



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

CERTIFICATION TEST REPORT

FOR

**HANDHELD TOUCH SCREEN IPOD MUSIC DEVICE WITH 802.11B/G AND
BLUETOOTH RADIO FUNCTIONS**

MODEL NUMBER: A1318

**FCC ID: BCG-2310
IC: 579C-2310**

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Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	08/04/09	Initial Issue	F. Ibrahim
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITY LOOP
CUPERTINO, CALIFORNIA 95014, U.S.A.

EUT DESCRIPTION: HANDHELD TOUCH SCREEN IPOD MUSIC DEVICE WITH
802.11B/G AND BLUETOOTH RADIO FUNCTIONS

MODEL: A1318

SERIAL NUMBER: A1-A 0044, A1-B 0004, D1-Y 0002

DATE TESTED: JULY 29 – 31, 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. 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:



FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:



TOM CHEN
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. 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 A1318 is an iPod Touch product. This is a handheld touch screen iPod music device with 802.11b/g and Bluetooth radio functions. The A1318 measures 111.49 mm (4.389 inches) long x 62.29 mm (2.452 inches) wide x 8.2 5mm (0.325 inches) thick and weighs 107.7 grams (3.8 oz.). The rechargeable battery is not user accessible.

The Apple A1318 comes with one of two memory configurations, 32 / 64 Giga Bytes for storing music, video or data. The Apple A1318 function is fully compatible with Apple's iTunes software. The Apple A1318 in box materials include; Apple earbuds (no microphone), and 30pin 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	18.17	65.61
2412 - 2462	802.11g	23.36	216.77

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an inverted F antenna, with a maximum gain of 1.2 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was mfgtest-seqcmds.bin
bcm94329OLYMPICN18.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested in three orthogonal orientations X, Y and Z. It was determined that X orientation is worst-case; therefore orientation X was used for all testing.

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 b mode were made at 1 Mb/s and g mode was 6 Mb/s.

For radiated emissions below 1 GHz and conducted emissions, the channel with highest power was used; this was determined to be Mid Channel in 11b mode.

5.6. DESCRIPTION OF TEST SETUP

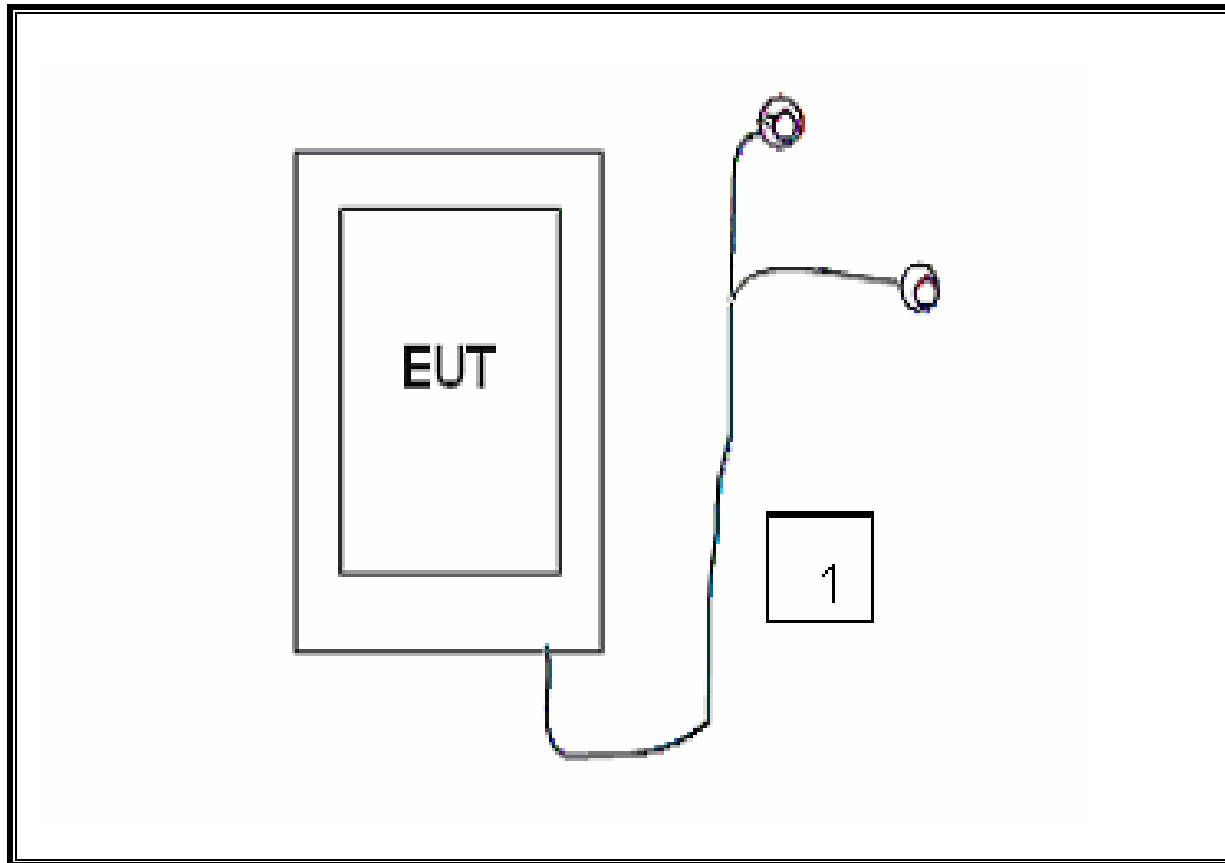
SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Mouse	Apple	A1152	KY6041L43U3MC	DoC
Laptop	Apple	MacBook	PT384939	DoC
AC/DC Adapter	Apple	A1184	N/A	DoC
Earphone	Apple	N/A	N/A	DoC

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	Audio	1	Ear Jack	Un-Shielded	1.2m	N/A

SETUP DIAGRAM FOR RADIATED 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
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4407B	C01098	11/07/08	02/07/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	12/01/08	12/01/09
Horn Antenna	EMCO	3115	C00872	01/29/09	01/29/10
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	11/07/08	02/07/10
Power Meter	Agilent / HP	437B	N02778	11/04/08	08/04/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/09	01/14/10
Power Sensor, 18 GHz	Agilent / HP	8481A	N02784	04/22/08	10/22/09
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/09	01/14/10
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	09/29/07	11/29/09
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	04/06/08	09/06/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	C00626	10/29/08	10/29/09
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/29/08	10/29/09

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)

IC RSS-210 A8.2 (a)

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

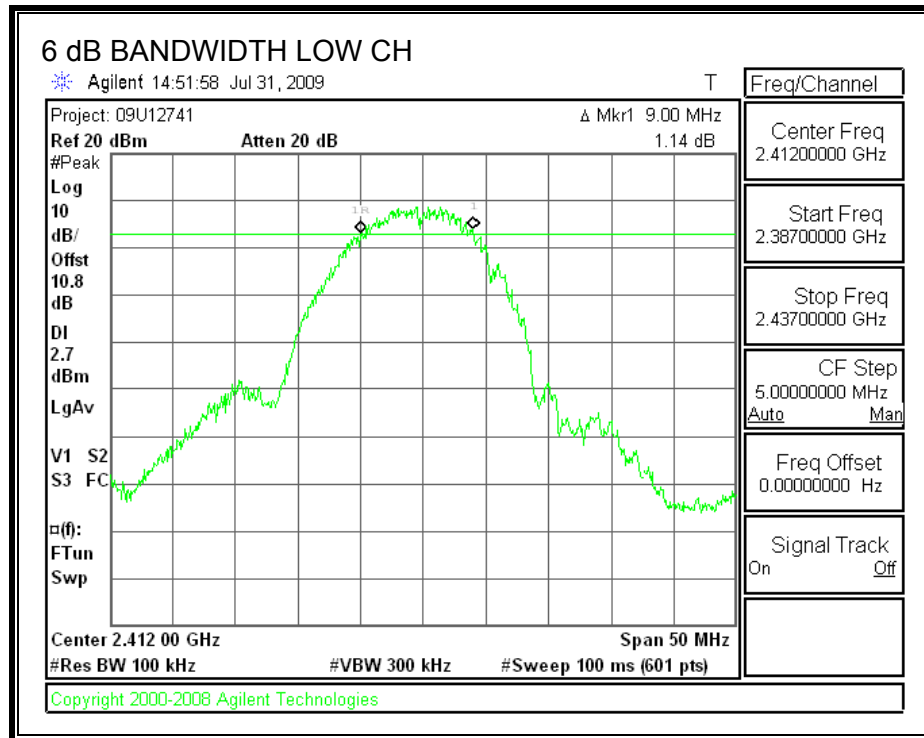
TEST PROCEDURE

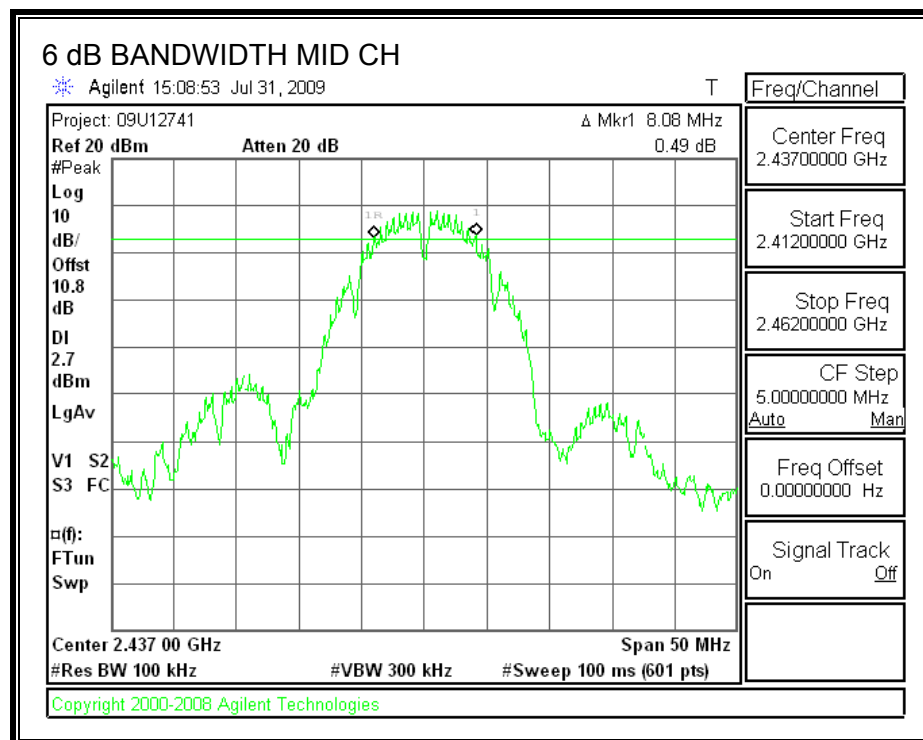
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

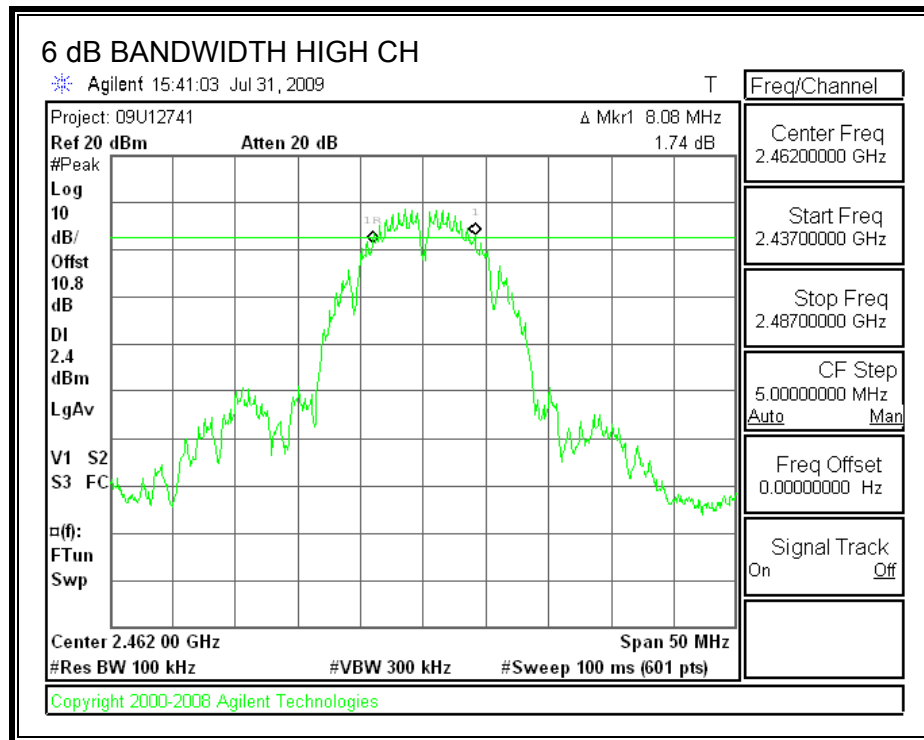
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	9.00	0.5
Middle	2437	8.08	0.5
High	2462	8.08	0.5

6 dB BANDWIDTH







7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

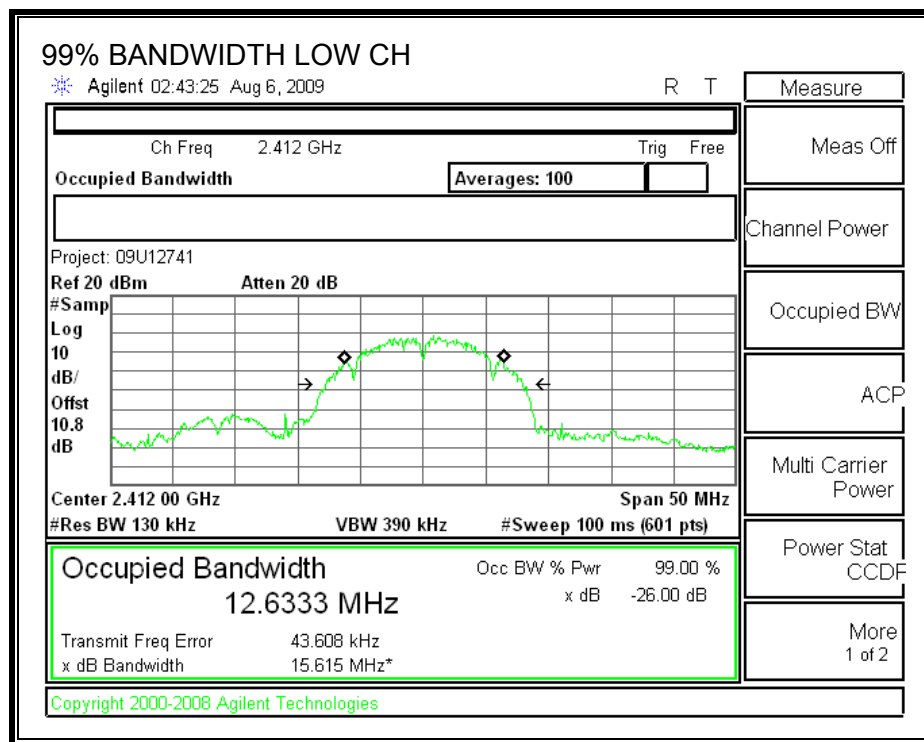
TEST PROCEDURE

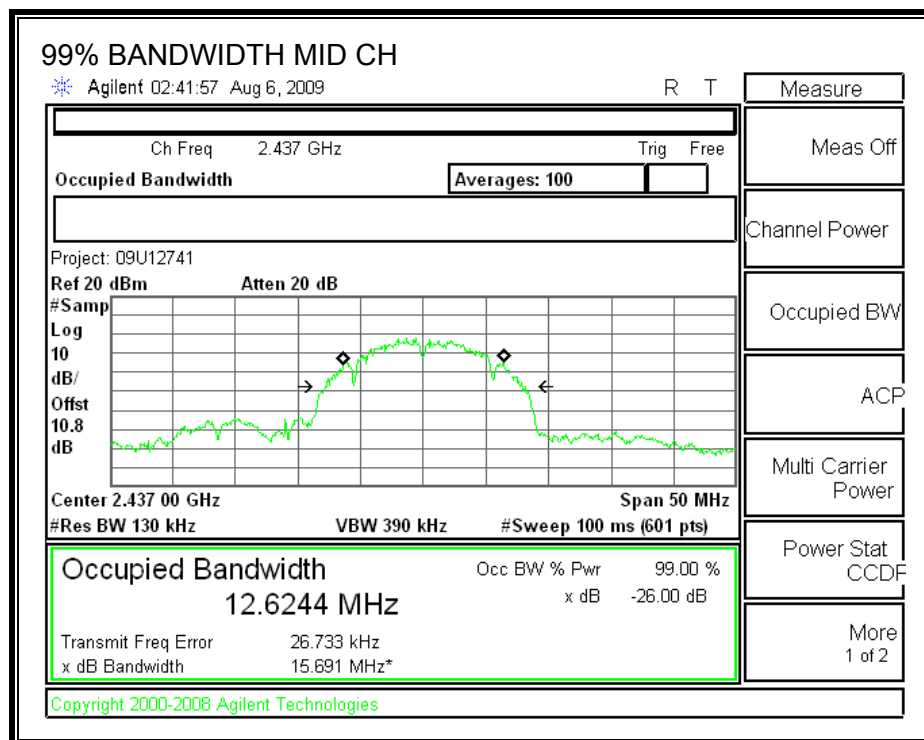
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

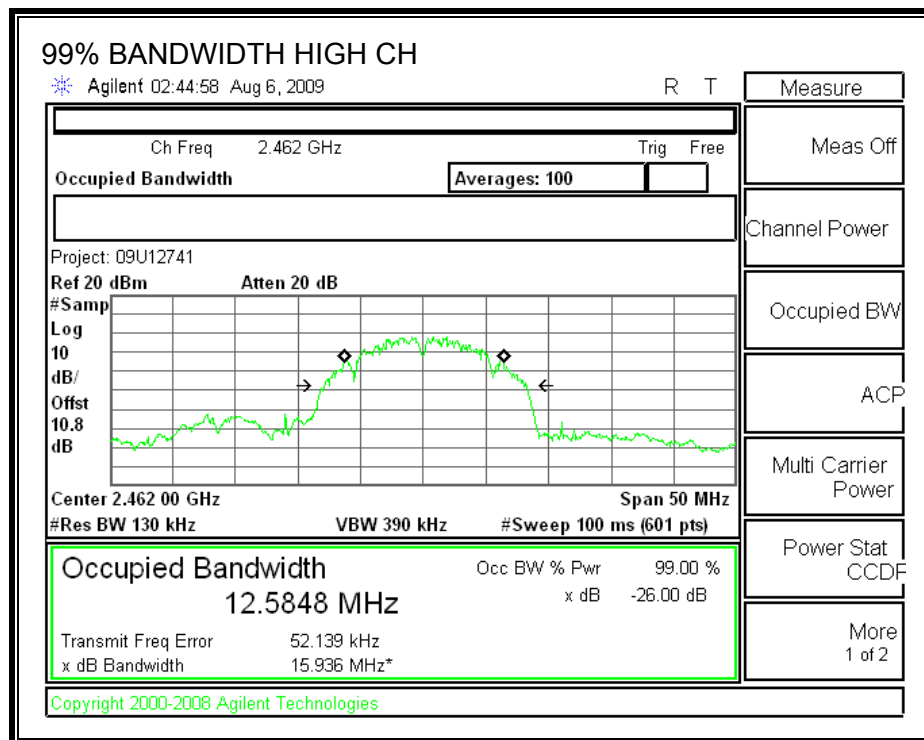
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	12.6333
Middle	2437	12.6244
High	2462	12.5848

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.

