



FCC CFR47 PART 15 SUBPART C

**CERTIFICATION TEST REPORT
FOR**

MC8687P MINI CARD 802.11 b/g RADIO CARD

MODEL NUMBER: MC8687P

FCC ID: UAY-MC8687P

REPORT NUMBER: 07U11510-1, REVISION A1

ISSUE DATE: JANUARY 15, 2007

Prepared for

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Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	12/21/07	Initial Issue	F. Ibrahim
A	01/14/08	Removed data and set up photos related to Mega Chip antenna	F. Ibrahim
1	01/15/08	Removed IC information from report.	S. Radecki

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MARVELL SEMICONDUCTOR, INC.
5488 MARVELL LANE, I-301
SANTA CLARA, CA 95054

EUT DESCRIPTION: MC8687P MINI CARD 802.11 b/g RADIO CARD

MODEL: MC8687P

SERIAL NUMBER: 00.50.43.20.A2.B4

DATE TESTED: DECEMBER 10 - 15, 2007


APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	No Non-Compliance Noted

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. 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 Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Tested By:



FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

VIEN TRAN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an MC8687P Mini Card 802.11 b/g transceiver.
The radio module is manufactured by Marvell.

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	21.10	128.82
2412 - 2462	802.11g	21.67	146.89

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the following antennas:

- 1) PIFA antenna, with a maximum gain of 3.64 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Marvell Semiconductor, Inc, rev. 10.0.03.
The test utility software used during testing was DutApiPci8687, rev. 1.0.0.2.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate for each mode was 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.

The worst-case channel is determined as the 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	Lenovo	T61	L3-A1931	MCLJ07H081
AC Adapter	Lenovo	PA-1900-171	92P1109	N/A

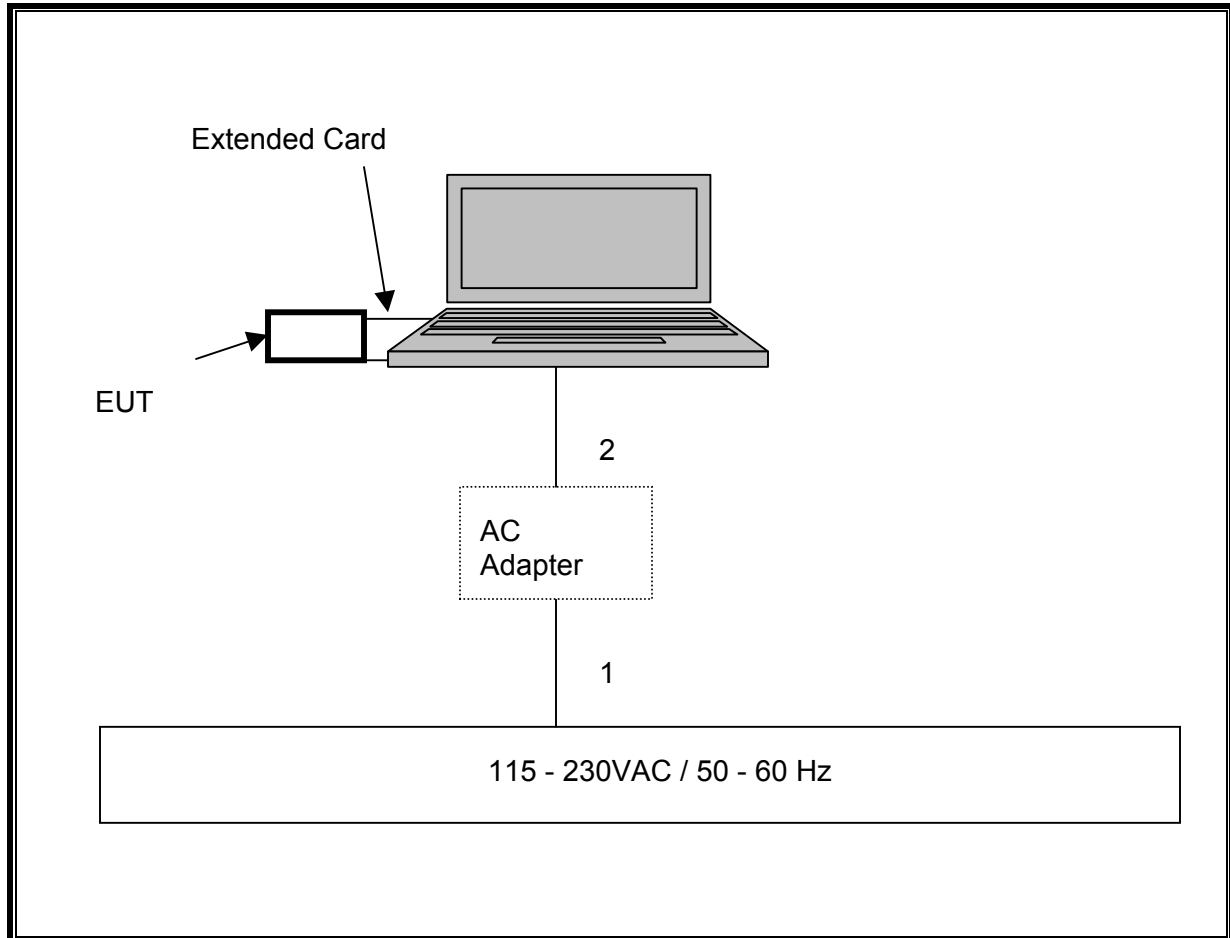
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	1 m	N/A
2	DC	1	DC	Unshielded	1.8 m	N/A

TEST SETUP

The EUT is installed in a host laptop computer via extended card during the tests. 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 Date	Cal Due
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	06/12/07	06/12/08
RF Filter Section	Agilent / HP	85420E	3705A00256	06/12/07	06/12/08
Antenna, Bilog 30 MHz ~ 2 GHz	Sunol Sciences	JB1	A121003	08/13/07	08/13/08
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00931	08/16/07	08/16/08
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	US42070220	08/14/08	08/14/08
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	08/15/07	04/15/08
2.4-2.5 GHz Reject Filter	Micro-Tronics	BRM50702	1	CNR	CNR
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	09/15/07	09/15/08
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	09/15/07	09/15/08
EMI Test Receiver	R & S	ESHS 20	827129/006	01/27/07	01/27/08
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/07	12/04/09
Peak / Average Power Sensor	Agilent	E9327A	C00964	12/07/07	12/02/09

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)

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

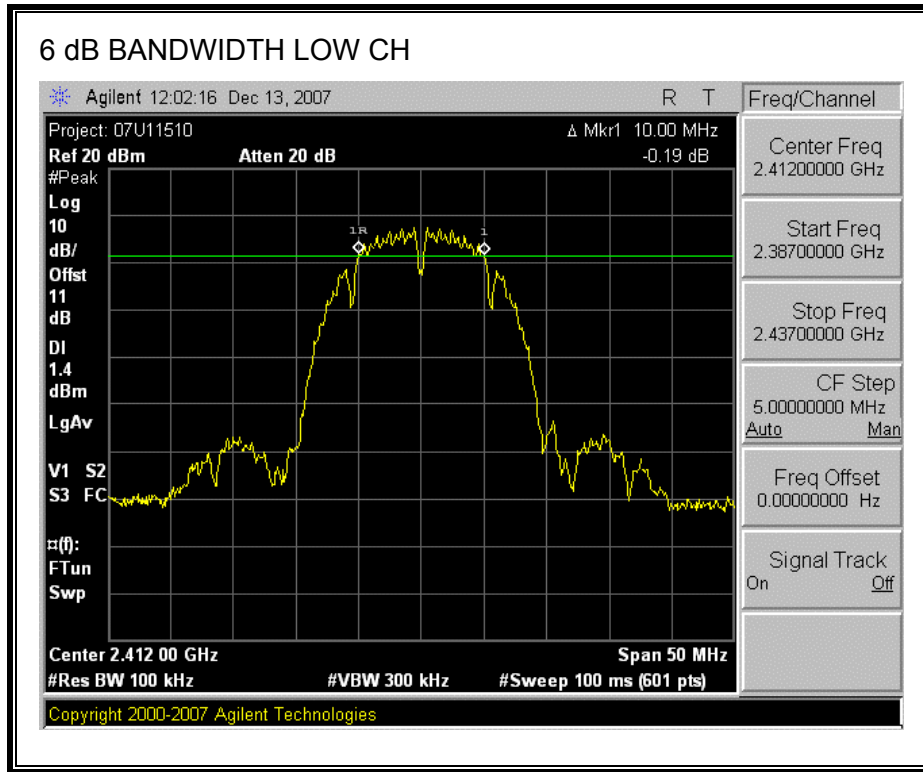
TEST PROCEDURE

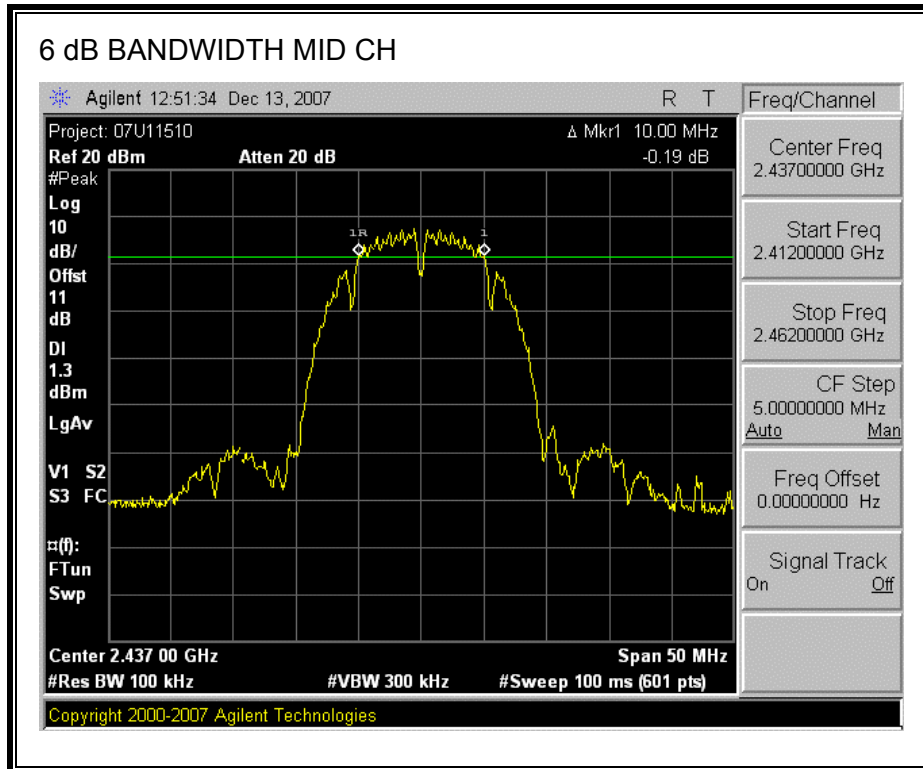
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

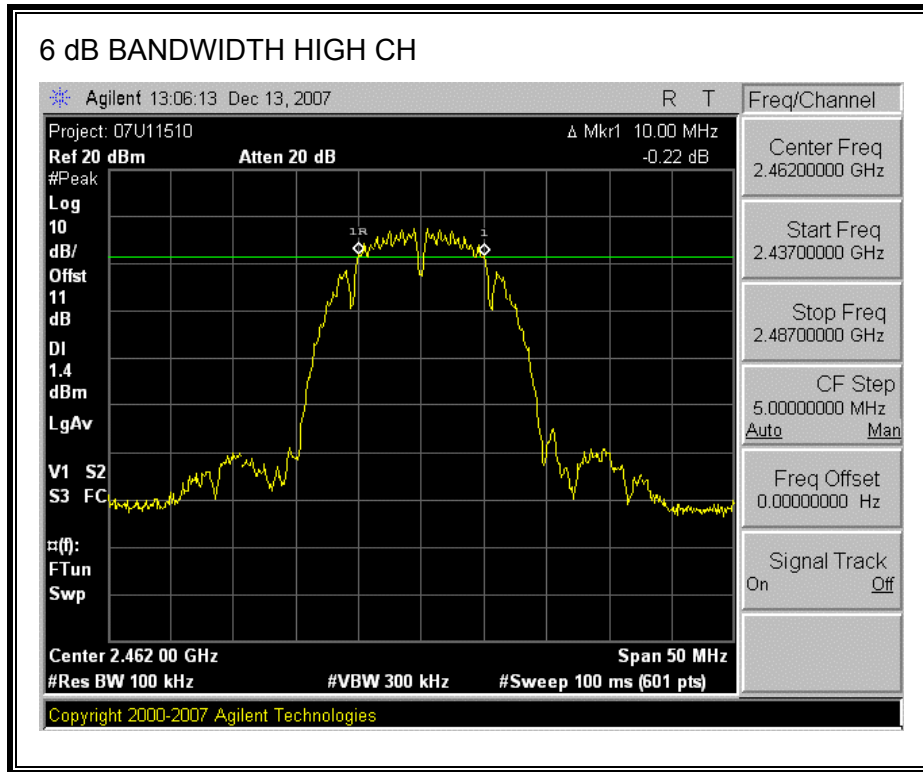
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	10	0.5
Middle	2437	10	0.5
High	2462	10	0.5

6 dB BANDWIDTH







7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

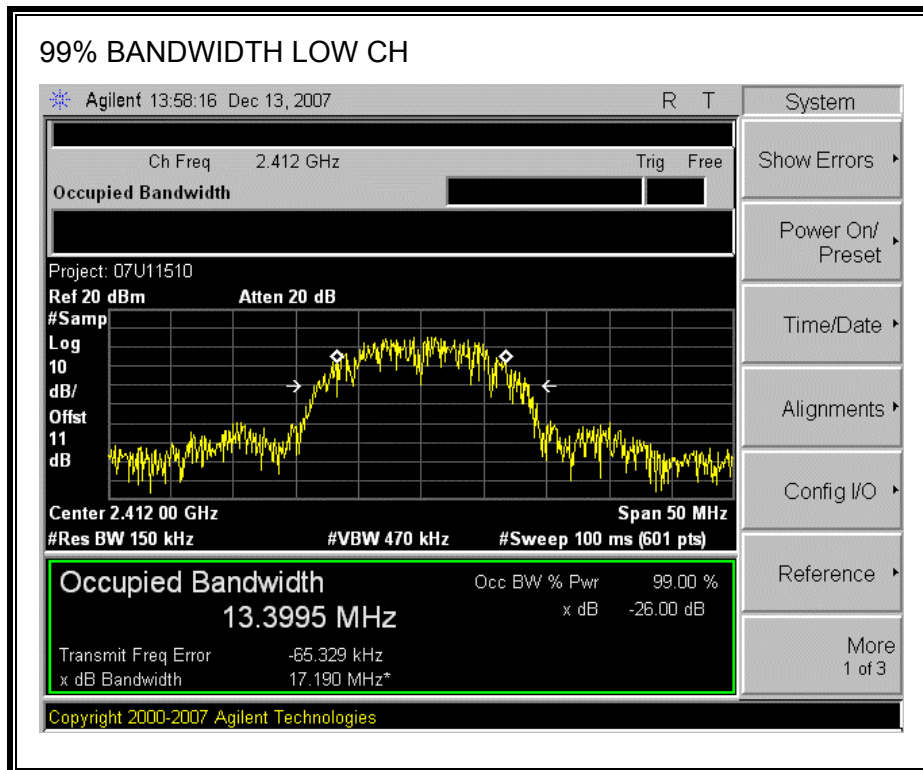
TEST PROCEDURE

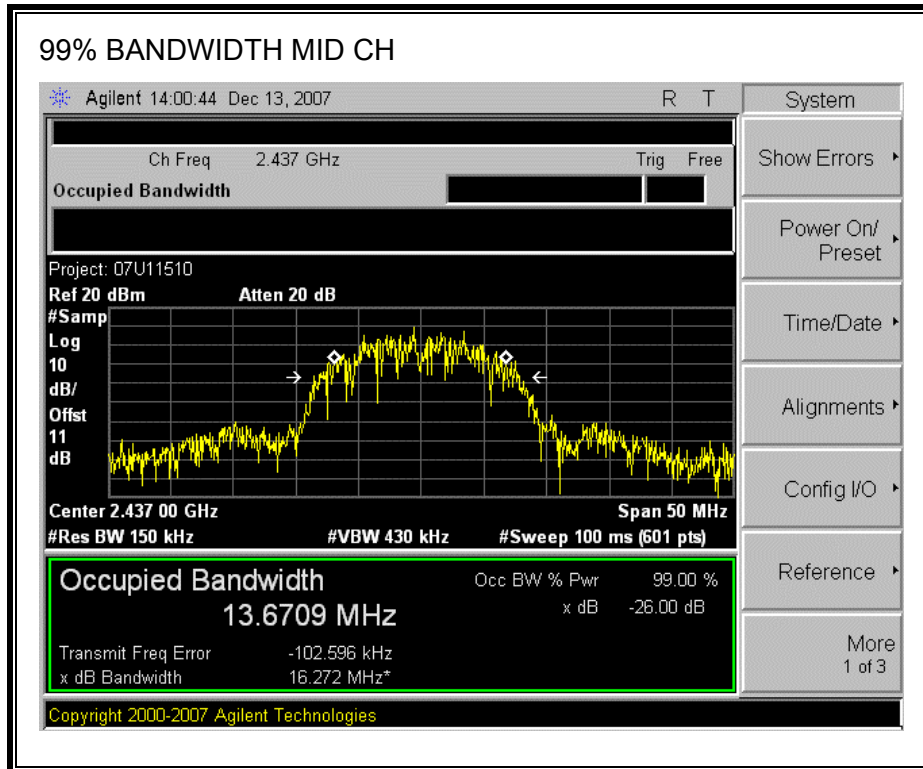
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

