



**FCC CFR47 PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 7**

**CERTIFICATION TEST REPORT**

**FOR**

**802.11 bgn + BT 2.1 (EDR)**

**MODEL NUMBER: A1367**

**FCC ID: BCG-E2407  
IC: 579C-E2407**

**REPORT NUMBER: 10U13294-1**

**ISSUE DATE: JULY 20, 2010**

*Prepared for*  
**APPLE INC.  
1 INFINITE LOOP  
CUPERTINO, CA. 95014, U.S.A.**

*Prepared by*  
**COMPLIANCE CERTIFICATION SERVICES  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888**



**NVLAP LAB CODE 200065-0**

Revision History

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC  
1 INFINITE LOOP  
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** 802.11 bgn + BT 2.1 (EDR)

**MODEL:** A1367

**SERIAL NUMBER:** A0551 (Radiated Unit); 0429 (Conducted Unit)

**DATE TESTED:** JULY 01-10, 2010

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:

Tested By:



THU CHAN  
ENGINEERING MANAGER  
COMPLIANCE CERTIFICATION SERVICES

CHIN PANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The Apple Model Number A1367 is an iPod Touch product. This is a handheld touch screen iPod music device with 802.11b/g/n and Bluetooth radio functions. The A1367 measures 110.8 mm (4.362 inches) long x 58.9 mm (2.318 inches) wide x 7.2 mm (0.283 inches) thick and weighs 99.2 grams (3.5 oz.). The rechargeable battery is not user accessible. The Apple A1367 comes with one of three memory configurations, 8 / 16 / 32 / 64 Giga Bytes for storing music, video or data. The Apple A1367 function is fully compatible with Apple's iTunes software. The Apple A1367 in box materials include; Apple ear buds (no microphone), and 30 pin to USB cable.

The radio module is manufactured by Murata.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	19.82	95.94
2412 - 2462	802.11g	25.20	331.13
2412 - 2462	802.11n	25.20	331.13

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 0.38 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Baker 8B 72.

The EUT driver software installed during testing was 4.219 RC46.13.

The test utility software used during testing was Broadcom WL tool.

## 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate for each mode is determined to be as follows, based on input from the manufacturer of the radio.

All final tests in the 802.11b mode were made at 1 Mb/s.  
 All final tests in the 802.11g mode were made at 6 Mb/s.  
 All final tests in the 802.11n mode were made at MCS0.

The worst-position was the EUT with highest emissions. To determine the worst-case, the EUT was investigated for X, Y, and Z-Positions, and the worst position among X, Y, and Z with AC/DC adapter. As a result, Y-position without AC/DC adapter turns out to be the worst-case.

For radiated emissions below 1 GHz the worst-case configuration is determined to be the mode and channel with the highest output power.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	Mac book Pro	PT389295	DoC
Laptop AC Adapter	Apple	A52	Y5629012TLYDVT	DoC
AC Adapter	Foxlink Technology	A1205 W005B050	NSW22061 LPS	DoC
Jig Card	Apple	N/A	N/A	N/A

### I/O CABLES

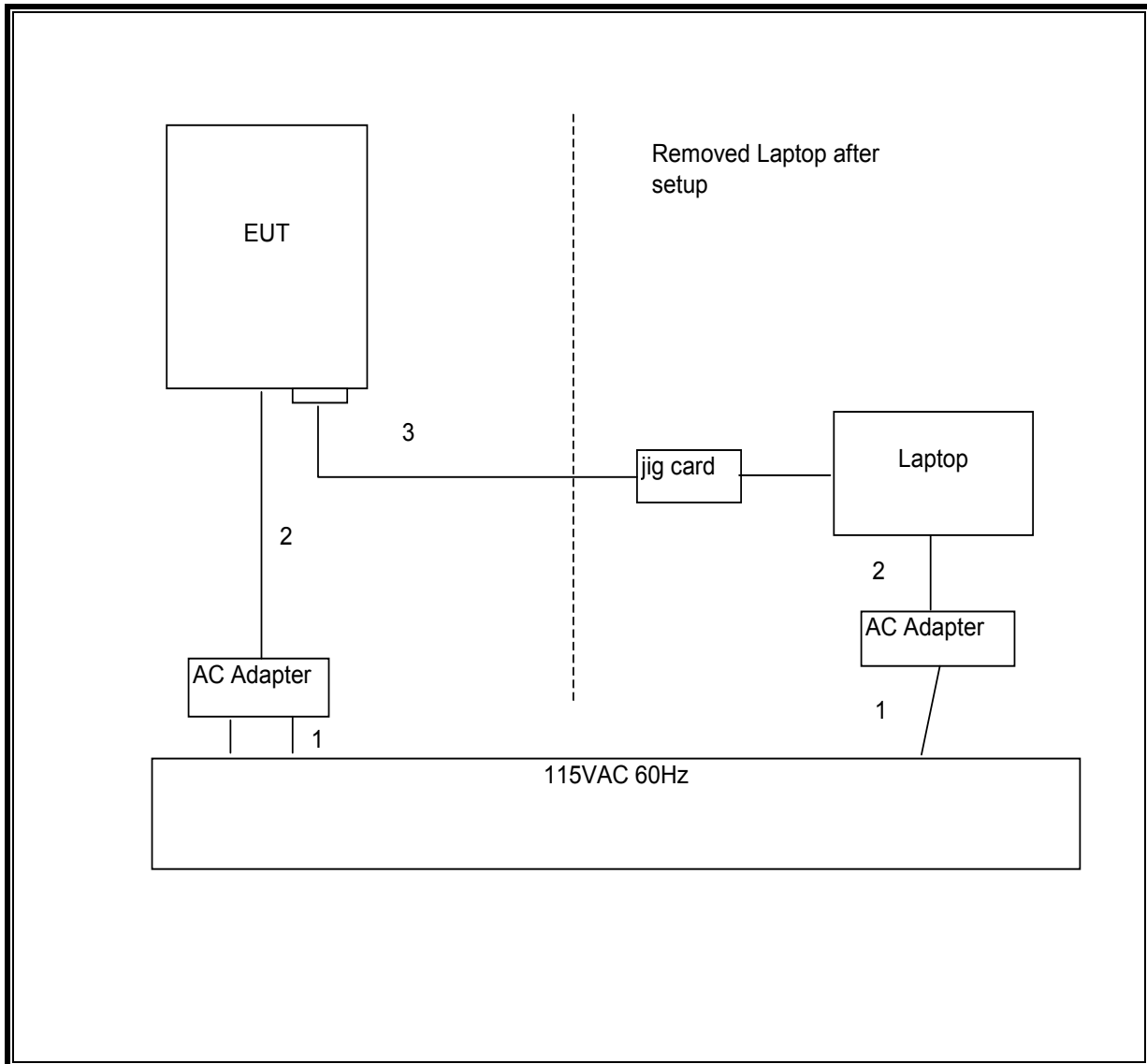
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	2m	N/A
2	DC	1	DC	Un-shielded	2m	N/A
3	USB	1	USB	Shielded	1m	Connect to Laptop for setup only

### TEST SETUP

The EUT is stand alone unit Test software exercised the radio card.



**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/31/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	08/04/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/14/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00778	07/06/11
Antenna, Horn, 18 GHz	EMCO	3115	C00783	07/29/10
EMI Test Receiver, 30 MHz	R&S	ESHS 20	N02396	05/06/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/06/10
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	01/07/12
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/11
Peak Power Meter	Boonton	4541	C01189	02/26/11
Peak Power Sensor	Boonton	57318	C01202	02/23/11
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRV50702	N02685	CNR

## 7. ANTENNA PORT TEST RESULTS

### 7.1. 802.11b MODE IN THE 2.4 GHz BAND

#### 7.1.1. 6 dB BANDWIDTH

##### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

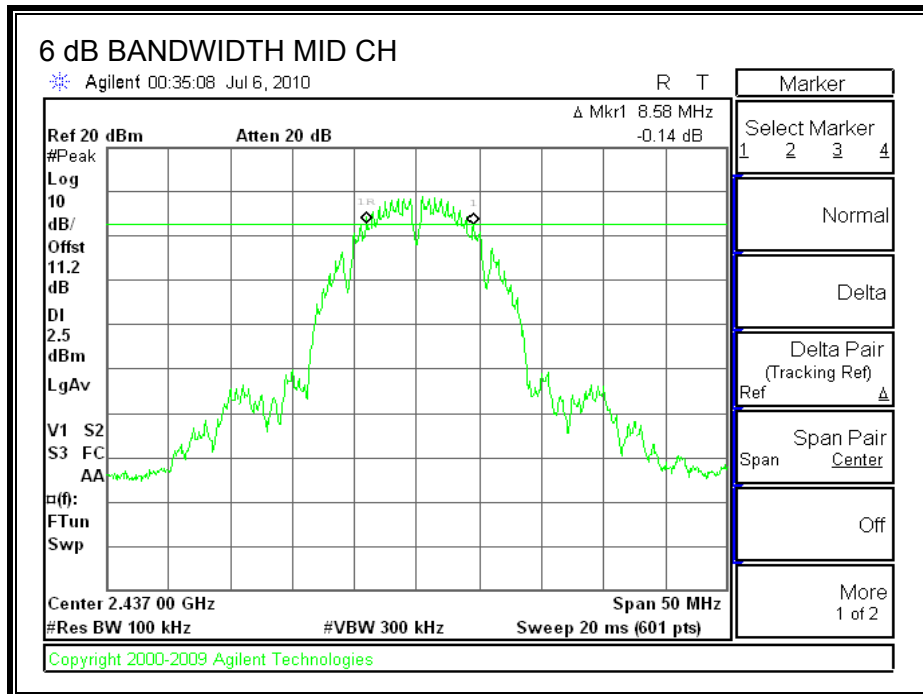
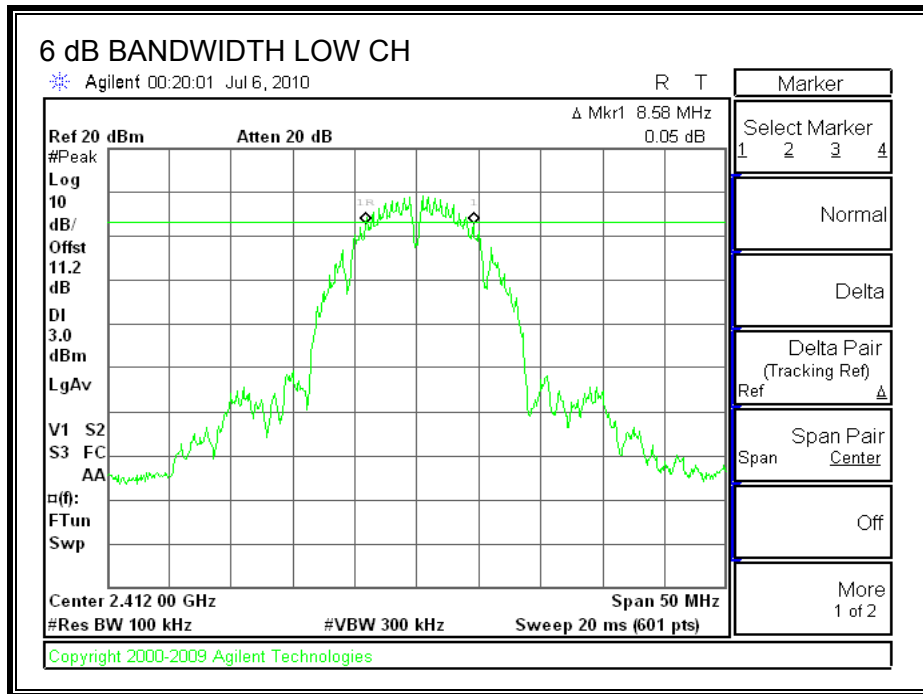
##### TEST PROCEDURE

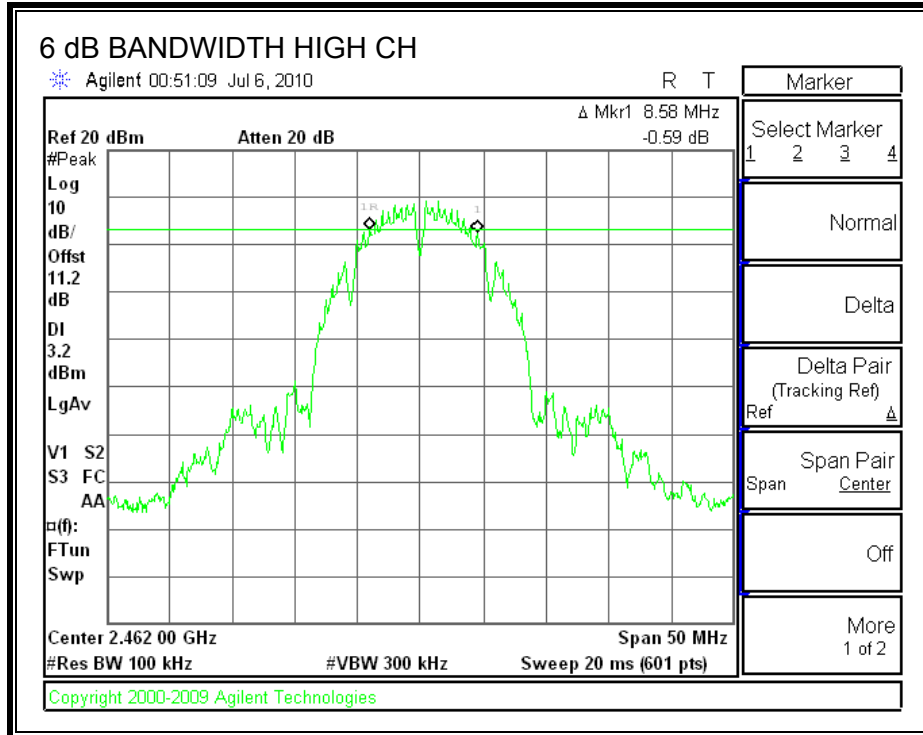
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

##### RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	8.58	0.5
Middle	2437	8.58	0.5
High	2462	8.58	0.5

**6 dB BANDWIDTH**





## 7.1.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

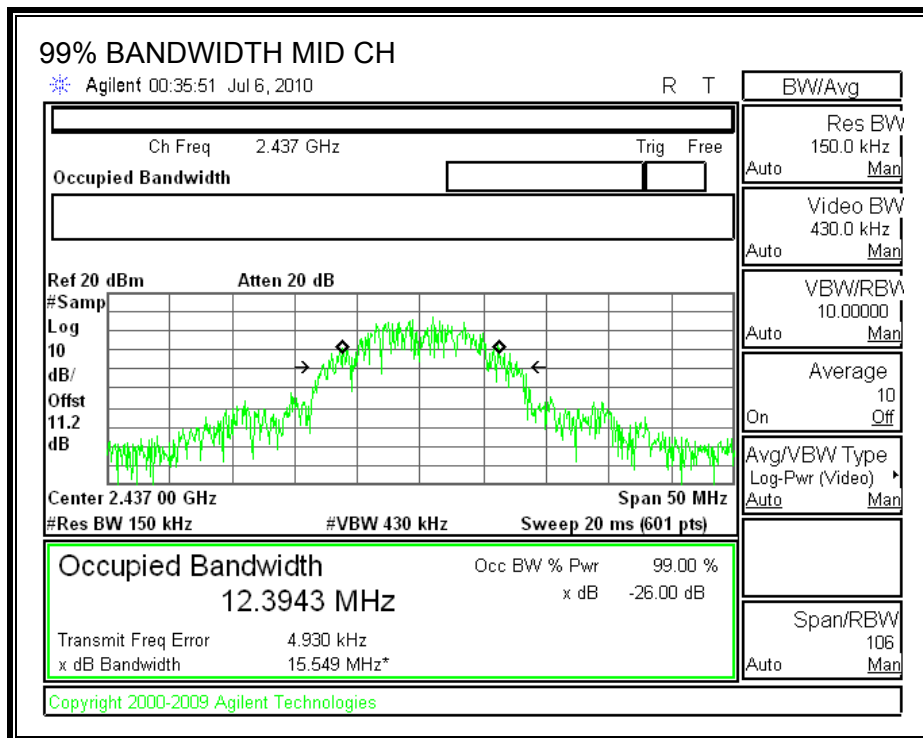
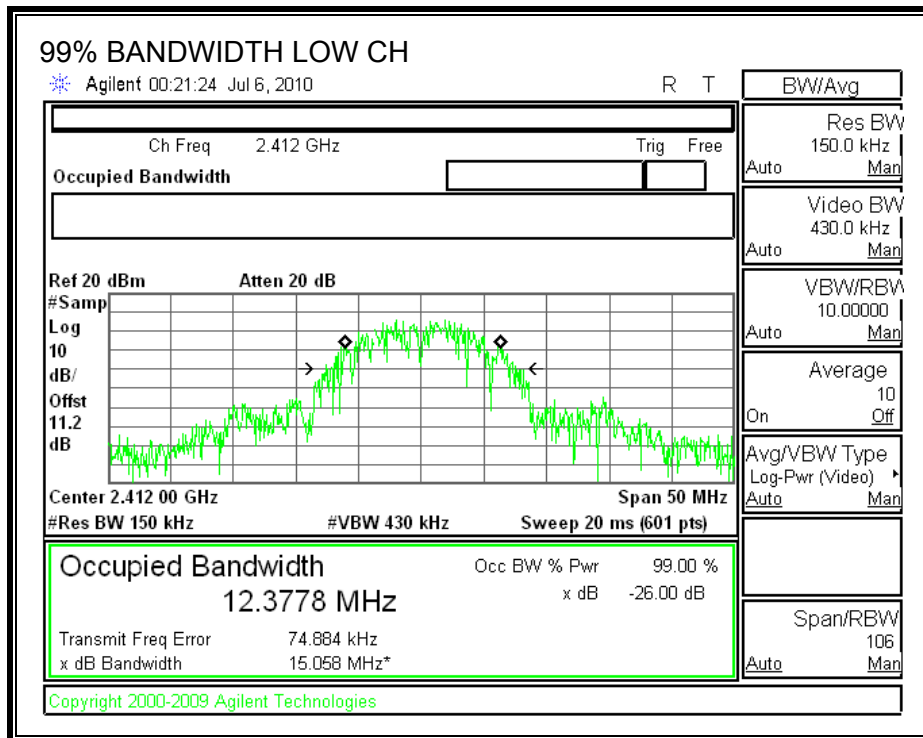
### TEST PROCEDURE

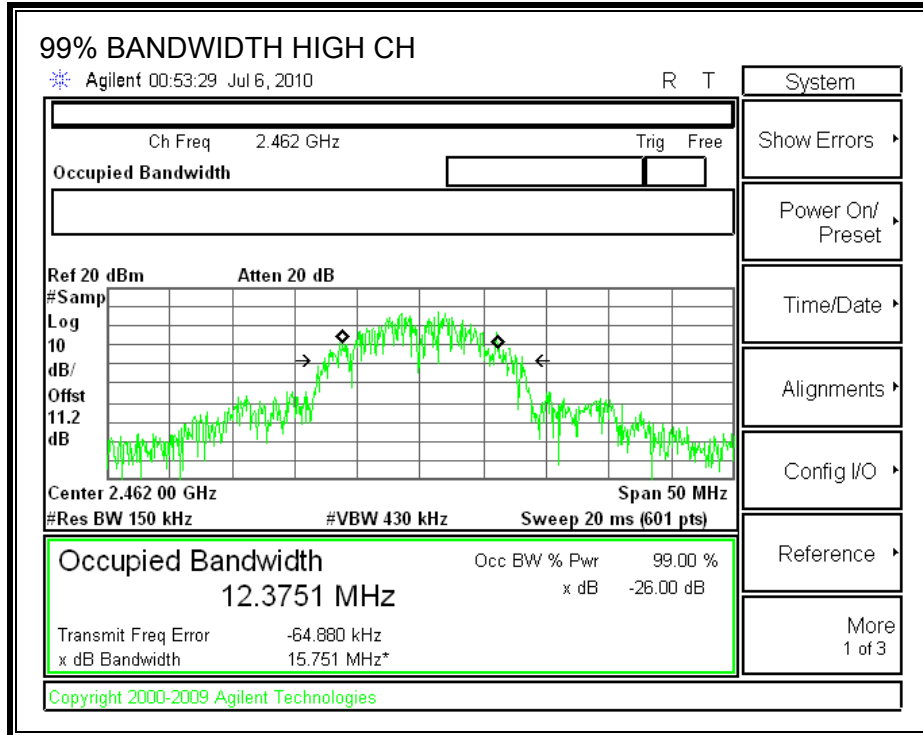
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	12.3778
Middle	2437	12.3943
High	2462	12.3751

**99% BANDWIDTH**







### 7.1.3. OUTPUT POWER

#### LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

#### TEST PROCEDURE

Peak power is measured by the Booton Power meter.

