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

CERTIFICATION TEST REPORT

FOR

802.11b/g/n WLAN RADIO MODULE

MODEL NUMBER: 1410-B

FCC ID: P9J-142401
IC: 4751A-142401

REPORT NUMBER: 12U14226-1, Revision C

ISSUE DATE: MARCH 15, 2012

Prepared for
TROPOS NETWORKS
555 DEL REY AVENUE
SUNNYVALE, CA 94085, U.S.A.

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

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/15/12	Initial Issue	F. Ibrahim
A	02/16/12	Revised section 5.2	F. Ibrahim
B	02/28/12	Revised test equipment list	F. Ibrahim
C	03/15/12	Revised section 7.4.3	F. Ibrahim

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: TROPOS NETWORKS
555 DEL REY AVENUE
SUNNYVALE, CA 94085, U.S.A.

EUT DESCRIPTION: 802.11b/g/n WLAN RADIO MODULE

MODEL: 1410-B

SERIAL NUMBER: 104

DATE TESTED: JANUARY 17- FEBRUARY 03, 2012

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

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

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

Approved & Released For UL CCS By:

FRANK IBRAHIM
EMC SUPERVISOR
UL CCS

Tested By:

THANH NGUYEN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

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

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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 802.11b/g/n WLAN RADIO MODULE.

The radio module is manufactured by Tropos Networks.

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	25.13	325.84
2412 – 2462	802.11g	25.04	319.15
2412 – 2462	802.11n HT20	27.39	548.28
2422 – 2452	802.11n HT40	27.35	543.25

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two Omni Monopole antennas, with a maximum gain of 7.4 dBi for each.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software and firmware installed in the EUT during testing was Atheros Radio Test version 2.19

The test utility software used during testing was Tera Term Pro, ttemppro.exe, and ART2/GUI Ver. 2. artgui.exe

5.5. WORST-CASE CONFIGURATION AND MODE

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

802.11b Mode: 1 Mbps.
802.11g Mode: 6 Mbps.
802.11n HT20 Mode: MCS 0.
802.11n HT40 Mode: MCS 0

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power as a worst-case scenario.

For Radiated Band Edge measurements preliminary testing showed that the worst case was Vertical polarization, so final measurements were performed with Vertical polarization.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	DELL	D510	HW30	DoC
AC Adapter	DELL	ADP-65 JB B	CN-0F8834-48661-59P	DoC
EUT AC Adapter	I.T.E	PW173KB1203F01	C2031	N/A

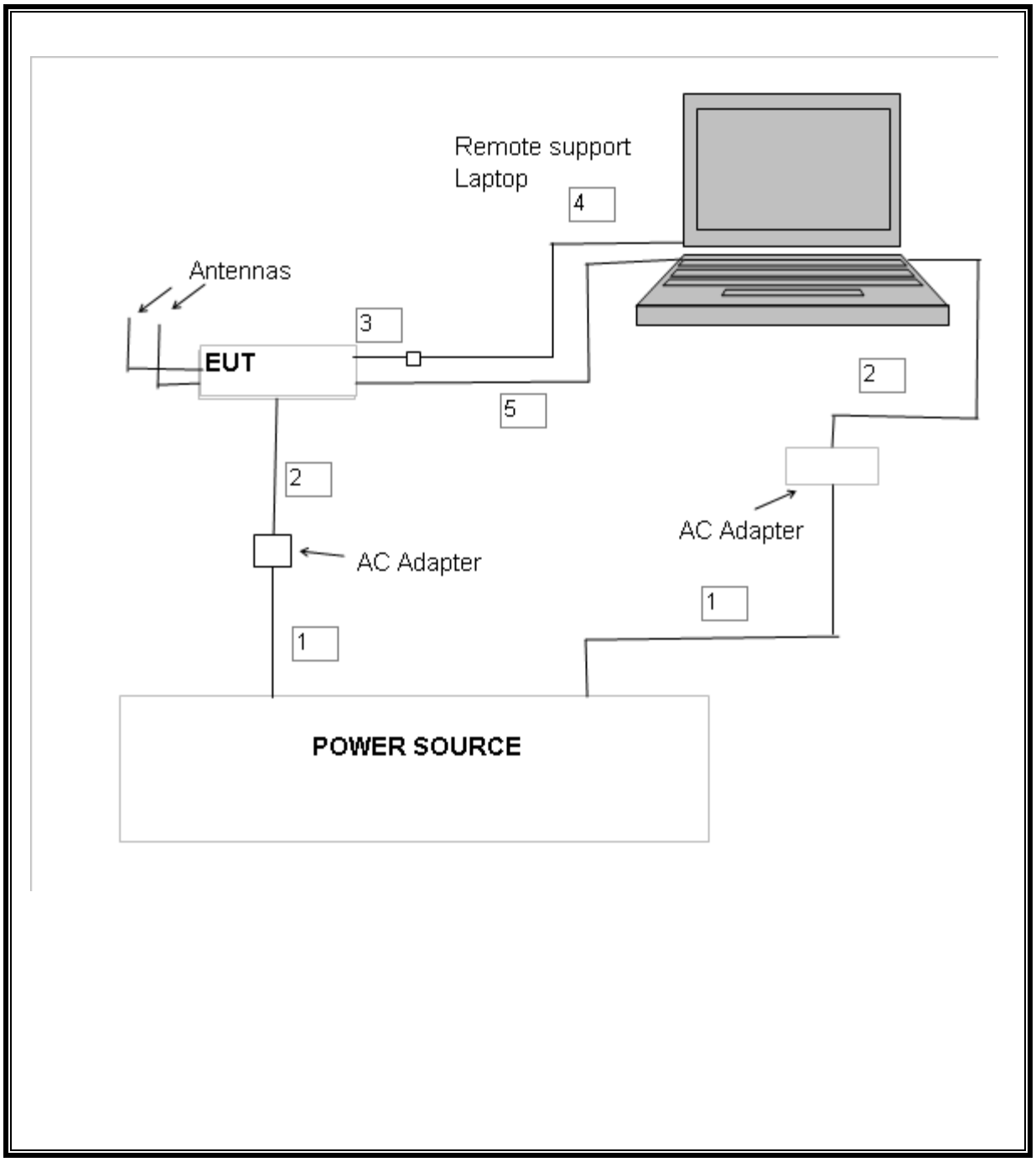
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	2	US115V	Unshielde	1m	N/A
2	DC	2	DC Plug	Unshielde	1.5m	N/A
3	LAN	1	RJ45	Unshielde	.2m	N/A
4	Serial Port	1	RS232	Unshielde	2m	N/A
5	LAN	1	RJ45	Unshielde	1.5m	N/A

TEST SETUP

The EUT is connected to the host laptop computer via LAN and Serial ports during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR 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**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	06/13/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/16/12
PreAmplifier	Agilent / HP	8447D	C00249	07/25/12
Antenna, Horn, 18 GHz	EMCO	3115	C00872	09/02/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	06/13/12
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	11/16/12
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/17/12
EMI Test Receiver	R&S	ESC17	10000741	07/02/12
Power Meter	Agilent / HP	437B	N02778	10/18/12
Power Sensor	Agilent / HP	8481A	CCS0078	08/01/13
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	MY46180491	08/11/12
Antenna Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/12

7. ANTENNA PORT TEST RESULTS

7.1. 802.11b LEGACY 2TX 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.

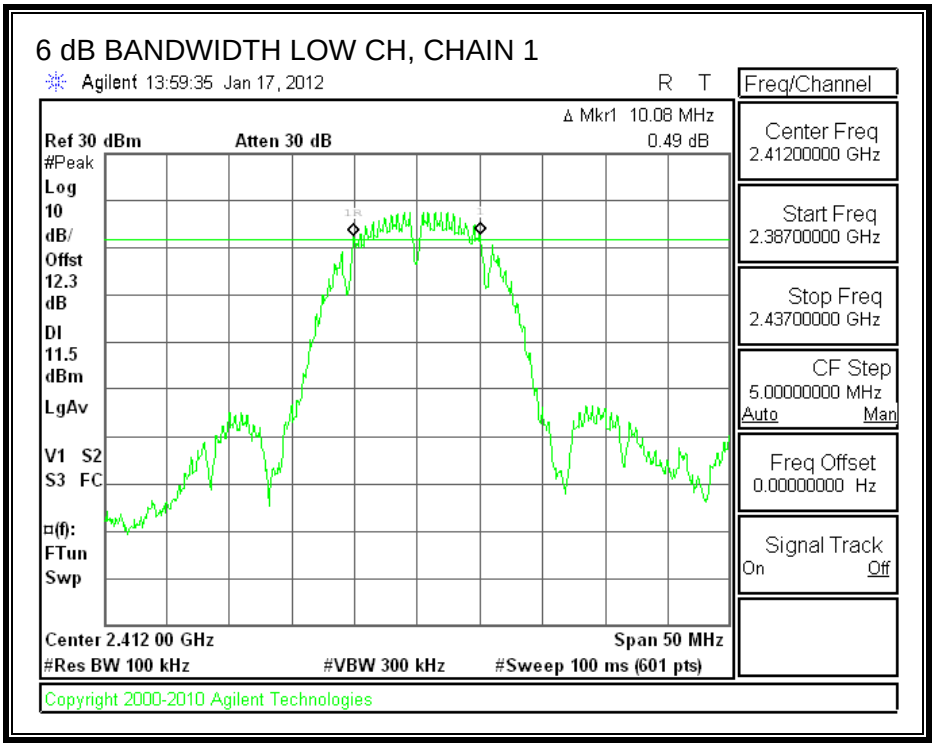
TEST PROCEDURE

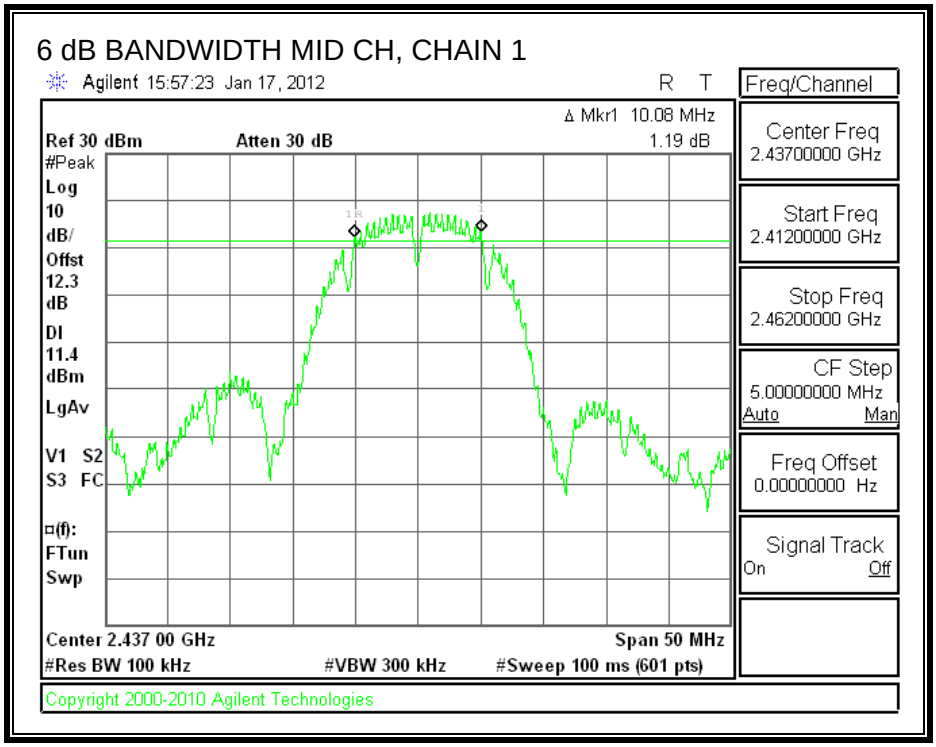
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

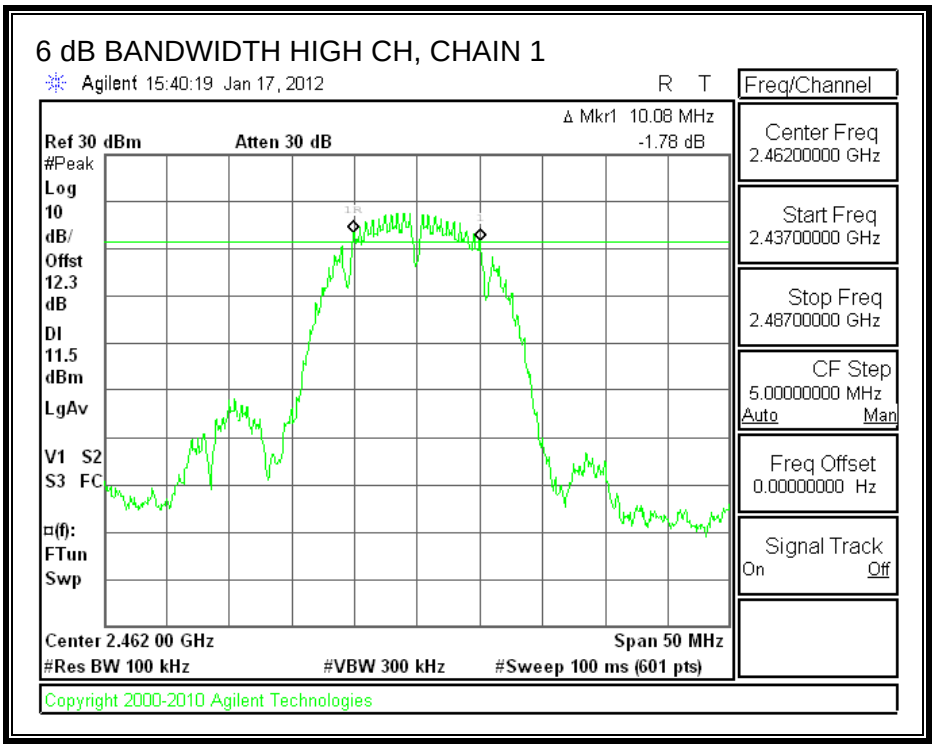
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	10.08	10.17	0.5
Middle	2437	10.08	10.08	0.5
High	2462	10.08	10.08	0.5

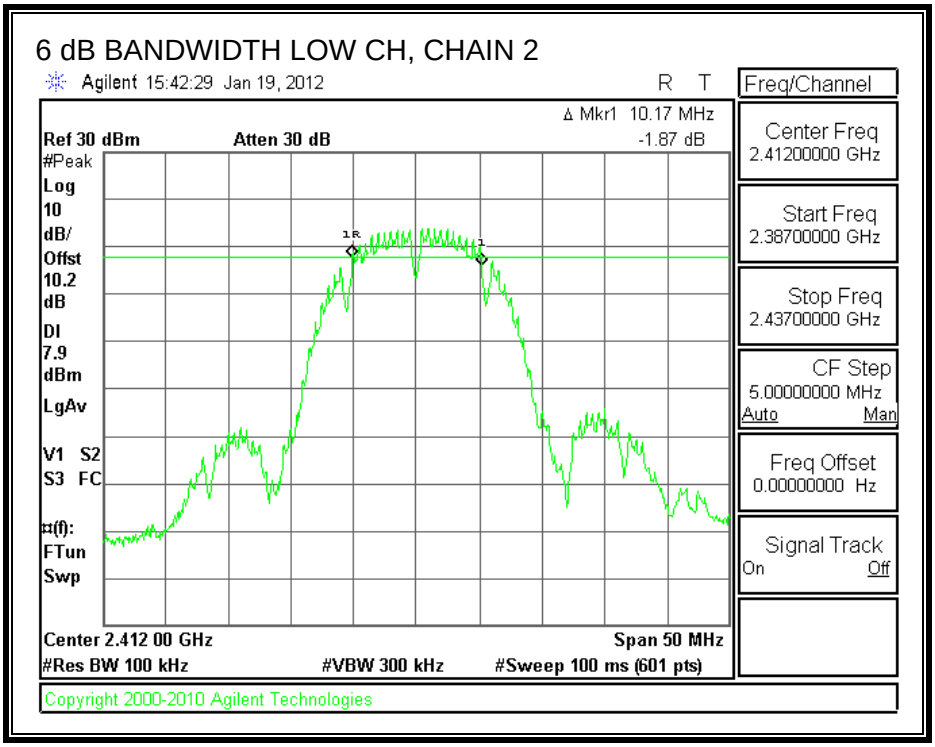
6 dB BANDWIDTH, CHAIN 1

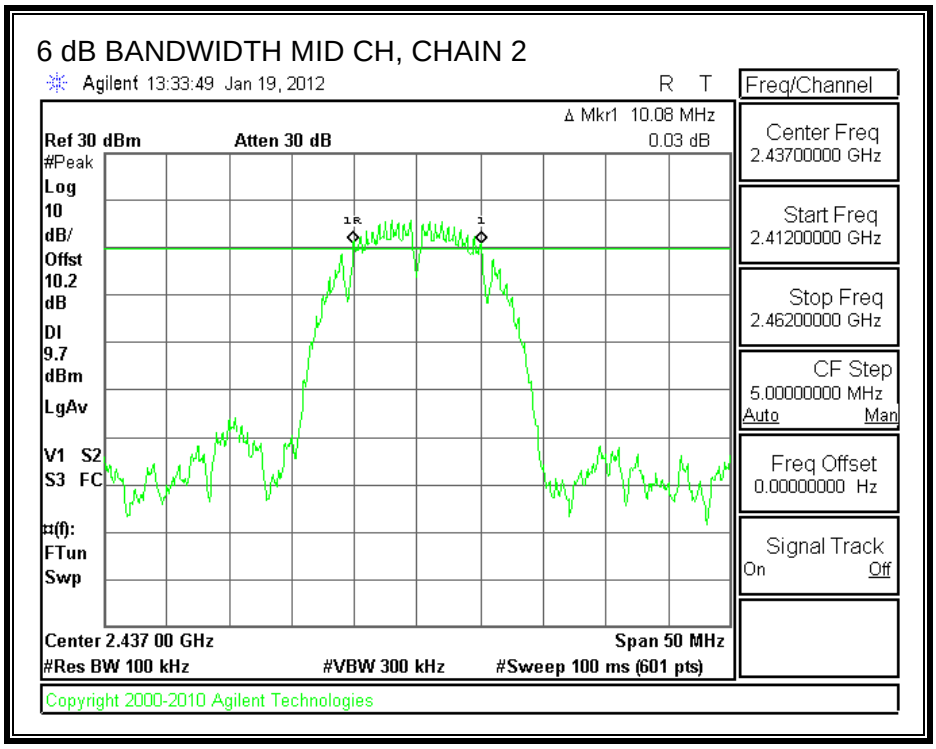


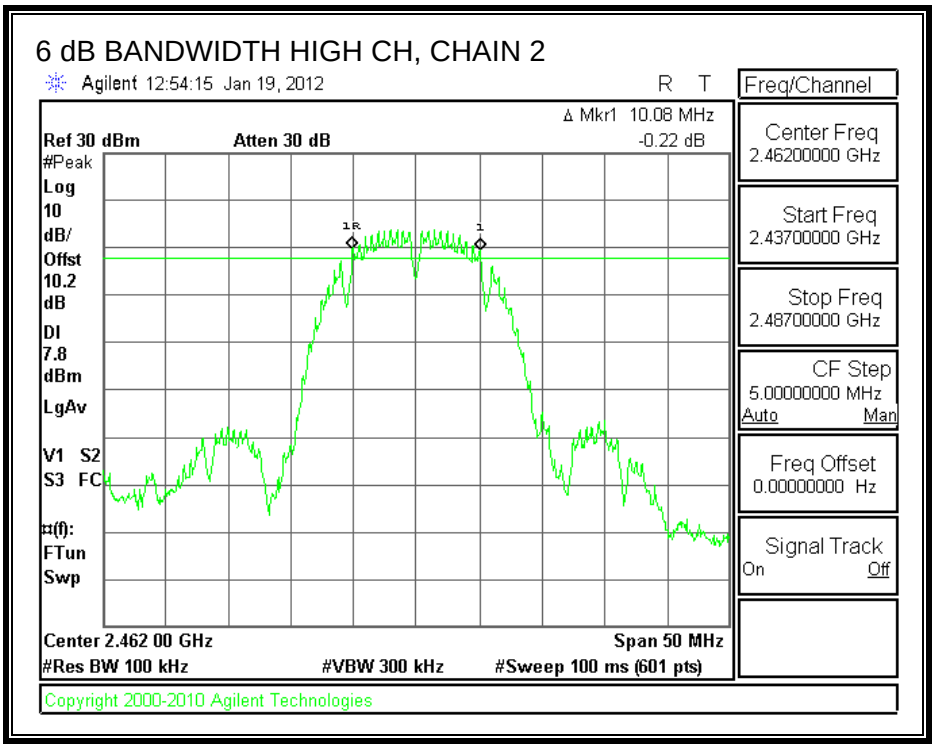




6 dB BANDWIDTH, CHAIN 2







7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

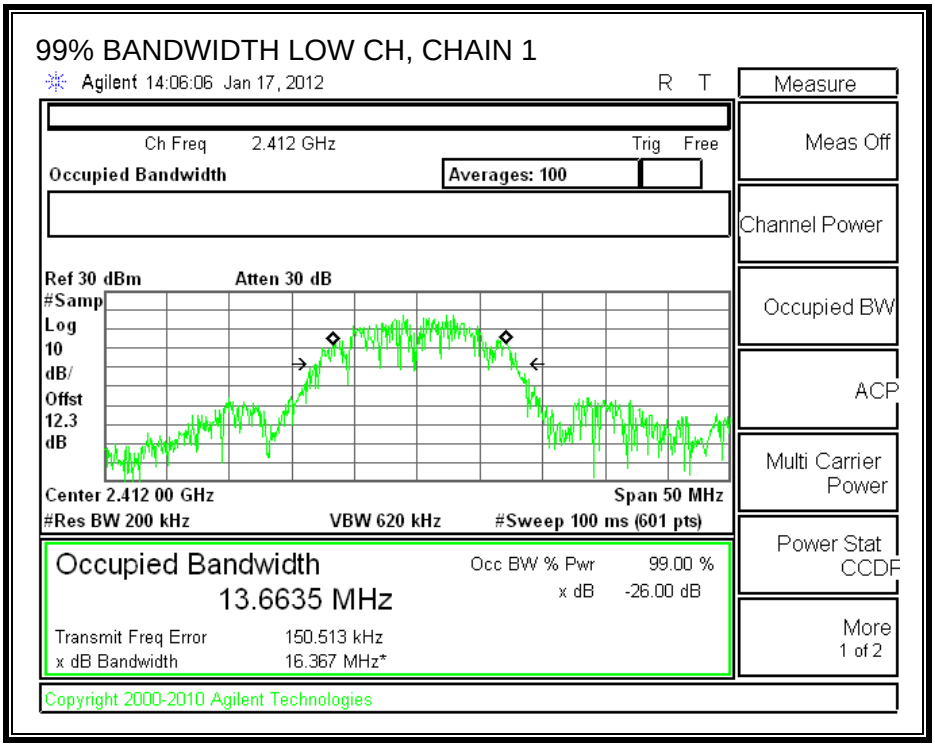
TEST PROCEDURE

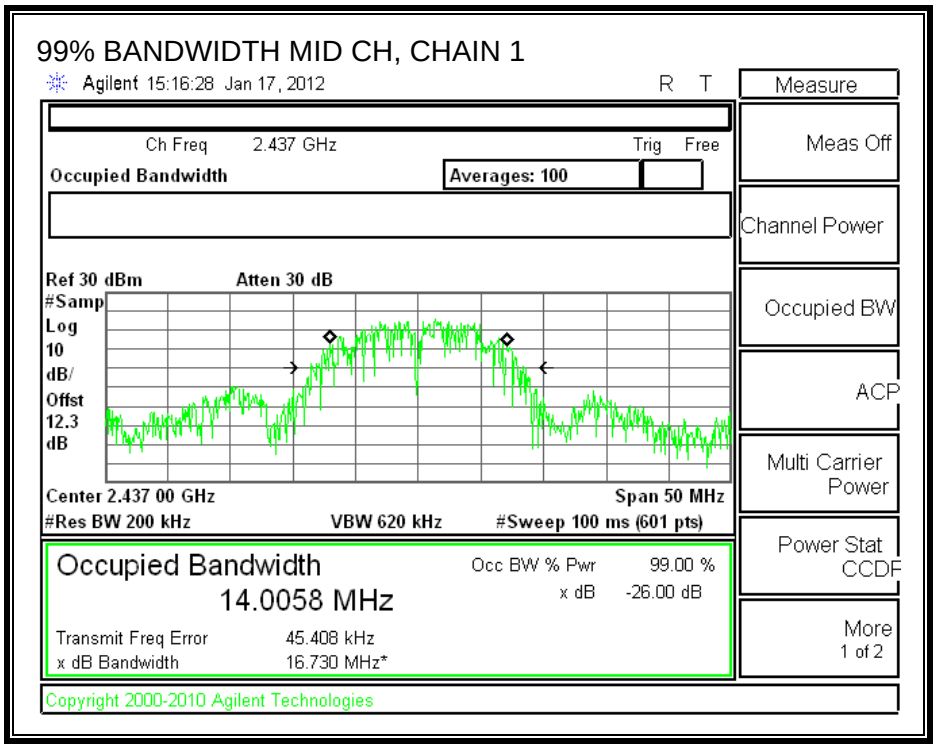
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

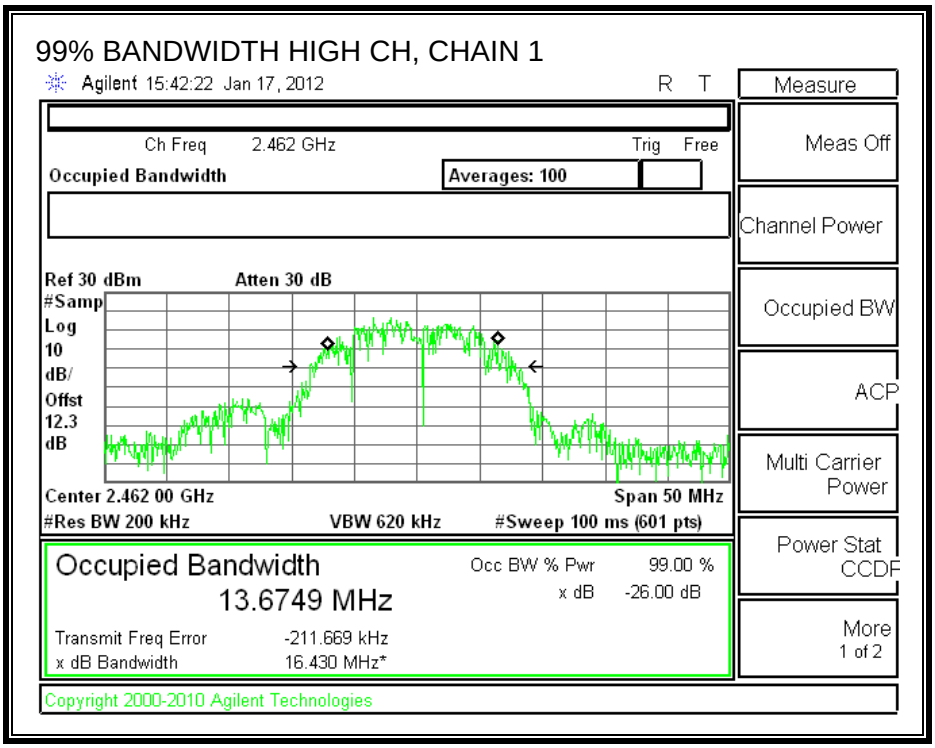
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	2412	13.6635	13.8742
Middle	2437	14.0058	13.6976
High	2462	13.6749	13.7806

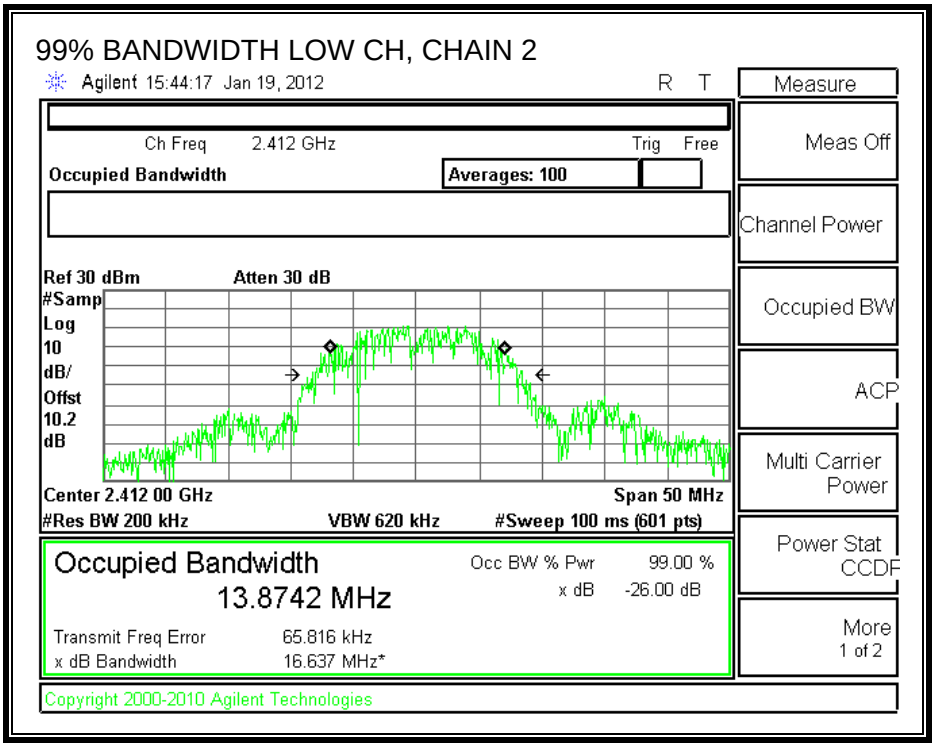
99% BANDWIDTH, CHAIN 1

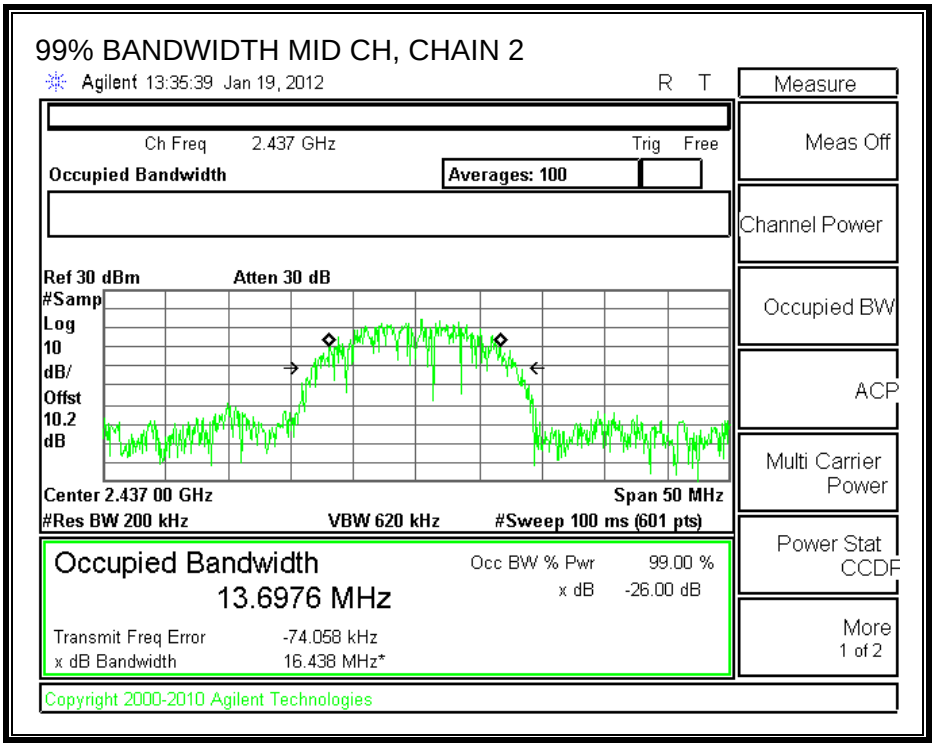


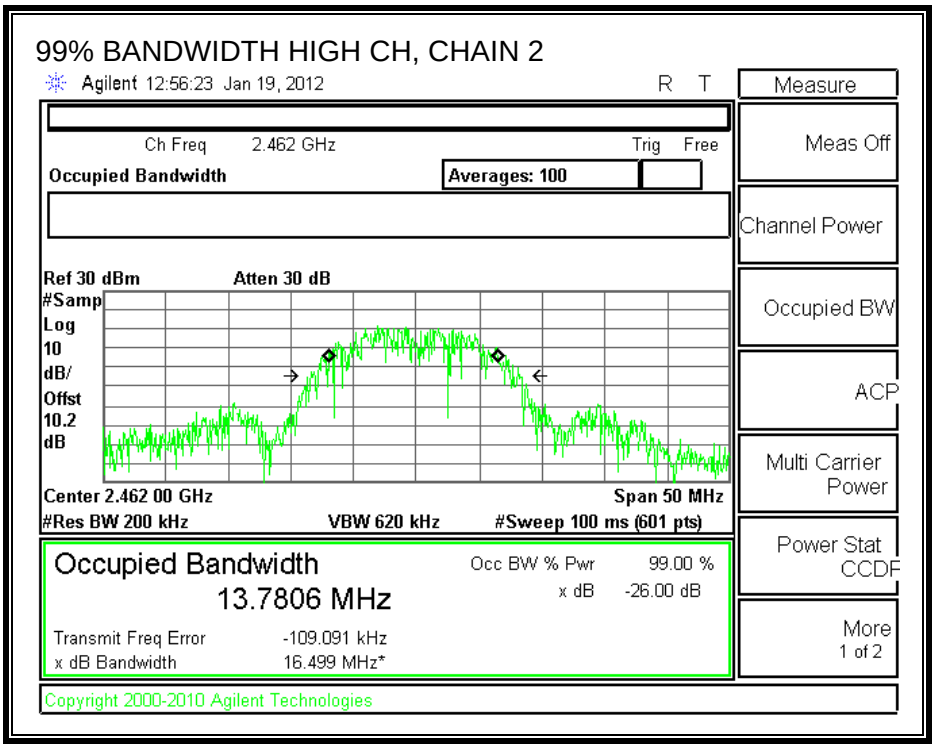




99% BANDWIDTH, CHAIN 2







7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
7.4	3.01	10.41

The maximum effective legacy gain is 10.41 dBi for other than fixed, point-to-point operations, therefore the limit is 25.59 dBm.

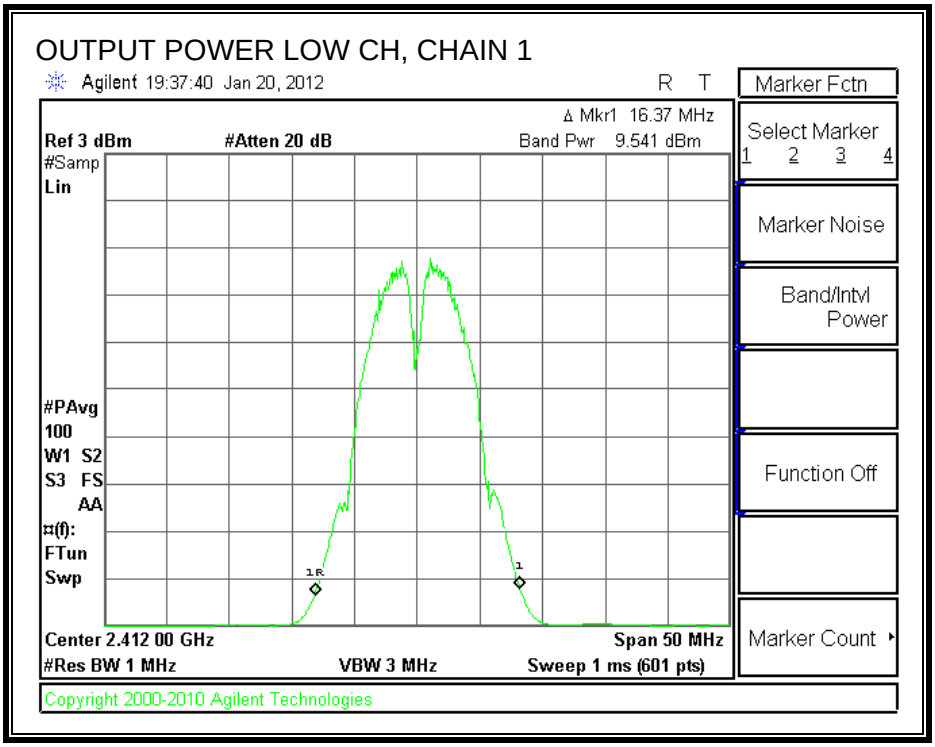
TEST PROCEDURE

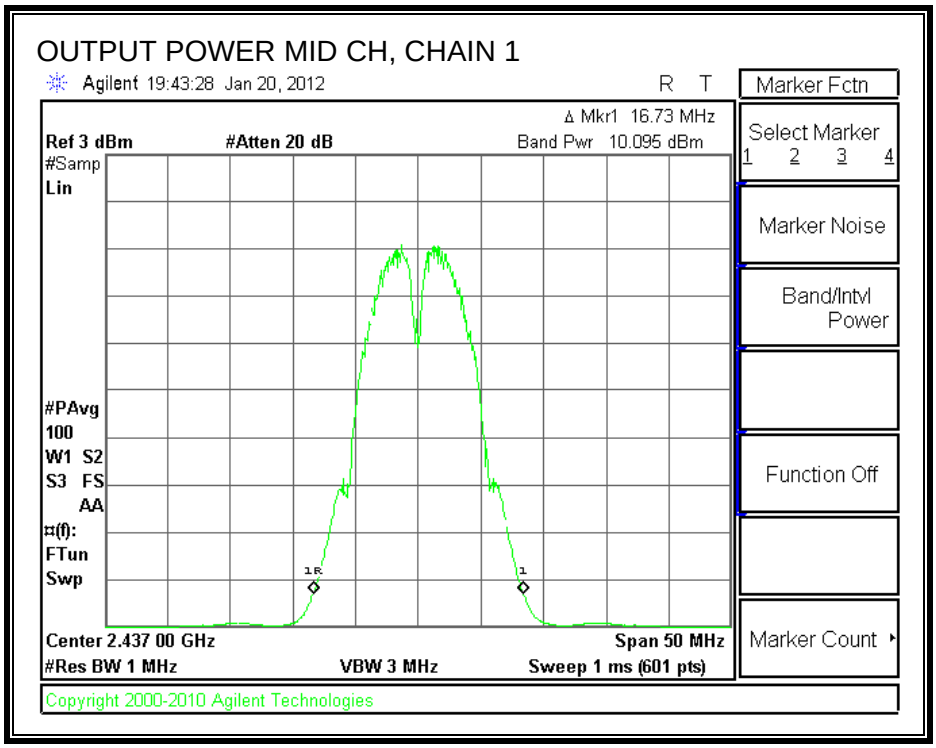
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

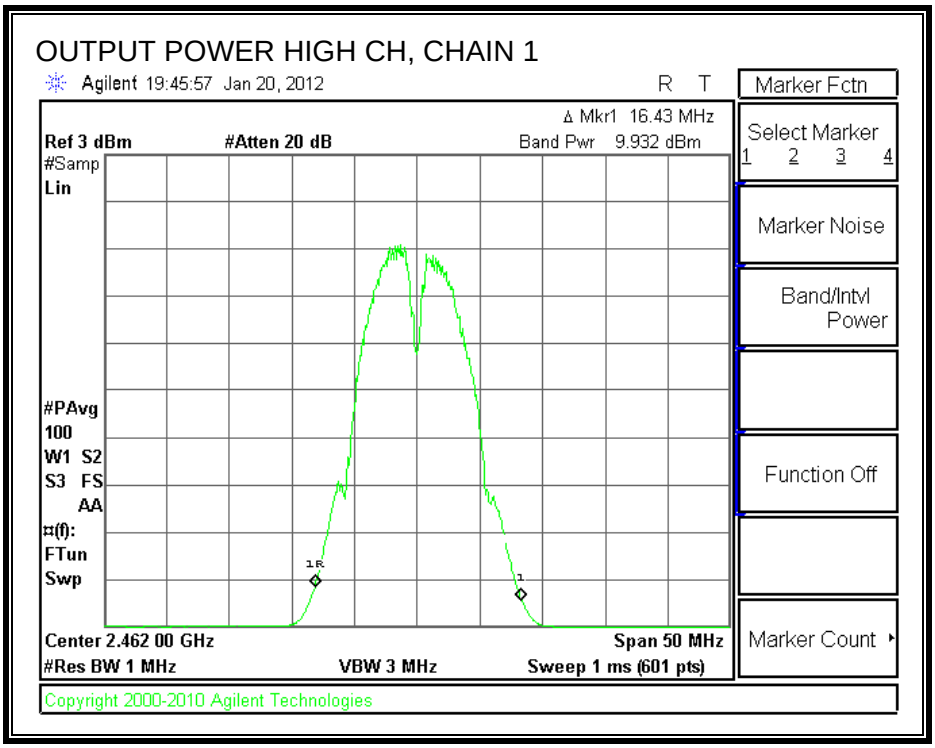
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	9.541	9.641	12.20	24.802	25.59	-0.788
Mid	2437	10.095	9.731	12.20	25.127	25.59	-0.463
High	2462	9.932	9.875	12.20	25.114	25.59	-0.476

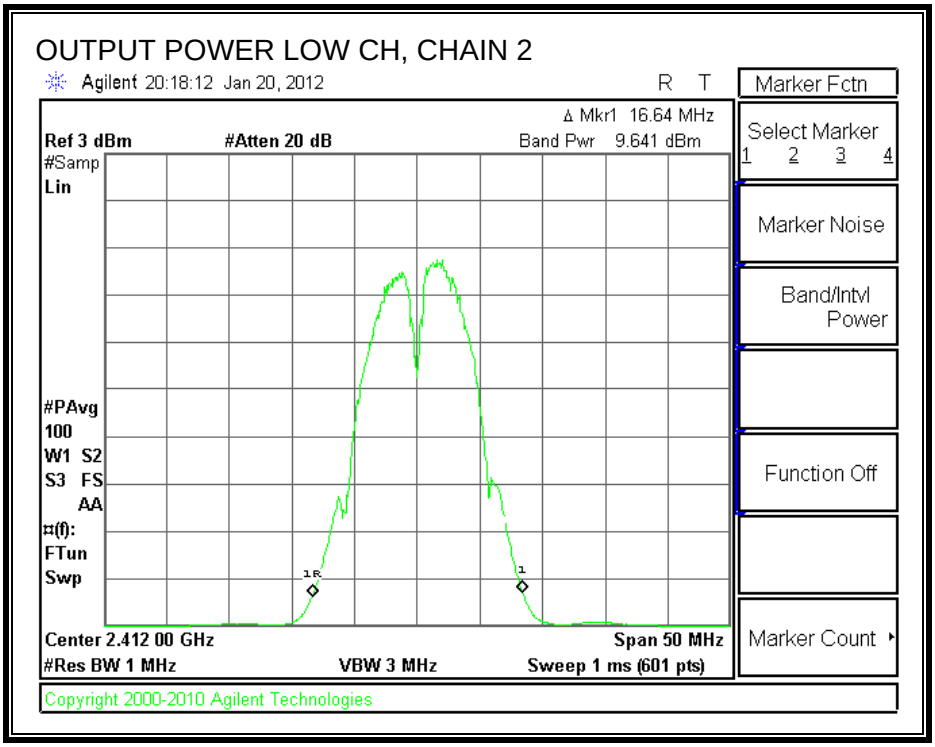
CHAIN 1 OUTPUT POWER

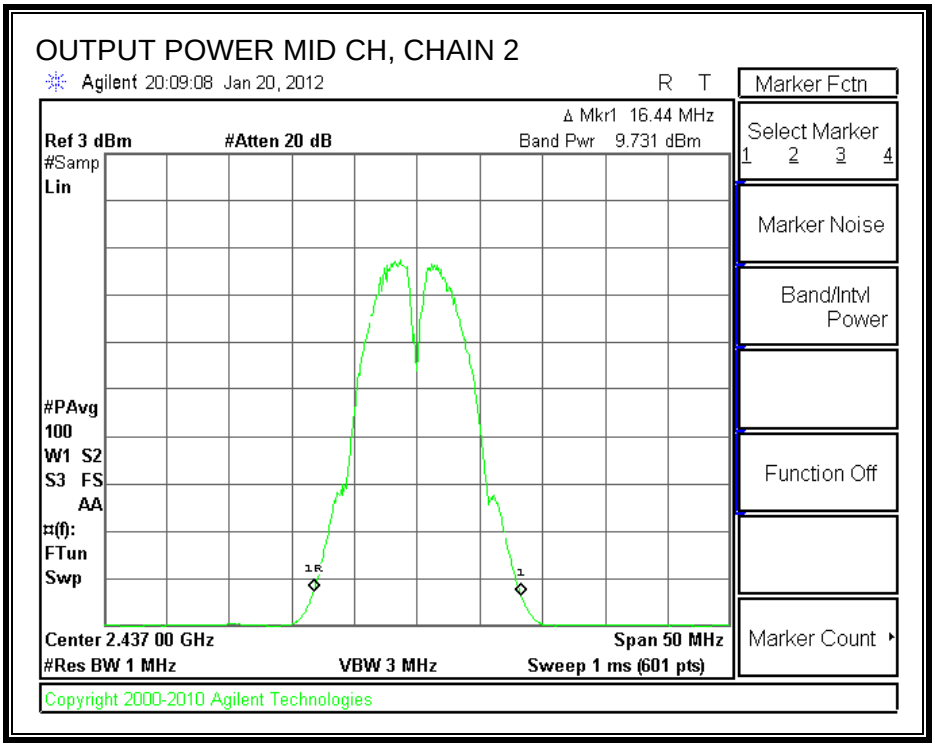


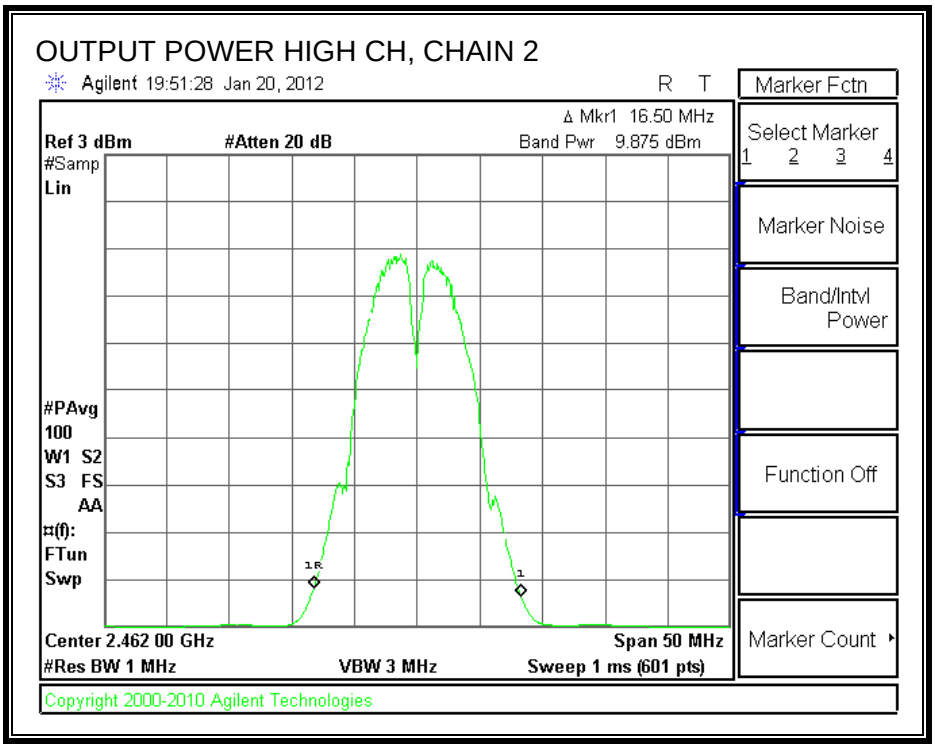




CHAIN 2 OUTPUT POWER







7.1.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.2 dB (including 10 dB pad and .2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2412	21.28	21.73	24.52
Middle	2437	21.43	21.95	24.71
High	2462	21.42	21.77	24.61

7.1.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

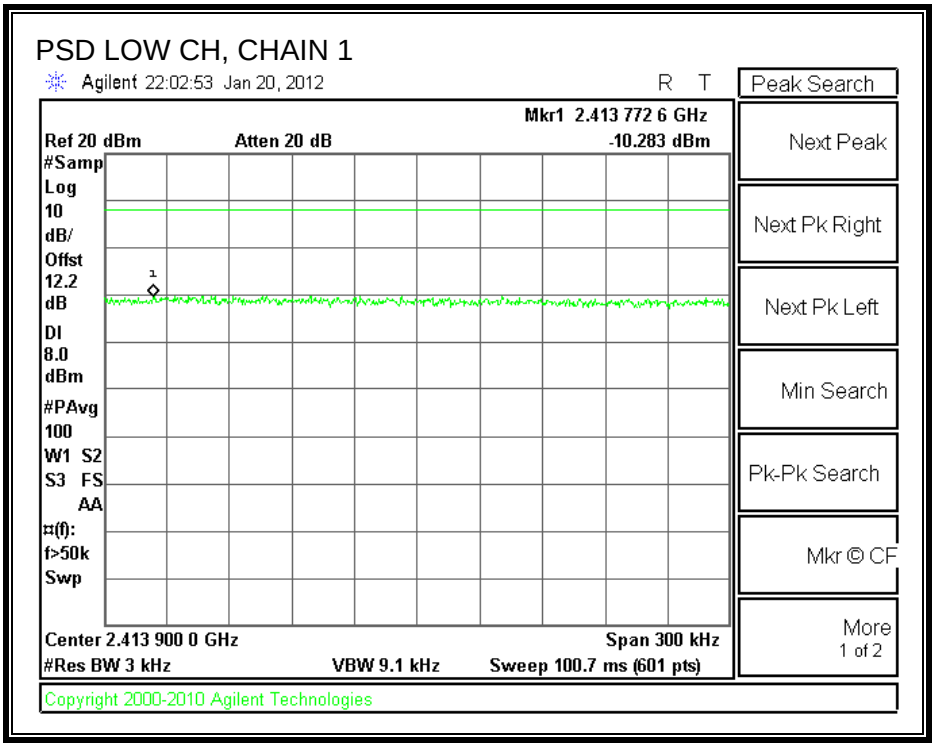
TEST PROCEDURE

Output power was measured based on the use of 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.

