



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

CERTIFICATION TEST REPORT

FOR

802.11g WIRELESS LAN + BLUETOOTH PCI-E MINI CARD

MODEL NUMBER: BCM94312HMGB

FCC ID: QDS-BRCM1044

IC: 4324A-BRCM1044

REPORT NUMBER: 09U12439-1

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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
---	03/24/09	Initial Issue	T. Chan
		.	

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, USA

EUT DESCRIPTION: 802.11g WIRELESS LAN + BLUETOOTH PCI-E MINI CARD

MODEL: BCM94312HMGB

SERIAL NUMBER: 10

DATE TESTED: MARCH 14-18, 2009

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. 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. 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:



THU CHAN
EMC 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 C63.4-2003, 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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11g Wireless LAN + Bluetooth PCI-E Mini Card and manufactured by Broadcom Corporation. Model number is BCM94312HMGB.

5.2. MAXIMUM OUTPUT POWER

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

2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Mode	Peak Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	23.53	225.42
2412 - 2462	802.11g	25.90	389.05

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an 802.11bg WLAN and Bluetooth antennas, with a maximum gain of 3.9dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was BCMWL5, rev. 5.10.0.0.

The test utility software used during testing was wl_tool, rev. 4.218.RC34.0.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate for each mode is determined to be as follows, based on preliminary tests of the chipset utilized in this radio.

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.

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	Dell	Inspiron 630m	454779	DoC
AC Adapter	Dell	LA65NS0-00	CN-ODF263-71615-6CG-F8C9	DoC

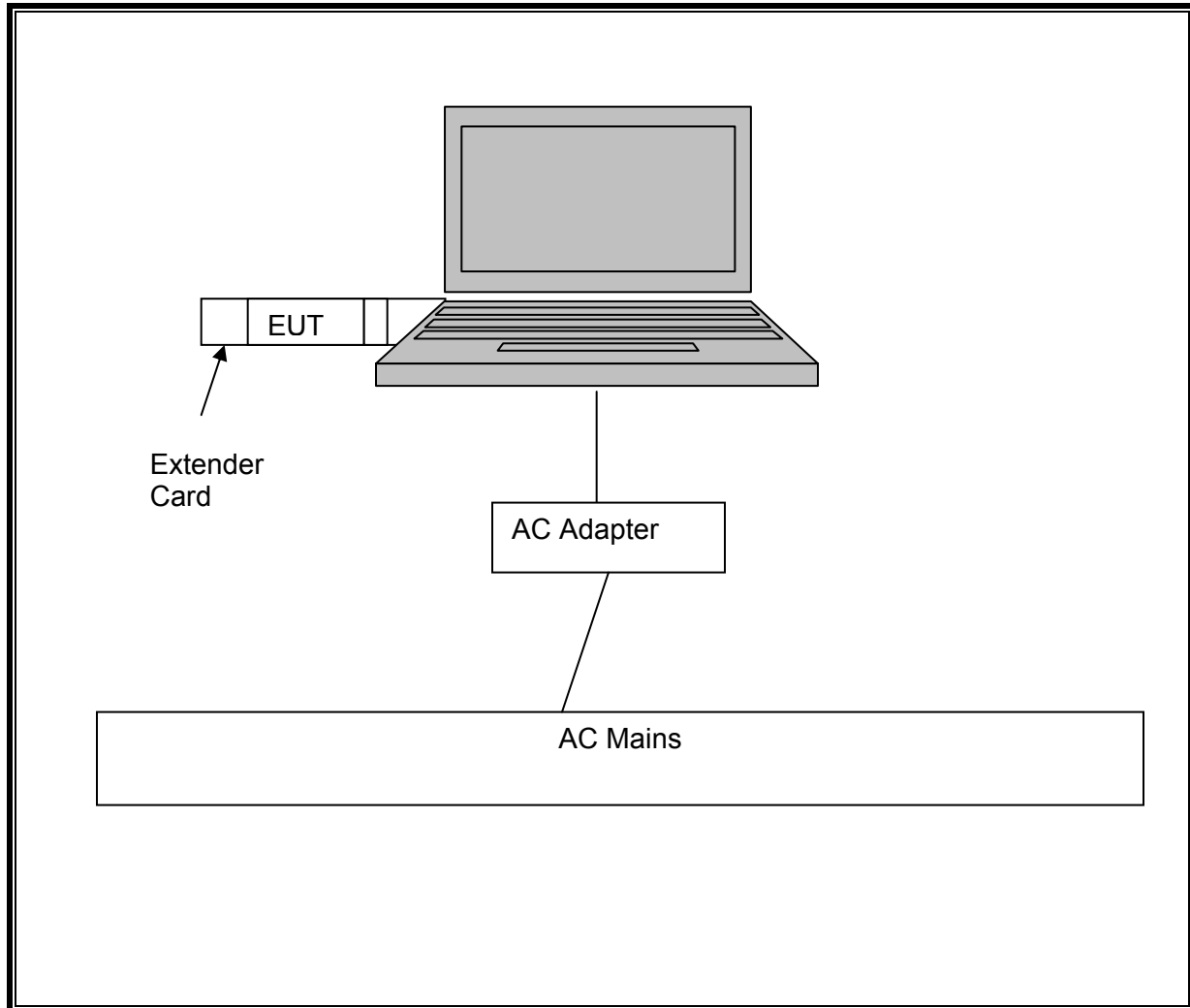
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	2m	N/A
2	DC	1	DC	Unshielded	1m	Ferrite on laptop's end

TEST SETUP

The EUT is connected to a host laptop computer via an extended card during the test. Test software exercised the radio card.

SETUP DIAGRAM



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	E4407B	C01101	07/27/10
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	11/14/09
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/10
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/06/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/09
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	03/31/09
Antenna, Horn, 18 GHz	EMCO	3115	C00872	04/22/09
Peak Power Meter	Boonton	4541	NA	01/19/10
Peak / Average Power Sensor	Boonton	57318	NA	02/02/10
2.4 - 2.5 Reject Filter	Micro Tronics	BRM50702	N/A	CNR

7. ANTENNA PORT TEST RESULTS

7.1. 802.11b MODE

7.1.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2), IC RSS-210 A8.2 (a) & LP0002 §3.10.1 (6) (6.2.1)
The minimum 6 dB bandwidth shall be at least 500 kHz.

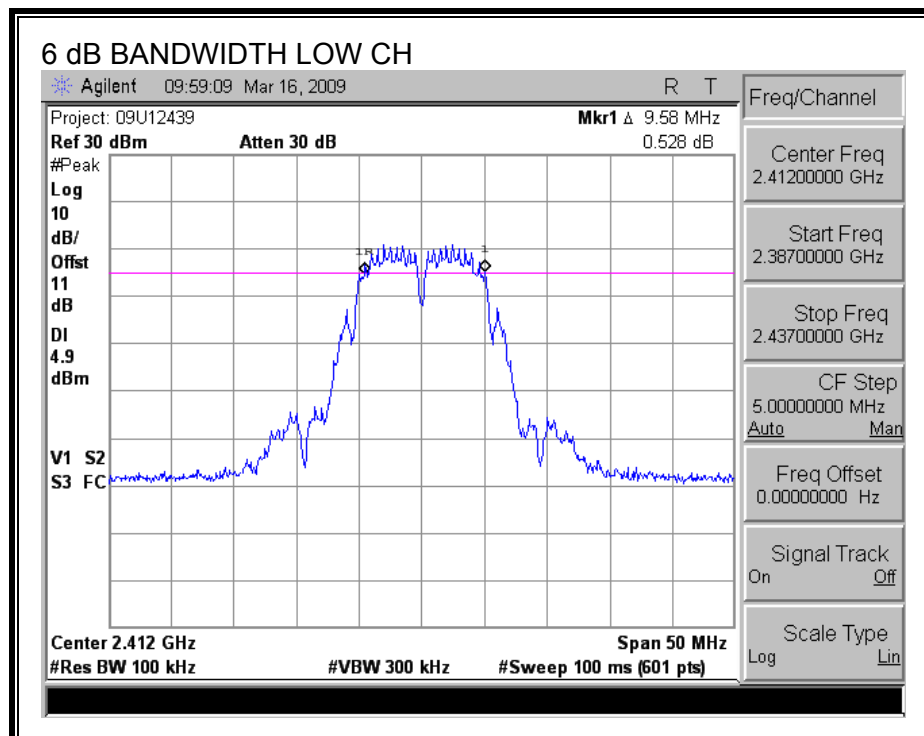
TEST PROCEDURE

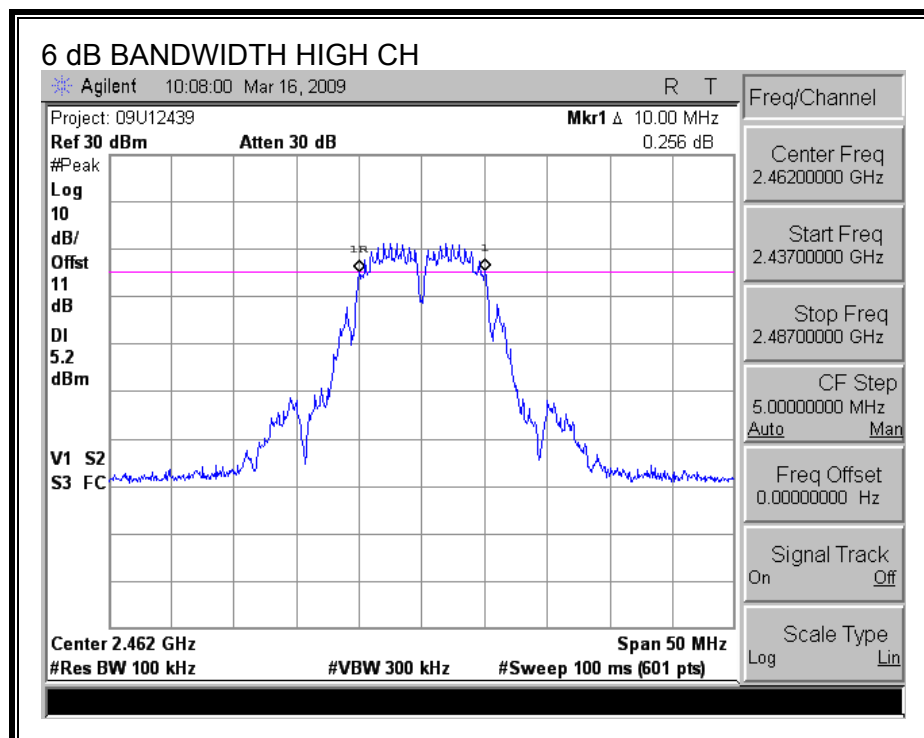
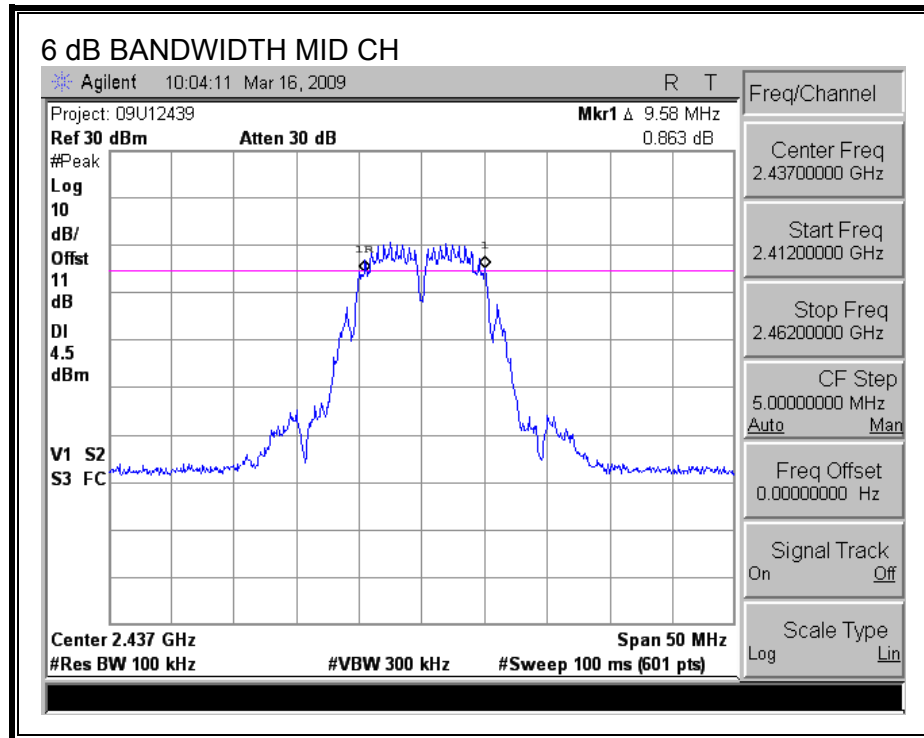
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	9.58	0.5
Middle	2437	9.58	0.5
High	2462	10.00	0.5

