



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

CERTIFICATION TEST REPORT

FOR

802.11 a/b/g/n 3X3 ACCESS POINT

MODEL NUMBER: A1409

**FCC ID: BCGA1409
IC: 579C-A1409**

REPORT NUMBER: 11U13703-16, Revision B

ISSUE DATE: MAY 31, 2011

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

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



NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	05/02/11	Initial Issue	F. Ibrahim
A	05/13/11	Revised all conducted spurious sections	F. Ibrahim
B	05/31/11	Revised section 1, section 2, section 6, and section 8.2.4.	F. Ibrahim

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION	6
4.2. SAMPLE CALCULATION	6
4.3. MEASUREMENT UNCERTAINTY	6
5. EQUIPMENT UNDER TEST	7
5.1. DESCRIPTION OF EUT	7
5.2. MAXIMUM OUTPUT POWER	7
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	8
5.4. SOFTWARE AND FIRMWARE	8
5.5. WORST-CASE CONFIGURATION AND MODE	9
5.6. DESCRIPTION OF TEST SETUP	10
6. TEST AND MEASUREMENT EQUIPMENT	12
7. ANTENNA PORT TEST RESULTS	13
7.1. 802.11b THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND	13
7.1.1. 6 dB BANDWIDTH	13
7.1.2. 99% BANDWIDTH	19
7.1.3. OUTPUT POWER	25
7.1.4. POWER SPECTRAL DENSITY	35
7.1.5. CONDUCTED SPURIOUS EMISSIONS	41
7.2. 802.11g THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND	51
7.2.1. 6 dB BANDWIDTH	51
7.2.2. 99% BANDWIDTH	57
7.2.3. OUTPUT POWER	63
7.2.4. POWER SPECTRAL DENSITY	73
7.2.5. CONDUCTED SPURIOUS EMISSIONS	79
7.3. 802.11n THREE CHAINS HT20 MODE IN THE 2.4 GHz BAND	89
7.3.1. 6 dB BANDWIDTH	89
7.3.2. 99% BANDWIDTH	95
7.3.3. OUTPUT POWER	101
7.3.4. POWER SPECTRAL DENSITY	111
7.3.5. CONDUCTED SPURIOUS EMISSIONS	117
7.4. 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND	127
7.4.1. 6 dB BANDWIDTH	127
7.4.2. 99% BANDWIDTH	133
7.4.3. OUTPUT POWER	139

7.4.4.	POWER SPECTRAL DENSITY	145
7.4.5.	CONDUCTED SPURIOUS EMISSIONS.....	151
7.5.	<i>802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND</i>	<i>161</i>
7.5.1.	6 dB BANDWIDTH	161
7.5.2.	99% BANDWIDTH	167
7.5.3.	OUTPUT POWER	173
7.5.4.	POWER SPECTRAL DENSITY	179
7.5.5.	CONDUCTED SPURIOUS EMISSIONS.....	185
7.6.	<i>802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND</i>	<i>195</i>
7.6.1.	6 dB BANDWIDTH	195
7.6.2.	99% BANDWIDTH	199
7.6.3.	OUTPUT POWER	203
7.6.4.	POWER SPECTRAL DENSITY	207
7.6.5.	CONDUCTED SPURIOUS EMISSIONS.....	211
8.	RADIATED TEST RESULTS	218
8.1.	<i>LIMITS AND PROCEDURE</i>	<i>218</i>
8.2.	<i>TRANSMITTER ABOVE 1 GHz</i>	<i>219</i>
8.2.1.	TX ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND	219
8.2.2.	TX ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND	225
8.2.3.	TX ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 2.4 GHz BAND	231
8.2.4.	TX ABOVE 1 GHz FOR 802.11a MODE IN THE 5.8 GHz BAND	237
8.2.5.	TX ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 5.8 GHz BAND	238
8.2.6.	TX ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 5.8 GHz BAND	239
8.3.	<i>RECEIVER ABOVE 1 GHz</i>	<i>240</i>
8.3.1.	RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 2.4 GHz BAND	240
8.3.2.	RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 5.8 GHz BAND	241
8.3.3.	RX ABOVE 1 GHz FOR 40 MHz BANDWIDTH IN THE 5.8 GHz BAND	242
8.4.	<i>RADIATED BELOW 1 GHz.....</i>	<i>243</i>
9.	AC POWER LINE CONDUCTED EMISSIONS	246
10.	MAXIMUM PERMISSIBLE EXPOSURE	250
11.	SETUP PHOTOS	254

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11 a/b/g/n 3X3 ACCESS POINT

MODEL: A1409

SERIAL NUMBER: C86F8006DM73

DATE TESTED: JANUARY 28 – MAY 13, 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 CCS By:



FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:



WILLIAM ZHUANG
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 3, ICES-003 ISSUE 4, 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.

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 EUT is an 802.11 a/b/g/n transceiver Access Point.

The radio module is manufactured by Apple.

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	24.10	257.04
2412 - 2462	802.11g	24.88	307.61
2412 - 2462	802.11n HT20	24.11	257.63

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11a	25.14	326.59
5745 - 5805	802.11n HT20	25.28	337.29
5755 - 5795	802.11n HT40	25.94	392.64

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes 3 IFA integrated antennas, with the following peak gains:

Frequency Range (MHz)	AP2 Peak gain dBi	AP3 Peak gain dBi	AP4 Peak gain dBi
2.4 - 2483.5	0.1	0.27	4.32

Frequency Range (MHz)	AP1 Peak gain (dBi)	AP2 Peak gain (dBi)	AP3 Peak gain (dBi)
5725 - 5850	4.38	0.81	3.09

5.4. SOFTWARE AND FIRMWARE

The Utility software installed in the EUT during testing was 5.100.51.22 (WLTEST)

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.

Worst-case data rates as provided by the manufacturer are:

For 11b mode: 1Mbps

For 11g mode: 6Mbps

For 11n HT20 (2.4 GHz band): MCS0

For 11a mode: 6Mbps

For 11n HT20 (5.8 GHz band): MCS0

For 11n HT40 (5.8 GHz band): MCS0

EUT only has one orientation (laid down on the desktop) and it was tested in that orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Laptop	Apple	Mac Book	PT429161
AC Adaptor	Apple	A1344	N/A

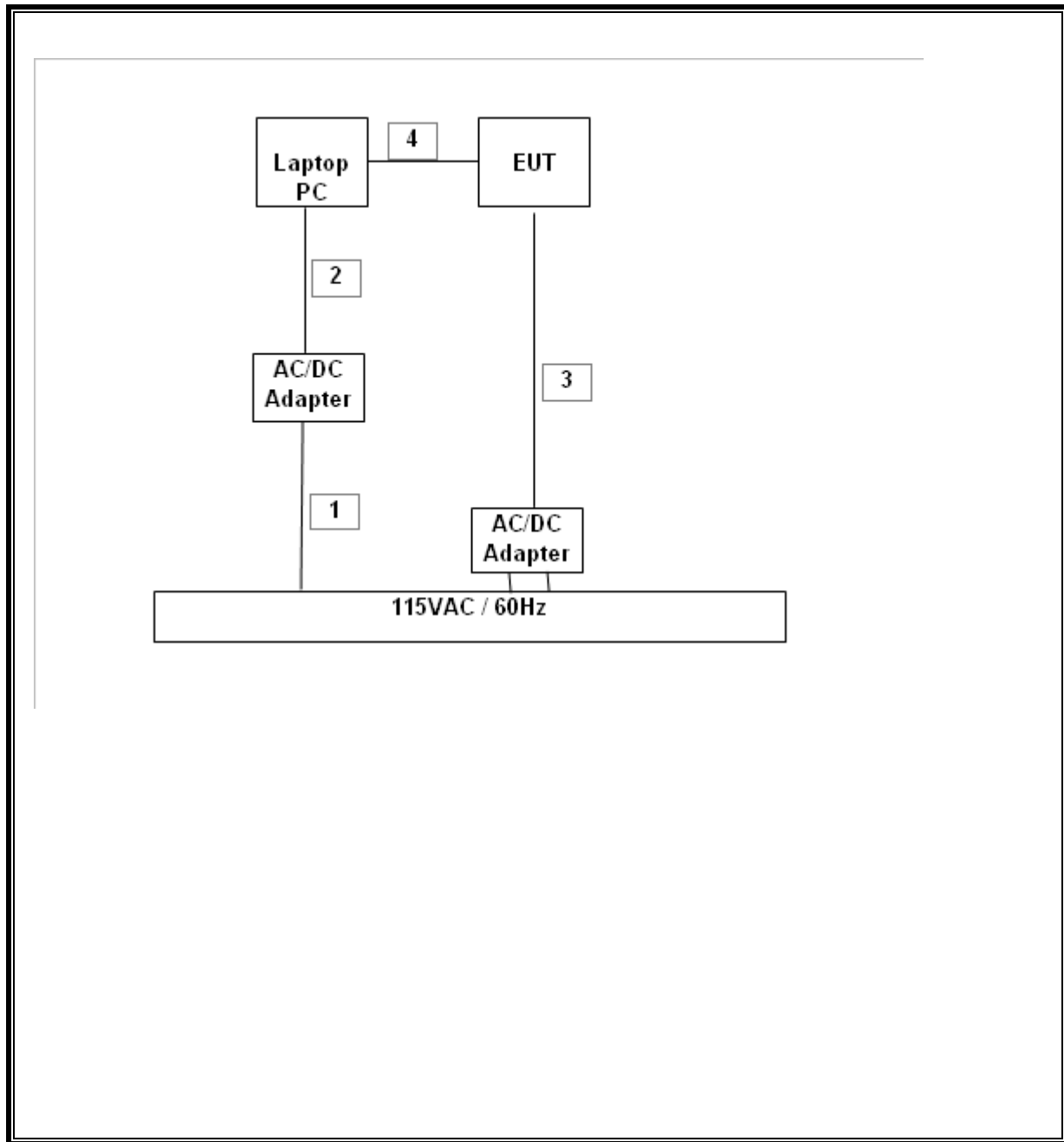
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	unshielded	2m	N/A
2	DC	1	DC	unshielded	2.5m	N/A
3	DC	1	DC	unshielded	2m	N/A
4	Ethernet	4	RJ45	Shielded	1.5m	N/A

TEST SETUP

The Access Point EUT is controlled externally with a laptop, via Ethernet.

SETUP DIAGRAM FOR RADIO TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/11
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/27/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/12/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/06/11
Antenna, Horn, 26.5 GHz	ARA	MMH-1826/B	C00980	06/25/11
Antenna, Horn, 40 GHz	ARA	MMH-2640/B	C00981	06/08/11
Harmonic Mixer, 50 GHz	Agilent / HP	11970Q	C00769	05/05/11
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/11
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	05/08/11
Peak Power Meter	Boonton	4541	C01186	04/05/12
Peak Power Sensor	Boonton	57318	C01202	03/04/12
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/11

7. ANTENNA PORT TEST RESULTS

7.1. 802.11b THREE CHAINS LEGACY 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.

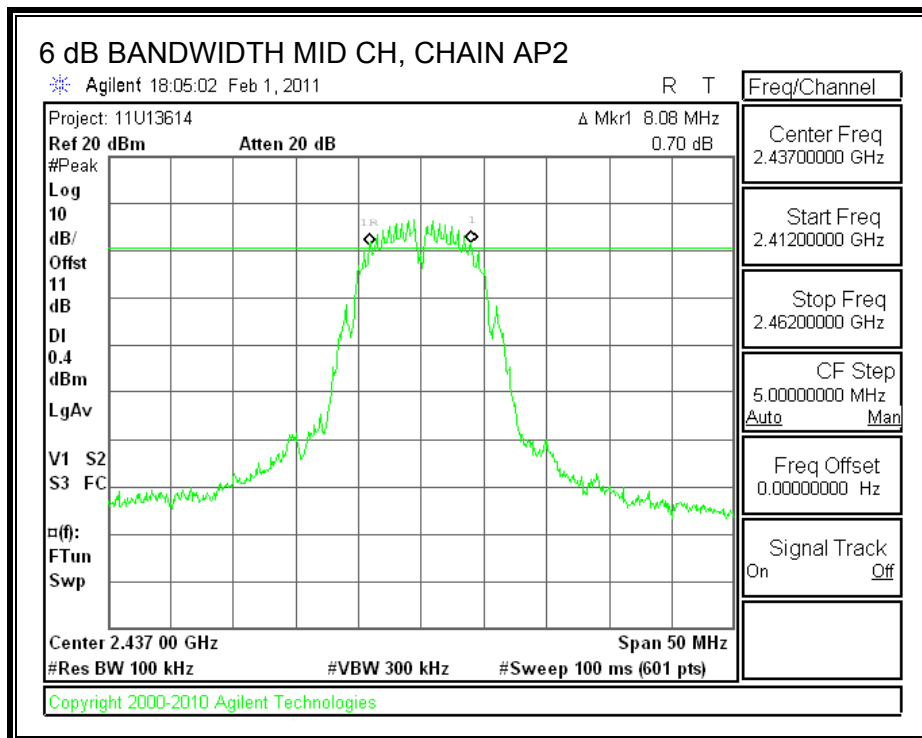
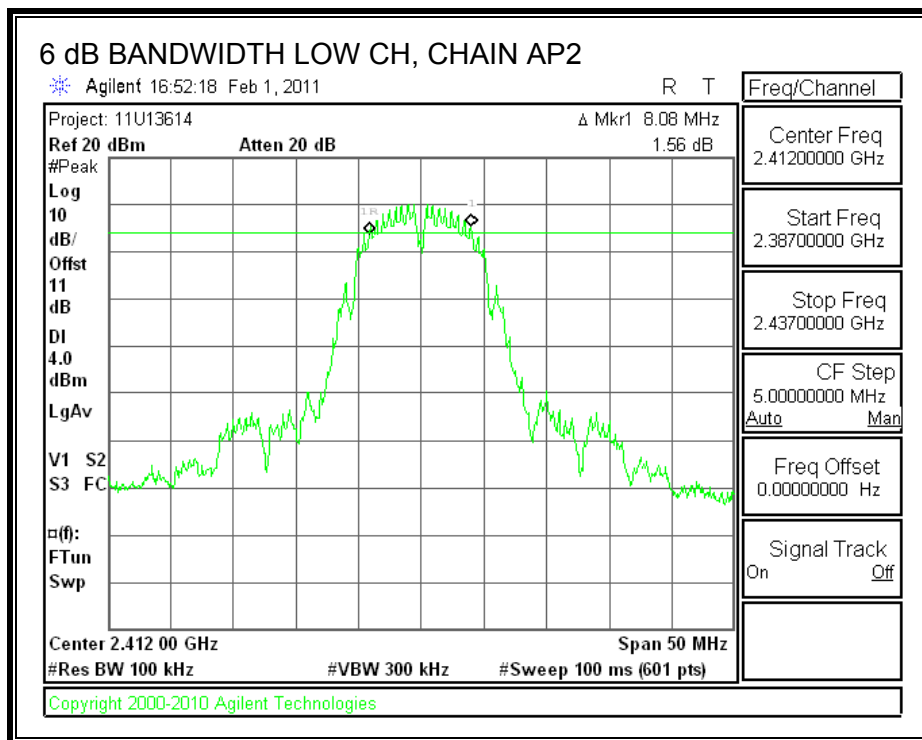
TEST PROCEDURE

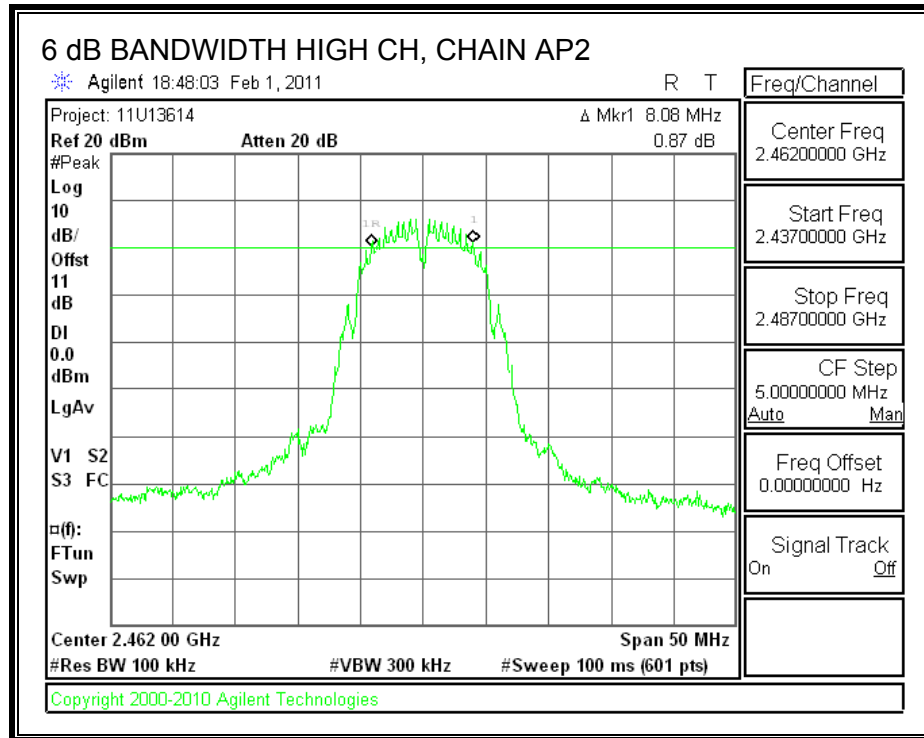
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

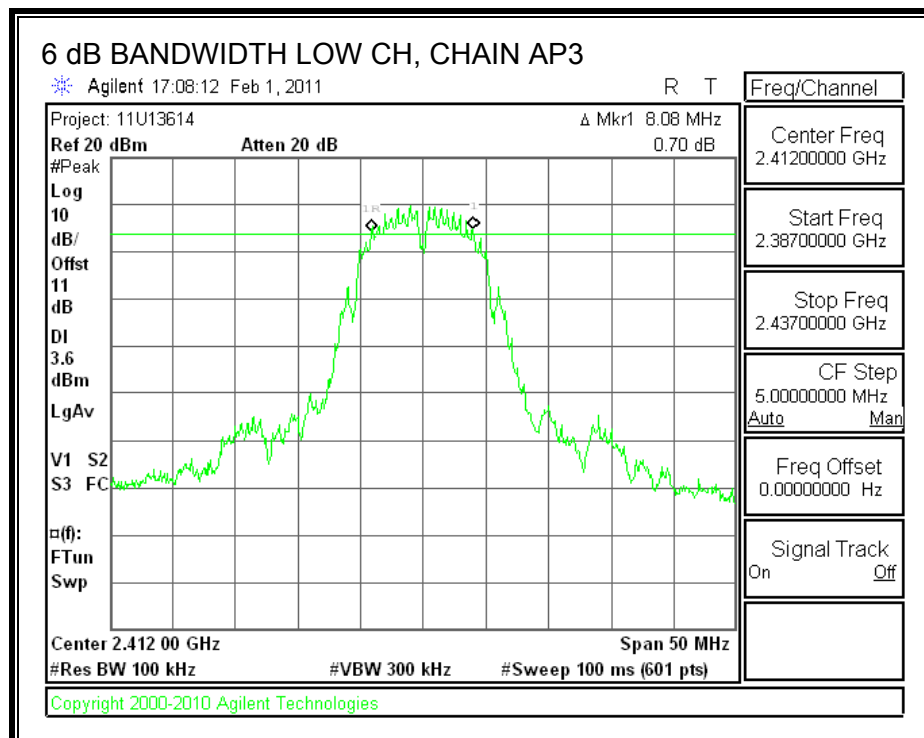
Channel	Frequency (MHz)	Chain AP2 6 dB BW (MHz)	Chain AP3 6 dB BW (MHz)	Chain AP4 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	8.08	8.08	8.08	0.5
Middle	2437	8.08	8.08	8.08	0.5
High	2462	8.08	8.08	8.08	0.5

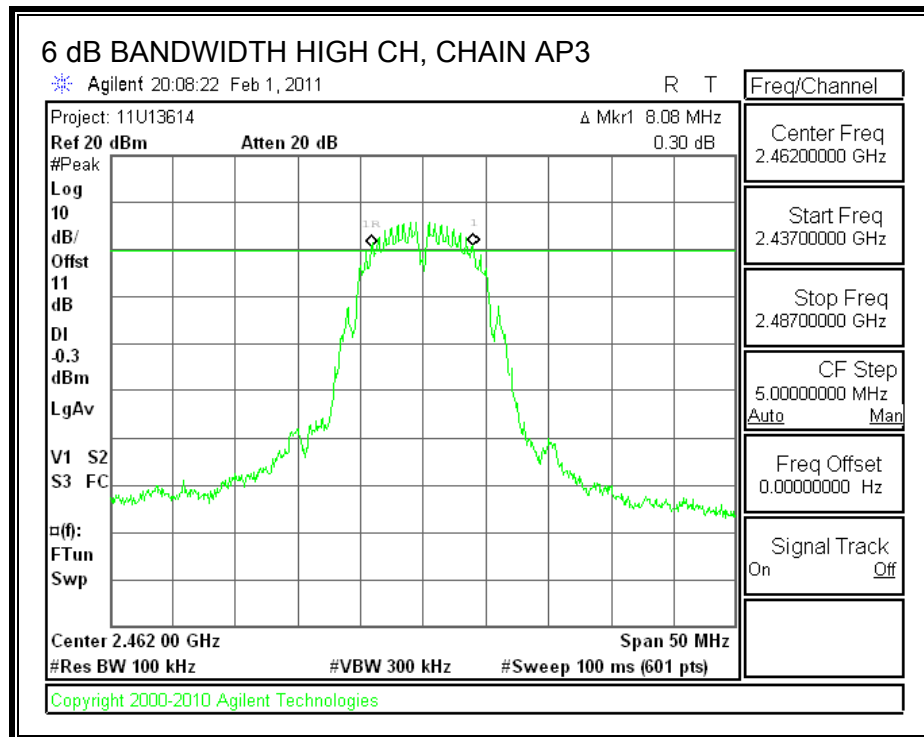
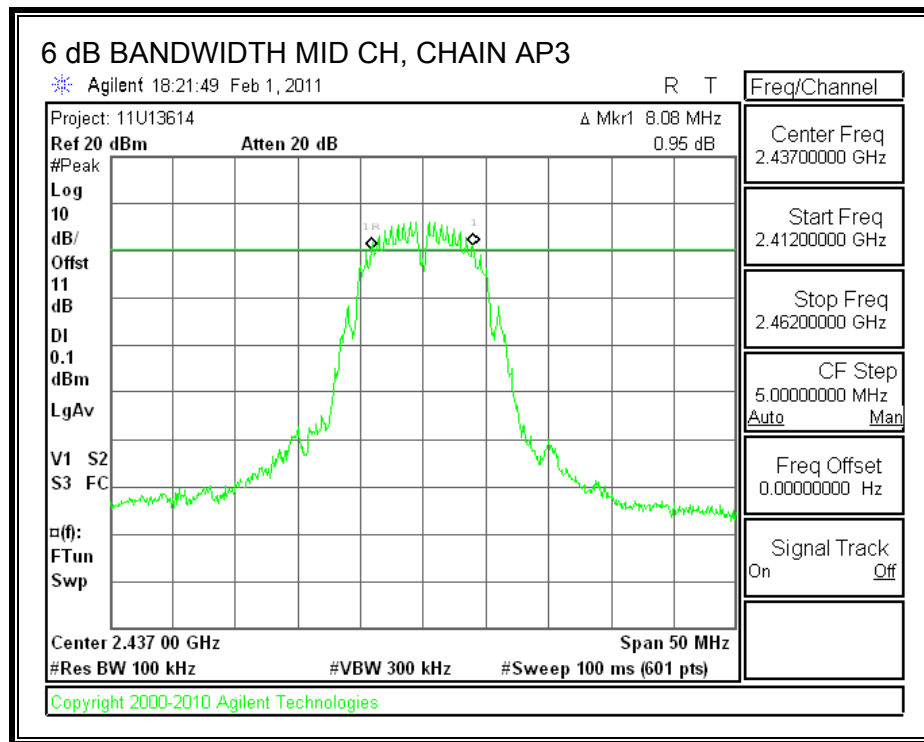
6 dB BANDWIDTH, CHAIN AP2



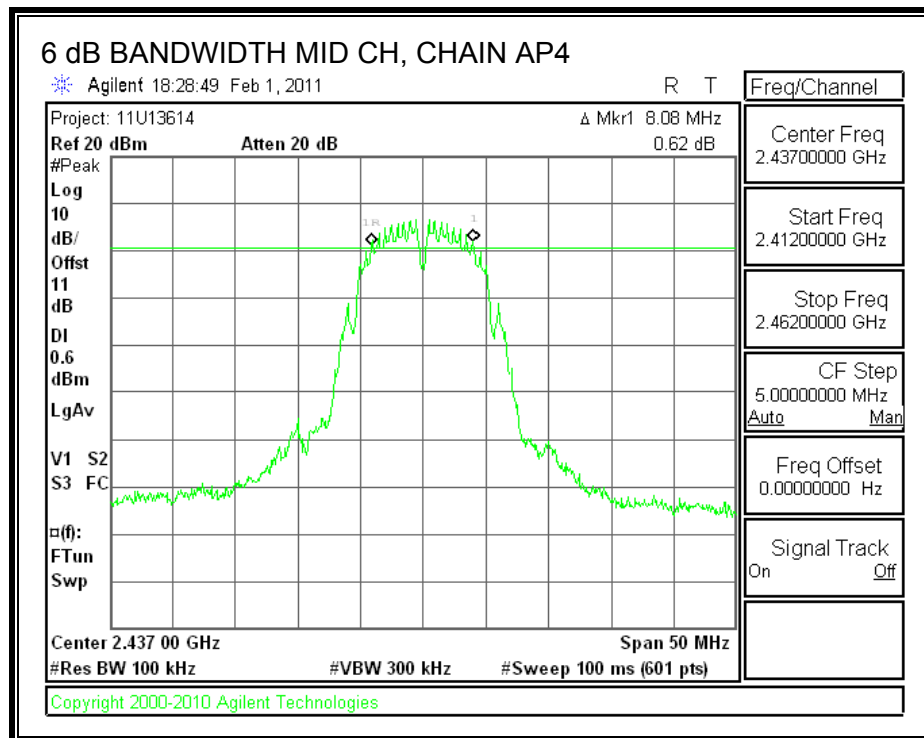
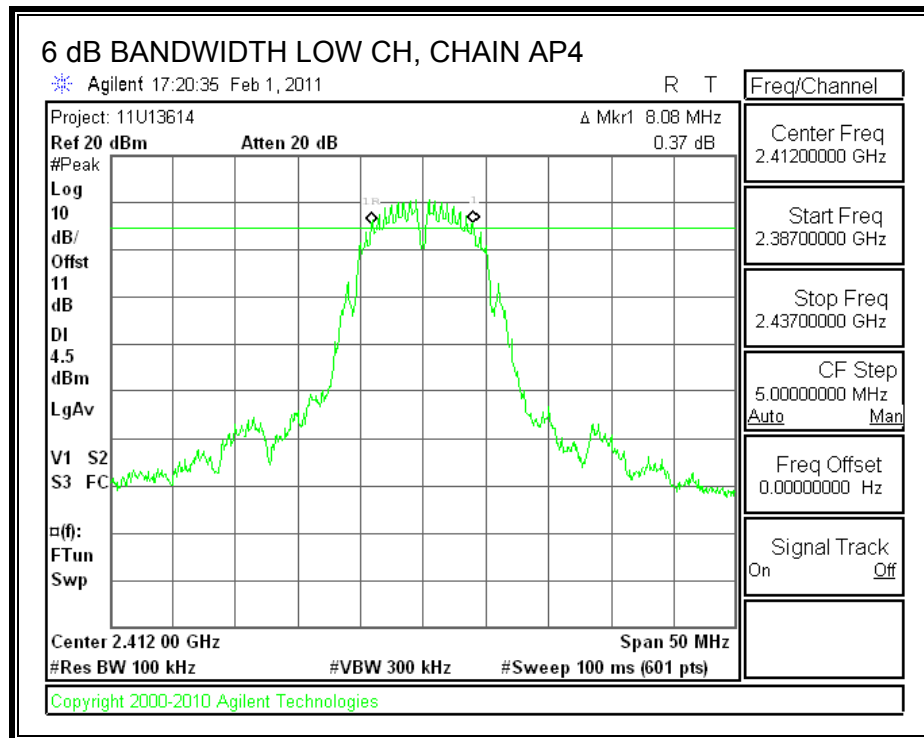


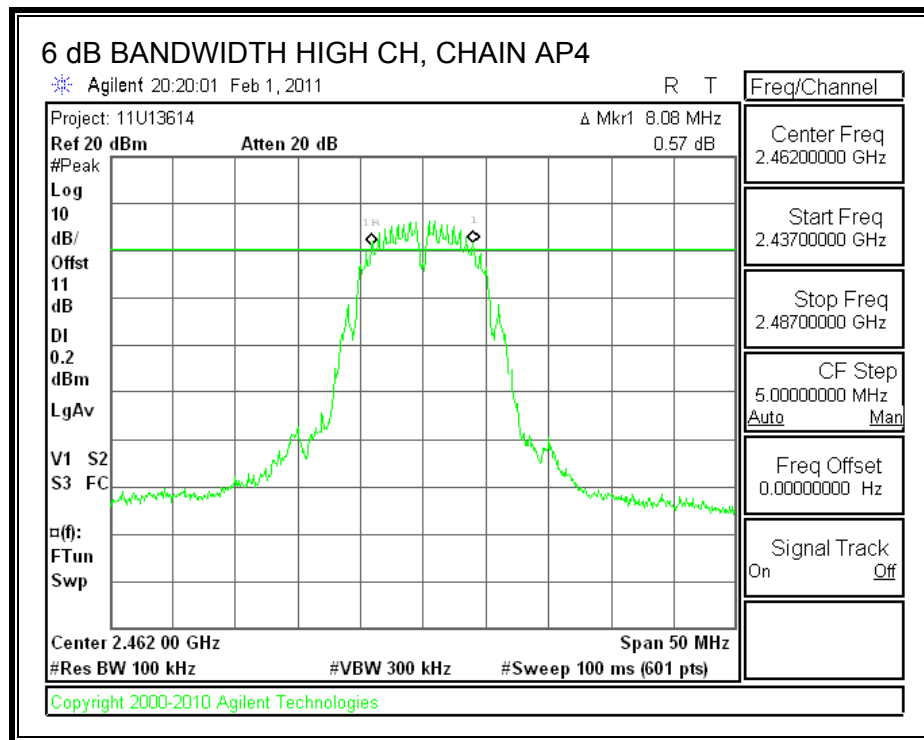
6 dB BANDWIDTH, CHAIN AP3





6 dB BANDWIDTH, CHAIN AP4





7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

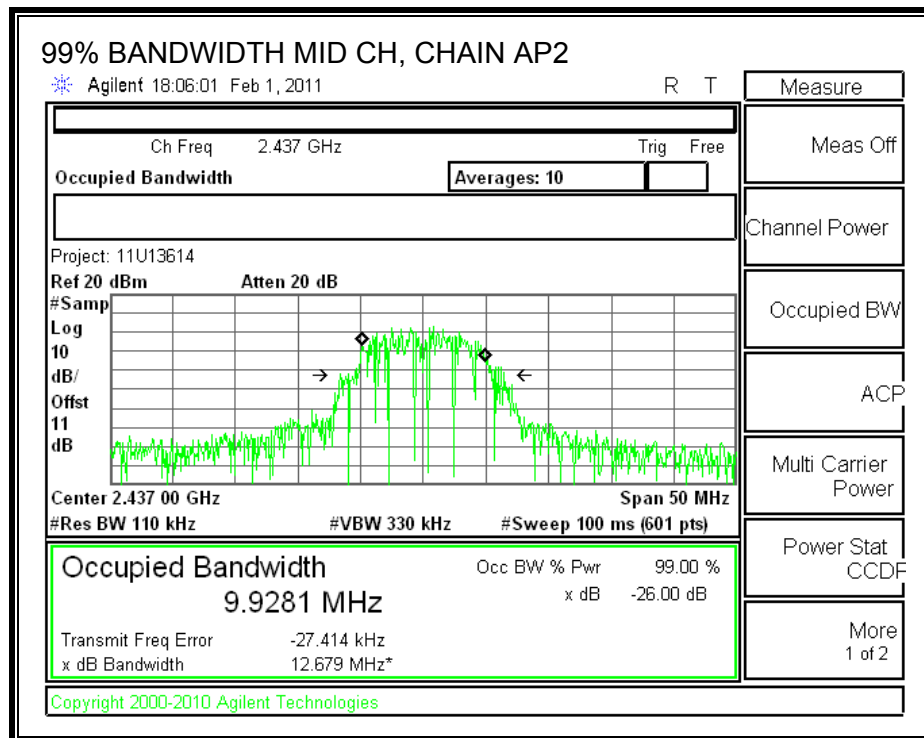
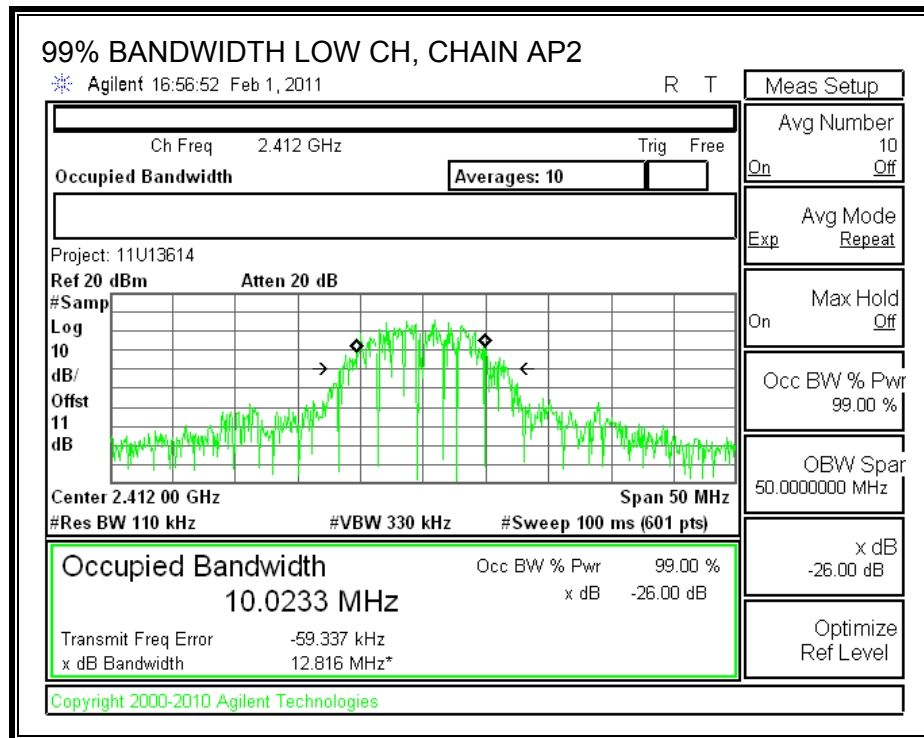
TEST PROCEDURE

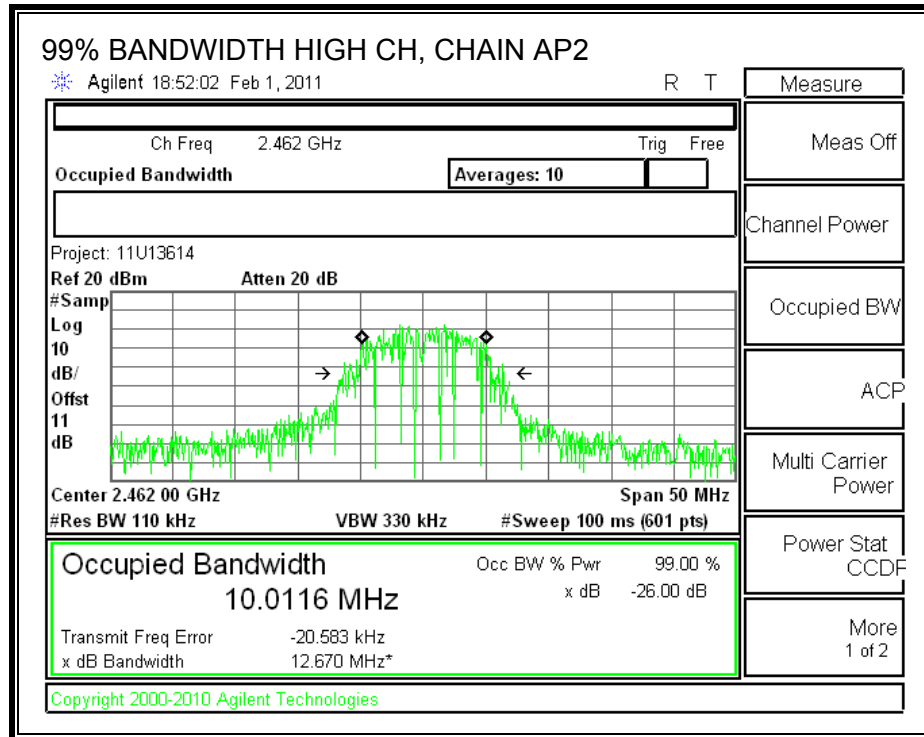
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

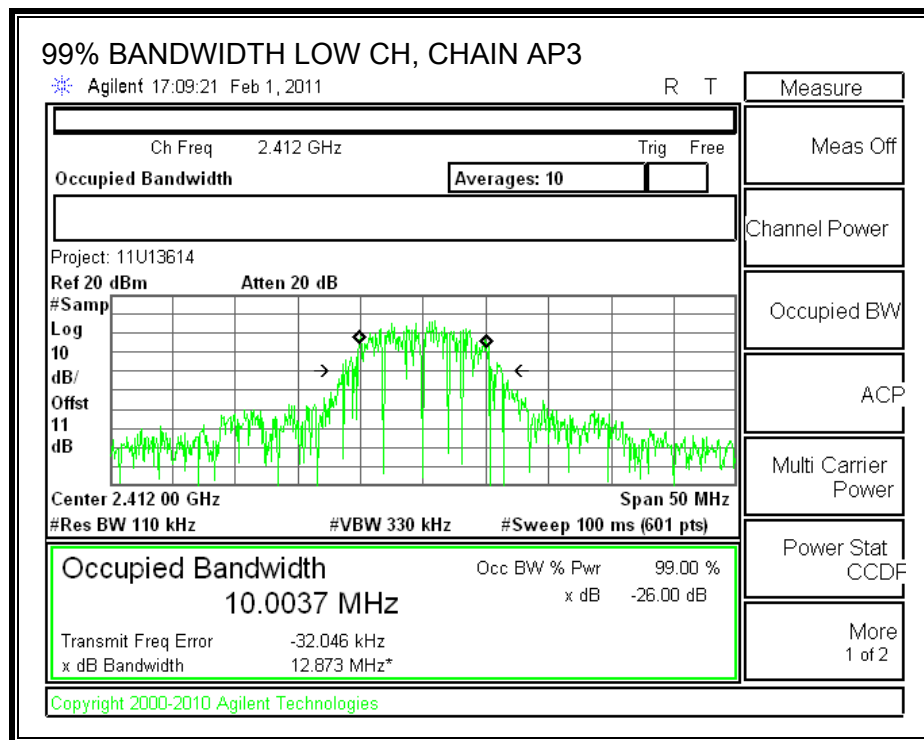
Channel	Frequency (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)	AP4 99% Bandwidth (MHz)
Low	2412	10.0233	10.0037	10.0165
Middle	2437	9.9281	9.9828	10.0297
High	2462	10.0116	9.9908	9.9641

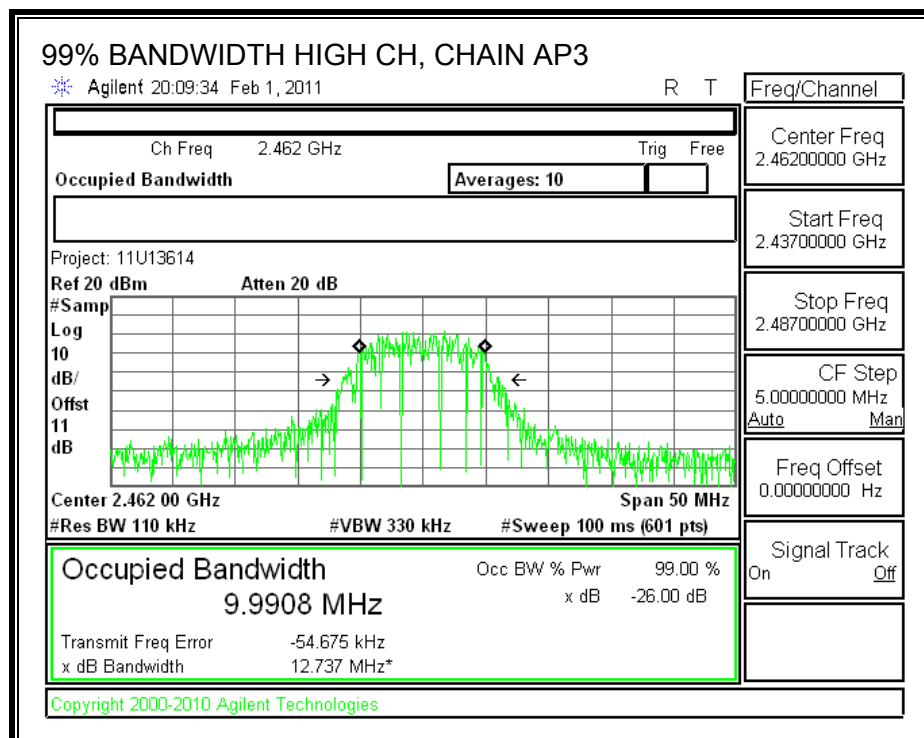
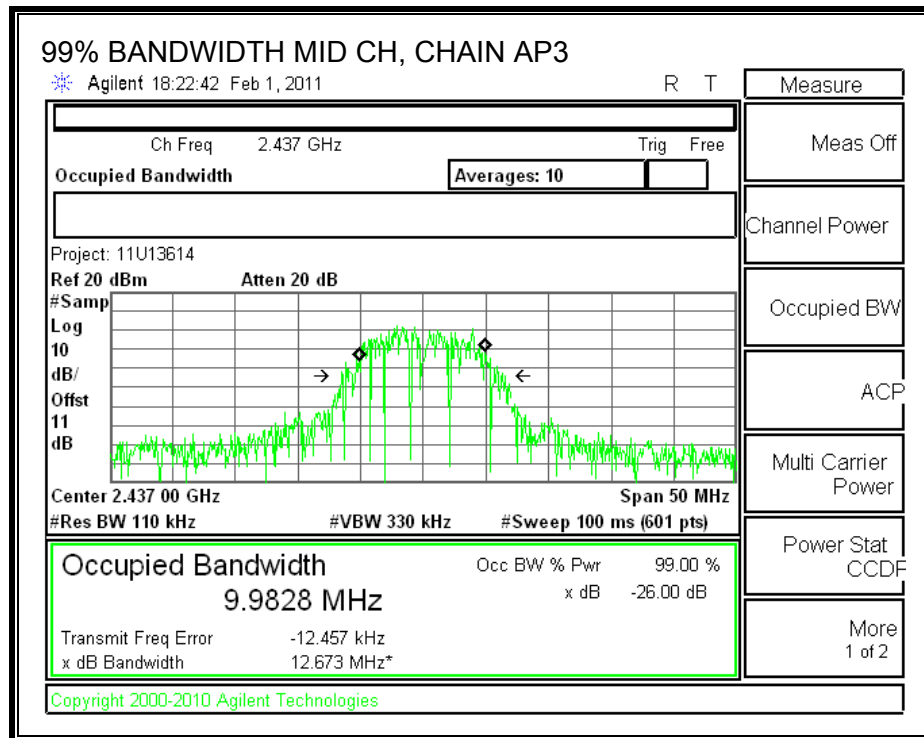
99% BANDWIDTH, CHAIN AP2



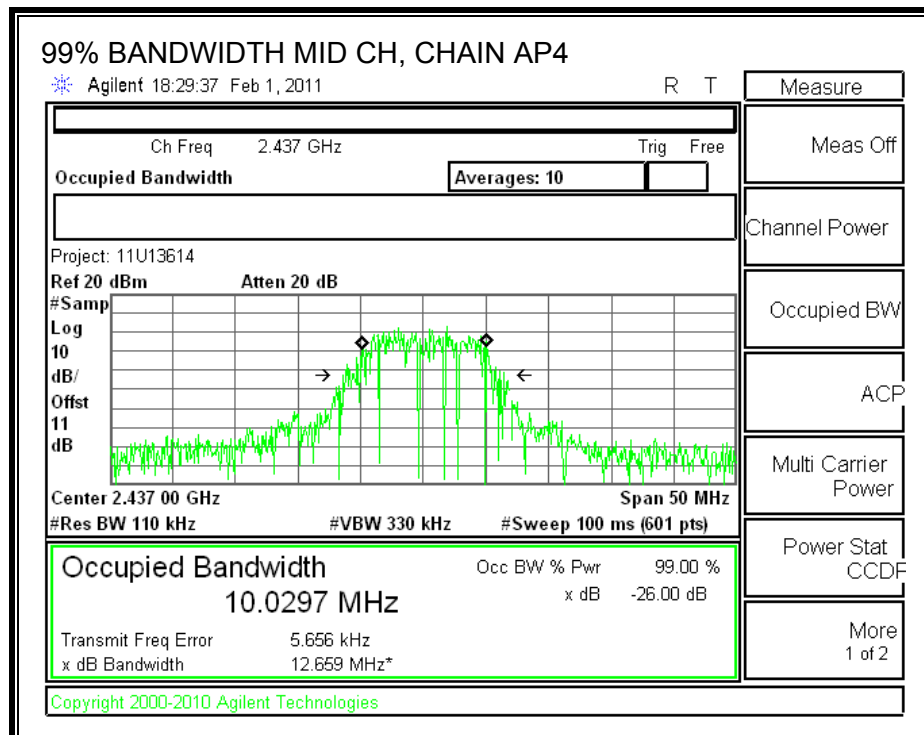
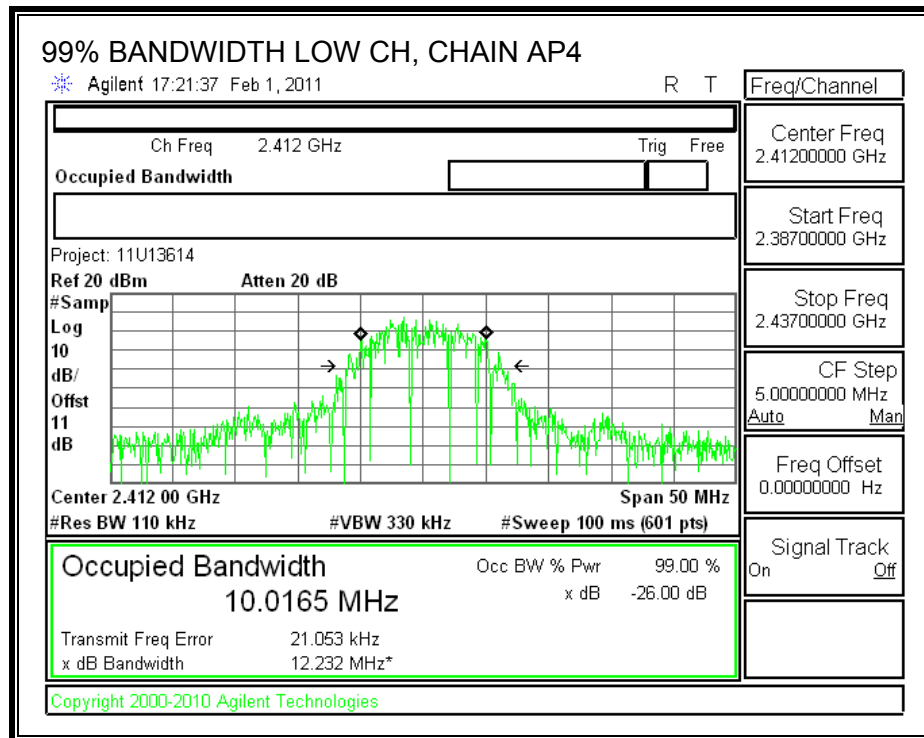


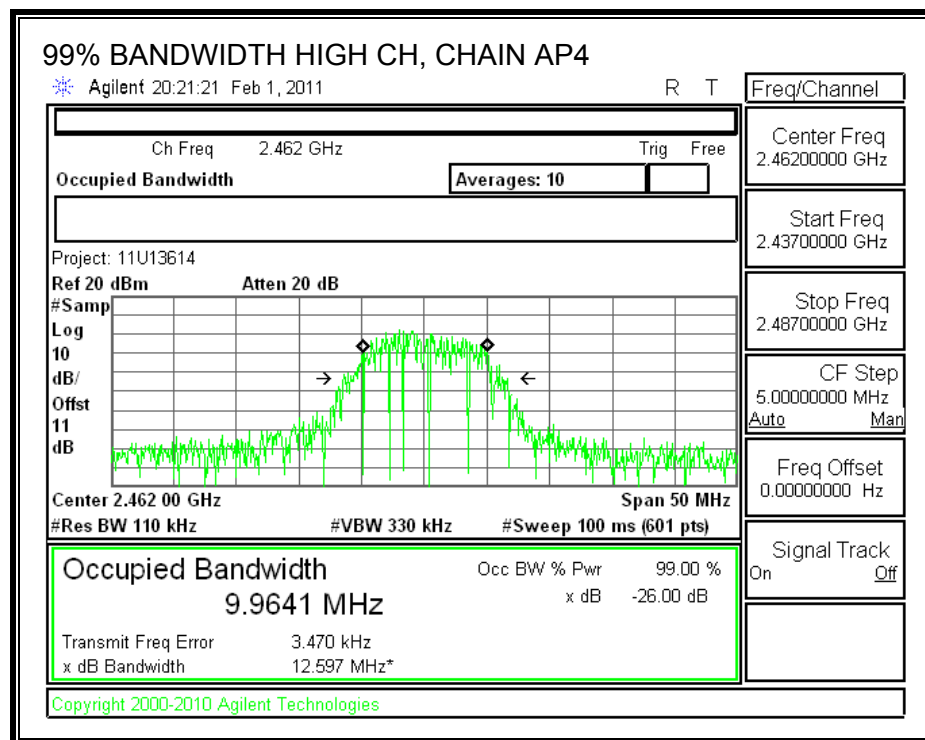
99% BANDWIDTH, CHAIN AP3





99% BANDWIDTH, CHAIN AP4





7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna Gain (AP2) (dBi)	Antenna Gain (AP3) (dBi)	Antenna Gain (AP4) (dBi)	Effective Legacy Gain (dBi)
0.1	0.27	4.32	6.80

The maximum effective legacy gain is 6.8 dBi for other than fixed, point-to-point operations, therefore the limit is 29.2 dBm.

TEST PROCEDURE

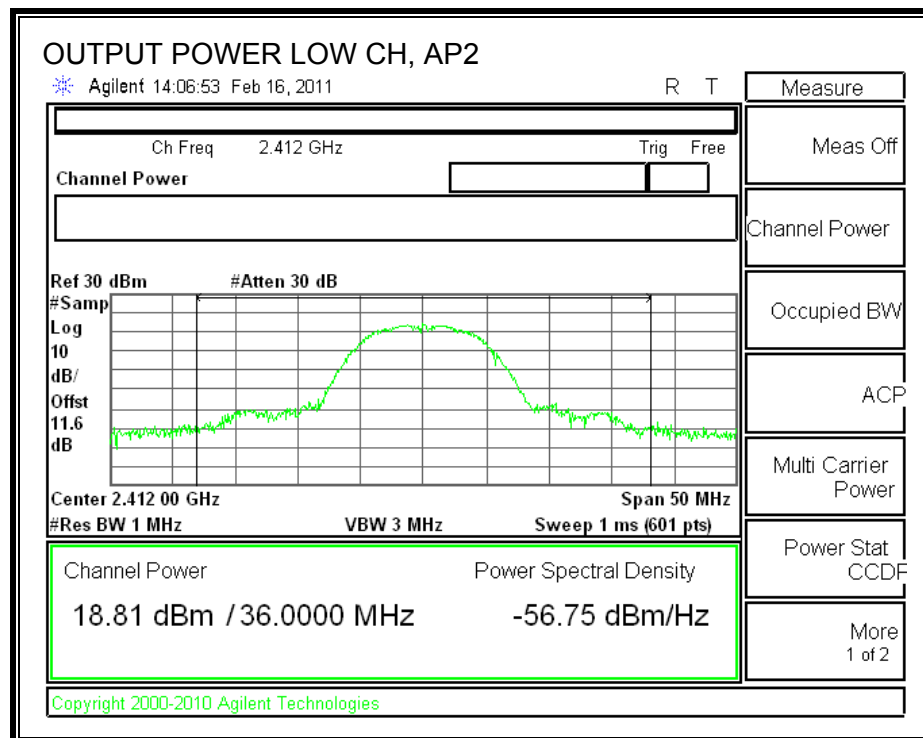
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

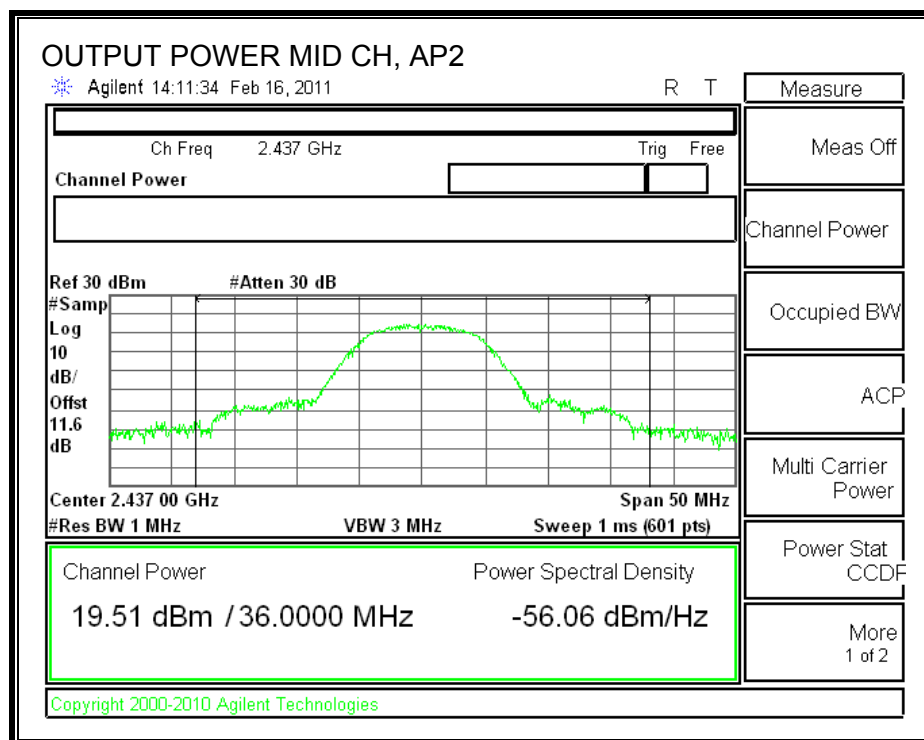
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

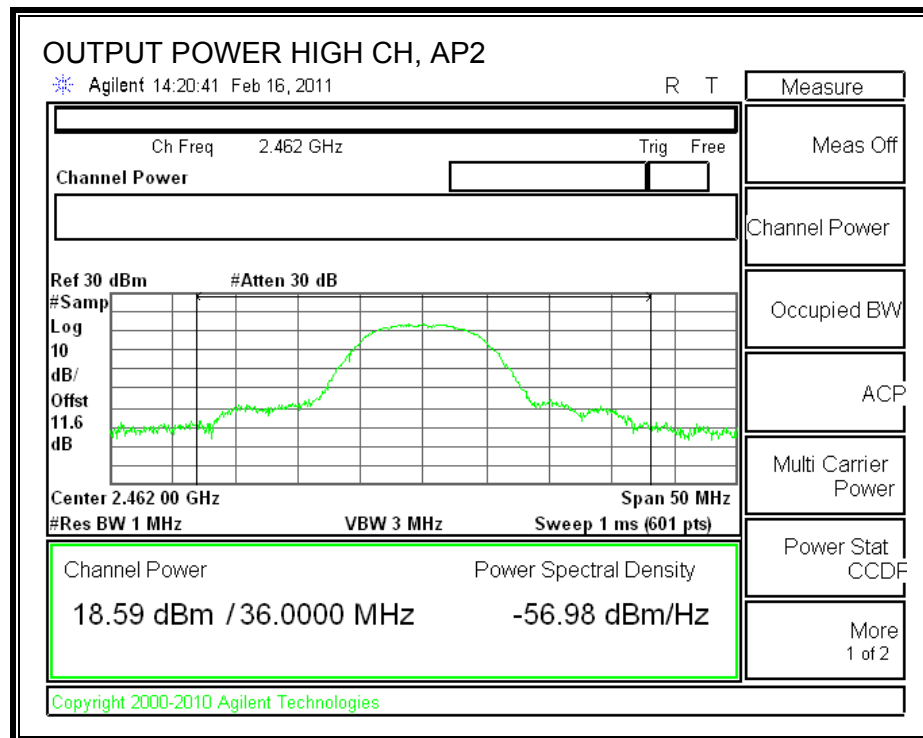
RESULTS

Channel	Frequency (MHz)	Chain AP2 Power (dBm)	Chain AP3 Power (dBm)	Chain AP4 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	18.81	18.35	19.11	0.00	23.54	29.20	-5.66
Mid	2437	19.51	18.98	19.48	0.00	24.10	29.20	-5.10
High	2462	18.59	18.31	18.50	0.00	23.24	29.20	-5.96

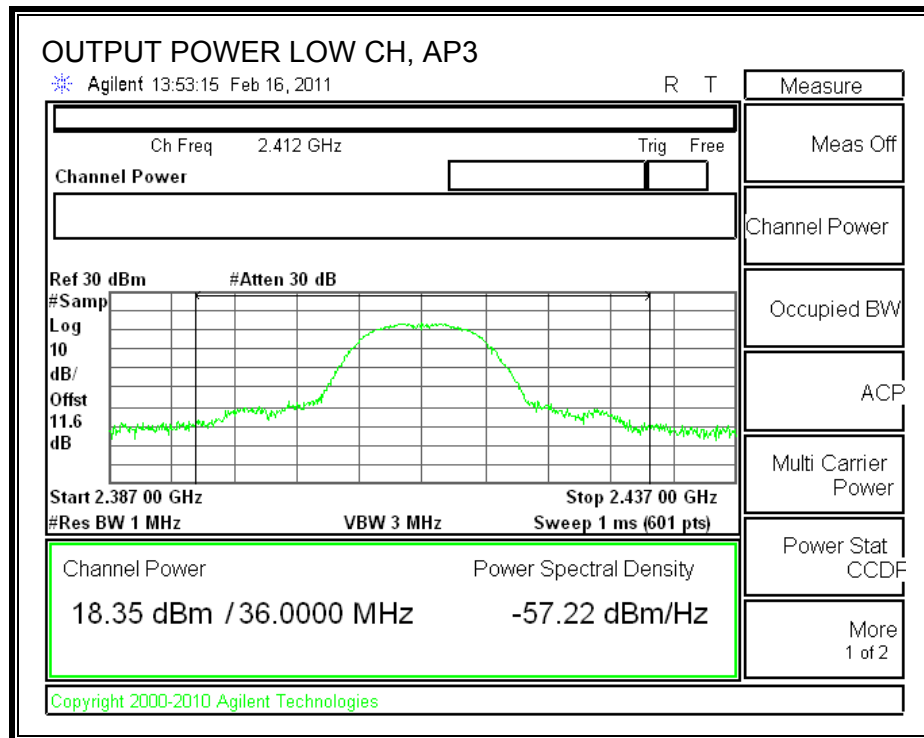
AP2 OUTPUT POWER

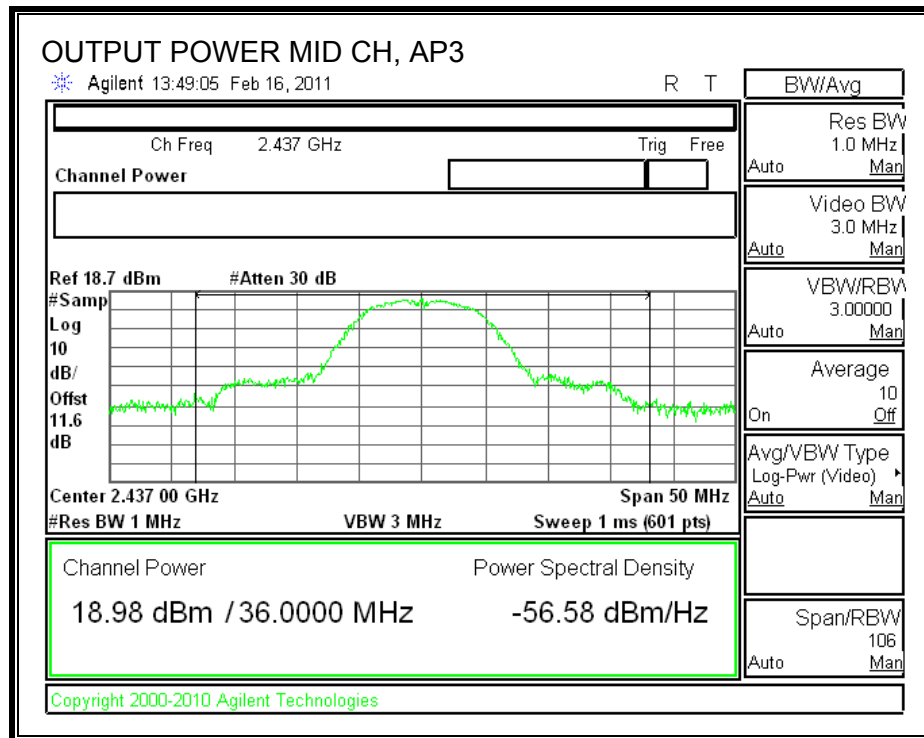


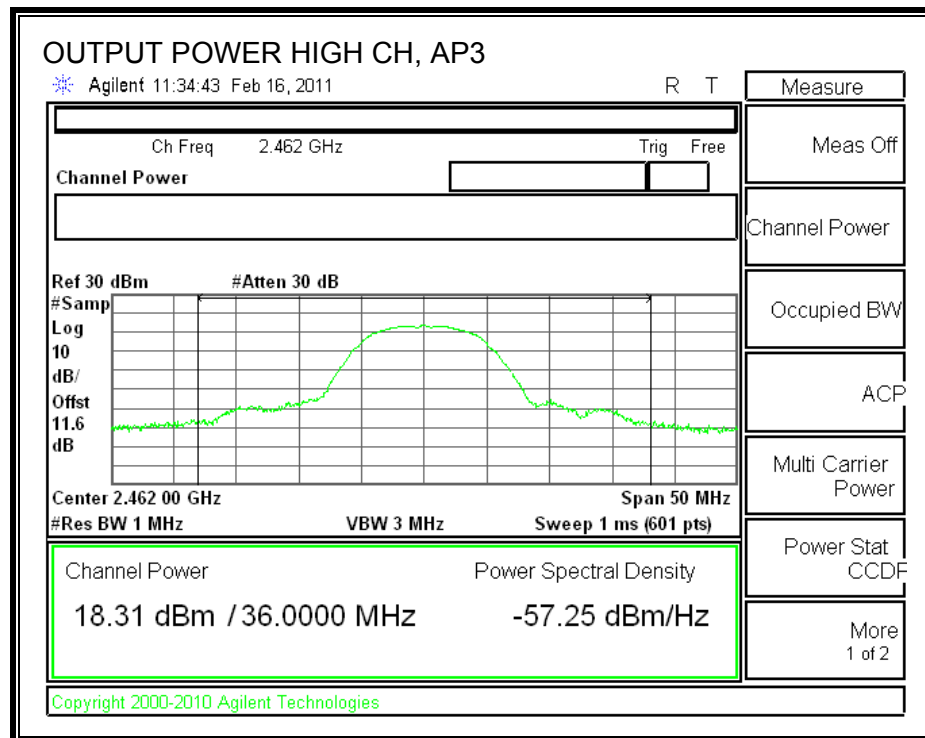




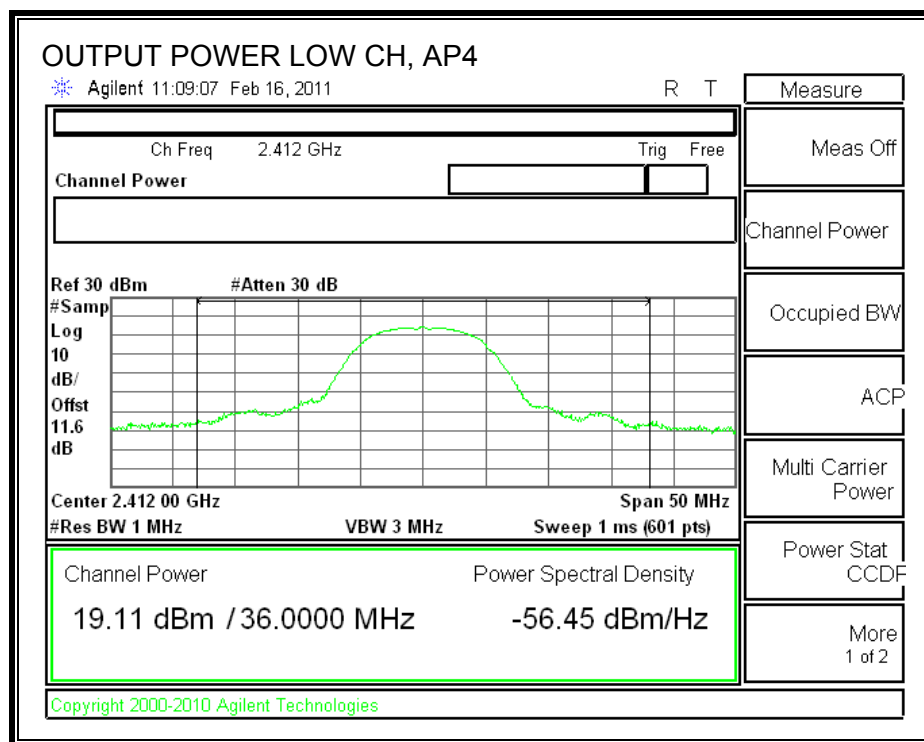
AP3 OUTPUT POWER

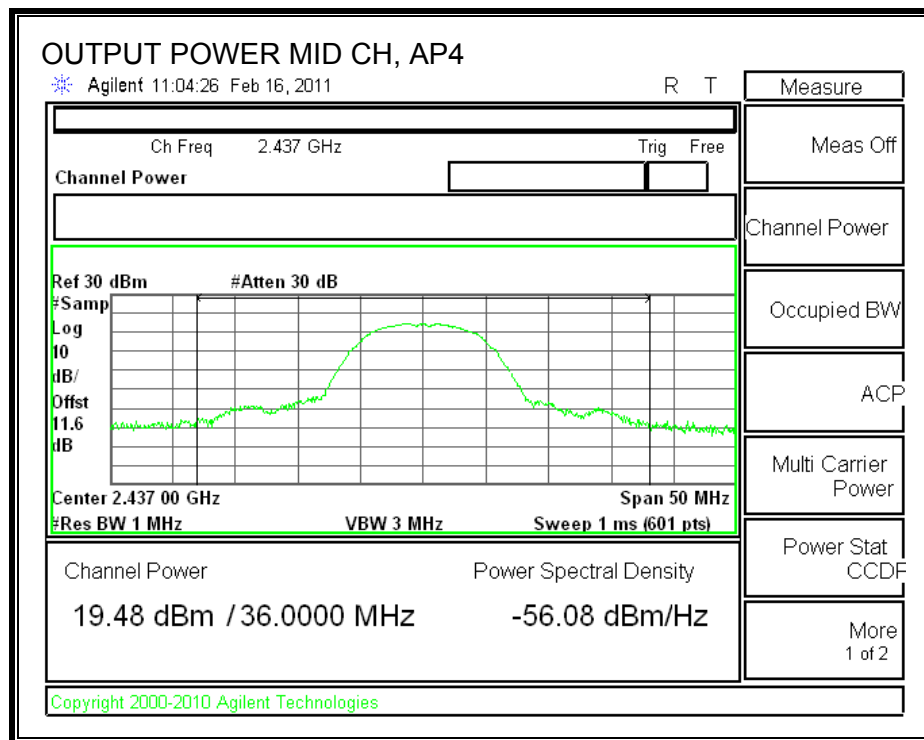


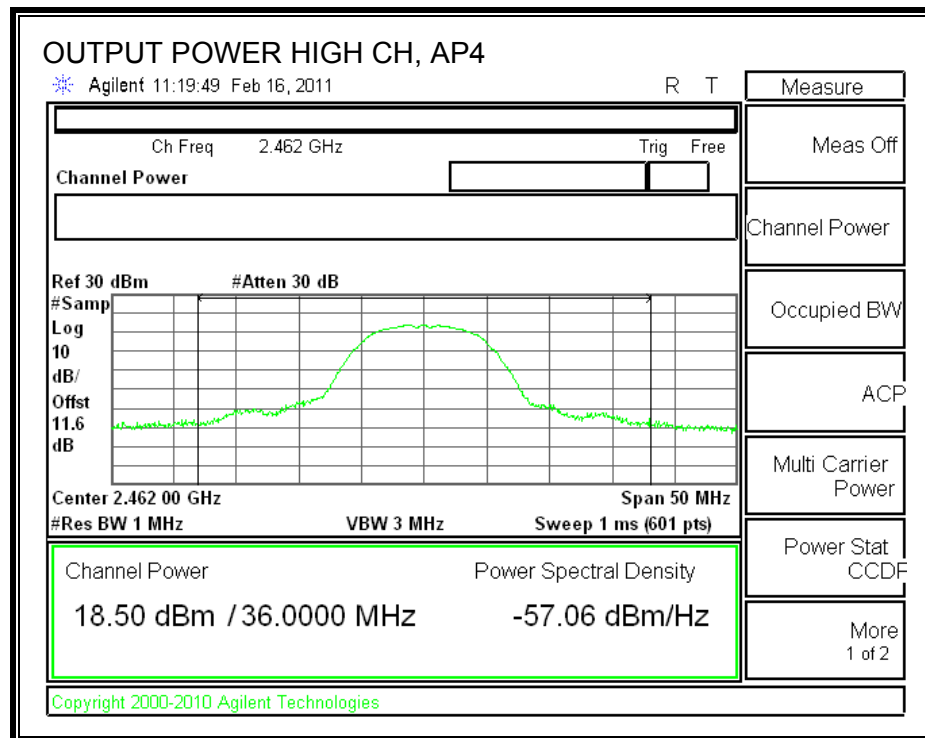




AP4 OUTPUT POWER







7.1.4. 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.

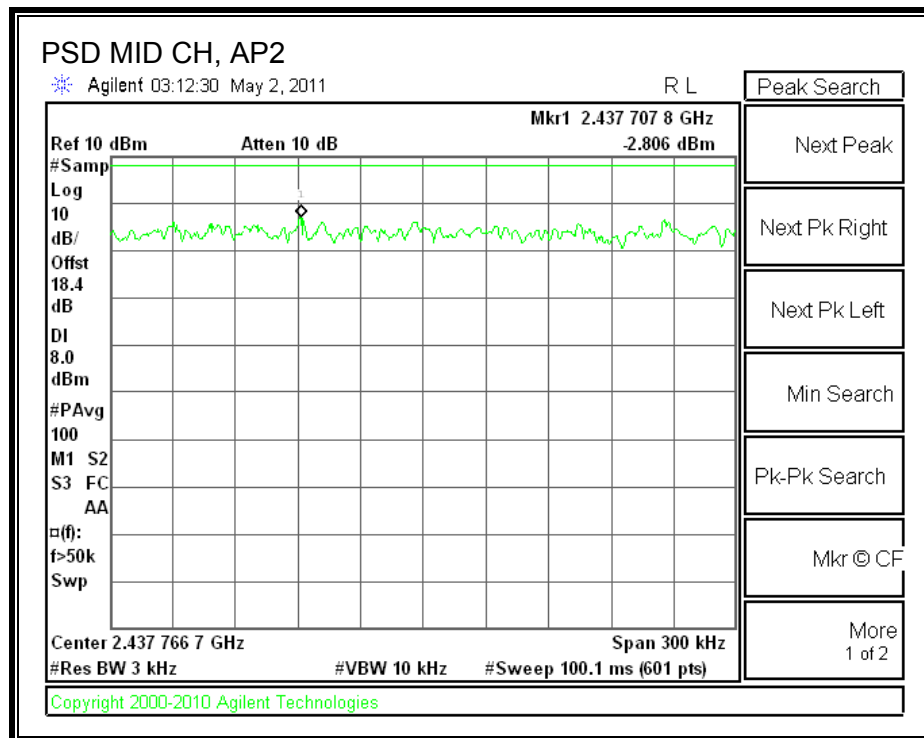
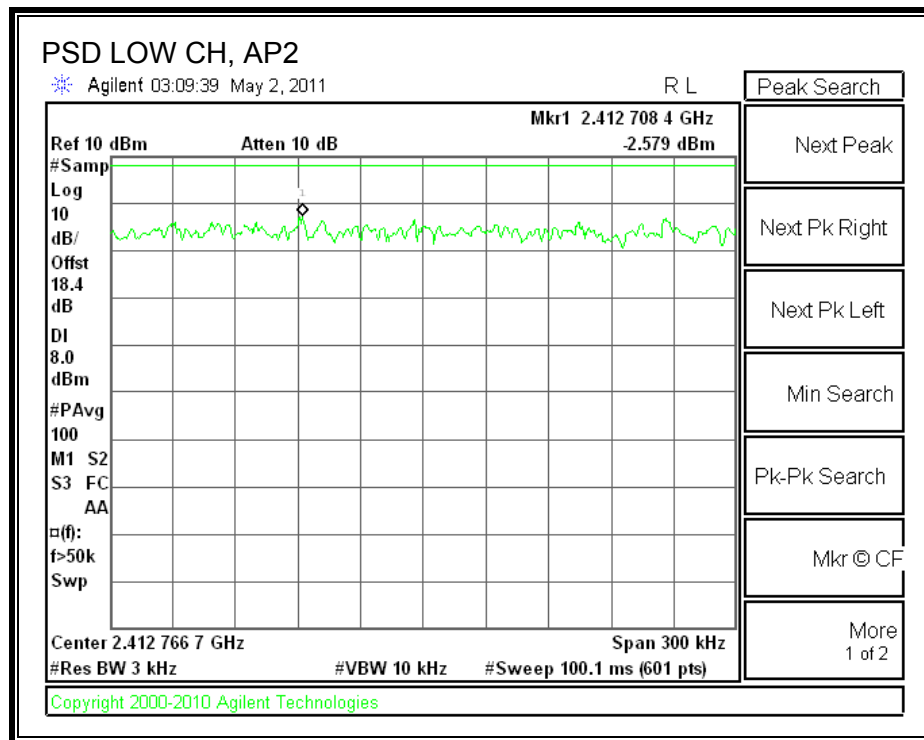
TEST PROCEDURE

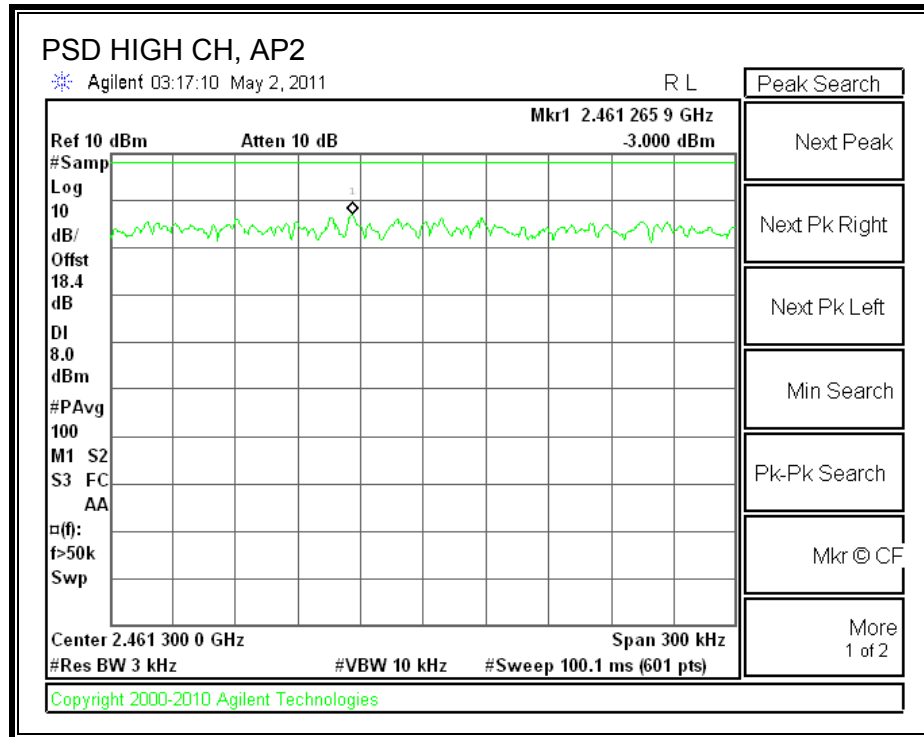
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

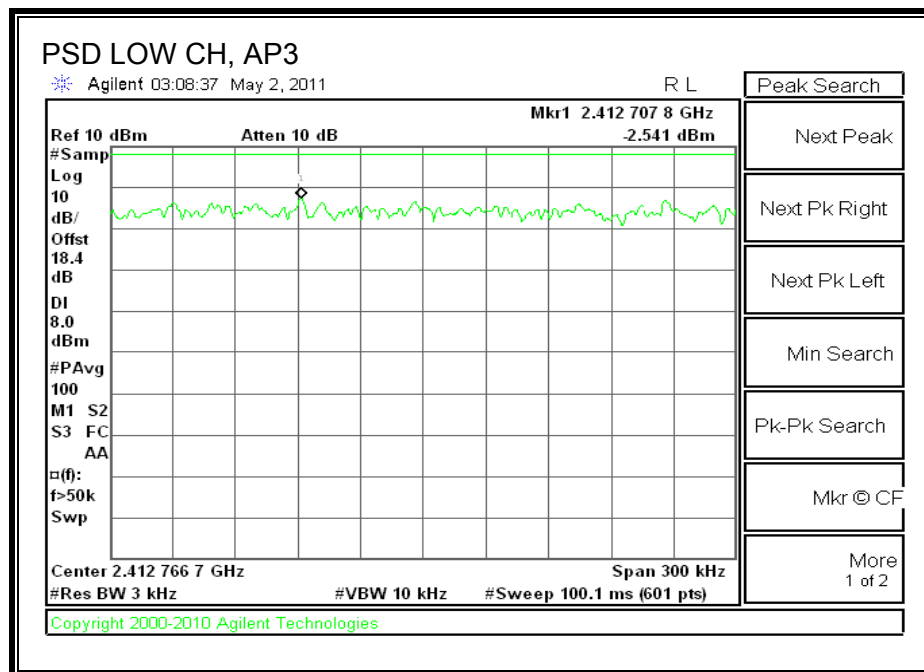
Channel	Frequency (MHz)	AP2 PSD (dBm)	AP3 PSD (dBm)	AP4 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-2.579	-2.541	-2.685	2.17	8	-5.83
Middle	2437	-2.806	-2.336	-2.925	2.09	8	-5.91
High	2462	-3.000	-2.868	-3.003	1.81	8	-6.19

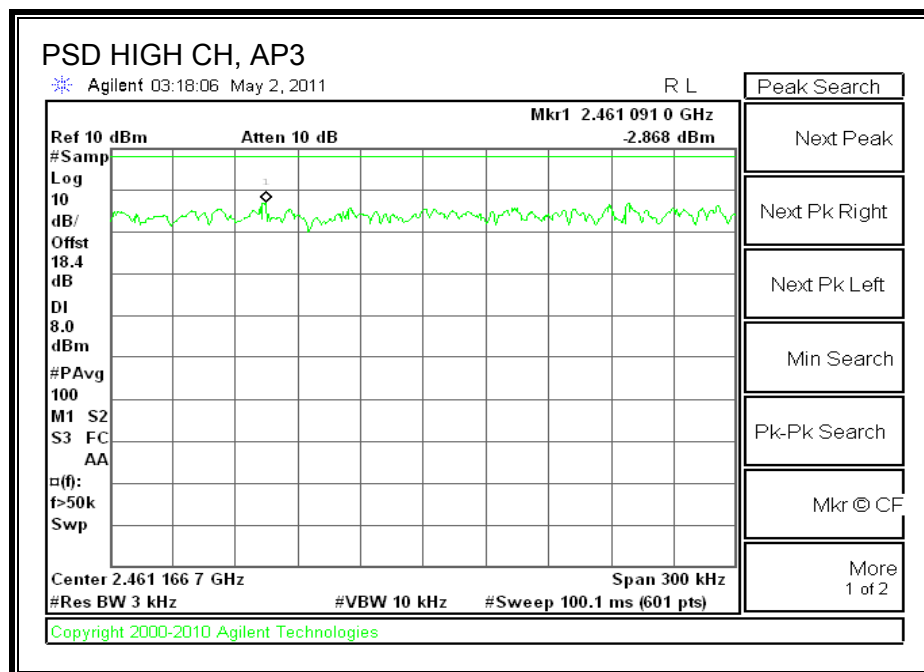
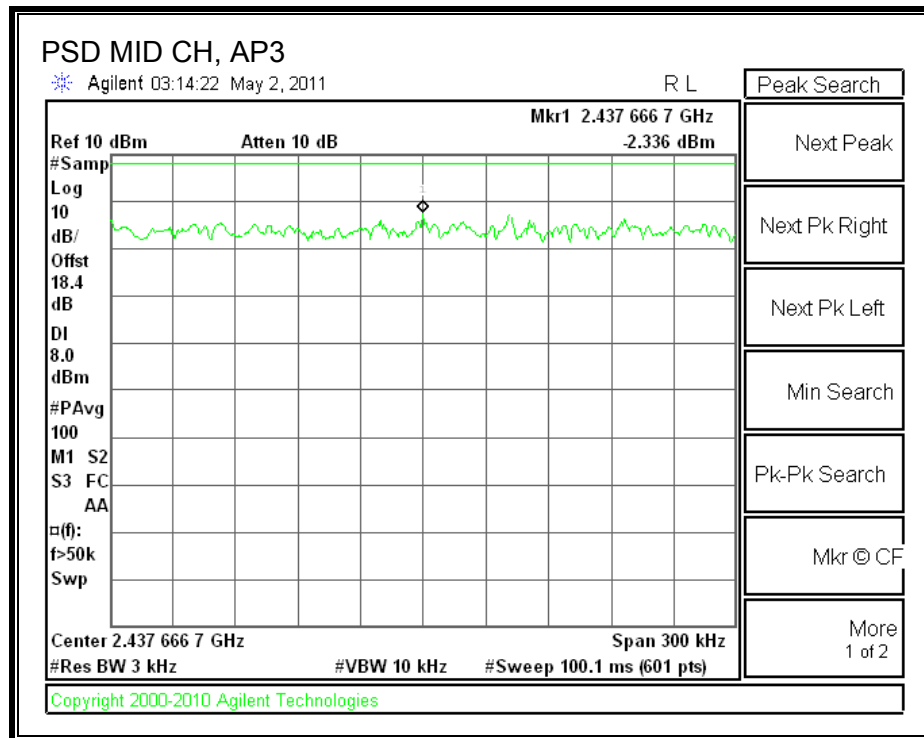
POWER SPECTRAL DENSITY, AP2



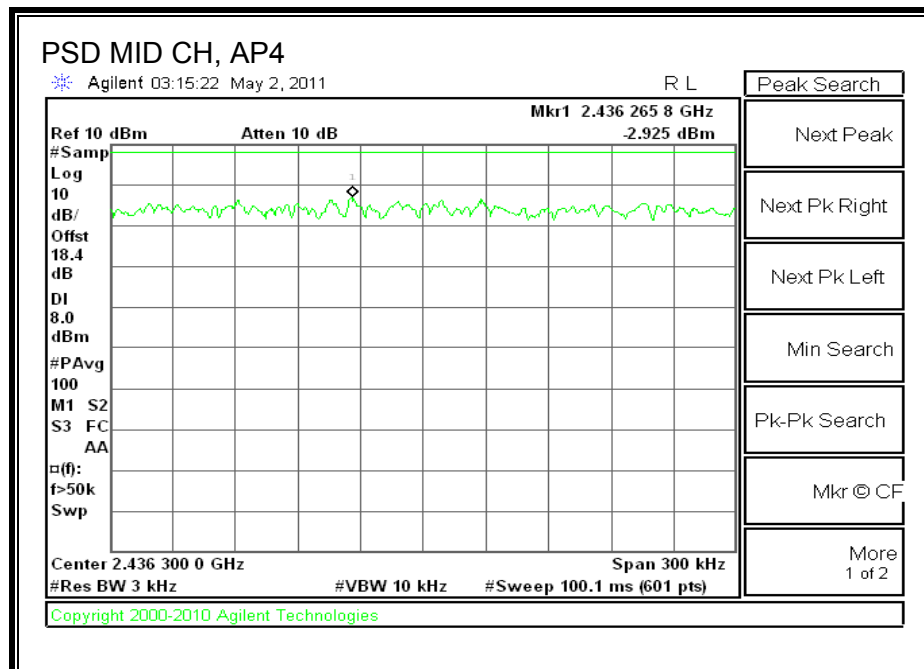
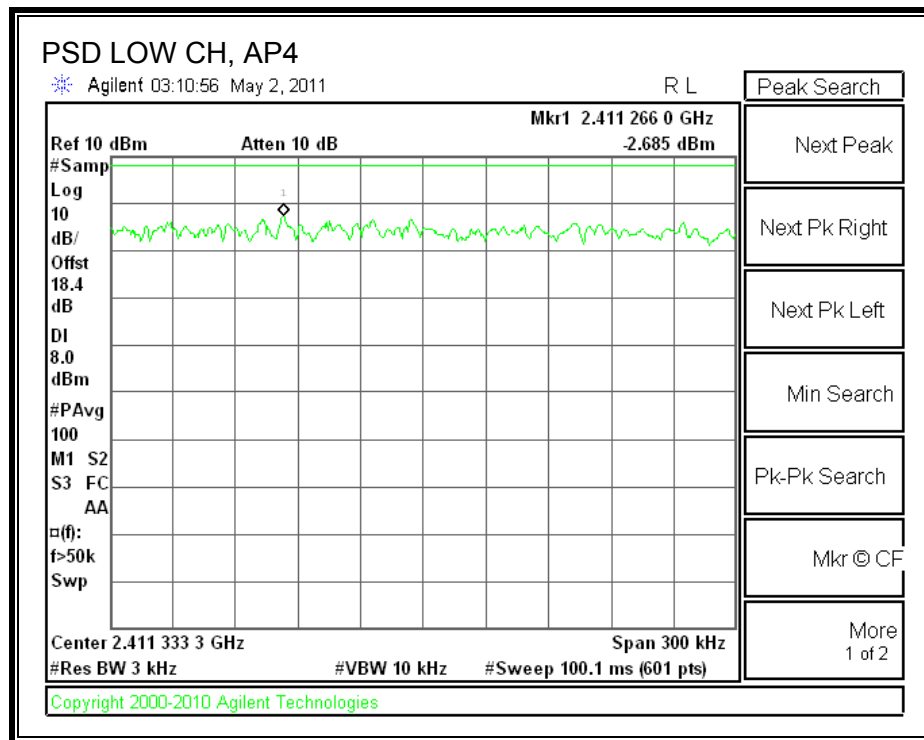


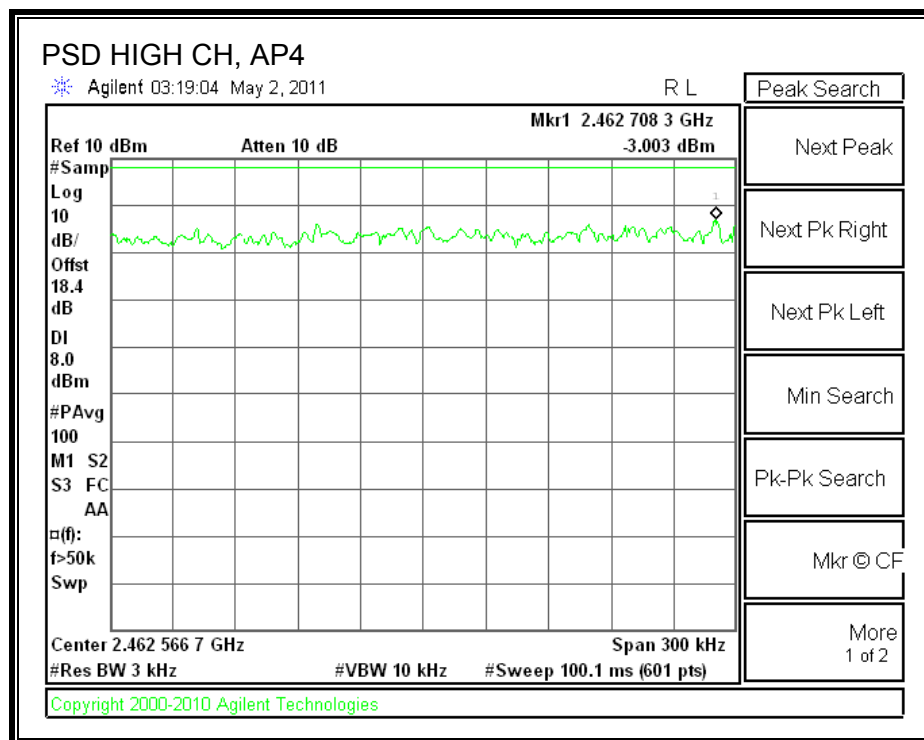
POWER SPECTRAL DENSITY, AP3





POWER SPECTRAL DENSITY, AP4





7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of RMS averaging over time interval; therefore the required attenuation is 30 dB.

