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

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n WLAN + Bluetooth PCI-E Custom Combination Card

MODEL NUMBER: BCM94331CSAX

FCC ID: QDS-BRCM1062
IC: 4324A-BRCM1062

REPORT NUMBER: 11U14154-8, Revision A

ISSUE DATE: JULY 06, 2012

Prepared for

BROADCOM CORPORATION
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Prepared by

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/01/12	Initial Issue	F. Ibrahim
A	07/06/12	Revised MPE section	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086, USA
EUT DESCRIPTION:	802.11a/b/g/n WLAN + Bluetooth PCI-E Custom Combination Card
MODEL:	BCM94331CSAX
SERIAL NUMBER:	C861475004JDNP60X, C86139600XCDNP60J, C86145004BDNP60
DATE TESTED:	NOVEMBER 29 - FEBRUARY 1, 2011

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

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

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

Approved & Released For UL CCS By:

FRANK IBRAHIM
EMC SUPERVISOR
UL CCS

Tested By:

DAVID GARCIA
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 802.11a/g/n WLAN + Bluetooth PCI-E Custom Combination Card.

The radio module is manufactured by Broadcom.

5.2. MAXIMUM OUTPUT POWER

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

2400 - 2483.5 MHz Authorized Frequency Band						
Frequency Range (MHz)	Mode	PK Power, Chain 1 (dBm)	PK Power, Chain 2 (dBm)	PK Power, Chain 3 (dBm)	Total PK power (dBm)	Total PK power (mW)
2412 - 2462	802.11b Legacy 1TX	Covered by the worst case 802.11b CDD 3TX Mode testing				
2412 - 2462	802.11b CDD 2TX	Covered by the worst case 802.11b CDD 3TX Mode testing				
2412 - 2462	802.11b CDD 3TX	19.27	18.76	18.95	23.77	238.21
2412 - 2462	802.11g Legacy 1TX	19.44	N/A	N/A	19.44	87.9
2412 - 2462	802.11n HT20 1TX	Covered by the worst case 802.11g Legacy Mode testing				
2412 - 2462	802.11g CDD 2TX	Covered by the worst case 802.11n HT20 CDD 2TX Mode testing				
2412 - 2462	802.11g CDD 3TX	Covered by the worst case 802.11n HT20 CDD 3TX Mode testing				
2412 - 2462	802.11n HT20 CDD 3TX	19.57	18.95	18.94	23.93	247.44
5725 - 5850 MHz Authorized Frequency Band						
Frequency Range (MHz)	Mode	PK Power, Chain 1 (dBm)	PK Power, Chain 2 (dBm)	PK Power, Chain 3 (dBm)	Total PK power (dBm)	Total PK power (mW)
5745 - 5825	802.11a Legacy 1TX	Covered by the worst case 802.11n HT20 CDD 3TX				
5745 - 5825	802.11n HT20 1TX	Covered by the worst case 802.11n HT20 CDD 3TX				
5745 - 5825	802.11a CDD 2TX	Covered by the worst case 802.11n HT20 CDD 2TX				
5745 - 5825	802.11a CDD 3TX	Covered by the worst case 802.11n HT20 CDD 3TX				
5745 - 5825	802.11n CDD 3TX	20.17	19.37	19.66	24.52	282.96
5755 - 5795	802.11n HT40 1TX	Covered by the worst case 802.11n HT40 CDD 3TX				
5755 - 5795	802.11n HT40 CDD 3TX	19.57	19.34	19.05	23.97	249.41

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

FCC/IC/NCC FMA - BCM94331CSAX
FCC ID: QDS-BRCM1062
IC ID: 4324A-BRCM1062

No.	Antenna Manufacturer	Antenna Type	Model	Peak gain @ 2412, 2422, 2432MHz,	Peak gain (5150-5250MHz)	Peak gain (5250-5350MHz) @5320MHz	Peak gain (5470-5725MHz) @5500,	Peak gain (5725-5850MHz) @5785,
1	Amphenol/Molex	802.11abgn WLAN Antenna	604-2961 Wi-Fi1	1.42	5.94	5.05	4.07	3.52
1	Amphenol/Molex	802.11abgn WLAN/BT Antenna	604-2961 Wi-Fi2 & Bluetooth	4.97	6.41	6.56	6.39	6.01
1	Amphenol/Molex	802.11abgn WLAN Antenna	604-2961 Wi-Fi3	3.93	2.38	3.01	4.09	3.59
			Composite 2x2	**7.49**	**9.19**	**8.88**	**8.40**	**7.976724045**
			Composite 3x3	**8.45**	**10.01**	**9.88**	**9.76**	**9.31**

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.106.98.42.
The test utility software used during testing was BCM Internal, rev. 5.106.RC98.42.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC.

Worst-Case data rates, as provided by the client, were as follows:

For 2.4 GHz Band:
802.11b: 1 Mb/s.
802.11g: 6 Mb/s.
802.11n 20MHz: MCS0.

For 5.8 GHz Band:
802.11a: 6 Mb/s.
802.11n 20MHz: MCS0.
802.11n 40MHz: MCS0

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.

For Radiated Band Edge & Harmonic 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	**Manuf.**	**Model**	**Serial Number**	**FCC ID**
Laptop PC	Lenovo	G560	CBU4495773	DoC
AC Adapter	Lenovo	PA-1650-56LC	11S36001651ZZ40008B9YU	N/A
Express Card Adapter	Catalyst	384-0153-002	BRCM 07	N/A
PCI Express Mini Card Adapter	Broadcom	BCM94331CSMFG (X29MFG)	1458963	N/A

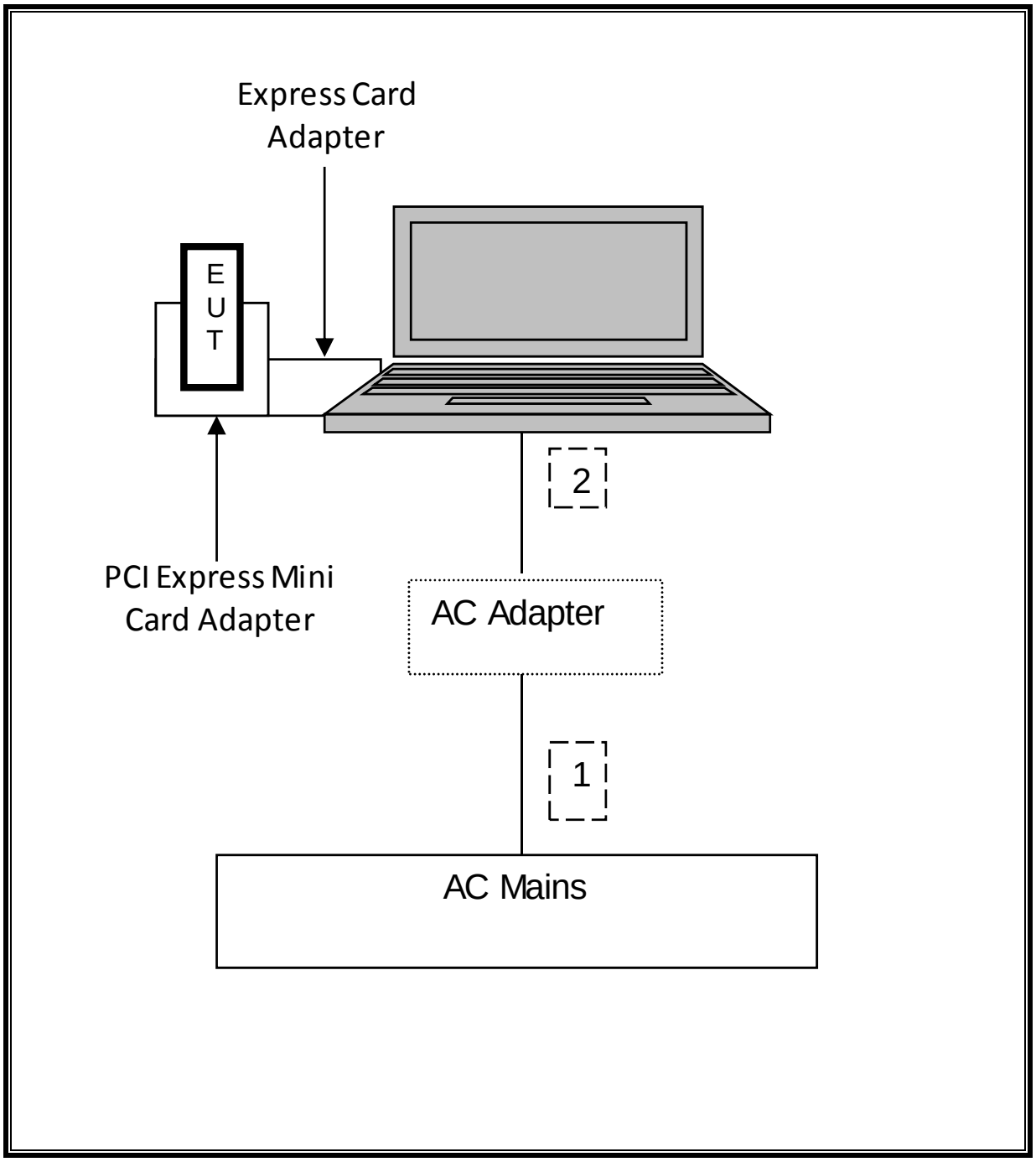
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	US 115V	Un-Shielded	6-ft.	Detachable. 3C/18AWG.
2	DC	1	DC	Un-Shielded	3-ft.	Ferrite-loaded, non-detachable. 2C/18AWG.

TEST SETUP

The EUT is attached to a jig board which is installed in the PCMCI slot of a host laptop computer 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 Date**	**Cal Due**
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/11	07/06/12
LISN, 30 MHz	FCC	50/250-25-2	C00626	11/17/11	11/17/12
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	05/11/11	05/11/12
Peak Power Meter	Agilent / HP	E4416A	C00963	03/22/11	03/22/13
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	04/13/11	04/13/12
EMI Receiver, 6.5GHz	Agilent / HP	85462A	CCS-0147	08/23/11	02/23/13
Antenna, Horn, 18 GHz	EMCO	3115	C00872	09/20/11	09/20/12
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	09/02/11	09/02/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	07/18/11	07/18/12
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRC13192	N02683	CNR	CNR
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/11	07/28/12
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01171	07/16/11	07/16/12
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	06/14/11	06/14/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	01/27/11	01/27/12
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/02/11	08/02/12

7. ANTENNA PORT TEST RESULTS

7.1. 802.11g 1TX 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.

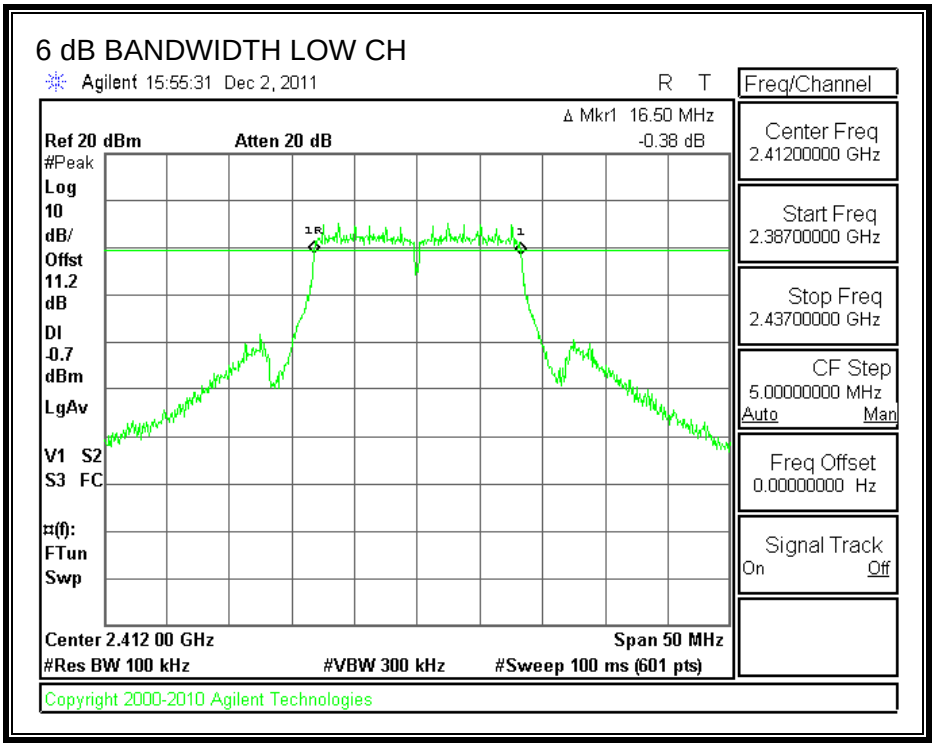
TEST PROCEDURE

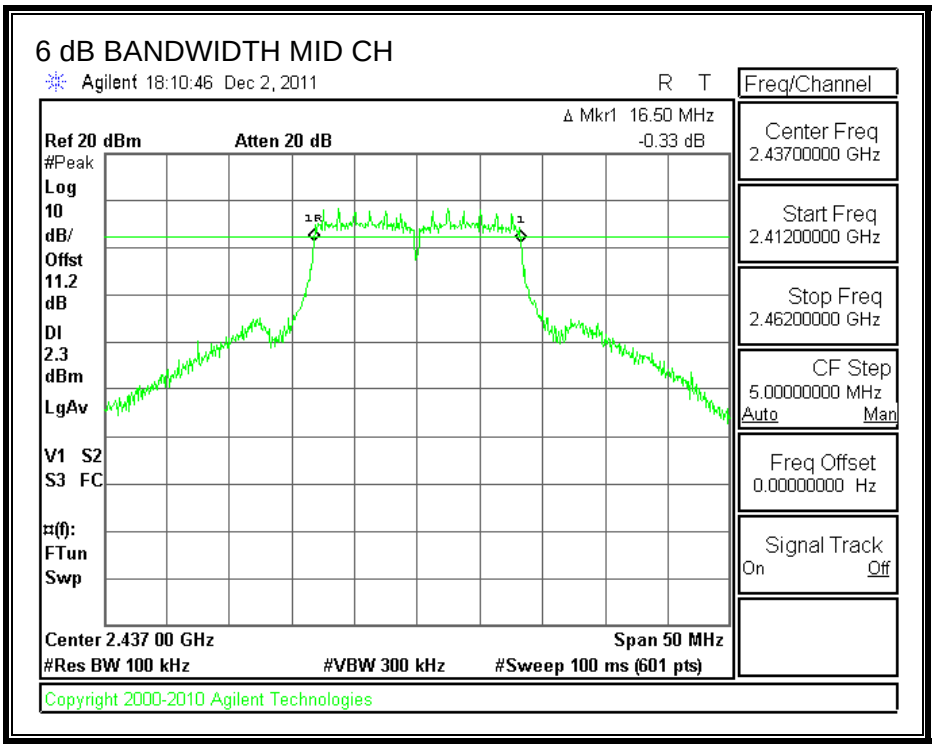
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

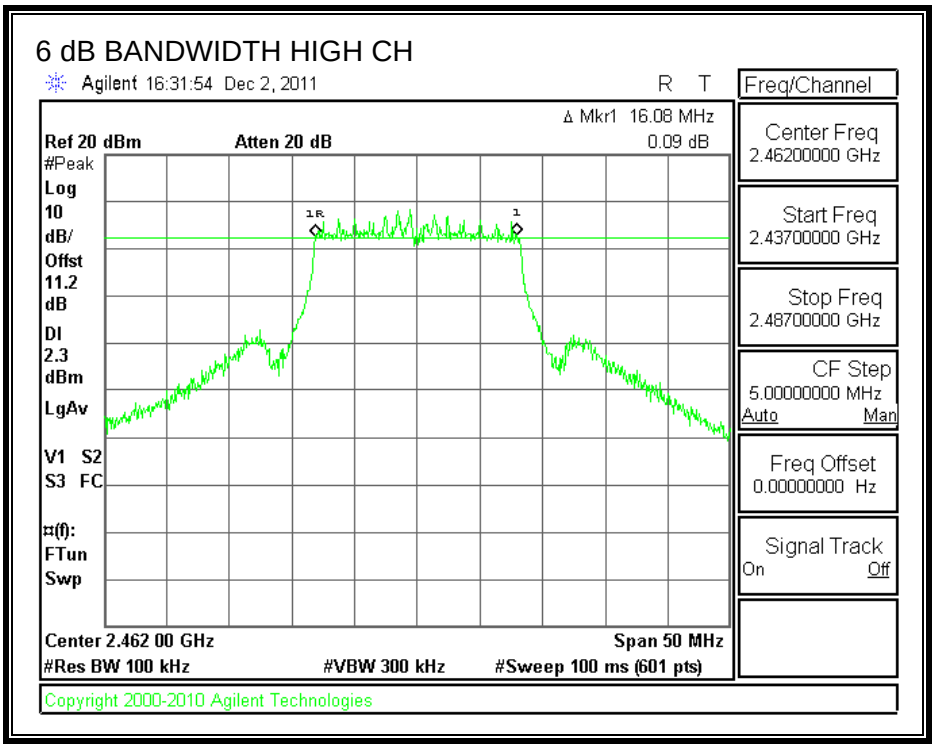
RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.50	0.5
Middle	2437	16.50	0.5
High	2462	16.08	0.5

6 dB BANDWIDTH







7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

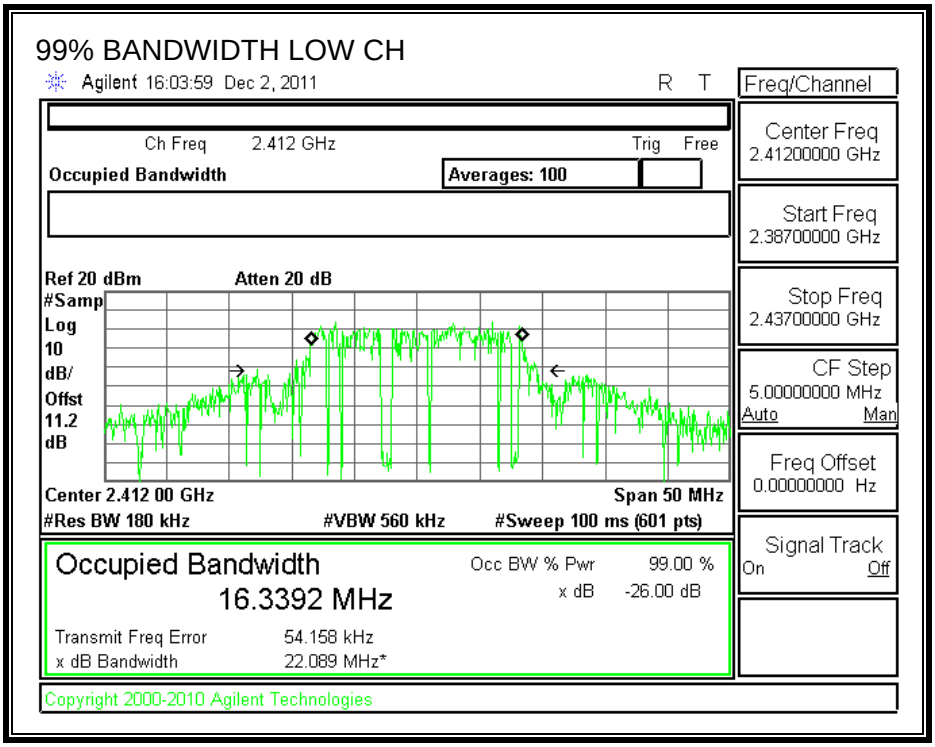
TEST PROCEDURE

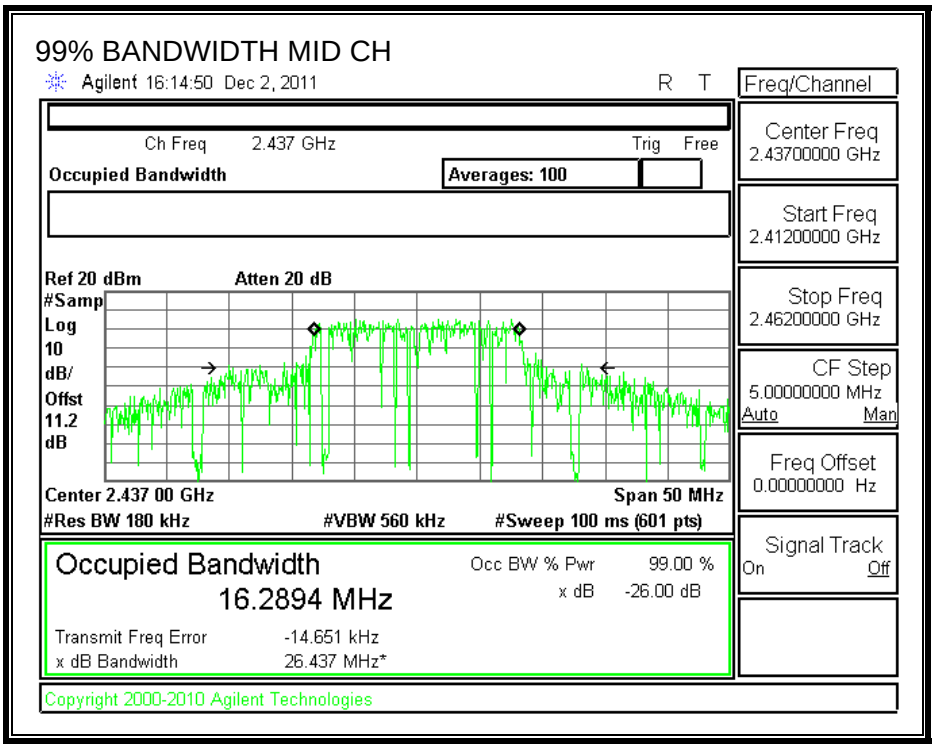
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

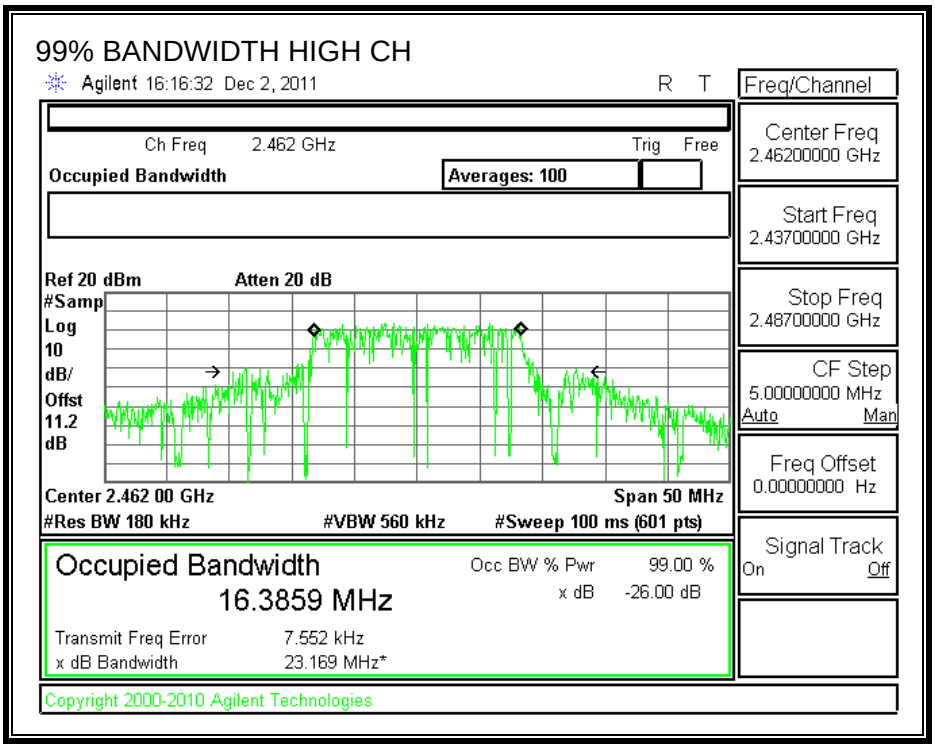
RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.3392
Middle	2437	16.2894
High	2462	16.3859

99% BANDWIDTH







7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

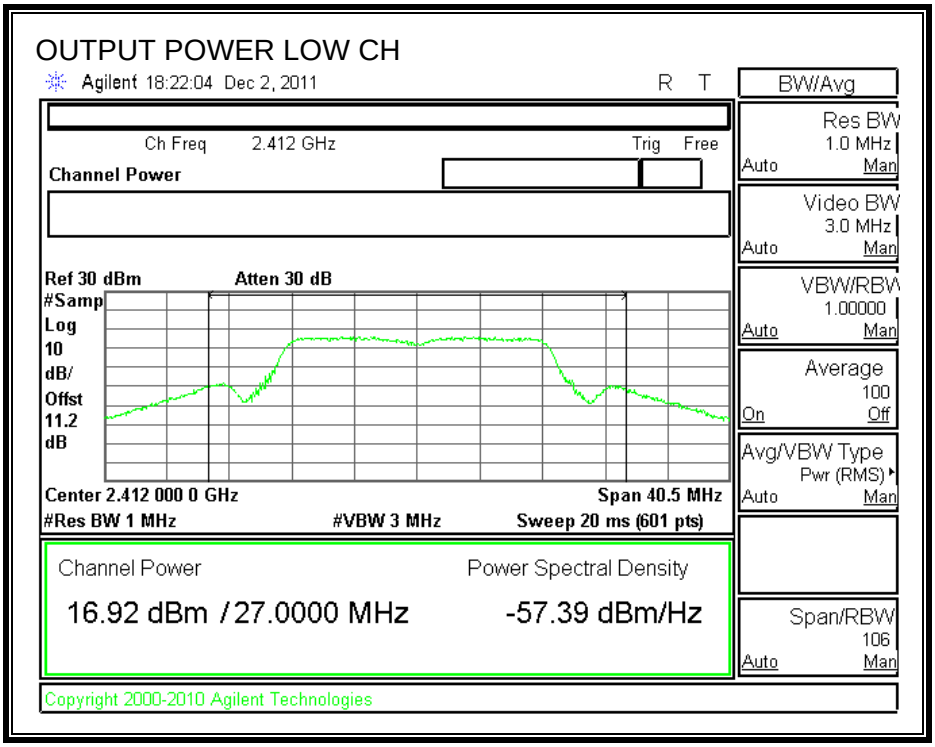
TEST PROCEDURE

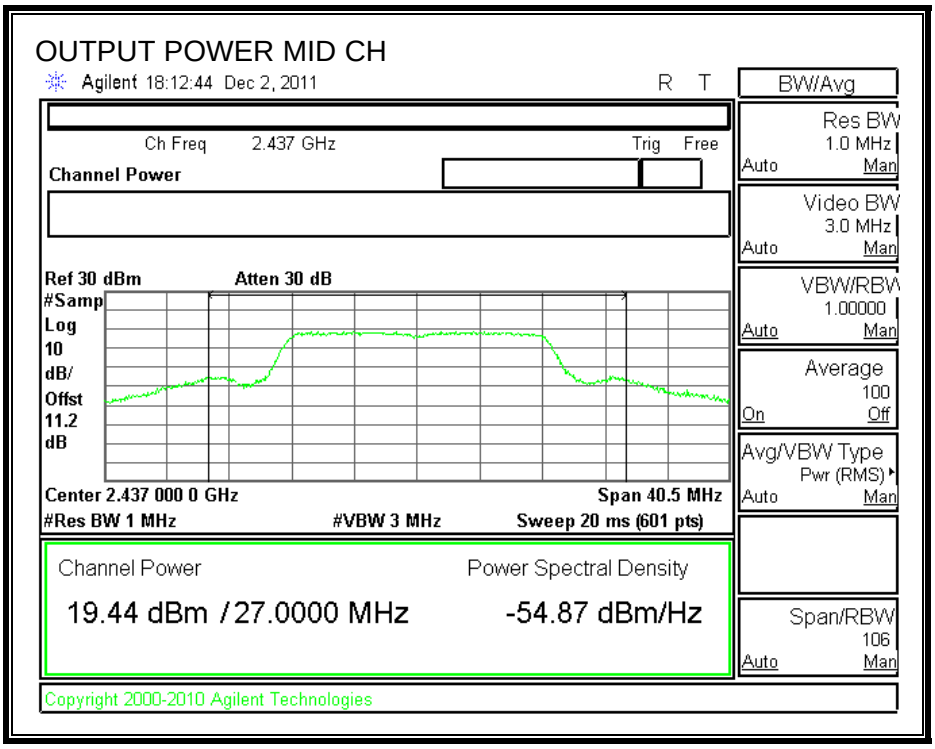
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

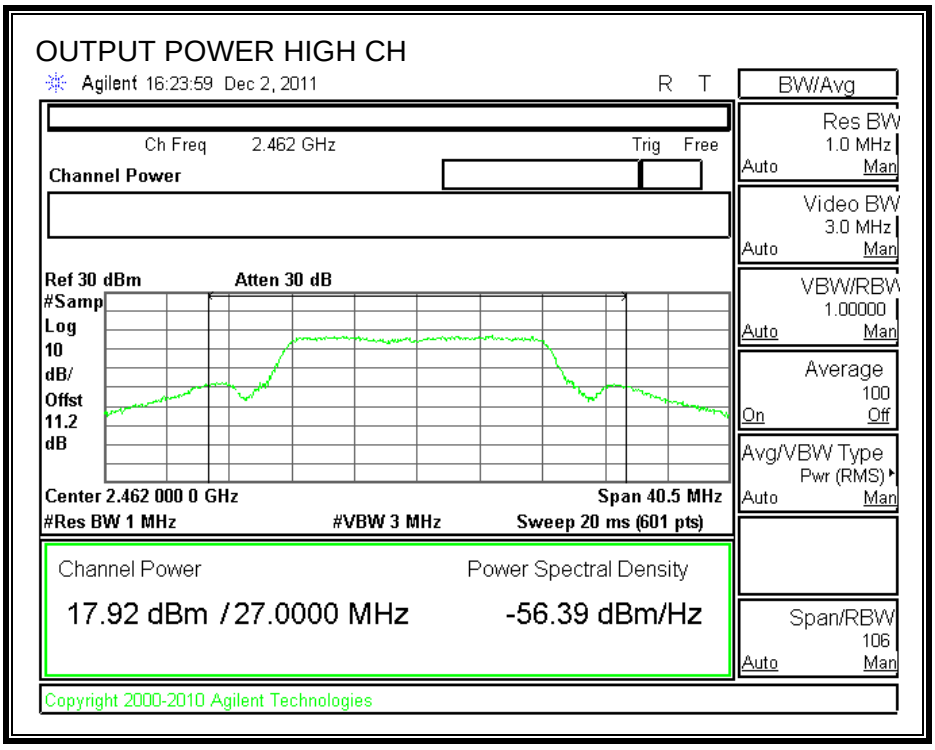
RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	16.92	30	-13.08
Middle	2437	19.44	30	-10.56
High	2462	17.92	30	-12.08

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 11.18 dB (including 10 dB pad and 1.18 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	2412	15.47
Middle	2437	19.06
High	2462	17.75

7.1.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

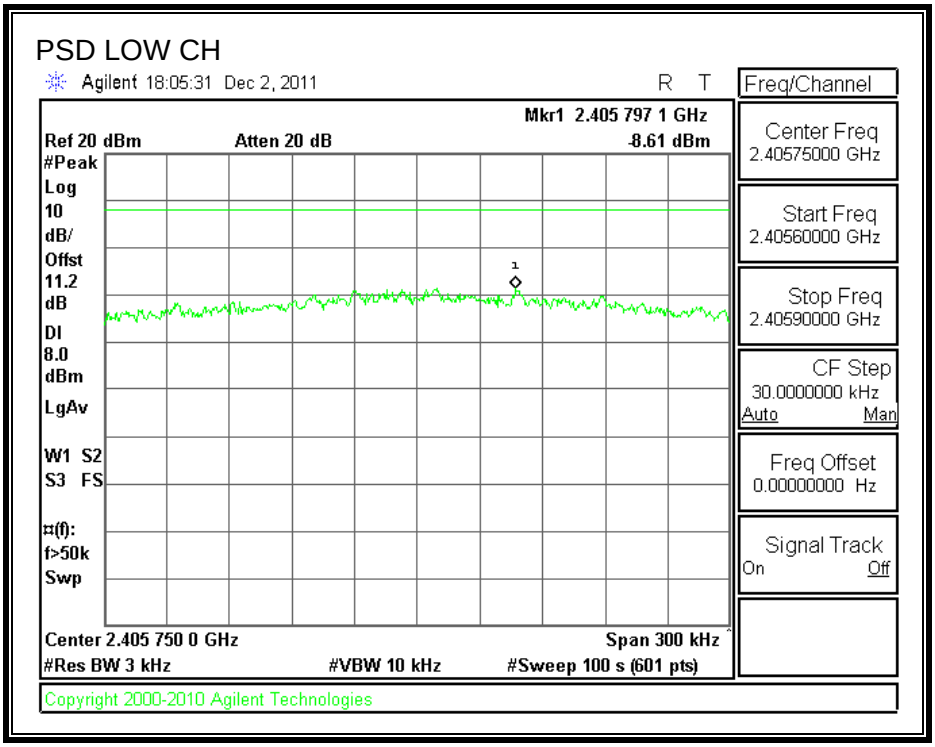
TEST PROCEDURE

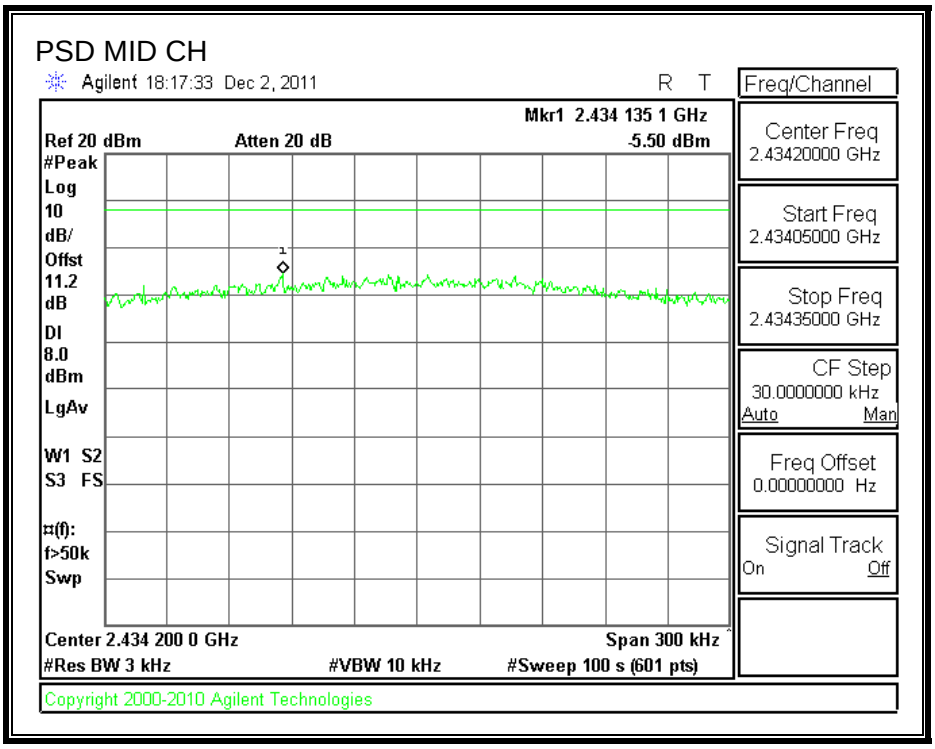
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

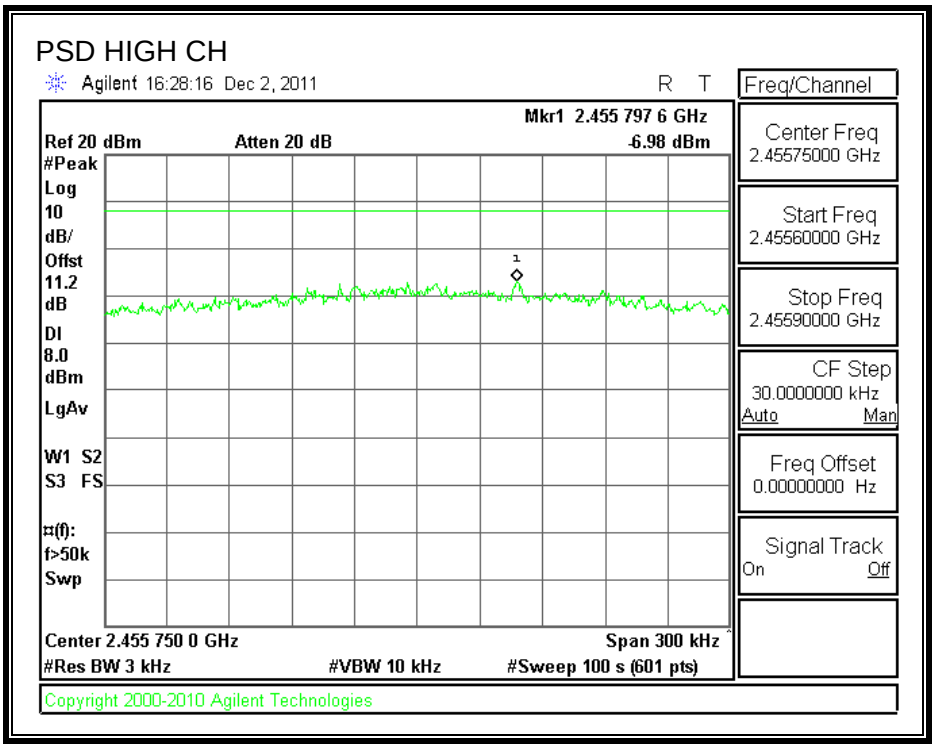
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.61	8	-16.61
Middle	2437	-5.50	8	-13.50
High	2462	-6.98	8	-14.98

POWER SPECTRAL DENSITY





PSD HIGH CH



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.

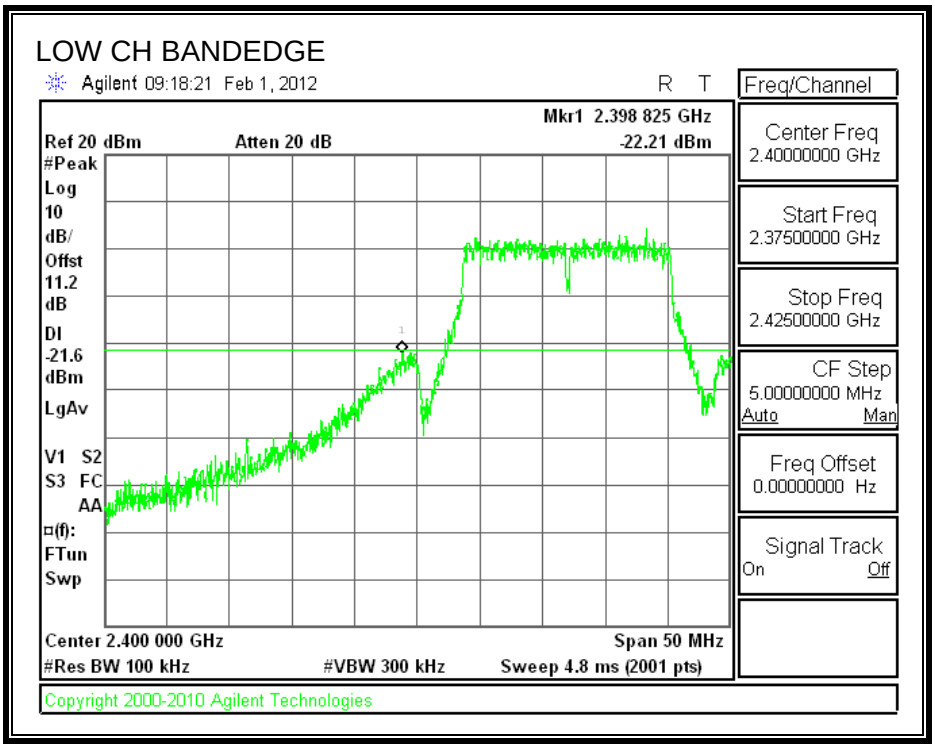
TEST PROCEDURE

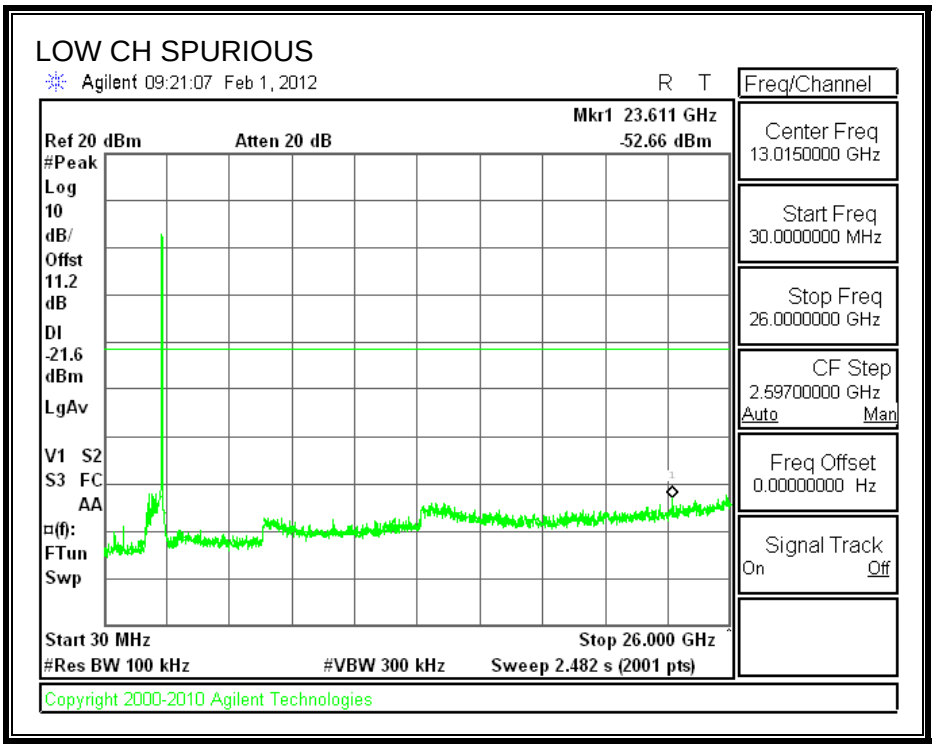
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

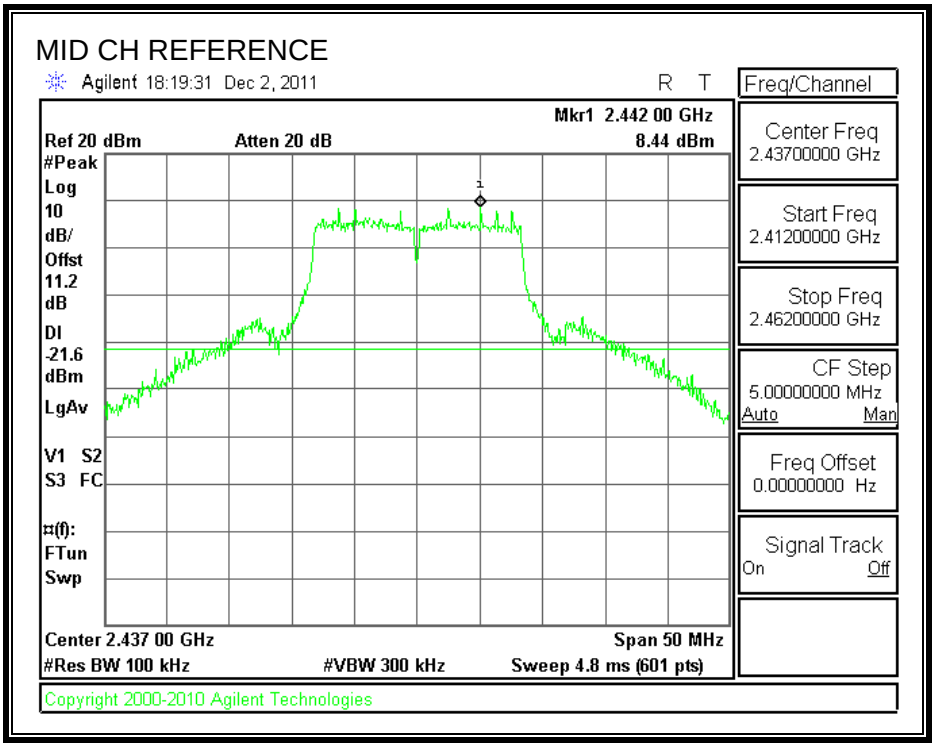
RESULTS

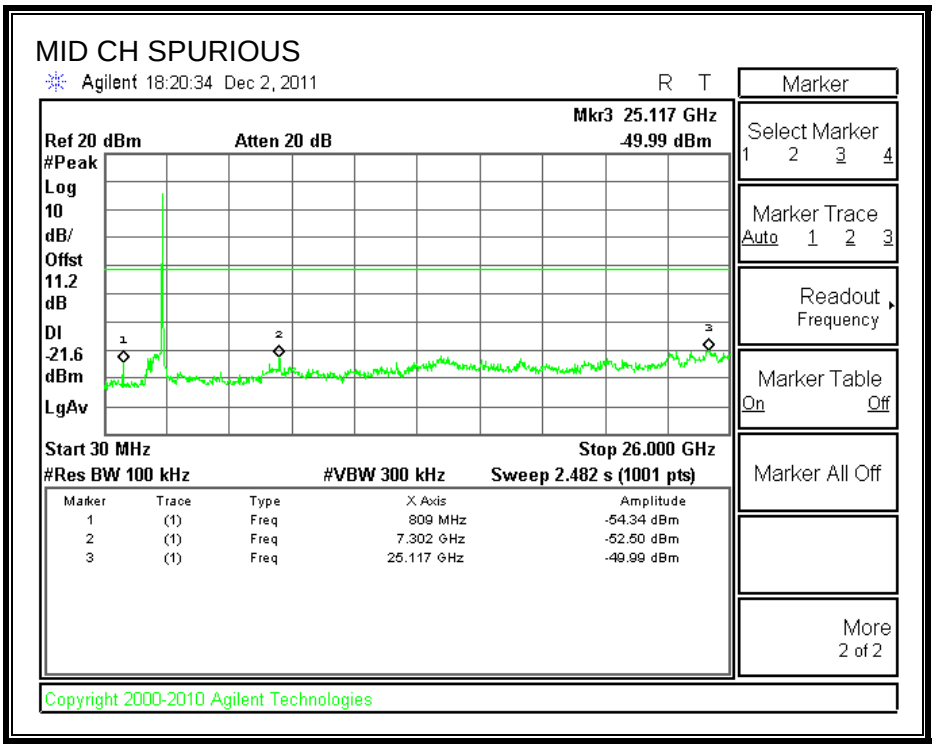
SPURIOUS EMISSIONS, LOW CHANNEL



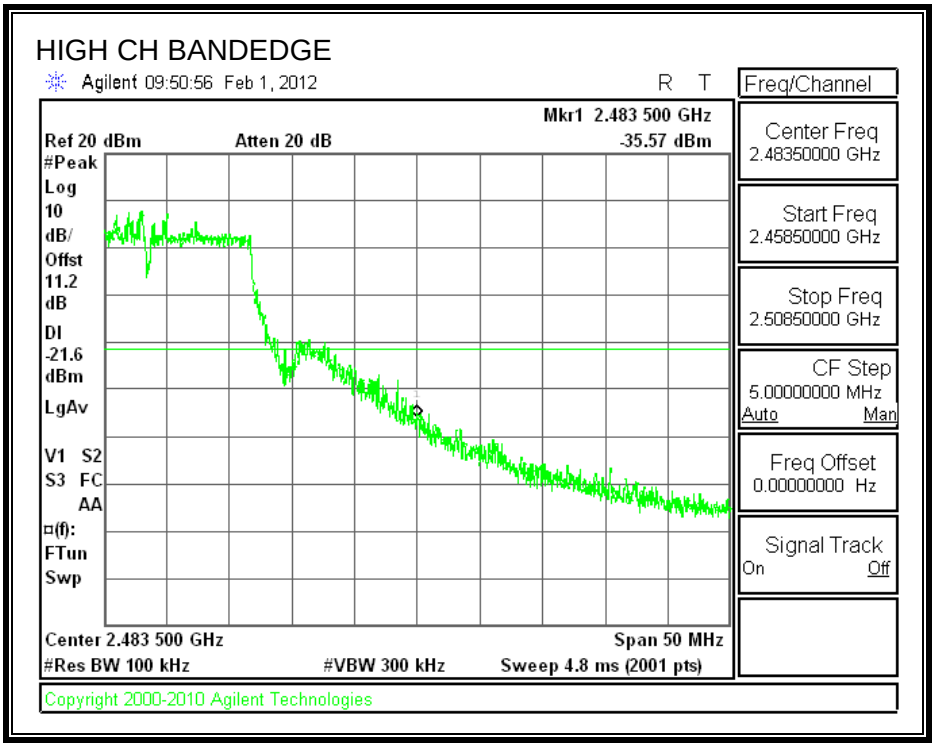


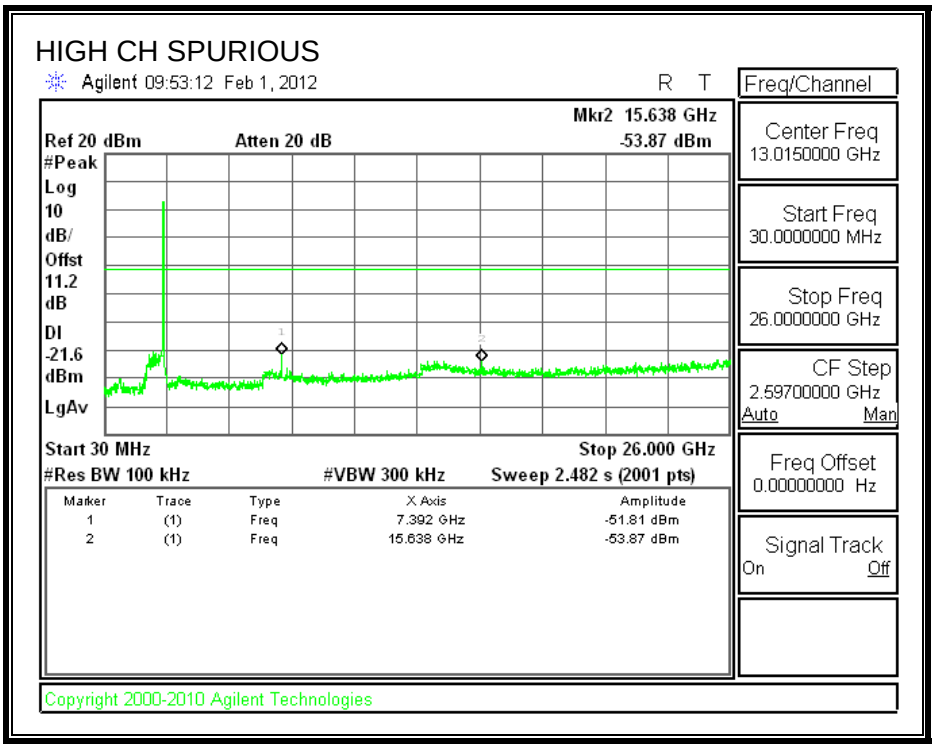
SPURIOUS EMISSIONS, MID CHANNEL





SPURIOUS EMISSIONS, HIGH CHANNEL





7.2. 802.11b CDD 3TX 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.

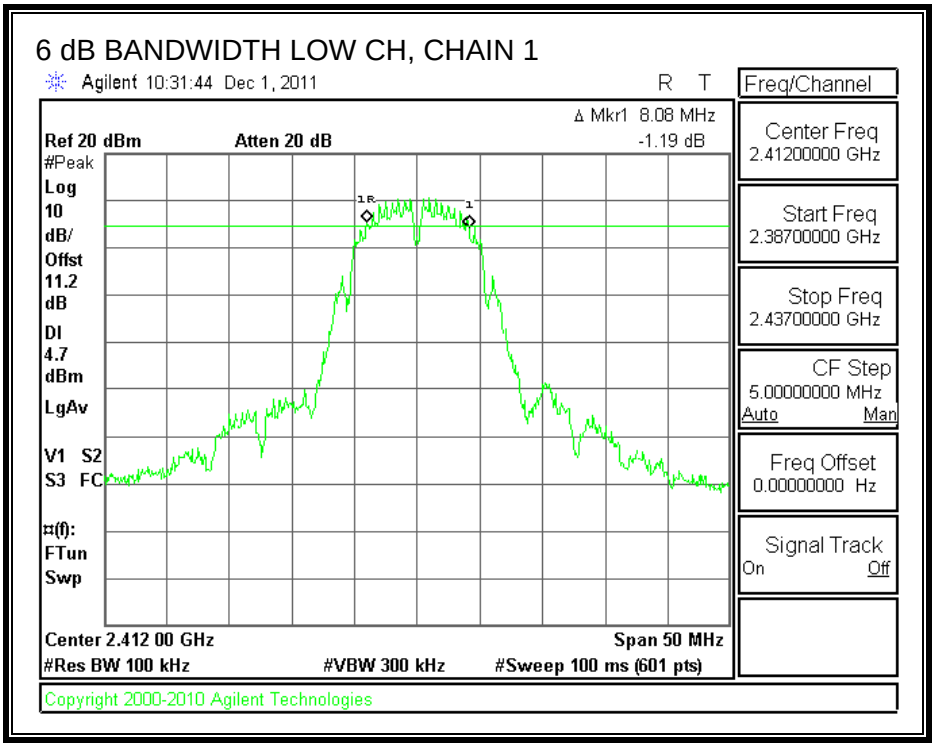
TEST PROCEDURE

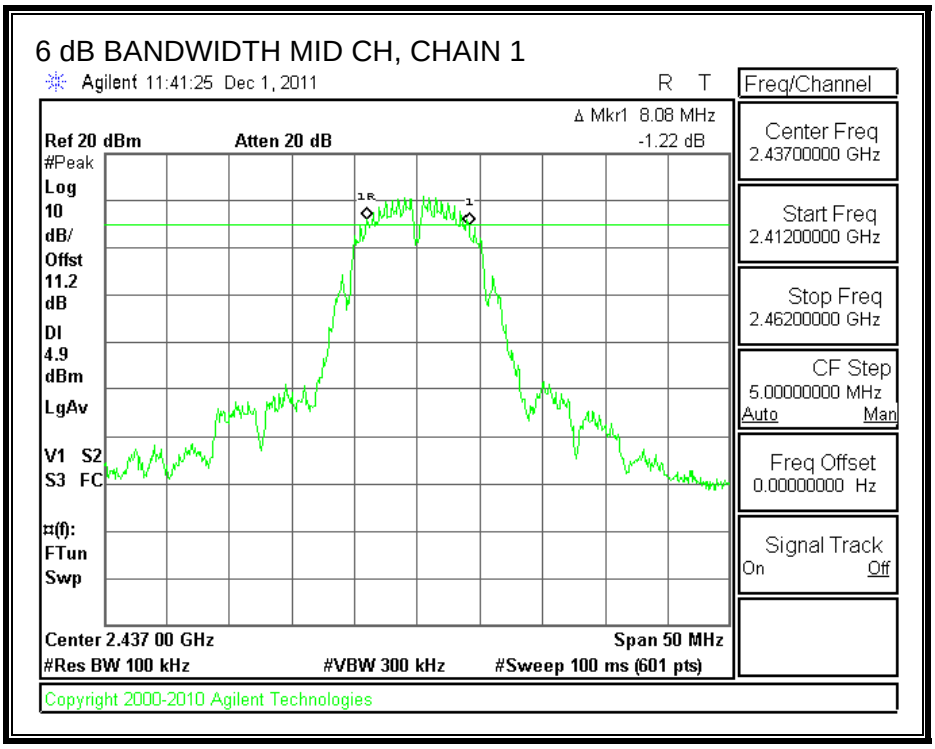
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

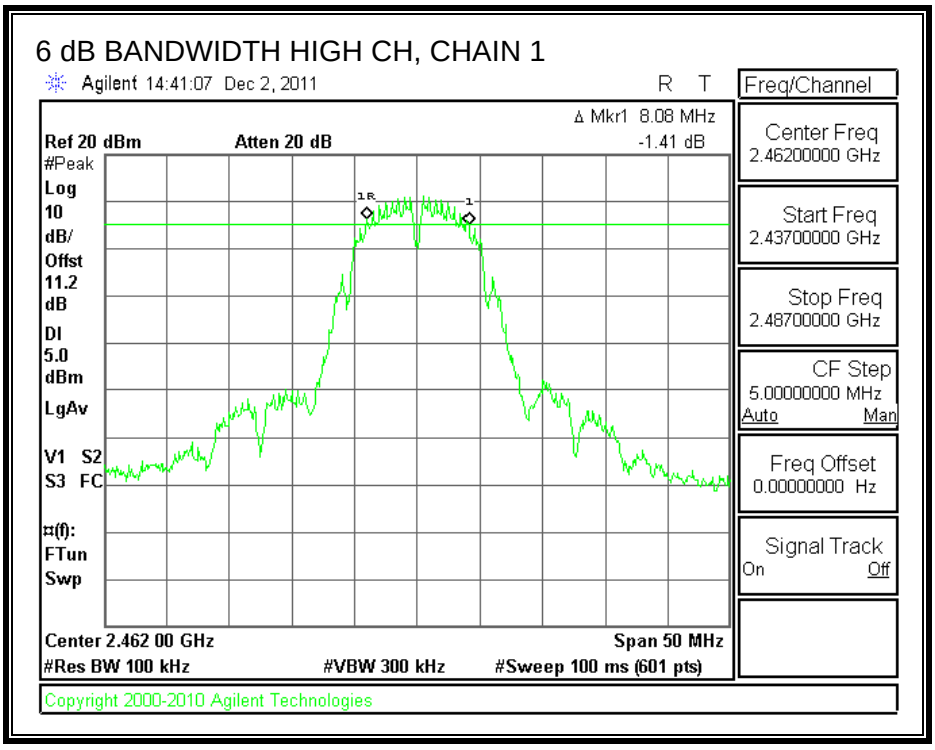
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	8.08	8.08	8.58	0.5
Middle	2437	8.08	8.58	8.08	0.5
High	2462	8.58	8.08	8.08	0.5

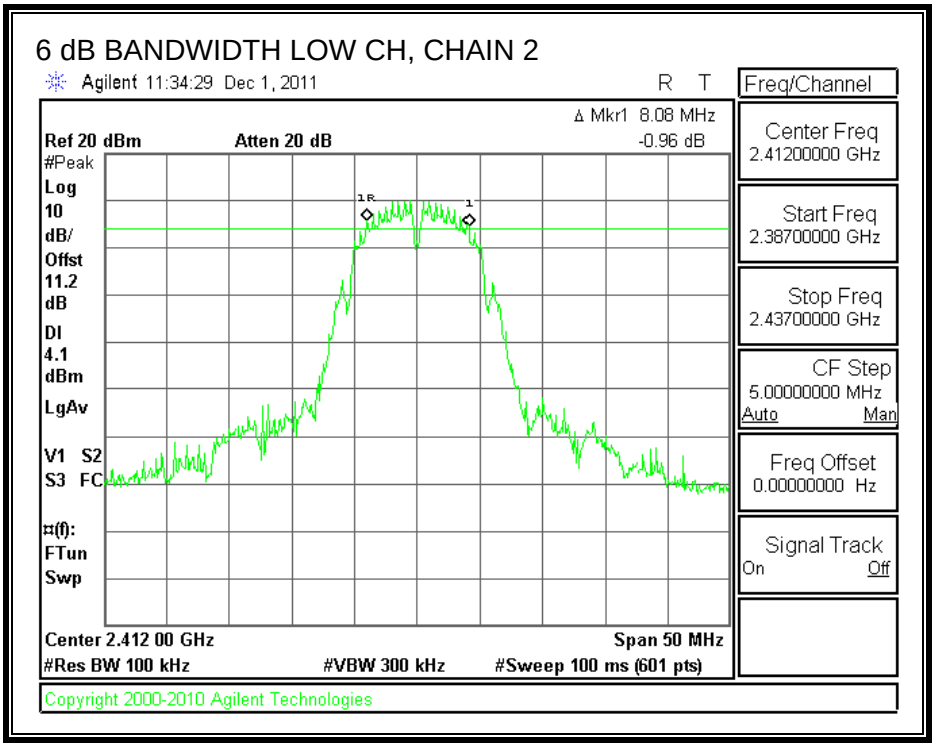
6 dB BANDWIDTH, CHAIN 1

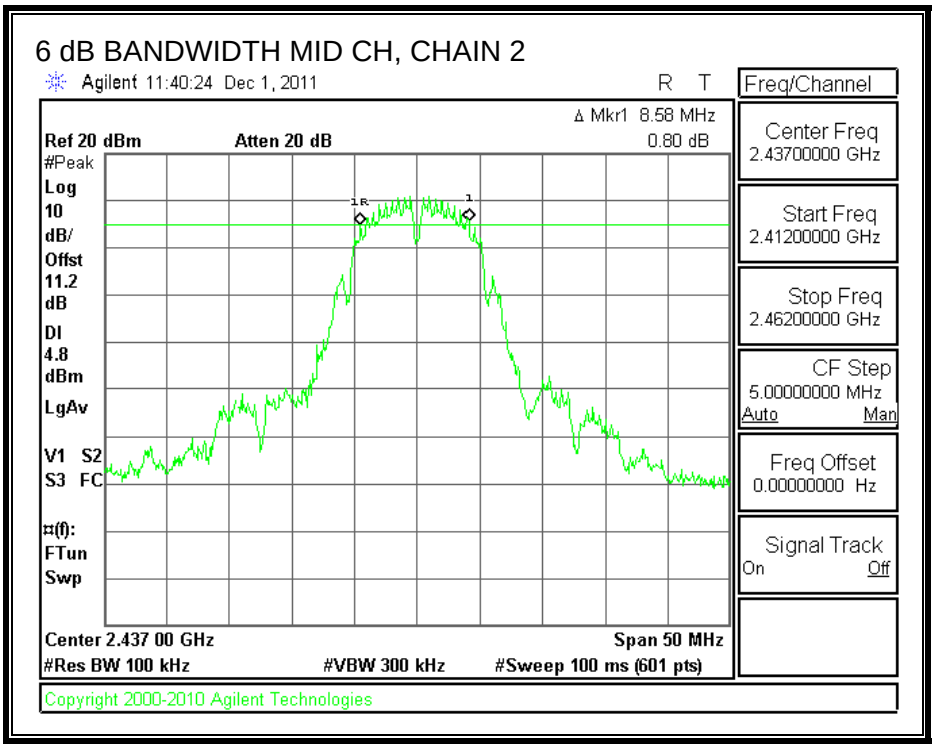


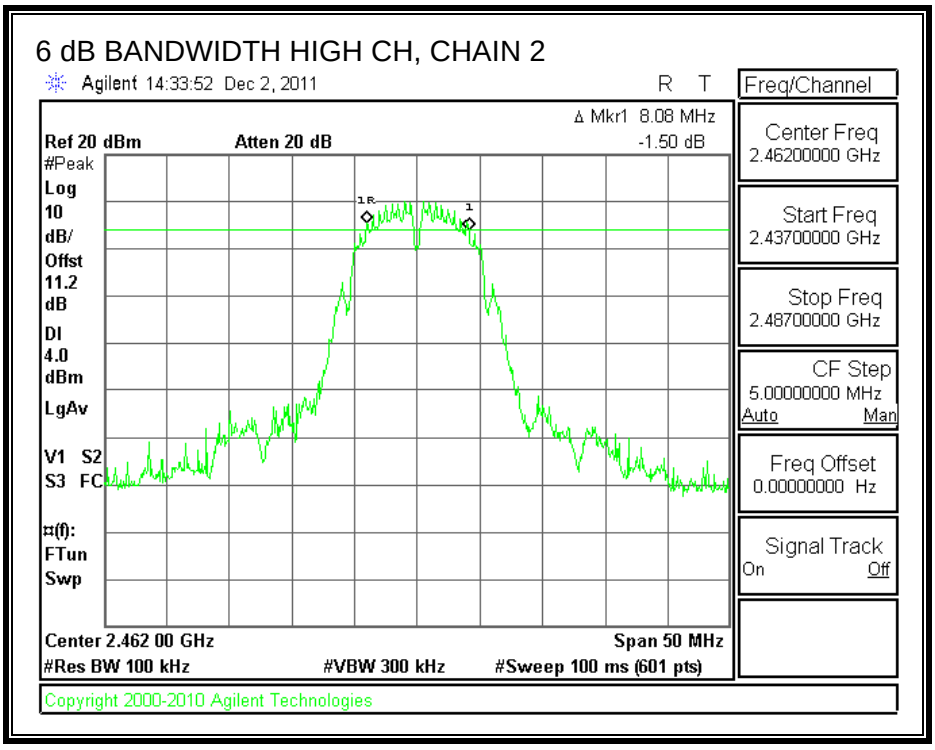




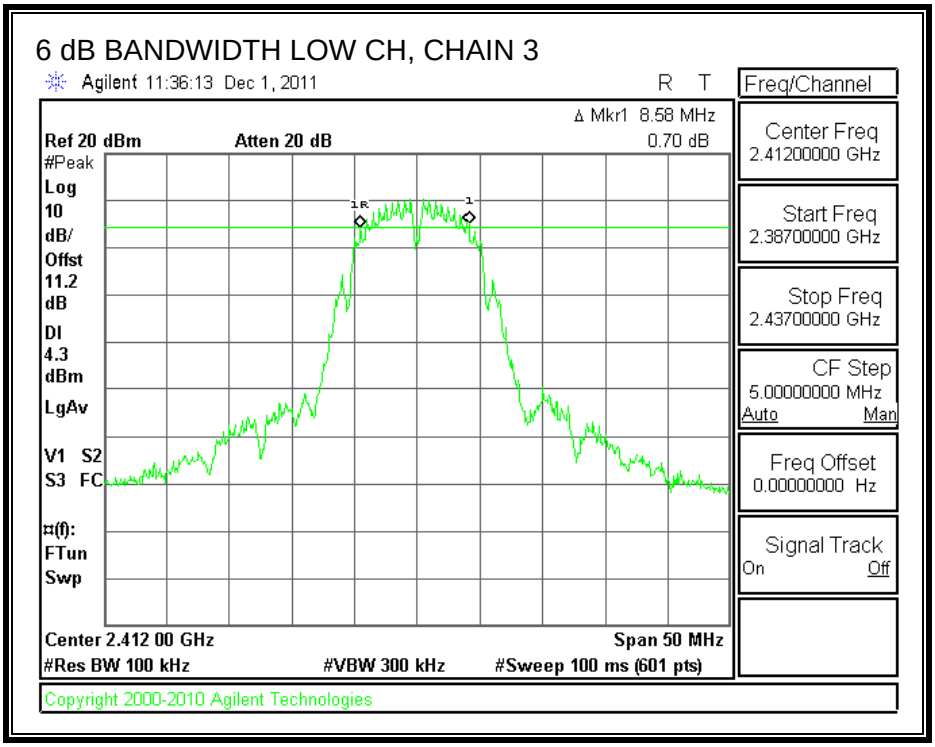
6 dB BANDWIDTH, CHAIN 2

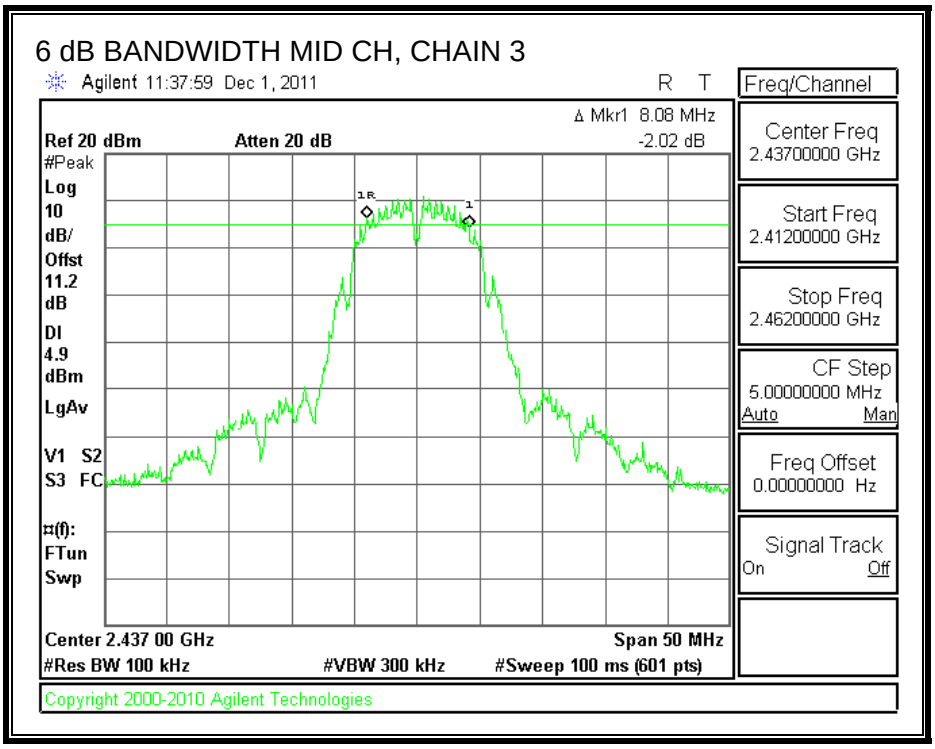


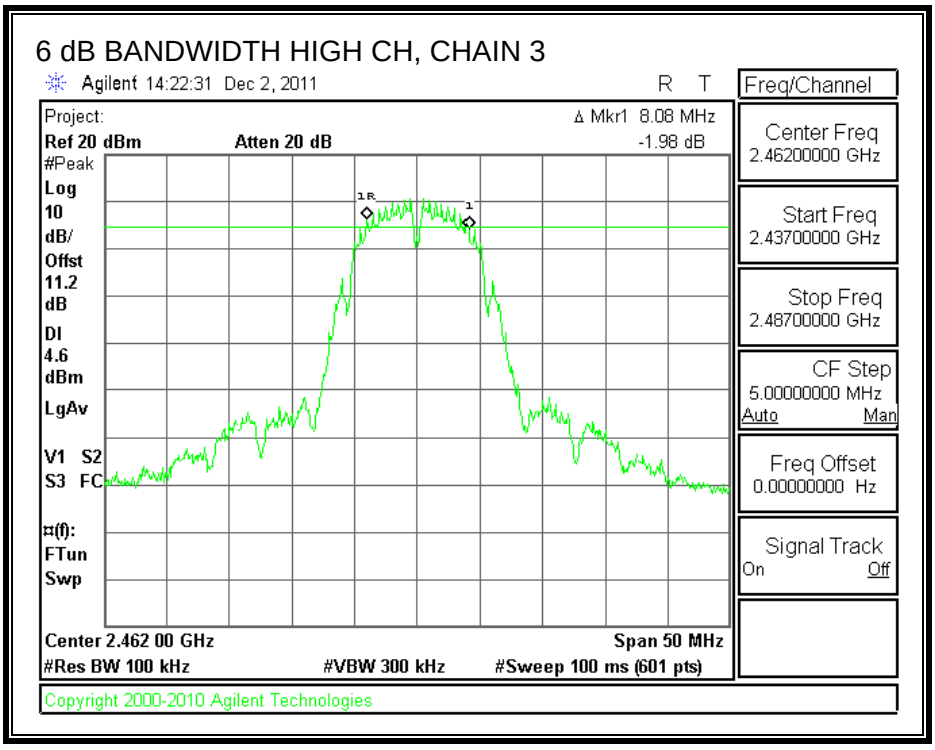




6 dB BANDWIDTH, CHAIN 3







7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

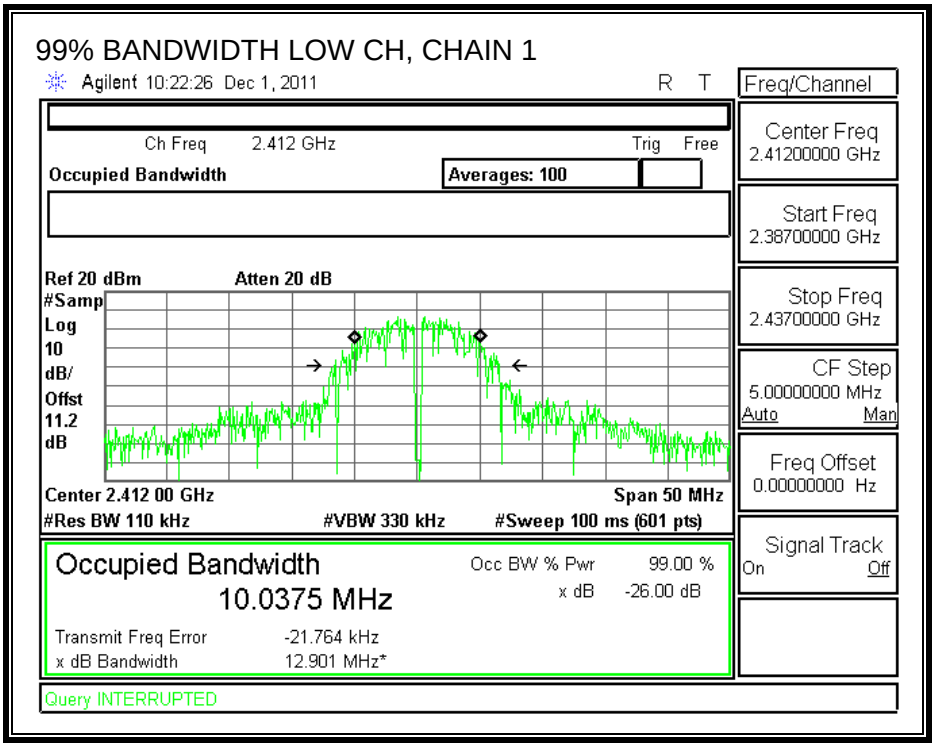
TEST PROCEDURE

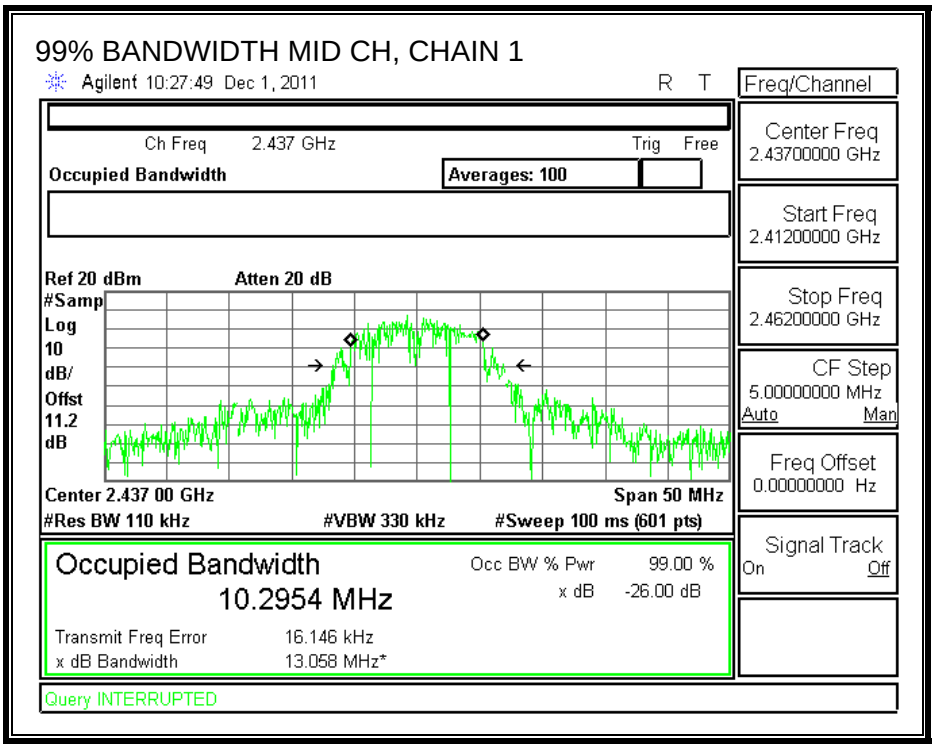
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

