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

# CERTIFICATION TEST REPORT

**FOR**

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

**MODEL NUMBER: BCM94331PCIEBT3A**

**FCC ID: QDS-BRCM1059**
**IC: 4324A-BRCM1059**

**REPORT NUMBER: 11U13734-1, REVISION A**

**ISSUE DATE: MAY 06, 2011**

*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 |
|---|---|---|---|
| -- | 05/02/11 | Initial Issue | T. Chan |
| A | 05/06/11 | Re-measured PSD and Conducted Spurious Emissions at Each Output per KDB Pub 662911 | David G. |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, USA

**EUT DESCRIPTION:** 802.11a/g/n WLAN + Bluetooth PCI-E Custom Combination Card

**MODEL:** BCM94331PCIEBT3A

**SERIAL NUMBER:** C961095004UDJY01W

**DATE TESTED:** MARCH 17 to MAY 6, 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:

THU CHAN
ENGINEERING MANAGER
UL CCS

Tested By:

VIEN TRAN
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 to 2483.5 MHz Authorized Band

| Frequency Range (MHz) | Mode | Peak Power Chain 1 (dBm) | Peak Power Chain 2 (dBm) | Peak Power Chain 3 (dBm) | Total Peak Power (dBm) | Output Power (mW) |
|---|---|---|---|---|---|---|
| 2412 - 2462 | 802.11b Three Chains CDD Legacy | 19.69 | 20.18 | 19.65 | 24.62 | 289.60 |
| 2412 - 2462 | 802.11g Legacy | | | | 19.23 | 83.75 |
| 2412 - 2462 | 802.11n 20MHz SISO | Covered by the worst case 802.11g Mode Legacy testing | | | | |
| 2412 - 2462 | 802.11g Three Chains CDD Legacy | Covered by the worst case 802.11nThree Chains 20MHz CDD | | | | |
| 2412 - 2462 | 802.11n Three Chain 20MHz CDD | 19.27 | 19.34 | 19.35 | 24.09 | 256.53 |

5725 to 5850 MHz Authorized Band

| Frequency Range (MHz) | Mode | Peak Power Chain 1 (dBm) | Peak Power Chain 2 (dBm) | Peak Power Chain 3 (dBm) | Total Peak Power (dBm) | Output Power (mW) |
|---|---|---|---|---|---|---|
| 5745 - 5825 | 802.11a Legacy | Covered by the worst case 802.11n Three Chain 20MHz CDD | | | | |
| | | N/A | 20.26 | N/A | 20.26 | 106.17 |
| 5745 - 5825 | 802.11n 20MHz SISO | Covered by the worst case 802.11n Three Chain 20MHz CDD | | | | |
| | | N/A | 20.26 | N/A | 20.26 | 106.17 |
| 5745 - 5825 | 802.11a Three Chains CDD Legacy | Covered by the worst case 802.11n Three Chain 20MHz CDD | | | | |
| 5745 - 5825 | 802.11n Three Chains 20MHz CDD | 20.18 | 20.26 | 20.05 | 24.94 | 311.56 |
| 5755 - 5795 | 802.11n 40MHz SISO | Covered by the worst case 802.11n Three Chain 40MHz CDD | | | | |
| | | N/A | N/A | 19.39 | 19.39 | 86.90 |
| 5755 - 5795 | 802.11n Three Chains 40MHz CDD | 19.29 | 19.36 | 19.39 | 24.12 | 258.11 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes three 802.11agn antennas, with a maximum gain as below table;

| | Antenna Gain | | | Antenna Gain |
|---|---|---|---|---|
| GHz | Ant 1 dBi | Ant 2 dBi | Ant 3 dBi | Combined dBi |
| 2.4 | 1.66 | 1.11 | **6.77** | **8.76** |

| | Antenna Gain | | | Antenna Gain |
|---|---|---|---|---|
| GHz | Ant 1 dBi | Ant 2 dBi | Ant 3 dBi | Combined dBi |
| 5.8 | 1.91 | 4.18 | **4.39** | **8.40** |

## 5.4. SOFTWARE AND FIRMWARE

_For 11b mode Legacy 3x3 CDD;
The EUT driver software installed during testing was Broadcom, rev. 5.100.98.0.
The test utility software used during testing was BCM Internal, rev. 5.100.RC98.0.

_For the other modes and data rates;
The EUT driver software installed during testing was Broadcom, rev. 5.100.98.29.
The test utility software used during testing was BCM Internal, rev. 5.100.RC98.29.

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

For 2.4GHz Band:
All final tests in the 802.11b Three Chains Mode (Legacy) were made at 1 Mb/s.
All final tests in the 802.11g Legacy mode were made at 6 Mb/s.
All final tests in the 802.11n Mode (20 MHz CDD/SDM) were made at MCS0.
All final tests in the 802.11n Mode (40 MHz CDD/SDM) were made at MCS0.

For 5.8GHz Band:
All final tests in the 802.11n Mode (20 MHz CDD/SDM) were made at MCS0
All final tests in the 802.11n Mode (40 MHz CDD/SDM) were made at 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, that was determined to be 11n Three Chains HT20 mode, mid channel..

For MIMO conducted spurious measurement preliminary testing showed that combiner is worst-case compared to individual chains; therefore final measurements were performed using combiner for all channels and modes.

For 2.4GHz and 5GHz bands MIMO PSD measurement preliminary testing showed that combiner is worst-case compared to individual chains; therefore final measurements were performed using combiner for all channels and modes.

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

All legacy/SISO modes were measured with the highest gain for each type of antenna.

All MIMO modes were measured with the highest combination of gains for each type of antenna. Note that this combination of antennas will not be implemented in the end product. This combination was selected for testing purposes only, to accommodate the highest gain of each antenna type in one single test configuration. The combined gain of this test configuration is higher than any combined gain that will be implemented in the end product.

## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

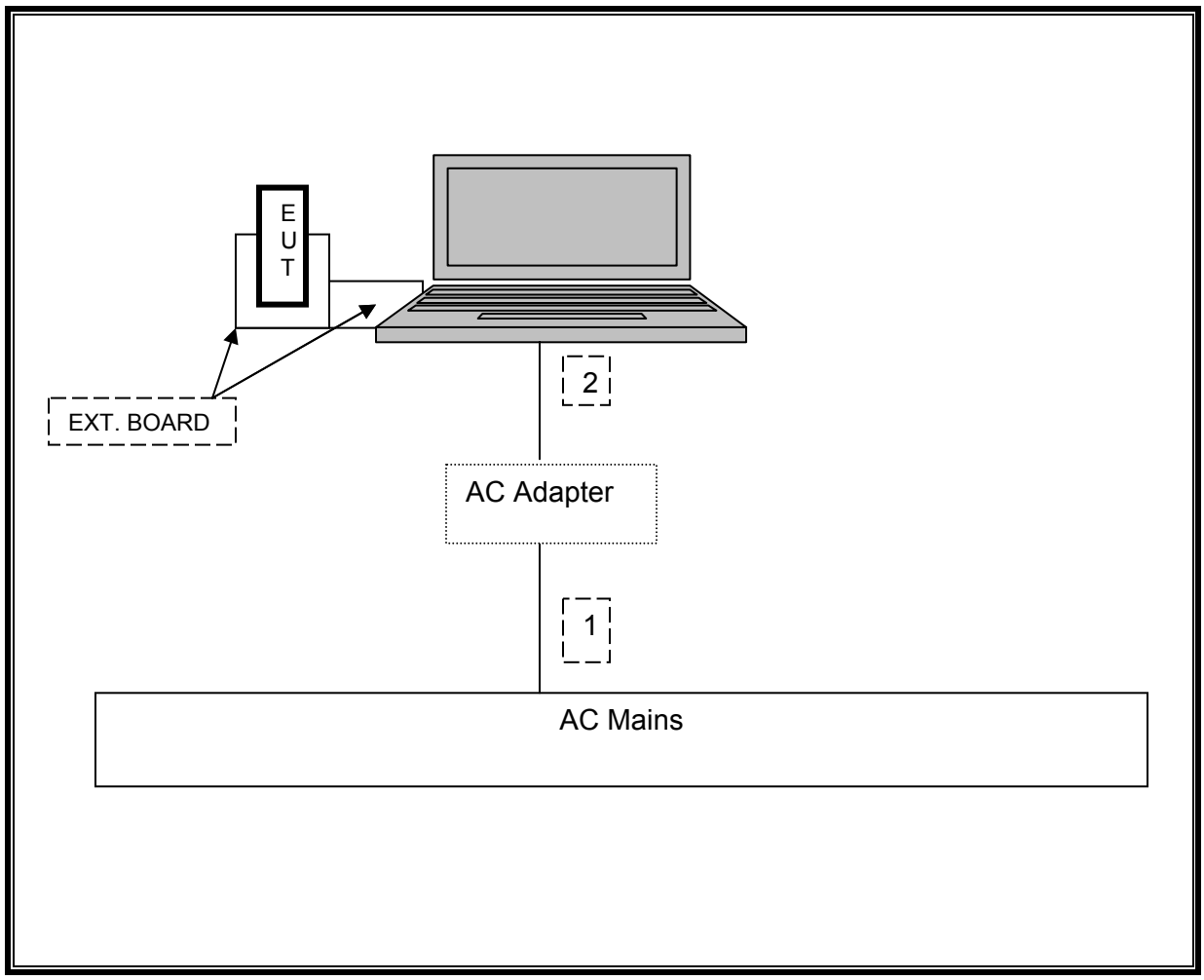
| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| Description | Manufacturer | Model | Serial Number | FCC ID |
| Laptop | Lenovo | G560 | CPU4495728 | DoC |
| AC Adapter | Lenovo | ADP-65KH B | 11S36001646ZZ1000AD9WJ | DoC |
| Adapter Board | Catalyst | MINI2EXP | BRCM 02 | N/A |
| Adapter Board | Broadcom | BCM94331PCIBT4HAD | 1385233 | 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 | Shielded | 1.5m | NA |
| 2 | DC | 1 | DC | Un-shielded | 1.5m | Ferrite at laptop's end |

**TEST SETUP**

**SETUP DIAGRAM**




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.

# 6. TEST AND MEASUREMENT EQUIPMENT

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

| TEST EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Asset** | **Cal Due** |
| Spectrum Analyzer, 44 GHz | Agilent / HP | E4446A | C00996 | 10/29/11 |
| EMI Receiver, 6.5 GHz | Agilent / HP | 8546A | 1963 | 08/19/11 |
| EMI Test Receiver, 30 MHz | R & S | ESHS 20 | N02396 | 05/06/12 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | C01171 | 07/14/11 |
| Antenna, Horn, 18 GHz | EMCO | 3115 | C00872 | 07/29/11 |
| Antenna, Horn, 26.5 GHz | ARA | MWH-1826/B | C00980 | 07/29/11 |
| Preamplifier, 1300 MHz | Agilent / HP | 8447D | C00778 | 07/06/11 |
| Preamplifier, 26.5 GHz | Agilent / HP | 8449B | C00749 | 08/04/11 |
| Peak Power Meter | Agilent / HP | E9327A | C00964 | 12/04/11 |
| Peak Power Sensor | Agilent / HP | E4416A | C00963 | 12/04/11 |
| Reject Filter, 2.4-2.5 GHz | Micro-Tronics | BRM50702 | N02685 | CNR |
| Reject Filter, 5.725-5.825 GHz | Micro-Tronics | BRC13192 | N02676 | CNR |
| LISN, 10 kHz ~ 30 MHz | Solar | 8012-50-R-24-BNC | N02481 | 11/05/11 |

# 7. ANTENNA PORT TEST RESULTS

## 7.1. 802.11b THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND

### 7.1.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

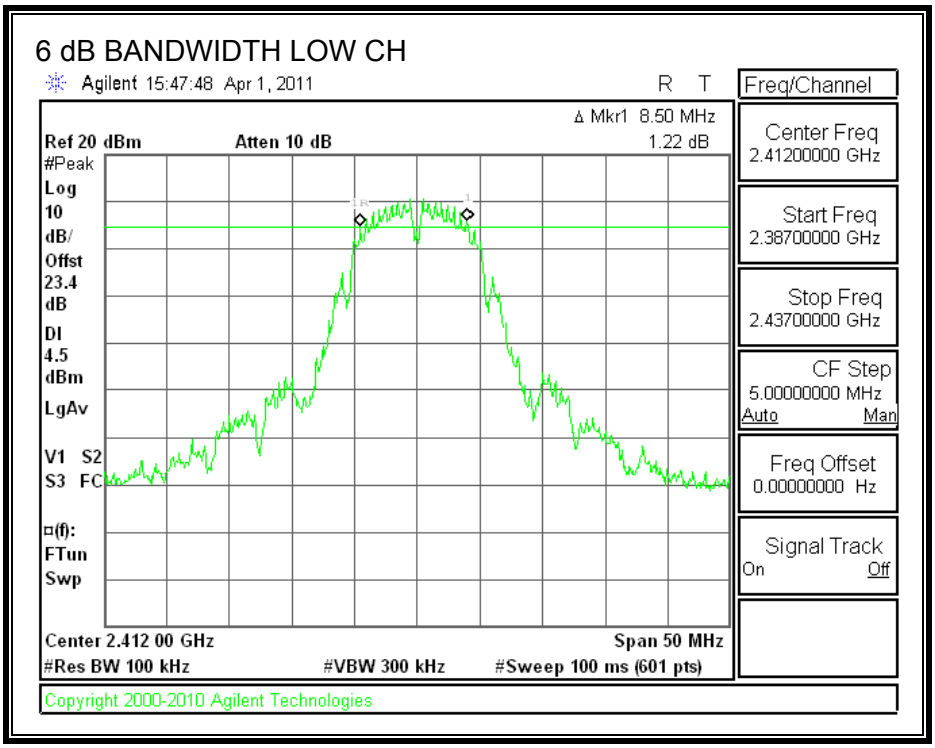
**TEST PROCEDURE**

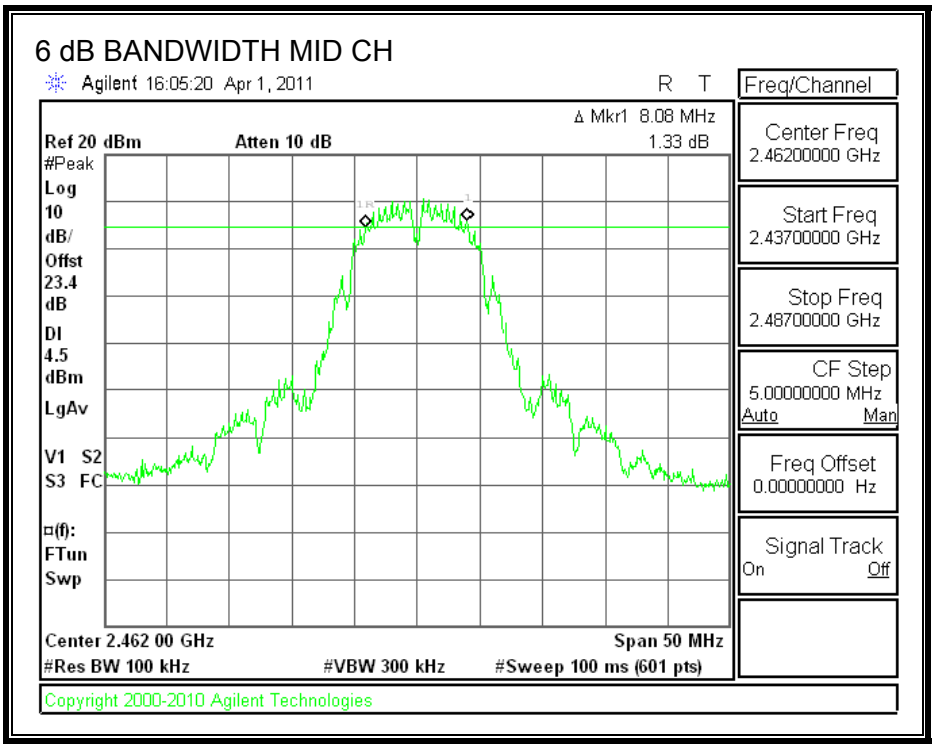
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

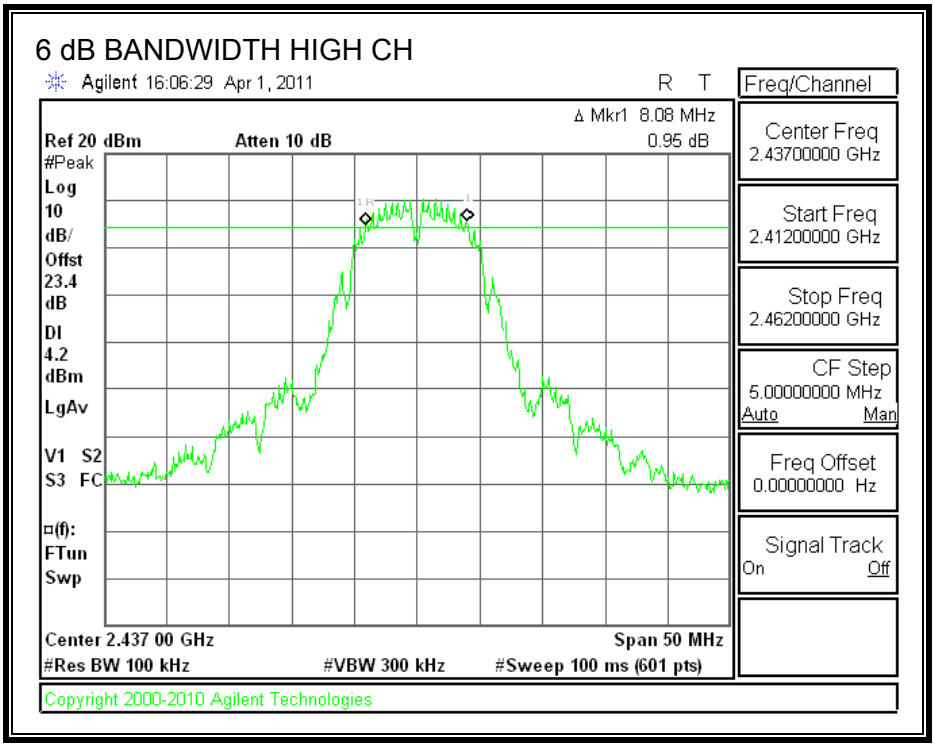
**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 2412 | 8.50 | 0.5 |
| Middle | 2437 | 8.08 | 0.5 |
| High | 2462 | 8.08 | 0.5 |

**6 dB BANDWIDTH**





### 7.1.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

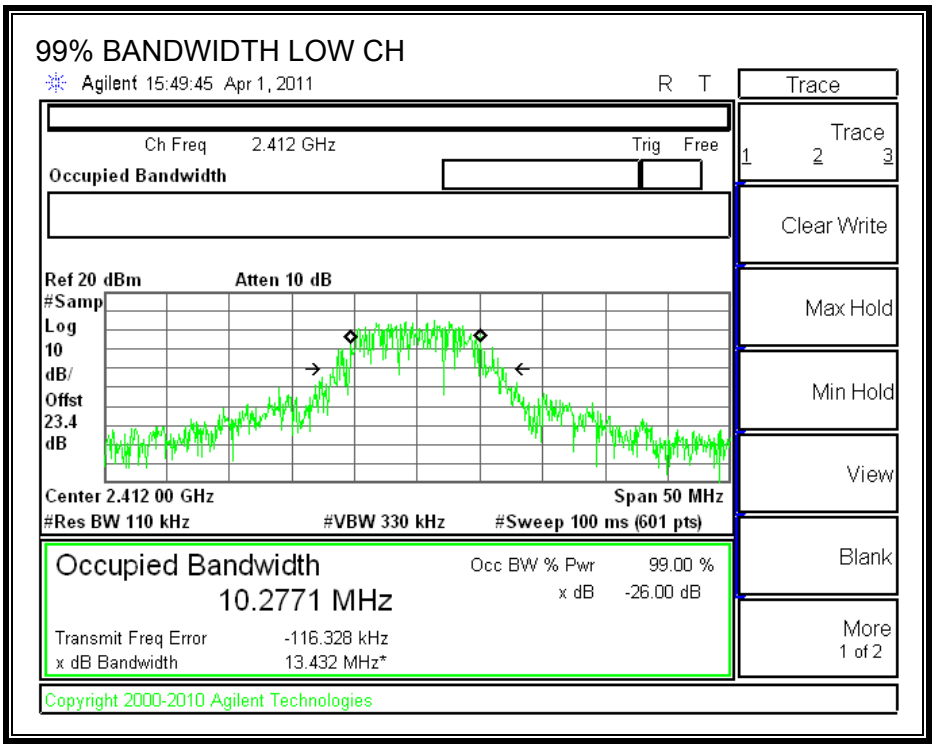
**TEST PROCEDURE**

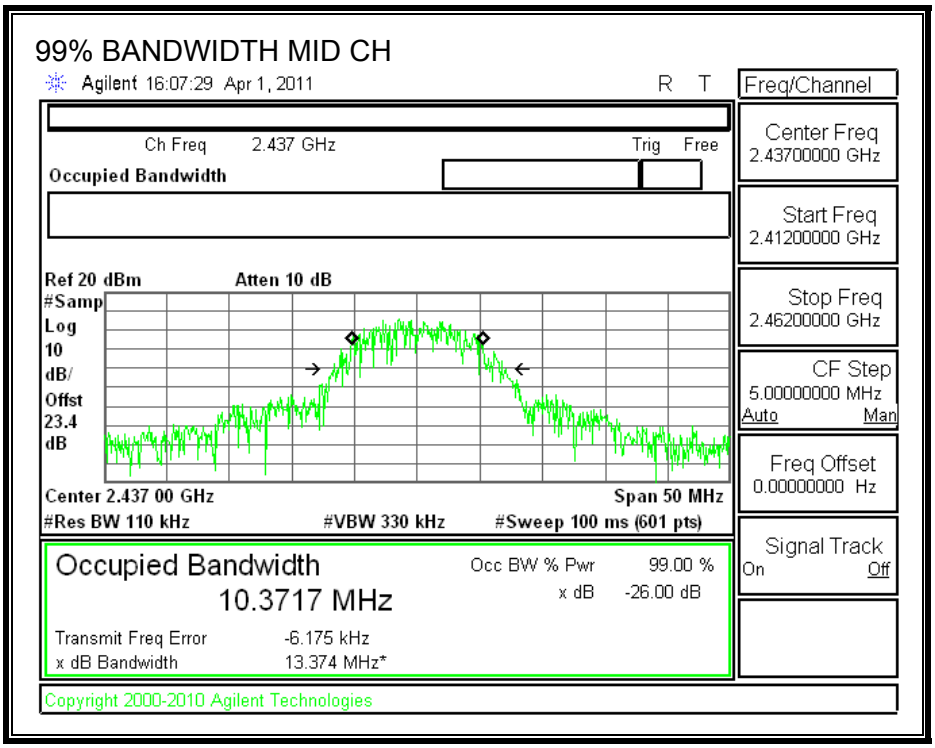
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

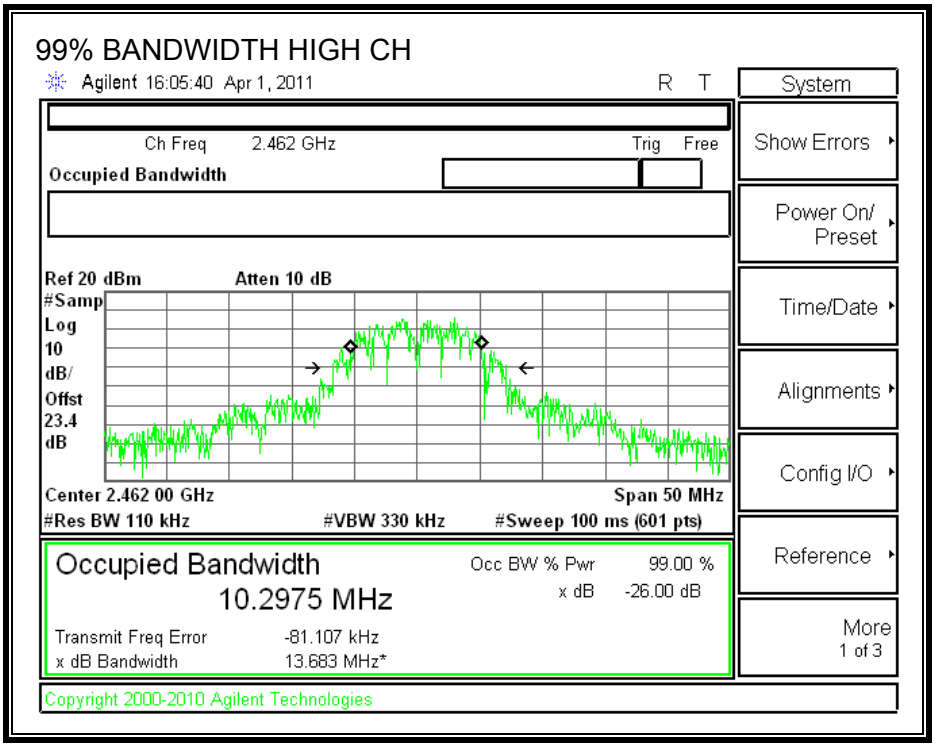
**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 2412 | 10.2771 |
| Middle | 2437 | 10.3717 |
| High | 2462 | 10.2975 |

**99% BANDWIDTH**





## 7.1.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The composite antenna gain is equal to 8.76 dBi, therefore the limit is 27.24 dBm.

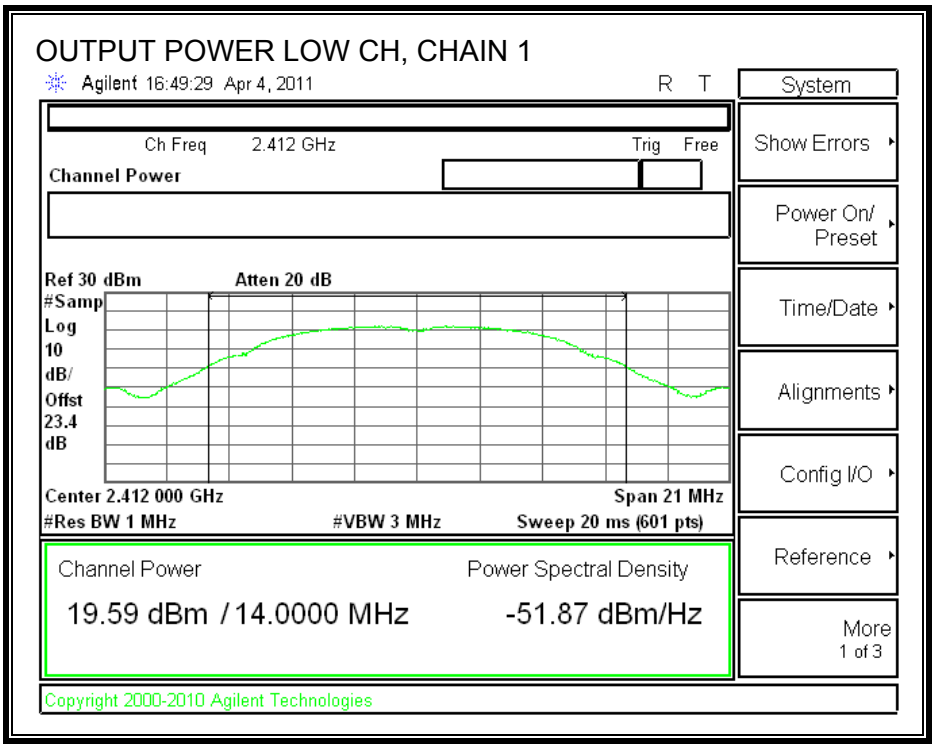
**TEST PROCEDURE – UNII METHOD**

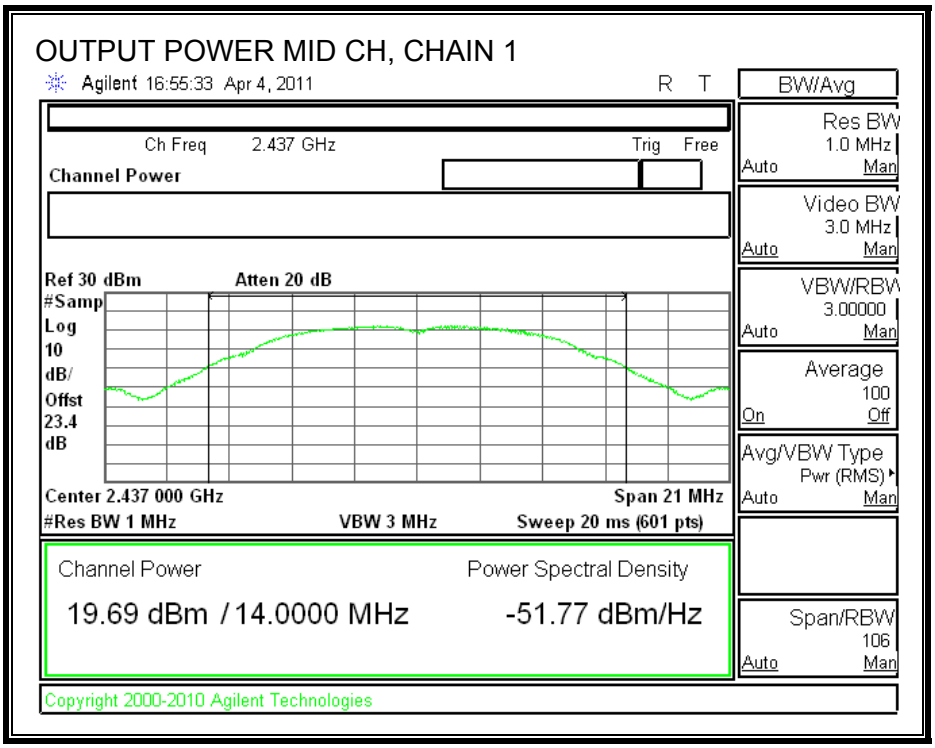
Output power was measured based on the use of RMS averaging over a time interval in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

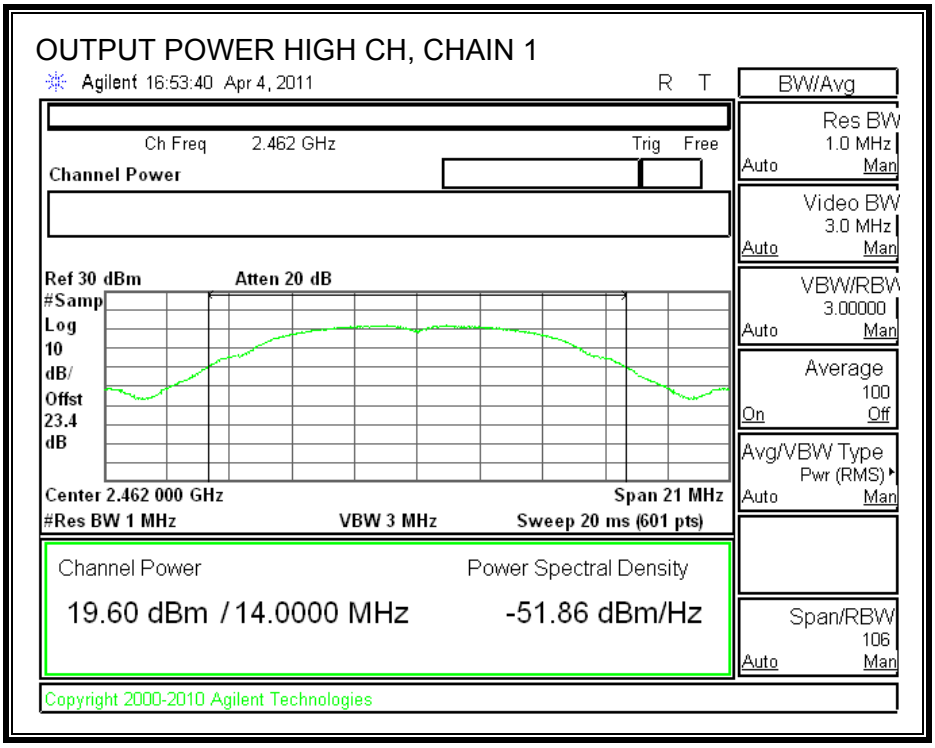
**RESULTS**

| Channel | Frequency (MHz) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 19.59 | 20.18 | 19.63 | 24.58 | 27.24 | -2.66 |
| Mid | 2437 | 19.69 | 20.18 | 19.65 | 24.62 | 27.24 | -2.62 |
| High | 2462 | 19.60 | 20.01 | 19.68 | 24.54 | 27.24 | -2.70 |

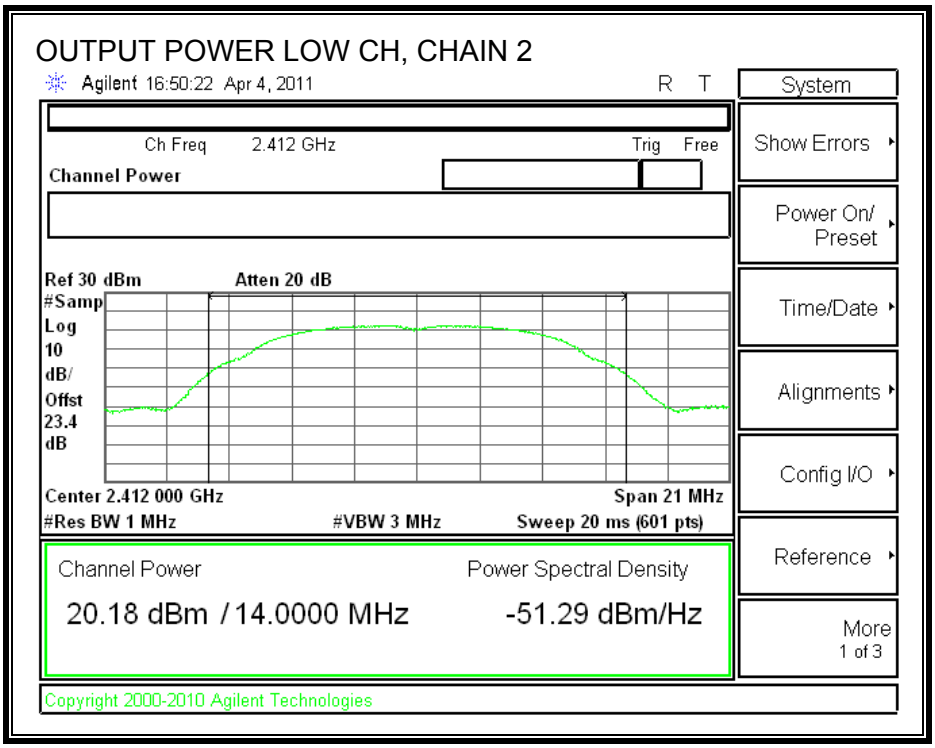
**CHAIN 1 OUTPUT POWER**

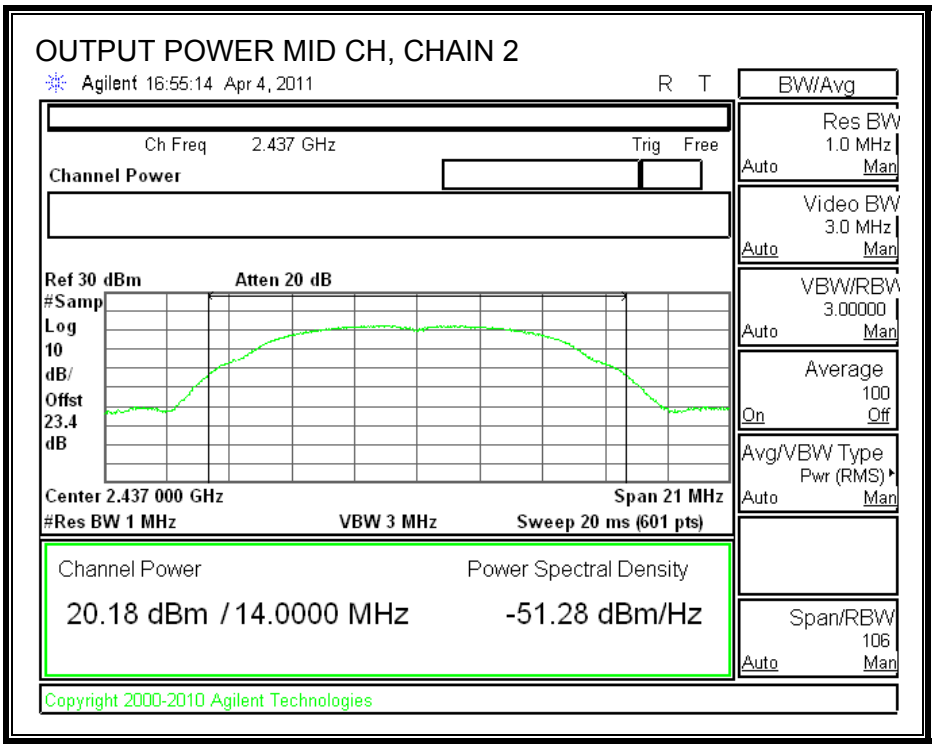


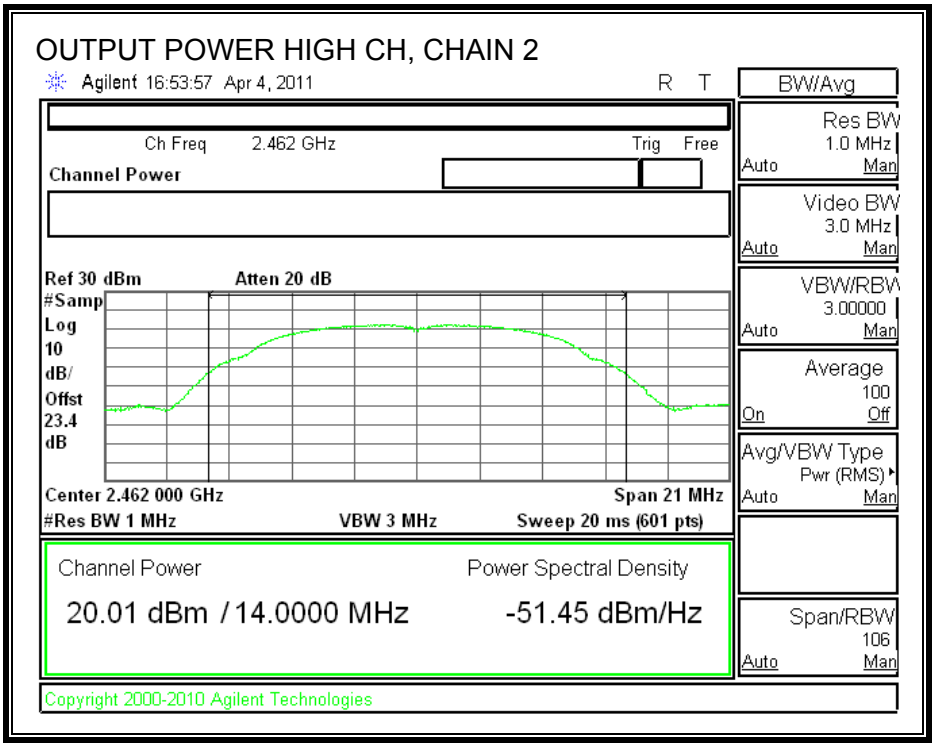





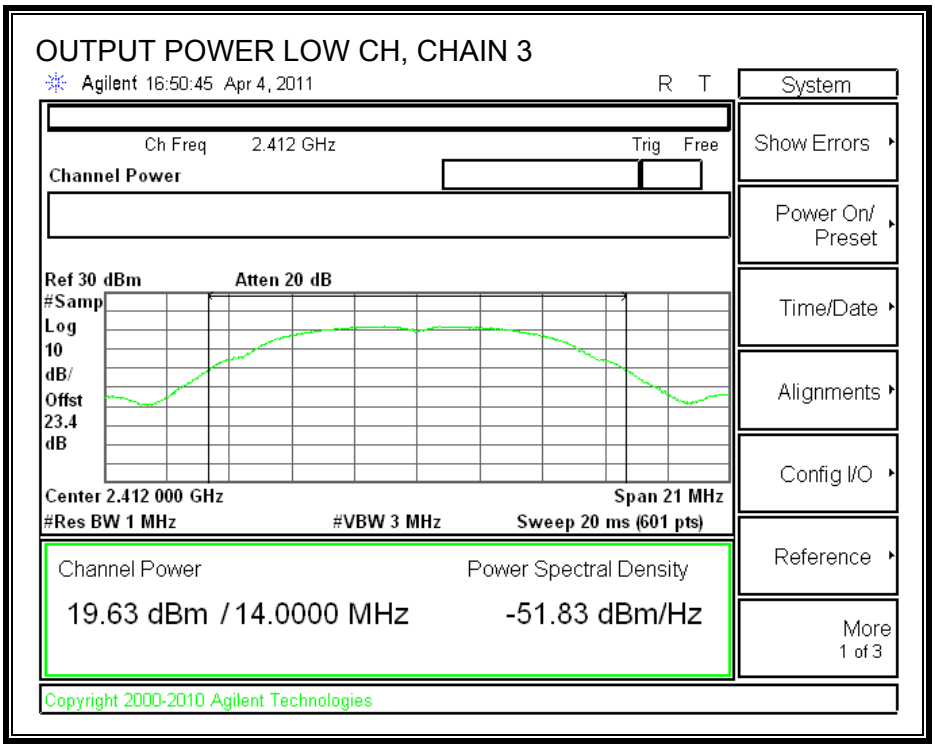
**CHAIN 2 OUTPUT POWER**

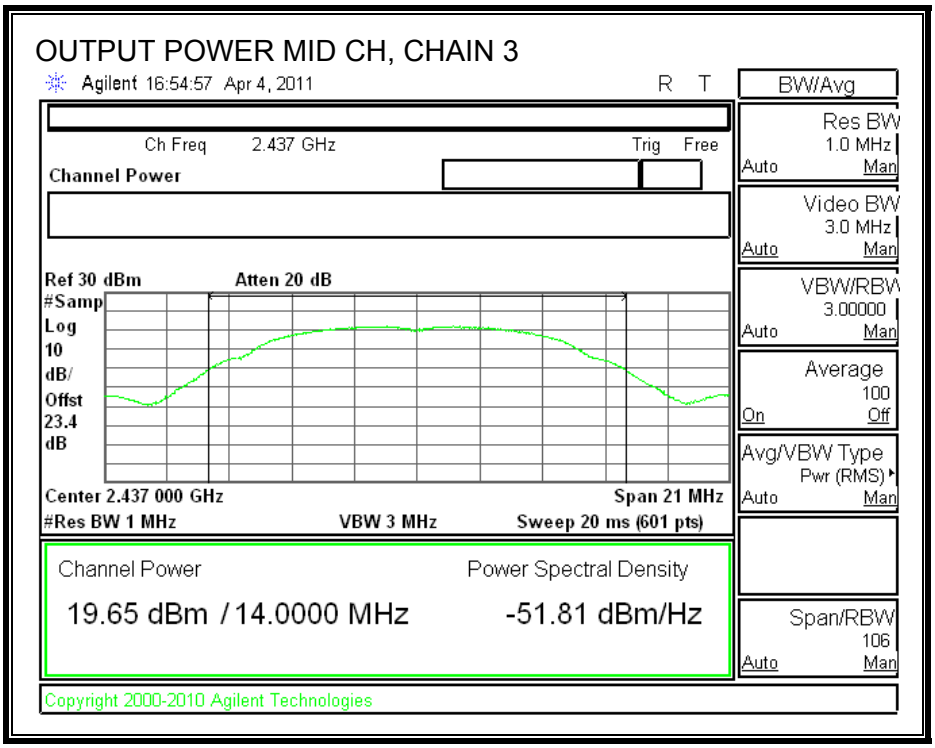


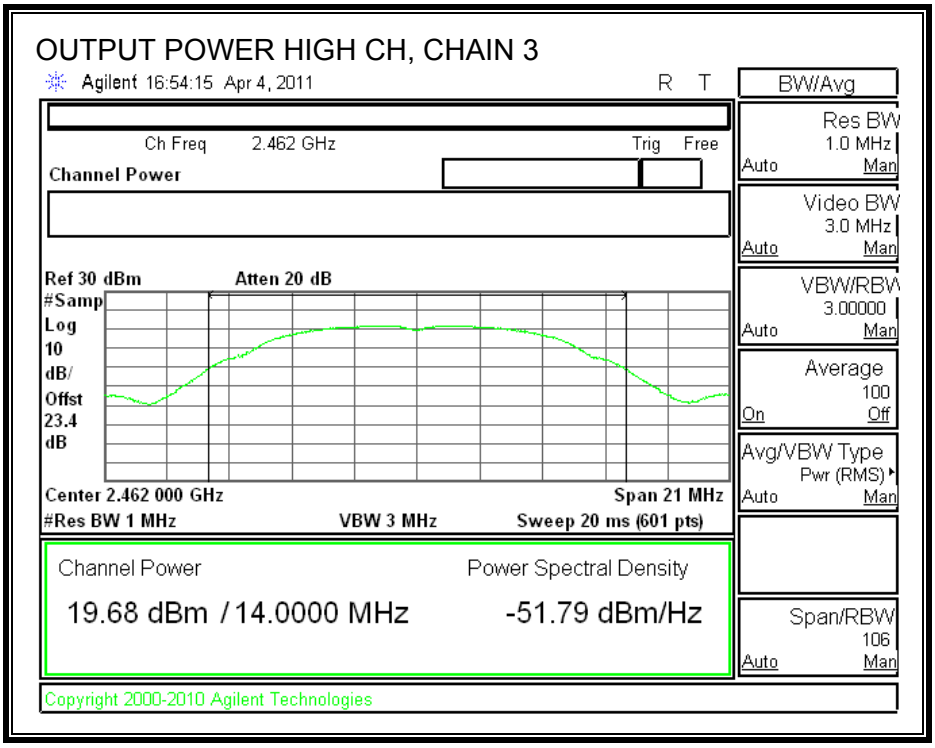





**CHAIN 3 OUTPUT POWER**





### 7.1.1. 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 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 2412 | 19.11 | 19.20 | 19.12 | 23.91 |
| Middle | 2437 | 19.00 | 19.23 | 19.05 | 23.87 |
| High | 2462 | 19.04 | 19.26 | 19.11 | 23.91 |

## 7.1.2. 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.

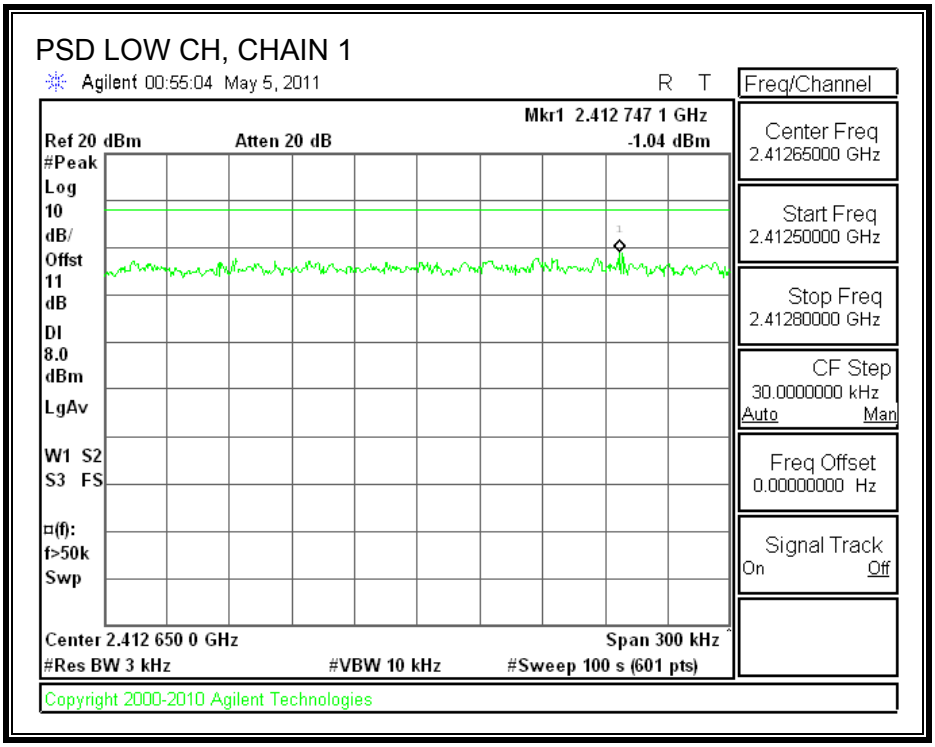
**TEST PROCEDURE**

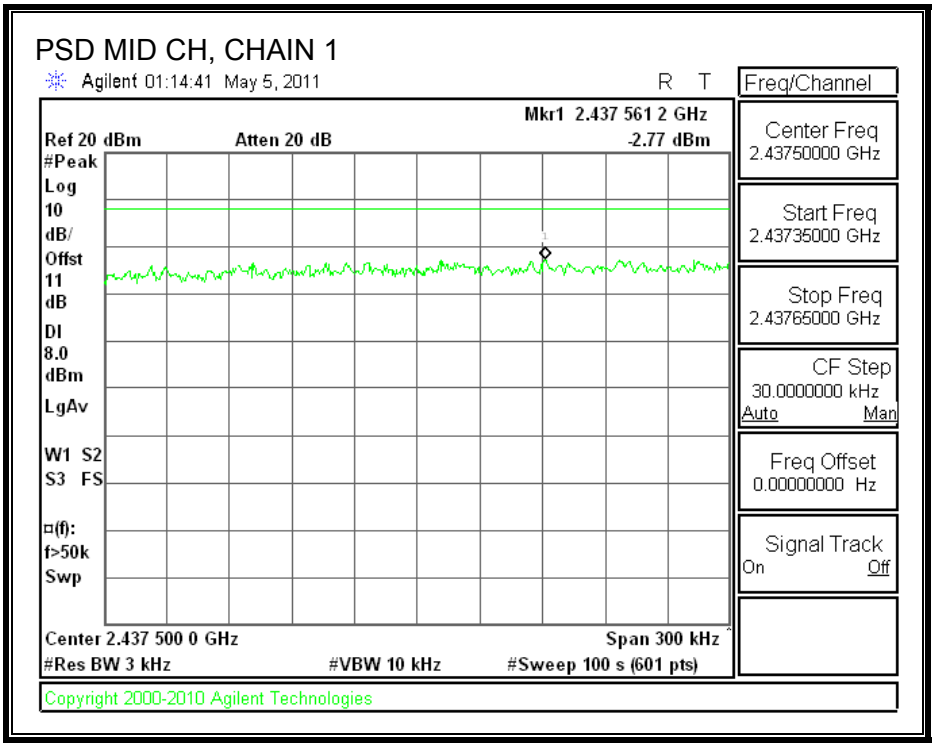
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

