



**FCC CFR47 PART 15 SUBPART C
FCC CFR47 PART 15 SUBPART B
INDUSTRY CANADA RSS-210 ISSUE 7
INDUSTRY CANADA ICES-003 ISSUE 4**

CERTIFICATION TEST REPORT

FOR

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

MODEL NUMBER: A1355

FCC ID: BCGA1355

IC: 579C-A1355

REPORT NUMBER: 09U12759-1

ISSUE DATE: OCTOBER 15, 2009

Prepared for
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NVLAP LAB CODE 200065-0

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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: A1355

SERIAL NUMBER: 6F92701YACG

DATE TESTED: AUGUST 10 - SEPTEMBER 25, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
CFR 47 Part 15 Subpart B	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass
INDUSTRY CANADA ICES-003 ISSUE 4	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

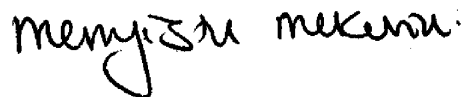
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:



FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:



MENGISTU MEKURIA
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, ICES-003 ISSUE 4, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

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

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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 Marvell.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	23.75	237.14
2412 - 2462	802.11g	21.56	143.22
2412 - 2462	802.11n HT20	21.17	130.92

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11a	23.07	202.77
5745 - 5805	802.11n HT20	22.17	164.82
5755 - 5795	802.11n HT40	21.44	139.32

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 firmware version is 7.5d11auto20090904T0200-TOT_develop.

The test utility software is m4Tool_CL_OL_k10a_PPSD.

5.5. WORST-CASE CONFIGURATION AND MODE

For Radiated Emissions 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

For 5.8 GHz band, Peak Power Spectral Density was investigated for individual chains versus combiner, and it was determined that combiner is worst-case; therefore, all other measurements of PPSD in other channels and modes in the 5.8 GHz band were performed using a combiner.

For 5.8 GHz band, RF Conducted Spurious was investigated for individual chains versus combiner, and it was determined that the combiner is worst-case; therefore, all other measurements of RF conducted spurious in other channels and modes in the 5.8 GHz band were performed using a combiner.

For the digital configuration the EUT was connected to a laptop PC with minimum configuration, all ports of the EUT were connected to laptop PC and Ethernet switch, EUT was transmitting at the channel with highest output power and was being pinged by the laptop PC.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Laptop	Apple	Mac Book	PT358810
AC Adaptor	Apple	A1222	N/A

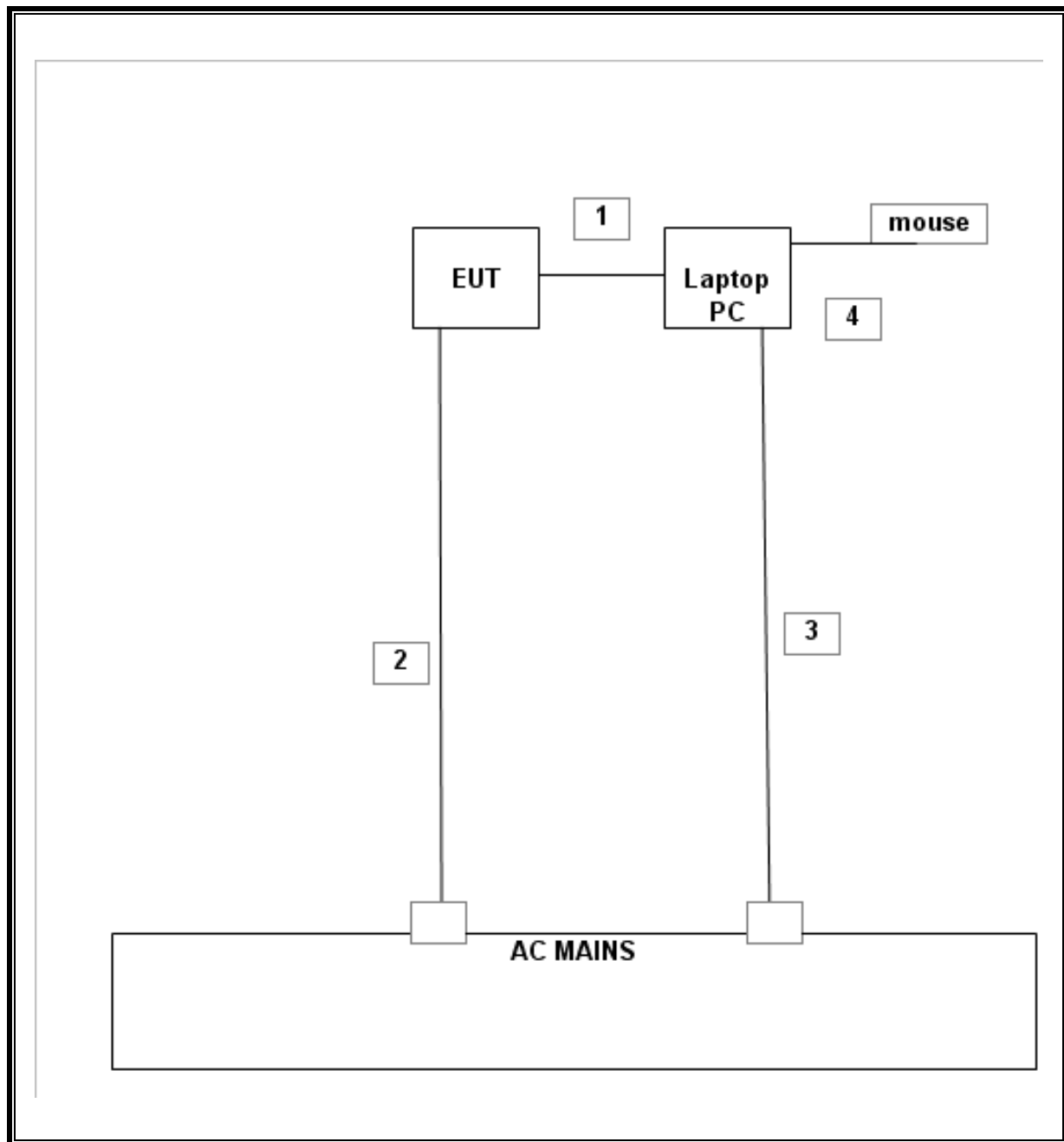
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	Ethernet	4	RJ43	unshielded	0.5m	N/A
2	DC	1	DC	unshielded	1m	N/A
3	DC	1	DC	unshielded	1m	N/A

TEST SETUP

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

SETUP DIAGRAM FOR RADIO TESTS



SETUP FOR DIGITAL DEVICE TESTS:

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Notebook PC	Apple	A1286	W891700599H	DoC
AC Adapter 1	Apple	A1290	02327	DoC
Printer	HP	7850	MY56K1304B	DoC
AC Adapter 2	HP	0957-2084	5715480604	DoC
Mouse	Apple	N/A	097	N/A
5 Port 10/100 Switch	Linksys	SD205	REF0043003586	DoC

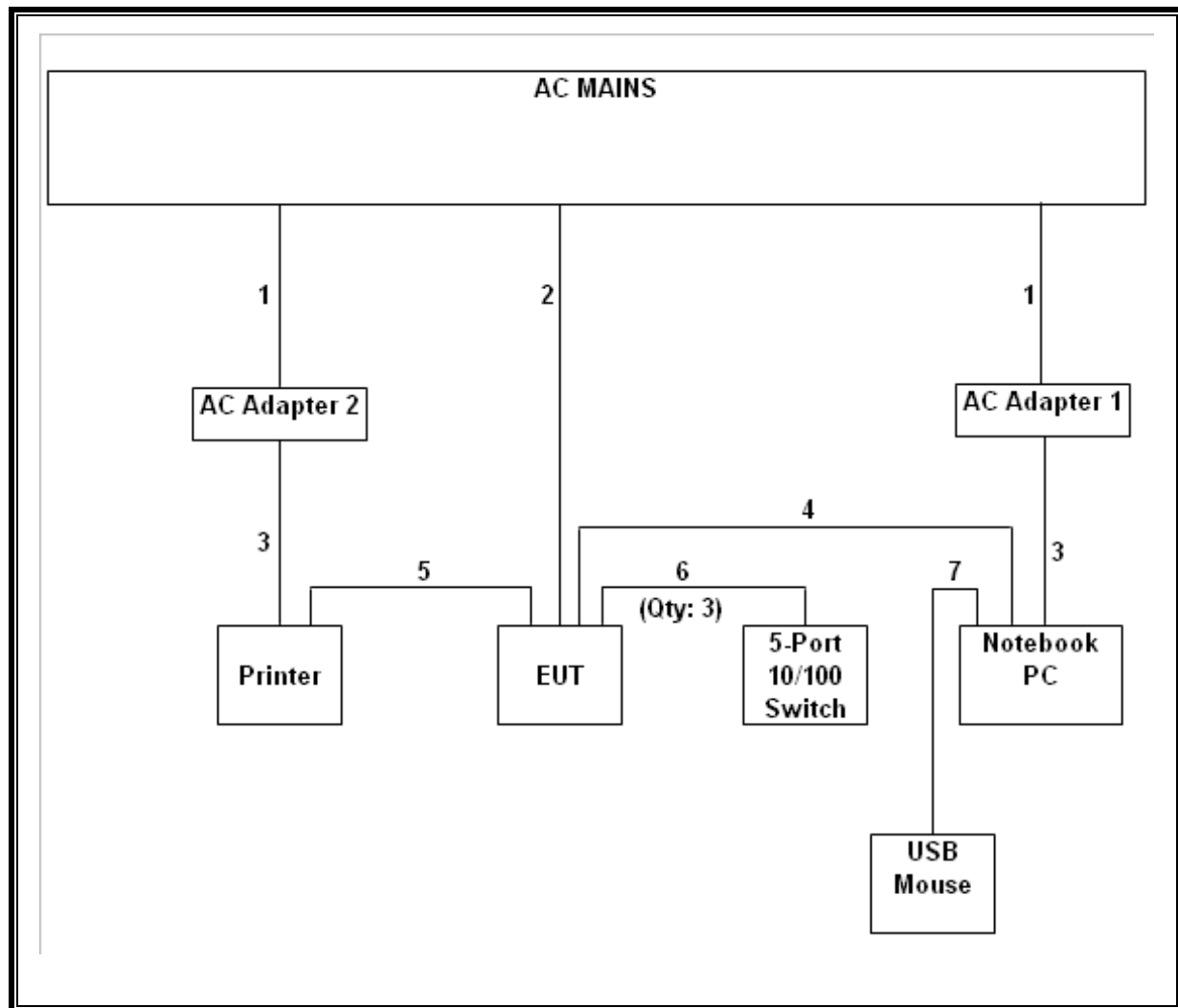
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC Input	2	3-Prong	Un-Shielded	1.5m	N/A
2	AC Input	1	2-Prong	Un-Shielded	2m	N/A
3	DC Input	2	Mini-Jack	Un-Shielded	2m	N/A
4	LAN	1	RJ-45	Un-Shielded	1m	N/A
5	USB	1	USB	Shielded	1.5m	N/A
6	LAN	3	RJ-45	Shielded	1m	Quantity: 3 Cables
7	USB	1	USB	Shielded	1m	N/A

TEST SETUP

The Access Point EUT ports were connected with support equipment. The data transfer between the laptop and the EUT was taking place during the test.

SETUP DIAGRAM FOR DIGITAL DEVICE 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
Power Meter	Agilent	N1911A	AOU254846	3/4/2010
Power Meter	Agilent	E4417A	AOU286038	21/7/2010
Power Sensor	Agilent	N1921A	2346	2/4/2010
Power Sensor	Agilent	E9323A	3562	21/7/2010
Power Sensor	Agilent	E9323A	3563	21/7/2010
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	2/3/2010
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	8/24/2010
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/16/2009
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	2/4/2010
Antenna, Horn, 18 GHz	EMCO	3115	C00945	1/29/2010
Antenna, Bilog, 2 GHz	Sundt Sciences	JB1	C01011	1/14/2010
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	5/6/2011
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/29/2009
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/2009

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.

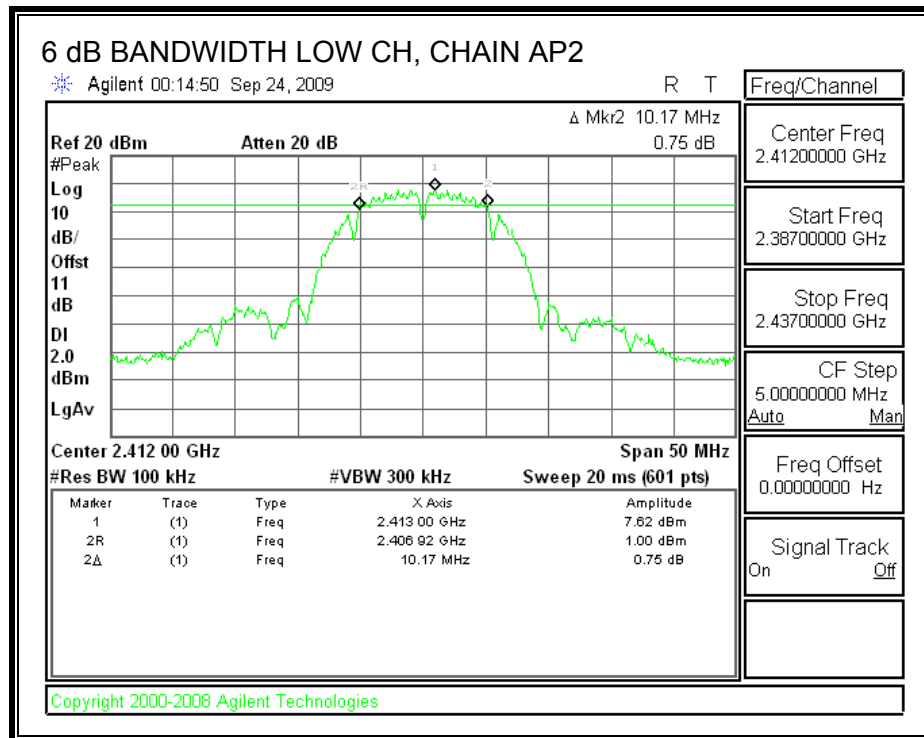
TEST PROCEDURE

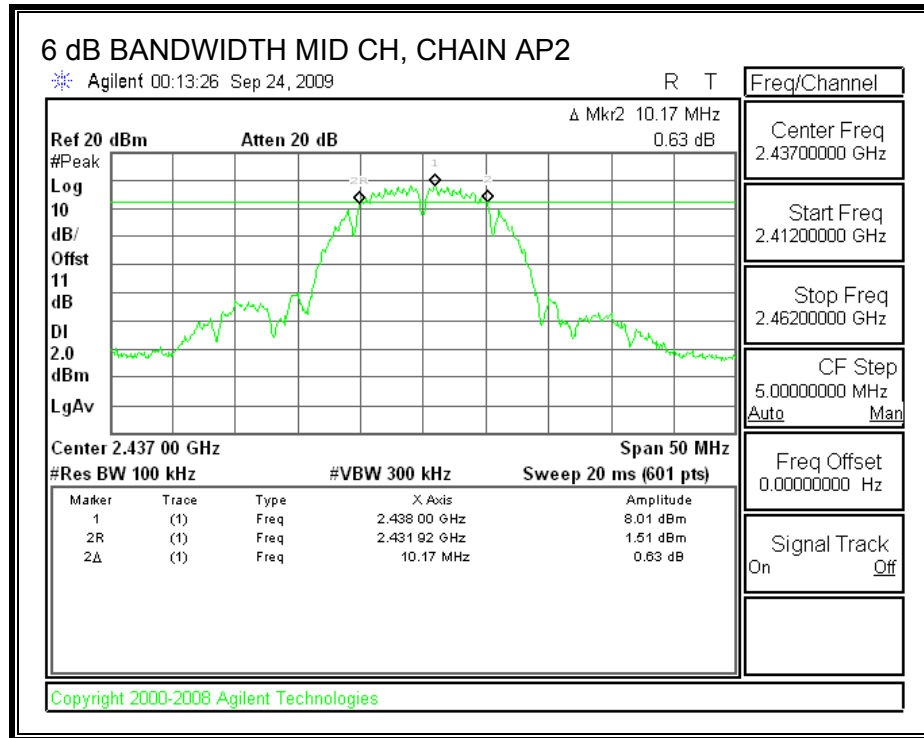
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

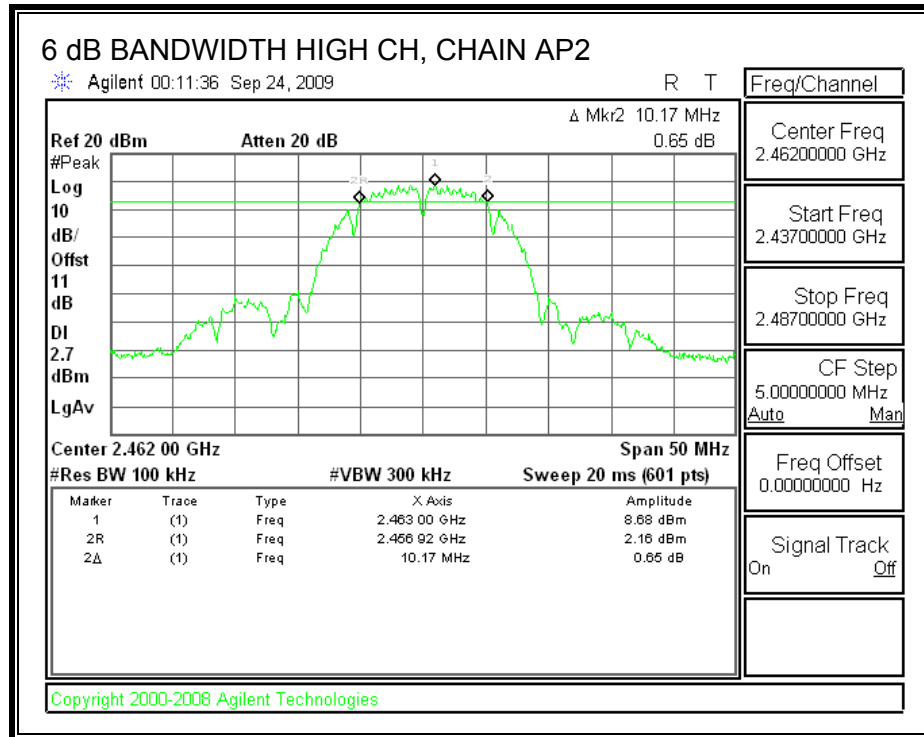
RESULTS

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	10.17000	10.33000	10.17000	0.5
Middle	2437	10.17000	10.17000	10.17000	0.5
High	2462	10.17000	10.17000	10.17000	0.5

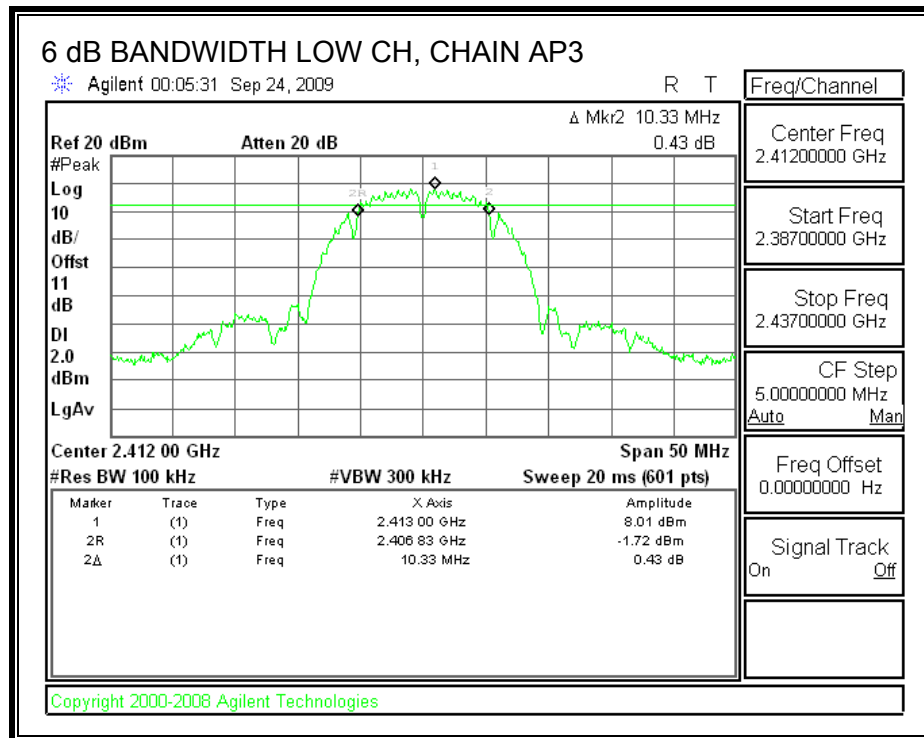
6 dB BANDWIDTH, CHAIN AP2

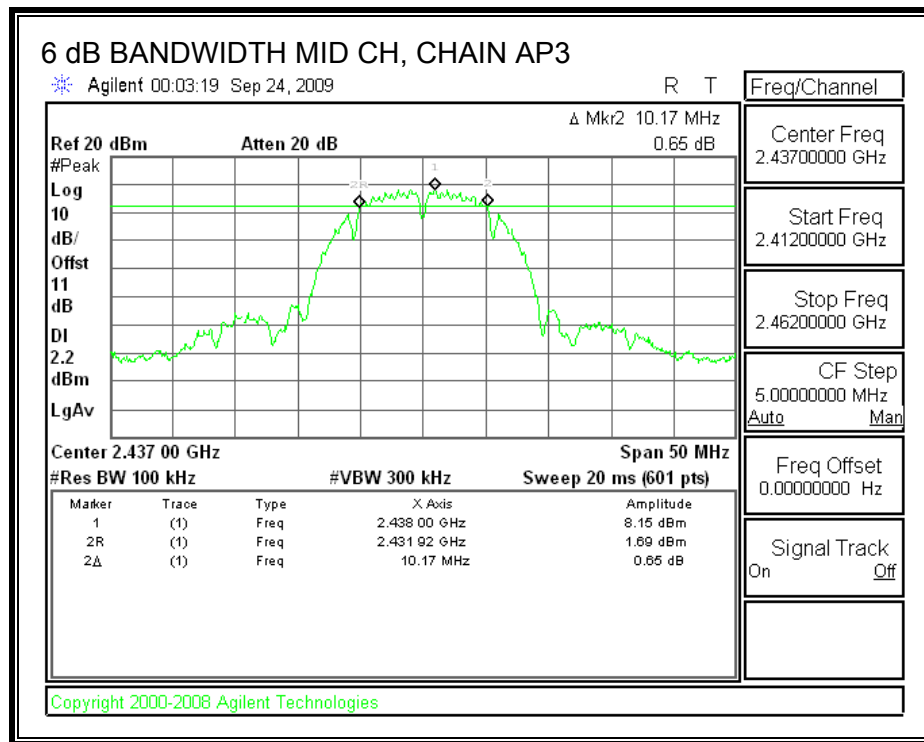


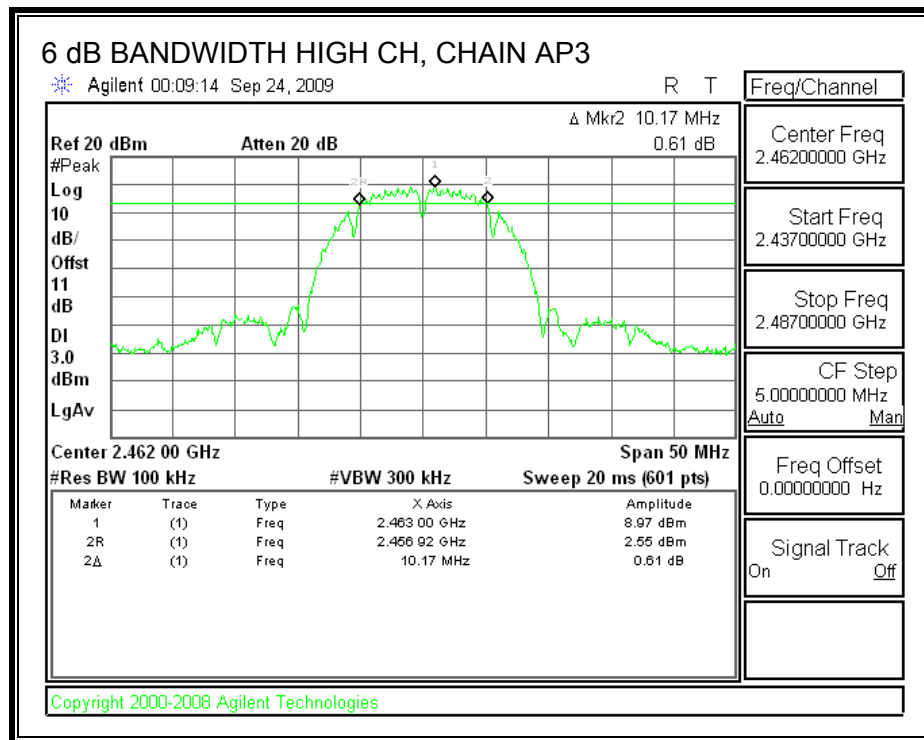




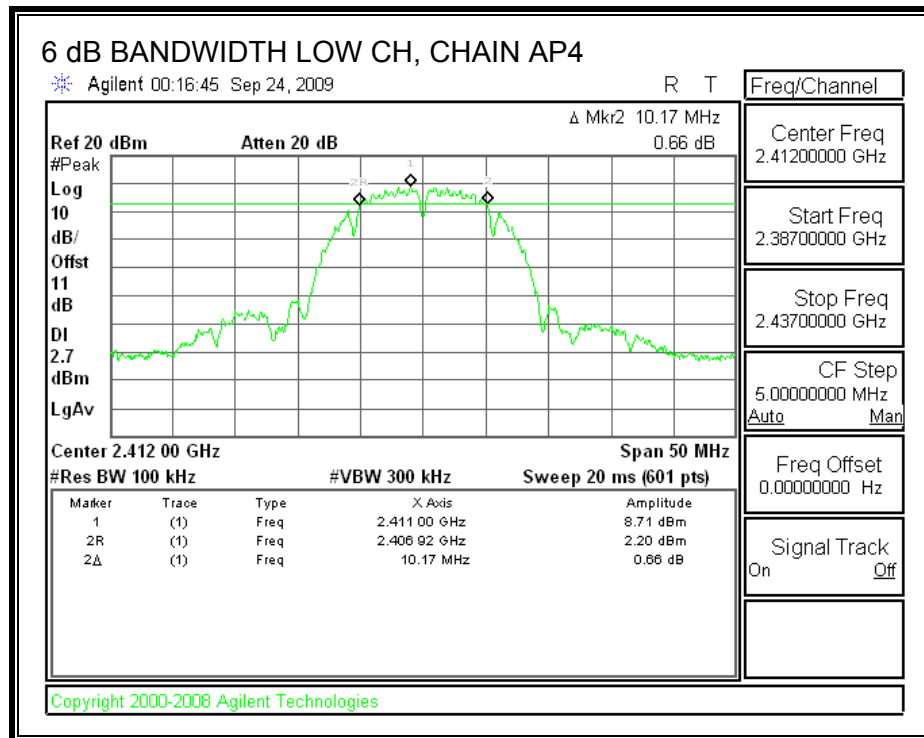
6 dB BANDWIDTH, CHAIN AP3

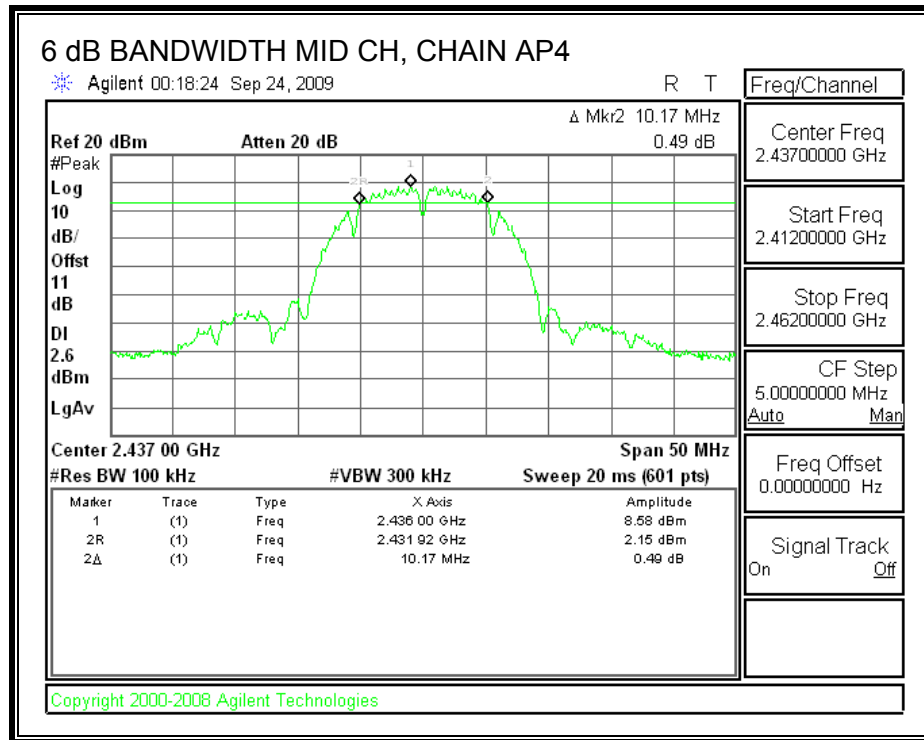


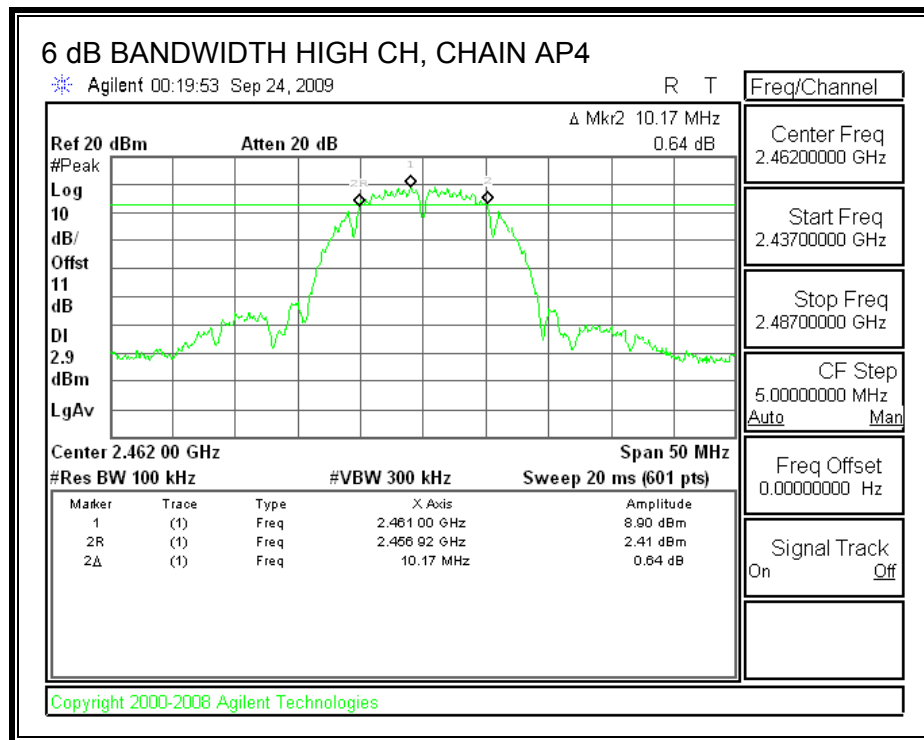




6 dB BANDWIDTH, CHAIN AP4







7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

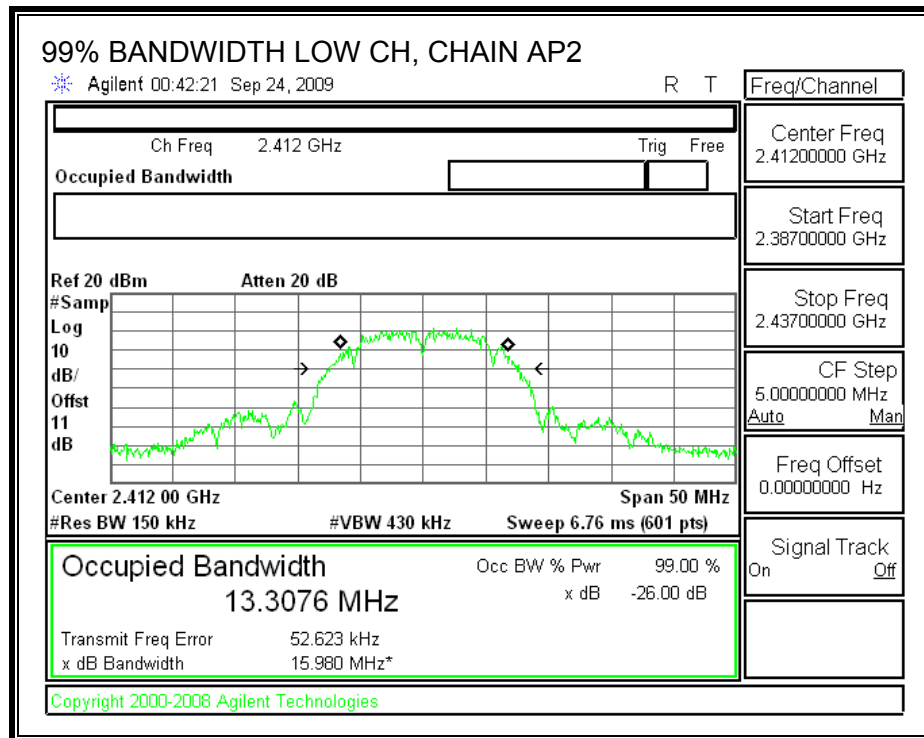
TEST PROCEDURE

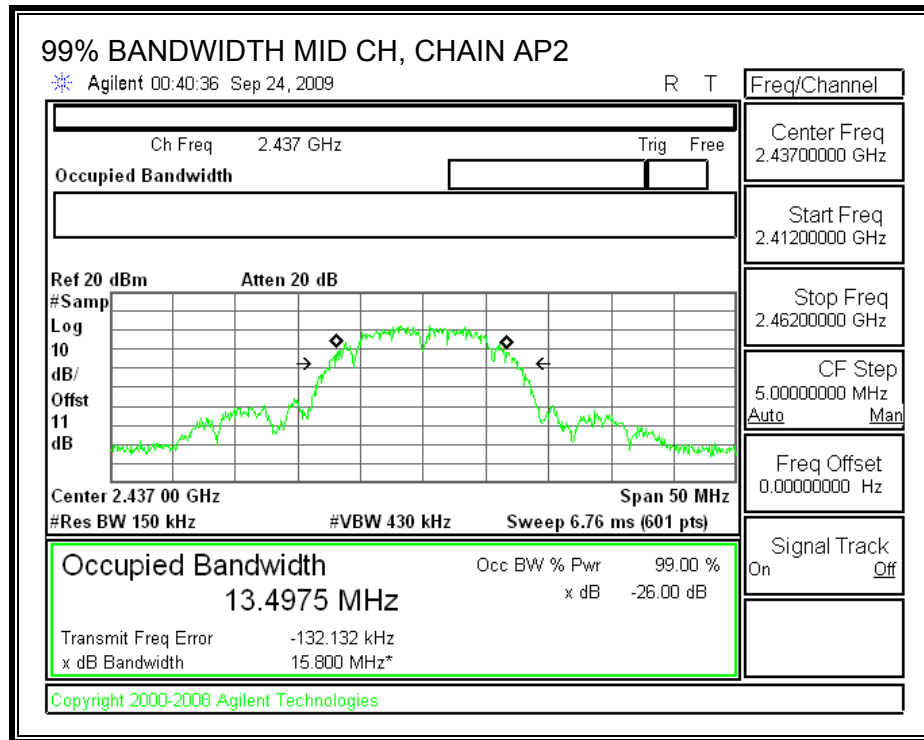
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

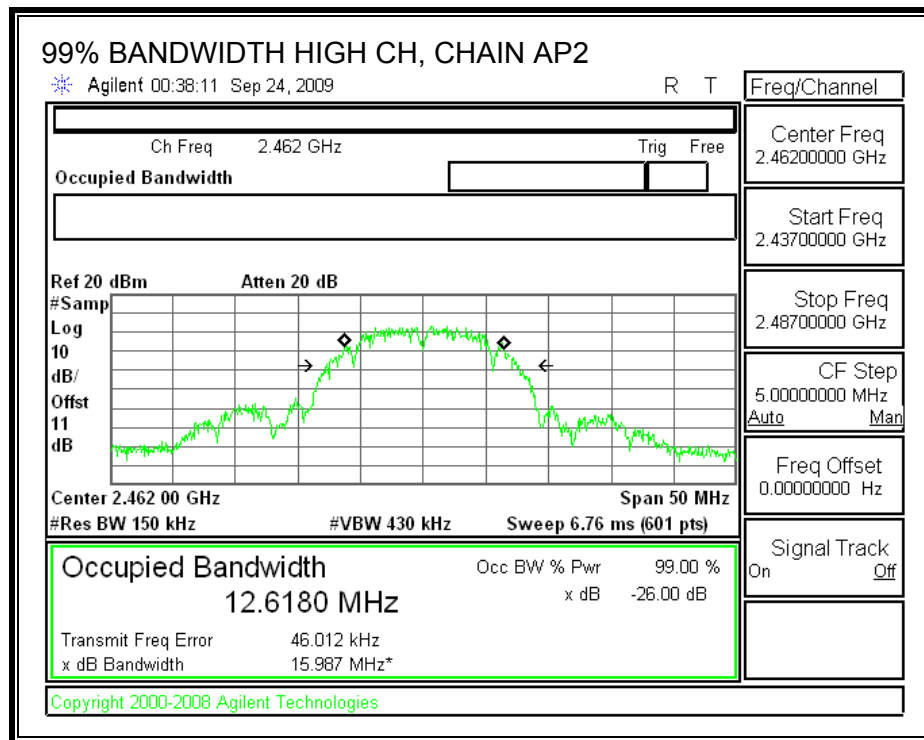
RESULTS

Channel	Frequency (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)	AP4 99% Bandwidth (MHz)
Low	2412	13.3076	13.4318	13.1132
Middle	2437	13.4975	13.4325	13.4304
High	2462	12.618	13.5701	13.0952

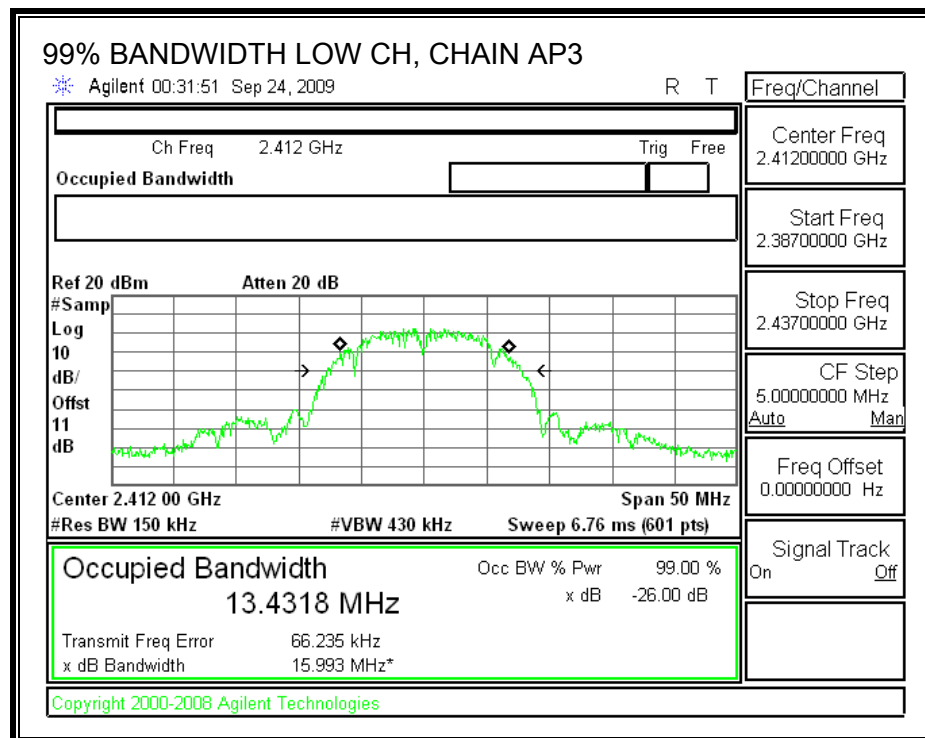
99% BANDWIDTH, CHAIN AP2

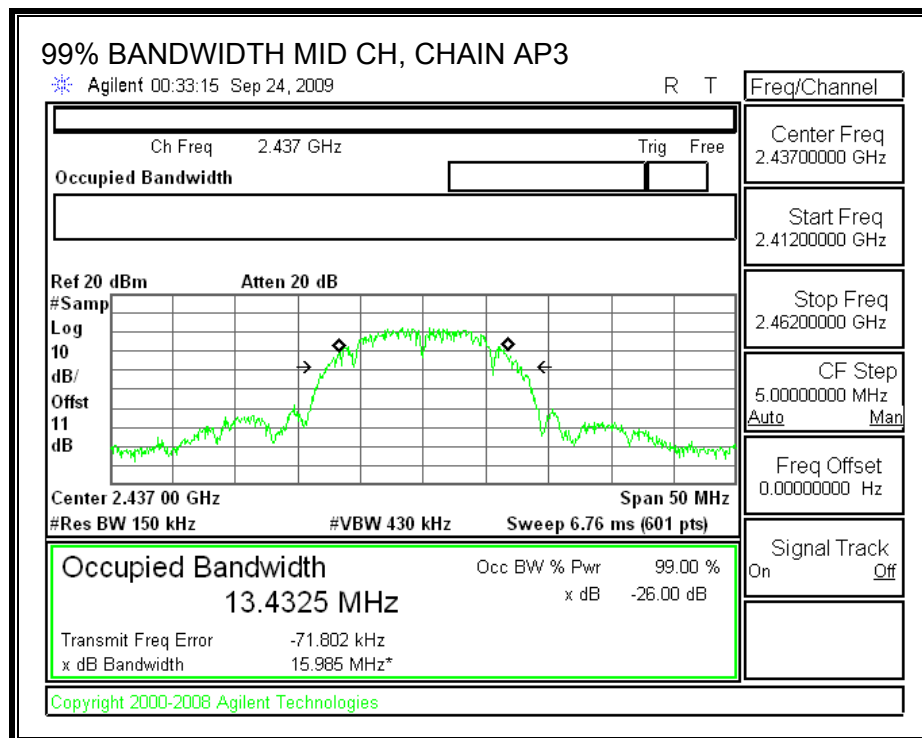


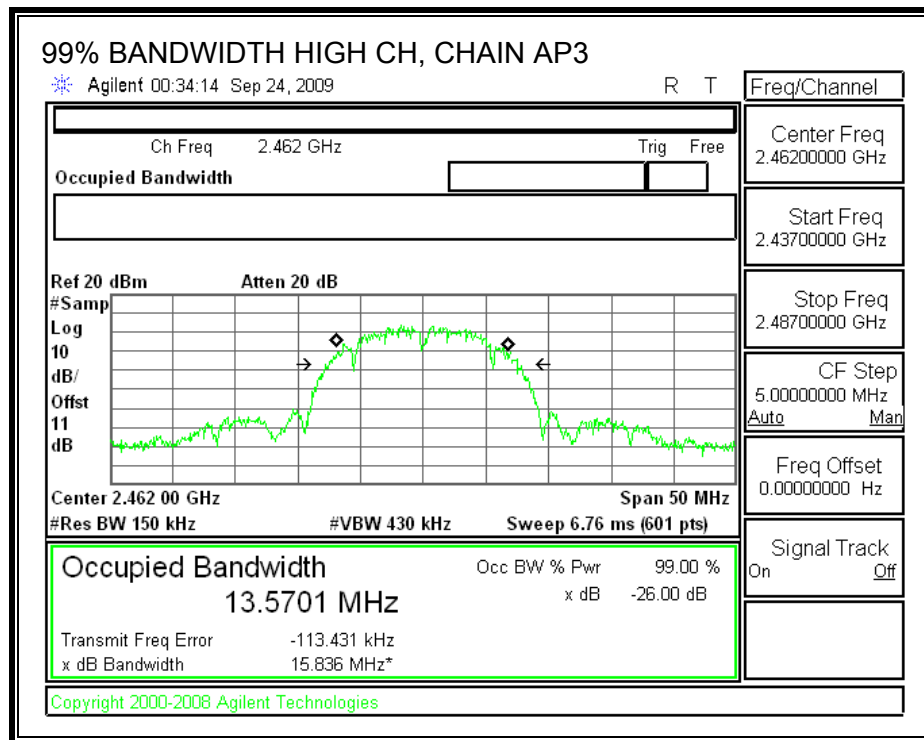




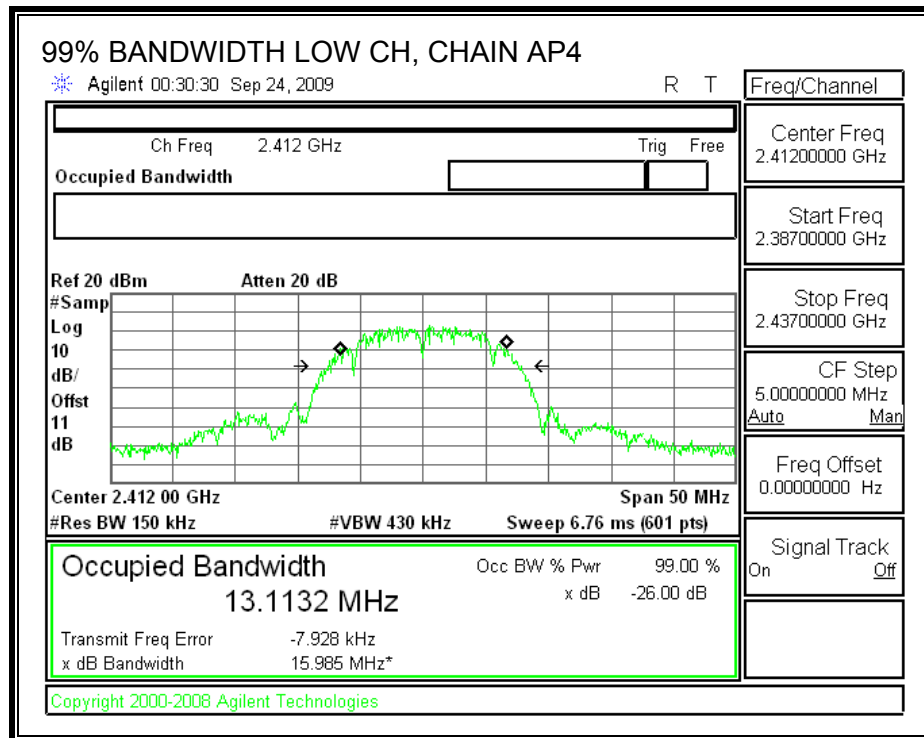
99% BANDWIDTH, CHAIN AP3

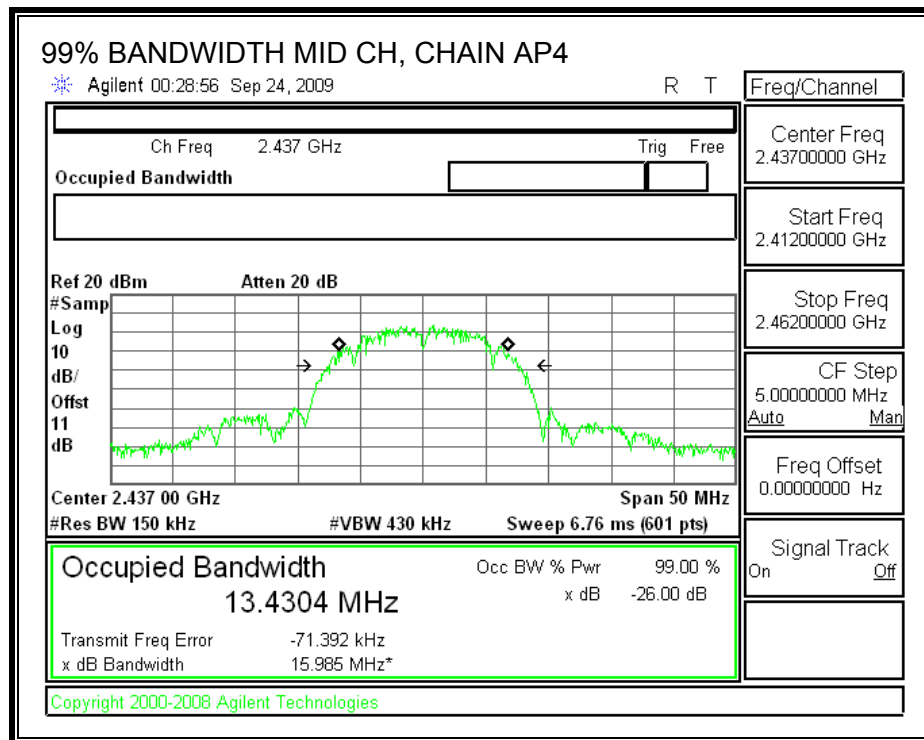


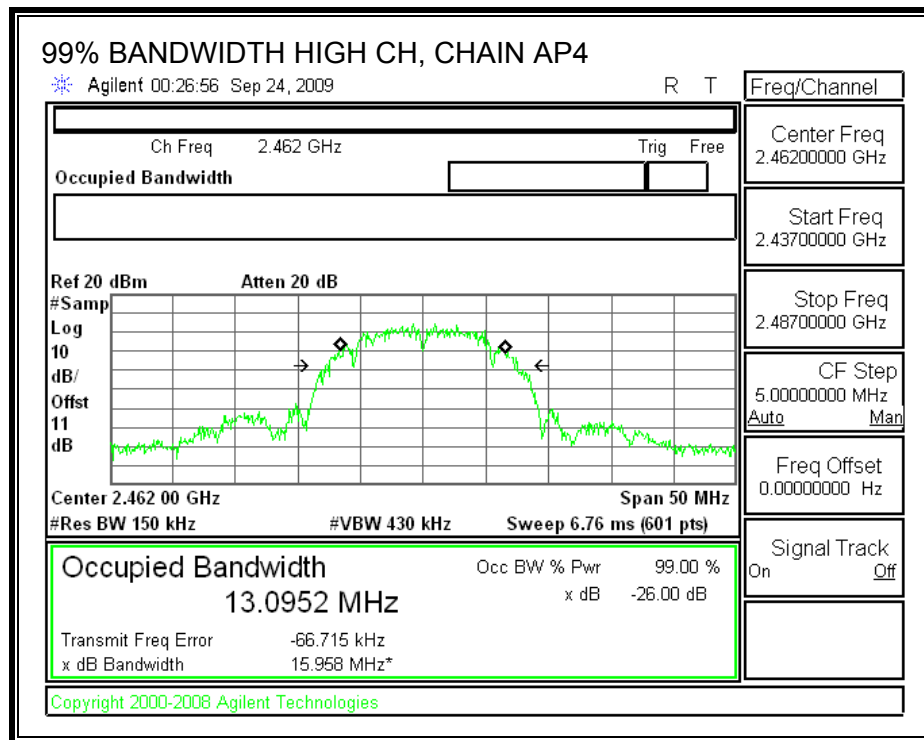




99% BANDWIDTH, CHAIN AP4







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 6.80 dBi for other than fixed, point-to-point operations, therefore the limit is 29.2 dBm.

TEST PROCEDURE

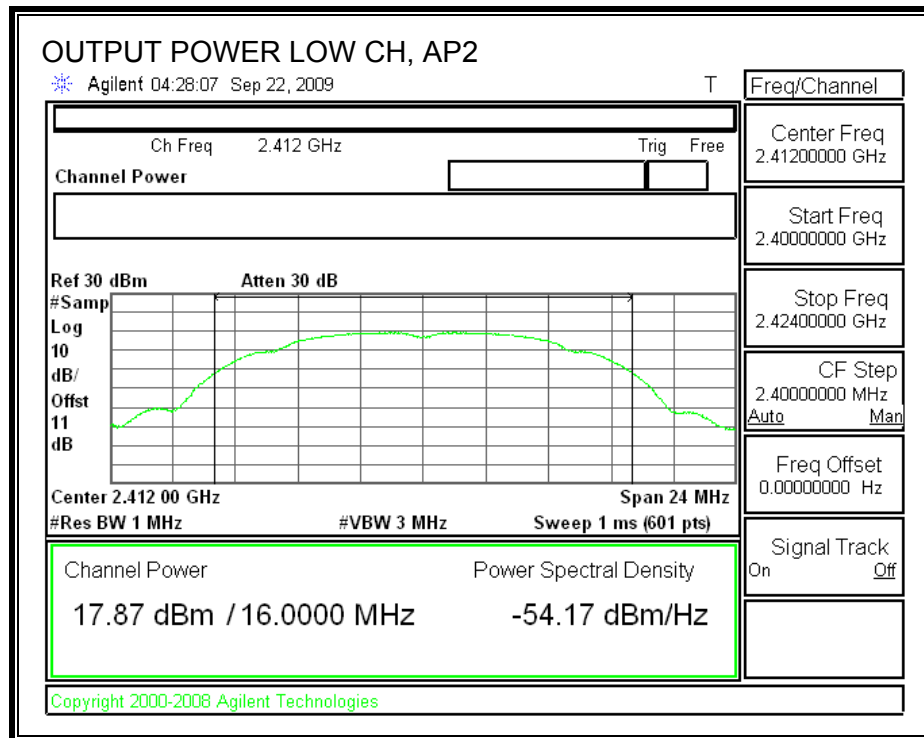
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

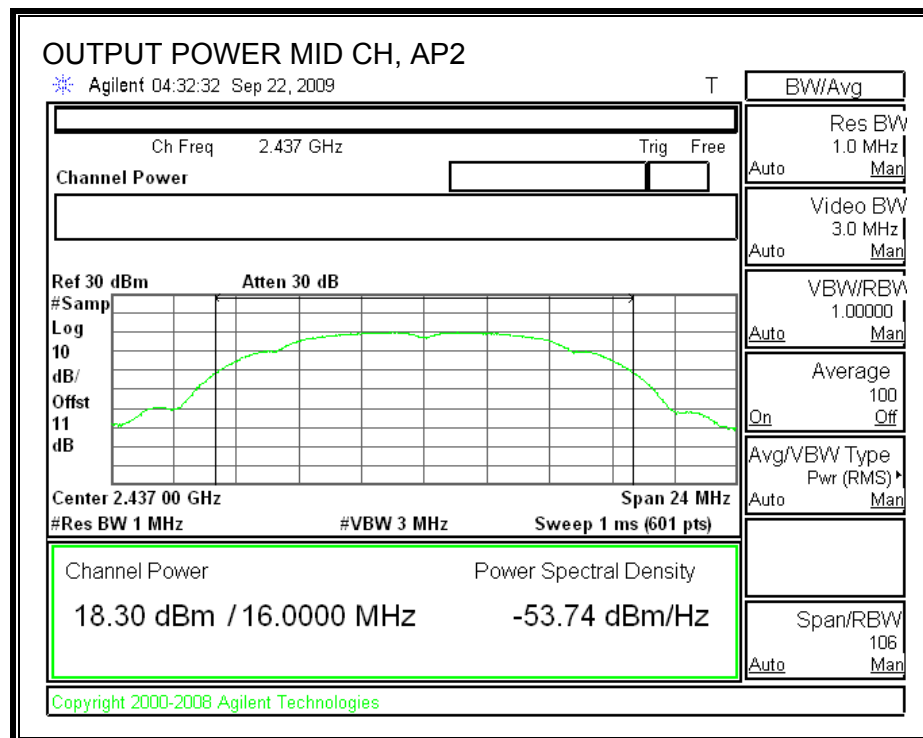
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

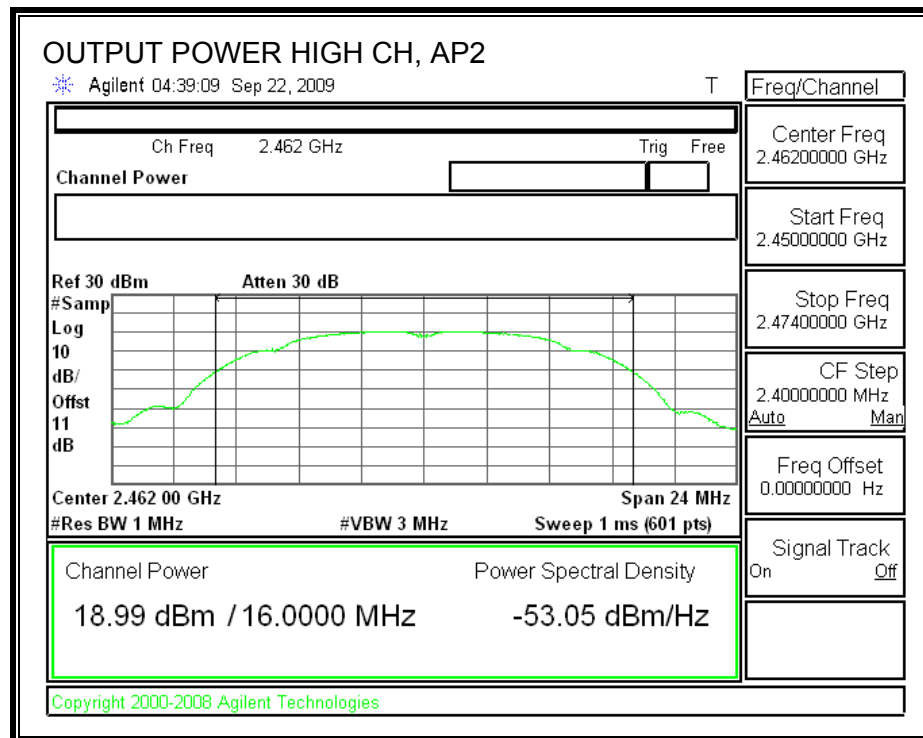
RESULTS

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	17.87	18.47	18.06	0.00	22.91	29.20	-6.29
Mid	2437	18.30	19.10	18.52	0.00	23.42	29.20	-5.78
High	2462	18.99	19.40	18.51	0.00	23.75	29.20	-5.45

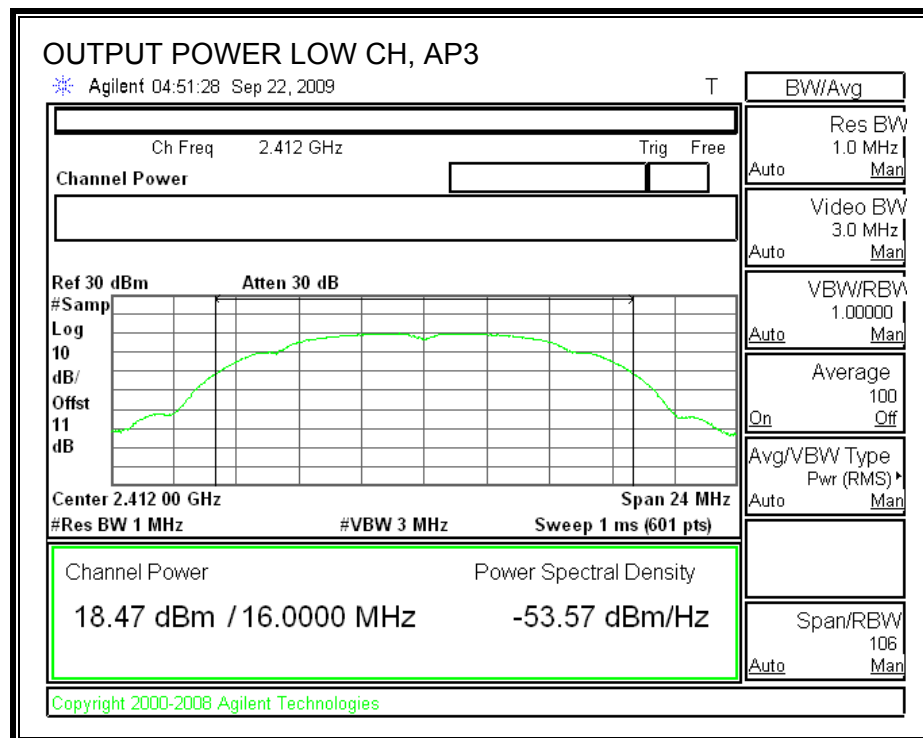
AP2 OUTPUT POWER

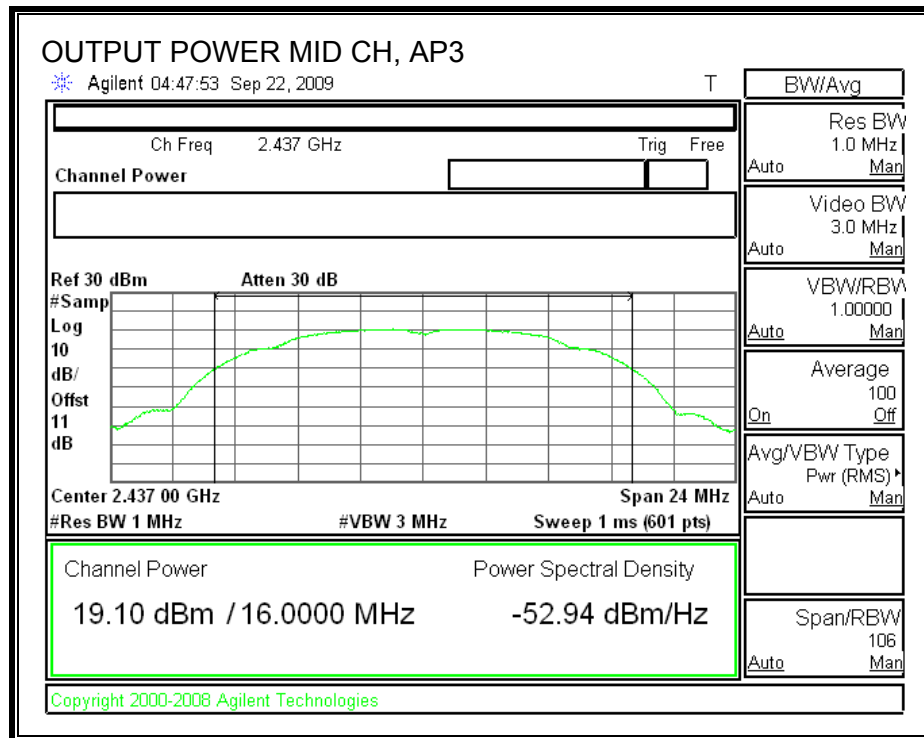


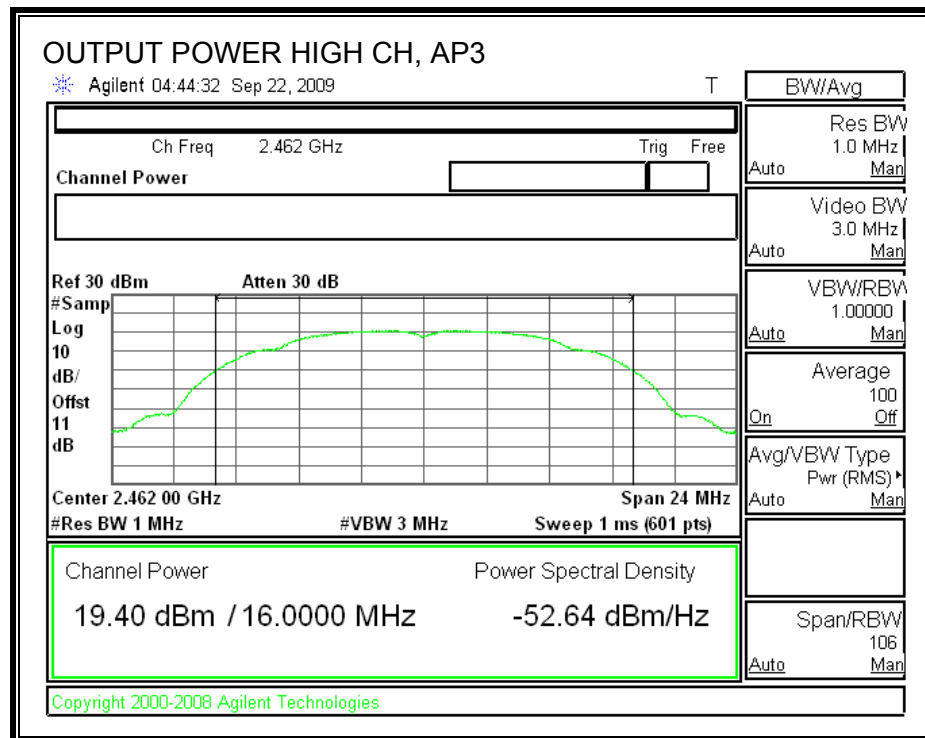




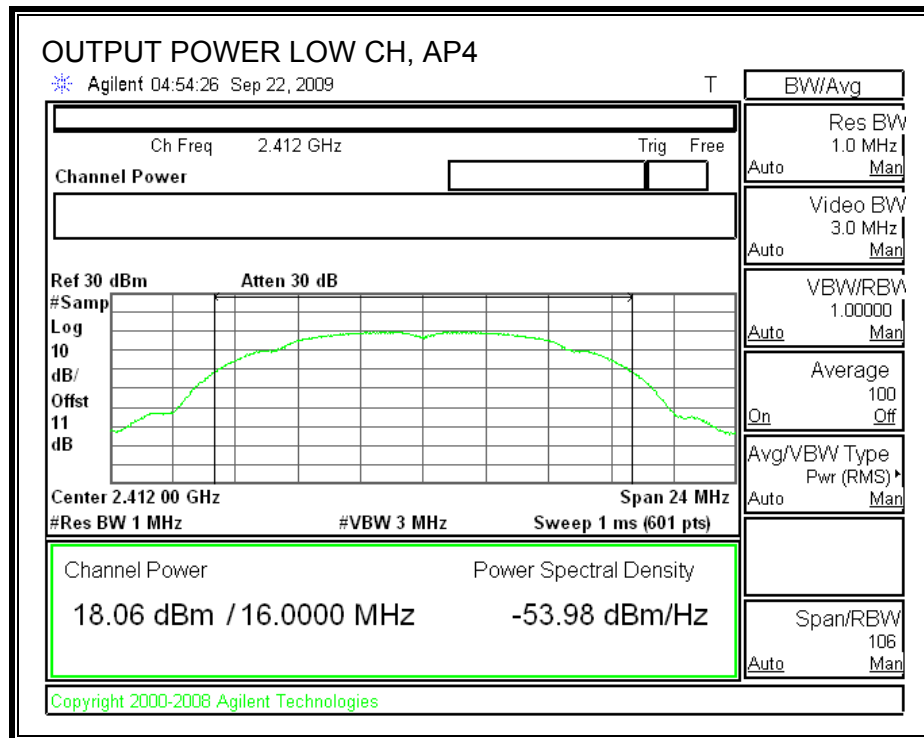
AP3 OUTPUT POWER

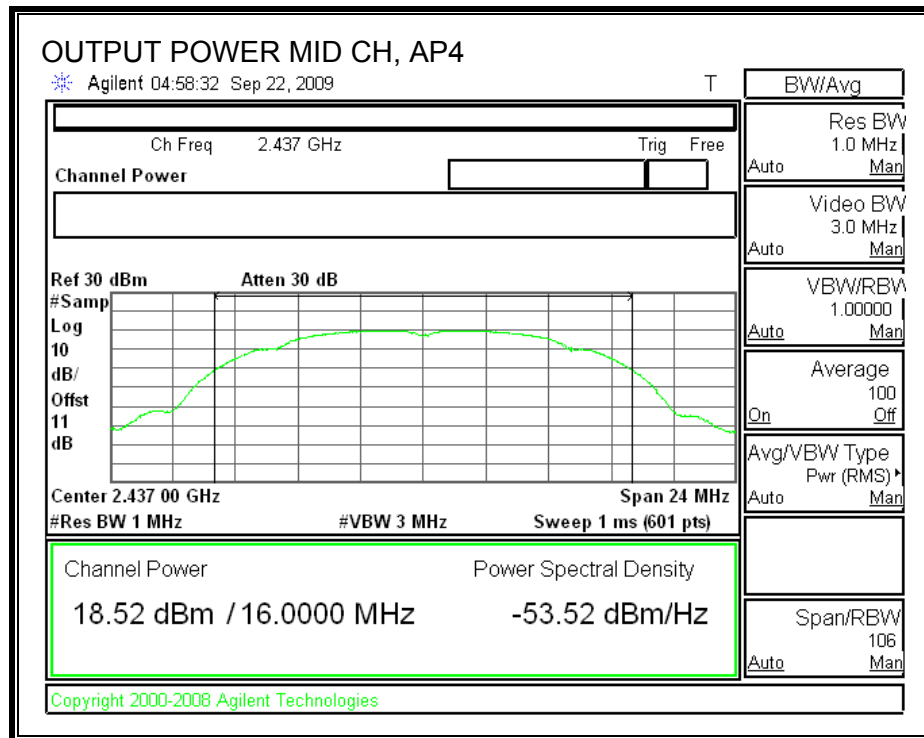


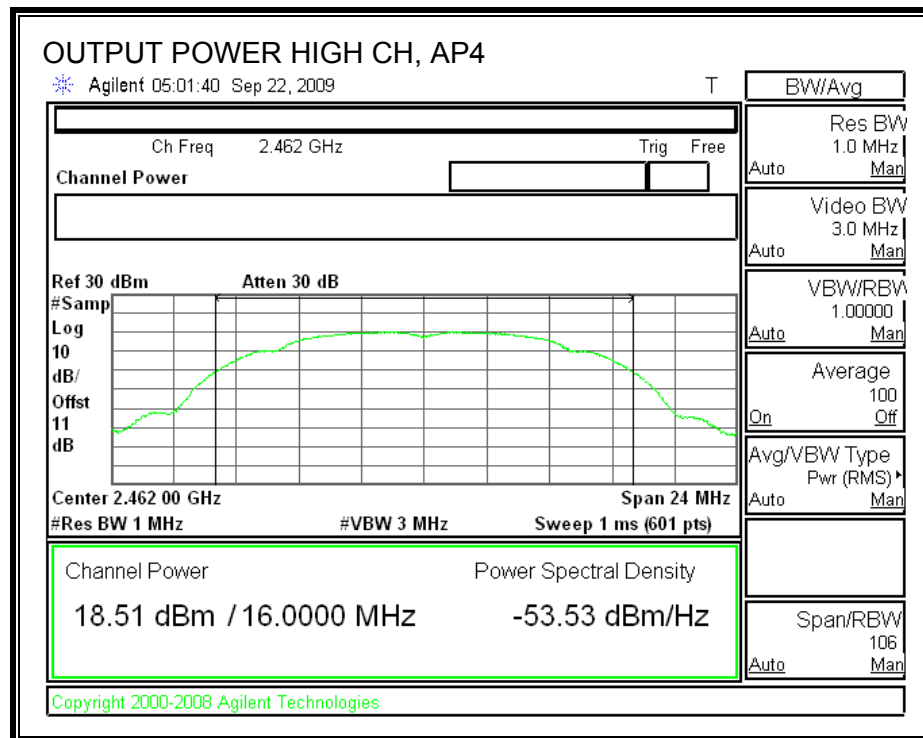




AP4 OUTPUT POWER







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

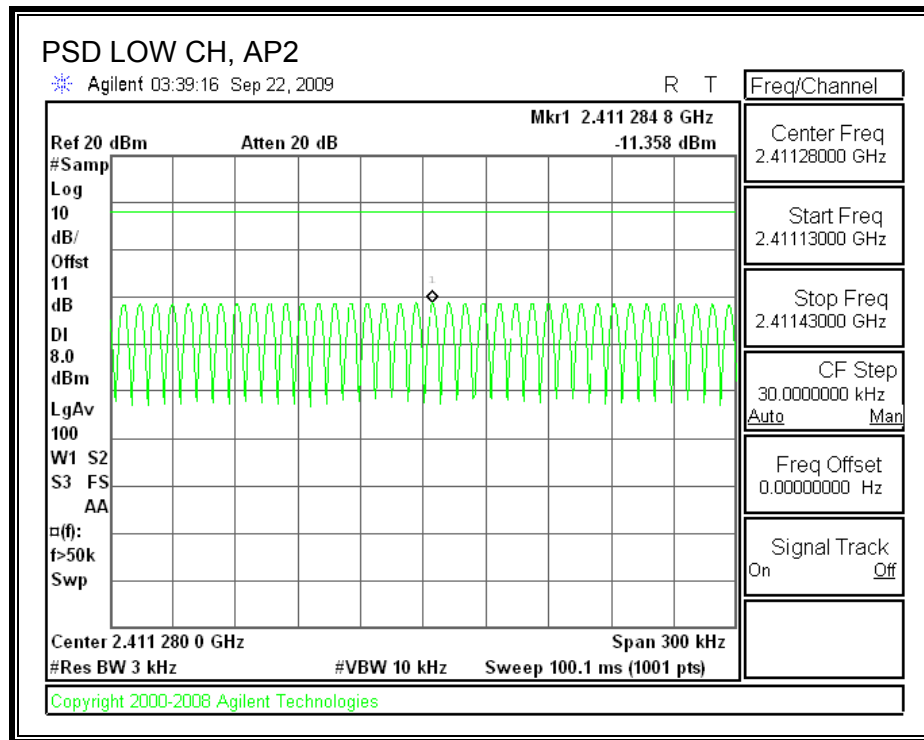
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

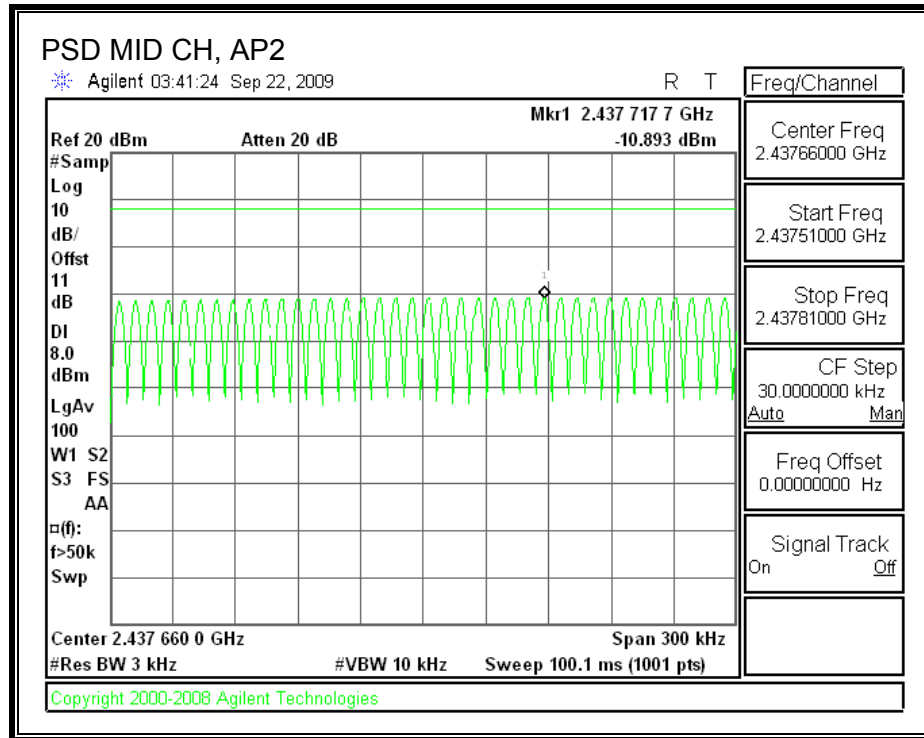
RESULTS

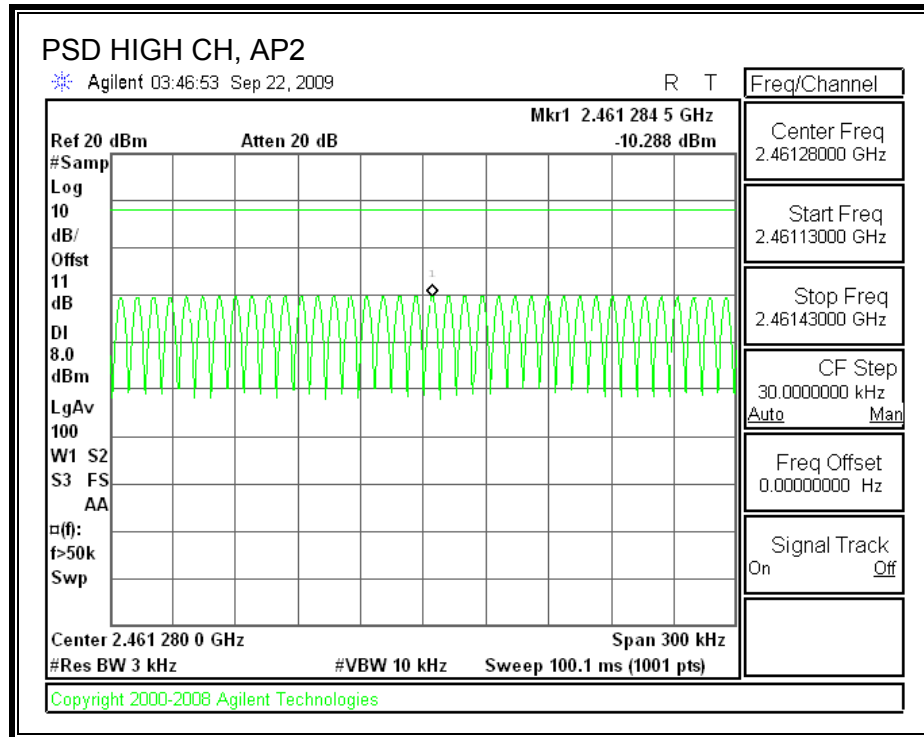
Channel	Frequency (MHz)	AP2 PSD (dBm)	AP3 PSD (dBm)	AP4 PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-11.358	-10.771	-11.315	8	-18.77
Middle	2437	-10.893	-10.673	-10.98	8	-18.67
High	2462	-10.288	-9.905	-10.253	8	-17.91

Channel	Frequency (MHz)	PSD with Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-6.15	8	-14.15
Middle	2437	-3.52	8	-11.52
High	2462	-0.43	8	-8.43

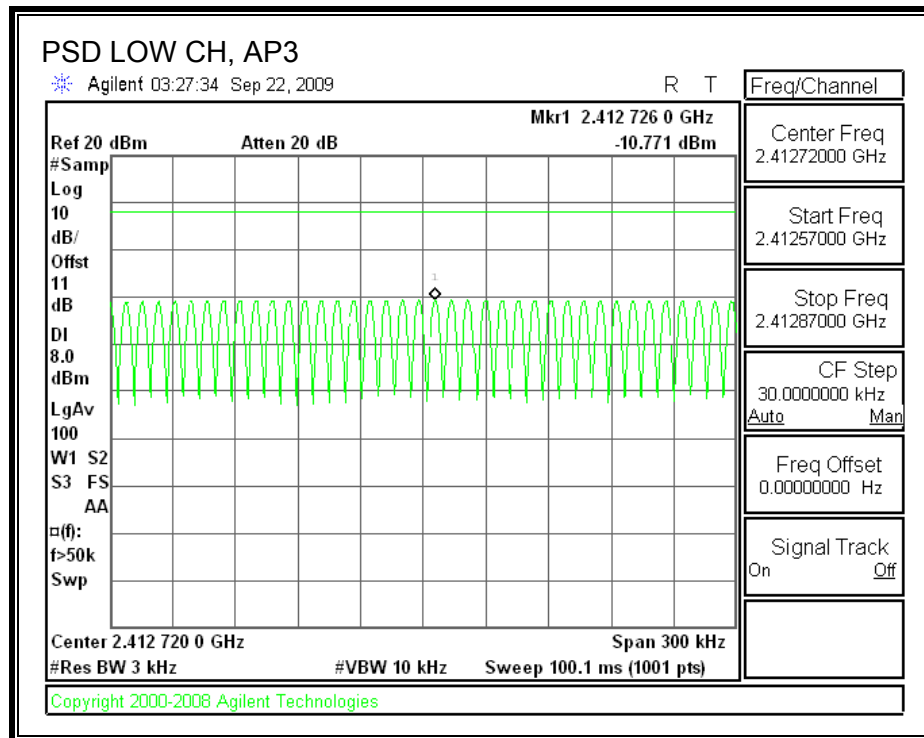
POWER SPECTRAL DENSITY, AP2

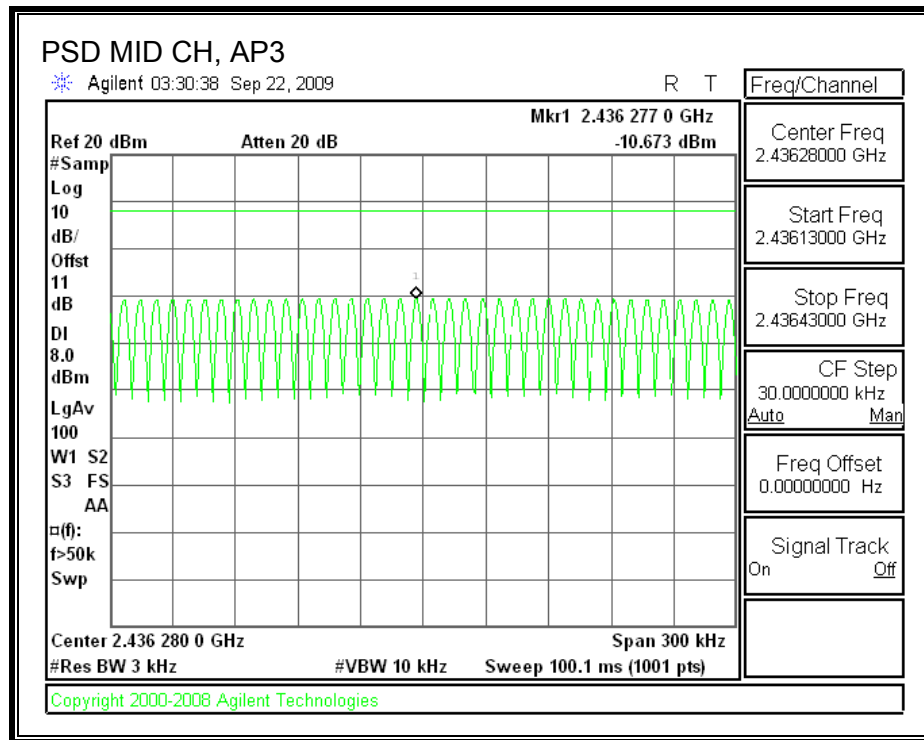


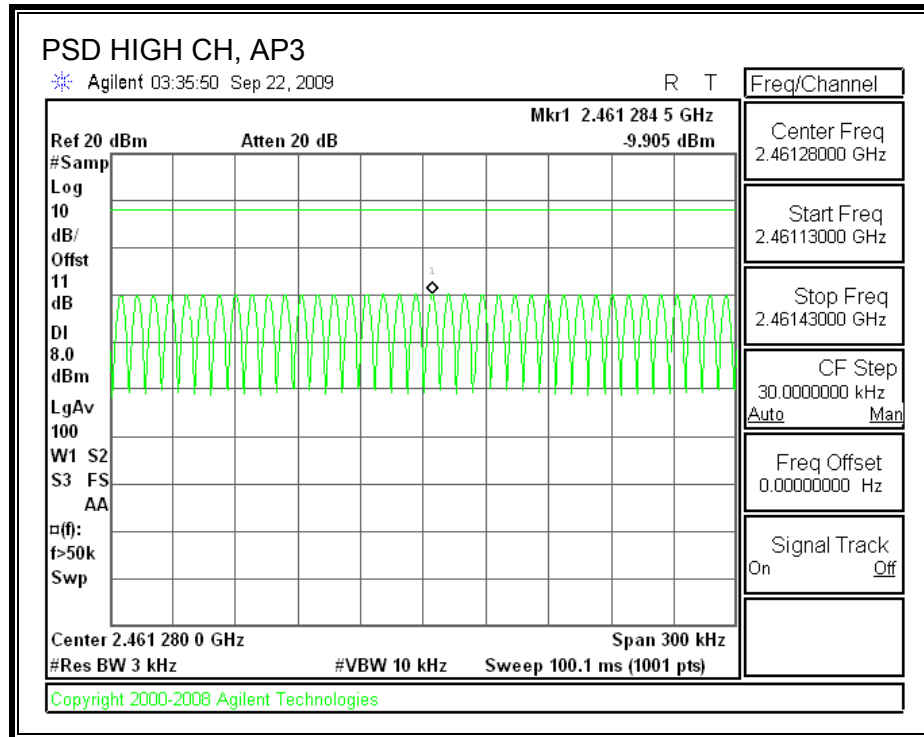




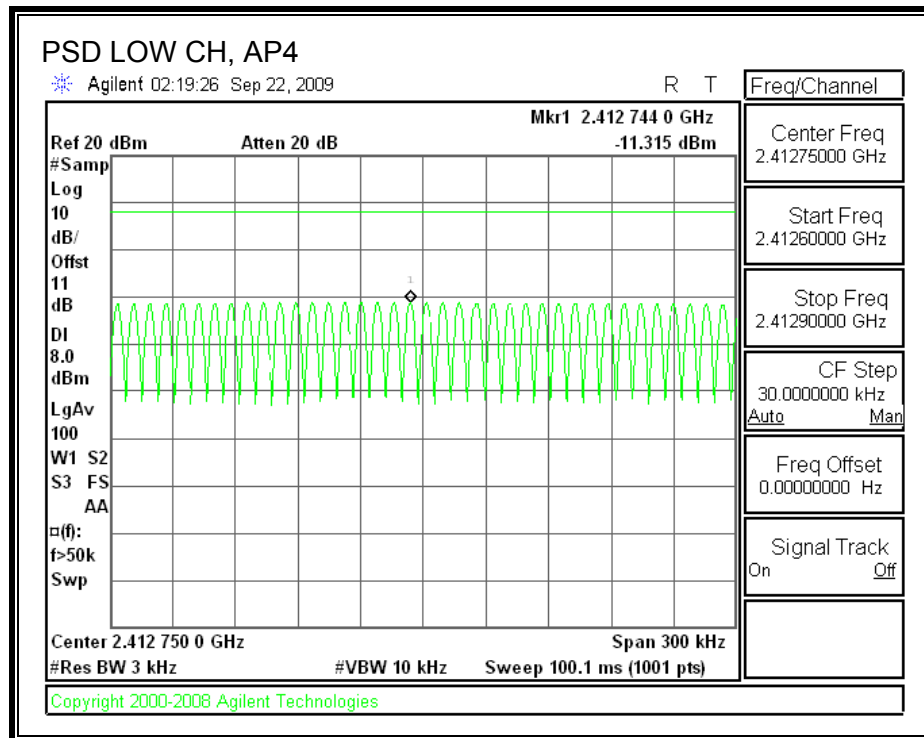
POWER SPECTRAL DENSITY, AP3

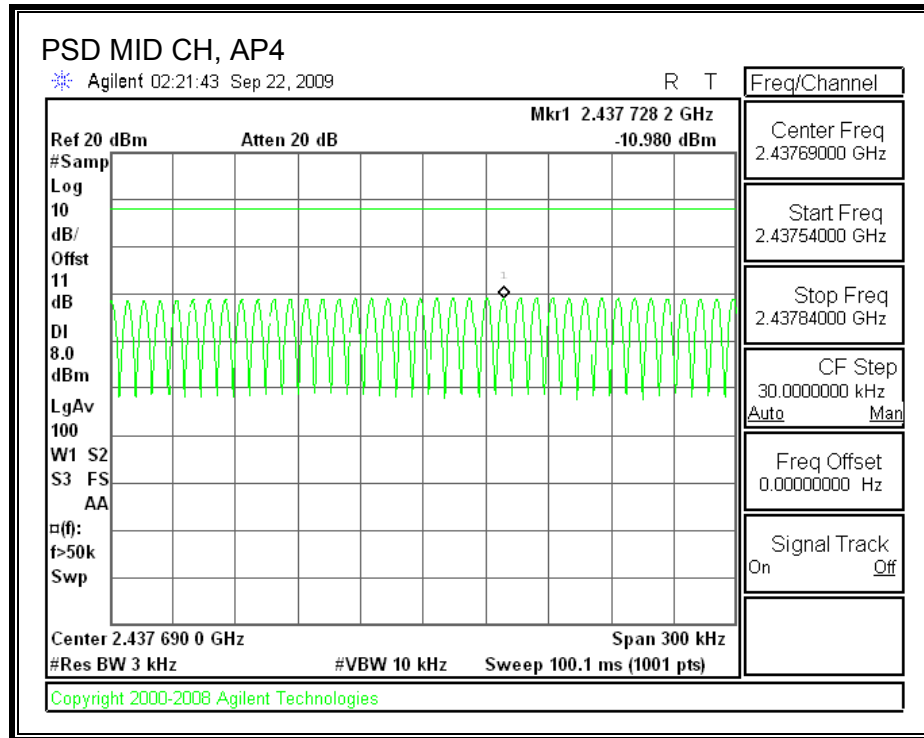


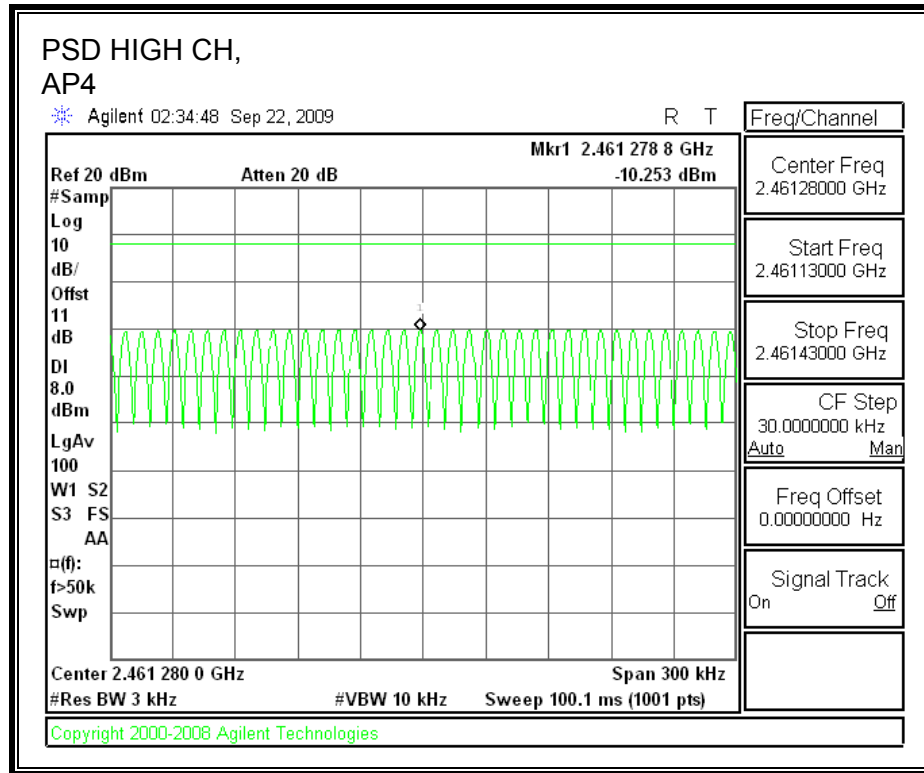




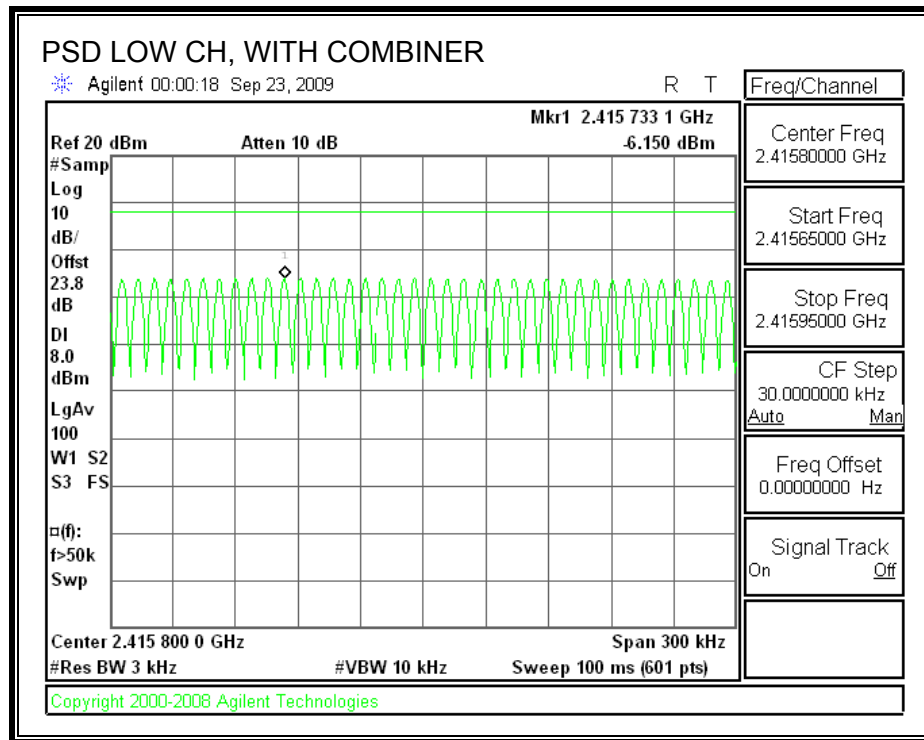
POWER SPECTRAL DENSITY, AP4

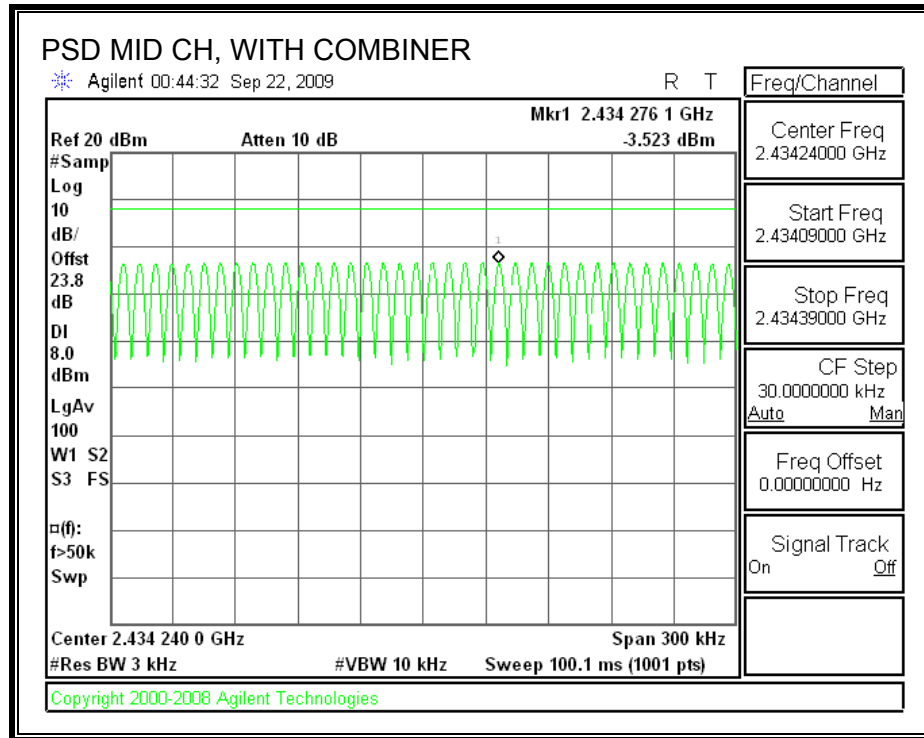


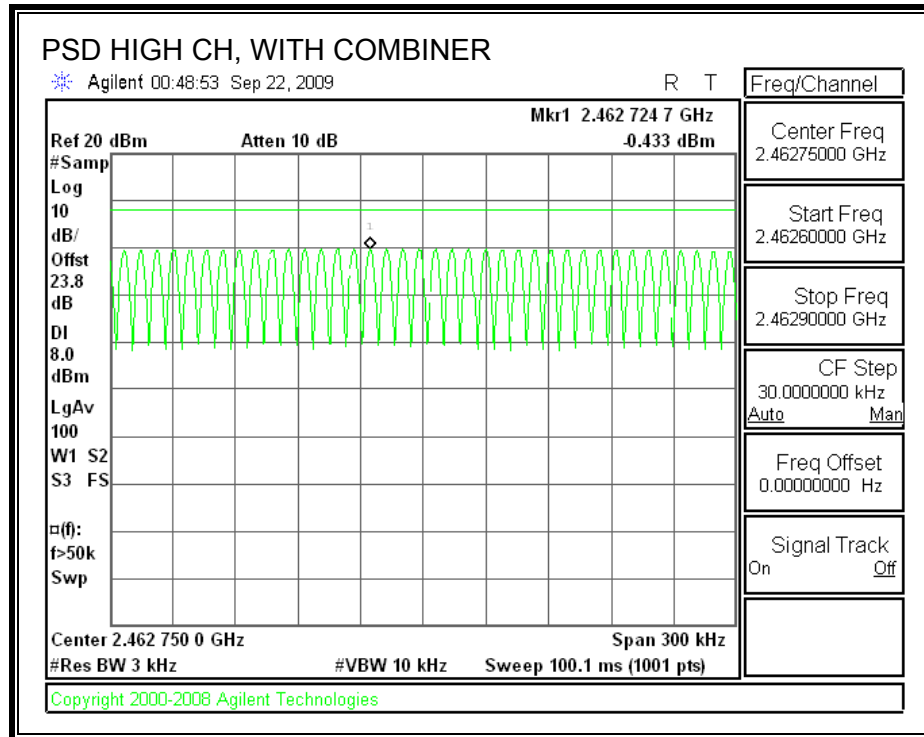




POWER SPECTRAL DENSITY, WITH COMBINER







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.

