



**FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

CERTIFICATION TEST REPORT

FOR

802.11 a/b/g/n radio, Bluetooth Radio Function

MODEL NUMBER: 1403

**FCC ID: BCGA1403
IC: 579C-A1403**

REPORT NUMBER: 11U13938-4, Revision B

ISSUE DATE: FEBRUARY 3, 2012

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
	12/12/2011	Initial Issue	F. Ibrahim
A	02/02/12	Revised 1. Model number 2. FCC and IC ID	A. Zaffar
B	02/03/12	Revised EUT Description	A. Zaffar

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: The Apple iPad, Model A1403 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the CDMA/GSM 2G/3G/LTE data radio functions.

MODEL: A1403

SERIAL NUMBER: PT667496, PT654922

DATE TESTED: NOVEMBER 1-2, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

Compliance Certification Services (UL 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 UL 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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL 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 UL CCS By:

Tested By:



FRANK IBRAHIM
EMC SUPERVISOR
UL CCS



CHIN PANG
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

UL 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:

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

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 iPad, Model A1403 is a tablet device with iPod functions (music, application support, and video), 802.11a/b/g/n radio, Bluetooth radio functions, and cellular using the CDMA/GSM 2G/3G/LTE data radio functions.

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)
2402 - 2480	BLE	9.31	8.531

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA integrated antennas, with the following peak gains in -0.26 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Broadcom Bluetool.

The EUT software installed during testing was 9A287.

5.5. WORST-CASE CONFIGURATION AND MODE

For Radiated Emissions below 1 GHz and Power line Conducted Emissions, the channel with the highest conducted output power was selected as worst-case scenario.

The worst-position was the EUT with highest emissions. To determine the worst-case, the EUT is a portable device that has three orientations; therefore X, Y and Z orientations have been investigated with and without AC adapter, and the worst case was found to be at Z position without AC Adapter.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
BT Tester	Rohde & Schwarz	CBT	2174-12-17	NA
Directional Coupler	Krytar	1905-1-24	2233-6-28	NA
Headset	Apple	NA	NA	NA

I/O CABLES (Conducted Setup)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	In/Out	1	SMA	Shielded	0.2m	NA
2	In/Out	1	SMA	Shielded	0.6m	NA
3	Antenna Port	1	SMA	Shielded	0.1m	NA

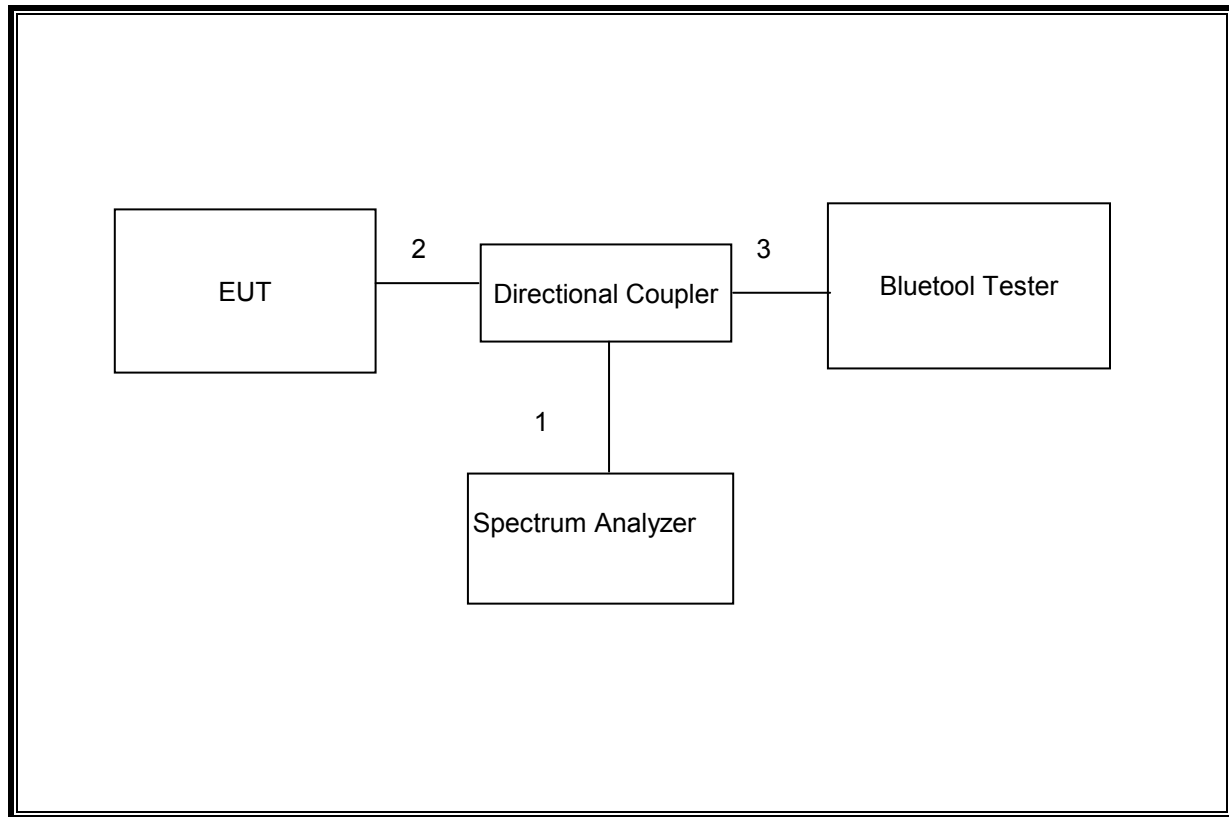
I/O CABLES (Radiated Setup)

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115VAC	Shielded	2m	NA
2	DC	1	DC	Shielded	1m	NA
3	Jack	1	Earphone	Shielded	0.5m	NA
4	Antenna Port	1	Horn	Un-shielded	2m	NA

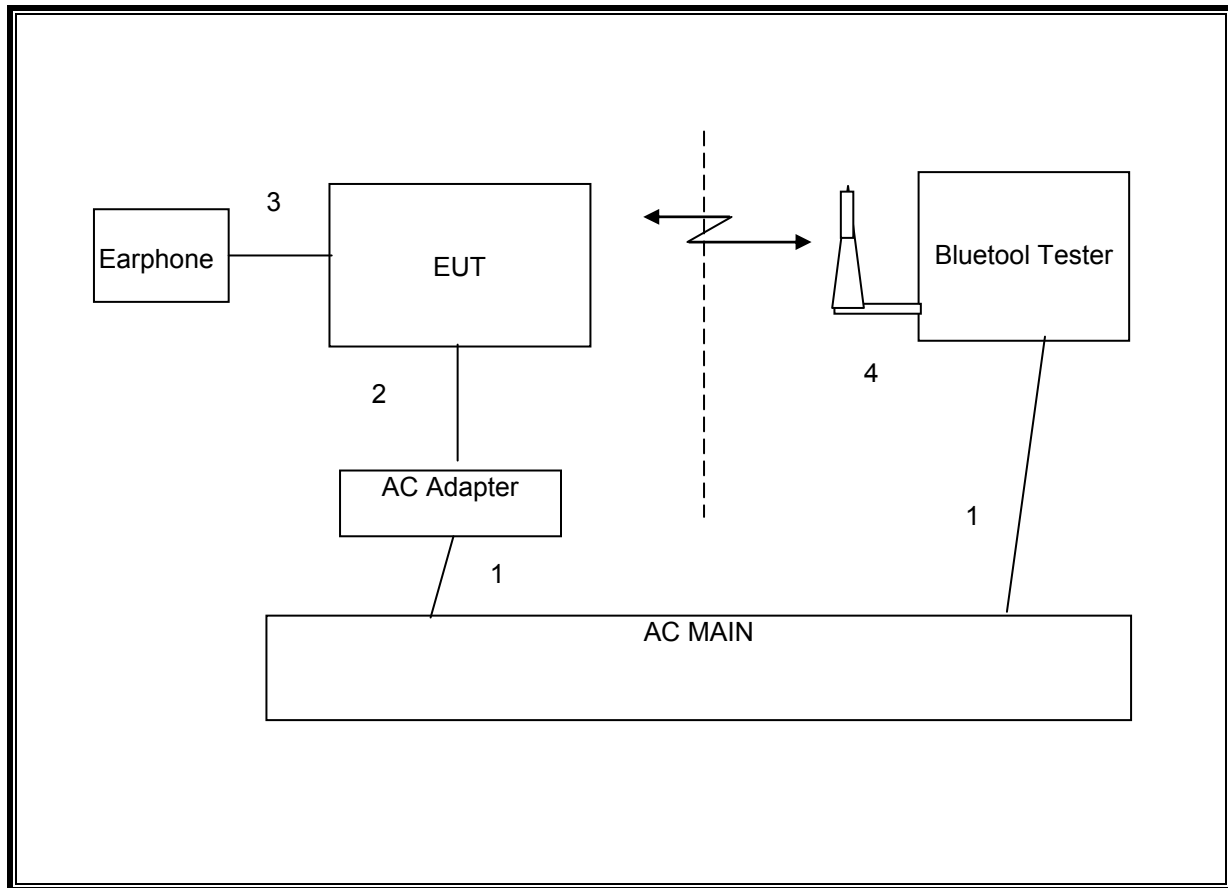
TEST SETUP

The EUT is a stand-alone device.