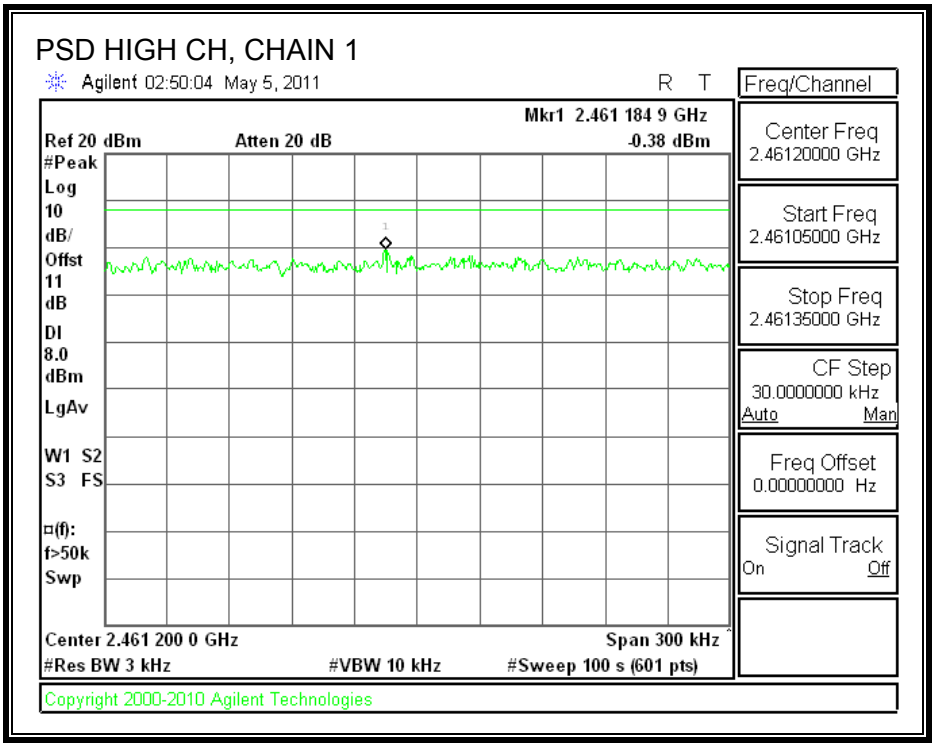
**RESULTS**

| Channel | Frequency (MHz) | Chain 1 PSD (dBm) | Chain 2 PSD (dBm) | Chain 3 PSD (dBm) | Total PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | -1.04 | -0.81 | -0.86 | 3.87 | 8 | -4.13 |
| Middle | 2437 | -2.77 | 0.07 | -2.56 | 3.22 | 8 | -4.78 |
| High | 2462 | -0.38 | -1.23 | -1.98 | 3.62 | 8 | -4.38 |

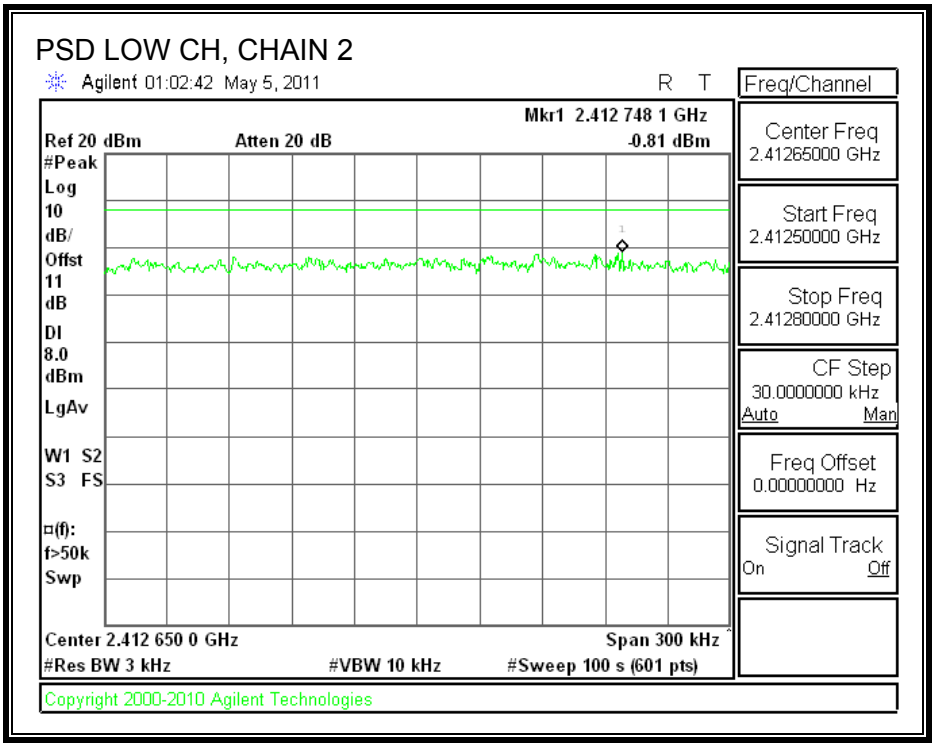
**POWER SPECTRAL DENSITY, CHAIN 1**

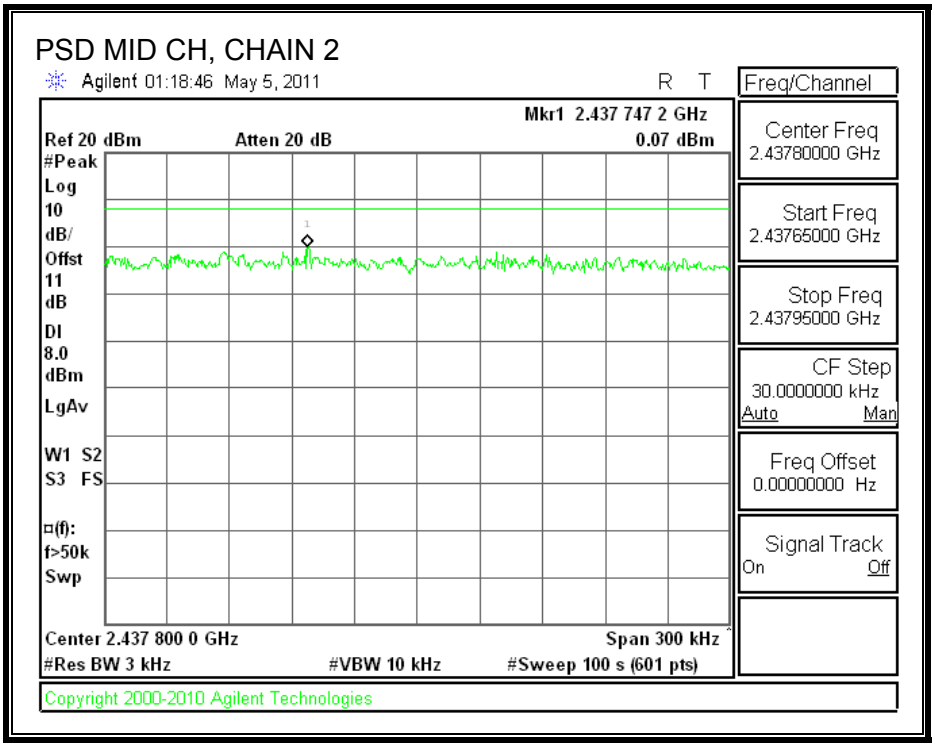


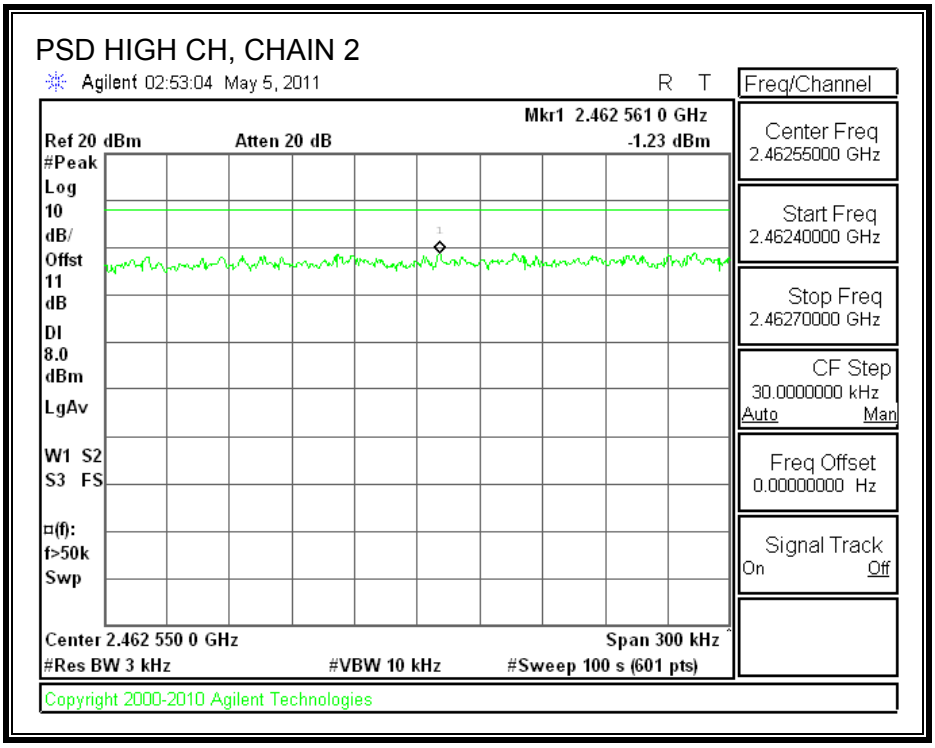




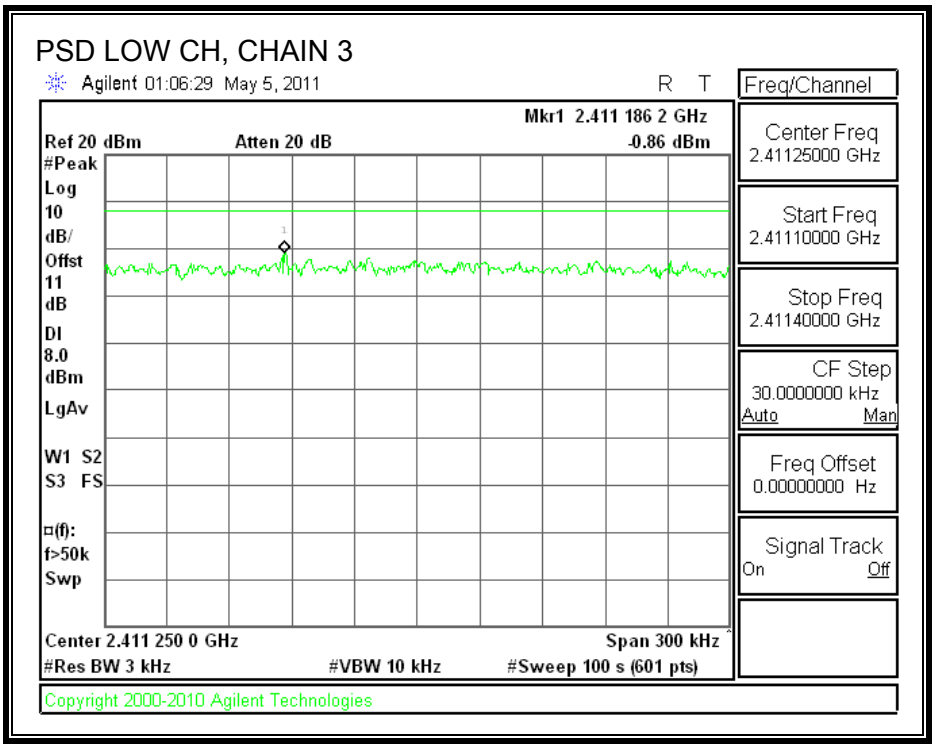
**POWER SPECTRAL DENSITY, CHAIN 2**

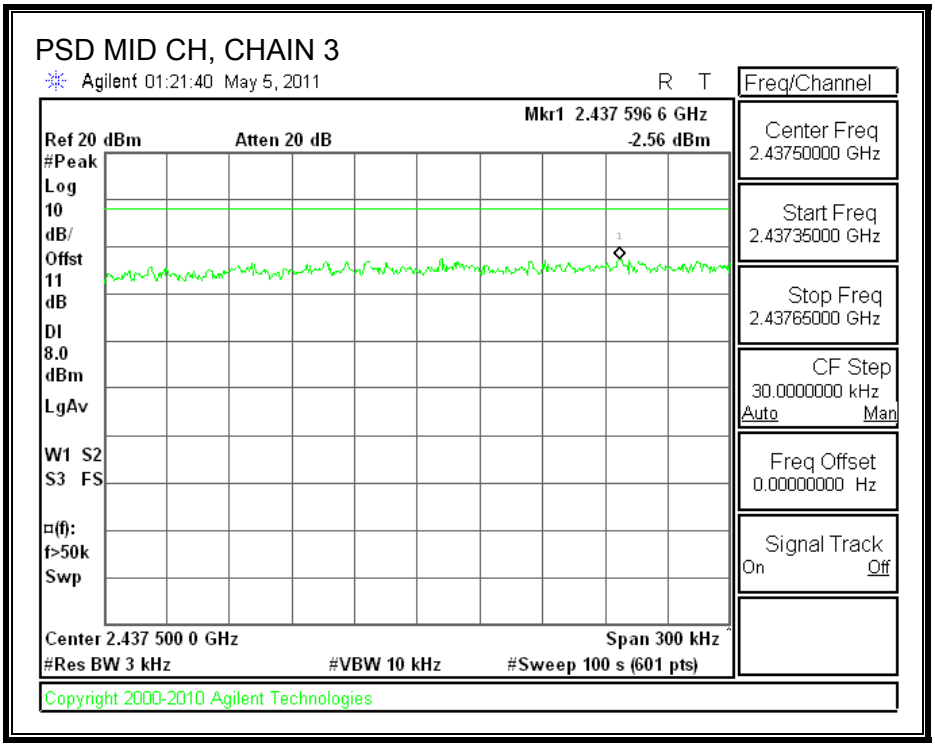


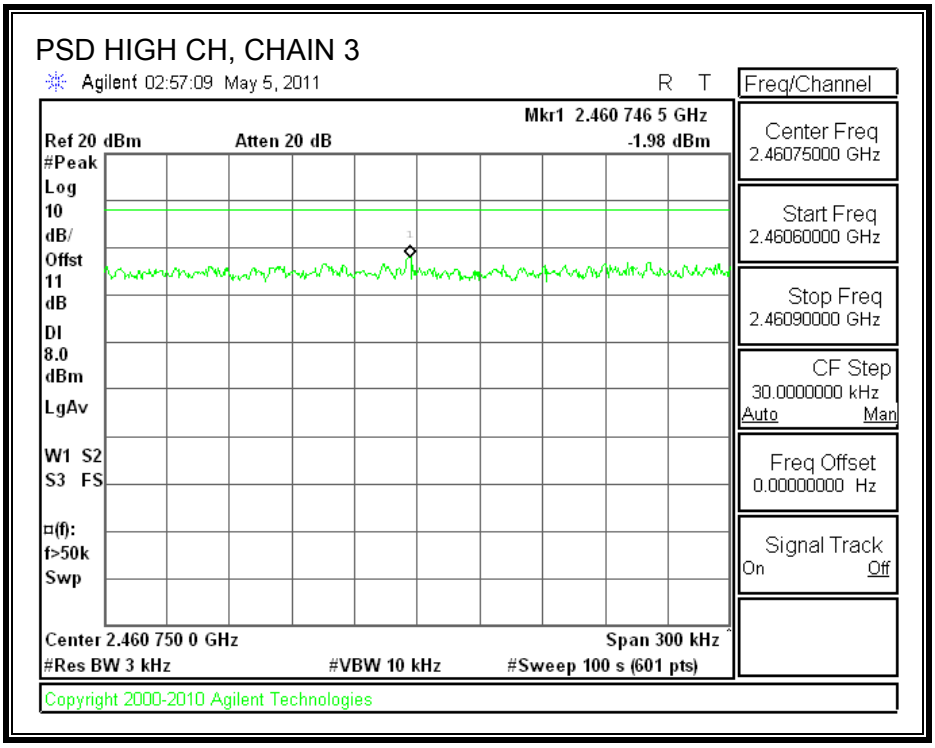




**POWER SPECTRAL DENSITY, CHAIN 3**







## 7.1.3. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 30 dB.

**TEST PROCEDURE**

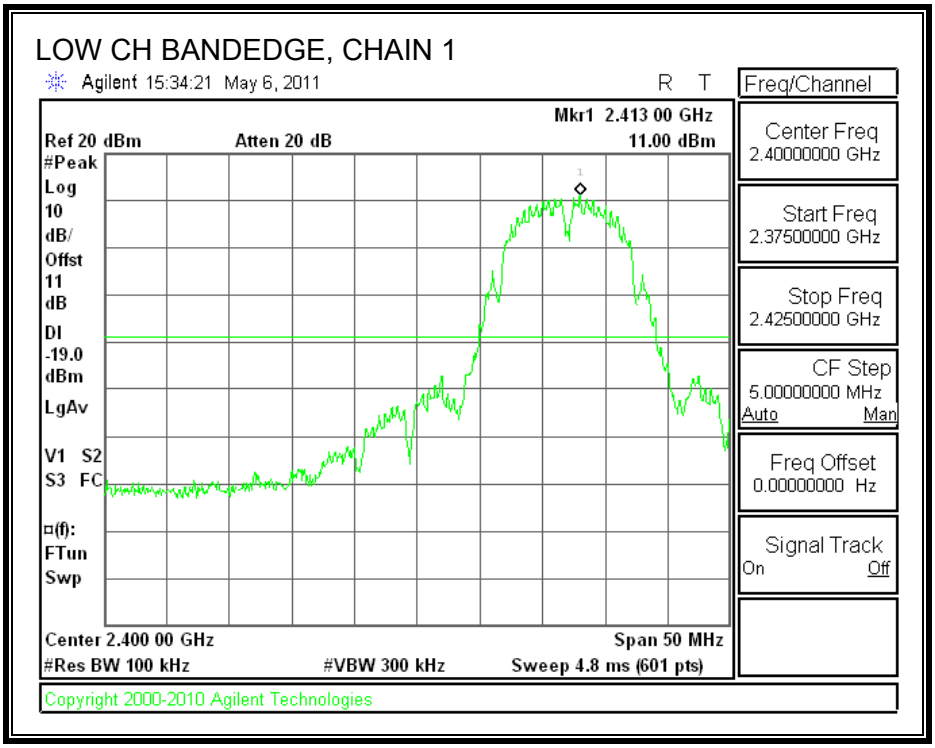
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

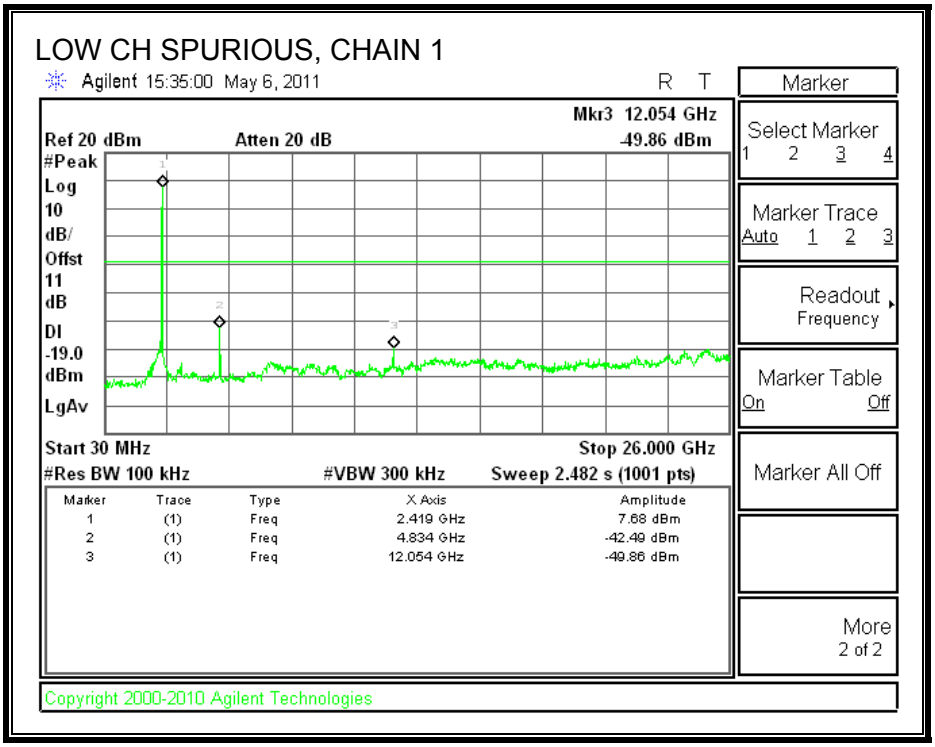
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