#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.65	30	-10.35
Middle	2437	19.82	30	-10.18
High	2462	19.78	30	-10.22

### 7.1.4. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11.2 dB (including 10 dB pad and 1.2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2412	16.80
Middle	2437	16.90
High	2462	16.80

### 7.1.5. POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

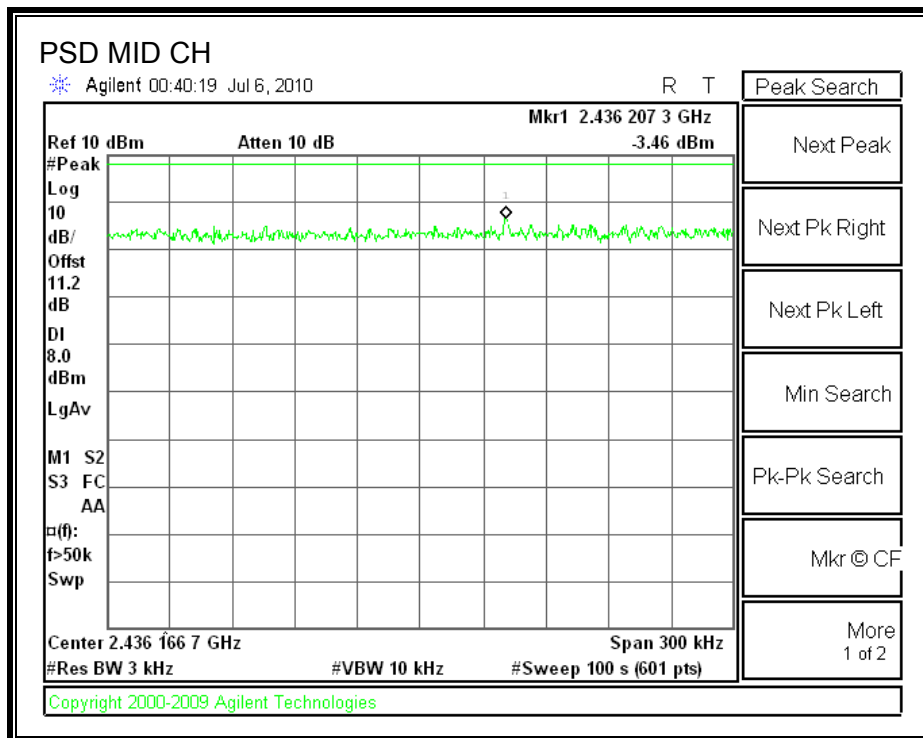
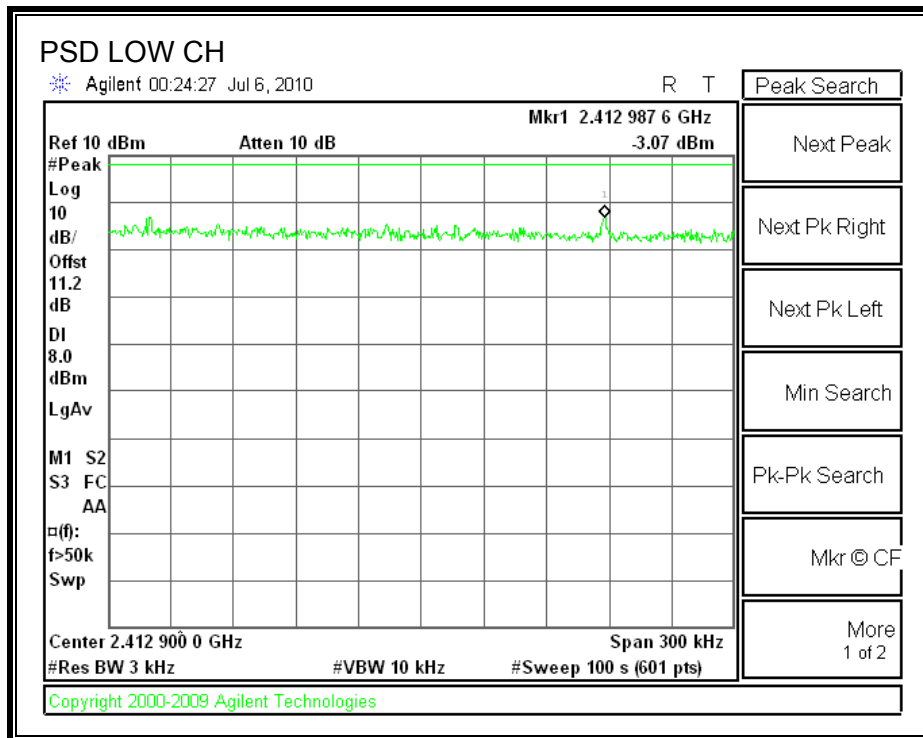
#### TEST PROCEDURE

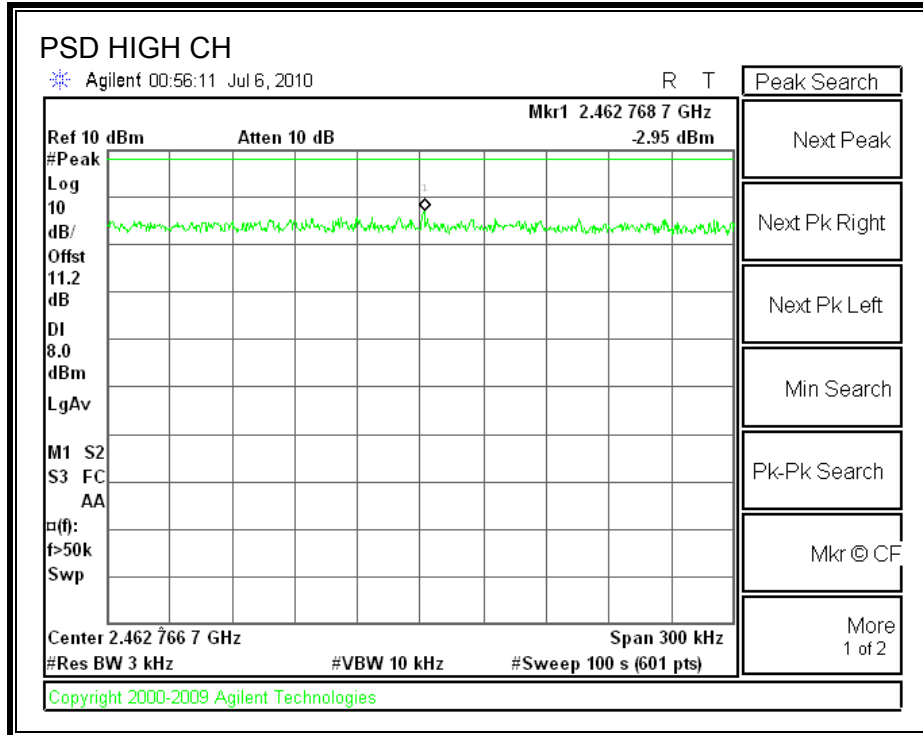
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

#### RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-3.07	8	-11.07
Middle	2437	-3.46	8	-11.46
High	2462	-2.95	8	-10.95

**POWER SPECTRAL DENSITY**





## **7.1.6. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

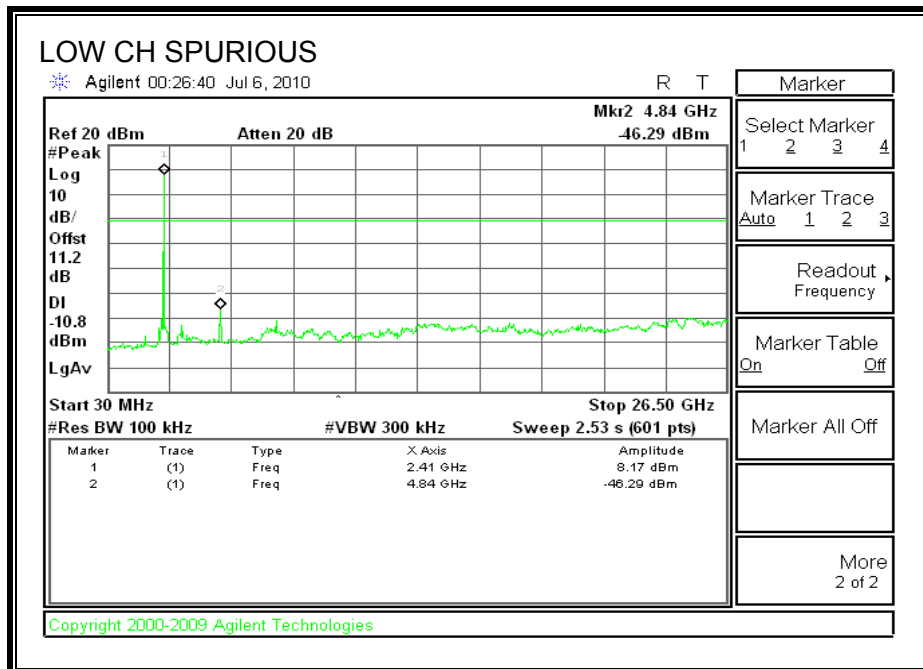
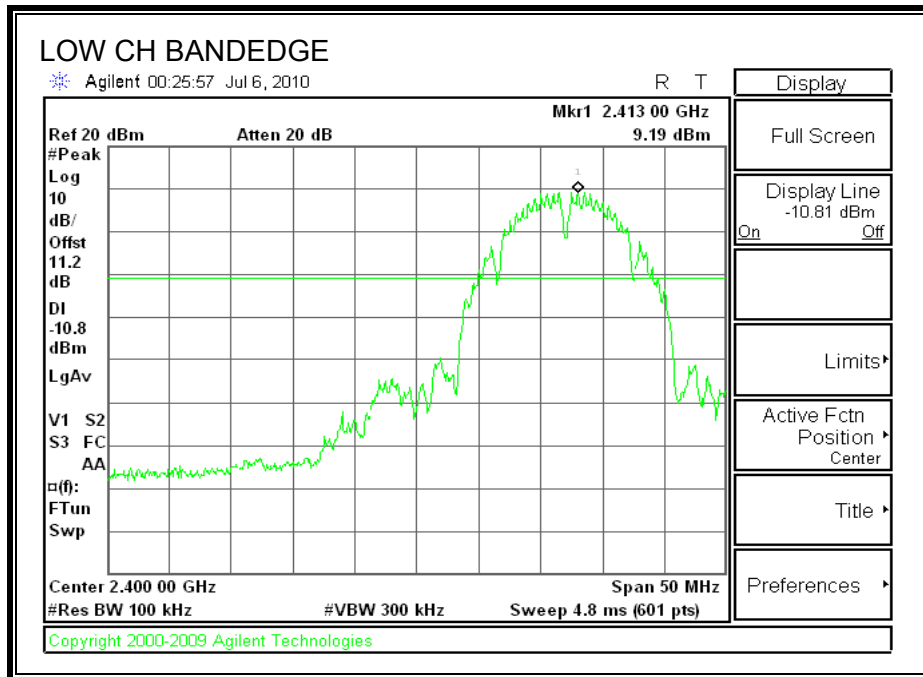
### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

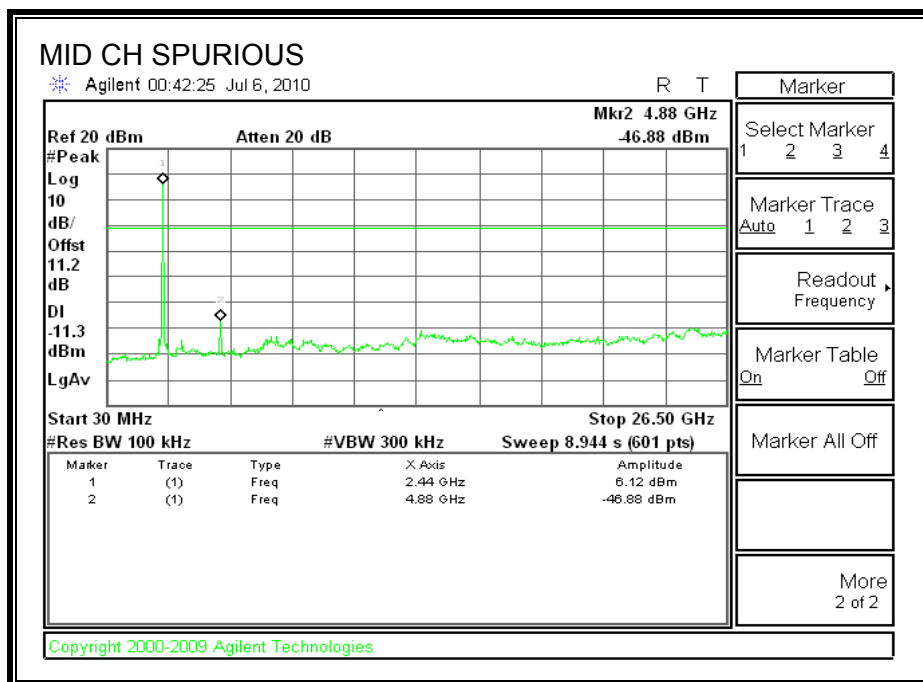
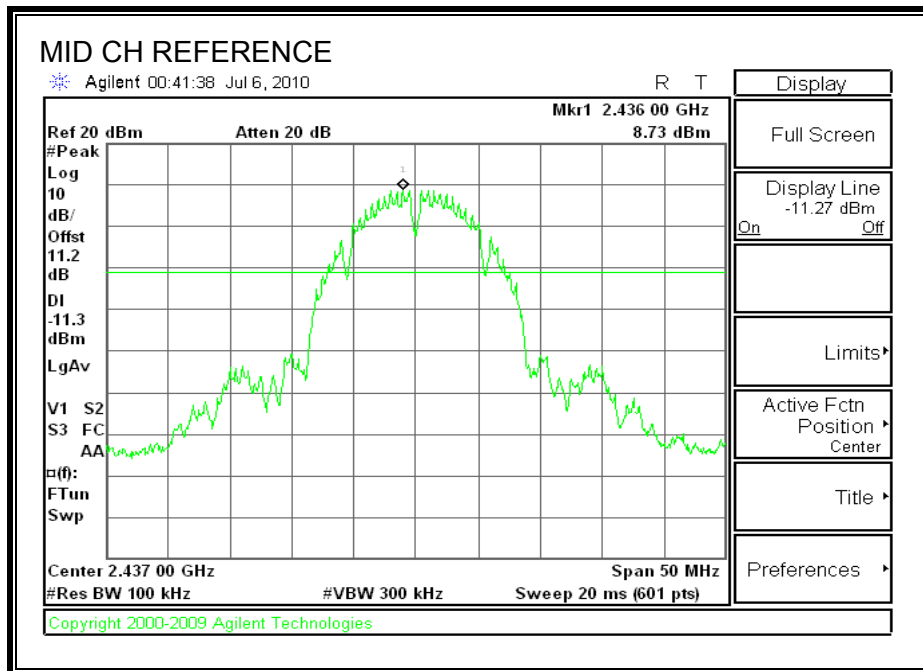
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

**SPURIOUS EMISSIONS, LOW CHANNEL**

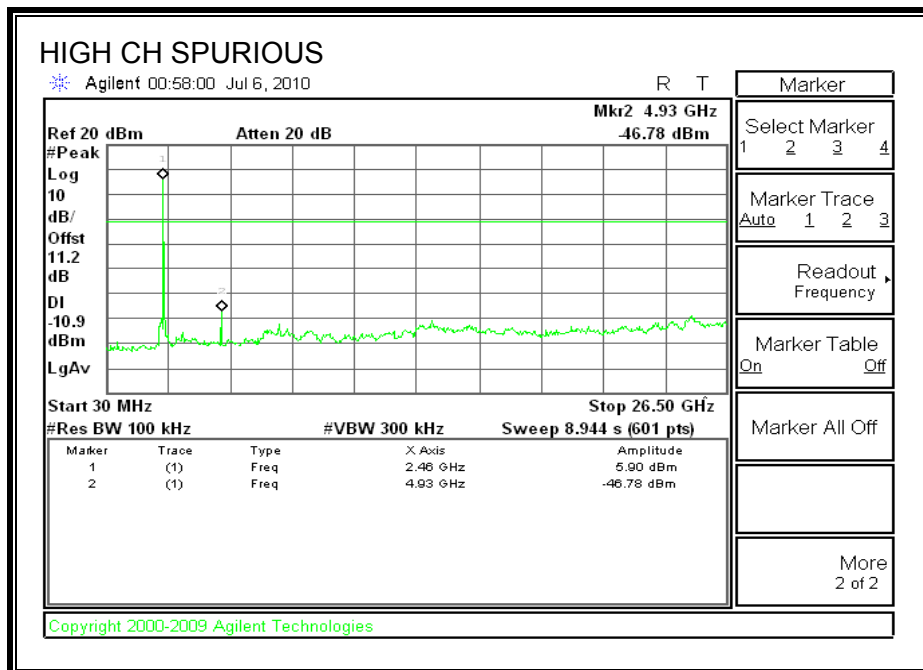
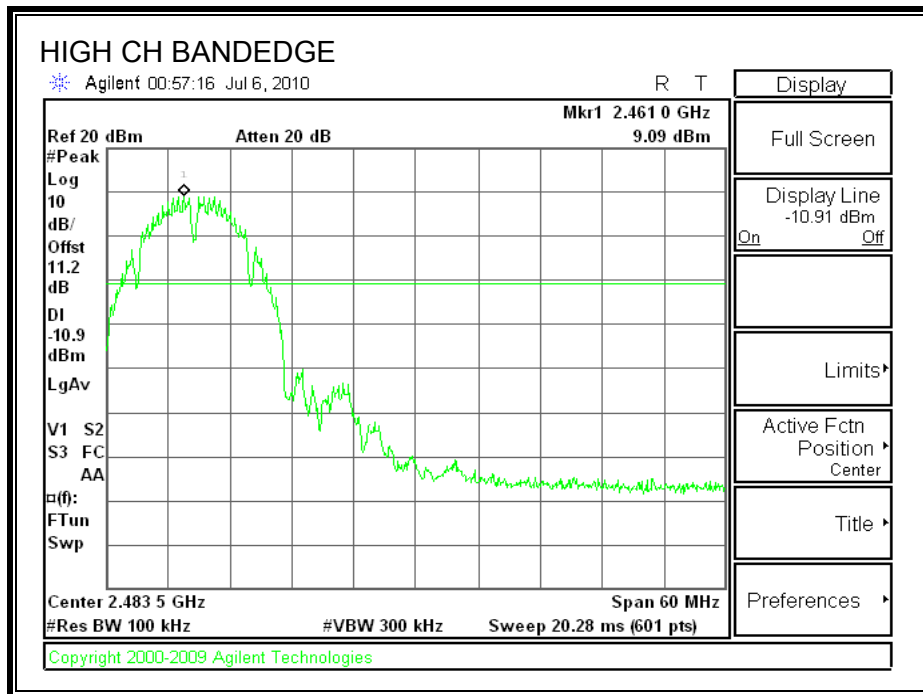


**SPURIOUS EMISSIONS, MID CHANNEL**





**SPURIOUS EMISSIONS, HIGH CHANNEL**



## 7.2. 802.11g MODE IN THE 2.4 GHz BAND

### 7.2.1. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

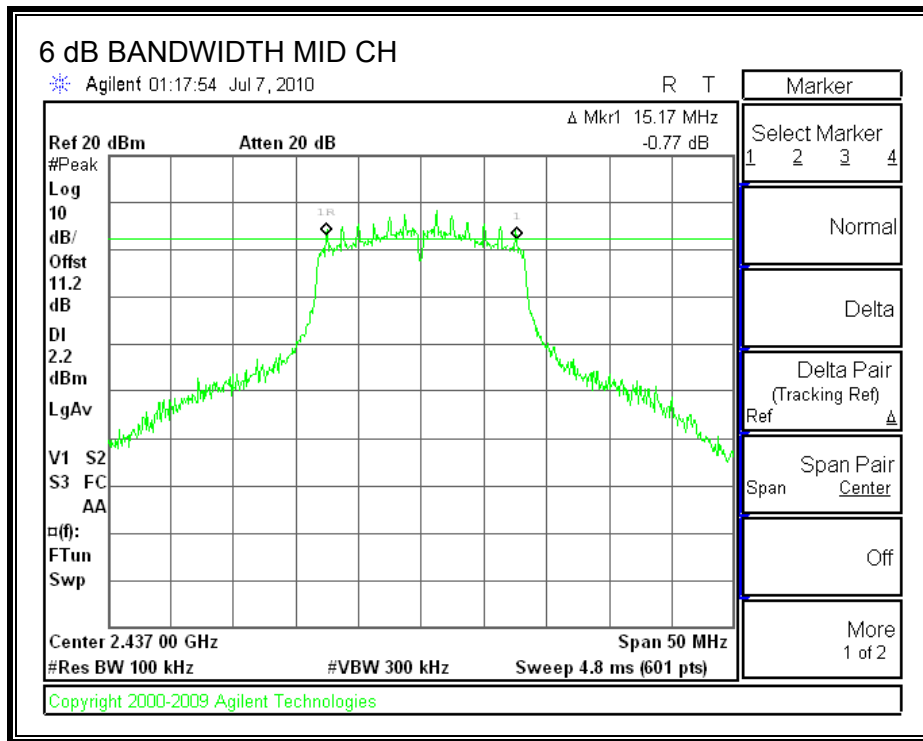
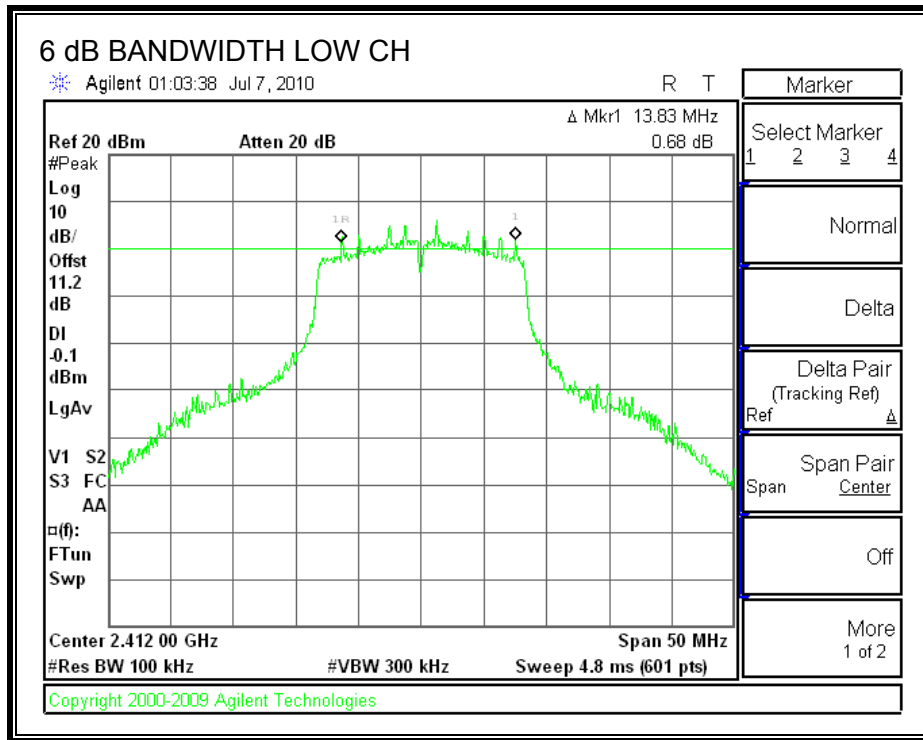
#### TEST PROCEDURE

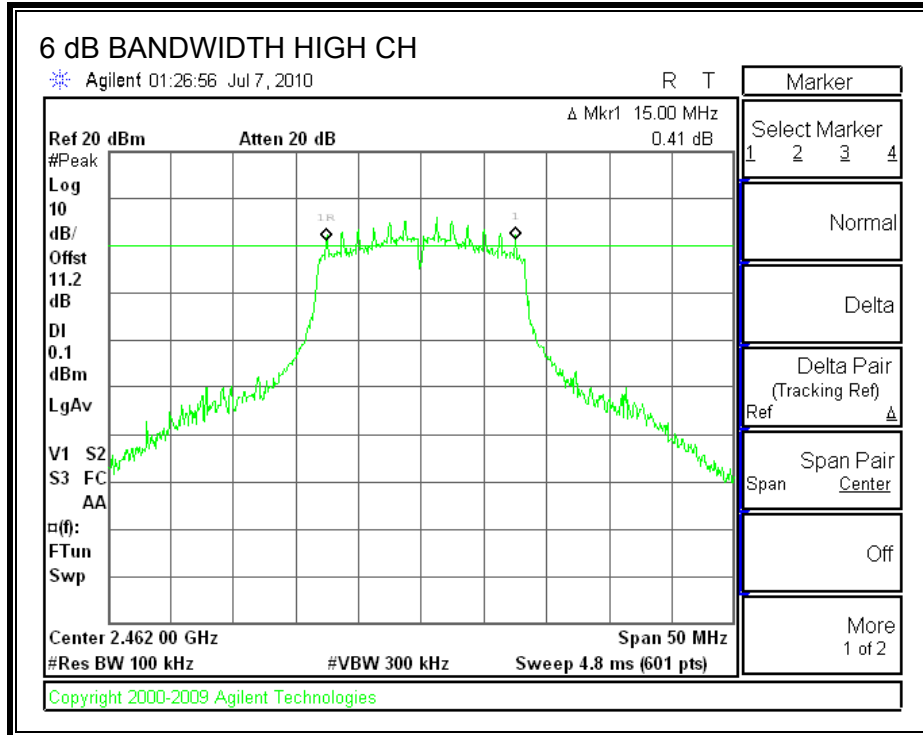
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

#### RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	13.83	0.5
Middle	2437	15.17	0.5
High	2462	15.00	0.5

**6 dB BANDWIDTH**





## 7.2.2. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

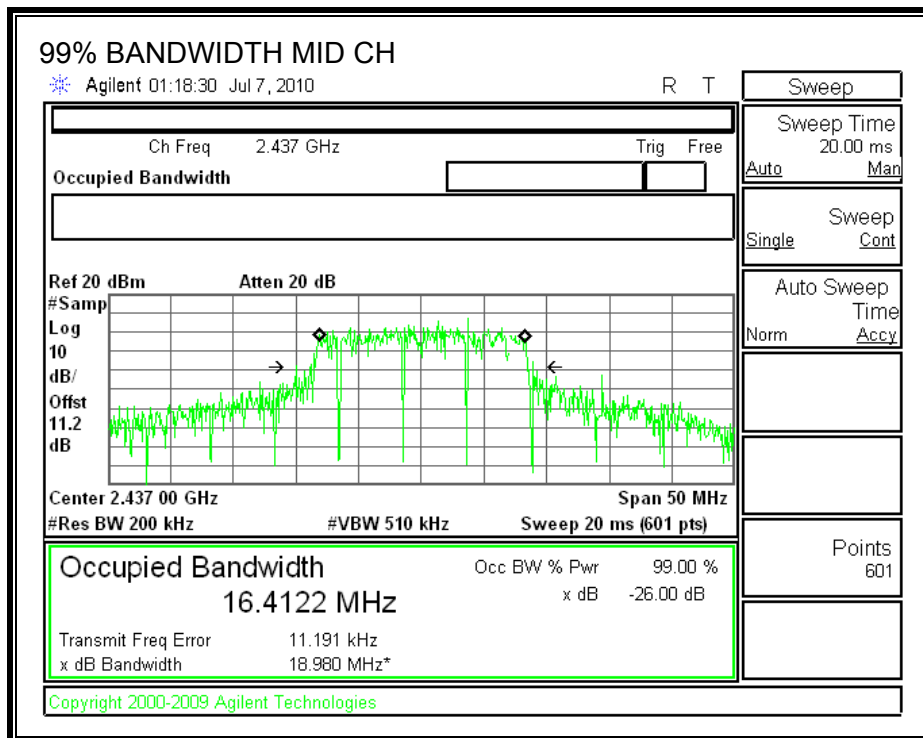
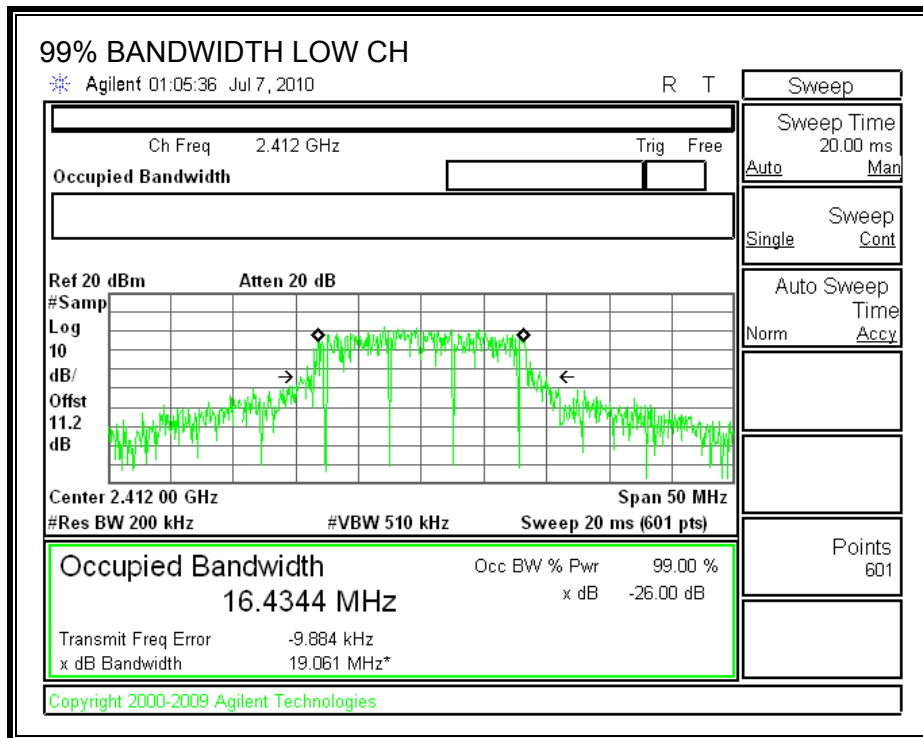
### TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.4344
Middle	2437	16.4122
High	2462	16.3802

**99% BANDWIDTH**





### 7.2.3. OUTPUT POWER

#### LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

#### TEST PROCEDURE

The transmitter output is connected to a Booton power meter.

#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.80	30	-6.20
Middle	2437	25.20	30	-4.80
High	2462	23.60	30	-6.40



## 7.2.4. AVERAGE POWER

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

### RESULTS

The cable assembly insertion loss of 11.2 dB (including 10 dB pad and 1.2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2412	14.65
Middle	2437	16.50
High	2462	14.50

## 7.2.5. POWER SPECTRAL DENSITY

### LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

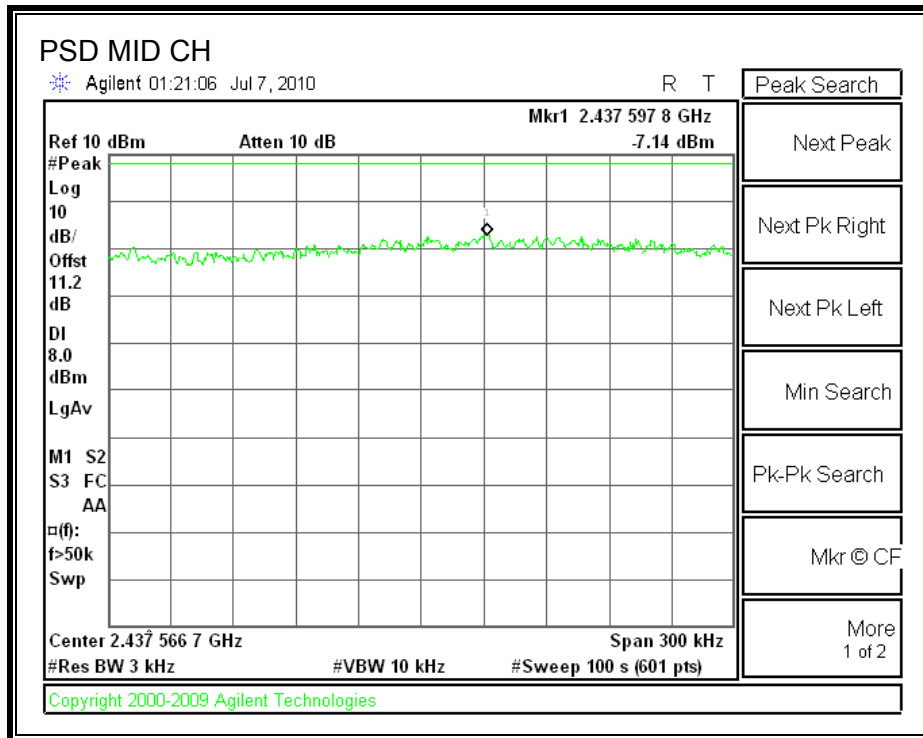
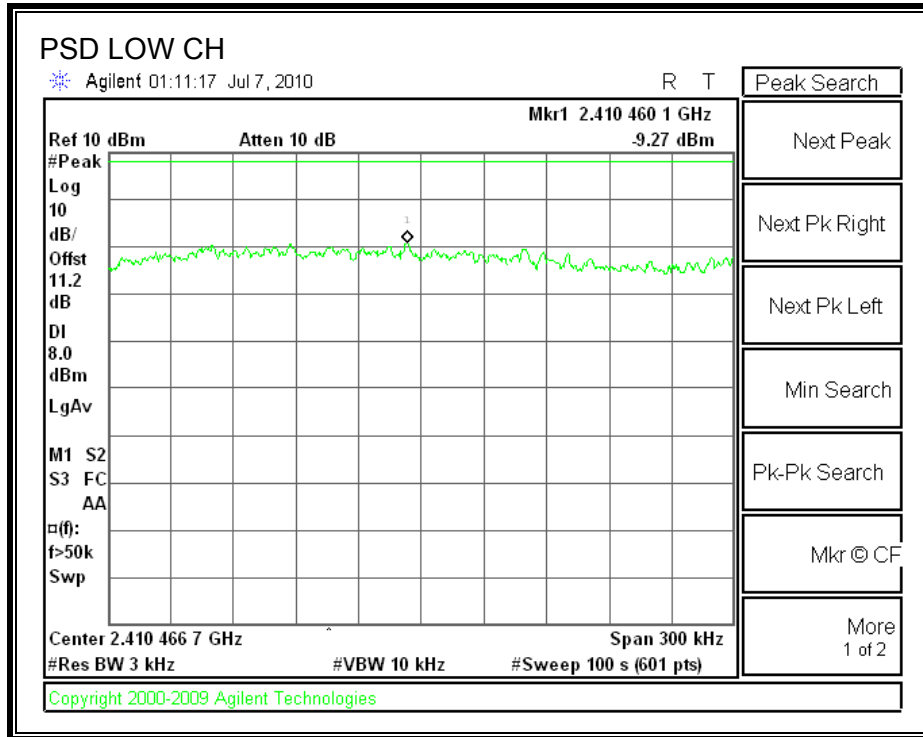
### TEST PROCEDURE

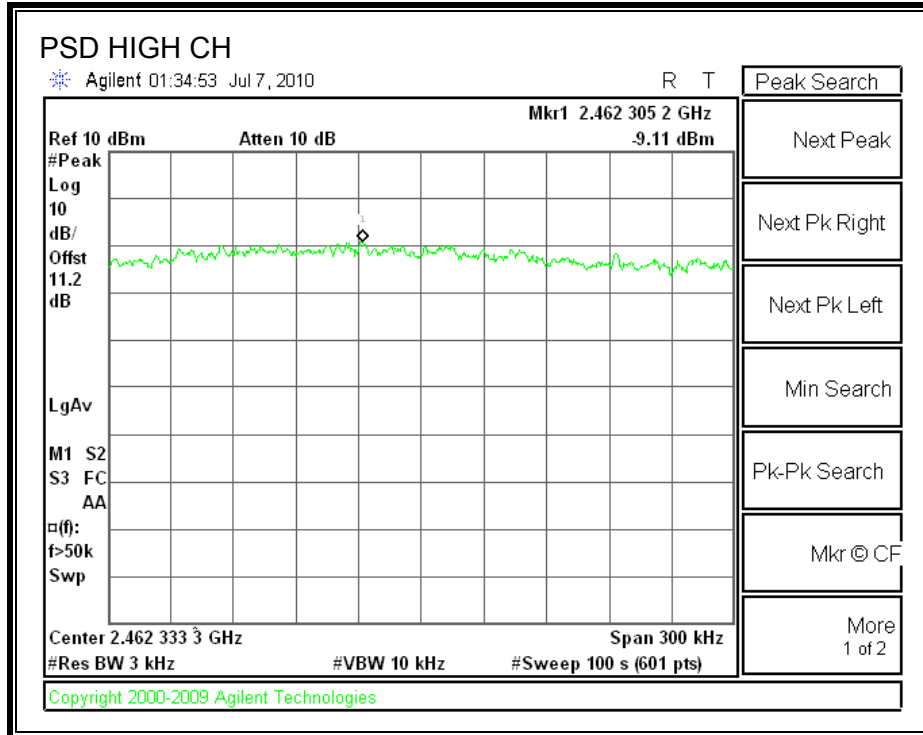
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

### RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-9.27	8	-17.27
Middle	2437	-7.14	8	-15.14
High	2462	-9.11	8	-17.11

**POWER SPECTRAL DENSITY**





## **7.2.6. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

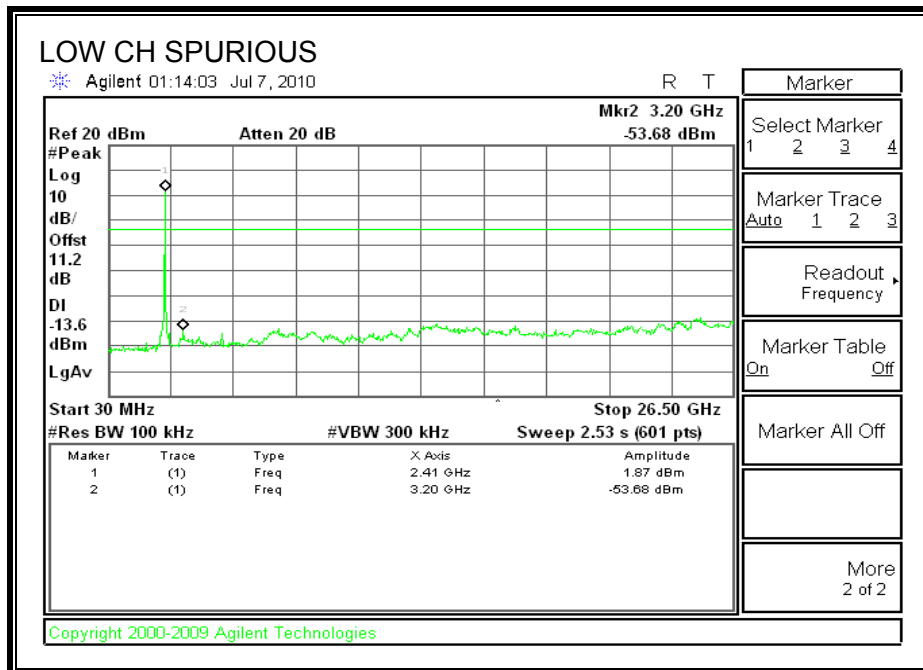
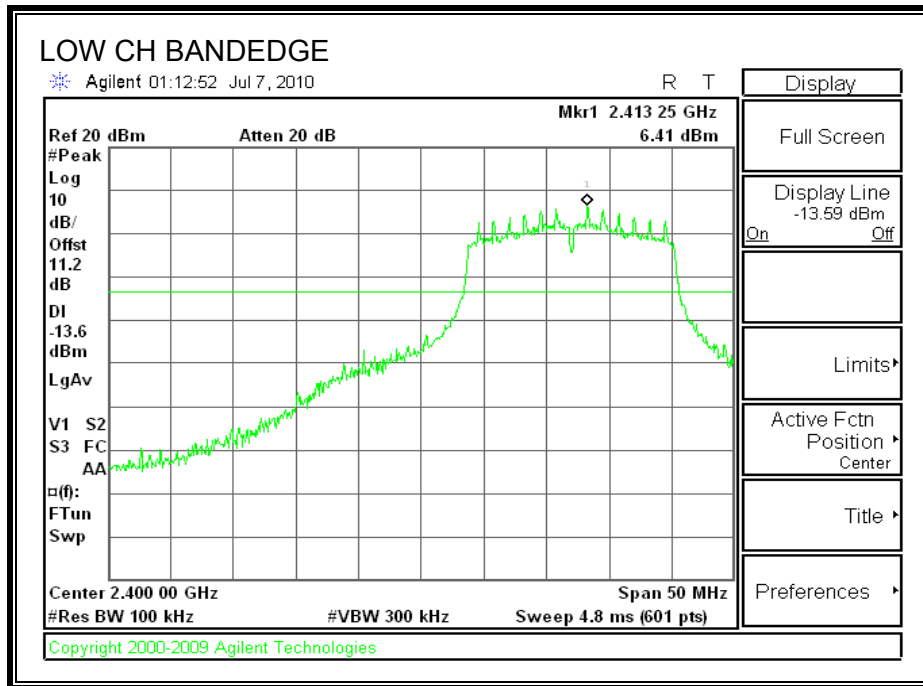
### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

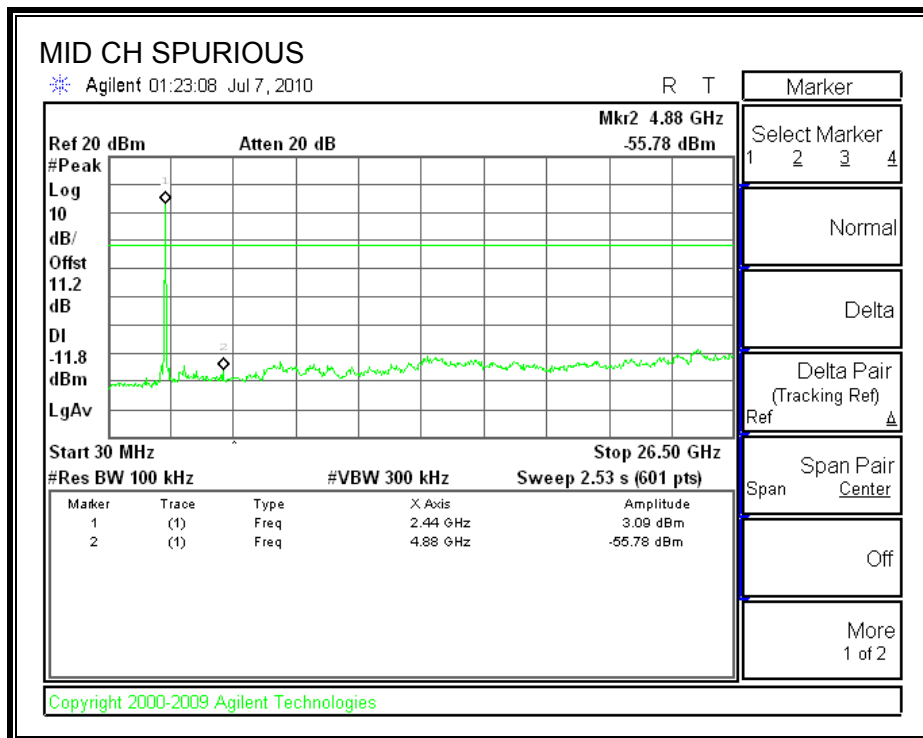
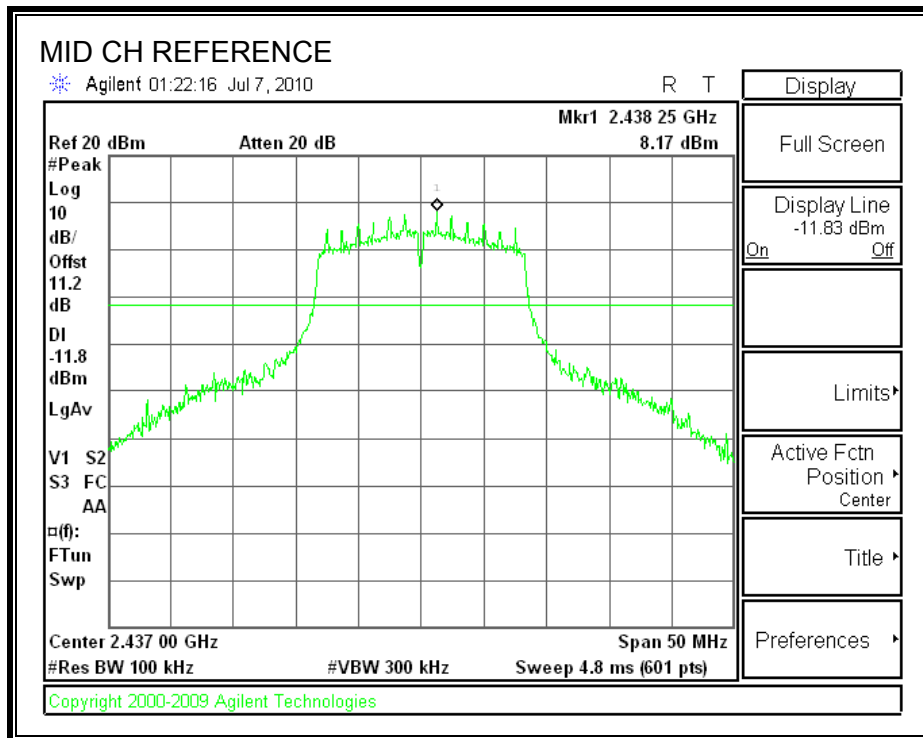
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

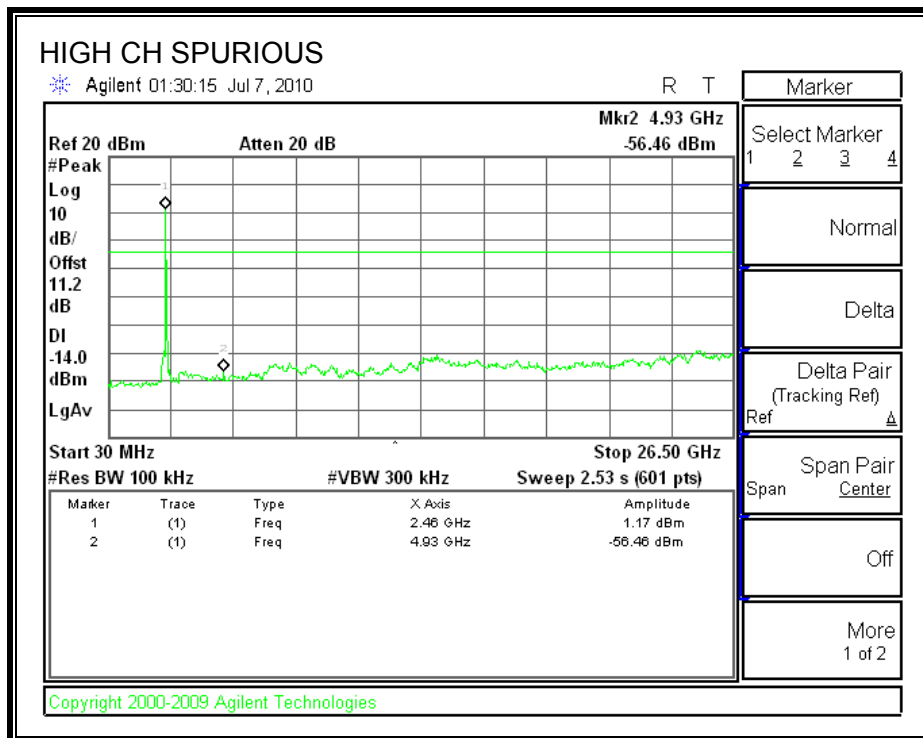
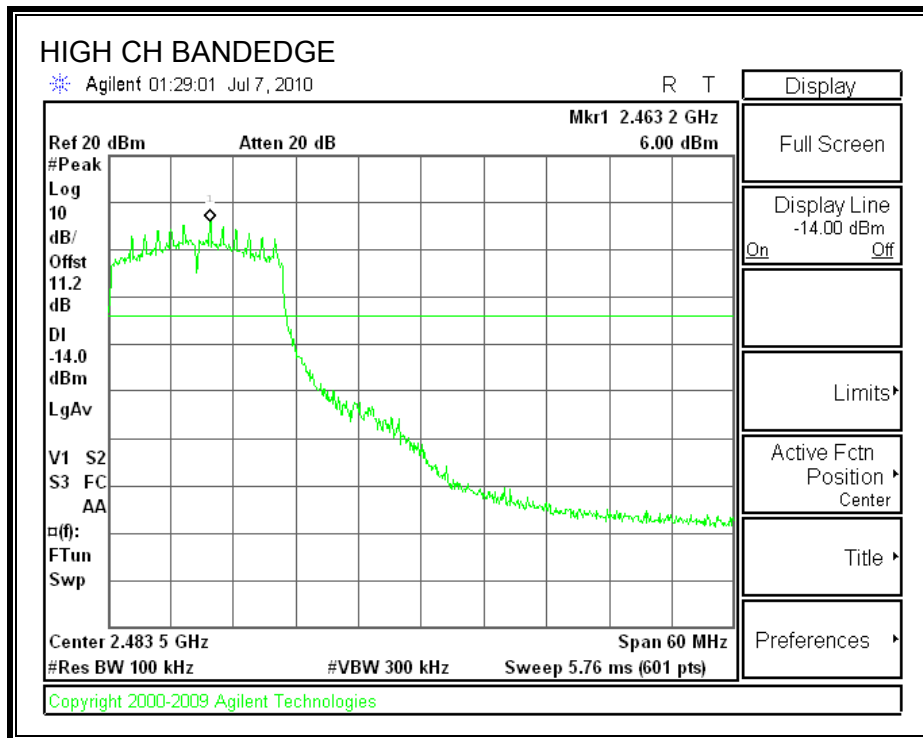
**SPURIOUS EMISSIONS, LOW CHANNEL**