6 dB BANDWIDTH





7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

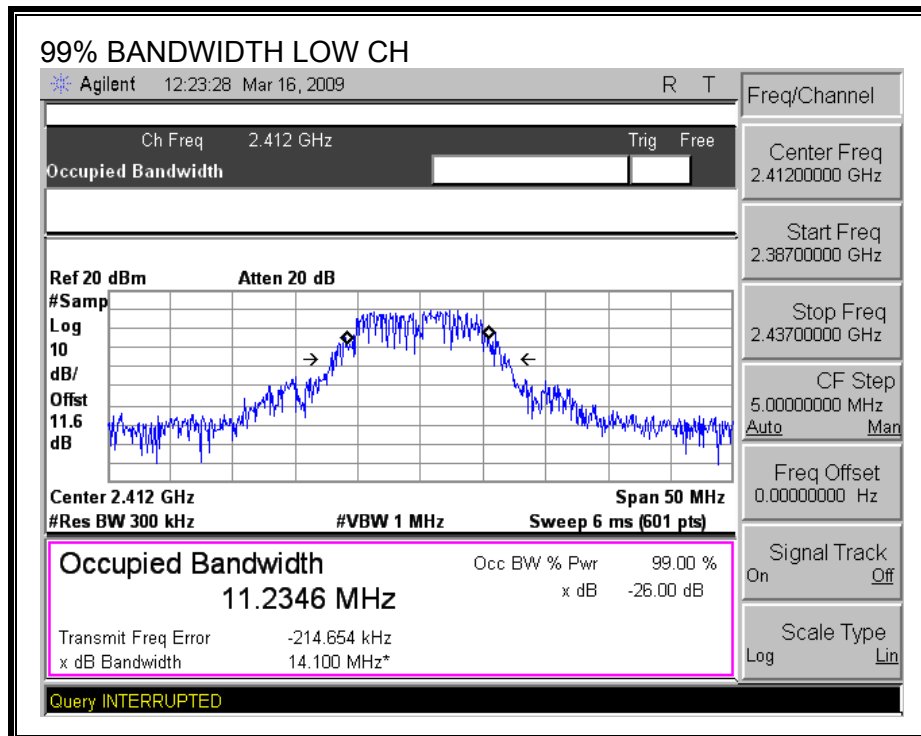
TEST PROCEDURE

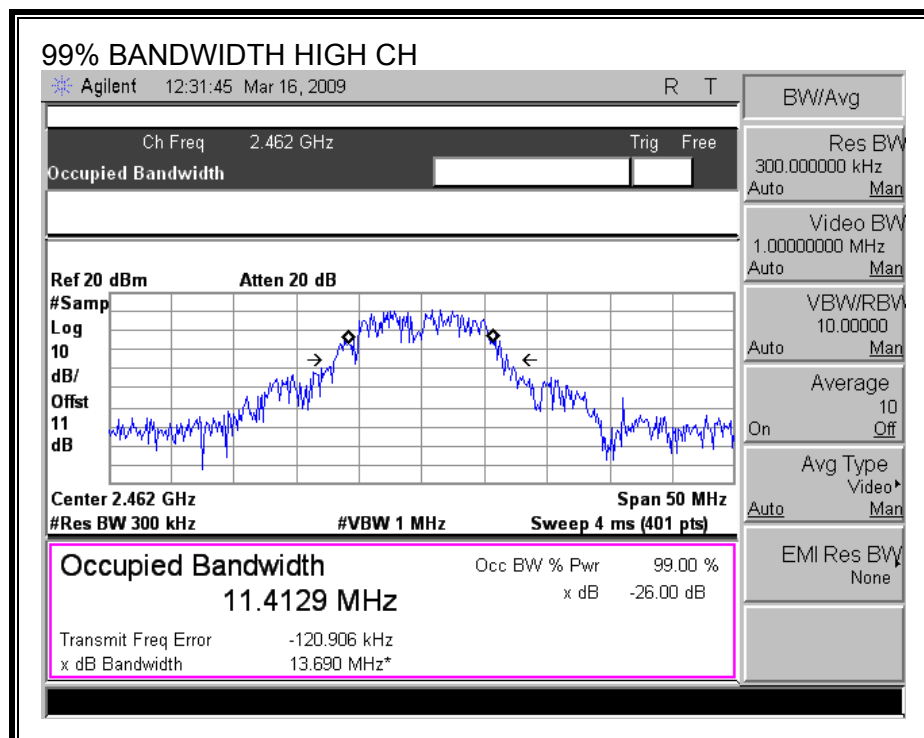
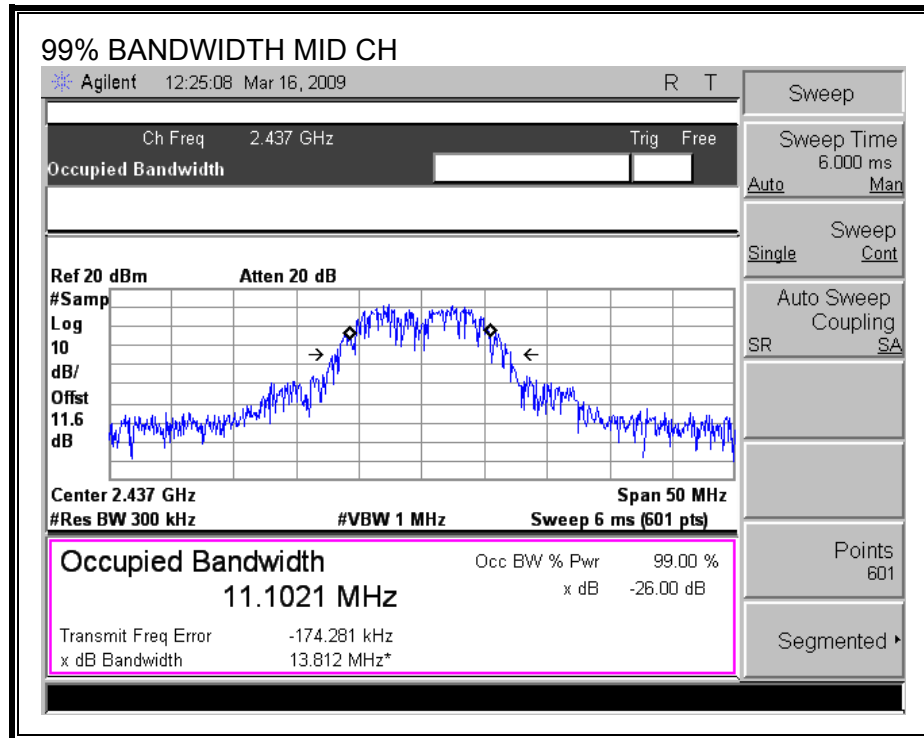
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	11.2346
Middle	2437	11.1021
High	2462	11.4129

99% BANDWIDTH





7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b), IC RSS-210 A8.4, LP0002 § 3.10.1 (2) (2.3); (3) (3.1.1)
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 peak 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 Meter Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.17	30	-6.83
Middle	2437	23.06	30	-6.94
High	2462	23.53	30	-6.47

7.1.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e), IC RSS-210 A8.2 (b), 3.10.1 (6) (6.2.2)

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.

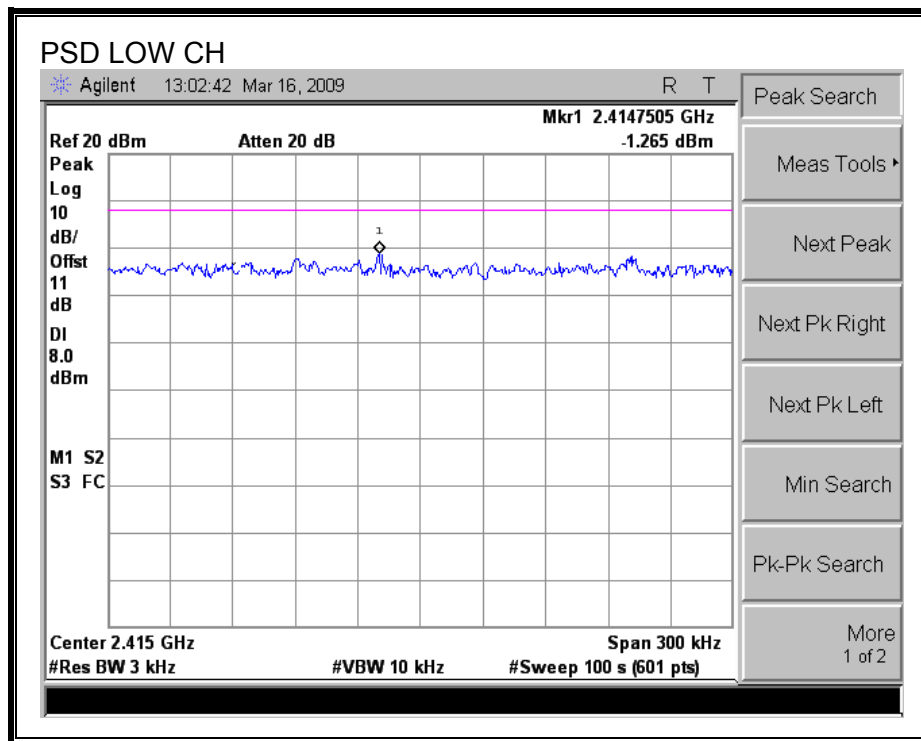
TEST PROCEDURE

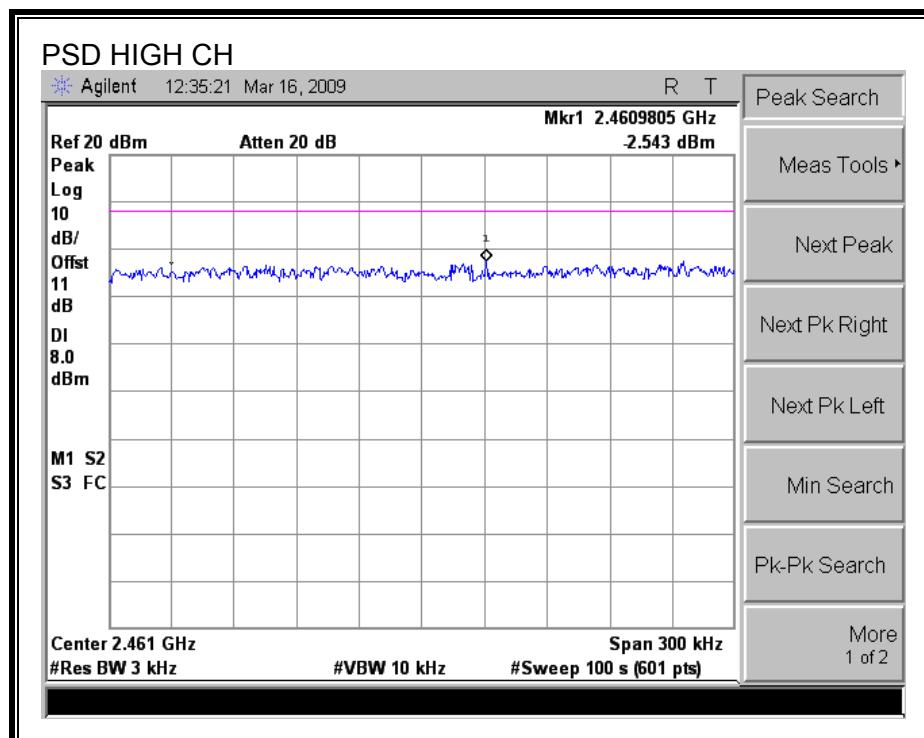
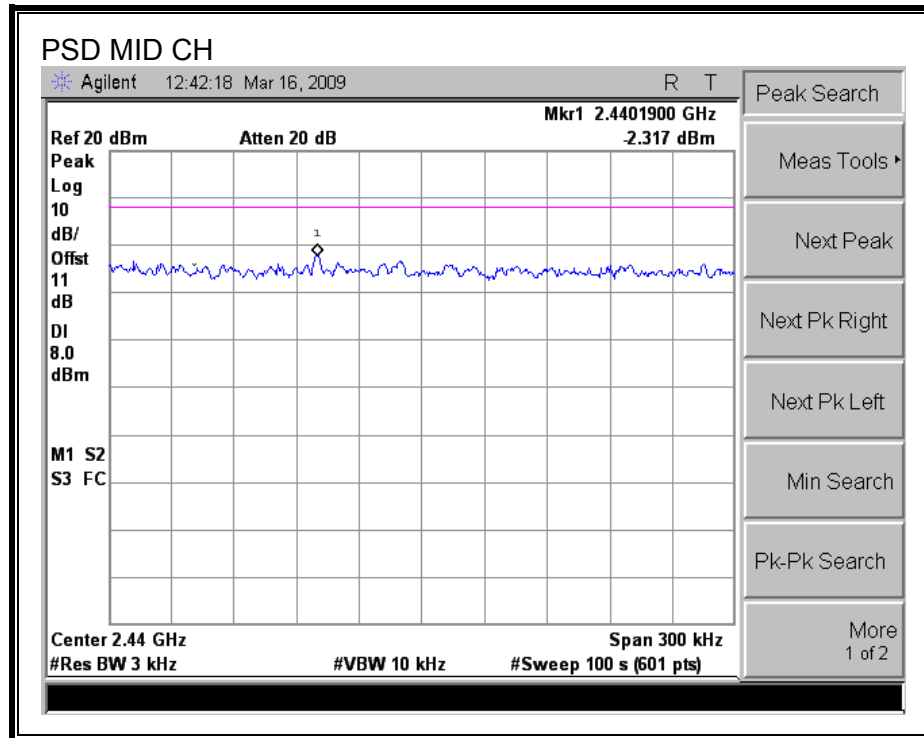
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-1.27	8	-9.27
Middle	2437	-2.32	8	-10.32
High	2462	-2.54	8	-10.54

POWER SPECTRAL DENSITY





7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d), IC RSS-210 A8.5, LP0002 § 3.10.1 (5)

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

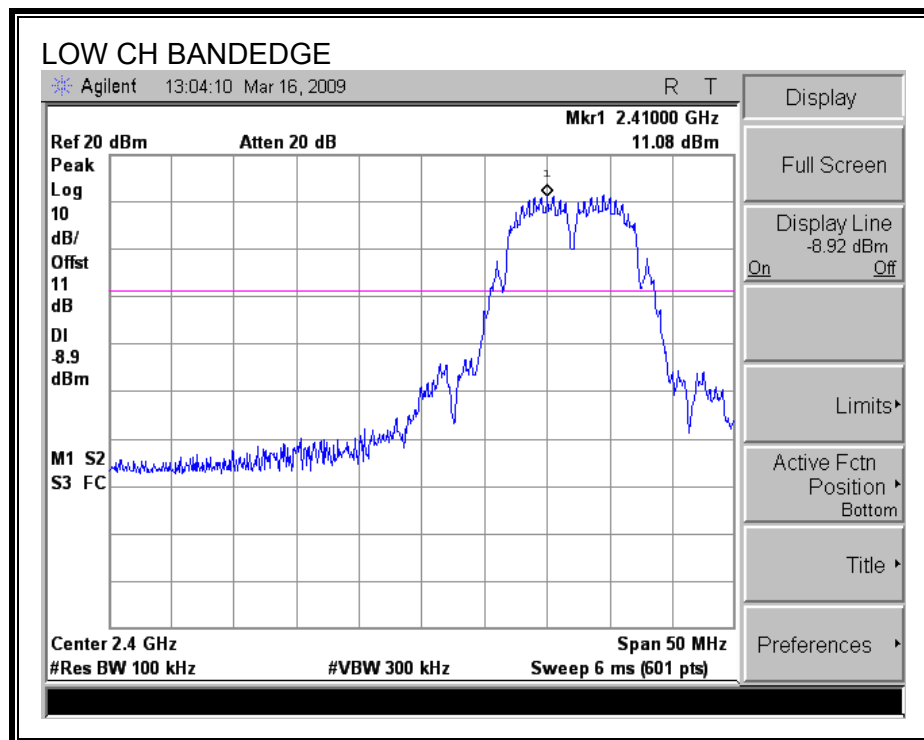
TEST PROCEDURE

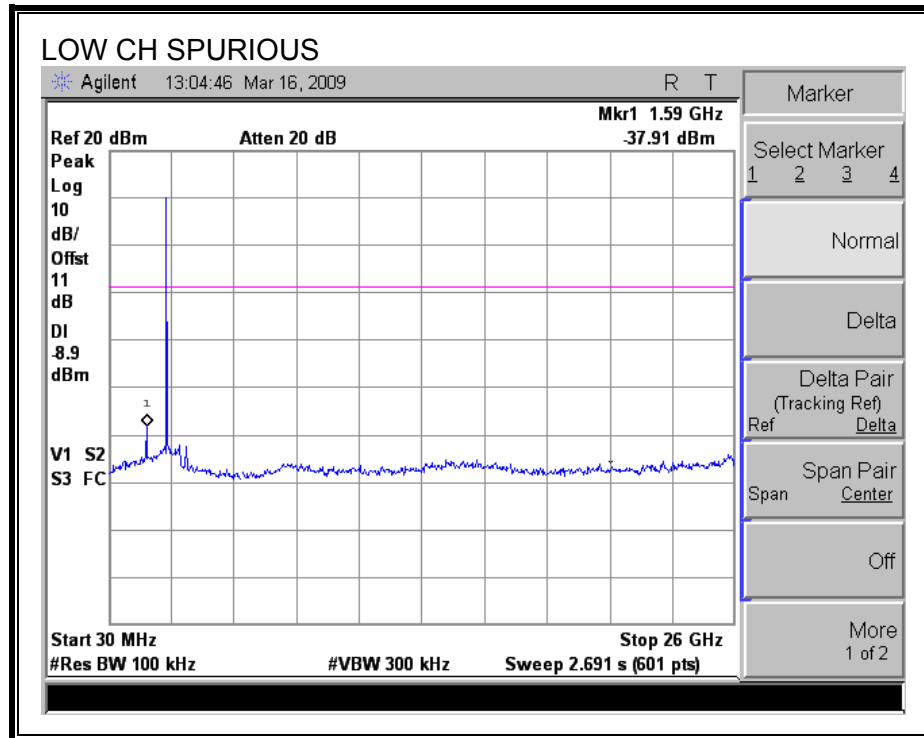
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