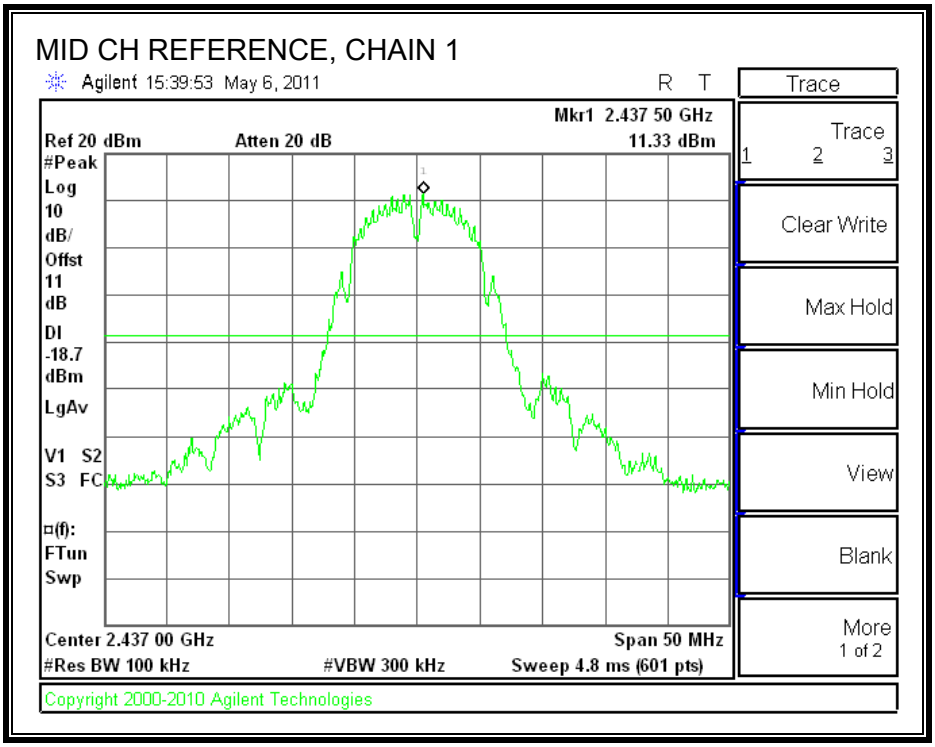
**RESULTS**

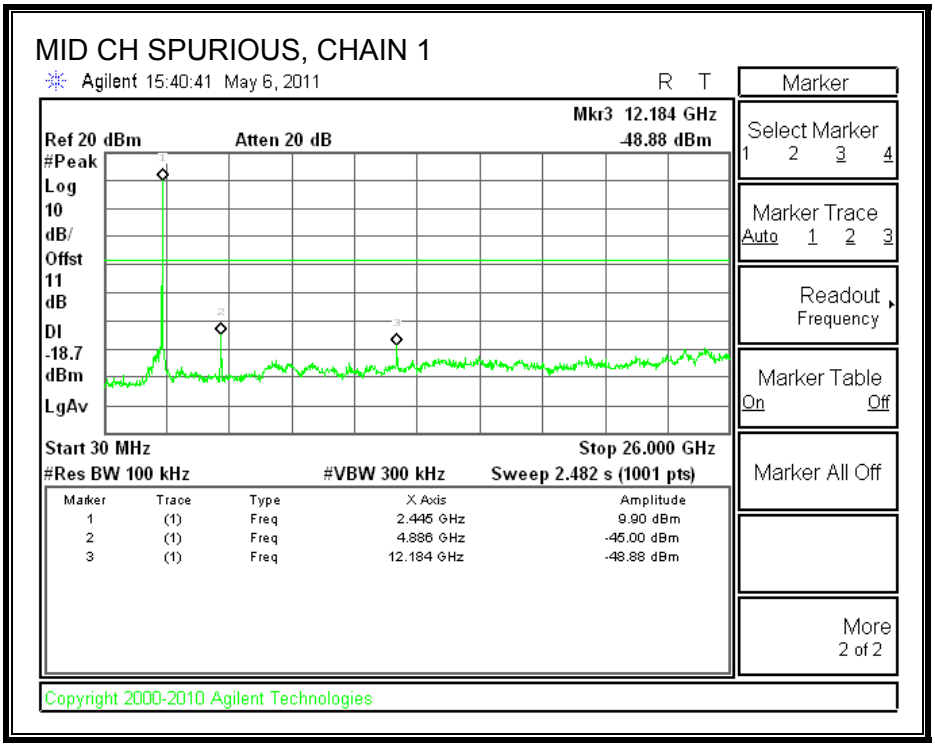
## RESULTS

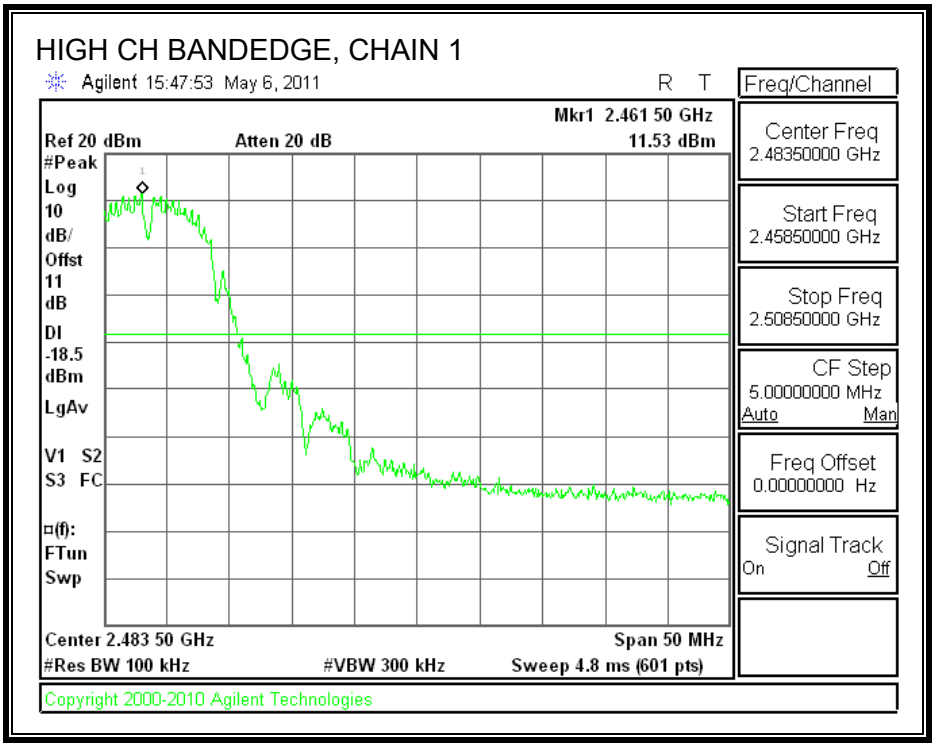
## CHAIN 1 SPURIOUS EMISSIONS

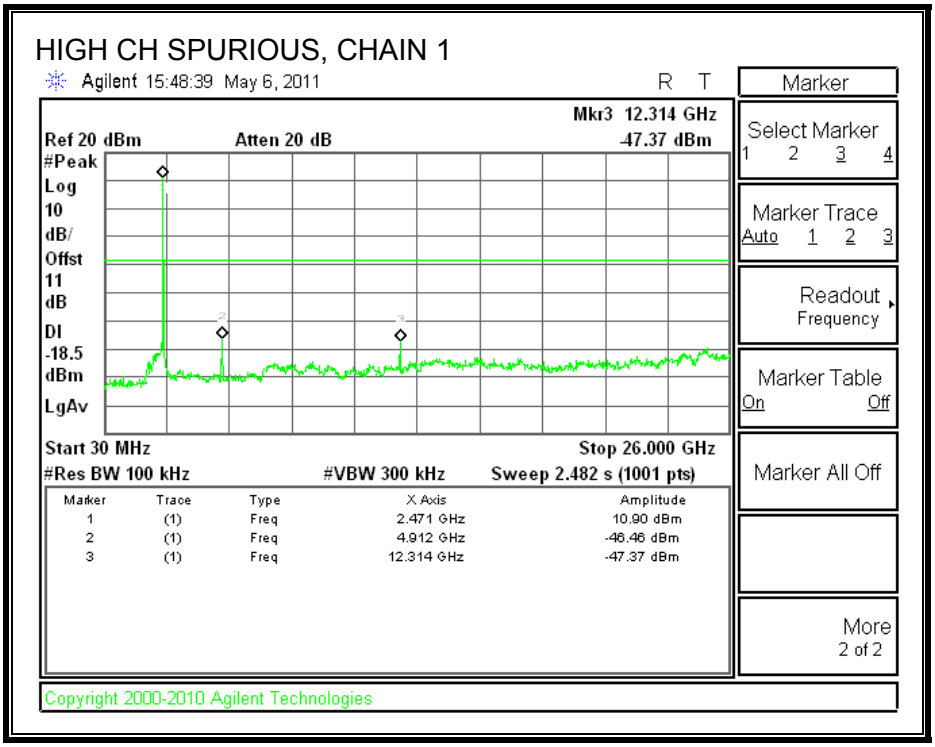




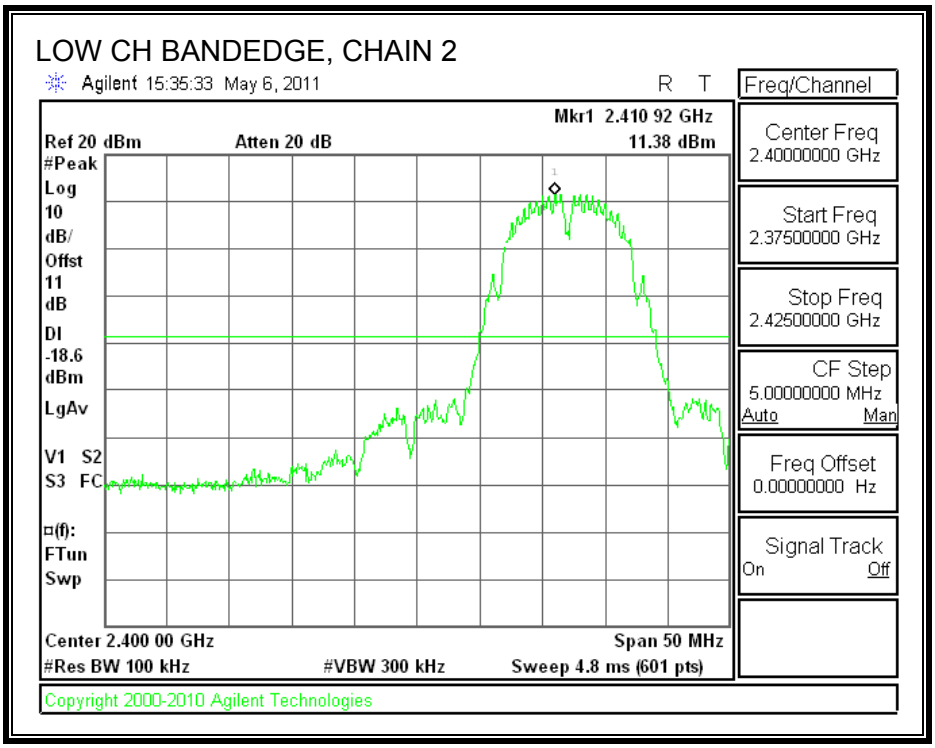


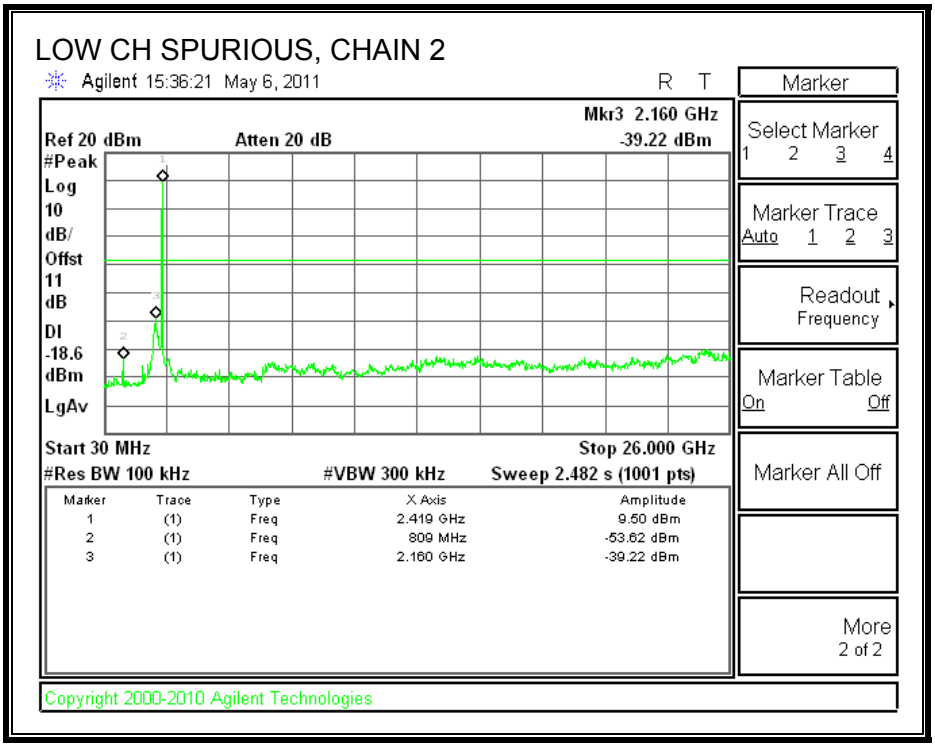




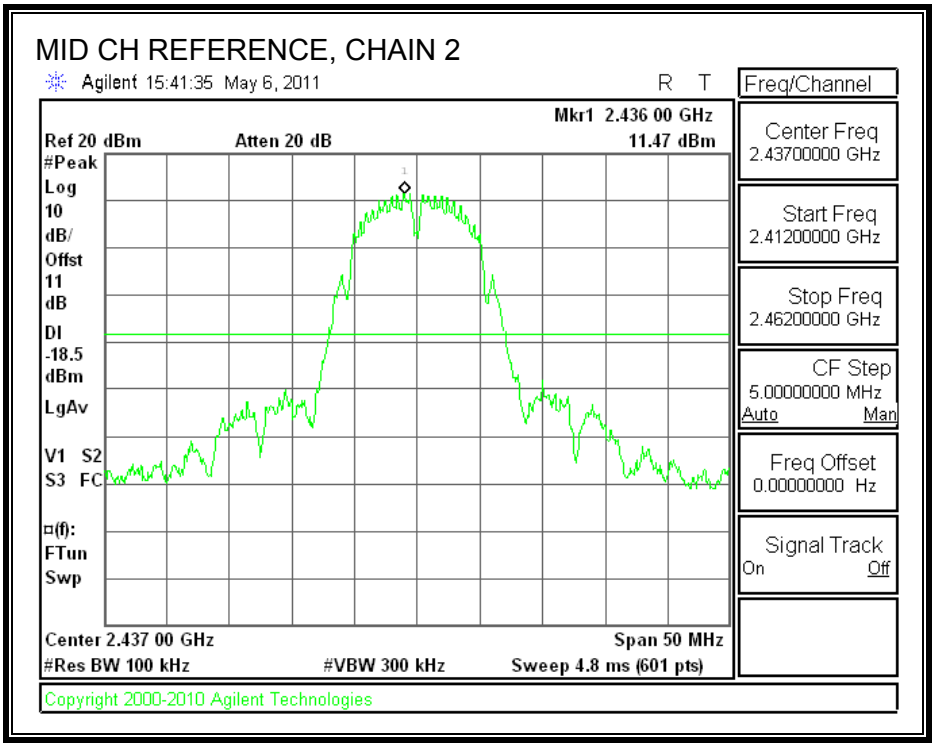


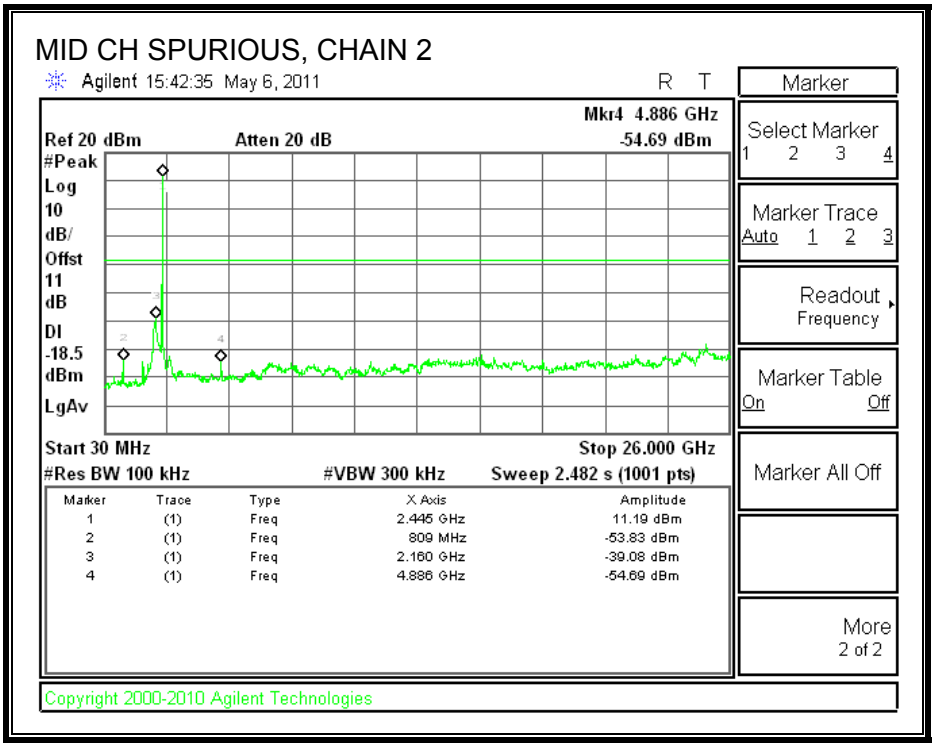
**CHAIN 2 SPURIOUS EMISSIONS**



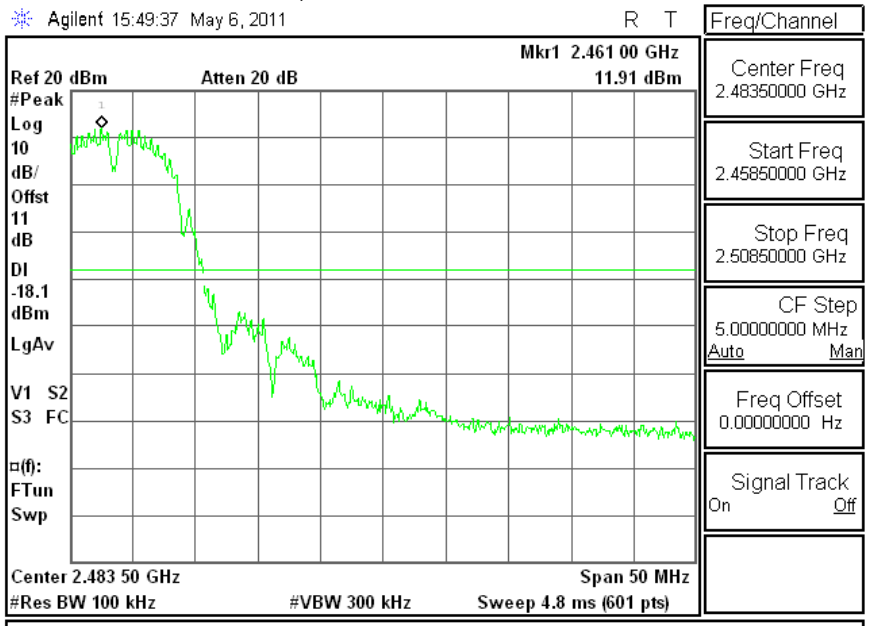


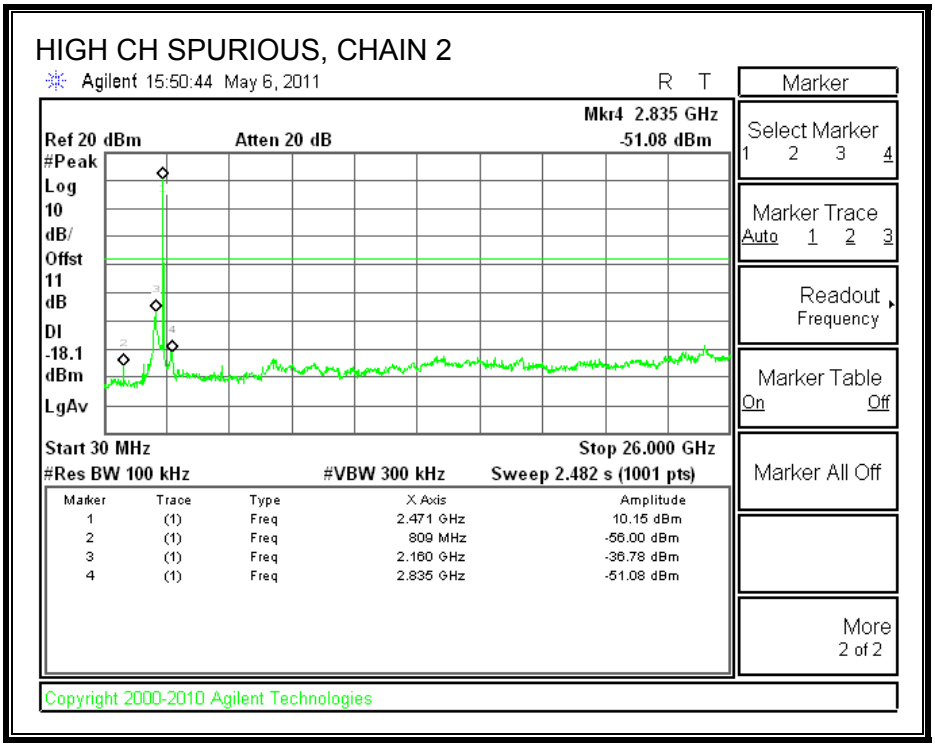
MID CH REFERENCE, CHAIN 2



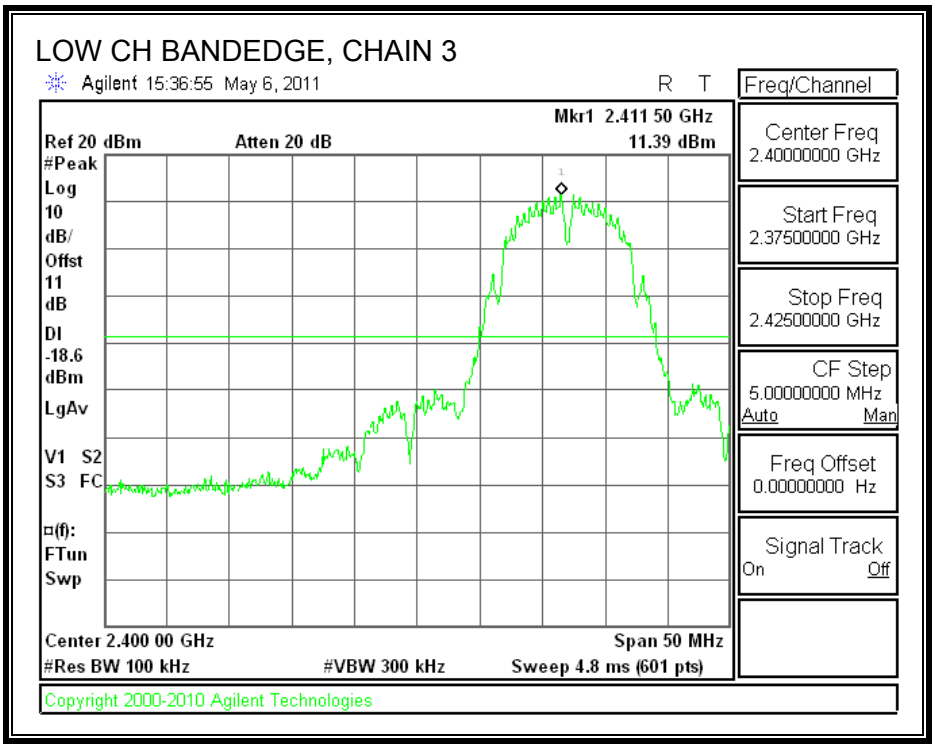


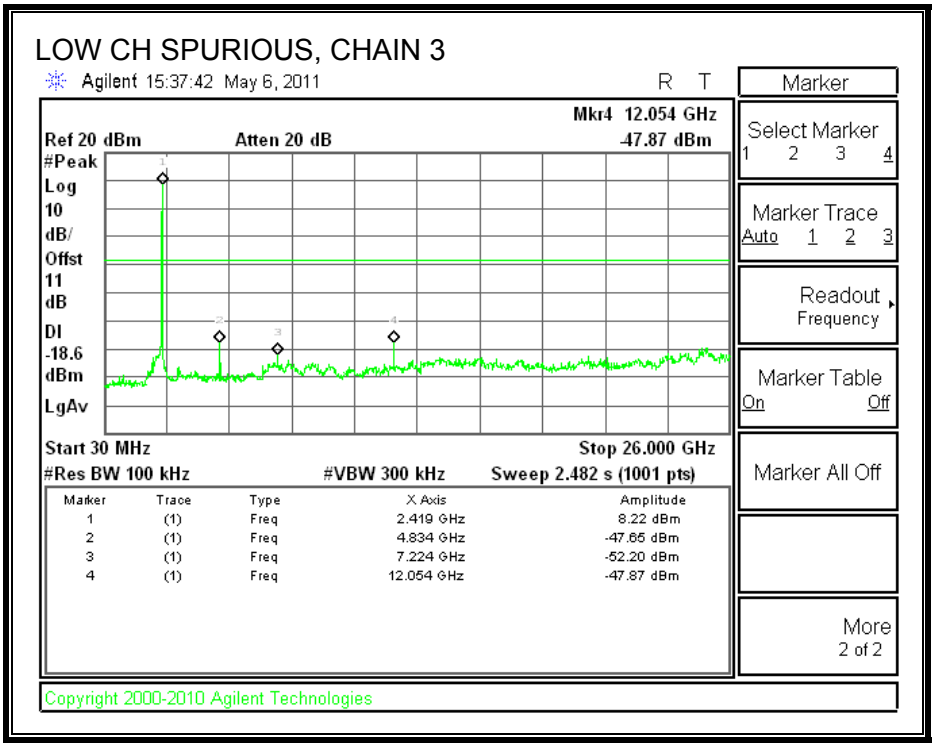
HIGH CH BANDEDGE, CHAIN 2



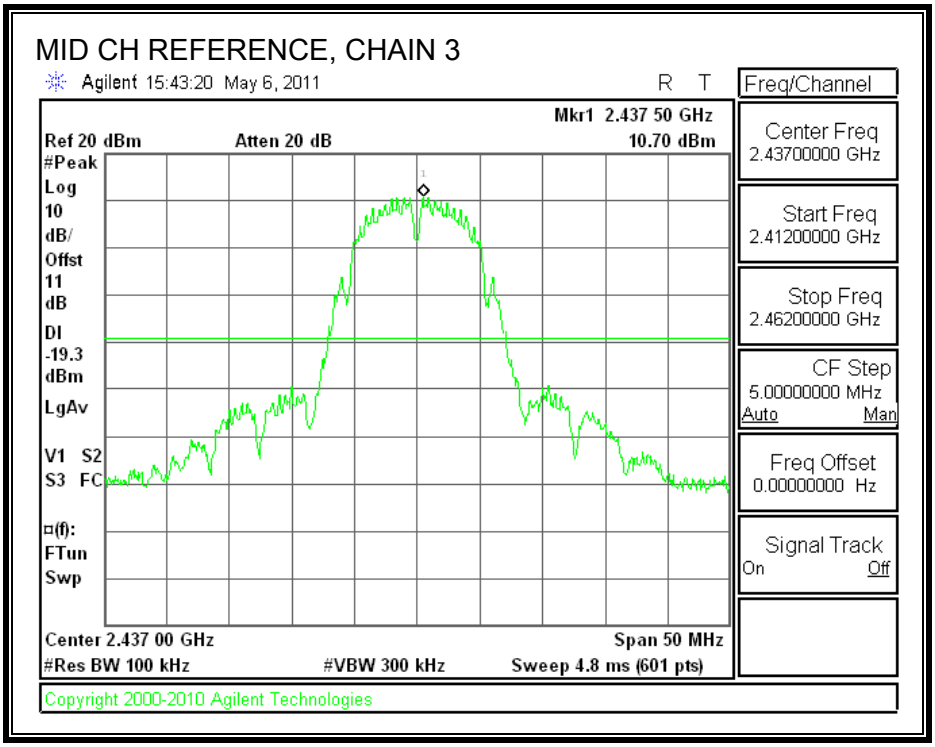


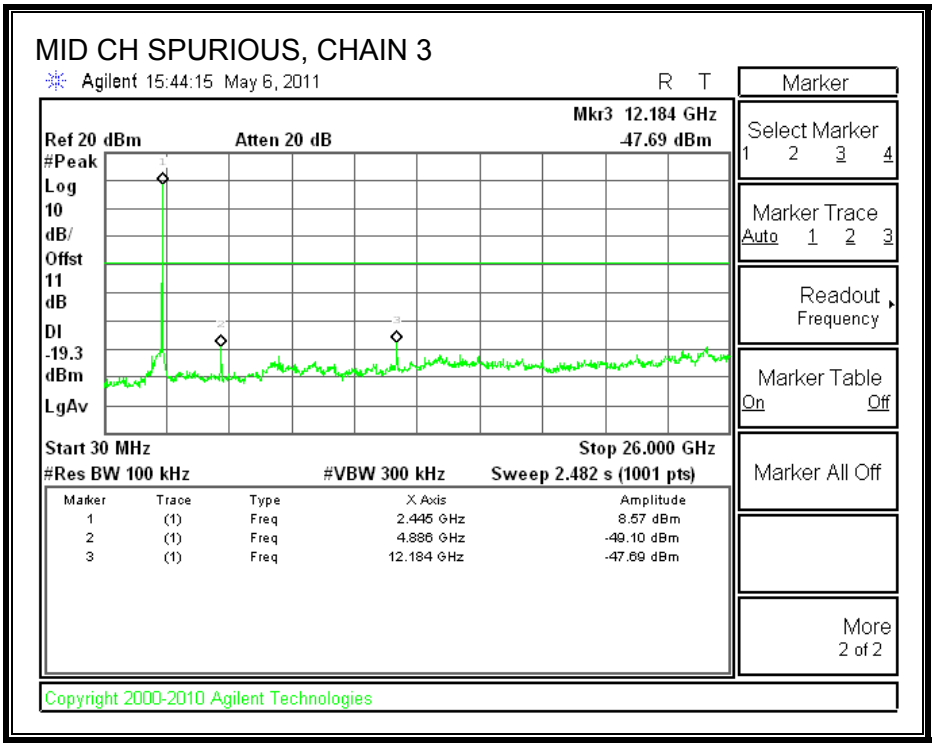
**CHAIN 3 SPURIOUS EMISSIONS**



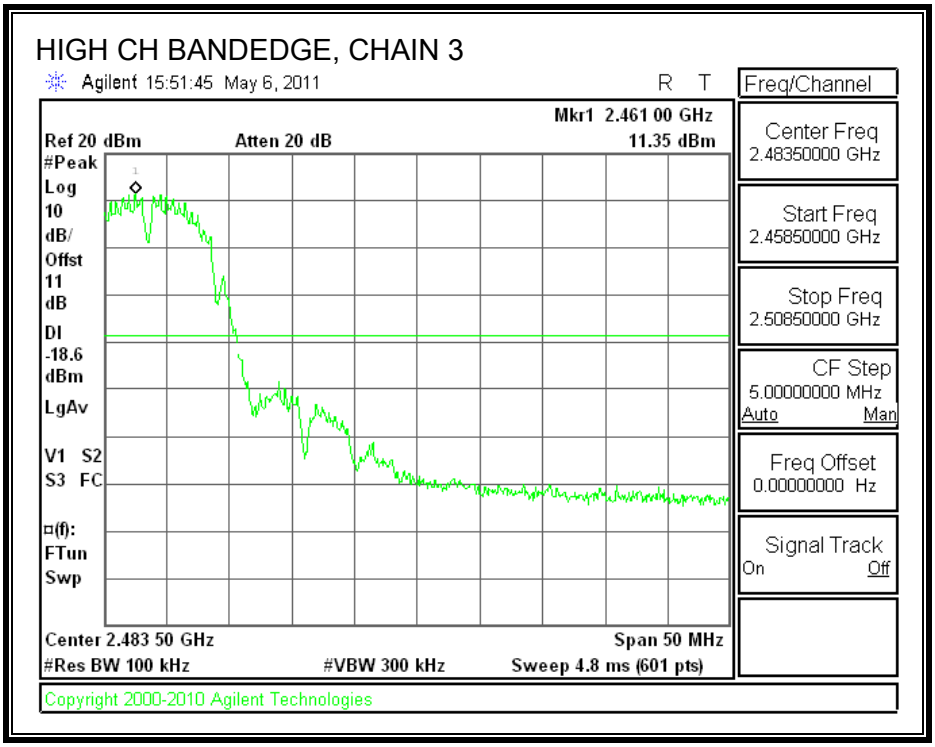


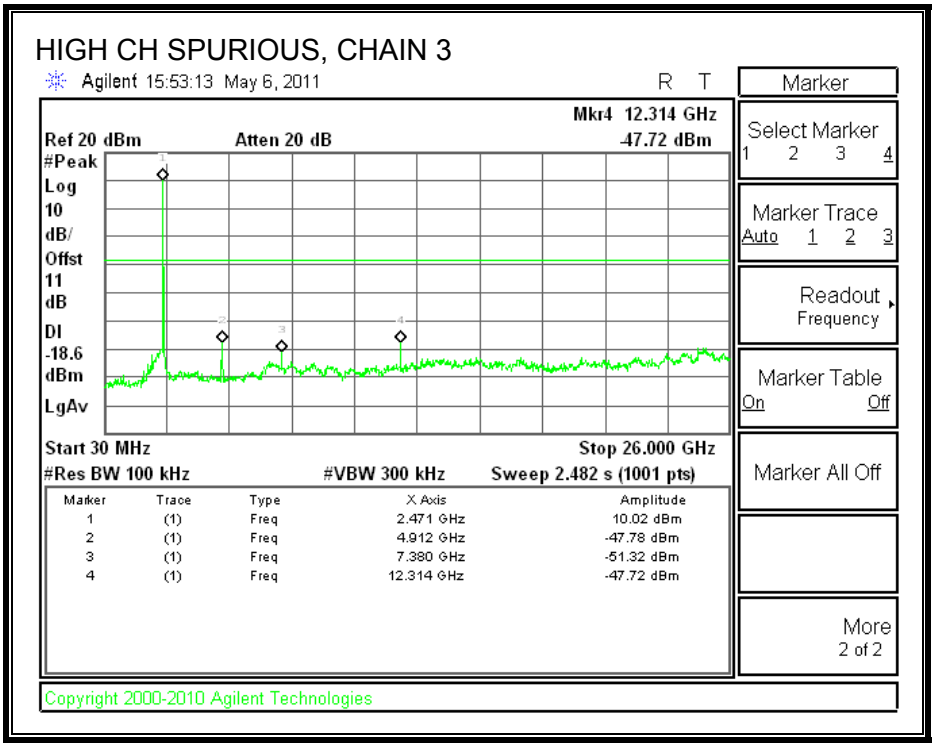
MID CH REFERENCE, CHAIN 3





HIGH CH BANDEDGE, CHAIN 3





## 7.2. 802.11g 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.

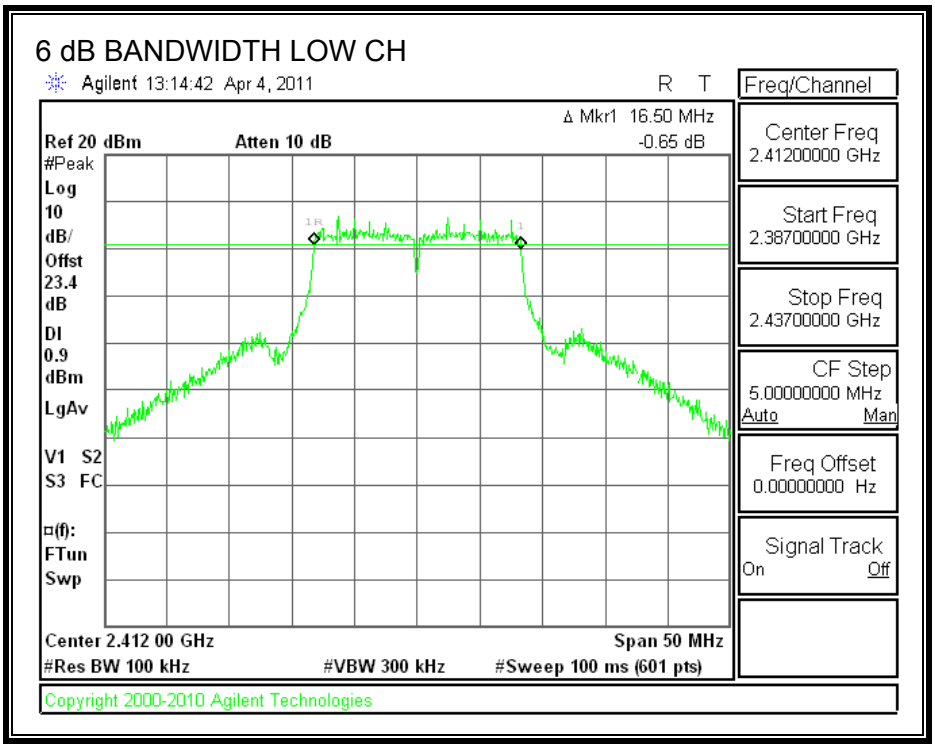
**TEST PROCEDURE**

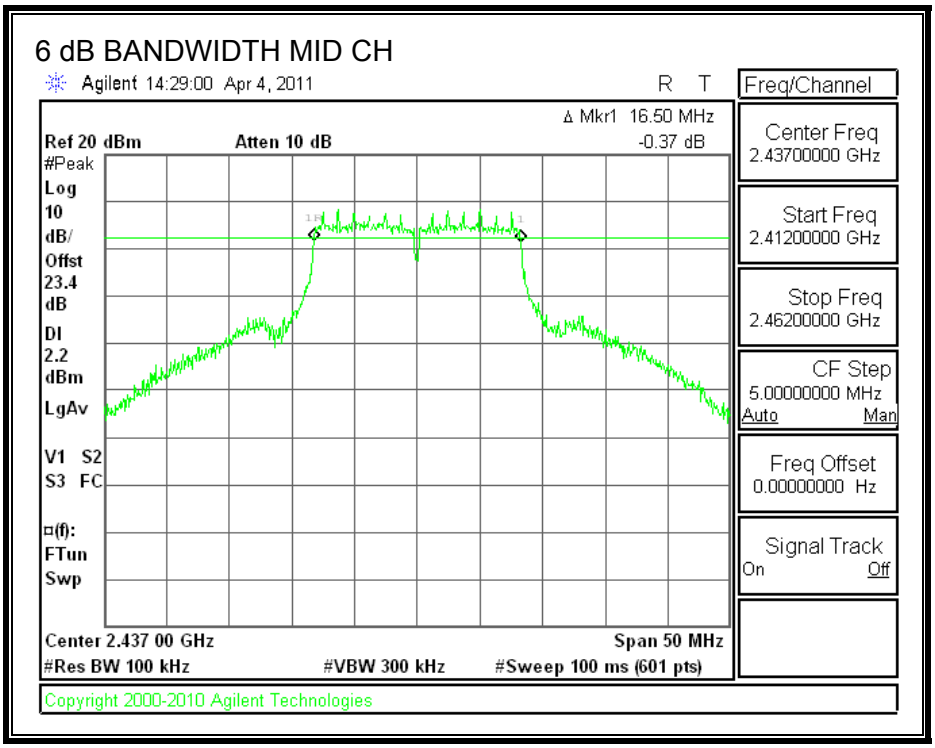
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

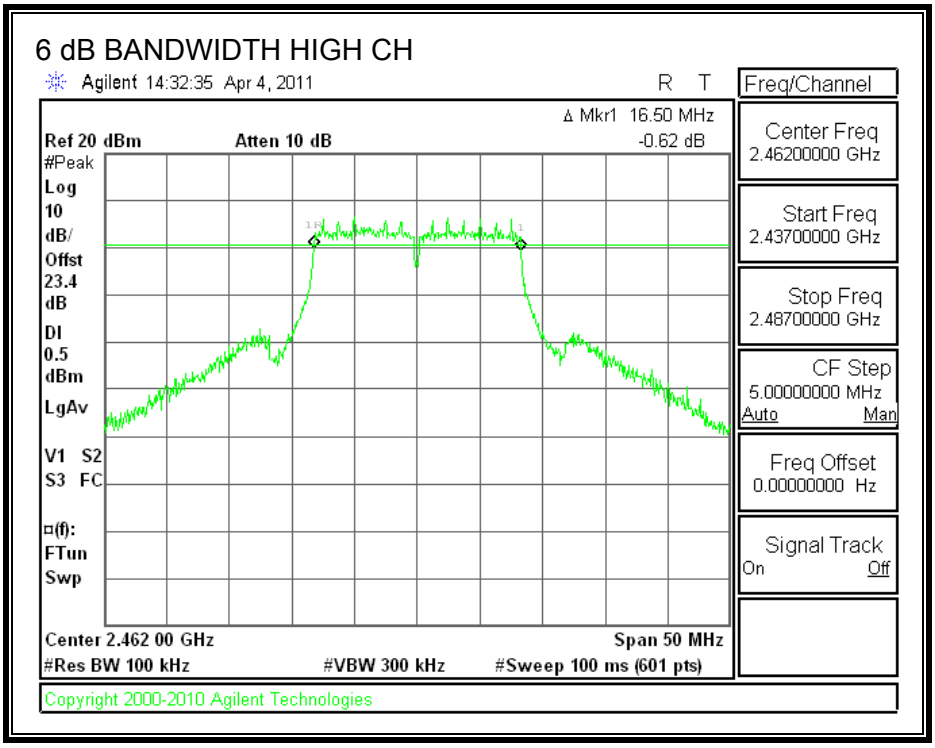
**RESULTS**

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

**6 dB BANDWIDTH**





### 7.2.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

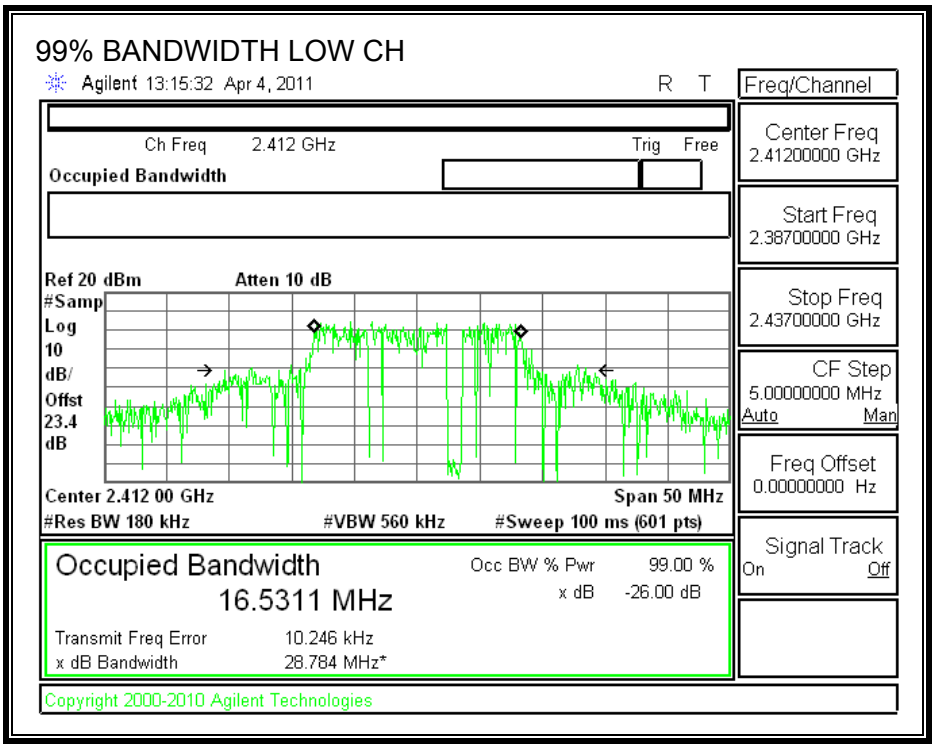
**TEST PROCEDURE**

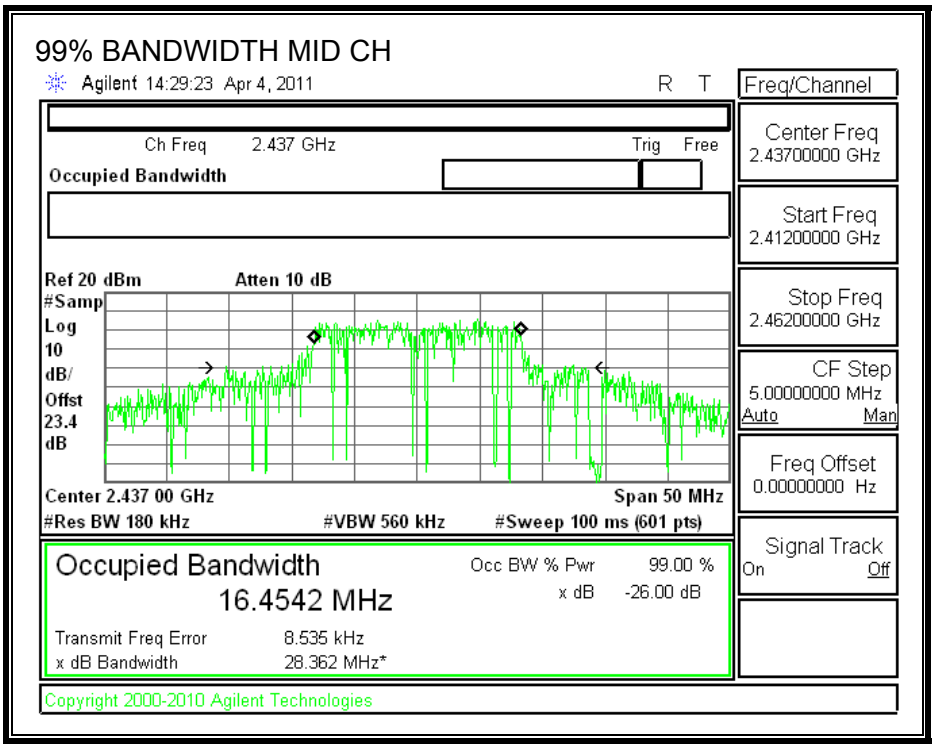
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

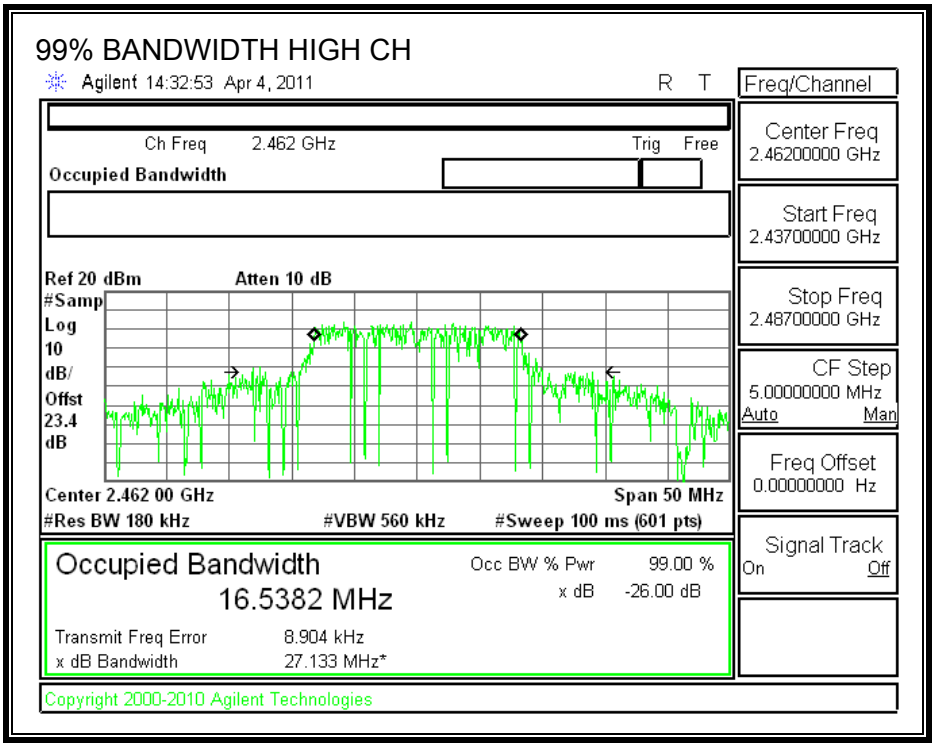
**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 2412 | 16.5311 |
| Middle | 2437 | 16.4542 |
| High | 2462 | 16.5382 |

**99% BANDWIDTH**





## 7.2.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is equal to 6.77 dBi, therefore the limit is 29.23 dBm.

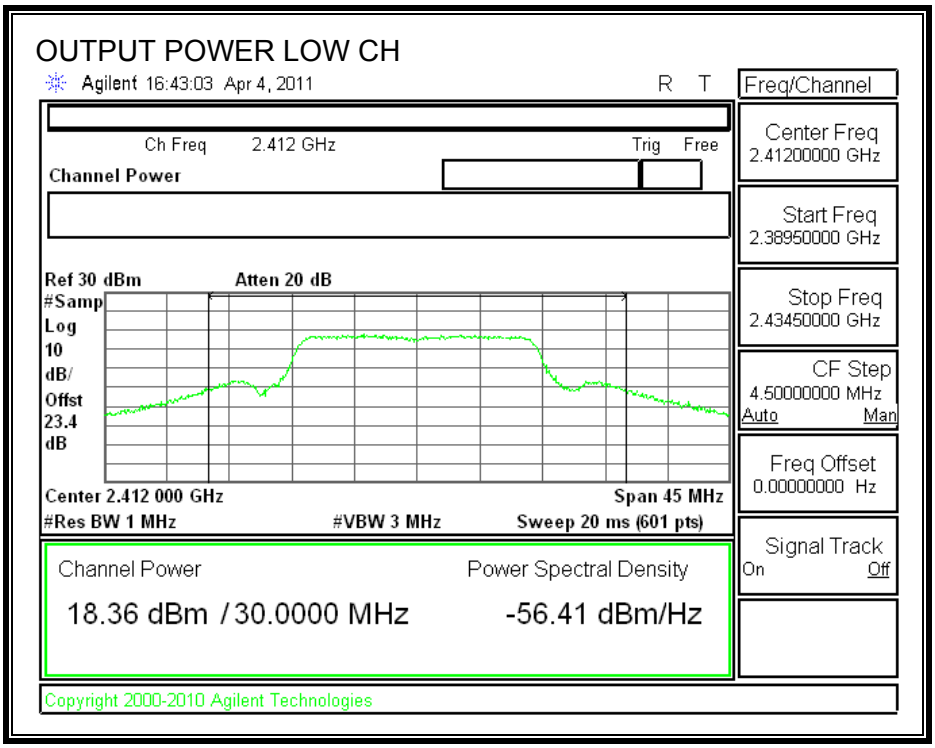
**TEST PROCEDURE – UNII METHOD**

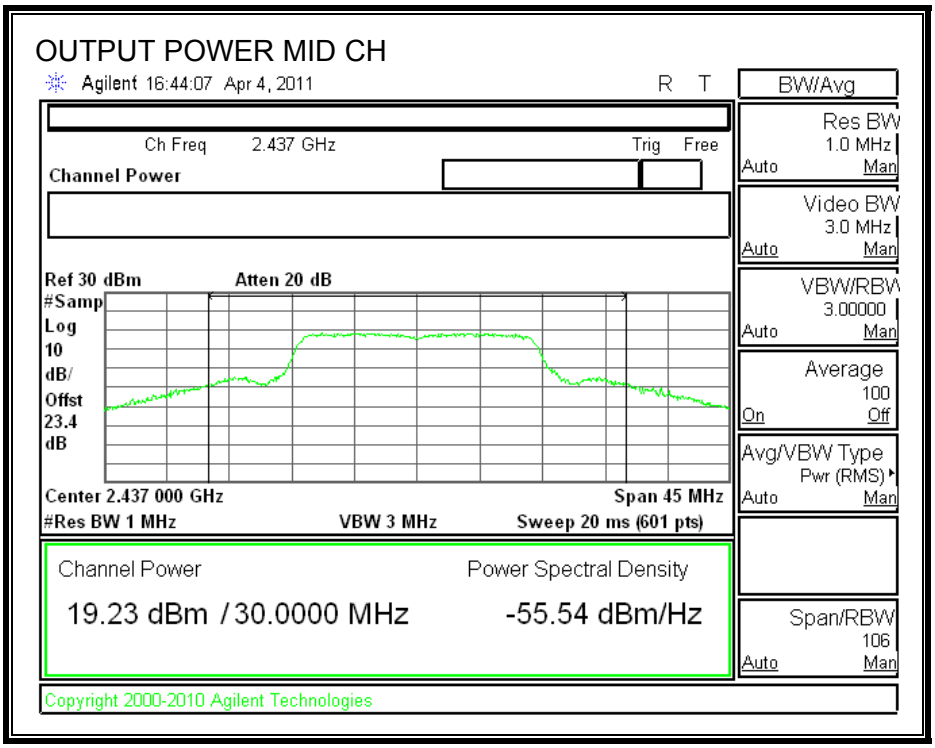
Output power was measured based on the use of RMS averaging over a time interval in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

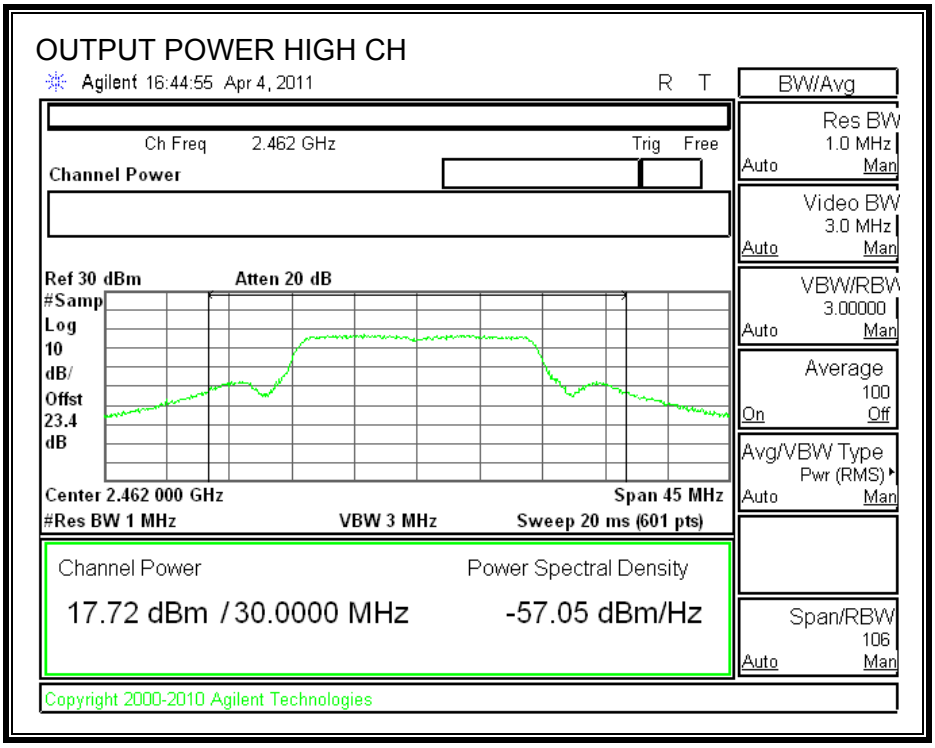
**RESULTS**

| Channel | Frequency (MHz) | Power (dBm) | Attenuator + Cable Loss (dB) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| Low | 2412 | 18.36 | 0.00 | 29.32 | -10.96 |
| Mid | 2437 | 19.23 | 0.00 | 29.32 | -10.09 |
| High | 2462 | 17.72 | 0.00 | 29.32 | -11.60 |

**OUTPUT POWER**





## 7.2.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

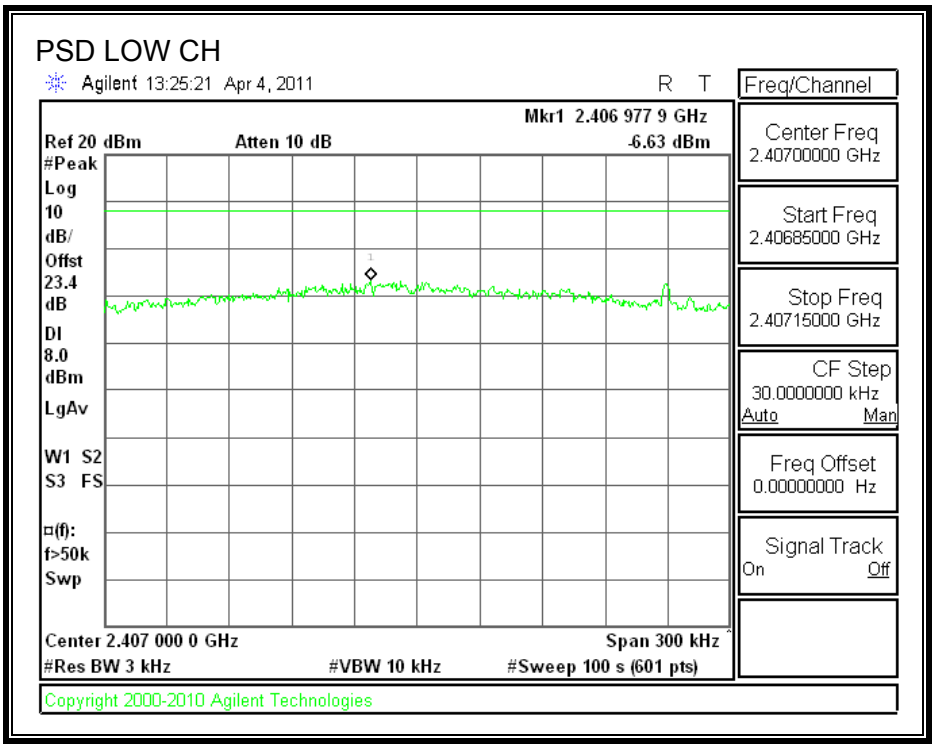
**TEST PROCEDURE**

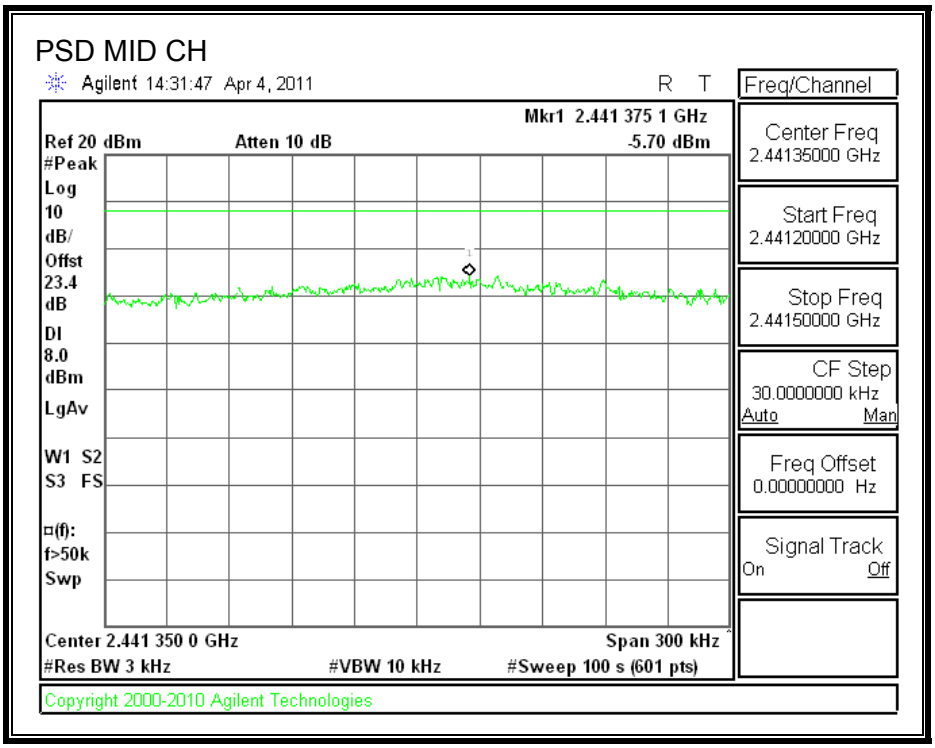
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

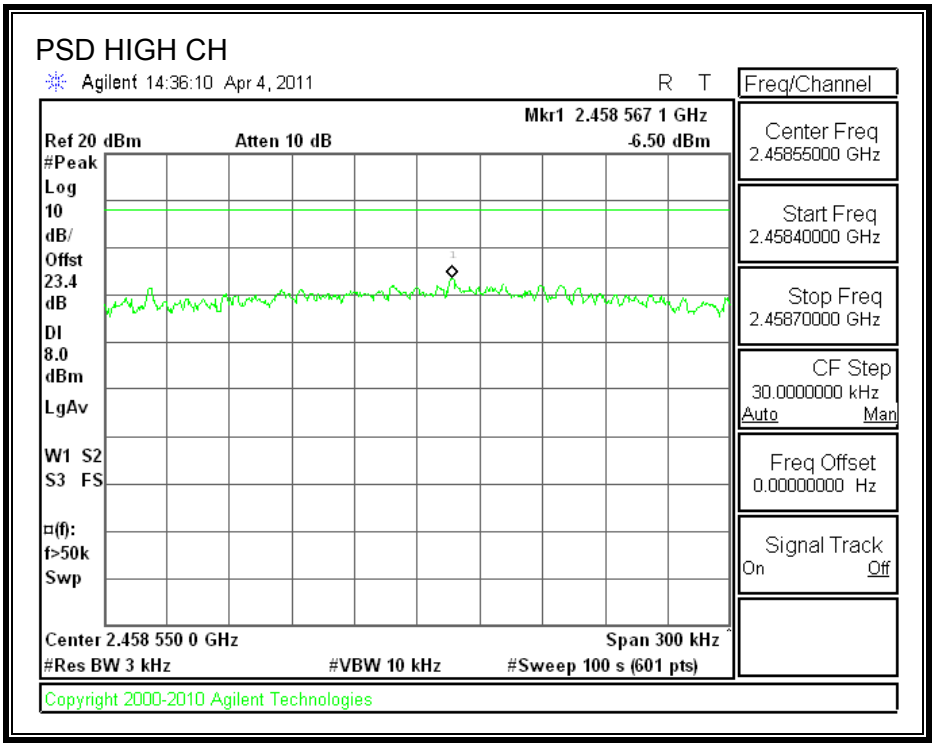
**RESULTS**

| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2412 | -6.63 | 8 | -14.63 |
| Middle | 2437 | -5.70 | 8 | -13.70 |
| High | 2462 | -6.50 | 8 | -14.50 |

**POWER SPECTRAL DENSITY**





### 7.2.5. CONDUCTED SPURIOUS EMISSIONS

Cover by testing to 11n HT20 3x3 CDD MCS0.

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

## 7.3.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

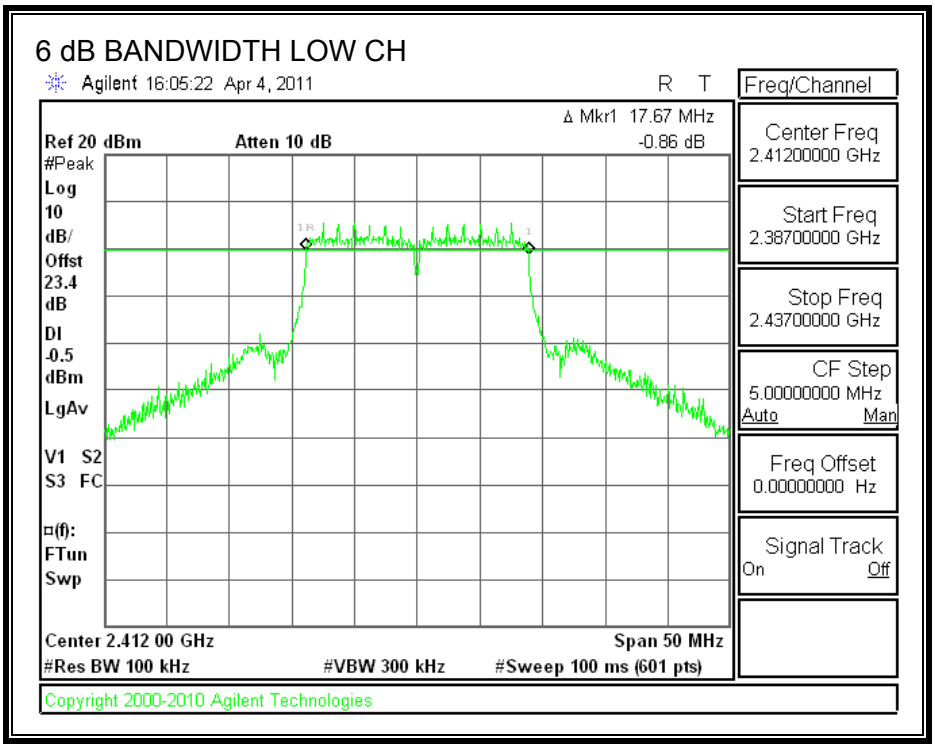
**TEST PROCEDURE**

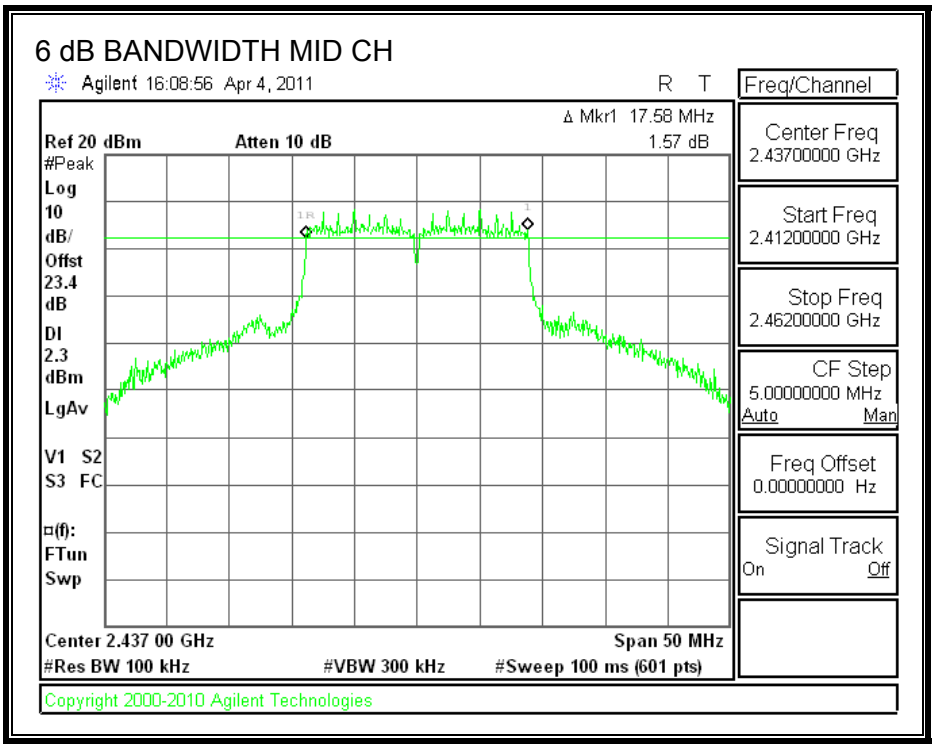
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

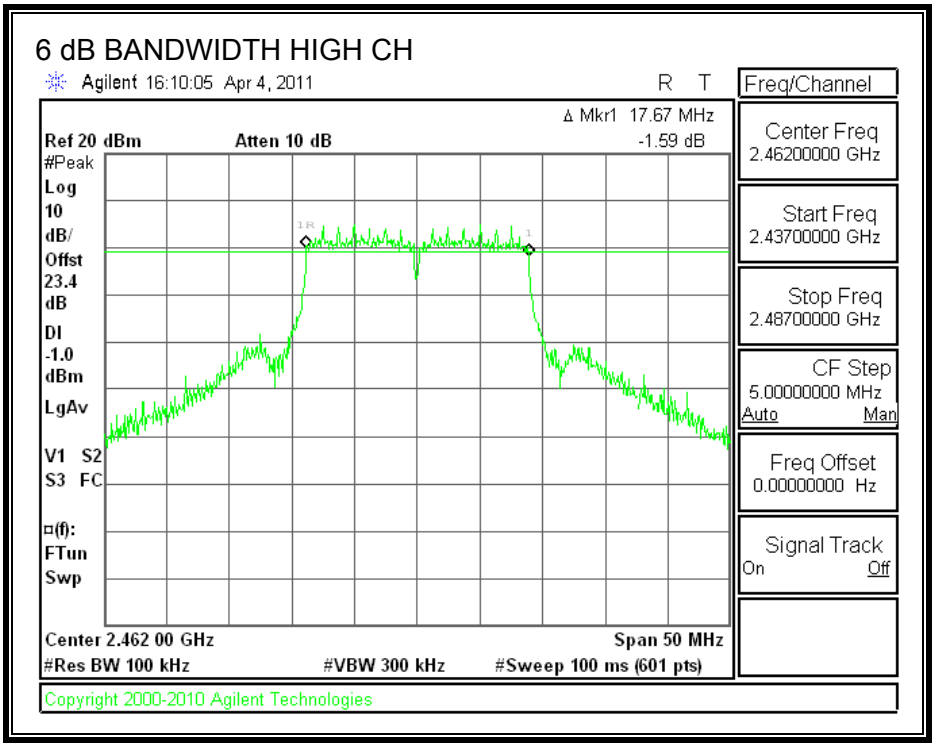
**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 2412 | 17.67 | 0.5 |
| Middle | 2437 | 17.58 | 0.5 |
| High | 2462 | 17.67 | 0.5 |

**6 dB BANDWIDTH**





### 7.3.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

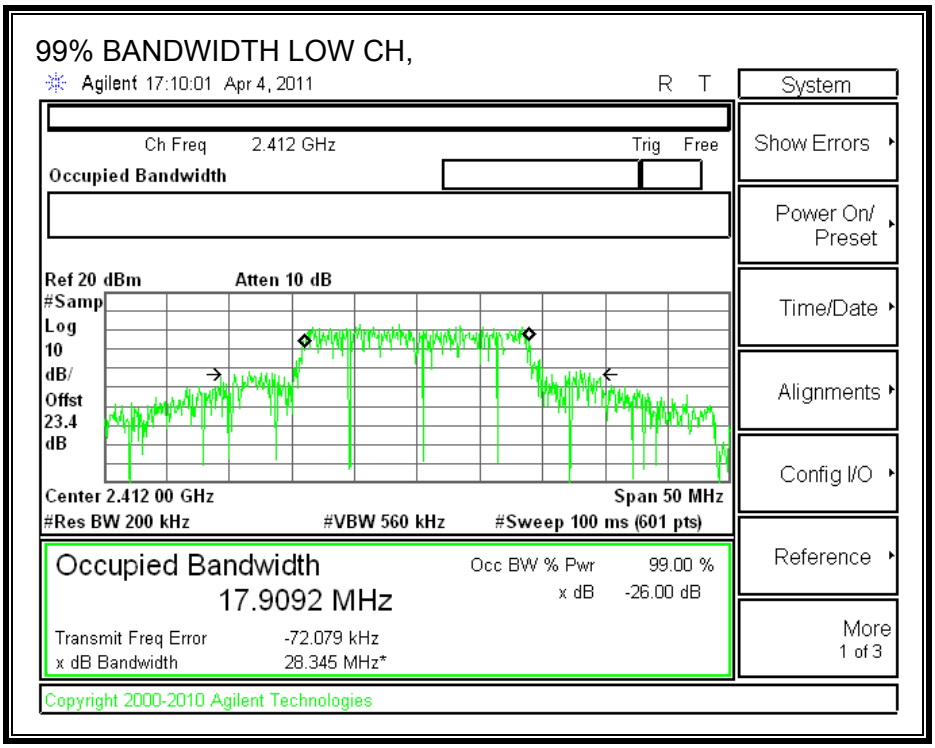
**TEST PROCEDURE**

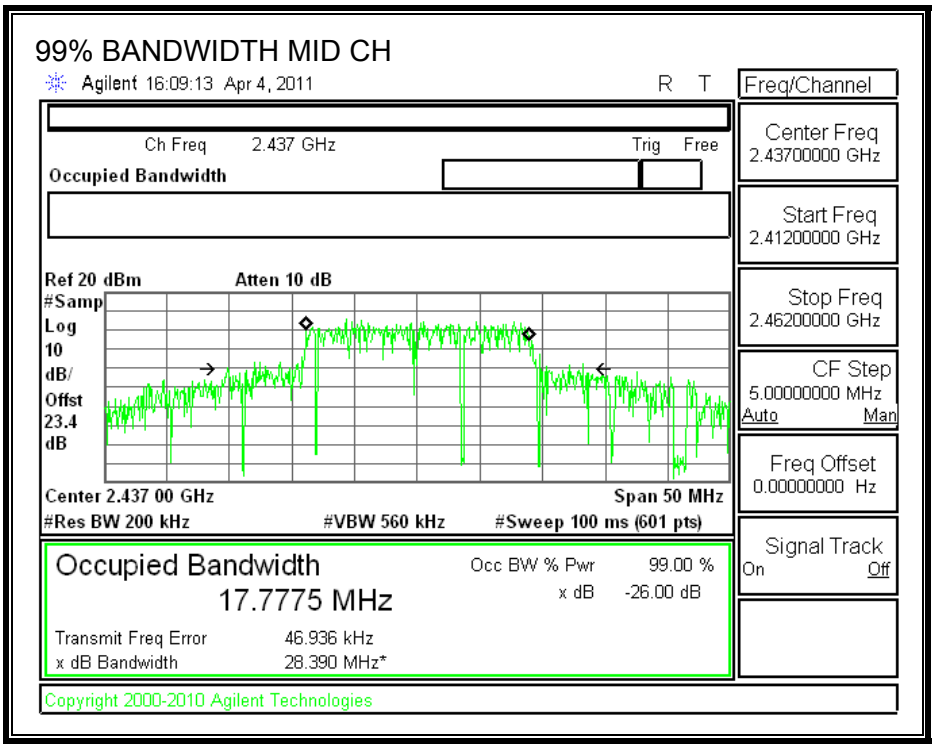
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

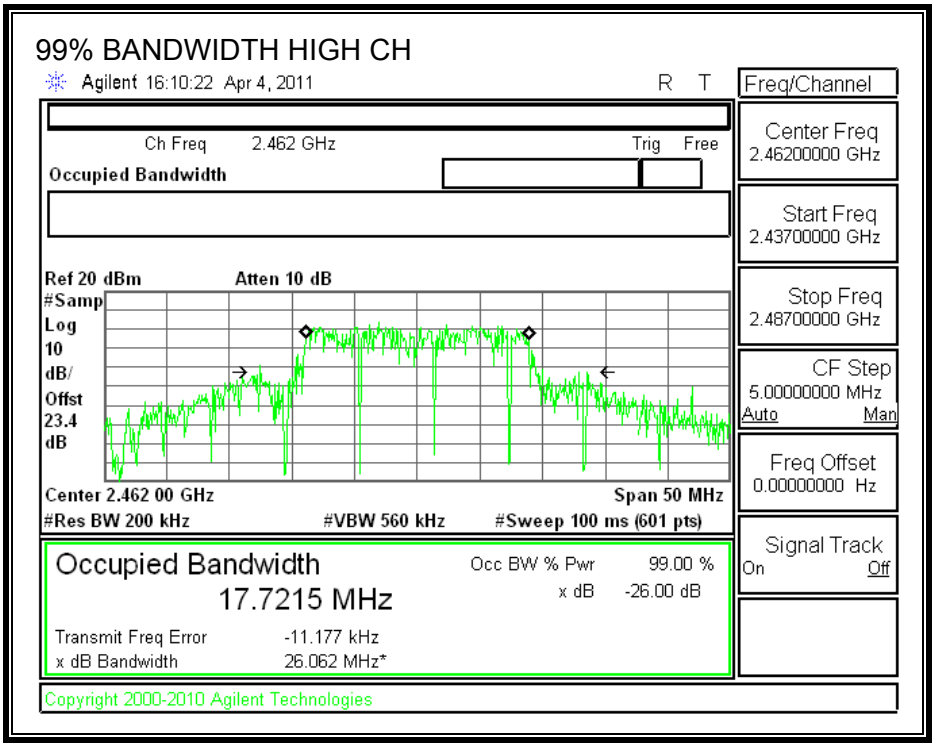
**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 2412 | 17.9092 |
| Middle | 2437 | 17.7775 |
| High | 2462 | 17.7215 |

**99% BANDWIDTH**





## 7.3.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The composite antenna gain is equal to 8.76 dBi, therefore the limit is 27.24 dBm.