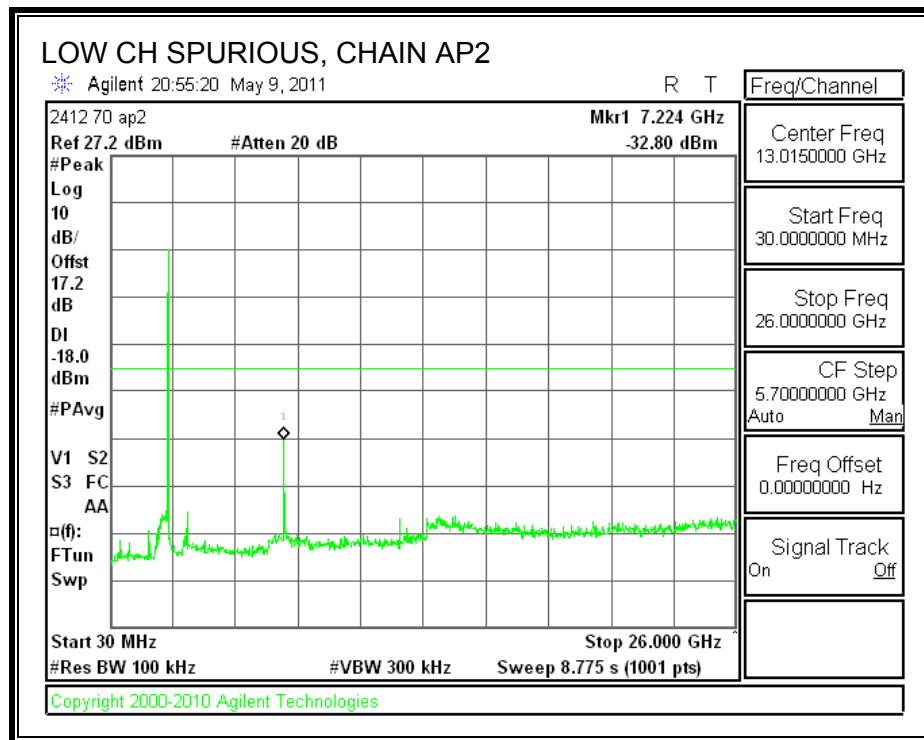
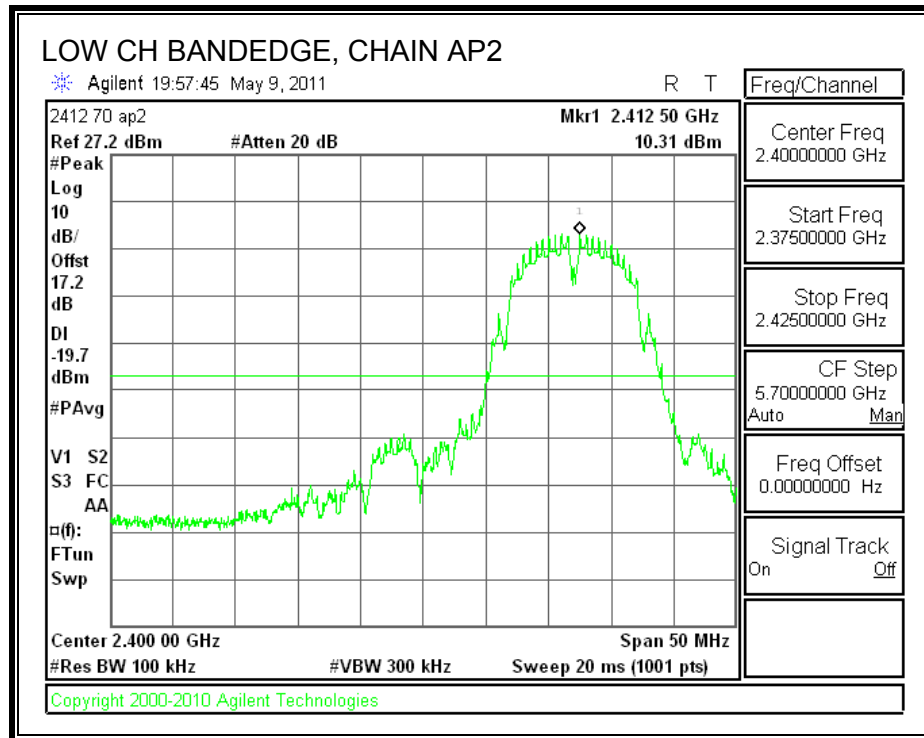
TEST PROCEDURE

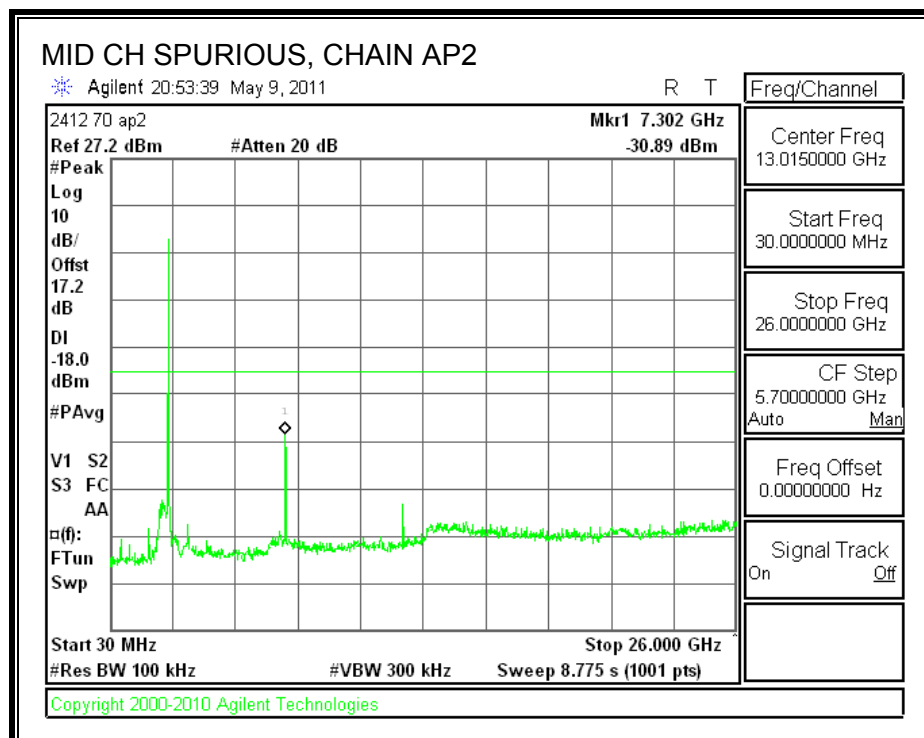
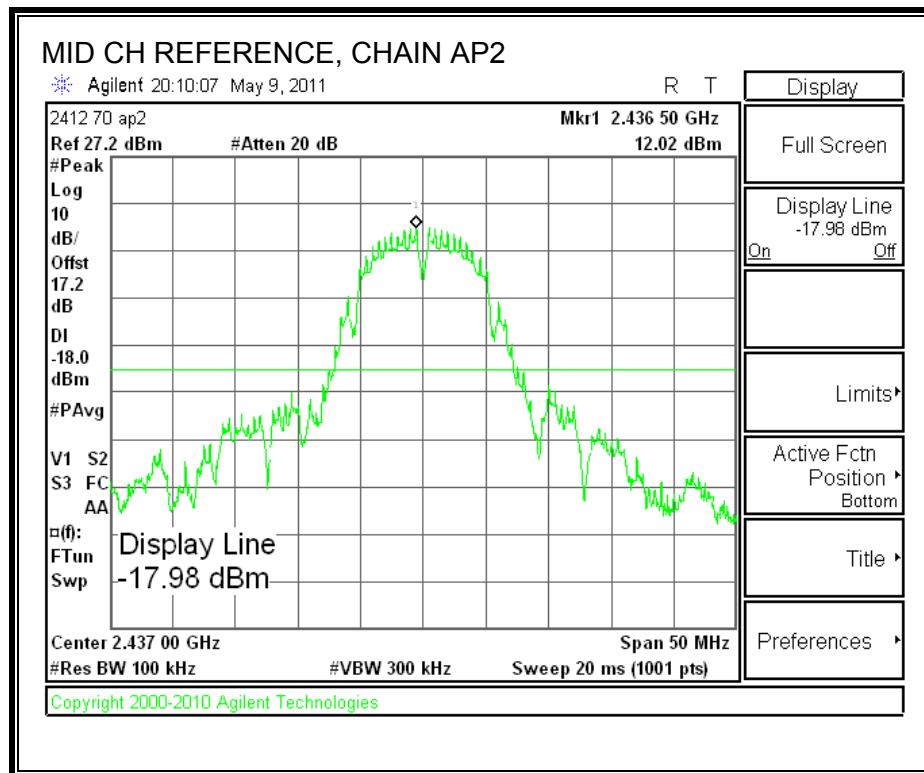
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

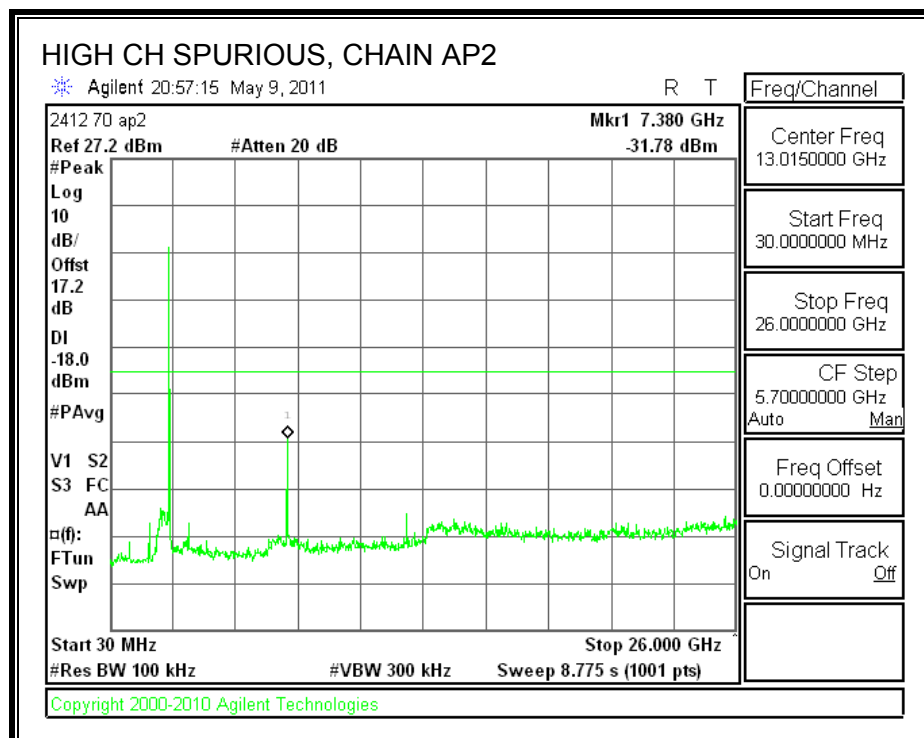
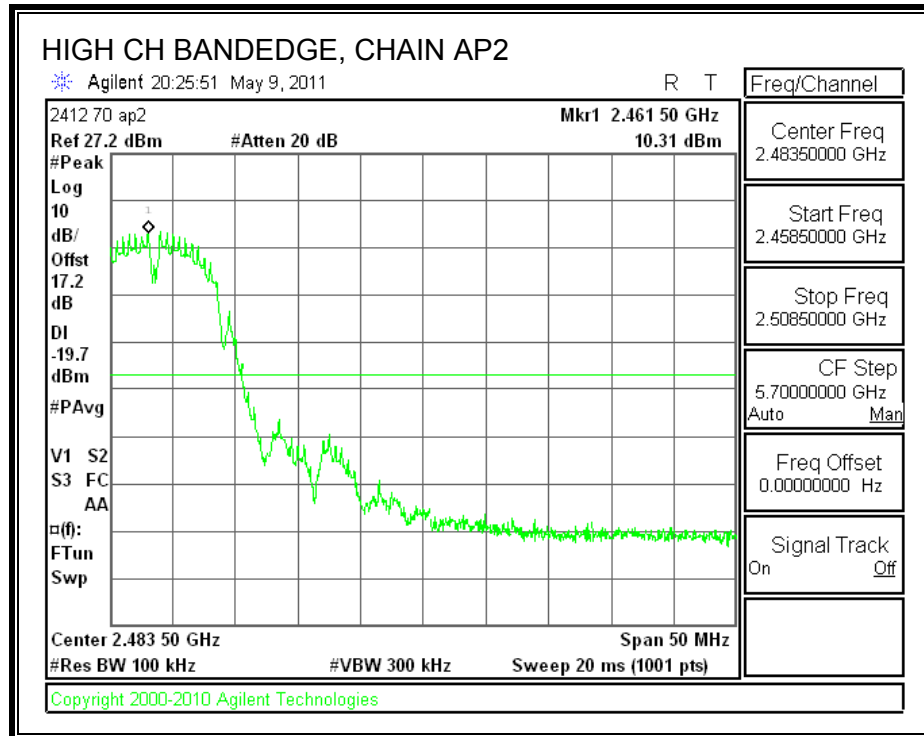
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

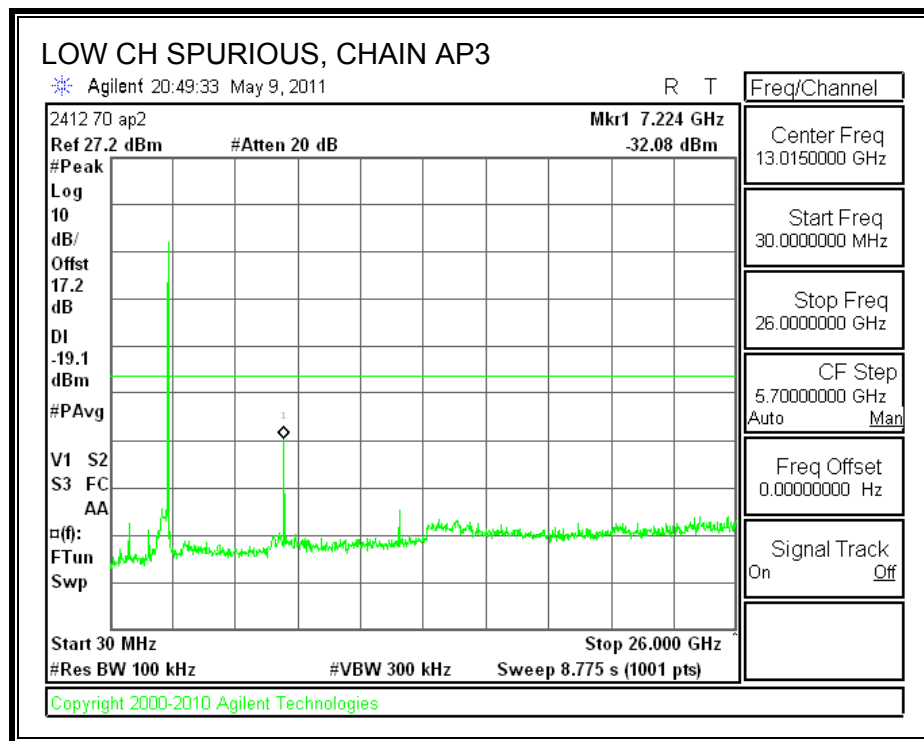
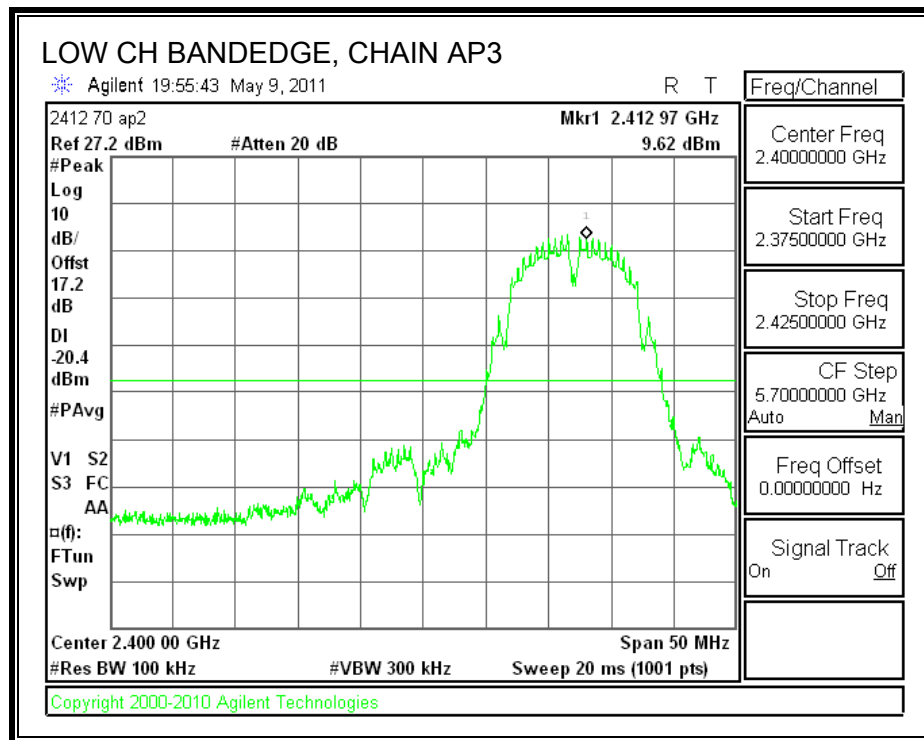
CHAIN AP2 SPURIOUS EMISSIONS

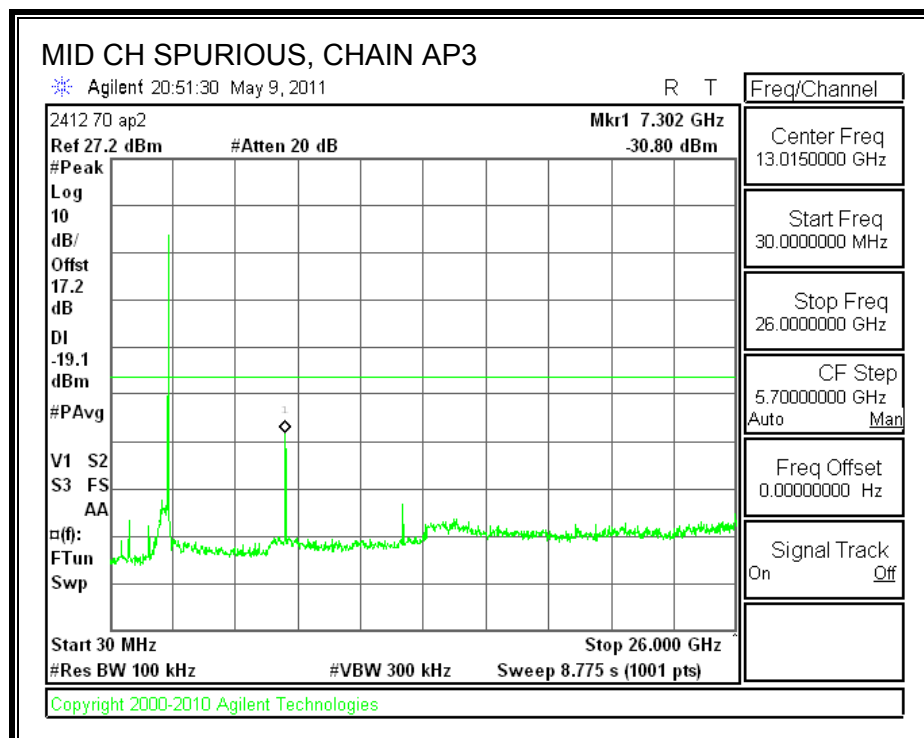
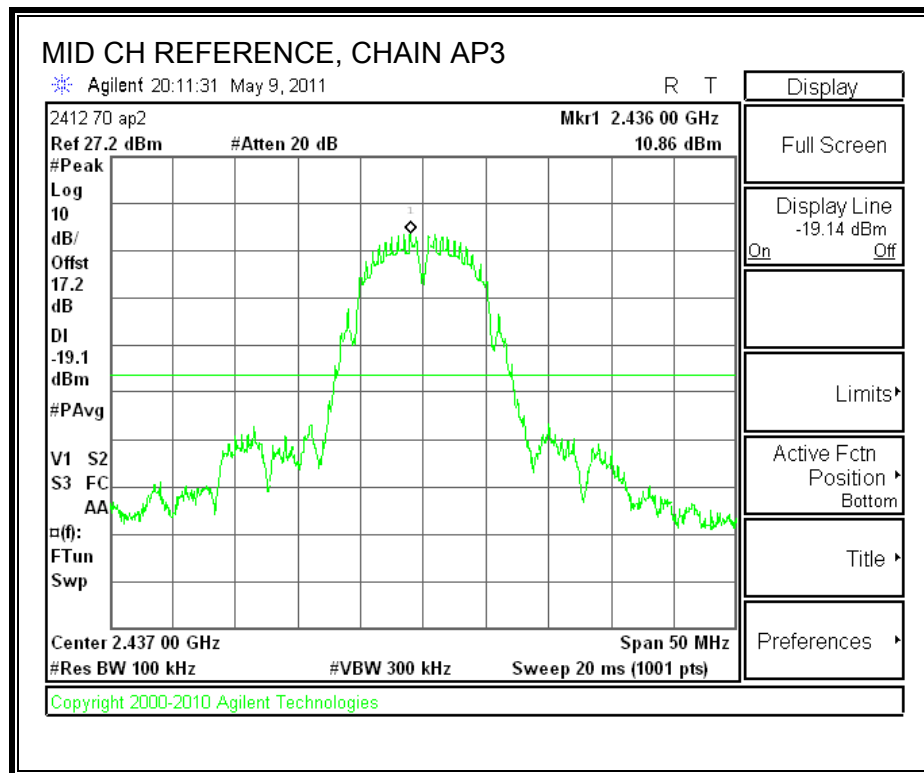


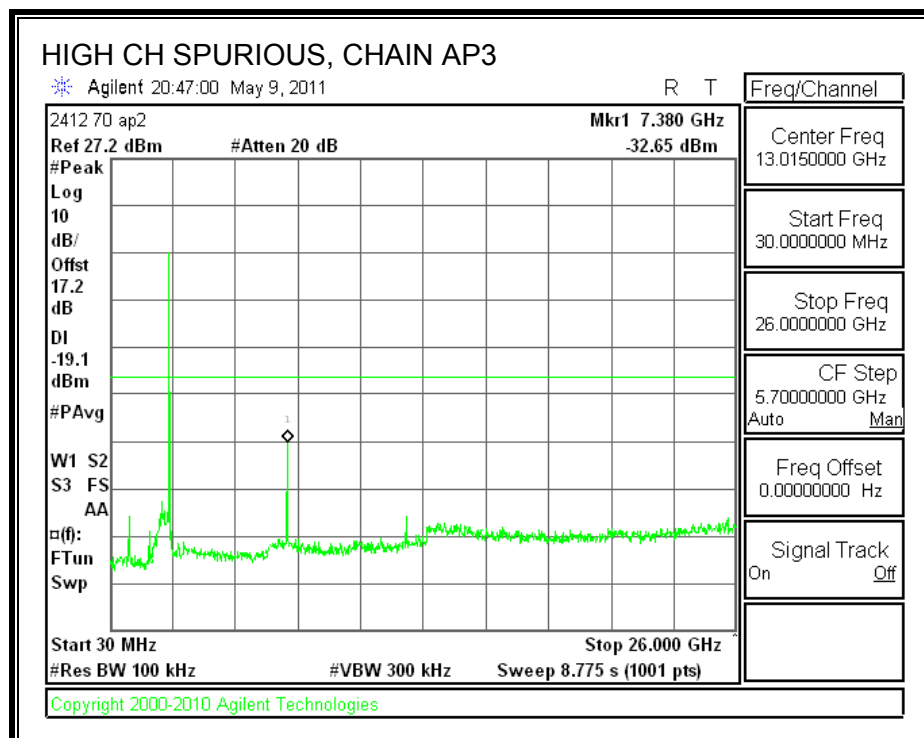
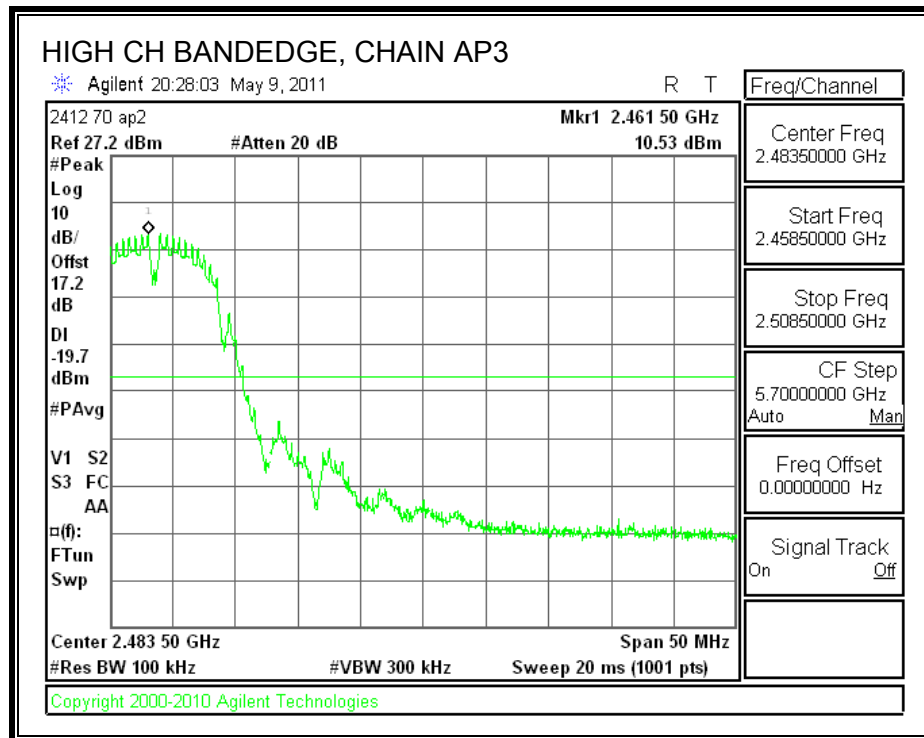




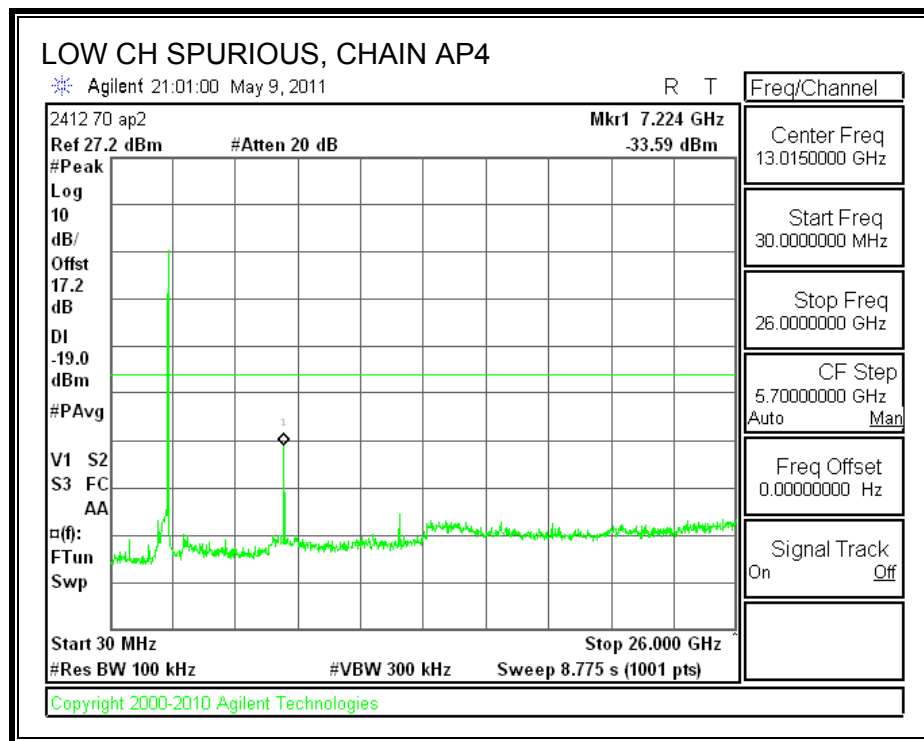
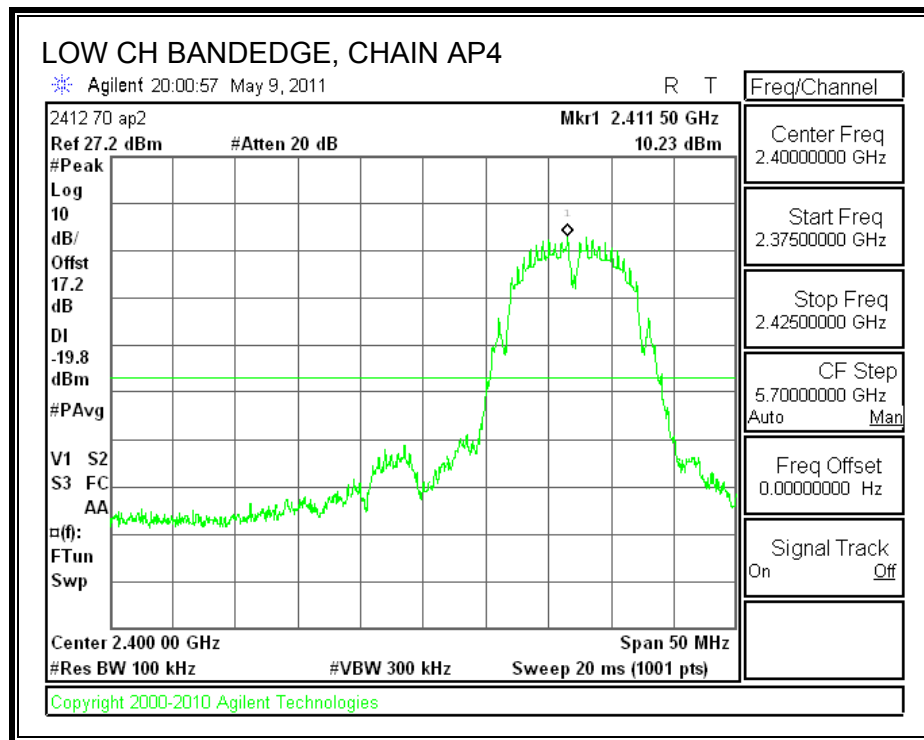
CHAIN AP3 SPURIOUS EMISSIONS

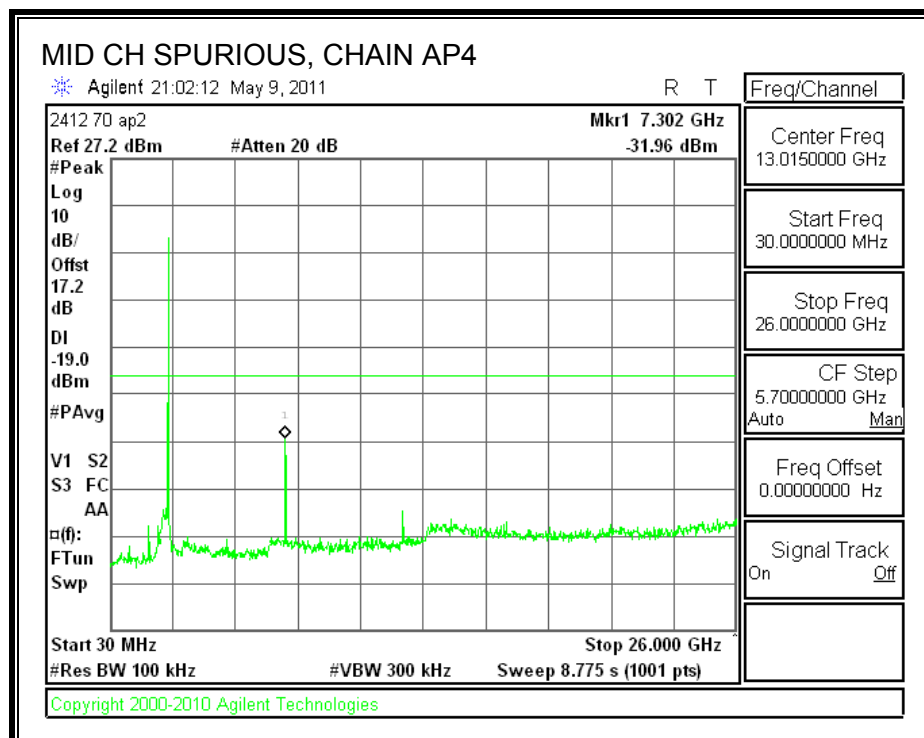
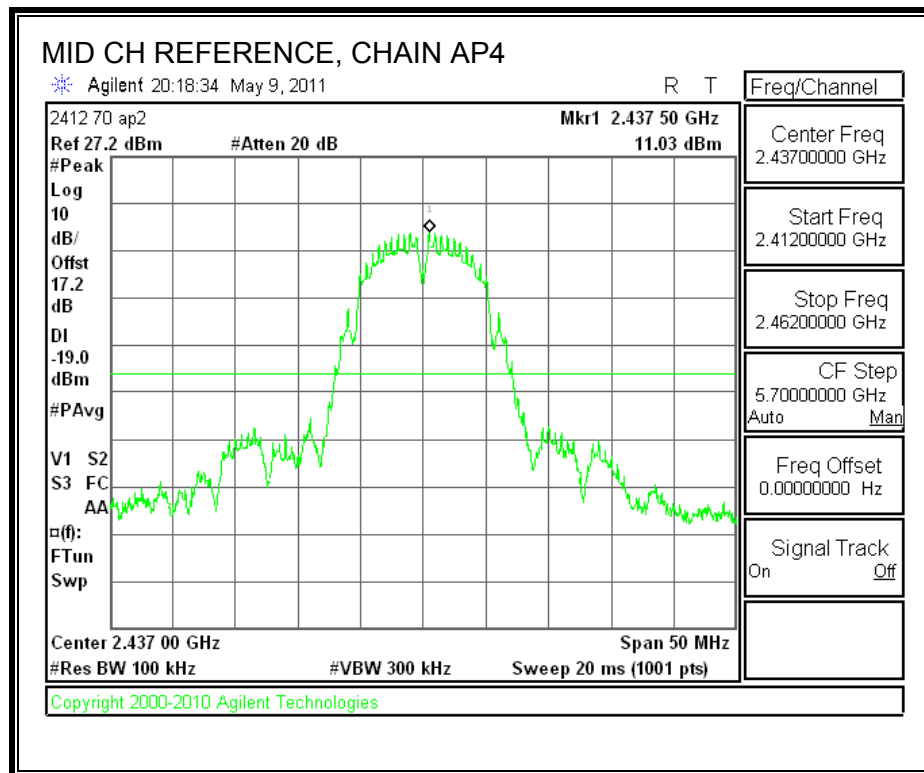


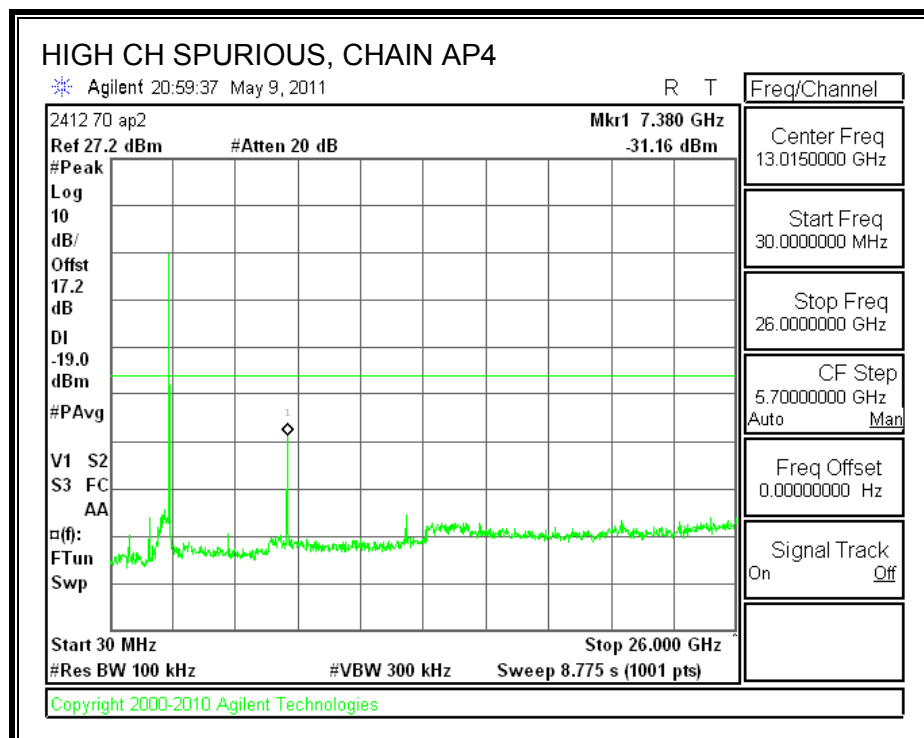
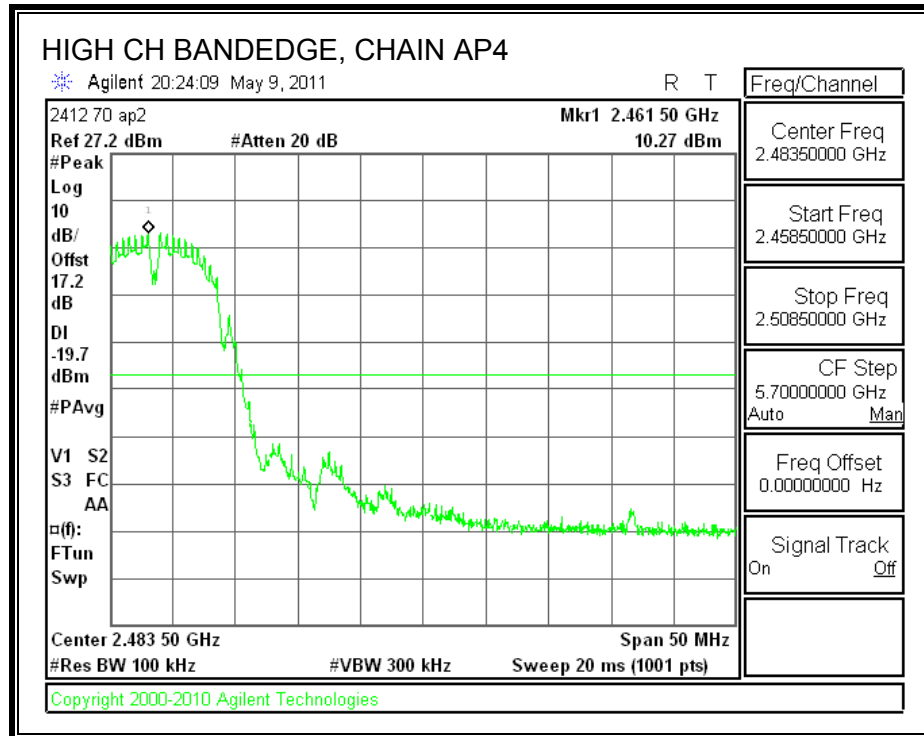




CHAIN AP4 SPURIOUS EMISSIONS







7.2. 802.11g THREE CHAINS LEGACY 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.

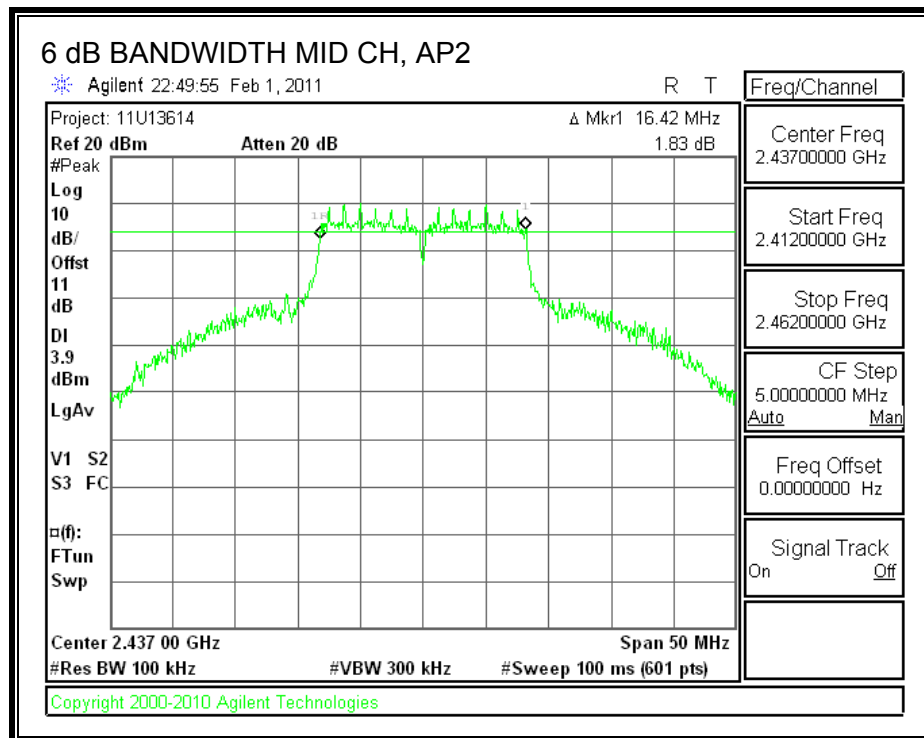
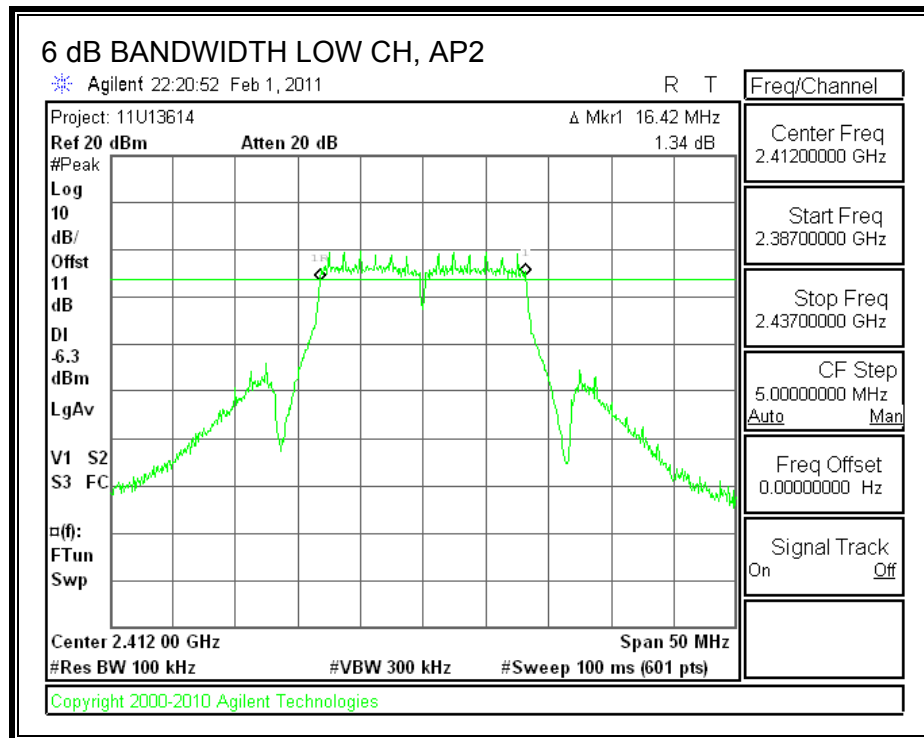
TEST PROCEDURE

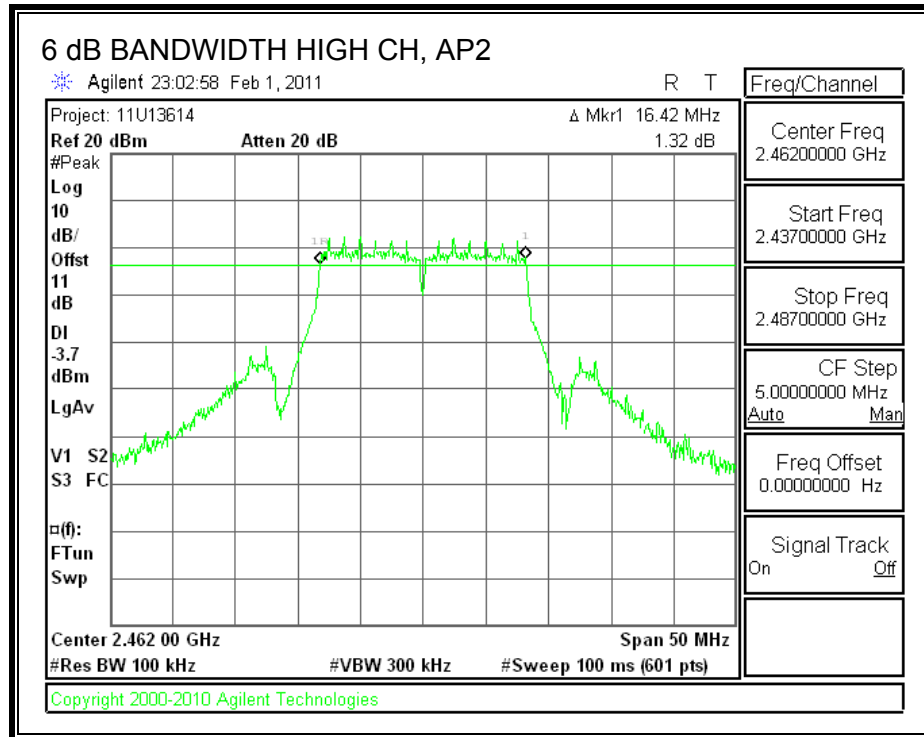
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

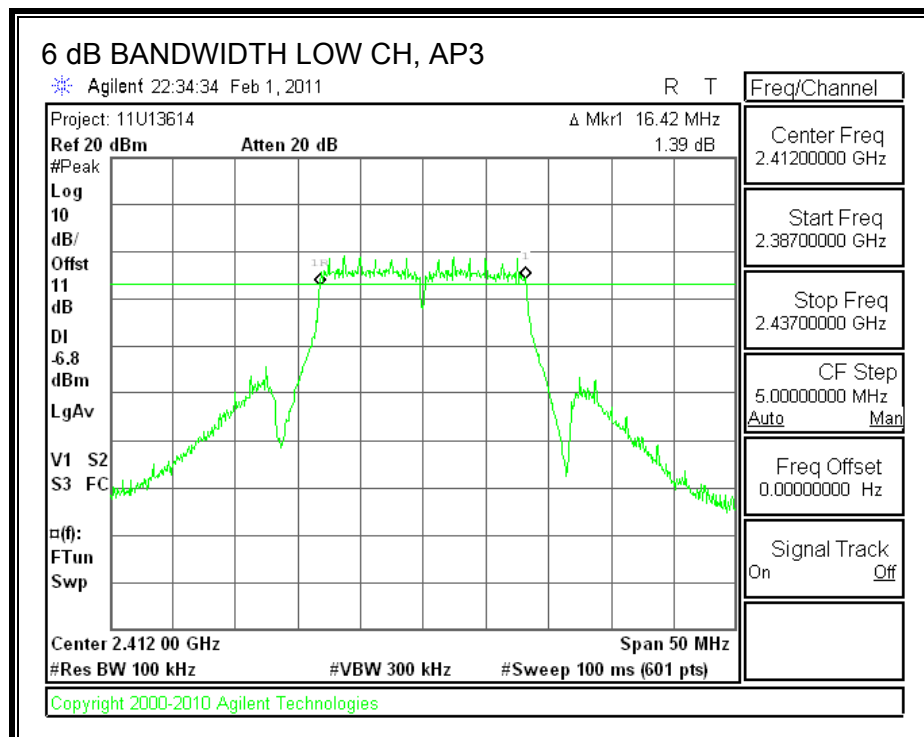
Channel	Frequency (MHz)	Chain AP2 6 dB BW (MHz)	Chain AP3 6 dB BW (MHz)	Chain AP4 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	16.42	16.42	16.50	0.5
Middle	2437	16.42	16.42	16.42	0.5
High	2462	16.42	16.42	16.42	0.5

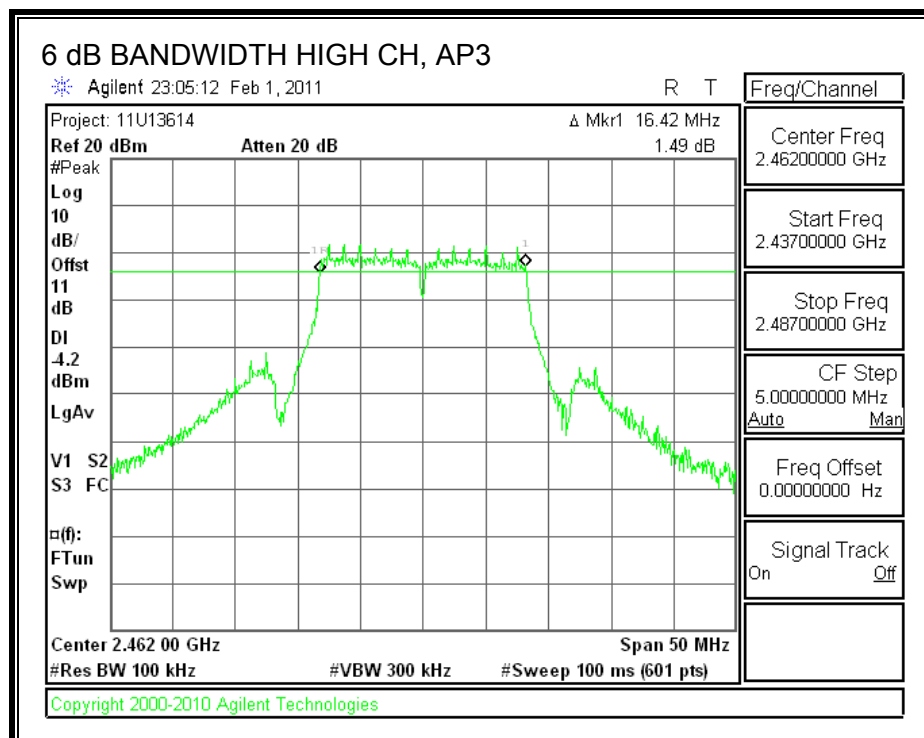
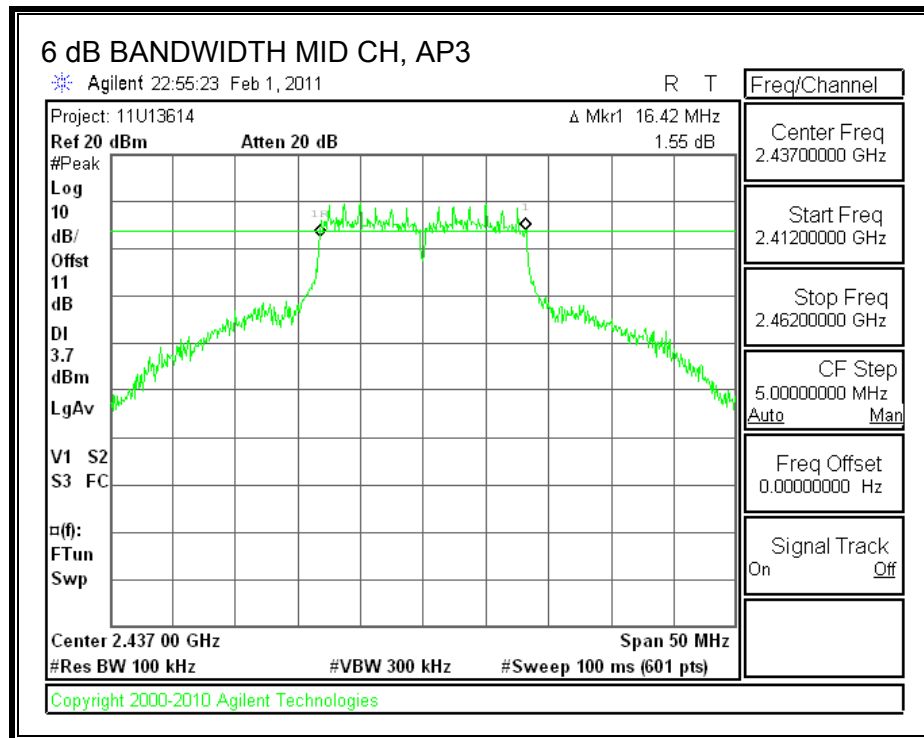
6 dB BANDWIDTH, AP2



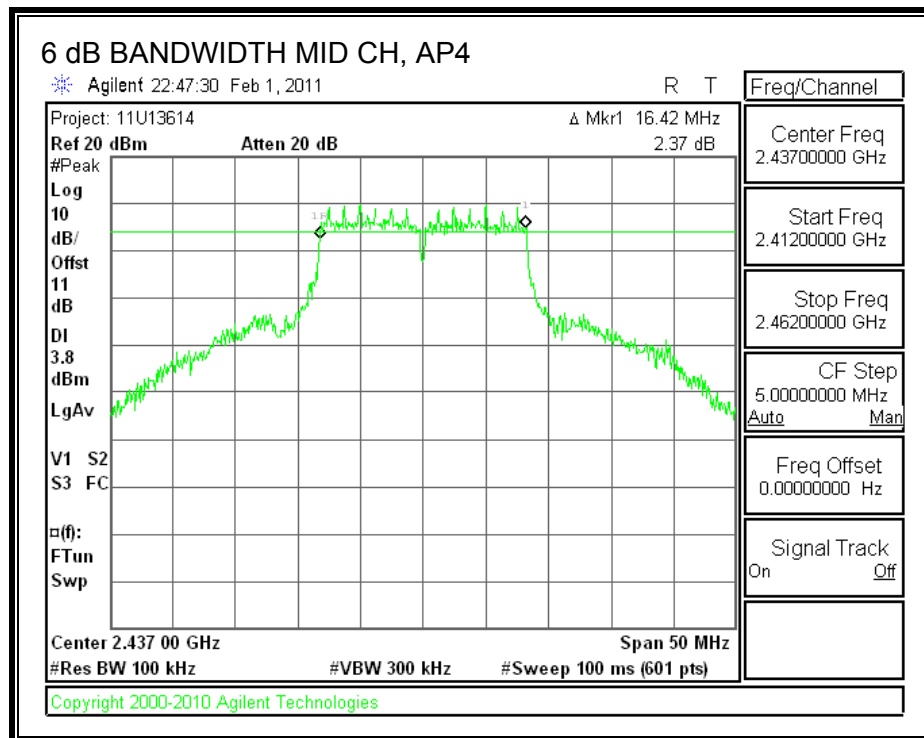
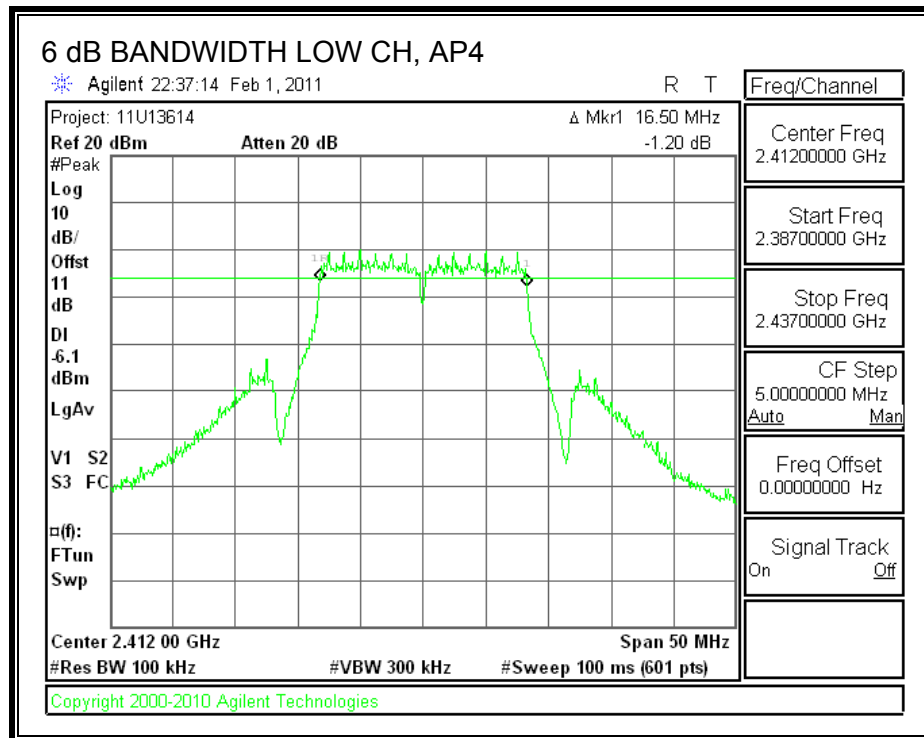


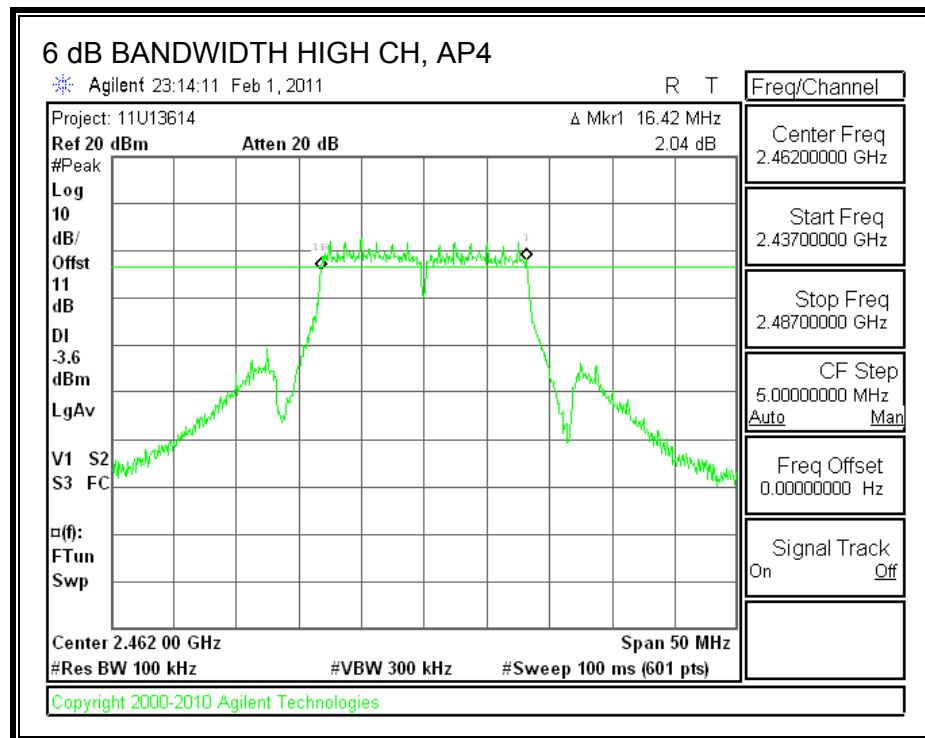
6 dB BANDWIDTH, AP3





6 dB BANDWIDTH, AP4





7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

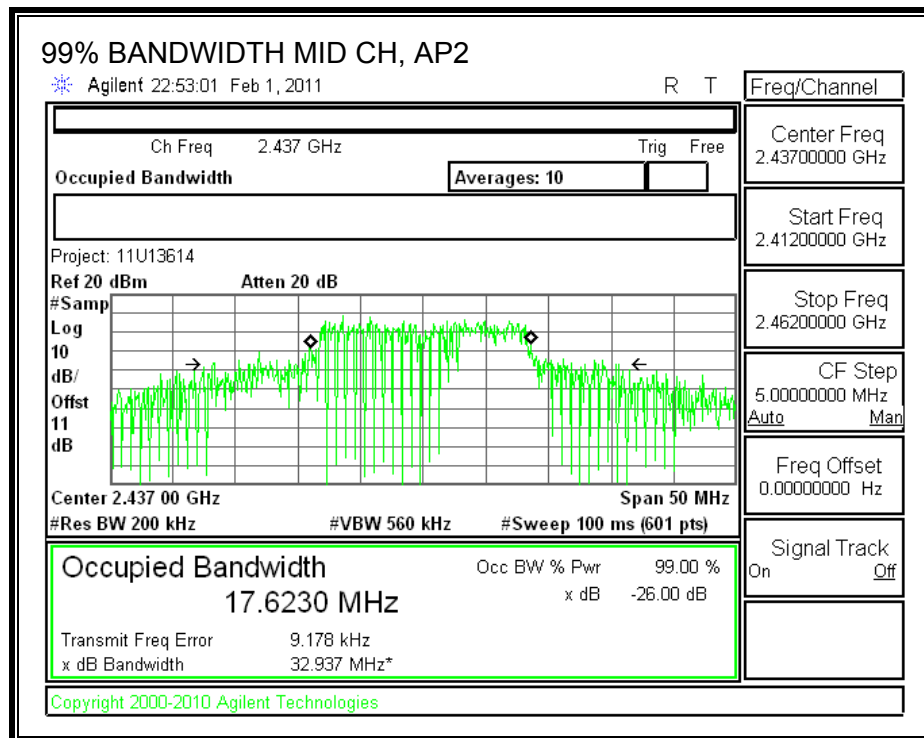
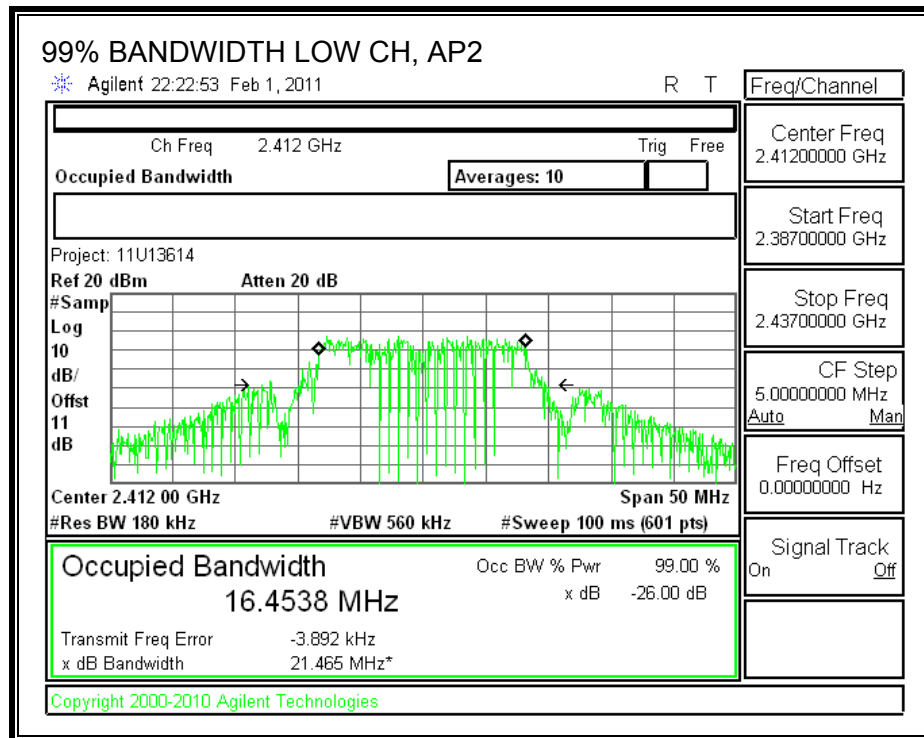
TEST PROCEDURE

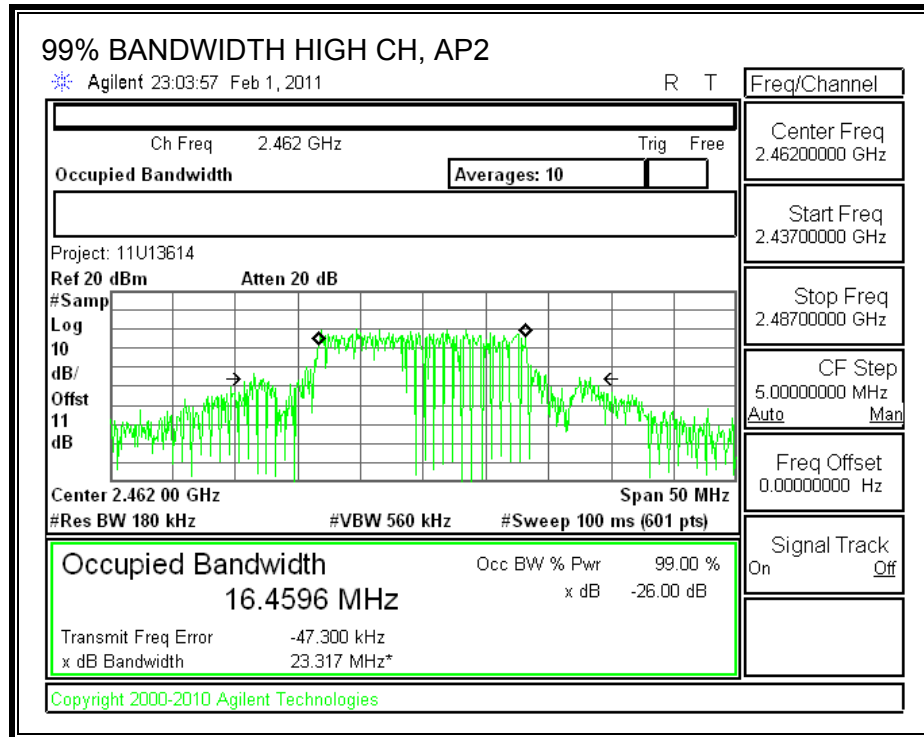
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

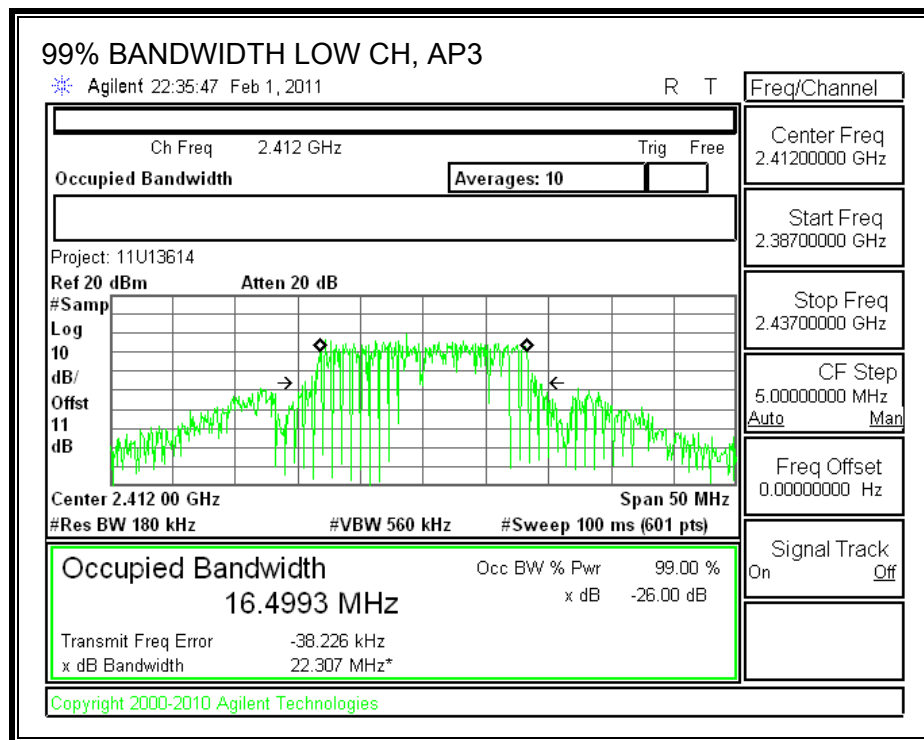
Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	2412	16.4538	16.4993	16.5196
Middle	2437	17.623	16.7592	16.569
High	2462	16.4596	16.5052	16.452

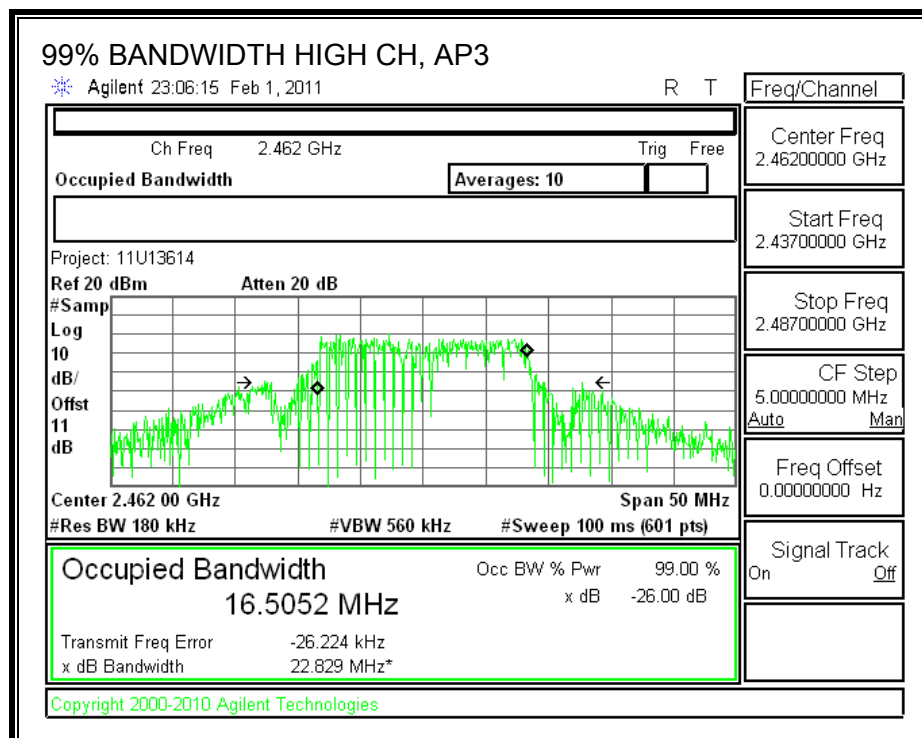
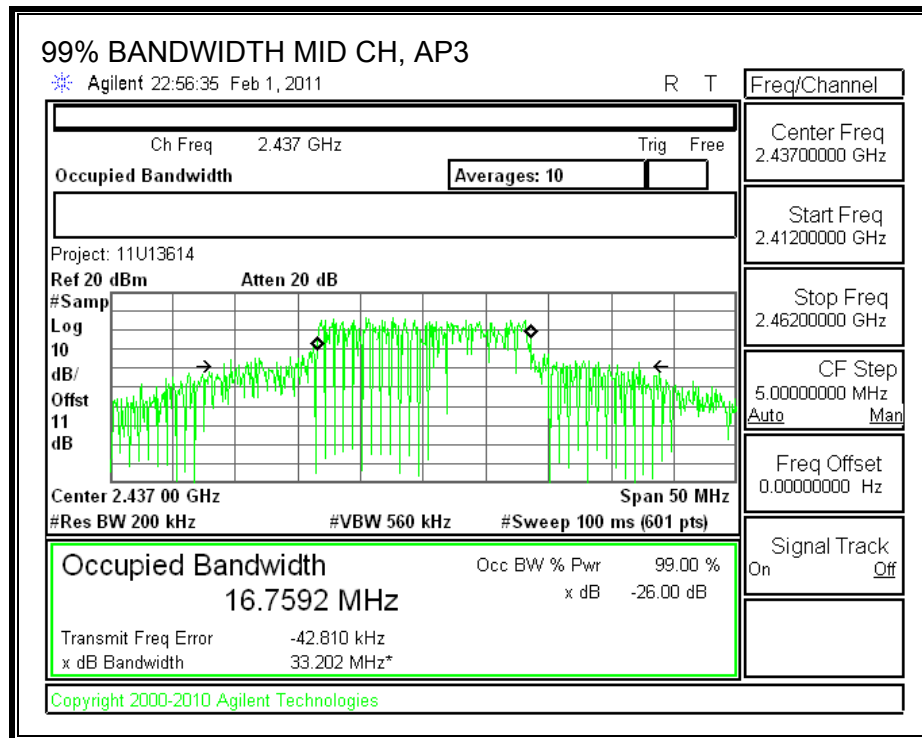
99% BANDWIDTH, AP2



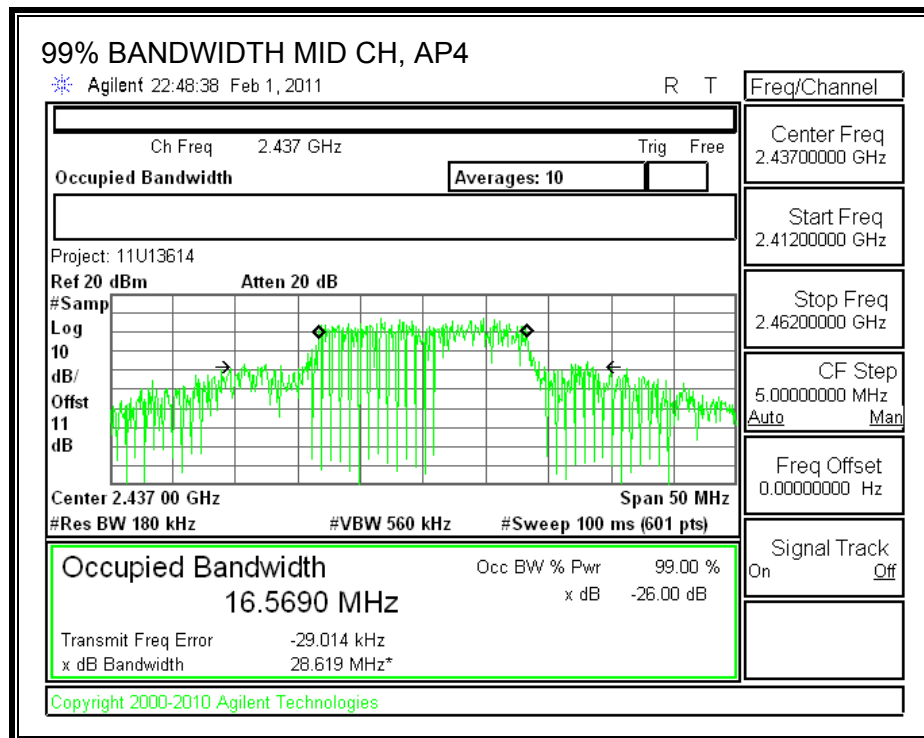
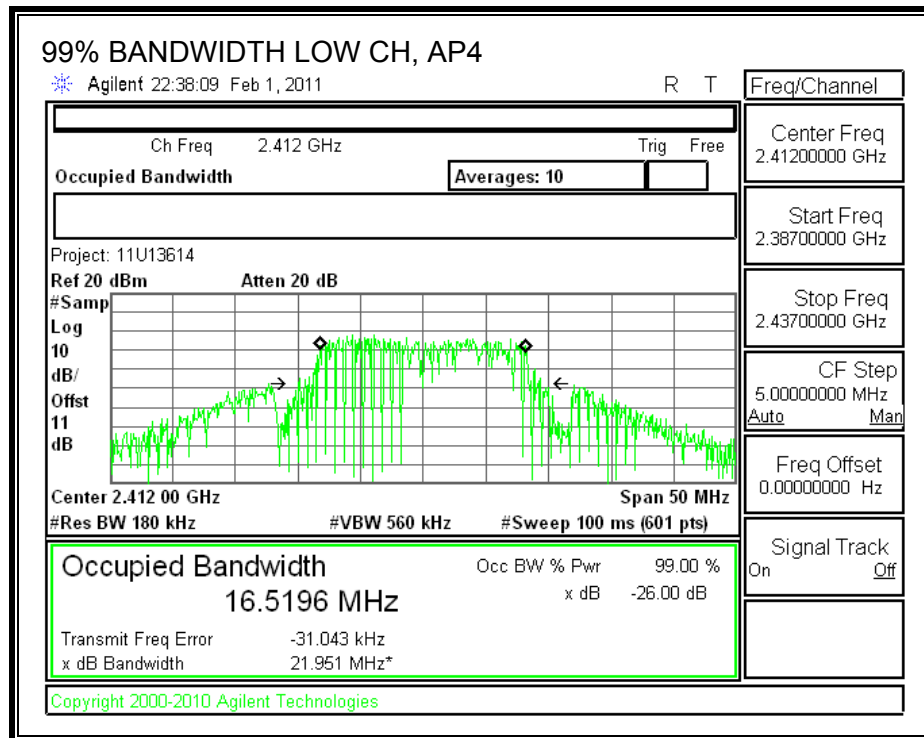


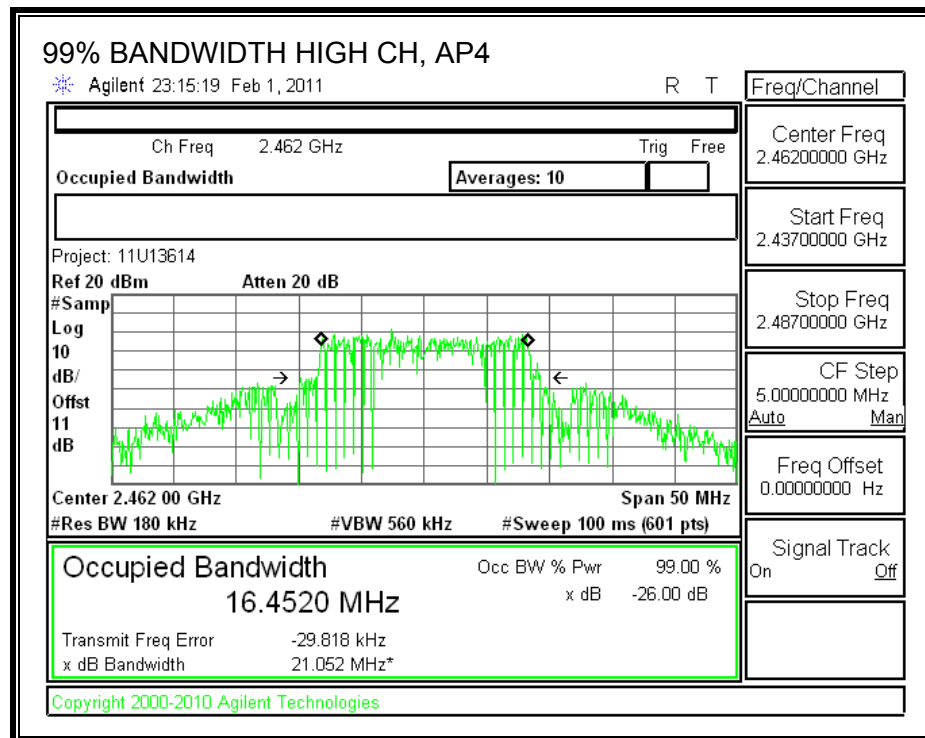
99% BANDWIDTH, AP3





99% BANDWIDTH, AP4





7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna Gain (AP2) (dBi)	Antenna Gain (AP3) (dBi)	Antenna Gain (AP4) (dBi)	Effective Legacy Gain (dBi)
0.1	0.27	4.32	6.80

The maximum effective legacy gain is 6.8 dBi for other than fixed, point-to-point operations, therefore the limit is 29.2 dBm.

TEST PROCEDURE

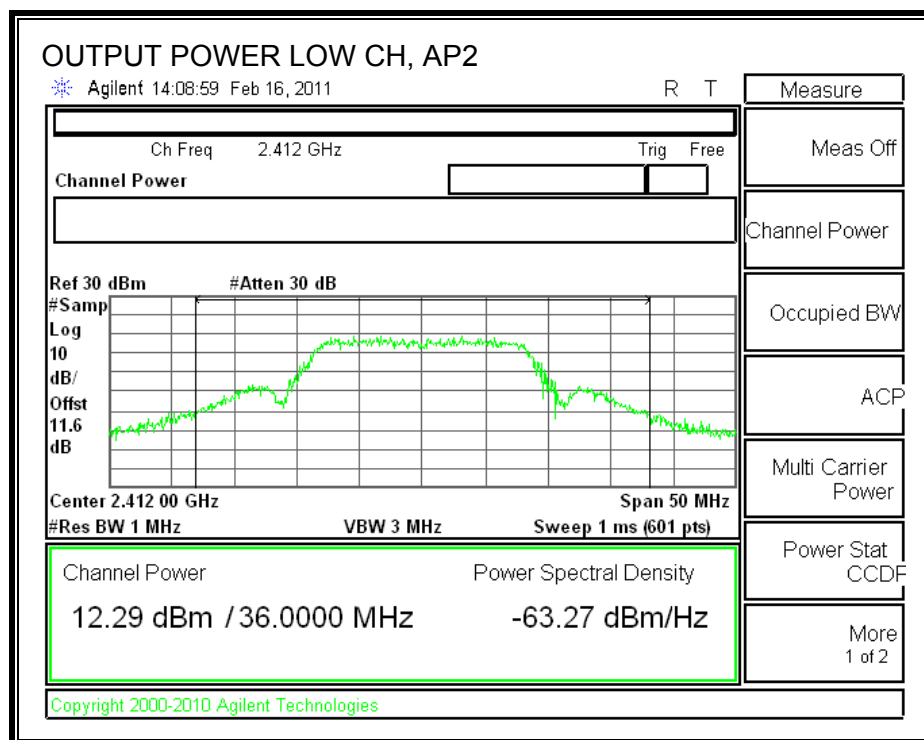
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

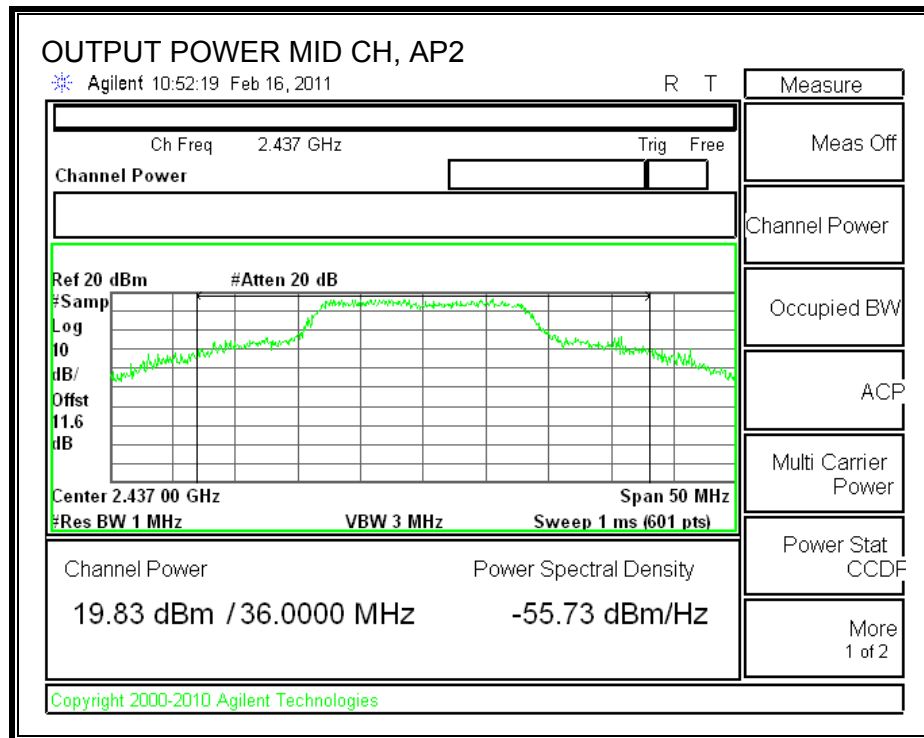
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

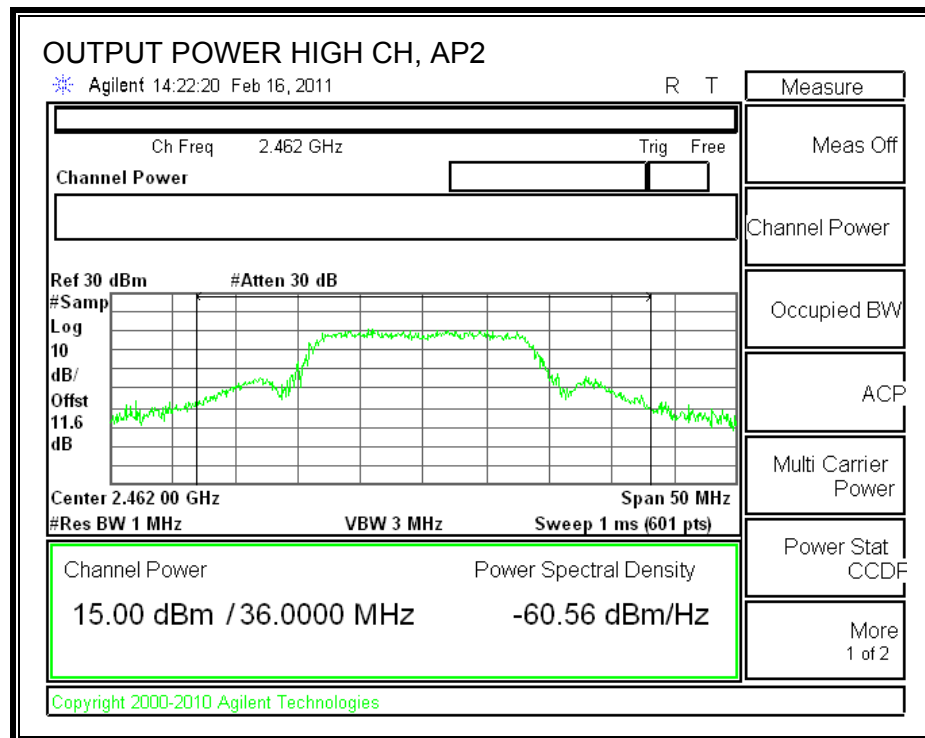
RESULTS

Channel	Frequency (MHz)	AP2 Power (dBm)	AP3 Power (dBm)	AP4 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	12.29	11.56	13.21	0.00	17.18	29.20	-12.02
Mid	2437	19.83	20.27	20.20	0.00	24.88	29.20	-4.32
High	2462	15.00	14.01	14.46	0.00	19.28	29.20	-9.92

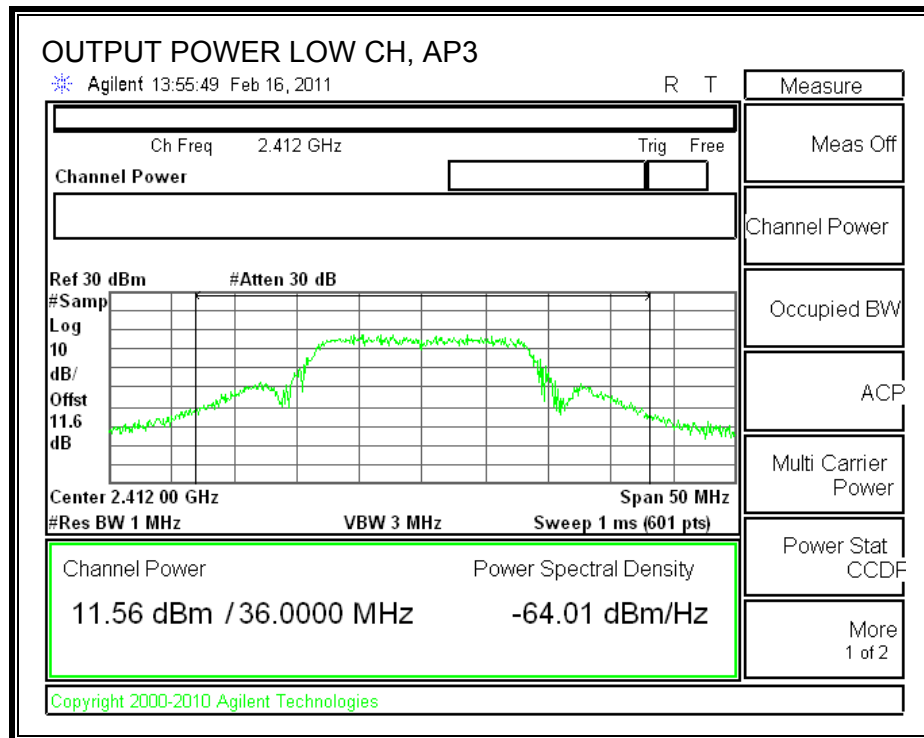
AP2 OUTPUT POWER

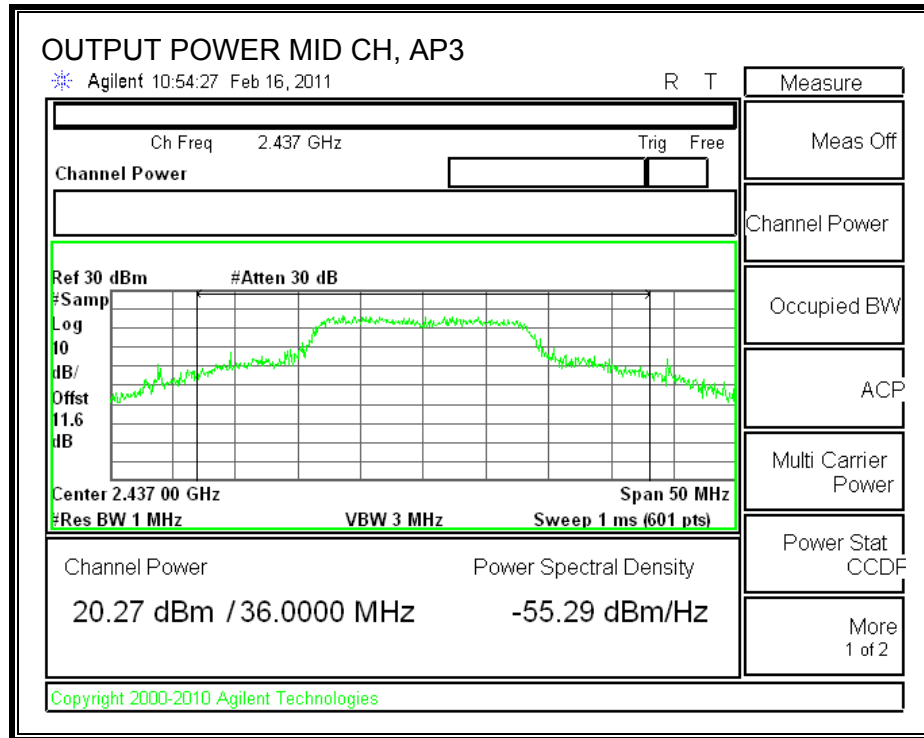


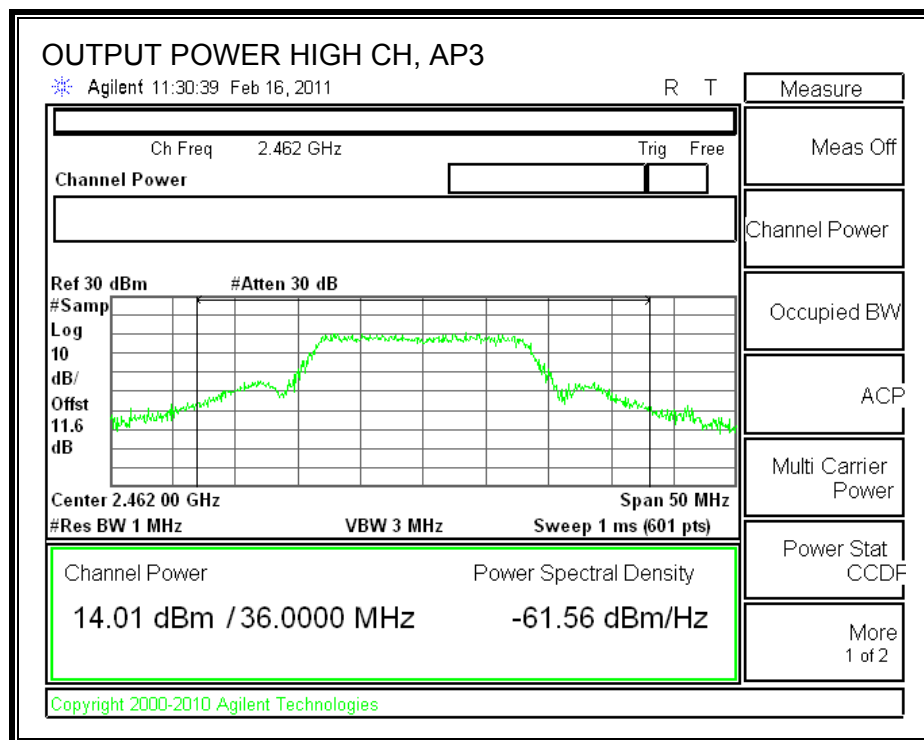




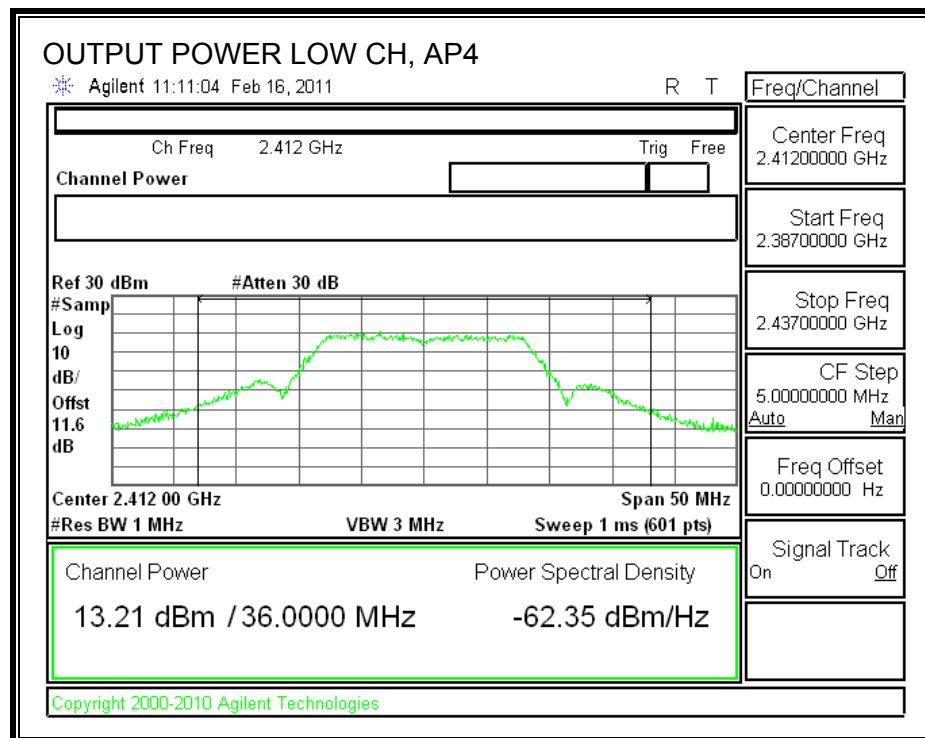
AP3 OUTPUT POWER

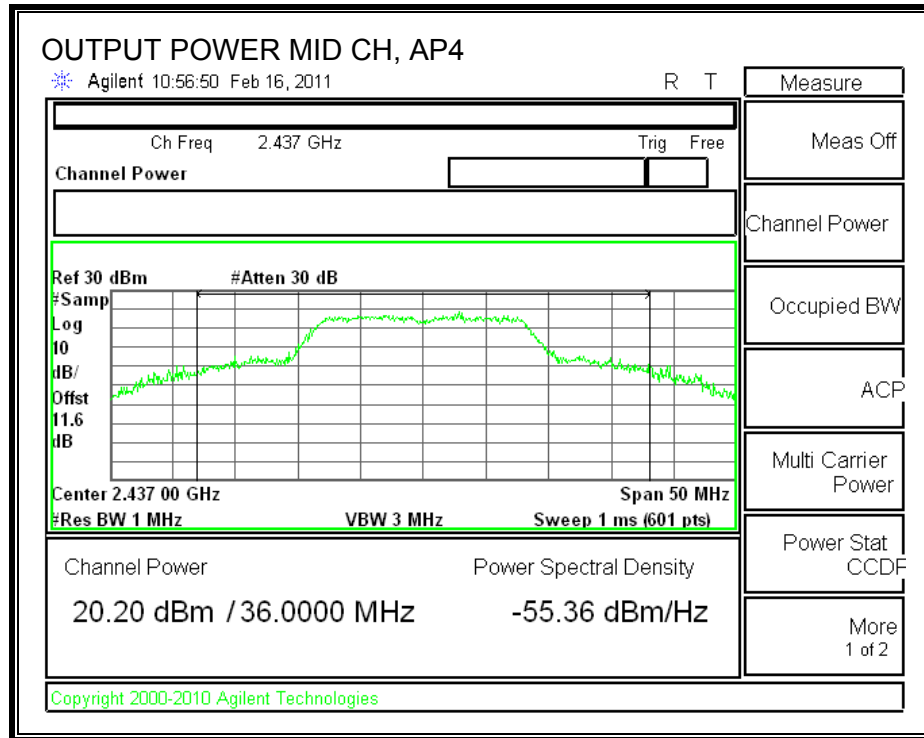


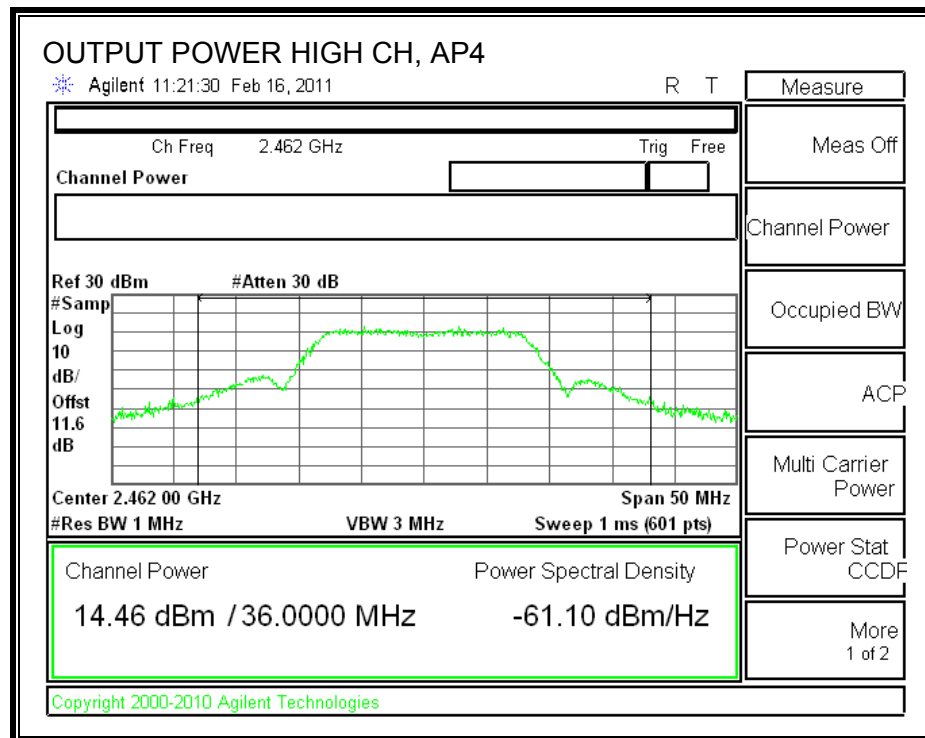




AP4 OUTPUT POWER







7.2.4. 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.