SETUP DIAGRAM FOR TESTS (CONDUCTED)



SETUP DIAGRAM FOR TESTS (RADIATED)



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, 44 GHz	Agilent / HP	E4446A	C01159	05/11/12
Antenna, Horn, 18 GHz	EMCO	3115	C00872	06/29/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	07/12/12
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/12
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/12
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	01/07/12
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/12
Bluetooth Test	R&S	CBT	NA	05/01/12
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/12

7. ANTENNA PORT TEST RESULTS

7.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

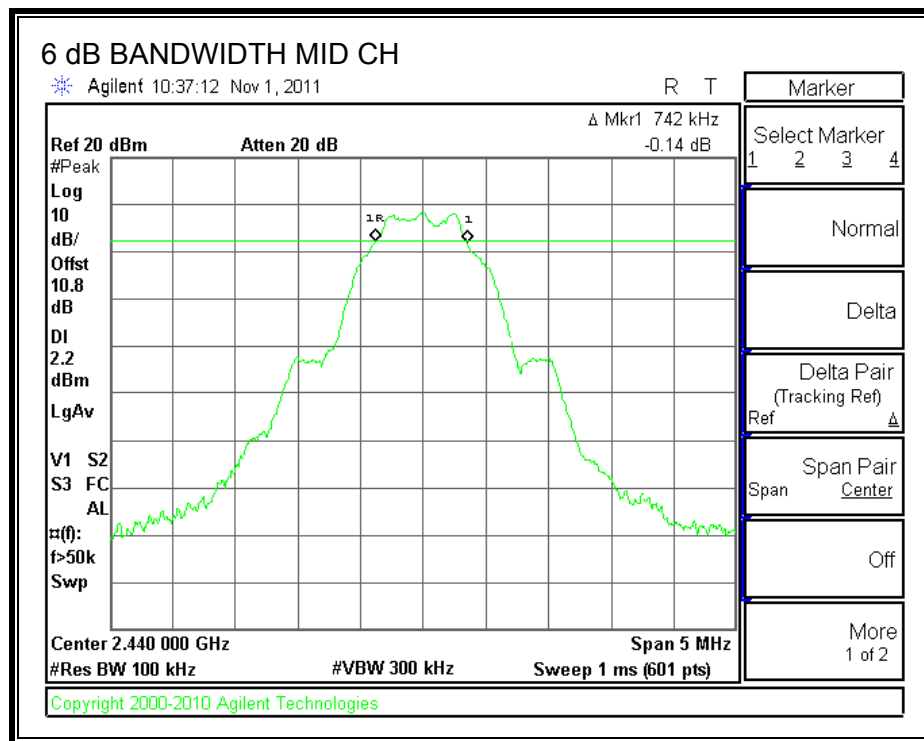
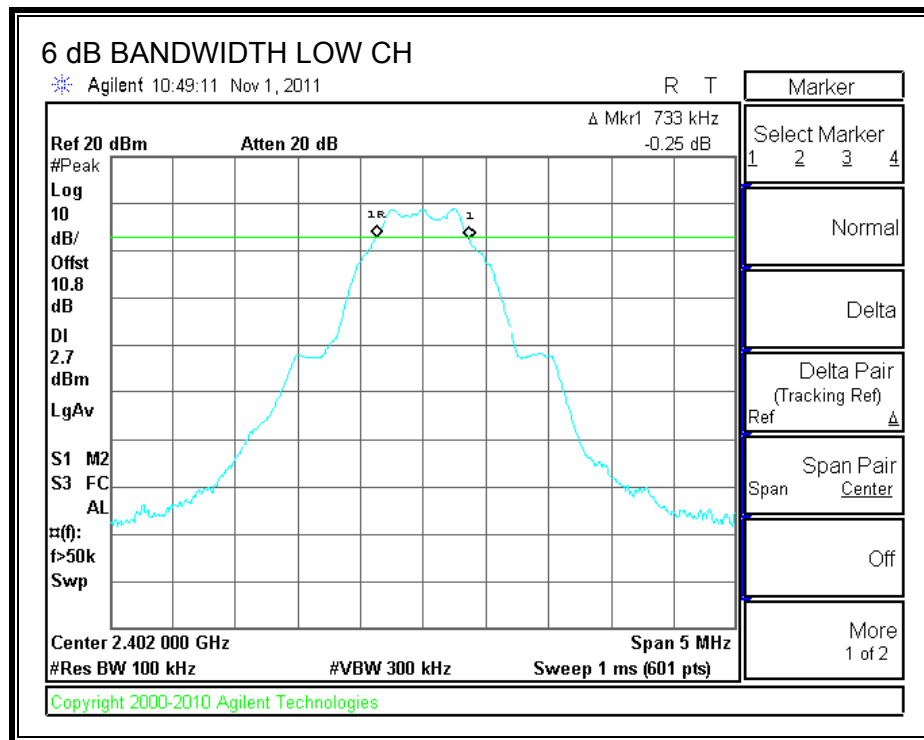
TEST PROCEDURE

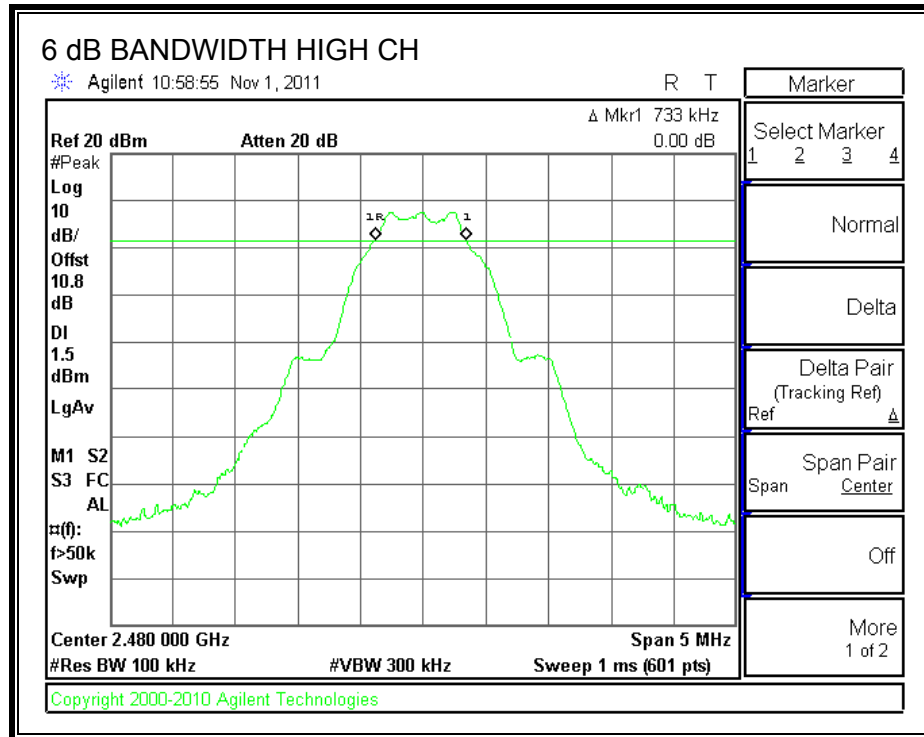
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.733	0.5
Middle	2440	0.742	0.5
High	2480	0.733	0.5

6 dB BANDWIDTH





7.2. 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

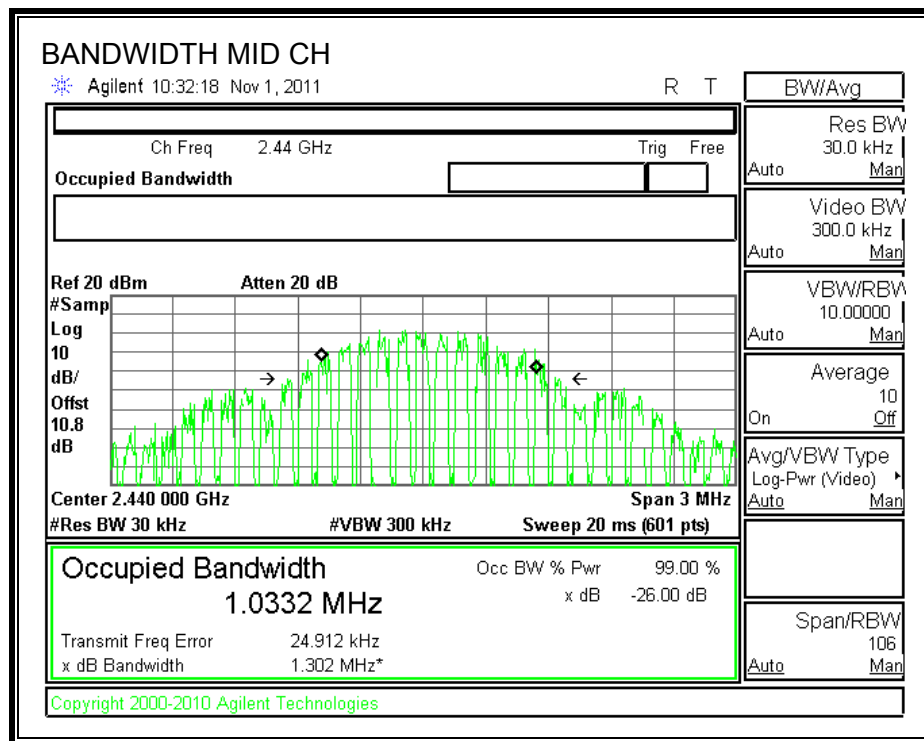
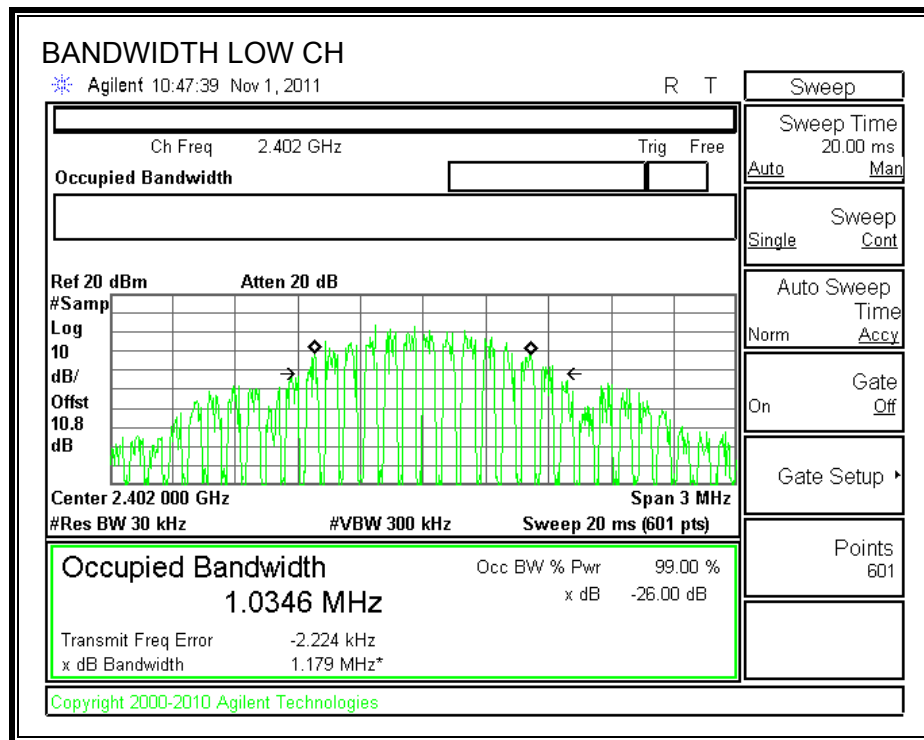
TEST PROCEDURE