**SPURIOUS EMISSIONS, MID CHANNEL**



**SPURIOUS EMISSIONS, HIGH CHANNEL**





### 7.3. 802.11n, SISO MCS0 IN THE 2.4 GHz BAND

#### 7.3.1. 6 dB BANDWIDTH

##### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

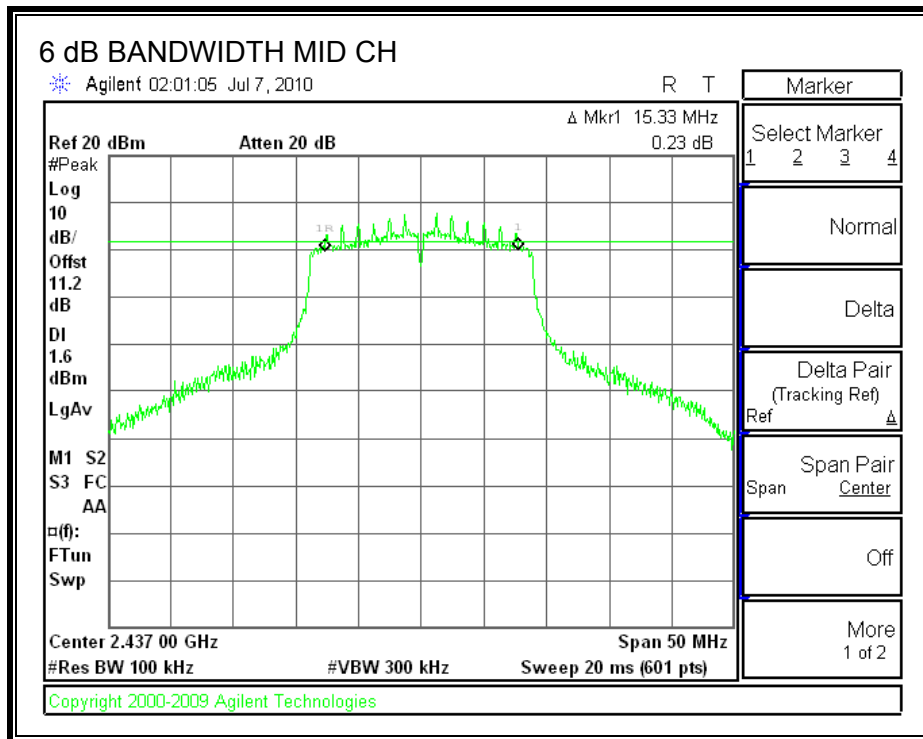
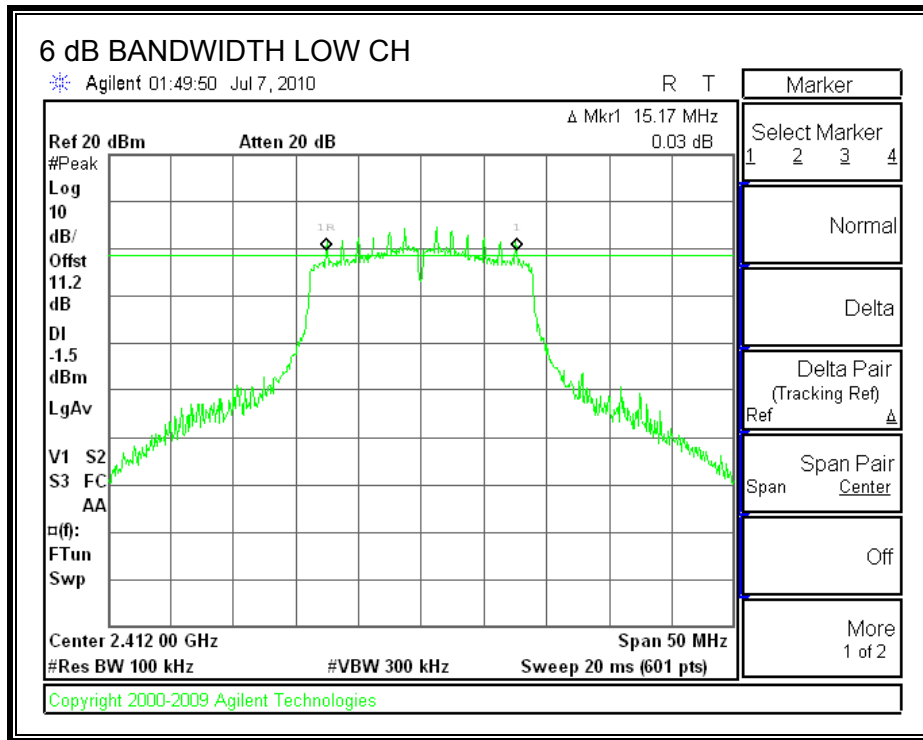
##### TEST PROCEDURE

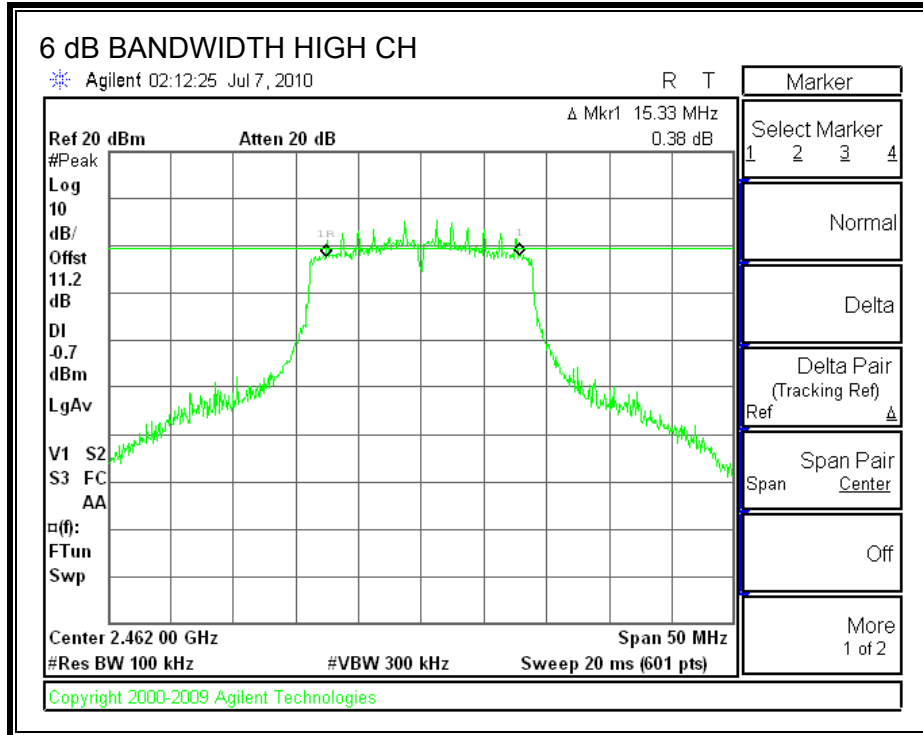
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

##### RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	15.17	0.5
Middle	2437	15.33	0.5
High	2462	15.33	0.5

**6 dB BANDWIDTH**





### 7.3.2. 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

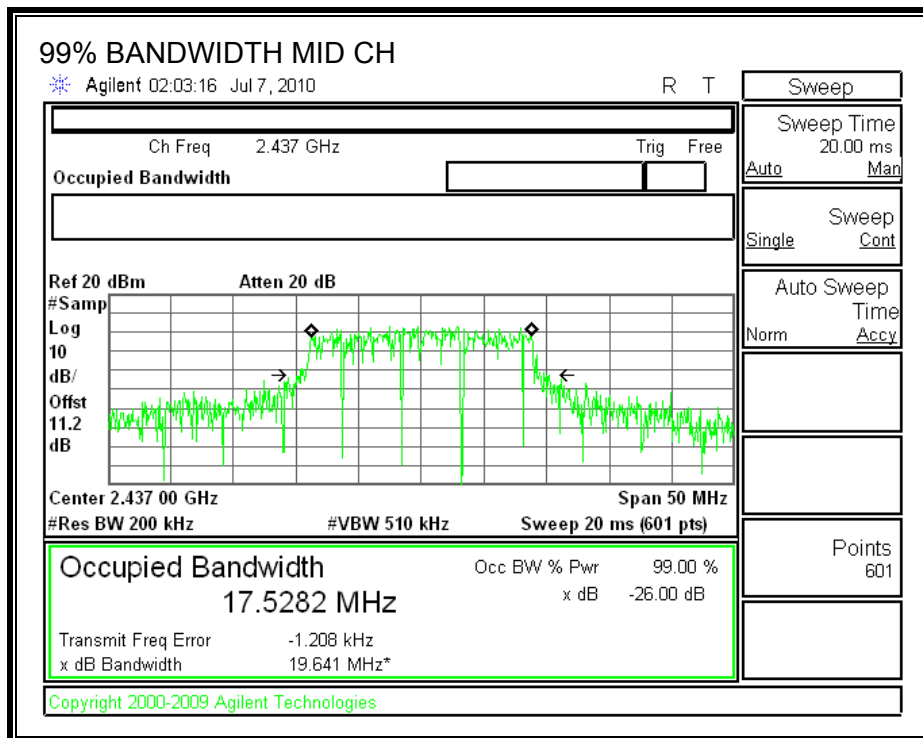
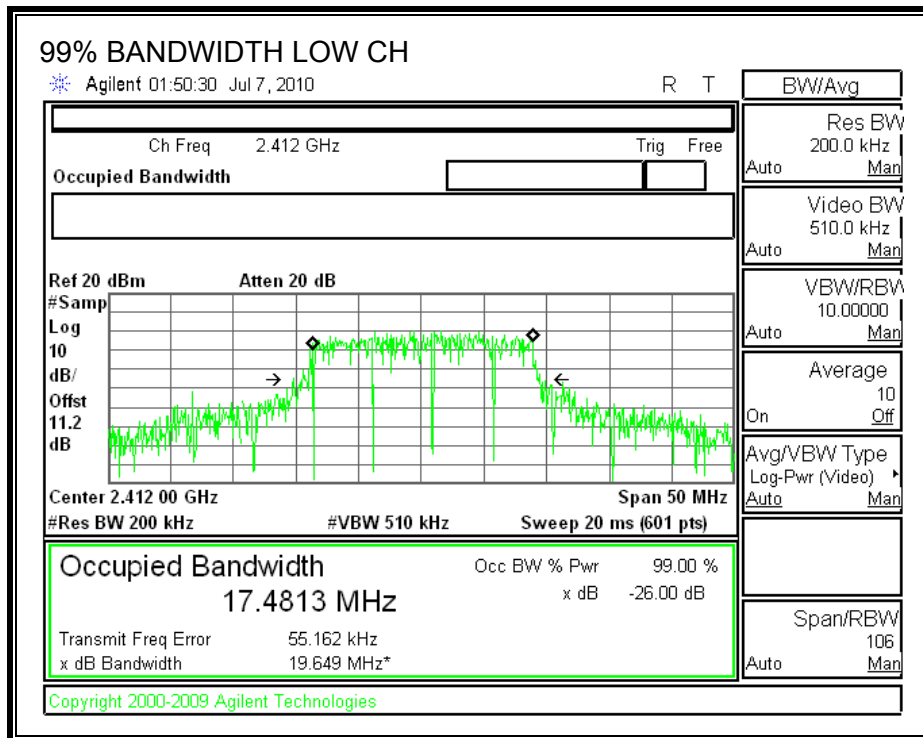
#### TEST PROCEDURE

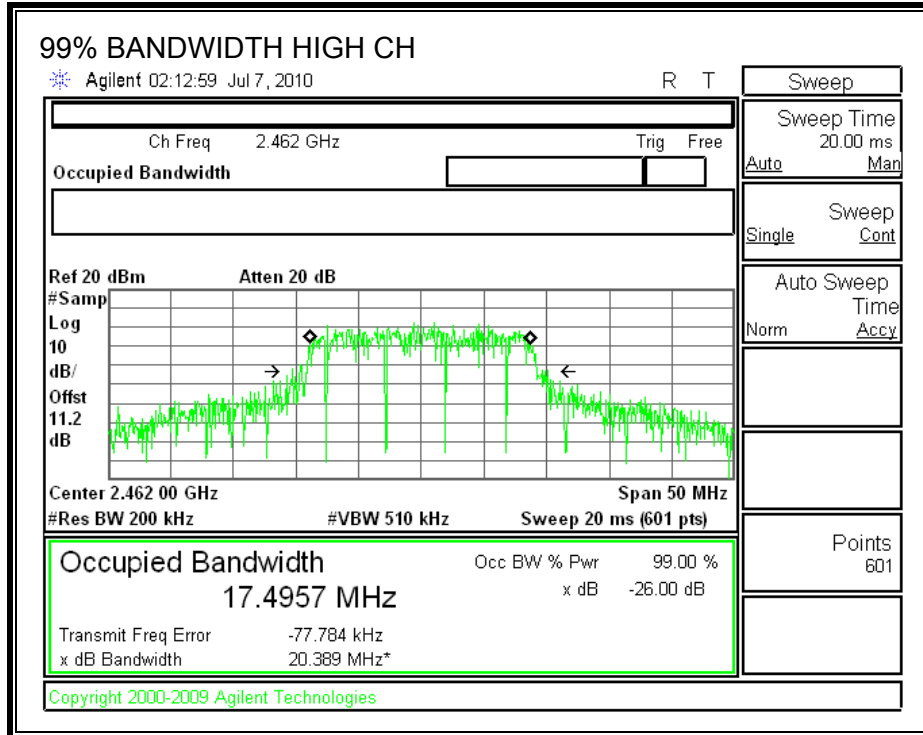
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	17.4813
Middle	2437	17.5282
High	2462	17.4957

**99% BANDWIDTH**





### 7.3.3. OUTPUT POWER

#### LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

#### TEST PROCEDURE

The transmitter output is connected to a Booton power meter.

#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.10	30	-6.90
Middle	2437	25.20	30	-4.80
High	2462	23.00	30	-7.00

### 7.3.4. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11.2 dB (including 10 dB pad and 1.2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2412	13.60
Middle	2437	16.60
High	2462	13.70



### 7.3.5. POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

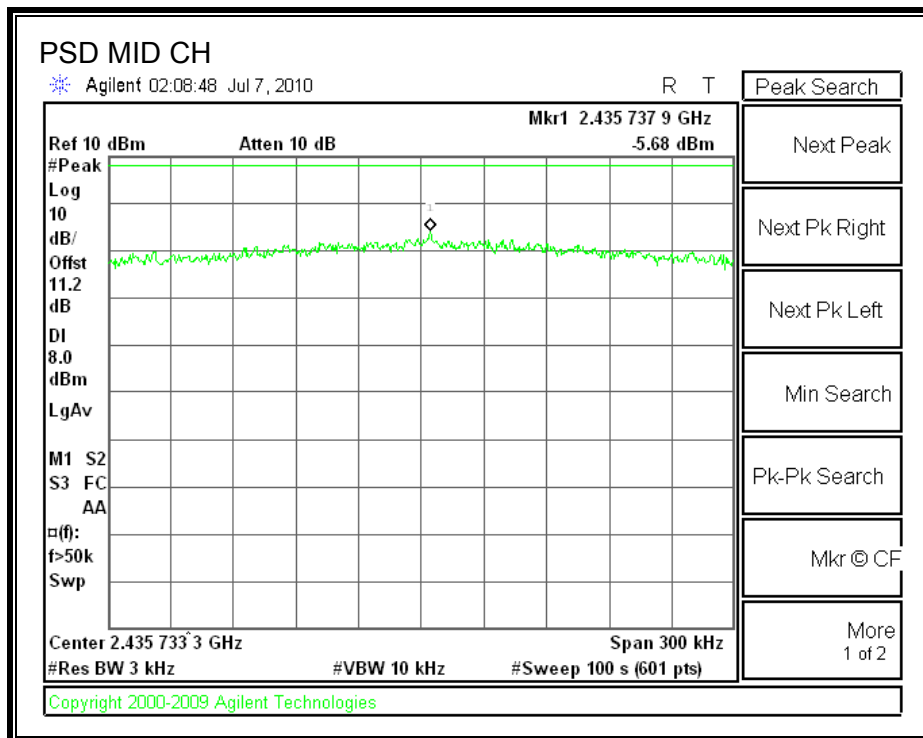
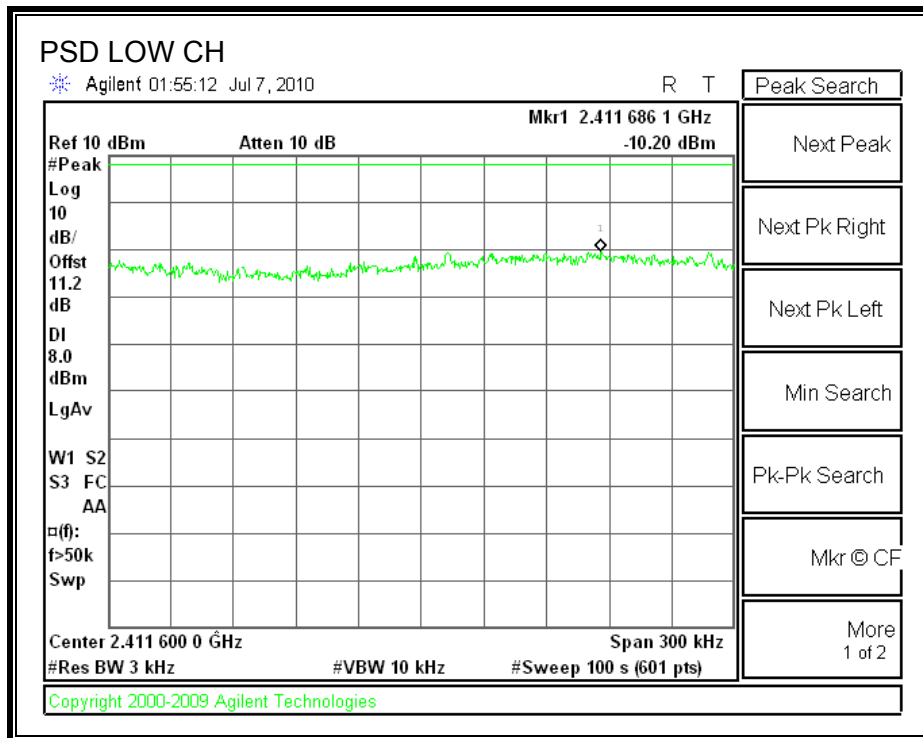
#### TEST PROCEDURE

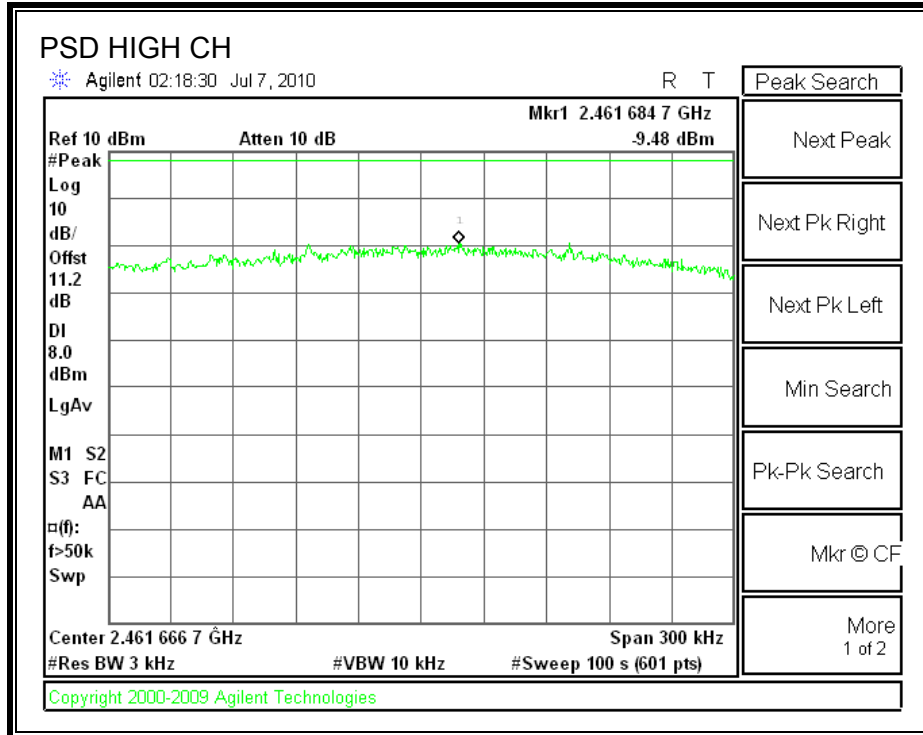
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

#### RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-10.20	8	-18.20
Middle	2437	-5.68	8	-13.68
High	2462	-9.48	8	-17.48