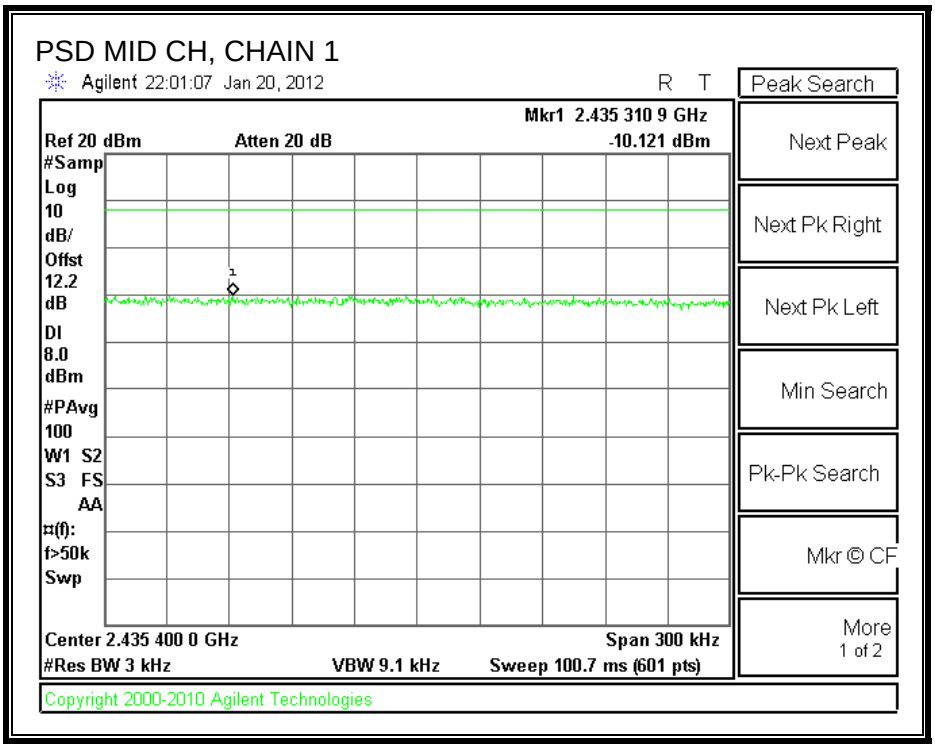
RESULTS

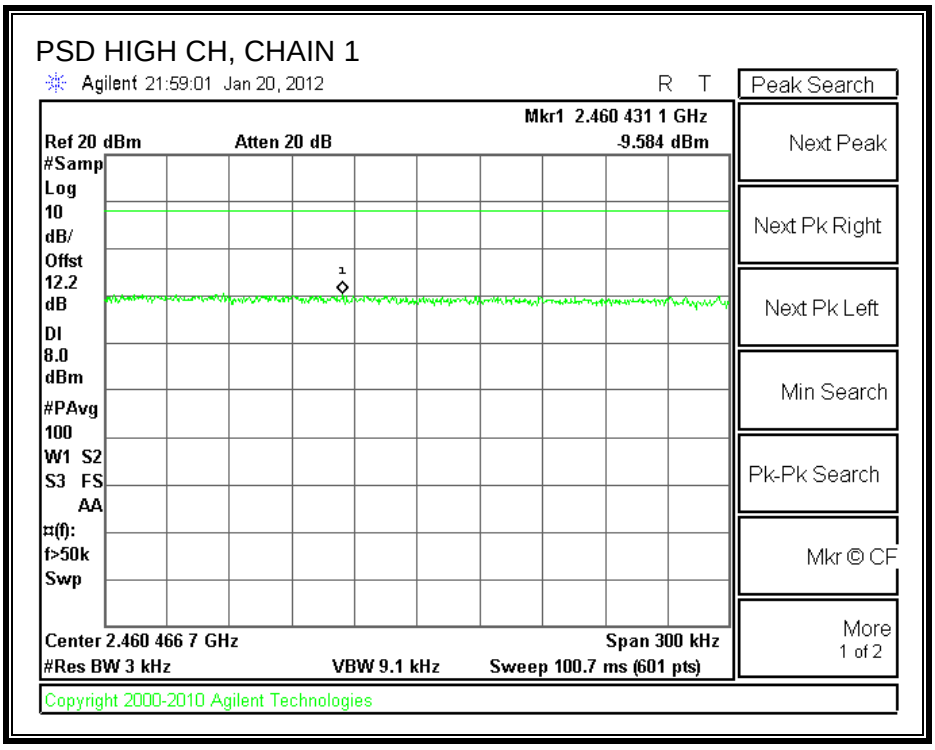
Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-10.283	-9.564	-6.90	8	-14.90
Middle	2437	-10.121	-9.270	-6.66	8	-14.66
High	2462	-9.584	-9.564	-6.56	8	-14.56

POWER SPECTRAL DENSITY, CHAIN 1

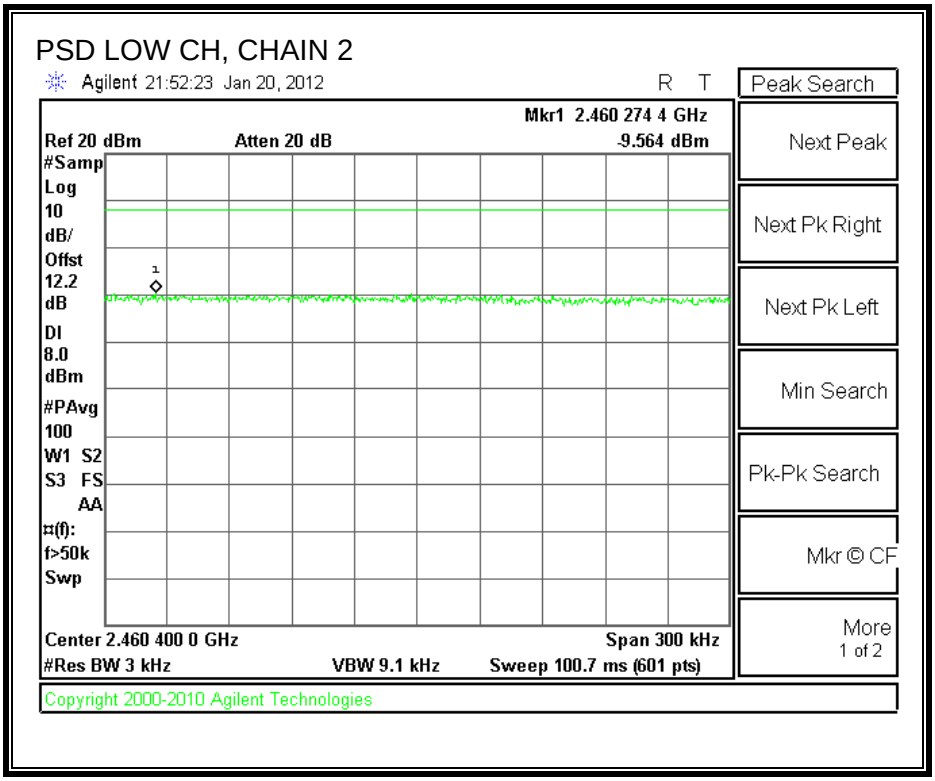


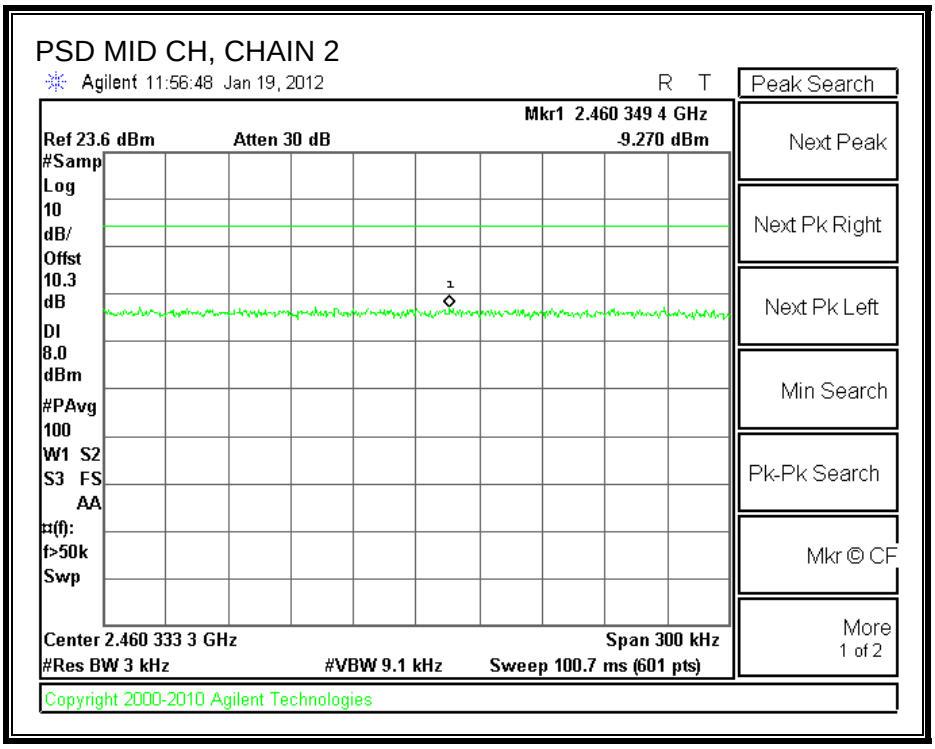
PSD MID CH, CHAIN 1

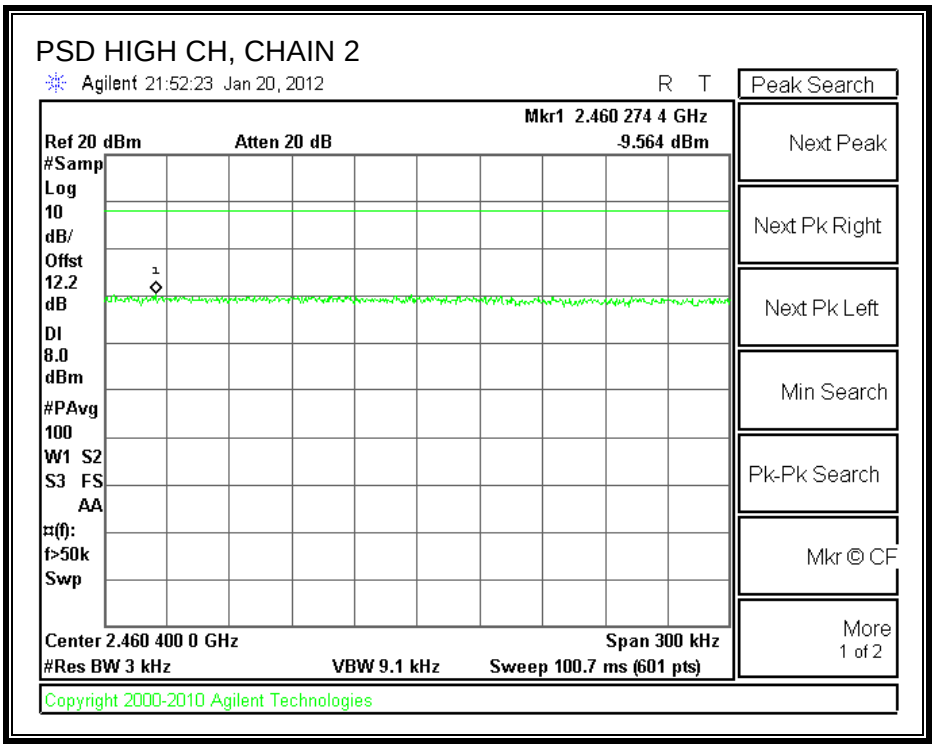




POWER SPECTRAL DENSITY, CHAIN 2







7.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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

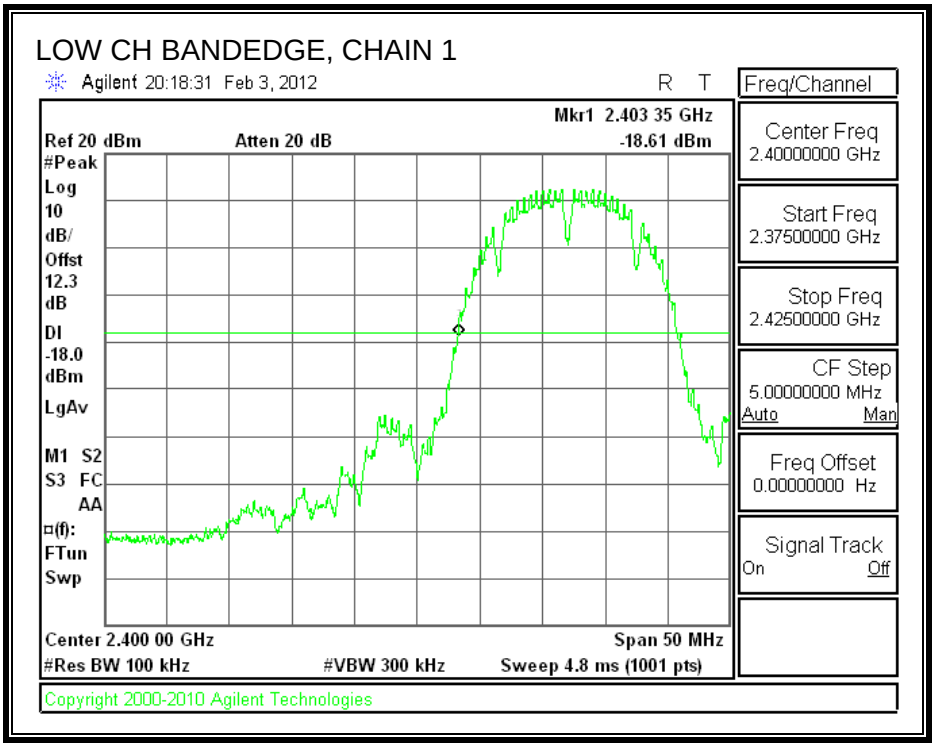
TEST PROCEDURE

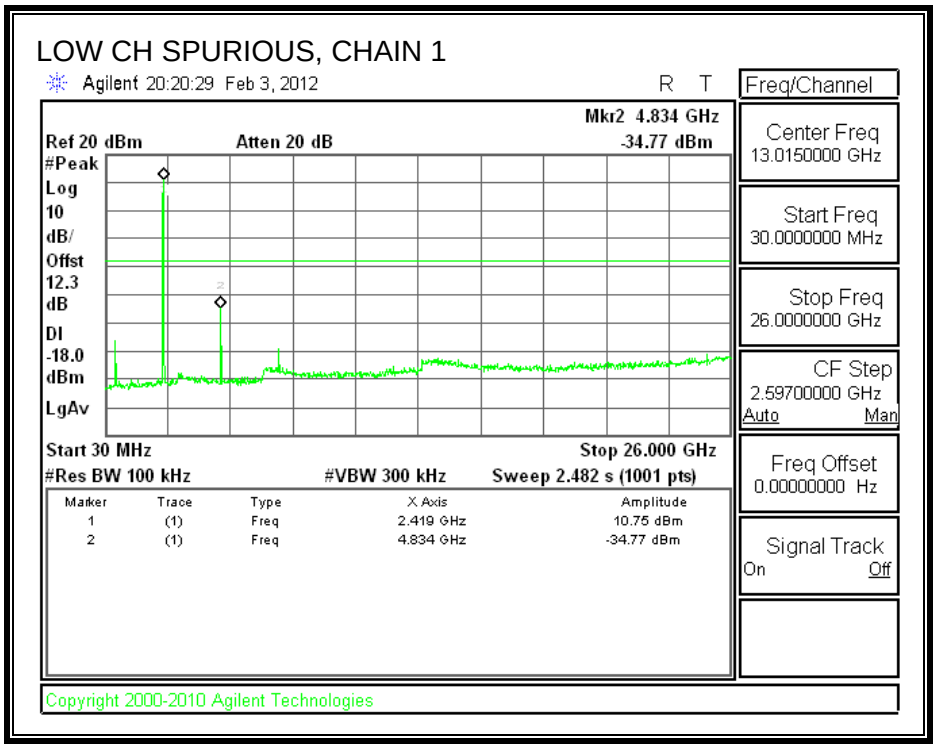
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

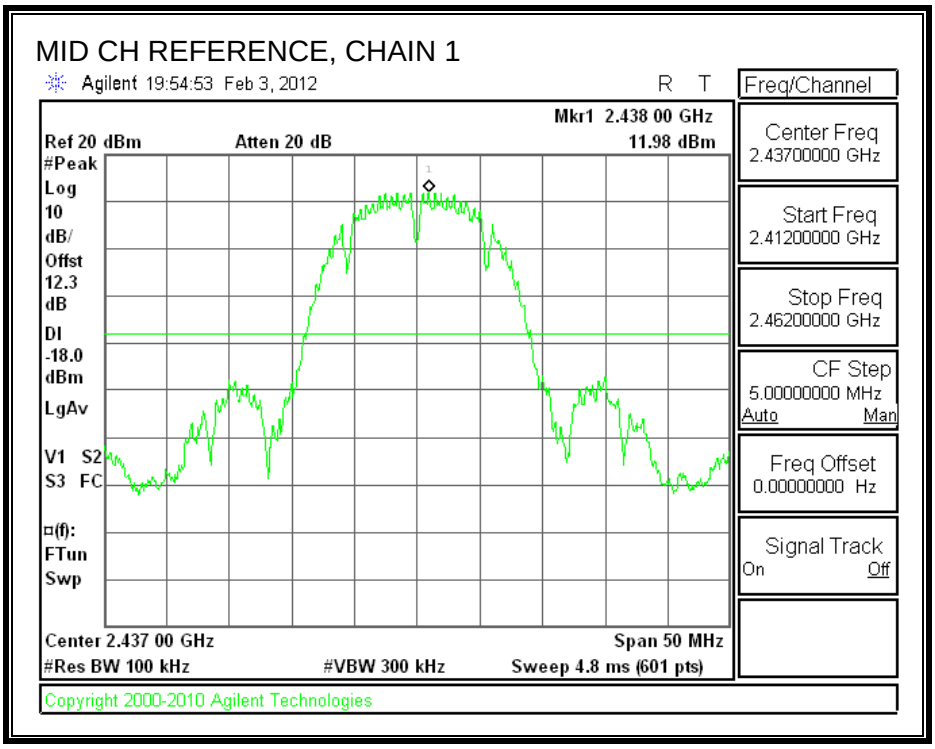
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

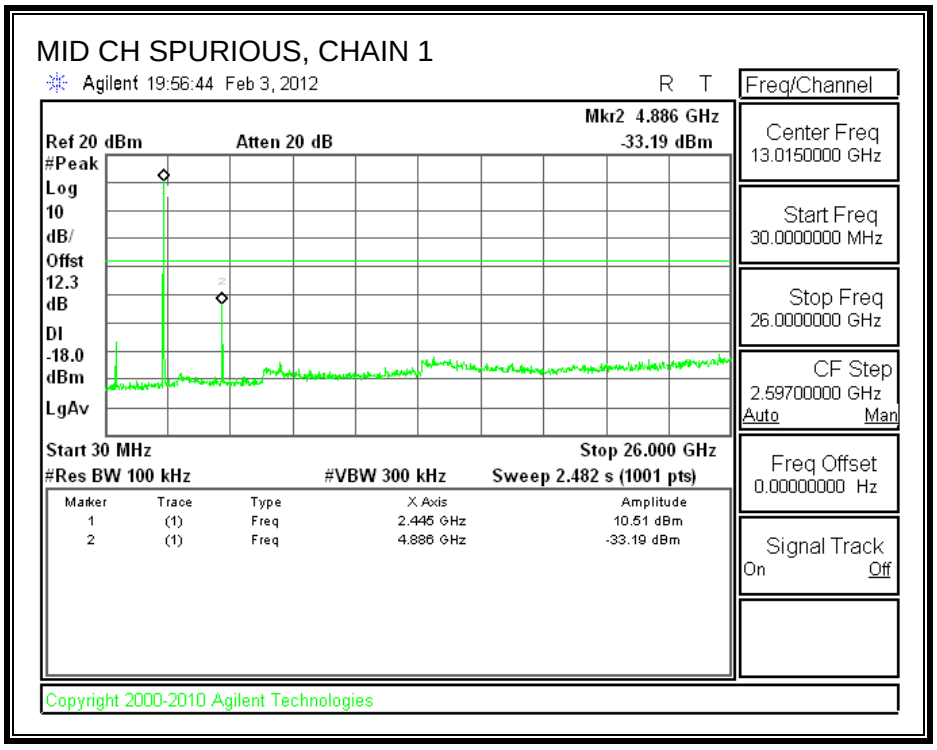
RESULTS

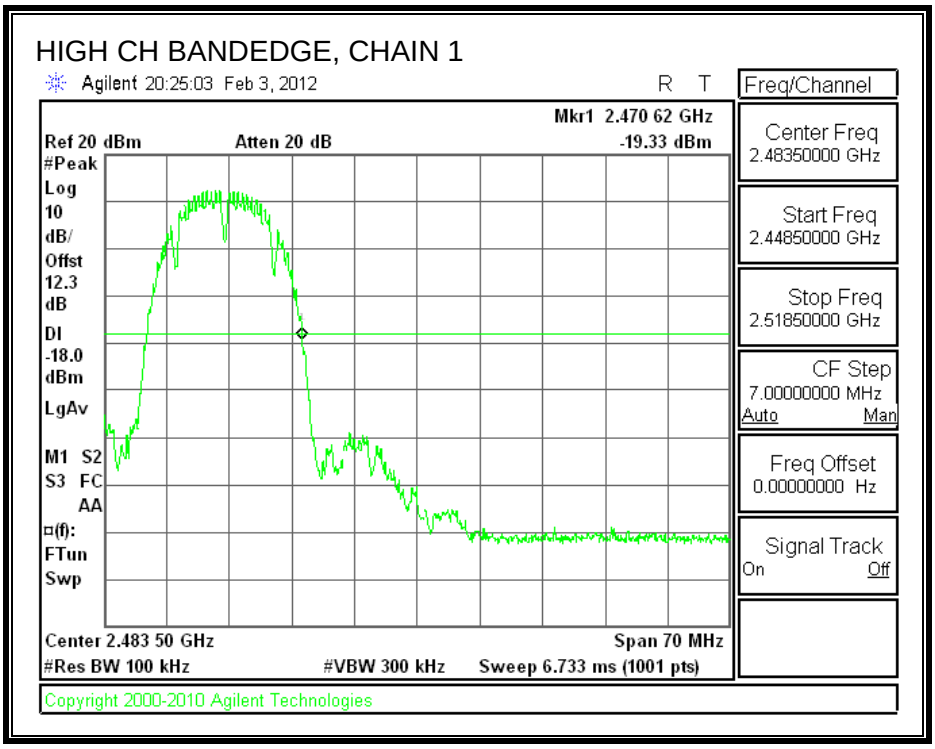
CHAIN 1 SPURIOUS EMISSIONS

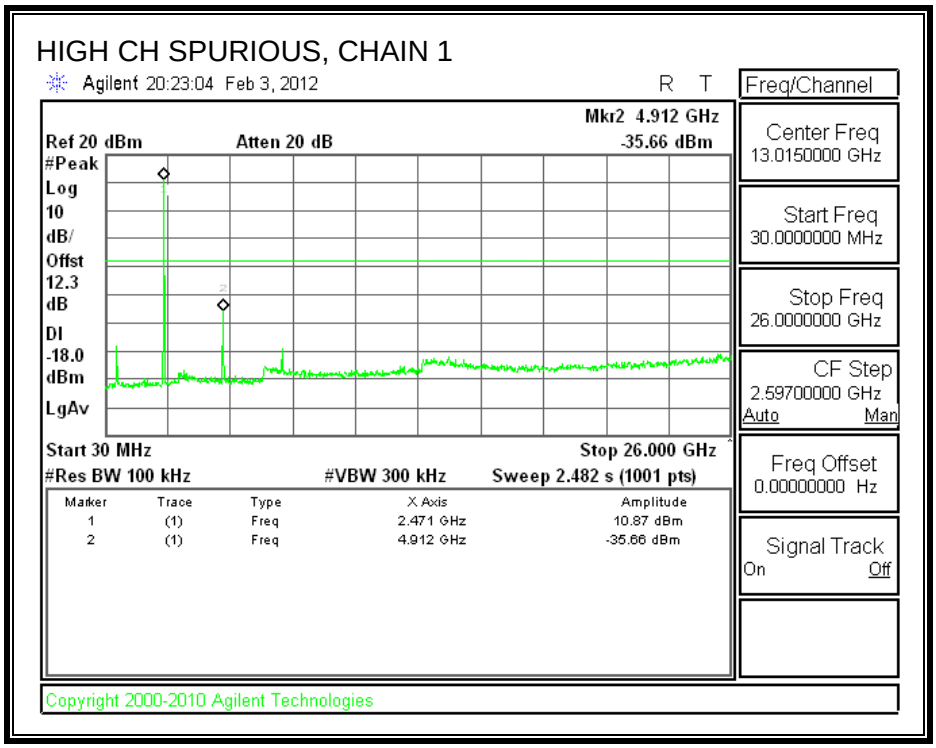




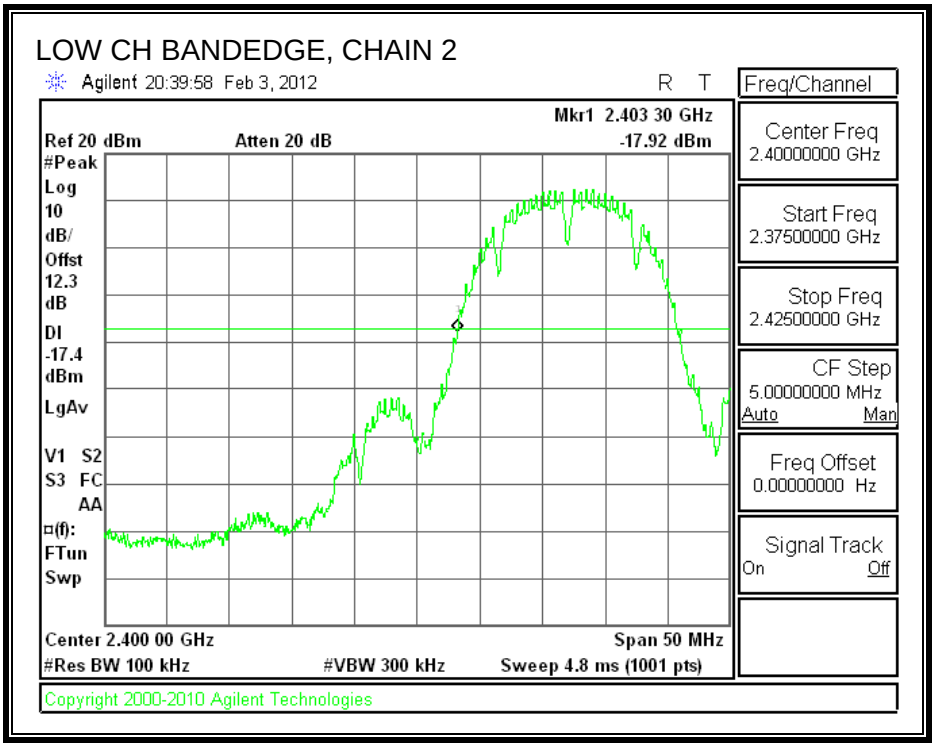


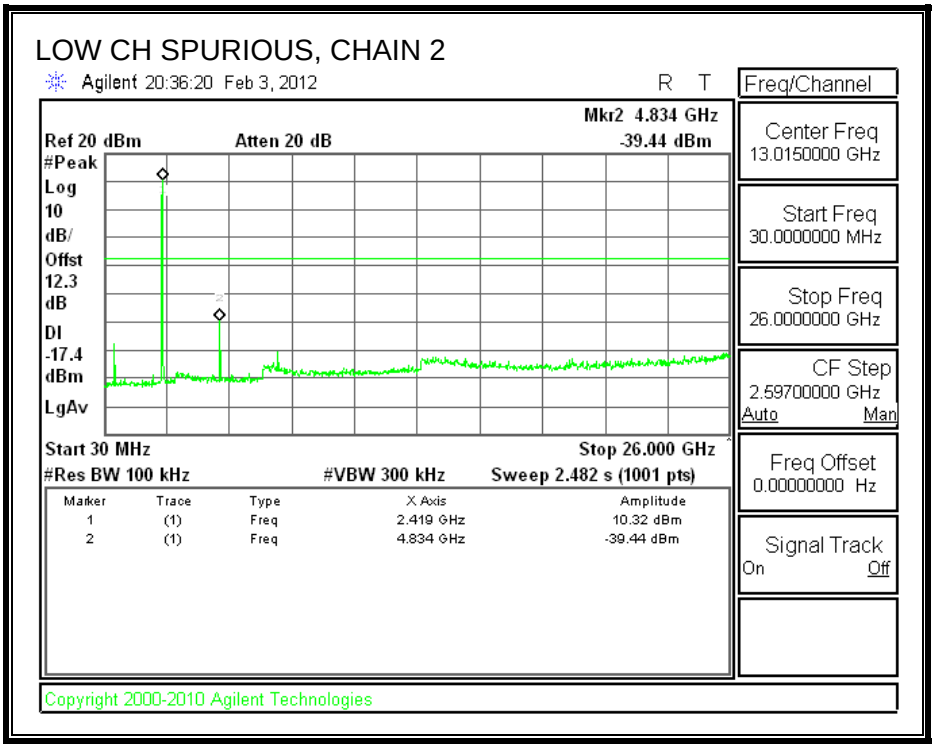


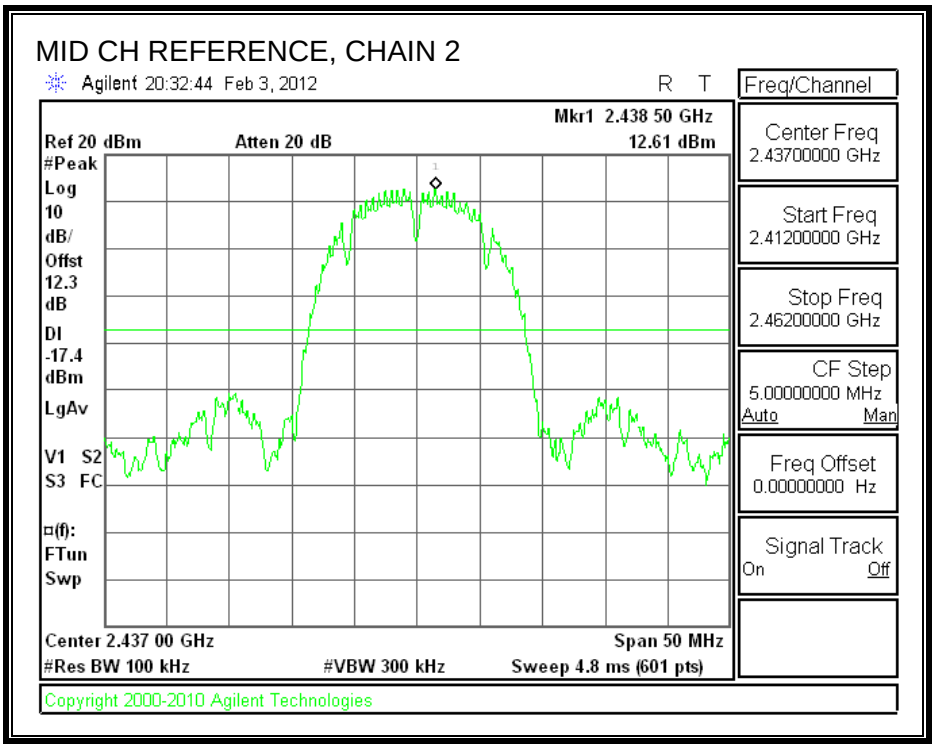


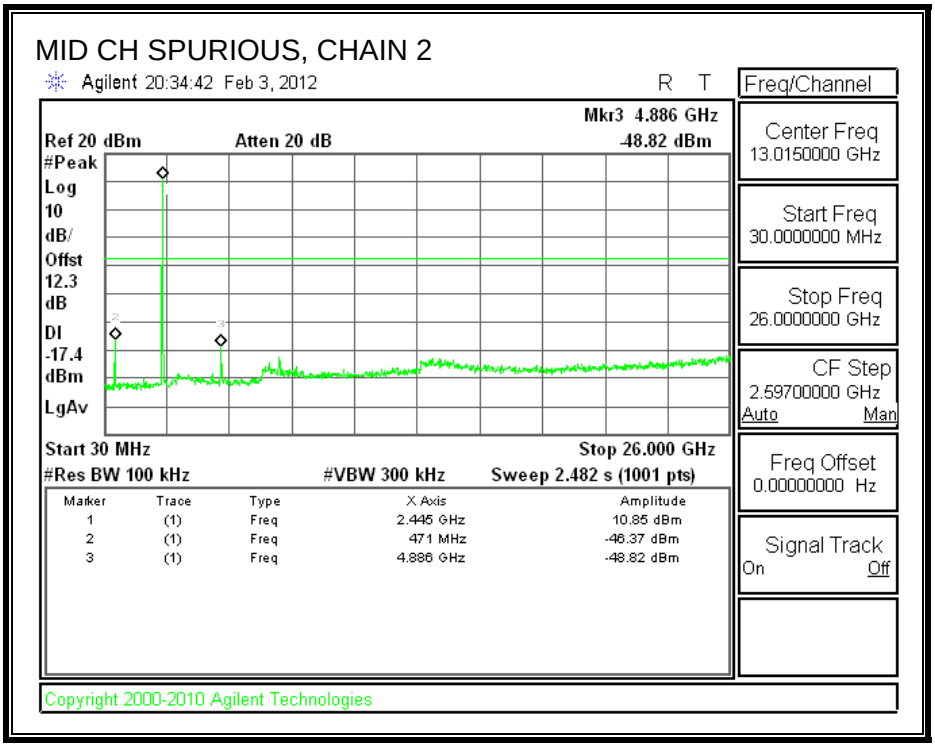


CHAIN 2 SPURIOUS EMISSIONS

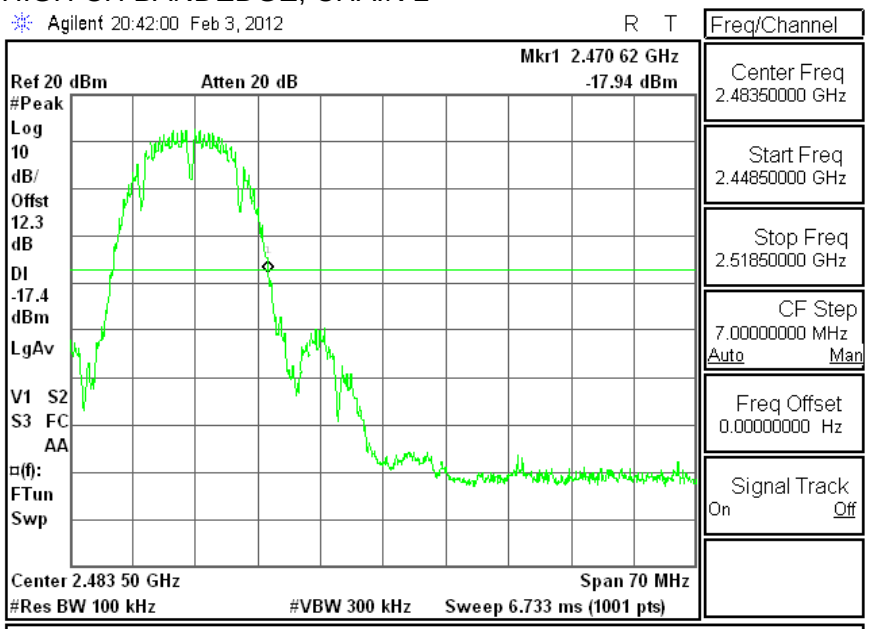




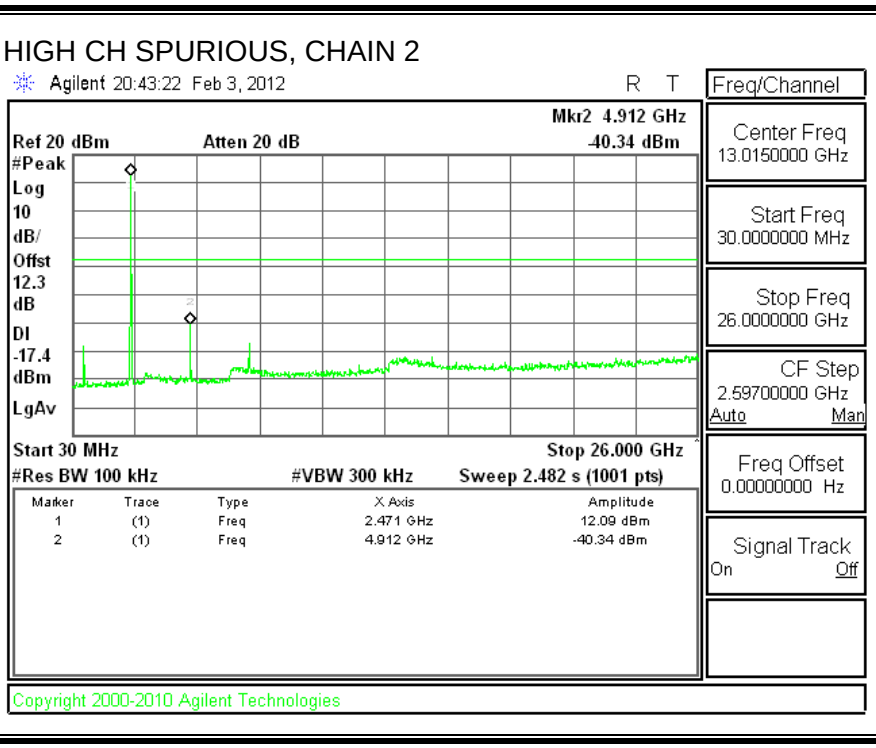




HIGH CH BANDEDGE, CHAIN 2



HIGH CH SPURIOUS, CHAIN 2



7.2. 802.11g LEGACY 2TX 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.

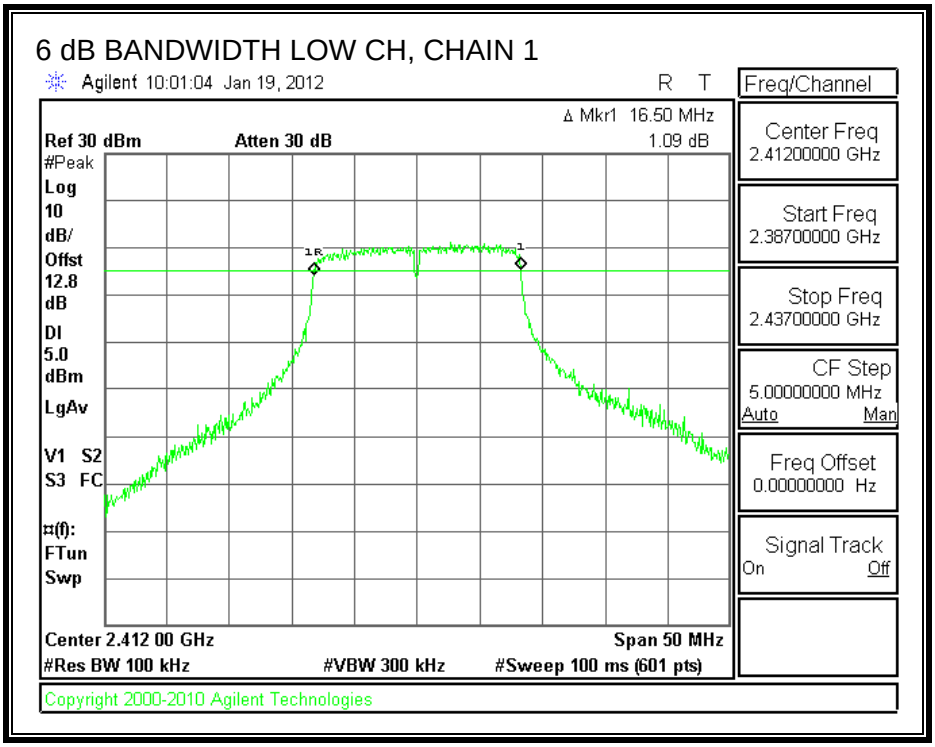
TEST PROCEDURE

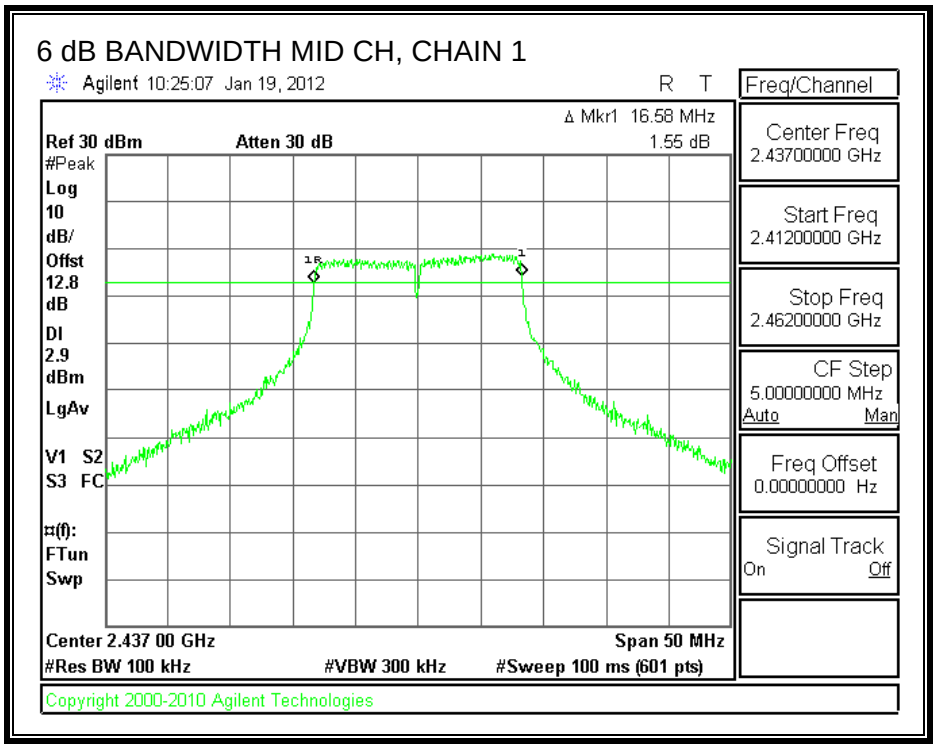
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

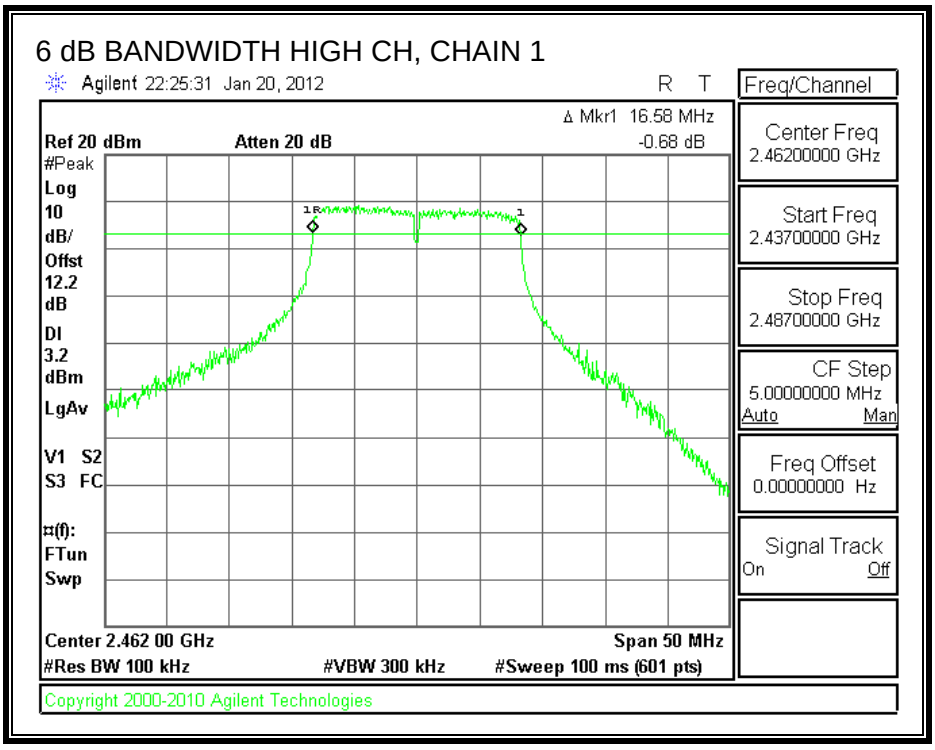
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	16.50	16.50	0.5
Middle	2437	16.58	16.58	0.5
High	2462	16.58	16.58	0.5

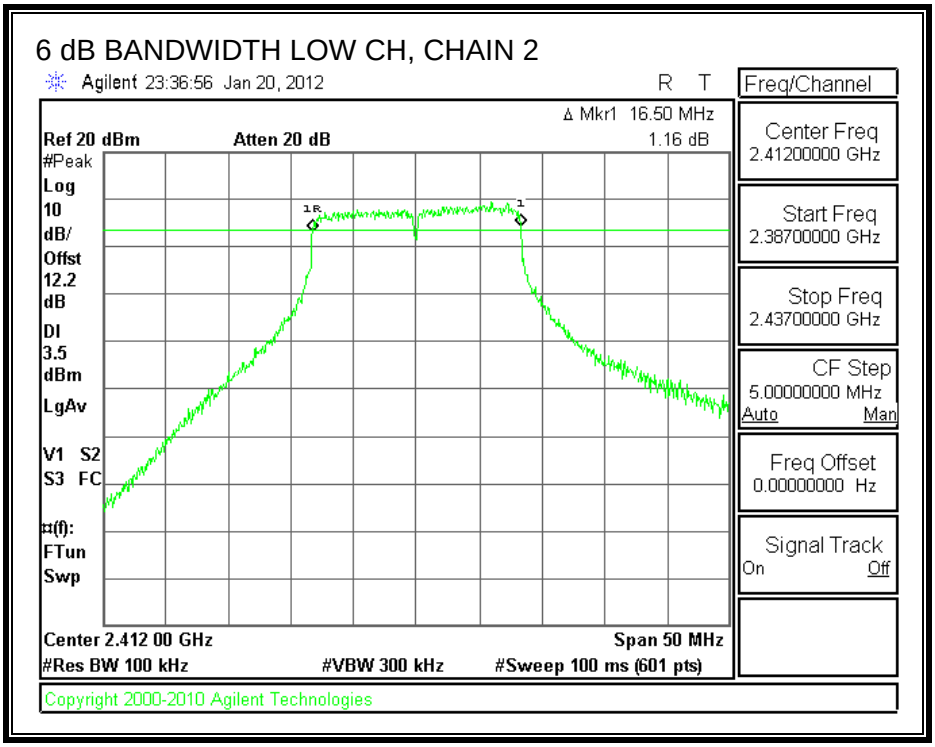
6 dB BANDWIDTH, CHAIN 1

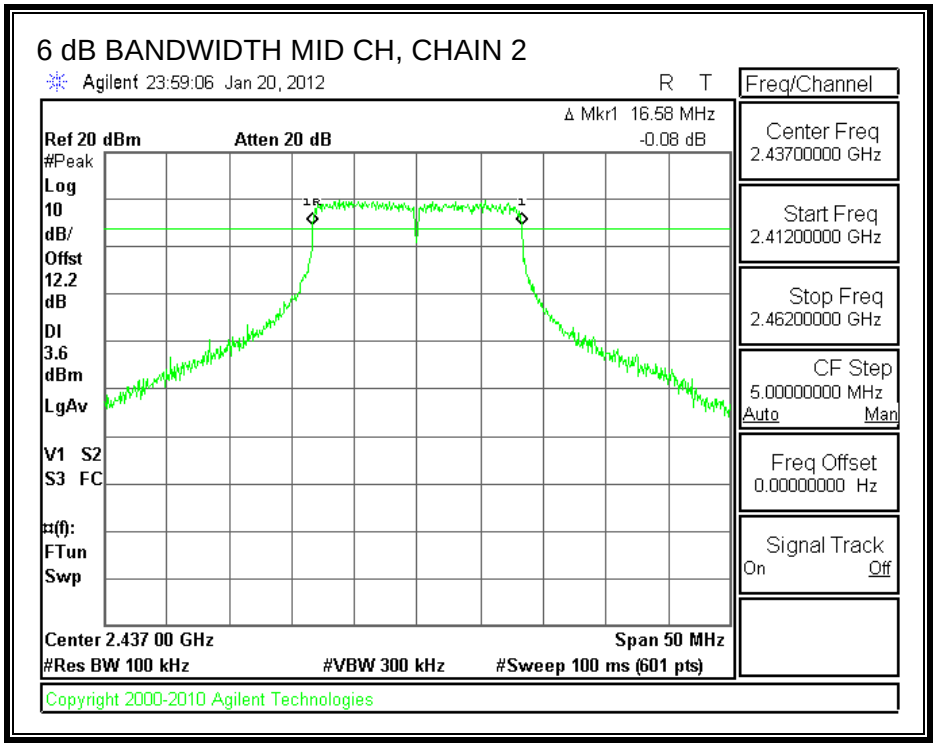


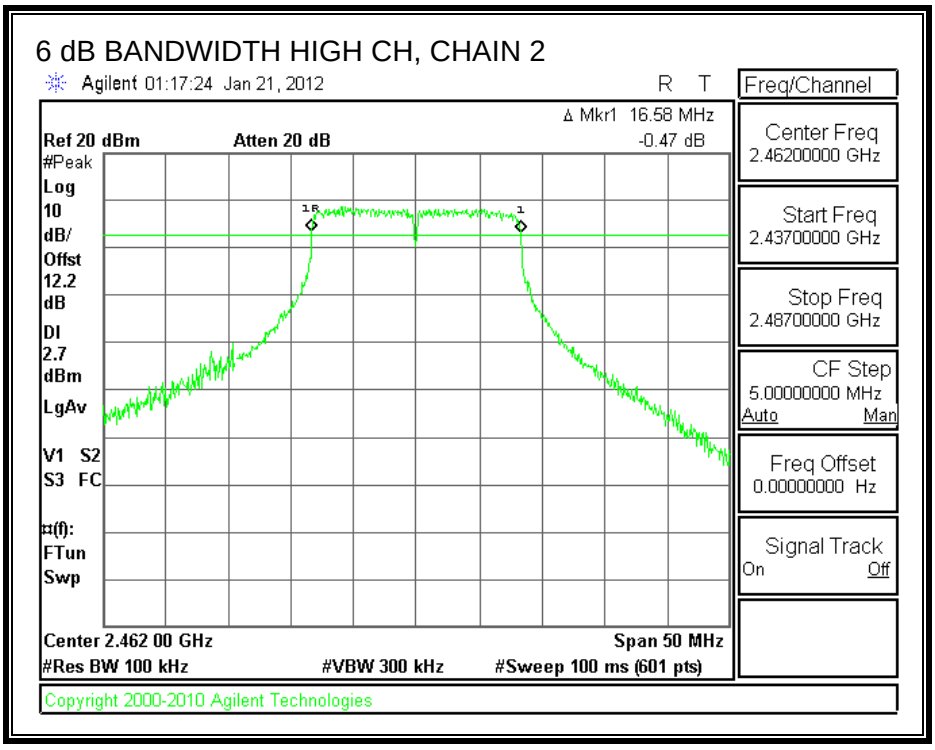




6 dB BANDWIDTH, CHAIN 2







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

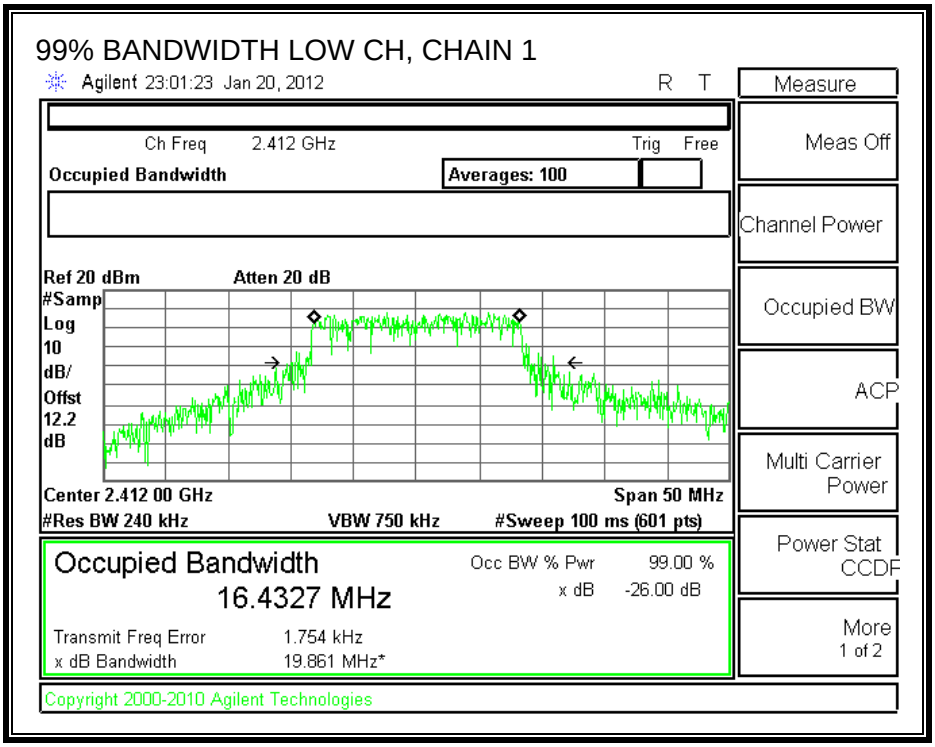
TEST PROCEDURE

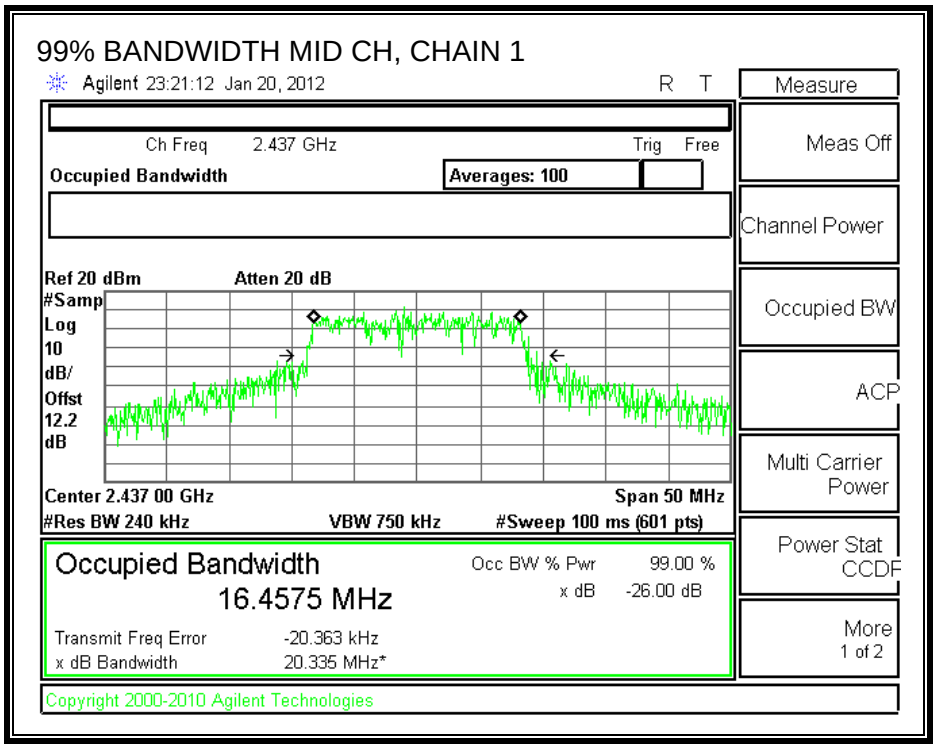
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