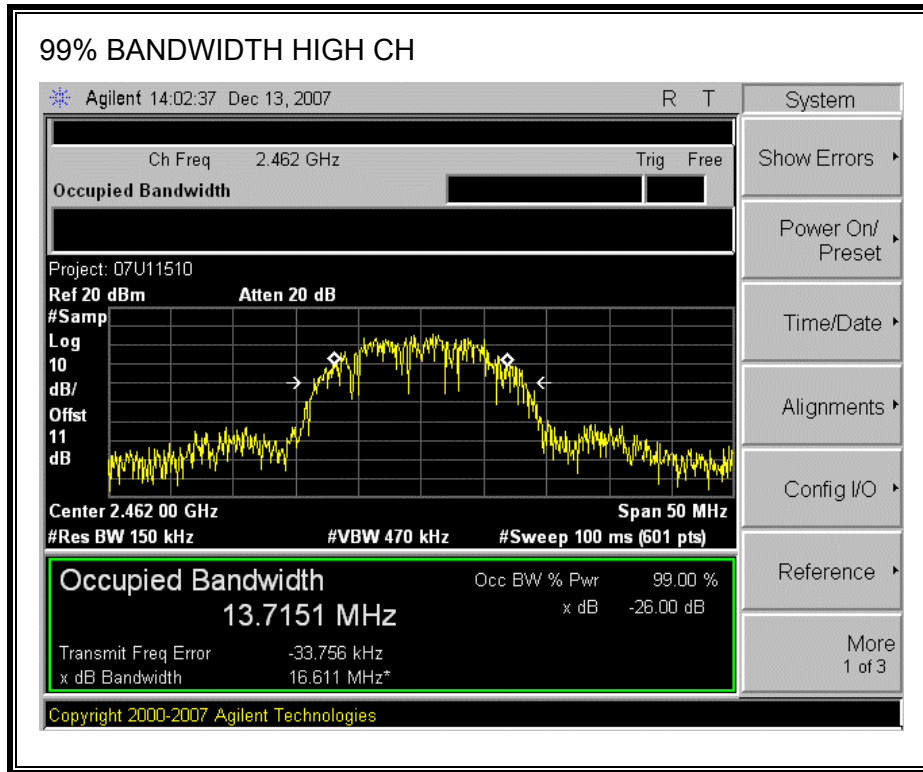
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	13.3995
Middle	2437	13.6709
High	2462	13.7151

99% BANDWIDTH







7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

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

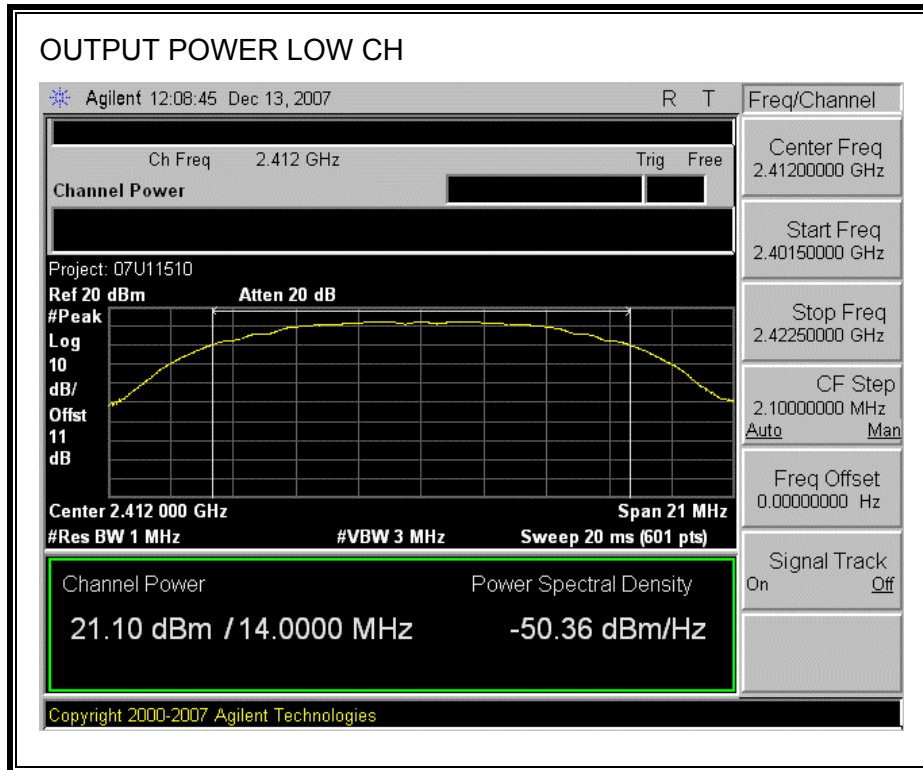
TEST PROCEDURE

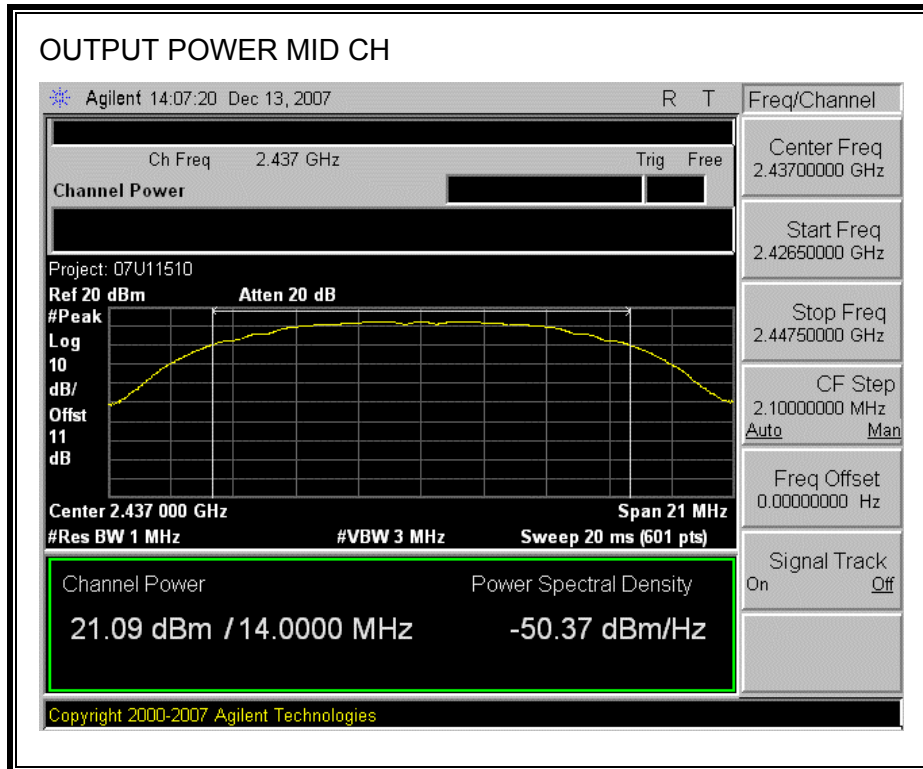
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

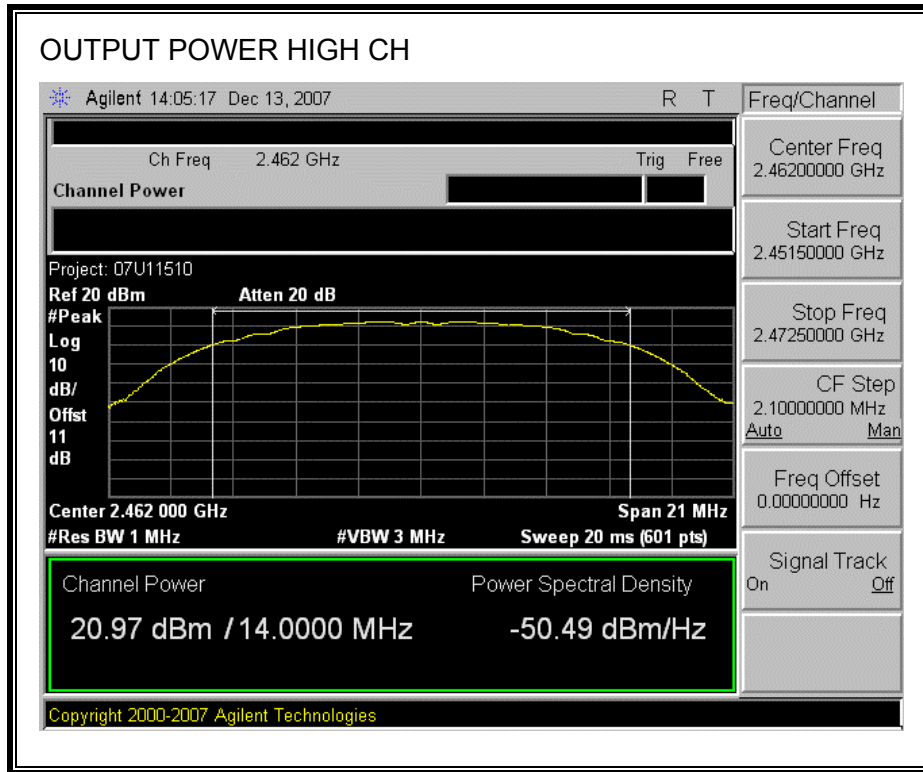
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	21.10	30	-8.90
Middle	2437	21.09	30	-8.91
High	2462	20.97	30	-9.03

OUTPUT POWER







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 dB (including 10 dB pad and 1 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	18.20
Middle	2437	18.15
High	2462	18.23

7.1.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

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.

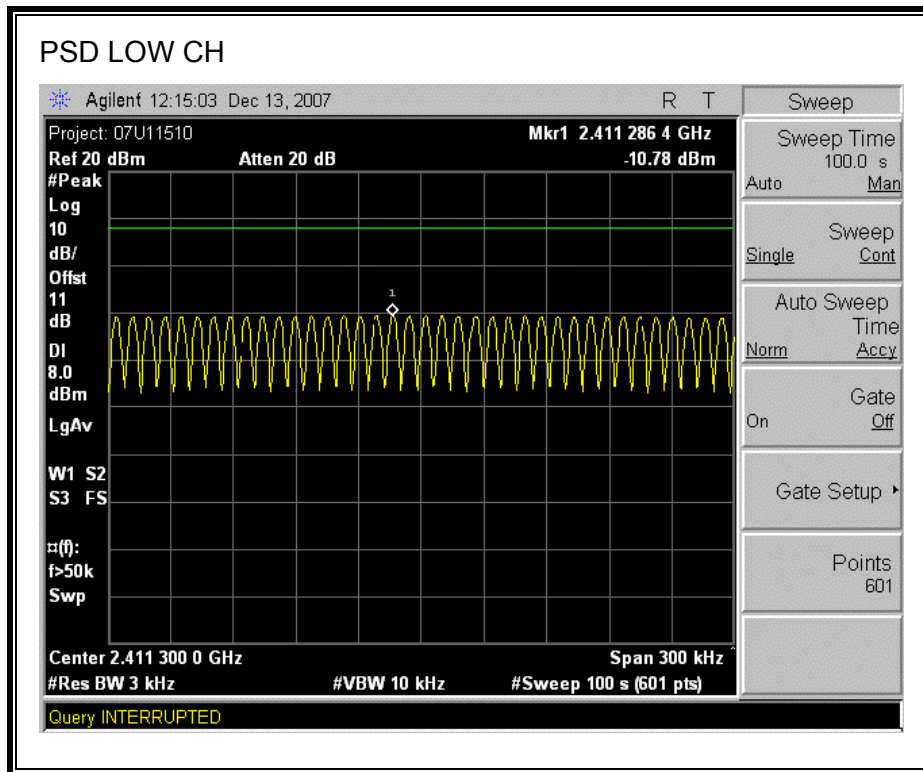
TEST PROCEDURE

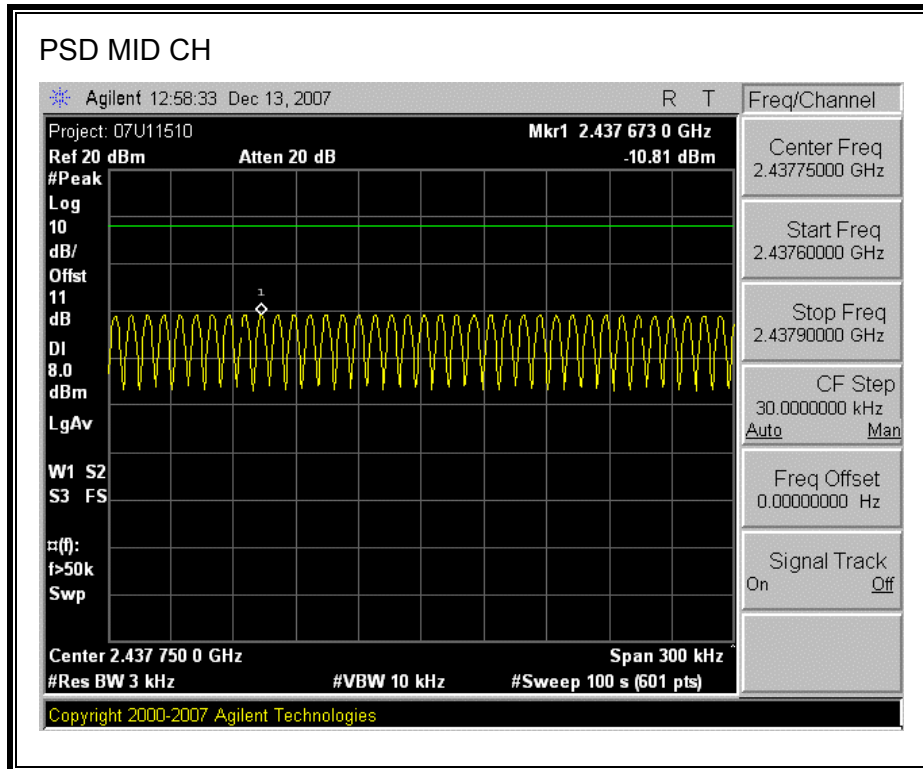
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

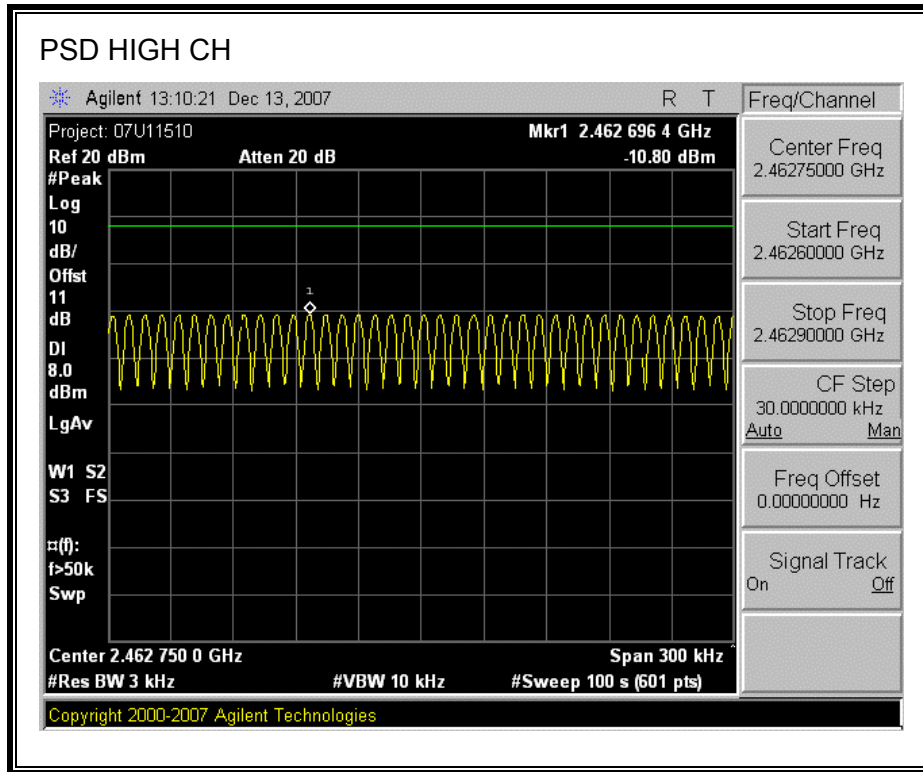
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-10.78	8	-18.78
Middle	2437	-10.81	8	-18.81
High	2462	-10.80	8	-18.80

POWER SPECTRAL DENSITY







7.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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