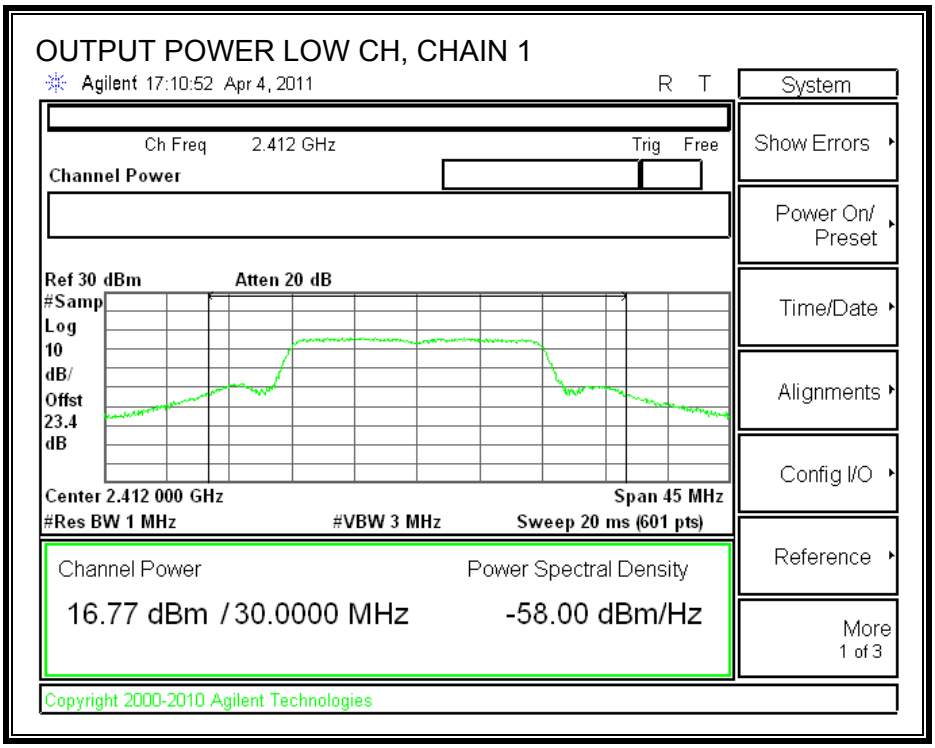
**TEST PROCEDURE – UNII METHOD**

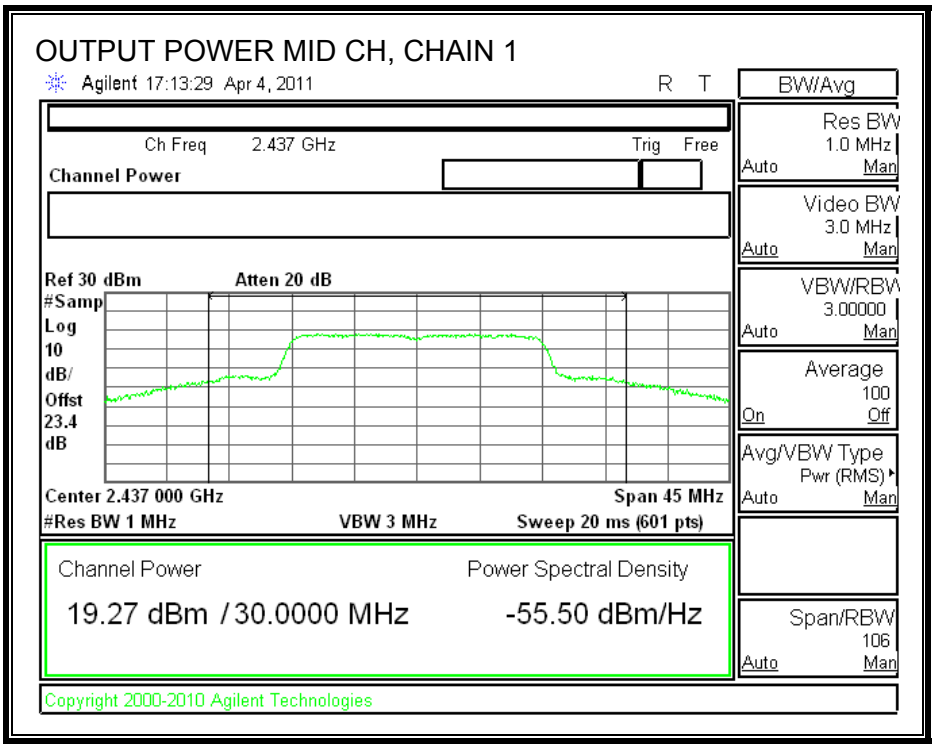
Output power was measured based on the use of RMS averaging over a time interval in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

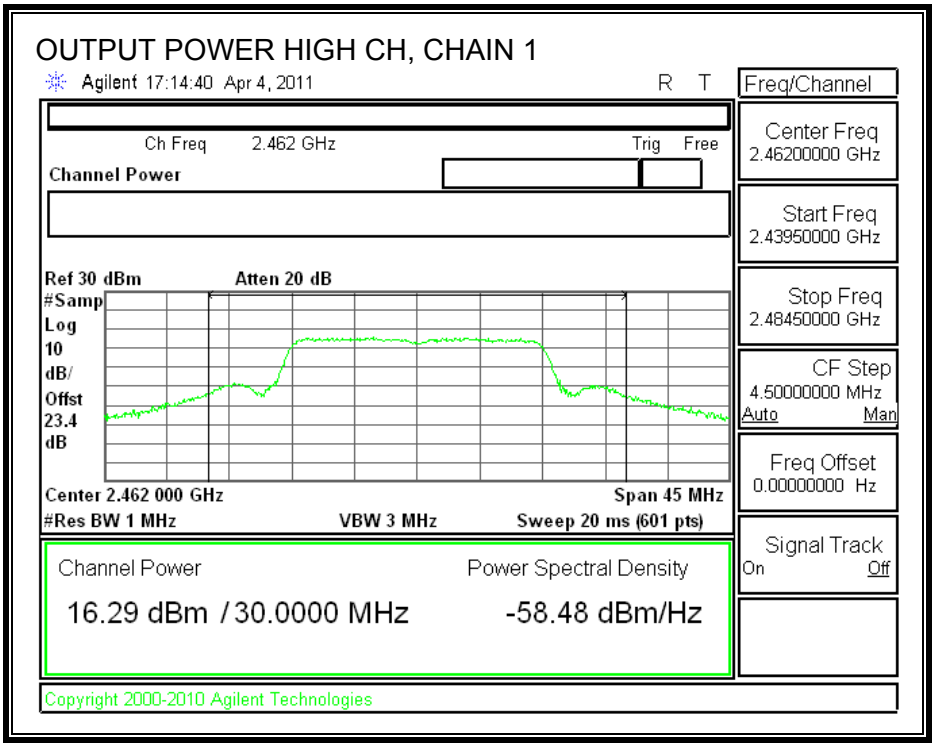
**RESULTS**

| Channel | Frequency (MHz) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 16.77 | 16.61 | 16.65 | 21.45 | 27.24 | -5.79 |
| Mid | 2437 | 19.27 | 19.34 | 19.35 | 24.09 | 27.24 | -3.15 |
| High | 2462 | 16.29 | 16.27 | 16.29 | 21.05 | 27.24 | -6.19 |

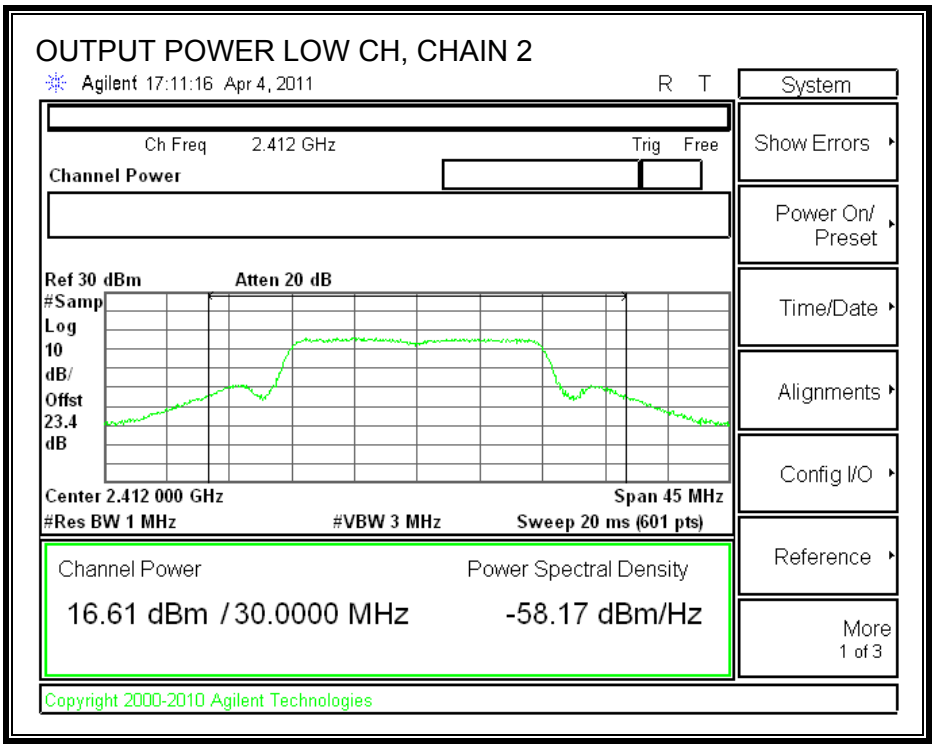
**CHAIN 1 OUTPUT POWER**

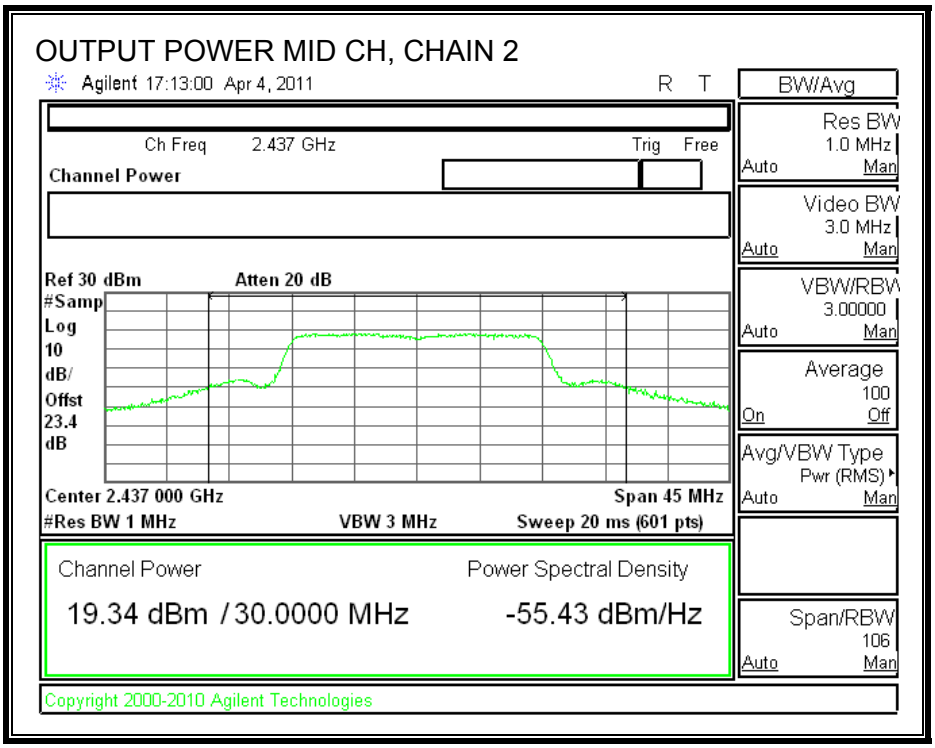


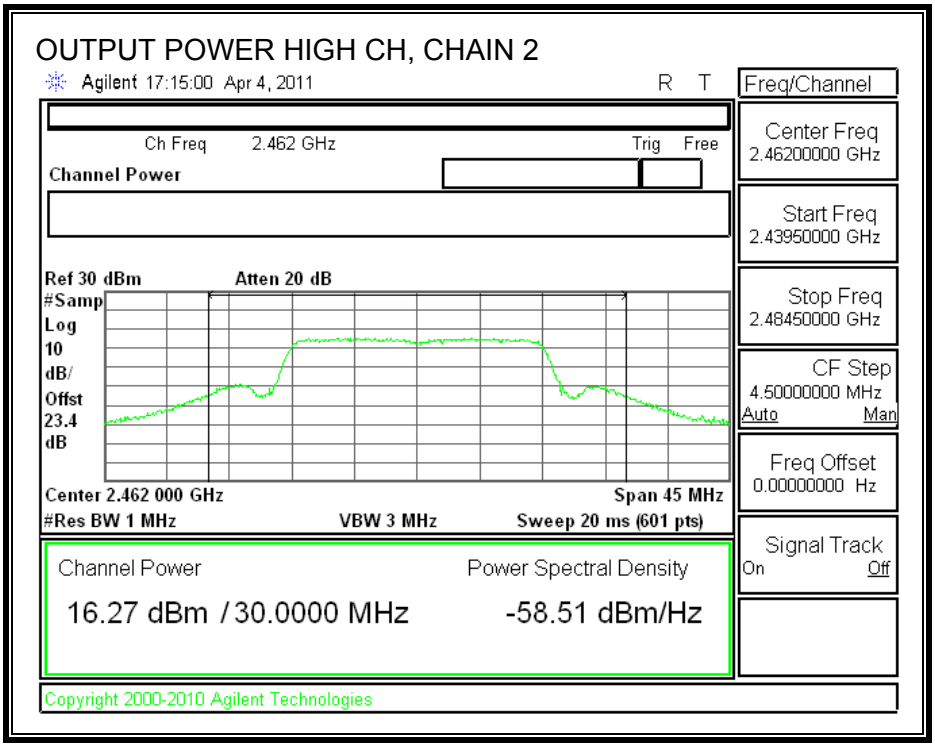





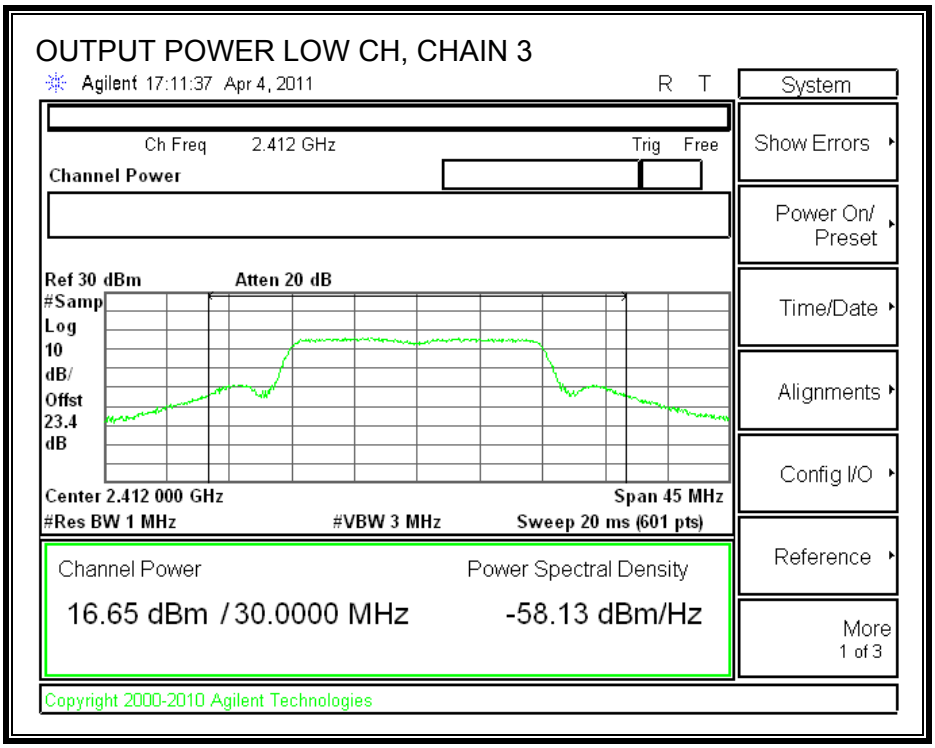
**CHAIN 2 OUTPUT POWER**

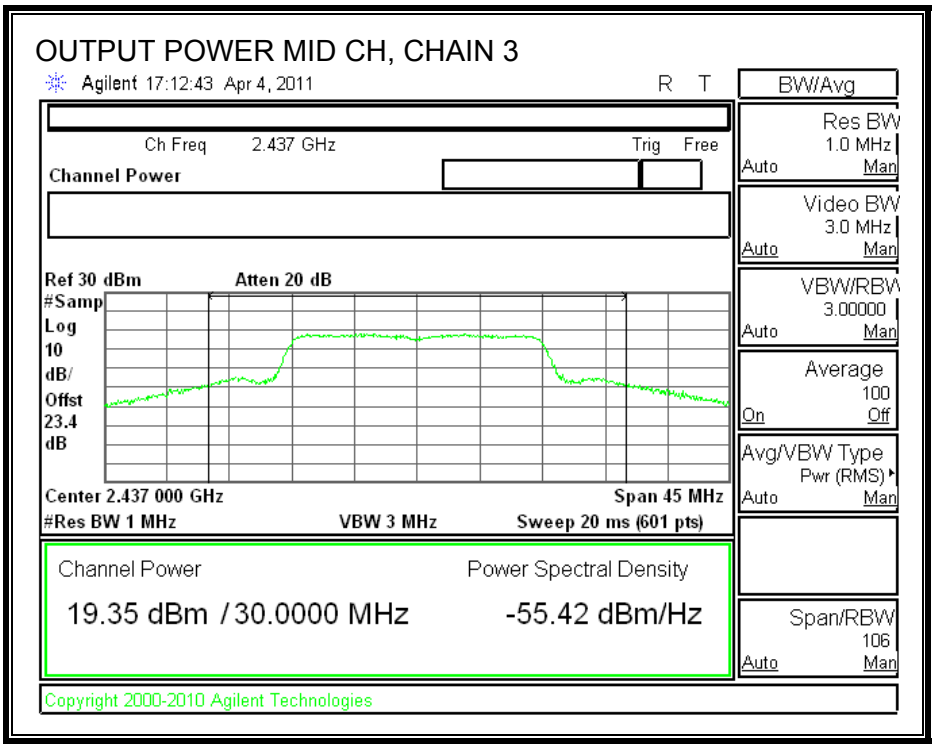


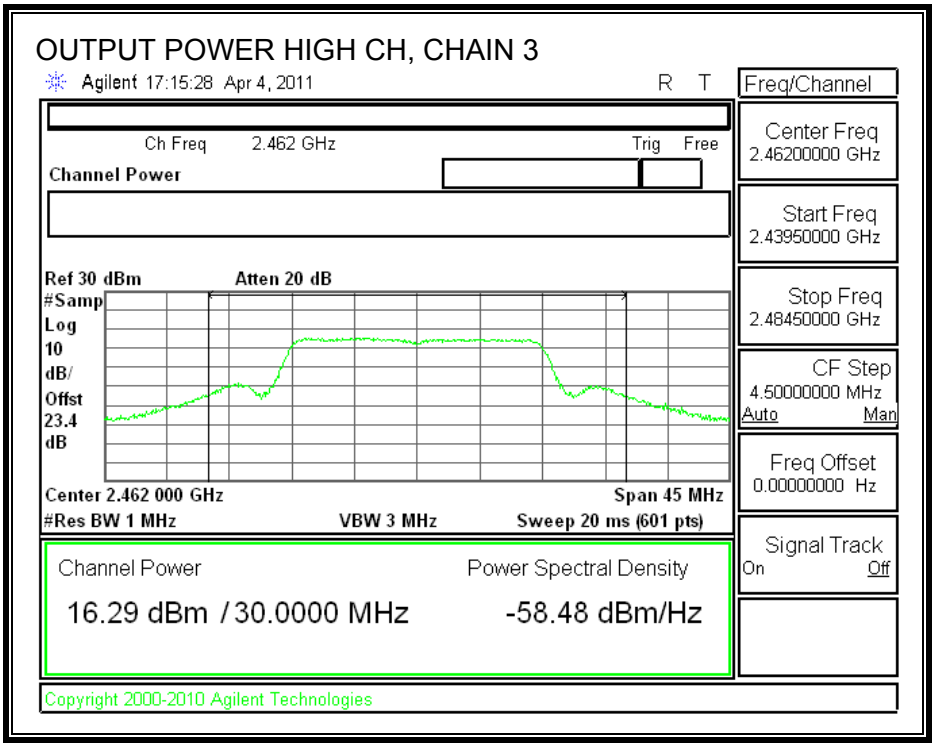





**CHAIN 3 OUTPUT POWER**





## 7.3.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

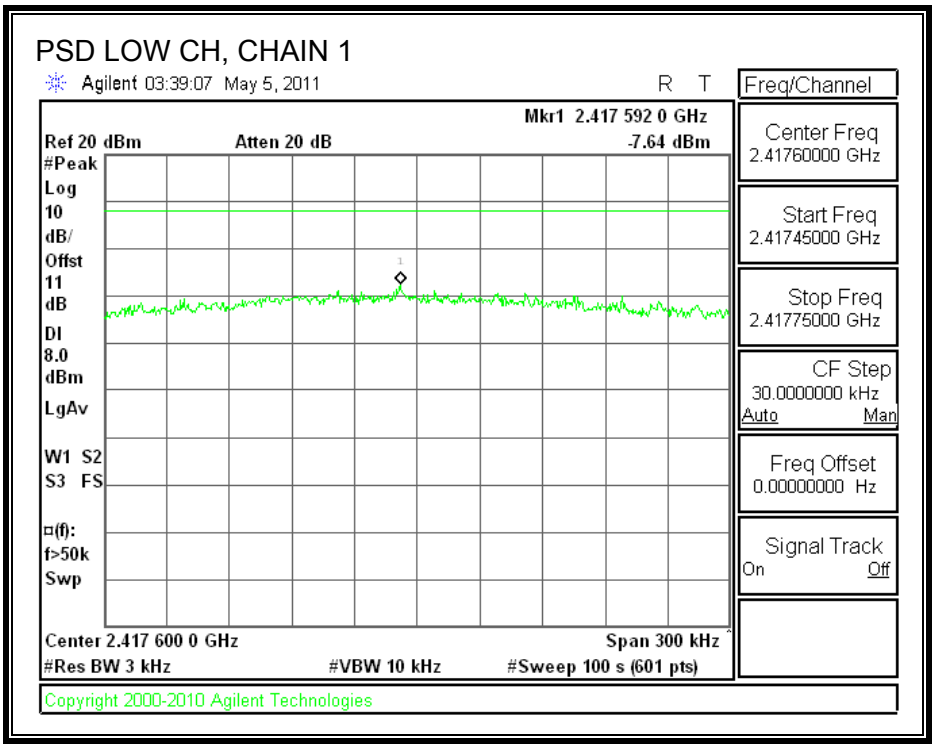
**TEST PROCEDURE**

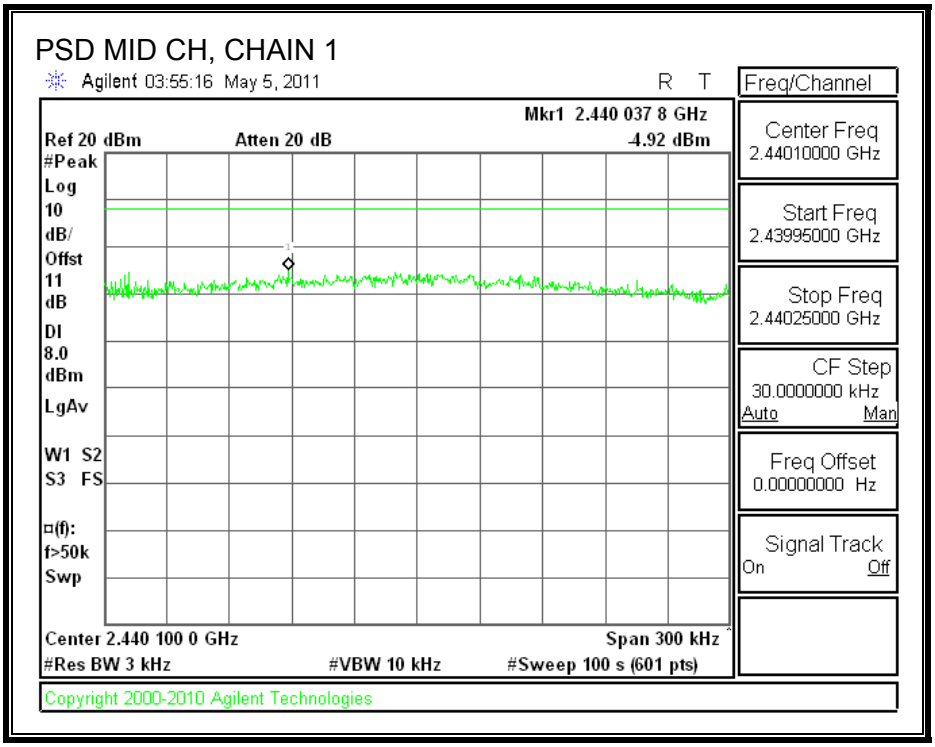
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

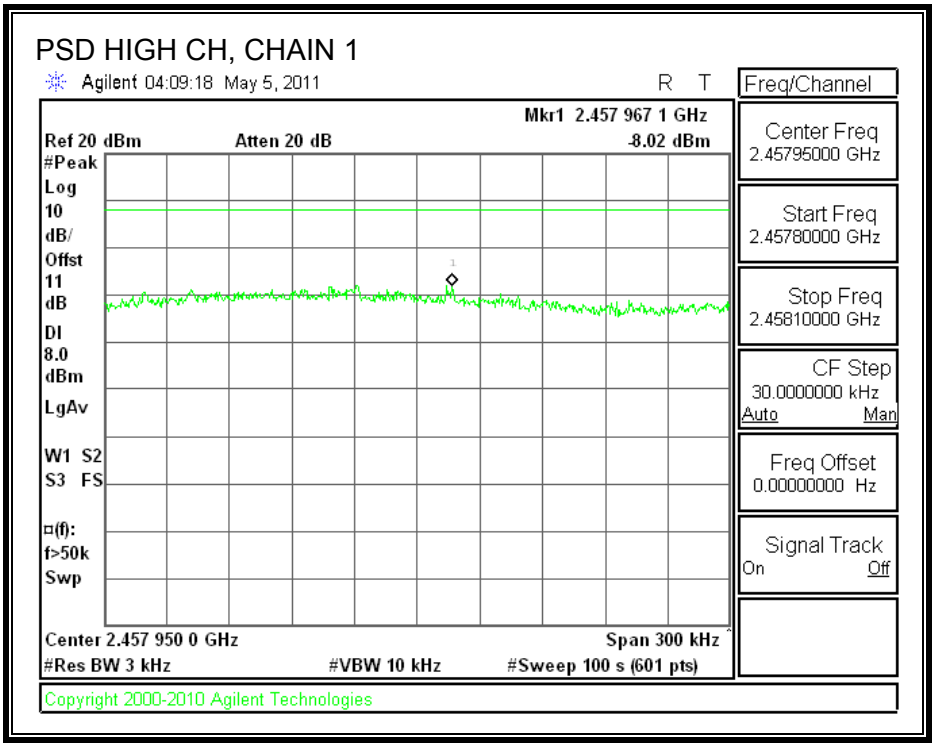
**RESULTS**

| Channel | Frequency (MHz) | Chain 1 PSD (dBm) | Chain 2 PSD (dBm) | Chain 3 PSD (dBm) | Total PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | -7.64 | -5.32 | -5.97 | -1.43 | 8 | -9.43 |
| Middle | 2437 | -4.92 | -4.39 | -5.18 | -0.05 | 8 | -8.05 |
| High | 2462 | -8.02 | -5.95 | -6.32 | -1.90 | 8 | -9.90 |

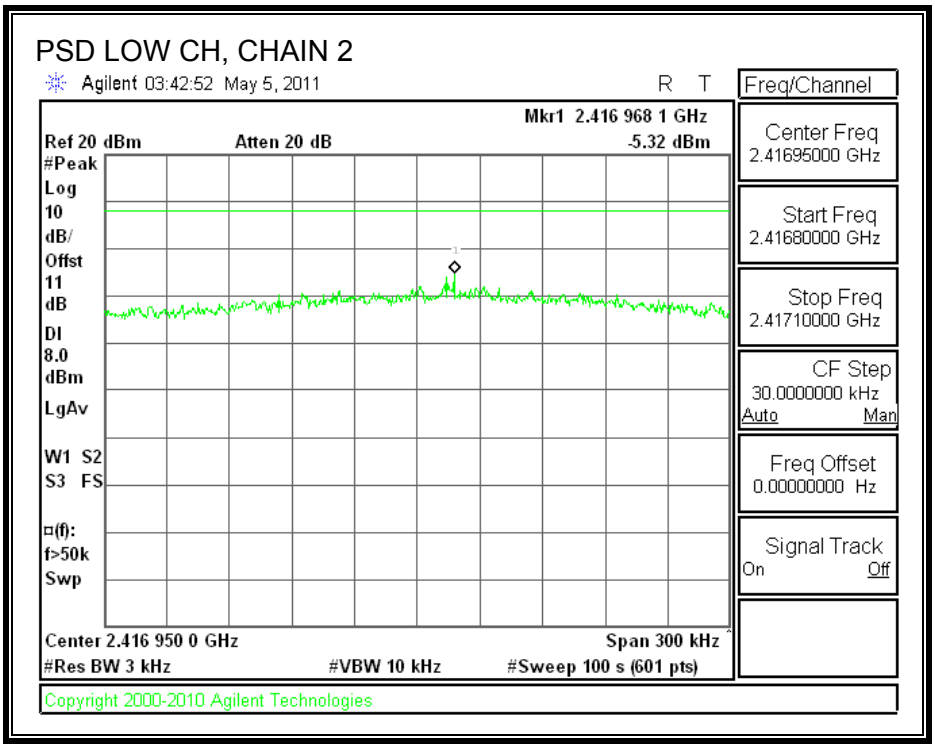
**POWER SPECTRAL DENSITY, CHAIN 1**

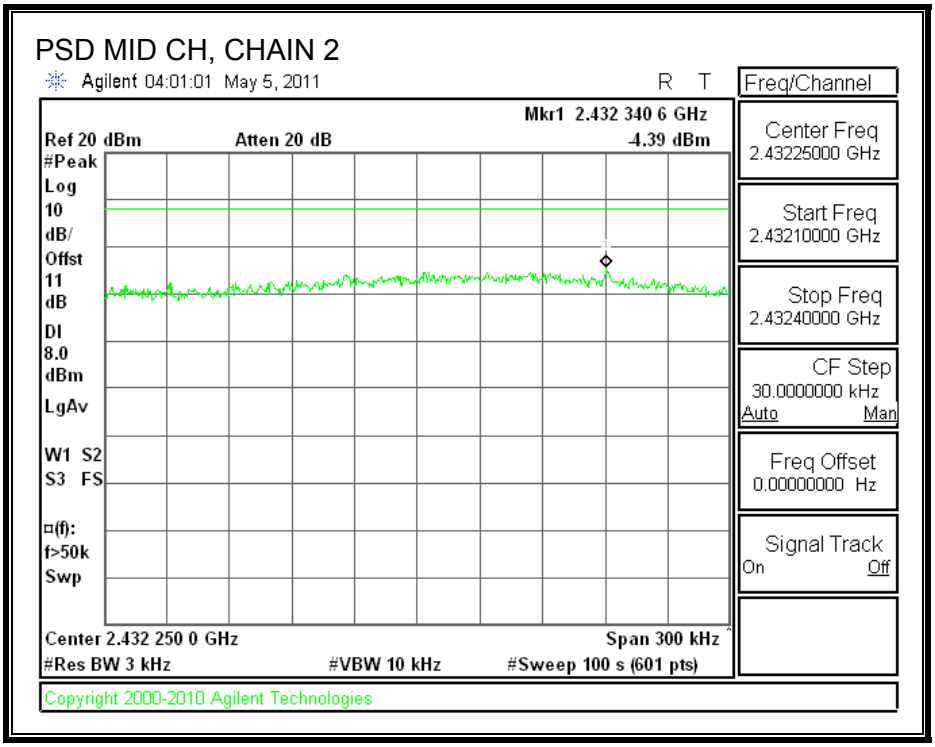


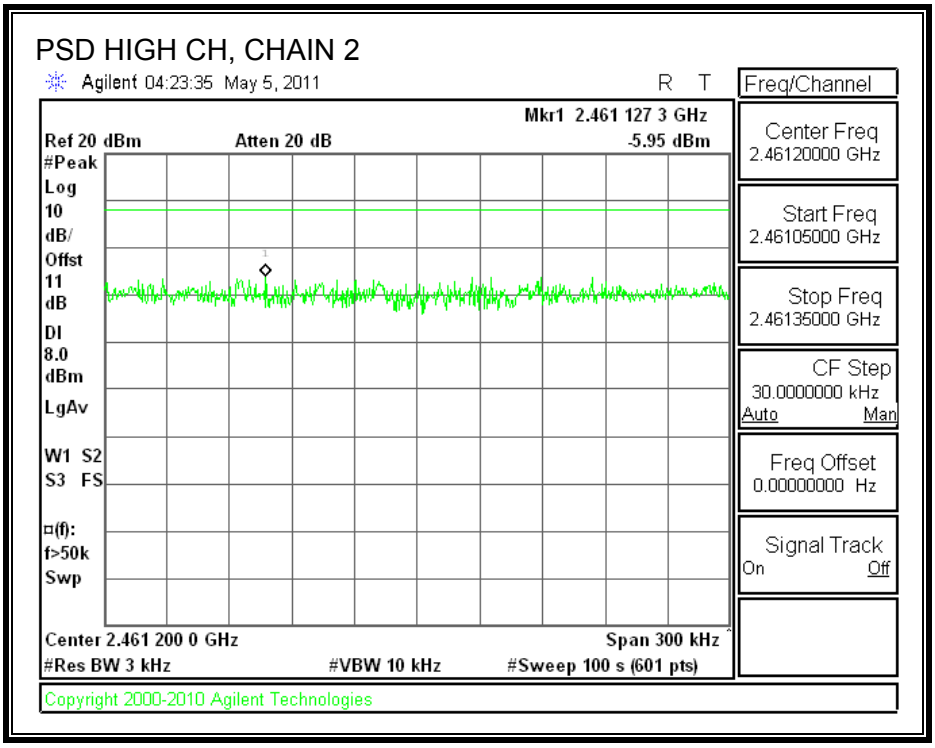




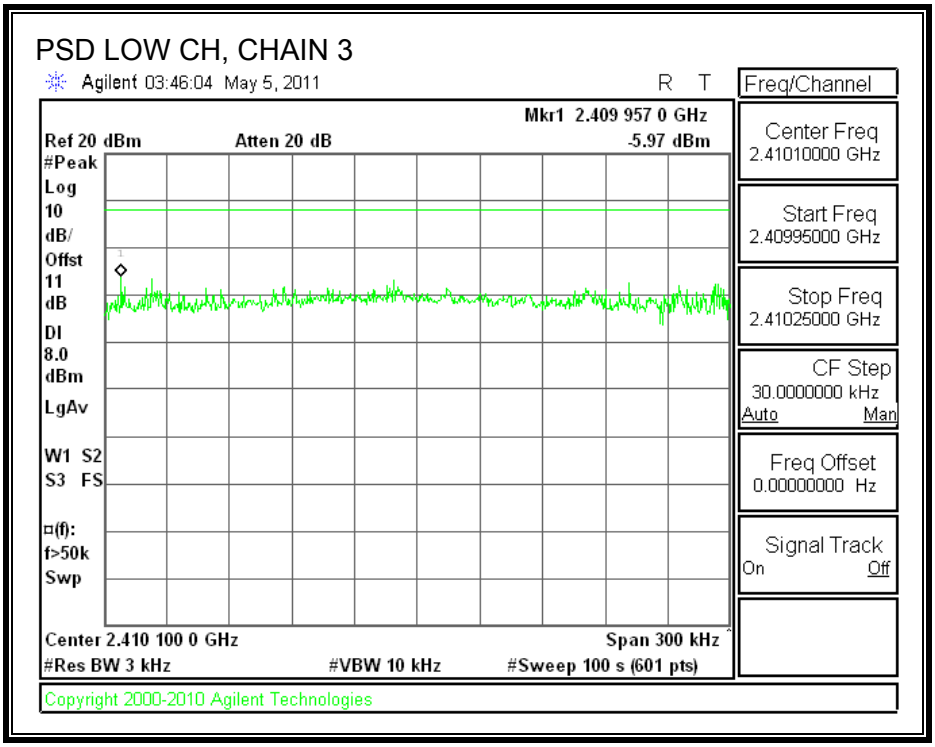
**POWER SPECTRAL DENSITY, CHAIN 2**

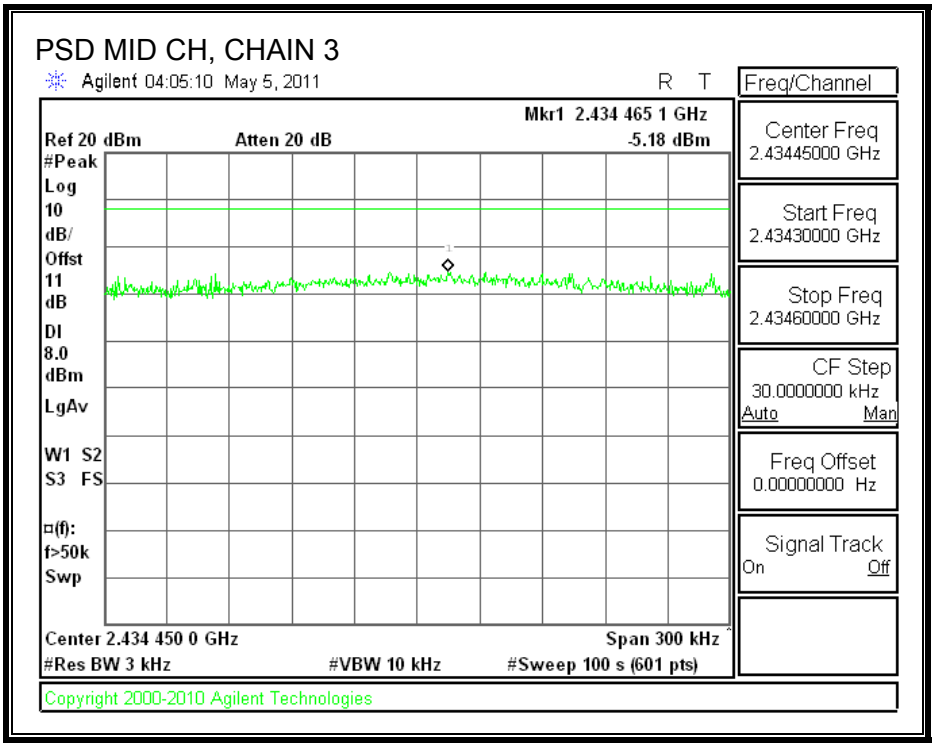


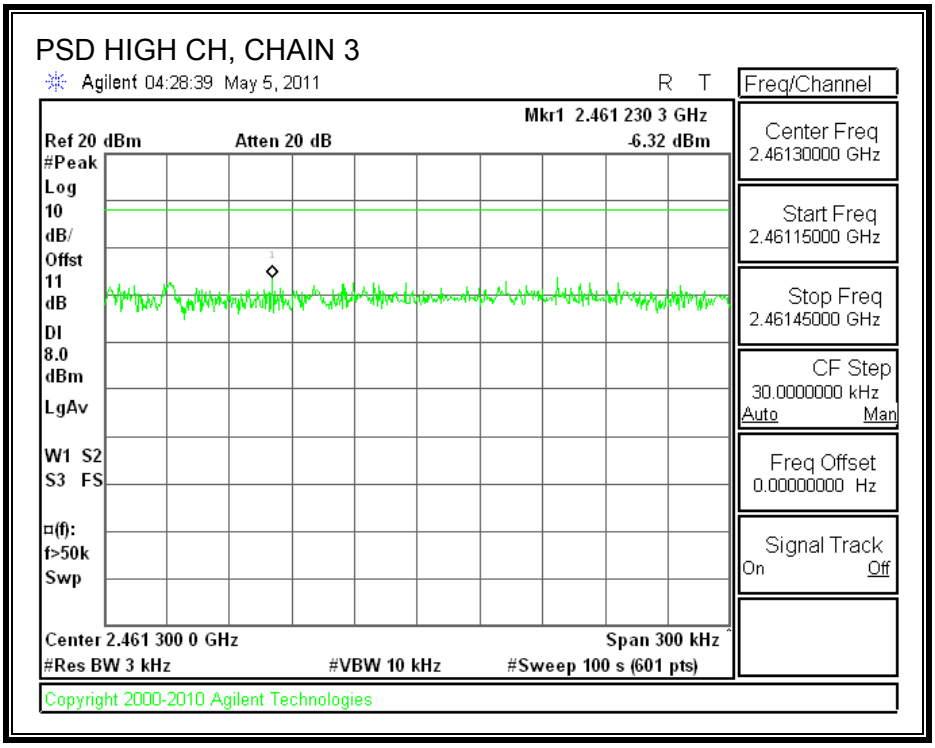




**POWER SPECTRAL DENSITY, CHAIN 3**







## 7.3.5. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of RMS averaging over 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.

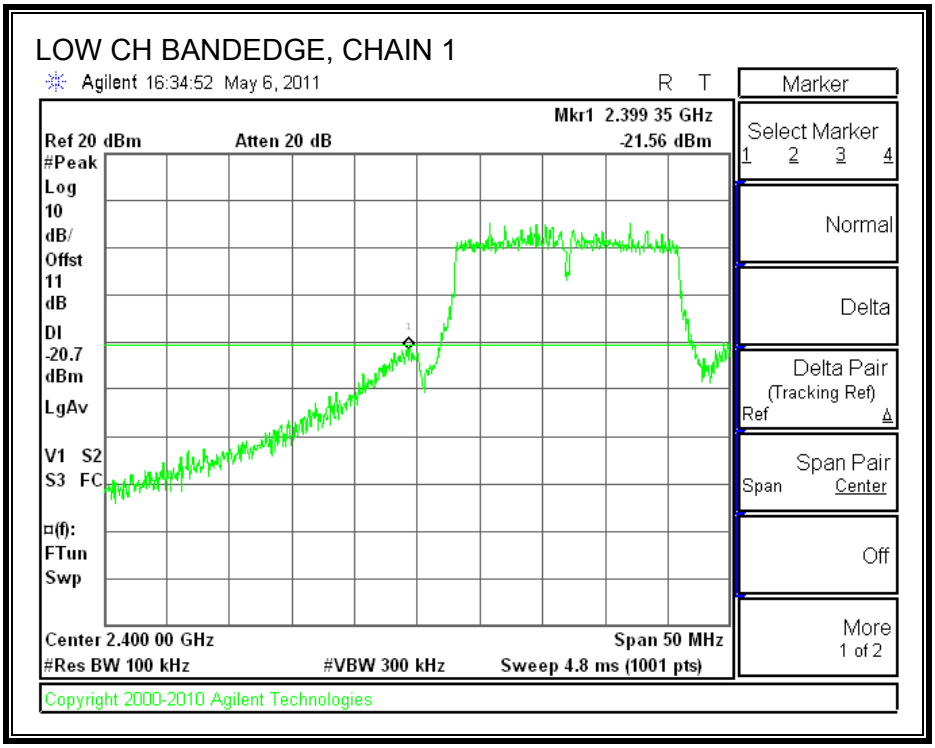
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

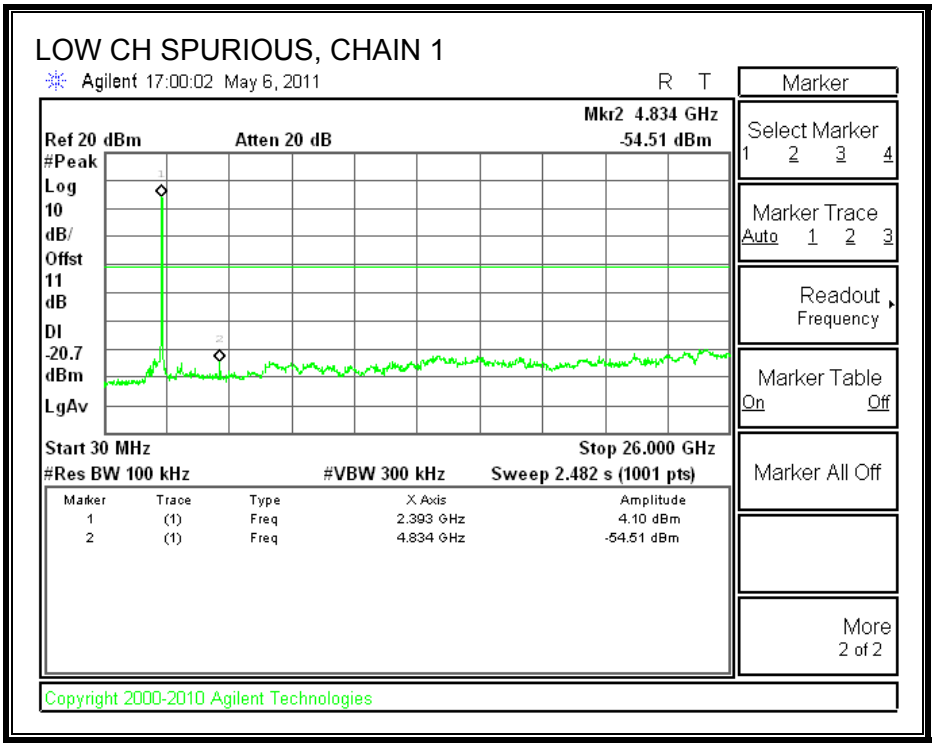
**RESULTS**

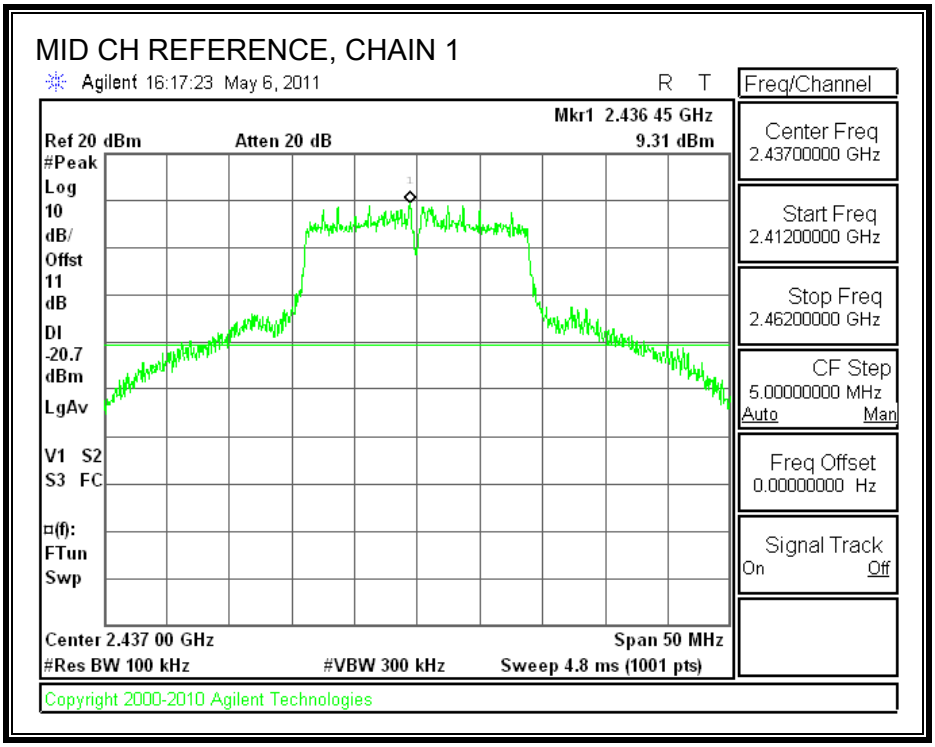
The -30dBc of low and high channels are based on mid channel reference point as highest output power.

