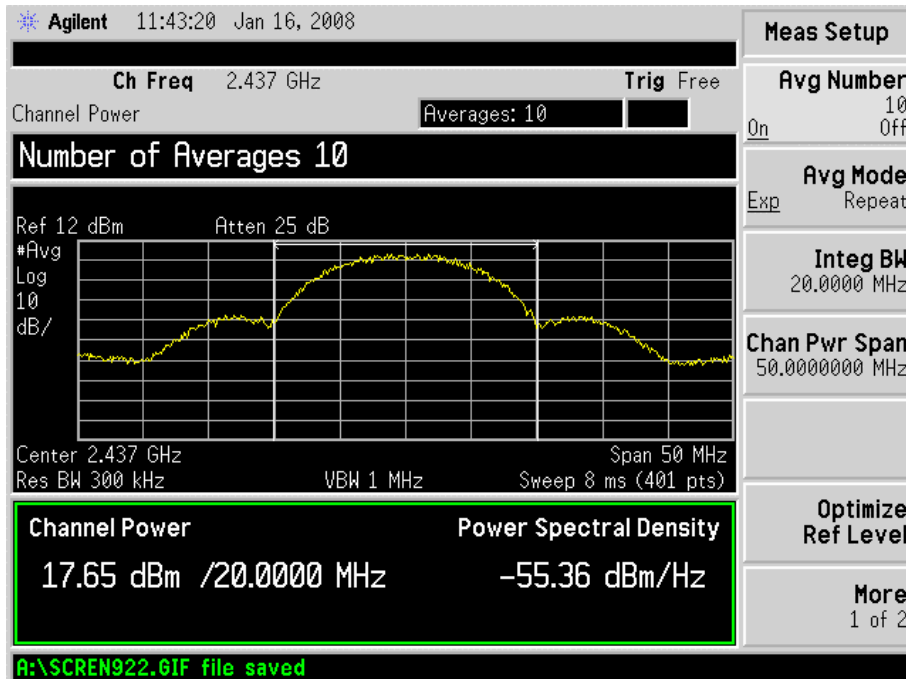
Test mode	Frequency MHz	Reading dBm	Output power W	Limit W
802.11b	2412	15.57	0.0361	1
	2437	17.65	0.0582	1
	2462	14.77	0.0300	1
802.11g	2412	8.13	0.0065	1
	2437	17.18	0.0522	1
	2462	7.22	0.0053	1

For 802.11b

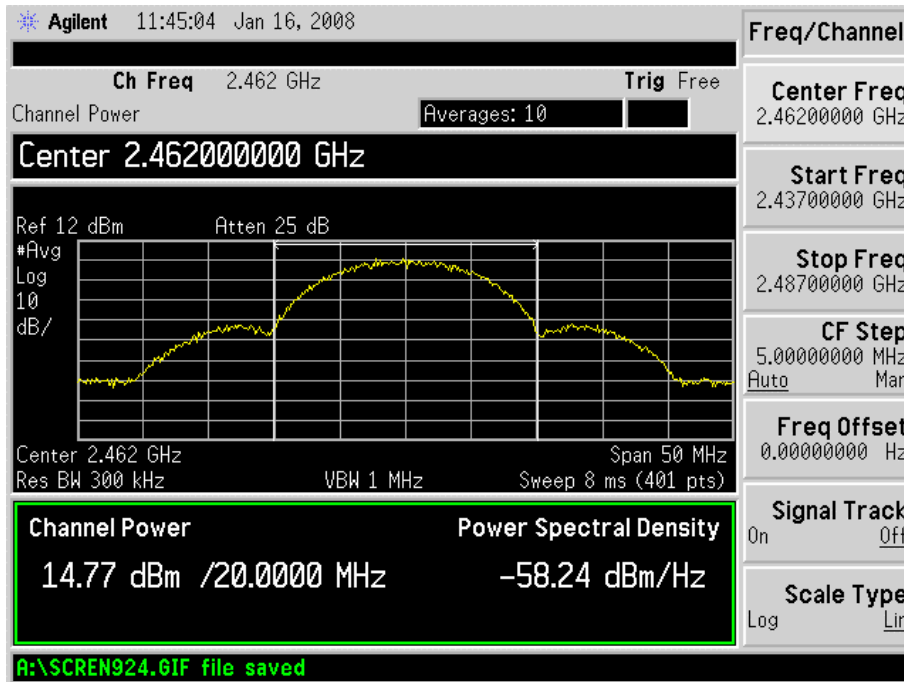
Low Channel:



Middle Channel:

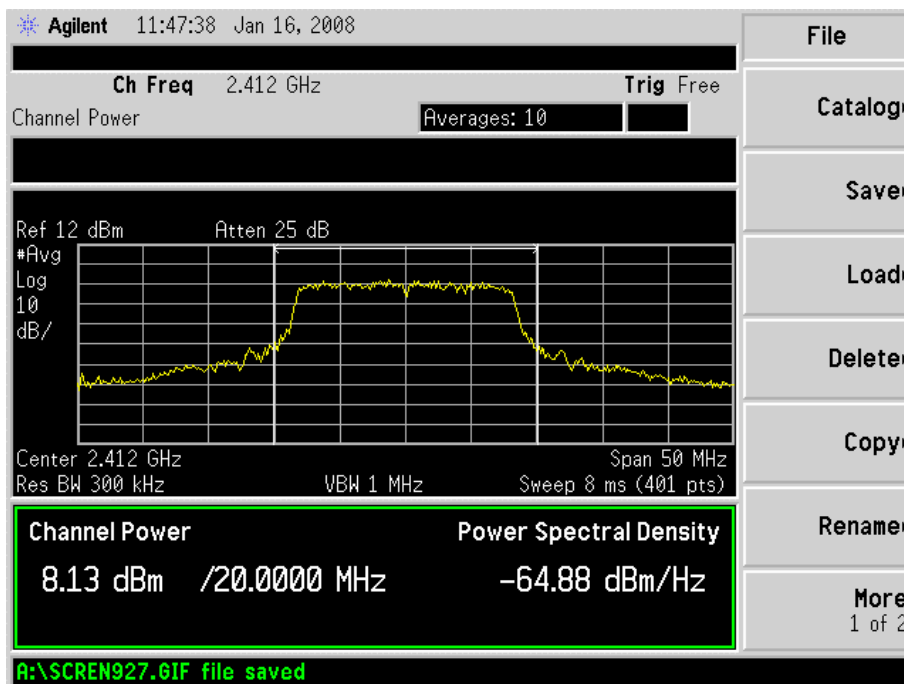


High Channel:

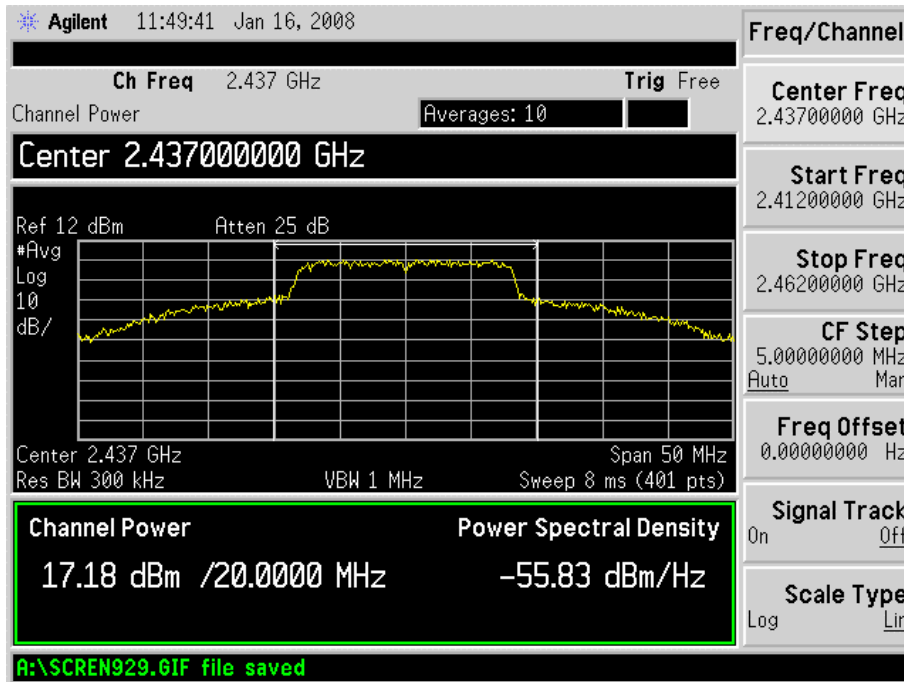


For 802.11g

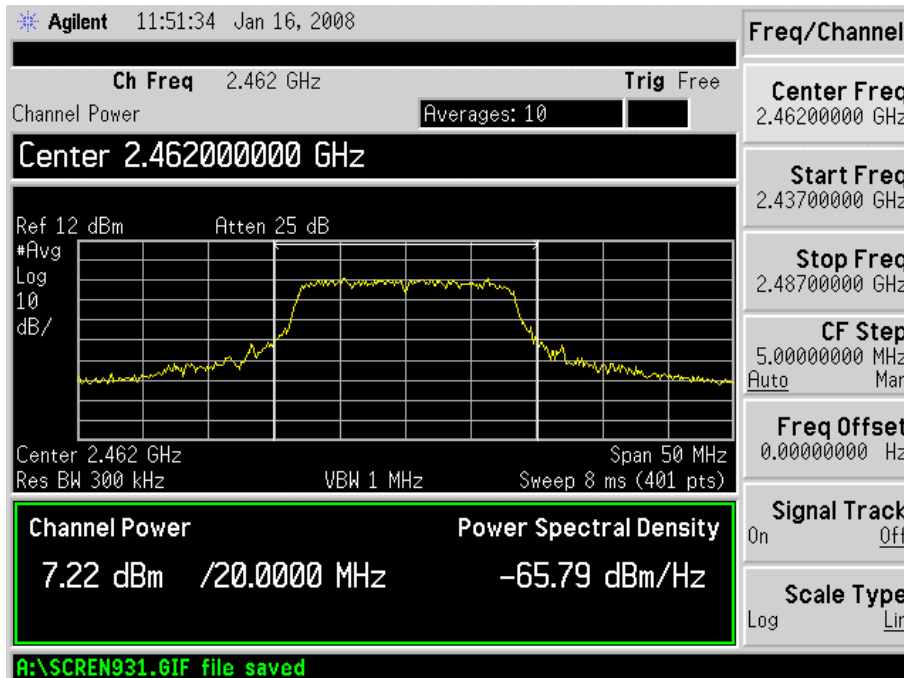
Low Channel:



Middle Channel:



High Channel:



8. FIELD STRENGTH OF SPURIOUS EMISSIONS

8.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ± 3.0 dB.

8.2 Standard Applicable

According to §15.247(c), 15.205 15.209(b) & 15.35 (b), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Section 15.209:

30 - 88 MHz 40 dBuV/m @3M

88 -216 MHz 43.5 dBuV/m @3M

216 -960 MHz 46 dBuV/m @3M

Above 960 MHz 54dBuV/m @3M

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

Emissions that fall in the restricted bands (15.205) must be less than 54dBuV/m otherwise the spurious and harmonics must be attenuated by at least 20dB.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Rohde & Schwarz	EMI Test Receiver	ESI26	830245/009	2007-1-26	2008-1-25
ETS	Multi_Device Controller	2090	57230	2007-1-26	2008-1-25
ETS	Receiver Antenna	2175	57337	2007-1-26	2008-1-25
ETS	50 ohm Coaxial Cable	SUCOFLEX 104	25498514	2007-1-26	2008-1-25
Rohde & Schwarz	Horn Antenna	HF906	100014	2007-1-26	2008-1-25