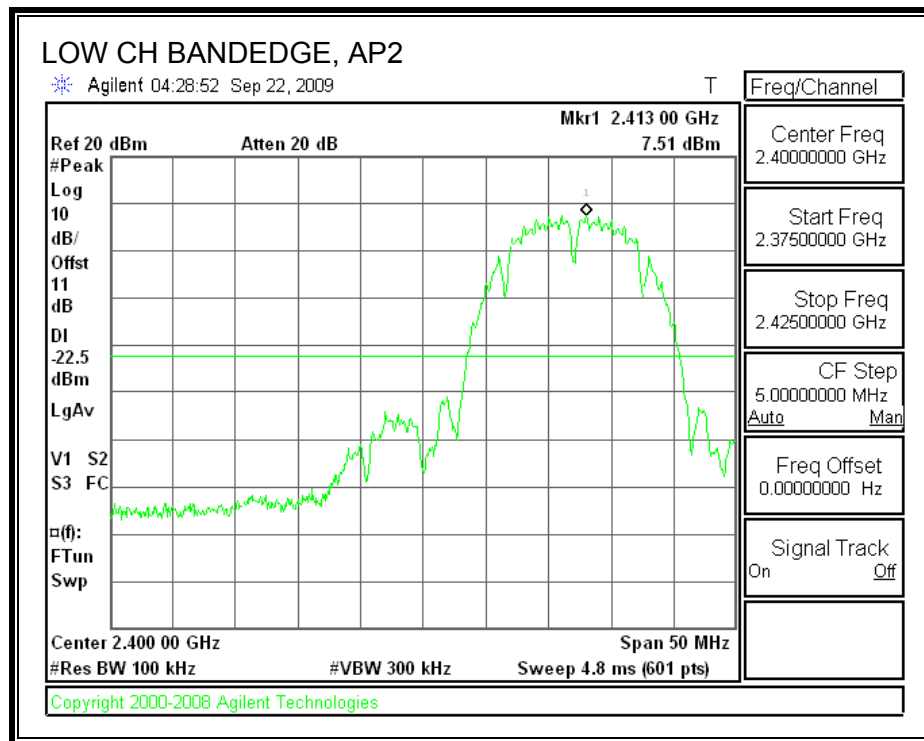
TEST PROCEDURE

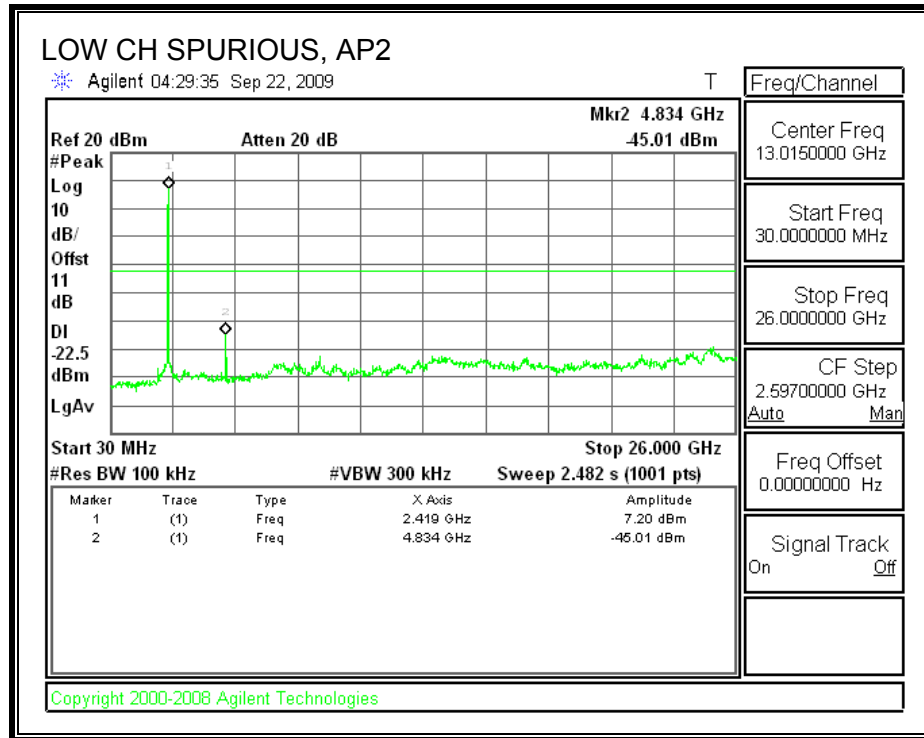
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

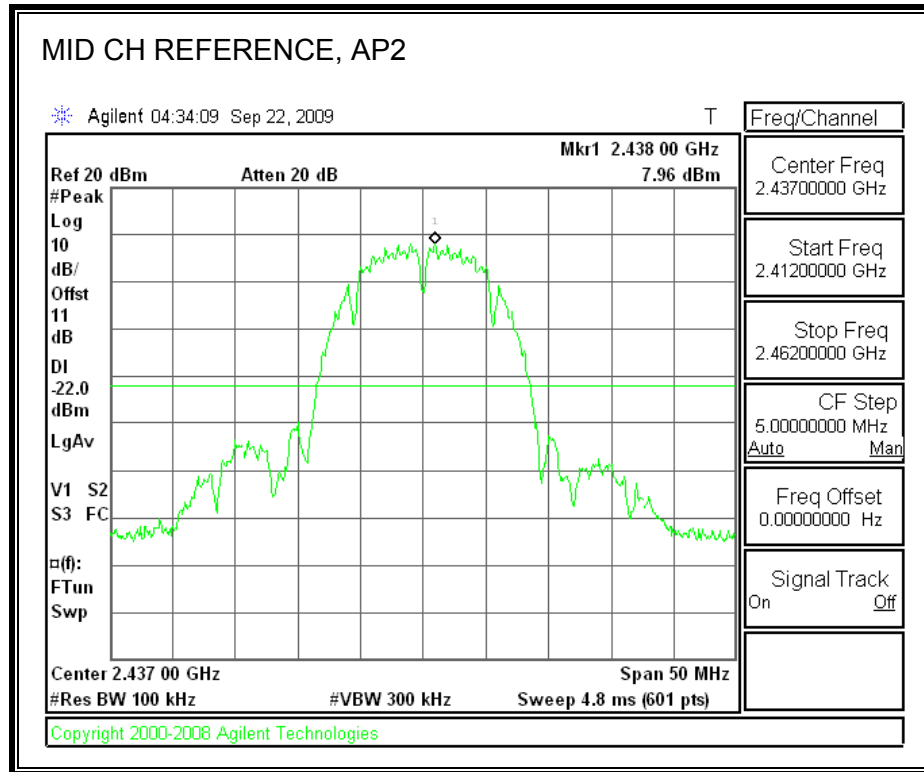
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

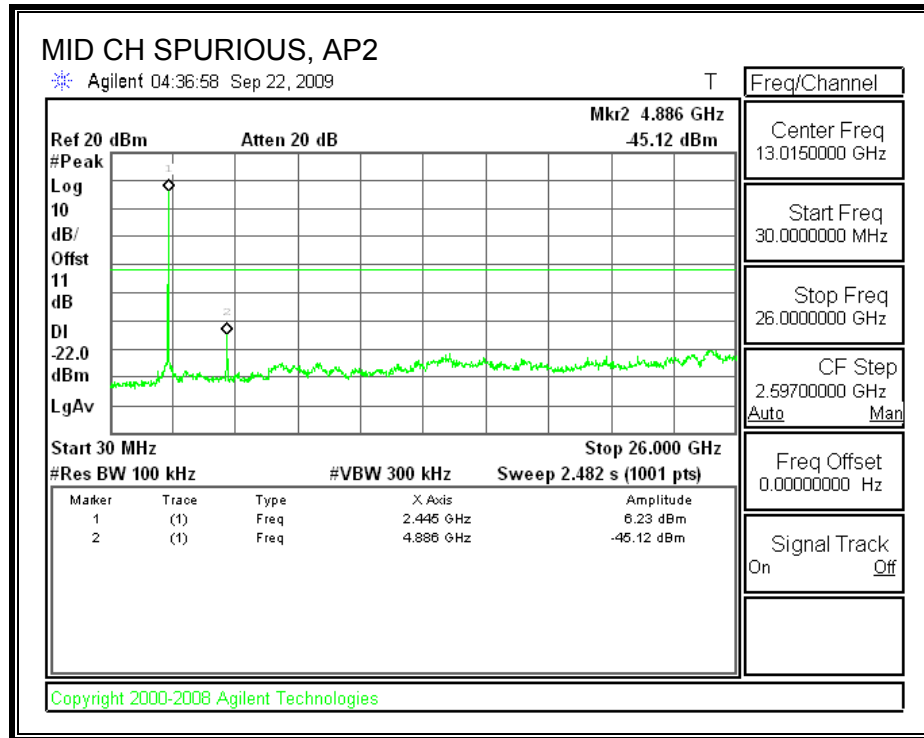
RESULTS

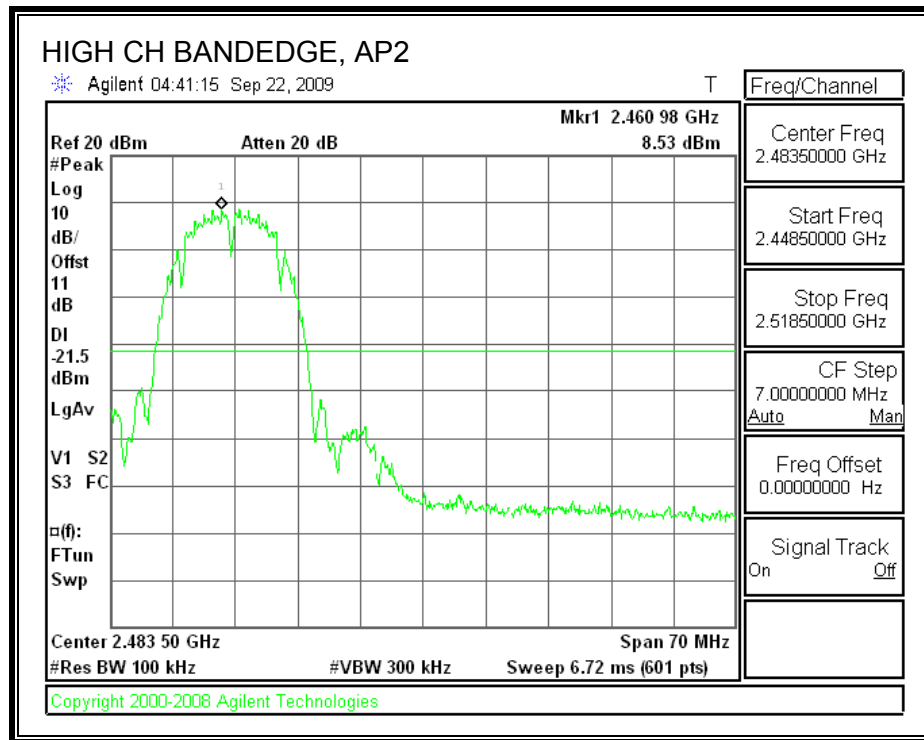
AP2 SPURIOUS EMISSIONS

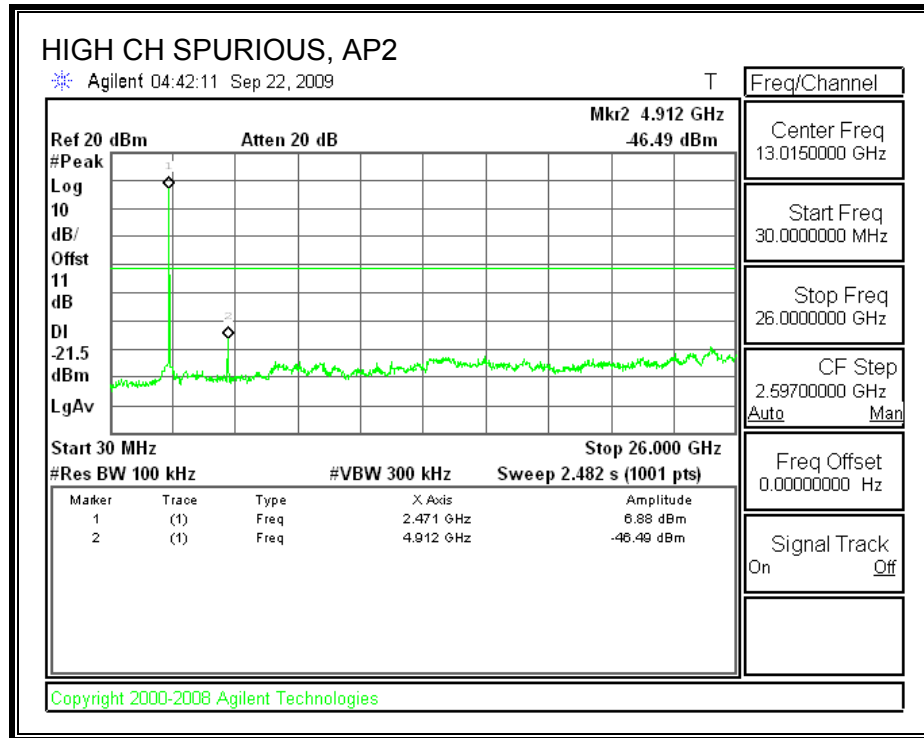




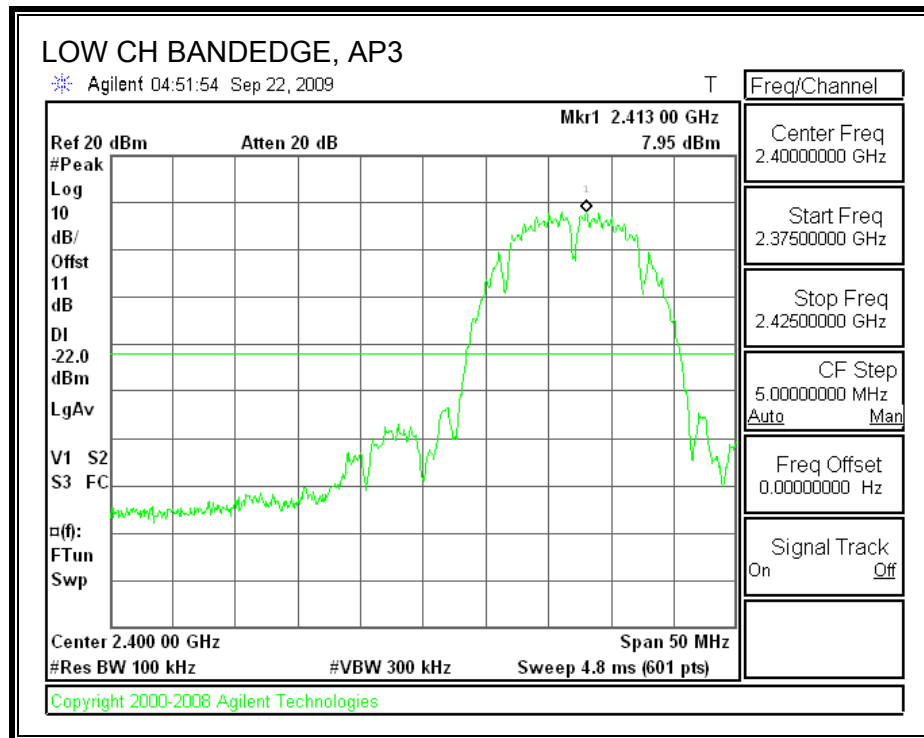


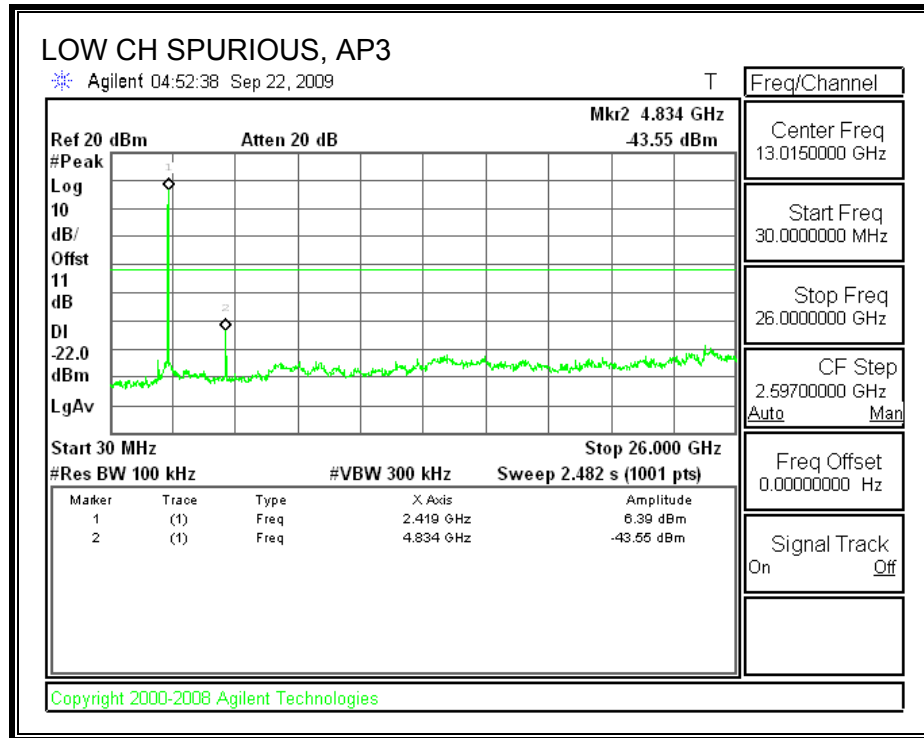


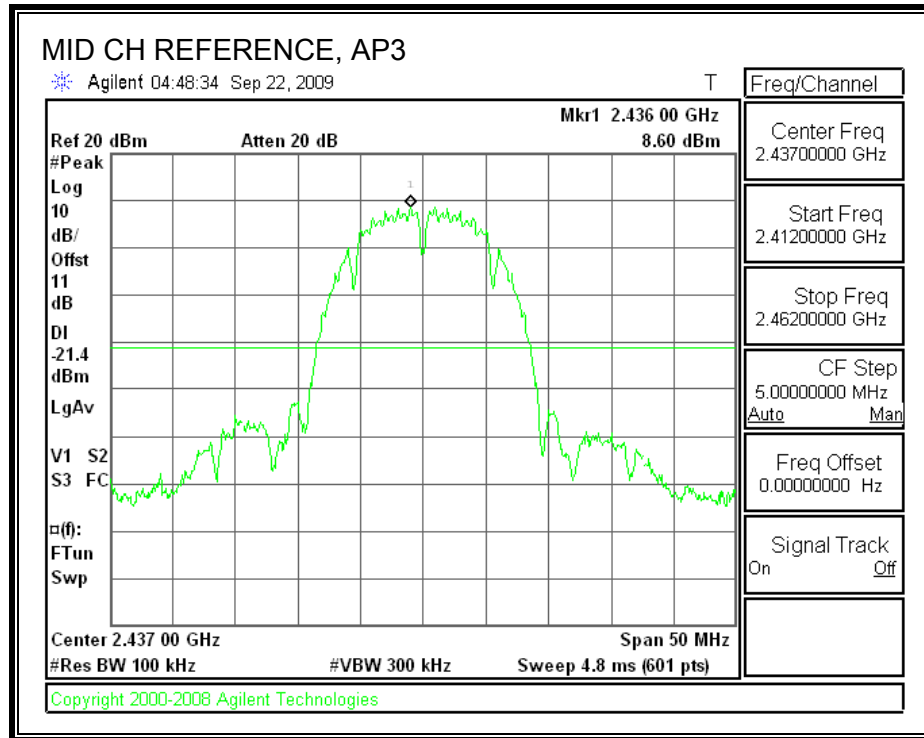


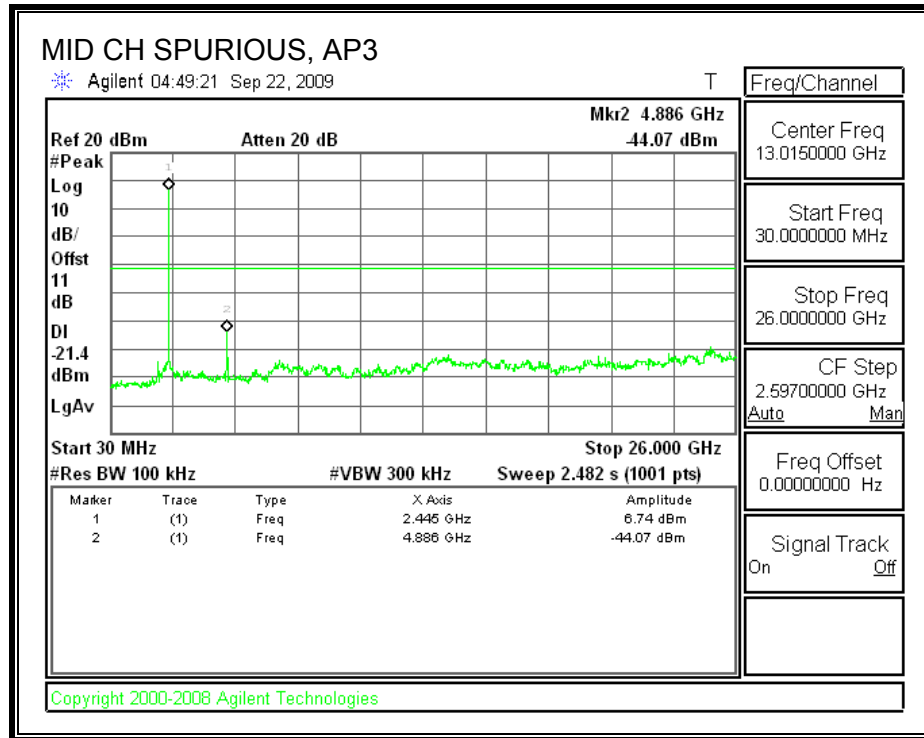


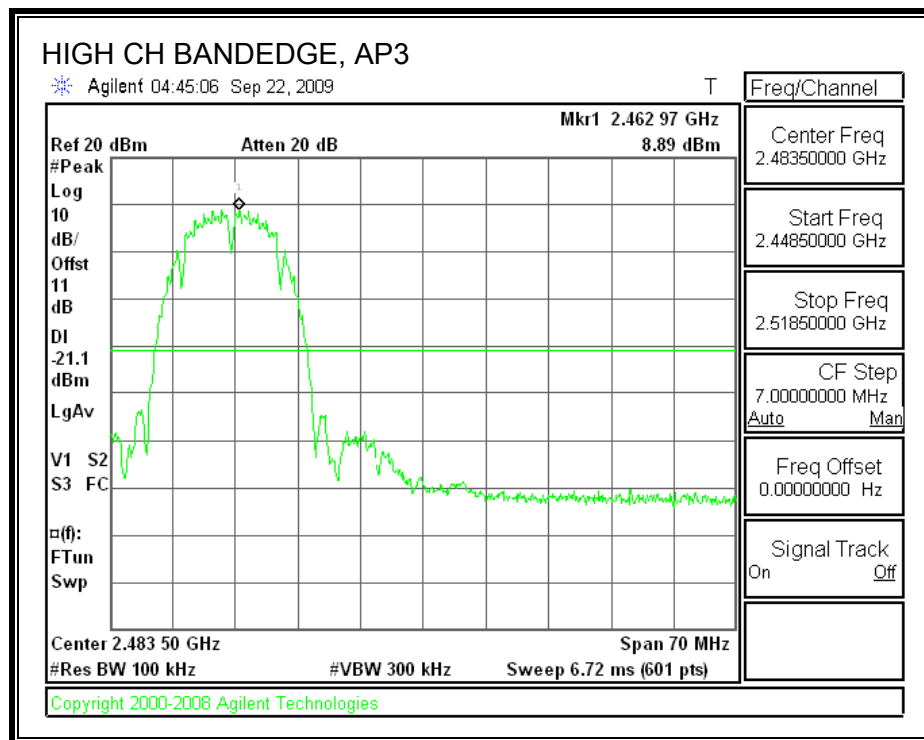
AP3 SPURIOUS EMISSIONS

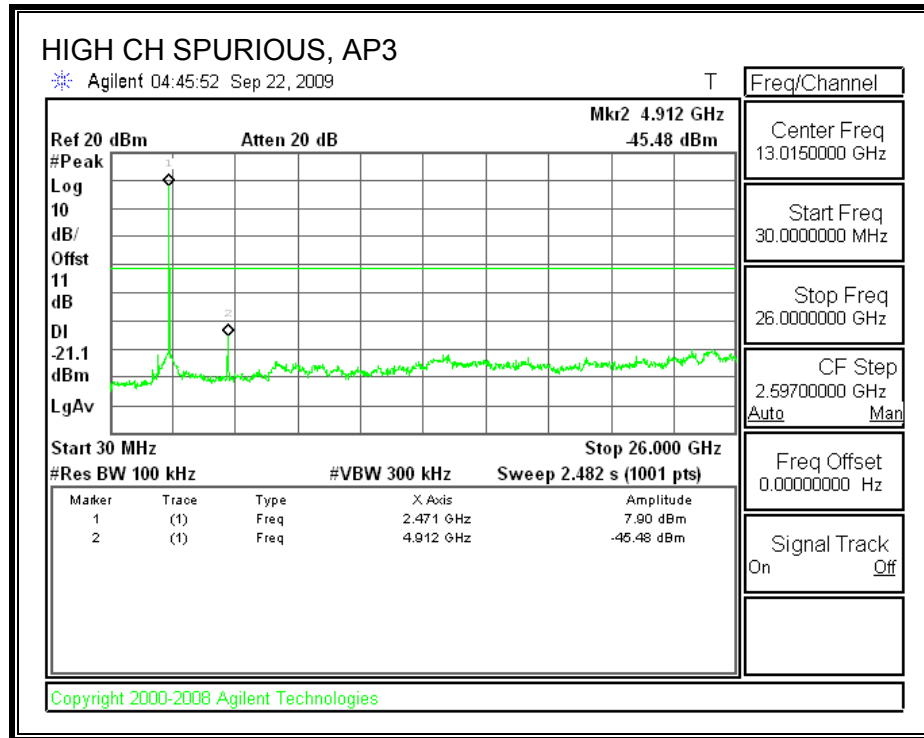




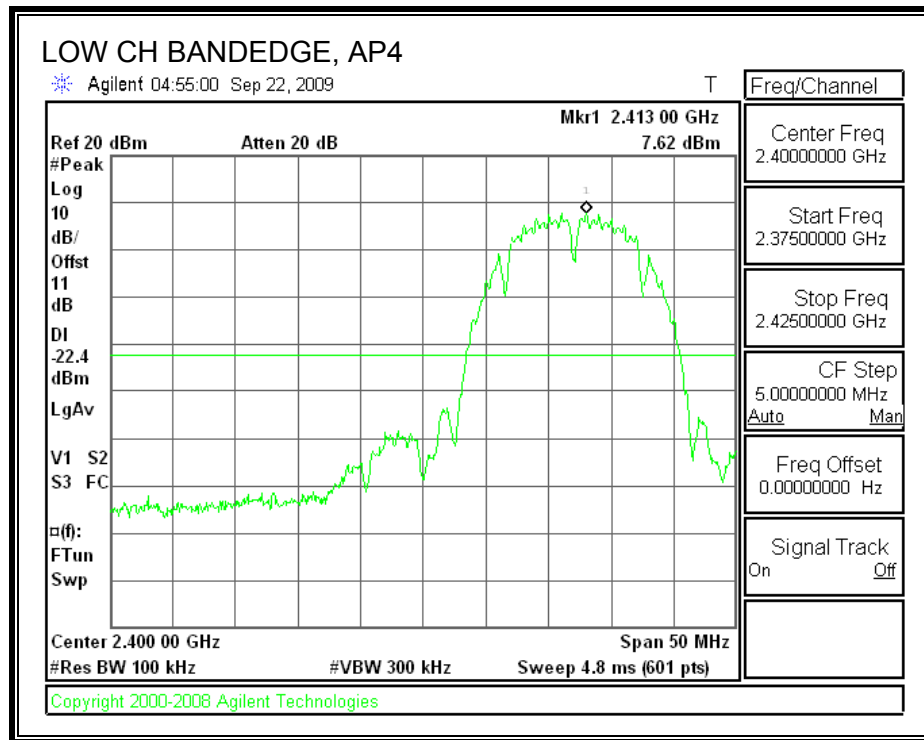


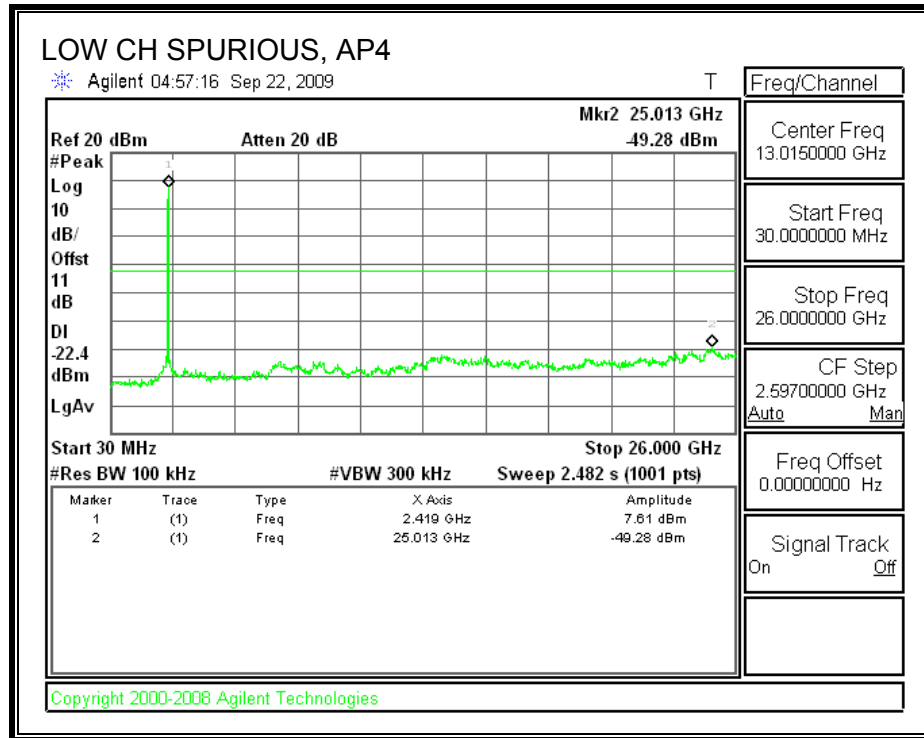


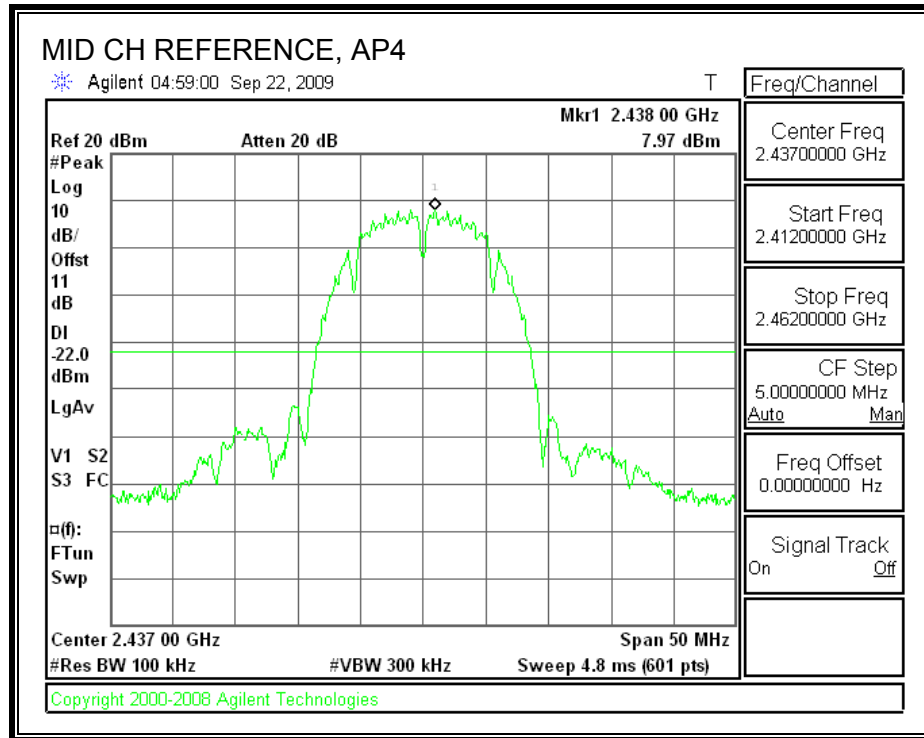


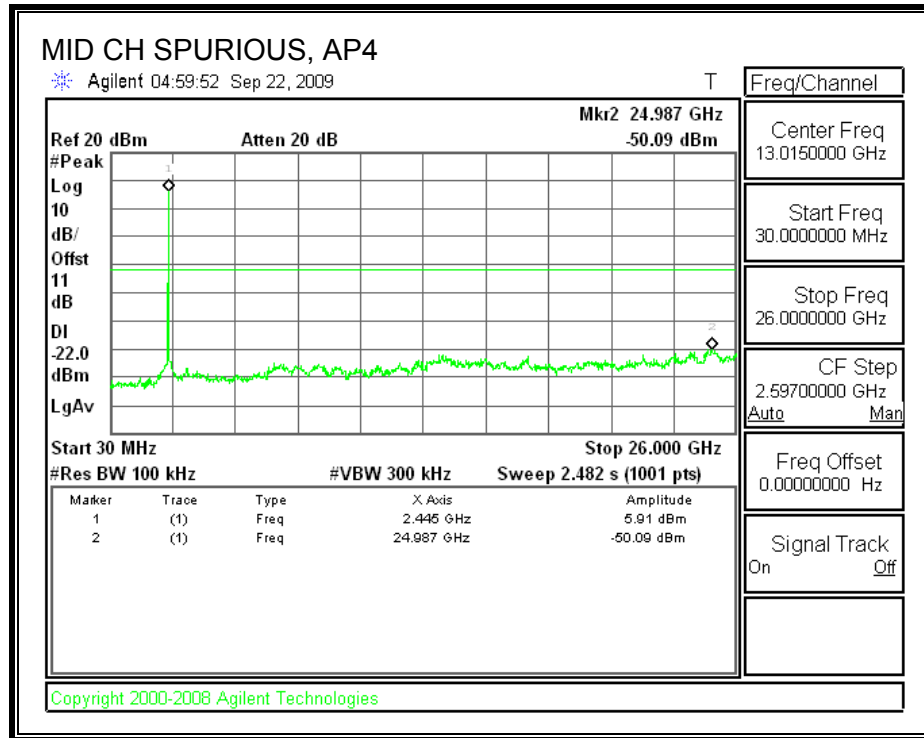


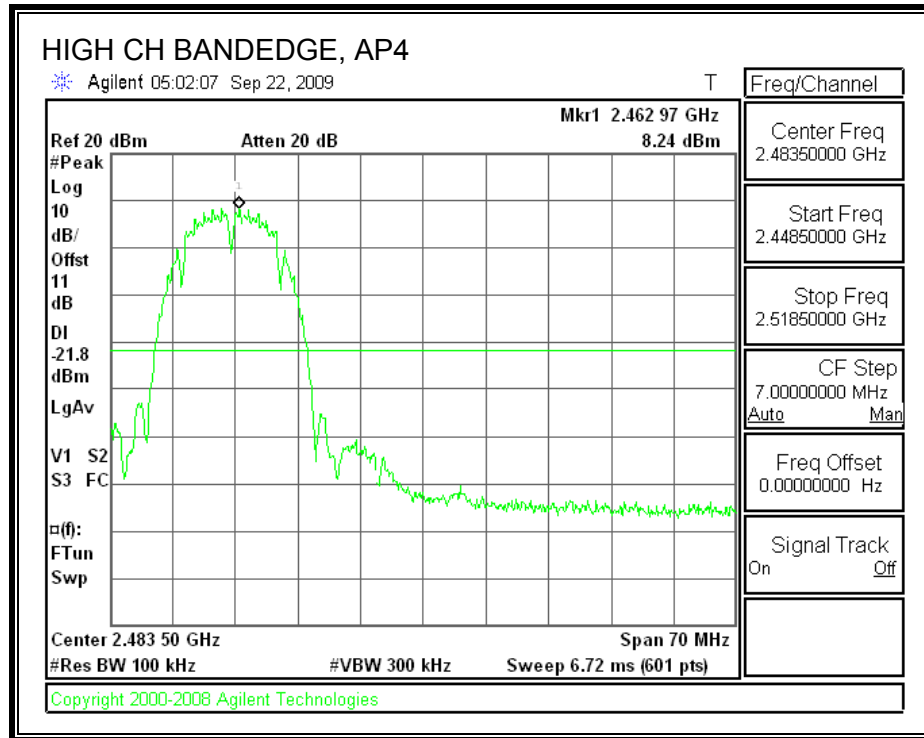
AP4 SPURIOUS EMISSIONS

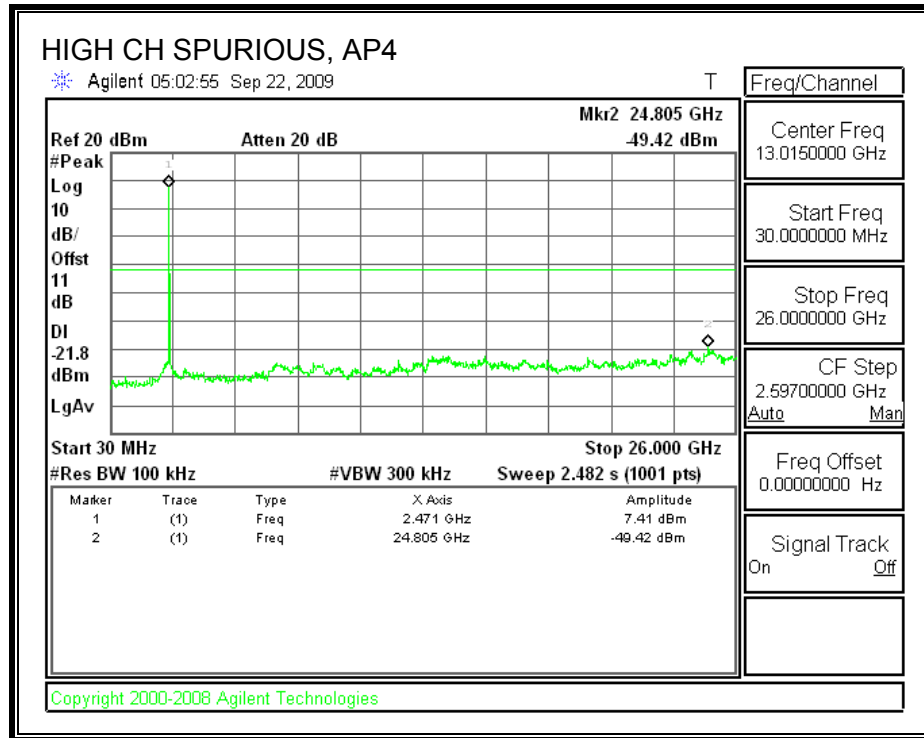




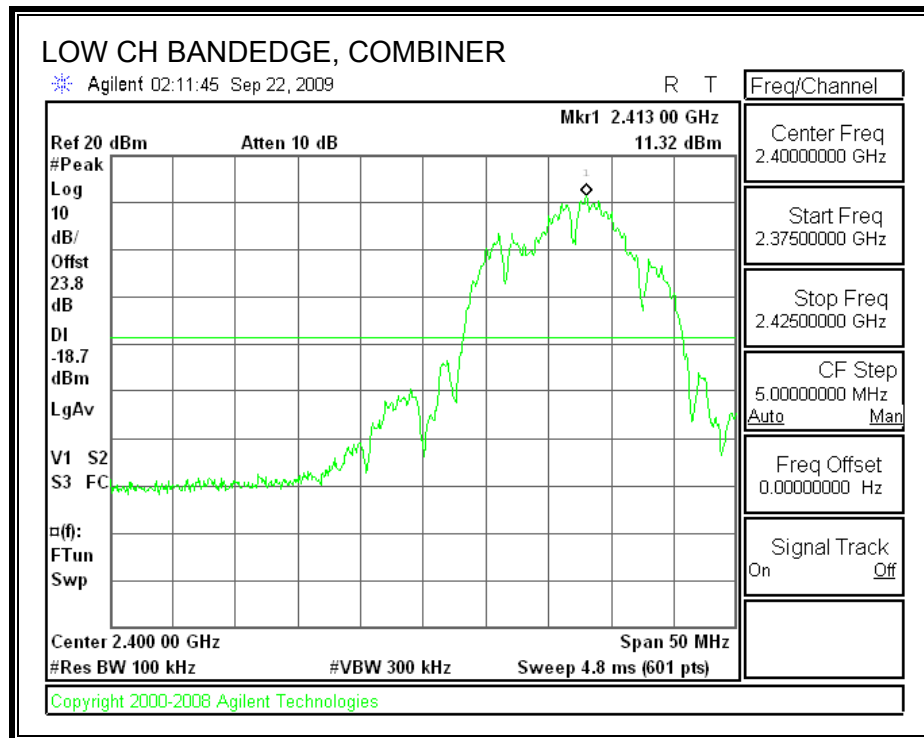


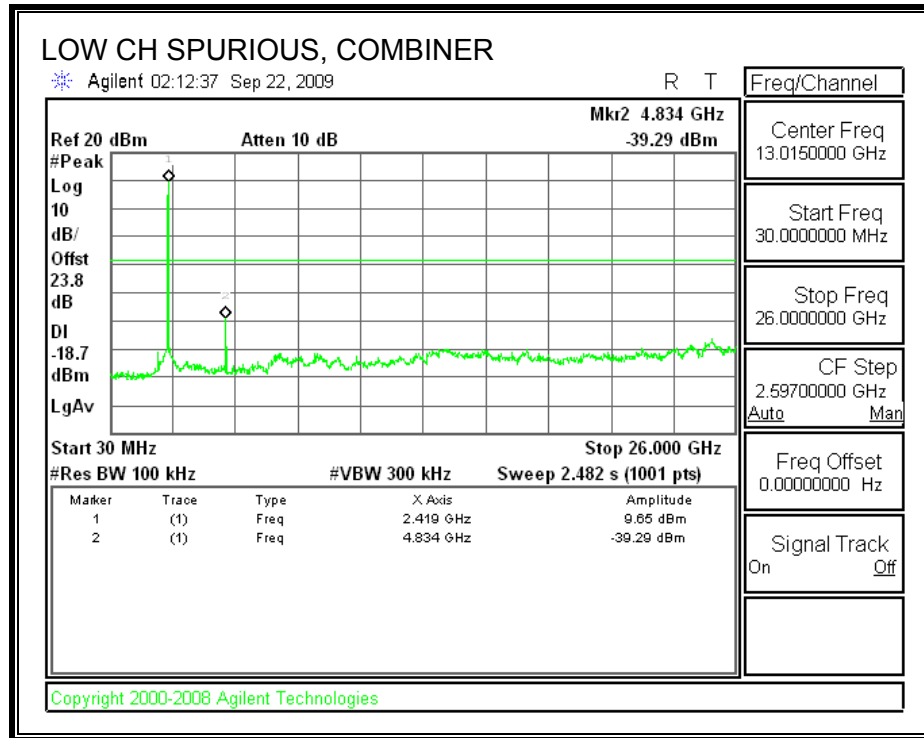


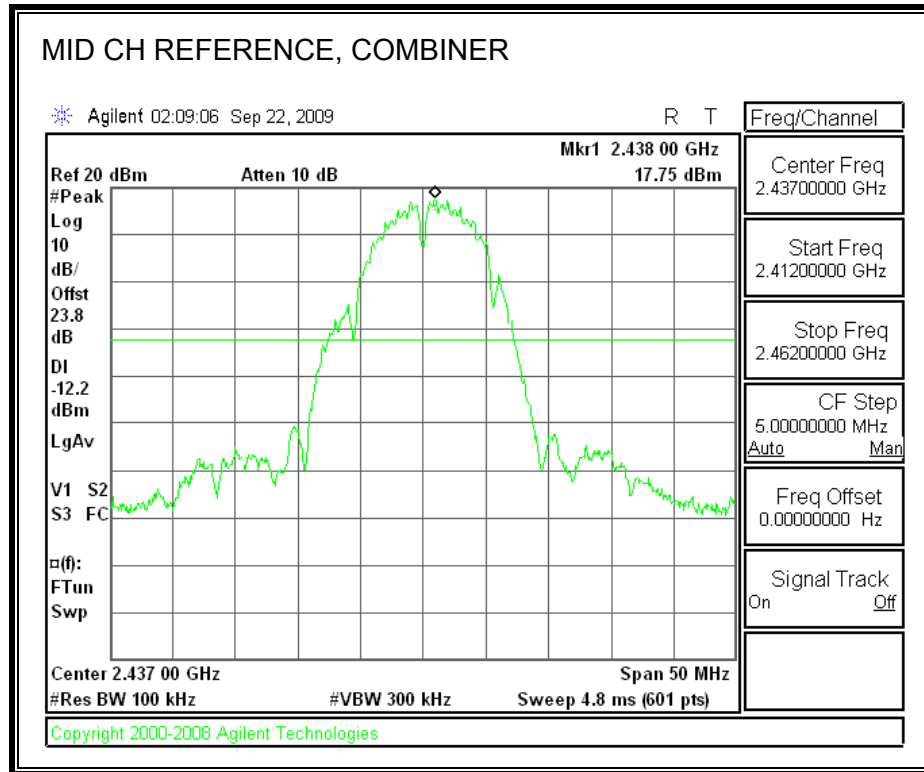


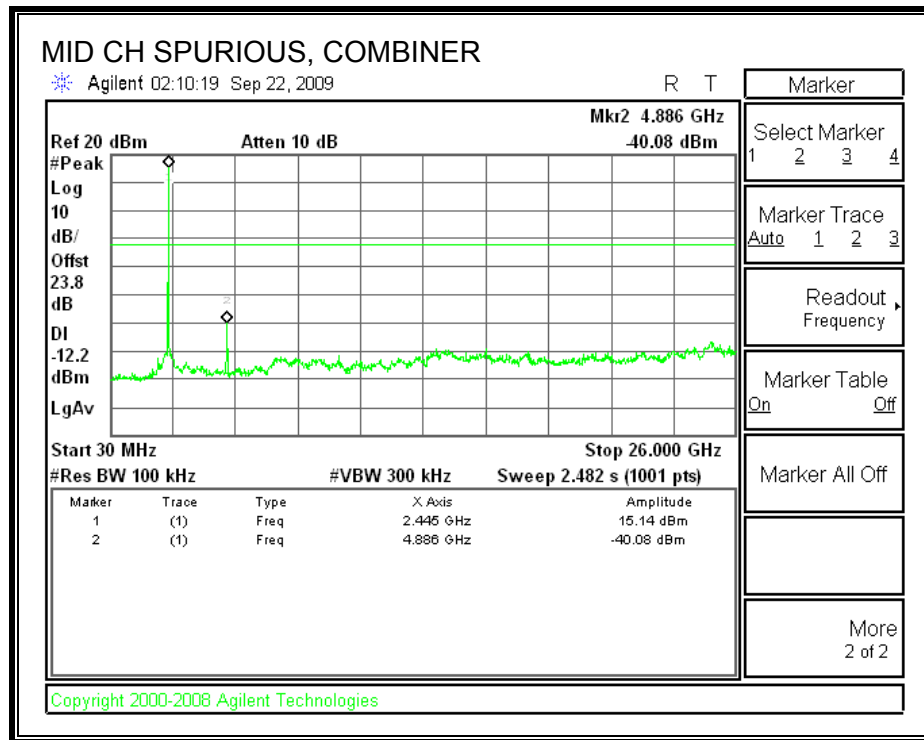


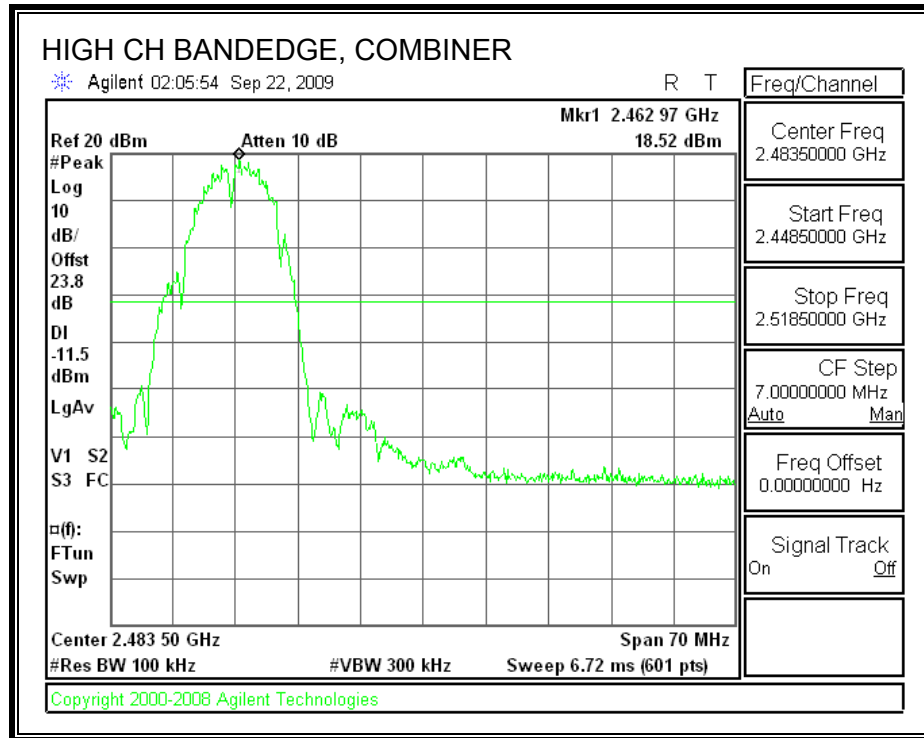
COMBINER SPURIOUS EMISSIONS

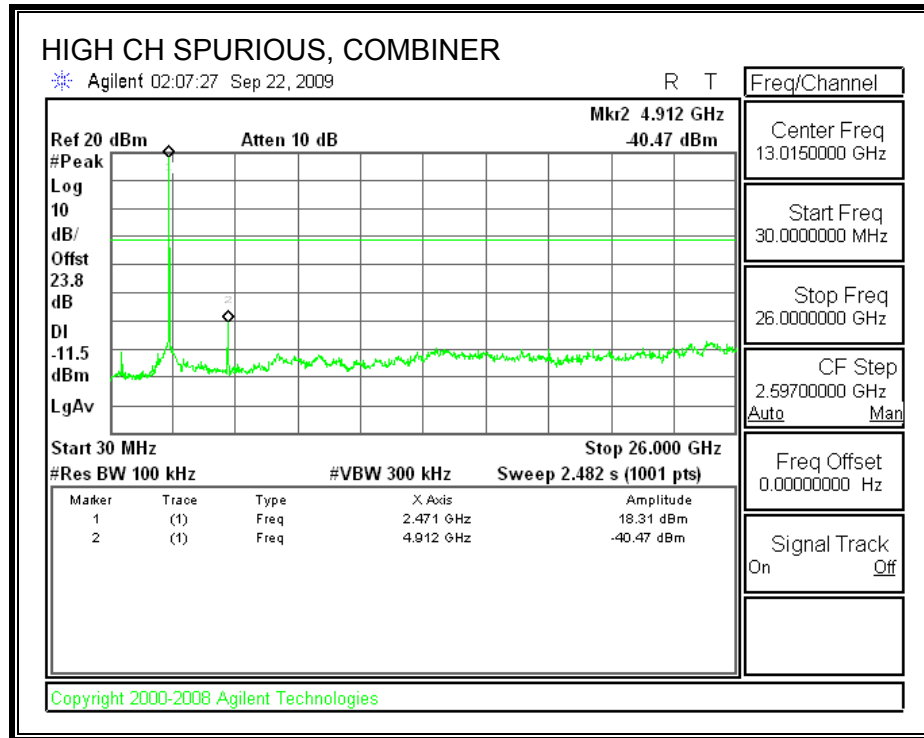












7.2. 802.11g THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND

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.

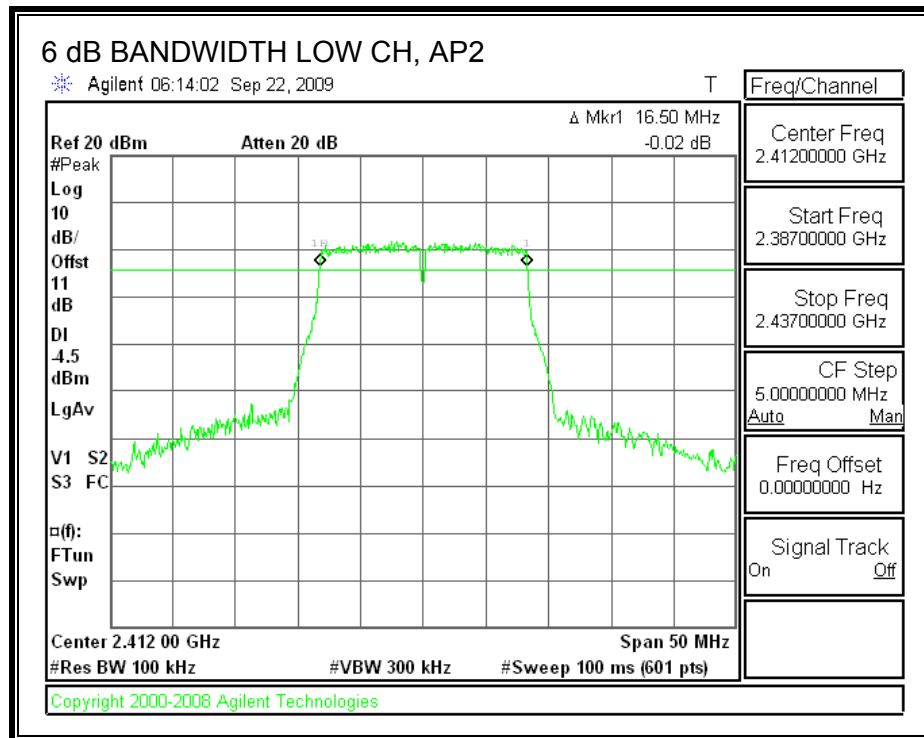
TEST PROCEDURE

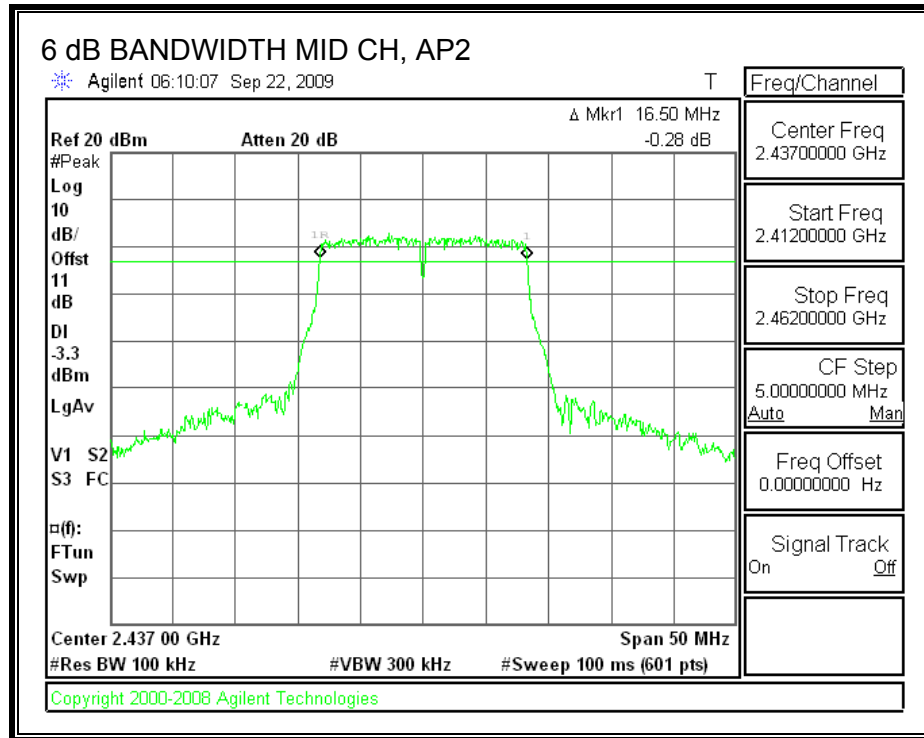
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

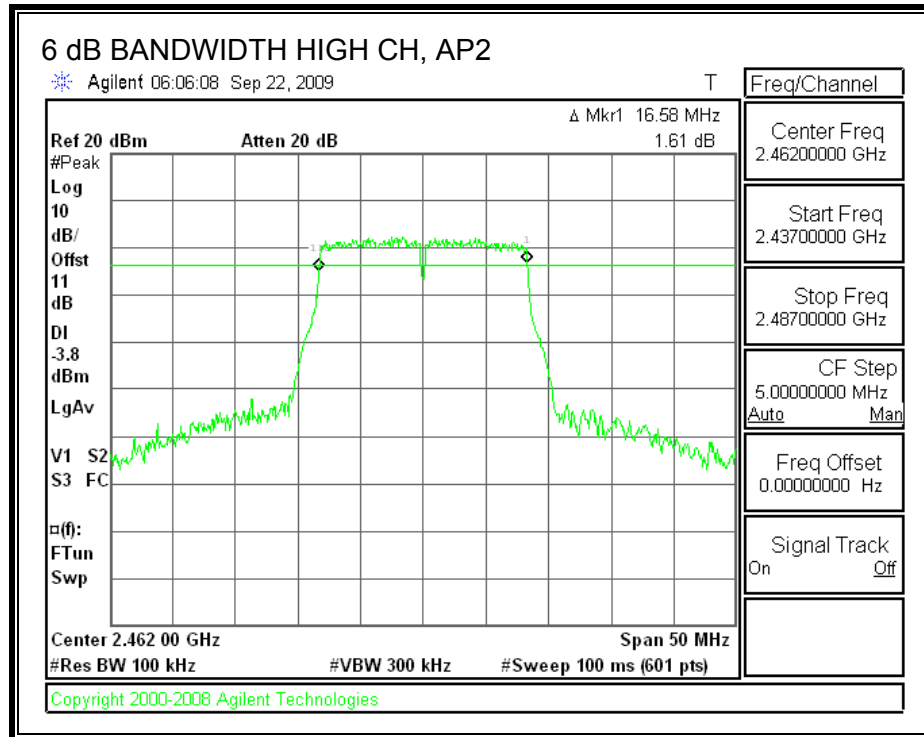
RESULTS

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	16.50	16.50	16.50	0.5
Middle	2437	16.50	16.50	16.50	0.5
High	2462	16.58	16.50	16.67	0.5

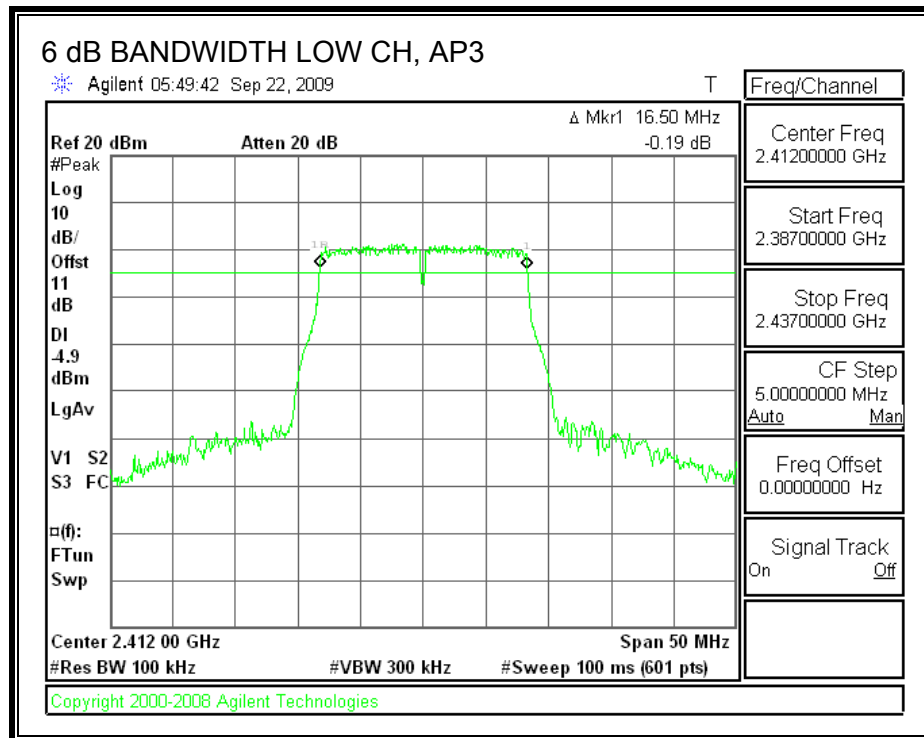
6 dB BANDWIDTH, AP2

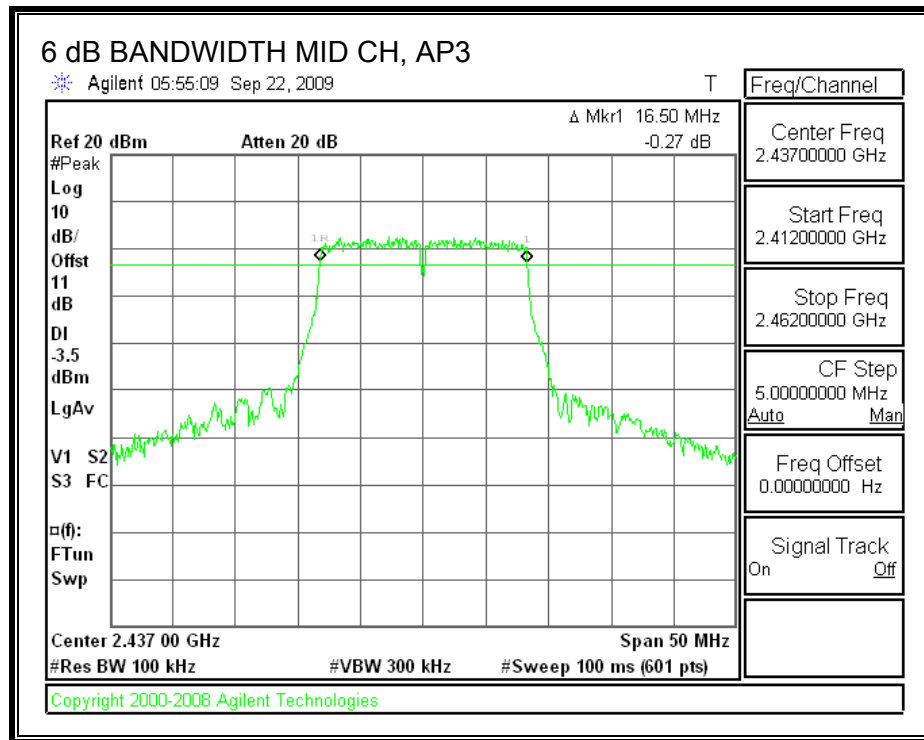


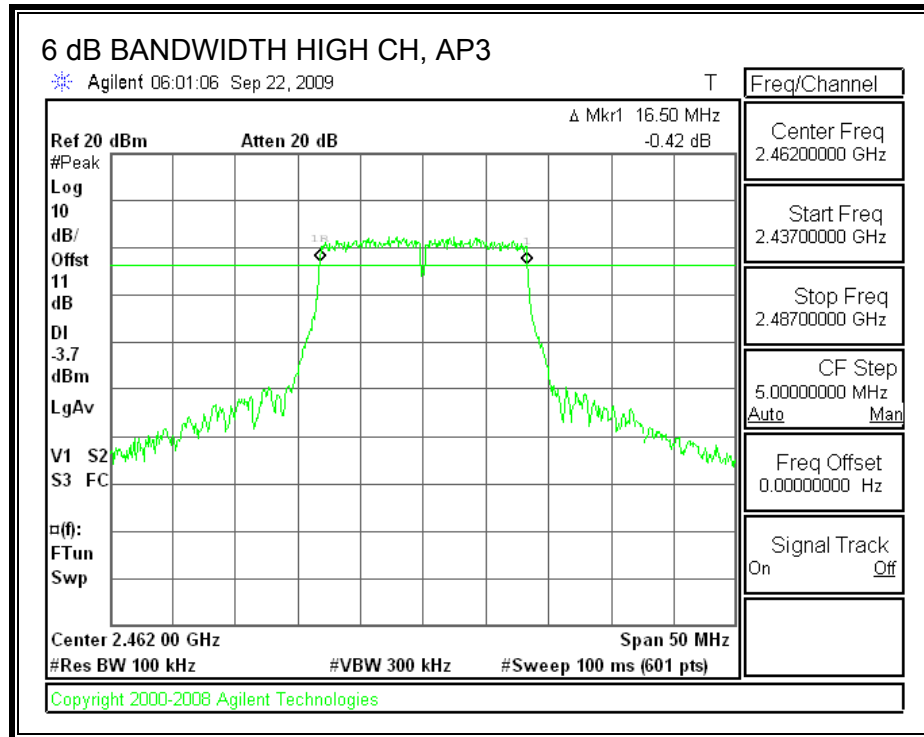




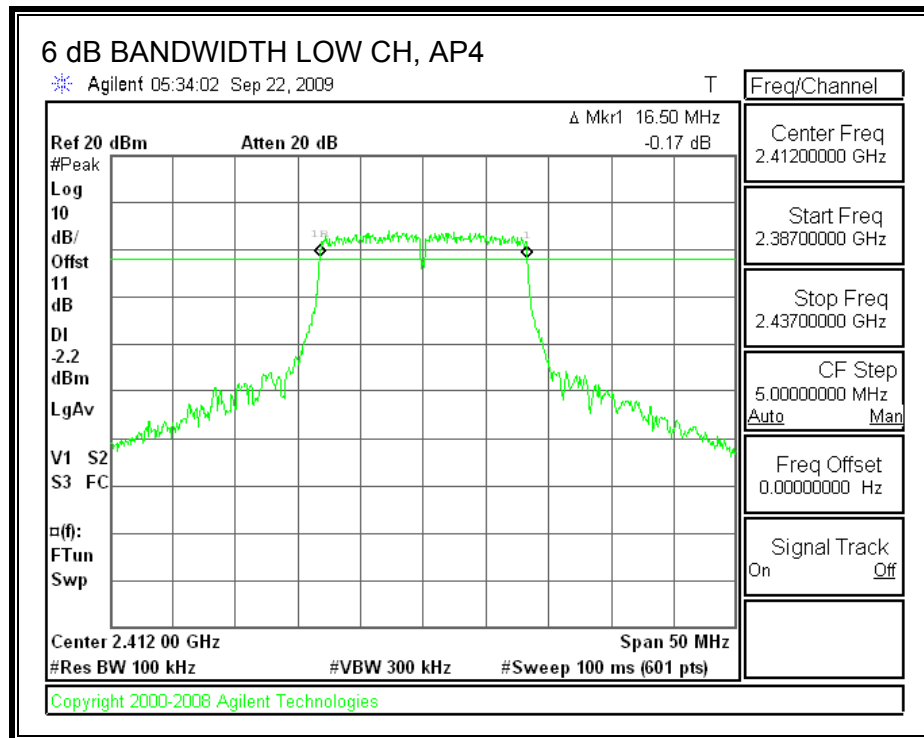
6 dB BANDWIDTH, AP3

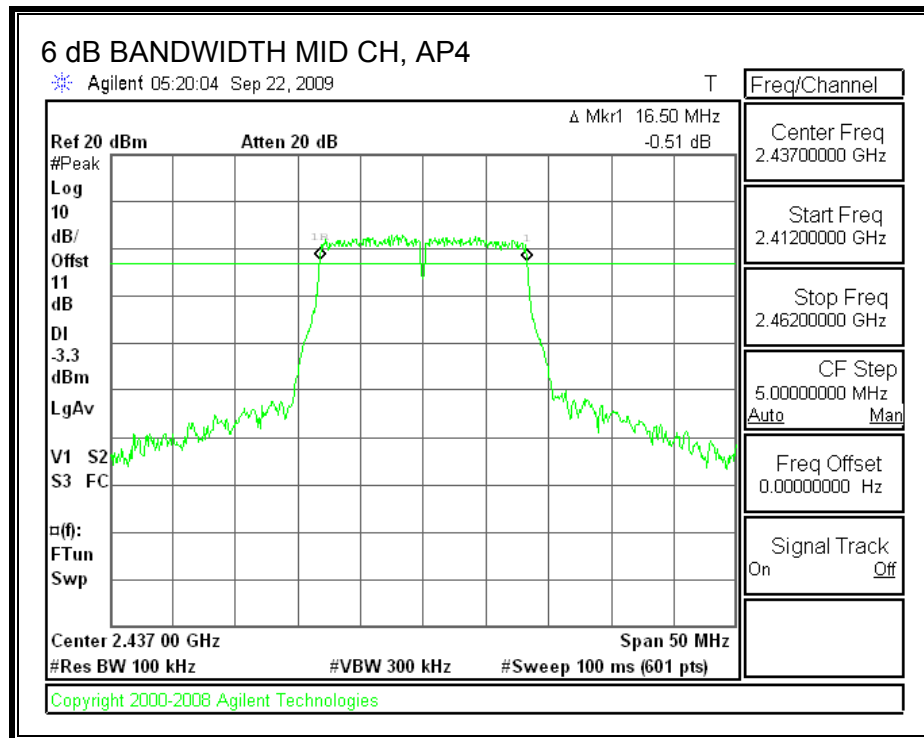


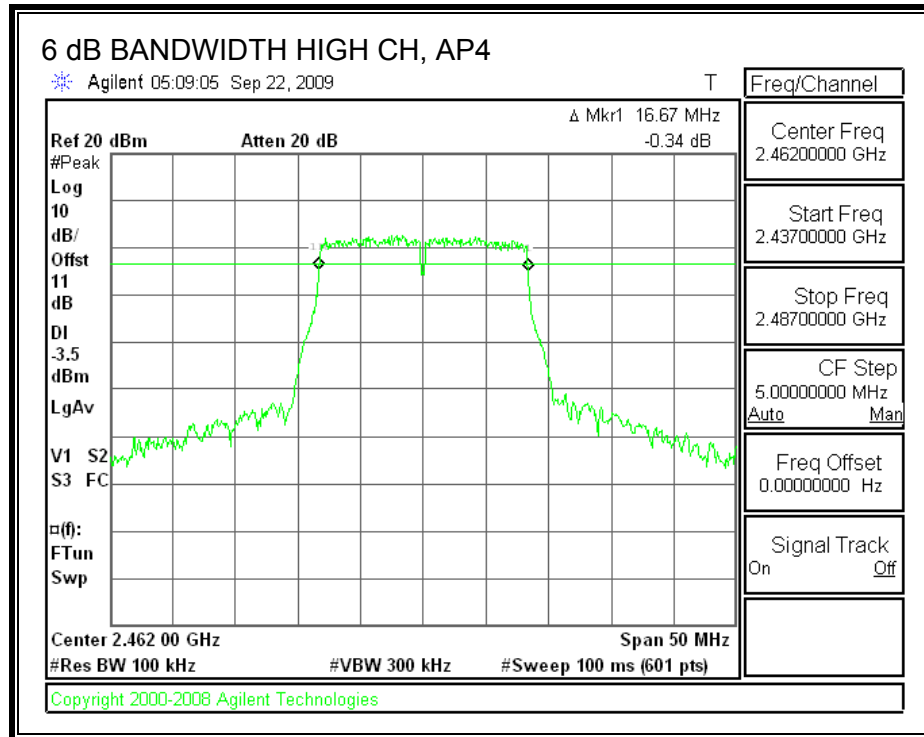




6 dB BANDWIDTH, AP4







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

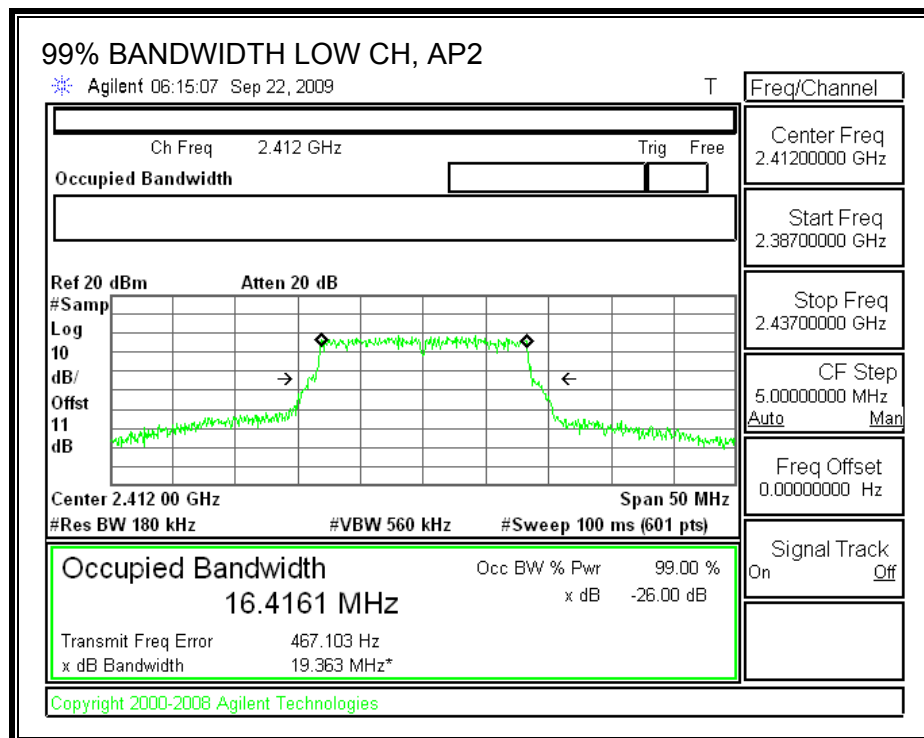
TEST PROCEDURE

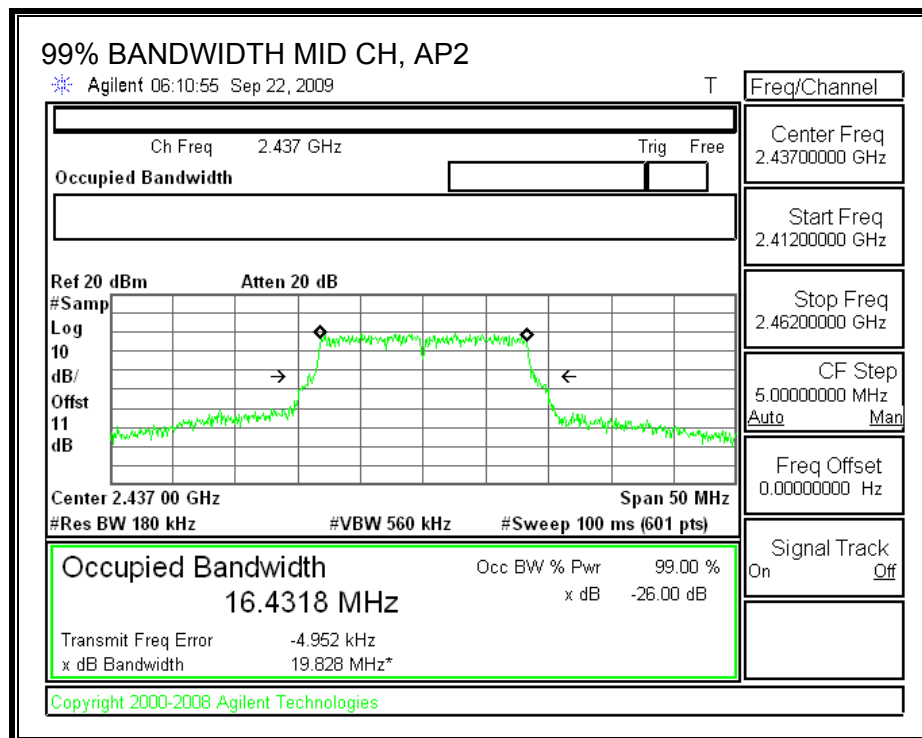
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

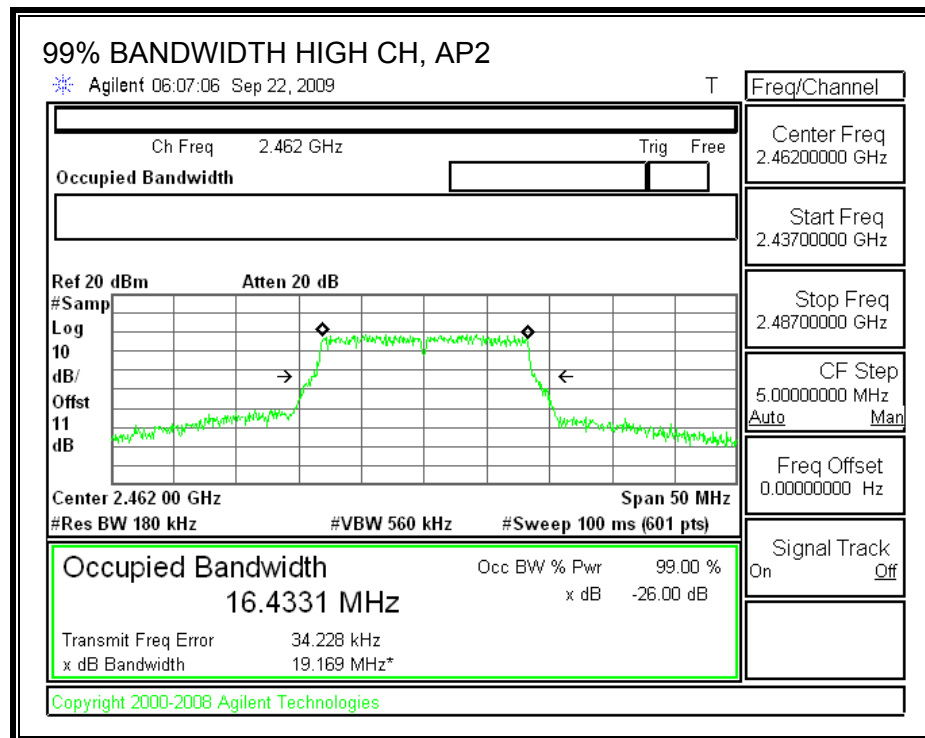
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	2412	16.4161	16.4456	16.2789
Middle	2437	16.4318	16.3773	16.3888
High	2462	16.4331	16.4032	16.4857

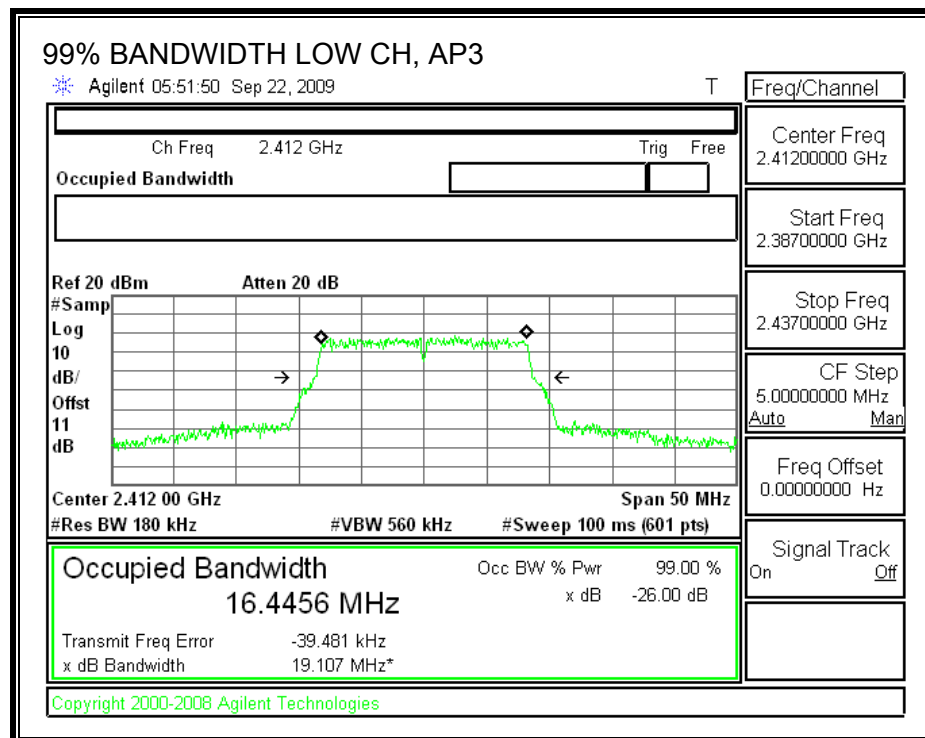
99% BANDWIDTH, AP2

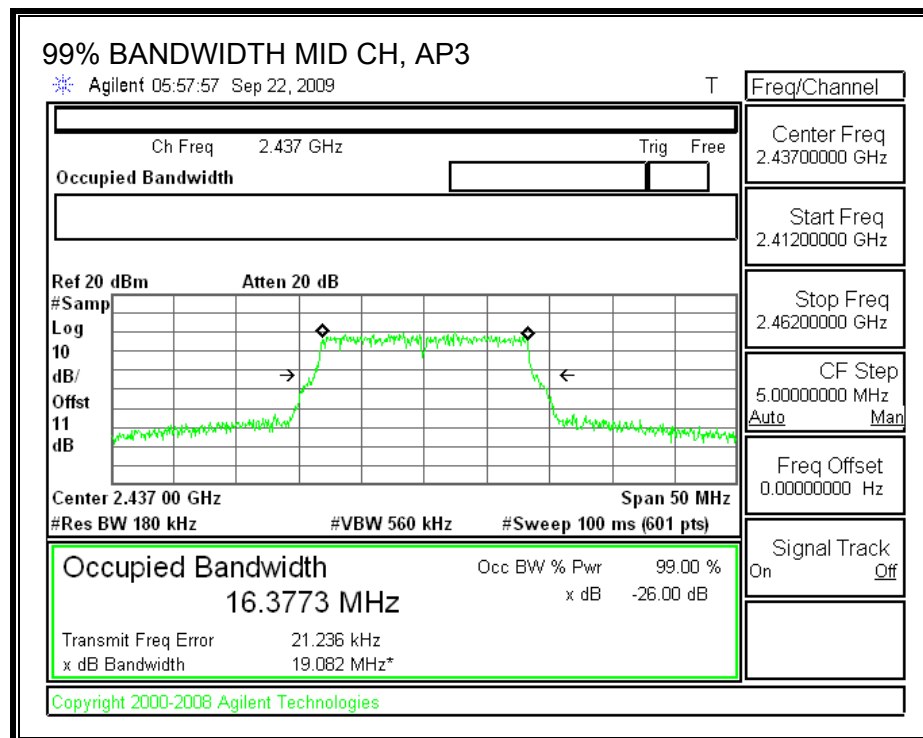


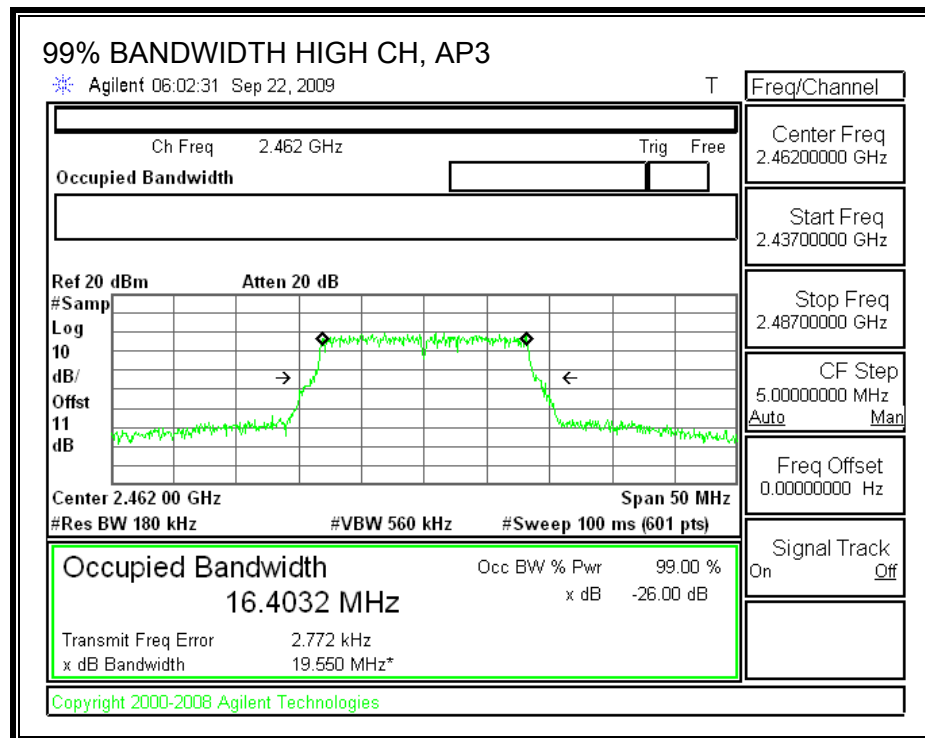




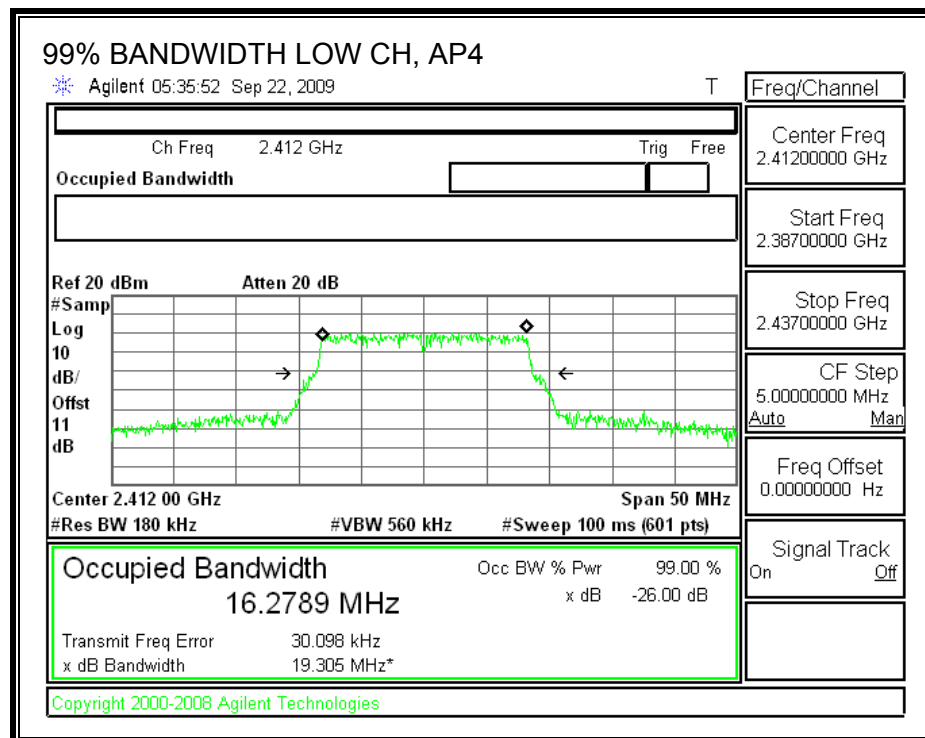
99% BANDWIDTH, AP3

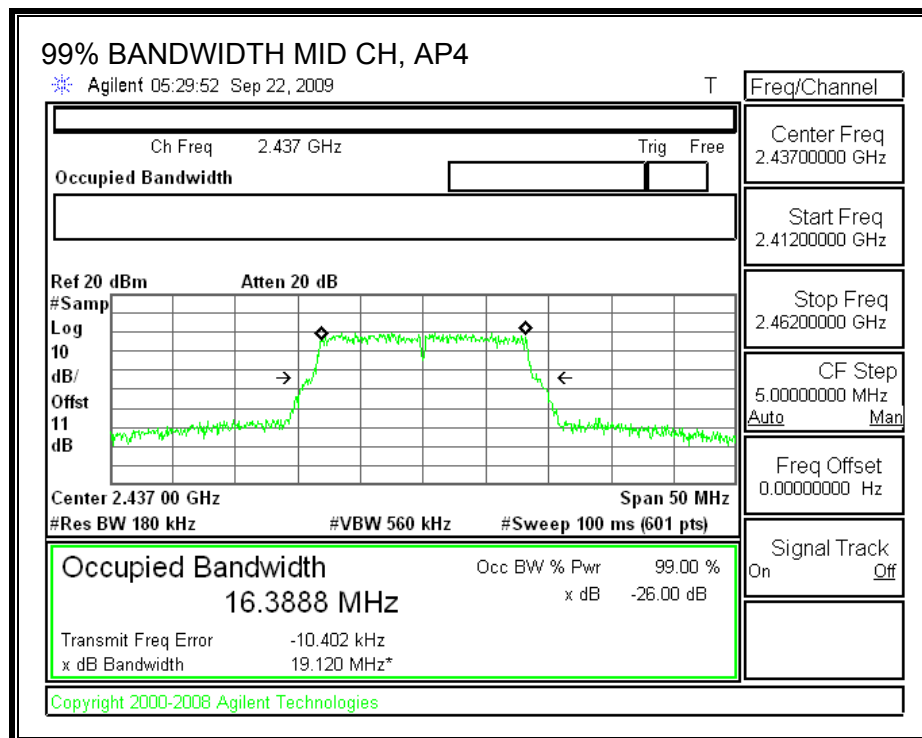


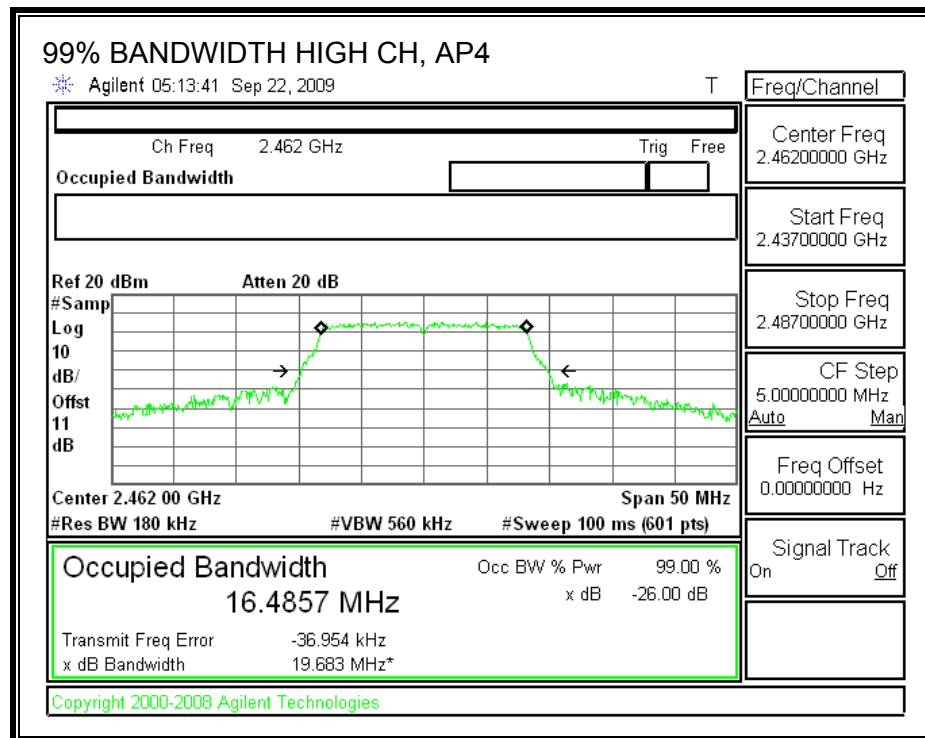




99% BANDWIDTH, AP4







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 6.80 dBi for other than fixed, point-to-point operations, therefore the limit is 29.2 dBm.