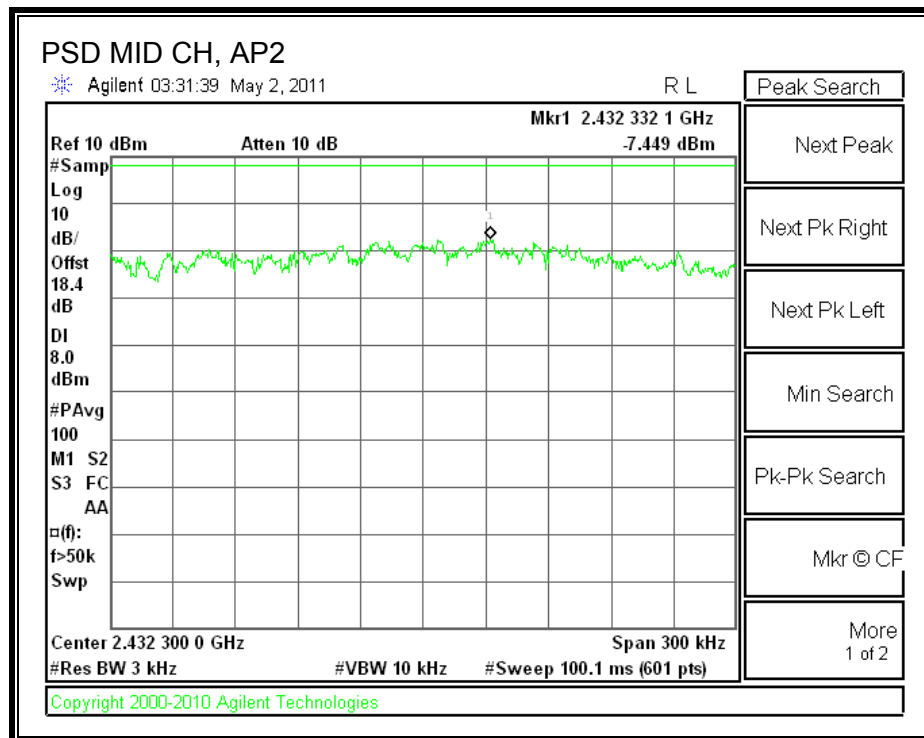
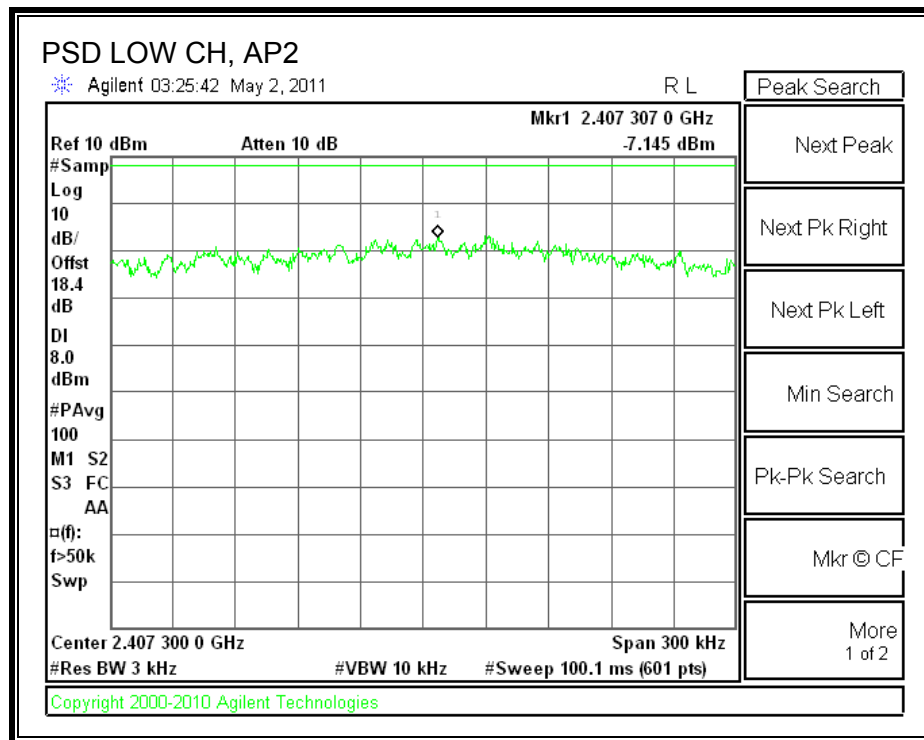
TEST PROCEDURE

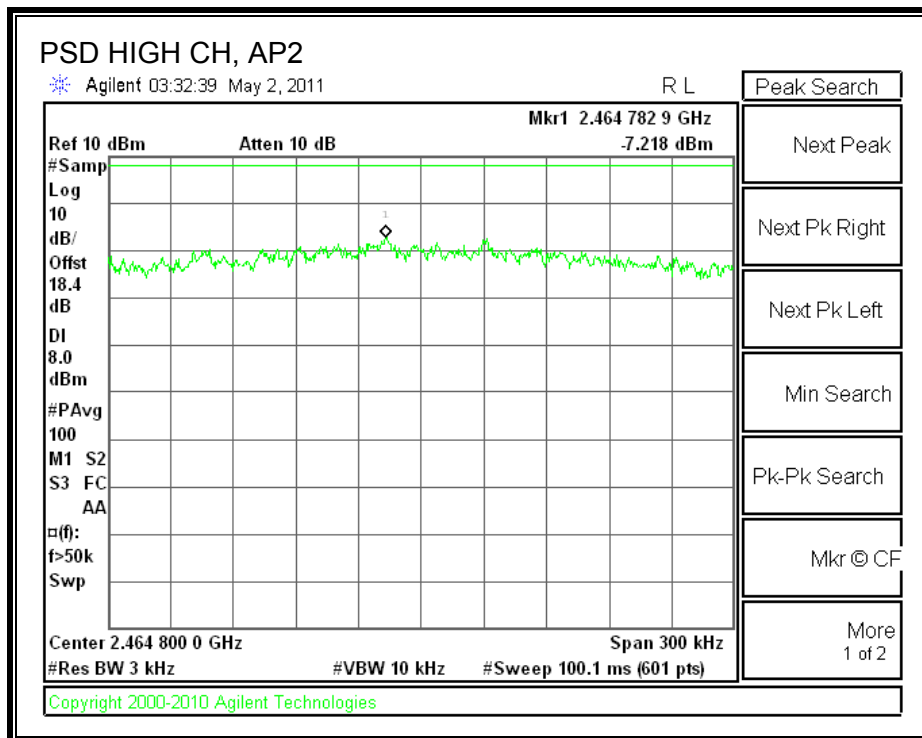
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

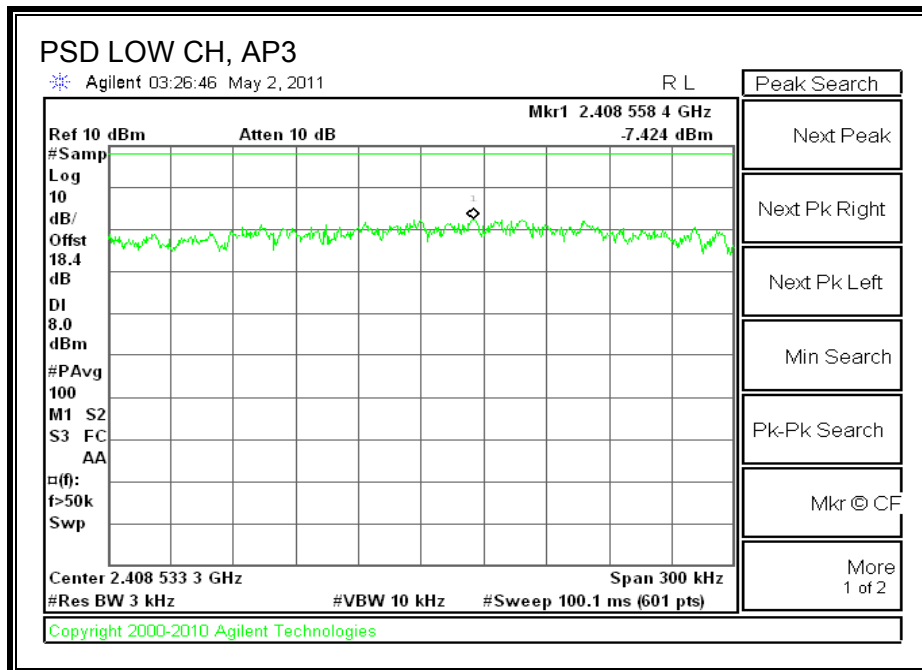
Channel	Frequency (MHz)	AP2 PSD (dBm)	AP3 PSD (dBm)	AP4 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-7.145	-7.424	-6.537	-2.25	8	-10.25
Middle	2437	-7.449	-7.576	-6.665	-2.44	8	-10.44
High	2462	-7.218	-8.405	-7.962	-3.06	8	-11.06

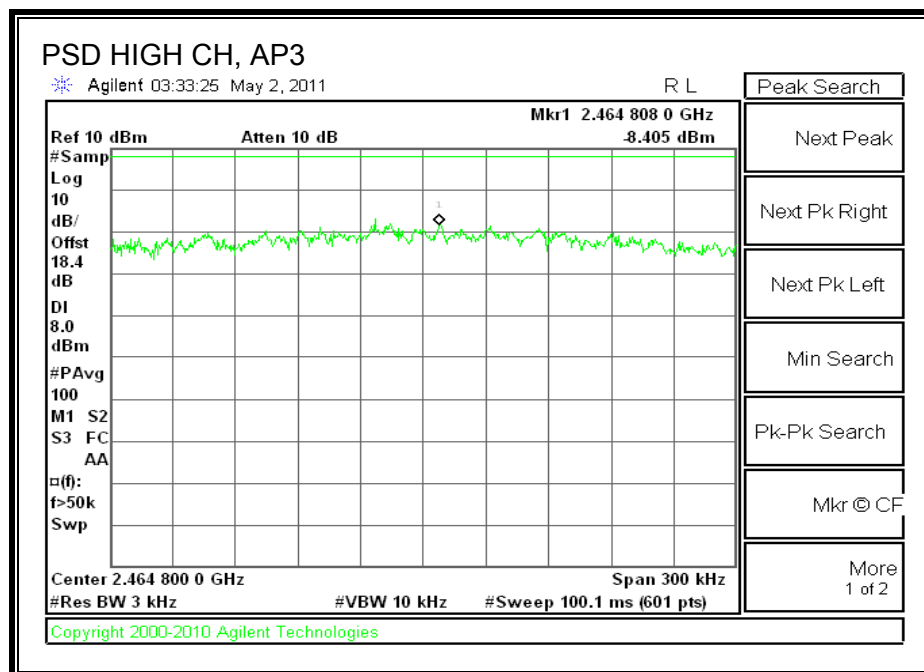
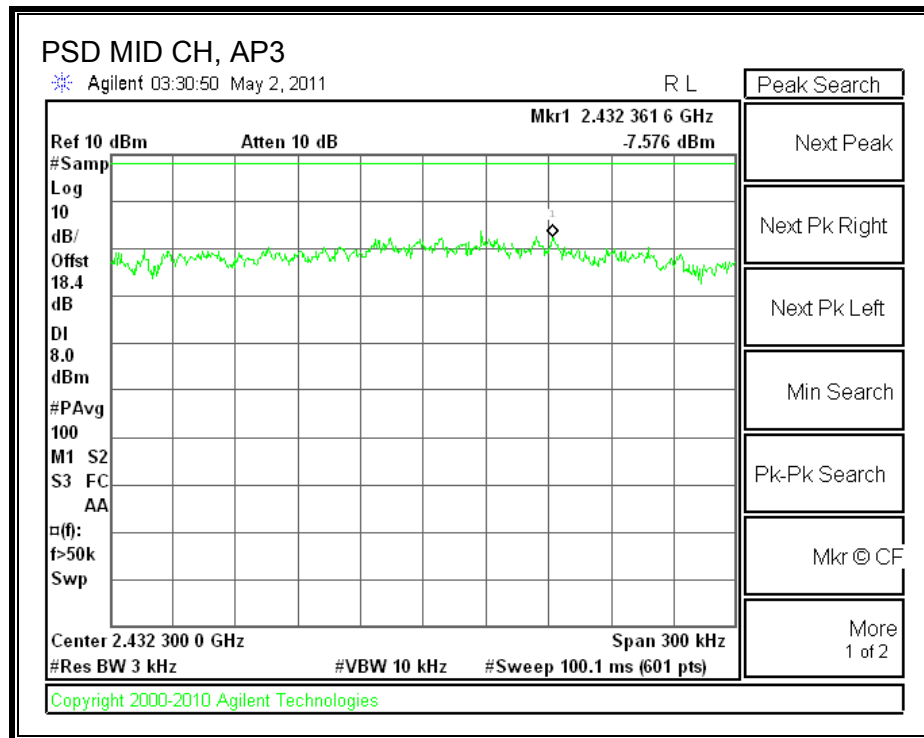
POWER SPECTRAL DENSITY, AP2



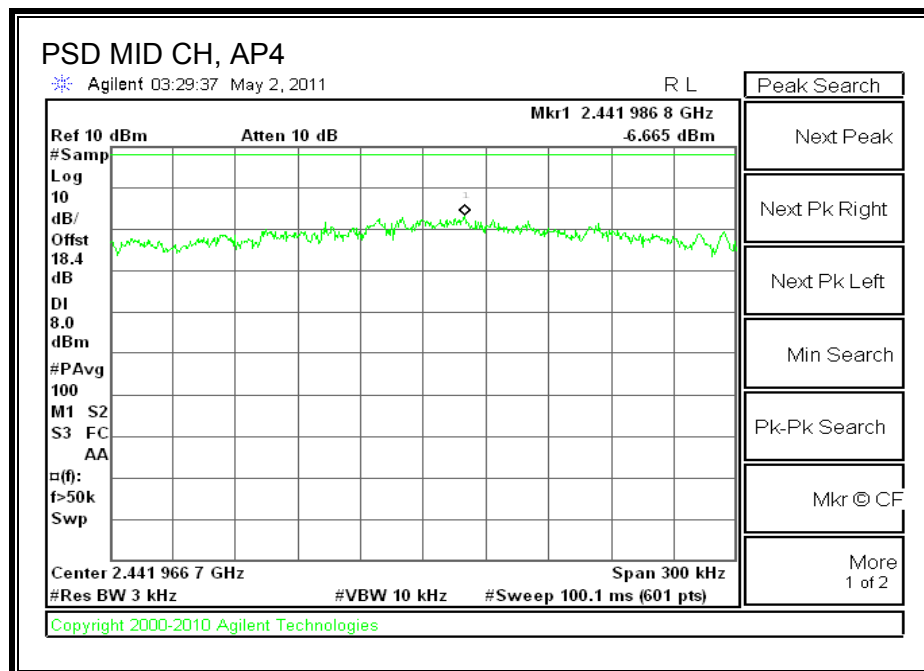
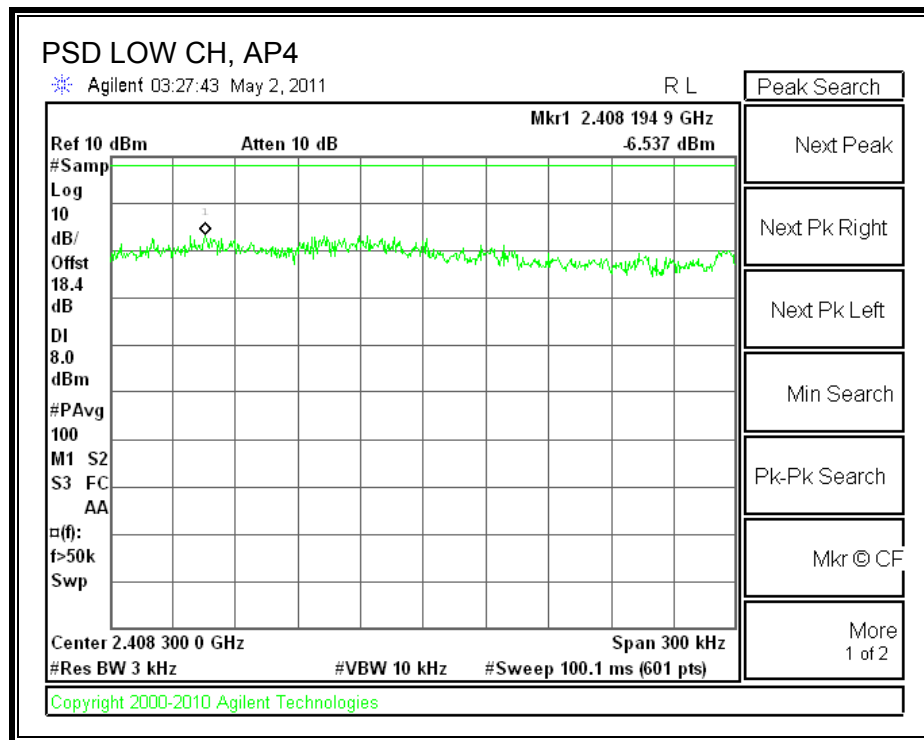


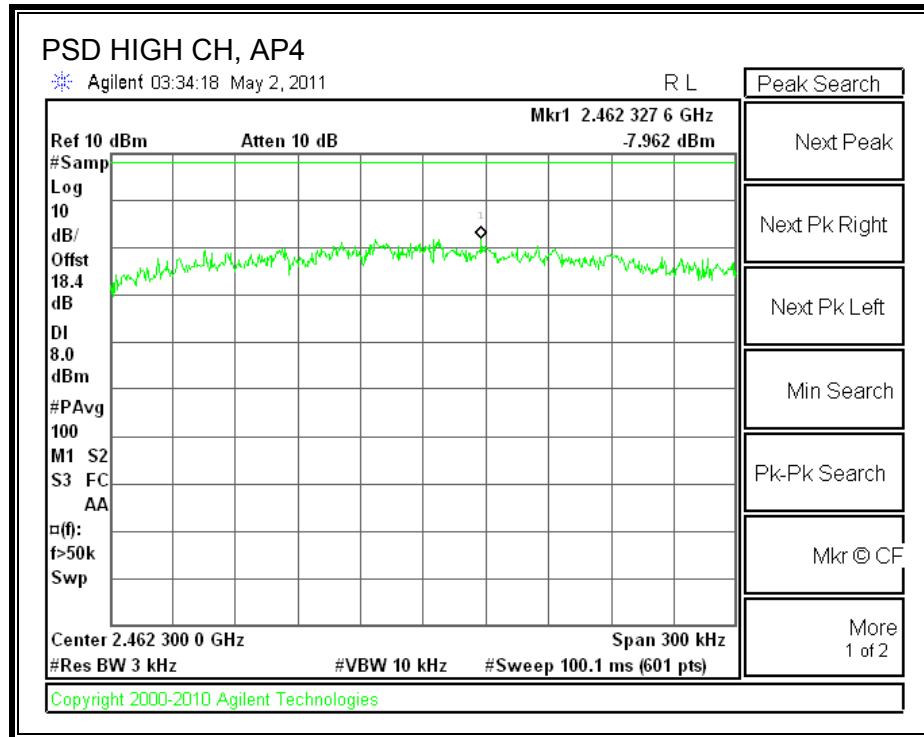
POWER SPECTRAL DENSITY, AP3





POWER SPECTRAL DENSITY, AP4





7.2.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of RMS averaging over time interval; therefore the required attenuation is 30 dB.

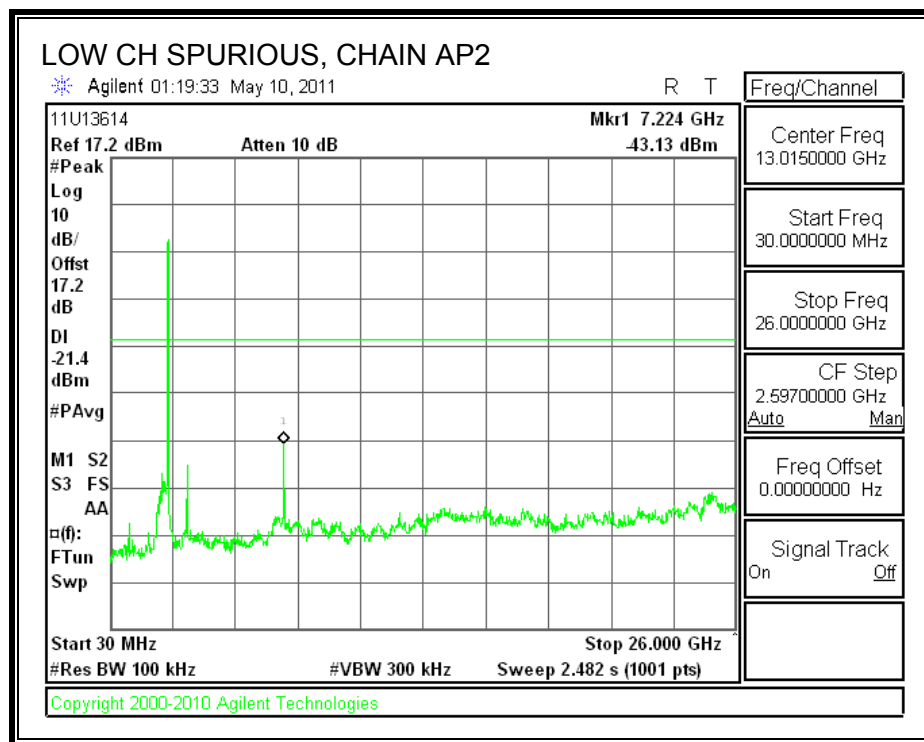
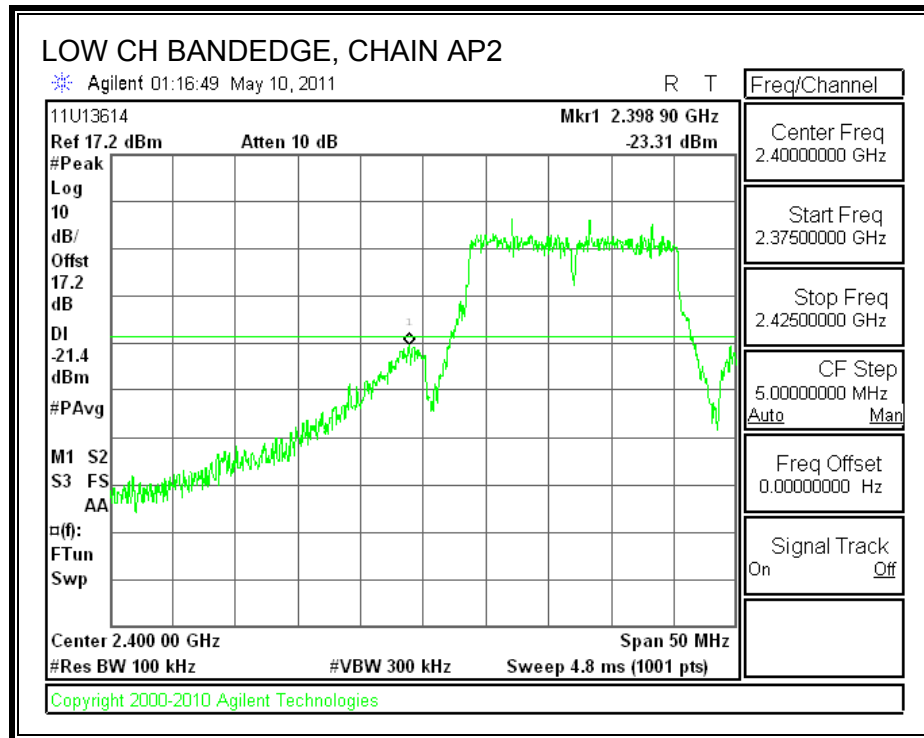
TEST PROCEDURE

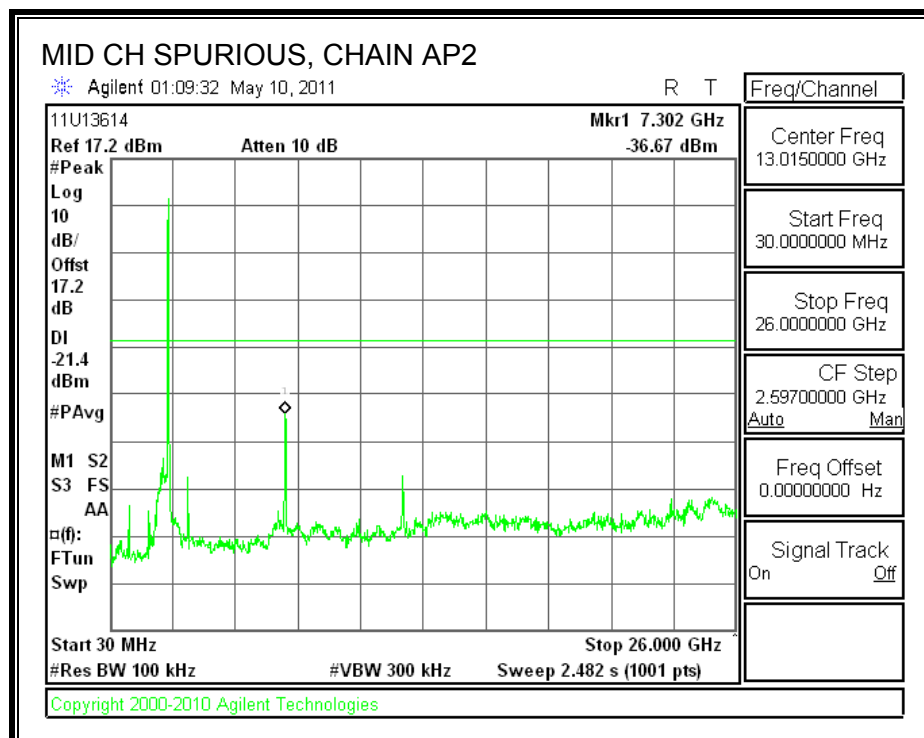
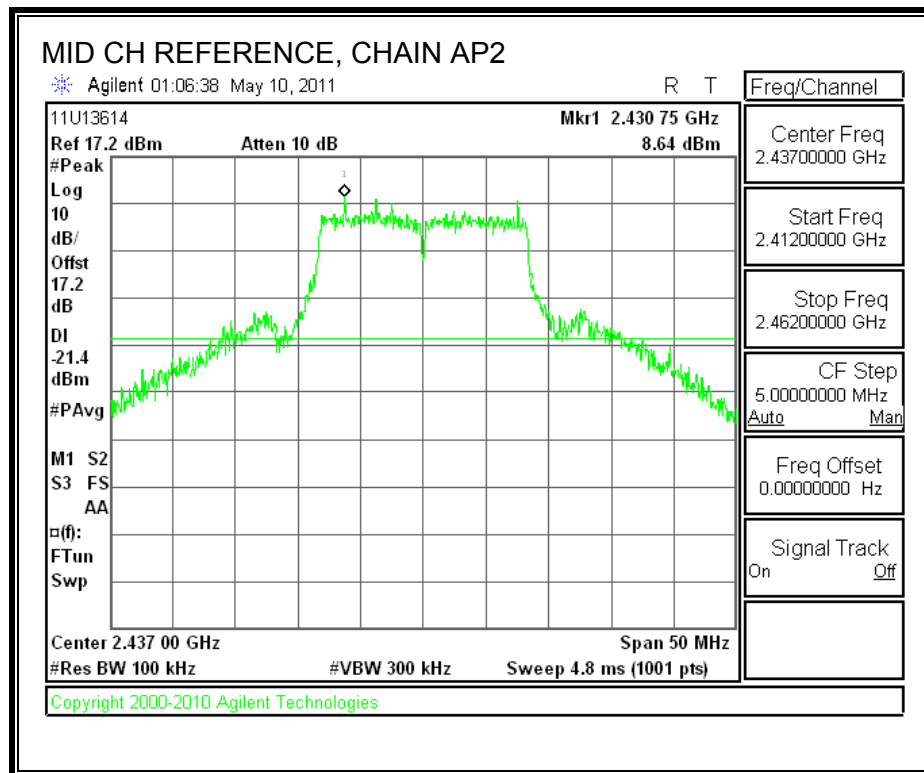
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

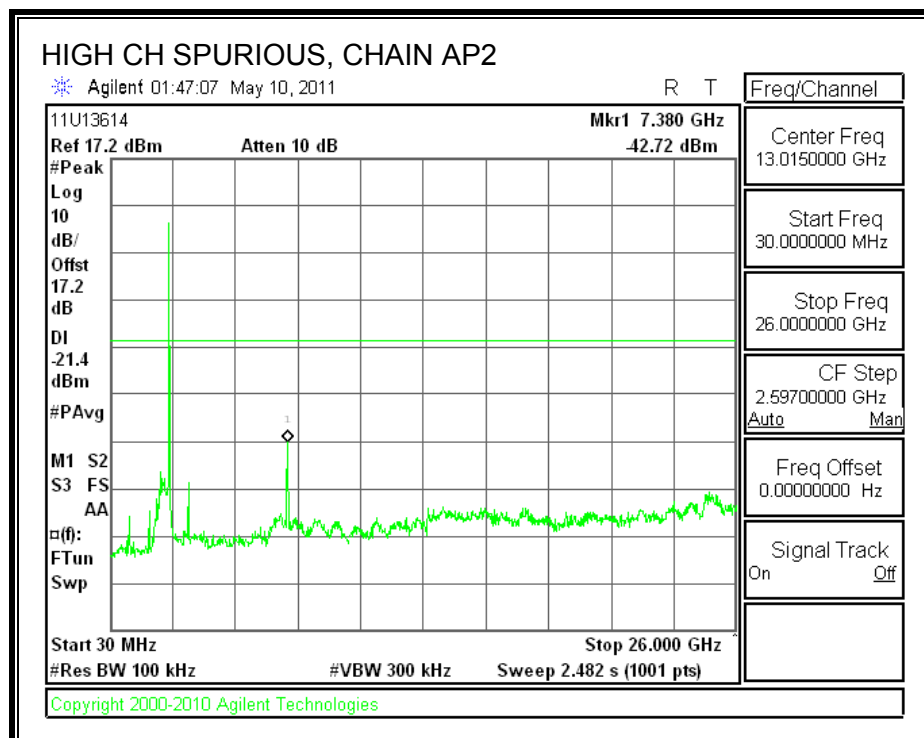
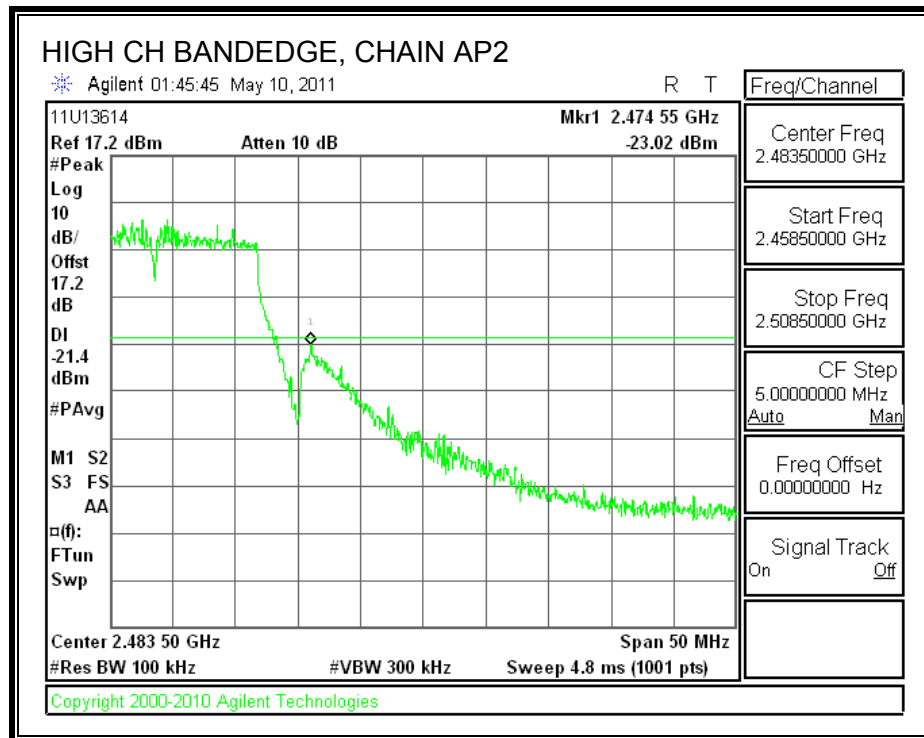
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

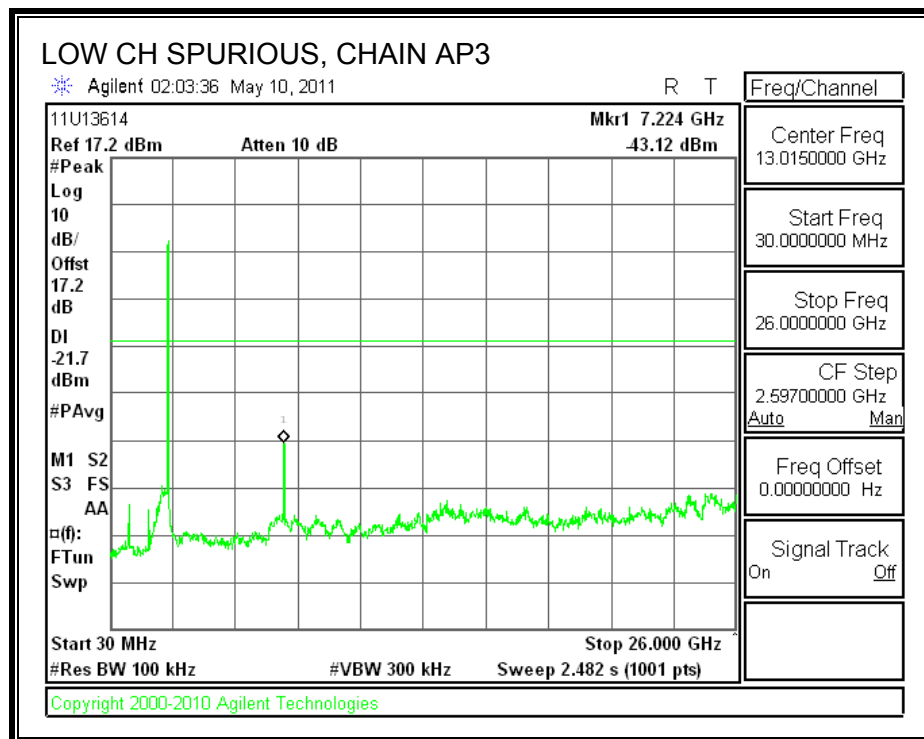
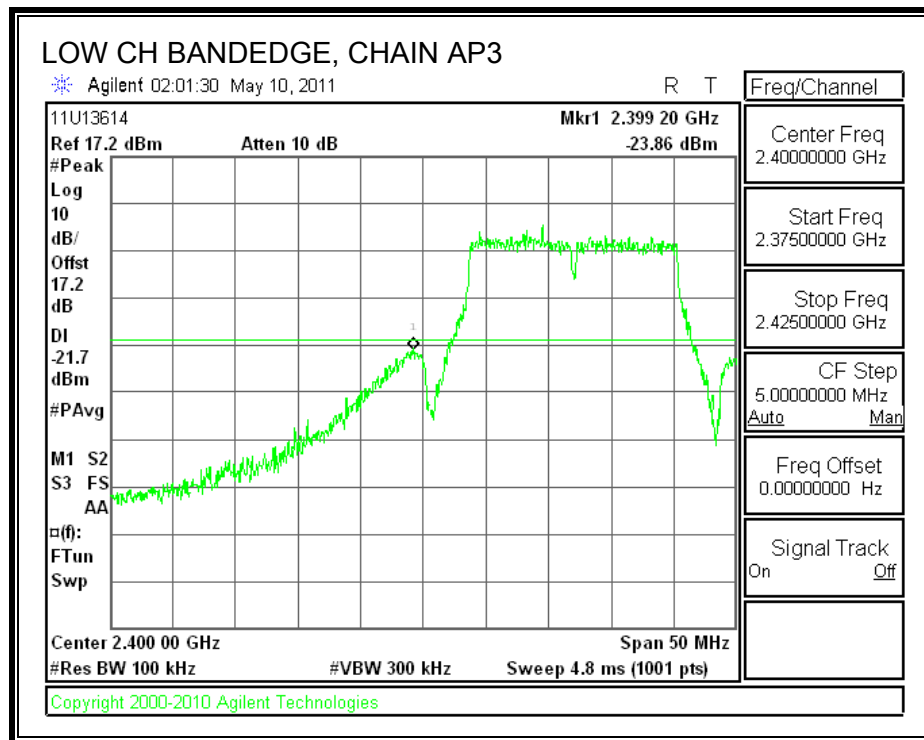
CHAIN AP2 SPURIOUS EMISSIONS

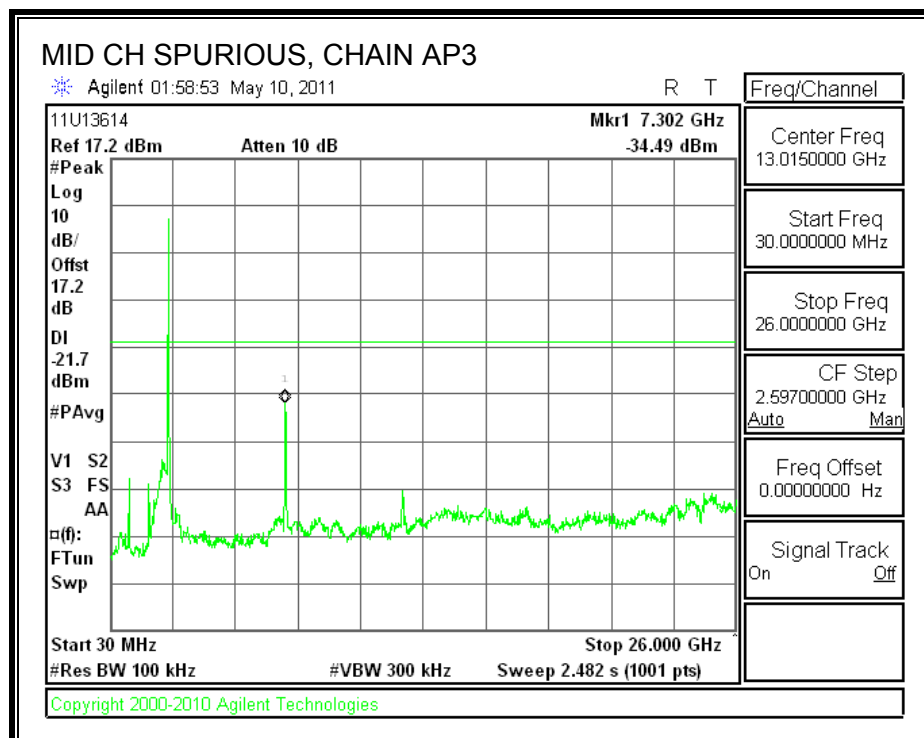
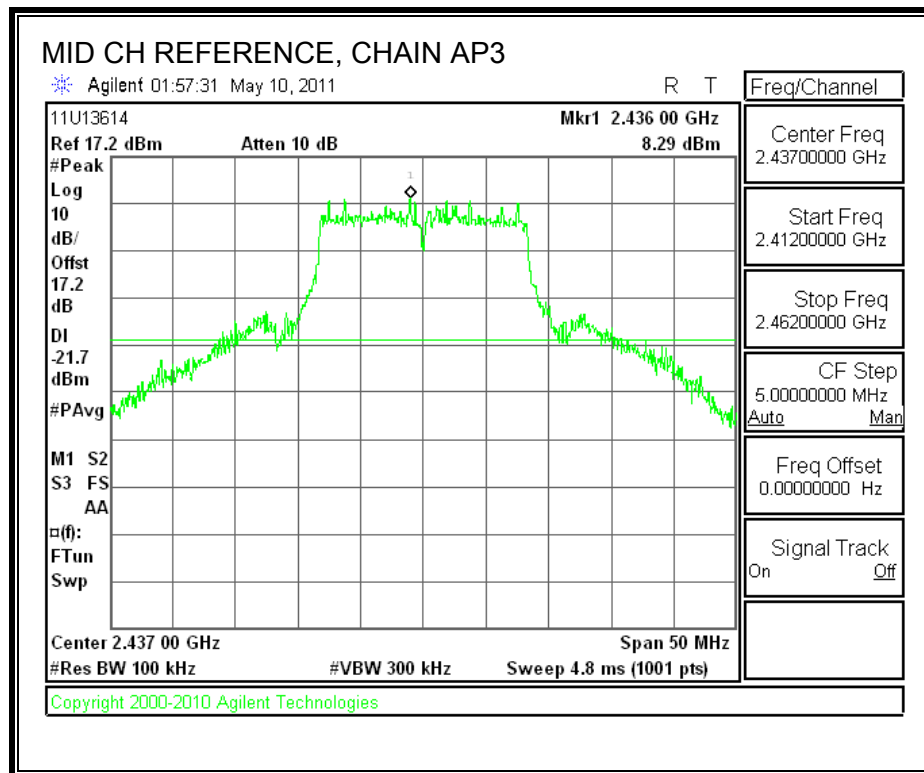


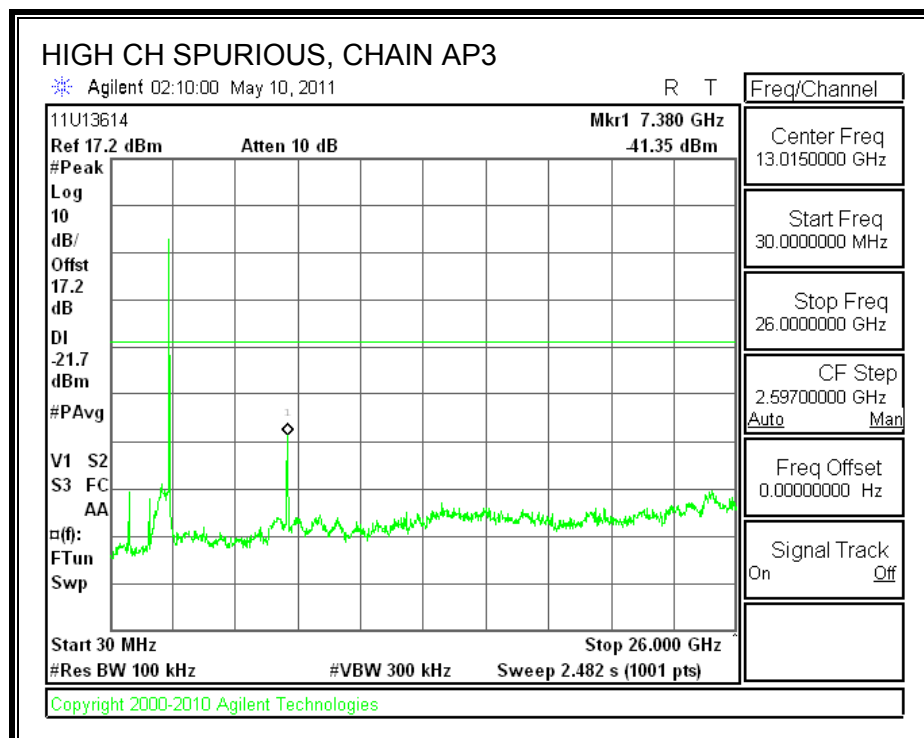
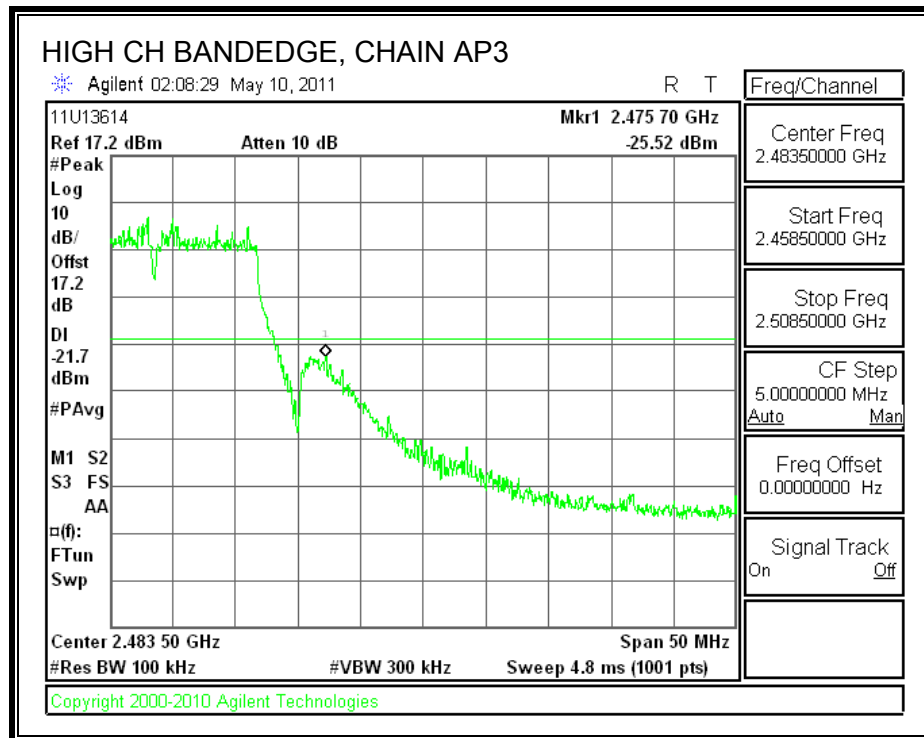




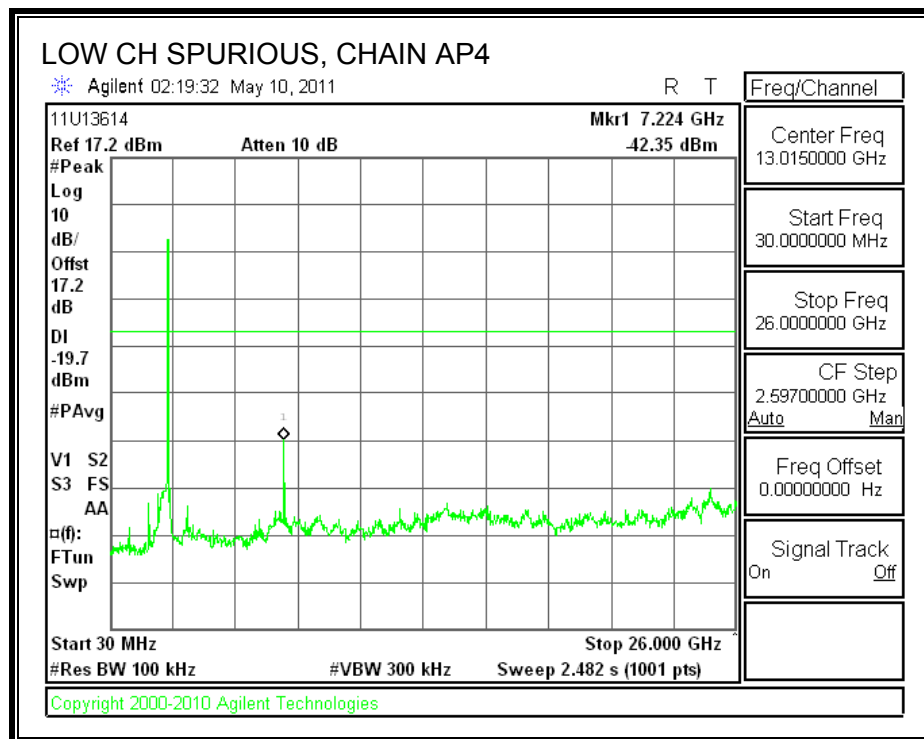
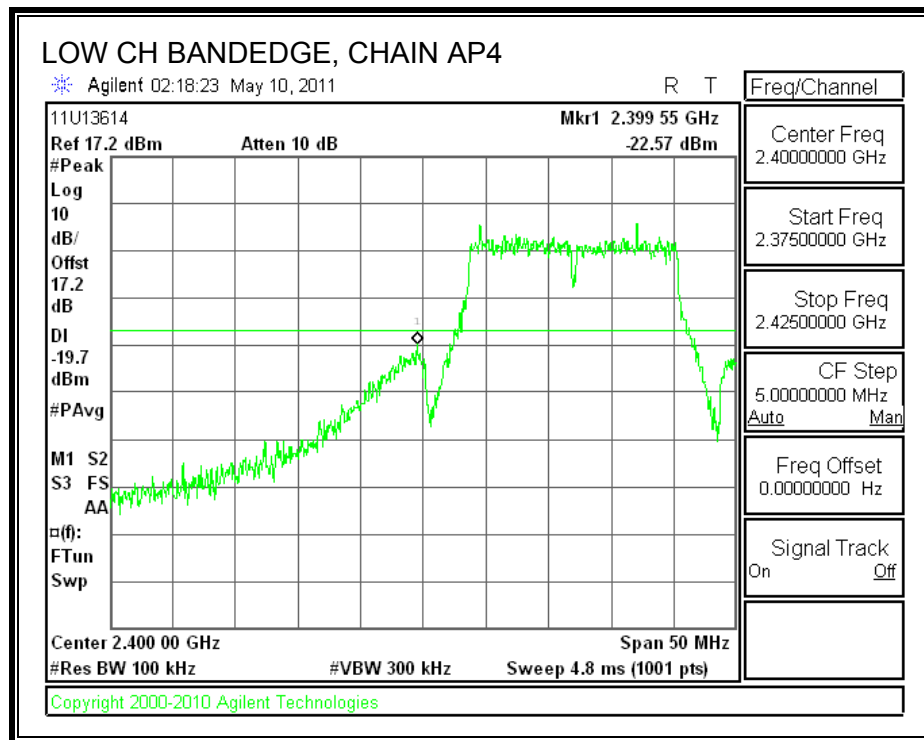
CHAIN AP3 SPURIOUS EMISSIONS

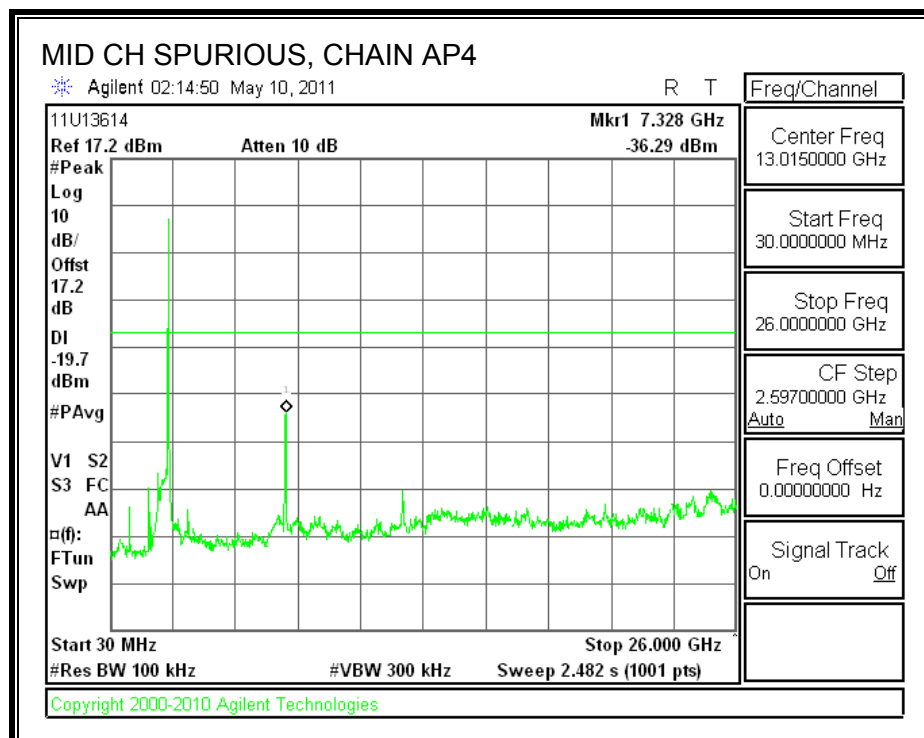
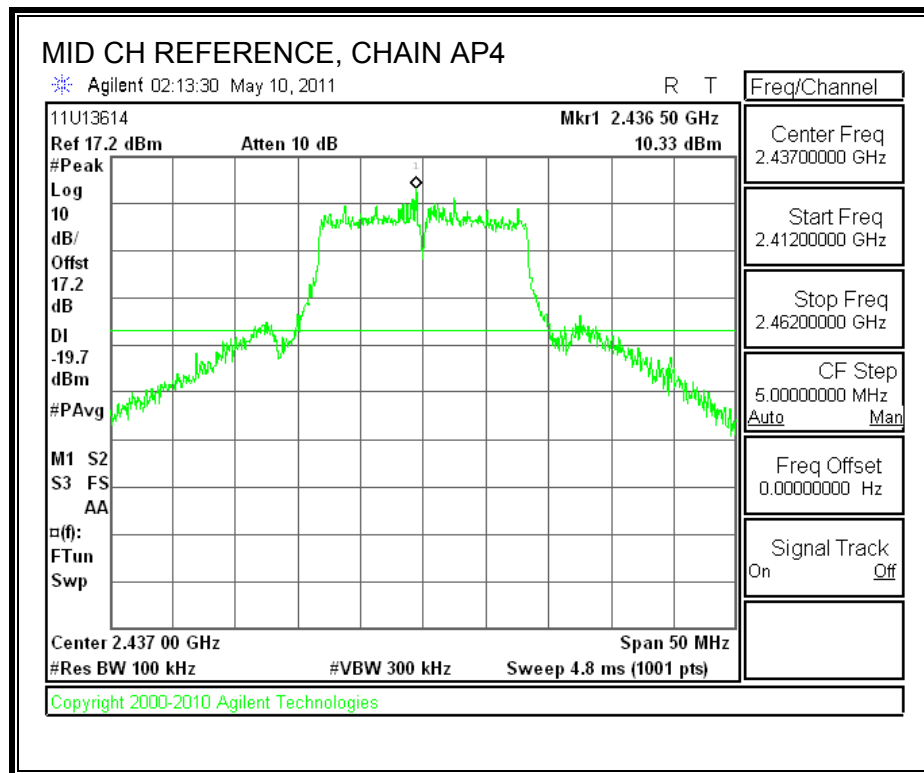


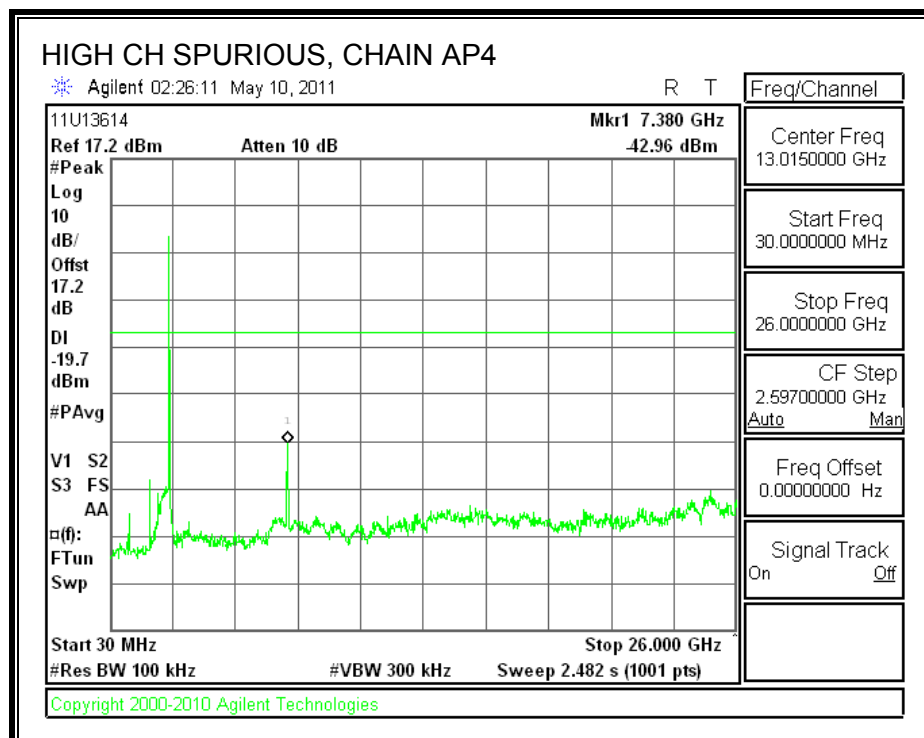
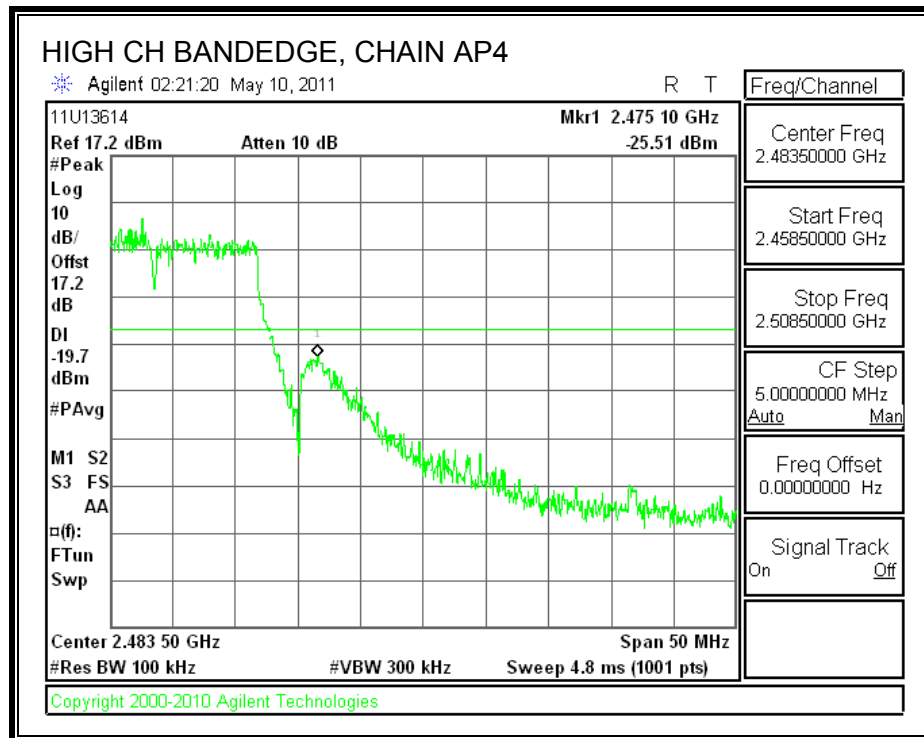




CHAIN AP4 SPURIOUS EMISSIONS







7.3. 802.11n THREE CHAINS HT20 MODE IN THE 2.4 GHz BAND

7.3.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

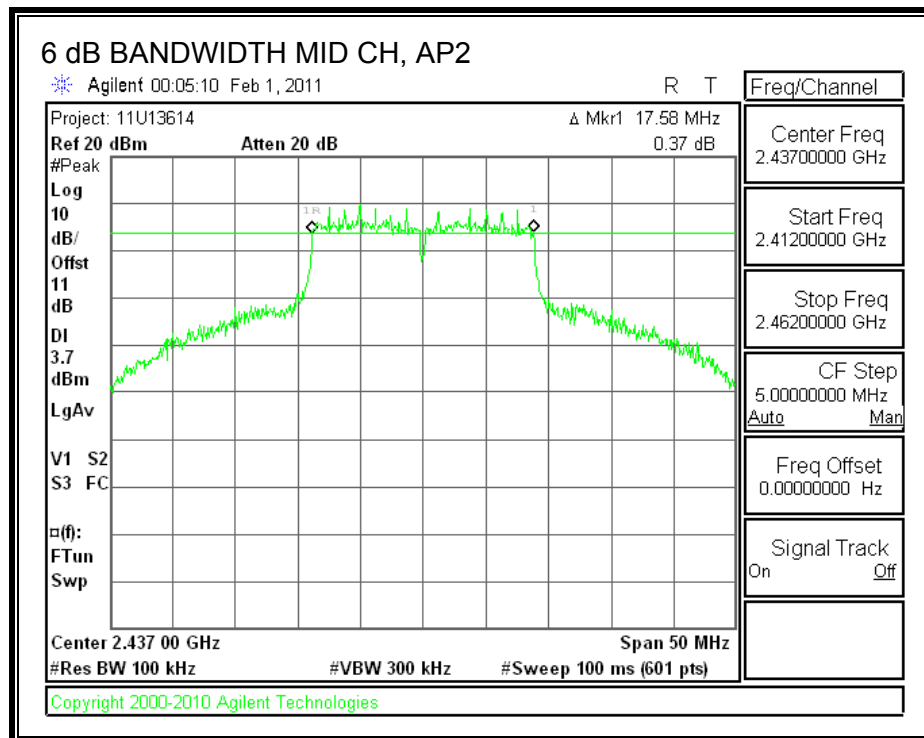
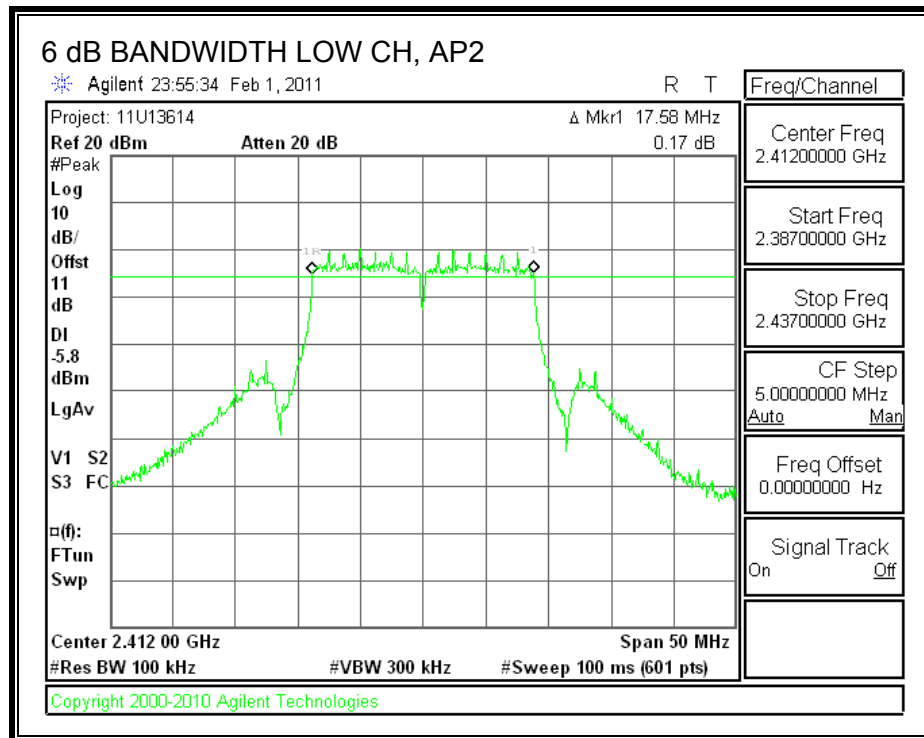
TEST PROCEDURE

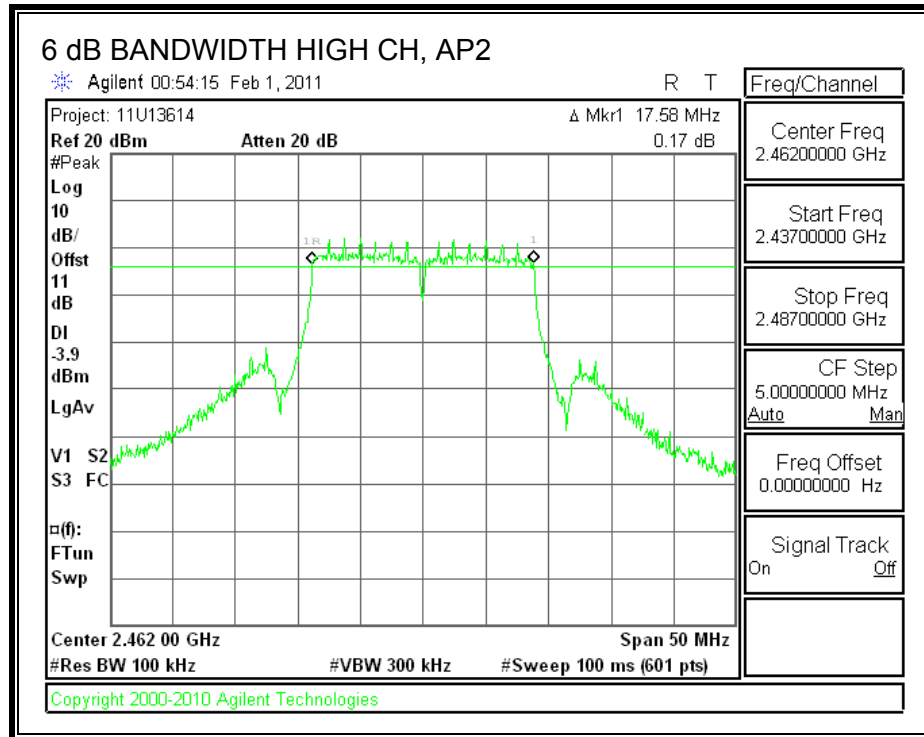
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

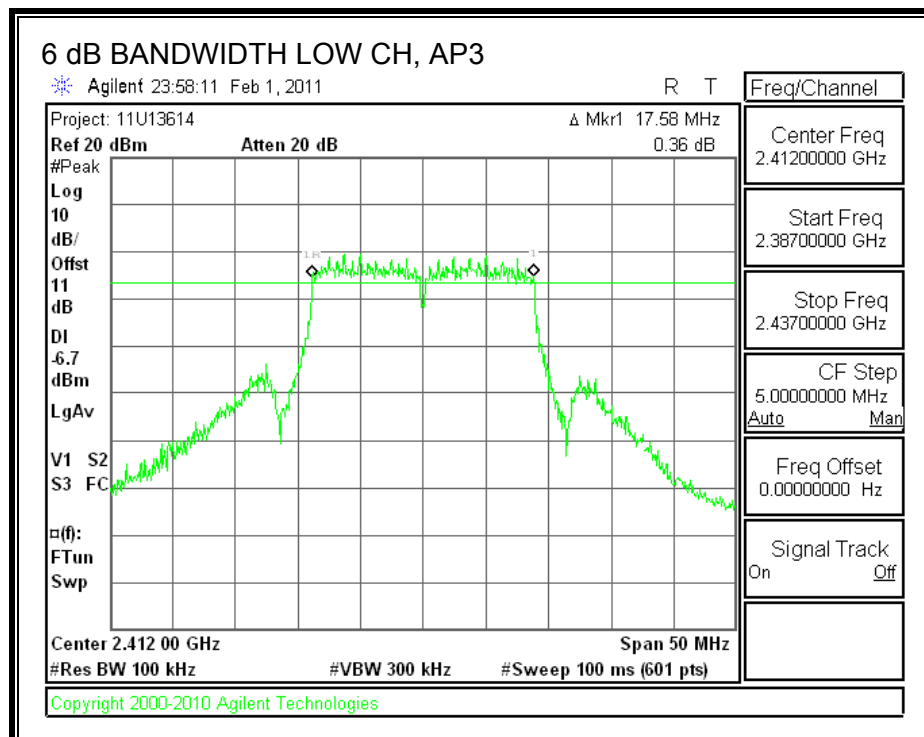
Channel	Frequency (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	AP4 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	17.58	17.58	17.58	0.5
Middle	2437	17.58	17.58	17.33	0.5
High	2462	17.58	17.58	17.58	0.5

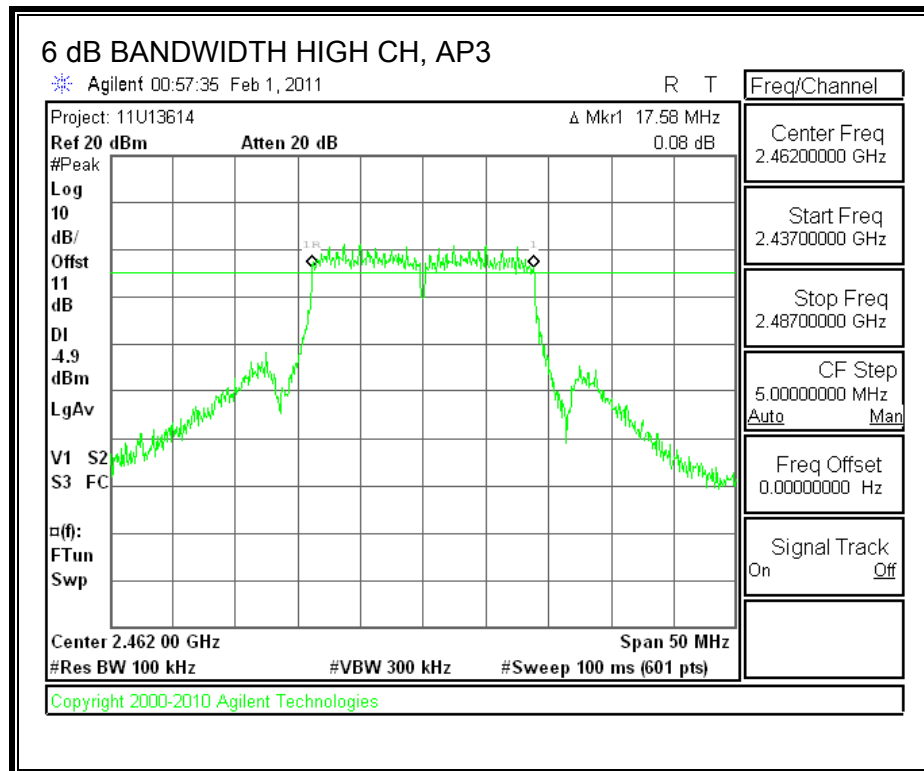
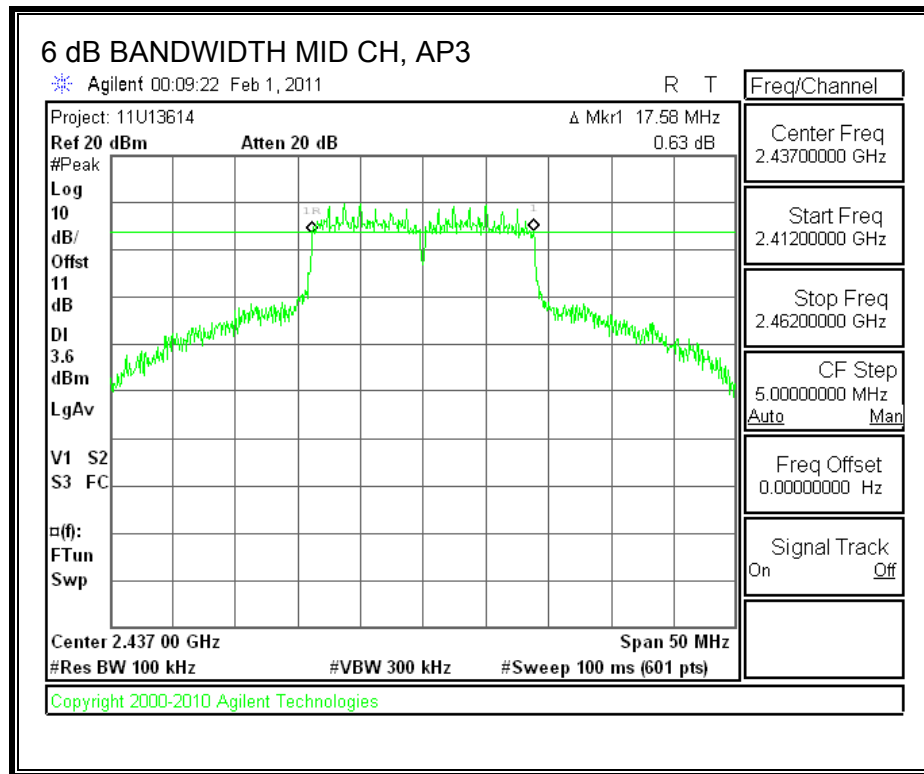
6 dB BANDWIDTH, AP2



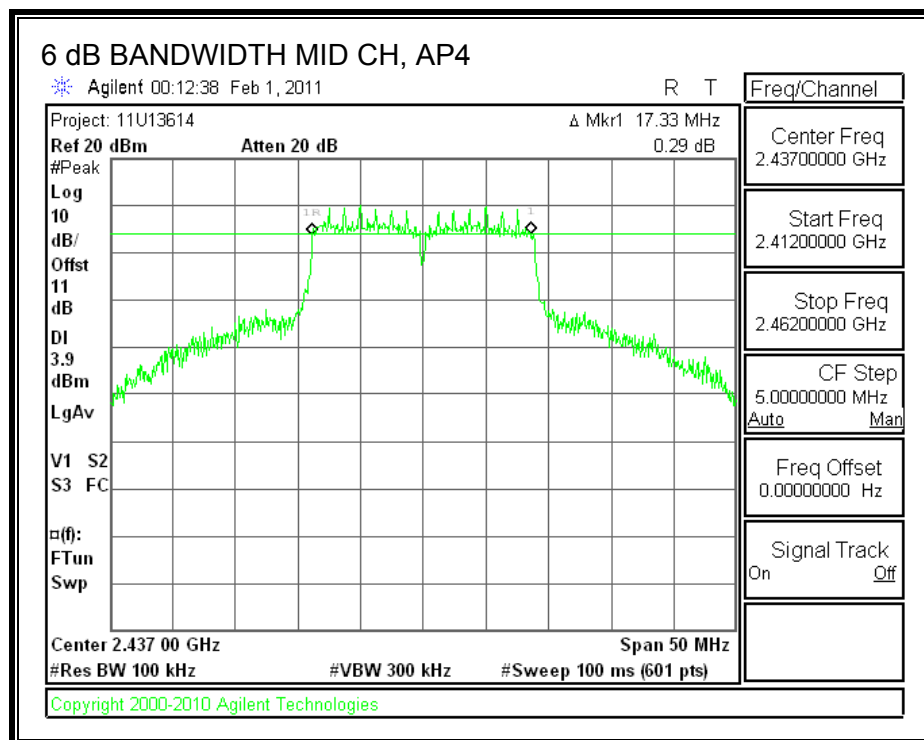
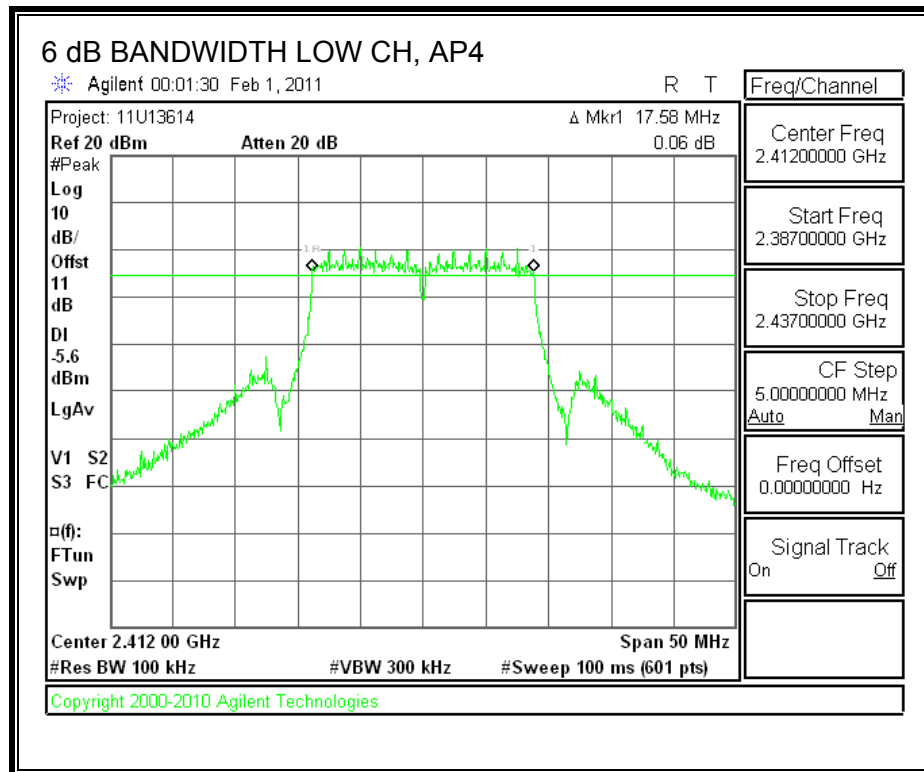


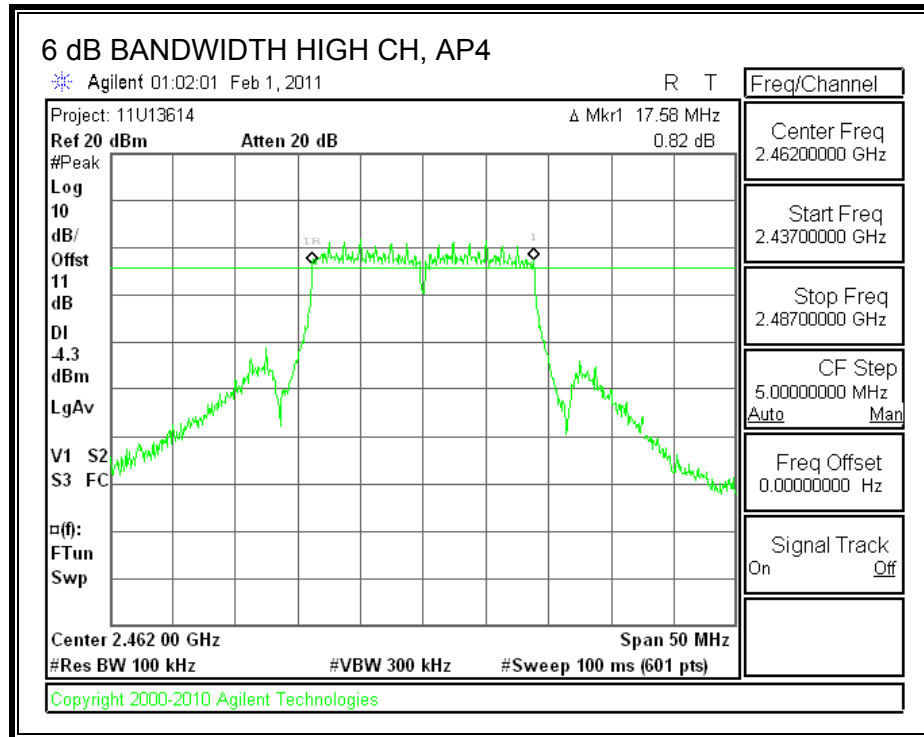
6 dB BANDWIDTH, AP3





6 dB BANDWIDTH, AP4





7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

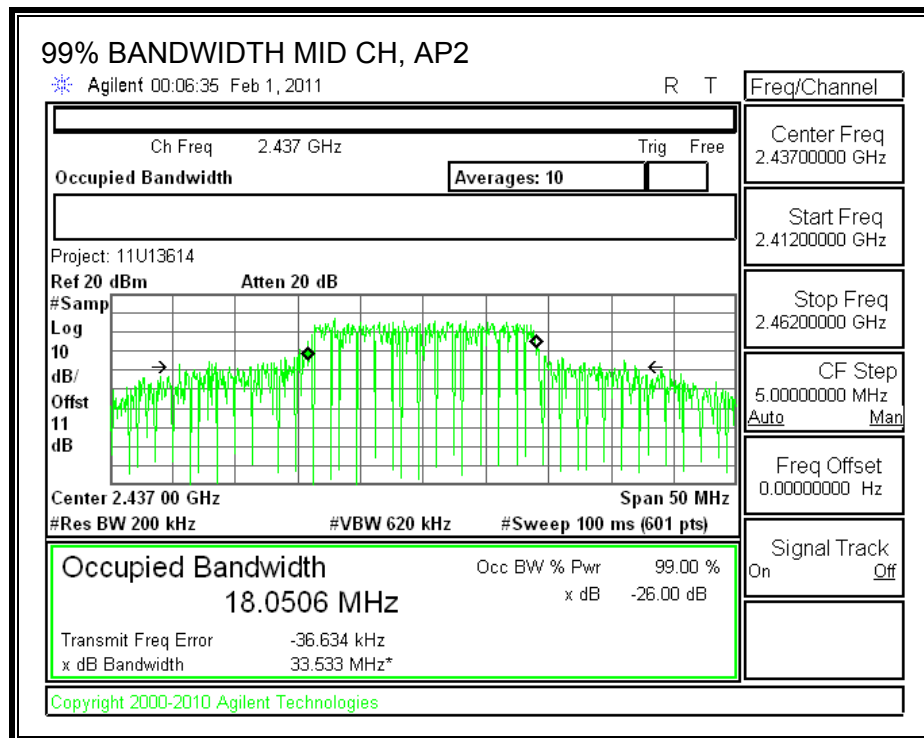
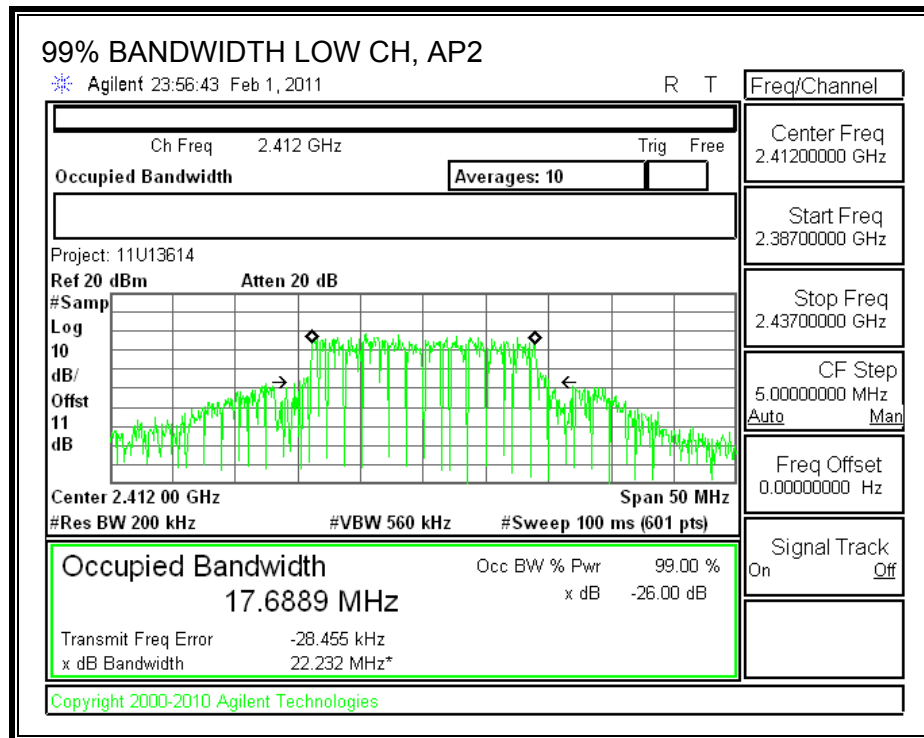
TEST PROCEDURE

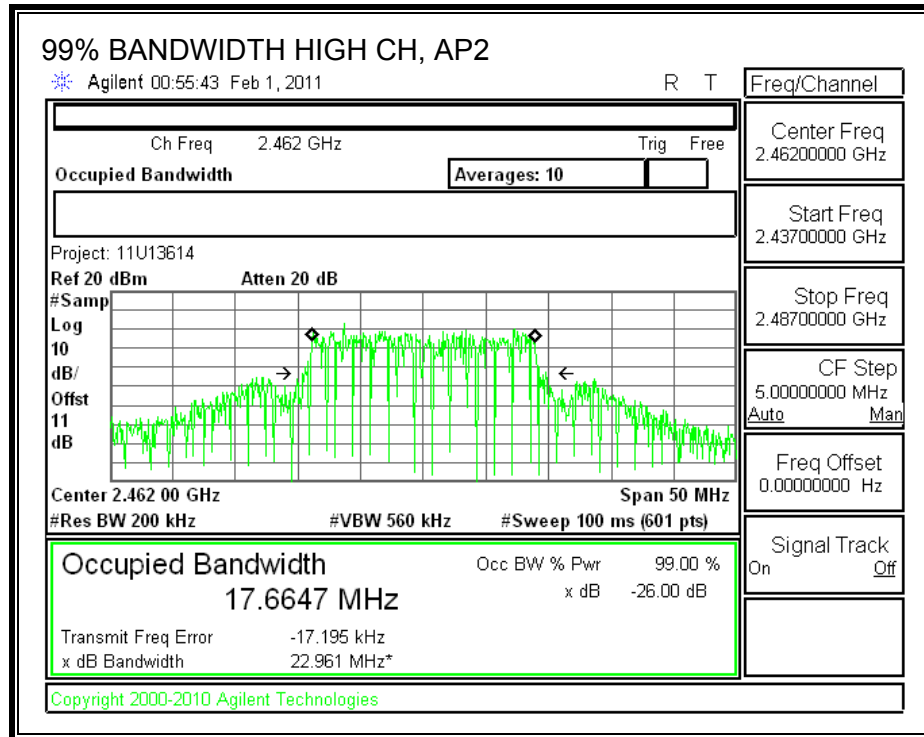
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

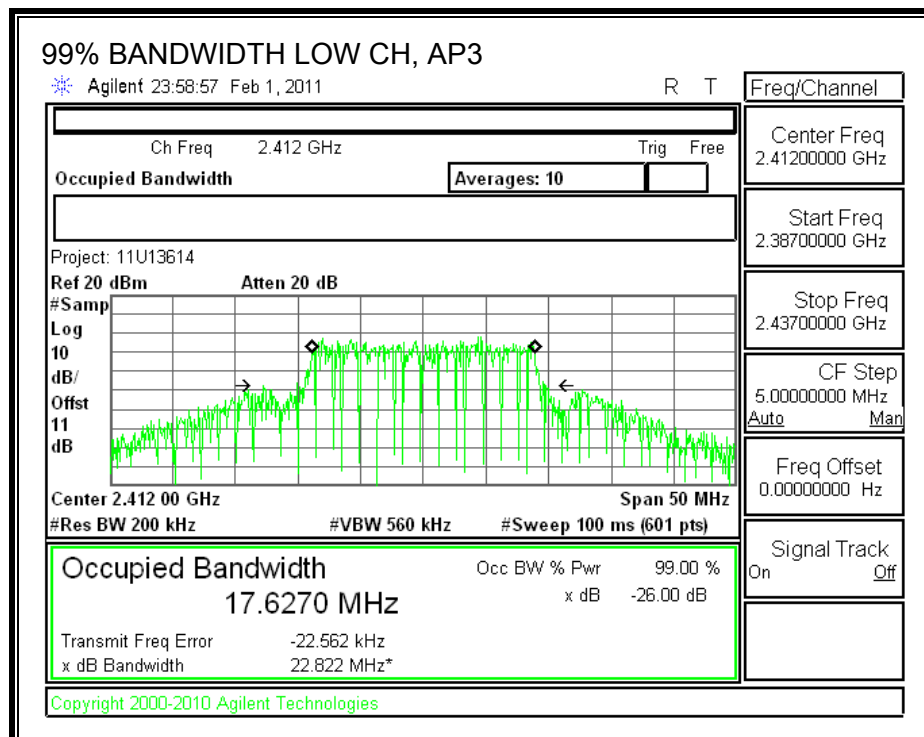
Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	2412	17.6889	17.627	17.6528
Middle	2437	18.0506	17.863	17.7258
High	2462	17.6647	17.6644	17.6102

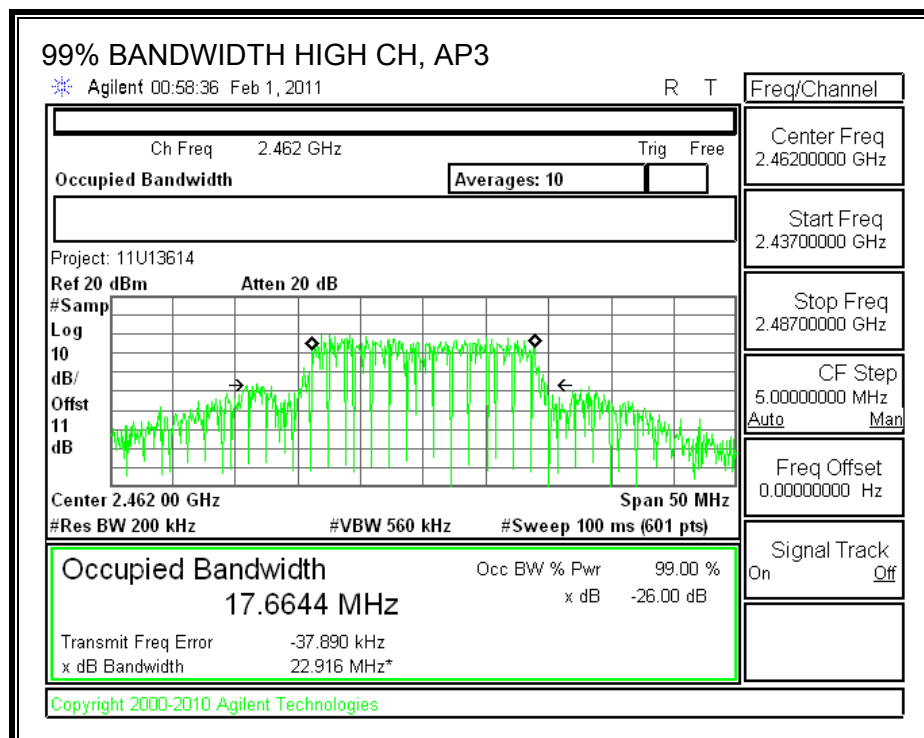
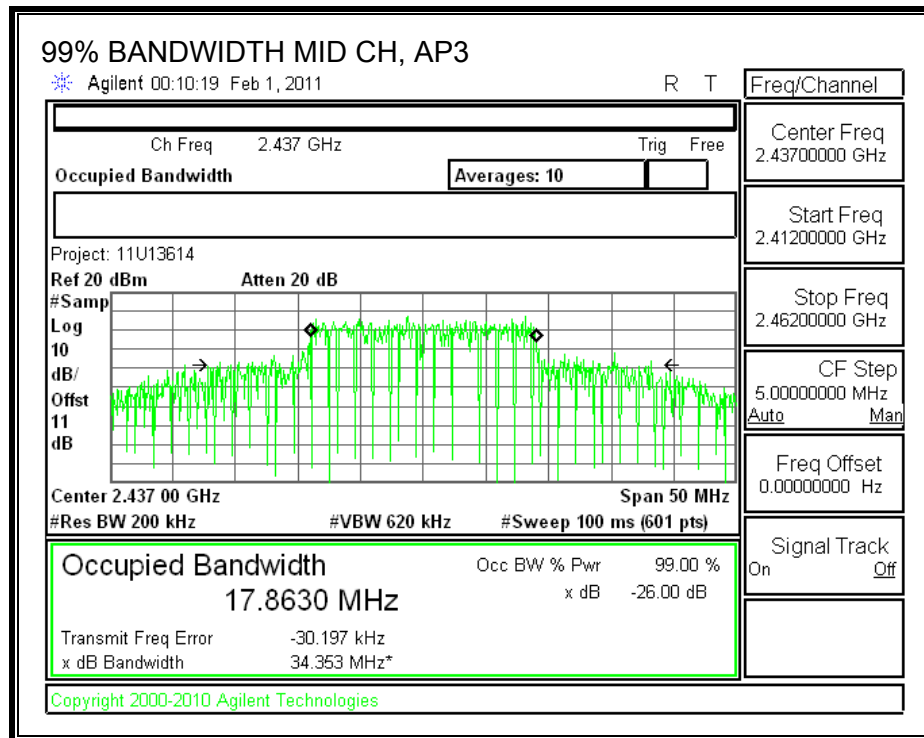
99% BANDWIDTH, AP2



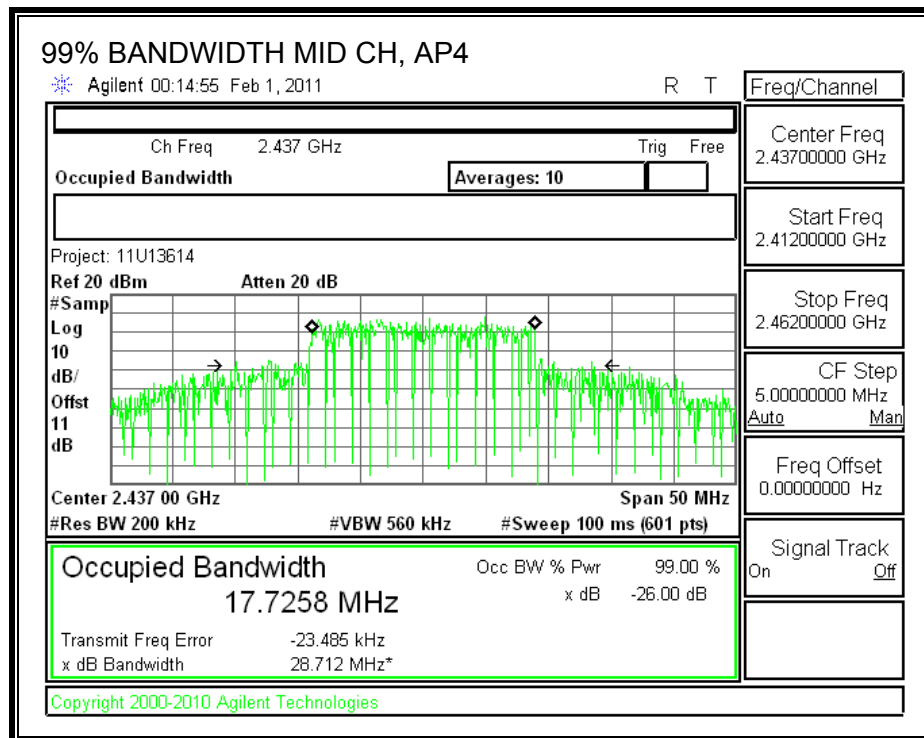
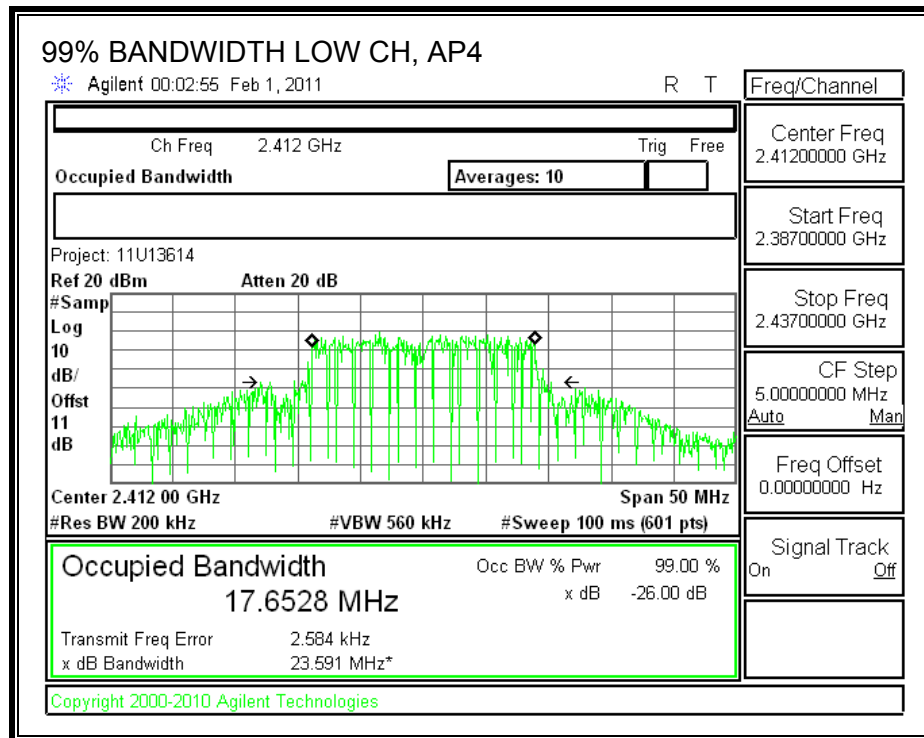