**POWER SPECTRAL DENSITY**





### **7.3.6. CONDUCTED SPURIOUS EMISSIONS**

#### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

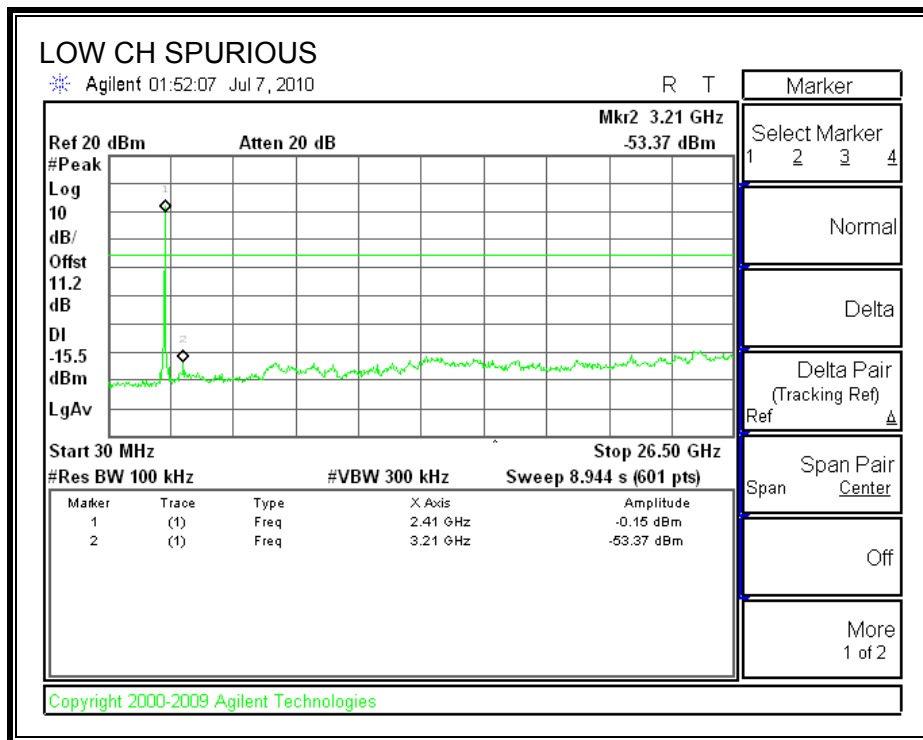
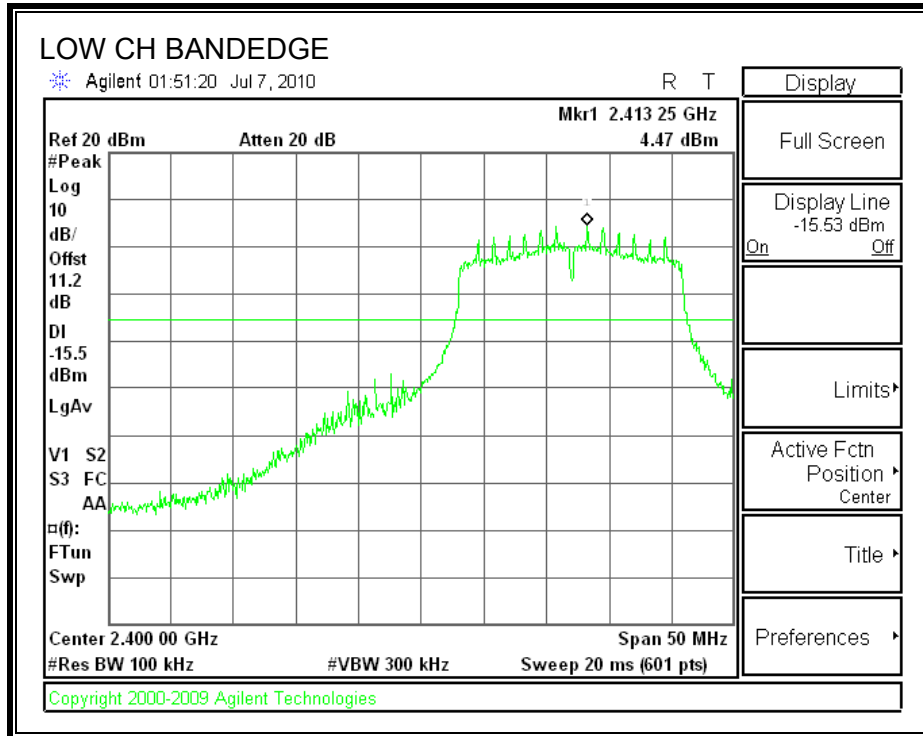
#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

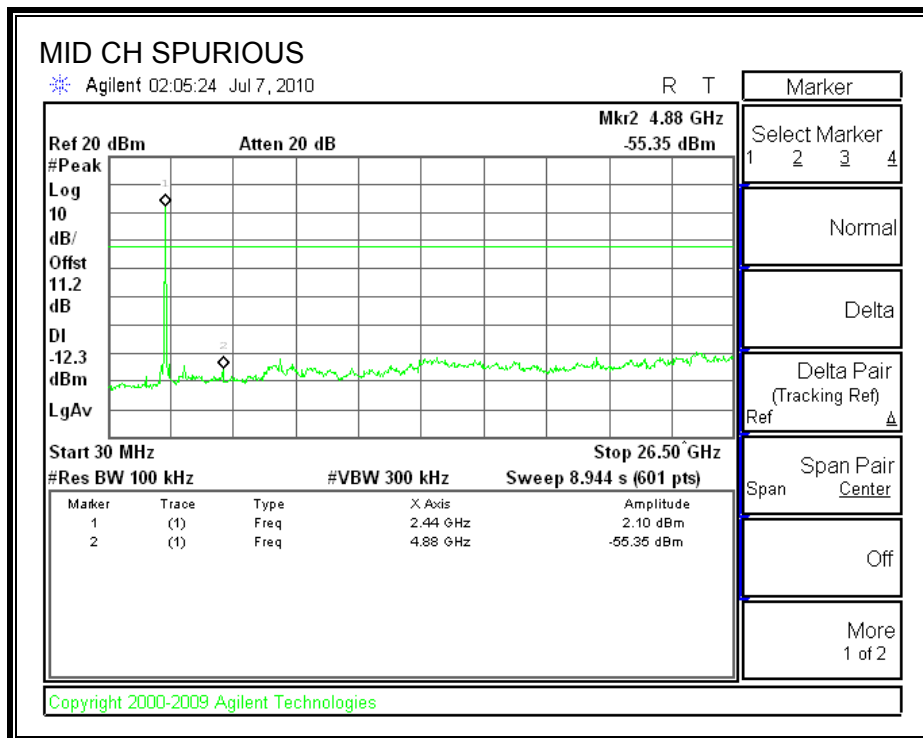
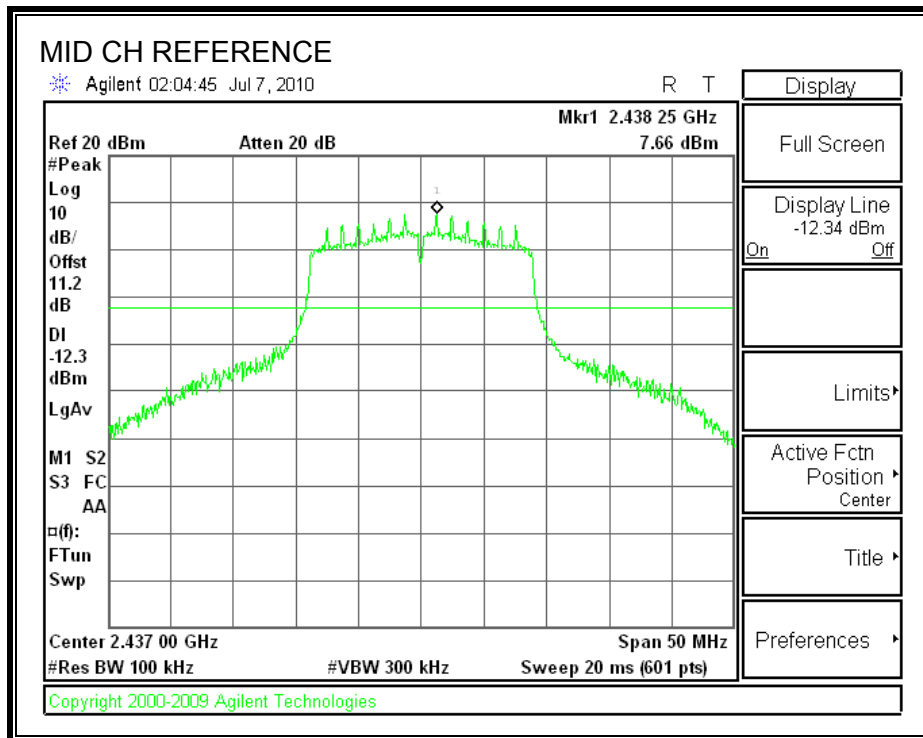
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

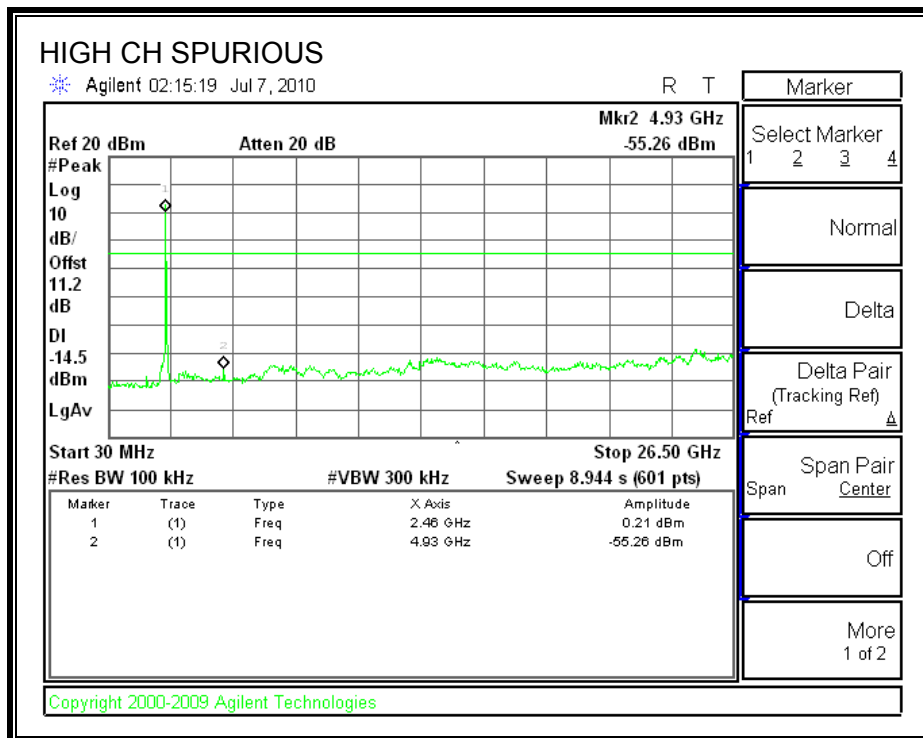
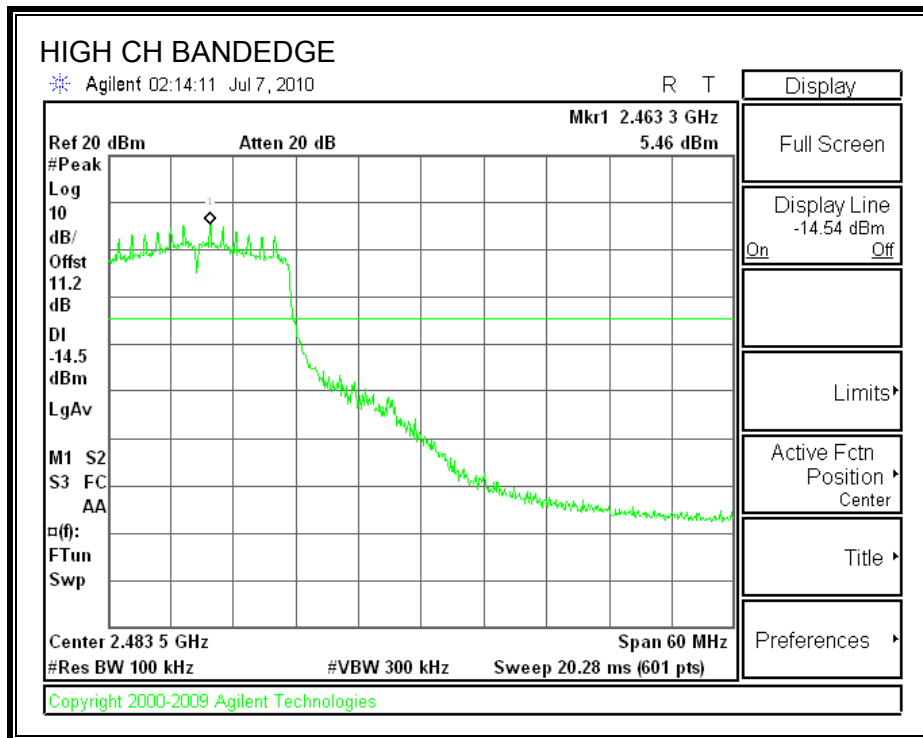
**SPURIOUS EMISSIONS, LOW CHANNEL**



**SPURIOUS EMISSIONS, MID CHANNEL**



**SPURIOUS EMISSIONS, HIGH CHANNEL**



## 8. RADIATED TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

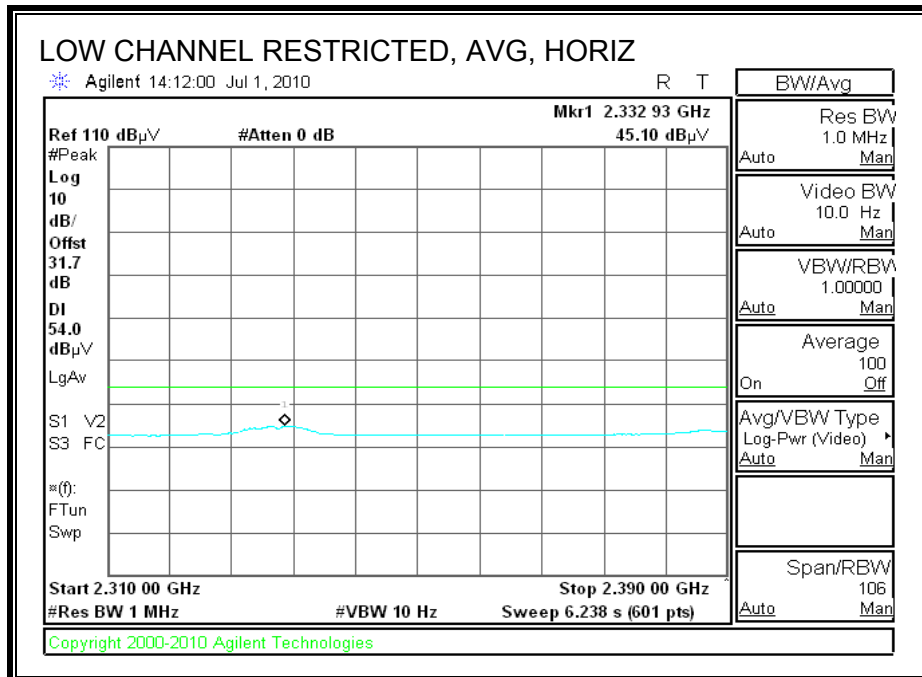
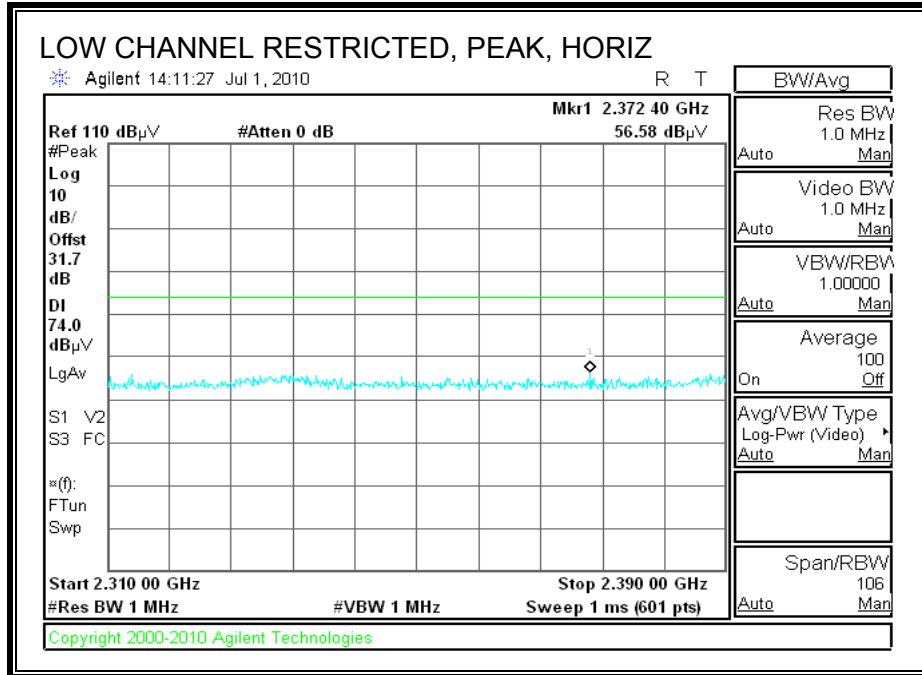
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.



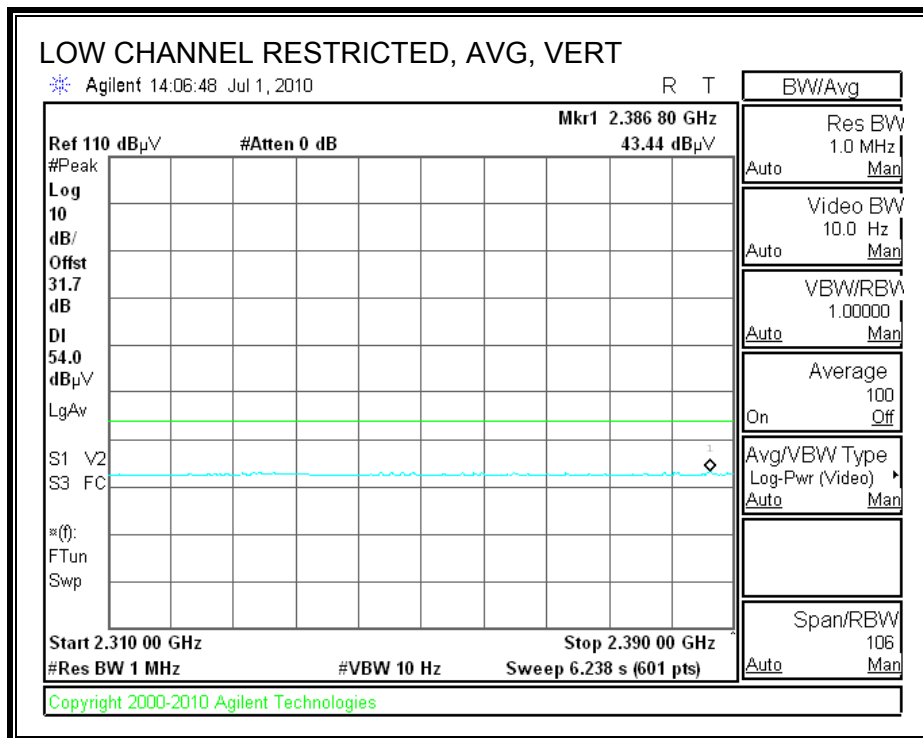
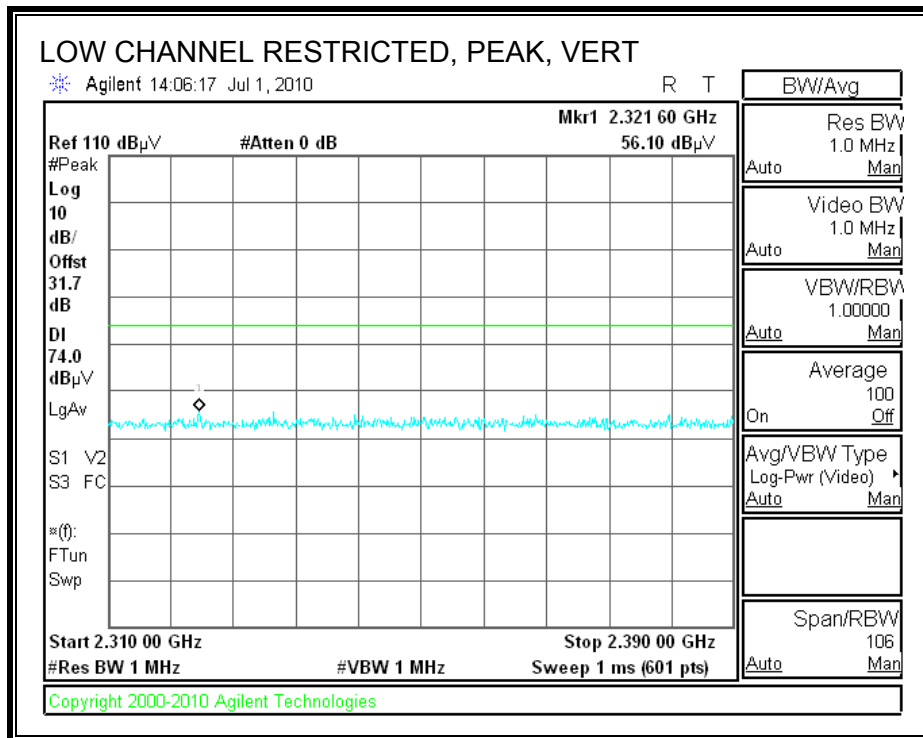
## 8.2. TRANSMITTER ABOVE 1 GHz