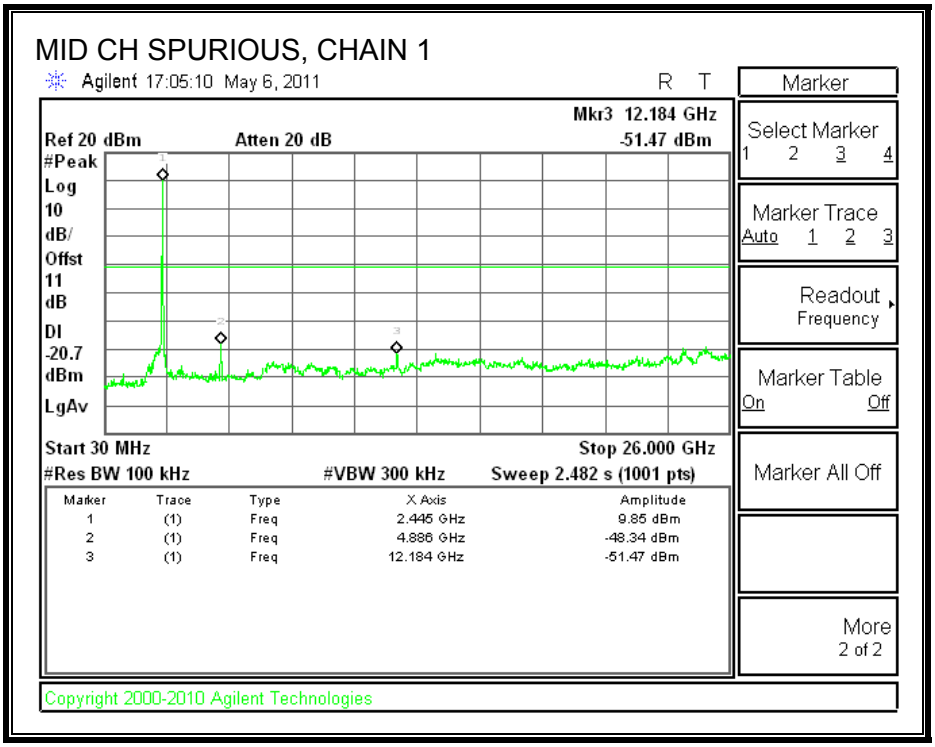
## RESULTS

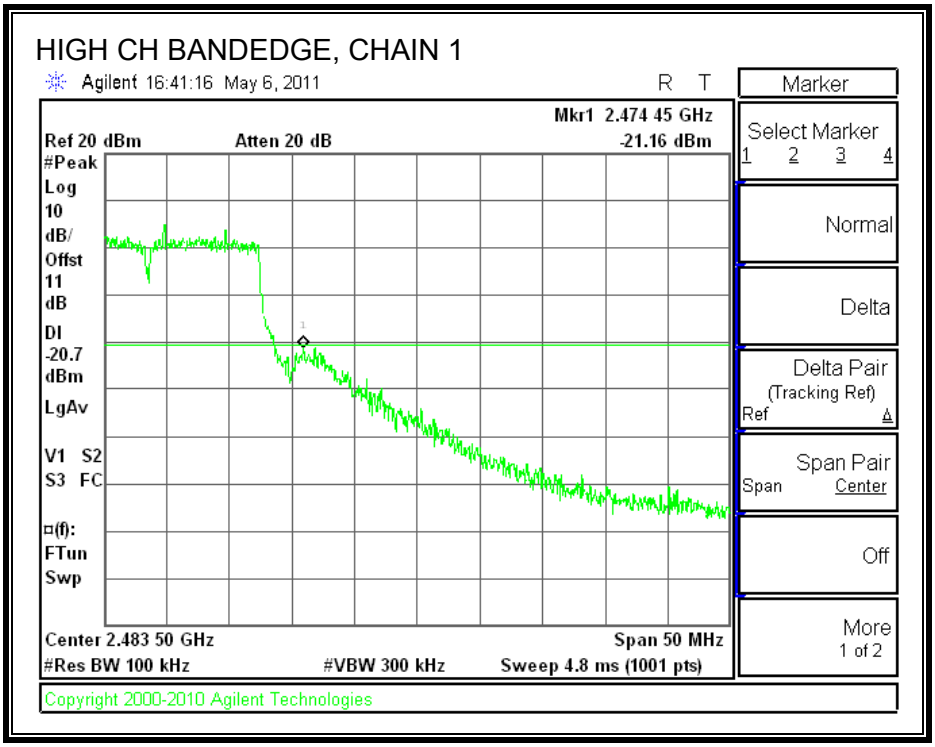
## CHAIN 1 SPURIOUS EMISSIONS

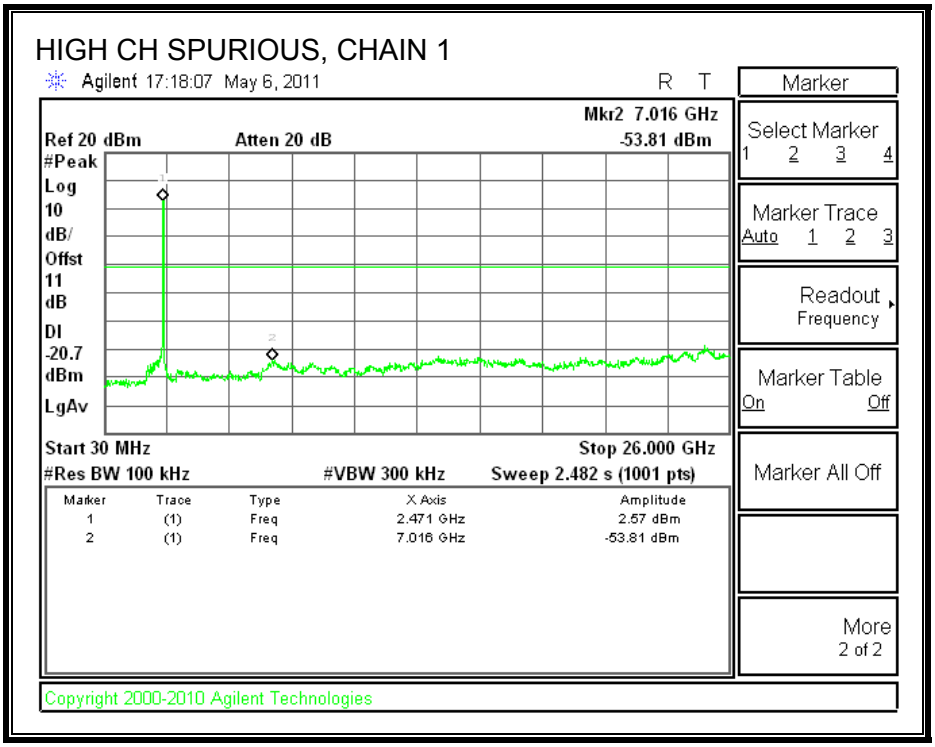




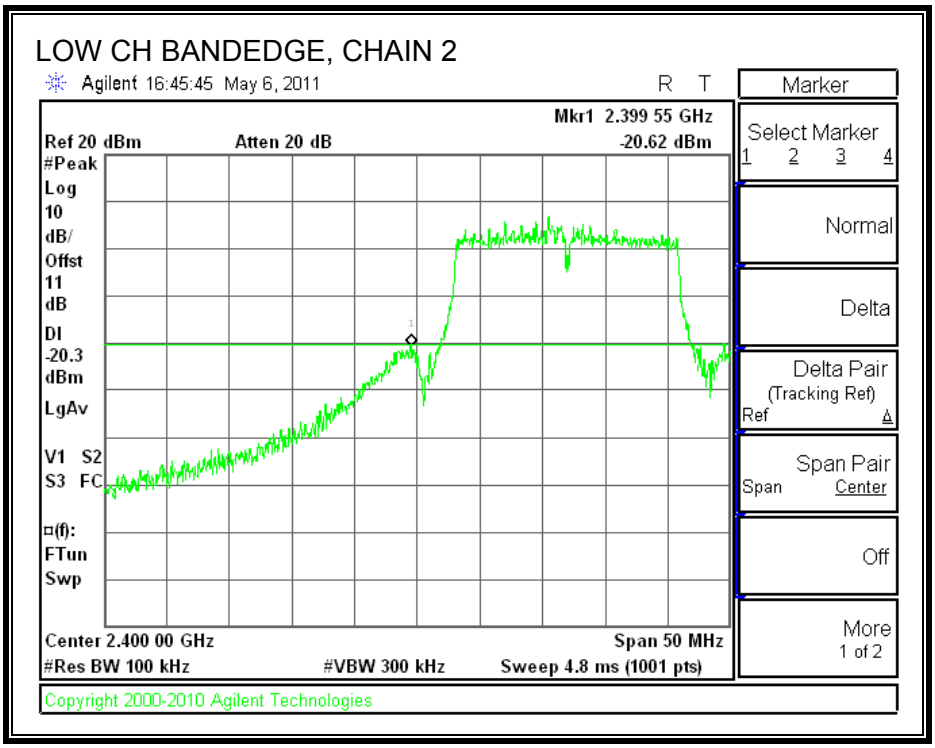


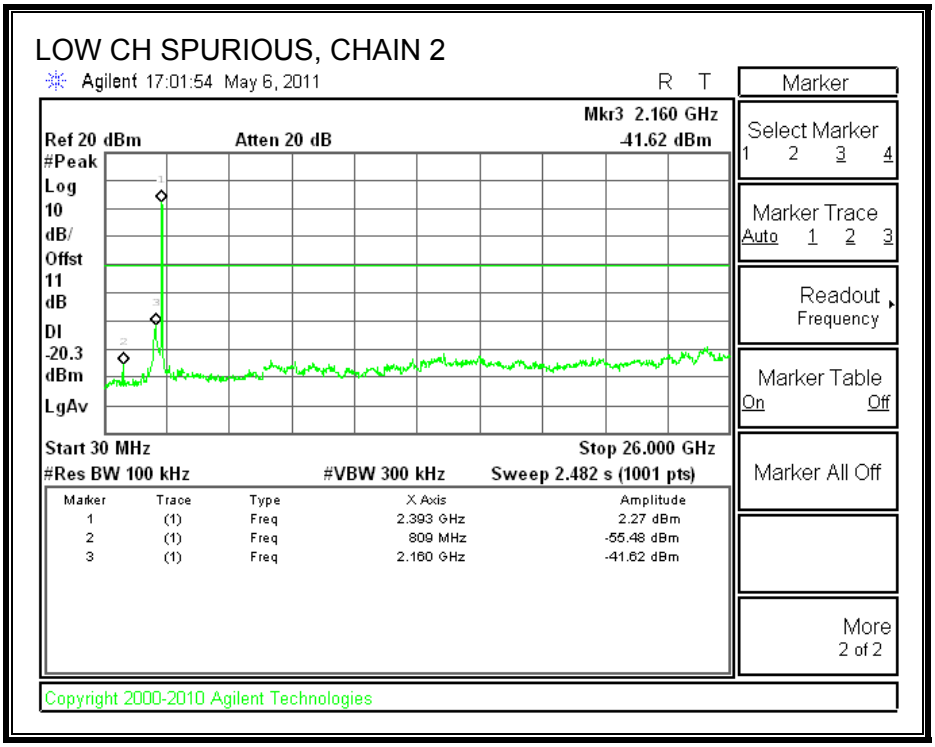




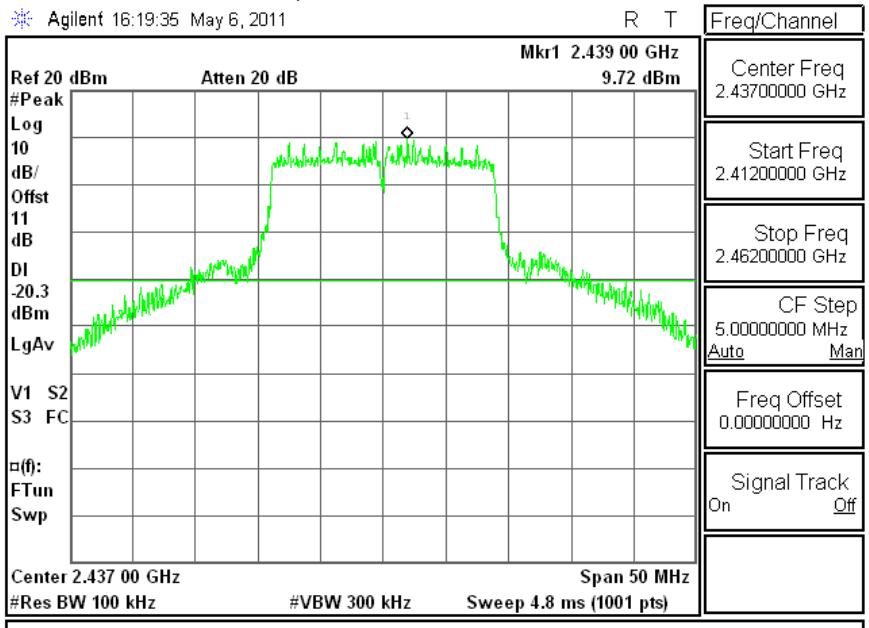


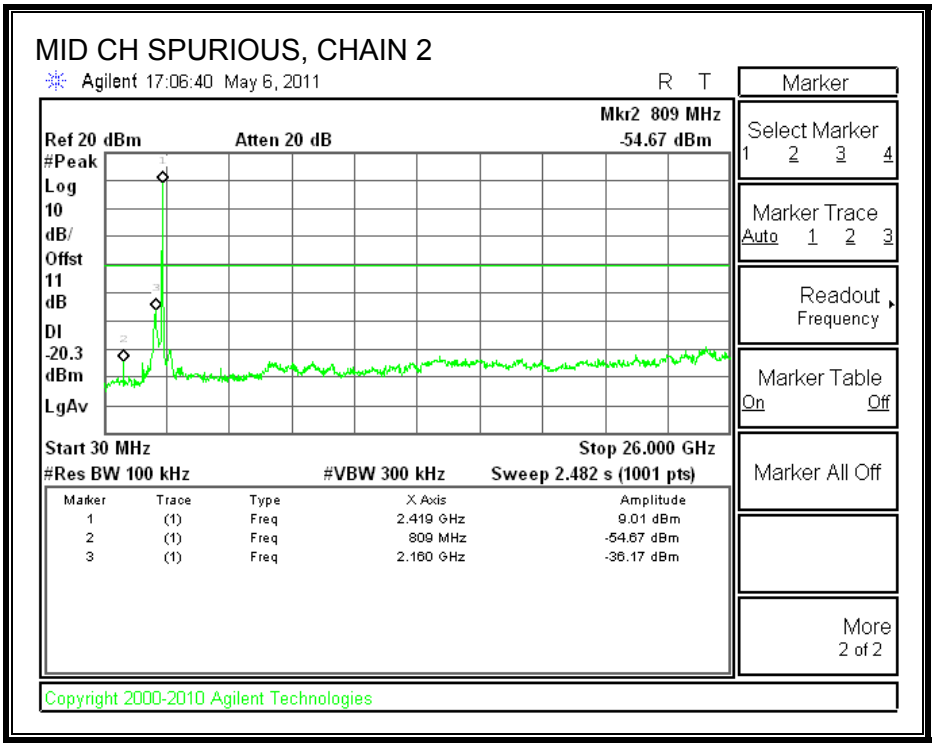
**CHAIN 2 SPURIOUS EMISSIONS**



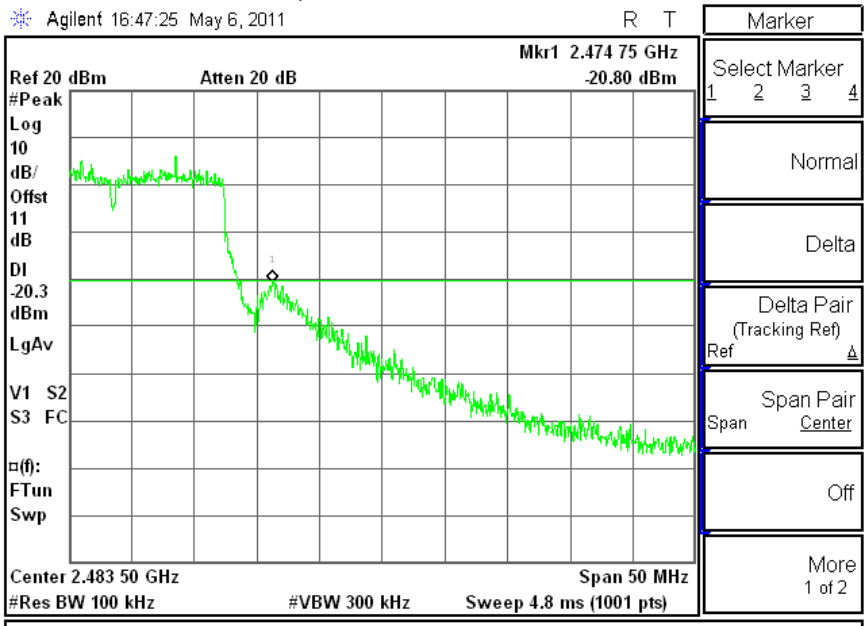


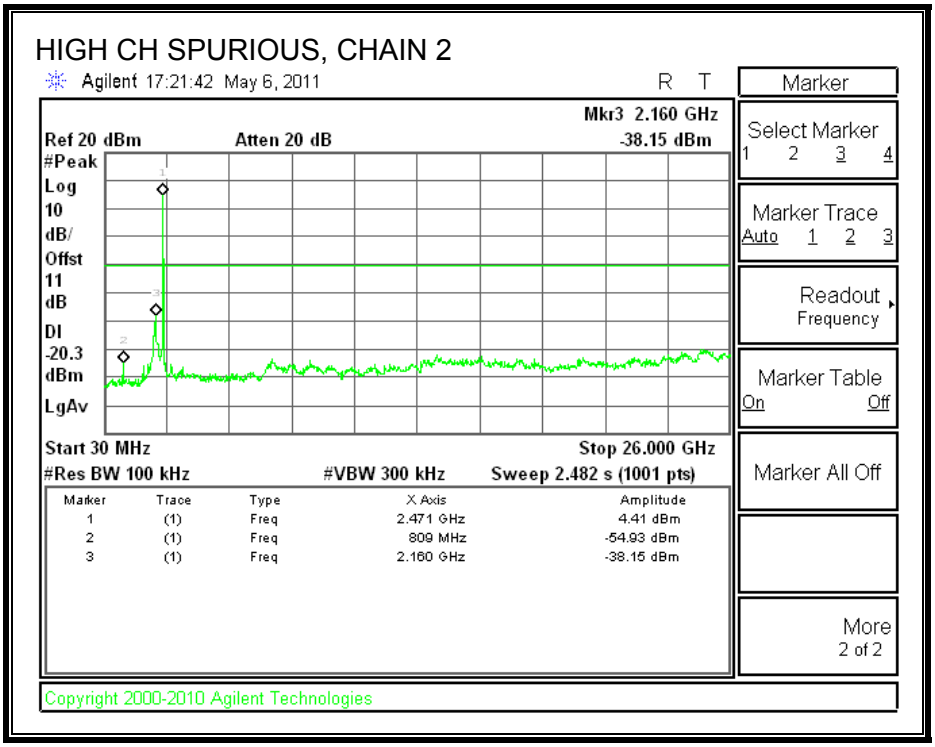
MID CH REFERENCE, CHAIN 2



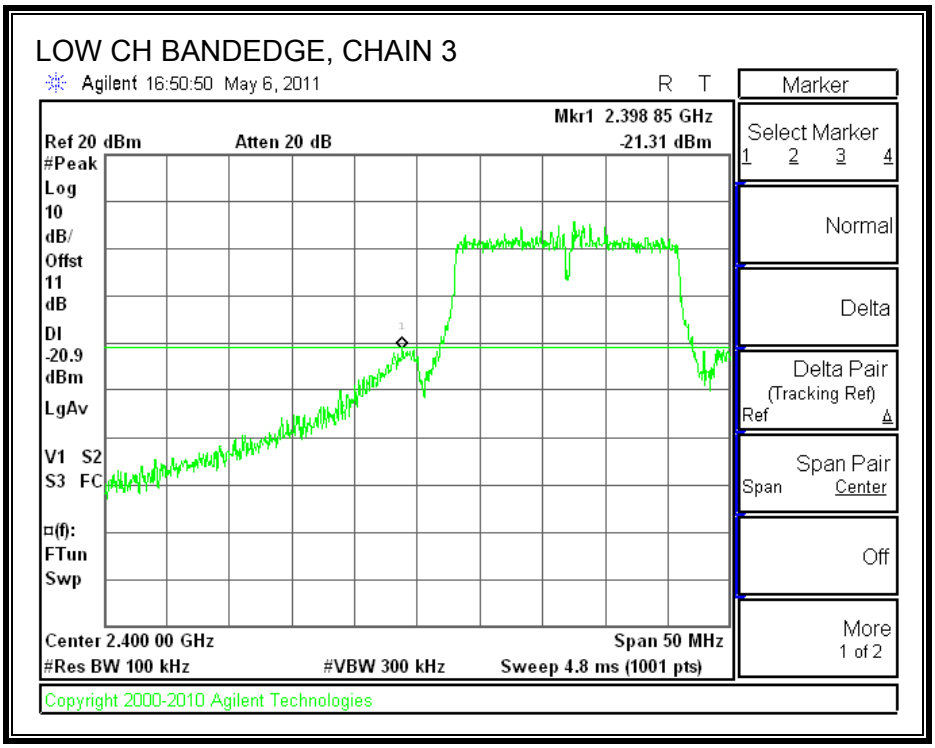


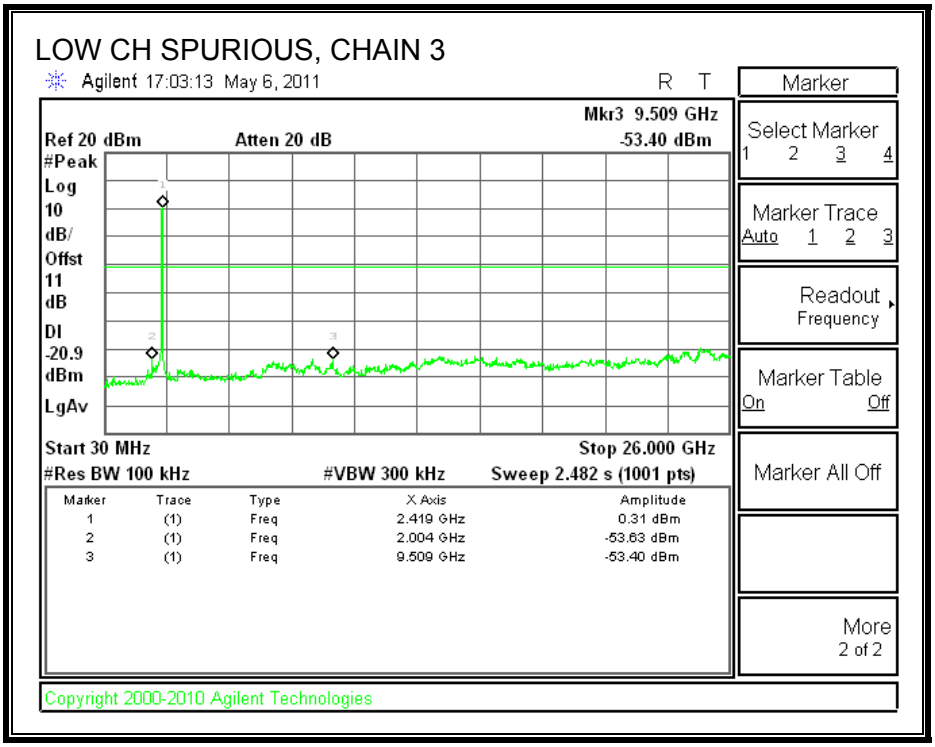
HIGH CH BANDEDGE, CHAIN 2



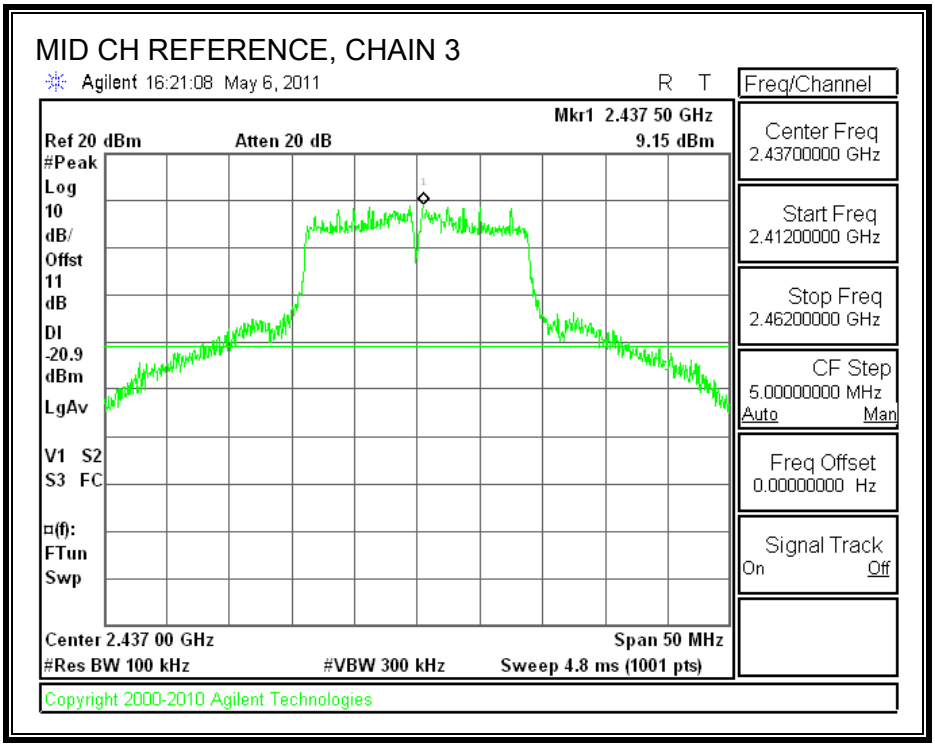


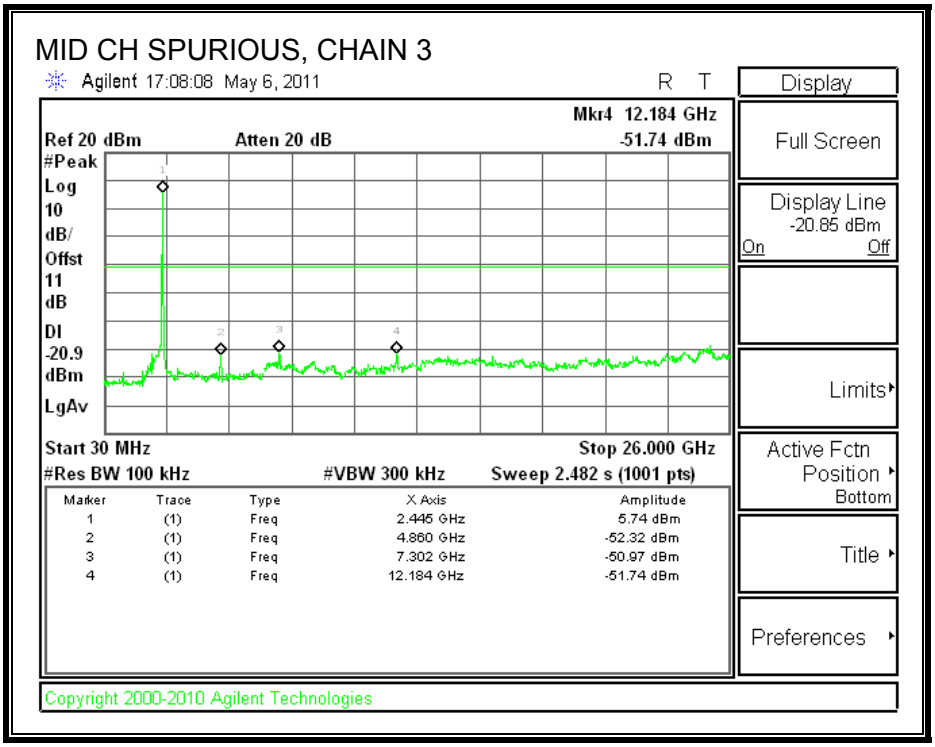
**CHAIN 3 SPURIOUS EMISSIONS**

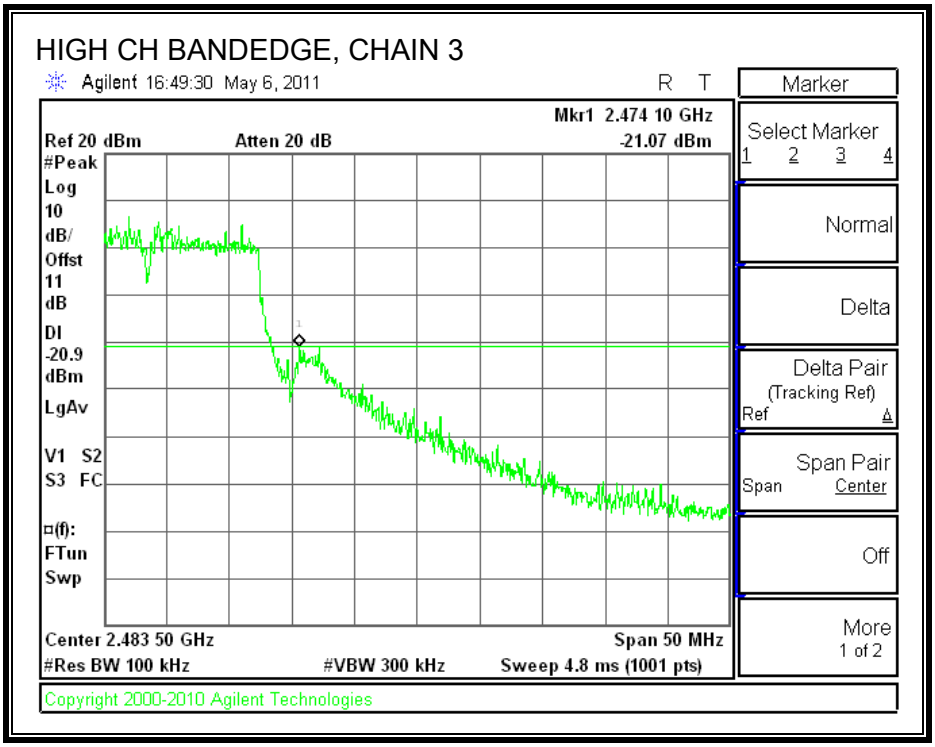


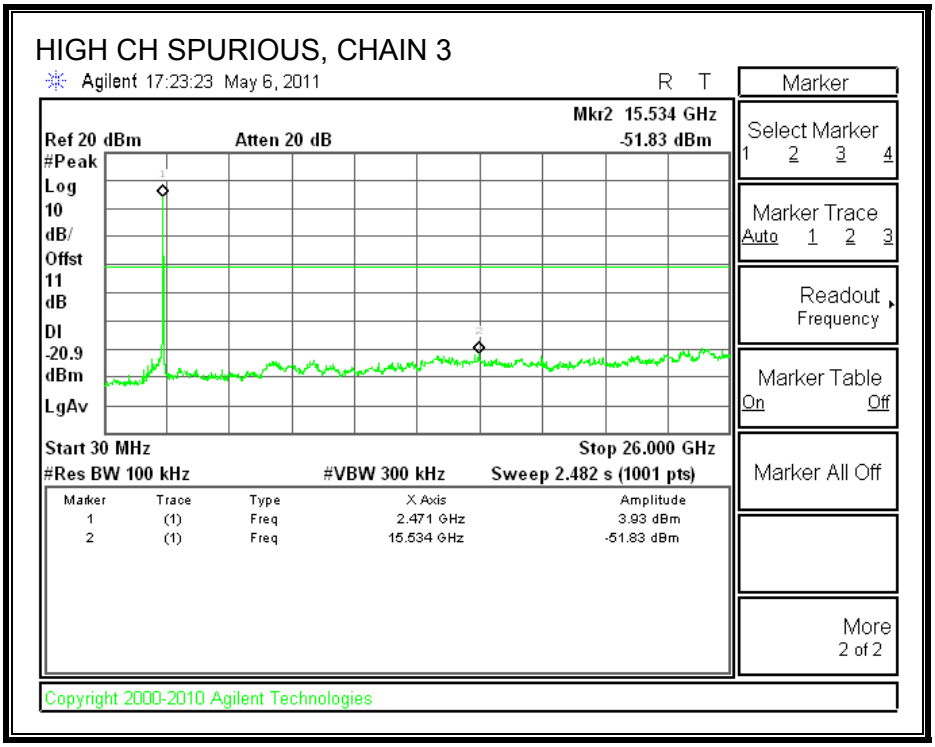


MID CH REFERENCE, CHAIN 3









# 7.4. 802.11n THREE CHAINS HT20 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.

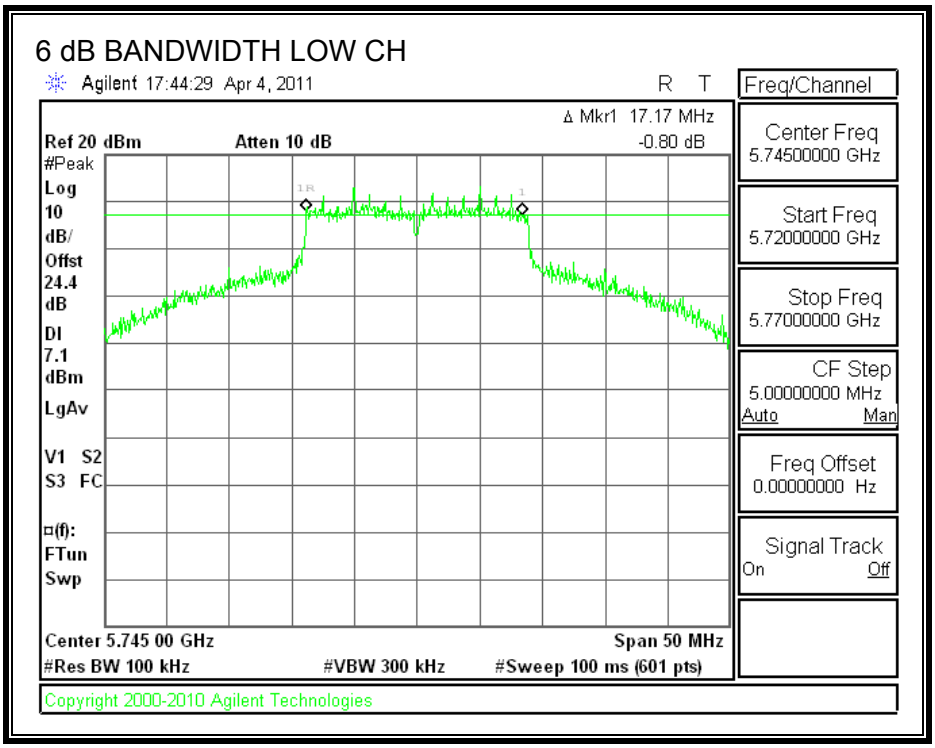
**TEST PROCEDURE**

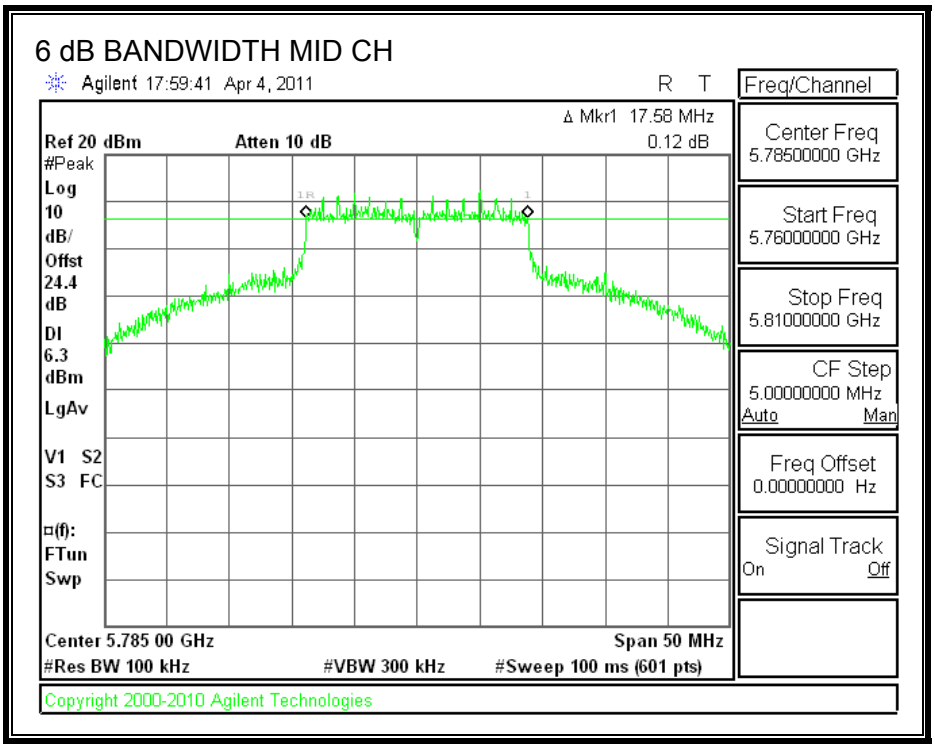
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

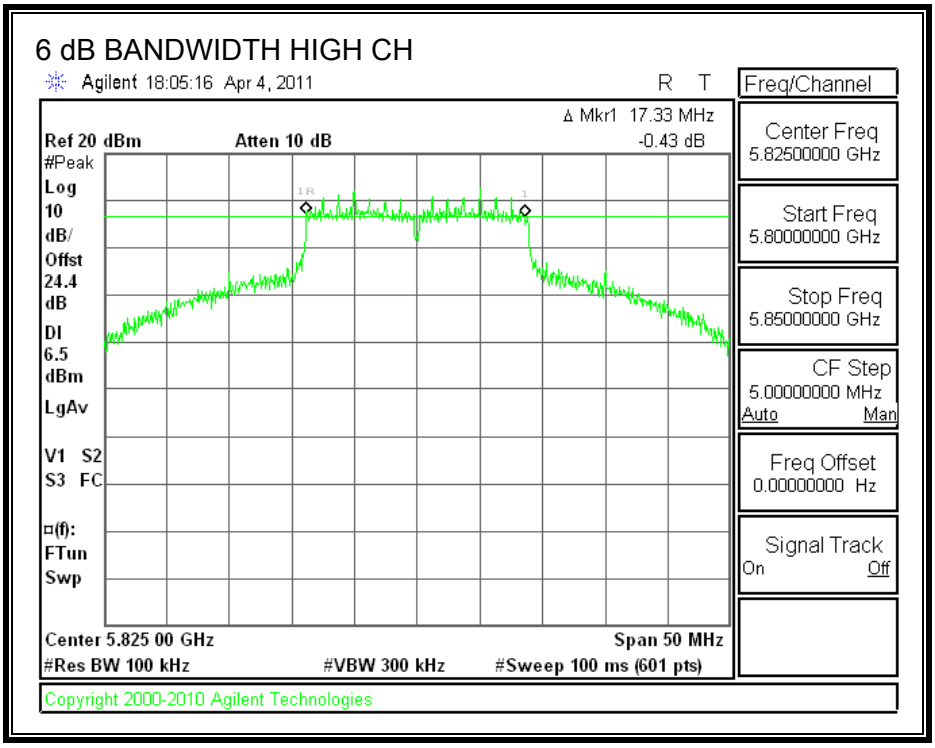
**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 5745 | 17.17 | 0.5 |
| Middle | 5785 | 17.58 | 0.5 |
| High | 5825 | 17.33 | 0.5 |

**6 dB BANDWIDTH**





### 7.4.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

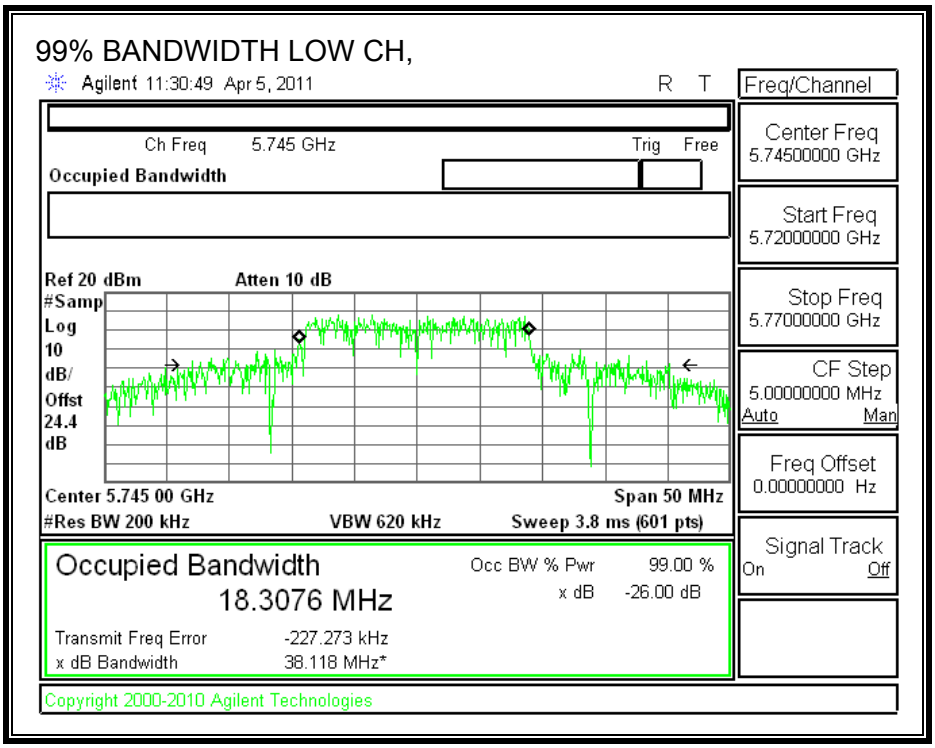
**TEST PROCEDURE**

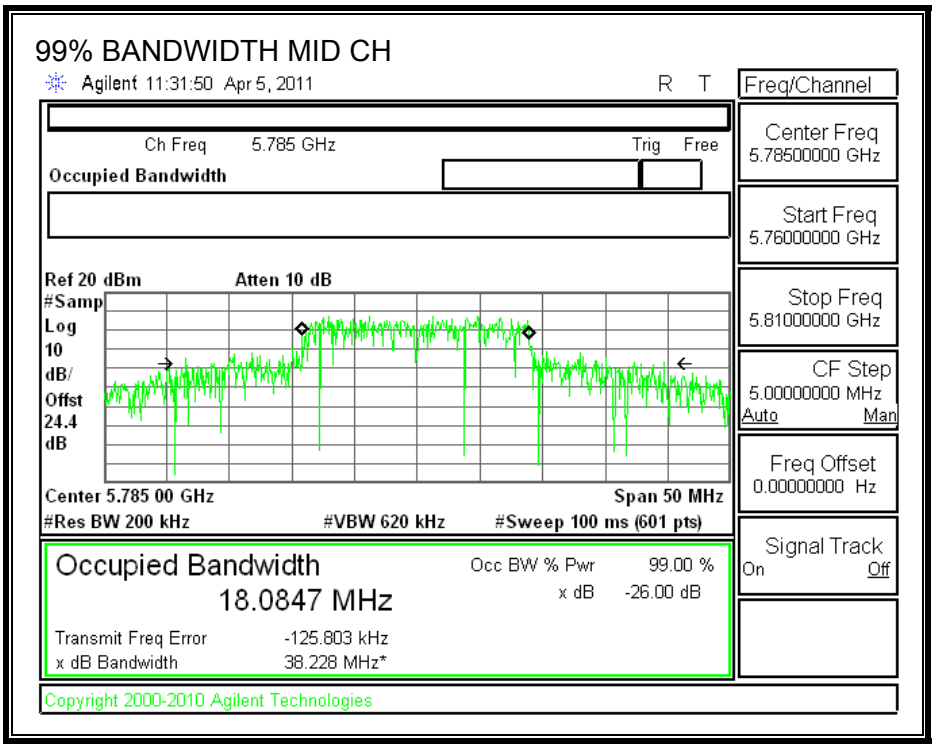
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

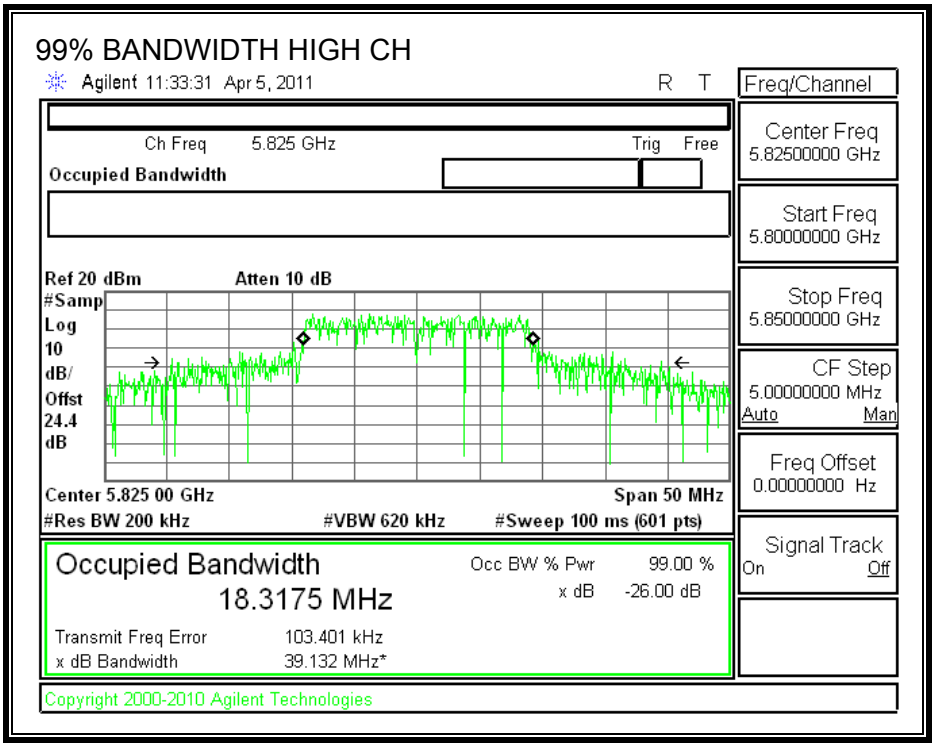
**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 5745 | 18.3076 |
| Middle | 5785 | 18.0847 |
| High | 5825 | 18.3175 |

**99% BANDWIDTH**





## 7.4.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The composite antenna gain is equal to 8.40 dBi, therefore the limit is 27.60 dBm.