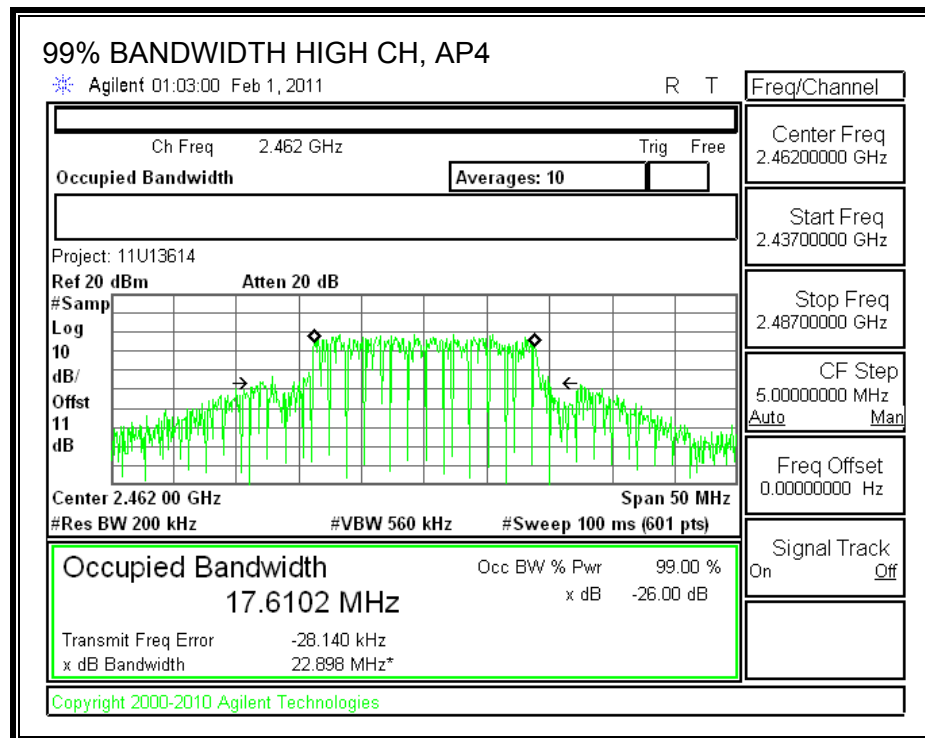
99% BANDWIDTH, AP3





99% BANDWIDTH, AP4





7.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain of **4.32 dBi** is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

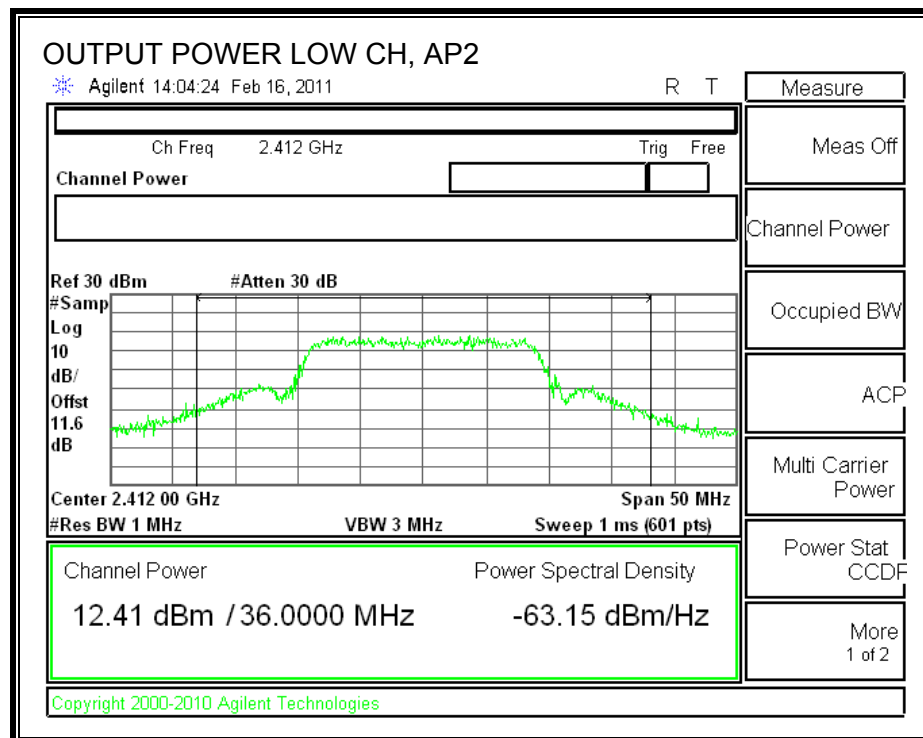
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

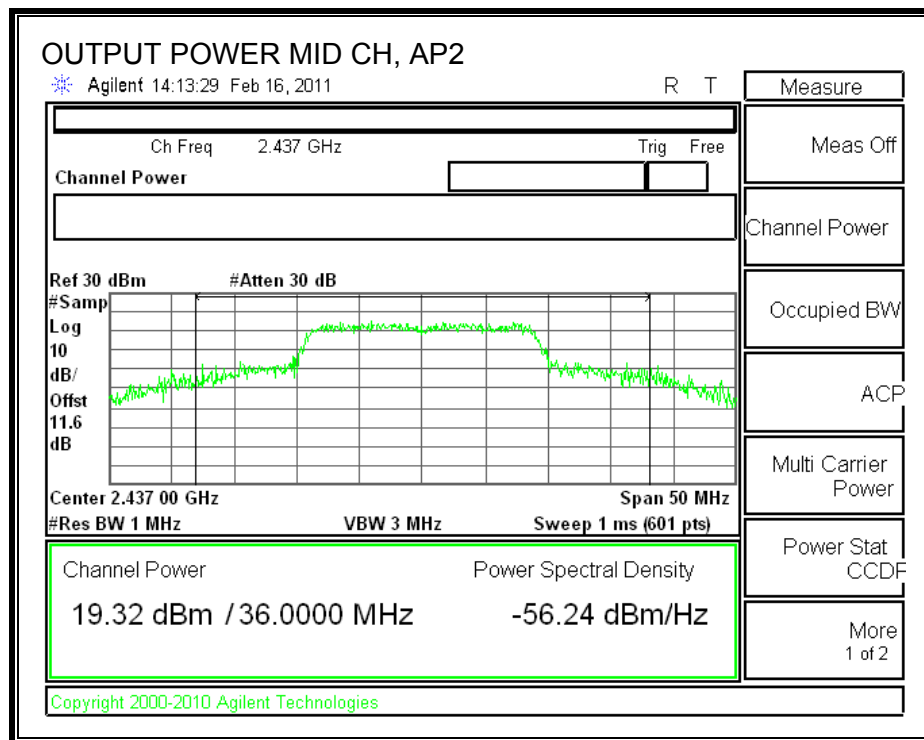
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

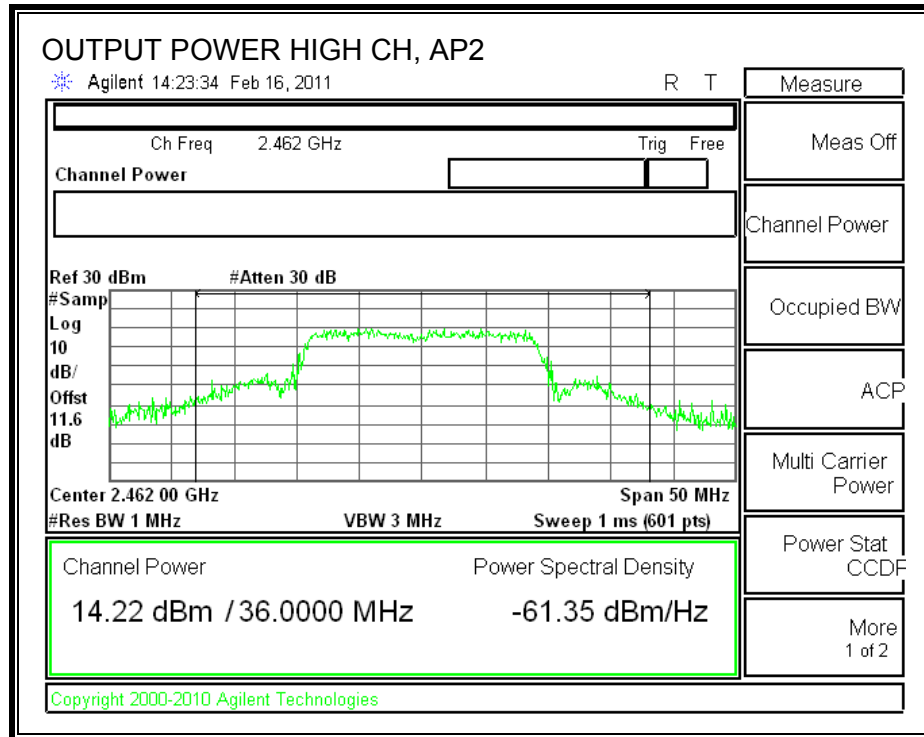
RESULTS

Channel	Frequency (MHz)	AP2 Power (dBm)	AP3 Power (dBm)	AP4 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	12.41	11.62	12.20	0.00	16.86	30.00	-13.14
Mid	2437	19.32	19.32	19.38	0.00	24.11	30.00	-5.89
High	2462	14.22	14.18	14.03	0.00	18.92	30.00	-11.08

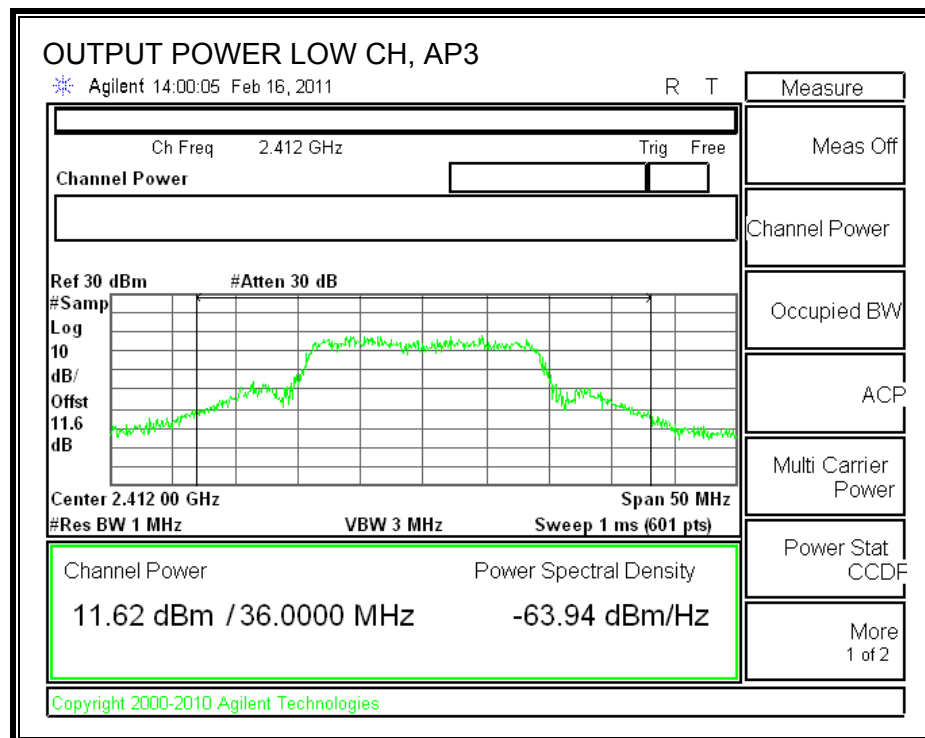
AP2 OUTPUT POWER

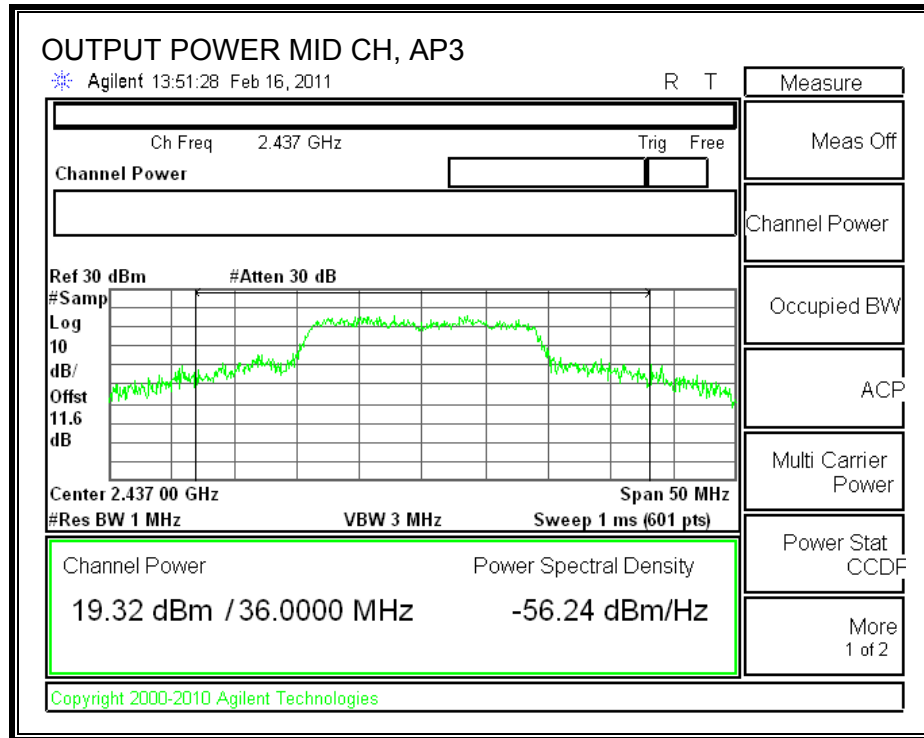


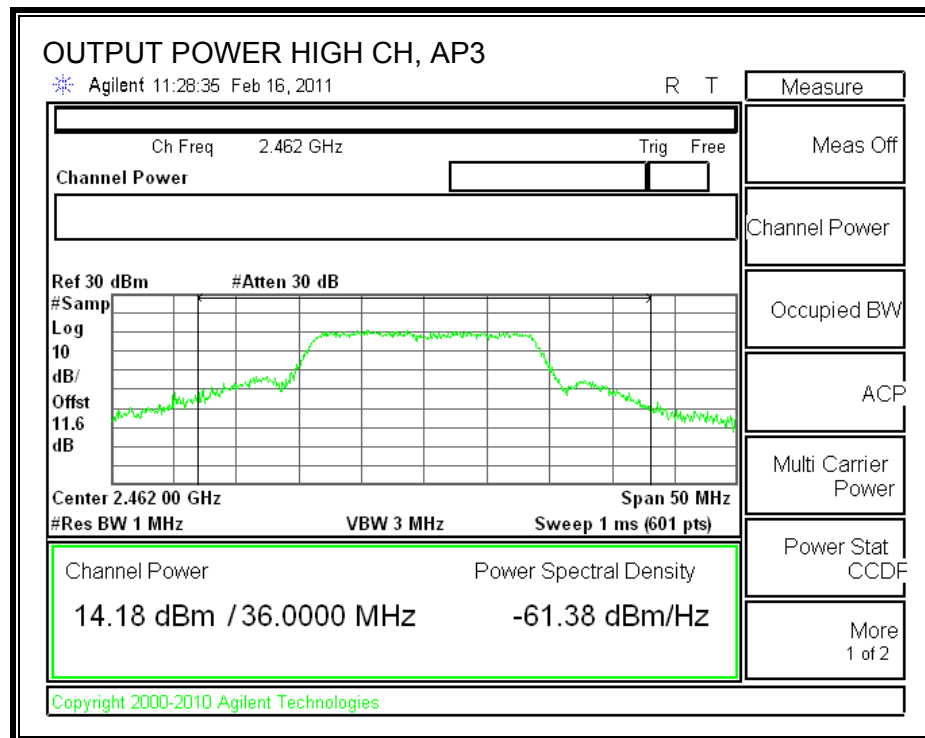




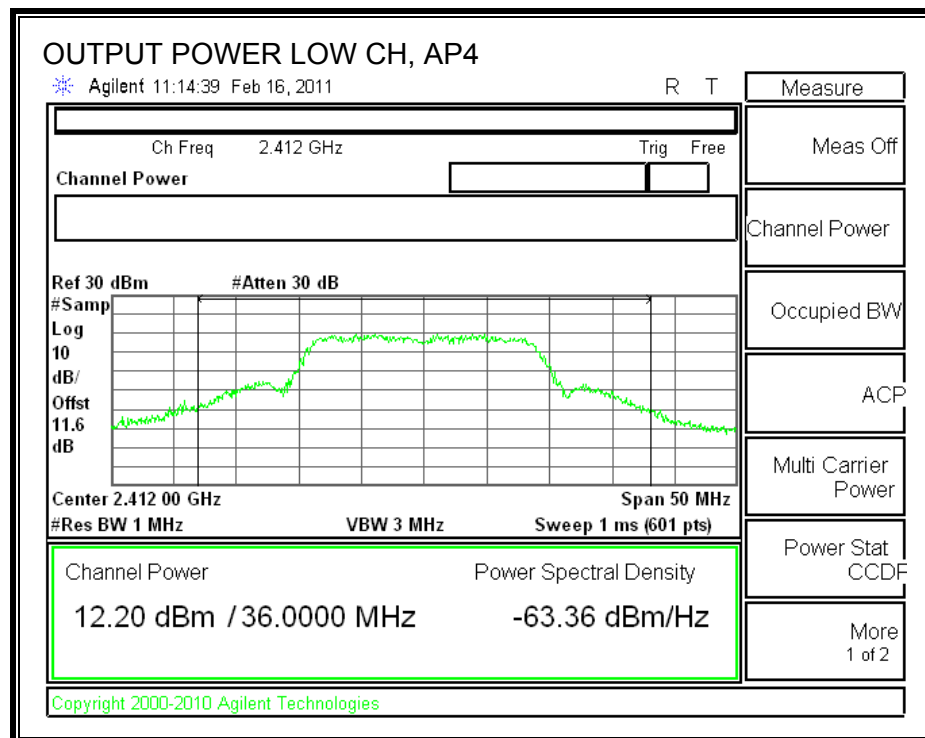
AP3 OUTPUT POWER

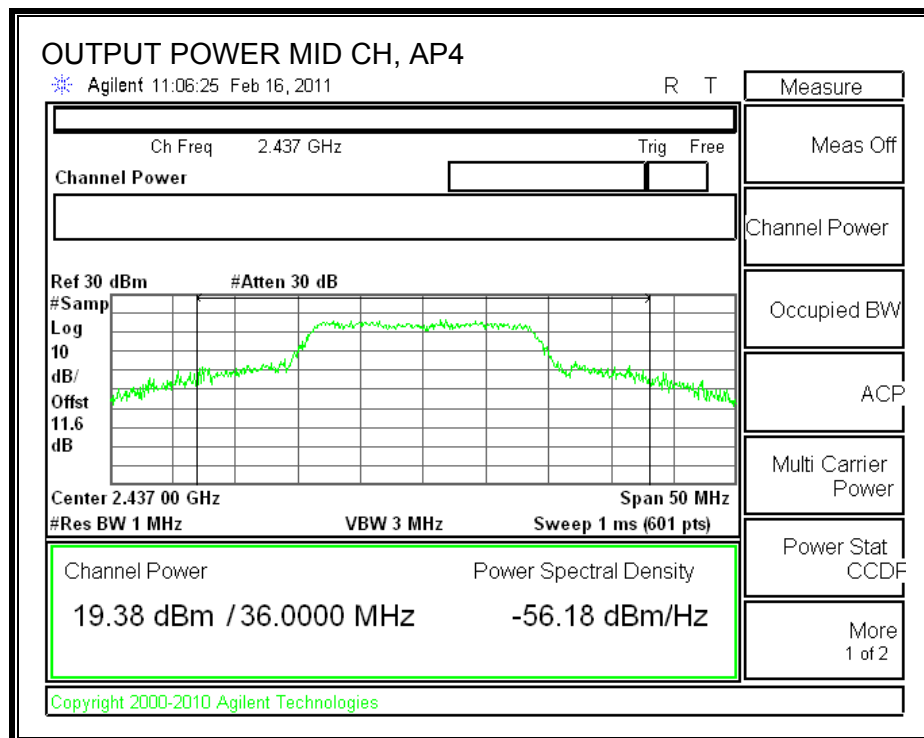


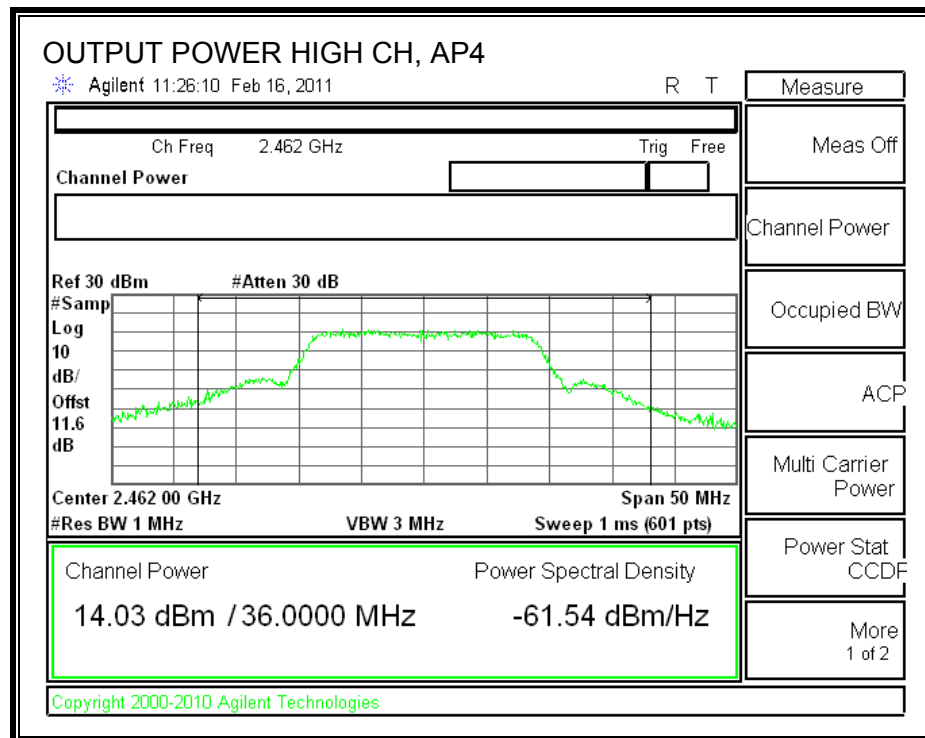




AP4 OUTPUT POWER







7.3.4. 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.

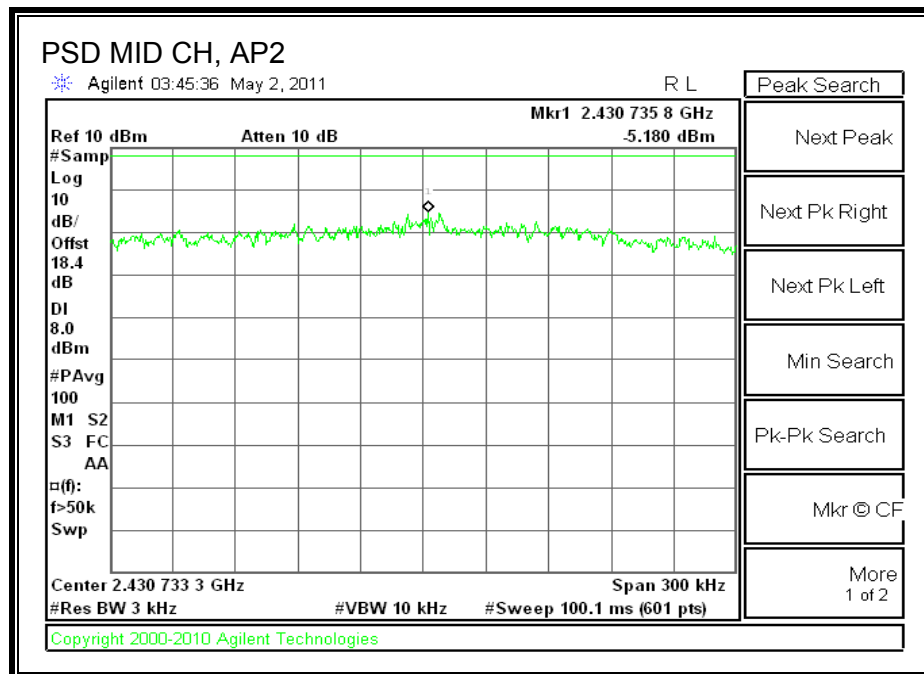
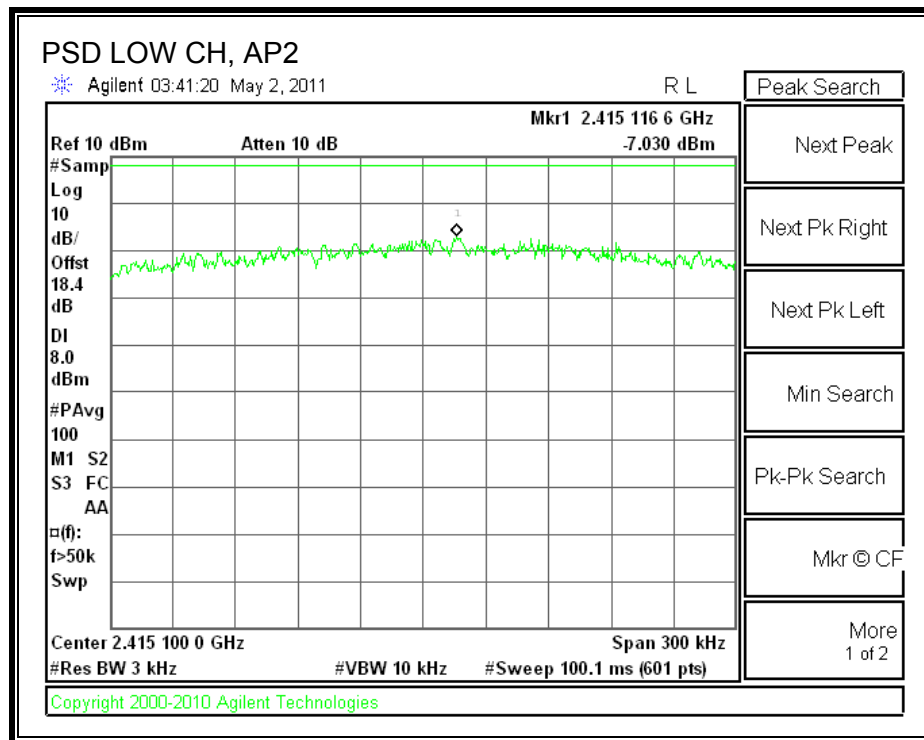
TEST PROCEDURE

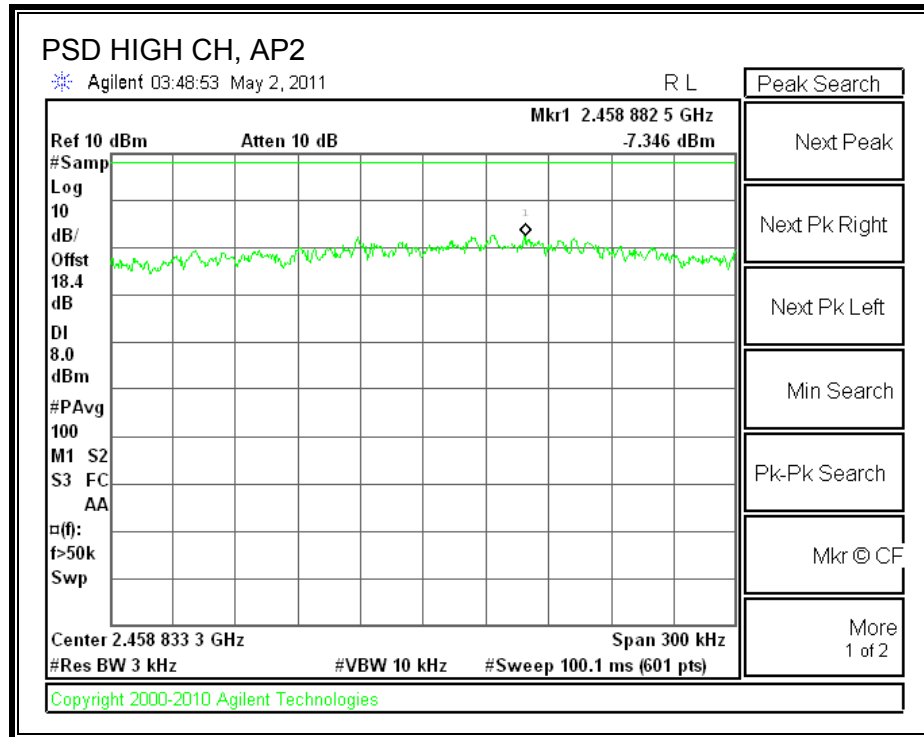
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

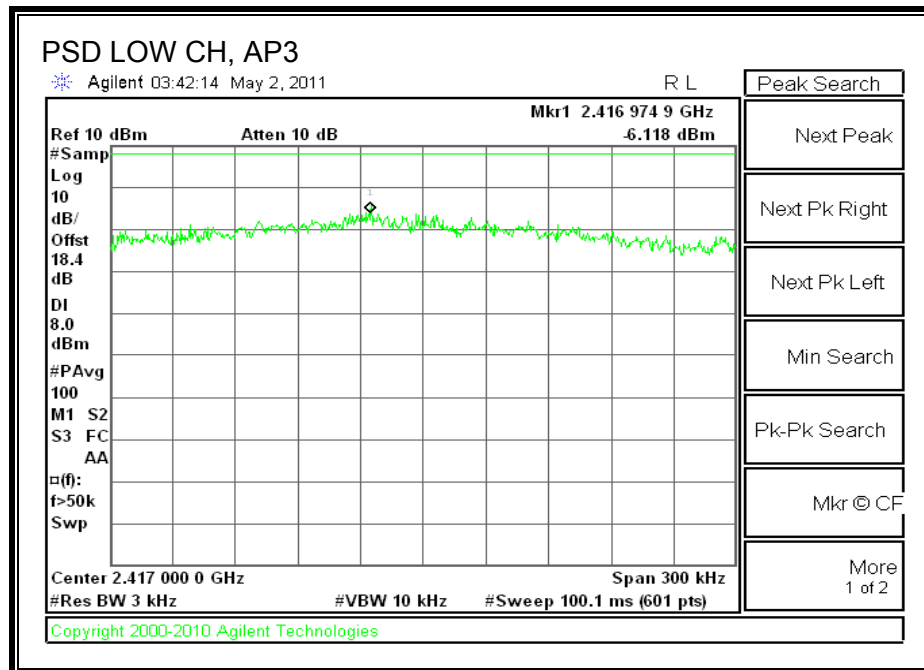
Channel	Frequency (MHz)	AP2 PSD (dBm)	AP3 PSD (dBm)	AP4 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-7.03	-6.118	-6.013	-1.59	8	-9.59
Middle	2437	-5.18	-6.602	-7.498	-1.55	8	-9.55
High	2462	-7.346	-7.235	-7.43	-2.57	8	-10.57

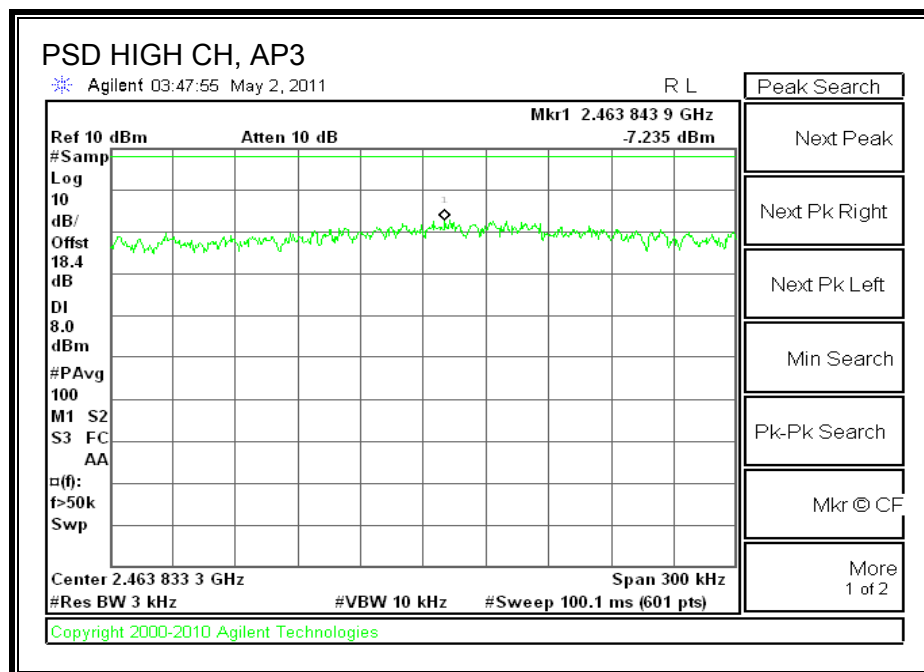
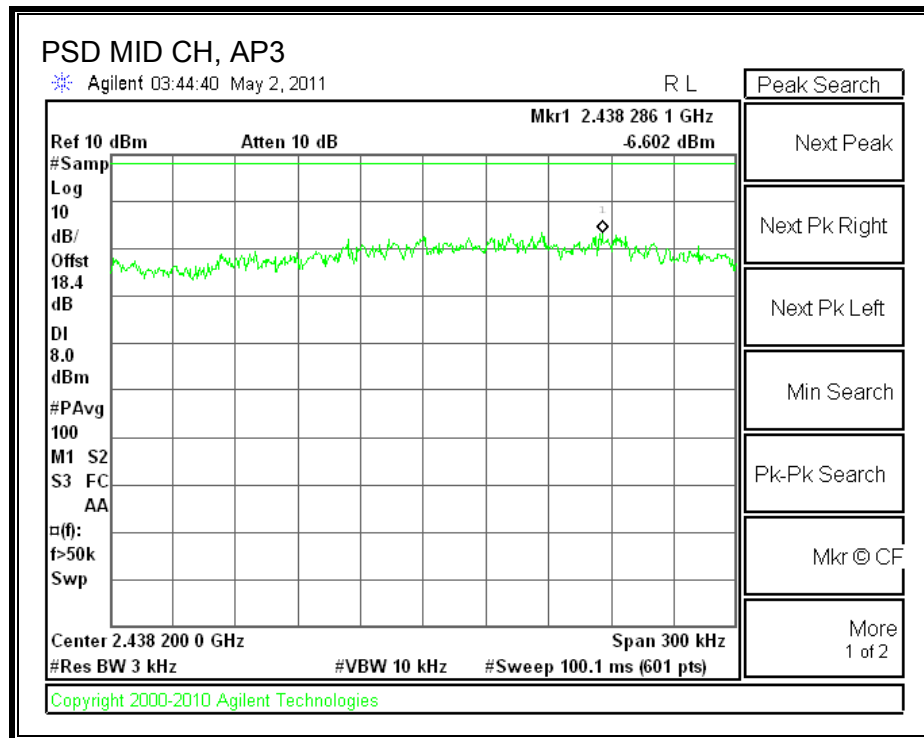
POWER SPECTRAL DENSITY, AP2



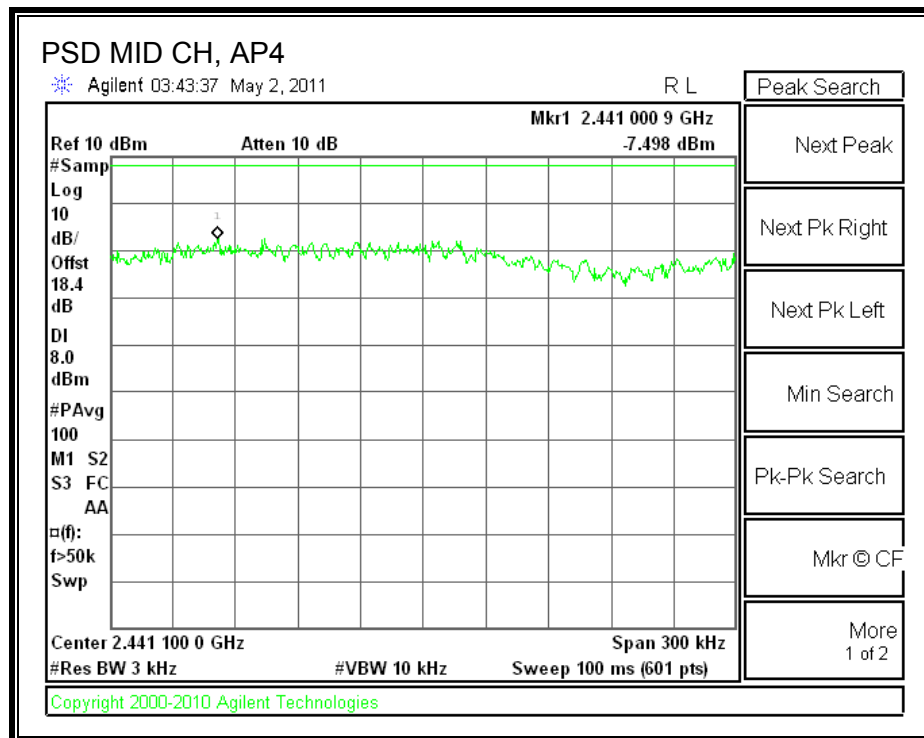
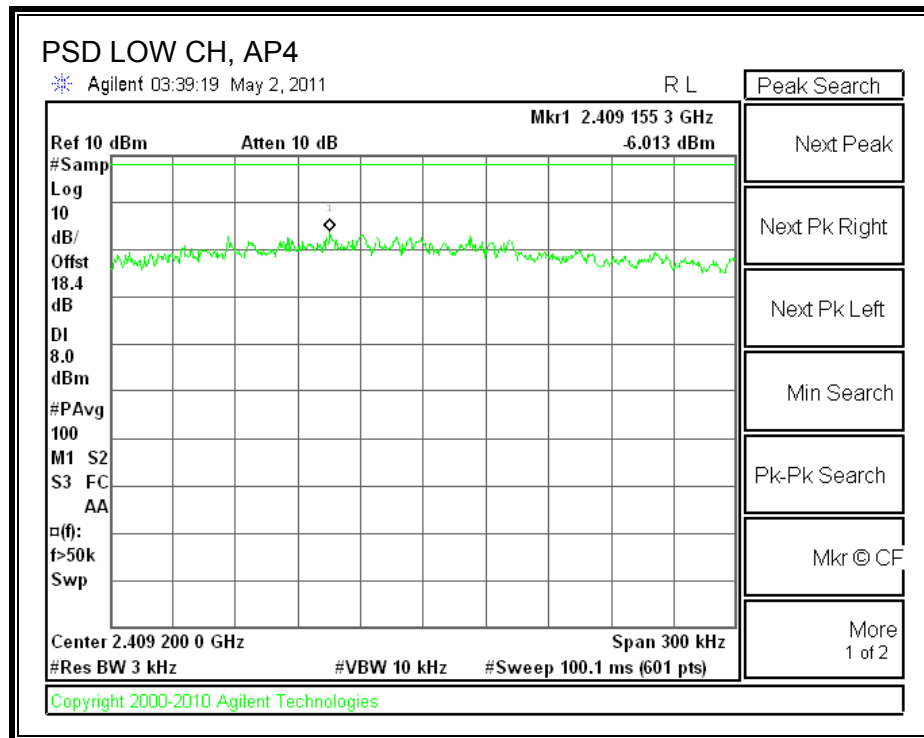


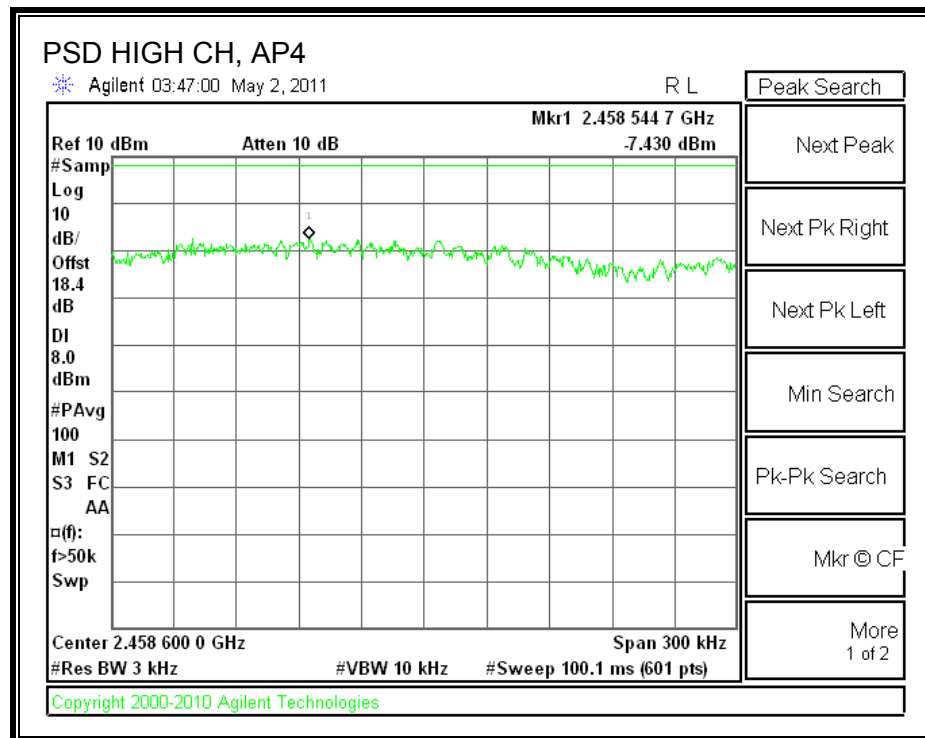
POWER SPECTRAL DENSITY, AP3





POWER SPECTRAL DENSITY, AP4





7.3.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of RMS averaging over time interval; therefore the required attenuation is 30 dB.

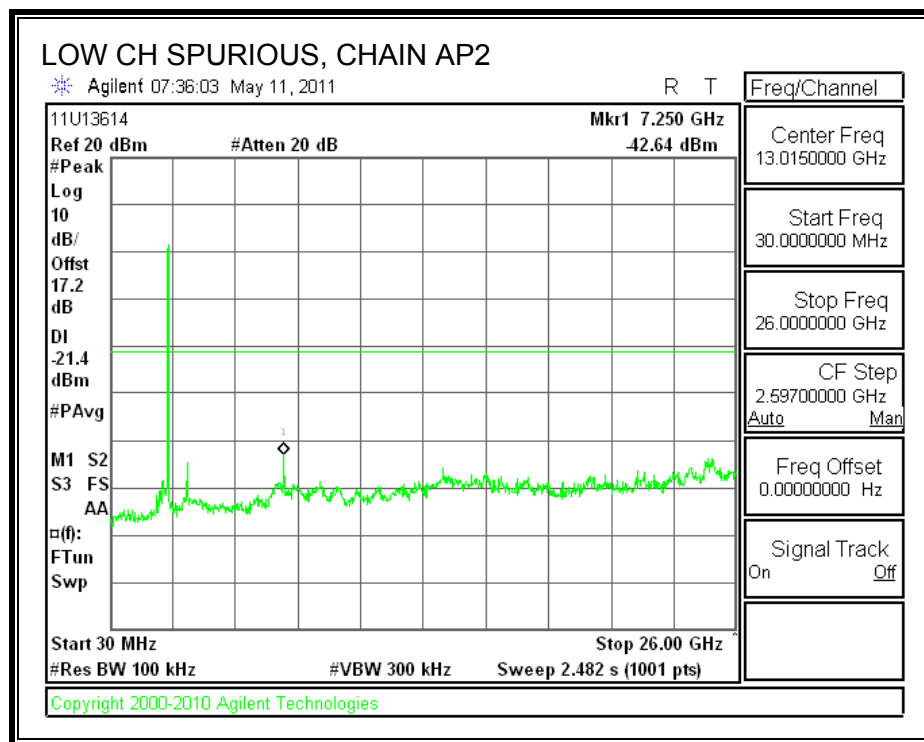
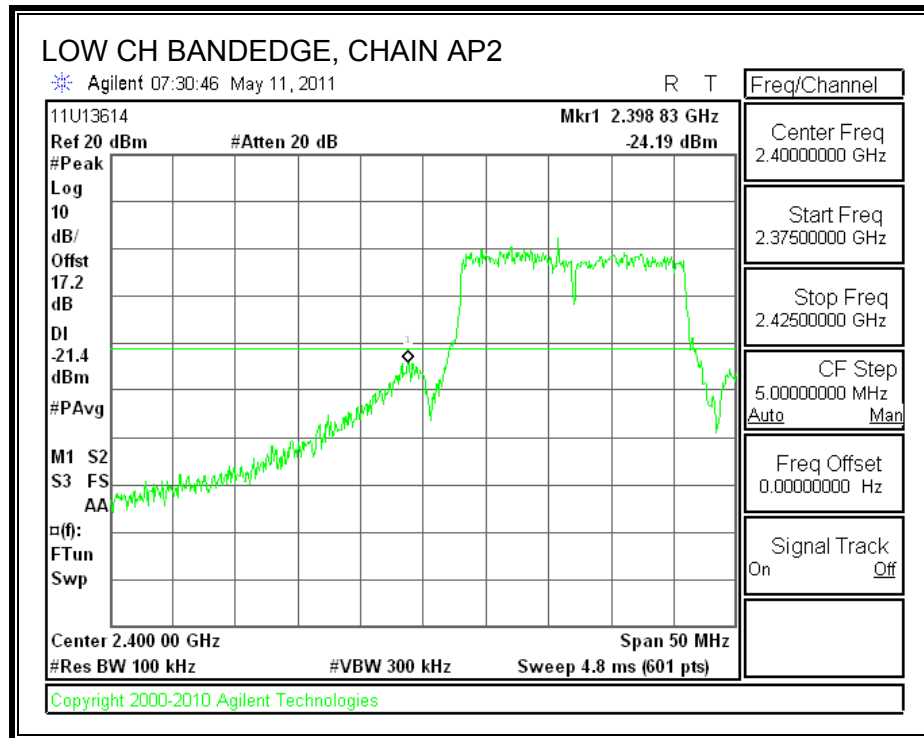
TEST PROCEDURE

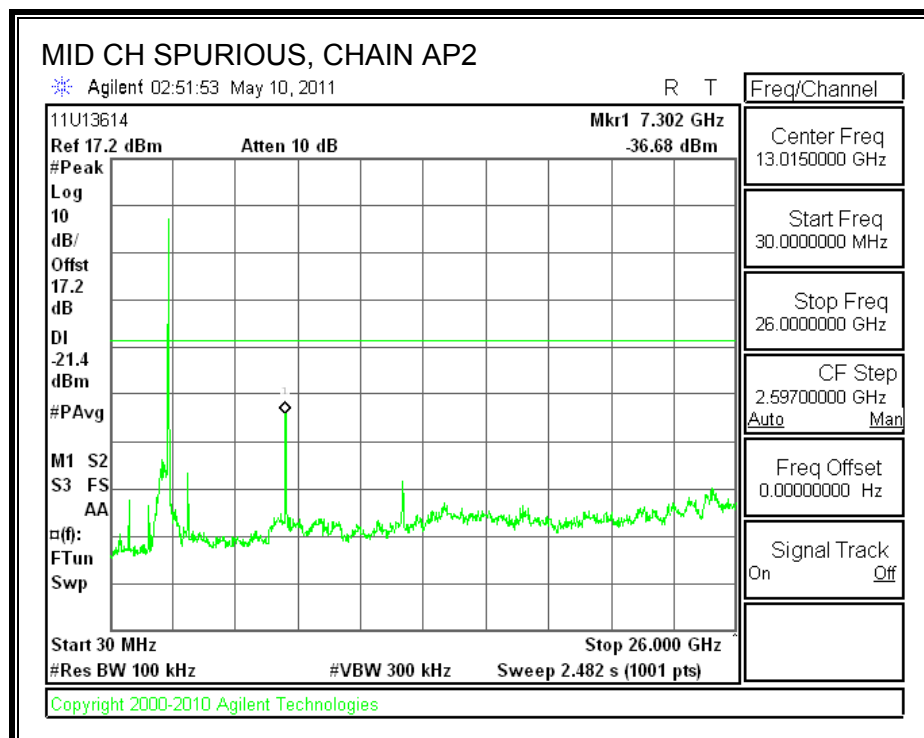
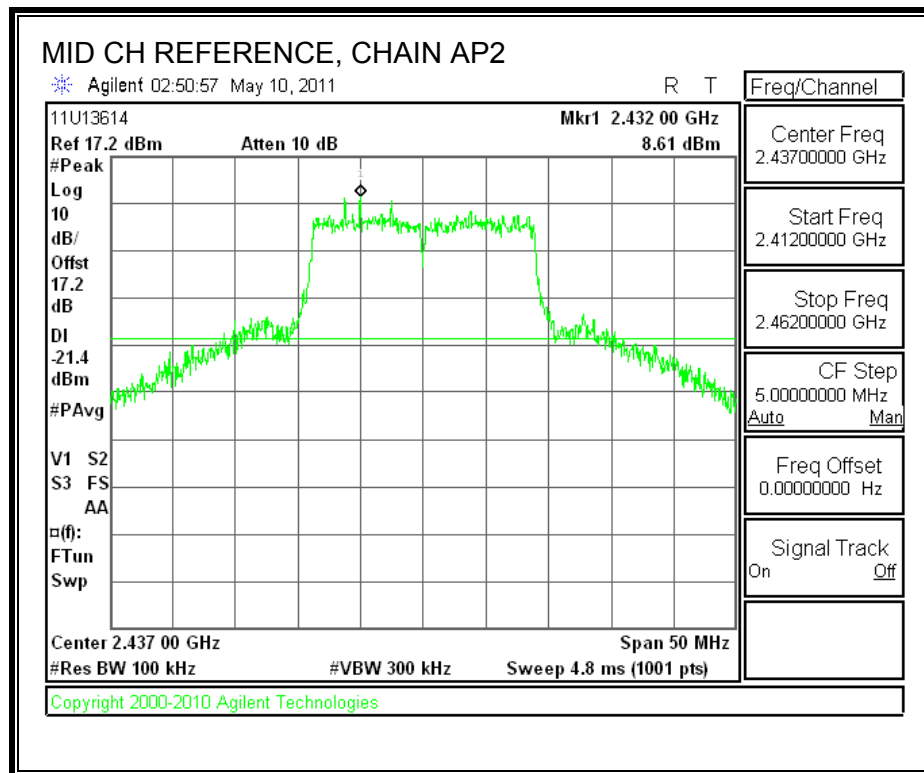
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

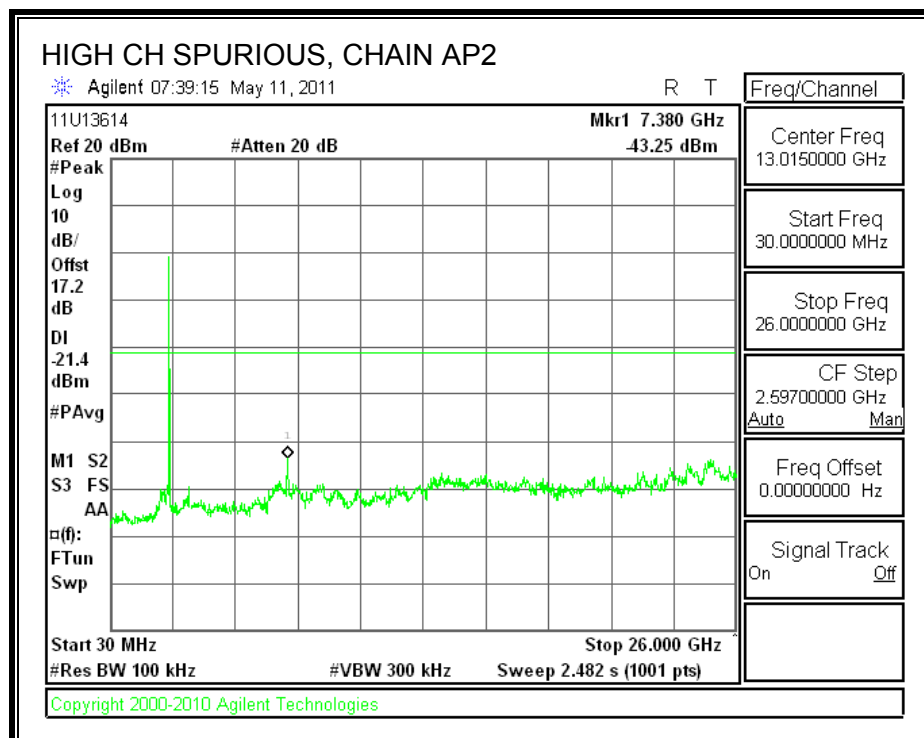
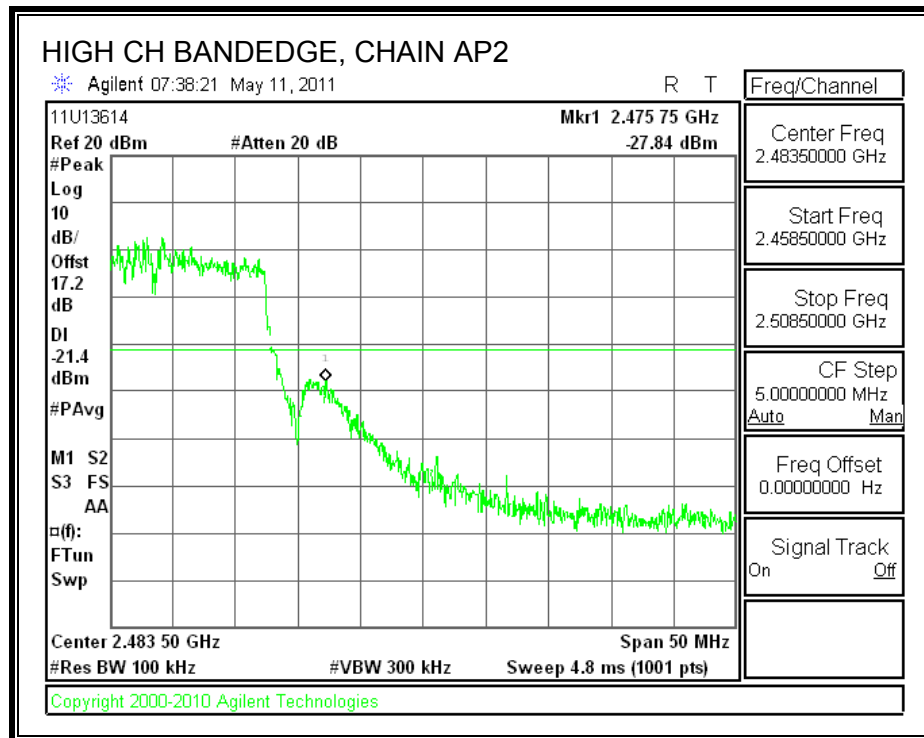
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

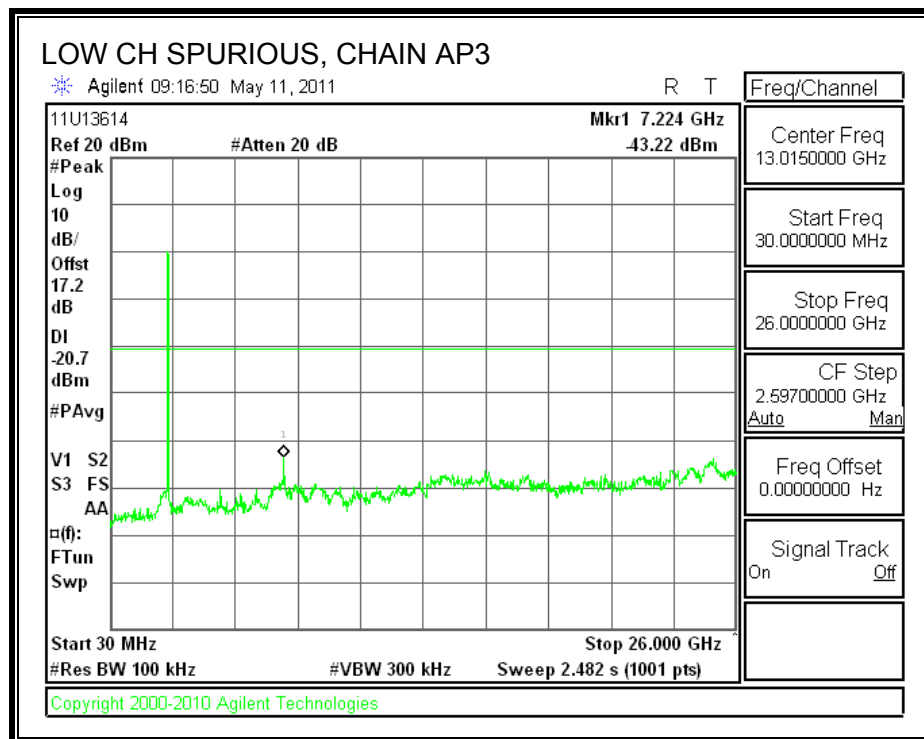
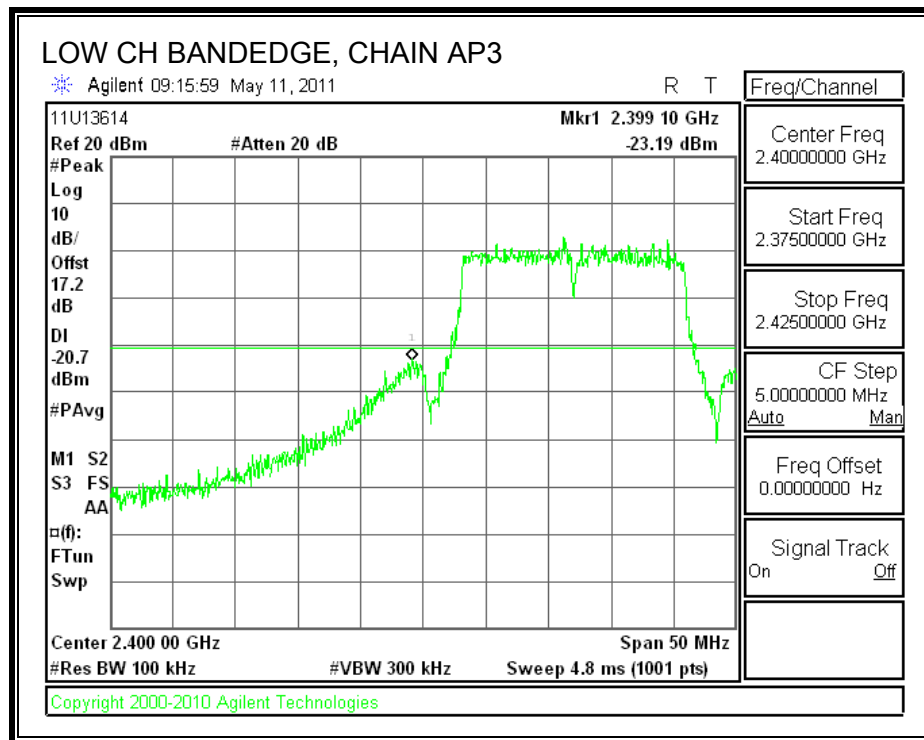
CHAIN AP2 SPURIOUS EMISSIONS

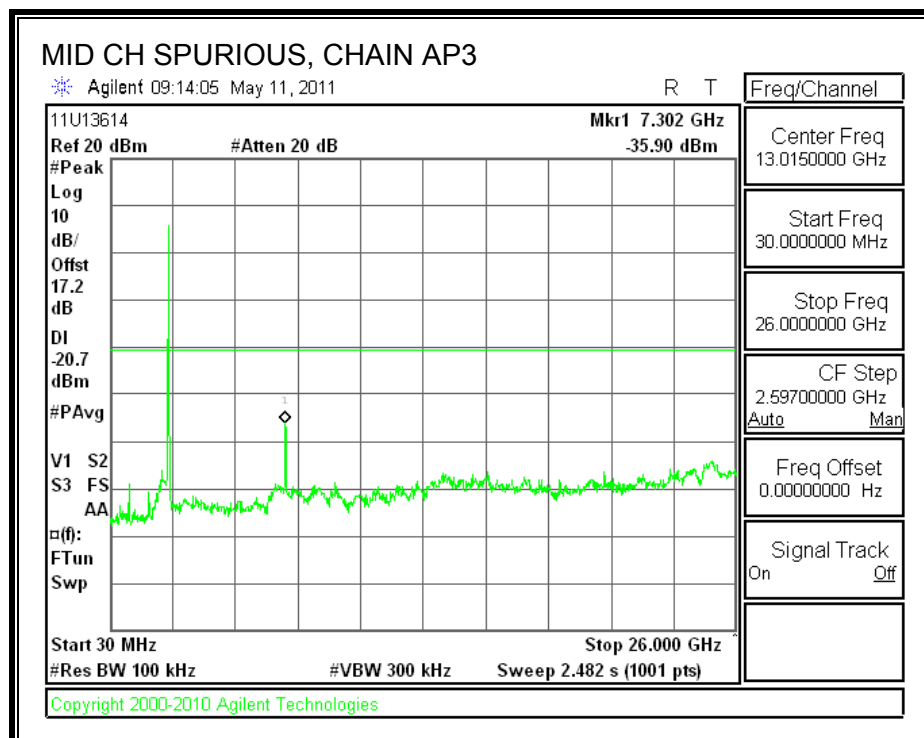
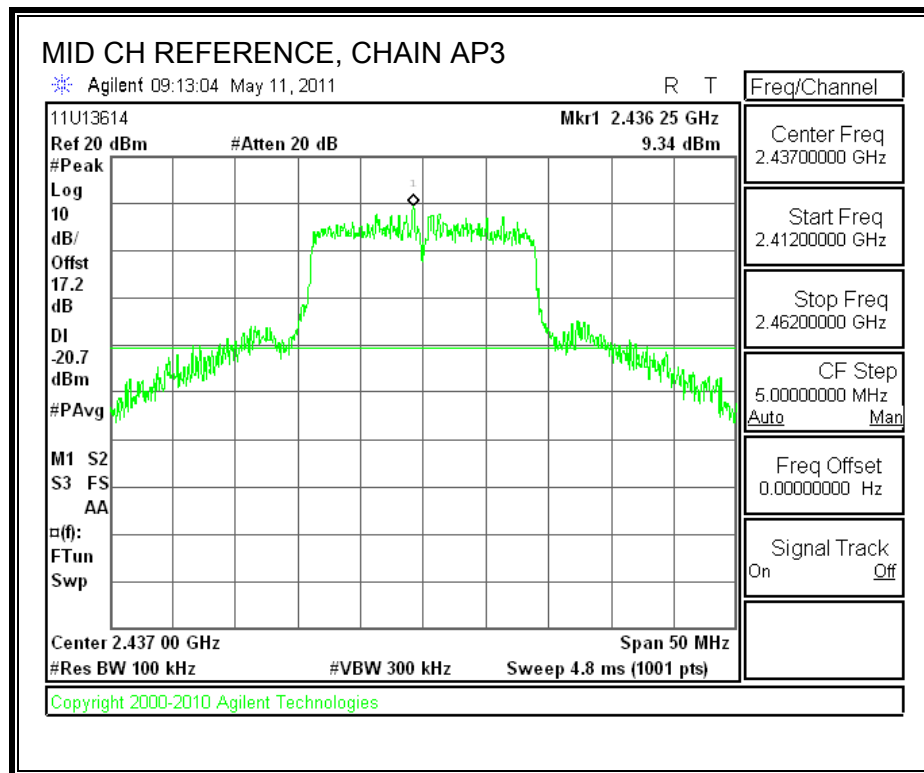


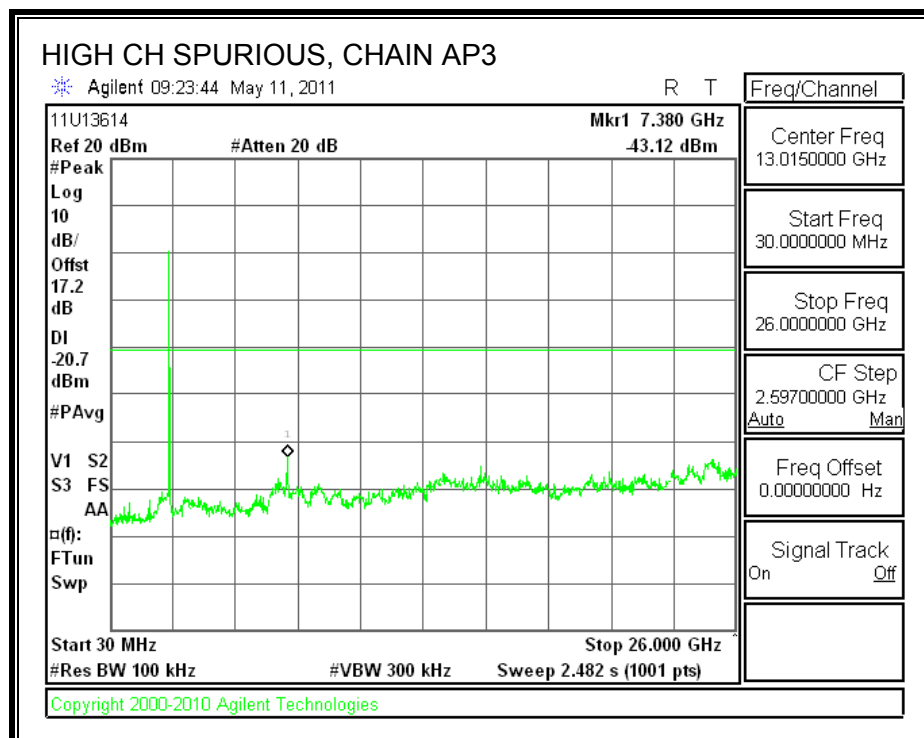
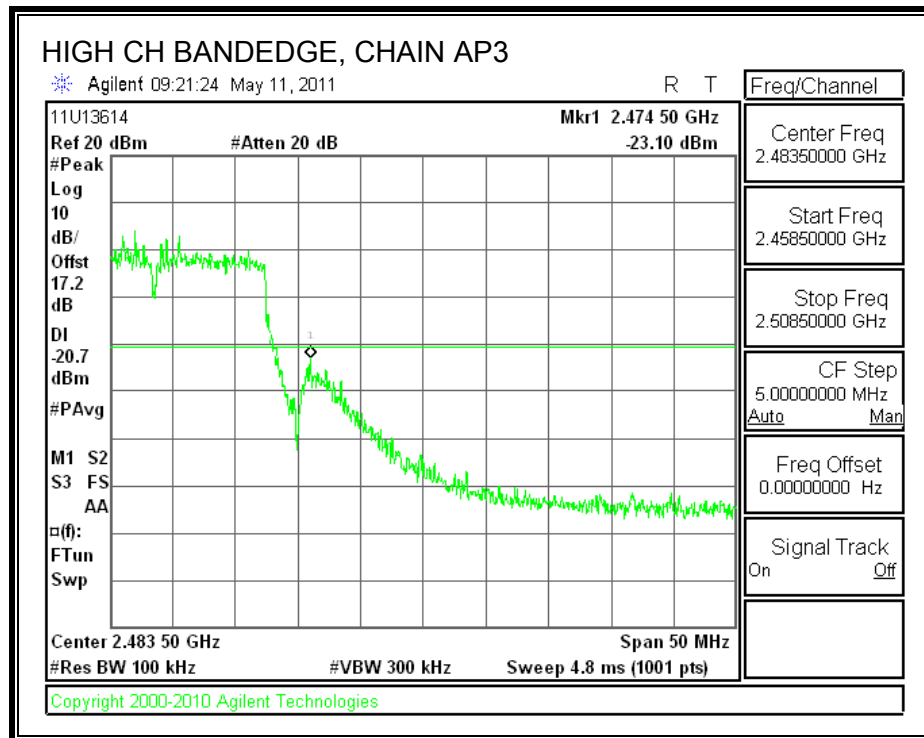




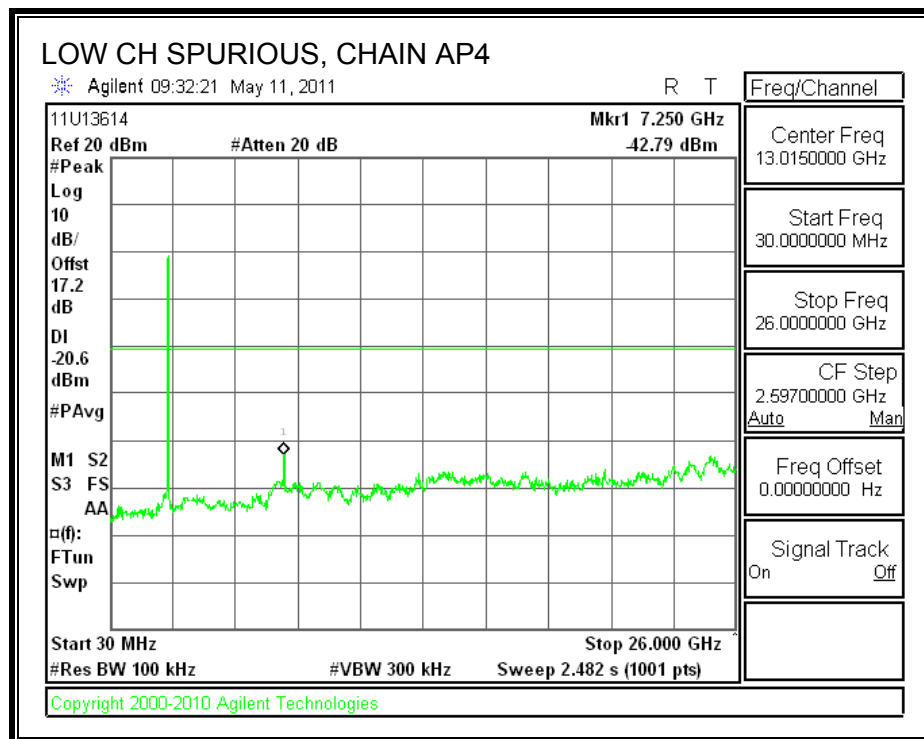
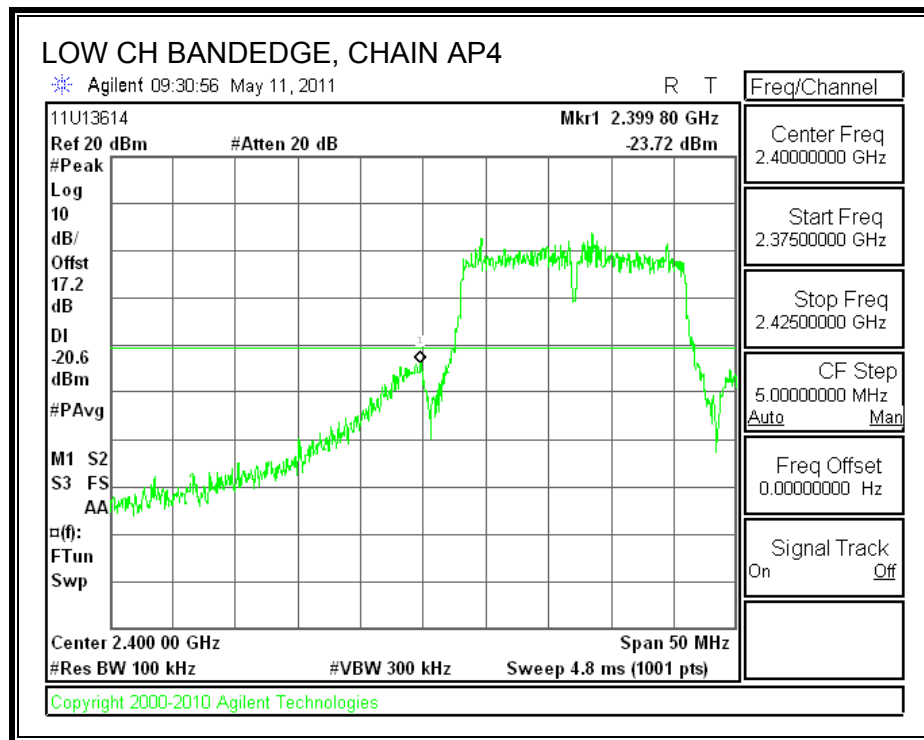
CHAIN AP3 SPURIOUS EMISSIONS

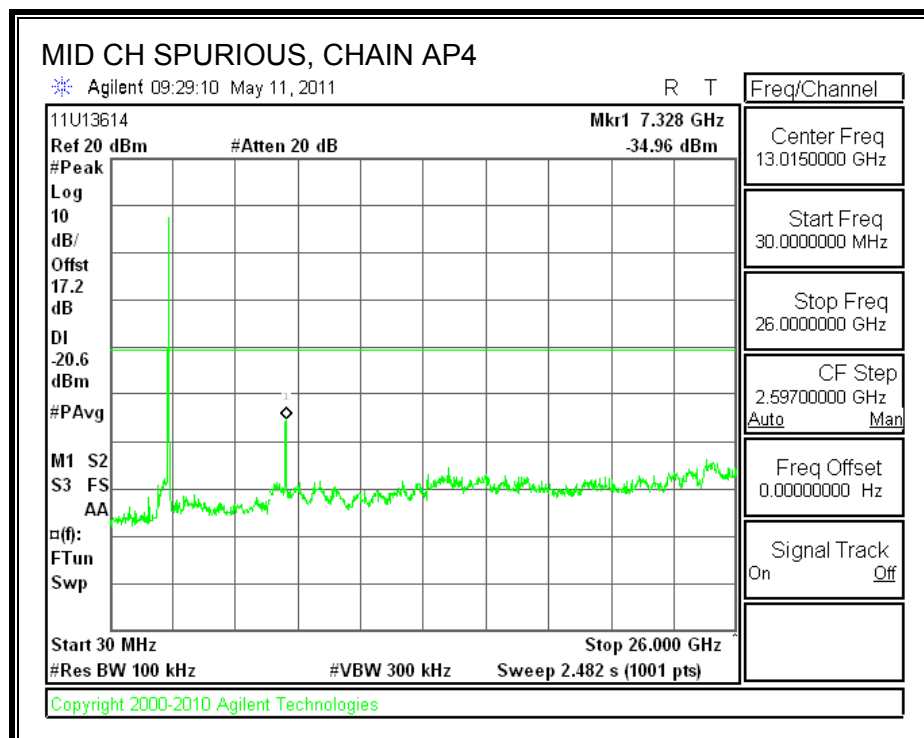
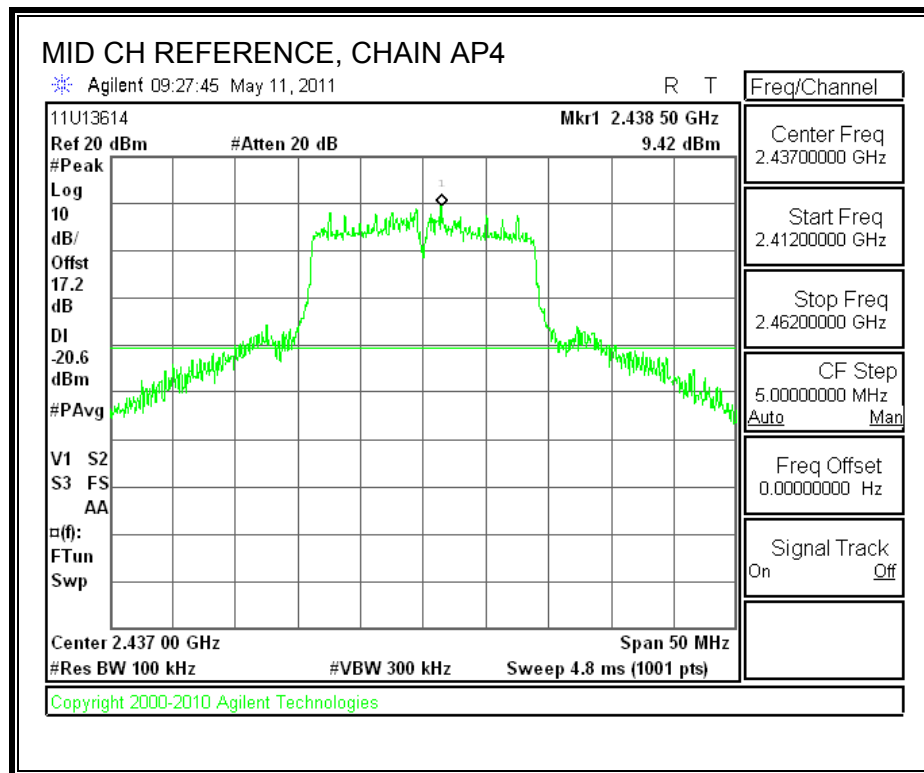


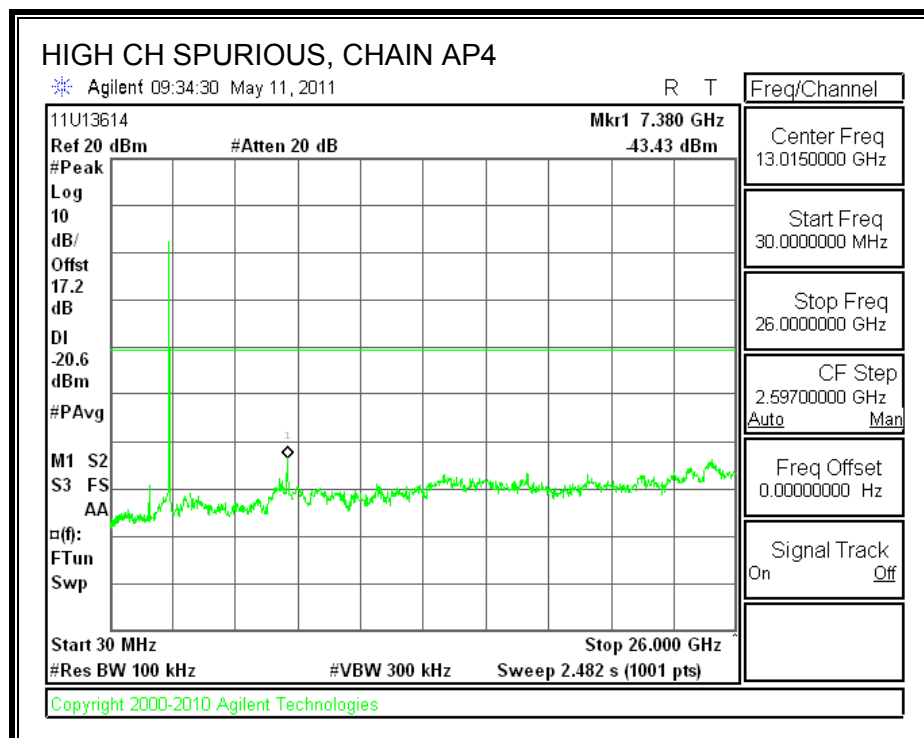
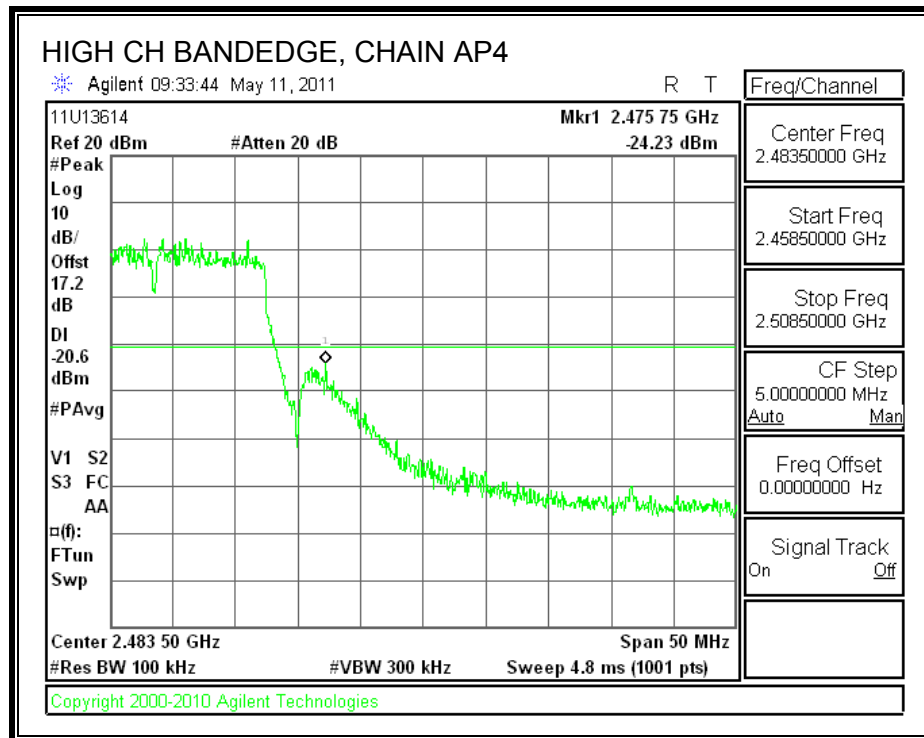




CHAIN AP4 SPURIOUS EMISSIONS







7.4. 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND

7.4.1. 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.

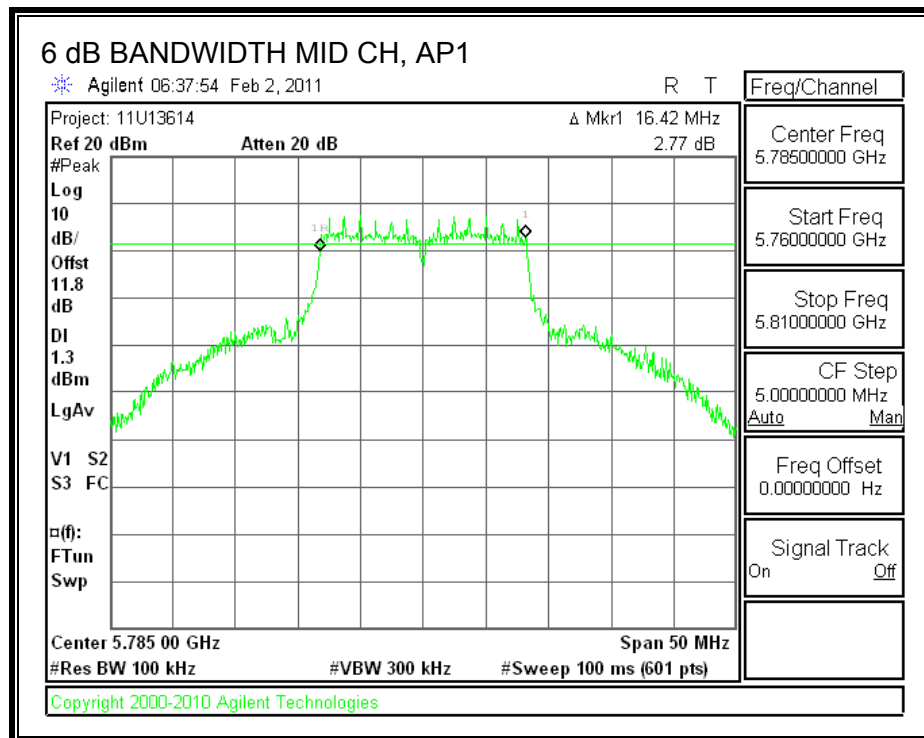
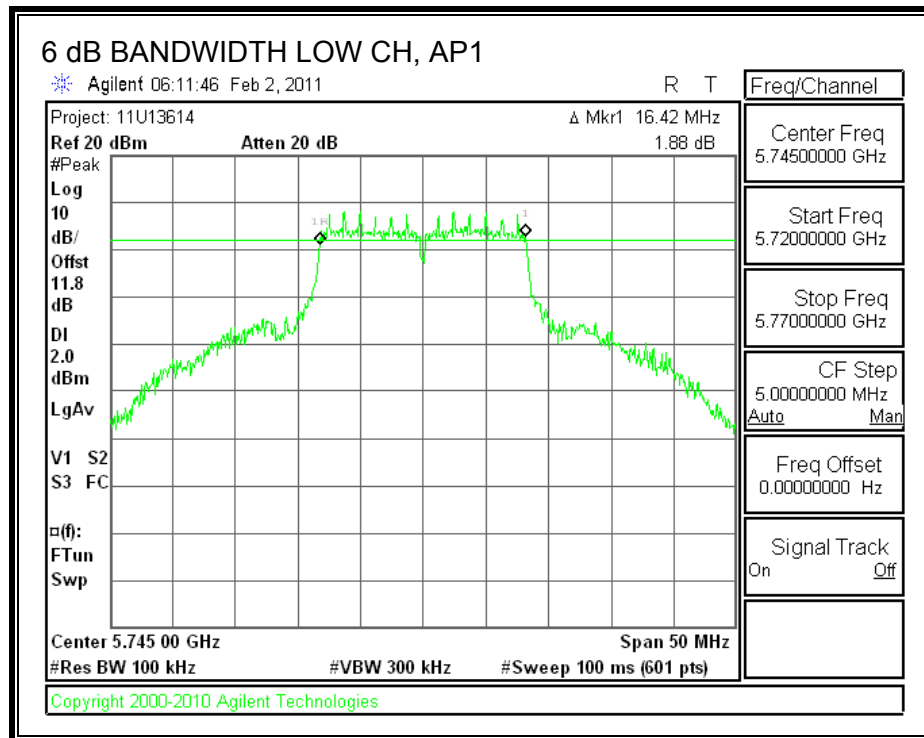
TEST PROCEDURE

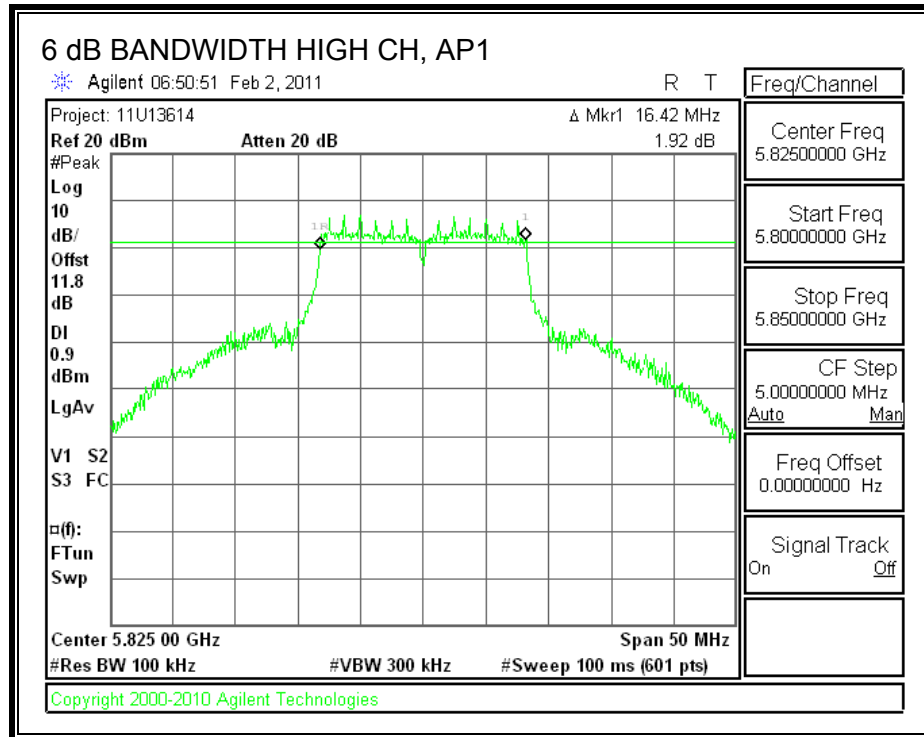
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

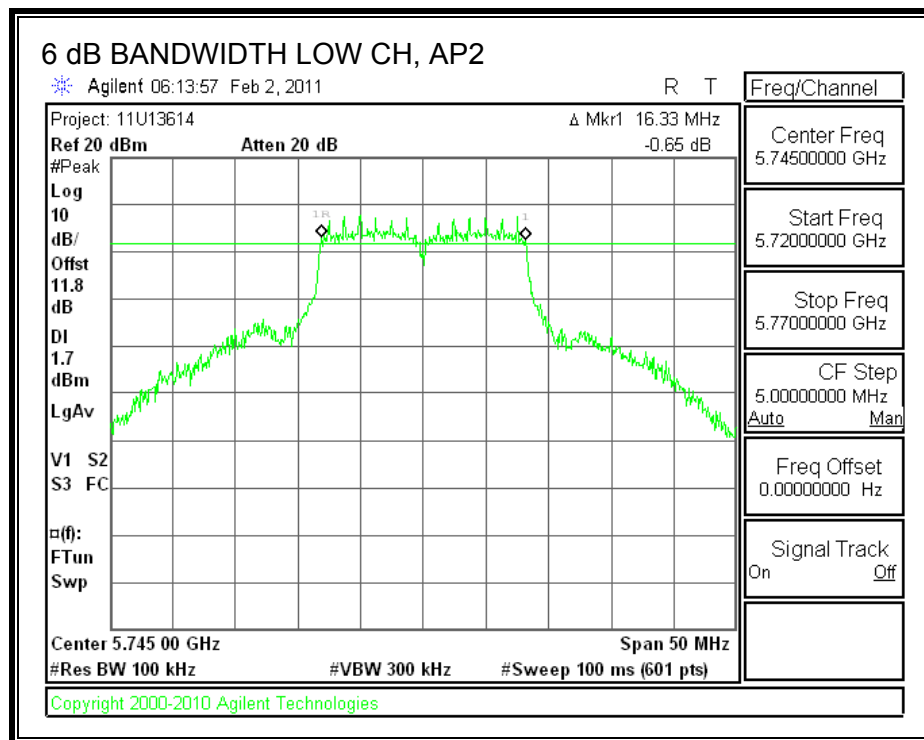
Channel	Frequency (MHz)	AP1 6 dB BW (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	16.42	16.33	16.33	0.5
Middle	5785	16.42	16.33	16.33	0.5
High	5825	16.42	16.33	16.5	0.5

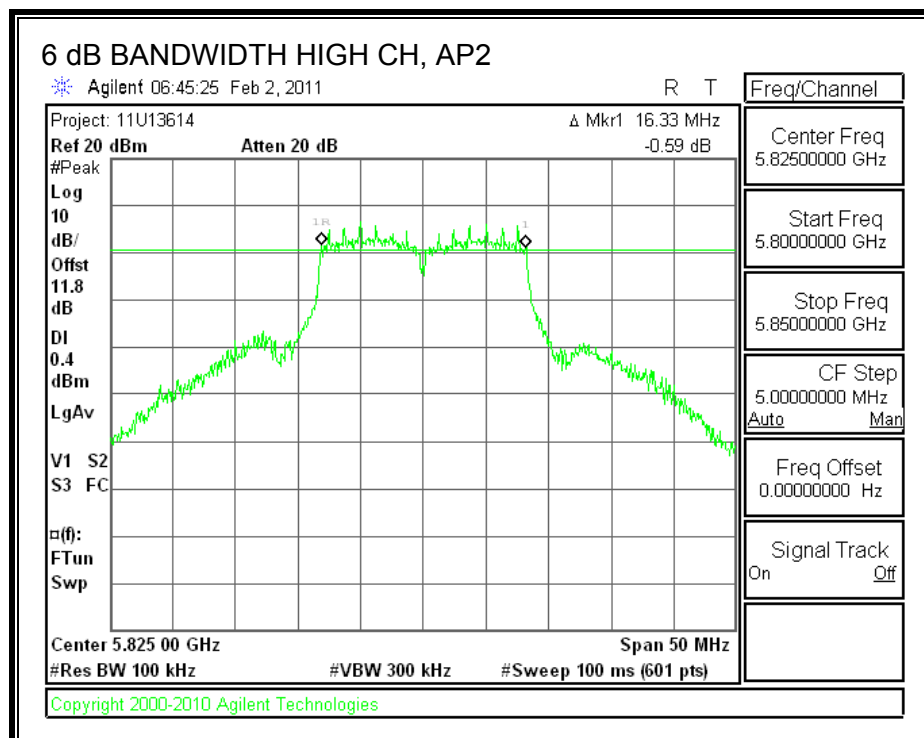
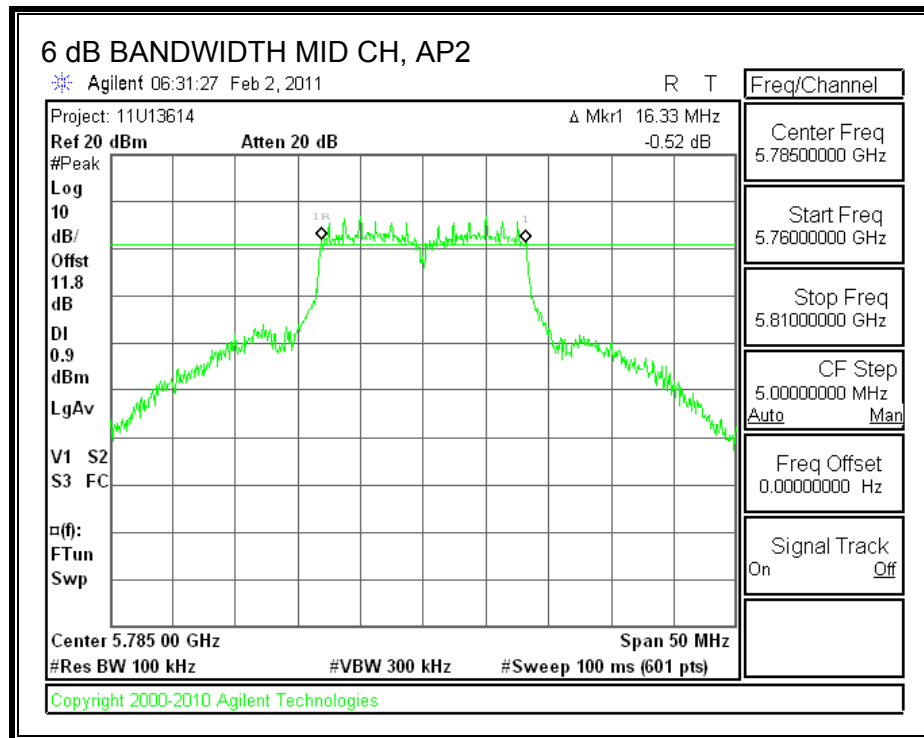
6 dB BANDWIDTH, AP1



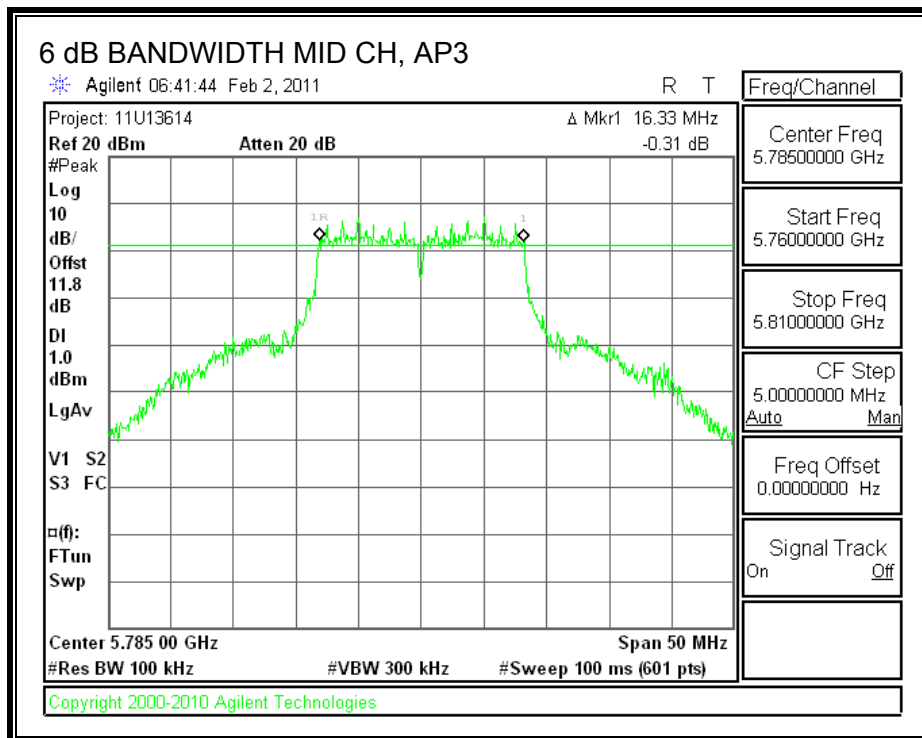
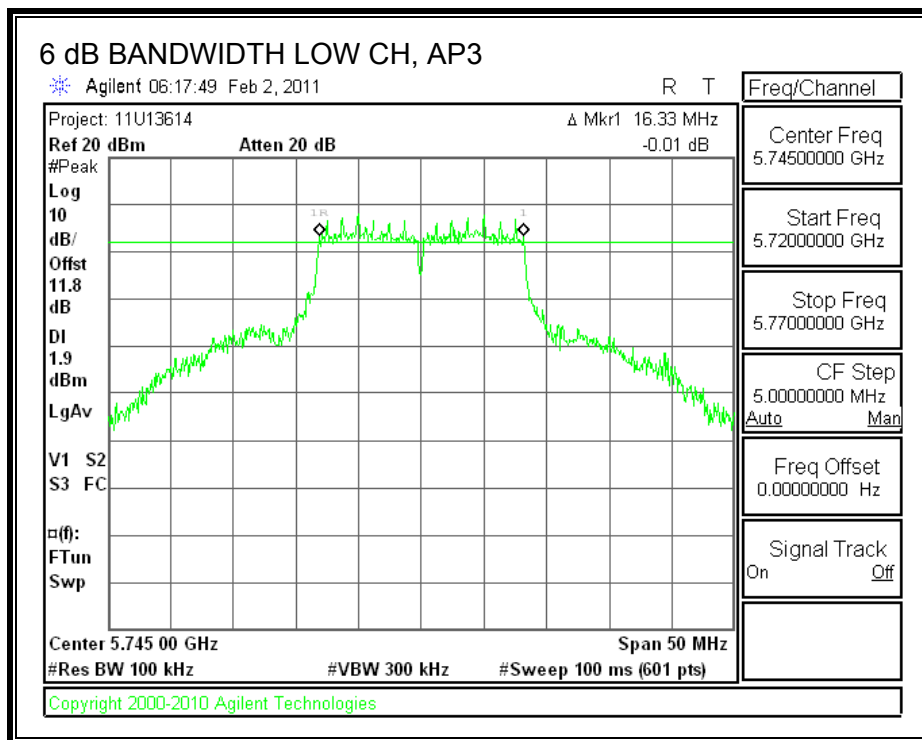