### 8.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

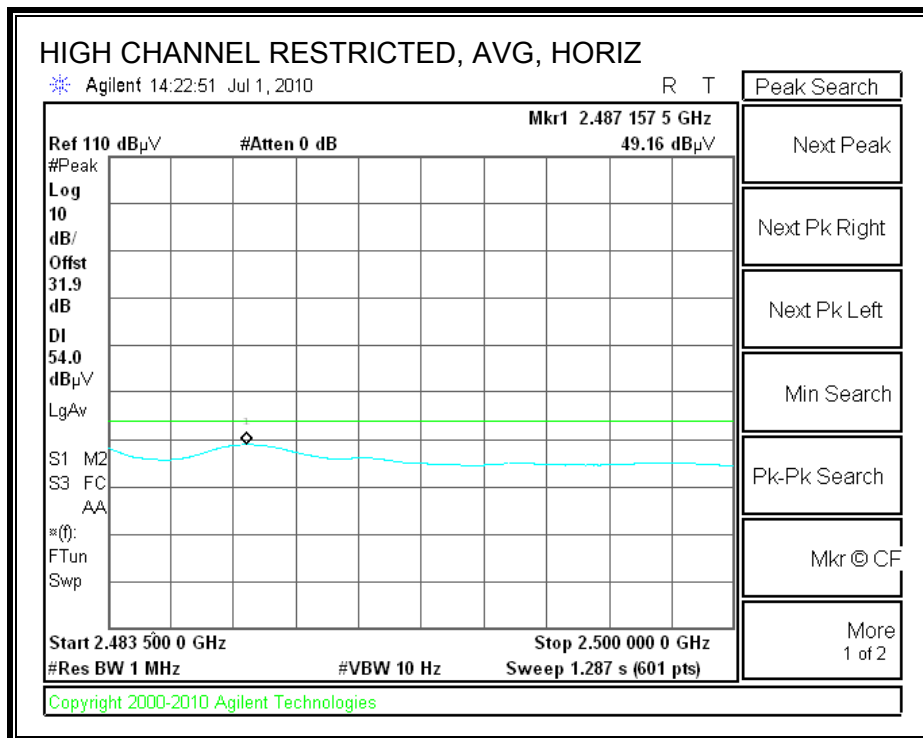
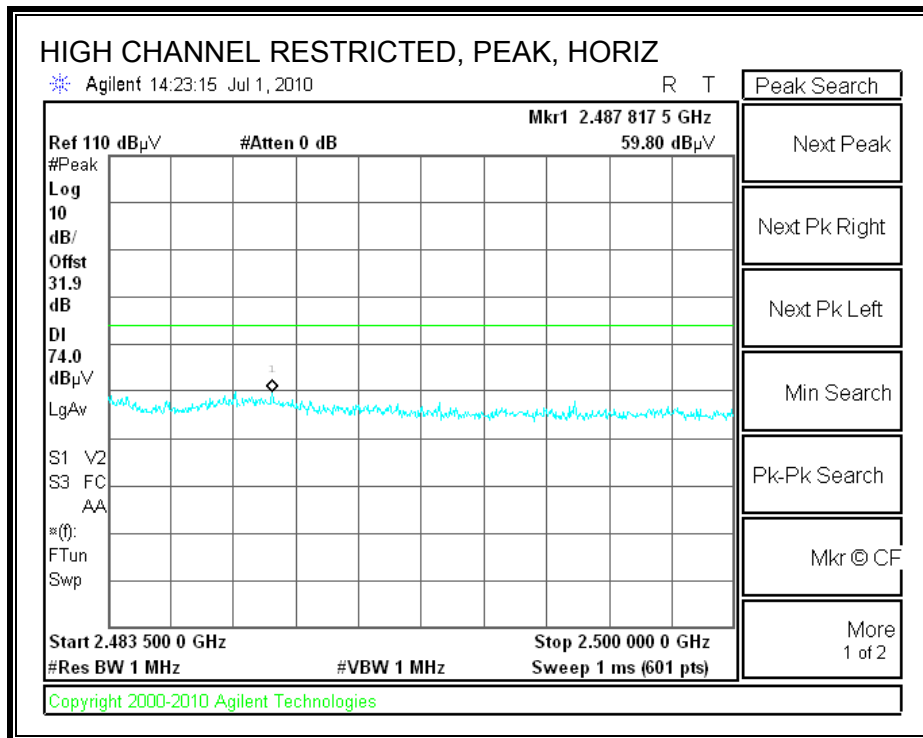
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



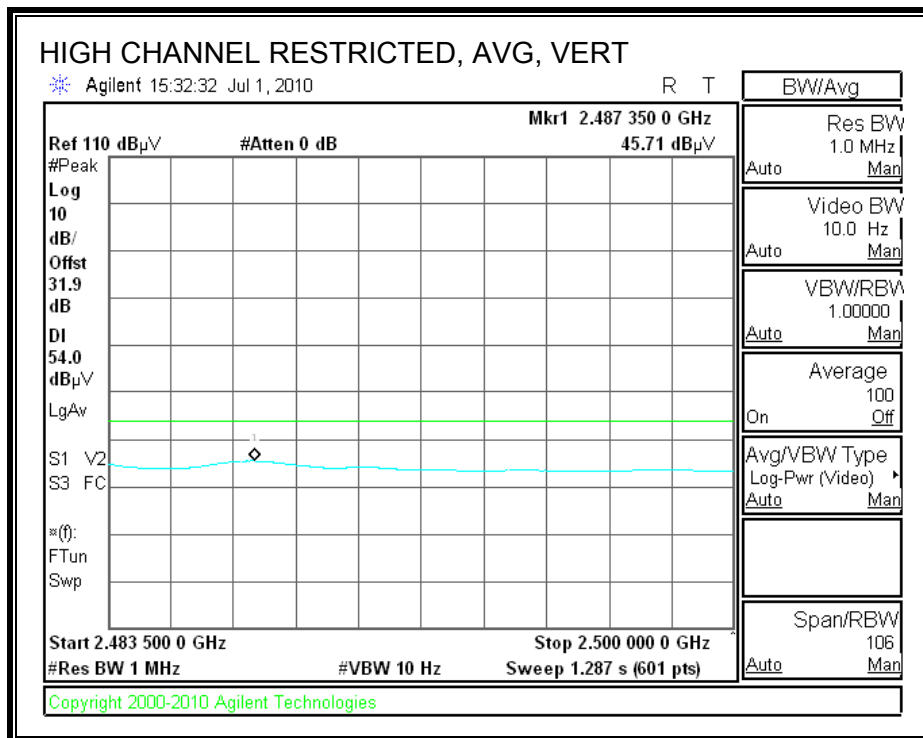
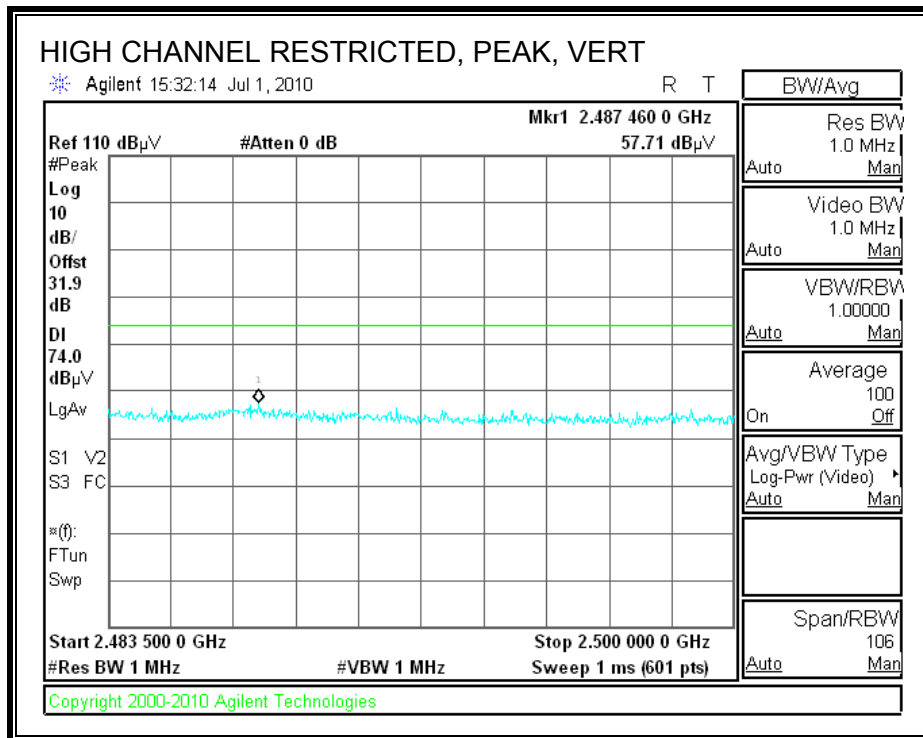
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

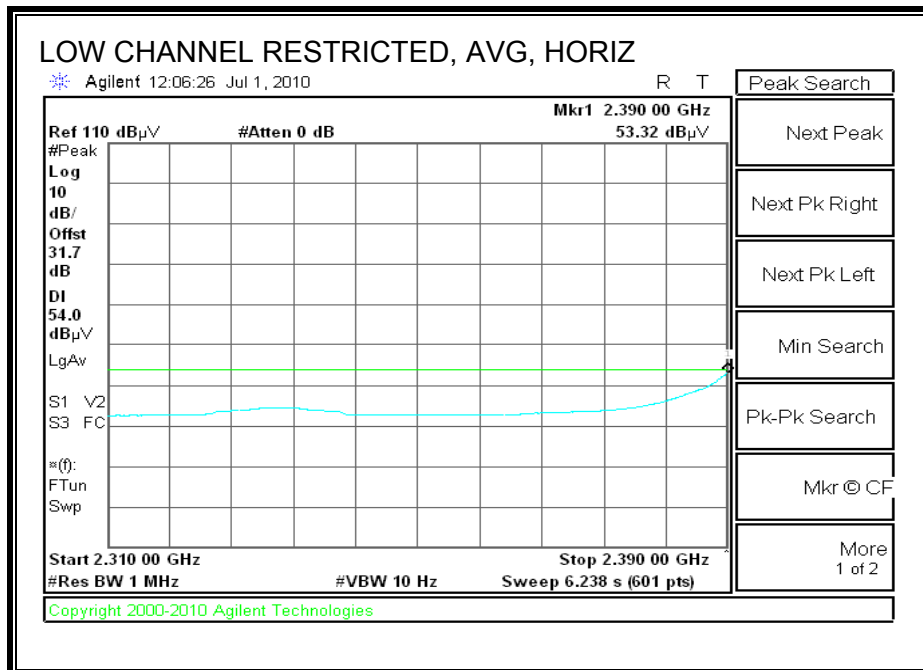
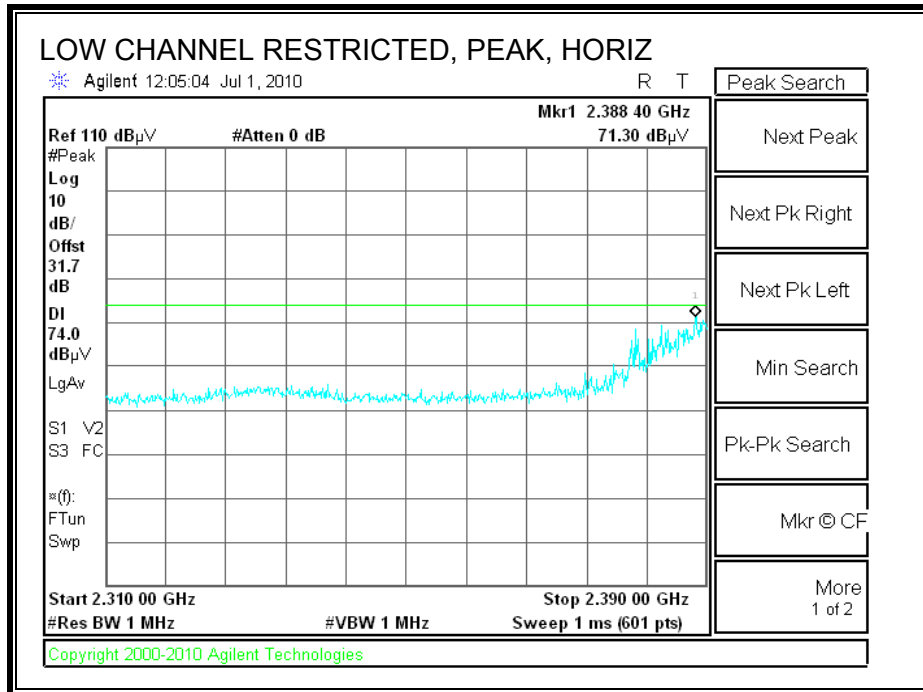


**HARMONICS AND SPURIOUS EMISSIONS**

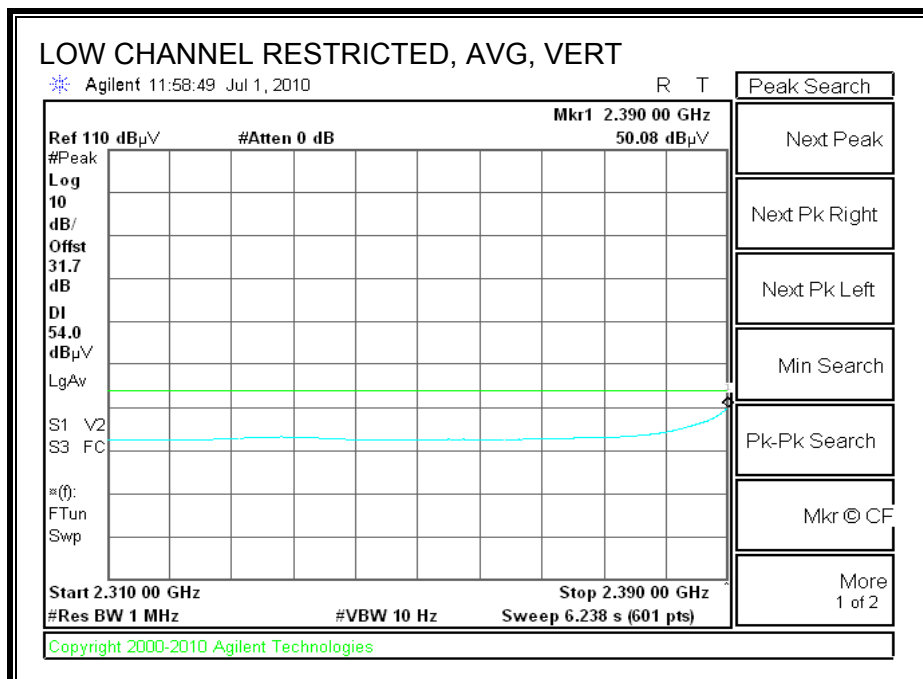
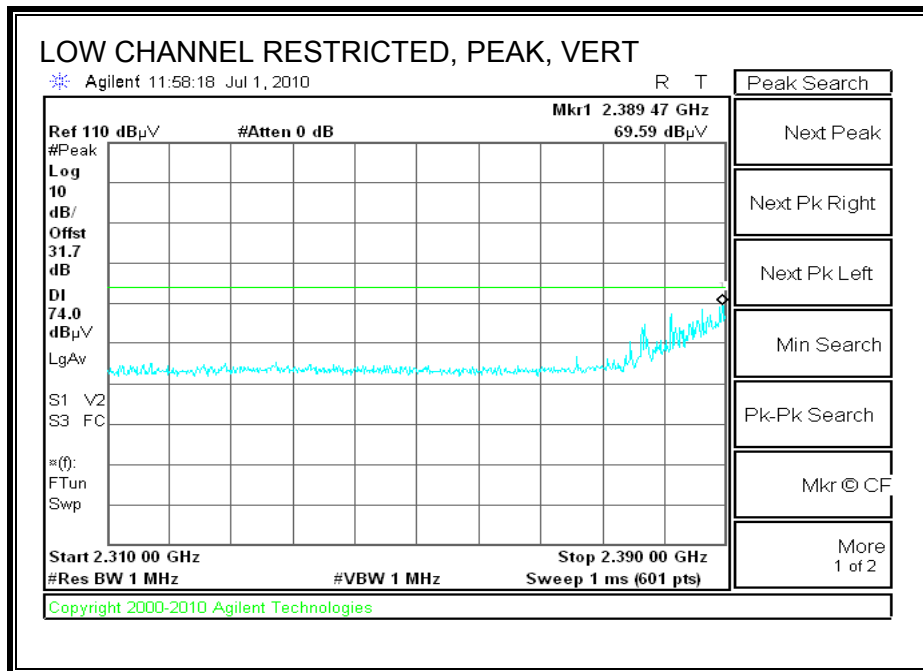
High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Chin Pang											
Date:		07/02/10											
Project #:		10U13294											
EUT Description:		802.11 bgn + BT 2.1 (EDR)											
Test Target:		FCC 15.247											
Mode Oper:		TX, b mode											
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit									
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit									
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit									
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit									
CL	Cable Loss	HPF	High Pass Filter										
f	Dist	Read	AF	CL	Amp	D Corr	Filtr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP
<b>Low Ch, 2412MHz</b>													
4.824	3.0	38.7	32.8	5.8	-34.8	0.0	0.0	42.4	74.0	-31.6	V	P	
4.824	3.0	25.9	32.8	5.8	-34.8	0.0	0.0	29.6	54.0	-24.4	V	A	
4.824	3.0	37.9	32.8	5.8	-34.8	0.0	0.0	41.6	74.0	-32.4	H	P	
4.824	3.0	25.7	32.8	5.8	-34.8	0.0	0.0	29.4	54.0	-24.6	H	A	
<b>Mid Ch, 2437MHz</b>													
4.874	3.0	37.9	32.8	5.8	-34.9	0.0	0.0	41.7	74.0	-32.3	V	P	
4.874	3.0	25.5	32.8	5.8	-34.9	0.0	0.0	29.3	54.0	-24.7	V	A	
7.311	3.0	43.9	35.2	7.3	-34.7	0.0	0.0	51.7	74.0	-22.3	V	P	
7.311	3.0	38.3	35.2	7.3	-34.7	0.0	0.0	46.2	54.0	-7.8	V	A	
4.874	3.0	38.2	32.8	5.8	-34.9	0.0	0.0	42.0	74.0	-32.0	H	P	
4.874	3.0	25.7	32.8	5.8	-34.9	0.0	0.0	29.5	54.0	-24.5	H	A	
7.311	3.0	40.4	35.2	7.3	-34.7	0.0	0.0	48.2	74.0	-25.8	H	P	
7.311	3.0	33.0	35.2	7.3	-34.7	0.0	0.0	40.8	54.0	-13.2	H	A	
<b>High Ch, 2462MHz</b>													
4.924	3.0	41.0	32.8	5.9	-34.9	0.0	0.0	44.9	74.0	-29.1	V	P	
4.924	3.0	28.1	32.8	5.9	-34.9	0.0	0.0	32.0	54.0	-22.0	V	A	
7.386	3.0	43.7	35.3	7.3	-34.6	0.0	0.0	51.7	74.0	-22.3	V	P	
7.386	3.0	37.8	35.3	7.3	-34.6	0.0	0.0	45.8	54.0	-8.2	V	A	
4.924	3.0	37.5	32.8	5.9	-34.9	0.0	0.0	41.4	74.0	-32.6	H	P	
4.924	3.0	26.2	32.8	5.9	-34.9	0.0	0.0	30.1	54.0	-23.9	H	A	
7.386	3.0	44.4	35.3	7.3	-34.6	0.0	0.0	52.3	74.0	-21.7	H	P	
7.386	3.0	40.4	35.3	7.3	-34.6	0.0	0.0	48.4	54.0	-5.6	H	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

### 8.2.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

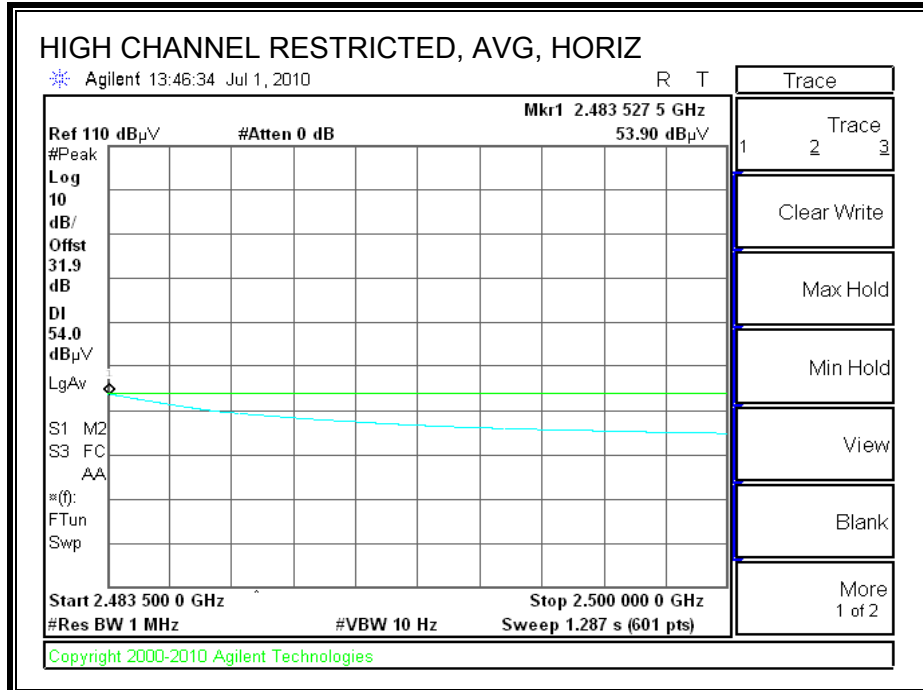
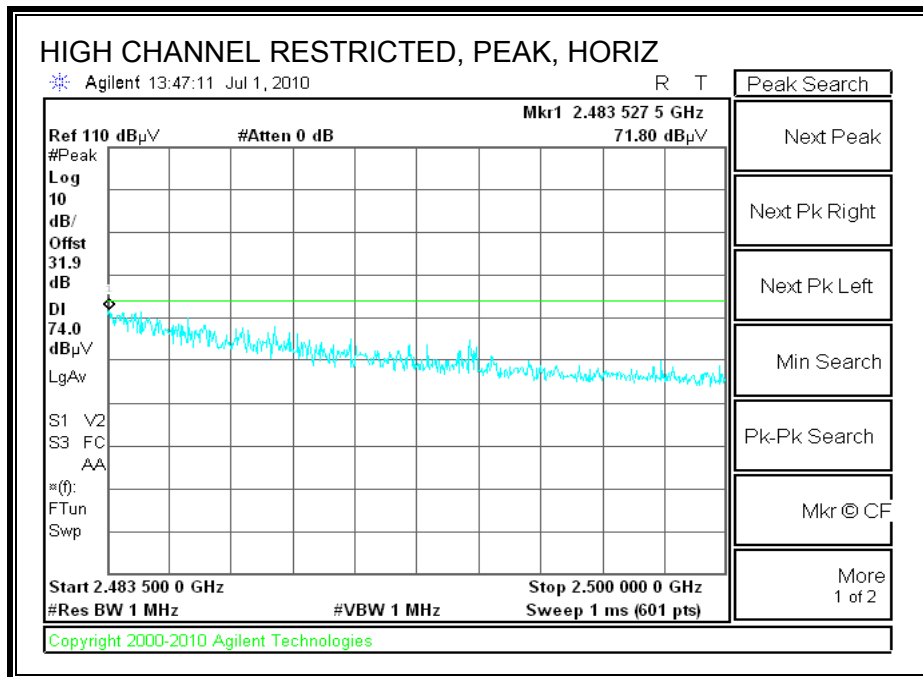
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