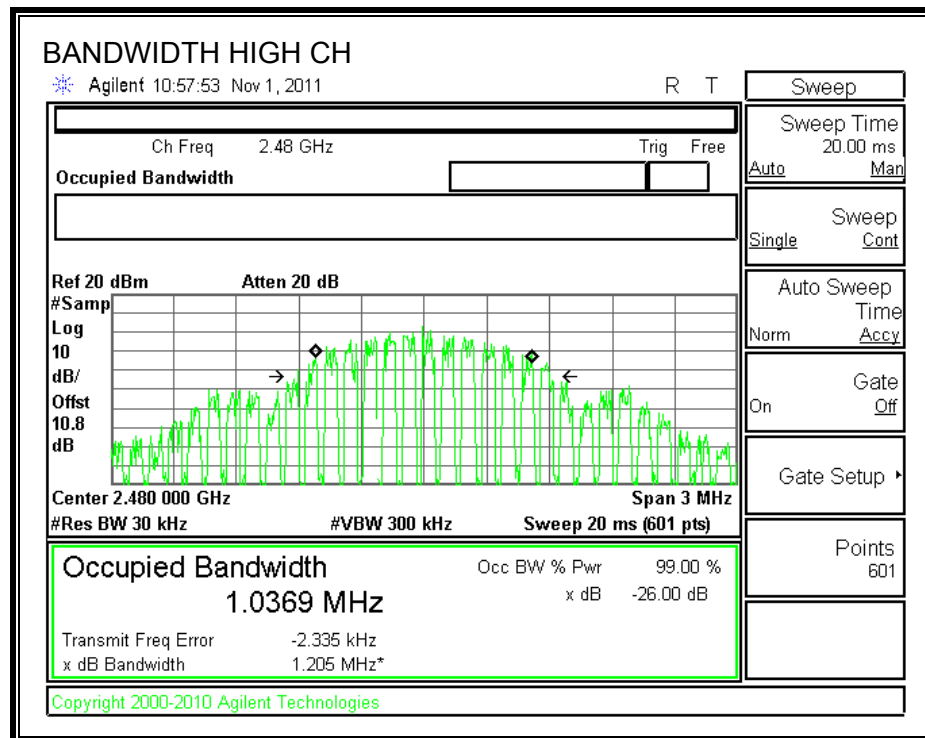
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0346
Middle	2440	1.0332
High	2480	1.0369

99% BANDWIDTH





7.3. OUTPUT POWER

LIMIT

§15.247 (b) (1)

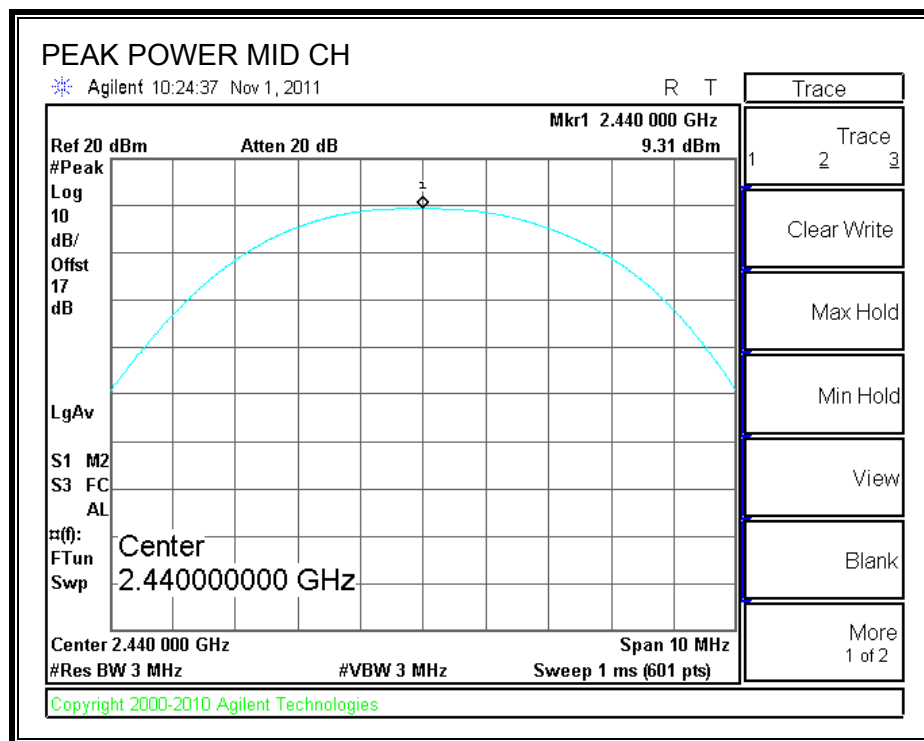
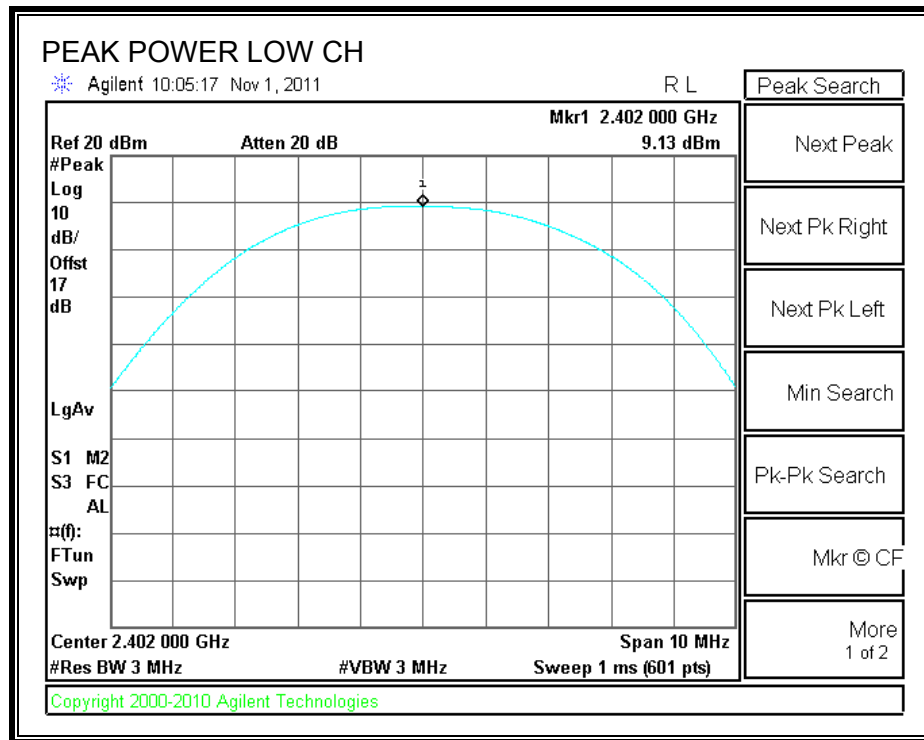
The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

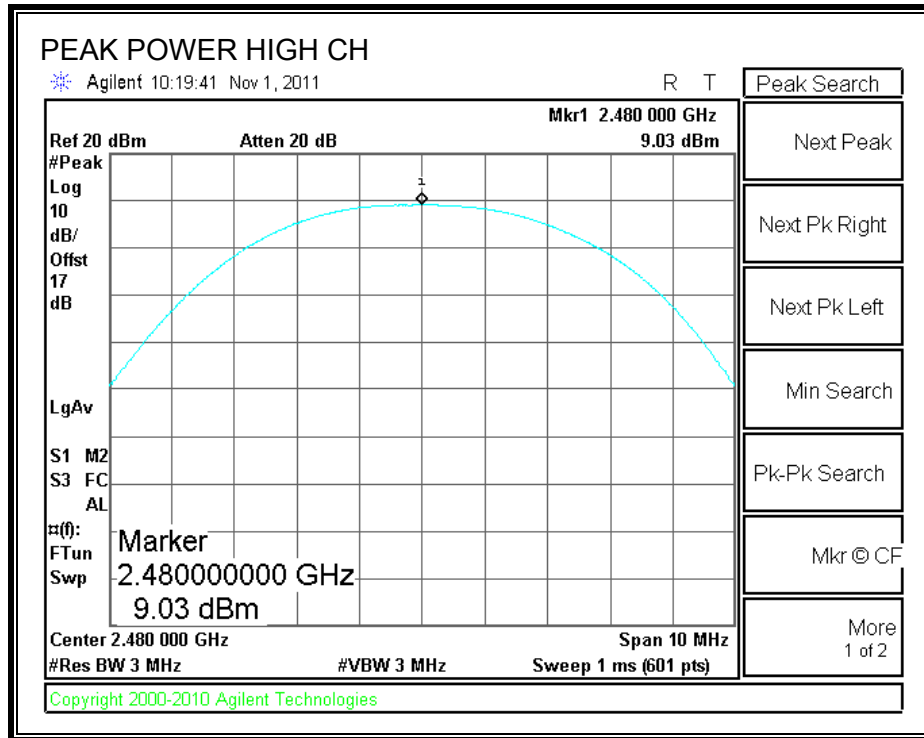
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer, and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.13	30	-20.87
Middle	2440	9.31	30	-20.69
High	2480	9.03	30	-20.97





7.4. AVERAGE POWER

LIMIT

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)	Average Power (dBm)
Low	2402	8.80
Middle	2441	8.90
High	2480	8.70

7.5. 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.

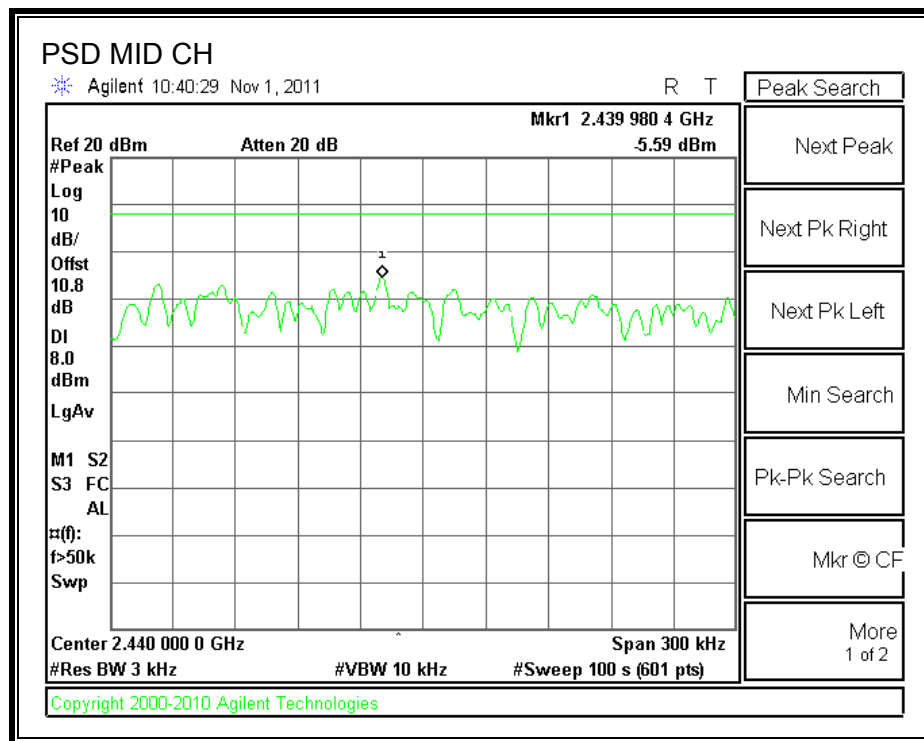
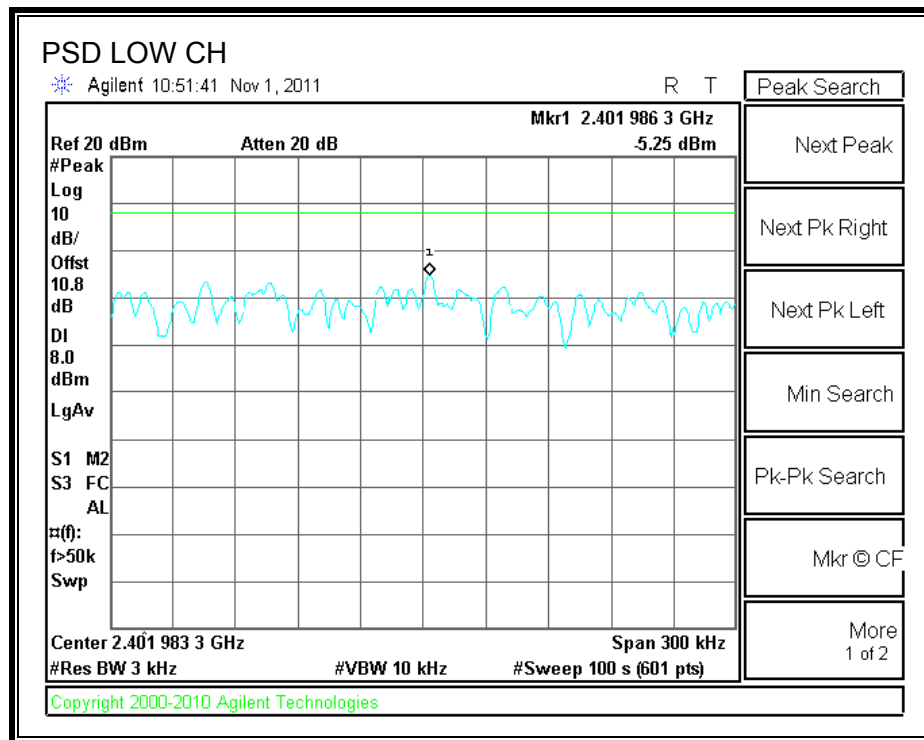
TEST PROCEDURE