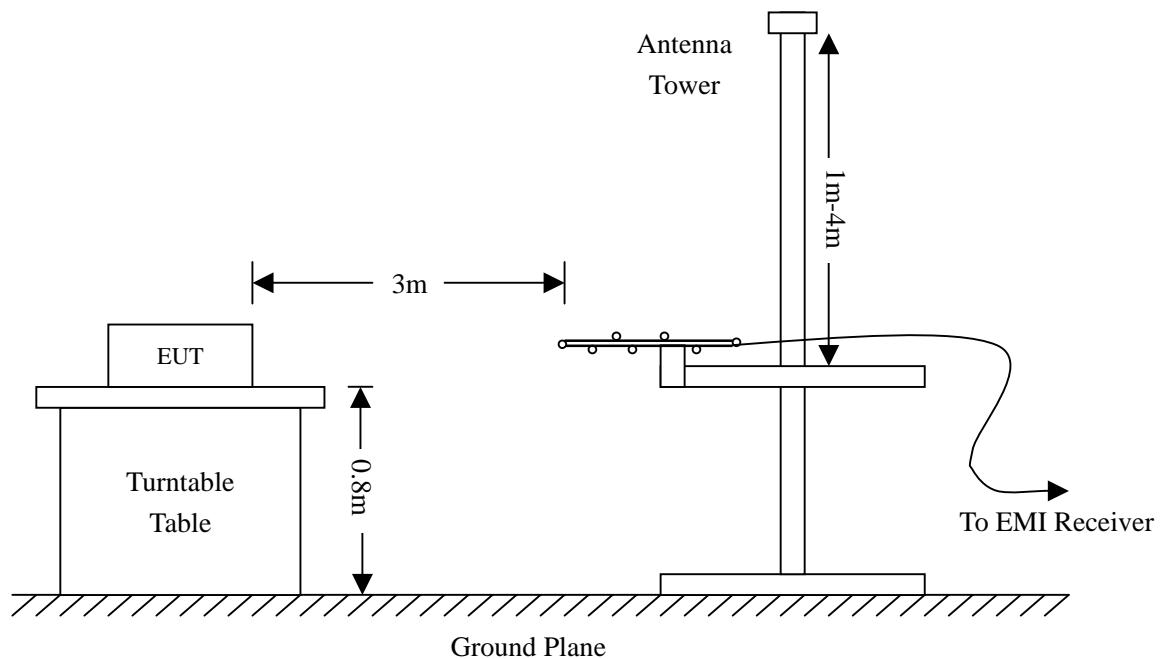
Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

8.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



8.5 Corrected Amplitude & Margin Calculation

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

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

8.6 Environmental Conditions

Temperature:	22° C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

8.7 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst margin of:

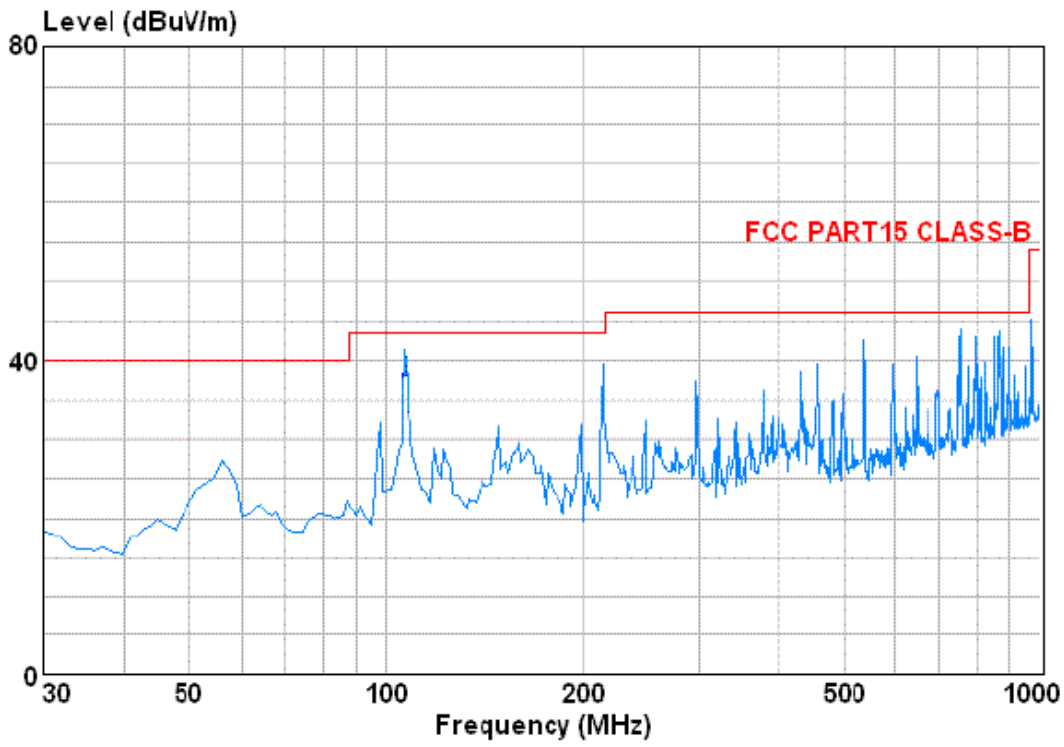
-1.2 dBμV at 865.1 MHz in the Vertical polarization, 30 MHz to 25 GHz, 3Meters