TEST PROCEDURE

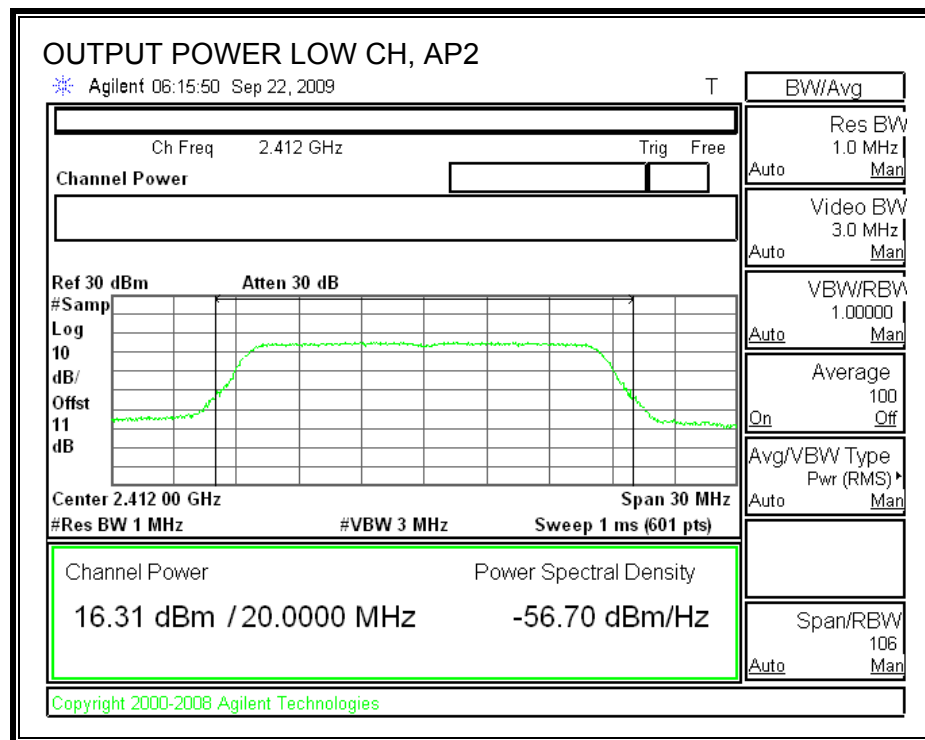
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

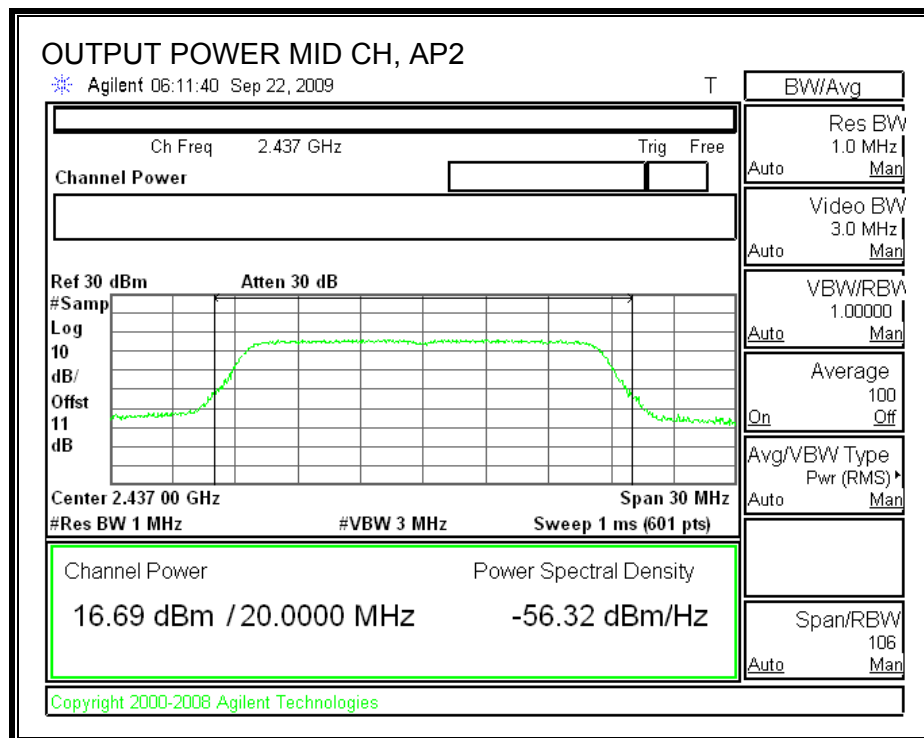
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

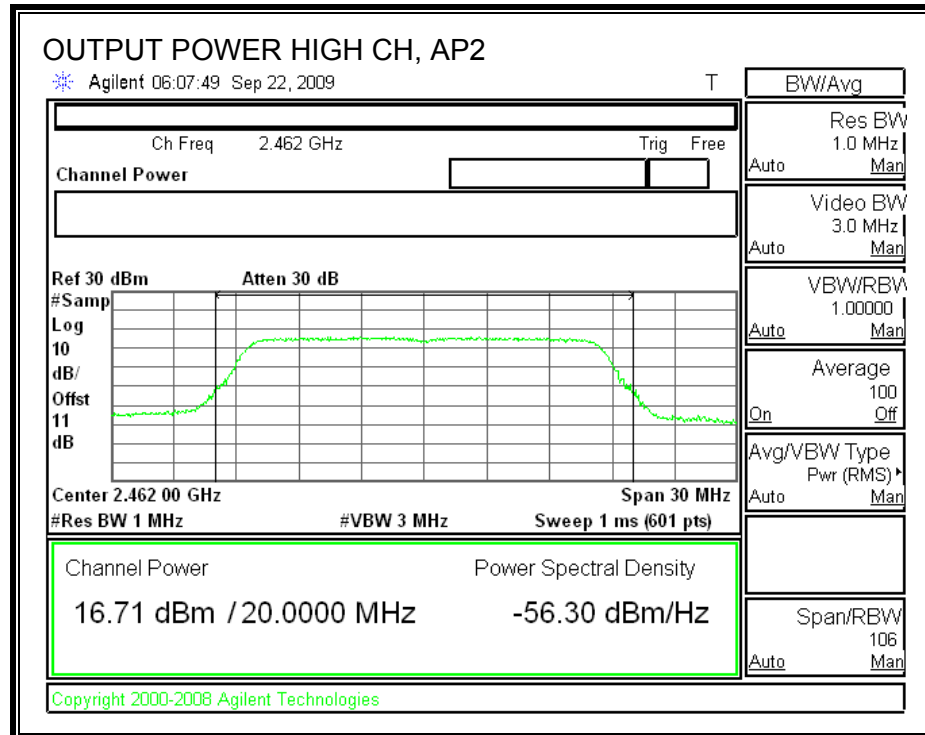
RESULTS

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	16.31	15.25	18.09	0.00	21.48	29.20	-7.72
Mid	2437	16.69	16.97	16.70	0.00	21.56	29.20	-7.64
High	2462	16.71	16.18	17.13	0.00	21.46	29.20	-7.74

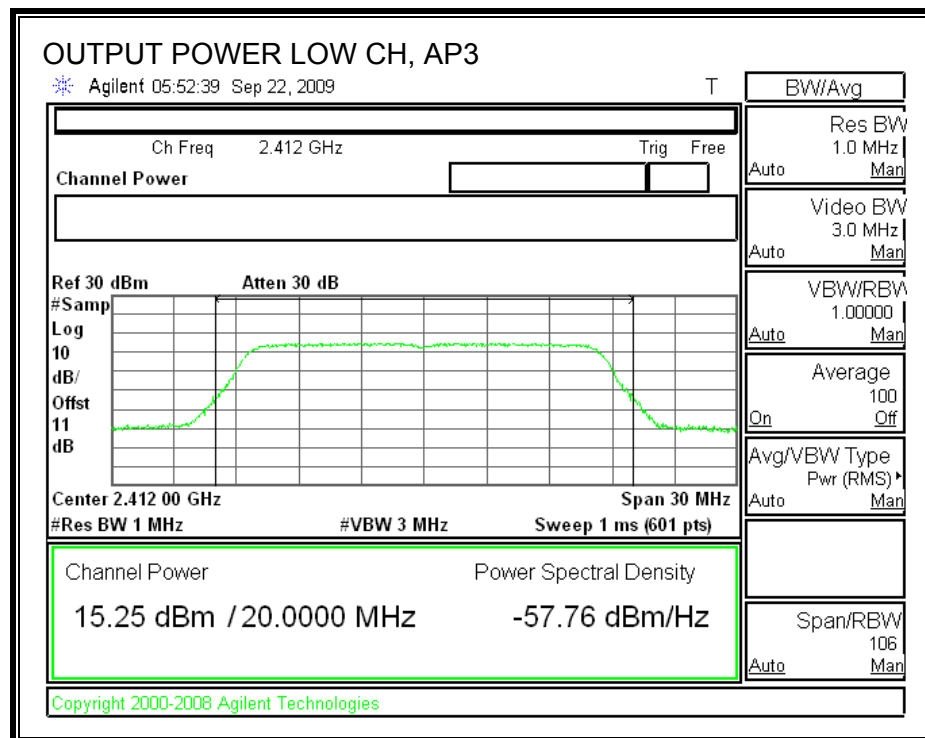
AP2 OUTPUT POWER

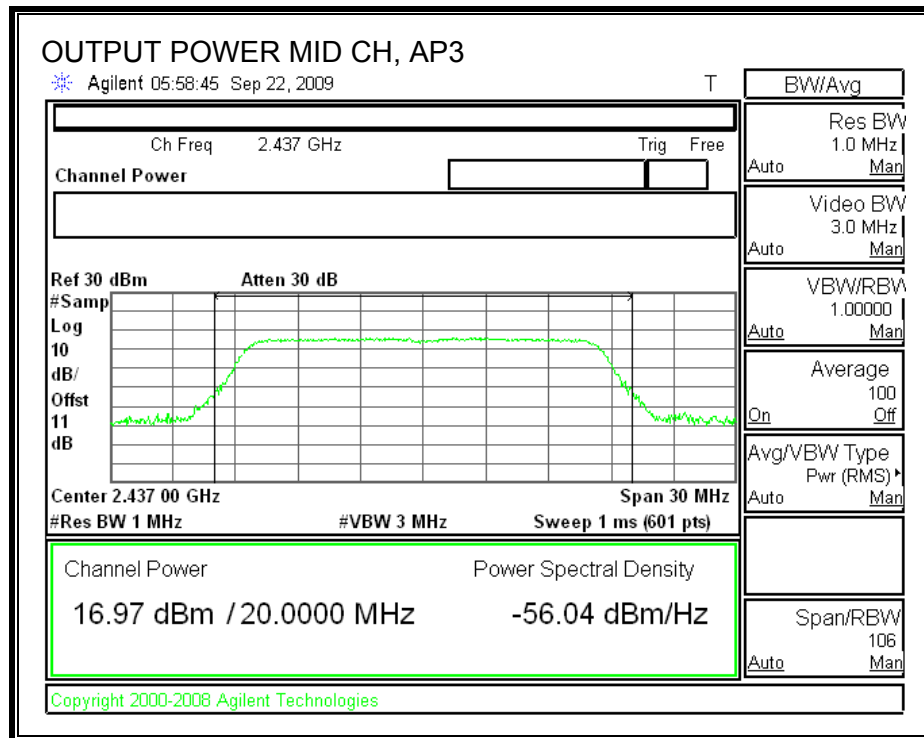


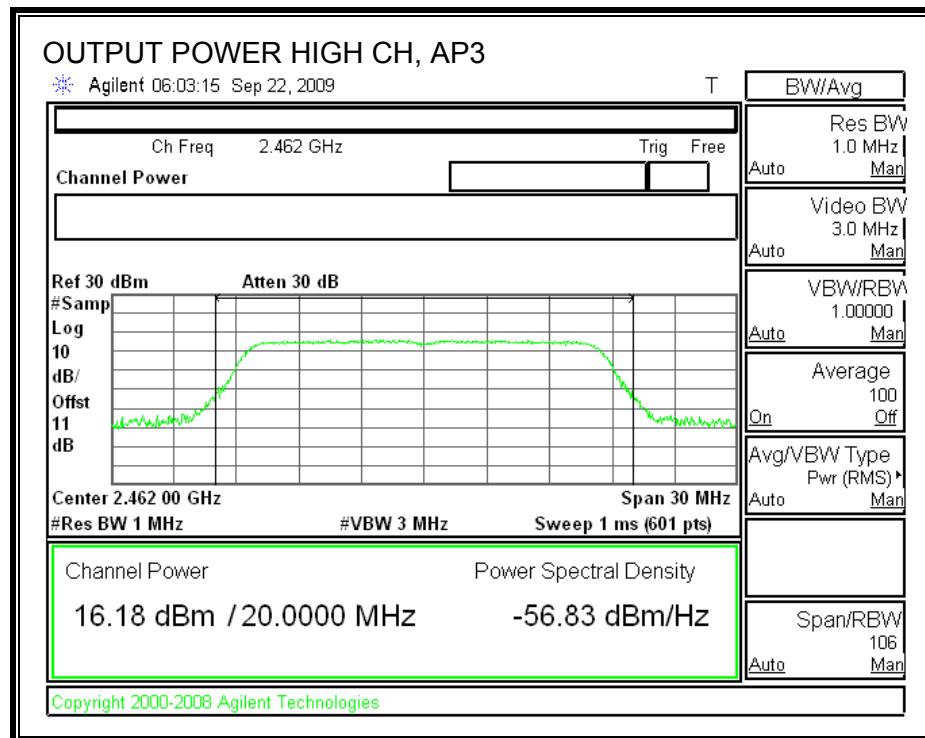




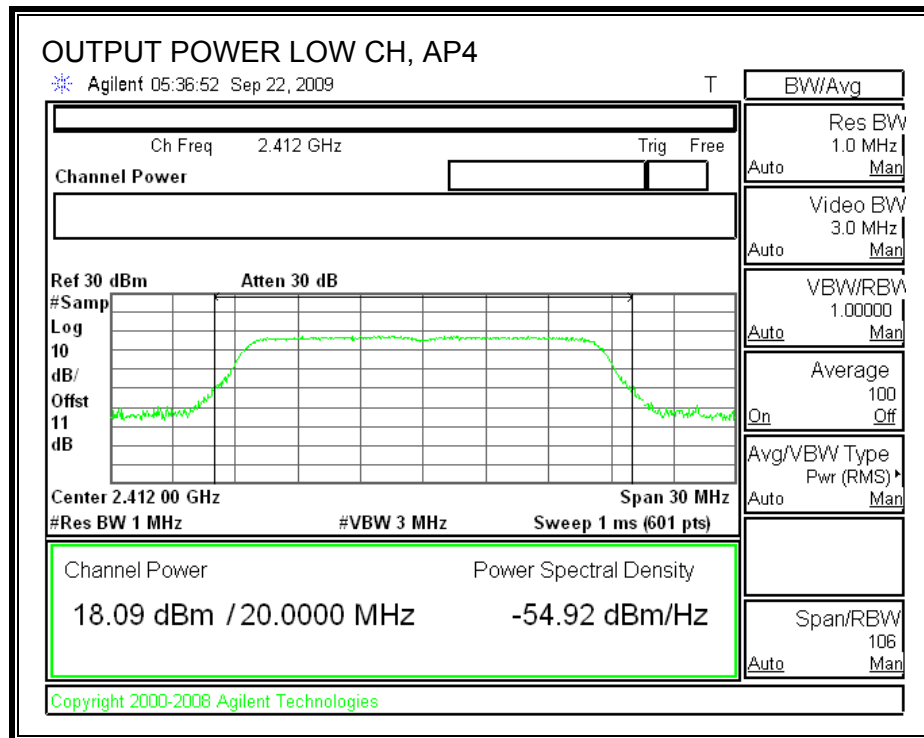
AP3 OUTPUT POWER

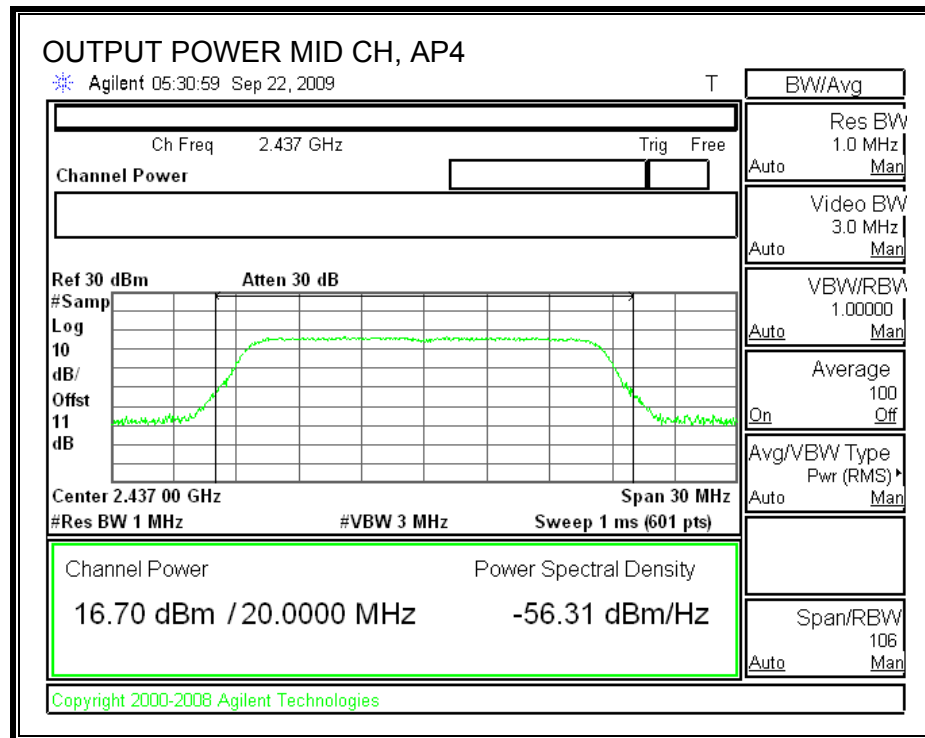


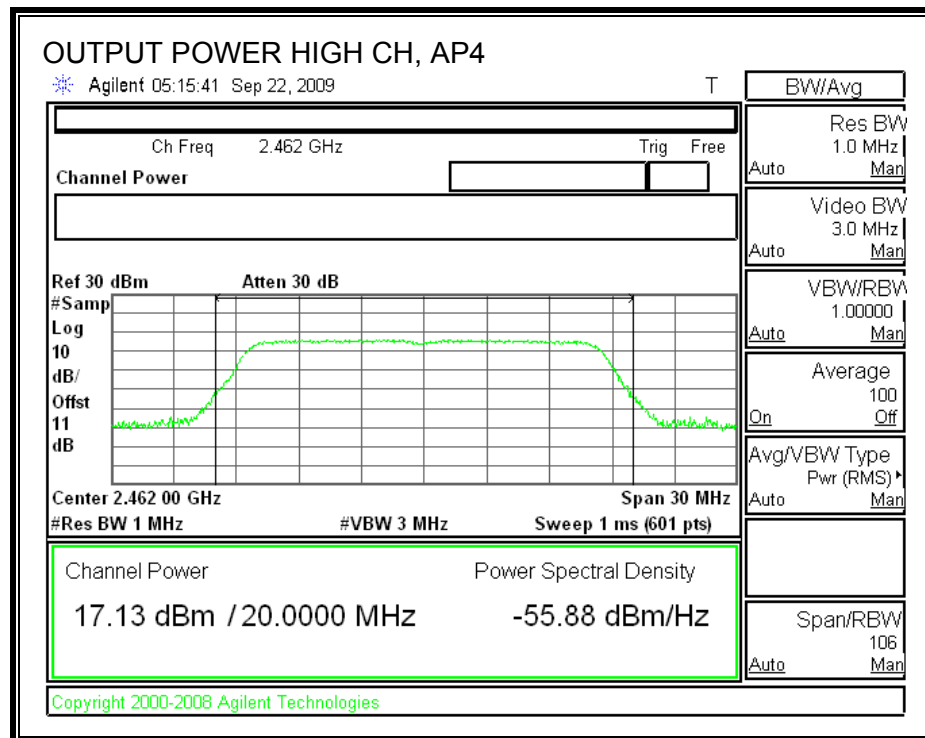




AP4 OUTPUT POWER







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

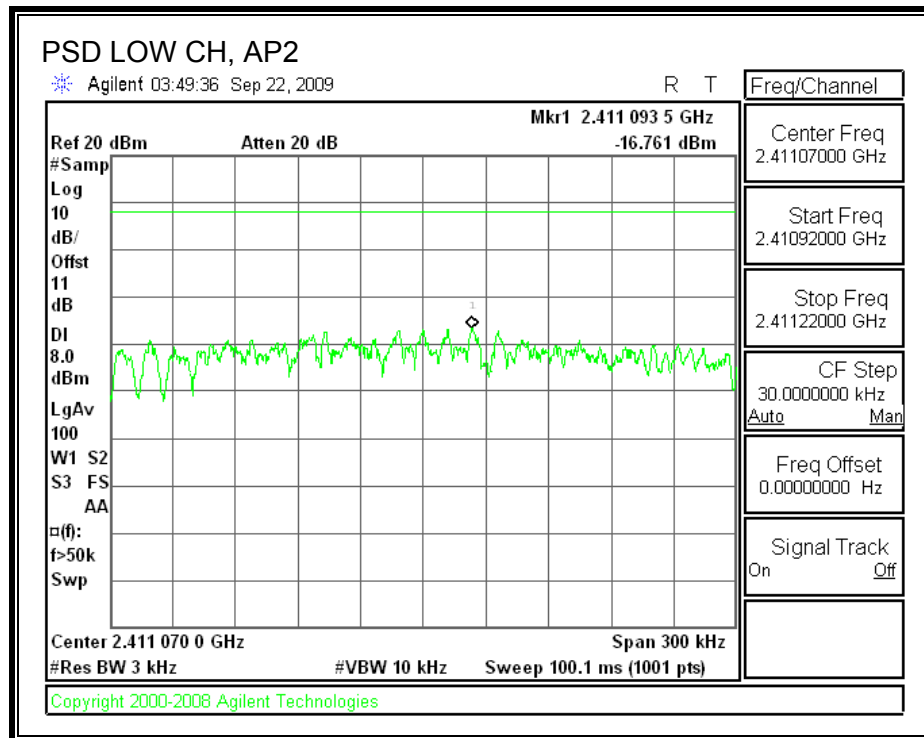
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

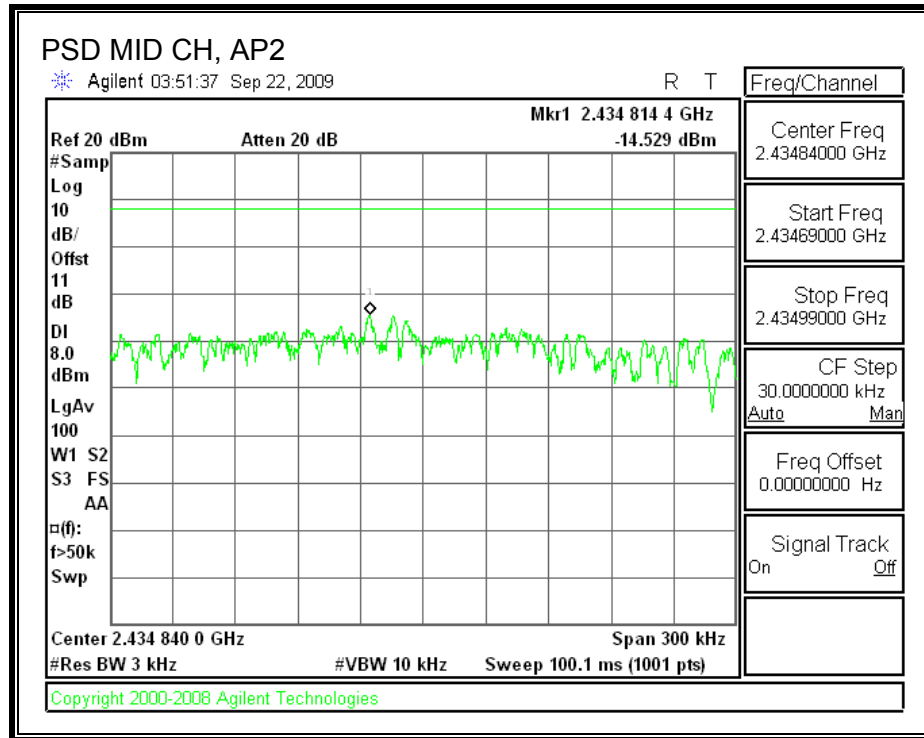
RESULTS

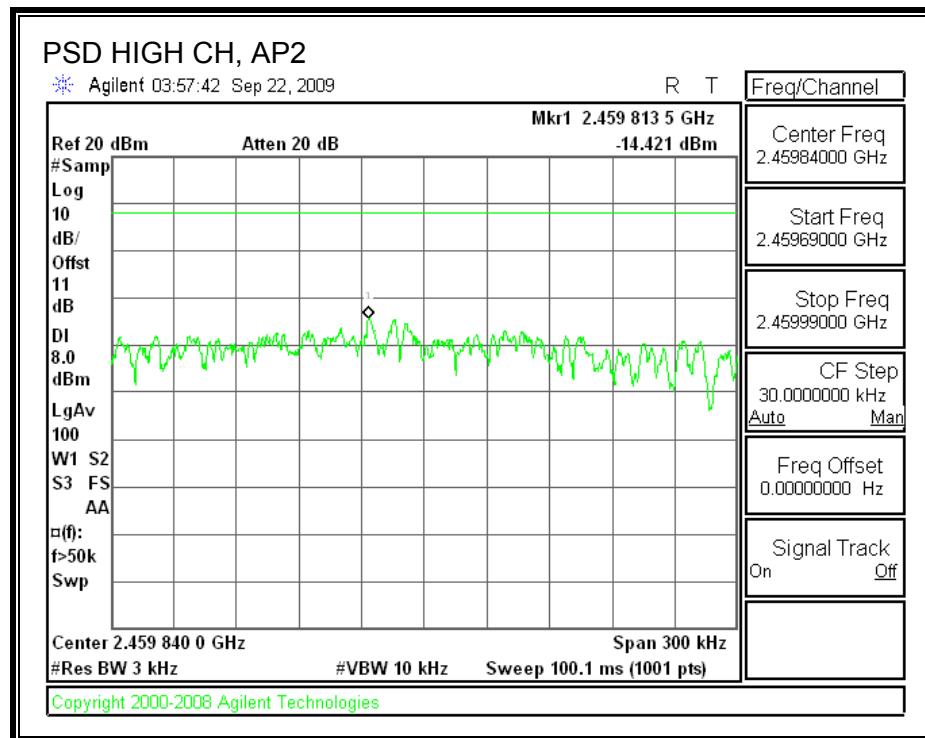
Channel	Frequency (MHz)	AP2 PSD (dBm)	AP3 PSD (dBm)	AP4 PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-16.761	-15.848	-16.424	8	-23.85
Middle	2437	-14.529	-15.322	-15.911	8	-22.53
High	2462	-14.421	-16.319	-14.311	8	-22.31

Channel	Frequency (MHz)	PSD with Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-16.213	8	-24.21
Middle	2437	-5.685	8	-13.69
High	2462	-15.088	8	-23.09

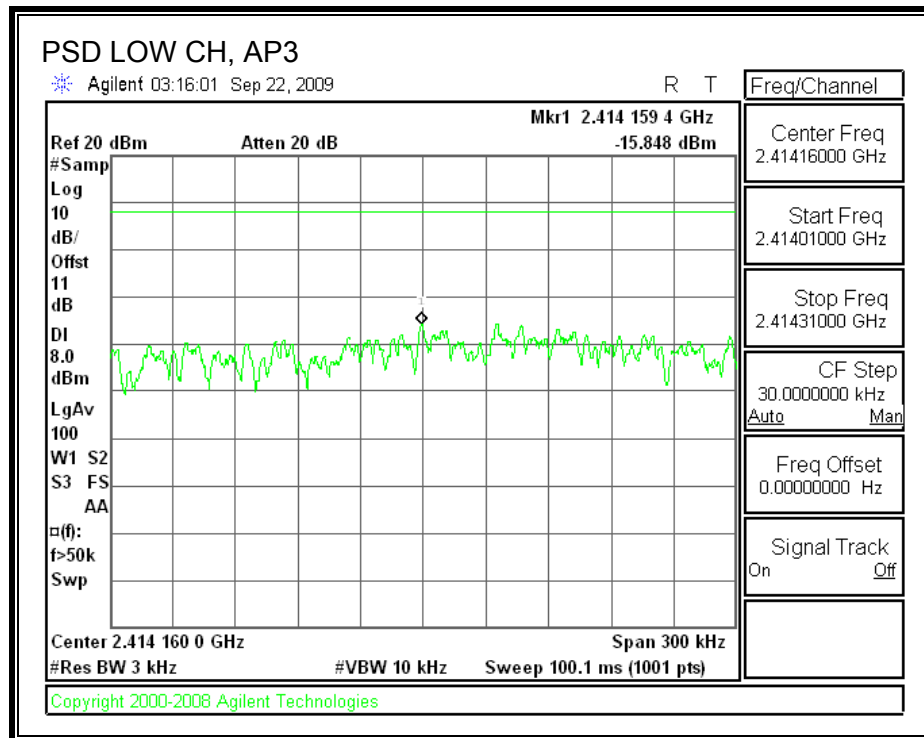
POWER SPECTRAL DENSITY, AP2

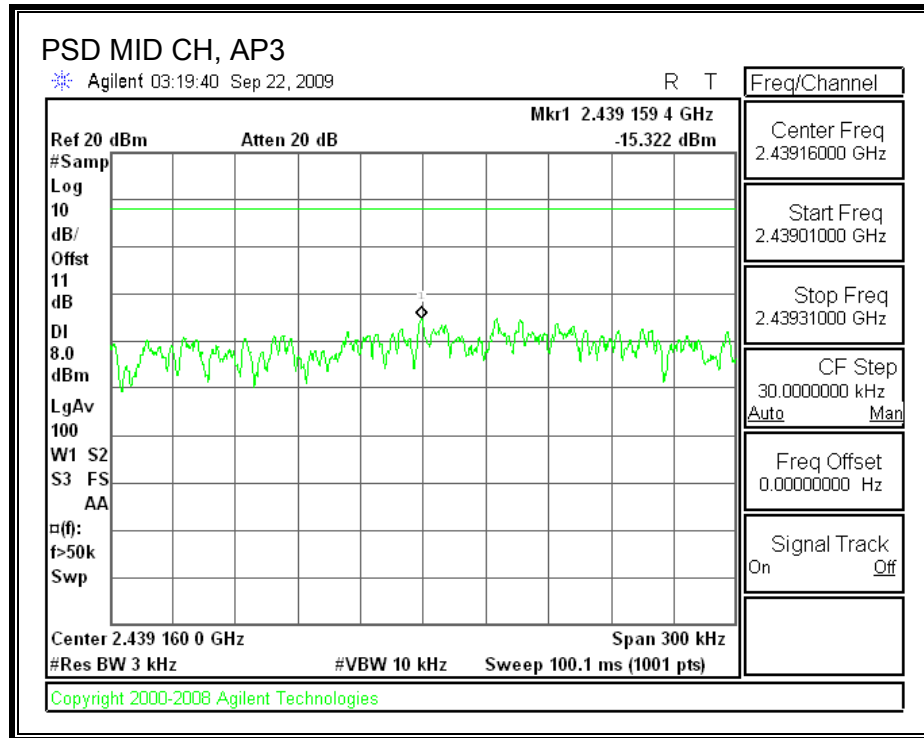


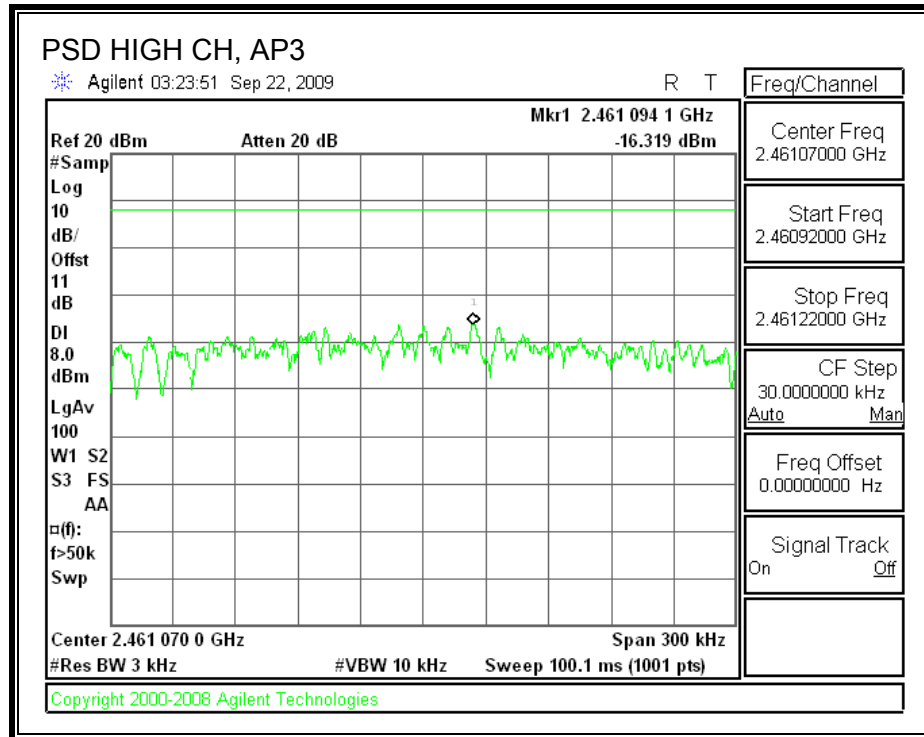




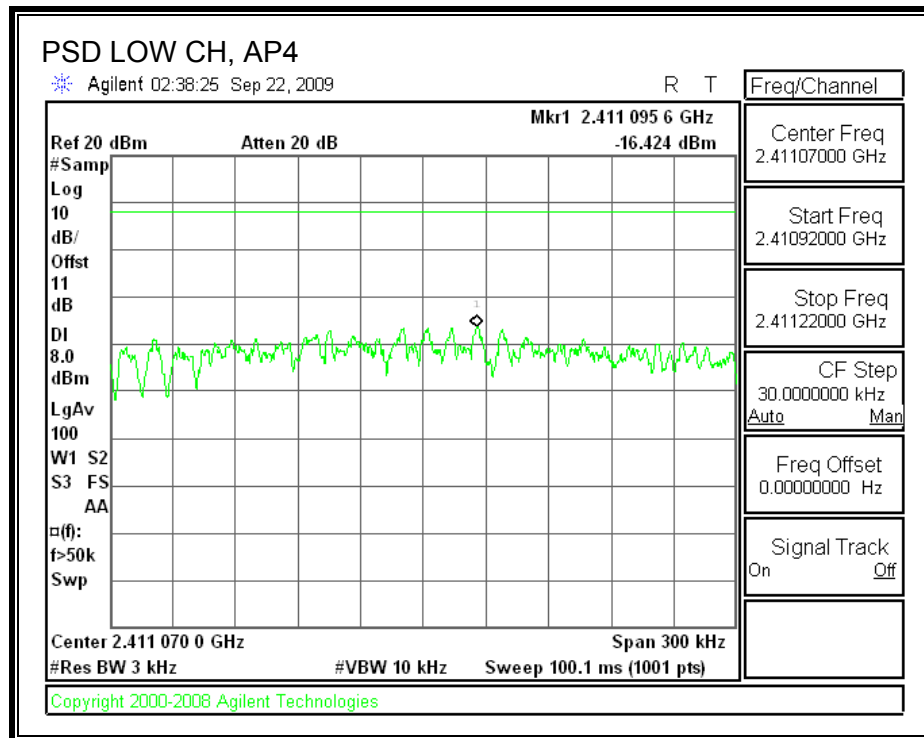
POWER SPECTRAL DENSITY, AP3

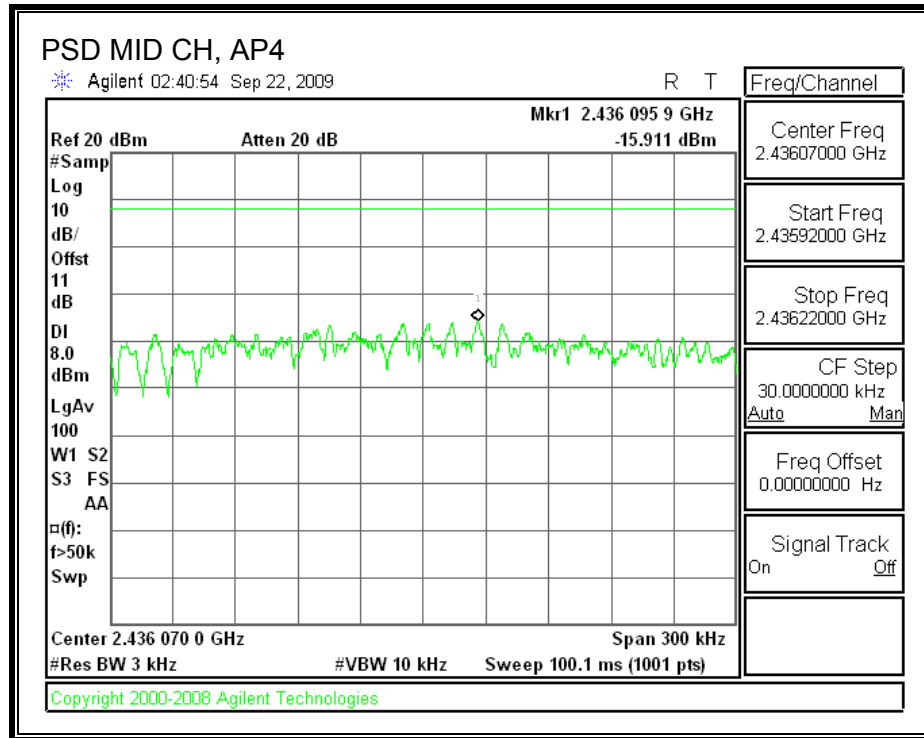


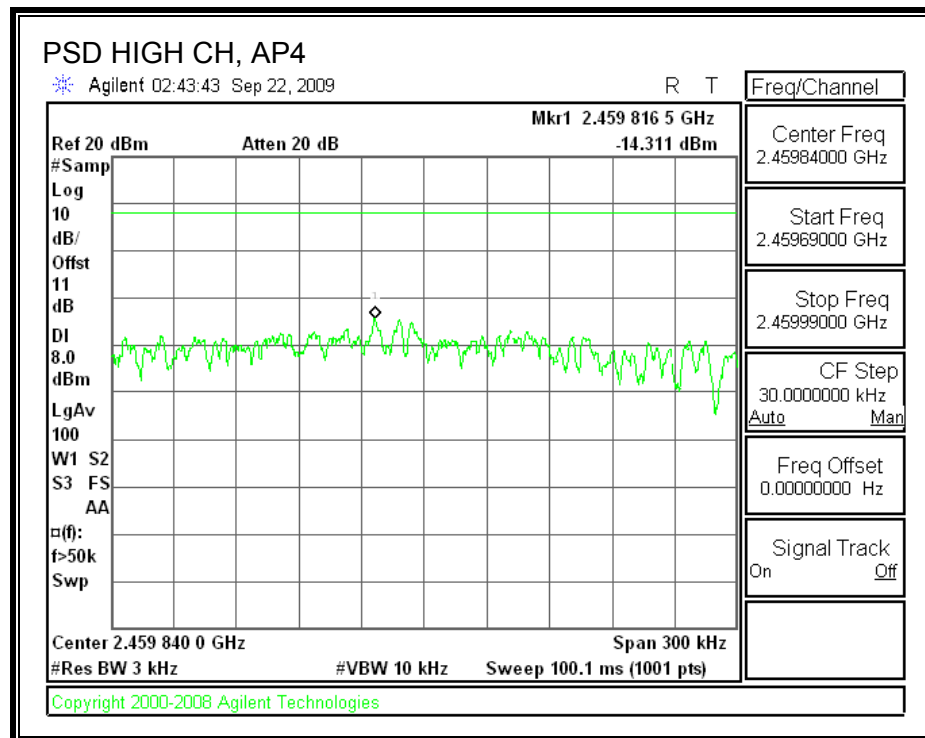




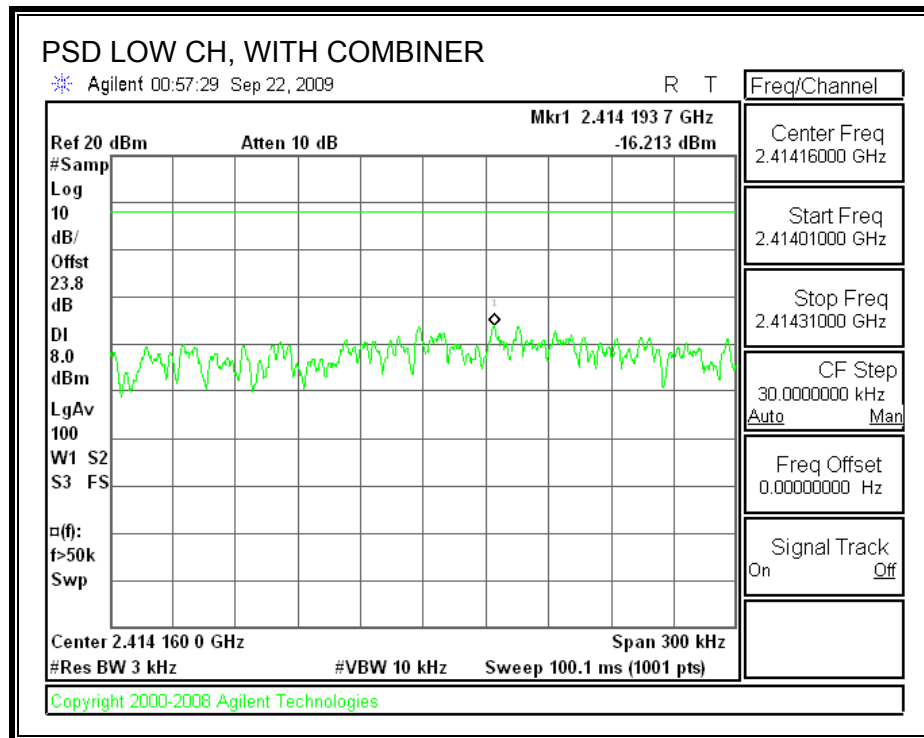
POWER SPECTRAL DENSITY, AP4

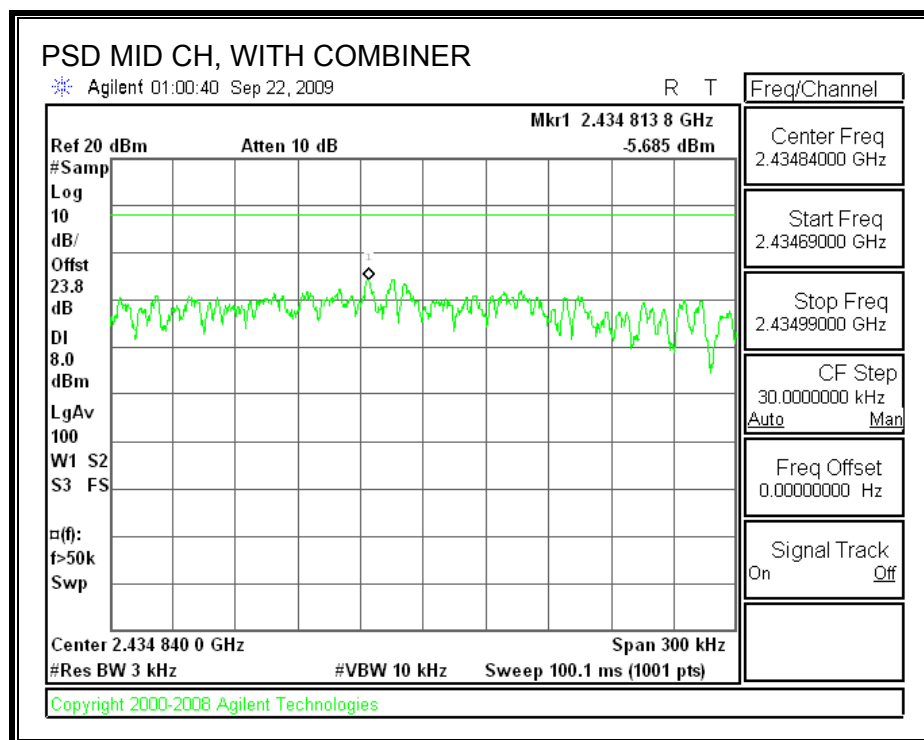


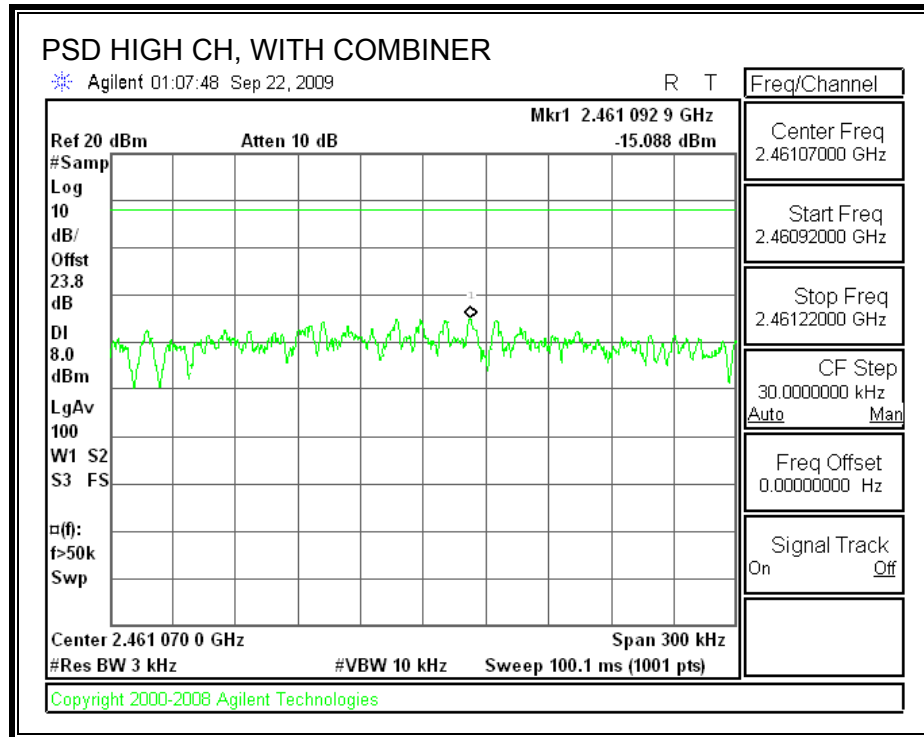




POWER SPECTRAL DENSITY, WITH COMBINER







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.

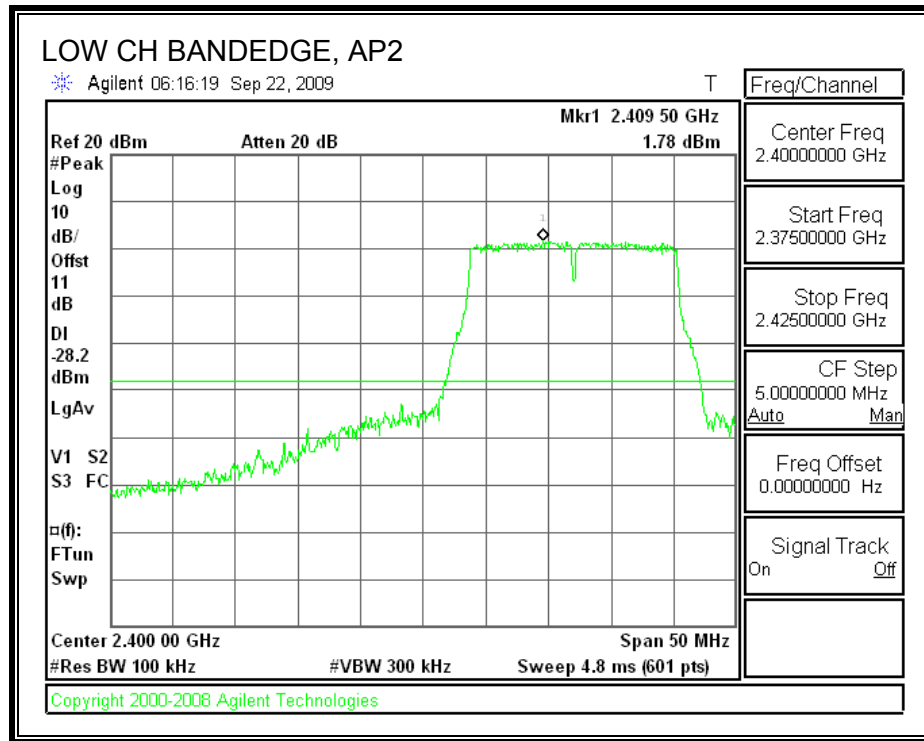
TEST PROCEDURE

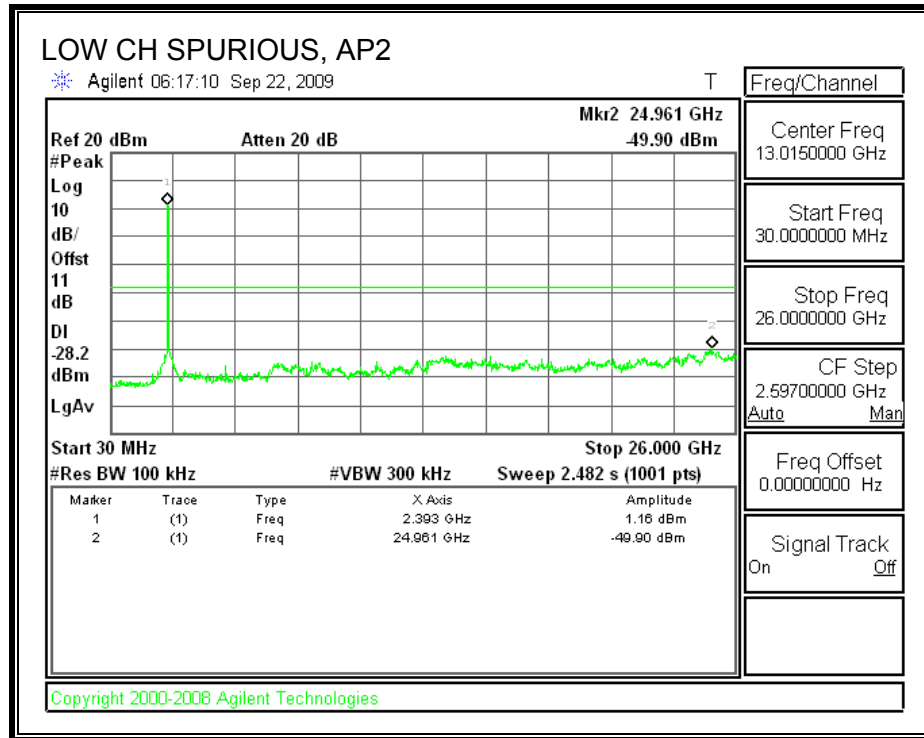
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

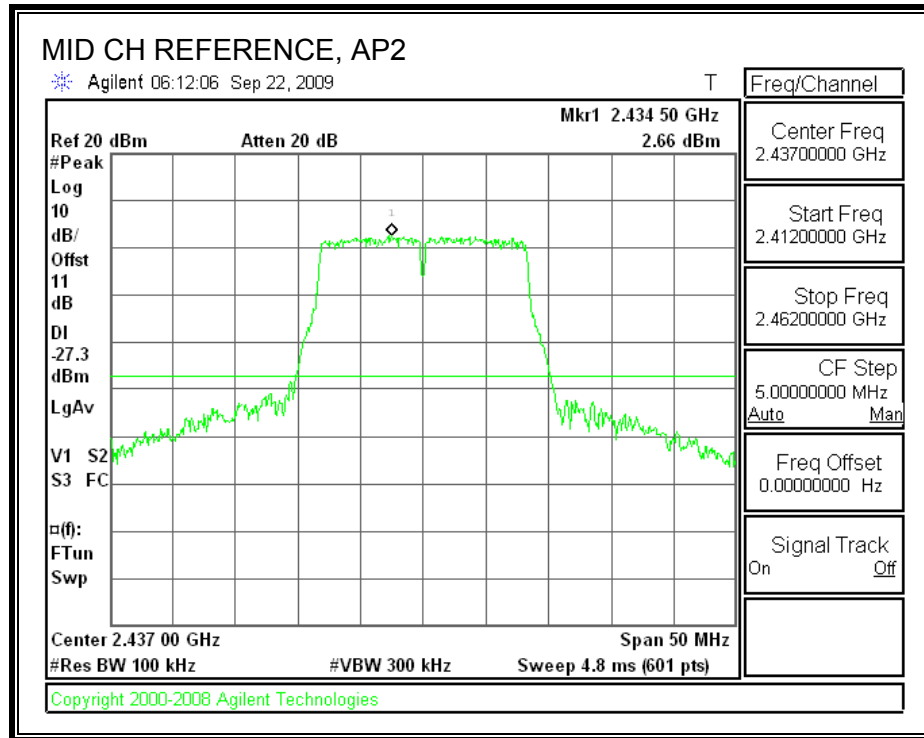
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

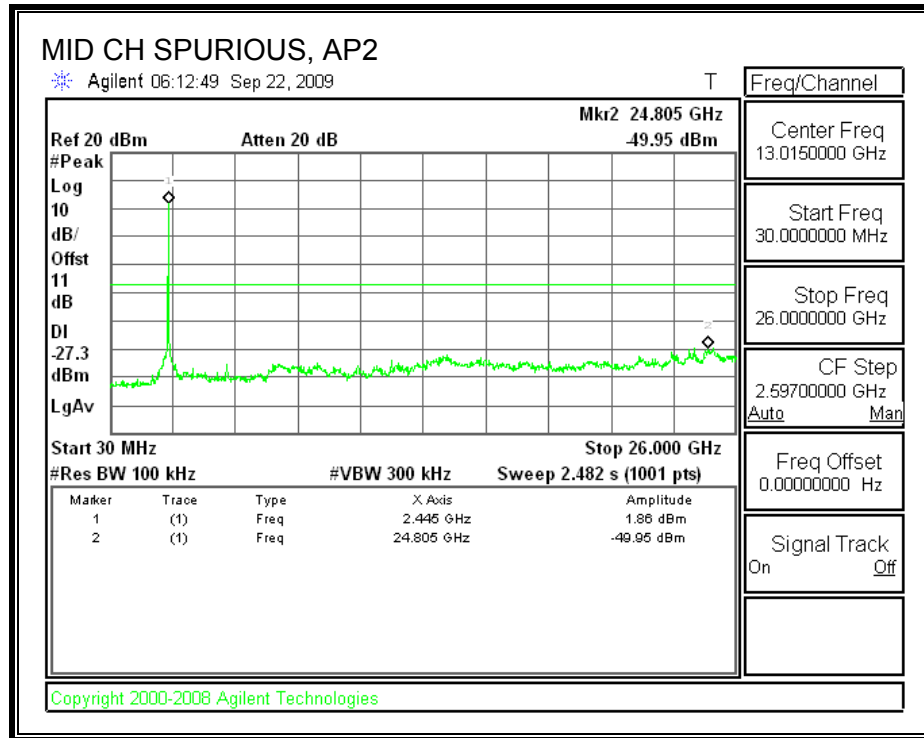
RESULTS

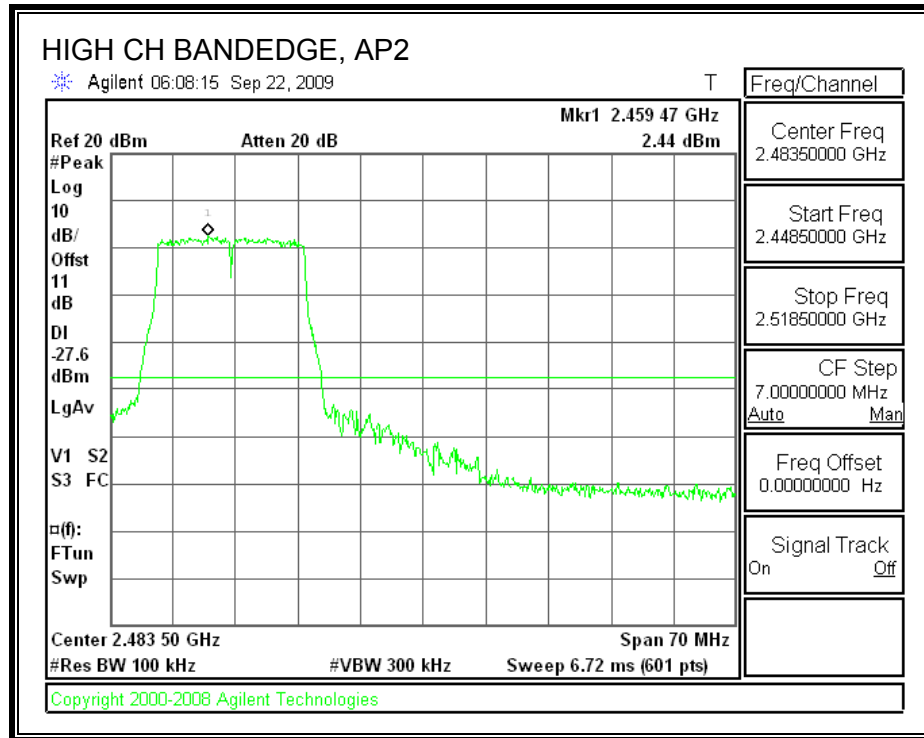
AP2 SPURIOUS EMISSIONS

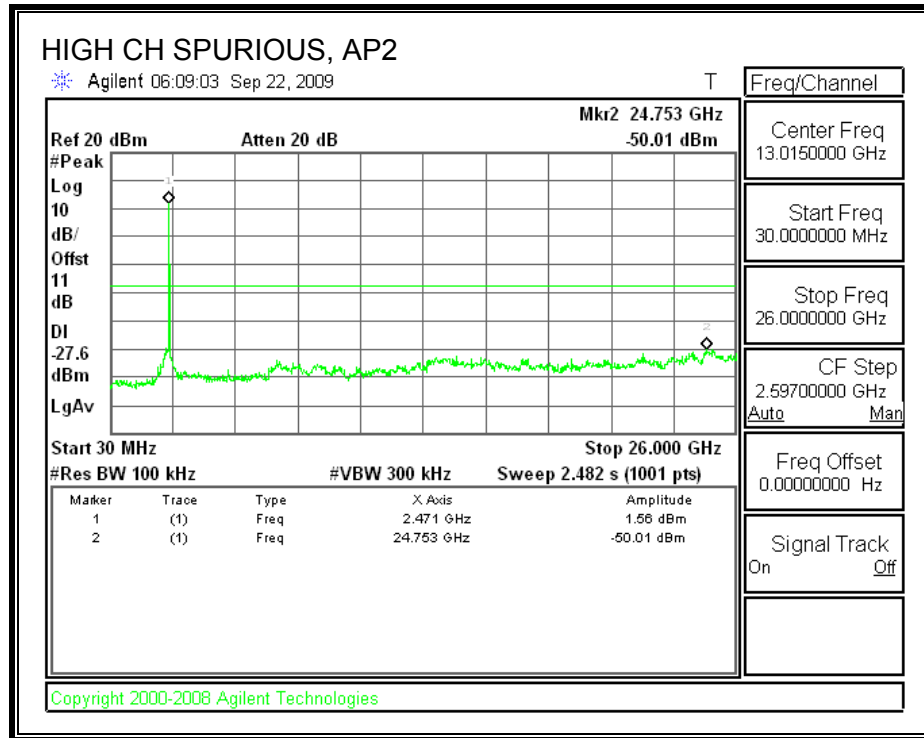




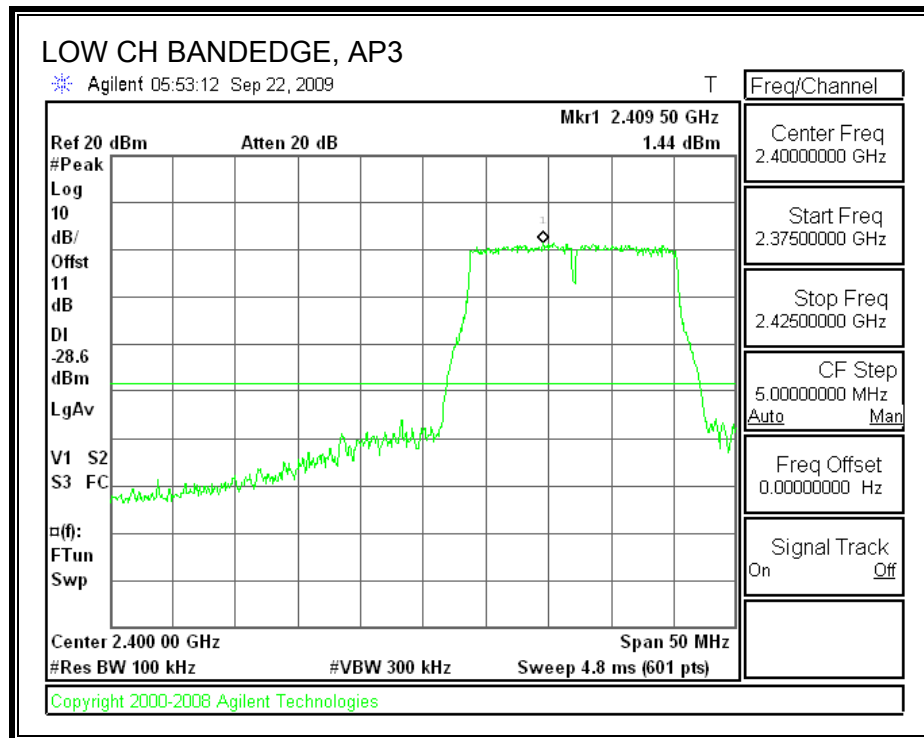


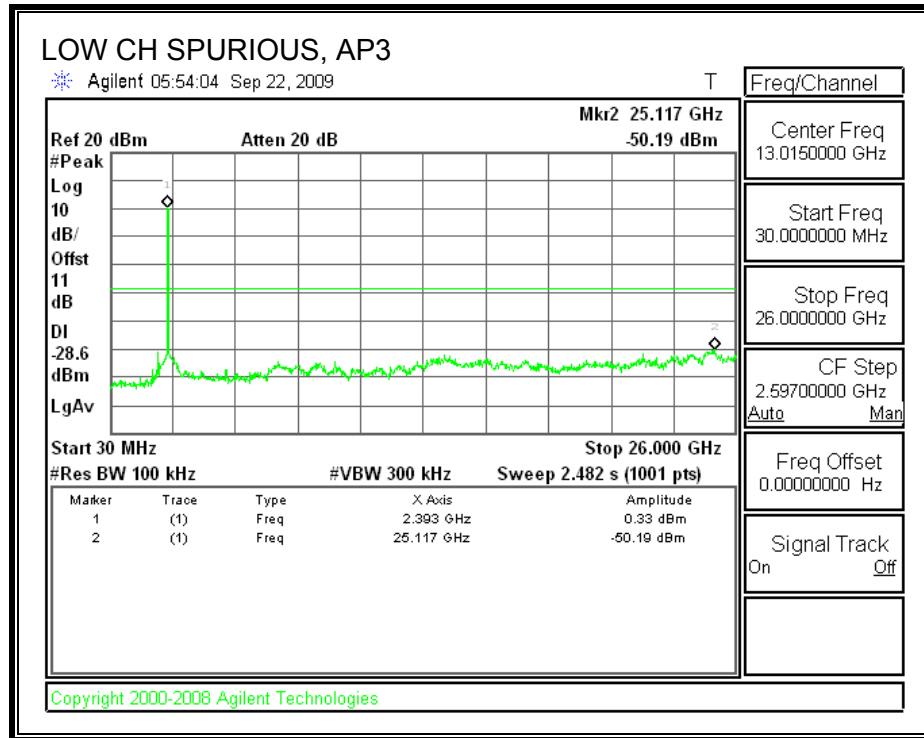


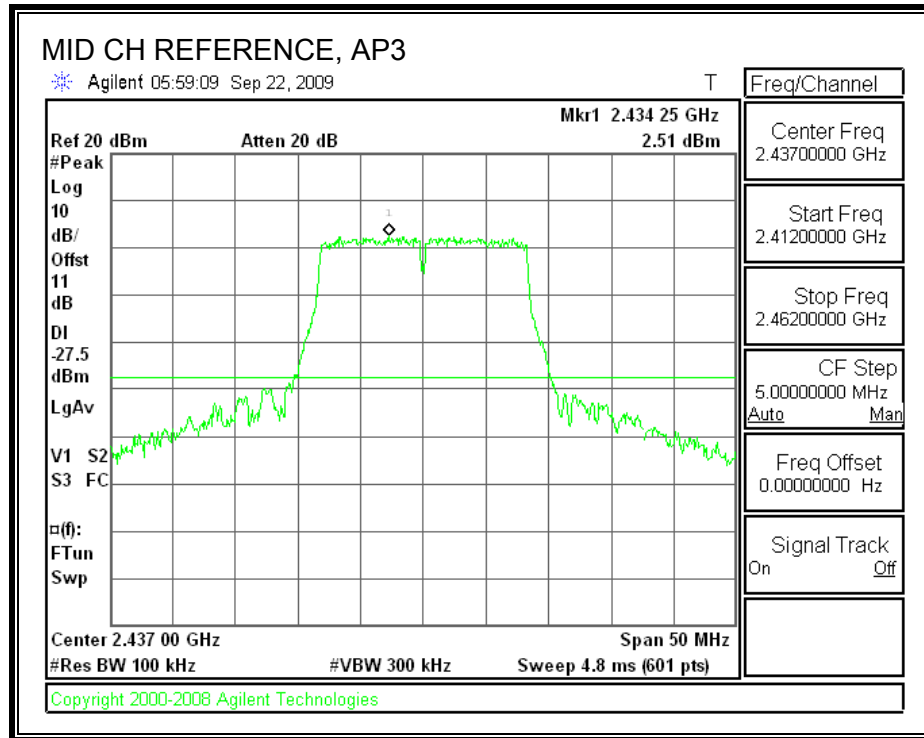


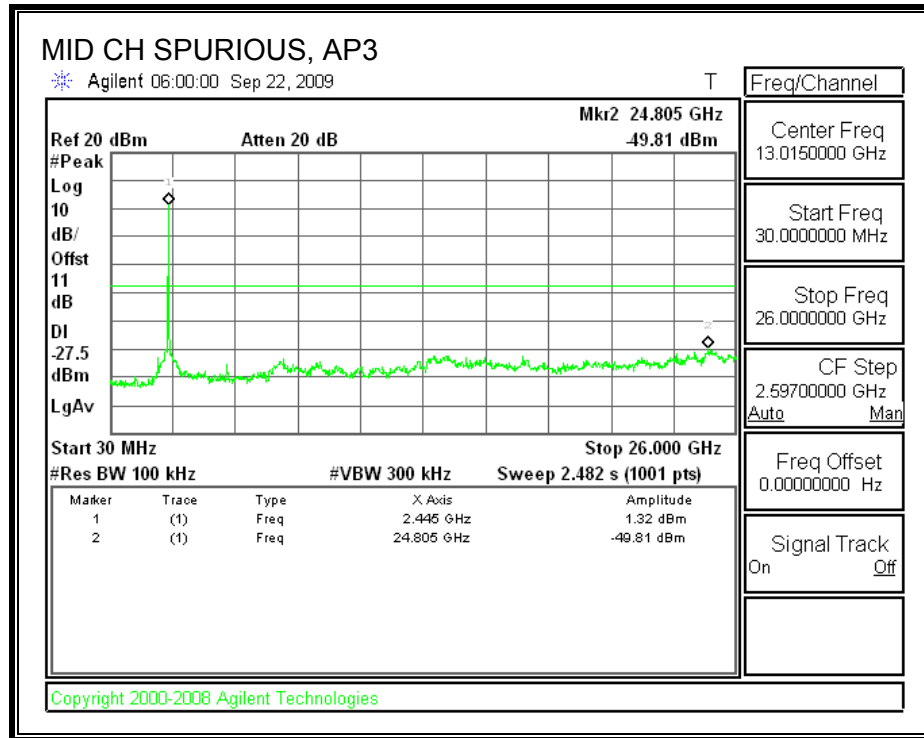


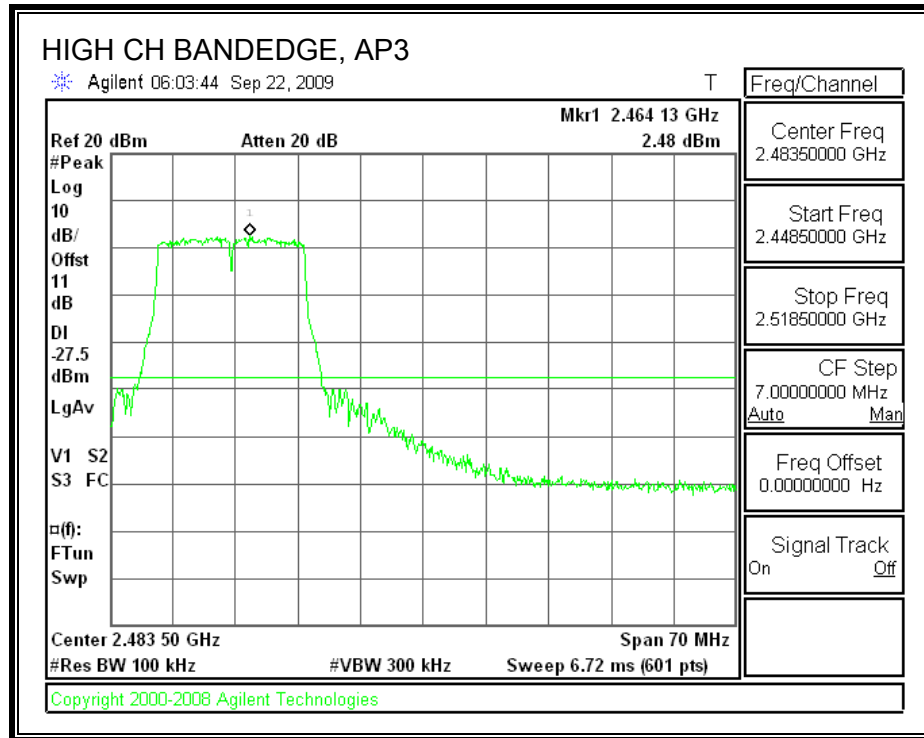
AP3 SPURIOUS EMISSIONS

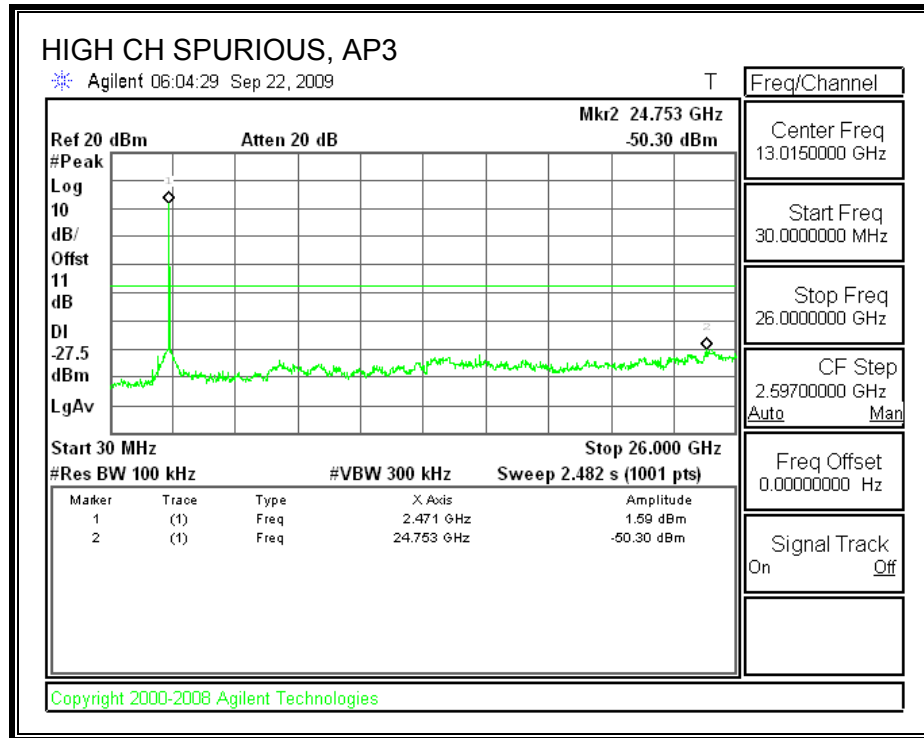




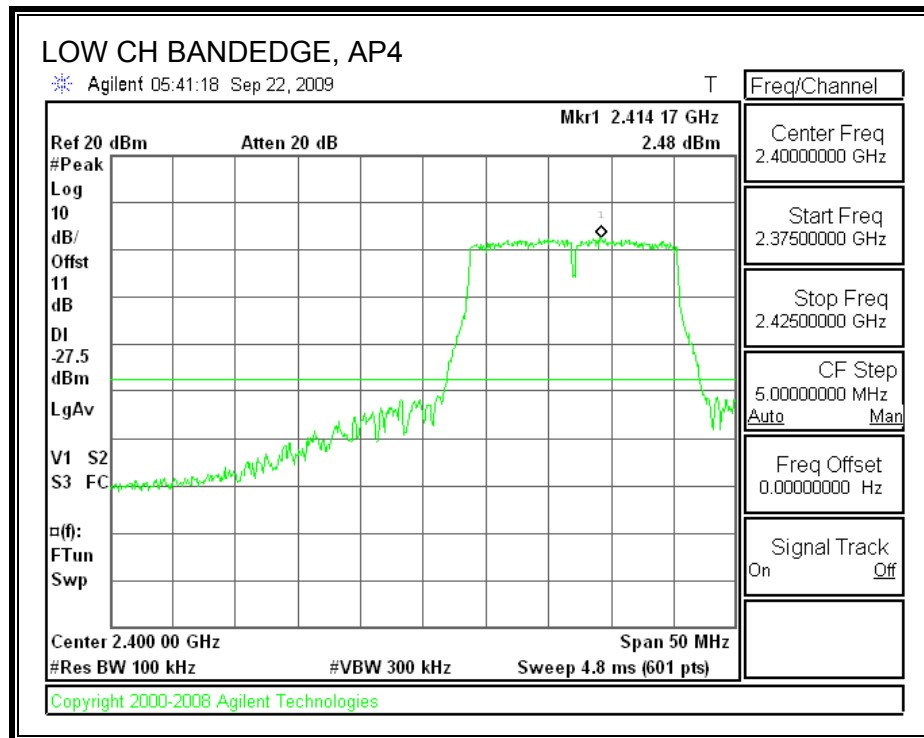


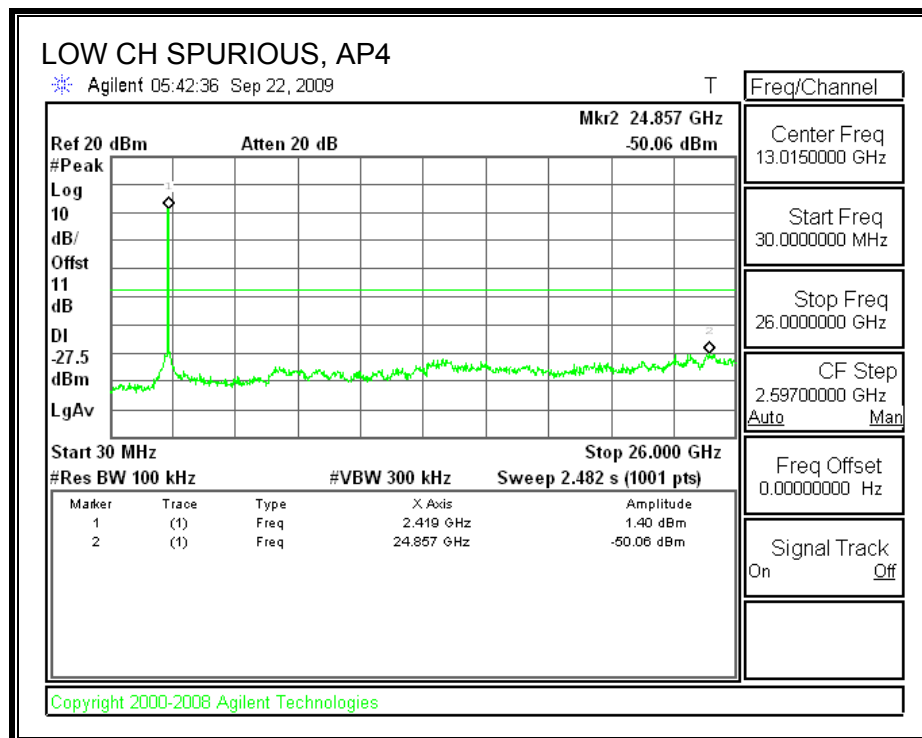


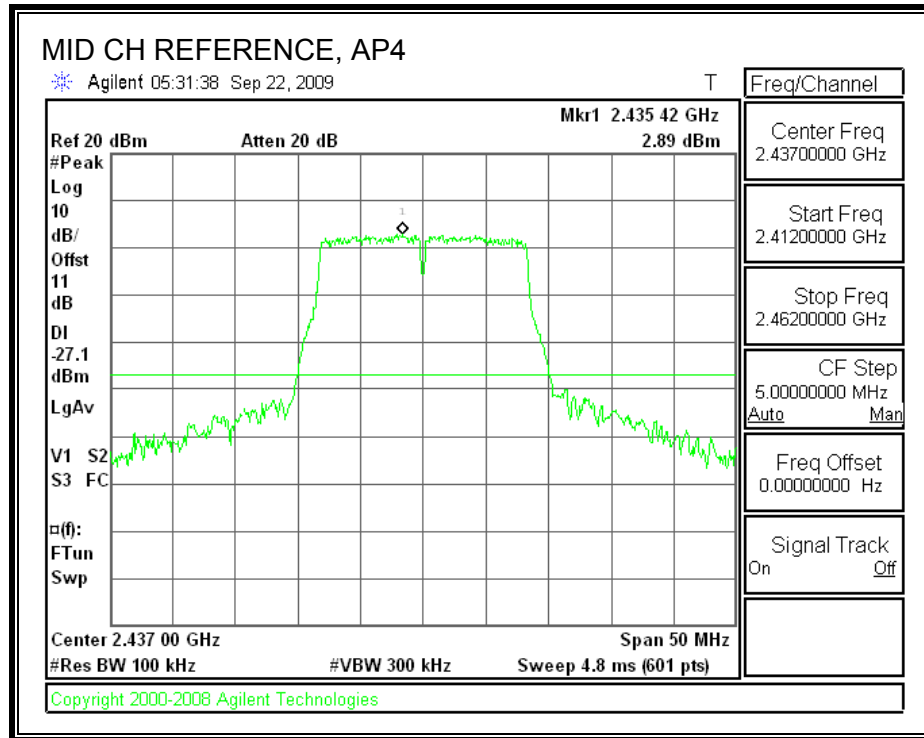


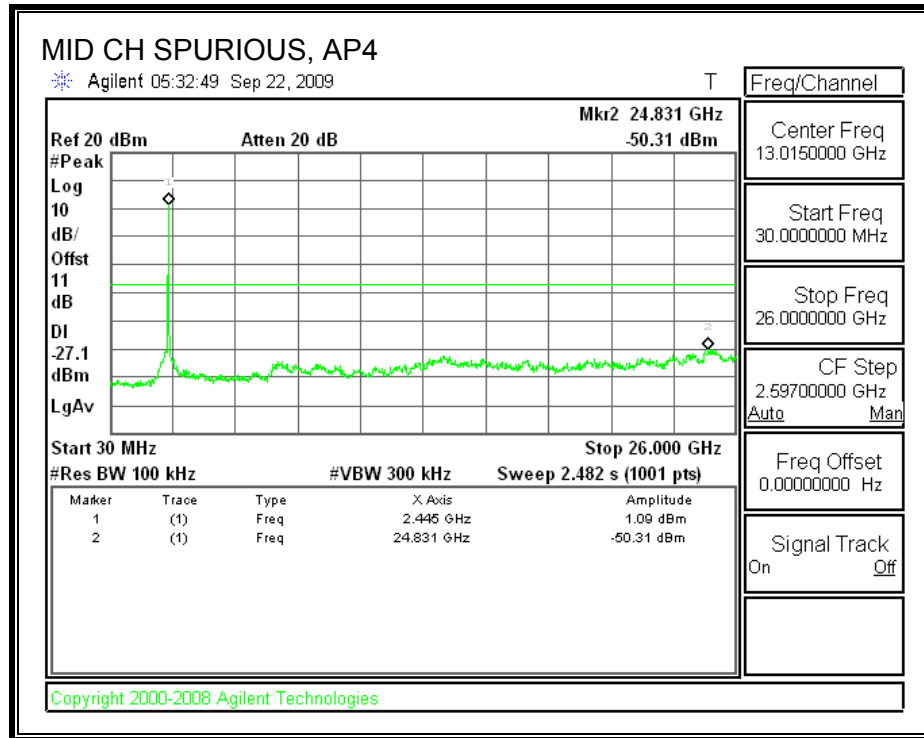


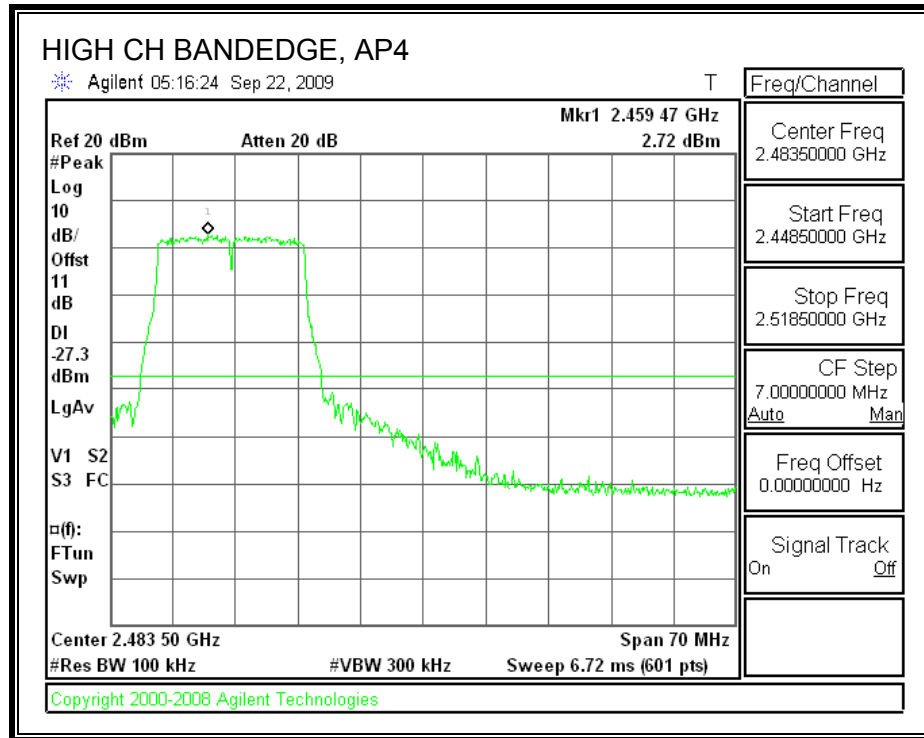
AP4 SPURIOUS EMISSIONS

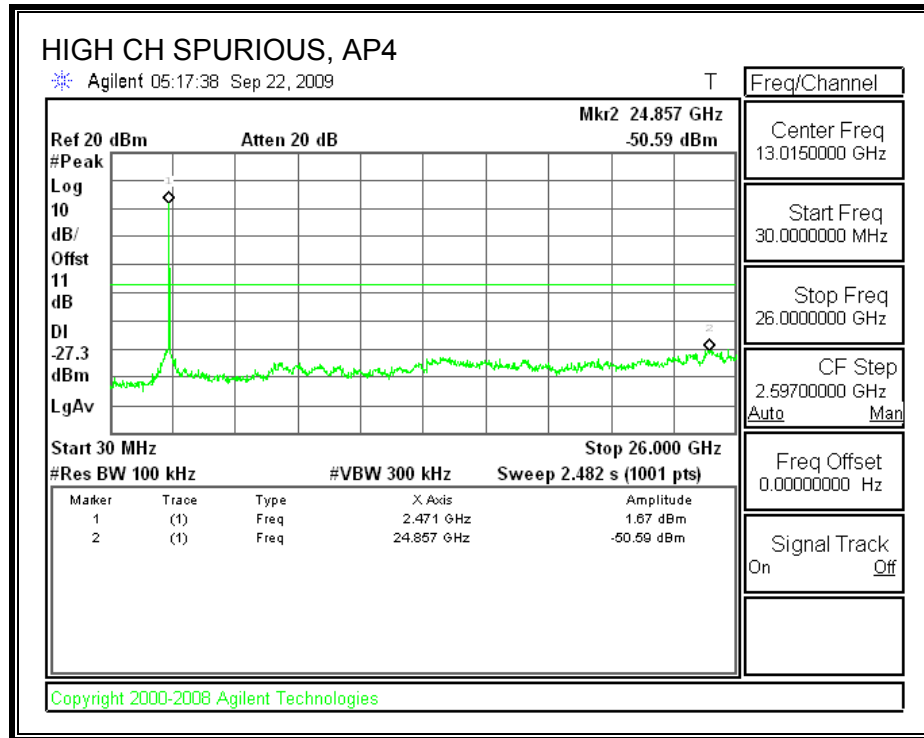




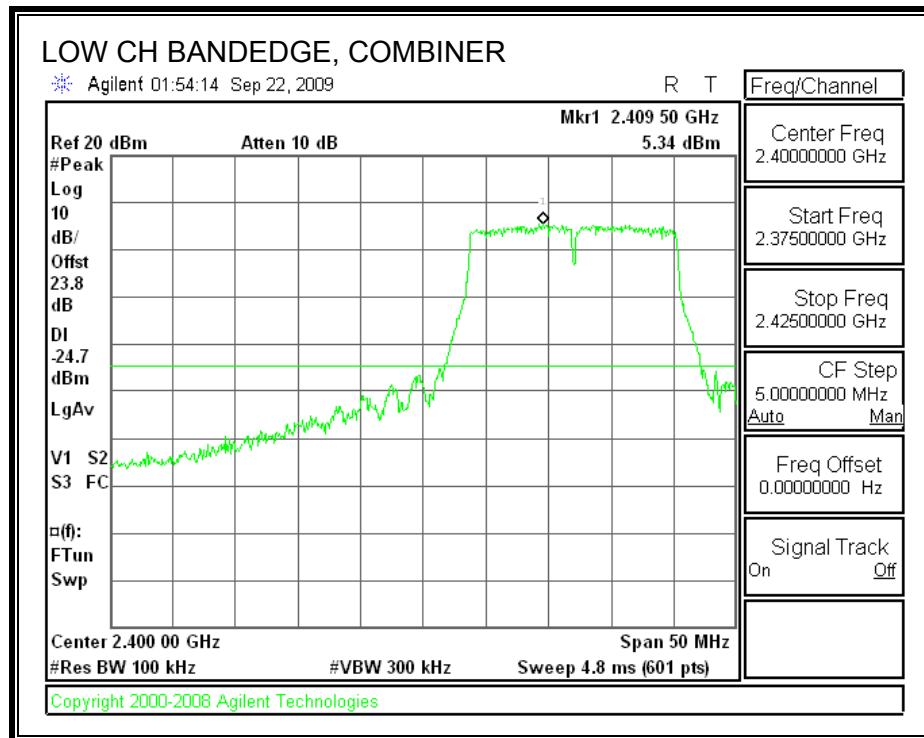


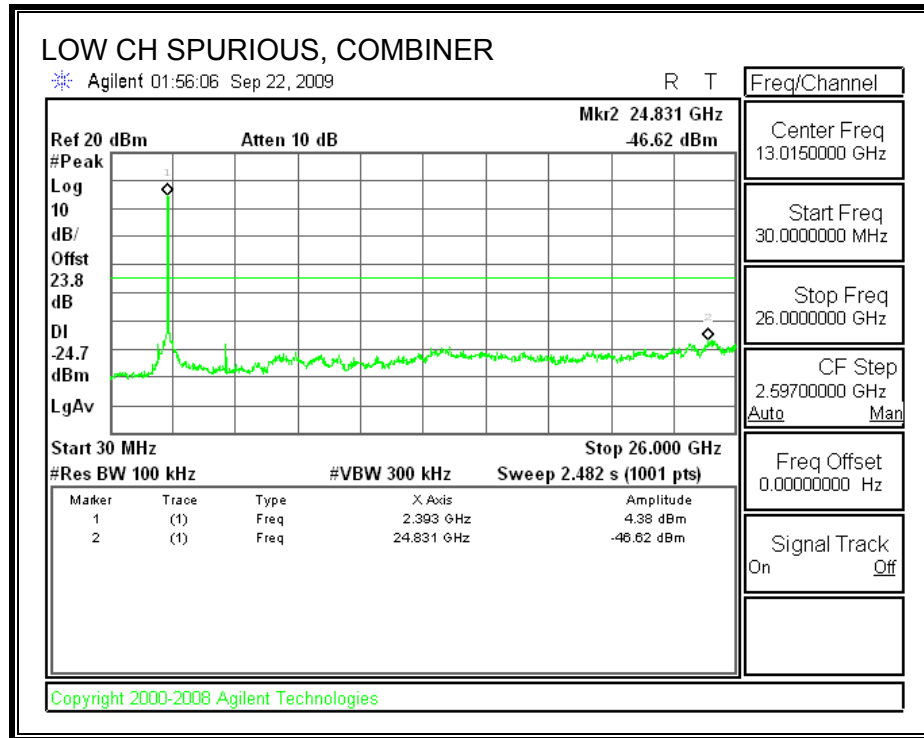


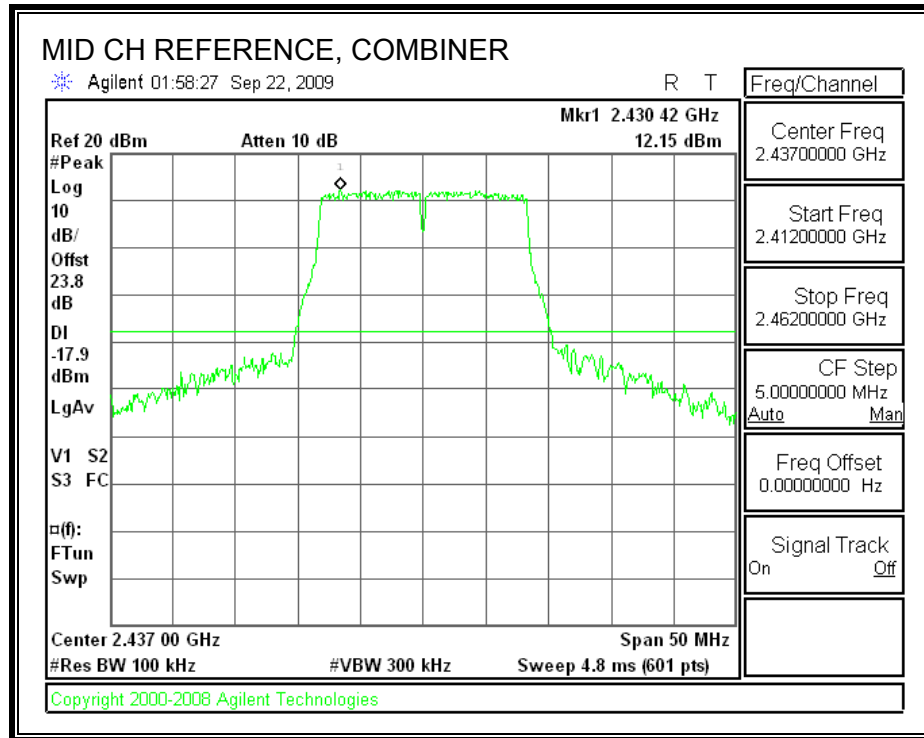


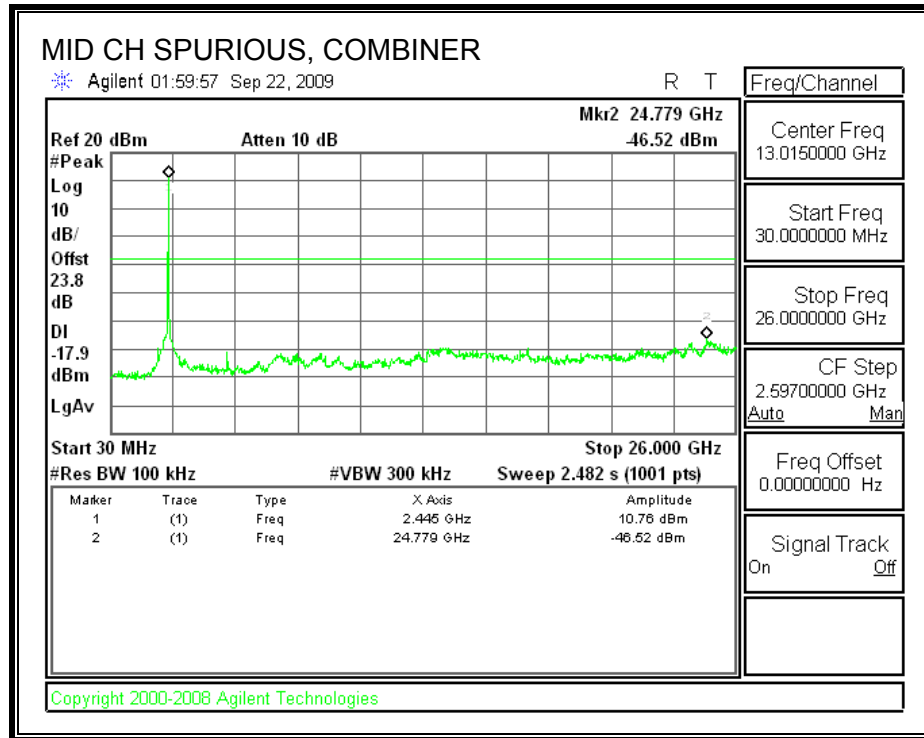


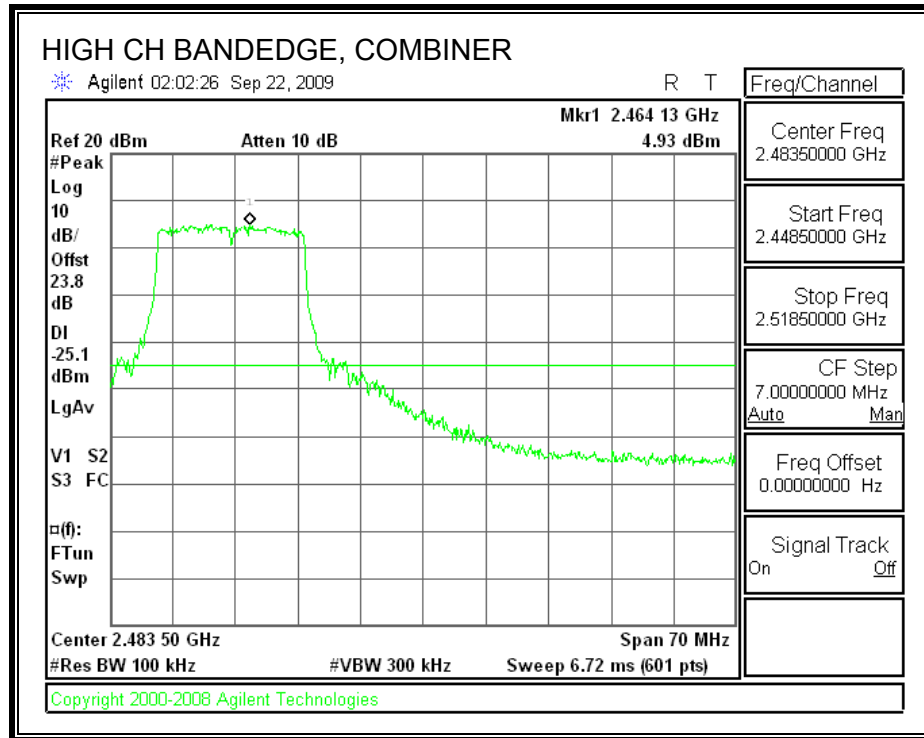
COMBINER SPURIOUS EMISSIONS

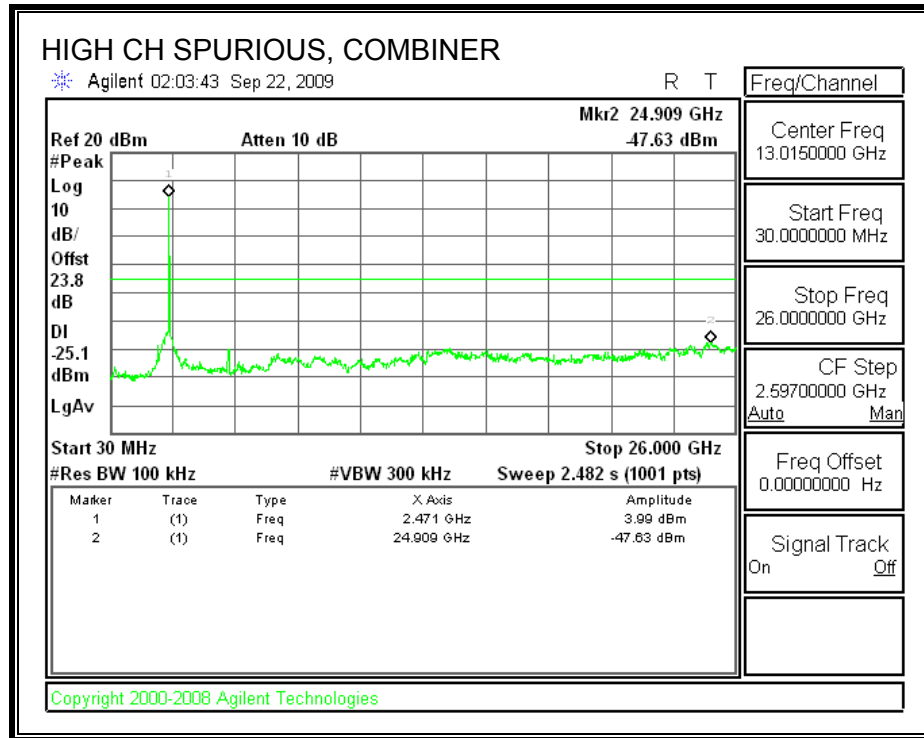












7.3. 802.11n THREE CHAINS HT20 MODE IN THE 2.4 GHz BAND

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.