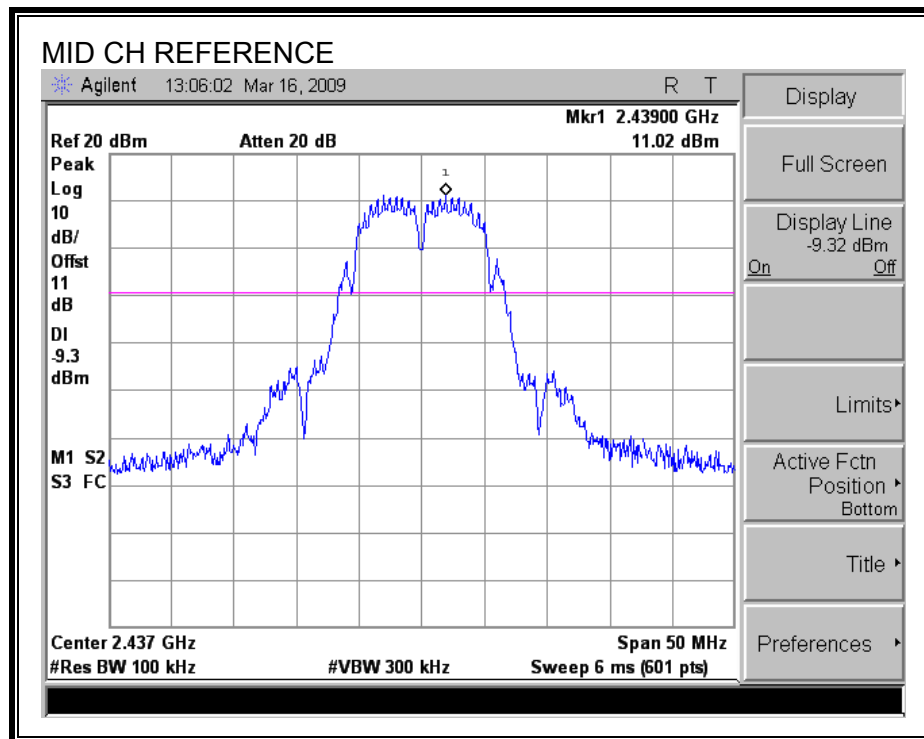
RESULTS

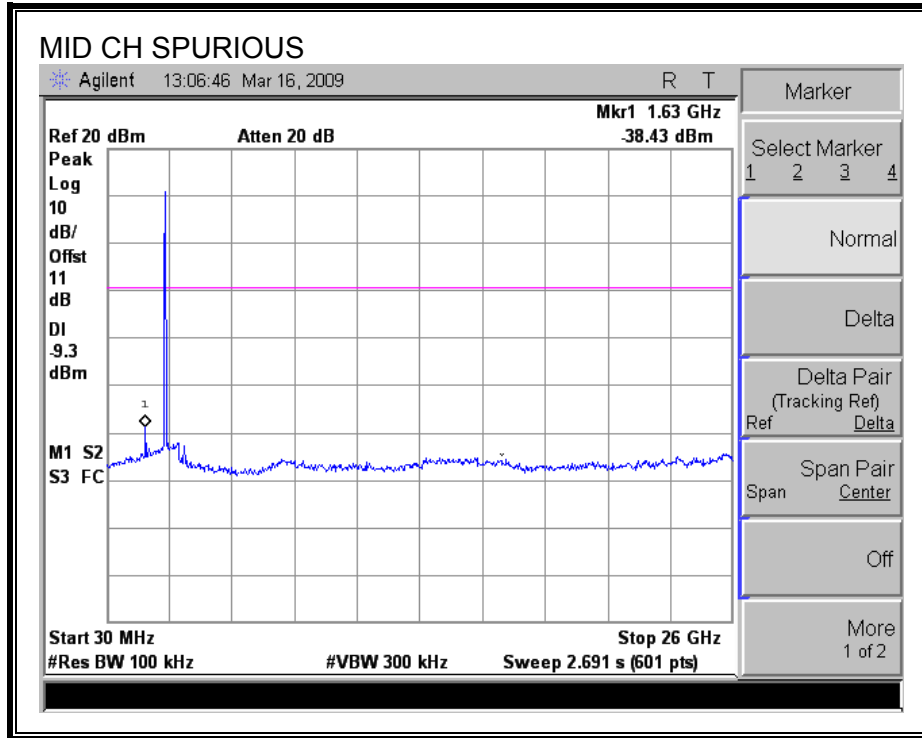
SPURIOUS EMISSIONS, LOW CHANNEL



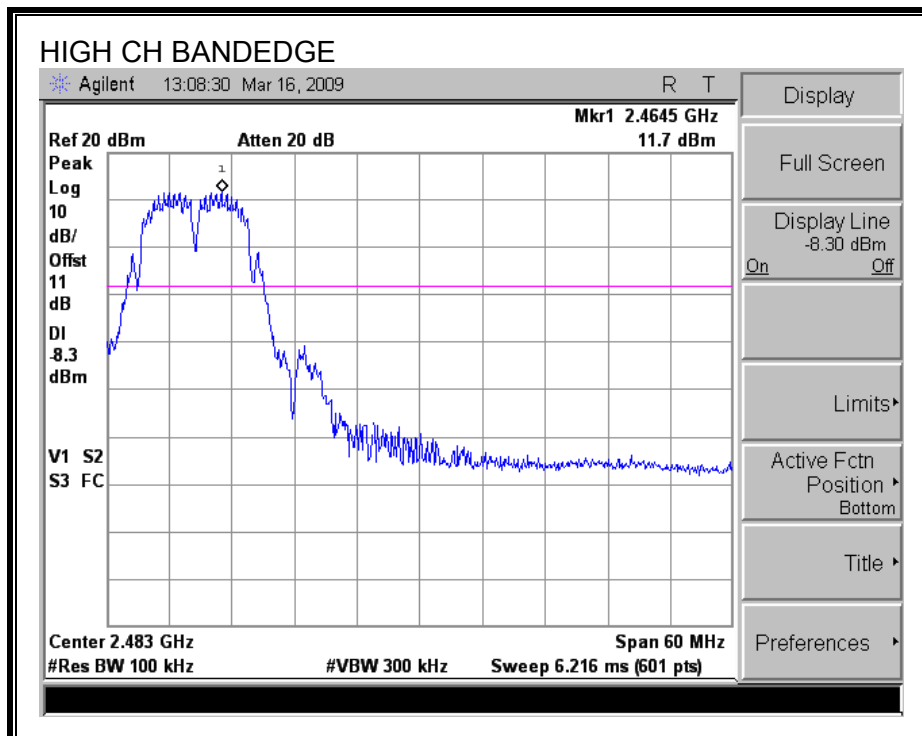


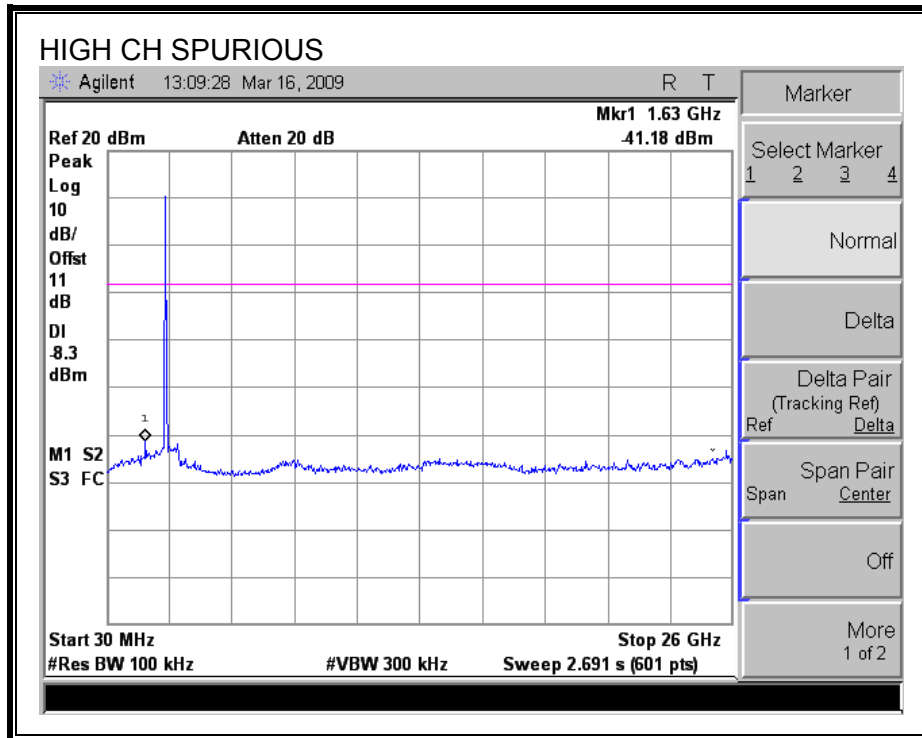
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





7.2. 802.11g MODE

7.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2), IC RSS-210 A8.2 (a) & LP0002 §3.10.1 (6) (6.2.1)
The minimum 6 dB bandwidth shall be at least 500 kHz.

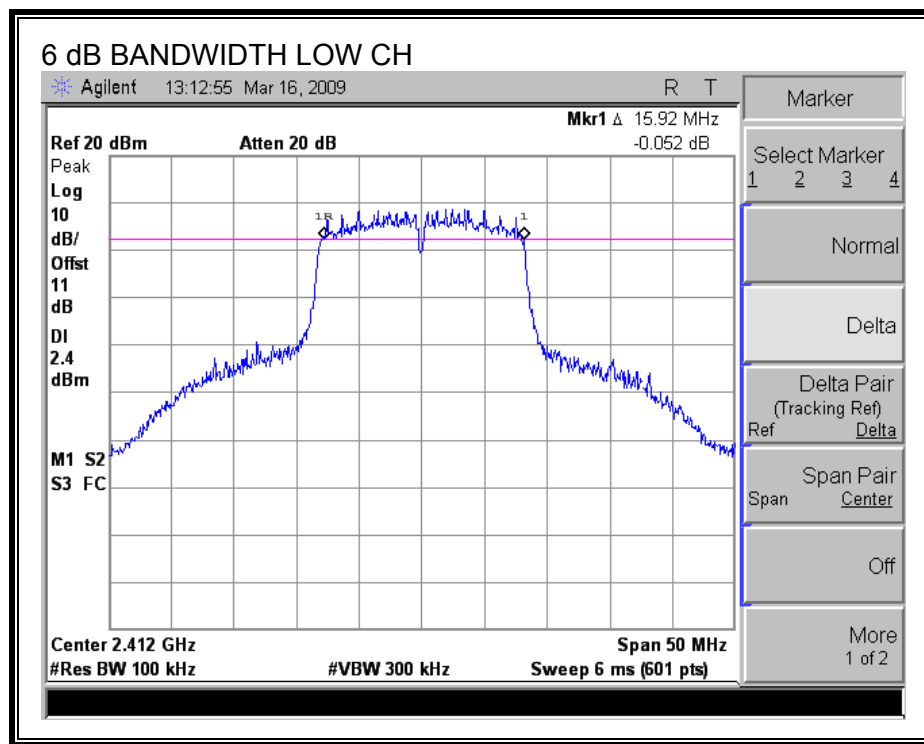
TEST PROCEDURE

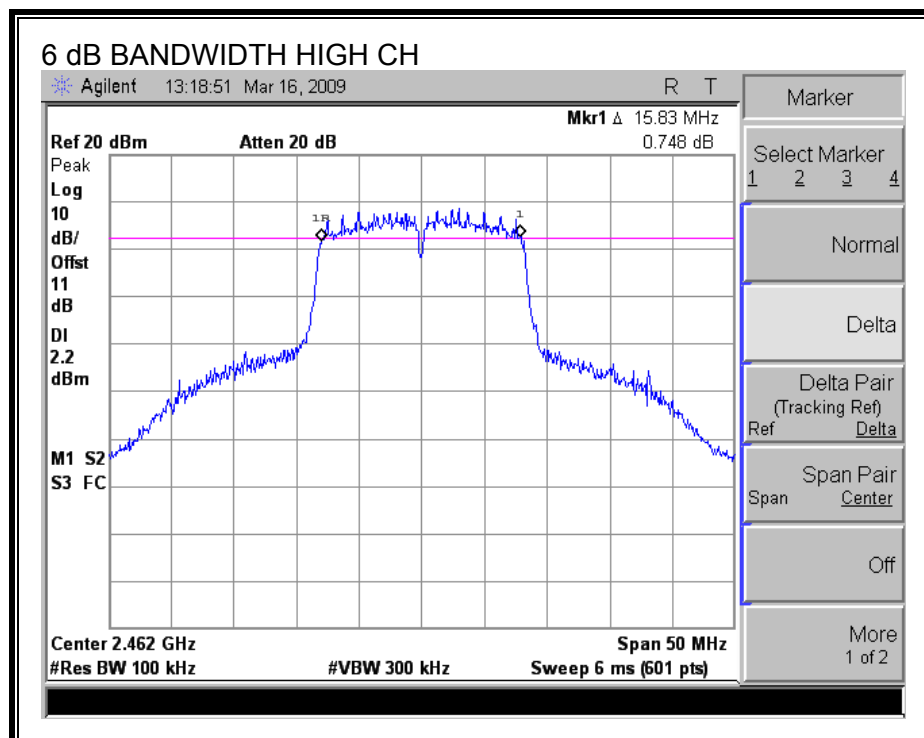
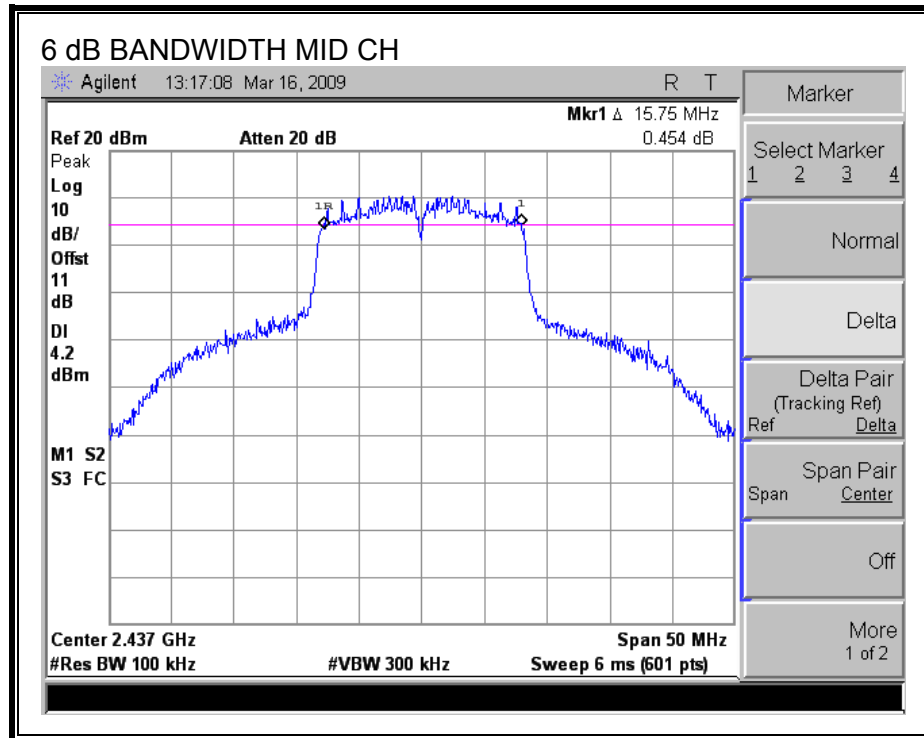
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	15.92	0.5
Middle	2437	15.75	0.5
High	2462	15.83	0.5