Frequency MHz	Detector	Meter Reading dBuV	Direction Degree	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Correction Amplitude dBuV/m	Limit dBuV/m	Margin dB
Radiation emission (30MHz to 1GHz)										
865.1	QP	43.8	45	V	22.2	3.4	24.62	44.8	46	-1.2
53.1	QP	55.1	45	V	8.5	0.7	26.24	38.0	40	-2.0
750.6	QP	44.4	60	V	21.6	3.2	25.28	43.9	46	-2.1
108.2	QP	55.2	135	H	11.0	1.0	25.89	41.3	43.5	-2.2
465.0	QP	49.8	120	V	17.4	2.3	25.73	43.8	46	-2.2
750.6	QP	43.8	90	H	21.6	3.2	25.28	43.3	46	-2.7
568.1	QP	47.2	45	H	19.0	2.6	25.9	42.9	46	-3.1
533.5	QP	47.5	0	H	18.6	2.5	25.79	42.8	46	-3.2
215.0	QP	52.0	180	H	11.4	1.3	25.06	39.6	43.5	-3.9
152.5	QP	48.8	0	V	13.1	1.1	25.51	37.5	43.5	-6.0
Low Channel (1G to 25GHz)										
4824.0	AV	43.2	270	V	34.1	5.2	33.0	49.5	54	-4.5
4824.0	AV	41.1	60	H	34.1	5.2	33.0	47.4	54	-6.6
7236.0	AV	37.2	90	V	37.4	6.1	33.5	47.2	54	-6.8
7236.0	AV	36.3	45	H	37.4	6.1	33.5	46.3	54	-7.7
4824.0	PK	45.8	90	V	34.1	5.2	33.0	52.1	74	-21.9
7236.0	PK	39.8	270	V	37.4	6.1	33.5	49.8	74	-24.2
4824.0	PK	43.3	45	H	34.1	5.2	33.0	49.6	74	-24.4
7236.0	PK	36.6	180	H	37.4	6.1	33.5	46.6	74	-27.4
2412.0	AV	102.0	60	H	29.1	3.7	34.0	100.8		(Fund.)
2412.0	AV	107.7	270	V	29.1	3.7	34.0	106.5		(Fund.)
2412.0	PK	103.5	45	H	29.1	3.7	34.0	102.3		(Fund.)
2412.0	PK	109.7	90	V	29.1	3.7	34.0	108.5		(Fund.)
Middle Channel (1G to 25GHz)										
7311.0	AV	39.9	270	V	37.4	6.1	33.5	49.9	54	-4.1
4874.0	AV	42.9	90	V	34.1	5.2	33.0	49.2	54	-4.8
7311.0	AV	37.2	60	H	37.4	6.1	33.5	47.2	54	-6.8
4874.0	AV	40.4	45	H	34.1	5.2	33.0	46.7	54	-7.3
7311.0	PK	44.8	45	V	37.4	6.1	33.5	54.8	74	-19.2
7311.0	PK	43.6	45	H	37.4	6.1	33.5	53.6	74	-20.4
4874.0	PK	47.1	270	V	34.1	5.2	33.0	53.4	74	-20.6
4874.0	PK	44.9	180	H	34.1	5.2	33.0	51.2	74	-22.8
2437.0	AV	109.8	45	H	29.1	3.7	34.0	108.6		(Fund.)
2437.0	AV	115.7	90	V	29.1	3.7	34.0	114.5		(Fund.)
2437.0	PK	111.7	90	H	29.1	3.7	34.0	110.5		(Fund.)
2437.0	PK	116.6	60	V	29.1	3.7	34.0	115.4		(Fund.)