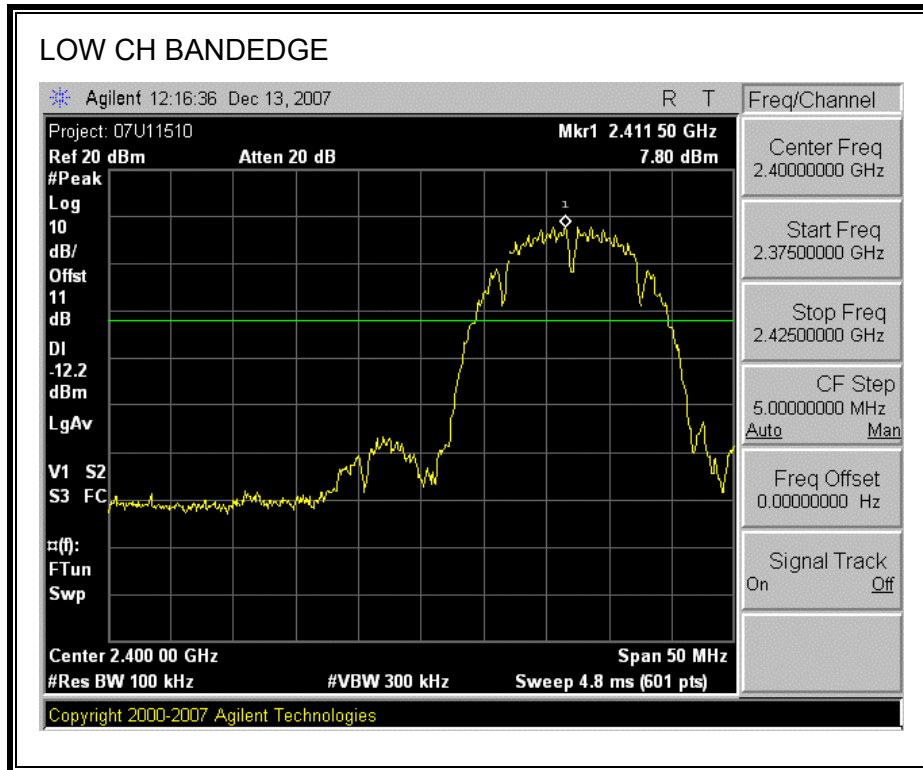
TEST PROCEDURE

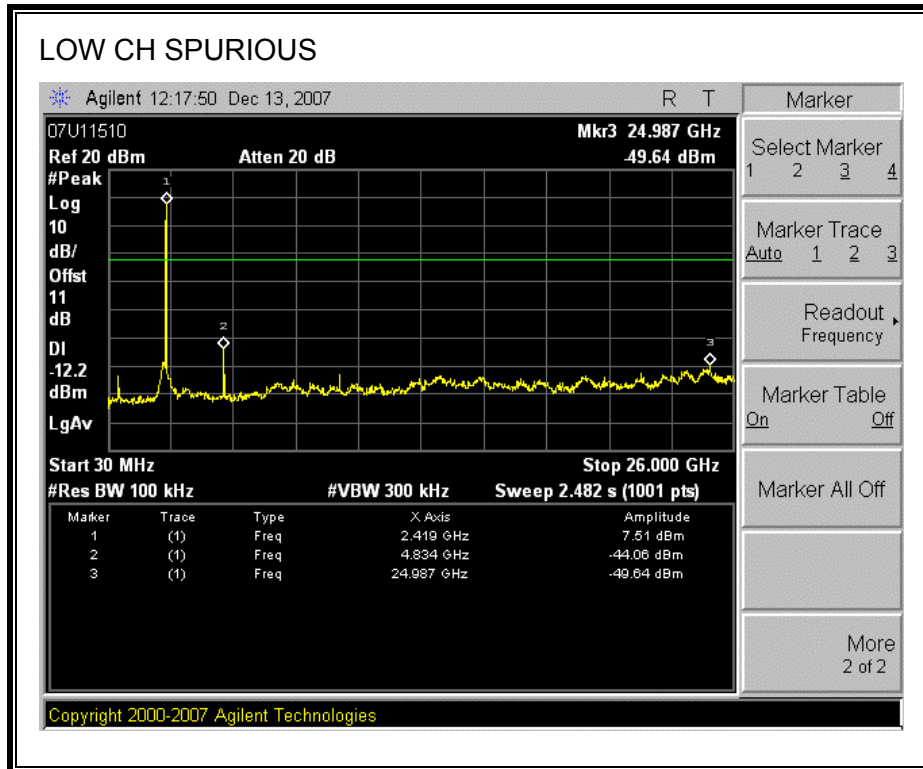
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

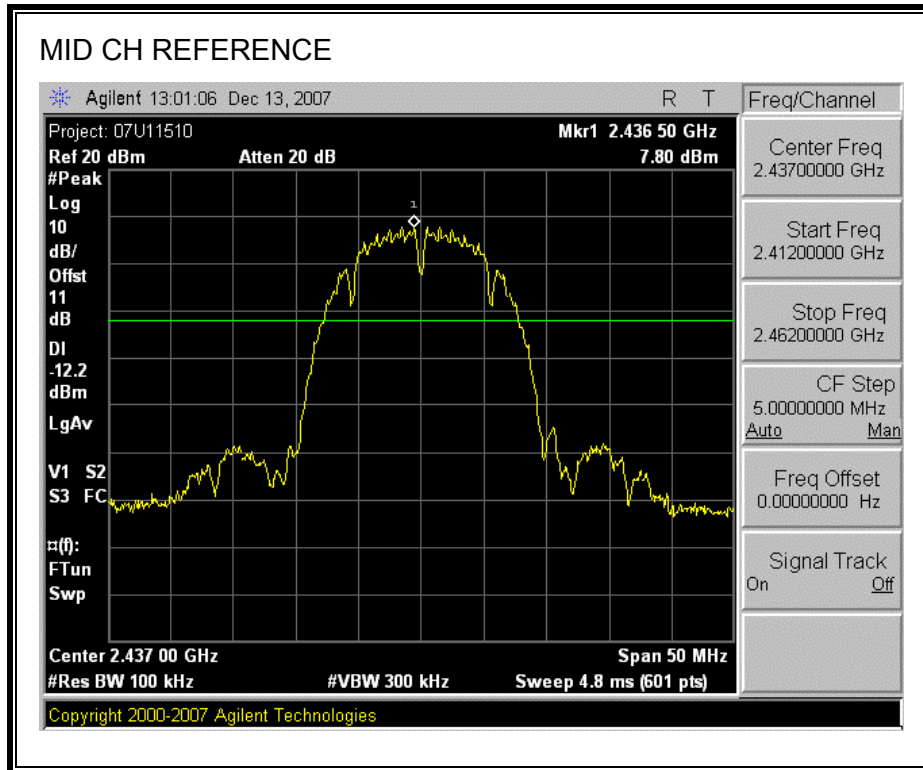
RESULTS

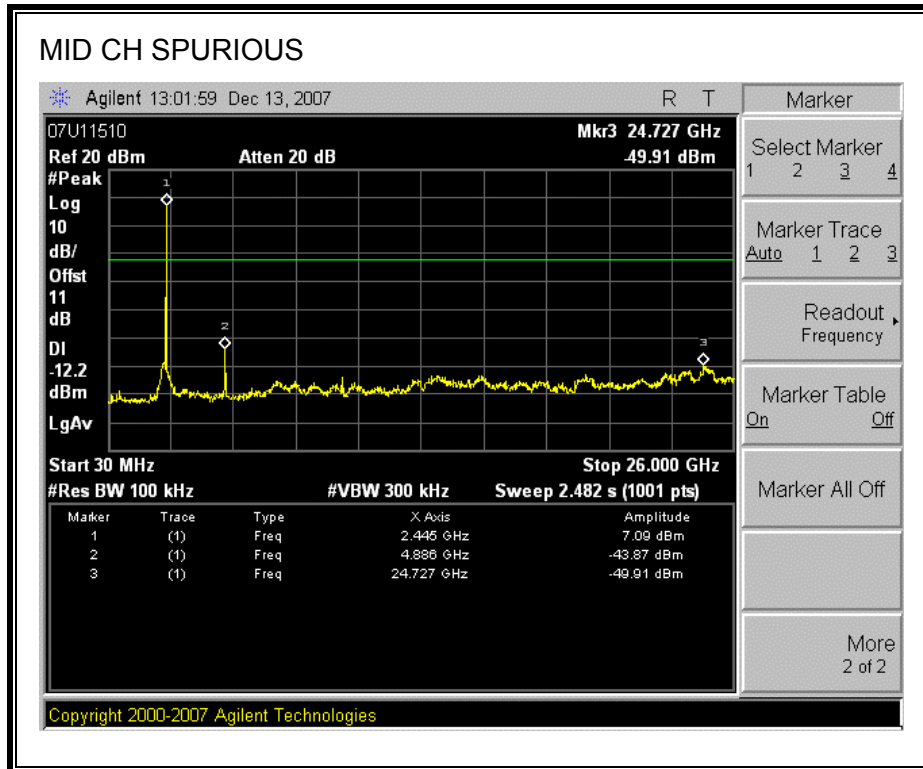
SPURIOUS EMISSIONS, LOW CHANNEL



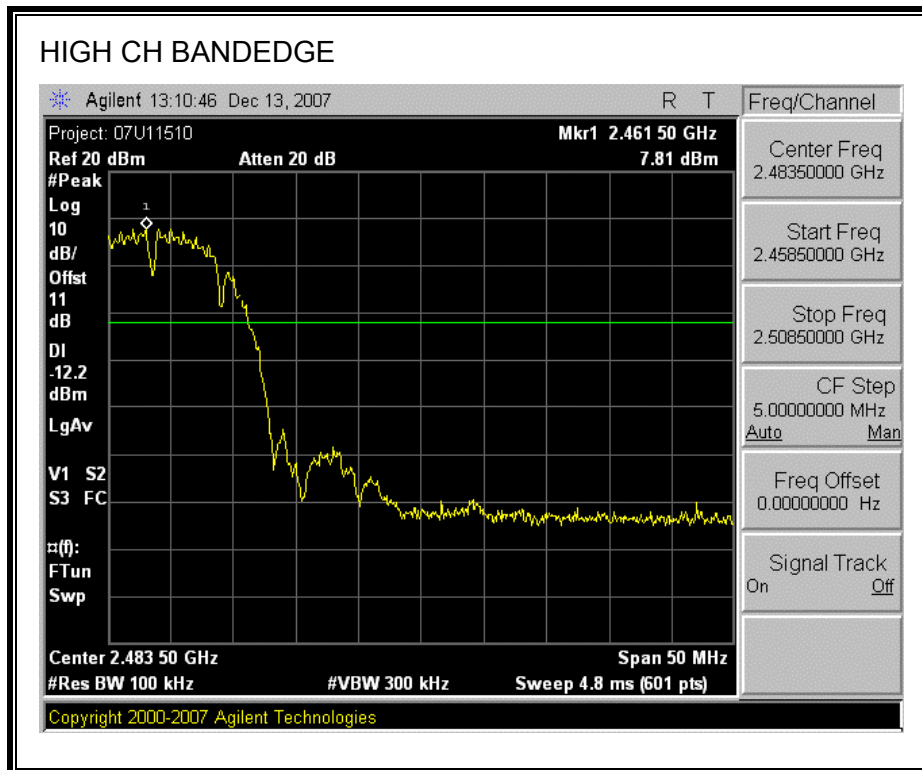


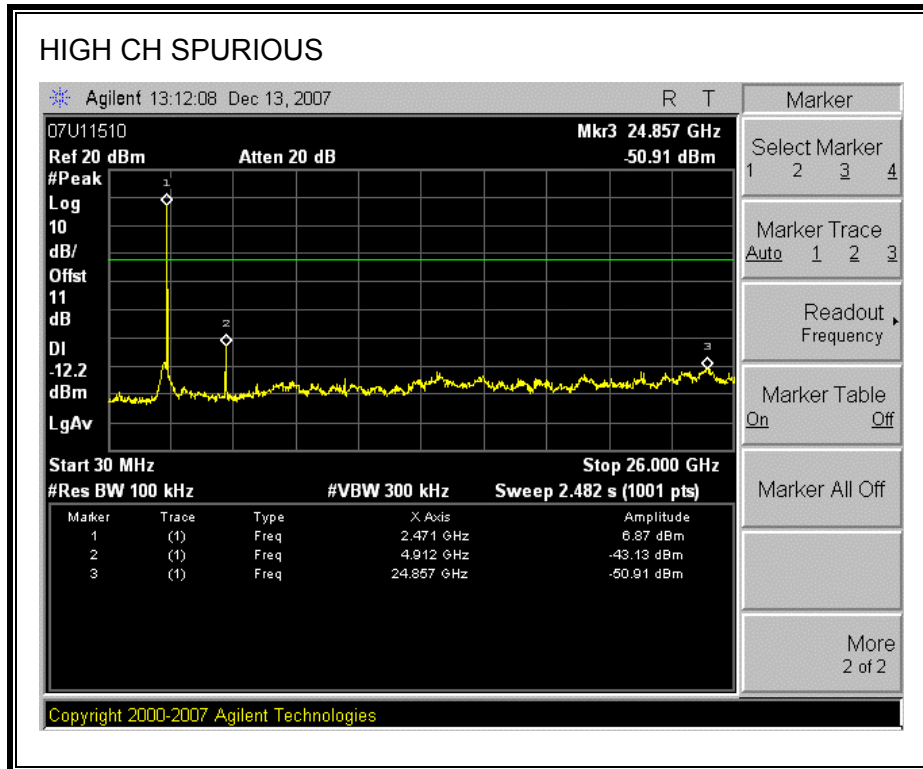
SPURIOUS EMISSIONS, MID CHANNEL





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)

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

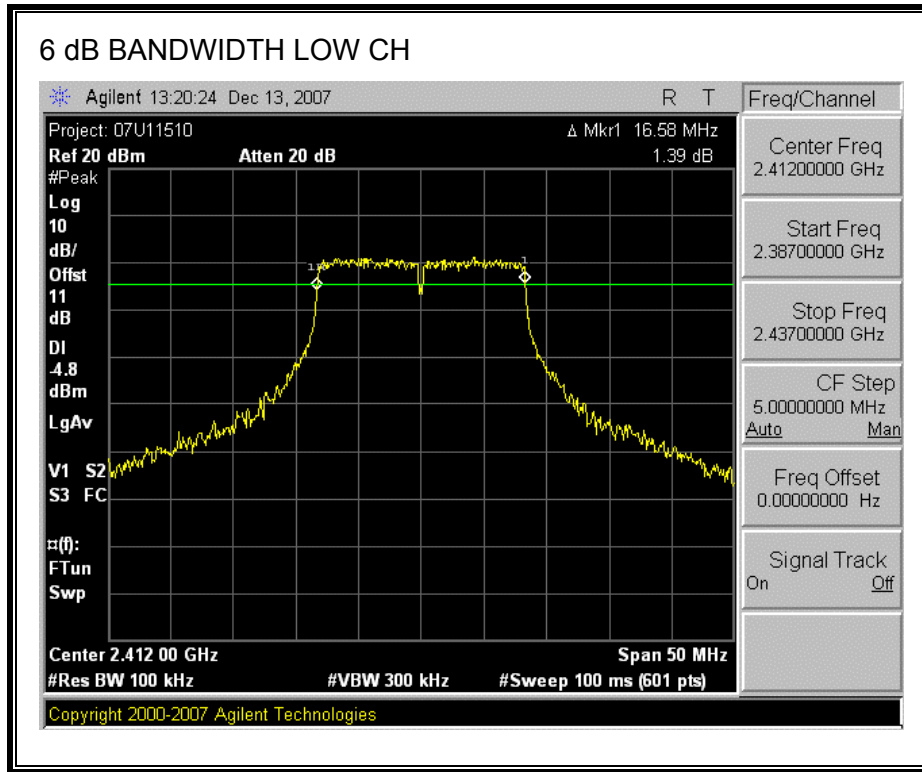
TEST PROCEDURE

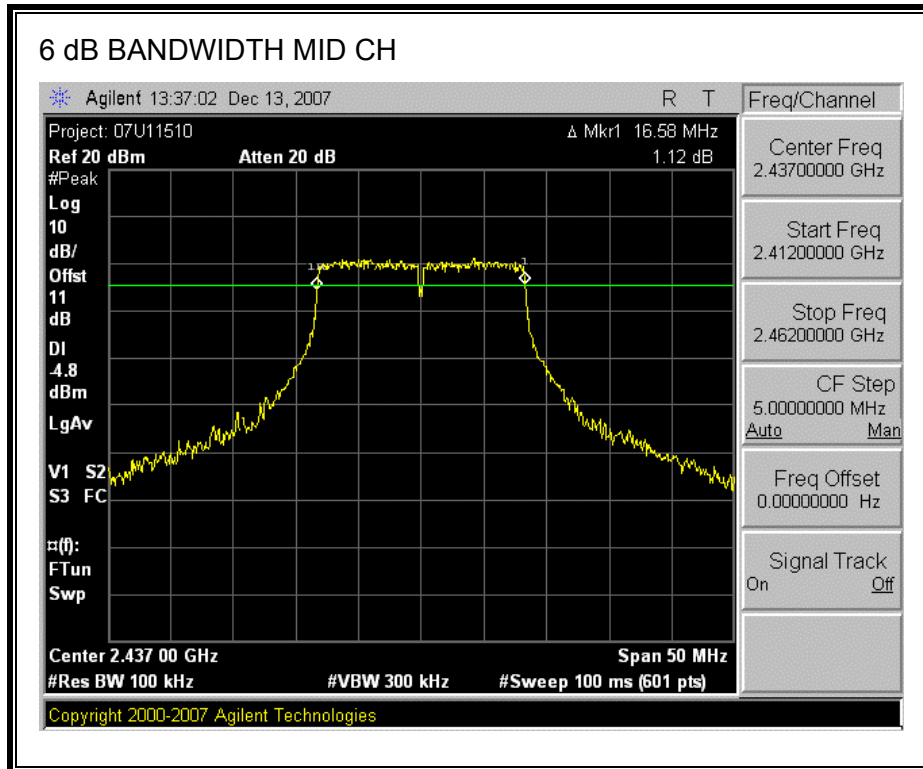
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