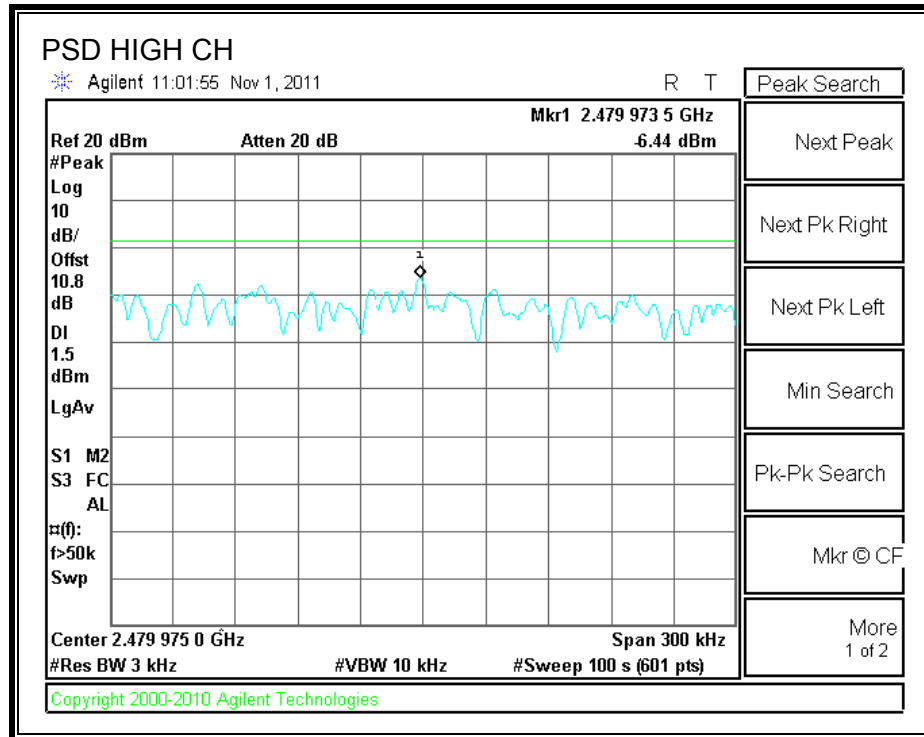
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-5.25	8	-13.25
Middle	2440	-5.59	8	-13.59
High	2480	-6.44	8	-14.44

POWER SPECTRAL DENSITY





7.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Limit = -20 dBc

TEST PROCEDURE

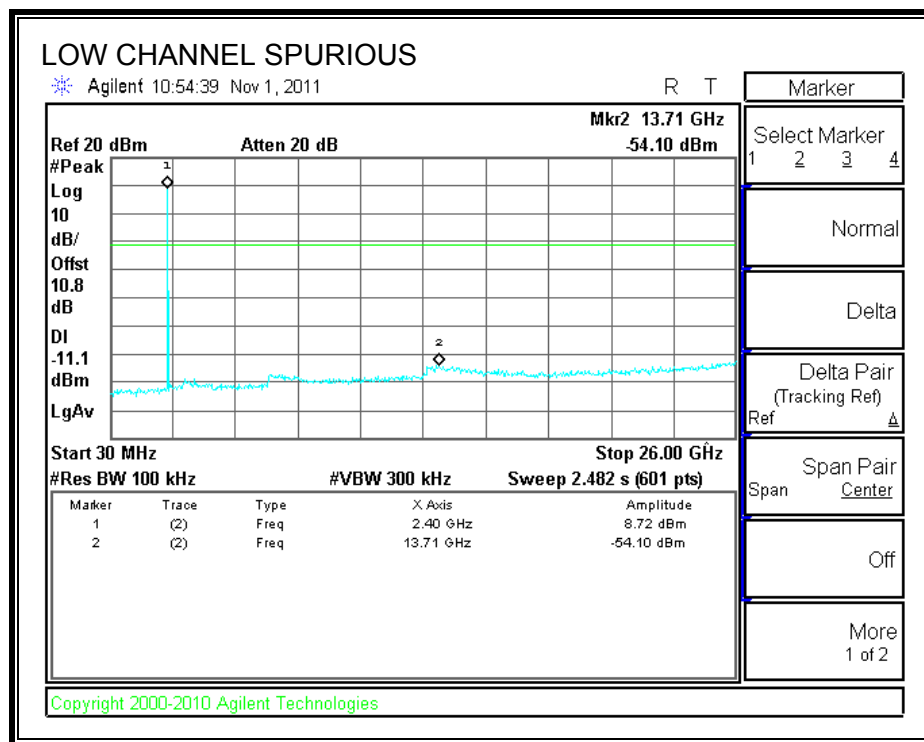
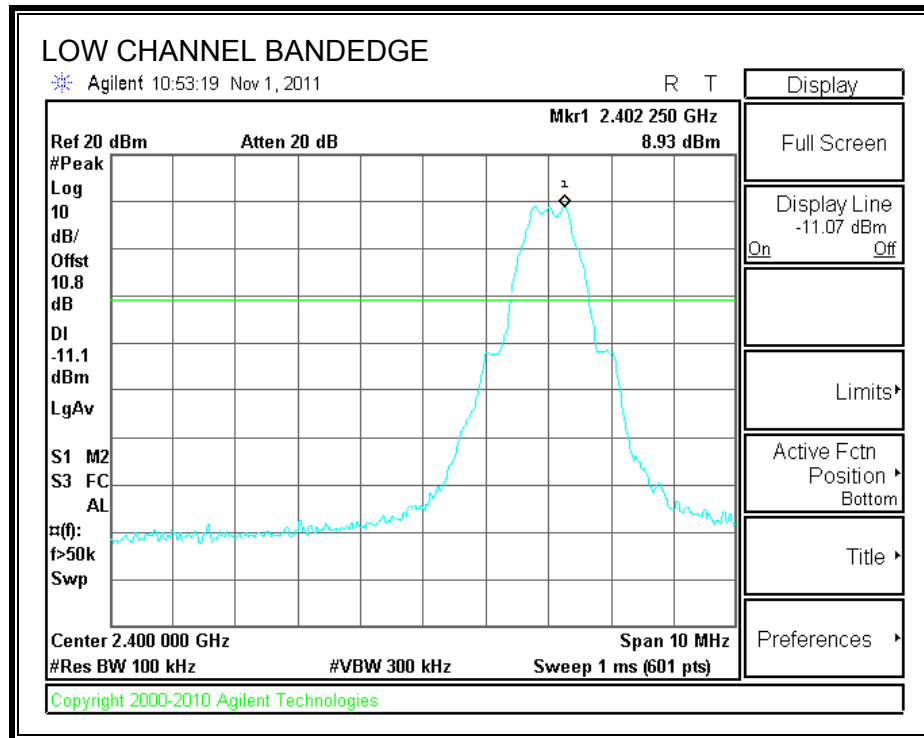
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