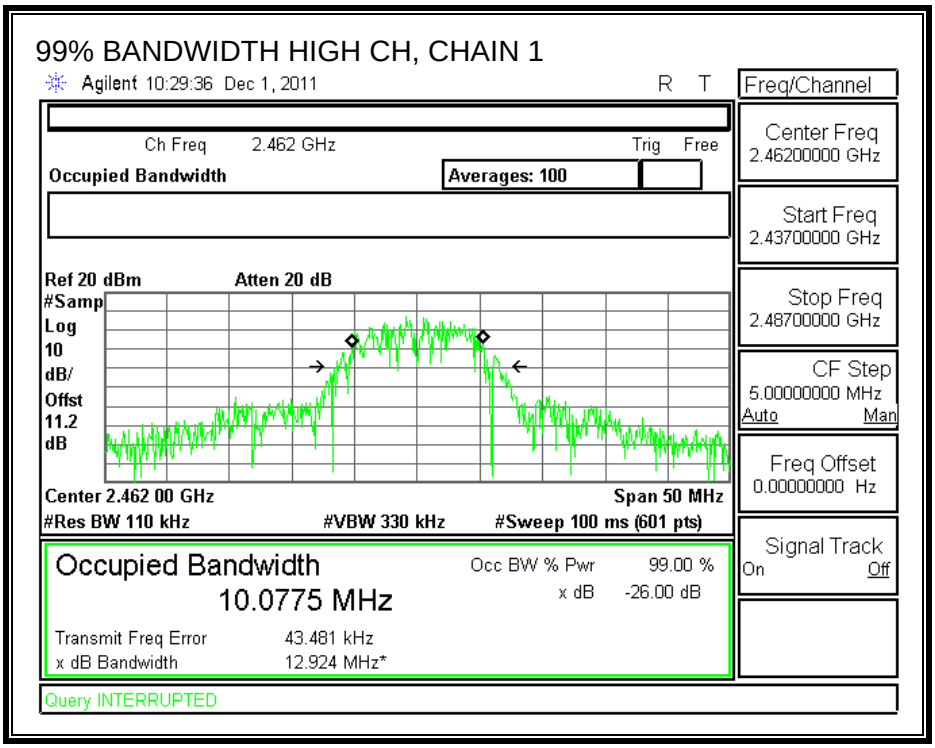
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	2412	10.0375	10.0152	10.1141
Middle	2437	10.2954	10.1634	10.0702
High	2462	10.0775	10.0496	10.0294

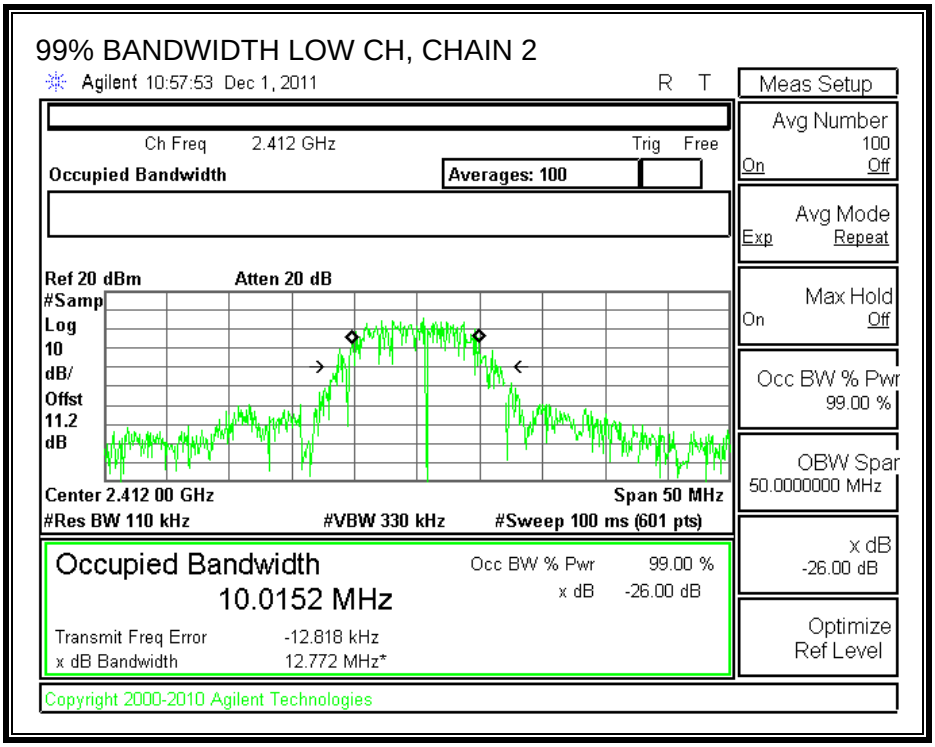
99% BANDWIDTH, CHAIN 1

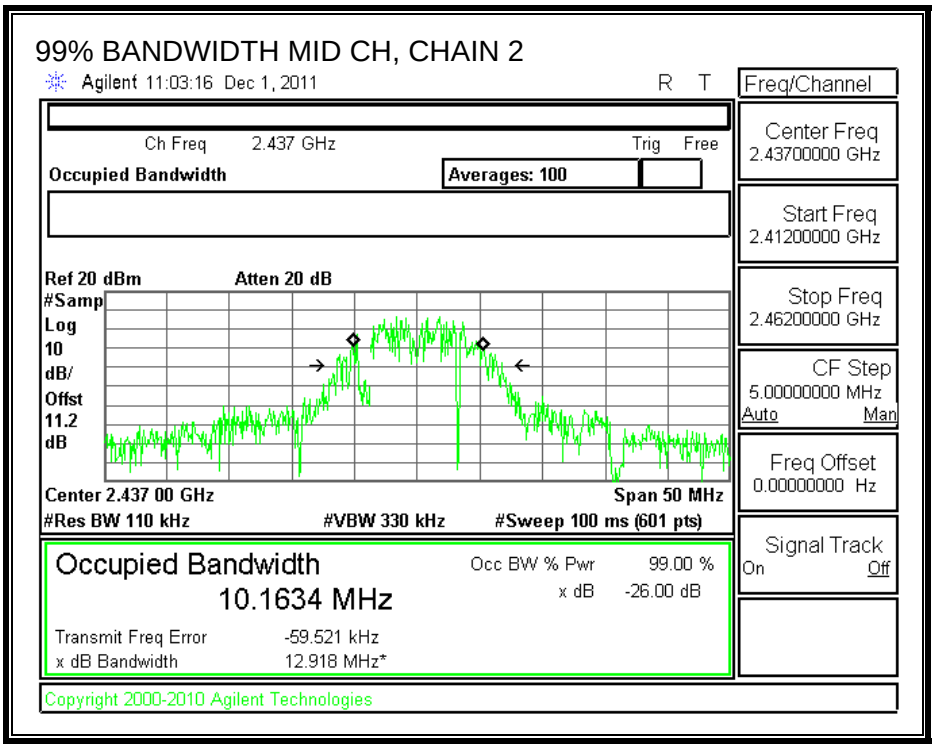


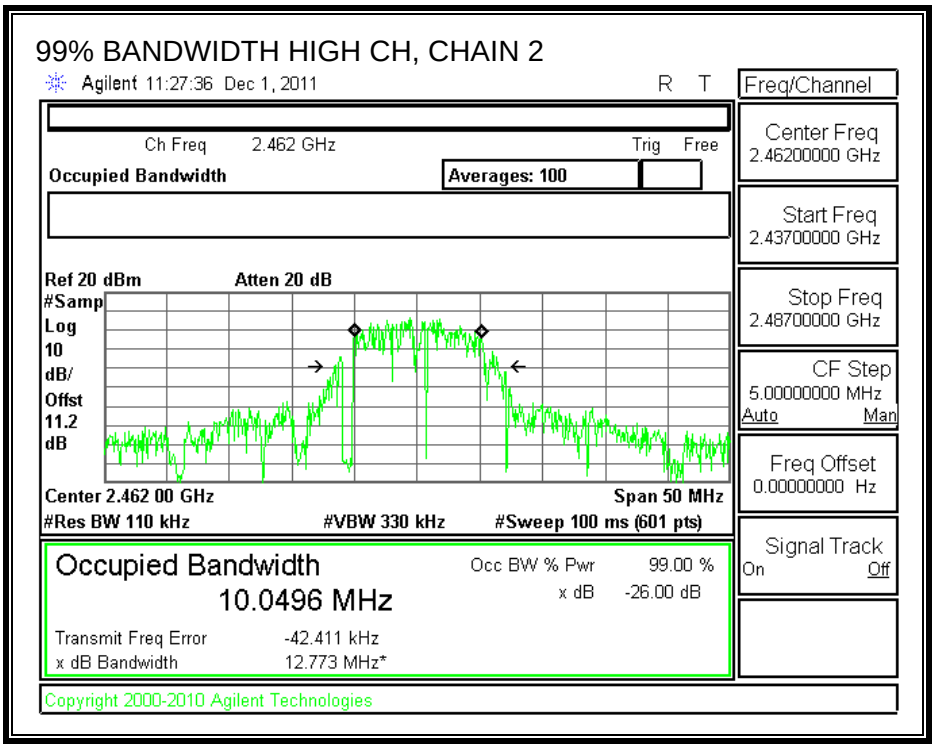




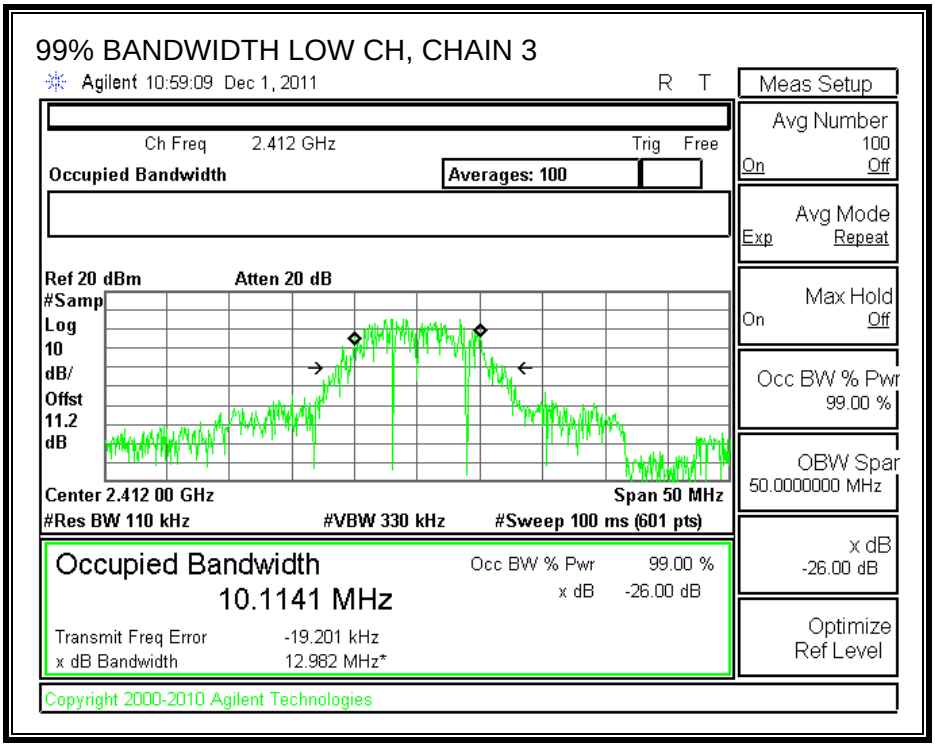
99% BANDWIDTH, CHAIN 2

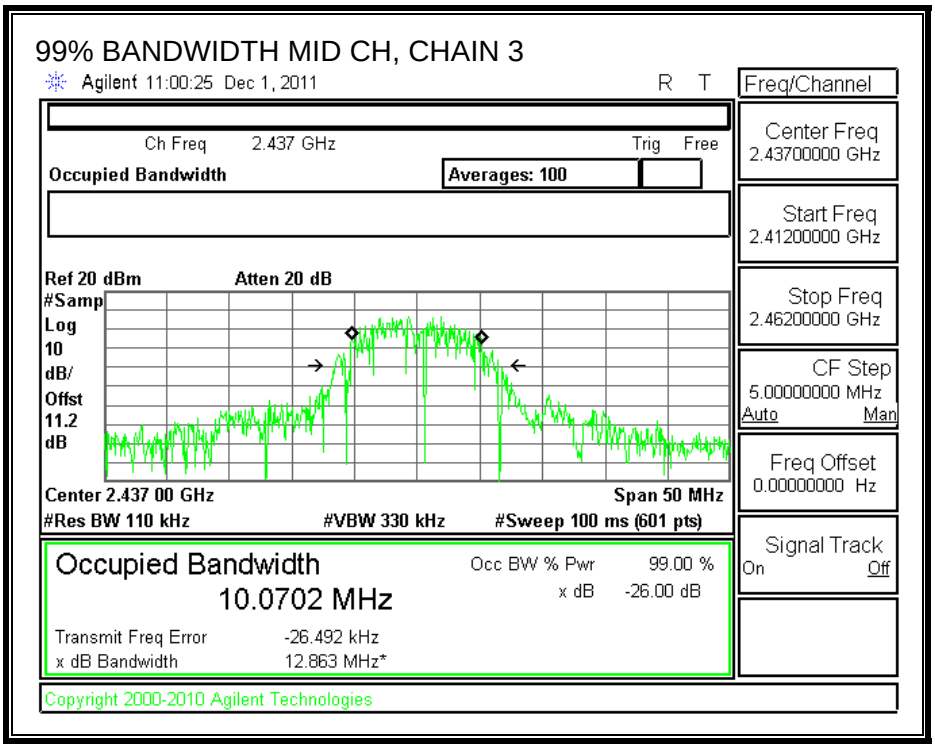


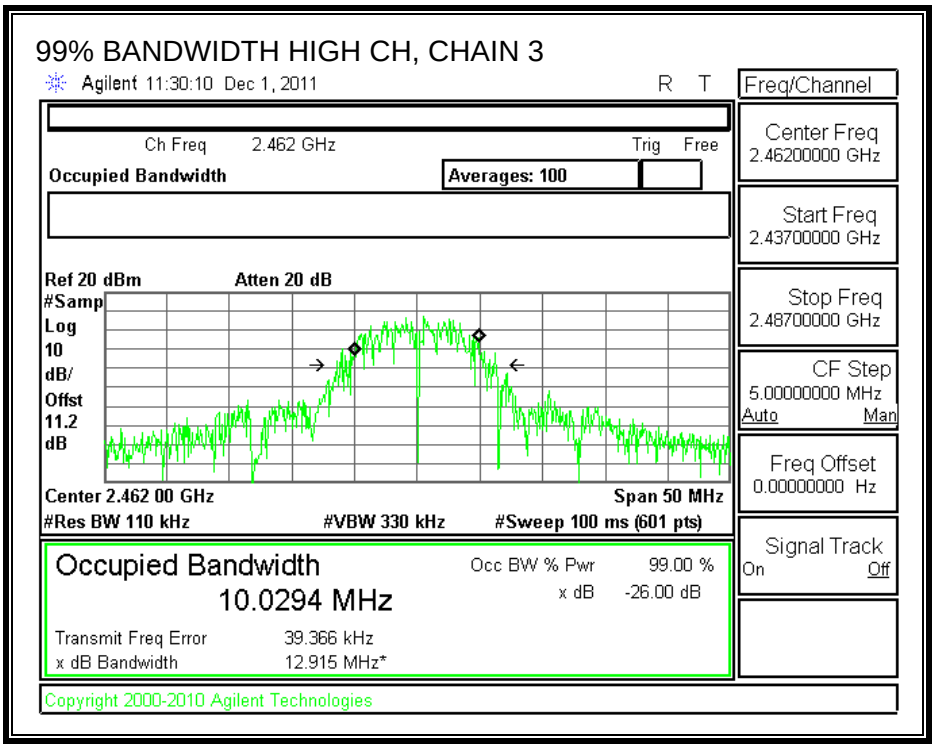




99% BANDWIDTH, CHAIN 3







7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Antenna Gain (Chain 1) (dBi)	Antenna Gain (Chain 2) (dBi)	Antenna Gain (Chain 3) (dBi)	Effective Legacy Gain (dBi)
1.42	4.97	3.93	8.45

The maximum effective legacy gain is 8.45 dBi for other than fixed, point-to-point operations, therefore the limit is 27.55 dBm.

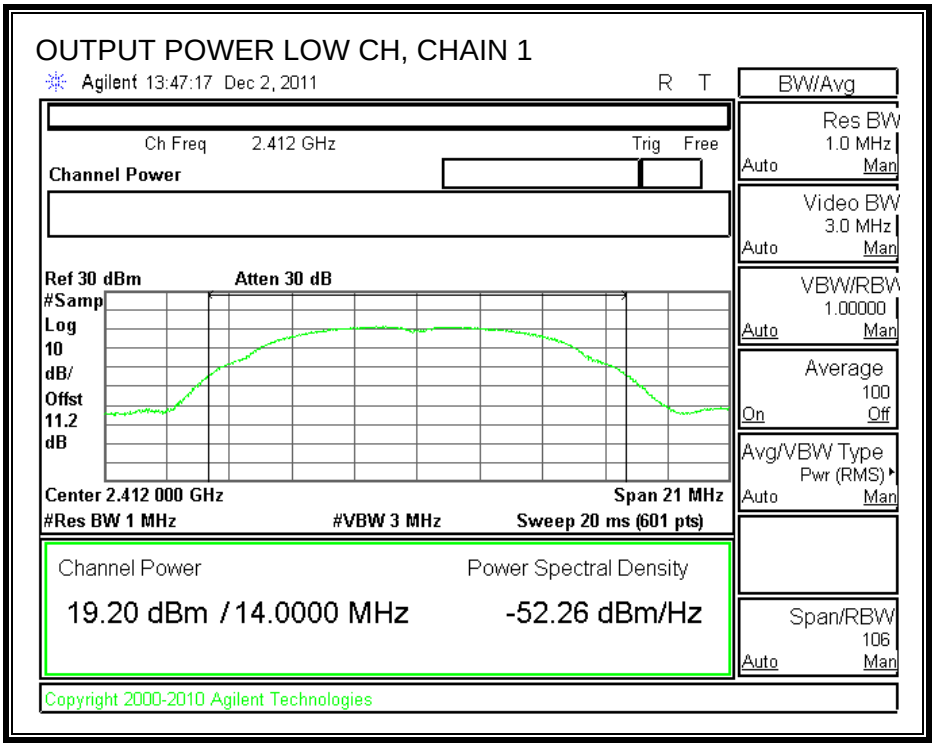
TEST PROCEDURE

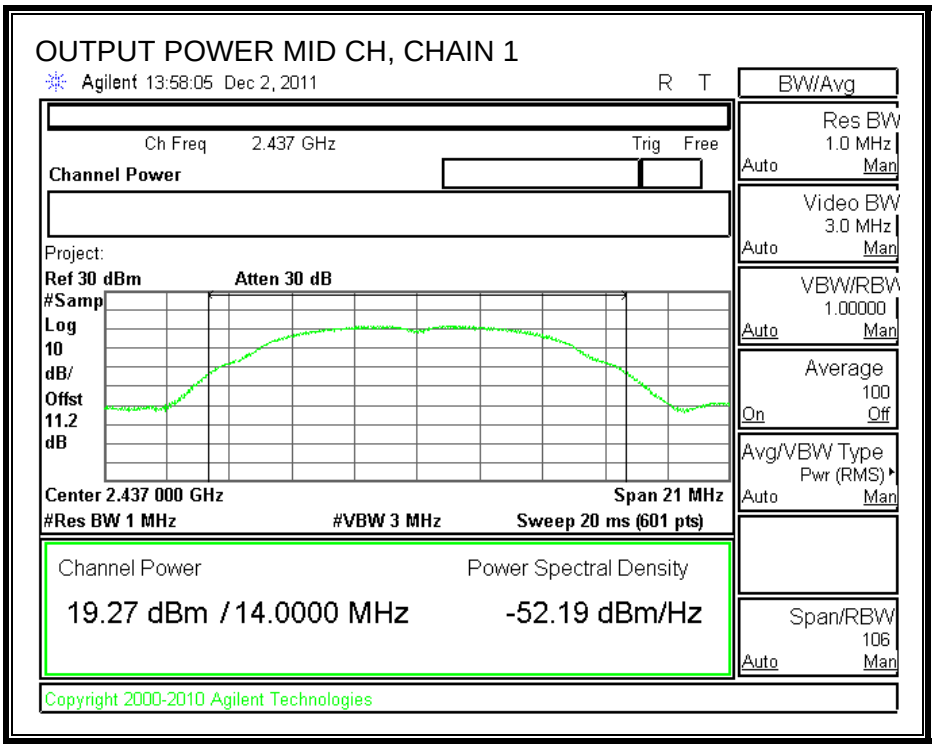
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

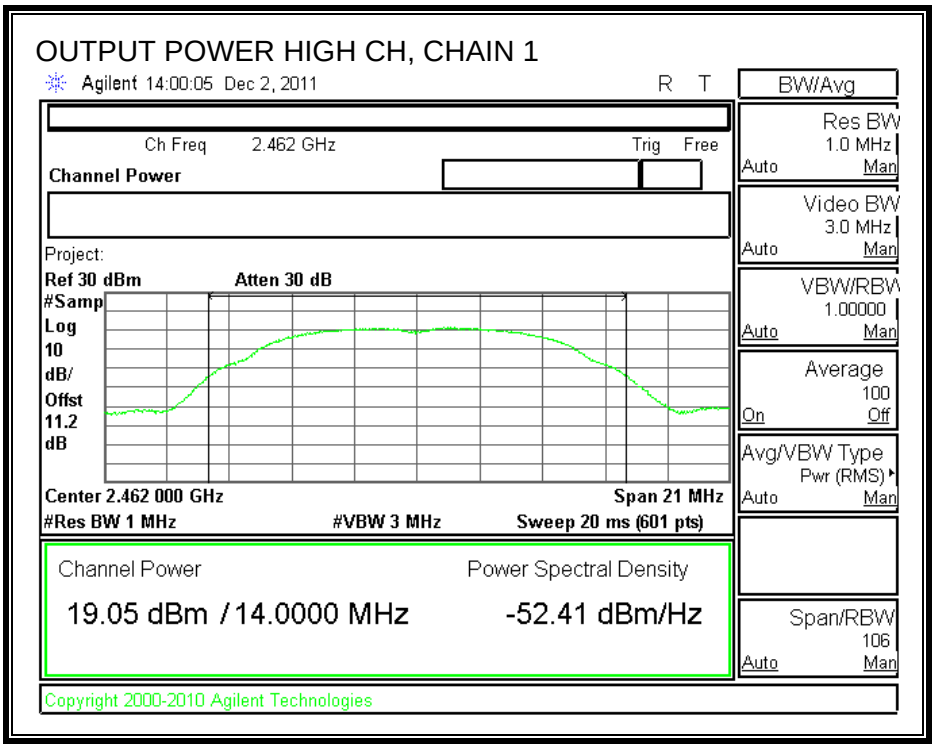
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.20	18.76	18.52	23.61	27.55	-3.94
Mid	2437	19.27	18.76	18.95	23.77	27.55	-3.78
High	2462	19.05	18.65	18.80	23.61	27.55	-3.94

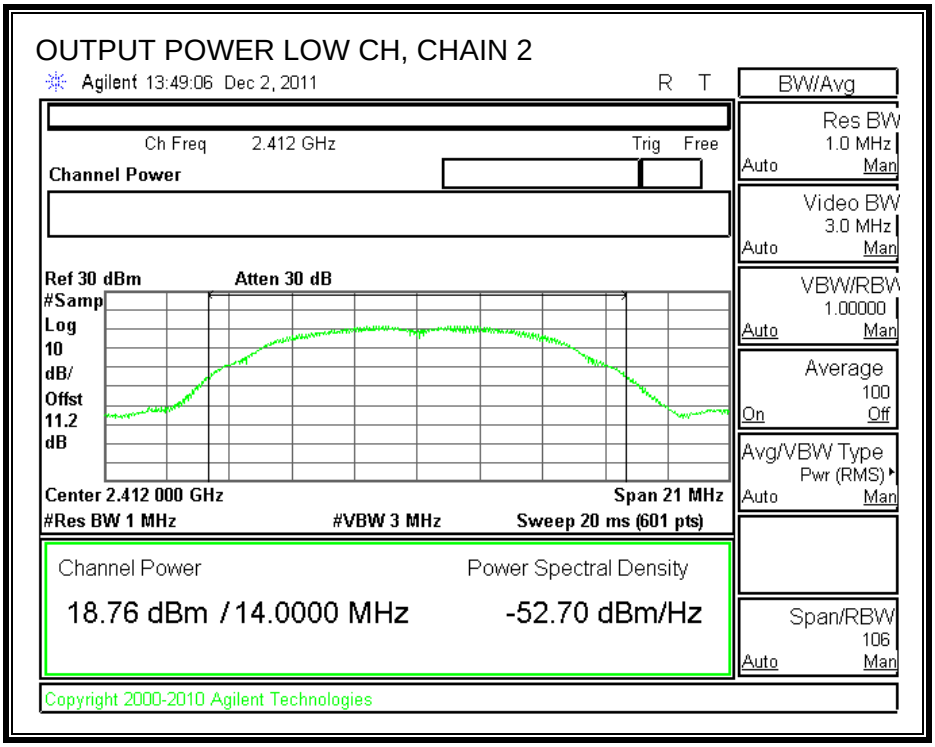
CHAIN 1 OUTPUT POWER

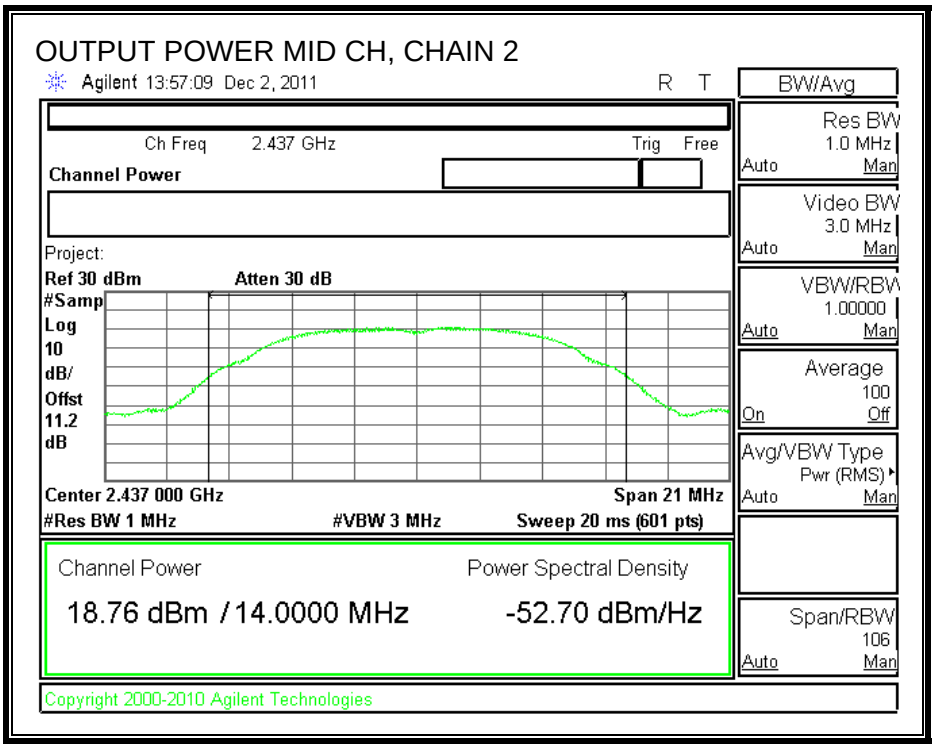


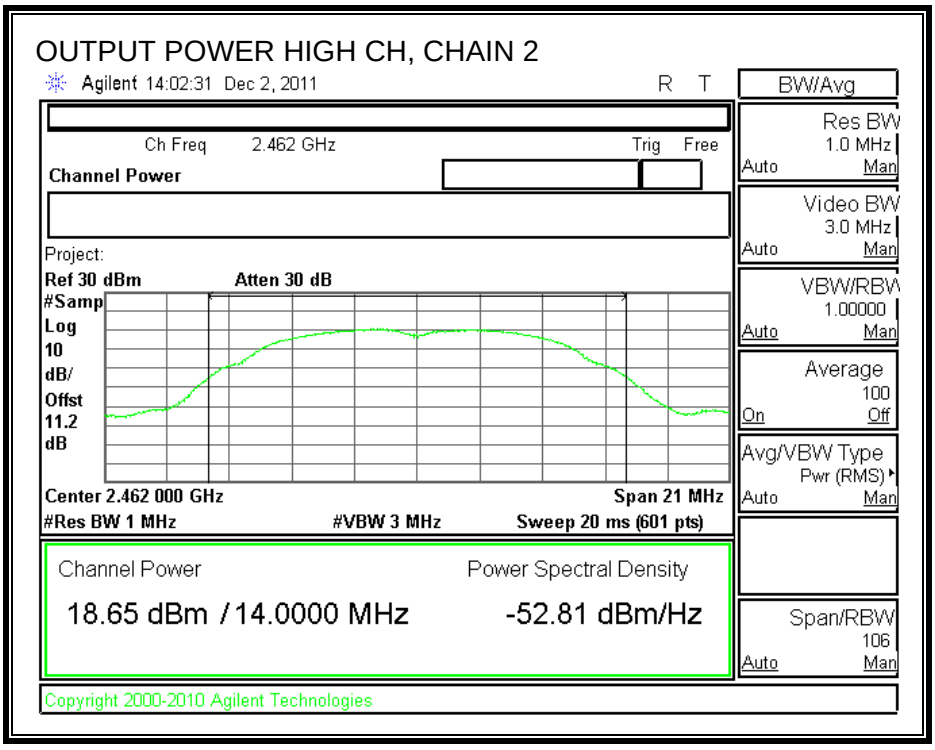




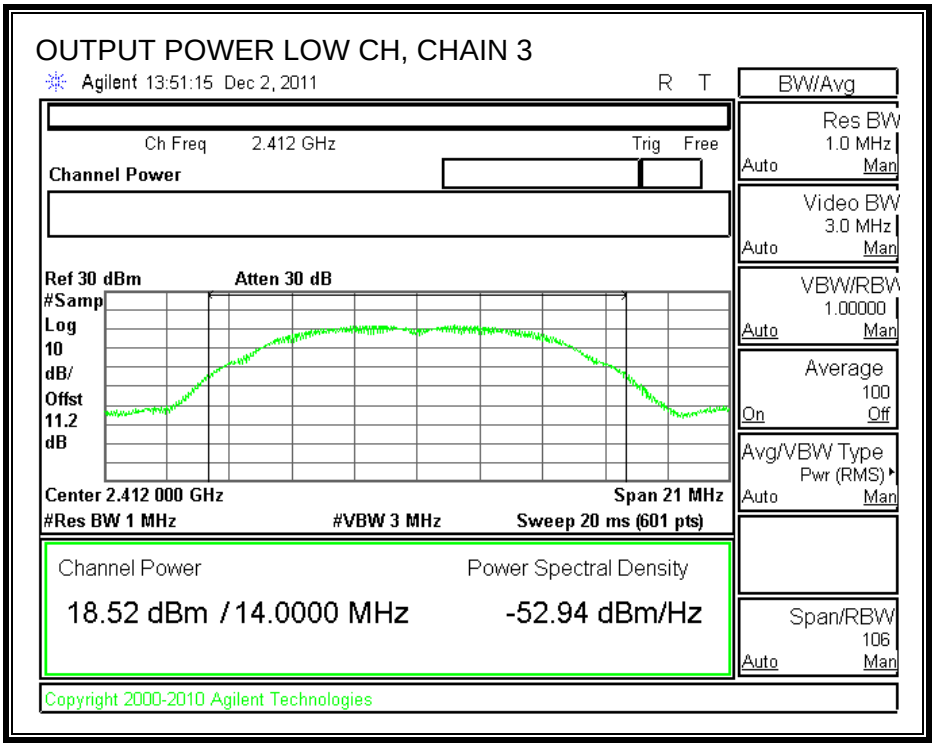
CHAIN 2 OUTPUT POWER

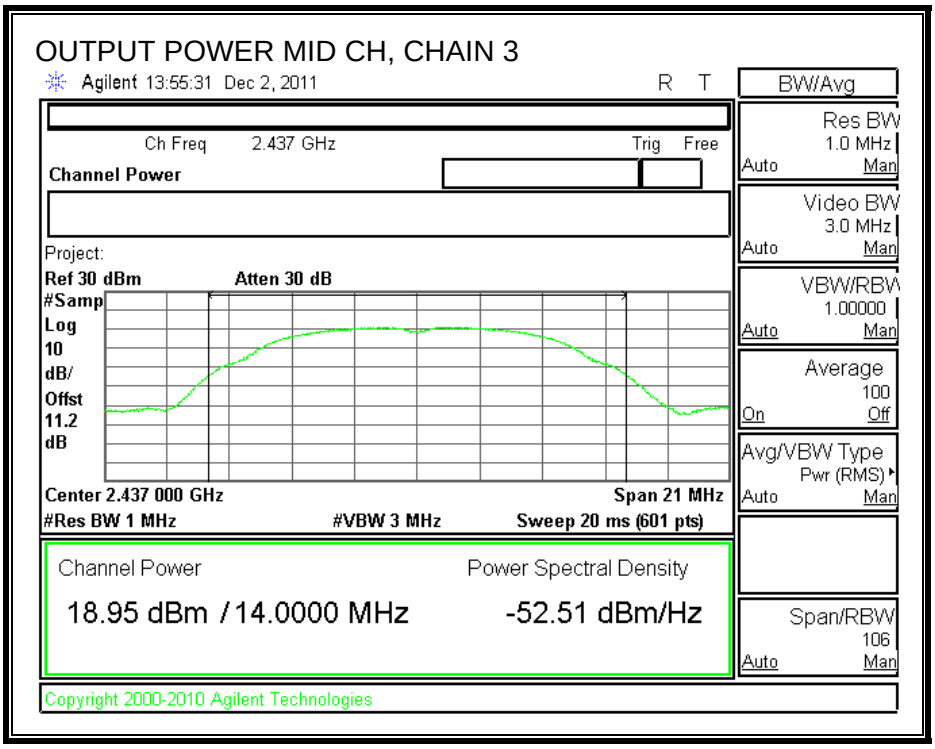


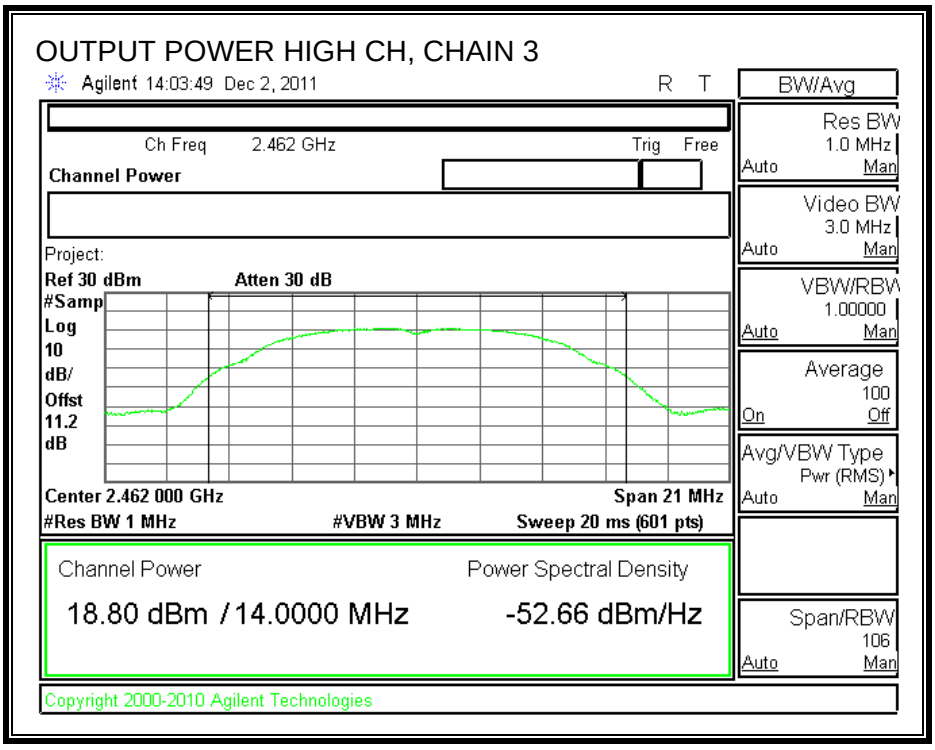




CHAIN 3 OUTPUT POWER







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 11.18 dB (including 10 dB pad and 1.18 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)	Chain 3 Power (dBm)	Total Power (dBm)
Low	2412	19.01	18.44	18.57	23.45
Middle	2437	19.05	18.61	18.75	23.58
High	2462	19.03	18.44	18.59	23.47

7.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

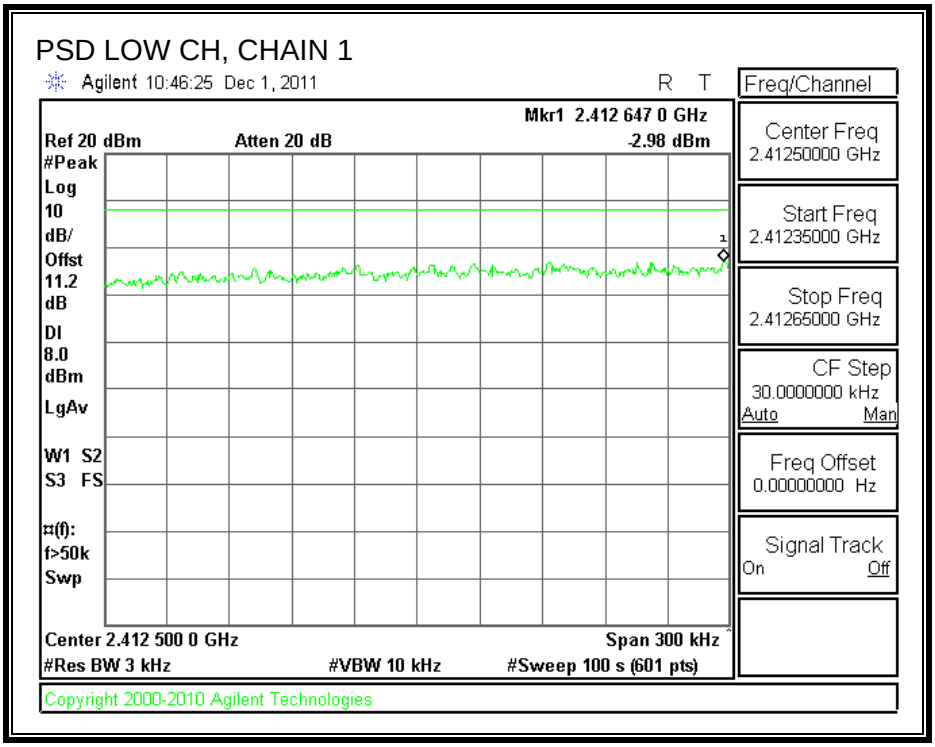
TEST PROCEDURE

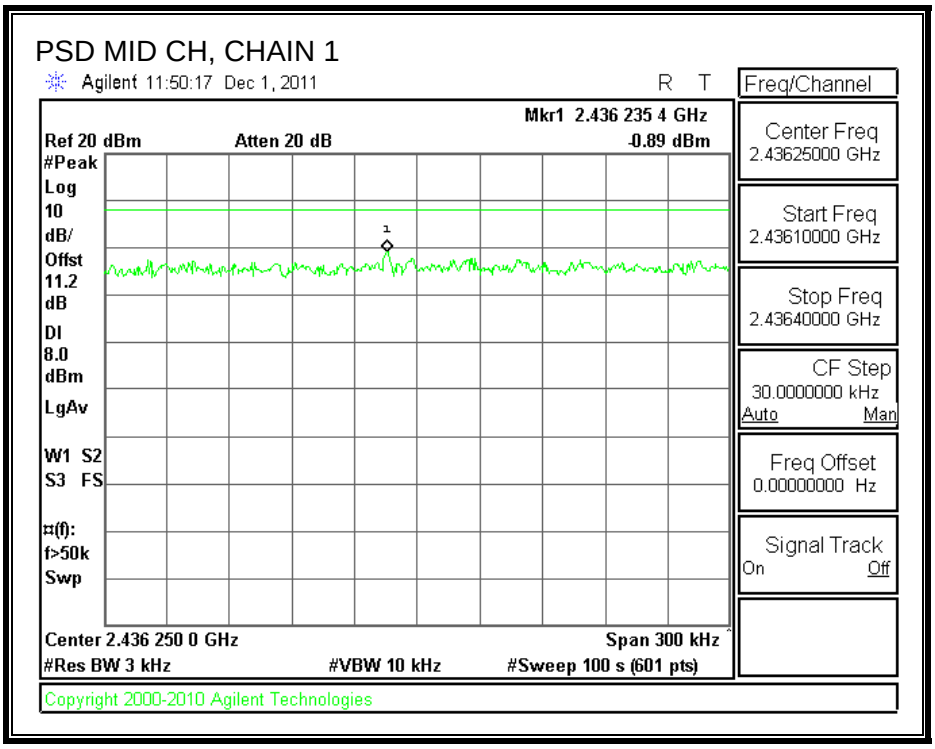
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

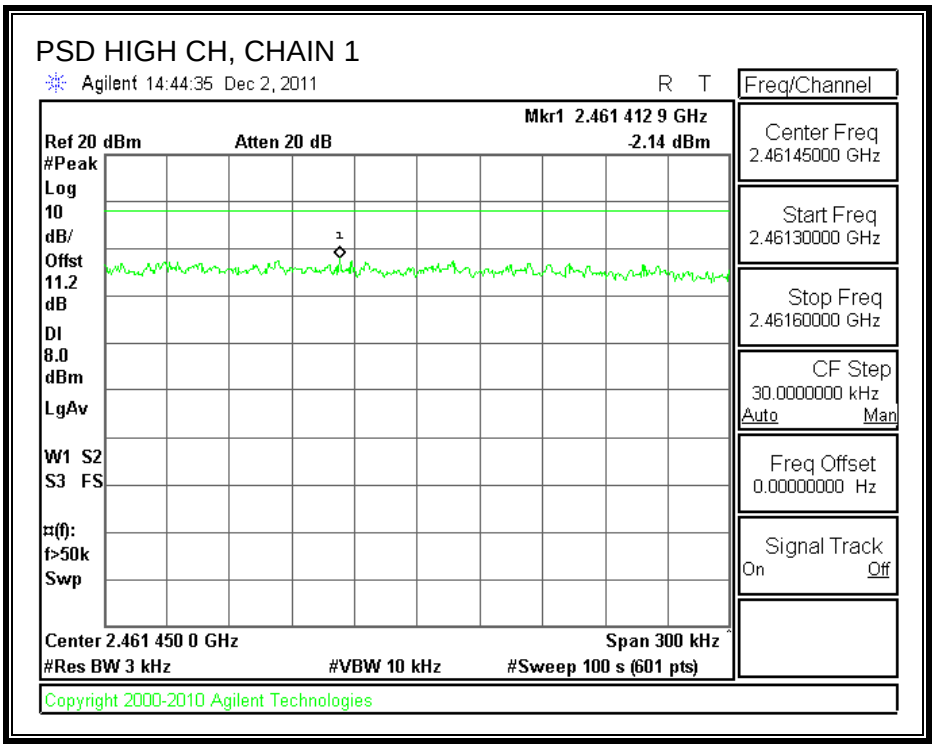
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-2.98	-4.22	-2.73	1.51	8	-6.49
Middle	2437	-0.89	-1.38	-1.24	3.61	8	-4.39
High	2462	-2.14	-2.85	-3.06	2.11	8	-5.89

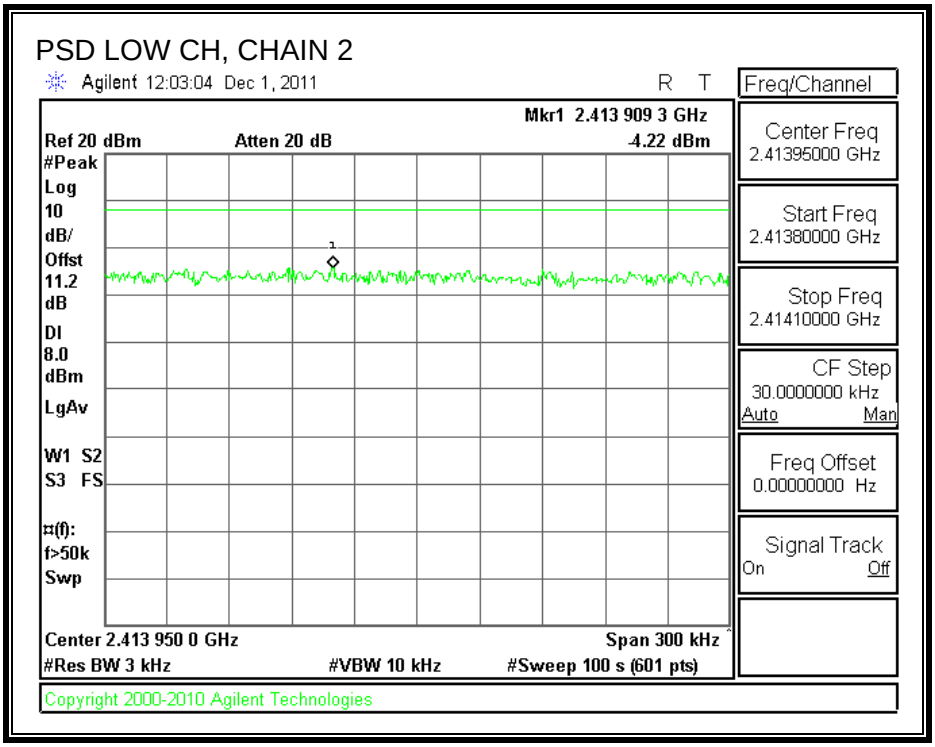
POWER SPECTRAL DENSITY, CHAIN 1

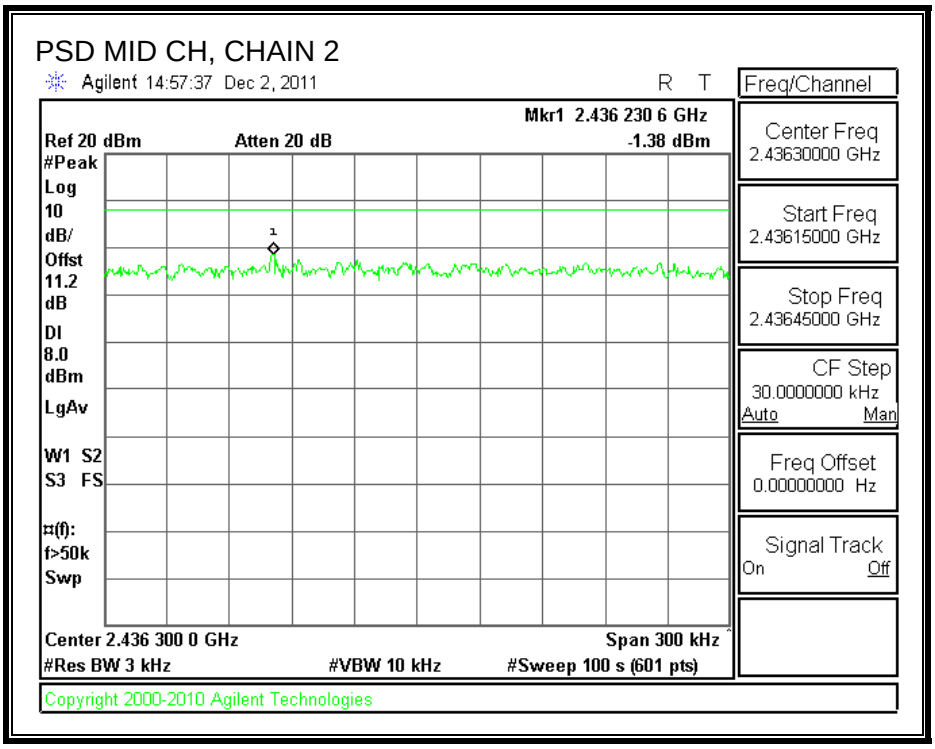


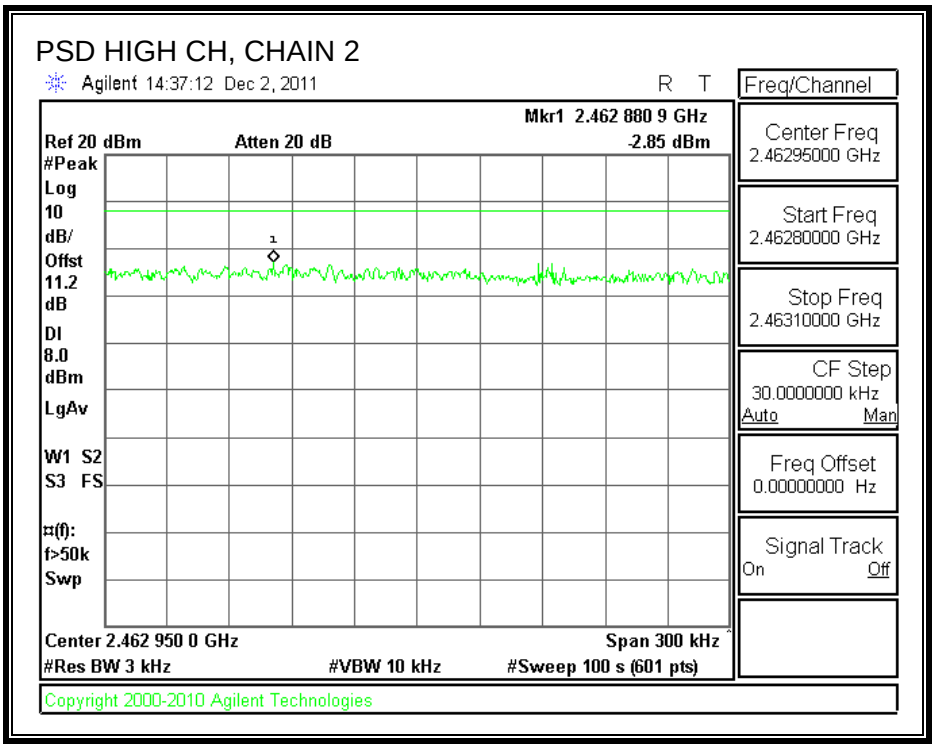




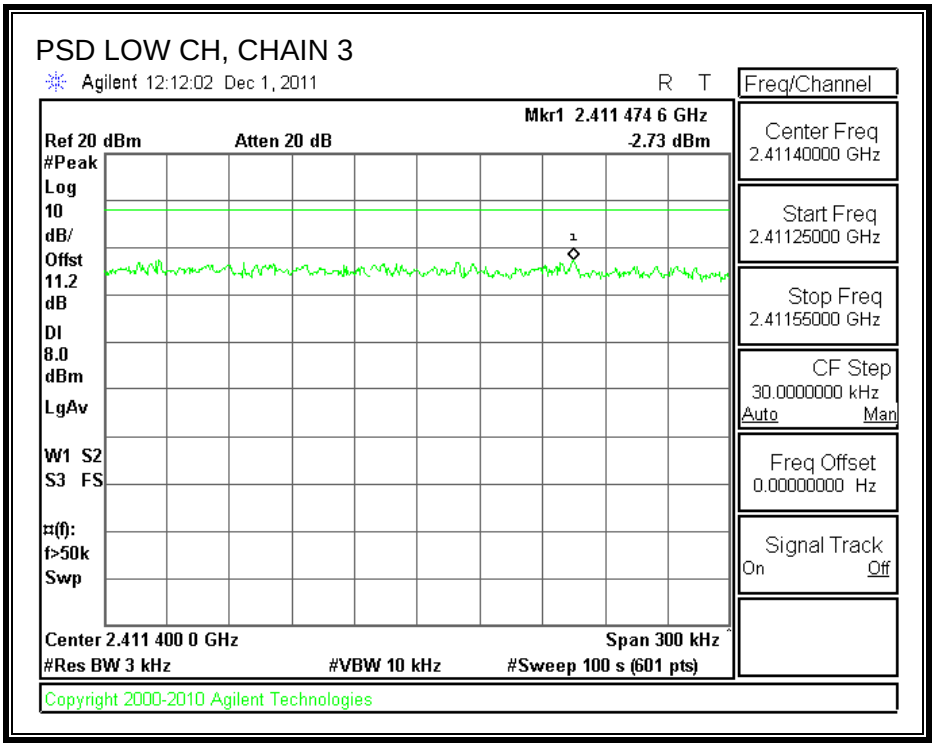
POWER SPECTRAL DENSITY, CHAIN 2

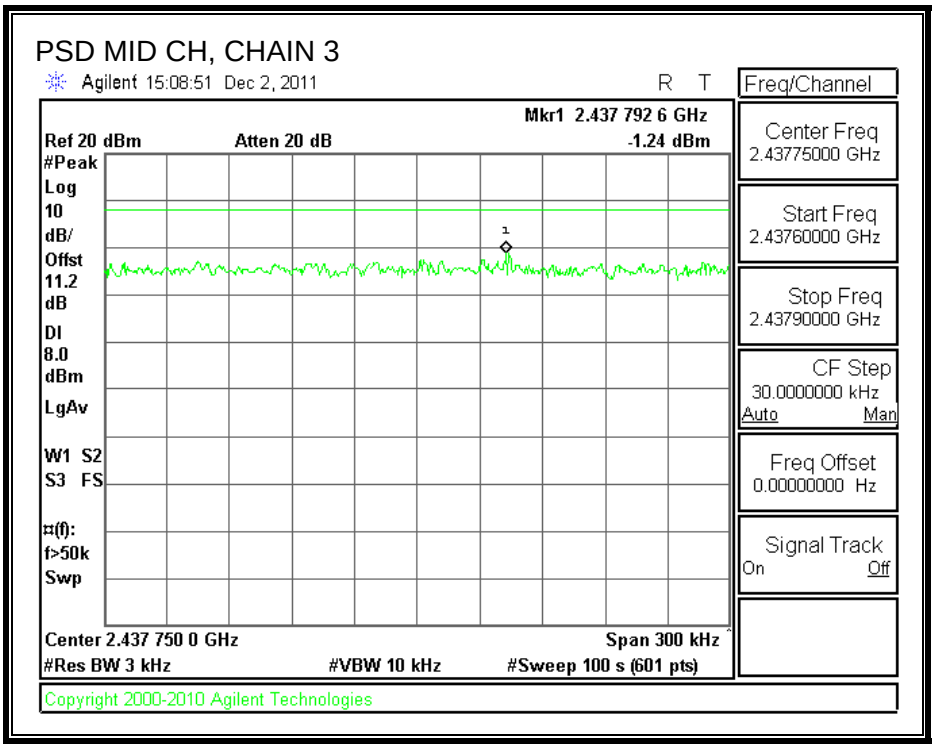


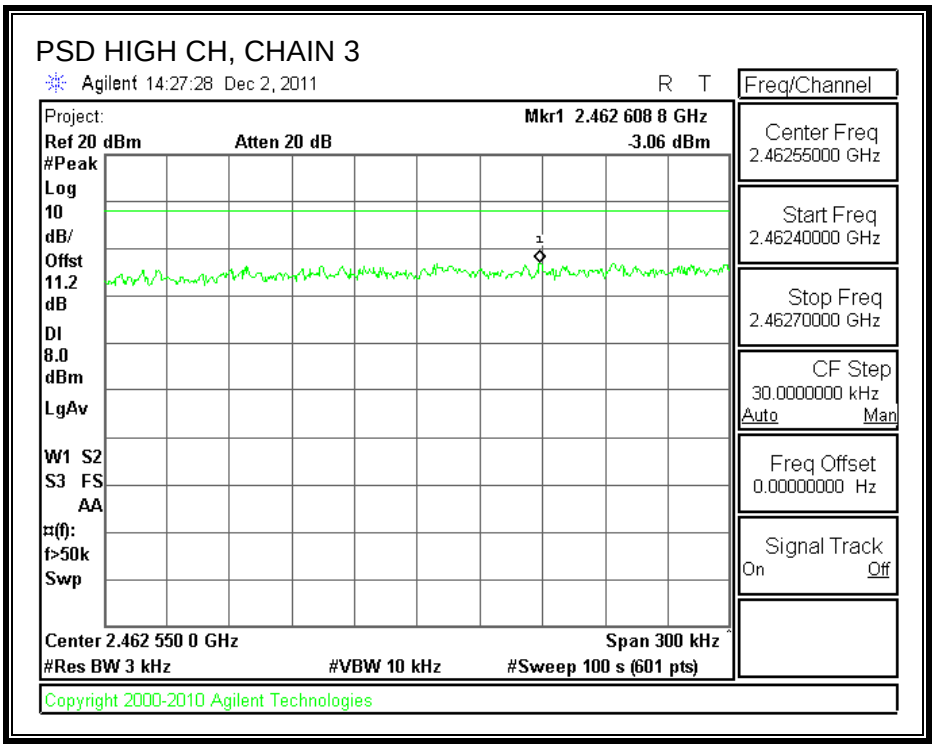




POWER SPECTRAL DENSITY, CHAIN 3







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.

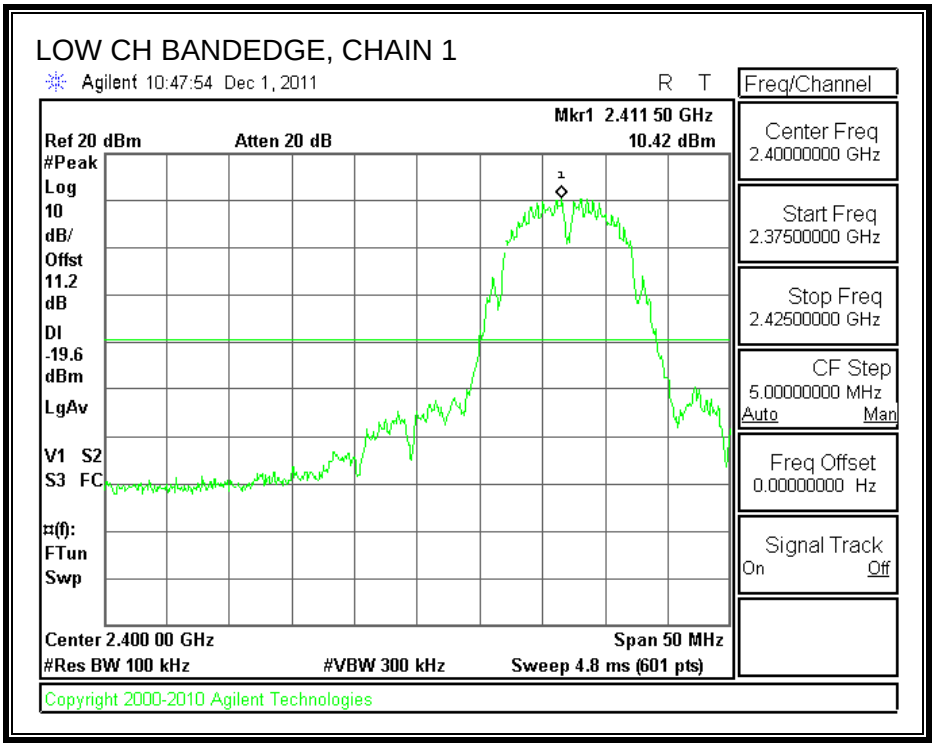
TEST PROCEDURE

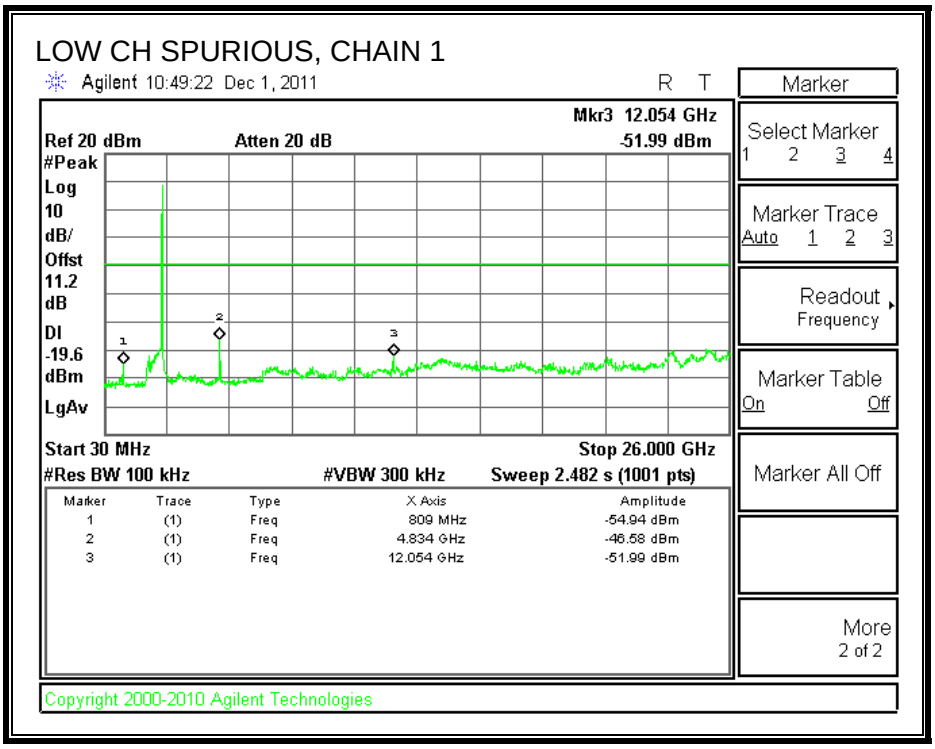
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

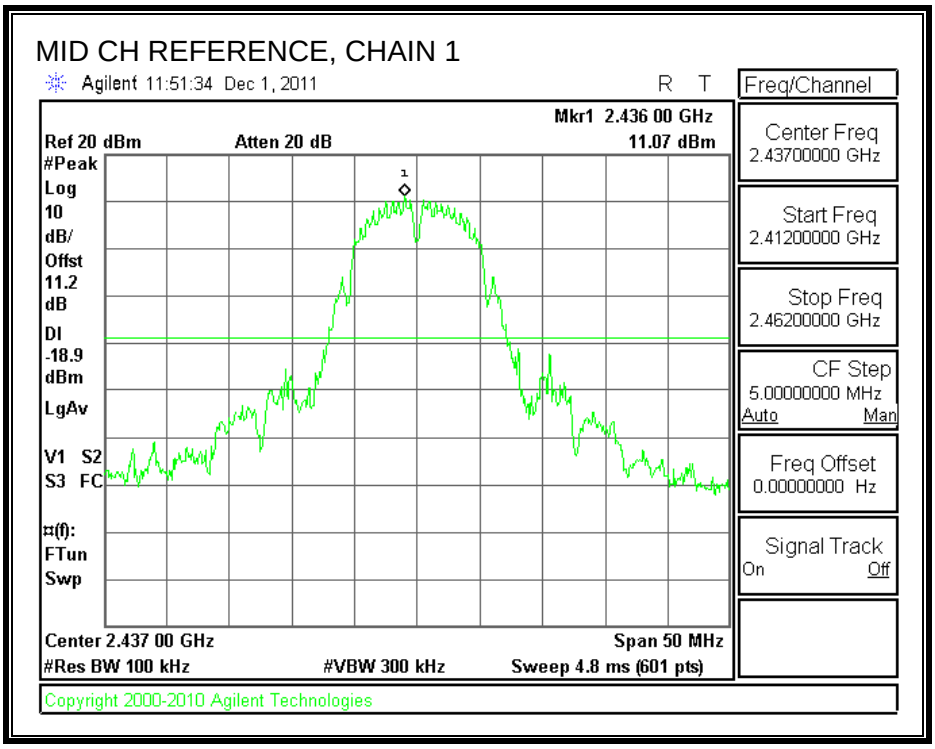
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