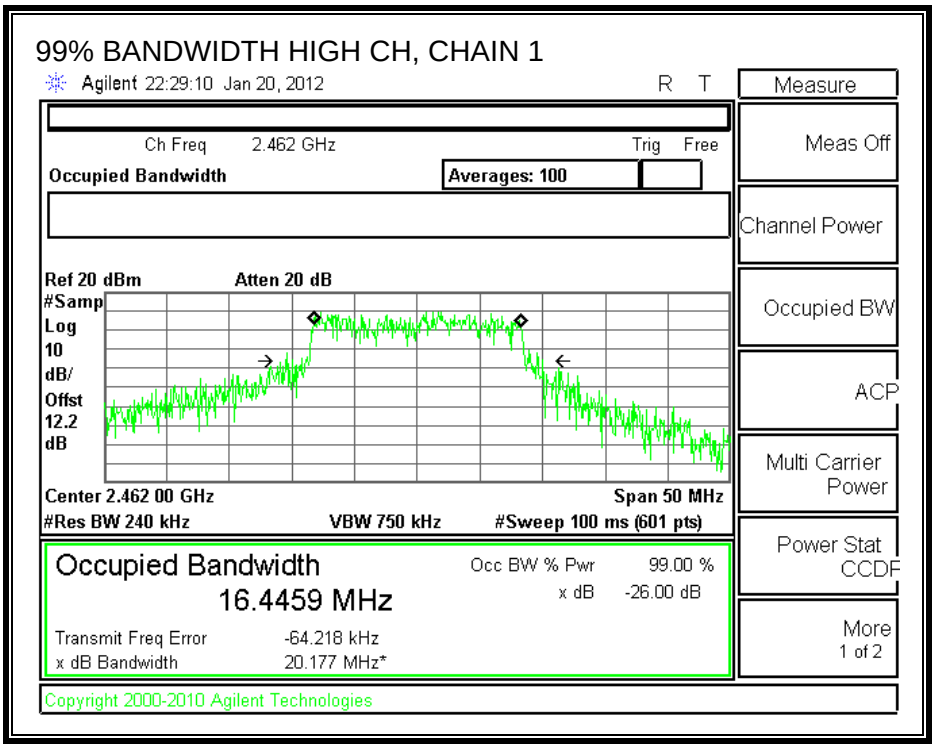
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	2412	16.4327	16.4575
Middle	2437	16.4575	16.4706
High	2462	16.4459	16.4498

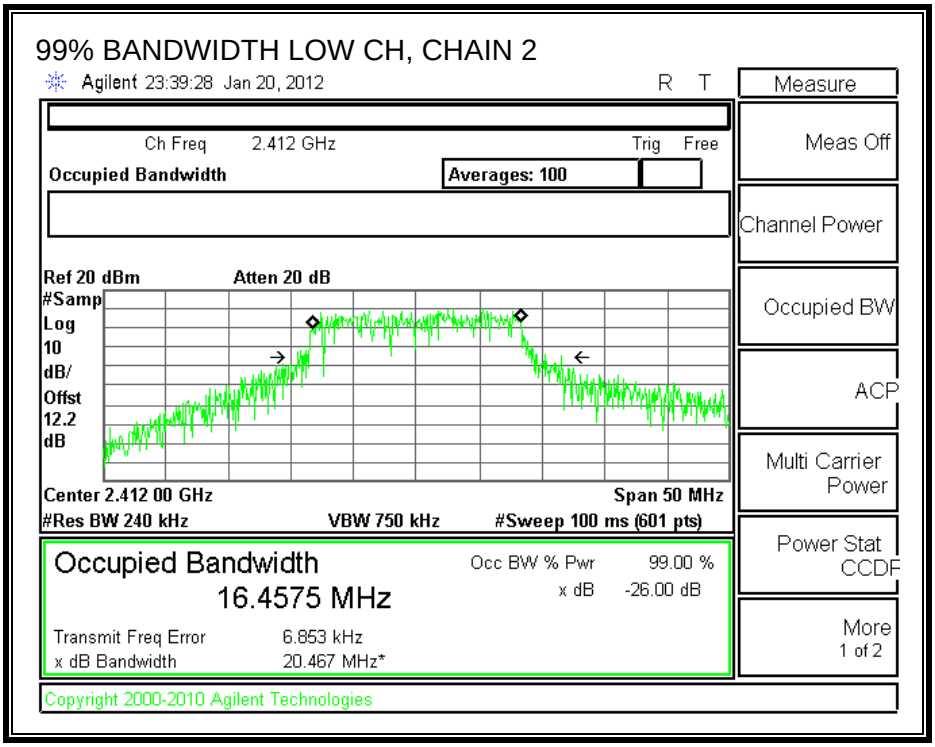
99% BANDWIDTH, CHAIN 1

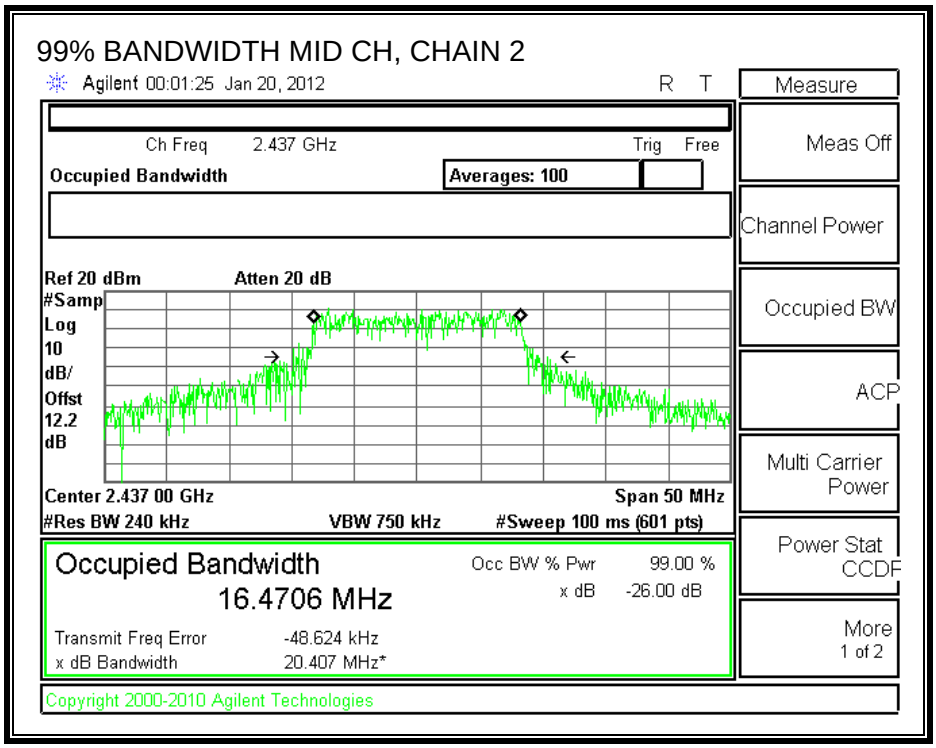


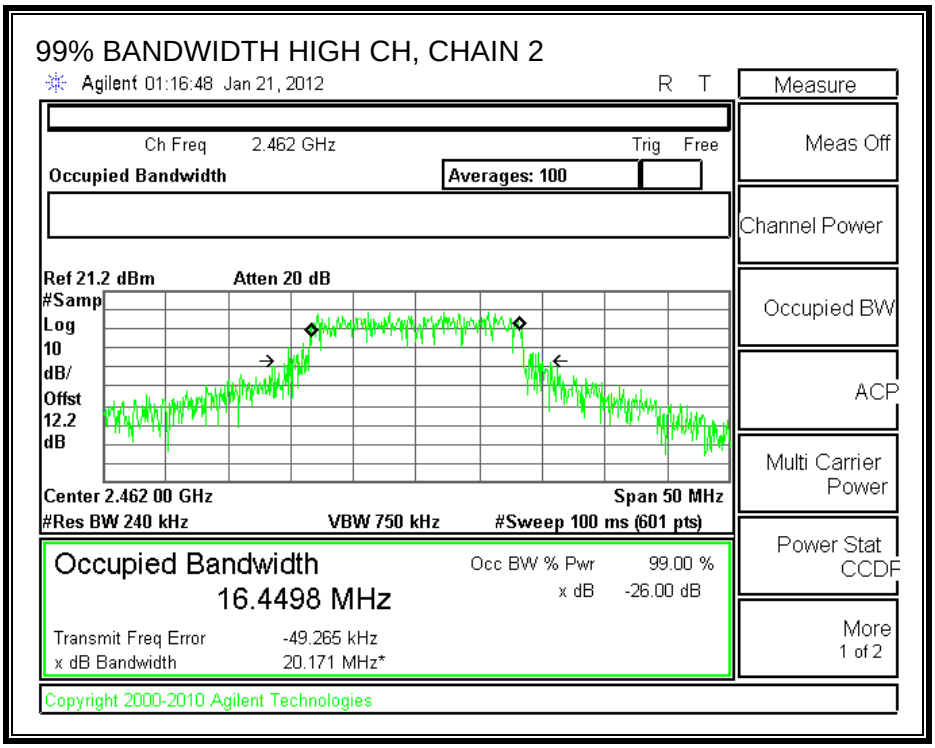




99% BANDWIDTH, CHAIN 2







7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
7.4	3.01	10.41

The maximum effective legacy gain is 10.41 dBi for other than fixed, point-to-point operations, therefore the limit is 25.59 dBm.

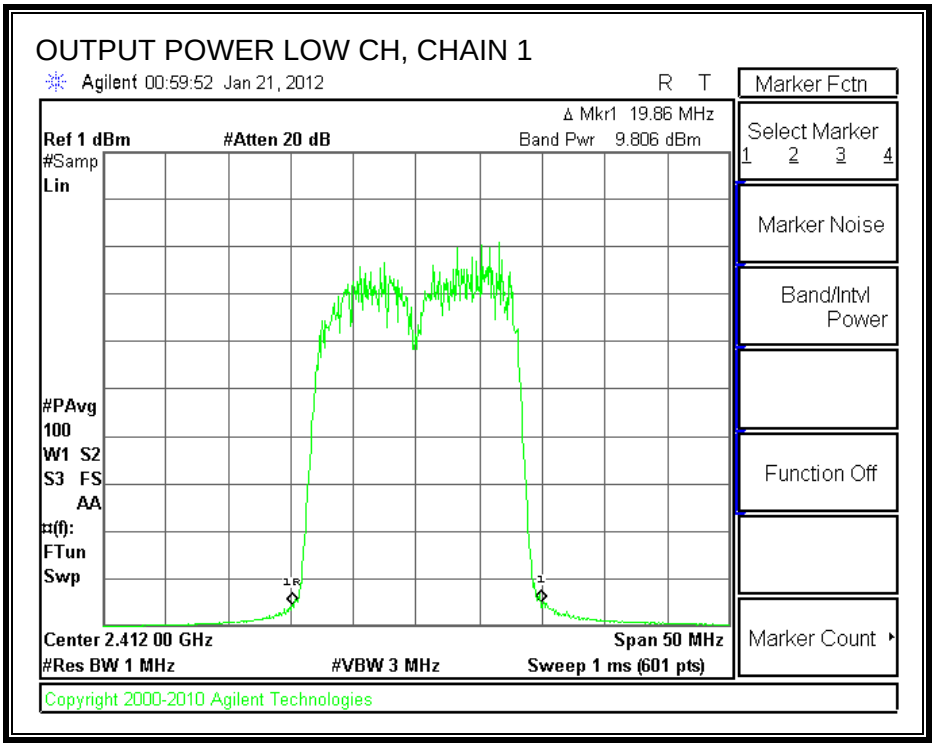
TEST PROCEDURE

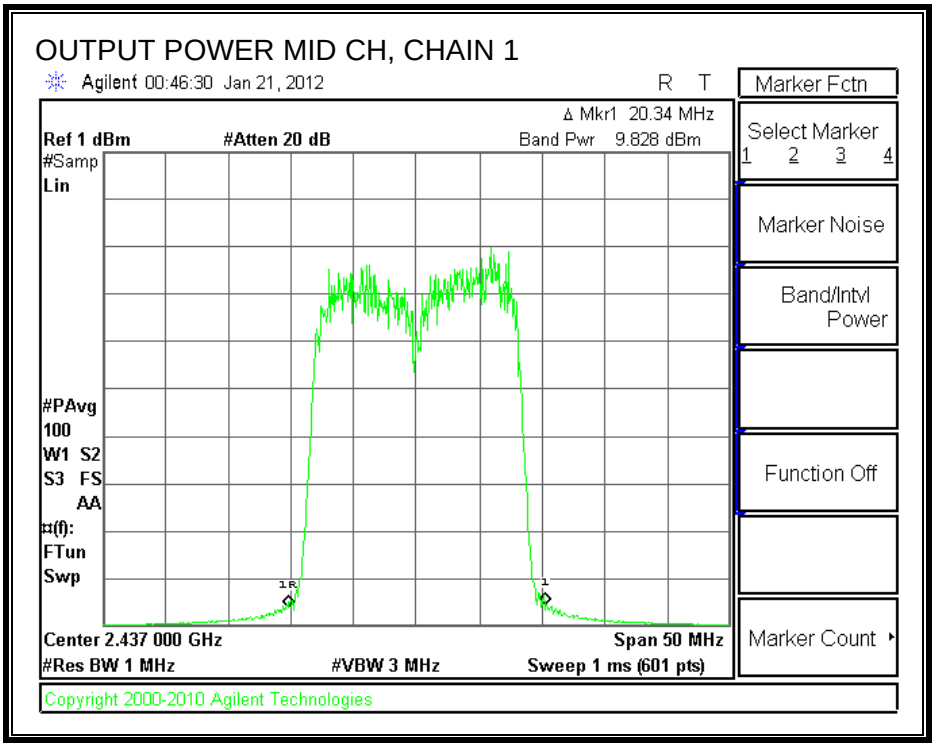
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

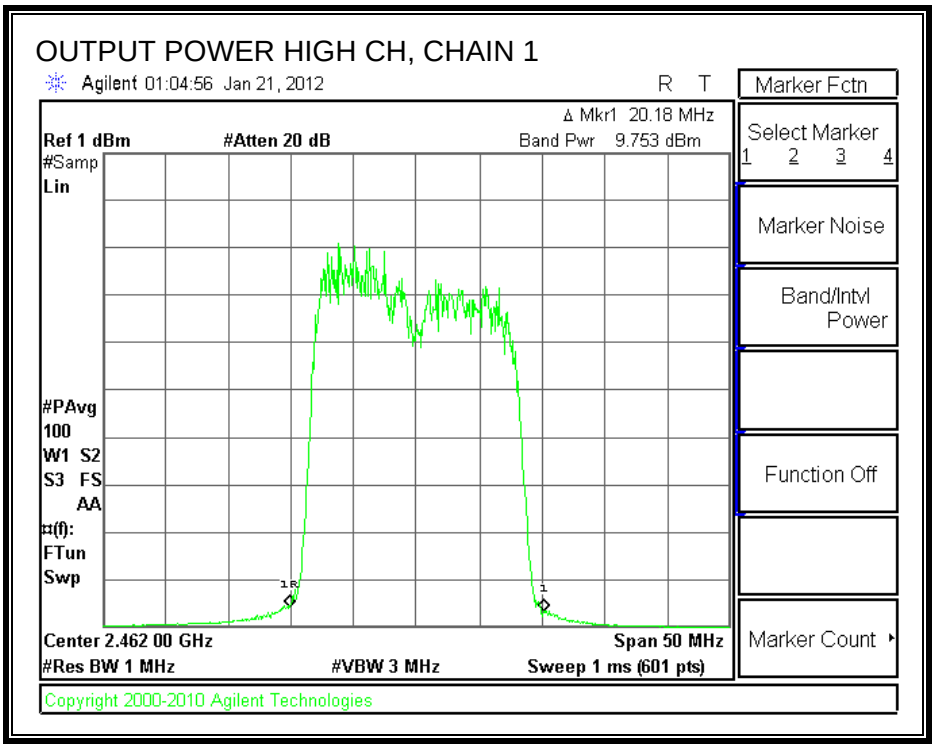
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	9.806	9.842	12.20	25.034	25.59	-0.556
Mid	2437	9.828	9.836	12.20	25.042	25.59	-0.548
High	2462	9.753	9.887	12.20	25.031	25.59	-0.559

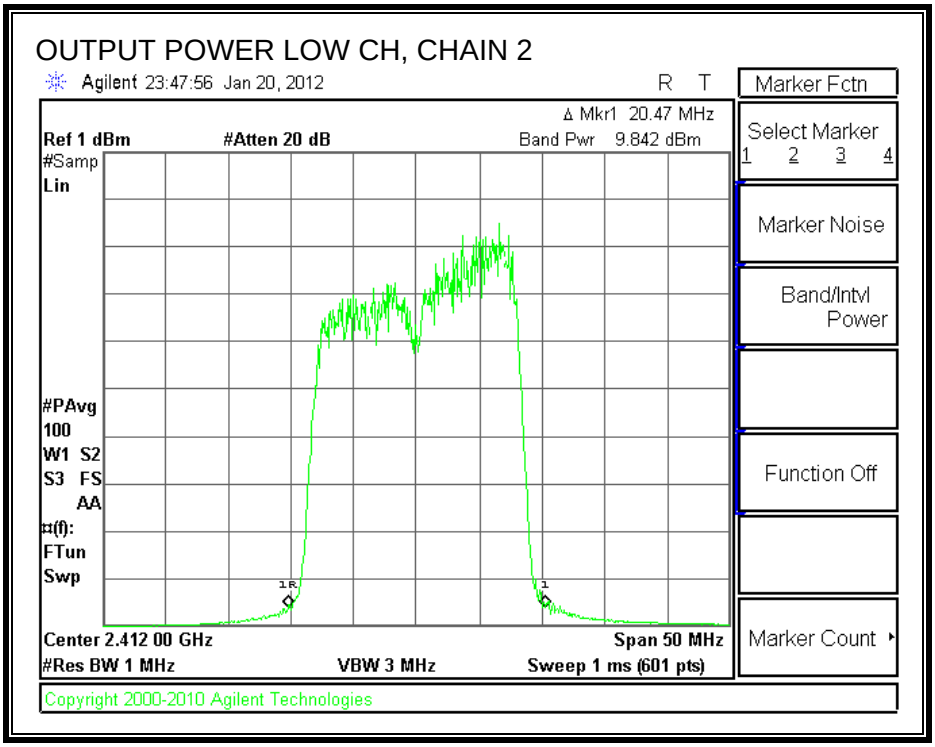
CHAIN 1 OUTPUT POWER

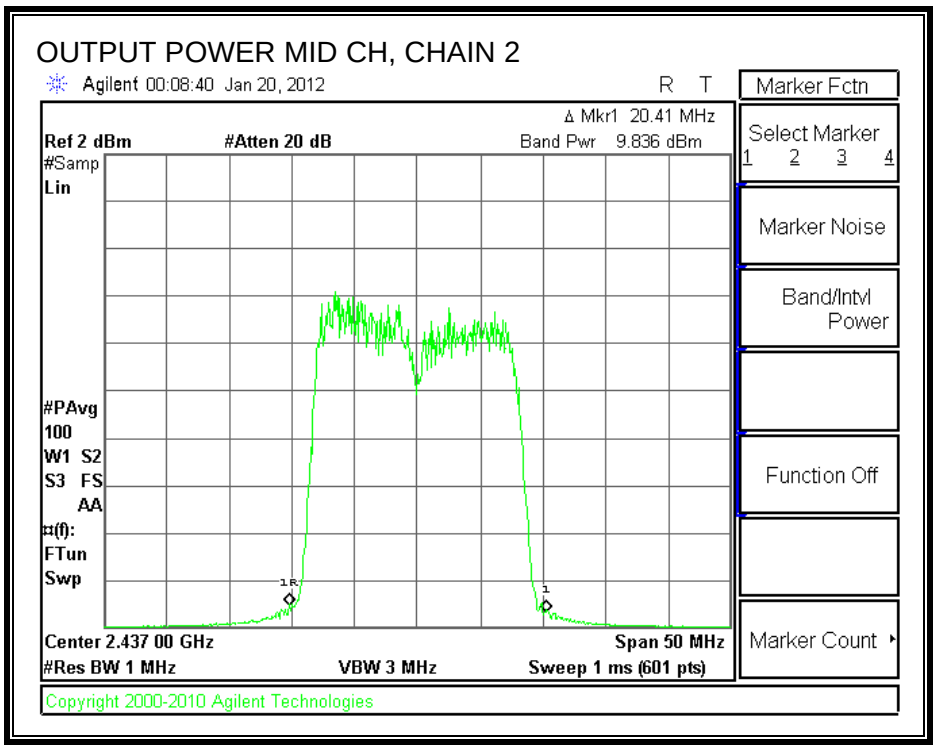


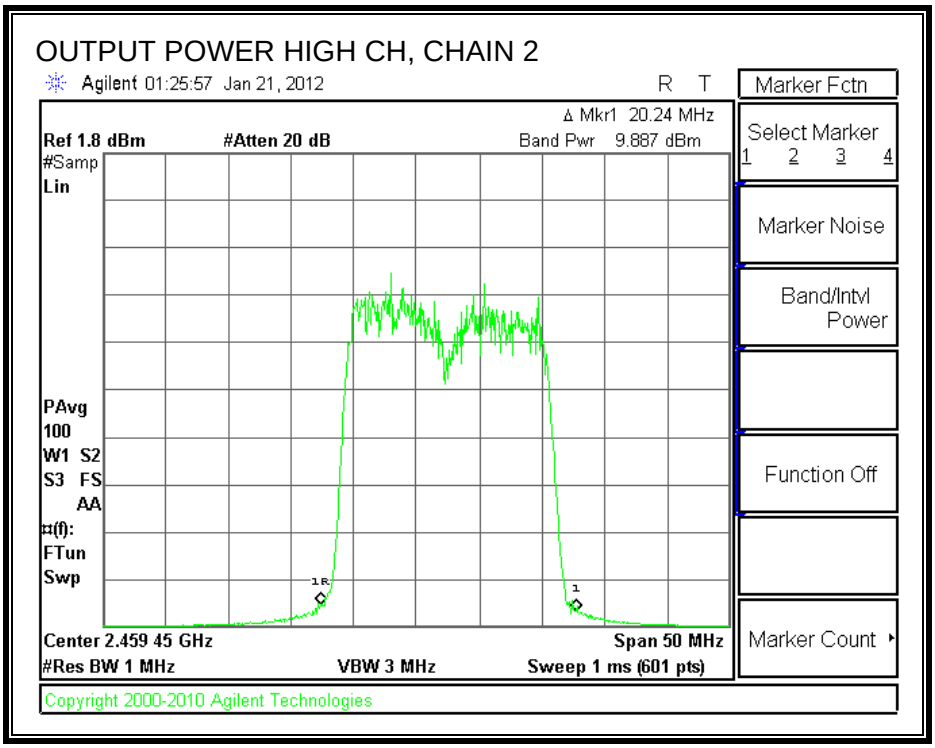




CHAIN 2 OUTPUT POWER







7.2.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.2dB (including 10 dB pad and .2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2412	21.34	21.50	24.43
Middle	2437	22.10	22.20	25.16
High	2462	21.95	22.12	25.05

7.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

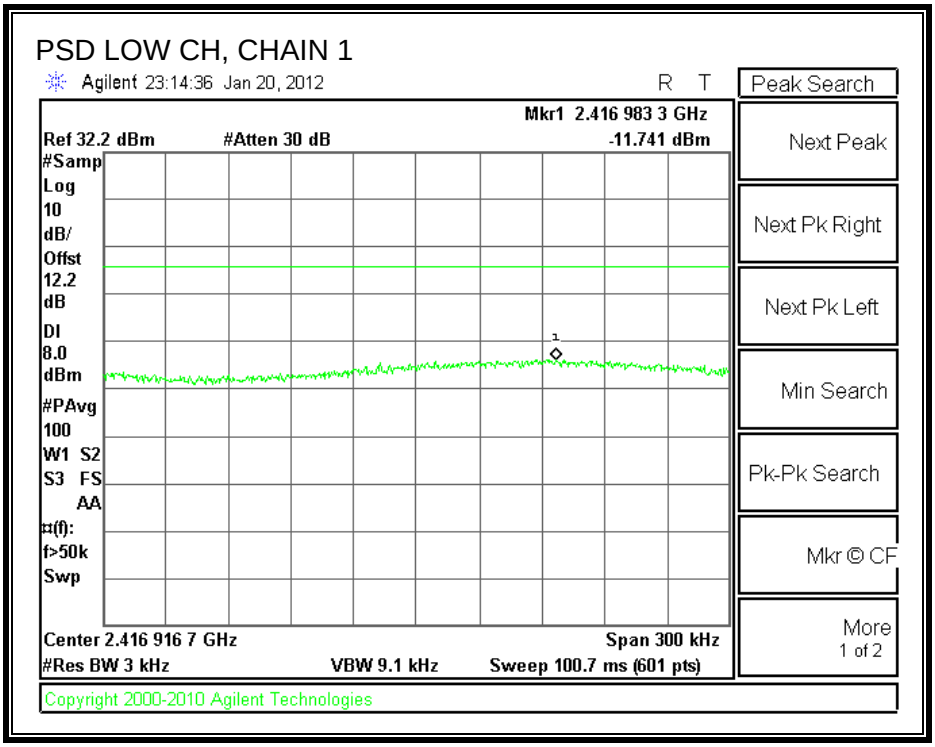
TEST PROCEDURE

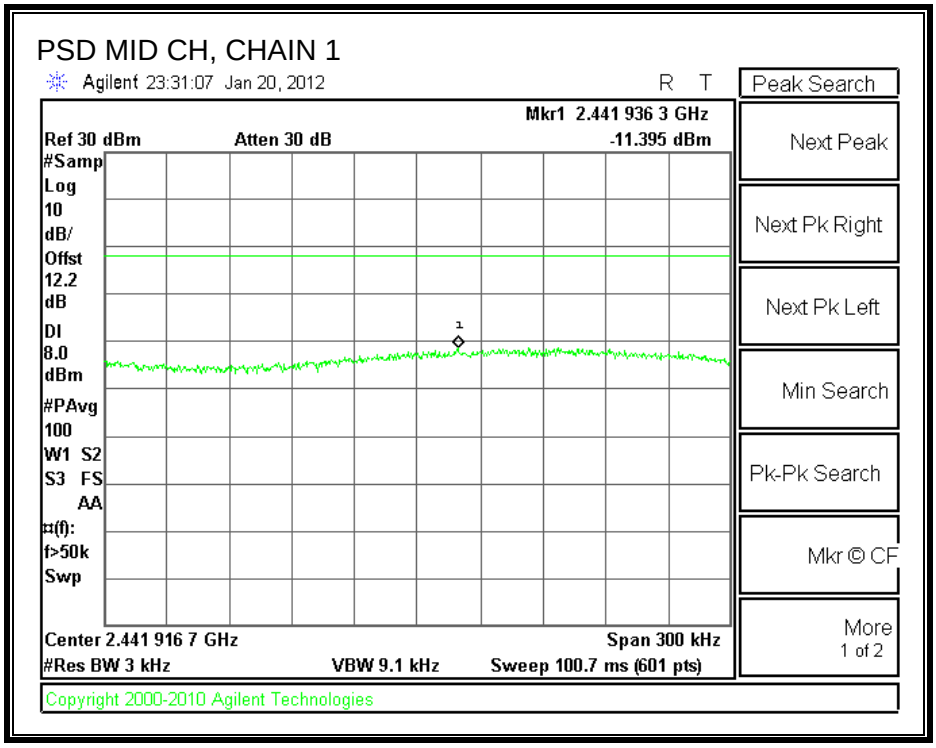
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document “Measurement of Digital Transmission Systems Operating under Section 15.247”, March 23, 2005.

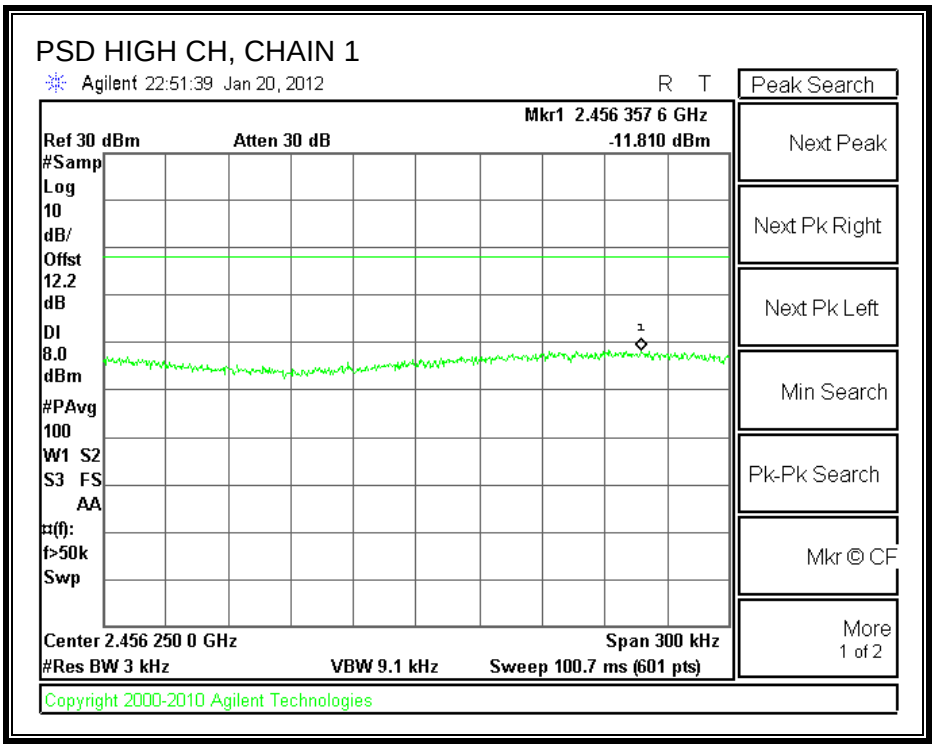
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-11.741	-12.074	-8.89	8	-16.89
Middle	2437	-11.395	-11.325	-8.35	8	-16.35
High	2462	-11.810	-12.706	-9.22	8	-17.22

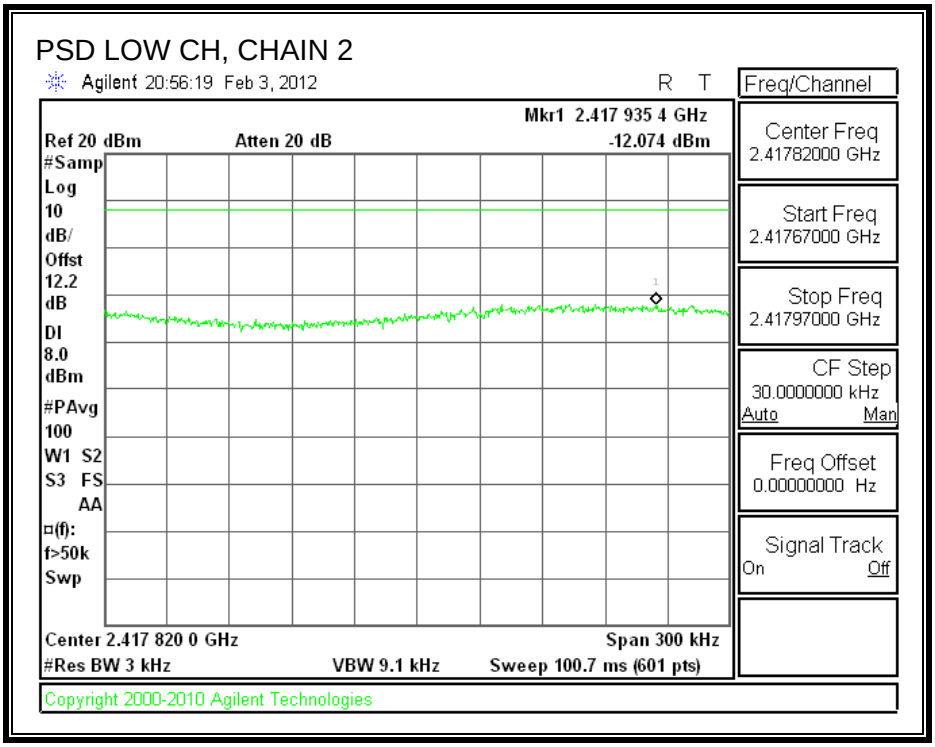
POWER SPECTRAL DENSITY, CHAIN 1

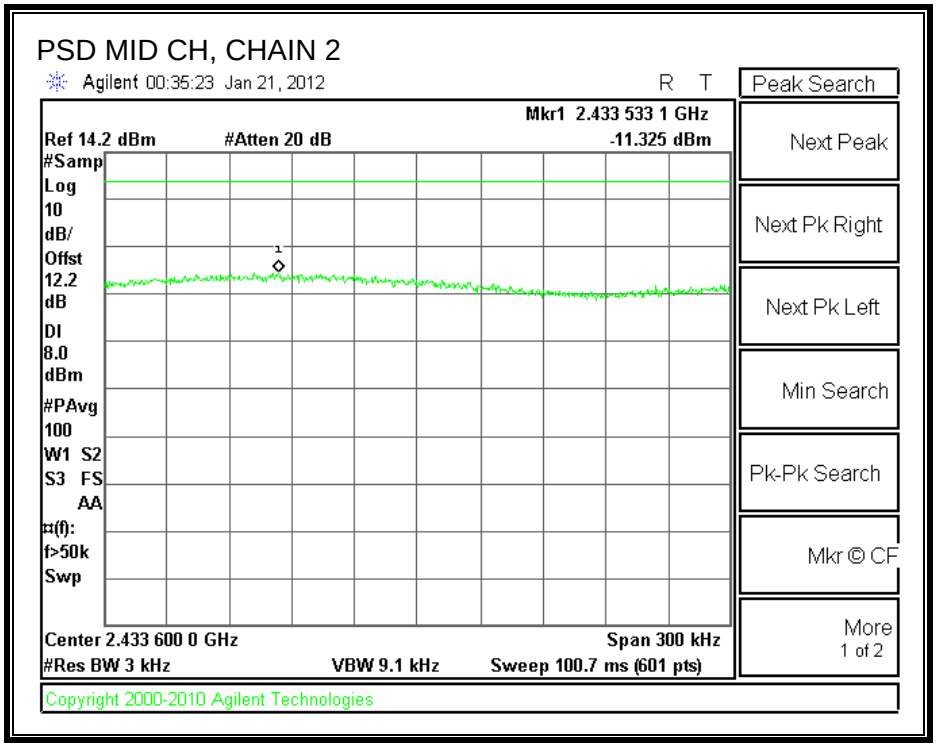


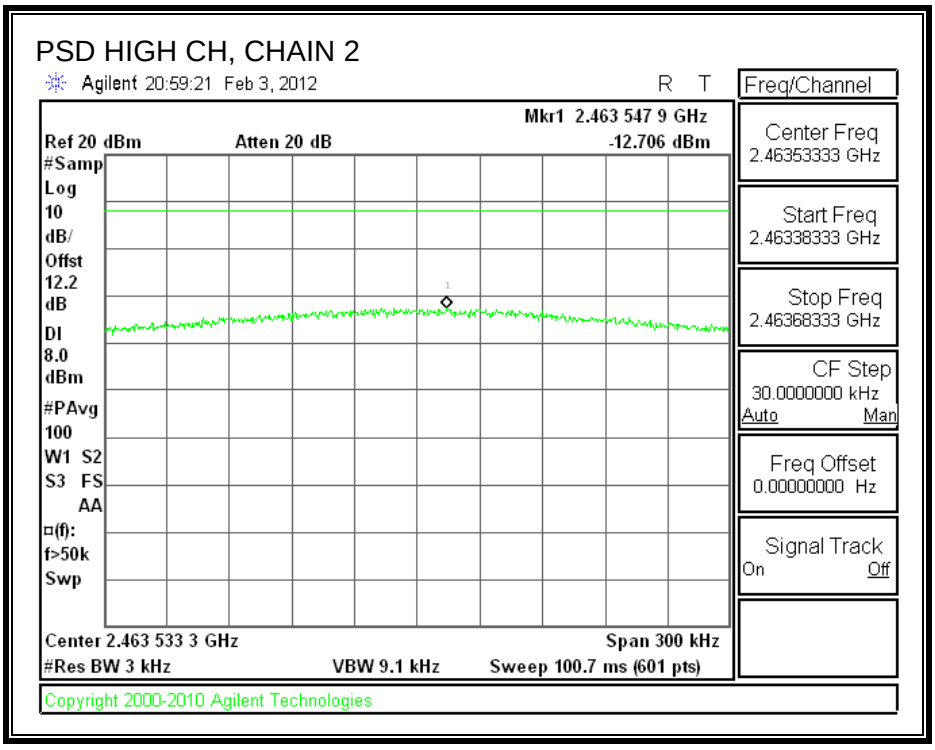




POWER SPECTRAL DENSITY, CHAIN 2







7.2.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

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

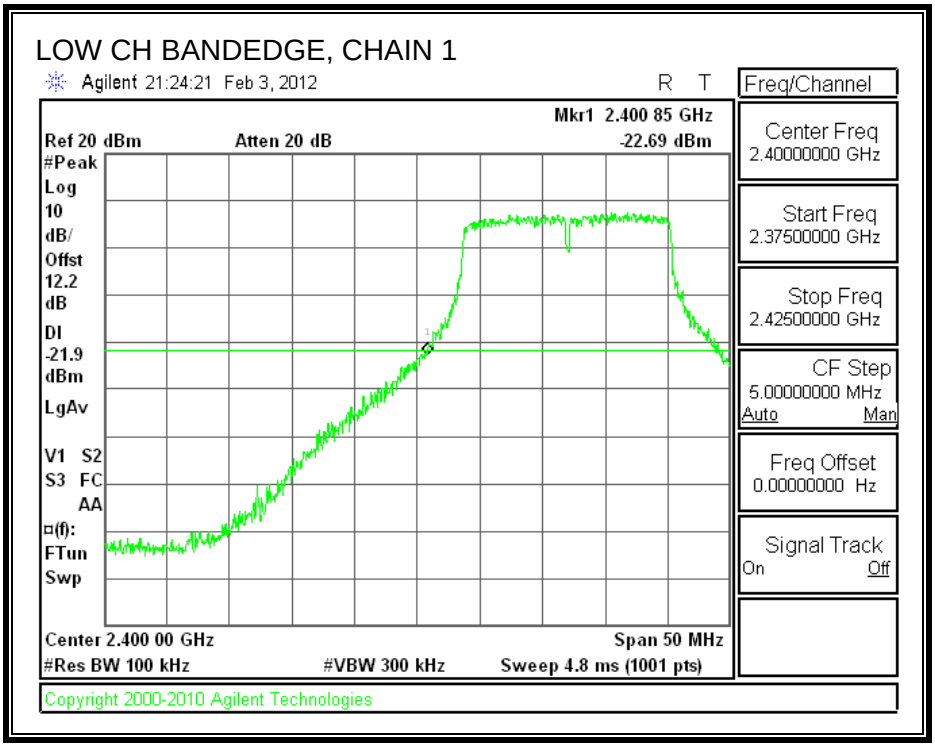
TEST PROCEDURE

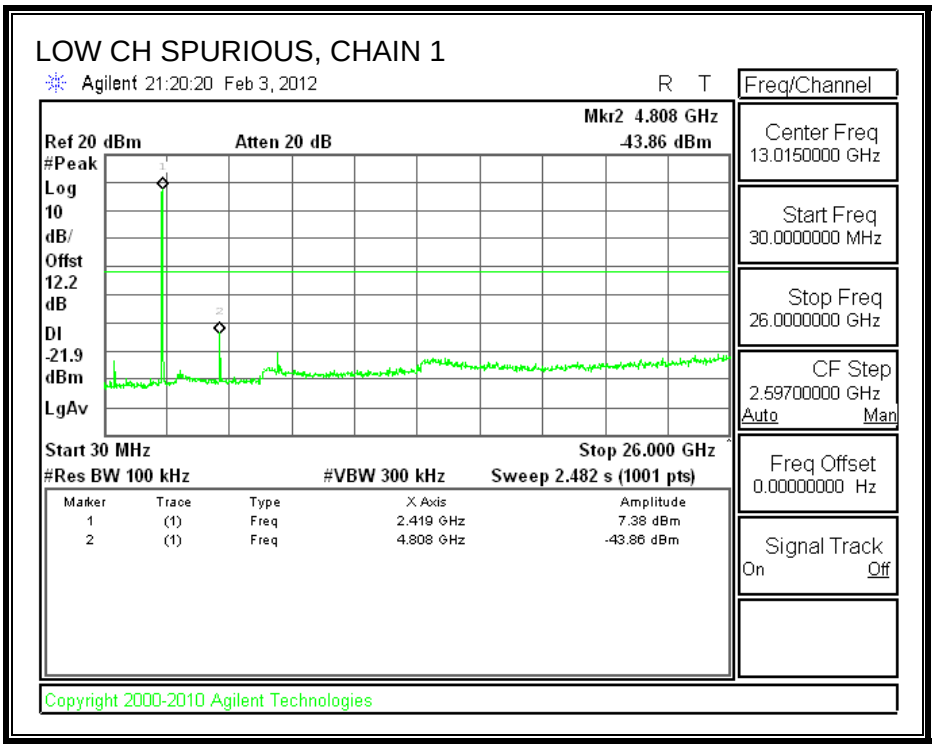
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