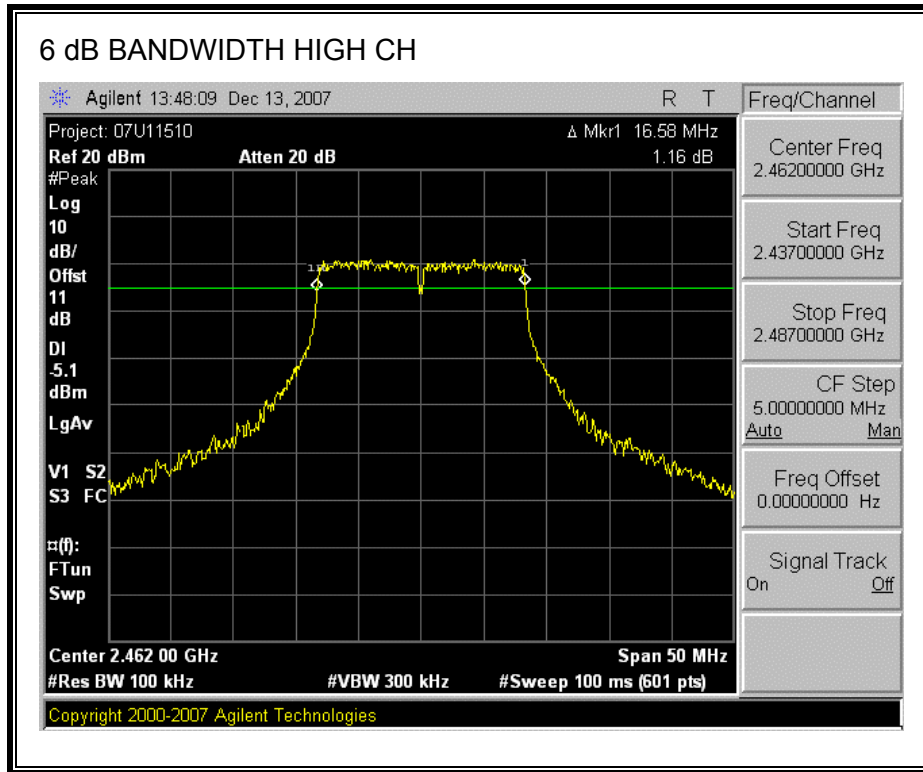
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.58	0.5
Middle	2437	16.58	0.5
High	2462	16.58	0.5

6 dB BANDWIDTH







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

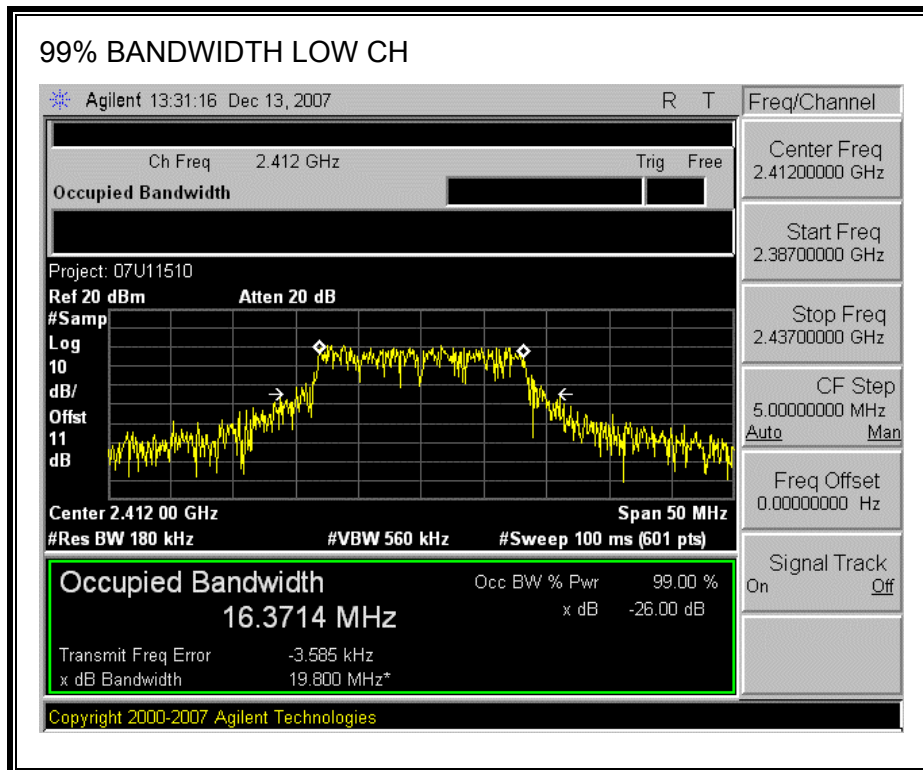
TEST PROCEDURE

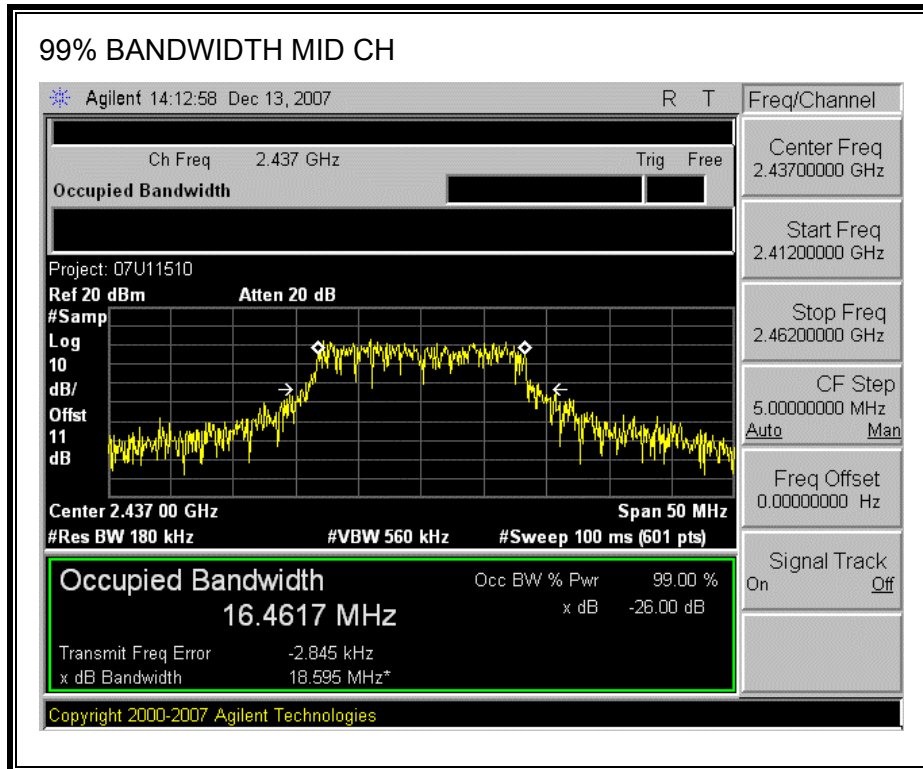
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

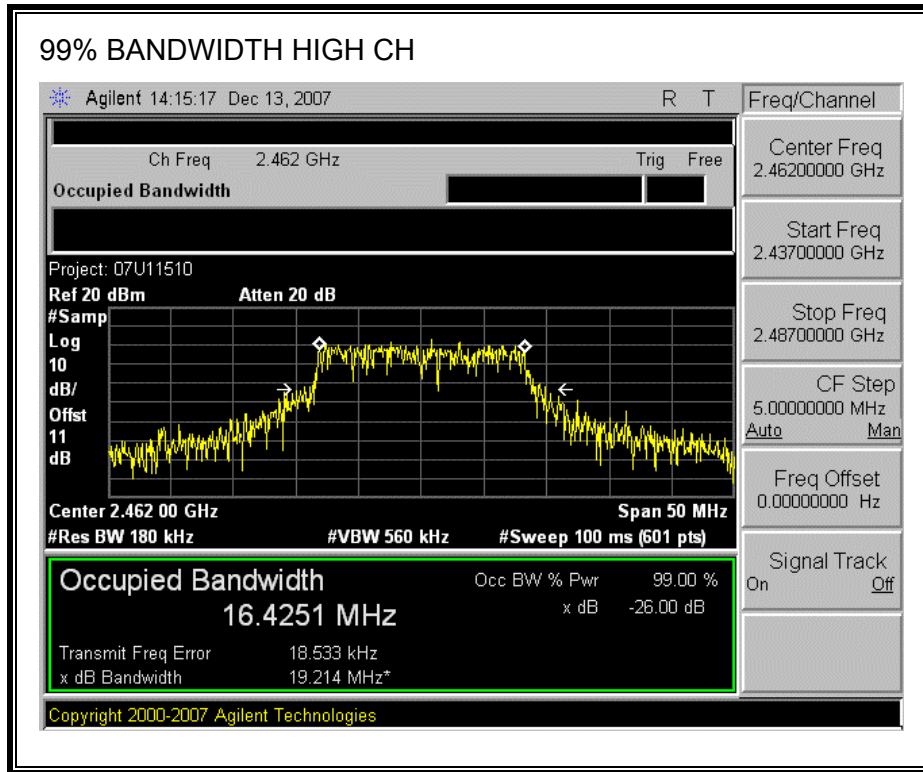
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.3714
Middle	2437	16.4617
High	2462	16.4251

99% BANDWIDTH







7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

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

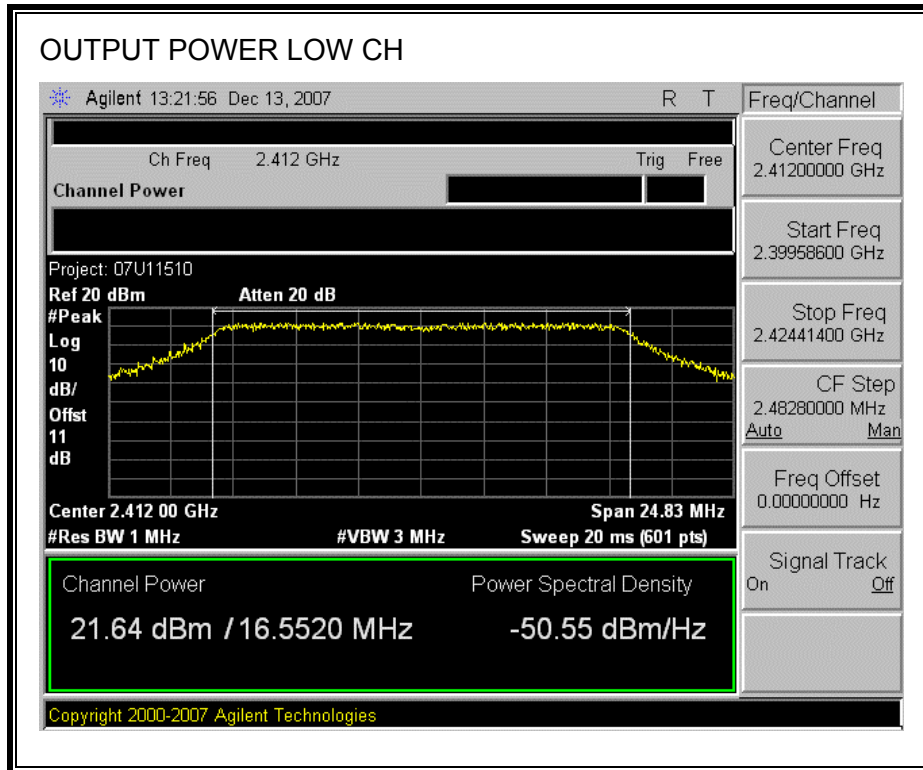
TEST PROCEDURE

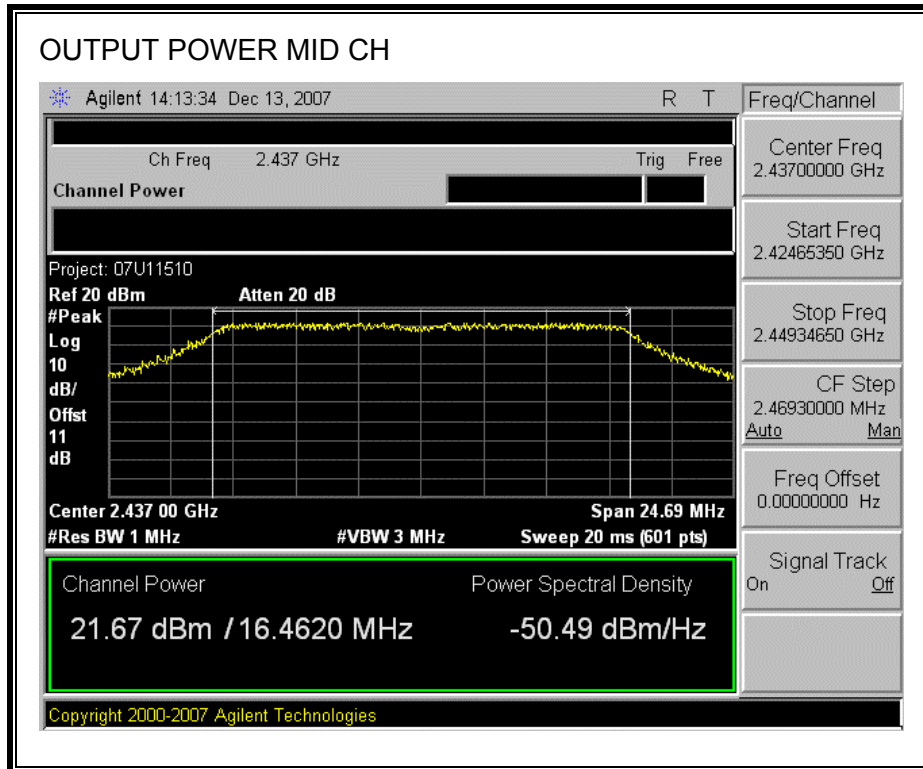
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

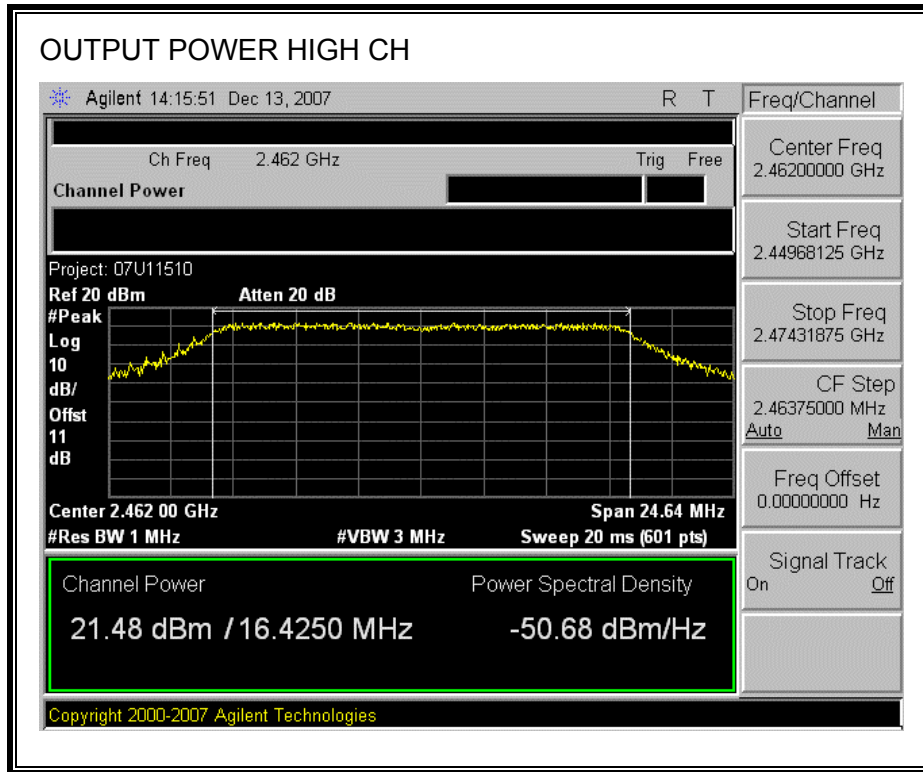
RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	21.64	30	-8.36
Middle	2437	21.67	30	-8.33
High	2462	21.48	30	-8.52

OUTPUT POWER







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 dB (including 10 dB pad and 1 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	15.22
Middle	2437	15.24
High	2462	15.23

7.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

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.