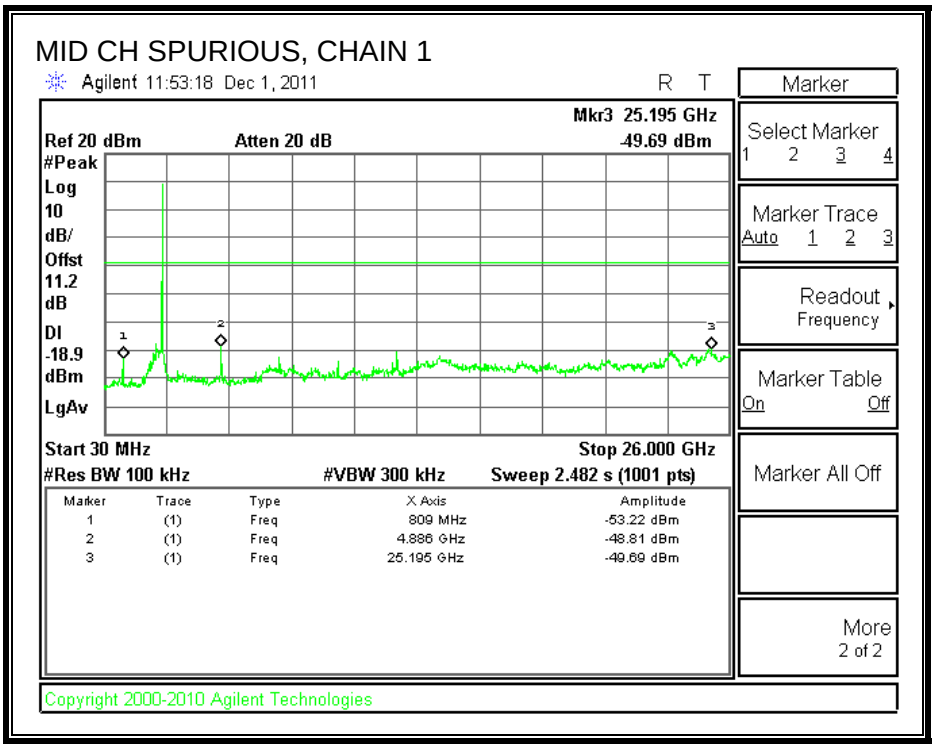
RESULTS

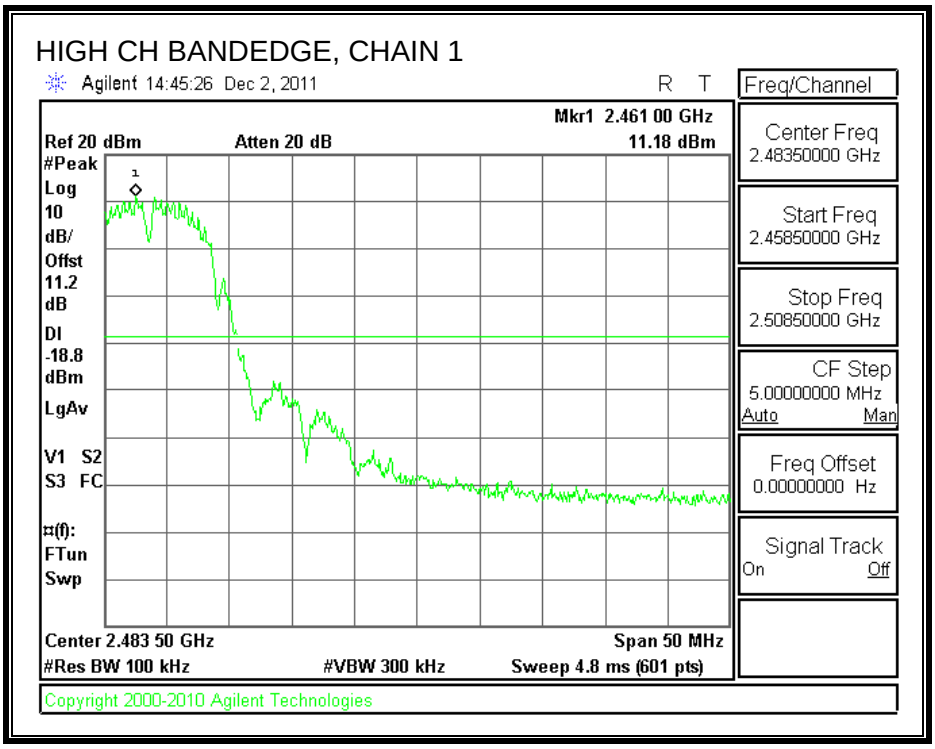
CHAIN 1 SPURIOUS EMISSIONS

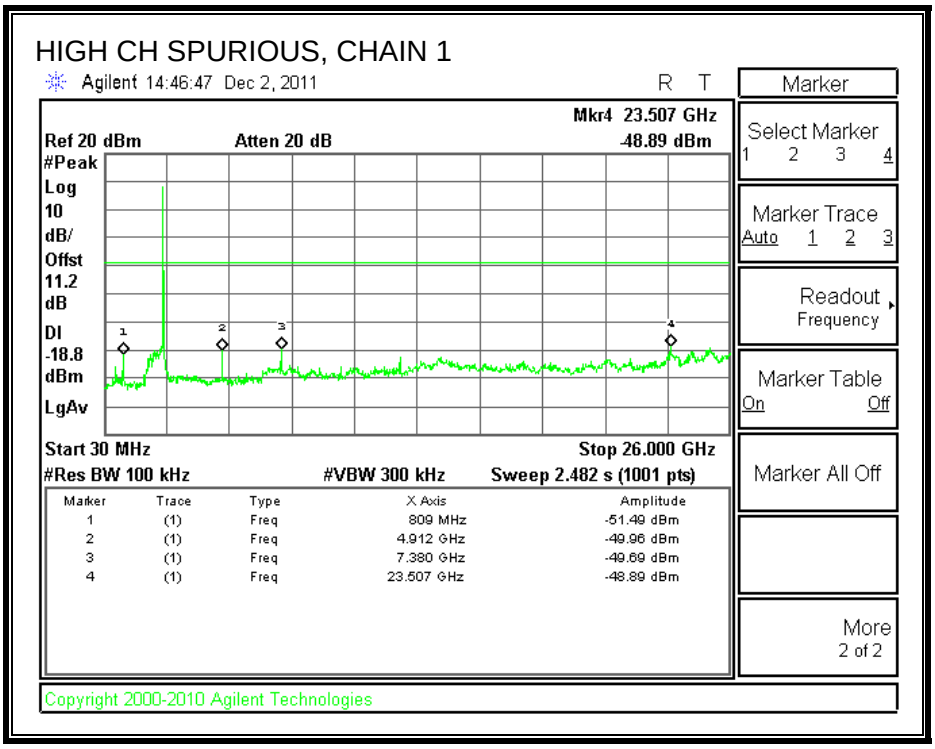




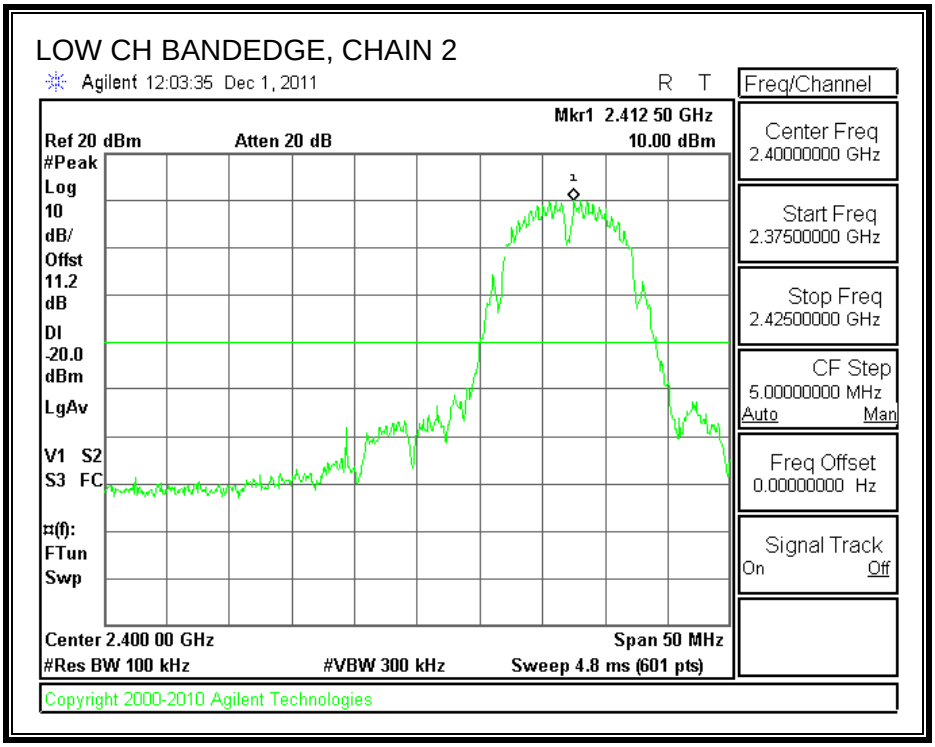


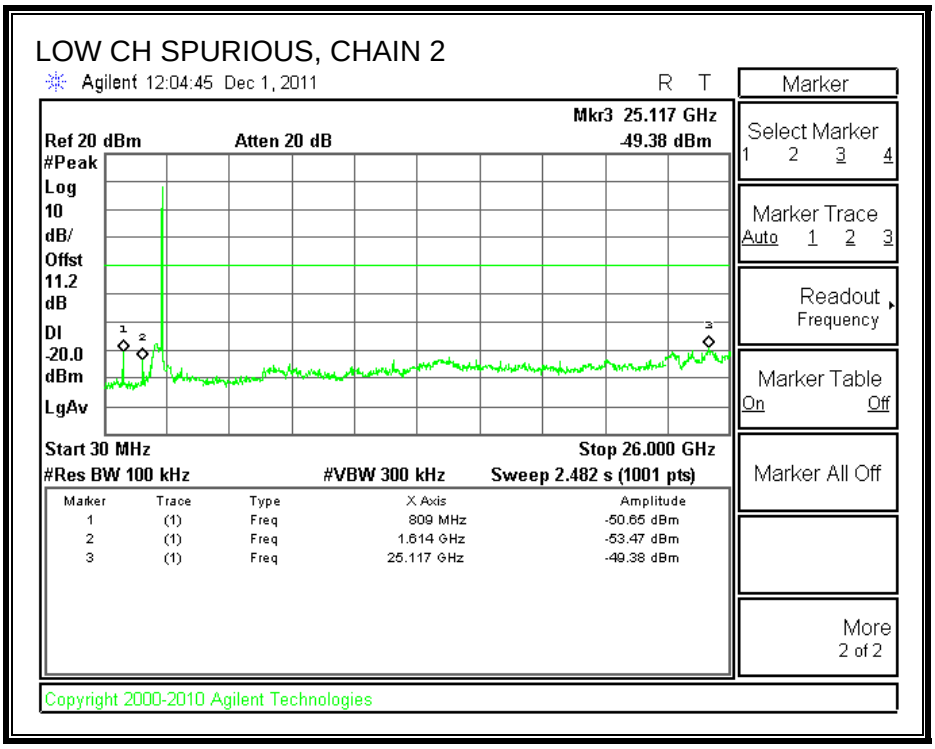


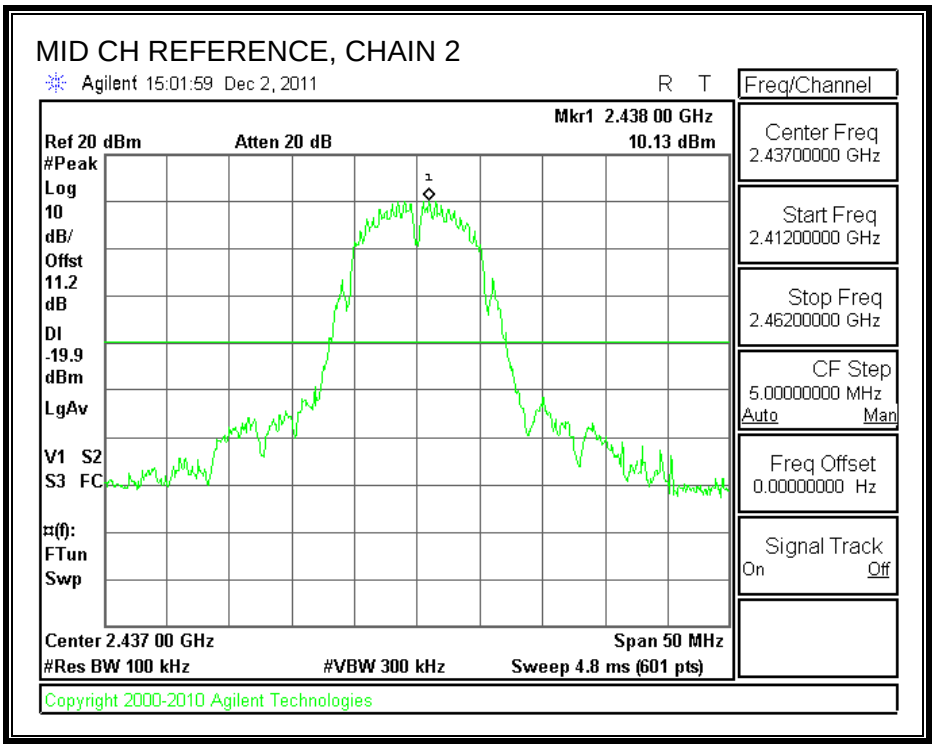


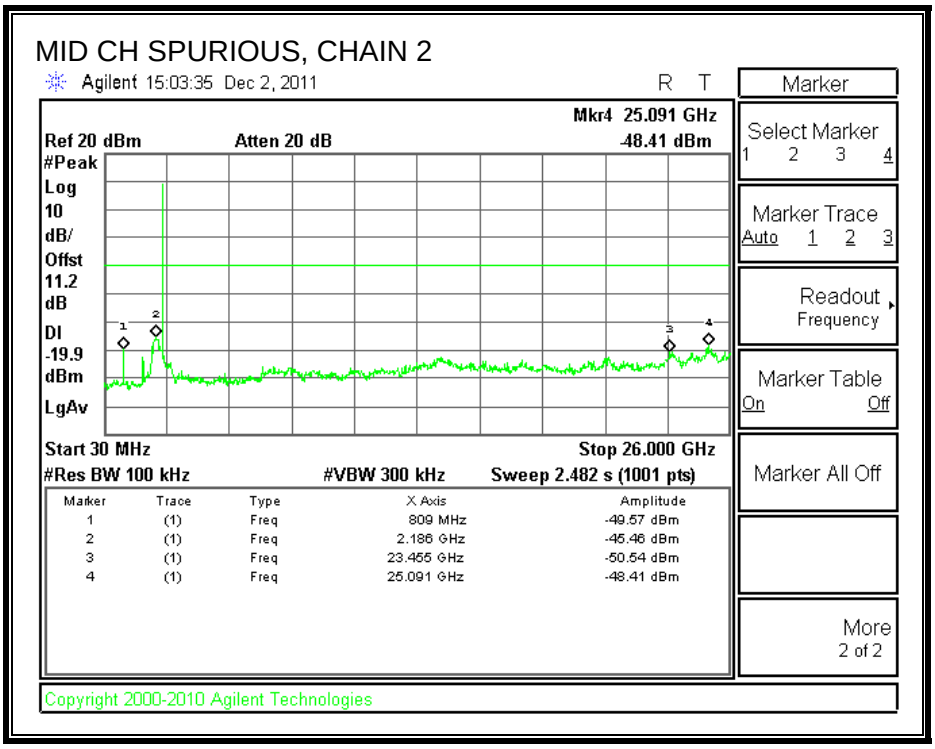


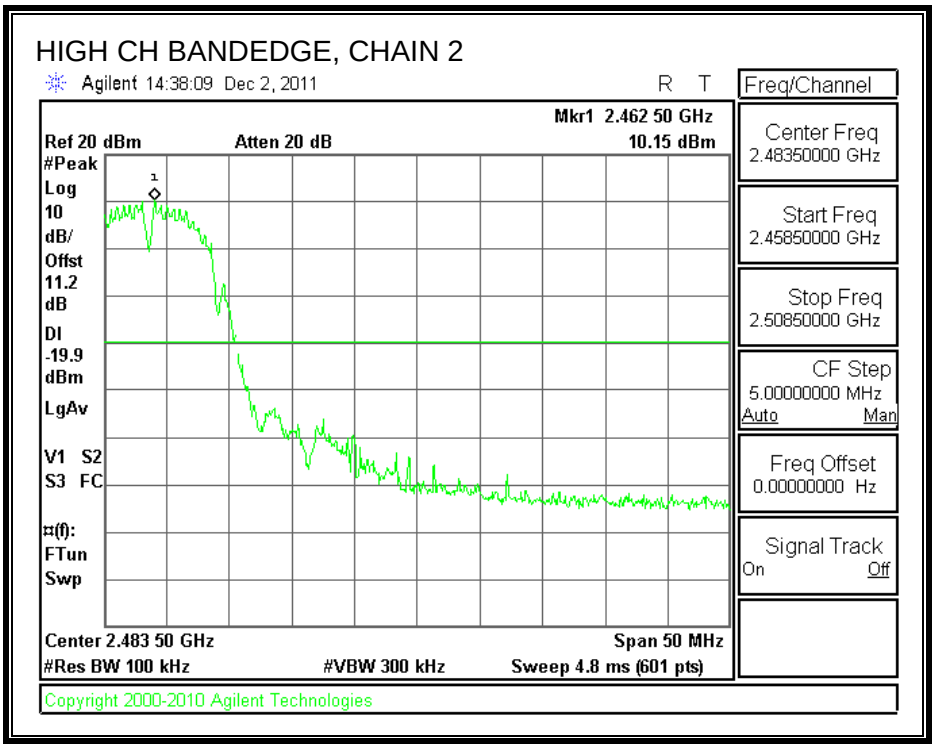
CHAIN 2 SPURIOUS EMISSIONS

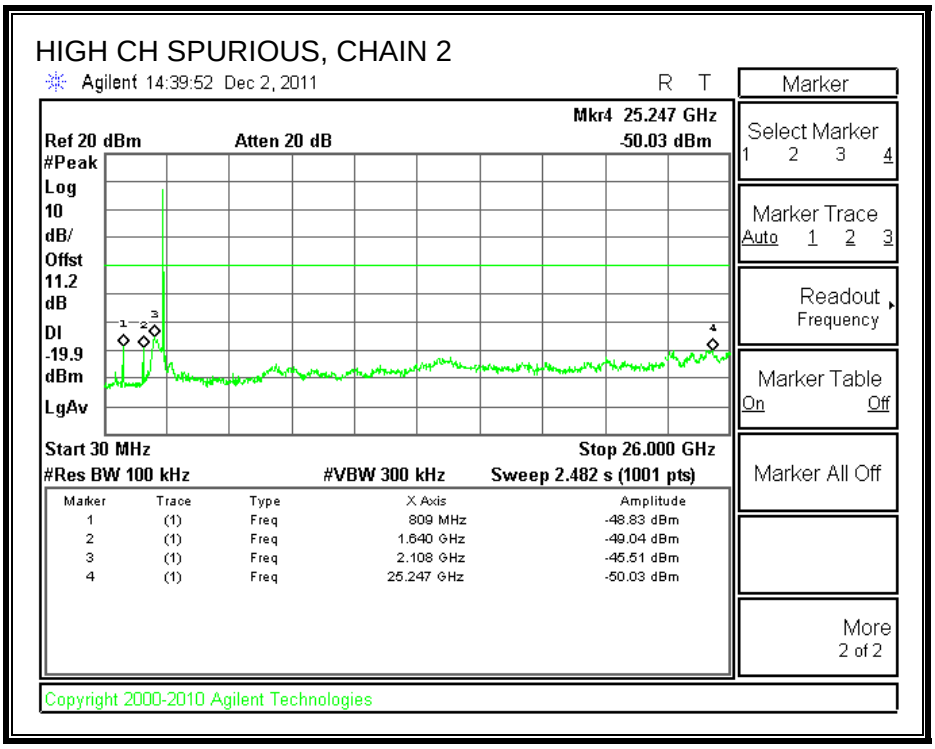




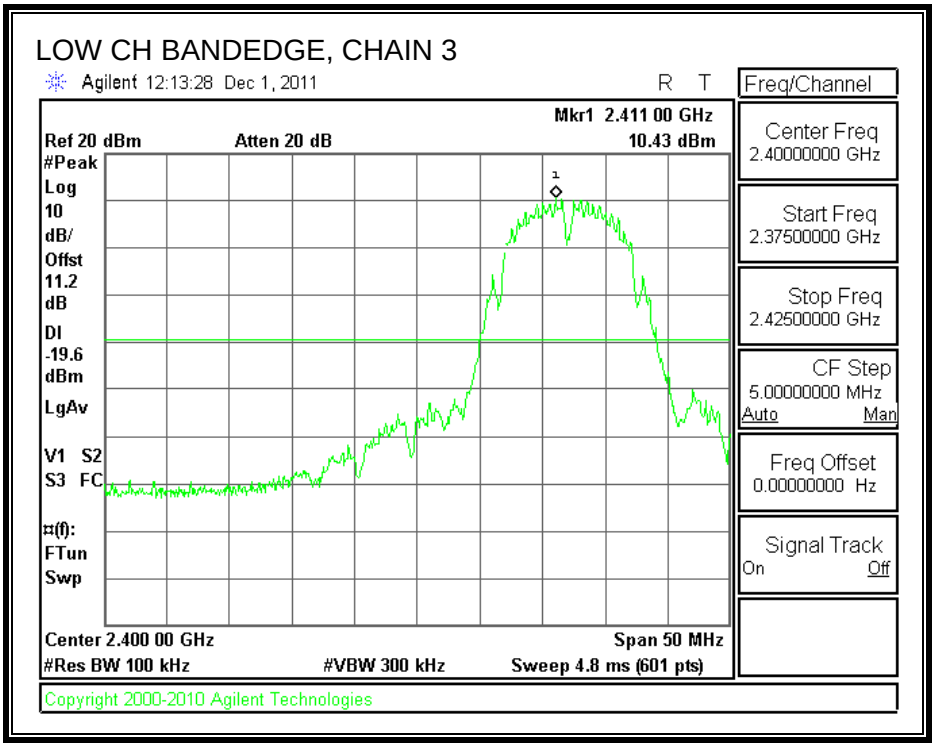


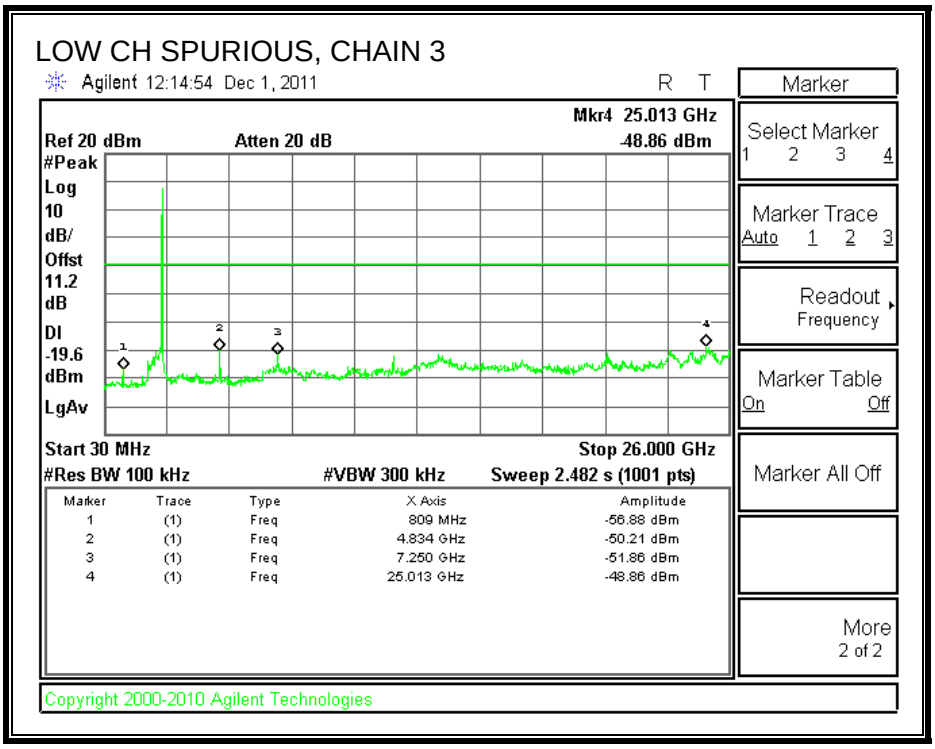


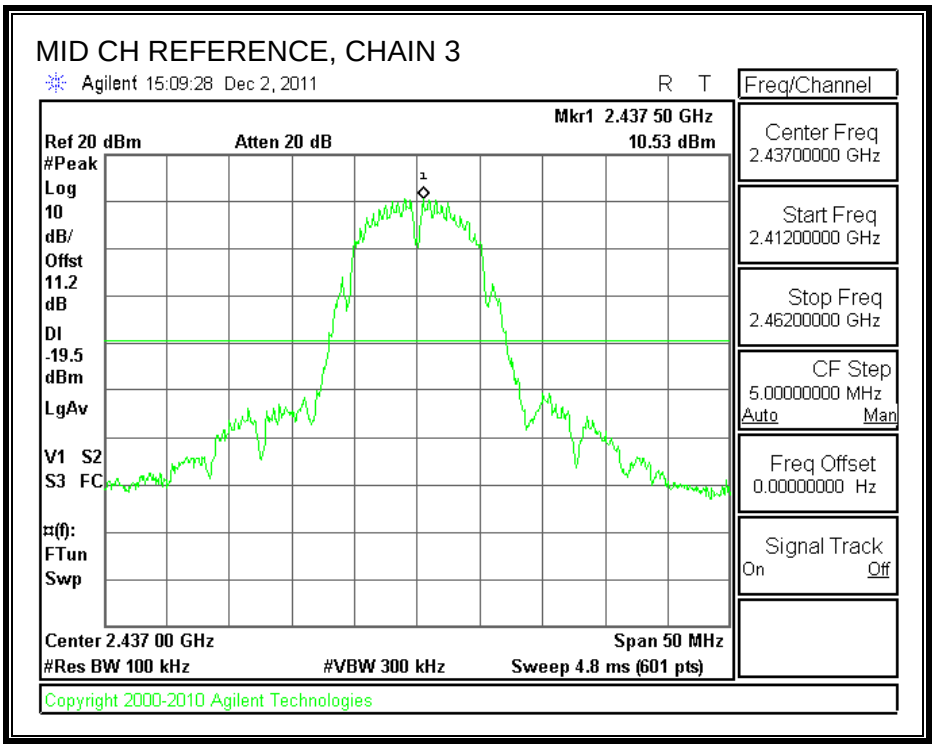


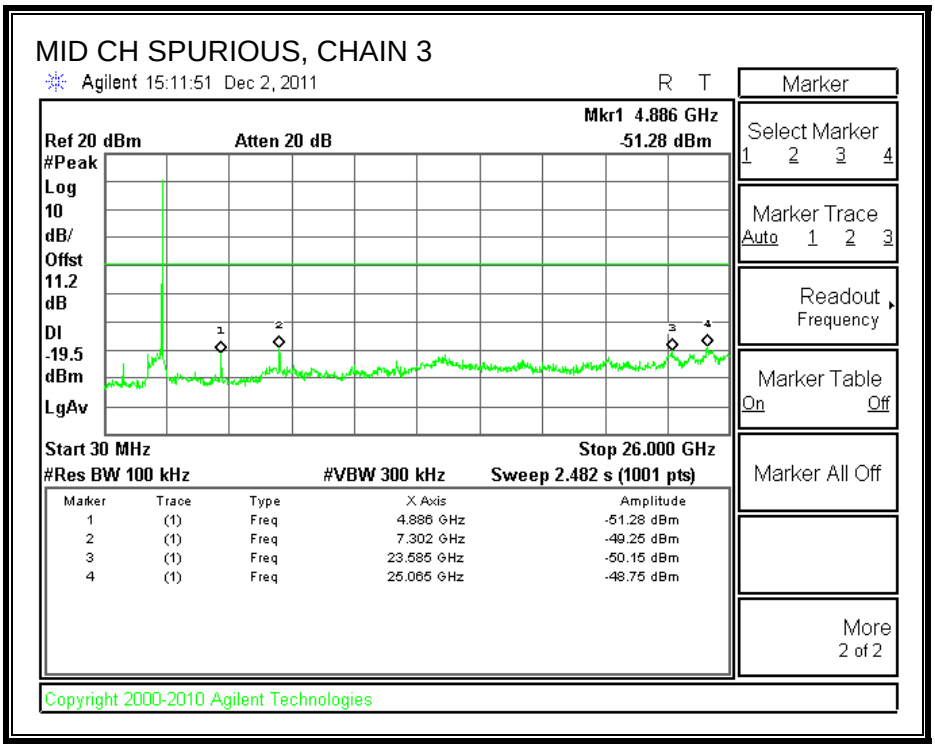


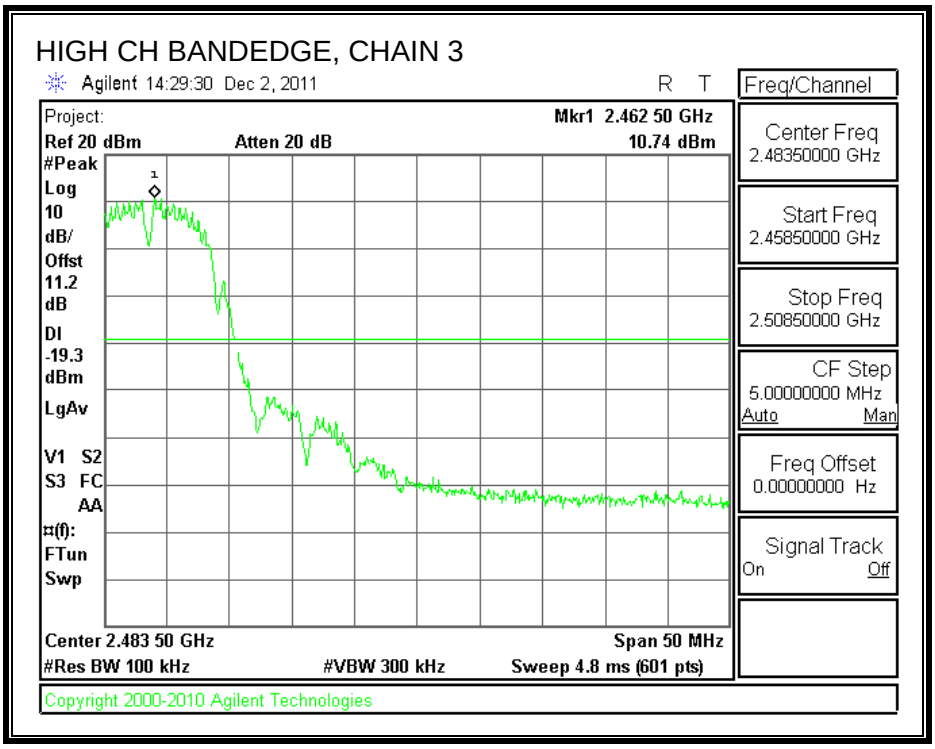
CHAIN 3 SPURIOUS EMISSIONS

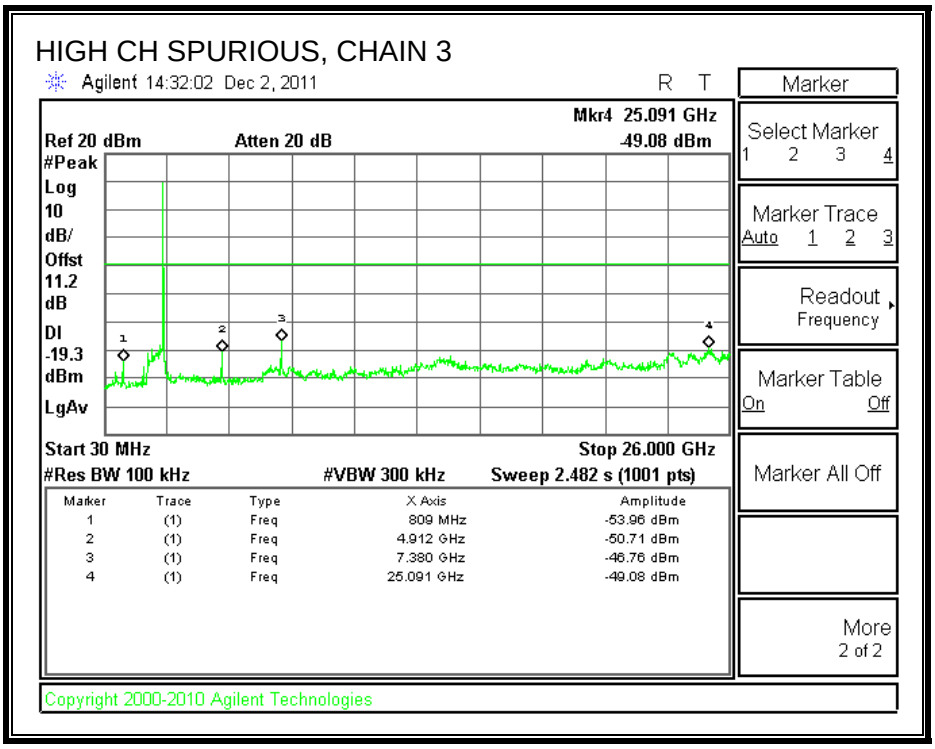












7.3. 802.11n HT20 CDD 3TX MODE IN THE 2.4 GHz BAND

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.

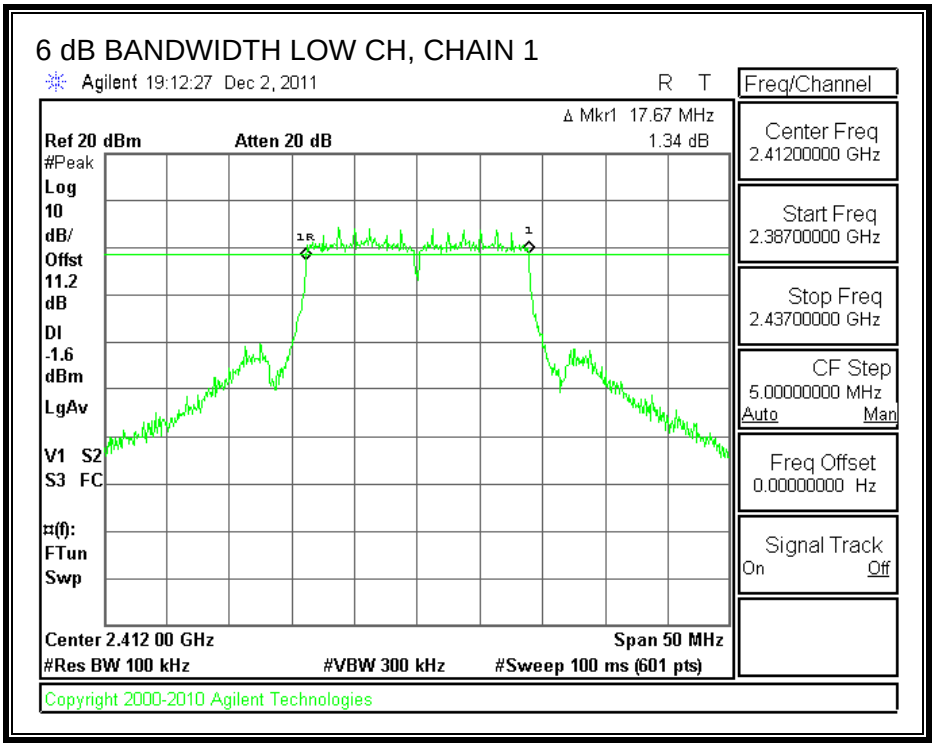
TEST PROCEDURE

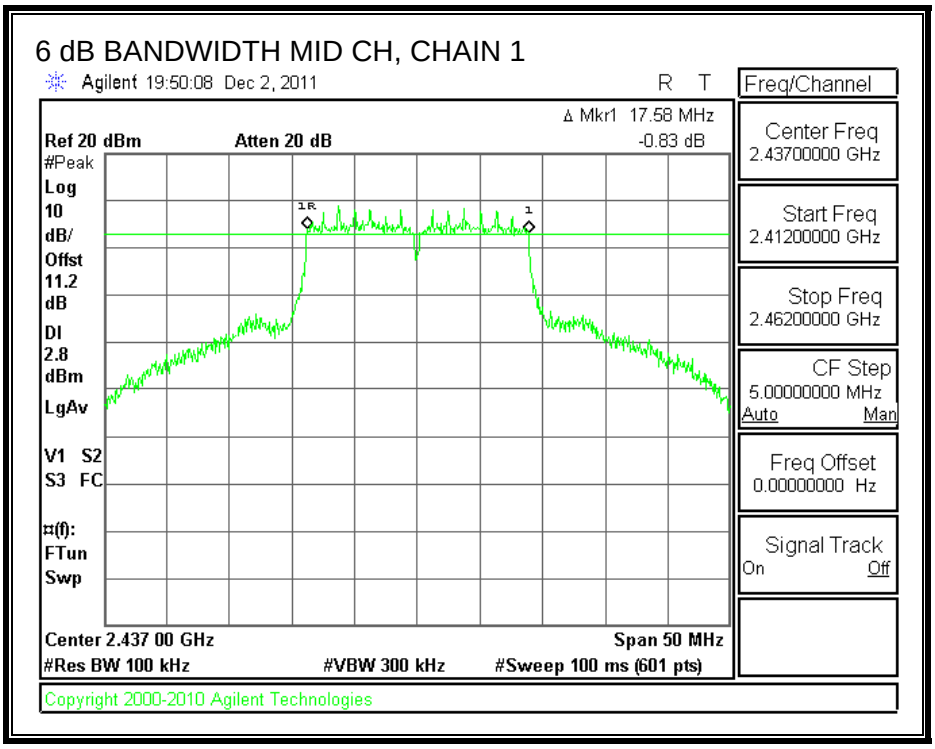
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

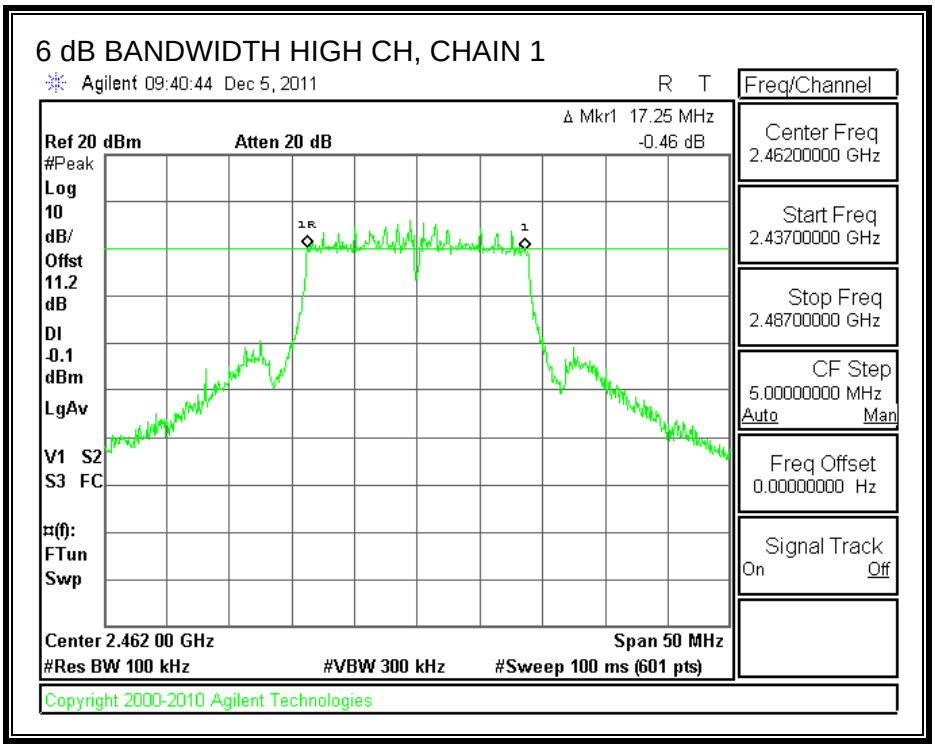
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	2412	17.67	17.67	17.67	0.5
Middle	2437	17.58	17.67	17.67	0.5
High	2462	17.25	16.33	17.00	0.5

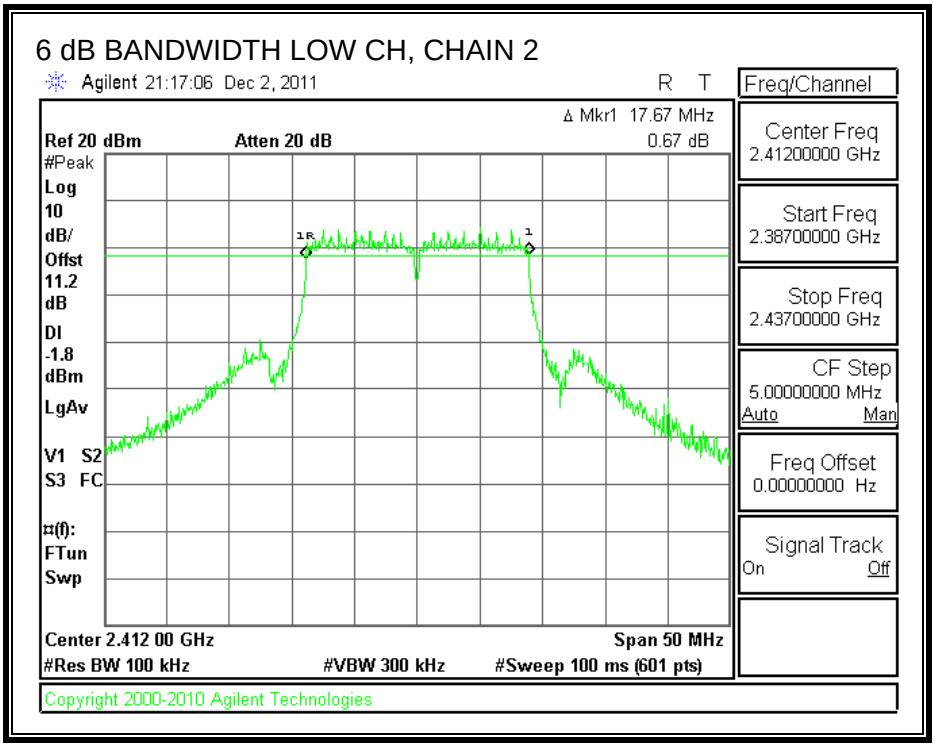
6 dB BANDWIDTH, CHAIN 1

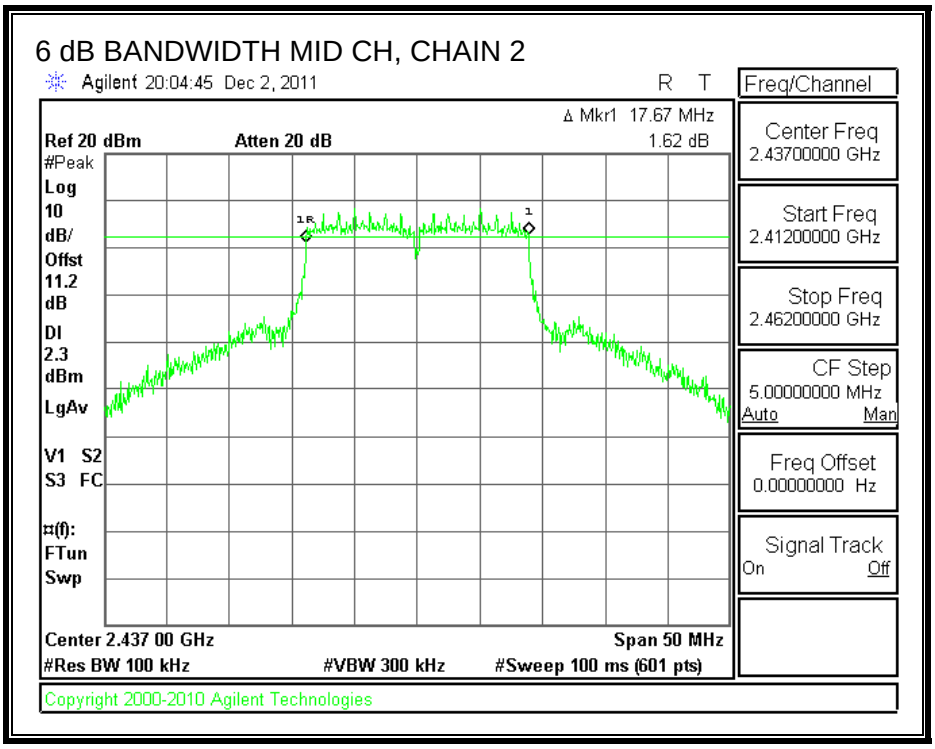


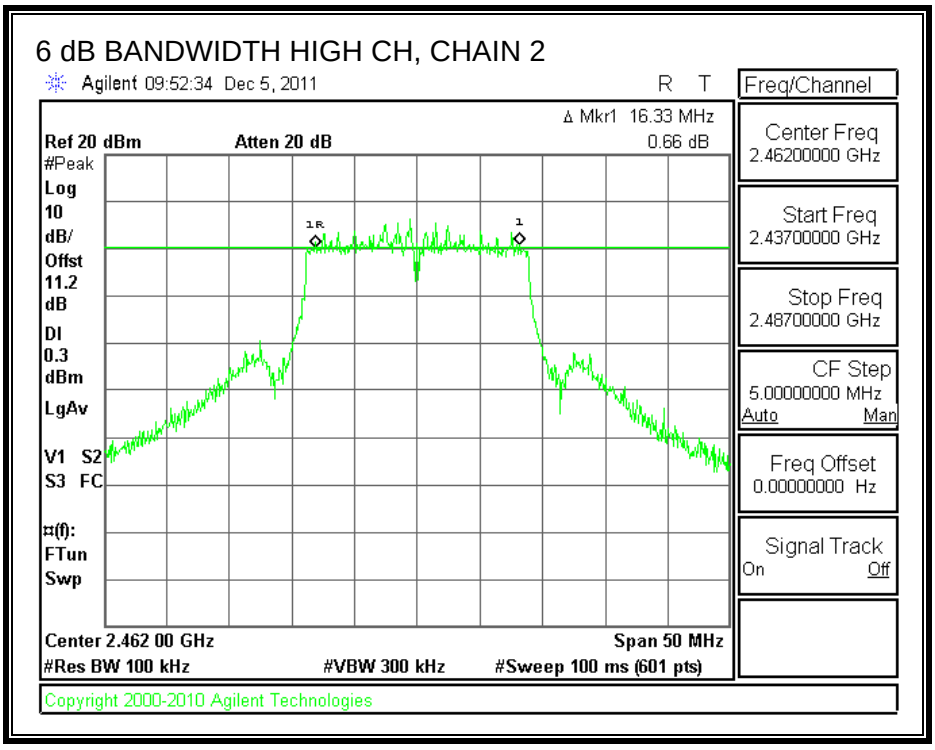




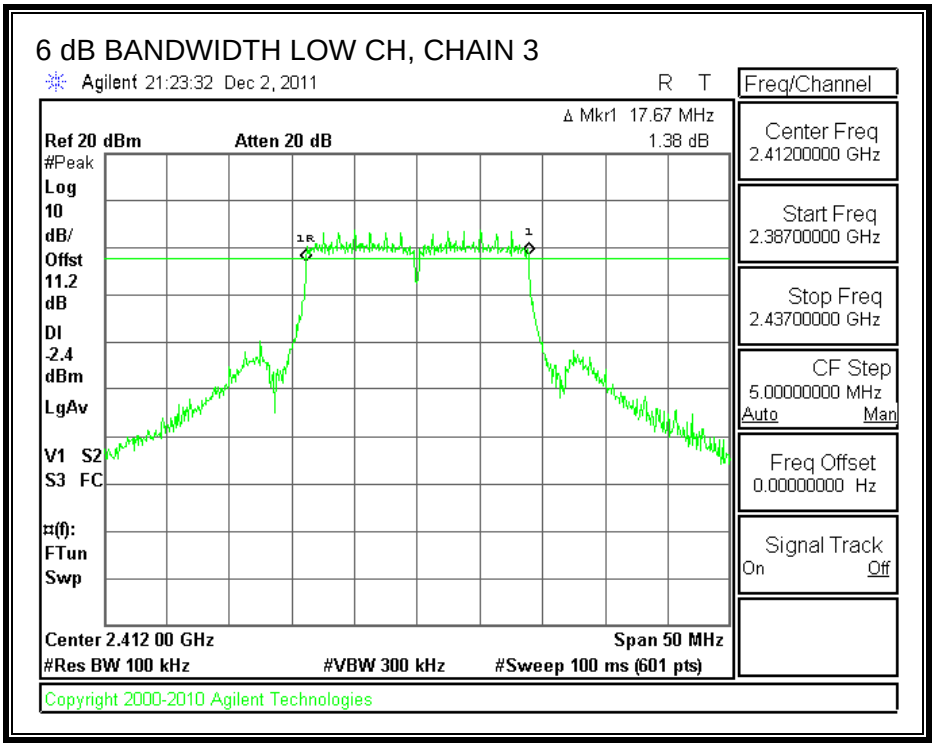
6 dB BANDWIDTH, CHAIN 2

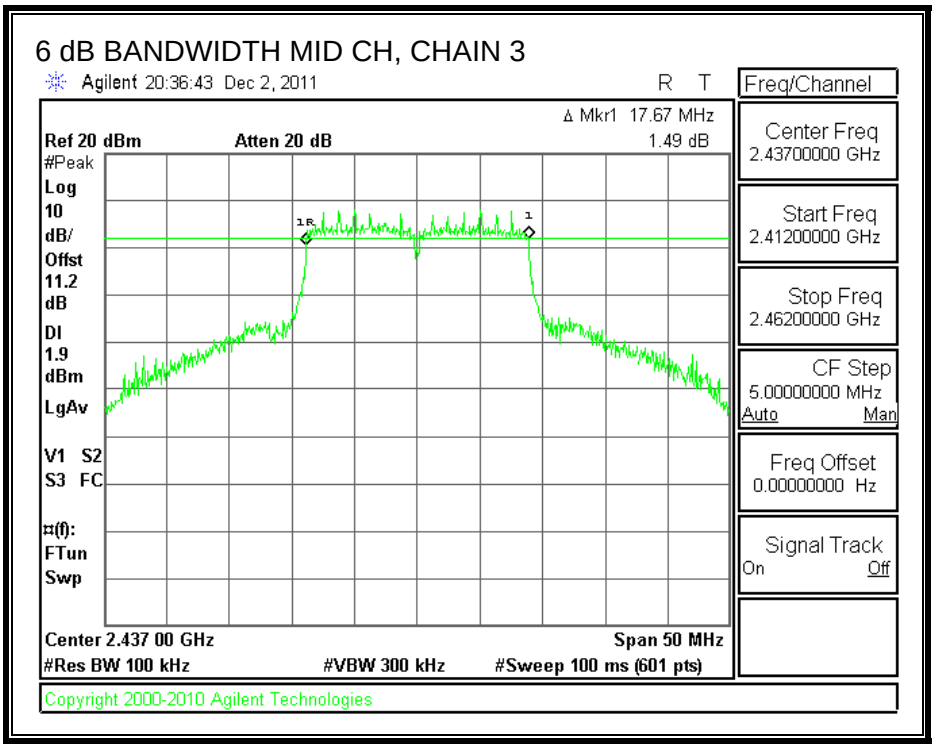


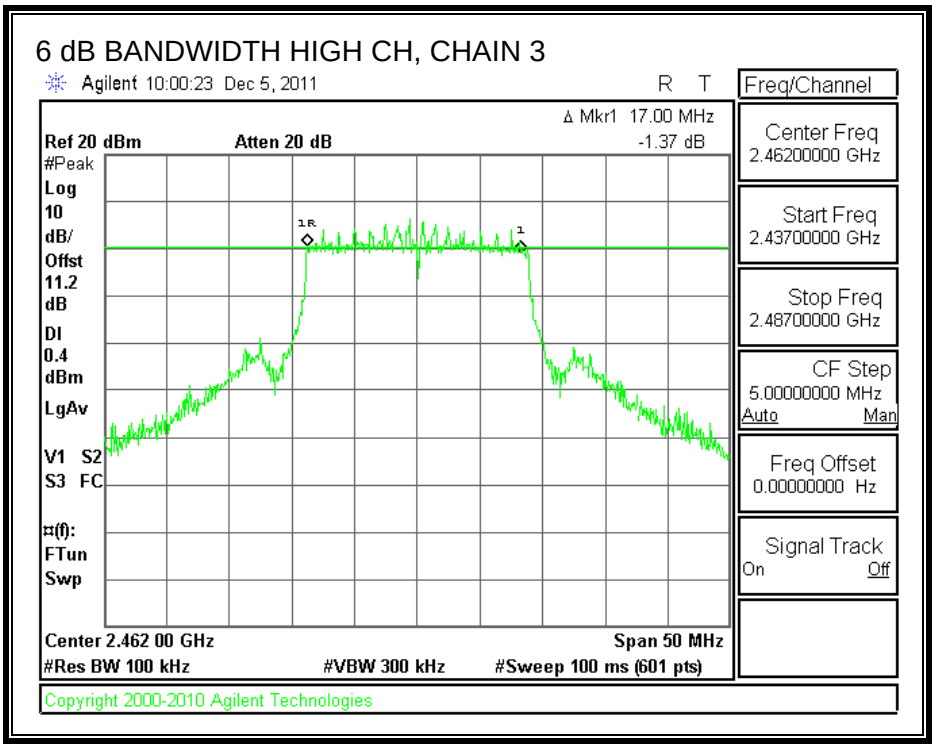




6 dB BANDWIDTH, CHAIN 3







7.3.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

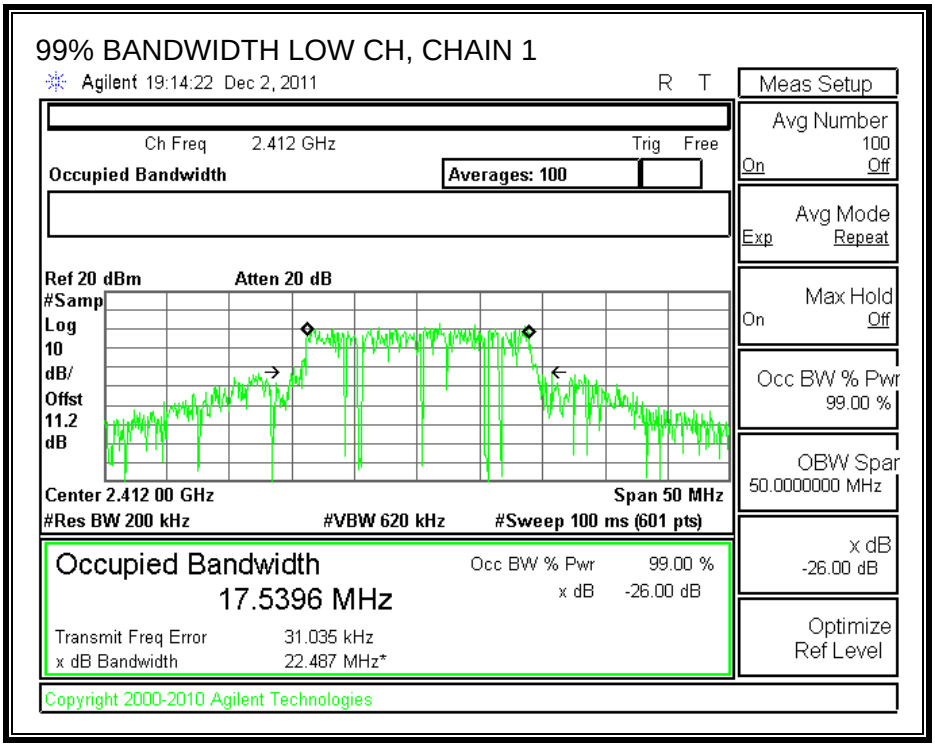
TEST PROCEDURE

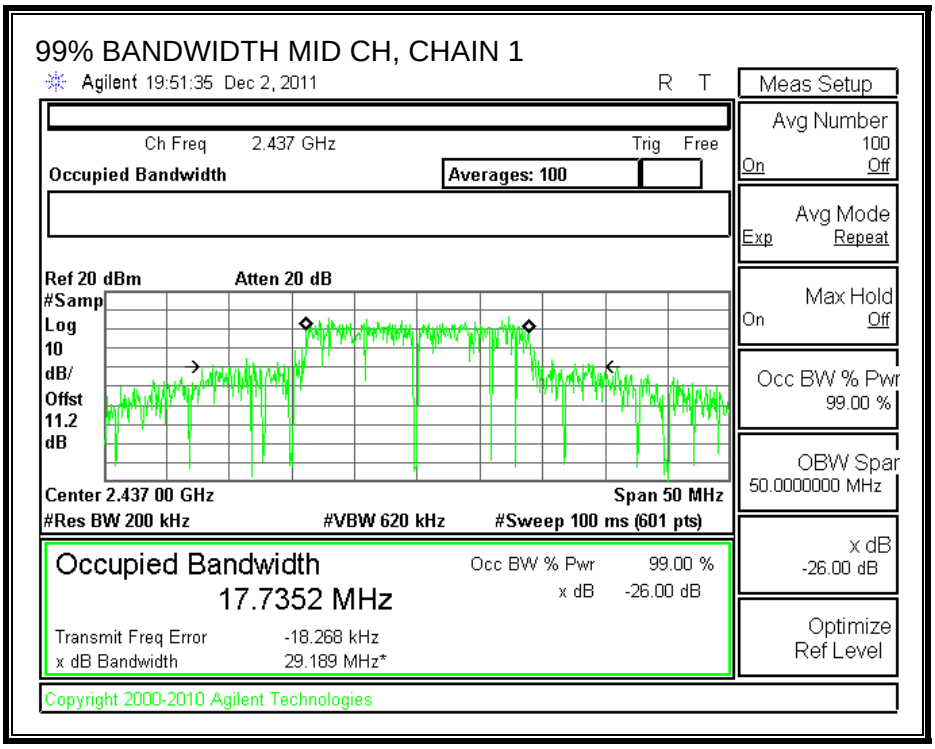
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

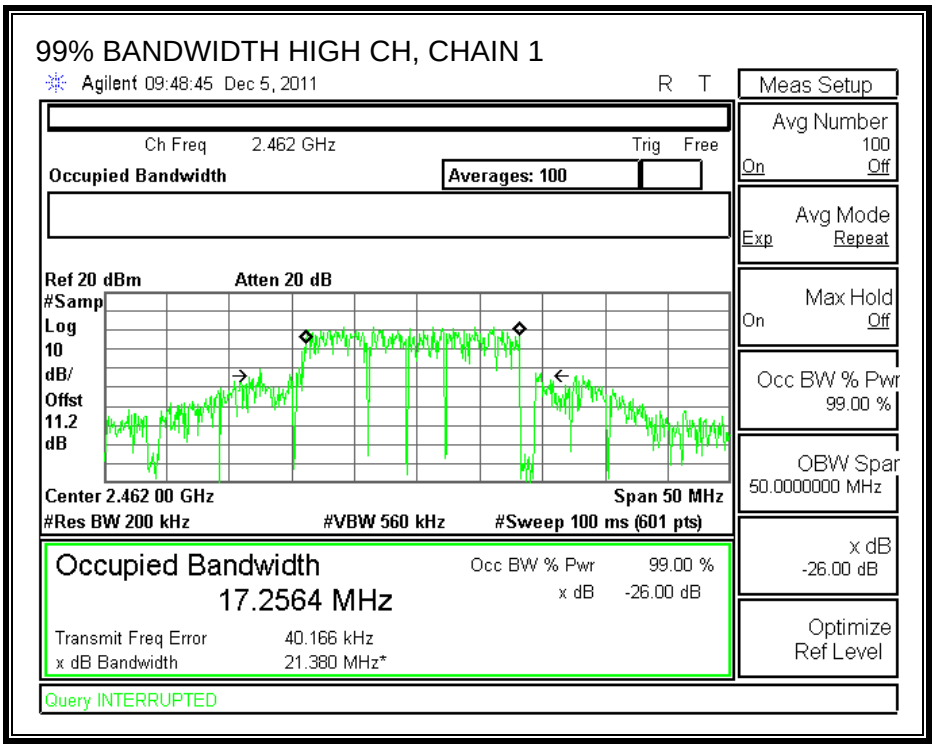
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	2412	17.5396	17.3706	17.5182
Middle	2437	17.7352	17.5780	17.6348
High	2462	17.2564	17.3091	17.2849

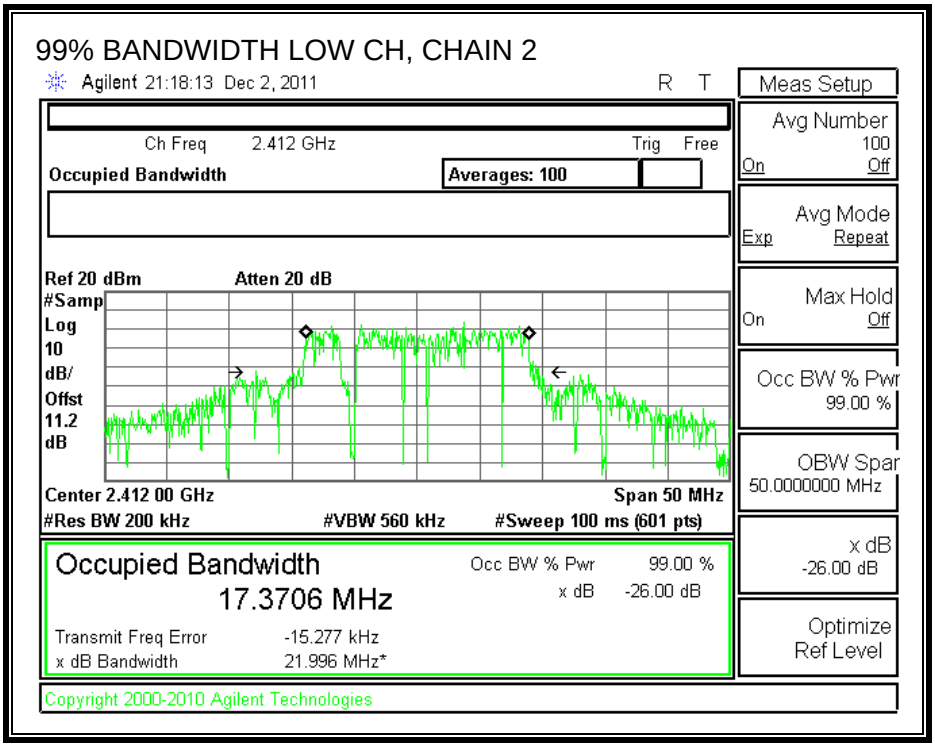
99% BANDWIDTH, CHAIN 1

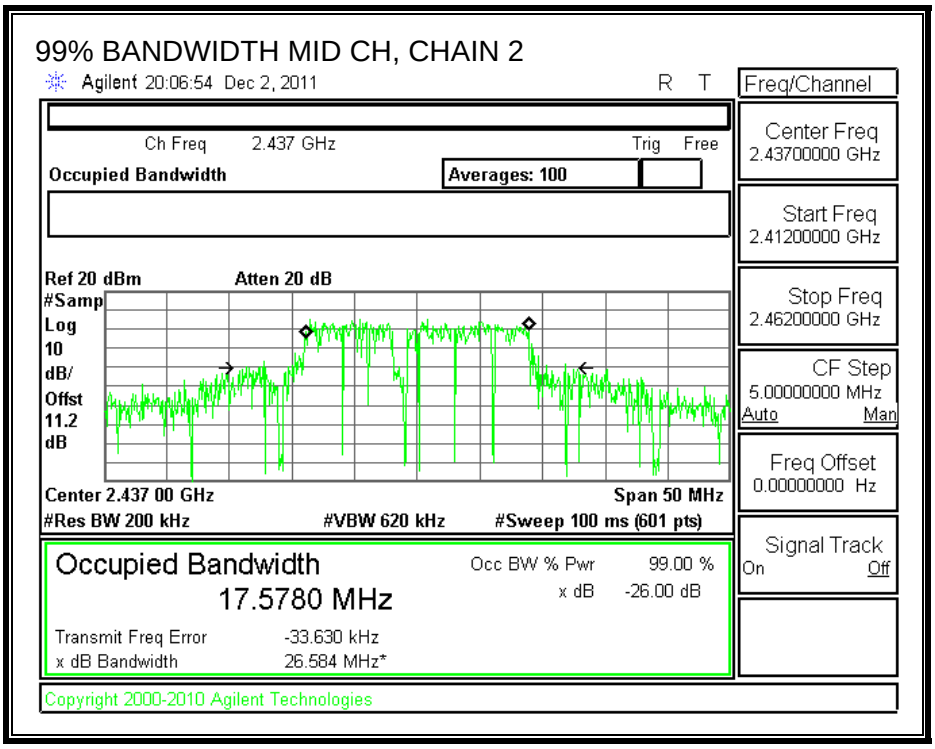


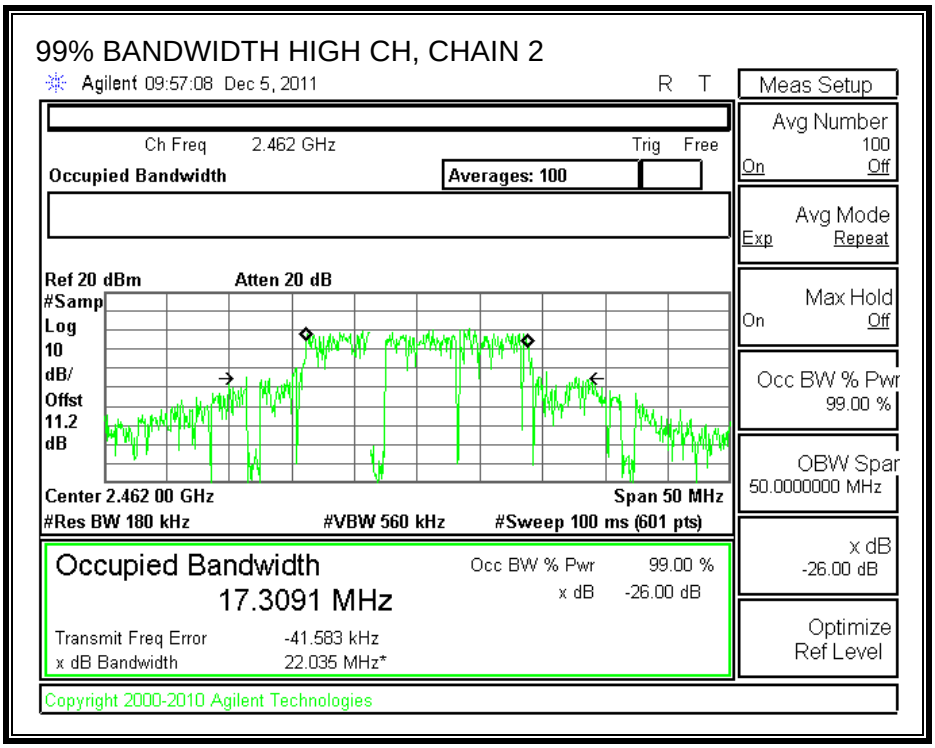




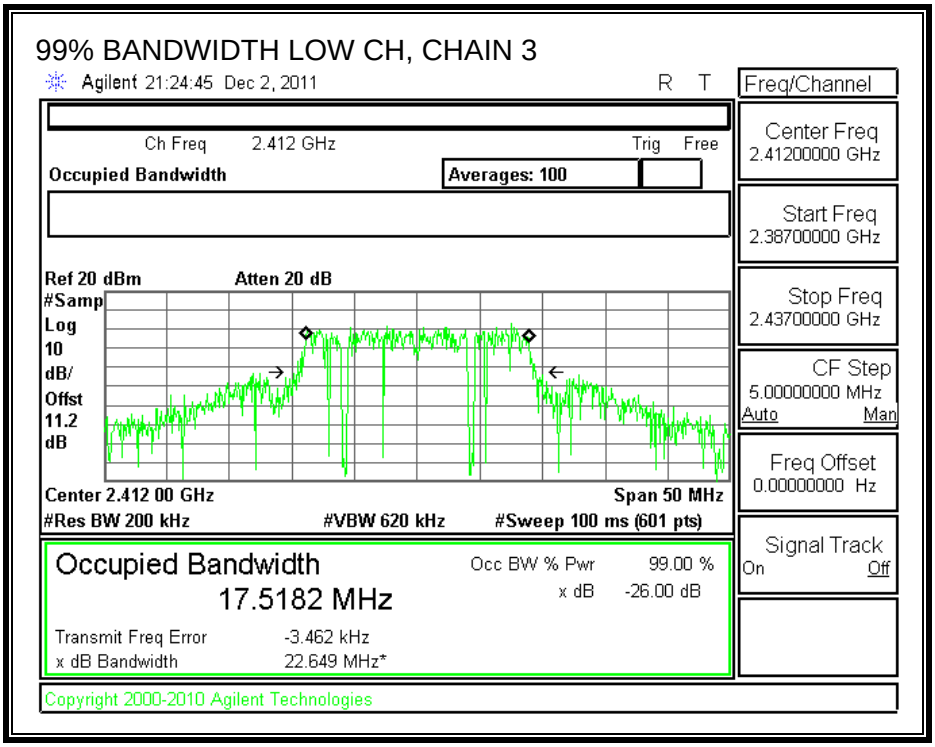
99% BANDWIDTH, CHAIN 2

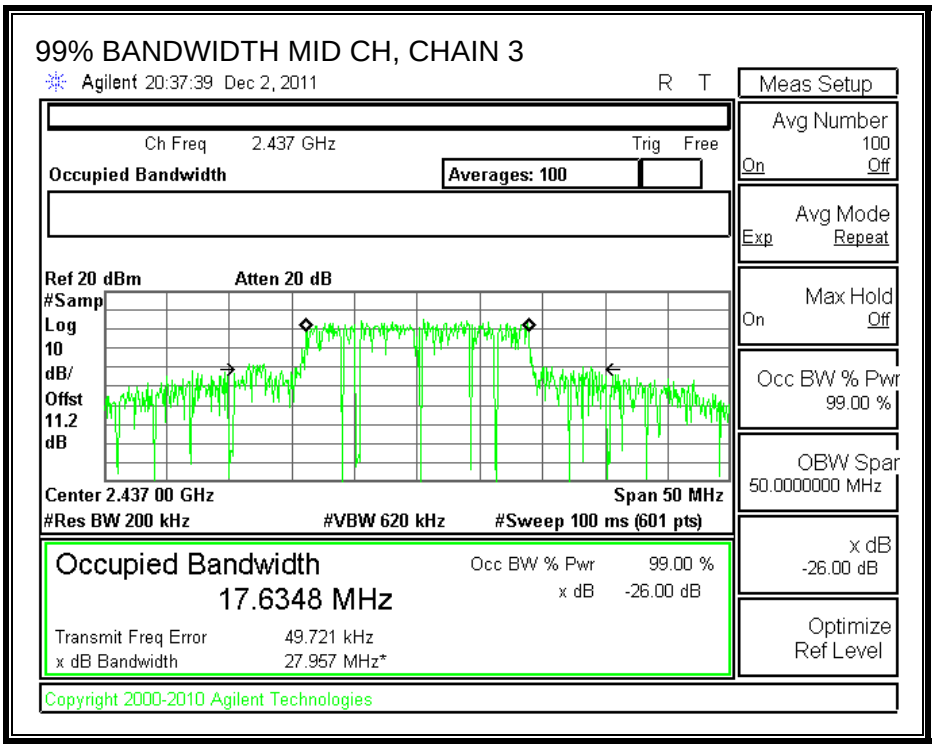


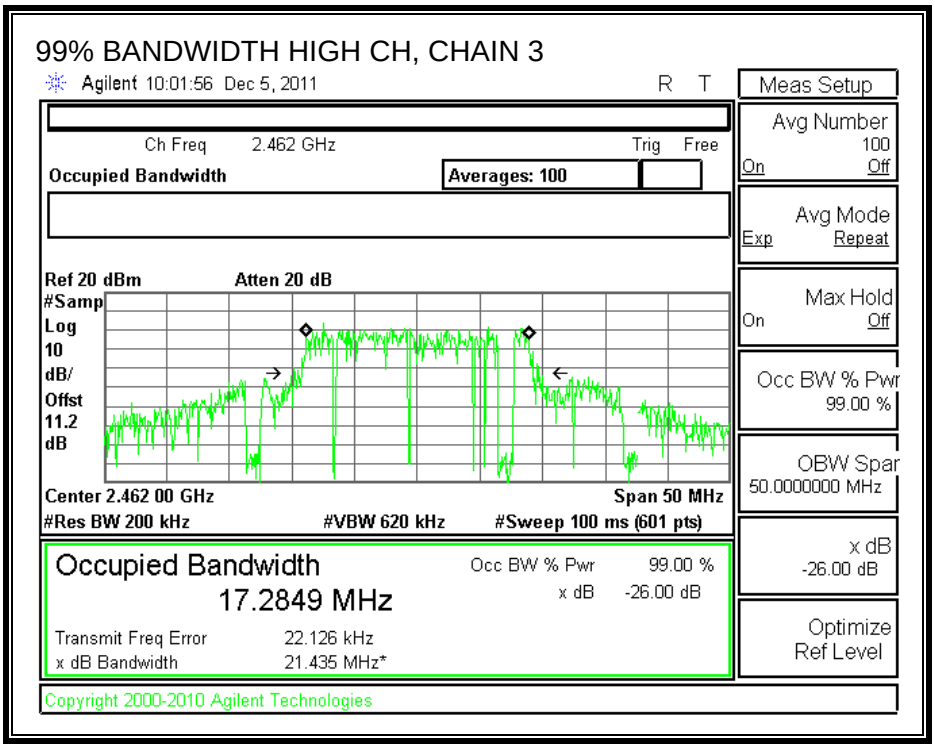




99% BANDWIDTH, CHAIN 3







7.3.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

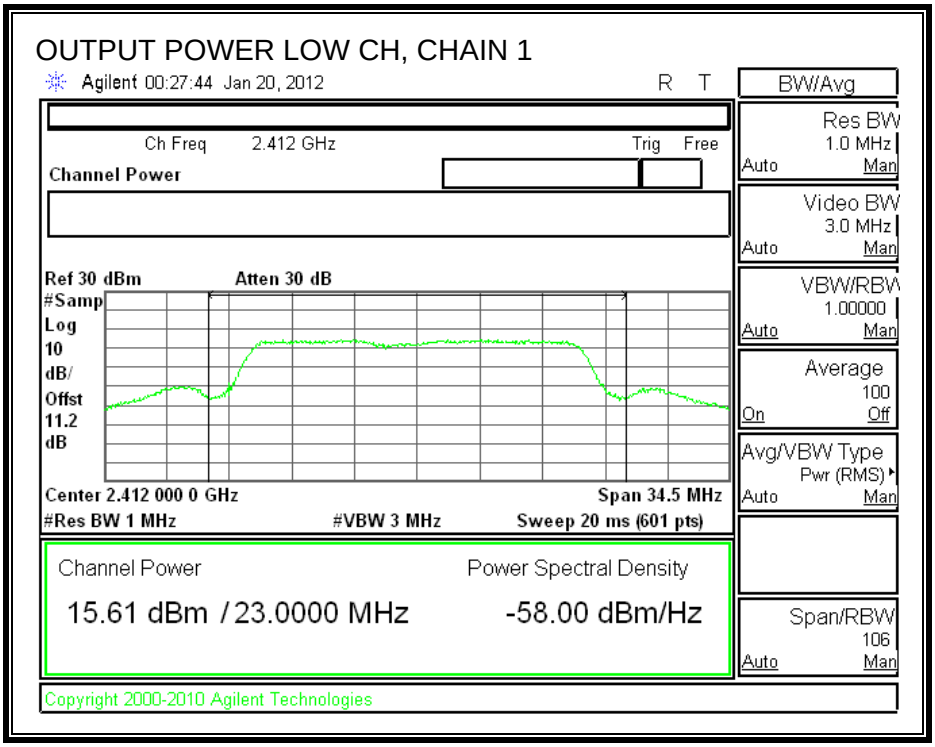
TEST PROCEDURE

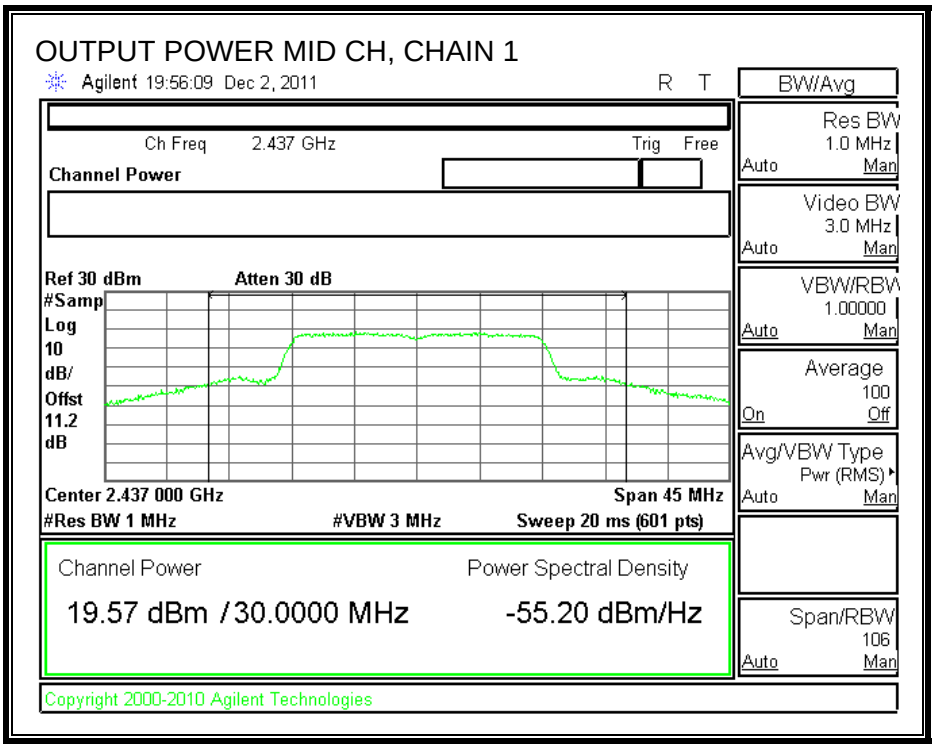
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

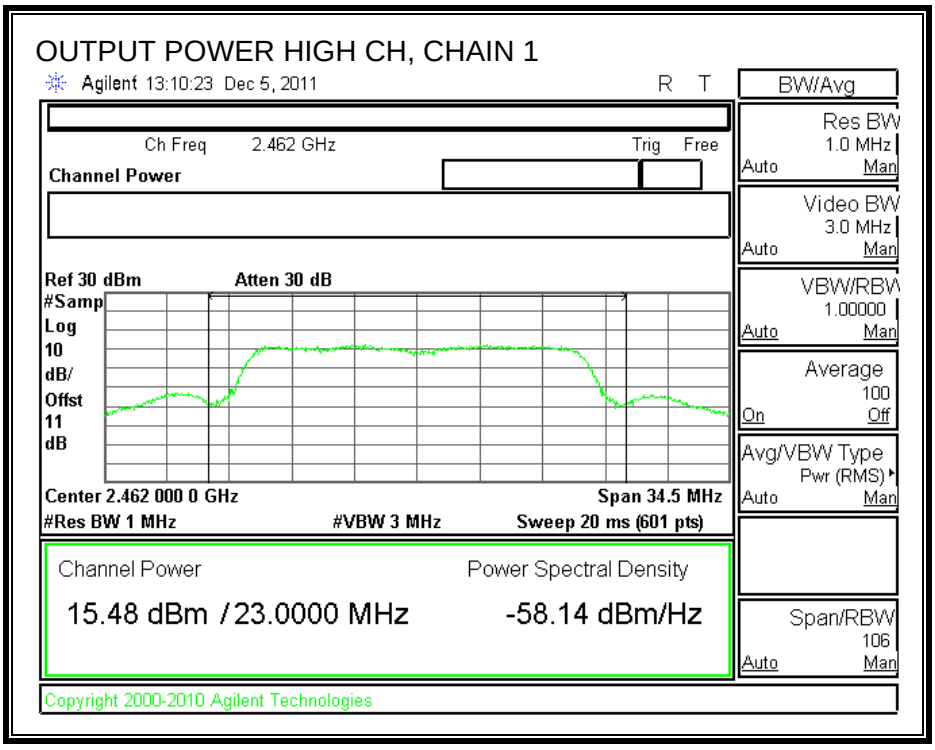
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	15.61	15.58	15.18	20.23	30.00	-9.77
Mid	2437	19.57	18.95	18.94	23.93	30.00	-6.07
High	2462	15.48	15.47	15.49	20.25	30.00	-9.75

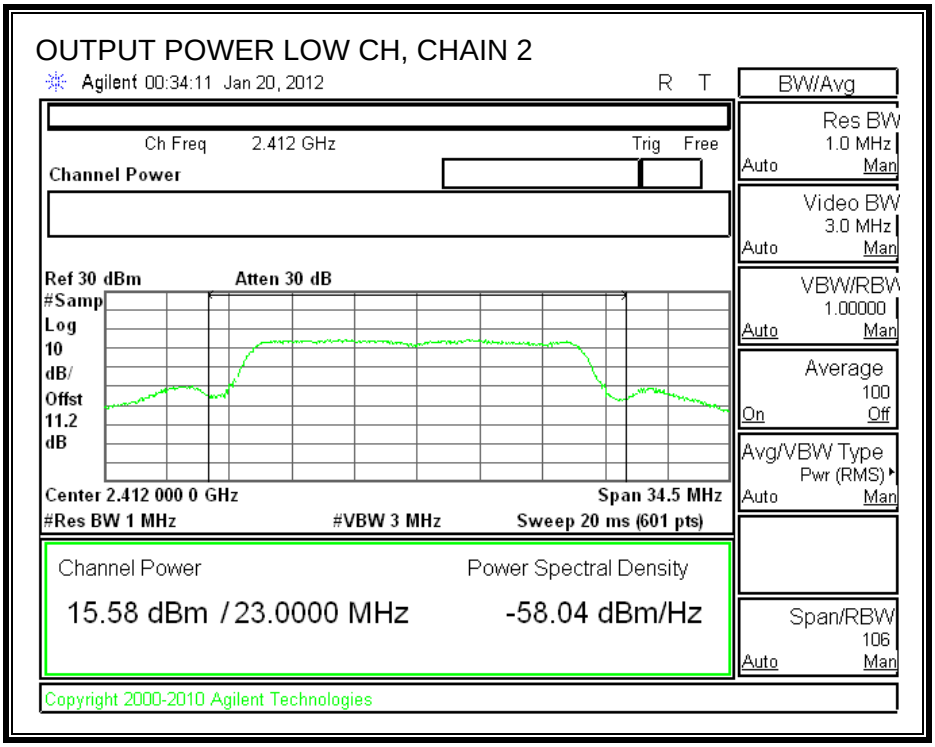
CHAIN 1 OUTPUT POWER

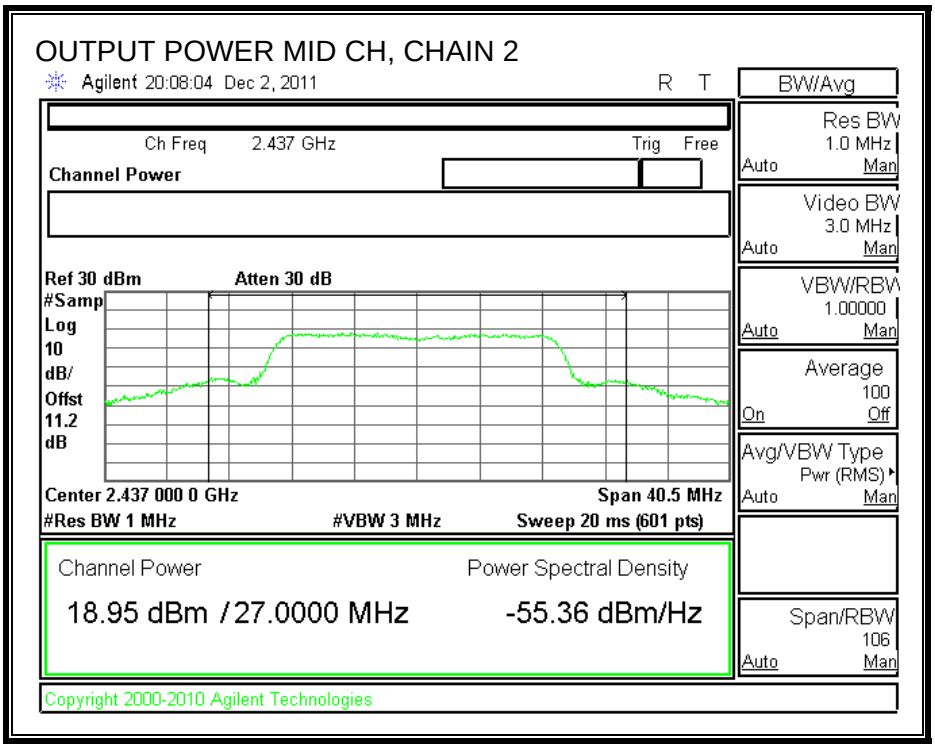


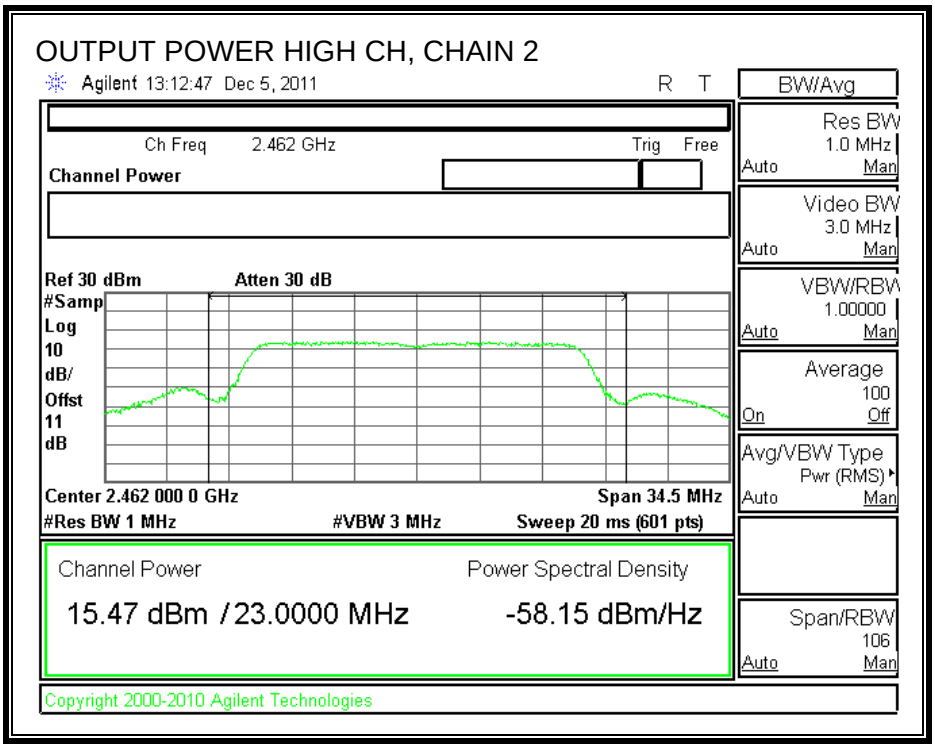




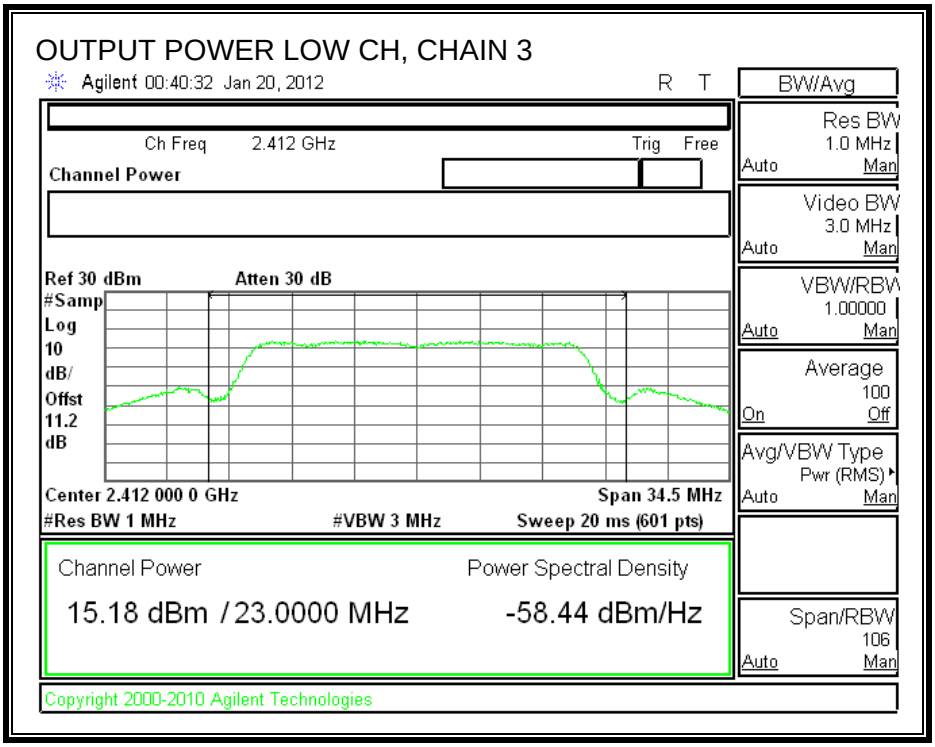
CHAIN 2 OUTPUT POWER

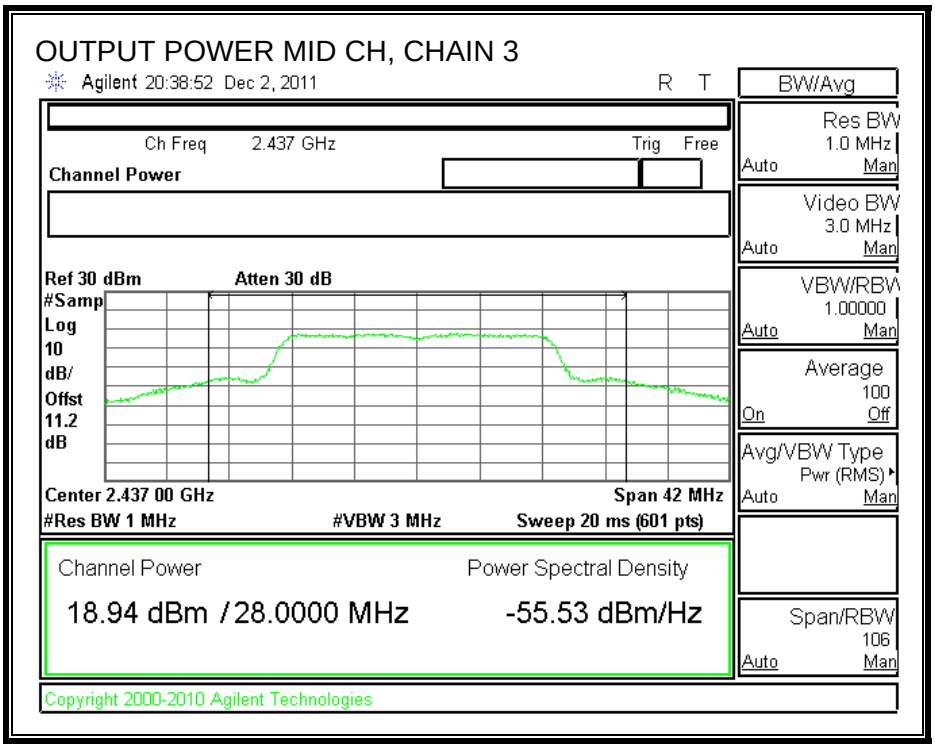


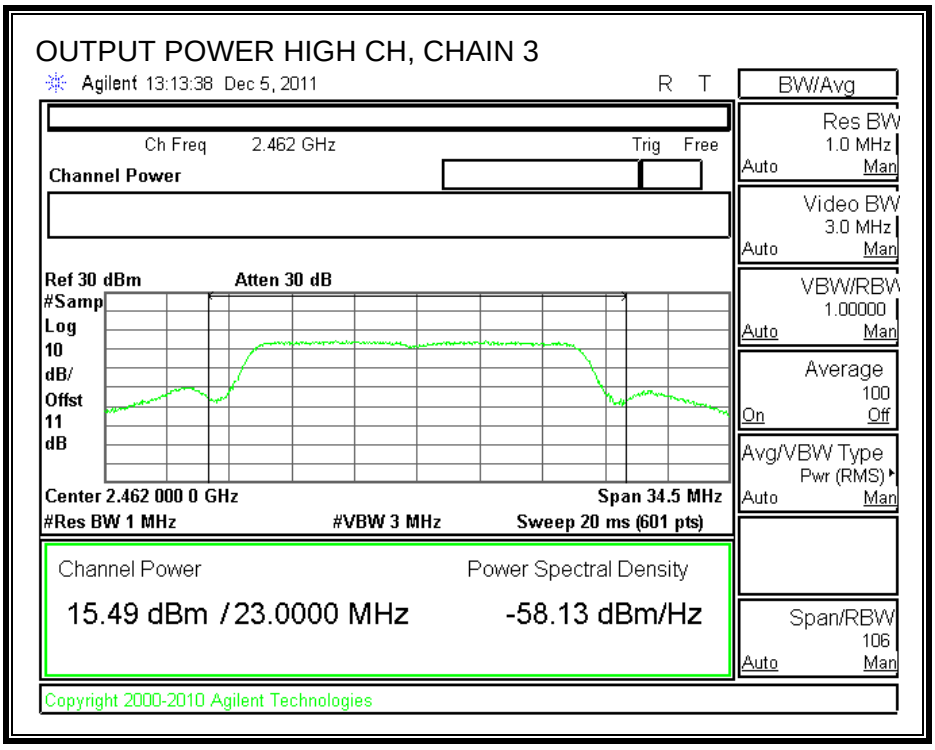




CHAIN 3 OUTPUT POWER







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 11.18 dB (including 10 dB pad and 1.18 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)	Chain 3 Power (dBm)	Total Power (dBm)
Low	2412	15.18	15.10	15.15	19.91
Middle	2437	19.19	18.68	18.80	23.67
High	2462	15.14	15.04	15.14	19.88

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.