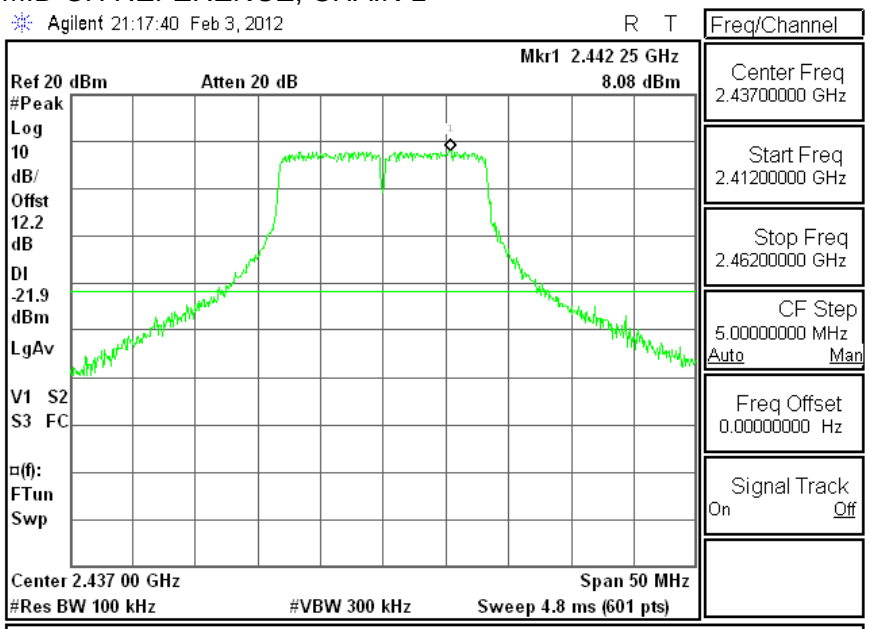
RESULTS

CHAIN 1 SPURIOUS EMISSIONS

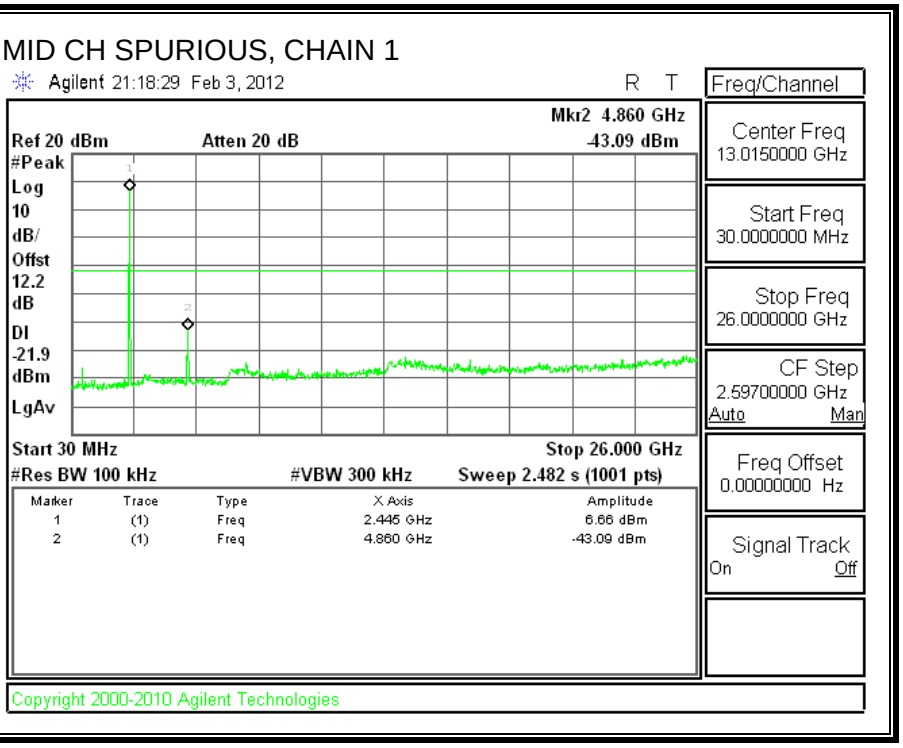




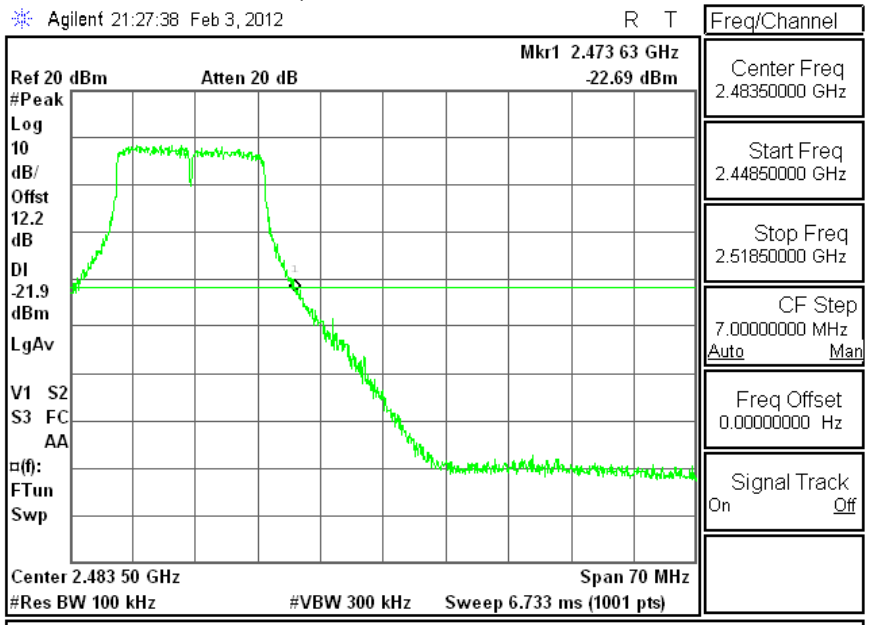
MID CH REFERENCE, CHAIN 1



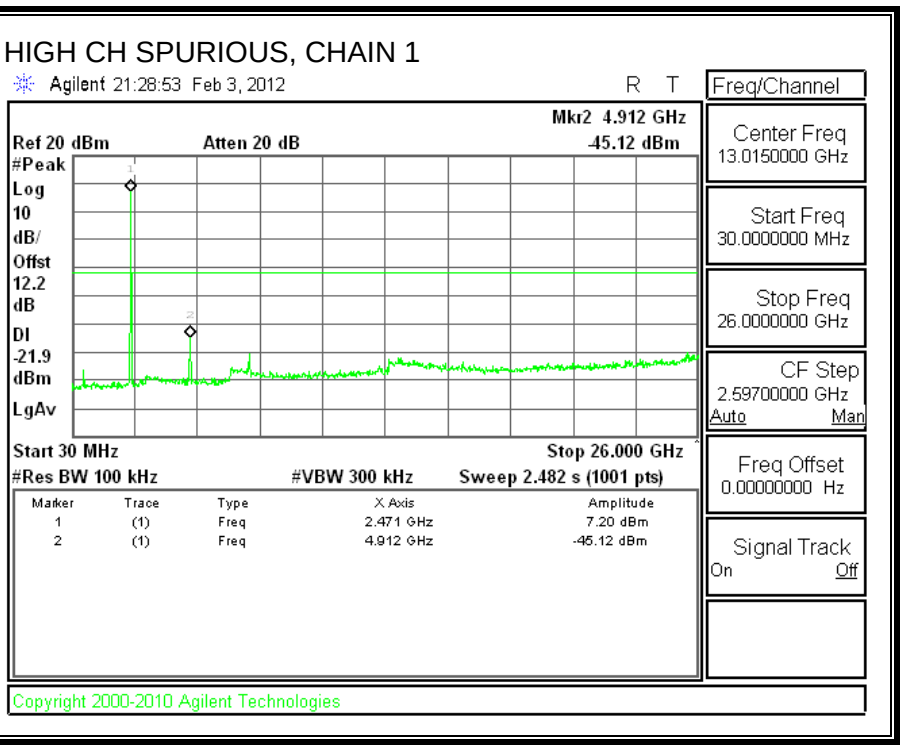
MID CH SPURIOUS, CHAIN 1



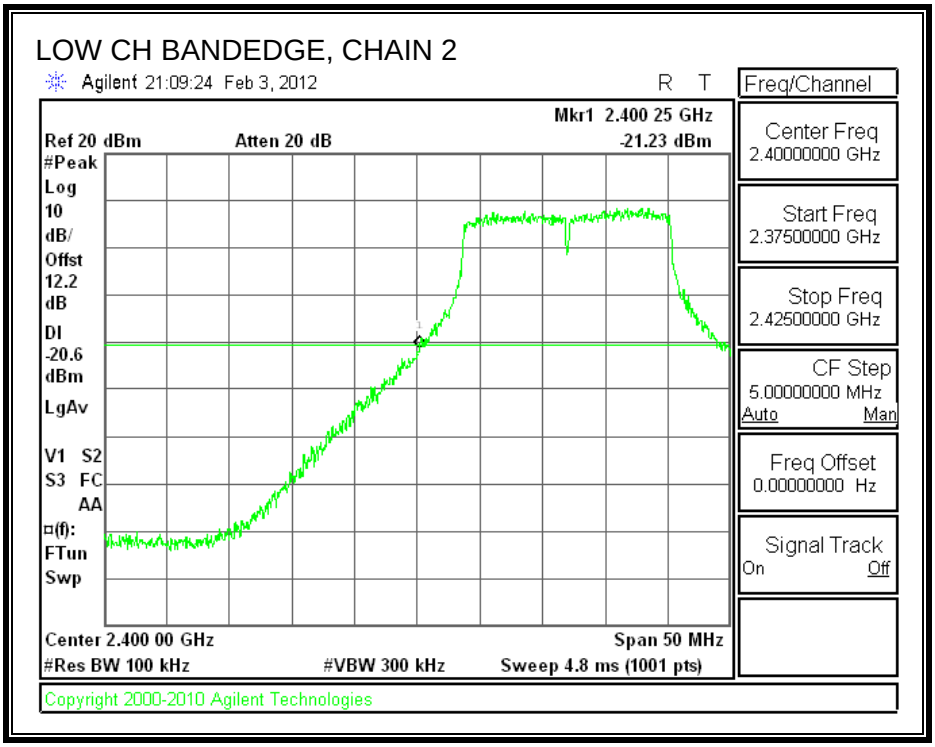
HIGH CH BANDEDGE, CHAIN 1

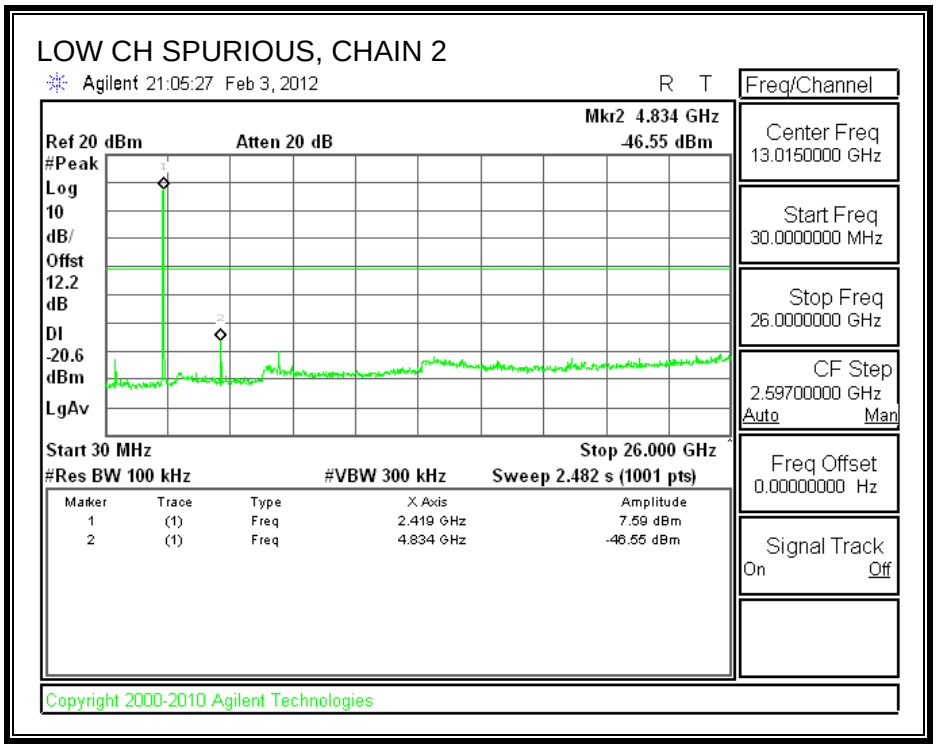


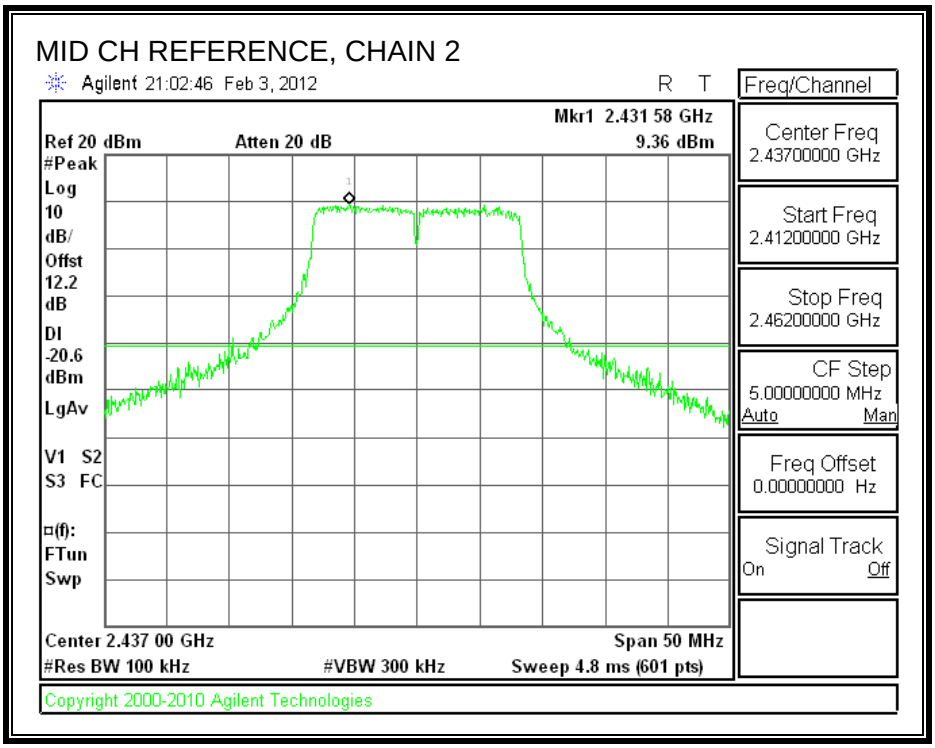
HIGH CH SPURIOUS, CHAIN 1

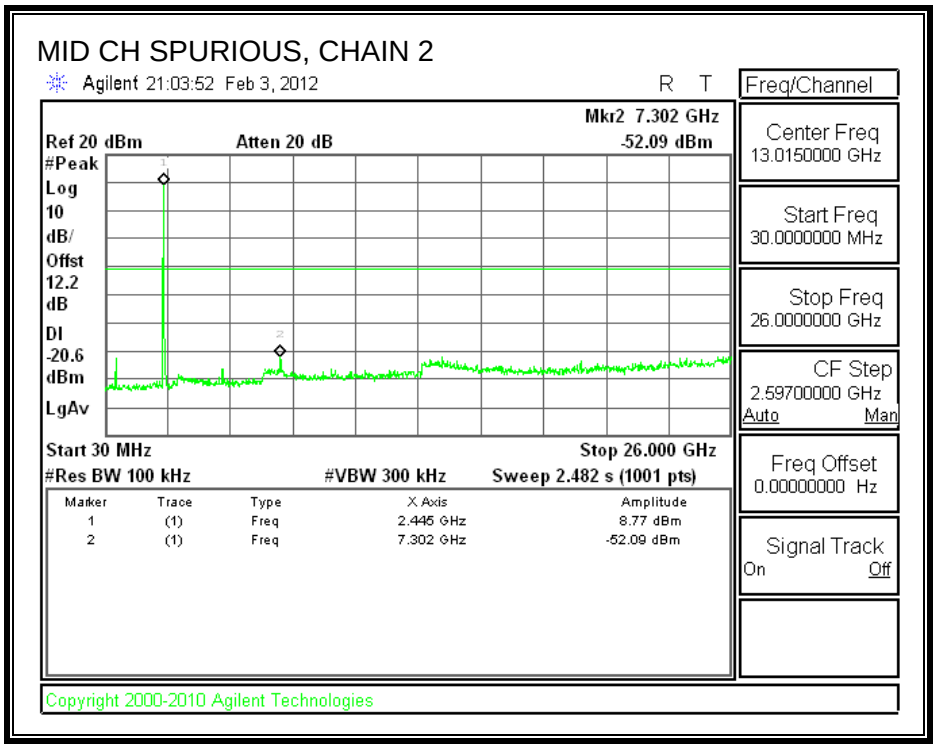


CHAIN 2 SPURIOUS EMISSIONS

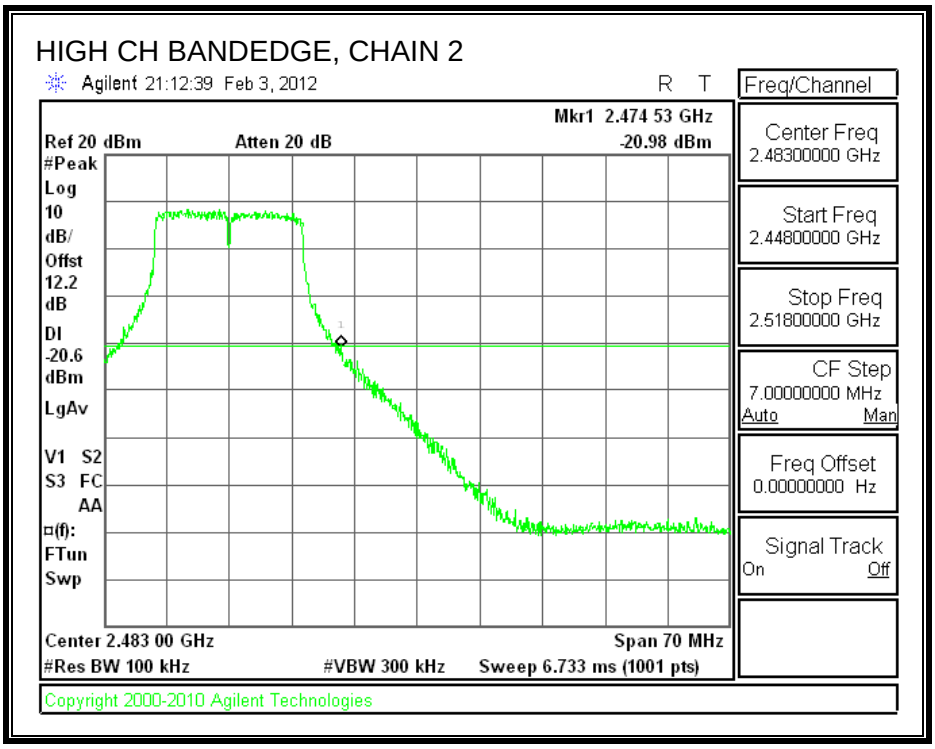




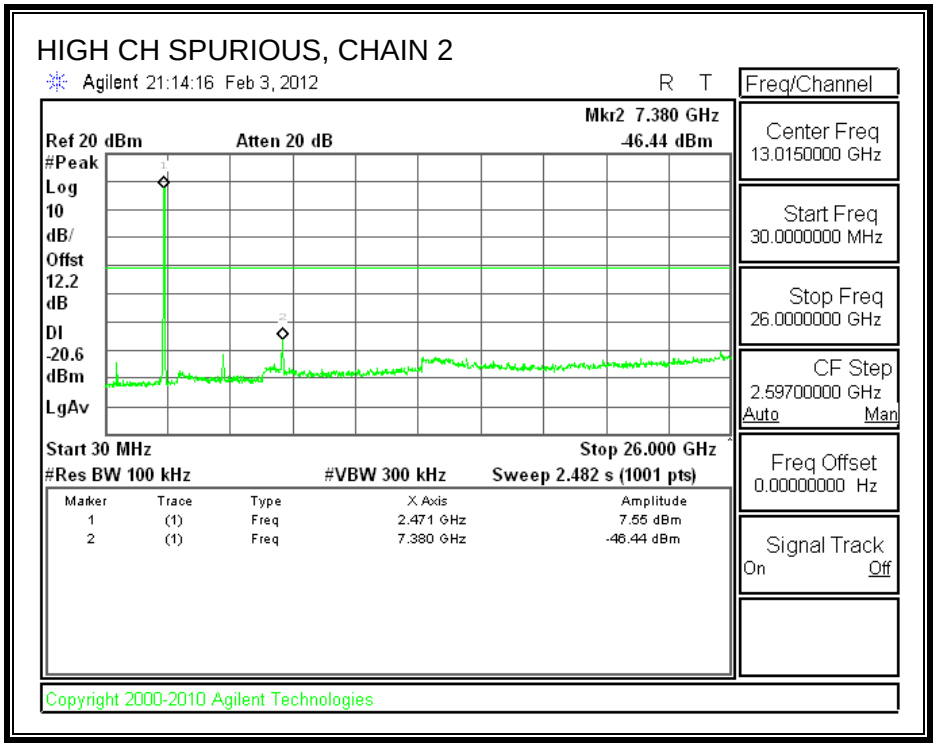




HIGH CH BANDEDGE, CHAIN 2



HIGH CH SPURIOUS, CHAIN 2



7.3. 802.11n HT20 2TX 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.

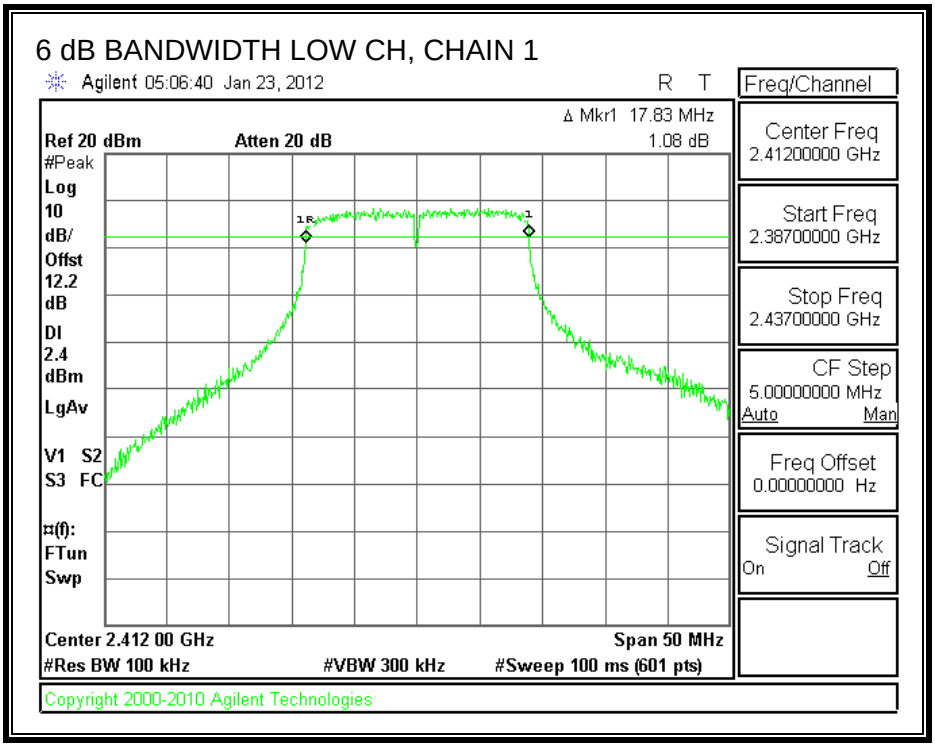
TEST PROCEDURE

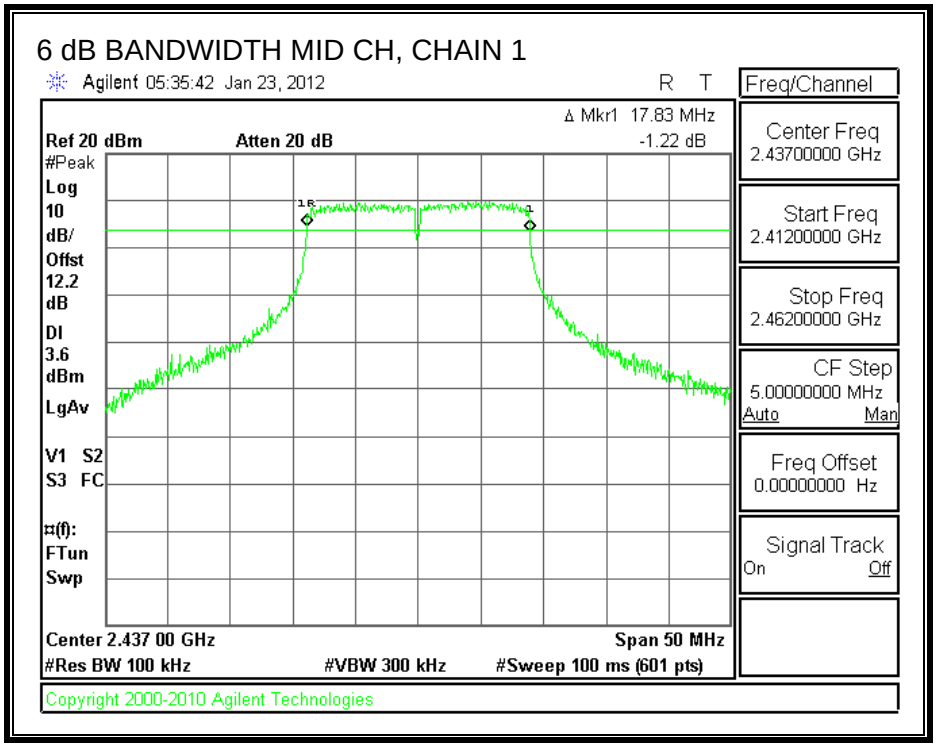
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

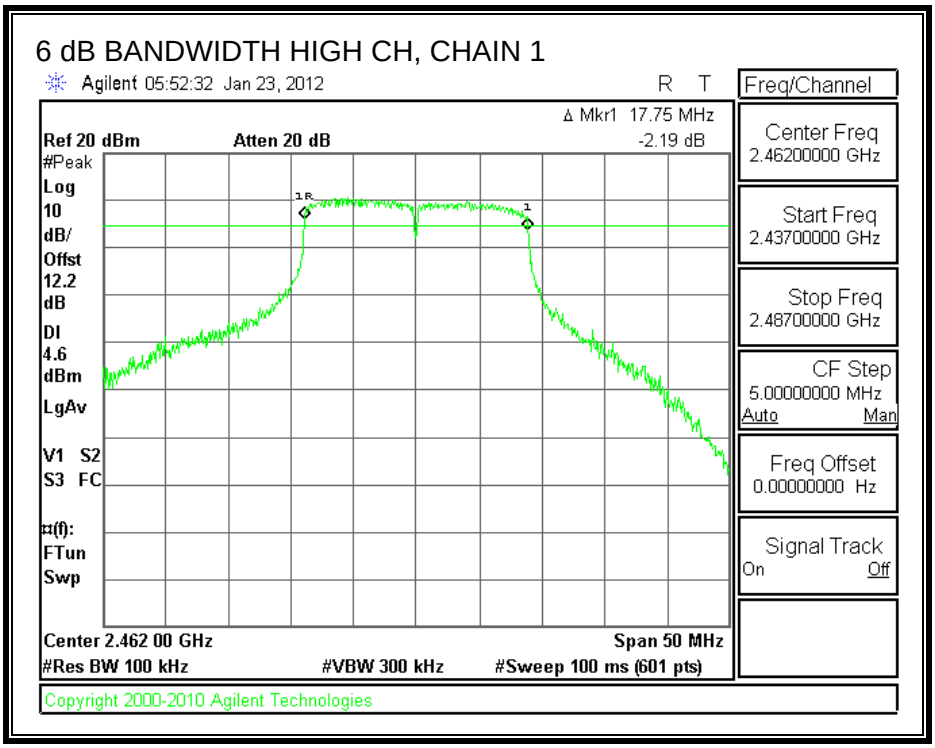
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	17.83	17.83	0.5
Middle	2437	17.83	17.83	0.5
High	2462	17.75	17.75	0.5

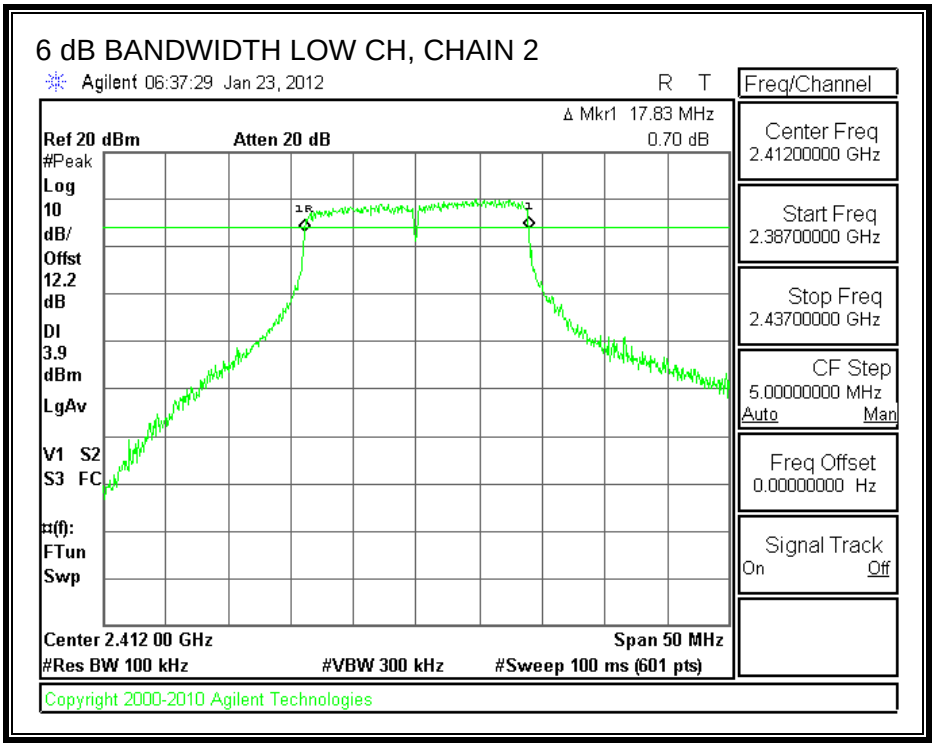
6 dB BANDWIDTH, CHAIN 1

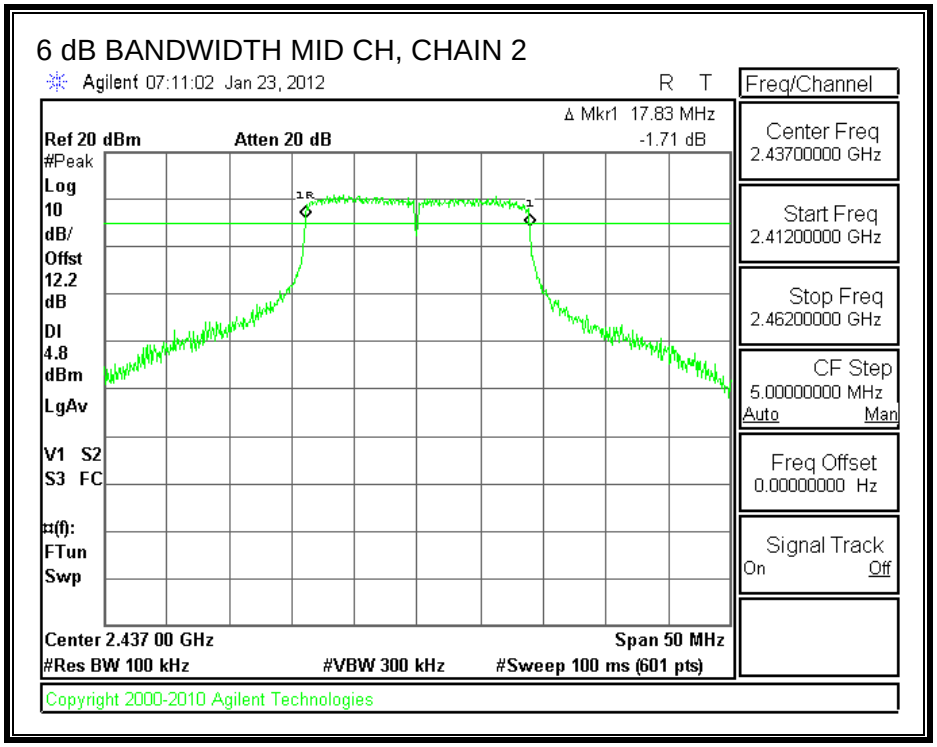


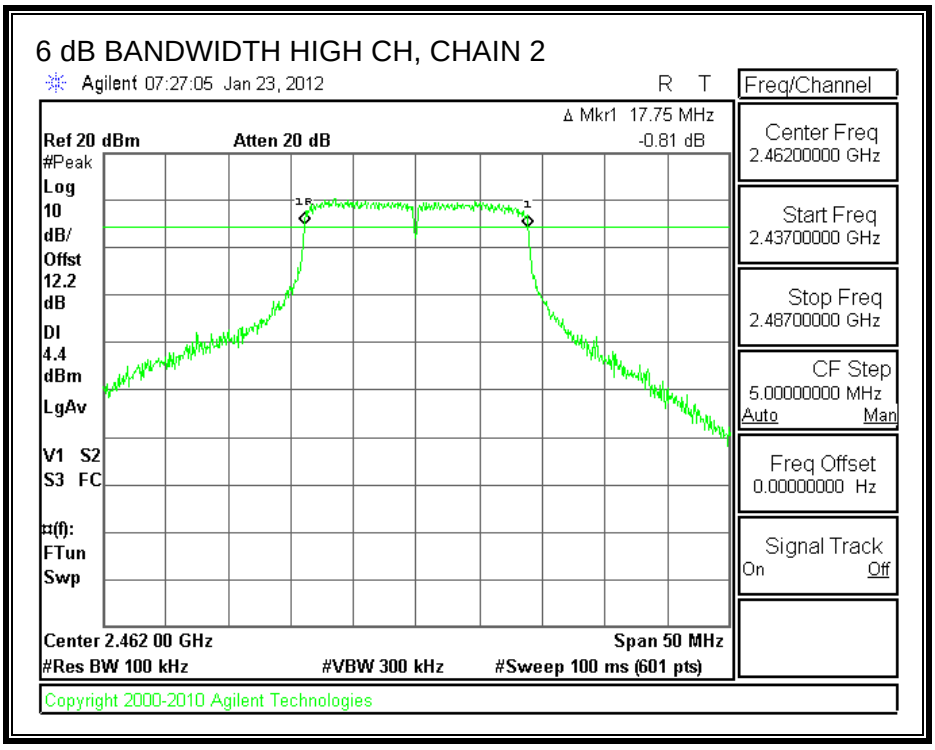




6 dB BANDWIDTH, CHAIN 2







7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

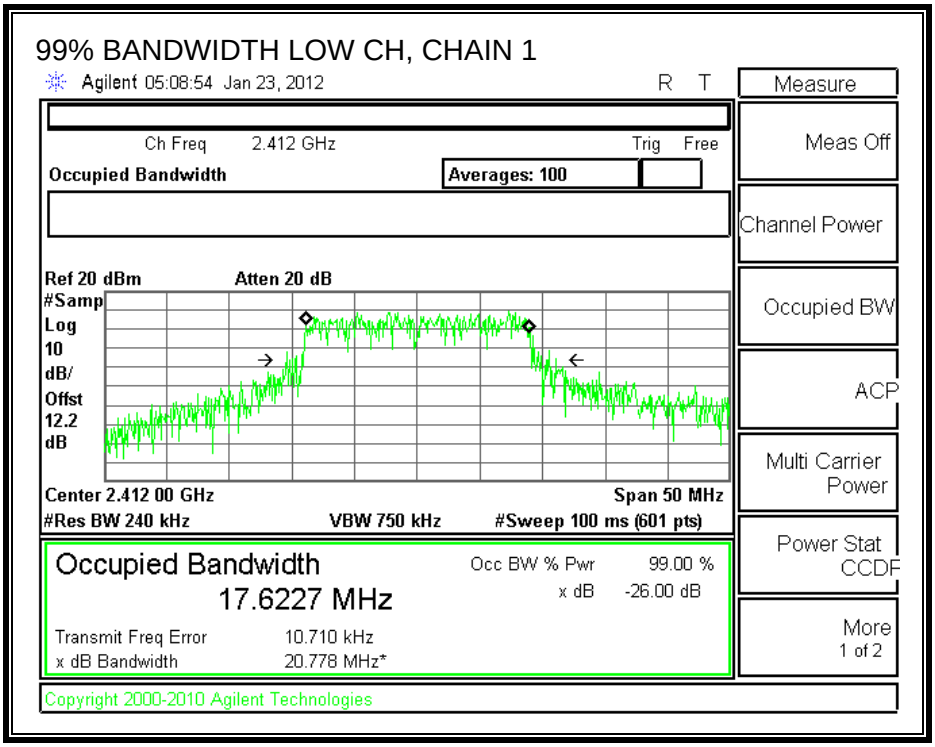
TEST PROCEDURE

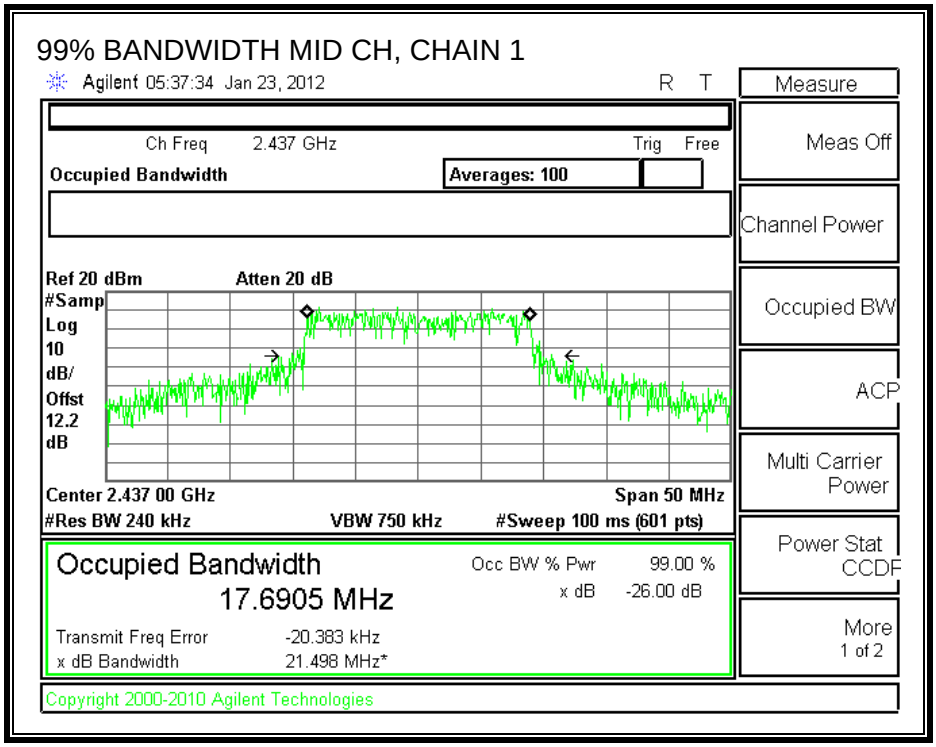
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

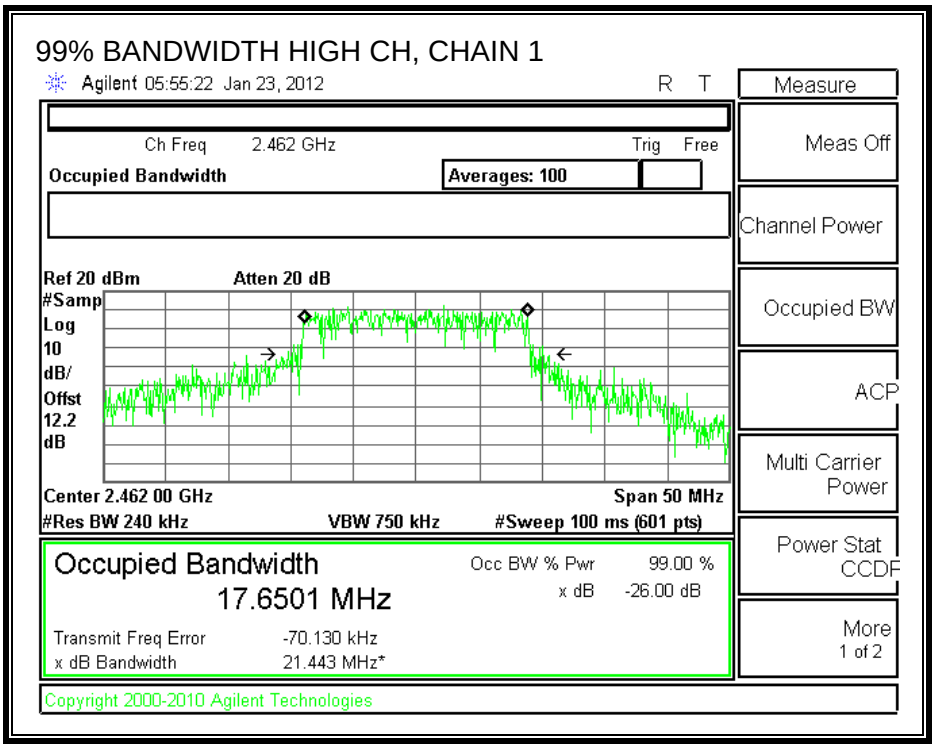
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	2412	17.6227	17.6597
Middle	2437	17.6905	17.6885
High	2462	17.6501	17.6568

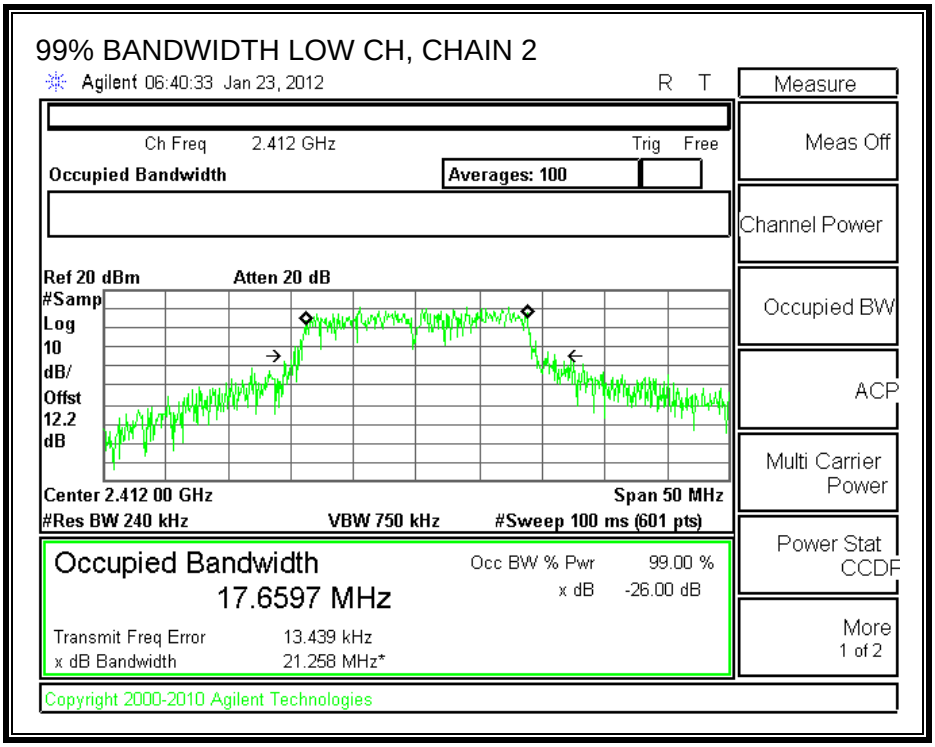
99% BANDWIDTH, CHAIN 1

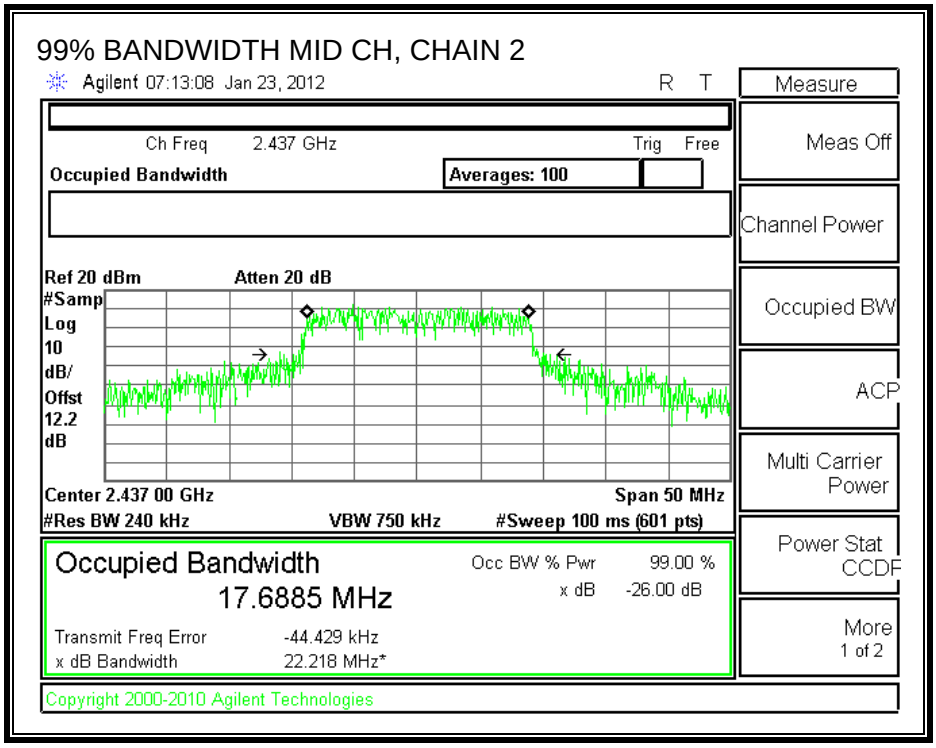


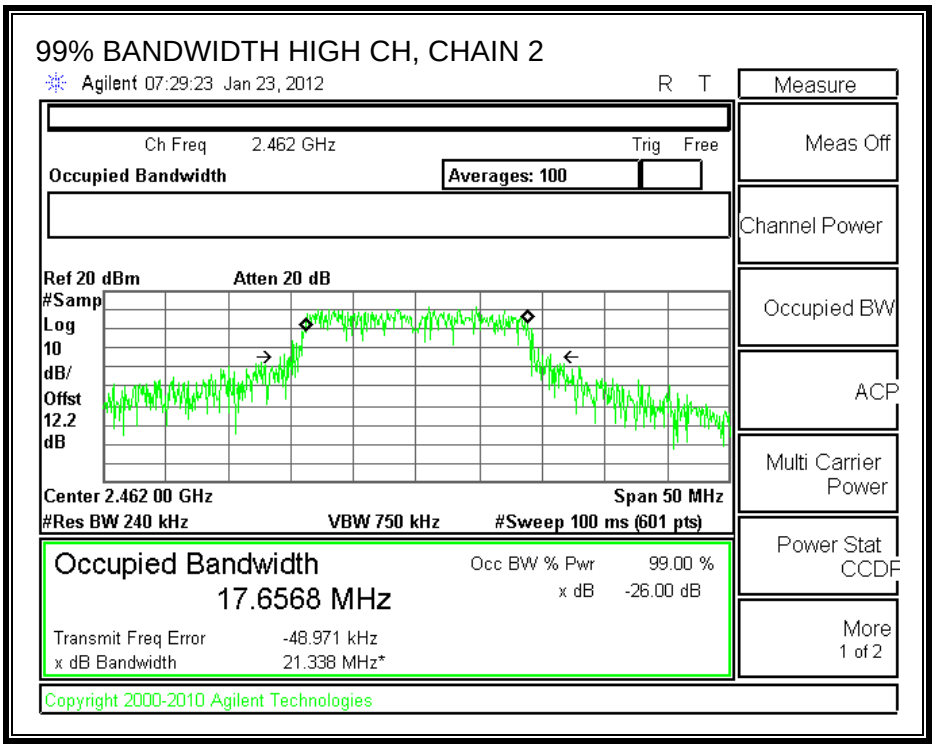




99% BANDWIDTH, CHAIN 2







7.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is 7.4 dBi for other than fixed, point-to-point operations, therefore the limit is 28.6 dBm.