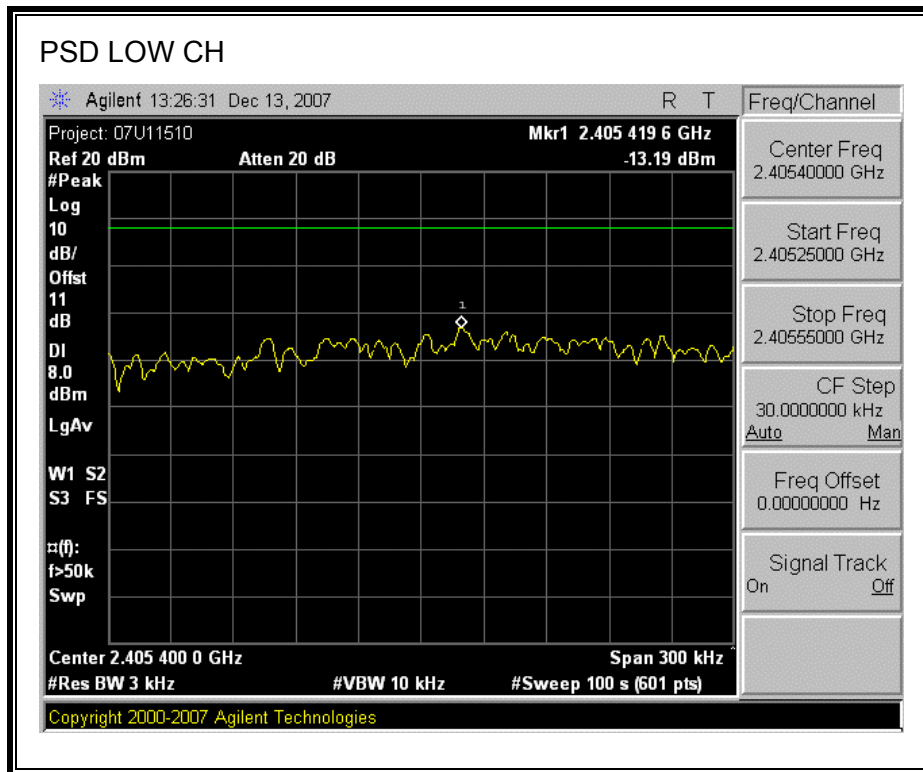
TEST PROCEDURE

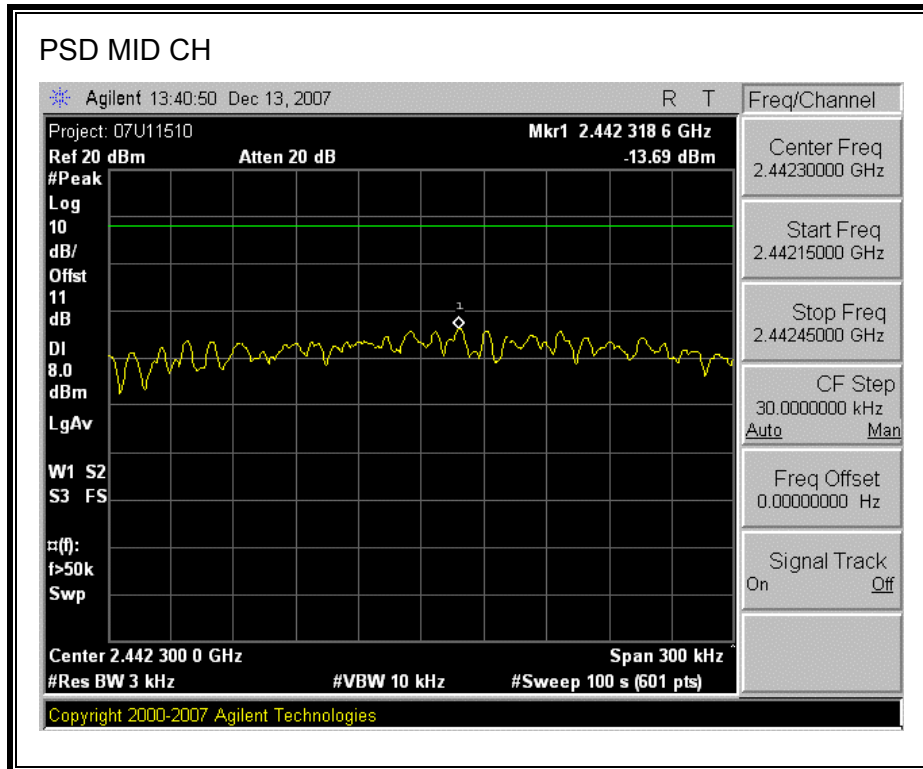
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

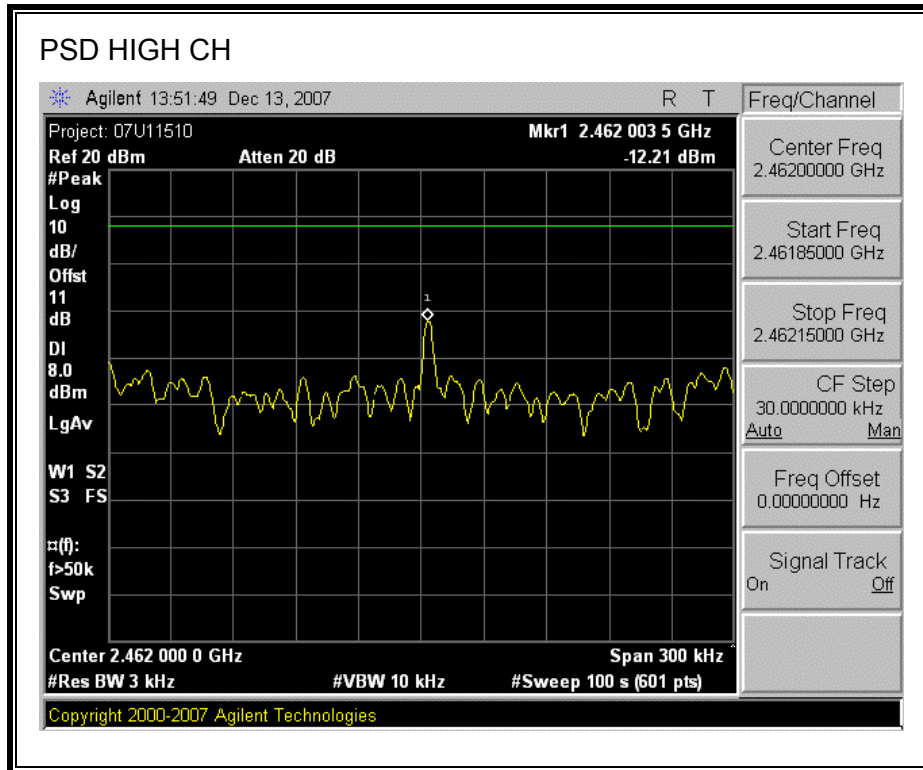
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-13.19	8	-21.19
Middle	2437	-13.69	8	-21.69
High	2462	-12.21	8	-20.21

POWER SPECTRAL DENSITY







7.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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

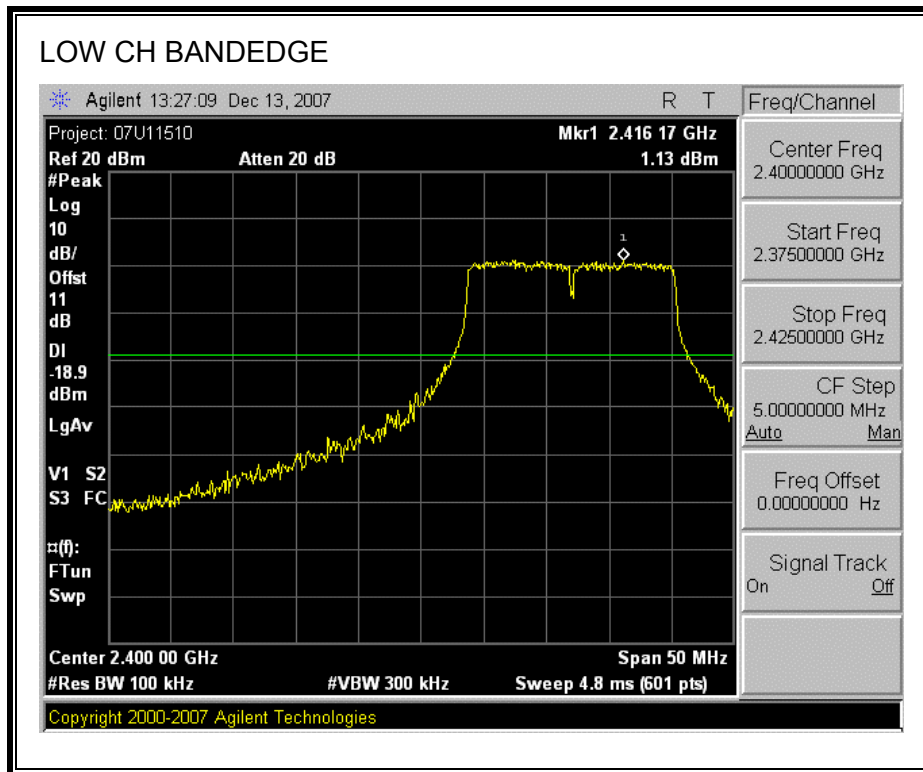
TEST PROCEDURE

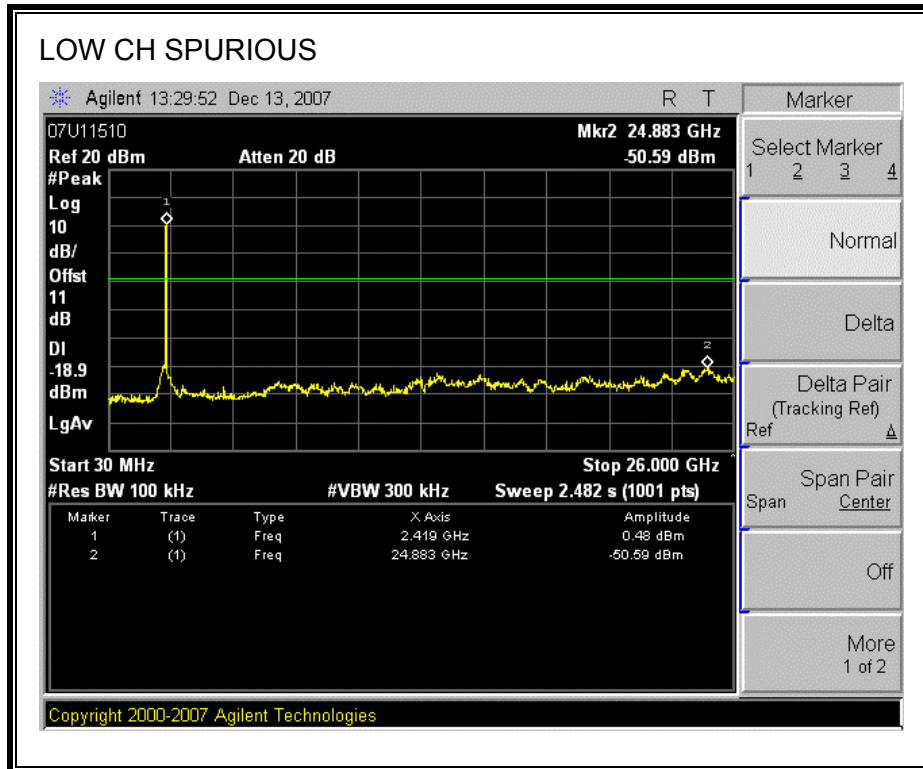
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

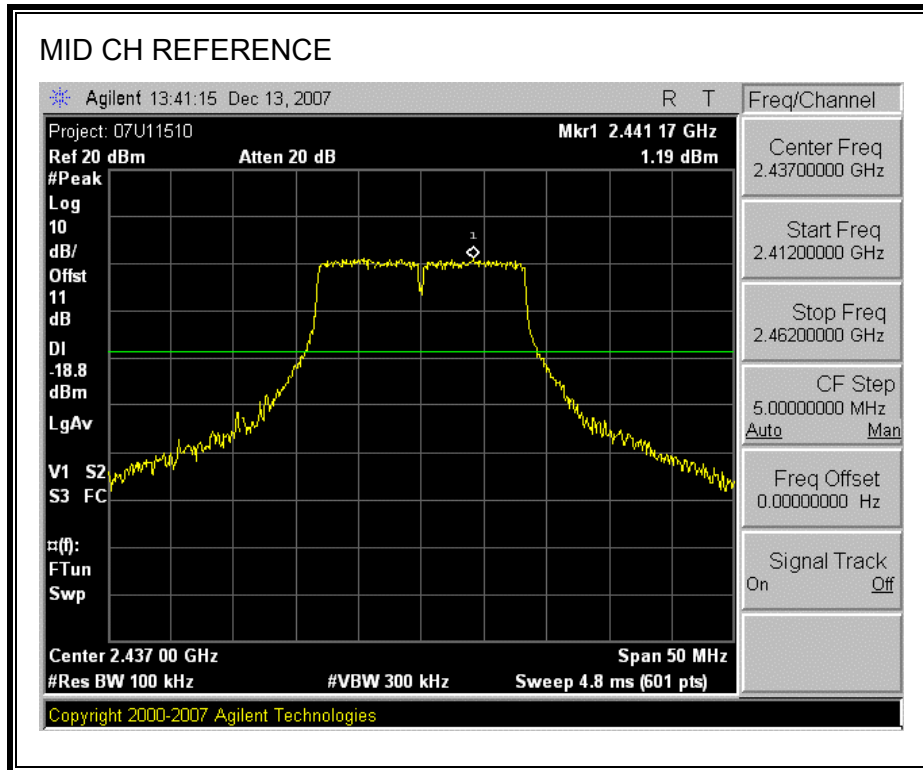
RESULTS

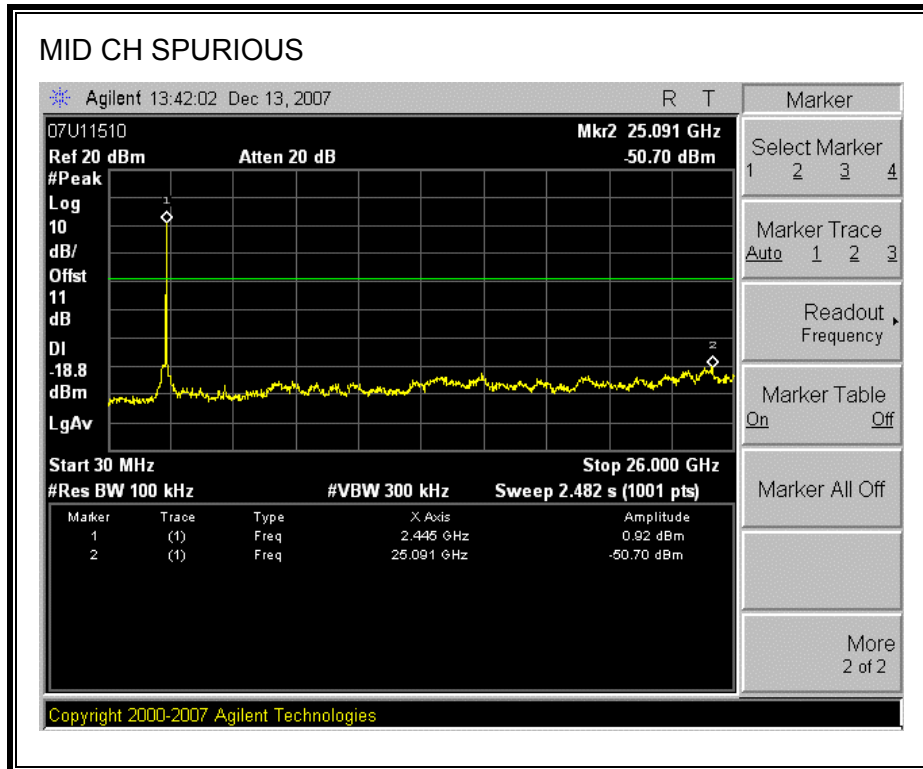
SPURIOUS EMISSIONS, LOW CHANNEL



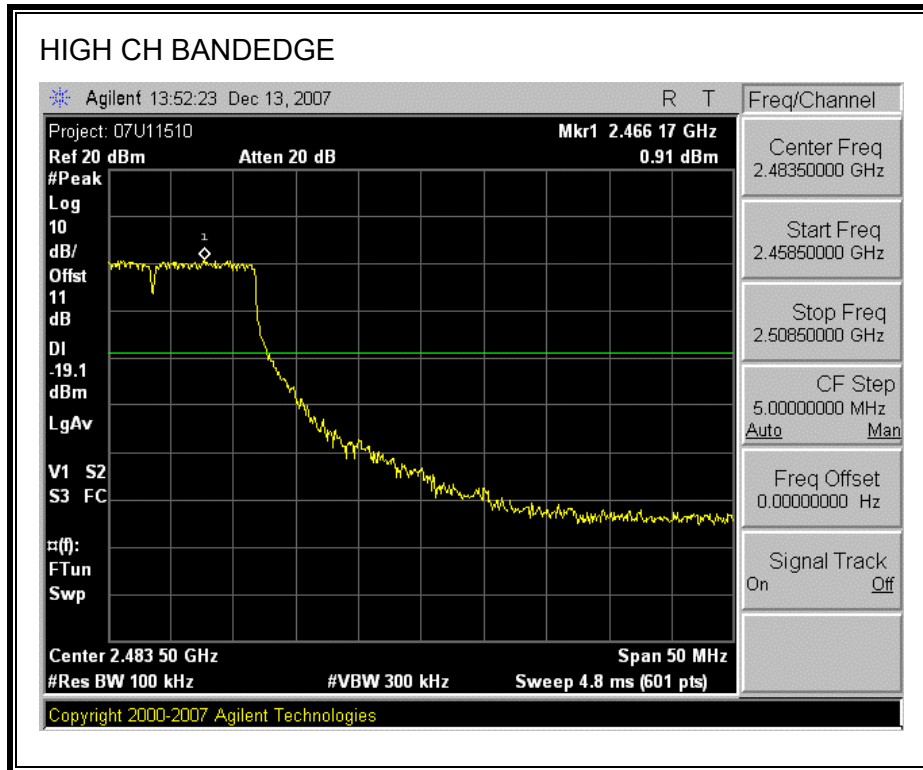


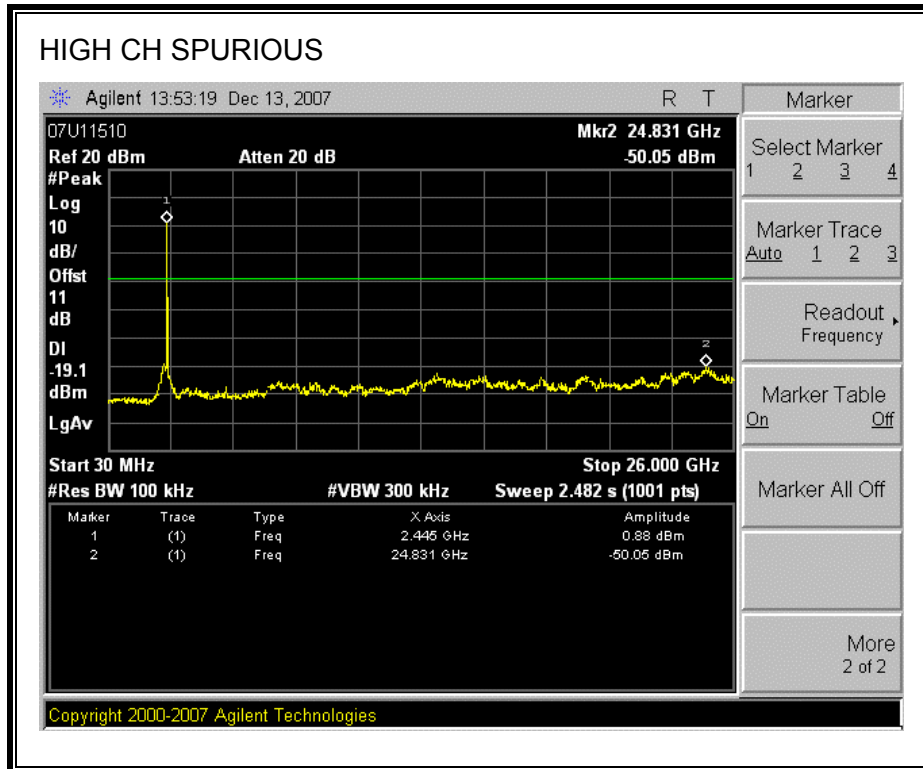
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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.