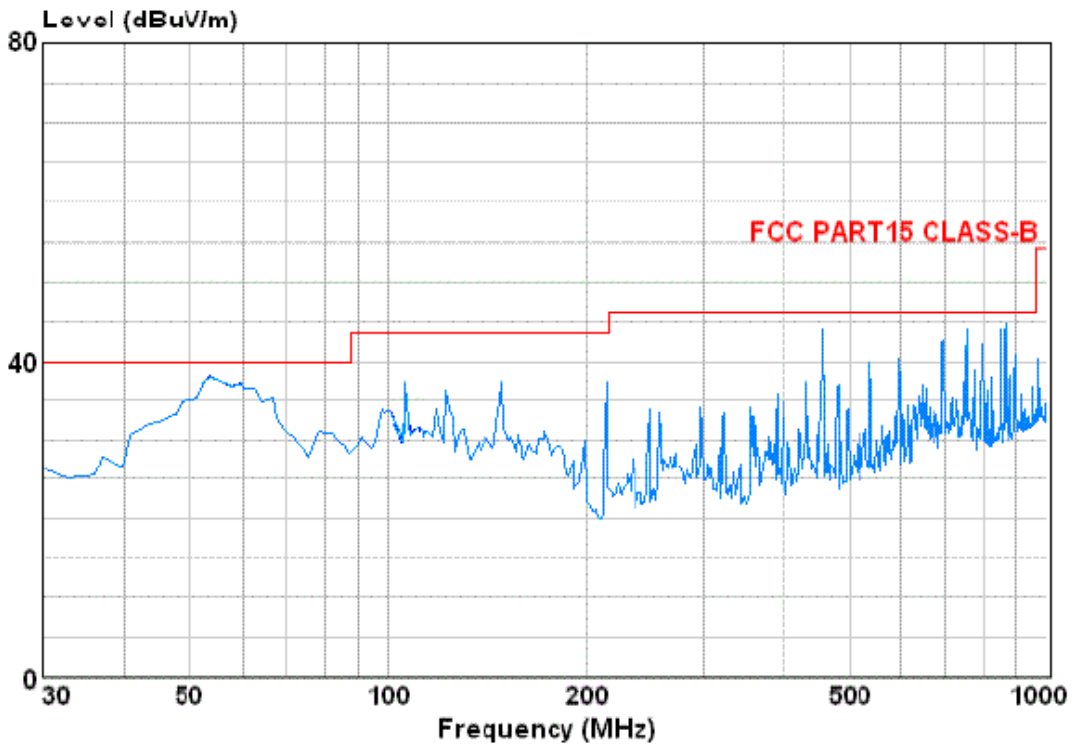
High Channel (1G to 25GHz)										
7386.0	AV	38.8	270	V	37.4	6.1	33.5	48.8	54	-5.2
4924.0	AV	41.2	90	V	34.1	5.2	33.0	47.5	54	-6.5
7386.0	AV	37.3	60	H	37.4	6.1	33.5	47.3	54	-6.7
4924.0	AV	40.3	60	H	34.1	5.2	33.0	46.6	54	-7.4
7386.0	PK	42.7	45	V	37.4	6.1	33.5	52.7	74	-21.3
4924.0	PK	46.1	270	V	34.1	5.2	33.0	52.4	74	-21.6
4924.0	PK	44.3	180	H	34.1	5.2	33.0	50.6	74	-23.4
7386.0	PK	40.1	45	H	37.4	6.1	33.5	50.1	74	-23.9
2462.0	AV	101.4	45	H	29.1	3.7	34.0	100.2		(Fund.)
2462.0	AV	106.9	90	V	29.1	3.7	34.0	105.7		(Fund.)
2462.0	PK	102.9	90	H	29.1	3.7	34.0	101.7		(Fund.)
2462.0	PK	108.7	90	V	29.1	3.7	34.0	107.5		(Fund.)