6 dB BANDWIDTH





7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

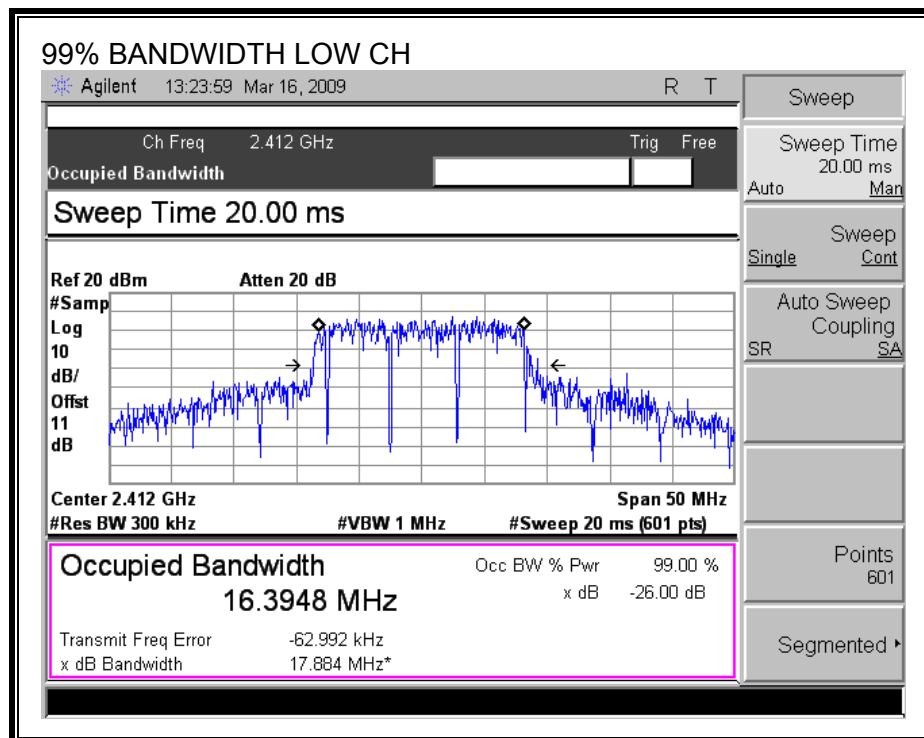
TEST PROCEDURE

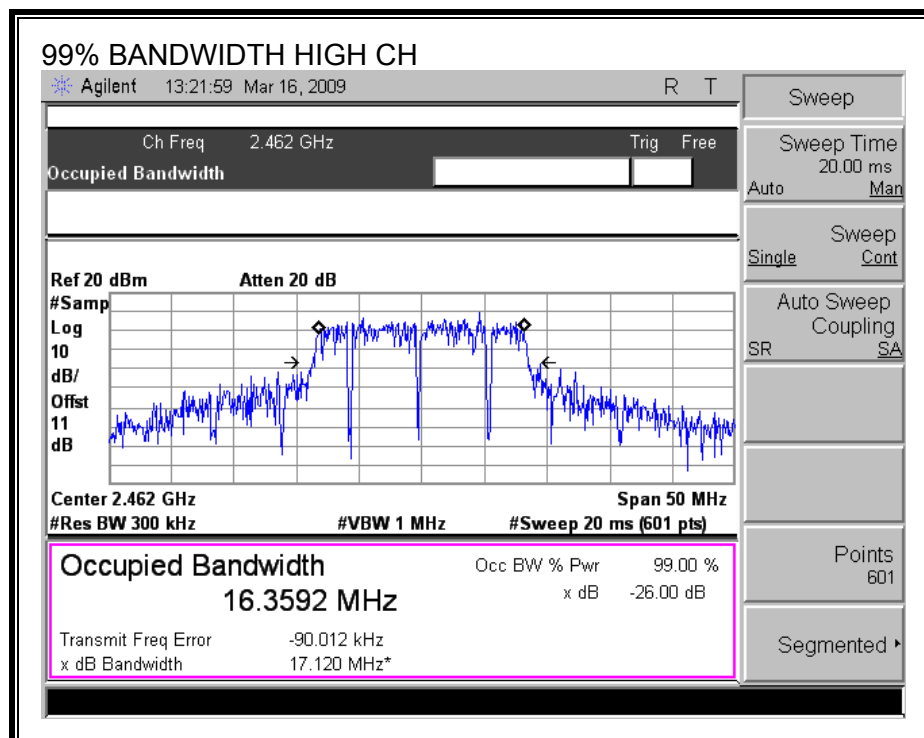
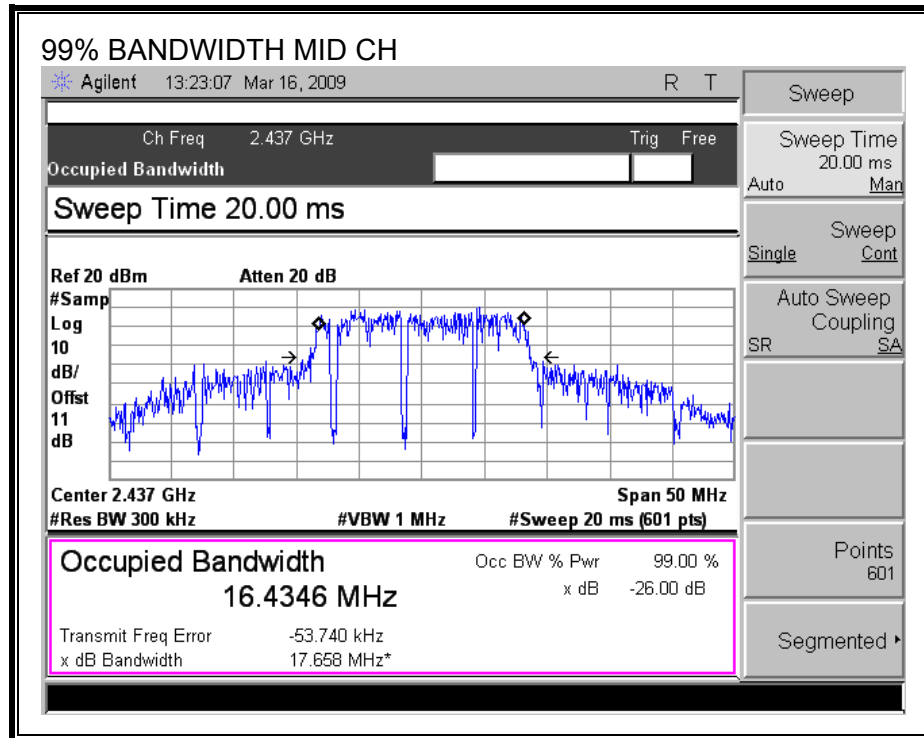
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.3948
Middle	2437	16.4346
High	2462	16.3592

99% BANDWIDTH





7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b), IC RSS-210 A8.4, LP0002 § 3.10.1 (2) (2.3); (3) (3.1.1)

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 peak 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 Meter Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	25.80	30	-4.20
Middle	2437	25.90	30	-4.10
High	2462	25.00	30	-5.00

7.2.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e), IC RSS-210 A8.2 (b), 3.10.1 (6) (6.2.2)

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.

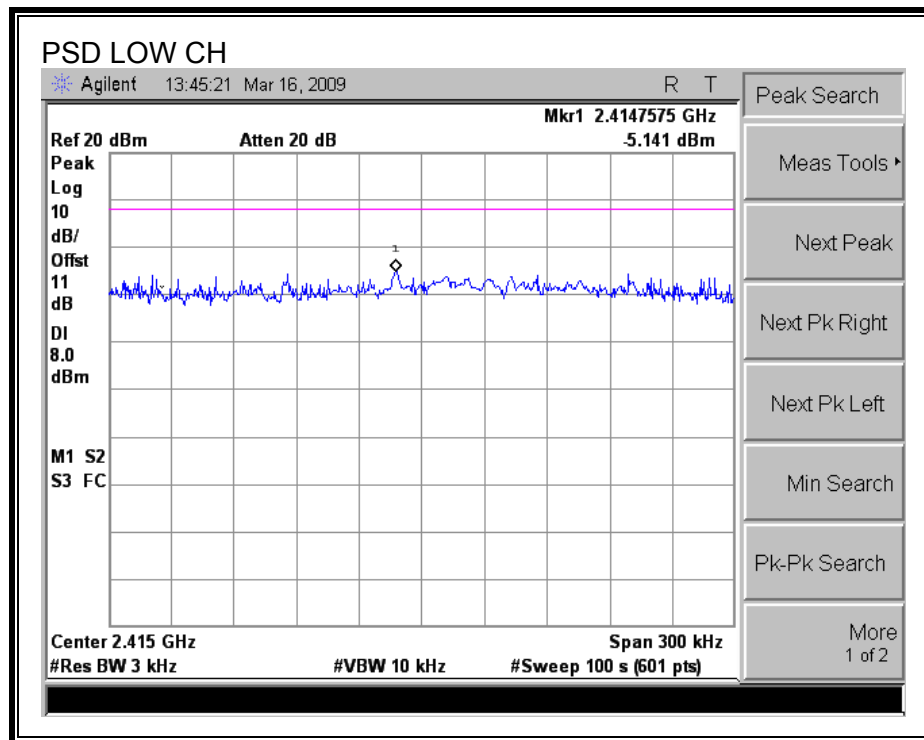
TEST PROCEDURE

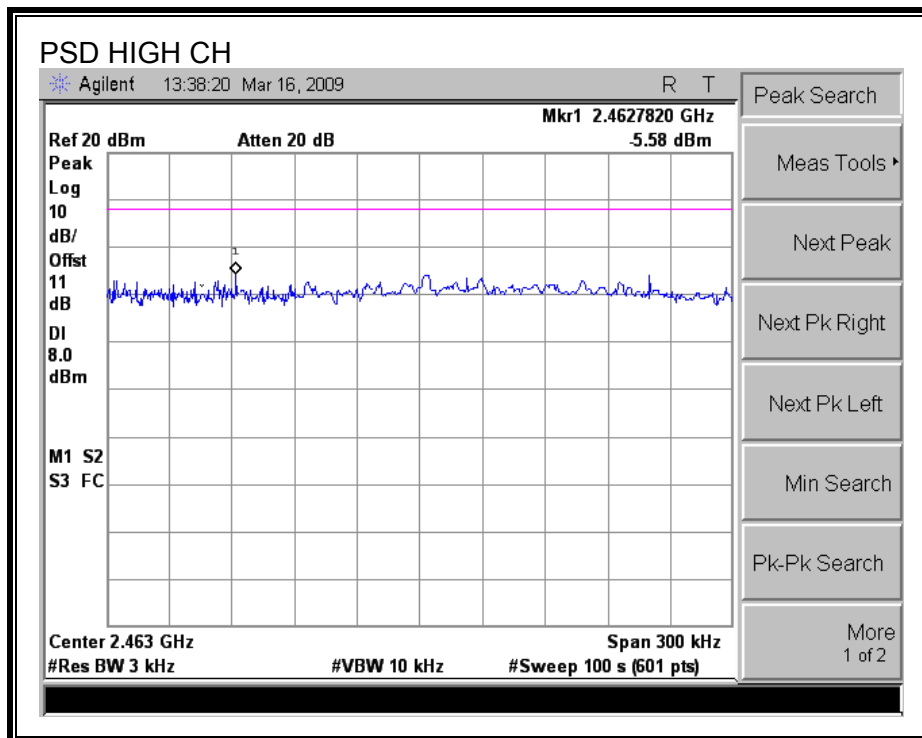
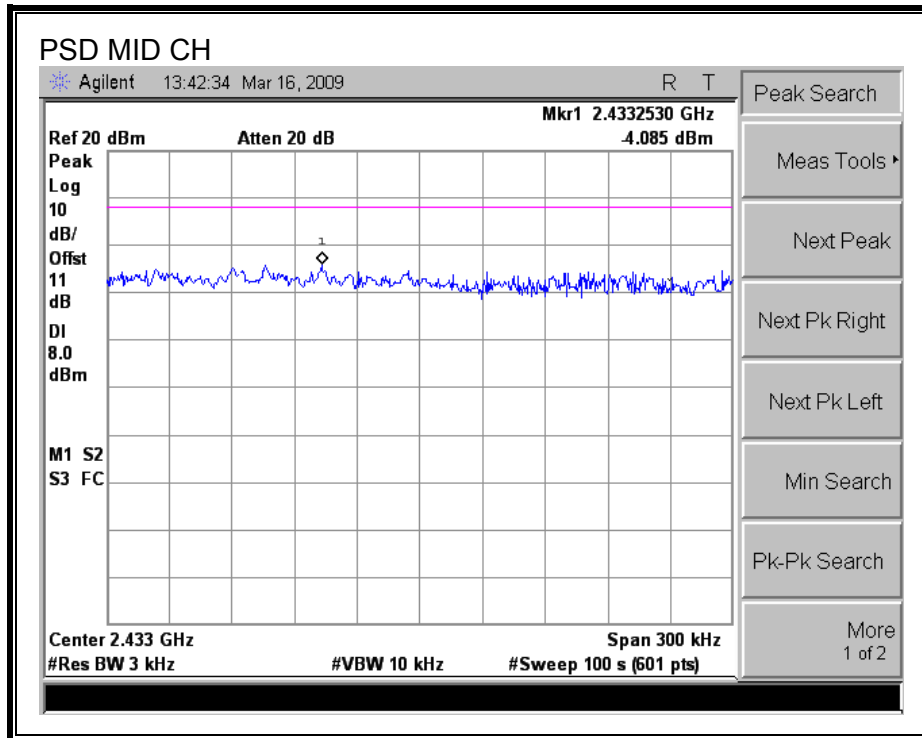
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-5.14	8	-13.14
Middle	2437	-4.09	8	-12.09
High	2462	-5.58	8	-13.58

POWER SPECTRAL DENSITY





7.2.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d), IC RSS-210 A8.5, LP0002 § 3.10.1 (5)