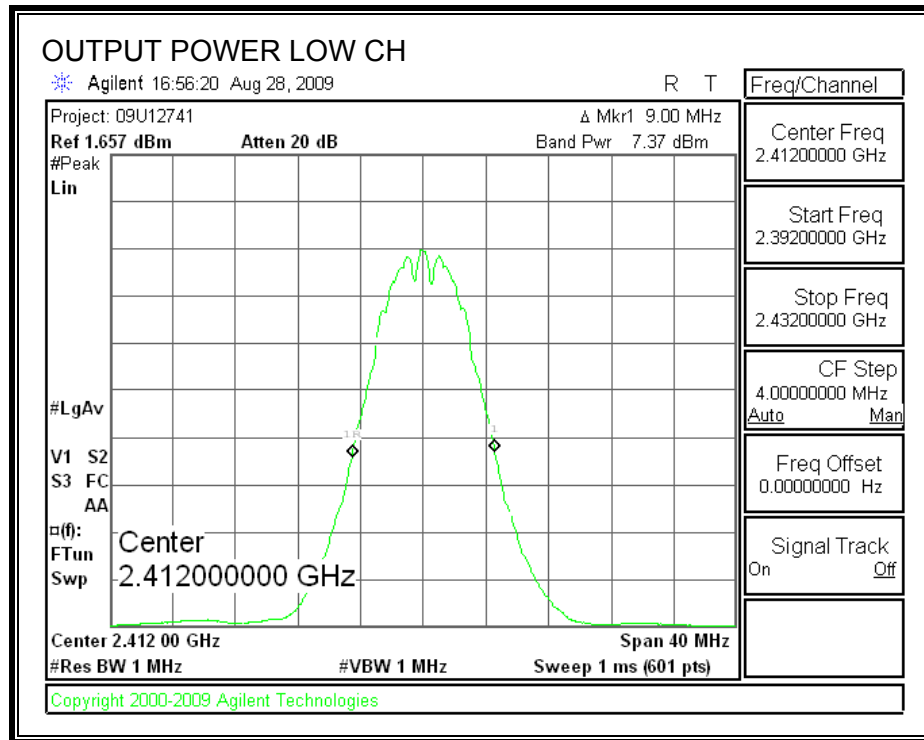
TEST PROCEDURE

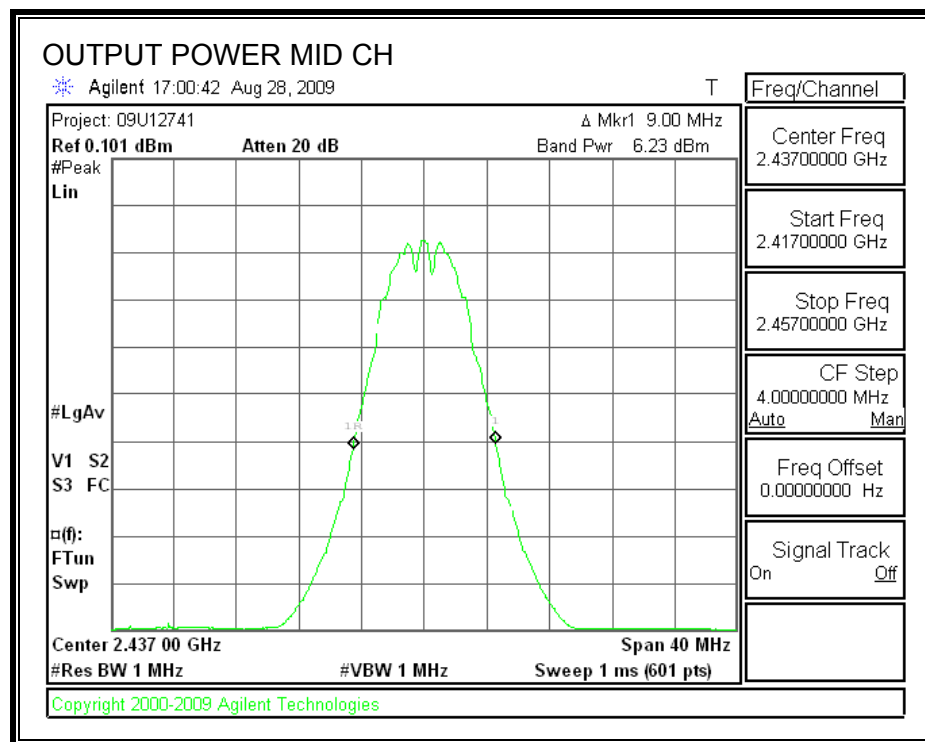
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

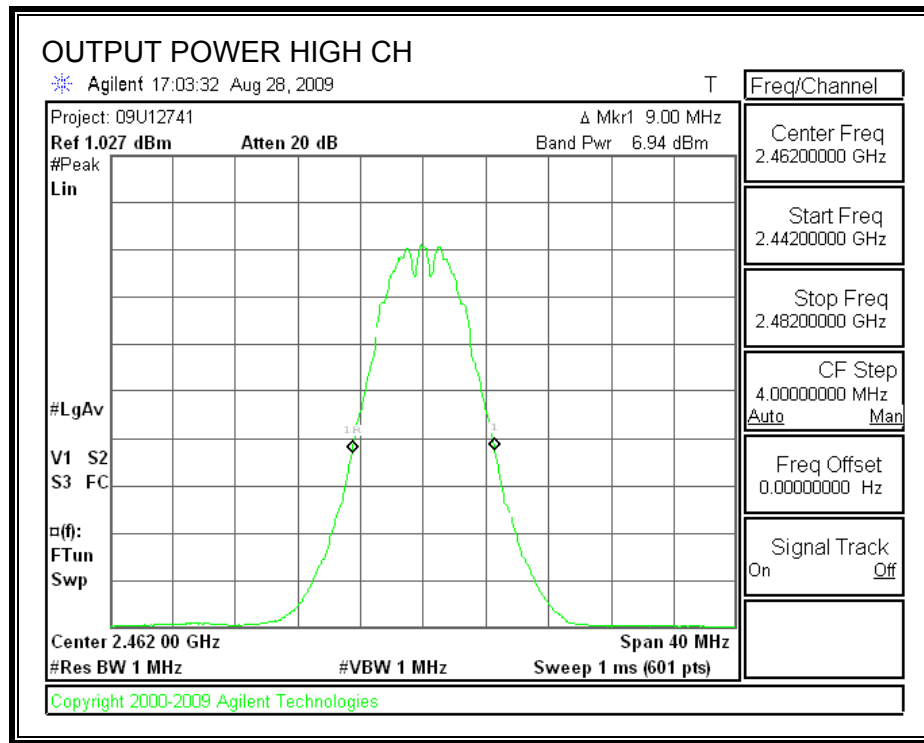
RESULTS

Channel	Frequency (MHz)	Spectrum Analyzer Reading (dBm)	Attenuator and Cable Offset (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	7.37	10.8	18.17	30	-11.83
Middle	2437	6.23	10.8	17.03	30	-12.97
High	2462	6.94	10.8	17.74	30	-12.26

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 10.8 dB (including 10 dB pad and 0.8 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	15.10
Middle	2437	15.00
High	2462	15.10

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.

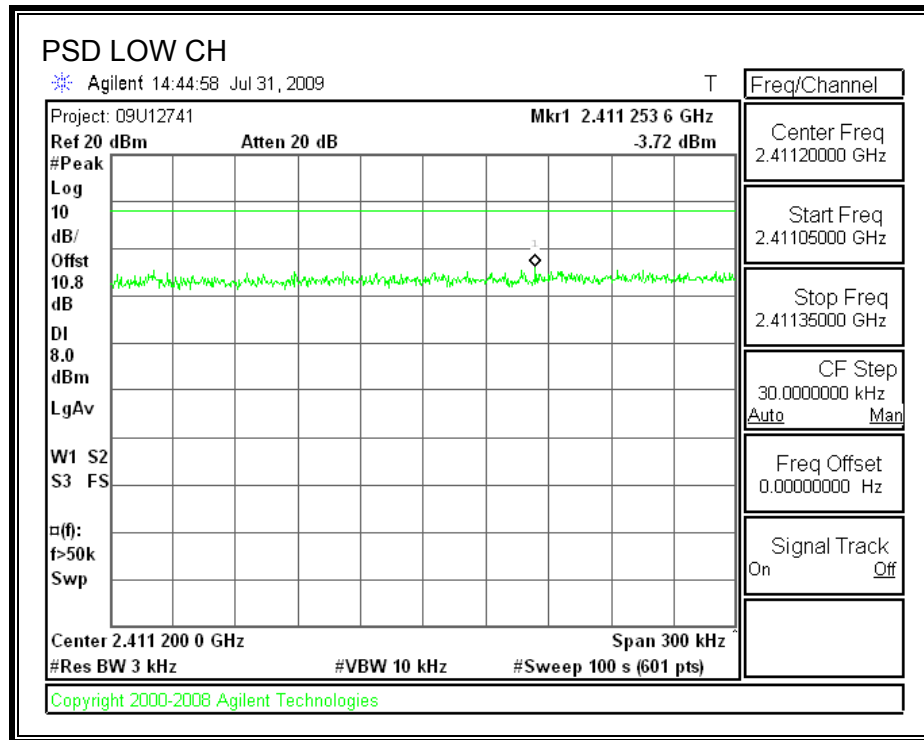
TEST PROCEDURE

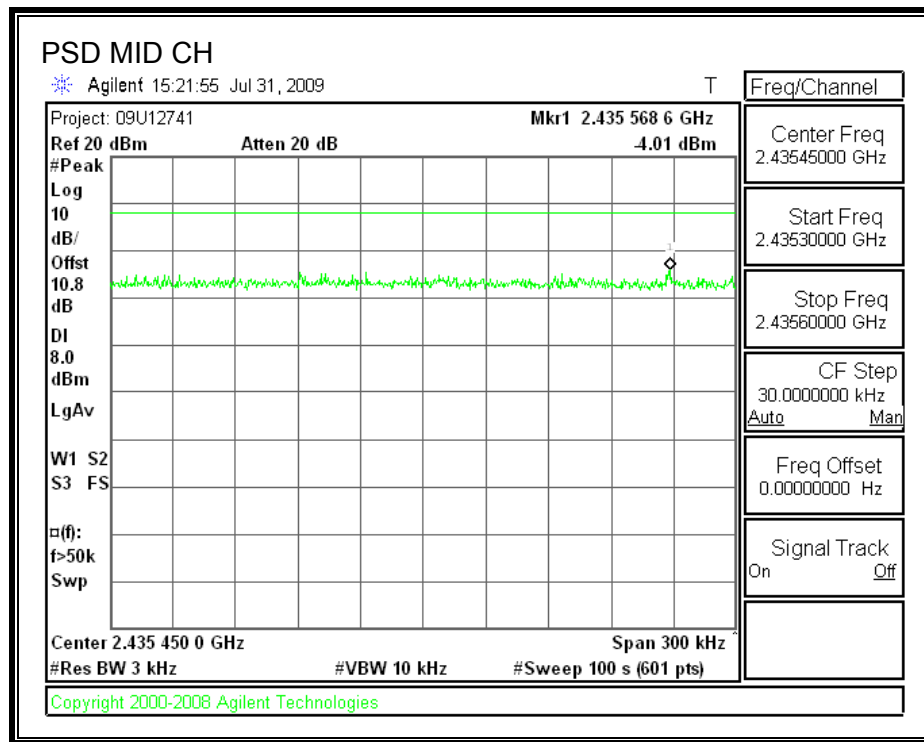
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

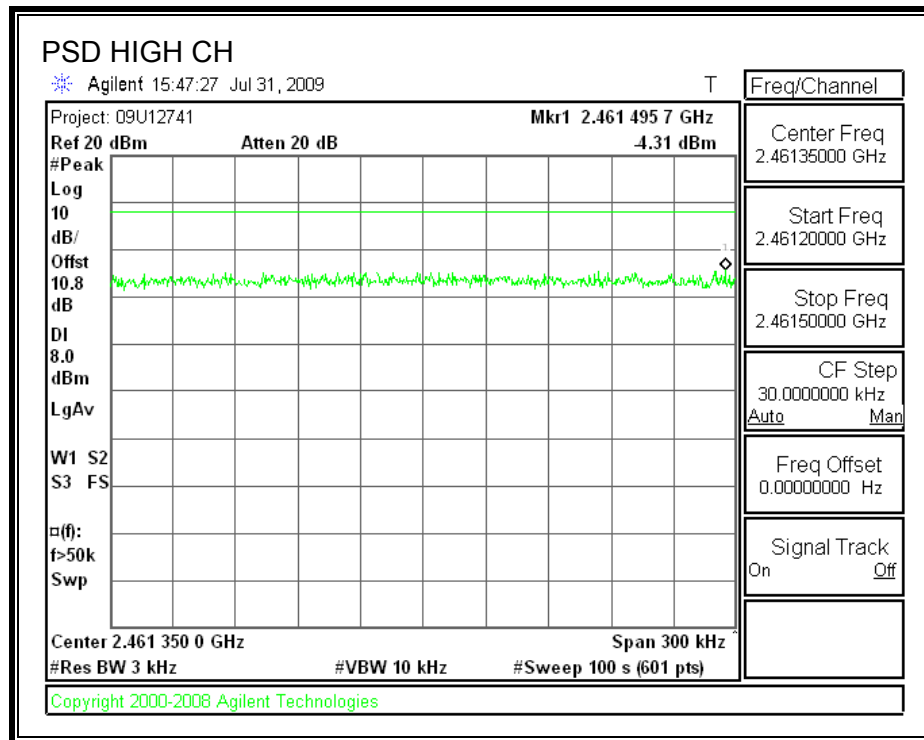
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-3.72	8	-11.72
Middle	2437	-4.01	8	-12.01
High	2462	-4.31	8	-12.31

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.

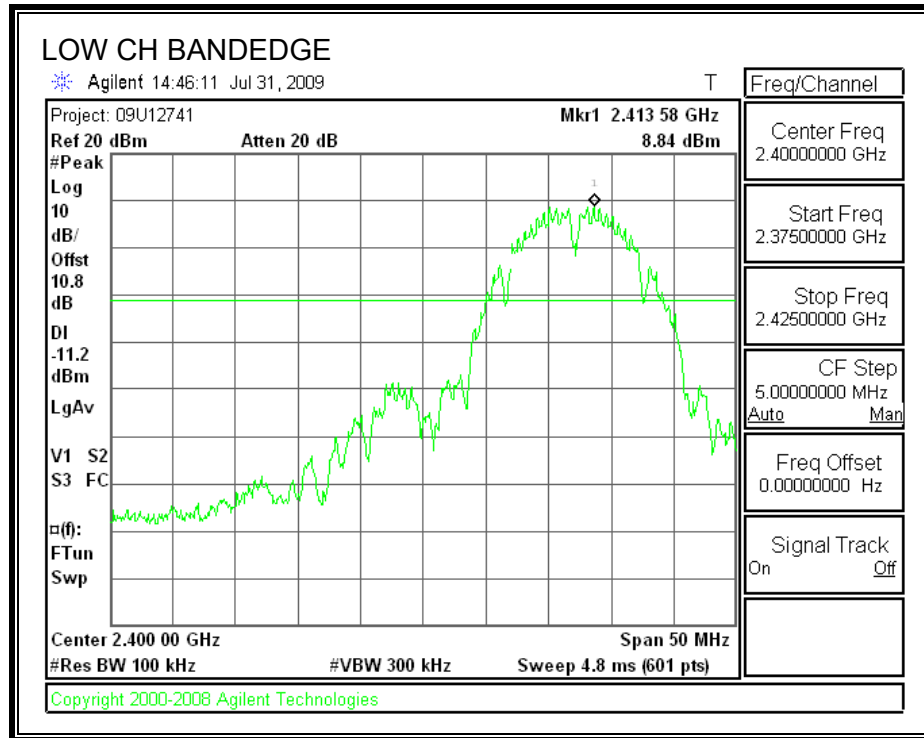
TEST PROCEDURE

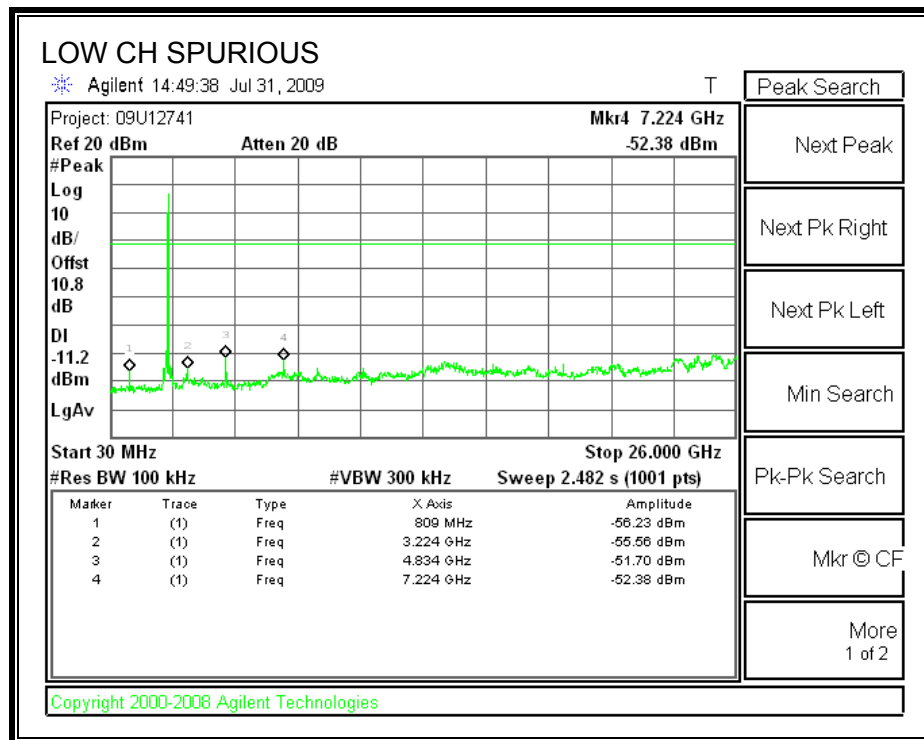
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