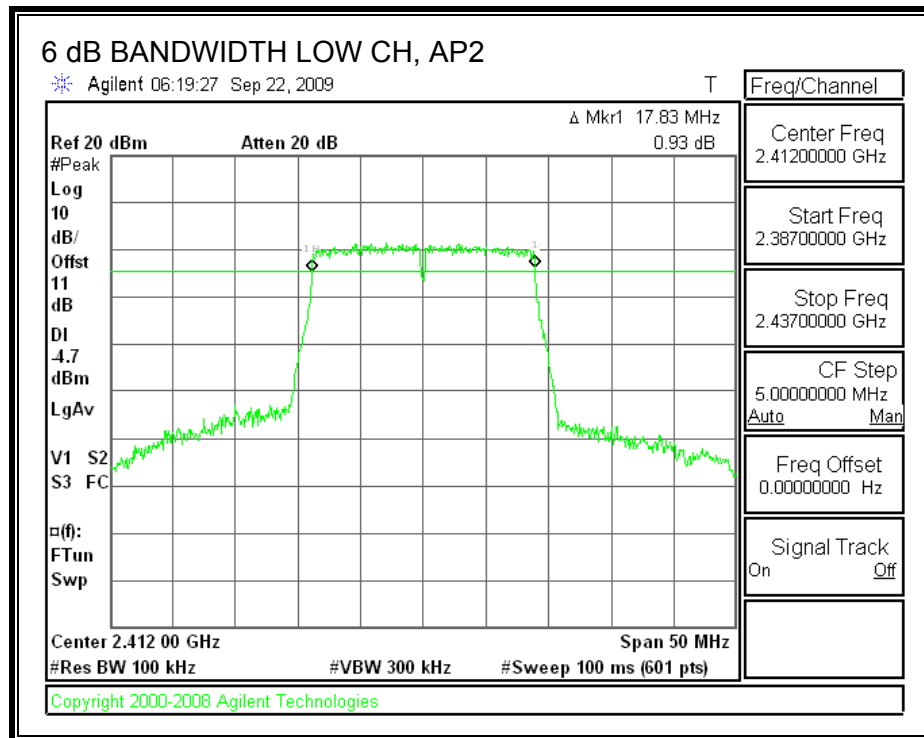
TEST PROCEDURE

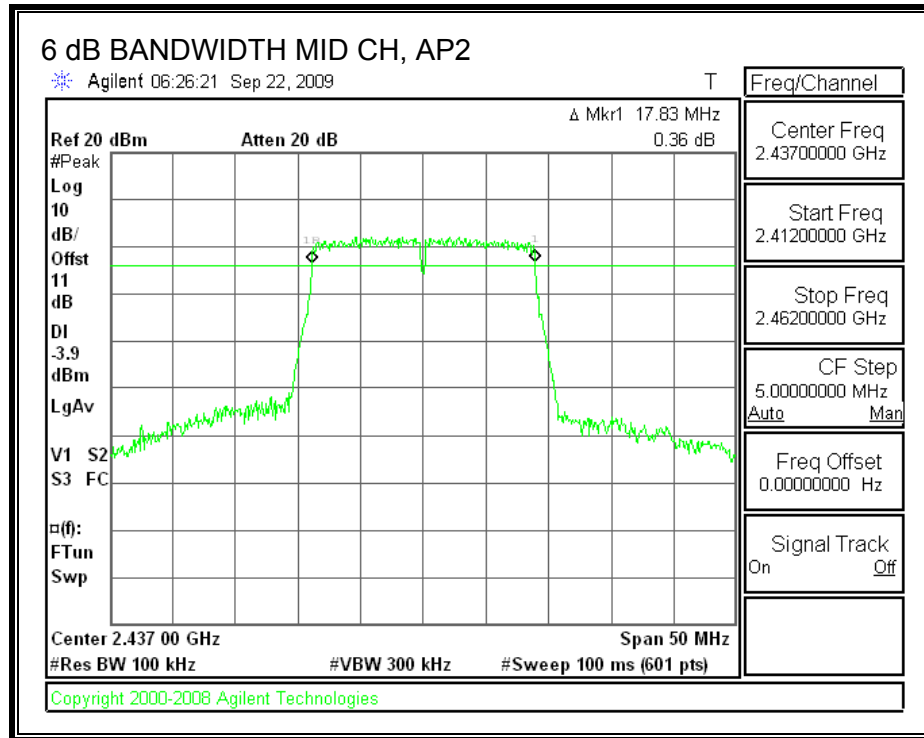
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

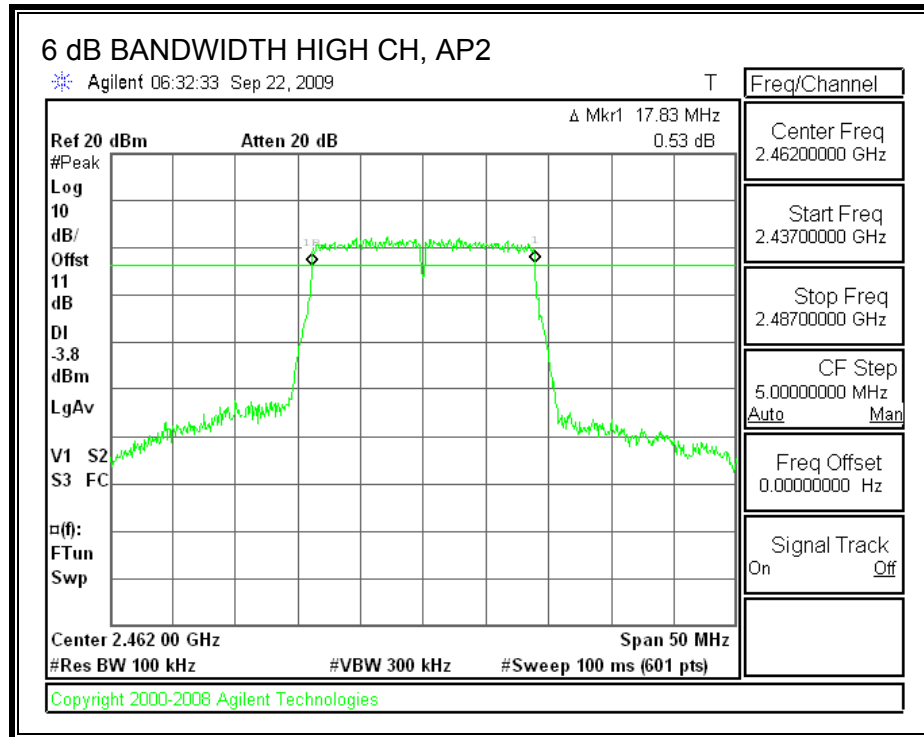
RESULTS

Channel	Frequency (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	AP4 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	17.83	17.83	17.83	0.5
Middle	2437	17.83	17.83	17.83	0.5
High	2462	17.83	17.83	17.83	0.5

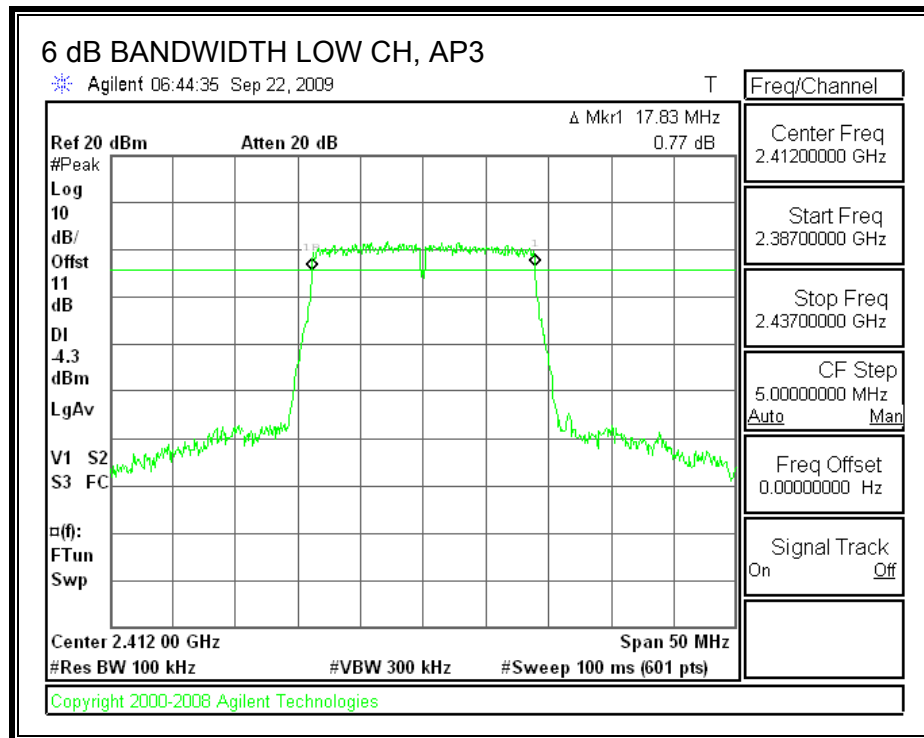
6 dB BANDWIDTH, AP2

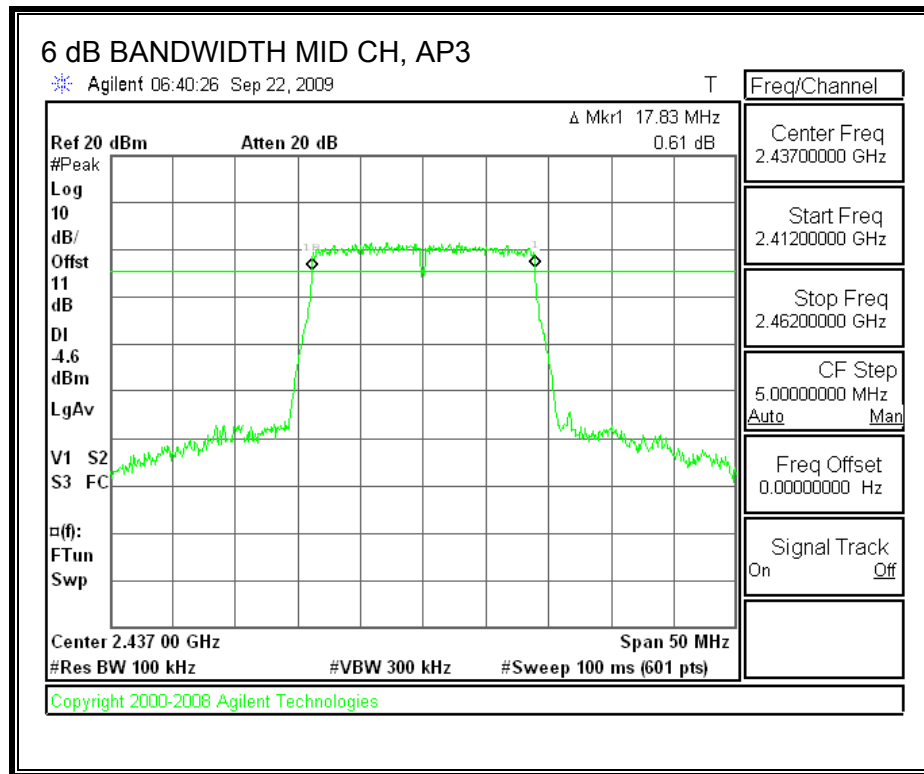


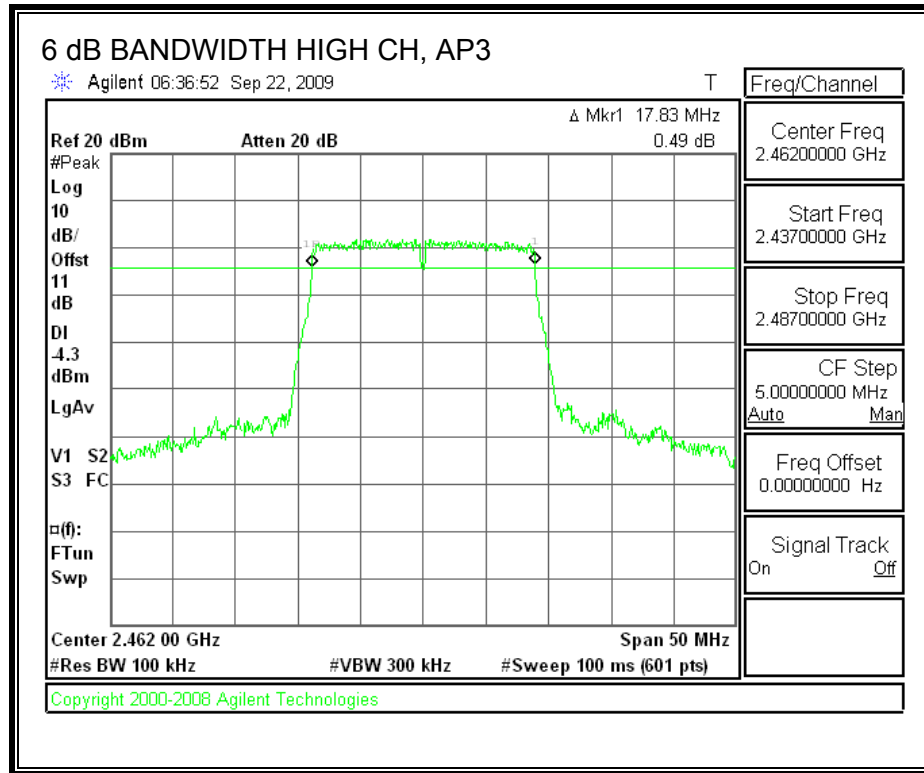




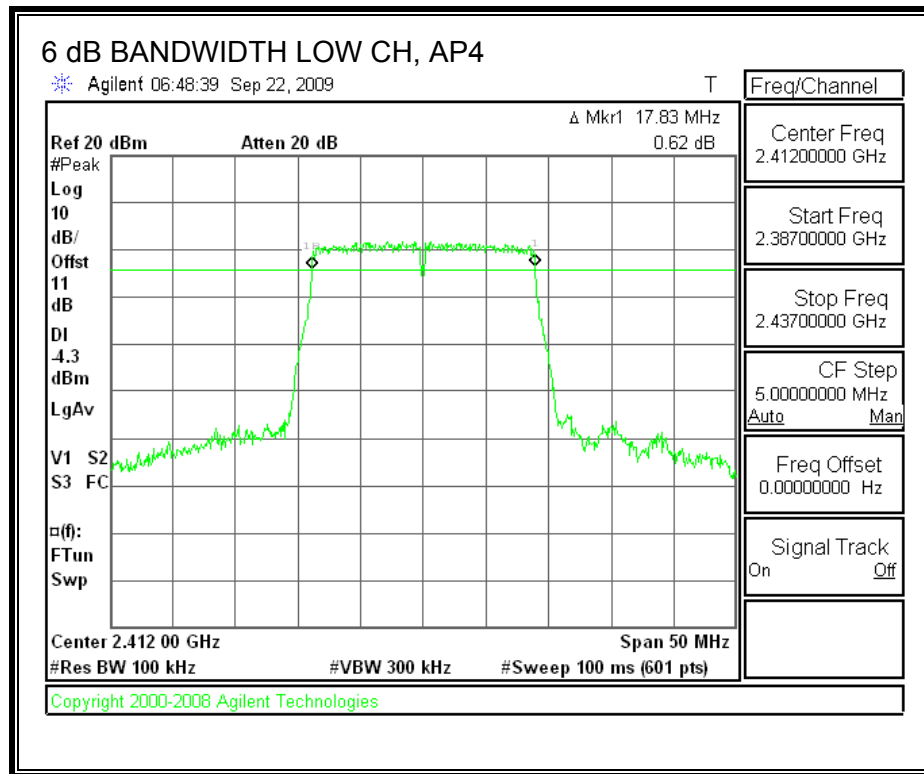
6 dB BANDWIDTH, AP3

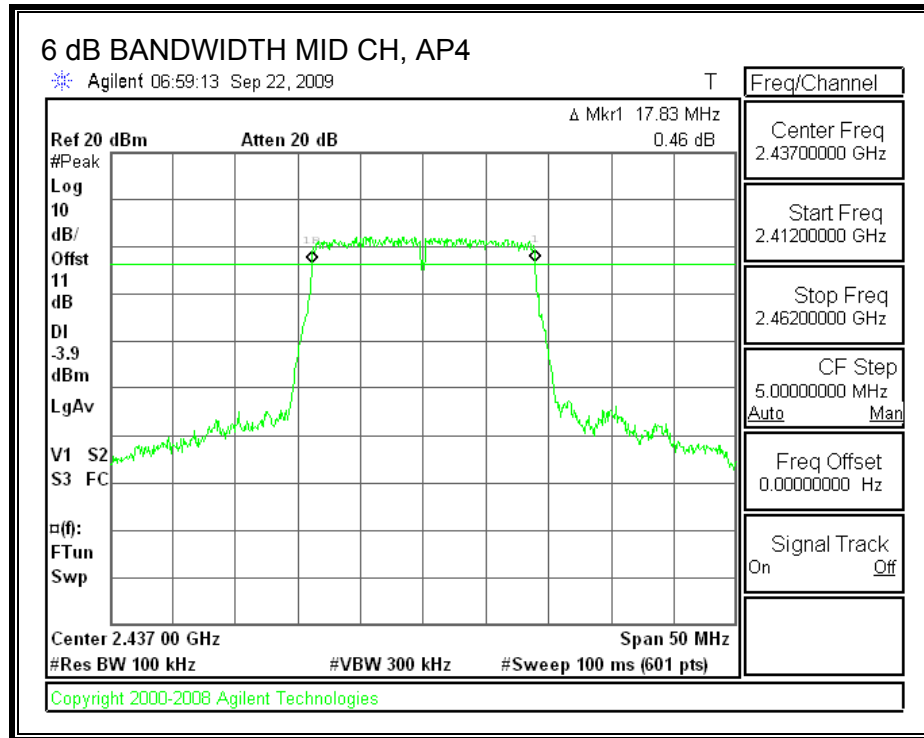


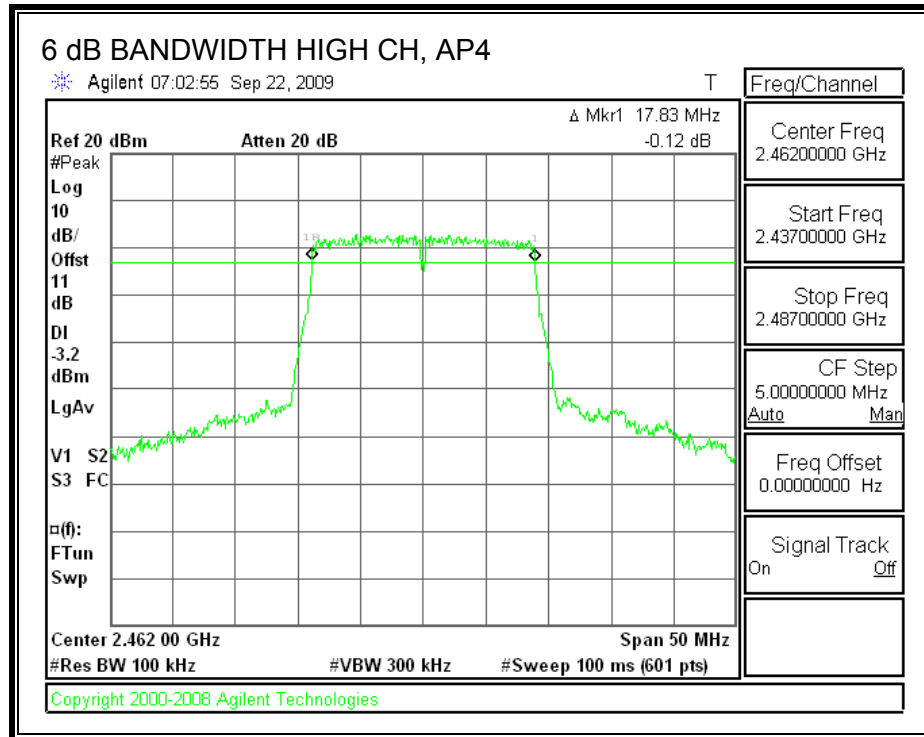




6 dB BANDWIDTH, AP4







7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

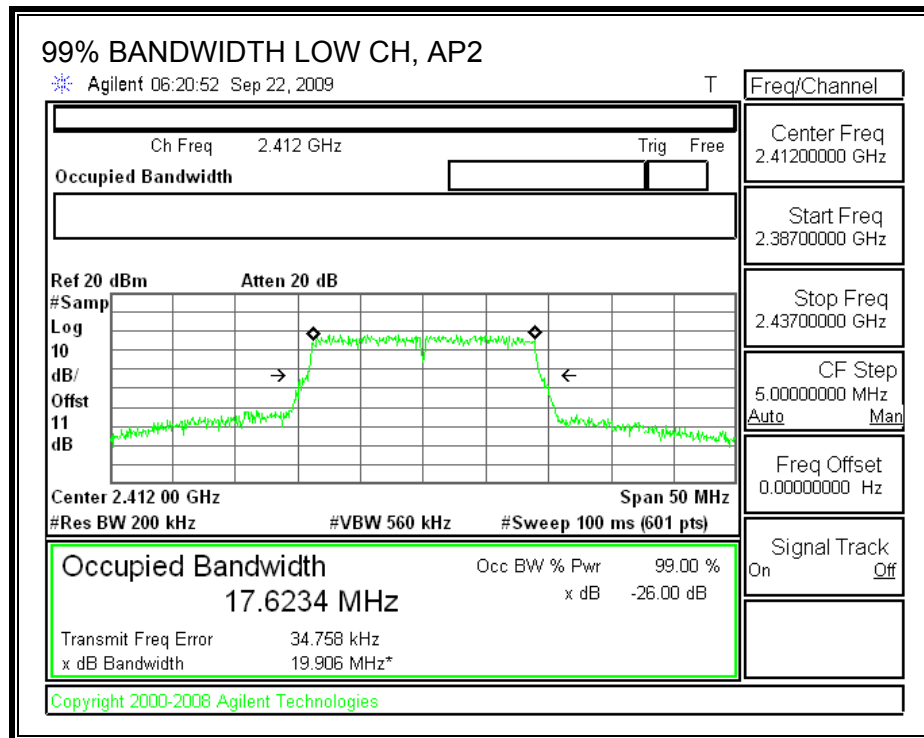
TEST PROCEDURE

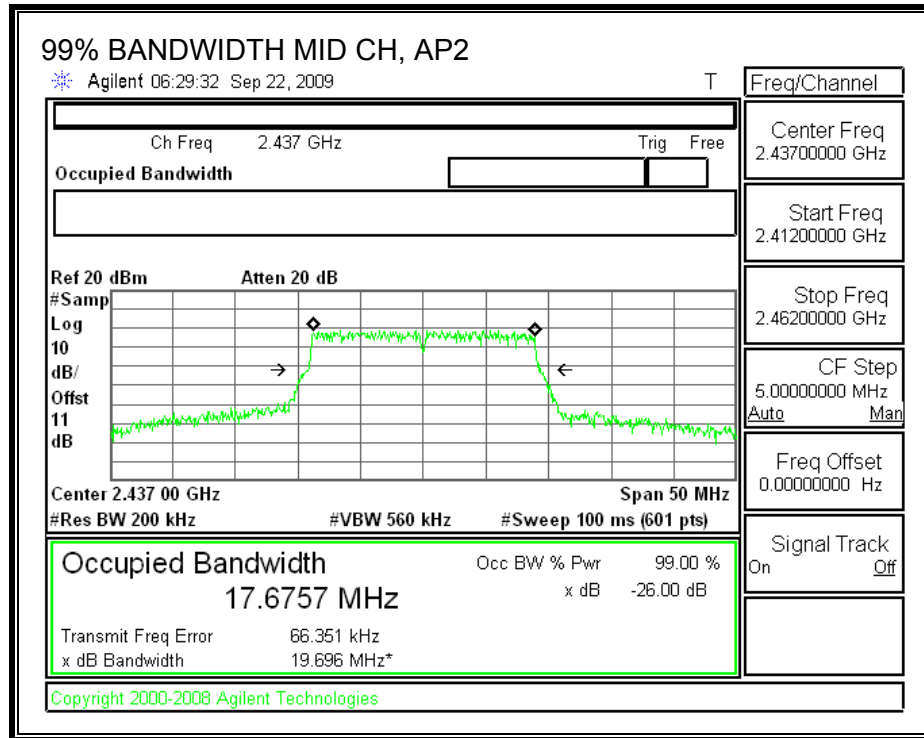
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

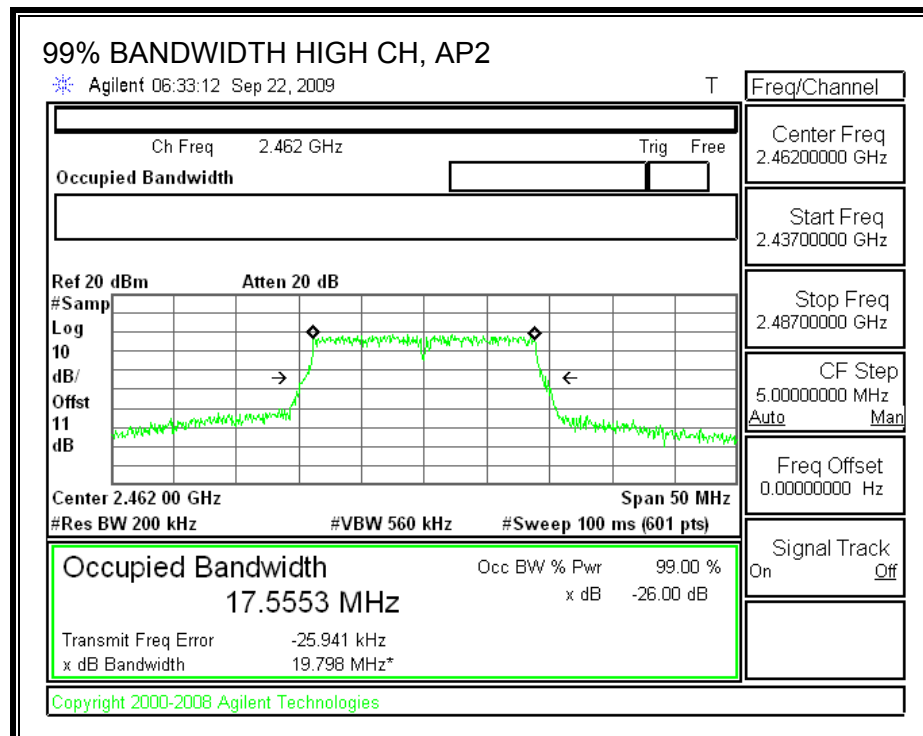
RESULTS

Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	2412	17.6234	17.5798	17.5428
Middle	2437	17.6757	17.7064	17.5287
High	2462	17.5553	17.6409	17.5392

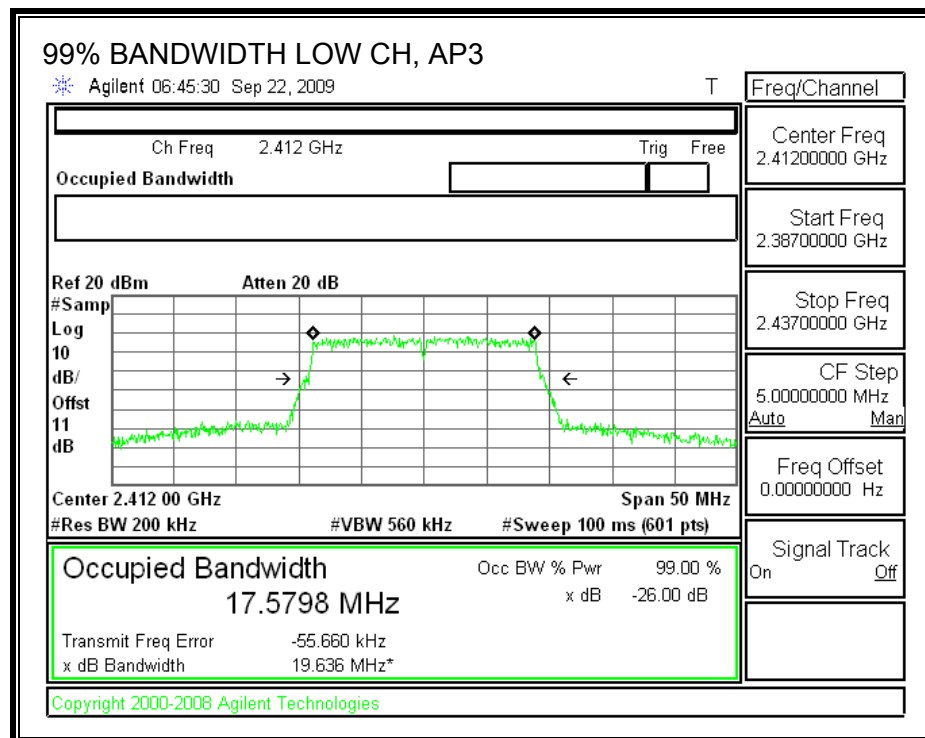
99% BANDWIDTH, AP2

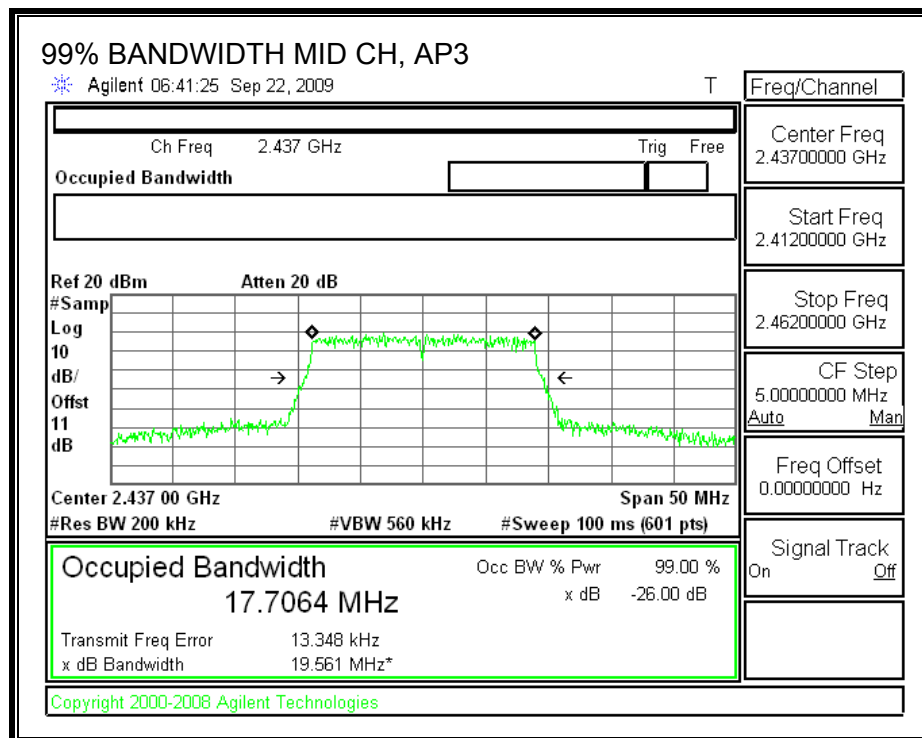


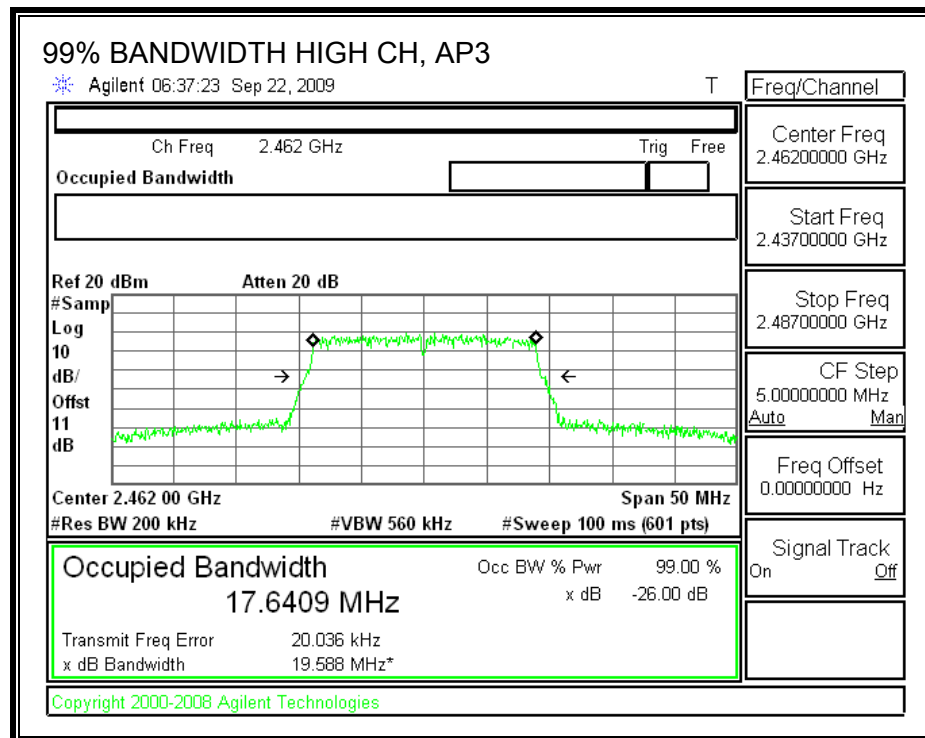




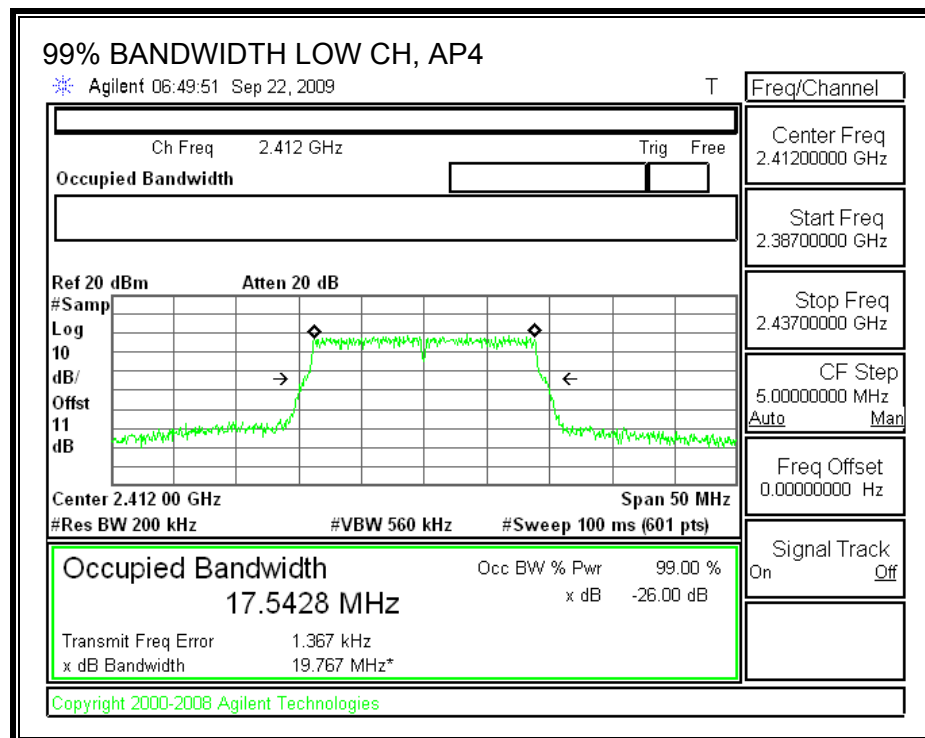
99% BANDWIDTH, AP3

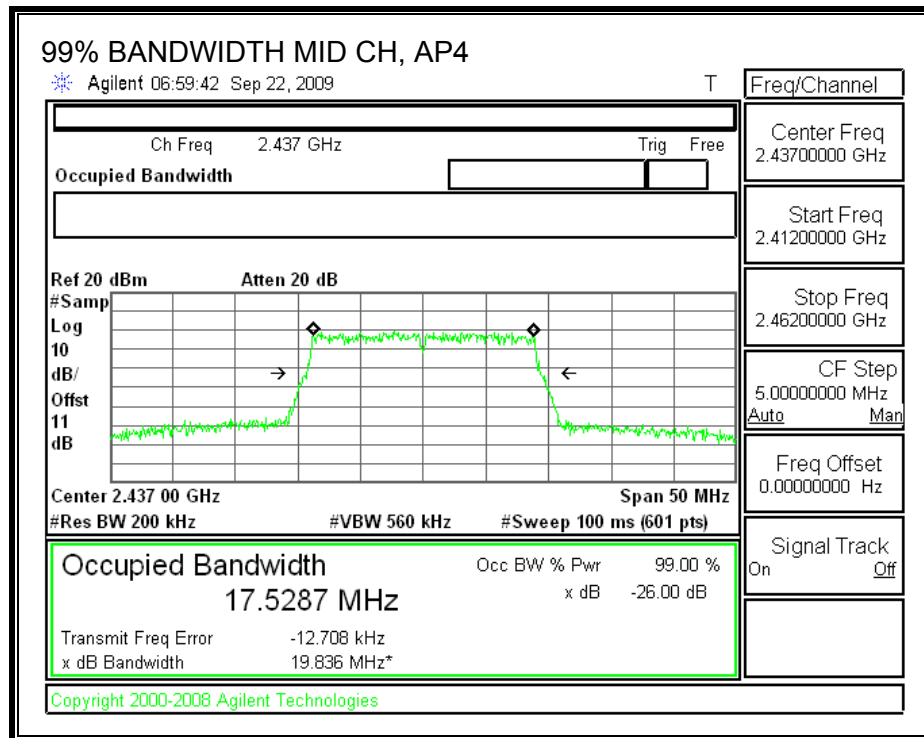


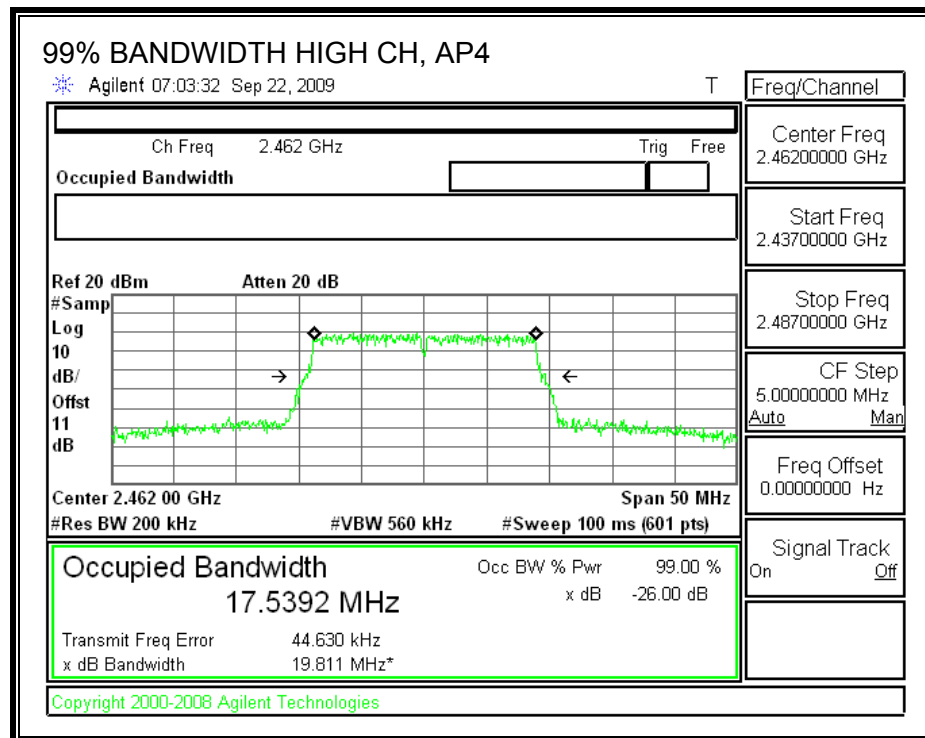




99% BANDWIDTH, AP4







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

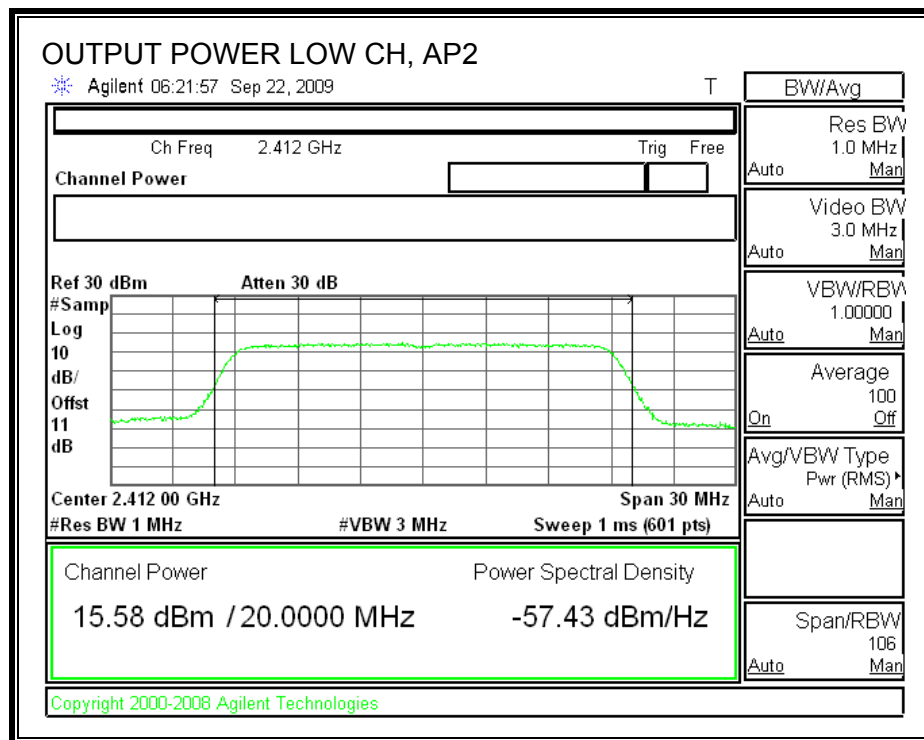
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

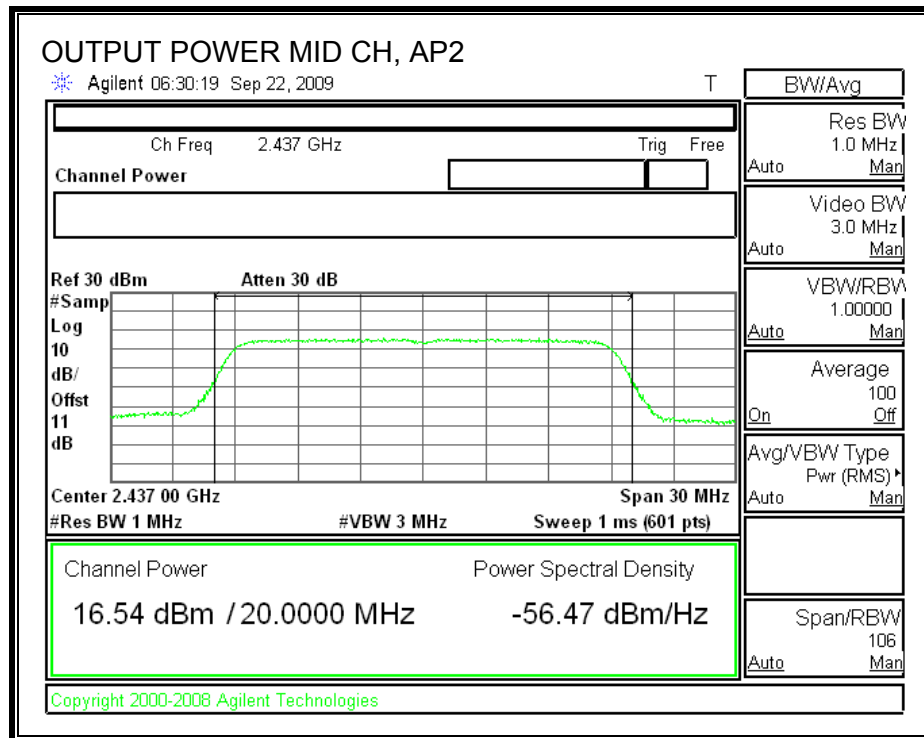
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

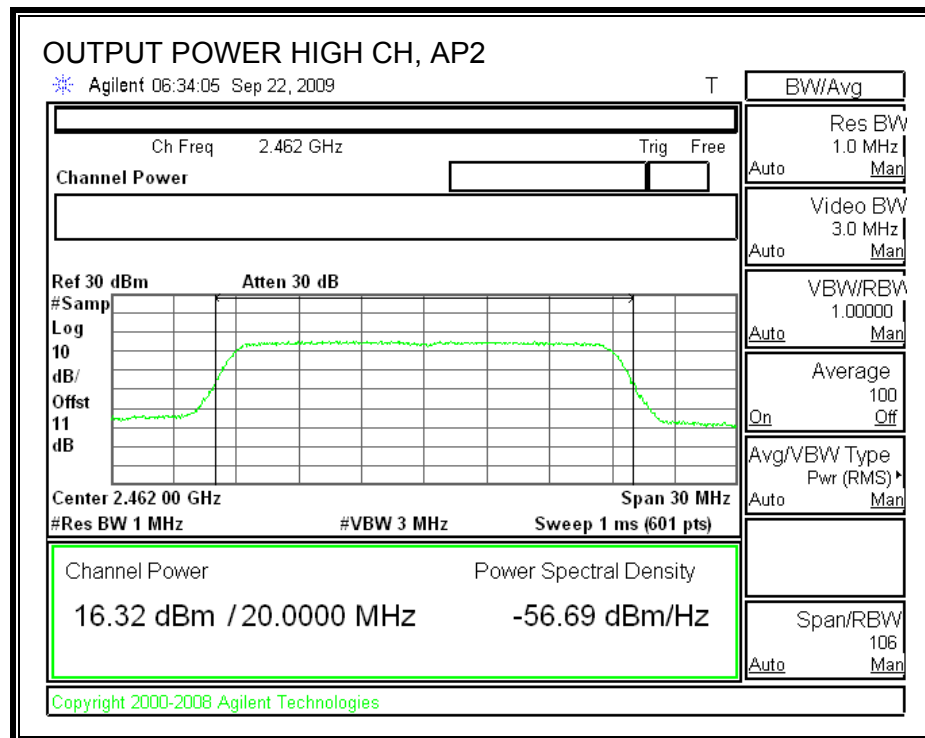
RESULTS

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	15.58	15.91	16.24	0.00	20.69	30.00	-9.31
Mid	2437	16.54	15.74	16.69	0.00	21.11	30.00	-8.89
High	2462	16.32	16.10	16.75	0.00	21.17	30.00	-8.83

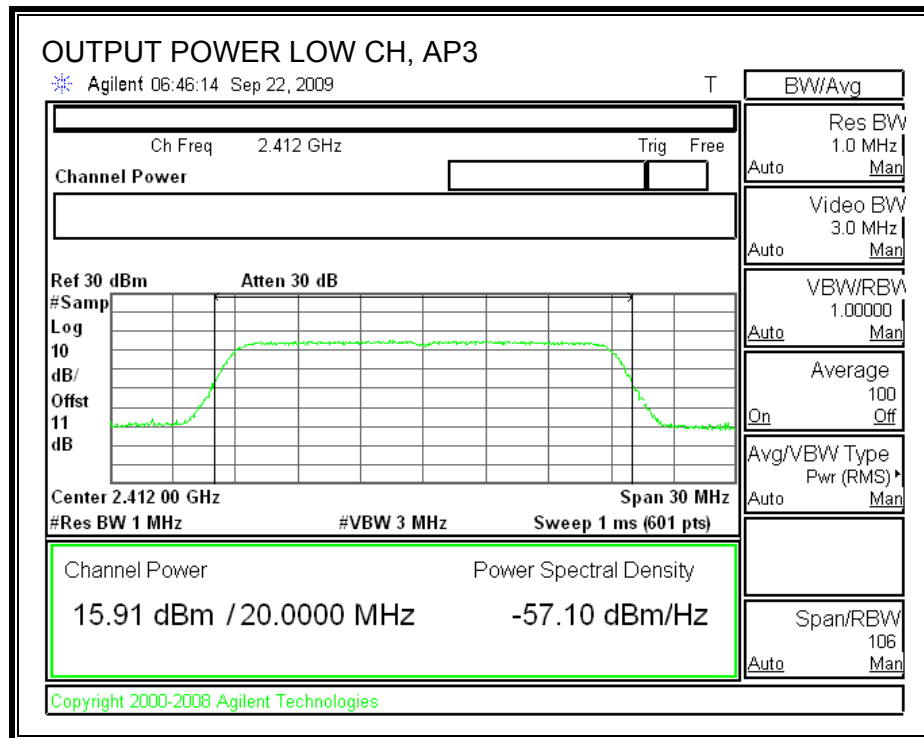
AP2 OUTPUT POWER

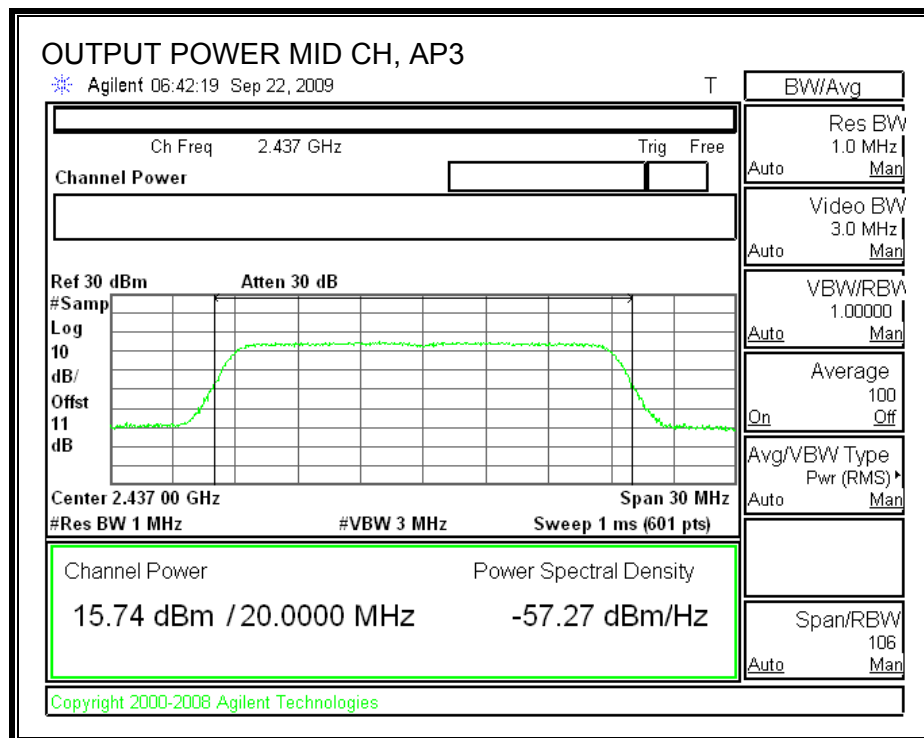


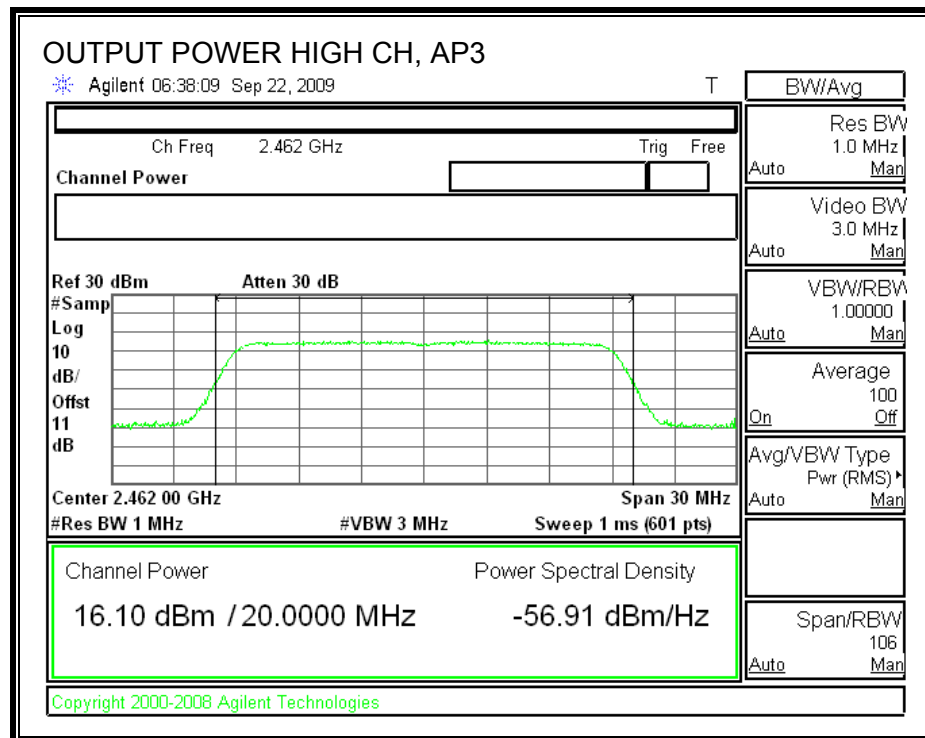




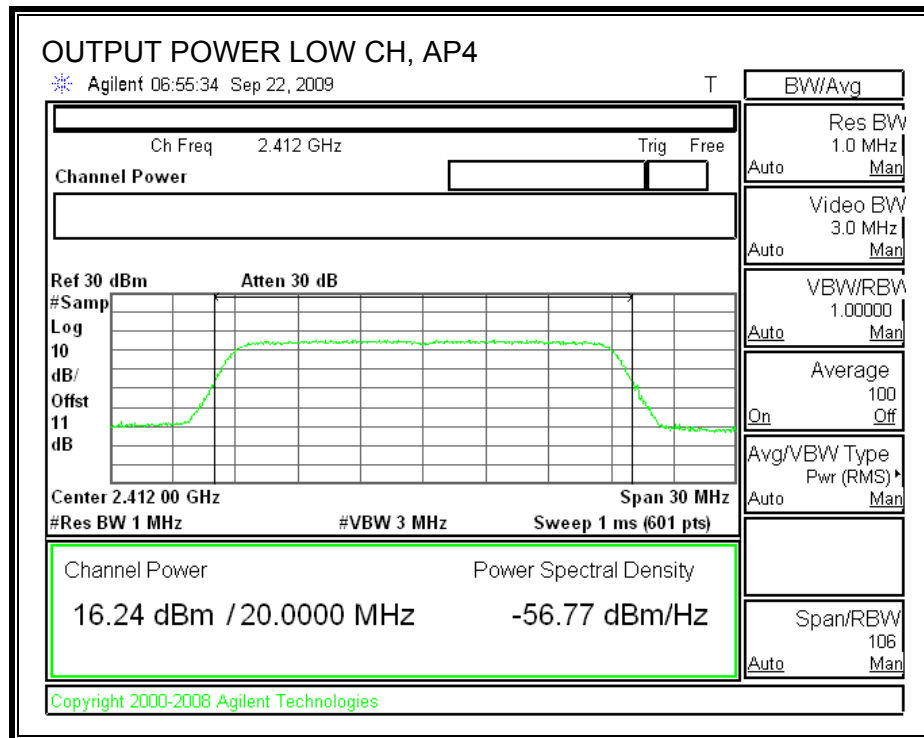
AP3 OUTPUT POWER

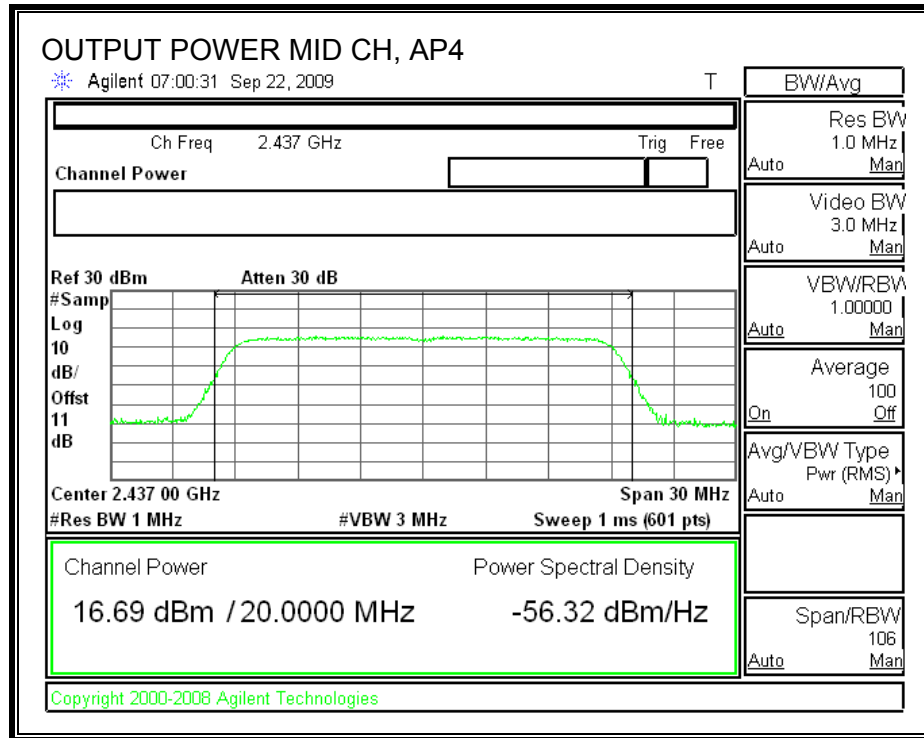


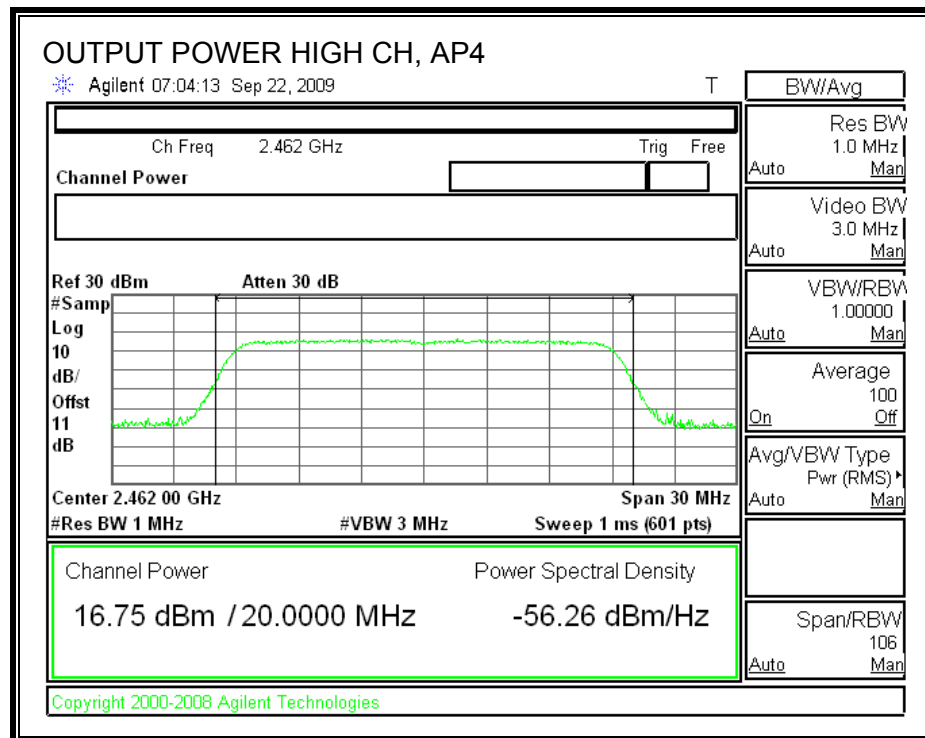




AP4 OUTPUT POWER







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

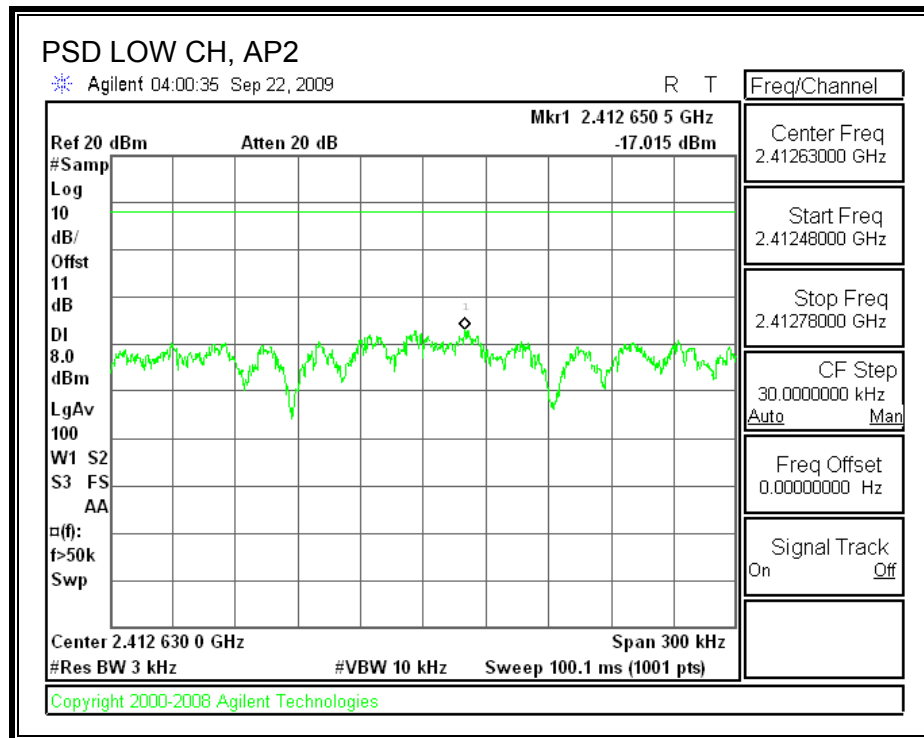
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

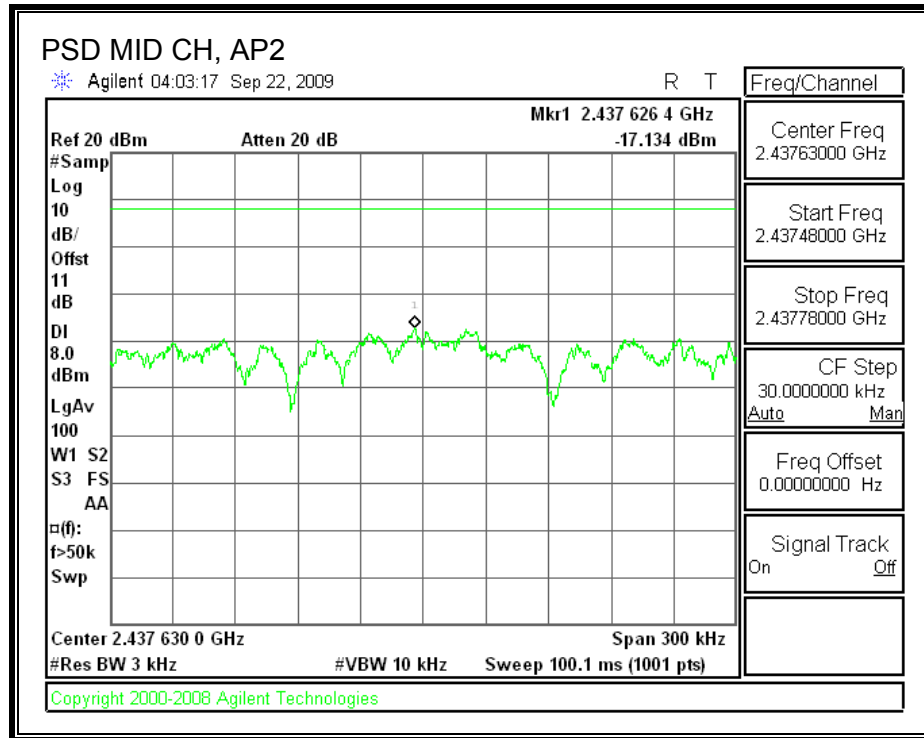
RESULTS

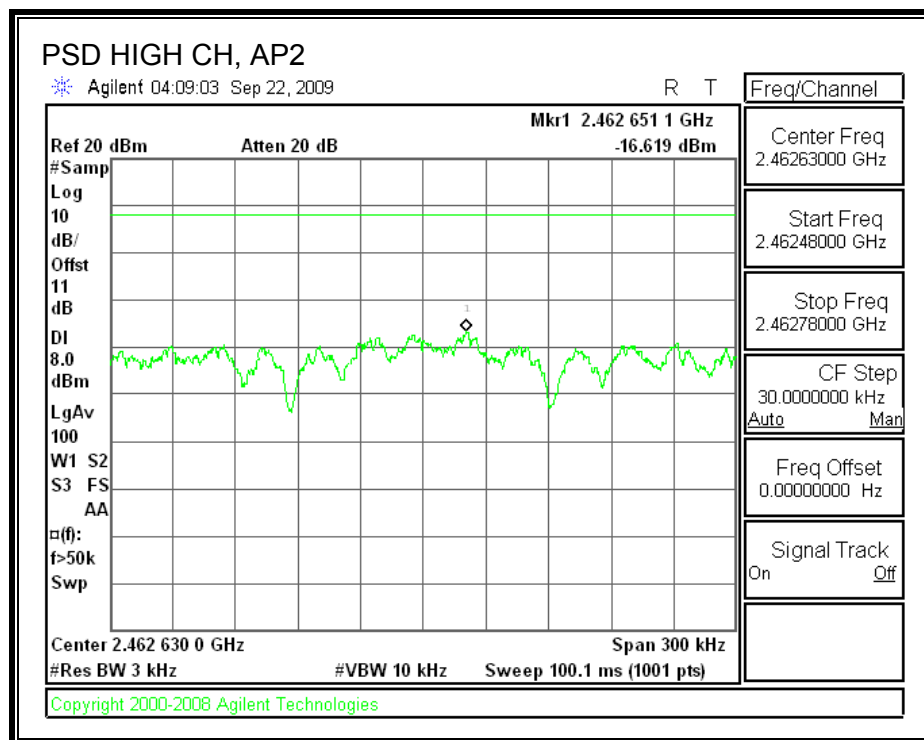
Channel	Frequency (MHz)	AP2 PSD (dBm)	AP3 PSD (dBm)	AP4 PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-17.015	-17.226	-16.419	8	-24.42
Middle	2437	-17.134	-16.938	-16.639	8	-24.64
High	2462	-16.619	-16.688	-16.67	8	-24.62

Channel	Frequency (MHz)	PSD with Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-14.562	8	-22.56
Middle	2437	-15.346	8	-23.35
High	2462	-15.700	8	-23.70

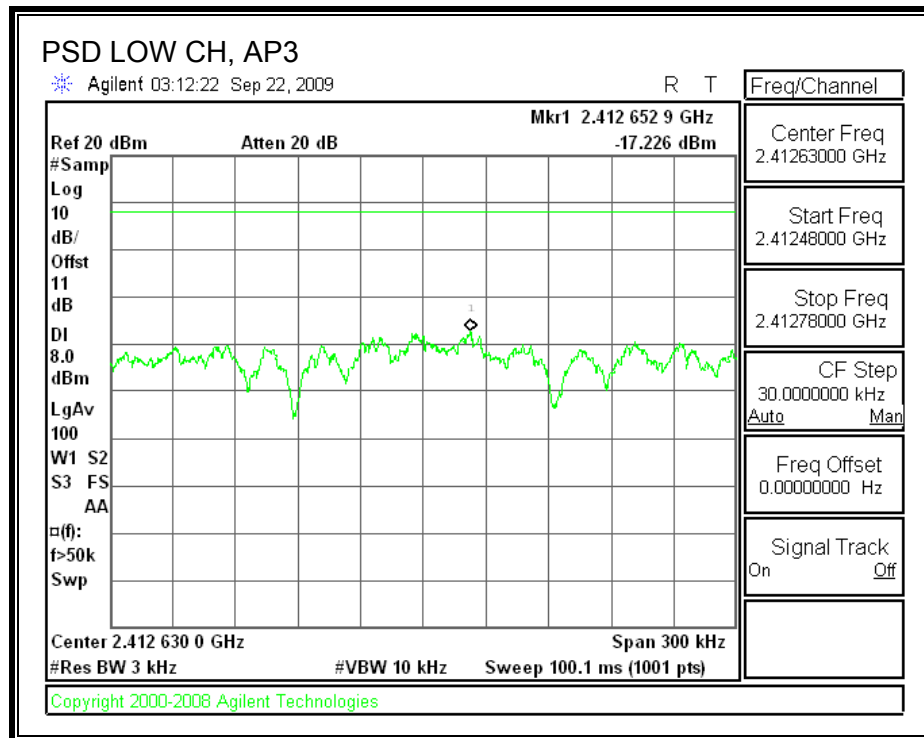
POWER SPECTRAL DENSITY, AP2

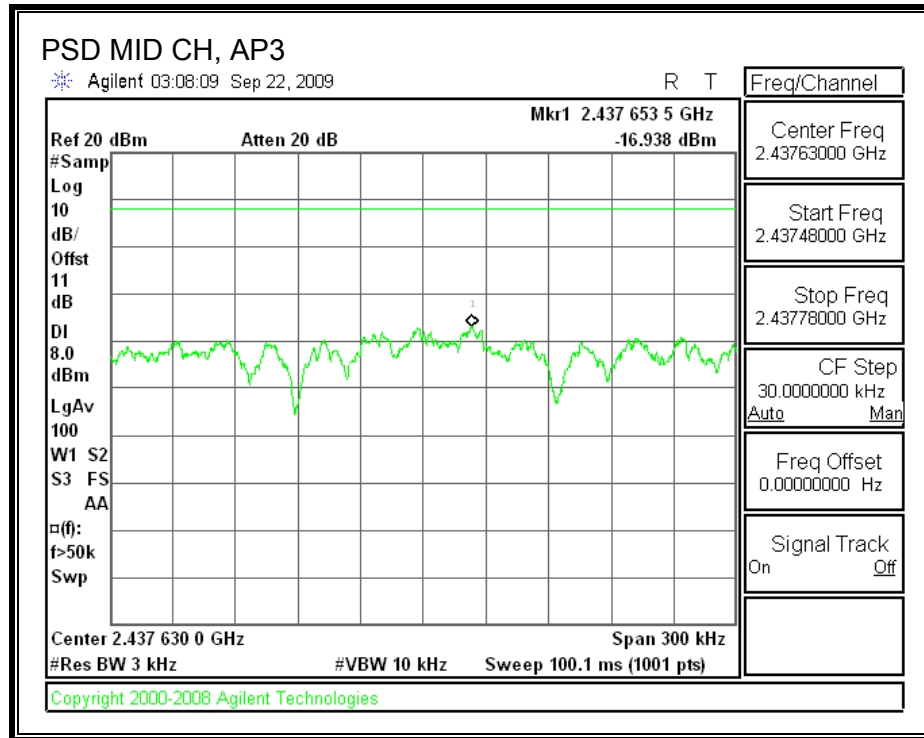


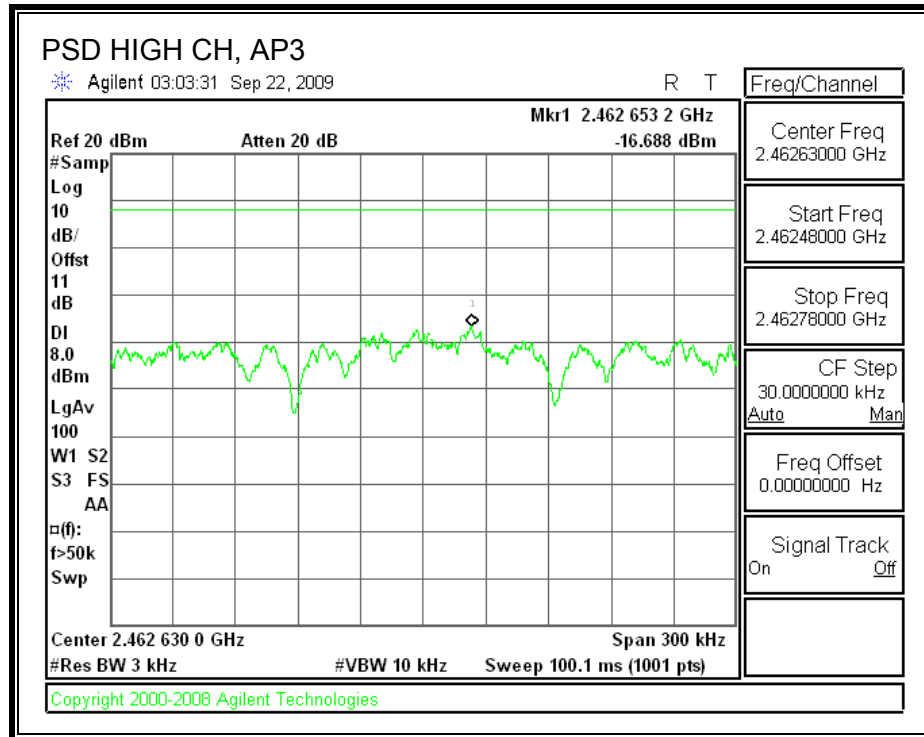




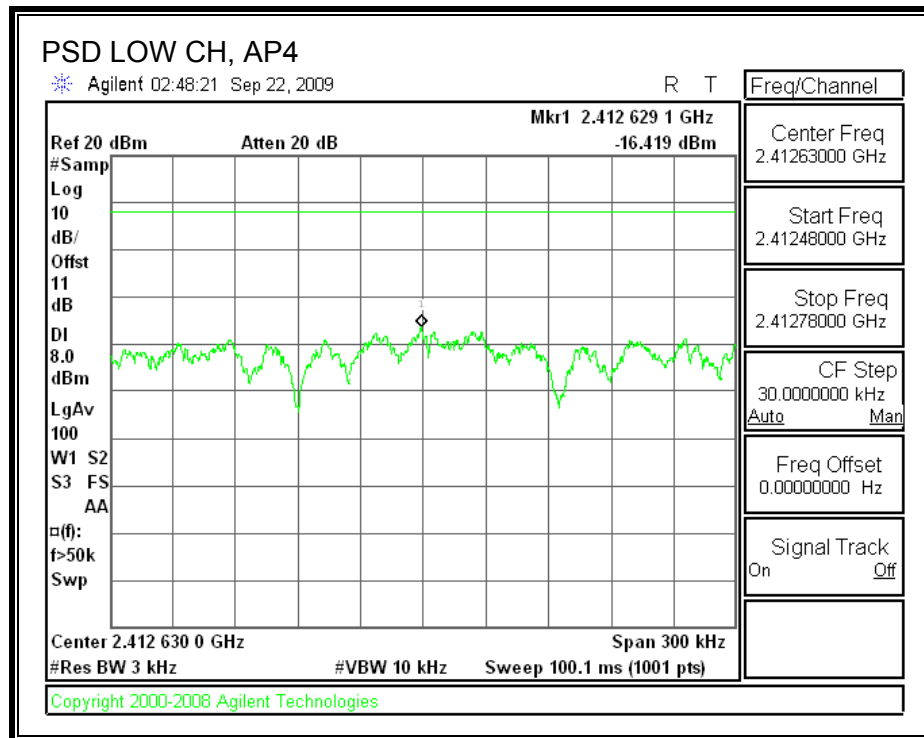
POWER SPECTRAL DENSITY, AP3

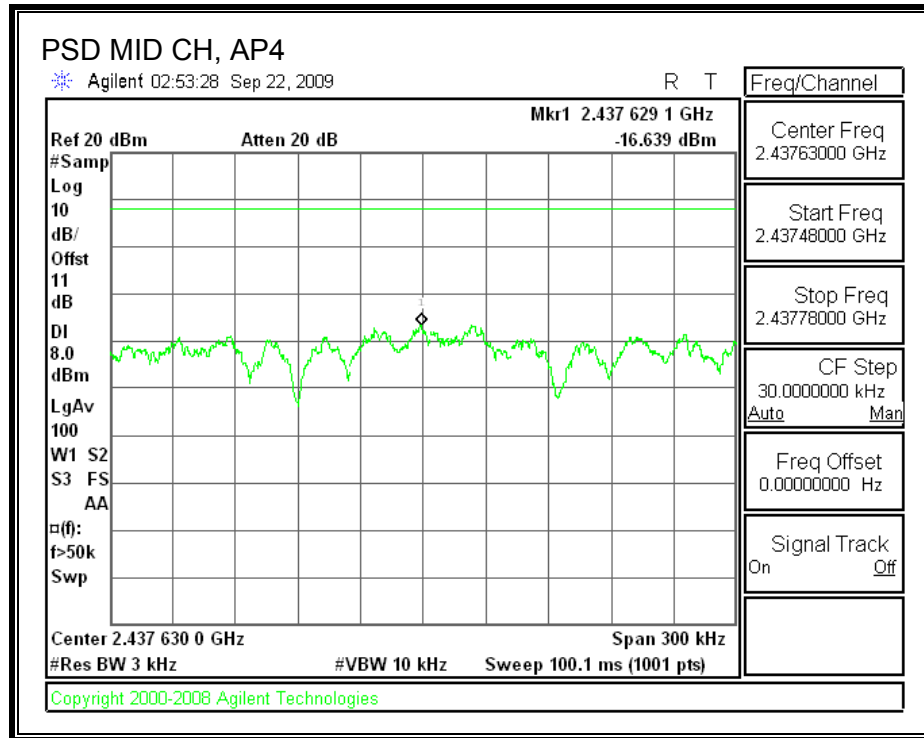


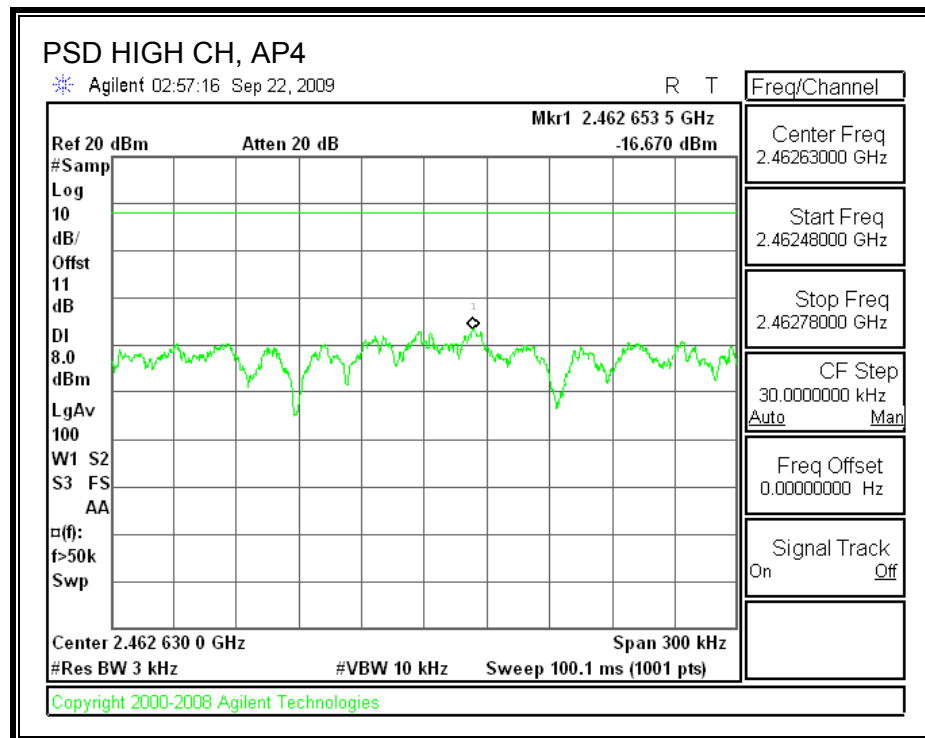




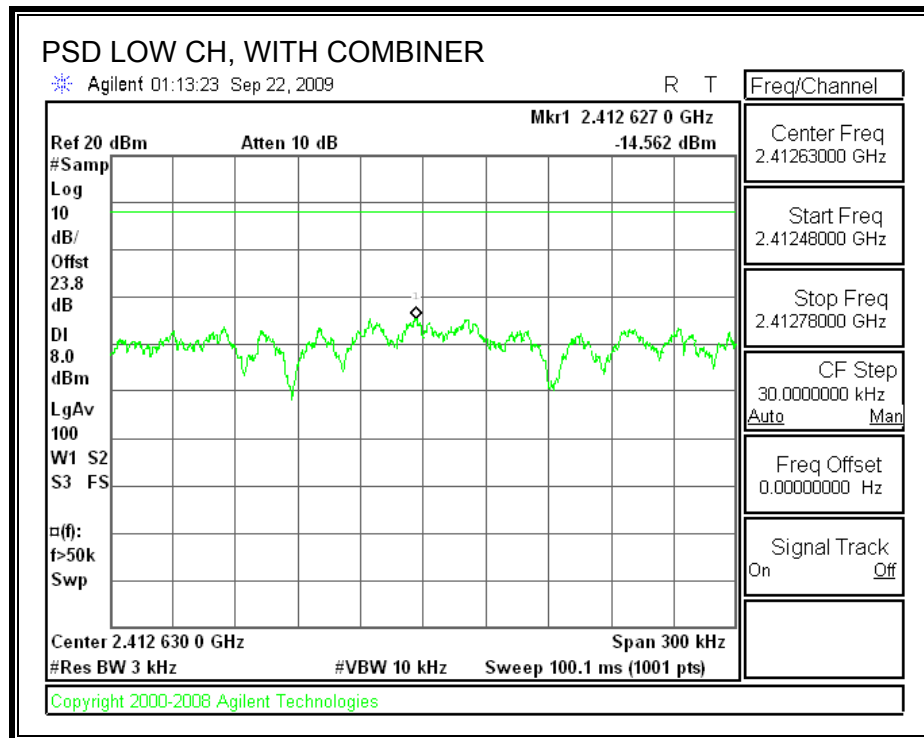
POWER SPECTRAL DENSITY, AP4

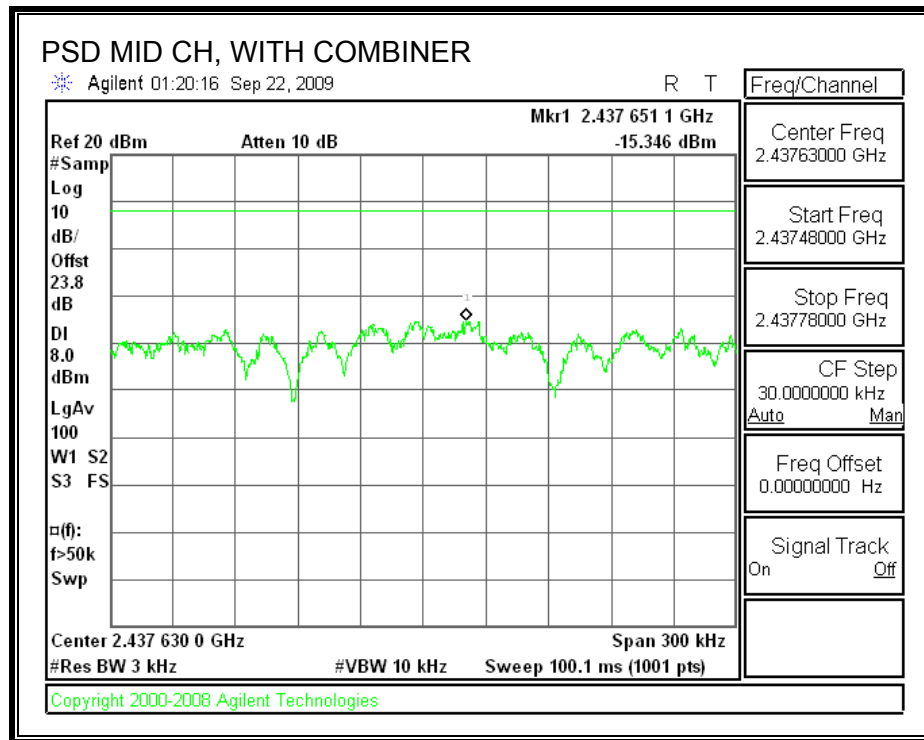


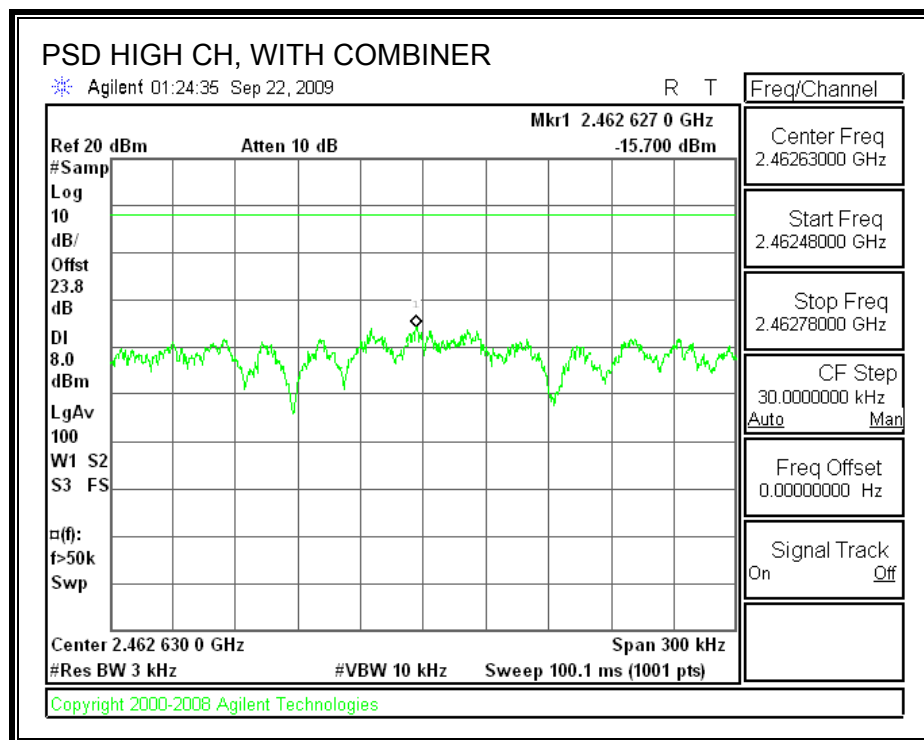




POWER SPECTRAL DENSITY, WITH COMBINER







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.