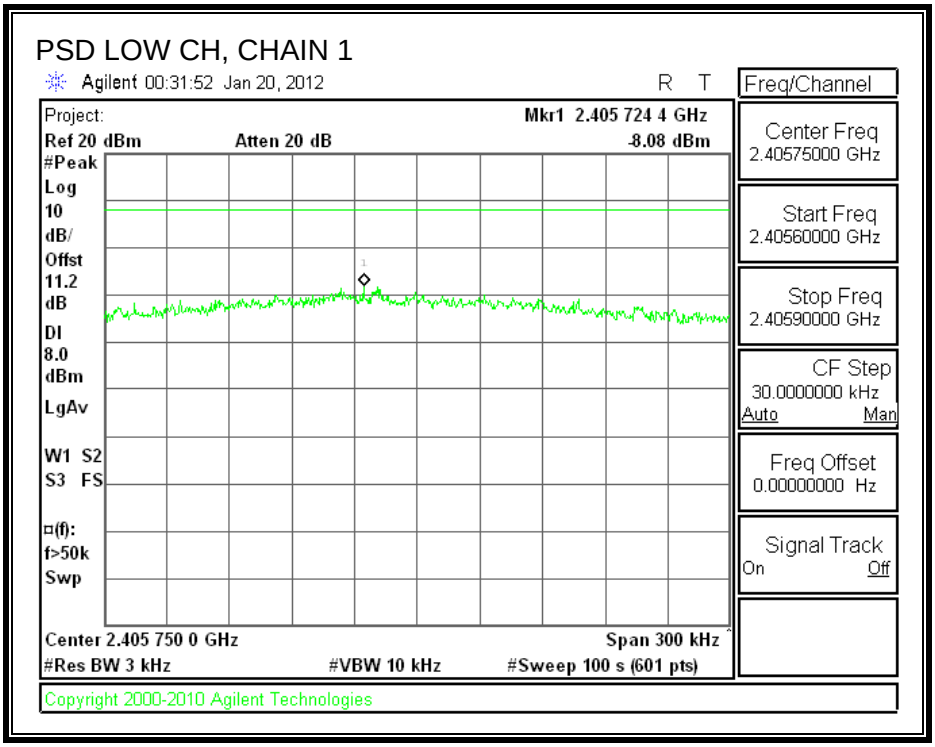
TEST PROCEDURE

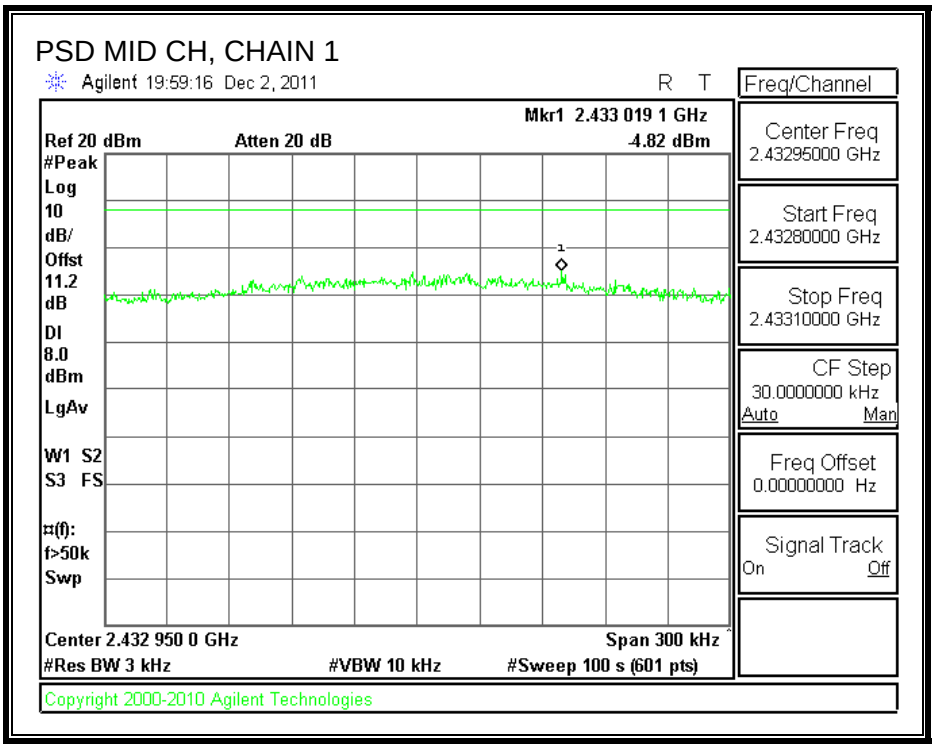
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

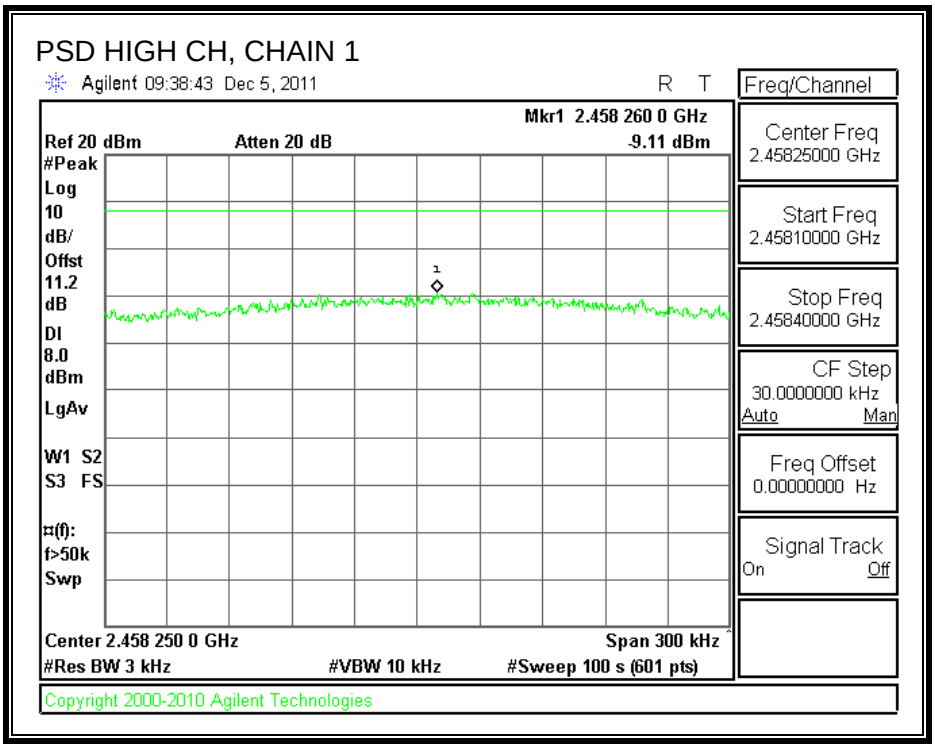
RESULTS

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.08	-10.03	-9.67	-4.40	8	-12.40
Middle	2437	-4.82	-6.54	-6.16	-1.00	8	-9.00
High	2462	-9.11	-10.26	-10.00	-4.99	8	-12.99

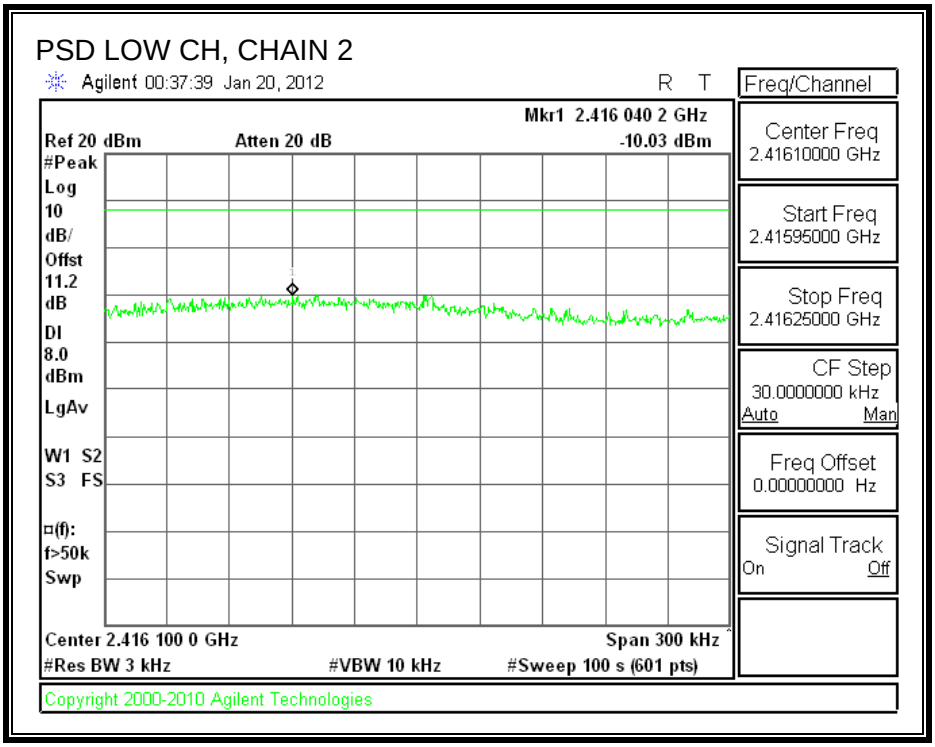
POWER SPECTRAL DENSITY, CHAIN 1

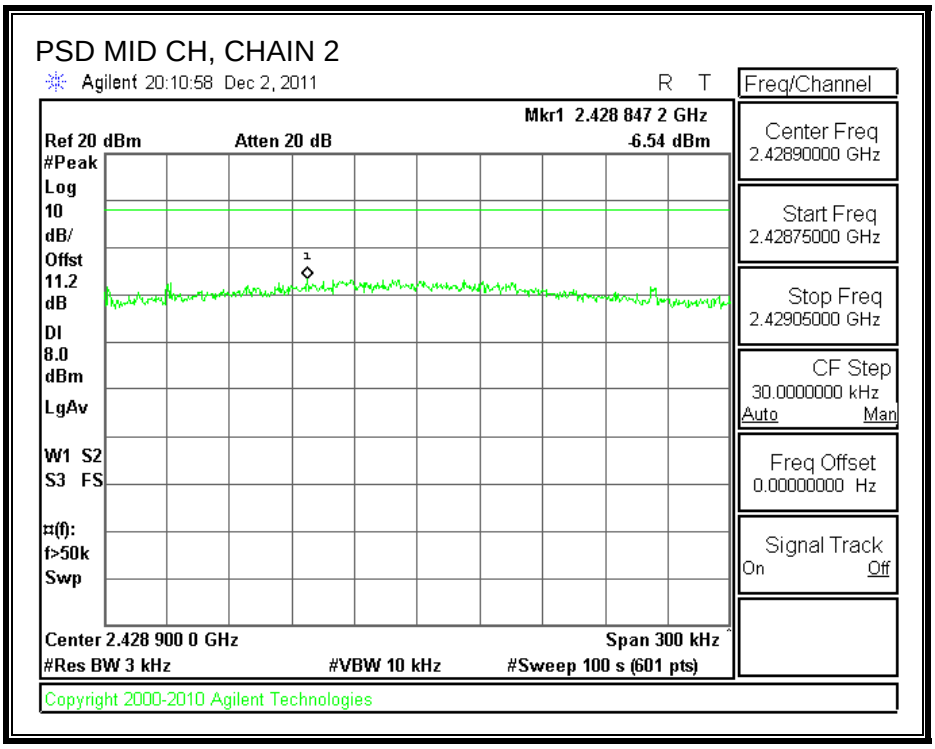


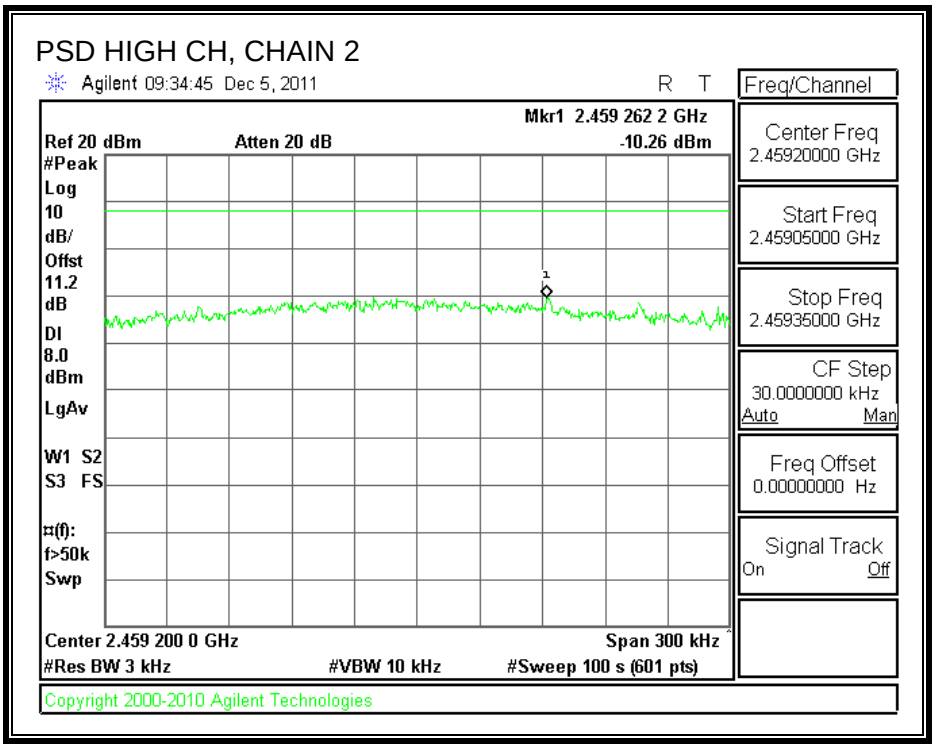




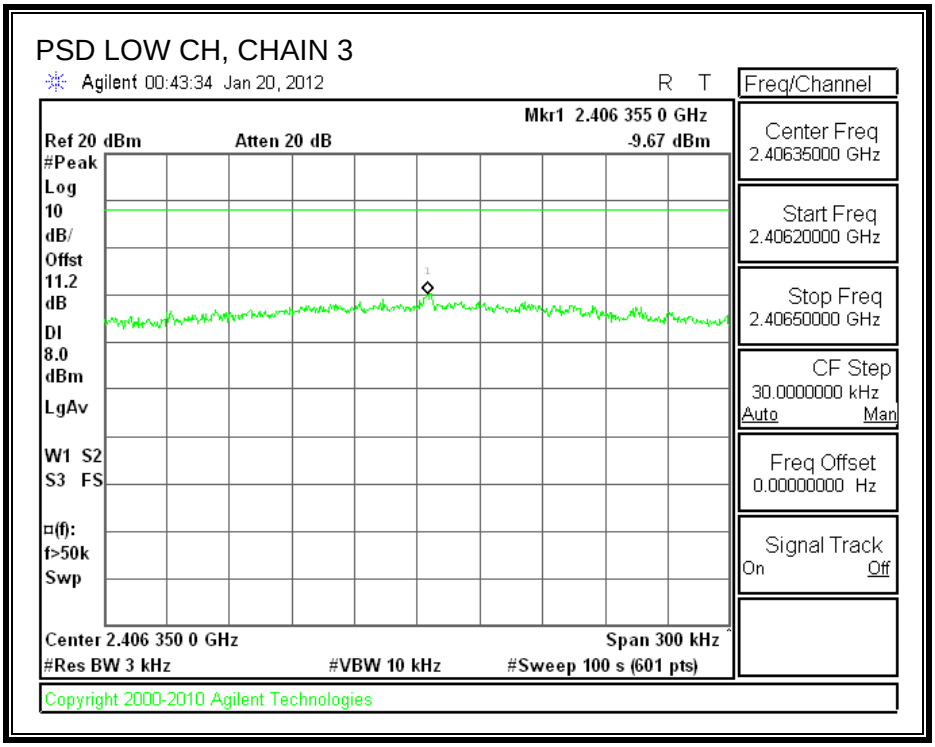
POWER SPECTRAL DENSITY, CHAIN 2

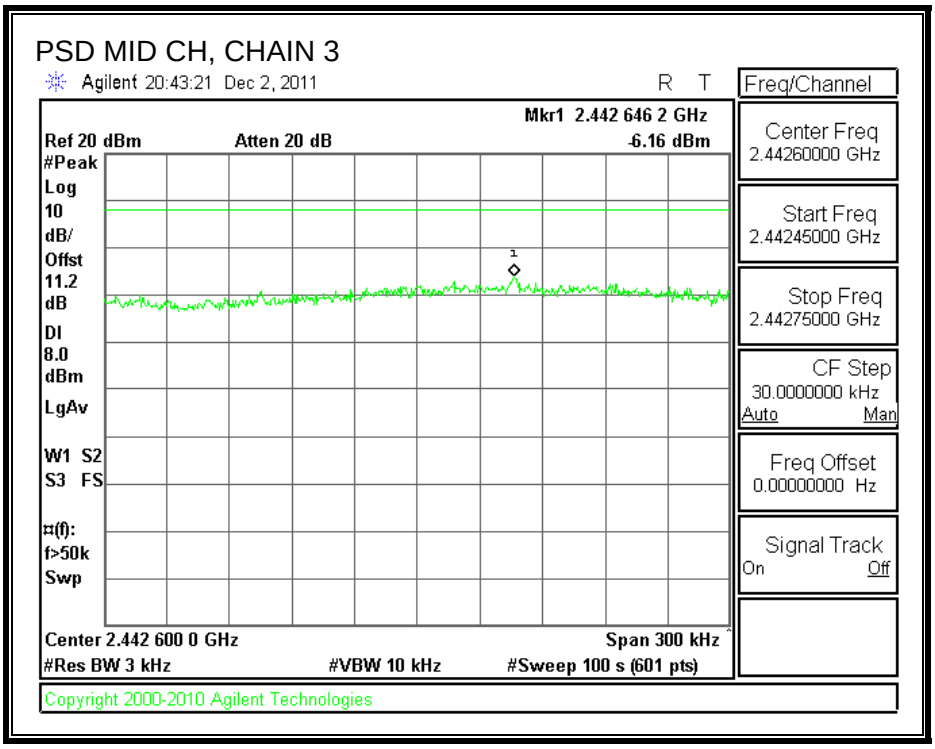


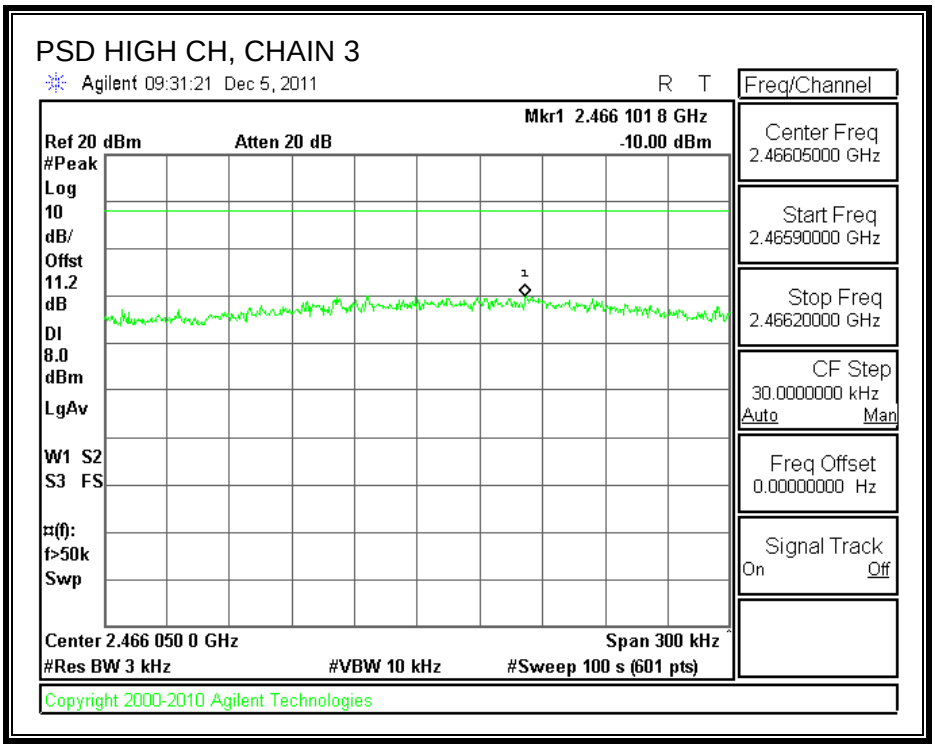




POWER SPECTRAL DENSITY, CHAIN 3







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.

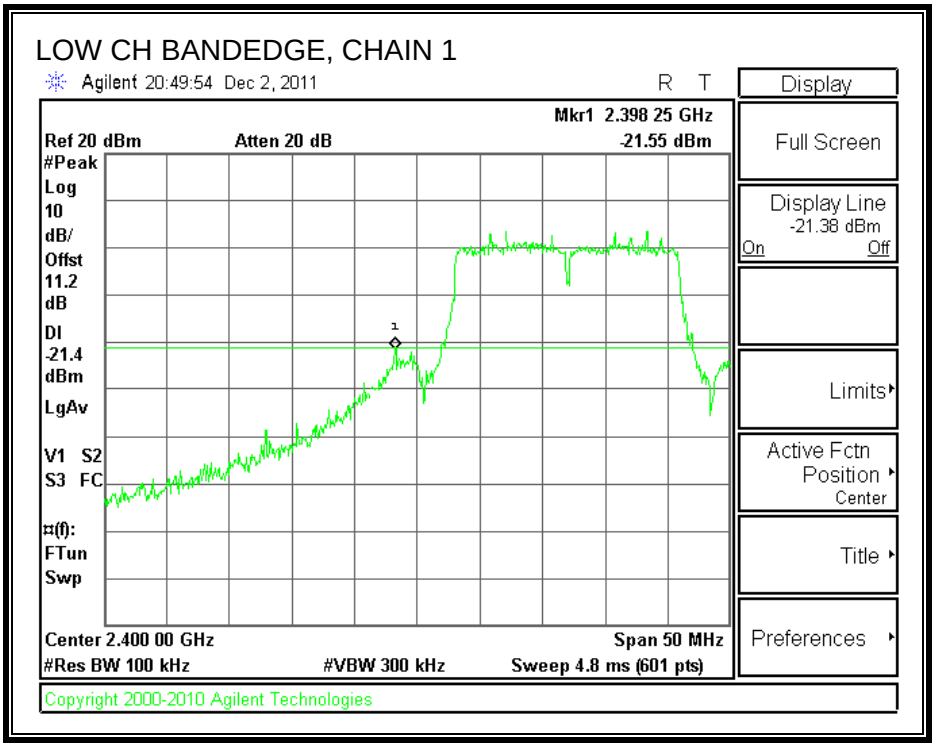
TEST PROCEDURE

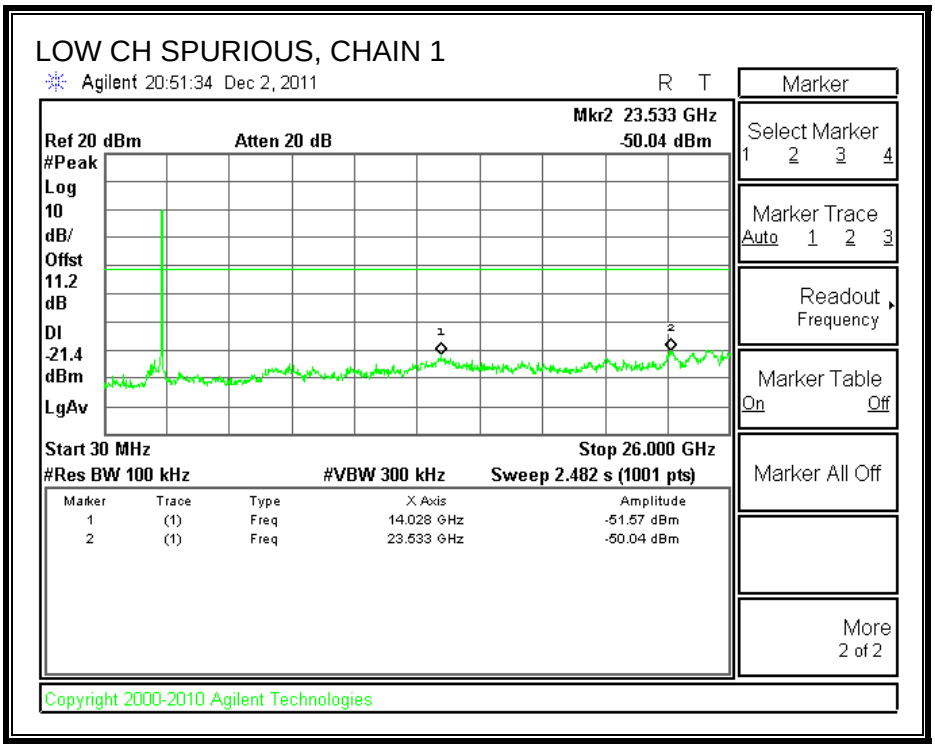
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

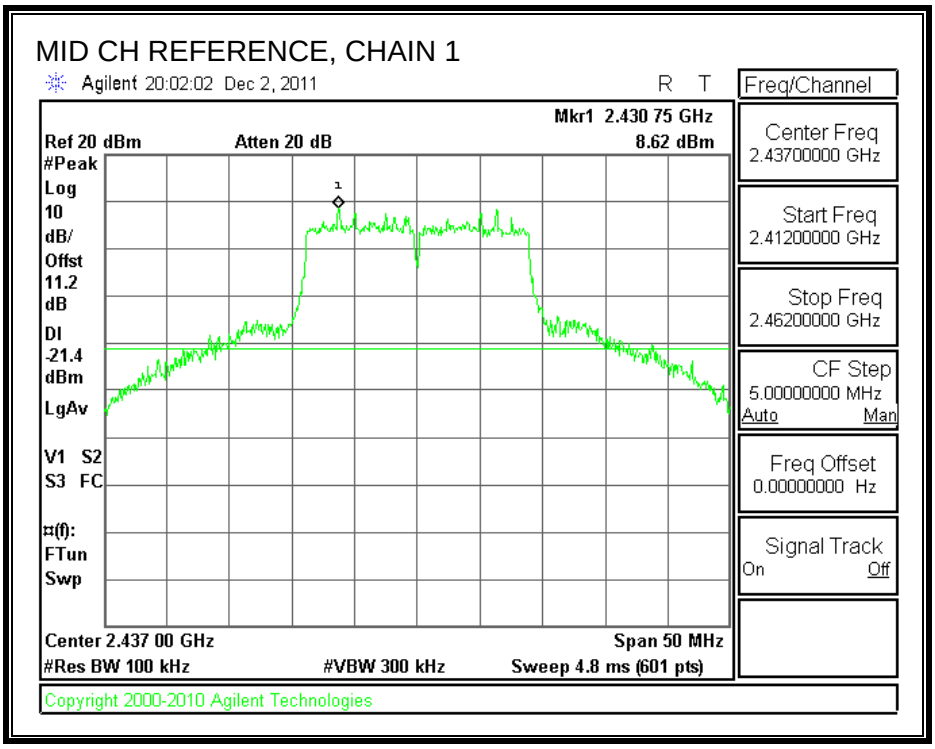
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

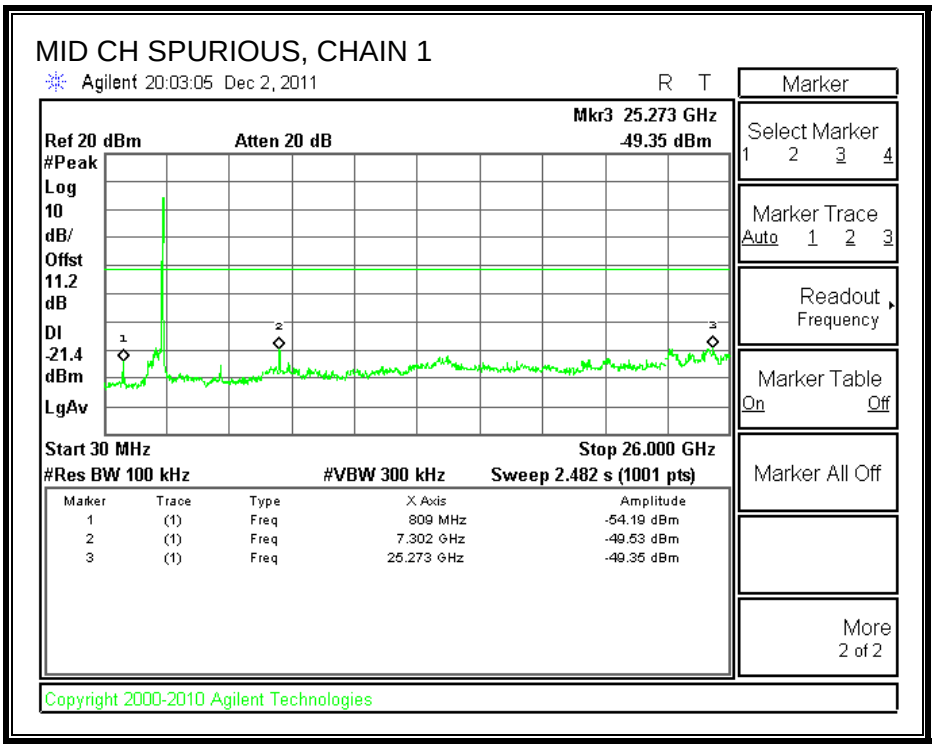
RESULTS

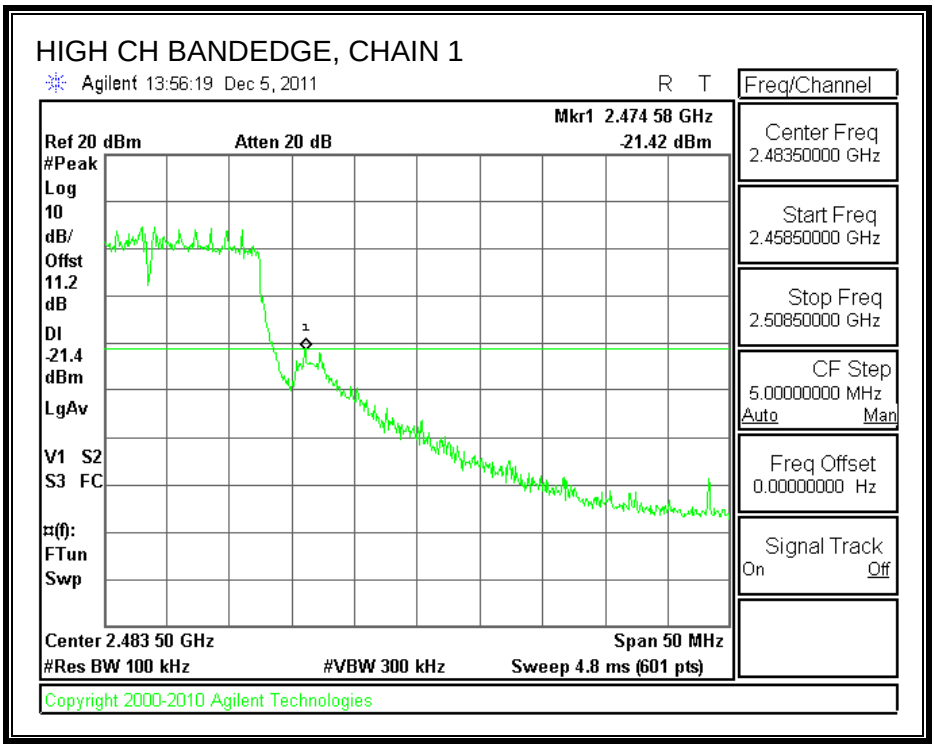
CHAIN 1 SPURIOUS EMISSIONS

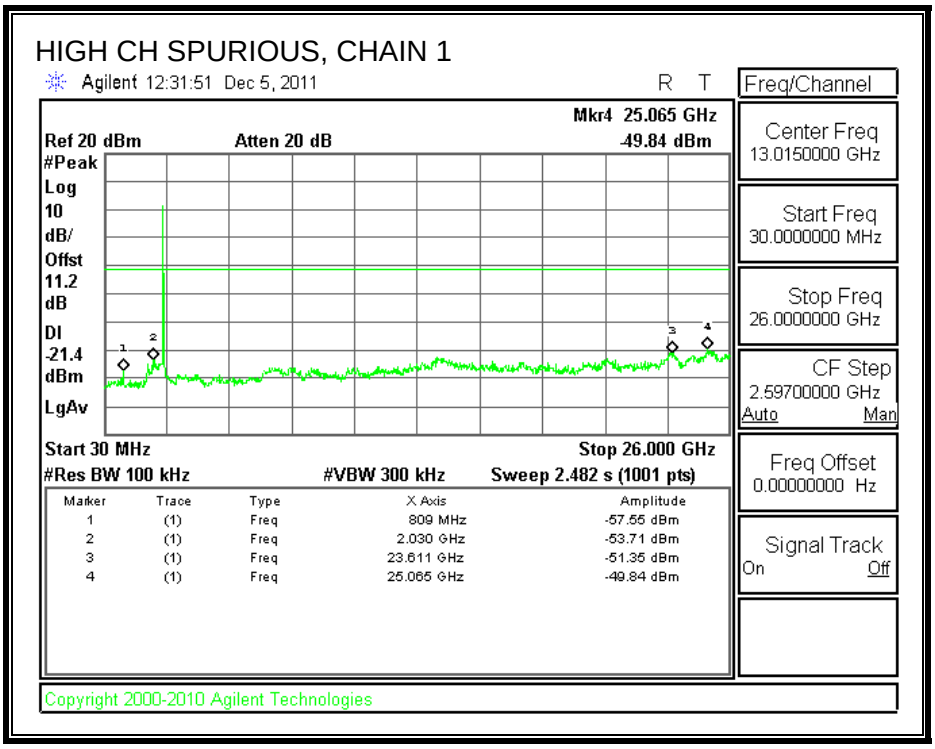




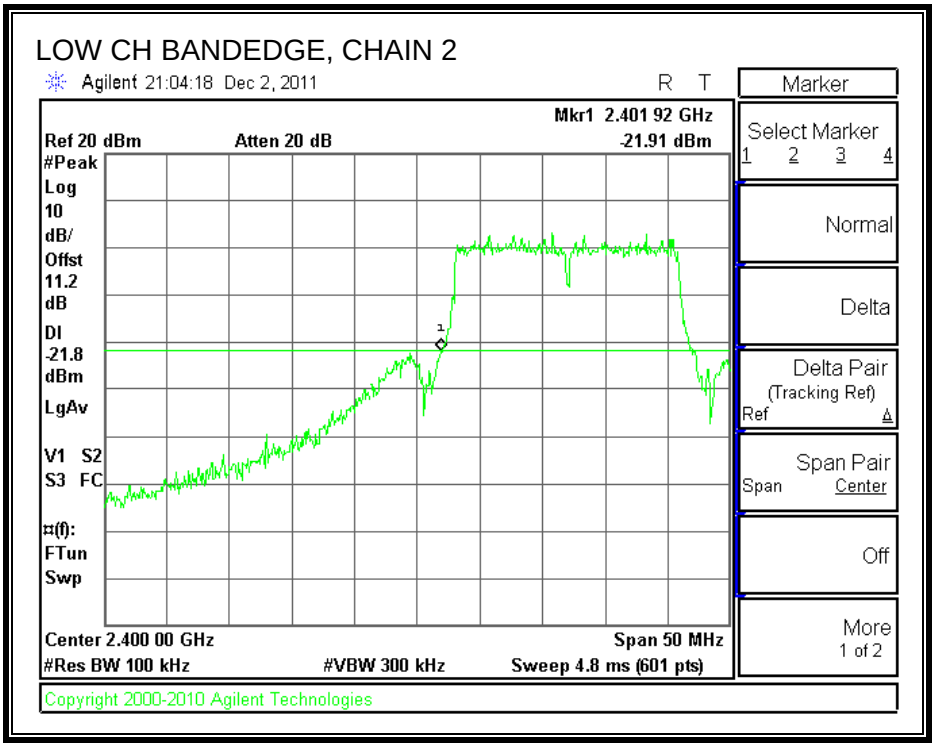


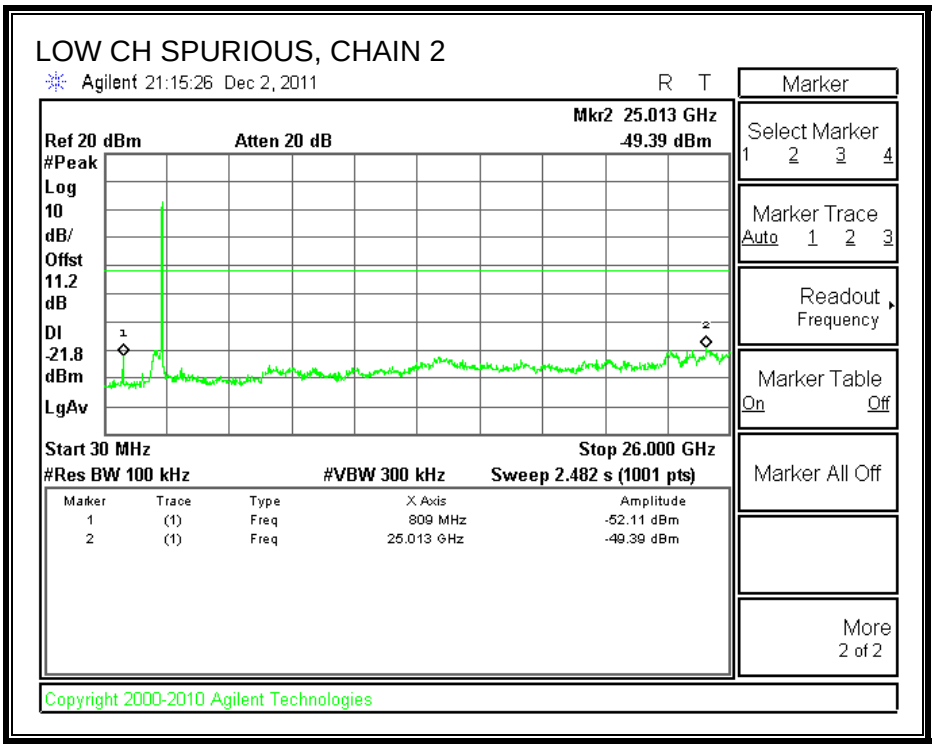




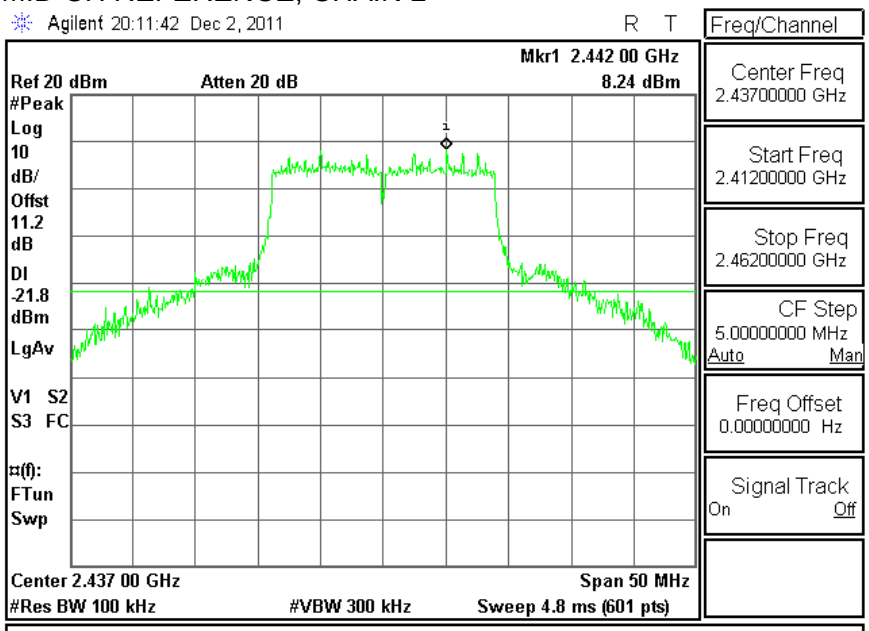


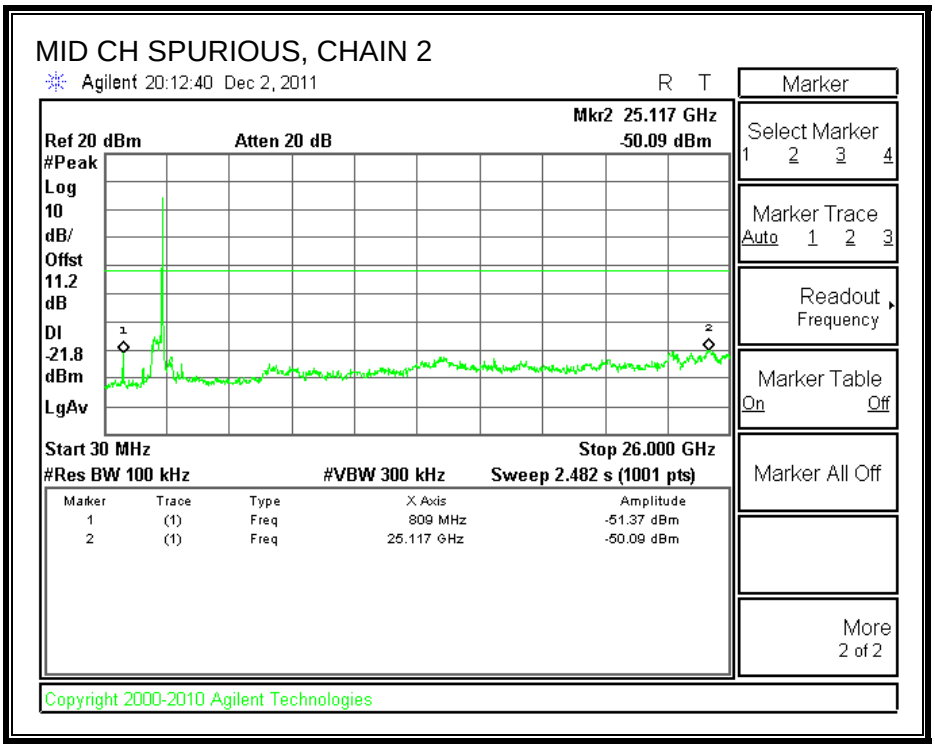
CHAIN 2 SPURIOUS EMISSIONS

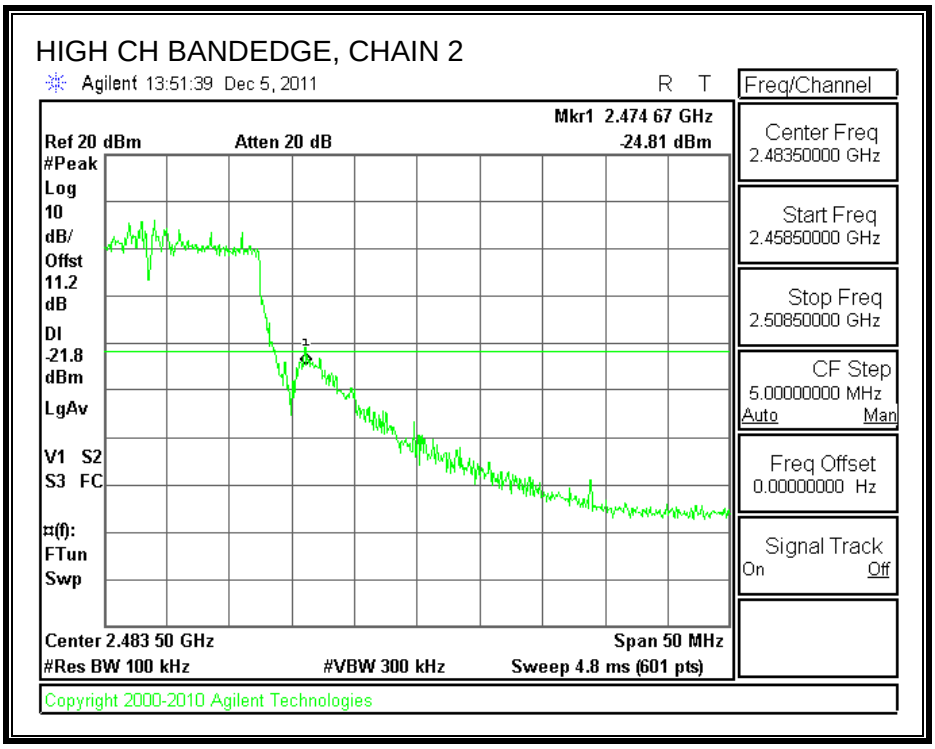


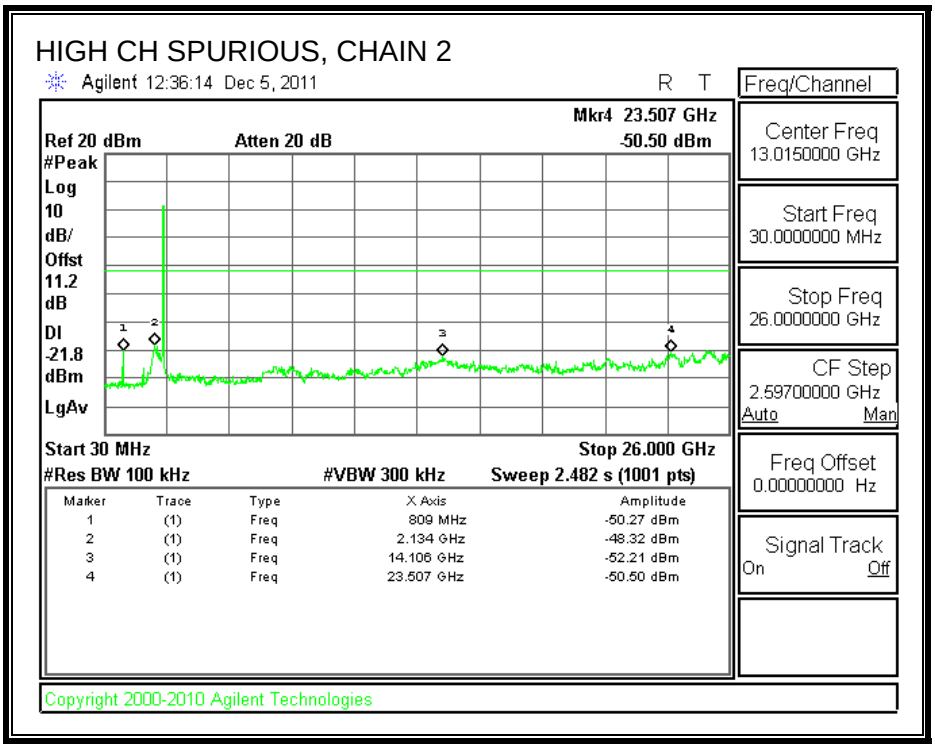


MID CH REFERENCE, CHAIN 2

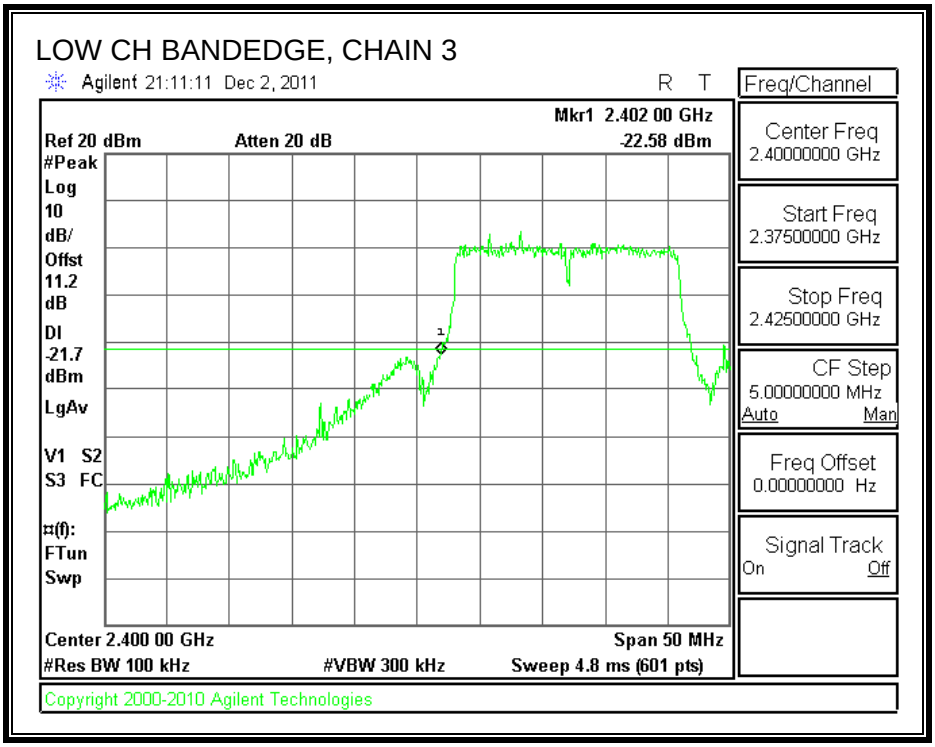


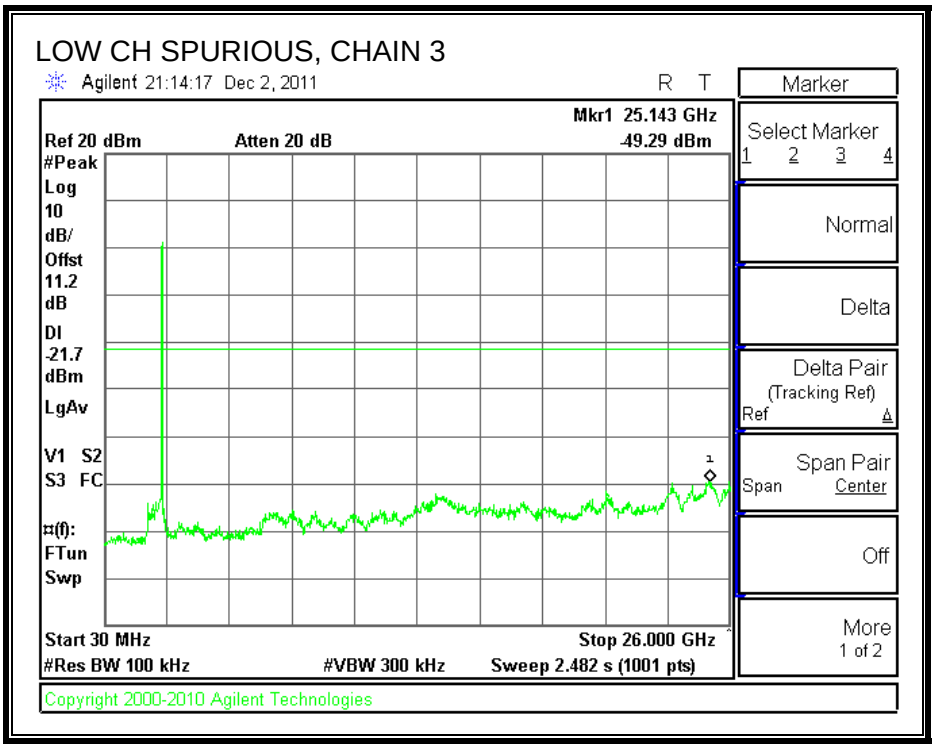


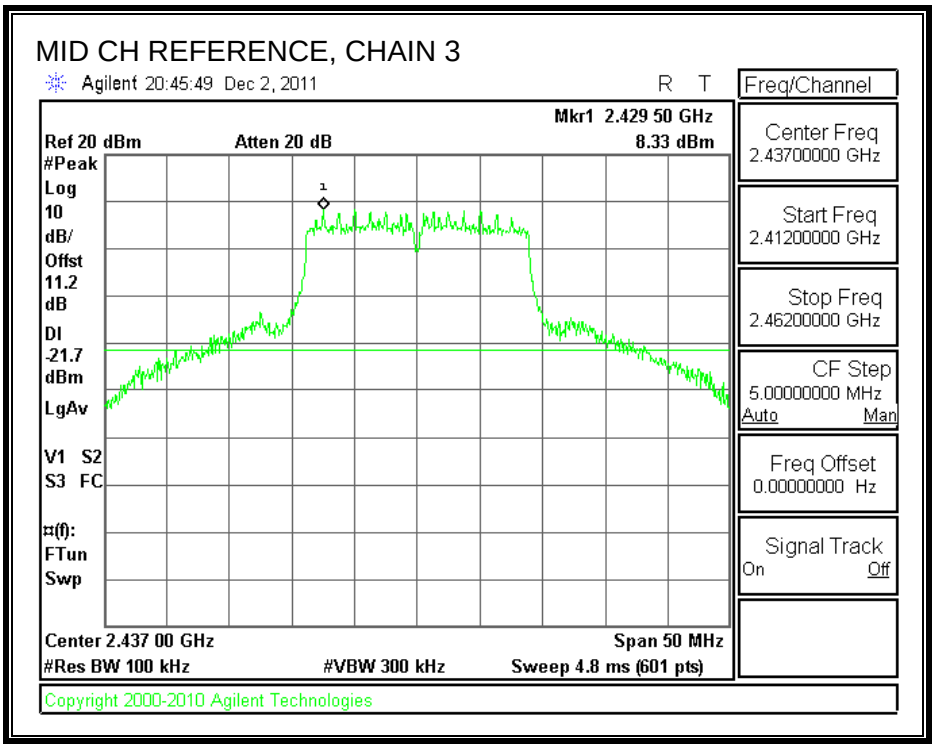


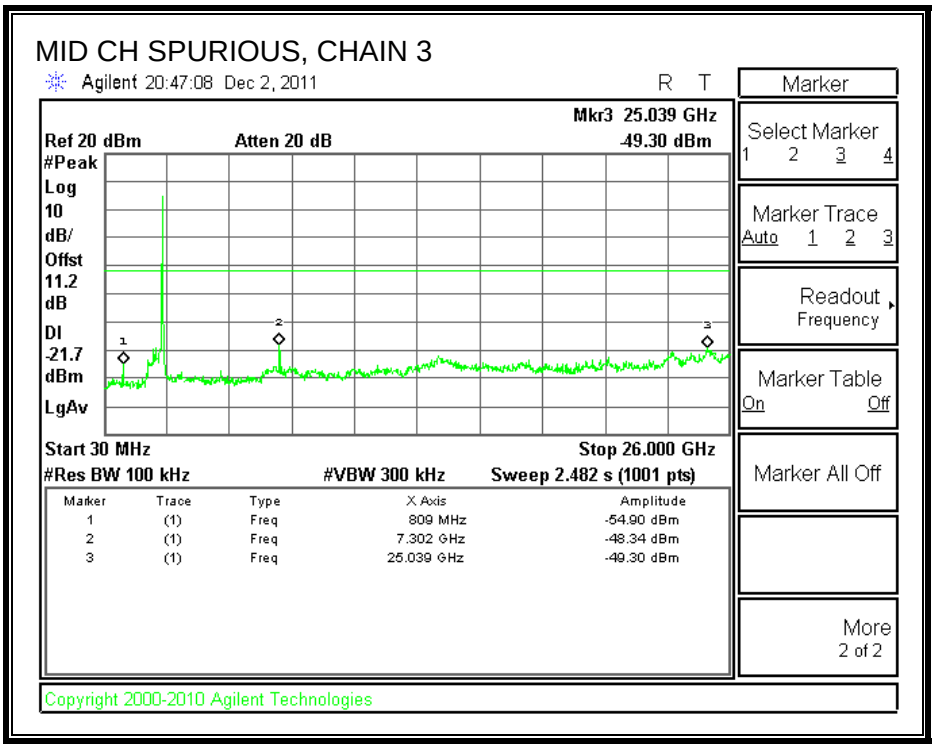


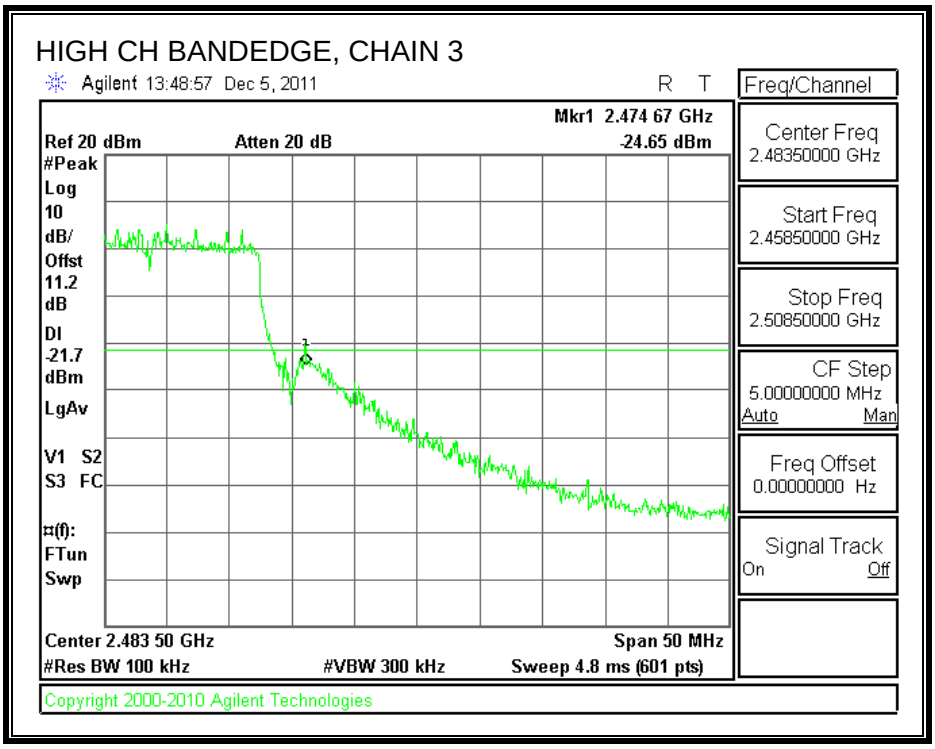
CHAIN 3 SPURIOUS EMISSIONS

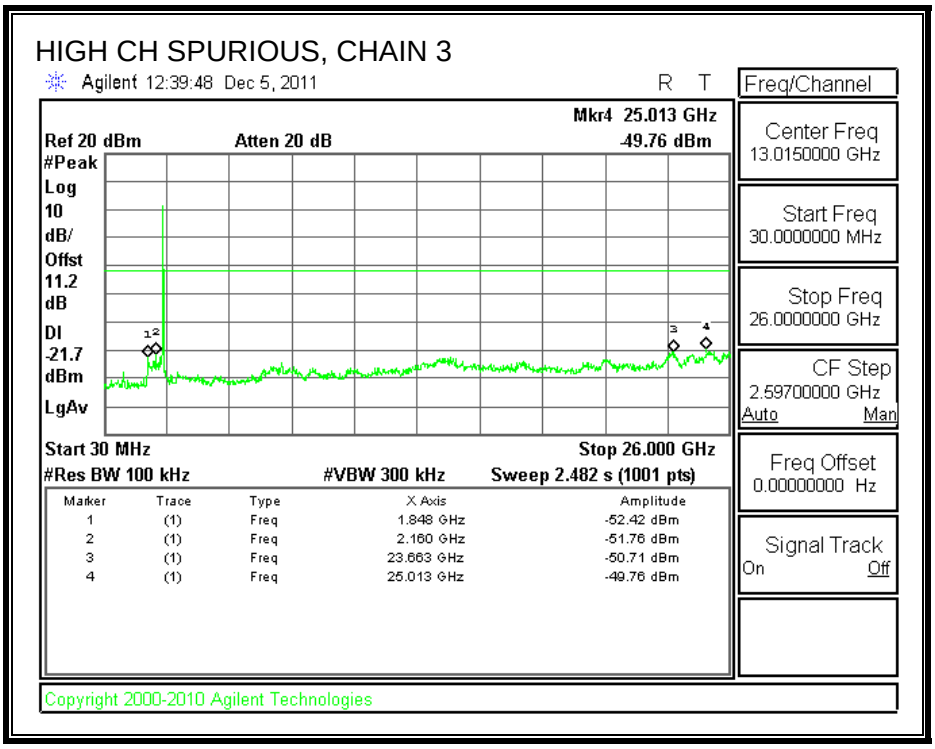












7.4. 802.11n HT20 CDD 3TX MODE IN THE 5.8 GHz BAND

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.

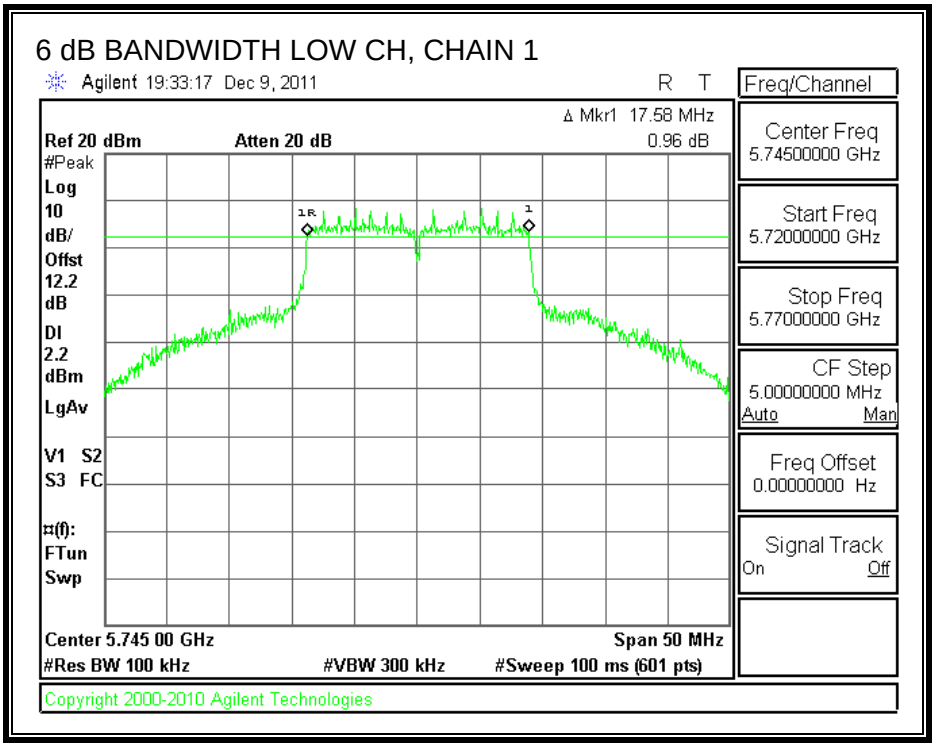
TEST PROCEDURE

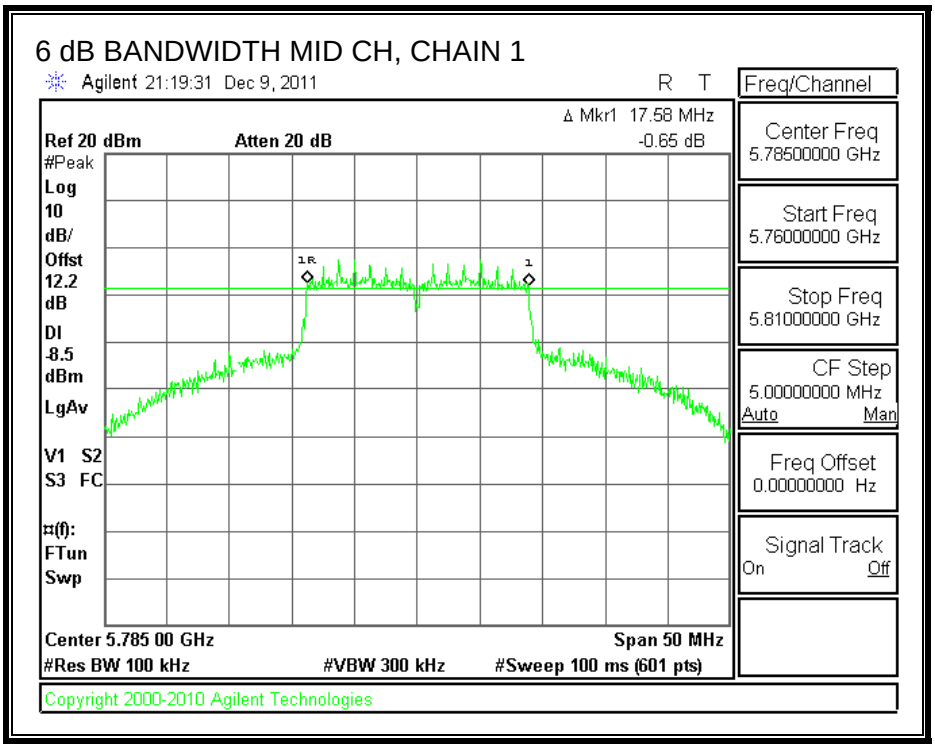
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

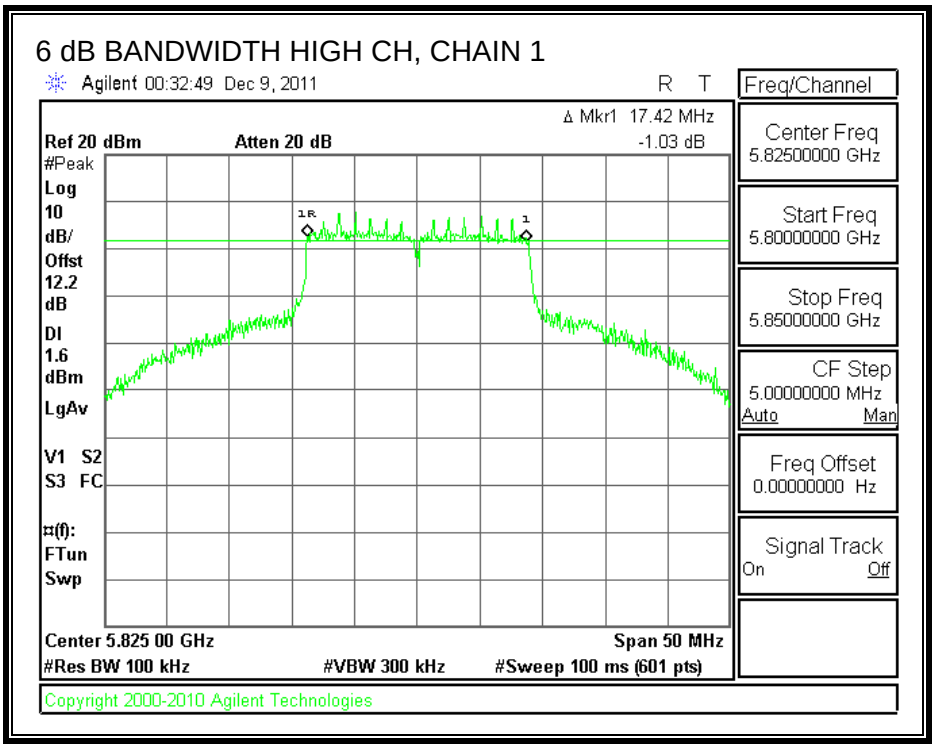
RESULTS

Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5745	17.58	17.58	17.58	0.5
Middle	5785	17.58	17.67	17.58	0.5
High	5825	17.42	17.58	17.58	0.5