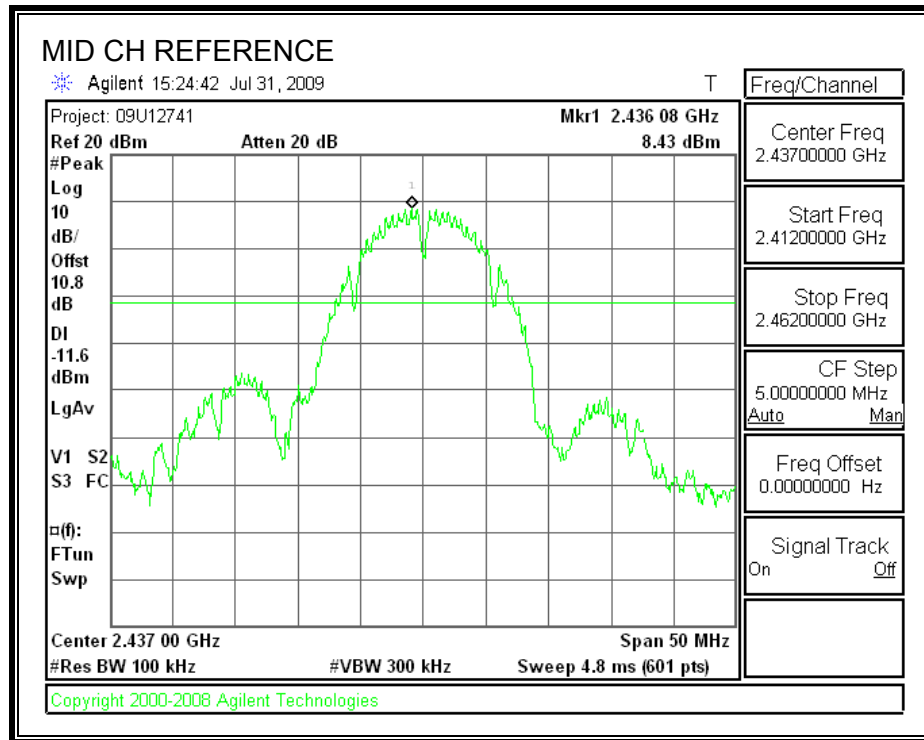
RESULTS

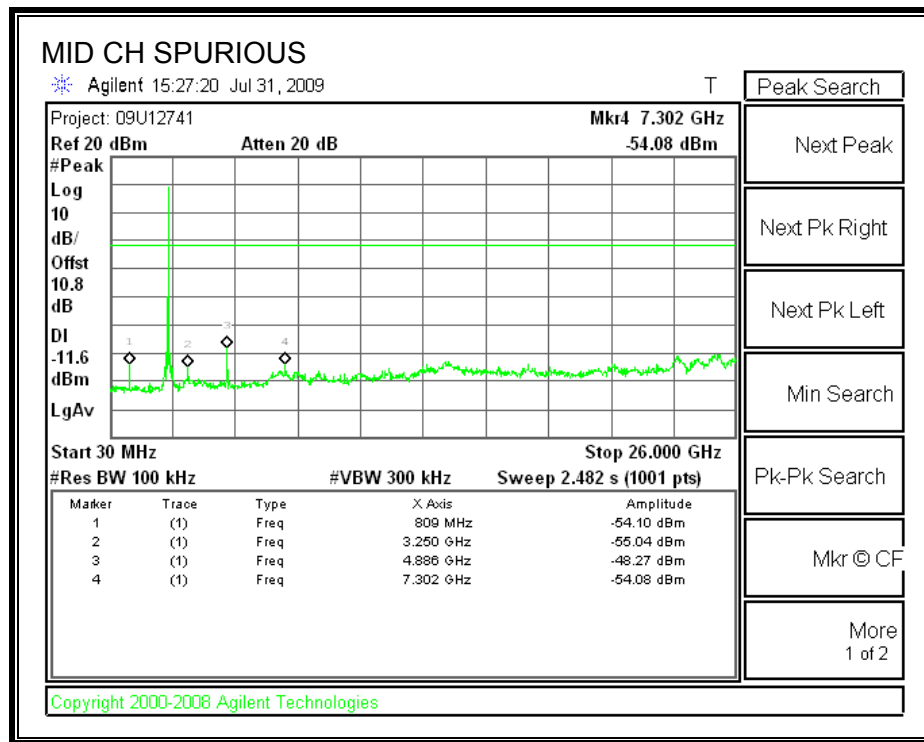
SPURIOUS EMISSIONS, LOW CHANNEL



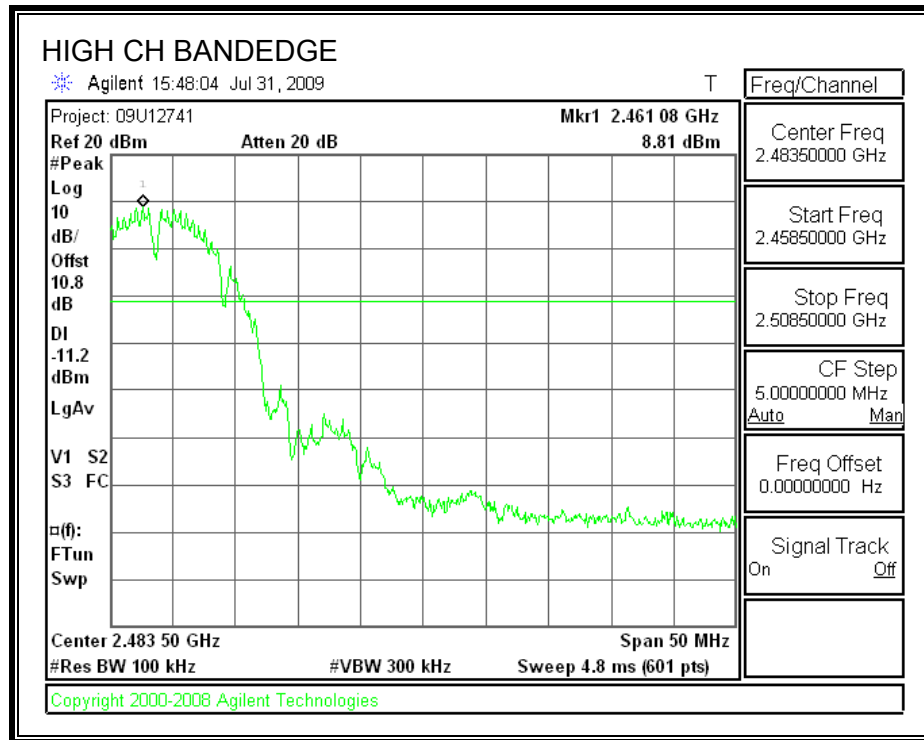


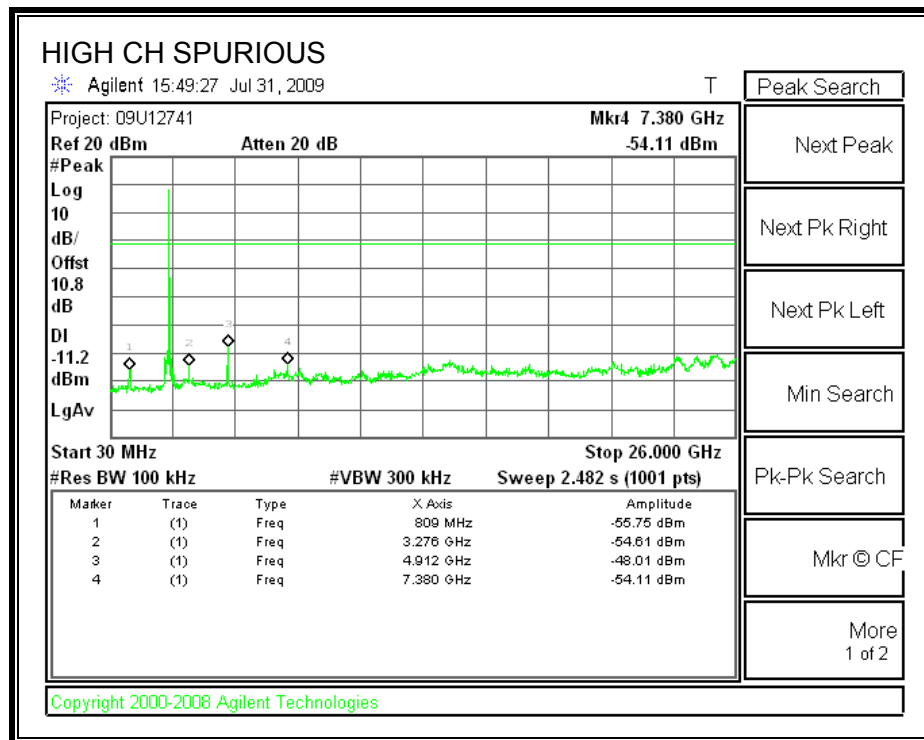
SPURIOUS EMISSIONS, MID CHANNEL





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.

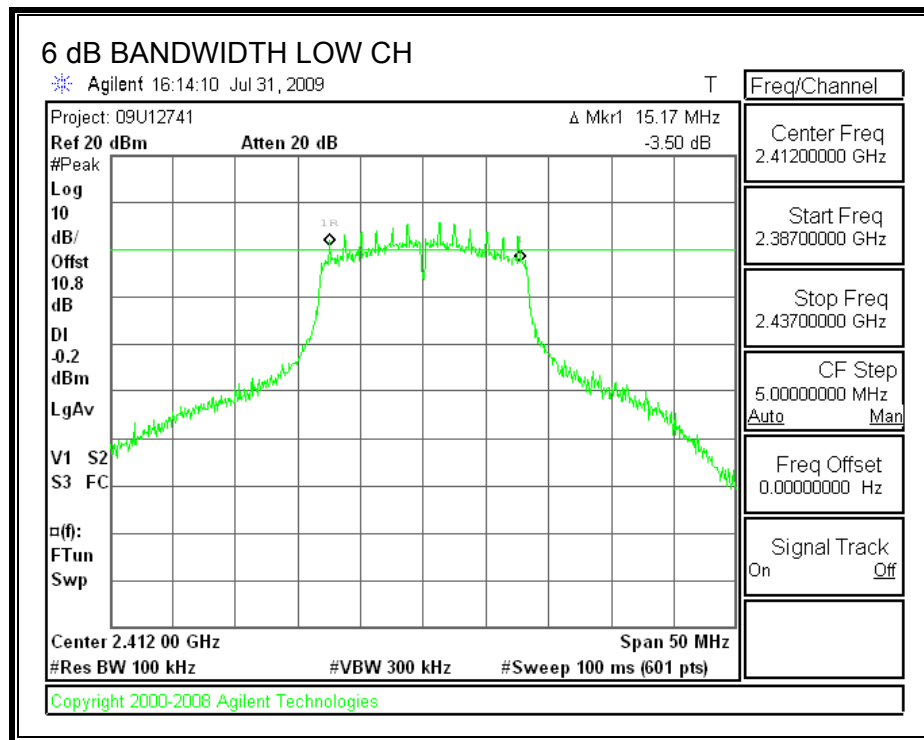
TEST PROCEDURE

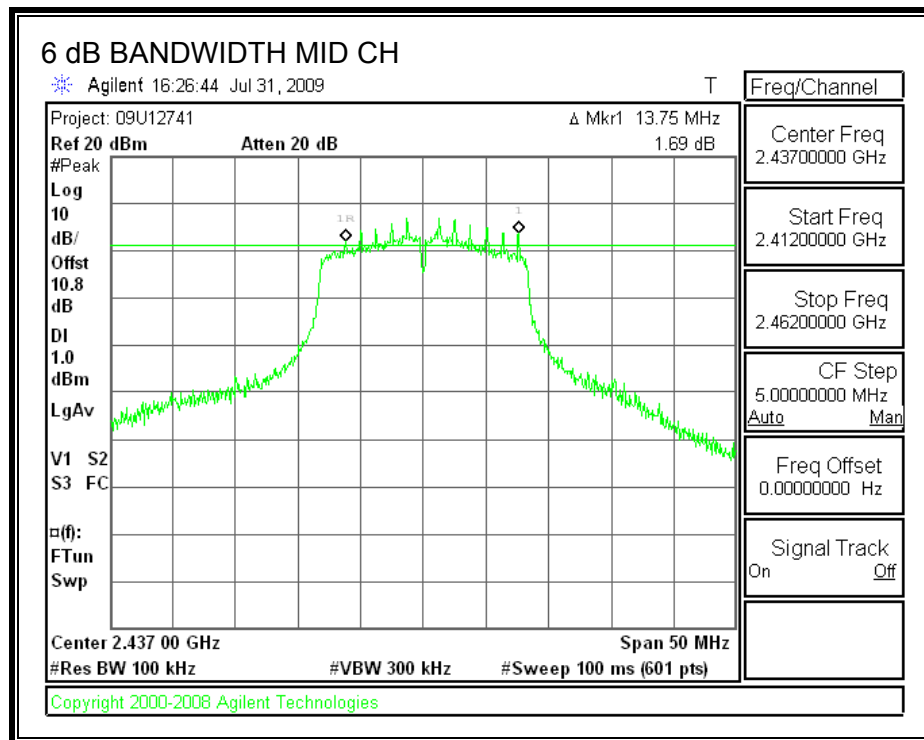
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

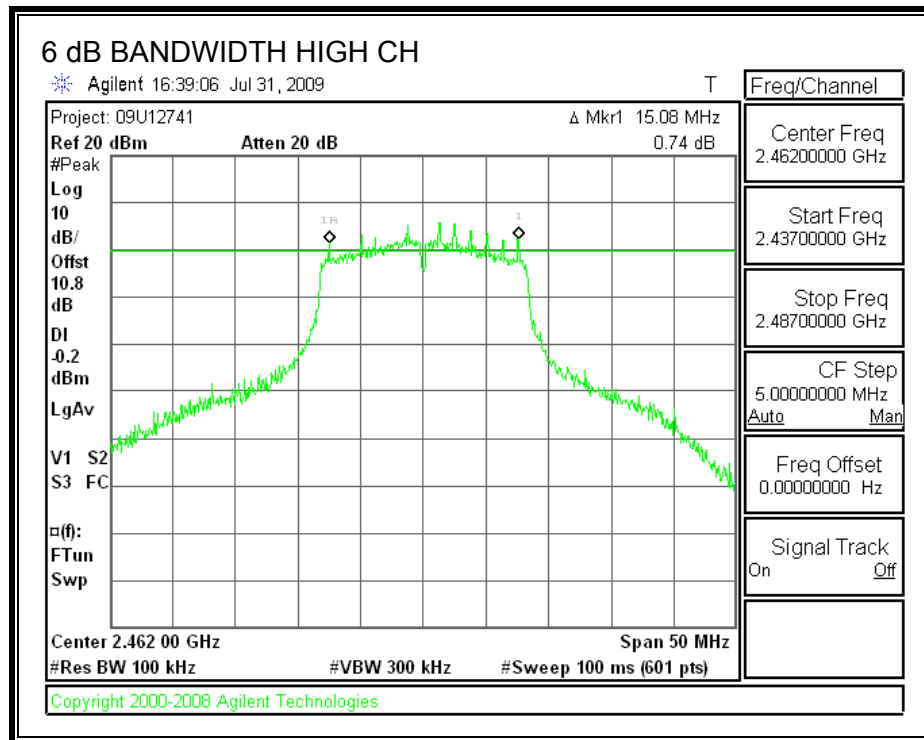
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	15.17	0.5
Middle	2437	13.75	0.5
High	2462	15.08	0.5

6 dB BANDWIDTH







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

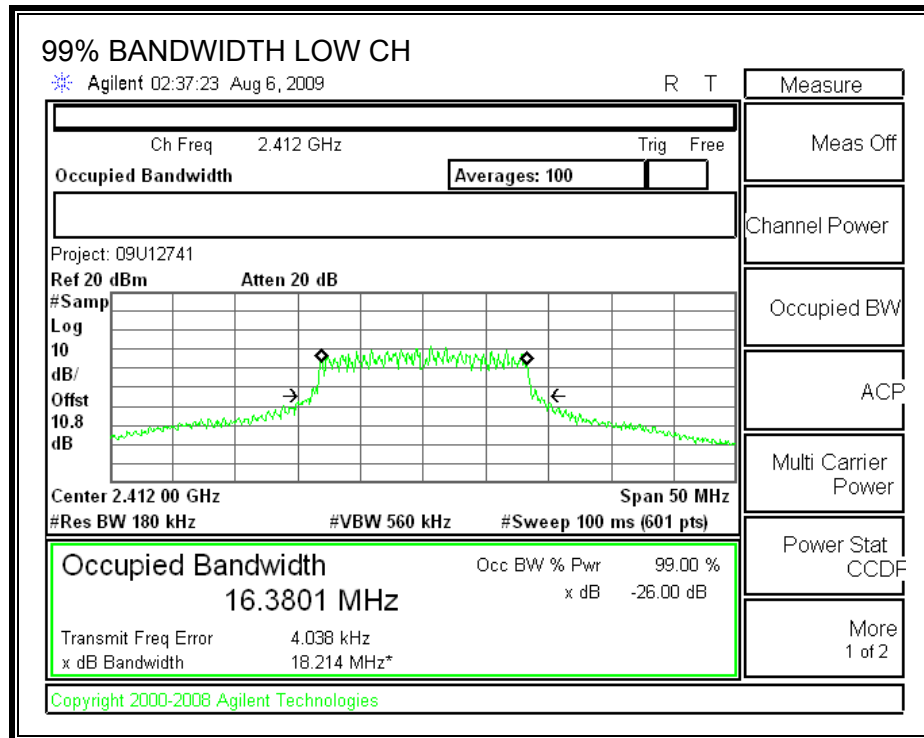
TEST PROCEDURE

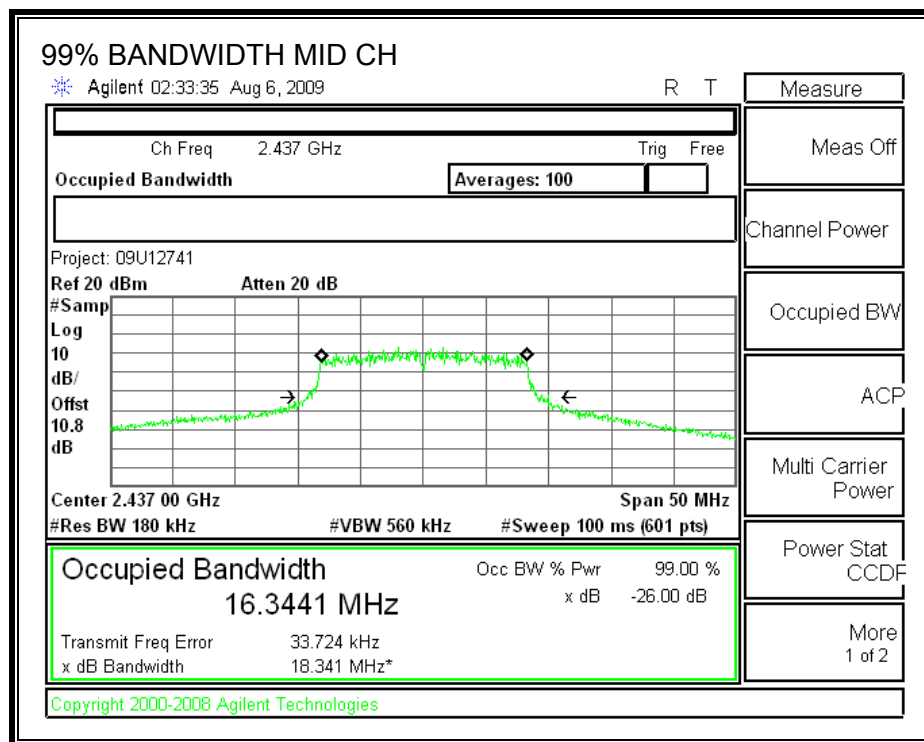
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

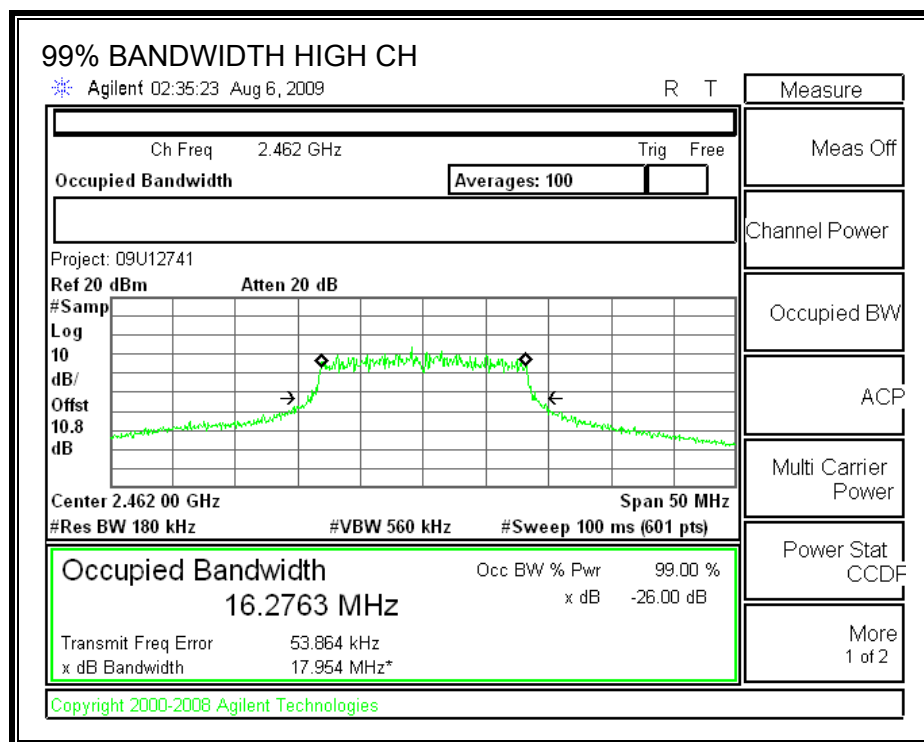
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.3801
Middle	2437	16.3441
High	2462	16.2763

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.