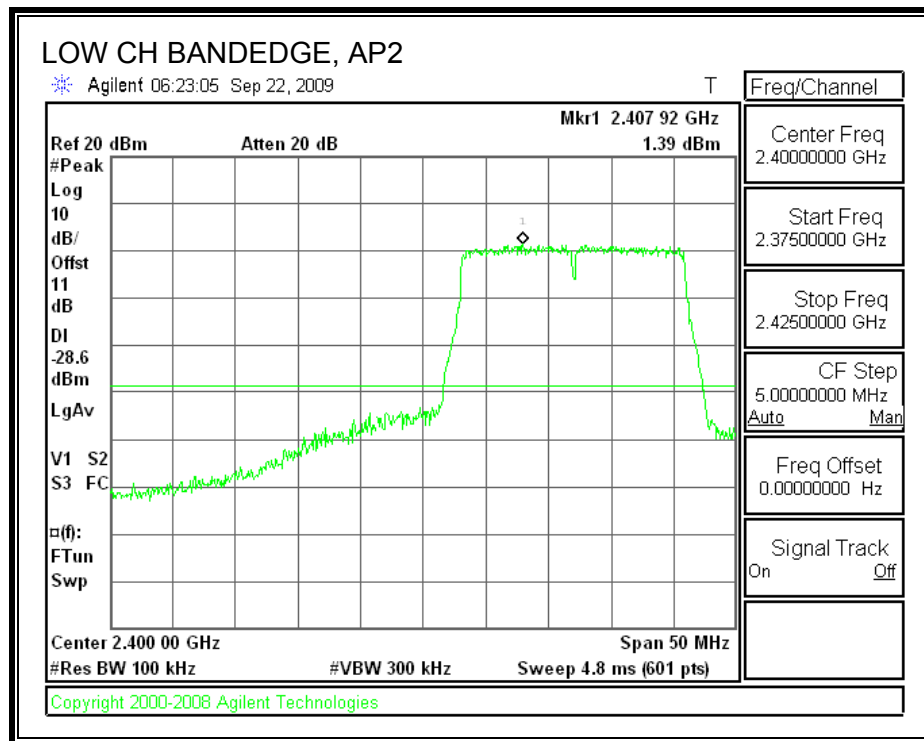
TEST PROCEDURE

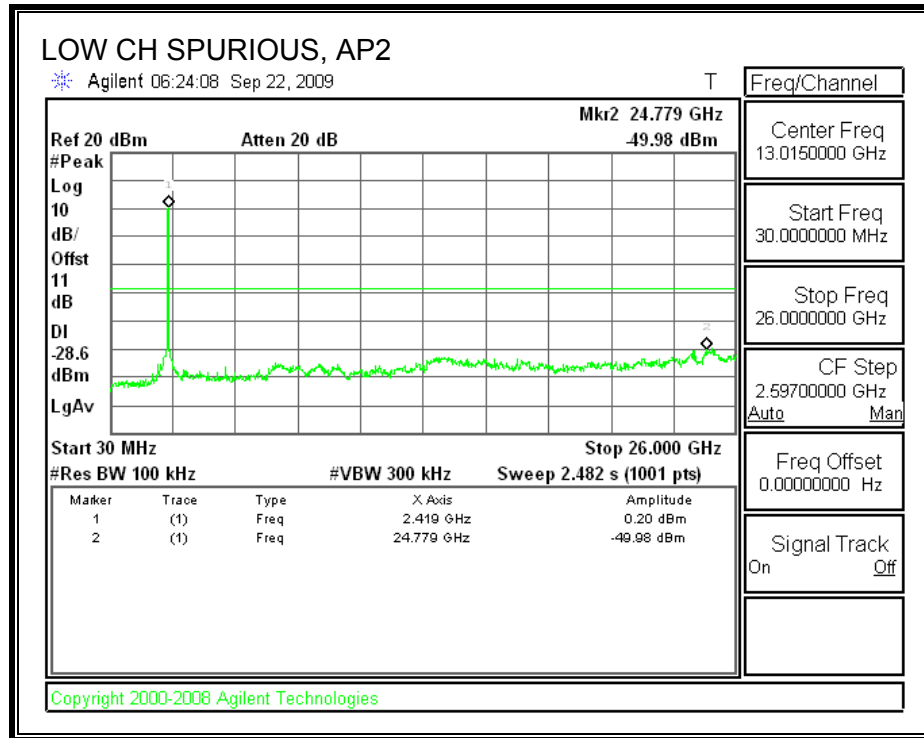
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

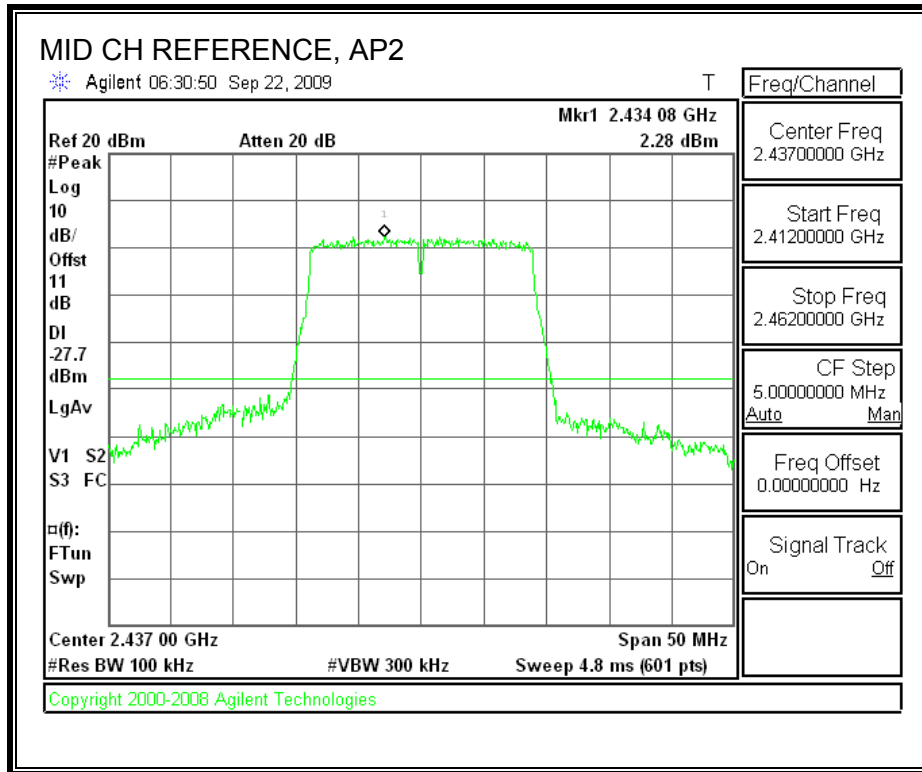
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

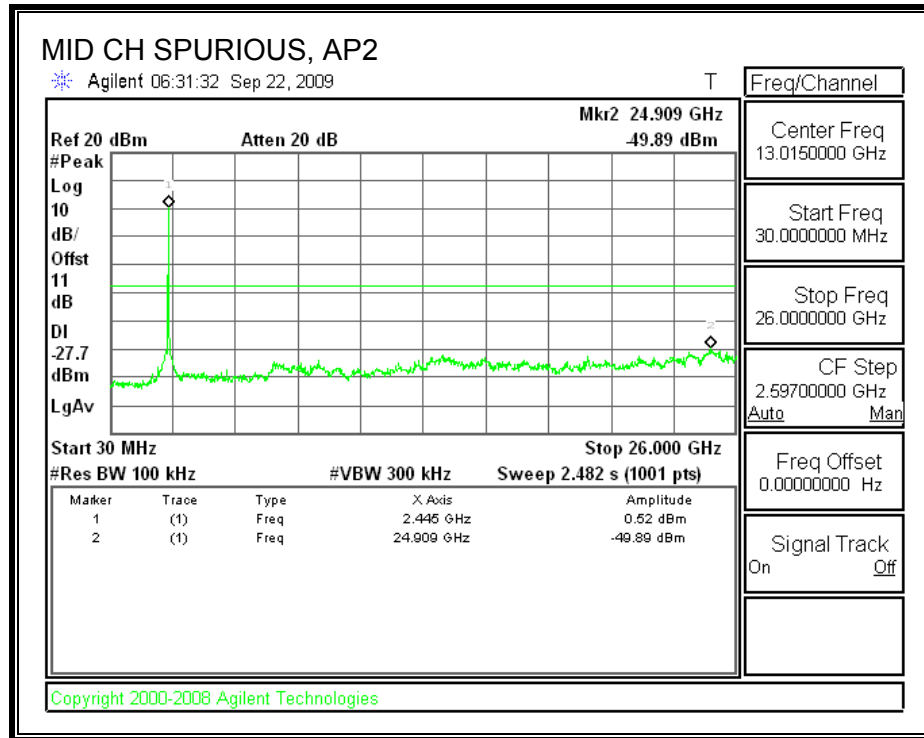
RESULTS

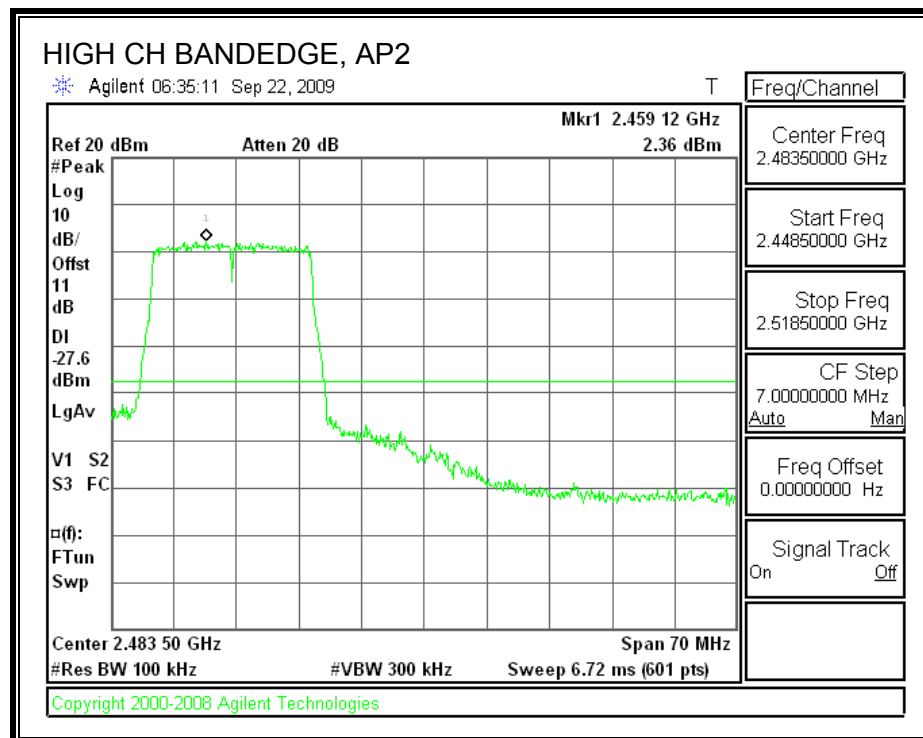
AP2 SPURIOUS EMISSIONS

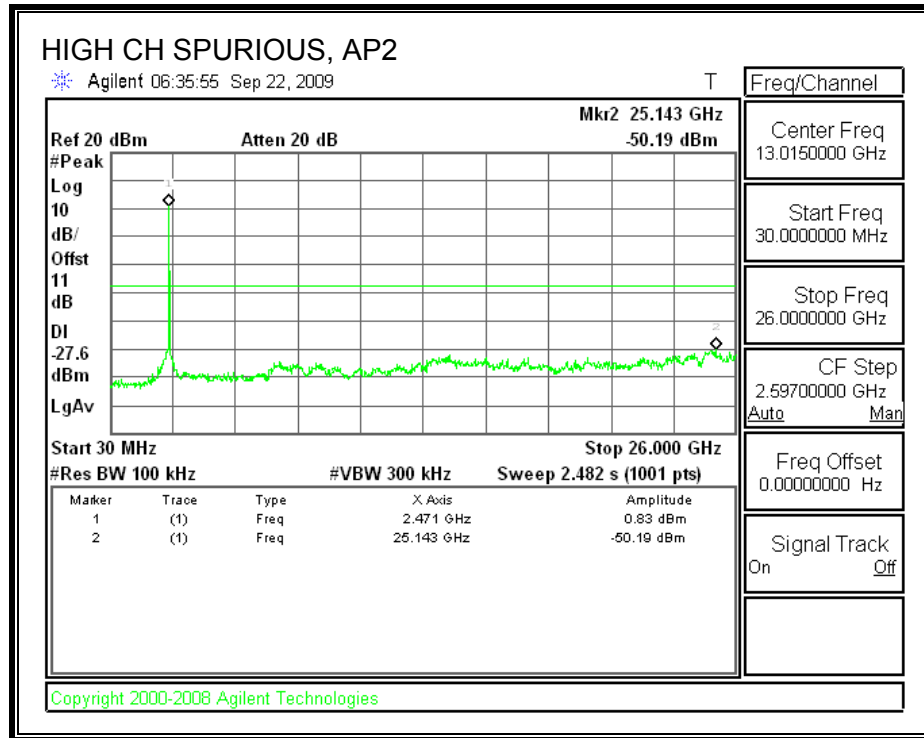




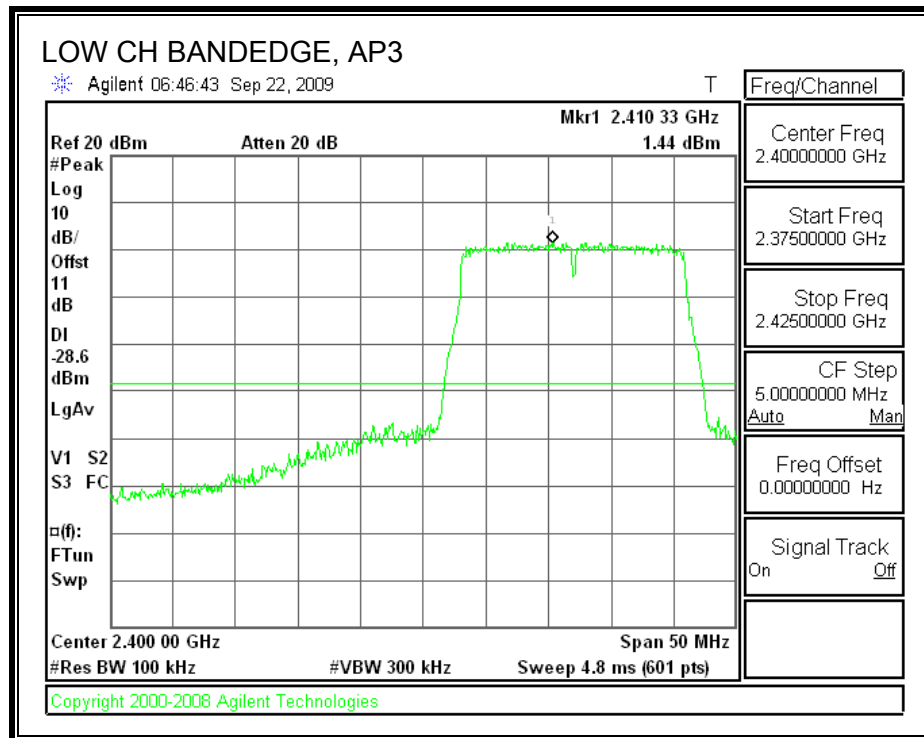


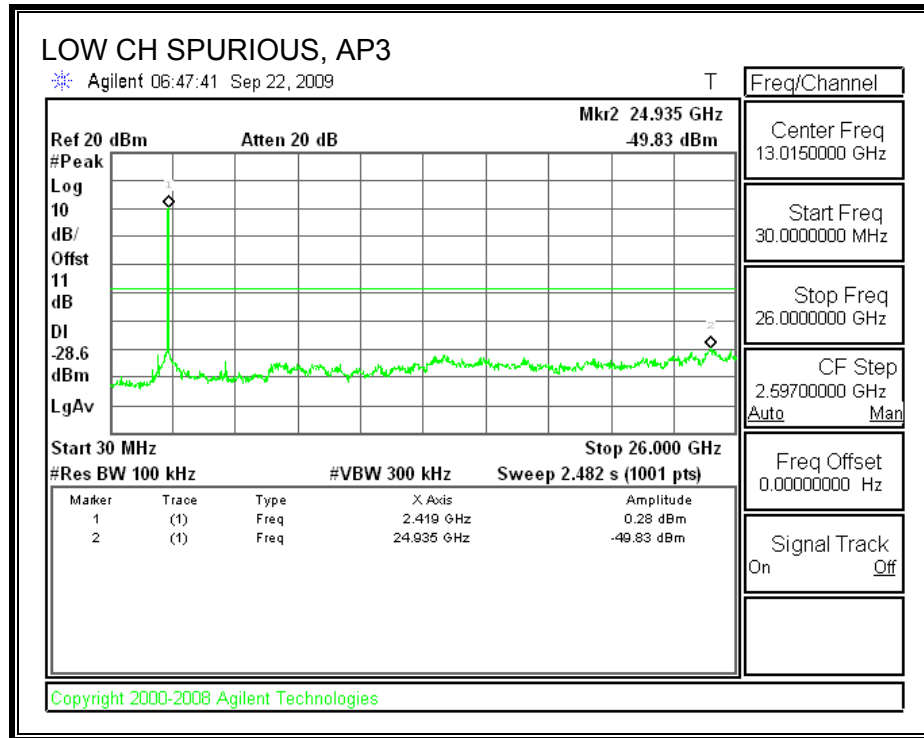


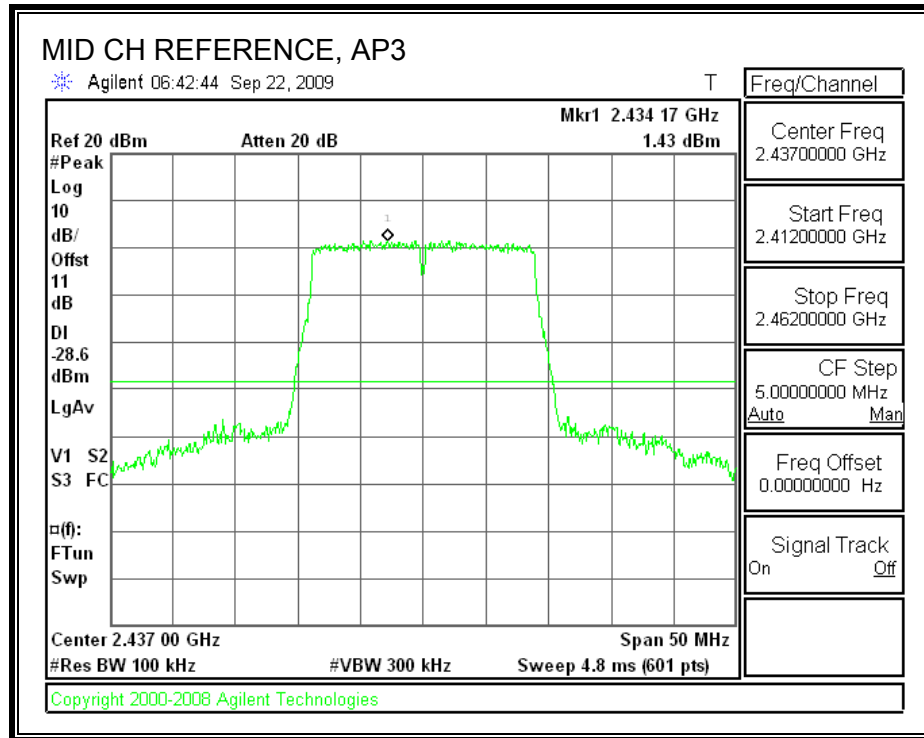


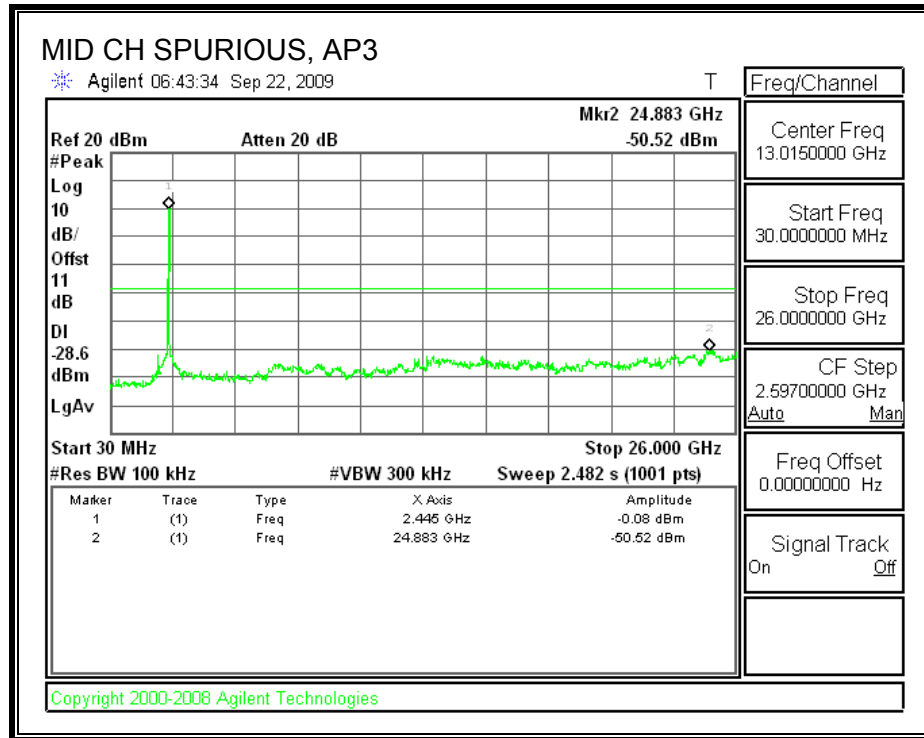


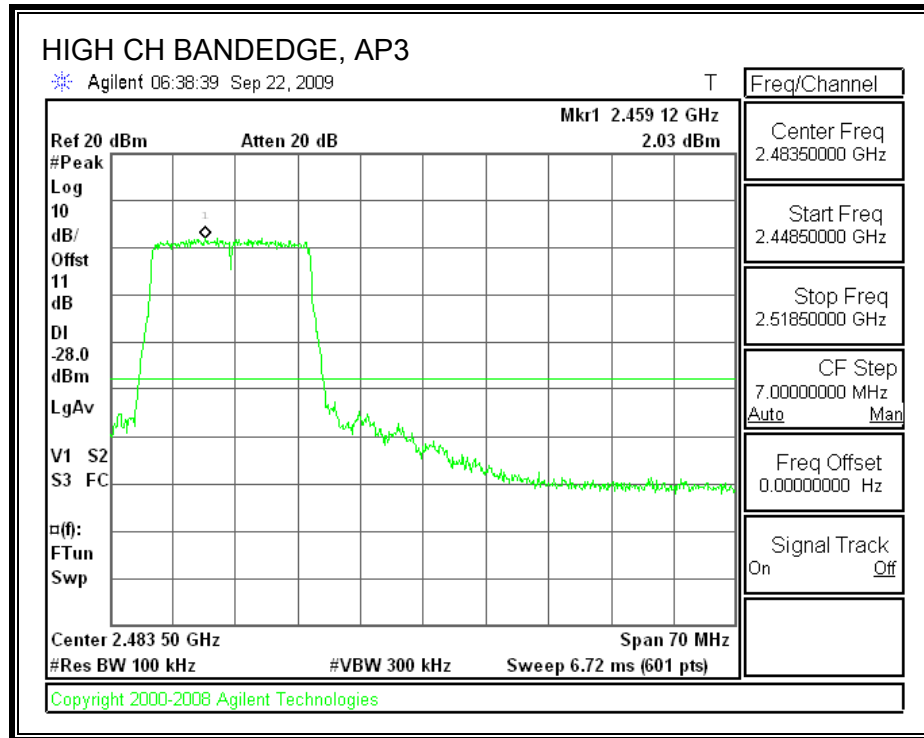
AP3 SPURIOUS EMISSIONS

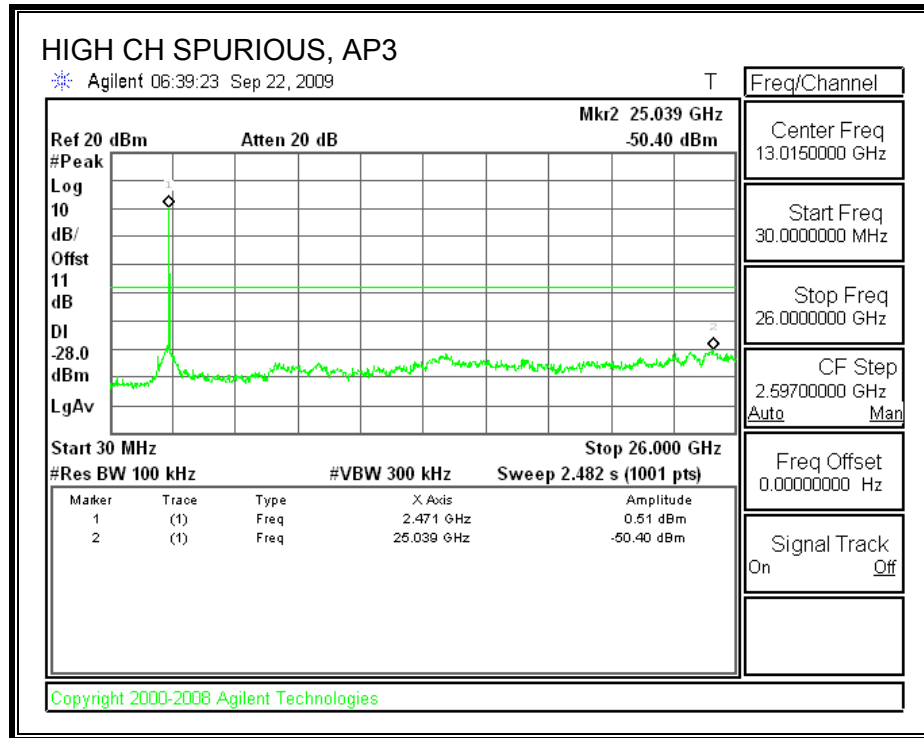




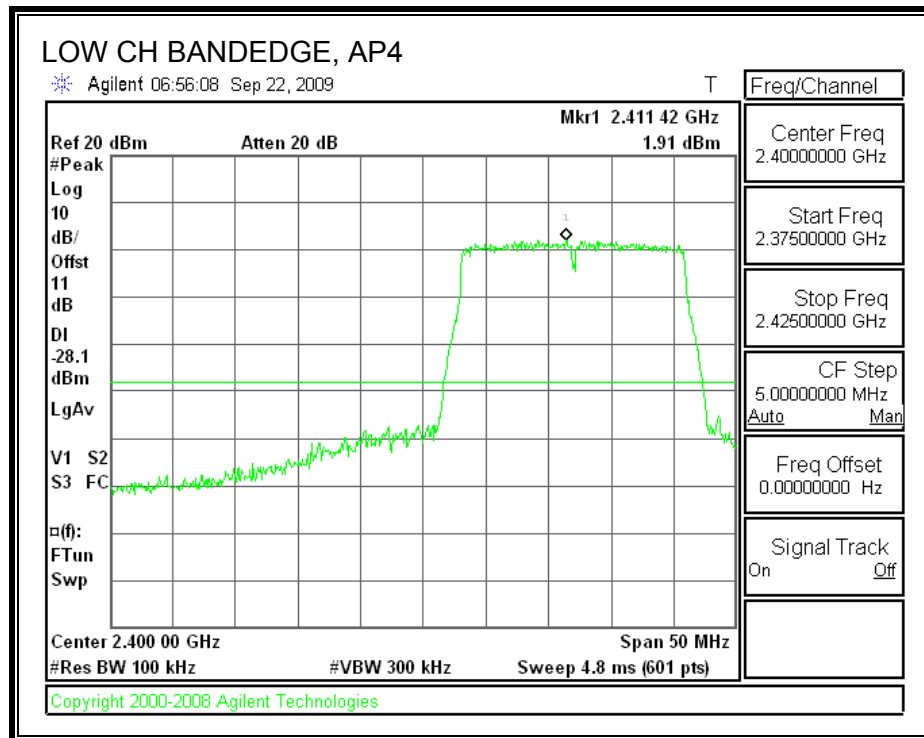


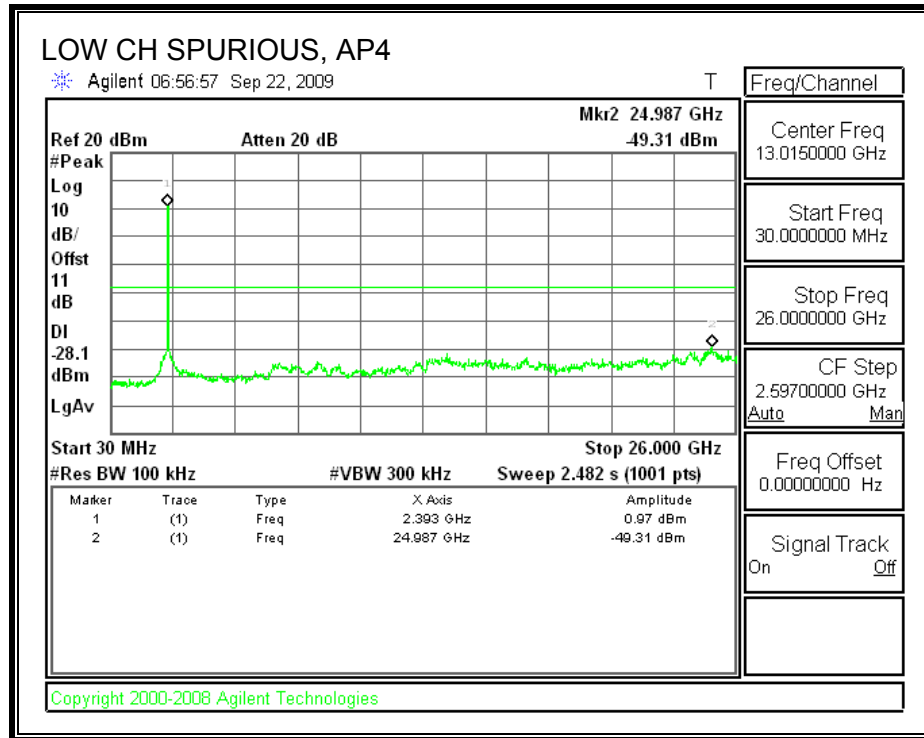


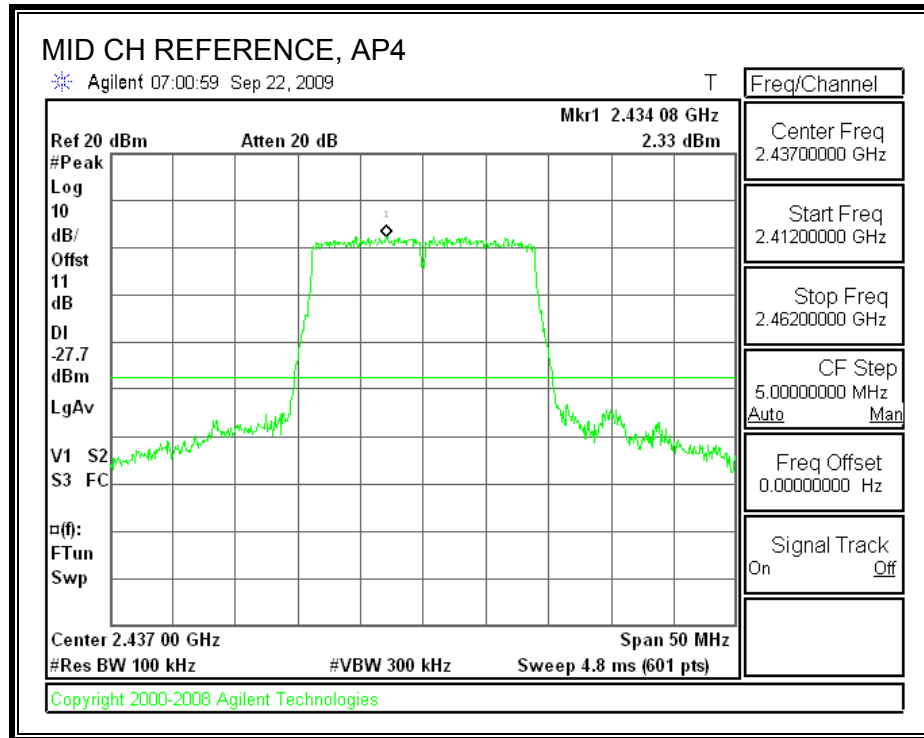


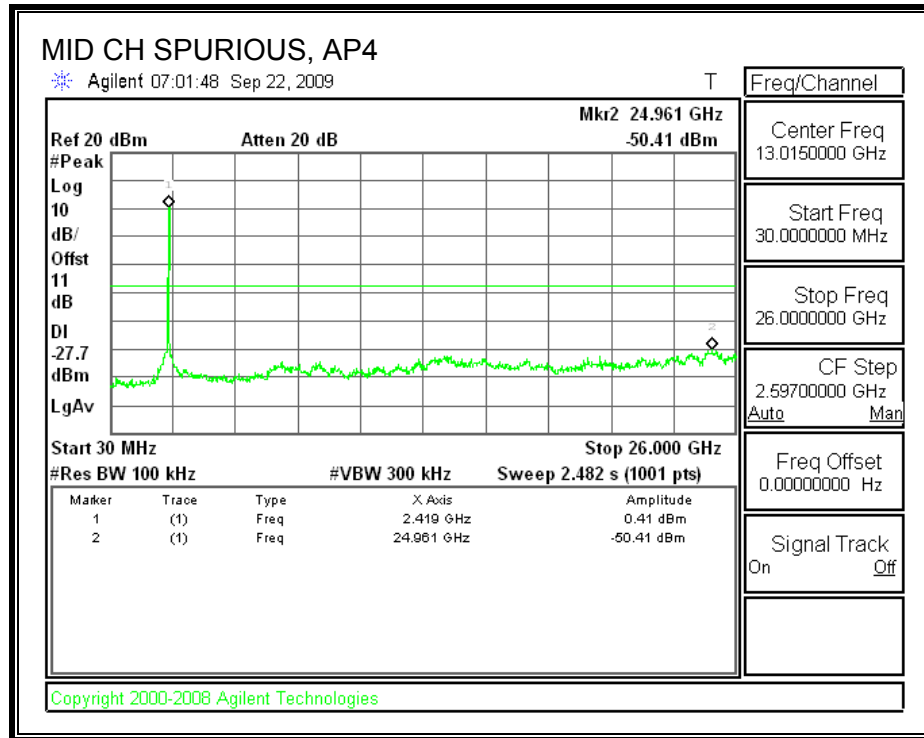


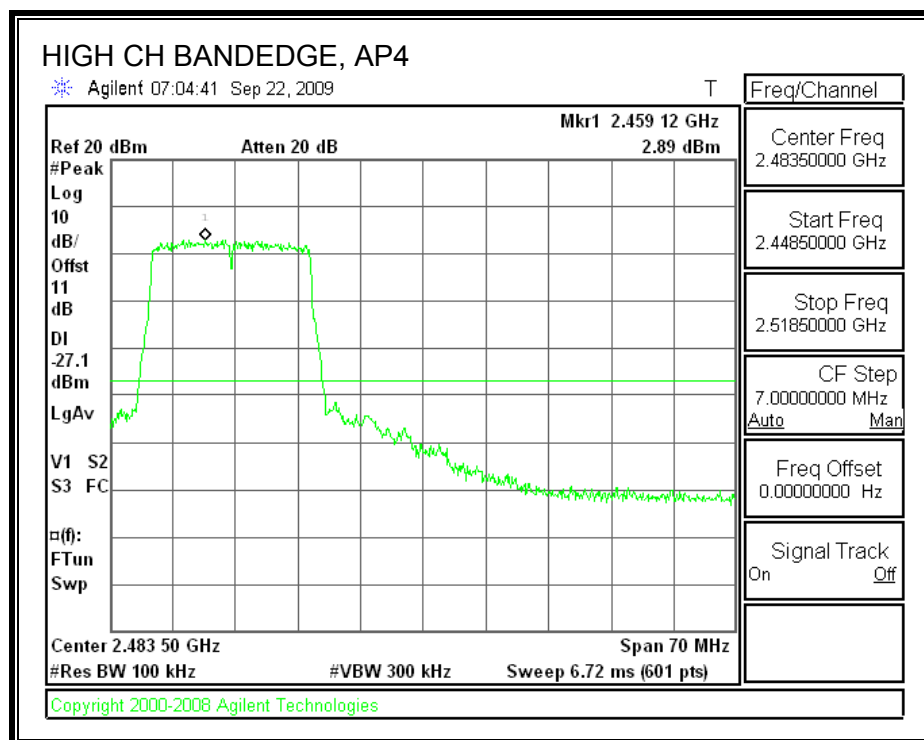
AP4 SPURIOUS EMISSIONS

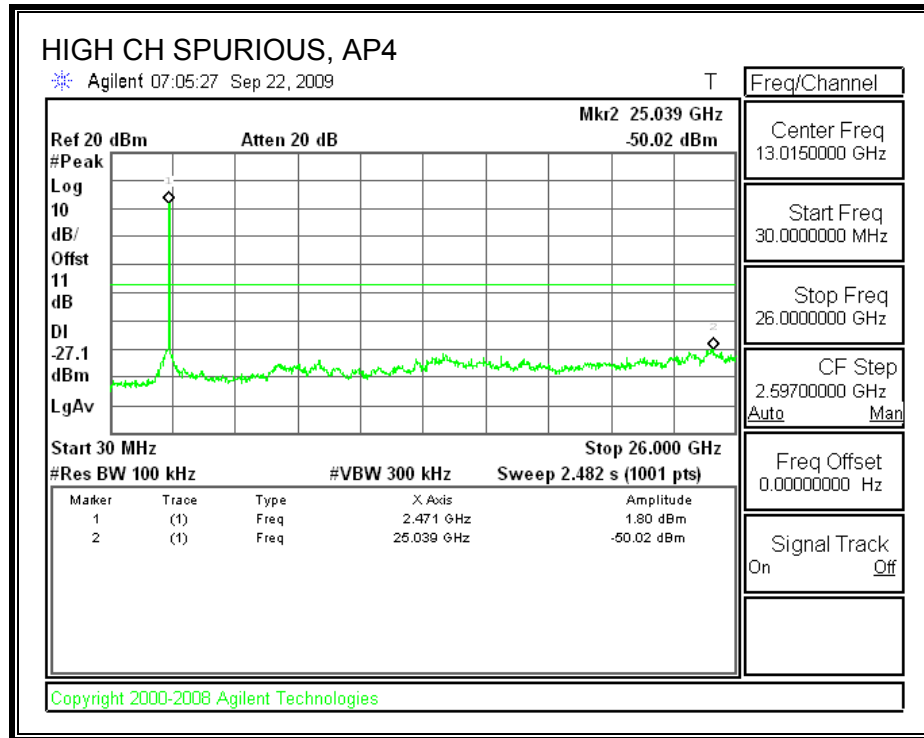




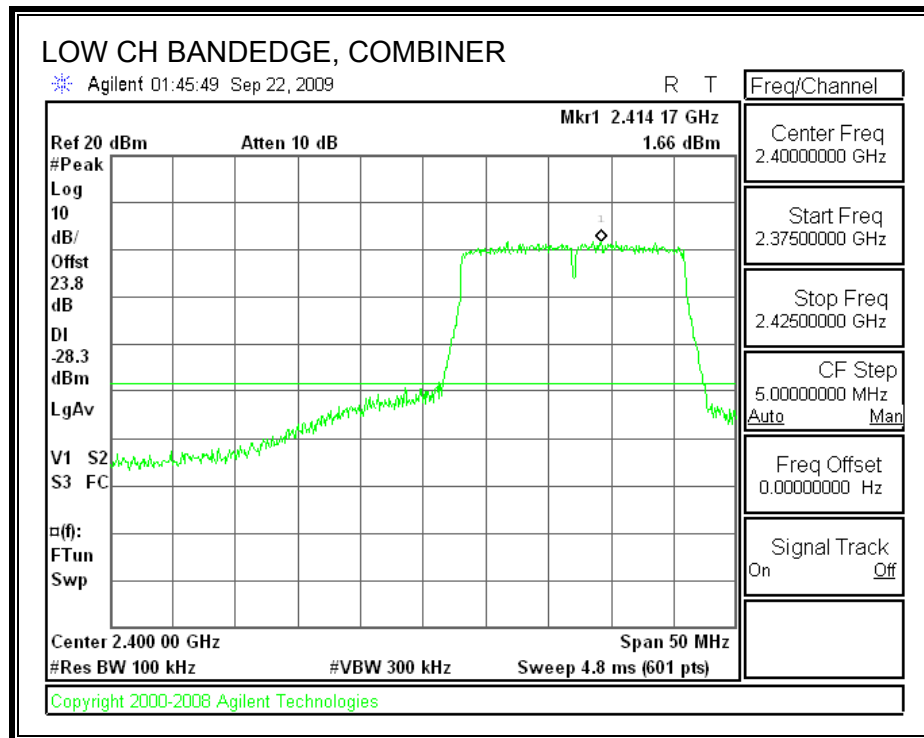


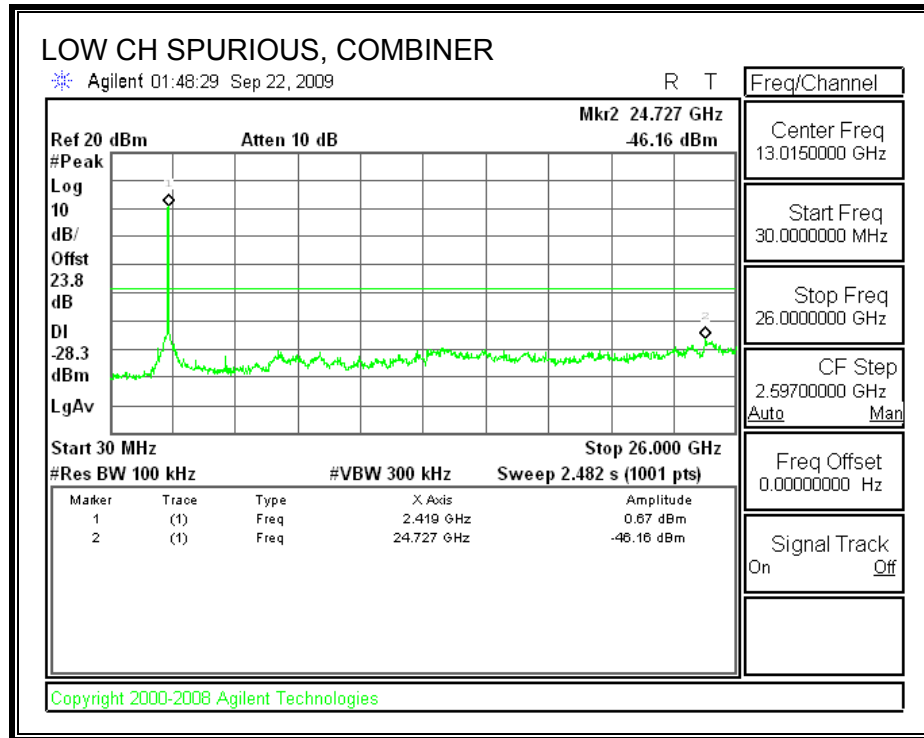


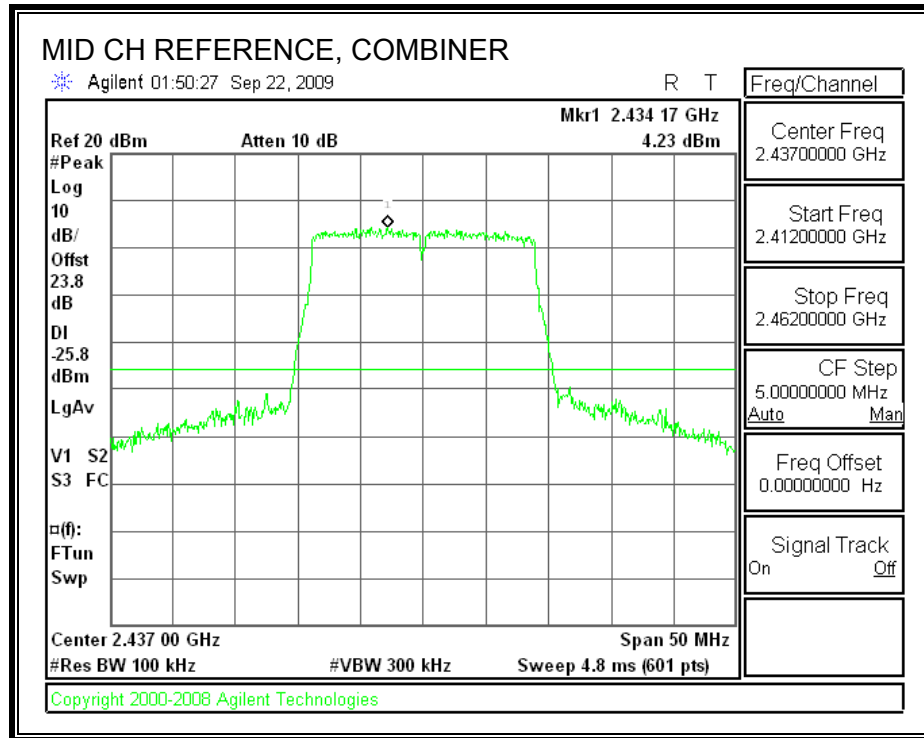


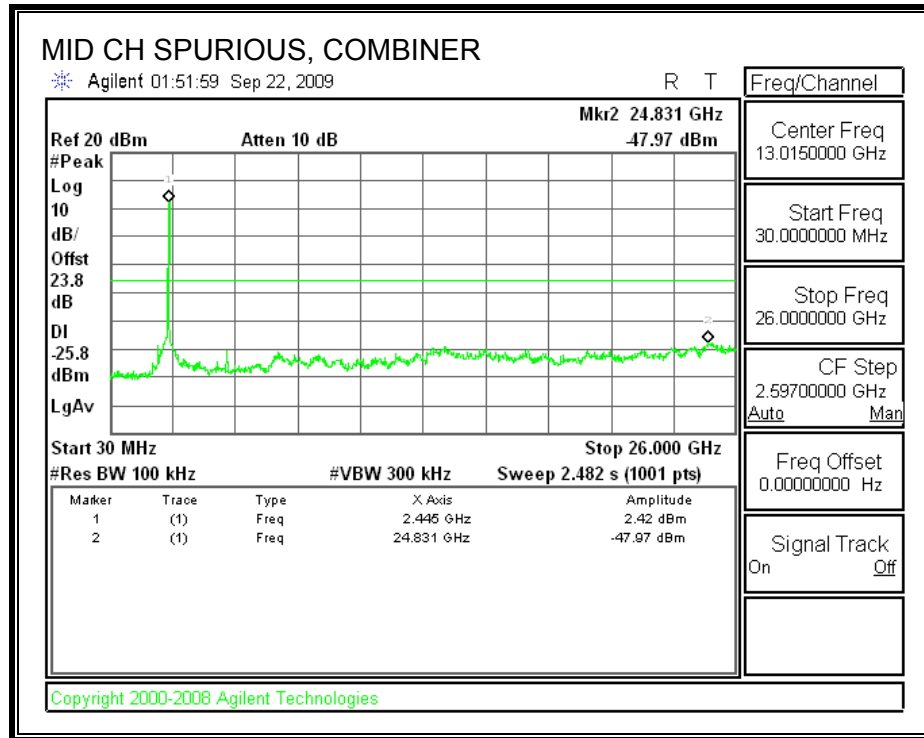


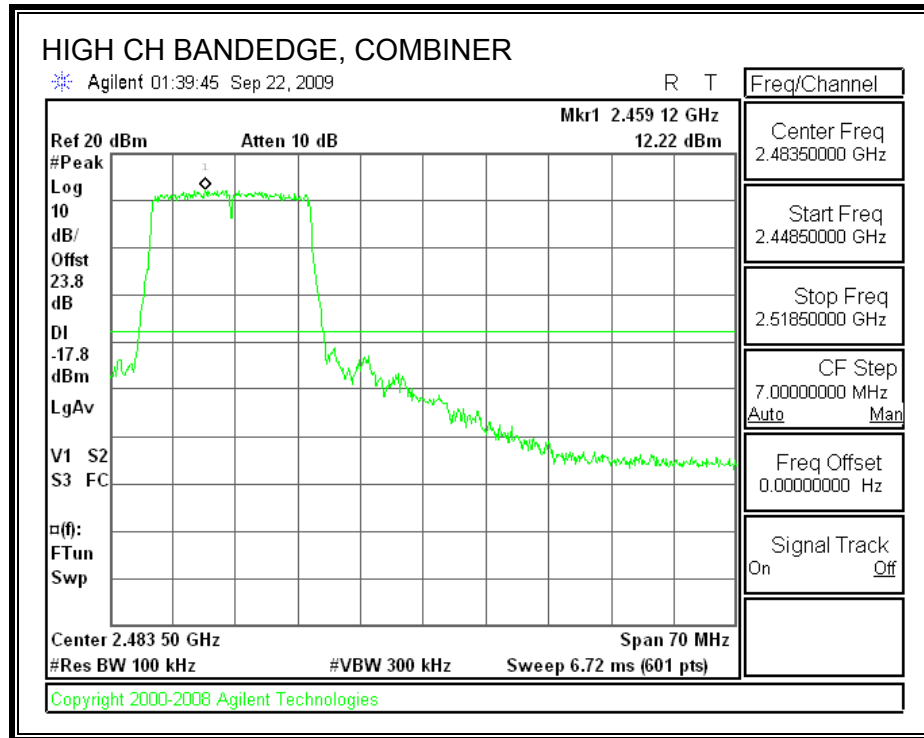
COMBINER SPURIOUS EMISSIONS

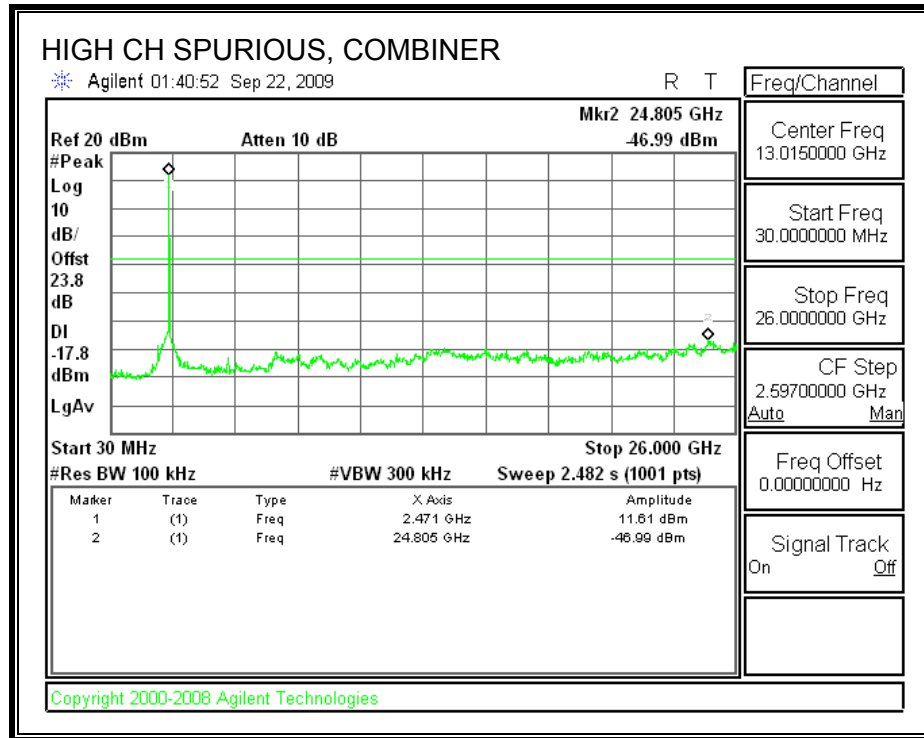












7.4. 802.11a THREE CHAINS MODE IN THE 5.8 GHz BAND

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.

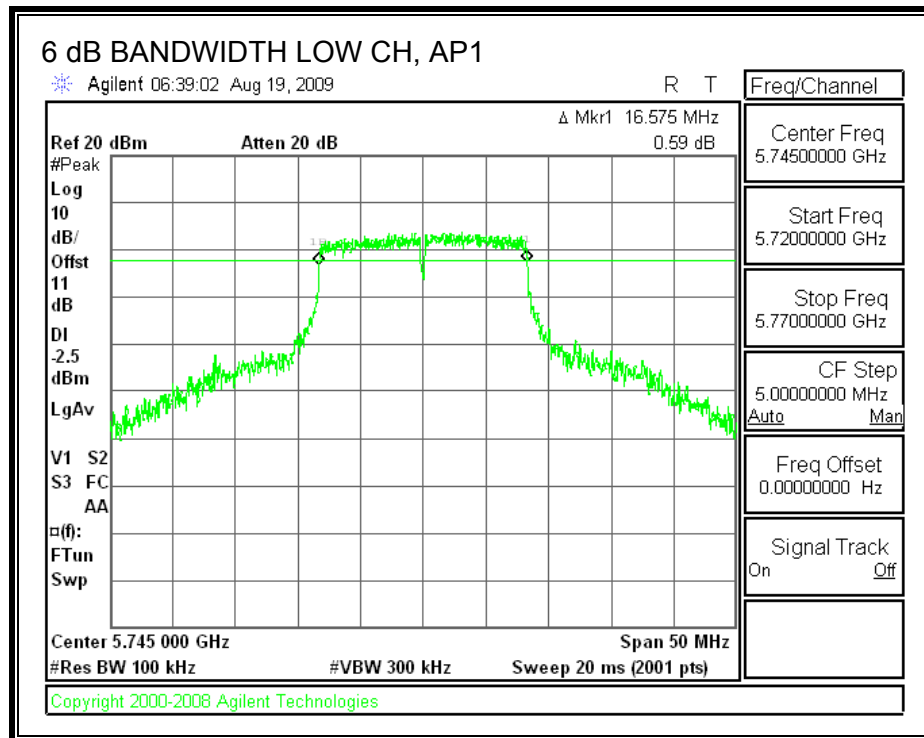
TEST PROCEDURE

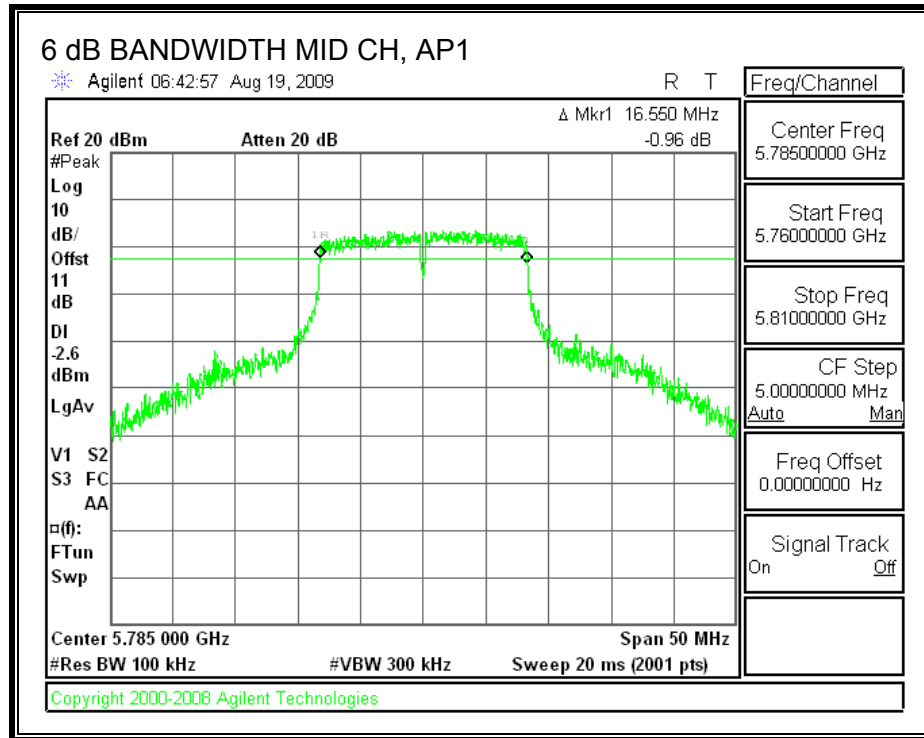
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

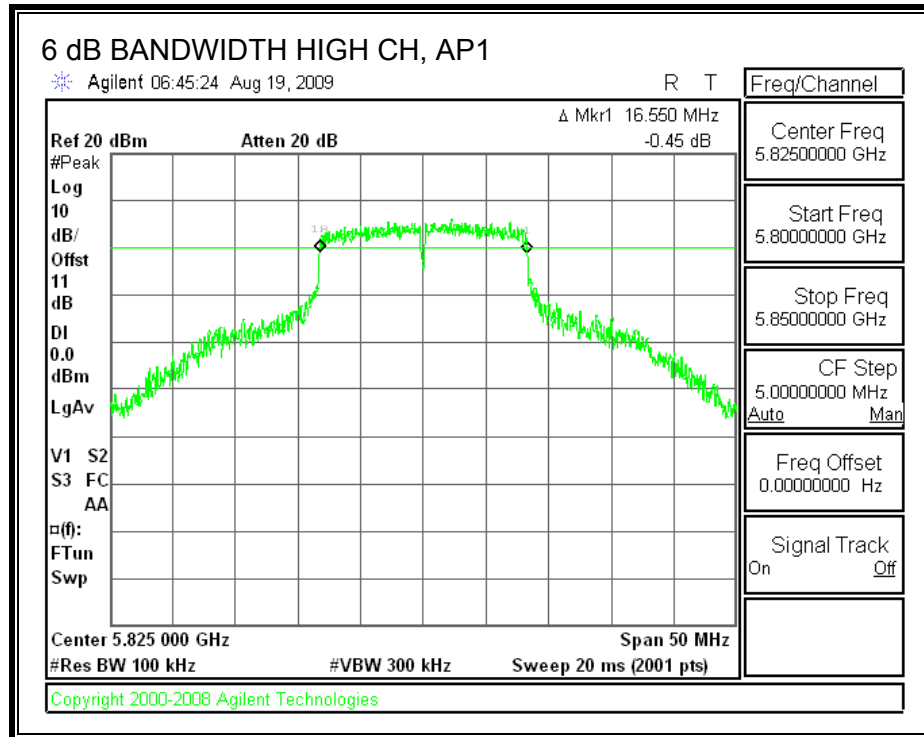
RESULTS

Channel	Frequency (MHz)	AP1 6 dB BW (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	16.575	16.55	16.55	0.5
Middle	5785	16.55	16.35	16.475	0.5
High	5825	16.55	16.525	13.95	0.5

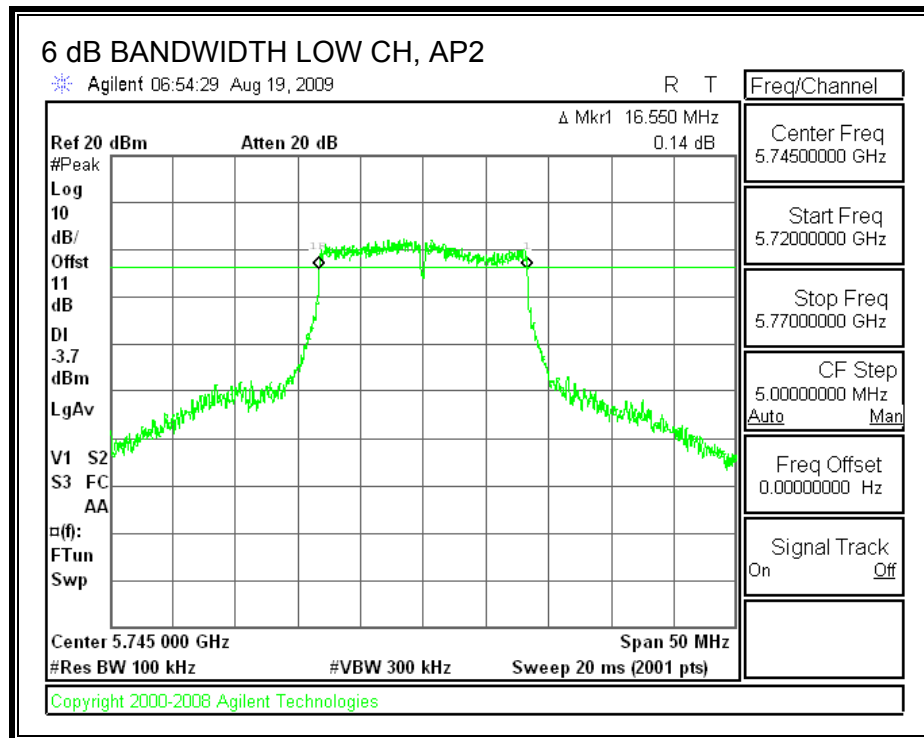
6 dB BANDWIDTH, AP1

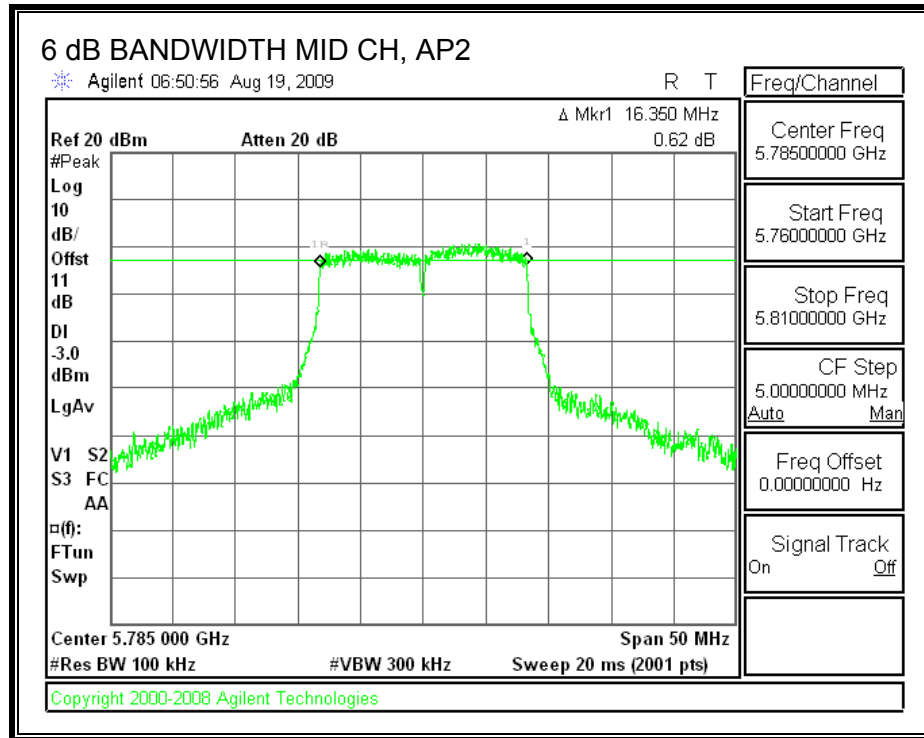


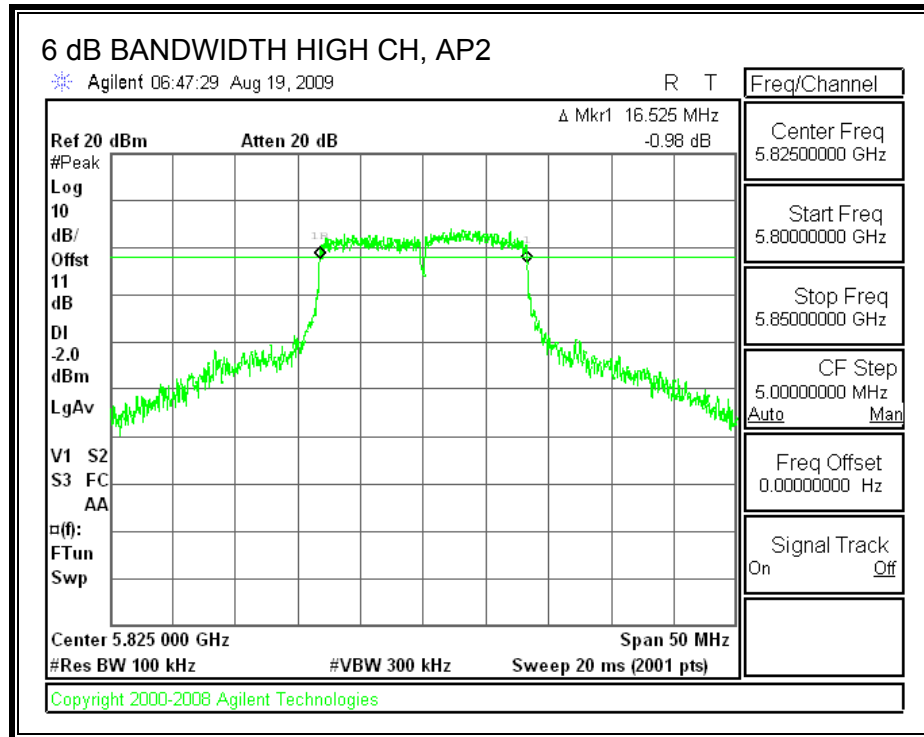




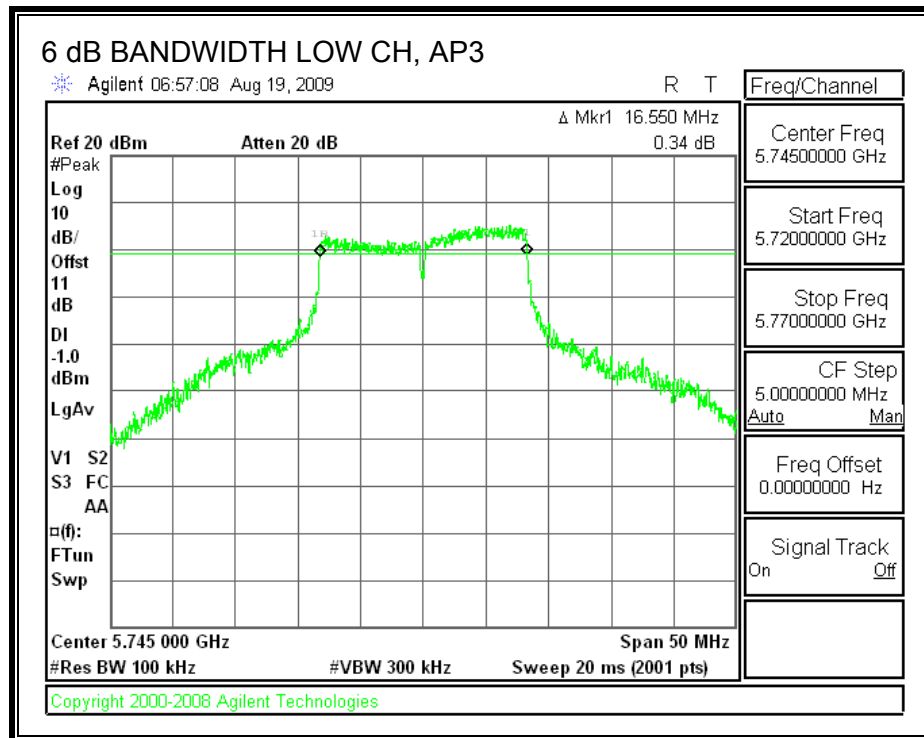
6 dB BANDWIDTH, AP2

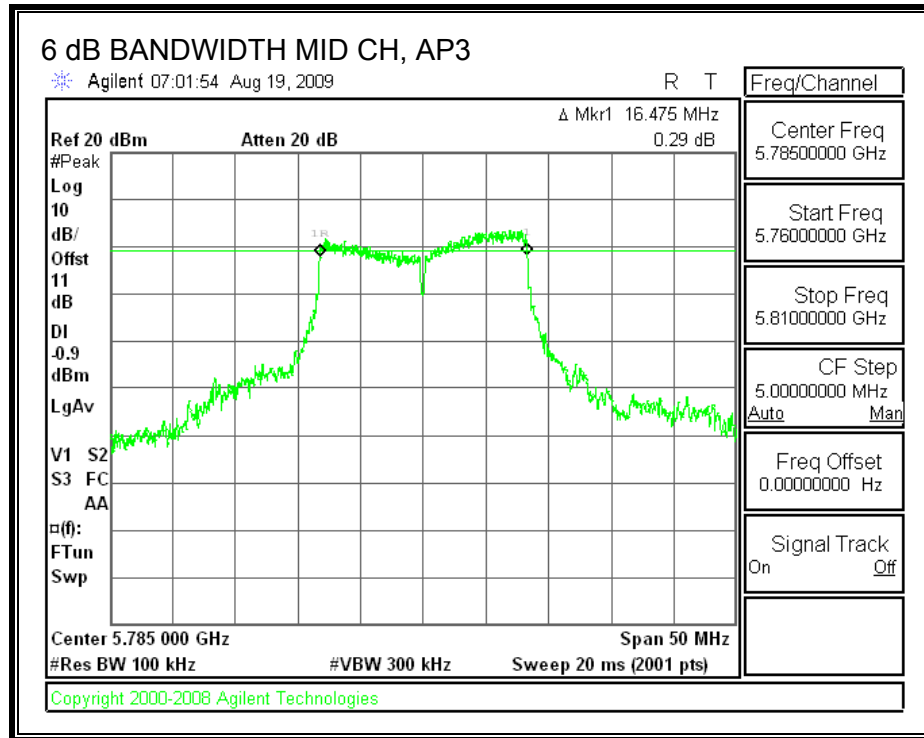


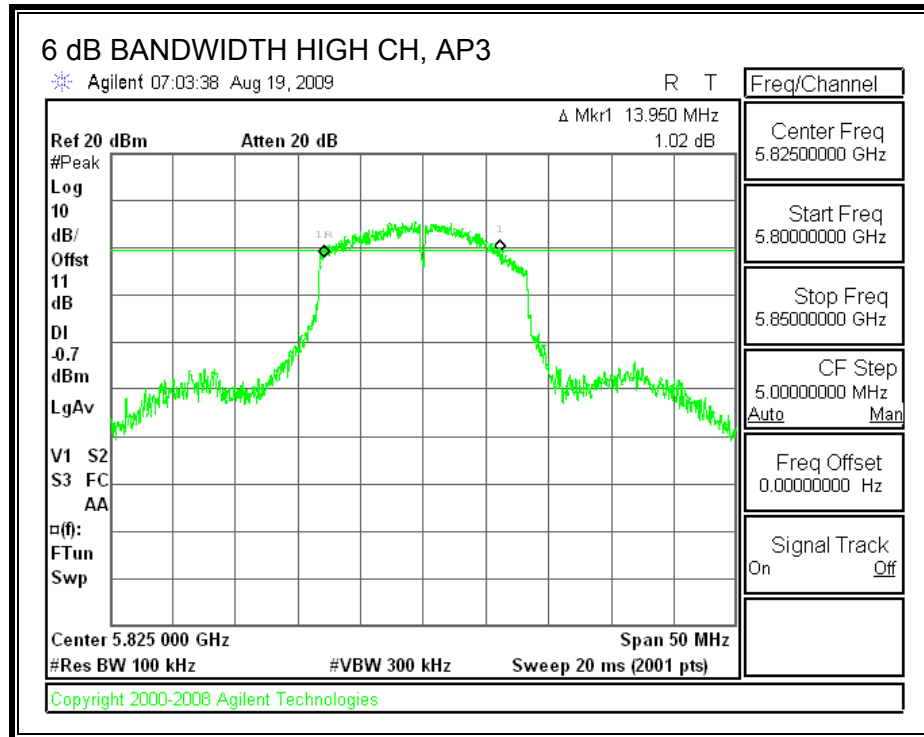




6 dB BANDWIDTH, AP3







7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

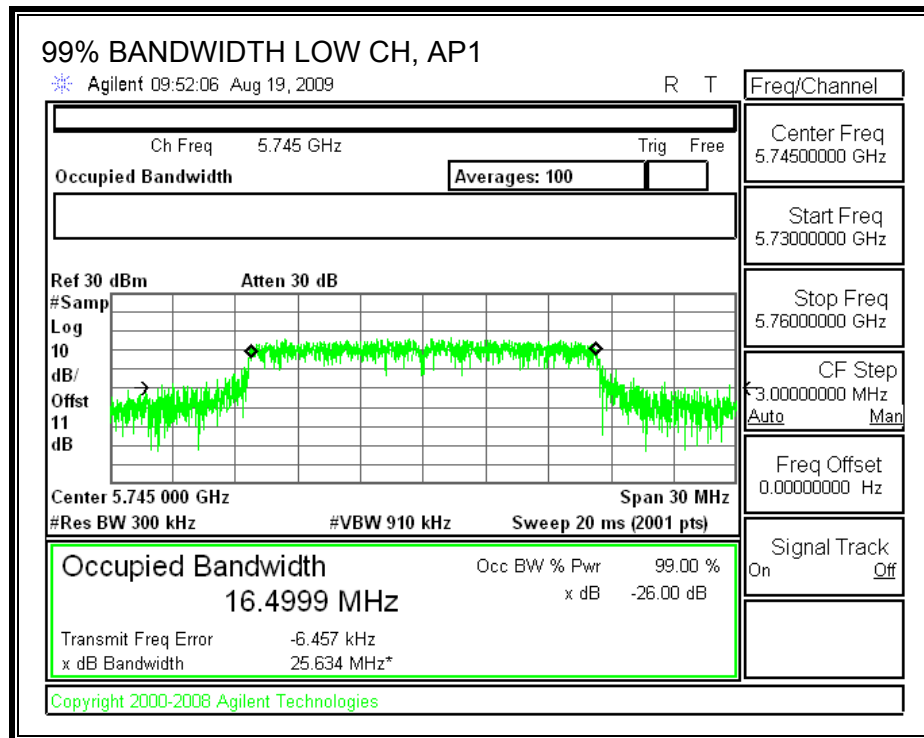
TEST PROCEDURE

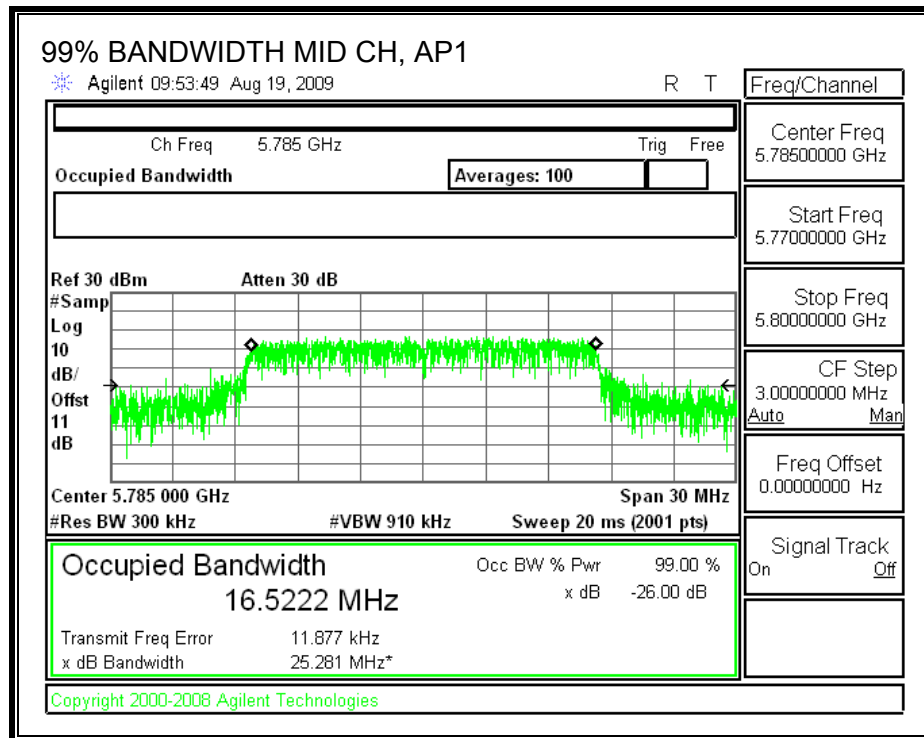
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

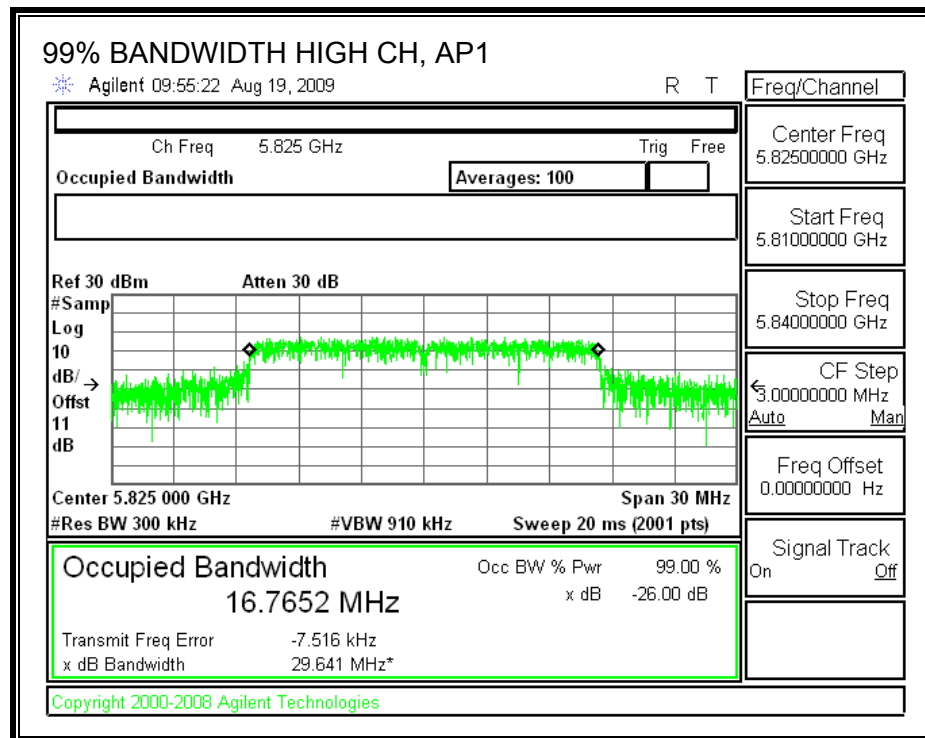
RESULTS

Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	5745	16.4999	16.5031	16.3646
Middle	5785	16.5222	16.4574	16.1744
High	5825	16.7652	16.5586	16.7034

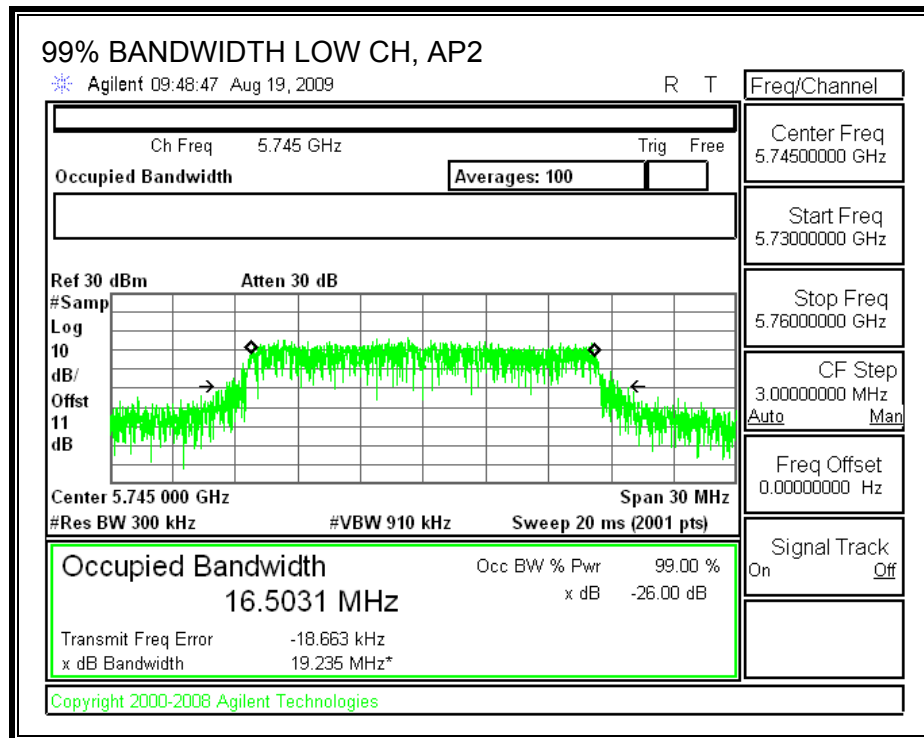
99% BANDWIDTH, AP1

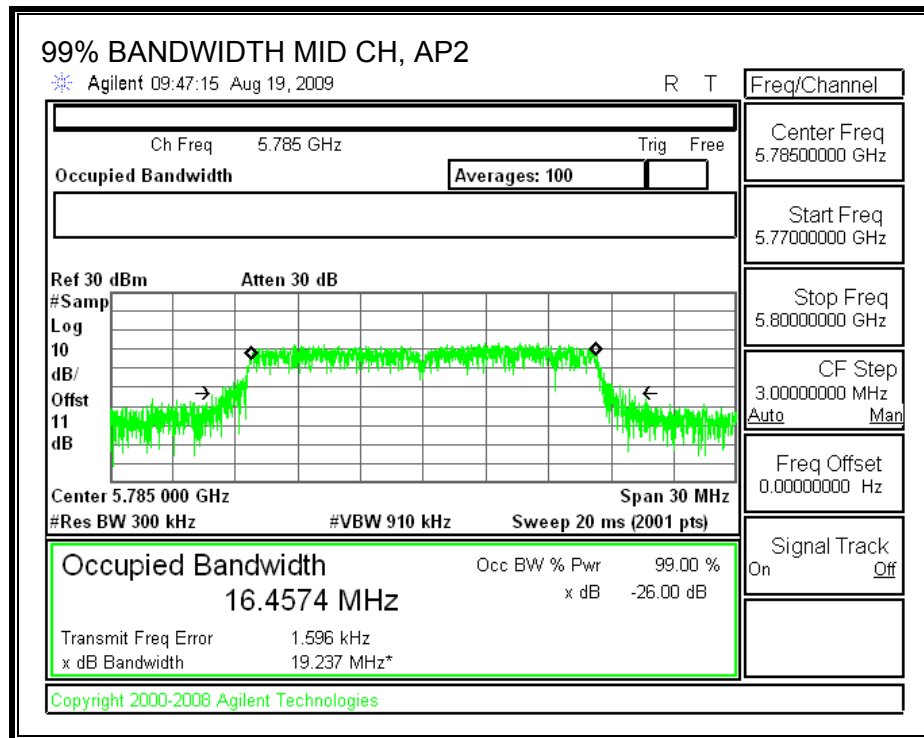


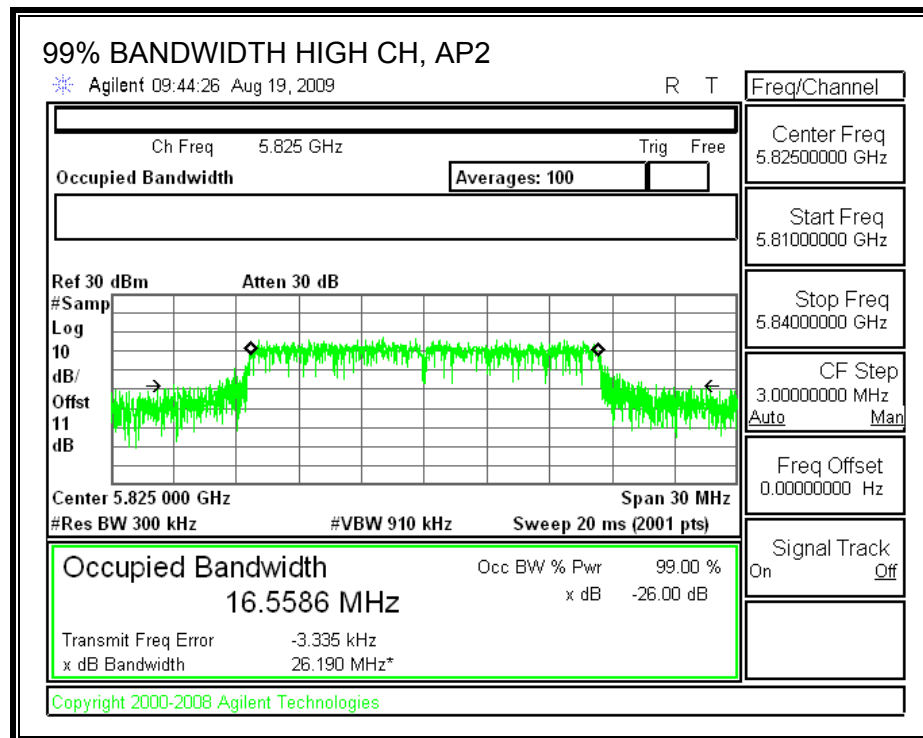




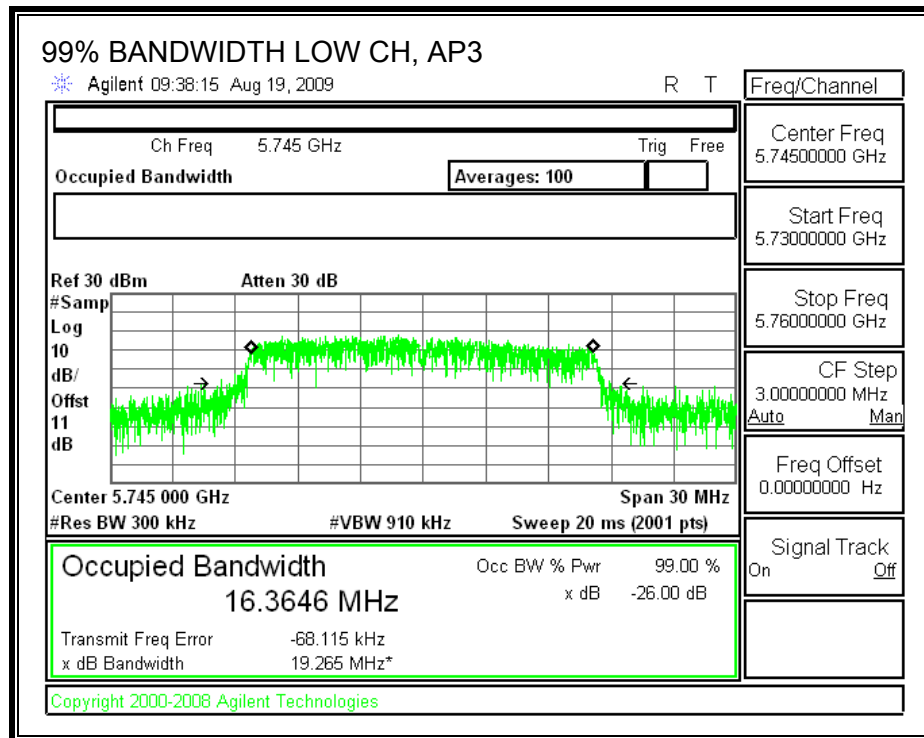
99% BANDWIDTH, AP2

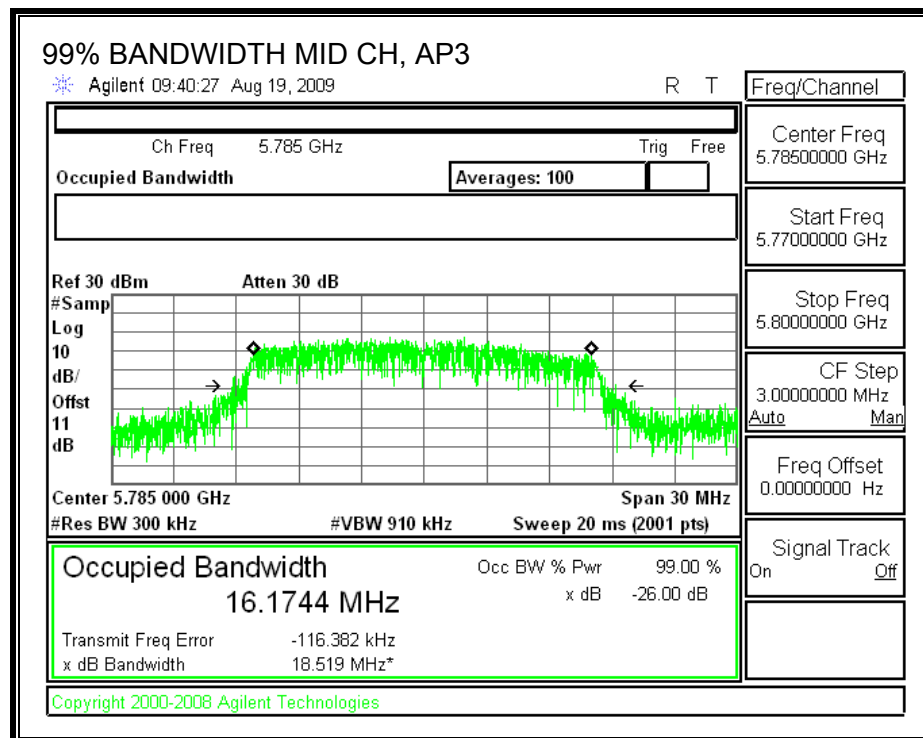


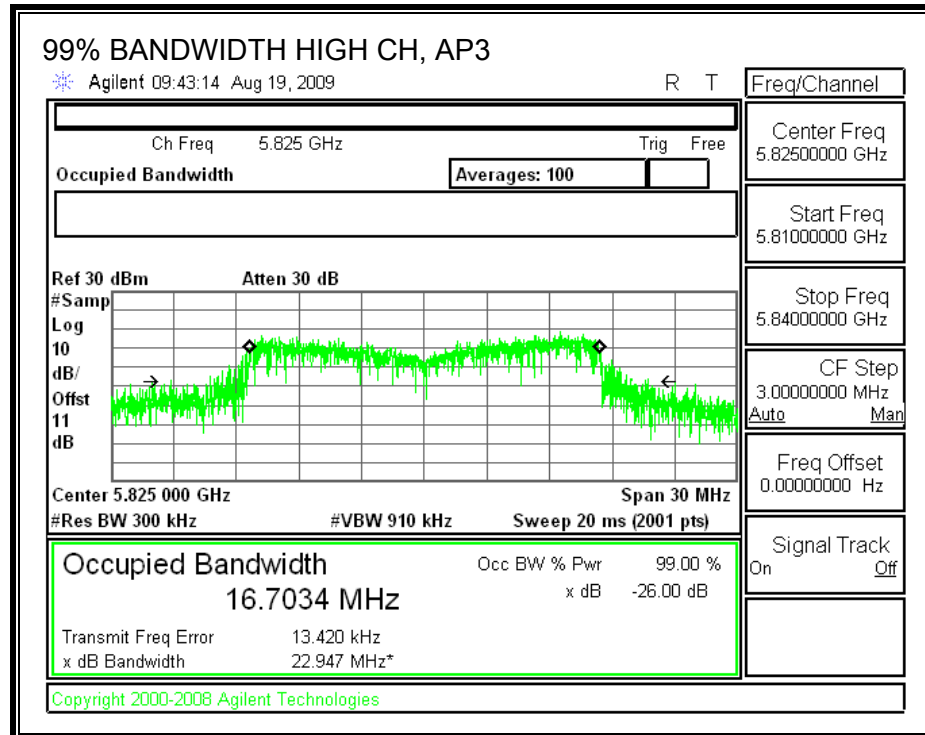




99% BANDWIDTH, AP3







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

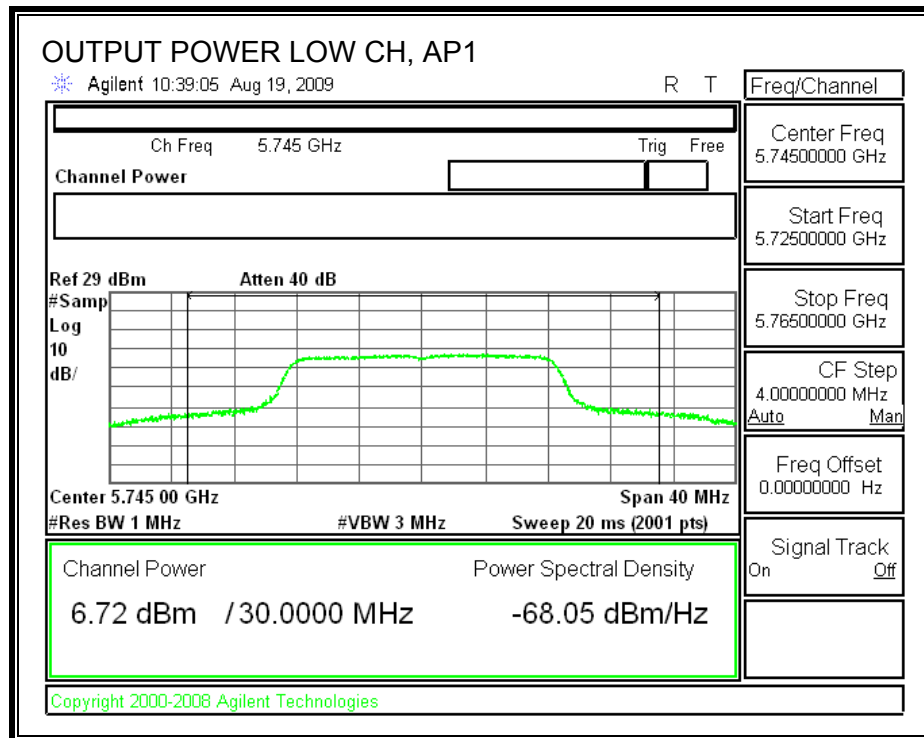
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