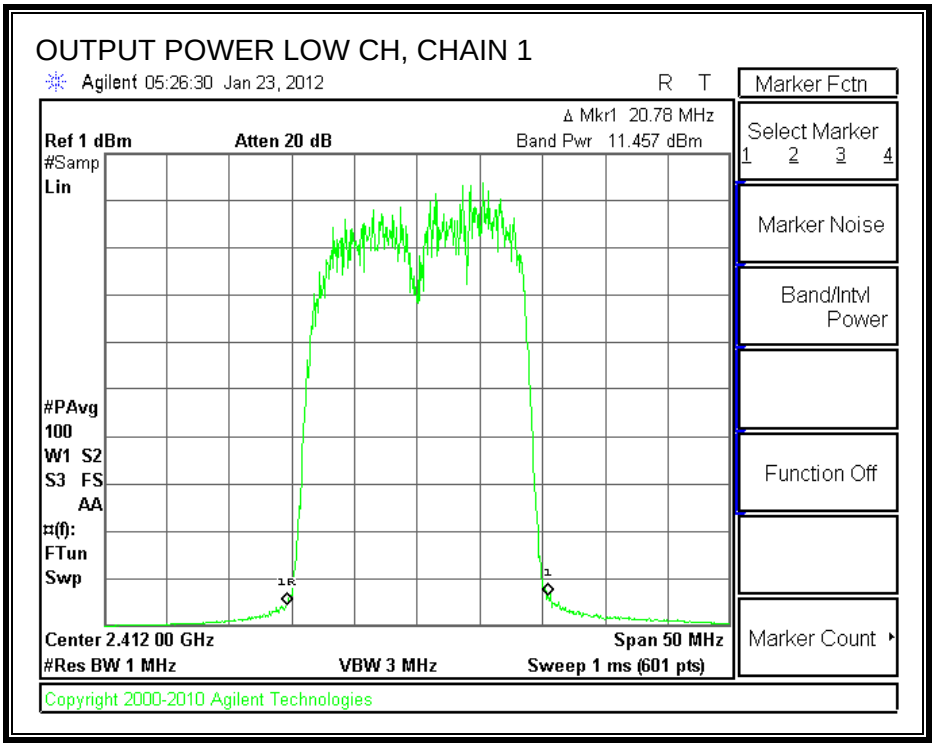
TEST PROCEDURE

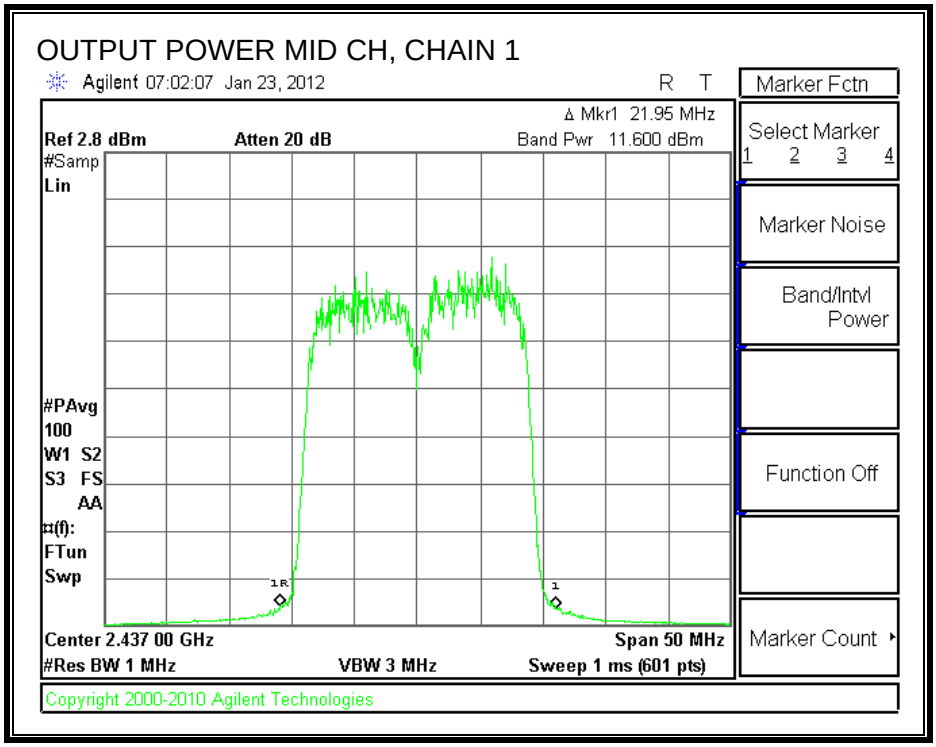
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

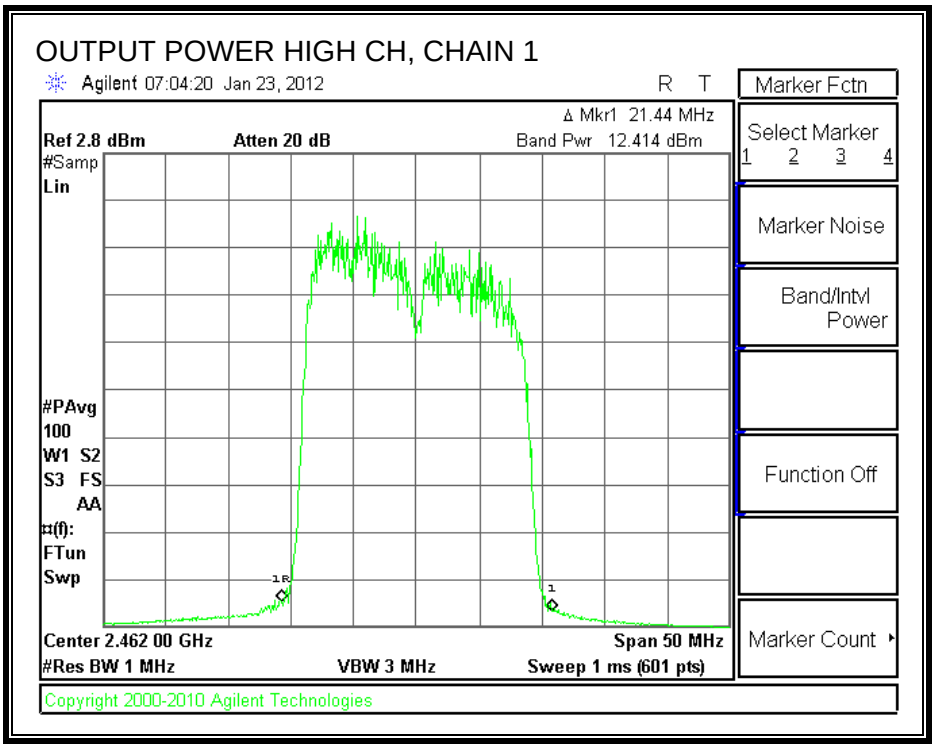
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	11.457	11.248	12.20	26.564	28.60	-2.036
Mid	2437	11.600	12.642	12.20	27.362	28.60	-1.238
High	2462	12.414	11.940	12.20	27.394	28.60	-1.206

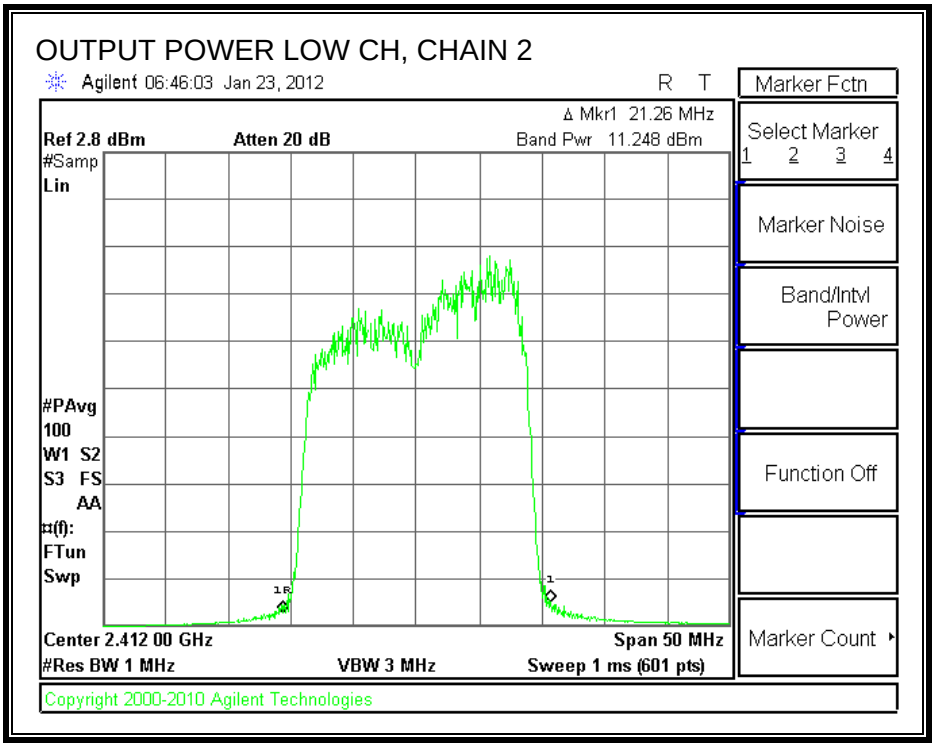
CHAIN 1 OUTPUT POWER

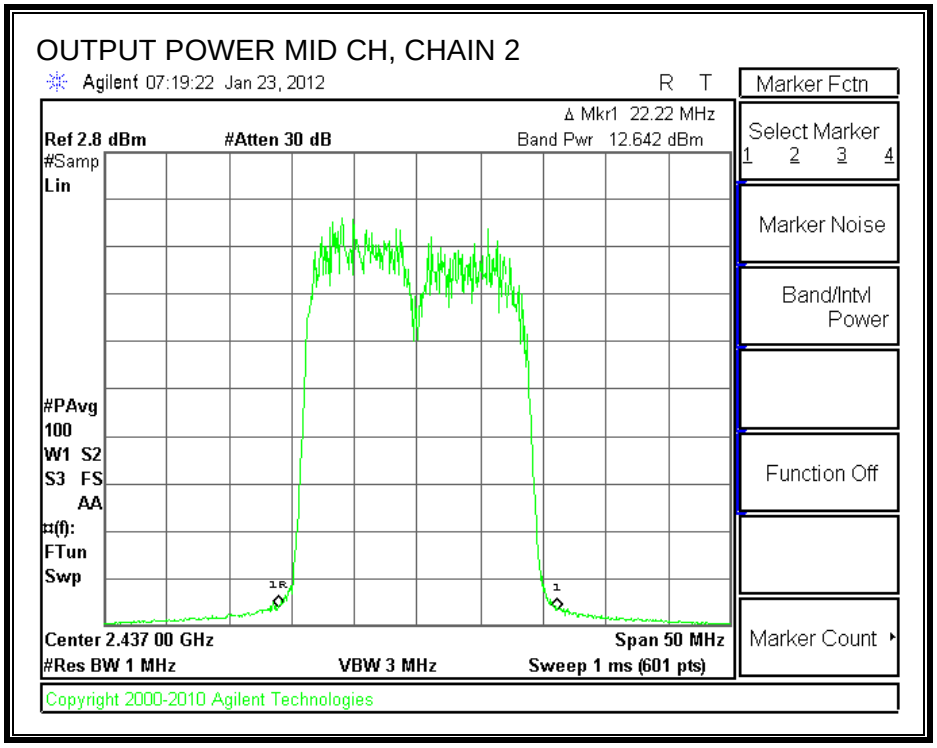




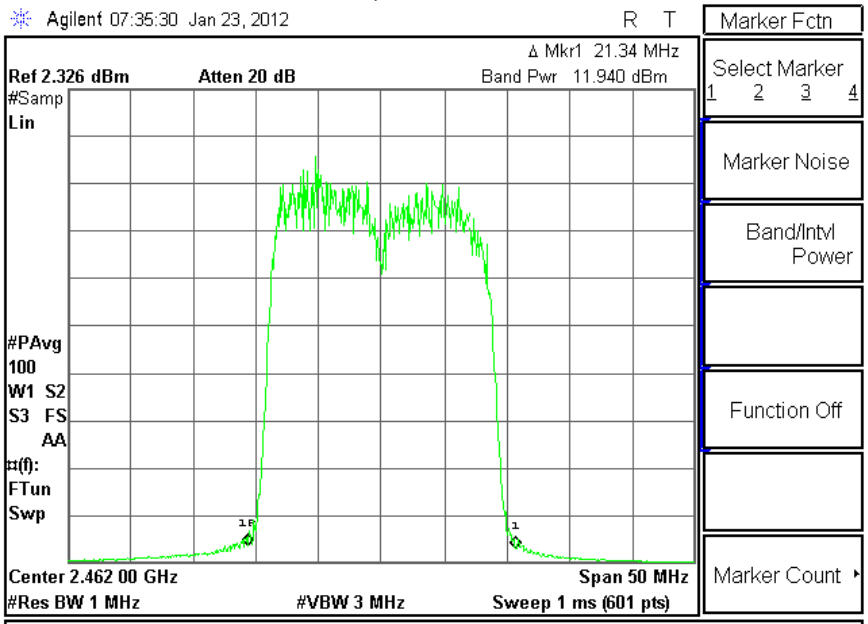


CHAIN 2 OUTPUT POWER





OUTPUT POWER HIGH CH, CHAIN 2



7.3.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.2 dB (including 10 dB pad and .2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2412	20.46	20.38	23.43
Middle	2437	22.04	22.75	25.42
High	2462	21.90	21.73	24.83

7.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

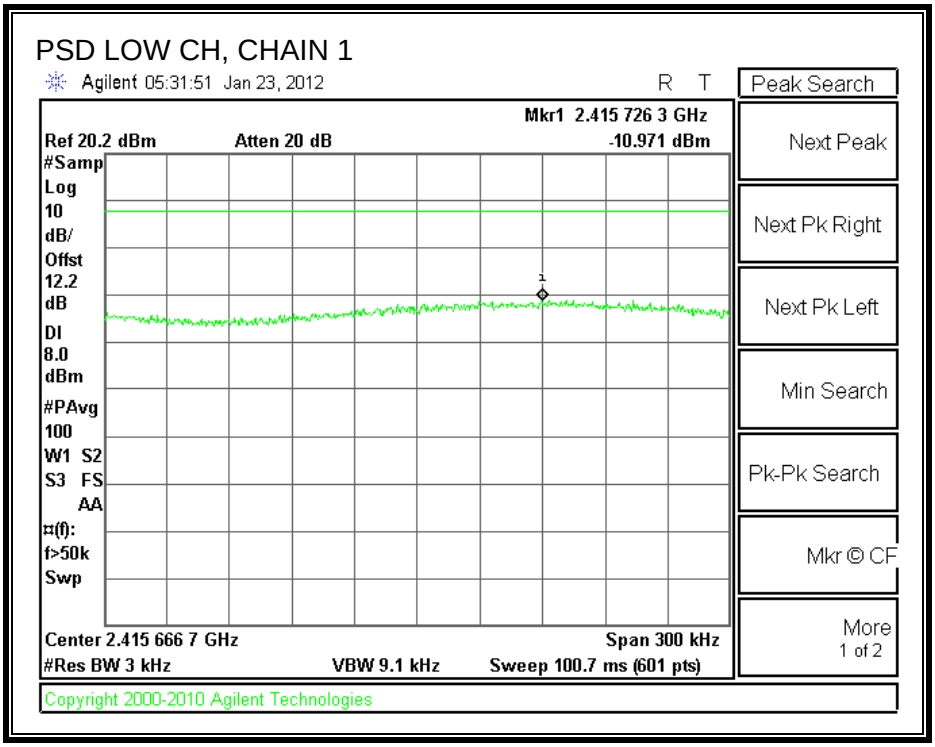
TEST PROCEDURE

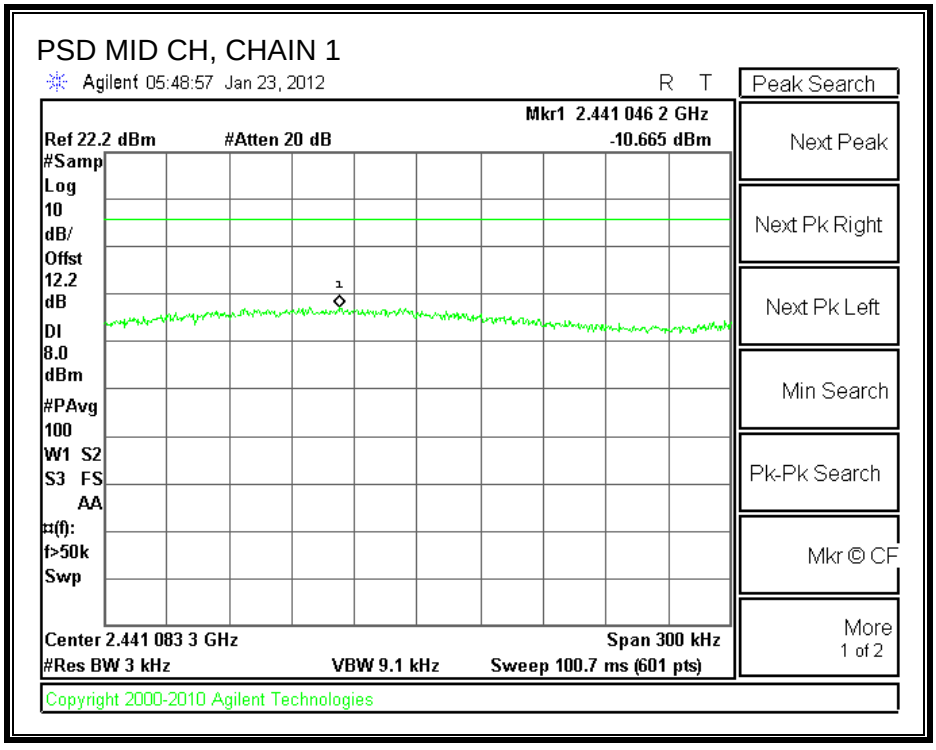
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document “Measurement of Digital Transmission Systems Operating under Section 15.247”, March 23, 2005.

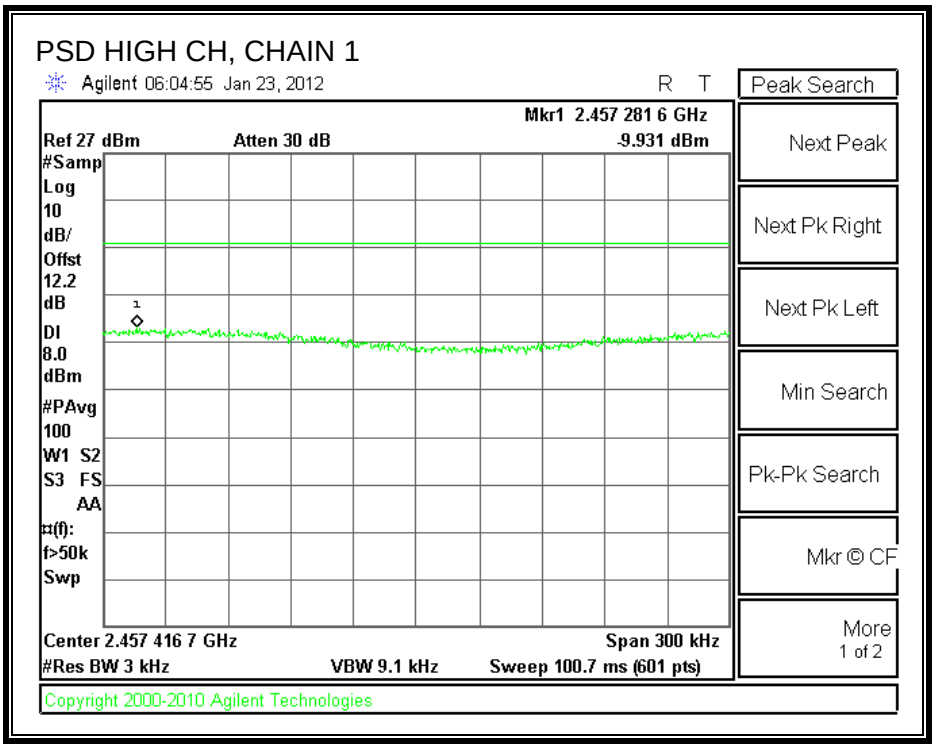
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-10.971	-10.597	-7.77	8	-15.77
Middle	2437	-10.665	-12.067	-8.30	8	-16.30
High	2462	-9.931	-10.556	-7.22	8	-15.22

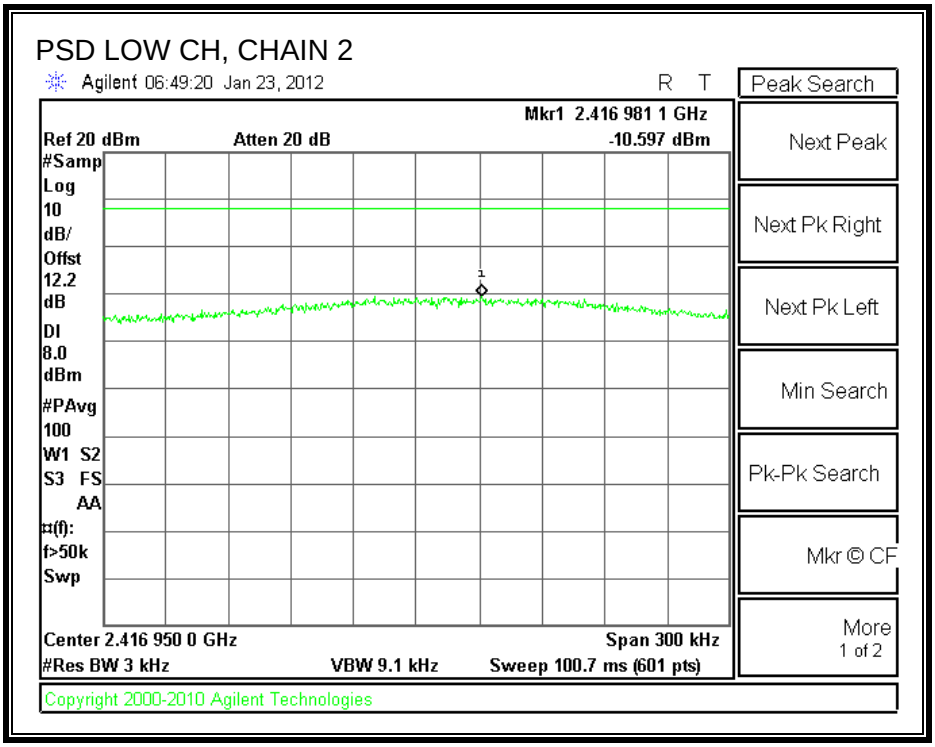
POWER SPECTRAL DENSITY, CHAIN 1

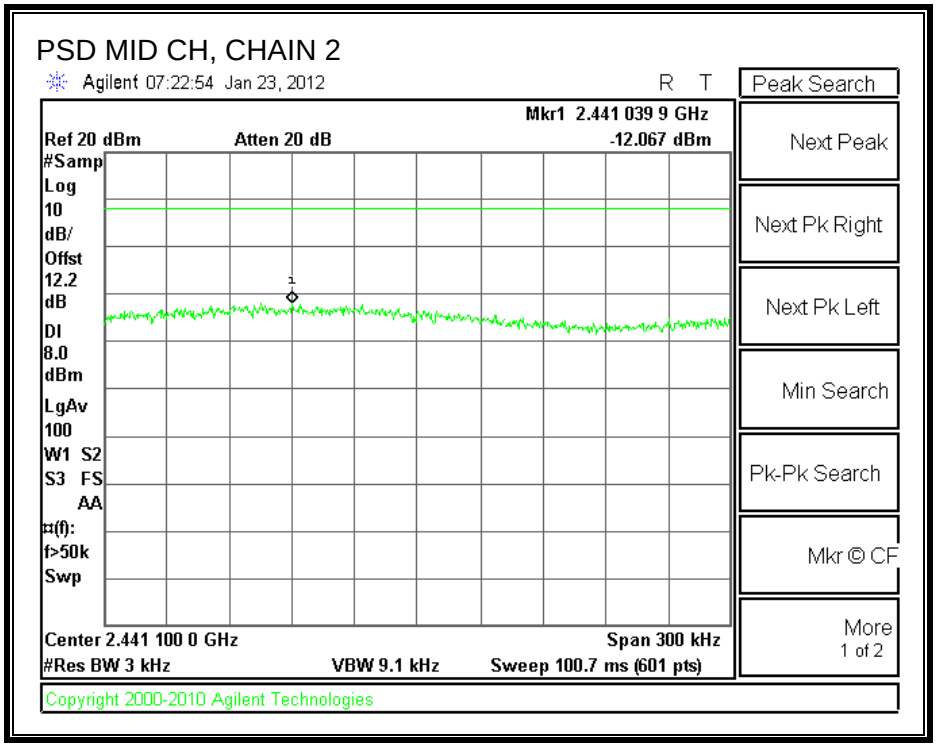


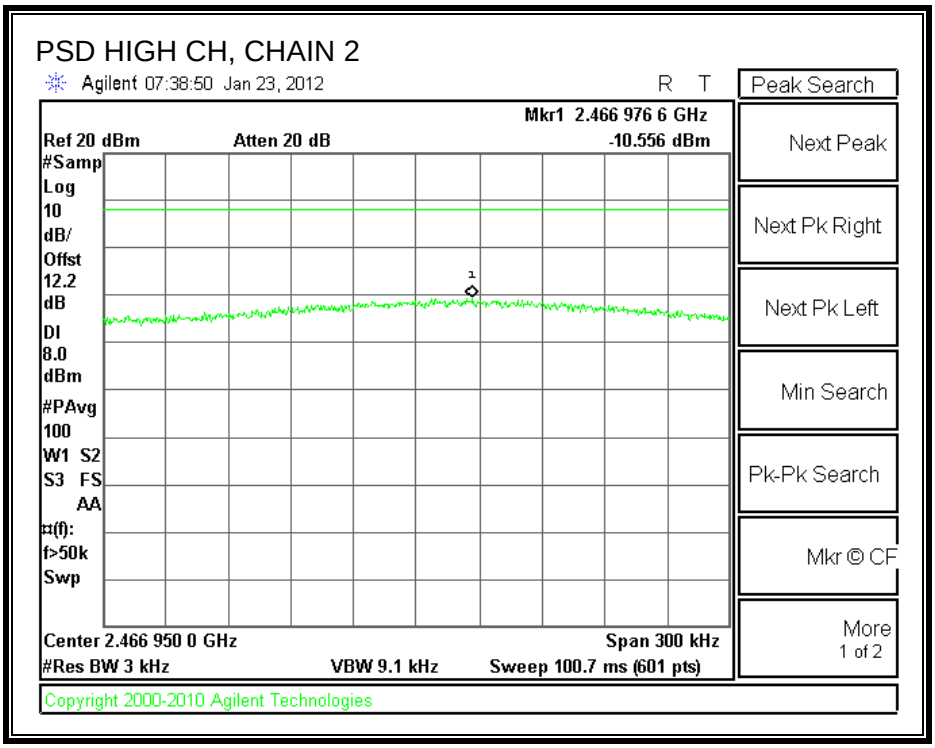




POWER SPECTRAL DENSITY, CHAIN 2







7.3.6. 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 a time interval, therefore the required attenuation is 30 dB.

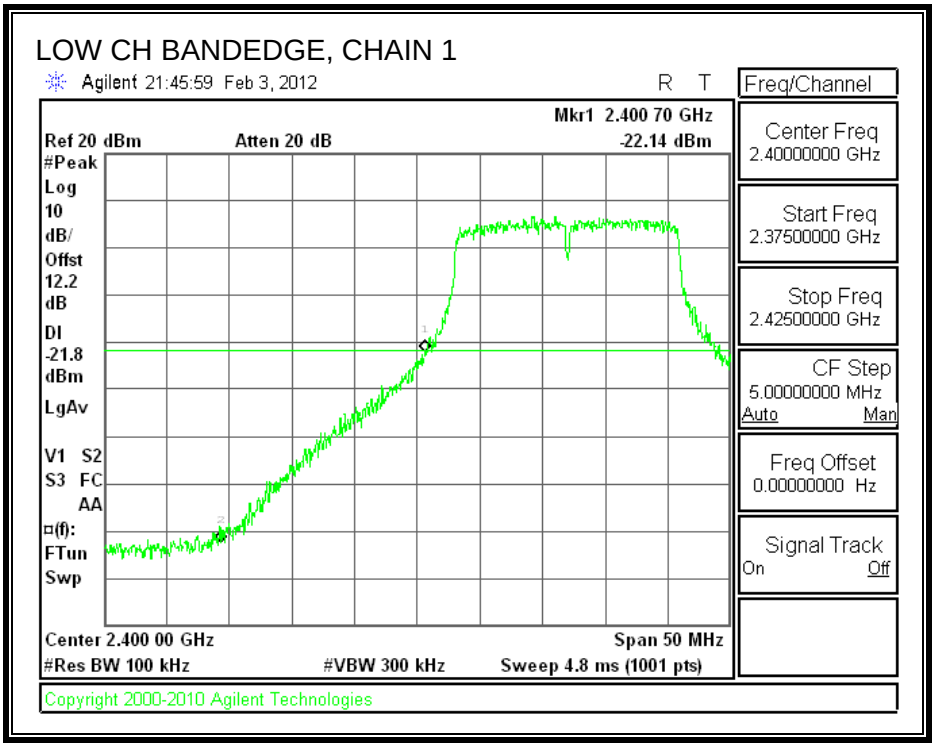
TEST PROCEDURE

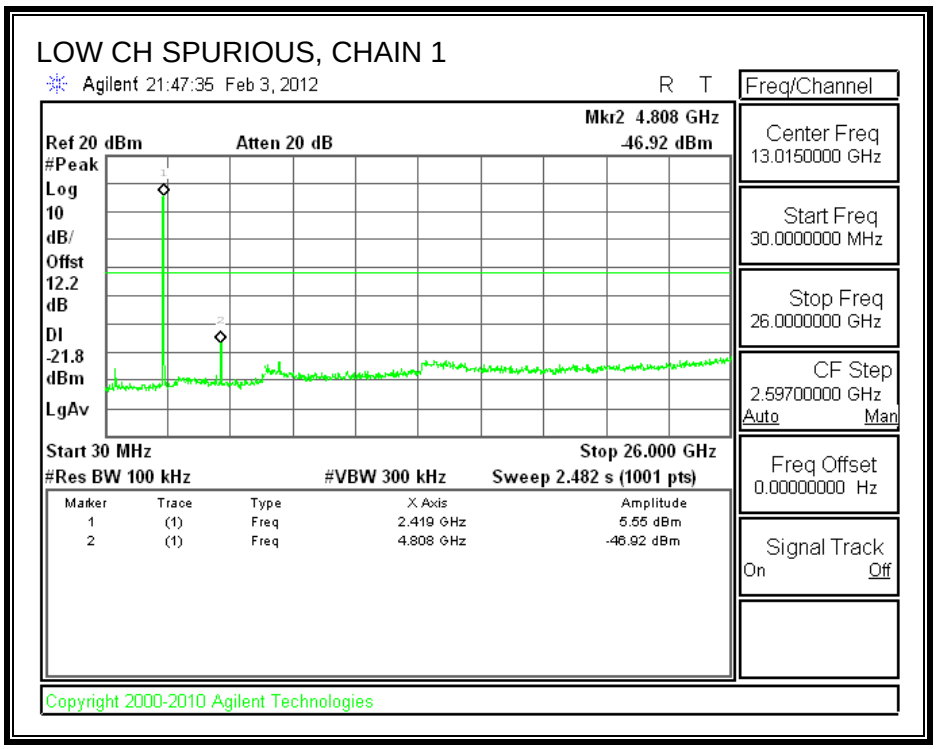
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

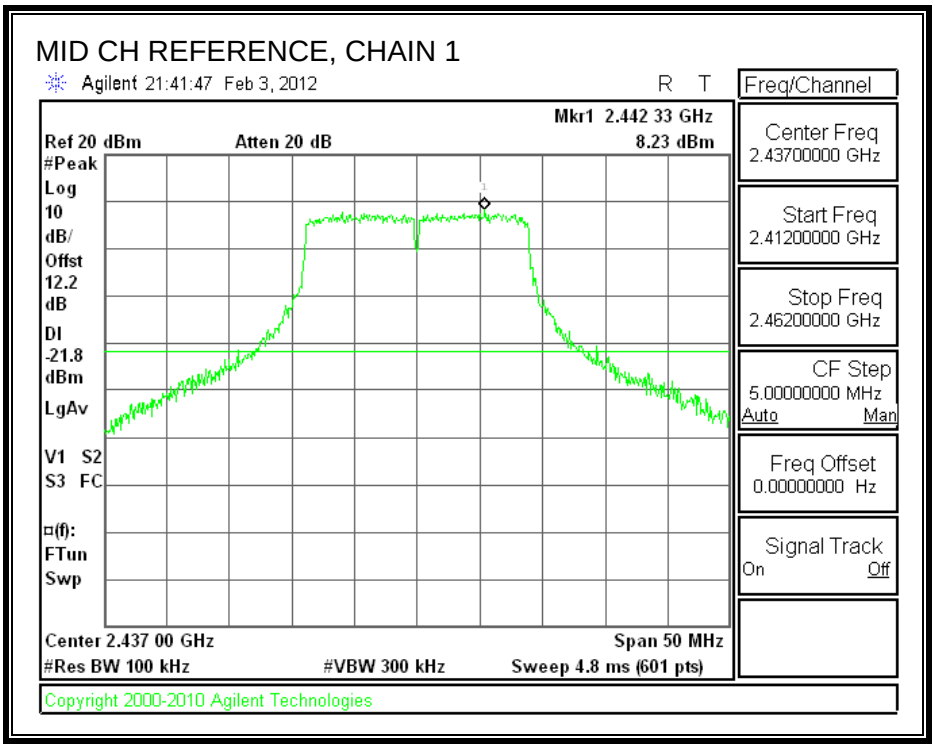
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

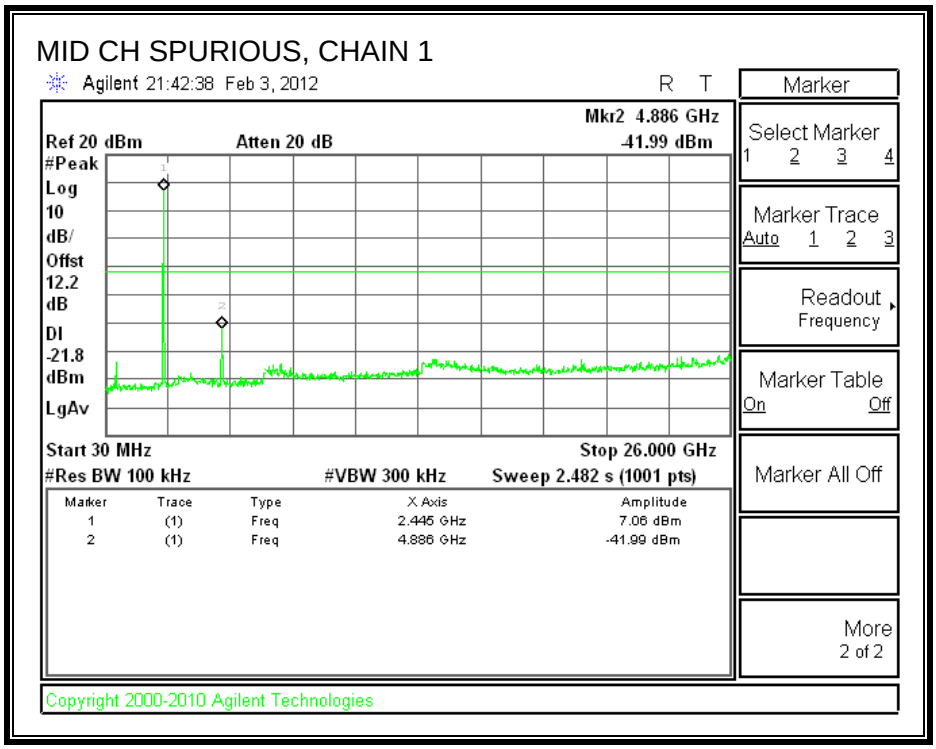
RESULTS

CHAIN 1 SPURIOUS EMISSIONS

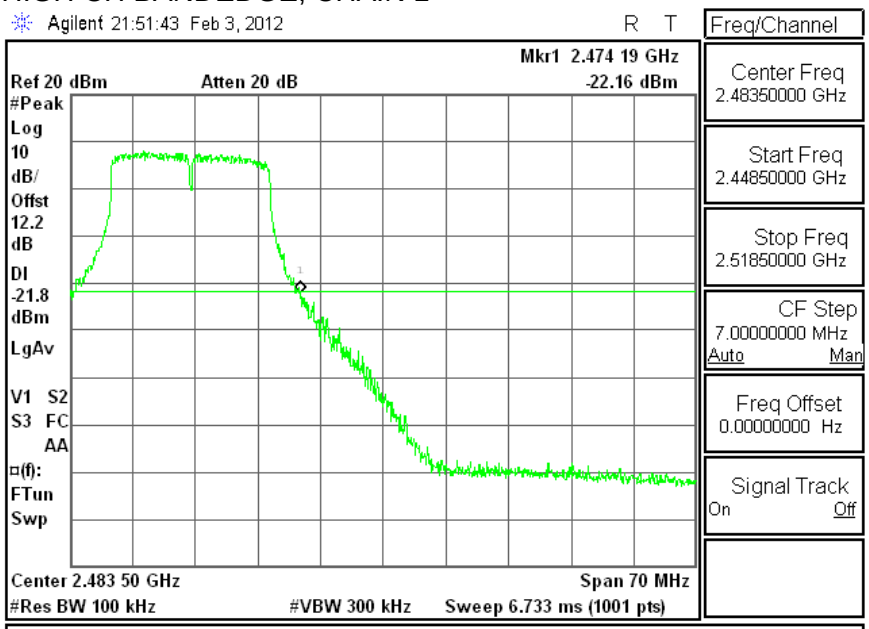




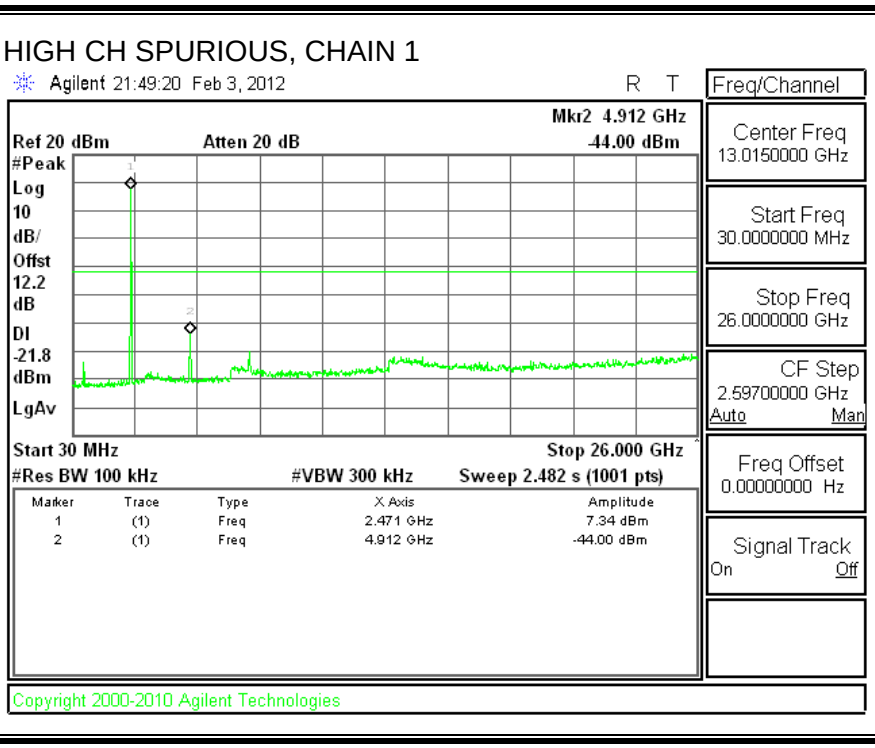




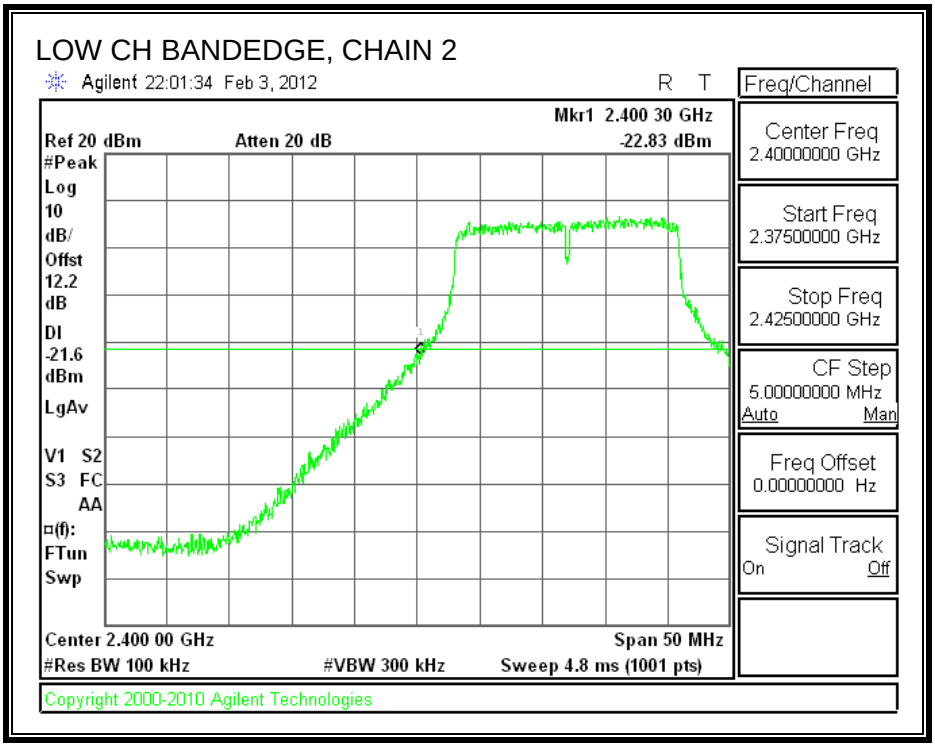
HIGH CH BANDEDGE, CHAIN 1

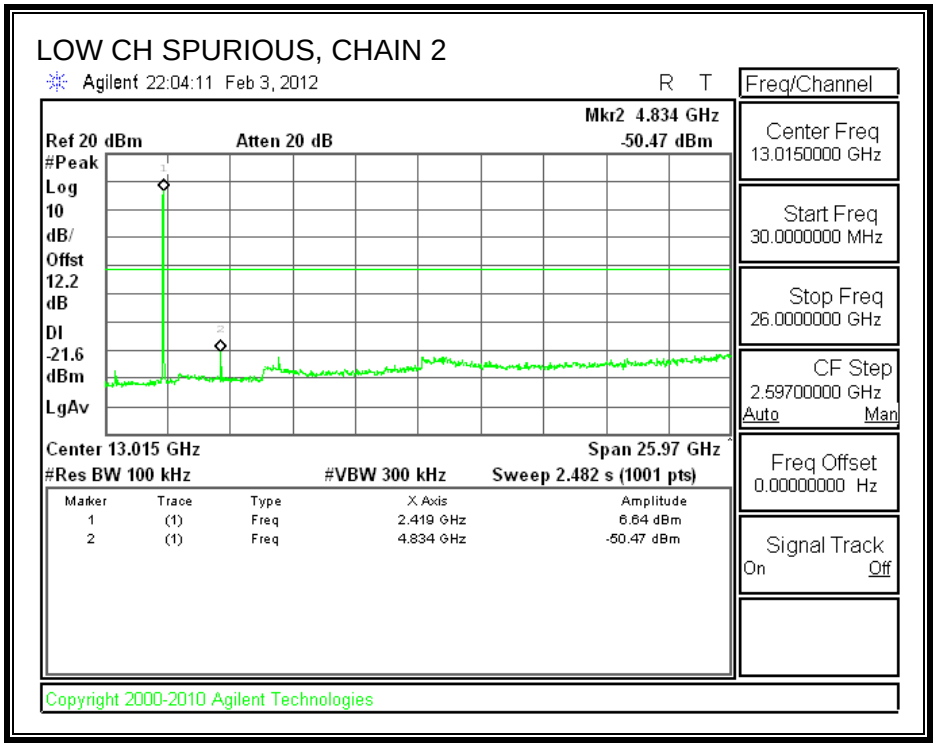


HIGH CH SPURIOUS, CHAIN 1

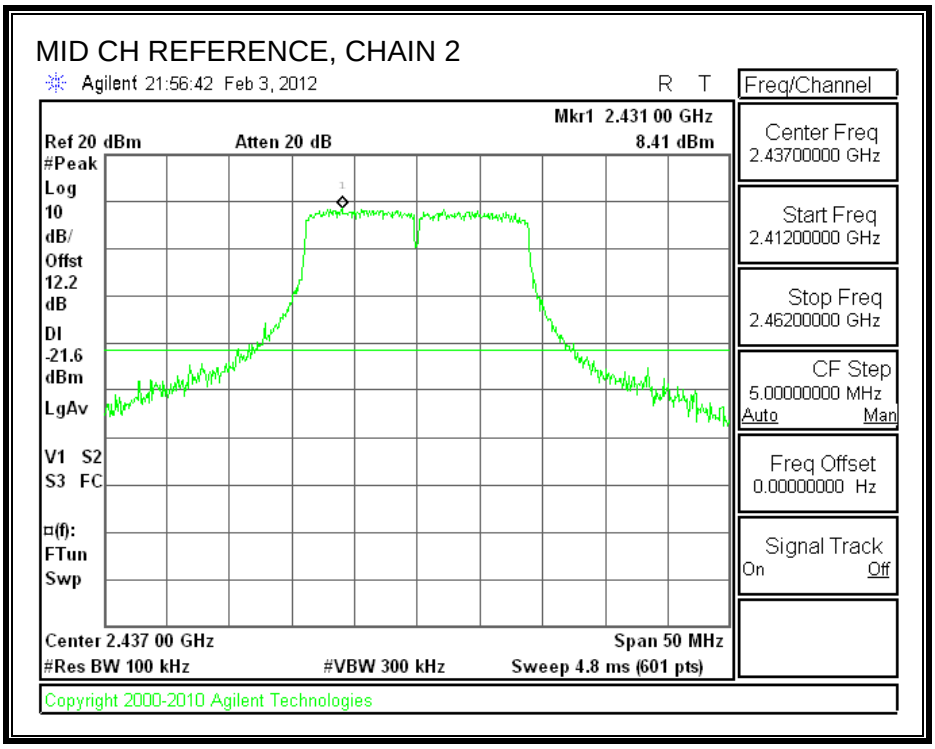


CHAIN 2 SPURIOUS EMISSIONS

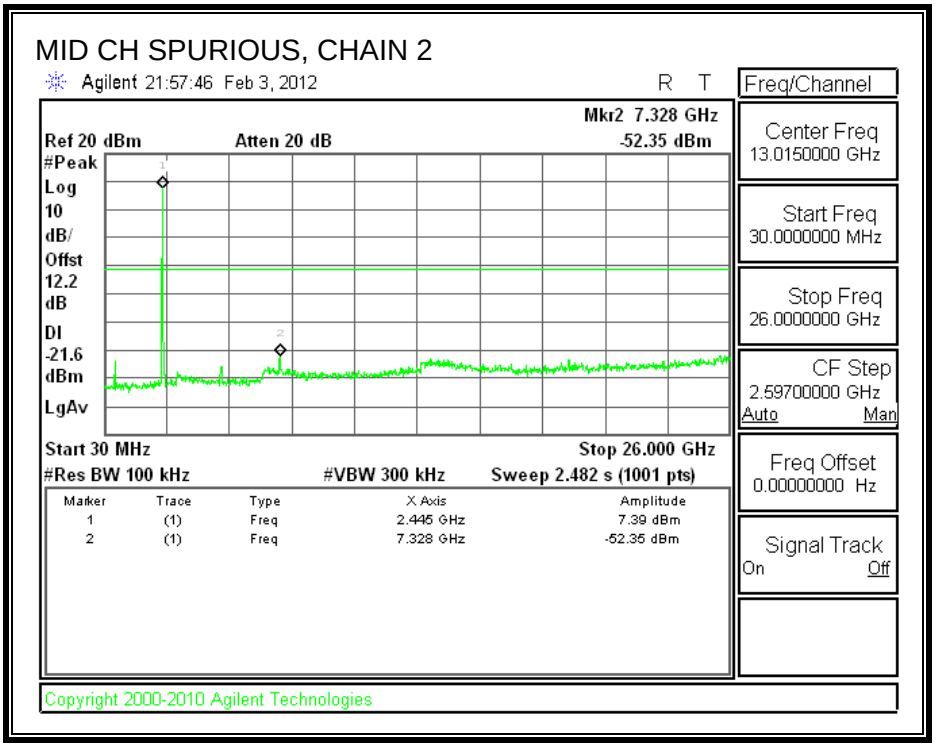




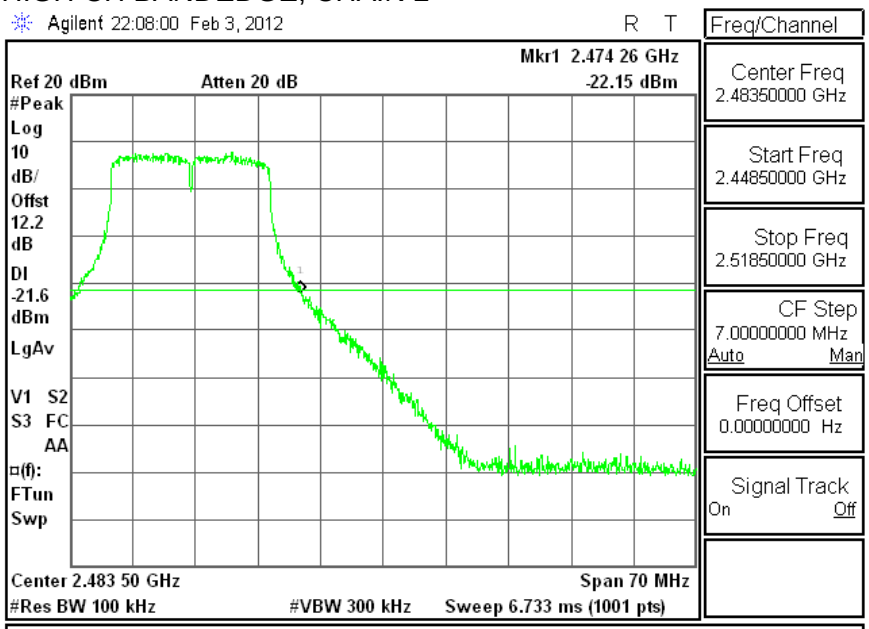
MID CH REFERENCE, CHAIN 2



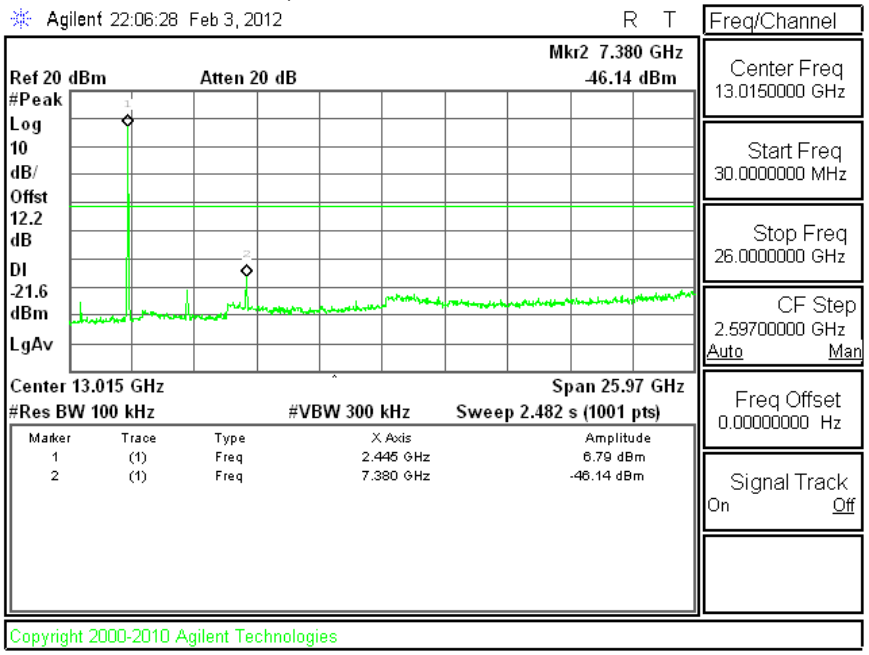
MID CH SPURIOUS, CHAIN 2



HIGH CH BANDEDGE, CHAIN 2



HIGH CH SPURIOUS, CHAIN 2



7.4. 802.11n HT40 2TX MODE IN THE 2.4 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.