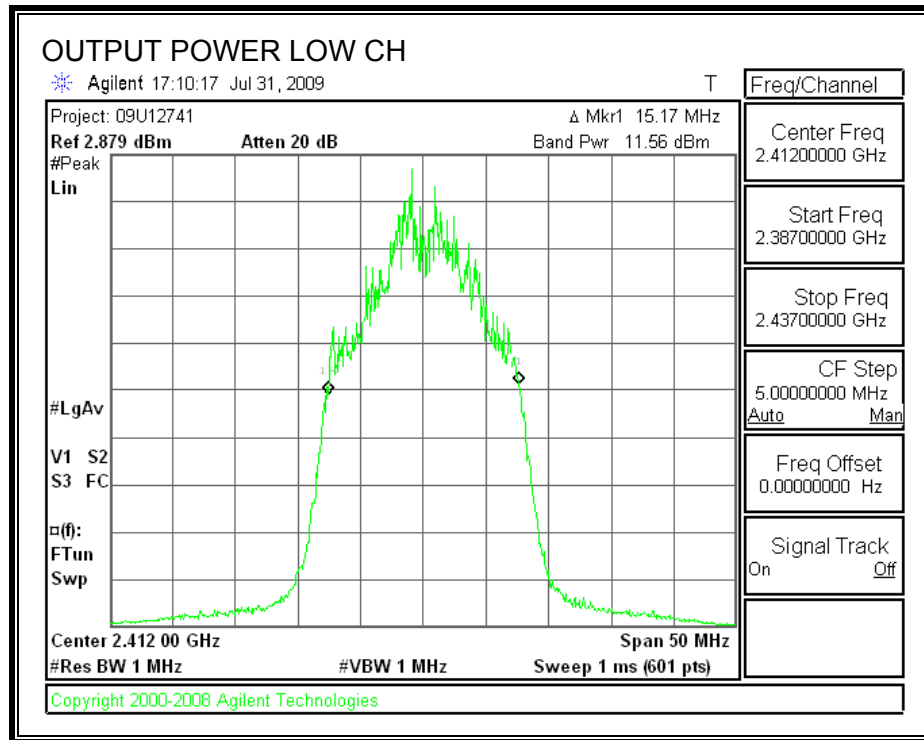
TEST PROCEDURE

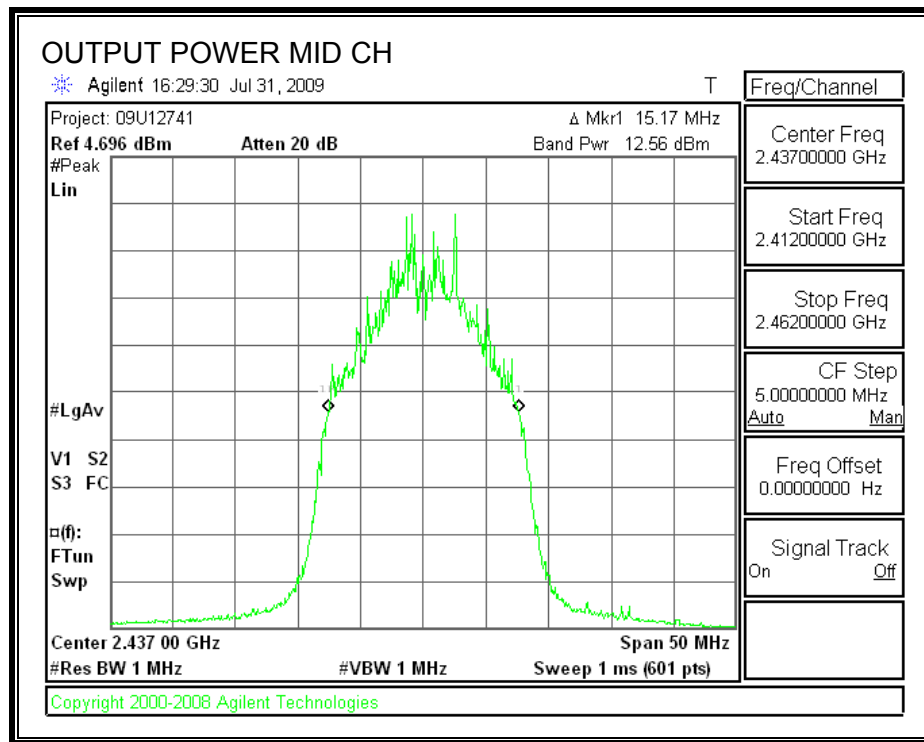
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

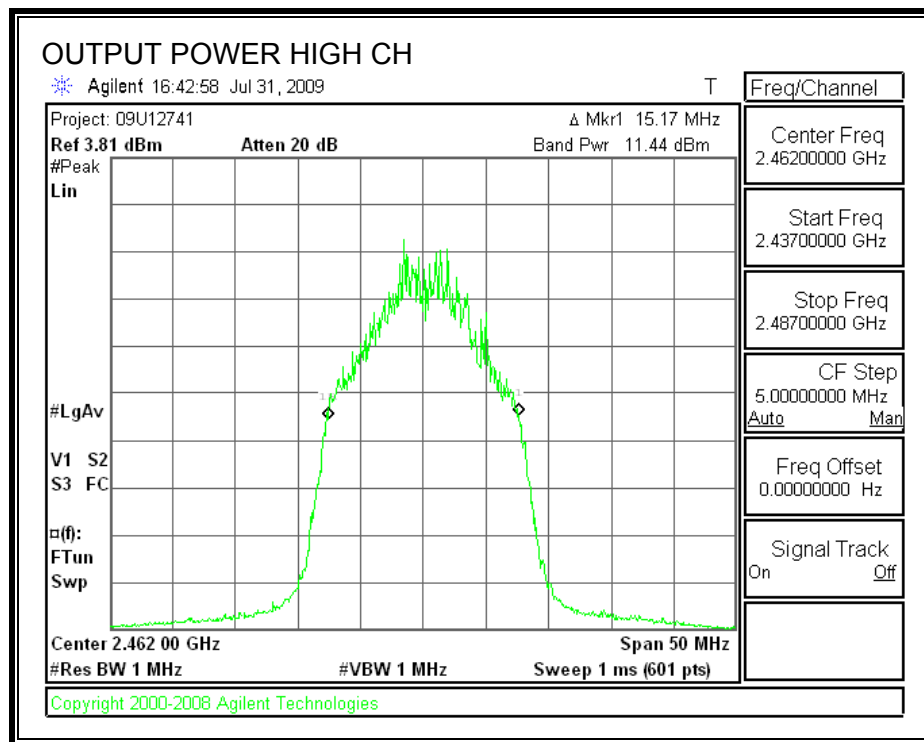
RESULTS

Channel	Frequency (MHz)	Spectrum Analyzer Reading (dBm)	Attenuator and Cable Offset (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	11.56	10.8	22.36	30	-7.64
Middle	2437	12.56	10.8	23.36	30	-6.64
High	2462	11.44	10.8	22.24	30	-7.76

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 10.8 dB (including 10 dB pad and 0.8 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	14.10
Middle	2437	15.10
High	2462	14.00

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.

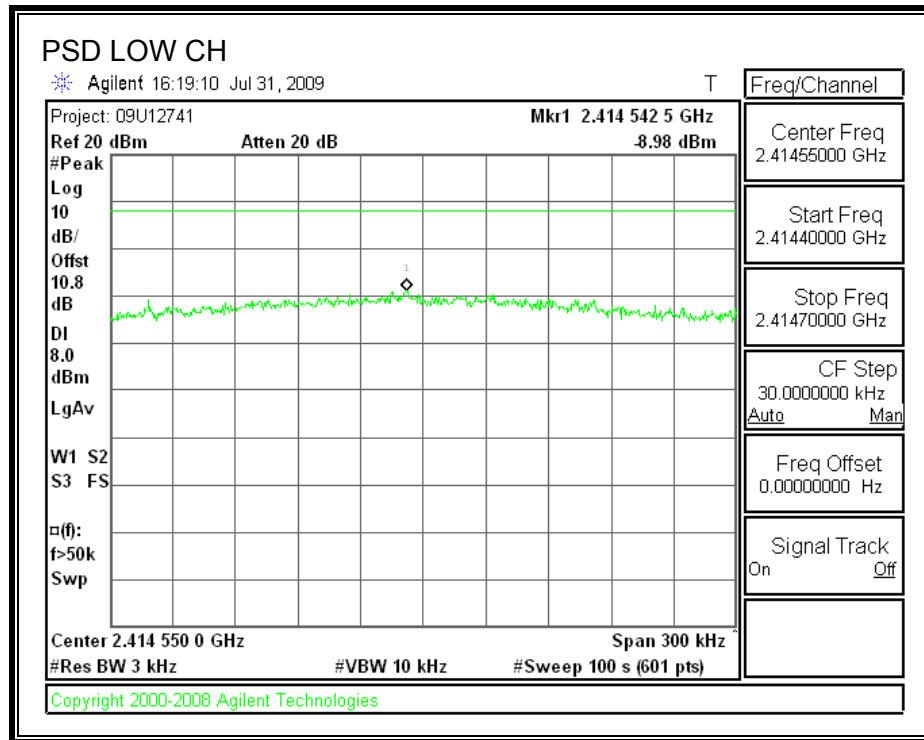
TEST PROCEDURE

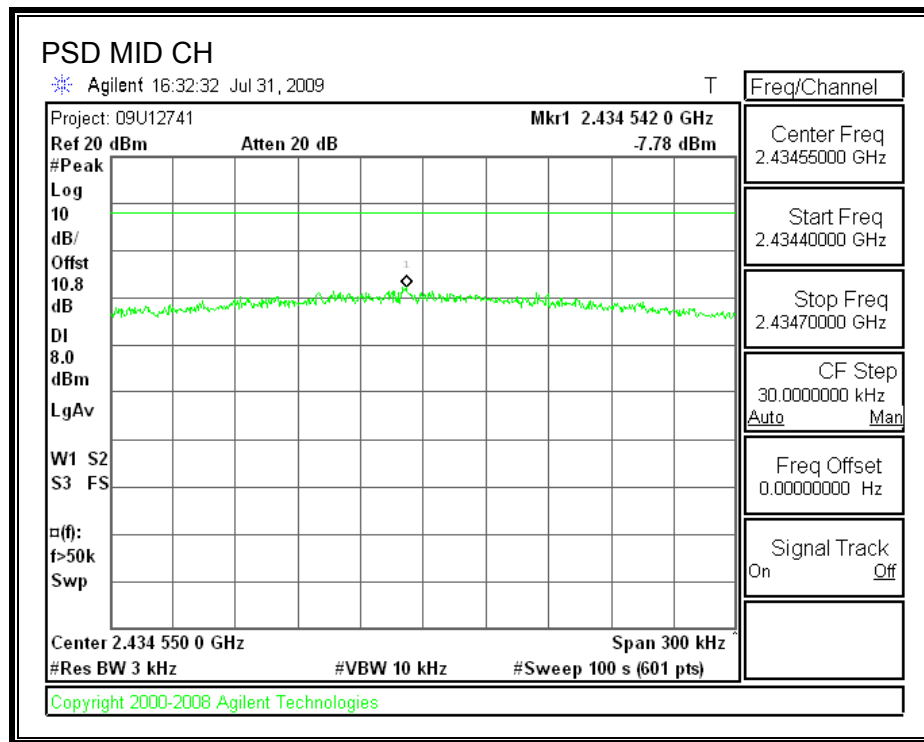
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

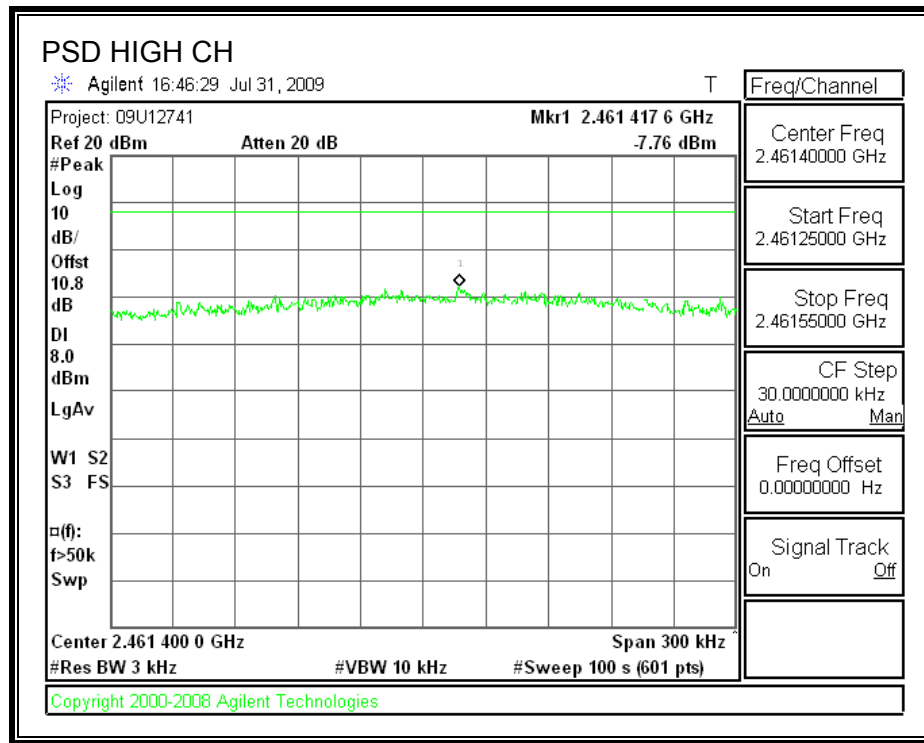
RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.98	8	-16.98
Middle	2437	-7.78	8	-15.78
High	2462	-7.76	8	-15.76

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.

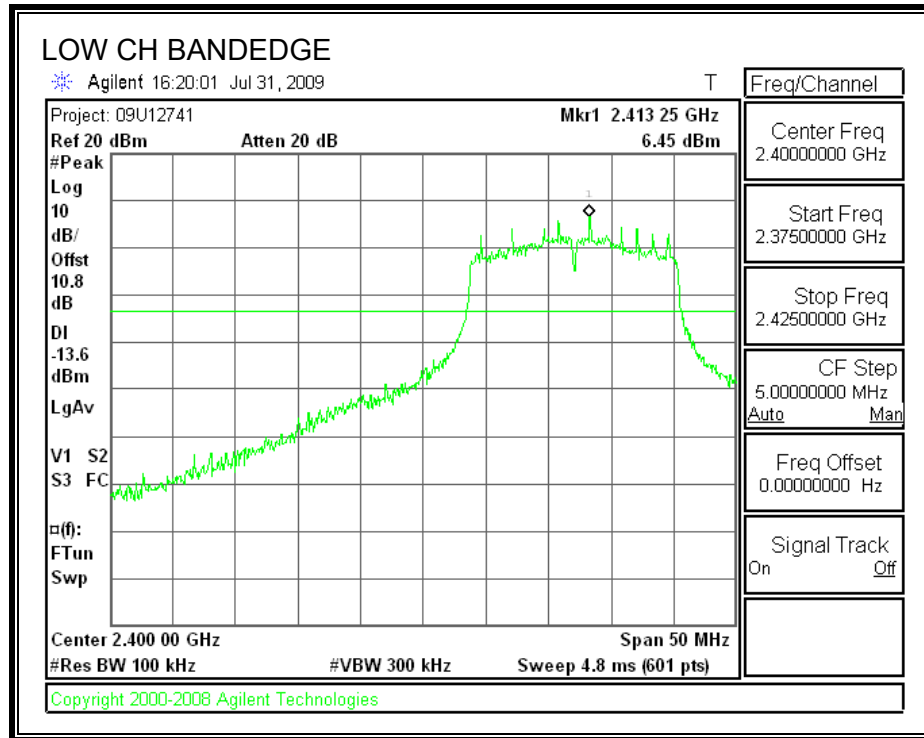
TEST PROCEDURE

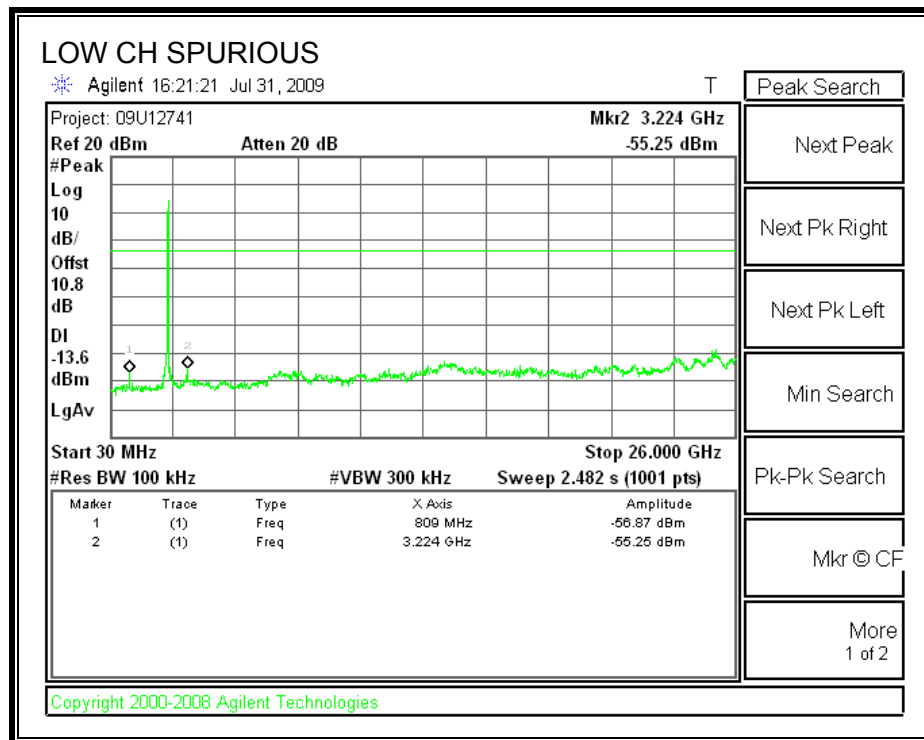
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The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