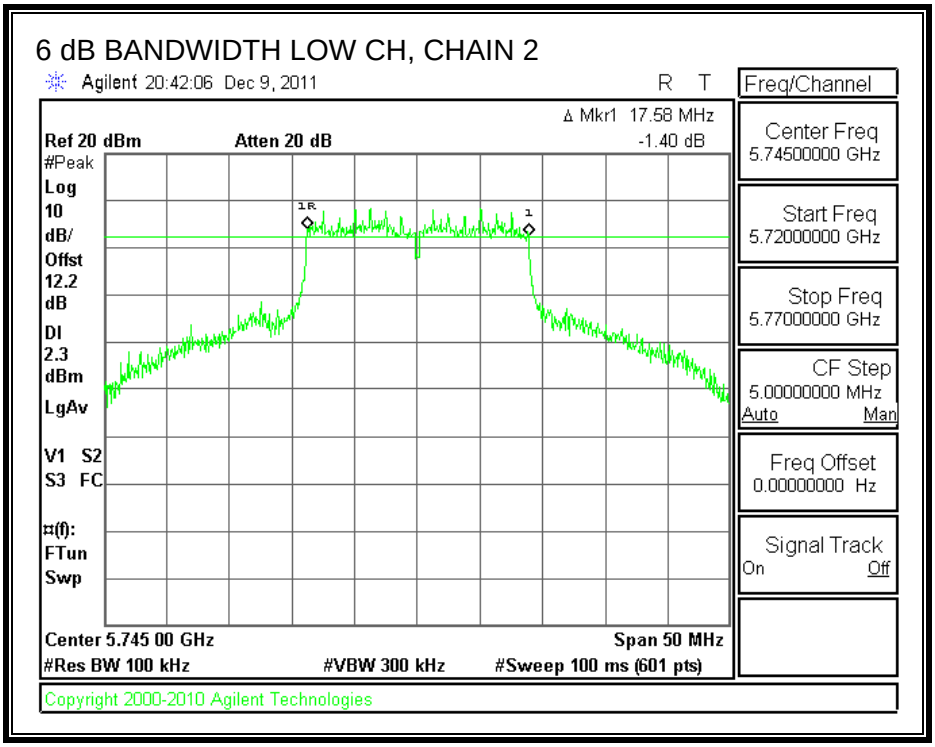
6 dB BANDWIDTH, CHAIN 1

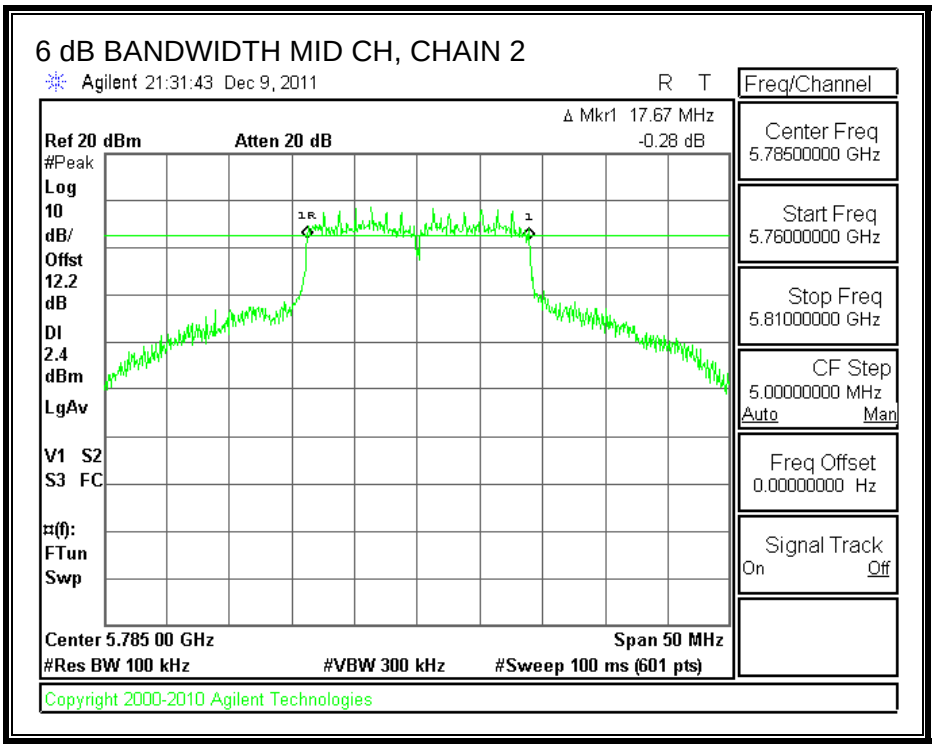


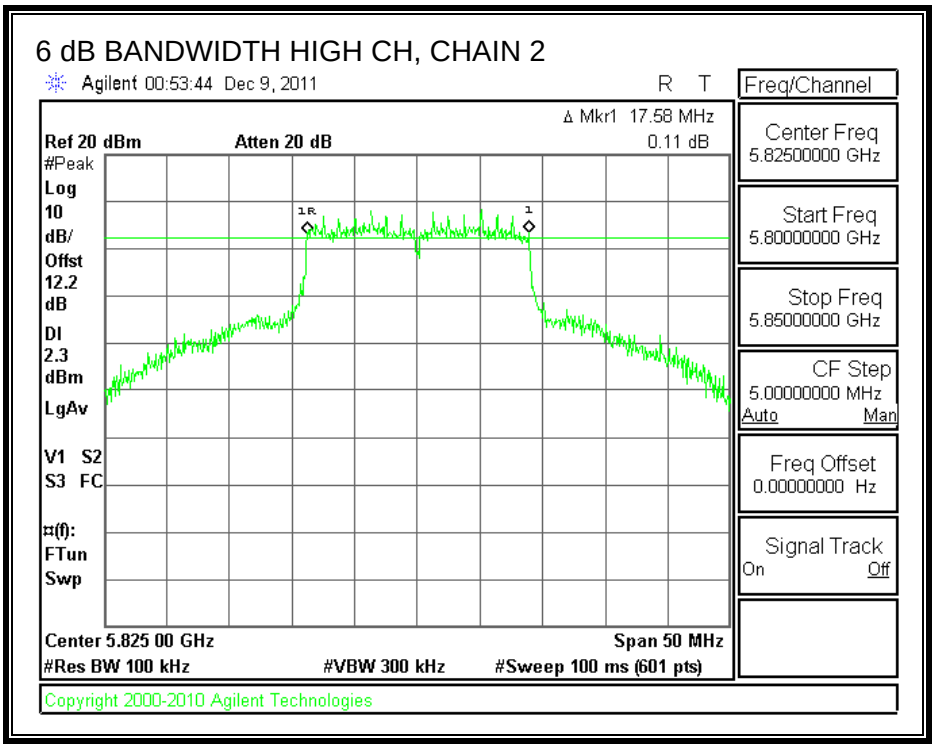




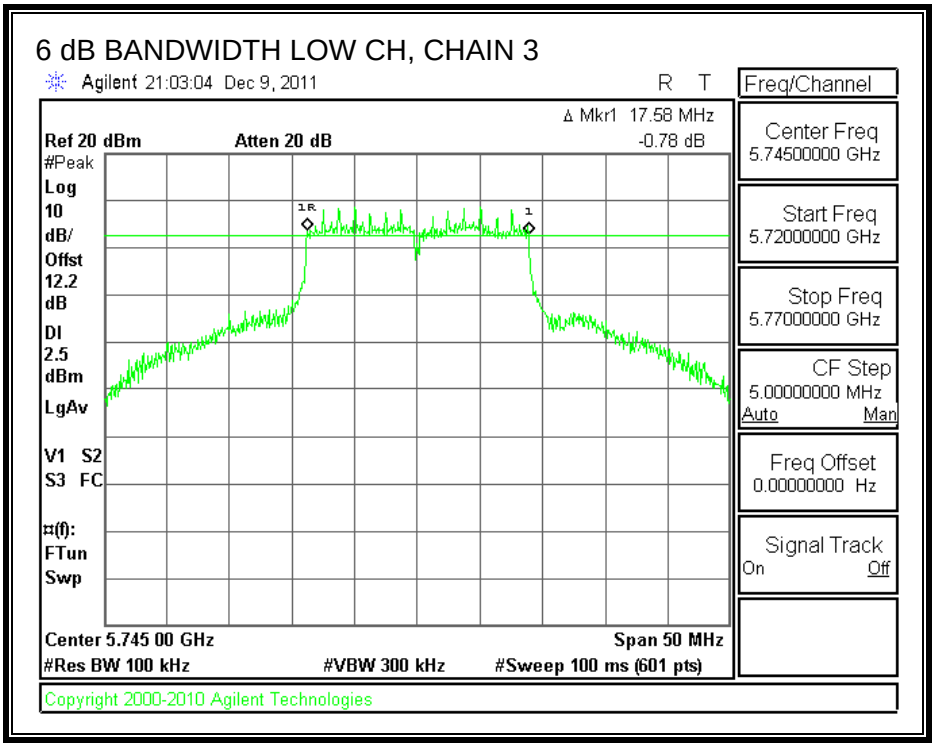
6 dB BANDWIDTH, CHAIN 2

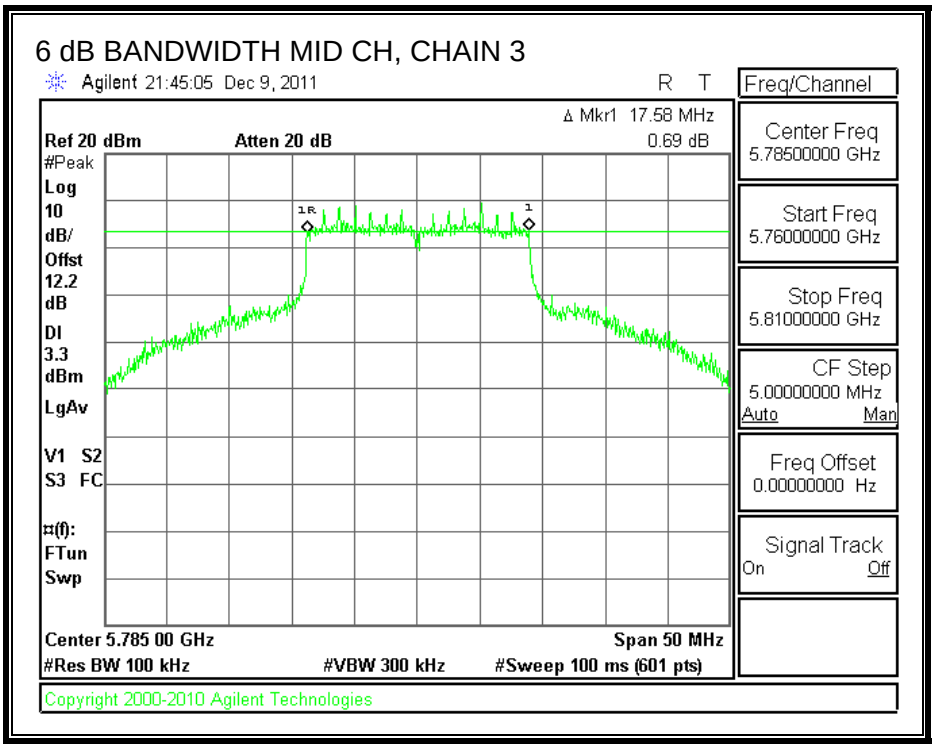


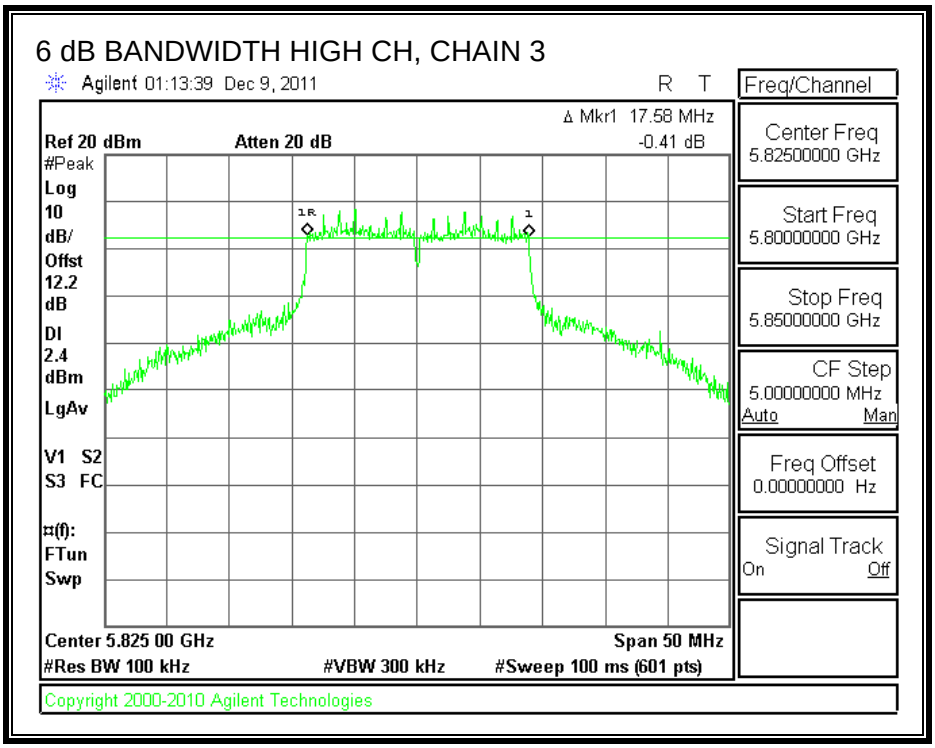




6 dB BANDWIDTH, CHAIN 3







7.4.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

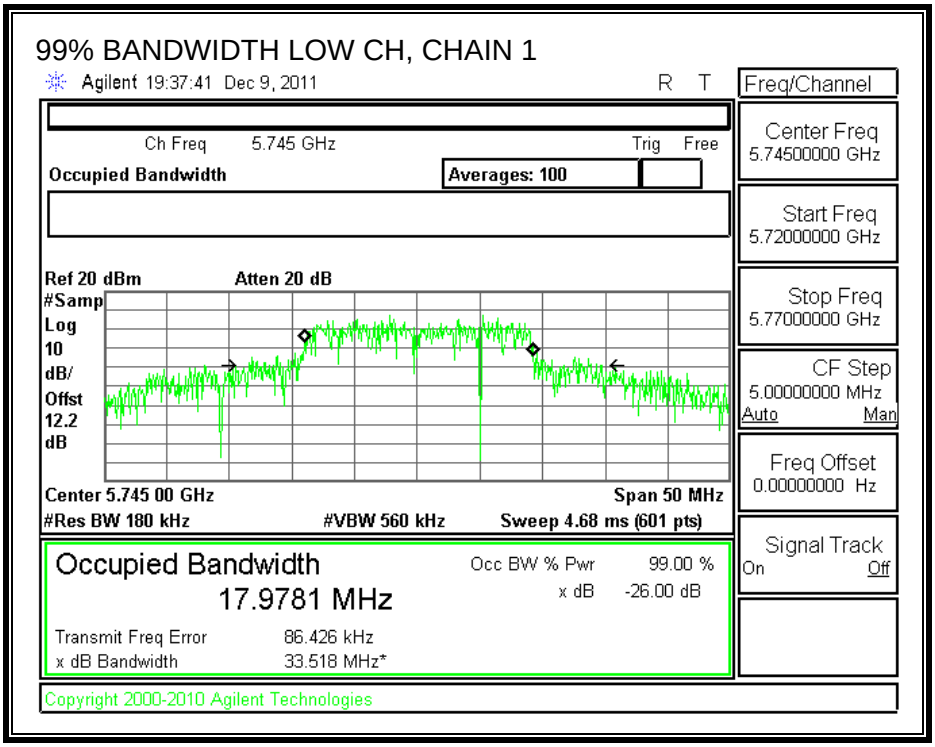
TEST PROCEDURE

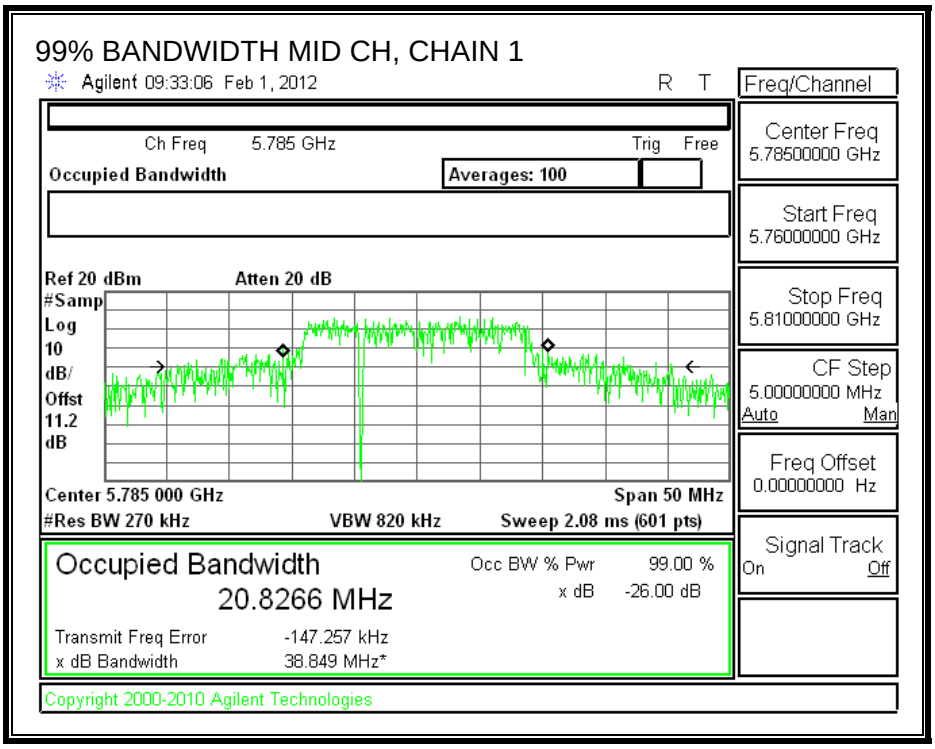
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

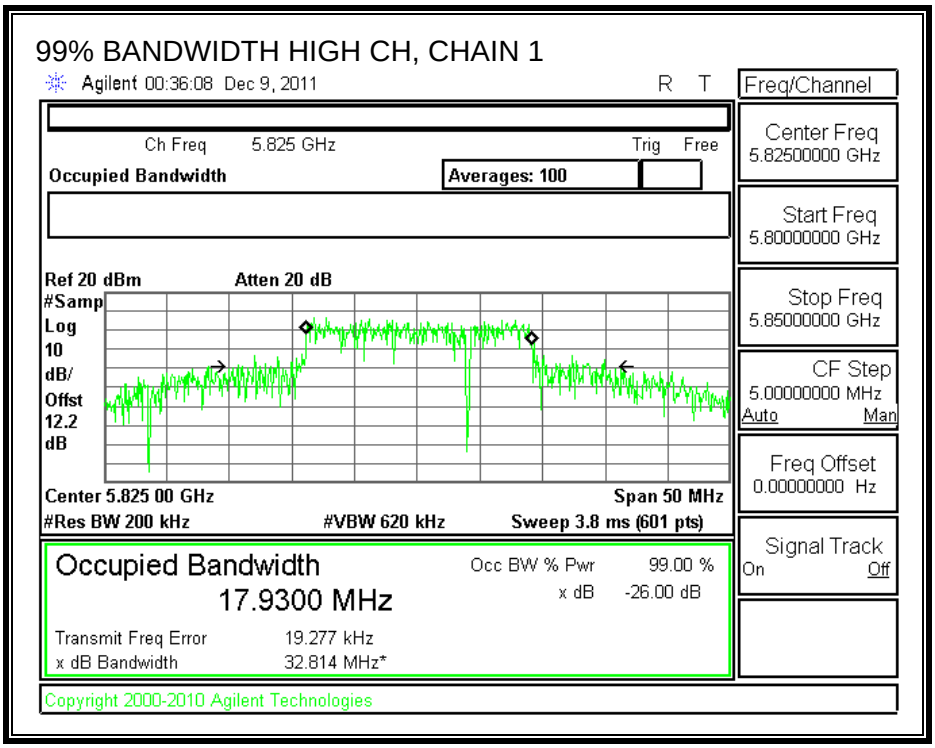
RESULTS

Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	5745	17.9781	17.8105	17.8225
Middle	5785	20.8266	18.2201	18.4659
High	5825	17.9300	17.7879	17.8585

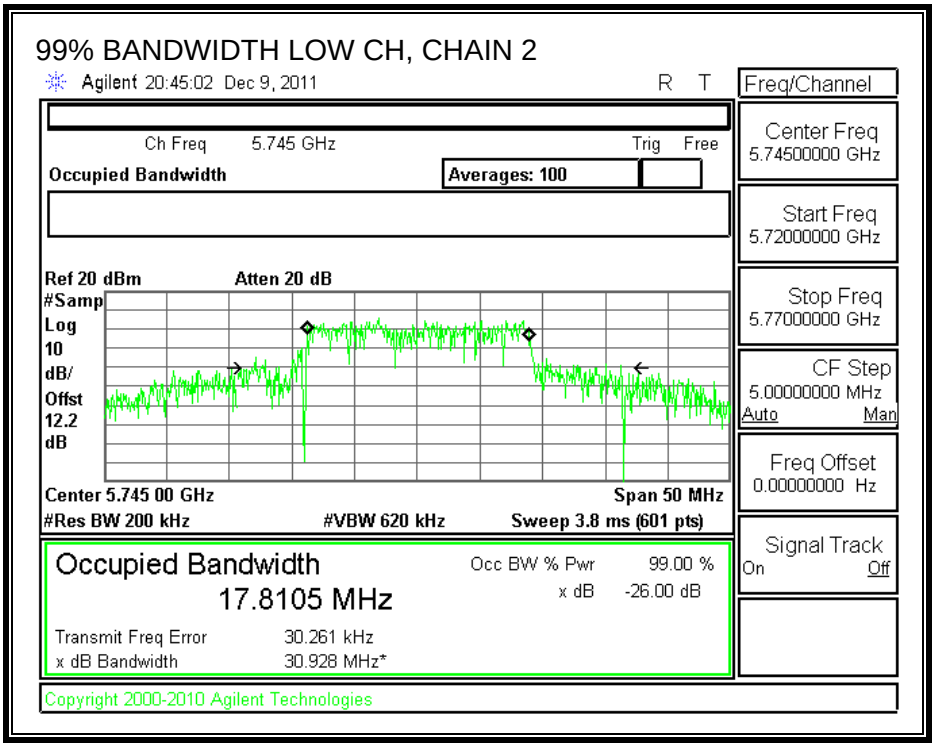
99% BANDWIDTH, CHAIN 1

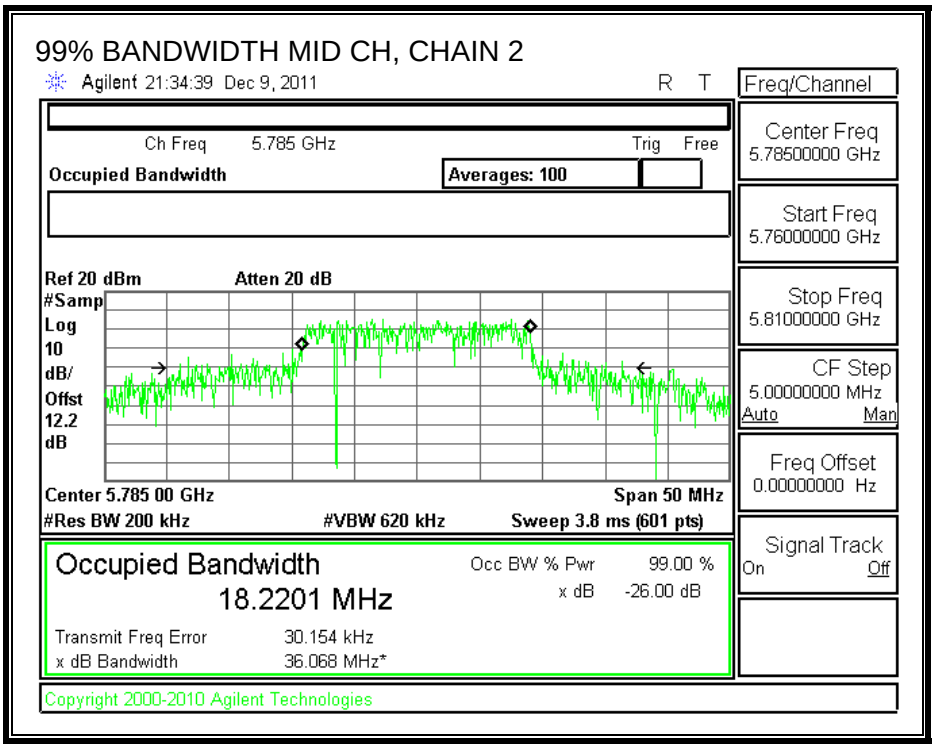


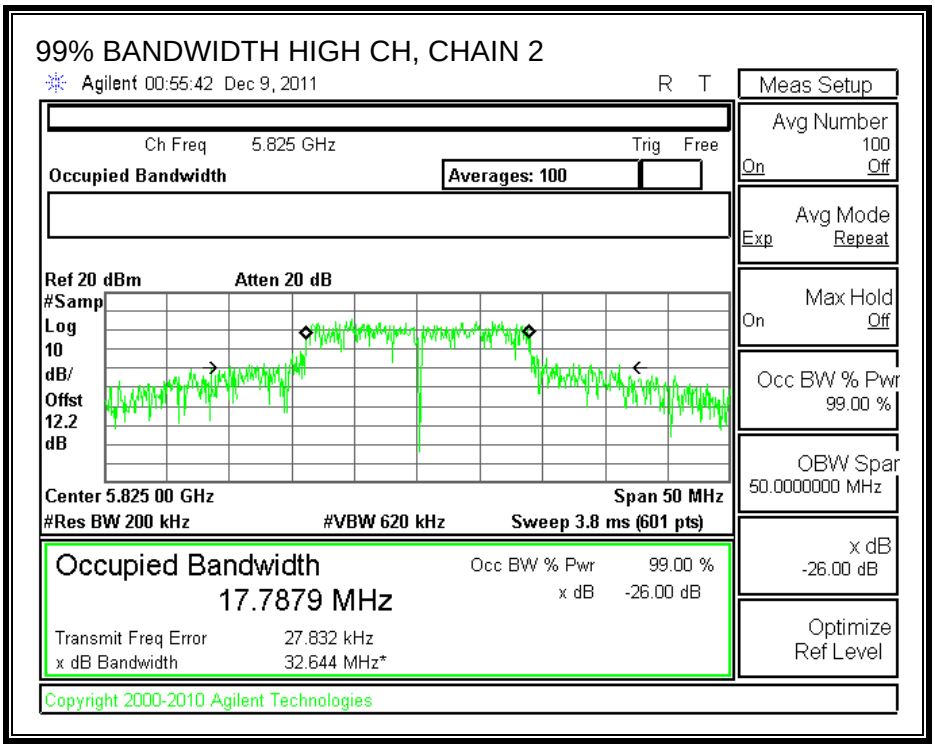




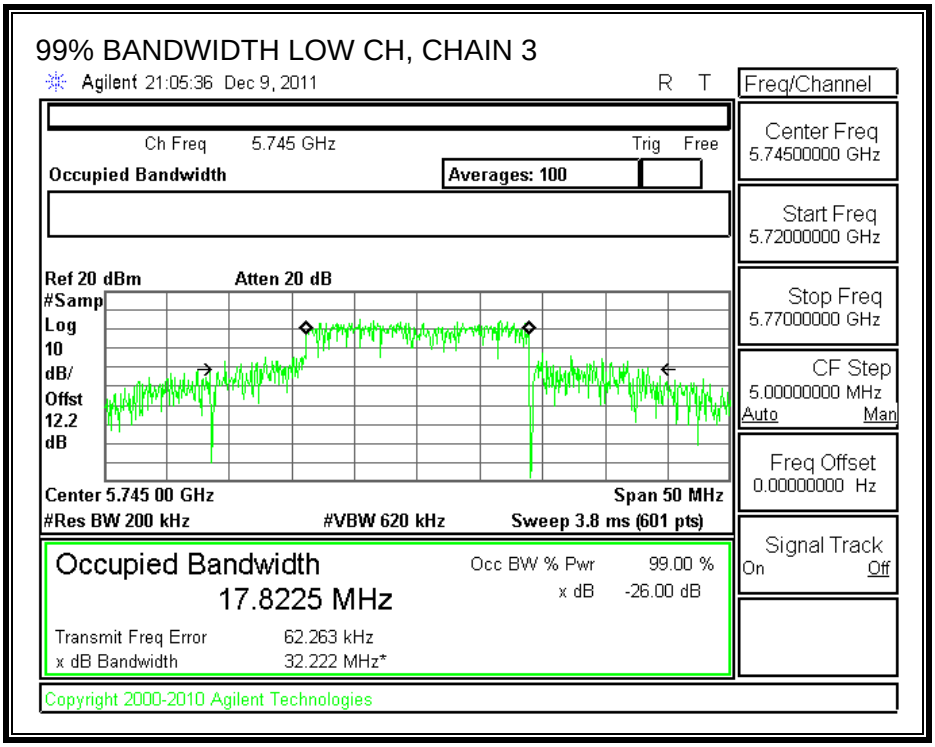
99% BANDWIDTH, CHAIN 2

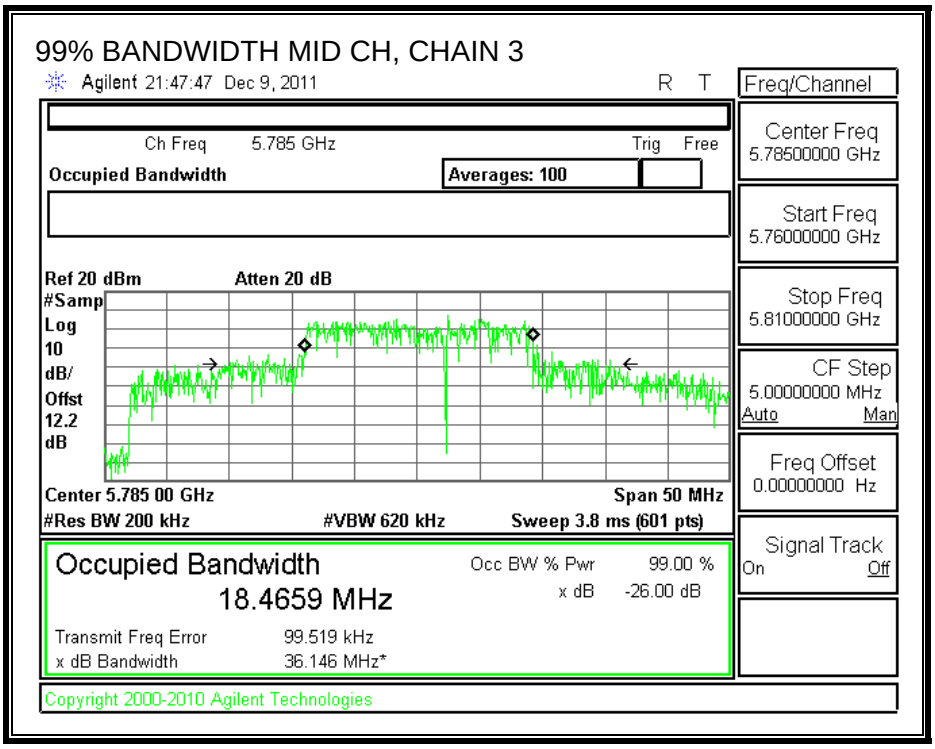


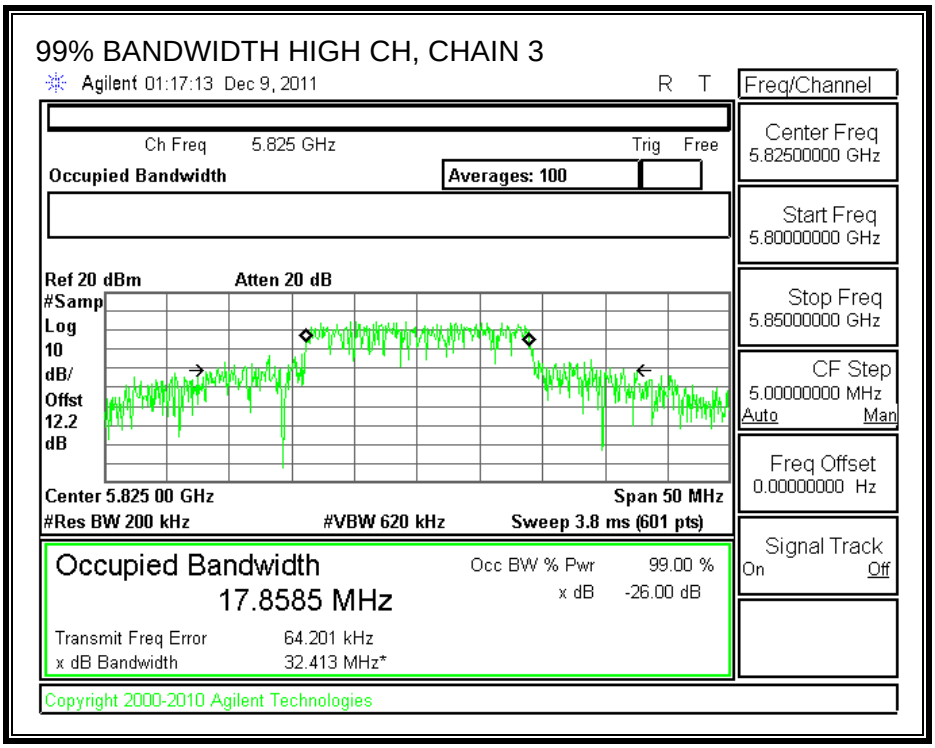




99% BANDWIDTH, CHAIN 3







7.4.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The combined antenna gain is 9.31 dBi for other than fixed, point-to-point operations, therefore the limit is 26.69 dBm.

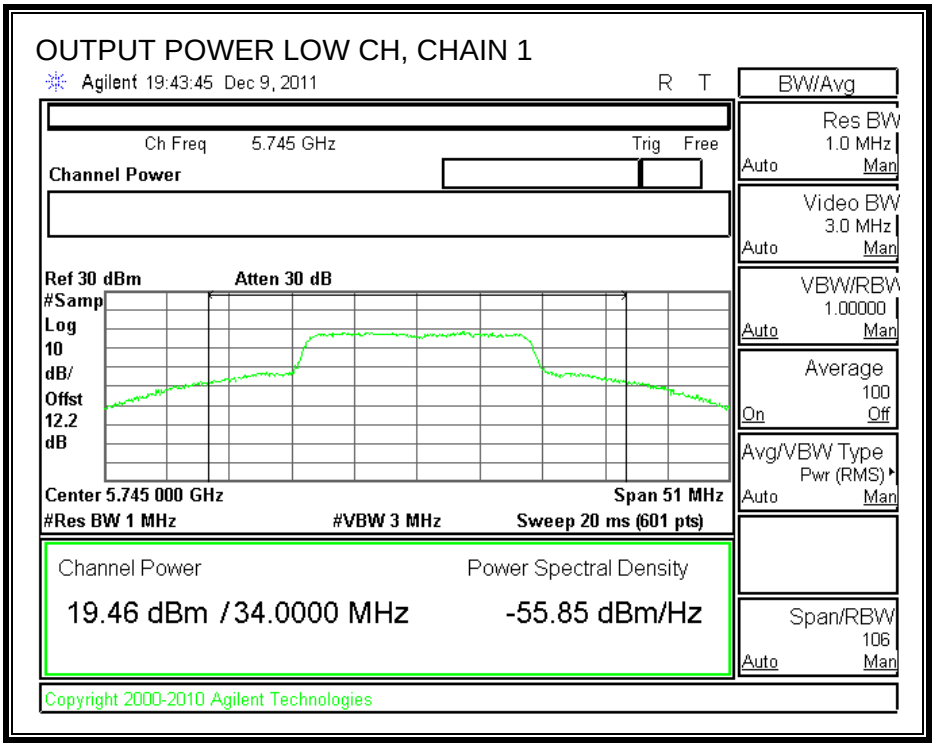
TEST PROCEDURE

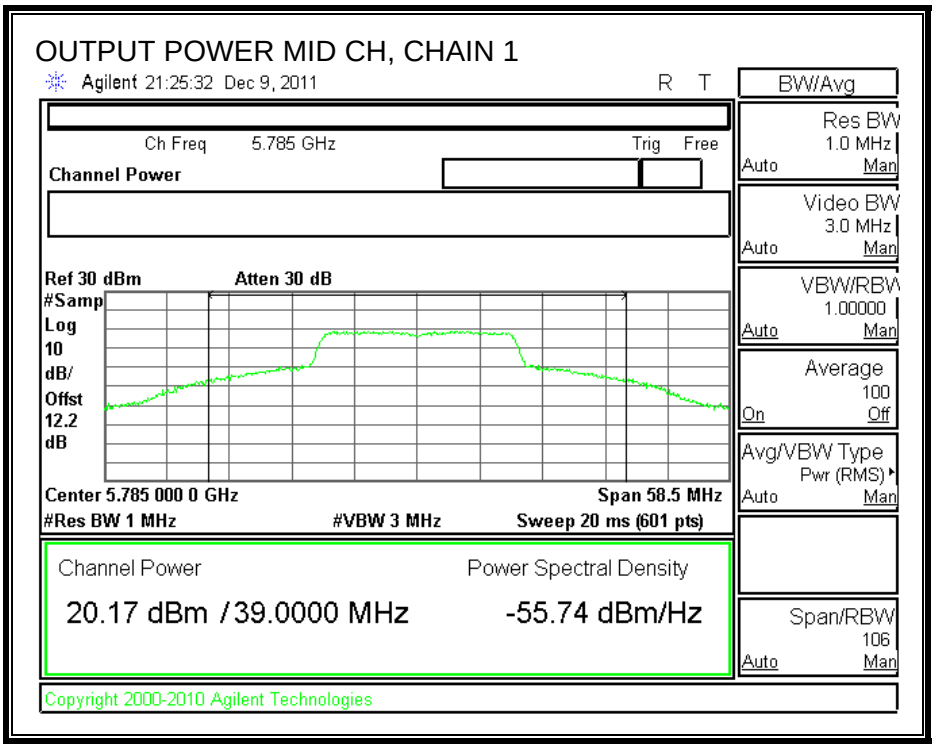
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

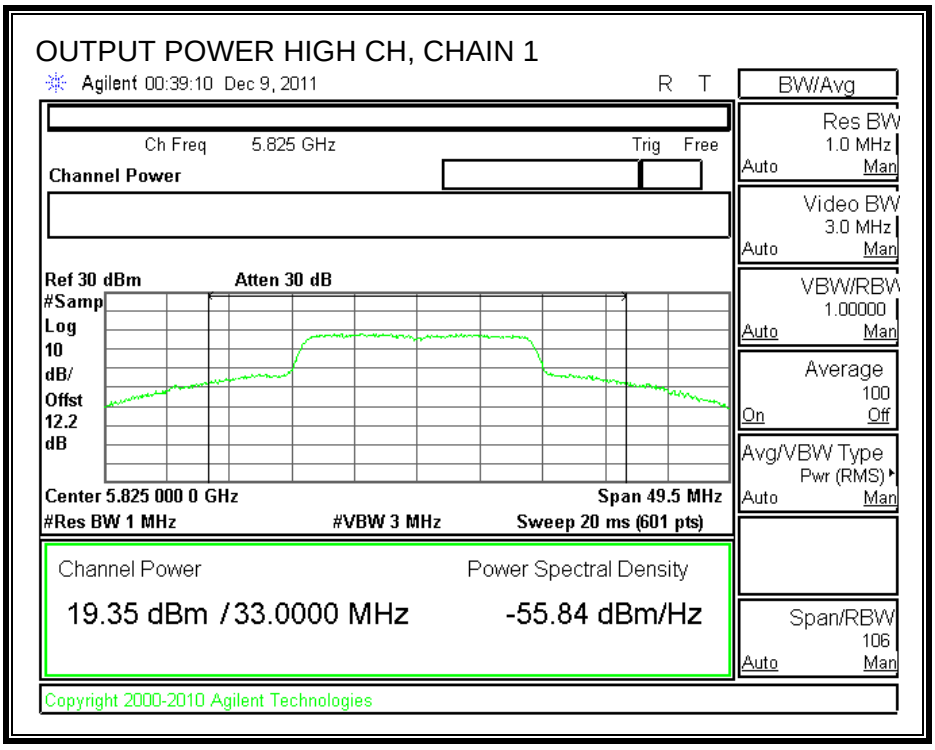
RESULTS

Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	19.46	18.83	18.86	23.83	26.69	-2.86
Mid	5785	20.17	19.37	19.66	24.52	26.69	-2.17
High	5825	19.35	19.02	18.96	23.88	26.69	-2.81

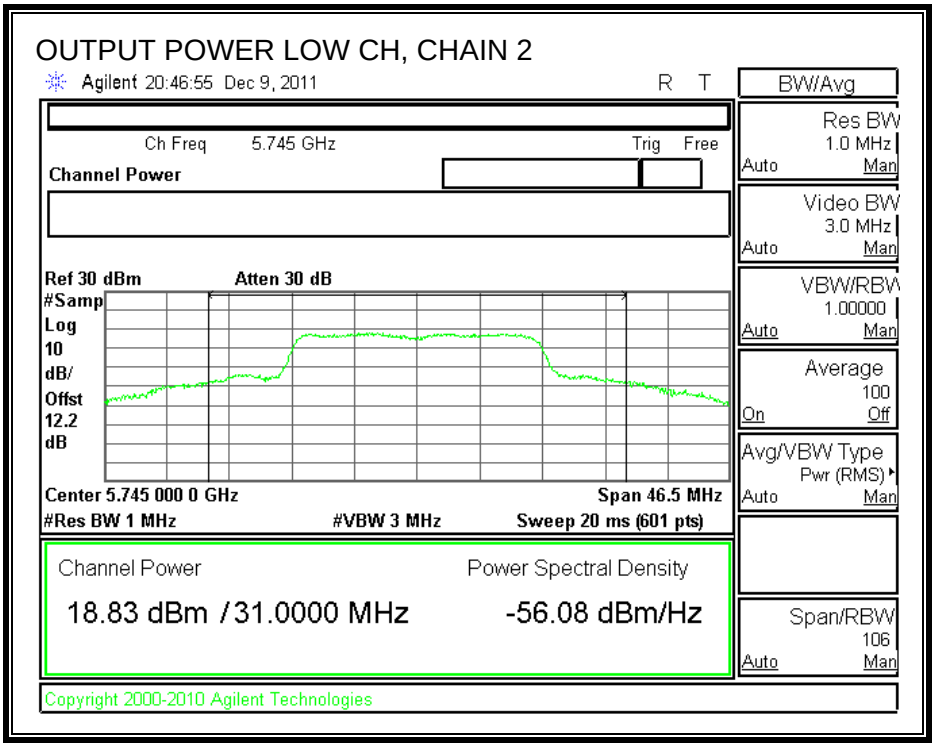
CHAIN 1 OUTPUT POWER

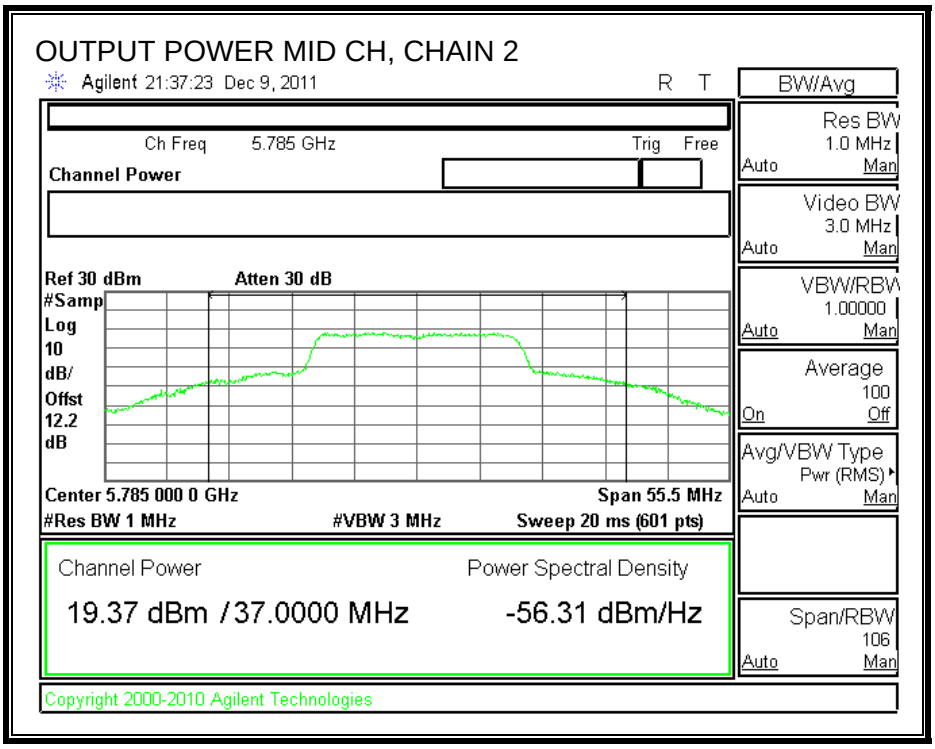


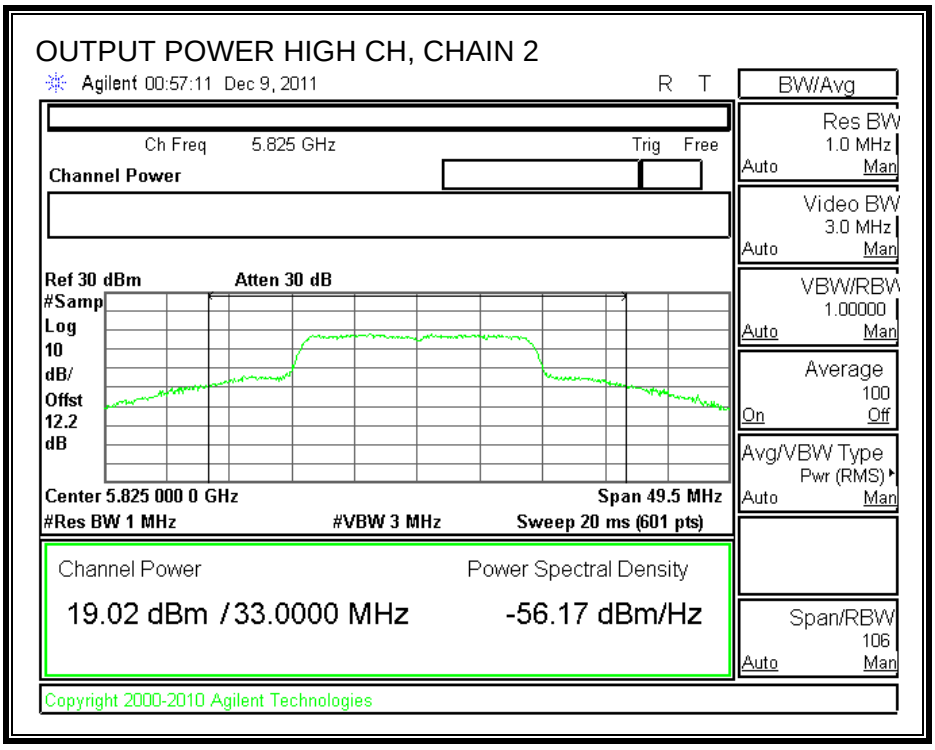




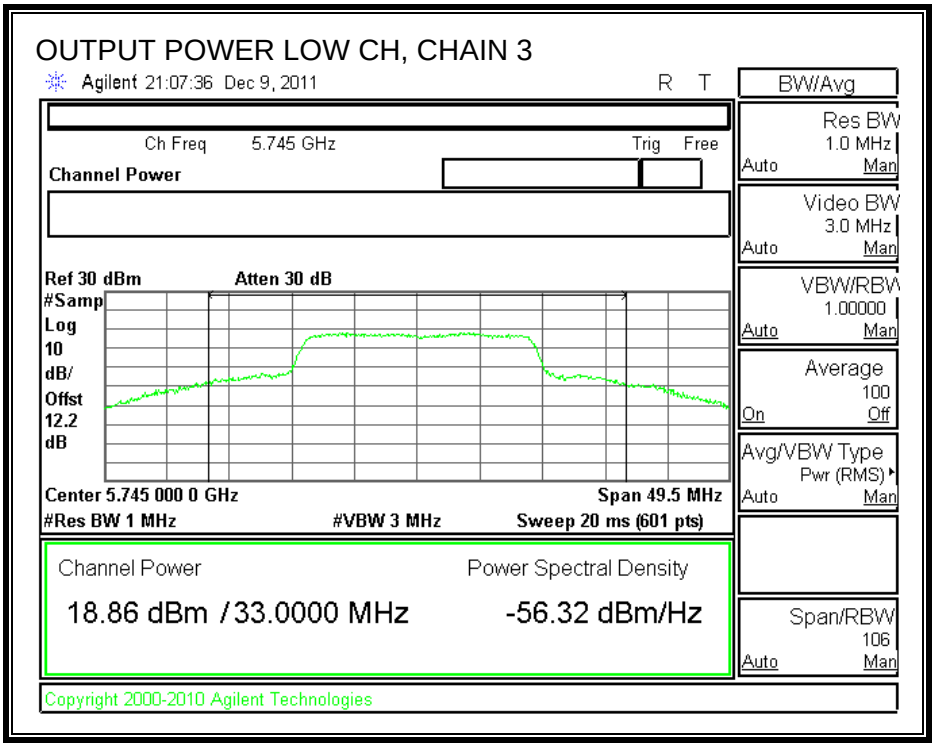
CHAIN 2 OUTPUT POWER

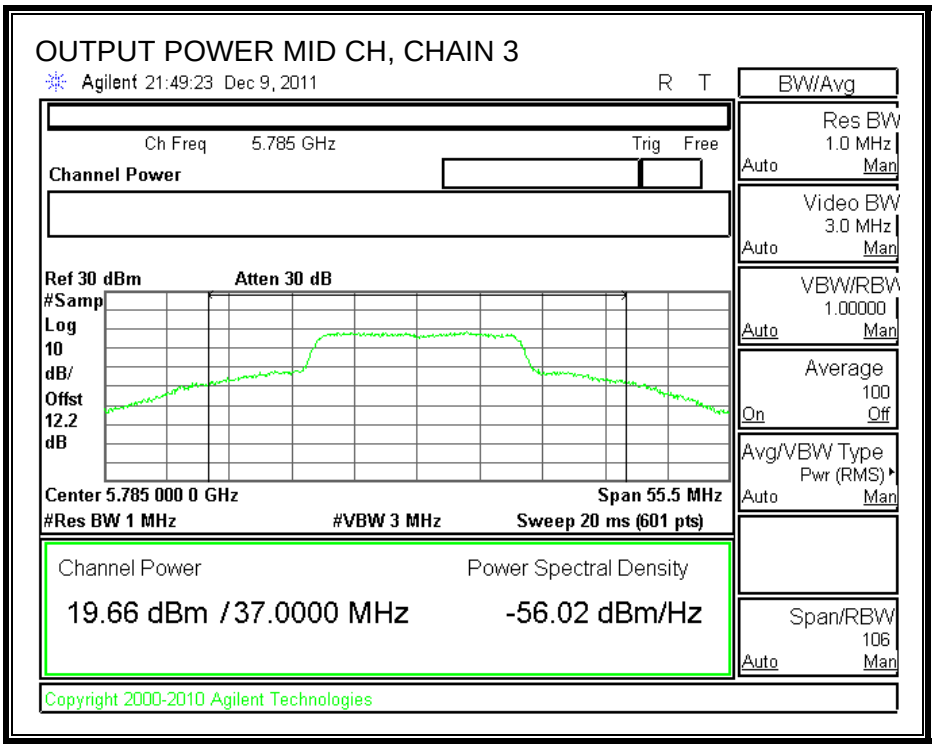


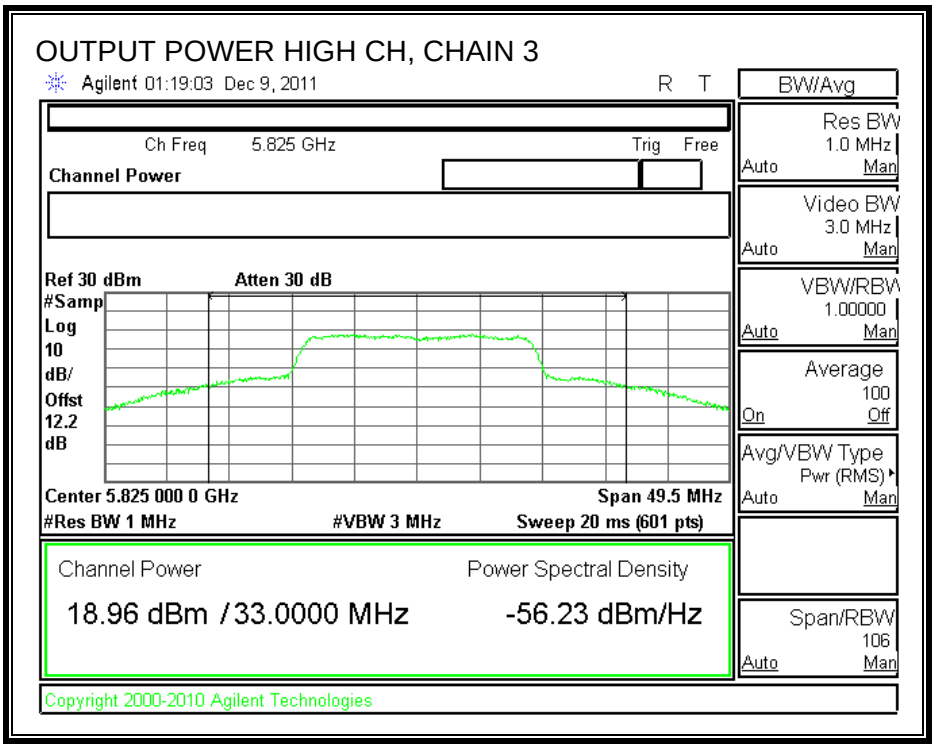




CHAIN 3 OUTPUT POWER







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 12.2 dB (including 10 dB pad and 2.2 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)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5745	18.10	17.58	17.61	22.54
Middle	5785	19.13	18.26	18.40	23.38
High	5825	18.10	17.73	17.36	22.51

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.

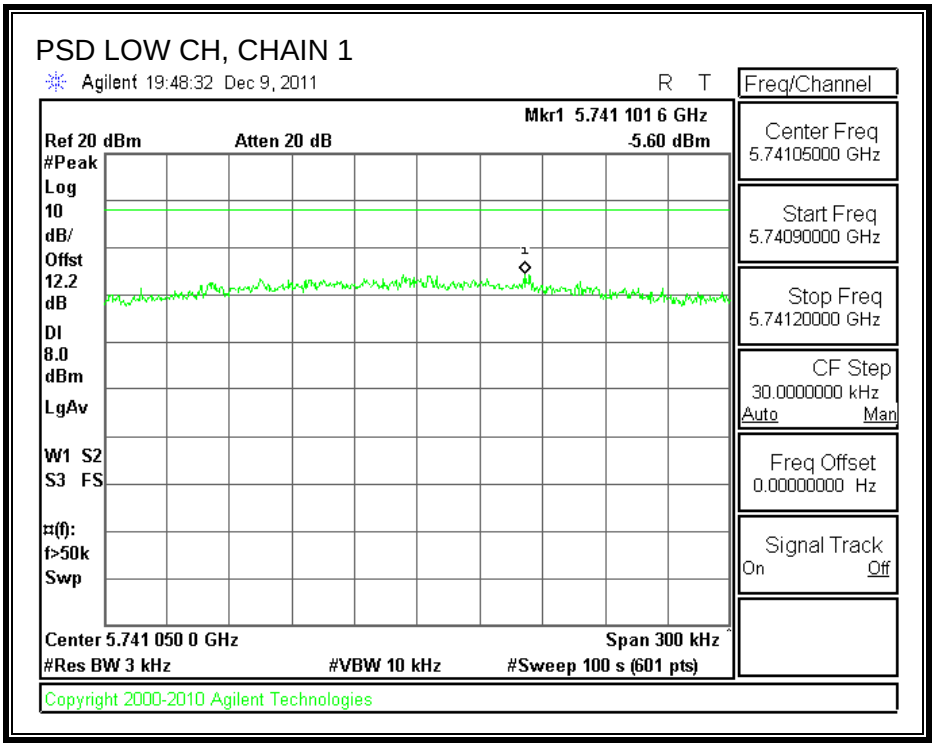
TEST PROCEDURE

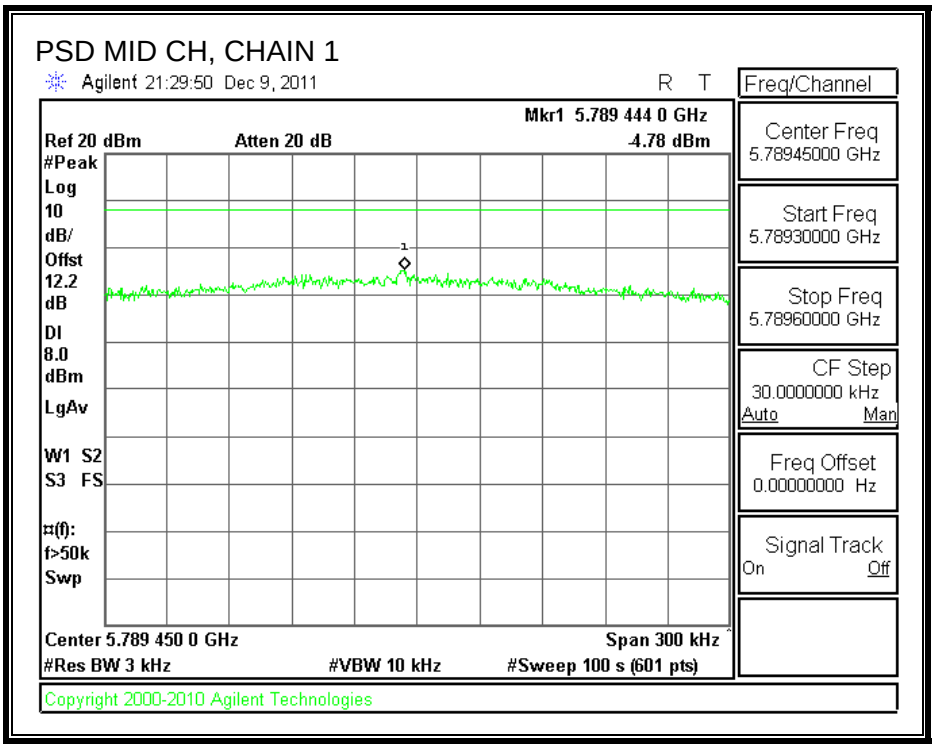
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

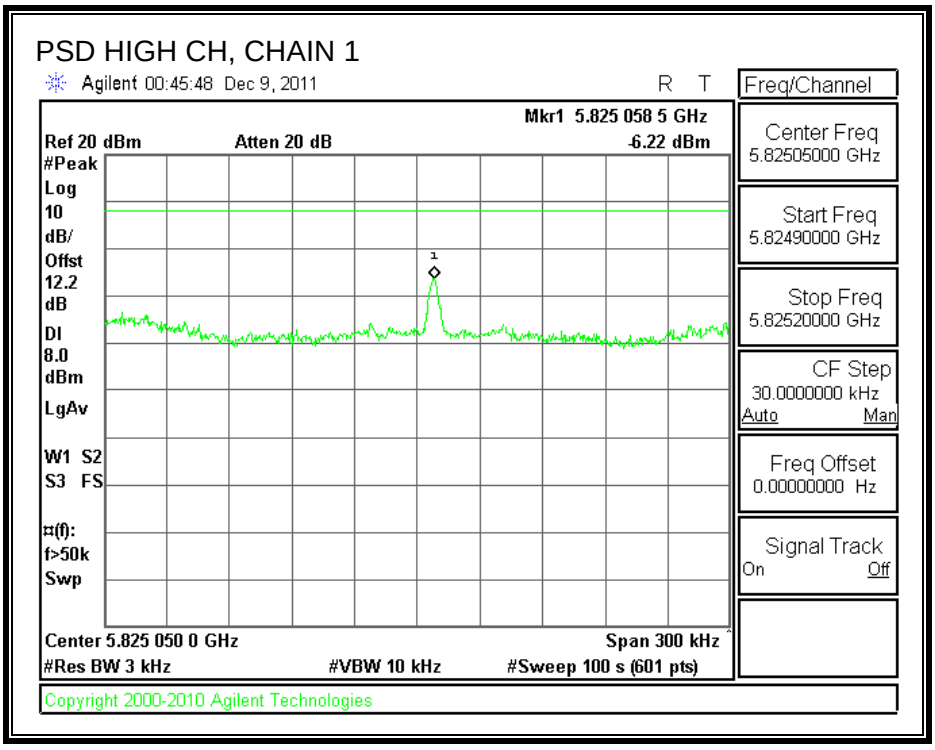
RESULTS:

Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-5.6	-6.86	-3.34	-0.25	8	-8.25
Middle	5785	-4.78	-4.99	-2.06	1.04	8	-6.96
High	5825	-6.22	-6.65	-6.55	-1.70	8	-9.70

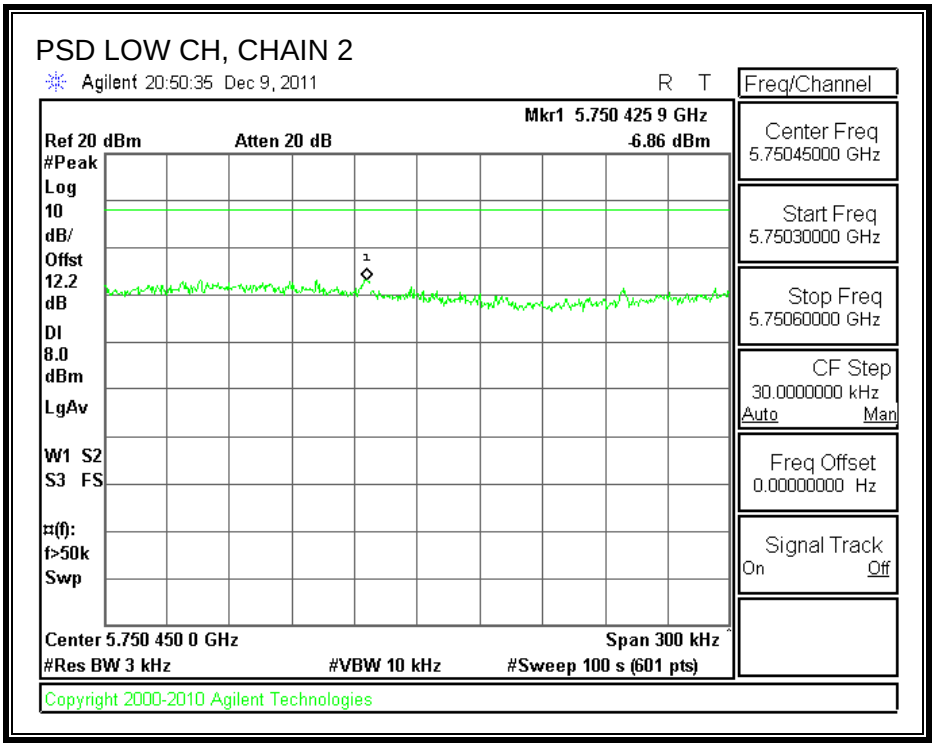
POWER SPECTRAL DENSITY, CHAIN 1

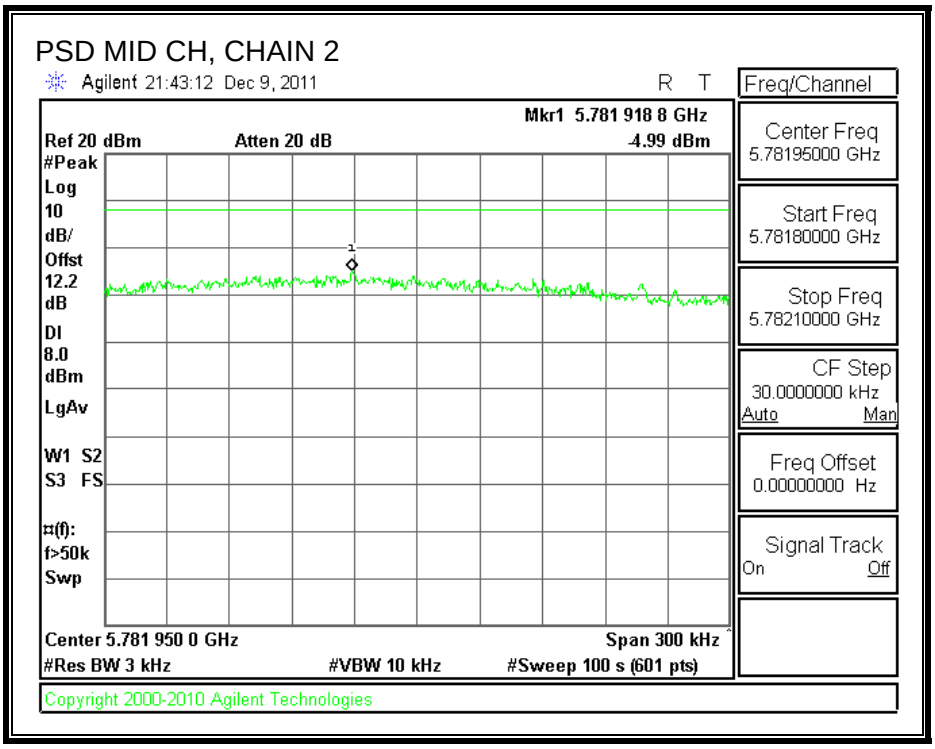


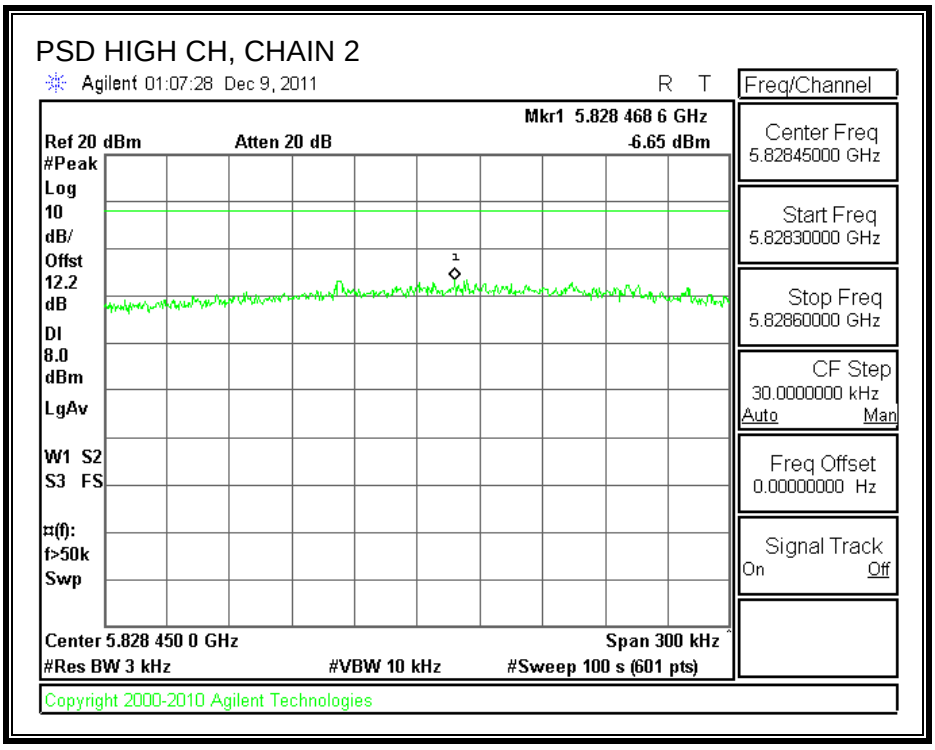




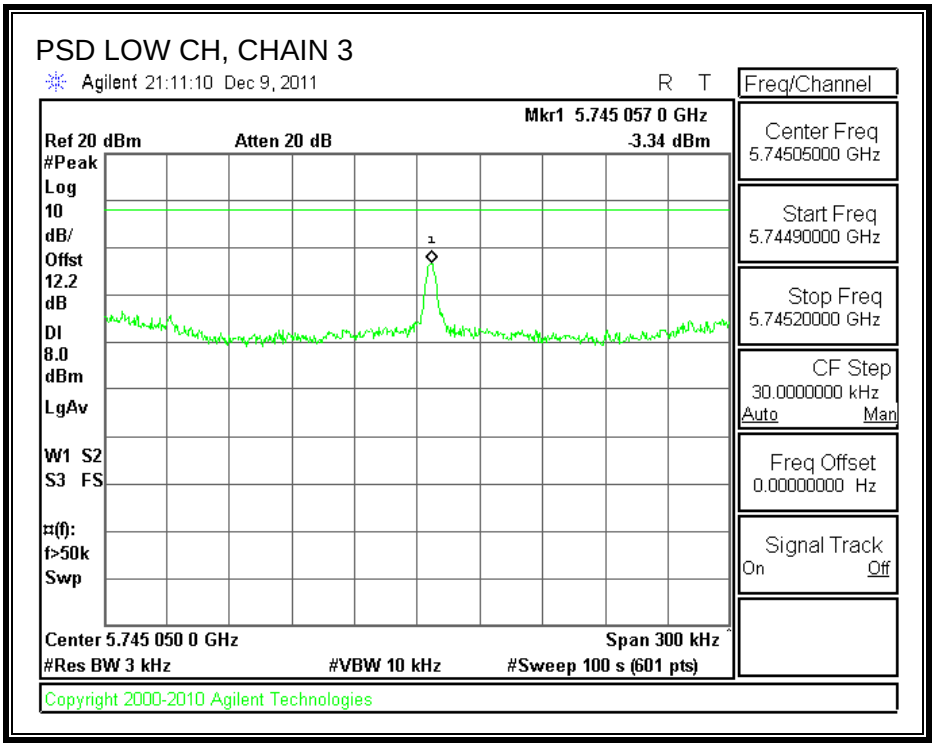
POWER SPECTRAL DENSITY, CHAIN 2

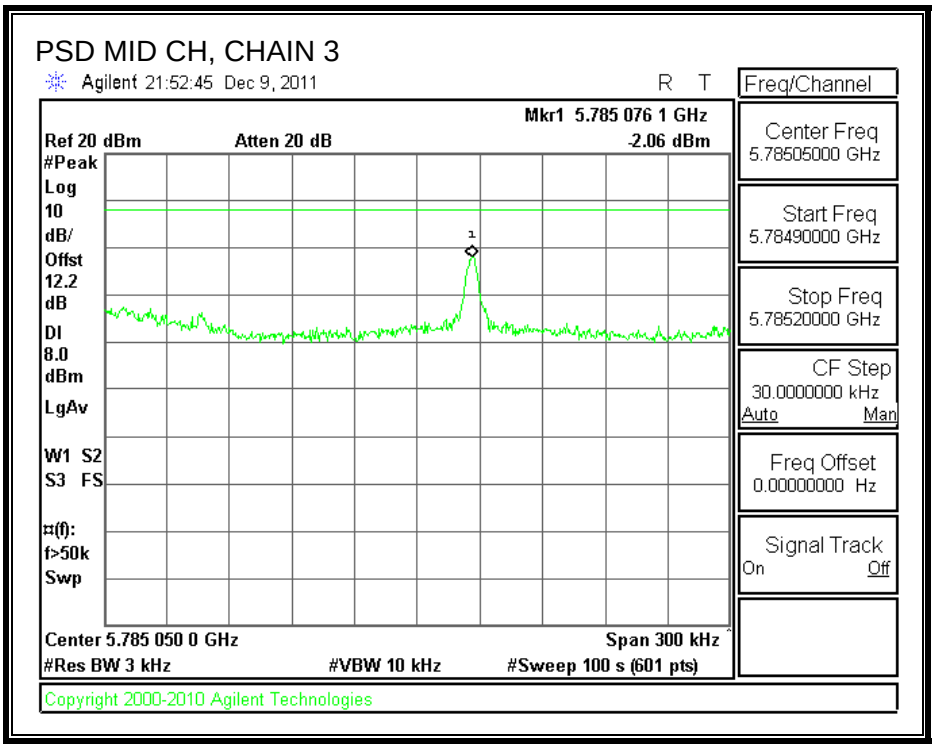




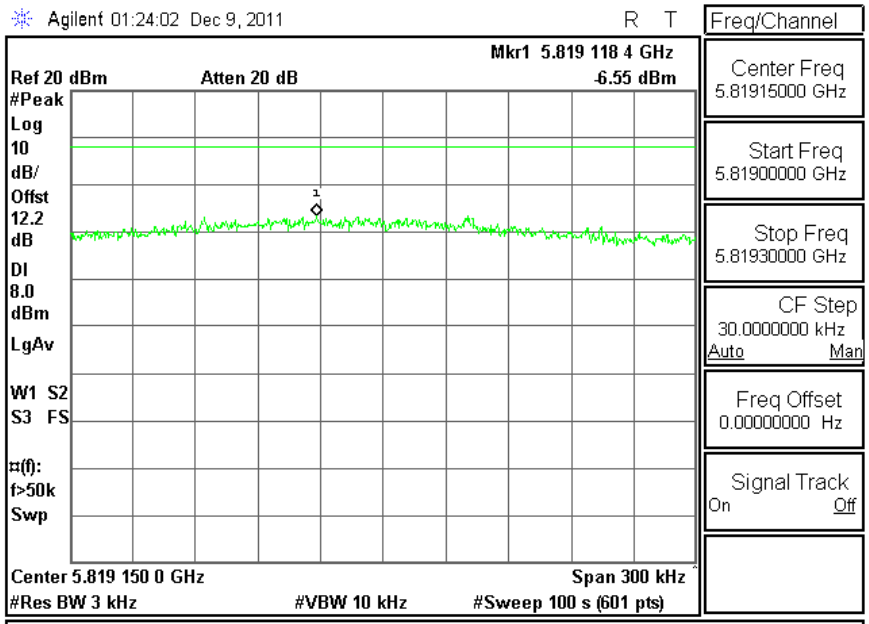


POWER SPECTRAL DENSITY, CHAIN 3





PSD HIGH CH, CHAIN 3



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.