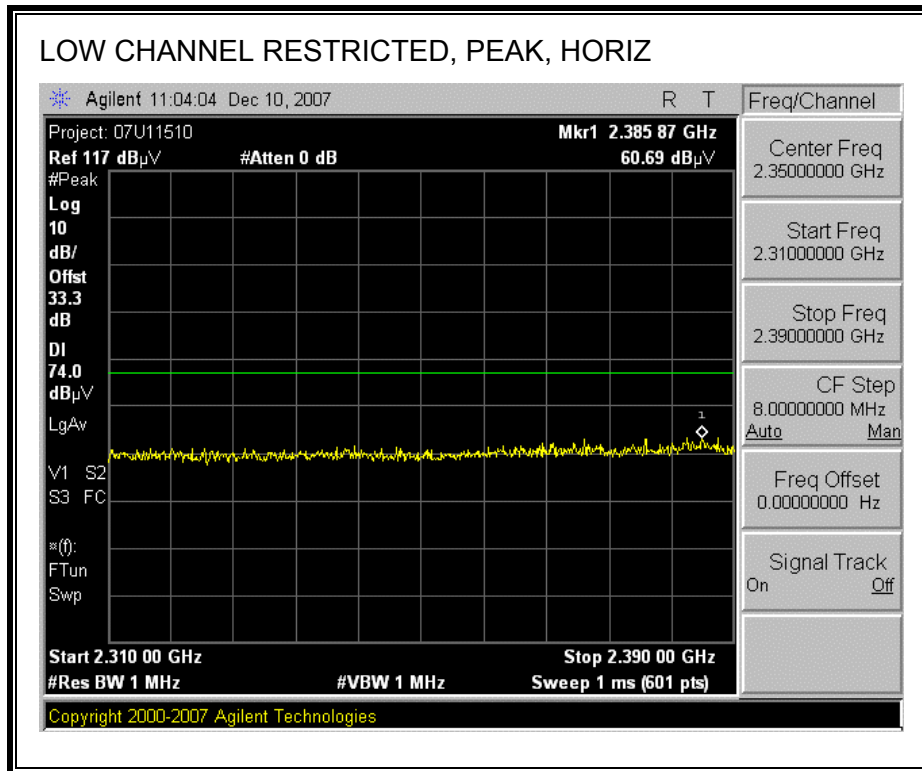
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

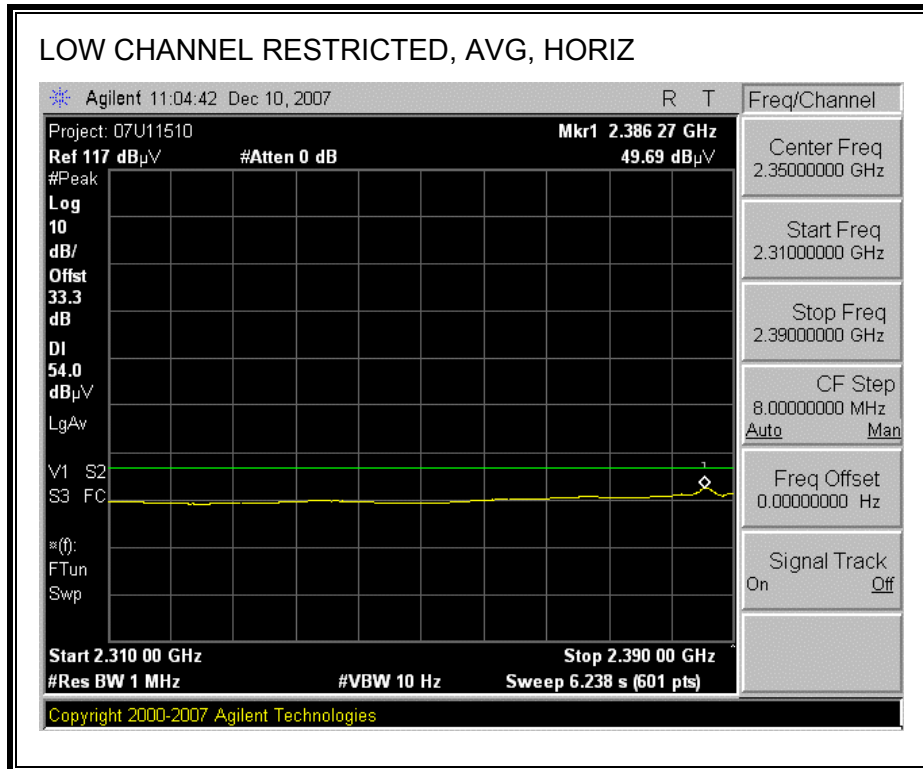
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz (PIFA 3.64dBi ANTENNA)

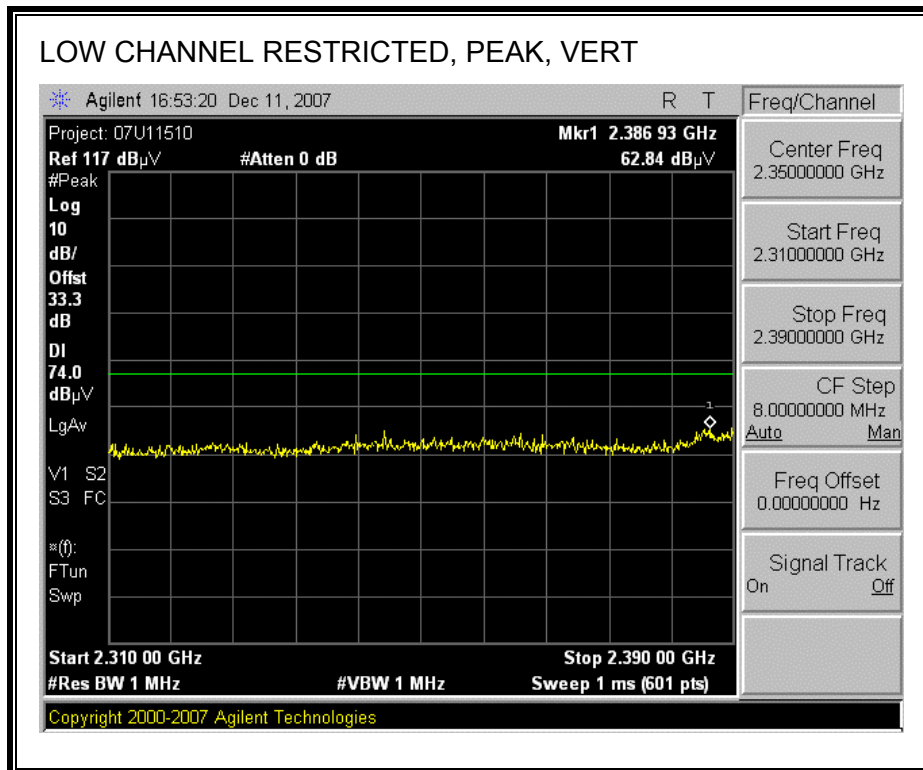
8.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE

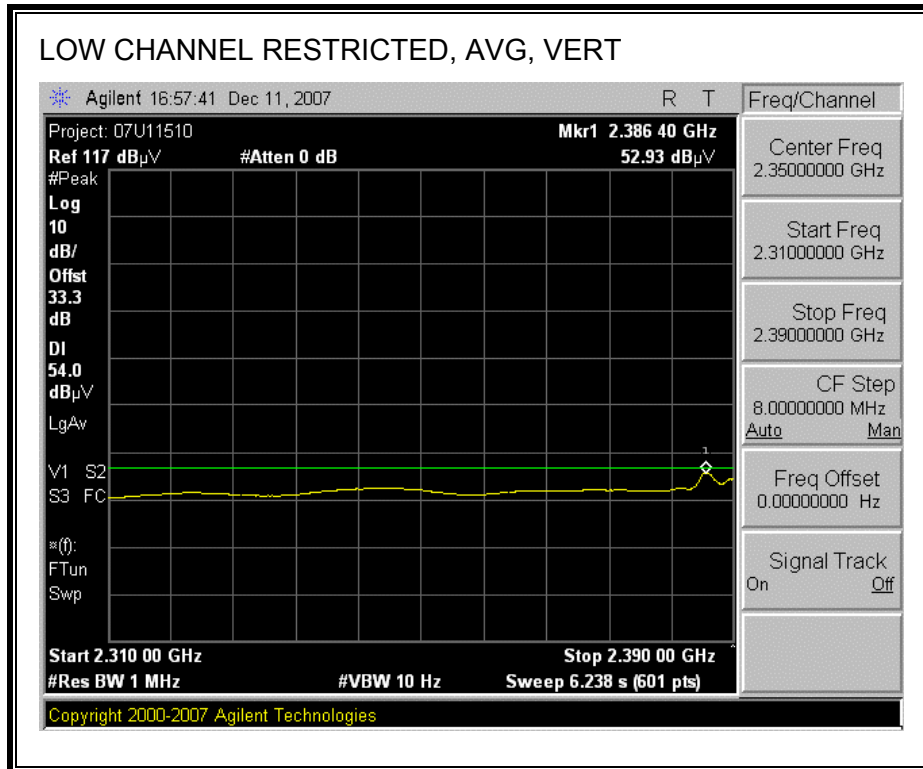
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



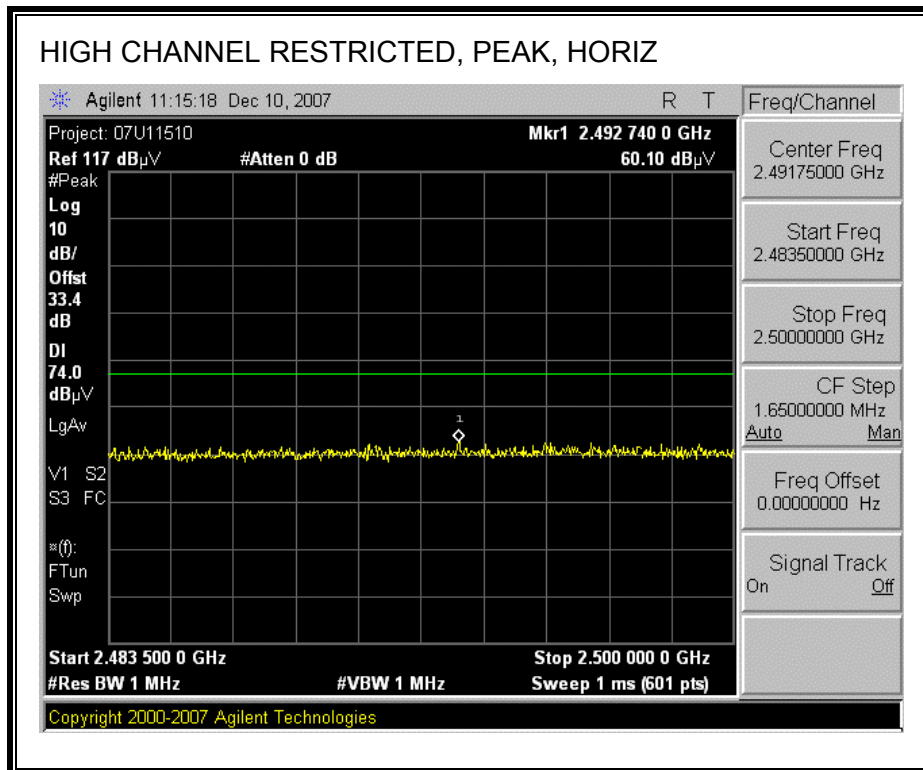


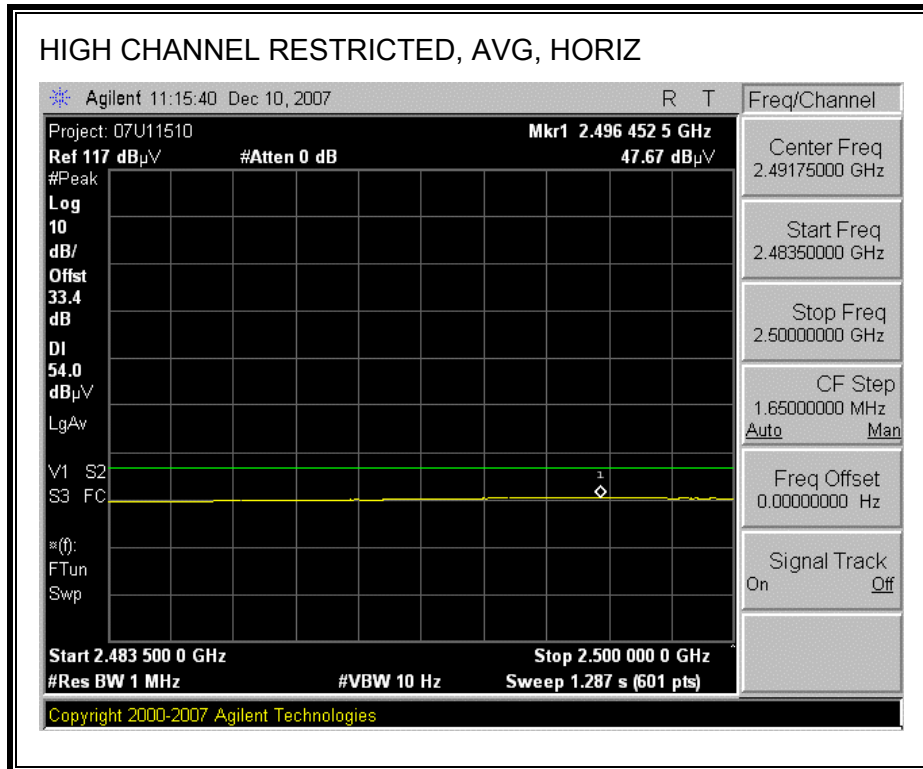
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



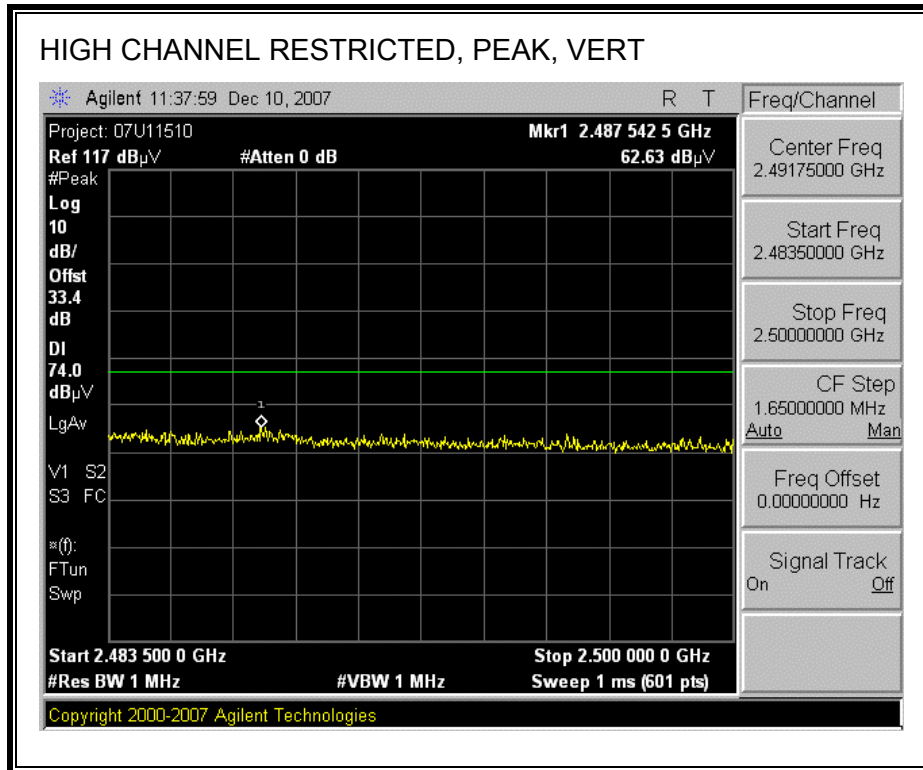


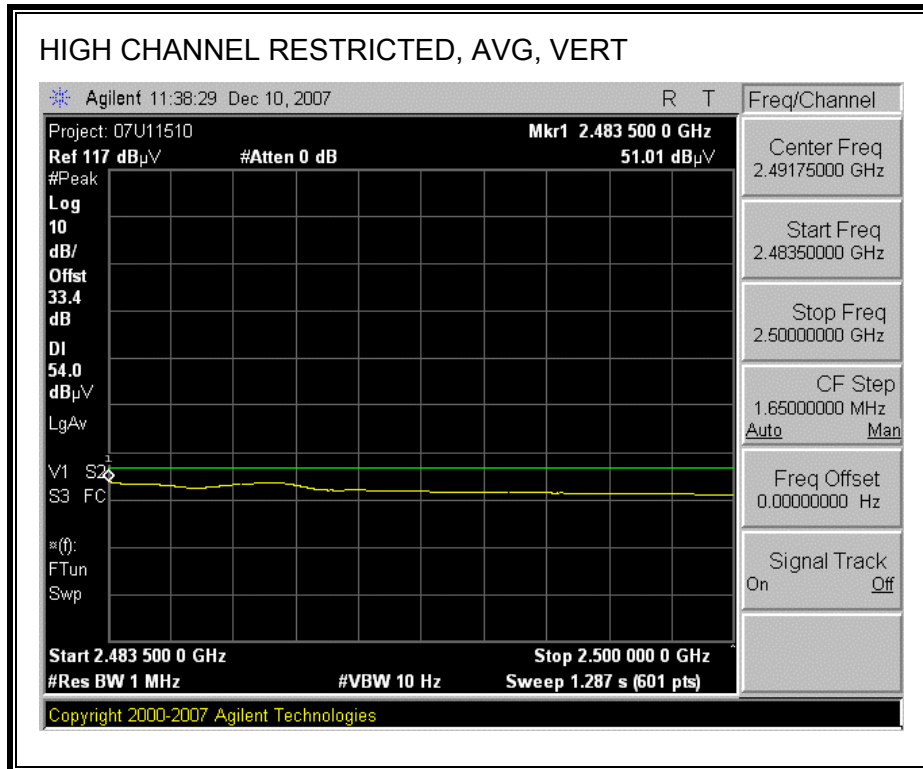
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
 Compliance Certification Services, 3 Meter _ C Chamber