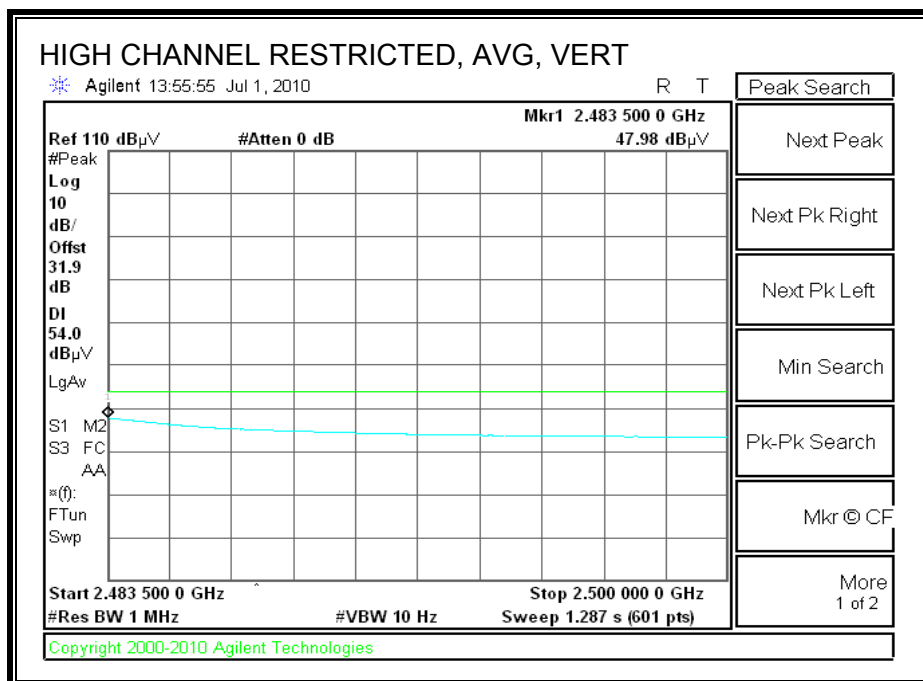
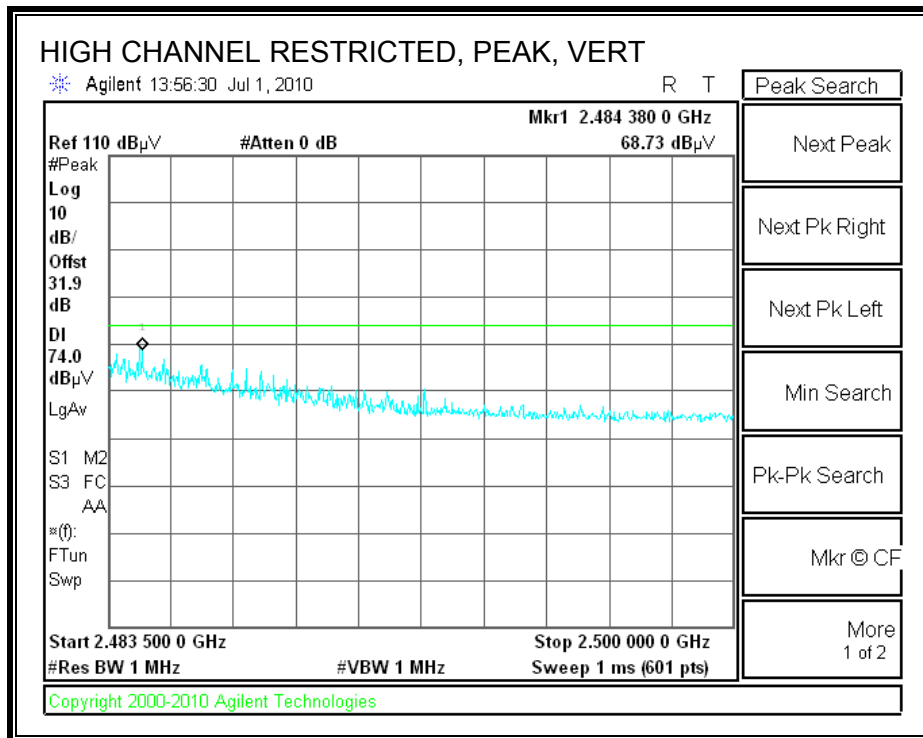


**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

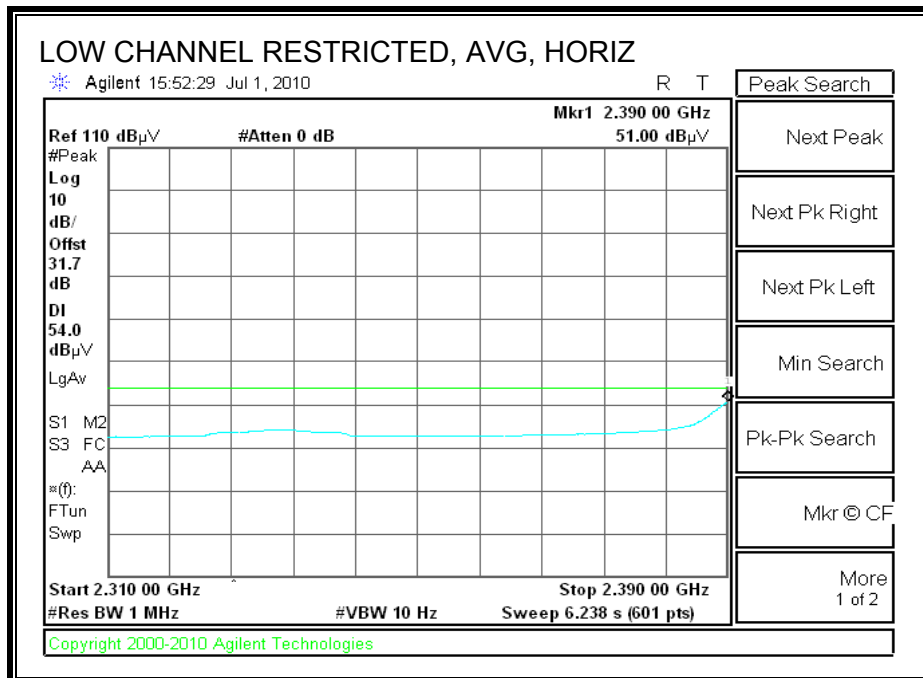
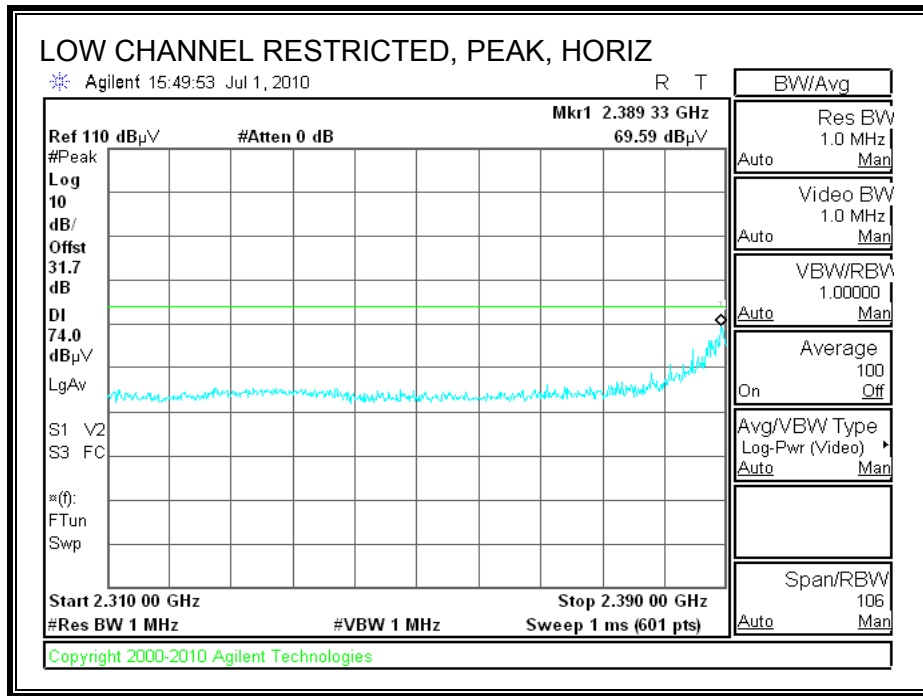


**HARMONICS AND SPURIOUS EMISSIONS**

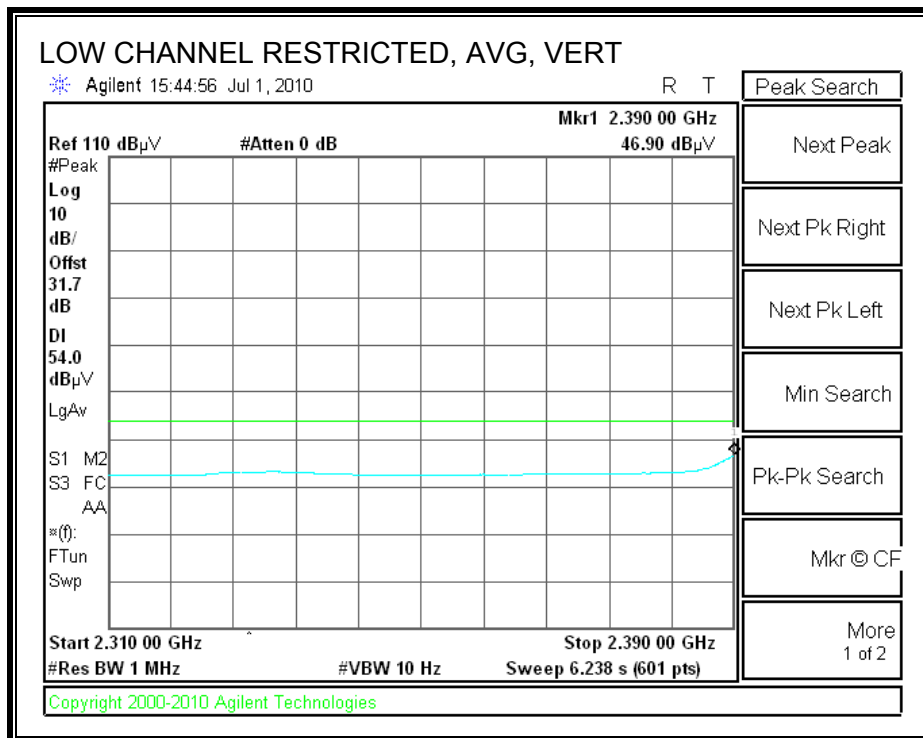
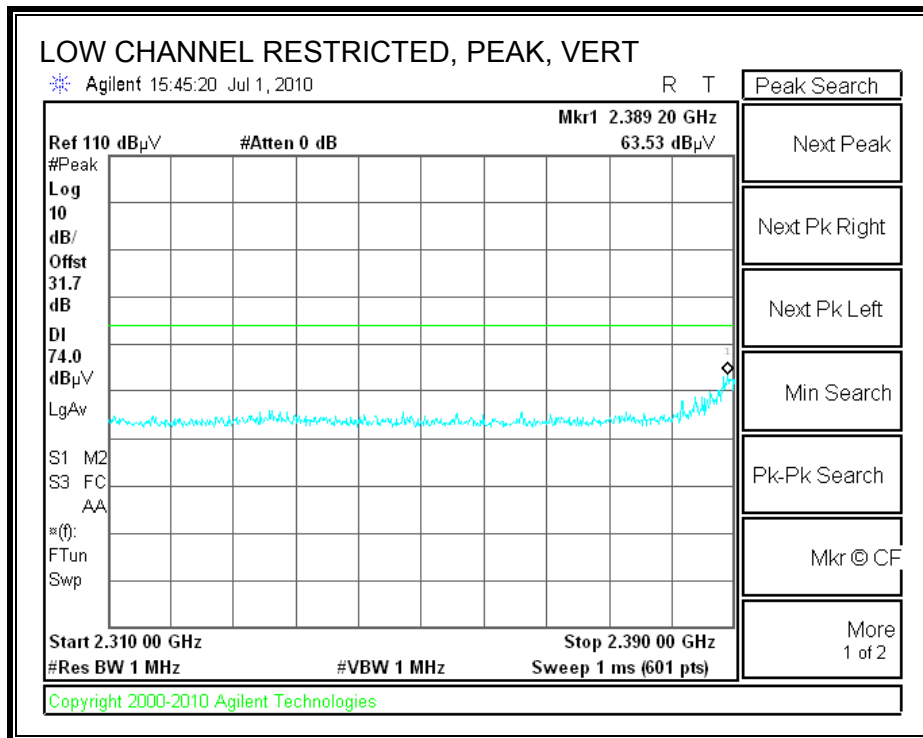
High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Chin Pang											
Date:		07/02/10											
Project #:		10U13294											
EUT Description:		802.11 bgn + BT 2.1 (EDR)											
Test Target:		FCC 15.247											
Mode Oper:		TX, g mode											
f	Measurement Frequency		Amp	Preamp Gain		Average Field Strength Limit							
Dist	Distance to Antenna		D Corr	Distance Correct to 3 meters		Peak Field Strength Limit							
Read	Analyzer Reading		Avg	Average Field Strength @ 3 m		Margin vs. Average Limit							
AF	Antenna Factor		Peak	Calculated Peak Field Strength		Margin vs. Peak Limit							
CL	Cable Loss		HPF	High Pass Filter									
f	Dist	Read	AF	CL	Amp	D Corr	Filtr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP
<b>Low Ch, 2412MHz</b>													
4.824	3.0	38.2	32.8	5.8	-34.8	0.0	0.0	41.9	74.0	-32.1	H	P	
4.824	3.0	25.7	32.8	5.8	-34.8	0.0	0.0	29.4	54.0	-24.6	H	A	
4.824	3.0	38.2	32.8	5.8	-34.8	0.0	0.0	41.9	74.0	-32.1	V	P	
4.824	3.0	25.8	32.8	5.8	-34.8	0.0	0.0	29.5	54.0	-24.5	V	A	
<b>Mid Ch, 2437MHz</b>													
4.874	3.0	37.3	32.8	5.8	-34.9	0.0	0.0	41.1	74.0	-32.9	H	P	
4.874	3.0	25.3	32.8	5.8	-34.9	0.0	0.0	29.1	54.0	-24.9	H	A	
7.311	3.0	44.5	35.2	7.3	-34.7	0.0	0.0	52.3	74.0	-21.7	H	P	
7.311	3.0	29.5	35.2	7.3	-34.7	0.0	0.0	37.3	54.0	-16.7	H	A	
4.874	3.0	37.8	32.8	5.8	-34.9	0.0	0.0	41.6	74.0	-32.4	V	P	
4.874	3.0	25.4	32.8	5.8	-34.9	0.0	0.0	29.2	54.0	-24.8	V	A	
7.311	3.0	43.9	35.2	7.3	-34.7	0.0	0.0	51.7	74.0	-22.3	V	P	
7.311	3.0	30.0	35.2	7.3	-34.7	0.0	0.0	37.8	54.0	-16.2	V	A	
<b>High Ch, 2462MHz</b>													
4.924	3.0	37.6	32.8	5.9	-34.9	0.0	0.0	41.4	74.0	-32.6	H	P	
4.924	3.0	25.4	32.8	5.9	-34.9	0.0	0.0	29.3	54.0	-24.7	H	A	
7.386	3.0	38.7	35.3	7.3	-34.6	0.0	0.0	46.7	74.0	-27.3	H	P	
7.386	3.0	25.5	35.3	7.3	-34.6	0.0	0.0	33.5	54.0	-20.5	H	A	
4.924	3.0	38.0	32.8	5.9	-34.9	0.0	0.0	41.8	74.0	-32.2	V	P	
4.924	3.0	25.5	32.8	5.9	-34.9	0.0	0.0	29.3	54.0	-24.7	V	A	
7.386	3.0	37.8	35.3	7.3	-34.6	0.0	0.0	45.8	74.0	-28.2	V	P	
7.386	3.0	25.4	35.3	7.3	-34.6	0.0	0.0	33.3	54.0	-20.7	V	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

### 8.2.3. TRANSMITTER ABOVE 1 GHz FOR 802.11n IN THE 2.4 GHz BAND

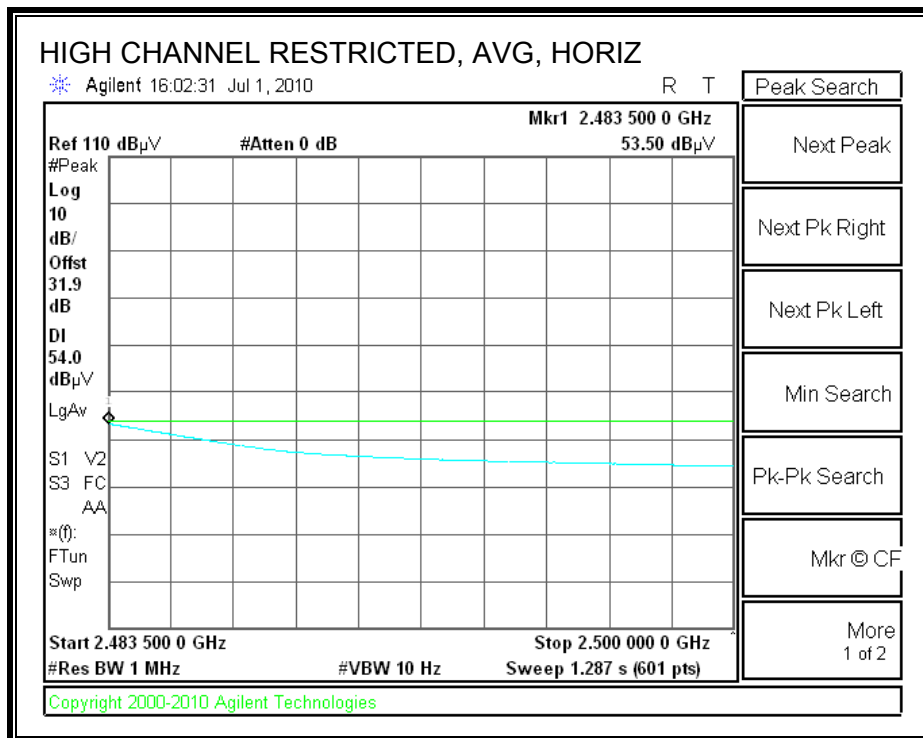
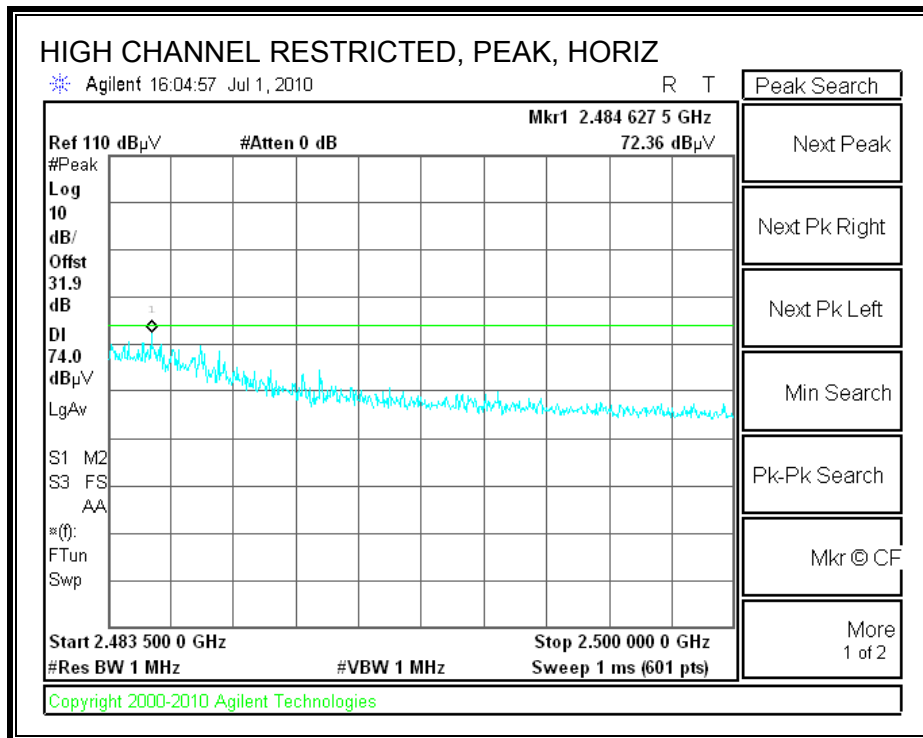
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



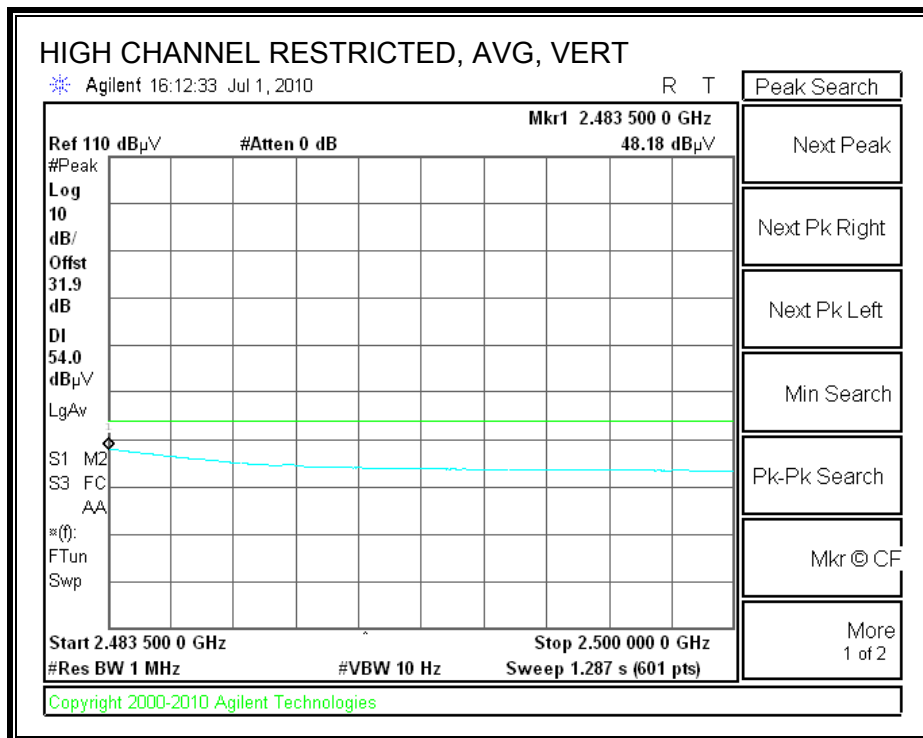
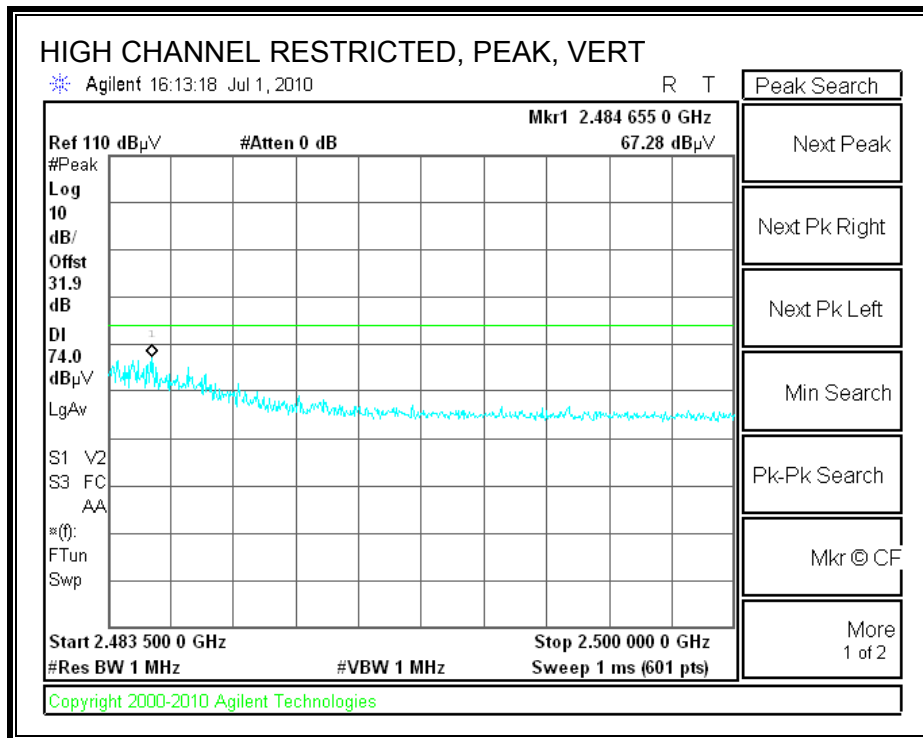
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Chin Pang											
Date:		07/02/10											
Project #:		10U13294											
EUT Description:		802.11 bgn + BT 2.1 (EDR)											
Test Target:		FCC 15.247											
Mode Oper:		TX, 802.11n MCS0											
f	Measurement Frequency			Amp	Preamp Gain			Average Field Strength Limit					
Dist	Distance to Antenna			D Corr	Distance Correct to 3 meters			Peak Field Strength Limit					
Read	Analyzer Reading			Avg	Average Field Strength @ 3 m			Margin vs. Average Limit					
AF	Antenna Factor			Peak	Calculated Peak Field Strength			Margin vs. Peak Limit					
CL	Cable Loss			HPF	High Pass Filter								
f	Dist	Read	AF	CL	Amp	D Corr	Filtr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP
<b>Low Ch, 2412MHz</b>													
4.824	3.0	38.3	32.8	5.8	-34.8	0.0	0.0	42.0	74.0	-32.0	V	P	
4.824	3.0	27.2	32.8	5.8	-34.8	0.0	0.0	31.0	54.0	-23.0	V	A	
4.824	3.0	38.0	32.8	5.8	-34.8	0.0	0.0	41.7	74.0	-32.3	H	P	
4.824	3.0	25.6	32.8	5.8	-34.8	0.0	0.0	29.3	54.0	-24.7	H	A	
<b>Mid Ch, 2437MHz</b>													
4.874	3.0	38.2	32.8	5.8	-34.9	0.0	0.0	41.9	74.0	-32.1	V	P	
4.874	3.0	25.3	32.8	5.8	-34.9	0.0	0.0	29.1	54.0	-24.9	V	A	
7.311	3.0	44.3	35.2	7.3	-34.7	0.0	0.0	52.1	74.0	-21.9	V	P	
7.311	3.0	30.6	35.2	7.3	-34.7	0.0	0.0	38.4	54.0	-15.6	V	A	
4.874	3.0	37.5	32.8	5.8	-34.9	0.0	0.0	41.3	74.0	-32.7	H	P	
4.874	3.0	25.3	32.8	5.8	-34.9	0.0	0.0	29.1	54.0	-24.9	H	A	
7.311	3.0	42.6	35.2	7.3	-34.7	0.0	0.0	50.4	74.0	-23.6	H	P	
7.311	3.0	28.7	35.2	7.3	-34.7	0.0	0.0	36.5	54.0	-17.5	H	A	
<b>High Ch, 2462MHz</b>													
4.924	3.0	37.4	32.8	5.9	-34.9	0.0	0.0	41.2	74.0	-32.8	V	P	
4.924	3.0	25.4	32.8	5.9	-34.9	0.0	0.0	29.2	54.0	-24.8	V	A	
7.386	3.0	41.2	35.3	7.3	-34.6	0.0	0.0	49.2	74.0	-24.8	V	P	
7.386	3.0	27.0	35.3	7.3	-34.6	0.0	0.0	35.0	54.0	-19.0	V	A	
4.924	3.0	37.6	32.8	5.9	-34.9	0.0	0.0	41.5	74.0	-32.5	H	P	
4.924	3.0	25.4	32.8	5.9	-34.9	0.0	0.0	29.2	54.0	-24.8	H	A	
7.386	3.0	38.6	35.3	7.3	-34.6	0.0	0.0	46.6	74.0	-27.4	H	P	
7.386	3.0	25.8	35.3	7.3	-34.6	0.0	0.0	33.7	54.0	-20.3	H	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