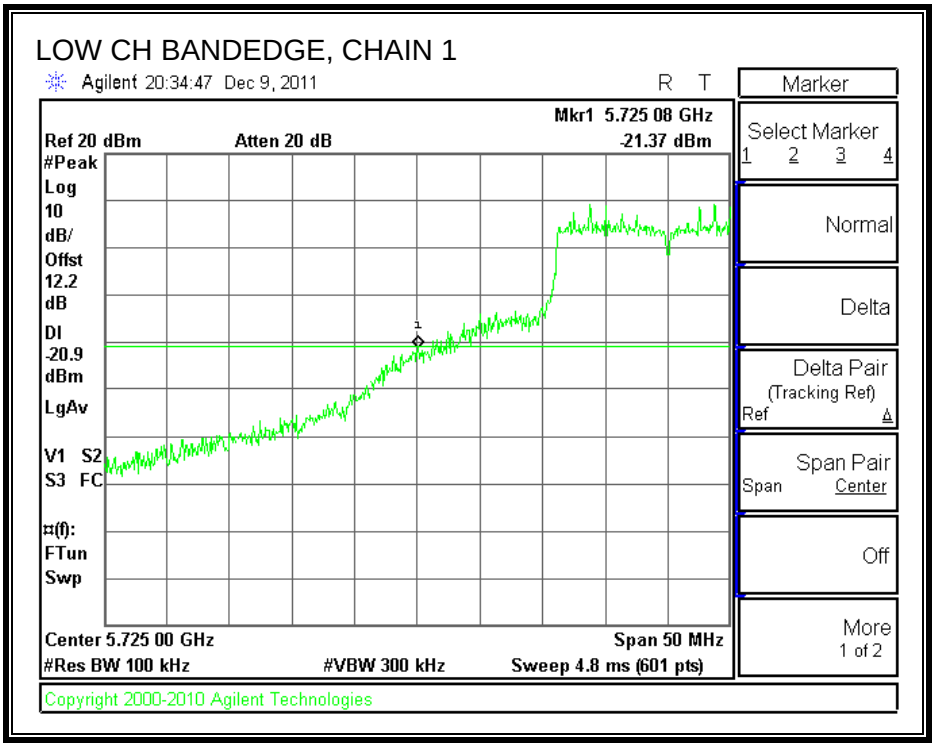
TEST PROCEDURE

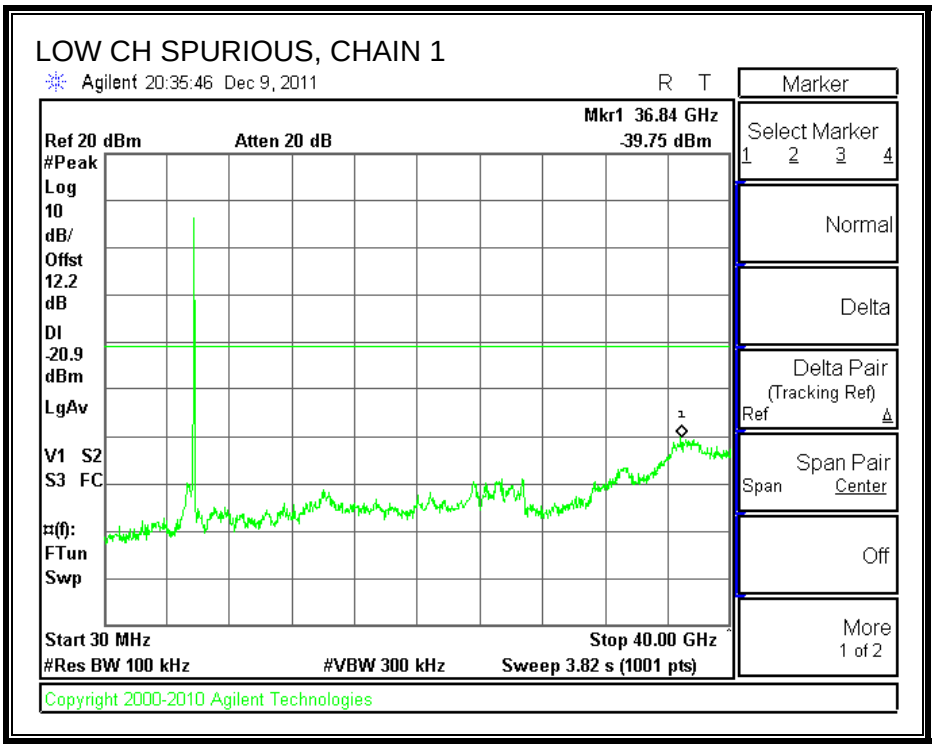
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

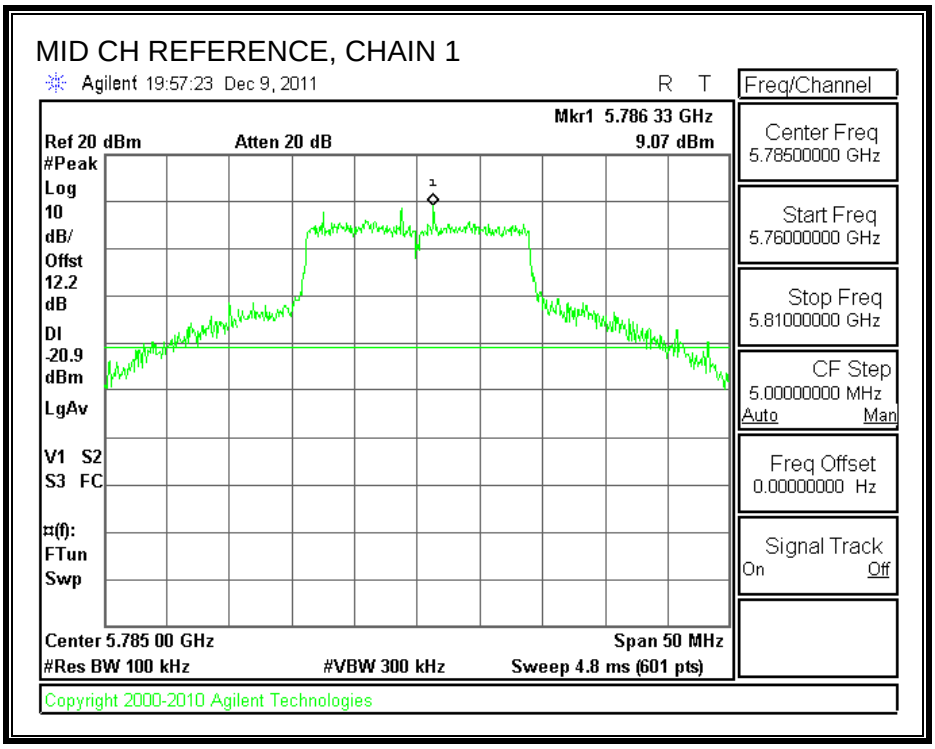
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

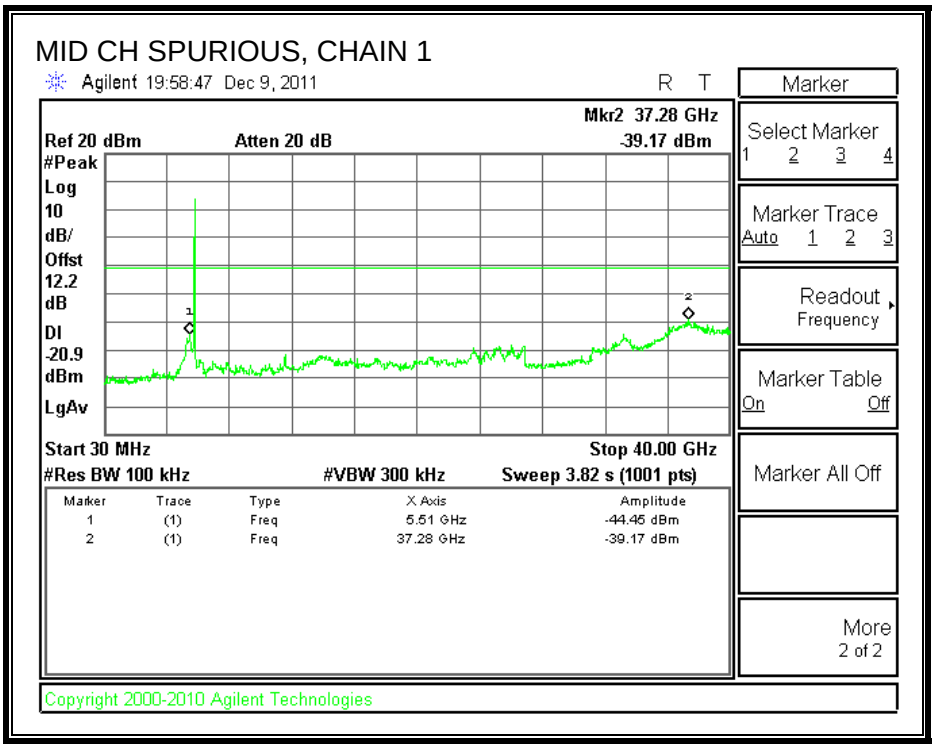
RESULTS

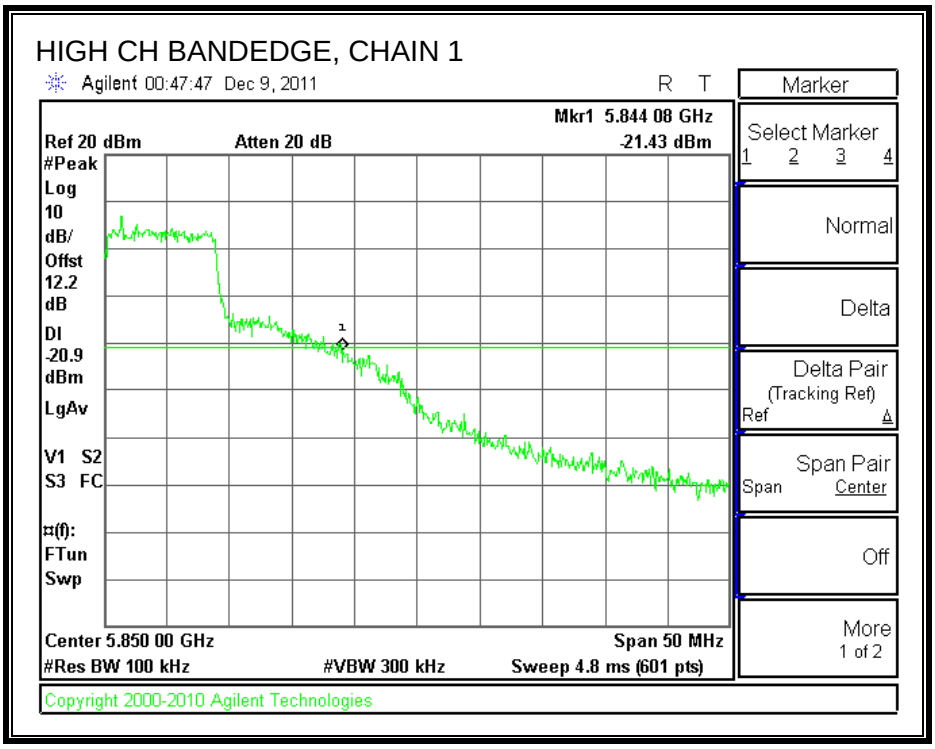
CHAIN 1 SPURIOUS EMISSIONS

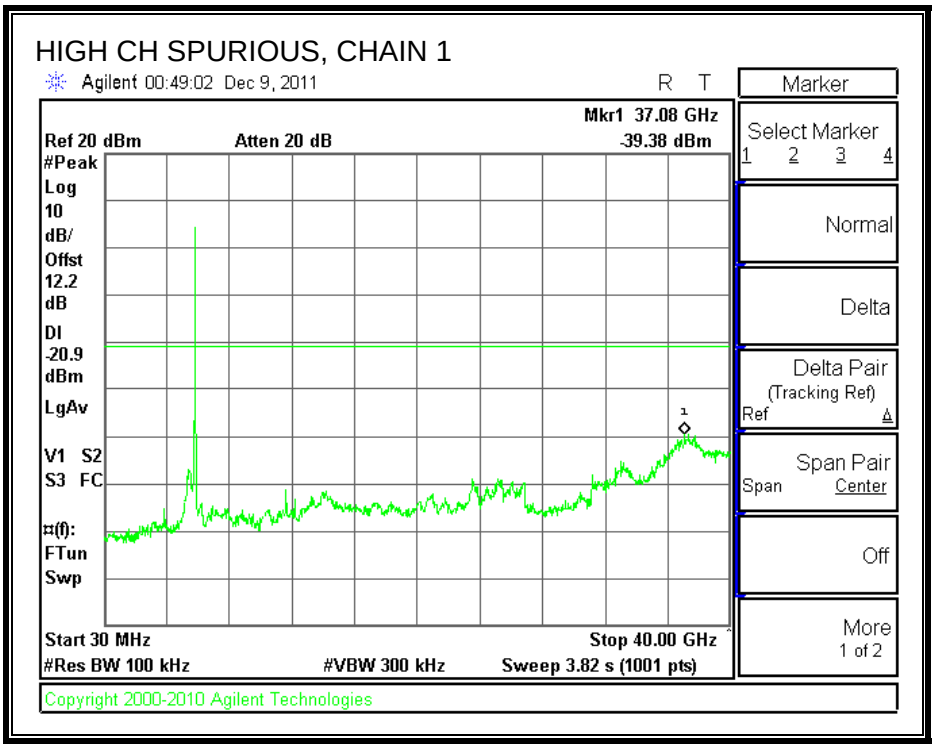




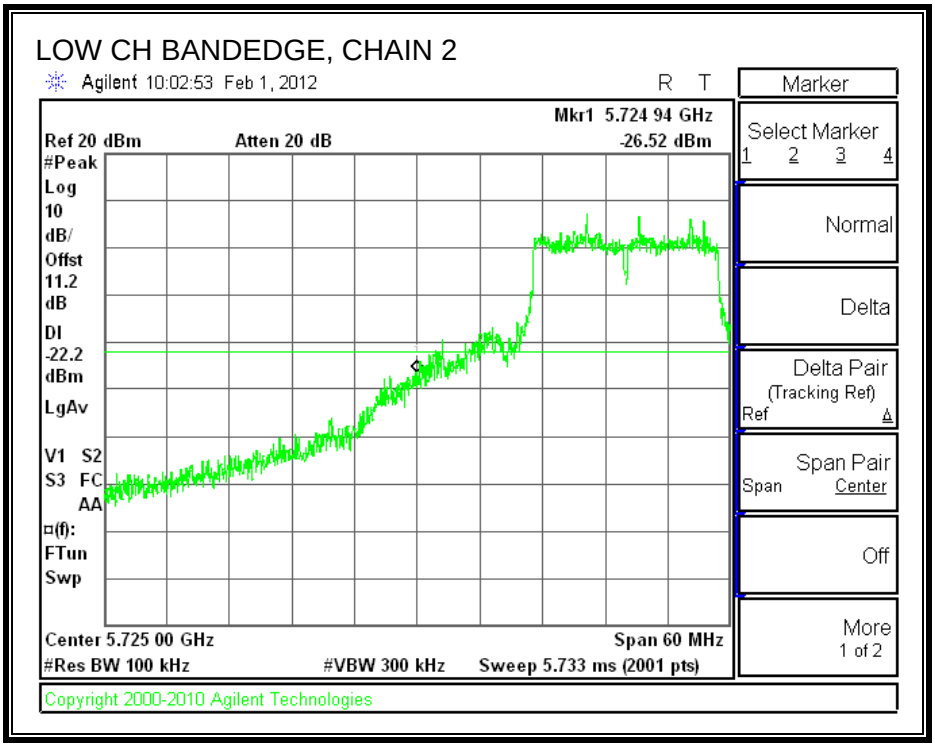


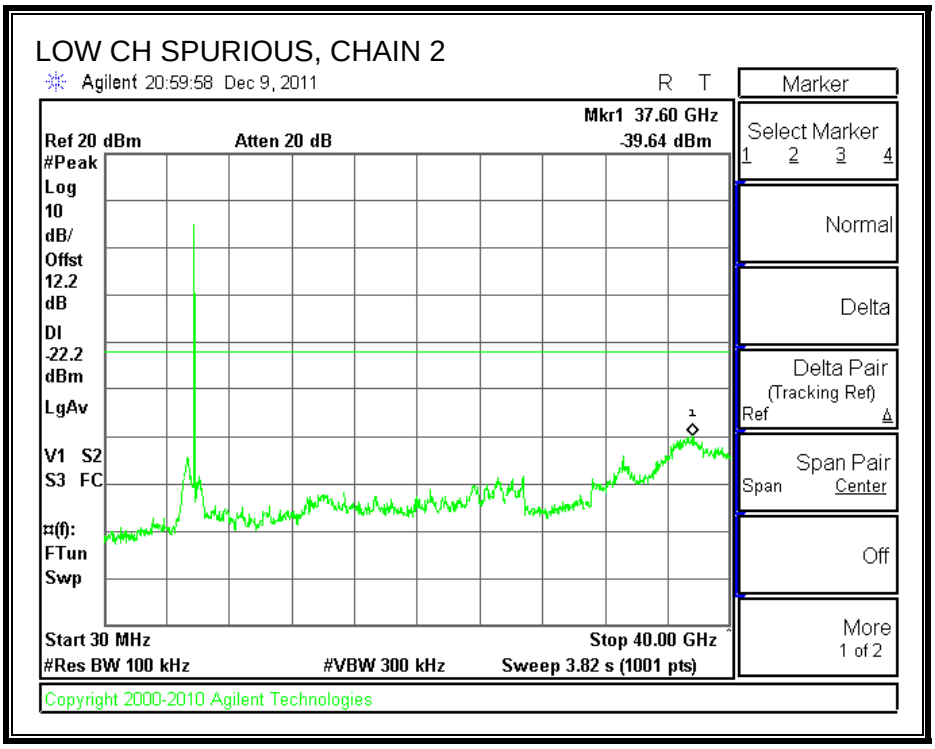


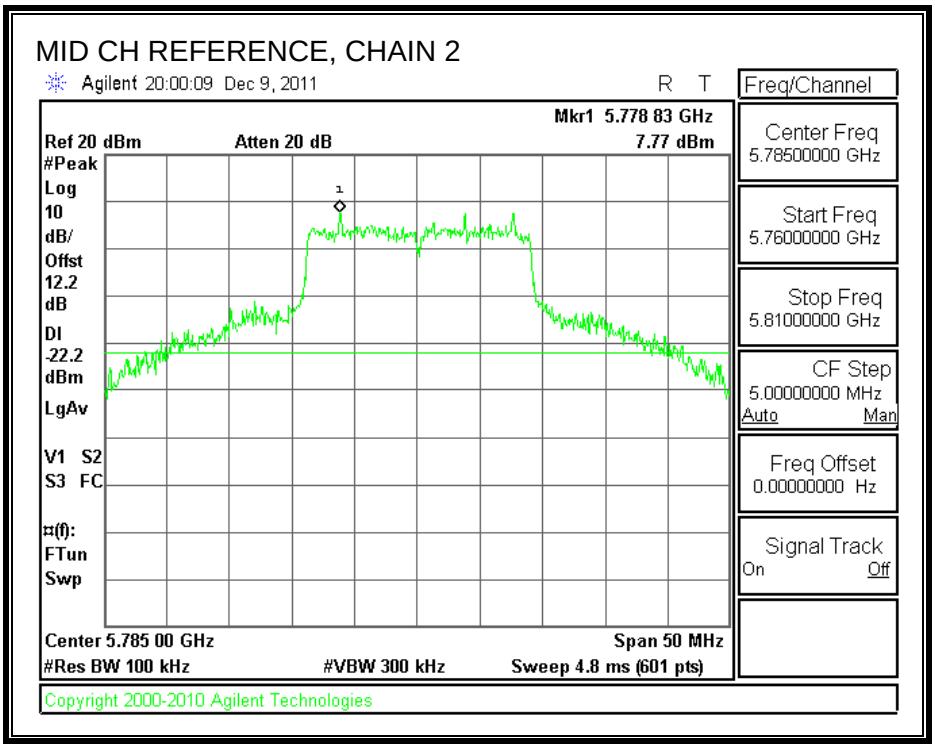


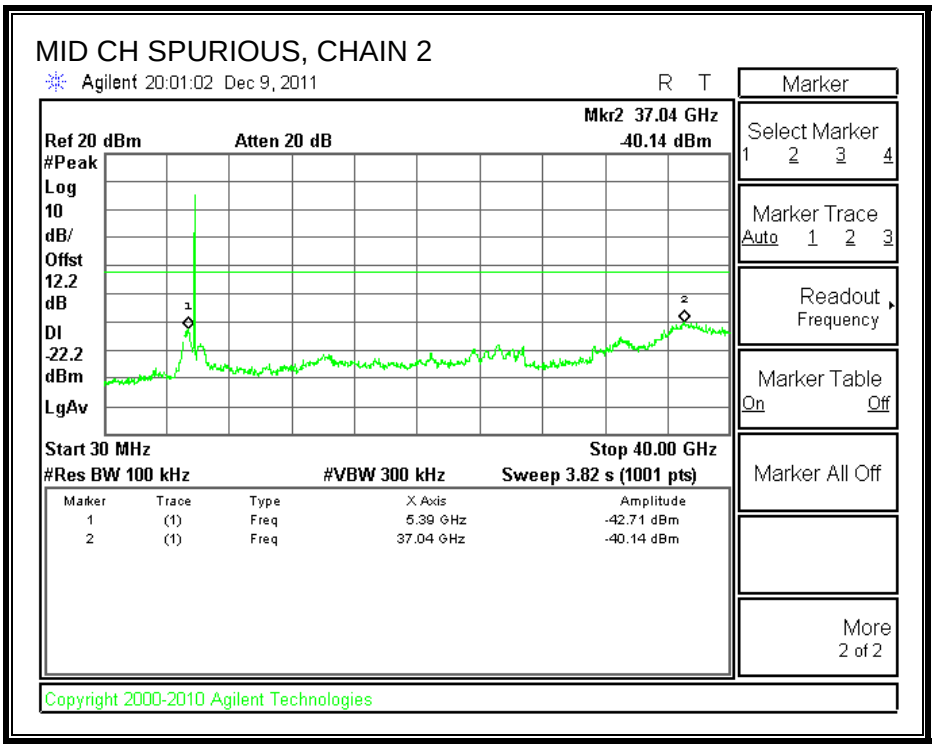


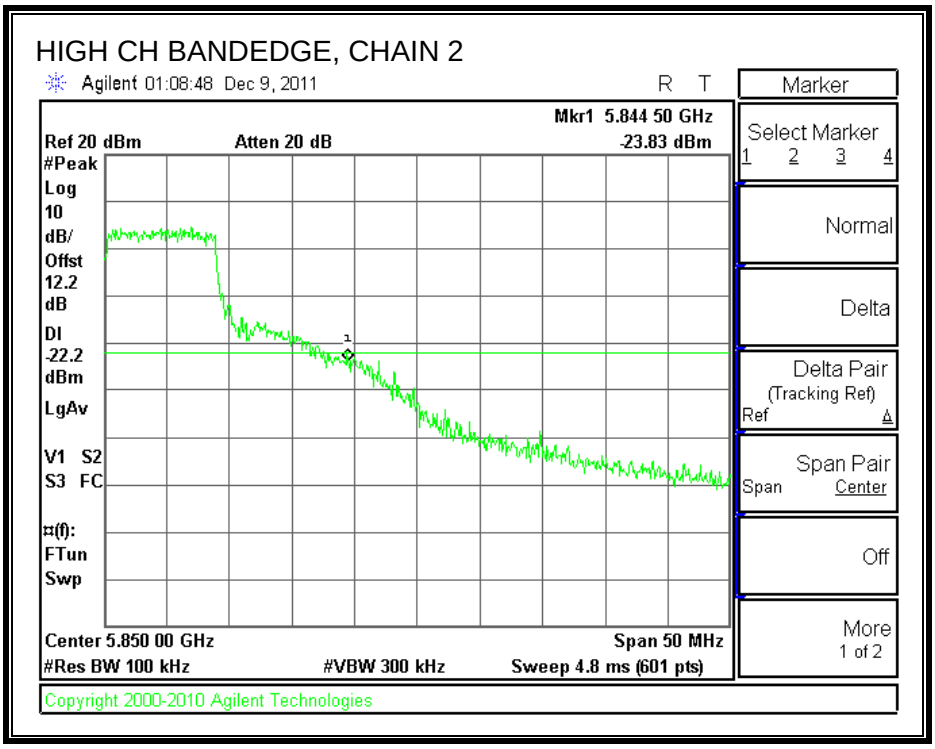
CHAIN 2 SPURIOUS EMISSIONS

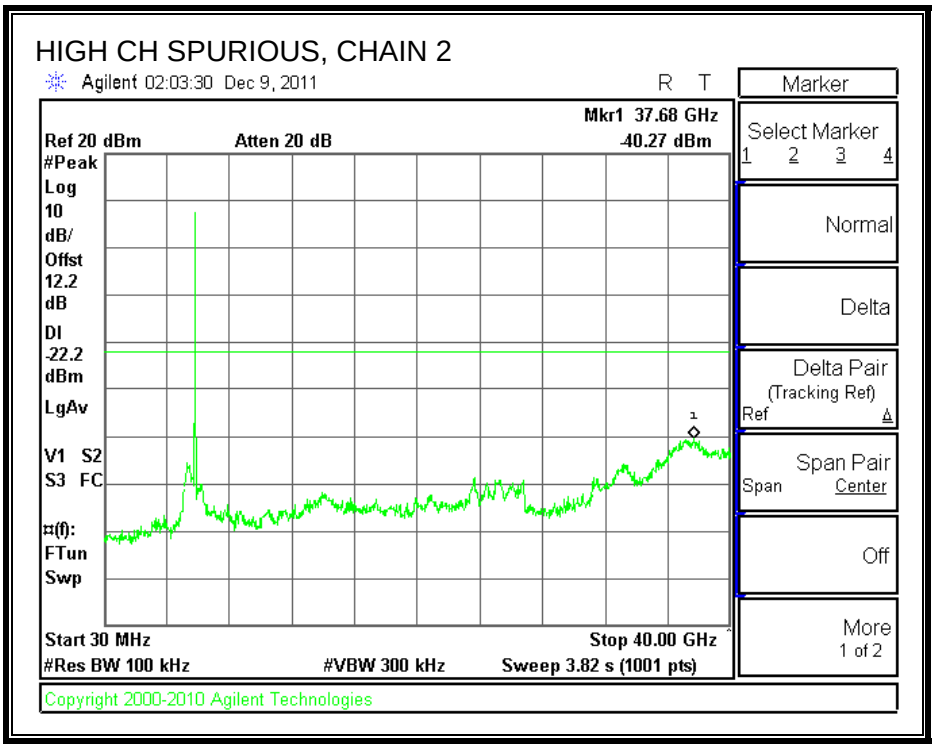




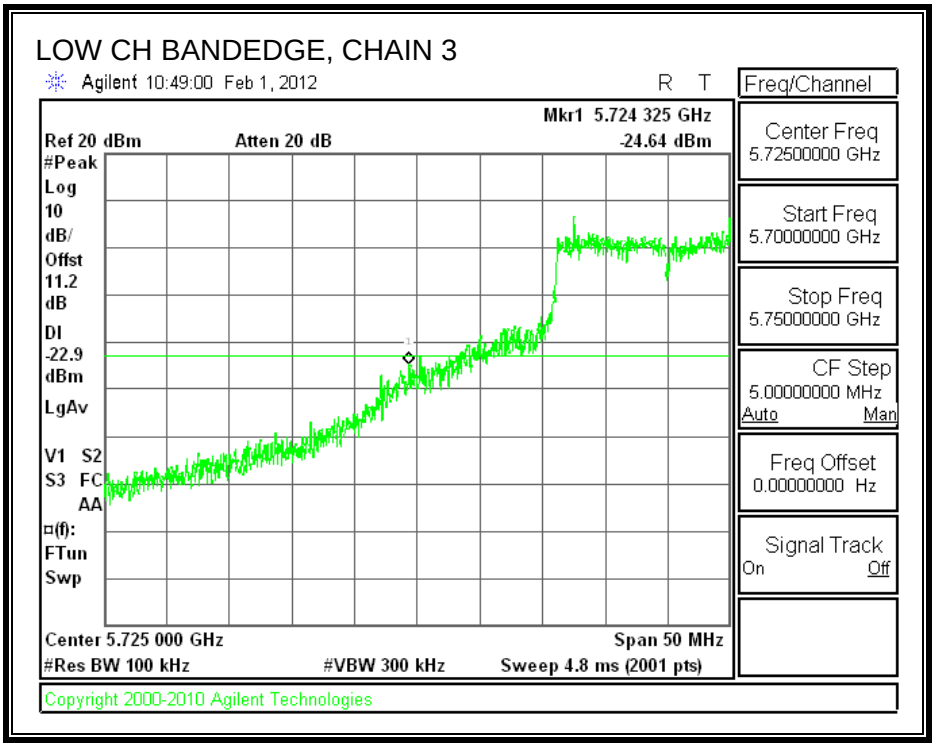


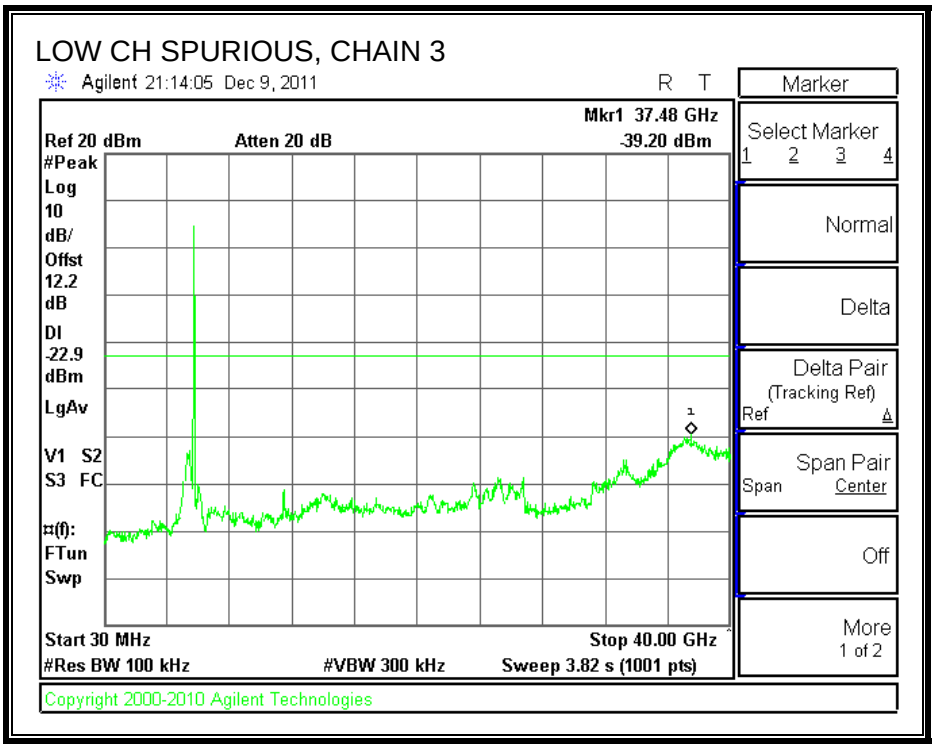


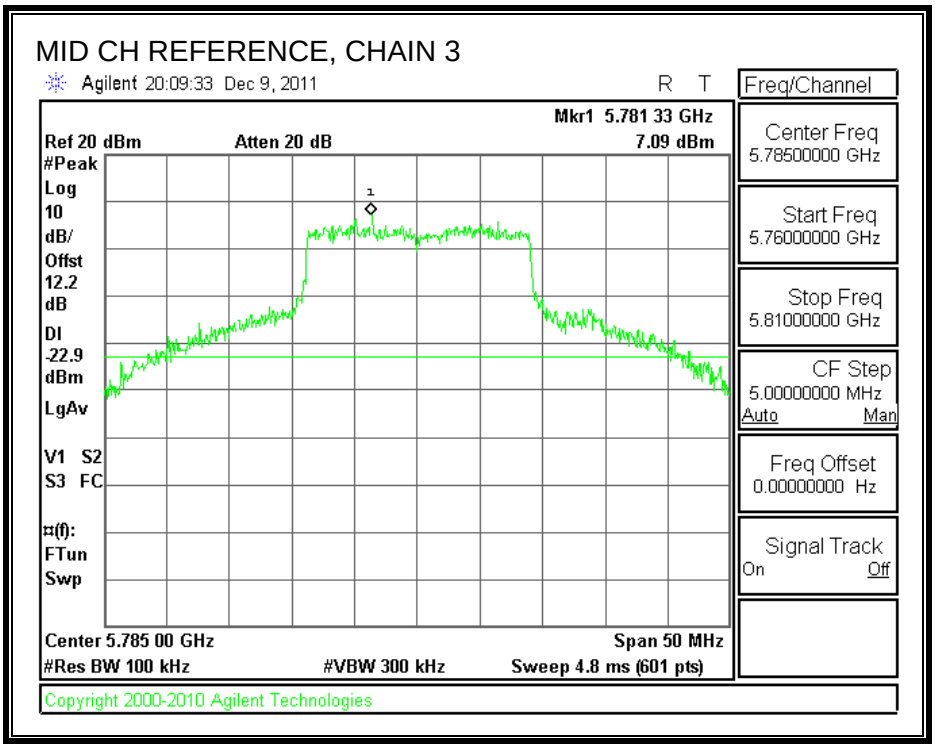


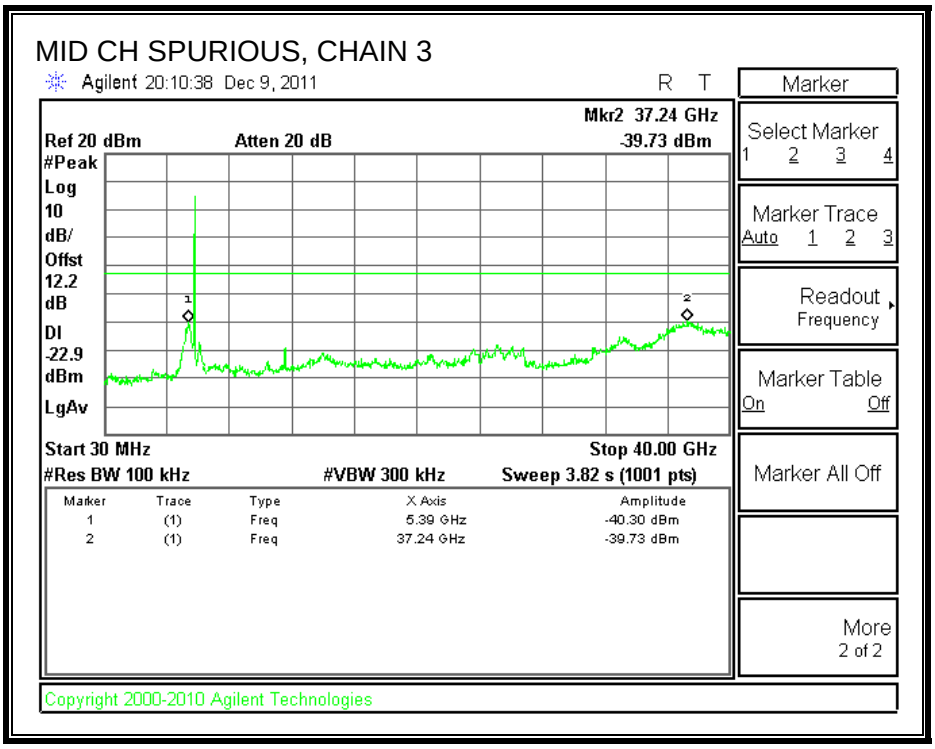


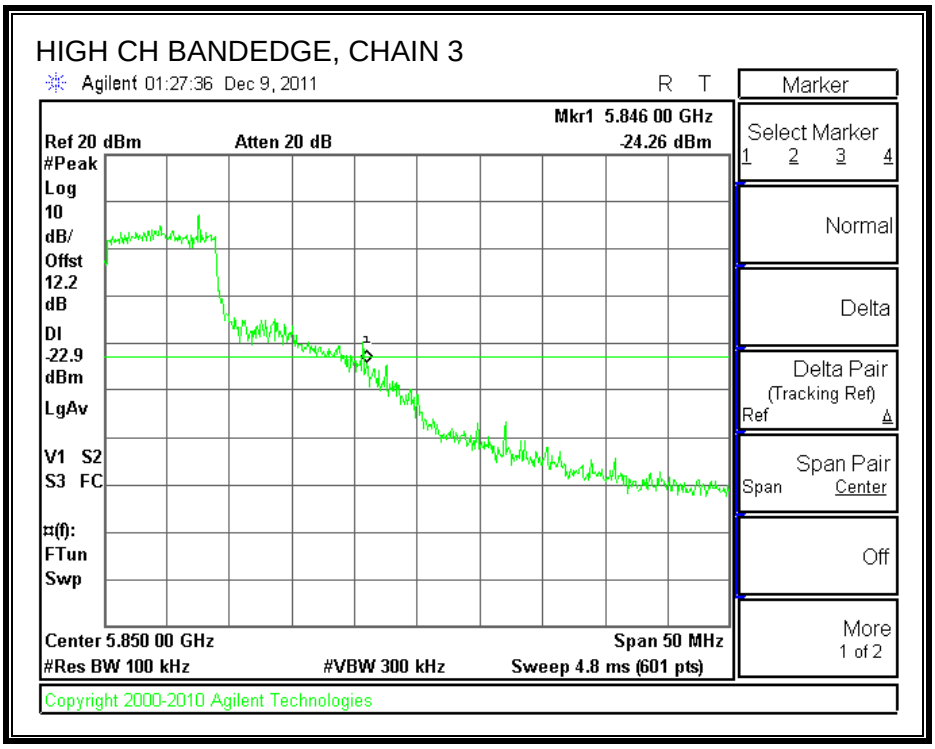
CHAIN 3 SPURIOUS EMISSIONS

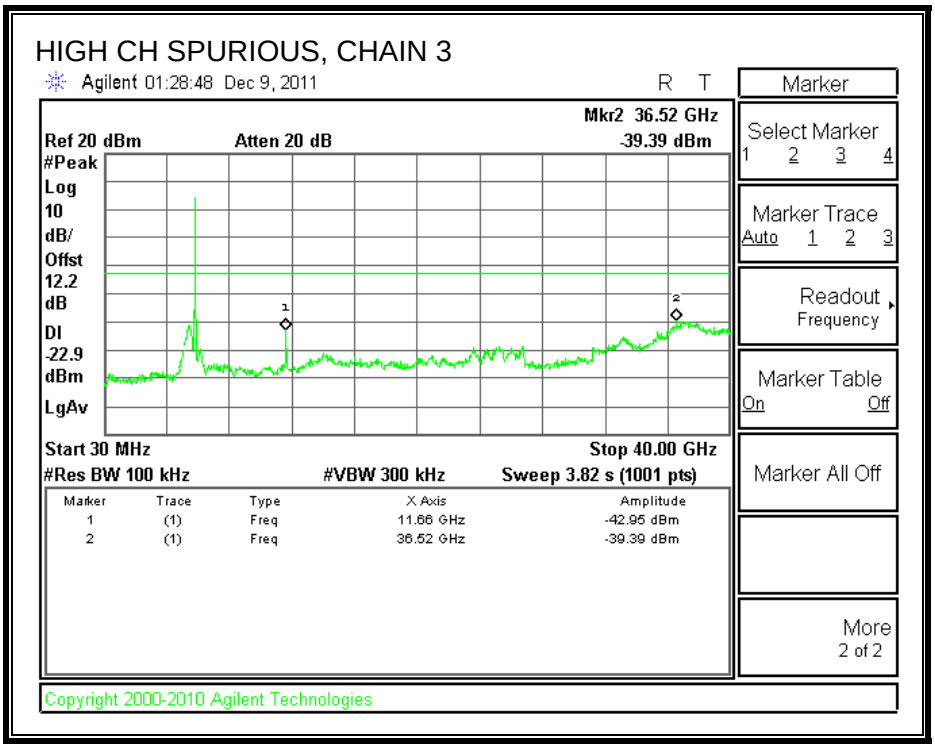












7.5. 802.11n HT40 CDD 3TX MODE IN THE 5.8 GHz BAND

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.

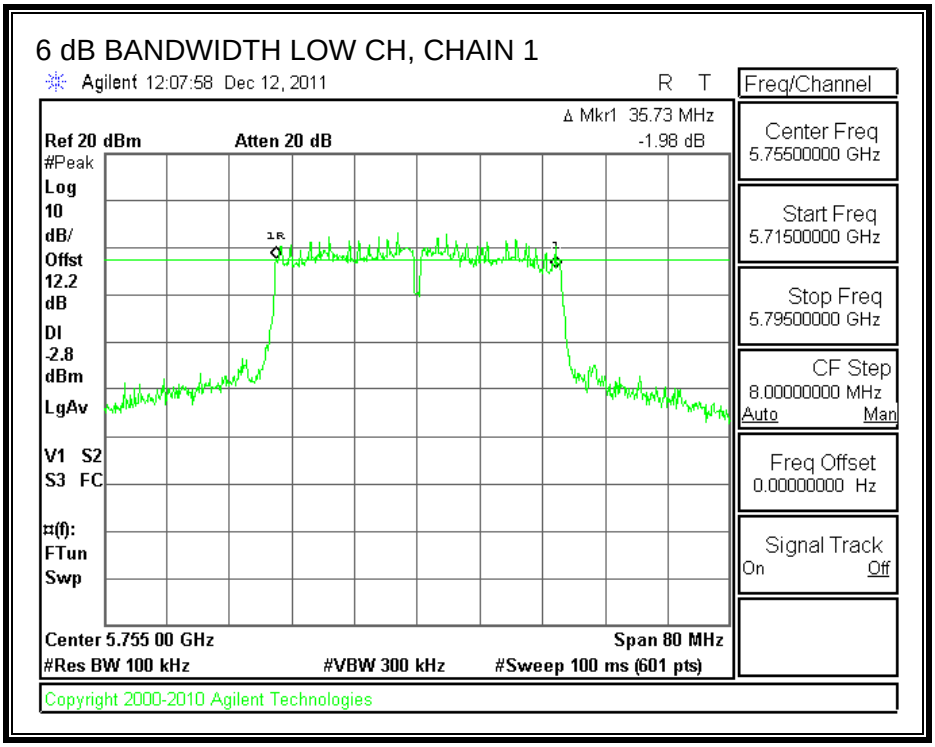
TEST PROCEDURE

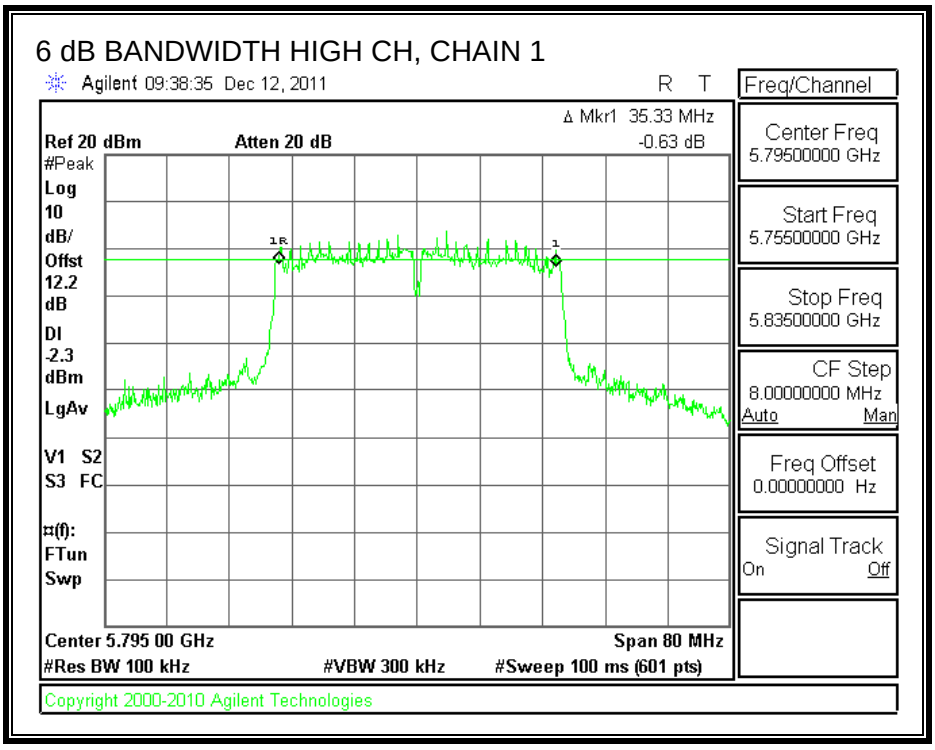
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

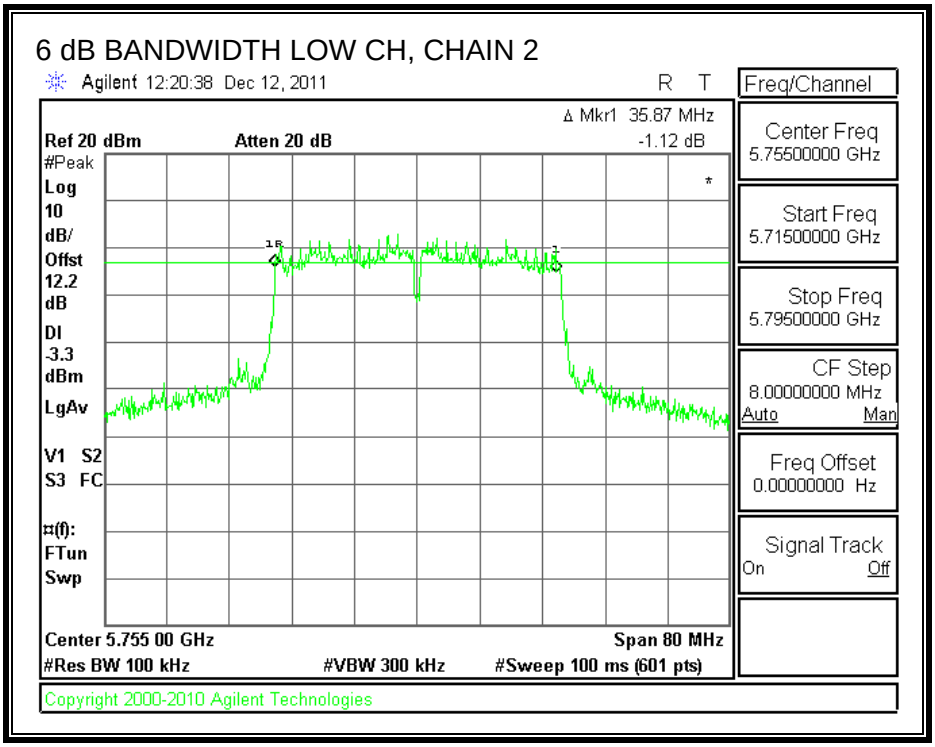
Channel	Frequency (MHz)	Chain 1 6 dB BW (MHz)	Chain 2 6 dB BW (MHz)	Chain 3 6 dB BW (MHz)	Minimum Limit (MHz)
Low	5755	35.73	35.87	36.27	0.5
High	5795	35.33	35.87	36.40	0.5

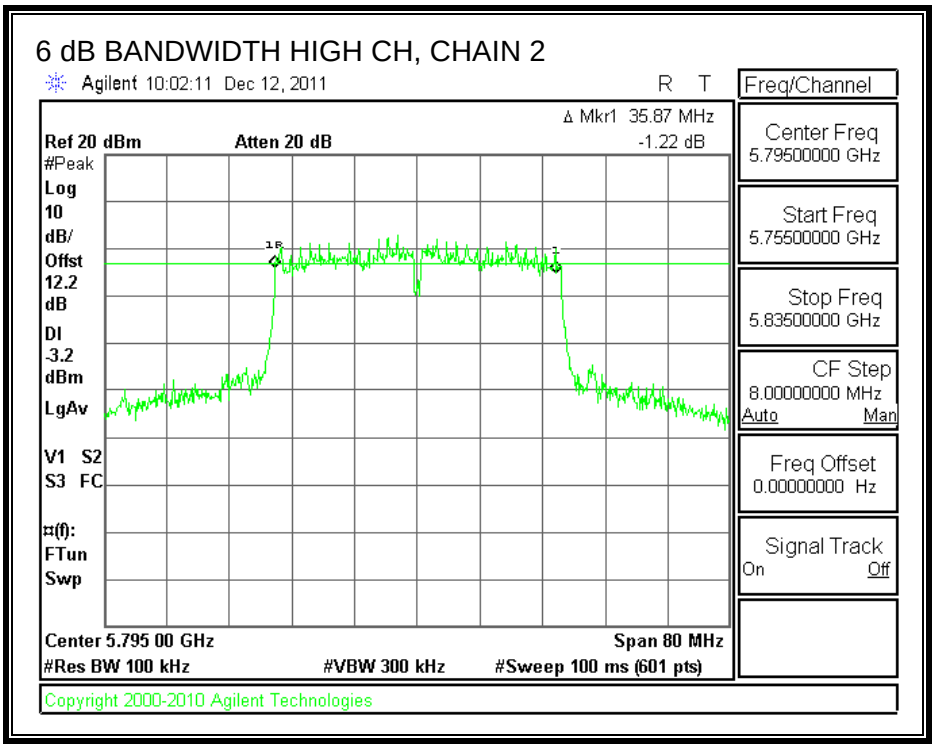
6 dB BANDWIDTH, CHAIN 1



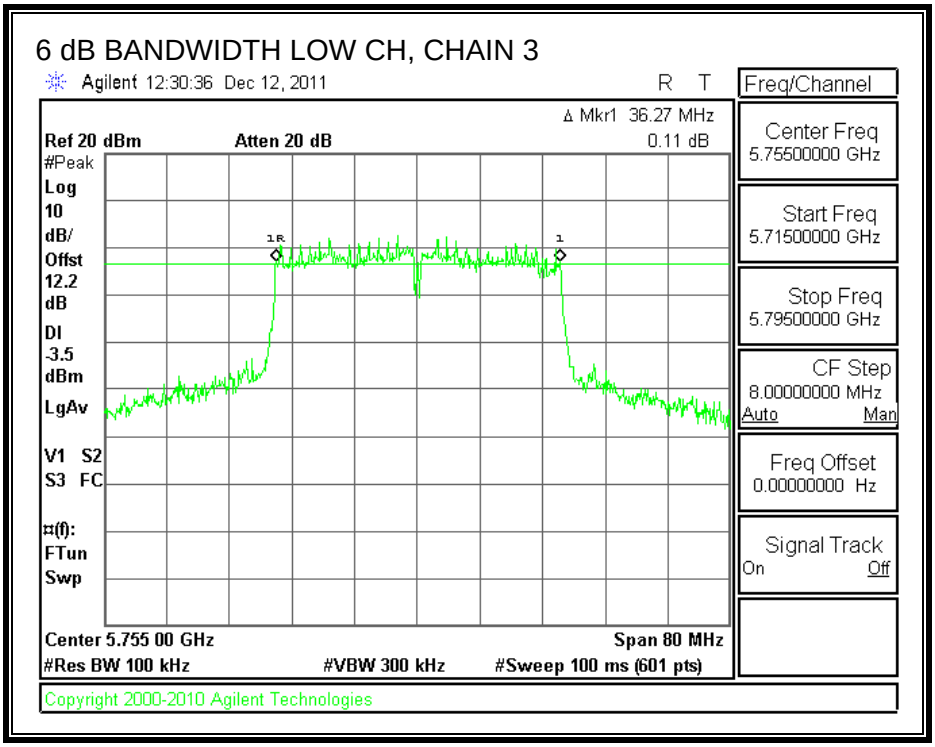


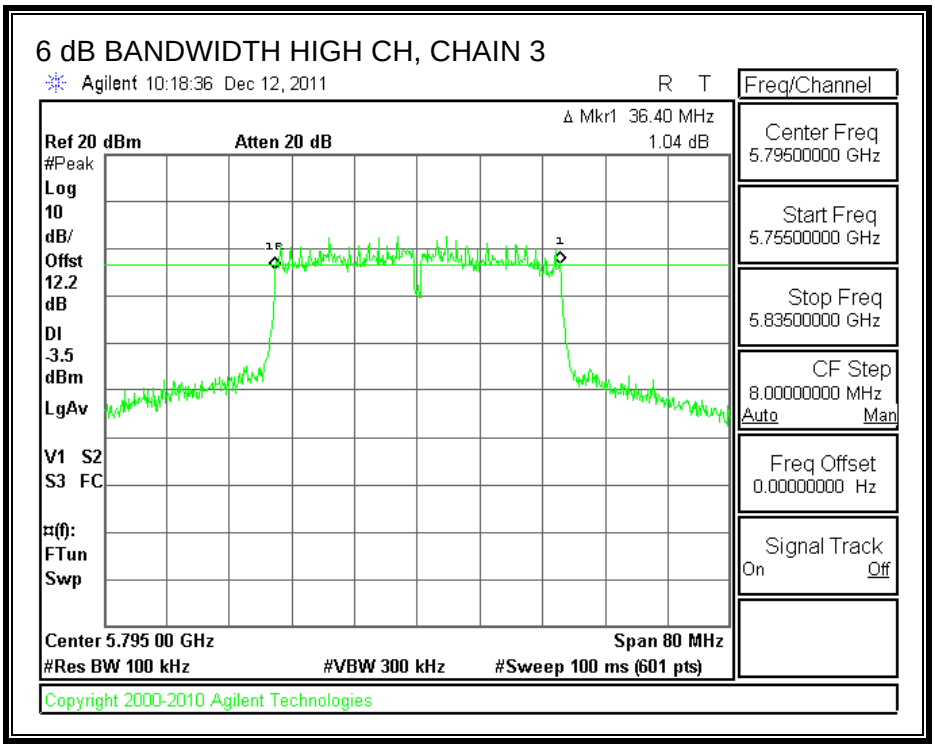
6 dB BANDWIDTH, CHAIN 2





6 dB BANDWIDTH, CHAIN 3





7.5.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

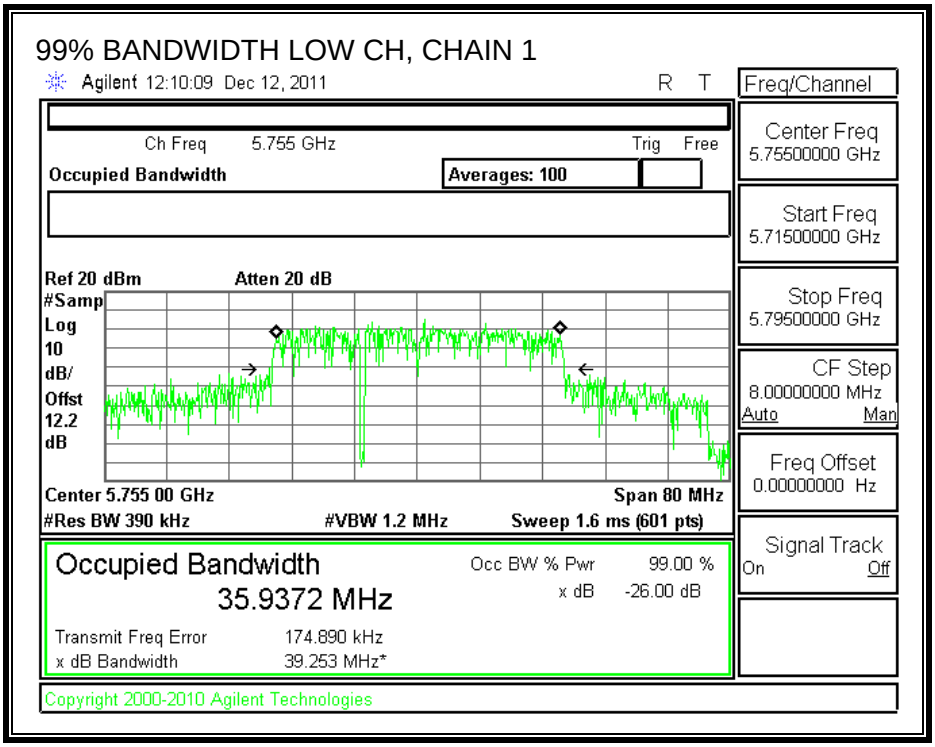
TEST PROCEDURE

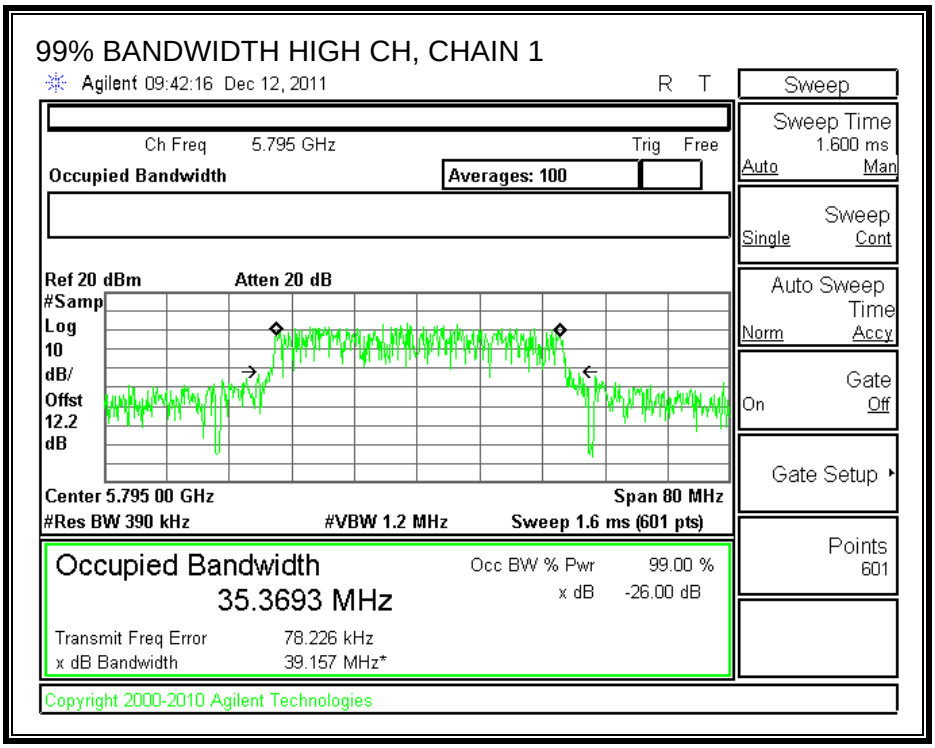
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

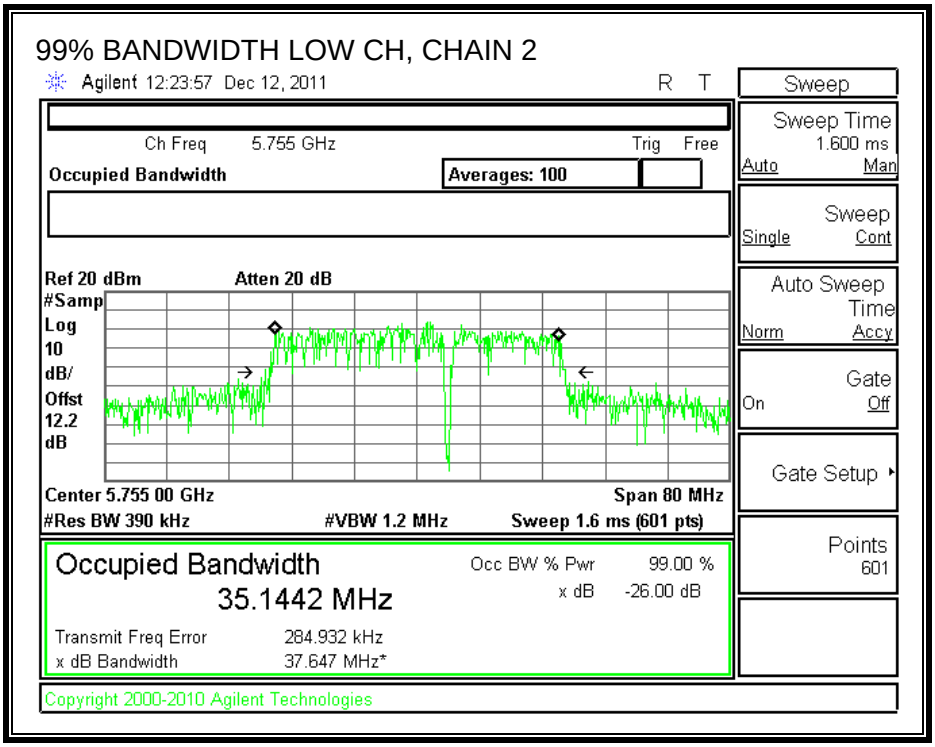
Channel	Frequency (MHz)	Chain 1 99% Bandwidth (MHz)	Chain 2 99% Bandwidth (MHz)	Chain 3 99% Bandwidth (MHz)
Low	5755	35.9372	35.1442	34.9184
High	5795	35.3693	35.7307	35.6069

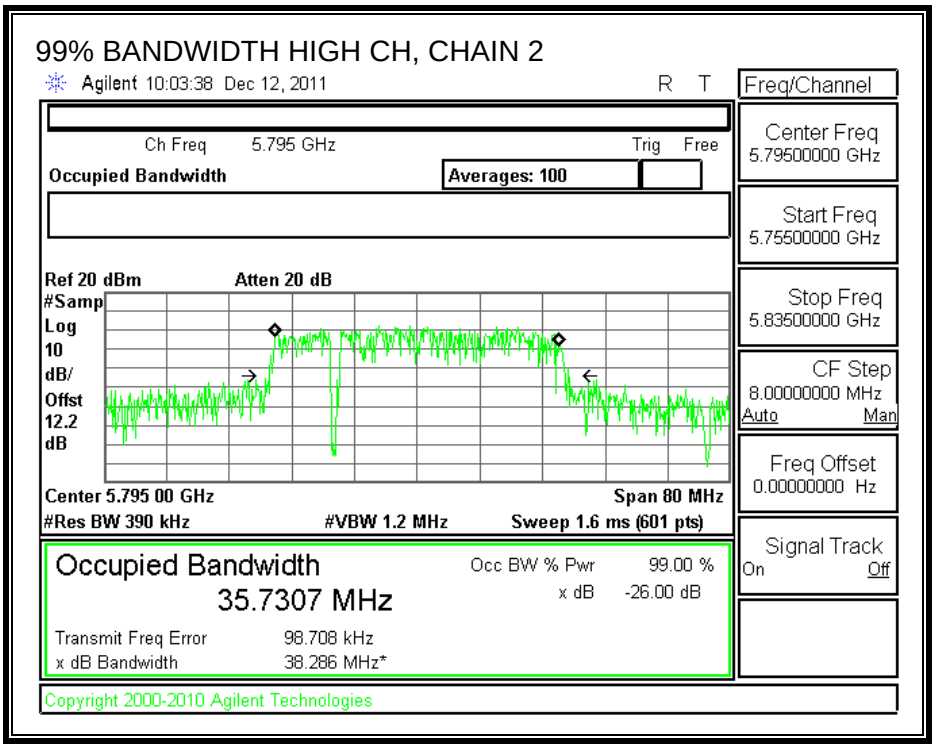
99% BANDWIDTH, CHAIN 1



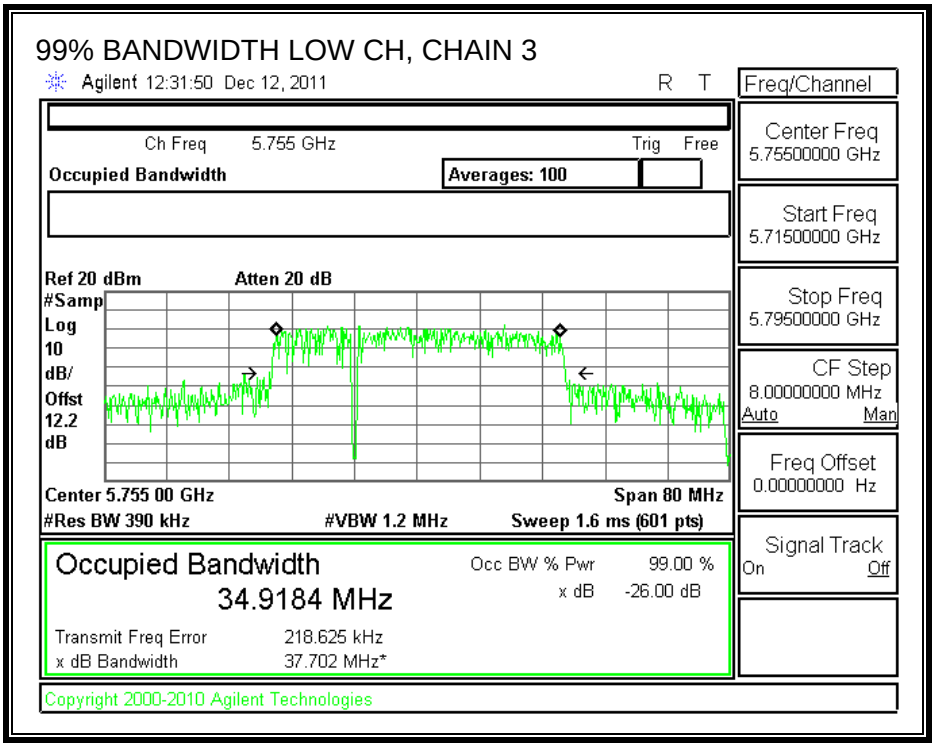


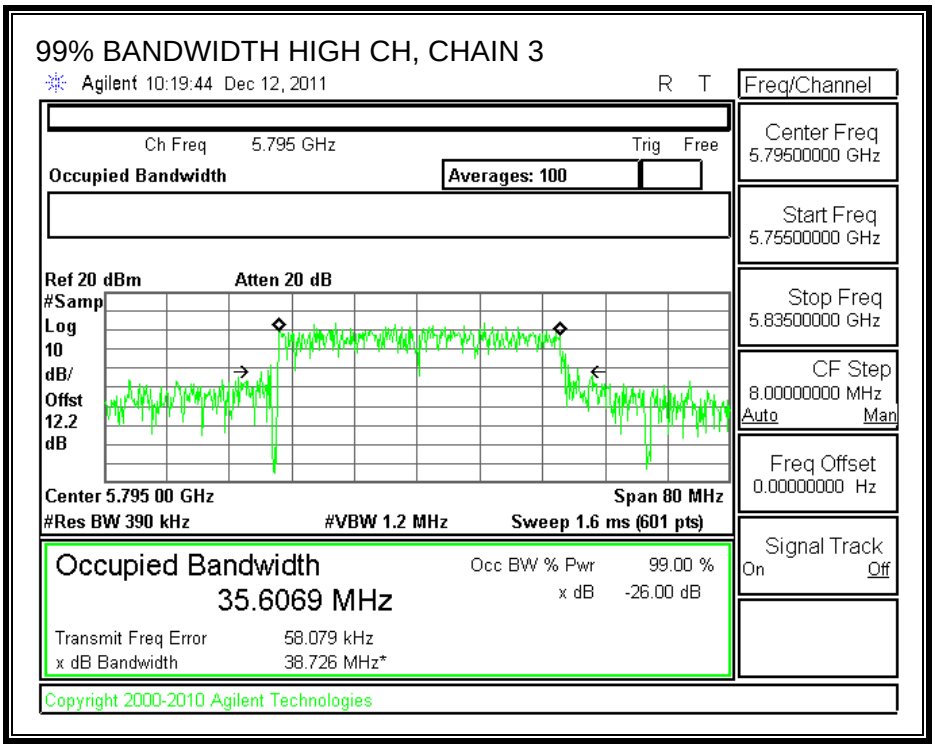
99% BANDWIDTH, CHAIN 2





99% BANDWIDTH, CHAIN 3





7.5.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The composite antenna gain is equal to 9.31 dBi, therefore the limit is 26.69 dBm.

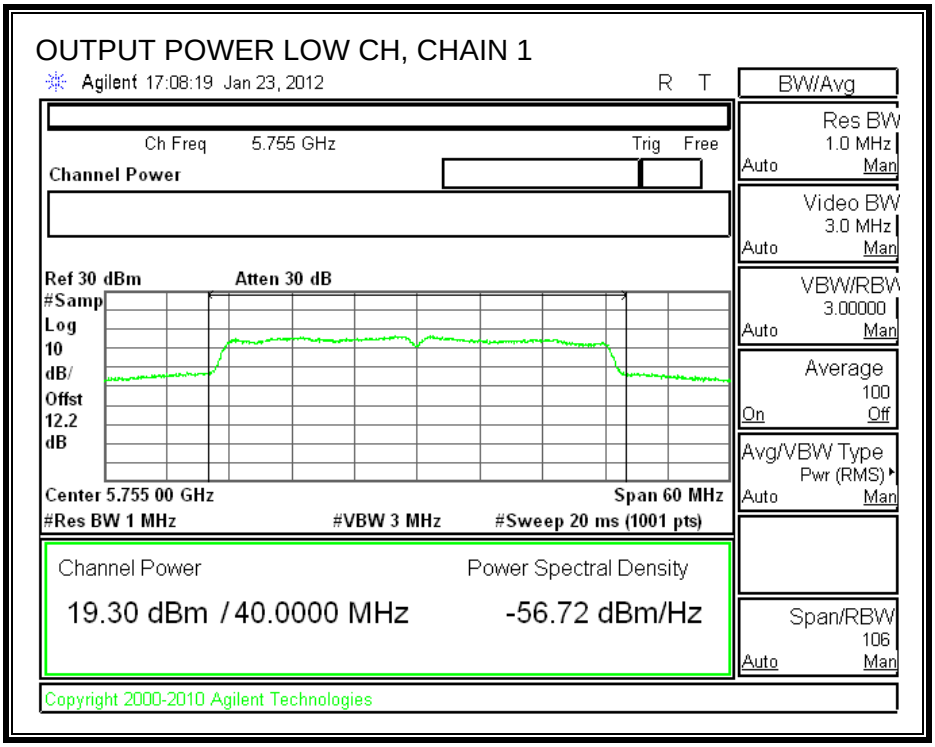
TEST PROCEDURE

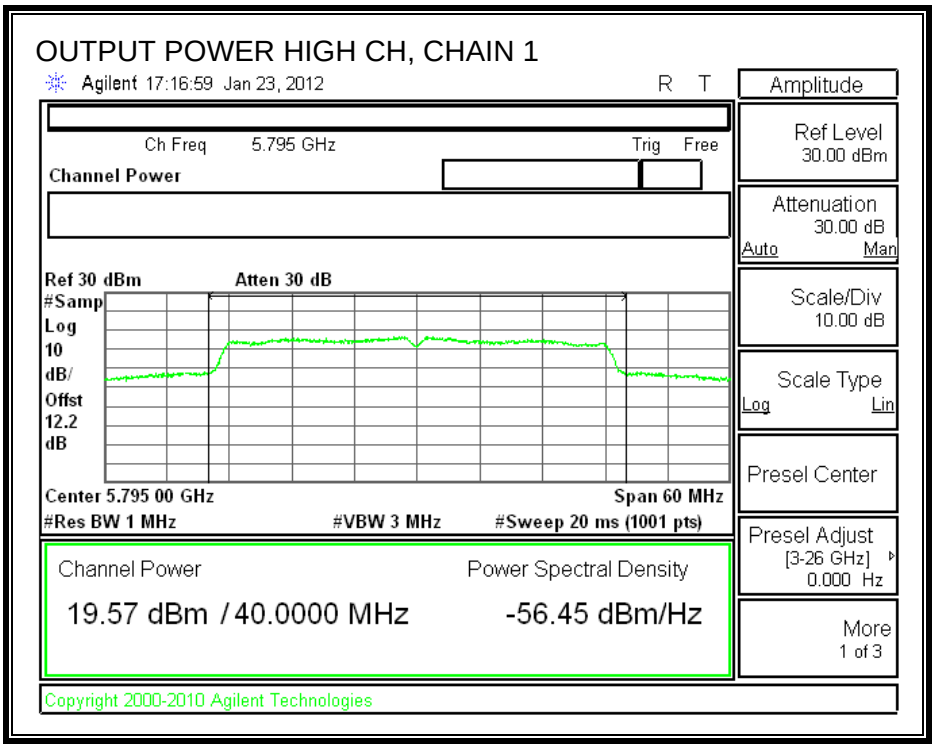
Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

RESULTS

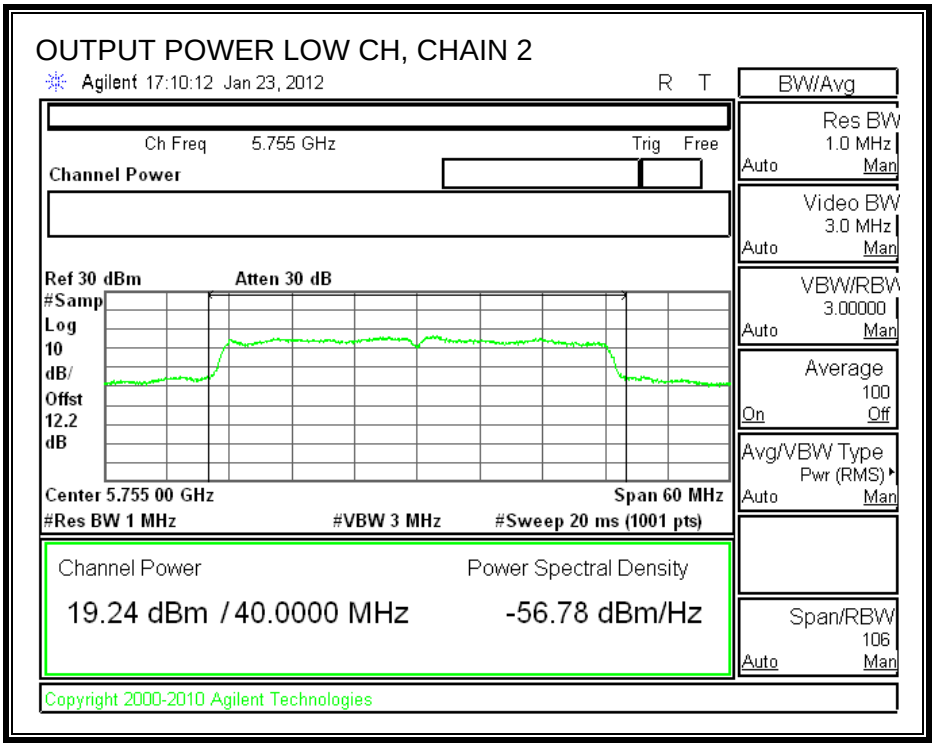
Channel	Frequency (MHz)	Chain 1 PK Power (dBm)	Chain 2 PK Power (dBm)	Chain 3 PK Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5755	19.30	19.24	19.05	23.97	26.69	-2.72
High	5795	19.57	19.34	18.55	23.95	26.69	-2.74

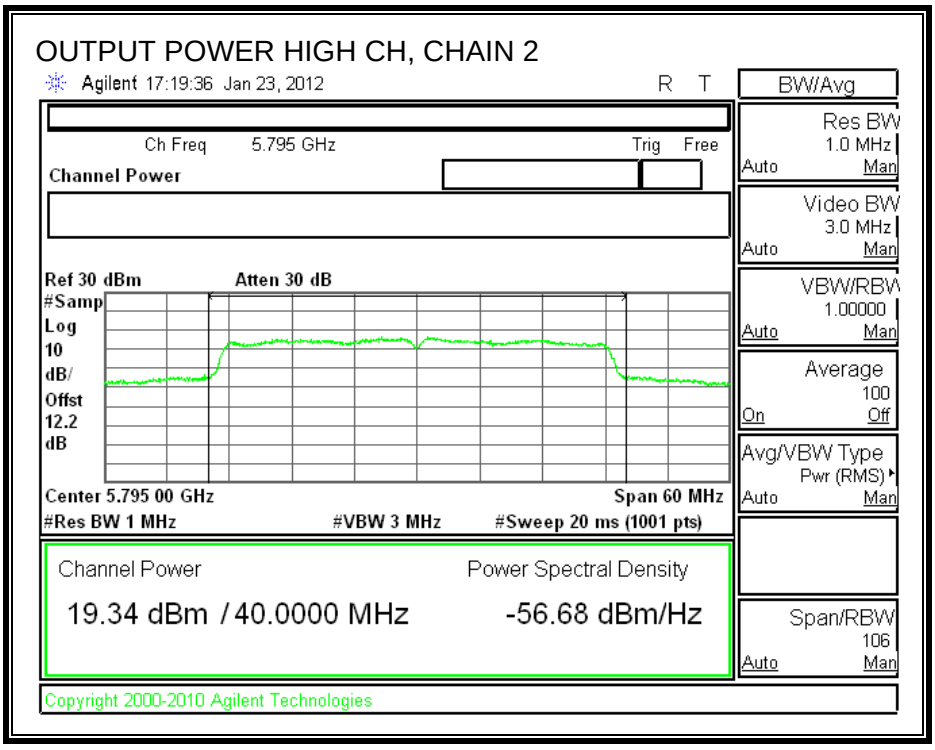
CHAIN 1 OUTPUT POWER



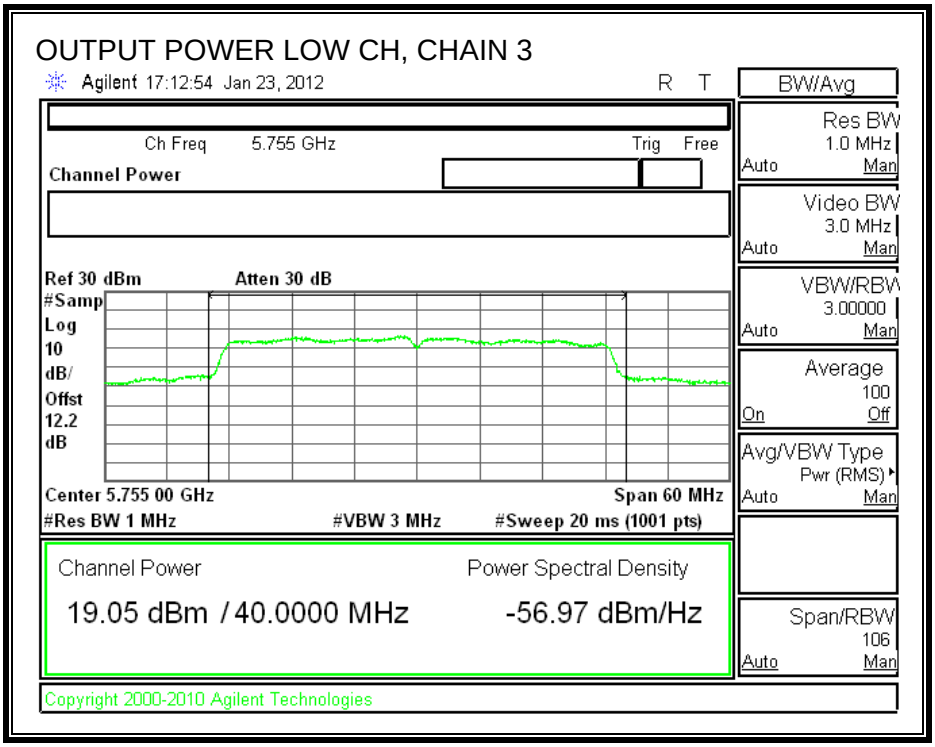


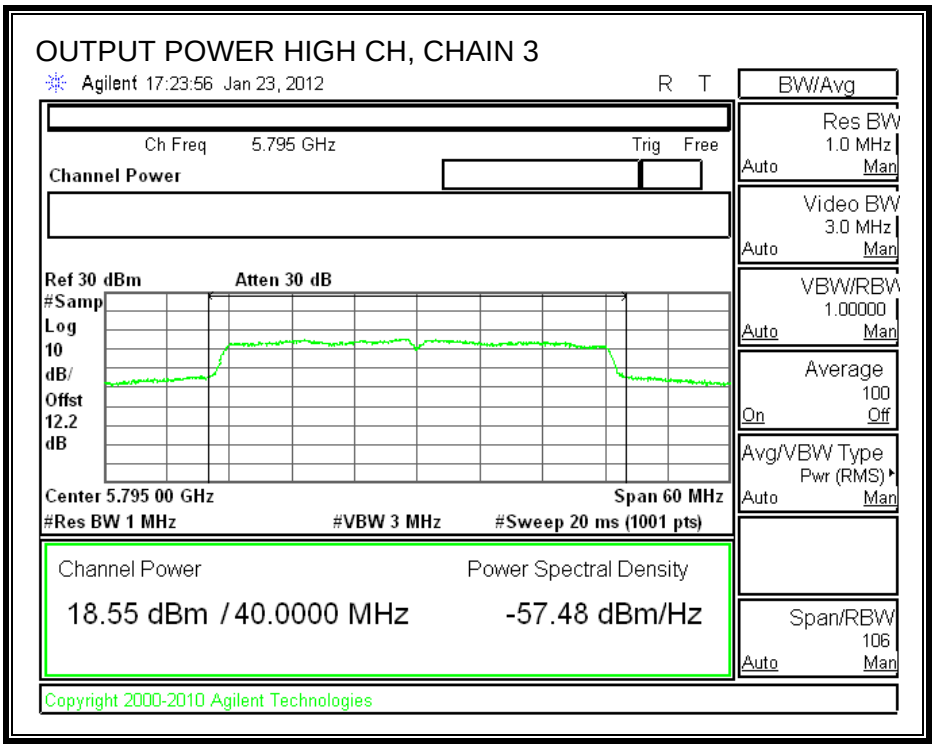
CHAIN 2 OUTPUT POWER





CHAIN 3 OUTPUT POWER





7.5.4. 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 12.2 dB (including 10 dB pad and 1.2 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)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5755	19.23	18.86	18.89	23.77
High	5795	19.35	19.06	18.47	23.75

7.5.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

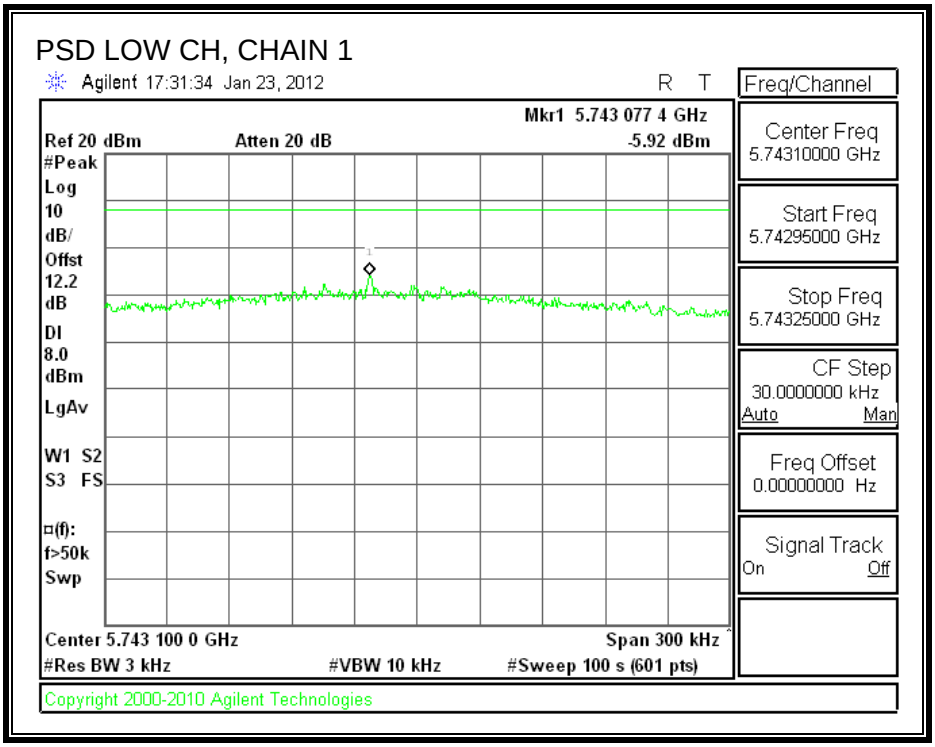
TEST PROCEDURE

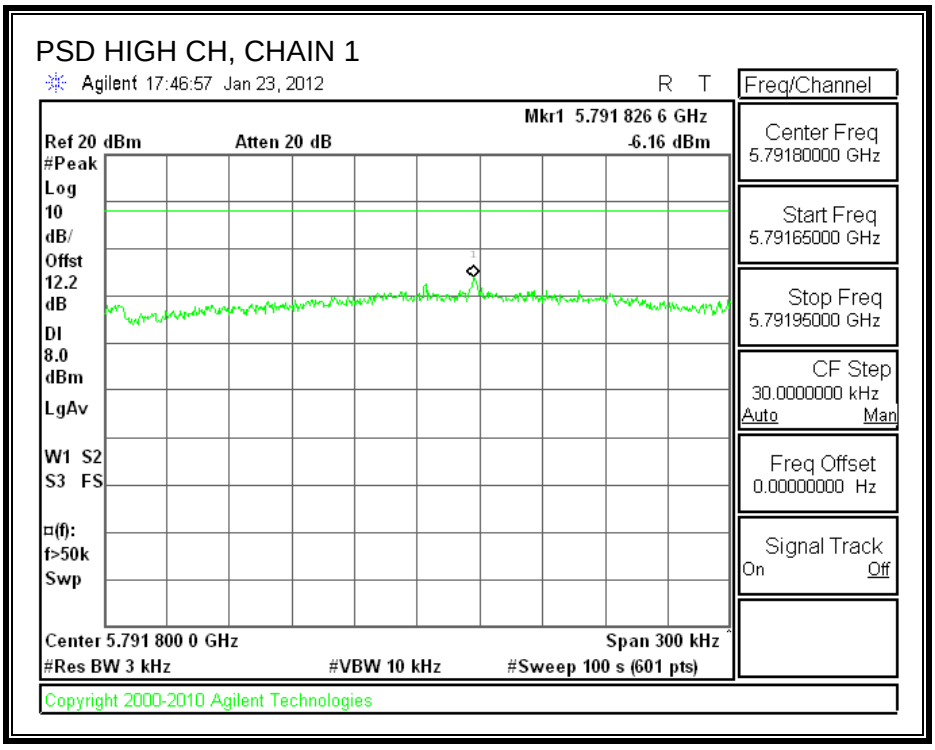
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS:

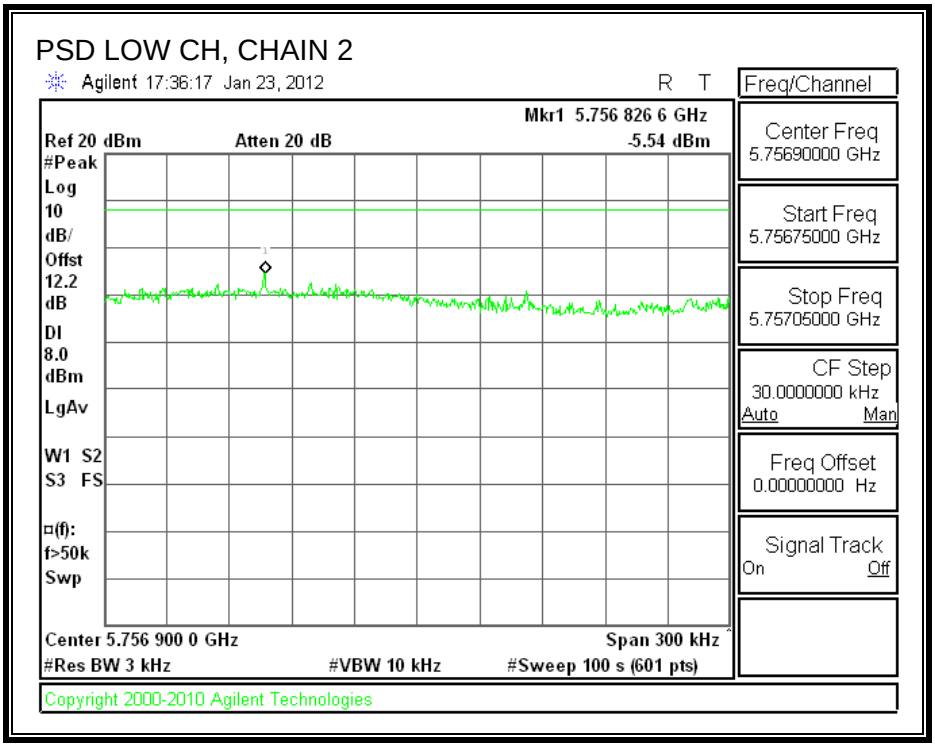
Channel	Frequency (MHz)	Chain 1 PSD (dBm)	Chain 2 PSD (dBm)	Chain 3 PSD (dBm)	Total PSD (dBm)	Limit (dBm)	Margin (dB)
Low	5755	-5.92	-5.54	-8.27	-1.65	8	-9.65
High	5795	-6.16	-7.08	-8.5	-2.37	8	-10.37

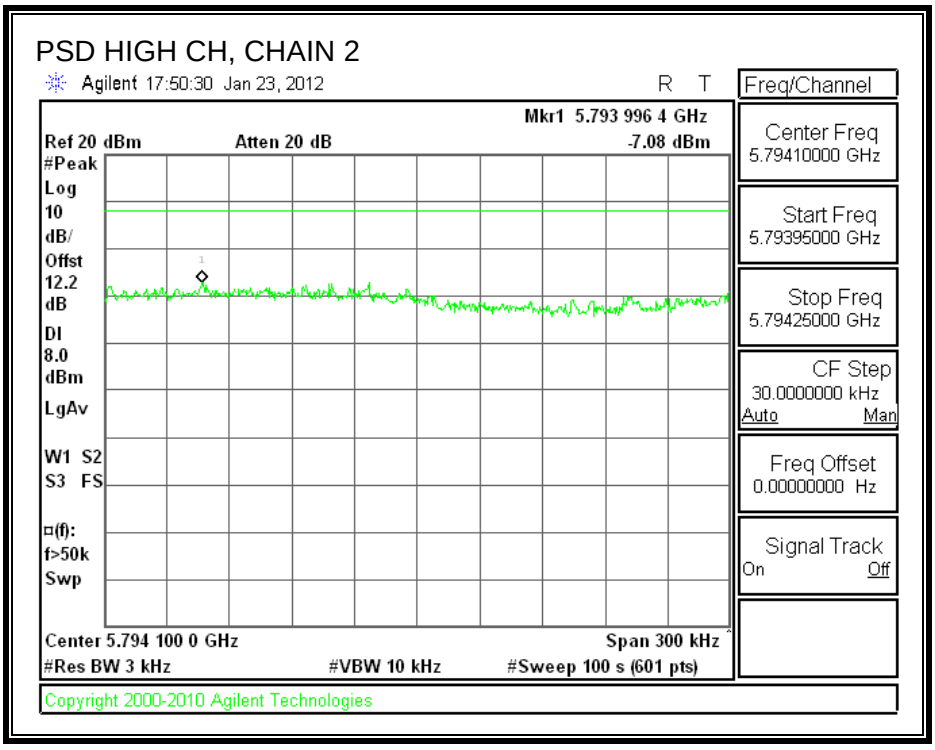
POWER SPECTRAL DENSITY, CHAIN 1



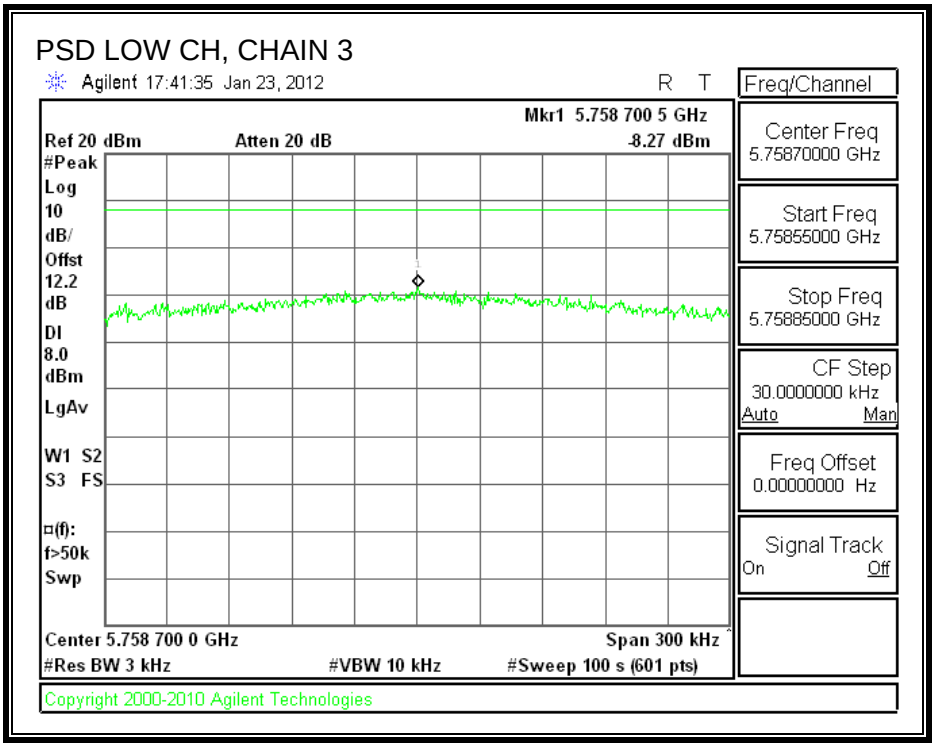


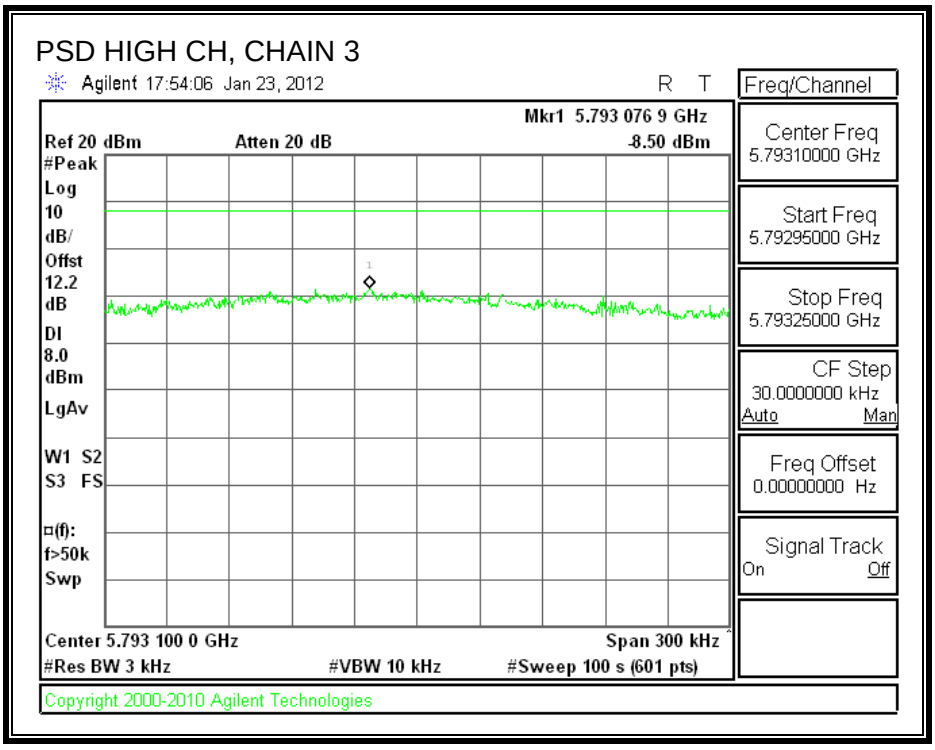
POWER SPECTRAL DENSITY, CHAIN 2





POWER SPECTRAL DENSITY, CHAIN 3





7.5.6. 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.