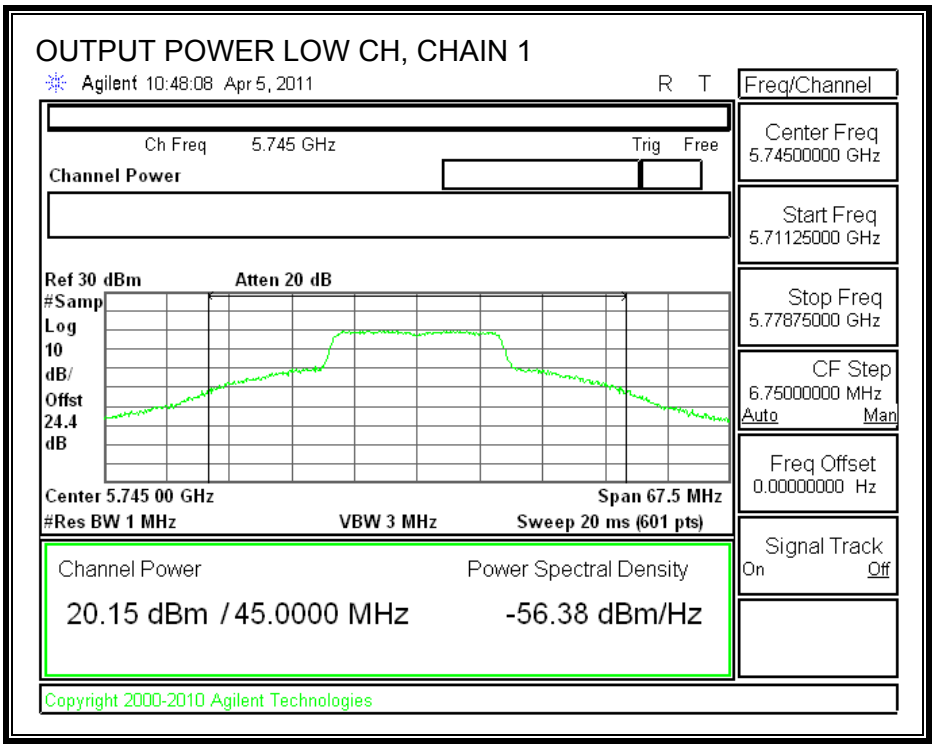
**TEST PROCEDURE – UNII METHOD**

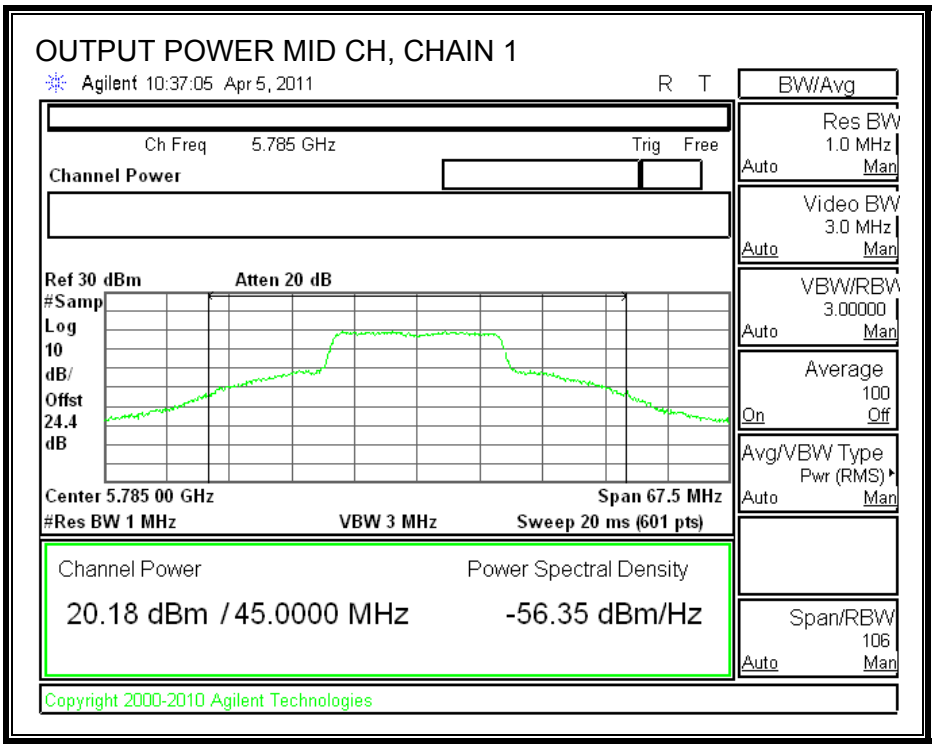
Output power was measured based on the use of RMS averaging over a time interval in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

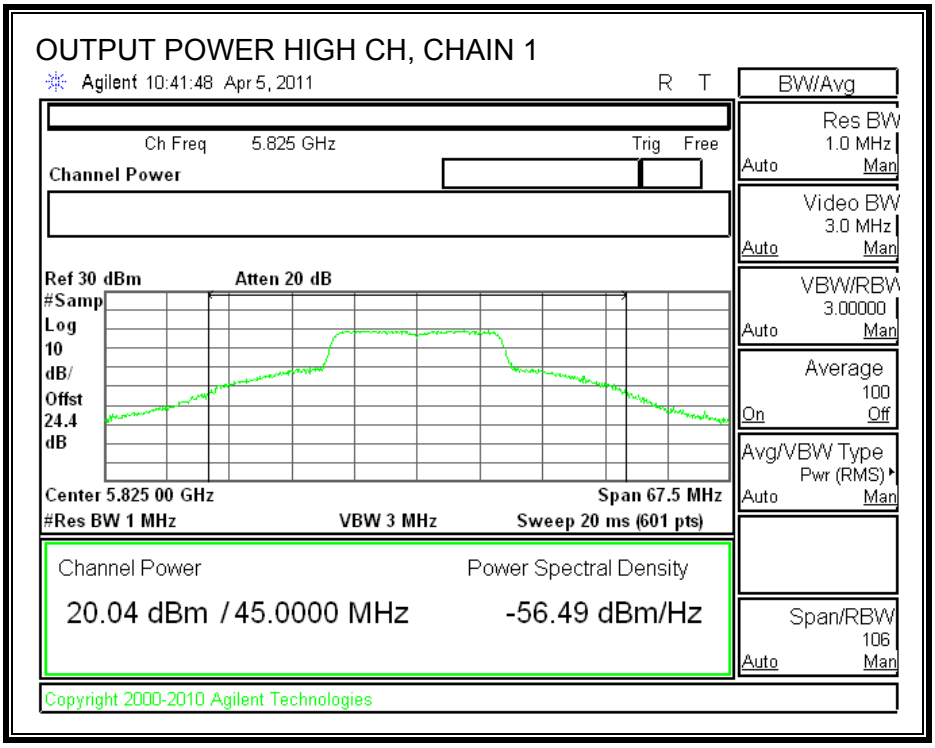
**RESULTS**

| Channel | Frequency (MHz) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5745 | 20.15 | 20.13 | 20.19 | 24.93 | 27.60 | -2.67 |
| Mid | 5785 | 20.18 | 20.26 | 20.05 | 24.94 | 27.60 | -2.66 |
| High | 5825 | 20.04 | 20.13 | 20.04 | 24.84 | 27.60 | -2.76 |

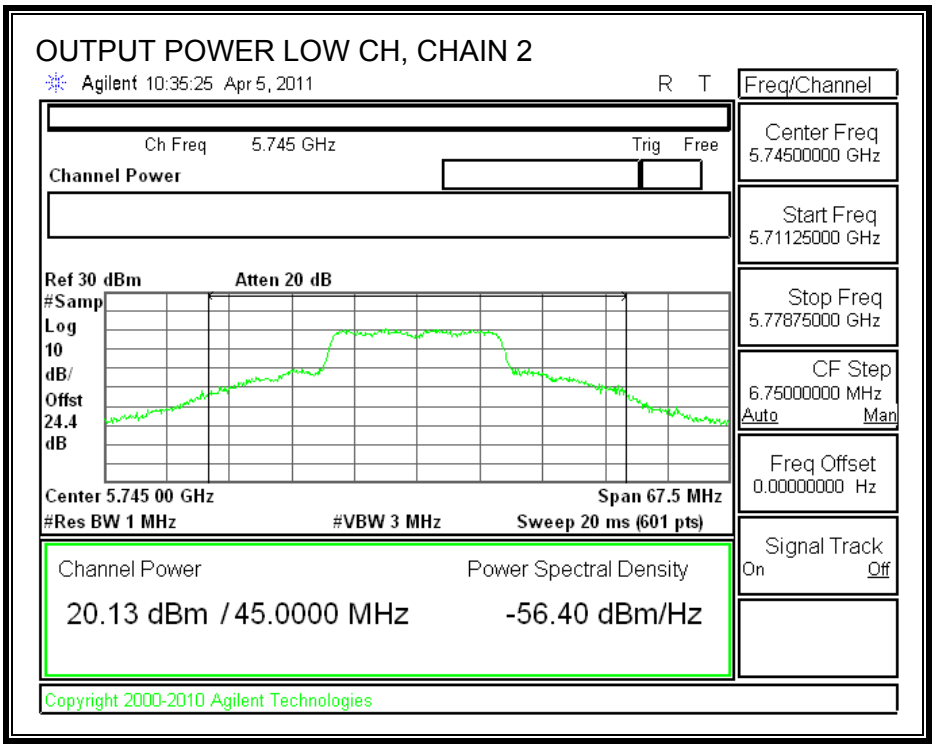
**CHAIN 1 OUTPUT POWER**

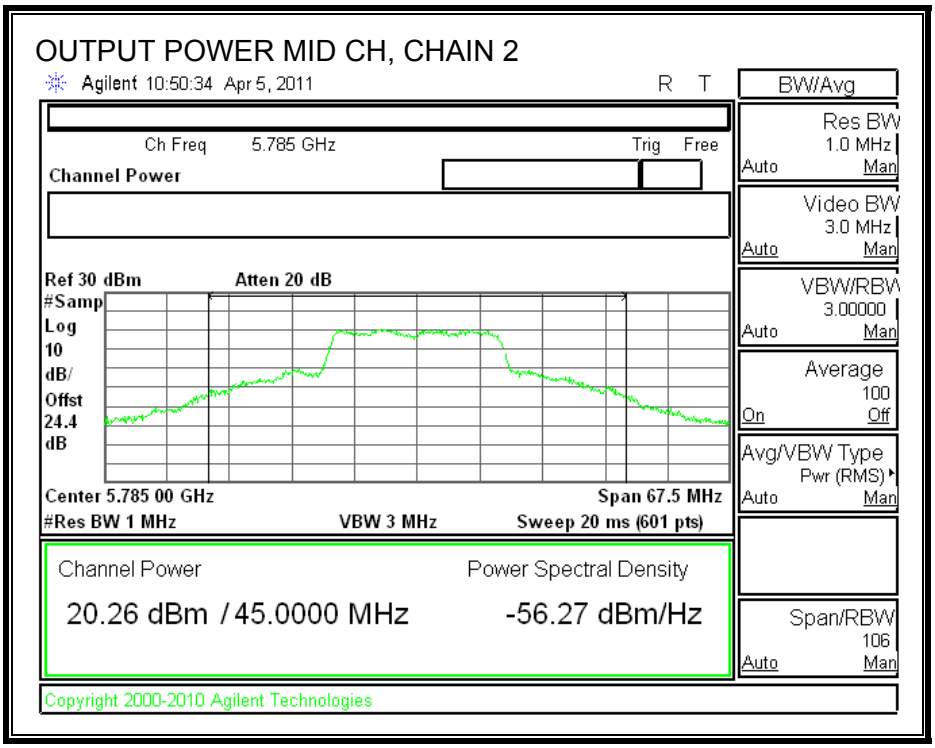


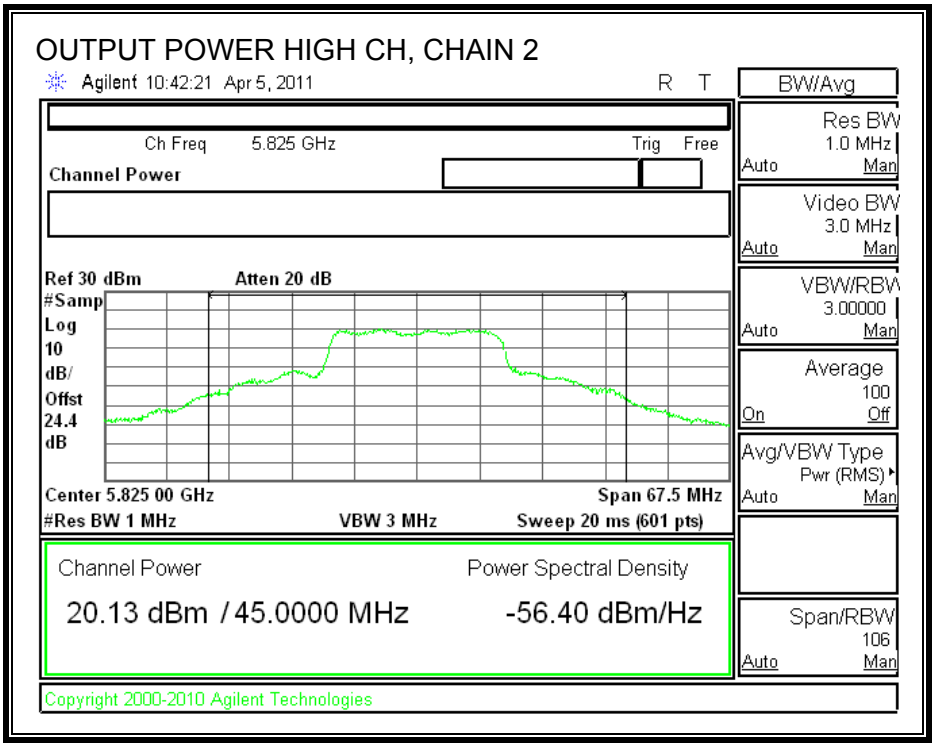





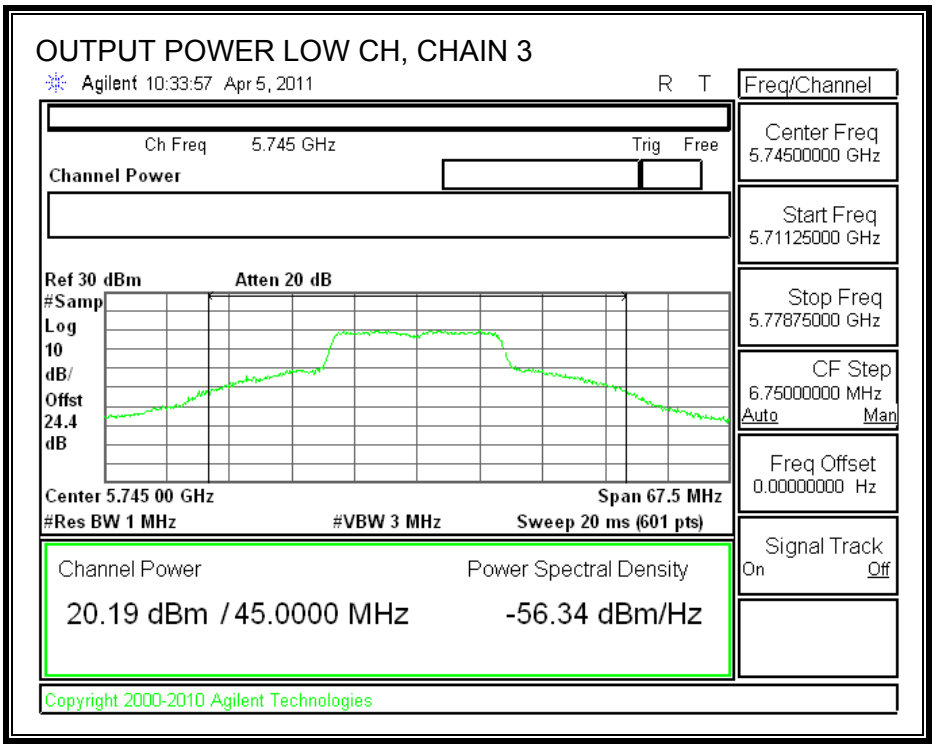
**CHAIN 2 OUTPUT POWER**

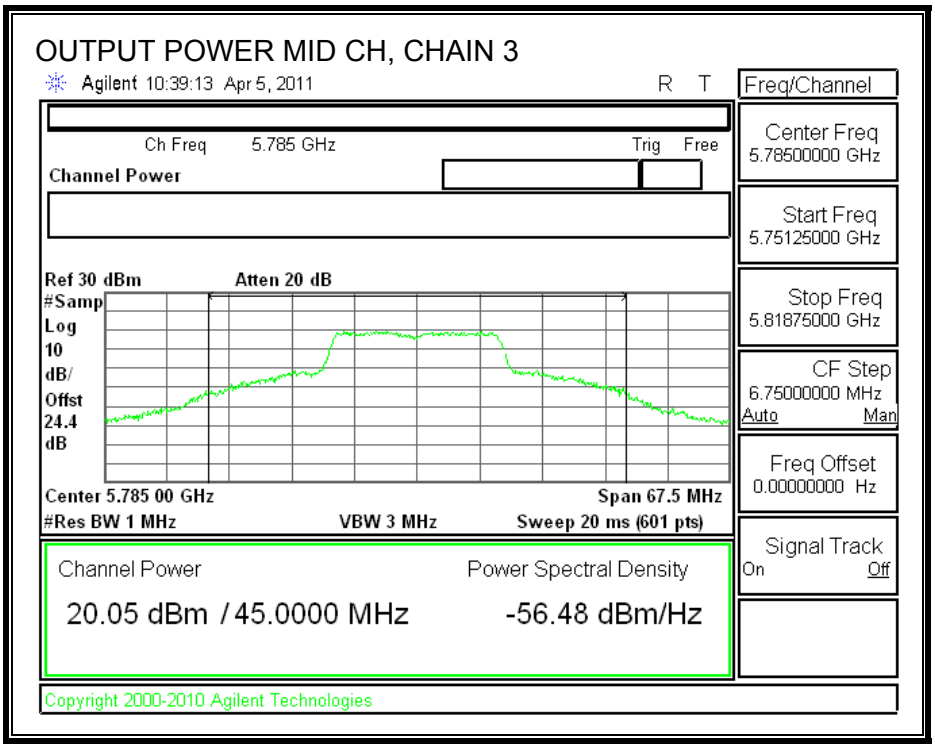


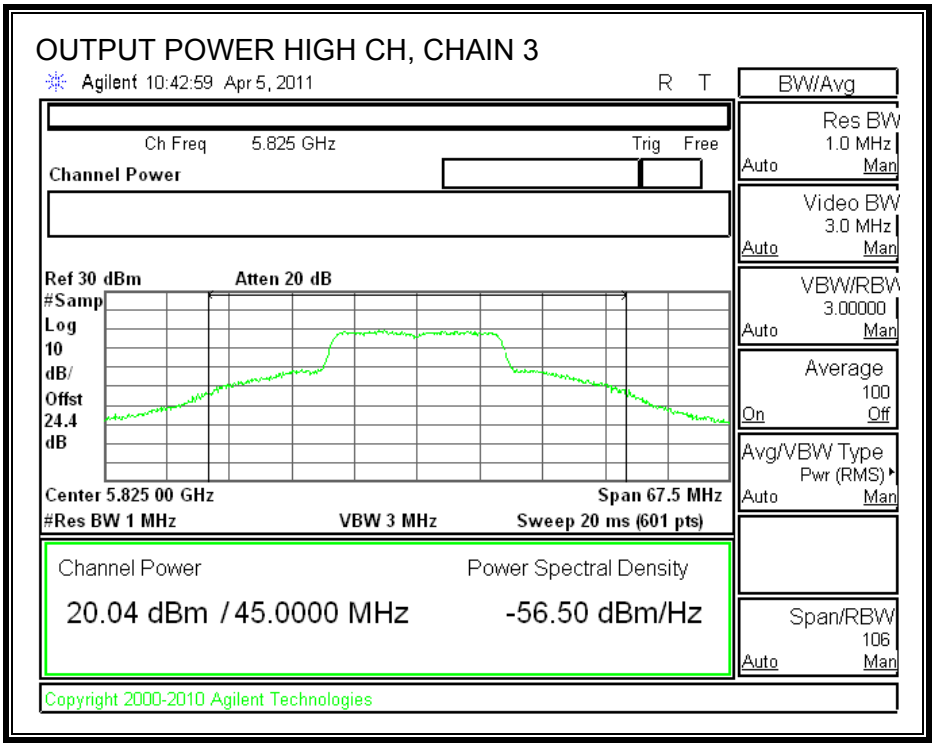





**CHAIN 3 OUTPUT POWER**





## 7.4.1. 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 11.40 dB (including 10 dB pad and 1.40 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 | 19.22 | 19.23 | 19.15 | 23.97 |
| Middle | 5785 | 19.13 | 19.25 | 19.15 | 23.95 |
| High | 5825 | 19.14 | 19.16 | 19.10 | 23.90 |

## 7.4.2. 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.

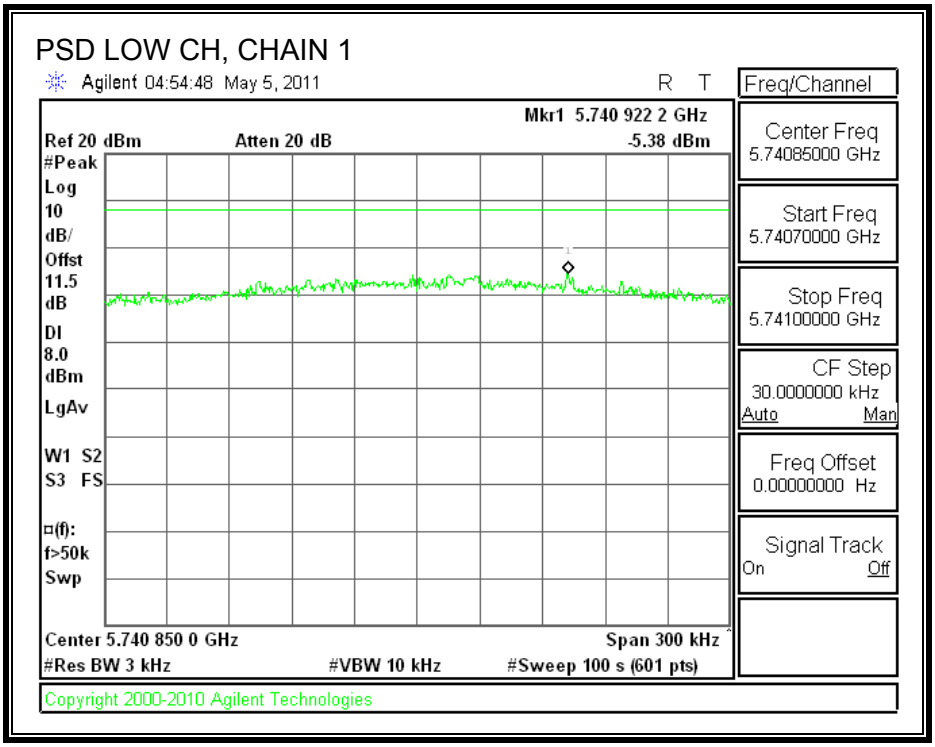
**TEST PROCEDURE**

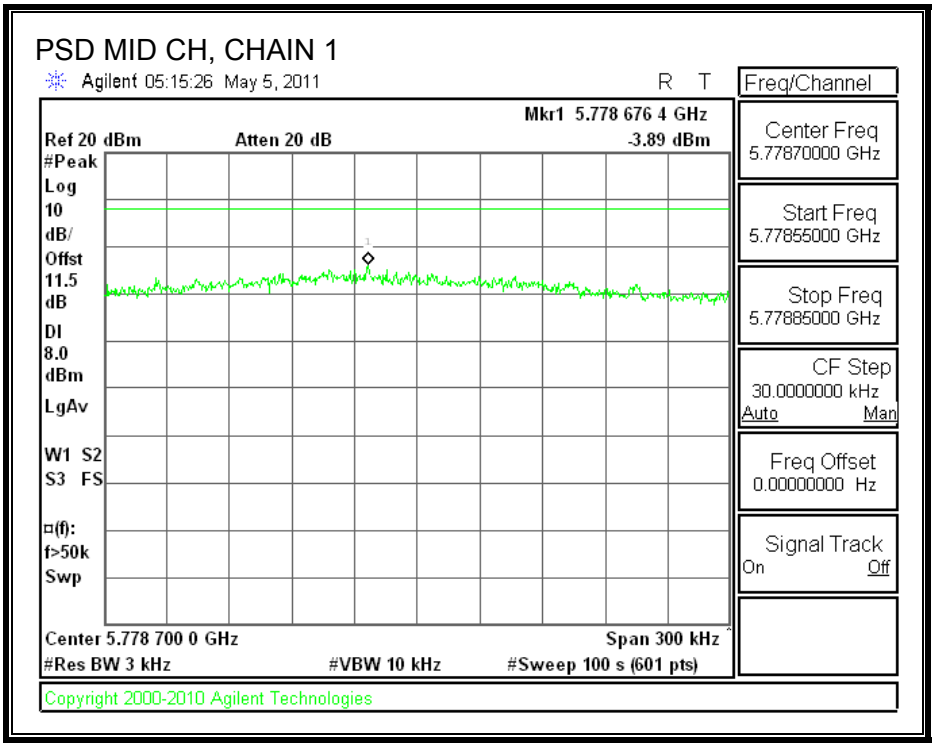
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

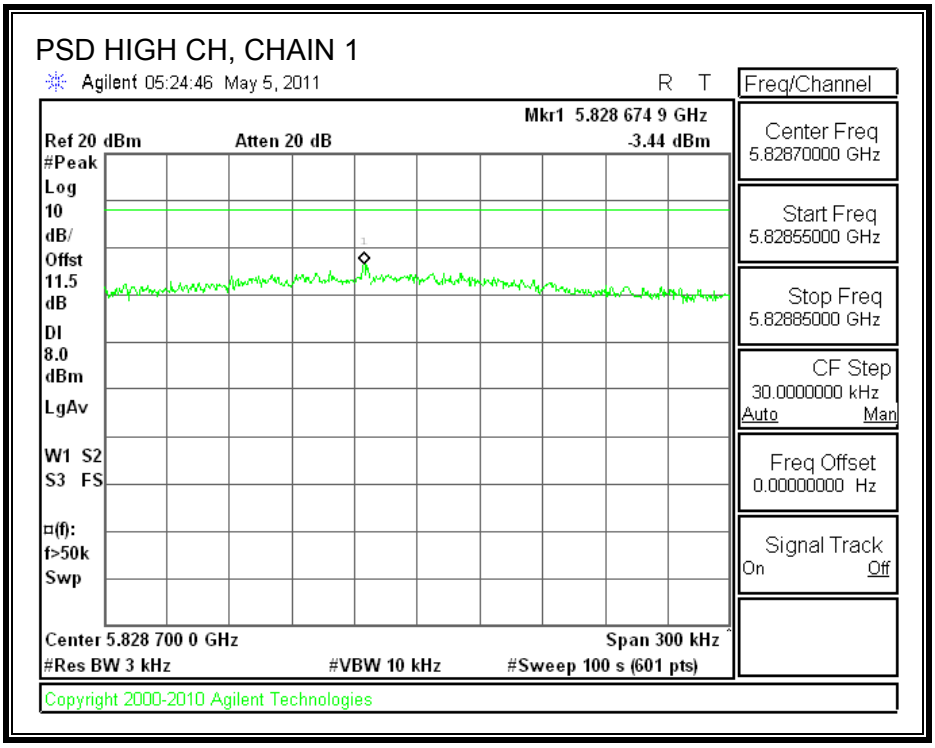
**RESULTS:**

| Channel | Frequency (MHz) | Chain 1 PSD (dBm) | Chain 2 PSD (dBm) | Chain 3 PSD (dBm) | Total PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5745 | -5.38 | -3.54 | -3.93 | 0.56 | 8 | -7.44 |
| Middle | 5785 | -3.89 | -3.04 | -3.14 | 1.43 | 8 | -6.57 |
| High | 5825 | -3.44 | -1.77 | -3.13 | 2.05 | 8 | -5.95 |

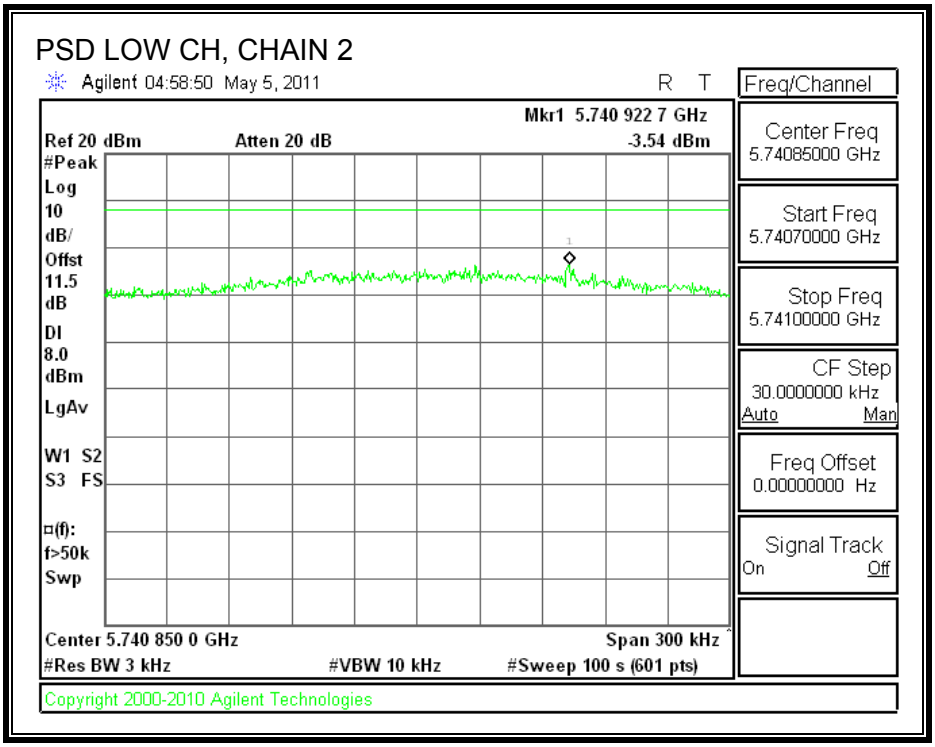
**POWER SPECTRAL DENSITY, CHAIN 1**

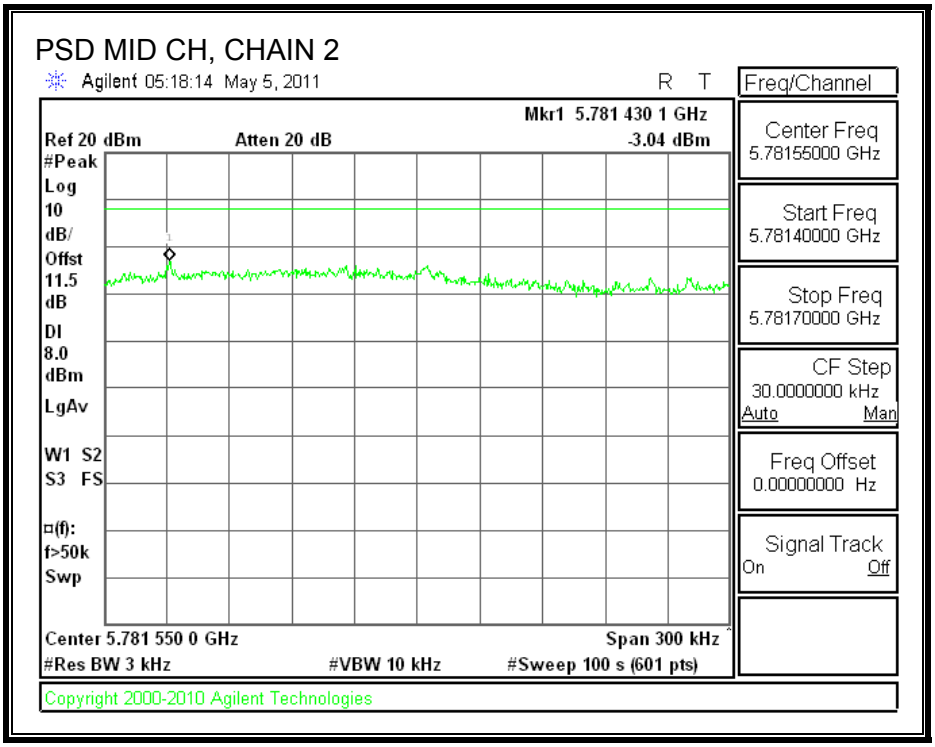


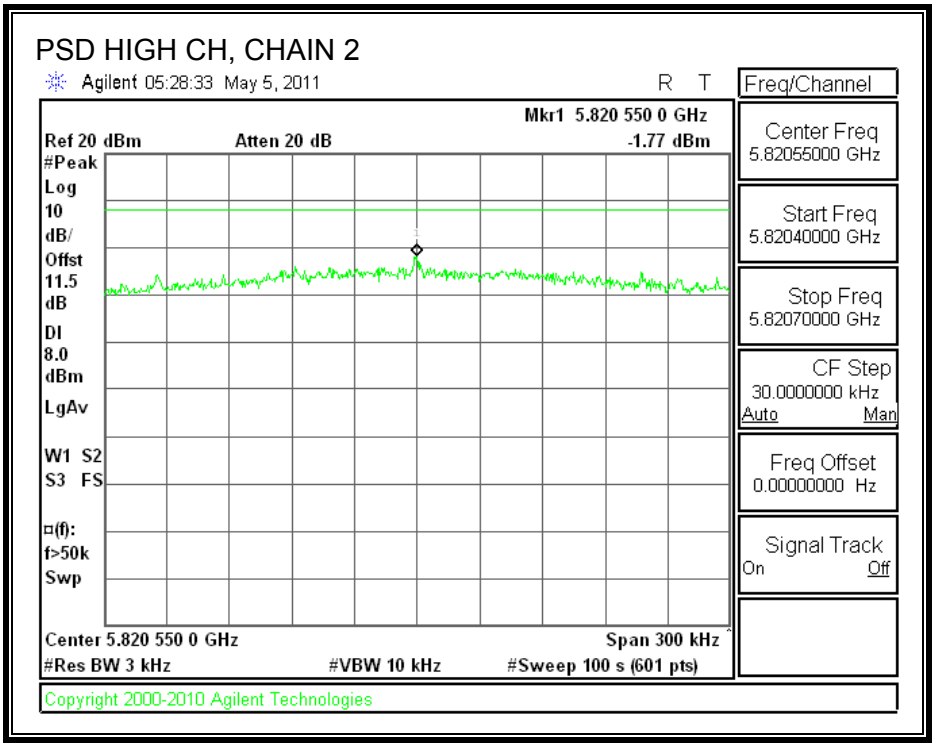




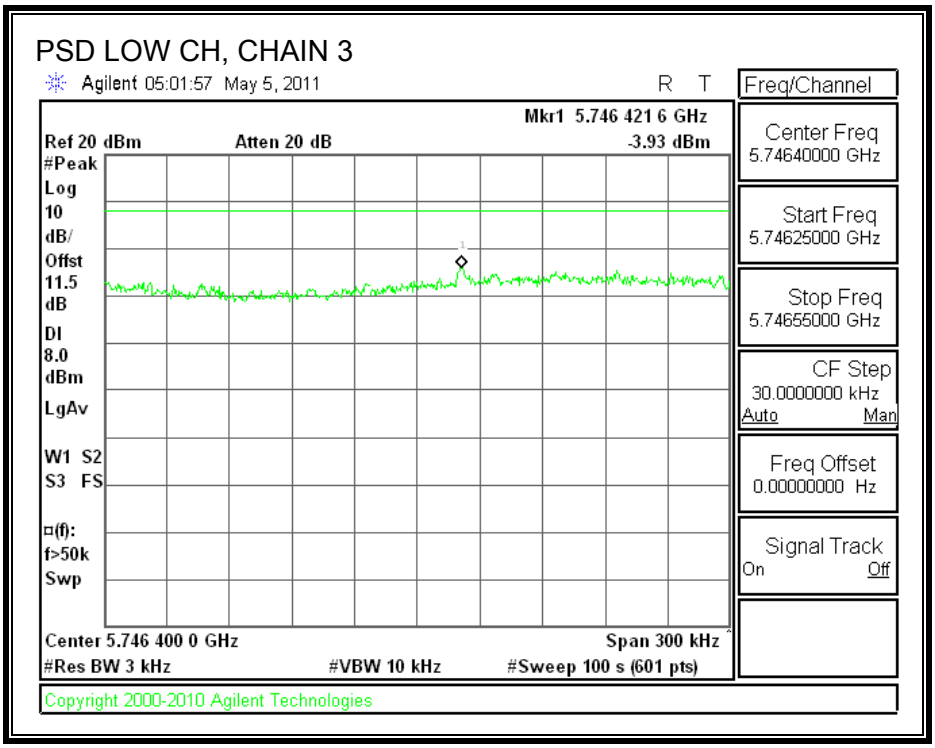
**POWER SPECTRAL DENSITY, CHAIN 2**

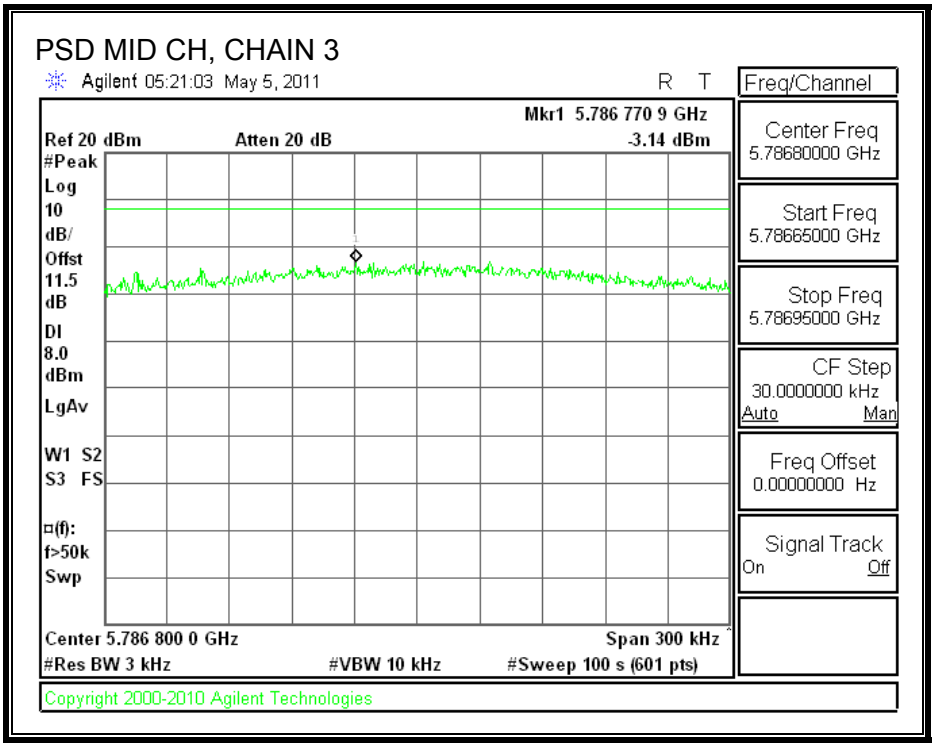


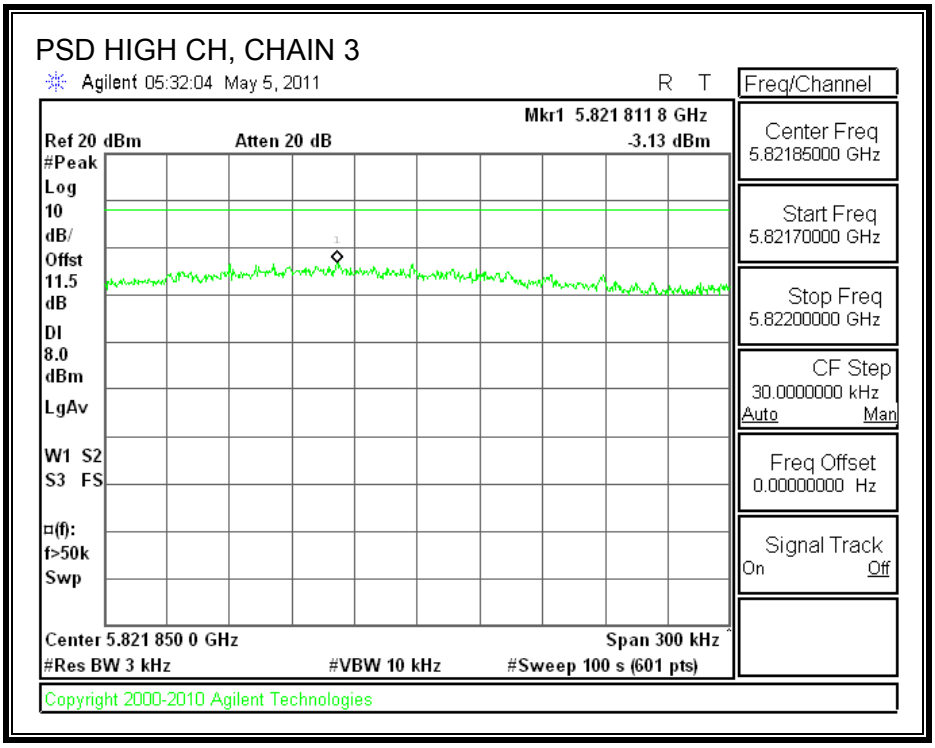




**POWER SPECTRAL DENSITY, CHAIN 3**







## 7.4.3. 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.

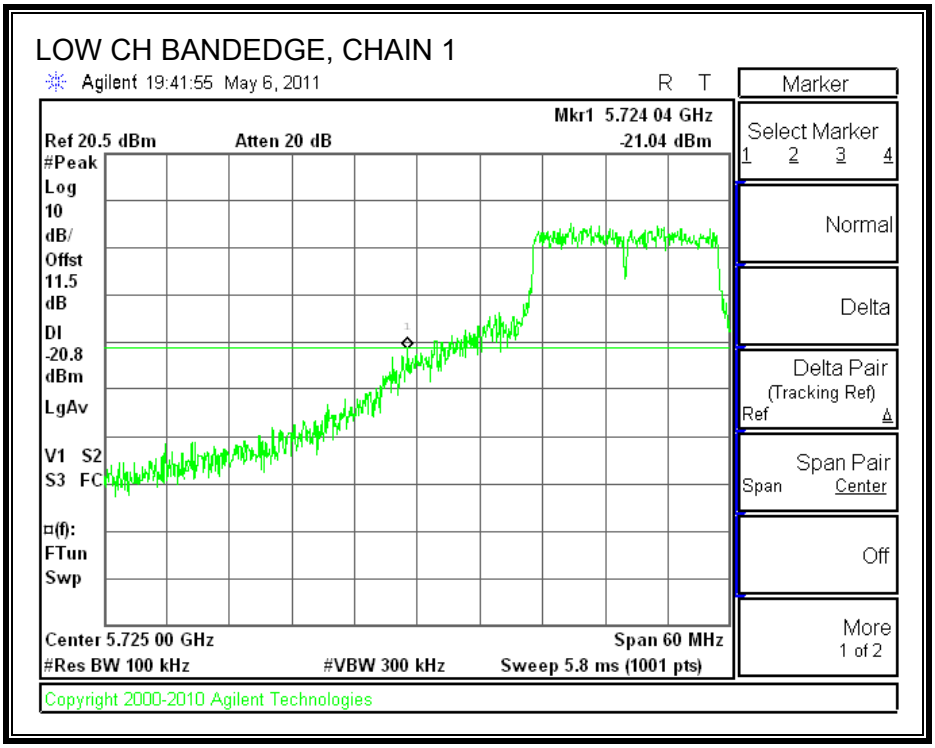
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

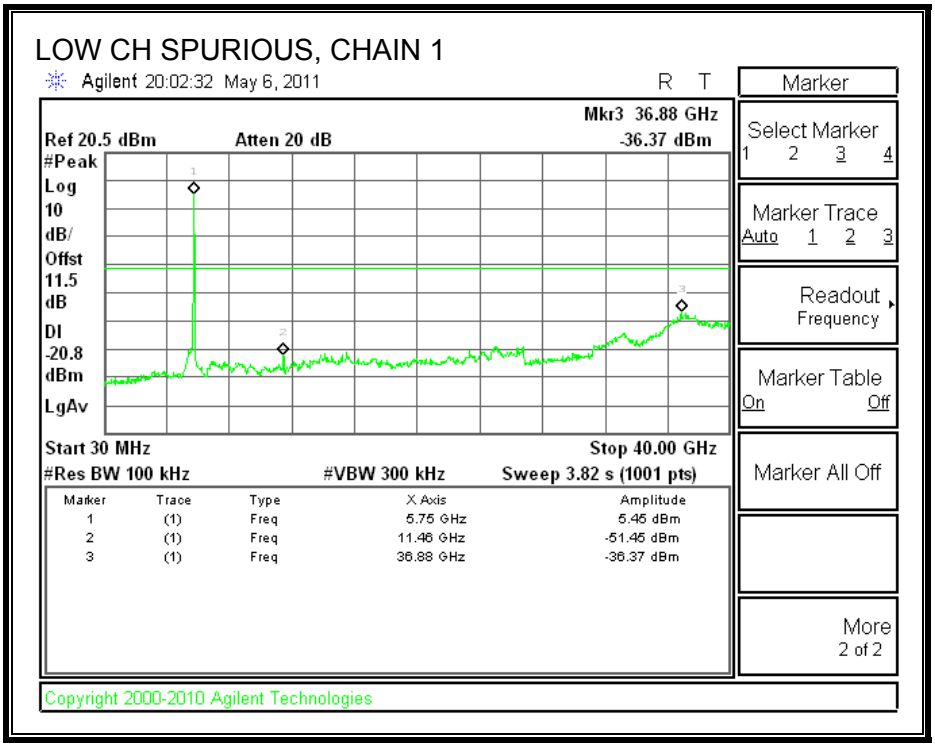
**RESULTS**

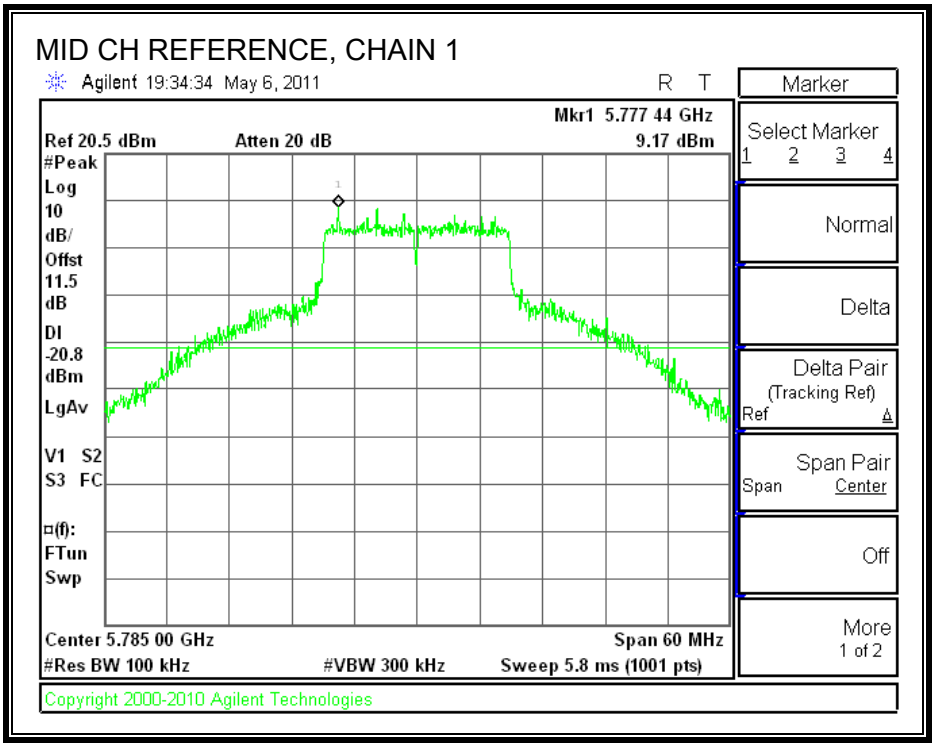
The -30dBc of low and high channels are based on mid channel reference point as highest output power.