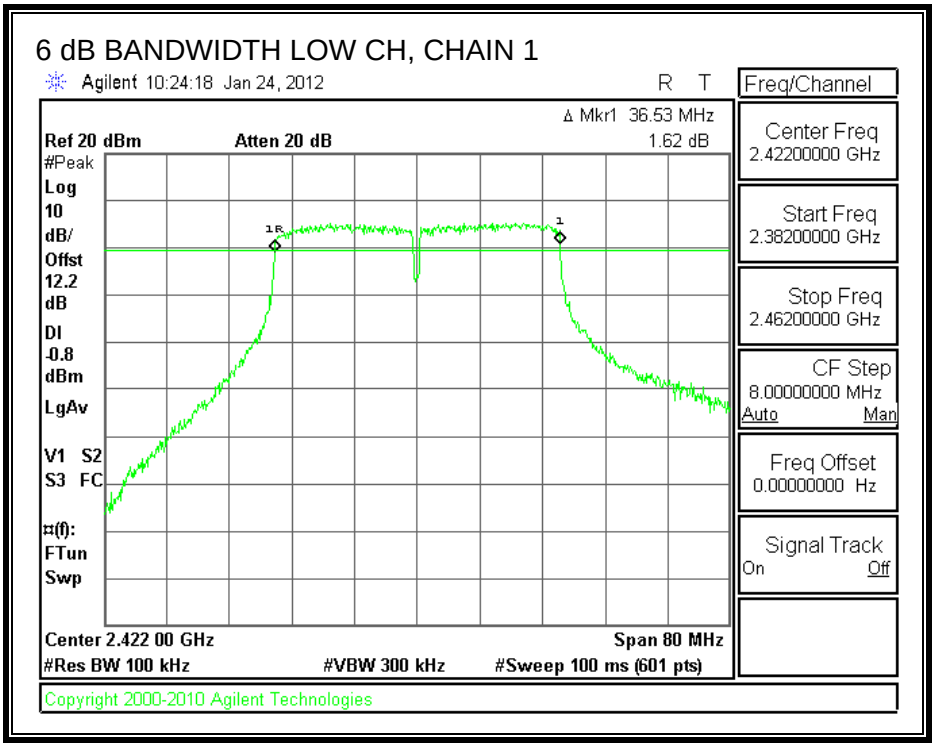
TEST PROCEDURE

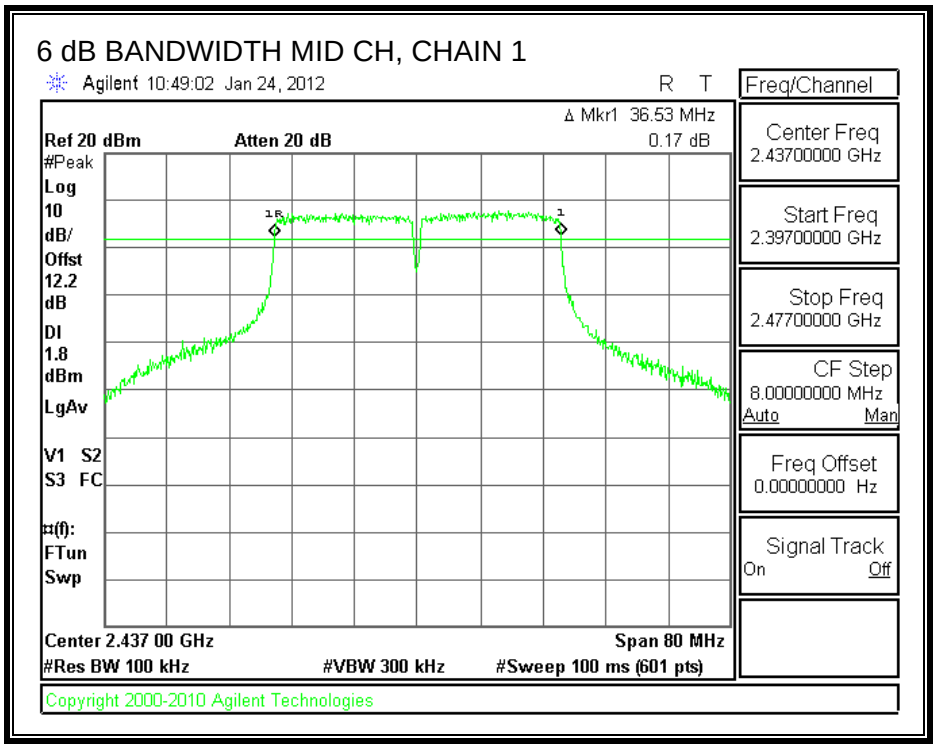
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

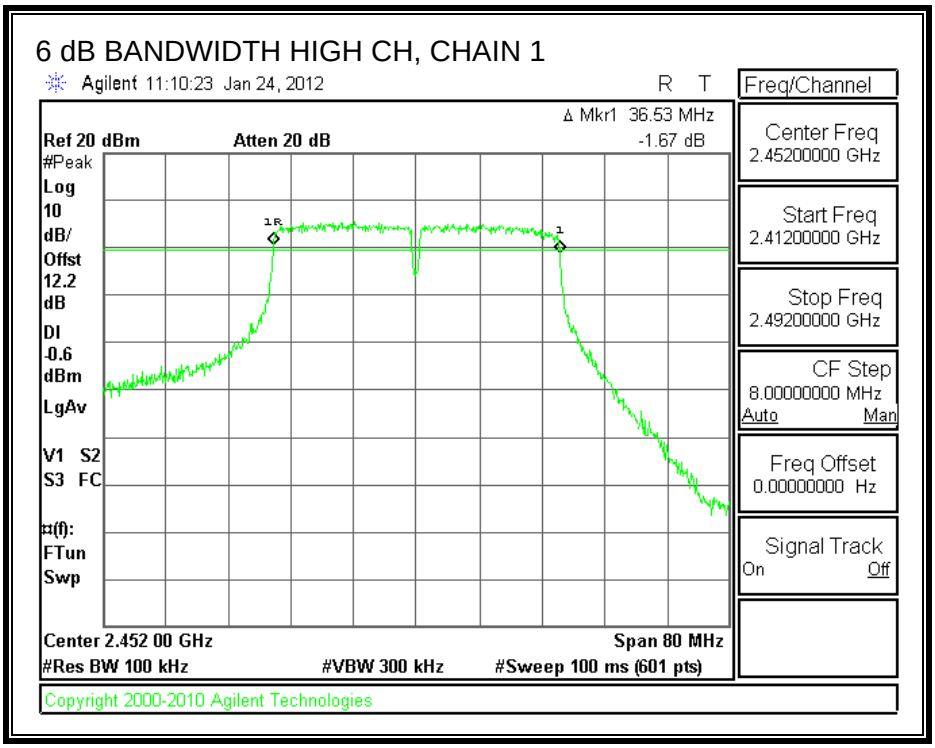
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2422	36.53	36.53	0.5
Middle	2437	36.53	36.53	0.5
High	2452	36.53	36.40	0.5

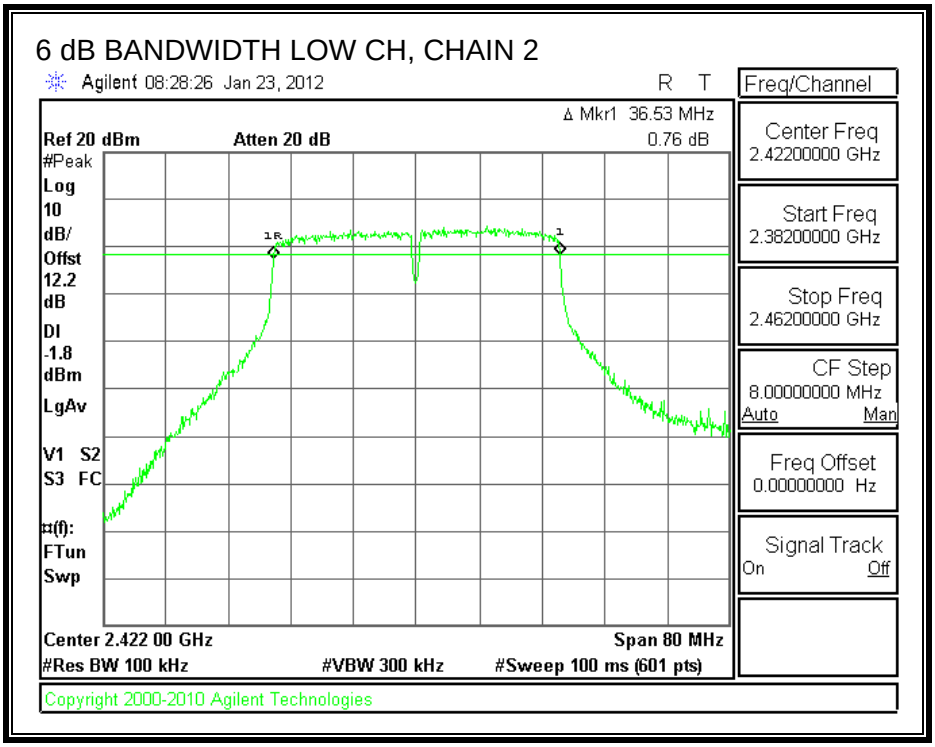
6 dB BANDWIDTH, CHAIN 1

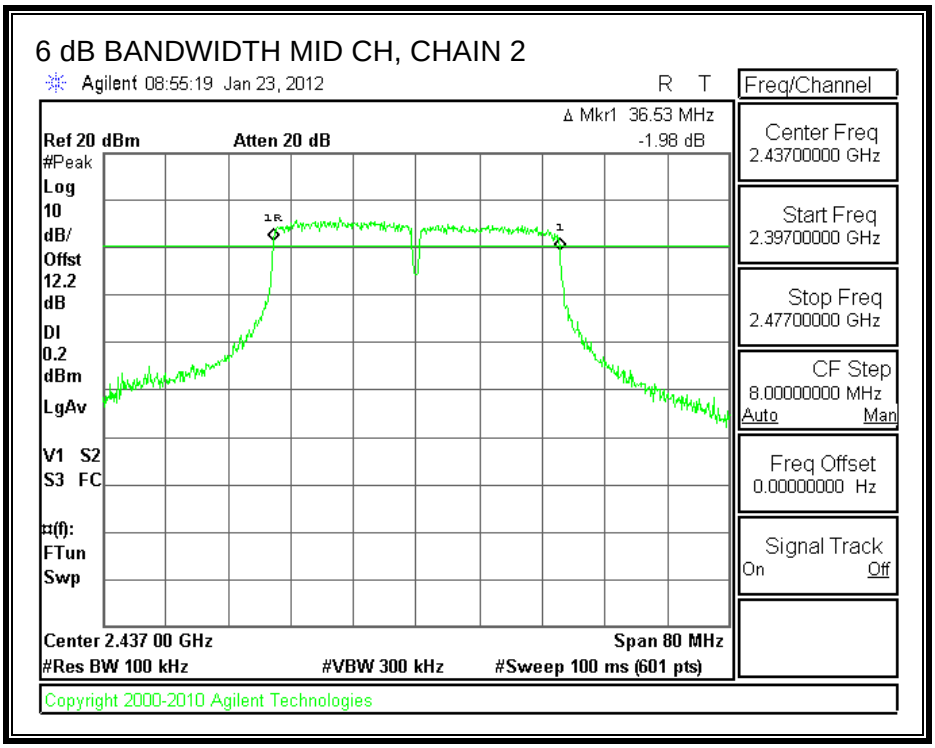


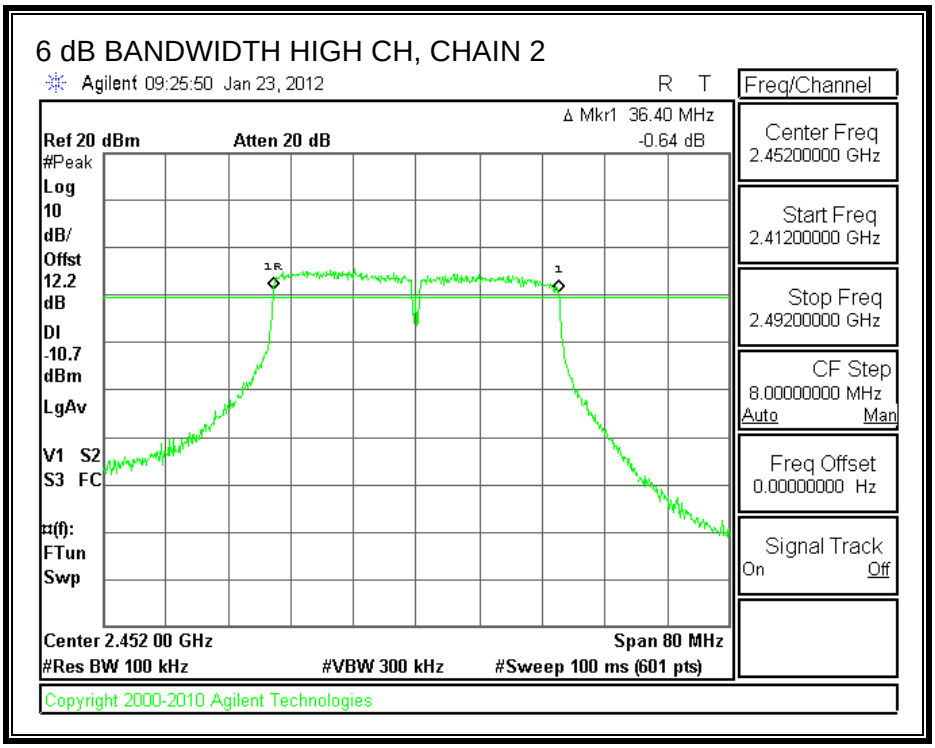




6 dB BANDWIDTH, CHAIN 2







7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

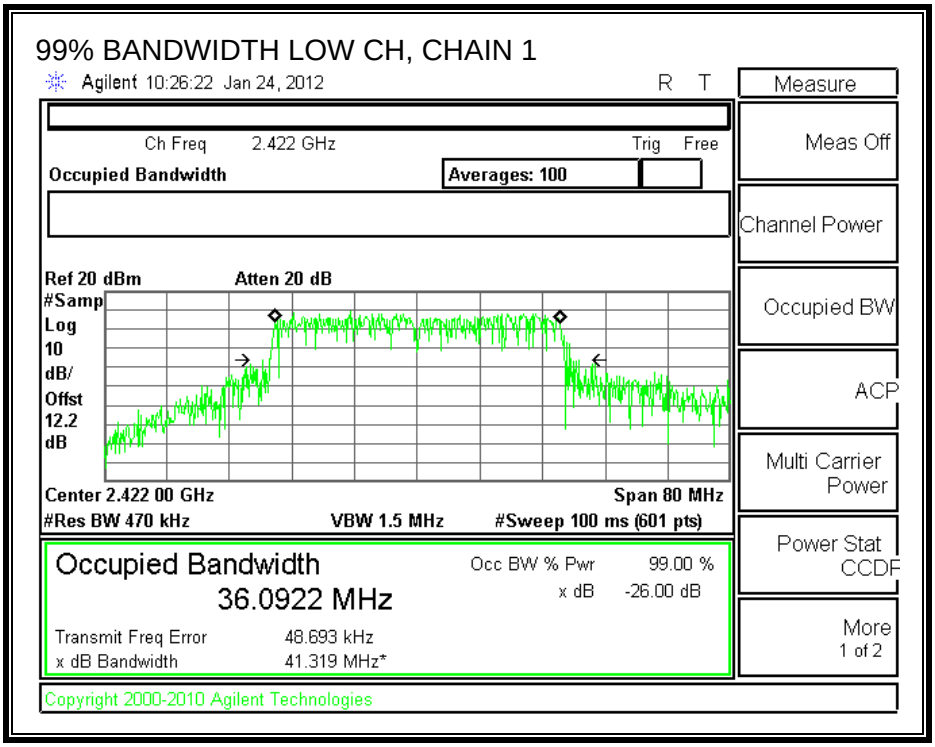
TEST PROCEDURE

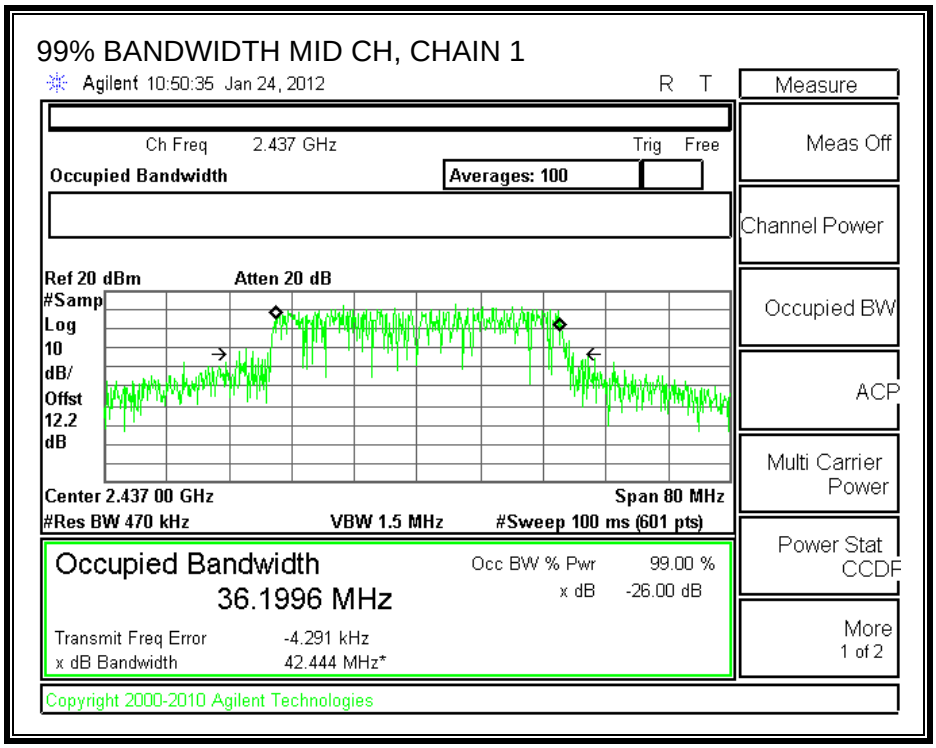
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

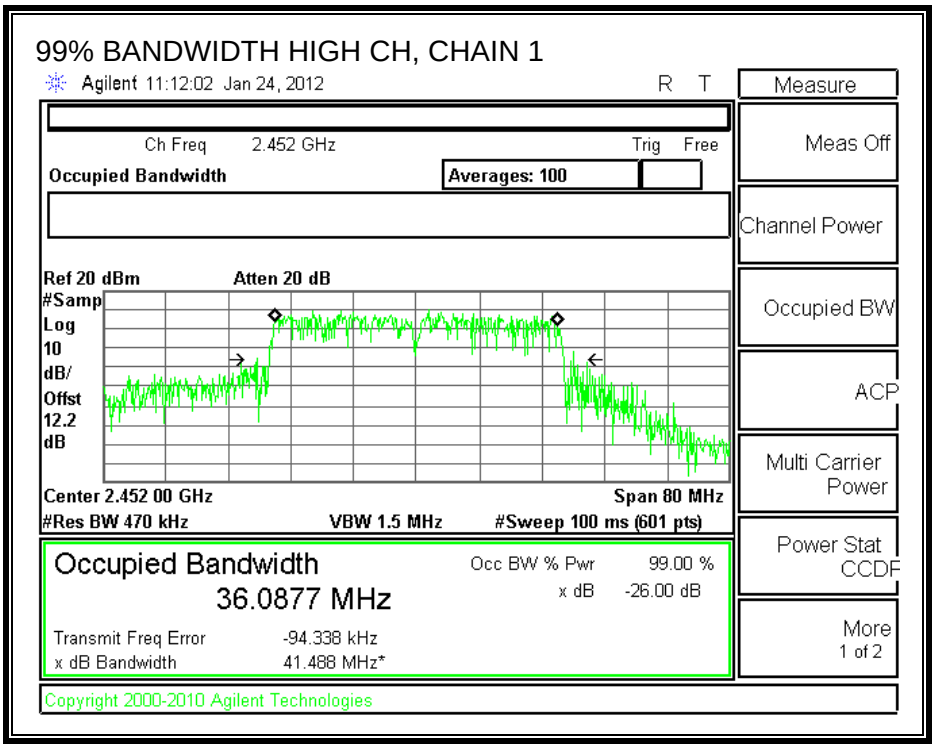
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)
Low	2422	36.0922	36.0604
Middle	2437	36.1996	36.1573
High	2452	36.0877	36.1131

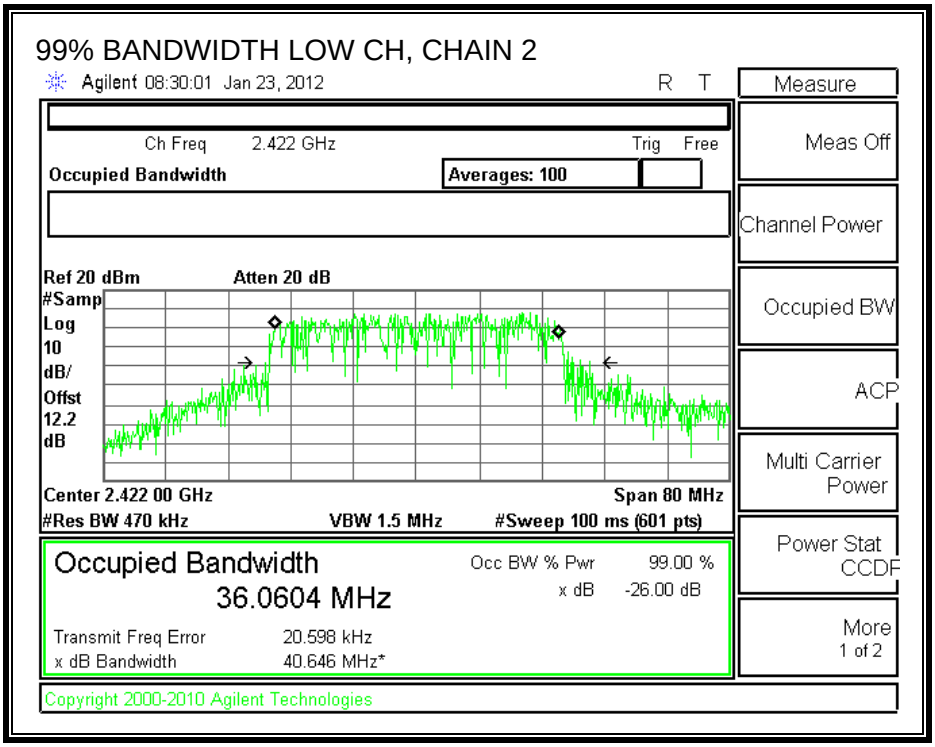
99% BANDWIDTH, CHAIN 1

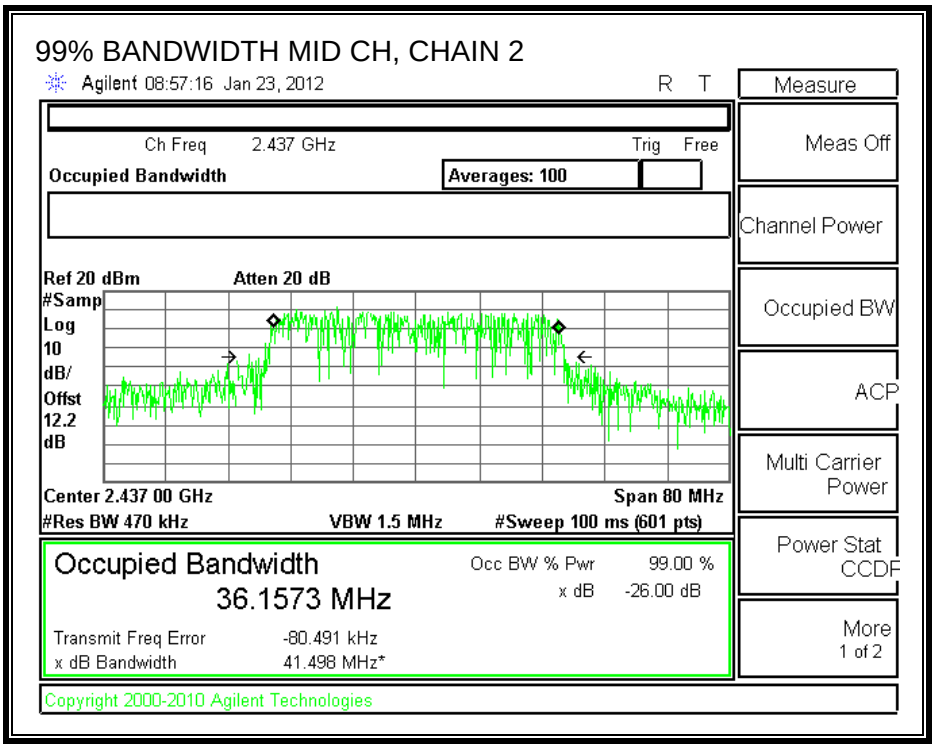


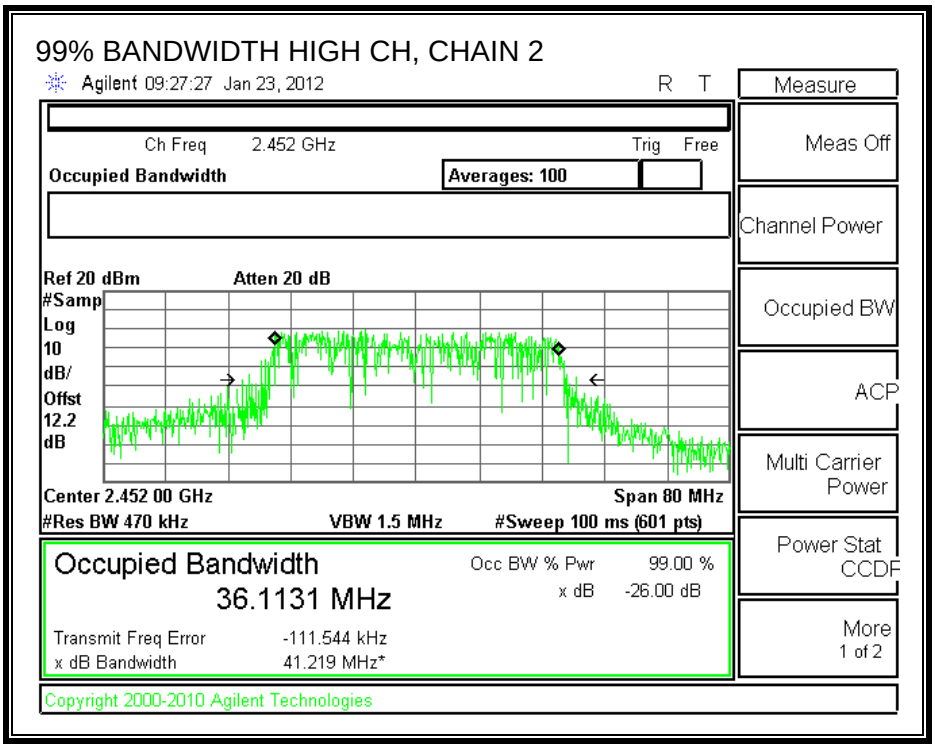




99% BANDWIDTH, CHAIN 2







7.4.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is 7.4 dBi for other than fixed, point-to-point operations, therefore the limit is 28.6 dBm.

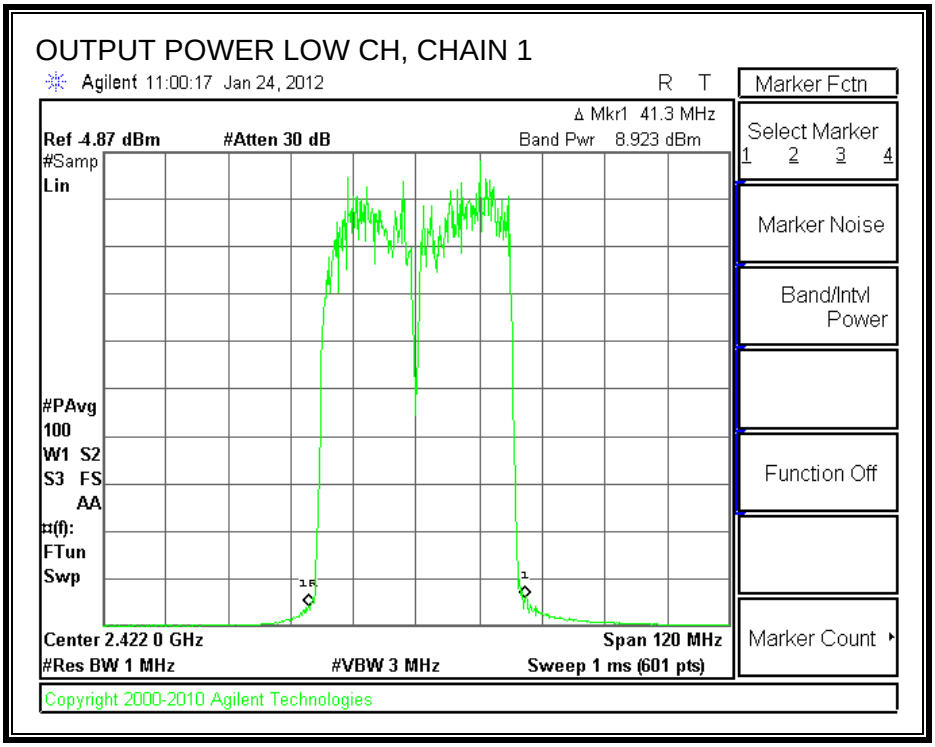
TEST PROCEDURE

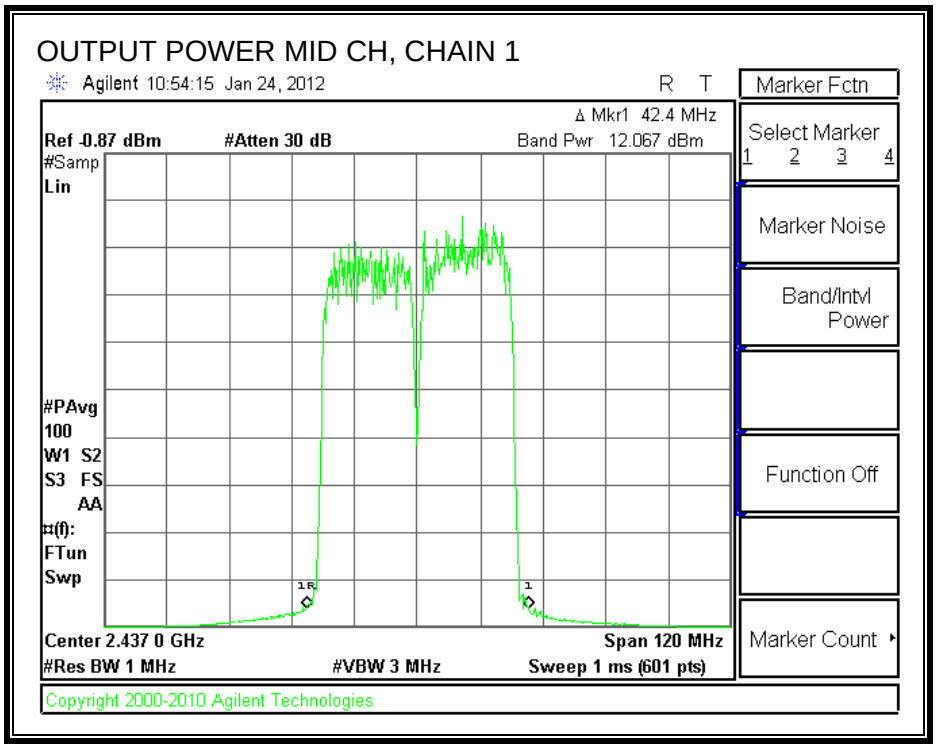
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

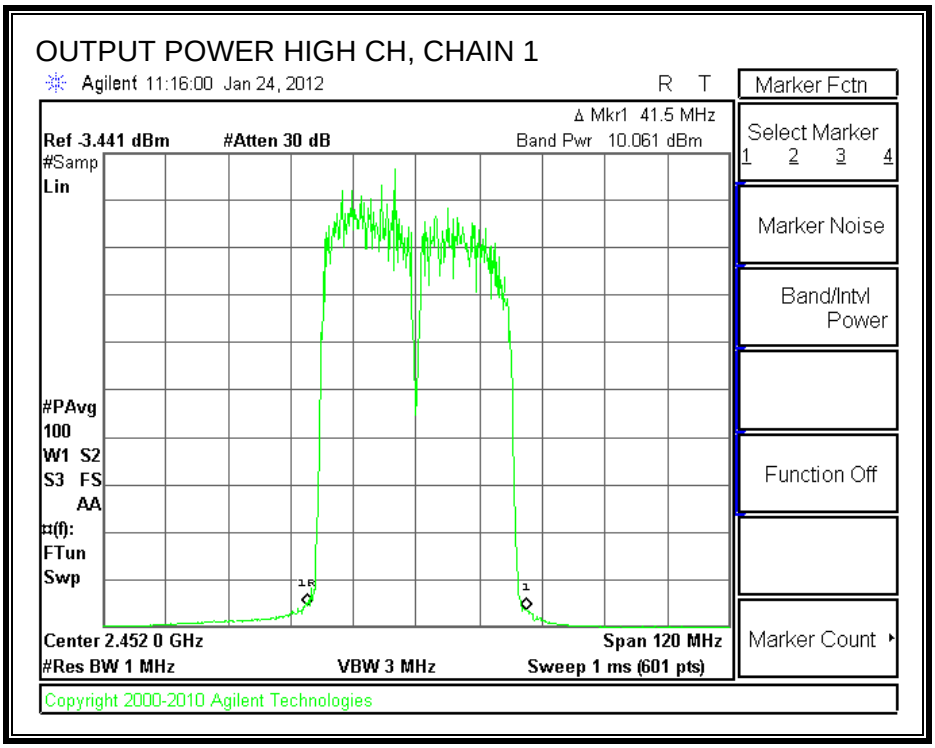
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Attenuator + Cable Offset (dB)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2422	8.923	8.786	12.20	24.065	28.60	-4.535
Mid	2437	12.067	12.217	12.20	27.353	28.60	-1.247
High	2452	10.061	11.025	12.20	25.780	28.60	-2.820

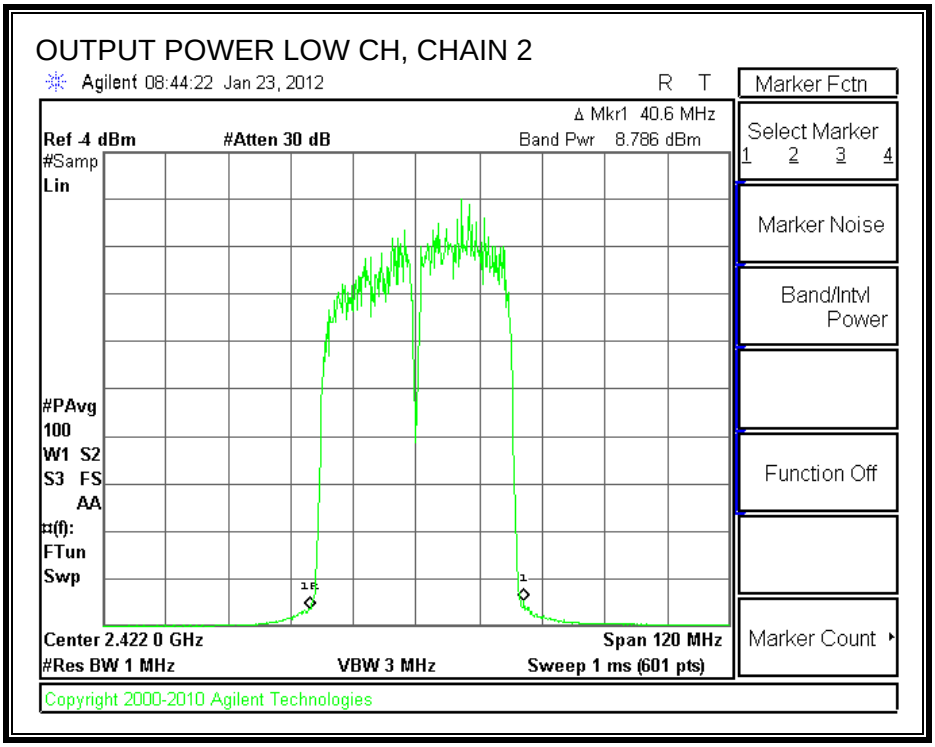
CHAIN 1 OUTPUT POWER

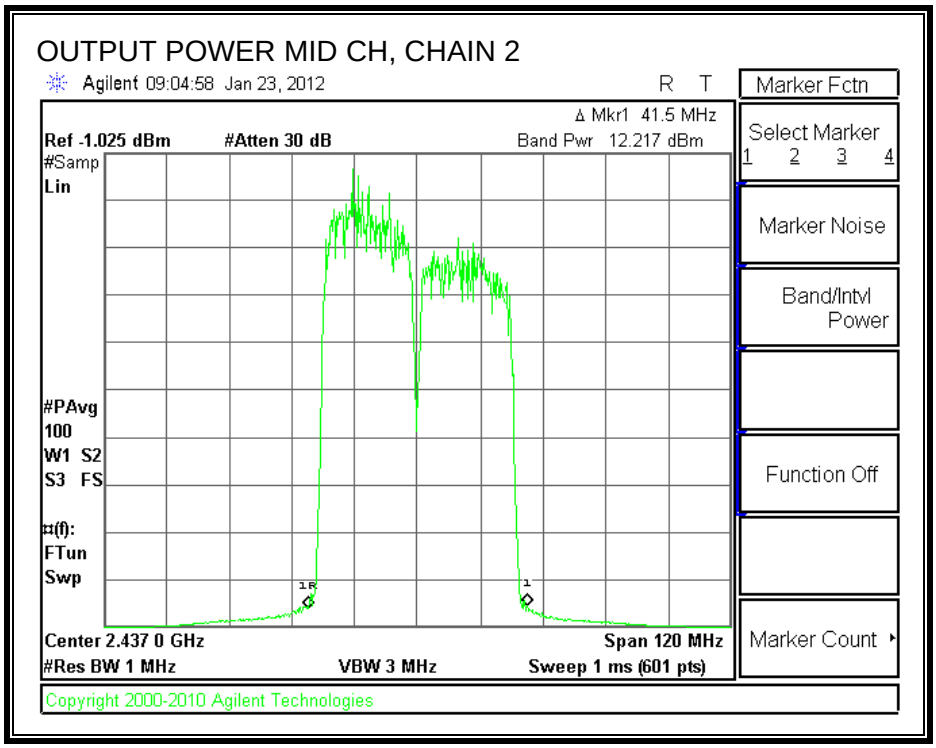


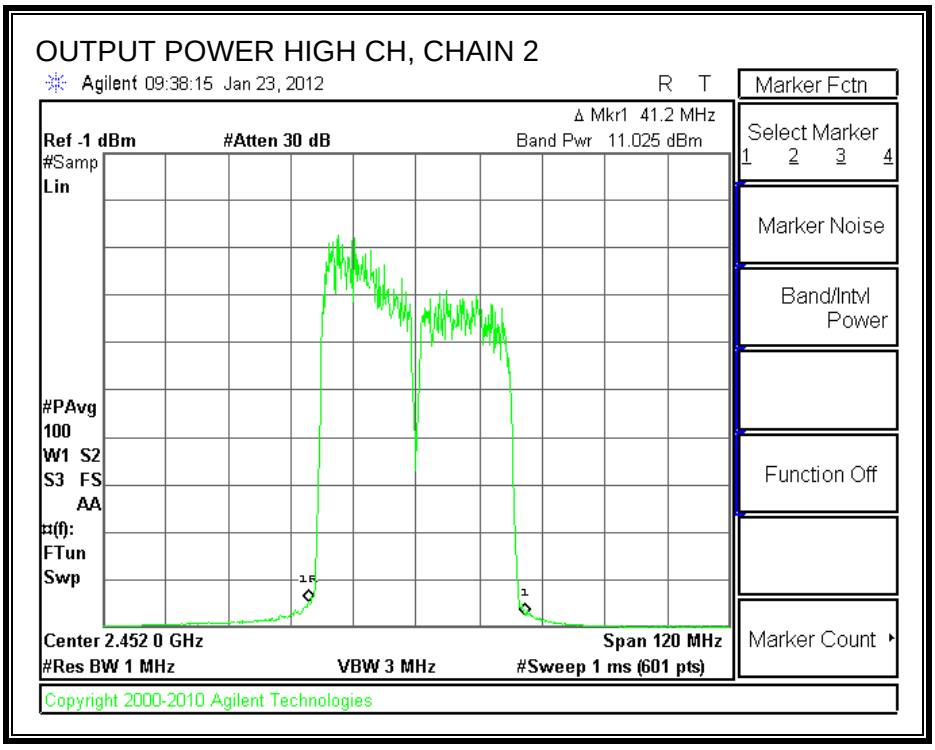




CHAIN 2 OUTPUT POWER







7.4.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.2 dB (including 10 dB pad and .2 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
Low	2422	19.68	19.87	22.79
Middle	2437	22.12	22.10	25.12
High	2452	19.59	19.65	22.63

7.4.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

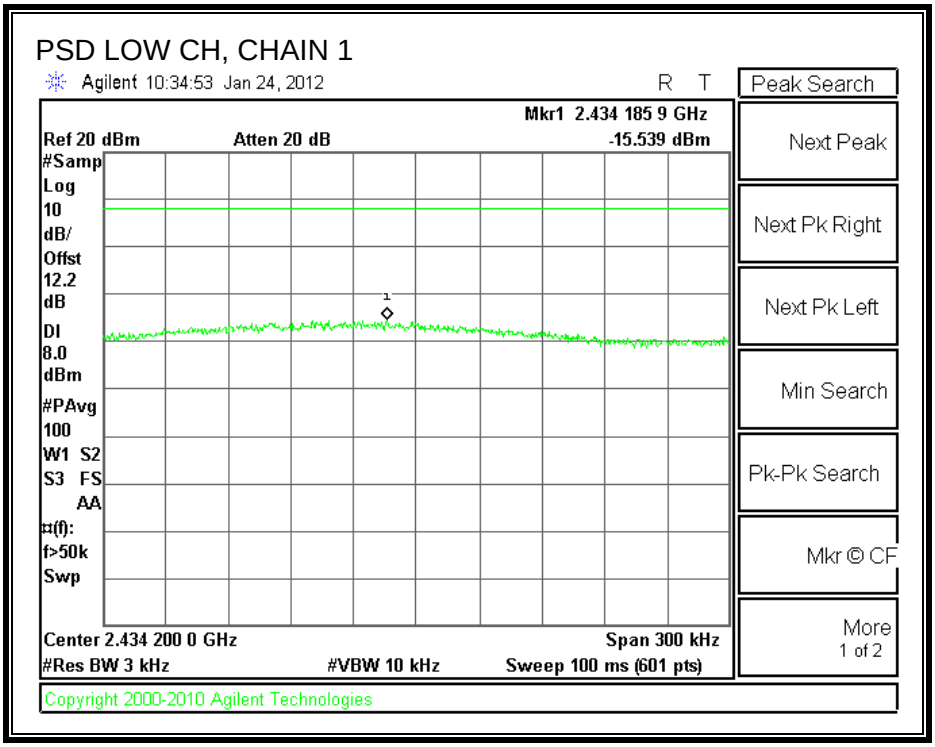
TEST PROCEDURE

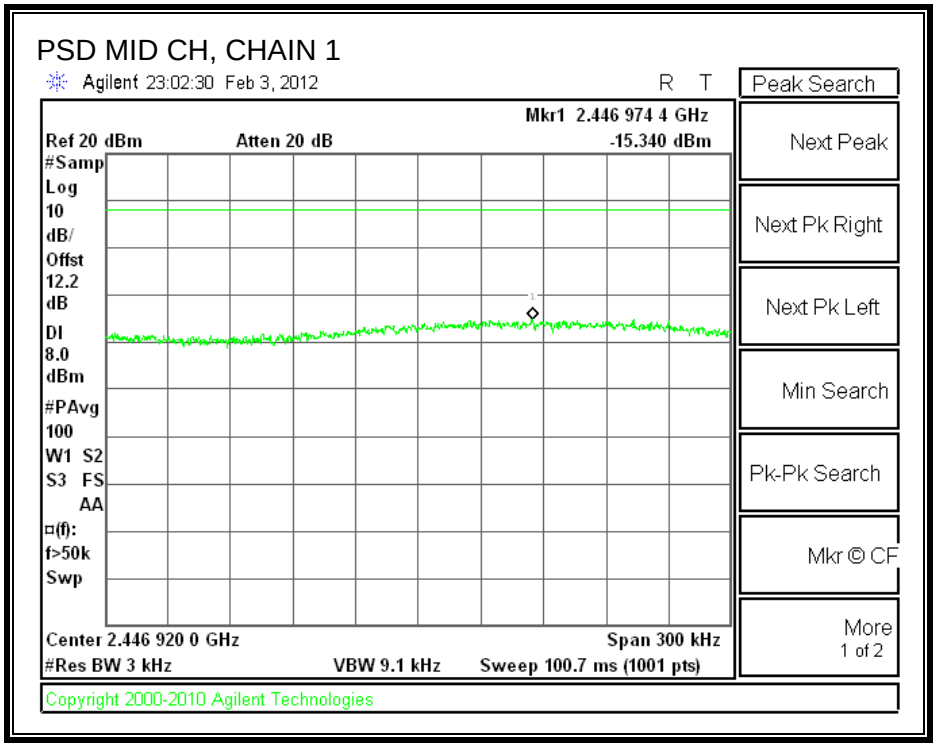
Output power was measured based on the use of RMS averaging over a time interval, therefore the power spectral density was measured using PSD Option 2 in accordance with FCC document “Measurement of Digital Transmission Systems Operating under Section 15.247”, March 23, 2005.

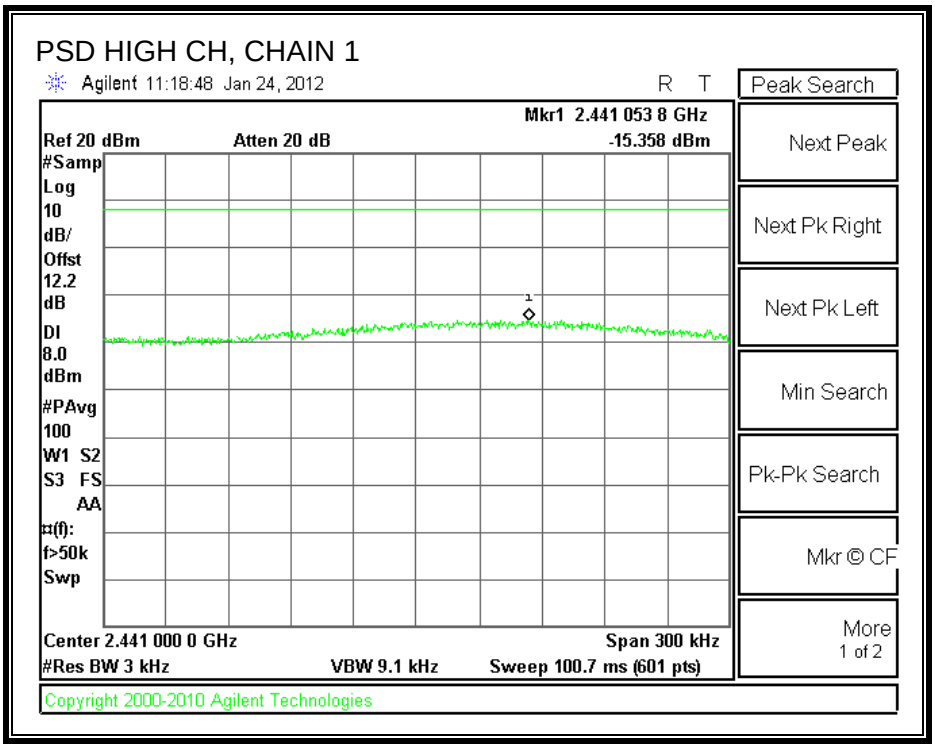
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2422	-15.539	-15.003	-12.25	8	-20.25
Middle	2437	-15.340	-14.148	-11.69	8	-19.69
High	2452	-15.358	-13.819	-11.51	8	-19.51

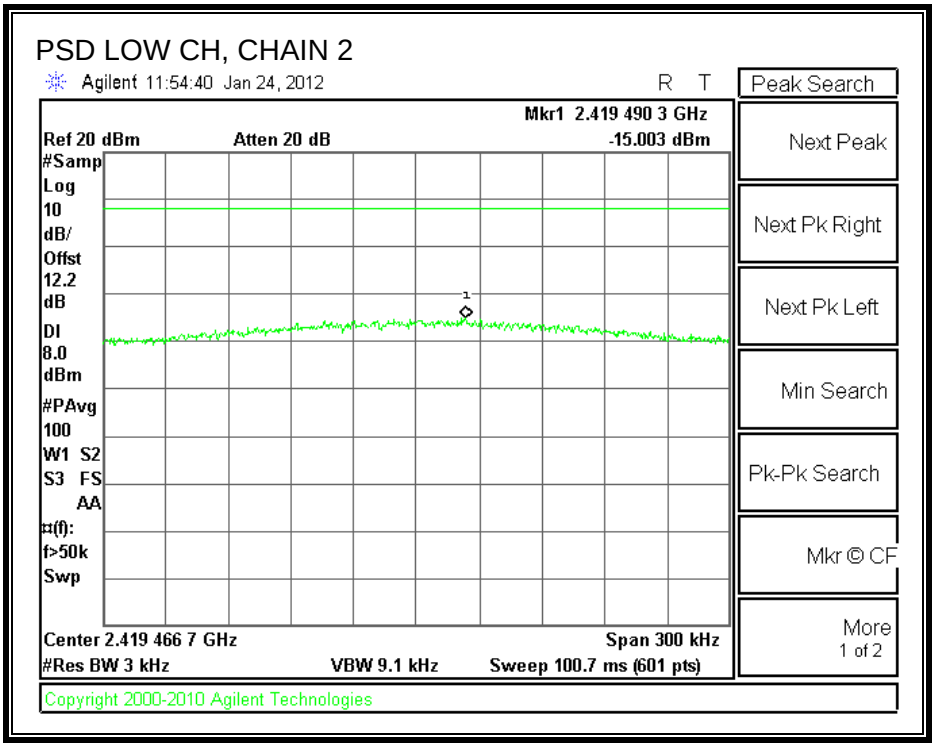
POWER SPECTRAL DENSITY, CHAIN 1

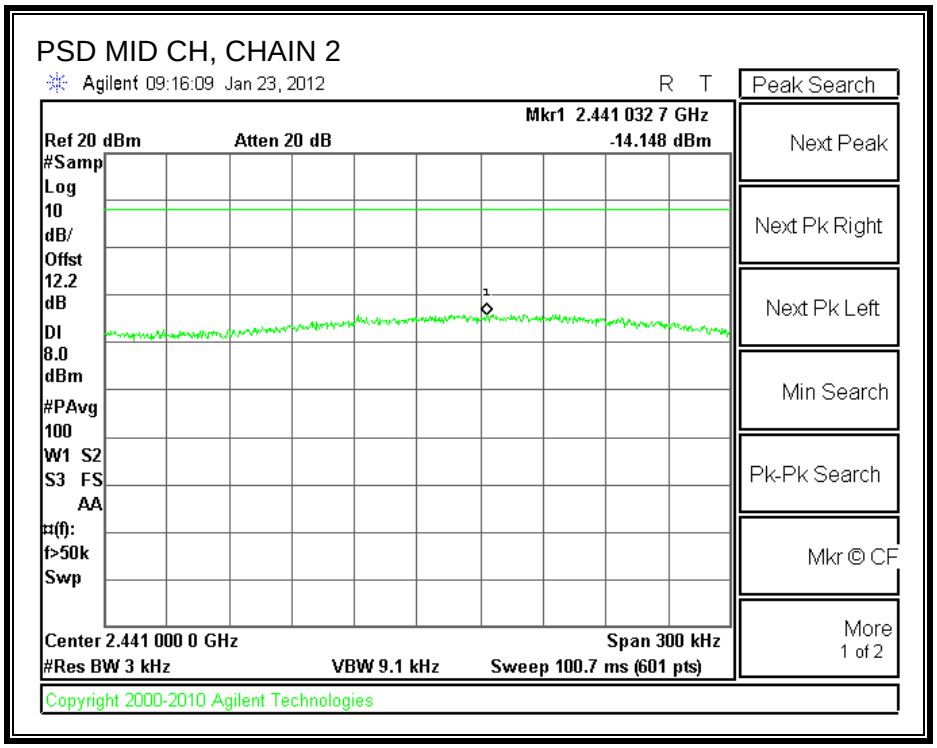


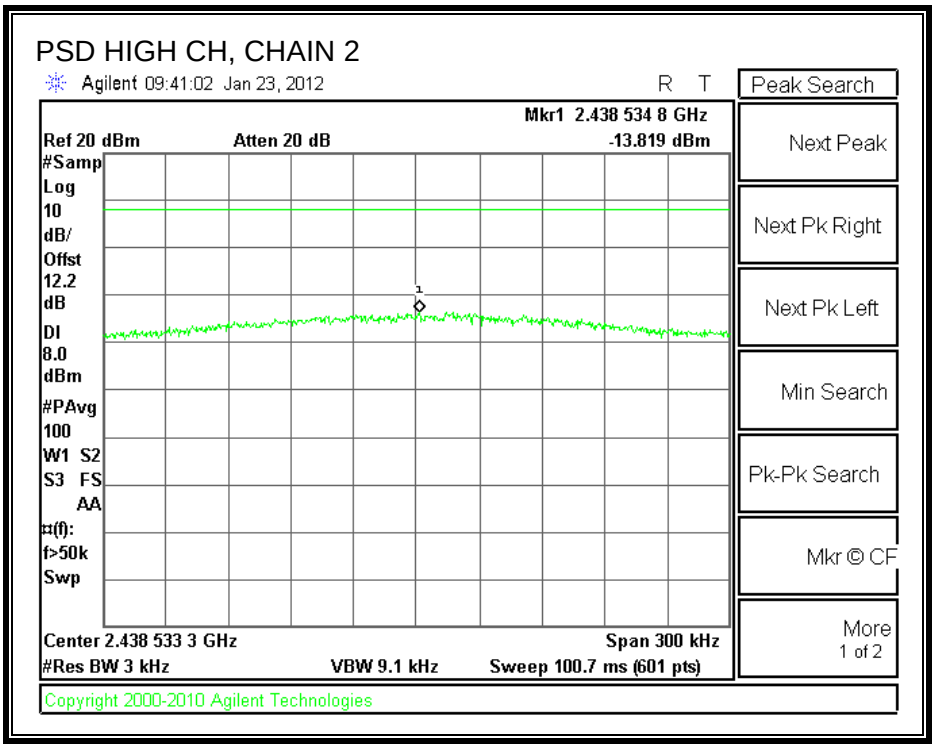




POWER SPECTRAL DENSITY, CHAIN 2







7.4.6. 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 a time interval, therefore the required attenuation is 30 dB.