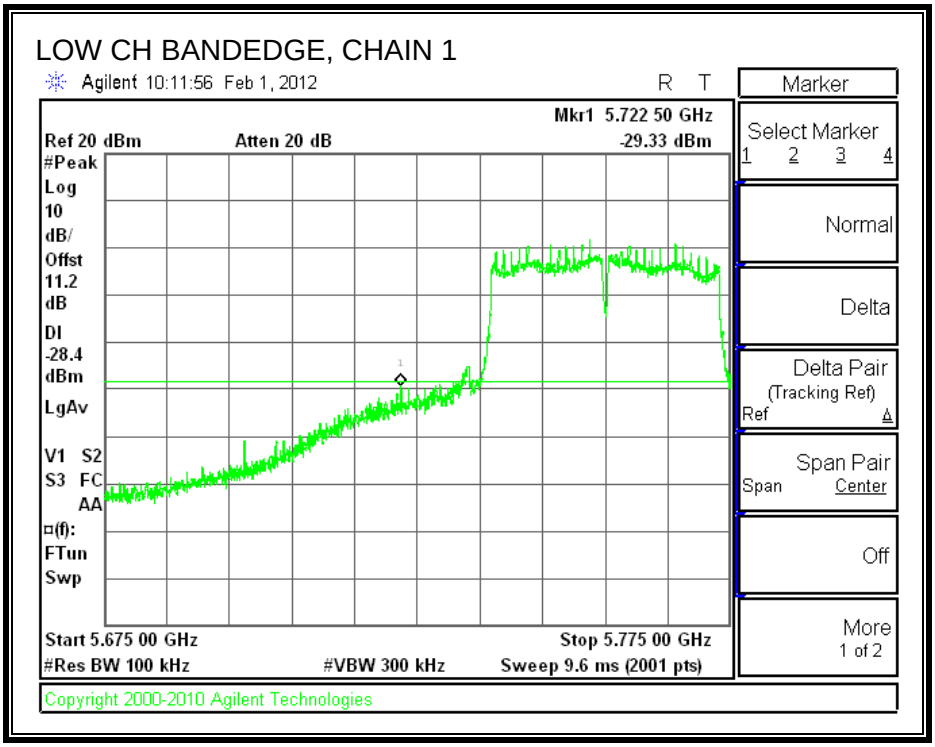
TEST PROCEDURE

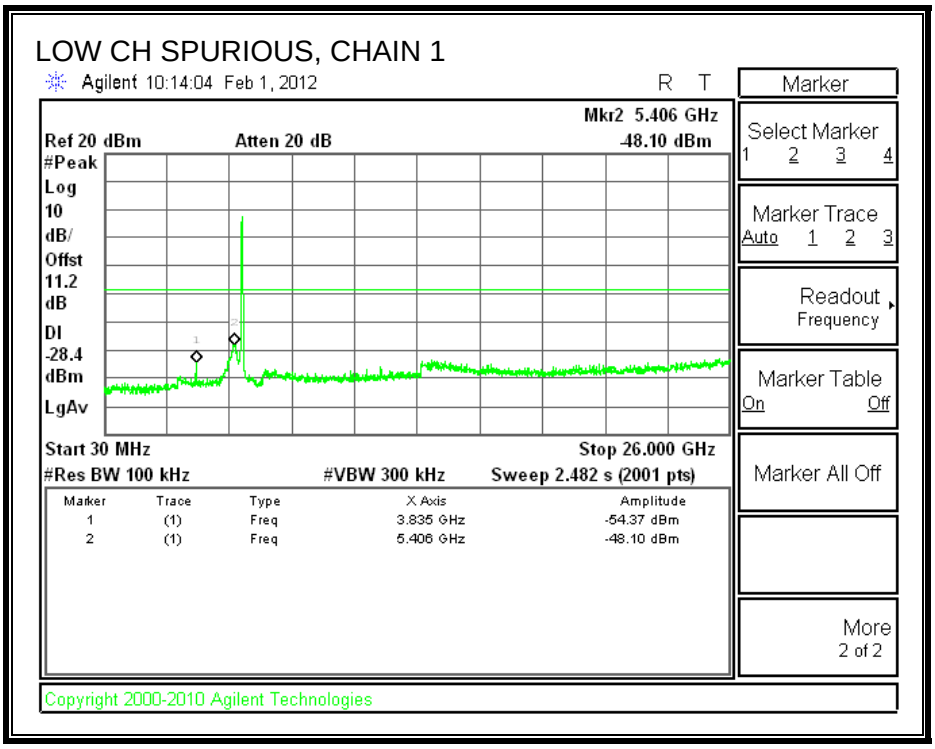
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

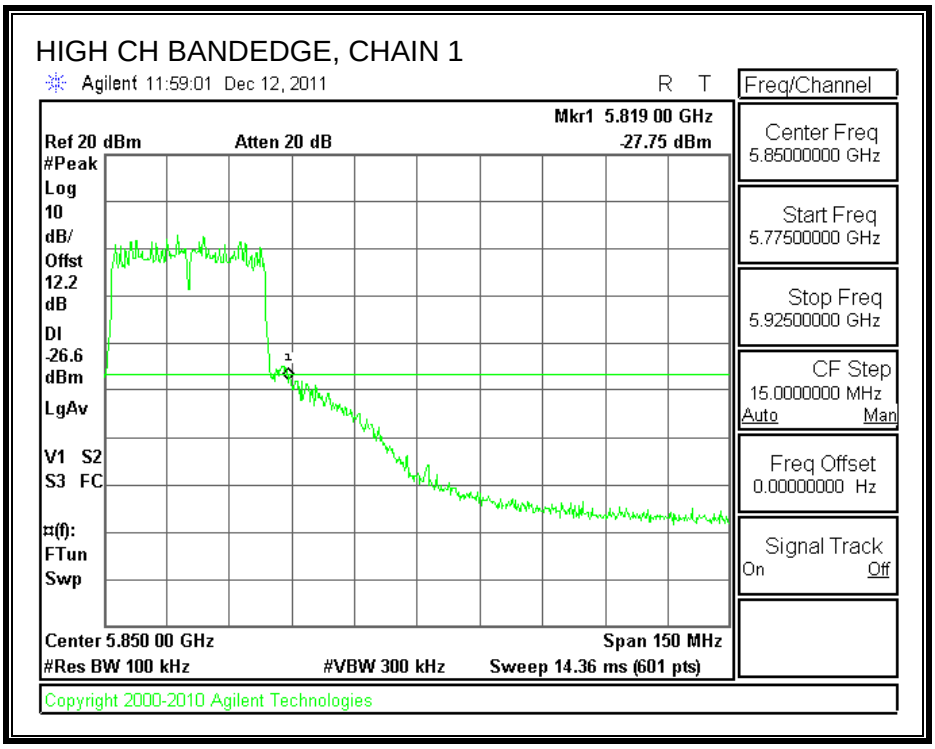
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

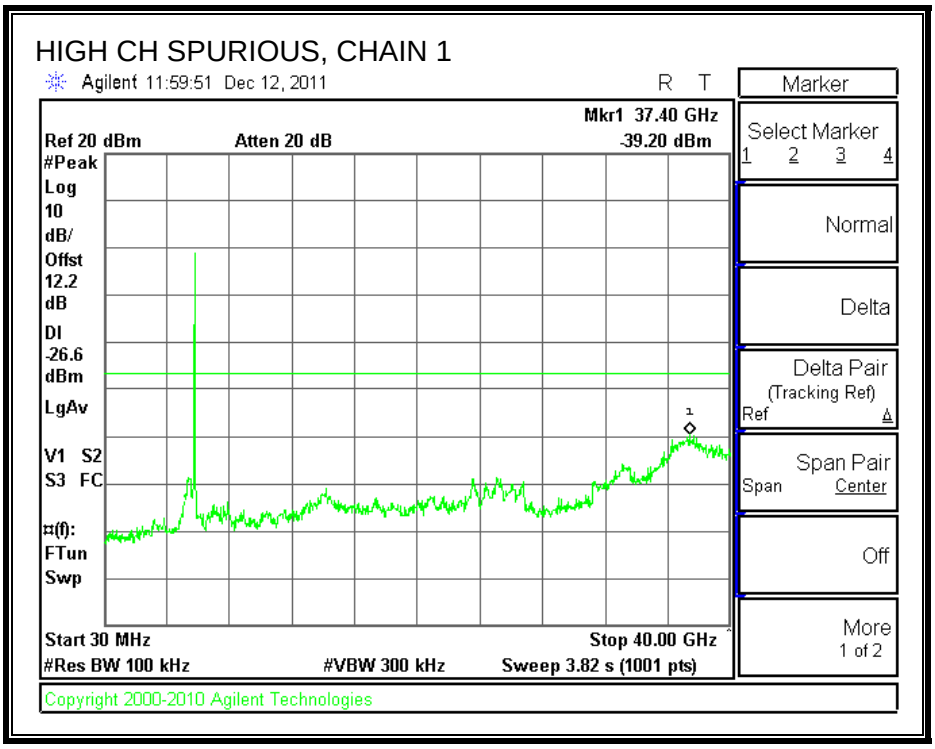
RESULTS

CHAIN 1 SPURIOUS EMISSIONS

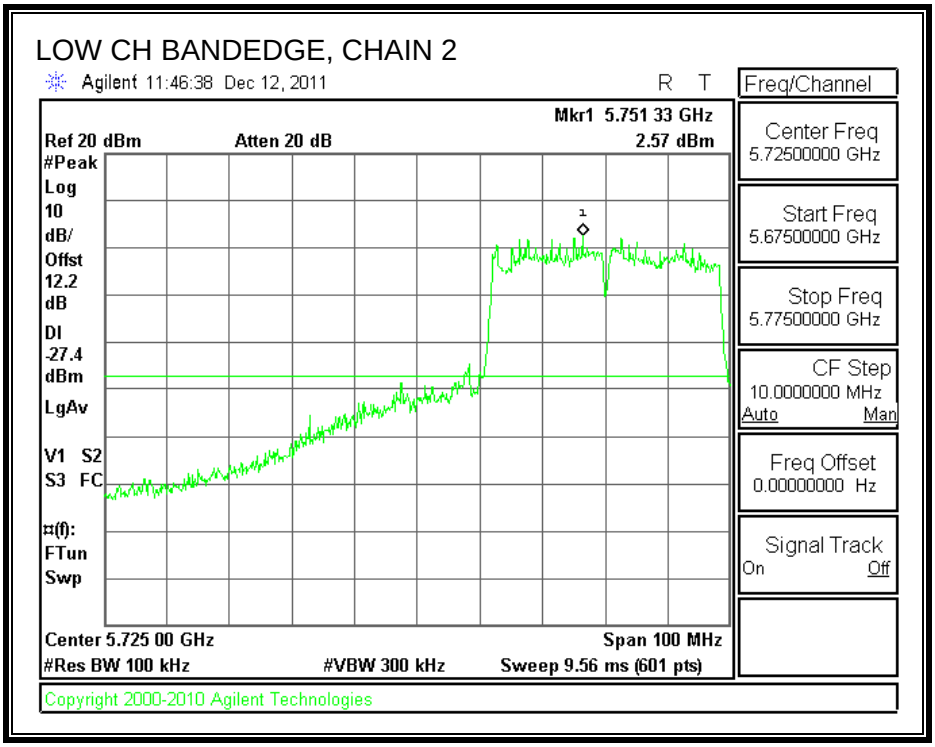


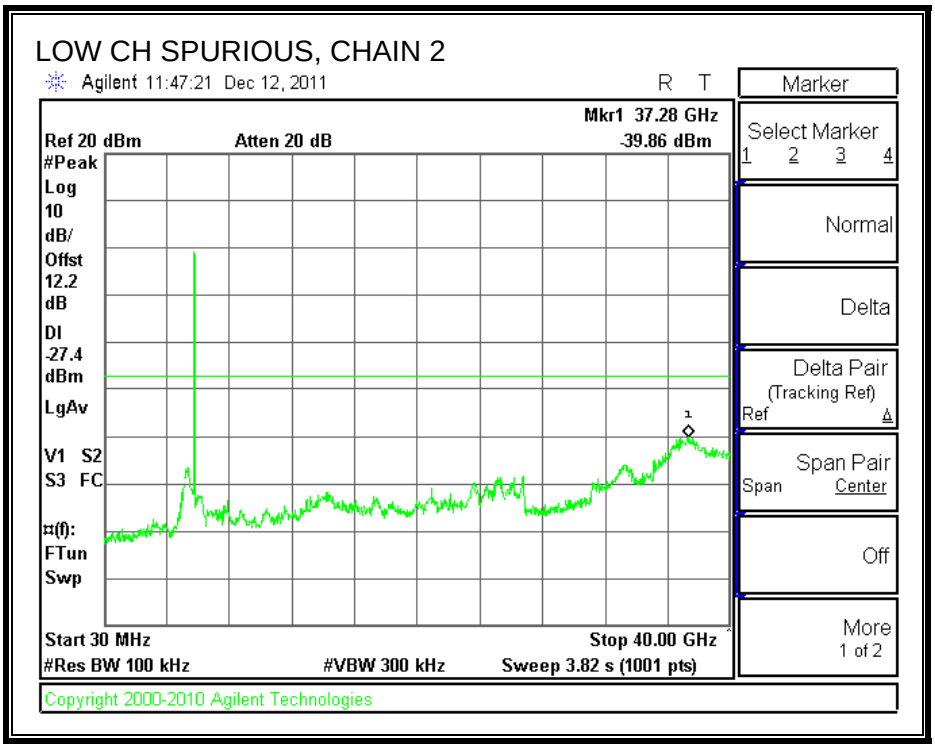


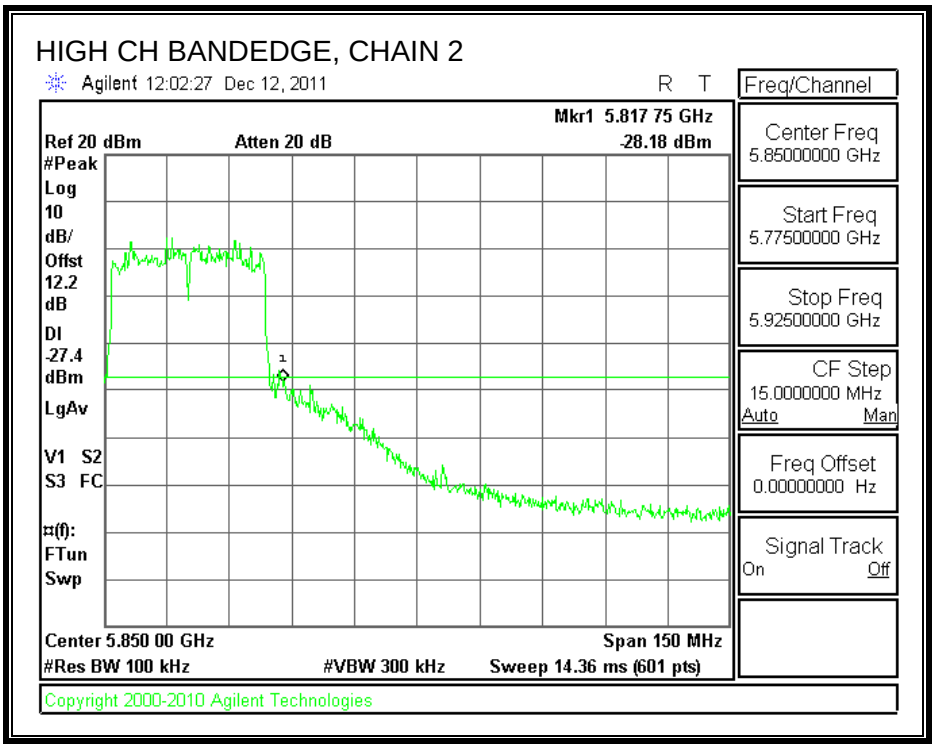


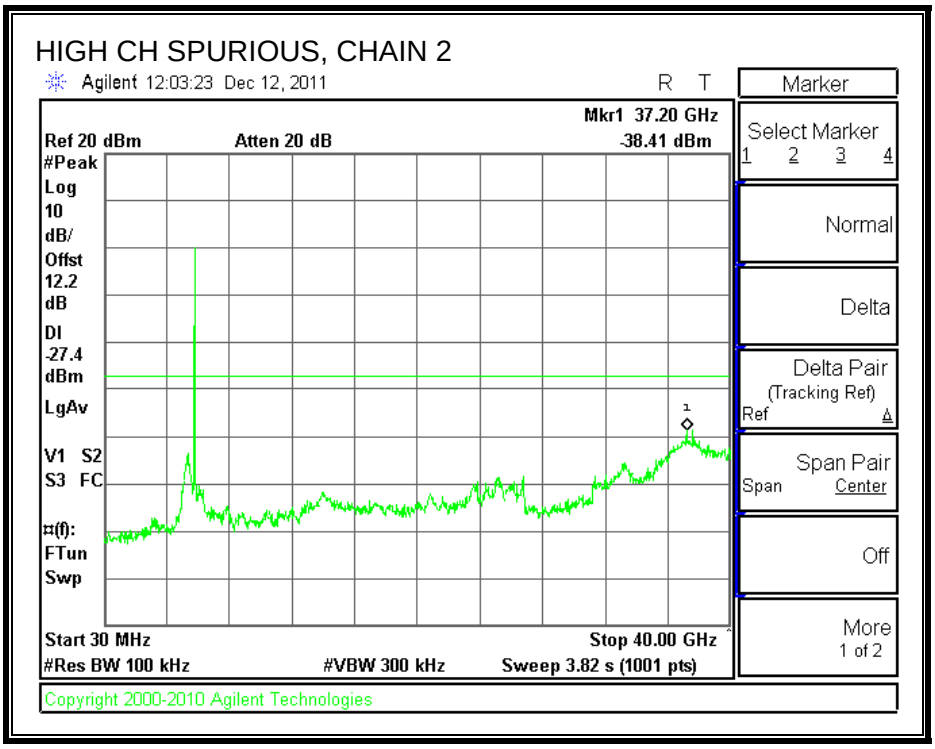


CHAIN 2 SPURIOUS EMISSIONS

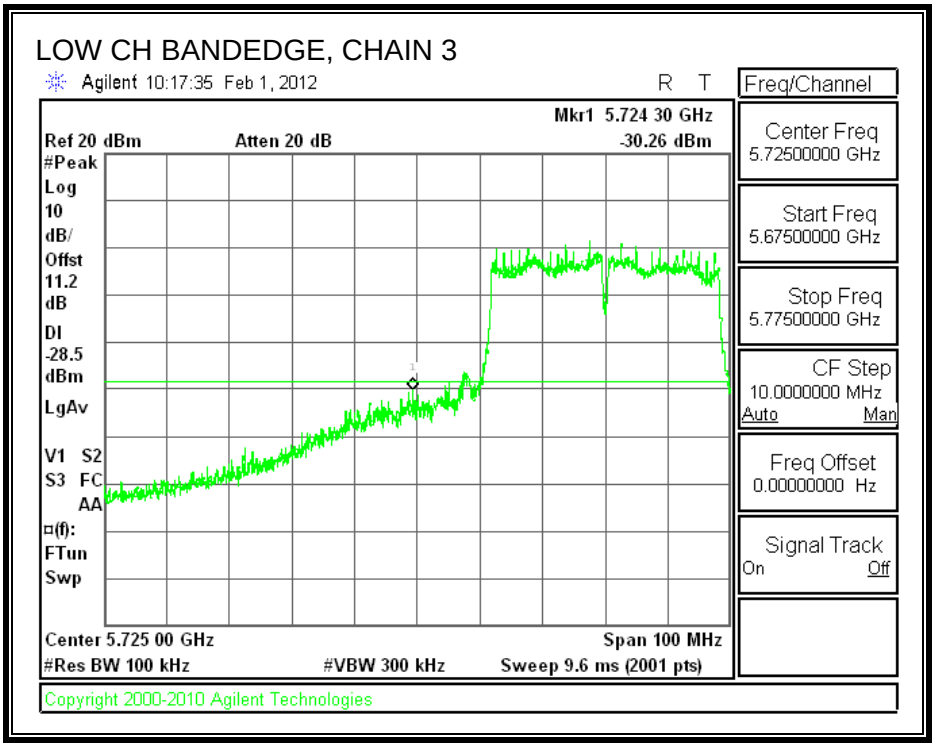


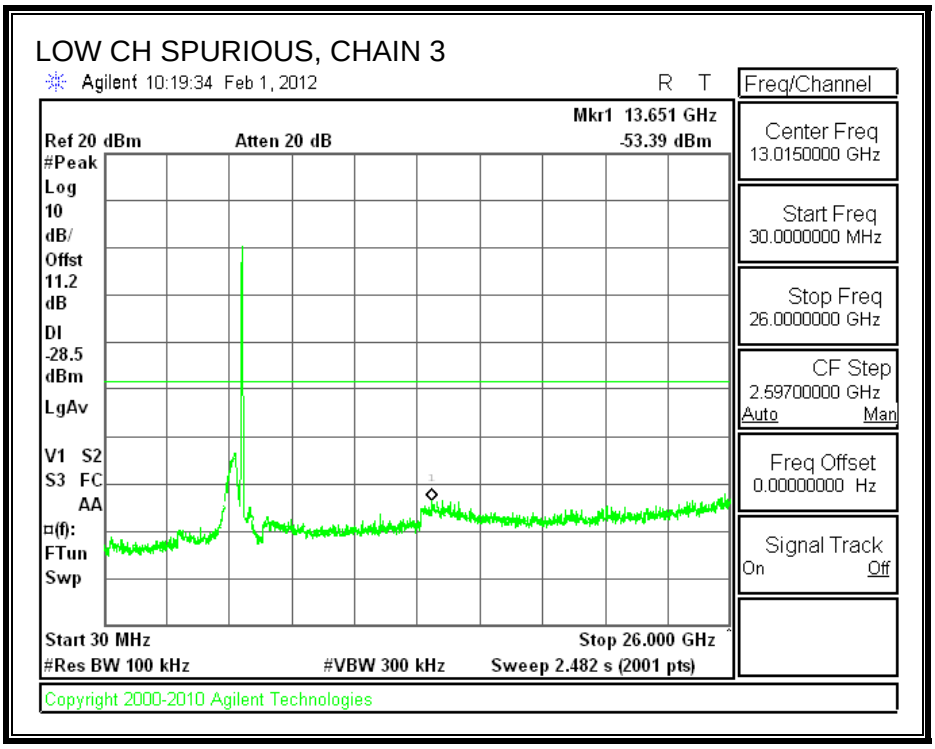


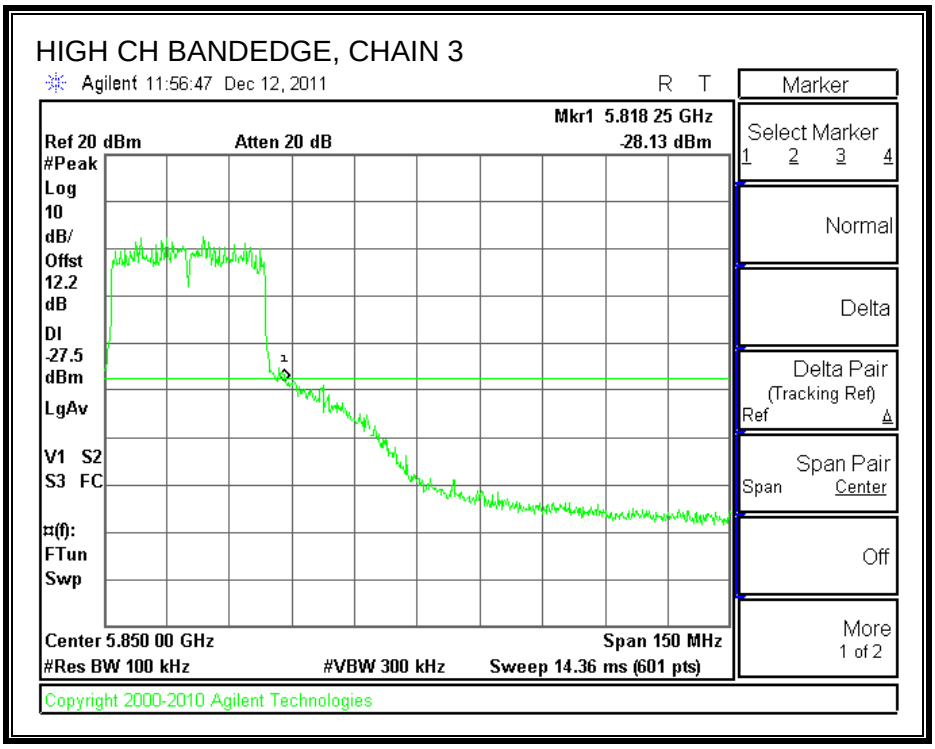


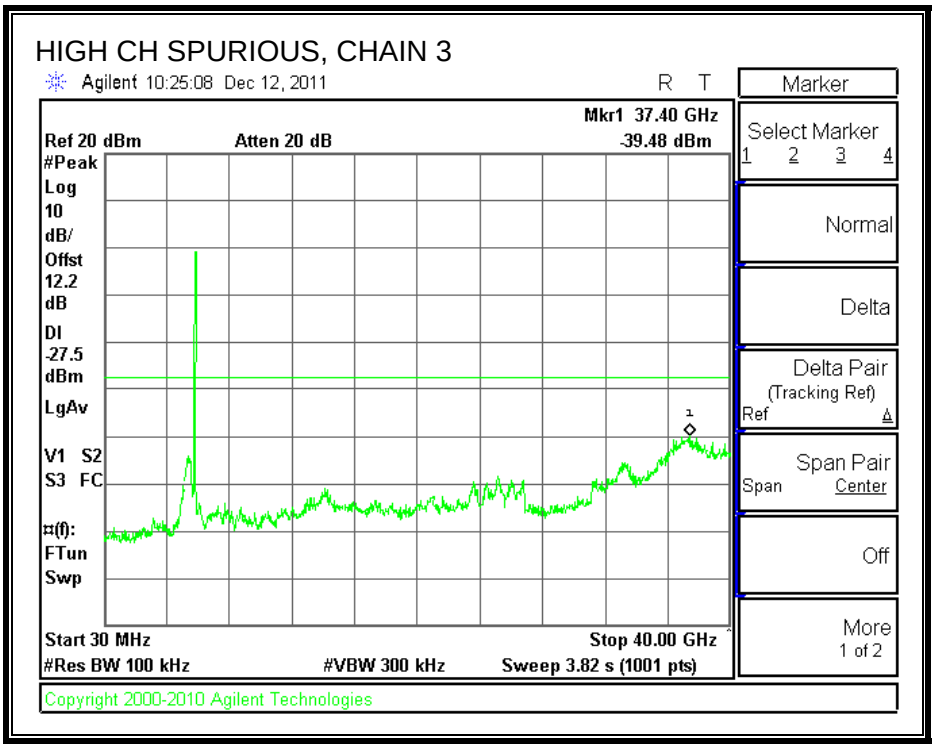


CHAIN 3 SPURIOUS EMISSIONS









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.

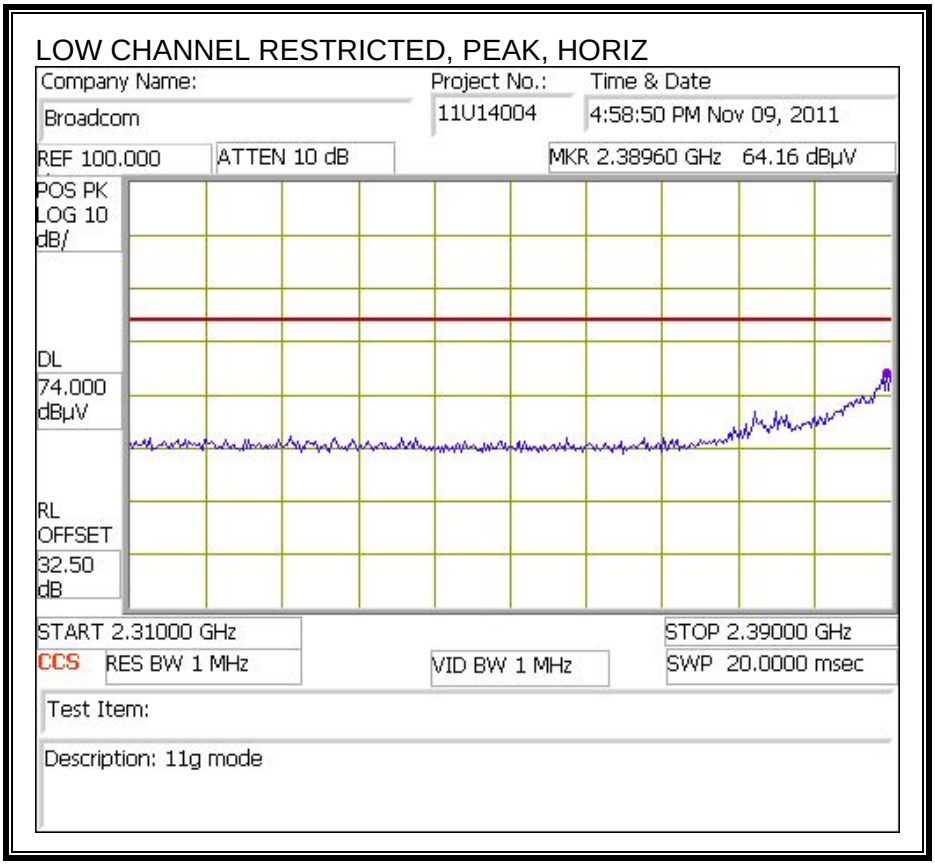
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

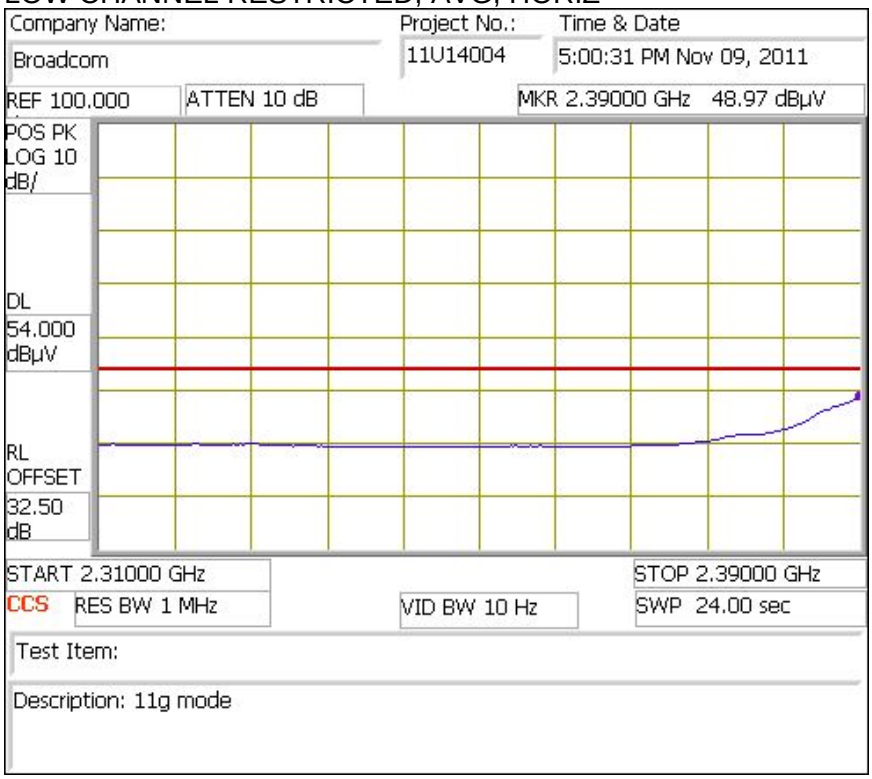
8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. TX ABOVE 1 GHz, 802.11g 1TX MODE IN THE 2.4 GHz BAND

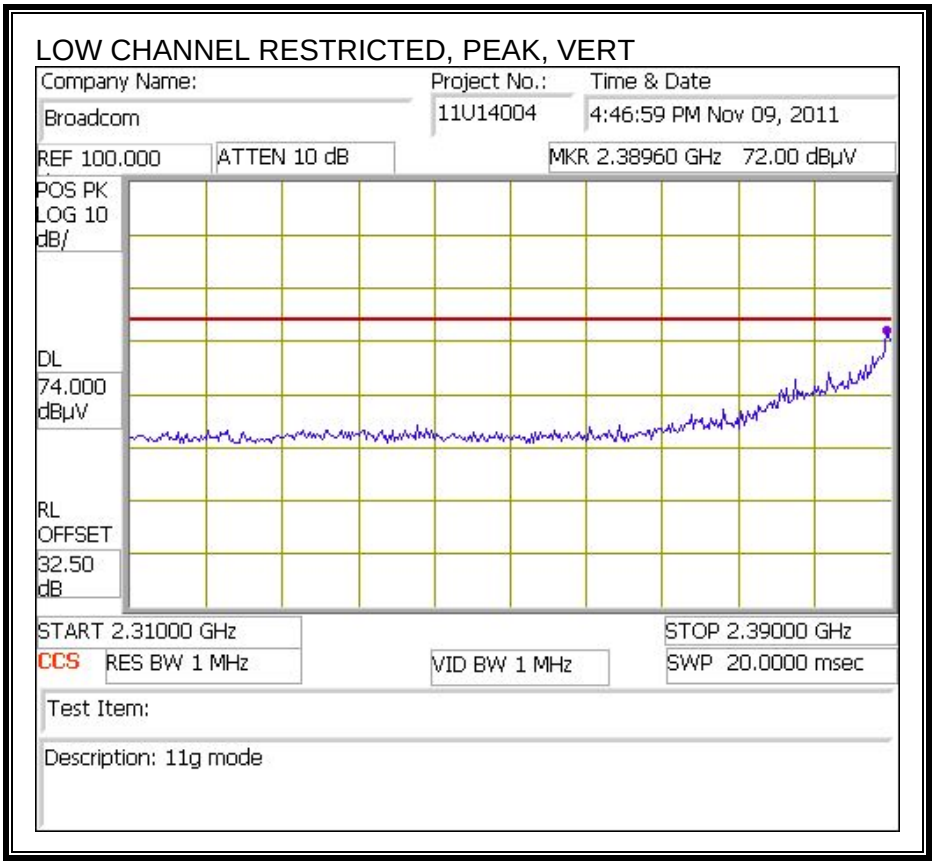
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



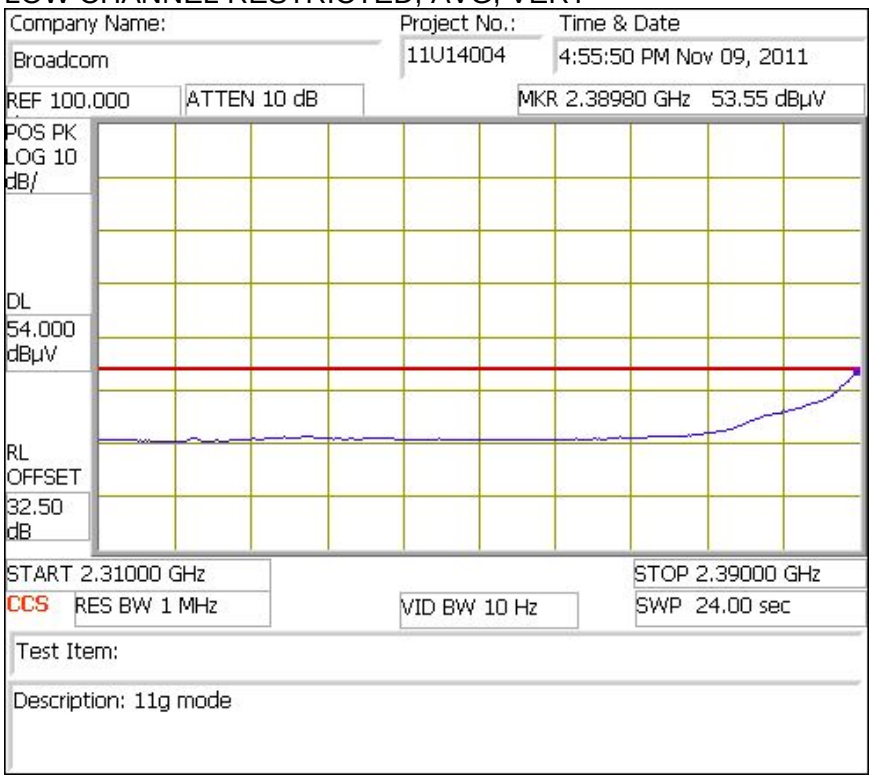
LOW CHANNEL RESTRICTED, AVG, HORIZ



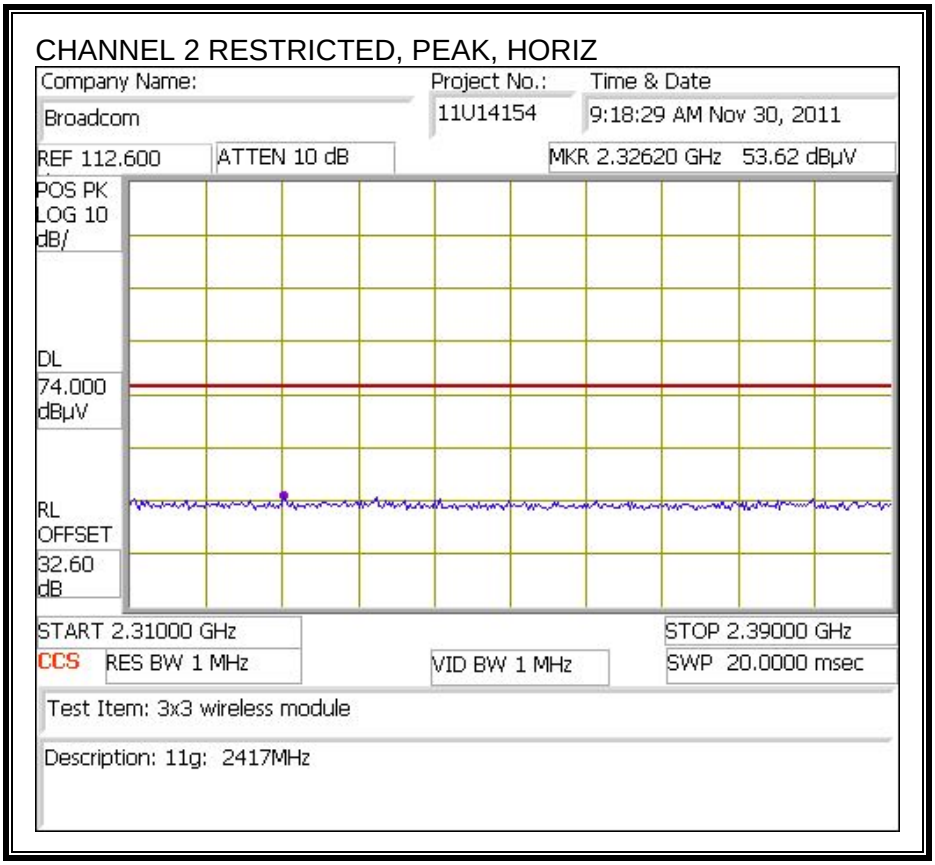
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



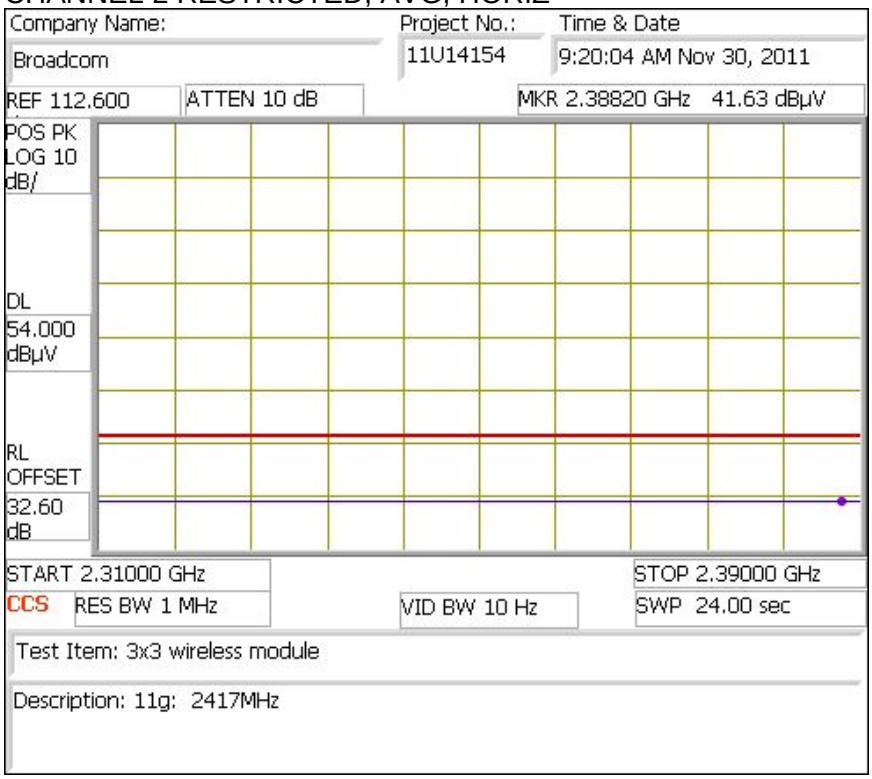
LOW CHANNEL RESTRICTED, AVG, VERT



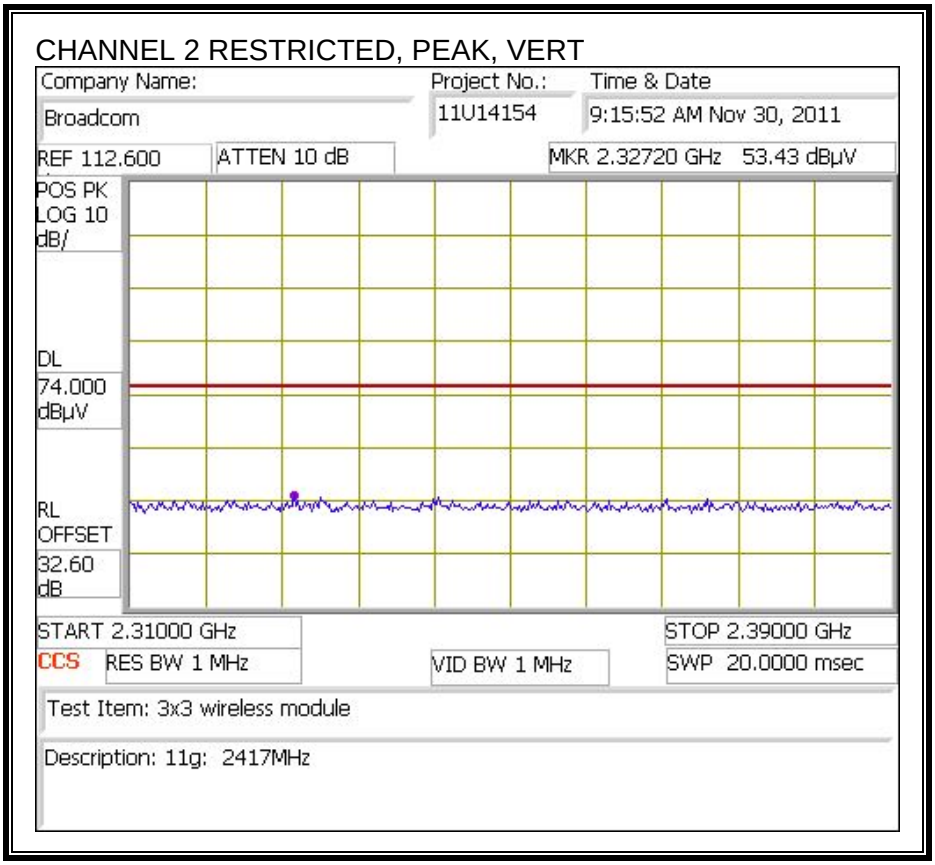
RESTRICTED BANDEDGE (CHANNEL 2, HORIZONTAL)



CHANNEL 2 RESTRICTED, AVG, HORIZ

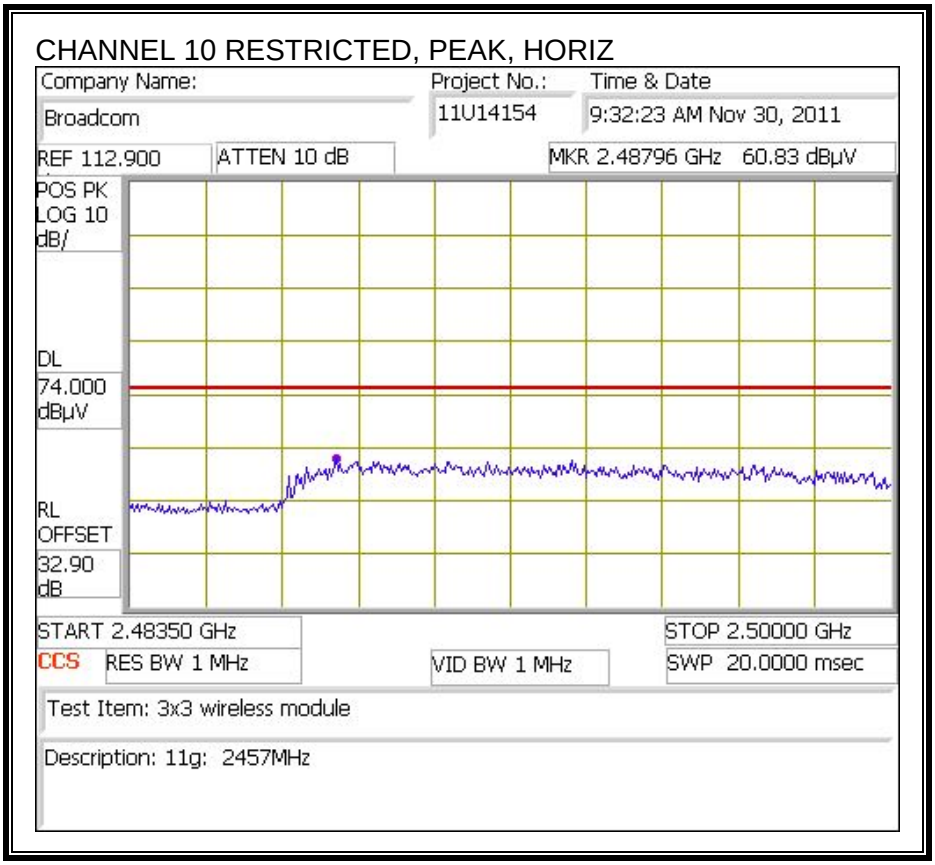


RESTRICTED BANDEDGE (CHANNEL 2, VERTICAL)

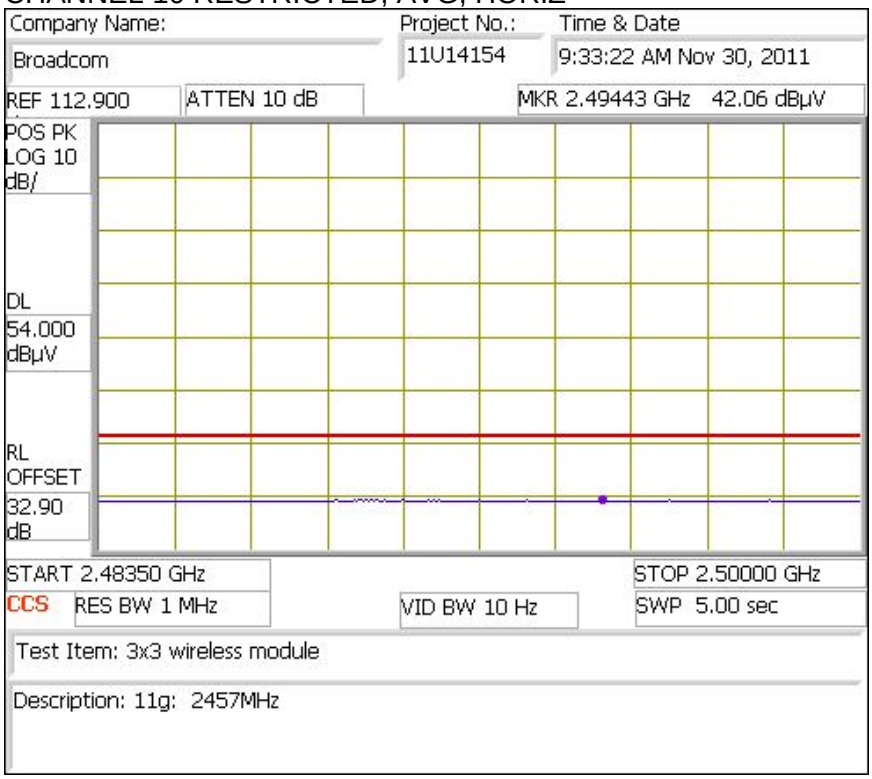


CHANNEL 2 RESTRICTED, AVG, VERT

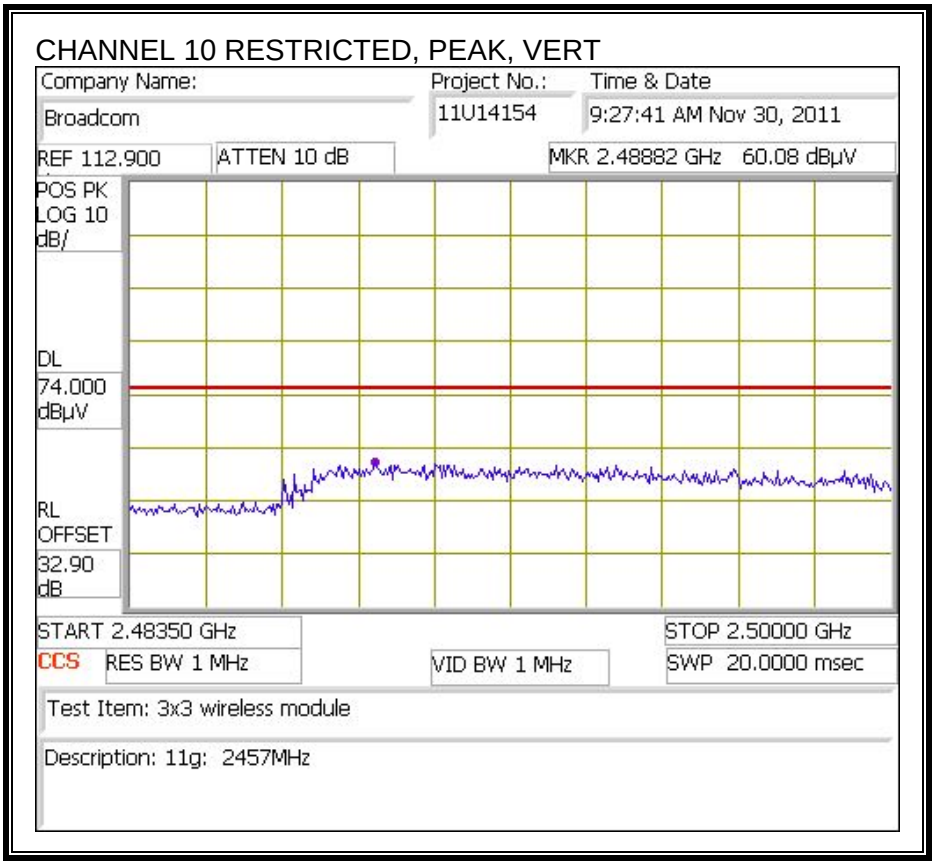
RESTRICTED BANDEDGE (CHANNEL 10, HORIZONTAL)



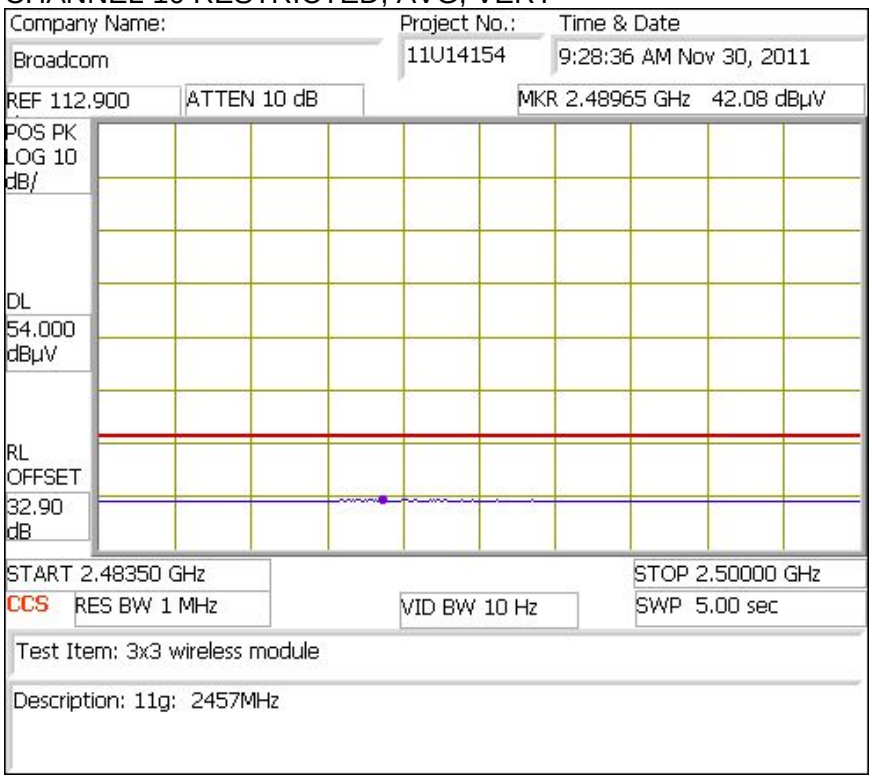
CHANNEL 10 RESTRICTED, AVG, HORIZ



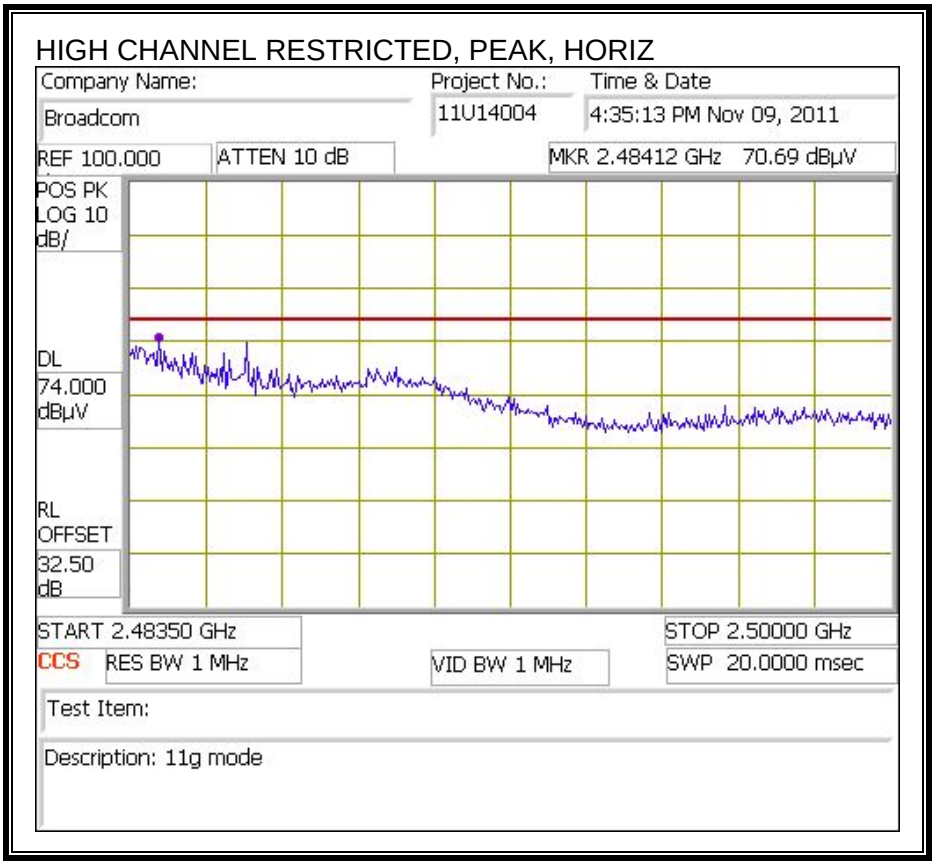
RESTRICTED BANDEDGE (CHANNEL 10, VERTICAL)



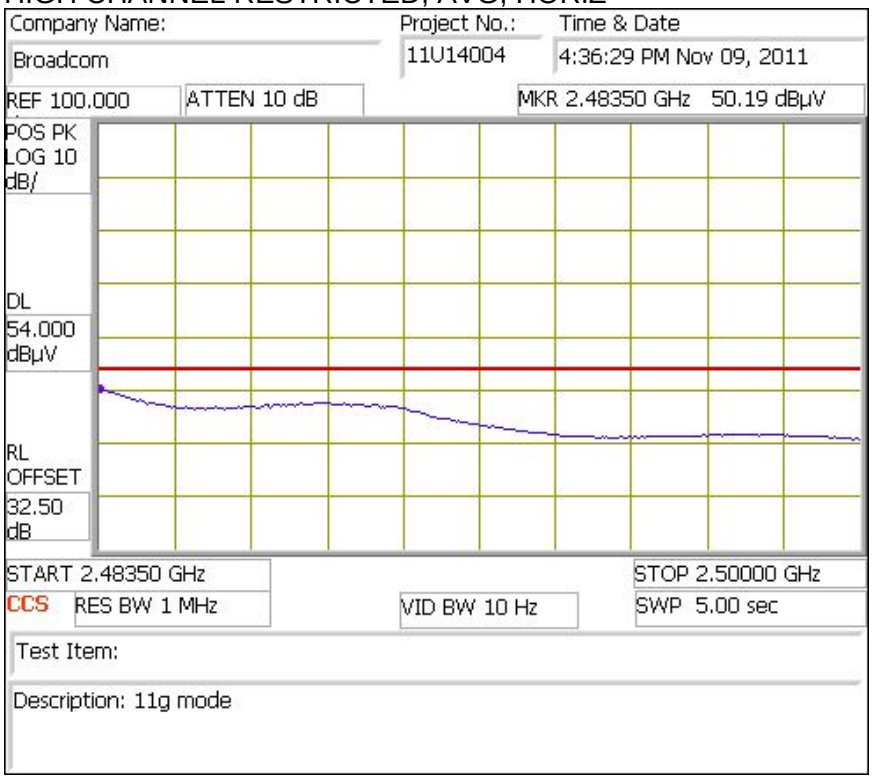
CHANNEL 10 RESTRICTED, AVG, VERT



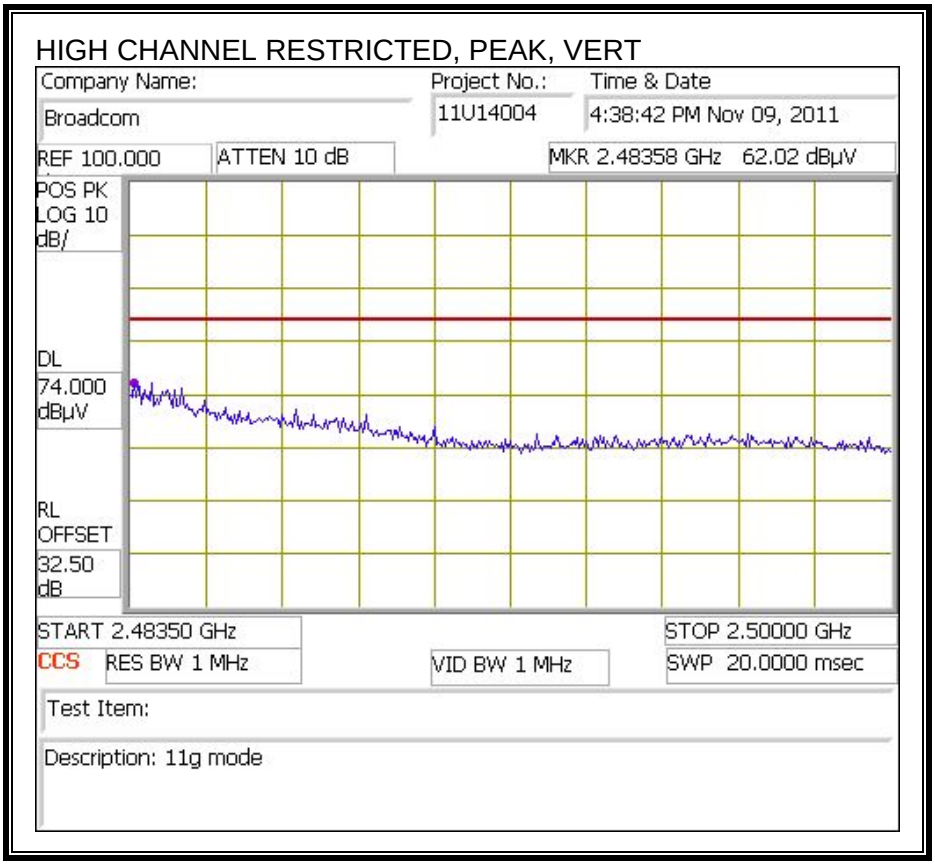
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



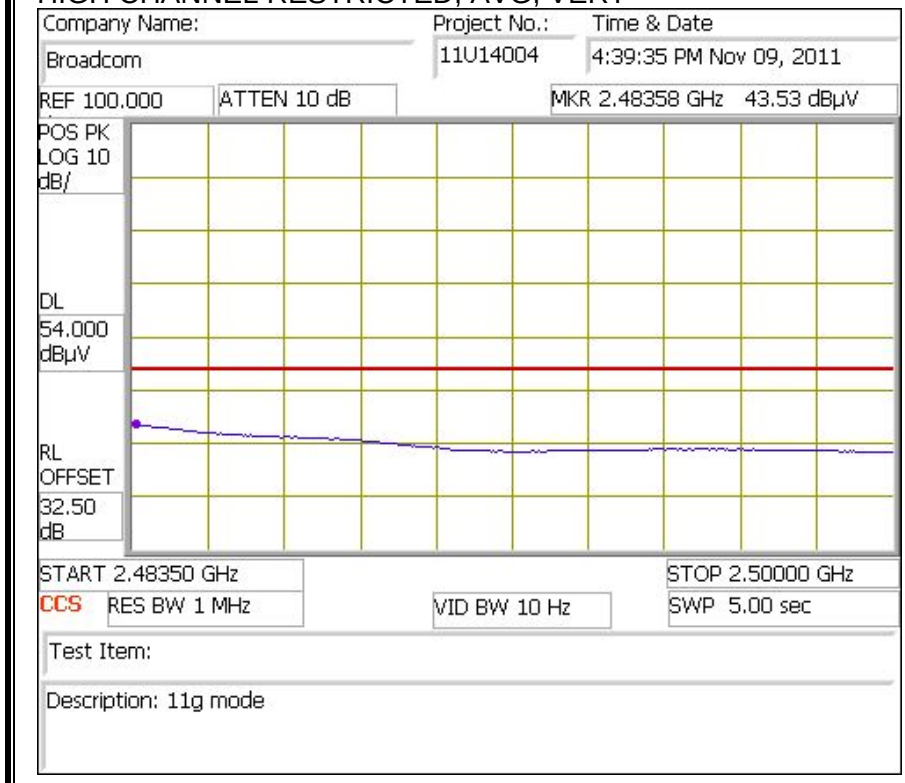
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

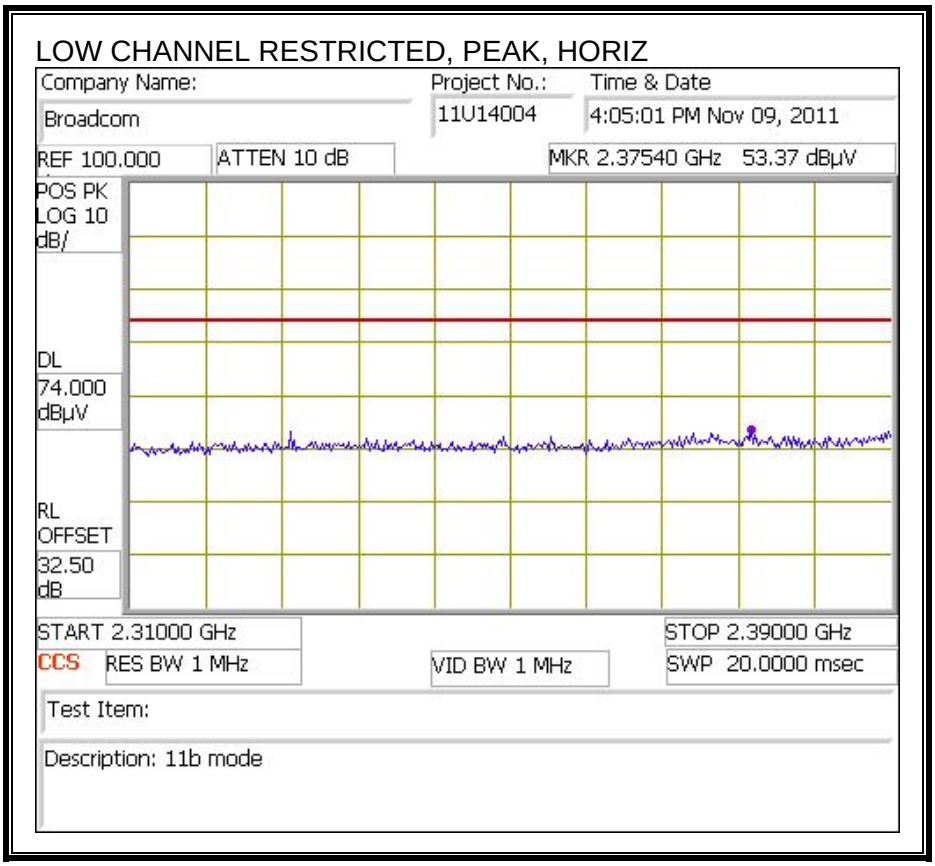


HIGH CHANNEL RESTRICTED, AVG, VERT

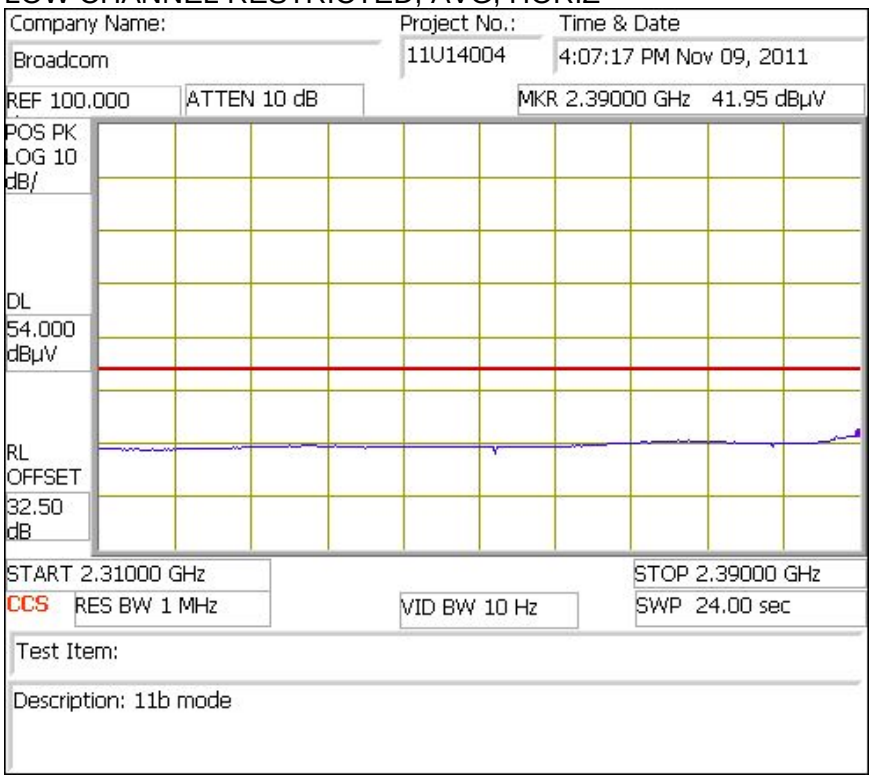


8.2.2. TX ABOVE 1 GHz, 802.11b CDD 3TX MODE IN THE 2.4 GHz BAND

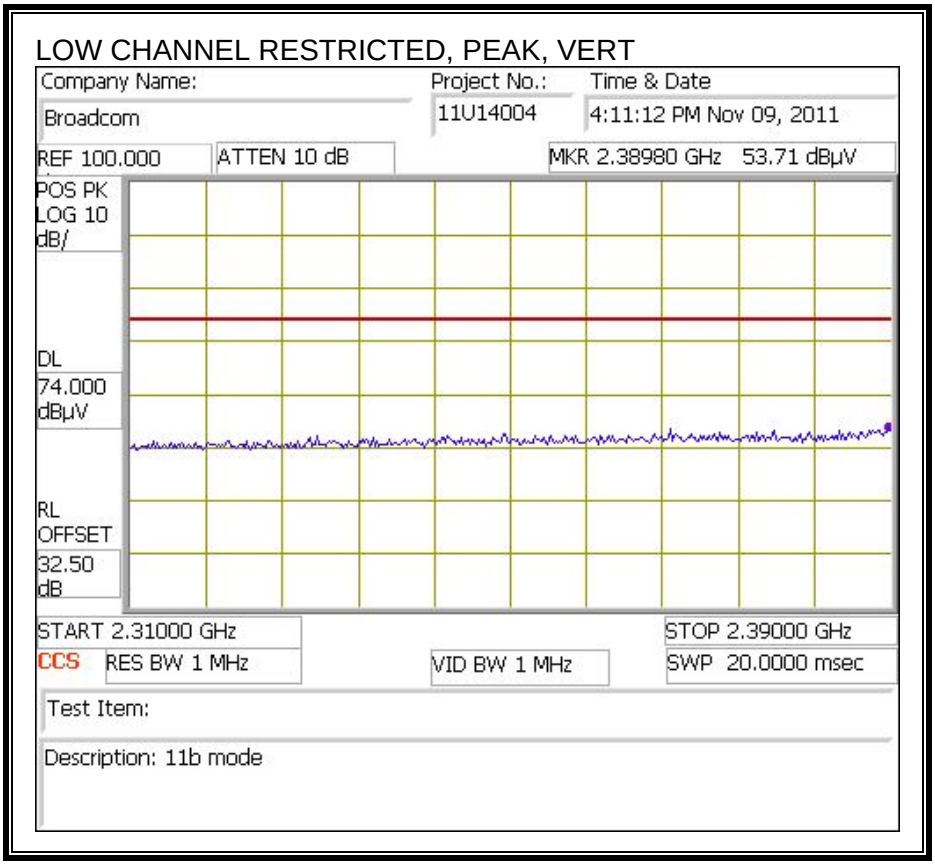
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