Company: Marvell Semiconductor, Inc.
 Project #: 07U11510
 Date: 12/11/2007
 Test Engineer: Vien Tran
 Configuration: EUT with PIFA 3.64dBi Antenna
 Mode: Tx 11b Mode

Test Equipment:

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T34 HP 8449B			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	
	Gordon 177080004	Thanh 208946003	HPF_4.0GHz		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz

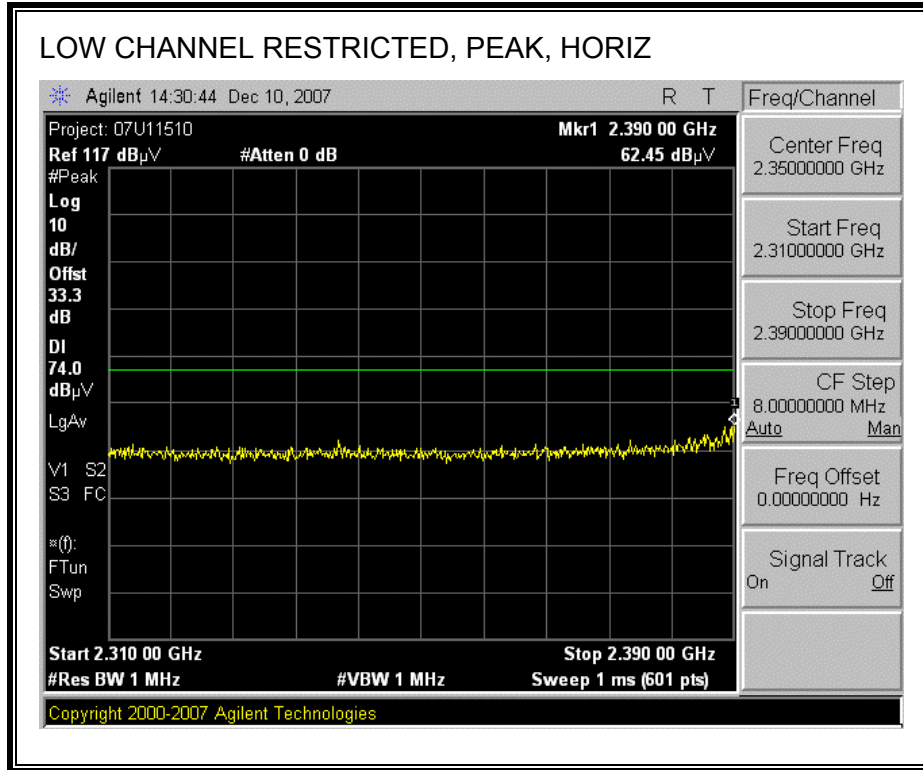
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW CHANNEL, 2412 MHz															
4.824	3.0	51.5	46.7	33.7	3.2	-34.8	0.0	0.6	54.2	49.4	74	54	-19.8	-4.6	V
12.060	3.0	44.2	32.4	37.4	5.0	-32.5	0.0	0.9	55.0	43.1	74	54	-19.0	-10.9	V
4.824	3.0	52.4	48.5	33.7	3.2	-34.8	0.0	0.6	55.1	51.2	74	54	-18.9	-2.8	H
12.060	3.0	42.7	31.6	37.4	5.0	-32.5	0.0	0.9	53.5	42.4	74	54	-20.5	-11.6	H
MID CHANNEL, 2437 MHz															
4.874	3.0	51.3	48.2	33.7	3.2	-34.8	0.0	0.6	54.1	51.0	74	54	-19.9	-3.0	V
7.311	3.0	40.2	30.8	35.2	4.0	-34.1	0.0	0.6	45.9	36.5	74	54	-28.1	-17.5	V
4.874	3.0	52.5	49.1	33.7	3.2	-34.8	0.0	0.6	55.3	51.9	74	54	-18.7	-2.1	H
7.311	3.0	44.5	32.2	35.2	4.0	-34.1	0.0	0.6	50.2	37.9	74	54	-23.8	-16.1	H
HIGH CHANNEL, 2462 MHz															
4.924	3.0	47.8	44.2	33.8	3.3	-34.8	0.0	0.6	50.6	47.0	74	54	-23.4	-7.0	V
7.386	3.0	43.1	30.1	35.2	4.0	-34.1	0.0	0.6	48.8	35.8	74	54	-25.2	-18.2	V
4.924	3.0	49.5	45.1	33.8	3.3	-34.8	0.0	0.6	52.3	47.9	74	54	-21.7	-6.1	H
7.386	3.0	44.7	31.2	35.2	4.0	-34.1	0.0	0.6	50.4	36.9	74	54	-23.6	-17.1	H

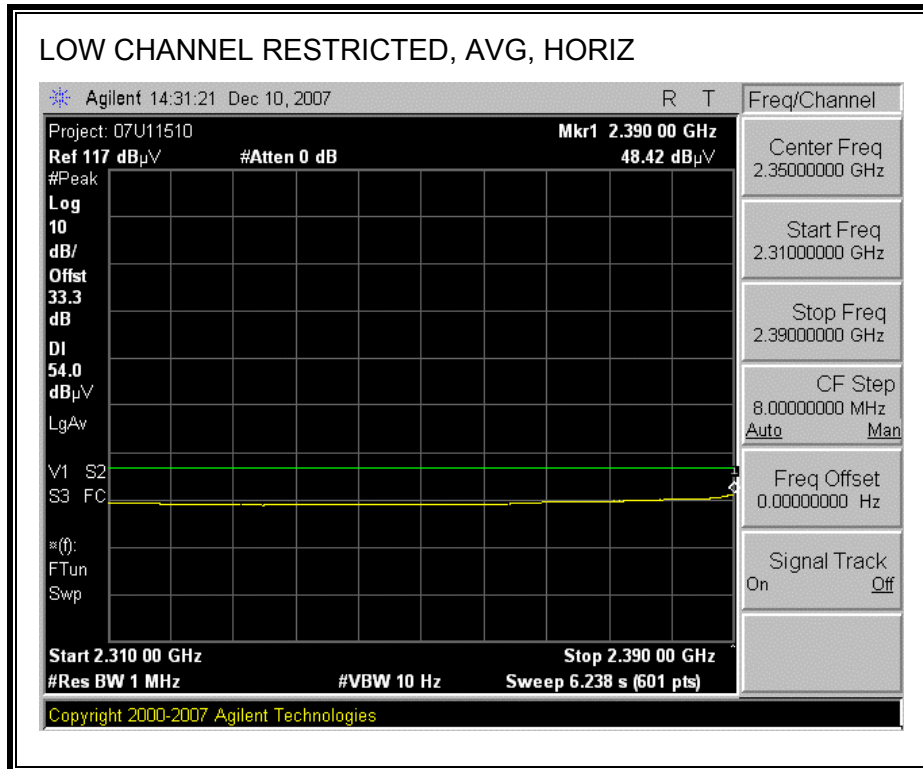
No other emissions were detected above system noise floor

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		

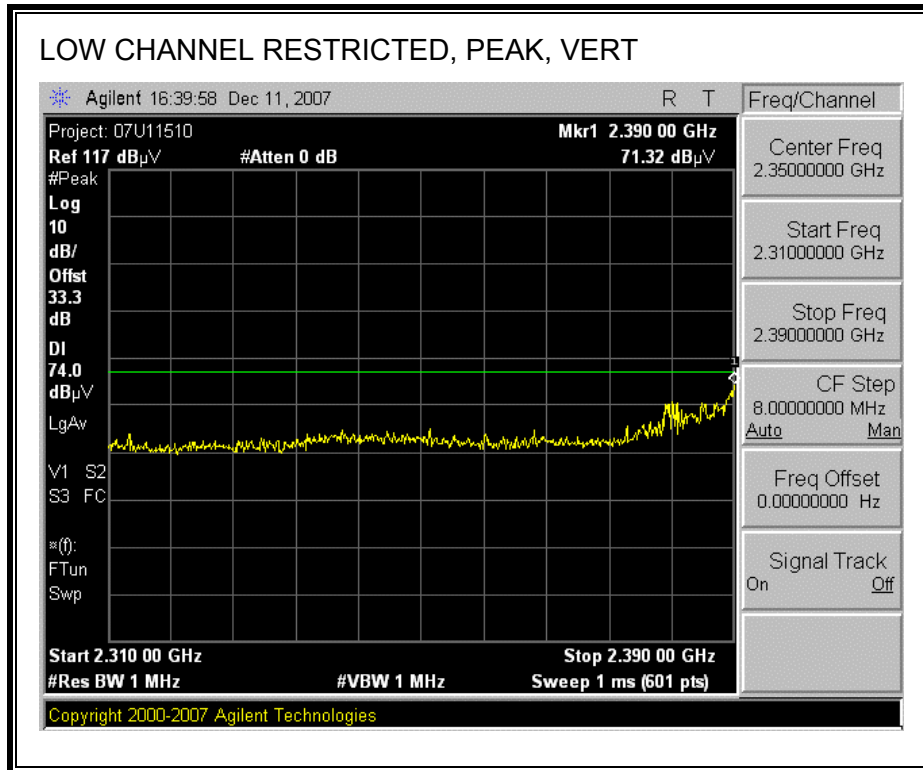
8.2.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE

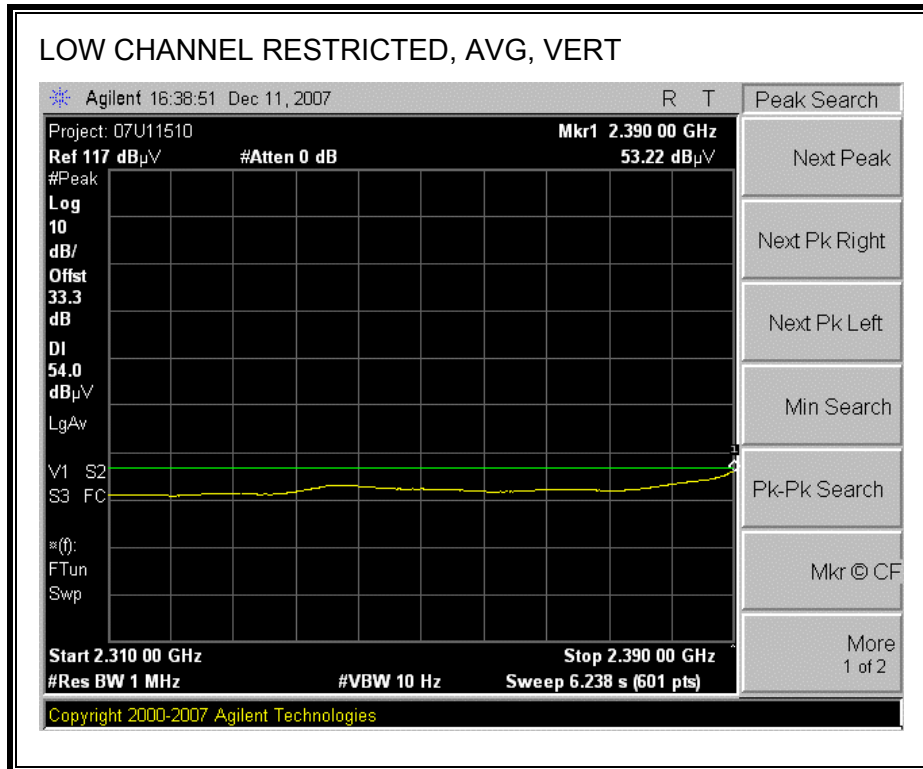
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



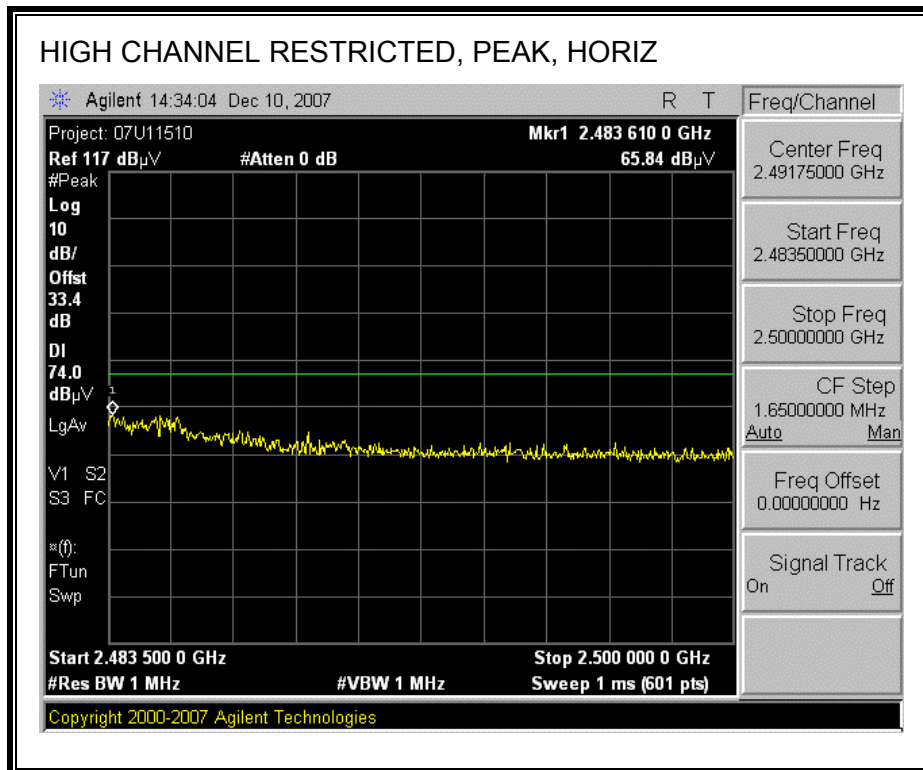


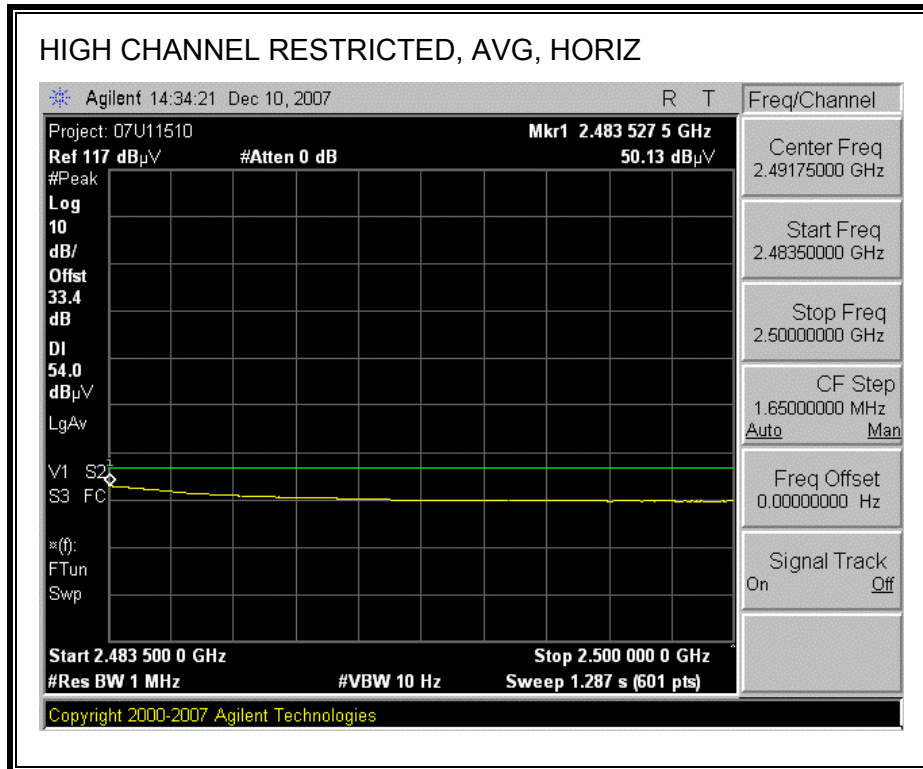
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