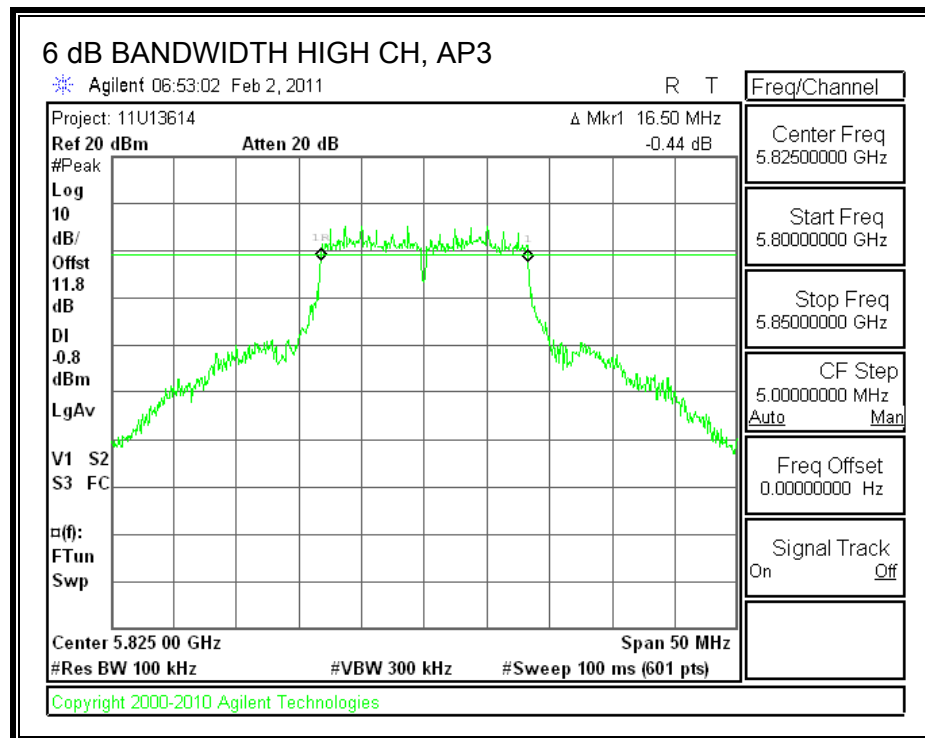
6 dB BANDWIDTH, AP2





6 dB BANDWIDTH, AP3





7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

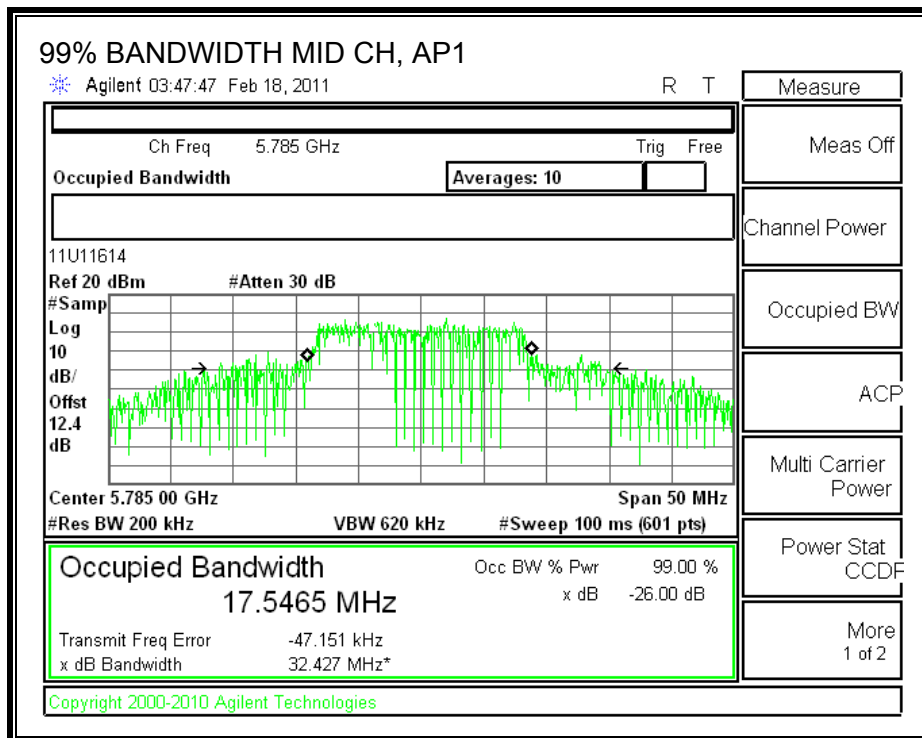
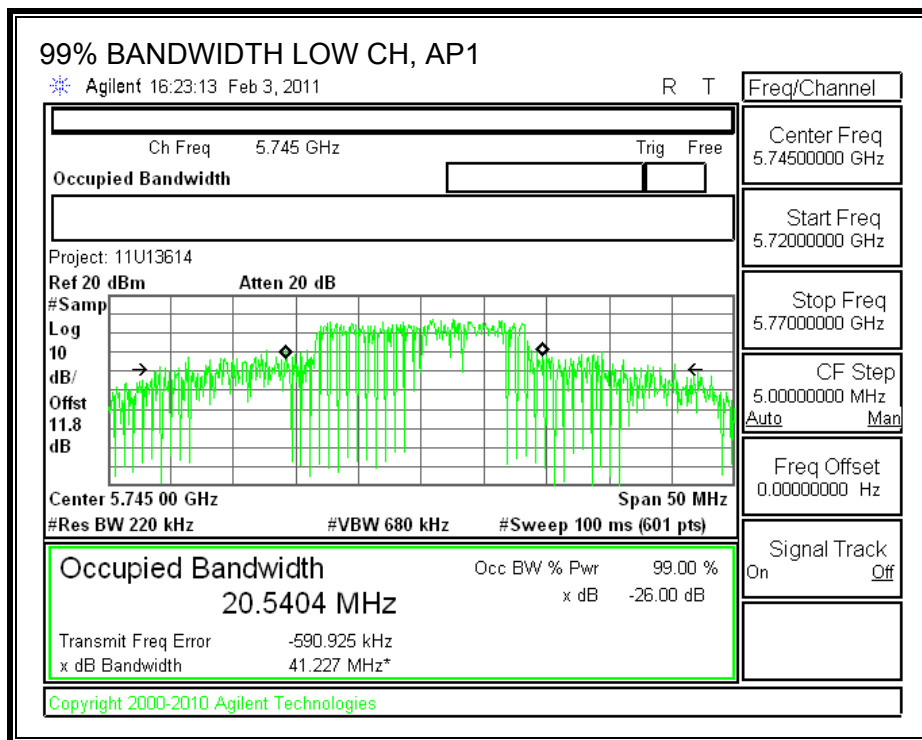
TEST PROCEDURE

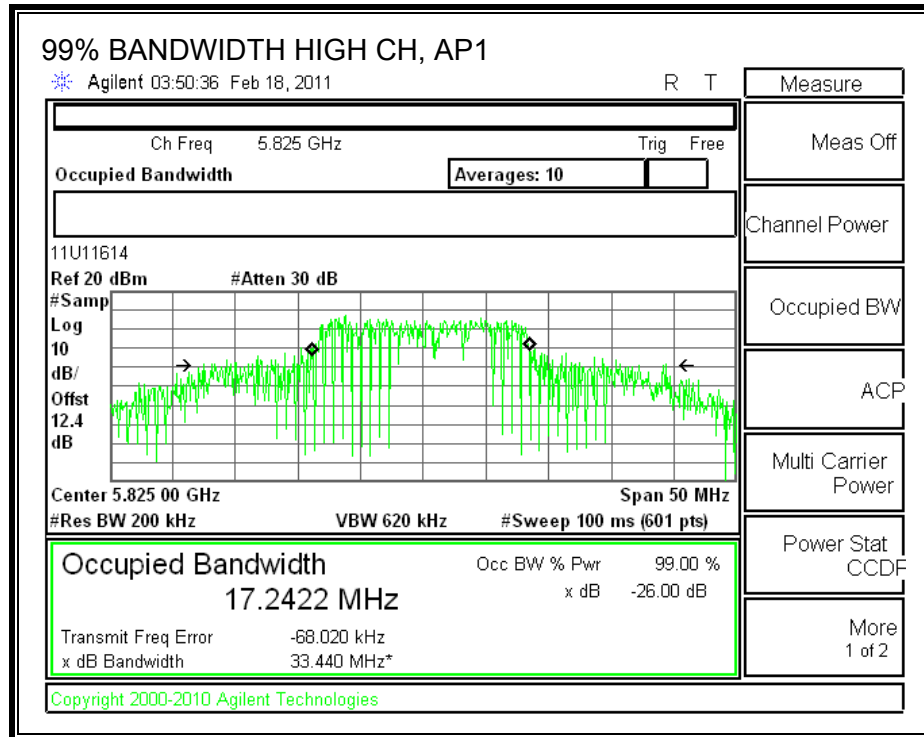
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

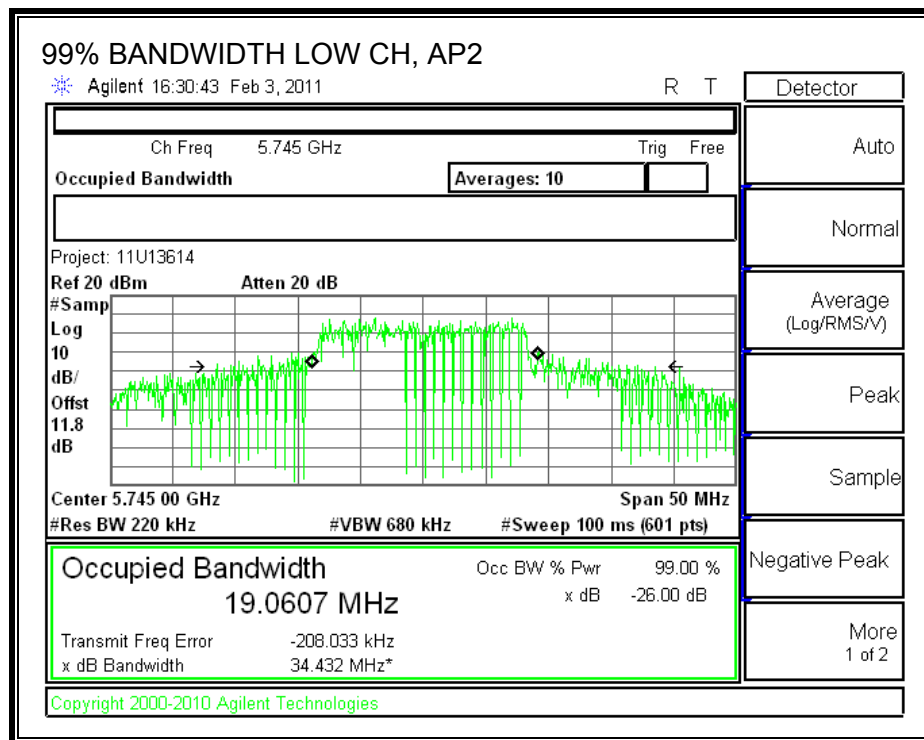
Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	5745	20.5404	19.0607	19.2224
Middle	5785	17.5465	18.4594	17.8583
High	5825	17.2422	17.5025	17.1152

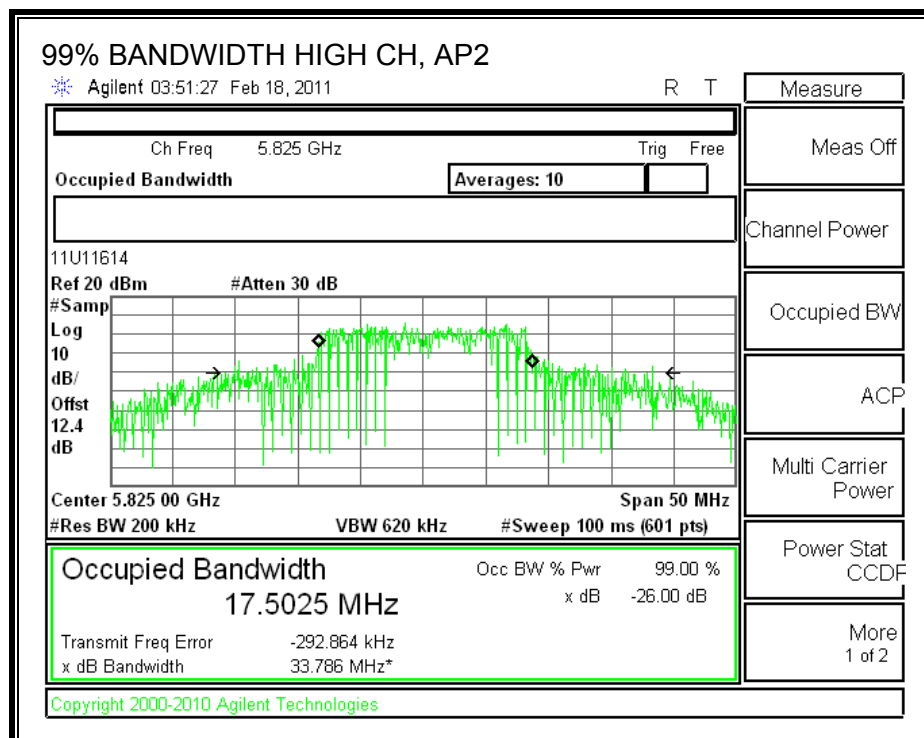
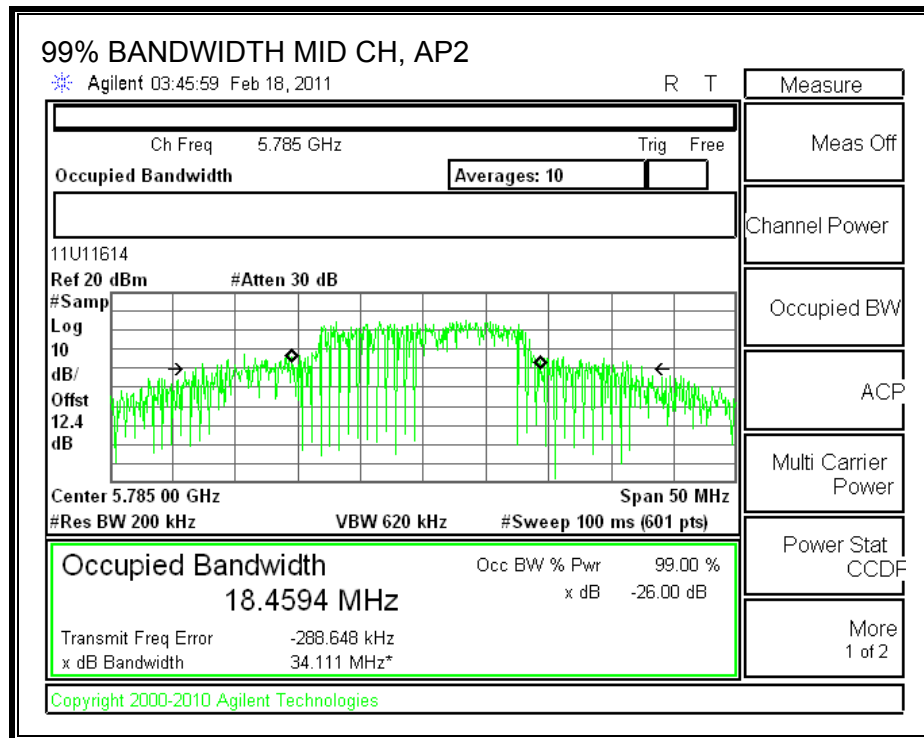
99% BANDWIDTH, AP1



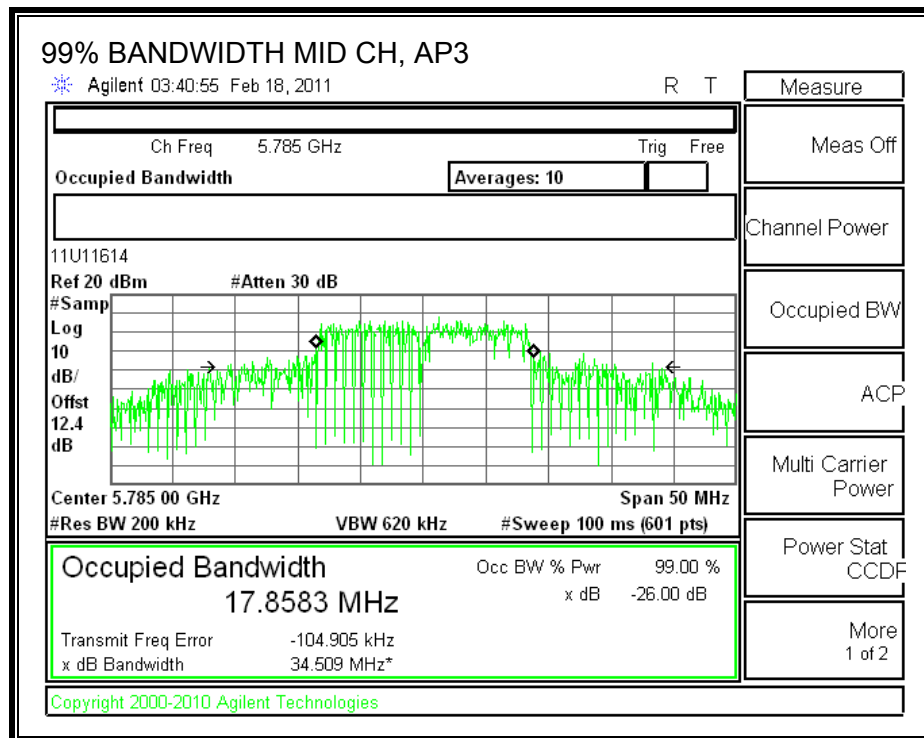
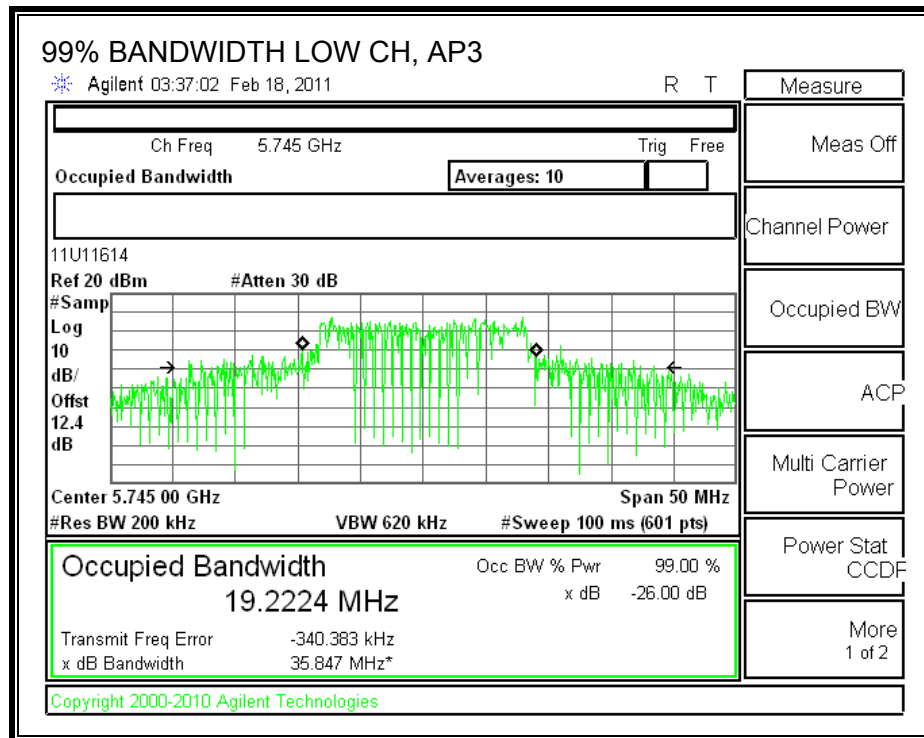


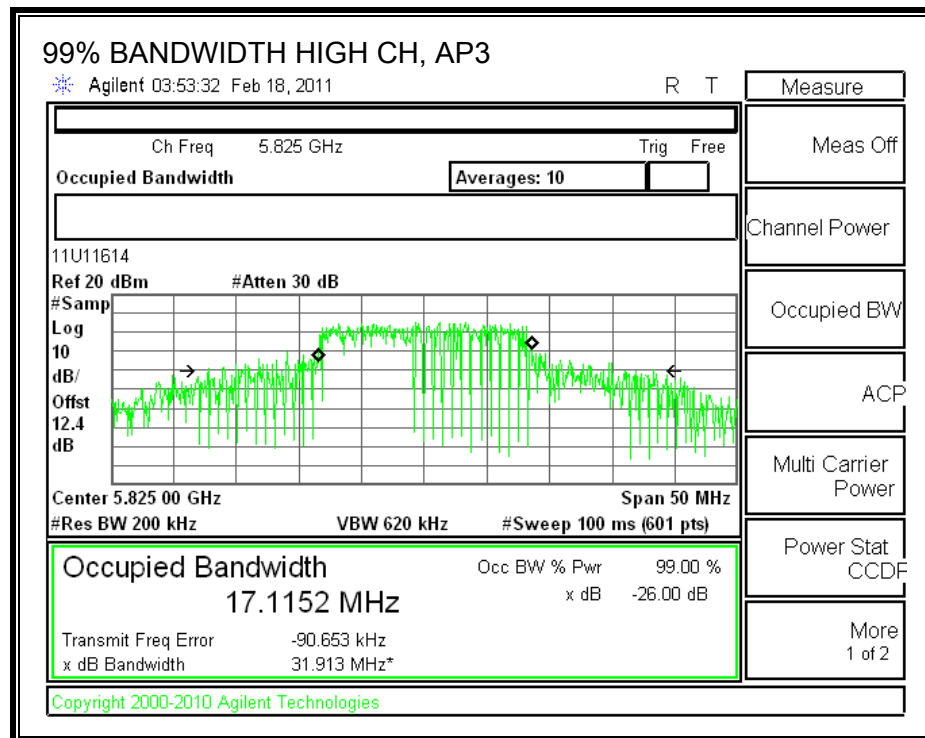
99% BANDWIDTH, AP2





99% BANDWIDTH, AP3





7.4.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna Gain (AP1) (dBi)	Antenna Gain (AP2) (dBi)	Antenna Gain (AP3) (dBi)	Effective Legacy Gain (dBi)
4.38	0.81	3.09	7.77

The maximum effective legacy gain is **7.77 dBi** for other than fixed, point-to-point operations, therefore the limit is **28.23** dBm.

TEST PROCEDURE

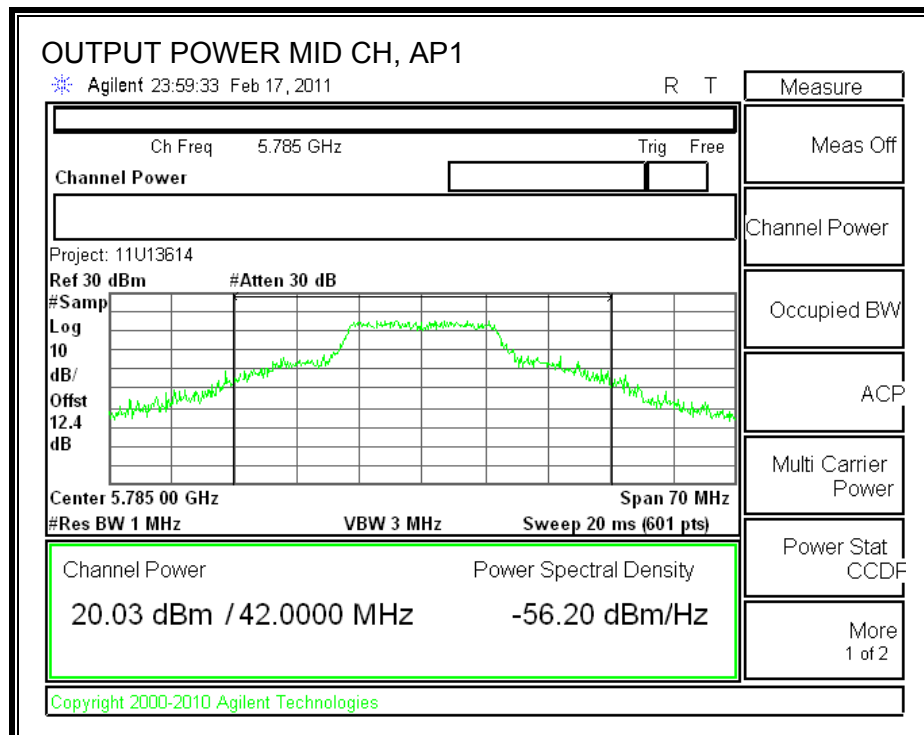
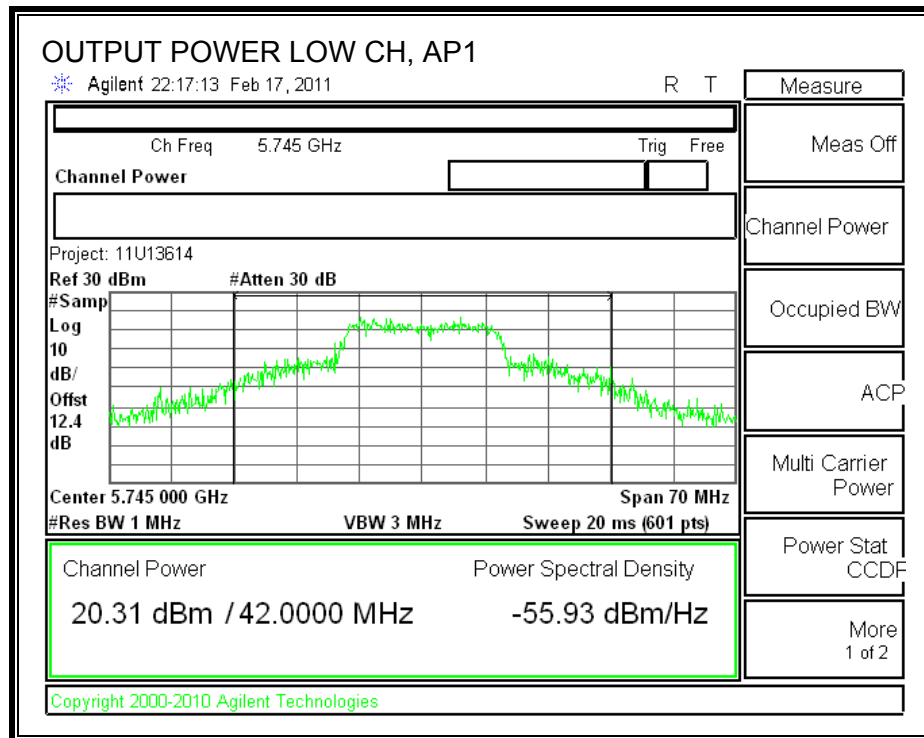
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

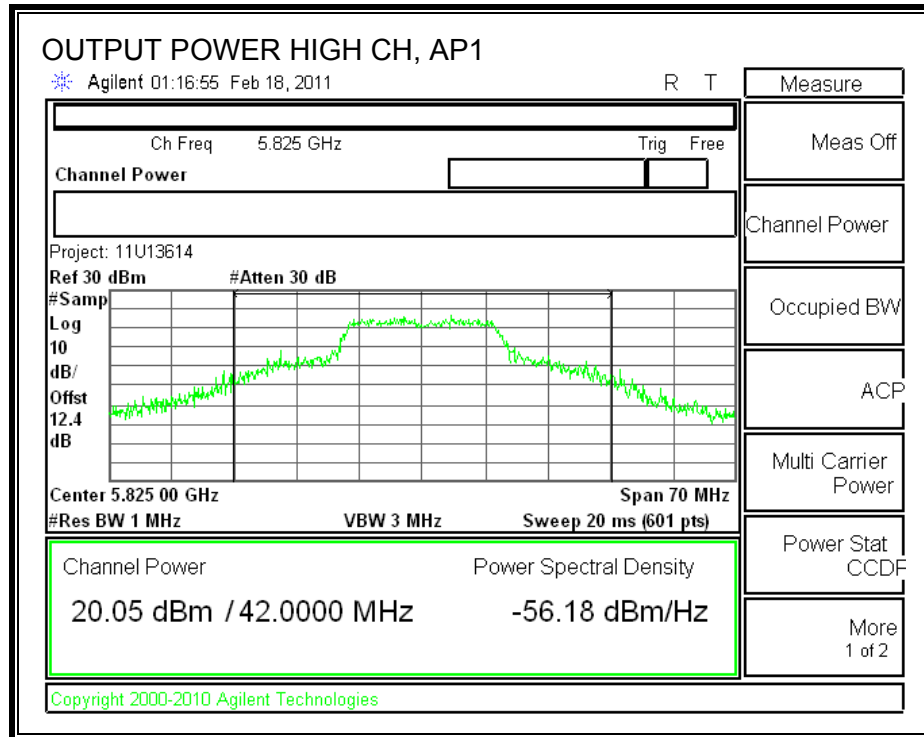
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

RESULTS

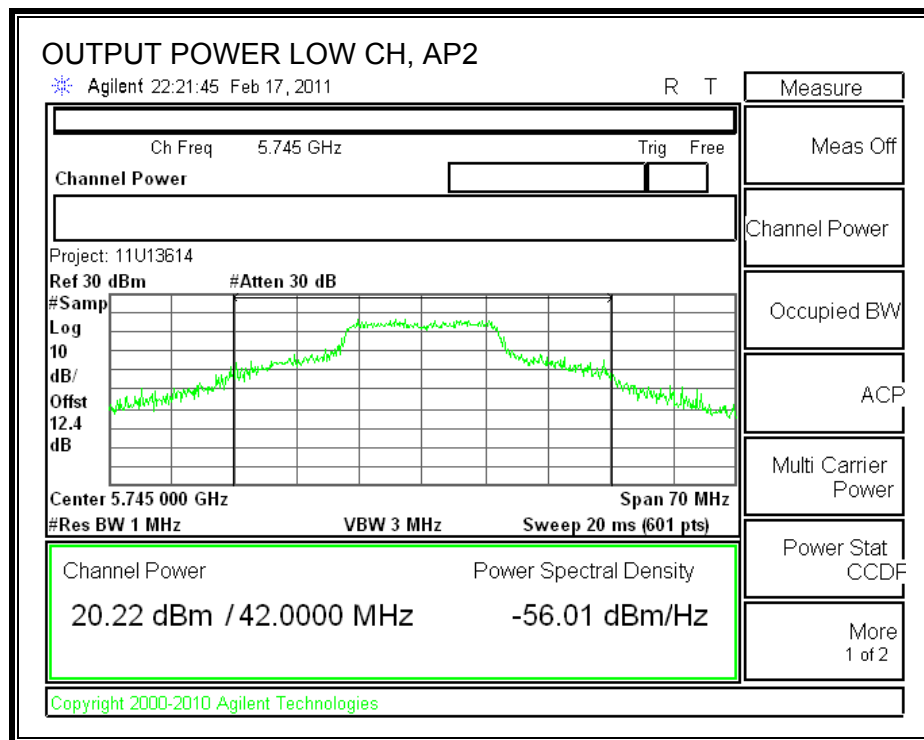
Channel	Frequency (MHz)	AP1 Power (dBm)	AP2 Power (dBm)	AP3 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	20.31	20.22	20.57	0.00	25.14	28.23	-3.09
Mid	5785	20.03	20.06	20.01	0.00	24.80	28.23	-3.43
High	5825	20.05	19.08	20.15	0.00	24.56	28.23	-3.67

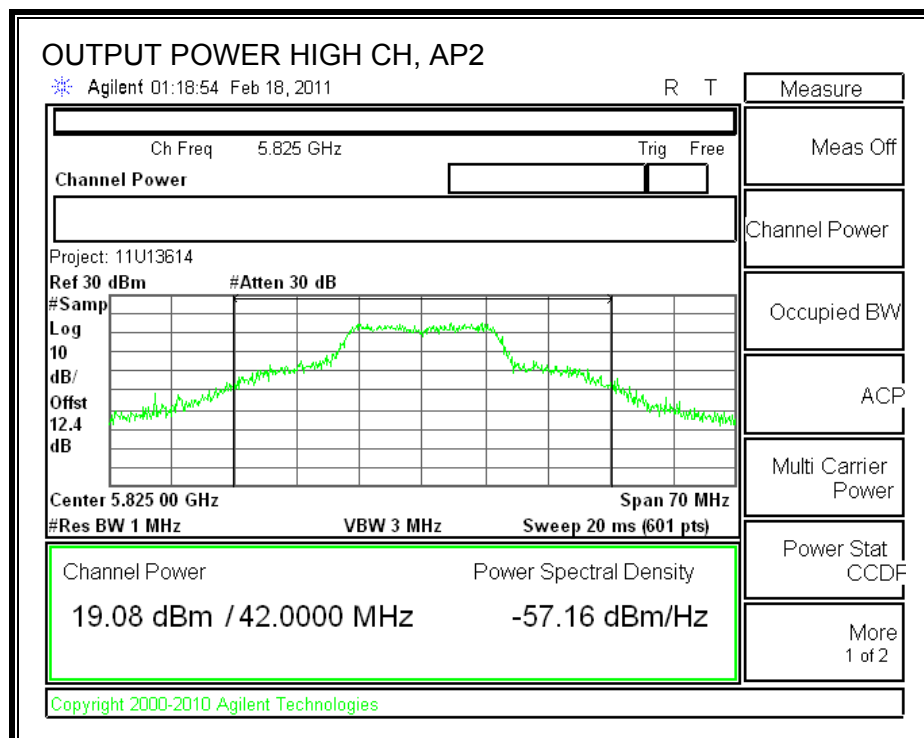
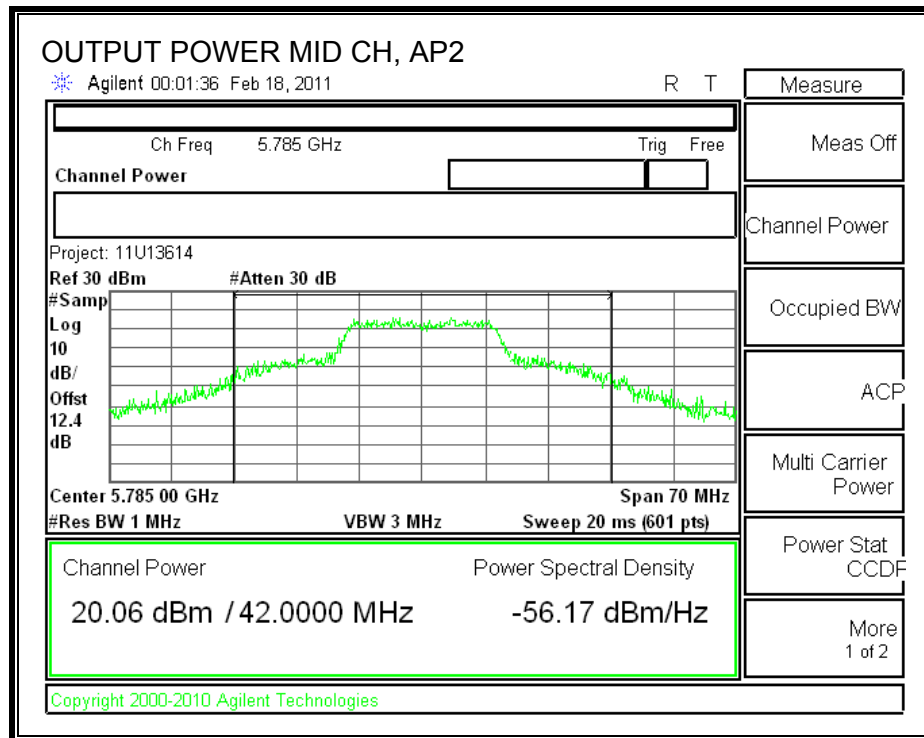
AP1 OUTPUT POWER



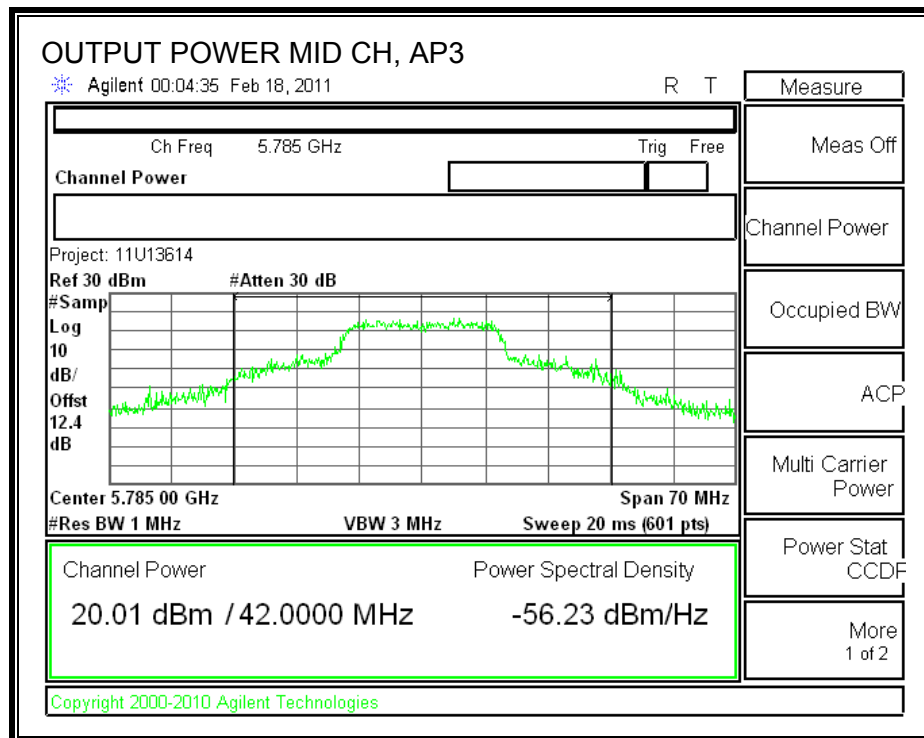
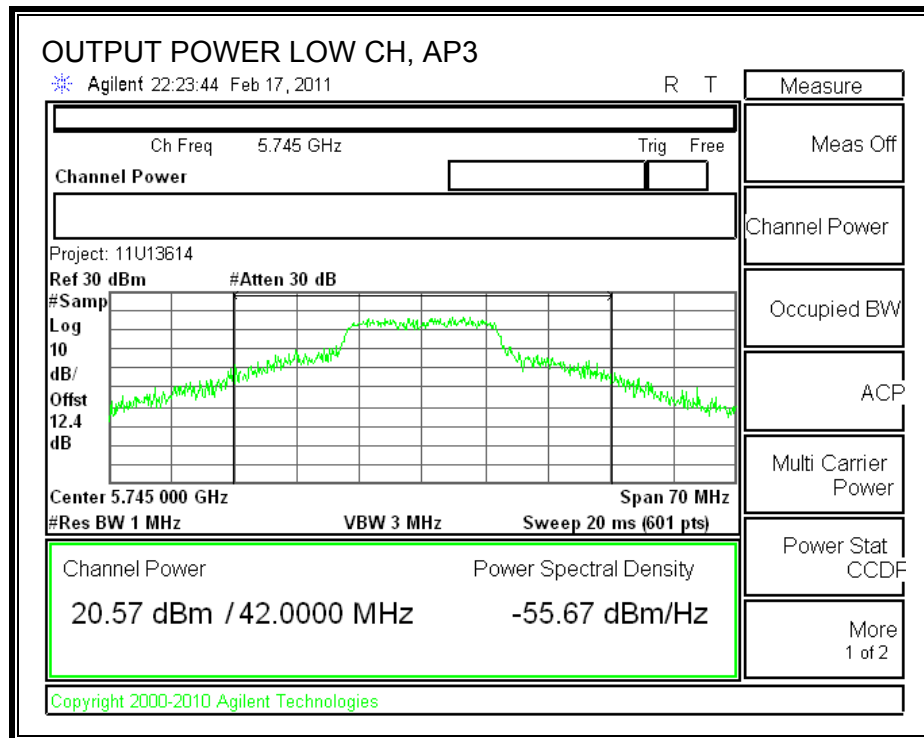


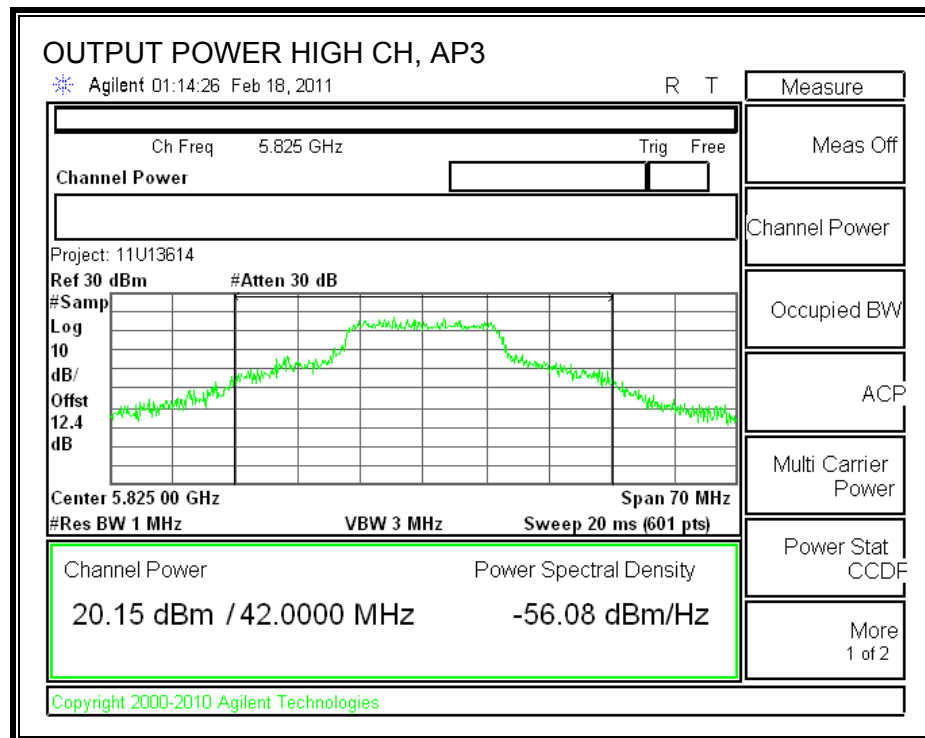
AP2 OUTPUT POWER





AP3 OUTPUT POWER





7.4.4. 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.

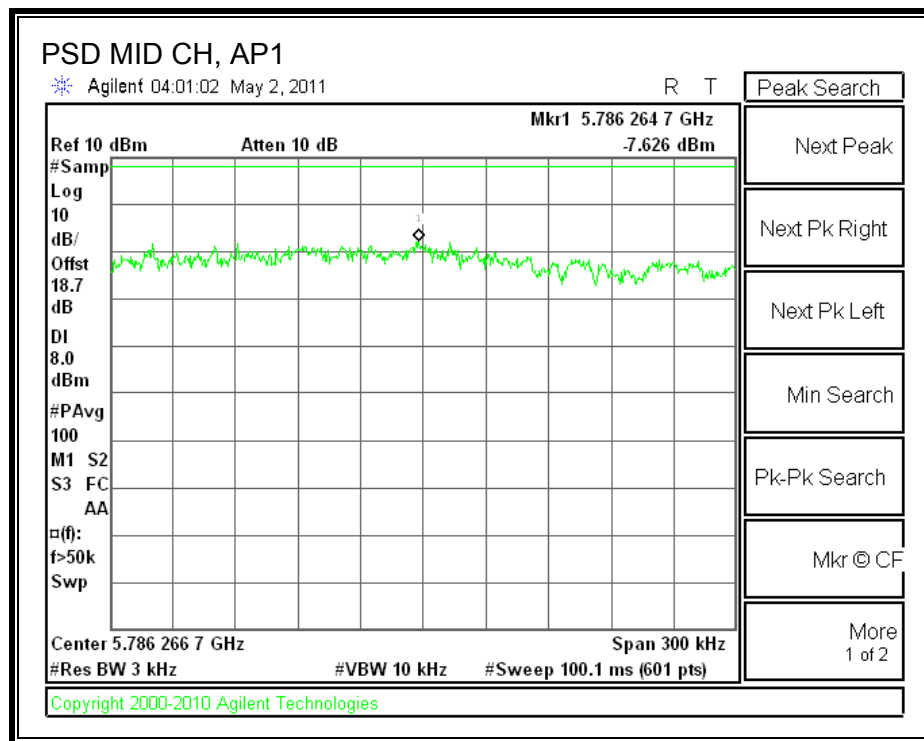
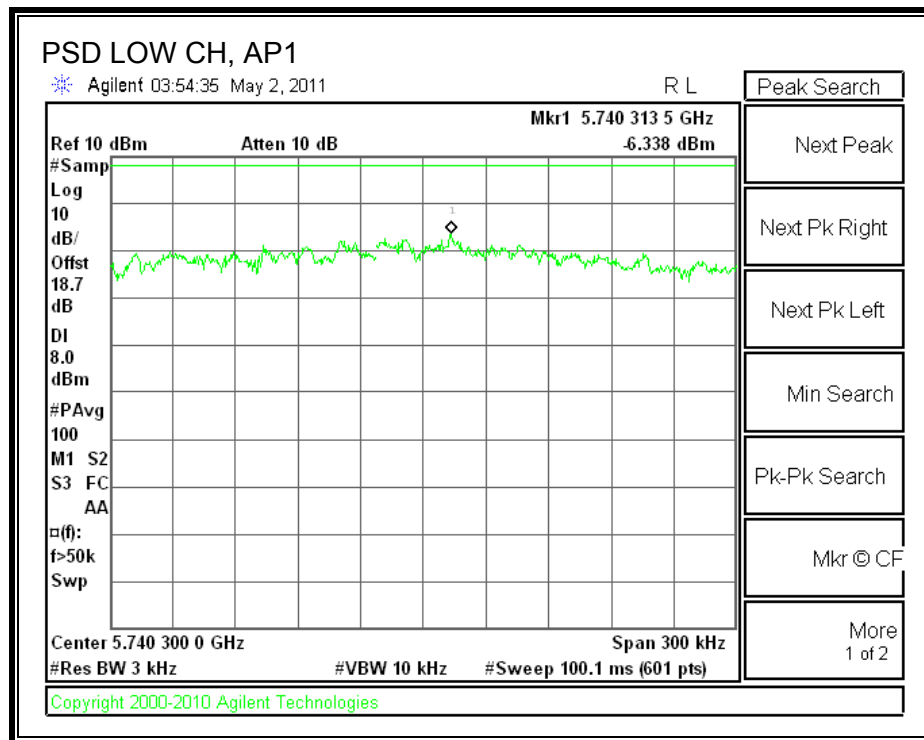
TEST PROCEDURE

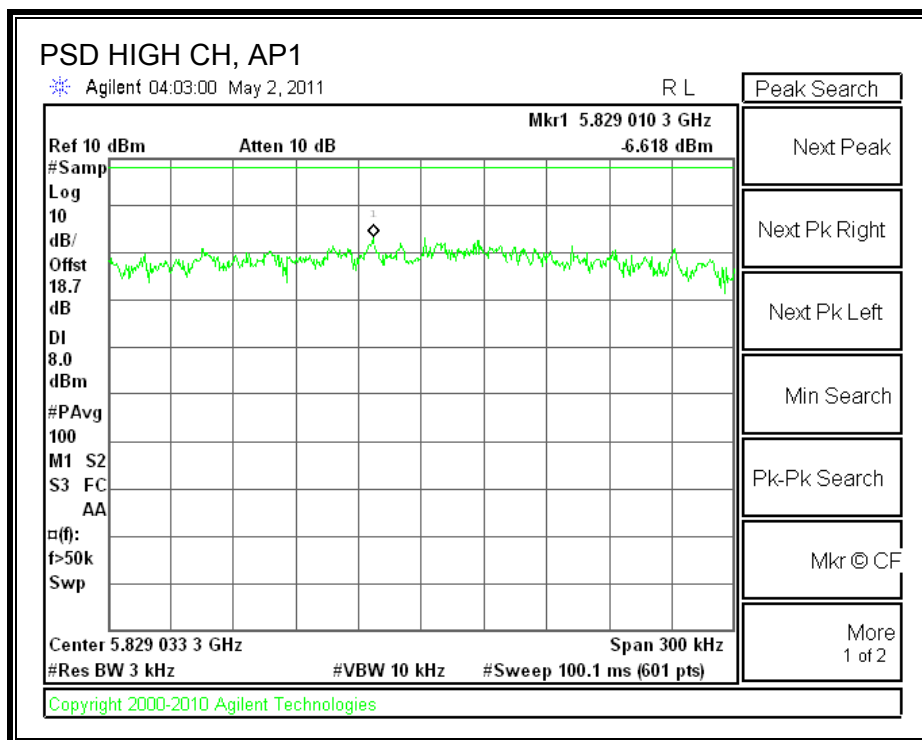
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS:

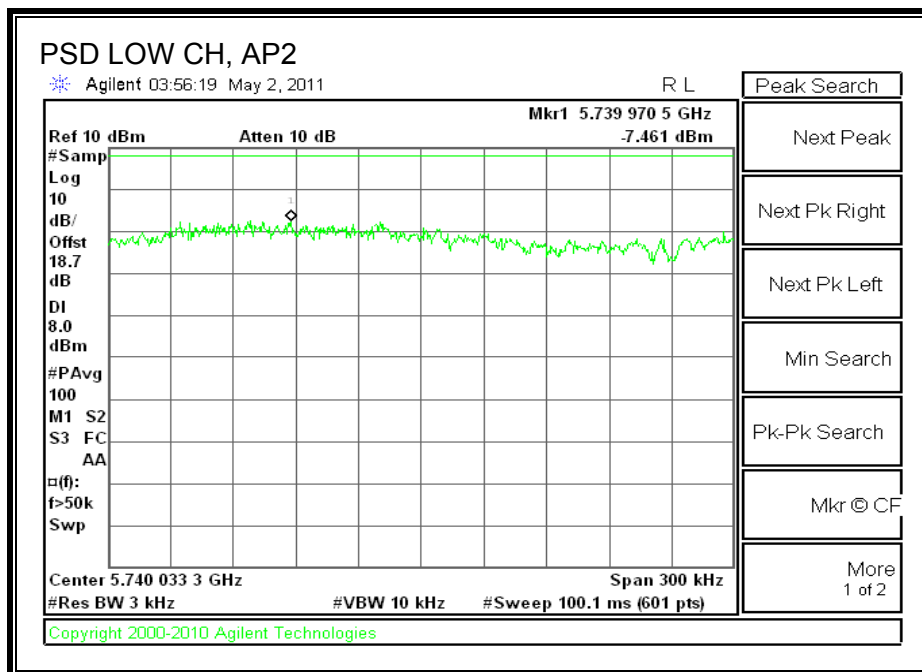
Channel	Frequency (MHz)	AP1 PSD (dBm)	AP2 PSD (dBm)	AP3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-6.338	-7.461	-7.34	-2.25	8	-10.25
Middle	5785	-7.626	-8.344	-7.975	-3.20	8	-11.20
High	5825	-6.618	-7.000	-8.228	-2.46	8	-10.46

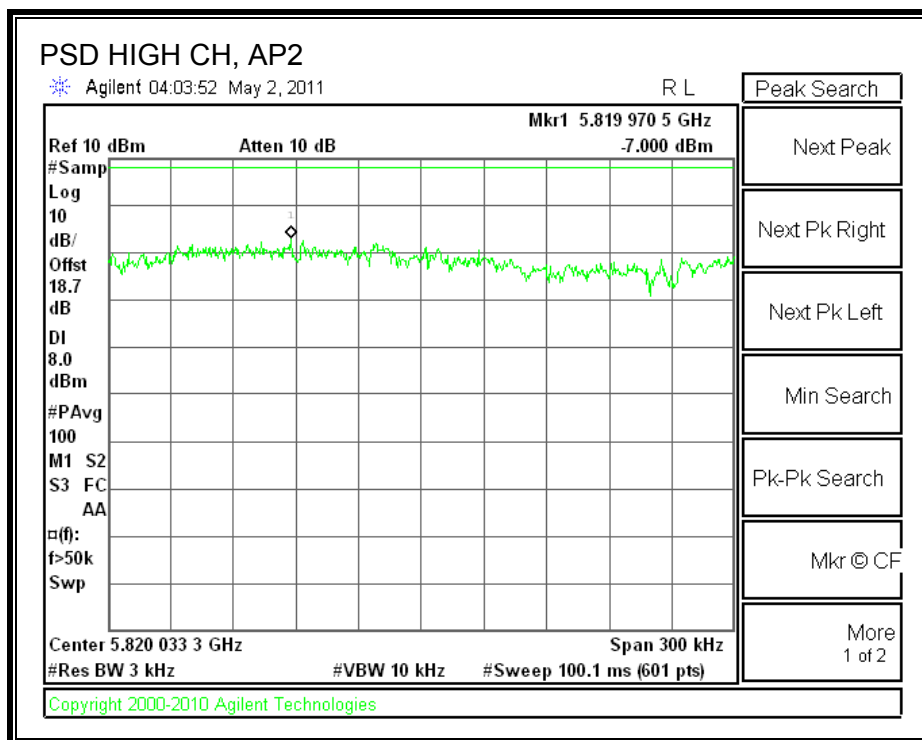
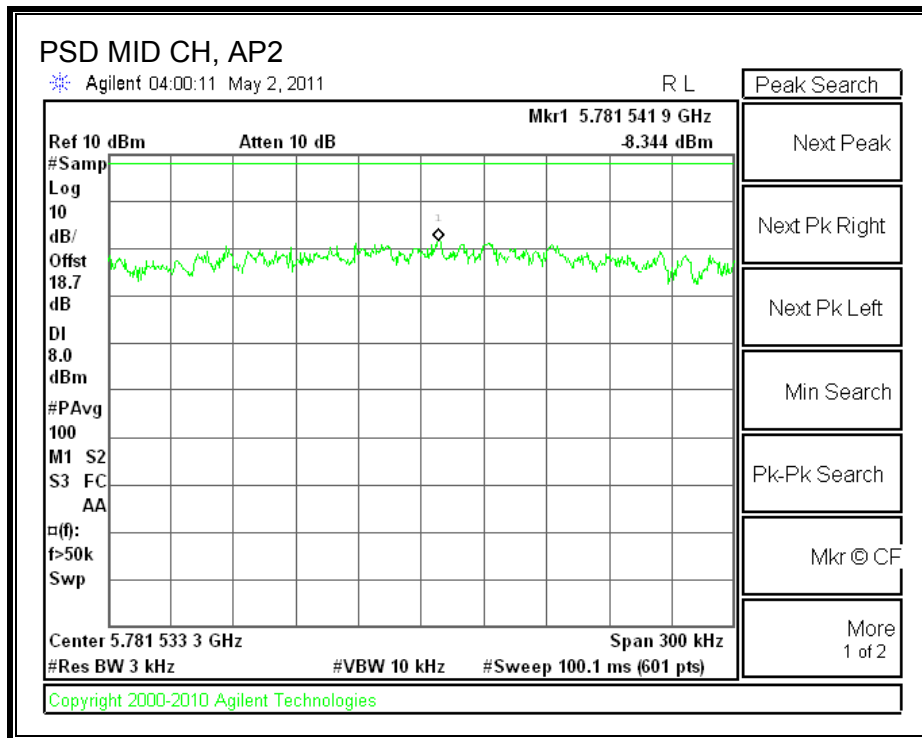
POWER SPECTRAL DENSITY, AP1



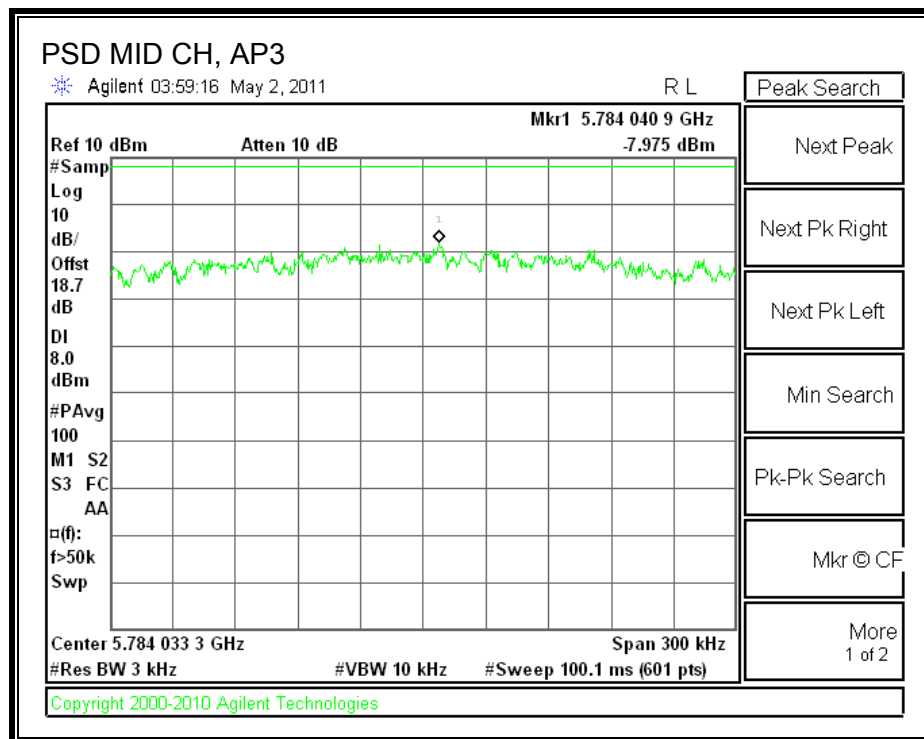
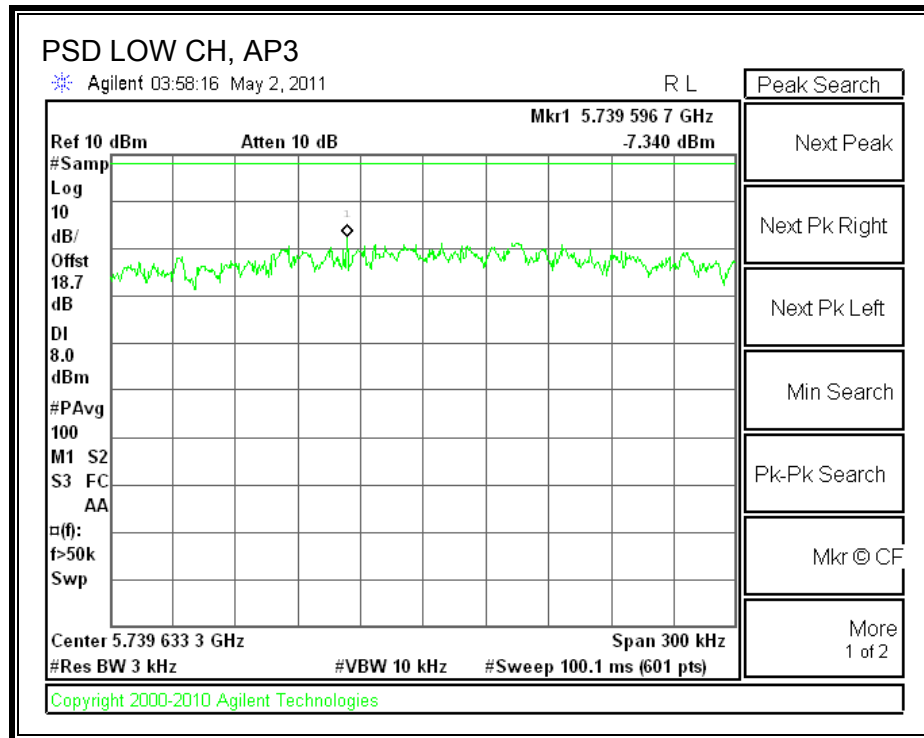


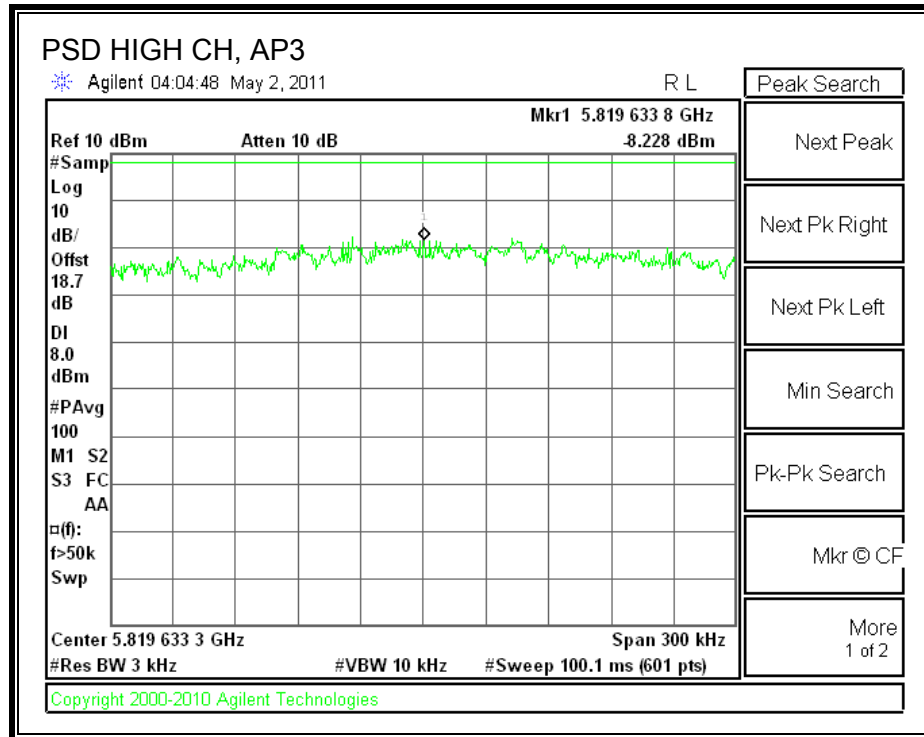
POWER SPECTRAL DENSITY, AP2





POWER SPECTRAL DENSITY, AP3





7.4.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of RMS averaging over time interval; therefore the required attenuation is 30 dB.

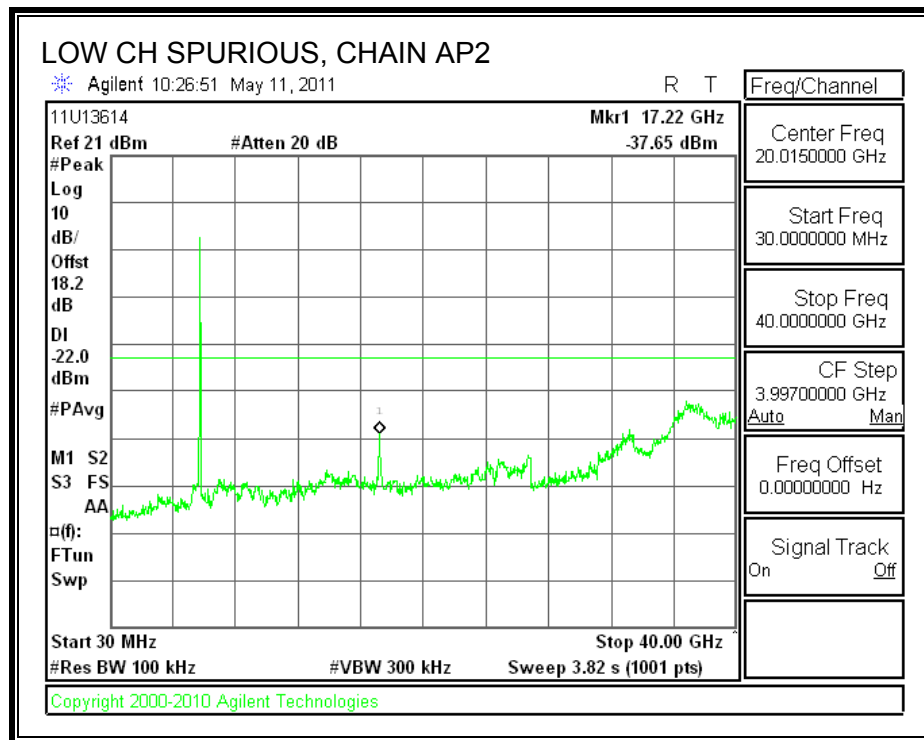
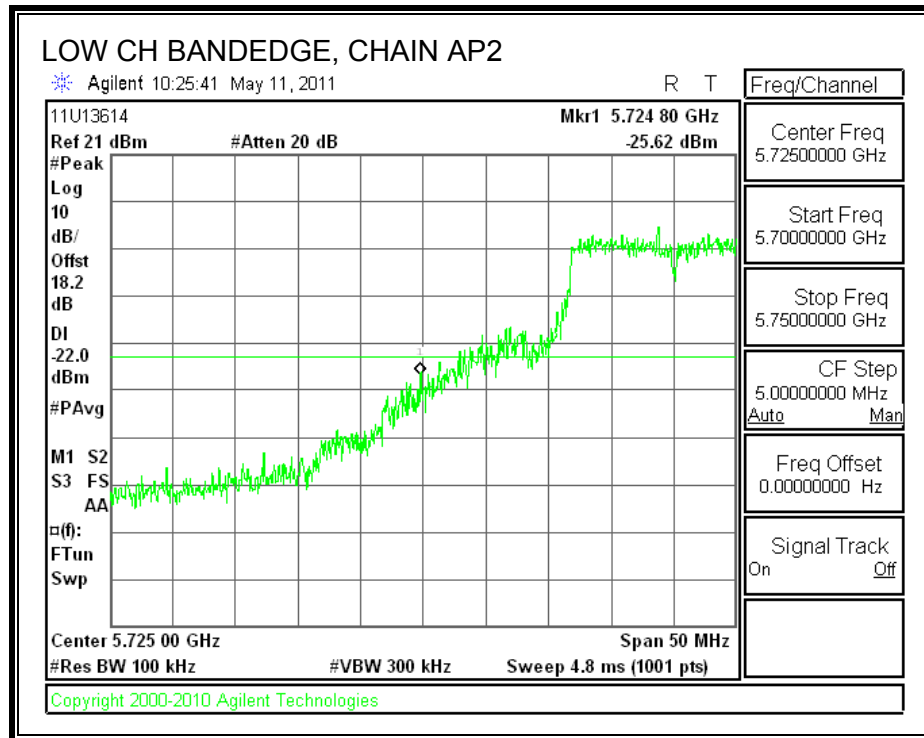
TEST PROCEDURE

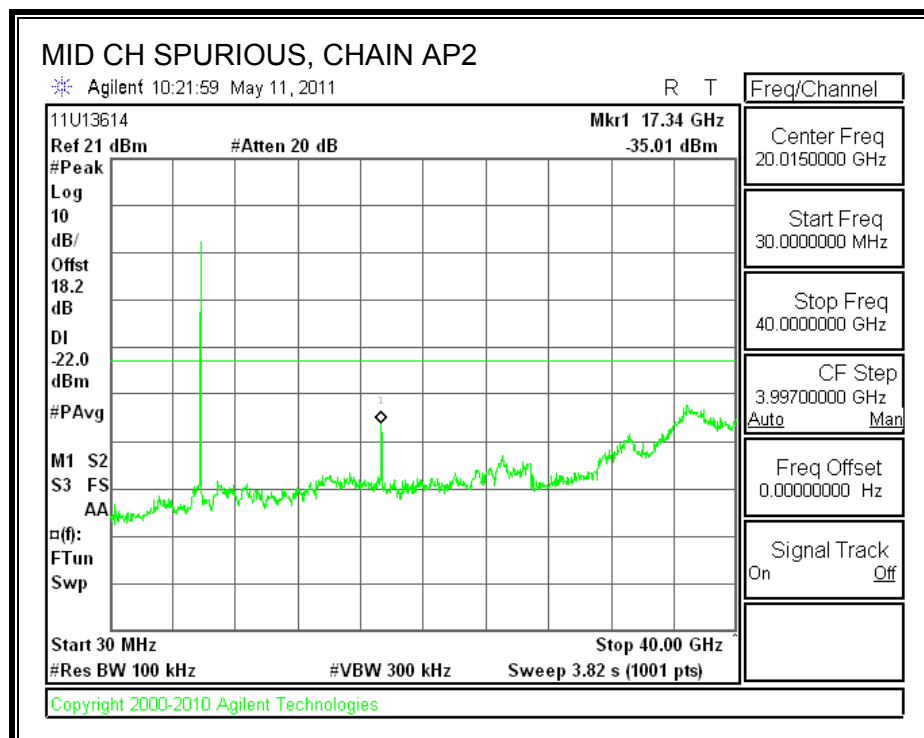
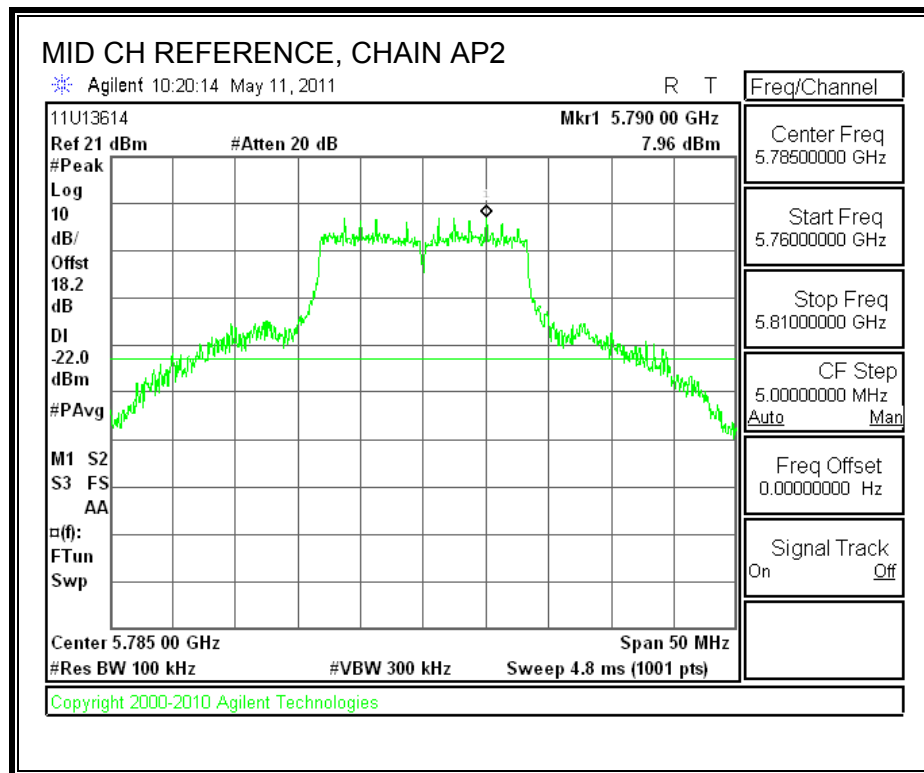
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

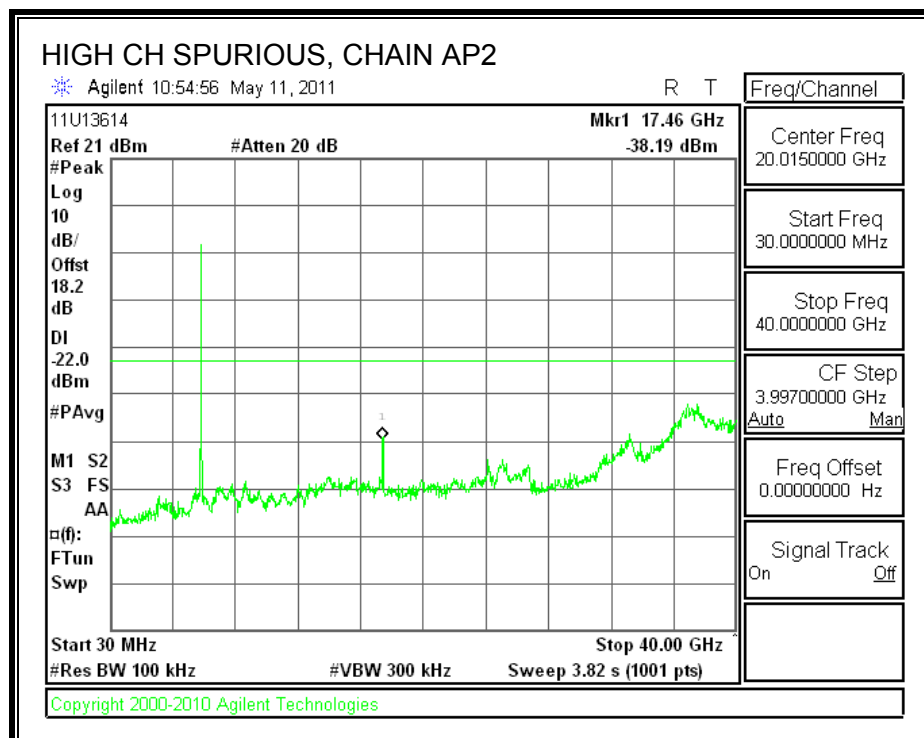
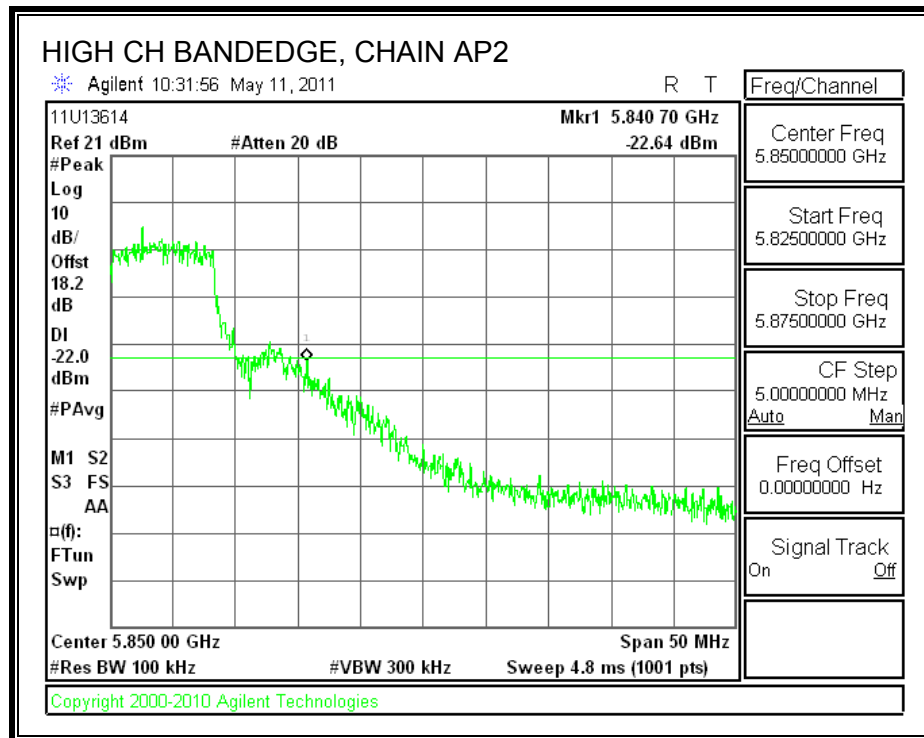
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

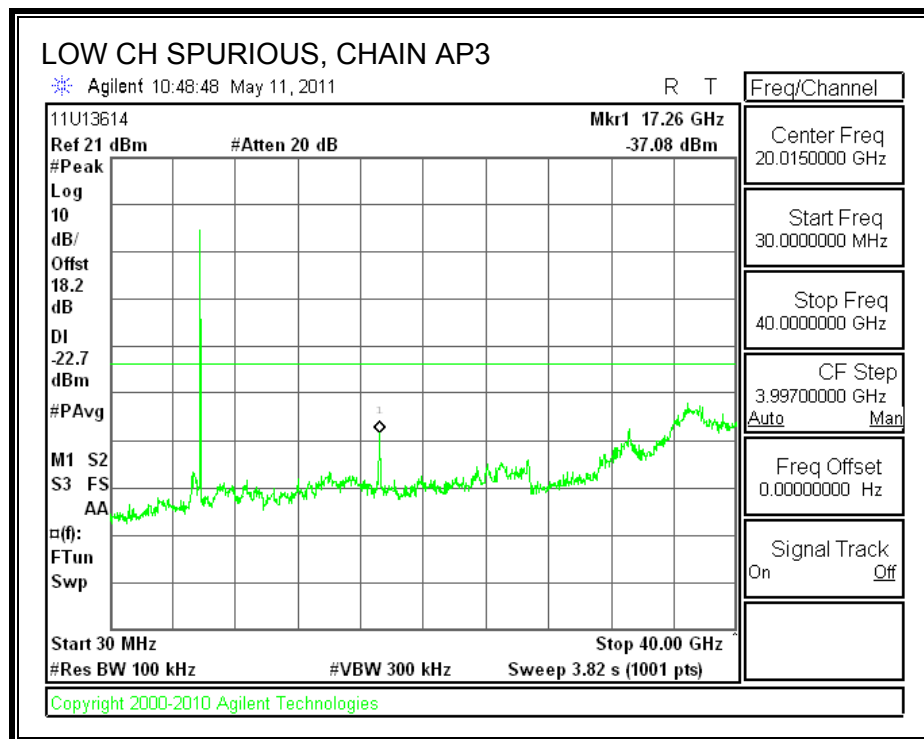
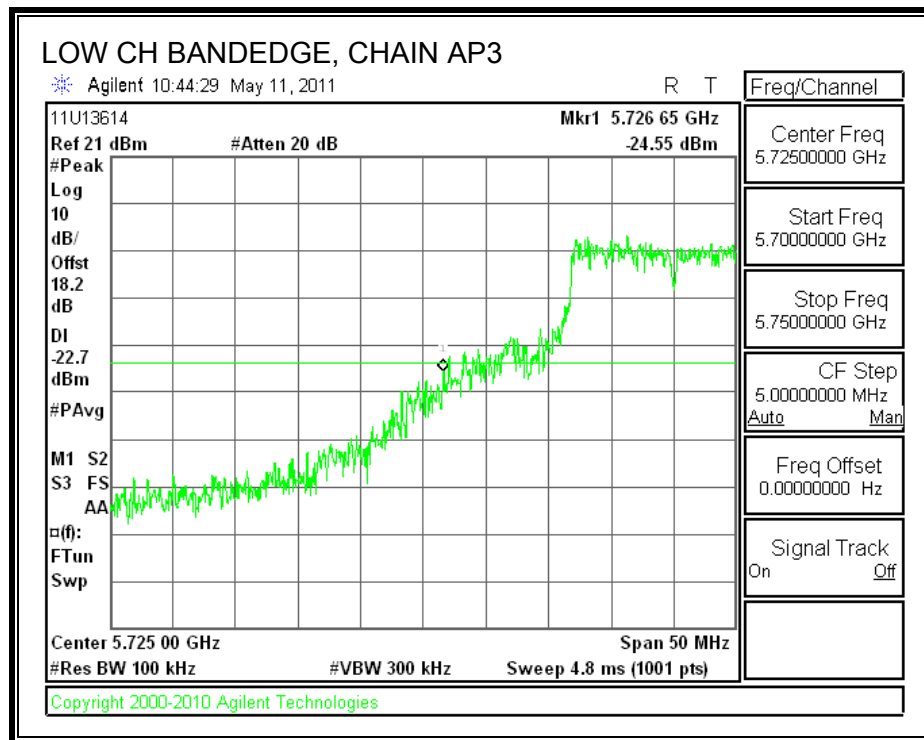
CHAIN AP2 SPURIOUS EMISSIONS

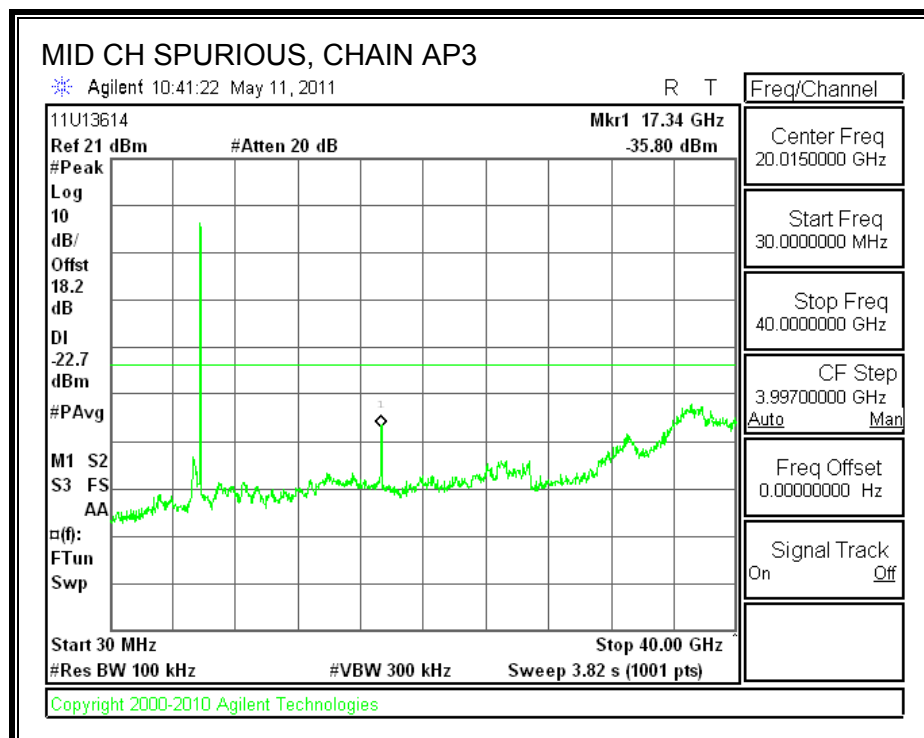
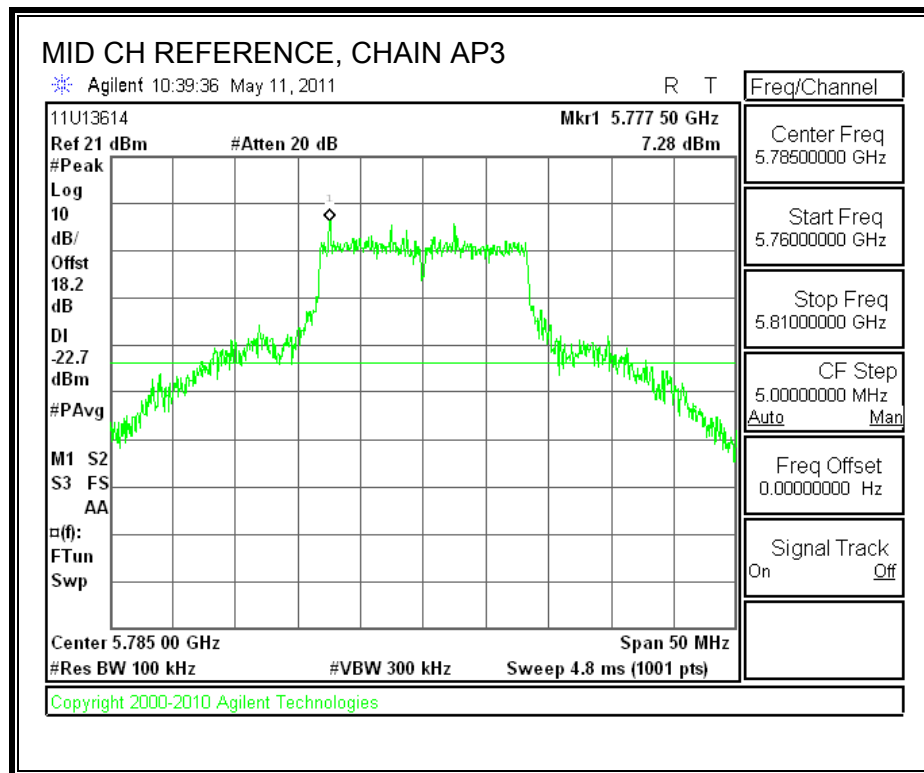


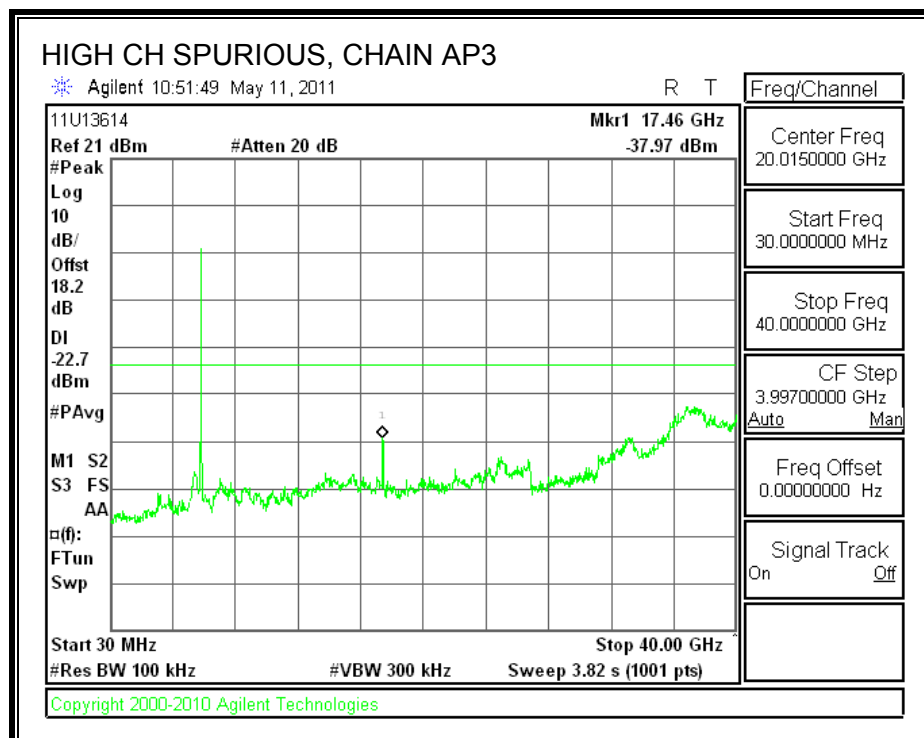
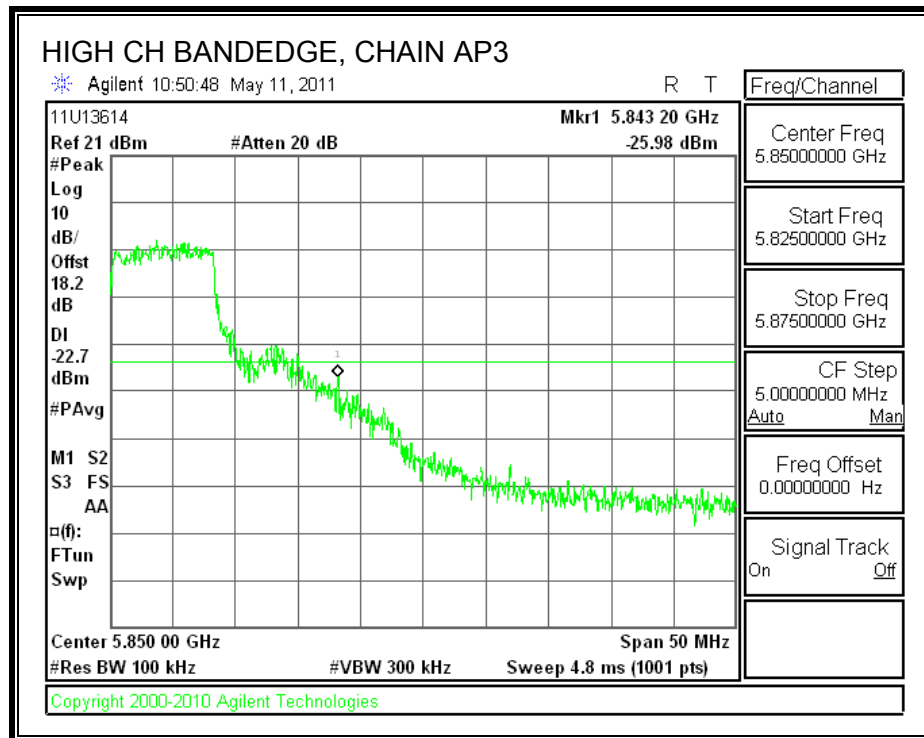




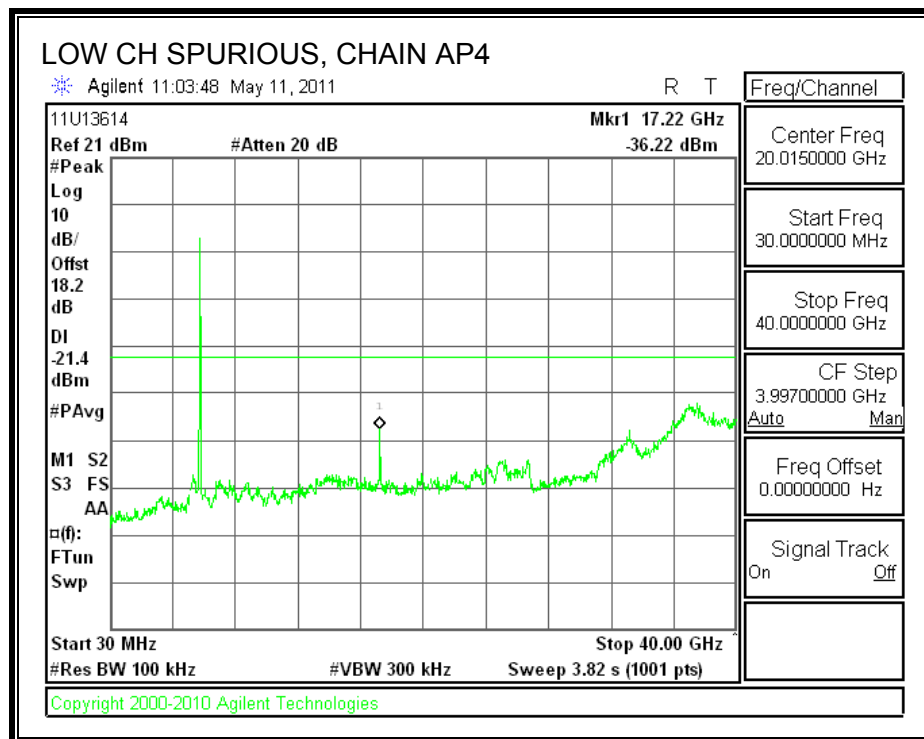
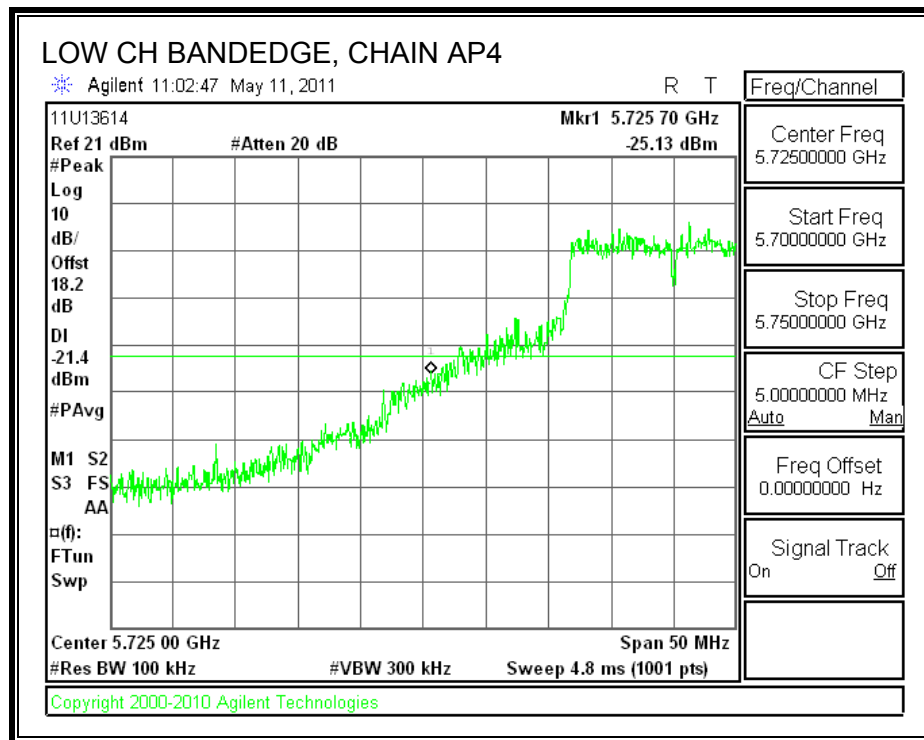
CHAIN AP3 SPURIOUS EMISSIONS