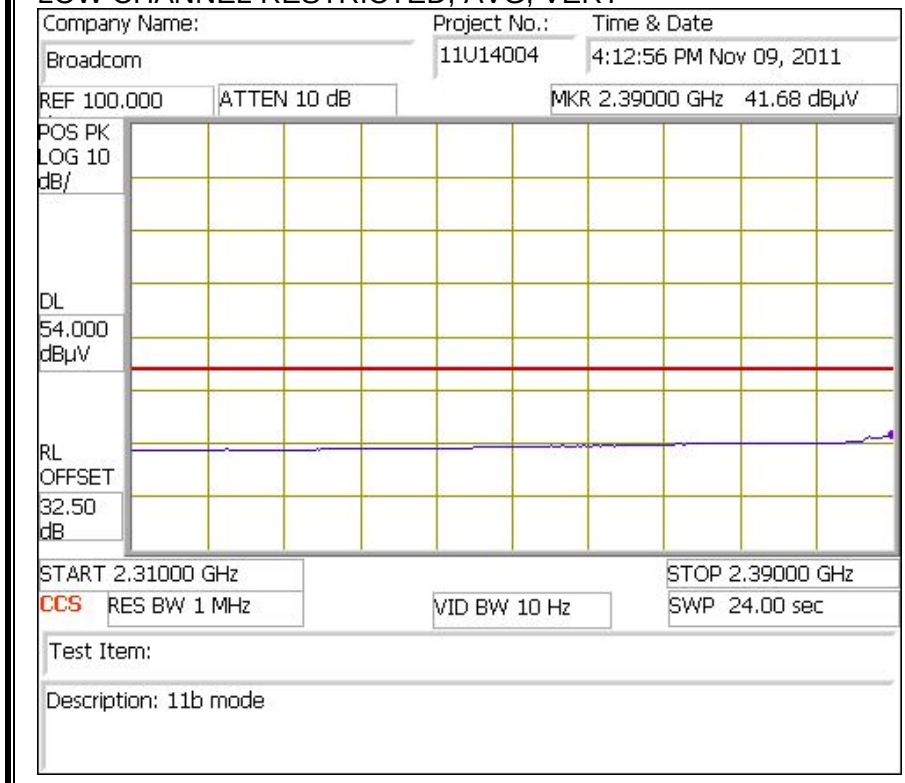
LOW CHANNEL RESTRICTED, AVG, HORIZ



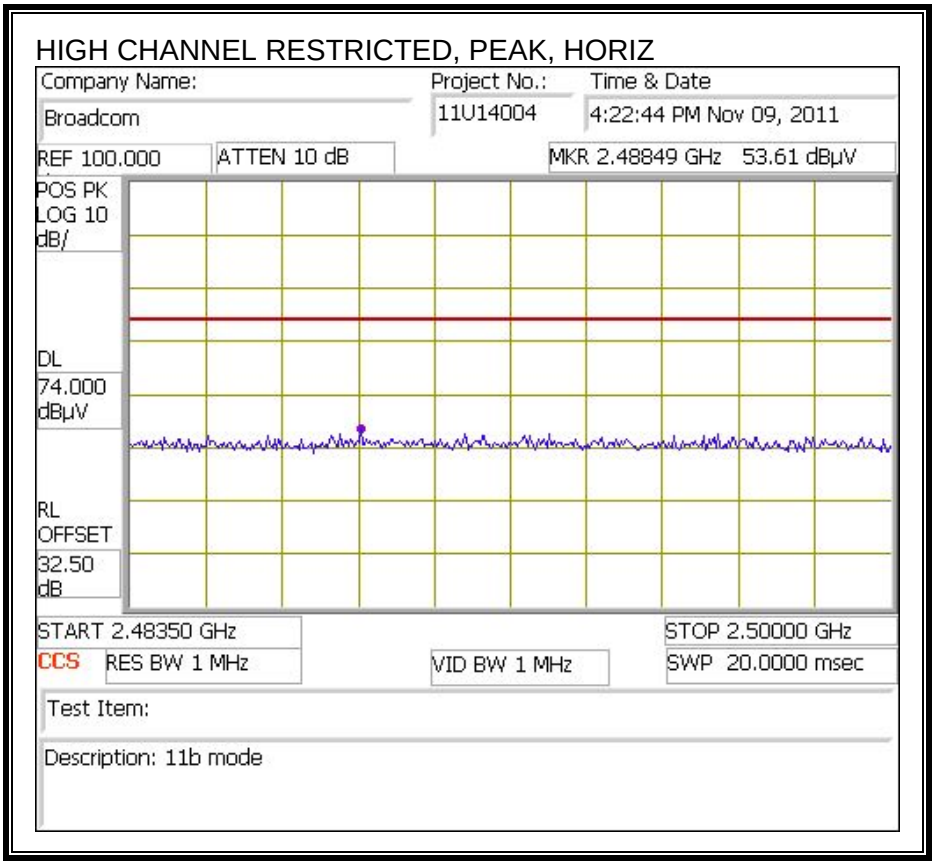
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



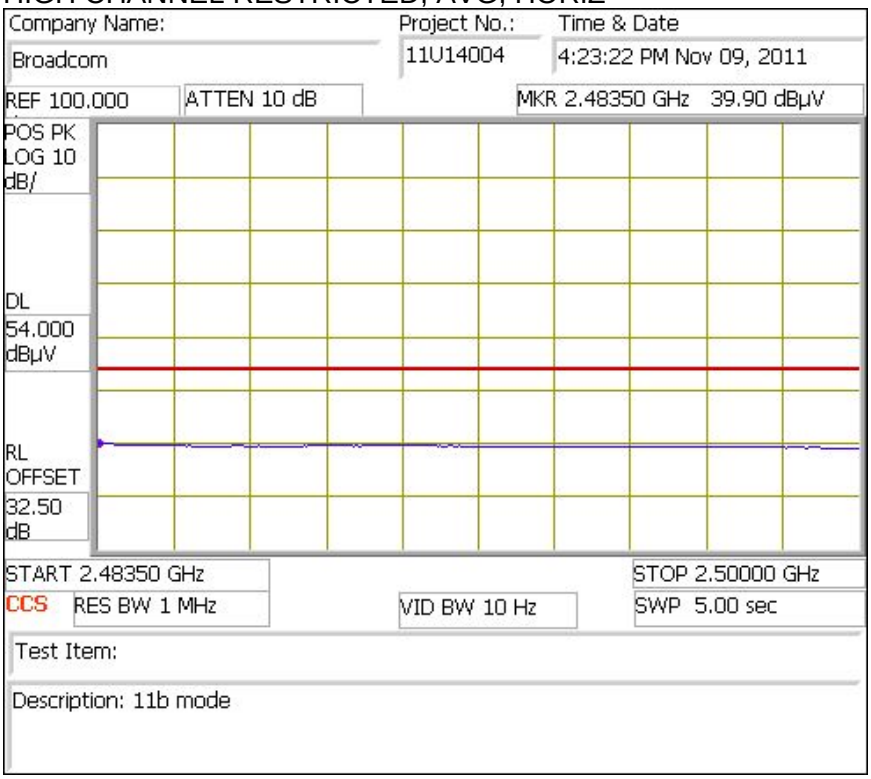
LOW CHANNEL RESTRICTED, AVG, VERT



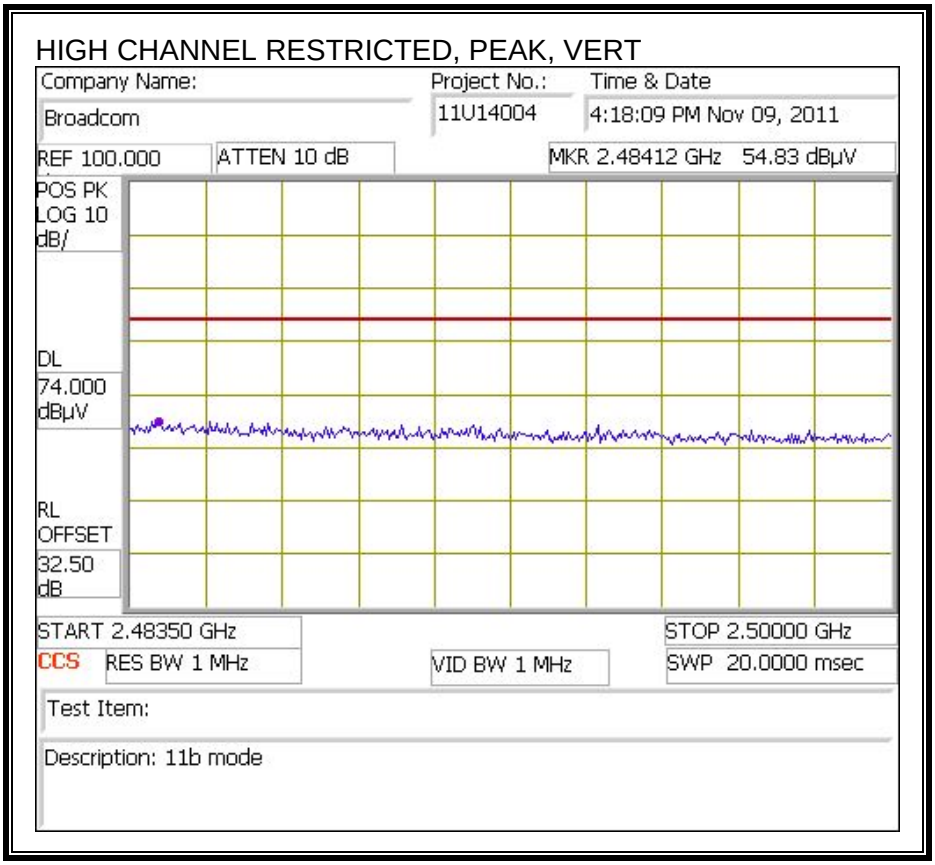
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



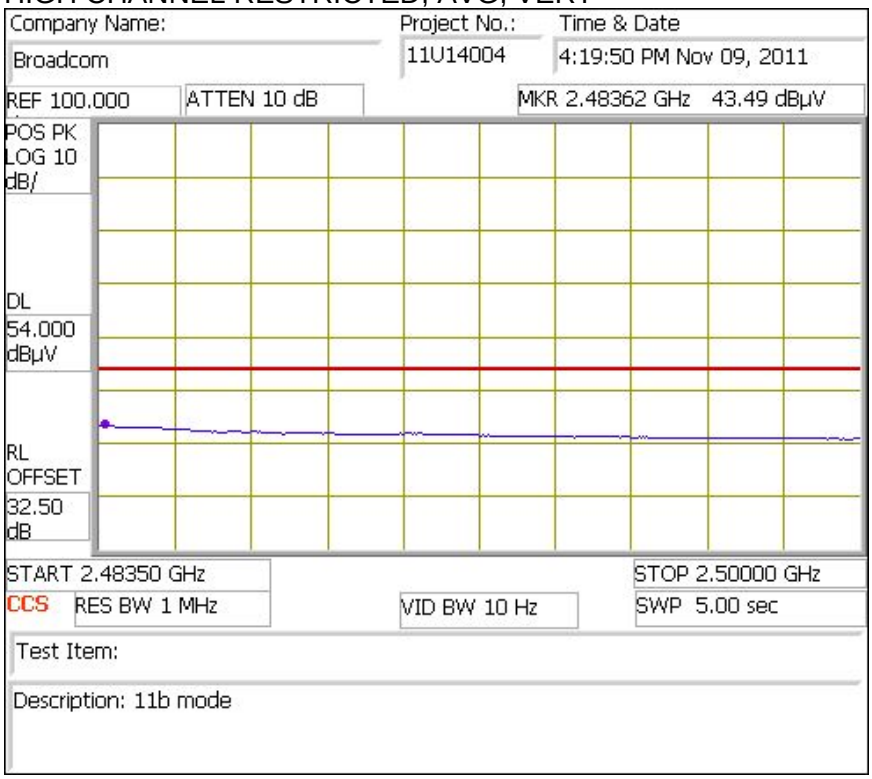
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: David Garcia
Date: 11/09/11
Project #: 11U14004
Company: Broadcom
Test Target: FCC 15 209 B
Mode Oper: 11b, Tx

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

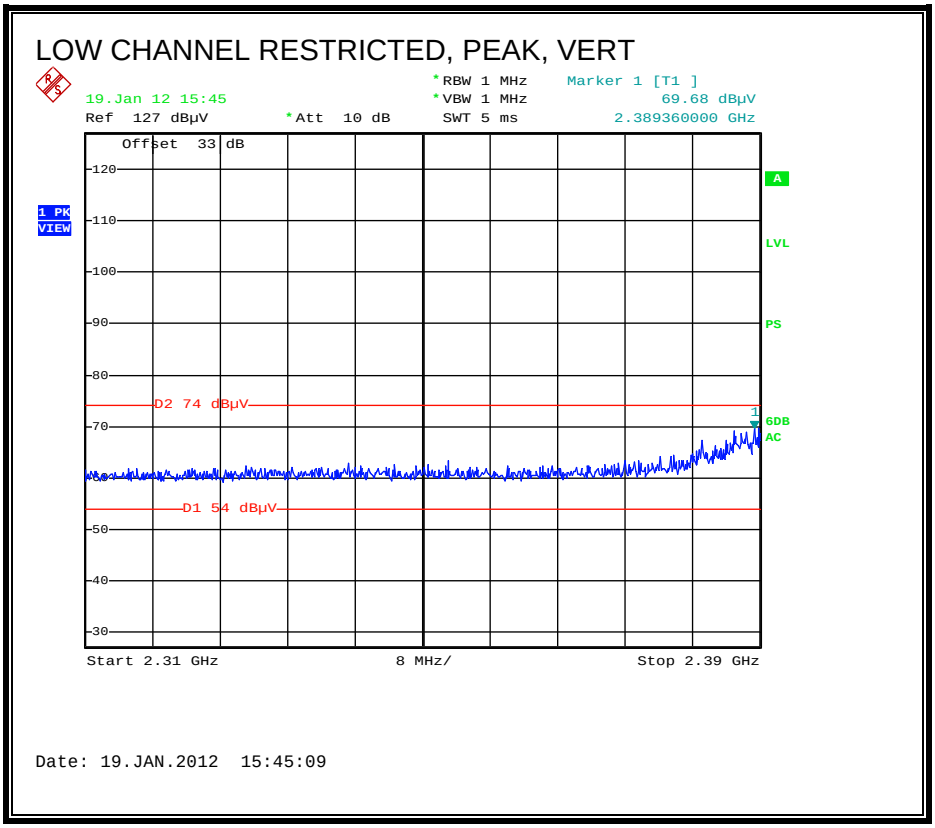
Average Field Strength Limit
Peak Field Strength Limit
Margin vs. Average Limit
Margin vs. Peak Limit

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: 2412 MHz															
4.824	3.0	40.0	33.4	5.8	-36.5	0.0	0.0	42.7	74.0	-31.3	H	P	100.1	233.4	
4.824	3.0	32.5	33.4	5.8	-36.5	0.0	0.0	35.3	54.0	-18.7	H	A	100.1	233.4	
12.060	3.0	34.7	39.3	9.8	-35.4	0.0	0.0	48.4	74.0	-25.6	H	P	177.8	249.7	
12.060	3.0	22.5	39.3	9.8	-35.4	0.0	0.0	36.2	54.0	-17.8	H	A	177.8	249.7	
4.824	3.0	45.0	33.4	5.8	-36.5	0.0	0.0	47.8	74.0	-26.2	V	P	100.0	284.2	
4.824	3.0	40.9	33.4	5.8	-36.5	0.0	0.0	43.7	54.0	-10.3	V	A	100.0	284.2	
12.060	3.0	39.9	39.3	9.8	-35.4	0.0	0.0	53.5	74.0	-20.5	V	P	151.9	36.5	
12.060	3.0	34.1	39.3	9.8	-35.4	0.0	0.0	47.8	54.0	-6.2	V	A	151.9	36.5	
Mid Channel: 2437 MHz															
4.874	3.0	38.5	33.5	5.8	-36.5	0.0	0.0	41.4	74.0	-32.6	H	P	142.5	187.6	
4.874	3.0	25.2	33.5	5.8	-36.5	0.0	0.0	28.0	54.0	-26.0	H	A	142.5	187.6	
7.311	3.0	37.9	35.7	7.3	-36.2	0.0	0.0	44.7	74.0	-29.3	H	P	143.4	12.2	
7.311	3.0	24.9	35.7	7.3	-36.2	0.0	0.0	31.7	54.0	-22.3	H	A	143.4	12.2	
12.185	3.0	34.2	39.3	9.8	-35.4	0.0	0.0	48.0	74.0	-26.0	H	P	127.7	198.3	
12.185	3.0	22.4	39.3	9.8	-35.4	0.0	0.0	36.1	54.0	-17.9	H	A	127.7	198.3	
4.874	3.0	42.0	33.5	5.8	-36.5	0.0	0.0	44.9	74.0	-29.1	V	P	100.1	280.3	
4.874	3.0	37.3	33.5	5.8	-36.5	0.0	0.0	40.1	54.0	-13.9	V	A	100.1	280.3	
7.311	3.0	47.0	35.7	7.3	-36.2	0.0	0.0	53.8	74.0	-20.2	V	P	168.2	60.4	
7.311	3.0	42.4	35.7	7.3	-36.2	0.0	0.0	49.1	54.0	-4.9	V	A	168.2	60.4	
12.185	3.0	37.4	39.3	9.8	-35.4	0.0	0.0	51.1	74.0	-22.9	V	P	147.7	200.0	
12.185	3.0	29.4	39.3	9.8	-35.4	0.0	0.0	43.1	54.0	-10.9	V	A	147.7	200.0	
High Channel: 2462 MHz															
4.924	3.0	37.7	33.5	5.9	-36.5	0.0	0.0	40.6	74.0	-33.4	H	P	198.5	179.1	
4.924	3.0	26.4	33.5	5.9	-36.5	0.0	0.0	29.4	54.0	-24.6	H	A	198.5	179.1	
7.386	3.0	39.6	35.8	7.3	-36.2	0.0	0.0	46.6	74.0	-27.4	H	P	143.9	245.4	
7.386	3.0	32.0	35.8	7.3	-36.2	0.0	0.0	39.0	54.0	-15.0	H	A	143.9	245.4	
12.310	3.0	34.9	39.3	9.9	-35.4	0.0	0.0	48.7	74.0	-25.3	H	P	130.0	26.5	
12.310	3.0	22.5	39.3	9.9	-35.4	0.0	0.0	36.3	54.0	-17.7	H	A	130.0	26.5	
4.924	3.0	42.1	33.5	5.9	-36.5	0.0	0.0	45.1	74.0	-28.9	V	P	104.0	234.0	
4.924	3.0	36.2	33.5	5.9	-36.5	0.0	0.0	39.1	54.0	-14.9	V	A	104.0	234.0	
7.386	3.0	45.9	35.8	7.3	-36.2	0.0	0.0	52.9	74.0	-21.1	V	P	107.8	279.9	
7.386	3.0	41.3	35.8	7.3	-36.2	0.0	0.0	48.2	54.0	-5.8	V	A	107.8	279.9	
12.310	3.0	38.3	39.3	9.9	-35.4	0.0	0.0	52.1	74.0	-21.9	V	P	172.4	196.9	
12.310	3.0	30.7	39.3	9.9	-35.4	0.0	0.0	44.5	54.0	-9.5	V	A	172.4	196.9	

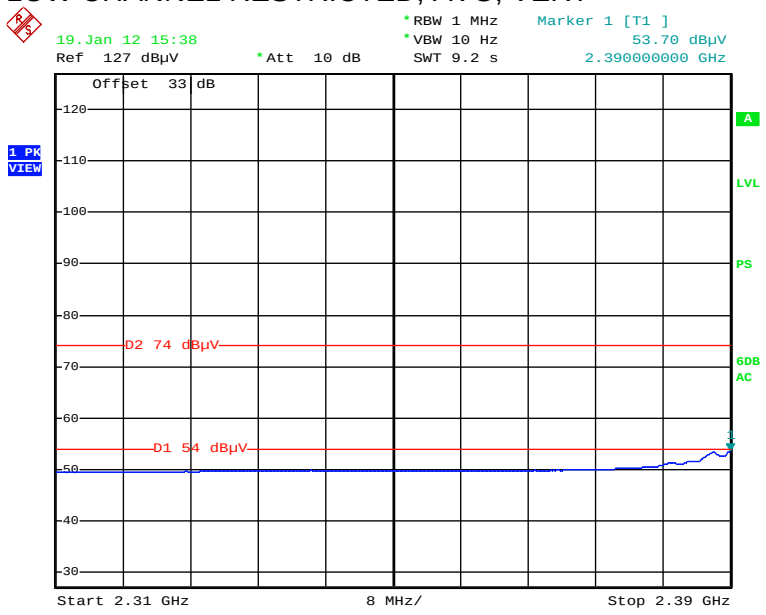
Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.2.3. TX ABOVE 1 GHz, 802.11n HT20 CDD 3TX MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

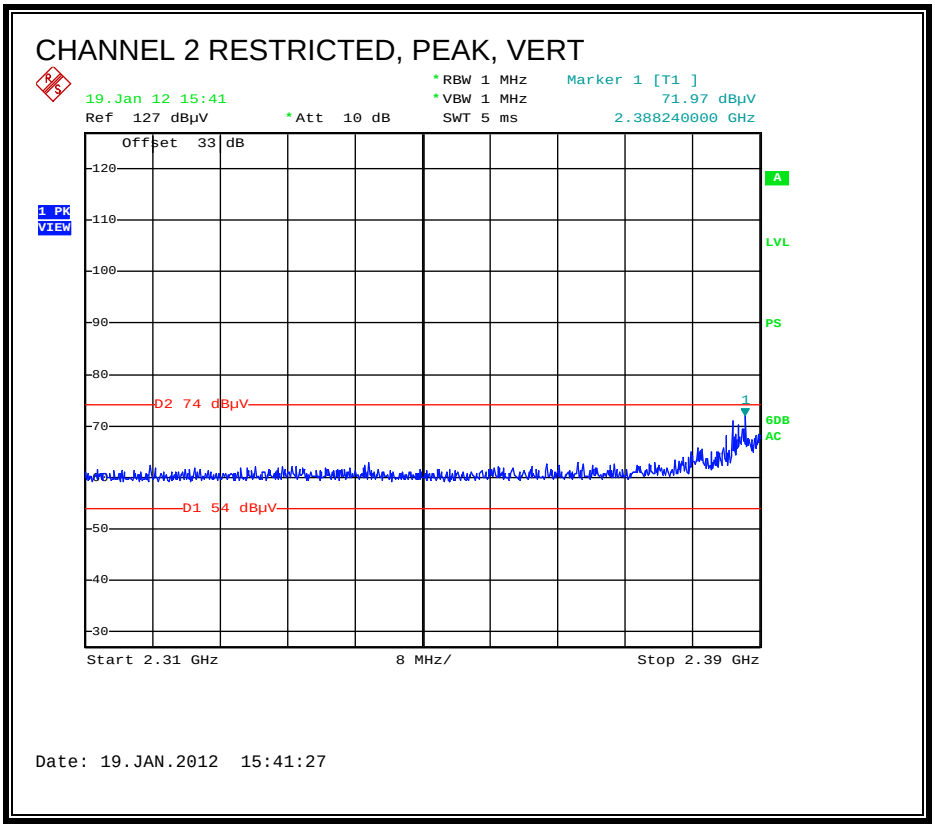


LOW CHANNEL RESTRICTED, AVG, VERT

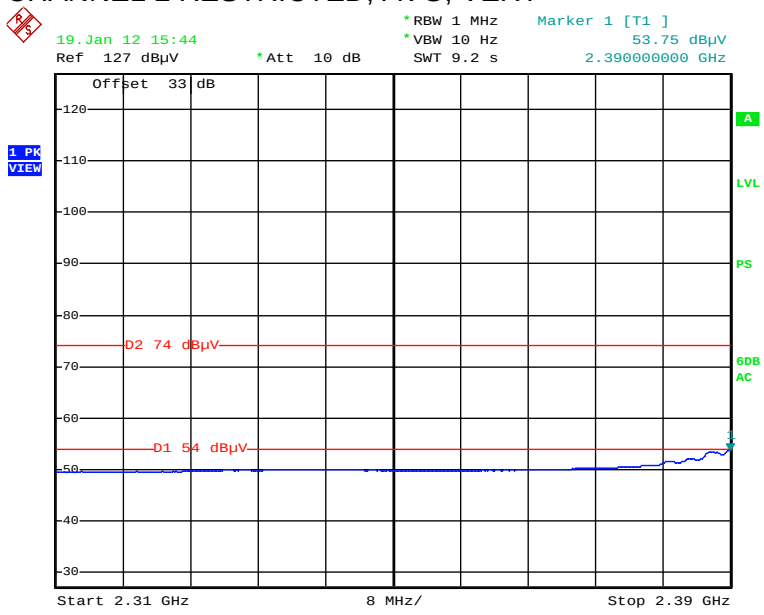


Date: 19.JAN.2012 15:38:21

RESTRICTED BANDEDGE (CHANNEL 2, VERTICAL)

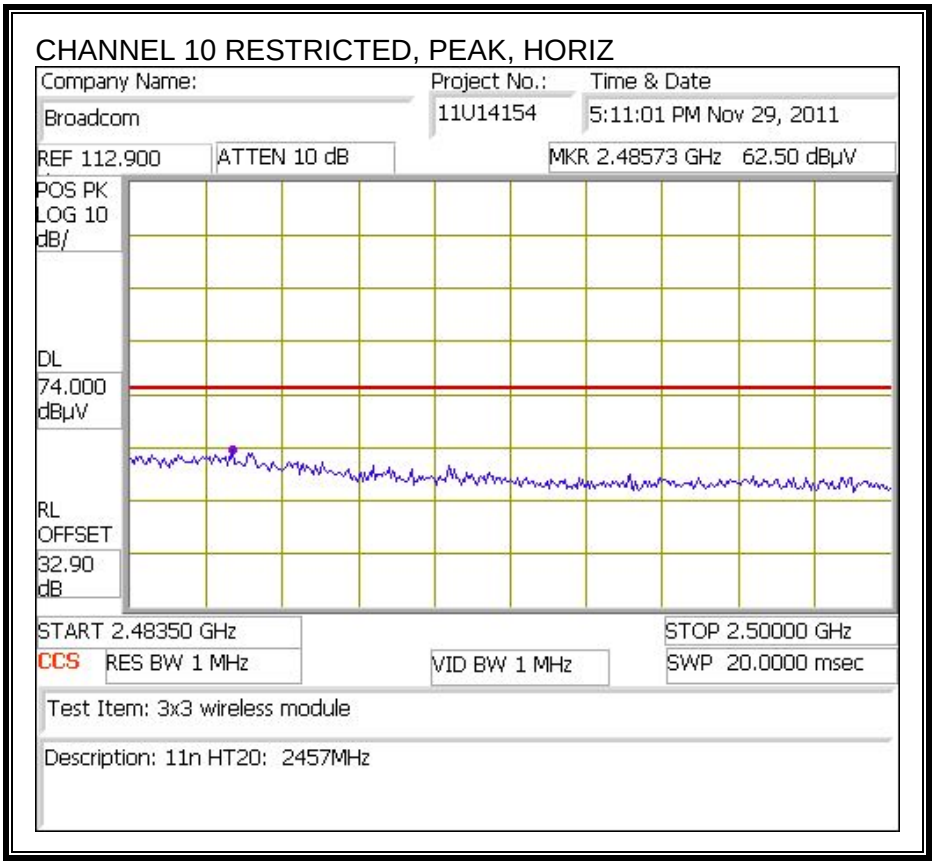


CHANNEL 2 RESTRICTED, AVG, VERT

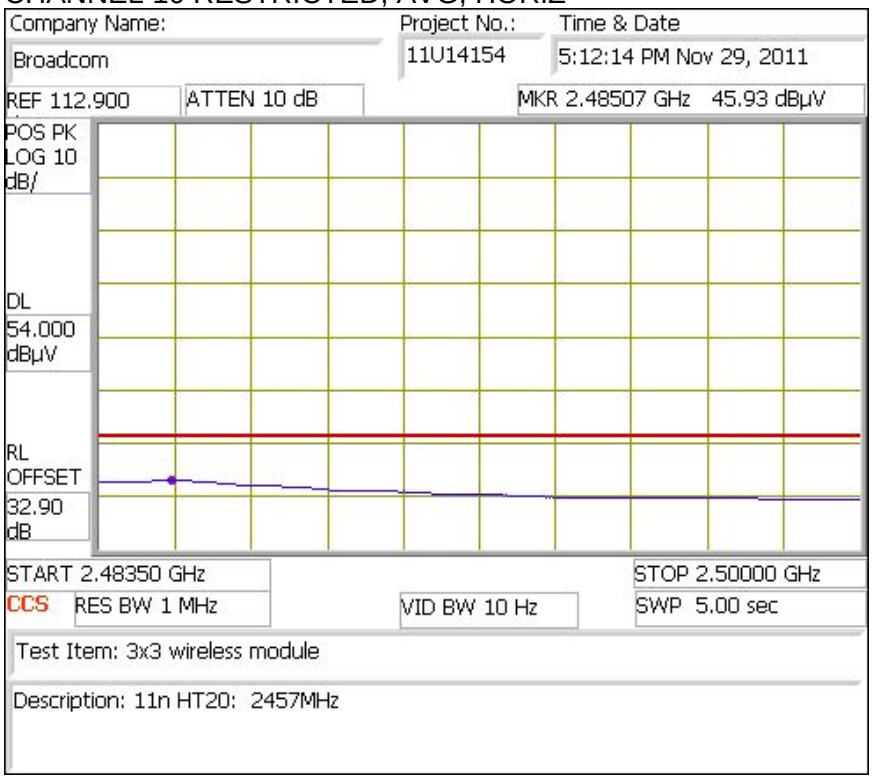


Date: 19.JAN.2012 15:44:33

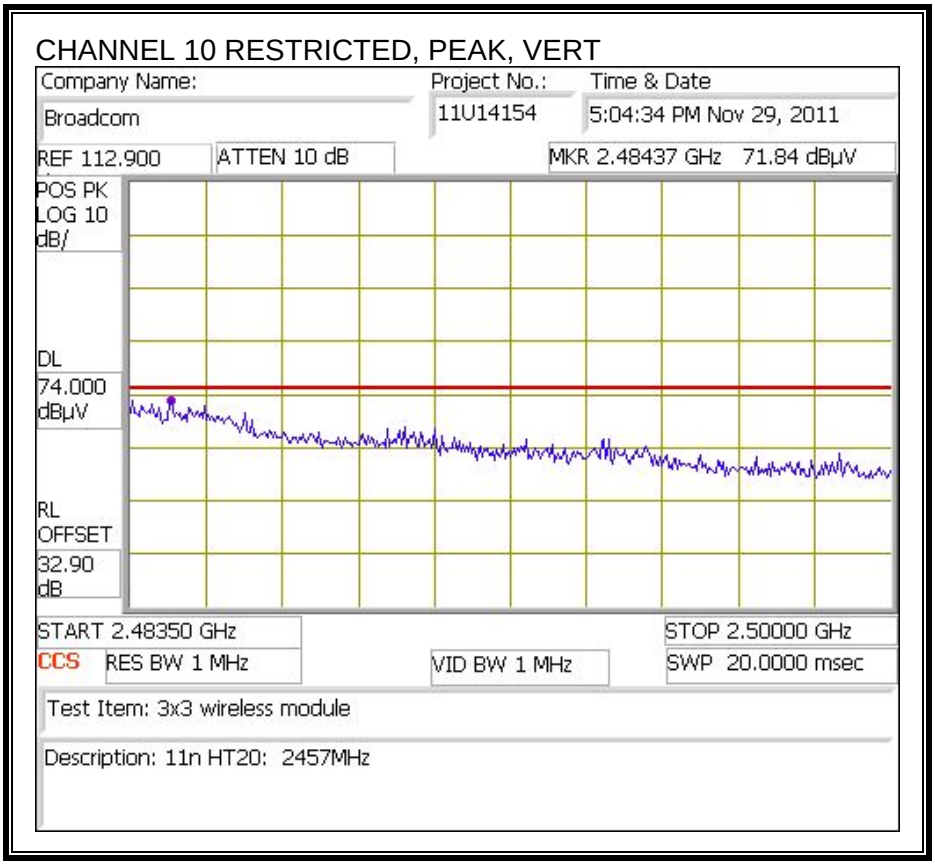
RESTRICTED BANDEDGE (CHANNEL 10, HORIZONTAL)



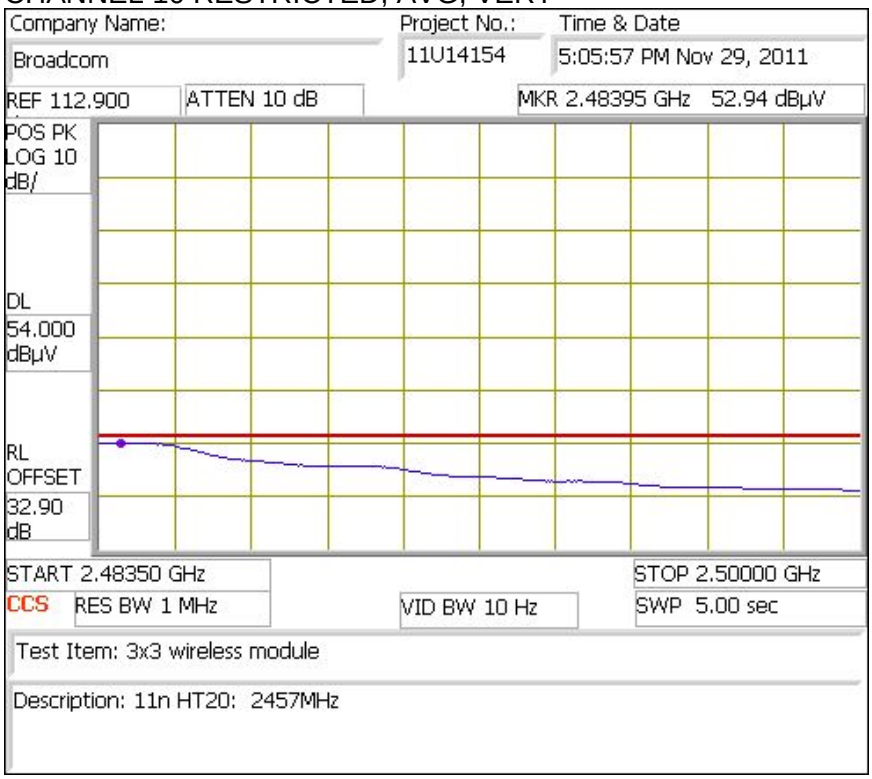
CHANNEL 10 RESTRICTED, AVG, HORIZ



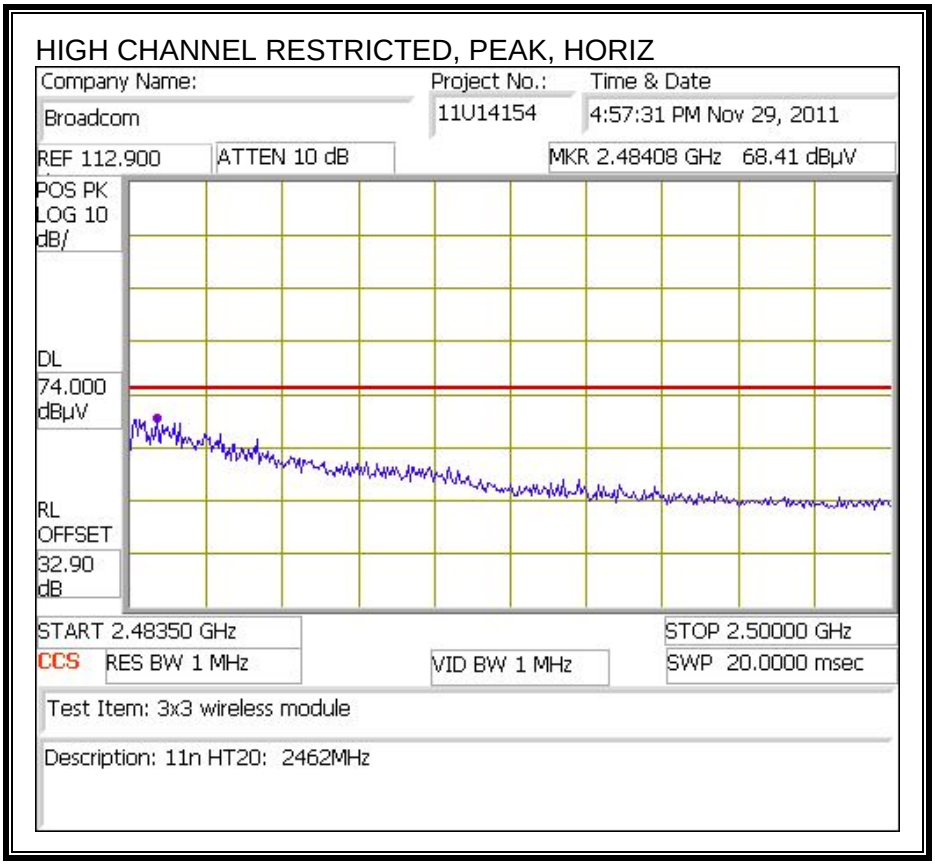
RESTRICTED BANDEDGE (CHANNEL 10, VERTICAL)



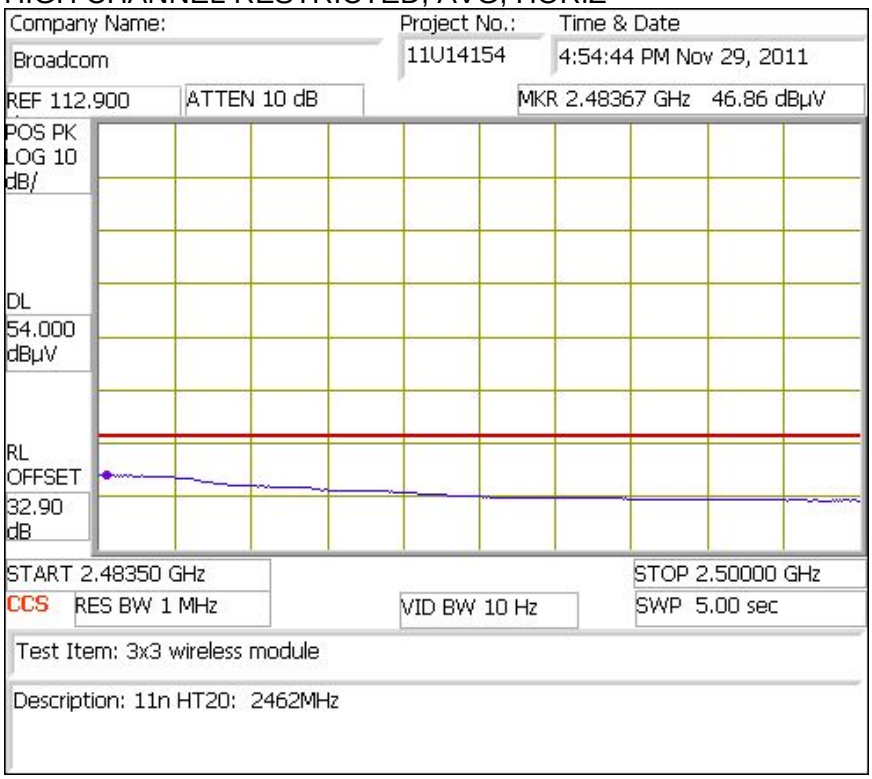
CHANNEL 10 RESTRICTED, AVG, VERT



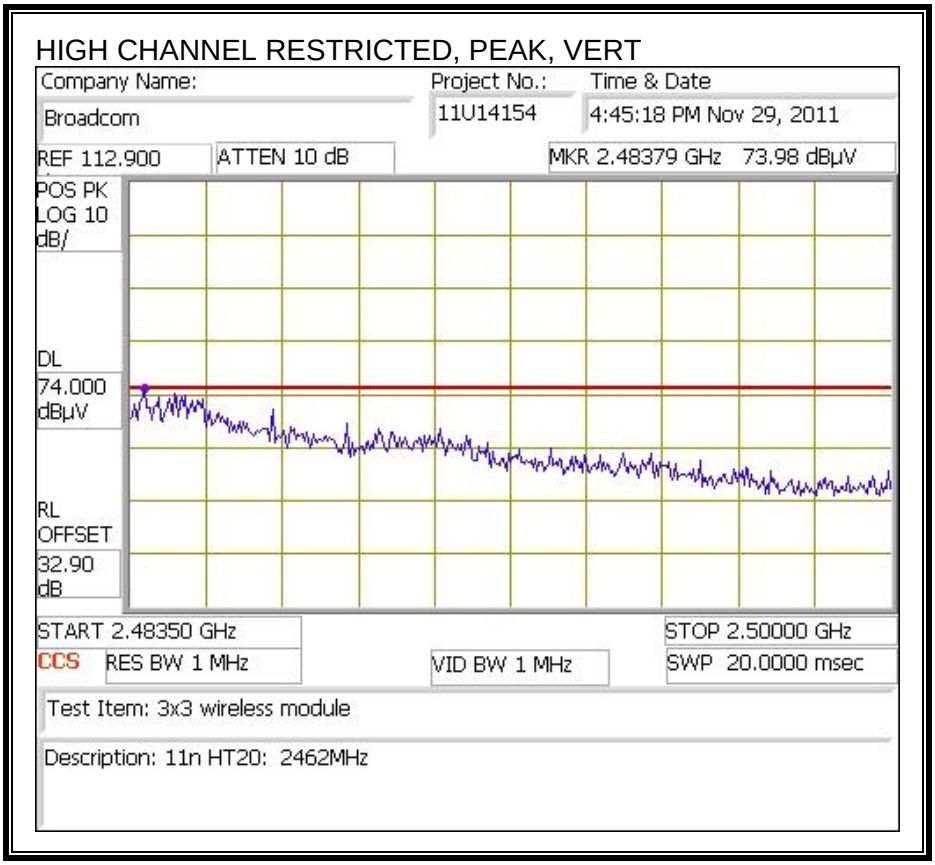
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



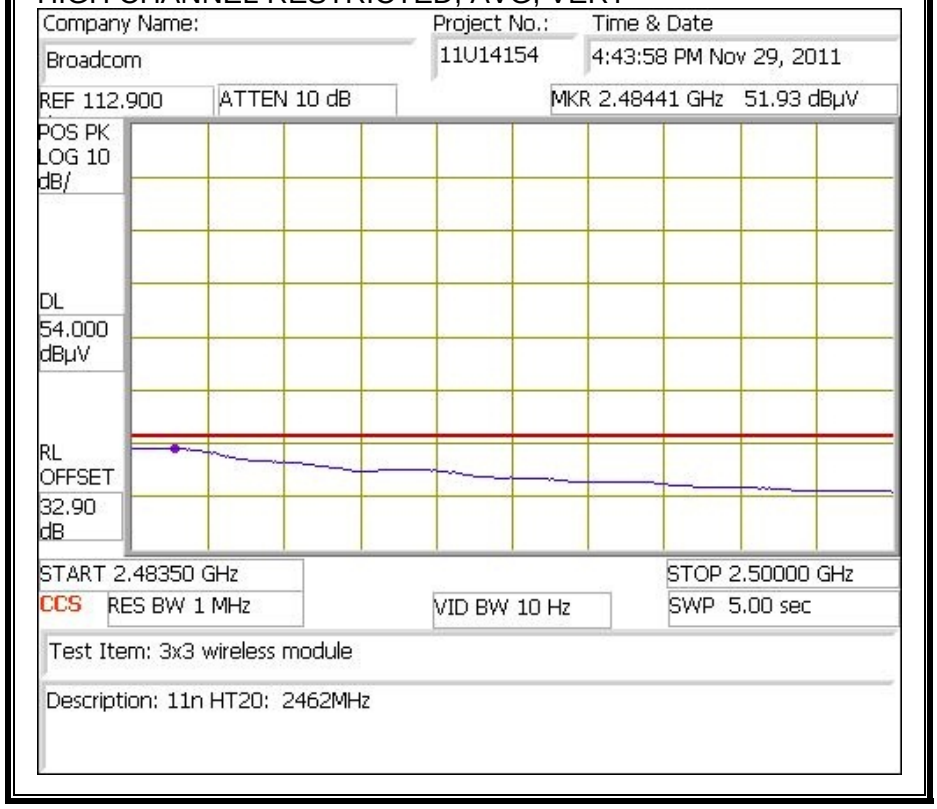
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Test Engr: Mark Nolting
Date: 11/30/11
Project #: 11U14154
Company: BroadCpm
Test Target: FCC 15.205
Mode Oper: 11n HT20 MCS0

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
channel freq: 2412MHz													19dBm setting
4.824	3.0	38.4	33.4	5.8	-36.5	0.0	0.5	41.7	74.0	-32.4	H	P	
4.824	3.0	25.5	33.4	5.8	-36.5	0.0	0.5	28.8	54.0	-25.2	H	A	
12.060	3.0	35.1	39.3	9.8	-35.4	0.0	0.8	49.6	74.0	-24.4	H	P	
12.060	3.0	22.8	39.3	9.8	-35.4	0.0	0.8	37.3	54.0	-16.7	H	A	
4.824	3.0	40.8	33.4	5.8	-36.5	0.0	0.5	44.1	74.0	-29.9	V	P	
4.824	3.0	26.3	33.4	5.8	-36.5	0.0	0.5	29.6	54.0	-24.4	V	A	
12.060	3.0	34.4	39.3	9.8	-35.4	0.0	0.8	48.9	74.0	-25.1	V	P	
12.060	3.0	22.7	39.3	9.8	-35.4	0.0	0.8	37.2	54.0	-16.8	V	A	
channel freq: 2437MHz													19dBm setting
4.874	3.0	38.2	33.2	5.8	-34.8	0.0	0.0	42.4	74.0	-31.6	V	P	
4.874	3.0	26.4	33.2	5.8	-34.8	0.0	0.0	30.6	54.0	-23.4	V	A	
7.311	3.0	44.2	36.3	7.3	-34.1	0.0	0.0	53.6	74.0	-20.4	V	P	
7.311	3.0	31.5	36.3	7.3	-34.1	0.0	0.0	40.9	54.0	-13.1	V	A	
12.185	3.0	45.4	39.4	9.8	-32.5	0.0	0.0	62.1	74.0	-11.9	V	P	
12.185	3.0	31.0	39.4	9.8	-32.5	0.0	0.0	47.7	54.0	-6.3	V	A	
4.874	3.0	37.5	33.2	5.8	-34.8	0.0	0.0	41.7	74.0	-32.3	H	P	
4.874	3.0	25.2	33.2	5.8	-34.8	0.0	0.0	29.4	54.0	-24.6	H	A	
7.311	3.0	38.8	36.3	7.3	-34.1	0.0	0.0	48.2	74.0	-25.8	H	P	
7.311	3.0	25.1	36.3	7.3	-34.1	0.0	0.0	34.5	54.0	-19.5	H	A	
12.185	3.0	35.4	39.4	9.8	-32.5	0.0	0.0	52.1	74.0	-21.9	H	P	
12.185	3.0	22.8	39.4	9.8	-32.5	0.0	0.0	39.5	54.0	-14.5	H	A	
channel freq: 2462MHz													19dBm setting
4.924	3.0	42.8	33.2	5.9	-34.8	0.0	0.0	47.0	74.0	-27.0	V	P	
4.924	3.0	25.8	33.2	5.9	-34.8	0.0	0.0	30.0	54.0	-24.0	V	A	
7.386	3.0	40.1	36.4	7.3	-34.1	0.0	0.0	49.8	74.0	-24.2	V	P	
7.386	3.0	25.3	36.4	7.3	-34.1	0.0	0.0	34.9	54.0	-19.1	V	A	
12.310	3.0	34.7	39.4	9.9	-32.5	0.0	0.0	51.5	74.0	-22.5	V	P	
12.310	3.0	22.0	39.4	9.9	-32.5	0.0	0.0	38.8	54.0	-15.2	V	A	
4.924	3.0	36.6	33.2	5.9	-34.8	0.0	0.0	40.9	74.0	-33.1	H	P	
4.924	3.0	24.4	33.2	5.9	-34.8	0.0	0.0	28.6	54.0	-25.4	H	A	
7.386	3.0	35.6	36.4	7.3	-34.1	0.0	0.0	45.2	74.0	-28.8	H	P	
7.386	3.0	23.4	36.4	7.3	-34.1	0.0	0.0	33.1	54.0	-20.9	H	A	
12.310	3.0	34.4	39.4	9.9	-32.5	0.0	0.0	51.2	74.0	-22.8	H	P	
12.310	3.0	21.6	39.4	9.9	-32.5	0.0	0.0	38.4	54.0	-15.6	H	A	

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

8.2.4. TX ABOVE 1 GHz, 802.11n HT20 3TX MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: David Garcia
Date: 12/28/11
Project #: 11U14154
Company: Broadcom
Test Target: FCC 15.205
Mode Oper: HT20 3x3 MCS0 CDD, 5.8GHz Band

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Channel: 5745MHz													
11.490	3.0	35.7	38.9	11.2	-32.5	0.0	0.7	53.9	74.0	-20.1	H	P	
11.490	3.0	23.7	38.9	11.2	-32.5	0.0	0.7	41.9	54.0	-12.1	H	A	
11.490	3.0	36.1	38.9	11.2	-32.5	0.0	0.7	54.4	74.0	-19.6	V	P	
11.490	3.0	23.9	38.9	11.2	-32.5	0.0	0.7	42.1	54.0	-11.9	V	A	
Mid Channel: 5785MHz													
11.570	3.0	36.9	38.9	11.3	-32.5	0.0	0.7	55.3	74.0	-18.7	H	P	
11.570	3.0	25.2	38.9	11.3	-32.5	0.0	0.7	43.6	54.0	-10.4	H	A	
11.570	3.0	39.6	38.9	11.3	-32.5	0.0	0.7	58.0	74.0	-16.0	V	P	
11.570	3.0	27.3	38.9	11.3	-32.5	0.0	0.7	45.8	54.0	-8.2	V	A	
High Channel: 5825MHz													
11.650	3.0	35.0	39.0	11.4	-32.5	0.0	0.7	53.6	74.0	-20.4	H	P	
11.650	3.0	23.1	39.0	11.4	-32.5	0.0	0.7	41.7	54.0	-12.3	H	A	
11.650	3.0	39.2	39.0	11.4	-32.5	0.0	0.7	57.8	74.0	-16.2	V	P	
11.650	3.0	27.2	39.0	11.4	-32.5	0.0	0.7	45.8	54.0	-8.2	V	A	

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

8.2.5. TX ABOVE 1 GHz, 802.11n HT40 3TX MODE IN THE 5.8 GHz BAND

HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: David Garcia
Date: 01/18/12
Project #: 11U14154
Company: Broadcom
Test Target: FCC 15.205
Mode Oper: HT40 3x3 CDD MCS0

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

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
5755 MHz													
11.510	3.0	40.9	38.8	9.5	-35.8	0.0	0.7	54.1	74.0	-19.9	V	P	
11.510	3.0	27.0	38.8	9.5	-35.8	0.0	0.7	40.2	54.0	-13.8	V	A	
11.510	3.0	36.4	38.8	9.5	-35.8	0.0	0.7	49.6	74.0	-24.4	H	P	
11.510	3.0	24.4	38.8	9.5	-35.8	0.0	0.7	37.6	54.0	-16.4	H	A	
5795 MHz													
11.590	3.0	40.2	38.9	9.5	-35.8	0.0	0.7	53.6	74.0	-20.4	V	P	
11.590	3.0	27.6	38.9	9.5	-35.8	0.0	0.7	41.0	54.0	-13.0	V	A	
11.590	3.0	37.7	38.9	9.5	-35.8	0.0	0.7	51.8	74.0	-22.2	H	P	
11.590	3.0	25.1	38.9	9.5	-35.8	0.0	0.7	39.1	54.0	-14.9	H	A	

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

8.3. RECEIVER ABOVE 1 GHz

8.3.1. RECEIVER ABOVE 1 GHz, 20 MHz BANDWIDTH

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Company: Broadcom
Project #: 11U14154
Date: 11/30/2011
Test Engineer: David Garcia
Configuration: EUT / Laptop
Mode: Rx Mode_20MHz Bandwidth in 5 GHz Band

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B		T39; ARA 18-26GHz; S/N:1013	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)
1.621	3.0	56.3	40.9	26.8	3.6	-36.9	0.0	0.0	49.8	34.4	74	54	-24.2	-19.6	H
1.786	3.0	55.7	38.2	27.4	3.8	-36.6	0.0	0.0	50.2	32.7	74	54	-23.8	-21.3	H
2.501	3.0	57.3	36.3	28.8	4.6	-35.6	0.0	0.0	55.1	34.1	74	54	-18.9	-19.9	H
5.000	3.0	51.1	29.6	33.2	6.9	-34.0	0.0	0.0	57.2	35.8	74	54	-16.8	-18.2	H
1.198	3.0	60.2	44.0	25.5	3.0	-37.5	0.0	0.0	51.2	35.0	74	54	-22.8	-19.0	V
1.798	3.0	55.4	37.4	27.4	3.8	-36.6	0.0	0.0	50.0	32.0	74	54	-24.0	-22.0	V
2.501	3.0	58.3	36.0	28.8	4.6	-35.6	0.0	0.0	56.1	33.8	74	54	-17.9	-20.2	V
5.000	3.0	54.2	30.9	33.2	6.9	-34.0	0.0	0.0	60.3	37.0	74	54	-13.7	-17.0	V
															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		

8.3.2. RECEIVER ABOVE 1 GHz, 40 MHz BANDWIDTH

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Company: Broadcom
Project #: 11U14154
Date: 11/30/2011
Test Engineer: David Garcia
Configuration: EUT / Laptop
Mode: Rx Mode_40MHz Bandwidth in 5 GHz Band

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B		T39; ARA 18-26GHz; S/N:1013	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)
1.600	3.0	57.7	42.2	26.8	3.5	-36.9	0.0	0.0	51.1	35.6	74	54	-22.9	-18.4	H
1.795	3.0	56.5	38.8	27.4	3.8	-36.6	0.0	0.0	51.0	33.3	74	54	-23.0	-20.7	H
2.490	3.0	58.1	37.8	28.8	4.6	-35.6	0.0	0.0	55.9	35.6	74	54	-18.1	-18.4	H
5.000	3.0	51.0	32.4	33.2	6.9	-34.0	0.0	0.0	57.1	38.5	74	54	-16.9	-15.5	H
1.655	3.0	59.3	42.0	27.0	3.6	-36.8	0.0	0.0	53.0	35.7	74	54	-21.0	-18.3	V
2.125	3.0	60.4	39.1	28.2	4.2	-36.1	0.0	0.0	56.6	35.3	74	54	-17.4	-18.7	V
2.490	3.0	59.0	37.3	28.8	4.6	-35.6	0.0	0.0	56.8	35.1	74	54	-17.2	-18.9	V
5.000	3.0	55.4	37.7	33.2	6.9	-34.0	0.0	0.0	61.5	43.8	74	54	-12.5	-10.2	V
															V

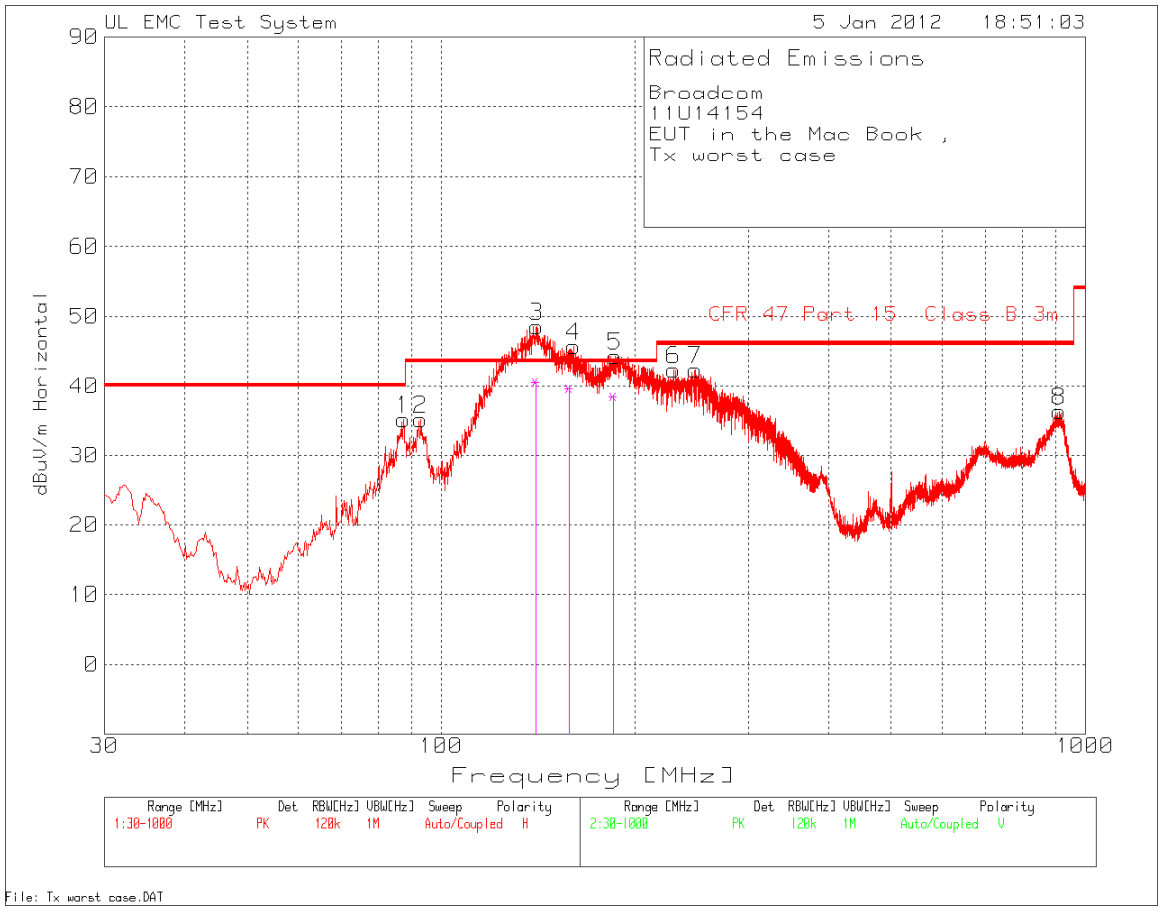
Rev. 07.08.11

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

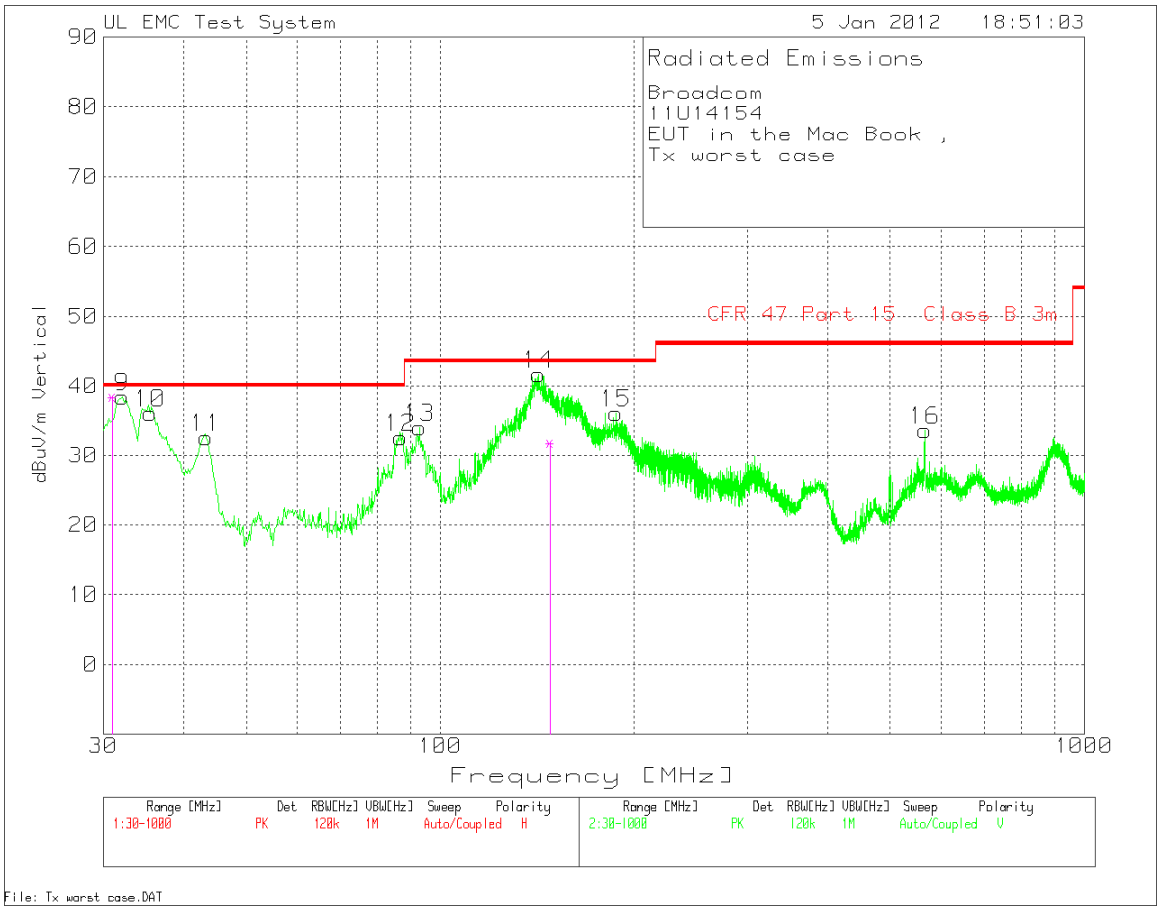
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



EMI DATA

Broadcom
11U14154
EUT in the Mac Book
Tx worst case

Range: 1 30 - 1000MHz										
Test Frequency	Meter	Detector	Amplifier Factor	Ant, Cable factor	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity	
87.3781	54.75	PK	-27	7.5	35.25	40	-4.75	251	Horz	
92.9996	54.18	PK	-26.9	7.9	35.18	43.5	-8.32	251	Horz	
140.8793	61.9	PK	-26.4	13.1	48.6	43.5	5.1	251	Horz	
140.2957	53.92	QP	-26.5	13.1	40.52	43.5	-2.98	245	Horz	
160.6515	58.82	PK	-26.2	13.1	45.72	43.5	2.22	176	Horz	
158.2391	52.74	QP	-26.2	13.1	39.64	43.5	-3.86	181	Horz	
186.6267	59.1	PK	-25.9	11.1	44.3	43.5	0.8	176	Horz	
185.3917	53.38	QP	-26	11.1	38.48	43.5	-5.02	115	Horz	
229.8541	56.19	PK	-25.6	11.8	42.39	46	-3.61	100	Horz	
248.4632	55.98	PK	-25.4	11.8	42.38	46	-3.62	100	Horz	
911.6067	38.09	PK	-23.9	22.2	36.39	46	-9.61	100	Horz	
Range: 2 30 - 1000MHz										
Test Frequency	Meter	Detector	Amplifier Factor	Ant, Cable factor	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity	
32.1323	46.92	PK	-27.5	19	38.42	40	-1.58	101	Vert	
31.0368	46.39	QP	-27.5	19.5	38.39	40	-1.61	107	Vert	Noise from MacBook
35.4277	46.42	PK	-27.5	17.2	36.12	40	-3.88	101	Vert	
43.3753	47.71	PK	-27.4	12.3	32.61	40	-7.39	101	Vert	
86.9904	52.2	PK	-27	7.5	32.7	40	-7.3	176	Vert	
92.8058	53.11	PK	-26.9	7.9	34.11	43.5	-9.39	176	Vert	
142.2362	55.06	PK	-26.4	13	41.66	43.5	-1.84	251	Vert	
148.3681	45.5	QP	-26.4	12.7	31.8	43.5	-11.7	250	Vert	
187.5959	50.99	PK	-25.9	11.1	36.19	43.5	-7.31	176	Vert	
566.3689	41.57	PK	-25.8	17.9	33.67	46	-12.33	101	Vert	

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

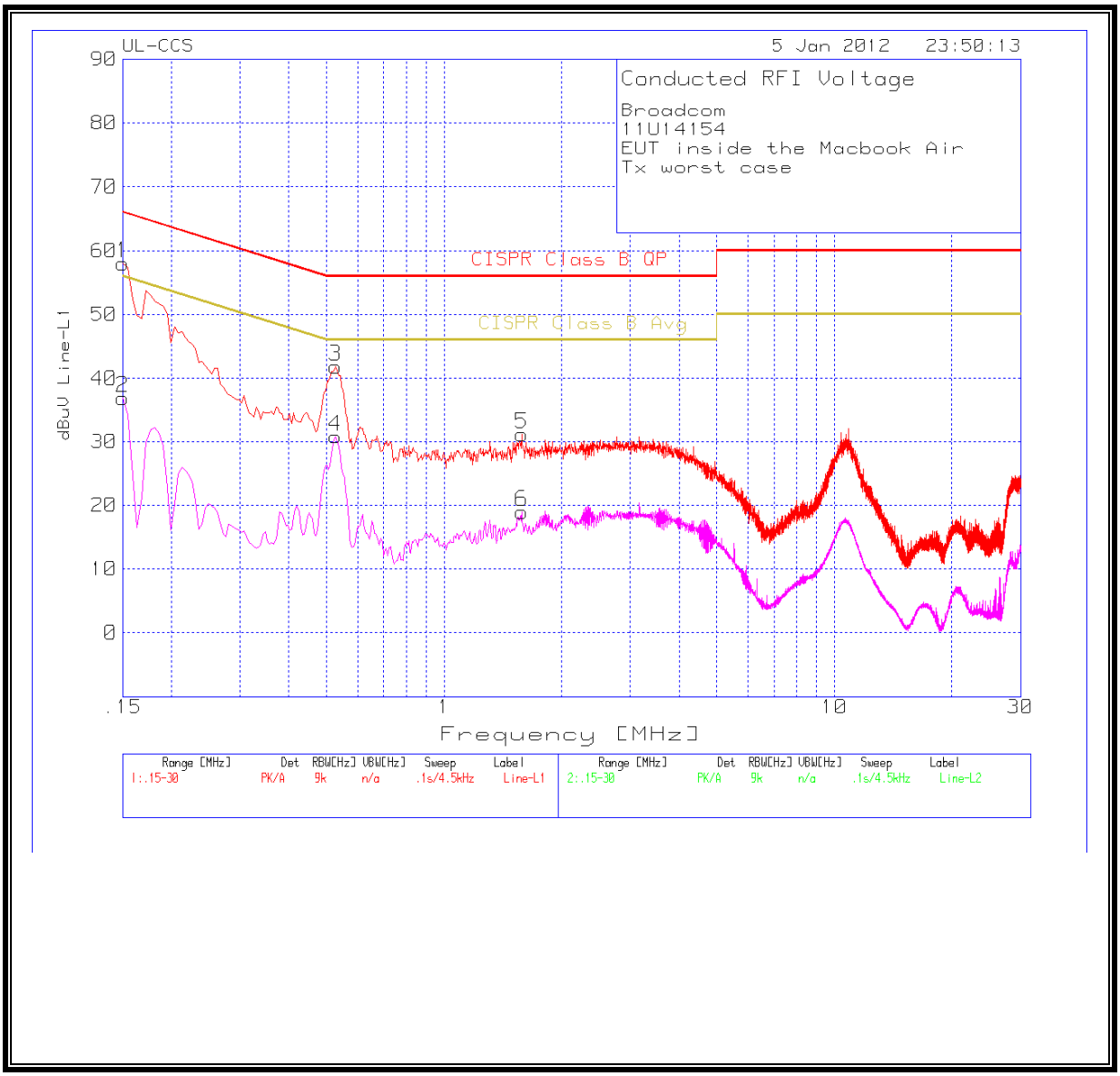
RESULTS

6 WORST EMISSIONS

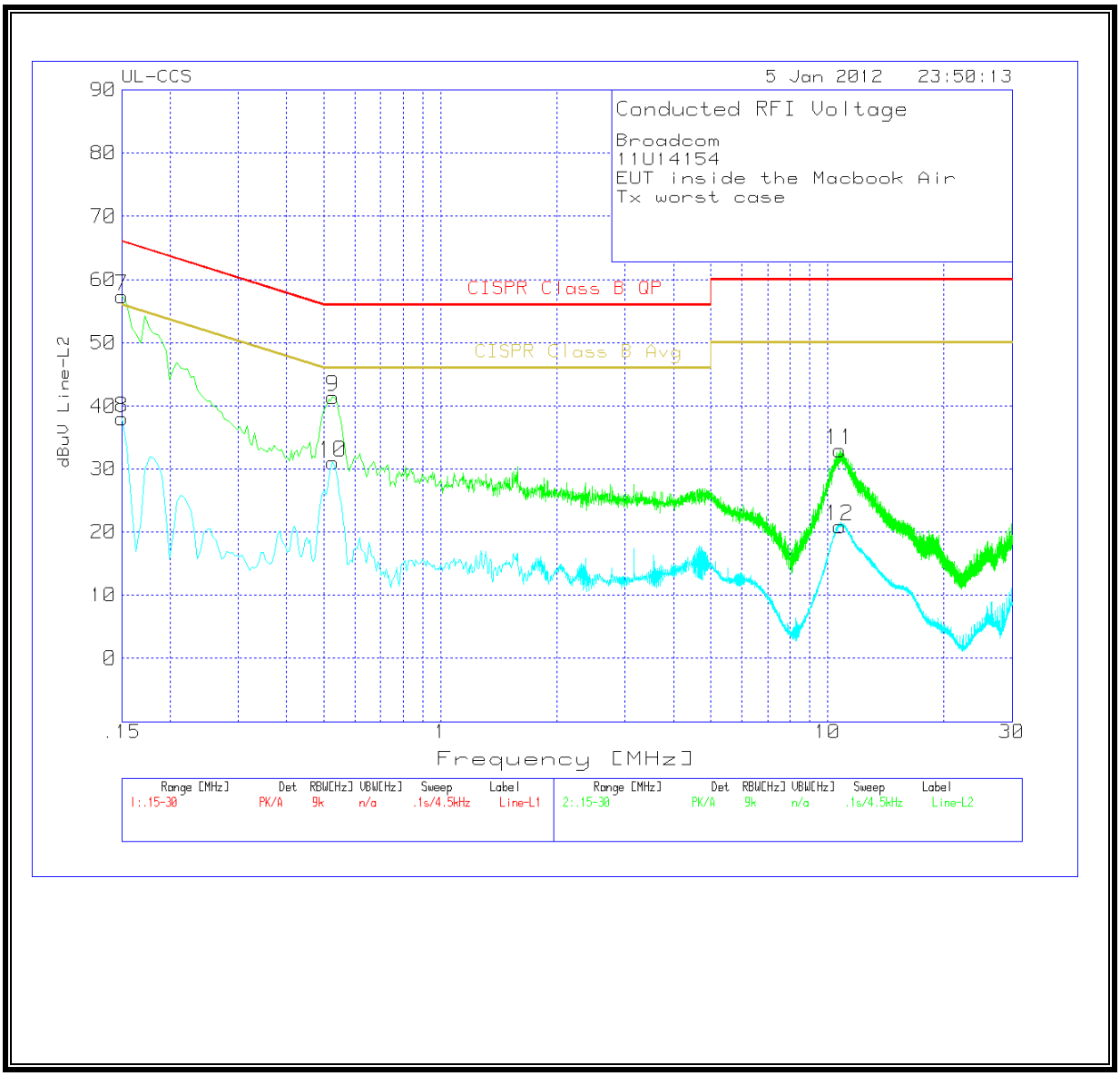
Broadcom
11U14154
EUT inside the Macbook Air
Tx worst case

Line-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables	dBuV	CISPR Class B QP	Margin	CISPR Class B Avg	Margin
0.15	57.88	PK	0.1	0	57.98	66	-8.02	-	-
0.15	36.86	Av	0.1	0	36.96	-	-	56	-19.04
0.528	41.72	PK	0.1	0	41.82	56	-14.18	-	-
0.528	30.73	Av	0.1	0	30.83	-	-	46	-15.17
1.581	31.05	PK	0.1	0.1	31.25	56	-24.75	-	-
1.581	18.77	Av	0.1	0.1	18.97	-	-	46	-27.03
Line-L2 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables	dBuV	CISPR Class B QP	Margin	CISPR Class B Avg	Margin
0.15	57.24	PK	0.1	0	57.34	66	-8.66	-	-
0.15	38.03	Av	0.1	0	38.13	-	-	56	-17.87
0.528	41.41	PK	0.1	0	41.51	56	-14.49	-	-
0.528	31.06	Av	0.1	0	31.16	-	-	46	-14.84
10.7475	32.65	PK	0.2	0.2	33.05	60	-26.95	-	-
10.7475	20.46	Av	0.2	0.2	20.86	-	-	50	-29.14

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

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100) * EIRP

where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in W

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

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

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

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

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

LIMITS

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency, as 824 MHz / 1500 = 0.55 mW/cm^2 (FCC) and 824 MHz / 150 = 5.5 W/m^2 (IC).

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)**	**Duty Cycle (%)**	**IC Power Density (W/m^2)**	**FCC Power Density (mW/cm^2)**
2.4 GHz	Bluetooth	N/A		7.89	1.11	100		
2.4 + 5 GHz	WLAN	1		19.35	6.01	99		
2.4 + 5 GHz	WLAN	2		19.06	6.01	99		
2.4 + 5 GHz	WLAN	3		18.89	6.01	99		
Combined			0.20				1.93	0.193

Note: the AV output power and antenna gains shown above in this table are the highest power and antenna gain between 2.4 GHz and 5.8 GHz band as worst-case scenario.