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

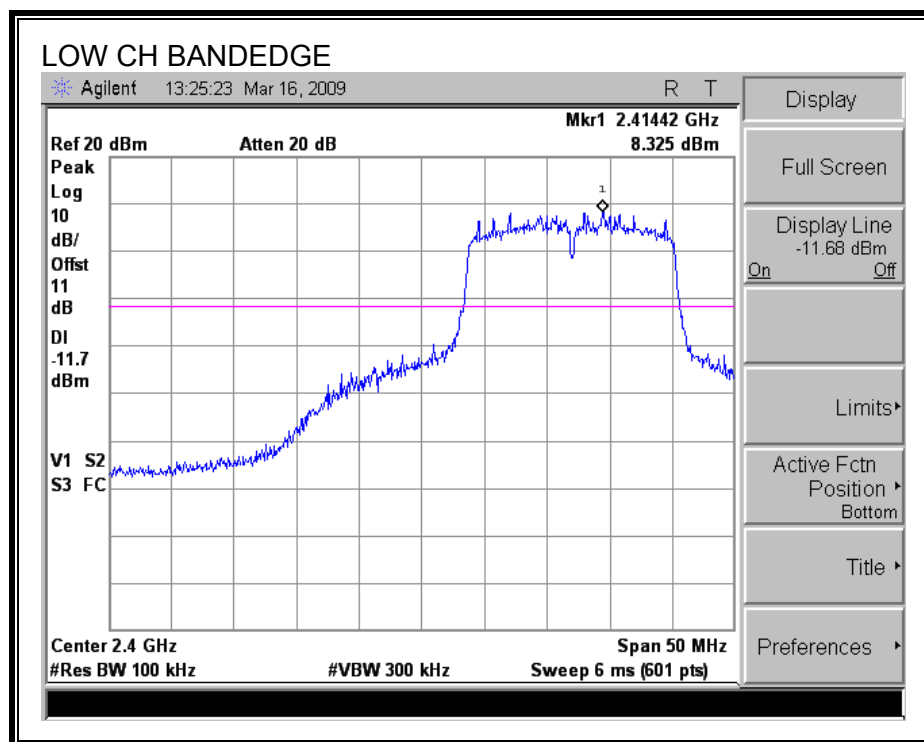
TEST PROCEDURE

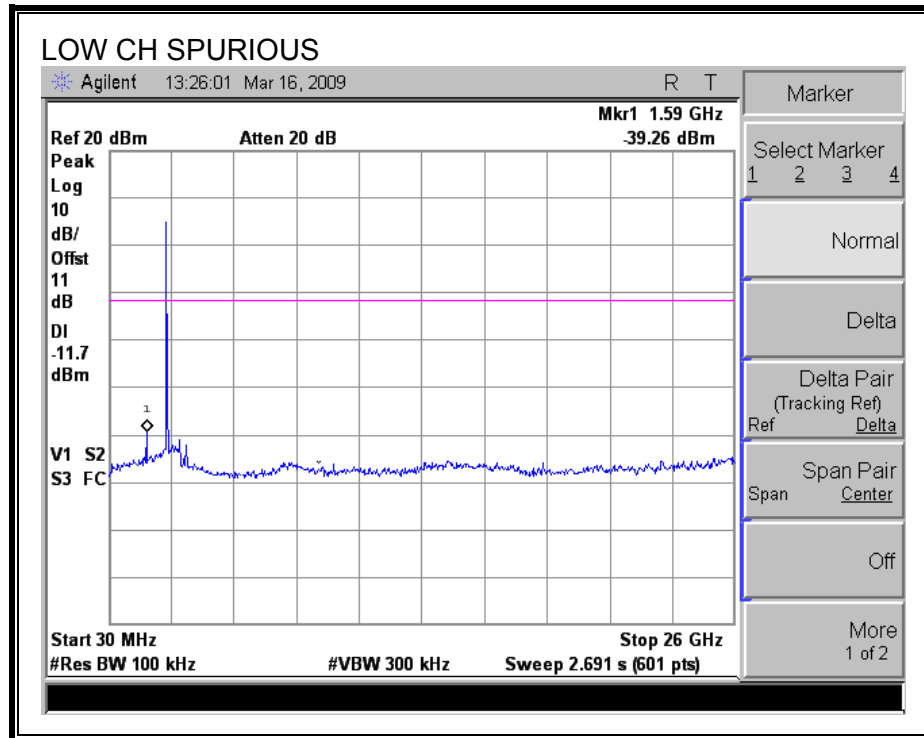
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

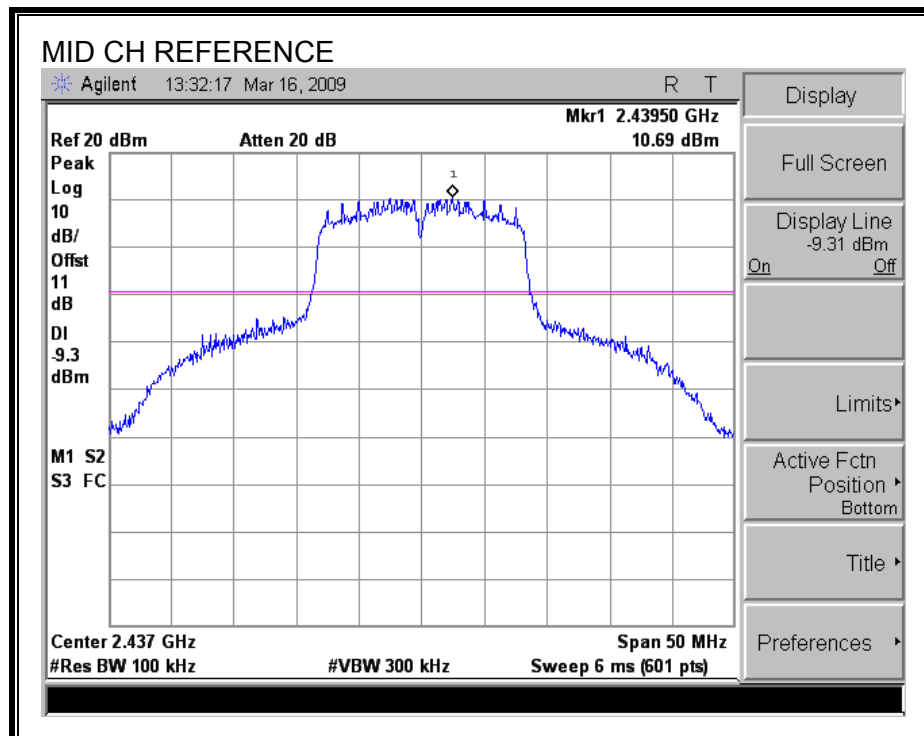
RESULTS

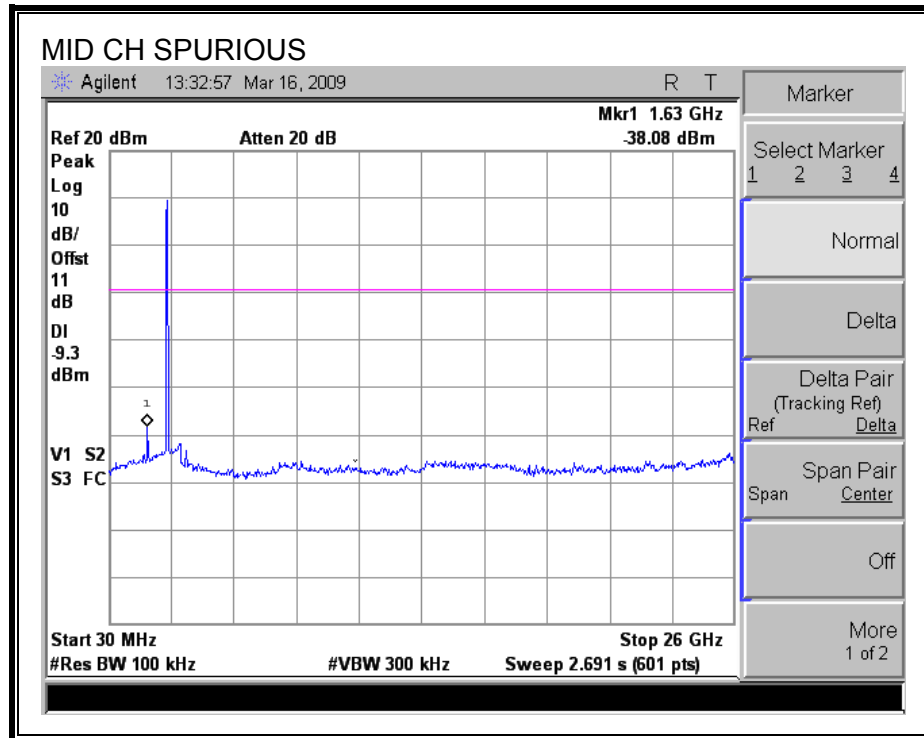
SPURIOUS EMISSIONS, LOW CHANNEL



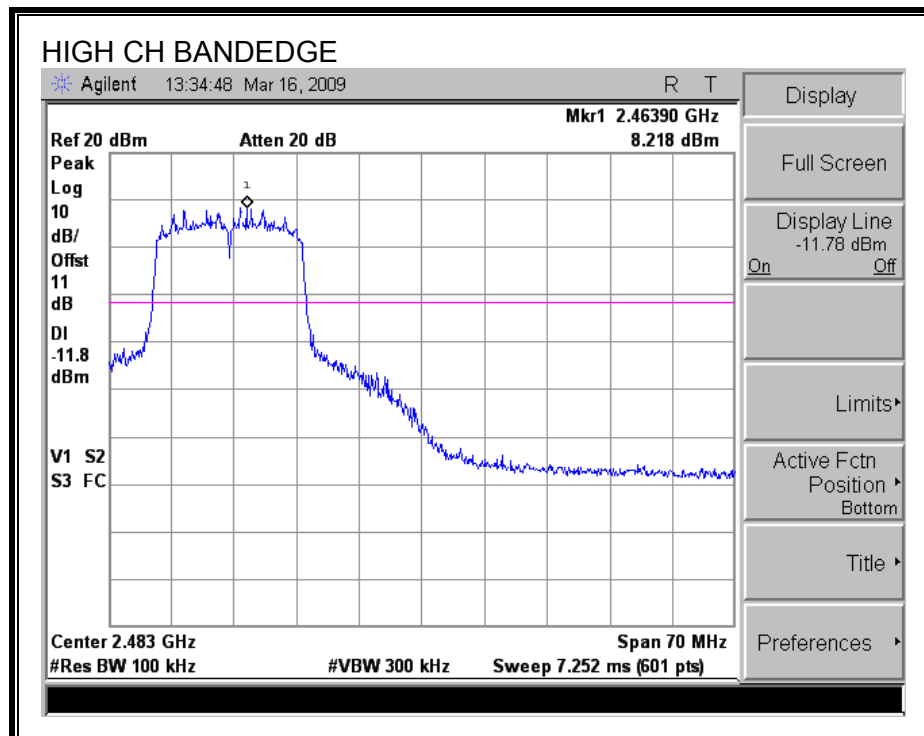


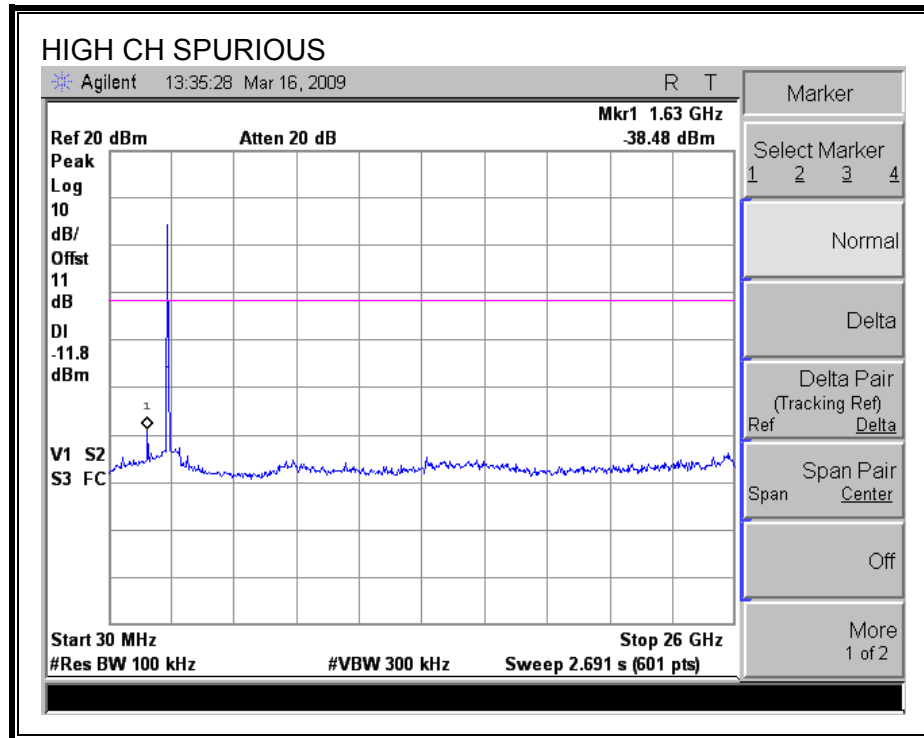
SPURIOUS EMISSIONS, MID CHANNEL





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

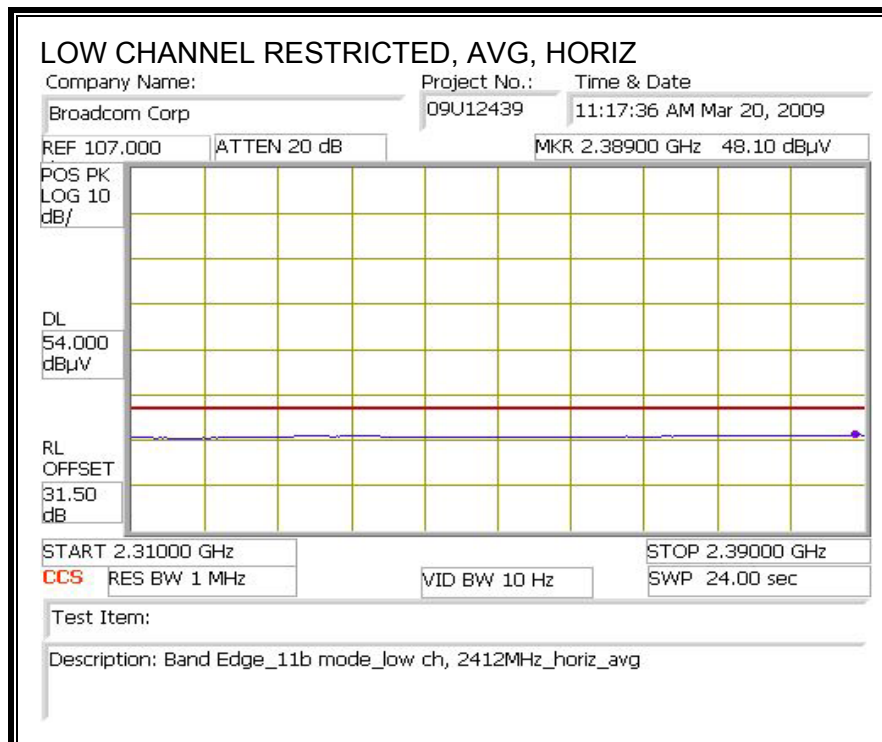
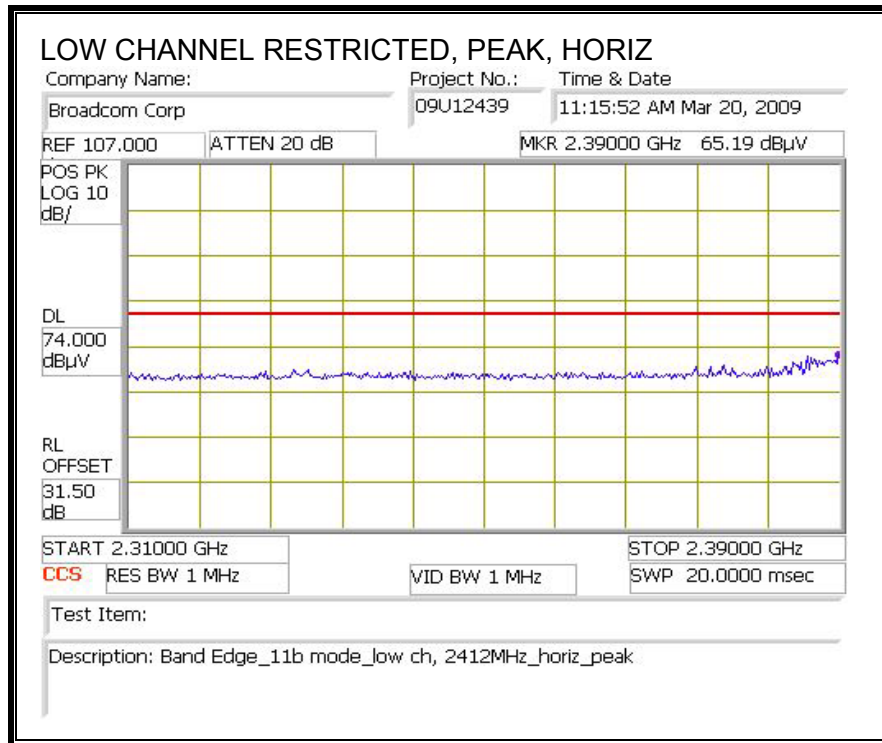
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