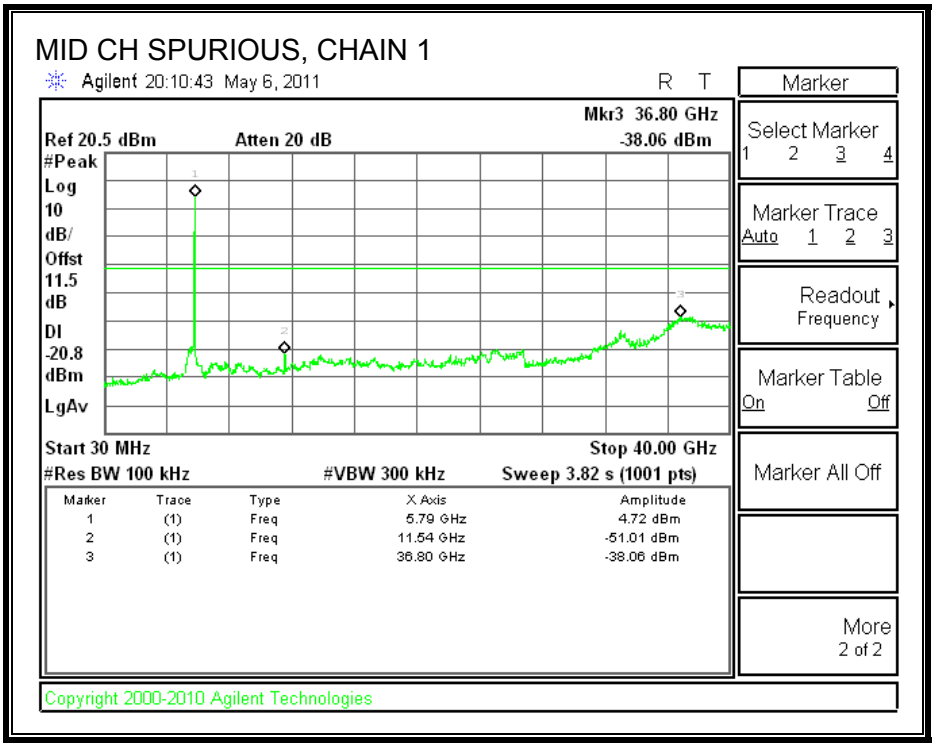
## RESULTS

## CHAIN 1 SPURIOUS EMISSIONS

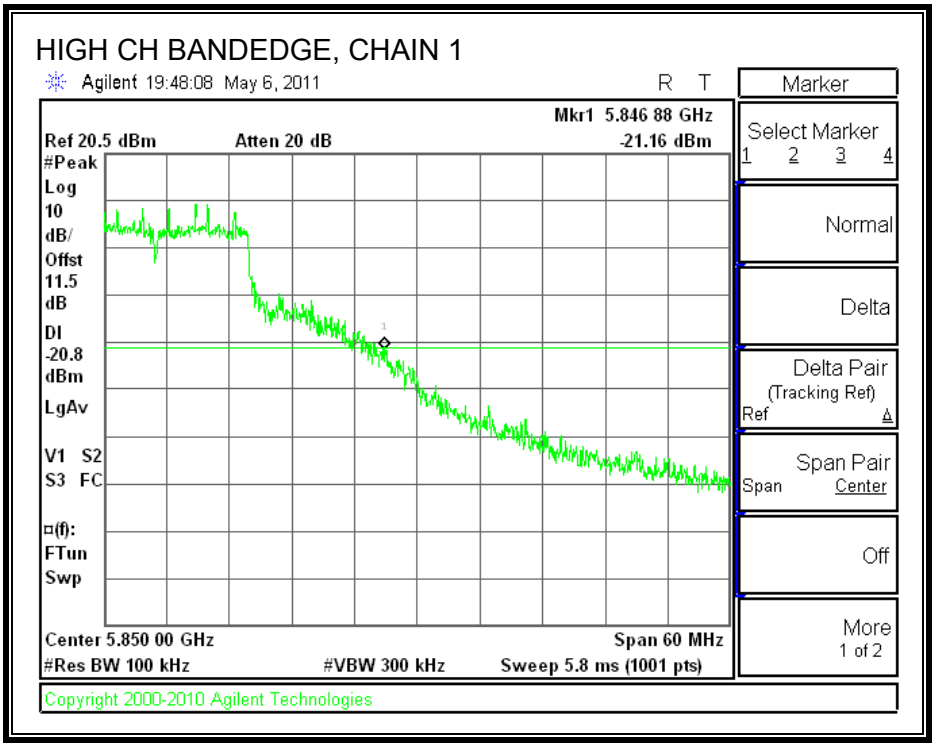


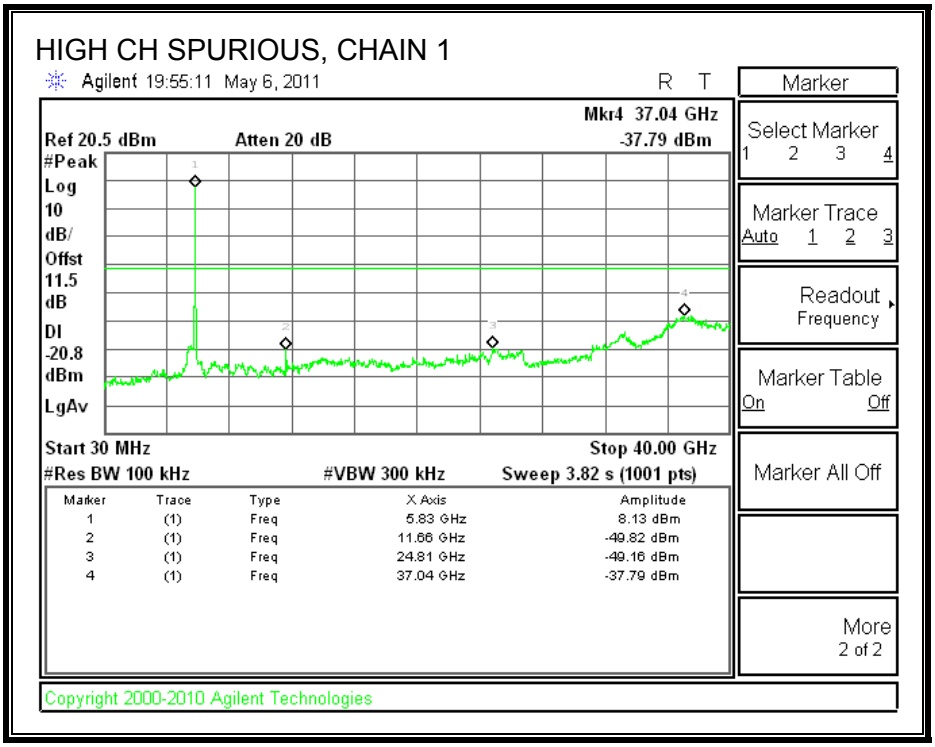




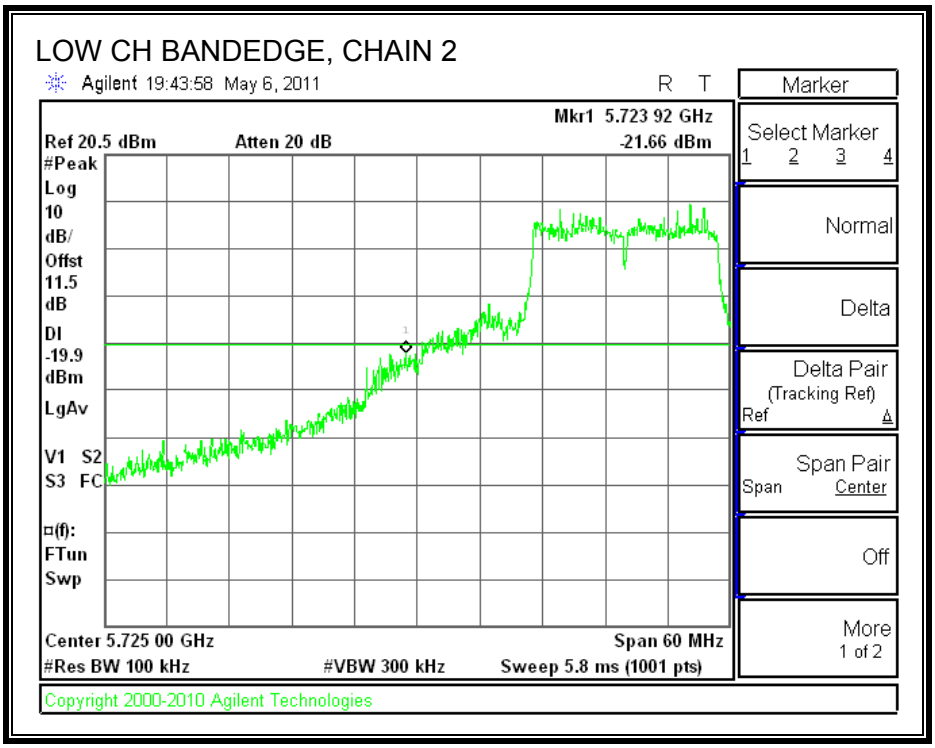


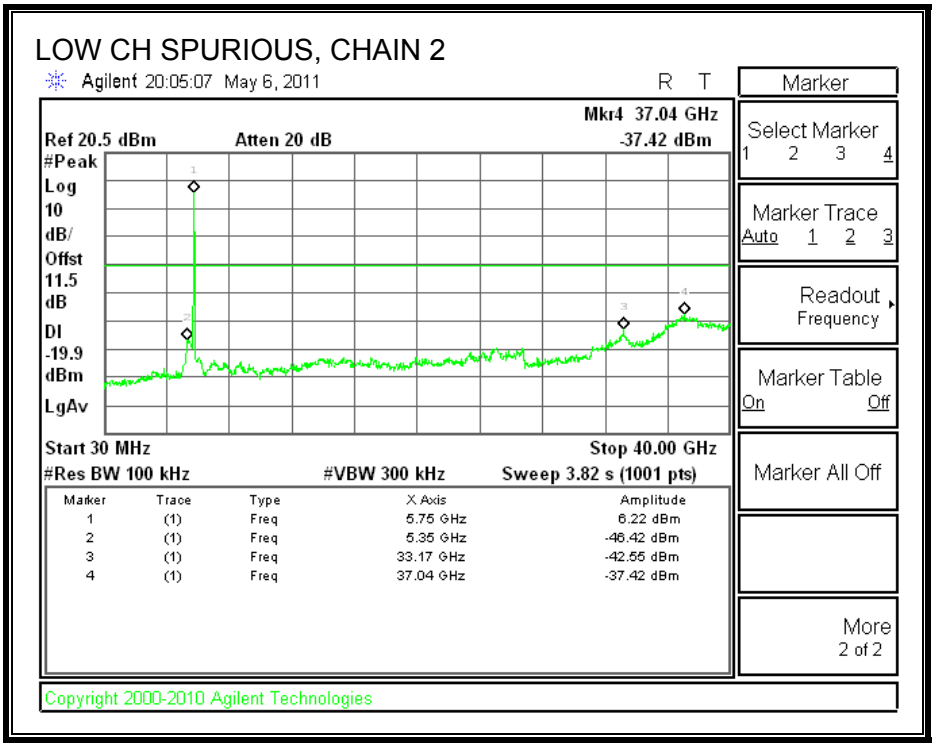
HIGH CH BANDEDGE, CHAIN 1



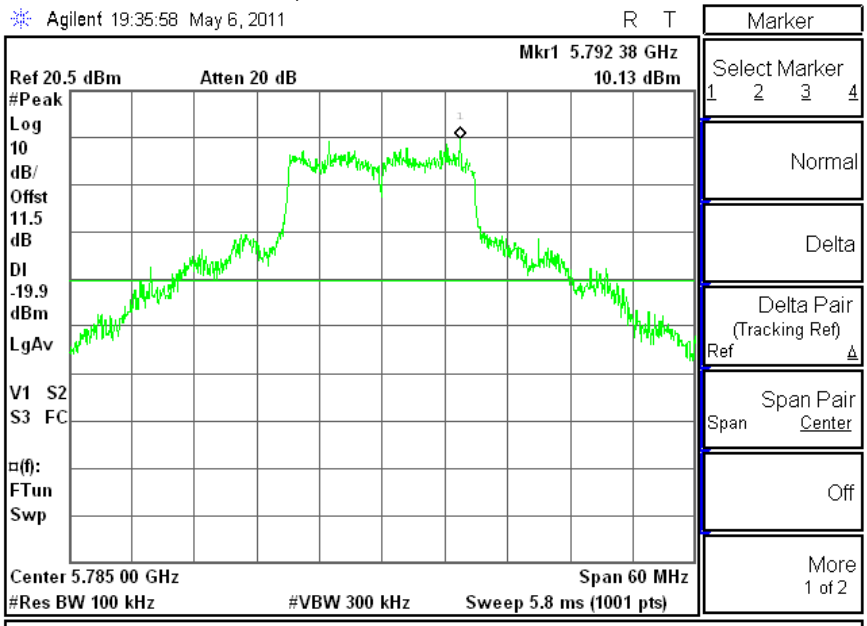


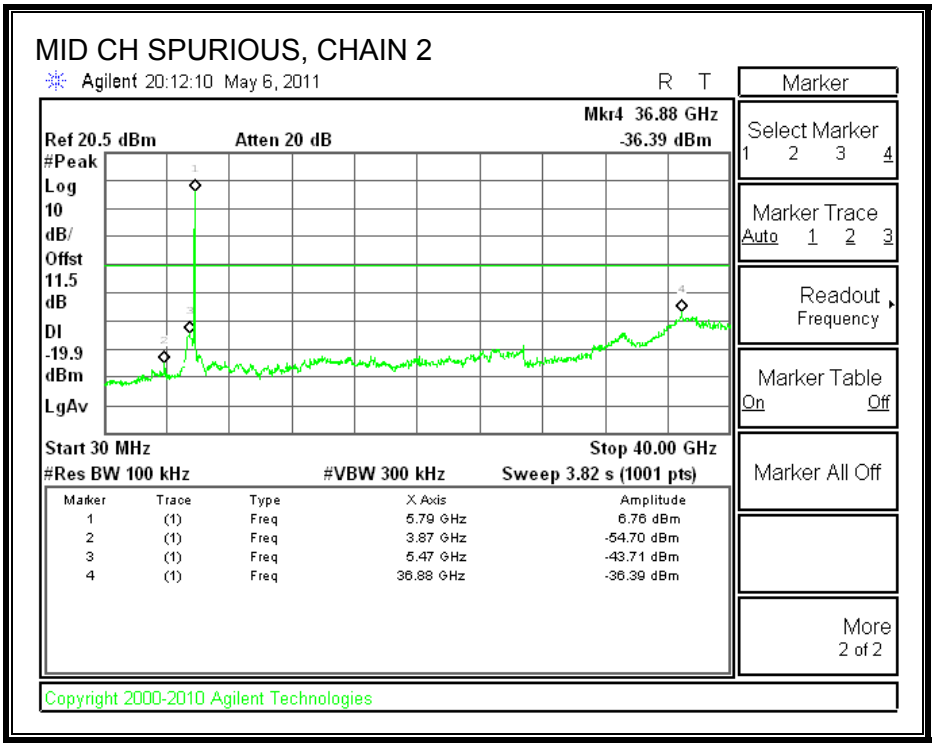
**CHAIN 2 SPURIOUS EMISSIONS**



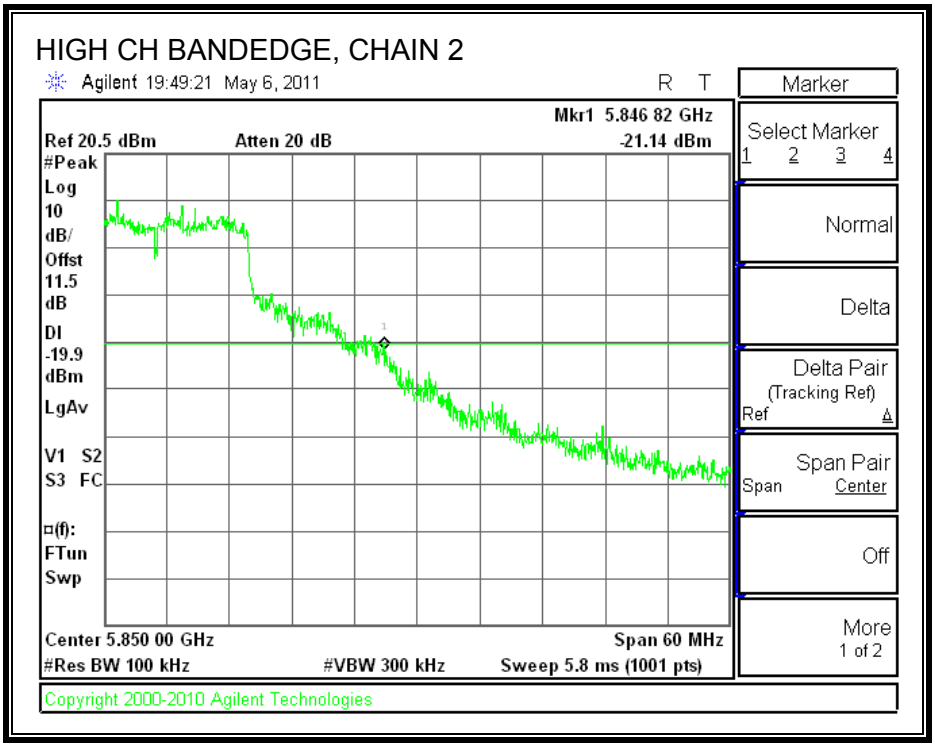


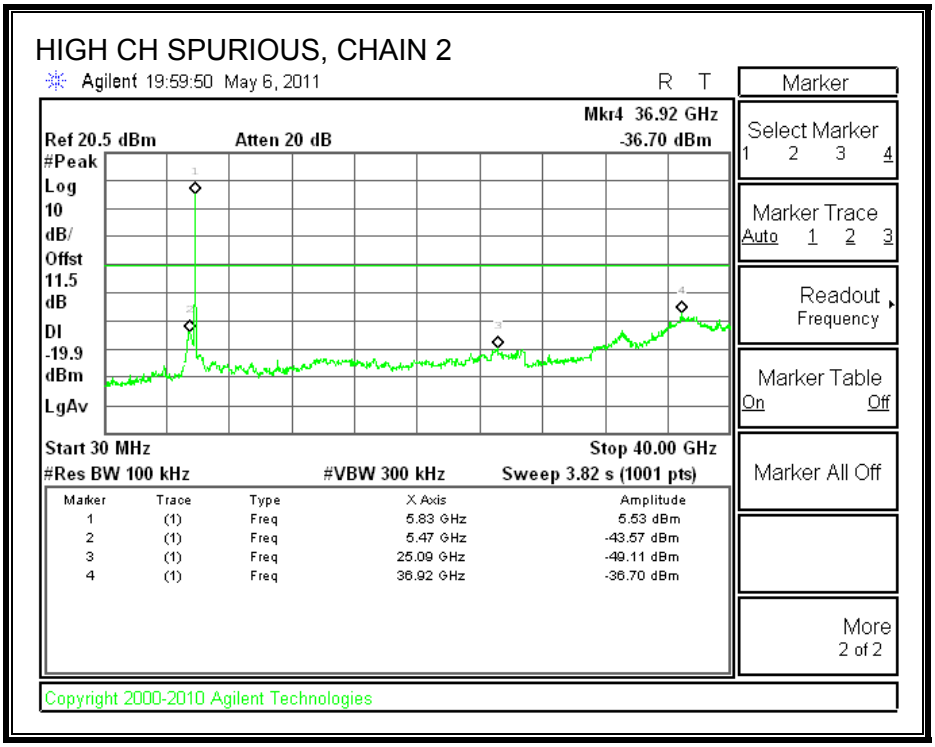
MID CH REFERENCE, CHAIN 2



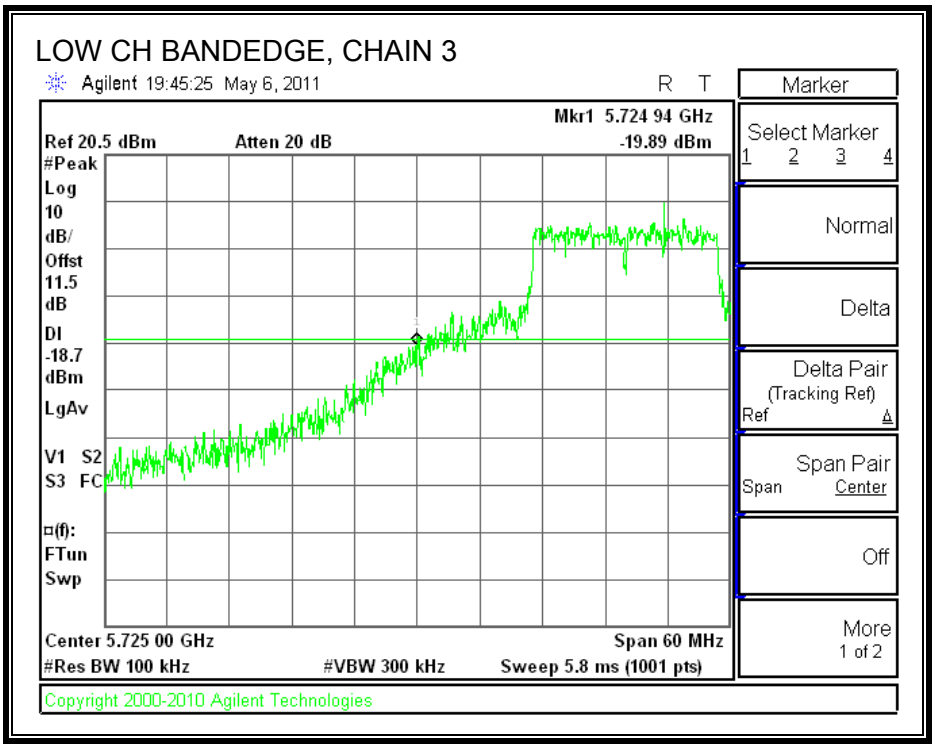


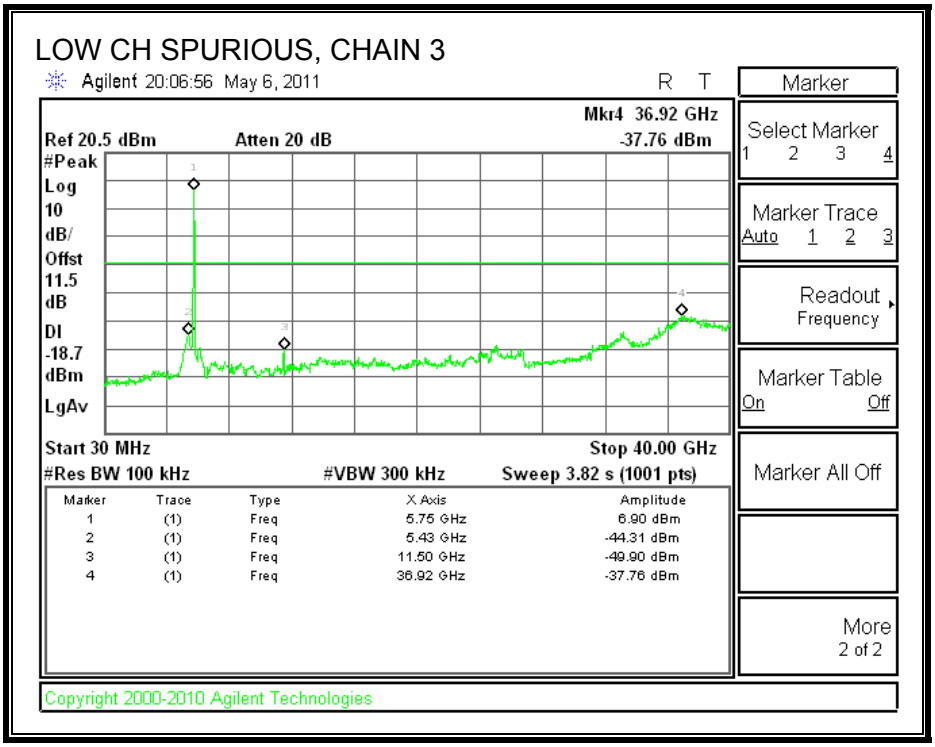
HIGH CH BANDEDGE, CHAIN 2



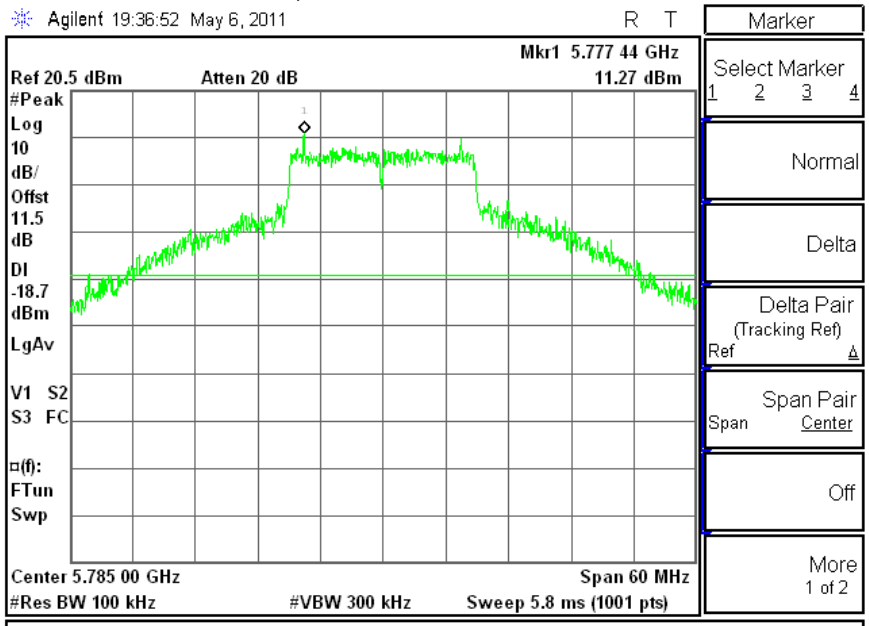


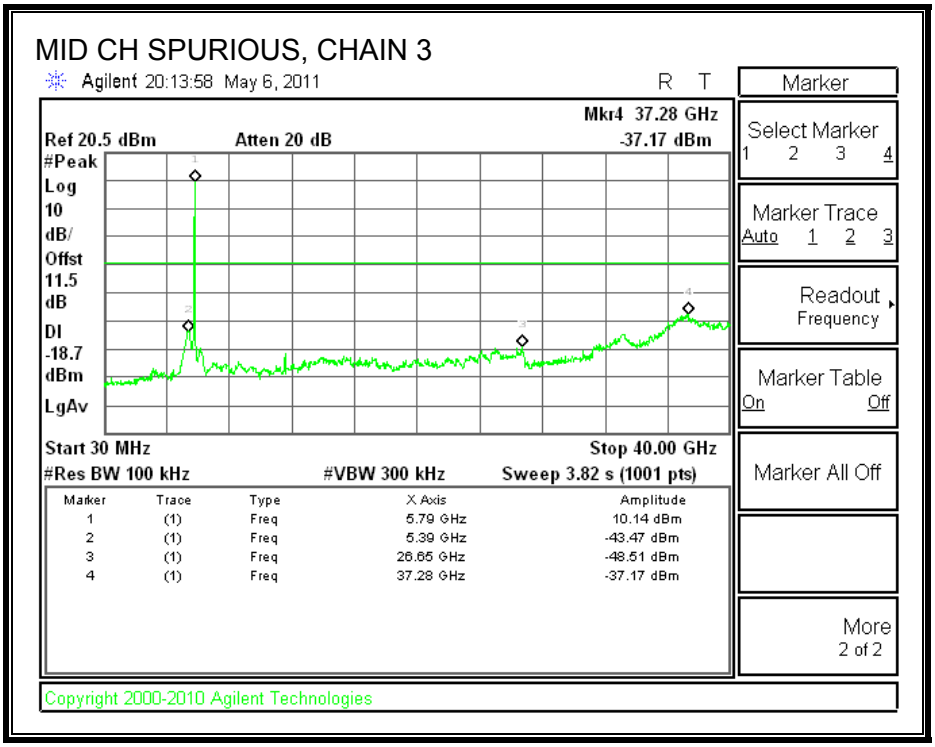
**CHAIN 3 SPURIOUS EMISSIONS**



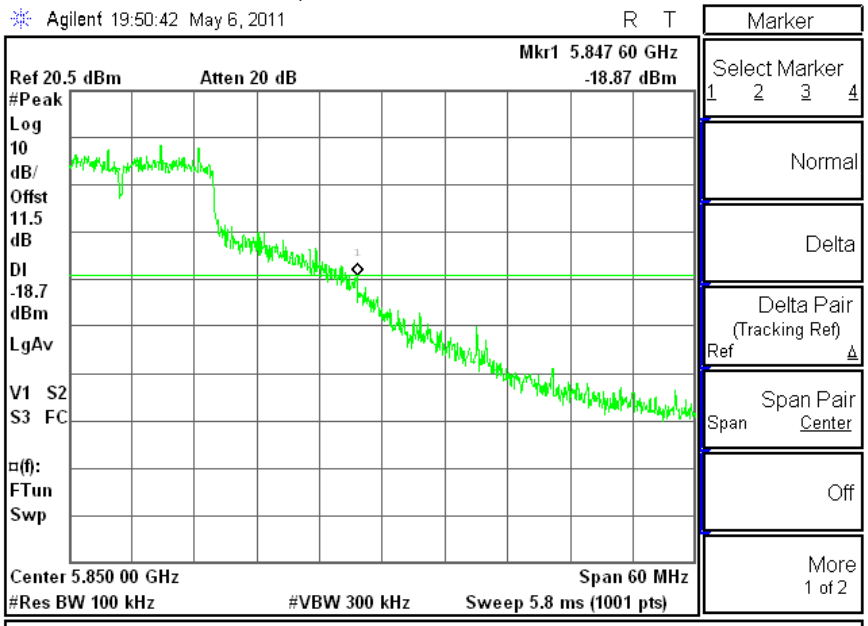


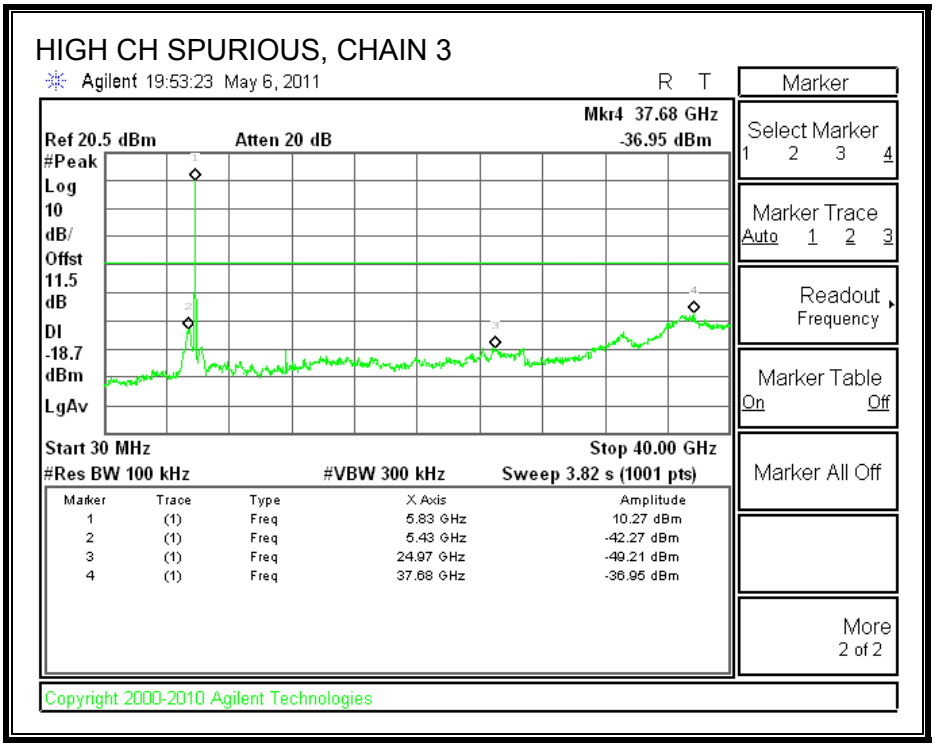
MID CH REFERENCE, CHAIN 3





HIGH CH BANDEDGE, CHAIN 3





# 7.5. 802.11n THREE CHAINS HT40 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.

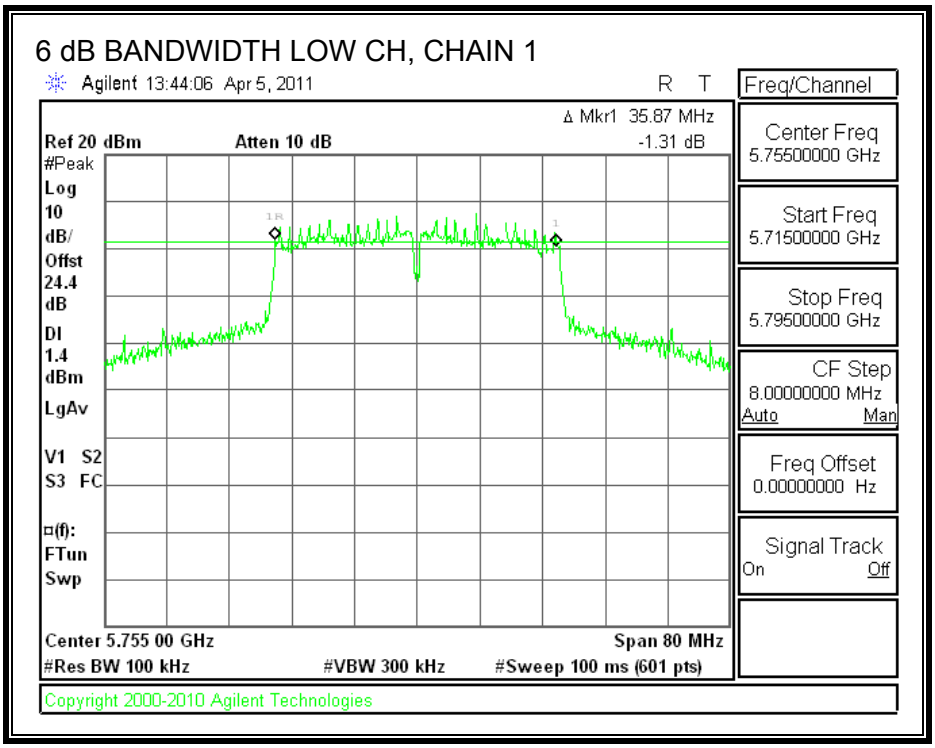
**TEST PROCEDURE**

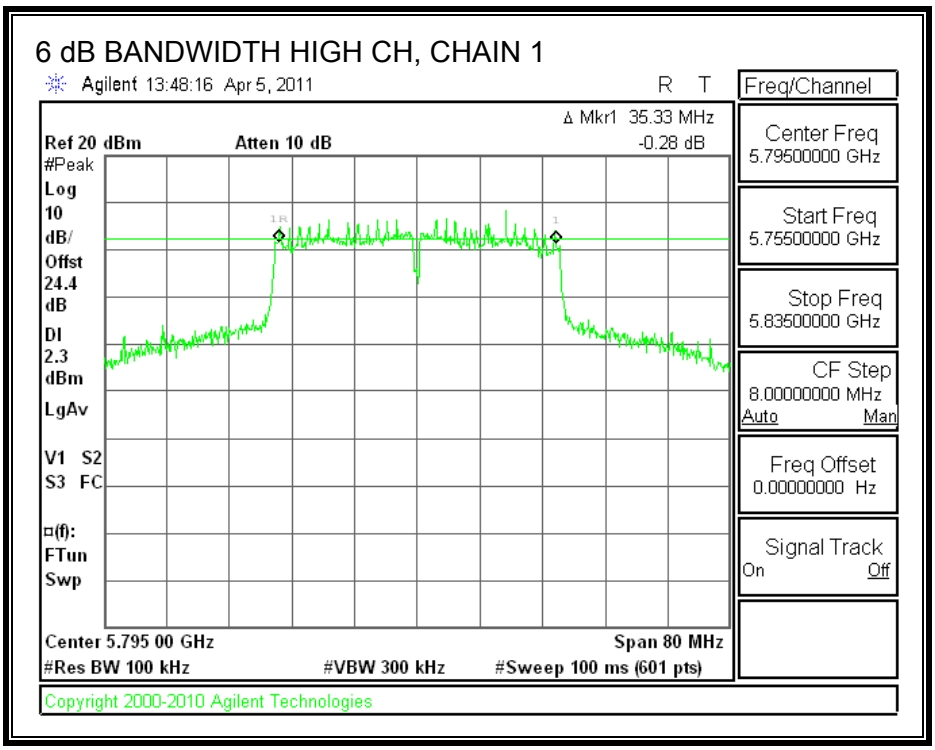
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 5755 | 35.87 | 0.5 |
| High | 5795 | 35.33 | 0.5 |

**6 dB BANDWIDTH**



### 7.5.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

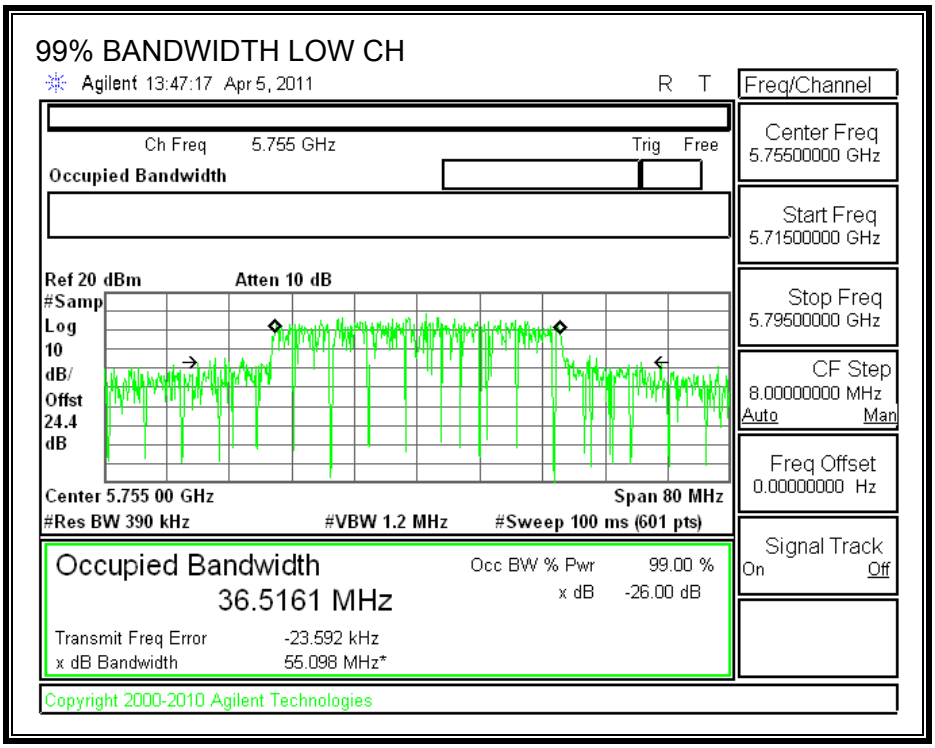
**TEST PROCEDURE**

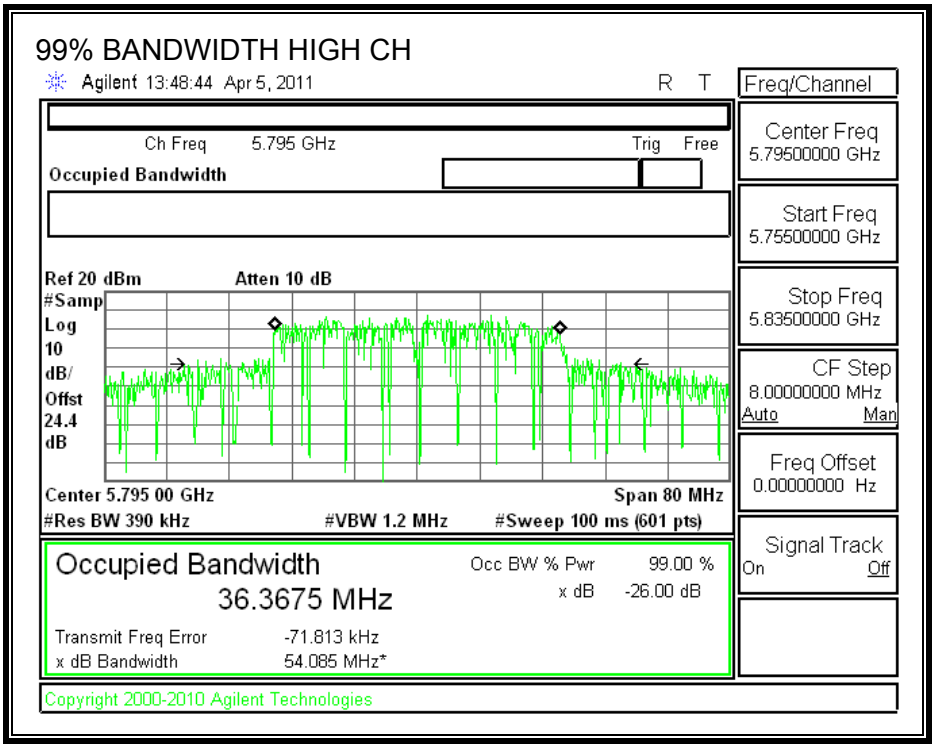
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

**RESULTS**

| Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|
| 5755 | 35.5161 |
| 5795 | 36.3675 |

**99% BANDWIDTH**



## 7.5.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The composite antenna gain is equal to 8.40 dBi, therefore the limit is 27.60 dBm.