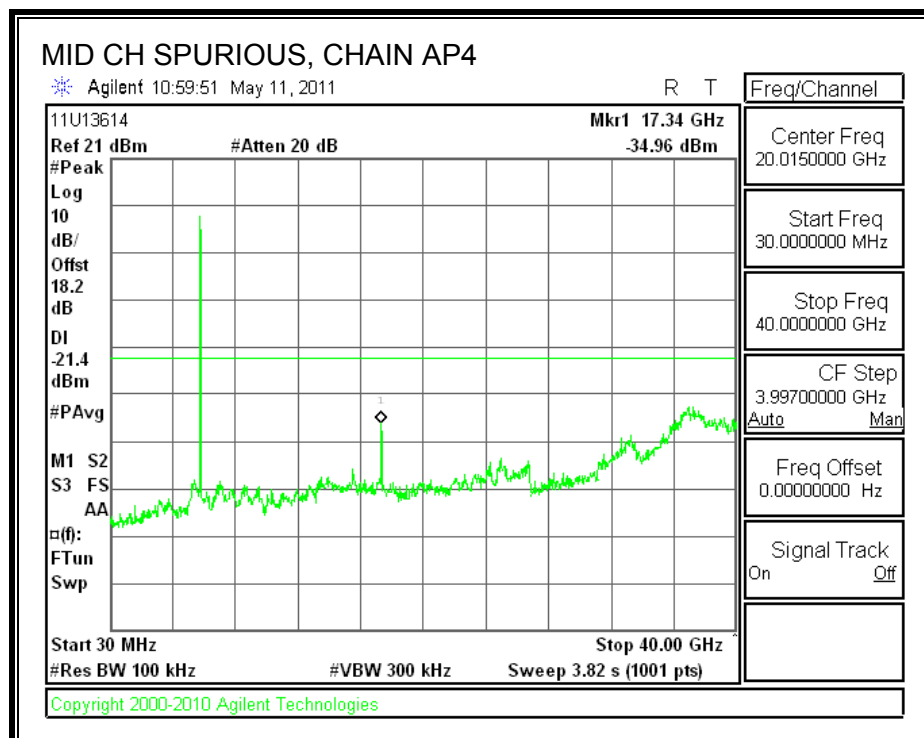
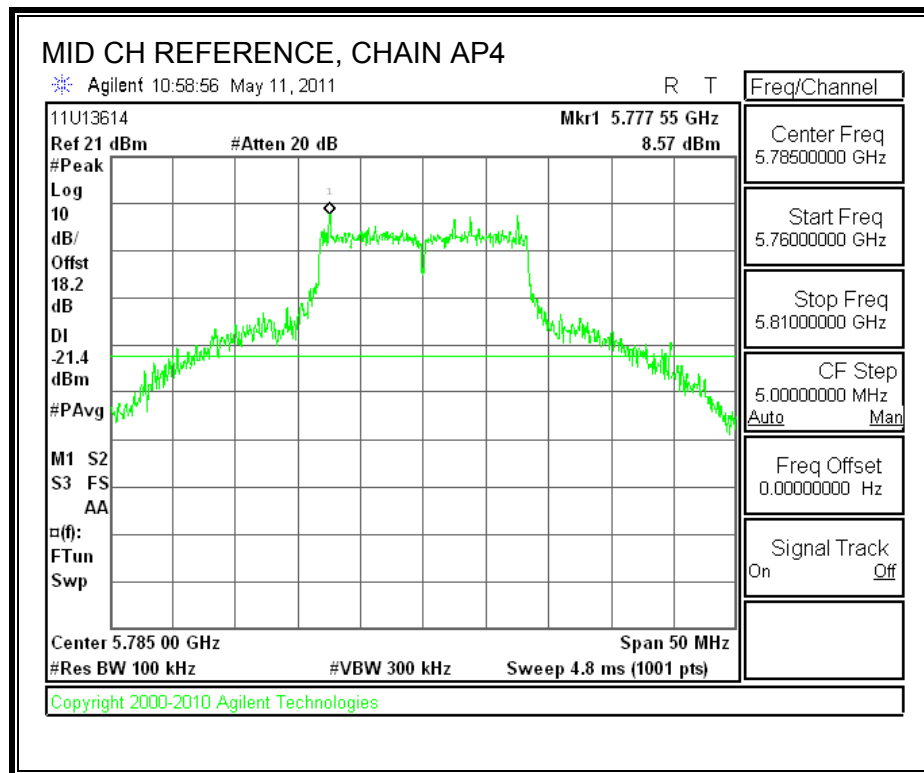


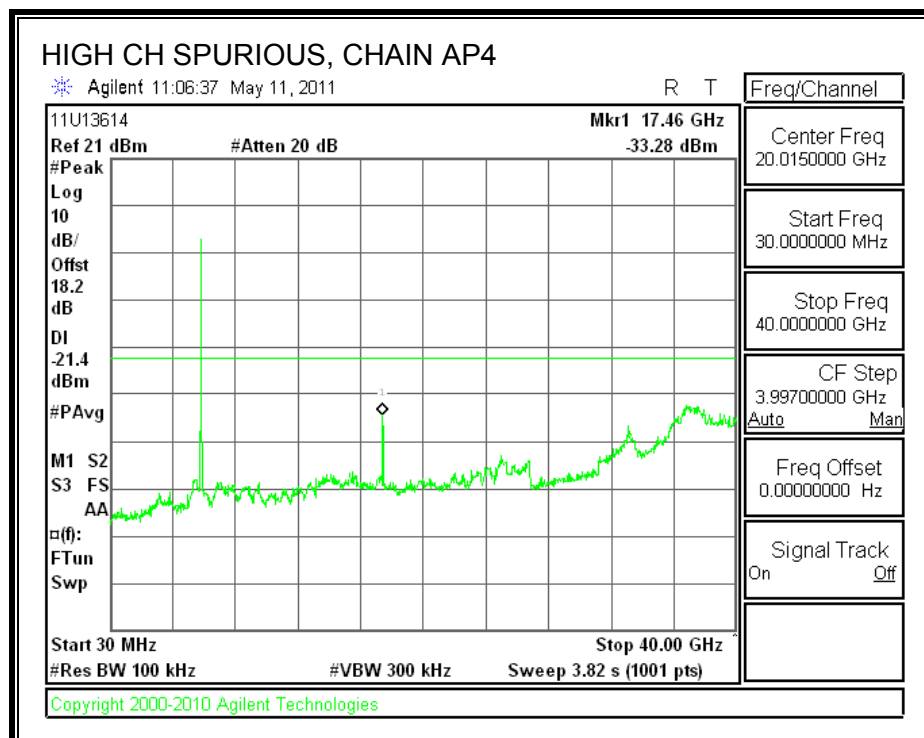
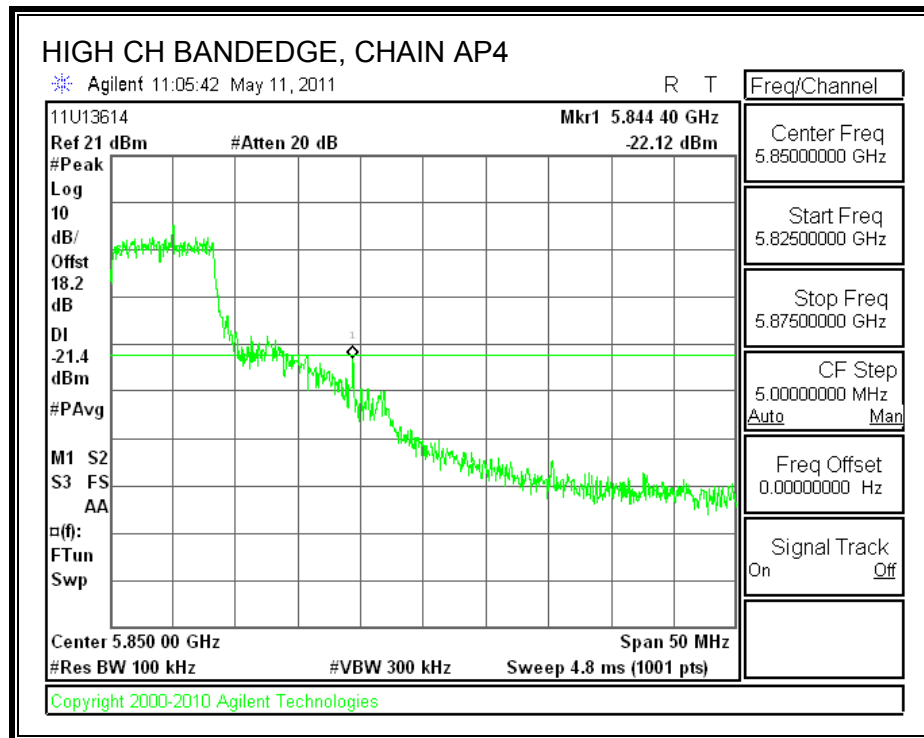




CHAIN AP4 SPURIOUS EMISSIONS







7.5. 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND

7.5.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

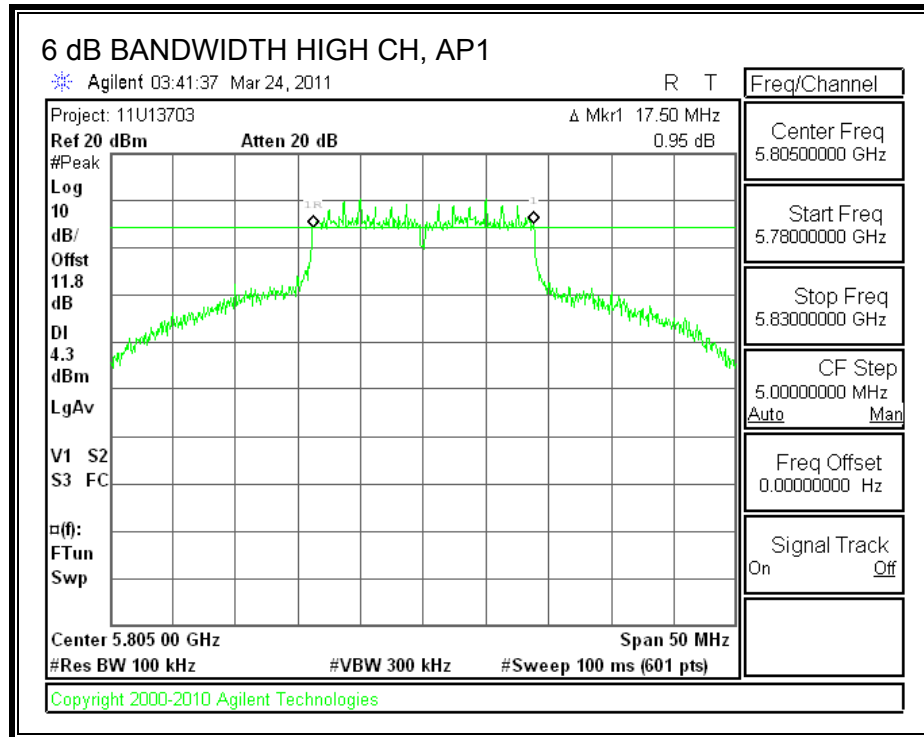
The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

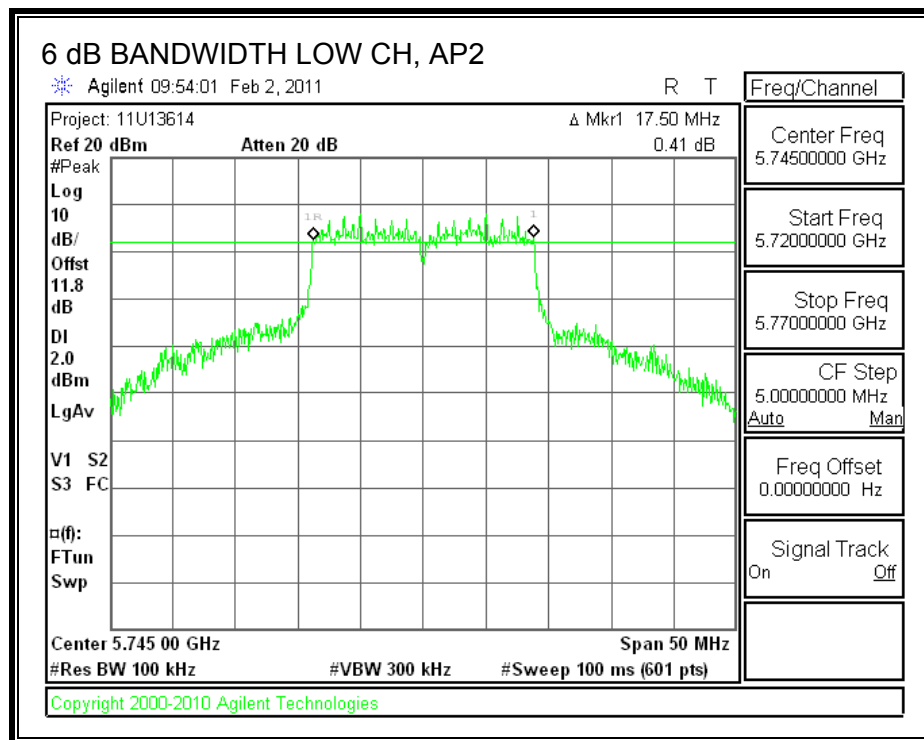
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

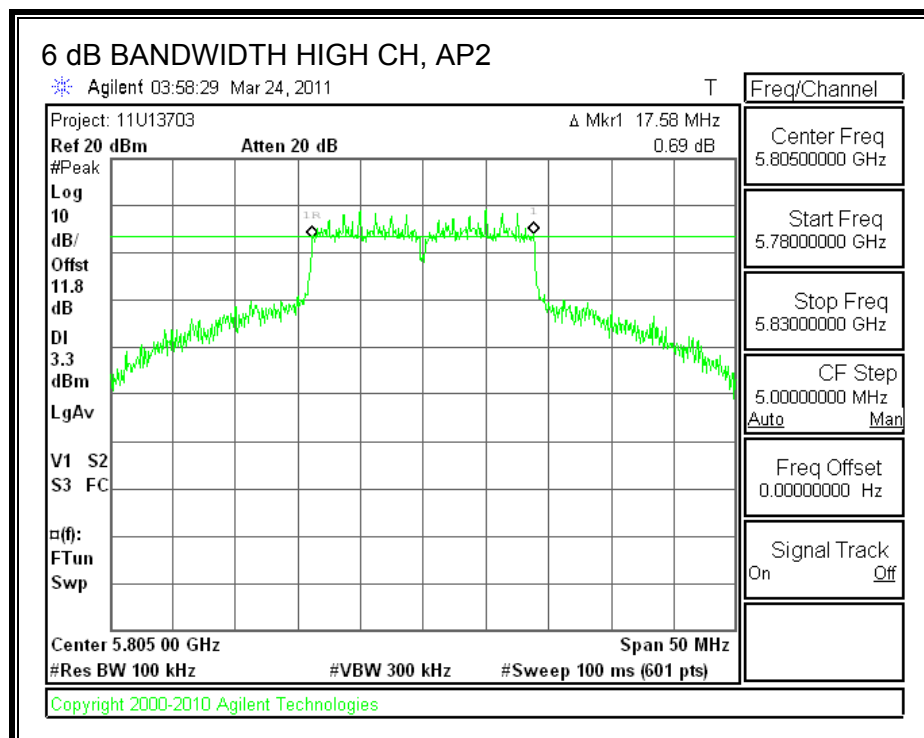
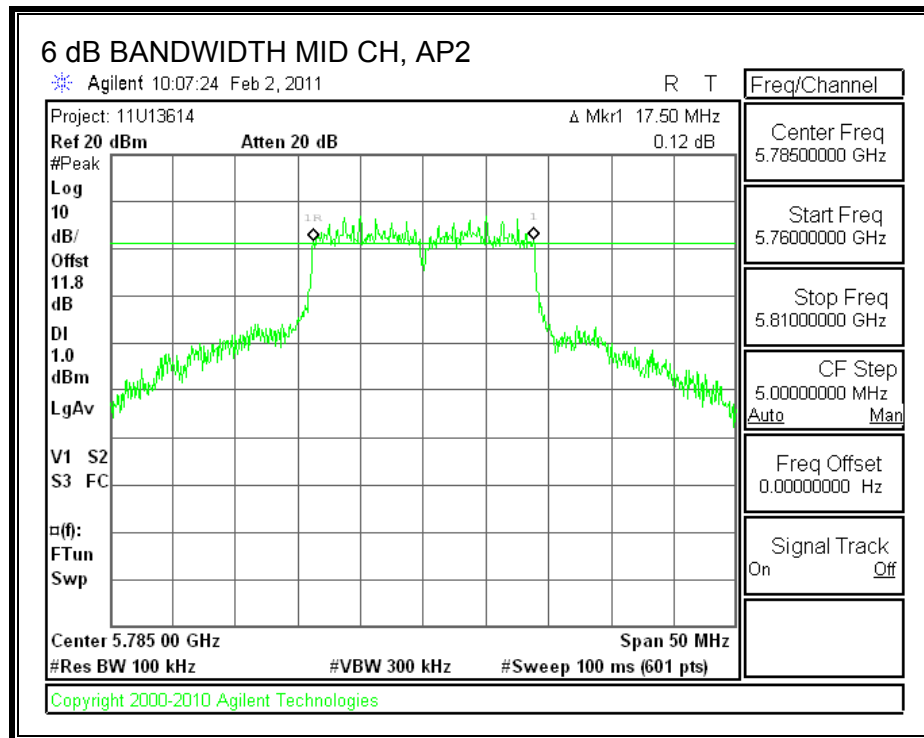
RESULTS

Channel	Frequency (MHz)	AP1 6 dB BW (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	17.5	17.5	17.5	0.5
Middle	5785	17.5	17.5	17.5	0.5
High	5805	17.5	17.58	17.5	0.5

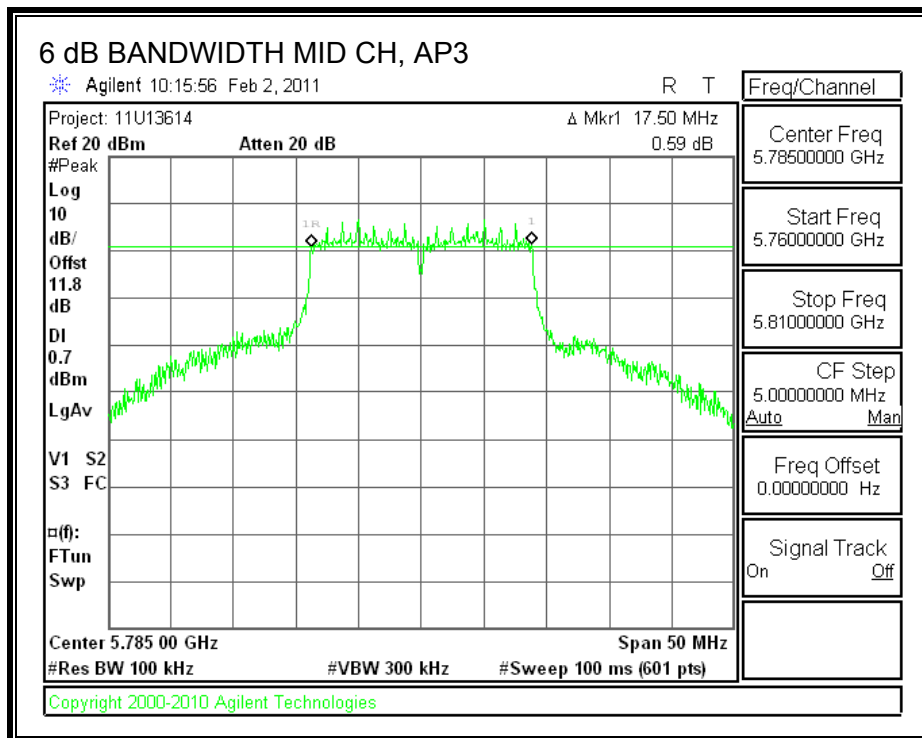
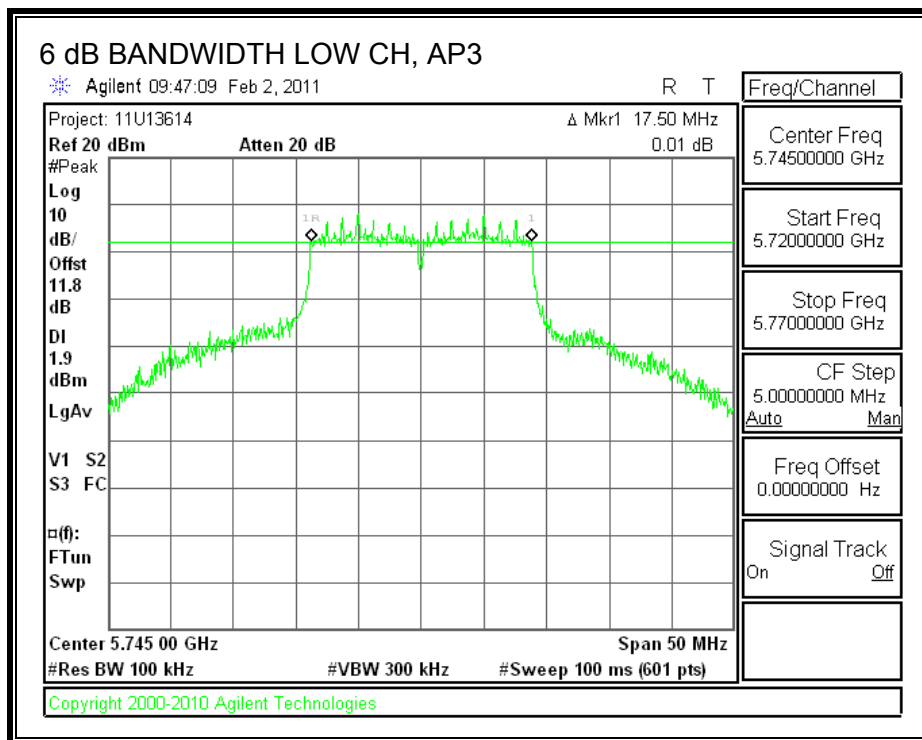


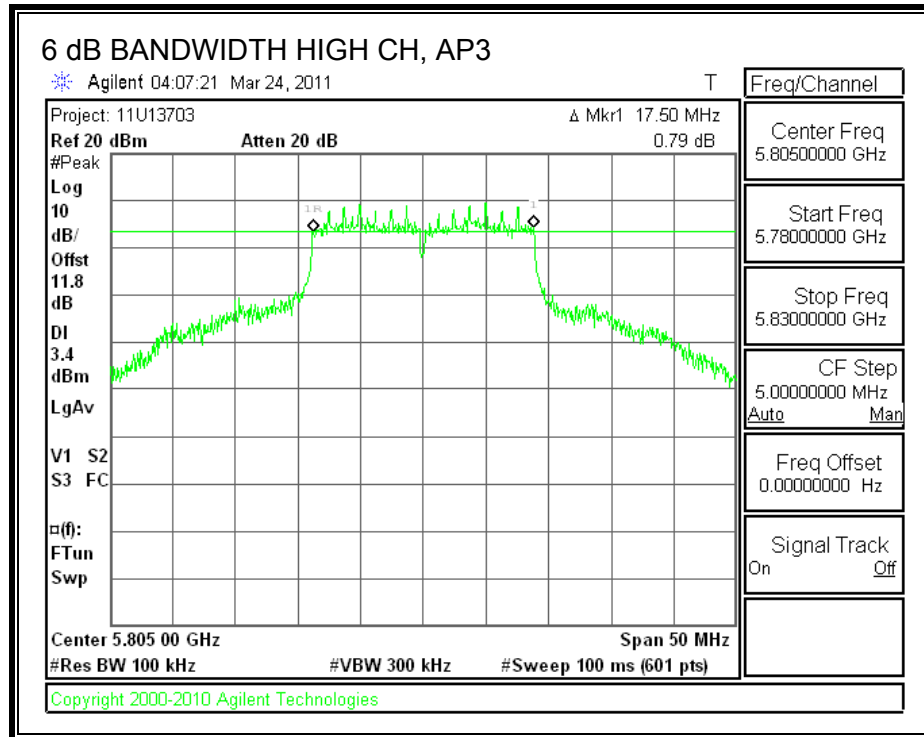
6 dB BANDWIDTH, AP2





6 dB BANDWIDTH, AP3





7.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

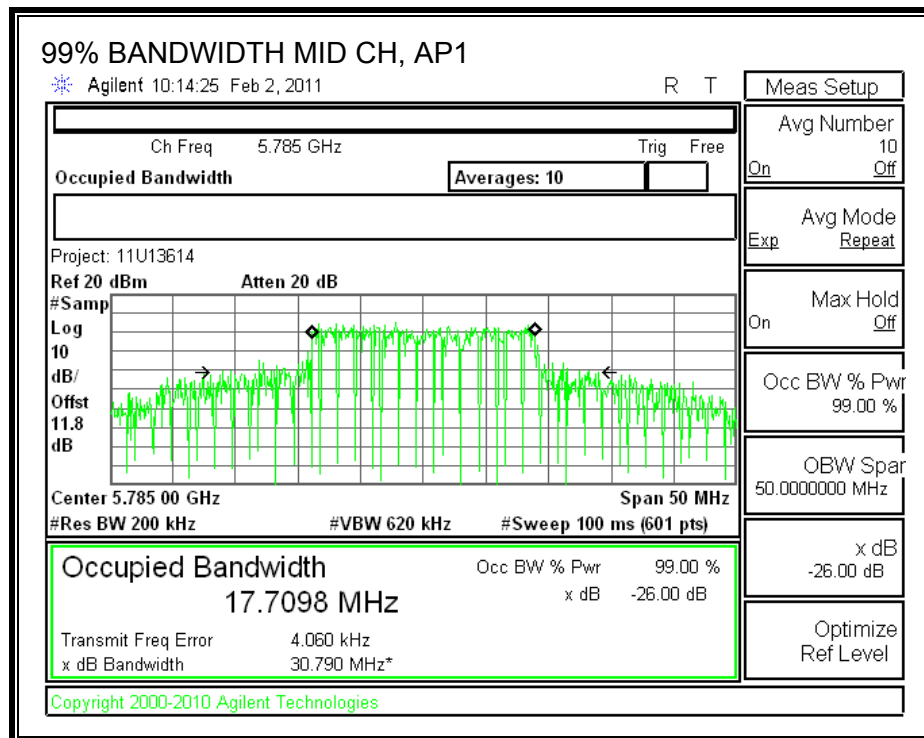
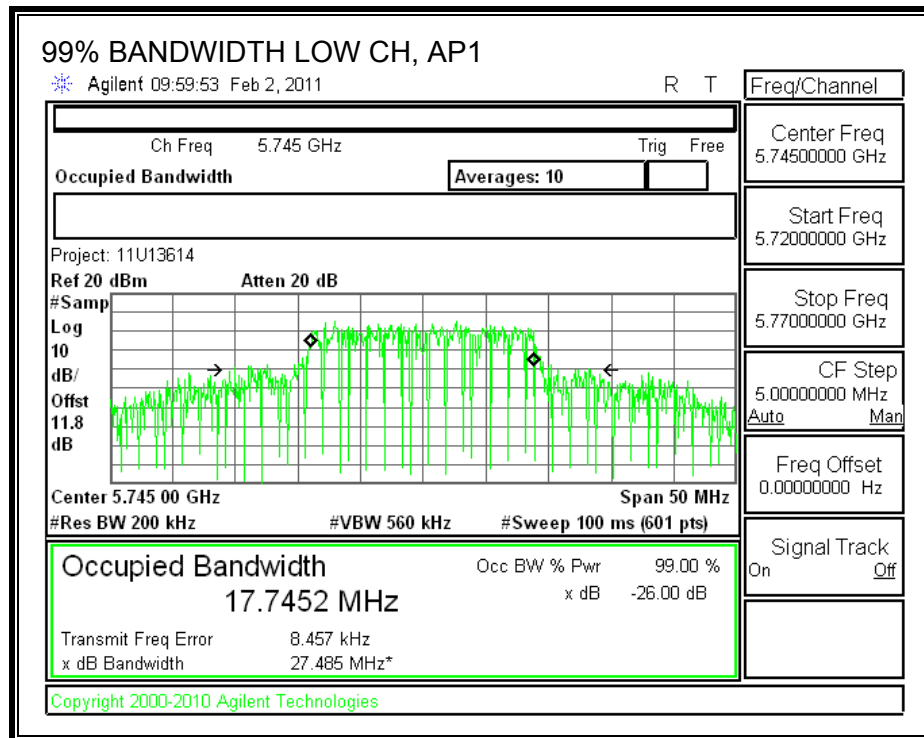
TEST PROCEDURE

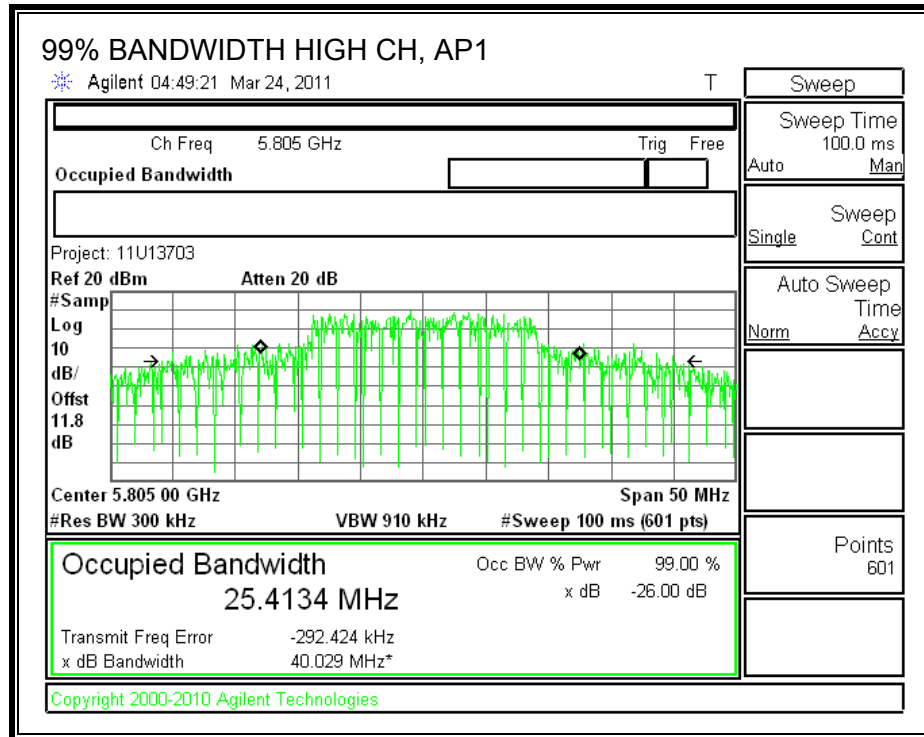
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

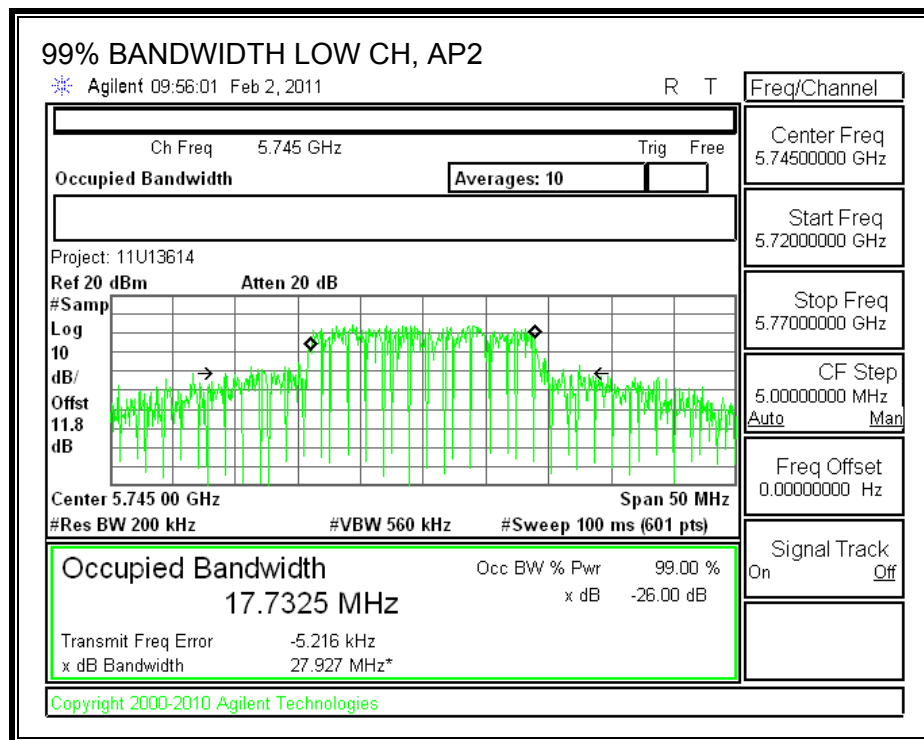
Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	5745	17.7452	17.7325	17.7563
Middle	5785	17.7098	17.7182	17.7442
High	5805	25.4134	20.4763	19.142

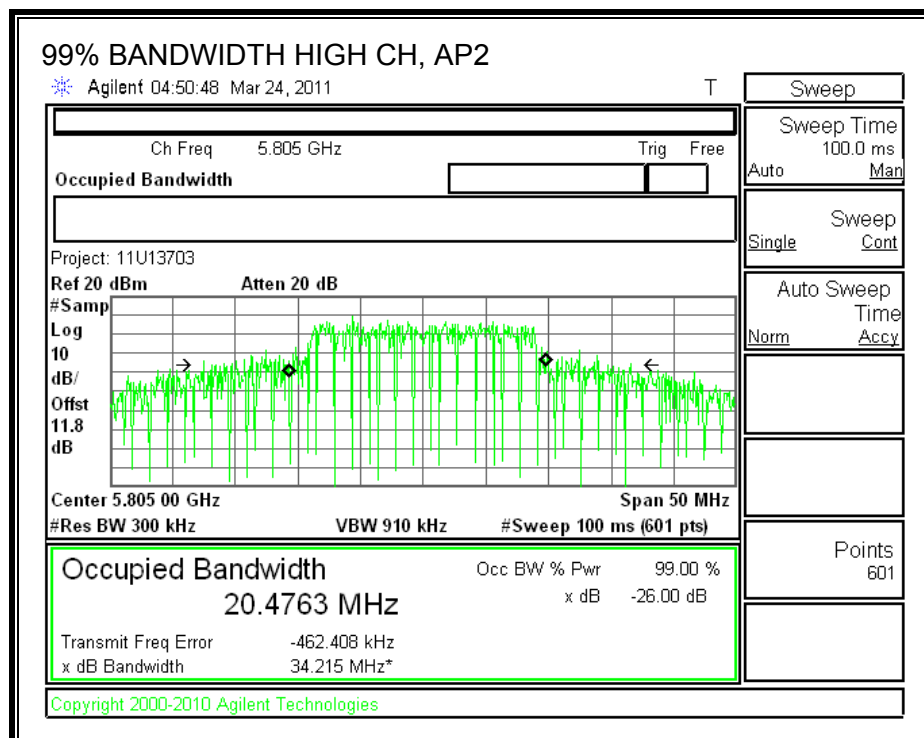
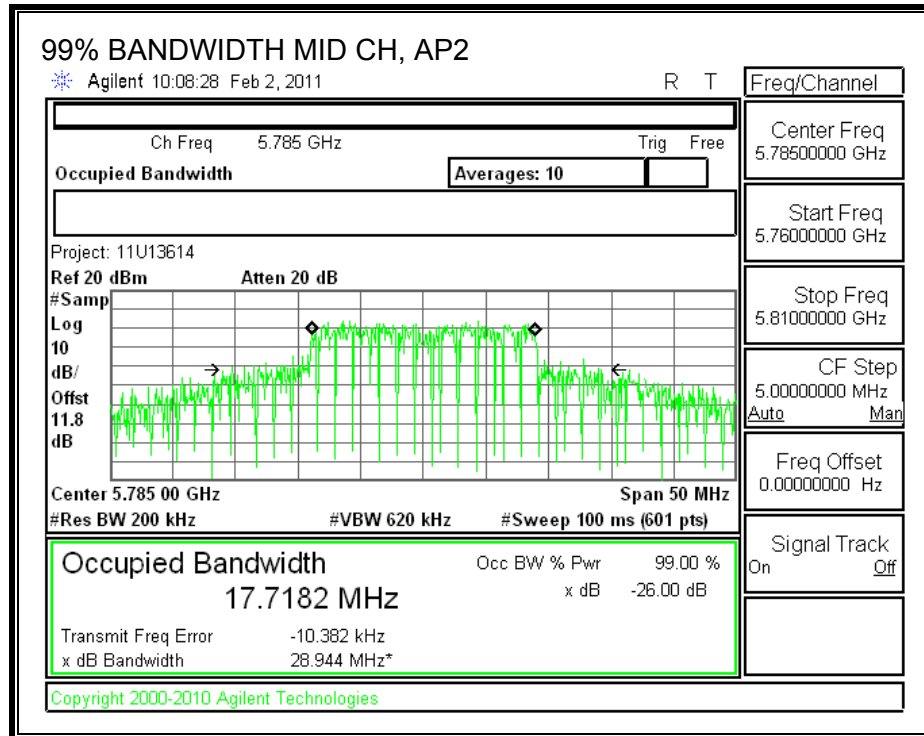
99% BANDWIDTH, AP1



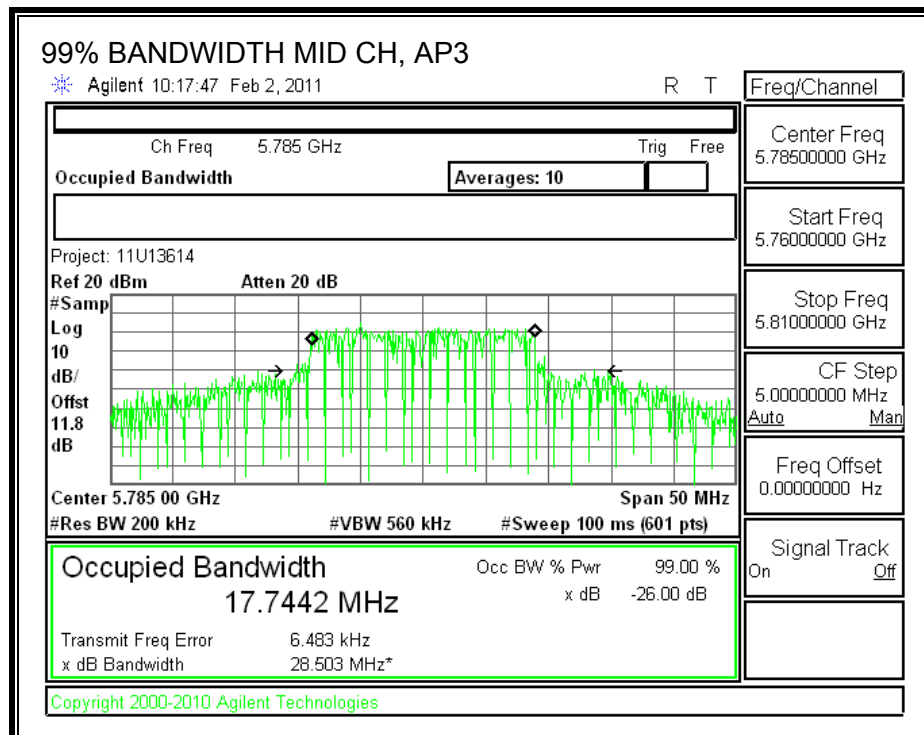
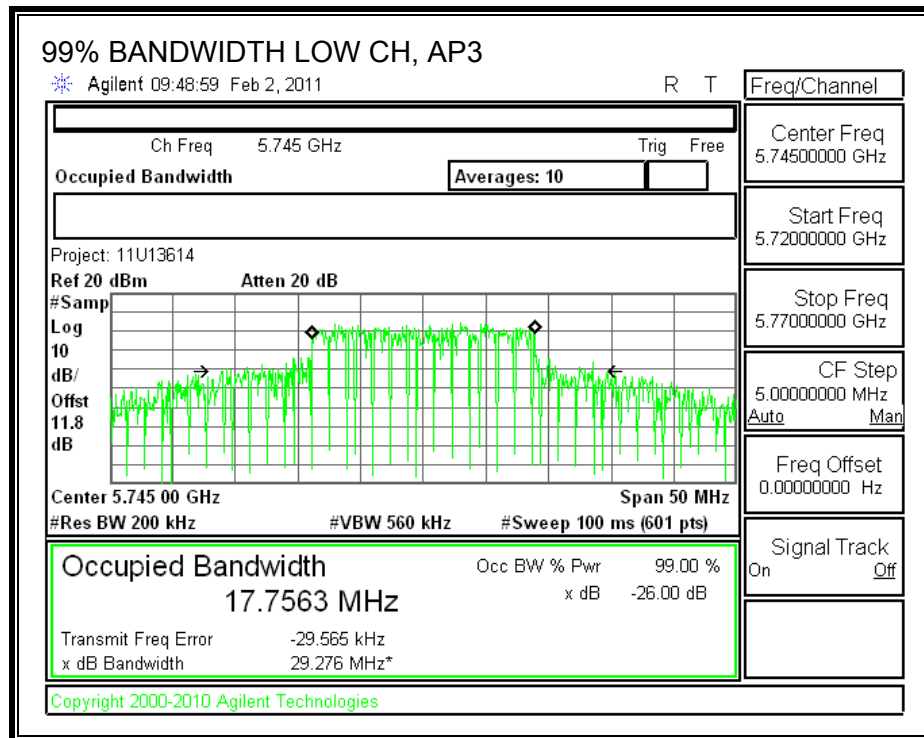


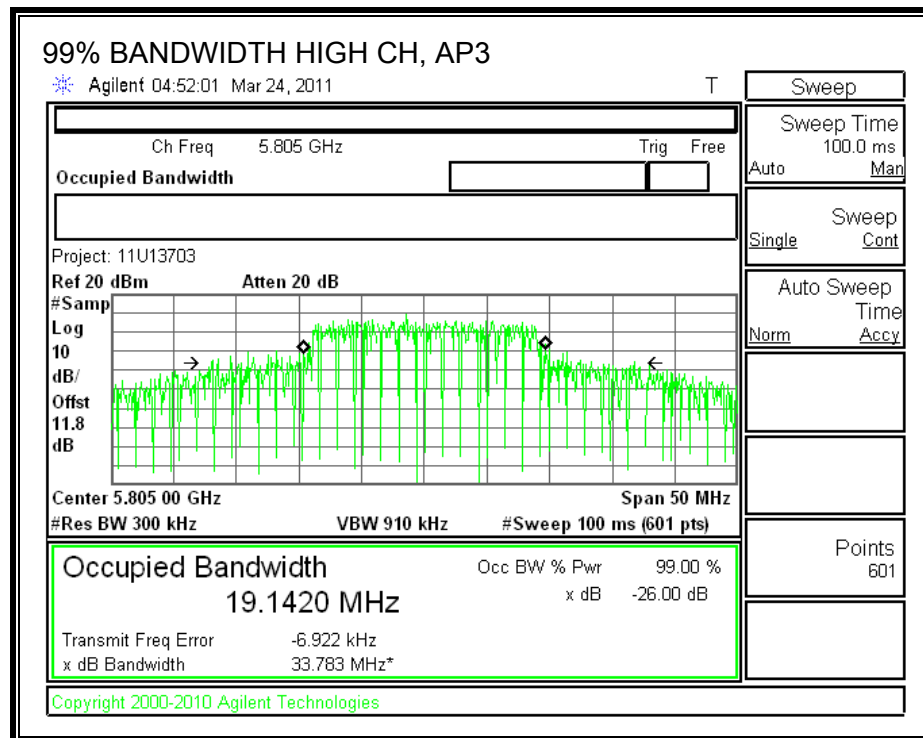
99% BANDWIDTH, AP2





99% BANDWIDTH, AP3





7.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to **4.38 dBi**, therefore the limit is 30 dBm.

TEST PROCEDURE

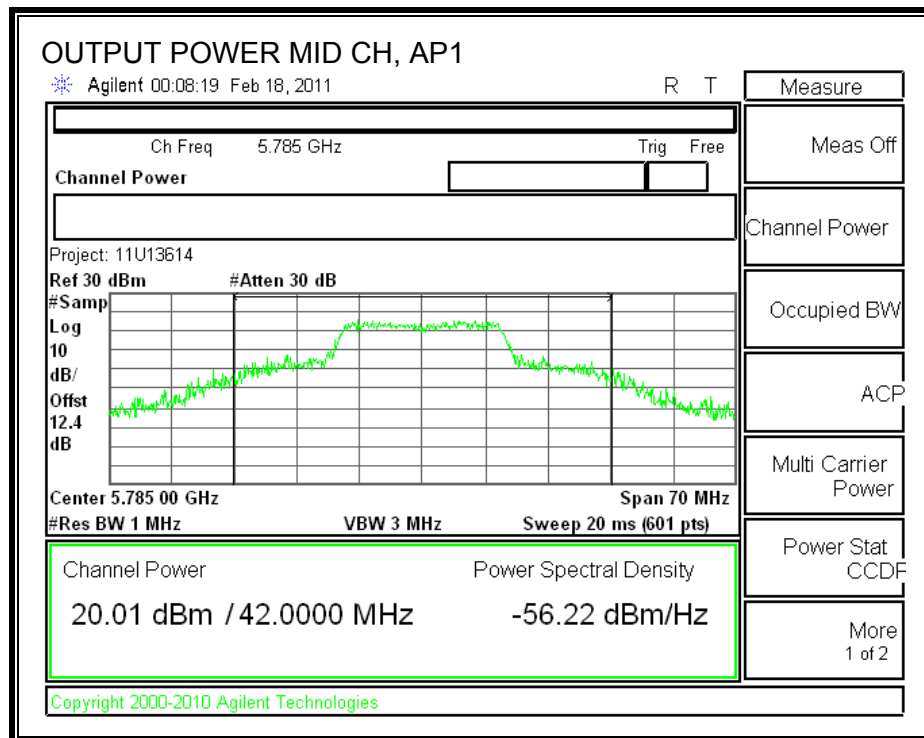
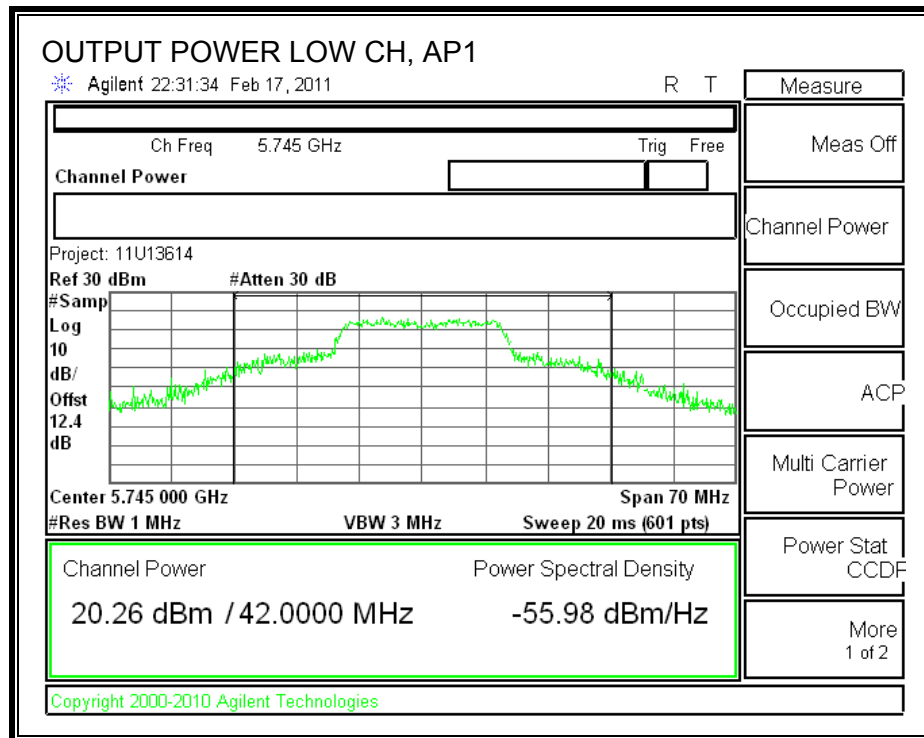
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

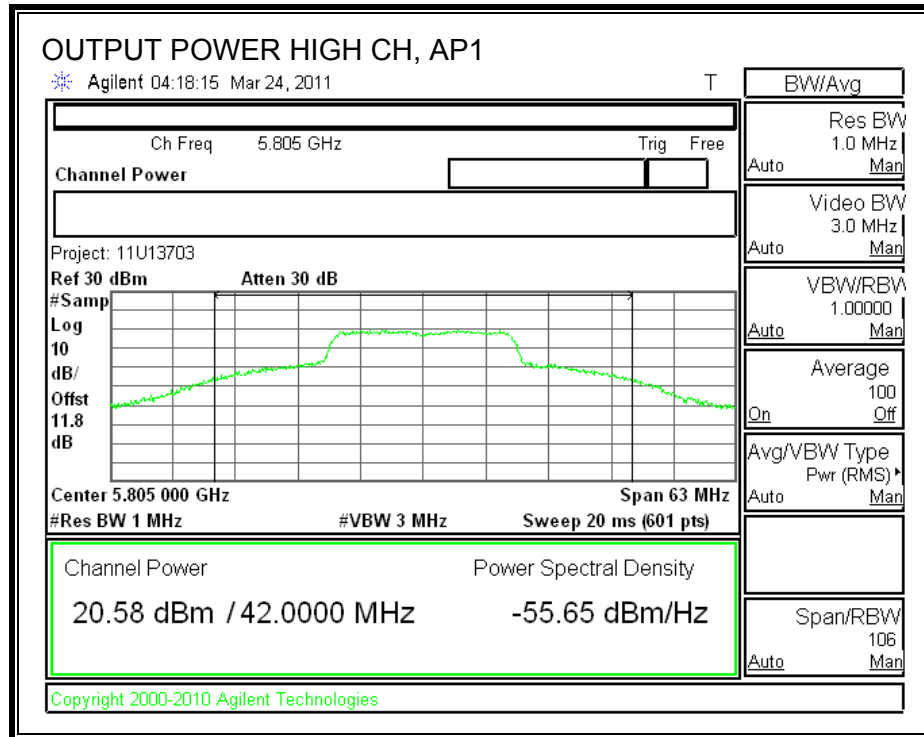
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

RESULTS

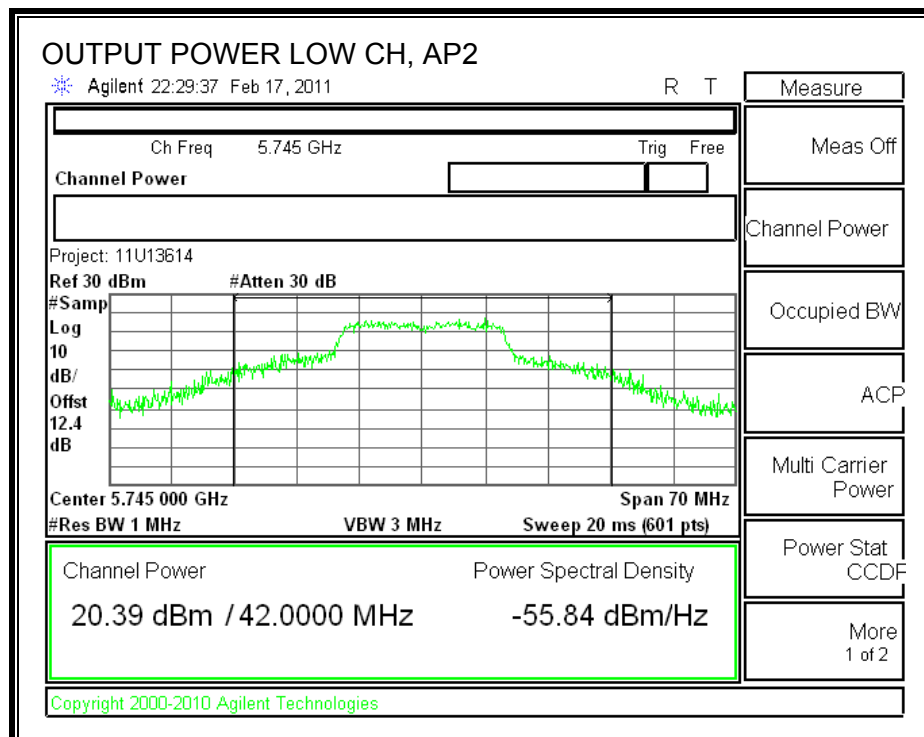
Channel	Frequency (MHz)	AP 1 Power (dBm)	AP 2 Power (dBm)	AP 3 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	20.26	20.39	20.86	0.00	25.28	30.00	-4.72
Mid	5785	20.01	19.89	20.20	0.00	24.81	30.00	-5.19
High	5805	20.58	18.96	19.58	0.00	24.53	30.00	-5.47

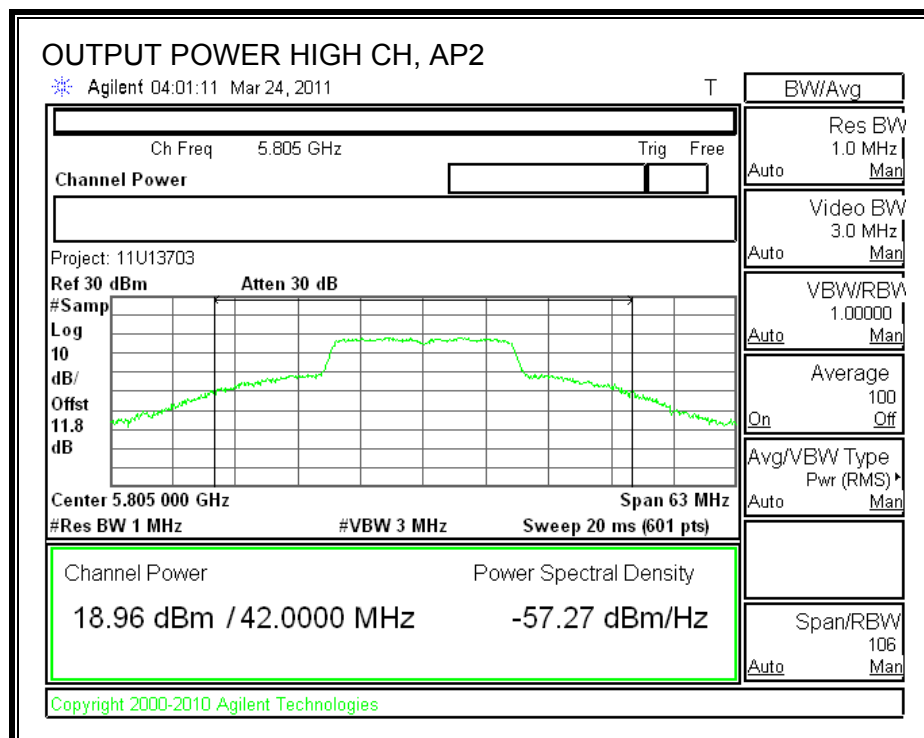
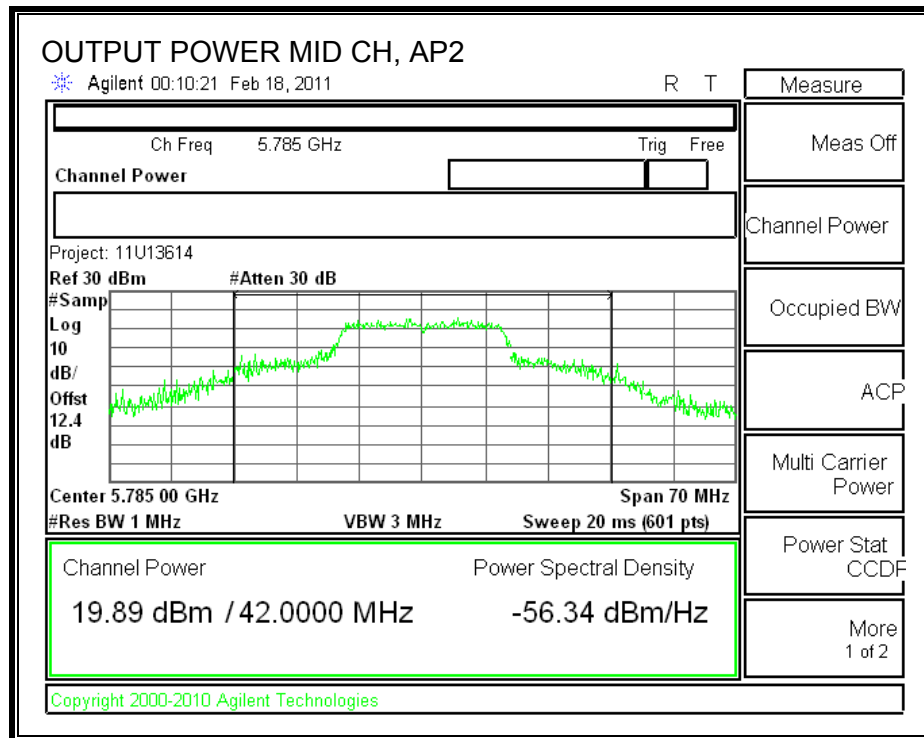
AP1 OUTPUT POWER



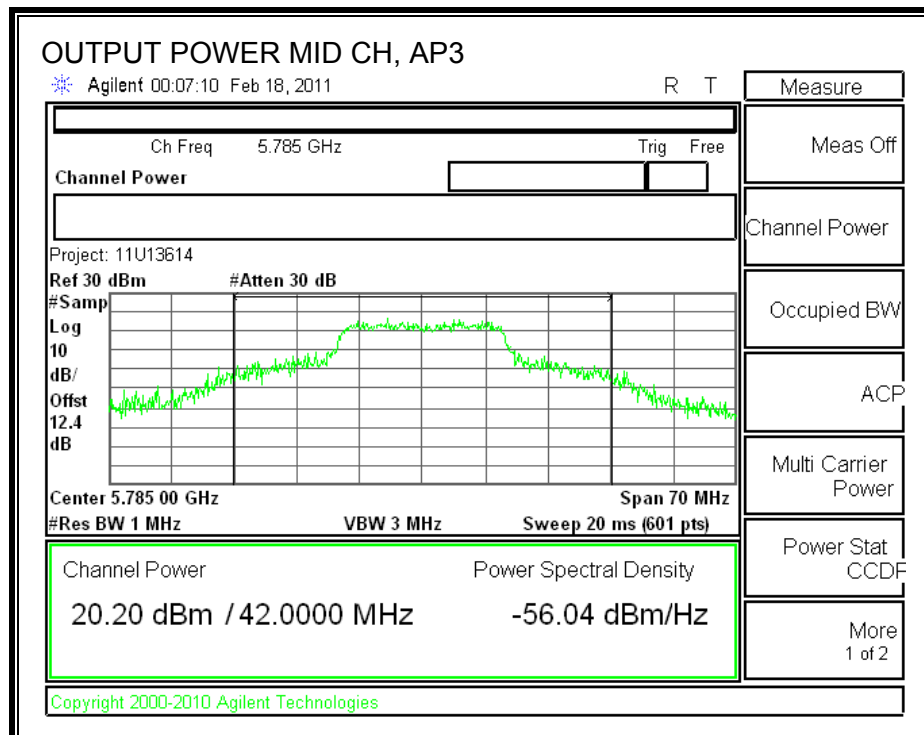
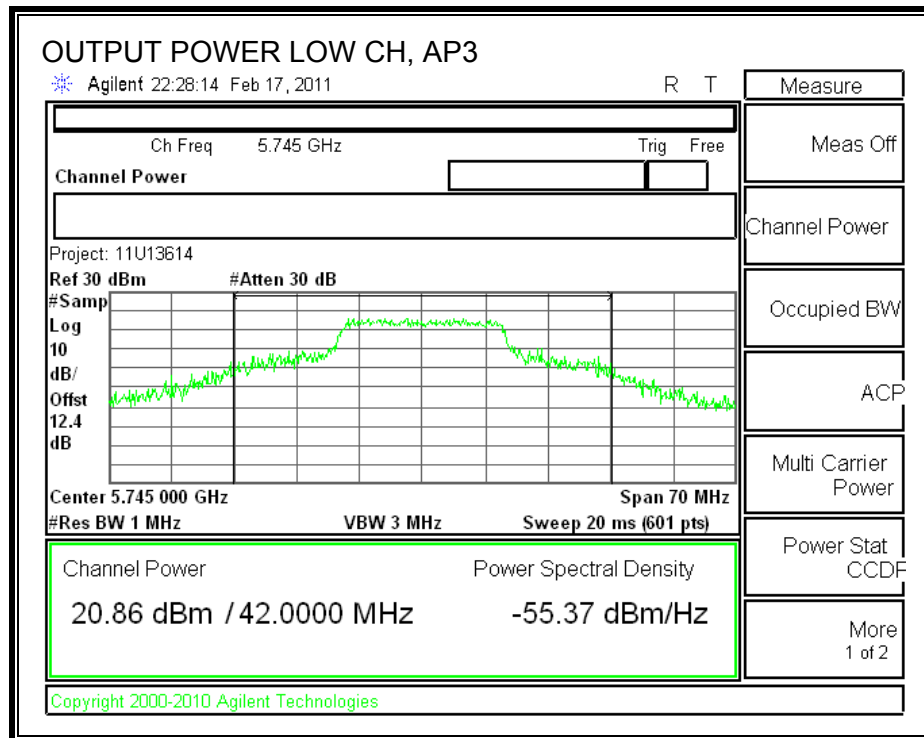


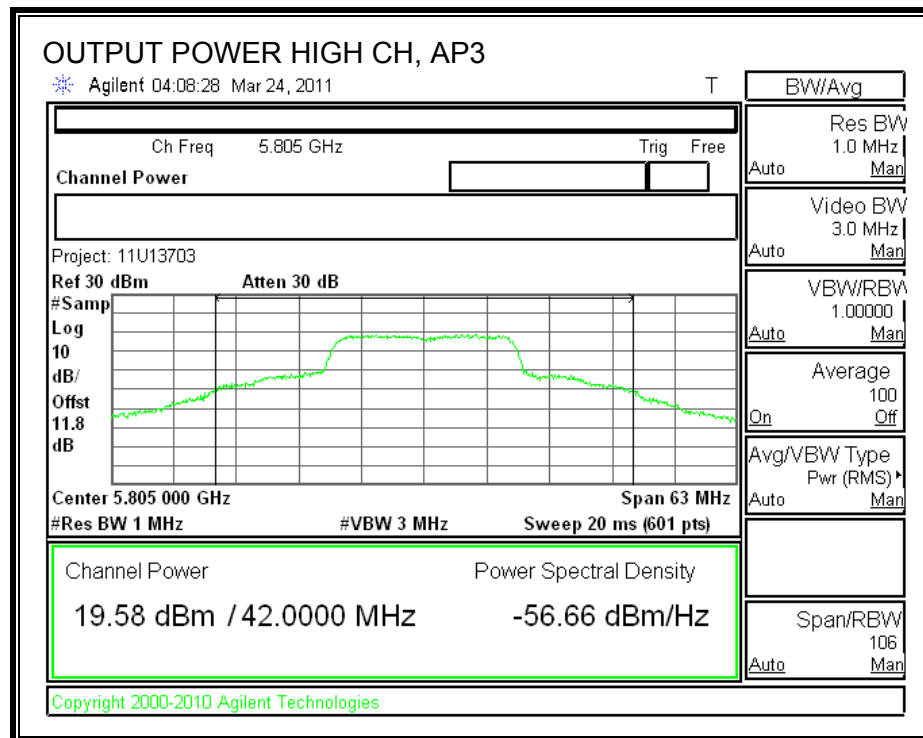
AP2 OUTPUT POWER





AP3 OUTPUT POWER





7.5.4. 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.

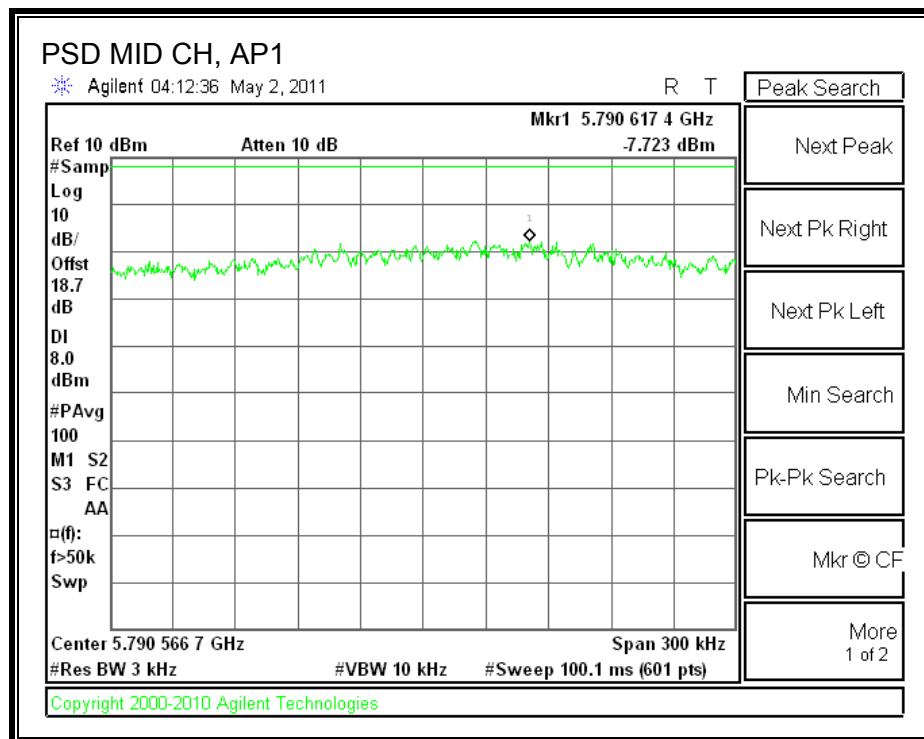
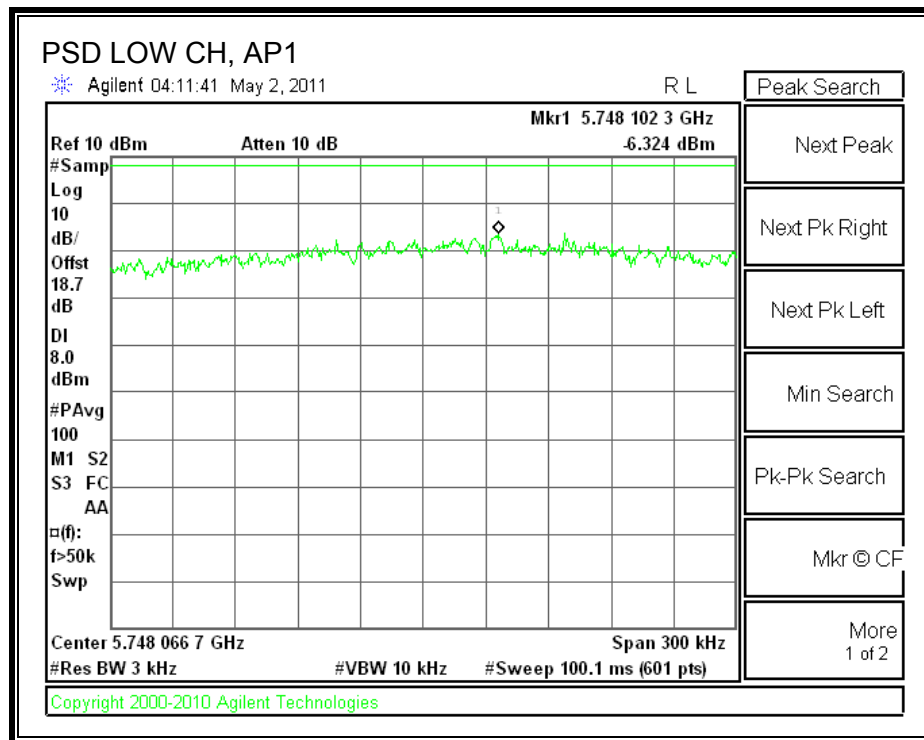
TEST PROCEDURE

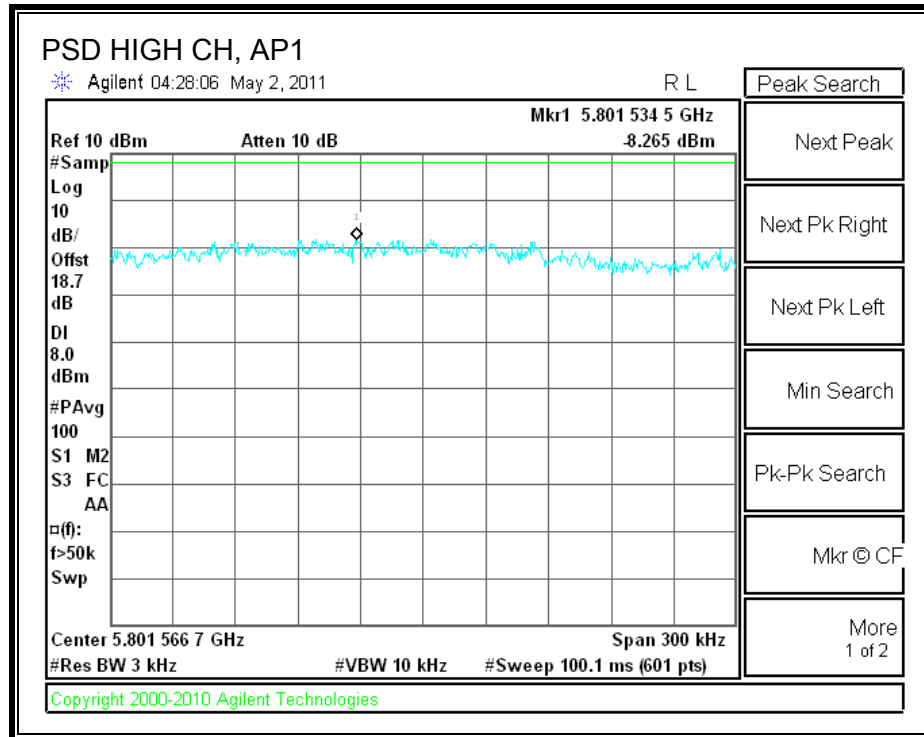
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS:

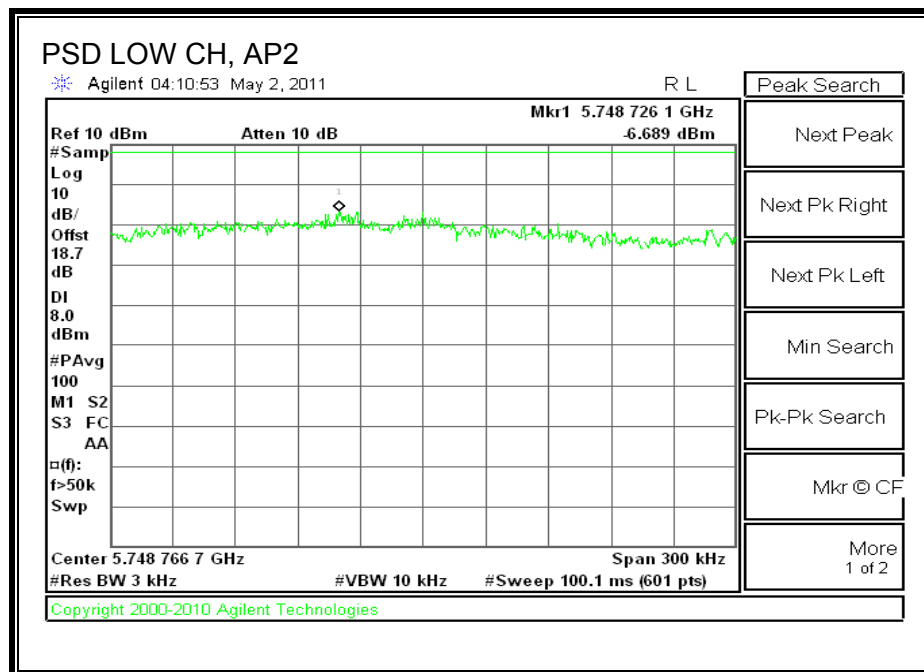
Channel	Frequency (MHz)	AP1 PSD (dBm)	AP2 PSD (dBm)	AP3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-6.324	-6.689	-7.571	-2.06	8	-10.06
Middle	5785	-7.723	-7.693	-8.078	-3.06	8	-11.06
High	5805	-8.265	-8.191	-7.975	-3.37	8	-11.37

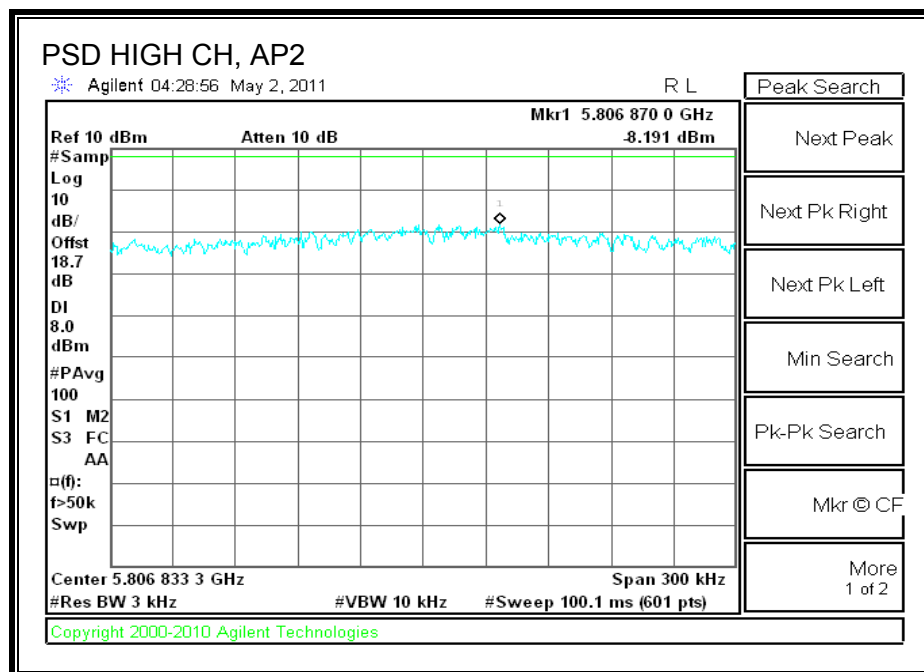
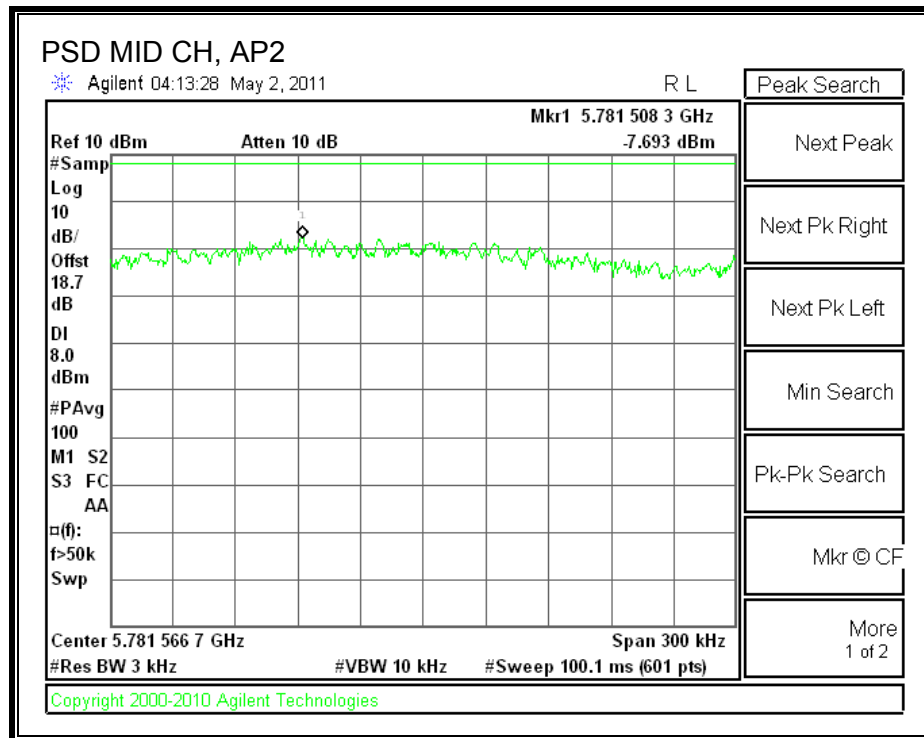
POWER SPECTRAL DENSITY, AP1



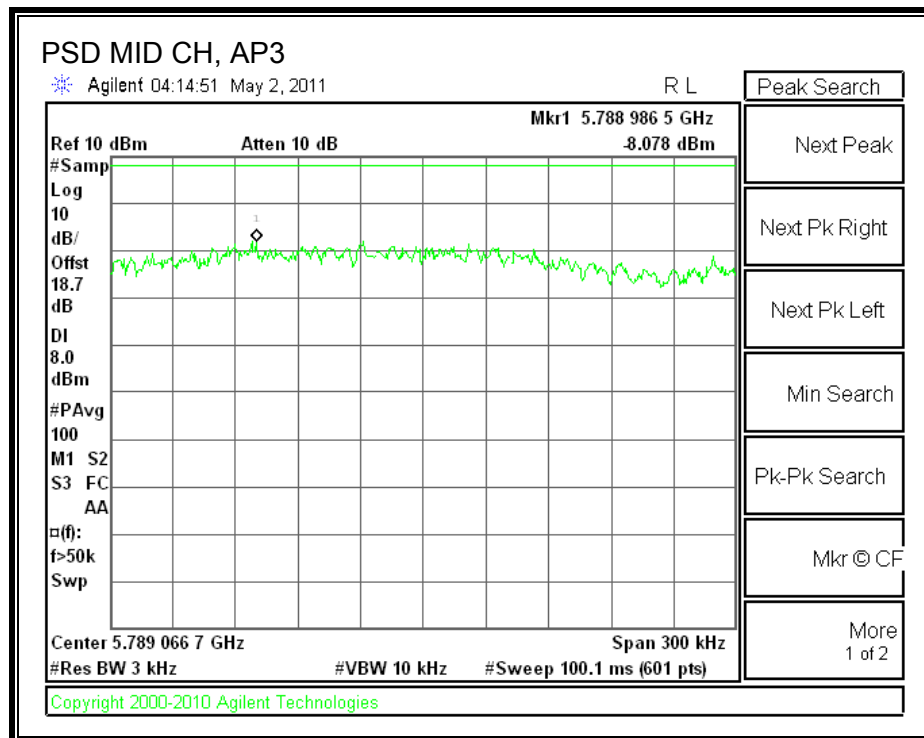
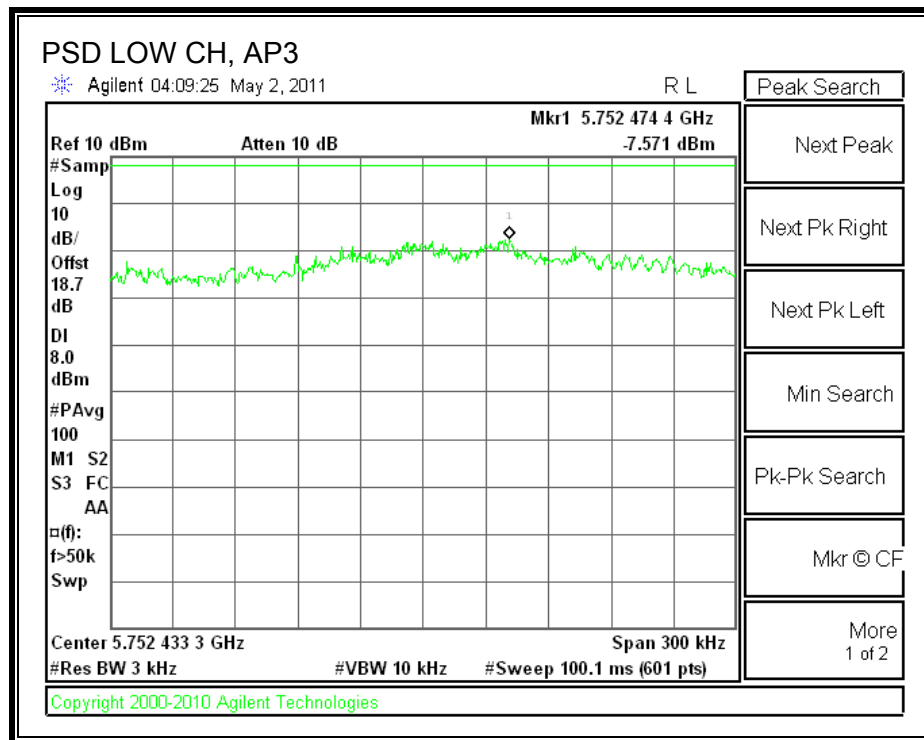


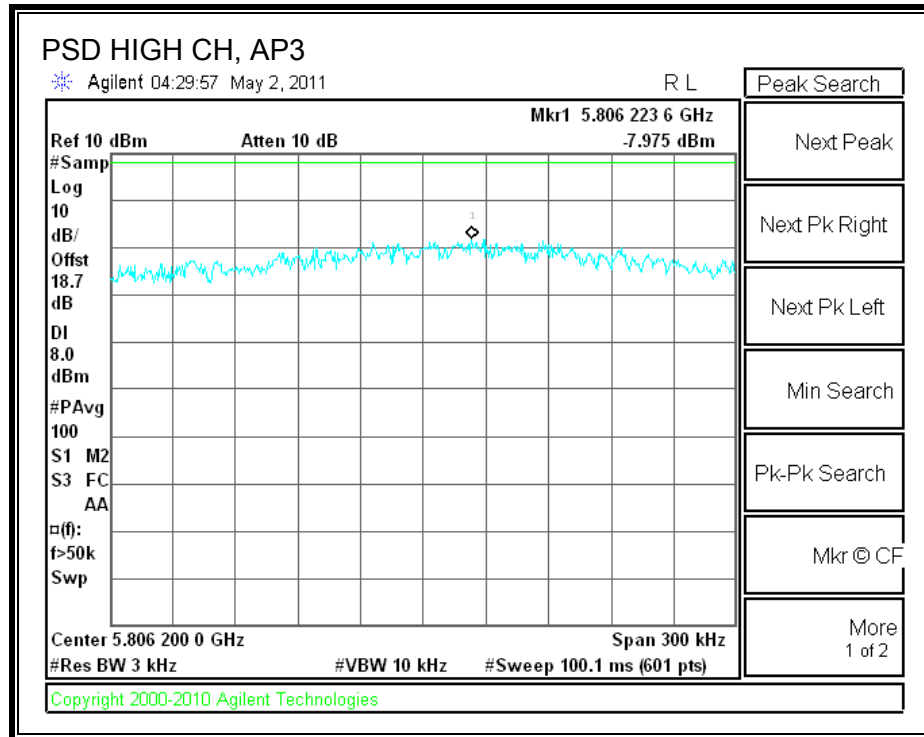
POWER SPECTRAL DENSITY, AP2





POWER SPECTRAL DENSITY, AP3





7.5.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of RMS averaging over time interval; therefore the required attenuation is 30 dB.