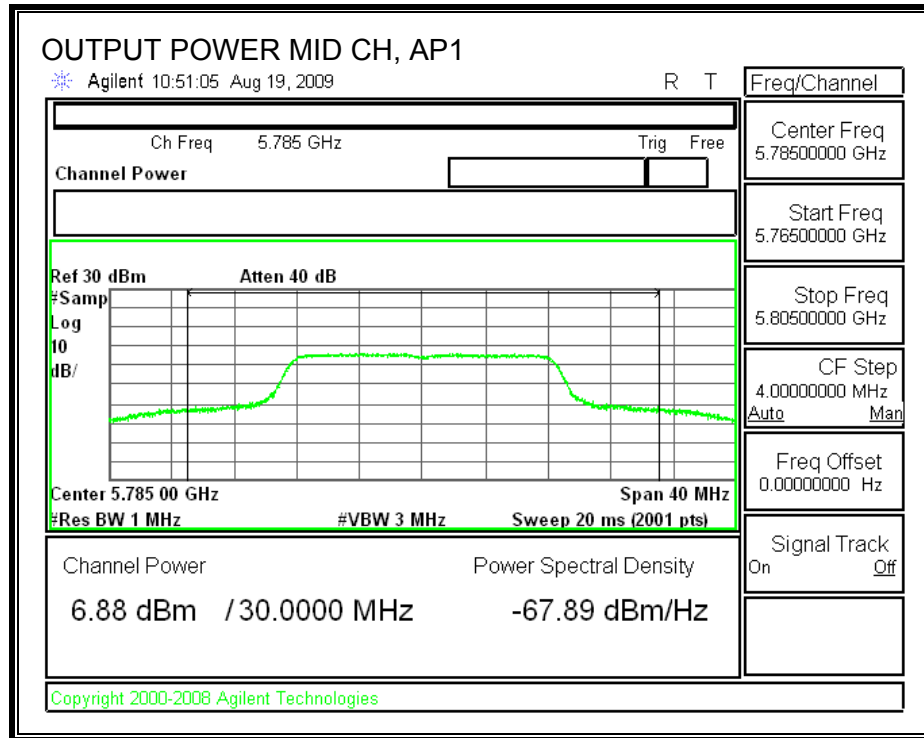
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

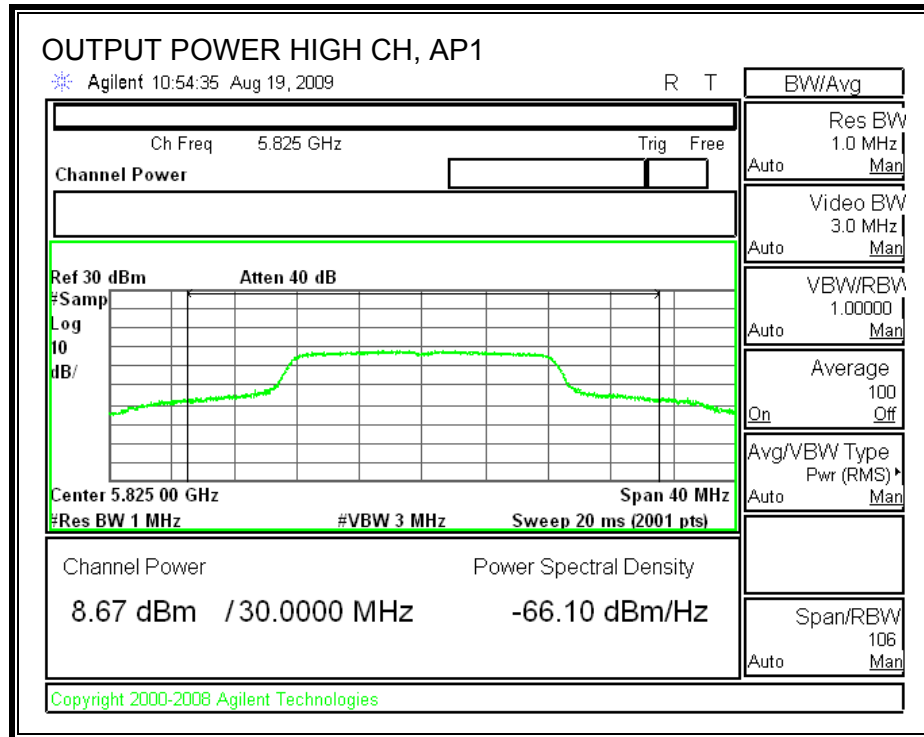
RESULTS

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	6.72	4.31	6.86	11.00	21.88	28.23	-6.35
Mid	5785	6.88	3.68	5.10	11.00	21.19	28.23	-7.04
High	5825	8.67	6.67	6.12	11.00	23.07	28.23	-5.16

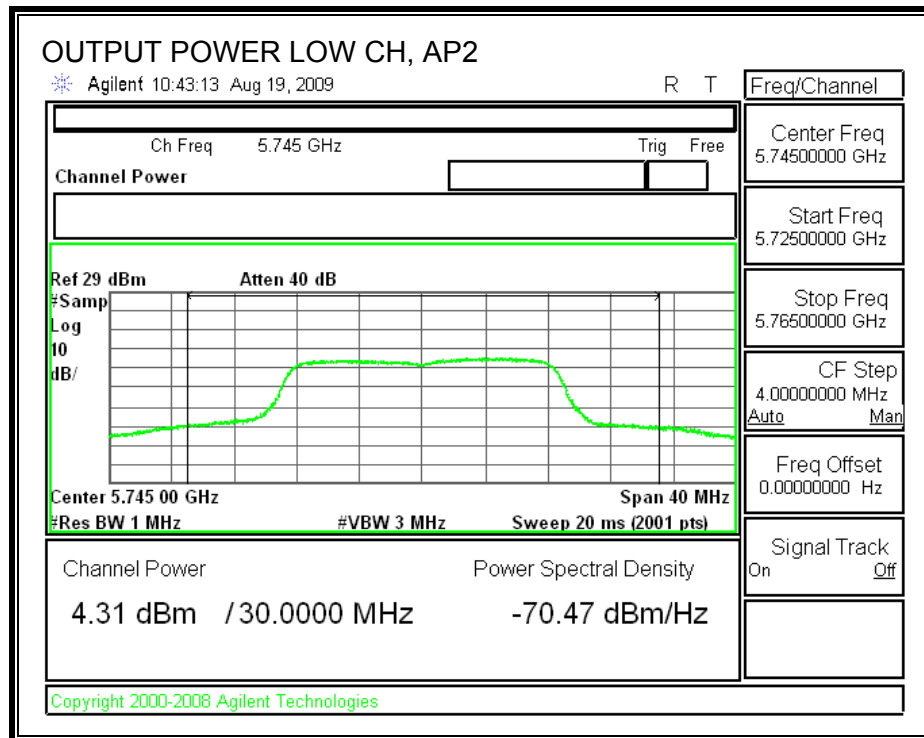
AP1 OUTPUT POWER

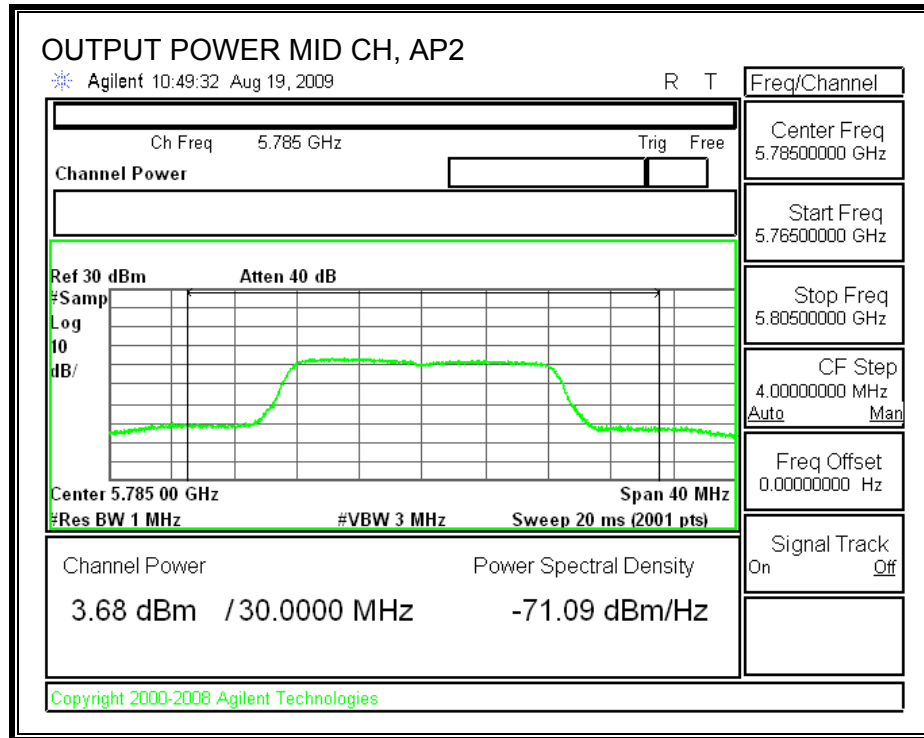


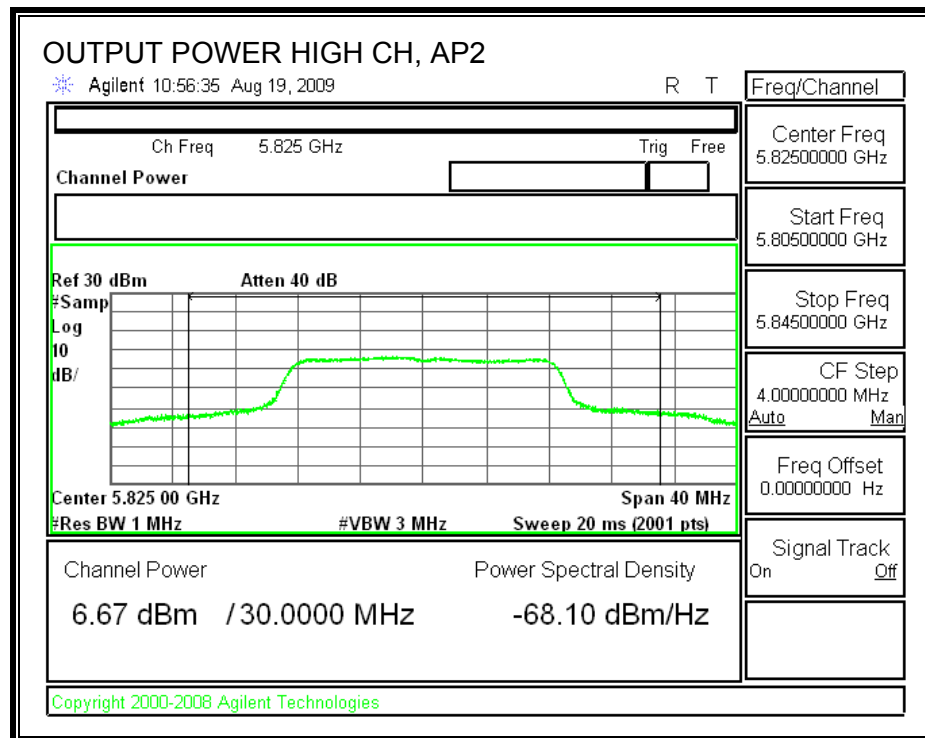




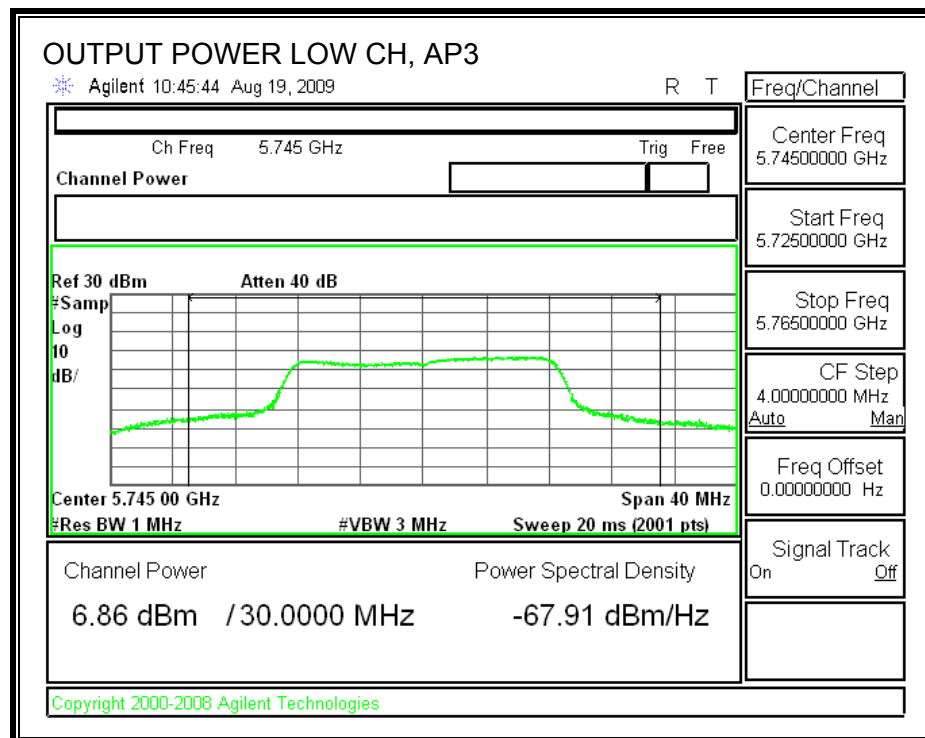
AP2 OUTPUT POWER

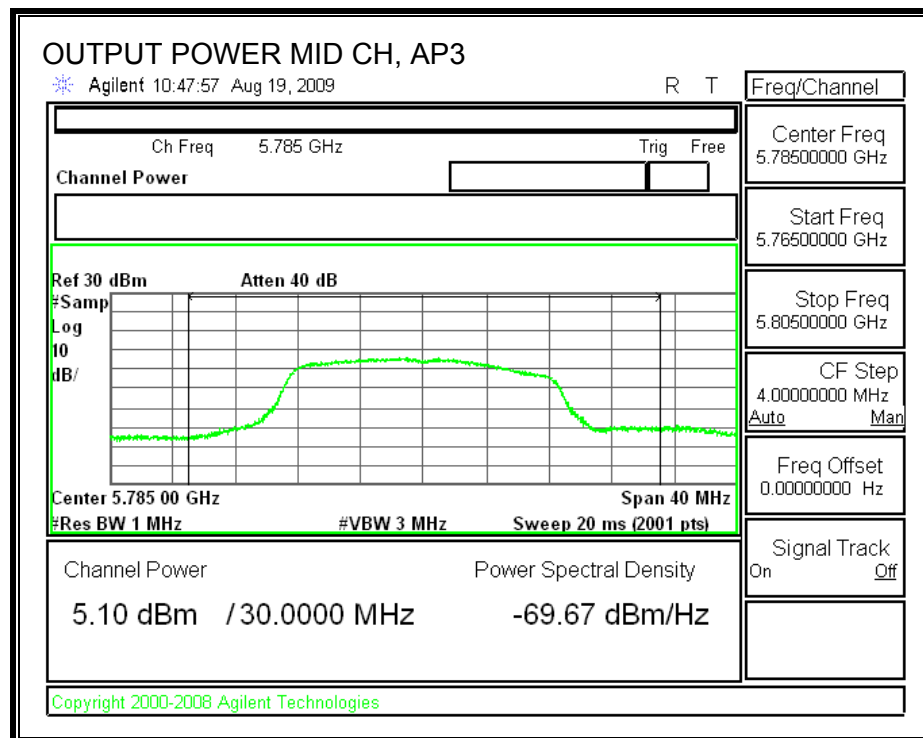


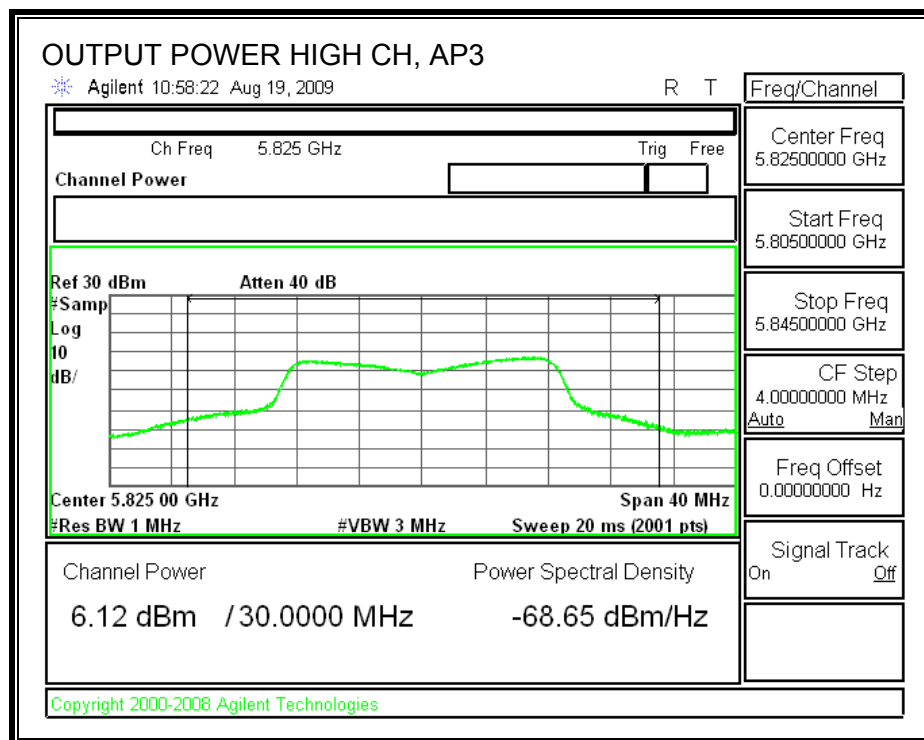




AP3 OUTPUT POWER







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.

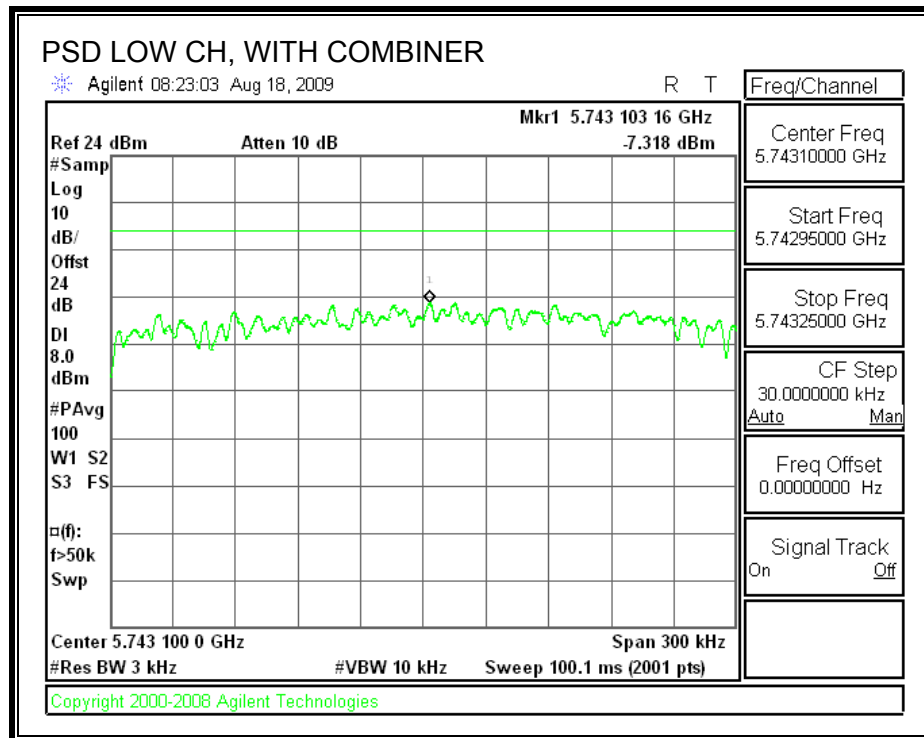
TEST PROCEDURE

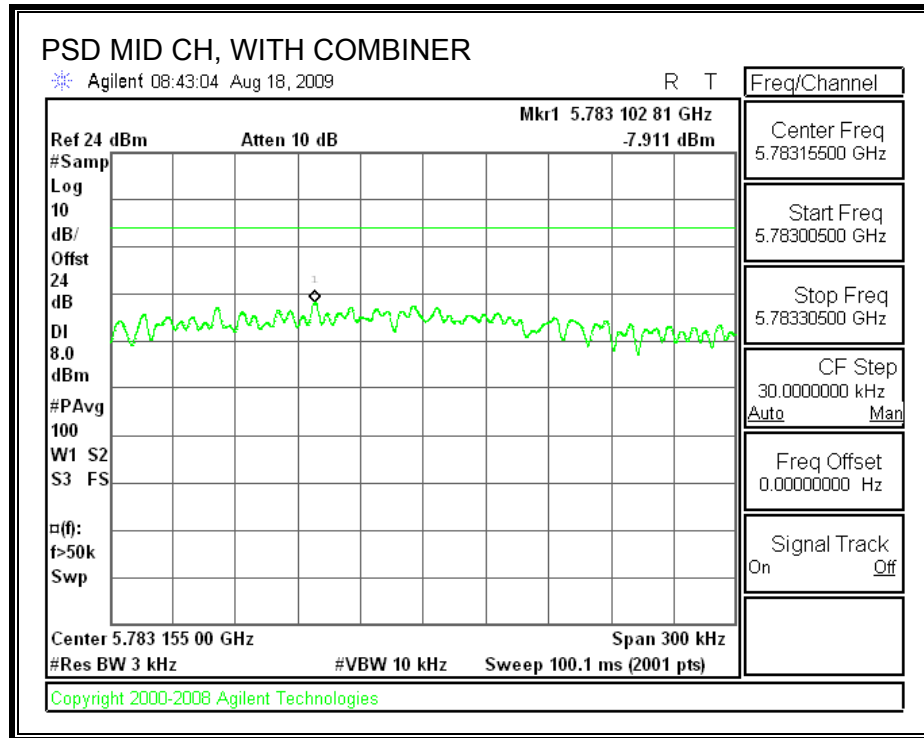
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

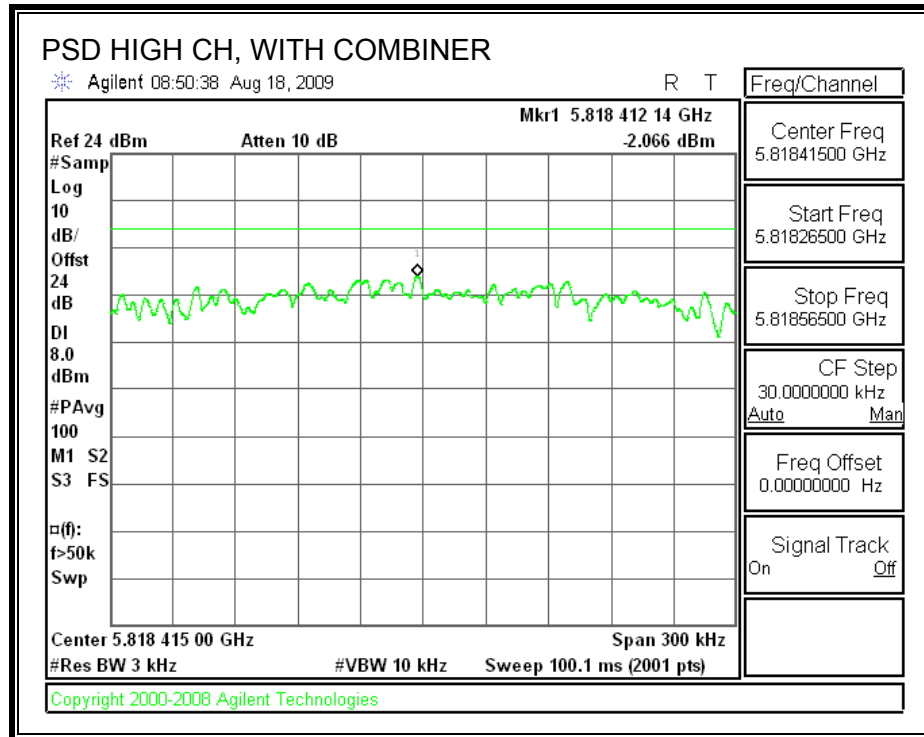
RESULTS:

Channel	Frequency (MHz)	PSD with Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-7.318	8	-15.32
Middle	5785	-7.911	8	-15.91
High	5825	-2.066	8	-10.07

POWER SPECTRAL DENSITY, WITH COMBINER







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.

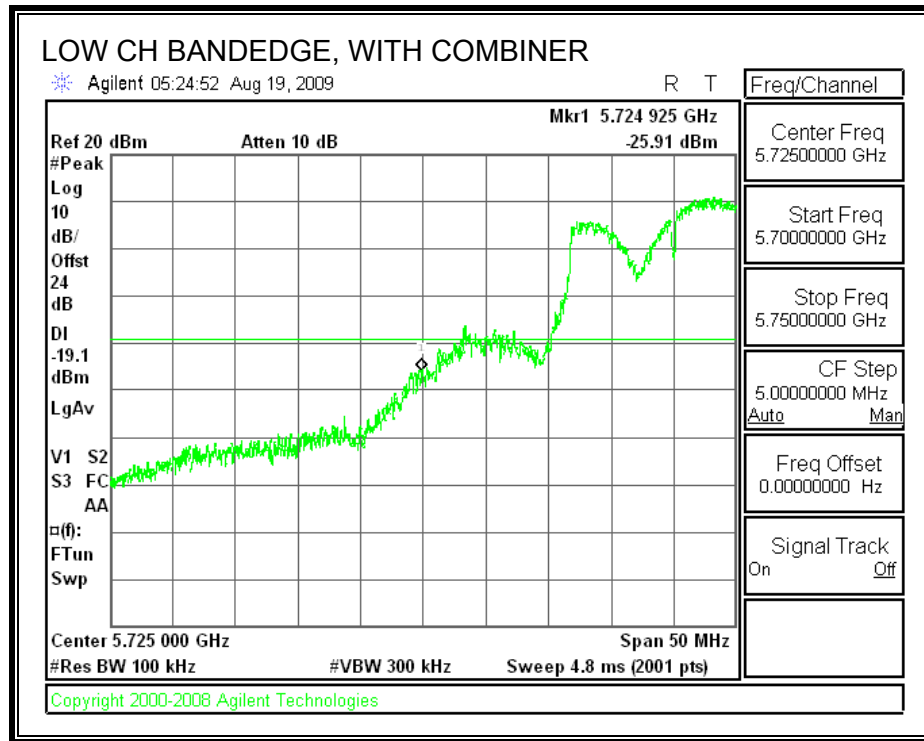
TEST PROCEDURE

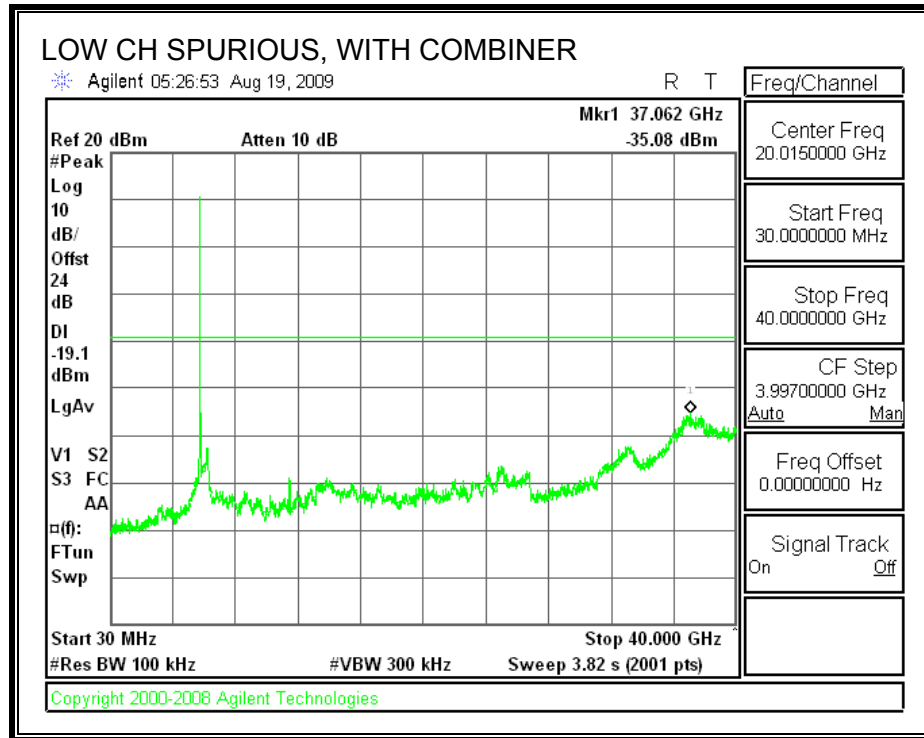
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

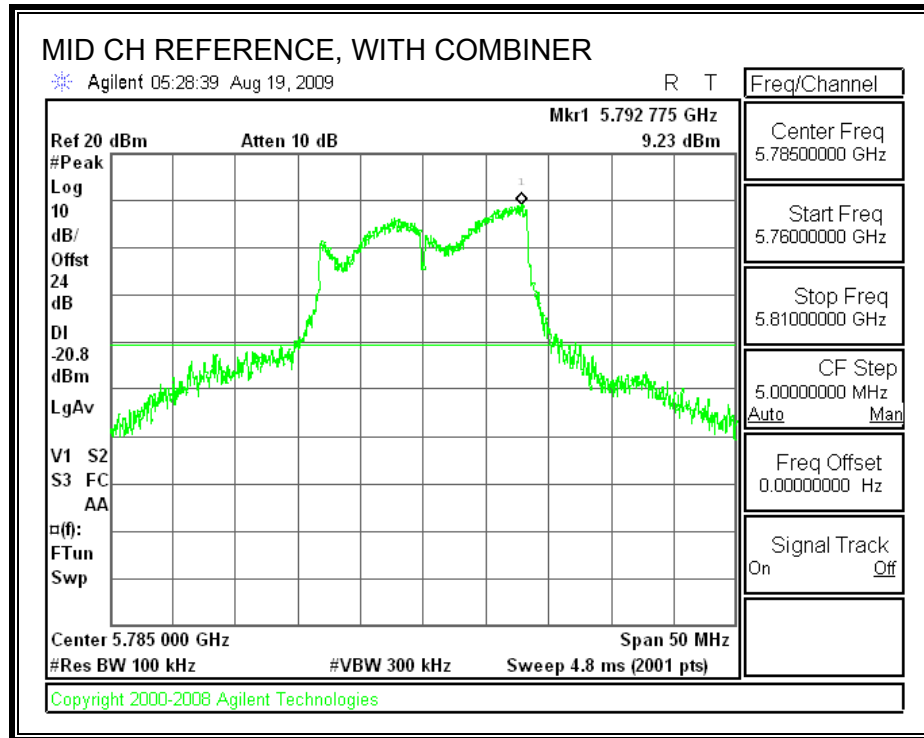
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

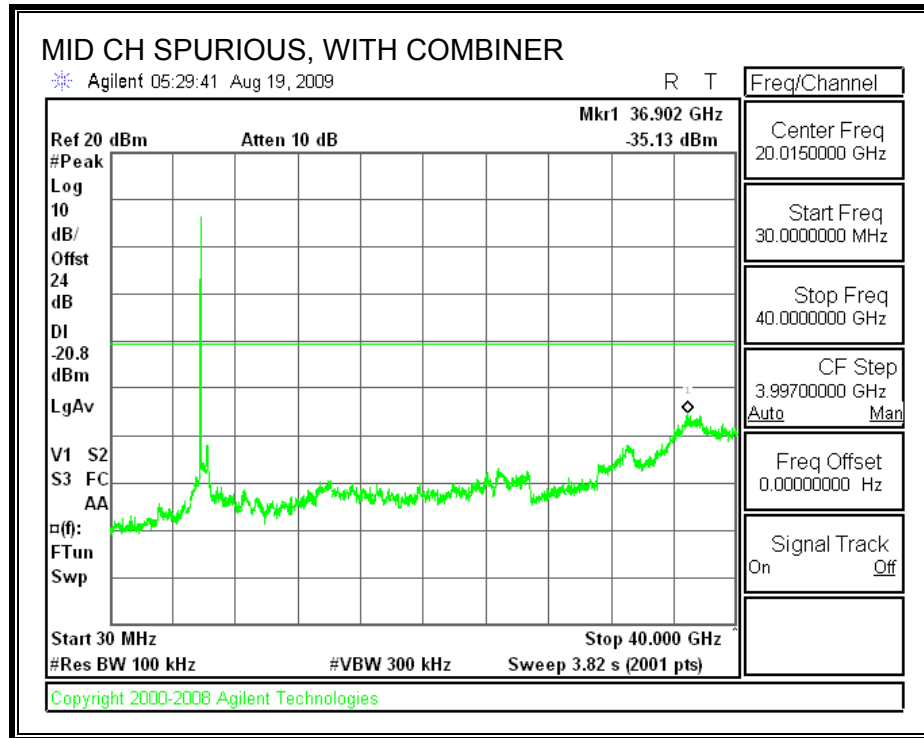
RESULTS

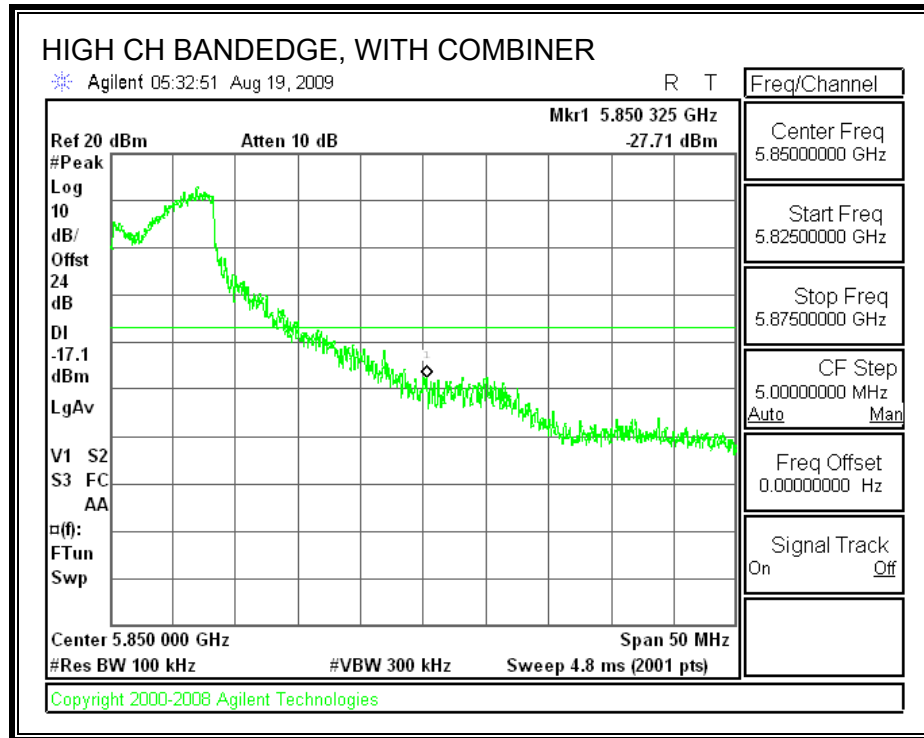
SPURIOUS EMISSIONS WITH COMBINER

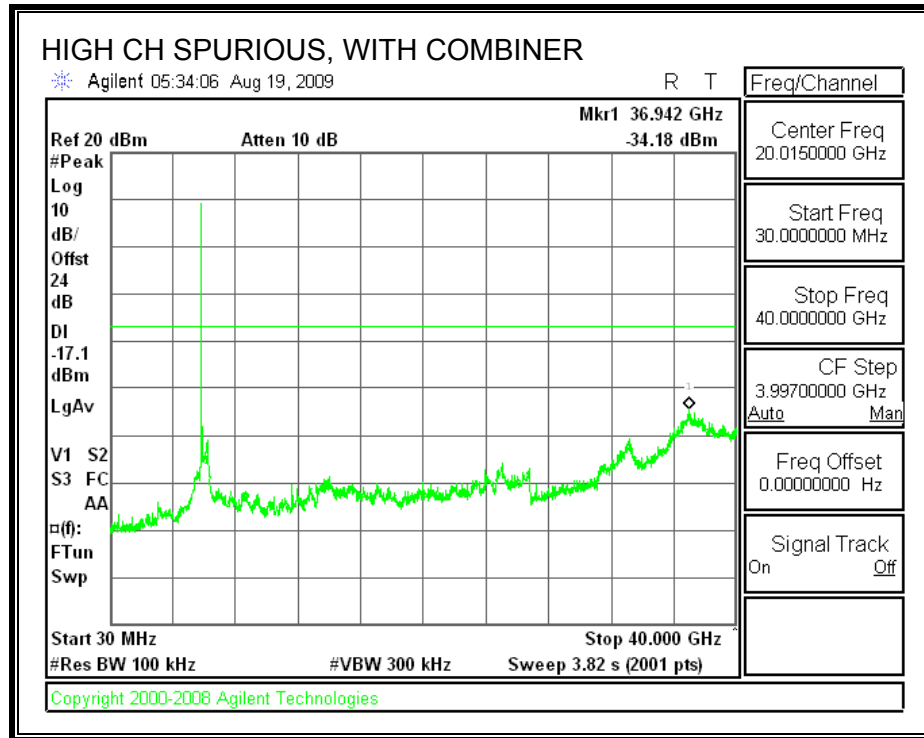












7.5. 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND

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.

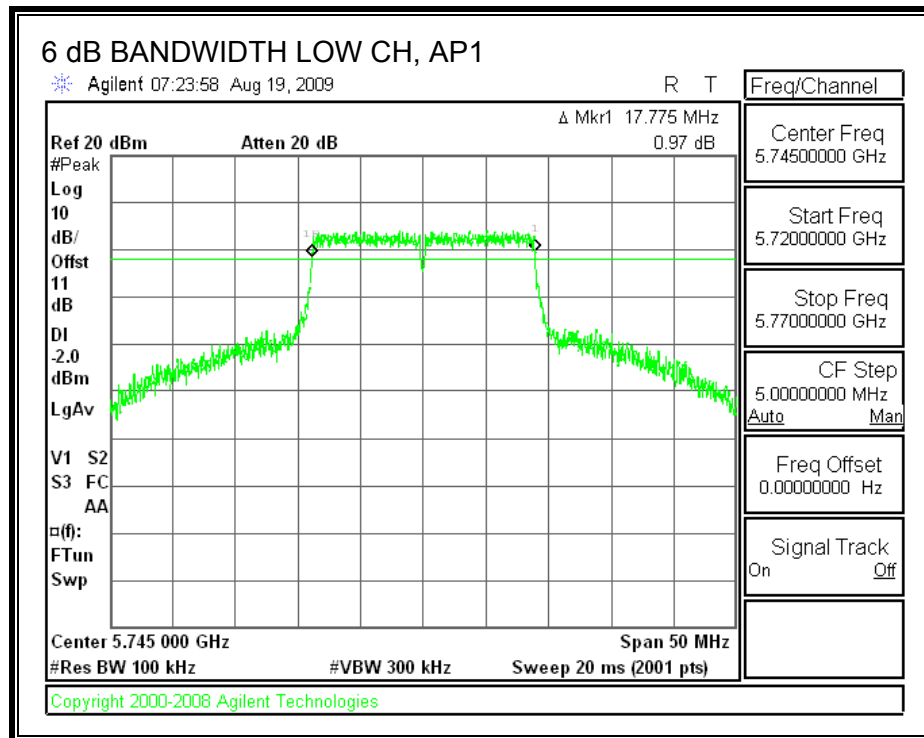
TEST PROCEDURE

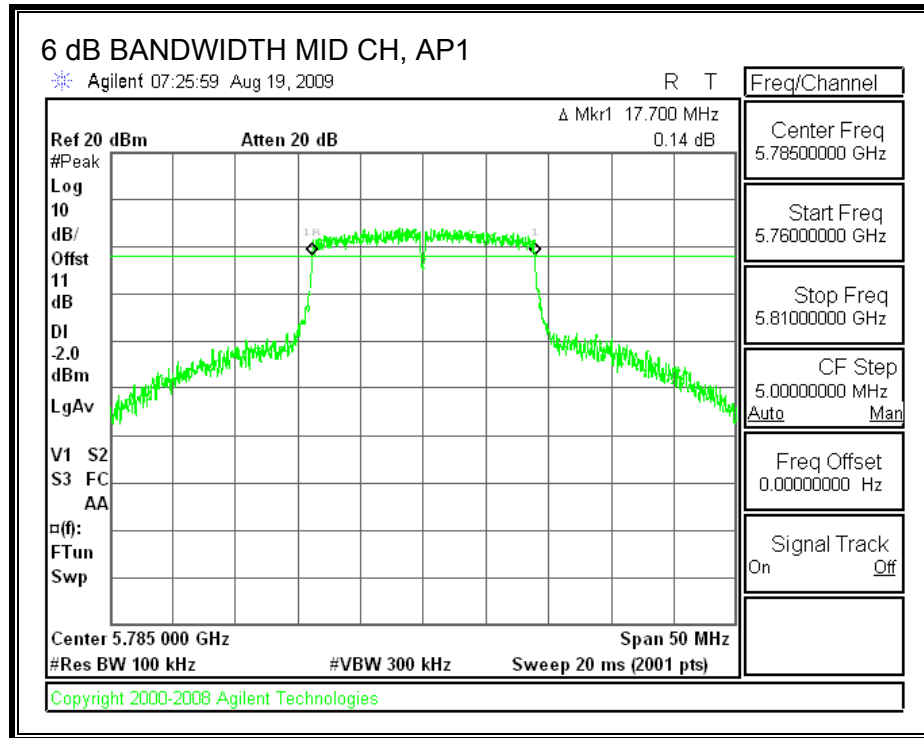
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

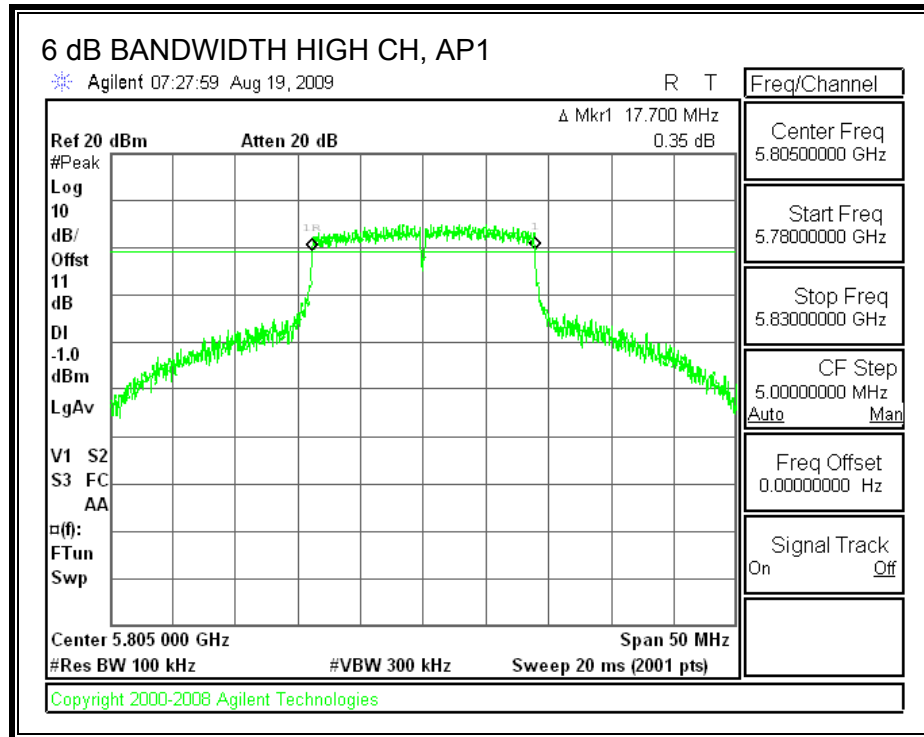
RESULTS

Channel	Frequency (MHz)	AP1 6 dB BW (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	17.775	17.725	17.475	0.5
Middle	5785	17.7	17.775	14.2	0.5
High	5805	17.7	17.7	17.8	0.5

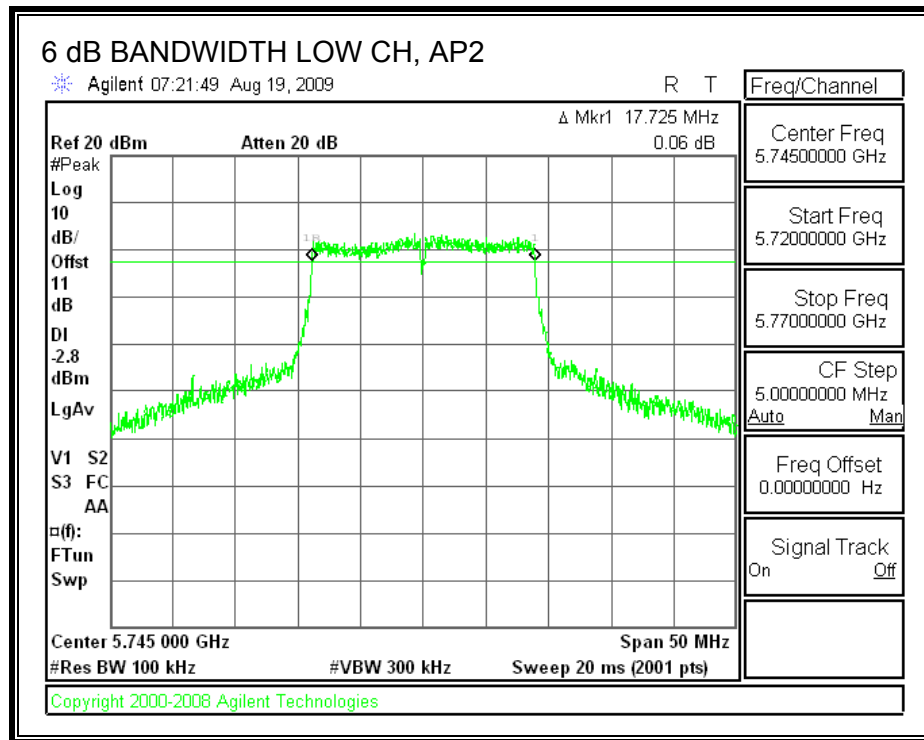
6 dB BANDWIDTH, AP1

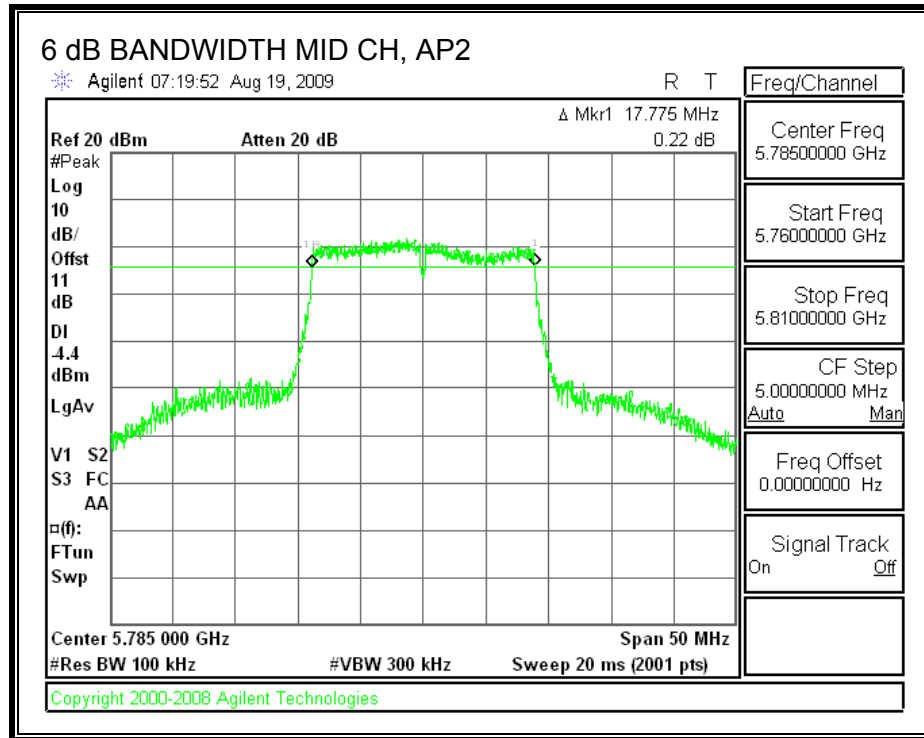


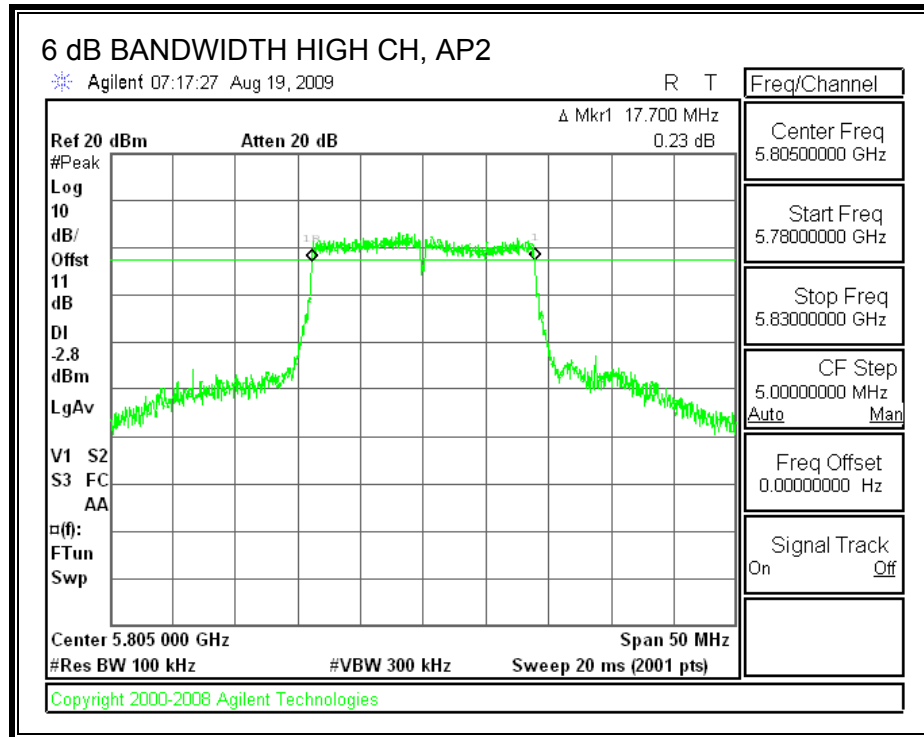




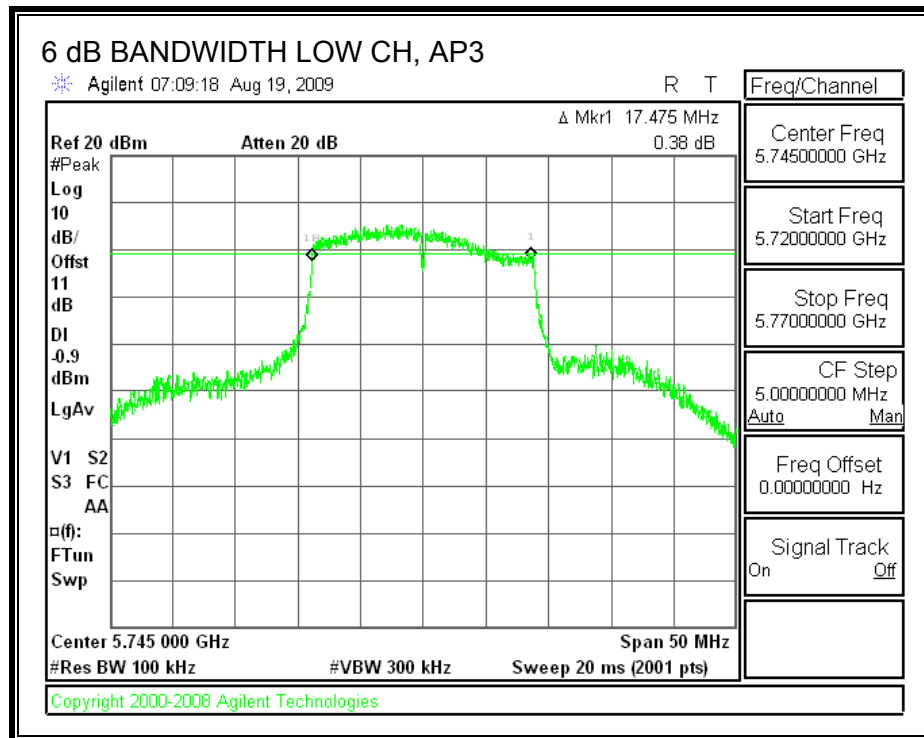
6 dB BANDWIDTH, AP2

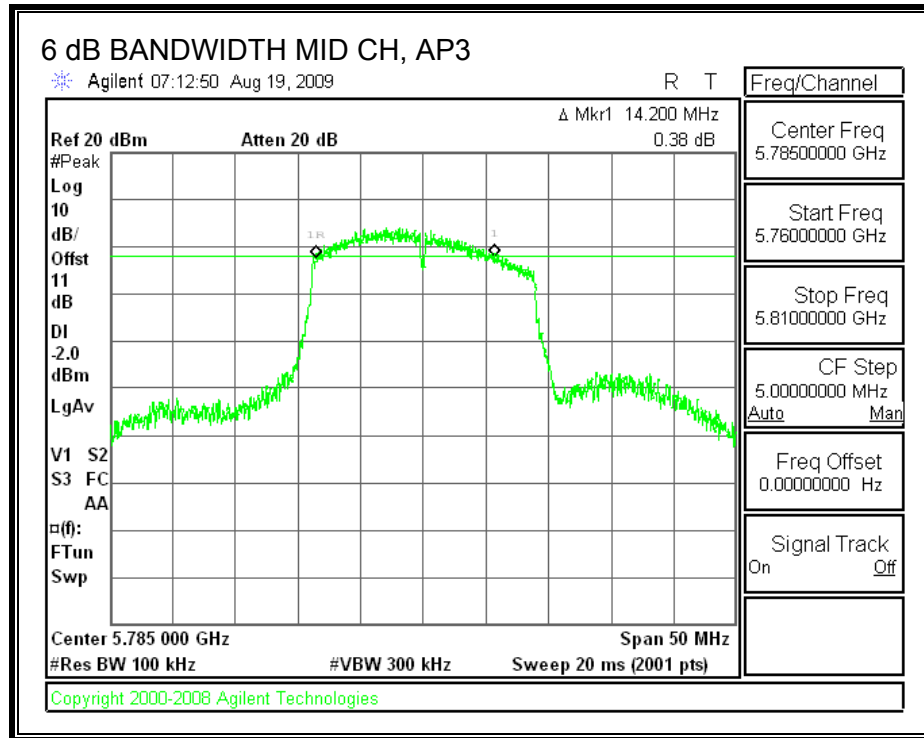


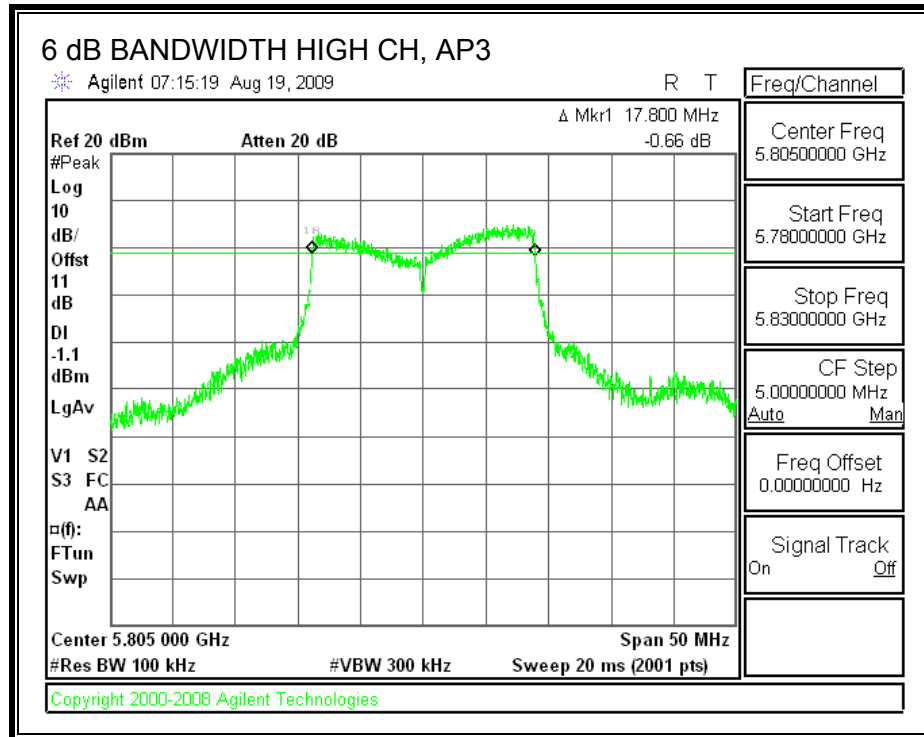




6 dB BANDWIDTH, AP3







7.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

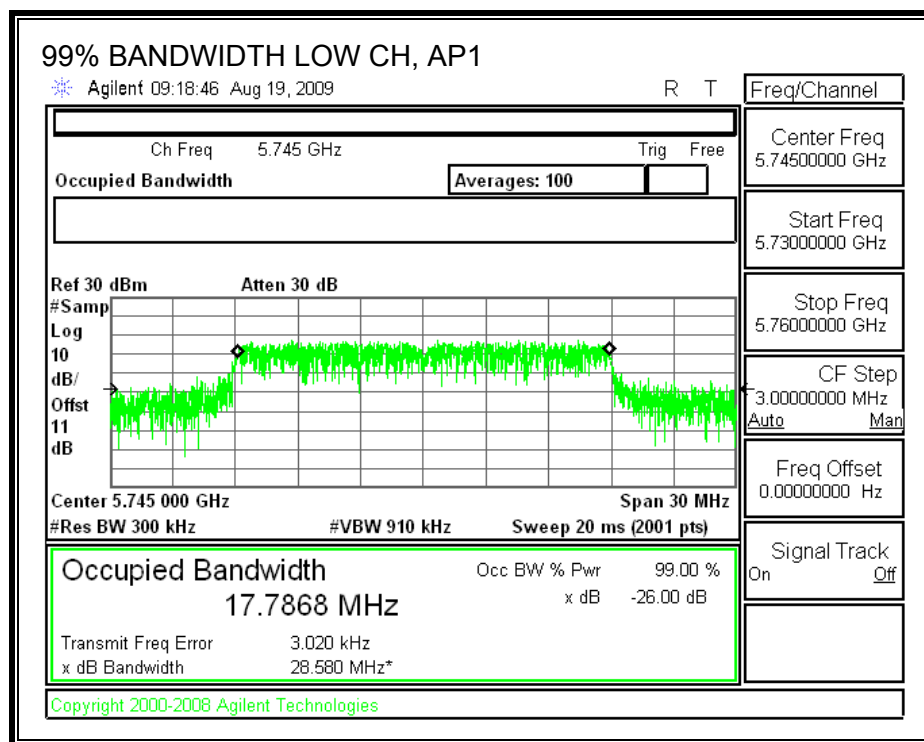
TEST PROCEDURE

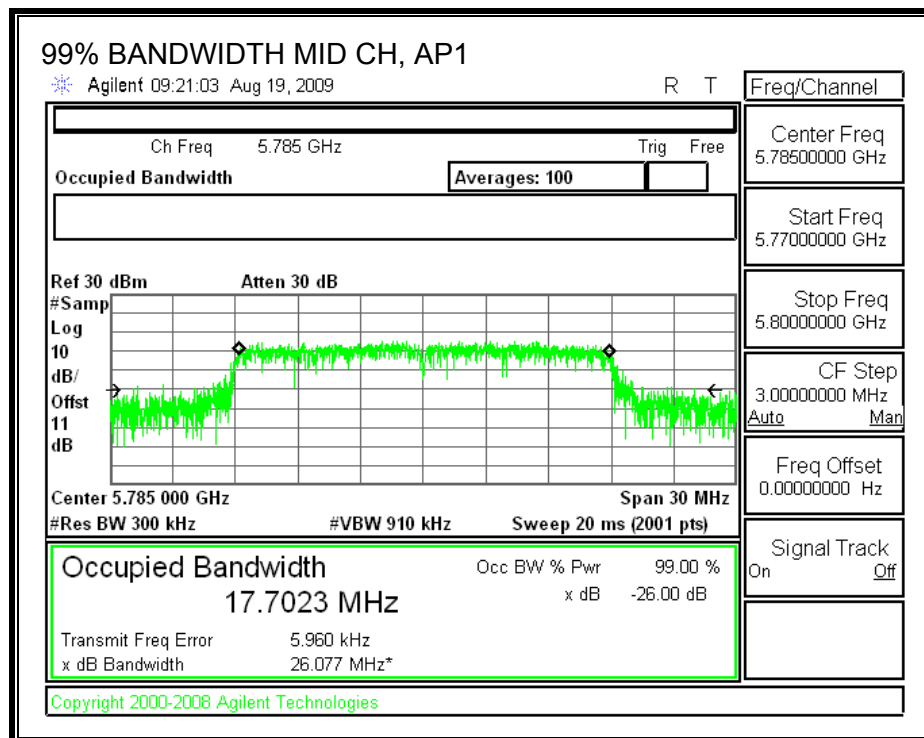
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

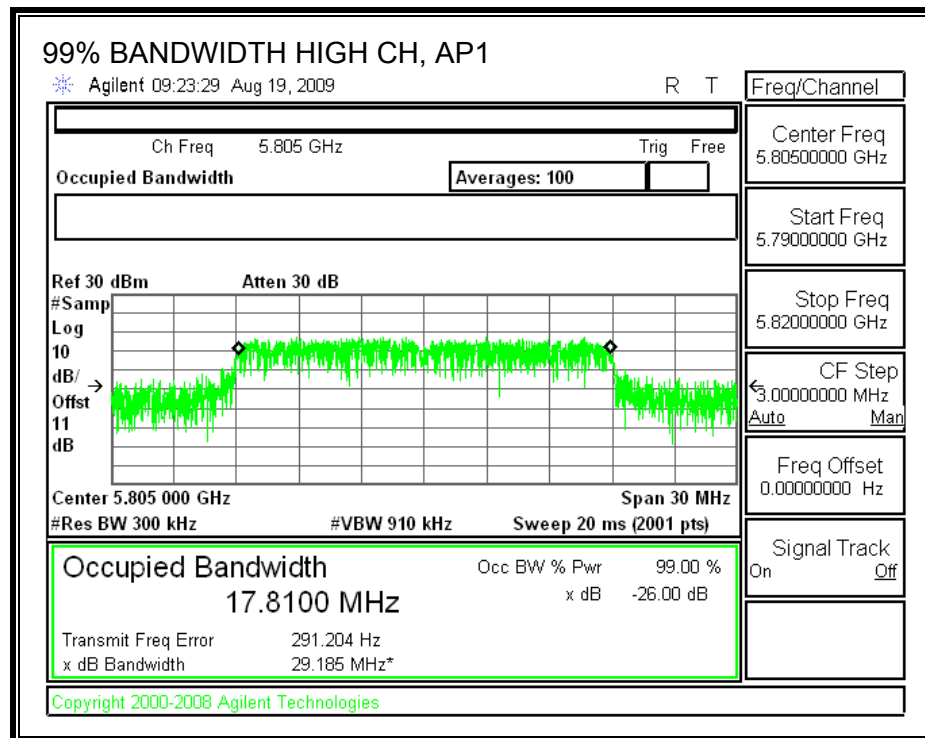
RESULTS

Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	5745	17.7868	17.6653	17.8303
Middle	5785	17.7023	17.6585	17.8478
High	5805	17.81	17.6808	17.8676

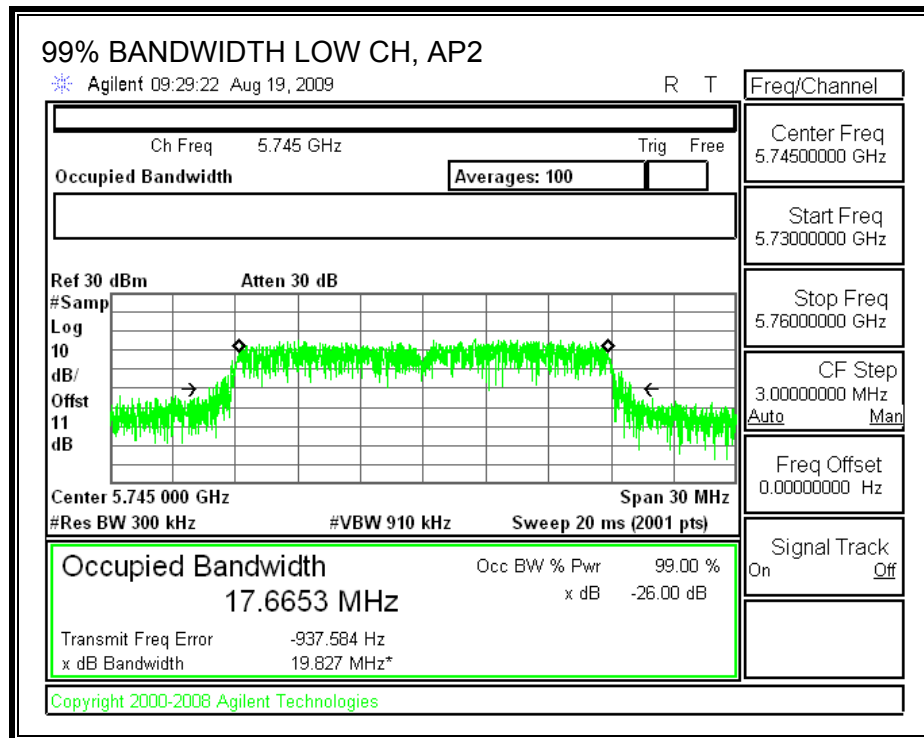
99% BANDWIDTH, AP1

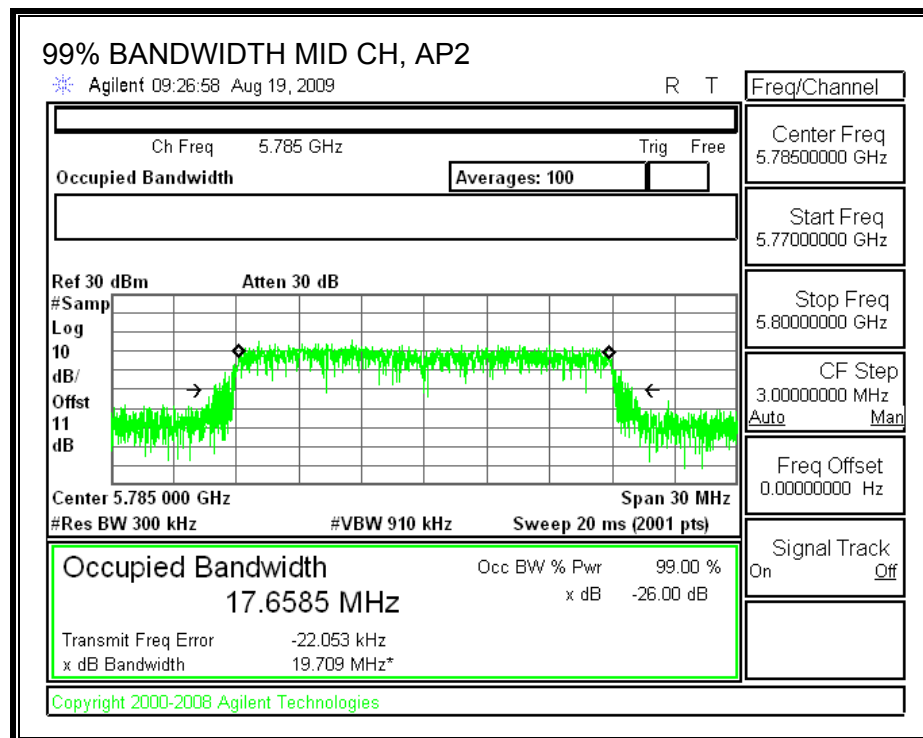


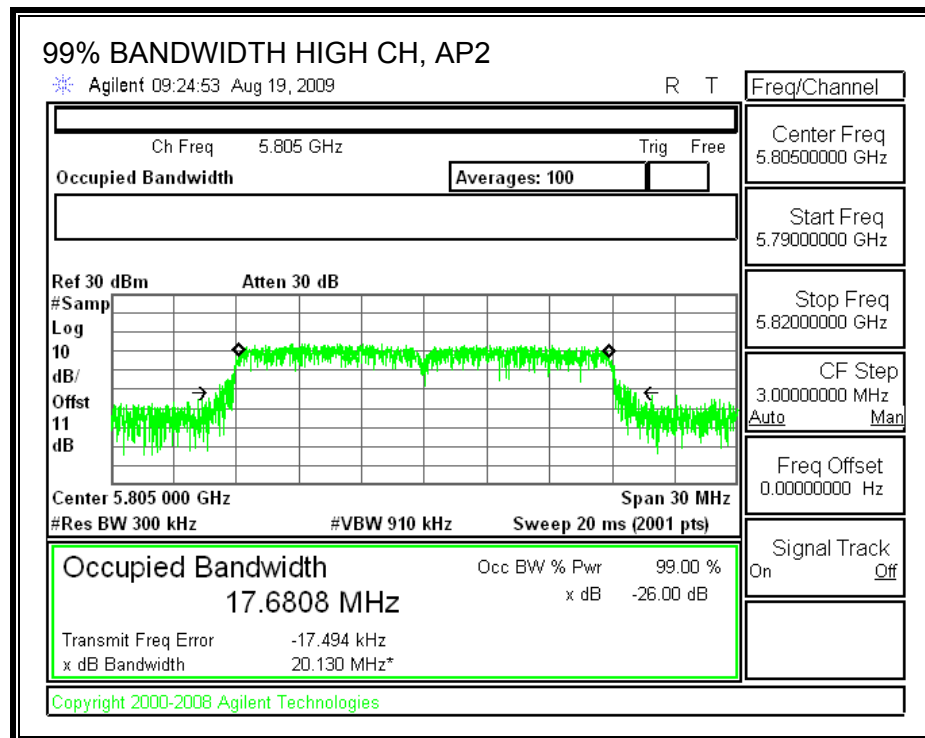




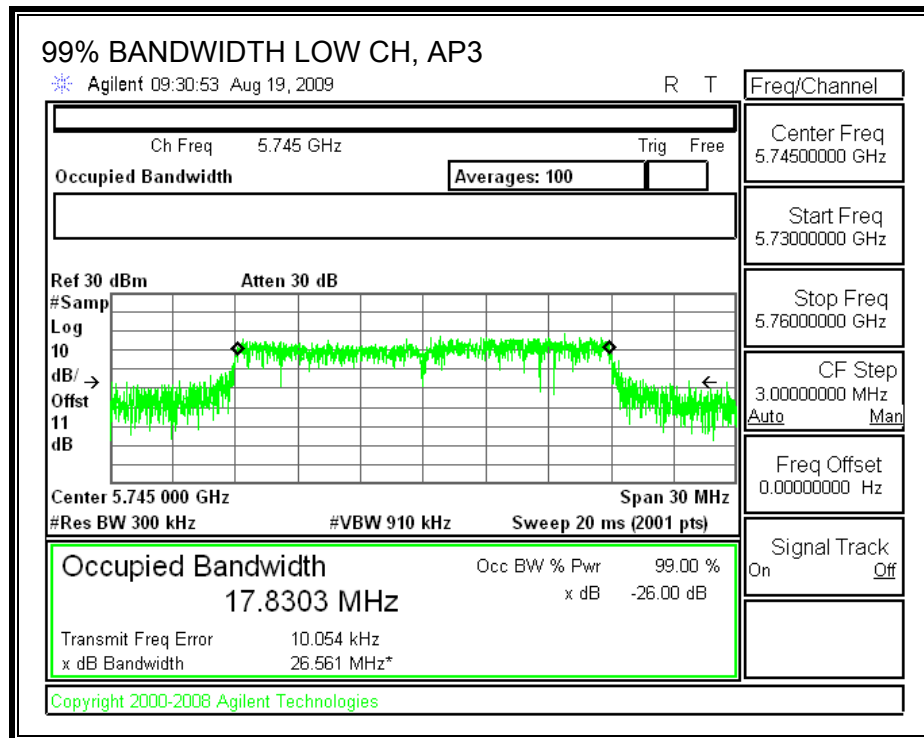
99% BANDWIDTH, AP2

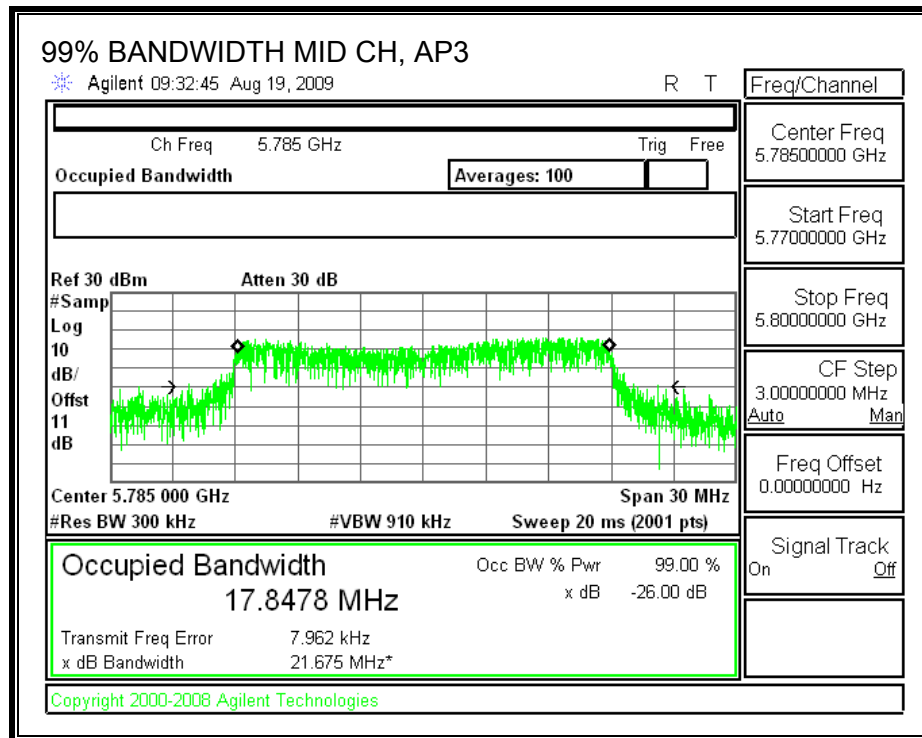


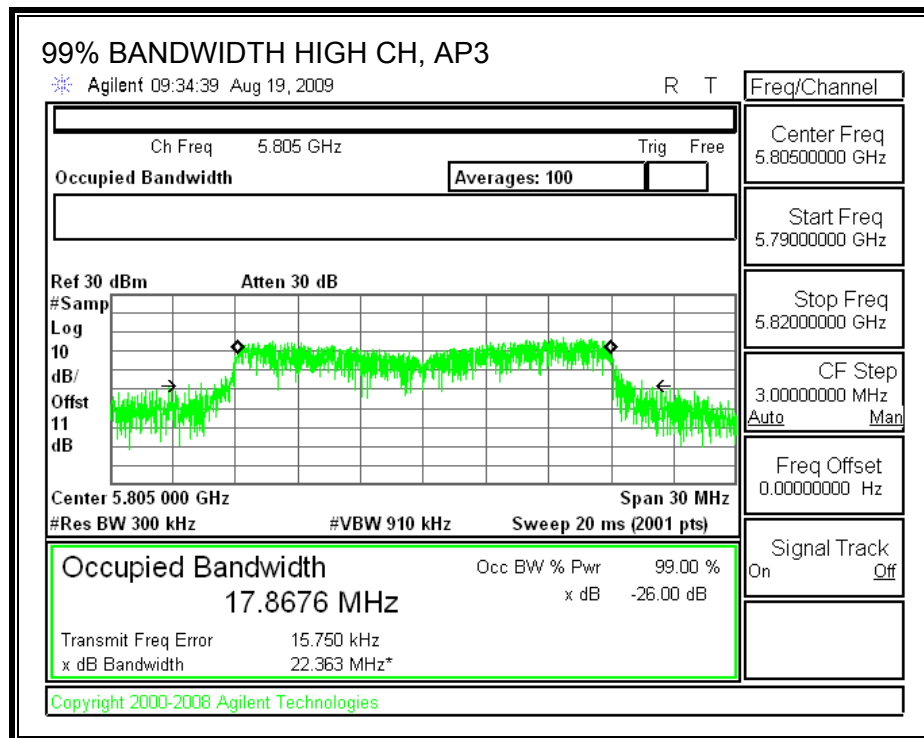




99% BANDWIDTH, AP3







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

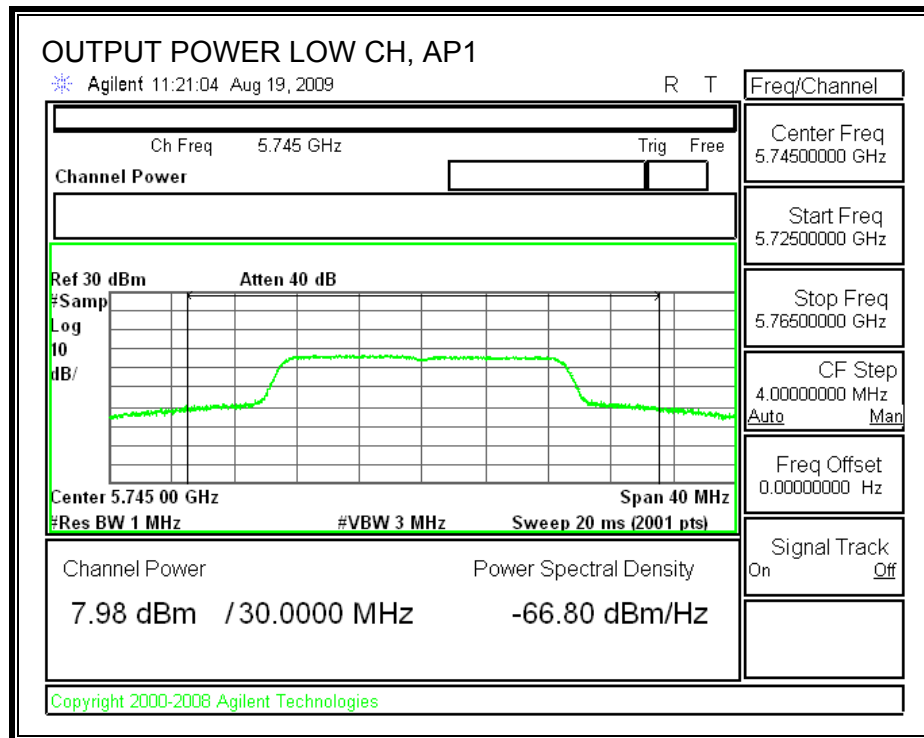
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

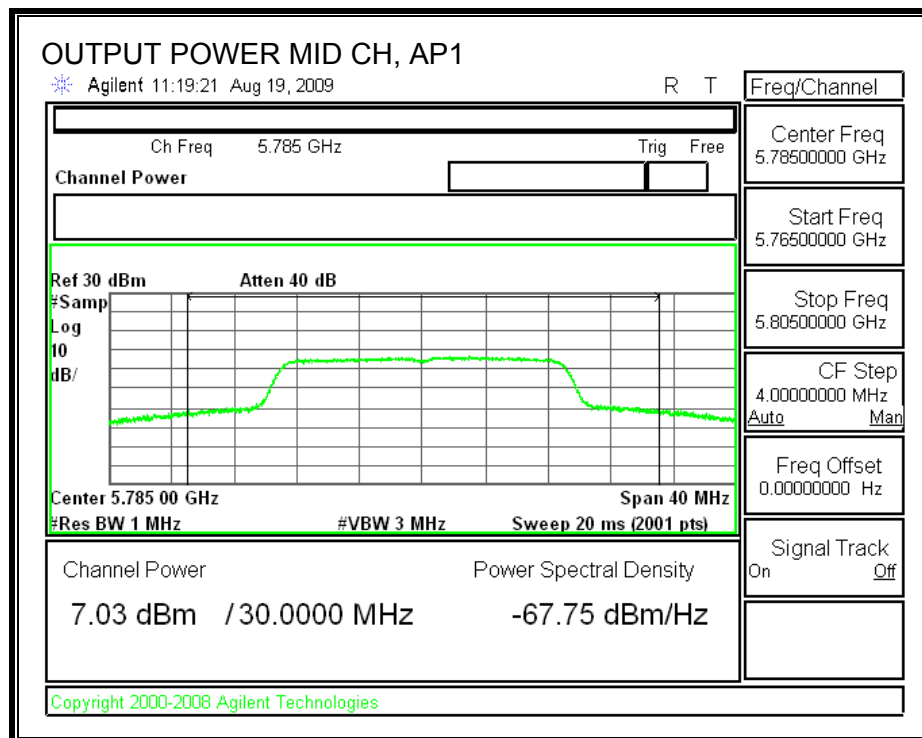
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

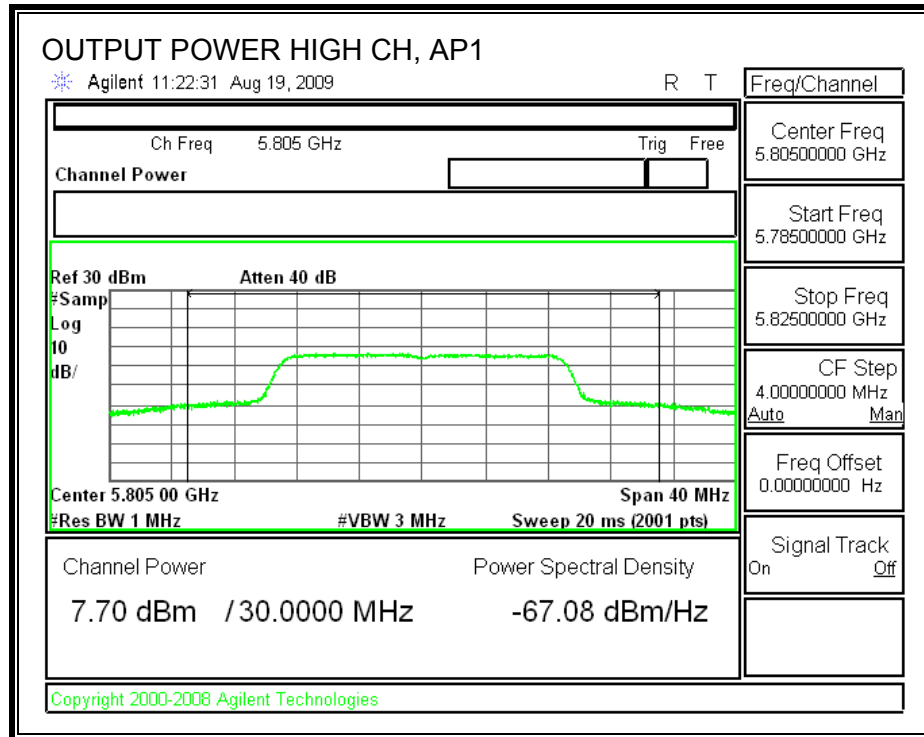
RESULTS

Channel	Frequency (MHz)	AP1 Power (dBm)	AP2 Power (dBm)	AP3 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	7.98	4.28	6.16	11.00	22.17	30.00	-7.83
Mid	5785	7.03	3.53	5.07	11.00	21.22	30.00	-8.78
High	5805	7.70	4.70	6.02	11.00	22.09	30.00	-7.91

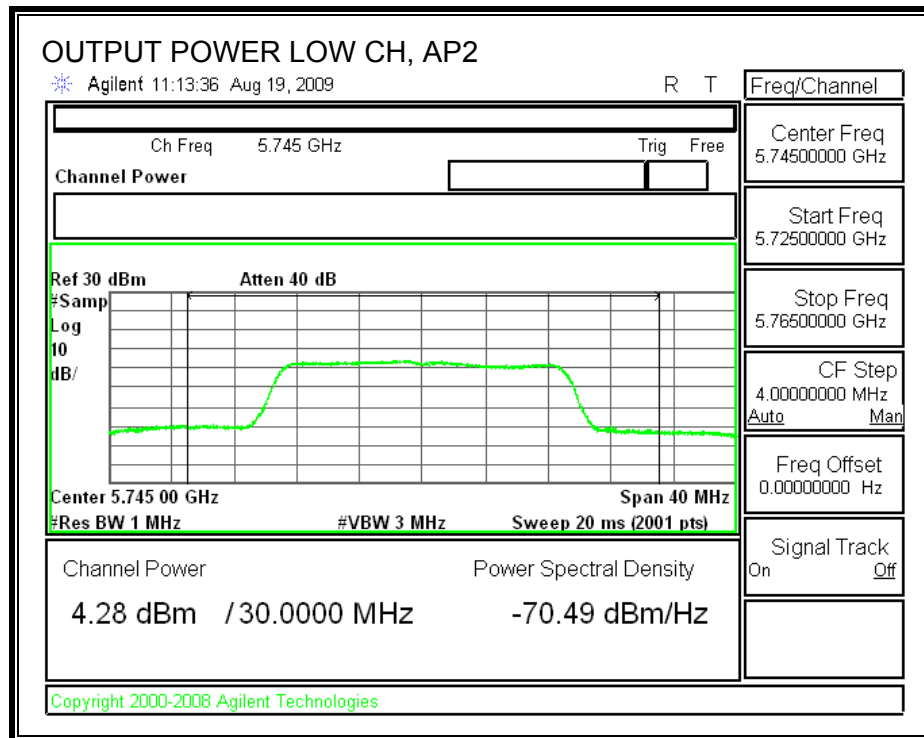
AP1 OUTPUT POWER

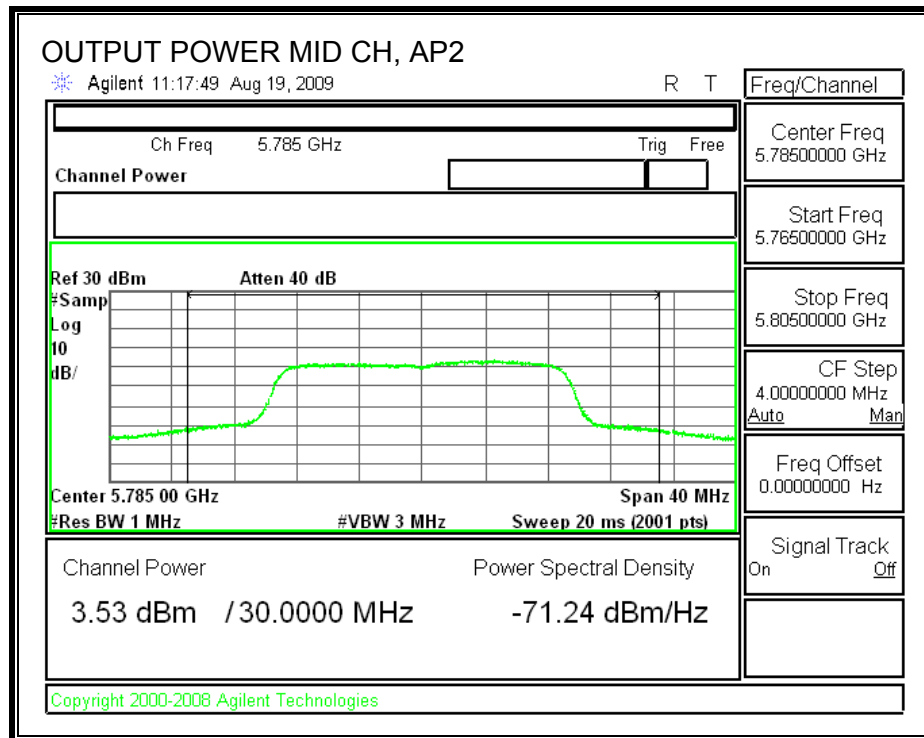


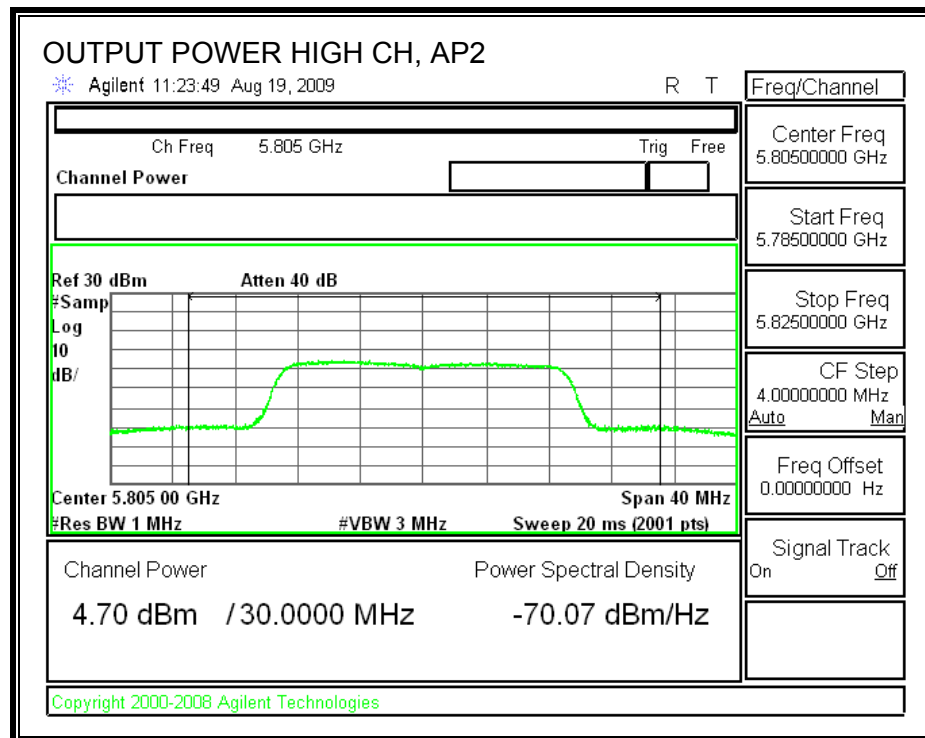




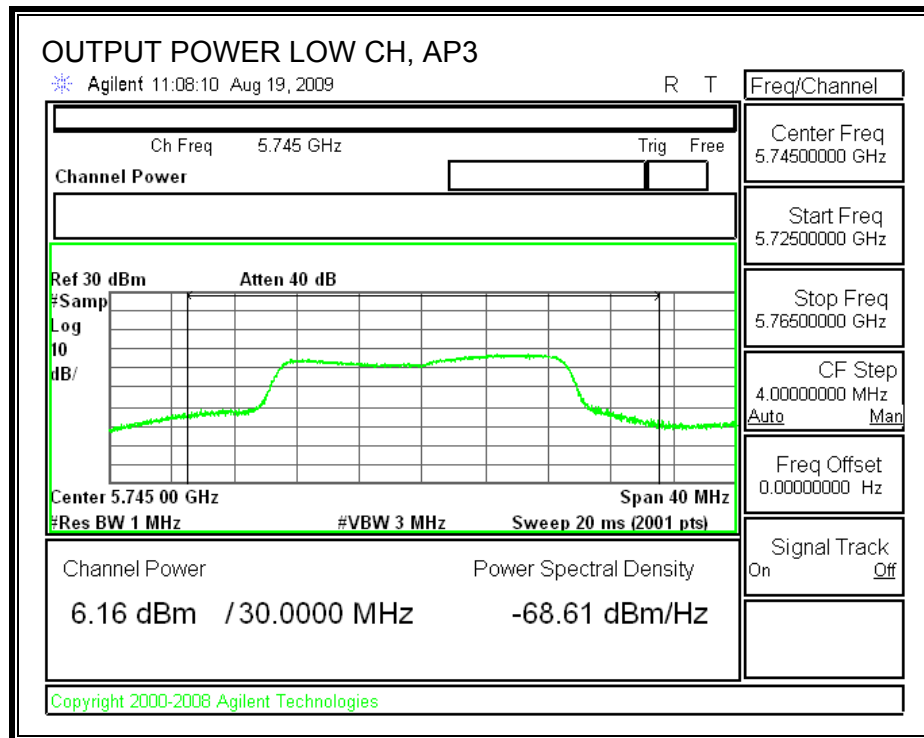
AP2 OUTPUT POWER

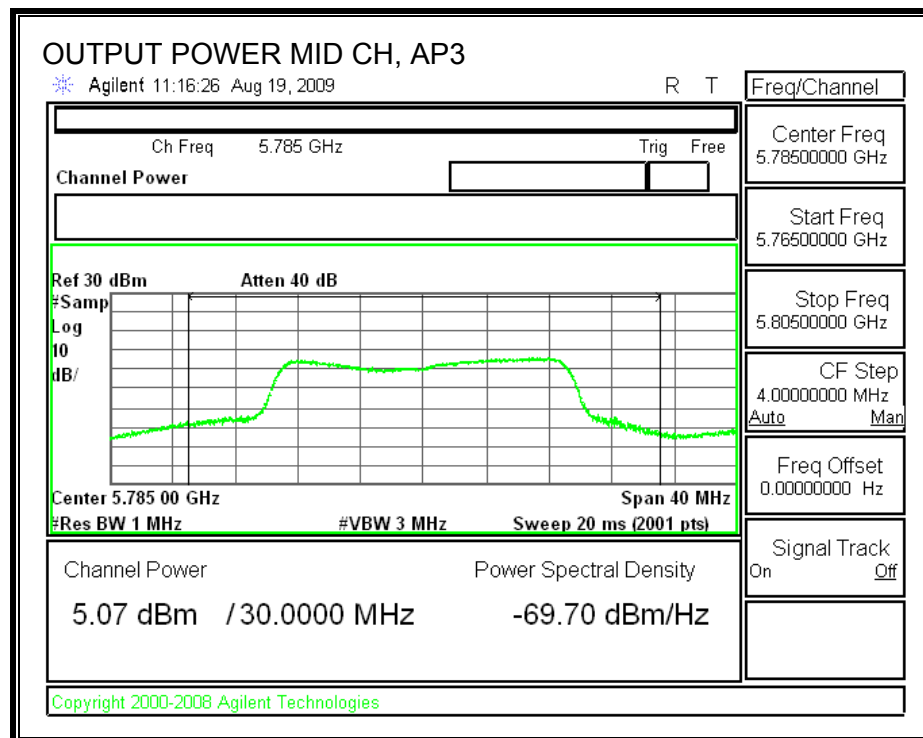


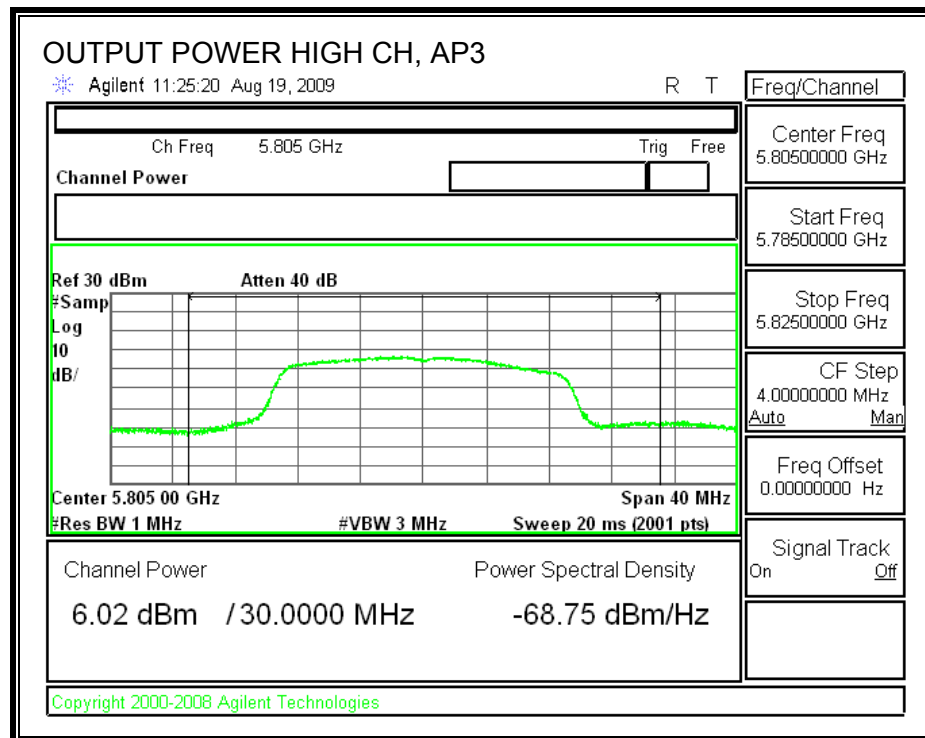




AP3 OUTPUT POWER







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.