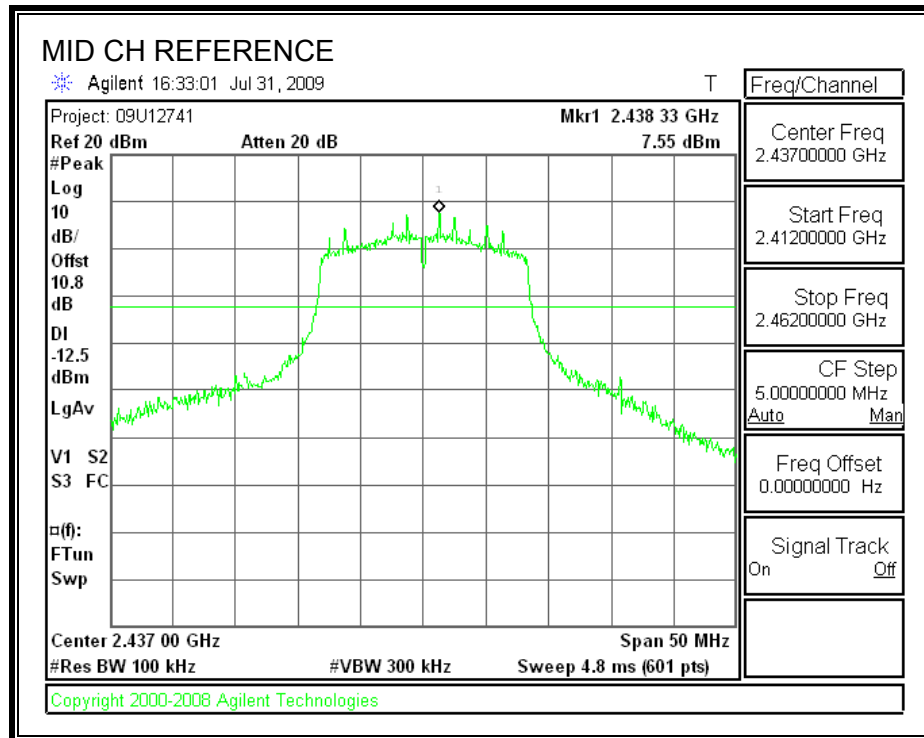
RESULTS

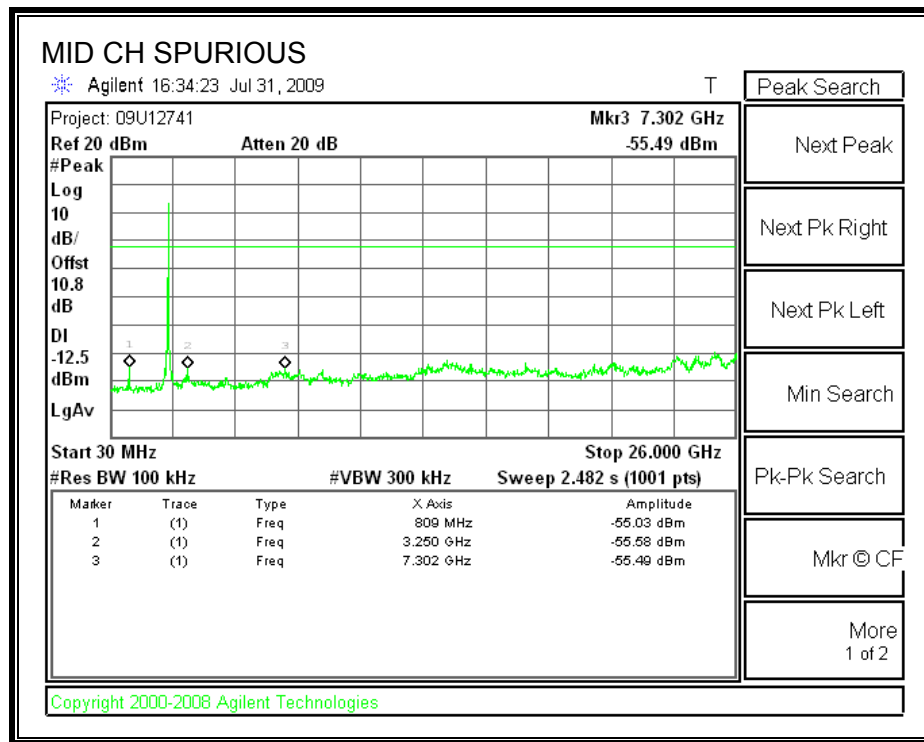
SPURIOUS EMISSIONS, LOW CHANNEL



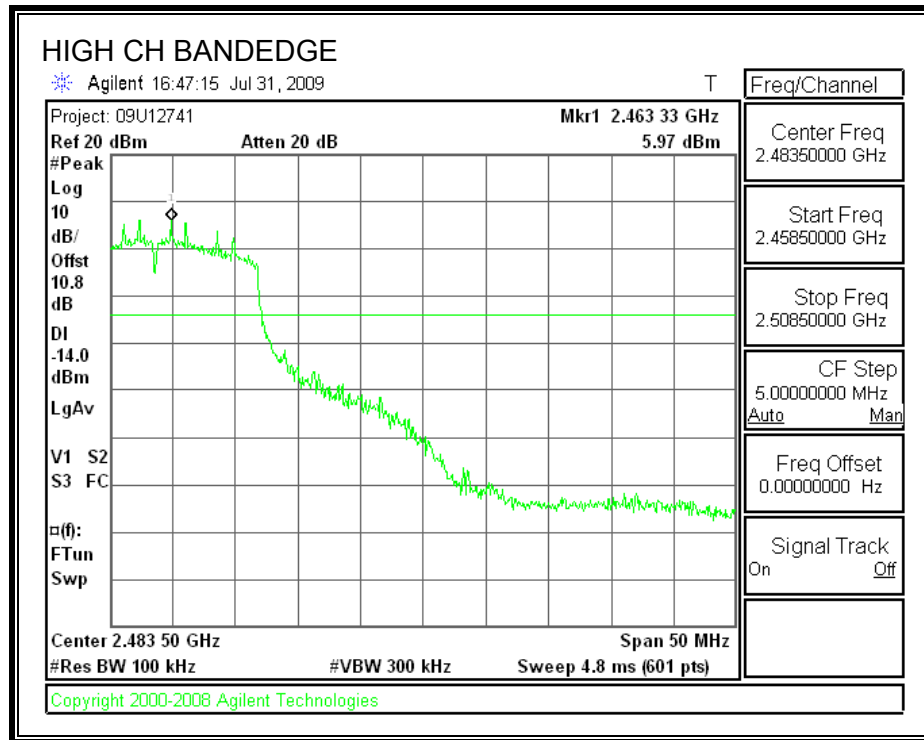


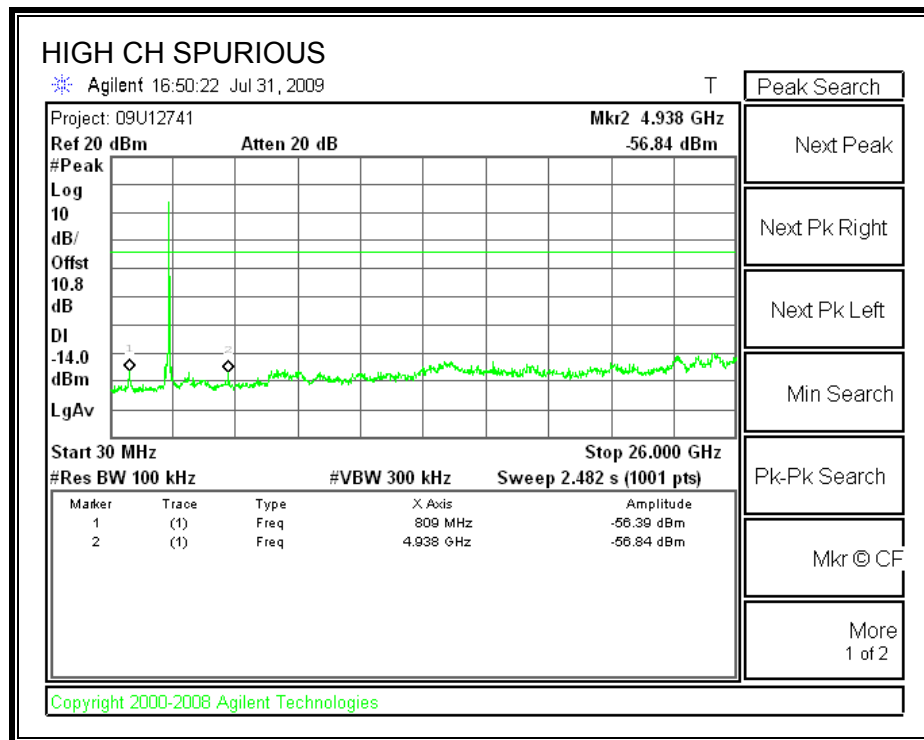
SPURIOUS EMISSIONS, MID CHANNEL





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.

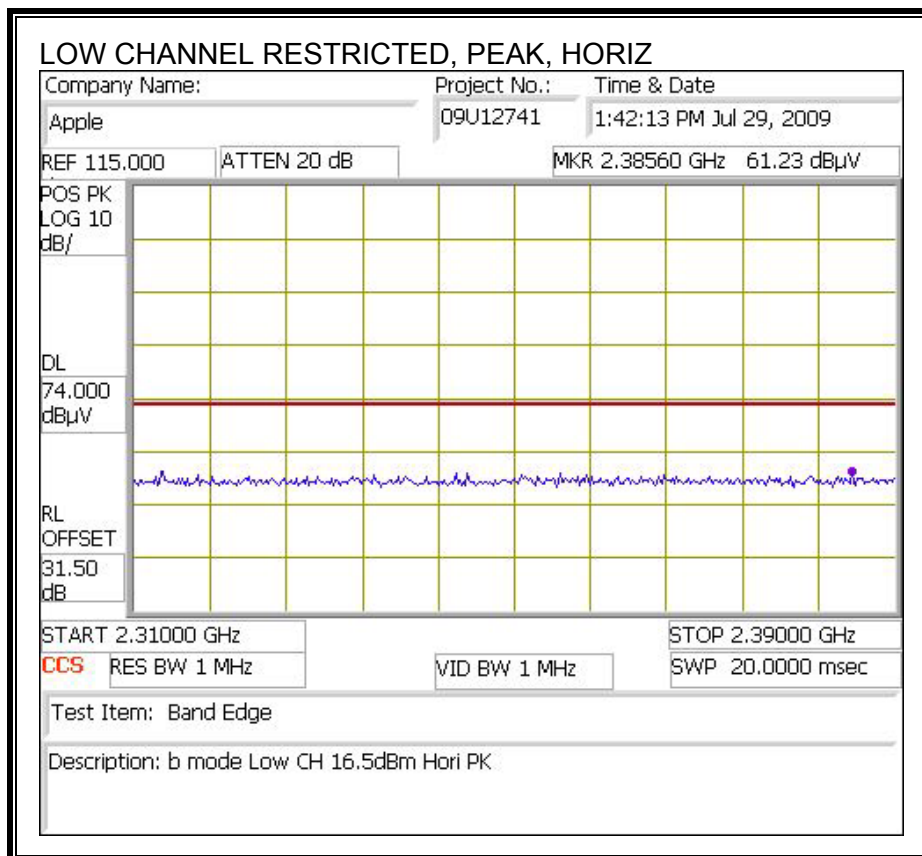
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

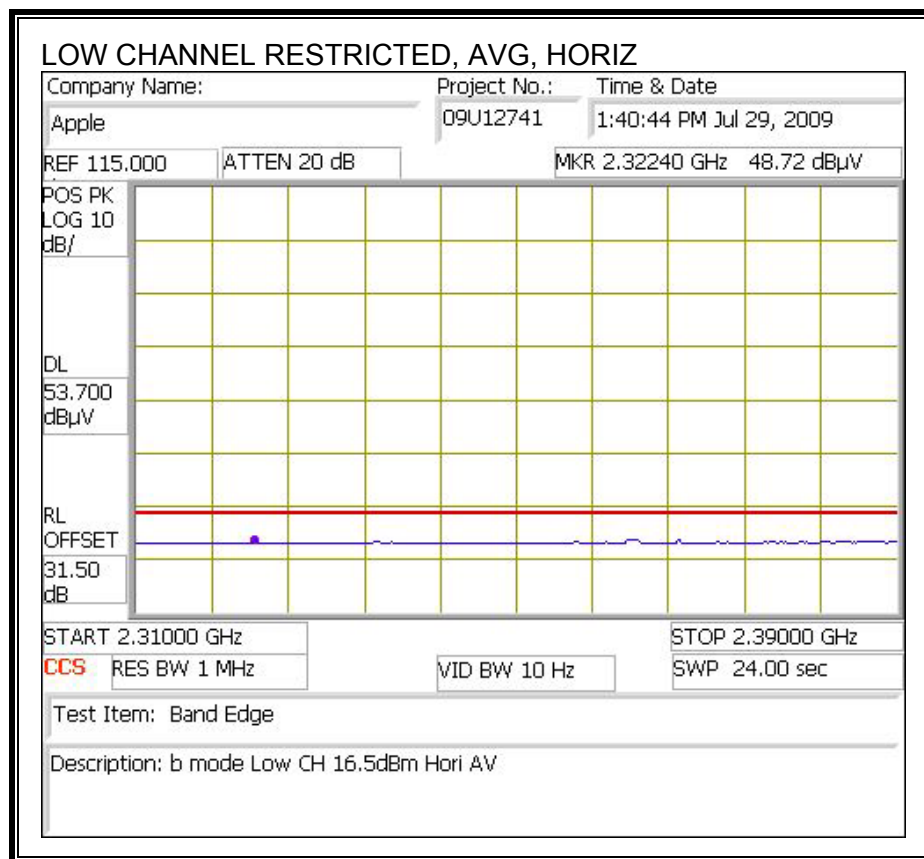
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

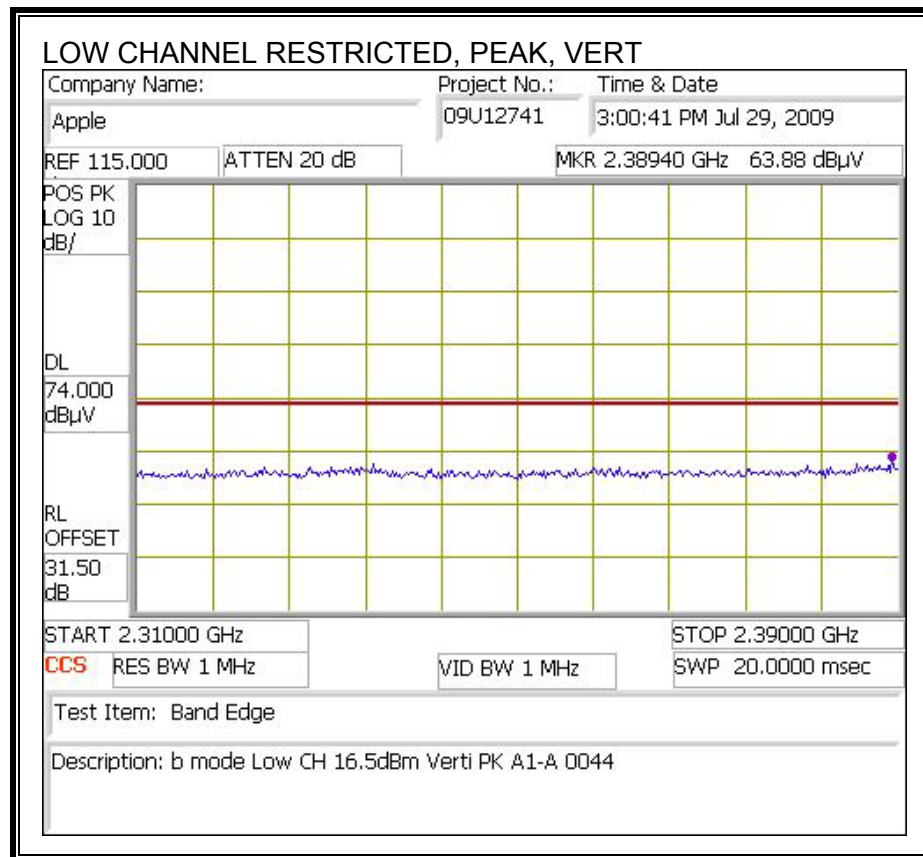
8.2.1. TX ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

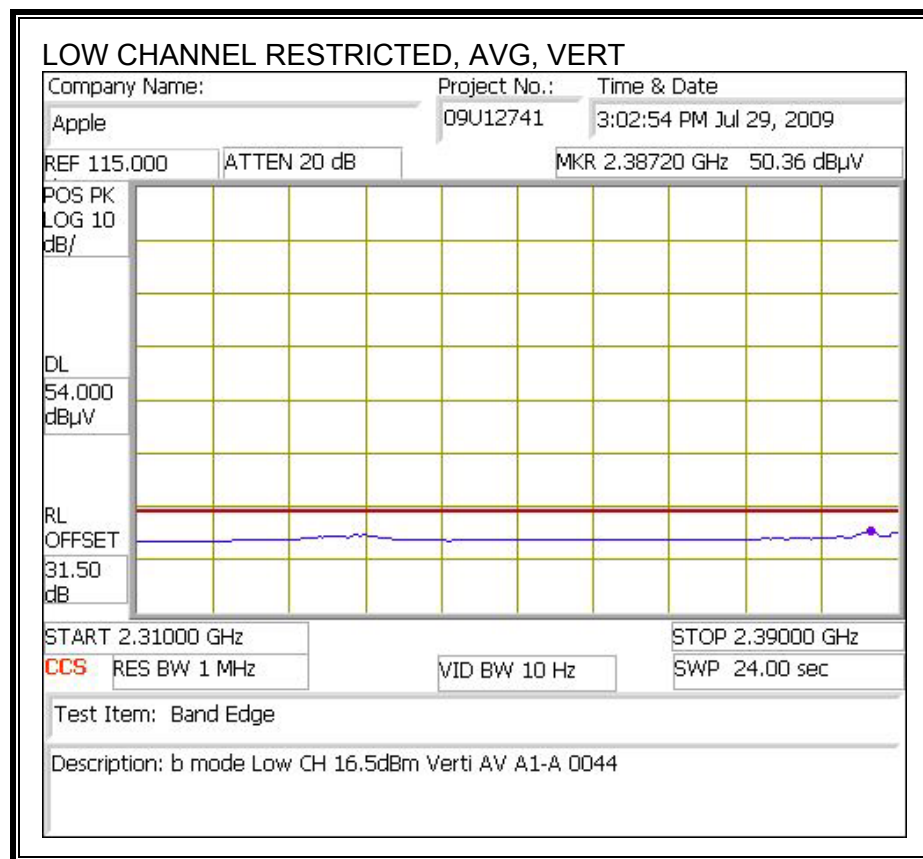
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