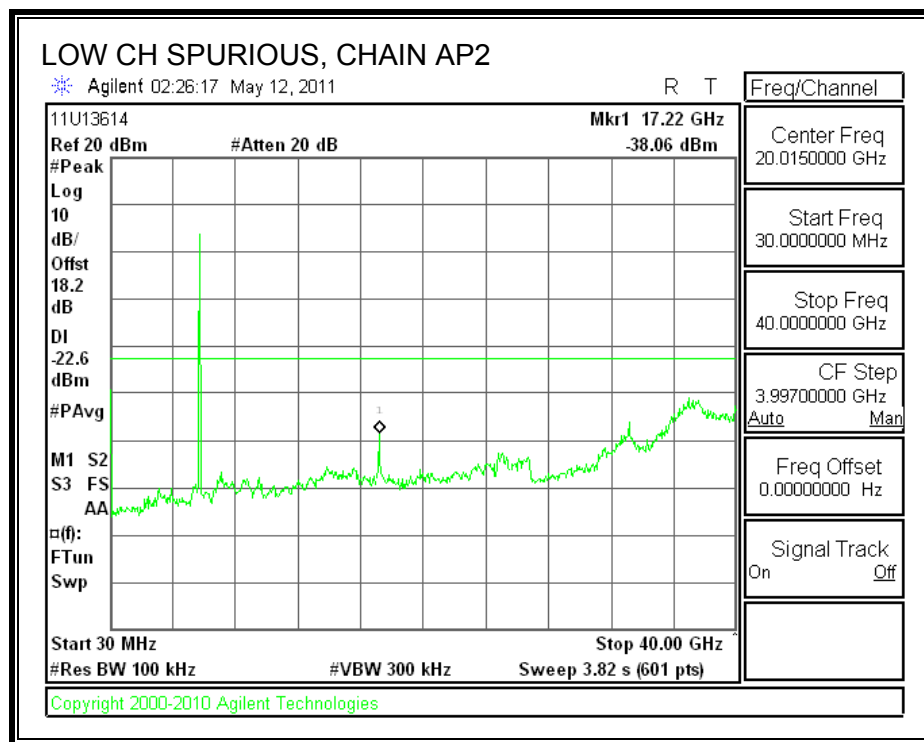
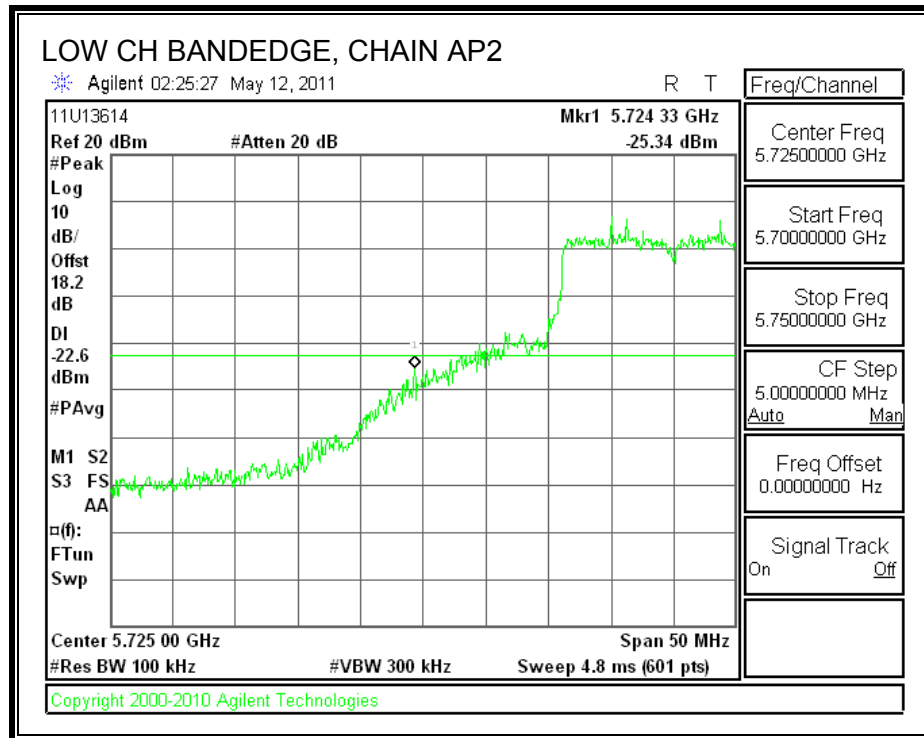
TEST PROCEDURE

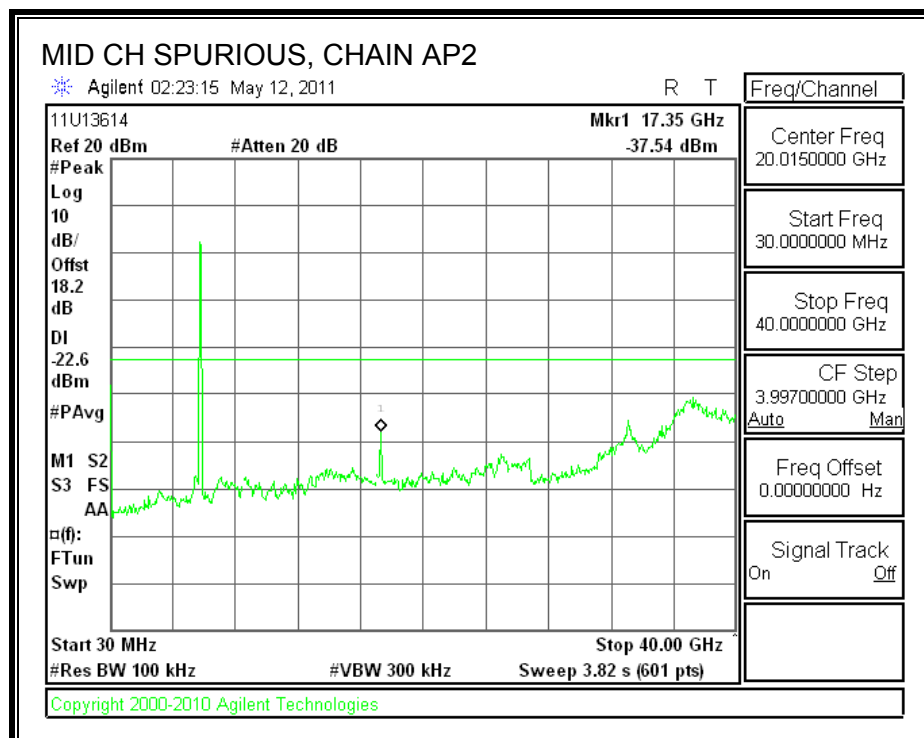
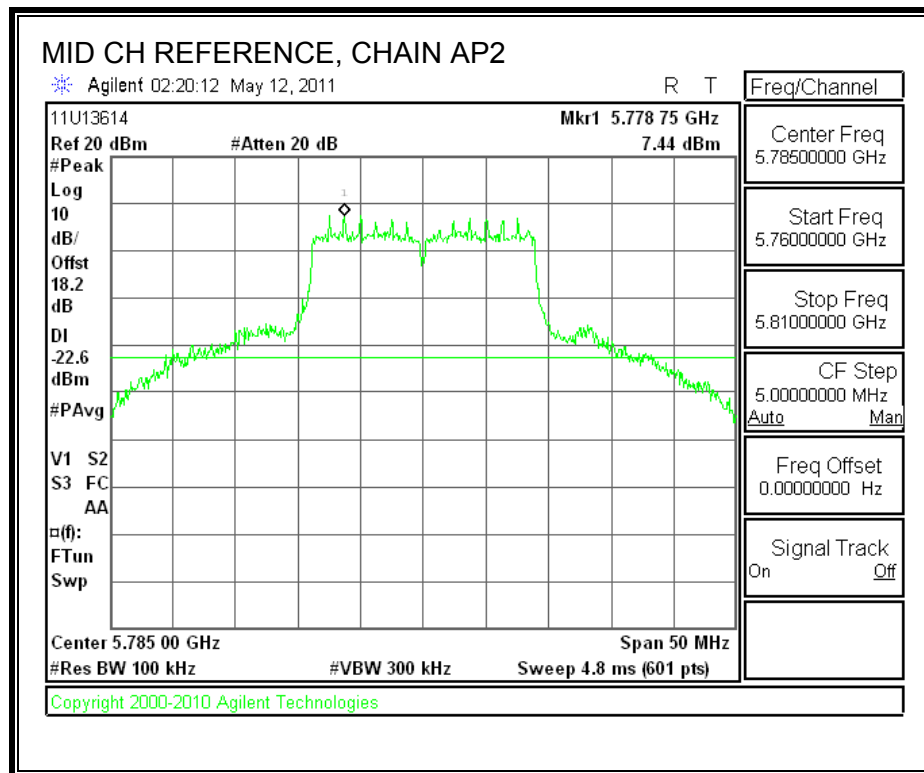
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

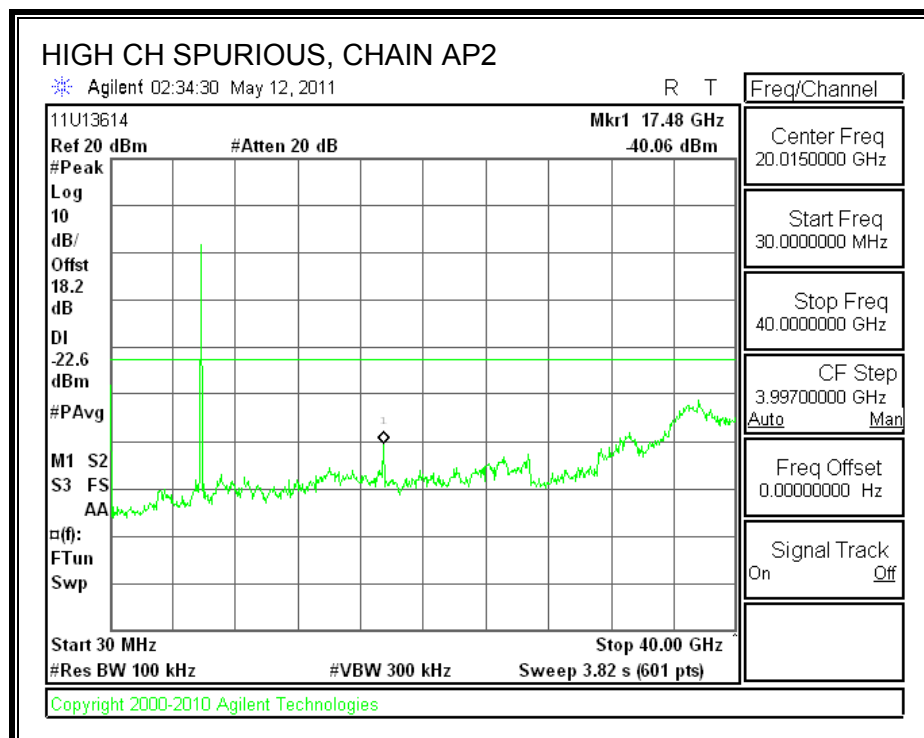
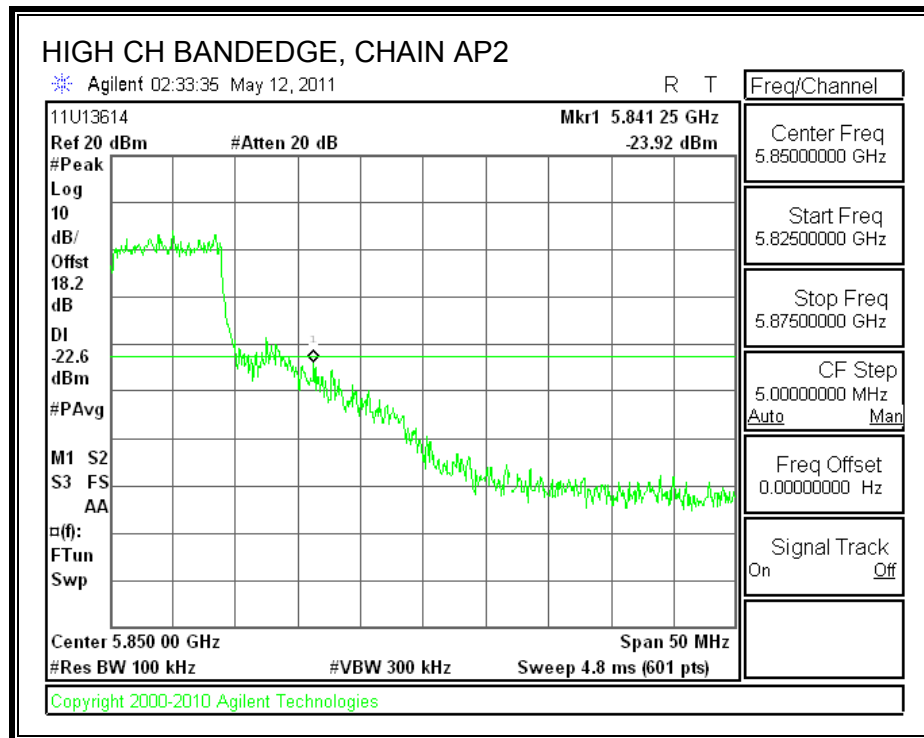
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

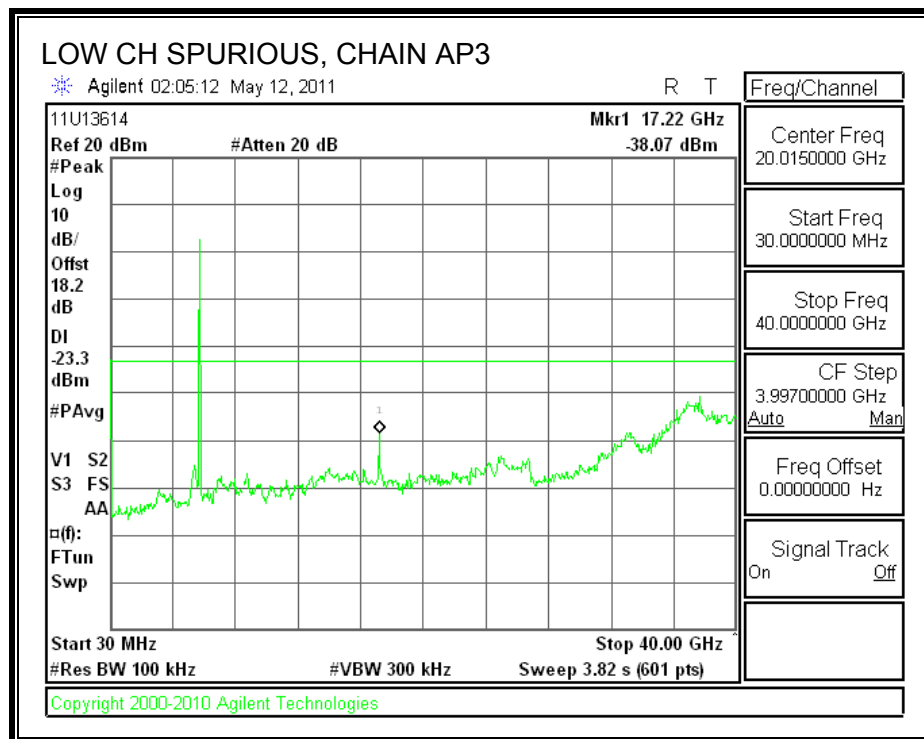
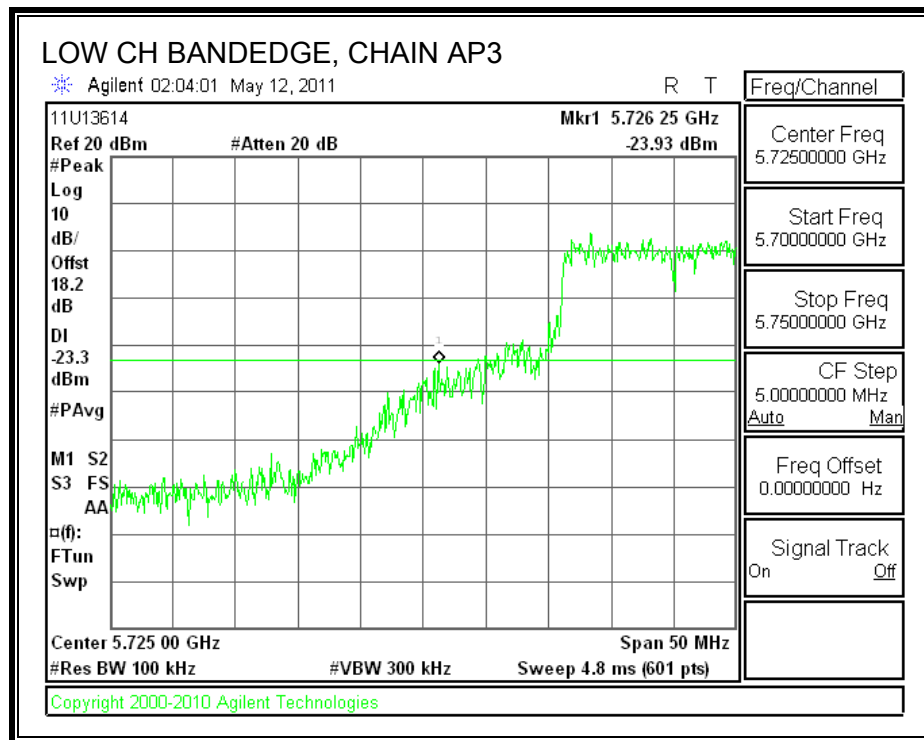
CHAIN AP2 SPURIOUS EMISSIONS

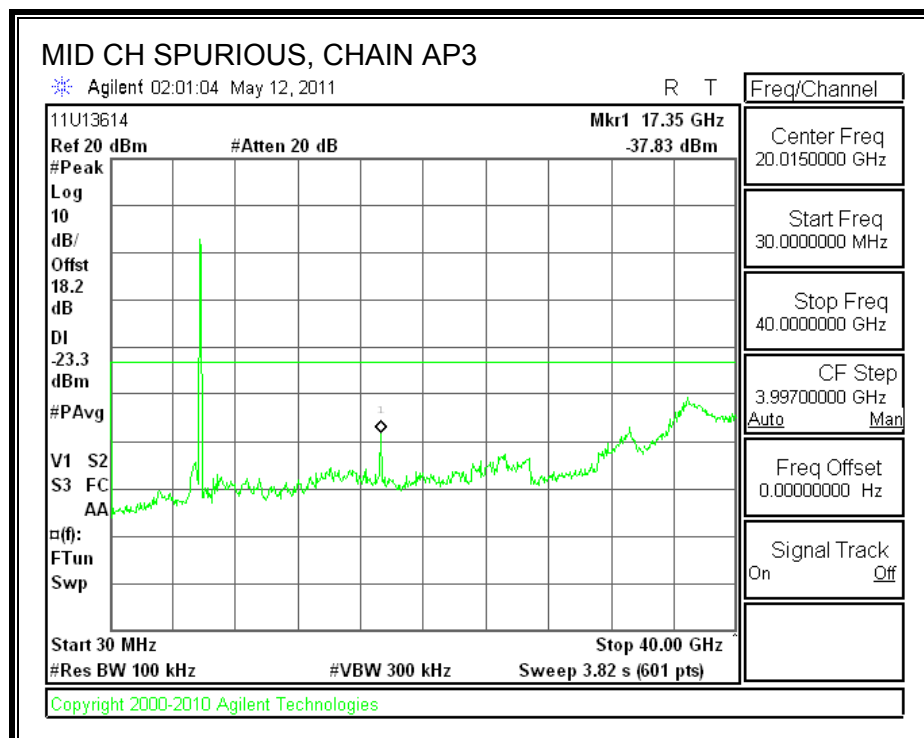
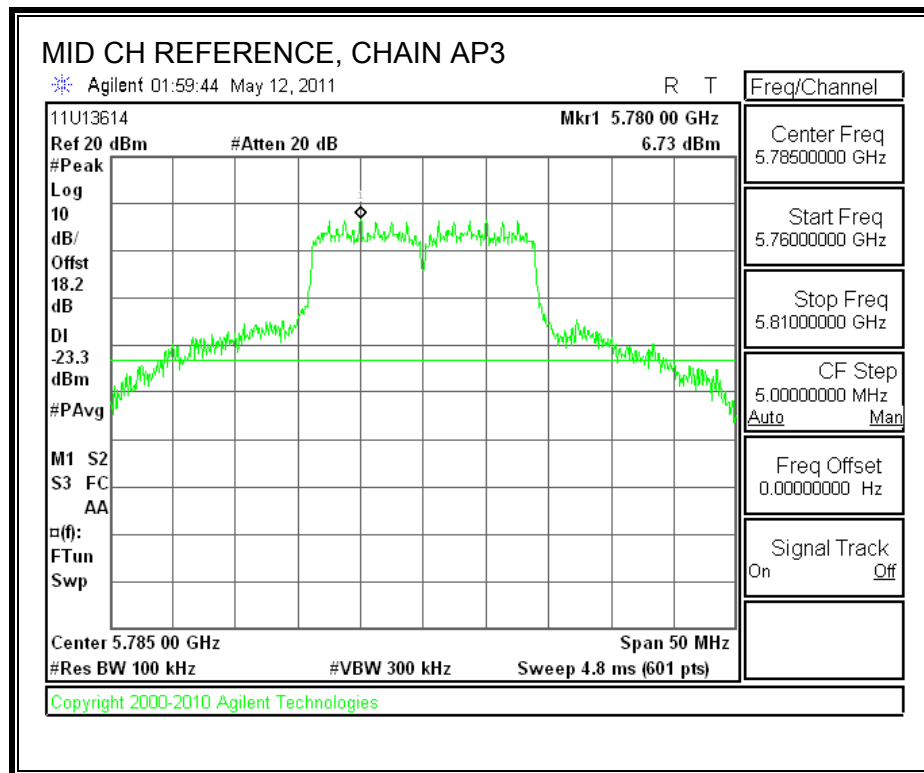


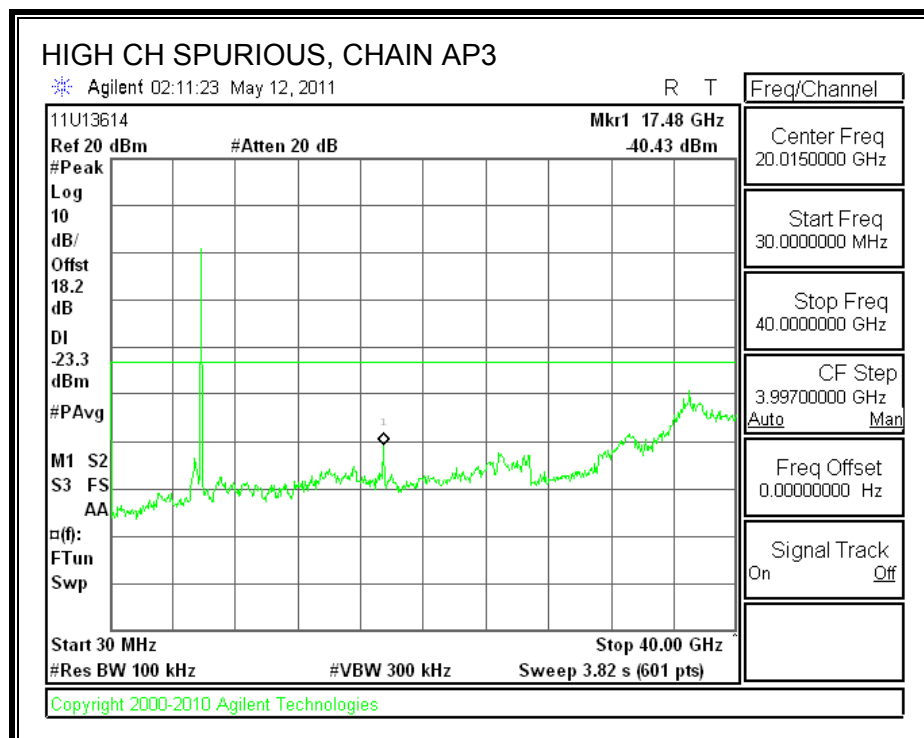
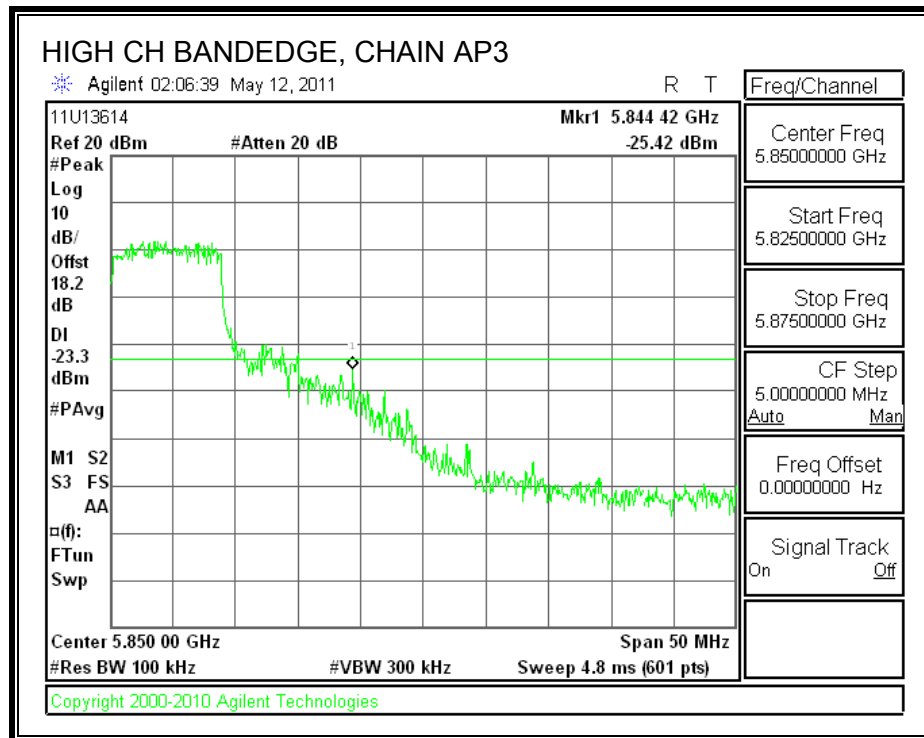




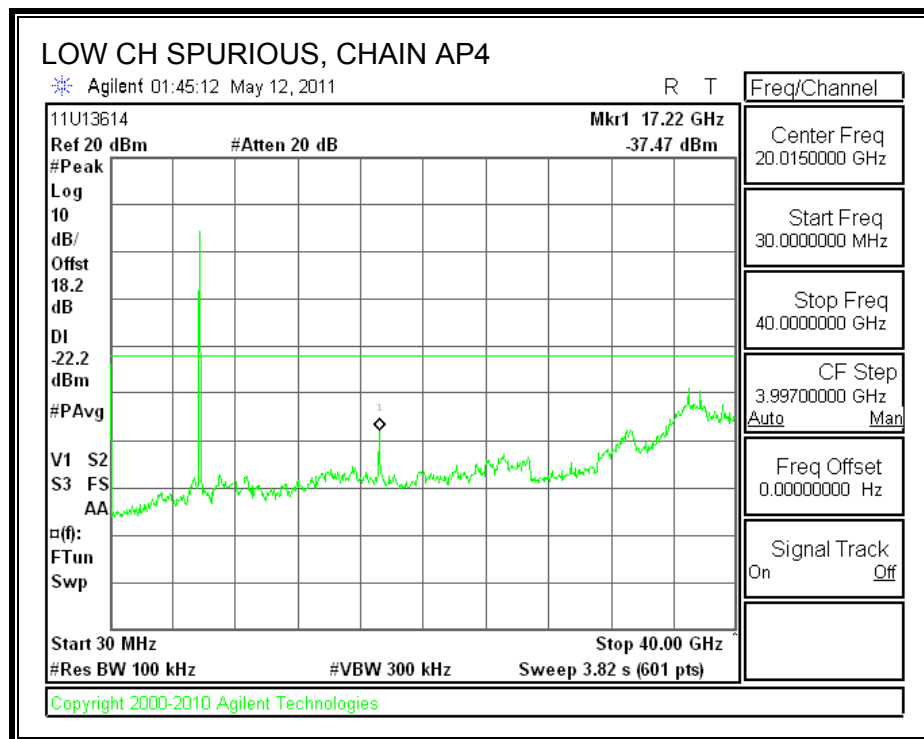
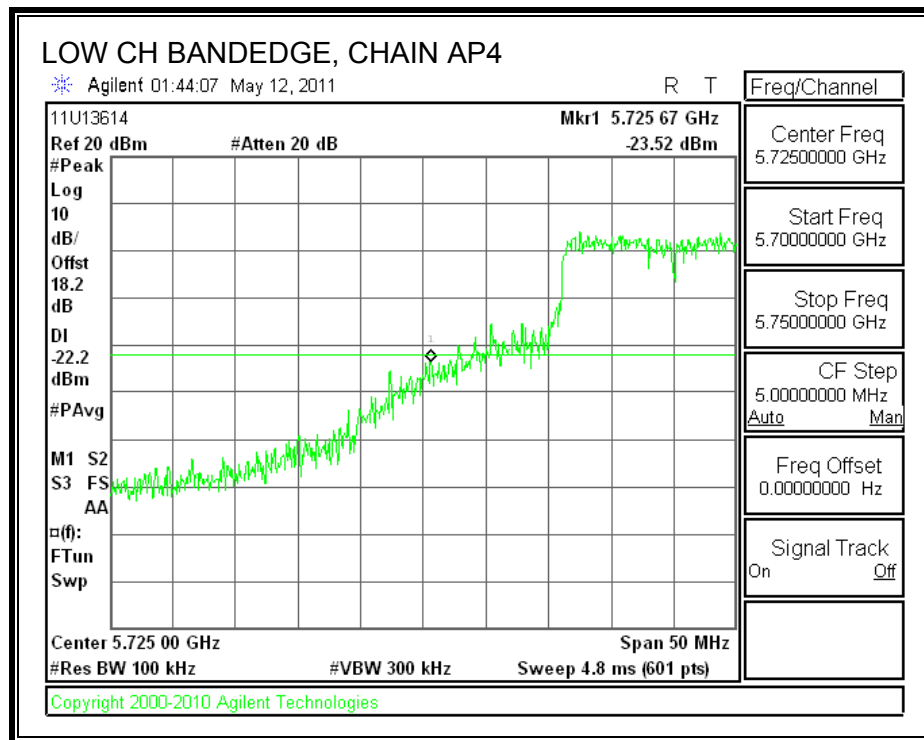
CHAIN AP3 SPURIOUS EMISSIONS

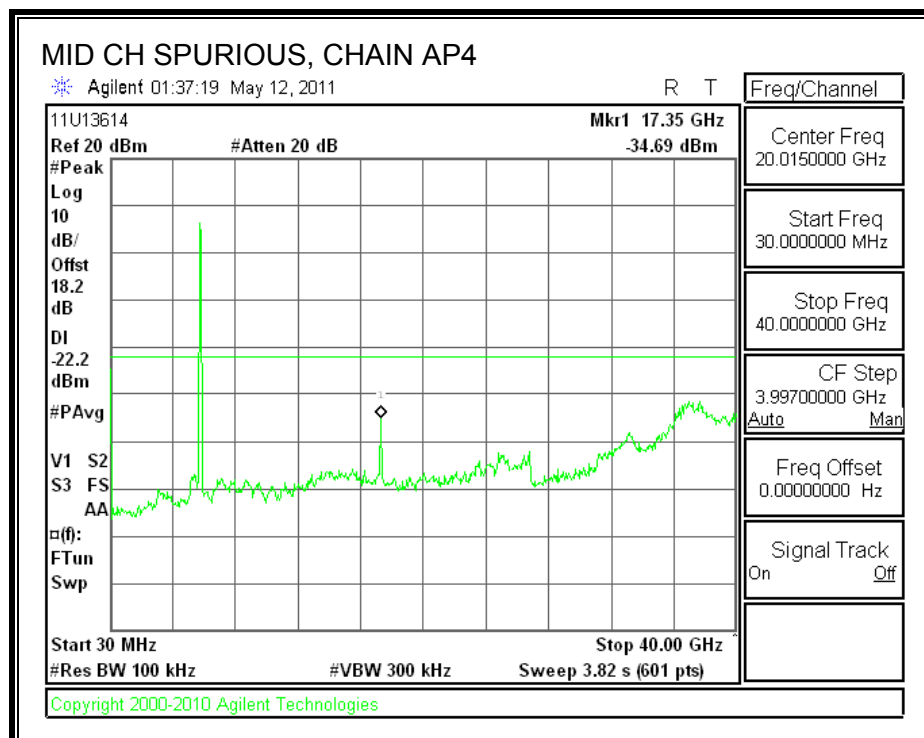
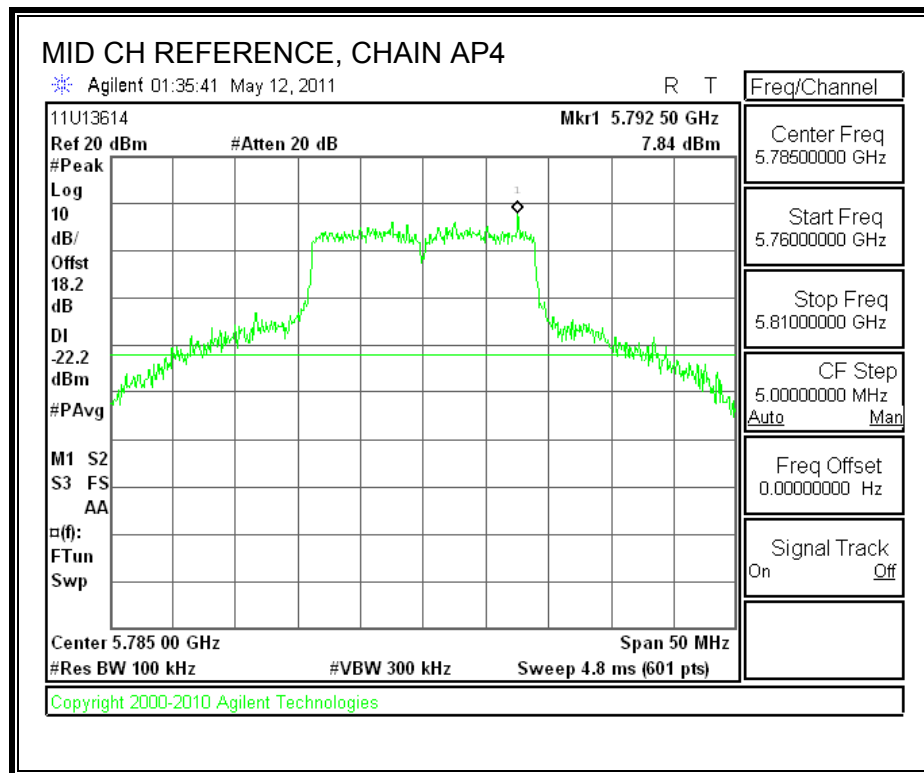


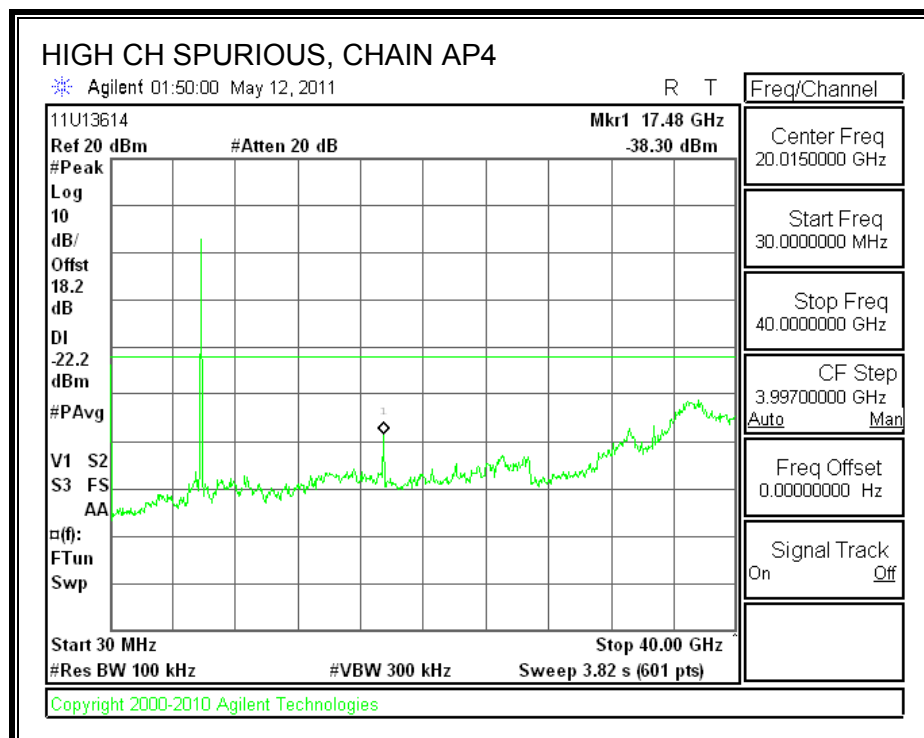
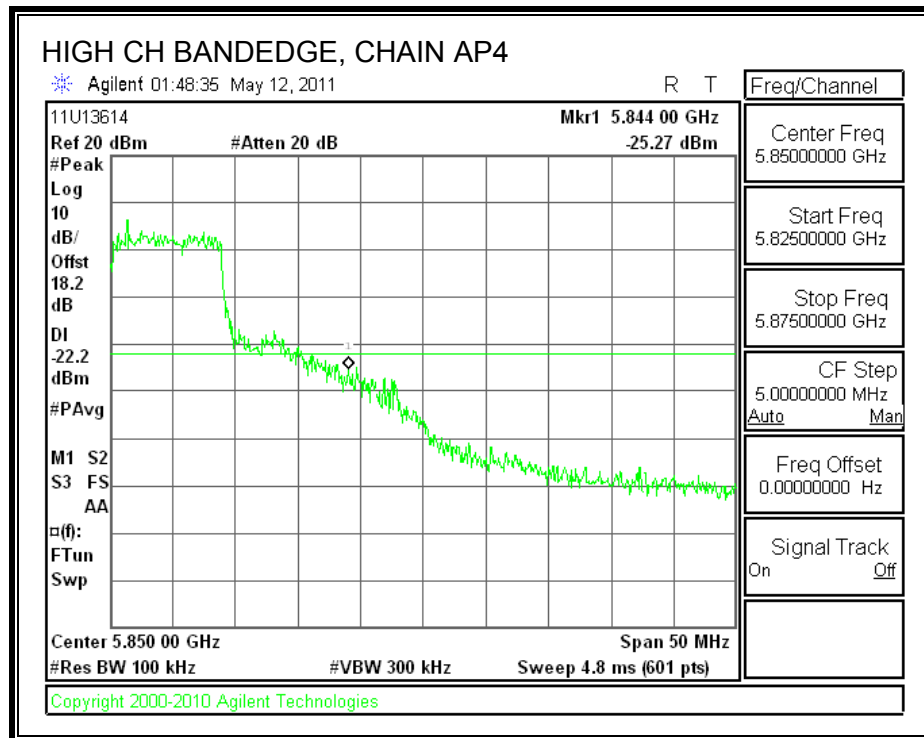




CHAIN AP4 SPURIOUS EMISSIONS







7.6. 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND

7.6.1. 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.

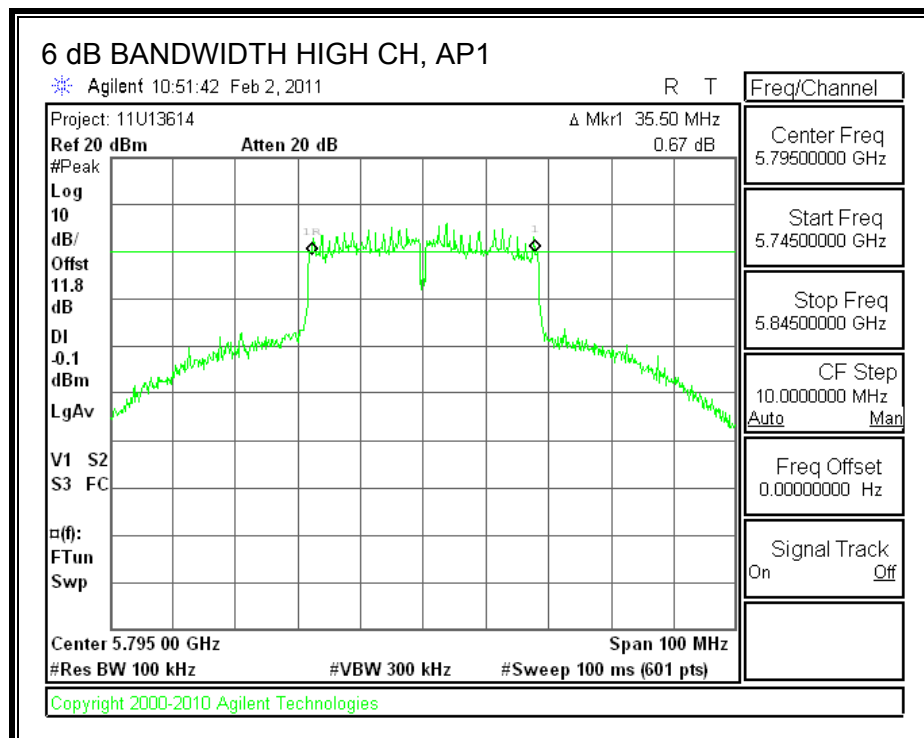
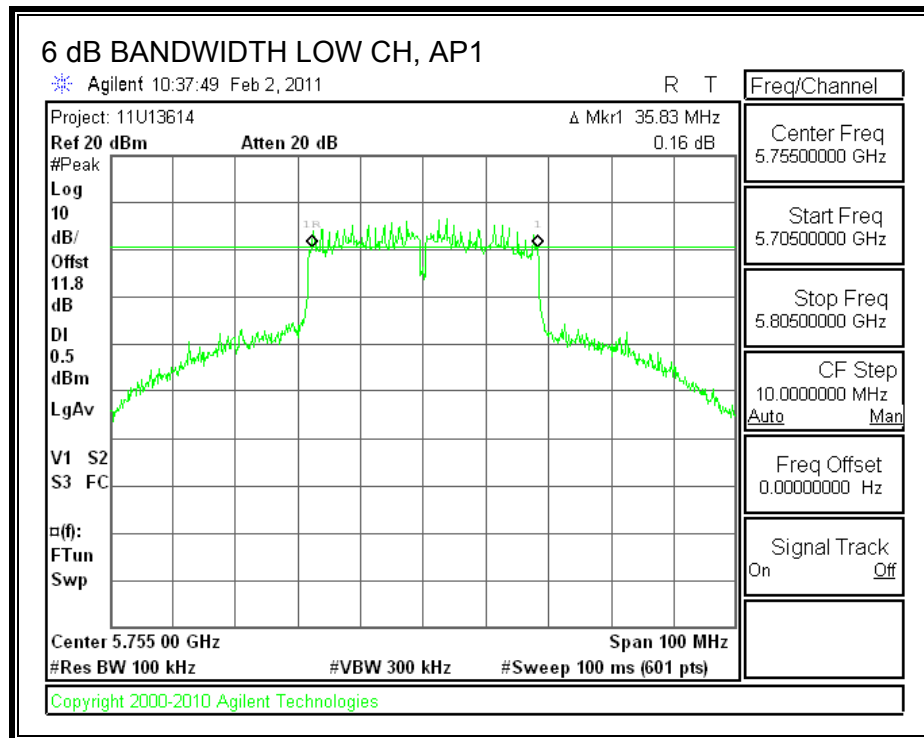
TEST PROCEDURE

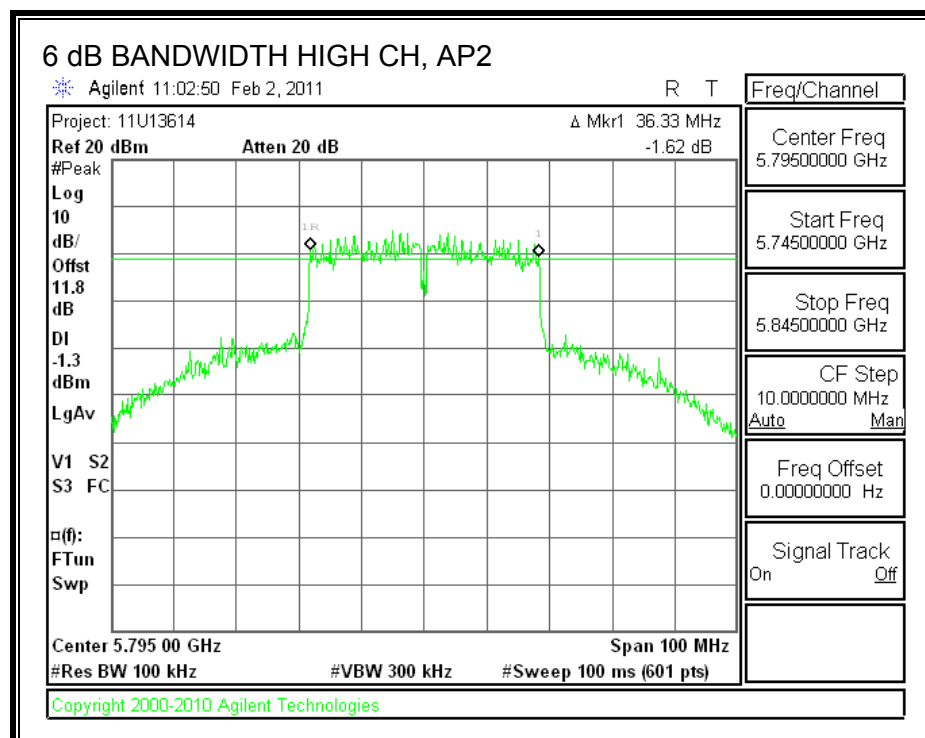
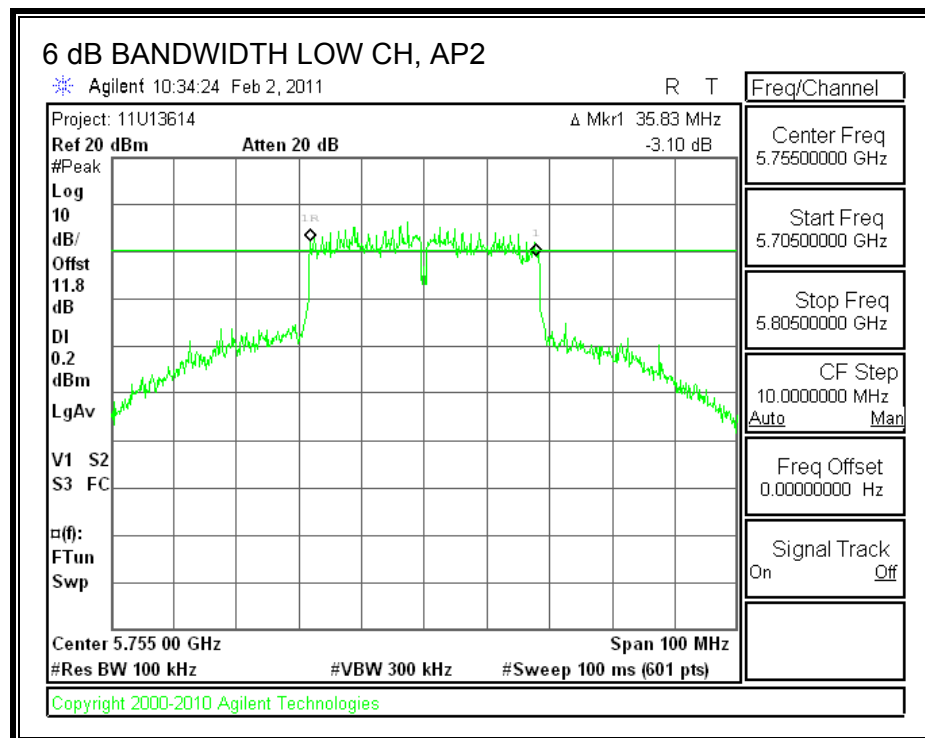
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

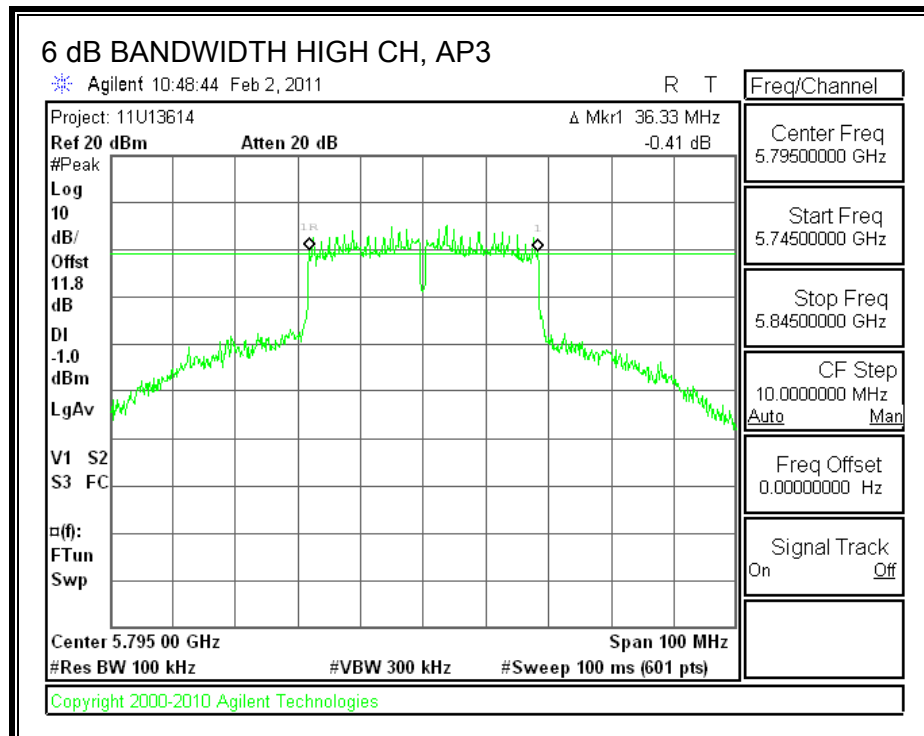
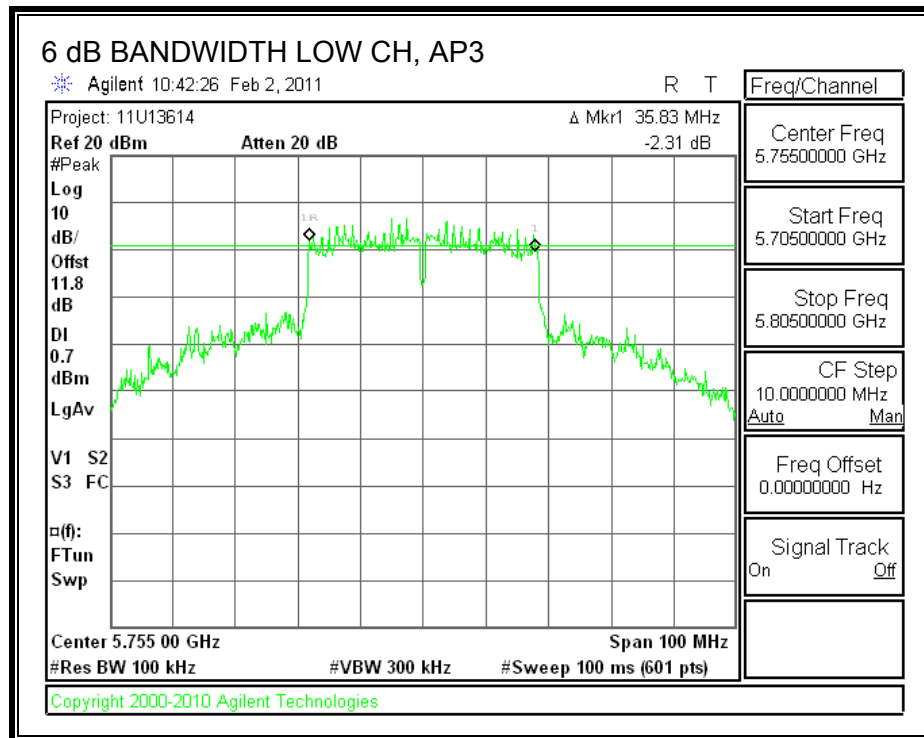
Channel	Frequency (MHz)	AP1 6 dB BW (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5755	35.83	35.83	35.83	0.5
High	5795	35.5	36.33	36.33	0.5

6 dB BANDWIDTH, AP1





6 dB BANDWIDTH, AP3



7.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

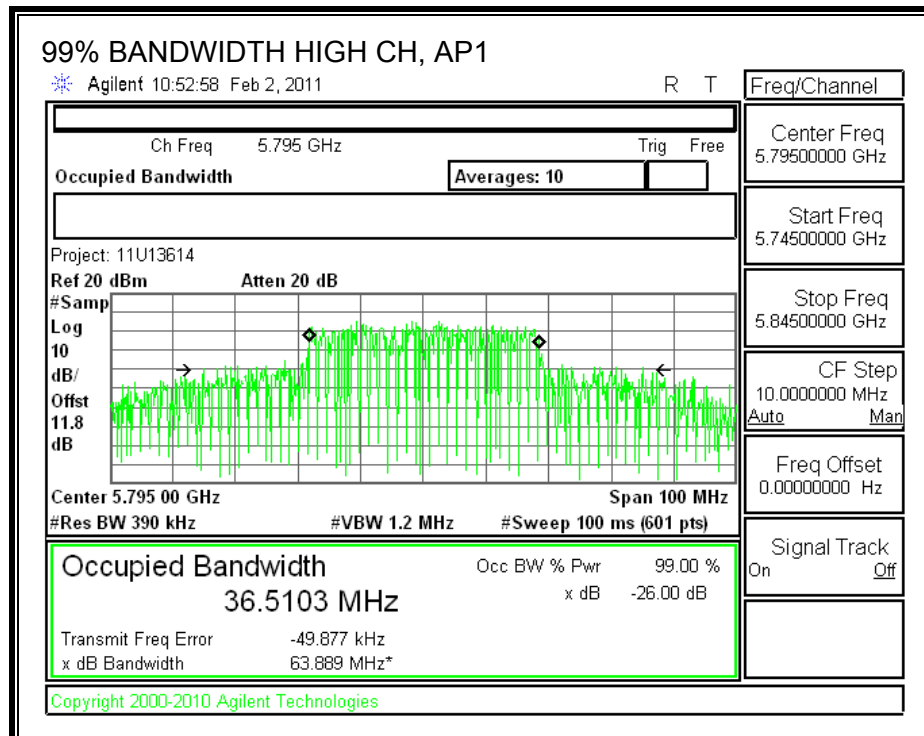
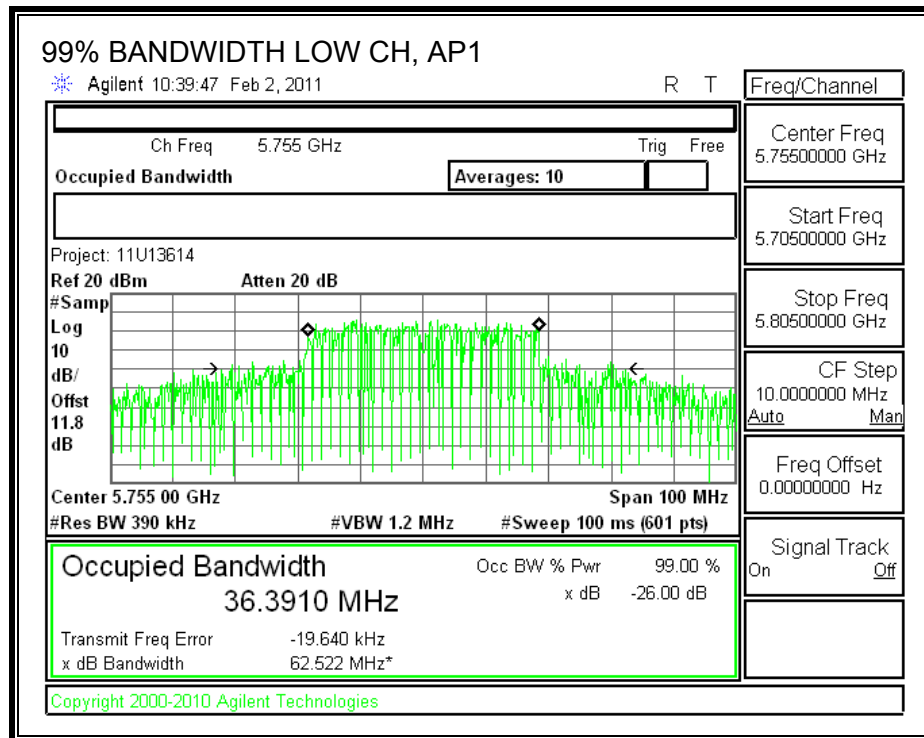
TEST PROCEDURE

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.

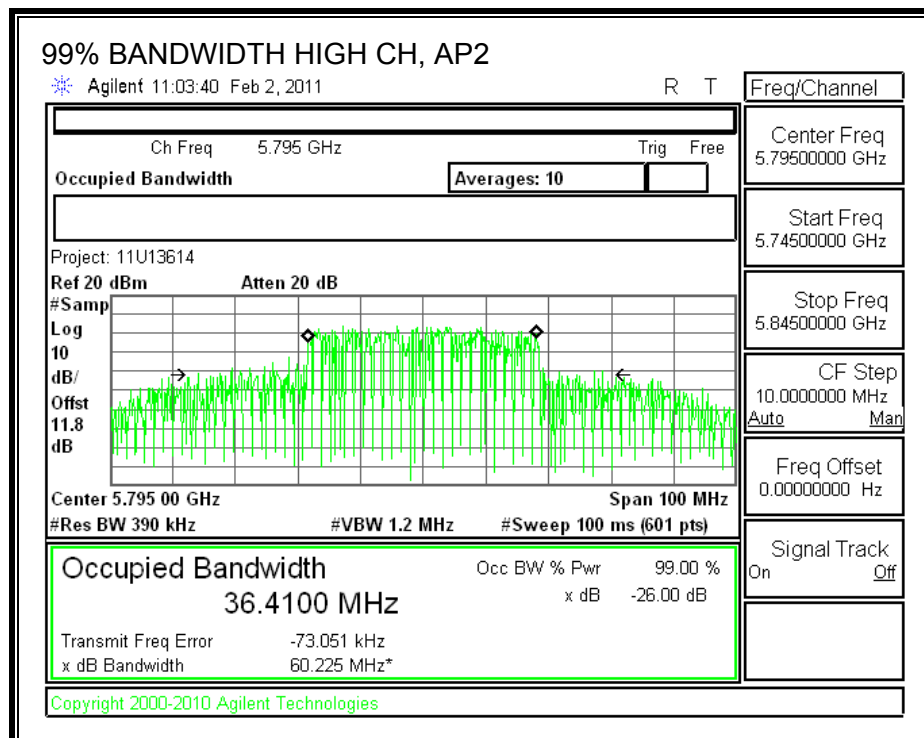
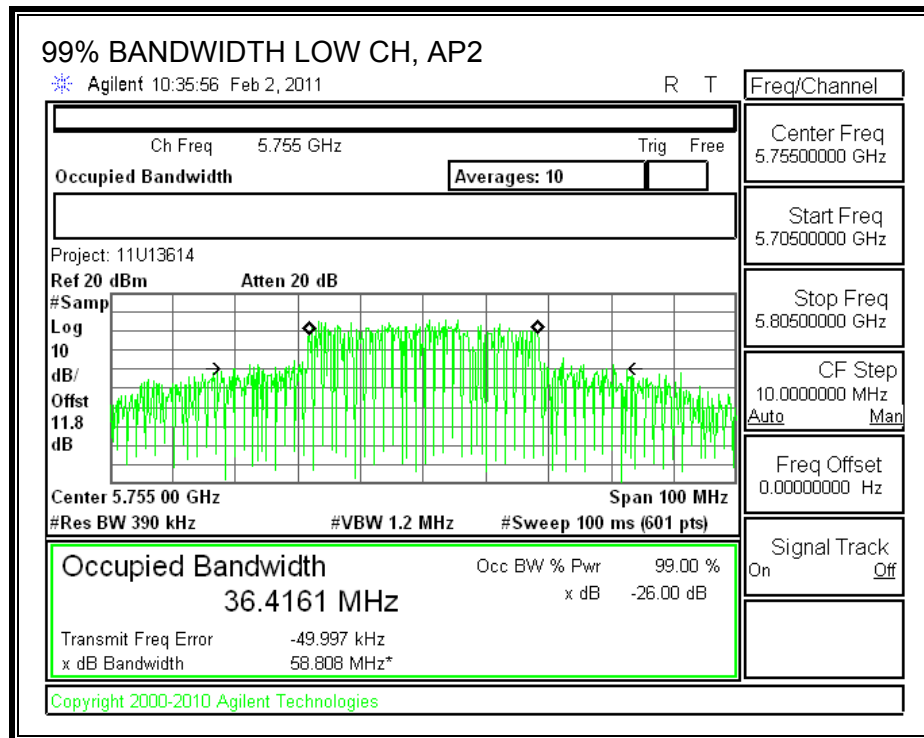
RESULTS

Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	5755	36.391	36.4161	36.6136
High	5795	36.5103	36.41	36.3818

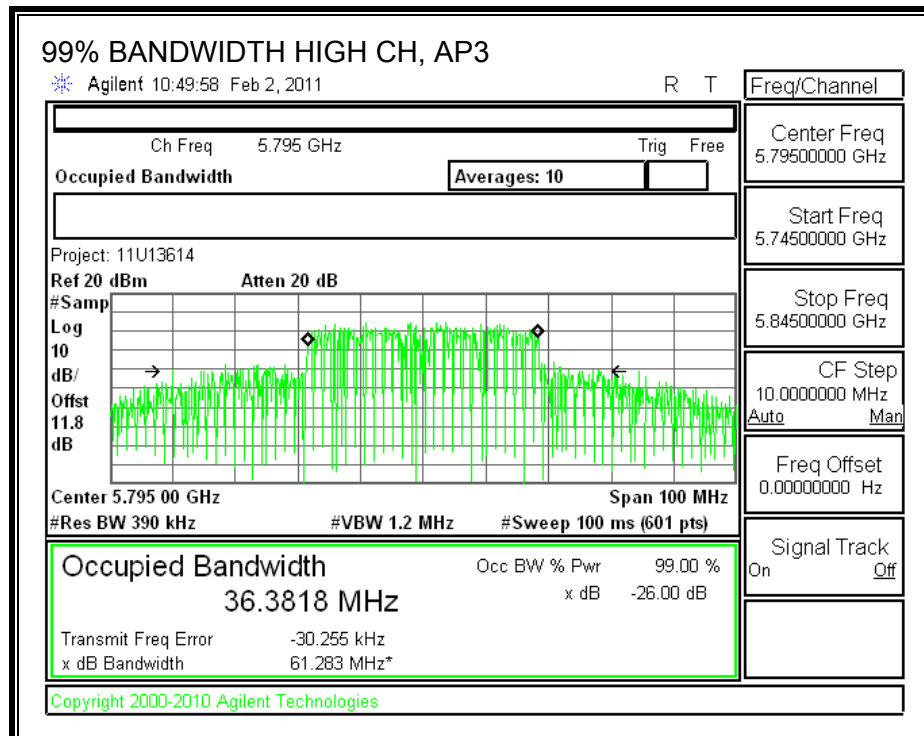
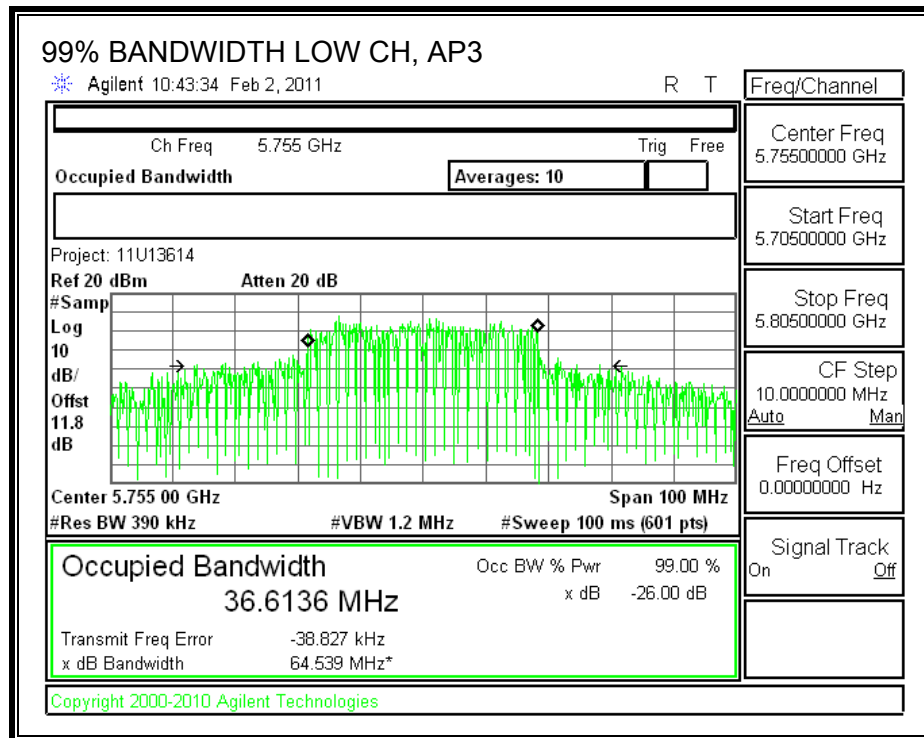
99% BANDWIDTH, AP1



99% BANDWIDTH, AP2



99% BANDWIDTH, AP3



7.6.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to **4.38 dBi**, therefore the limit is 30 dBm.

TEST PROCEDURE

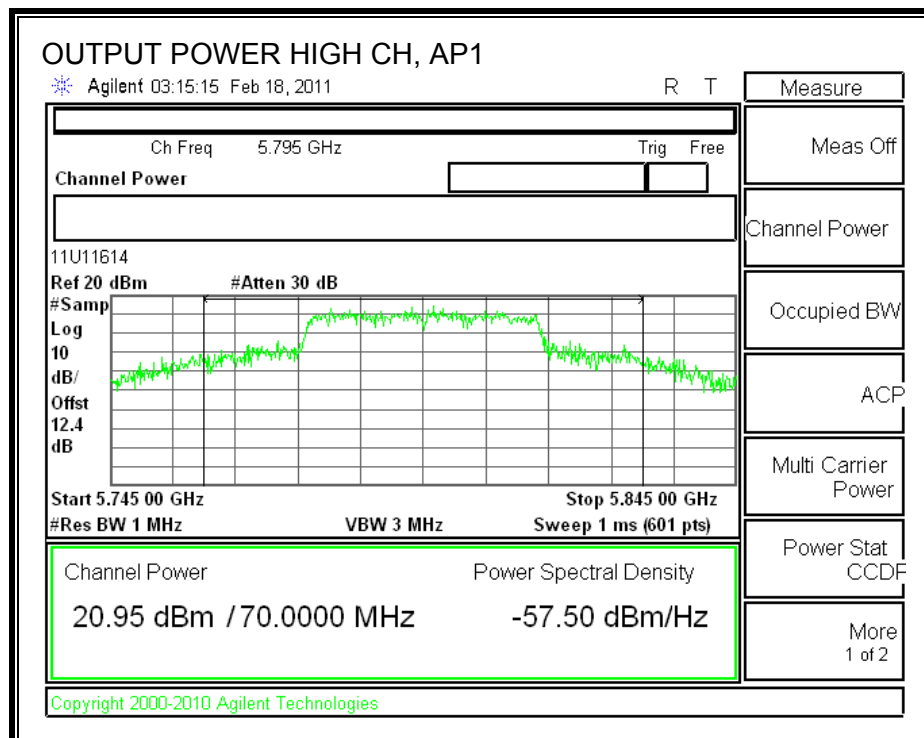
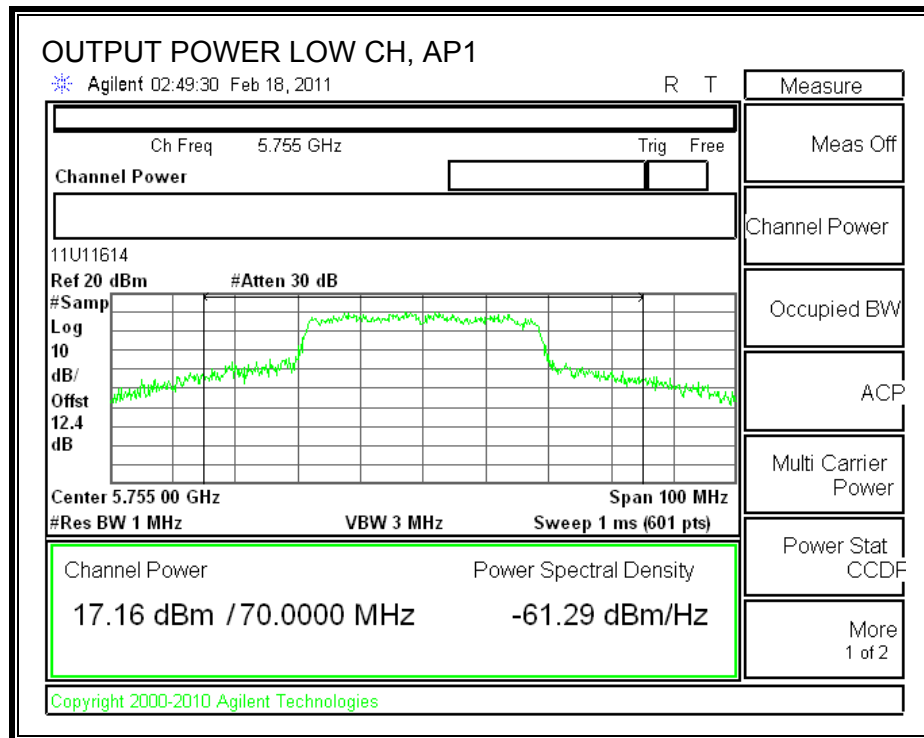
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

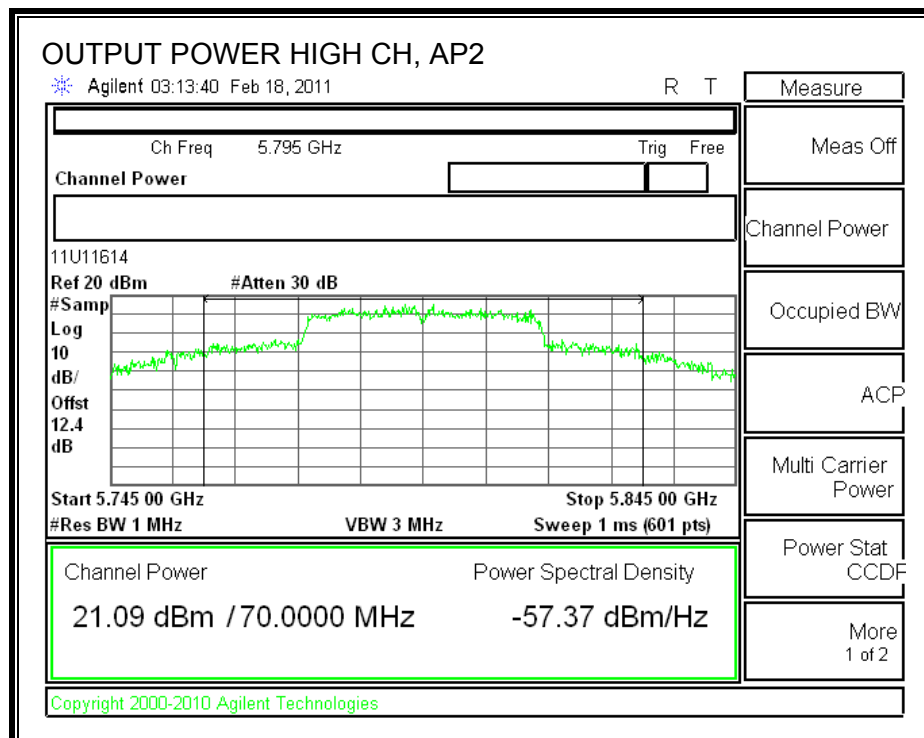
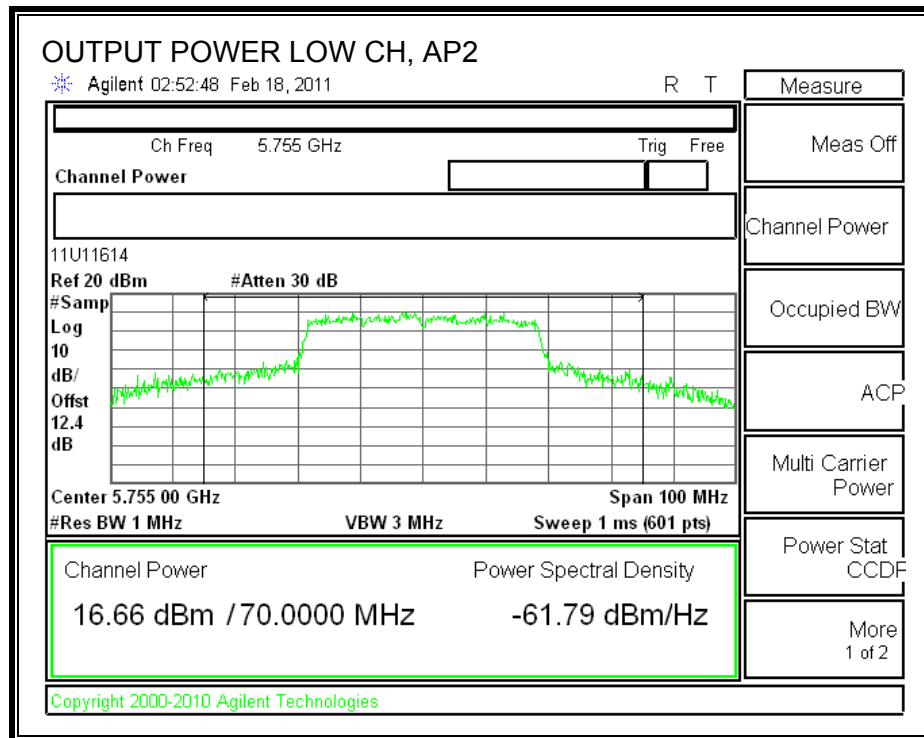
RESULTS

Channel	Frequency (MHz)	AP1 Power (dBm)	AP2 Power (dBm)	AP3 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5755	17.16	16.66	17.87	0.00	22.03	30.00	-7.97
High	5795	20.95	21.09	21.45	0.00	25.94	30.00	-4.06

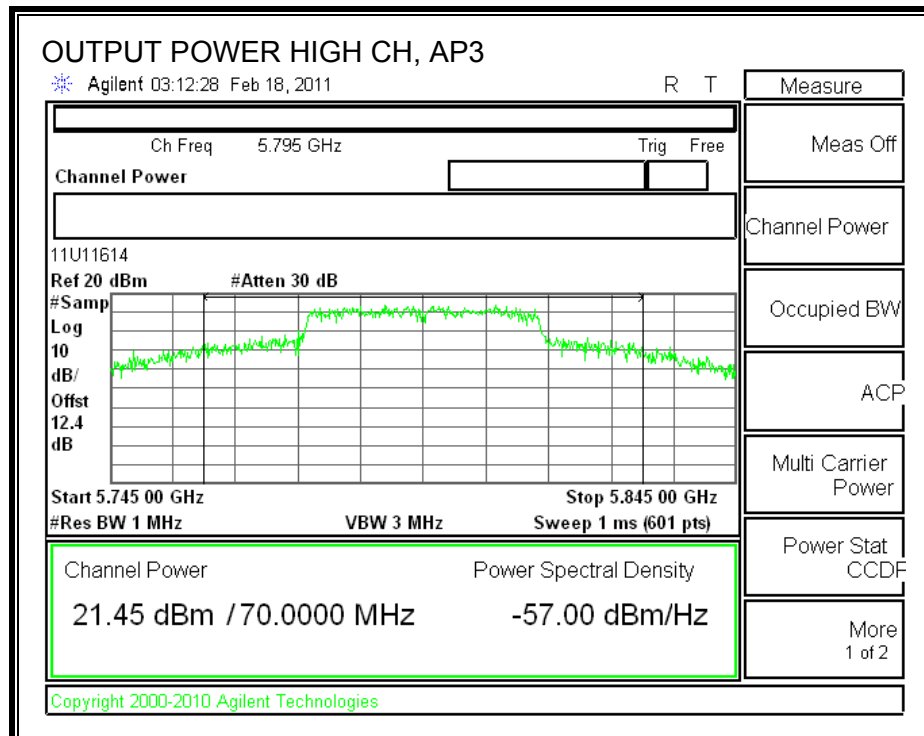
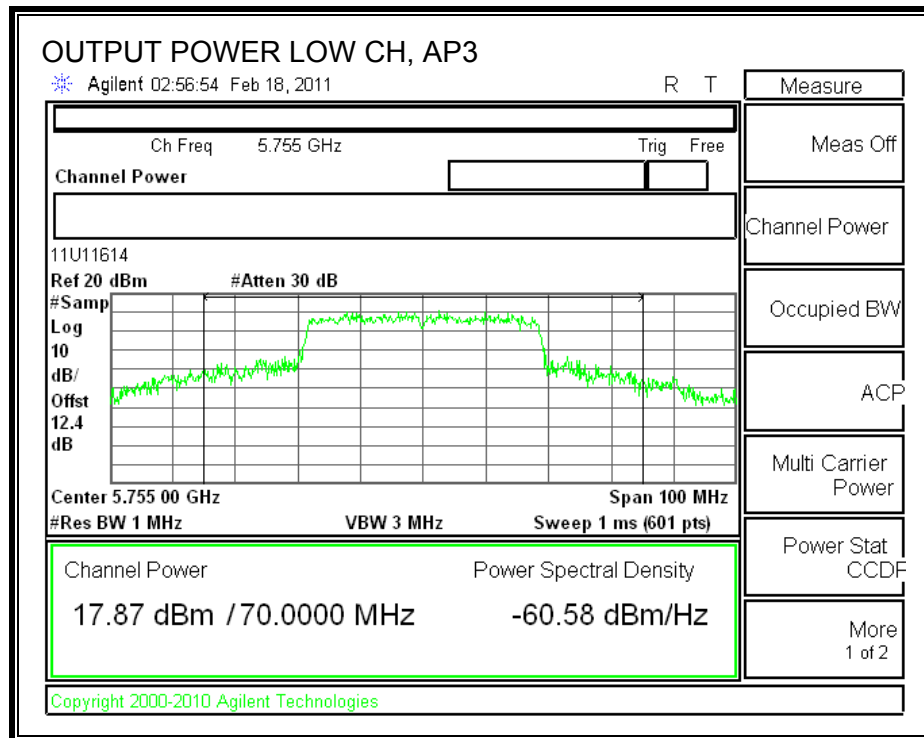
AP1 OUTPUT POWER



AP2 OUTPUT POWER



AP3 OUTPUT POWER



7.6.4. 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.

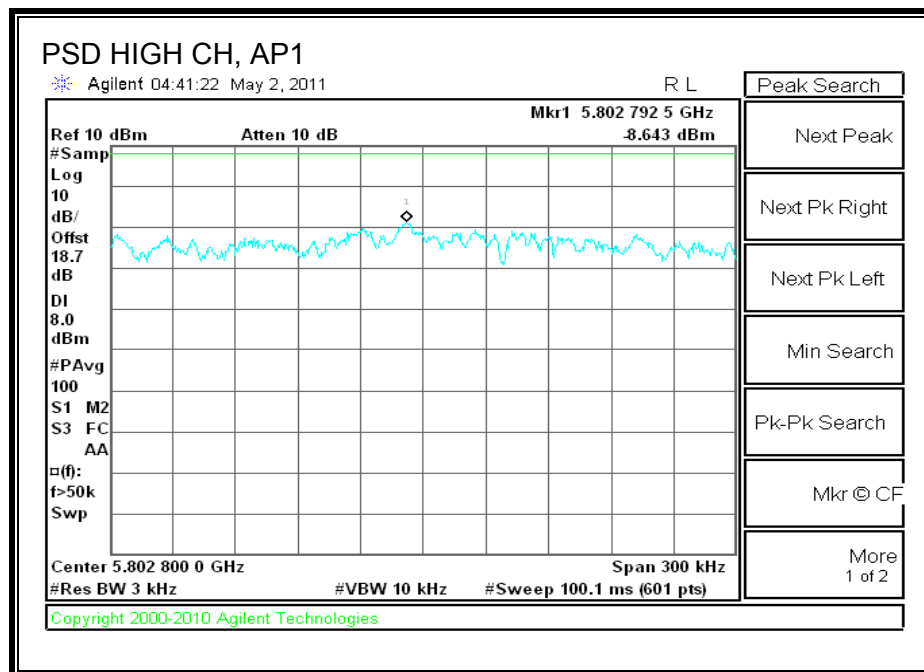
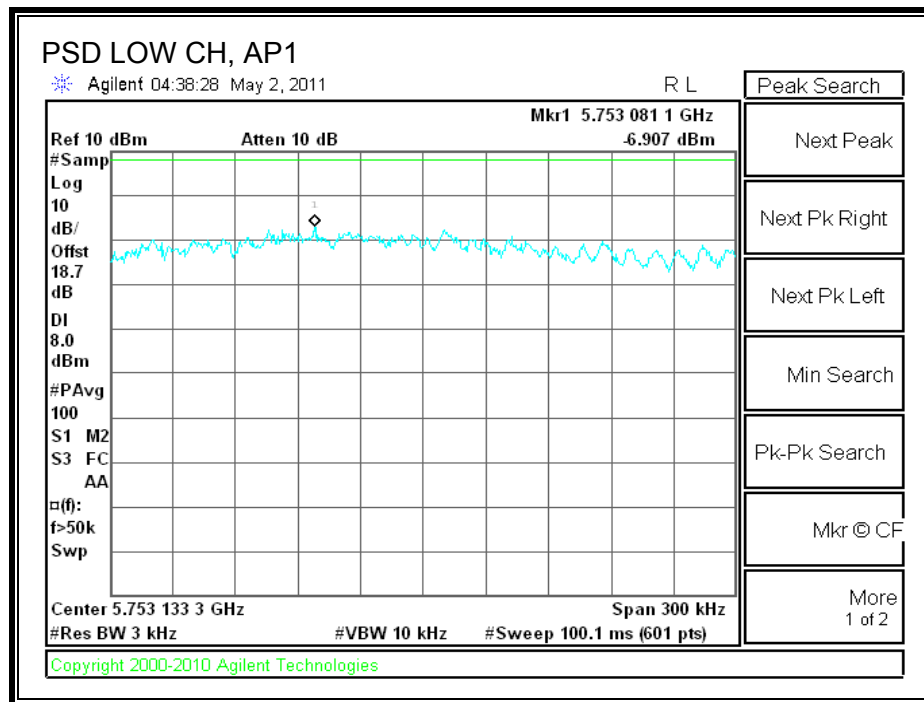
TEST PROCEDURE

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.

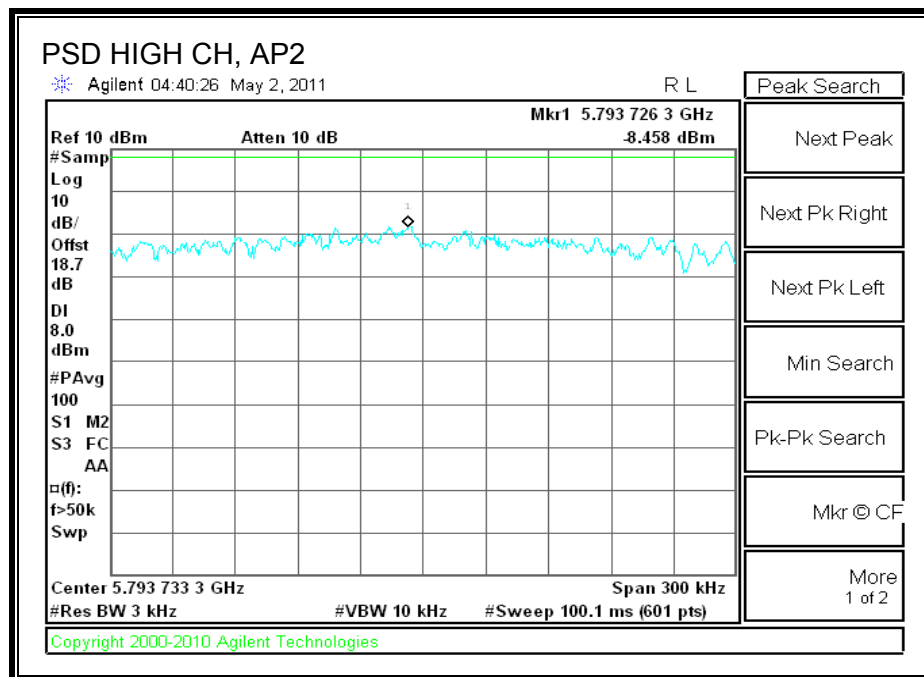
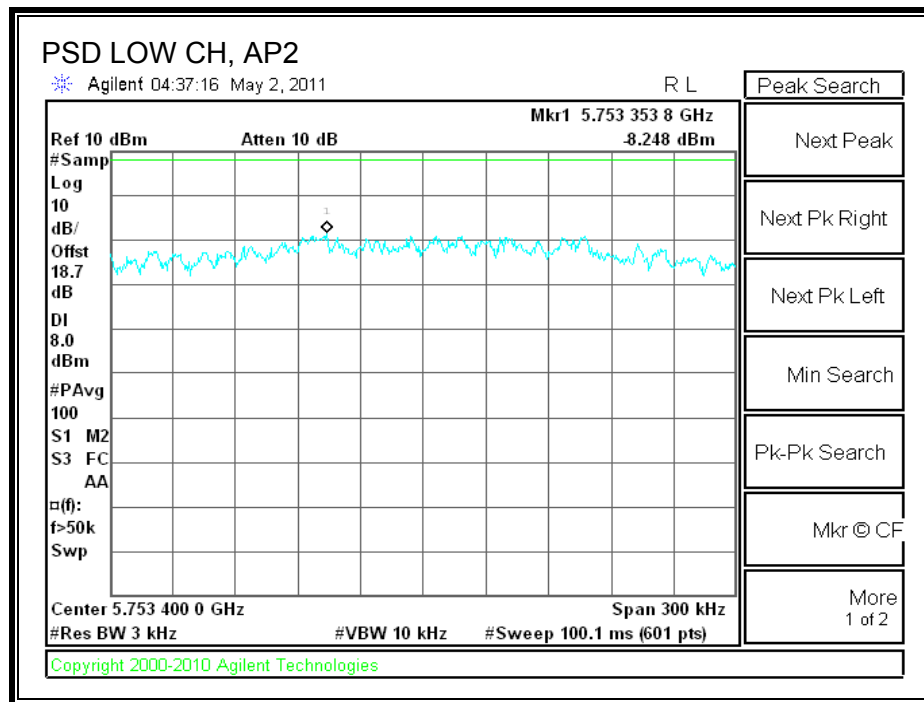
RESULTS:

Channel	Frequency (MHz)	AP1 PSD (dBm)	AP2 PSD (dBm)	AP3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5755	-6.907	-8.248	-8.502	-3.06	8	-11.06
High	5795	-8.643	-8.458	-8.618	-3.80	8	-11.80

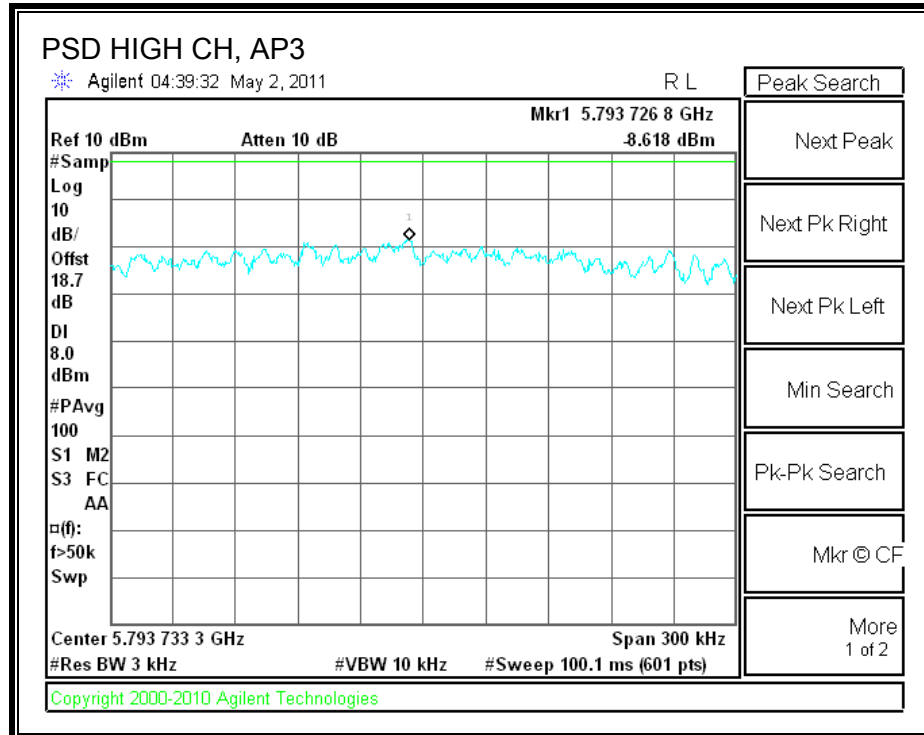
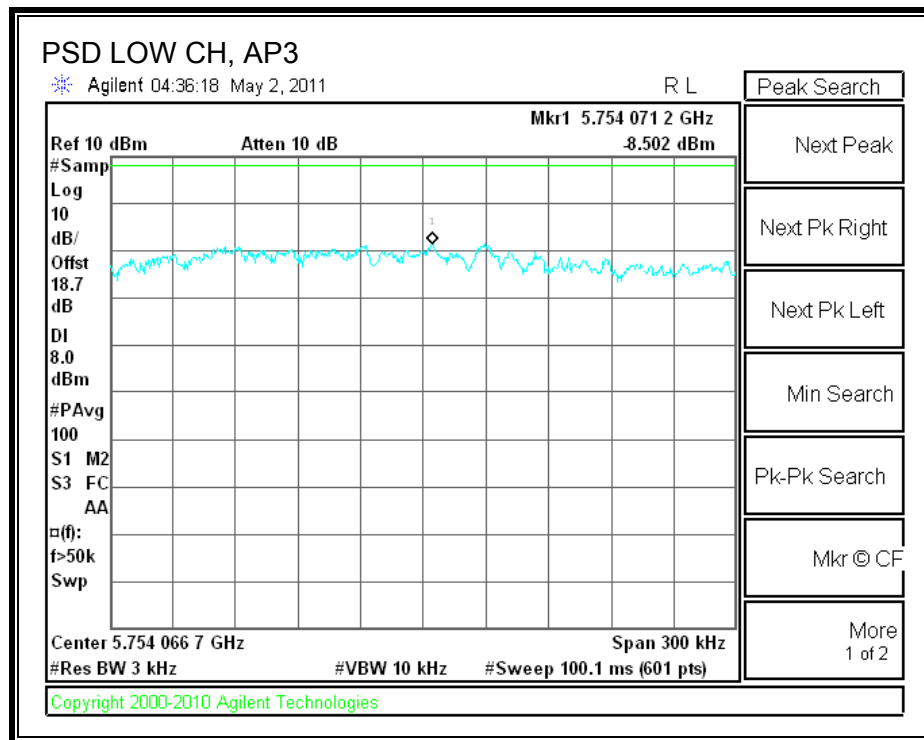
POWER SPECTRAL DENSITY, AP1



POWER SPECTRAL DENSITY, AP2



POWER SPECTRAL DENSITY, AP3



7.6.5. 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 30 dB.

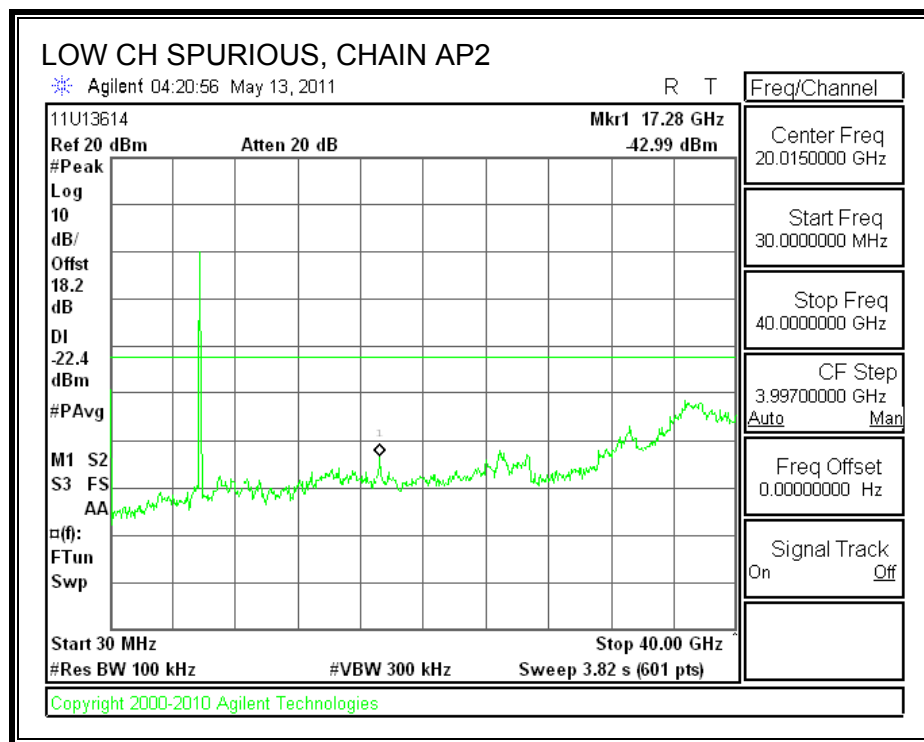
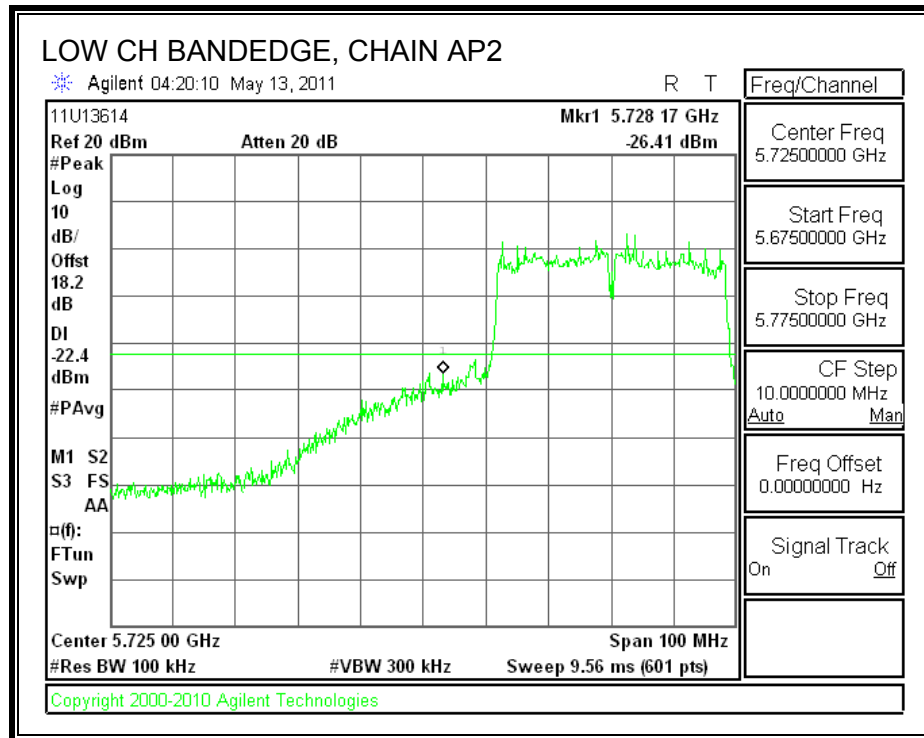
TEST PROCEDURE

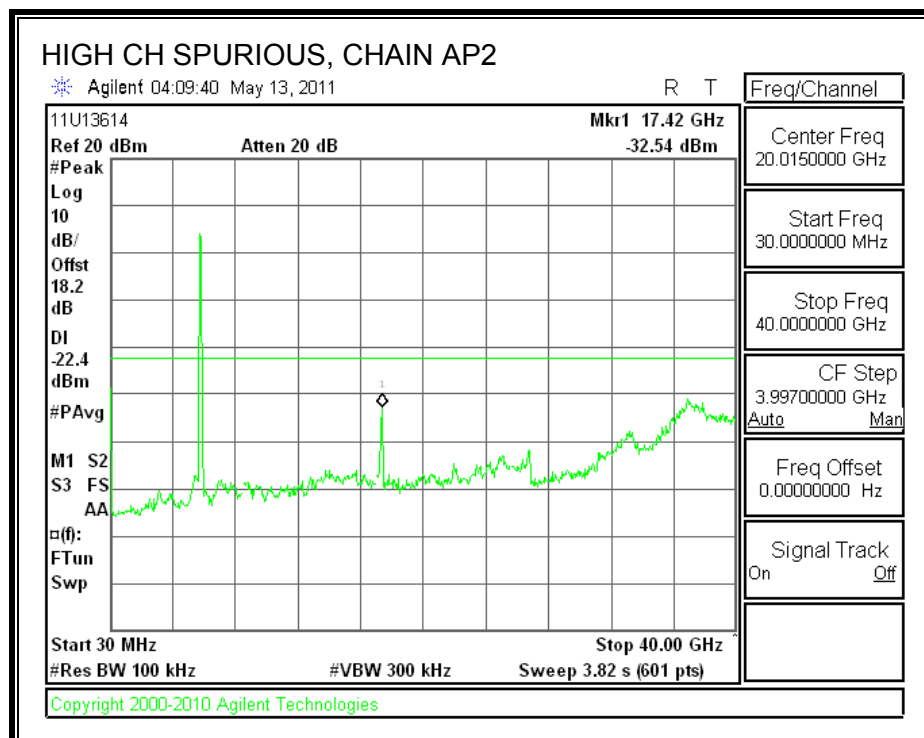
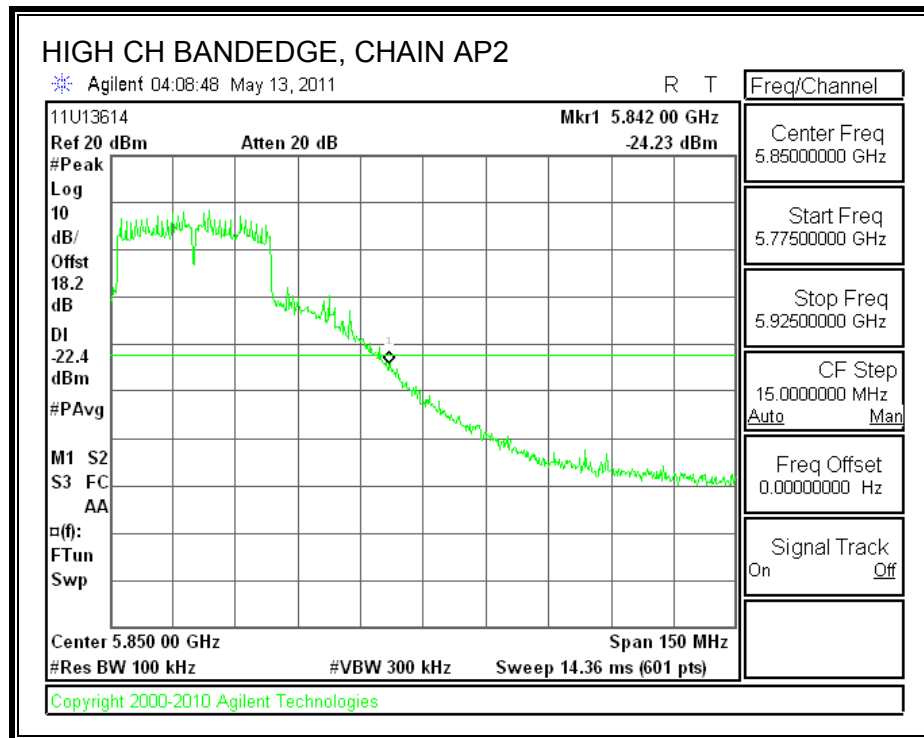
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

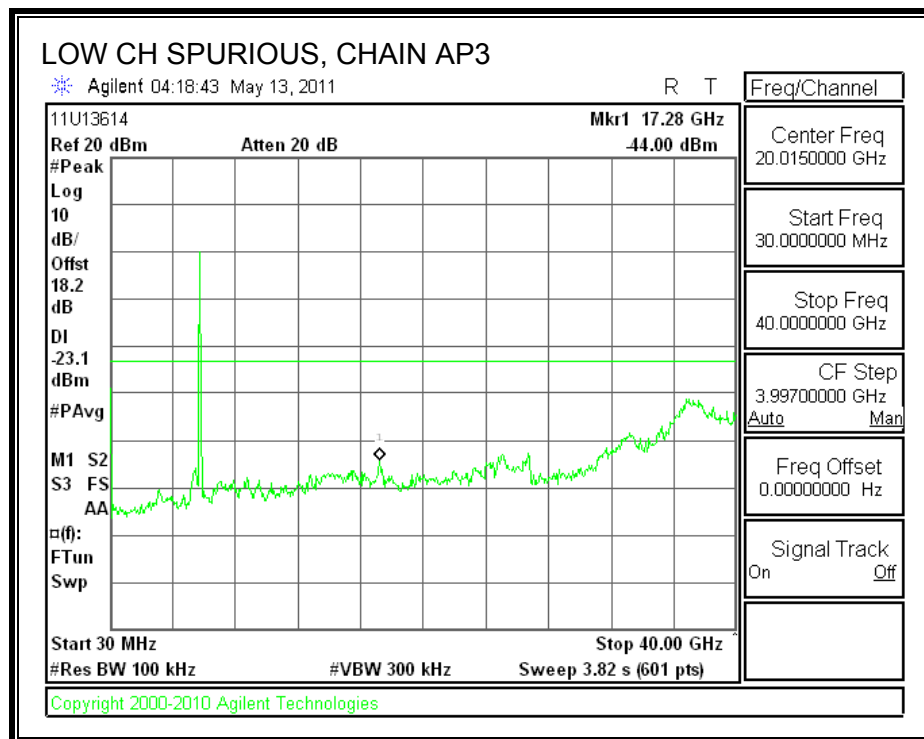
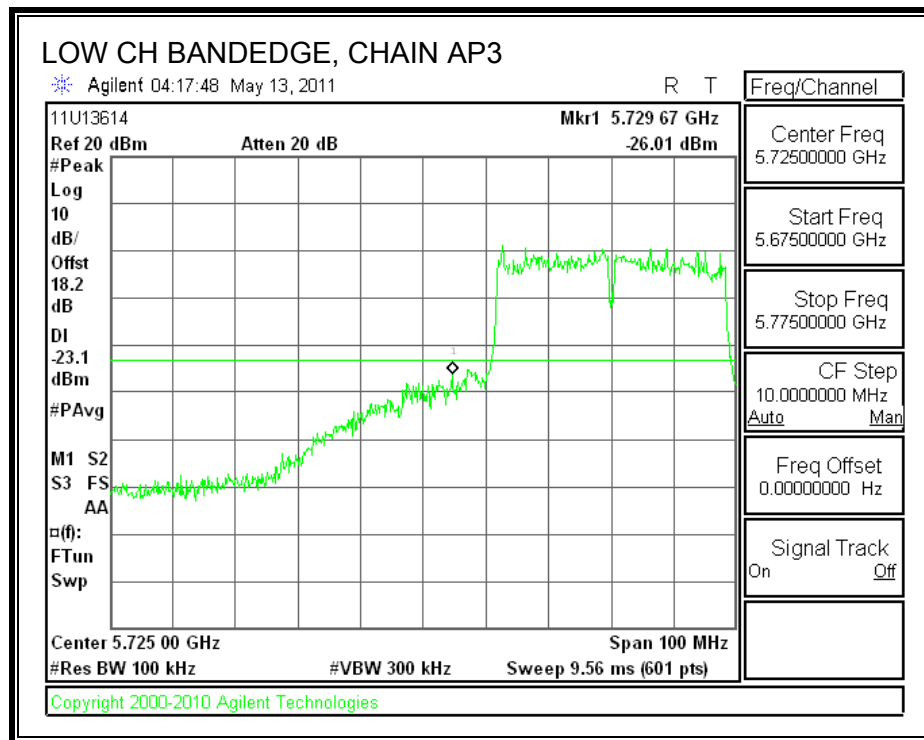
RESULTS

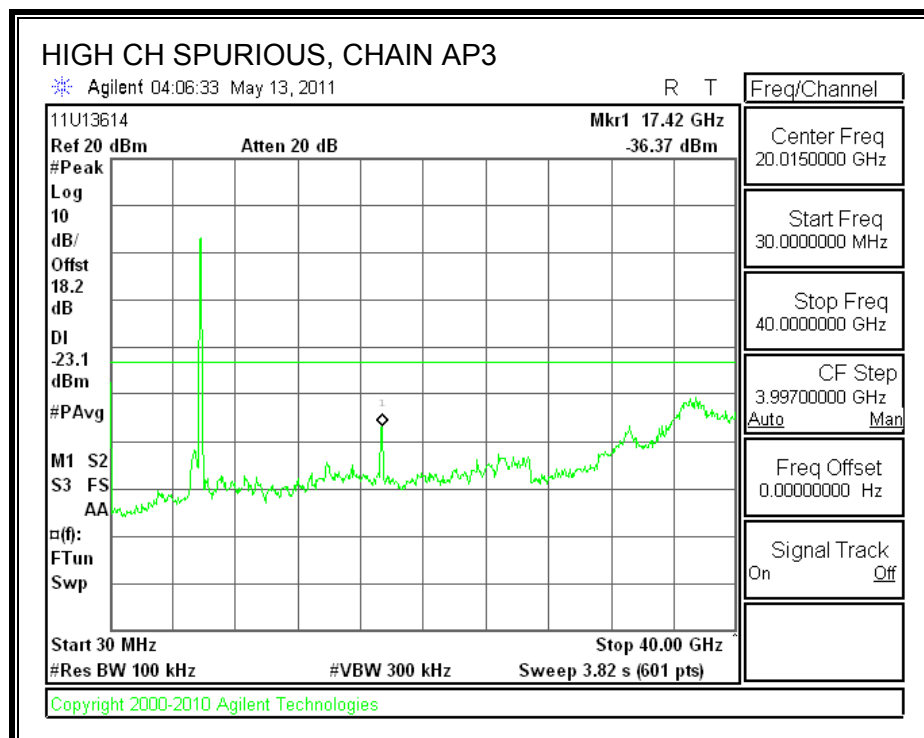
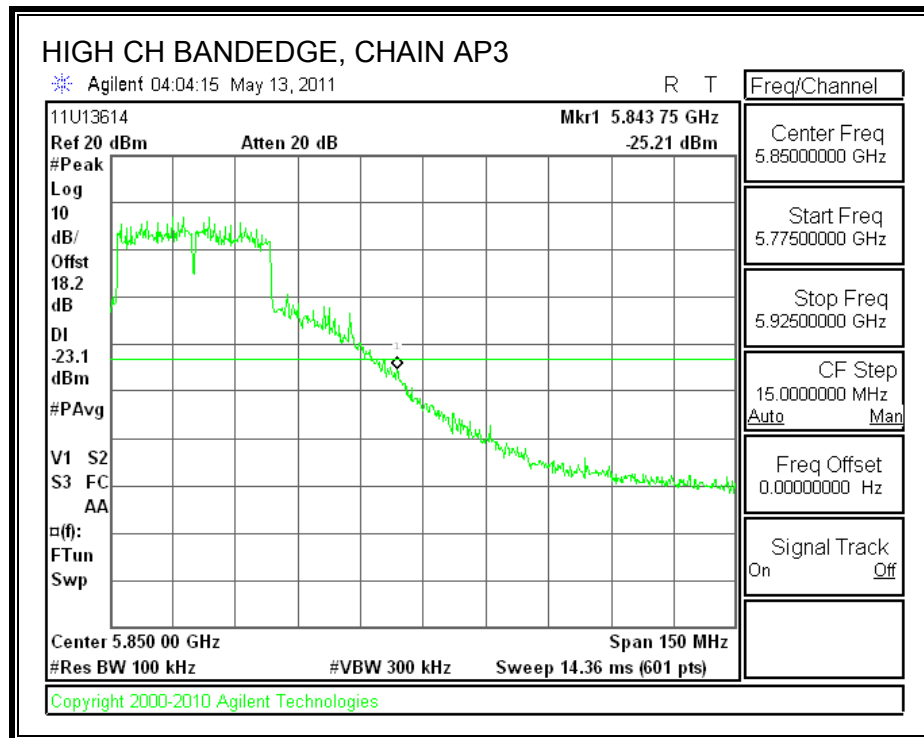
CHAIN AP2 SPURIOUS EMISSIONS