Note: Testing is carried out with frequency rang 30MHz to the tenth harmonics, which above 5th Harmonics is close to the noise base even antenna close up to 1meter distance according the measurement of ANSI C63.4.

Test Result/Plots:
From 30 MHz to 1 GHz
Horizontal:



Vertical:



9. OUT OF BAND EMISSIONS

9.1 Standard Applicable

According to §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.

9.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date	Due. Date
Agilent	Spectrum Analyzer	E4402B	US41192821	2007-06-30	2008-06-29
ETS	Receiver Antenna	2175	57337	2007-01-26	2008-01-25
ETS	50 ohm Coaxial Cable	SUCOFLEX 104	25498514	2007-01-26	2008-01-25
Rohde & Schwarz	Horn Antenna	HF906	100014	2007-01-26	2008-01-25

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

9.3 Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW, VBW=100KHz, Span=50MHz, Sweep = auto
3. Set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2438.5MHz, then mark the higher-level emission for comparing with the FCC rules.

9.4 Environmental Conditions

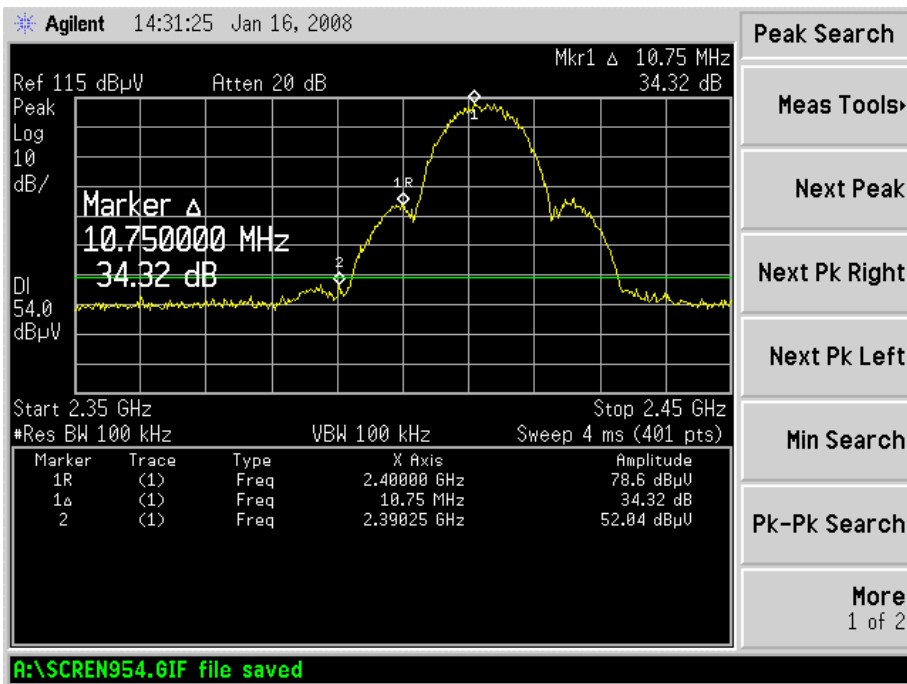
Temperature:	21° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