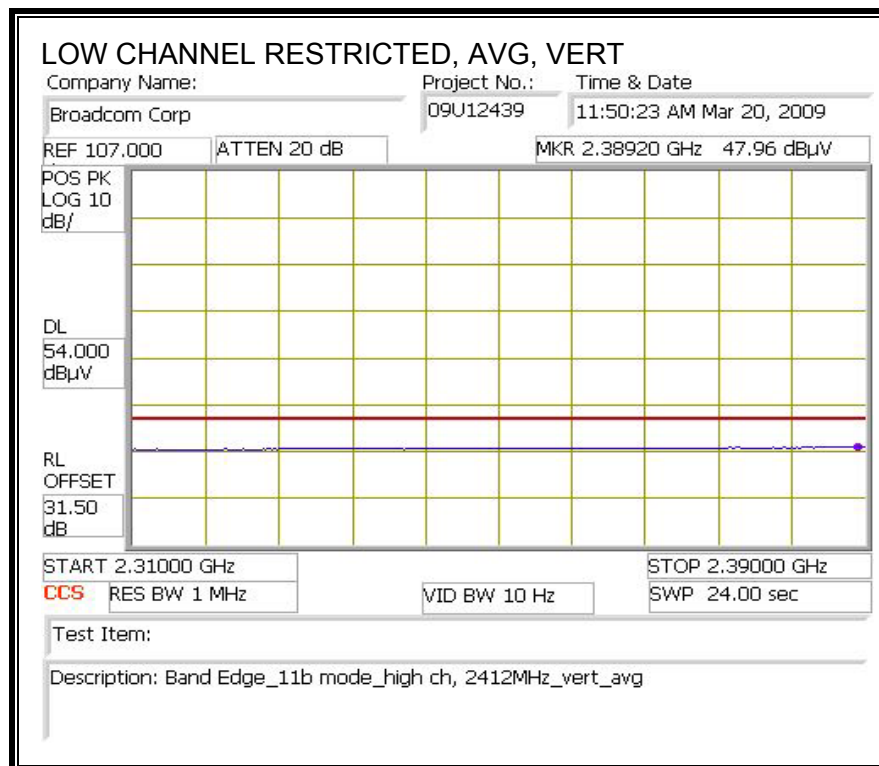
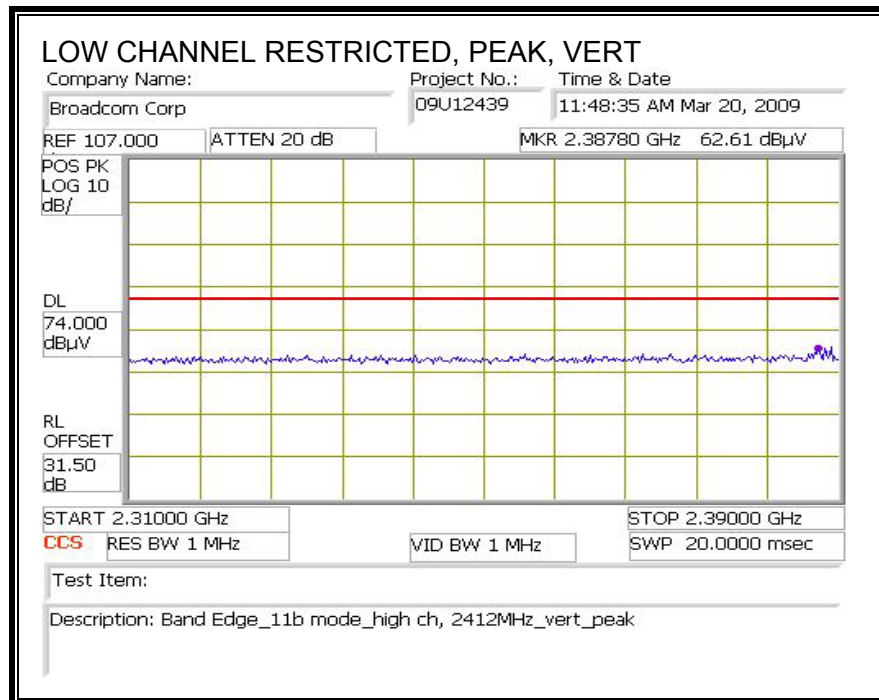
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.1.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE

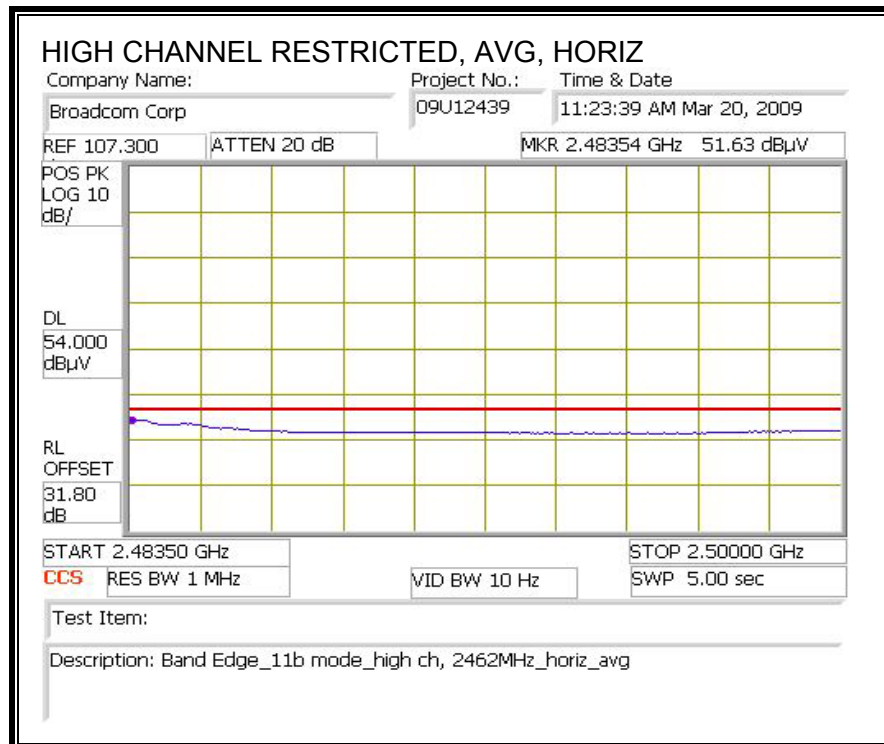
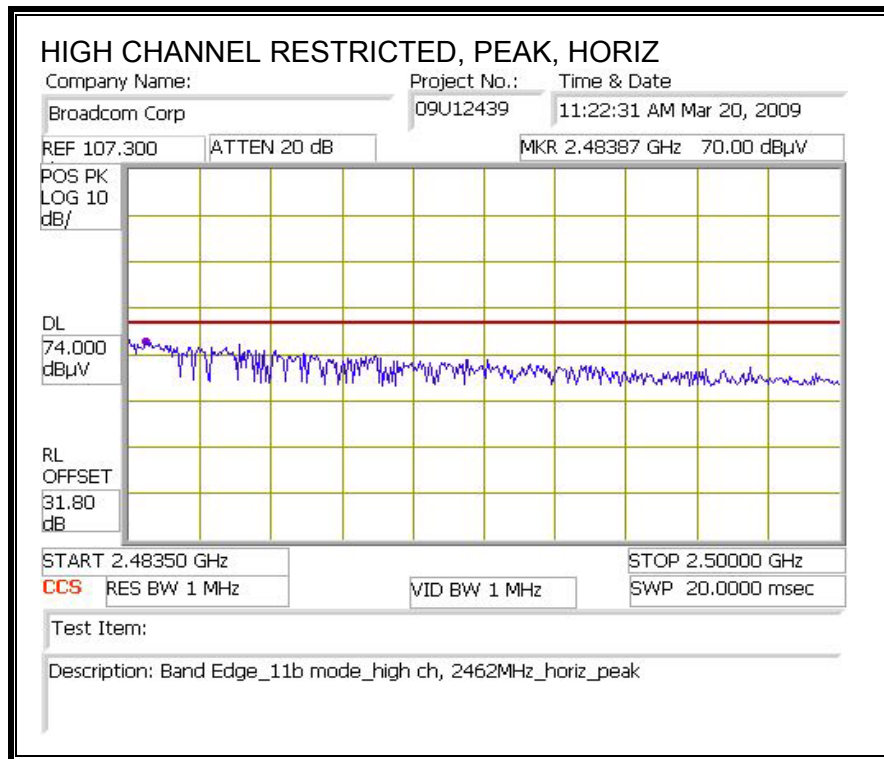
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



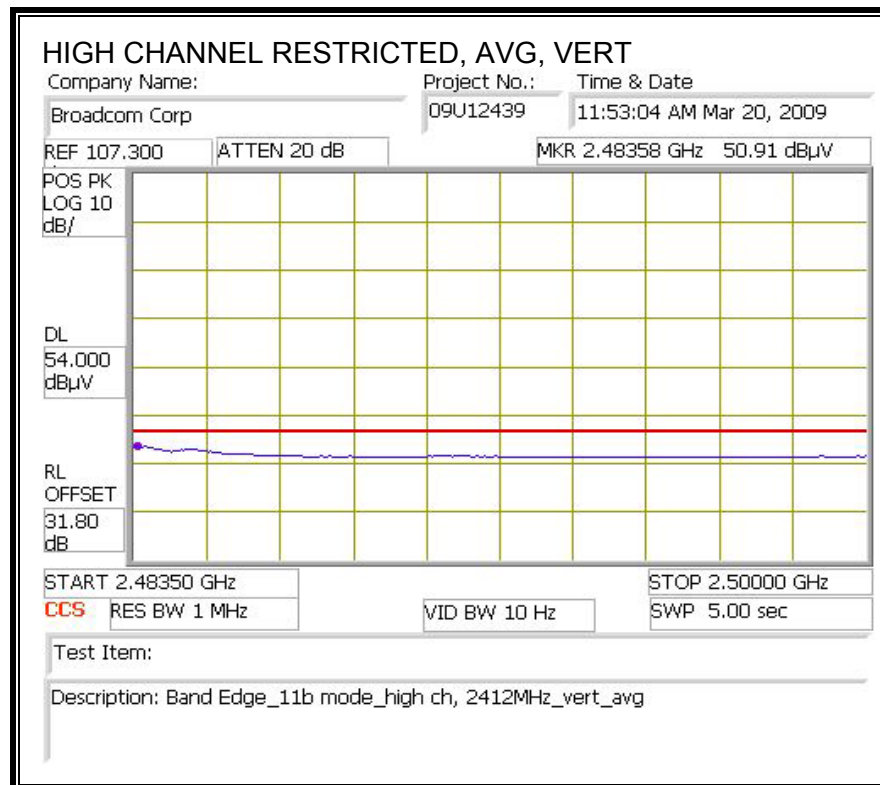
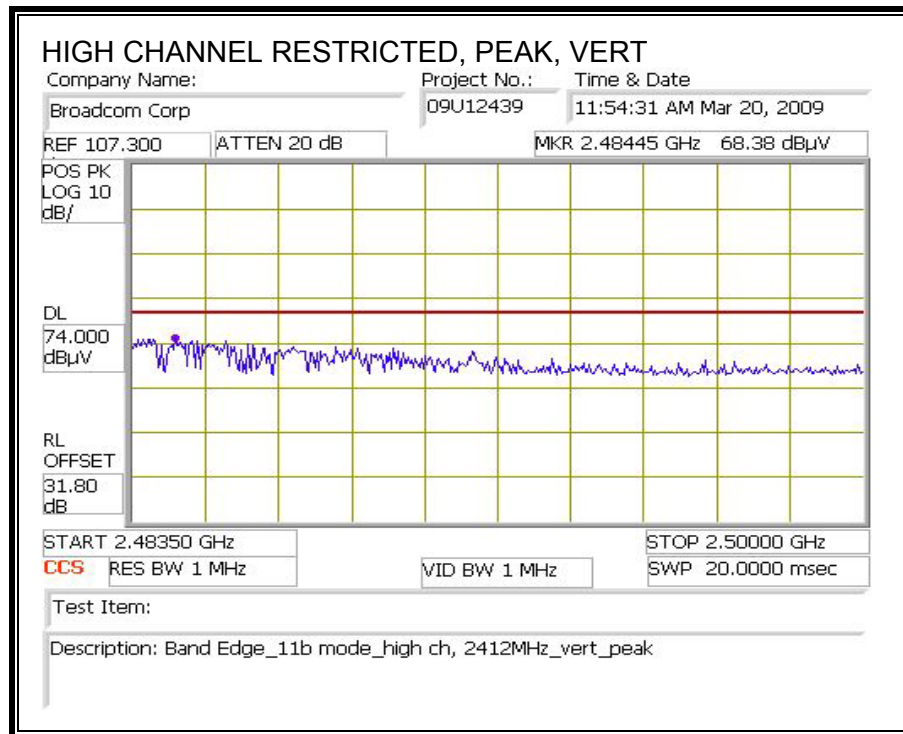
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



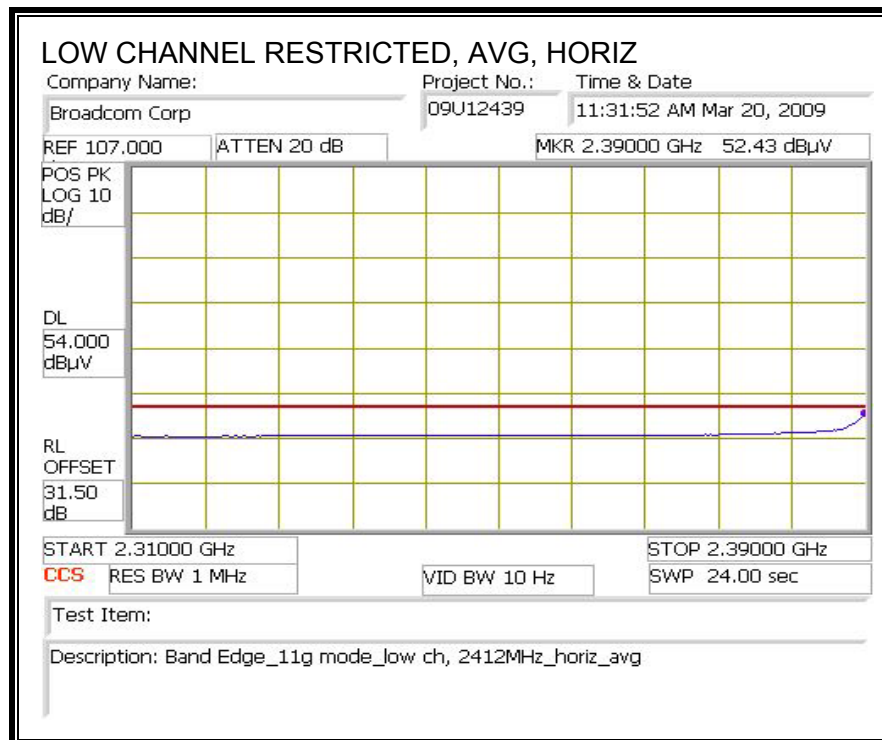
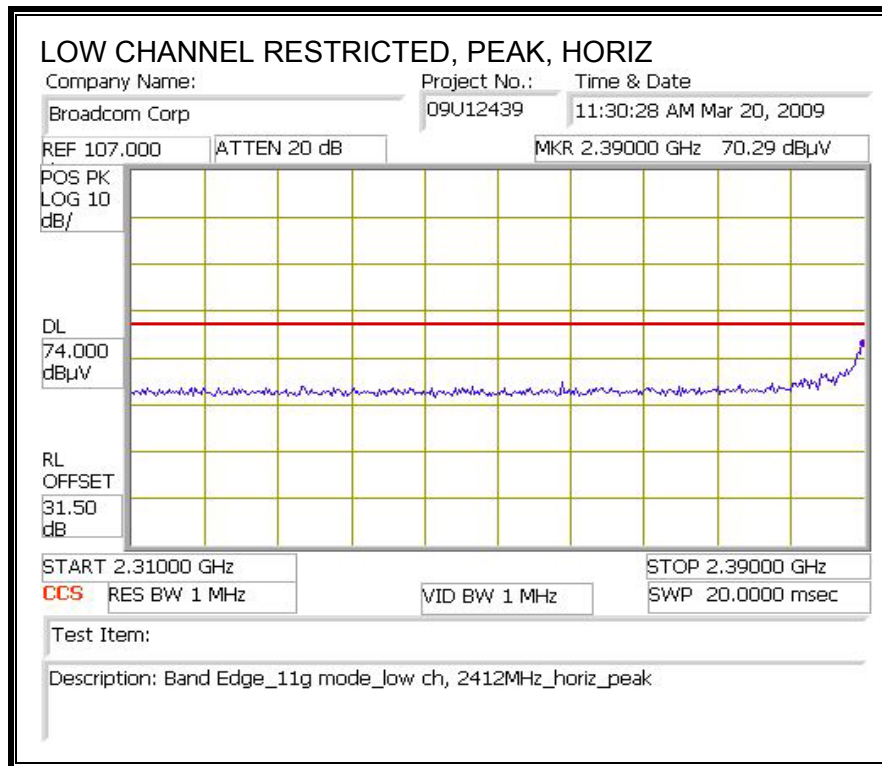
RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