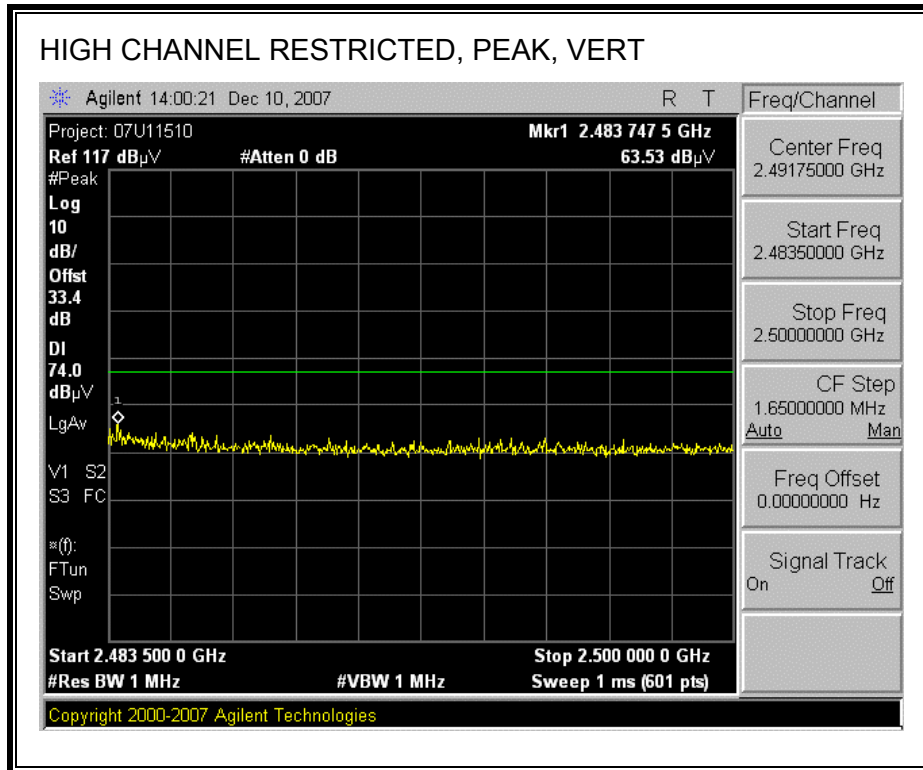


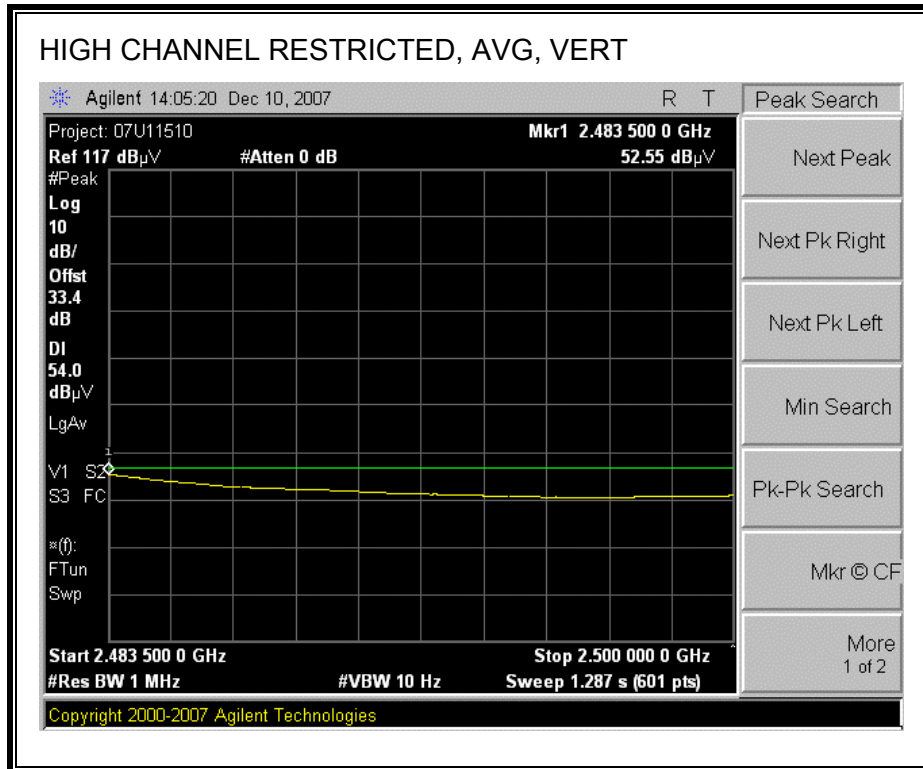
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
 Compliance Certification Services, 3 Meter _ C Chamber

Company: Marvell Semiconductor, Inc.
 Project #: 07U11510
 Date: 12/11/2007
 Test Engineer: Vien Tran
 Configuration: EUT with PIFA 3.64dBi Antenna
 Mode: Tx 11g Mode

Test Equipment:

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T34 HP 8449B			FCC 15.205

HI Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
	Gordon 177080004	Thanh 208946003	HPF_4.0GHz		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	Fldr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW CHANNEL, 2412 MHz															
4.824	3.0	46.4	33.5	33.7	3.2	-34.8	0.0	0.6	49.1	36.2	74	54	-24.9	-17.8	V
4.824	3.0	46.7	34.0	33.7	3.2	-34.8	0.0	0.6	49.4	36.7	74	54	-24.6	-17.3	H
MID CHANNEL, 2437 MHz															
4.874	3.0	49.8	36.9	33.7	3.2	-34.8	0.0	0.6	52.6	39.7	74	54	-21.4	-14.3	V
7.311	3.0	44.9	33.7	35.2	4.0	-34.1	0.0	0.6	50.6	39.4	74	54	-23.4	-14.6	V
4.874	3.0	50.7	37.5	33.7	3.2	-34.8	0.0	0.6	53.5	40.3	74	54	-20.5	-13.7	H
7.311	3.0	45.7	34.5	35.2	4.0	-34.1	0.0	0.6	51.4	40.2	74	54	-22.6	-13.8	H
HIGH CHANNEL, 2462 MHz															
4.924	3.0	48.7	35.8	33.8	3.3	-34.8	0.0	0.6	51.5	38.6	74	54	-22.5	-15.4	V
7.386	3.0	43.8	32.6	35.2	4.0	-34.1	0.0	0.6	49.5	38.3	74	54	-24.5	-15.7	V
4.924	3.0	49.6	36.4	33.8	3.3	-34.8	0.0	0.6	52.4	39.2	74	54	-21.6	-14.8	H
7.386	3.0	44.6	33.4	35.2	4.0	-34.1	0.0	0.6	50.3	39.1	74	54	-23.7	-14.9	H
No other emissions were detected above system noise floor															

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		

8.3. WORST-CASE BELOW 1 GHz

PIFA 3.64dBi ANTENNA

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

COMPLIANCE		#:		Date:		Time:	
Engineering Services, Inc.		07U11510.EMI		12-12-2007		14:55:15	
FREMONT, CA							
Condition: FCC CLASS-B HORIZONTAL							
Engineer: : Vien Tran							
Company: : Marvell							
Project #: : 07U11510							
Test Configuration: : EUT with PIFA 3.64dBi Antenna							
Mode of operation: : Tx Worst-Case							
Test Target: : FCC CLASS B							
Page: 1							
	Freq	Read	Factor	Level	Limit	Over	Probe
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	dB
1	86.260	52.00	-19.44	32.56	40.00	-7.44	Peak 7.88
2	141.550	46.80	-13.35	33.45	43.50	-10.05	Peak 13.64
3	239.520	49.80	-14.53	35.27	46.00	-10.73	Peak 11.89
4	331.670	55.50	-11.46	44.04	46.00	-1.96	Peak 14.62
5	664.380	42.20	-4.15	38.05	46.00	-7.95	Peak 20.12
6	996.120	39.30	-0.55	38.75	54.00	-15.25	Peak 23.64

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

COMPLIANCE		# : 07U11510.EMI		Date: 12-12-2007		Time: 14:46:23	
Condition: FCC CLASS-B VERTICAL							
Engineer: : Vien Tran							
Company: : Marvell							
Project #: : 07U11510							
Test Configuration: : EUT with PIFA 3.64dBi Antenna							
Mode of operation: : Tx Worst-Case							
Test Target: : FCC CLASS B							
Page: 1							
	Freq	Read	Factor	Level	Limit	Over	Probe
	MHz	Level		dBuV/m	Line	Limit	Factor
		dBuV	dB	dBuV/m	dBuV/m	dB	dB
1	33.880	43.70	-8.01	35.69	40.00	-4.31	Peak 19.78
2	106.630	47.60	-15.77	31.83	43.50	-11.67	Peak 11.41
3	310.330	41.40	-12.02	29.38	46.00	-16.62	Peak 14.15
4	332.640	44.30	-11.42	32.88	46.00	-13.12	Peak 14.65
5	399.570	41.60	-9.92	31.68	46.00	-14.32	Peak 15.97
6	663.410	39.50	-4.18	35.32	46.00	-10.68	Peak 20.11

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

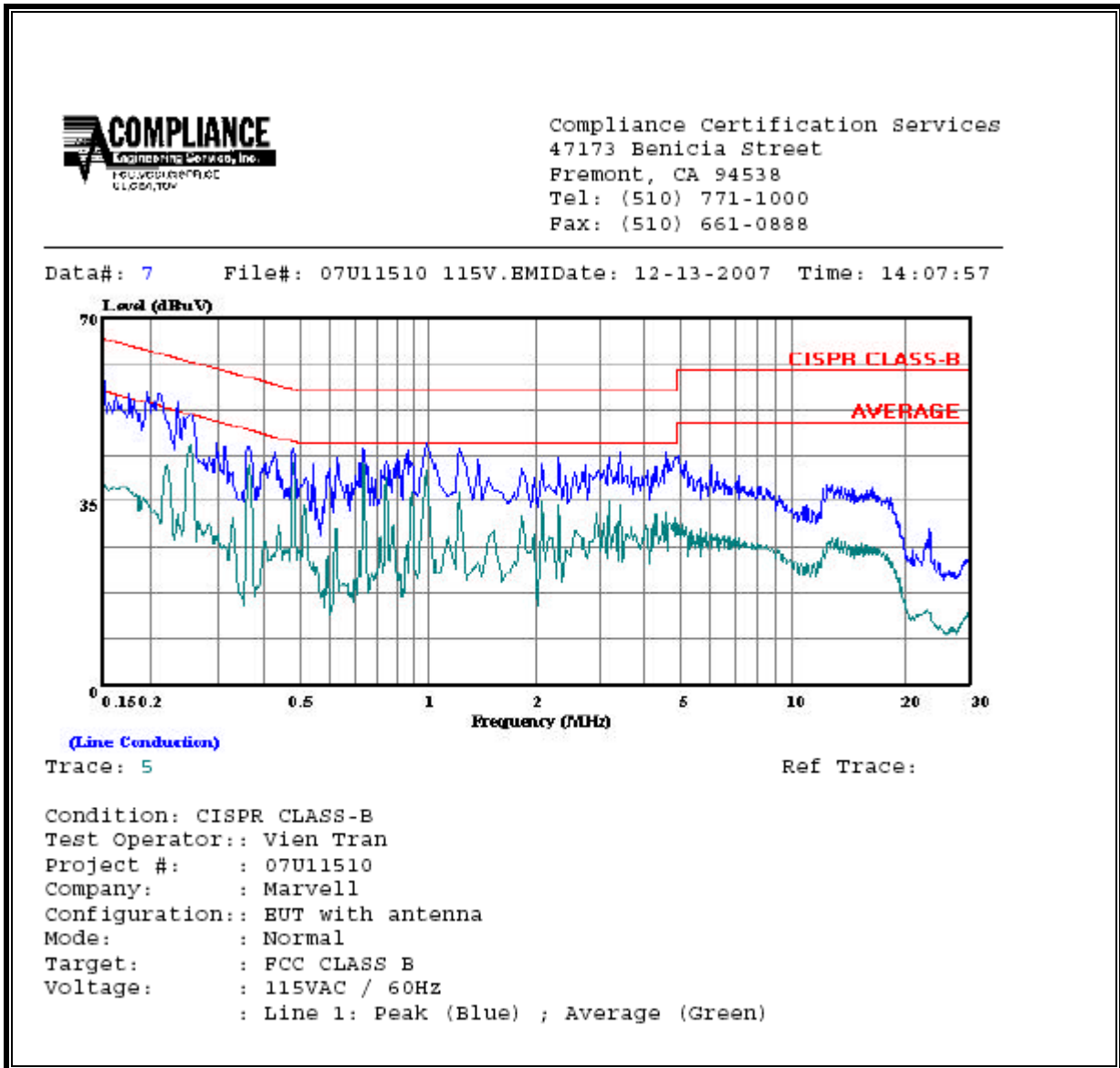
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

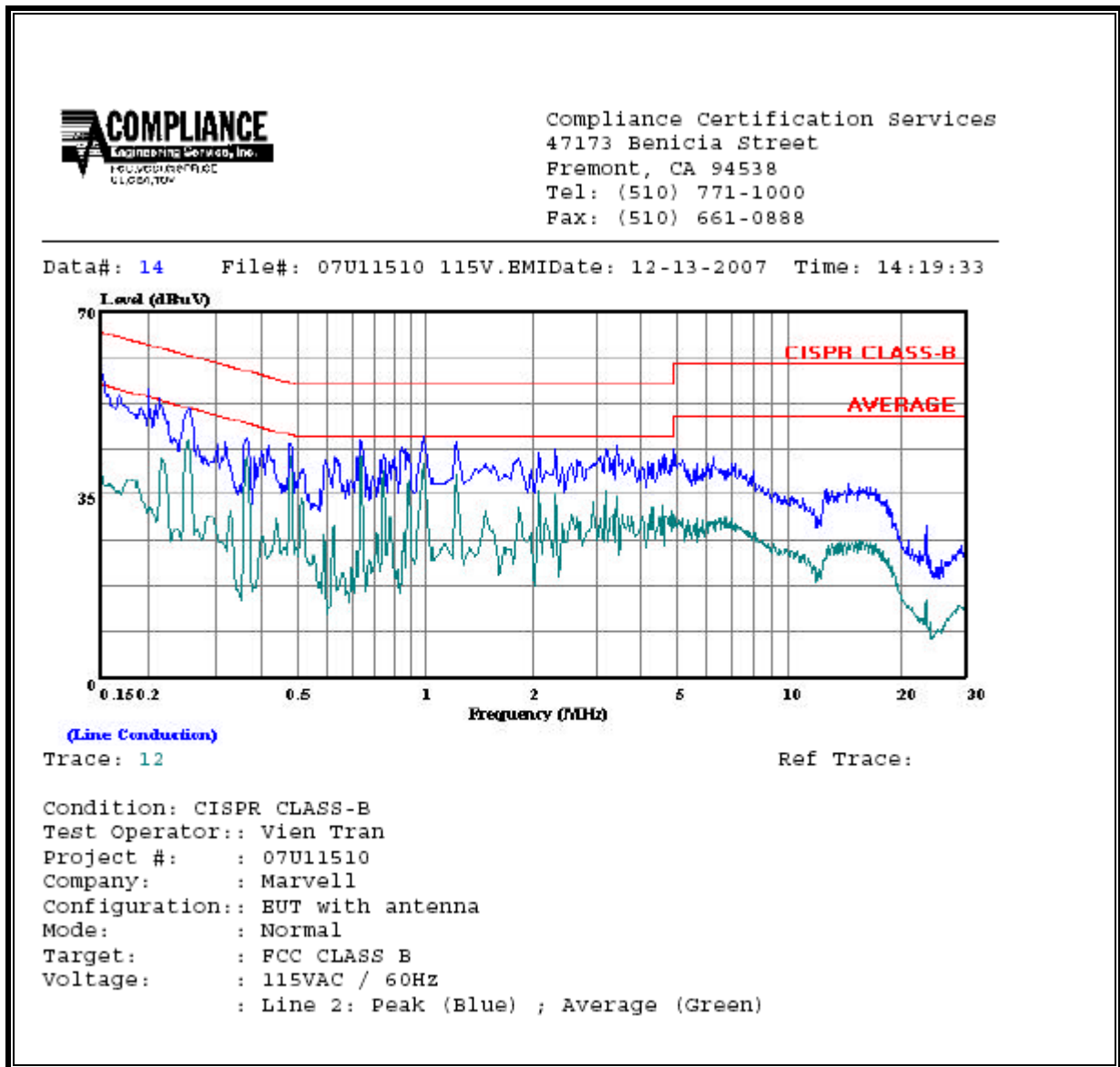
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)										
Freq. (MHz)	Reading			Class (dB)	Limit QP	FCC B		Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)			AV	QP (dB)	AV (dB)		
0.15	59.42	--	40.65	0.00	66.00	56.00	-6.58	-15.35	L1	
0.26	51.54	--	45.71	0.00	61.56	51.56	-10.02	-5.85	L1	
1.08	45.96	--	41.08	0.00	56.00	46.00	-10.04	-4.92	L1	
0.15	59.15	--	40.78	0.00	66.00	56.00	-6.85	-15.22	L2	
0.26	51.43	--	45.39	0.00	61.56	51.56	-10.13	-6.17	L2	
1.08	45.92	--	40.81	0.00	56.00	46.00	-10.08	-5.19	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 ²)	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 ²)	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 ²)	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 ²)	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.

CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain yields:

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm²

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

The power density in units of mW/cm² is converted to units of W/m² by multiplying by a factor of 10.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm²

RESULTS

(MPE distance equals 20 cm)

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm ²)	IC Power Density (W/m ²)
WLAN	2.4 GHz	20.0	21.67	3.64	0.07	0.68