### 8.3. RECEIVER ABOVE 1 GHz

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Project #: 10U13294  
 Date: 7/2/2010  
 Test Engineer: Chin Pang  
 Configuration: EUT and AC Adapter  
 Mode: RX

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T59; S/N: 3245 @3m	T145 Agilent 3008A0056			FCC 15.209

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
3' cable 22807700	12' cable 22807600	20' cable 22807500			Average Measurements RBW=1MHz; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fln dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.017	3.0	47.0	31.5	24.0	2.4	-36.1	0.0	0.0	37.2	21.7	74	54	-36.8	-32.3	H
1.333	3.0	45.0	30.7	25.2	2.8	-35.9	0.0	0.0	37.0	22.7	74	54	-37.0	-31.3	H
1.125	3.0	45.5	31.5	24.4	2.5	-36.1	0.0	0.0	36.4	22.4	74	54	-37.6	-31.6	V
1.333	3.0	44.2	30.6	25.2	2.8	-35.9	0.0	0.0	36.2	22.6	74	54	-37.8	-31.4	V

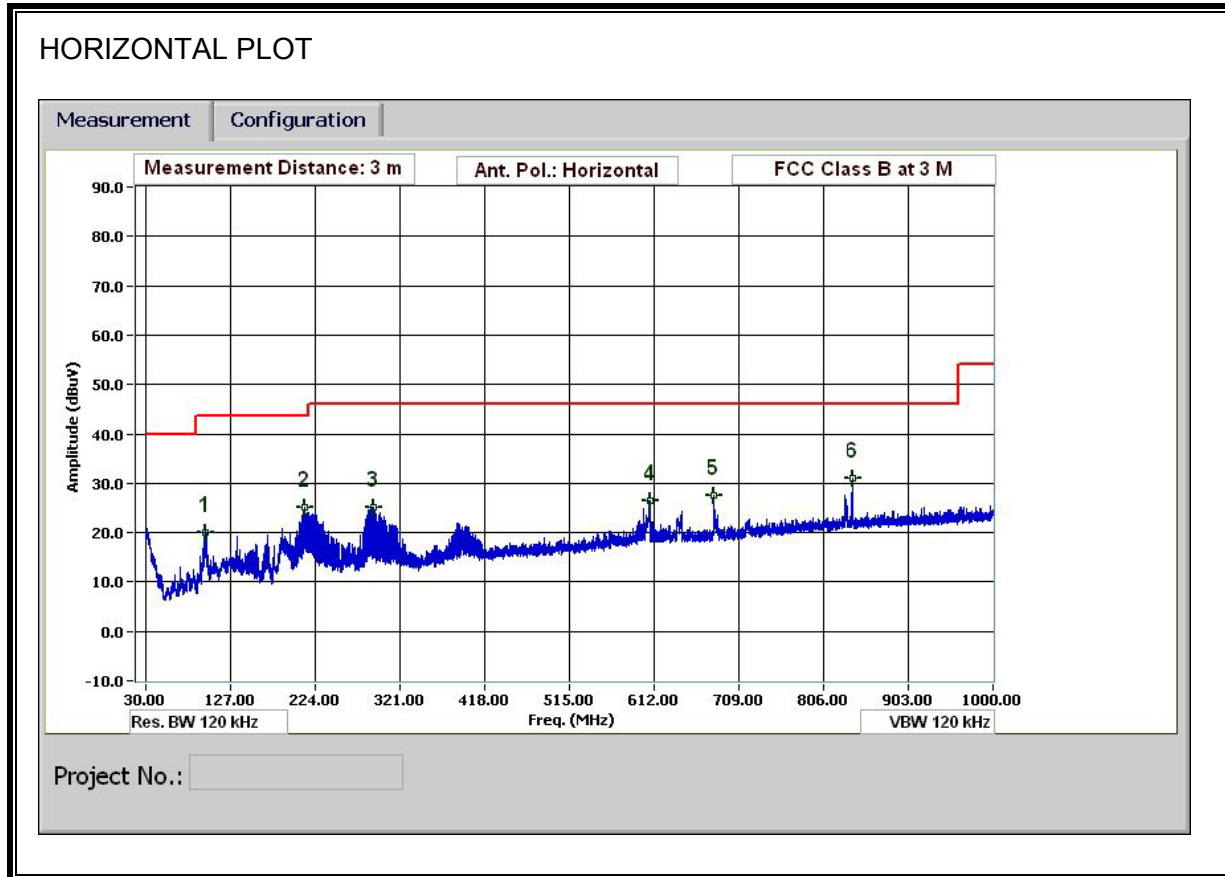
*Note:* No emissions were found above 1GHz within 20dB of the limit.  
 Rev. 07.22.09

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

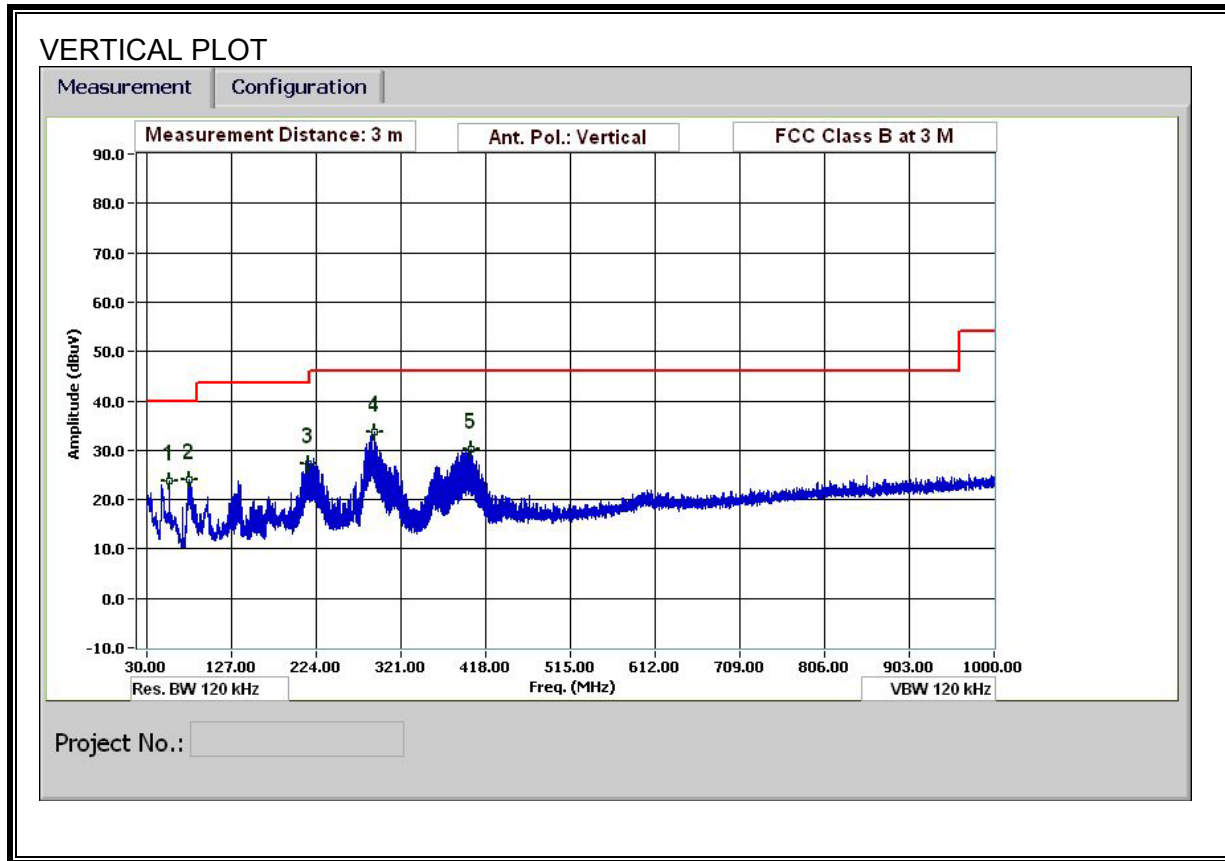


### 8.4. WORST-CASE BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**



**VERTICAL& HORIZONTAL DATA**

30-1000MHz Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Chin Pang											
Date:		07/02/10											
Project #:		10U13294											
EUT Description:		802.11 bgn + BT 2.1 (EDR)											
Test Target:		FCC 15C											
Mode Oper:		TX ( Worst Case)											
f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit								
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters										
Read	Analyzer Reading	Filter	Filter Insert Loss										
AF	Antenna Factor	Corr.	Calculated Field Strength										
CL	Cable Loss	Limit	Field Strength Limit										
f	Dist	Read	AF	CL	Amp	D Corr	Filter	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
MHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	
<b>horiz</b>													
98.403	3.0	39.0	9.7	0.9	29.5	0.0	0.0	20.0	43.5	-23.5	H	P	
211.567	3.0	40.8	12.0	1.3	28.9	0.0	0.0	25.2	43.5	-18.3	H	P	
290.051	3.0	39.4	13.0	1.6	28.8	0.0	0.0	25.2	46.0	-20.8	H	P	
606.864	3.0	35.2	18.3	2.4	29.6	0.0	0.0	26.3	46.0	-19.7	H	P	
680.307	3.0	35.4	19.0	2.6	29.6	0.0	0.0	27.5	46.0	-18.5	H	P	
839.553	3.0	35.8	21.2	2.9	28.9	0.0	0.0	30.9	46.0	-15.1	H	P	
56.401	3.0	44.8	7.9	0.6	29.6	0.0	0.0	23.8	40.0	-16.2	V	P	
78.482	3.0	45.2	7.7	0.8	29.6	0.0	0.0	24.1	40.0	-15.9	V	P	
215.528	3.0	42.7	11.9	1.3	28.9	0.0	0.0	27.2	43.5	-16.3	V	P	
290.171	3.0	48.0	13.0	1.6	28.8	0.0	0.0	33.7	46.0	-12.3	V	P	
400.935	3.0	42.5	15.0	1.9	29.3	0.0	0.0	30.2	46.0	-15.8	V	P	
Rev. 1.27.09													
Note: No other emissions were detected above the system noise floor.													

## 9. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

\*Decreases with the logarithm of the frequency.

### TEST PROCEDURE

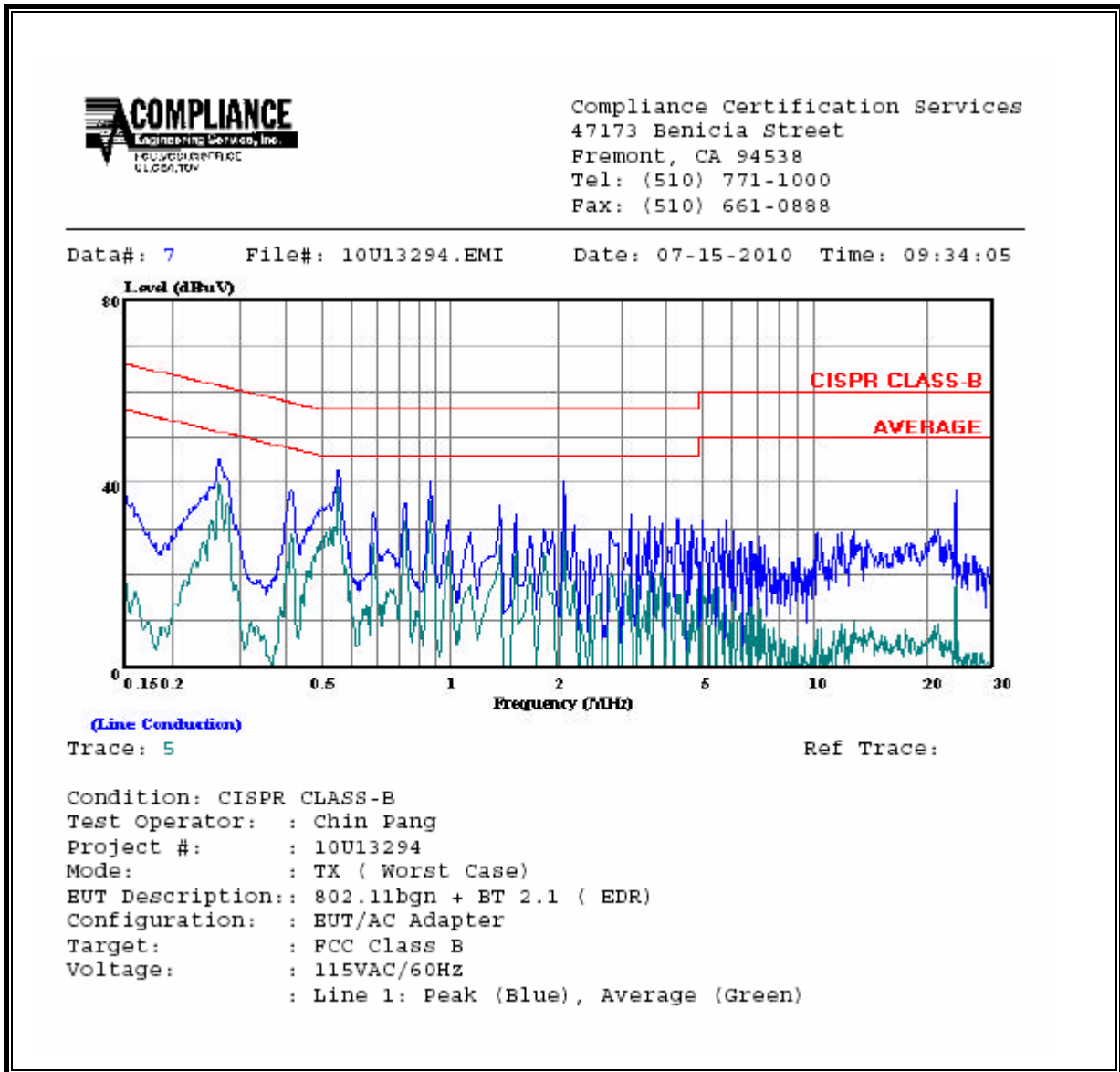
ANSI C63.4

### RESULTS

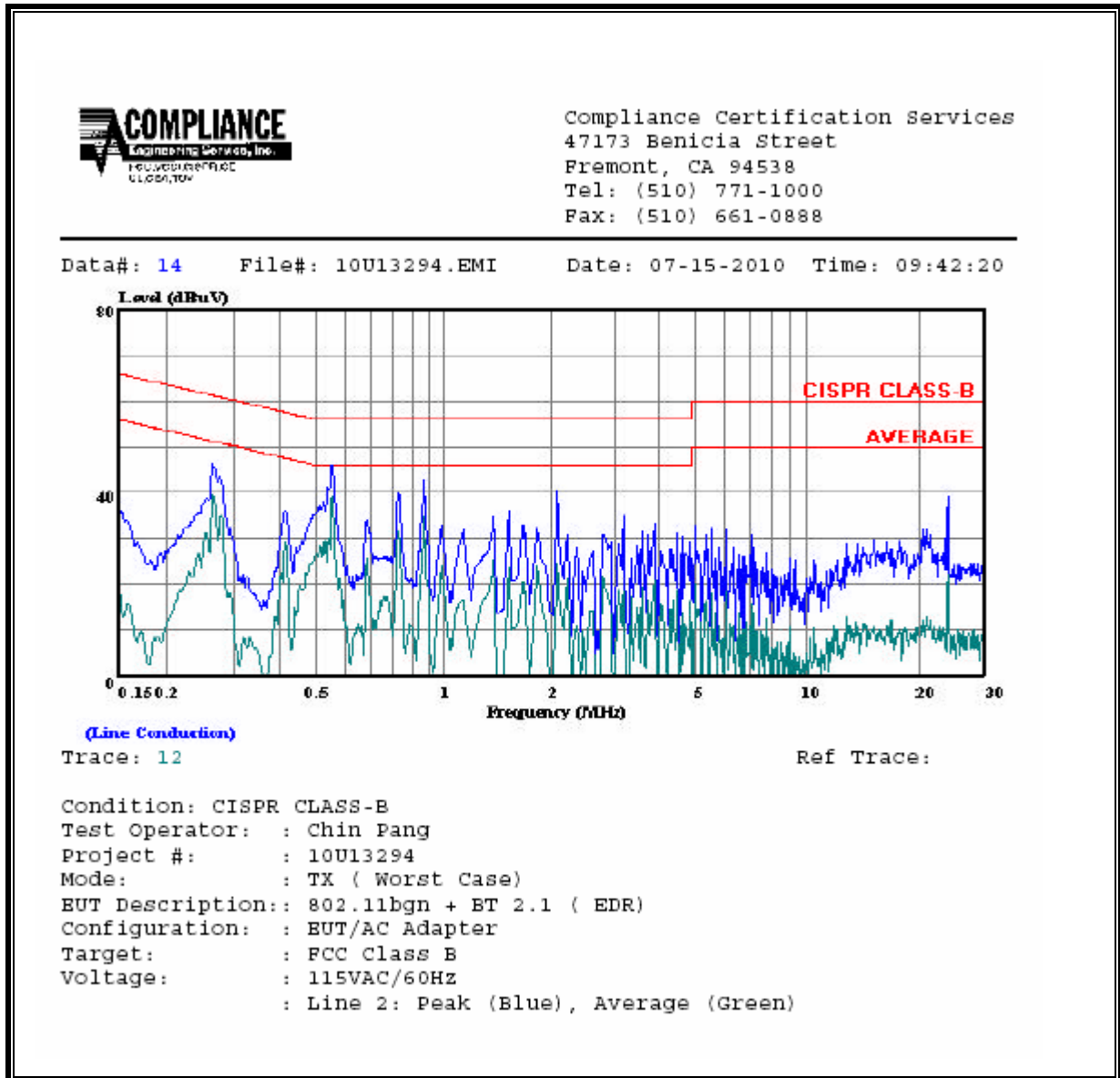
**6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Class (dB)	Limit QP	EN B AV	Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
0.27	45.05	--	39.40	0.00	61.15	51.15	-16.10	-11.75	L1
0.55	42.70	--	39.28	0.00	56.00	46.00	-13.30	-6.72	L1
0.97	40.35	--	35.85	0.00	56.00	46.00	-15.65	-10.15	L1
0.27	45.86	--	39.09	0.00	61.15	51.15	-15.29	-12.06	L2
0.55	46.07	--	39.00	0.00	56.00	46.00	-9.93	-7.00	L2
0.97	42.46	--	34.76	0.00	56.00	46.00	-13.54	-11.24	L2
6 Worst Data									

**LINE 1 RESULTS**



**LINE 2 RESULTS**



## 10. MAXIMUM PERMISSIBLE EXPOSURE

### FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) 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 <sup>2</sup> )	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
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

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.



**IC RULES**

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5  
 Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)**

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

- Notes:**
1. Frequency, *f*, is in MHz.
  2. A power density of 10 W/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.
  3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

## **EQUATIONS**

Power density is given by:

$$S = \text{EIRP} / (4 * \text{Pi} * \text{D}^2)$$

where

S = Power density in W/m<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m<sup>2</sup> is converted to units of mW/cm<sup>2</sup> by dividing by 10.

Distance is given by:

$$D = \text{SQRT} (\text{EIRP} / (4 * \text{Pi} * S))$$

where

D = Separation distance in m

EIRP = Equivalent Isotropic Radiated Power in W

S = Power density in W/m<sup>2</sup>

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power \* Gain product (in linear units) of each transmitter.

$$\text{Total EIRP} = (P1 * G1) + (P2 * G2) + \dots + (Pn * Gn)$$

where

Px = Power of transmitter x

Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

## **LIMITS**

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm<sup>2</sup>

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m<sup>2</sup>

**RESULTS**

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m <sup>2</sup> )	FCC Power Density (mW/cm <sup>2</sup> )
2.4 GHz	WLAN	0.20	25.20	0.38	0.72	0.072