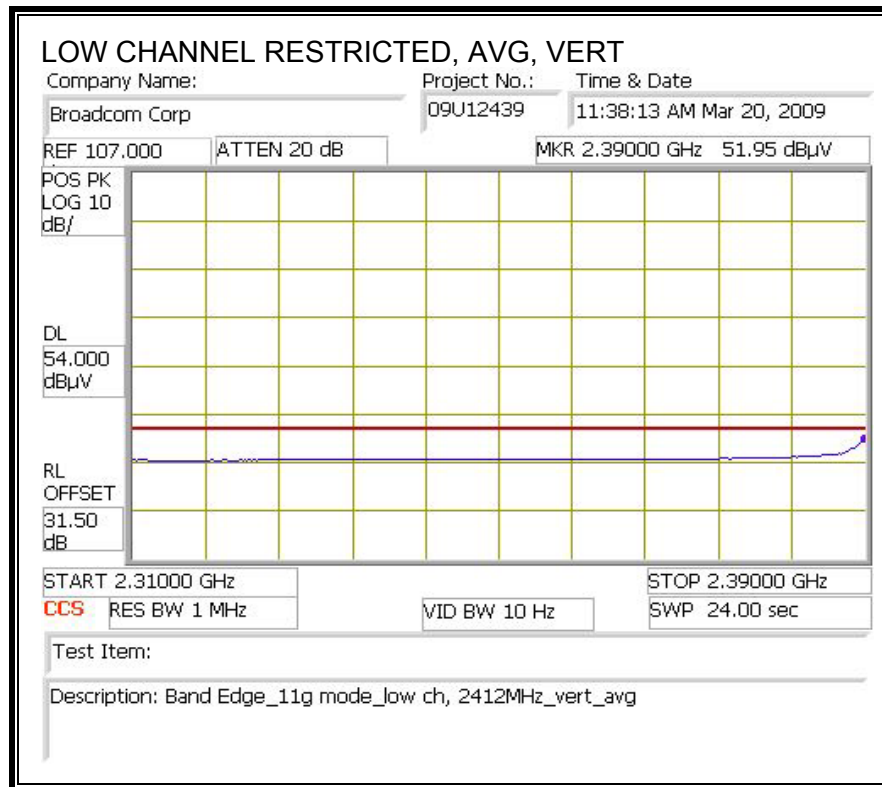
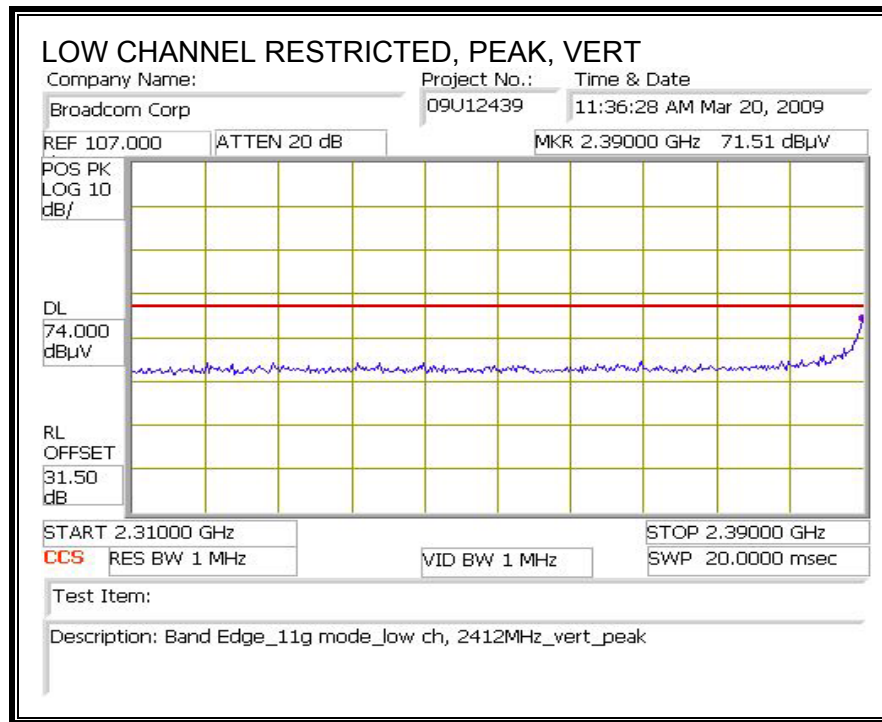
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Broadcom															
Project #: 09U12439															
Date: 3/13/09															
Test Engineer: Chin Pang															
Configuration: EUT/Antenna															
Mode: TX, Wlan b mode															
Test Equipment:															
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit			
T60; S/N: 2238 @3m			T34 HP 8449B									FCC 15.205			
Hi Frequency Cables															
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			
3' cable 22807700			12' cable 22807600			20' cable 22807500						R_001			
<div style="display: flex; justify-content: space-between;"> <div> Peak Measurements REBW=VBW=1MHz Average Measurements REBW=1MHz; VBW=10Hz </div> </div>															
f GHz	Dist (m)	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr 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 Ch, 2412MHz															
4.824	3.0	43.5	38.1	32.7	5.8	-34.8	0.0	0.0	47.1	41.7	74	54	-26.9	-12.3	H
4.824	3.0	45.3	40.8	32.7	5.8	-34.8	0.0	0.0	48.9	44.4	74	54	-25.1	-9.6	V
Mid Ch, 2437MHz															
4.874	3.0	43.6	38.2	32.7	5.8	-34.8	0.0	0.0	47.3	41.9	74	54	-26.7	-12.1	H
7.311	3.0	40.5	28.5	35.5	7.3	-34.1	0.0	0.0	49.1	37.1	74	54	-24.9	-16.9	H
4.874	3.0	45.2	40.7	32.7	5.8	-34.8	0.0	0.0	48.9	44.4	74	54	-25.1	-9.6	V
7.311	3.0	42.0	31.2	35.5	7.3	-34.1	0.0	0.0	50.6	39.8	74	54	-23.4	-14.2	V
High Ch, 2462MHz															
4.924	3.0	45.6	41.0	32.7	5.9	-34.8	0.0	0.0	49.4	44.8	74	54	-24.6	-9.2	H
7.386	3.0	40.0	28.1	35.6	7.3	-34.1	0.0	0.0	48.8	36.9	74	54	-25.2	-17.1	H
4.924	3.0	46.5	43.2	32.7	5.9	-34.8	0.0	0.0	50.3	47.0	74	54	-23.7	-7.0	V
7.386	3.0	41.0	29.0	35.6	7.3	-34.1	0.0	0.0	49.8	37.8	74	54	-24.2	-16.2	V
Rev. 11.10.08															
Note: No other emissions were detected above the 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										

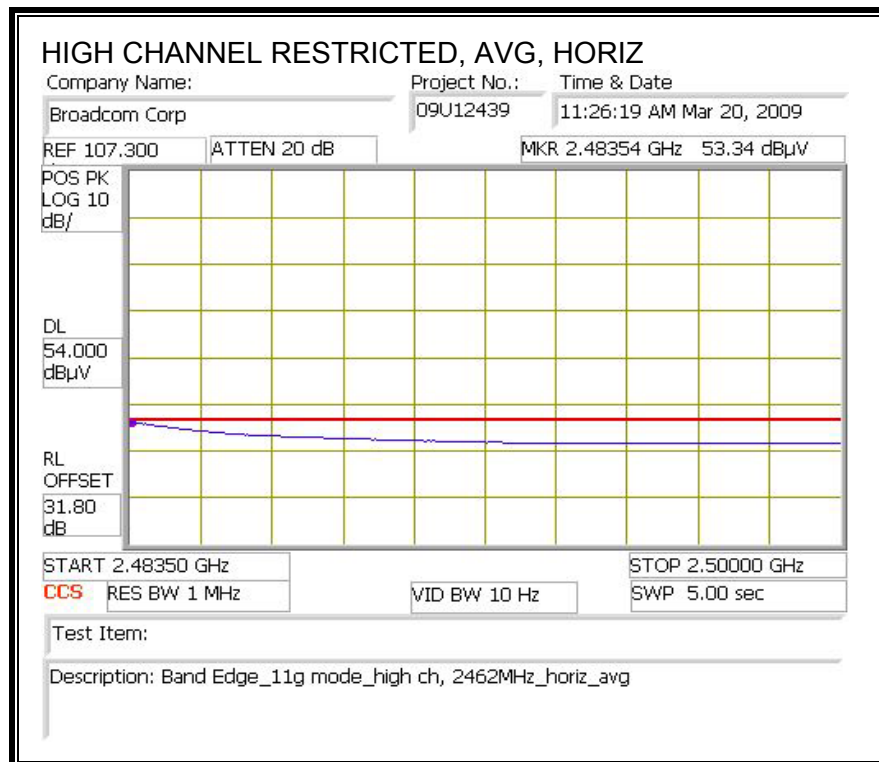
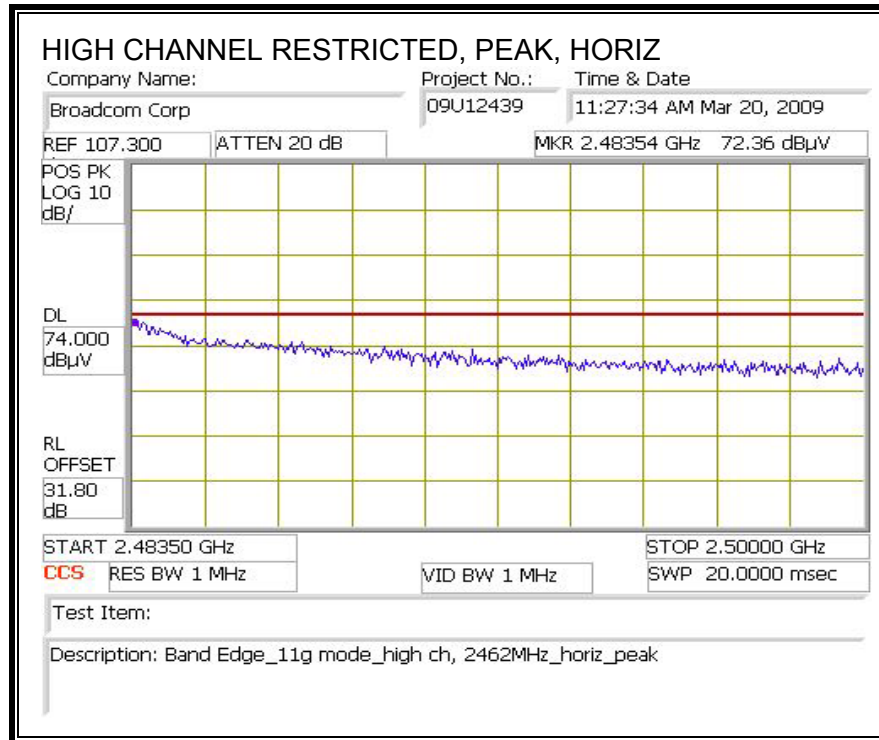
8.1.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