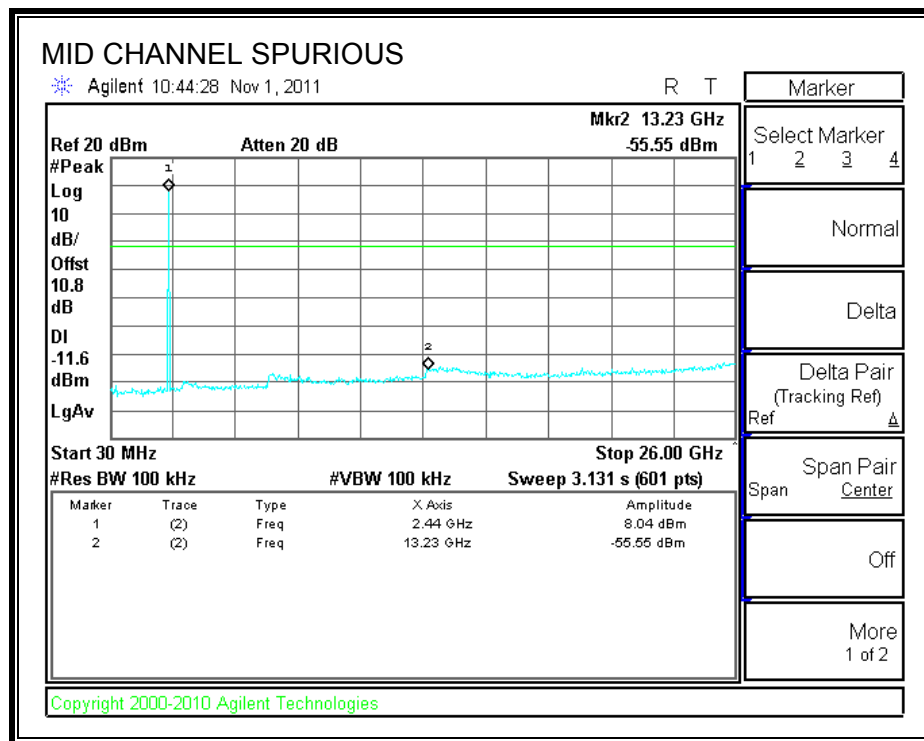
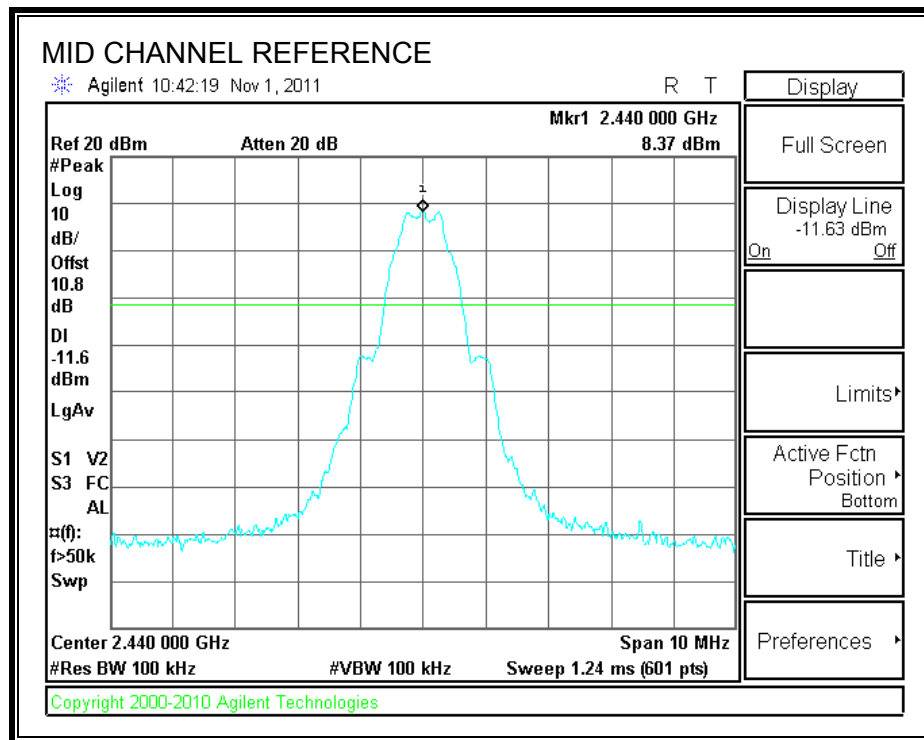
The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

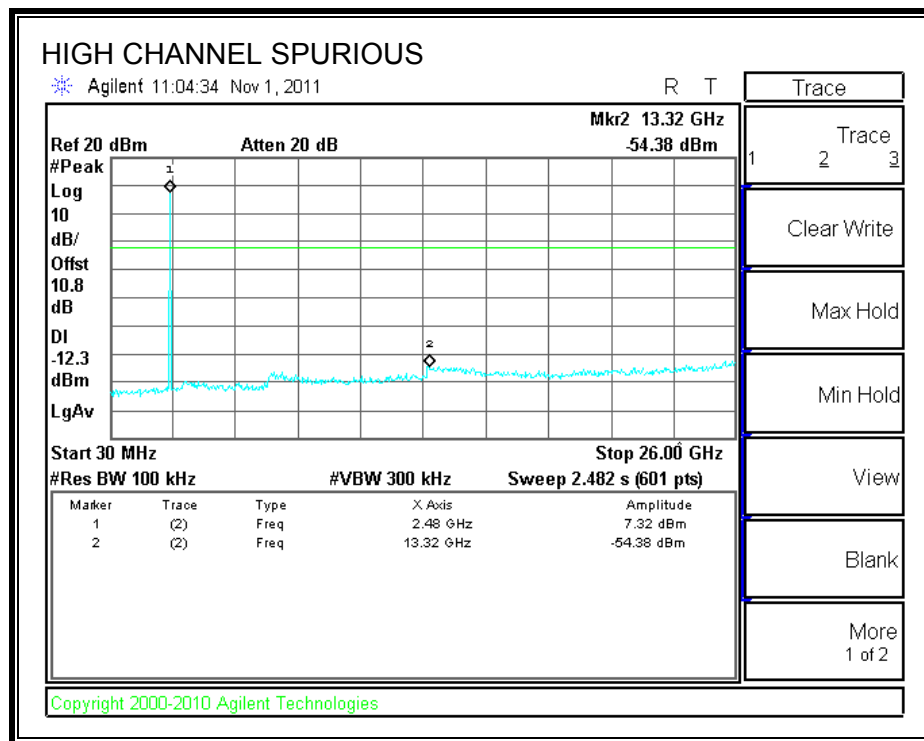
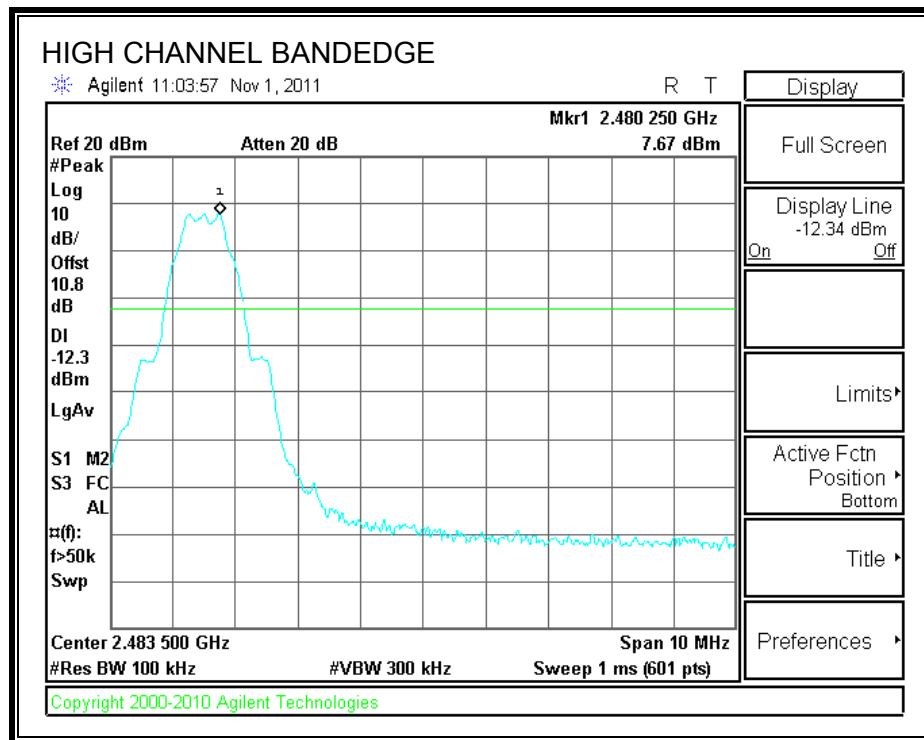
SPURIOUS EMISSIONS, LOW CHANNEL



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.

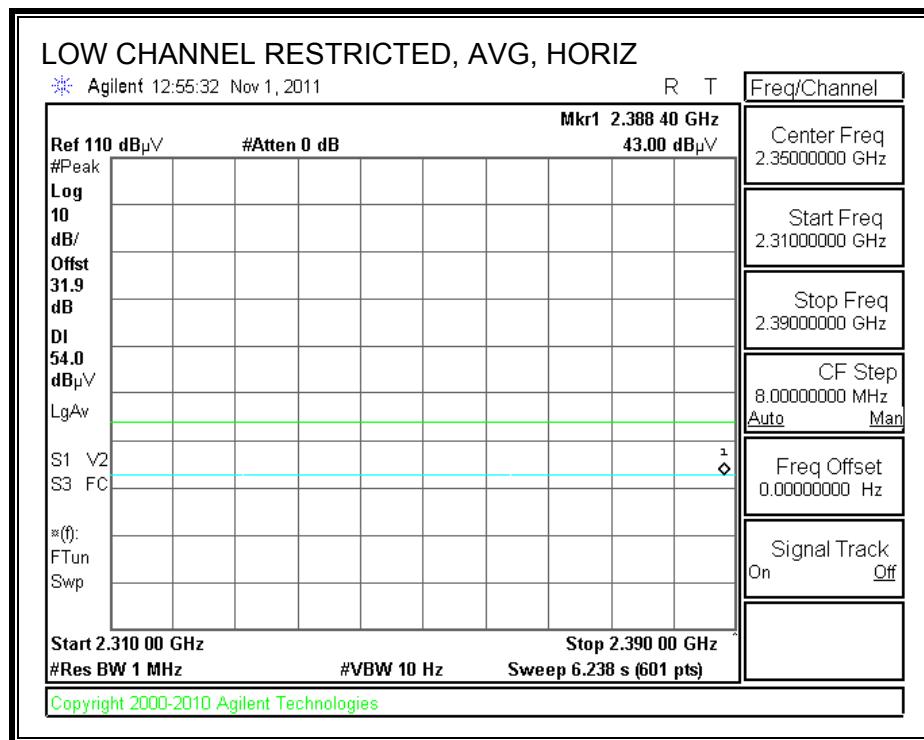
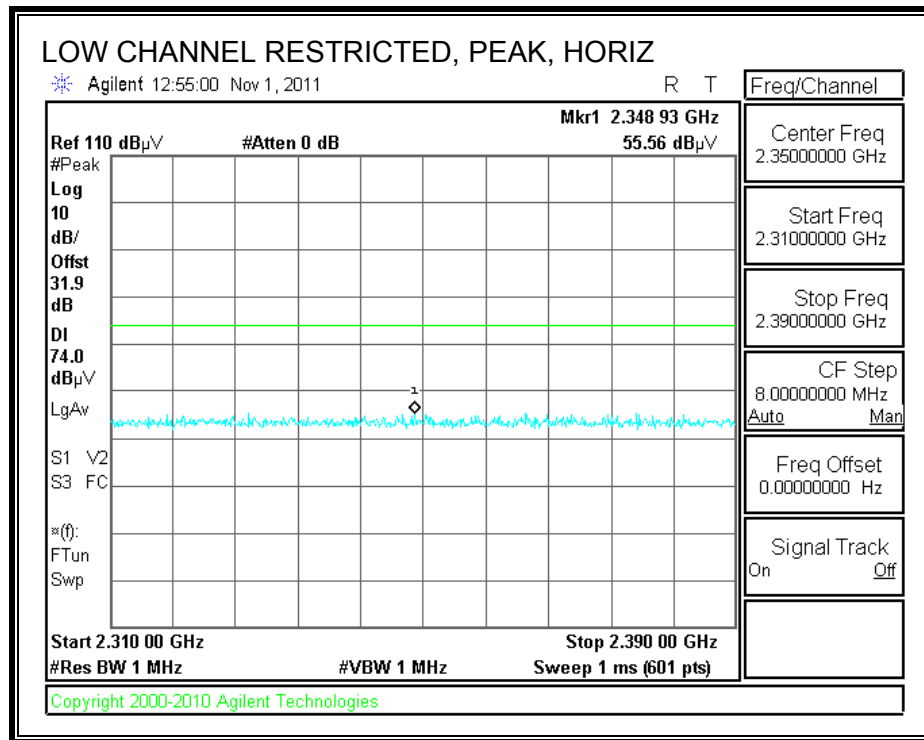
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

For 2.4 GHz band, 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.