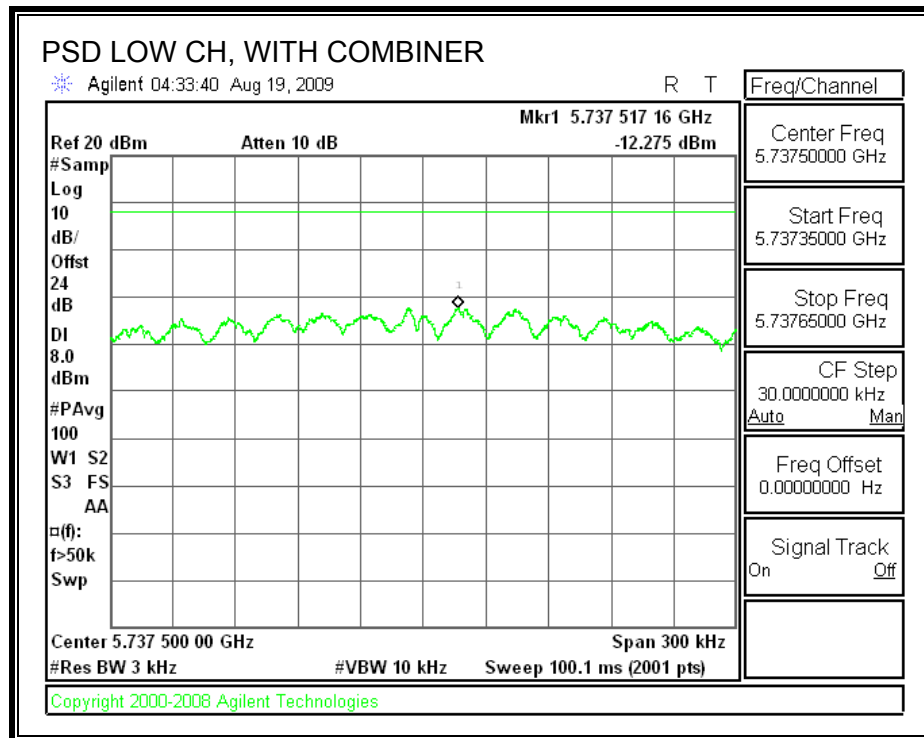
TEST PROCEDURE

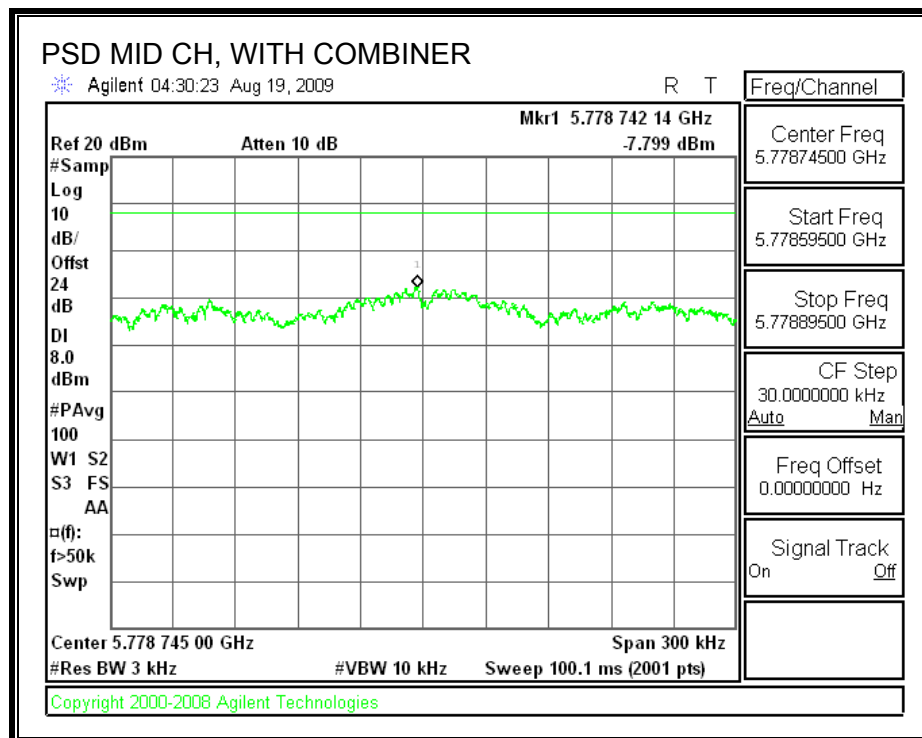
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

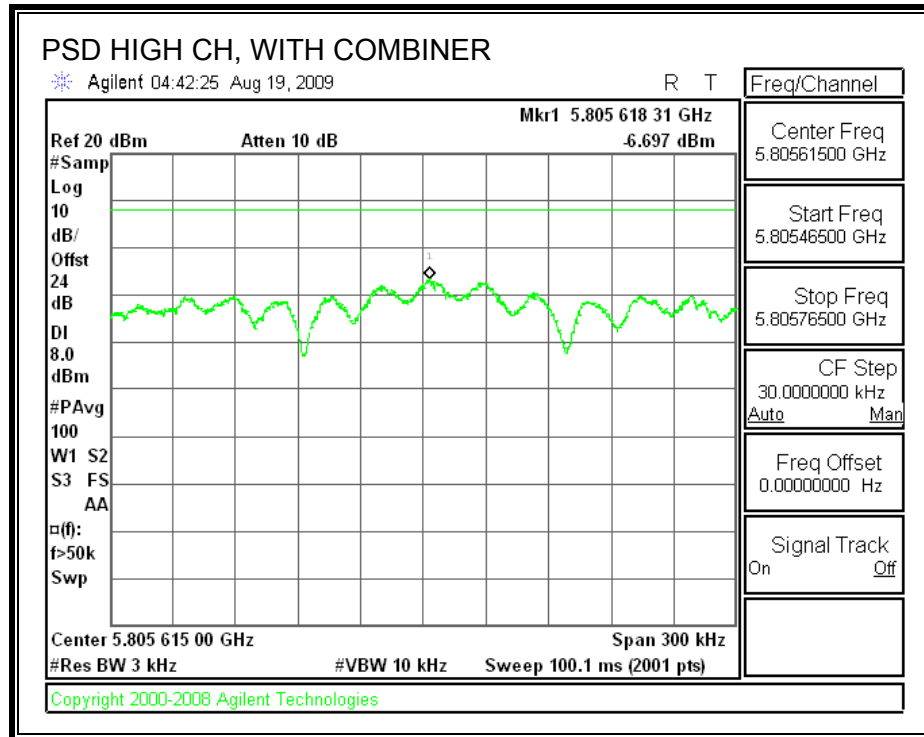
RESULTS:

Channel	Frequency (MHz)	PSD with Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-12.275	8	-20.28
Middle	5785	-7.799	8	-15.80
High	5805	-6.697	8	-14.70

POWER SPECTRAL DENSITY, WITH COMBINER







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.

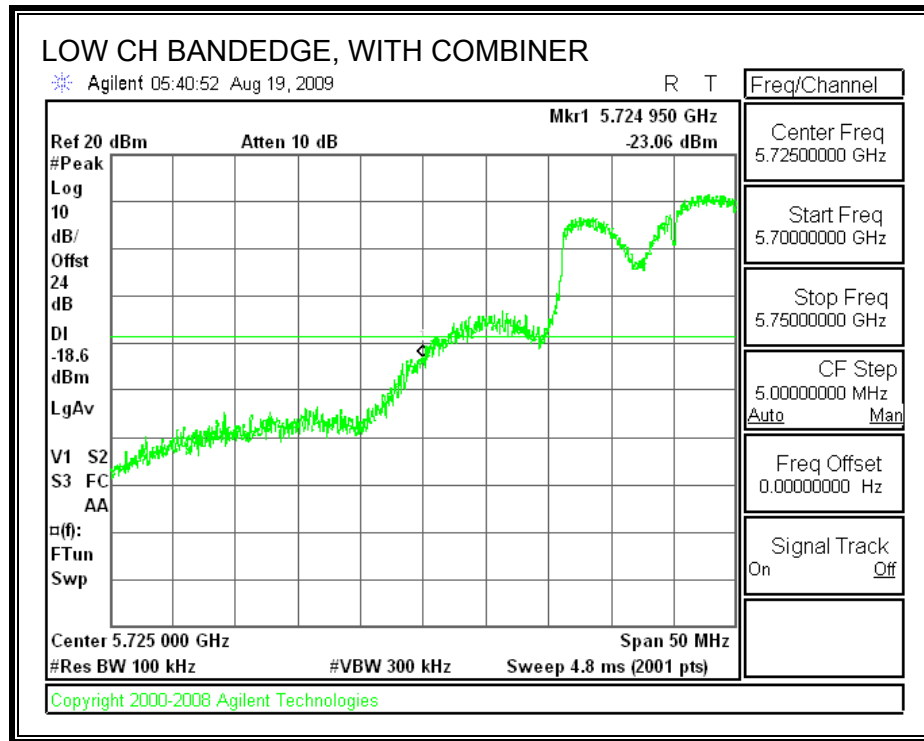
TEST PROCEDURE

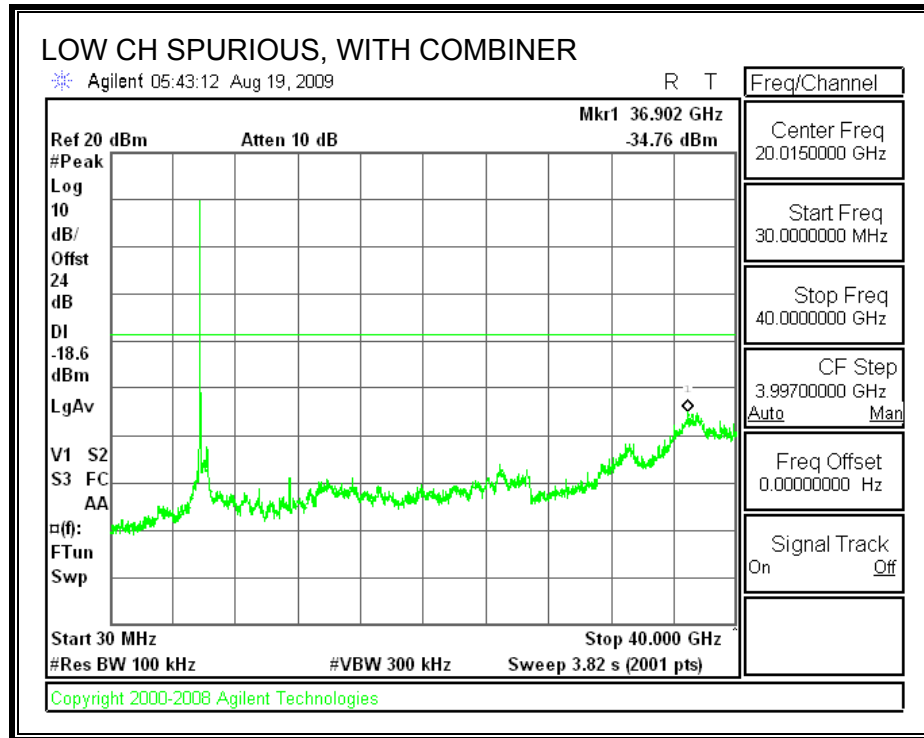
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

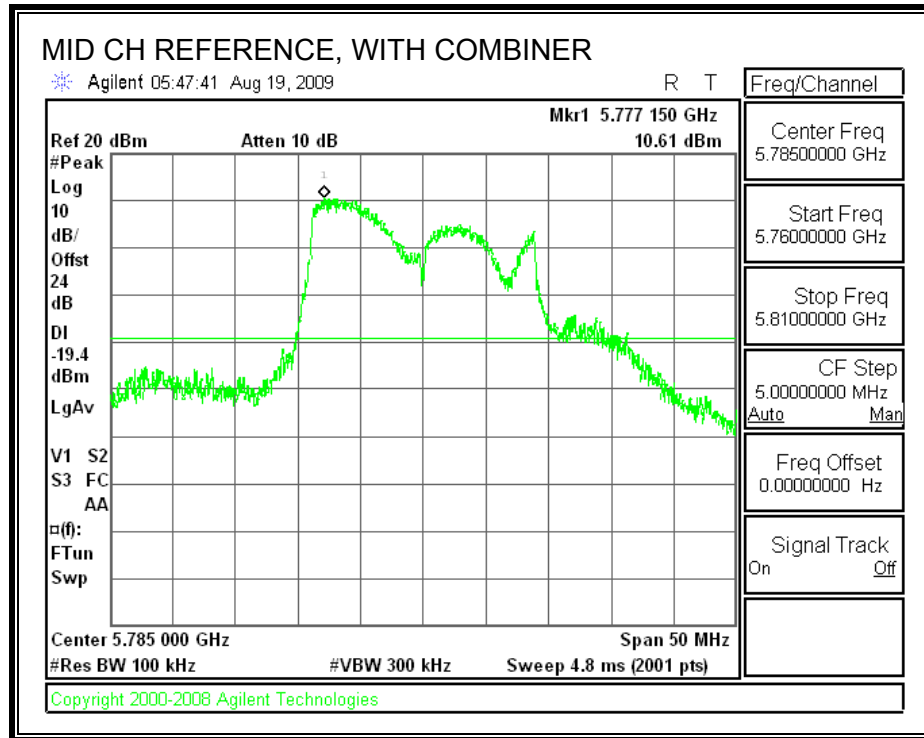
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

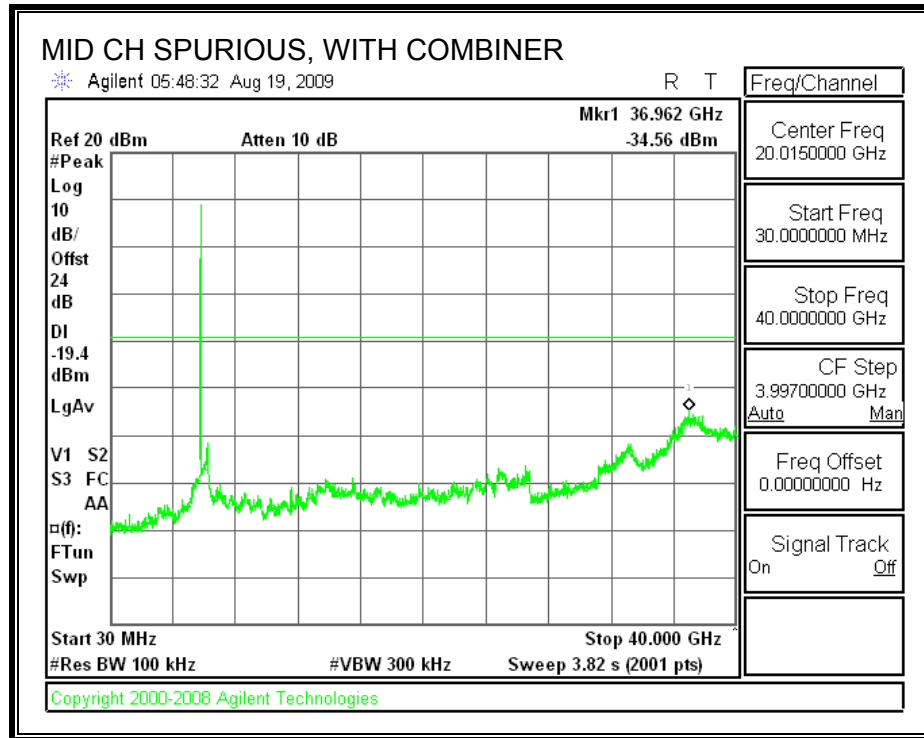
RESULTS

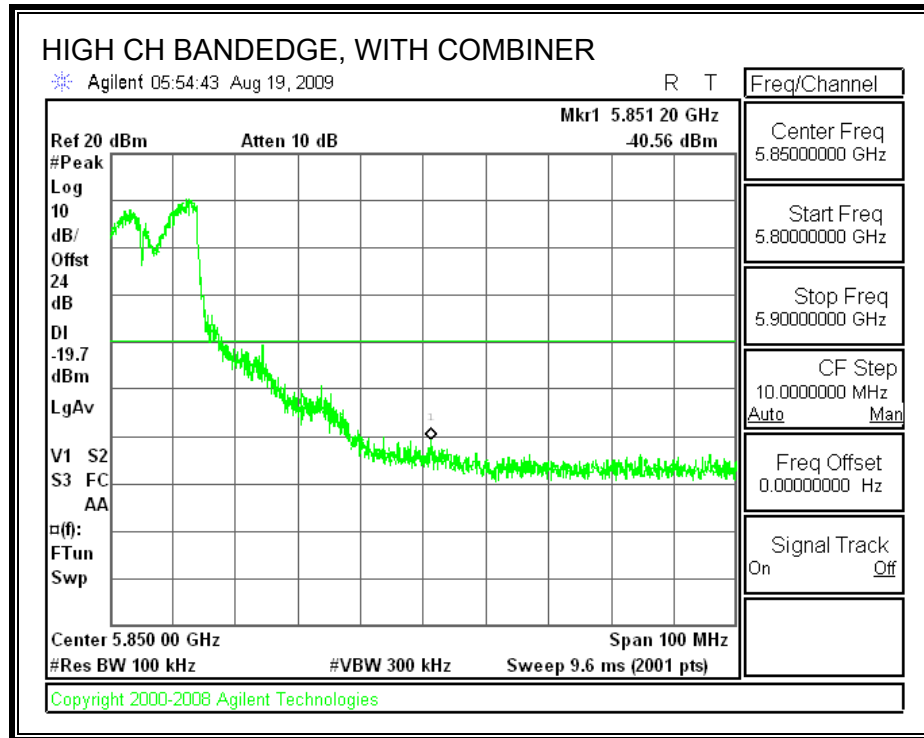
SPURIOUS EMISSIONS WITH COMBINER

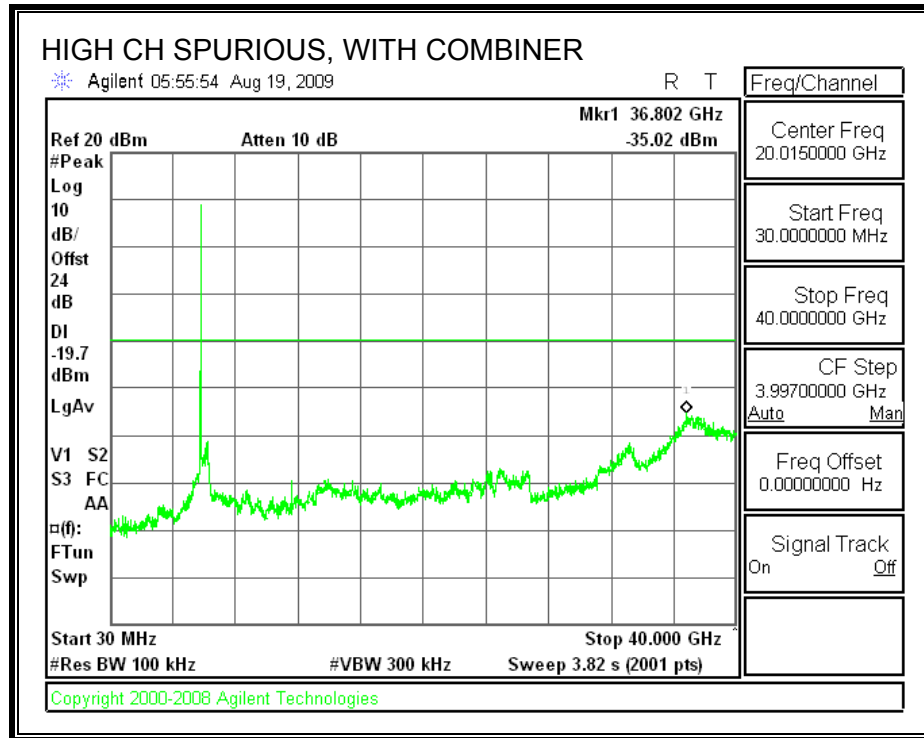












7.6. 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND

7.6.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

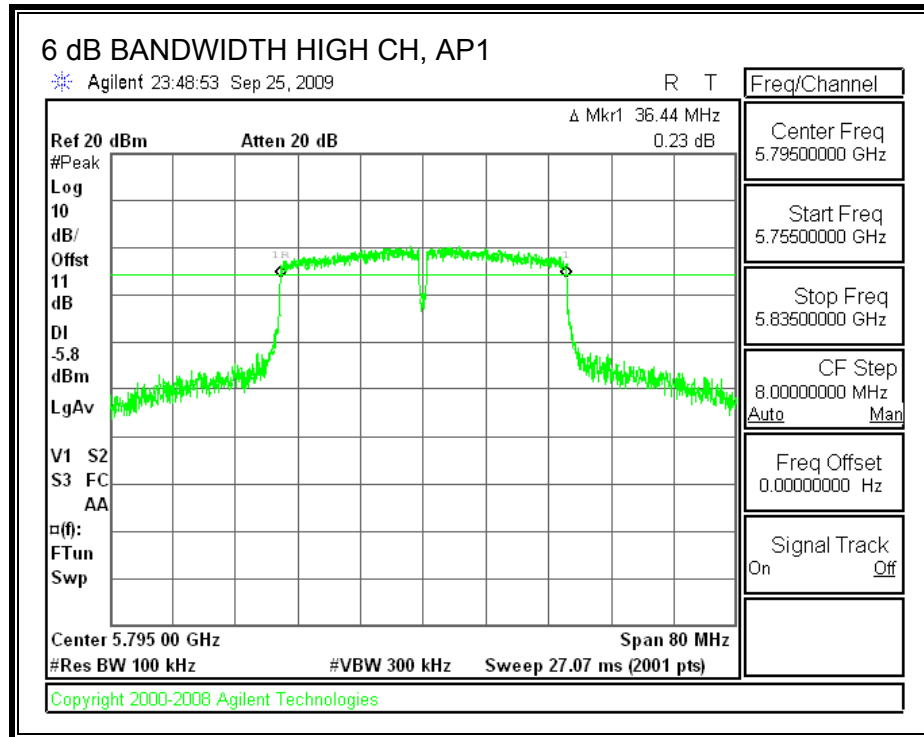
The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

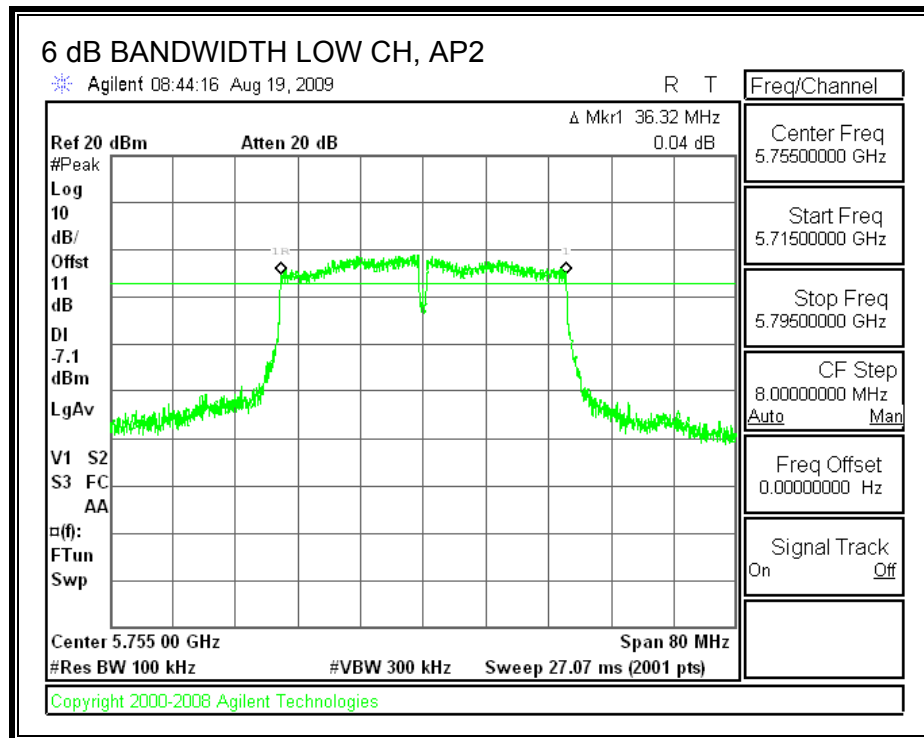
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

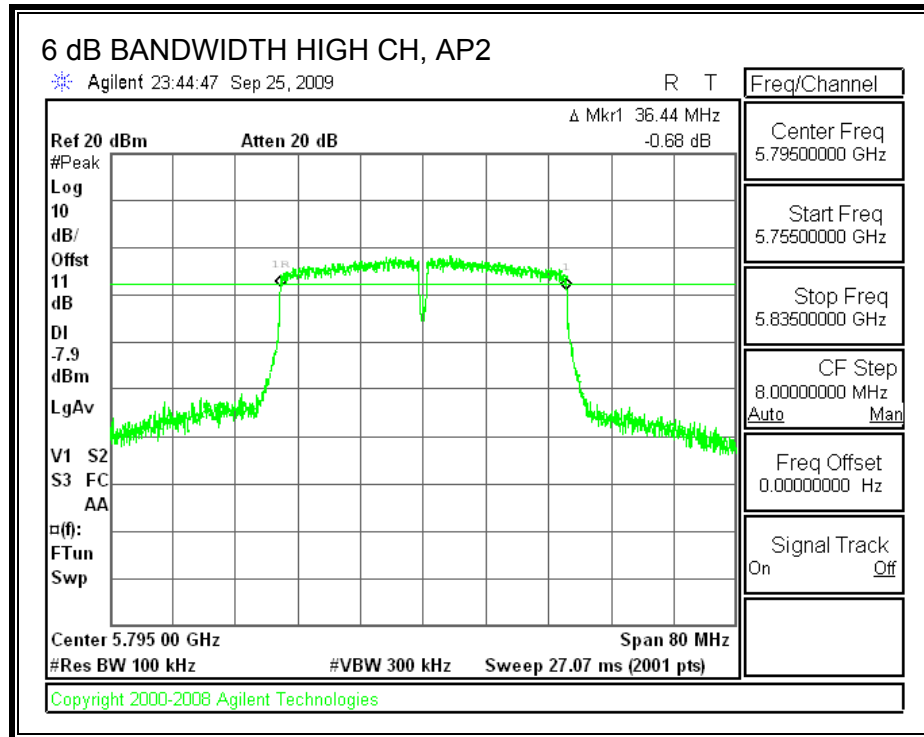
RESULTS

Channel	Frequency (MHz)	AP1 6 dB BW (MHz)	AP2 6 dB BW (MHz)	AP3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5755	36.32	36.32	32.28	0.5
High	5795	36.44	36.44	36.32	0.5

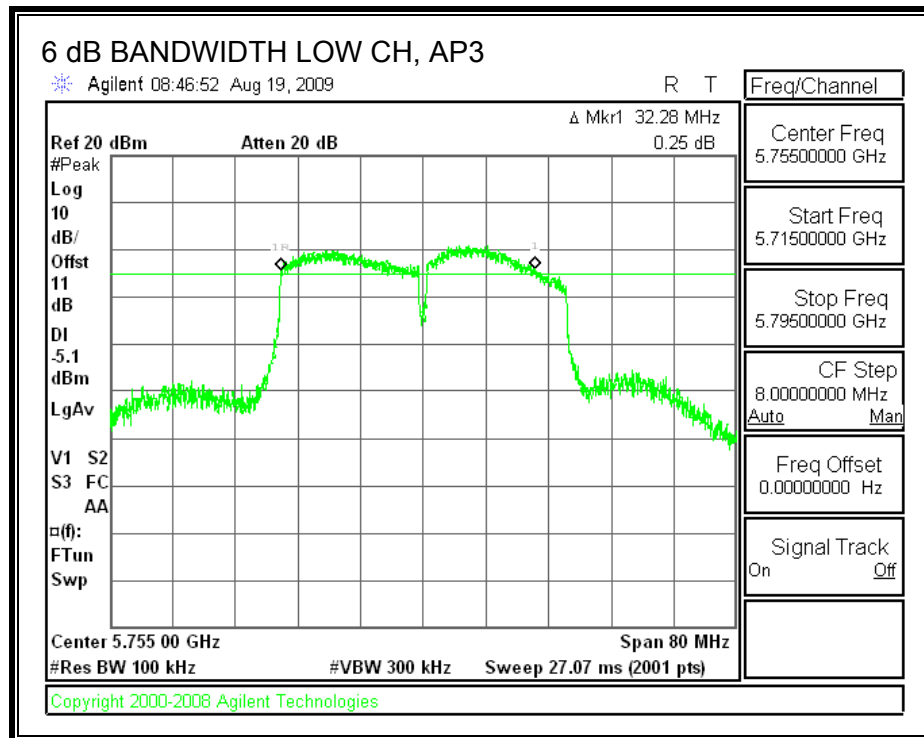


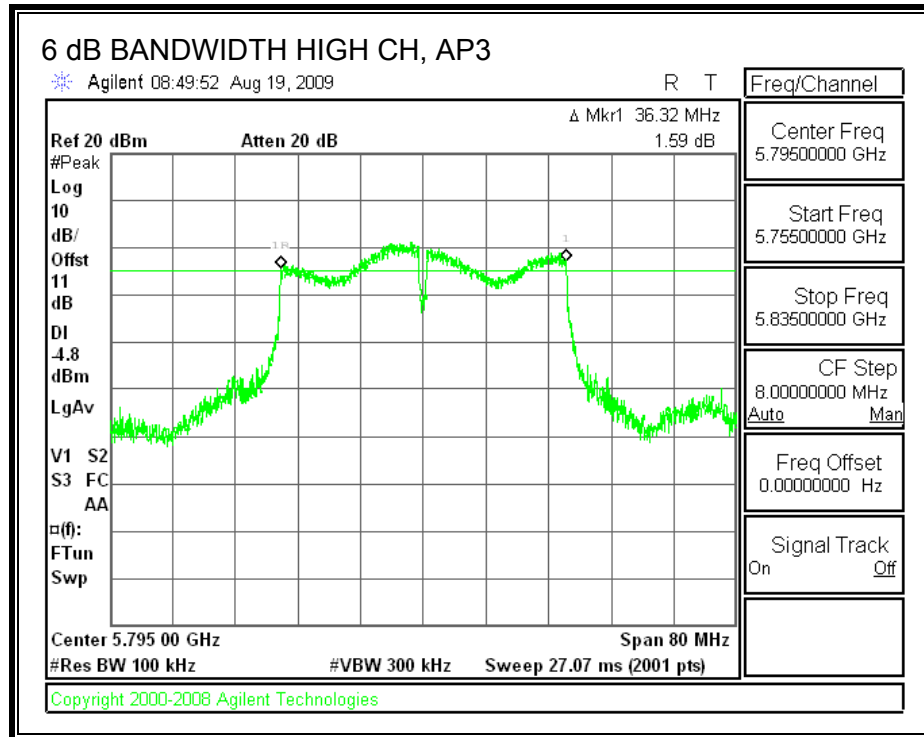
6 dB BANDWIDTH, AP2





6 dB BANDWIDTH, AP3





7.6.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

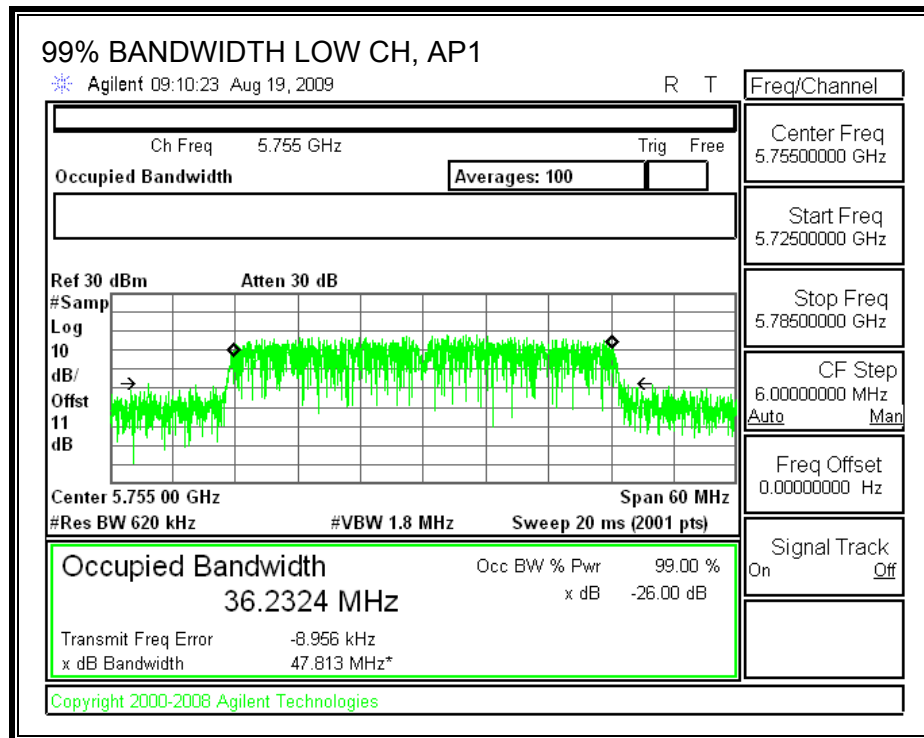
TEST PROCEDURE

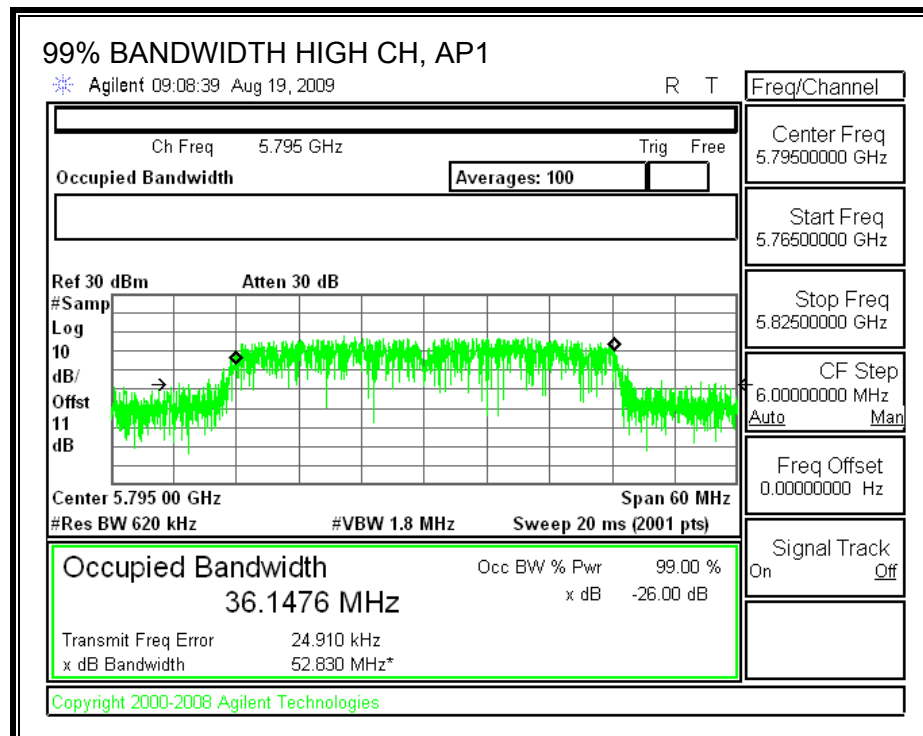
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

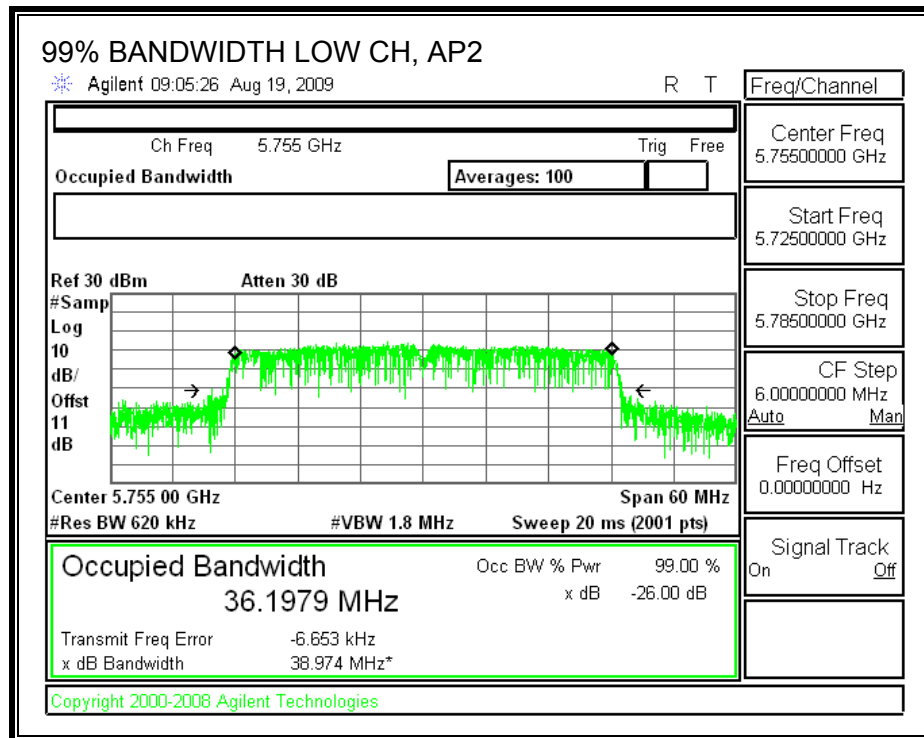
Channel	Frequency (MHz)	AP1 99% Bandwidth (MHz)	AP2 99% Bandwidth (MHz)	AP3 99% Bandwidth (MHz)
Low	5755	36.2324	36.1979	35.7266
High	5795	36.1476	36.2028	36.3614

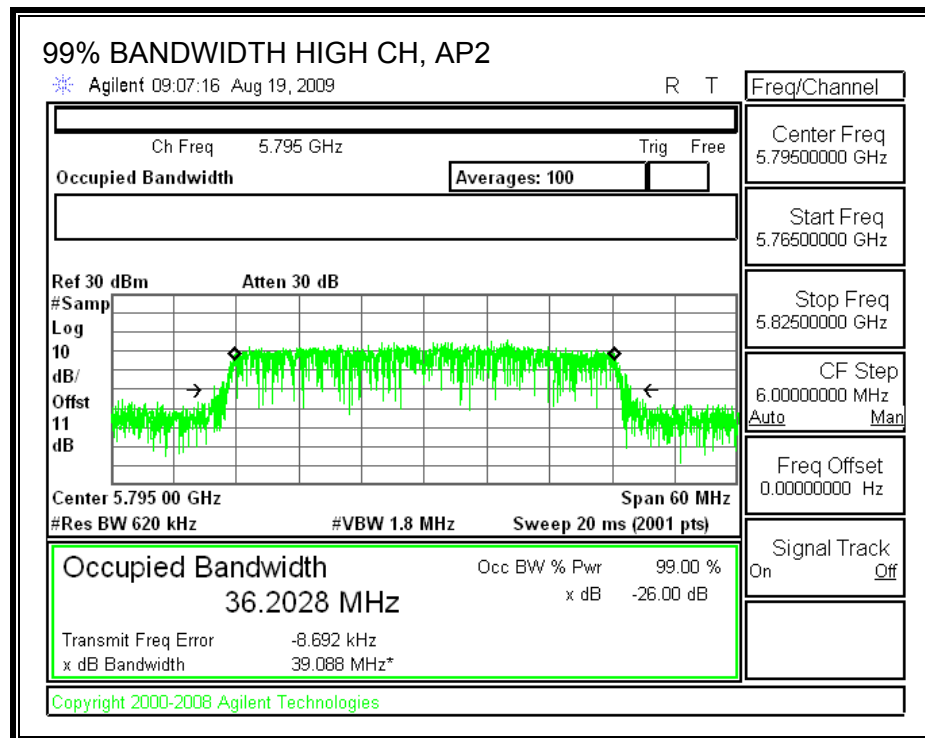
99% BANDWIDTH, AP1



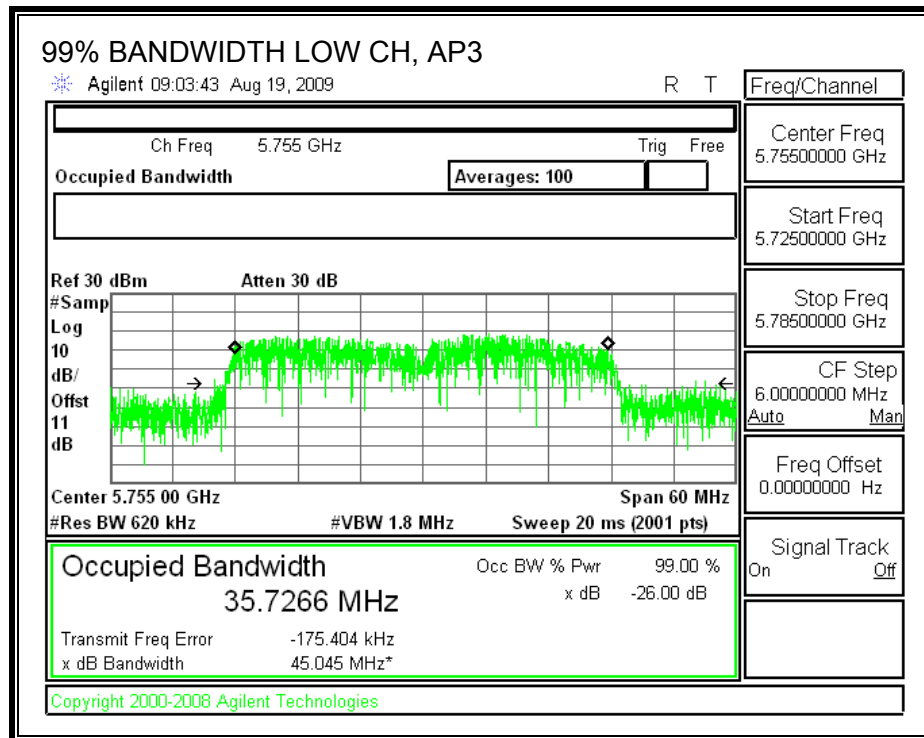


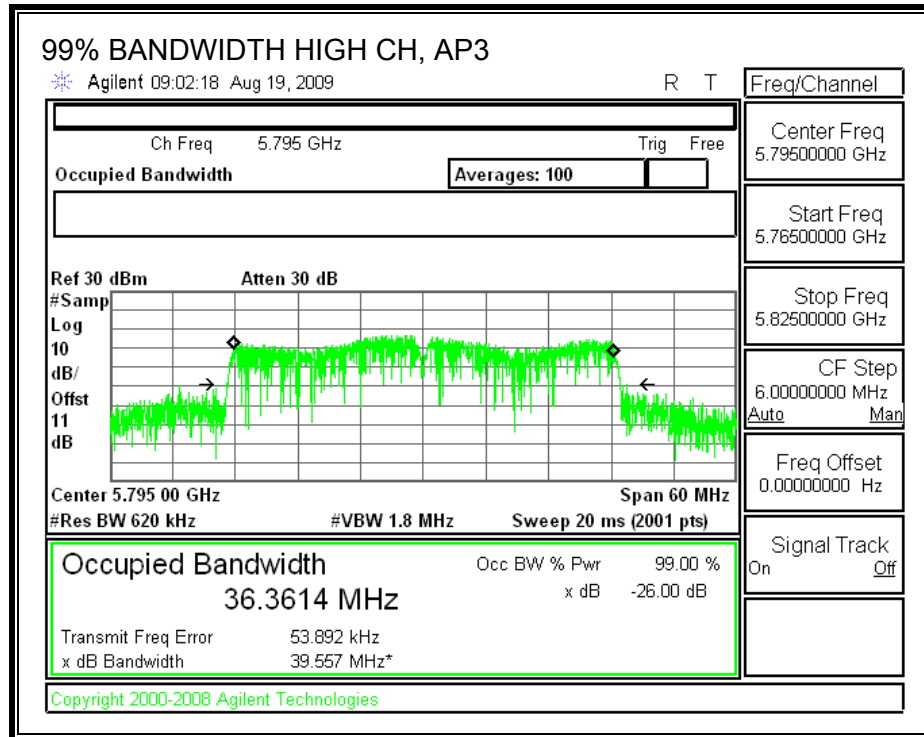
99% BANDWIDTH, AP2





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

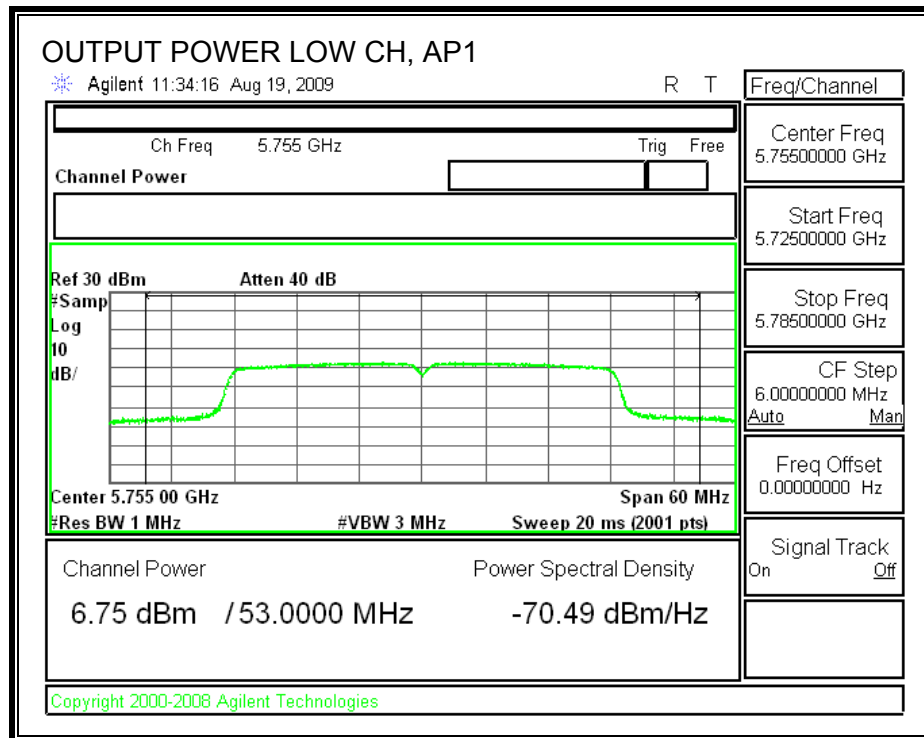
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 26dB bandwidth.

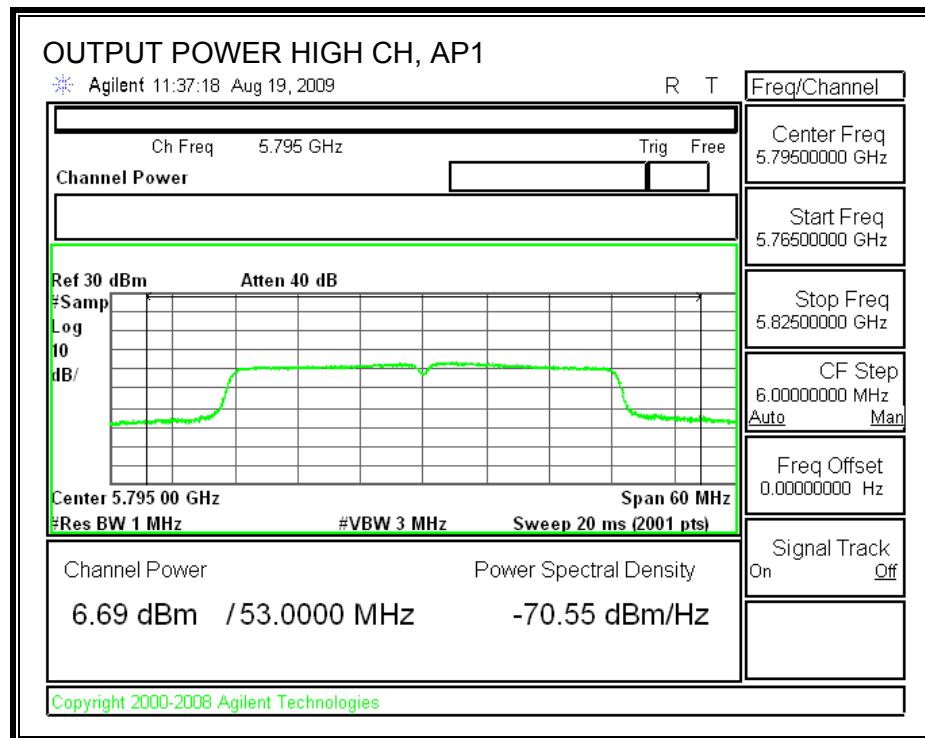
Maximum Conducted Output Power based on RMS averaging over a time interval is measured in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

RESULTS

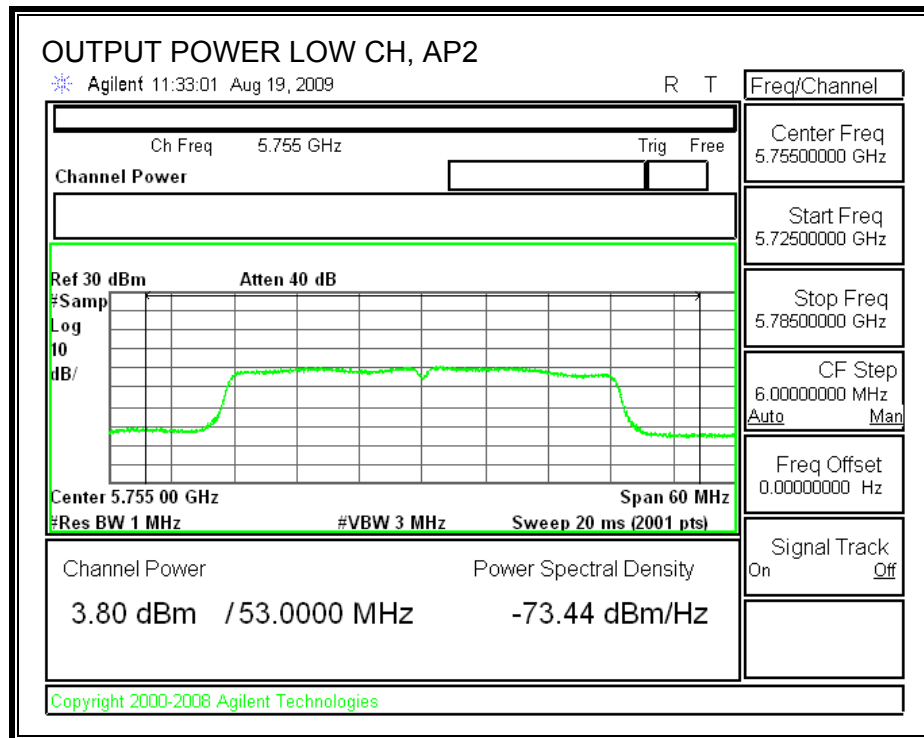
Channel	Frequency (MHz)	AP1 Power (dBm)	AP2 Power (dBm)	AP3 Power (dBm)	Attenuator + Cable Loss (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5755	6.75	3.80	5.86	11.00	21.41	30.00	-8.59
High	5795	6.69	4.40	5.61	11.00	21.44	30.00	-8.56

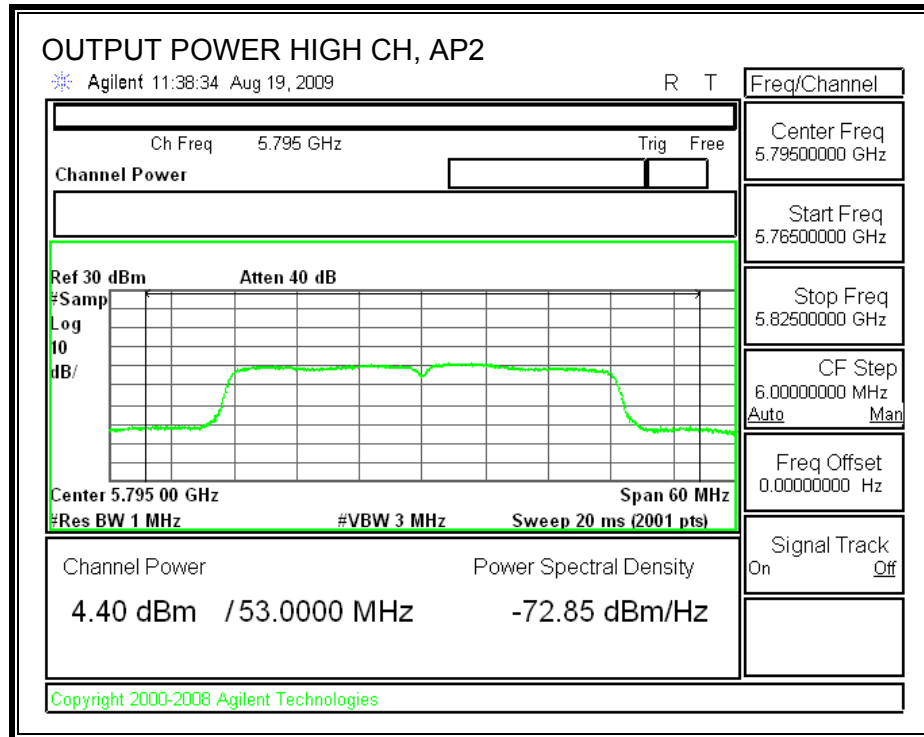
AP1 OUTPUT POWER



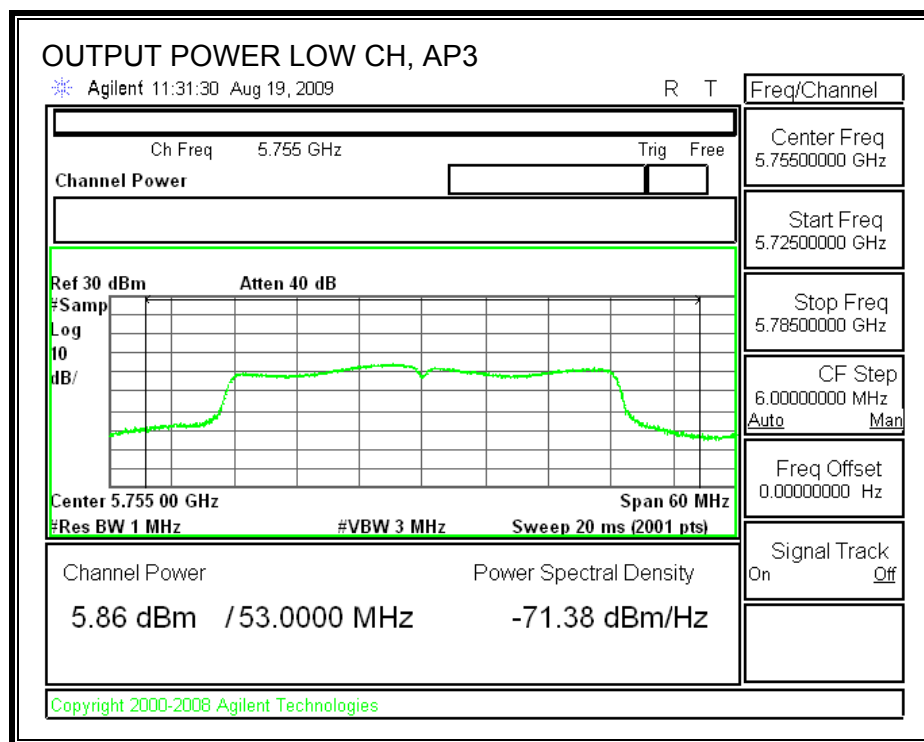


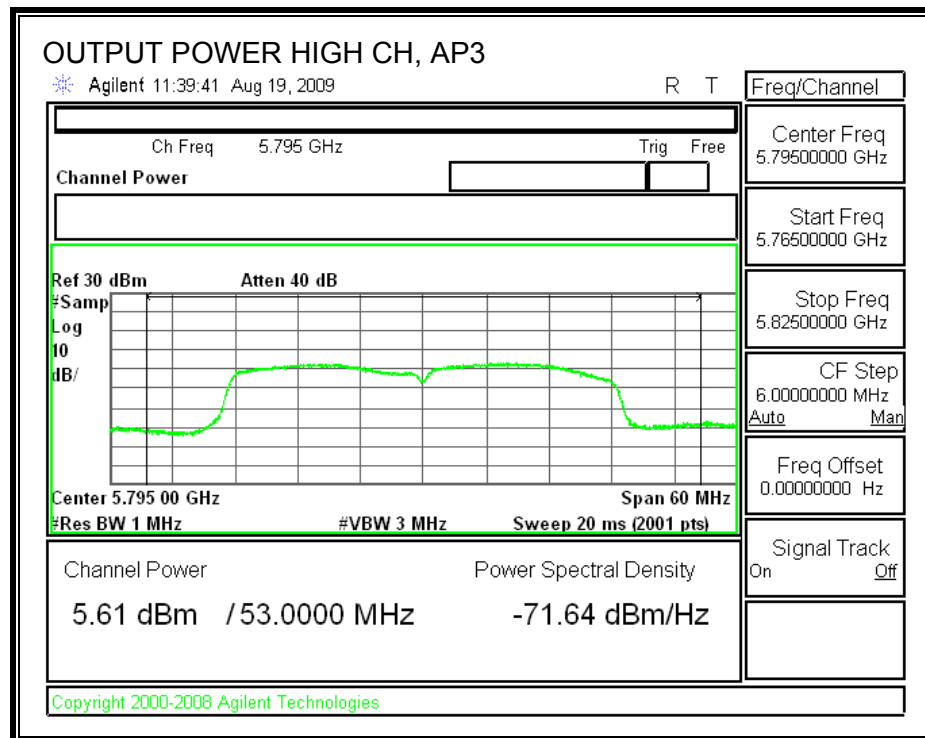
AP2 OUTPUT POWER





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.

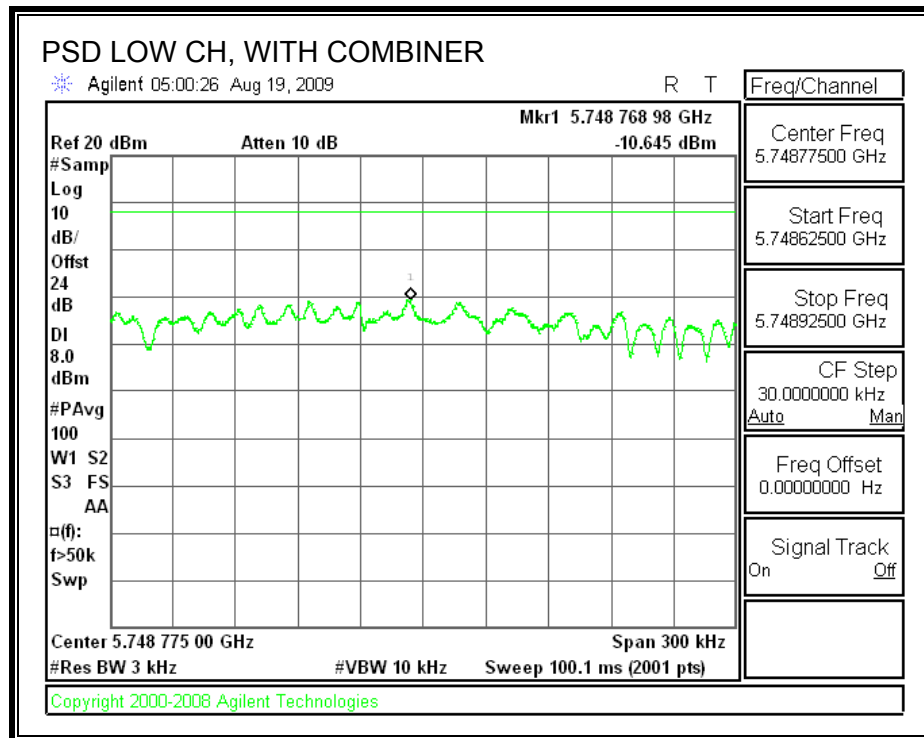
TEST PROCEDURE

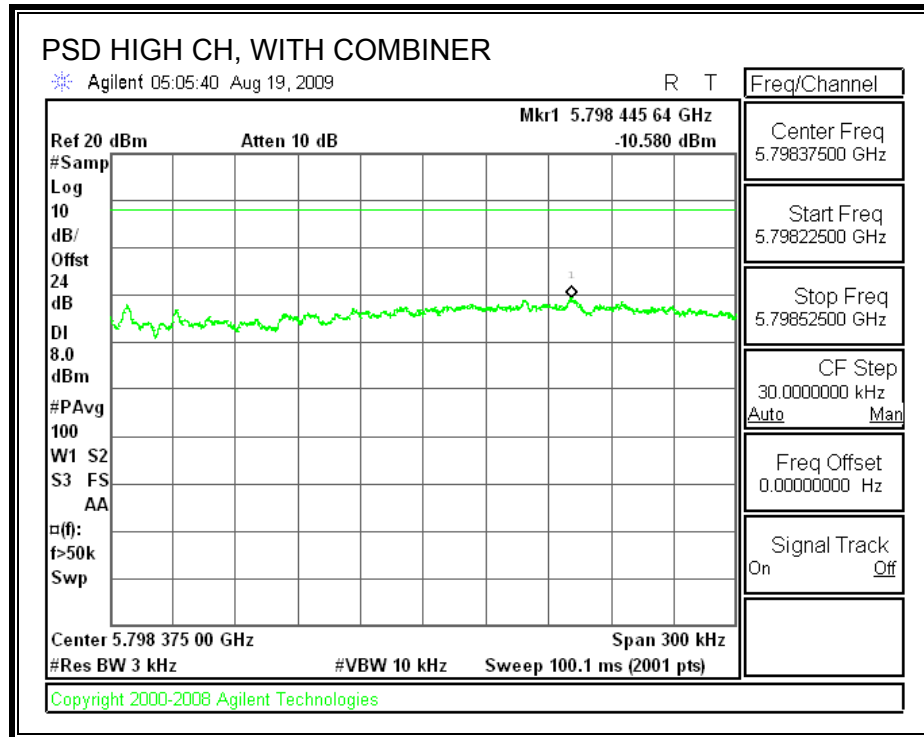
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS:

Channel	Frequency (MHz)	PSD with Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5755	-10.645	8	-18.65
High	5795	-10.580	8	-18.58

POWER SPECTRAL DENSITY, WITH COMBINER





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.

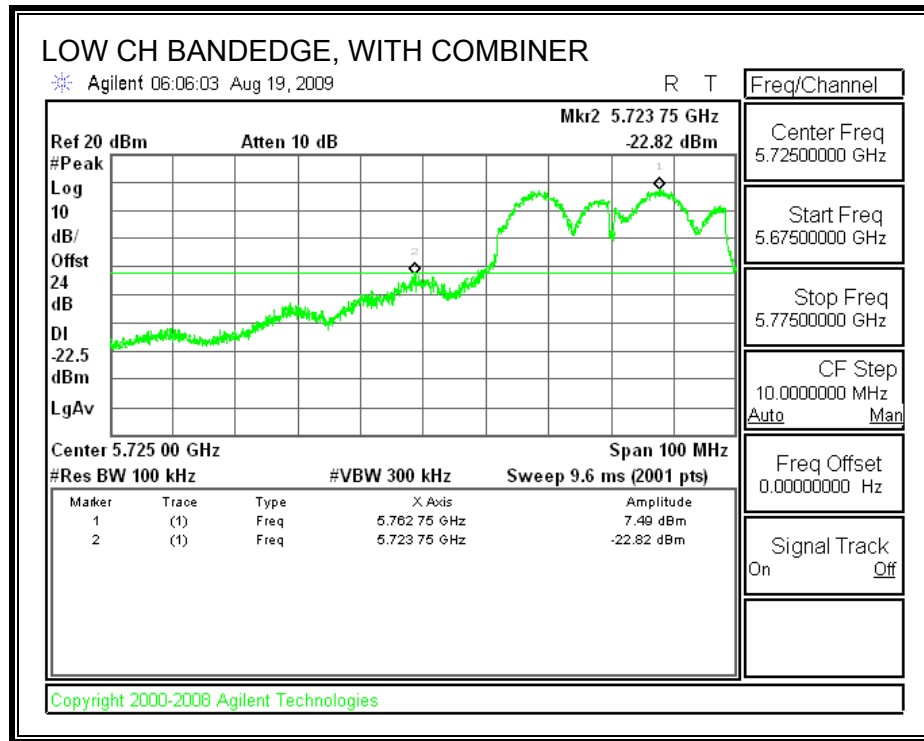
TEST PROCEDURE

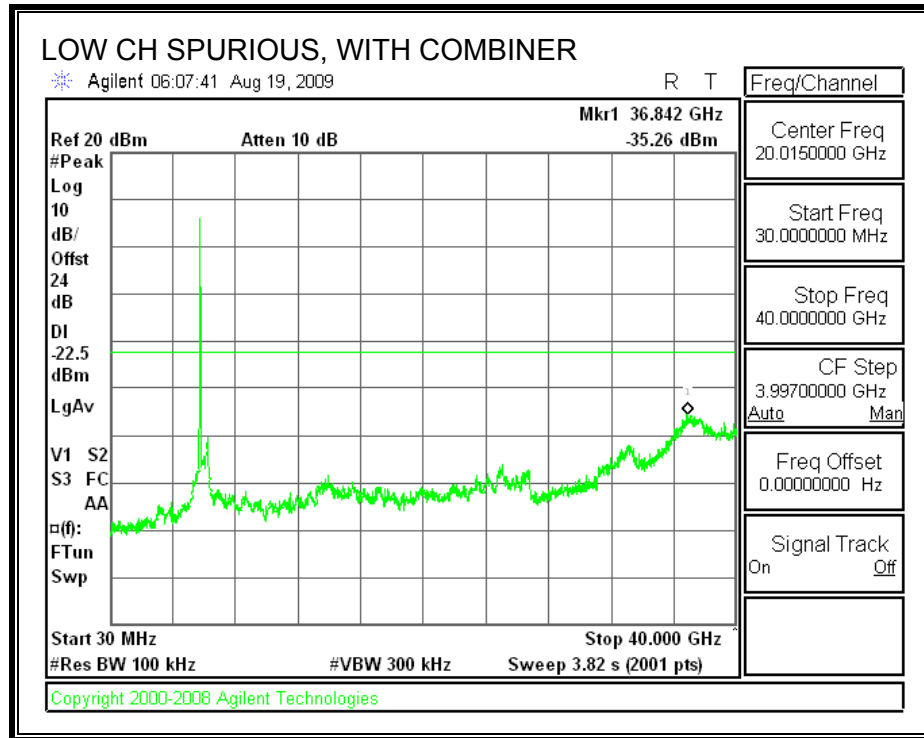
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

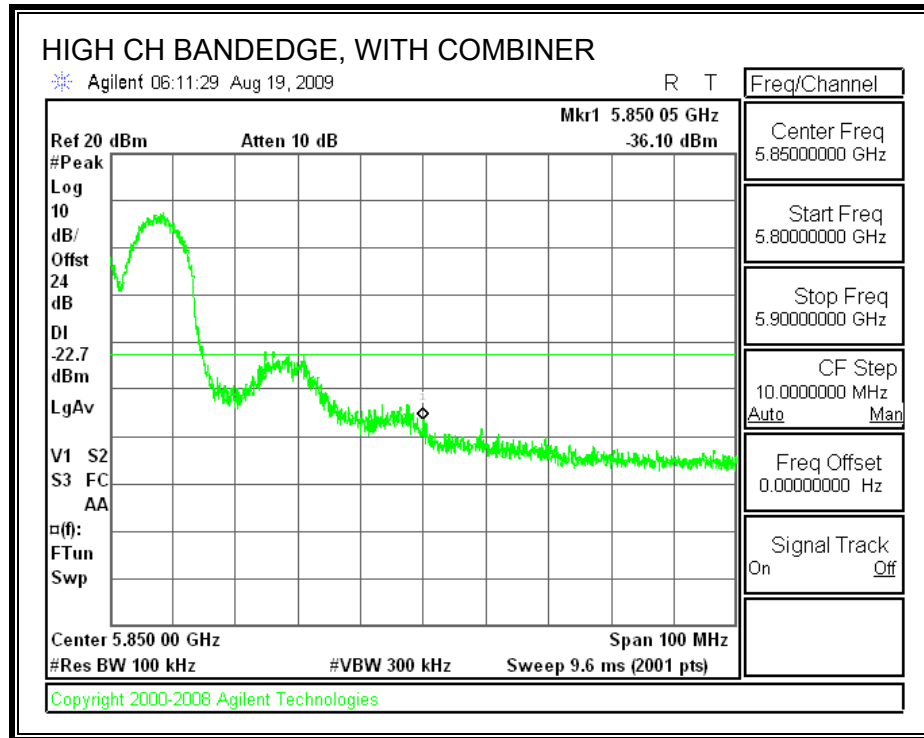
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

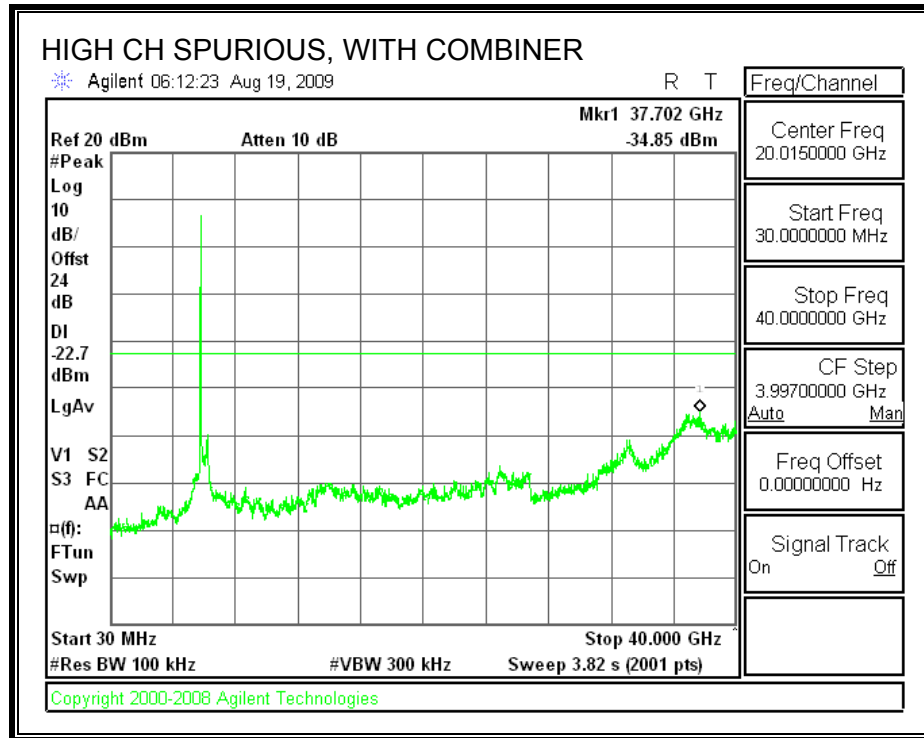
RESULTS

SPURIOUS EMISSIONS WITH COMBINER









7.7. RECEIVER CONDUCTED SPURIOUS EMISSIONS

LIMITS

IC RSS-GEN 7.2.3.1

Antenna Conducted Measurement: Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts (-57 dBm) in the band 30-1000 MHz, or 5 nanowatts (-53 dBm) above 1 GHz.

TEST PROCEDURE

IC RSS-GEN 4.10, Conducted Method

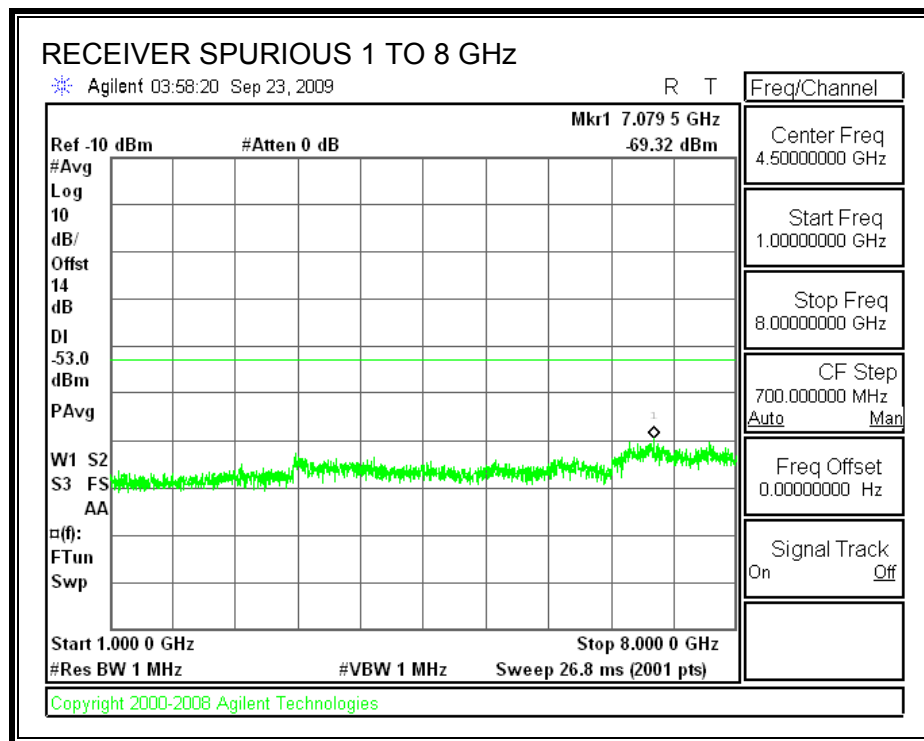
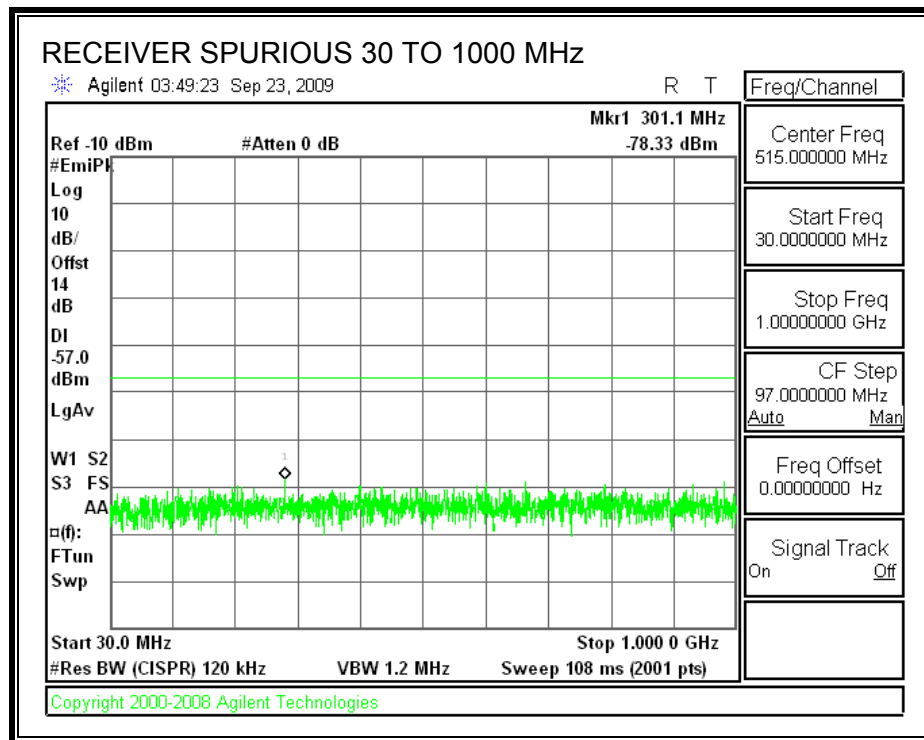
The receiver antenna port is connected to a spectrum analyzer.

The spectrum from 30 MHz to 8 GHz is investigated with the receiver set to the middle channel of the 2.4 GHz band.

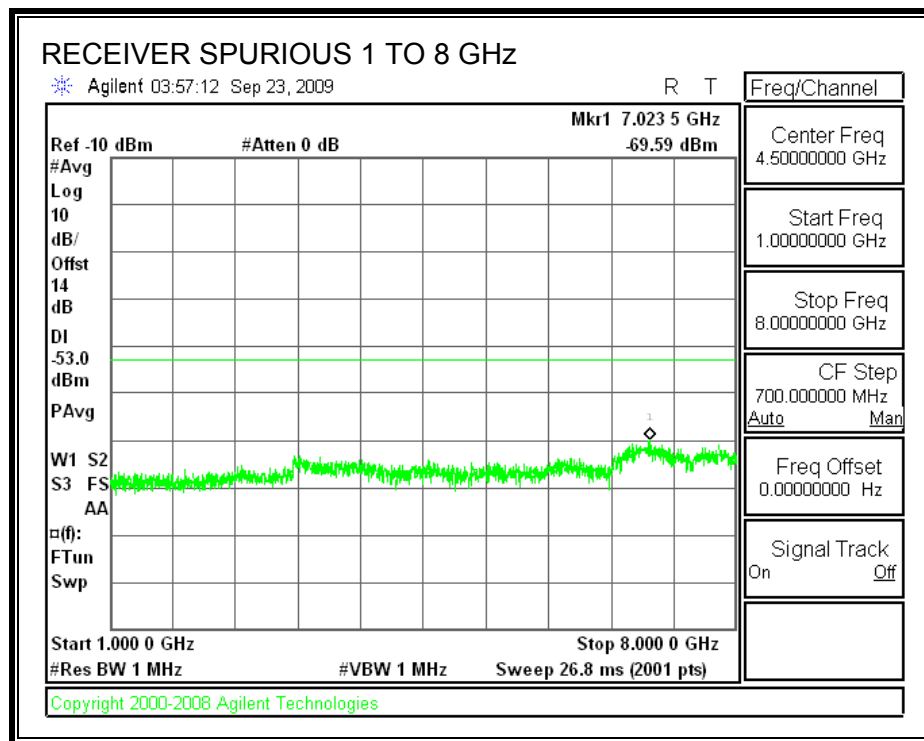
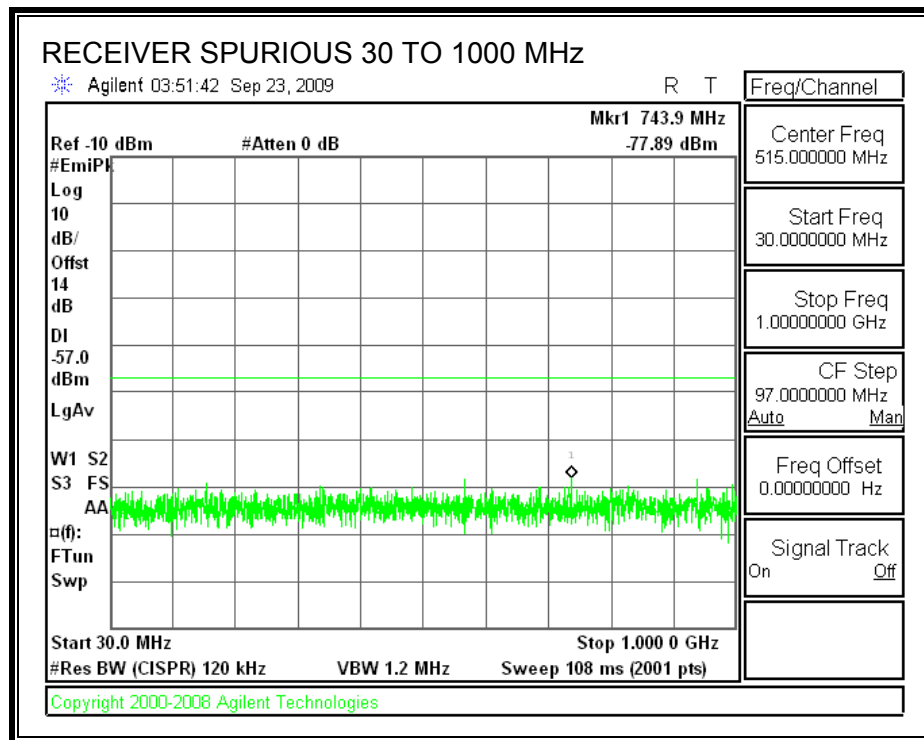
The spectrum from 30 MHz to 18 GHz is investigated with the receiver set to the middle channel of each 5 GHz band.

Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

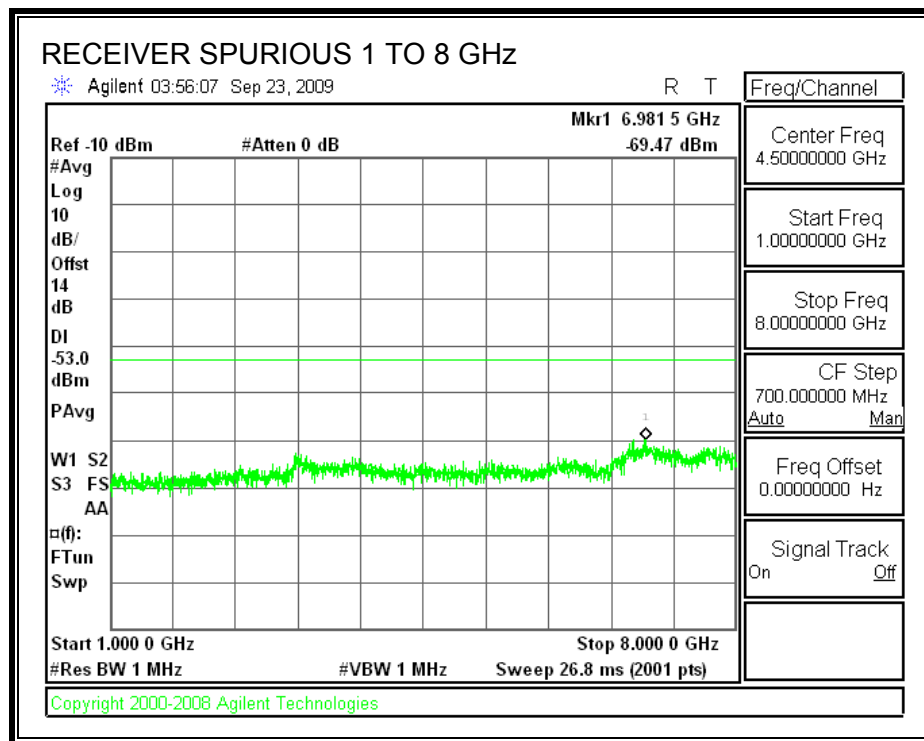
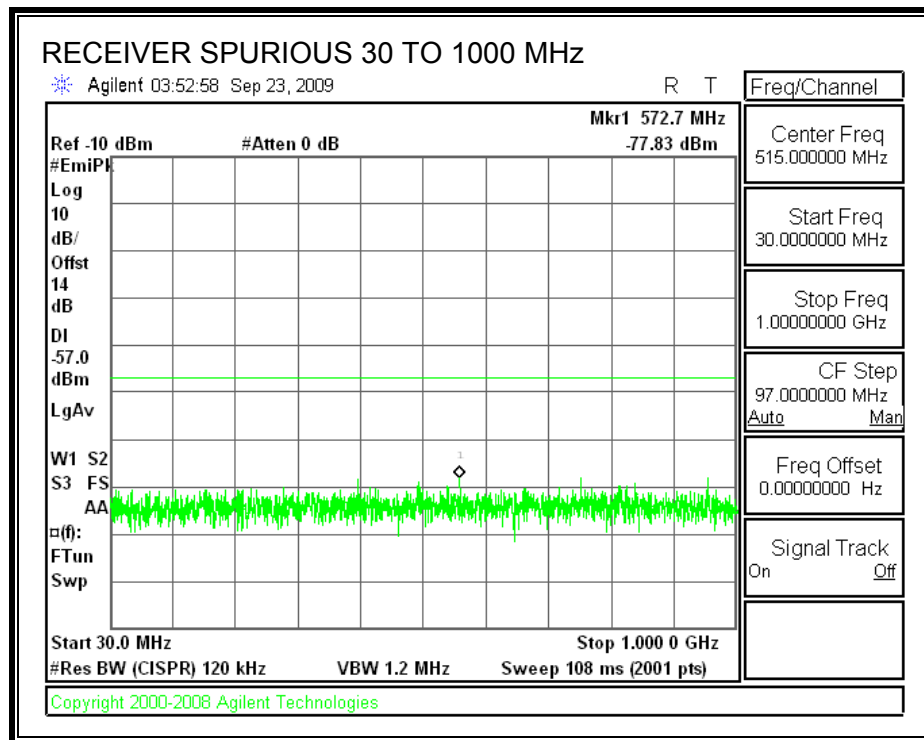
RECEIVER SPURIOUS EMISSIONS 802.11b MODE IN THE 2.4 GHz BAND



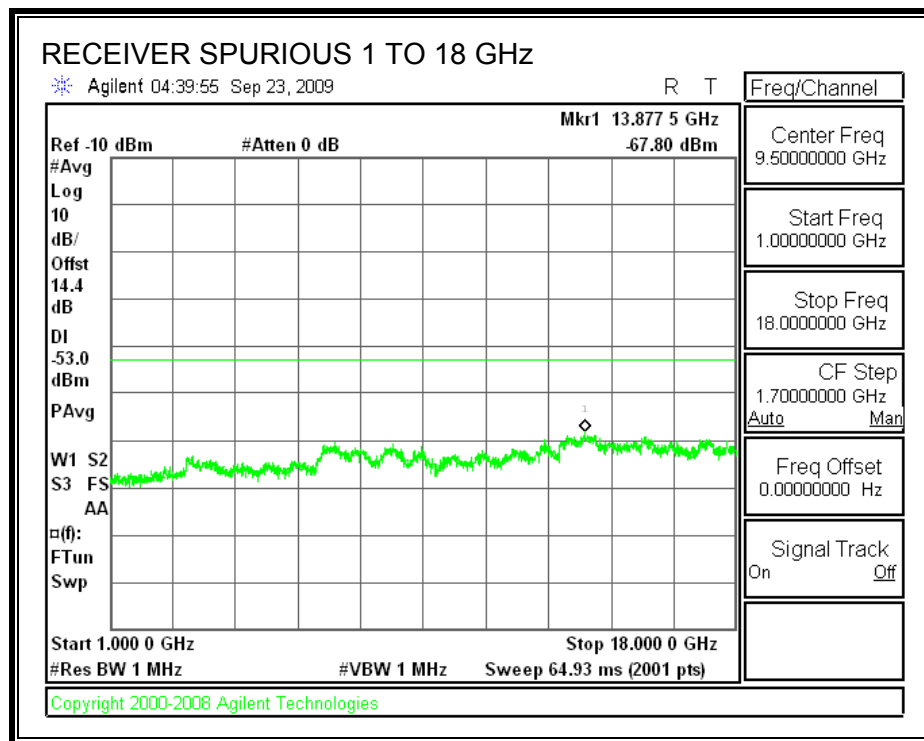
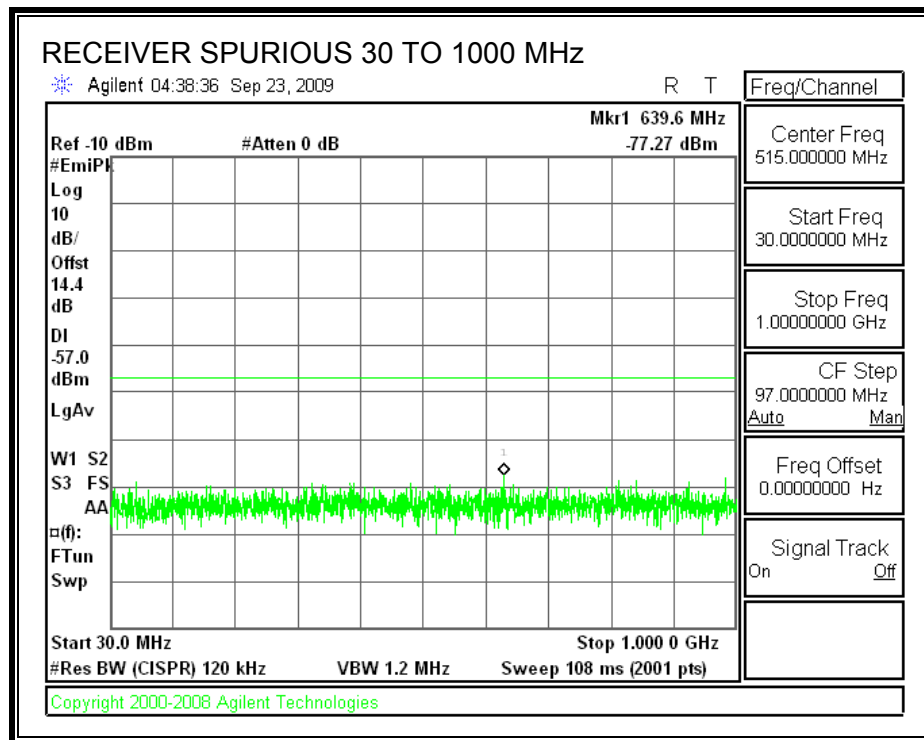
RECEIVER SPURIOUS EMISSIONS 802.11g MODE IN THE 2.4 GHz BAND



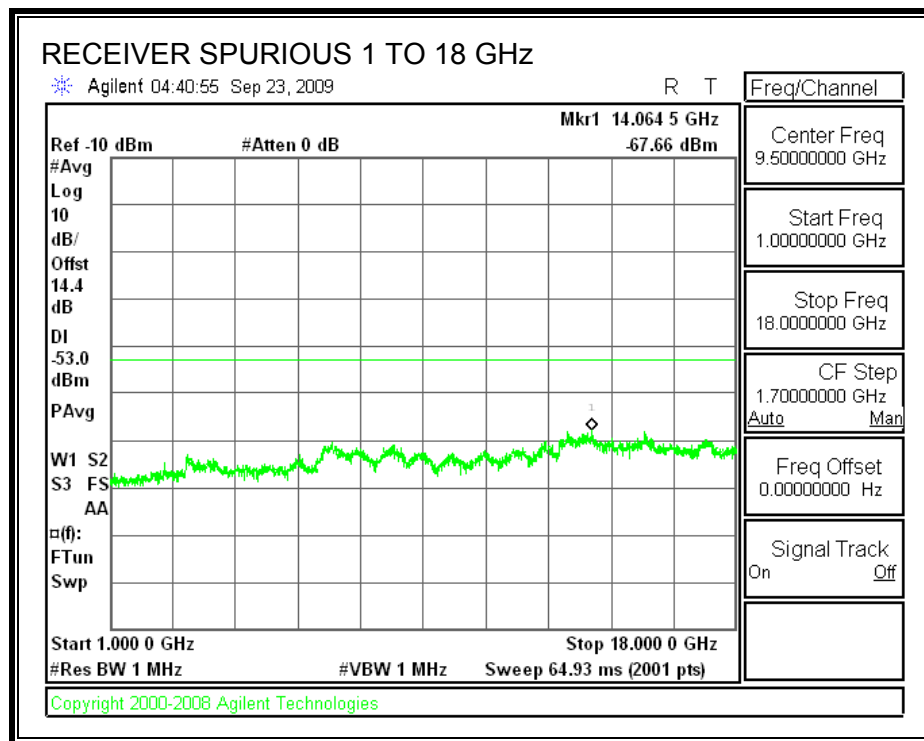
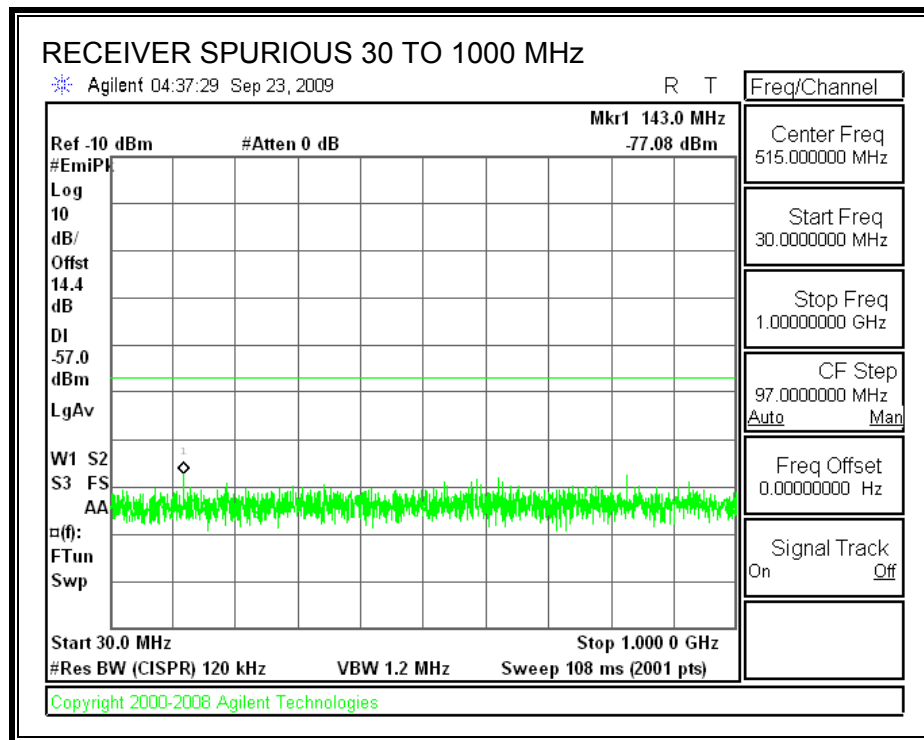
RECEIVER SPURIOUS EMISSIONS 802.11 HT20 MODE IN THE 2.4 GHz BAND



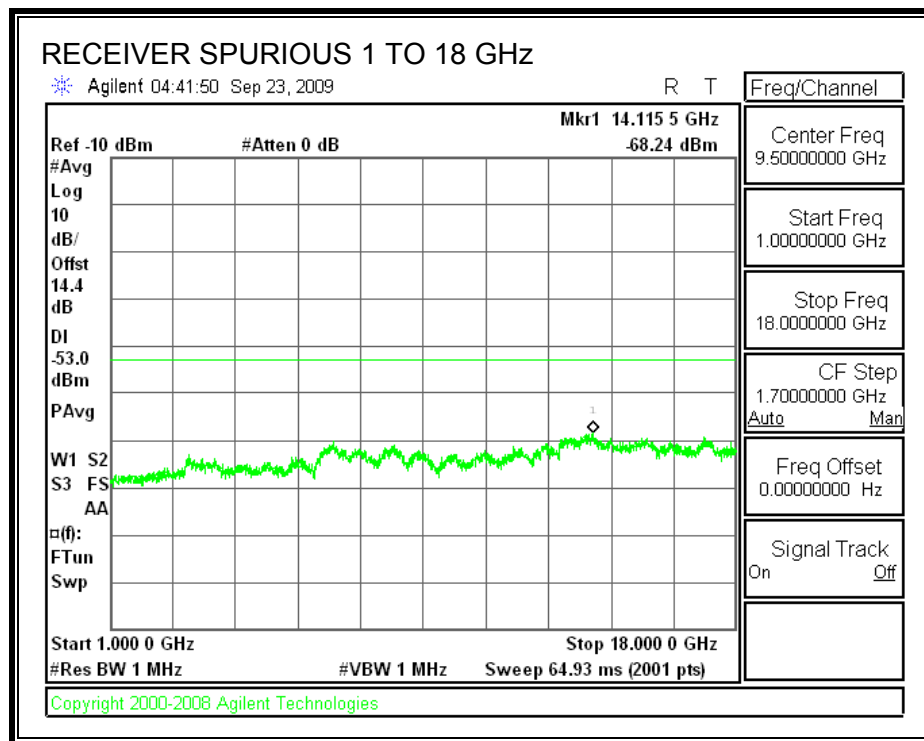
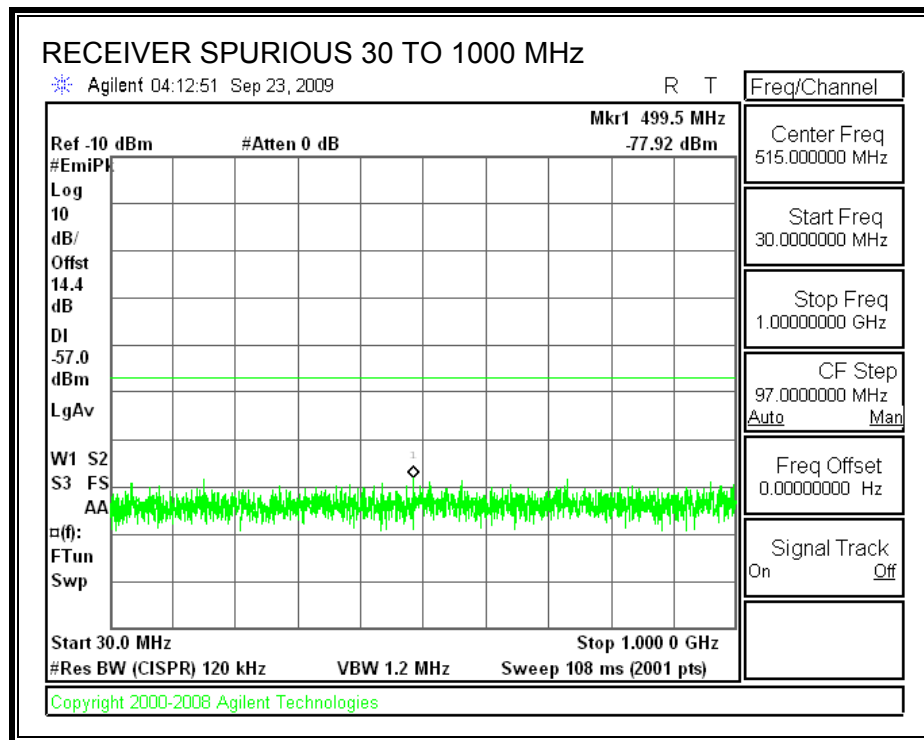
RECEIVER SPURIOUS EMISSIONS FOR 802.11a MODE IN THE 5.8 GHz BAND



RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT20 MODE IN THE 5.8 GHz BAND



RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT40 MODE IN THE 5.8 GHz BAND



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.

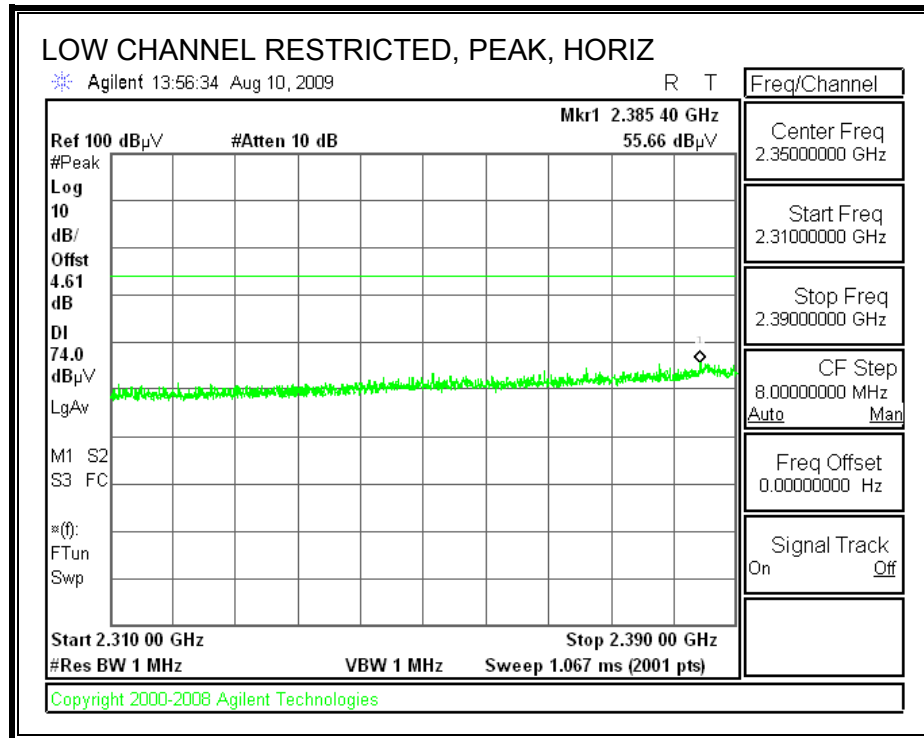
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

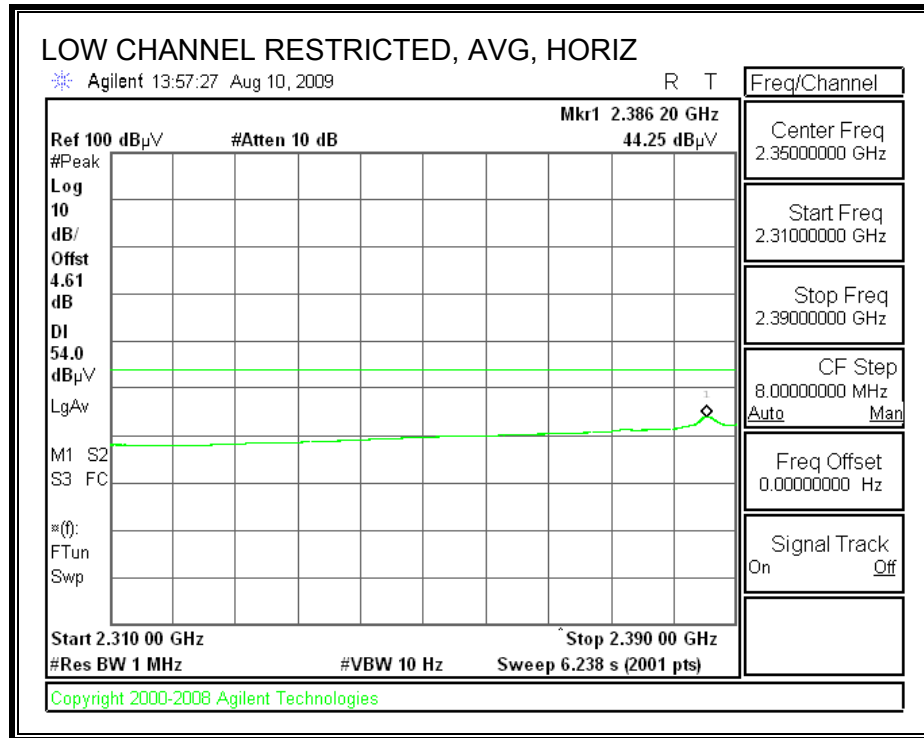
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

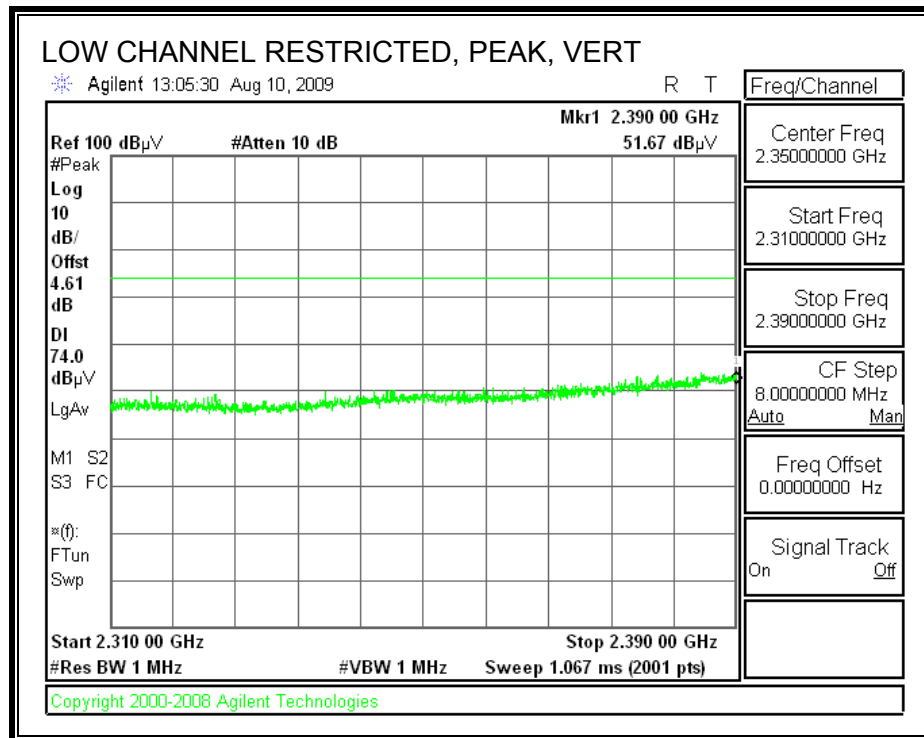
8.2.1. TX ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

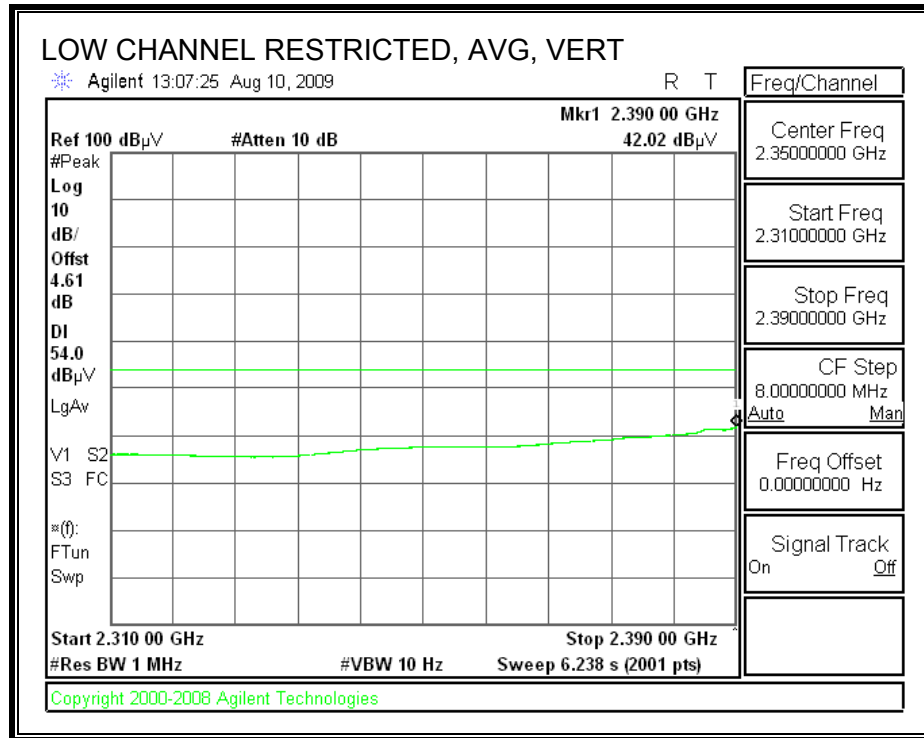
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



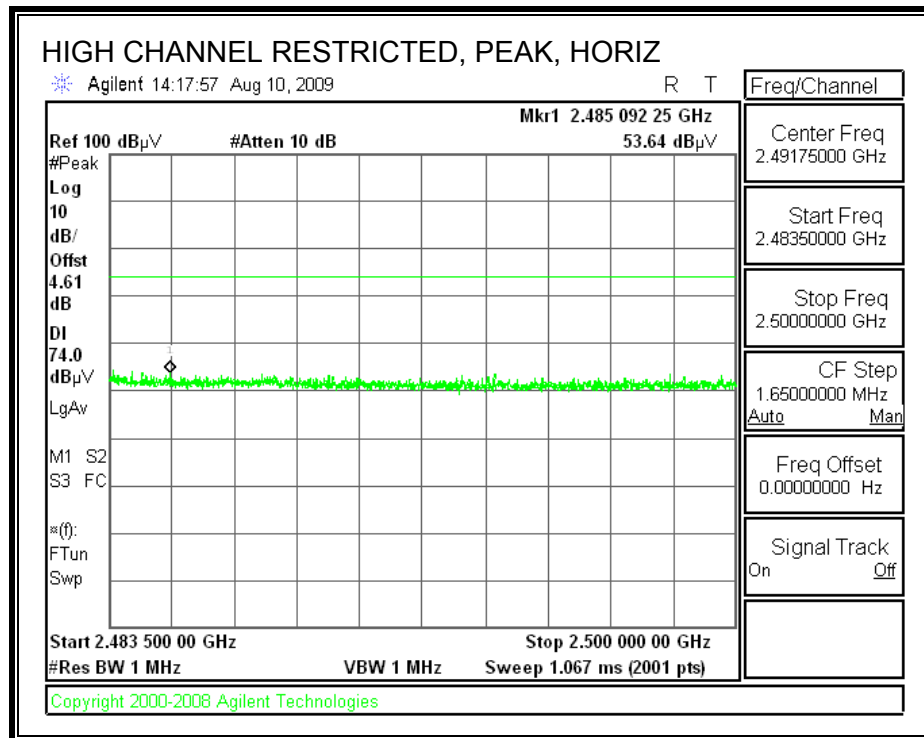


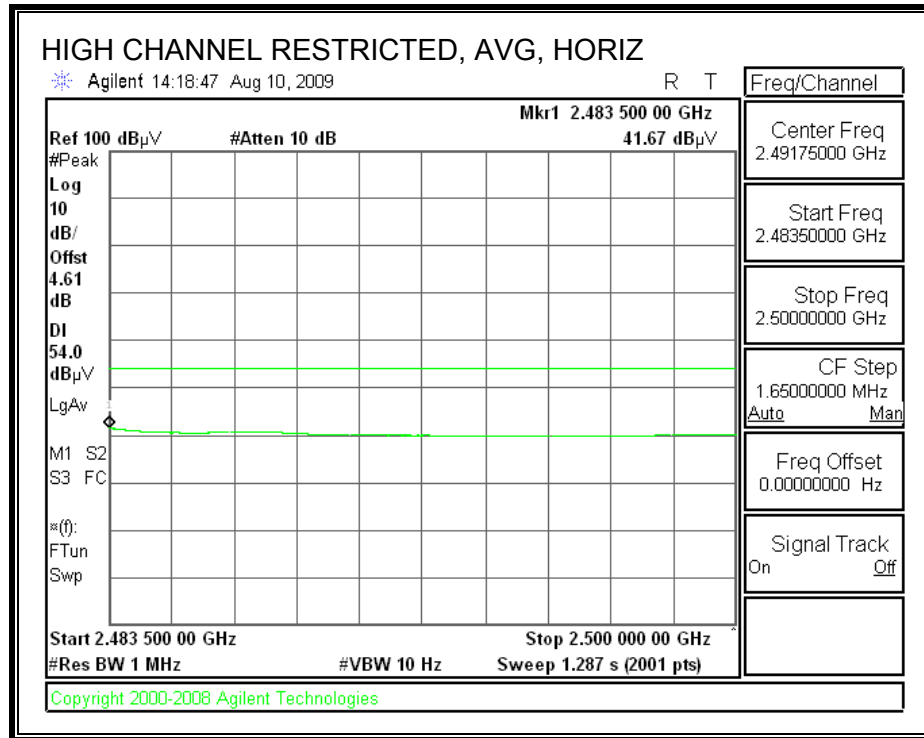
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



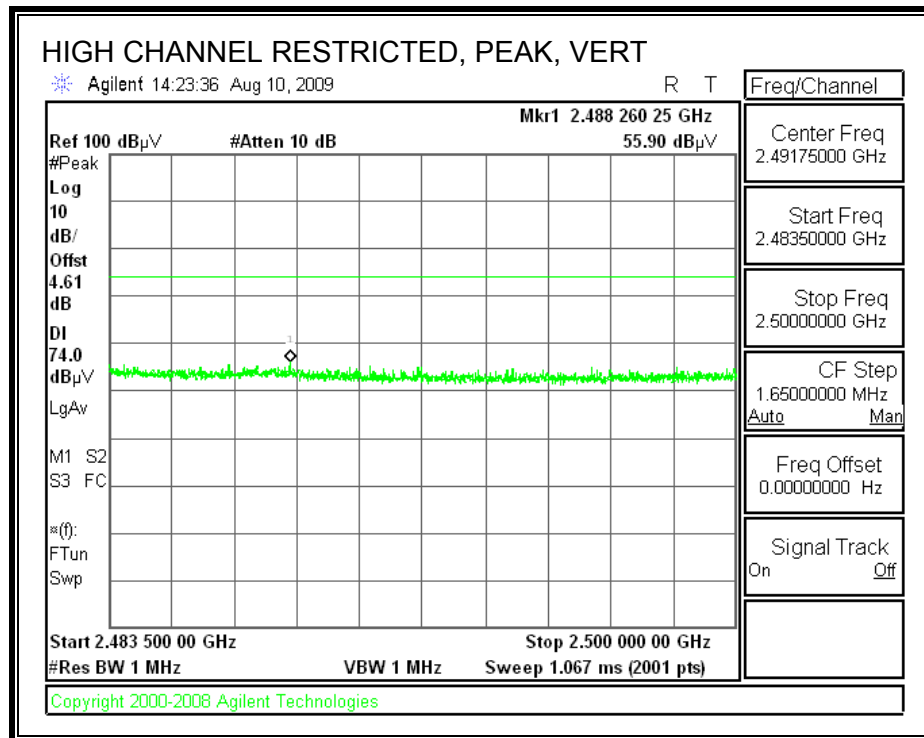


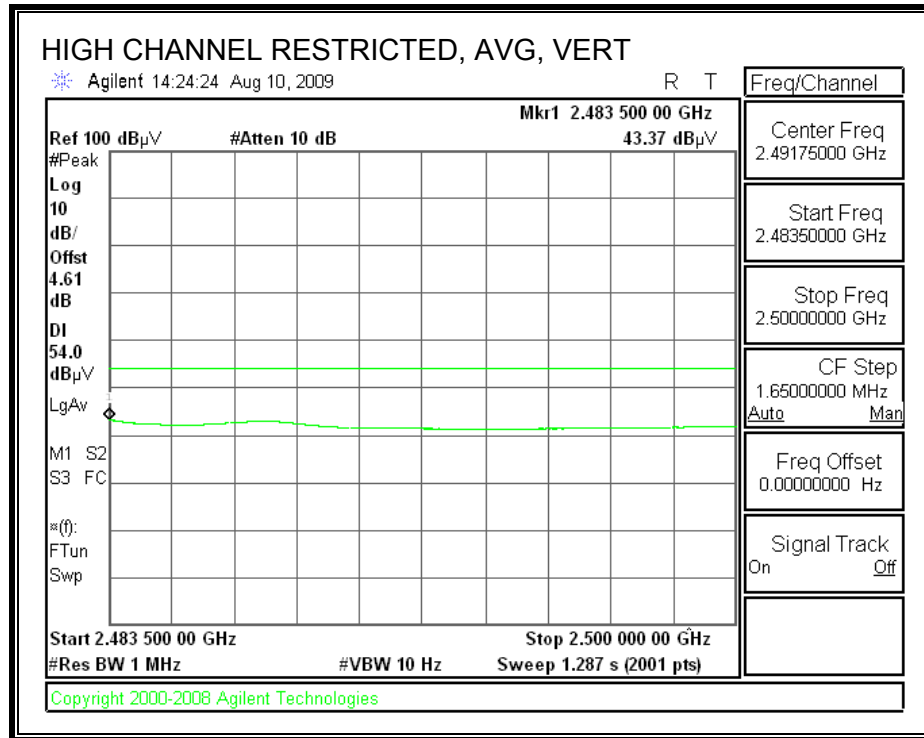
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



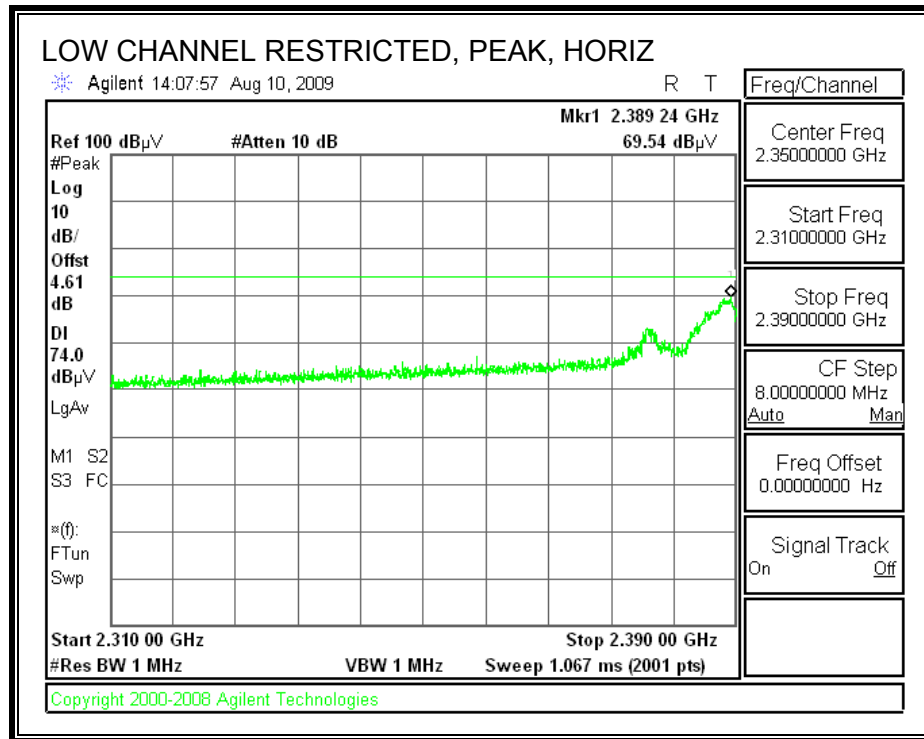


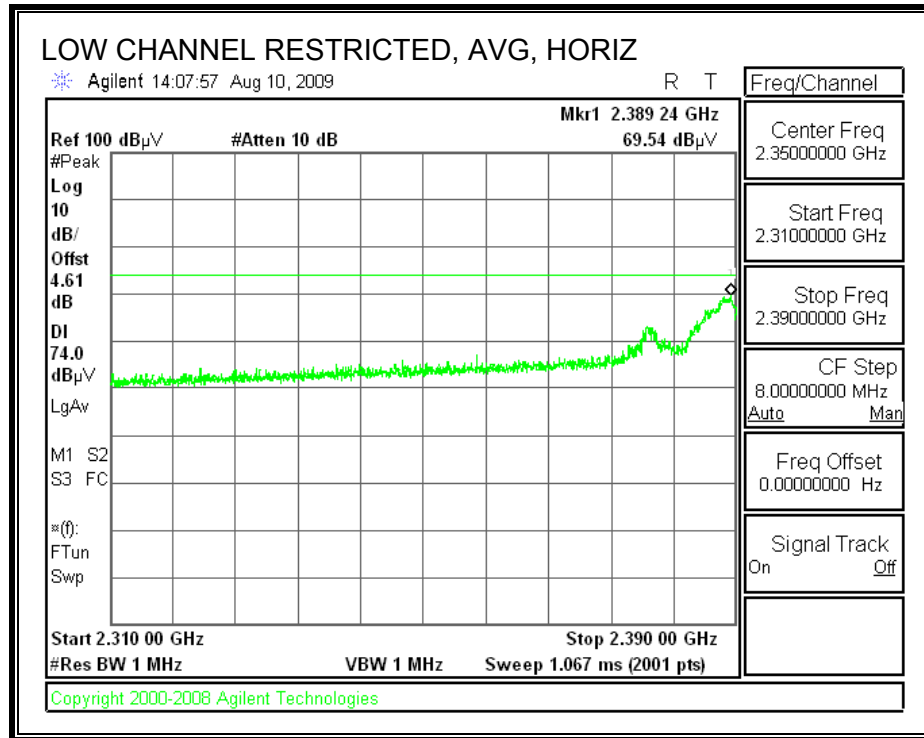
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company: Apple Project #: 09U12759 Date: 08/10/09 Test Engineer: Doug Anderson Configuration: EUT with Support PC Mode: Continuous Tx (11b)																
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T144 Miteq 3008A00931									FCC 15.205				
Hi Frequency Cables																
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			Peak Measurements	
3' cable 22807700			12' cable 22807600			20' cable 22807500						R_001			RBW=1MHz, VBW=10Hz	
Average Measurements																
RBW=1MHz, VBW=10Hz																
f	Dist	Read Pk	Read Avg.	AF	CL	Amp	D Corr	Ftr	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes	
GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)	
Low CH. (2412MHz)																
4.824	3.0	53.5	51.1	33.0	5.8	-36.5	0.0	0.0	55.8	53.4	74	54	-18.2	-0.6	V (Power = 20dBm)	
12.060	3.0	36.4	23.2	39.0	9.8	-35.4	0.0	0.0	49.8	36.5	74	54	-24.2	-17.5	V (Noise Floor)	
14.472	3.0	36.4	22.8	40.5	10.8	-35.3	0.0	0.0	52.5	38.9	74	54	-21.5	-15.1	V (Noise Floor)	
4.824	3.0	52.9	50.4	33.0	5.8	-36.5	0.0	0.0	55.3	52.8	74	54	-18.7	-1.2	H (Power = 18dBm)	
12.060	3.0	36.5	23.2	39.0	9.8	-35.4	0.0	0.0	49.8	36.5	74	54	-24.2	-17.5	H (Noise Floor)	
14.472	3.0	35.7	22.8	40.5	10.8	-35.3	0.0	0.0	51.7	38.9	74	54	-22.3	-15.1	H (Noise Floor)	
Mid CH. (2437MHz)																
4.874	3.0	49.7	46.6	33.1	5.8	-36.5	0.0	0.0	52.2	49.1	74	54	-21.8	-4.9	V (Power = 18dBm)	
7.311	3.0	40.4	29.8	35.3	7.3	-36.2	0.0	0.0	46.7	36.1	74	54	-27.3	-17.9	V	
12.185	3.0	36.5	23.9	39.0	9.8	-35.4	0.0	0.0	49.9	37.3	74	54	-24.1	-16.7	V (Noise Floor)	
4.874	3.0	50.6	48.2	33.1	5.8	-36.5	0.0	0.0	53.1	50.6	74	54	-20.9	-3.4	H (Power = 18dBm)	
7.311	3.0	37.2	25.7	35.3	7.3	-36.2	0.0	0.0	43.5	32.1	74	54	-30.5	-21.9	H (Noise Floor)	
12.185	3.0	36.7	24.0	39.0	9.8	-35.4	0.0	0.0	50.1	37.4	74	54	-23.9	-16.6	H (Noise Floor)	
High CH. (2462MHz)																
4.924	3.0	43.9	37.9	33.1	5.9	-36.5	0.0	0.0	46.4	40.4	74	54	-27.6	-13.6	V (Power = 18dBm)	
7.386	3.0	37.5	24.6	35.4	7.3	-36.2	0.0	0.0	44.0	31.1	74	54	-30.0	-22.9	V (Noise Floor)	
12.310	3.0	36.4	23.4	39.0	9.9	-35.4	0.0	0.0	49.9	36.8	74	54	-24.1	-17.2	V (Noise Floor)	
4.924	3.0	48.3	45.0	33.1	5.9	-36.5	0.0	0.0	50.8	47.5	74	54	-23.2	-6.5	H (Power = 18dBm)	
7.386	3.0	37.8	24.7	35.4	7.3	-36.2	0.0	0.0	44.3	31.2	74	54	-29.7	-22.8	H (Noise Floor)	
12.310	3.0	36.2	23.3	39.0	9.9	-35.4	0.0	0.0	49.7	36.8	74	54	-24.3	-17.2	H (Noise Floor)	
Rev. 11.10.08																
f	Measurement Frequency			Amp	Preamp Gain			Avg Lim	Average Field Strength Limit							
Dist	Distance to Antenna			D Corr	Distance Correct to 3 meters			Pk Lim	Peak Field Strength Limit							
Read	Analyzer Reading			Avg	Average Field Strength @ 3 m			Avg Mar	Margin vs. Average Limit							
AF	Antenna Factor			Peak	Calculated Peak Field Strength			Pk Mar	Margin vs. Peak Limit							
CL	Cable Loss			HPF	High Pass Filter											

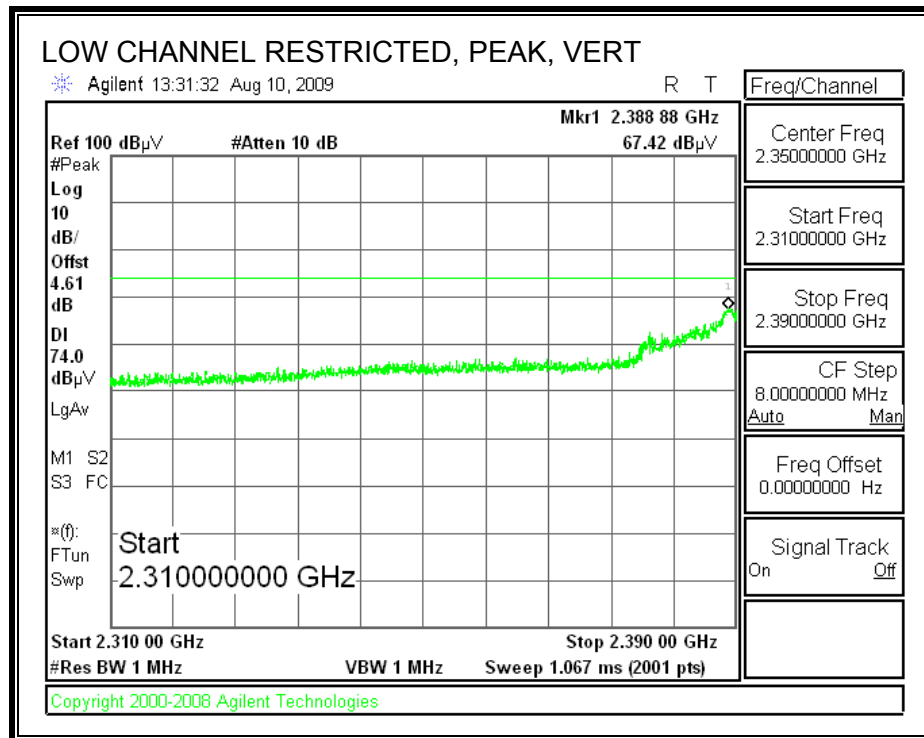
8.2.2. TX ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

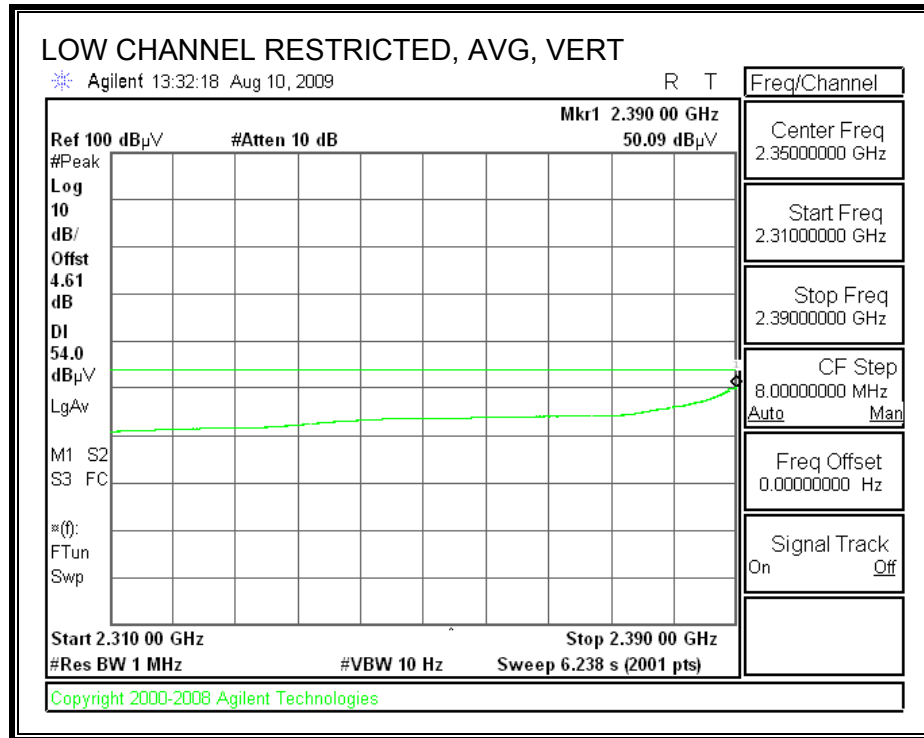
RESTRICTED BANEDGE (LOW CHANNEL, HORIZONTAL)



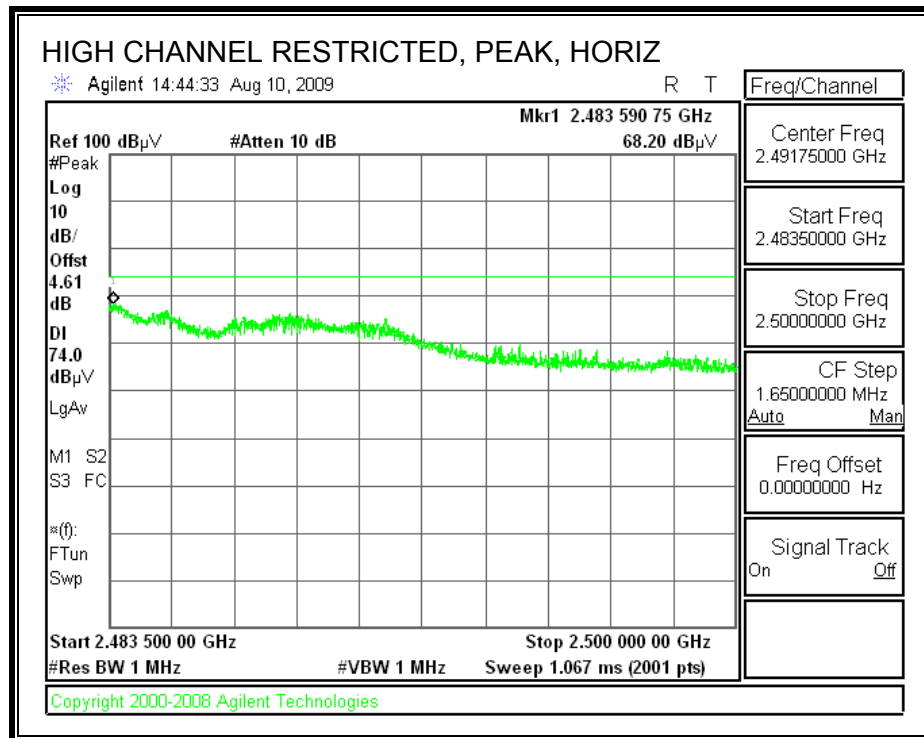


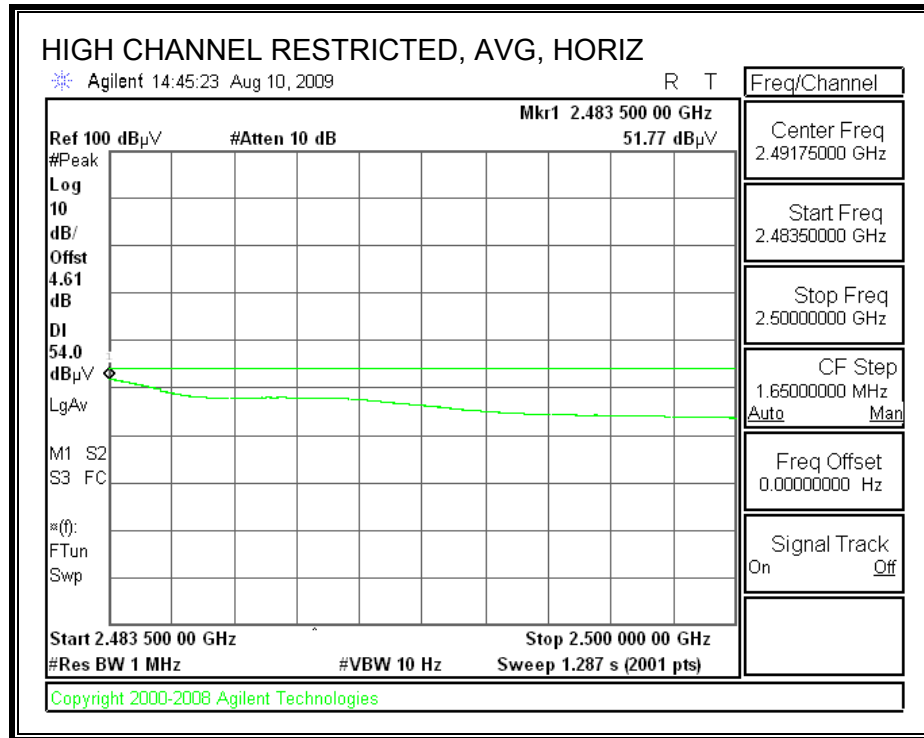
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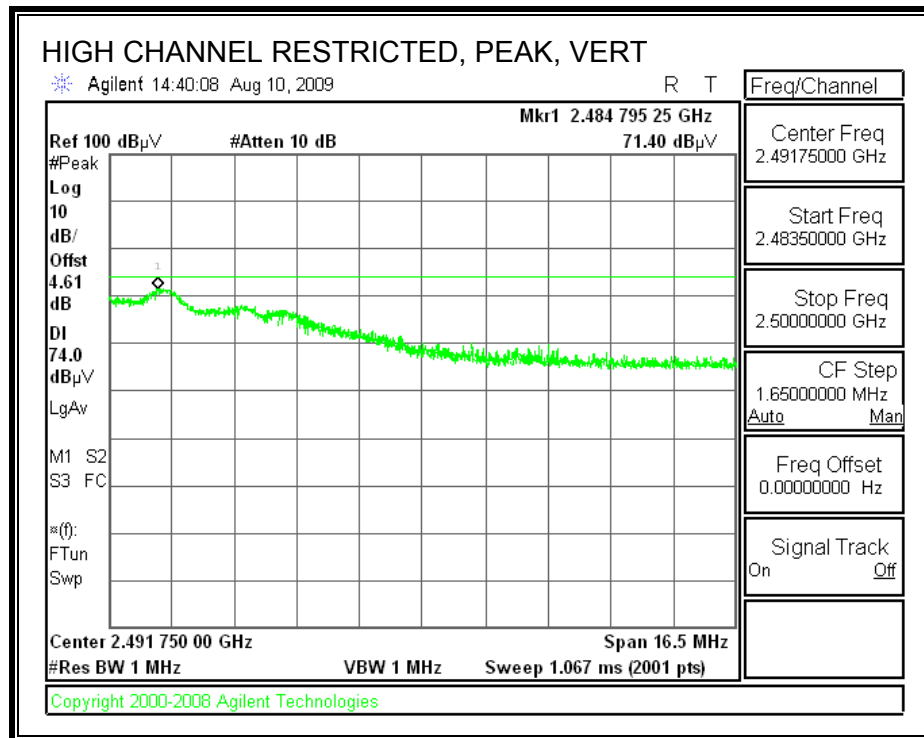


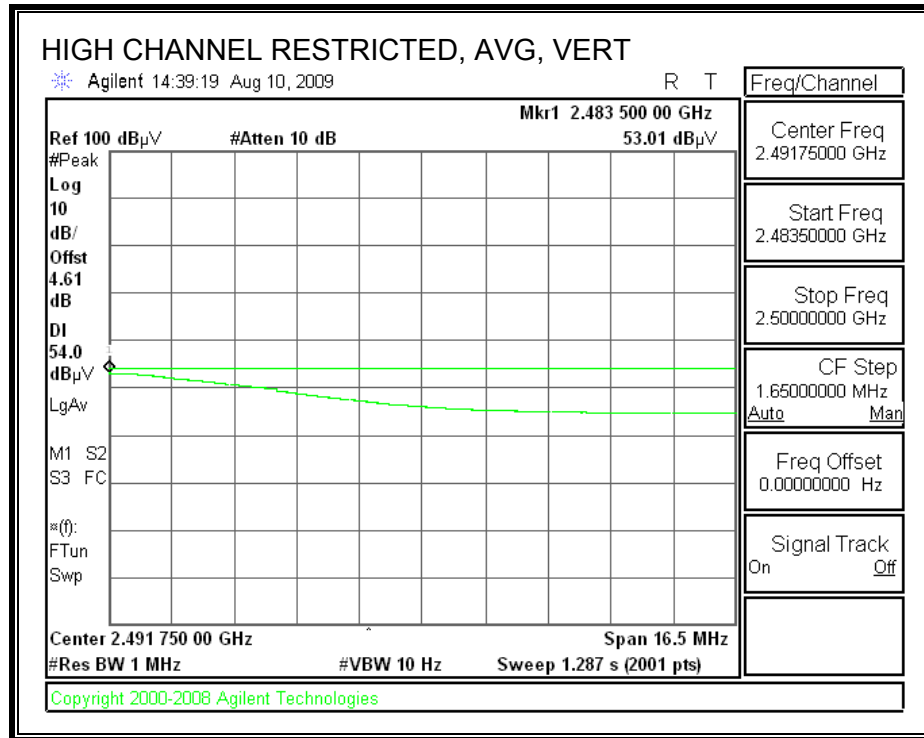
RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



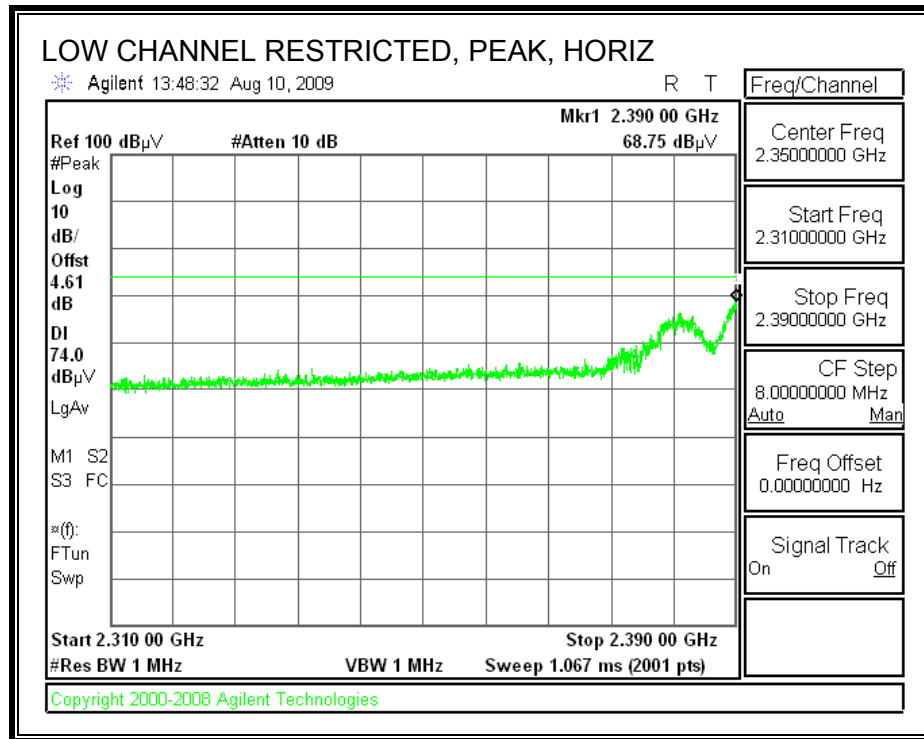


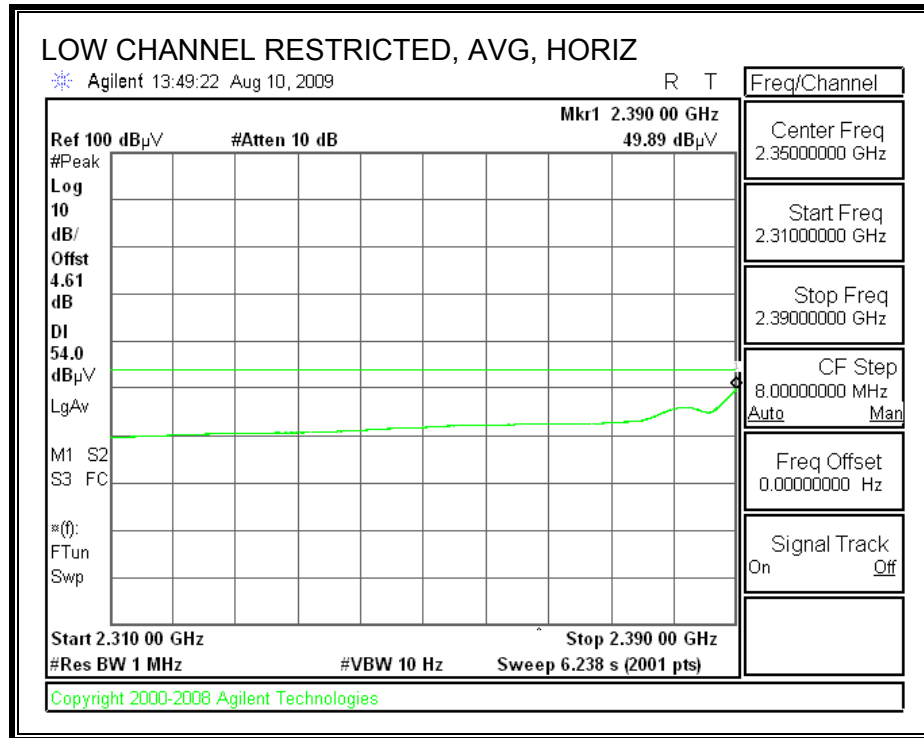
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company: Apple Project #: 09U12759 Date: 08/11/09 Test Engineer: Doug Anderson Configuration: EUT with Support PC Mode: Continuous Tx (11g)																
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T144 Miteq 3008A00931									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	Fitr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
Low CH. (2412MHz)																
4.824	3.0	51.7	37.2	33.0	5.8	-36.5	0.0	0.0	54.0	39.6	74	54	-20.0	-14.4	V	
12.060	3.0	42.0	27.6	39.0	9.8	-35.4	0.0	0.0	55.3	41.0	74	54	-18.7	-13.0	V (Noise Floor)	
14.472	3.0	43.9	29.7	40.5	10.8	-35.3	0.0	0.0	60.0	45.8	74	54	-14.0	-8.2	V (Noise Floor)	
4.824	3.0	51.6	38.7	33.0	5.8	-36.5	0.0	0.0	54.0	41.1	74	54	-20.0	-12.9	H	
12.060	3.0	45.6	31.7	39.0	9.8	-35.4	0.0	0.0	58.9	45.0	74	54	-15.1	-9.0	H (Noise Floor)	
14.472	3.0	41.0	28.3	40.5	10.8	-35.3	0.0	0.0	57.1	44.4	74	54	-16.9	-9.6	H (Noise Floor)	
Mid CH. (2437MHz)																
4.874	3.0	45.6	33.3	33.1	5.8	-36.5	0.0	0.0	48.1	35.7	74	54	-25.9	-18.3	V	
7.311	3.0	42.0	28.8	35.3	7.3	-36.2	0.0	0.0	48.3	35.2	74	54	-25.7	-18.8	V (Noise Floor)	
12.185	3.0	41.1	28.3	39.0	9.8	-35.4	0.0	0.0	54.5	41.7	74	54	-19.5	-12.3	V (Noise Floor)	
4.874	3.0	48.9	36.3	33.1	5.8	-36.5	0.0	0.0	51.4	38.7	74	54	-22.6	-15.3	H	
7.311	3.0	42.4	29.6	35.3	7.3	-36.2	0.0	0.0	48.8	35.9	74	54	-25.2	-18.1	H (Noise Floor)	
12.185	3.0	42.1	28.4	39.0	9.8	-35.4	0.0	0.0	55.5	41.8	74	54	-18.5	-12.2	H (Noise Floor)	
High CH. (2462MHz)																
4.924	3.0	40.9	28.3	33.1	5.9	-36.5	0.0	0.0	43.5	30.9	74	54	-30.5	-23.1	V	
7.386	3.0	41.4	28.7	35.4	7.3	-36.2	0.0	0.0	47.9	35.2	74	54	-26.1	-18.8	V (Noise Floor)	
12.310	3.0	40.7	27.7	39.0	9.9	-35.4	0.0	0.0	54.1	41.1	74	54	-19.9	-12.9	V (Noise Floor)	
4.924	3.0	47.9	34.0	33.1	5.9	-36.5	0.0	0.0	50.5	36.5	74	54	-23.5	-17.5	H	
7.386	3.0	42.1	28.4	35.4	7.3	-36.2	0.0	0.0	48.6	34.9	74	54	-25.4	-19.1	H (Noise Floor)	
12.310	3.0	41.2	27.8	39.0	9.9	-35.4	0.0	0.0	54.7	41.3	74	54	-19.3	-12.7	H (Noise Floor)	
Rev. 11.10.08																
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											

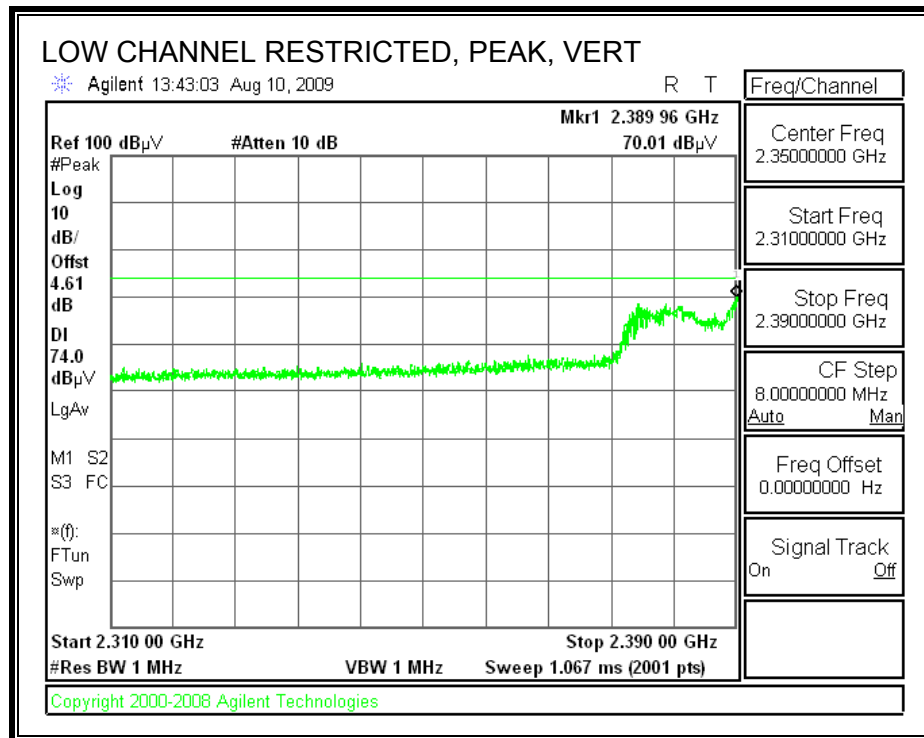
8.2.3. TX ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 2.4 GHz BAND

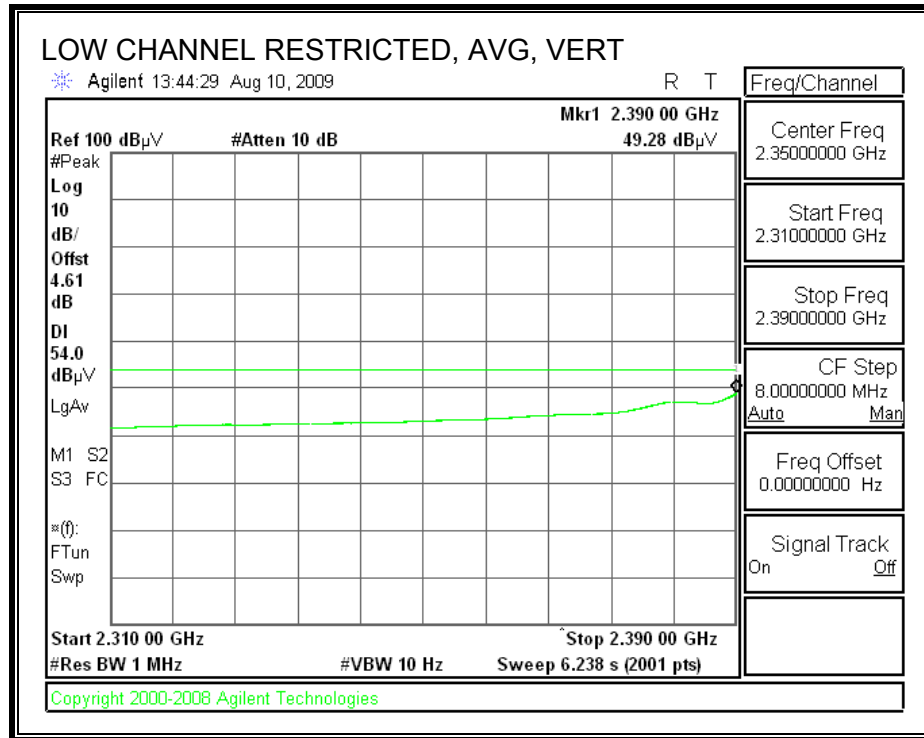
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



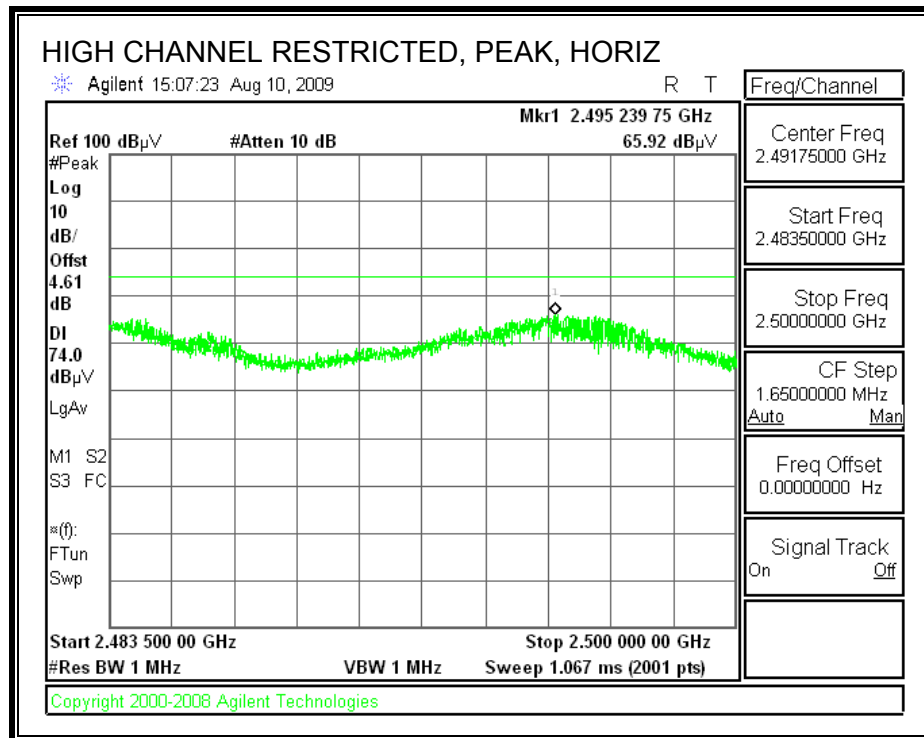


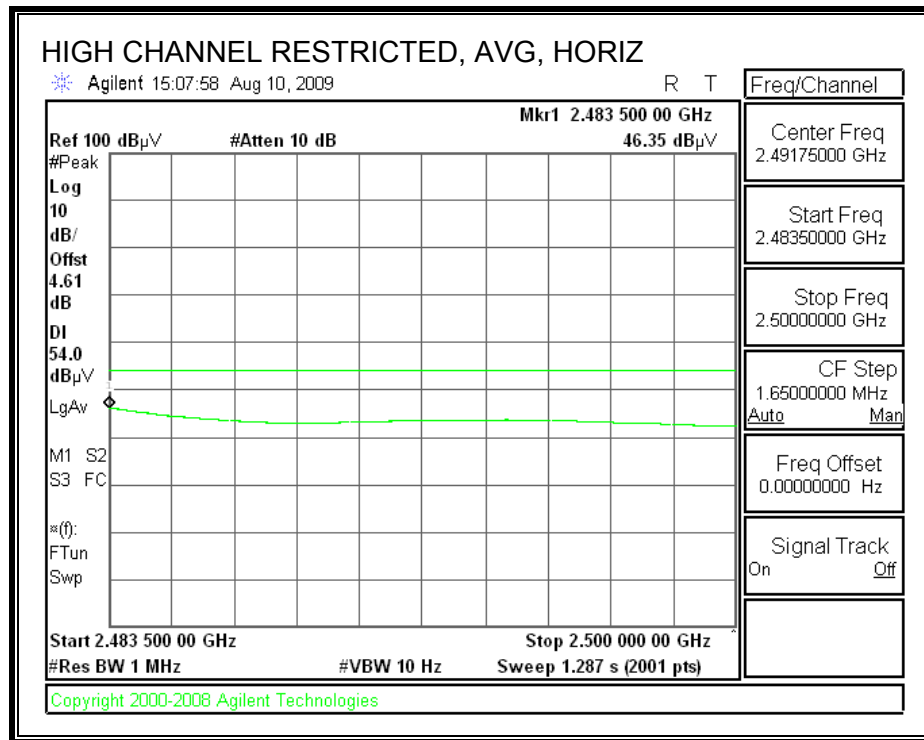
RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)



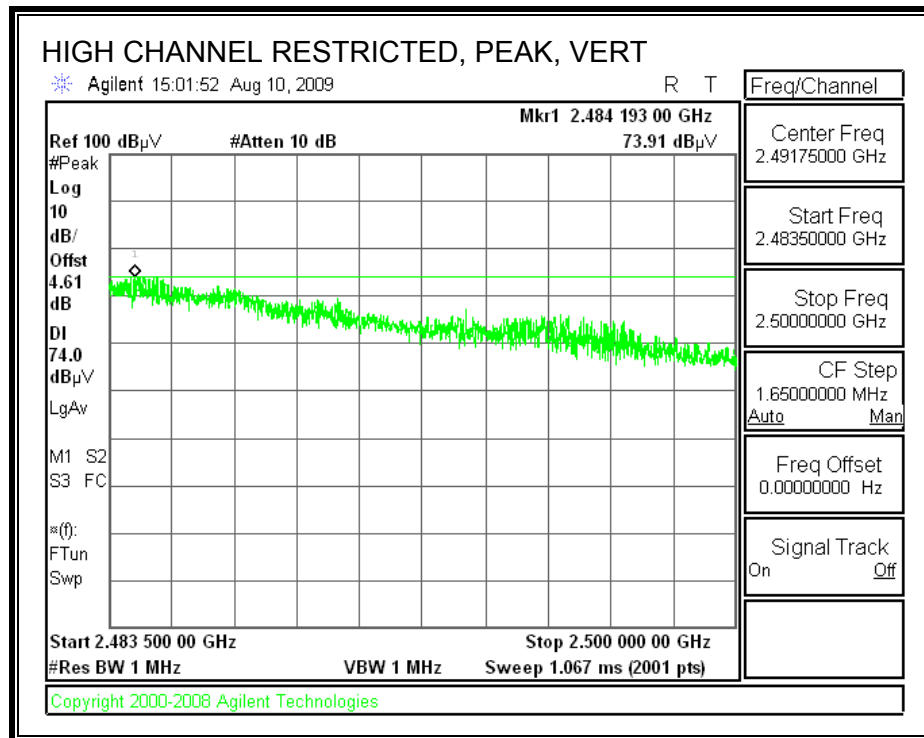


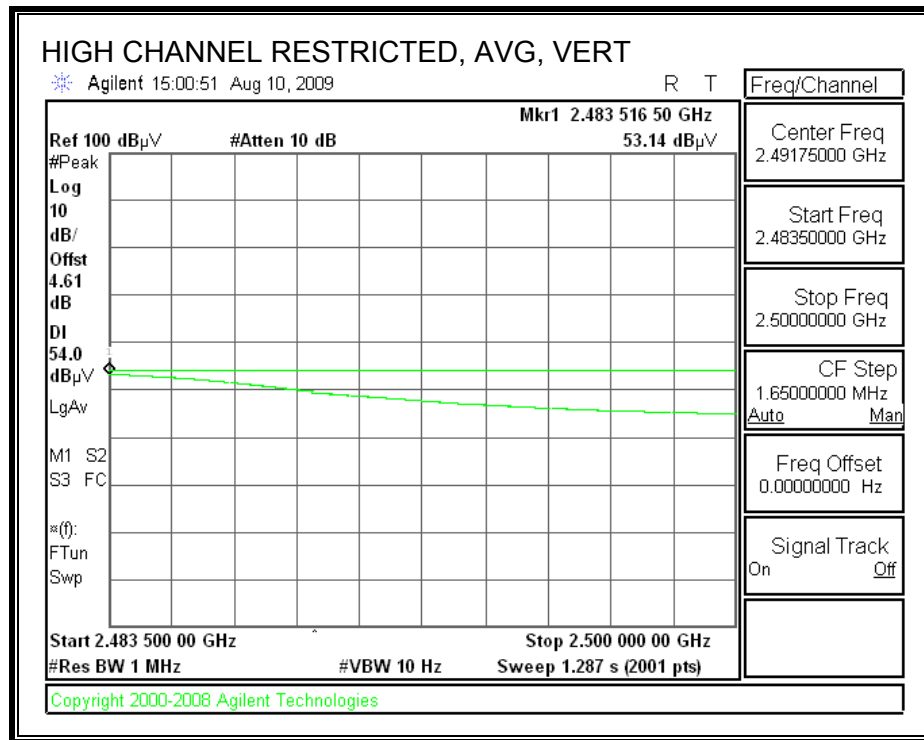
RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company: Apple Project #: 09U12759 Date: 08/11/09 Test Engineer: Doug Anderson Configuration: EUT with Support PC Mode: Continuous Tx (HT20)																
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T144 Miteq 3008A00931									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)	
Low CH. (2412MHz)																
4.824	3.0	49.8	33.4	33.0	5.8	-36.5	0.0	0.0	52.2	35.8	74	54	-21.8	-18.2	V	
12.060	3.0	42.4	27.7	39.0	9.8	-35.4	0.0	0.0	55.7	41.0	74	54	-18.3	-13.0	V (Noise Floor)	
14.472	3.0	43.3	30.3	40.5	10.8	-35.3	0.0	0.0	59.4	46.4	74	54	-14.6	-7.6	V (Noise Floor)	
4.824	3.0	52.2	37.3	33.0	5.8	-36.5	0.0	0.0	54.6	39.7	74	54	-19.4	-14.3	H	
12.060	3.0	41.0	28.1	39.0	9.8	-35.4	0.0	0.0	54.3	41.5	74	54	-19.7	-12.5	H (Noise Floor)	
14.472	3.0	41.9	30.6	40.5	10.8	-35.3	0.0	0.0	57.9	46.7	74	54	-16.1	-7.3	H (Noise Floor)	
Mid CH. (2437MHz)																
4.874	3.0	38.6	26.4	33.1	5.8	-36.5	0.0	0.0	41.1	28.8	74	54	-32.9	-25.2	V (Noise Floor)	
7.311	3.0	37.4	24.7	35.3	7.3	-36.2	0.0	0.0	43.8	31.0	74	54	-30.2	-23.0	V (Noise Floor)	
12.185	3.0	36.8	23.9	39.0	9.8	-35.4	0.0	0.0	50.2	37.3	74	54	-23.8	-16.7	V (Noise Floor)	
4.874	3.0	39.6	25.9	33.1	5.8	-36.5	0.0	0.0	42.1	28.4	74	54	-31.9	-25.6	H (Noise Floor)	
7.311	3.0	36.9	24.5	35.3	7.3	-36.2	0.0	0.0	43.2	30.8	74	54	-30.8	-23.2	H (Noise Floor)	
12.185	3.0	37.0	23.8	39.0	9.8	-35.4	0.0	0.0	50.4	37.2	74	54	-23.6	-16.8	H (Noise Floor)	
High CH. (2462MHz)																
4.924	3.0	41.0	29.4	33.1	5.9	-36.5	0.0	0.0	43.6	32.0	74	54	-30.4	-22.0	V	
7.386	3.0	39.7	28.7	35.4	7.3	-36.2	0.0	0.0	46.2	35.2	74	54	-27.8	-18.8	V (Noise Floor)	
12.310	3.0	40.6	27.7	39.0	9.9	-35.4	0.0	0.0	54.1	41.1	74	54	-19.9	-12.9	V (Noise Floor)	
4.924	3.0	48.1	33.2	33.1	5.9	-36.5	0.0	0.0	50.7	35.7	74	54	-23.3	-18.3	H	
7.386	3.0	41.6	28.6	35.4	7.3	-36.2	0.0	0.0	48.1	35.1	74	54	-25.9	-18.9	H (Noise Floor)	
12.310	3.0	40.4	27.3	39.0	9.9	-35.4	0.0	0.0	53.8	40.8	74	54	-20.2	-13.2	H (Noise Floor)	

Rev. 11.10.08

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		

8.2.4. 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 #: 09U12759 Date: 08/11/09 Test Engineer: Doug Anderson Configuration: EUT with Support PC Mode: Continuous Tx (11a)															
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T73; S/N: 6717 @3m		T144 Miteq 3008A00931						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		HPF_7.6GHz									
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low CH.(5745MHz)															
11.490	3.0	46.4	31.7	38.4	9.5	-35.9	0.0	0.7	59.1	44.4	74	54	-14.9	-9.6	V
11.490	3.0	48.2	35.0	38.4	9.5	-35.9	0.0	0.7	60.9	47.8	74	54	-13.1	-6.2	H
Mid CH.(5785MHz)															
11.570	3.0	41.4	28.7	38.5	9.5	-35.8	0.0	0.7	54.3	41.6	74	54	-19.7	-12.4	V (Noise Floor)
11.570	3.0	41.7	28.8	38.5	9.5	-35.8	0.0	0.7	54.7	41.7	74	54	-19.3	-12.3	H
High CH.(5825MHz)															
11.650	3.0	44.4	30.9	38.6	9.6	-35.7	0.0	0.7	57.6	44.0	74	54	-16.4	-10.0	V
11.650	3.0	47.8	33.7	38.6	9.6	-35.7	0.0	0.7	60.9	46.9	74	54	-13.1	-7.1	H
Rev. 11.10.08															
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 #: 09U12759 Date: 08/11/09 Test Engineer: Doug Anderson Configuration: EUT with Support PC Mode: Continuous Tx (HT20)																
Test Equipment:																
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit								
T73; S/N: 6717 @3m		T144 Miteq 3008A00931						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		HPF_7.6GHz										
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filt dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
Low CH. (5745MHz)																
11.490	3.0	48.2	32.8	38.4	9.5	-35.9	0.0	0.7	60.9	45.5	74	54	-13.1	-8.5	V	
11.490	3.0	51.4	37.0	38.4	9.5	-35.9	0.0	0.7	64.2	49.8	74	54	-9.8	-4.2	H	
Mid CH. (5785MHz)																
11.570	3.0	44.9	32.0	38.5	9.5	-35.8	0.0	0.7	57.8	44.9	74	54	-16.2	-9.1	V	
11.570	3.0	46.1	32.0	38.5	9.5	-35.8	0.0	0.7	59.0	44.9	74	54	-15.0	-9.1	H	
High CH. (5805MHz)																
11.610	3.0	45.6	32.2	38.5	9.5	-35.8	0.0	0.7	58.6	45.2	74	54	-15.4	-8.8	V	
11.610	3.0	48.3	33.8	38.5	9.5	-35.8	0.0	0.7	61.3	46.8	74	54	-12.7	-7.2	H	
Rev. 11.10.08																
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

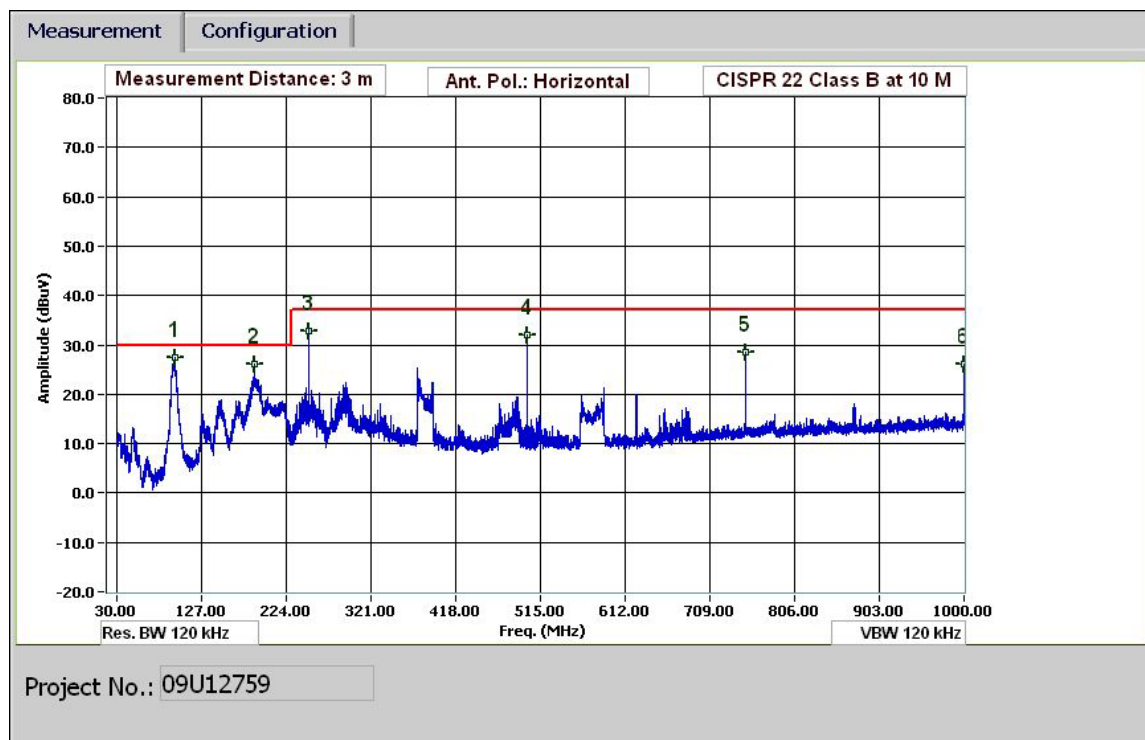
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company: Apple Project #: 09U12759 Date: 08/11/09 Test Engineer: Doug Anderson Configuration: EUT with Support PC Mode: Continuous Tx (HT40)																
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T144 Miteq 3008A00931									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			HPF_7.6GHz							
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fldr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
Low CH. (5755MHz)																
11.510	3.0	44.0	31.4	38.4	9.5	-35.8	0.0	0.7	56.8	44.2	74	54	-17.2	-9.8	V	
11.510	3.0	45.8	32.4	38.4	9.5	-35.8	0.0	0.7	58.6	45.2	74	54	-15.4	-8.8	H	
High CH. (5795MHz)																
11.590	3.0	46.1	32.9	38.5	9.5	-35.8	0.0	0.7	59.0	45.8	74	54	-15.0	-8.2	V	
11.590	3.0	43.5	30.7	38.5	9.5	-35.8	0.0	0.7	56.4	43.7	74	54	-17.6	-10.3	H	
Rev. 11.10.08																
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. RADIO AND DIGITAL DEVICE BELOW 1 GHz

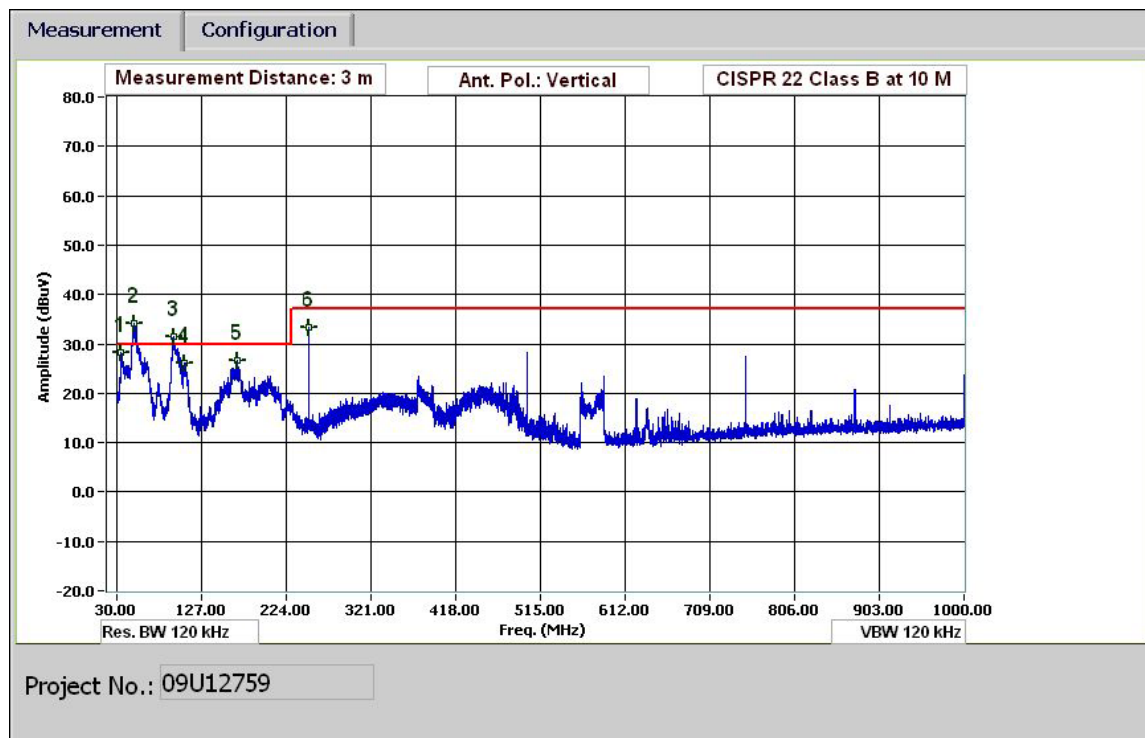
SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, HORIZONTAL)

HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (DIGITAL DEVICE, VERTICAL)

VERTICAL PLOT



TABULATED DATA

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

Test Engr: Doug Anderson
Date: 08/11/09 02/12/09
Project #: 09U12759 09U12759
Company: Apple
EUT Description: A/B/G/N Access Point
EUT M/N: 2357
Test Target: EN55022 Class B

Mode Oper: Continuous Tx and Pinging Data to Host PC

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
CL	Cable Loss	Limit	Field Strength Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
Continuous Tx / 2437 / HI20 / 20dBm: Vertical															
35.280	3.0	49.0	17.7	0.6	28.4	-10.5	0.0	28.4	30.0	-1.6	V	P	110.0	181.7	
49.801	3.0	64.0	8.5	0.6	28.4	-10.5	0.0	34.3	30.0	-4.3	V	P	100.0	75.5	
49.801	3.0	59.3	8.5	0.6	28.4	-10.5	0.0	34.3	30.0	-0.4	V	QP	100.0	75.5	
95.403	3.0	60.5	8.8	0.9	28.3	-10.5	0.0	31.4	30.0	-1.4	V	P	100.0	75.1	
95.403	3.0	55.5	8.8	0.9	28.3	-10.5	0.0	31.4	30.0	-3.6	V	QP	100.0	75.1	
107.763	3.0	52.5	11.4	1.0	28.3	-10.5	0.0	26.1	30.0	-3.9	V	P	100.0	45.4	
168.126	3.0	53.3	11.0	1.2	28.2	-10.5	0.0	26.7	30.0	-3.3	V	P	108.4	163.7	
249.969	3.0	58.8	11.8	1.4	28.2	-10.5	0.0	33.3	37.0	-3.7	V	P	100.0	43.6	
Continuous Tx / 2437 / HI20 / 20dBm: Horizontal															
96.243	3.0	56.3	9.0	0.9	28.3	-10.5	0.0	27.4	30.0	-2.6	H	P	250.0	360.0	
187.446	3.0	52.2	11.3	1.2	28.2	-10.5	0.0	26.0	30.0	-4.0	H	P	181.4	114.9	
250.089	3.0	58.2	11.8	1.4	28.2	-10.5	0.0	32.7	37.0	-4.3	H	P	165.9	200.7	
500.059	3.0	51.5	16.7	2.0	27.8	-10.5	0.0	32.0	37.0	-5.0	H	P	100.0	213.1	
750.030	3.0	43.4	20.3	2.5	27.3	-10.5	0.0	28.4	37.0	-8.6	H	P	134.4	97.9	
1000.000	3.0	39.1	22.5	3.0	27.9	-10.5	0.0	26.1	37.0	-10.9	H	P	180.6	101.7	

Rev. 1.27.09

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

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

6 WORST EMISSIONS

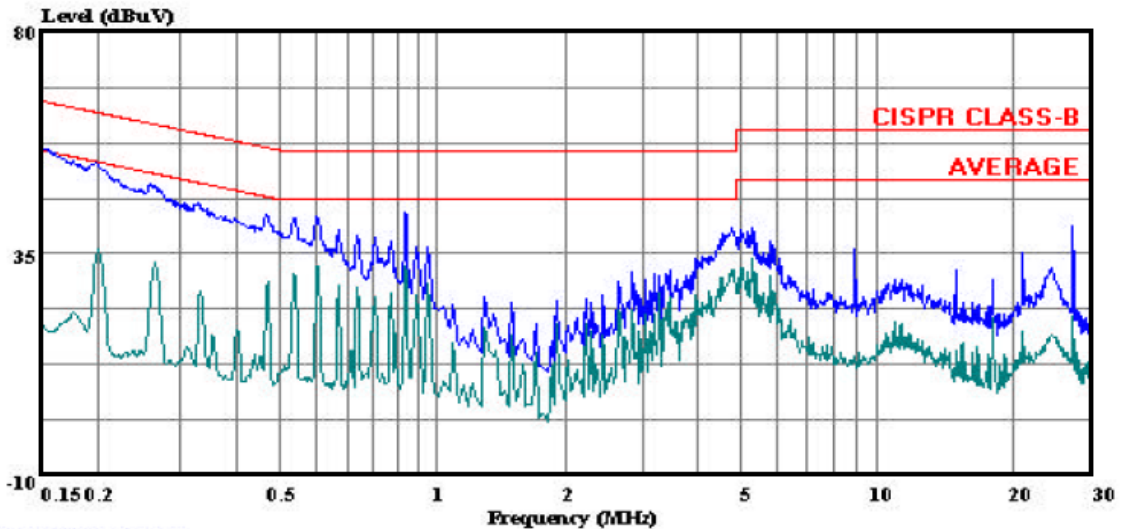
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.20	53.53	--	36.05	0.00	63.69	53.69	-10.16	-17.64	L1
0.26	49.05	--	33.15	0.00	61.34	51.34	-12.29	-18.19	L1
0.94	43.20	--	32.41	0.00	56.00	46.00	-12.80	-13.59	L1
0.20	53.73	--	37.84	0.00	63.69	53.69	-9.96	-15.85	L2
0.26	49.95	--	35.15	0.00	61.34	51.34	-11.39	-16.19	L2
0.94	42.97	--	32.45	0.00	56.00	46.00	-13.03	-13.55	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#: 21 File#: 09U12759 LC.EMI Date: 09-23-2009 Time: 15:35:37



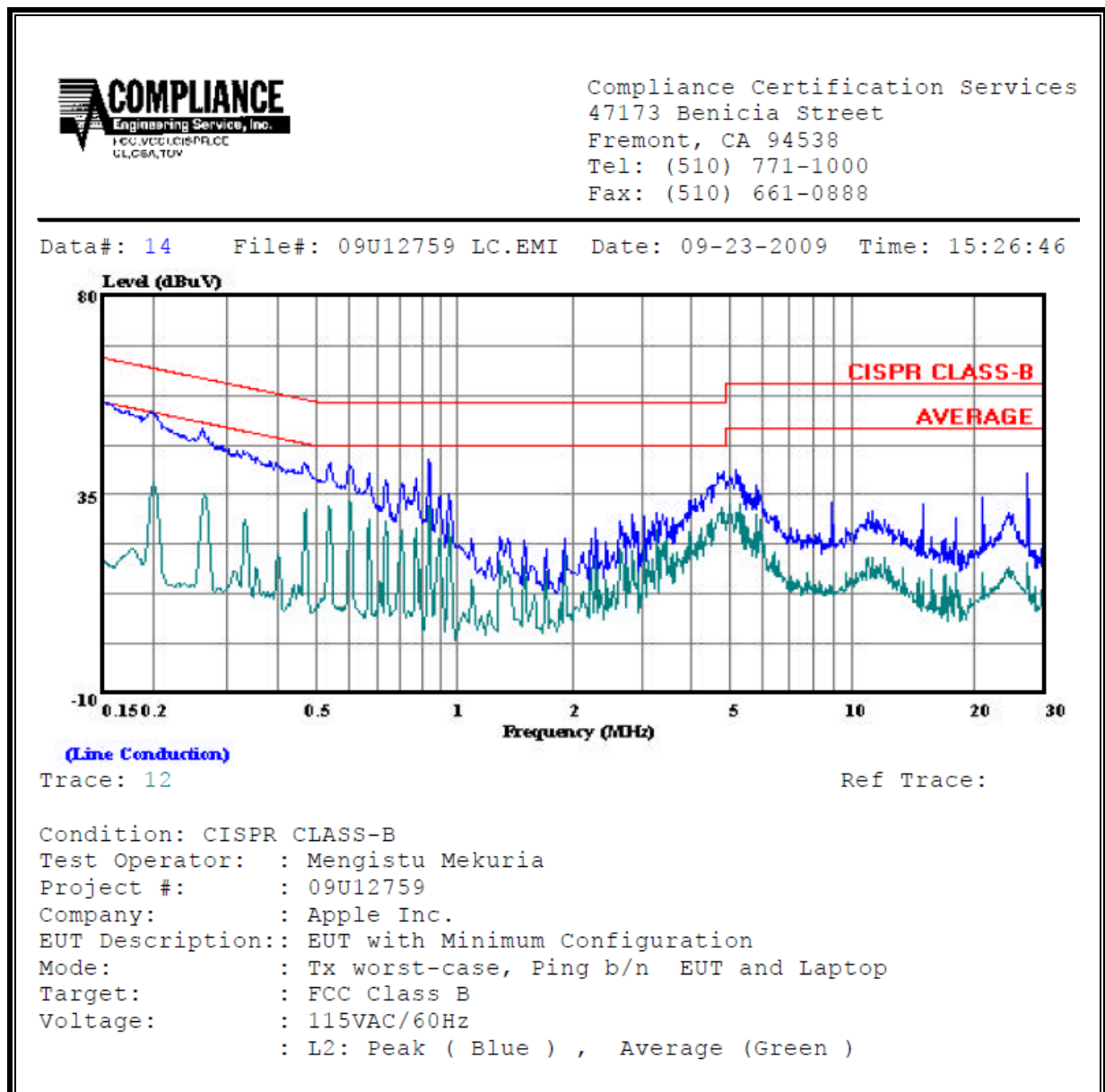
(Line Conduction)

Trace: 19

Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Mengistu Mekuria
Project #: : 09U12759
Company: : Apple Inc
EUT Description: EUT with Minimum Configuration
Mode: : Tx worst-case, Ping b/n EUT and Laptop
Target: : FCC Class B
Voltage: : 115VAC/60Hz
: L1: Peak (Blue) , Average (Green)

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 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.

$$\text{Total EIRP} = (P1 * G1) + (P2 * G2) + \dots + (Pn * Gn)$$

where

Px = Power of transmitter x

Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

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

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

RESULTS

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm^2)	IC Power Density (W/m^2)
WLAN, 11b	2.4 GHz	20.0	23.75	6.80	0.23	2.26
WLAN, 11g	2.4 GHz	20.0	21.56	6.80	0.14	1.36
WLAN, HT20	2.4 GHz	20.0	21.17	4.32	0.07	0.70
WLAN, 11a	5.8 GHz	20.0	23.07	7.77	0.24	2.41
WLAN, HT20	5.8 GHz	20.0	22.17	4.38	0.09	0.90
WLAN, HT40	5.8 GHz	20.0	21.44	4.38	0.08	0.76

Notes:

Antenna Gain for 11b, 11g and 11a is the combined antenna gain for both chains.

Antenna gain for HT20 and HT40 is the maximum antenna gain of both chains.

Output power is the combined output power for both chains.