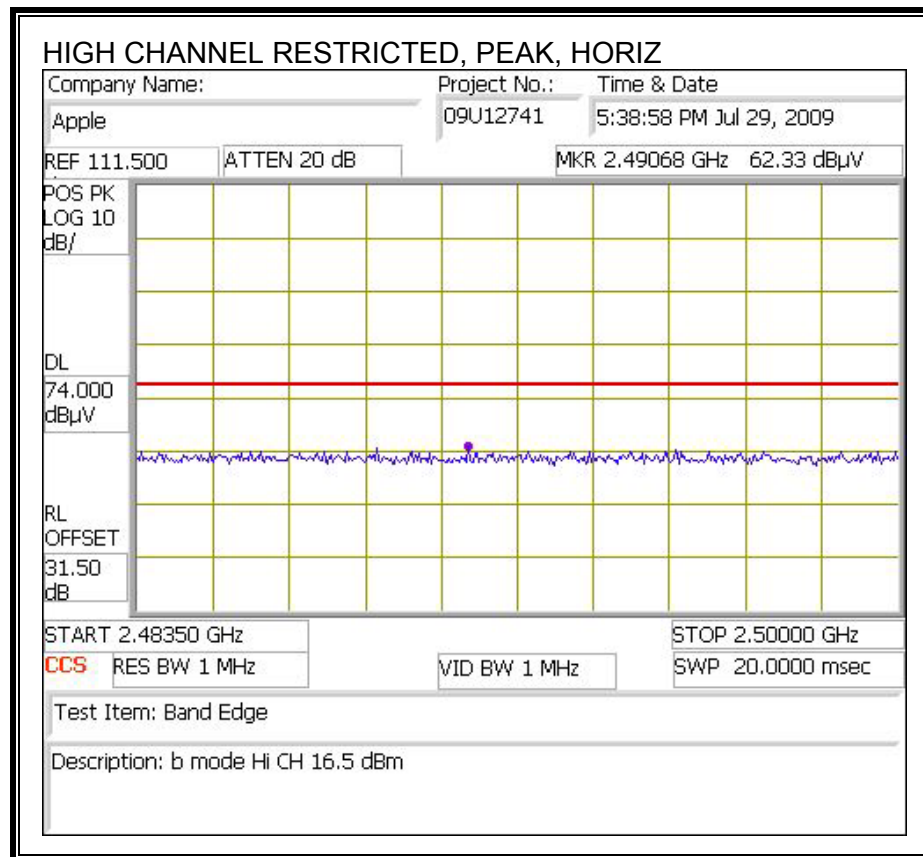


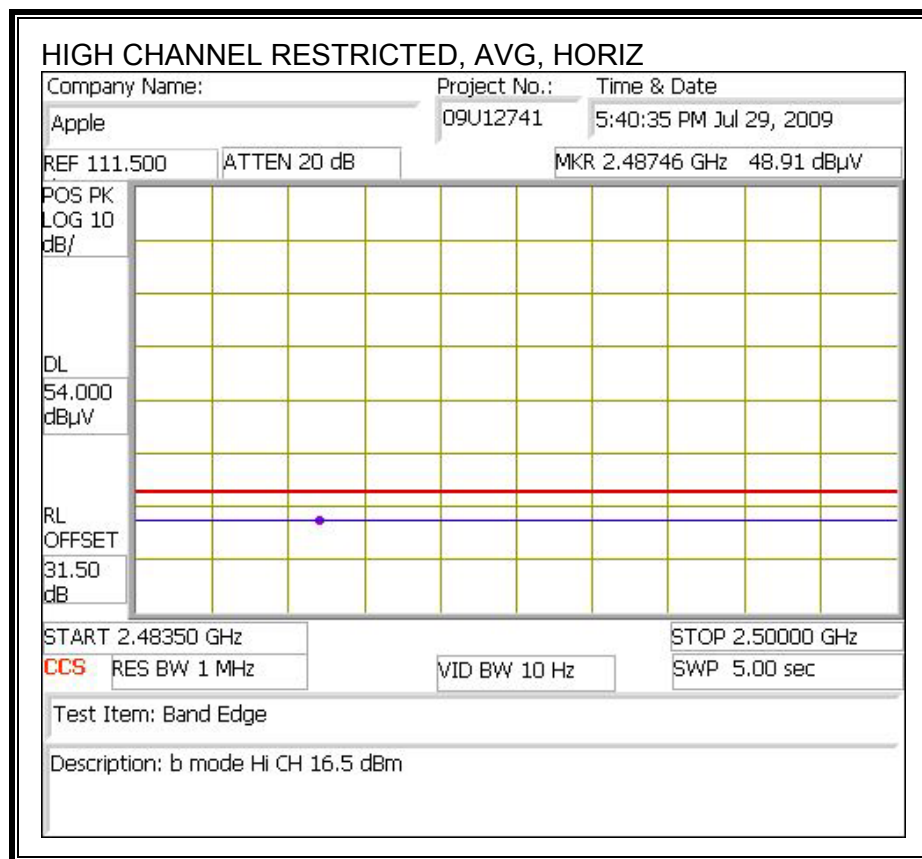
RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)



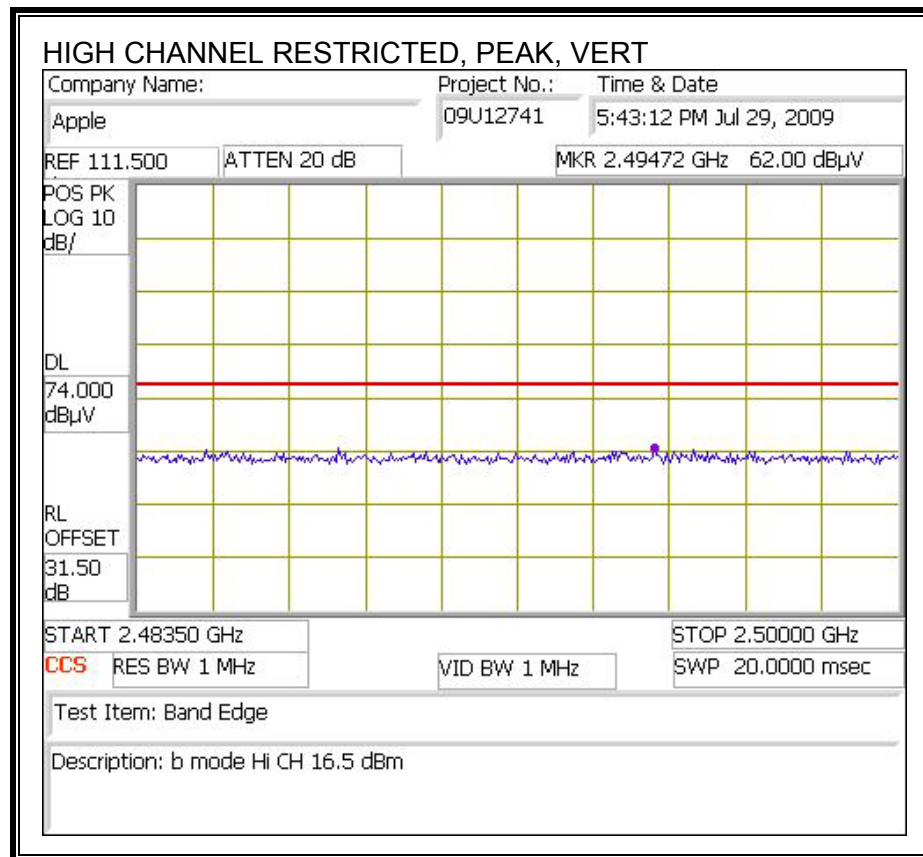


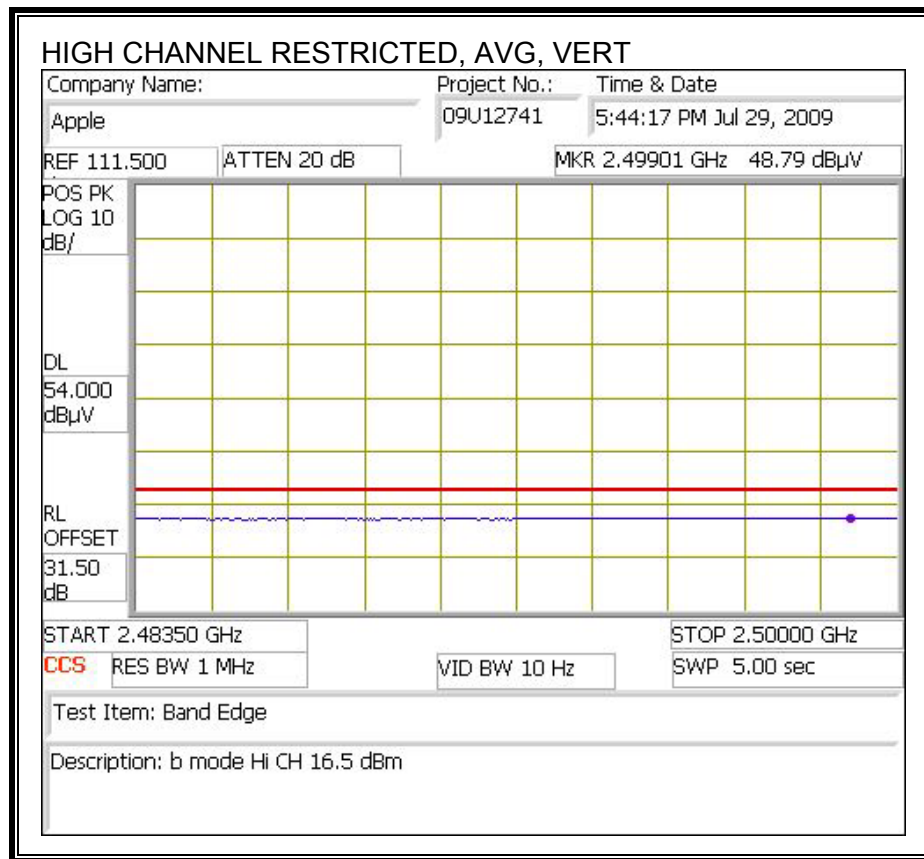
RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 07/30/09
Project #: 09U12741
Company: Apple Inc.
EUT Description: TBD
EUT M/N: EUT only
Test Target: FCC Class B
Mode Oper: Test mode TX, b mode

f	Measurement Frequency	Amp	Preamplifier 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	

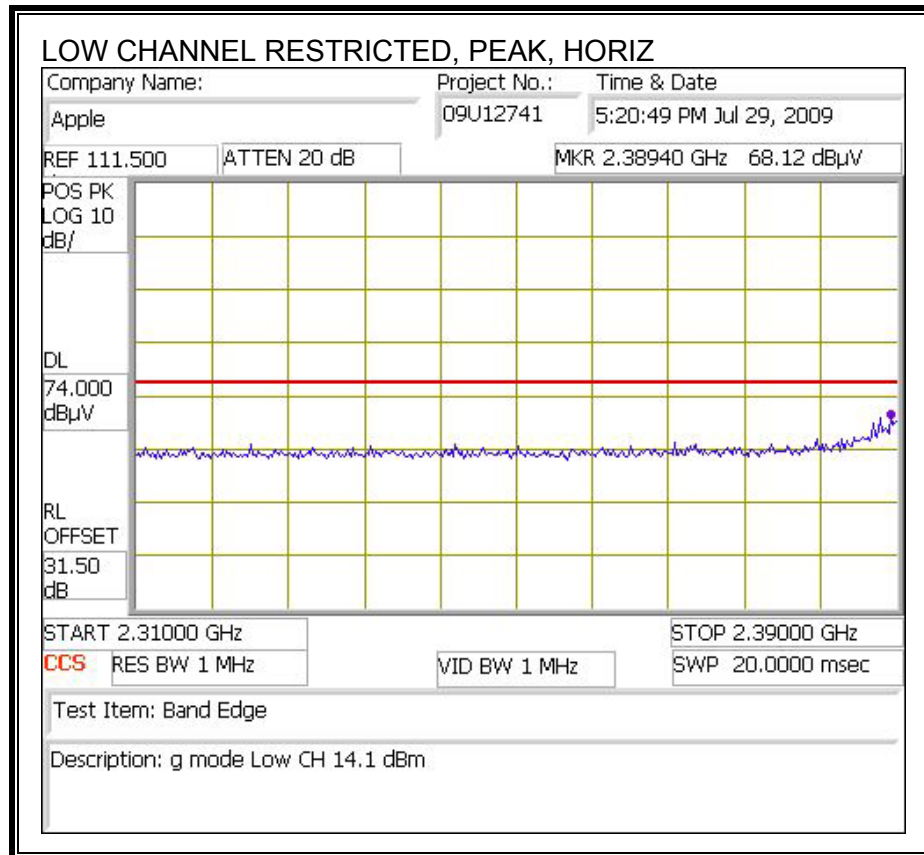
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fldr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
b mode 2412															
4.824	3.0	39.8	32.7	5.8	-34.8	0.0	0.0	43.4	74.0	-30.6	V	P	100.0	191.0	16.5 dBm
4.824	3.0	34.1	32.7	5.8	-34.8	0.0	0.0	37.8	54.0	-16.2	V	A	100.0	191.0	16.5 dBm
b mode 2412															
7.236	3.0	39.4	35.4	7.2	-34.1	0.0	0.0	47.8	74.0	-26.2	V	P	99.0	191.0	16.5 dBm
7.236	3.0	31.3	35.4	7.2	-34.1	0.0	0.0	39.8	54.0	-14.2	V	A	99.0	191.0	16.5 dBm
b mode 2412															
4.824	3.0	37.0	32.7	5.8	-34.8	0.0	0.0	40.7	74.0	-33.4	H	P	98.0	229.0	16.5 dBm
4.824	3.0	27.4	32.7	5.8	-34.8	0.0	0.0	31.0	54.0	-23.0	H	A	98.0	229.0	16.5 dBm
b mode 2412															
7.236	3.0	36.1	35.4	7.2	-34.1	0.0	0.0	44.6	74.0	-29.4	H	P	99.0	229.0	16.5 dBm
7.236	3.0	22.9	35.4	7.2	-34.1	0.0	0.0	31.4	54.0	-22.6	H	A	99.0	229.0	16.5 dBm
b mode 2412															
4.824	3.0	39.7	32.7	5.8	-34.8	0.0	0.0	43.3	74.0	-30.7	V	P	99.0	191.0	16.5 dBm
4.824	3.0	33.3	32.7	5.8	-34.8	0.0	0.0	36.9	54.0	-17.1	V	A	99.0	191.0	16.5 dBm
b mode 2437															
4.874	3.0	41.4	32.7	5.8	-34.8	0.0	0.0	45.1	74.0	-28.9	V	P	121.0	151.0	16.5 dBm
4.874	3.0	37.1	32.7	5.8	-34.8	0.0	0.0	40.9	54.0	-13.1	V	A	121.0	151.0	16.5 dBm
b mode 2437															
4.874	3.0	38.6	32.7	5.8	-34.8	0.0	0.0	42.3	74.0	-31.7	H	P	191.0	206.0	16.5 dBm
4.874	3.0	31.4	32.7	5.8	-34.8	0.0	0.0	35.2	54.0	-18.8	H	A	191.0	206.0	16.5 dBm
b mode 2462															
4.924	3.0	38.7	32.7	5.9	-34.8	0.0	0.0	42.5	74.0	-31.5	H	P	100.0	287.0	16.5 dBm
4.924	3.0	31.8	32.7	5.9	-34.8	0.0	0.0	35.6	54.0	-18.4	H	A	100.0	287.0	16.5 dBm
b mode 2462															
4.924	3.0	41.5	32.7	5.9	-34.8	0.0	0.0	45.3	74.0	-28.7	V	P	120.0	149.0	16.5 dBm
4.924	3.0	37.4	32.7	5.9	-34.8	0.0	0.0	41.2	54.0	-12.8	V	A	120.0	149.0	16.5 dBm

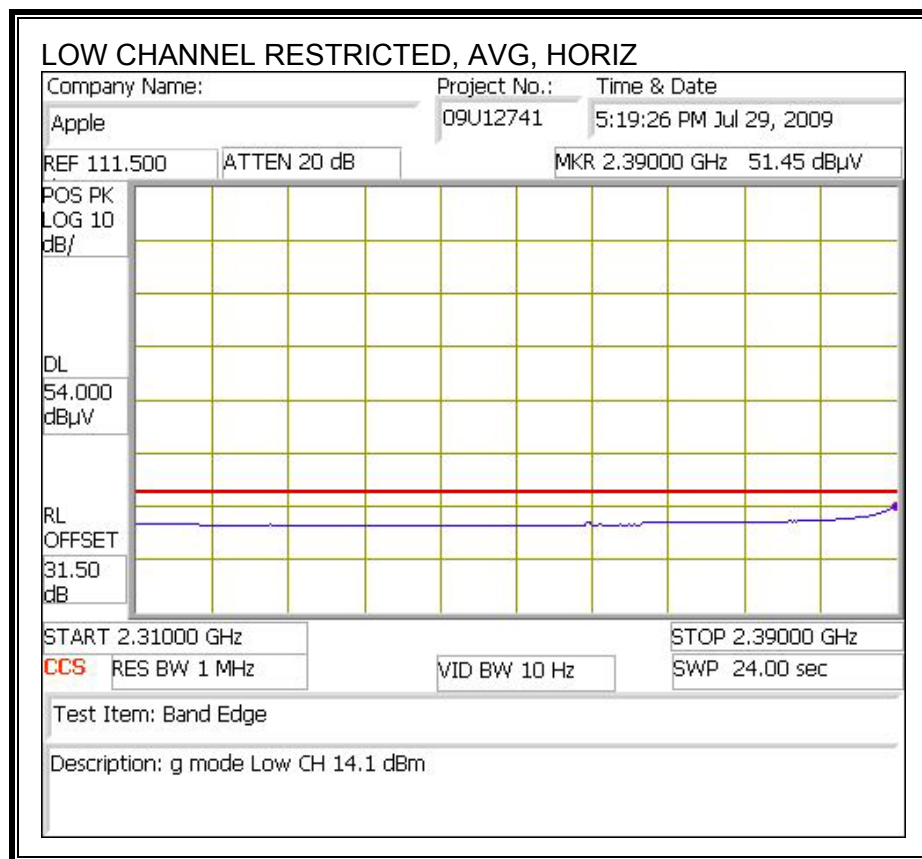
Rev. 4.1.2.7

Note: No other emissions were detected above the system noise floor.