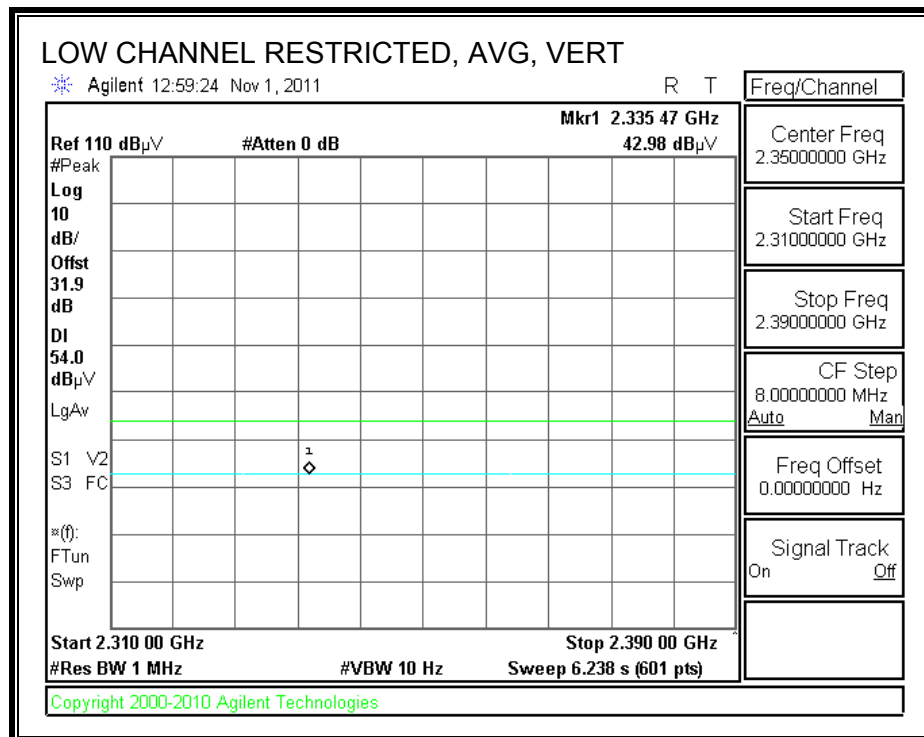
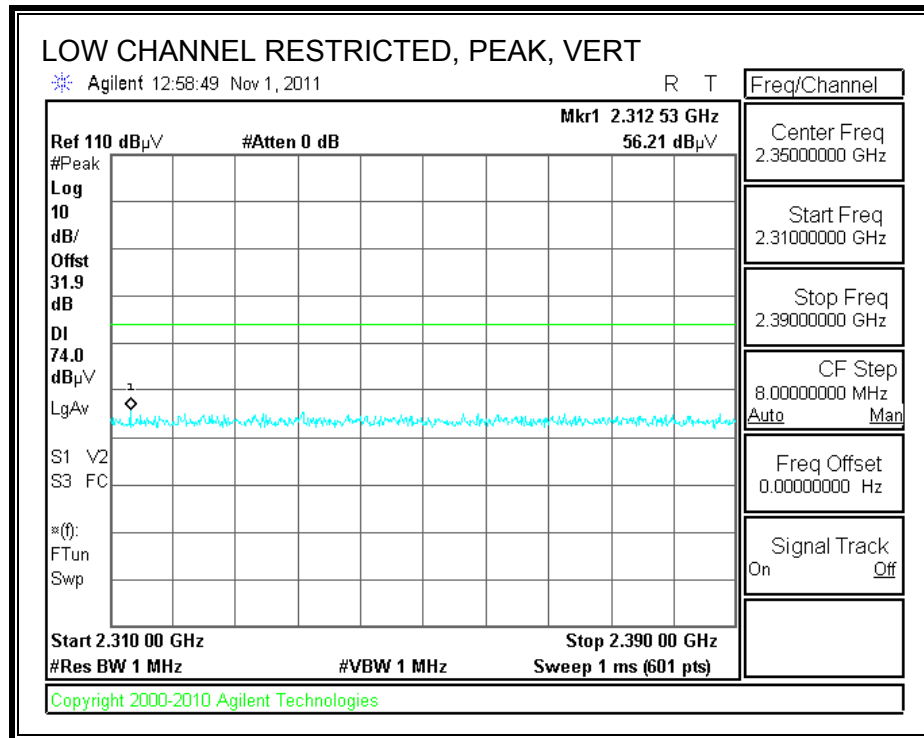
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

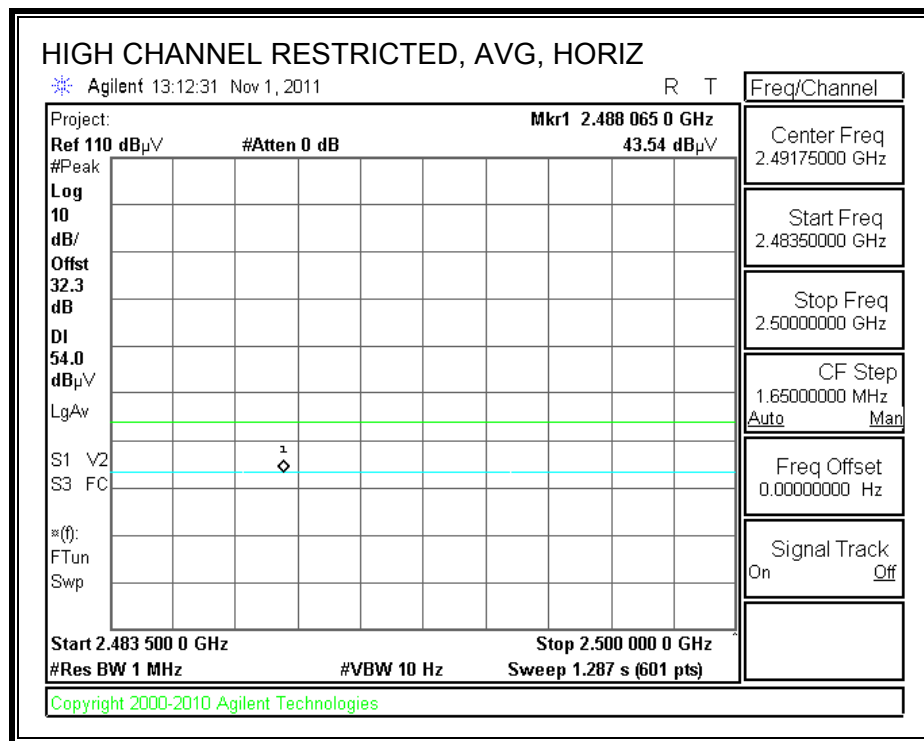
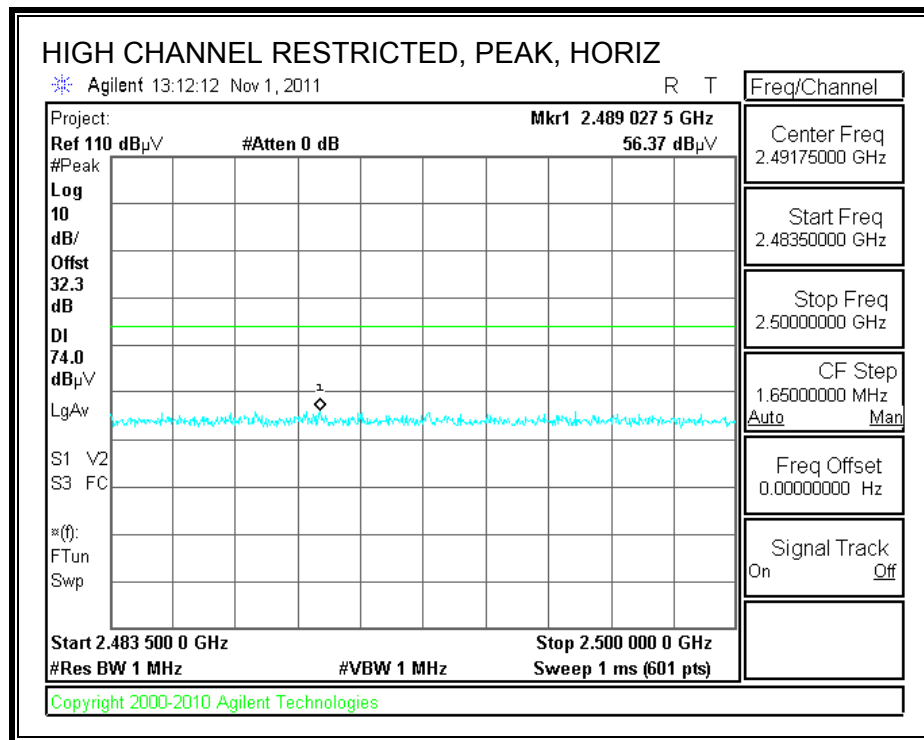
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