9.5 Summary of Test Results/Plots

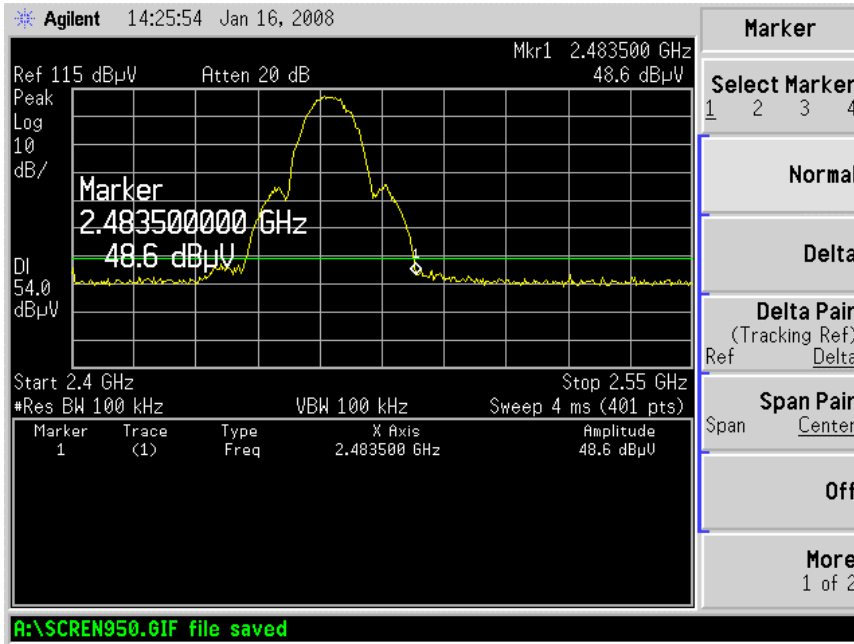
Test mode	Frequency MHz	Limit dBuV /dB	Result
802.11b	2390.00	<54dBuV	Pass
	2400.00	>20dB	Pass
	2483.50	<54dBuV	Pass
802.11g	2390.00	<54dBuV	Pass
	2400.00	>20dB	Pass
	2483.50	<54dBuV	Pass

For 802.11b

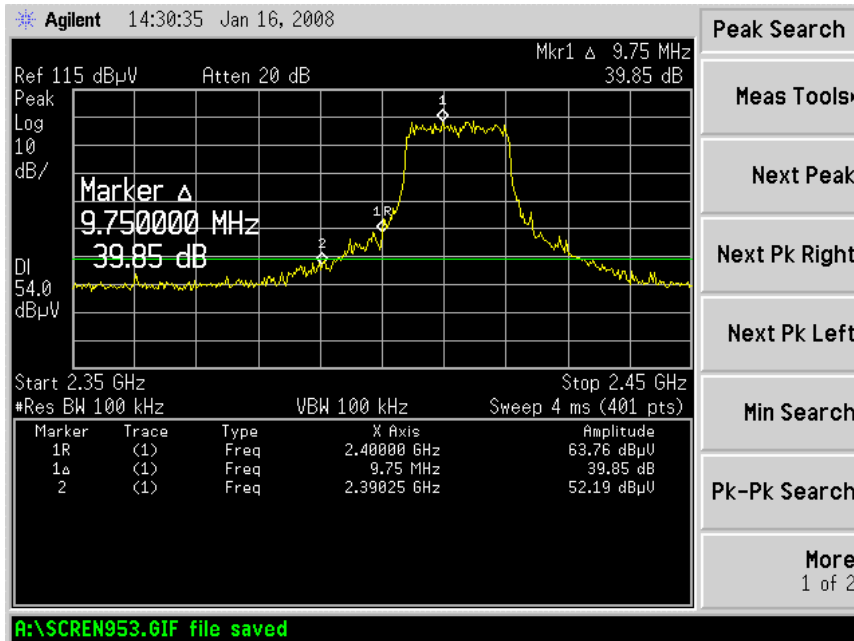
Lowest Bandedge



Highest Bandedge



For 802.11g
Lowest Bandedge



Highest Bandedge