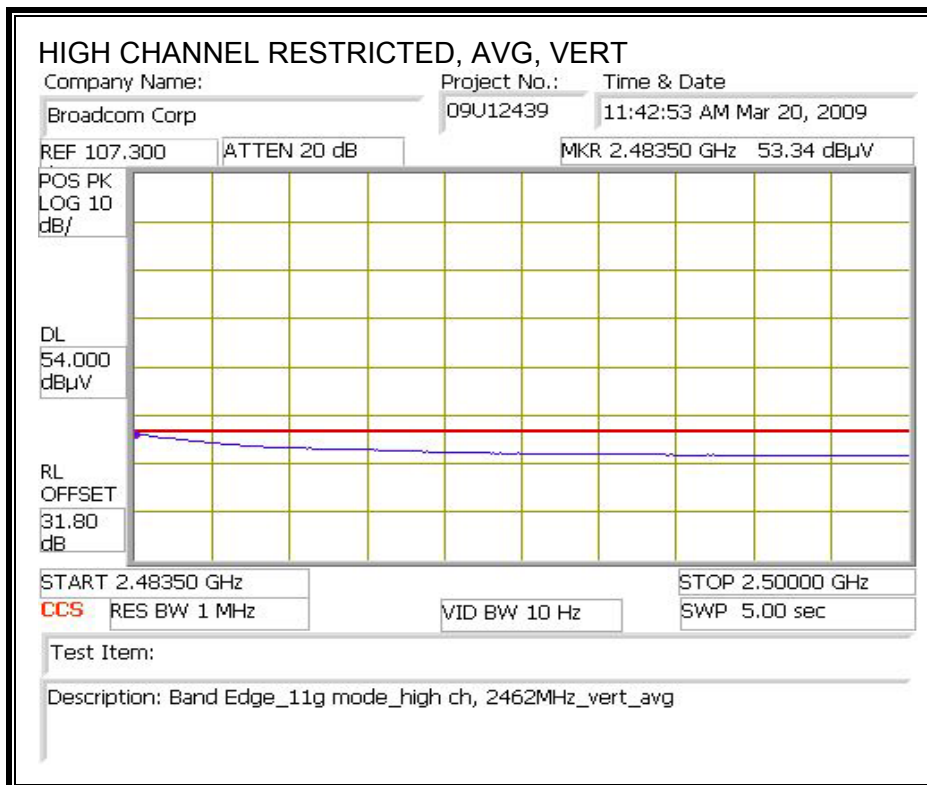
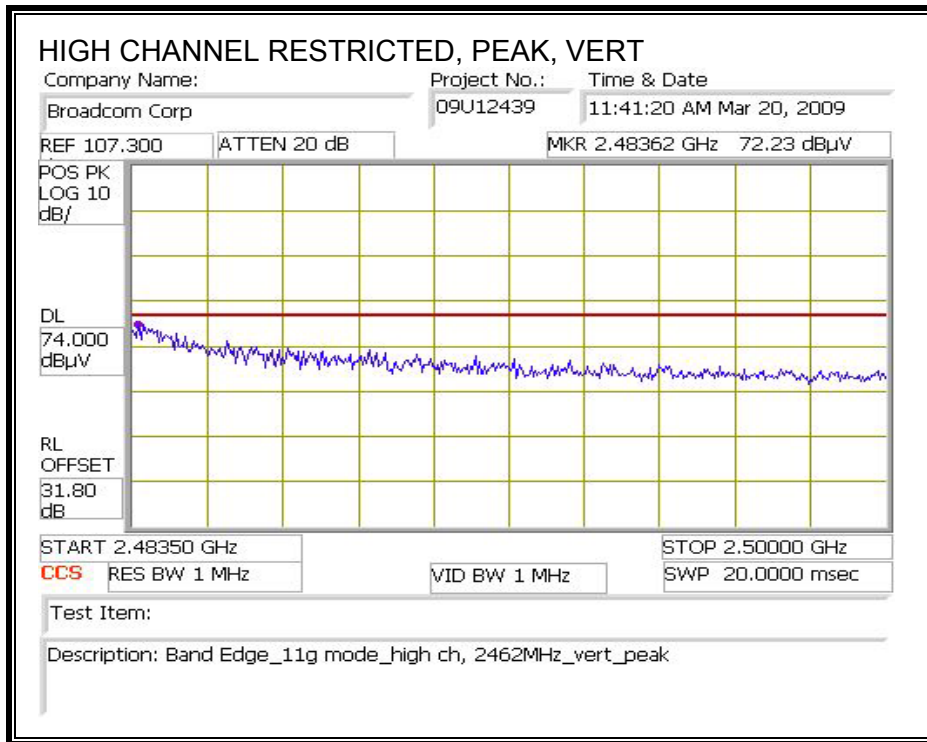
RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Broadcom Project #: 09U12439 Date: 3/13/09 Test Engineer: Chin Pang Configuration: EUT/Antenna Mode: TX, WLAN mode															
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T60; S/N: 2238 @3m		T34 HP 8449B						FCC 15.205							
Hi Frequency Cables															
3' cable 22807700		12' cable 22807600		20' cable 22807500		HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz; VBW=10Hz					
3' cable 22807700		12' cable 22807600		20' cable 22807500				R_001							
f GHz	Dist (m)	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr 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 Ch, 2412MHz															
4.824	3.0	40.5	28.5	32.7	5.8	-34.8	0.0	0.0	44.1	32.1	74	54	-29.9	-21.9	H
4.824	3.0	42.1	30.0	32.7	5.8	-34.8	0.0	0.0	45.7	33.6	74	54	-28.3	-20.4	V
Mid Ch, 2437MHz															
4.874	3.0	41.6	30.0	32.7	5.8	-34.8	0.0	0.0	45.3	33.7	74	54	-28.7	-20.3	H
7.311	3.0	40.5	28.0	35.5	7.3	-34.1	0.0	0.0	49.1	36.6	74	54	-24.9	-17.4	H
4.874	3.0	48.7	33.9	32.7	5.8	-34.8	0.0	0.0	52.4	37.6	74	54	-21.6	-16.4	V
7.311	3.0	41.7	29.0	35.5	7.3	-34.1	0.0	0.0	50.3	37.6	74	54	-23.7	-16.4	V
High Ch, 2462MHz															
4.924	3.0	41.2	29.3	32.7	5.9	-34.8	0.0	0.0	45.0	33.1	74	54	-29.0	-20.9	H
7.386	3.0	40.0	27.6	35.6	7.3	-34.1	0.0	0.0	48.8	36.4	74	54	-25.2	-17.6	H
4.924	3.0	43.0	30.0	32.7	5.9	-34.8	0.0	0.0	46.8	33.8	74	54	-27.2	-20.2	V
7.386	3.0	40.5	28.0	35.6	7.3	-34.1	0.0	0.0	49.3	36.8	74	54	-24.7	-17.2	V
Rev. 11.10.08															
Note: No other emissions were detected above the 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. RECEIVER ABOVE 1 GHz

High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Broadcom															
Project #: 09U12439															
Date: 3/13/09															
Test Engineer: Chin Pang															
Configuration: EUT/Antenna															
Mode: RX, Wlan (Worse Case)															
Test Equipment:															
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit			
T60; S/N: 2238 @3m			T34 HP 8449B									FCC 15.209			
Hi Frequency Cables															
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			
3' cable 22807700			12' cable 22807600			20' cable 22807500									
<div> <div>Peak Measurements</div> <div>RBW=VBW=1MHz</div> <div>Average Measurements</div> <div>RBW=1MHz; VBW=10Hz</div> </div>															
f	Dist	Read Pk	Read Avg	AF	CL	Amp	D Corr	Ftr	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes
GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
Mid Ch, 2441MHz															
1.000	3.0	54.6	41.2	24.5	2.4	-38.3	0.0	0.0	43.2	29.8	74	54	-30.8	-24.2	V
2.500	3.0	62.0	39.2	28.3	3.9	-36.3	0.0	0.0	58.0	35.2	74	54	-16.0	-18.8	V
1.000	3.0	56.0	42.9	24.5	2.4	-38.3	0.0	0.0	44.6	31.5	74	54	-29.4	-22.5	H
2.500	3.0	58.5	36.0	28.3	3.9	-36.3	0.0	0.0	54.5	32.0	74	54	-19.5	-22.0	H
Rev. 11.10.08															
Note: No other emissions were detected above the 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

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

30-1000MHz Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr: Chin Pang													
Date: 3/13/2009													
Project #: 09U12439													
Company: Broadcom													
EUT Description: 802.11g wireless Lan+Bluetooth PCI-E half mini card													
EUT M/N: BCM94312HMGB													
Test Target: FCC Class B													
Mode Oper: TX, Wlan (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	
Horizontal													
132.724	3.0	45.0	13.6	1.0	27.9	0.0	0.0	31.6	43.5	-11.9	H	P	
370.214	3.0	47.6	14.6	1.7	27.8	0.0	0.0	36.0	46.0	-10.0	H	P	
630.145	3.0	45.7	18.6	2.3	28.6	0.0	0.0	38.0	46.0	-8.0	H	P	
816.032	3.0	46.2	21.1	2.6	28.1	0.0	0.0	41.7	46.0	-4.3	H	P	
898.476	3.0	42.4	22.1	2.7	27.9	0.0	0.0	39.3	46.0	-6.7	H	P	
Vertical													
68.042	3.0	52.8	8.2	0.7	28.3	0.0	0.0	33.4	40.0	-6.6	V	P	
211.928	3.0	42.9	11.9	1.2	27.4	0.0	0.0	28.6	43.5	-14.9	V	P	
480.019	3.0	41.7	16.5	1.9	28.5	0.0	0.0	31.6	46.0	-14.4	V	P	
744.149	3.0	44.9	19.8	2.5	28.4	0.0	0.0	38.7	46.0	-7.3	V	P	
816.032	3.0	41.4	21.1	2.6	28.1	0.0	0.0	36.9	46.0	-9.1	V	P	
Rev. 1.27.09													

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

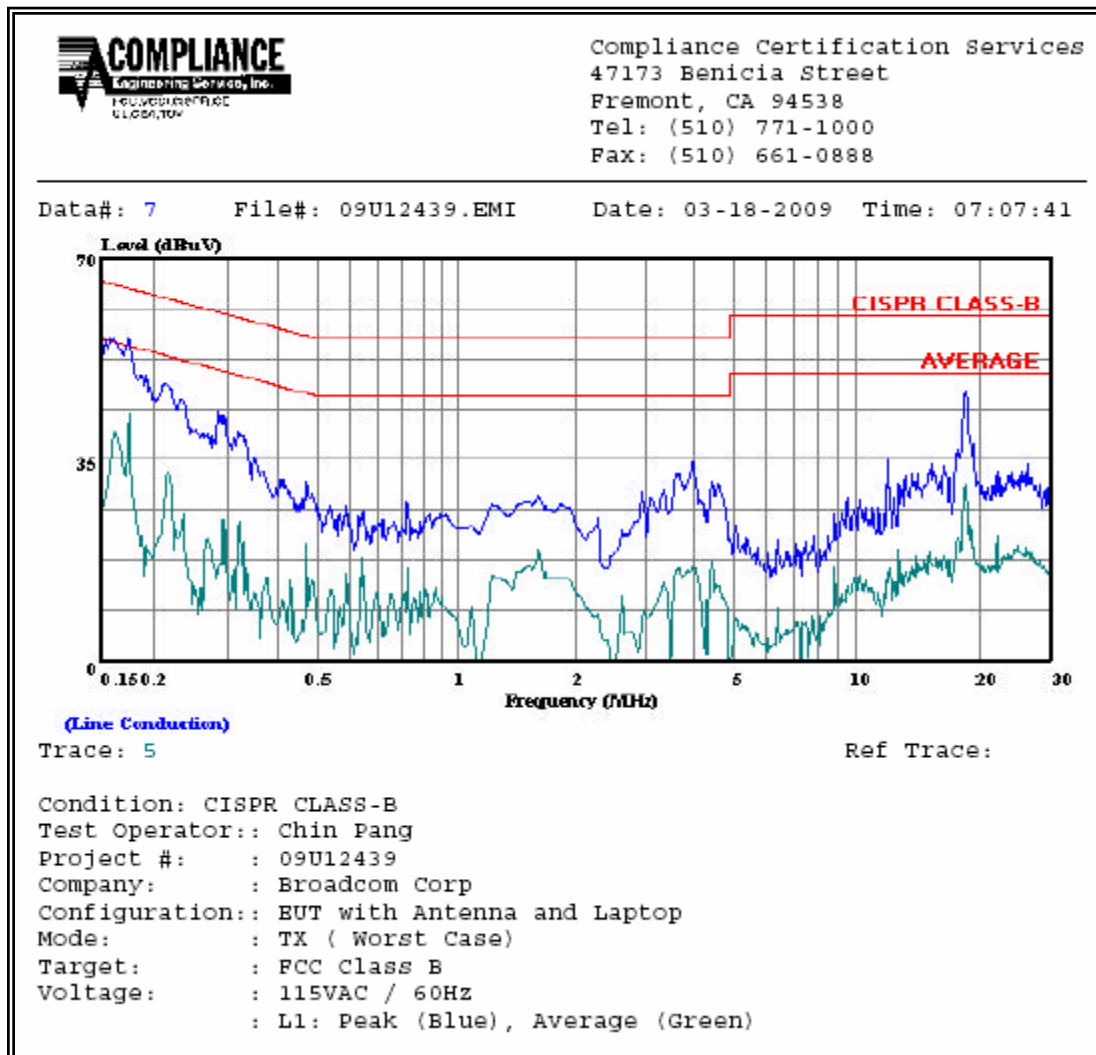
ANSI C63.4

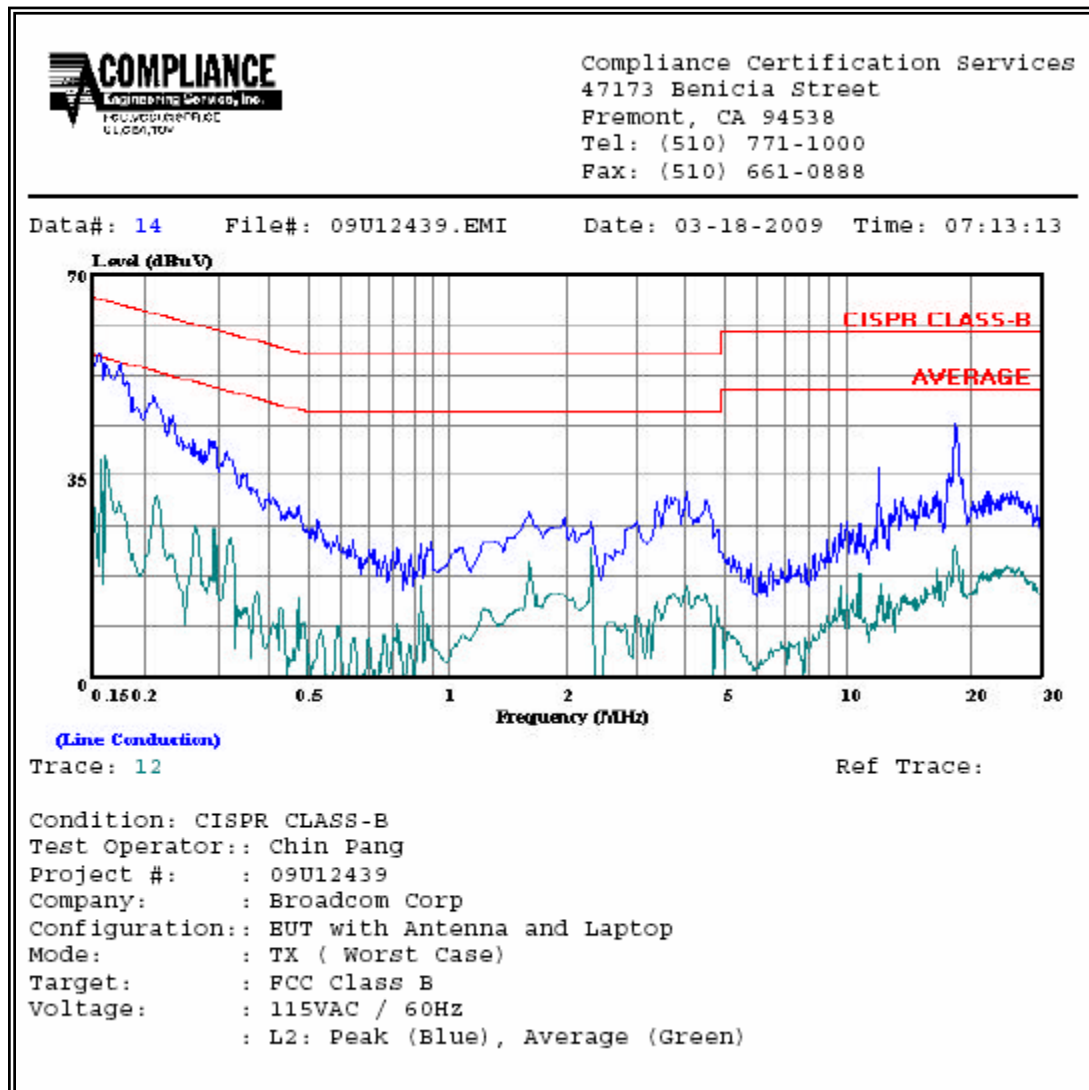
RESULTS

6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Closs (dB)	Limit QP	EN B AV	Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
0.16	55.95	--	43.10	0.00	65.41	55.41	-9.46	-12.31	L1
4.09	34.68	--	16.48	0.00	56.00	46.00	-21.32	-29.52	L1
18.52	46.92	--	30.62	0.00	60.00	50.00	-13.08	-19.38	L1
0.16	56.49	--	38.60	0.00	65.73	55.73	-9.24	-17.13	L2
4.14	32.23	--	15.89	0.00	56.00	46.00	-23.77	-30.11	L2
18.52	43.23	--	22.09	0.00	60.00	50.00	-16.77	-27.91	L2
6 Worst Data									

LINE 1 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.

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 ²)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* 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/m² is equivalent to 1 mW/cm².
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

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

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m²

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	25.90	3.90	0.19	1.90