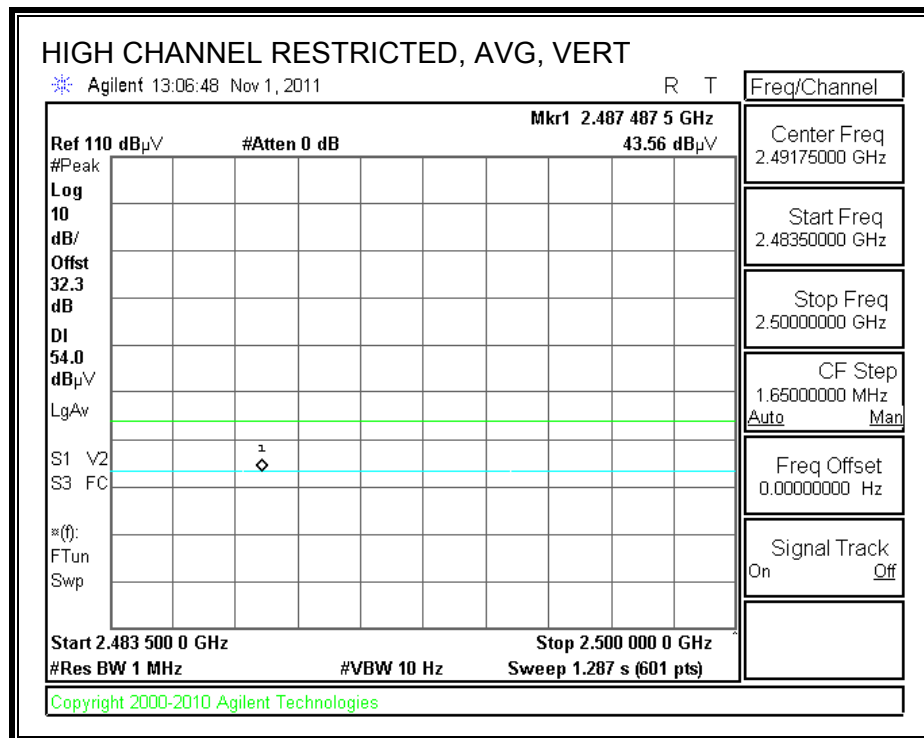
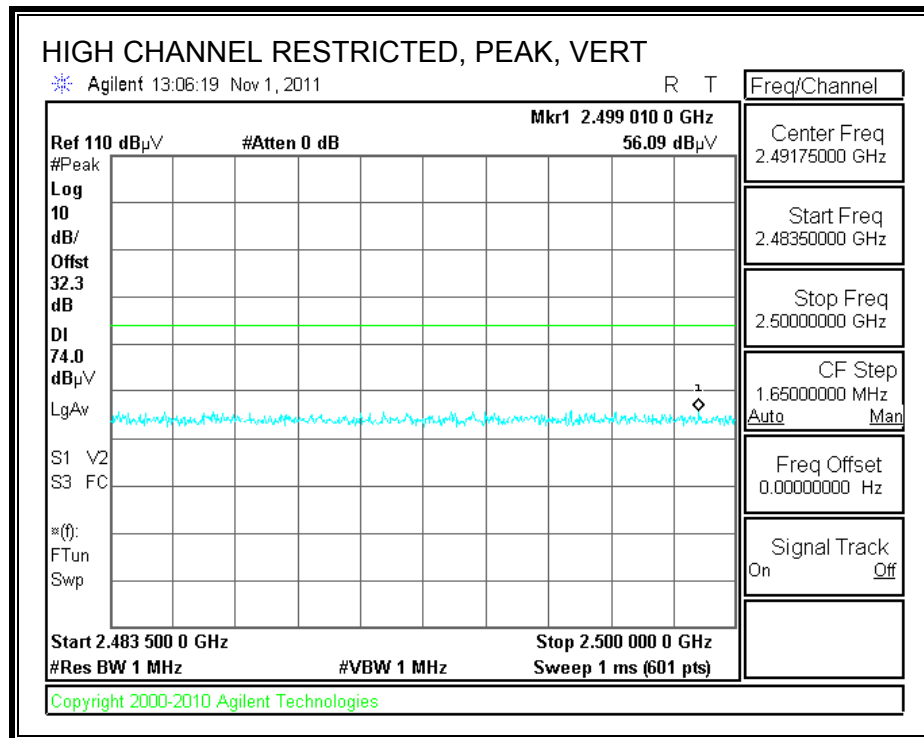
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 11/01/11
Project #: 11U13938
Company: Apple
Test Target: FCC 15.247
Mode Oper: TX, LE

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	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low ch, 2402MHz													
4.804	3.0	38.3	33.1	5.8	-34.8	0.0	0.0	42.3	74.0	-31.7	H	P	
4.804	3.0	25.3	33.1	5.8	-34.8	0.0	0.0	29.4	54.0	-24.6	H	A	
4.804	3.0	37.6	33.1	5.8	-34.8	0.0	0.0	41.7	74.0	-32.3	V	P	
4.804	3.0	25.3	33.1	5.8	-34.8	0.0	0.0	29.4	54.0	-24.6	V	A	
Mid Ch, 2440MHz													
4.880	3.0	38.1	33.2	5.8	-34.9	0.0	0.0	42.3	74.0	-31.7	H	P	
4.880	3.0	25.2	33.2	5.8	-34.9	0.0	0.0	29.5	54.0	-24.5	H	A	
7.320	3.0	37.2	36.2	7.3	-34.7	0.0	0.0	46.0	74.0	-28.0	H	P	
7.320	3.0	24.4	36.2	7.3	-34.7	0.0	0.0	33.3	54.0	-20.8	H	A	
4.880	3.0	37.3	33.2	5.8	-34.9	0.0	0.0	41.5	74.0	-32.5	V	P	
4.880	3.0	25.2	33.2	5.8	-34.9	0.0	0.0	29.5	54.0	-24.5	V	A	
7.320	3.0	36.4	36.2	7.3	-34.7	0.0	0.0	45.3	74.0	-28.7	V	P	
7.320	3.0	24.5	36.2	7.3	-34.7	0.0	0.0	33.3	54.0	-20.7	V	A	
High Ch, 2480Mhz													
4.960	3.0	38.0	33.3	5.9	-34.9	0.0	0.0	42.4	74.0	-31.6	H	P	
4.960	3.0	26.0	33.3	5.9	-34.9	0.0	0.0	30.4	54.0	-23.6	H	A	
7.440	3.0	36.7	36.4	7.3	-34.6	0.0	0.0	45.7	74.0	-28.3	H	P	
7.440	3.0	24.6	36.4	7.3	-34.6	0.0	0.0	33.6	54.0	-20.4	H	A	
4.960	3.0	38.4	33.3	5.9	-34.9	0.0	0.0	42.8	74.0	-31.2	V	P	
4.960	3.0	25.3	33.3	5.9	-34.9	0.0	0.0	29.7	54.0	-24.3	V	A	
7.440	3.0	37.3	36.4	7.3	-34.6	0.0	0.0	46.4	74.0	-27.6	V	P	
7.440	3.0	24.5	36.4	7.3	-34.6	0.0	0.0	33.6	54.0	-20.4	V	A	

Rev. 4.1.2.7

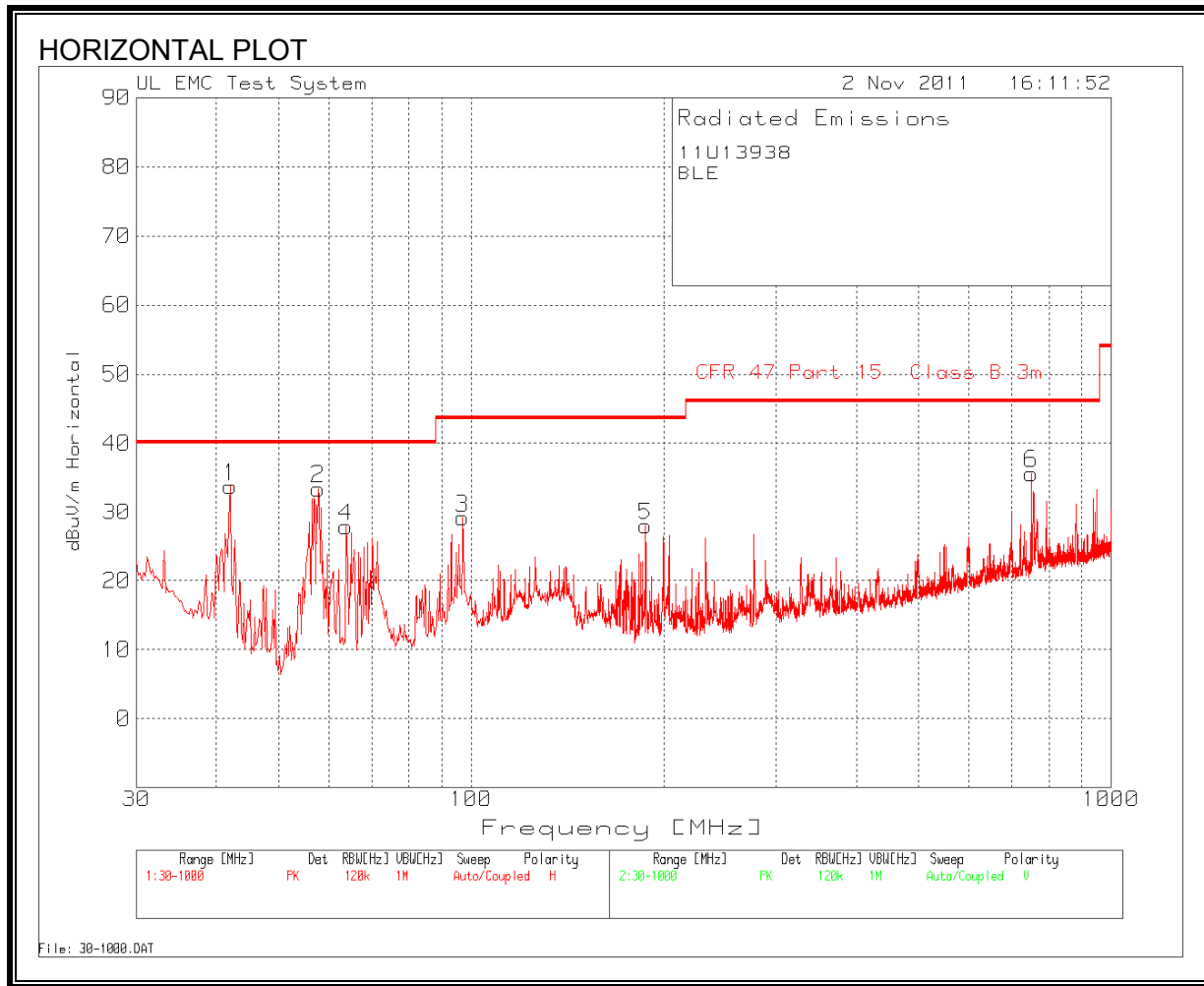
Note: No other emissions were detected above the system noise floor.