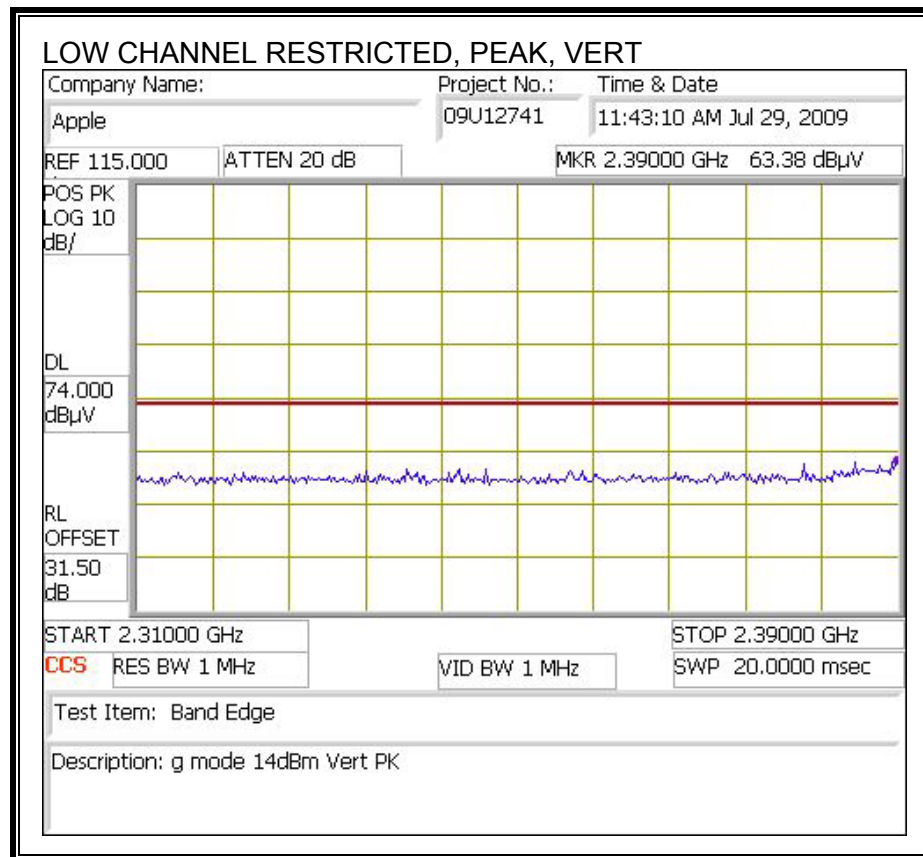
8.2.2. TX ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

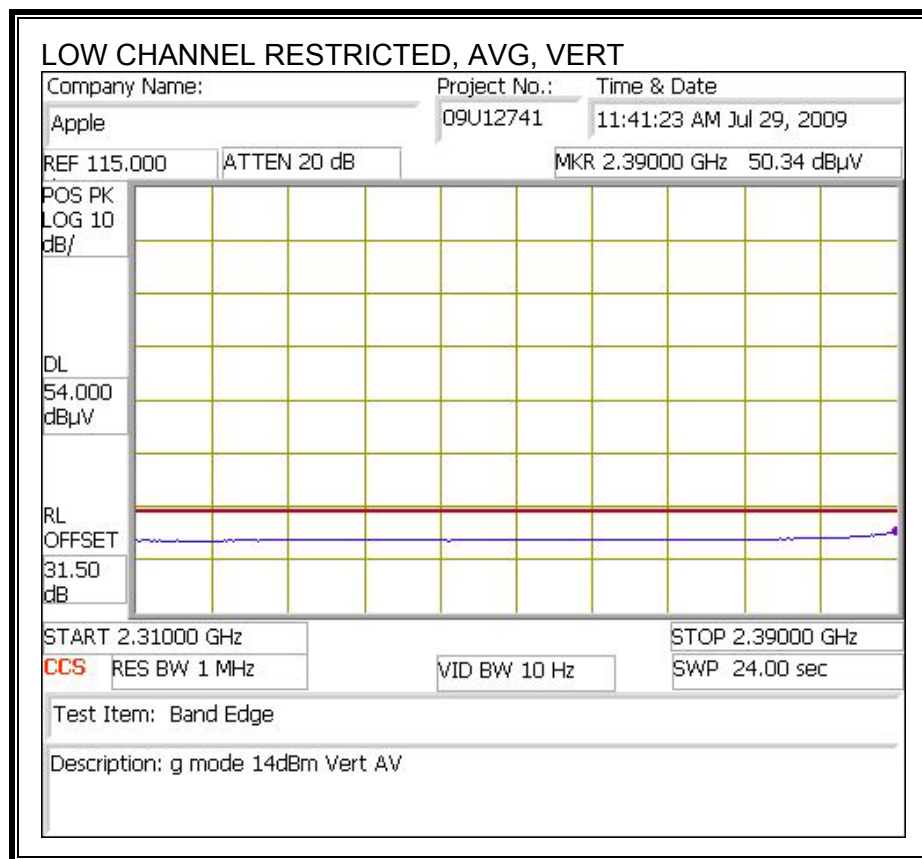
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



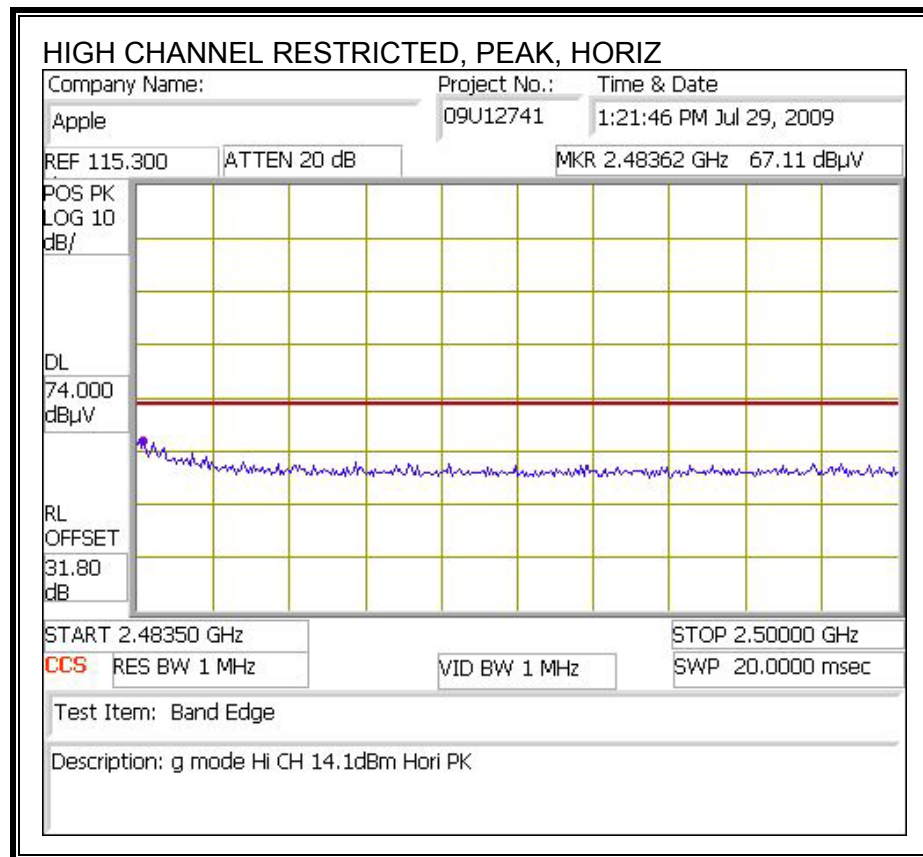


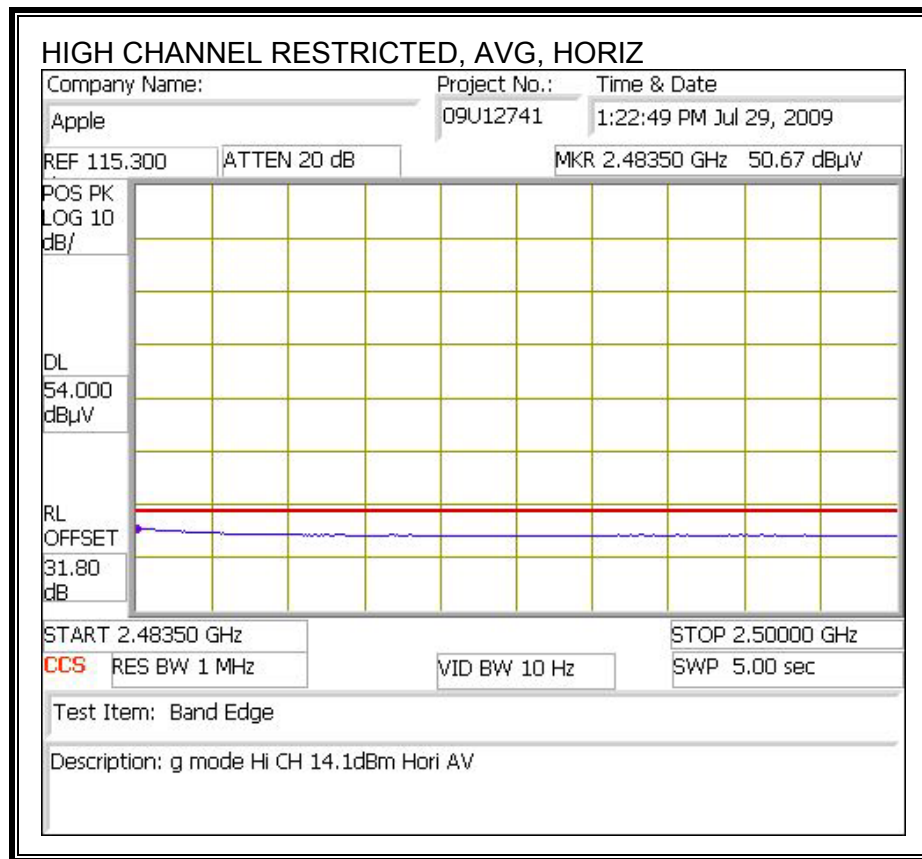
RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)



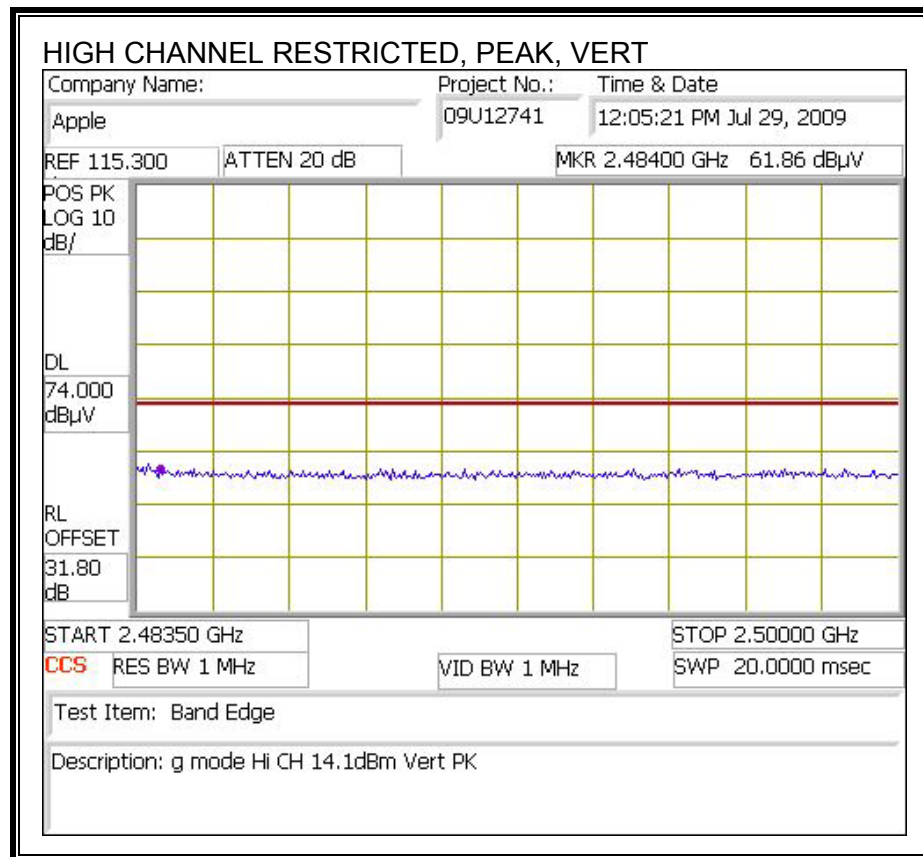


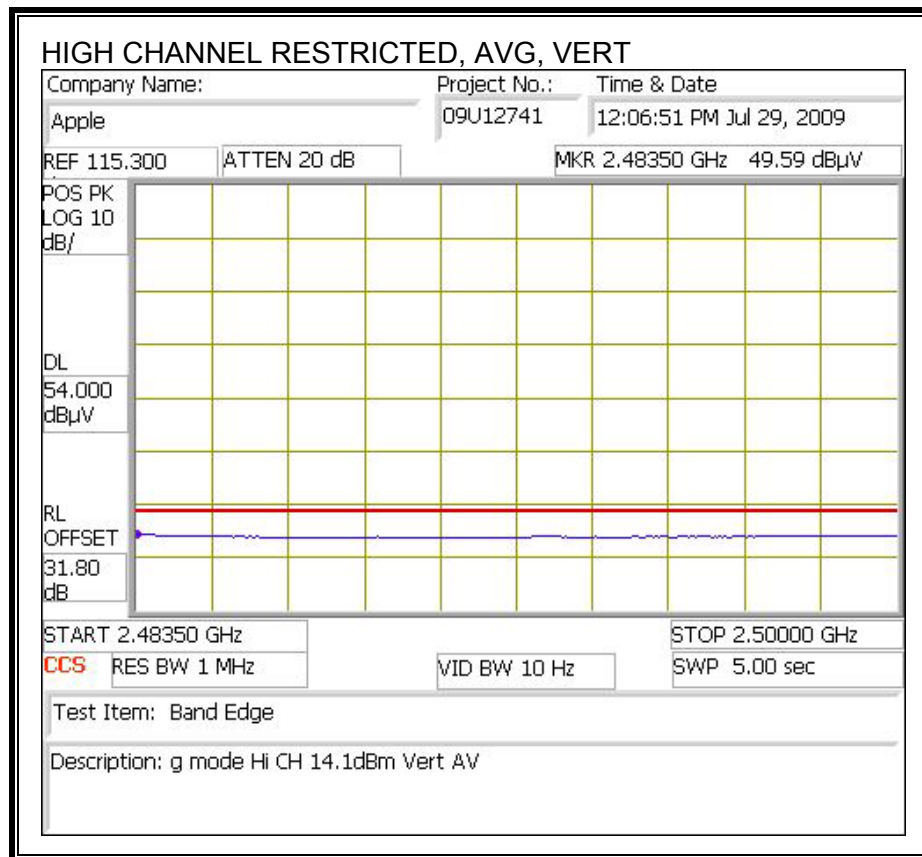
RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 07/30/09
Project #: 09U12741
Company: Apple Inc.
EUT Description: TBD
EUT M/N: EUT only
Test Target: FCC Class B
Mode Oper: Test mode 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 GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fctr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
g mode 2412															
4.824	3.0	37.4	32.7	5.8	-34.8	0.0	0.0	41.0	74.0	-33.0	V	P	100.0	246.0	14.1 dBm
4.824	3.0	23.8	32.7	5.8	-34.8	0.0	0.0	27.4	54.0	-26.6	V	A	100.0	246.0	14.1 dBm
g mode 2412															
4.824	3.0	36.1	32.7	5.8	-34.8	0.0	0.0	39.8	74.0	-34.2	H	P	100.0	328.0	14.1 dBm
4.824	3.0	23.9	32.7	5.8	-34.8	0.0	0.0	27.5	54.0	-26.5	H	A	100.0	328.0	14.1 dBm
g mode 2437															
4.874	3.0	36.4	32.7	5.8	-34.8	0.0	0.0	40.1	74.0	-33.9	H	P	100.0	312.0	14.1 dBm
4.874	3.0	24.3	32.7	5.8	-34.8	0.0	0.0	28.1	54.0	-26.0	H	A	100.0	312.0	14.1 dBm
g mode 2437															
4.874	3.0	38.9	32.7	5.8	-34.8	0.0	0.0	42.6	74.0	-31.4	V	P	120.0	150.0	14.1 dBm
4.874	3.0	25.5	32.7	5.8	-34.8	0.0	0.0	29.3	54.0	-24.7	V	A	120.0	150.0	14.1 dBm
g mode 2462															
4.924	3.0	37.4	32.7	5.9	-34.8	0.0	0.0	41.2	74.0	-32.8	V	P	101.0	150.0	14.1 dBm
4.924	3.0	25.3	32.7	5.9	-34.8	0.0	0.0	29.1	54.0	-24.9	V	A	101.0	150.0	14.1 dBm
g mode 2462															
4.924	3.0	36.1	32.7	5.9	-34.8	0.0	0.0	39.9	74.0	-34.1	H	P	103.0	138.0	14.1 dBm
4.924	3.0	24.1	32.7	5.9	-34.8	0.0	0.0	27.9	54.0	-26.1	H	A	103.0	138.0	14.1 dBm

Rev. 4.1.2.7

Note: No other emissions were detected above the system noise floor.

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 2.4 GHz BAND

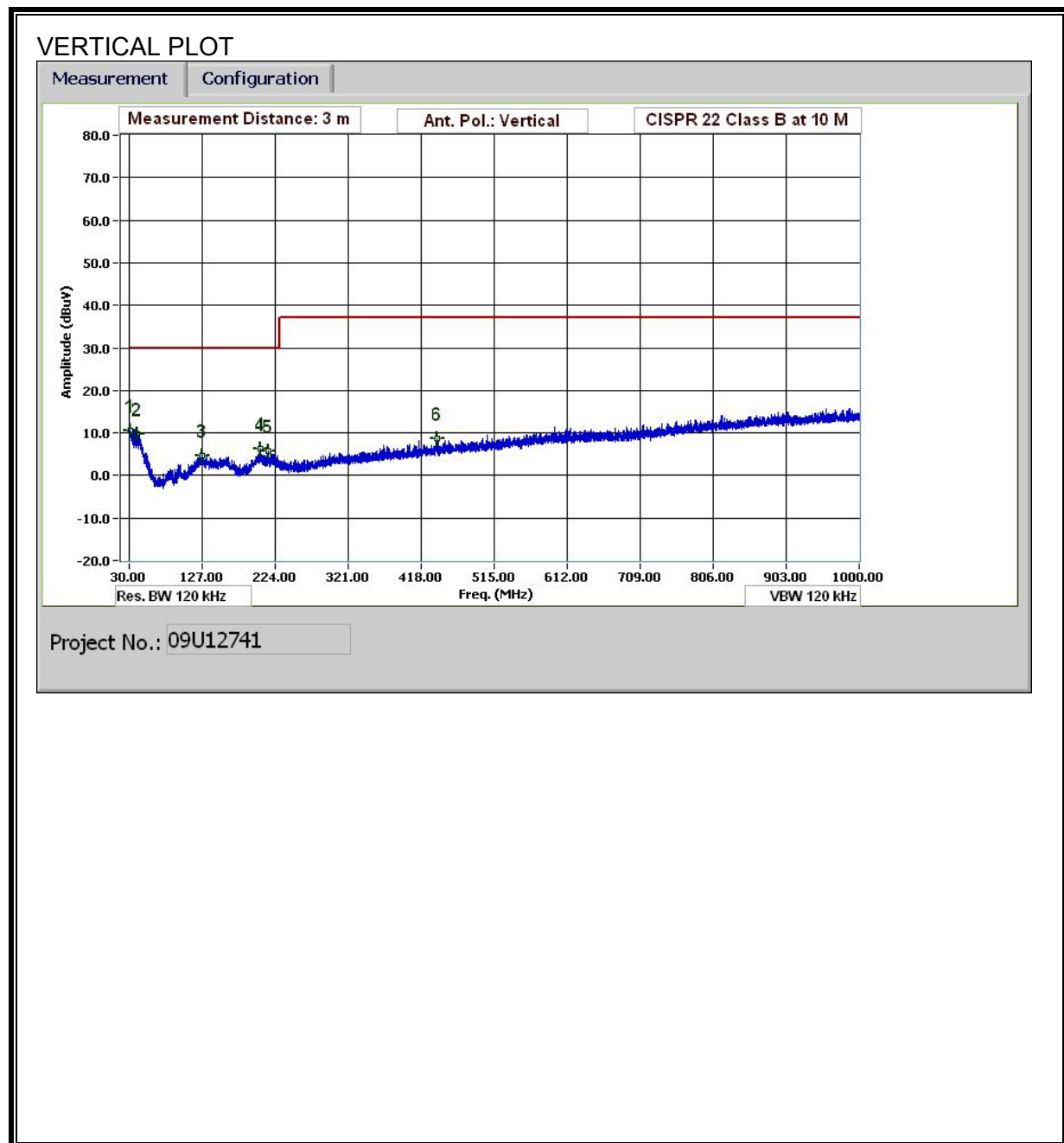
High Frequency Measurement																			
Compliance Certification Services, Fremont 5m Chamber																			
Company:		Apple Computer Inc.																	
Project #:		09U12741																	
Date:		7/30/2009																	
Test Engineer:		Tom Chen																	
Configuration:		EUT only																	
Mode:		Rx 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								T125; ARA 18-26GHz; S/N:1007				RX RSS 210			
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 GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Ftr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)				
1.139	3.0	44.5	29.5	26.8	2.5	-38.1	0.0	0.0	35.7	20.7	74	54	-38.3	-33.3	V				
1.848	3.0	44.0	29.0	28.7	3.3	-37.1	0.0	0.0	38.8	23.9	74	54	-35.2	-30.1	V				
2.974	3.0	40.5	26.5	30.8	4.3	-35.9	0.0	0.0	39.7	25.7	74	54	-34.3	-28.3	V				
1.228	3.0	44.7	29.7	27.0	2.6	-37.9	0.0	0.0	36.4	21.4	74	54	-37.6	-32.6	H				
1.547	3.0	44.4	29.4	27.9	3.0	-37.5	0.0	0.0	37.8	22.8	74	54	-36.2	-31.2	H				
2.054	3.0	42.2	27.2	29.1	3.5	-36.8	0.0	0.0	38.1	23.0	74	54	-35.9	-31.0	H				
No other Emissions were detected above system noise floor.																			
Rev. 10.15.08																			