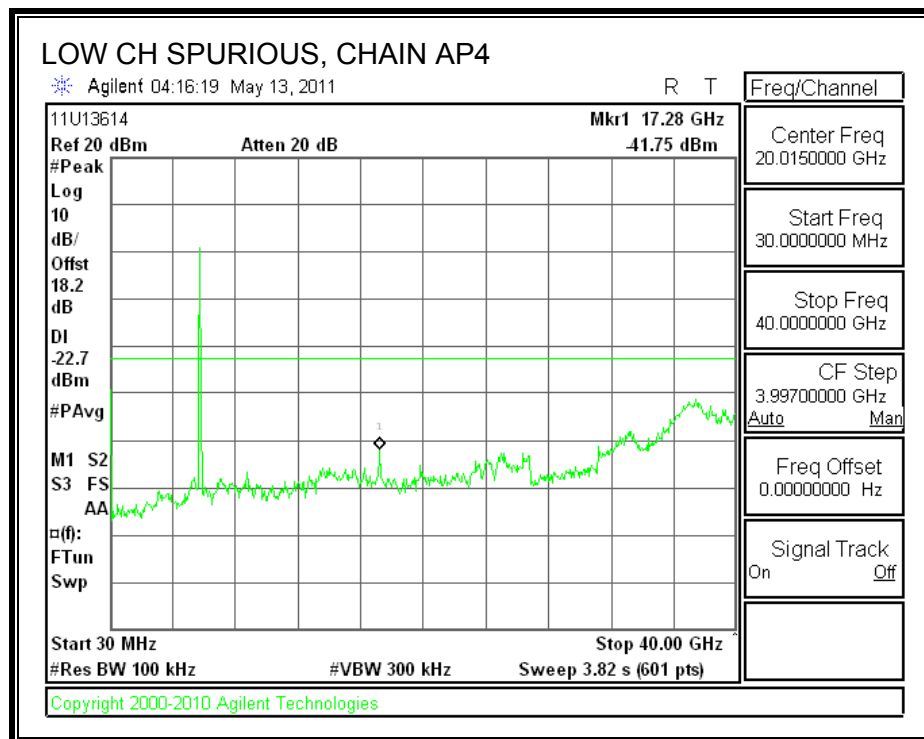
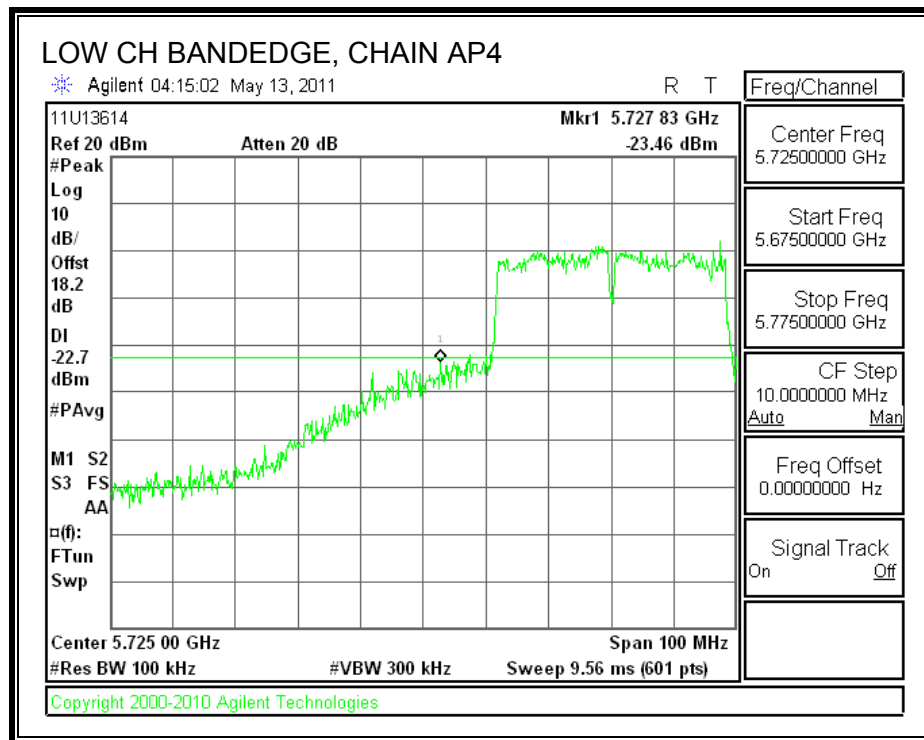


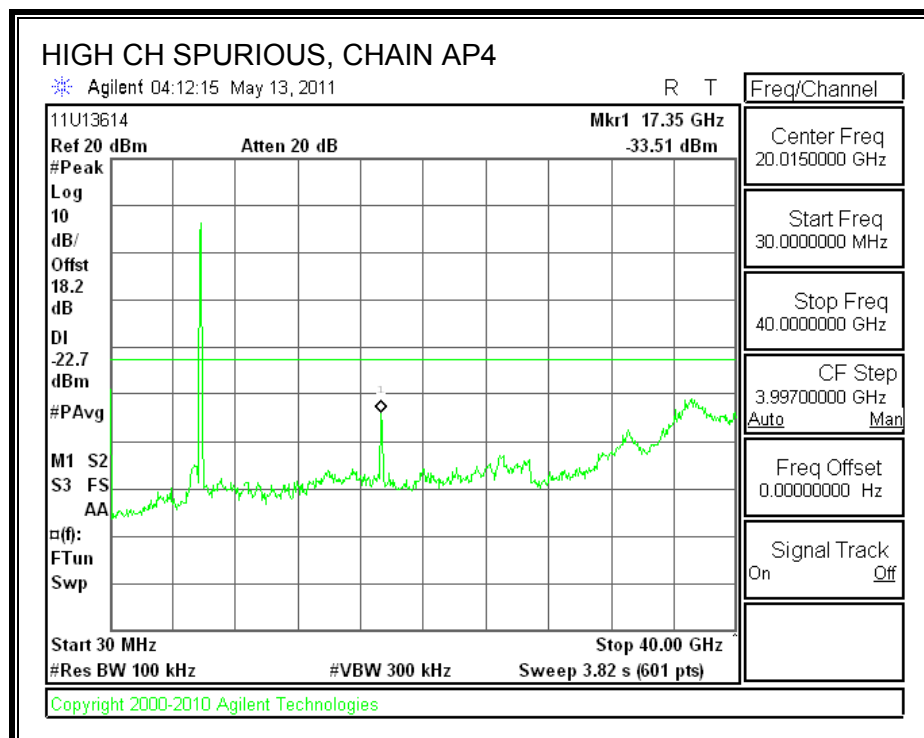
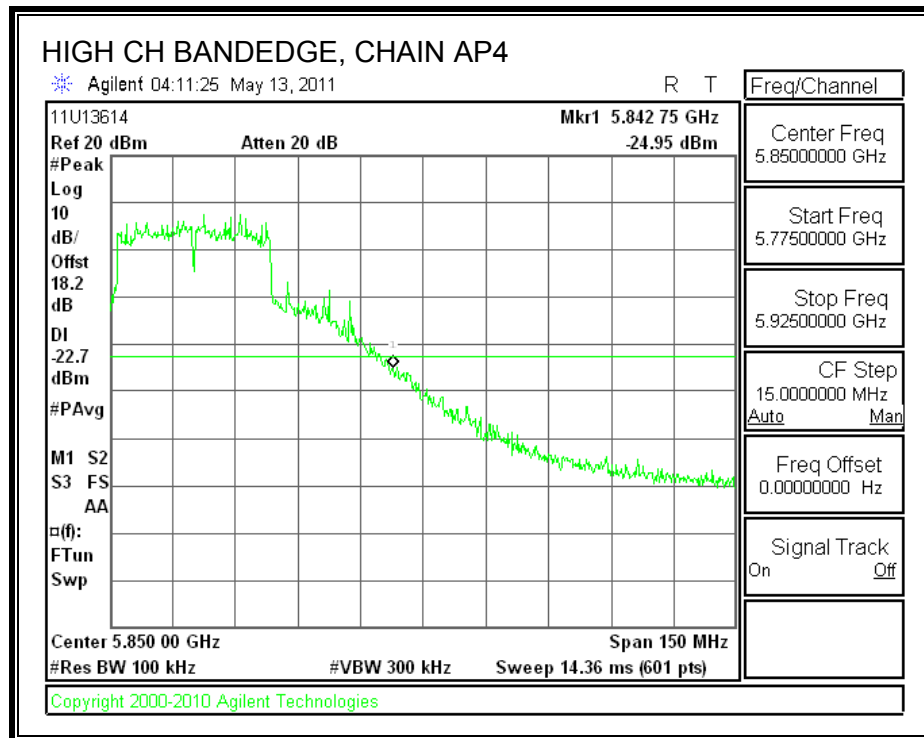
CHAIN AP3 SPURIOUS EMISSIONS





CHAIN AP4 SPURIOUS EMISSIONS





8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

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

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

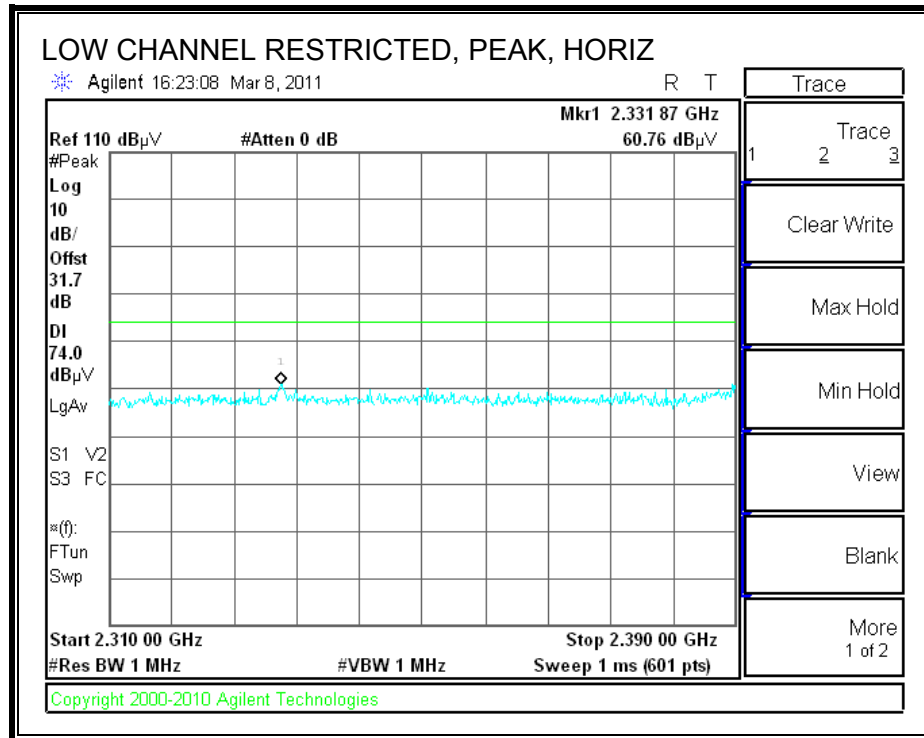
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

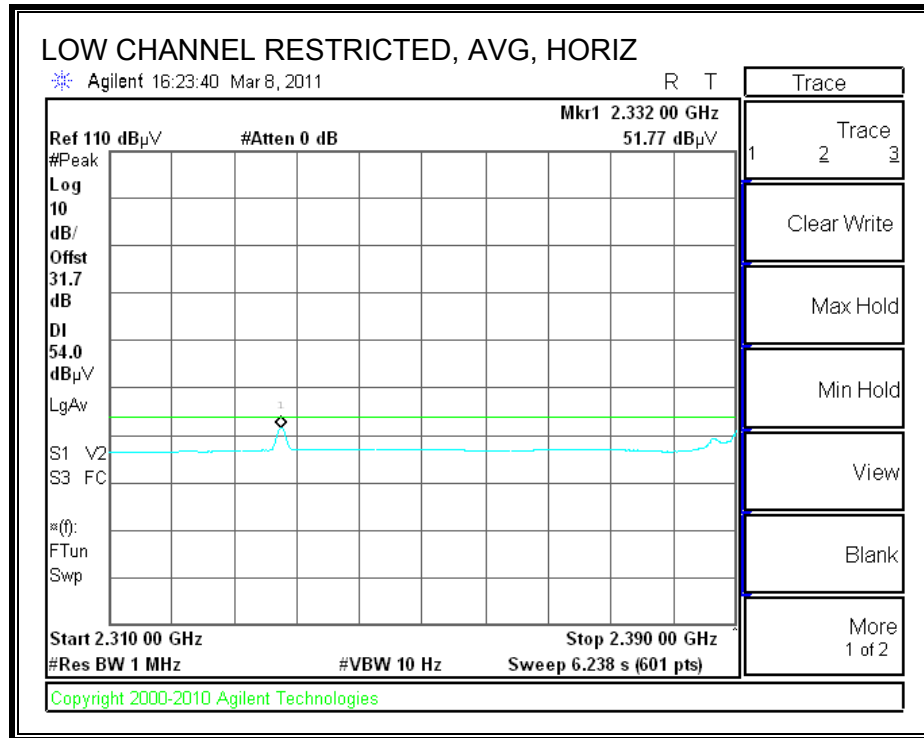
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

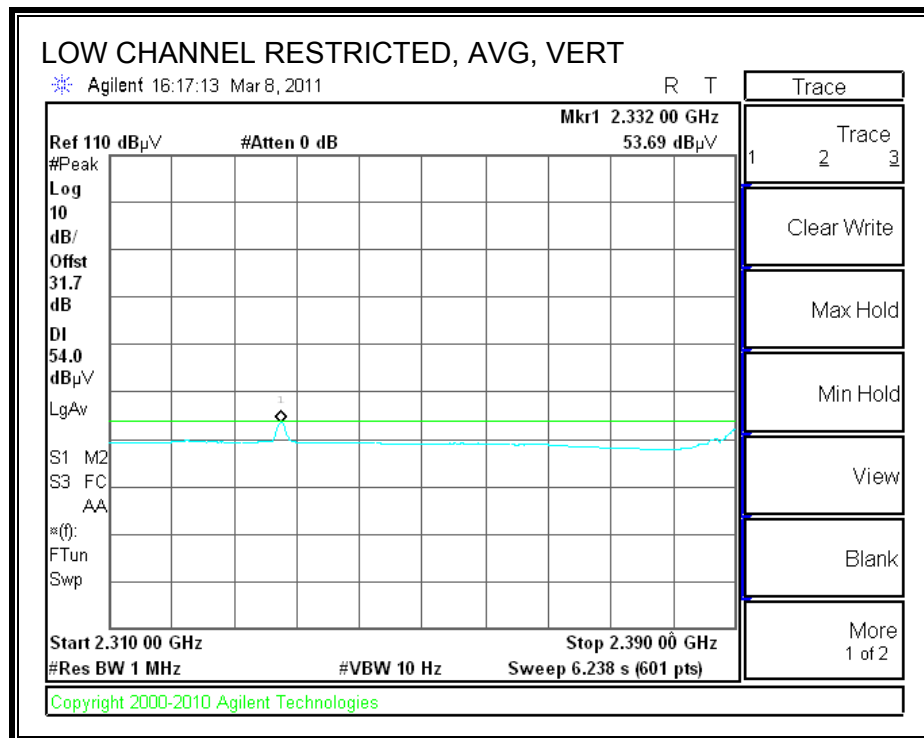
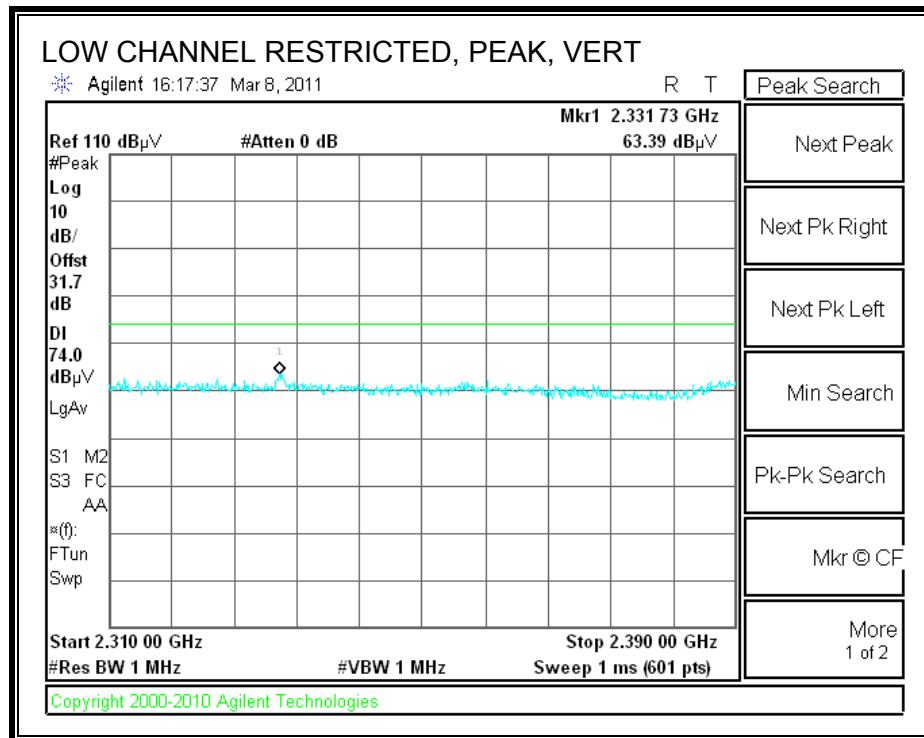
8.2.1. TX ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

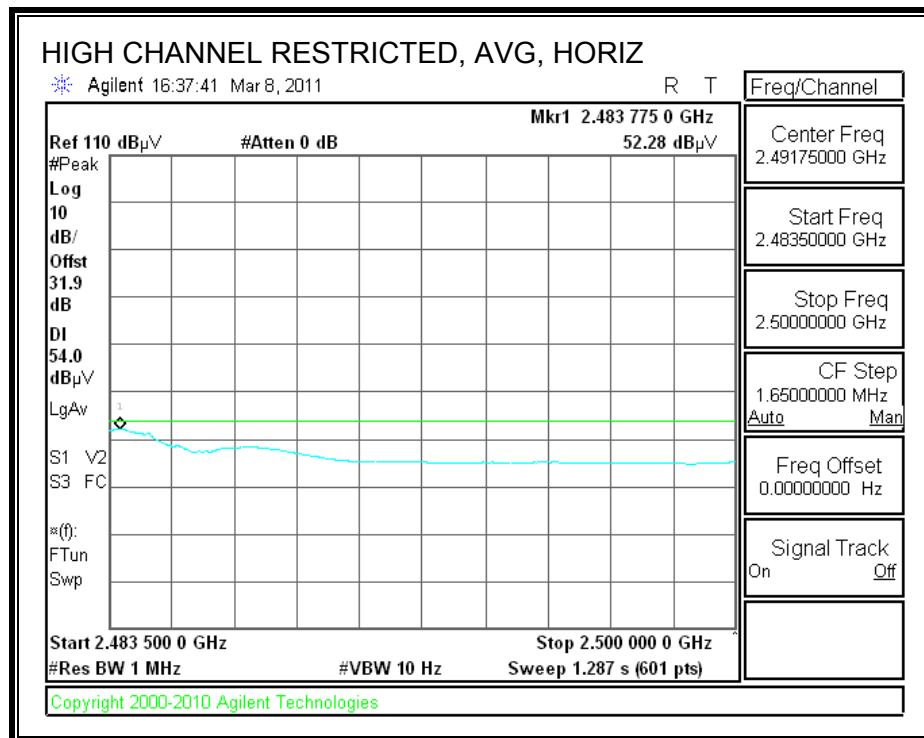
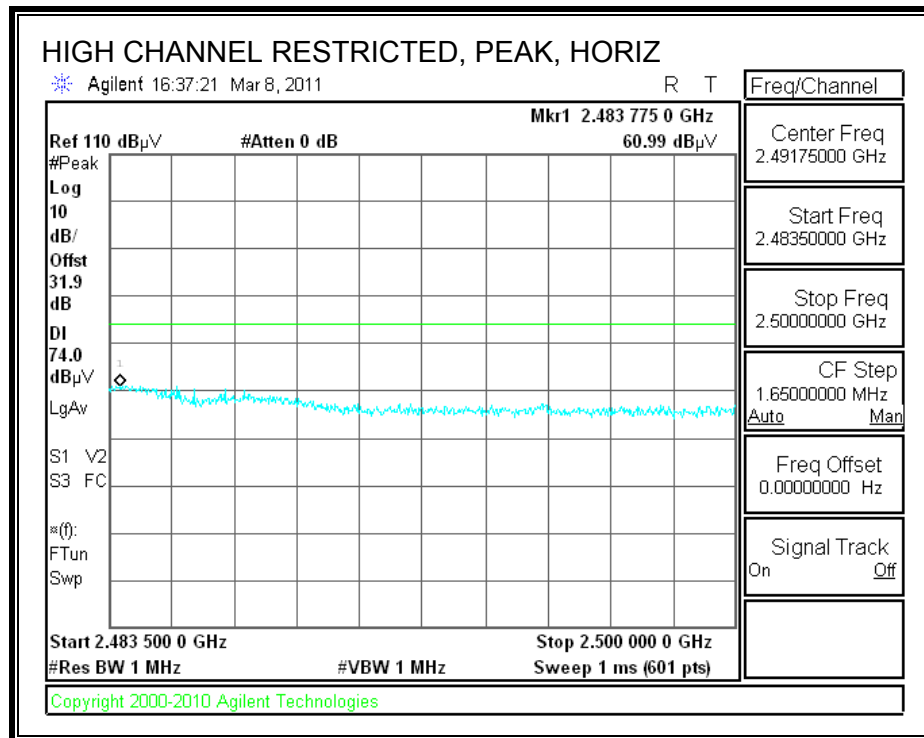




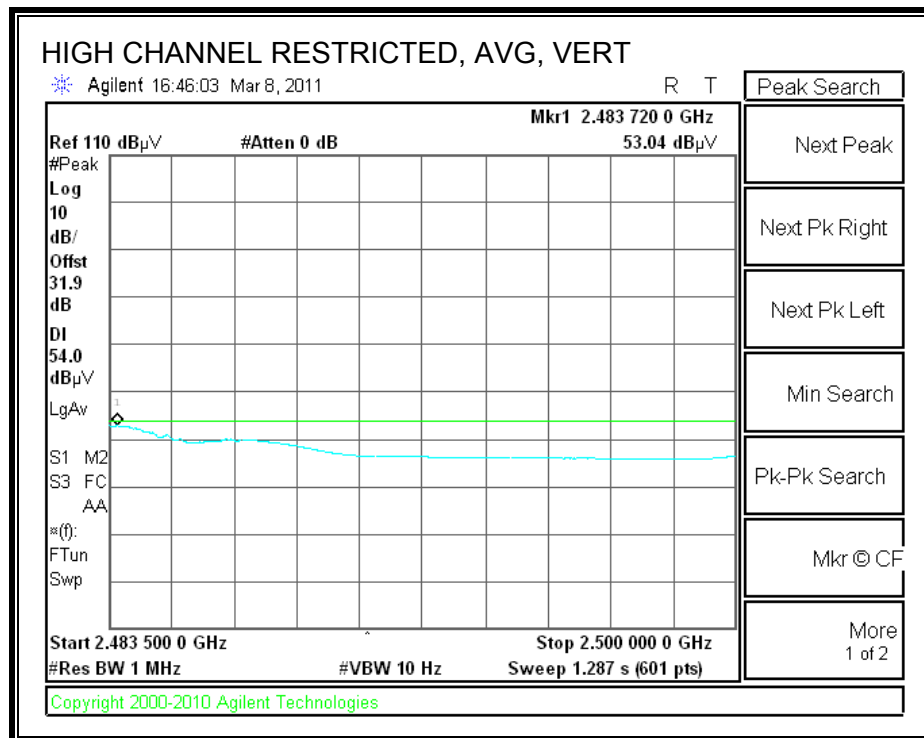
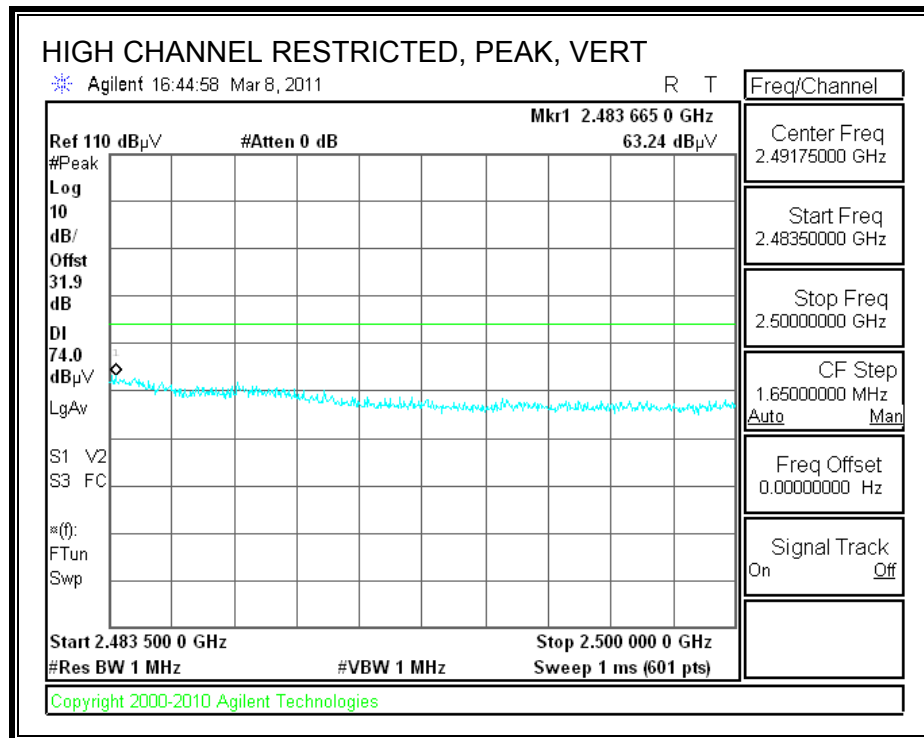
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 03/08/11
Project #: 11U13703
Company: Apple
Test Target: FCC 15.247
Mode Oper: TX, b mode

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

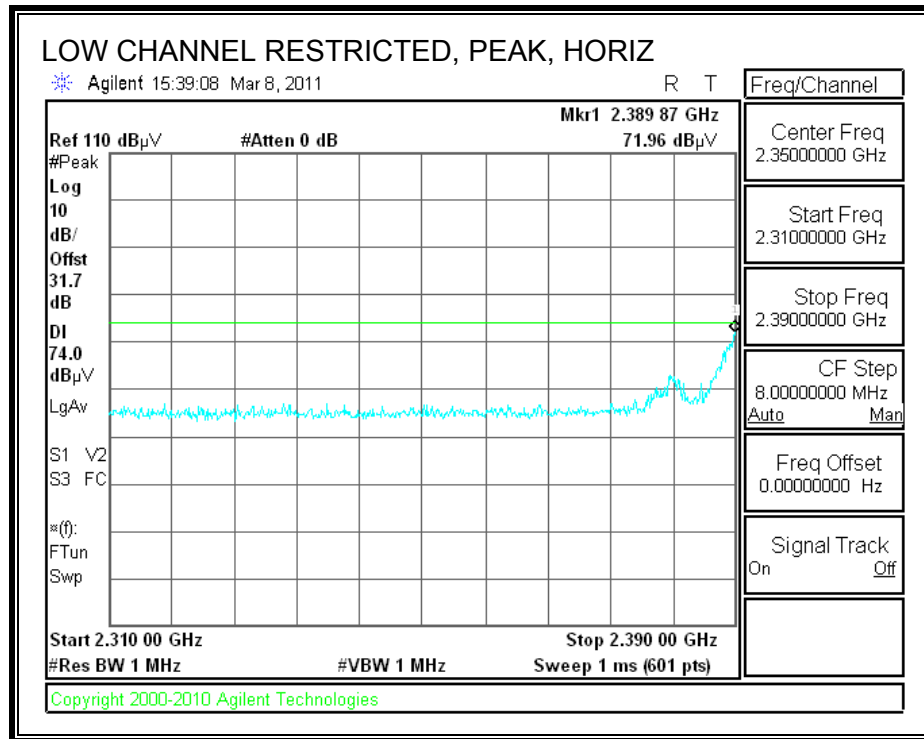
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	38.6	32.8	5.8	-34.8	0.0	0.0	42.3	74.0	-31.7	V	P	
4.824	3.0	29.4	32.8	5.8	-34.8	0.0	0.0	33.1	54.0	-20.9	V	A	
4.824	3.0	44.3	32.8	5.8	-34.8	0.0	0.0	48.0	74.0	-26.0	H	P	
4.824	3.0	40.3	32.8	5.8	-34.8	0.0	0.0	44.0	54.0	-10.0	H	A	
Mid Ch, 2437MHz													
4.874	3.0	42.9	32.8	5.8	-34.9	0.0	0.0	46.7	74.0	-27.3	V	P	
4.874	3.0	37.4	32.8	5.8	-34.9	0.0	0.0	41.2	54.0	-12.8	V	A	
7.311	3.0	37.7	35.2	7.3	-34.7	0.0	0.0	45.5	74.0	-28.5	V	P	
7.311	3.0	25.1	35.2	7.3	-34.7	0.0	0.0	32.9	54.0	-21.1	V	A	
4.874	3.0	40.7	32.8	5.8	-34.9	0.0	0.0	44.5	74.0	-29.5	H	P	
4.874	3.0	34.5	32.8	5.8	-34.9	0.0	0.0	38.3	54.0	-15.7	H	A	
7.311	3.0	37.1	35.2	7.3	-34.7	0.0	0.0	44.9	74.0	-29.1	H	P	
7.311	3.0	24.7	35.2	7.3	-34.7	0.0	0.0	32.5	54.0	-21.5	H	A	
High Ch, 2462MHz													
4.924	3.0	40.5	32.8	5.9	-34.9	0.0	0.0	44.4	74.0	-29.6	V	P	
4.924	3.0	34.1	32.8	5.9	-34.9	0.0	0.0	37.9	54.0	-16.1	V	A	
7.386	3.0	36.8	35.3	7.3	-34.6	0.0	0.0	44.7	74.0	-29.3	V	P	
7.386	3.0	24.5	35.3	7.3	-34.6	0.0	0.0	32.4	54.0	-21.6	V	A	
4.924	3.0	44.6	32.8	5.9	-34.9	0.0	0.0	48.4	74.0	-25.6	H	P	
4.924	3.0	41.1	32.8	5.9	-34.9	0.0	0.0	45.0	54.0	-9.0	H	A	
7.386	3.0	37.1	35.3	7.3	-34.6	0.0	0.0	45.1	74.0	-28.9	H	P	
7.386	3.0	24.7	35.3	7.3	-34.6	0.0	0.0	32.7	54.0	-21.3	H	A	

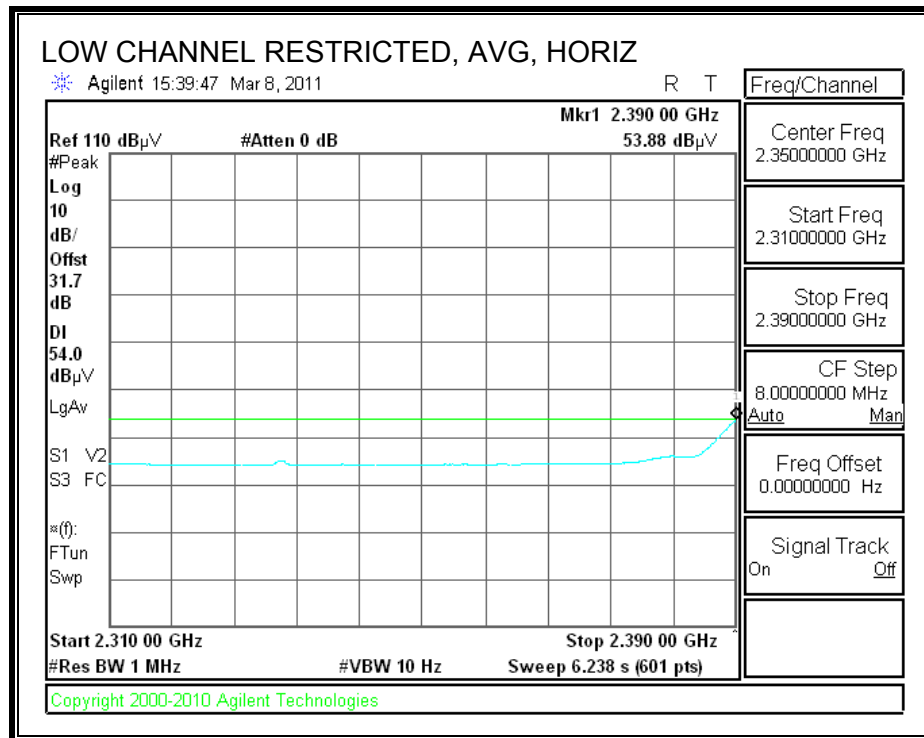
Rev. 4.1.2.7

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

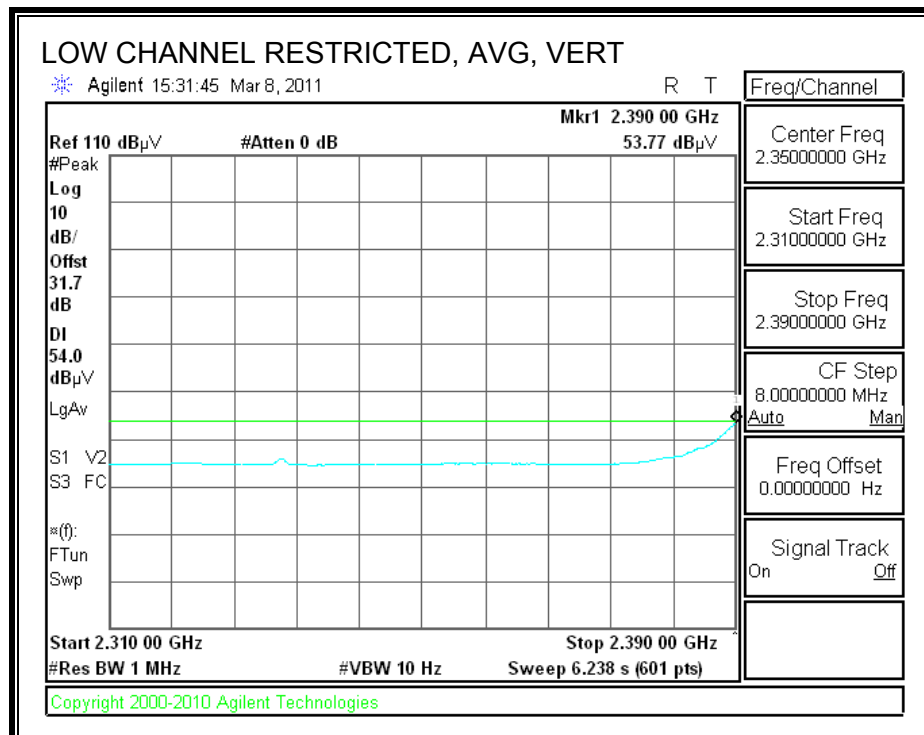
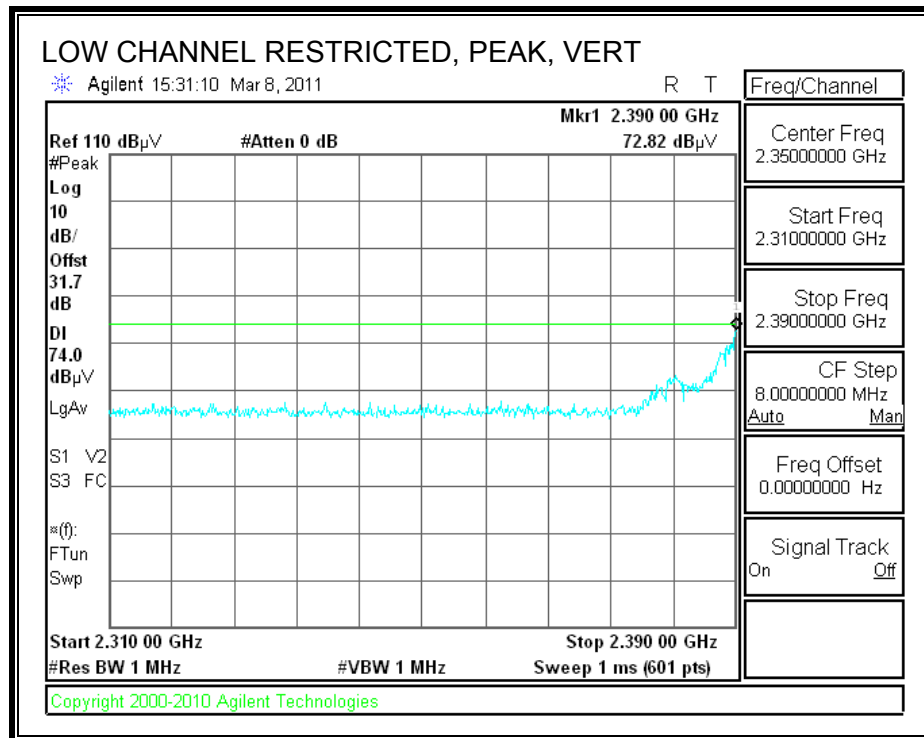
8.2.2. TX ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

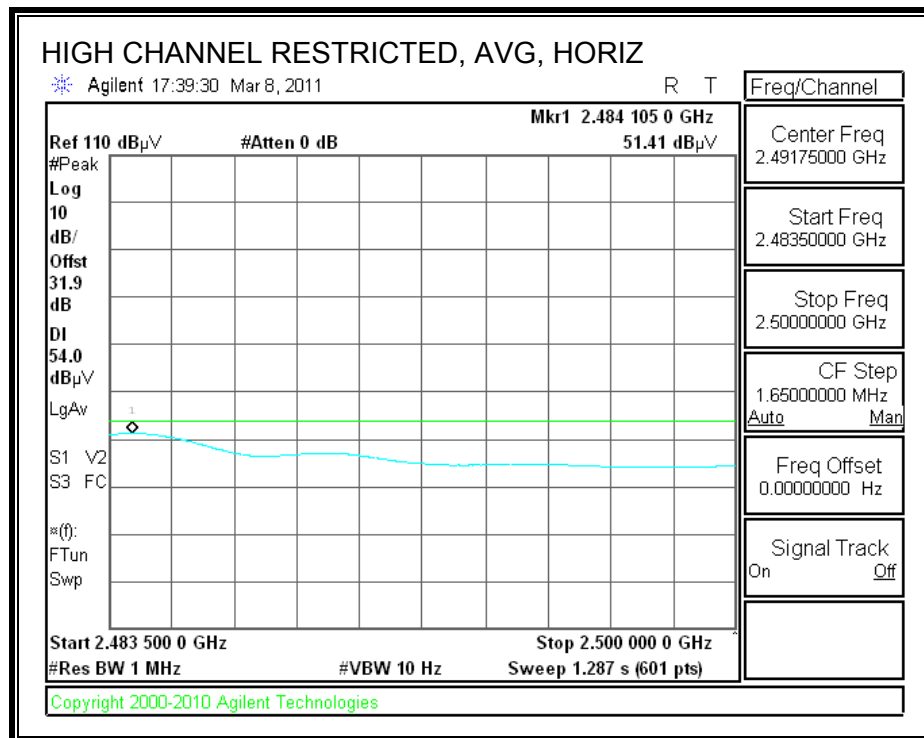
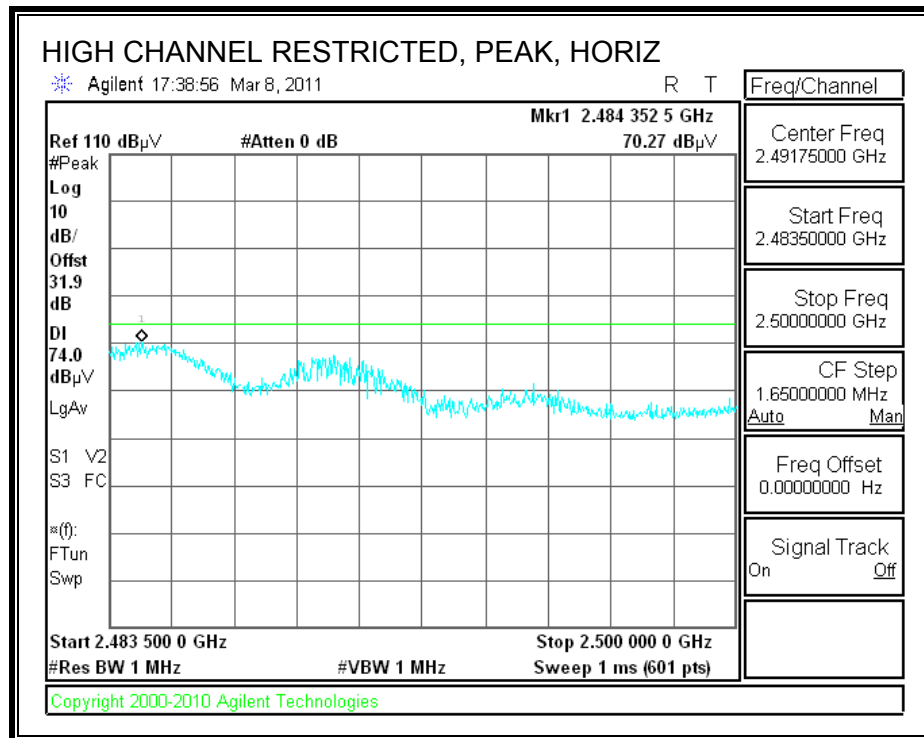




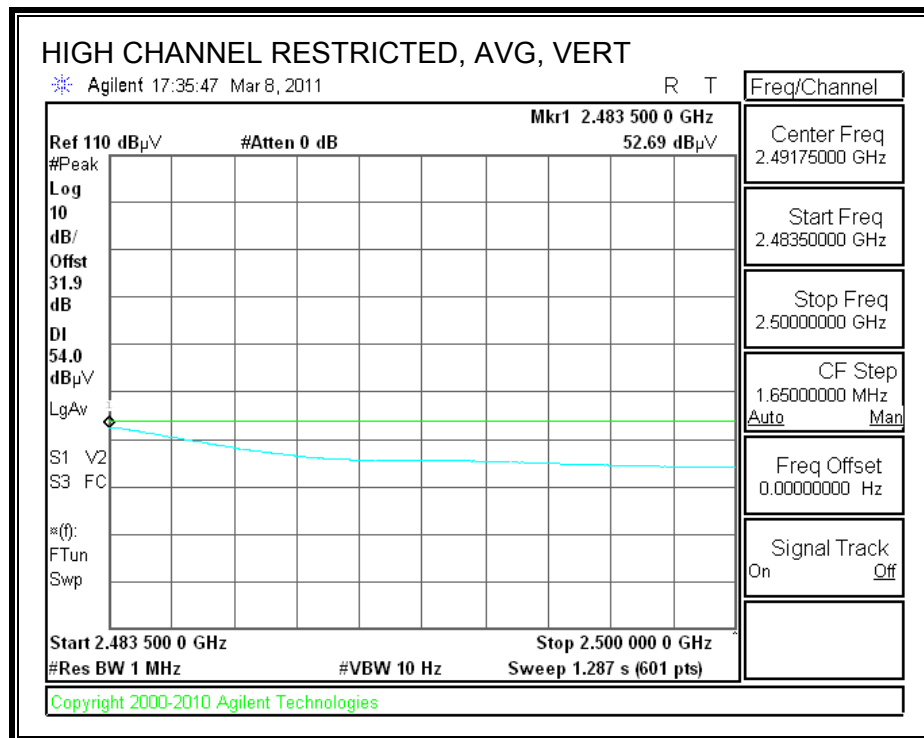
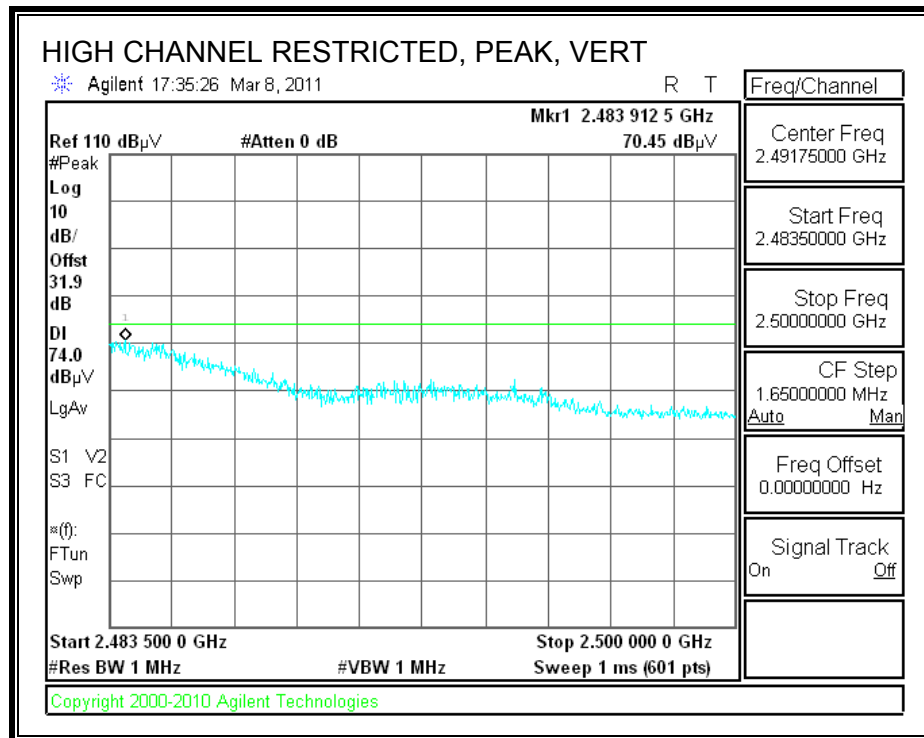
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 03/08/11
Project #: 11U133703
Company: Apple
Test Target: FCC 15.247
Mode Oper: TX, g mode

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

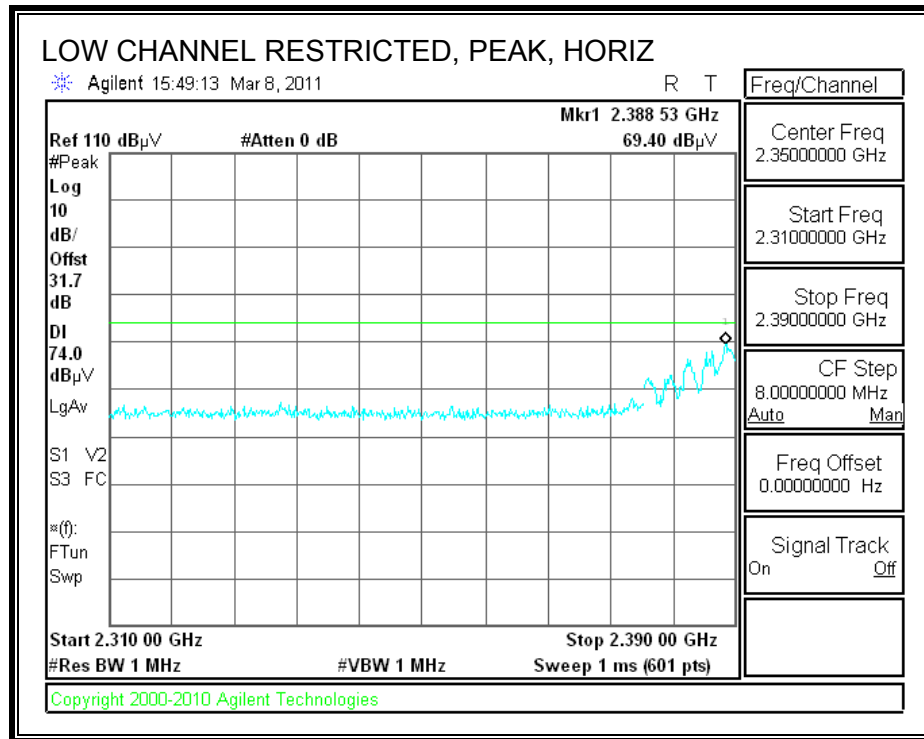
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Ftr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	38.9	32.8	5.8	-34.8	0.0	0.0	42.6	74.0	-31.4	V	P	
4.824	3.0	27.2	32.8	5.8	-34.8	0.0	0.0	30.9	54.0	-23.1	V	A	
4.824	3.0	41.1	32.8	5.8	-34.8	0.0	0.0	44.8	74.0	-29.2	H	P	
4.824	3.0	28.8	32.8	5.8	-34.8	0.0	0.0	32.5	54.0	-21.5	H	A	
Mid Ch, 2437MHz													
4.874	3.0	38.1	32.8	5.8	-34.9	0.0	0.0	41.8	74.0	-32.2	H	P	
4.874	3.0	25.1	32.8	5.8	-34.9	0.0	0.0	28.9	54.0	-25.1	H	A	
7.311	3.0	36.9	35.2	7.3	-34.7	0.0	0.0	44.7	74.0	-29.3	H	P	
7.311	3.0	24.6	35.2	7.3	-34.7	0.0	0.0	32.4	54.0	-21.6	H	A	
4.874	3.0	38.1	32.8	5.8	-34.9	0.0	0.0	41.9	74.0	-32.1	V	P	
4.874	3.0	25.6	32.8	5.8	-34.9	0.0	0.0	29.4	54.0	-24.6	V	A	
7.311	3.0	36.7	35.2	7.3	-34.7	0.0	0.0	44.5	74.0	-29.5	V	P	
7.311	3.0	24.6	35.2	7.3	-34.7	0.0	0.0	32.4	54.0	-21.6	V	A	
High Ch, 2462MHz													
4.924	3.0	38.0	32.8	5.9	-34.9	0.0	0.0	41.9	74.0	-32.1	V	P	
4.924	3.0	26.0	32.8	5.9	-34.9	0.0	0.0	29.9	54.0	-24.1	V	A	
7.386	3.0	37.2	35.3	7.3	-34.6	0.0	0.0	45.1	74.0	-28.9	V	P	
7.386	3.0	24.5	35.3	7.3	-34.6	0.0	0.0	32.4	54.0	-21.6	V	A	
4.924	3.0	40.8	32.8	5.9	-34.9	0.0	0.0	44.7	74.0	-29.3	H	P	
4.924	3.0	28.9	32.8	5.9	-34.9	0.0	0.0	32.7	54.0	-21.3	H	A	
7.386	3.0	37.6	35.3	7.3	-34.6	0.0	0.0	45.6	74.0	-28.4	H	P	
7.386	3.0	24.5	35.3	7.3	-34.6	0.0	0.0	32.5	54.0	-21.5	H	A	

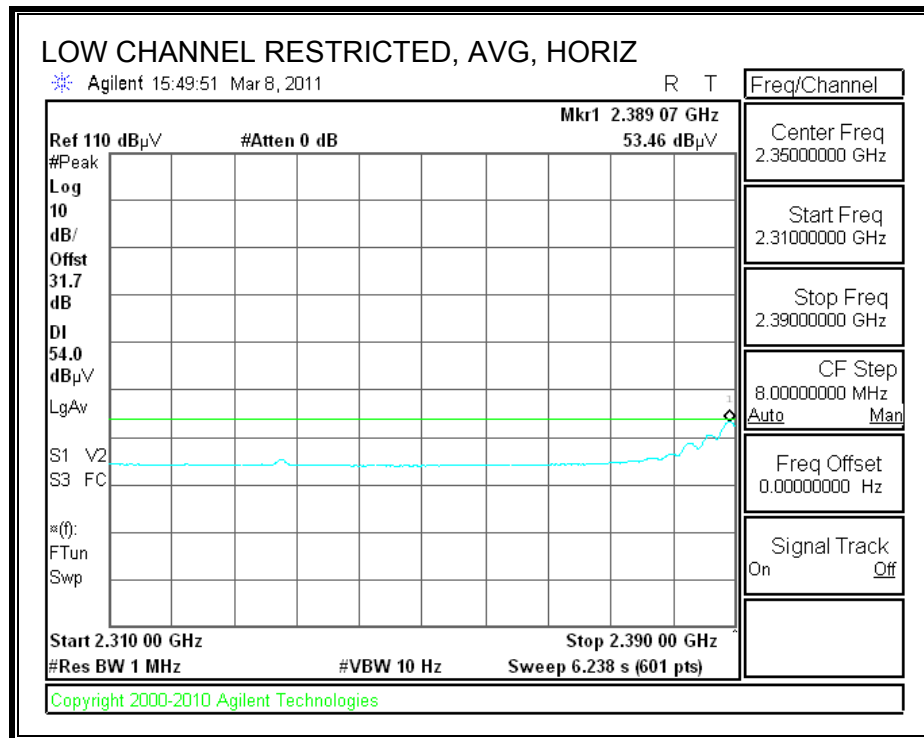
Rev. 4.1.2.7

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

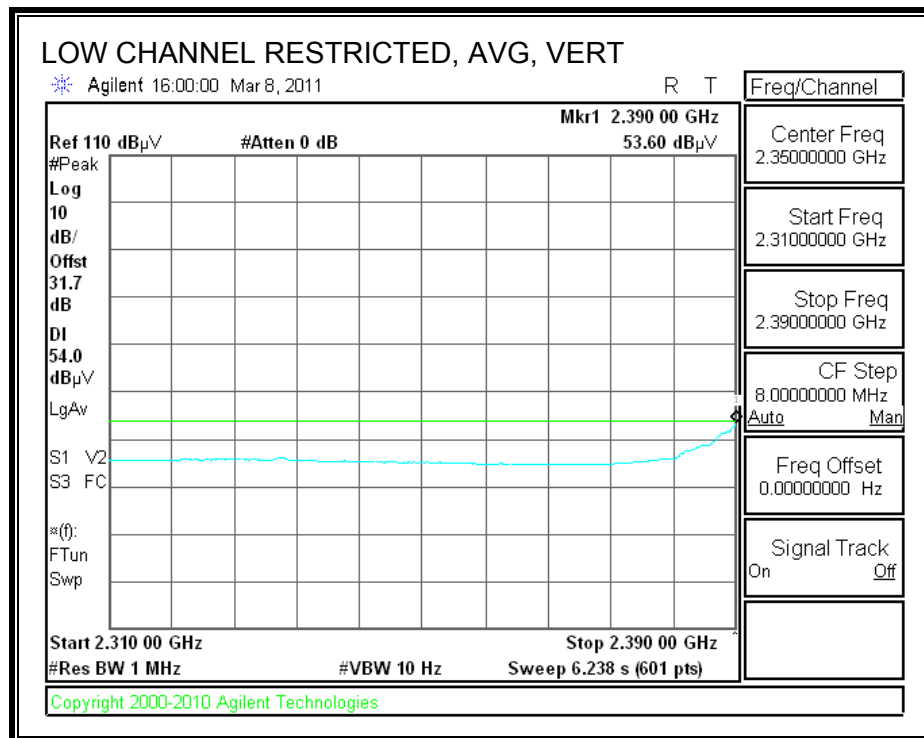
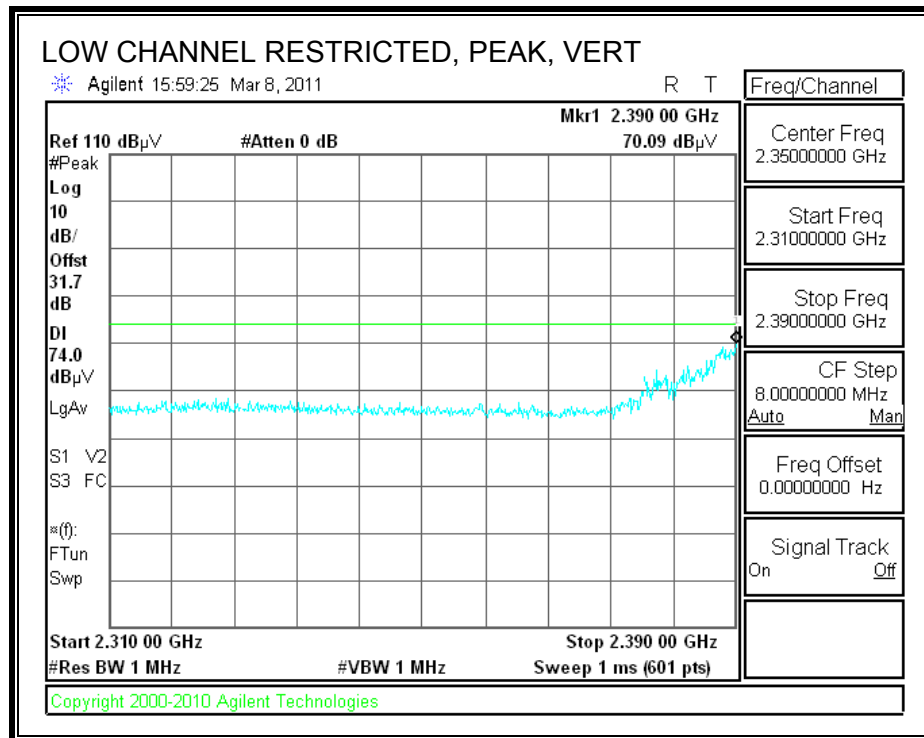
8.2.3. TX ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

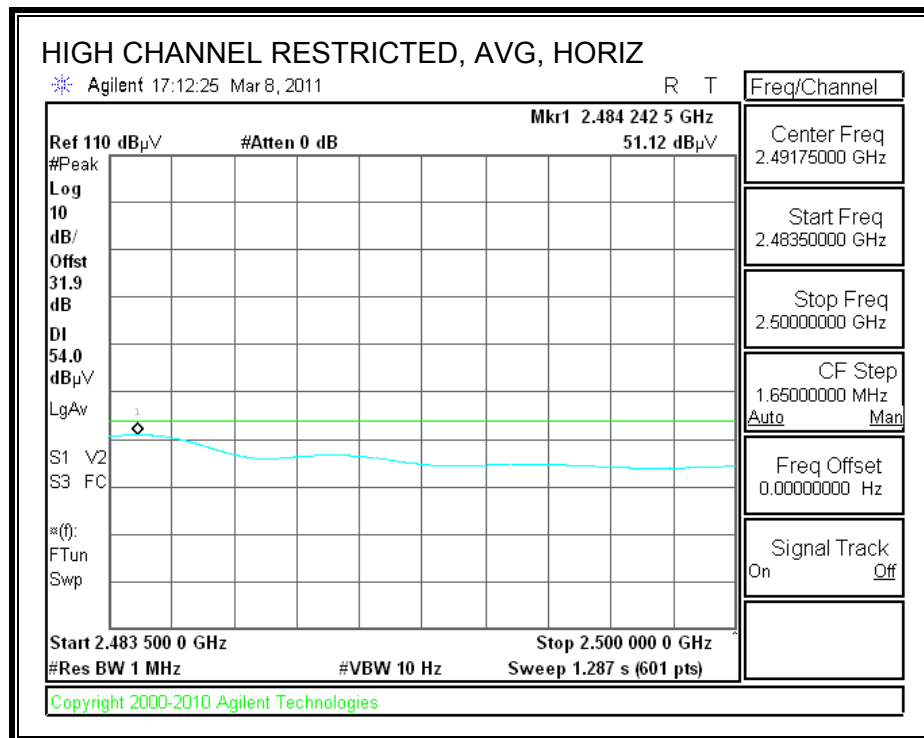
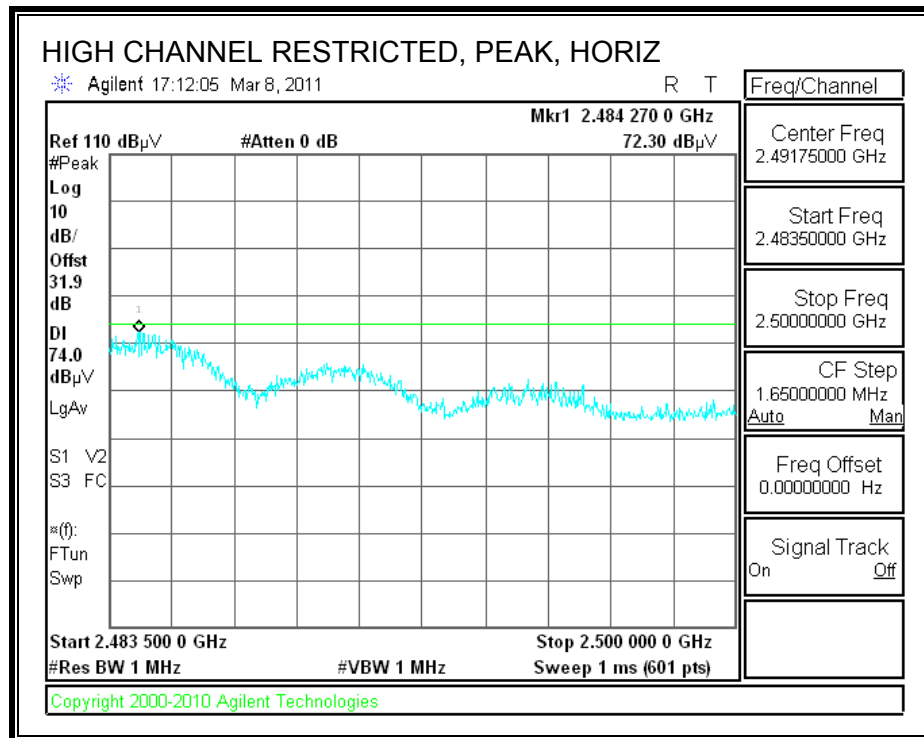




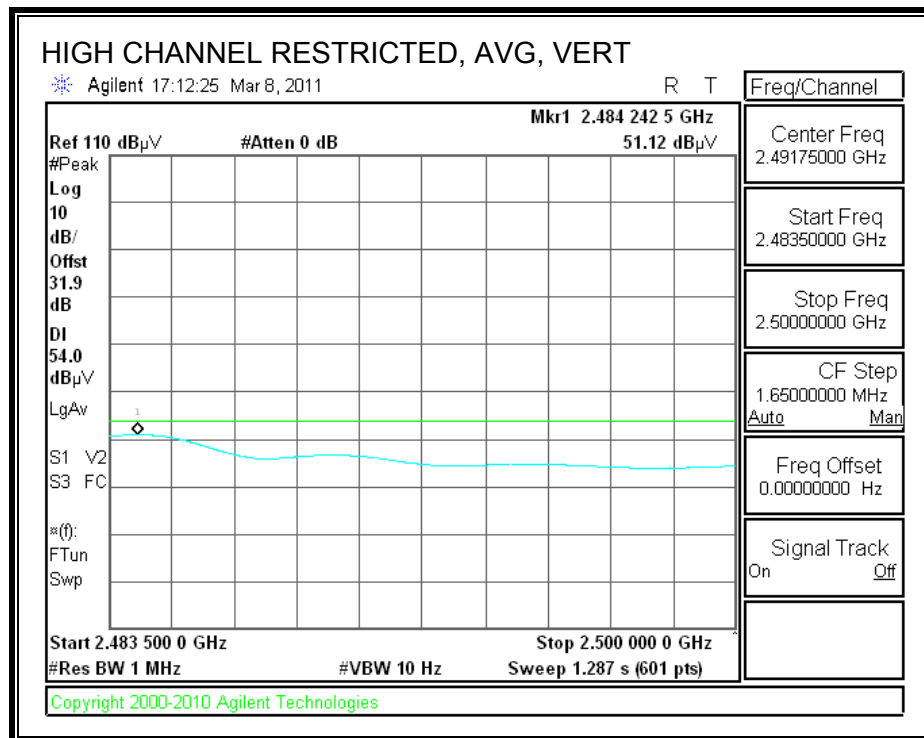
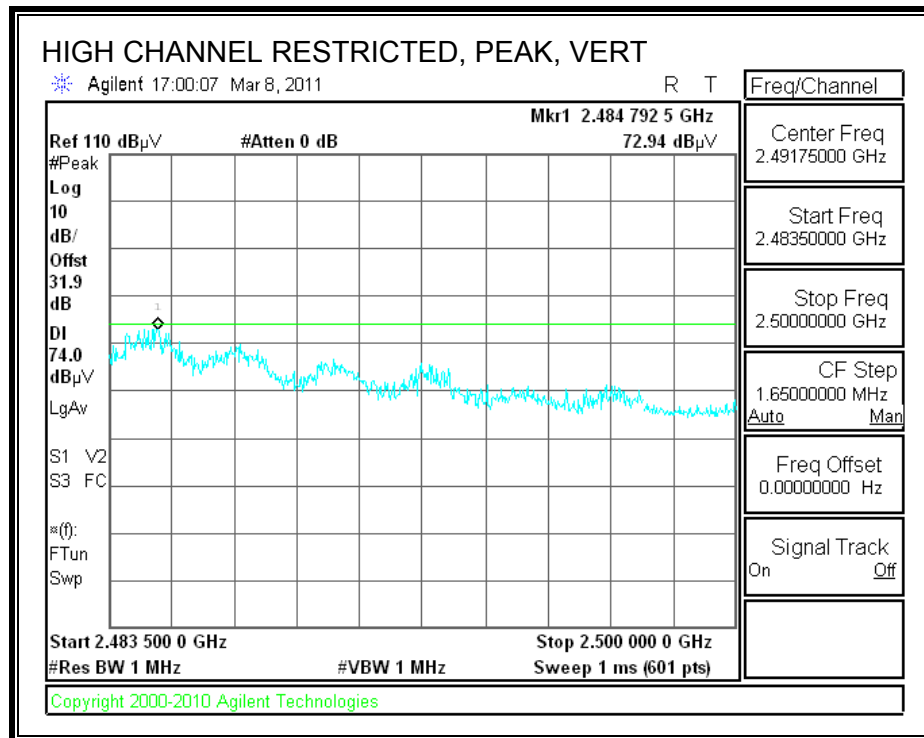
RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Chin Pang
Date: 03/08/11
Project #: 11U13703
Company: Apple
Test Target: FCC 15.247
Mode Oper: TX, HT20

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	Fitr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant Pol V/H	Det. P/A/QP	Notes
Low Ch, 2412MHz													
4.824	3.0	40.7	32.8	5.8	-34.8	0.0	0.0	44.4	74.0	-29.6	H	P	
4.824	3.0	28.6	32.8	5.8	-34.8	0.0	0.0	32.3	54.0	-21.7	H	A	
4.824	3.0	38.9	32.8	5.8	-34.8	0.0	0.0	42.6	74.0	-31.4	V	P	
4.824	3.0	25.7	32.8	5.8	-34.8	0.0	0.0	29.4	54.0	-24.6	V	A	
Mid Ch, 2437MHz													
4.874	3.0	38.0	32.8	5.8	-34.9	0.0	0.0	41.8	74.0	-32.2	V	P	
4.874	3.0	25.8	32.8	5.8	-34.9	0.0	0.0	29.6	54.0	-24.4	V	A	
7.311	3.0	37.4	35.2	7.3	-34.7	0.0	0.0	45.2	74.0	-28.8	V	P	
7.311	3.0	24.6	35.2	7.3	-34.7	0.0	0.0	32.4	54.0	-21.6	V	A	
4.874	3.0	37.9	32.8	5.8	-34.9	0.0	0.0	41.7	74.0	-32.3	H	P	
4.874	3.0	25.2	32.8	5.8	-34.9	0.0	0.0	29.0	54.0	-25.0	H	A	
7.311	3.0	36.5	35.2	7.3	-34.7	0.0	0.0	44.3	74.0	-29.7	H	P	
7.311	3.0	24.7	35.2	7.3	-34.7	0.0	0.0	32.5	54.0	-21.5	H	A	
High Ch, 2462MHz													
4.924	3.0	40.4	32.8	5.9	-34.9	0.0	0.0	44.2	74.0	-29.8	H	P	
4.924	3.0	28.2	32.8	5.9	-34.9	0.0	0.0	32.0	54.0	-22.0	H	A	
7.386	3.0	37.0	35.3	7.3	-34.6	0.0	0.0	45.0	74.0	-29.0	H	P	
7.386	3.0	24.5	35.3	7.3	-34.6	0.0	0.0	32.5	54.0	-21.5	H	A	
4.924	3.0	42.5	32.8	5.9	-34.9	0.0	0.0	46.3	74.0	-27.7	V	P	
4.924	3.0	27.6	32.8	5.9	-34.9	0.0	0.0	31.4	54.0	-22.6	V	A	
7.386	3.0	37.1	35.3	7.3	-34.6	0.0	0.0	45.1	74.0	-28.9	V	P	
7.386	3.0	24.4	35.3	7.3	-34.6	0.0	0.0	32.3	54.0	-21.7	V	A	

Rev. 4.1.2.7

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

8.2.4. TX ABOVE 1 GHz FOR 802.11a MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Company: Apple Project #: 11U13703 Date: 03/09/11 Test Engineer: Doug Anderson Configuration: EUT with Support PC Mode: 802.11a / Continuous Transmit																	
Test Equipment:																	
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit					
T60; S/N: 2238 @3m			T34 HP 8449B			T88 Miteq 26-40GHz			T39-T88 ARA 18-40GHz & Mixer > 40GHz			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	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)		
802.11a / Low Channel (5745 MHz):																	
11.490	3.0	47.9	34.2	38.0	9.5	-32.5	0.0	0.0	62.8	49.2	74	54	-11.2	-4.8	V, Q=80		
11.490	3.0	49.2	37.4	38.0	9.5	-32.5	0.0	0.0	64.2	52.4	74	54	-9.8	-1.6	H, Q=78		
802.11a / Mid Channel (5785 MHz):																	
11.570	3.0	47.4	34.9	38.1	9.5	-32.5	0.0	0.0	62.5	50.0	74	54	-11.5	-4.0	V, Q=80		
11.570	3.0	50.8	38.1	38.1	9.5	-32.5	0.0	0.0	65.9	53.2	74	54	-8.1	-0.8	H, Q=80		
802.11a / High Channel (5825 MHz):																	
11.650	3.0	47.3	33.4	38.2	9.6	-32.5	0.0	0.0	62.5	48.7	74	54	-11.5	-5.3	V, Q=76		
11.650	3.0	54.7	38.8	38.2	9.6	-32.5	0.0	0.0	69.9	54.0	74	54	-4.1	0.0	H, Q=76		
Rev. 07.22.09																	
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit				
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit				
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit				
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit				
CL	Cable Loss					HPF	High Pass Filter										

8.2.5. TX ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Apple Project #: 11U13703 Date: 03/09/11 Test Engineer: Configuration: EUT with Support PC Mode: HT20 / Continuous Transmit															
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T60; S/N: 2238 @3m		T34 HP 8449B		T88 Miteq 26-40GHz		T39-T88 ARA 18-40GHz & Mixer > 40GHz		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	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
HT20 / Low Channel (5745 MHz):															
11.490	3.0	50.7	35.0	38.0	9.5	-32.5	0.0	0.0	65.7	50.0	74	54	-8.3	-4.0	V, Q=81
11.490	3.0	54.3	38.5	38.0	9.5	-32.5	0.0	0.0	69.3	53.5	74	54	-4.7	-0.5	H, Q=81
HT20 / Mid Channel (5785 MHz):															
11.570	3.0	47.6	33.6	38.1	9.5	-32.5	0.0	0.0	62.7	48.7	74	54	-11.3	-5.3	V, Q=82
11.570	3.0	50.8	37.0	38.1	9.5	-32.5	0.0	0.0	65.9	52.1	74	54	-8.1	-1.9	H, Q=82
HT20 / High Channel (5805 MHz):															
11.610	3.0	47.0	33.7	38.2	9.5	-32.5	0.0	0.0	62.2	48.9	74	54	-11.8	-5.1	V, Q=76
11.610	3.0	49.0	36.0	38.2	9.5	-32.5	0.0	0.0	64.2	51.2	74	54	-9.8	-2.8	H, Q=76
Rev. 07.22.09															
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit		
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit		
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit		
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit		
CL	Cable Loss					HPF	High Pass Filter								

8.2.6. TX ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: William Zhuang
Date: 03/22/11
Project #: 11U13703
Company: Apple Inc.
Test Target: FCC 15.205
Mode Oper: 802.11 HT40 Mode, Tx On

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	Fitr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
Low Ch. 5755 MHz															
11.510	3.0	55.3	38.4	9.5	-35.8	0.0	0.0	67.4	74.0	-6.6	H	P	124.5	34.3	q82
11.510	3.0	41.1	38.4	9.5	-35.8	0.0	0.0	53.2	54.0	-0.8	H	A	124.5	34.3	q82
11.510	3.0	52.1	38.4	9.5	-35.8	0.0	0.0	64.2	74.0	-9.8	V	P	139.1	107.2	q82
11.510	3.0	38.4	38.4	9.5	-35.8	0.0	0.0	50.5	54.0	-3.5	V	A	139.1	107.2	q82
High Ch. 5795 MHz															
11.590	3.0	54.2	38.5	9.5	-35.8	0.0	0.0	66.4	74.0	-7.6	H	P	135.1	36.4	q86
11.590	3.0	39.5	38.5	9.5	-35.8	0.0	0.0	51.8	54.0	-2.2	H	A	135.1	36.4	q86
11.590	3.0	50.8	38.5	9.5	-35.8	0.0	0.0	63.0	74.0	-11.0	V	P	131.2	258.7	q86
11.590	3.0	36.5	38.5	9.5	-35.8	0.0	0.0	48.8	54.0	-5.2	V	A	131.2	258.7	q86

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															
Project #:		11U13703													
Date:		1/28/2011													
Test Engineer:		Tom Chen													
Configuration:		EUT with support Laptop PC													
Mode:		RX mode, 20MHz band width													
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T73; S/N: 6717 @3m		T144 Miteq 3008A00931						RX RSS 210							
Hi Frequency Cables															
3' cable 22807700		12' cable 22807600		20' cable 22807500		HPF		Reject Filter		<u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz ; VBW=10Hz					
3' cable 22807700		12' cable 22807600		20' cable 22807500											
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)
1.147	3.0	57.2	44.6	24.3	2.5	-39.3	0.0	0.0	44.8	32.2	74	54	-29.2	-21.8	V
1.500	3.0	51.4	42.3	25.5	2.9	-38.8	0.0	0.0	41.1	32.0	74	54	-32.9	-22.0	V
1.593	3.0	53.8	33.1	25.8	3.0	-38.6	0.0	0.0	44.0	23.3	74	54	-30.0	-30.7	V
1.120	3.0	49.5	33.5	24.3	2.5	-39.3	0.0	0.0	36.9	21.0	74	54	-37.1	-33.0	H
1.193	3.0	51.1	34.1	24.5	2.6	-39.2	0.0	0.0	38.9	22.0	74	54	-35.1	-32.0	H
1.593	3.0	55.7	32.8	25.8	3.0	-38.6	0.0	0.0	45.9	23.1	74	54	-28.1	-30.9	H
Rev. 07.22.09															
f	Measurement Frequency			Amp	Preamp Gain			Avg Lim	Average Field Strength Limit						
Dist	Distance to Antenna			D Corr	Distance Correct to 3 meters			Pk Lim	Peak Field Strength Limit						
Read	Analyzer Reading			Avg	Average Field Strength @ 3 m			Avg Mar	Margin vs. Average Limit						
AF	Antenna Factor			Peak	Calculated Peak Field Strength			Pk Mar	Margin vs. Peak Limit						
CL	Cable Loss			HPF	High Pass Filter										

8.3.2. RX ABOVE 1 GHz FOR 20 MHz BANDWIDTH IN THE 5.8 GHz BAND

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company:		Apple Inc.														
Project #:		11U13703														
Date:		3/23/2011														
Test Engineer:		William Zhuang														
Configuration:		EUT with Laptop														
Mode:		HT20 Mode, Mid Ch. Rx On														
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T144 Miteq 3008A00931									RX RSS 210				
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										
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)	
1.125	3.0	53.4	37.5	24.3	2.5	-39.3	0.0	0.0	40.9	25.0	74	54	-33.1	-29.0	V	
1.200	3.0	50.7	42.3	24.5	2.6	-39.2	0.0	0.0	38.7	30.3	74	54	-35.3	-23.7	V	
1.125	3.0	48.7	42.9	24.3	2.5	-39.3	0.0	0.0	36.2	30.3	74	54	-37.8	-23.7	H	
1.200	3.0	45.8	32.9	24.5	2.6	-39.2	0.0	0.0	33.7	20.8	74	54	-40.3	-33.2	H	
Rev. 07.22.09																
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit			
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit			
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit			
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit			
CL	Cable Loss					HPF	High Pass Filter									

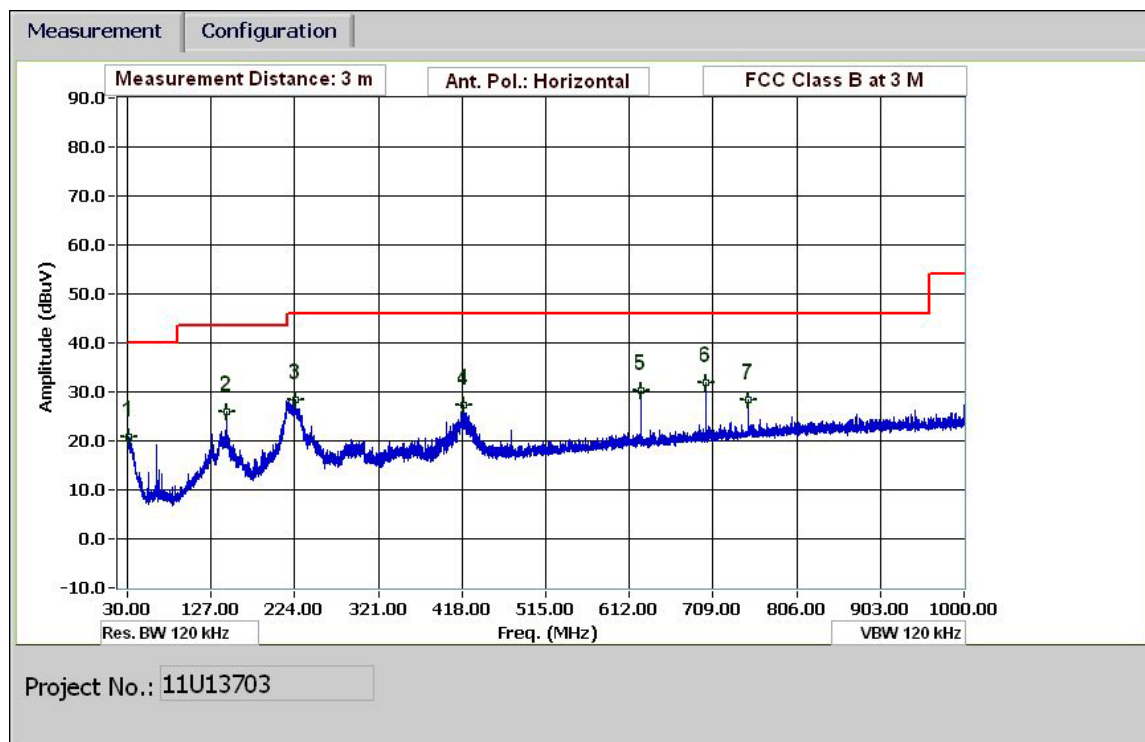
8.3.3. RX ABOVE 1 GHz FOR 40 MHz BANDWIDTH IN THE 5.8 GHz BAND

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company:		Apple Inc.														
Project #:		11U13703														
Date:		3/23/2011														
Test Engineer:		William Zhuang														
Configuration:		EUT with Laptop														
Mode:		HT40 Mode, High Ch. Rx On														
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T144 Miteq 3008A00931									RX RSS 210				
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										
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)	
1.065	3.0	54.1	40.0	24.1	2.4	-39.4	0.0	0.0	41.2	27.1	74	54	-32.8	-26.9	V	
1.147	3.0	59.9	39.4	24.3	2.5	-39.3	0.0	0.0	47.5	27.0	74	54	-26.5	-27.0	V	
1.191	3.0	60.3	39.2	24.5	2.6	-39.2	0.0	0.0	48.1	27.1	74	54	-25.9	-26.9	V	
1.594	3.0	53.4	35.9	25.9	3.0	-38.6	0.0	0.0	43.7	26.2	74	54	-30.3	-27.8	V	
1.065	3.0	48.3	35.4	24.1	2.4	-39.4	0.0	0.0	35.4	22.6	74	54	-38.6	-31.4	H	
1.147	3.0	54.1	41.0	24.3	2.5	-39.3	0.0	0.0	41.7	28.6	74	54	-32.3	-25.4	H	
1.191	3.0	54.4	35.7	24.5	2.6	-39.2	0.0	0.0	42.2	23.6	74	54	-31.8	-30.4	H	
1.594	3.0	47.5	33.0	25.9	3.0	-38.6	0.0	0.0	37.7	23.2	74	54	-36.3	-30.8	H	
Rev. 07.22.09																
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit			
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit			
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit			
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit			
CL	Cable Loss					HPF	High Pass Filter									

8.4. RADIATED BELOW 1 GHz

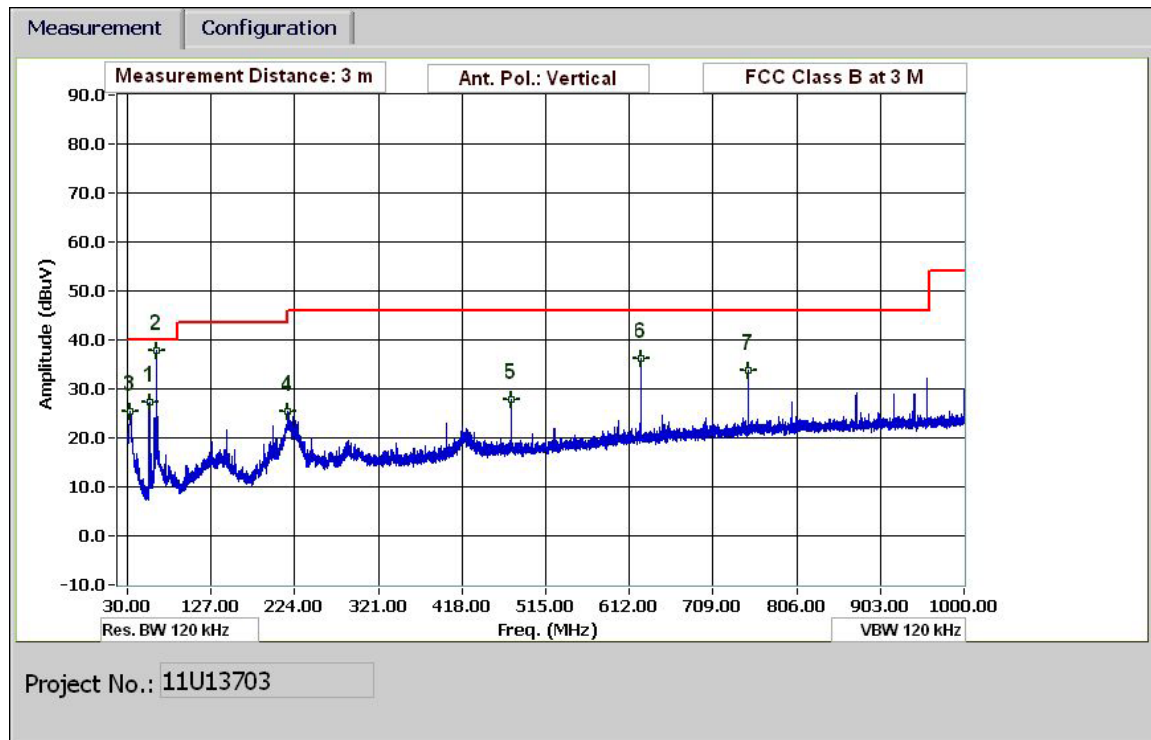
SPURIOUS EMISSIONS 30 TO 1000 MHz (HORIZONTAL)

HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (VERTICAL)

VERTICAL PLOT



TABULATED DATA

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

Test Engr: William Zhuang
Date: 03/22/11
Project #: 11U13703
Company: Apple Inc.
Test Target: FCC Class B
Mode Oper: 5.8 GHz band, 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	Pad dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
Horizontal															
31.44	3.0	29.1	19.5	0.5	28.4	0.0	0.0	20.7	40.0	-19.3	H	P	100.0	0 - 360	Prescan
145.085	3.0	40.1	12.9	1.1	28.3	0.0	0.0	25.9	43.5	-17.6	H	P	100.0	0 - 360	Prescan
224.528	3.0	43.5	11.9	1.3	28.2	0.0	0.0	28.4	46.0	-17.6	H	P	100.0	0 - 360	Prescan
419.296	3.0	38.2	15.3	1.9	28.0	0.0	0.0	27.3	46.0	-18.7	H	P	100.0	0 - 360	Prescan
624.985	3.0	36.7	18.7	2.3	27.4	0.0	0.0	30.3	46.0	-15.7	H	P	100.0	0 - 360	Prescan
700.228	3.0	37.1	19.6	2.5	27.2	0.0	0.0	31.9	46.0	-14.1	H	P	100.0	0 - 360	Prescan
750.03	3.0	32.9	20.3	2.5	27.3	0.0	0.0	28.4	46.0	-17.6	H	P	100.0	0 - 360	Prescan
Vertical															
33.24	3.0	34.5	18.7	0.5	28.4	0.0	0.0	25.4	40.0	-14.6	V	P	100.0	0 - 360	Prescan
55.561	3.0	47.0	8.1	0.7	28.4	0.0	0.0	27.4	40.0	-12.6	V	P	100.0	0 - 360	Prescan
64.321	3.0	57.5	8.0	0.7	28.4	0.0	0.0	37.8	40.0	-2.2	V	P	100.0	0 - 360	Prescan
215.648	3.0	40.4	11.9	1.3	28.2	0.0	0.0	25.4	43.5	-18.1	V	P	100.0	0 - 360	Prescan
474.978	3.0	37.4	16.3	2.0	27.9	0.0	0.0	27.8	46.0	-18.2	V	P	100.0	0 - 360	Prescan
625.105	3.0	42.5	18.7	2.3	27.4	0.0	0.0	36.1	46.0	-9.9	V	P	100.0	0 - 360	Prescan
750.03	3.0	38.4	20.3	2.5	27.3	0.0	0.0	33.9	46.0	-12.1	V	P	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

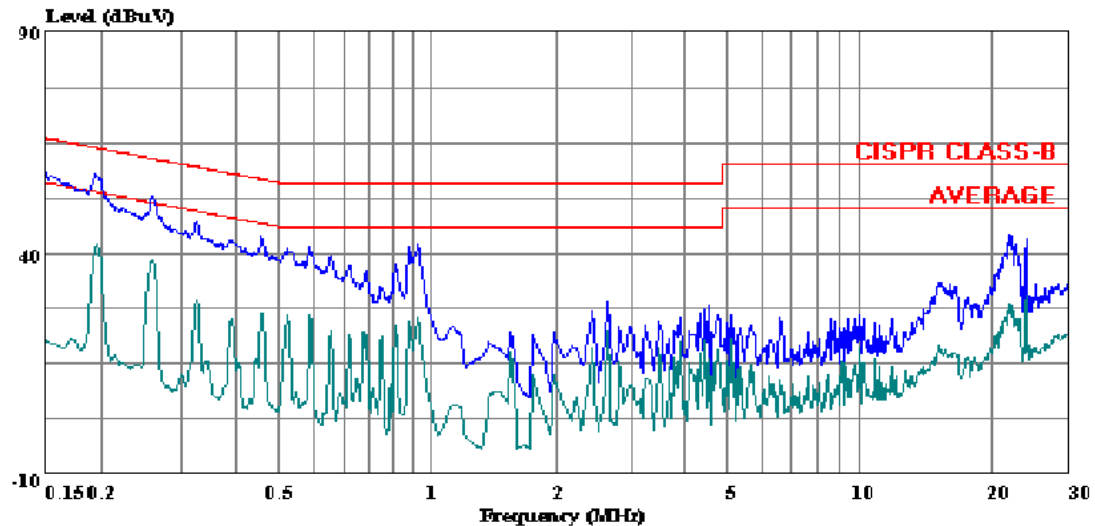
CONDUCTED EMISSIONS DATA									
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.19	57.88	--	41.81	0.00	63.91	53.91	-6.03	-12.10	L1
0.26	52.78	--	38.60	0.00	61.43	51.43	-8.65	-12.83	L1
1.03	42.02	--	25.70	0.00	56.00	46.00	-13.98	-20.30	L1
0.19	56.46	--	40.44	0.00	63.91	53.91	-7.45	-13.47	L2
0.26	51.80	--	37.05	0.00	61.43	51.43	-9.63	-14.38	L2
1.03	44.53	--	31.40	0.00	56.00	46.00	-11.47	-14.60	L2
6 Worst Data									

LINE 1 RESULTS



Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538
Tel: (510) 771-1000
Fax: (510) 661-0888

Data#: 7 File#: 11U13703-LC.EMI Date: 03-17-2011 Time: 11:02:24

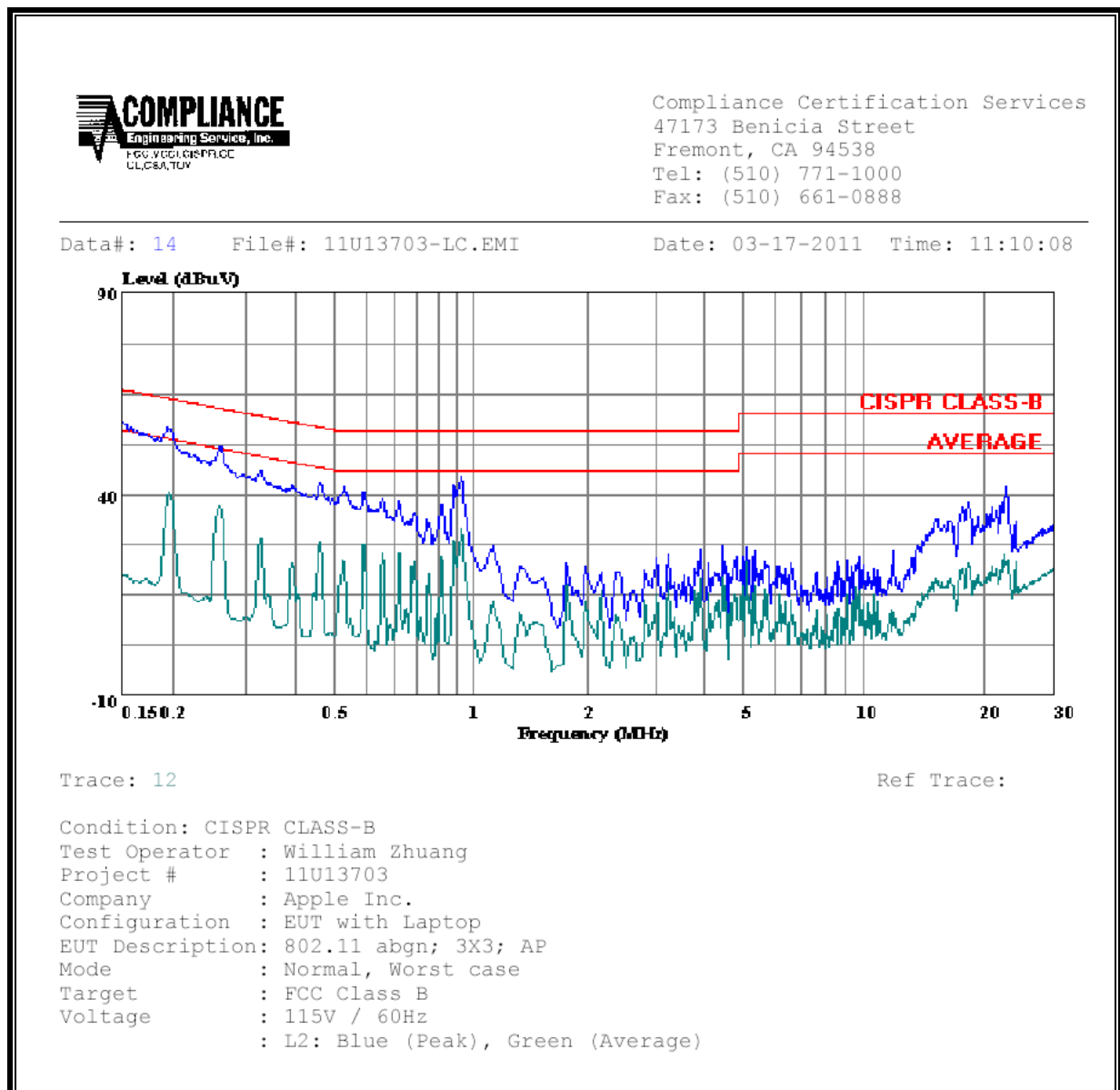


Trace: 5

Ref Trace:

Condition: CISPR CLASS-B
Test Operator : William Zhuang
Project # : 11U13703
Company : Apple Inc.
Configuration : EUT with Laptop
EUT Description: 802.11 abgn; 3X3; AP
Mode : Normal, Worst case
Target : FCC Class B
Voltage : 115V / 60Hz
 : L1: Blue (Peak), Green (Average)

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	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	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).

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.

Distance is given by:

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

where

D = Separation distance in m

EIRP = Equivalent Isotropic Radiated Power in W

S = Power density in W/m²

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

$$\text{Total EIRP} = (P_1 * G_1) + (P_2 * G_2) + \dots + (P_n * G_n)$$

where

P_x = Power of transmitter x

G_x = Numeric gain of antenna x

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply, a fraction of the exposure limit is established for each band, such that the sum of the fractions is less than or equal to one.

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

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency, as 824 MHz / 1500 = 0.55 mW/cm² (FCC) and 824 MHz / 150 = 5.5 W/m² (IC).

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

Multiple chain or colocated transmitters									
Band	Mode	Chain for MIMO	Separation Distance (m)	Output AV Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	Bluetooth	N/A		N/A	N/A	N/A	N/A		
2.4 GHz	WLAN	1		19.60	0.10	19.70	0.09		
2.4 GHz	WLAN	2		20.00	0.27	20.27	0.11		
2.4 GHz	WLAN	3		19.60	4.32	23.92	0.25		
Combined			0.20				0.45	0.89	0.089

Multiple chain or colocated transmitters									
Band	Mode	Chain for MIMO	Separation Distance (m)	Output AV Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP (W)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	Bluetooth	N/A		N/A	N/A	N/A	N/A		
5.8 GHz	WLAN	1		18.90	4.38	23.28	0.21		
5.8 GHz	WLAN	2		18.90	0.81	19.71	0.09		
5.8 GHz	WLAN	3		19.50	3.09	22.59	0.18		
Combined			0.20				0.49	0.97	0.097