8.3. RECEIVER ABOVE 1 GHz

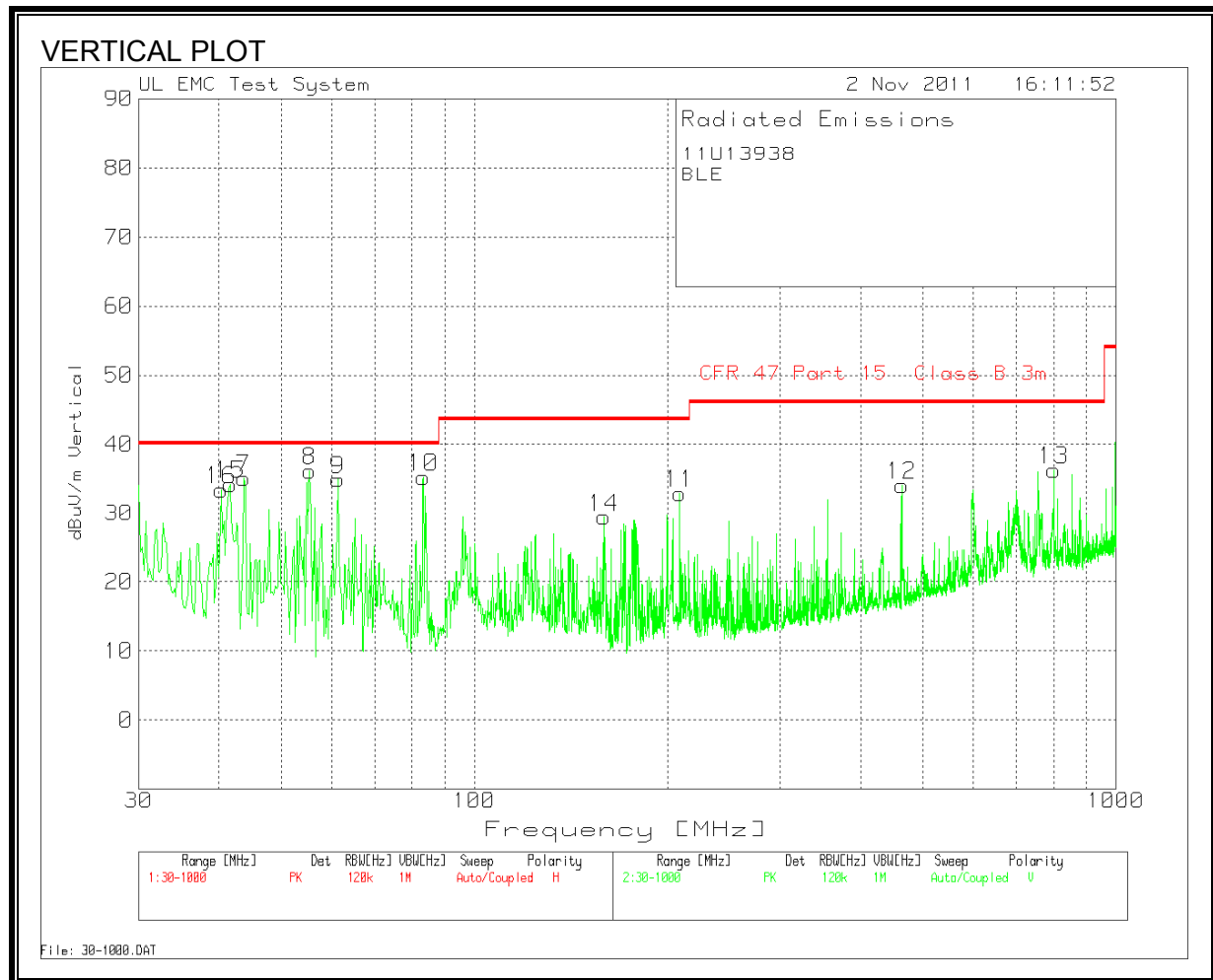
High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber-B																
Company:		Apple														
Project #:		11U13938														
Date:		11/2/2011														
Test Engineer:		Chin Pang														
Configuration:		EUT with AC Adapter and Earphone														
Mode:		BLE, RX, (Worst Case)														
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T59; S/N: 3245 @3m			T145 Agilent 3008A0056									FCC 15.209				
Hi Frequency Cables																
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			Peak Measurement RBW=VBW=1MHz	
3' cable 22807700			12' cable 22807600			20' cable 22807500									Average Measurement RBW=1MHz ; VBW=1MHz	
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)	
1.200	3.0	51.8	31.5	24.7	2.9	-35.8	0.0	0.0	43.5	23.2	74	54	-30.5	-30.8	H	
1.600	3.0	49.3	30.8	26.6	3.3	-35.6	0.0	0.0	43.6	25.1	74	54	-30.4	-28.9	H	
1.120	3.0	48.4	31.4	24.4	2.8	-35.9	0.0	0.0	39.6	22.6	74	54	-34.4	-31.4	V	
2.492	3.0	49.5	32.0	28.8	4.4	-35.2	0.0	0.0	47.4	29.9	74	54	-26.6	-24.1	V	
Rev. 07.08.11																
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									

8.4. 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

11U13938									
BLE									
Range 1 30 - 1000MHz									
Frequency	Reading	Detector	Cable Loss	Amp Gain	Bilog Factors	dBuV/m	Part 15B	Margin	Polarity
42.0184	49.26	PK	1	-29.4	12.9	33.76	40	-6.24	Horz
57.7198	53.85	PK	1.1	-29.4	7.9	33.45	40	-6.55	Horz
97.0703	47.72	PK	1.4	-29.3	9.3	29.12	43.5	-14.38	Horz
63.729	48.1	PK	1.2	-29.4	8	27.9	40	-12.1	Horz
187.4021	43.97	PK	1.9	-29	11.1	27.97	43.5	-15.53	Horz
750.1339	40.85	PK	3.8	-29.1	20.1	35.65	46	-10.35	Horz
Range 2 30 - 1000MHz									
Frequency	Reading	Detector	Cable Loss	Amp Gain	Bilog Factors	dBuV/m	Part 15B	Margin	Polarity
43.763	51.69	PK	1	-29.4	11.8	35.09	40	-4.91	Vert
55.3937	56.54	PK	1.1	-29.4	7.9	36.14	40	-3.86	Vert
61.4029	55.23	PK	1.2	-29.4	7.9	34.93	40	-5.07	Vert
83.3074	55.74	PK	1.3	-29.4	7.6	35.24	40	-4.76	Vert
209.1127	47.85	PK	2	-28.9	12	32.95	43.5	-10.55	Vert
463.8249	44.24	PK	3	-29.3	16.2	34.14	46	-11.86	Vert
801.6966	40.19	PK	4	-28.9	21	36.29	46	-9.71	Vert
159.1007	45.86	PK	1.7	-29.1	11	29.46	43.5	-14.04	Vert
41.6307	49.65	PK	0.9	-29.4	13.1	34.25	40	-5.75	Vert
40.2738	48.04	PK	0.9	-29.4	13.9	33.44	40	-6.56	Vert

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

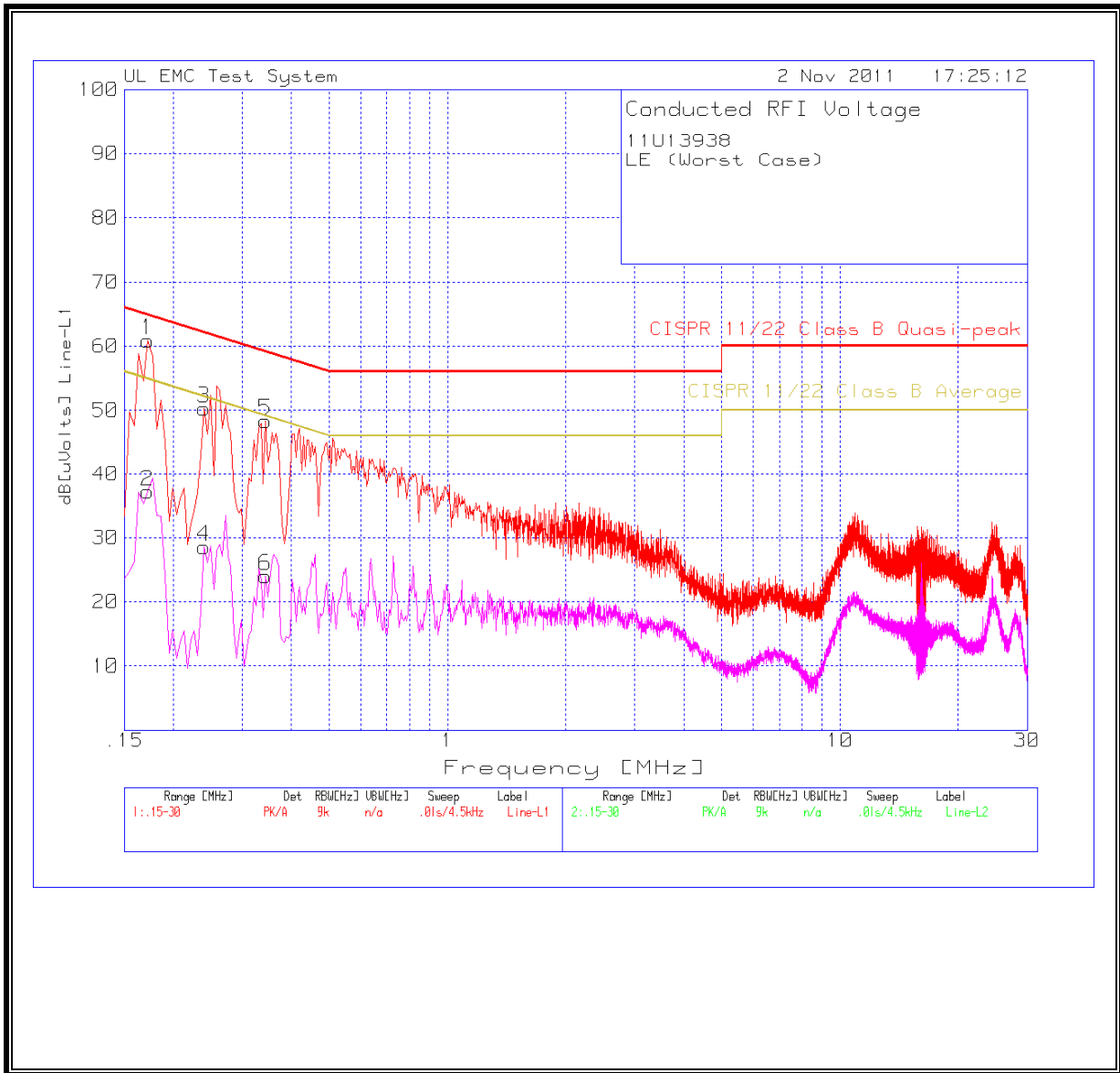
ANSI C63.4

RESULTS

6 WORST EMISSIONS

11U13938							
LE (Worst Case)							
Line-L1 .15 - 30MHz							
Frequency	Reading	Detector	dB[uVolts]	Class B Qp	Margin	Class B Avg	Margin
0.1725	60.93	PK	60.93	64.8	-3.87	54.8	6.13
0.1725	37.25	Av	37.25	-	-	54.8	-17.55
0.24	50.34	PK	50.34	62.1	-11.76	52.1	-1.76
0.24	28.57	Av	28.57	-	-	52.1	-23.53
0.3435	48.33	PK	48.33	59.1	-10.77	49.1	-0.77
0.3435	24.05	Av	24.05	-	-	49.1	-25.05
Line-L2 .15 - 30MHz							
Frequency	Reading	Detector	dB[uVolts]	Class B Qp	Margin	Class B Avg	Margin
0.168	60.07	PK	60.07	65.1	-5.03	55.1	4.97
0.168	39.35	Av	39.35	-	-	55.1	-15.75
0.2625	53.1	PK	53.1	61.4	-8.3	51.4	1.7
0.2625	28.97	Av	28.97	-	-	51.4	-22.43
0.348	47.4	PK	47.4	59	-11.6	49	-1.6
0.348	25.22	Av	25.22	-	-	49	-23.78

LINE 1 RESULTS



LINE 2 RESULTS