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)



HORIZONTAL AND VERTICAL DATA

30-1000MHz Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen
Date: 07/31/09
Project #: 09U12741
Company: Apple Computer Inc.
EUT Description: TBD
EUT M/N:
Test Target: FCC Class B
Mode Oper: Continuous 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 MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
Vertical															
30.840	3.0	29.5	19.6	0.5	28.4	-10.5	0.0	10.7	30.0	-19.3	V	EP	100.0	0 - 360	Prescan
40.680	3.0	34.9	13.1	0.6	28.4	-10.5	0.0	9.7	30.0	-20.3	V	EP	100.0	0 - 360	Prescan
126.724	3.0	28.0	14.0	0.9	28.0	-10.5	0.0	4.5	30.0	-25.5	V	EP	100.0	0 - 360	Prescan
204.487	3.0	31.1	11.9	1.2	27.4	-10.5	0.0	6.3	30.0	-23.7	V	EP	100.0	0 - 360	Prescan
215.528	3.0	30.6	11.9	1.2	27.4	-10.5	0.0	5.9	30.0	-24.1	V	EP	100.0	0 - 360	Prescan
438.857	3.0	29.8	15.7	1.8	28.3	-10.5	0.0	8.6	37.0	-28.4	V	EP	100.0	0 - 360	Prescan
Horizontal															
31.320	3.0	27.7	19.3	0.5	28.4	-10.5	0.0	8.7	30.0	-21.3	H	EP	100.0	0 - 360	Prescan
65.641	3.0	33.0	8.1	0.7	28.3	-10.5	0.0	3.0	30.0	-27.0	H	EP	100.0	0 - 360	Prescan
125.764	3.0	28.6	14.1	0.9	28.0	-10.5	0.0	5.2	30.0	-24.8	H	EP	100.0	0 - 360	Prescan
188.047	3.0	33.2	11.2	1.1	27.4	-10.5	0.0	7.6	30.0	-22.4	H	EP	100.0	0 - 360	Prescan
200.887	3.0	36.7	11.9	1.2	27.4	-10.5	0.0	12.0	30.0	-18.0	H	EP	100.0	0 - 360	Prescan
206.887	3.0	37.1	11.9	1.2	27.4	-10.5	0.0	12.4	30.0	-17.6	H	EP	100.0	0 - 360	Prescan

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

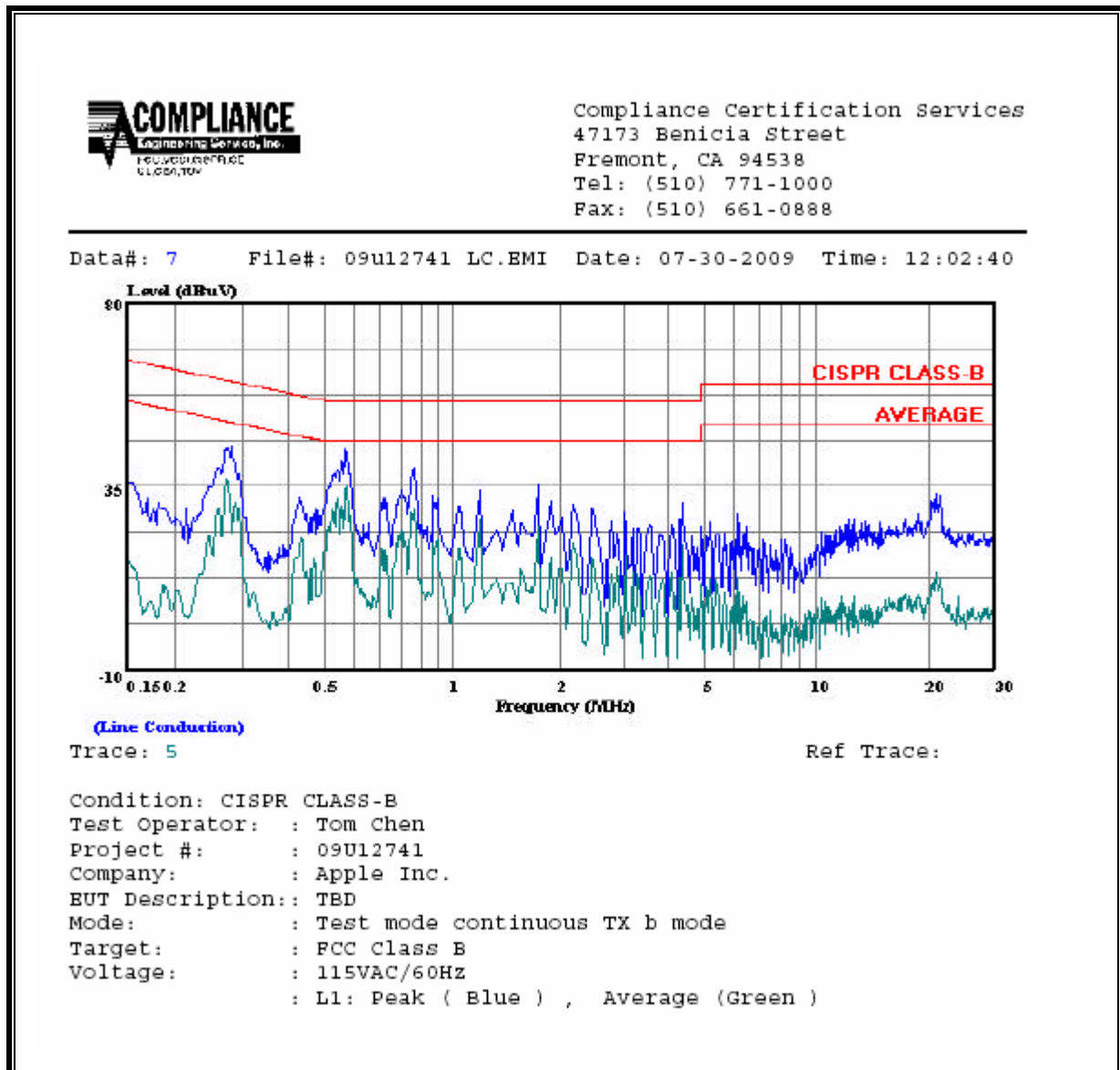
ANSI C63.4

RESULTS

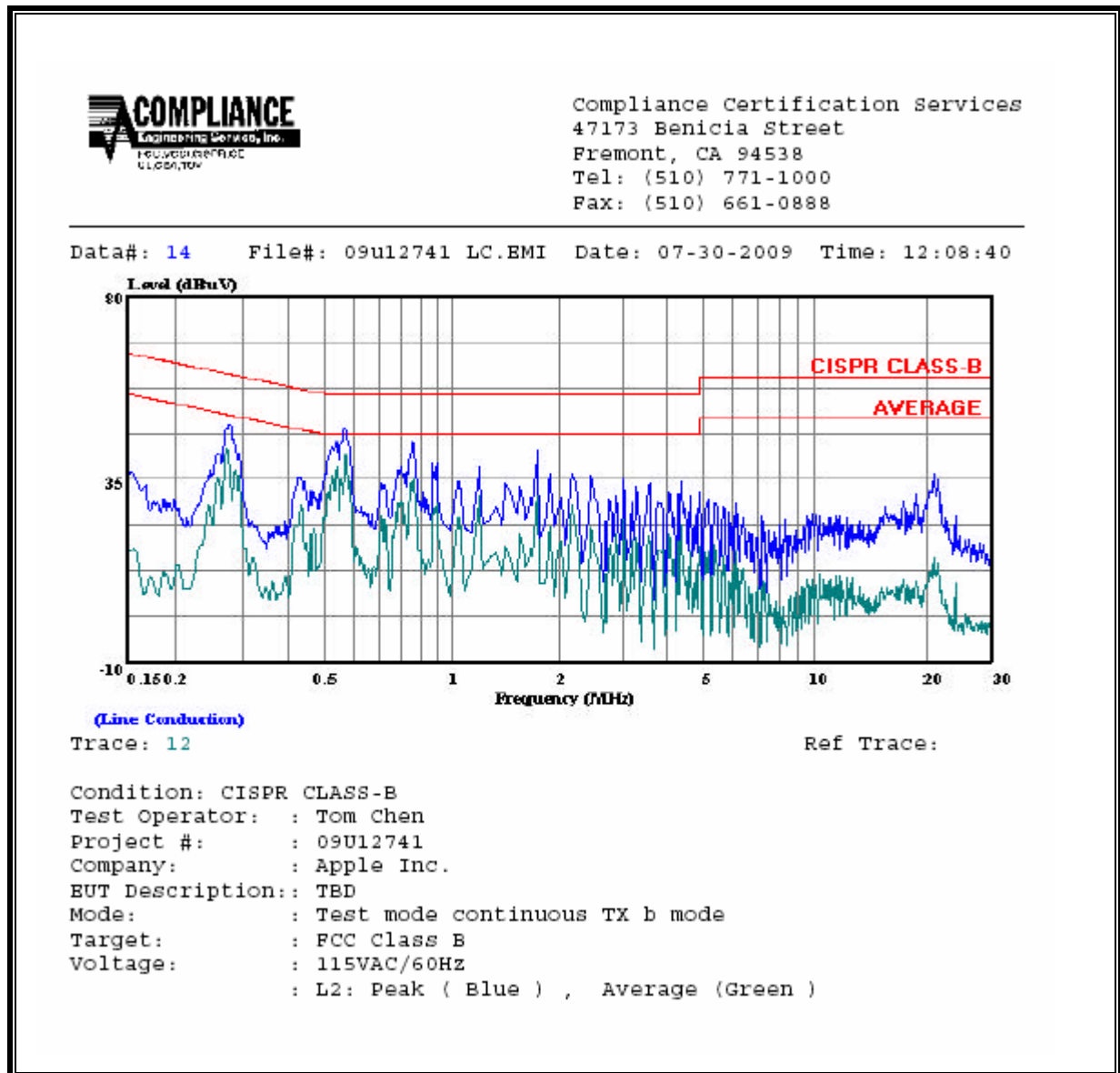
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.28	45.12	--	26.24	0.00	60.73	50.73	-15.61	-24.49	L1
0.57	44.04	--	34.59	0.00	56.00	46.00	-11.96	-11.41	L1
0.86	39.42	--	29.35	0.00	56.00	46.00	-16.58	-16.65	L1
0.28	48.52	--	35.68	0.00	60.76	50.76	-12.24	-15.08	L2
0.57	47.57	--	41.16	0.00	56.00	46.00	-8.43	-4.84	L2
0.86	44.34	--	34.54	0.00	56.00	46.00	-11.66	-11.46	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.

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	1.585 $f^{0.5}$	0.0042 $f^{0.5}$	$f/150$	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	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 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).

EQUATIONS

Power density is given by:

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

where

S = Power density in W/m²

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m² is converted to units of mW/cm² by dividing by 10.

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/cm²

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

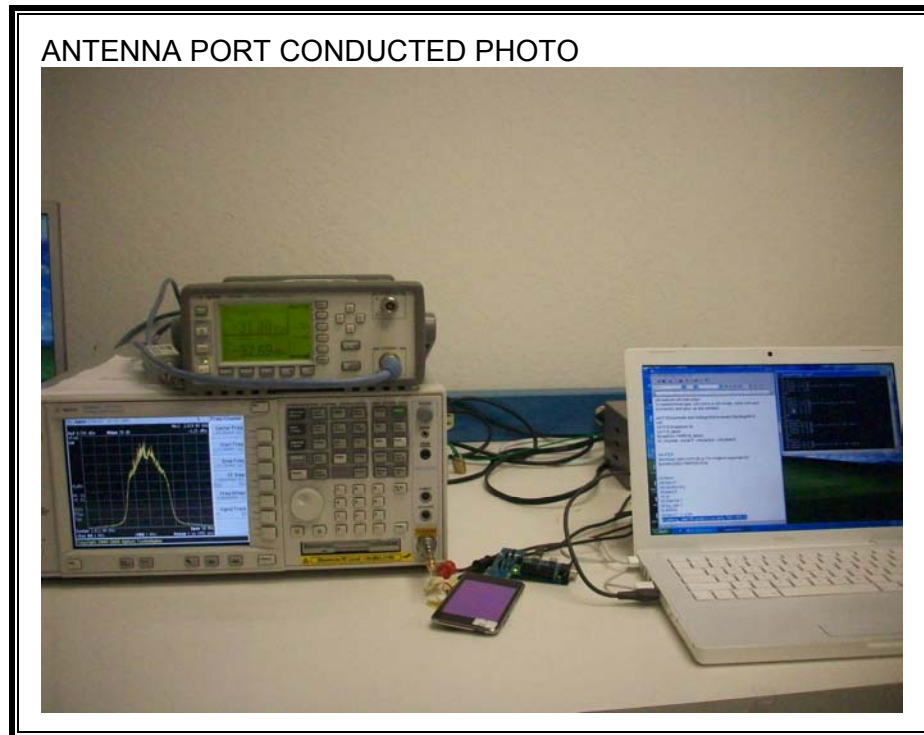
RESULTS

(MPE distance equals 20 cm)

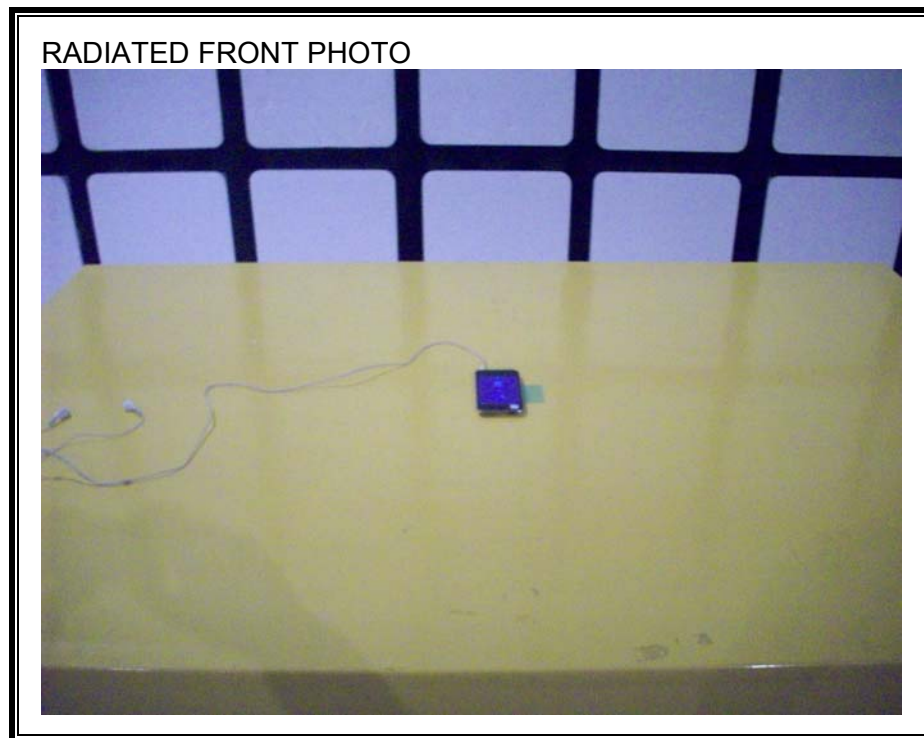
Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	WLAN	0.20	23.36	1.20	0.57	0.057

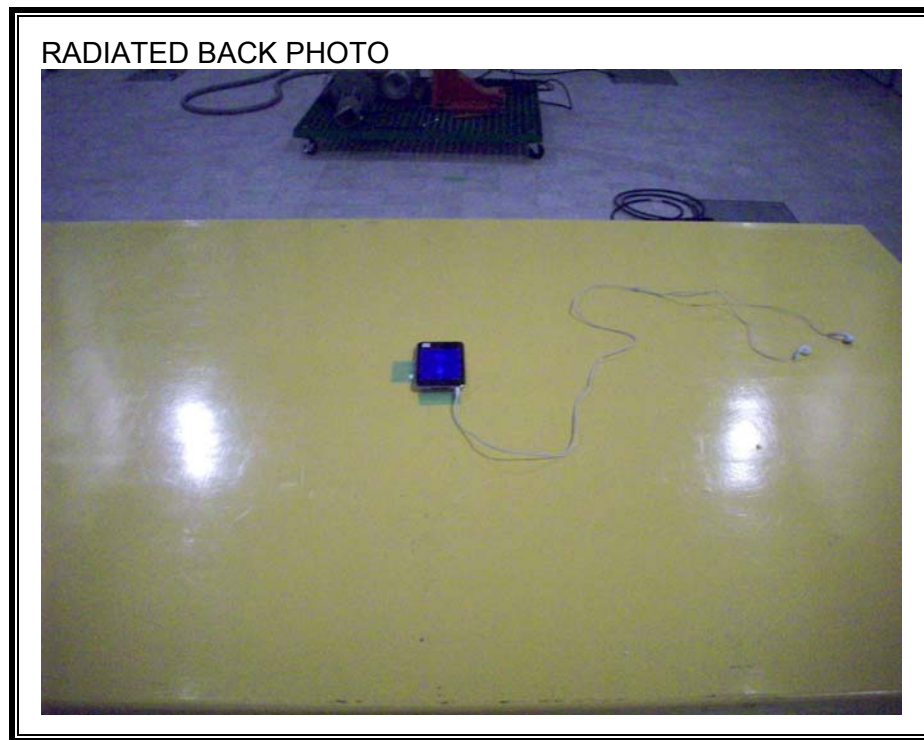
11. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



RADIATED RF MEASUREMENT SETUP





POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO



LINE CONDUCTED BACK PHOTO



END OF REPORT