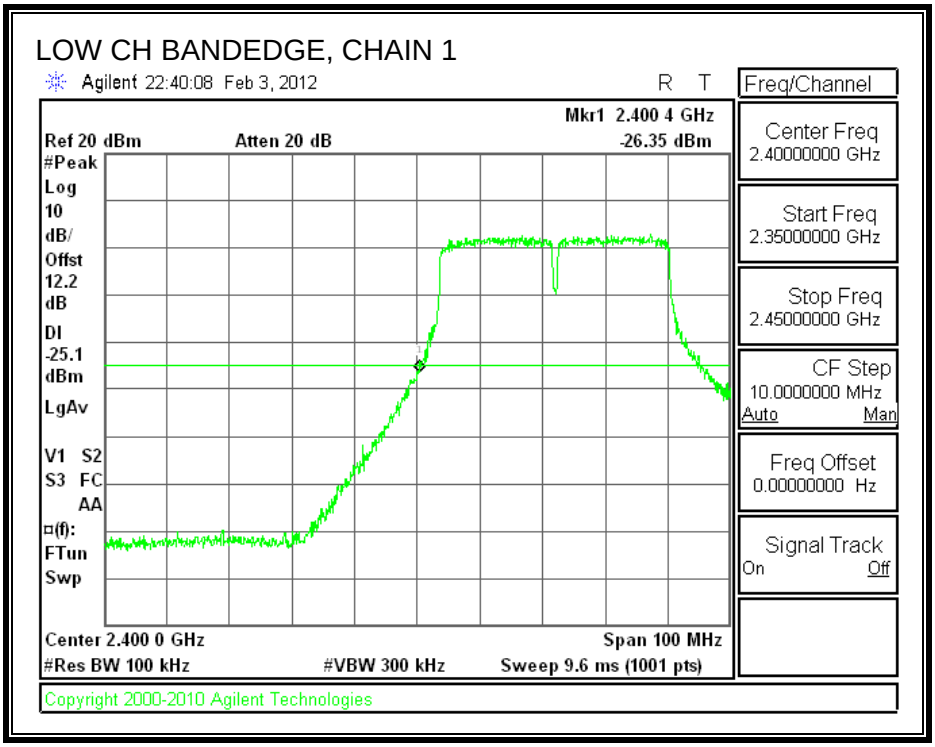
TEST PROCEDURE

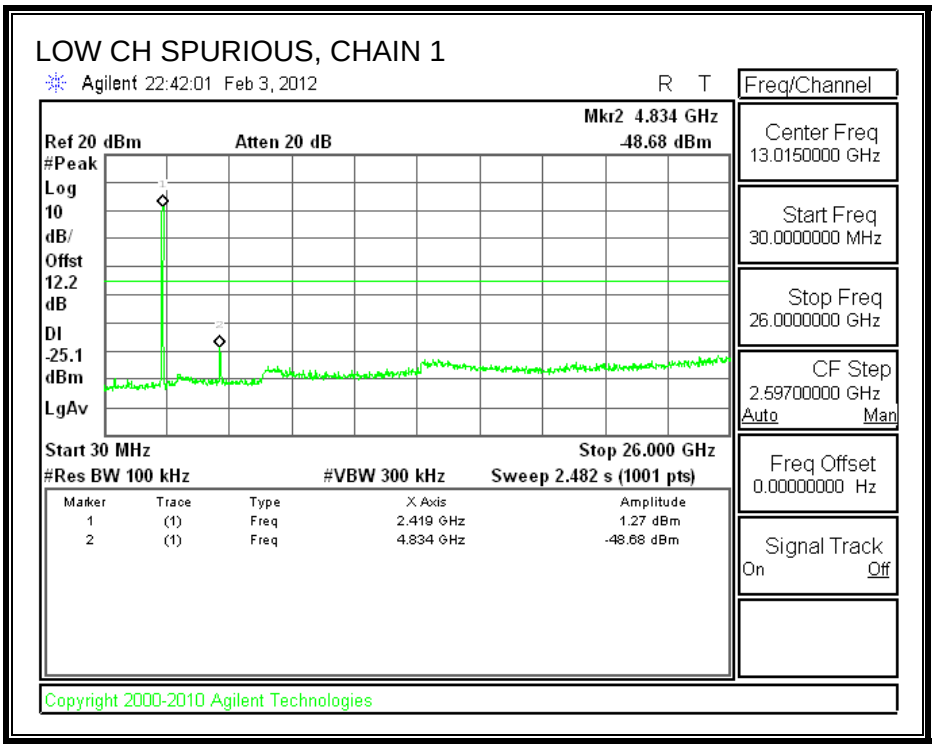
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

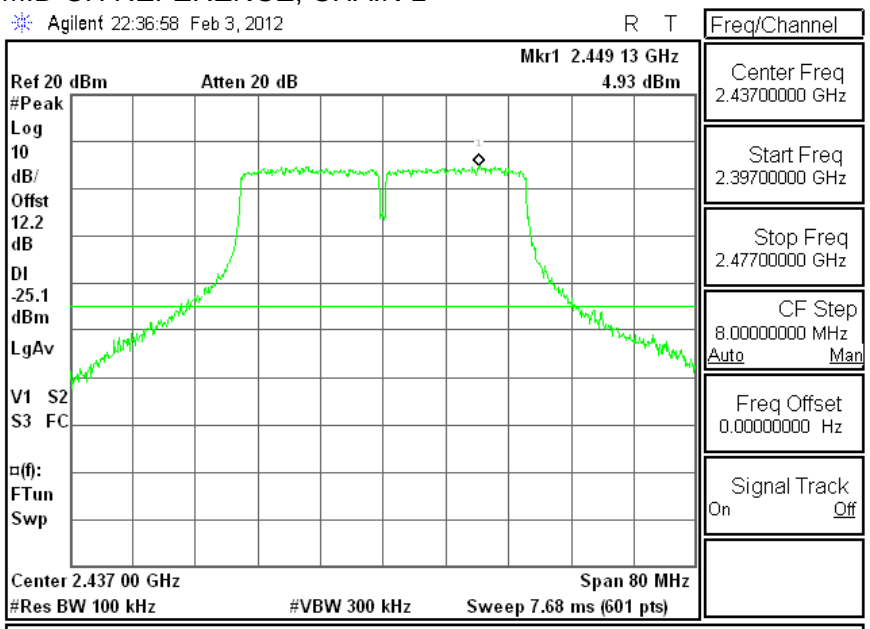
RESULTS

CHAIN 1 SPURIOUS EMISSIONS

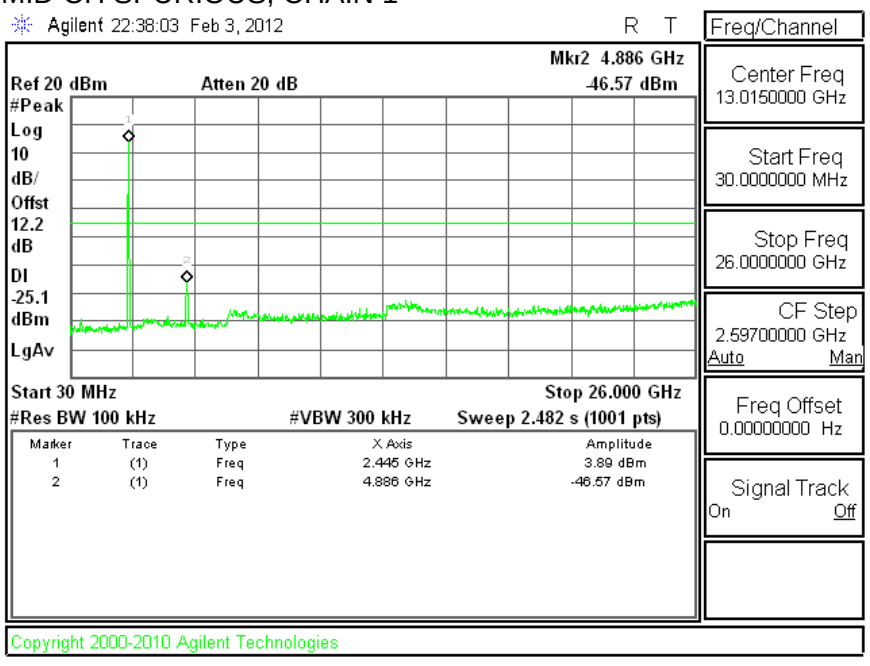




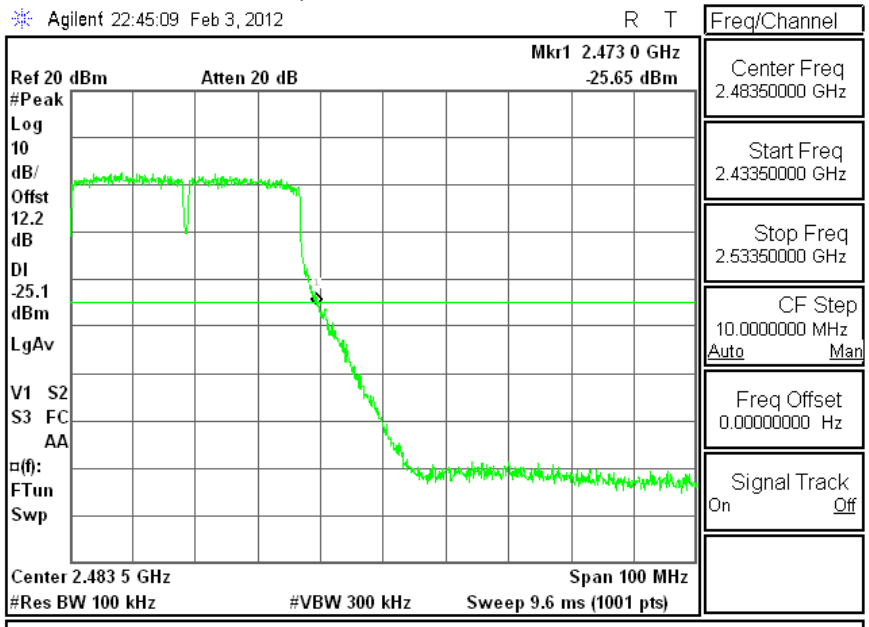
MID CH REFERENCE, CHAIN 1



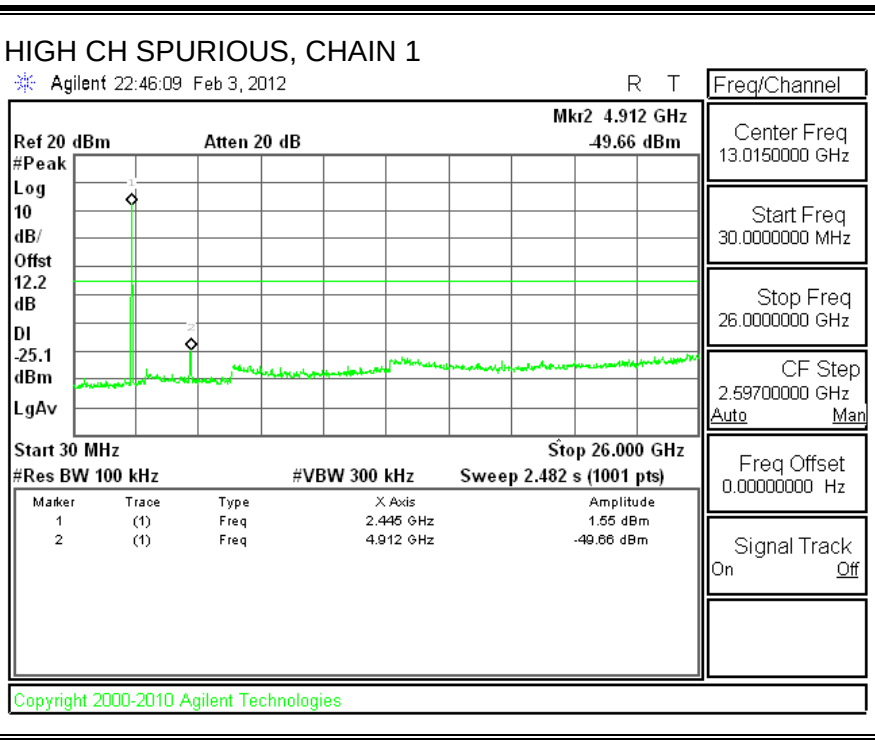
MID CH SPURIOUS, CHAIN 1



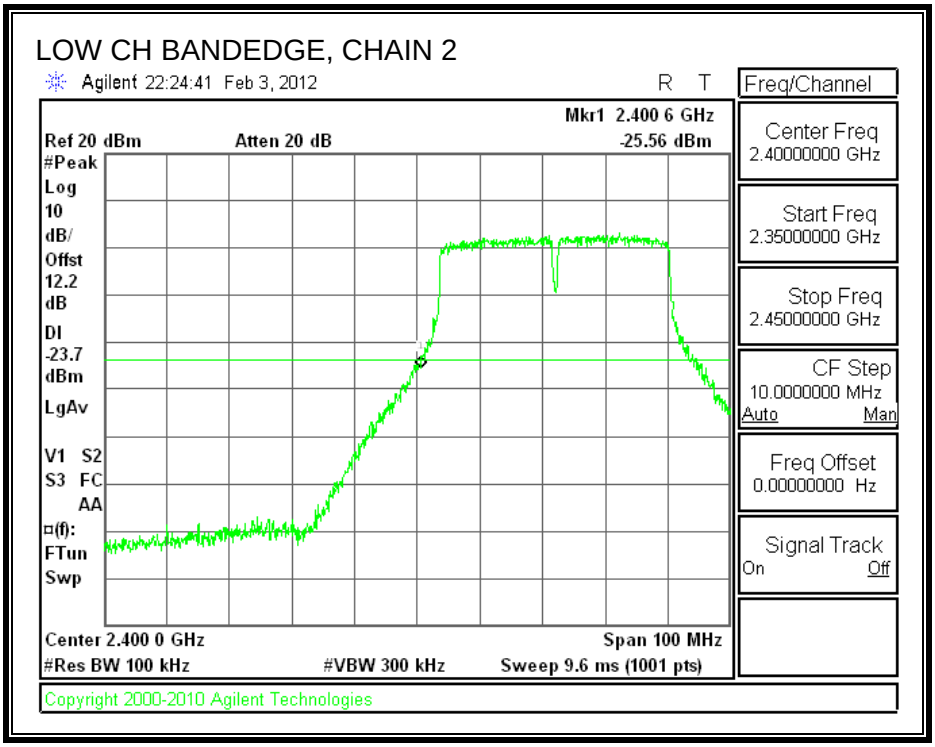
HIGH CH BANDEDGE, CHAIN 1

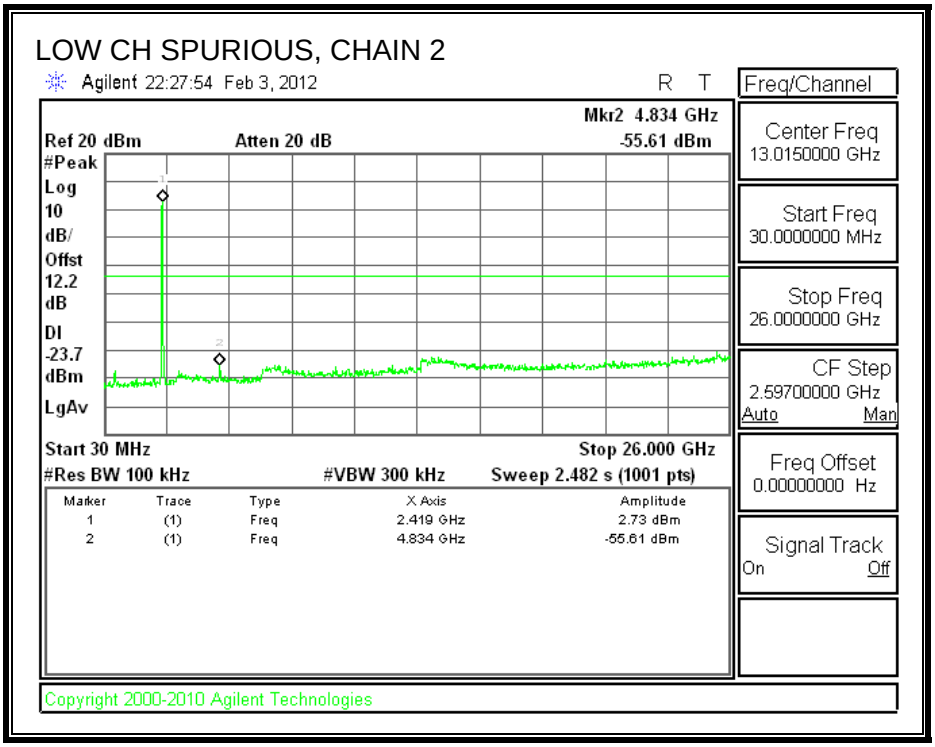


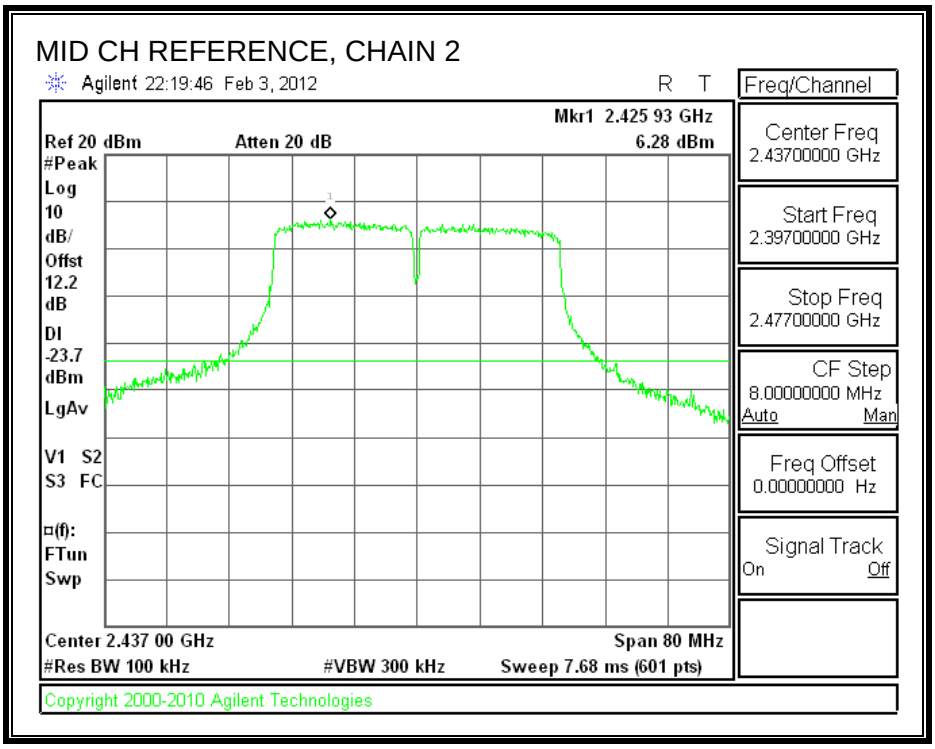
HIGH CH SPURIOUS, CHAIN 1

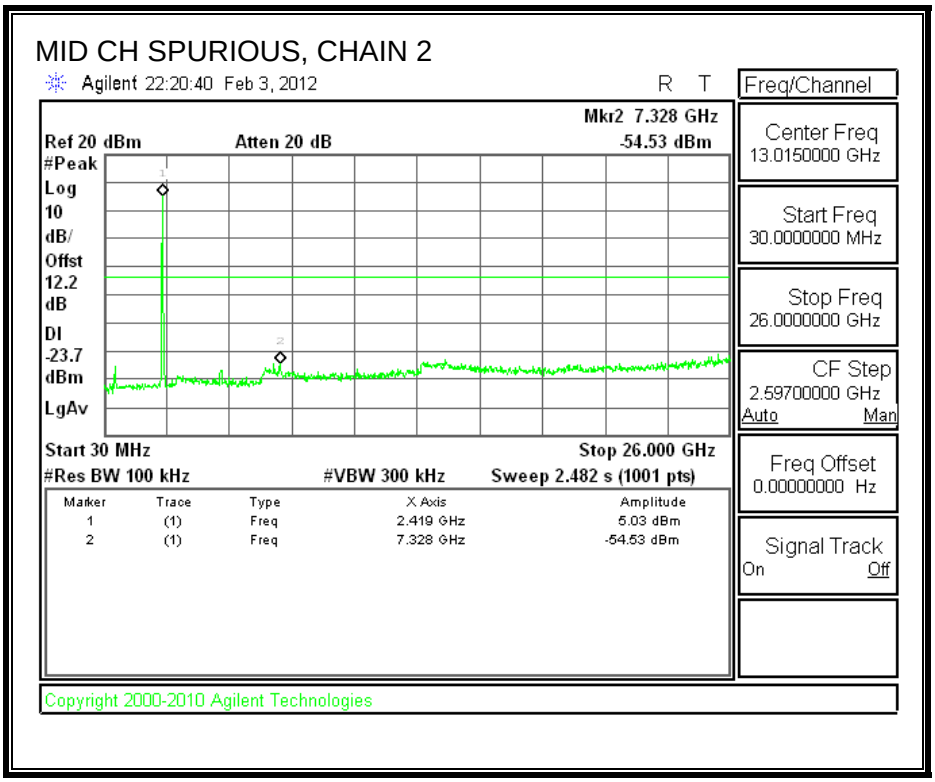


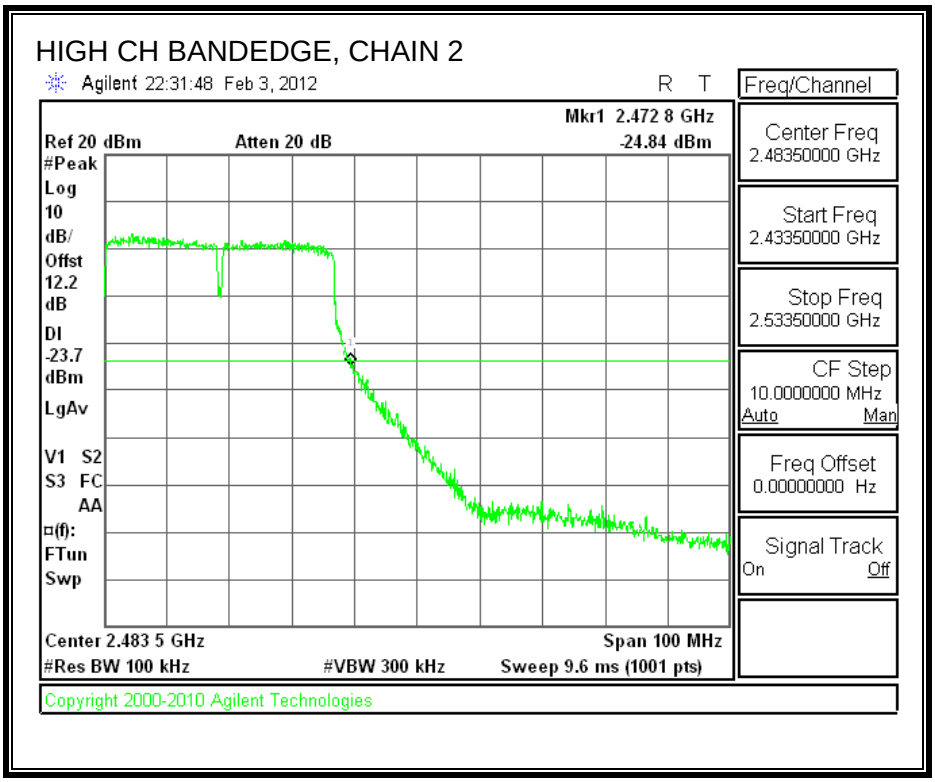
CHAIN 2 SPURIOUS EMISSIONS

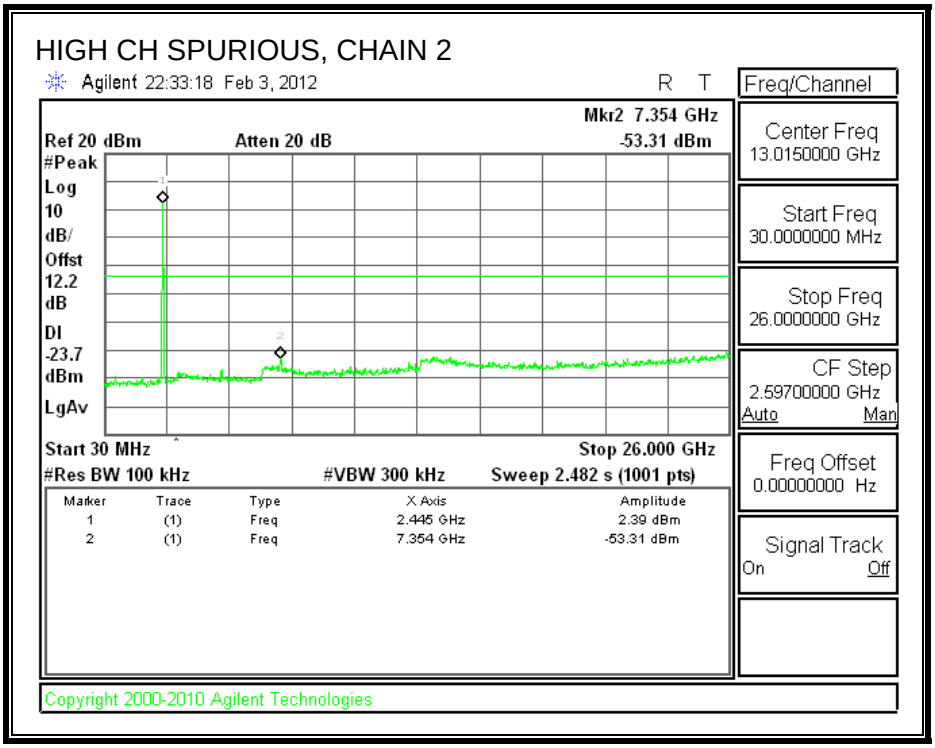












8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

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

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

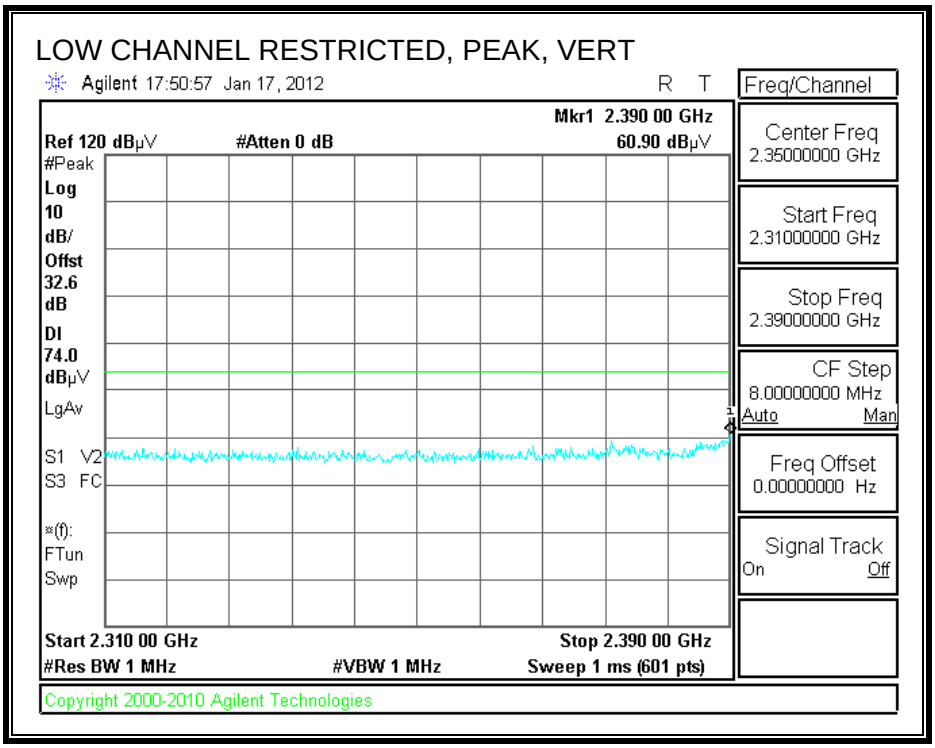
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

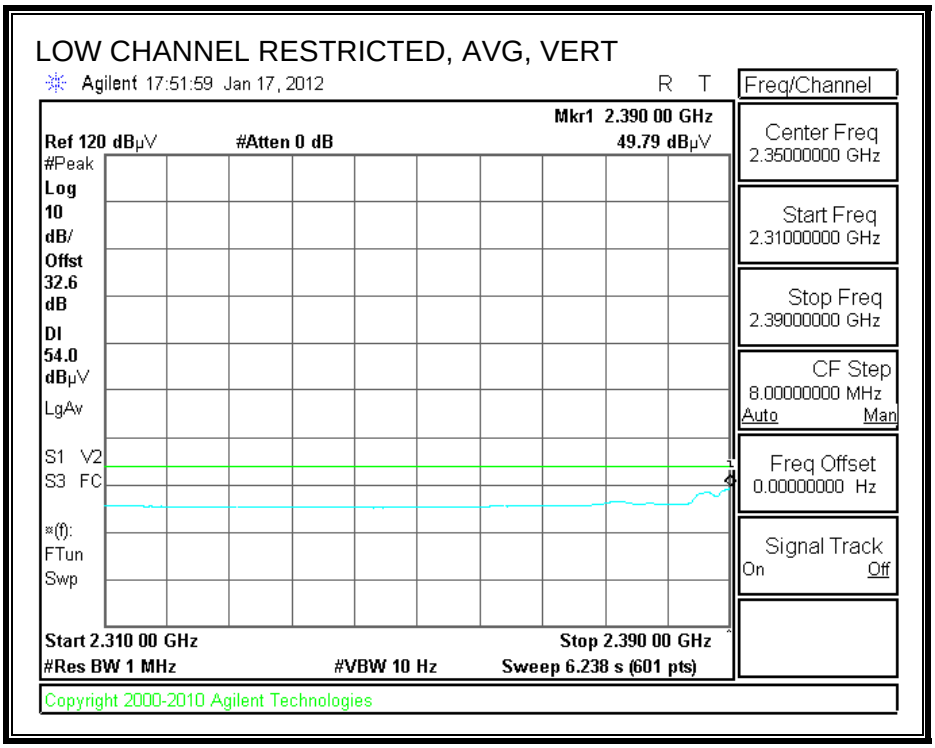
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

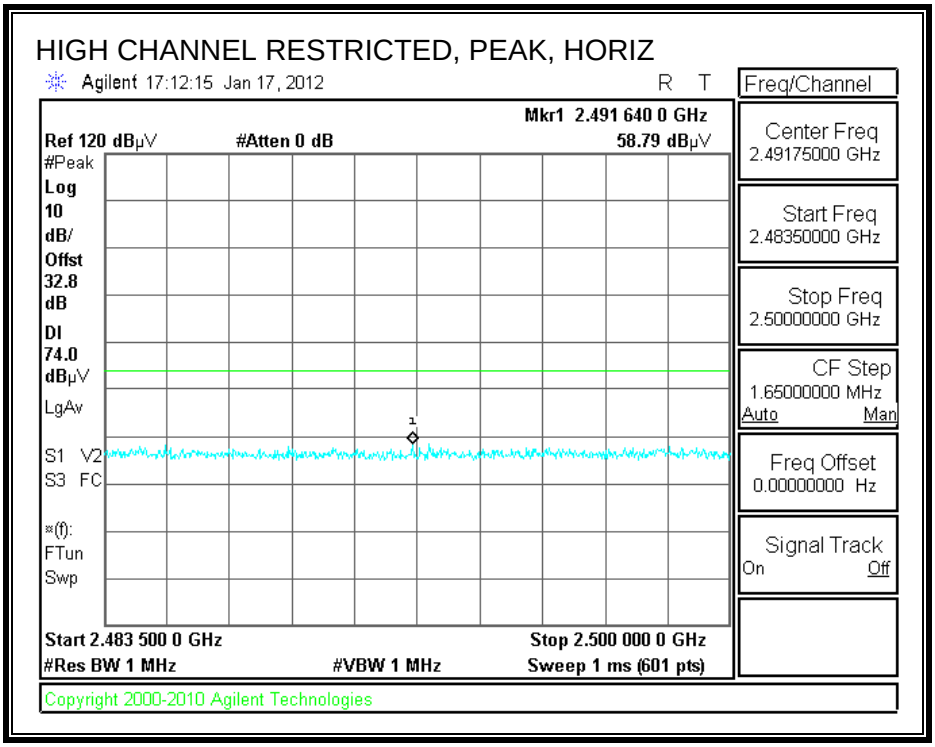
8.2.1. TX ABOVE 1 GHz, 802.11b LEGACY 2TX MODE IN THE 2.4 GHz BAND

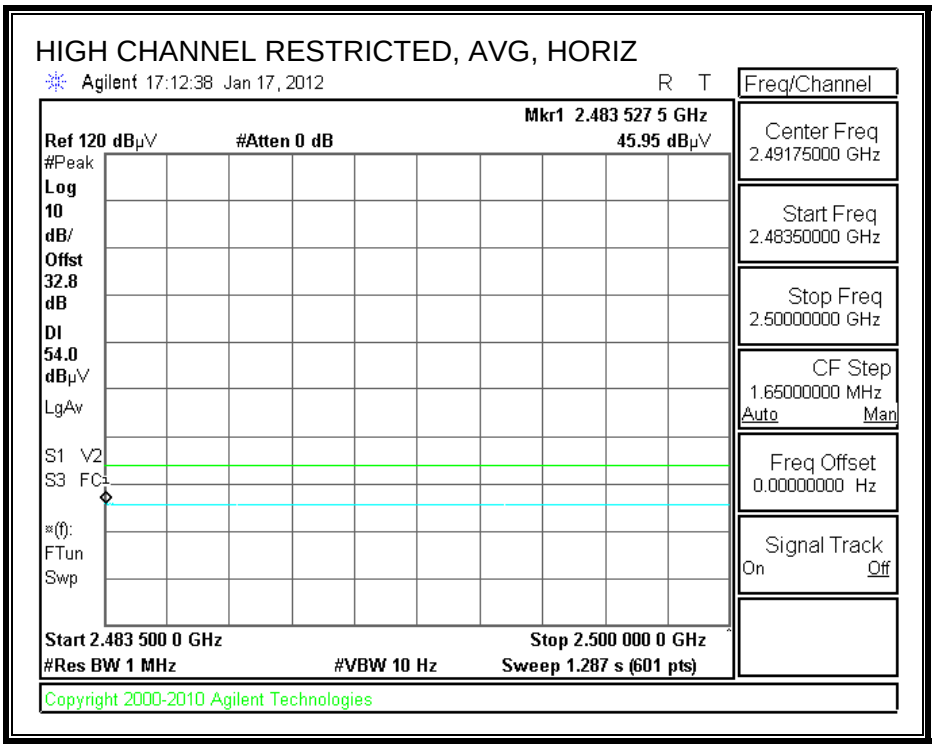
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL) N/A



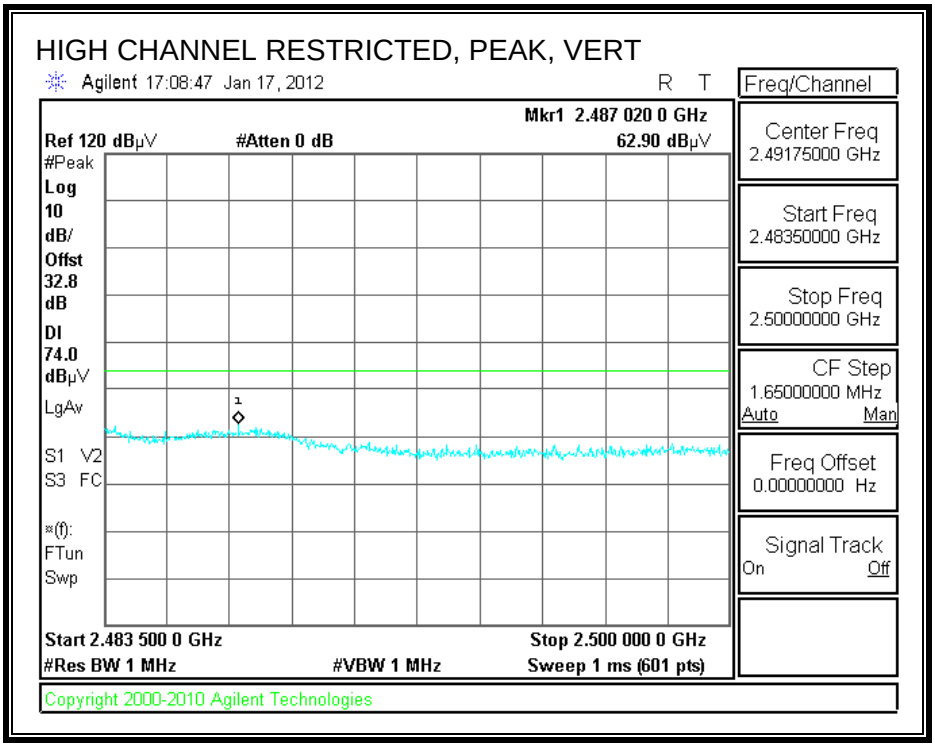


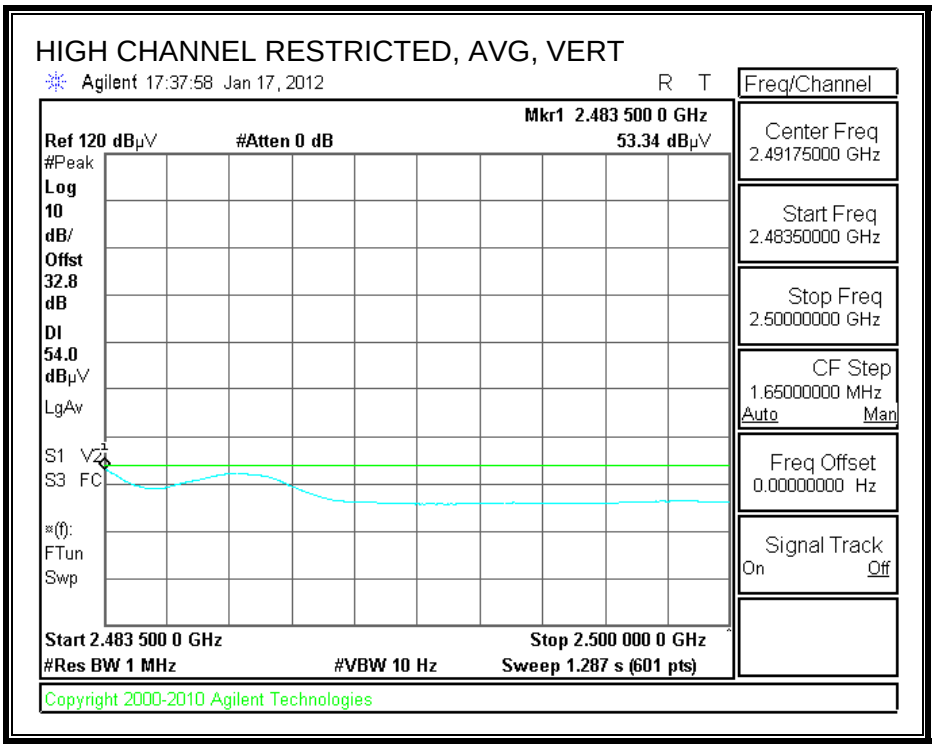
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Thanh Nguyen
Date: 01/17/12
Project #: 12U14226
Company: Tropos Networks
Test Target: FCC 15.247
Mode Oper: Continuously transmit b mode

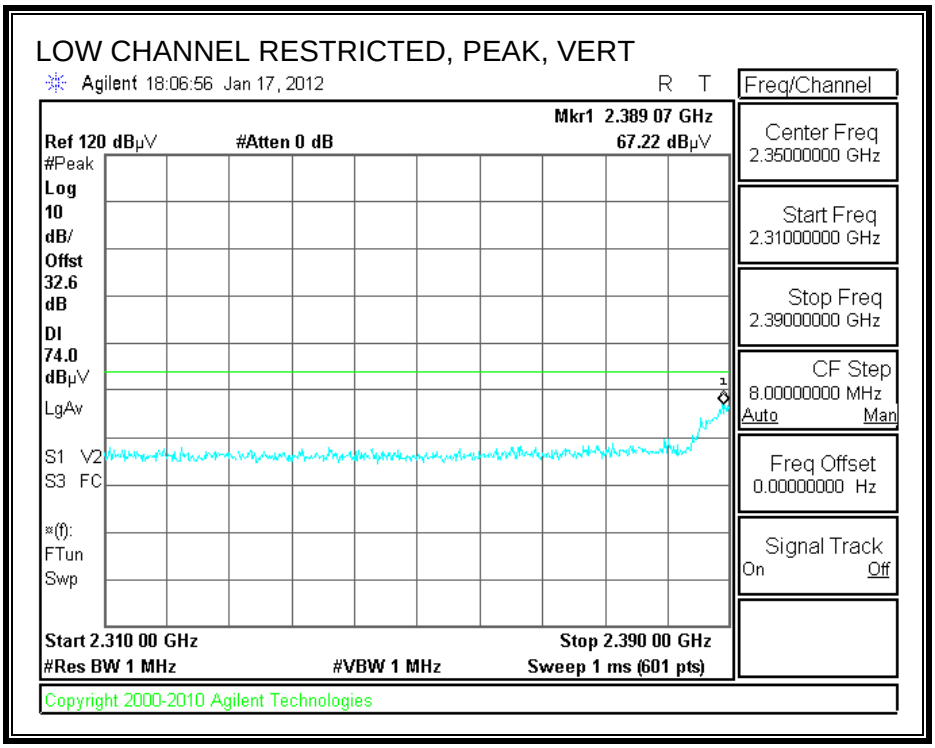
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

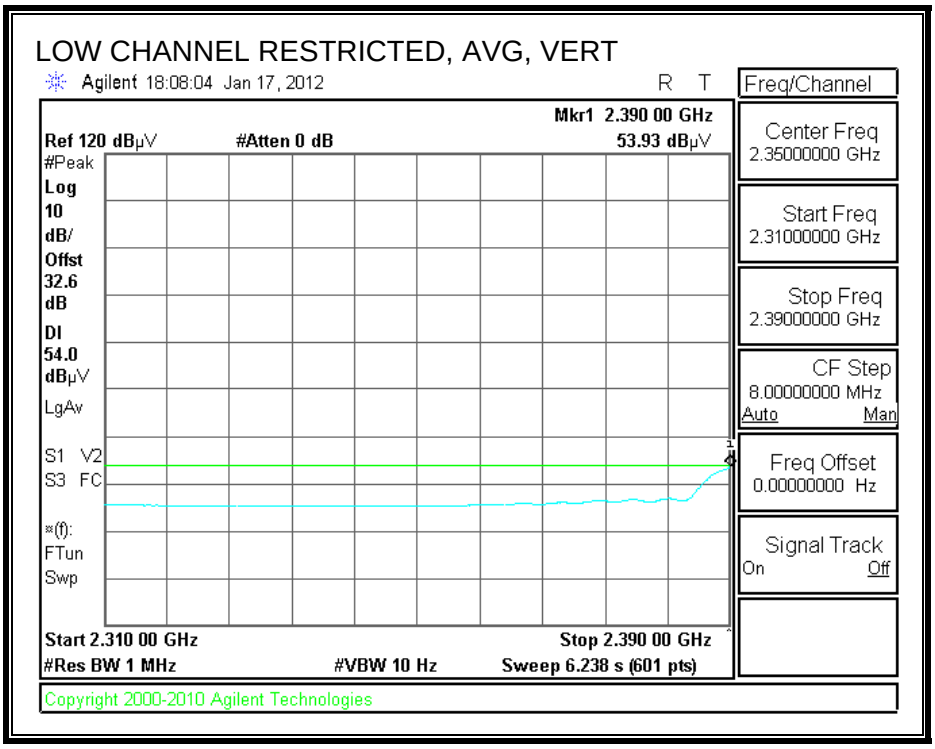
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
Low Channel															
4.824	3.0	50.3	33.1	6.8	-34.8	0.0	0.0	55.4	74.0	-18.6	V	P	100.0	111.0	
4.824	3.0	48.8	33.1	6.8	-34.8	0.0	0.0	53.8	54.0	-0.2	V	A	100.0	111.0	
7.236	3.0	38.1	36.2	9.1	-34.1	0.0	0.0	49.3	74.0	-24.7	V	P	100.0	145.0	
7.236	3.0	29.5	36.2	9.1	-34.1	0.0	0.0	40.6	54.0	-13.4	V	A	100.0	145.0	
9.648	3.0	35.5	38.3	9.1	-33.6	0.0	0.0	49.3	74.0	-24.7	V	P	99.0	142.0	
9.648	3.0	25.2	38.3	9.1	-33.6	0.0	0.0	39.0	54.0	-15.0	V	A	99.0	142.0	
4.824	3.0	42.0	33.1	6.8	-34.8	0.0	0.0	47.0	74.0	-27.0	H	P	98.0	289.0	
4.824	3.0	37.3	33.1	6.8	-34.8	0.0	0.0	42.4	54.0	-11.6	H	A	98.0	289.0	
7.236	3.0	36.2	36.2	9.1	-34.1	0.0	0.0	47.4	74.0	-26.6	H	P	193.0	305.0	
7.236	3.0	23.9	36.2	9.1	-34.1	0.0	0.0	35.1	54.0	-18.9	H	A	193.0	305.0	
4.874	3.0	43.2	33.2	6.8	-34.8	0.0	0.0	48.3	74.0	-25.7	V	P	98.0	91.0	
4.874	3.0	40.0	33.2	6.8	-34.8	0.0	0.0	45.2	54.0	-8.8	V	A	98.0	91.0	
Mid Ch															
4.874	3.0	43.6	33.2	6.8	-34.8	0.0	0.0	48.8	74.0	-25.2	V	P	98.0	93.0	
4.874	3.0	40.1	33.2	6.8	-34.8	0.0	0.0	45.2	54.0	-8.8	V	A	98.0	93.0	
7.311	3.0	35.7	36.3	9.1	-34.1	0.0	0.0	47.0	74.0	-27.0	V	P	189.0	228.0	
7.311	3.0	23.7	36.3	9.1	-34.1	0.0	0.0	35.0	54.0	-19.0	V	A	189.0	228.0	
4.874	3.0	44.5	33.2	6.8	-34.8	0.0	0.0	49.6	74.0	-24.4	H	P	98.0	282.0	
4.874	3.0	41.2	33.2	6.8	-34.8	0.0	0.0	46.3	54.0	-7.7	H	A	98.0	282.0	
7.311	3.0	35.4	36.3	9.1	-34.1	0.0	0.0	46.7	74.0	-27.3	H	P	98.0	282.0	
7.311	3.0	23.5	36.3	9.1	-34.1	0.0	0.0	34.8	54.0	-19.2	H	A	98.0	282.0	
High channel															
4.924	3.0	45.0	33.5	5.9	-36.5	0.0	0.0	48.0	74.0	-26.0	V	P	100.8	309.3	
4.924	3.0	42.4	33.5	5.9	-36.5	0.0	0.0	45.3	54.0	-8.7	V	A	100.8	309.3	
7.386	3.0	39.6	35.8	7.3	-36.2	0.0	0.0	46.5	74.0	-27.5	V	P	199.6	169.1	
7.386	3.0	32.3	35.8	7.3	-36.2	0.0	0.0	39.2	54.0	-14.8	V	A	199.6	169.1	
9.848	3.0	38.6	38.1	8.7	-37.0	0.0	0.0	48.3	74.0	-25.7	V	P	100.4	9.5	
9.848	3.0	33.4	38.1	8.7	-37.0	0.0	0.0	43.1	54.0	-10.9	V	A	100.4	9.5	
12.310	3.0	33.7	39.3	9.9	-35.4	0.0	0.0	47.5	74.0	-26.5	V	P	100.4	9.5	Noise floor
12.310	3.0	21.6	39.3	9.9	-35.4	0.0	0.0	35.4	54.0	-18.6	V	A	100.4	9.5	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

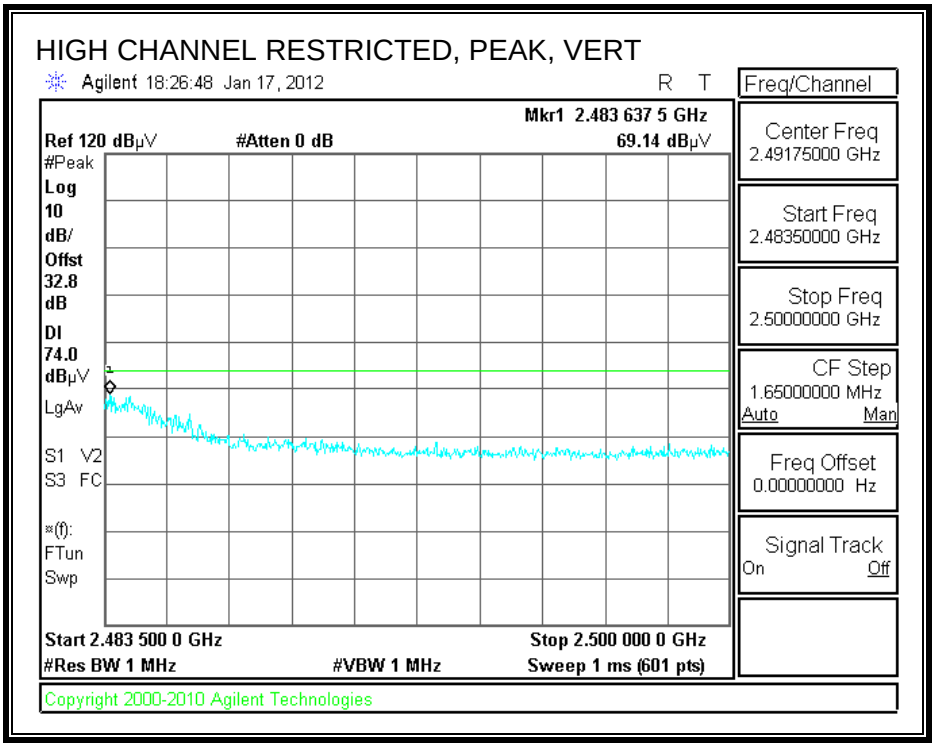
8.2.2. TX ABOVE 1 GHz, 802.11g LEGACY 2TX MODE IN THE 2.4 GHz BAND

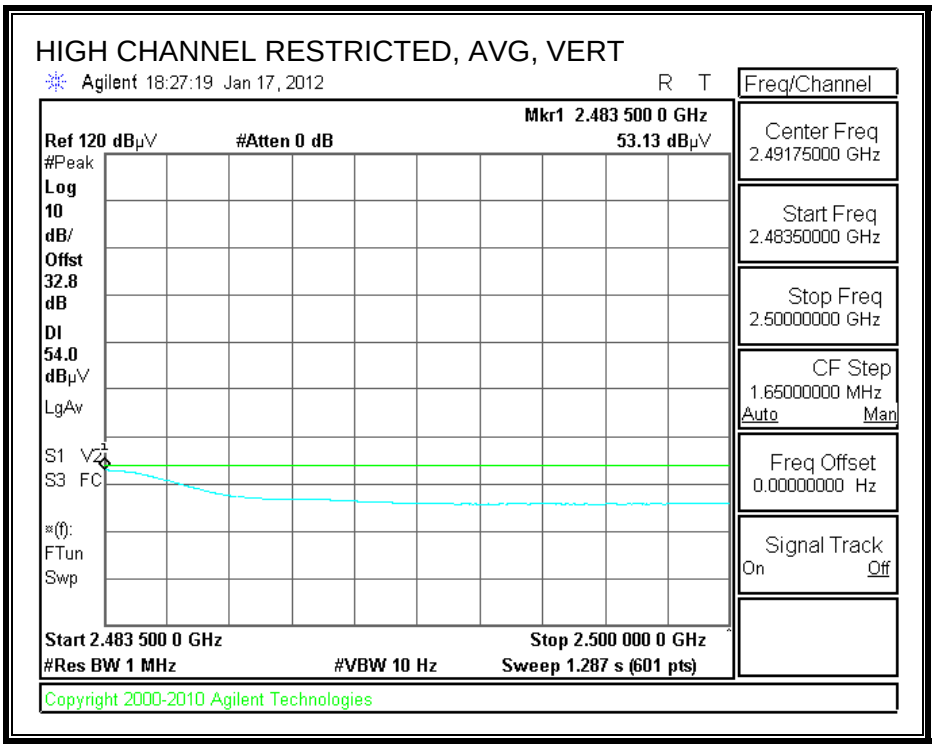
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Thanh Nguyen
Date: 01/17/12
Project #: 12U14226
Company: Tropos Networks
Test Target: FCC 15.247
Mode Oper: Continuously transmit g mode

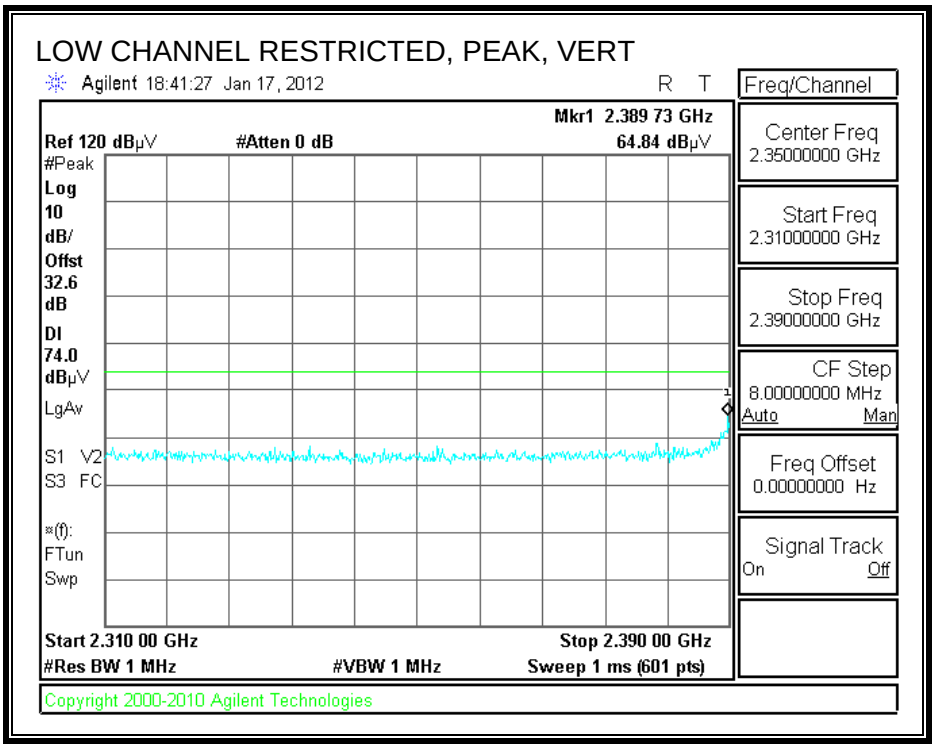
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

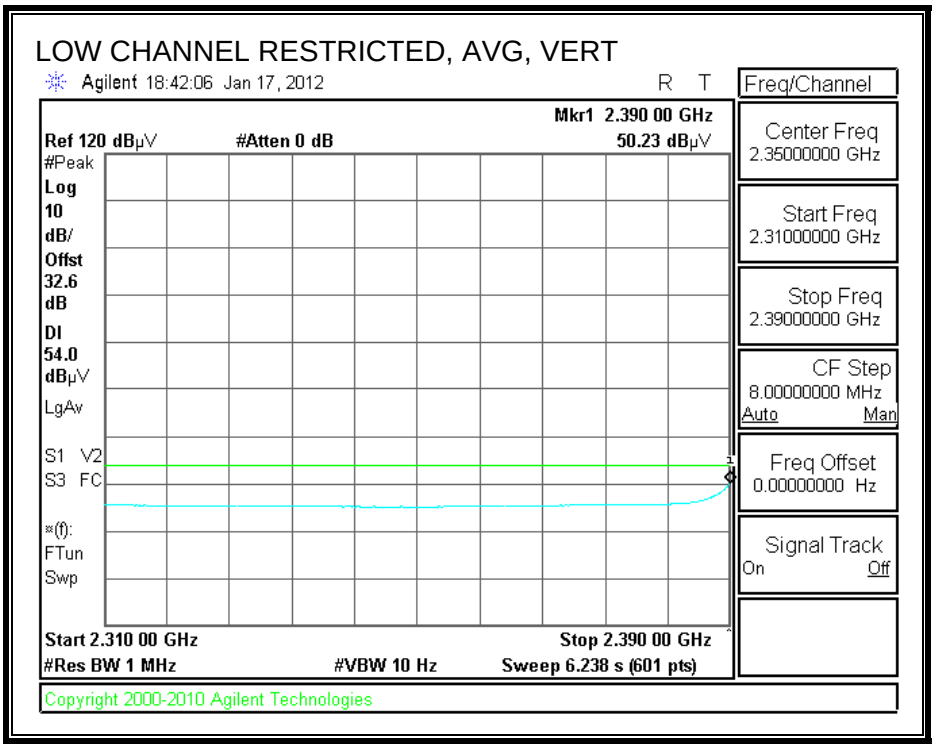
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
Low Channel															
4.824	3.0	52.3	33.4	5.8	-36.5	0.0	0.0	55.0	74.0	-19.0	V	P	103.9	172.8	
4.824	3.0	37.8	33.4	5.8	-36.5	0.0	0.0	40.6	54.0	-13.4	V	A	103.9	172.8	
7.236	3.0	41.4	35.6	7.2	-36.2	0.0	0.0	48.0	74.0	-26.0	V	P	108.9	196.9	
7.236	3.0	28.6	35.6	7.2	-36.2	0.0	0.0	35.2	54.0	-18.8	V	A	108.9	196.9	
9.648	3.0	39.0	38.0	8.5	-37.0	0.0	0.0	48.6	74.0	-25.4	V	P	101.3	230.2	Noise floor
9.648	3.0	26.4	38.0	8.5	-37.0	0.0	0.0	36.0	54.0	-18.0	V	A	101.3	230.2	Noise floor
4.824	3.0	45.6	33.4	5.8	-36.5	0.0	0.0	48.4	74.0	-25.6	H	P	100.3	255.6	
4.824	3.0	32.3	33.4	5.8	-36.5	0.0	0.0	35.1	54.0	-18.9	H	A	100.3	255.6	
7.236	3.0	36.6	35.6	7.2	-36.2	0.0	0.0	43.2	74.0	-30.8	H	P	100.3	255.6	Noise floor
7.236	3.0	24.1	35.6	7.2	-36.2	0.0	0.0	30.7	54.0	-23.3	H	A	100.3	255.6	Noise floor
Mid channel															
4.874	3.0	44.8	33.5	5.8	-36.5	0.0	0.0	47.7	74.0	-26.3	V	P	101.4	147.9	
4.874	3.0	30.6	33.5	5.8	-36.5	0.0	0.0	33.5	54.0	-20.6	V	A	101.4	147.9	
7.311	3.0	39.0	35.7	7.3	-36.2	0.0	0.0	45.7	74.0	-28.3	V	P	165.3	194.6	
7.311	3.0	26.8	35.7	7.3	-36.2	0.0	0.0	33.6	54.0	-20.4	V	A	165.3	194.6	
9.748	3.0	34.9	38.0	8.6	-37.0	0.0	0.0	44.5	74.0	-29.5	V	P	165.3	194.6	Noise floor
9.748	3.0	23.1	38.0	8.6	-37.0	0.0	0.0	32.7	54.0	-21.3	V	A	165.3	194.6	Noise floor
4.874	3.0	40.7	33.5	5.8	-36.5	0.0	0.0	43.5	74.0	-30.5	H	P	115.4	231.3	
4.874	3.0	28.9	33.5	5.8	-36.5	0.0	0.0	31.7	54.0	-22.3	H	A	115.4	231.3	
7.311	3.0	36.0	35.7	7.3	-36.2	0.0	0.0	42.8	74.0	-31.2	H	P	118.0	250.3	Noise floor
7.311	3.0	24.2	35.7	7.3	-36.2	0.0	0.0	30.9	54.0	-23.1	H	A	118.0	250.3	Noise floor
High channel															
4.924	3.0	43.4	33.5	5.9	-36.5	0.0	0.0	46.4	74.0	-27.6	V	P	103.3	303.8	
4.924	3.0	30.2	33.5	5.9	-36.5	0.0	0.0	33.2	54.0	-20.8	V	A	103.3	303.8	
7.386	3.0	41.3	35.8	7.3	-36.2	0.0	0.0	48.2	74.0	-25.8	V	P	187.2	152.3	
7.386	3.0	29.1	35.8	7.3	-36.2	0.0	0.0	36.0	54.0	-18.0	V	A	187.2	152.3	
9.848	3.0	36.8	38.1	8.7	-37.0	0.0	0.0	46.4	74.0	-27.6	V	P	100.6	18.1	
9.848	3.0	24.1	38.1	8.7	-37.0	0.0	0.0	33.7	54.0	-20.3	V	A	100.6	18.1	
4.924	3.0	42.0	33.5	5.9	-36.5	0.0	0.0	45.0	74.0	-29.0	H	P	100.4	235.2	
4.924	3.0	29.3	33.5	5.9	-36.5	0.0	0.0	32.2	54.0	-21.8	H	A	100.4	235.2	
7.386	3.0	37.1	35.8	7.3	-36.2	0.0	0.0	44.1	74.0	-29.9	H	P	100.7	11.3	Noise floor
7.386	3.0	25.0	35.8	7.3	-36.2	0.0	0.0	31.9	54.0	-22.1	H	A	100.7	11.3	Noise floor

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

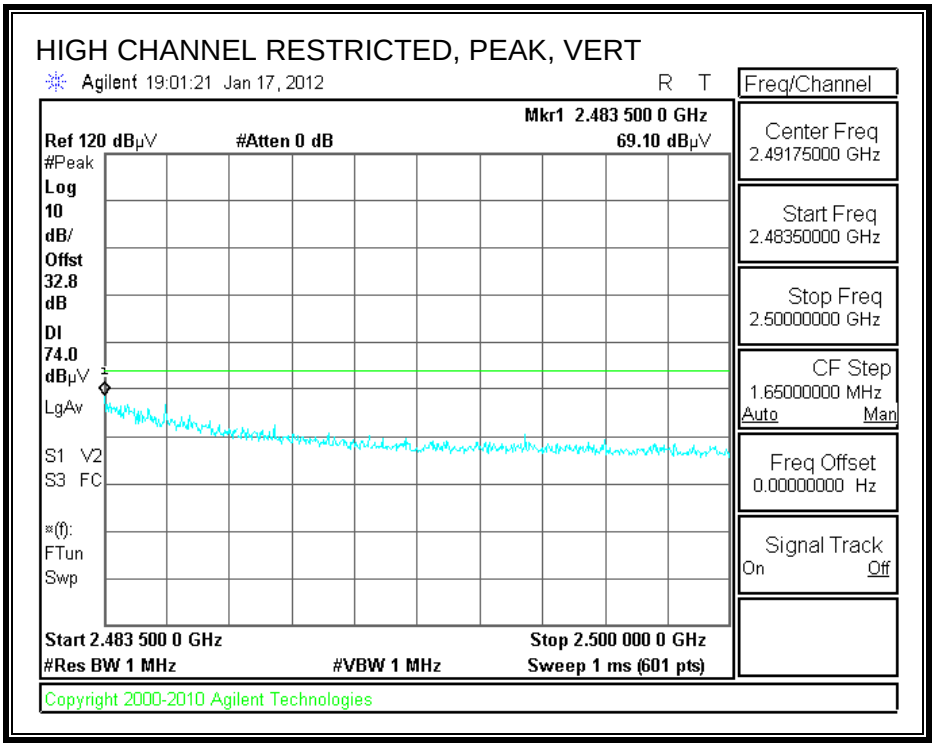
8.2.3. TX ABOVE 1 GHz, 802.11n HT20 2TX MODE IN THE 2.4 GHz BAND

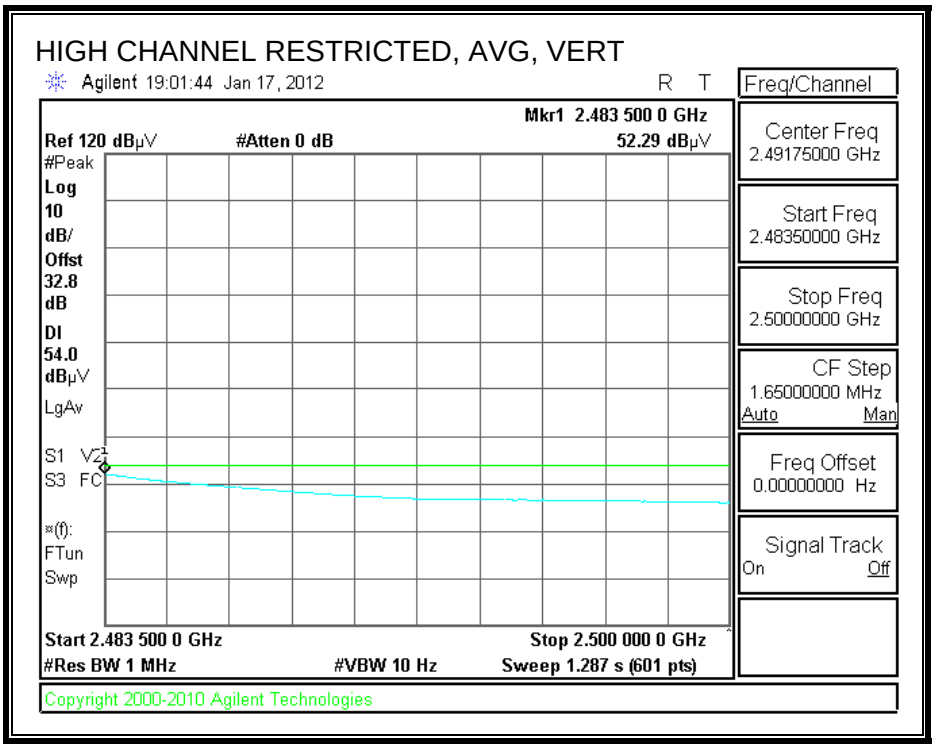
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Thanh Nguyen
Date: 01/17/12
Project #: 12U14226
Company: Tropos Networks
Test Target: FCC 15.247
Mode Oper: Continuously transmit HT20 mode

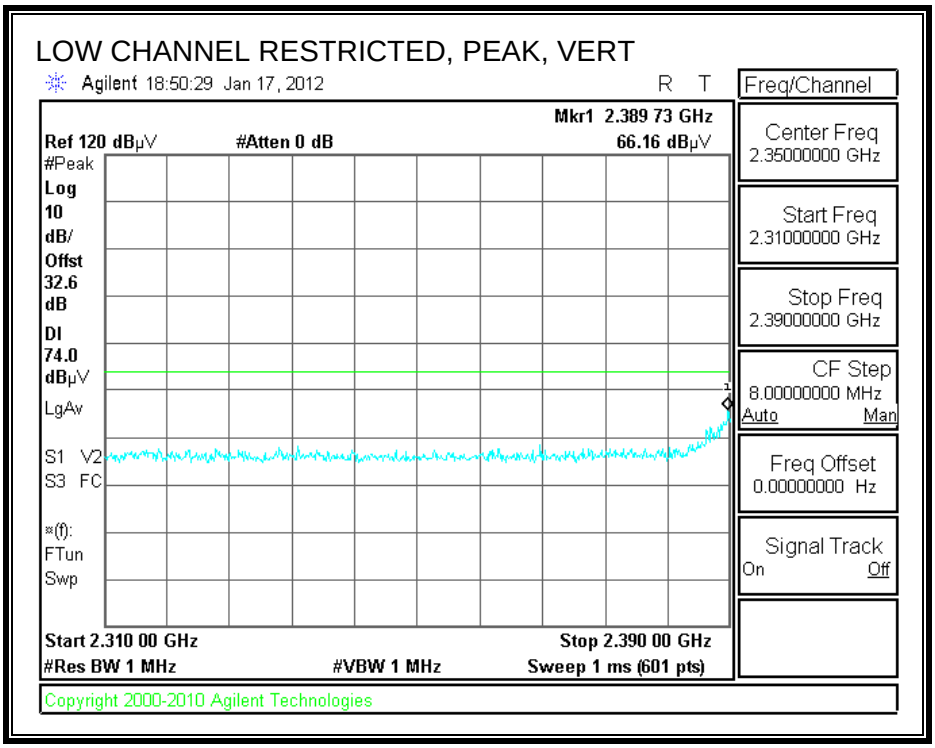
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

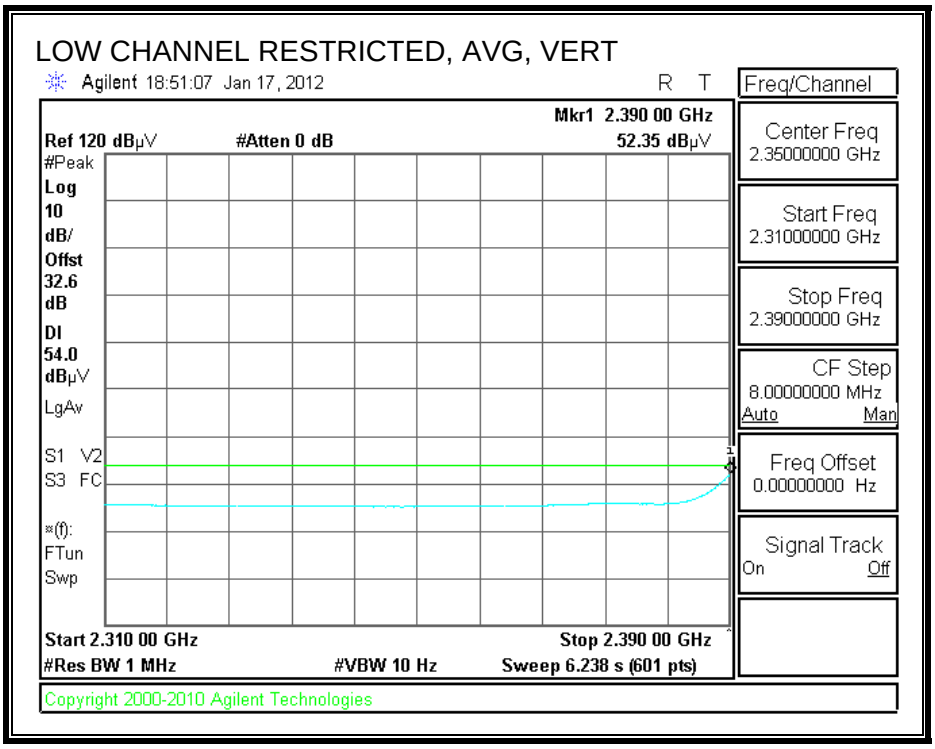
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
Low Channel															
4.824	3.0	53.8	33.4	5.8	-36.5	0.0	0.0	56.6	74.0	-17.4	V	P	103.0	178.2	
4.824	3.0	39.4	33.4	5.8	-36.5	0.0	0.0	42.2	54.0	-11.8	V	A	103.0	178.2	
7.236	3.0	40.5	35.6	7.2	-36.2	0.0	0.0	47.1	74.0	-26.9	V	P	112.4	163.5	Noise floor
7.236	3.0	27.8	35.6	7.2	-36.2	0.0	0.0	34.4	54.0	-19.6	V	A	112.4	163.5	Noise floor
4.824	3.0	46.0	33.4	5.8	-36.5	0.0	0.0	48.8	74.0	-25.2	H	P	100.0	61.2	
4.824	3.0	31.8	33.4	5.8	-36.5	0.0	0.0	34.6	54.0	-19.4	H	A	100.0	61.2	
7.236	3.0	36.4	35.6	7.2	-36.2	0.0	0.0	43.0	74.0	-31.0	H	P	165.3	187.2	Noise floor
7.236	3.0	24.4	35.6	7.2	-36.2	0.0	0.0	30.9	54.0	-23.1	H	A	165.3	187.2	Noise floor
Mid Channel															
4.874	3.0	45.6	33.5	5.8	-36.5	0.0	0.0	48.4	74.0	-25.6	V	P	101.4	165.0	
4.874	3.0	30.9	33.5	5.8	-36.5	0.0	0.0	33.7	54.0	-20.3	V	A	101.4	165.0	
7.311	3.0	39.2	35.7	7.3	-36.2	0.0	0.0	45.9	74.0	-28.1	V	P	180.2	157.2	Noise floor
7.311	3.0	26.0	35.7	7.3	-36.2	0.0	0.0	32.7	54.0	-21.3	V	A	180.2	157.2	Noise floor
4.874	3.0	41.8	33.5	5.8	-36.5	0.0	0.0	44.7	74.0	-29.3	H	P	100.0	227.2	
4.874	3.0	28.8	33.5	5.8	-36.5	0.0	0.0	31.7	54.0	-22.3	H	A	100.0	227.2	
7.311	3.0	36.5	35.7	7.3	-36.2	0.0	0.0	43.3	74.0	-30.7	H	P	124.2	268.1	Noise floor
7.311	3.0	24.2	35.7	7.3	-36.2	0.0	0.0	30.9	54.0	-23.1	H	A	124.2	268.1	Noise floor
High Channel															
4.924	3.0	49.0	33.5	5.9	-36.5	0.0	0.0	52.0	74.0	-22.0	V	P	100.4	305.4	
4.924	3.0	35.4	33.5	5.9	-36.5	0.0	0.0	38.4	54.0	-15.6	V	A	100.4	305.4	
7.386	3.0	44.5	35.8	7.3	-36.2	0.0	0.0	51.4	74.0	-22.6	V	P	142.4	166.7	
7.386	3.0	31.7	35.8	7.3	-36.2	0.0	0.0	38.7	54.0	-15.3	V	A	142.4	166.7	
9.848	3.0	35.2	38.1	8.7	-37.0	0.0	0.0	44.9	74.0	-29.1	V	P	142.4	166.7	Noise floor
9.848	3.0	23.3	38.1	8.7	-37.0	0.0	0.0	32.9	54.0	-21.1	V	A	142.4	166.7	Noise floor
4.924	3.0	45.9	33.5	5.9	-36.5	0.0	0.0	48.9	74.0	-25.1	H	P	100.0	234.9	
4.924	3.0	31.8	33.5	5.9	-36.5	0.0	0.0	34.7	54.0	-19.3	H	A	100.0	234.9	
7.386	3.0	38.0	35.8	7.3	-36.2	0.0	0.0	44.9	74.0	-29.1	H	P	100.0	234.9	Noise floor
7.386	3.0	25.0	35.8	7.3	-36.2	0.0	0.0	32.0	54.0	-22.0	H	A	100.0	234.9	Noise floor

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

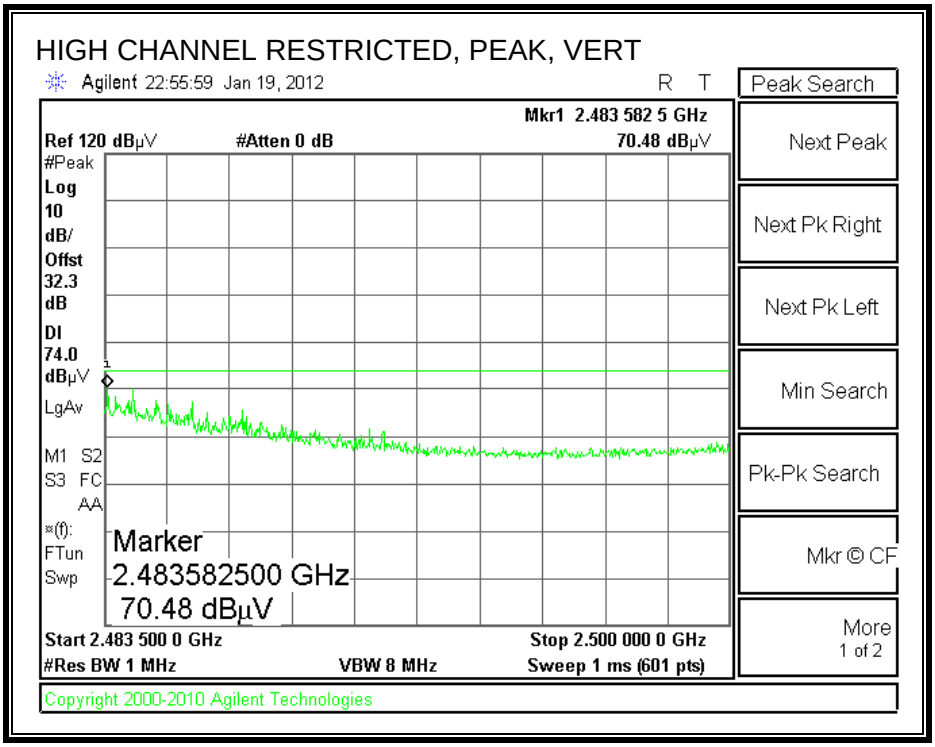
8.2.4. TX ABOVE 1 GHz, 802.11n HT40 2TX MODE IN THE 2.4 GHz BAND

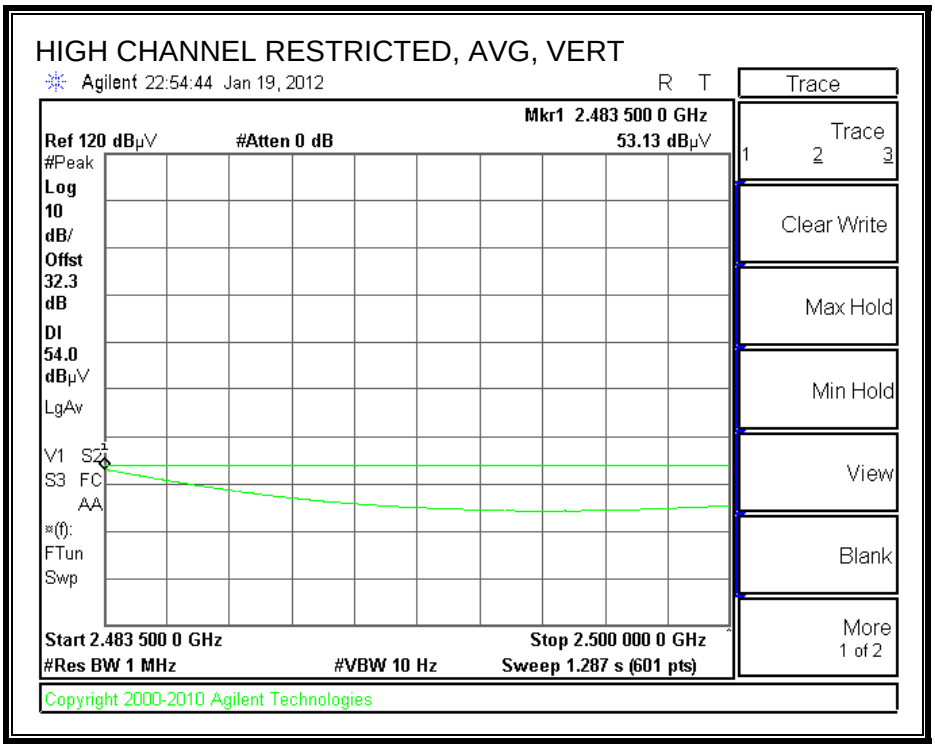
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Thanh Nguyen
Date: 01/17/12
Project #: 12U14226
Company: Tropos Networks
Test Target: FCC 15.247
Mode Oper: Continuously transmit HT40 mode

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
Low Channel															
4.844	3.0	50.8	33.5	5.8	-36.5	0.0	0.0	53.6	74.0	-20.4	V	P	101.1	173.5	
4.844	3.0	37.9	33.5	5.8	-36.5	0.0	0.0	40.7	54.0	-13.3	V	A	101.1	173.5	
7.266	3.0	40.1	35.6	7.2	-36.2	0.0	0.0	46.7	74.0	-27.3	V	P	103.3	161.9	
7.266	3.0	27.4	35.6	7.2	-36.2	0.0	0.0	34.0	54.0	-20.0	V	A	103.3	161.9	
4.844	3.0	41.5	33.5	5.8	-36.5	0.0	0.0	44.3	74.0	-29.7	H	P	103.3	77.3	
4.844	3.0	28.9	33.5	5.8	-36.5	0.0	0.0	31.7	54.0	-22.3	H	A	103.3	77.3	
7.266	3.0	36.1	35.6	7.2	-36.2	0.0	0.0	42.7	74.0	-31.3	H	P	103.3	77.3	
7.266	3.0	24.0	35.6	7.2	-36.2	0.0	0.0	30.6	54.0	-23.4	H	A	103.3	77.3	
Mid Channel															
4.874	3.0	49.6	33.5	5.8	-36.5	0.0	0.0	52.5	74.0	-21.5	V	P	104.8	239.8	
4.874	3.0	36.9	33.5	5.8	-36.5	0.0	0.0	39.8	54.0	-14.2	V	A	104.8	239.8	
7.311	3.0	37.1	35.7	7.3	-36.2	0.0	0.0	43.8	74.0	-30.2	V	P	104.8	239.8	
7.311	3.0	25.1	35.7	7.3	-36.2	0.0	0.0	31.9	54.0	-22.1	V	A	104.8	239.8	
9.748	3.0	35.9	38.0	8.6	-37.0	0.0	0.0	45.5	74.0	-28.5	V	P	104.8	239.8	
9.748	3.0	23.5	38.0	8.6	-37.0	0.0	0.0	33.1	54.0	-20.9	V	A	104.8	239.8	
4.874	3.0	45.8	33.5	5.8	-36.5	0.0	0.0	48.7	74.0	-25.3	H	P	100.0	246.7	
4.874	3.0	34.1	33.5	5.8	-36.5	0.0	0.0	36.9	54.0	-17.1	H	A	100.0	246.7	
7.311	3.0	36.6	35.7	7.3	-36.2	0.0	0.0	43.4	74.0	-30.6	H	P	100.0	246.7	
7.311	3.0	24.5	35.7	7.3	-36.2	0.0	0.0	31.2	54.0	-22.8	H	A	100.0	246.7	
High Channel															
4.904	3.0	52.2	33.5	5.9	-36.5	0.0	0.0	55.1	74.0	-18.9	V	P	116.0	132.0	
4.904	3.0	39.8	33.5	5.9	-36.5	0.0	0.0	42.7	54.0	-11.3	V	A	116.0	132.0	
7.356	3.0	41.6	35.8	7.3	-36.2	0.0	0.0	48.4	74.0	-25.6	V	P	116.0	132.0	
7.356	3.0	28.9	35.8	7.3	-36.2	0.0	0.0	35.7	54.0	-18.3	V	A	116.0	132.0	
4.904	3.0	47.9	33.5	5.9	-36.5	0.0	0.0	50.8	74.0	-23.2	H	P	102.1	235.8	
4.904	3.0	34.6	33.5	5.9	-36.5	0.0	0.0	37.5	54.0	-16.5	H	A	102.1	235.8	
7.356	3.0	37.5	35.8	7.3	-36.2	0.0	0.0	44.4	74.0	-29.6	H	P	102.1	235.8	
7.356	3.0	25.7	35.8	7.3	-36.2	0.0	0.0	32.5	54.0	-21.5	H	A	102.1	235.8	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.3. RECEIVER ABOVE 1 GHz IN THE 2.4 GHz BAND

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber-A

Company: Tropos Networks
Project #: 11U14226
Date: 1/18/2012
Test Engineer: Thanh Nguyen
Configuration: EUT with the remote support Laptop
Mode: Receive

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T144 Miteq 3008A00931			RX RSS 210

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.200	3.0	53.8	35.0	24.6	3.0	-38.5	0.0	0.0	42.8	24.0	74	54	-31.2	-30.0	V
1.439	3.0	53.5	47.3	25.4	3.3	-38.2	0.0	0.0	43.9	37.8	74	54	-30.1	-16.2	V
1.677	3.0	51.7	44.1	26.3	3.5	-37.9	0.0	0.0	43.5	36.0	74	54	-30.5	-18.0	V

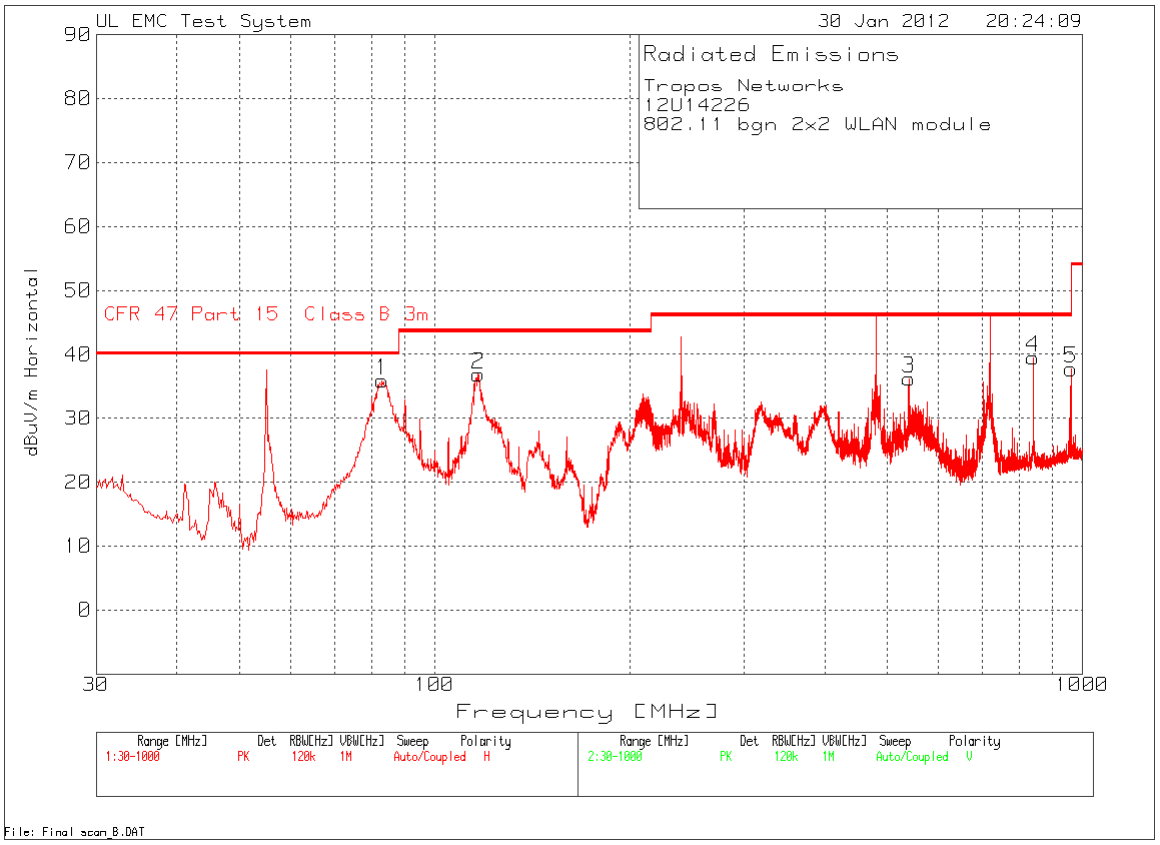
Rev. 07.08.11

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

8.4. WORST-CASE BELOW 1 GHz

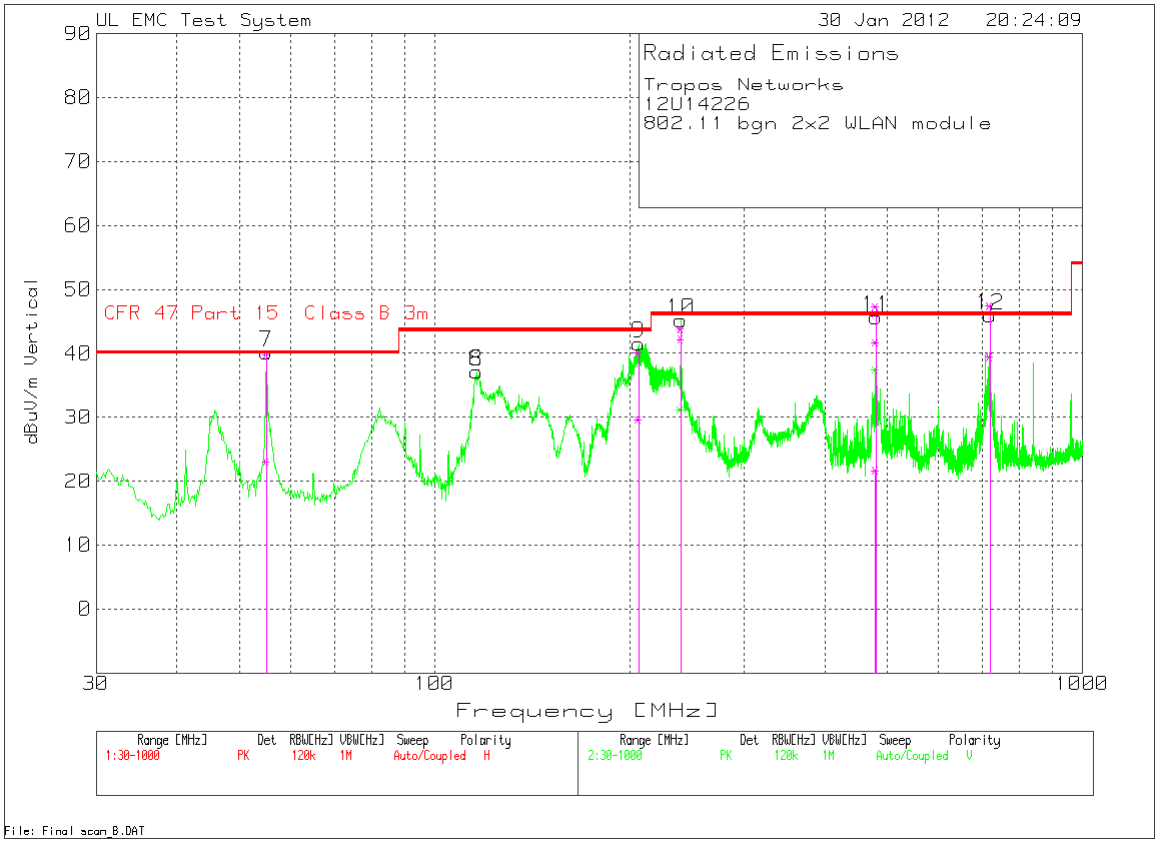
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



EMI DATA

Tropos Networks
12U14226
802.11 bgn 2x2 WLAN module

Range 1 30 - 1000MHz										
Test Frequenc	Meter Reading	Detector	PreAmp Gain	Antenna Factor	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Heigh (cm)	Polarity	Azimuth
82.9197	56.98	PK	-28.7	7.6	35.88	40	-4.12	400	Horz	
116.6487	52.18	PK	-28.4	13.1	36.88	43.5	-6.62	300	Horz	
540.1998	45.62	PK	-26.8	17.4	36.22	46	-9.78	100	Horz	
840.0779	43.49	PK	-25.2	21.2	39.49	46	-6.51	100	Horz	
960.0679	39.83	PK	-24.3	22.2	37.73	54	-16.27	100	Horz	
Range 2 30 - 1000MHz										
Test Frequenc	Meter Reading	Detector	PreAmp Gain	Antenna Factor	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Heigh (cm)	Polarity	
116.0671	52.52	PK	-28.4	13	37.12	43.5	-6.38	100	Vert	
55.006	61.29	PK	-29	7.9	40.19	40	0.19	100	Vert	
55	54.08	QP	-29	7.9	22.98	40	**-7.02**	241	Vert	216
116.0671	52.52	PK	-28.4	13	37.12	43.5	-6.38	100	Vert	
206.3989	57.01	PK	-27.5	12	41.51	43.5	-1.99	100	Vert	
206.4342	55.51	QP	-27.5	12	40.01	43.5	**-3.49**	185	Vert	101
239.9341	60.7	PK	-27.3	11.8	45.2	46	-0.8	200	Vert	
240.0122	59.27	QP	-27.3	11.8	43.77	46	**-2.23**	236	Vert	102
480.1079	56.27	PK	-27	16.4	45.67	46	-0.33	100	Vert	
479.9981	52.25	QP	-27	16.4	41.65	46	**-4.35**	251	Vert	124
720.0879	52.31	PK	-26	19.6	45.91	46	-0.09	100	Vert	
719.9891	45.78	QP	-26	19.6	39.38	46	**-6.62**	73	Vert	104

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

Tropos Networks

12U14226

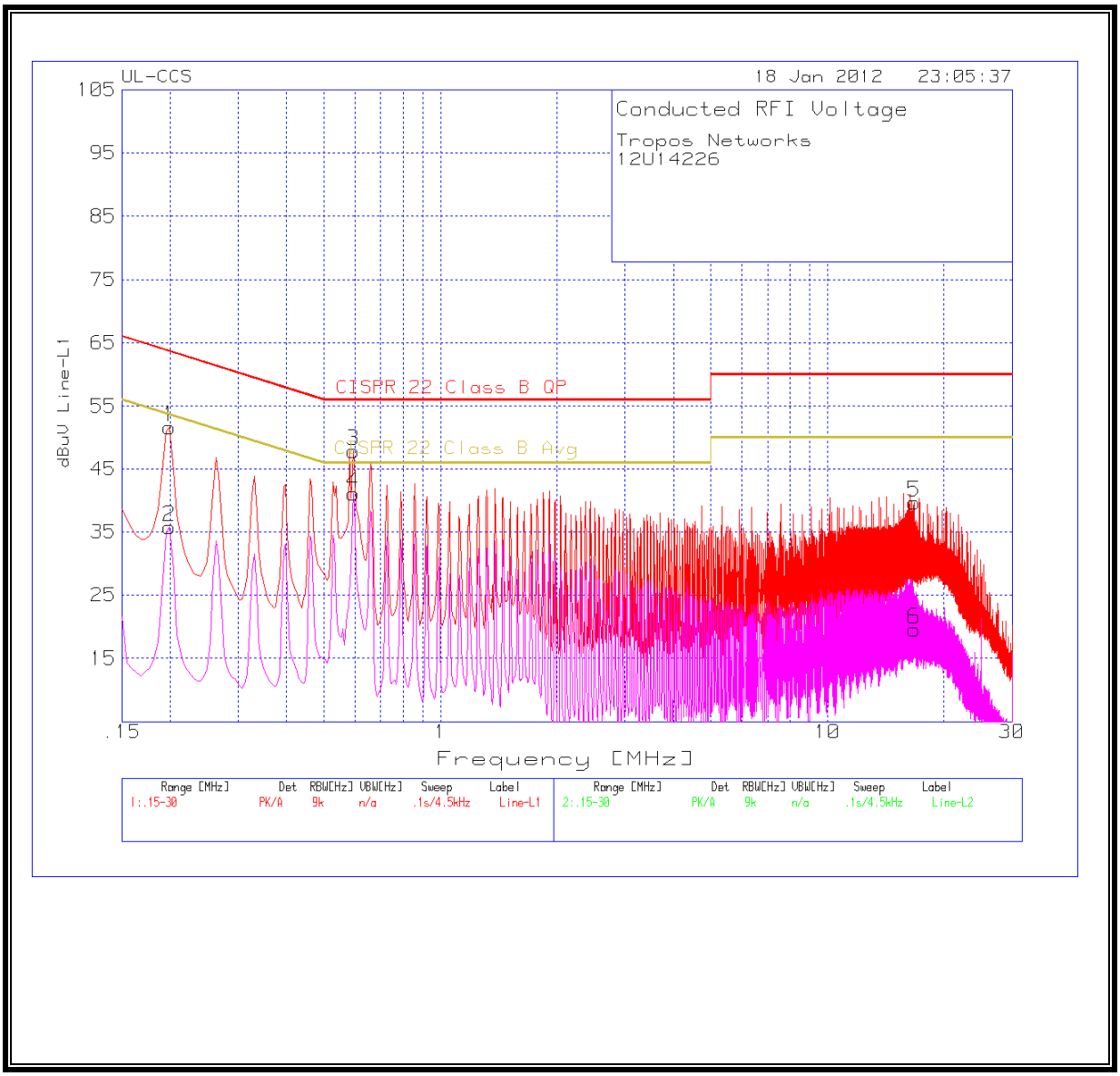
Line-L1 .15 - 30MHz

Test Freq. (MHz)	Meter Reading (dBuV)	Detector Type	LISN Factor [dB]	Path Loss (dB)	Corrected Reading (dBuV)	Class B Quasi-peak Limit	Quasi-Peak Margin	Class B Average Limit	Average Margin
0.1995	51.53	PK	0.1	0	51.63	63.6	-11.97	-	-
0.1995	35.6	Av	0.1	0	35.7	-	-	53.6	-17.9
0.5955	47.77	PK	0.1	0	47.87	56	-8.13	-	-
0.5955	40.97	Av	0.1	0	41.07	-	-	46	-4.93
16.7775	39.19	PK	0.2	0.2	39.59	60	-20.41	-	-
16.7775	19.15	Av	0.2	0.2	19.55	-	-	50	-30.45

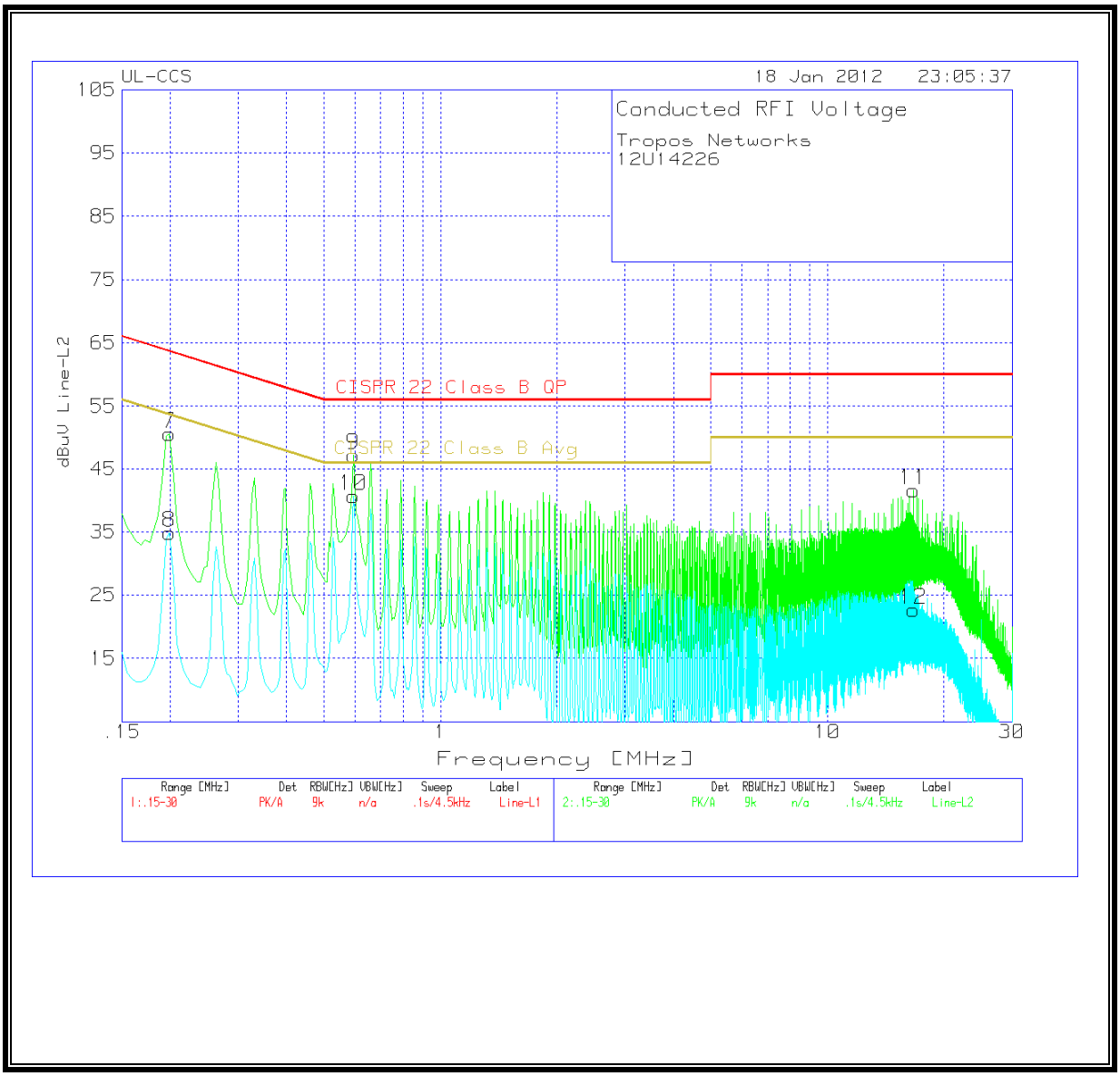
Line-L2 .15 - 30MHz

Test Freq. (MHz)	Meter Reading (dBuV)	Detector Type	LISN Factor [dB]	Path Loss (dB)	Corrected Reading (dBuV)	Class B Quasi-peak Limit	Quasi-Peak Margin	Class B Average Limit	Average Margin
0.1995	50.55	PK	0.1	0	50.65	63.6	-12.95	-	-
0.1995	34.7	Av	0.1	0	34.8	-	-	53.6	-18.8
0.5955	47.15	PK	0.1	0	47.25	56	-8.75	-	-
0.5955	40.62	Av	0.1	0	40.72	-	-	46	-5.28
16.71	41.21	PK	0.2	0.2	41.61	60	-18.39	-	-
16.71	22.34	Av	0.2	0.2	22.74	-	-	50	-27.26

LINE 1 RESULTS



LINE 2 RESULTS



10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	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/m^2 is equivalent to 1 mW/cm^2.
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 = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

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.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

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/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain for MIMO**	**Separation Distance (m)**	**Output AV Power (dBm)**	**Antenna Gain (dBi)**	**EIRP (dBm)**	**EIRP (W)**	**IC Power Density (W/m^2)**	**FCC Power Density (mW/cm^2)**
2.4 GHz	WLAN	1		22.12	7.40	29.52	0.90		
2.4 GHz	WLAN	2		22.75	7.40	30.15	1.04		
Combined			0.20				1.93	3.84	0.384