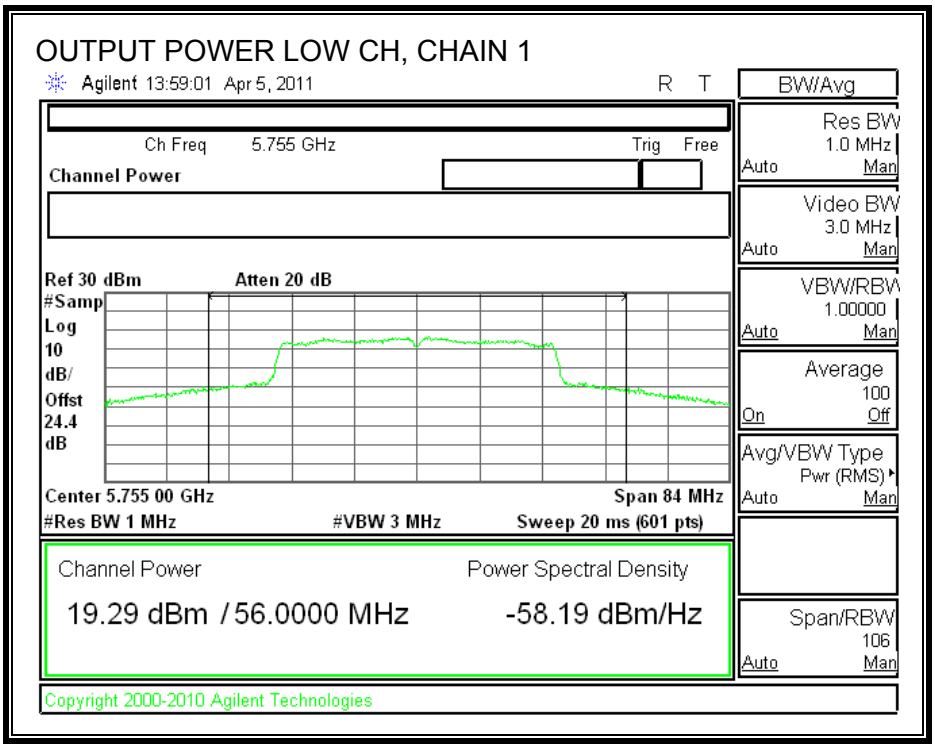
**TEST PROCEDURE – UNII METHOD**

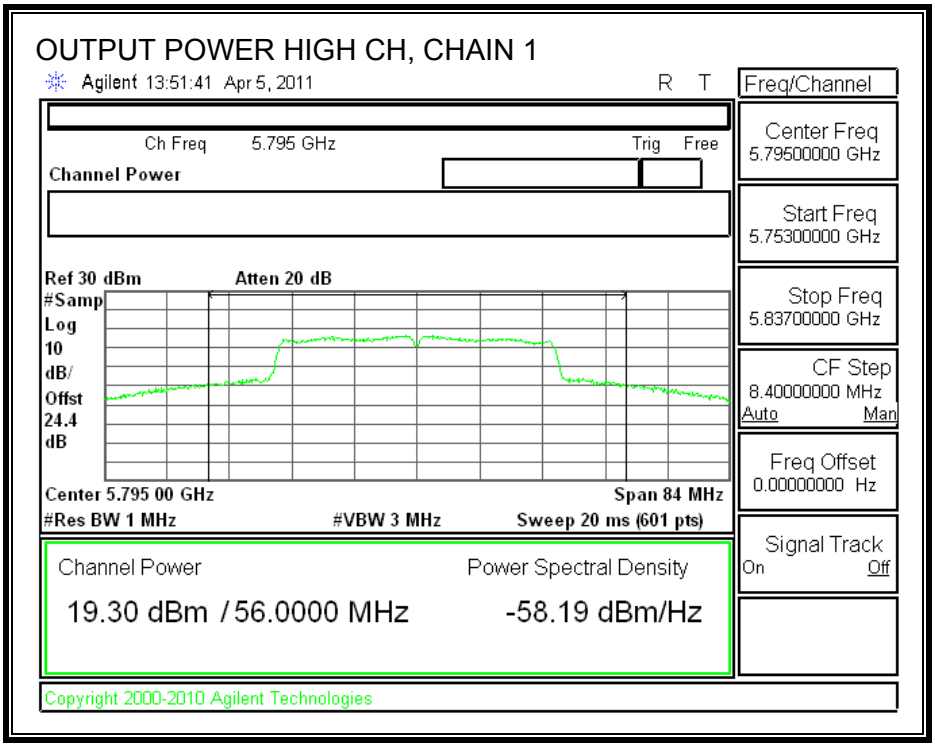
Output power was measured based on the use of RMS averaging over a time interval in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

**RESULTS**

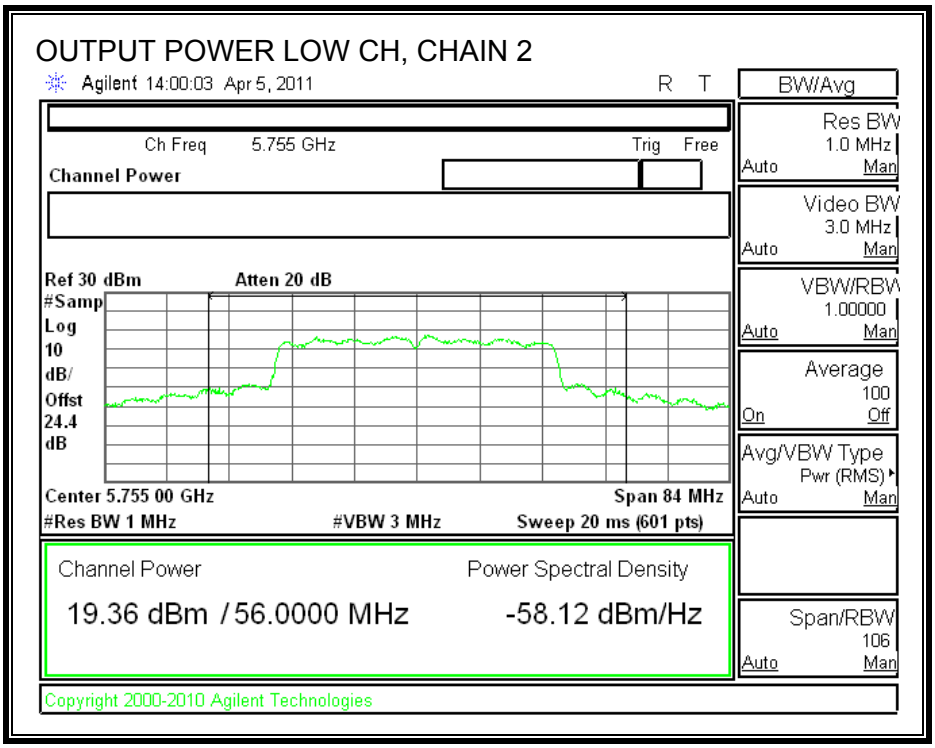
| Channel | Frequency (MHz) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Chain 3 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5755 | 19.29 | 19.36 | 19.39 | 24.12 | 27.60 | -3.48 |
| High | 5795 | 19.30 | 19.38 | 19.21 | 24.07 | 27.60 | -3.53 |

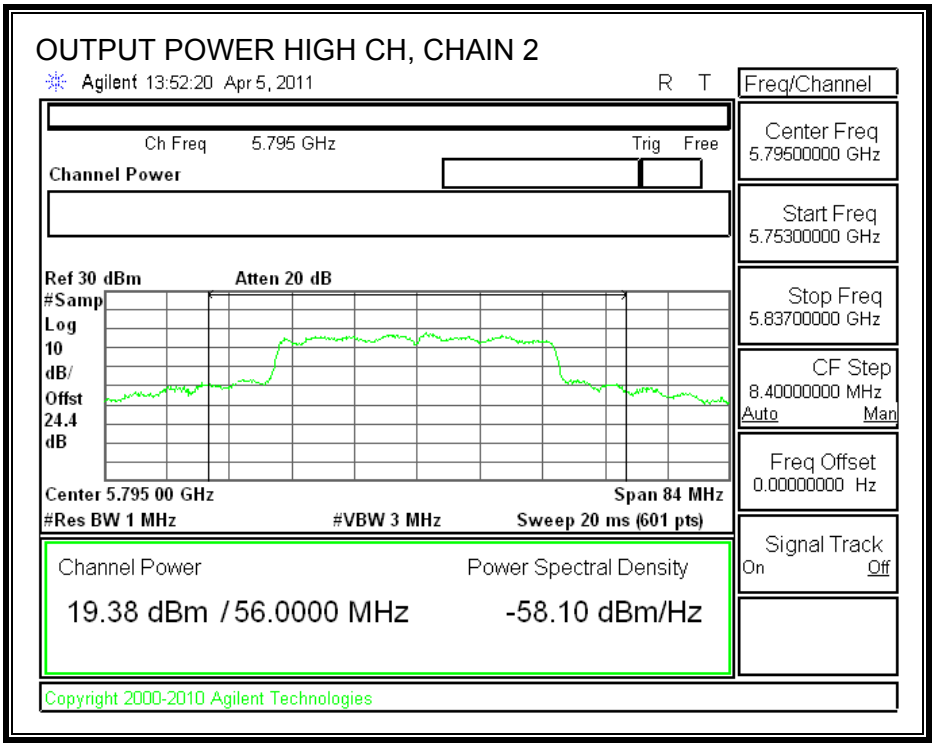
**CHAIN 1 OUTPUT POWER**



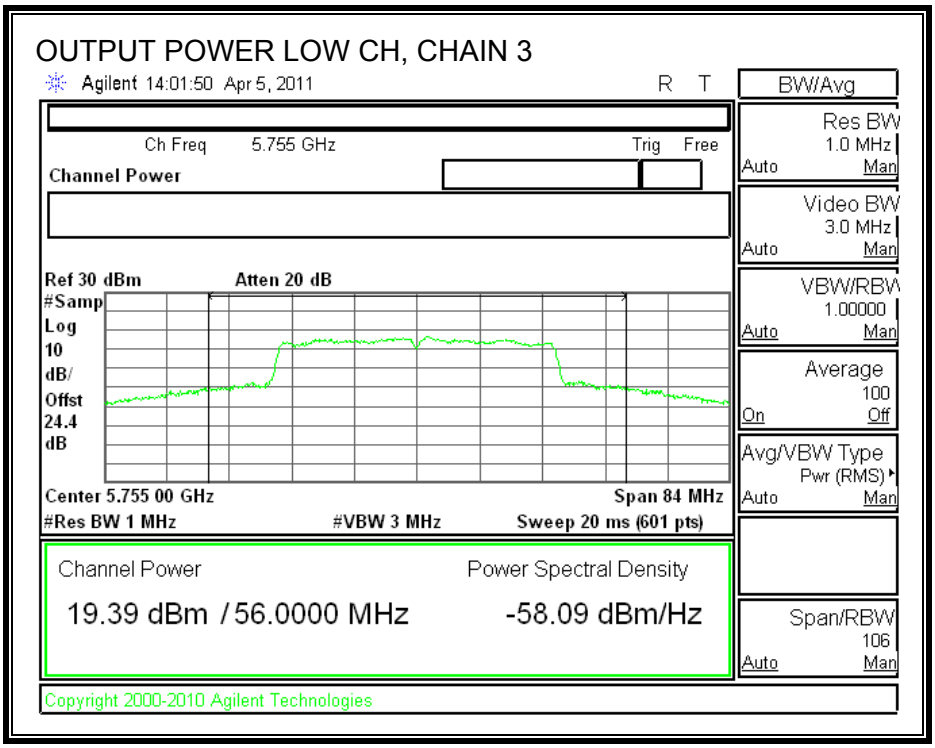



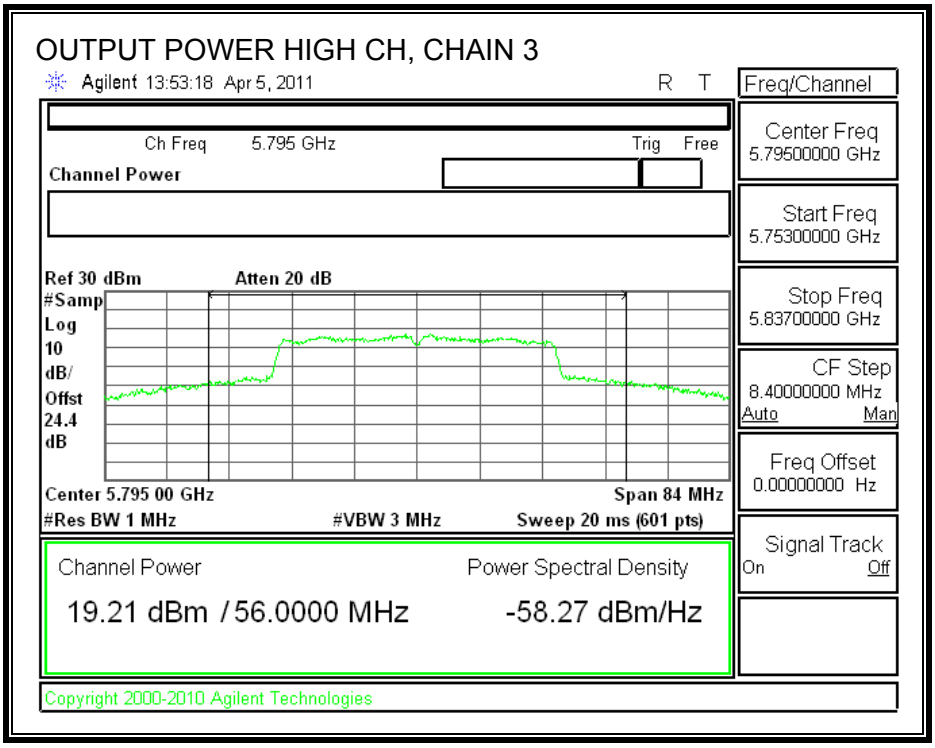
**CHAIN 2 OUTPUT POWER**



**CHAIN 3 OUTPUT POWER**



## 7.5.4. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

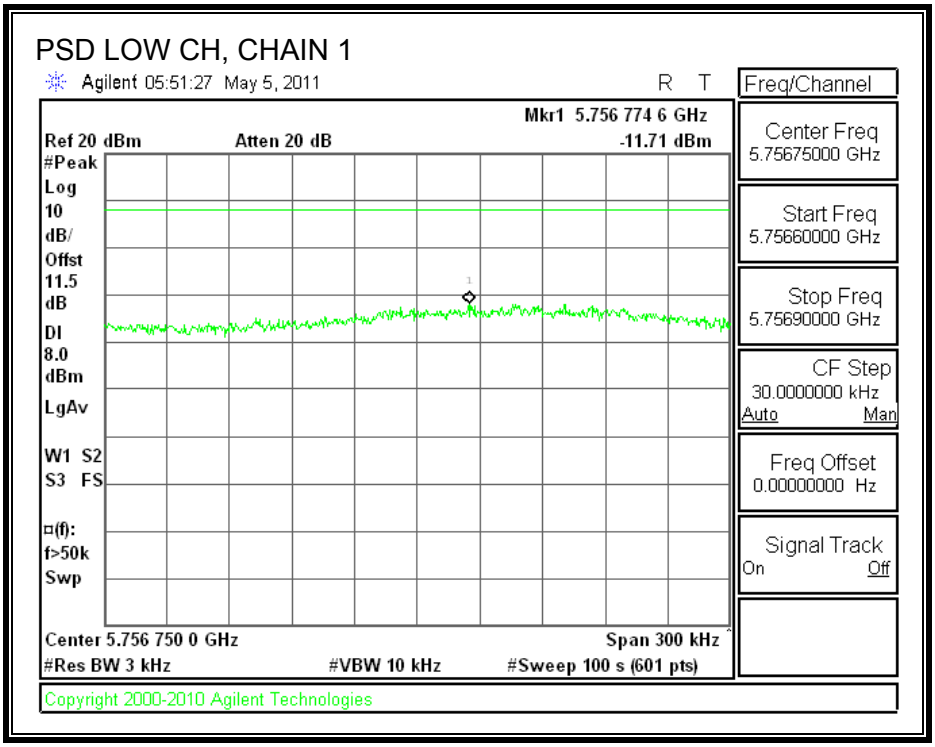
**TEST PROCEDURE**

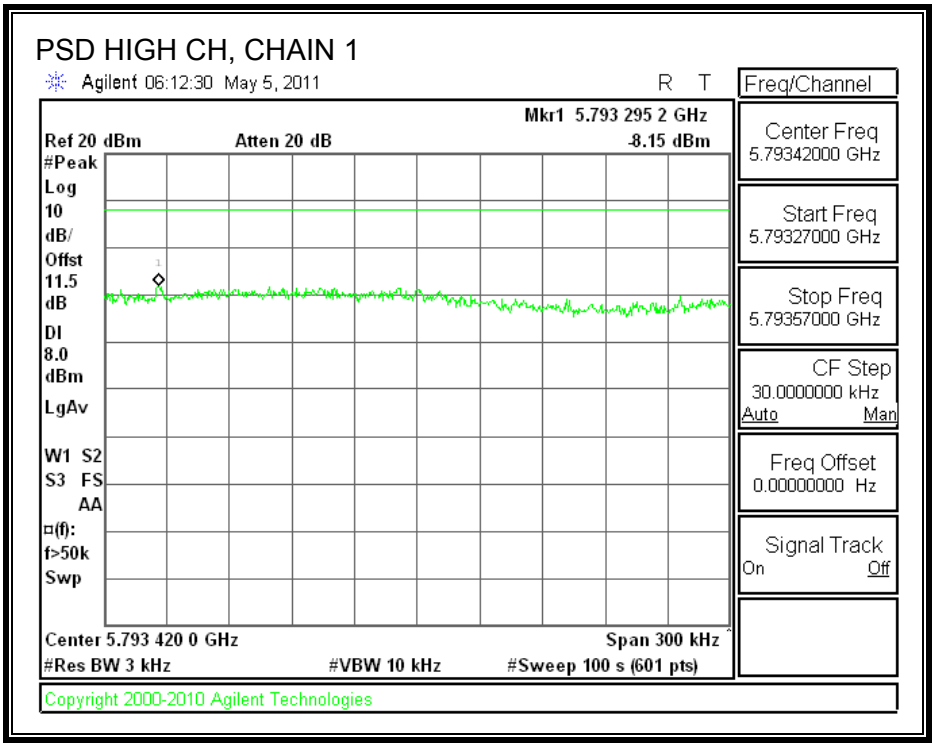
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

**RESULTS:**

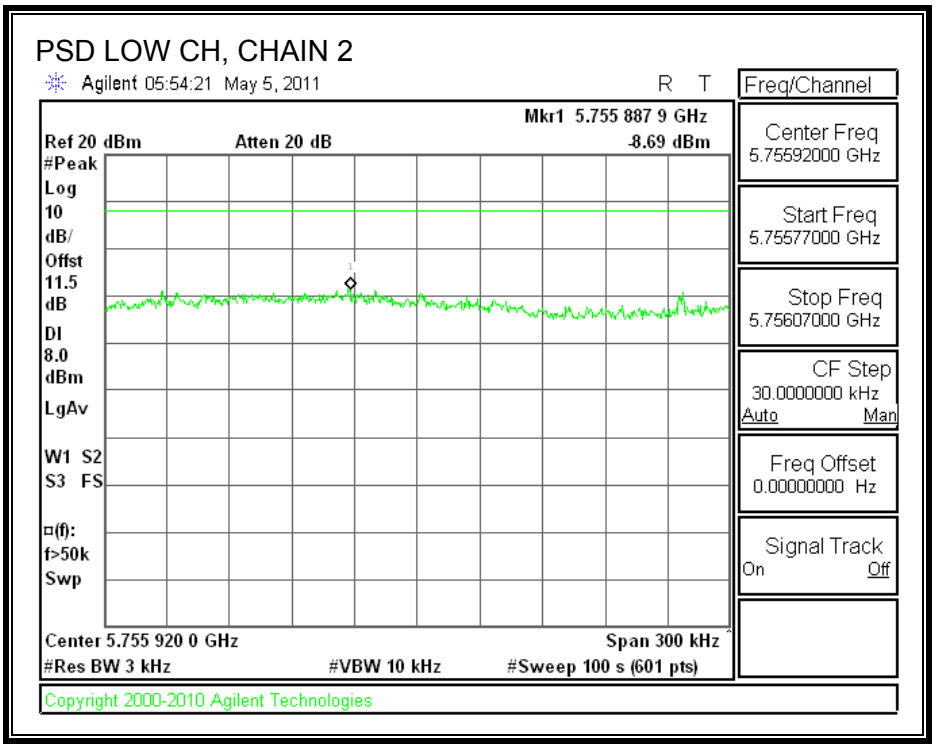
| Channel | Frequency (MHz) | Chain 1 PSD (dBm) | Chain 2 PSD (dBm) | Chain 3 PSD (dBm) | Total PSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5755 | -11.71 | -8.69 | -9.06 | -4.86 | 8 | -12.86 |
| High | 5795 | -8.15 | -5.32 | -6.2 | -1.63 | 8 | -9.63 |

**POWER SPECTRAL DENSITY, CHAIN 1**

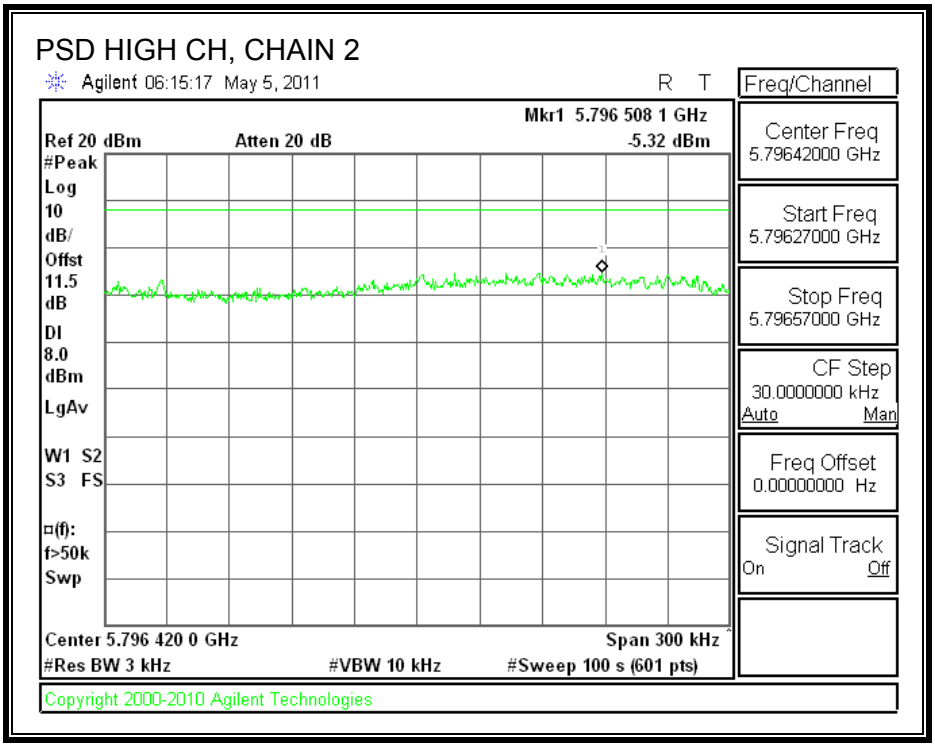




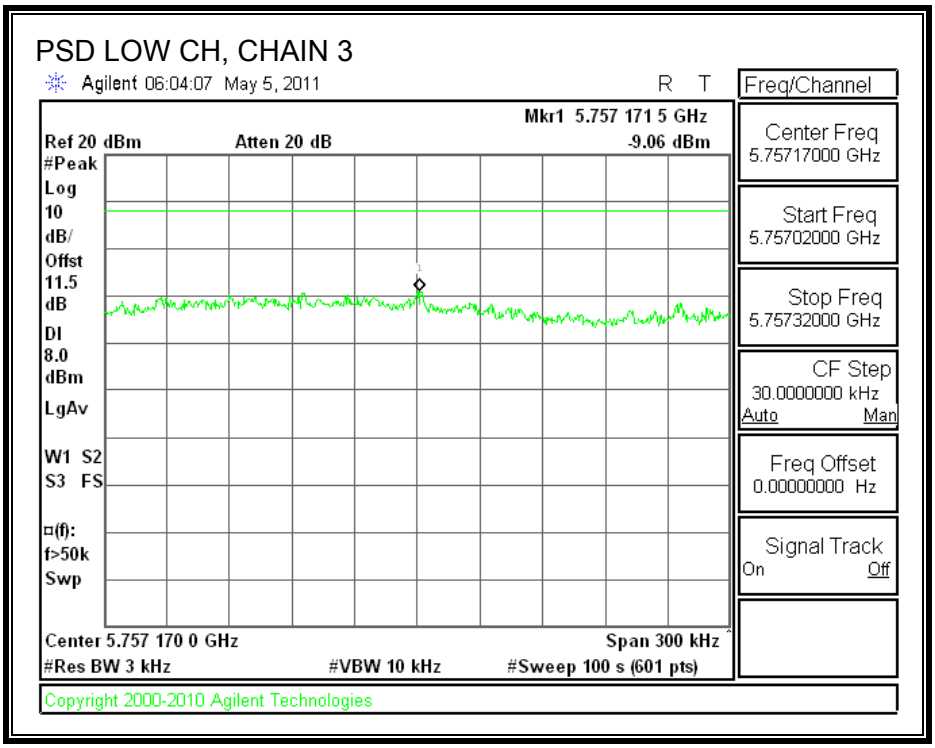
**POWER SPECTRAL DENSITY, CHAIN 2**

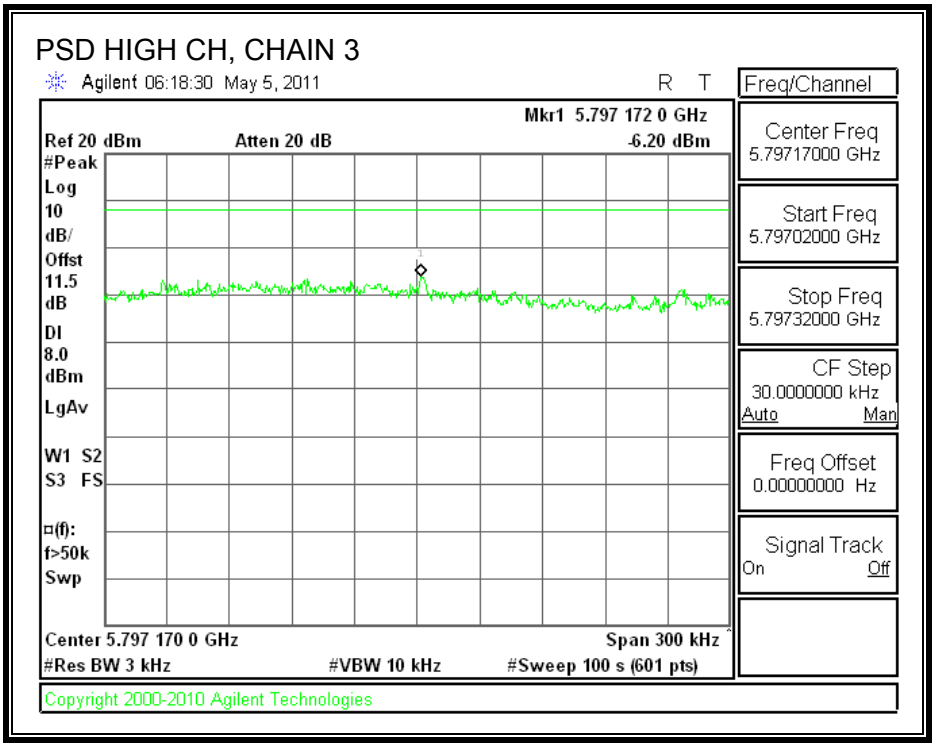


PSD HIGH CH, CHAIN 2



**POWER SPECTRAL DENSITY, CHAIN 3**





## 7.5.5. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

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

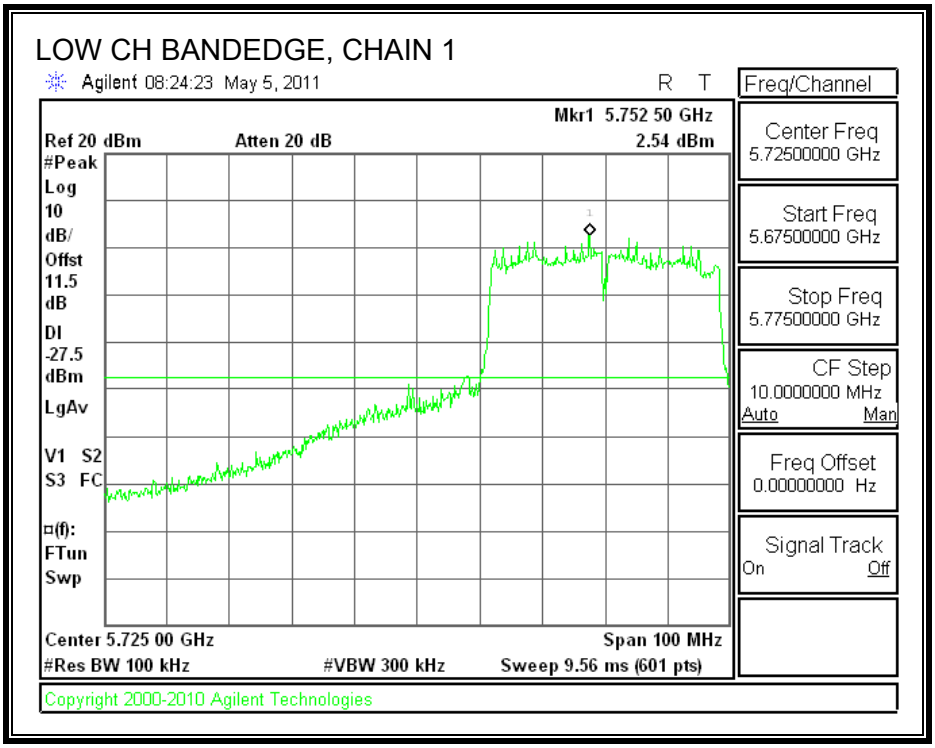
**TEST PROCEDURE**

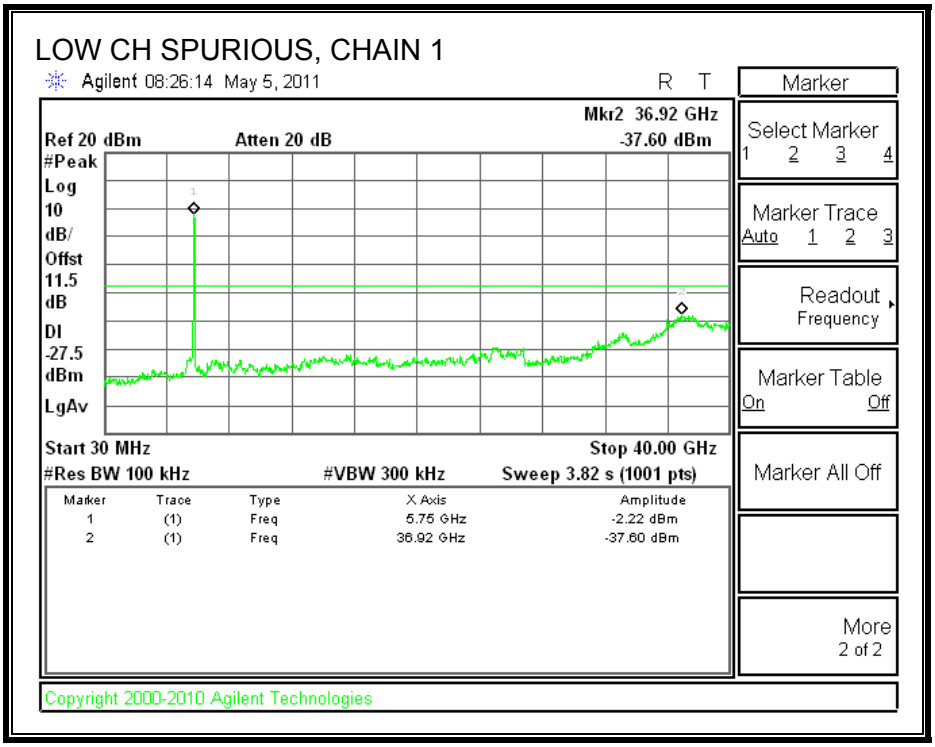
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

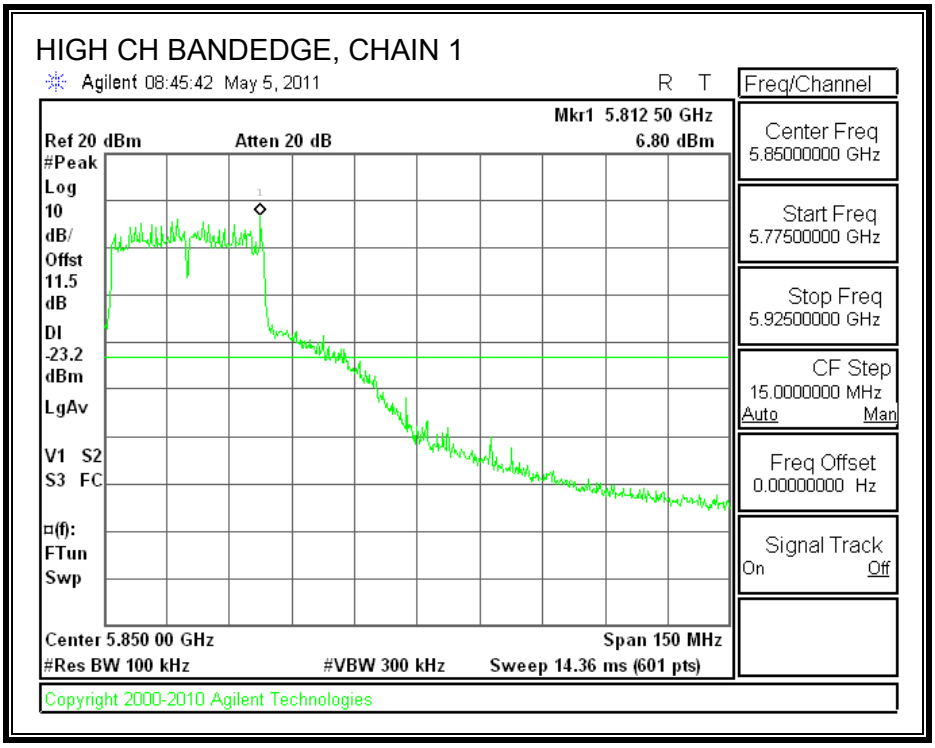
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

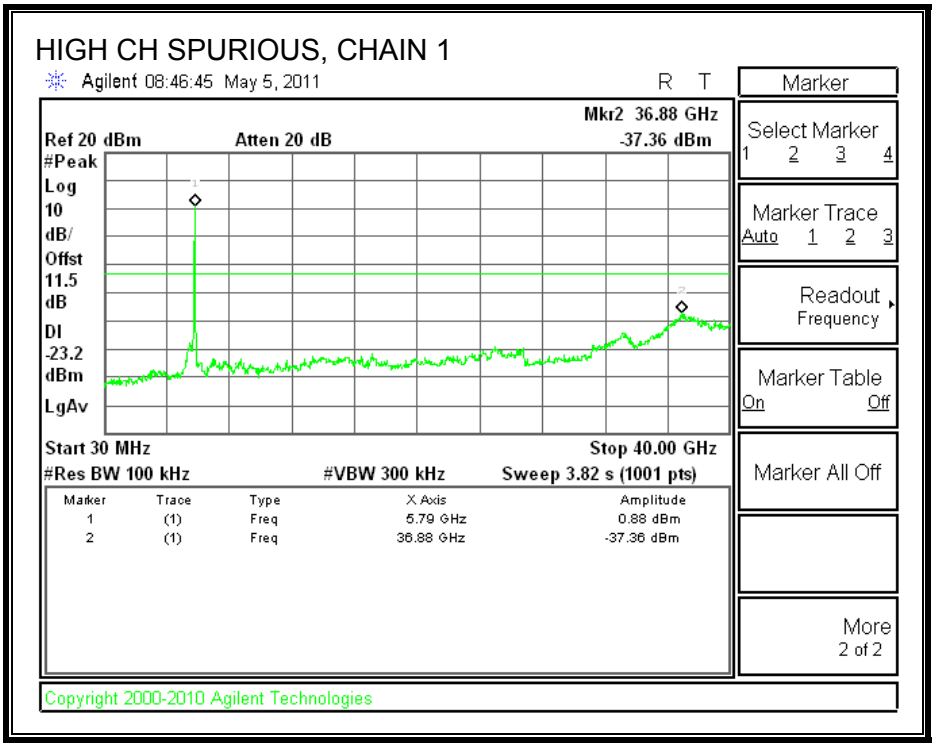
## RESULTS

## CHAIN 1 SPURIOUS EMISSIONS

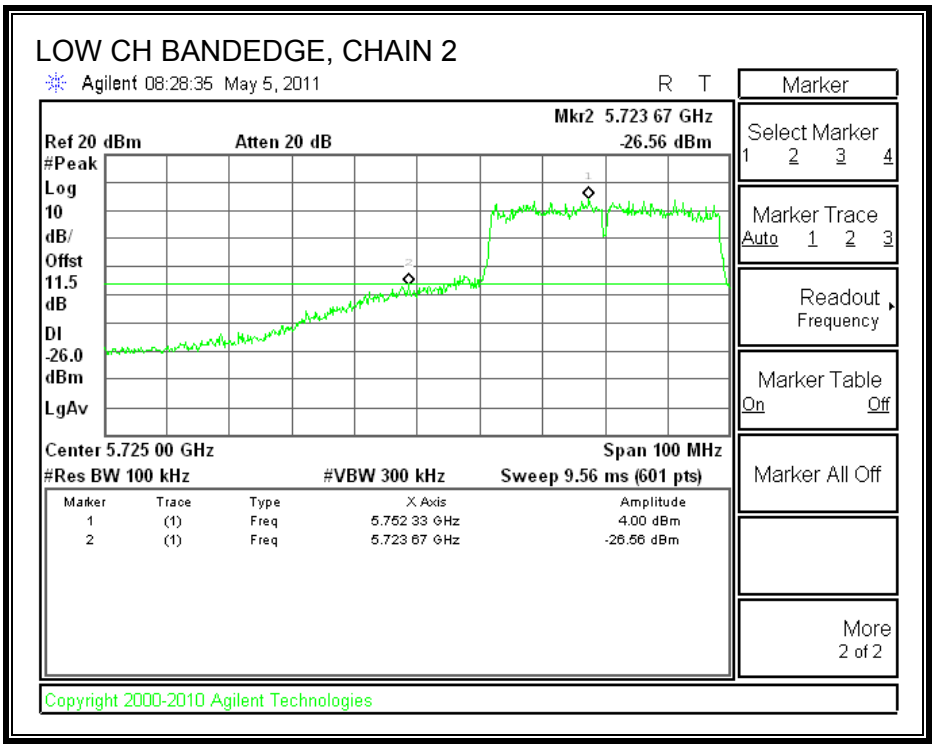


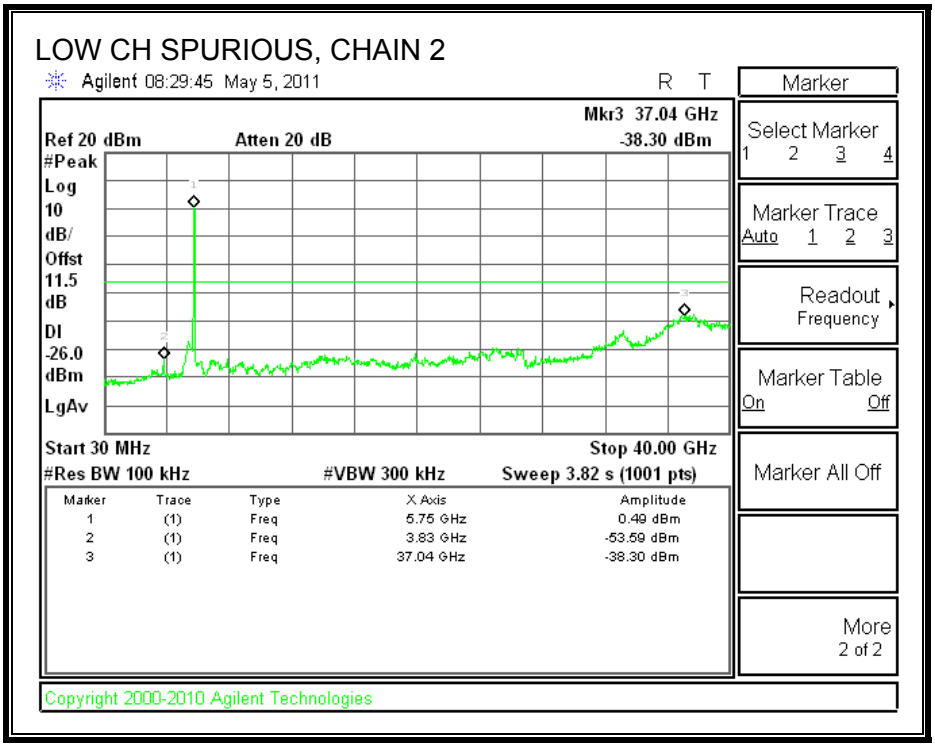




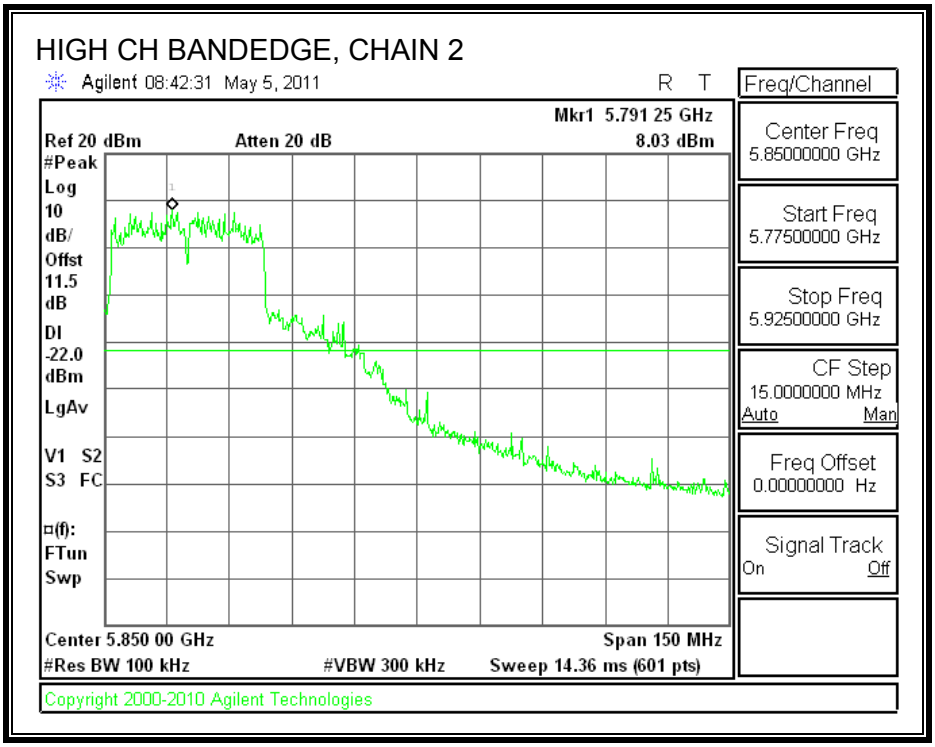


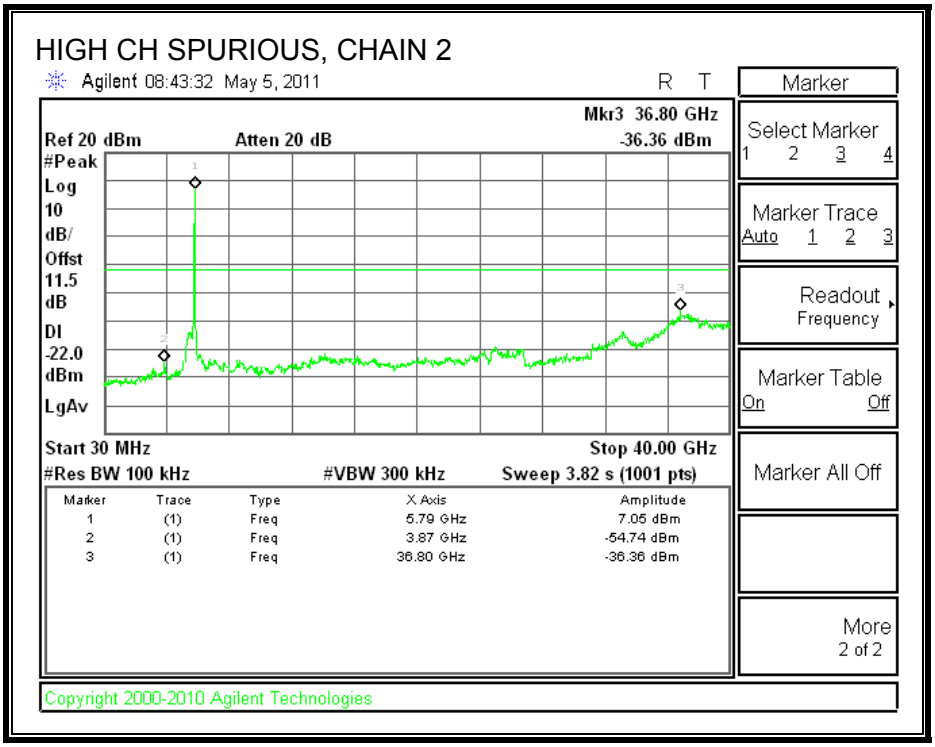
**CHAIN 2 SPURIOUS EMISSIONS**



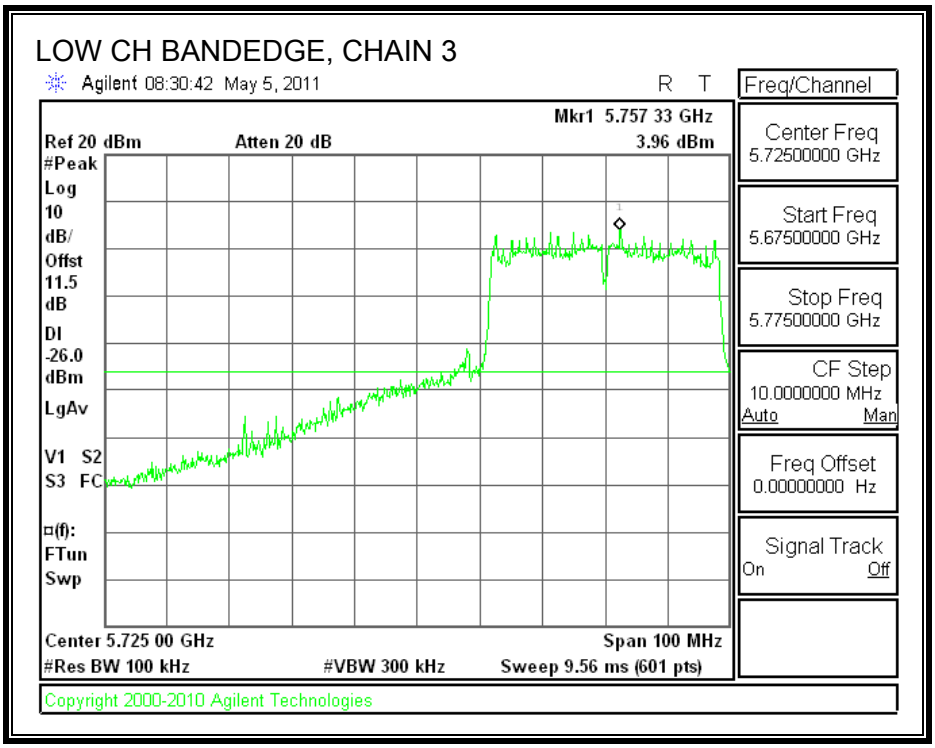


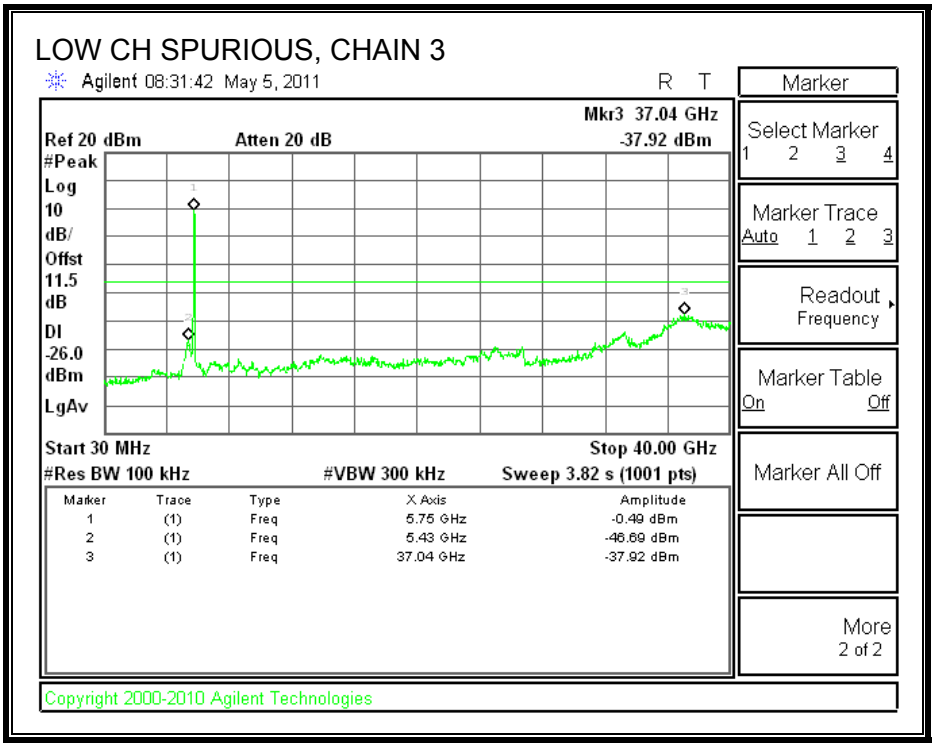
HIGH CH BANDEDGE, CHAIN 2



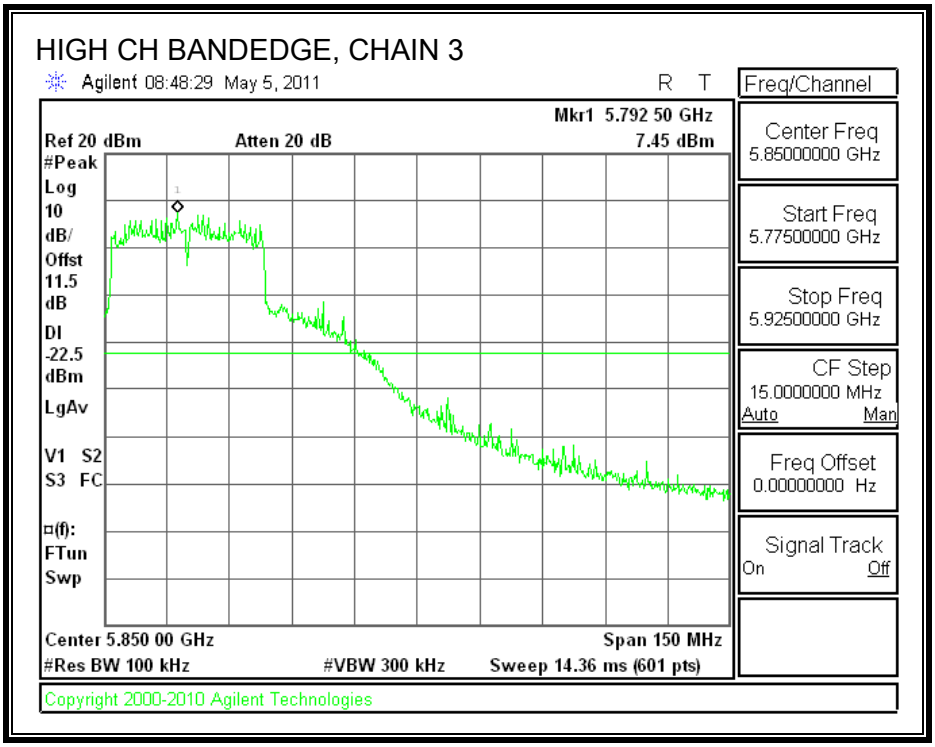


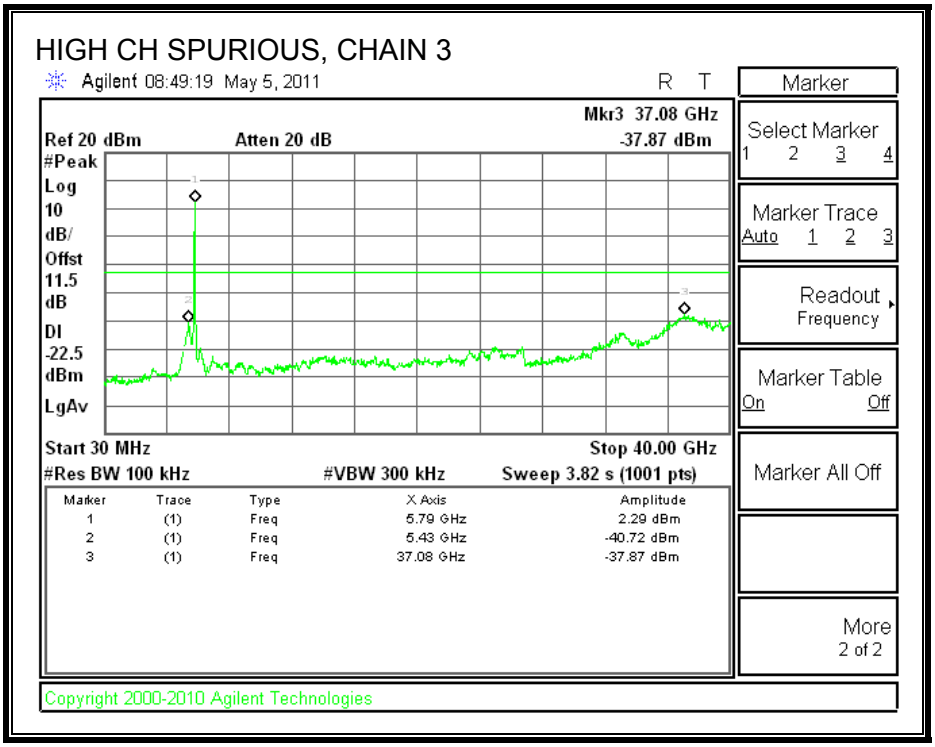
**CHAIN 3 SPURIOUS EMISSIONS**





HIGH CH BANDEDGE, CHAIN 3





# 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.

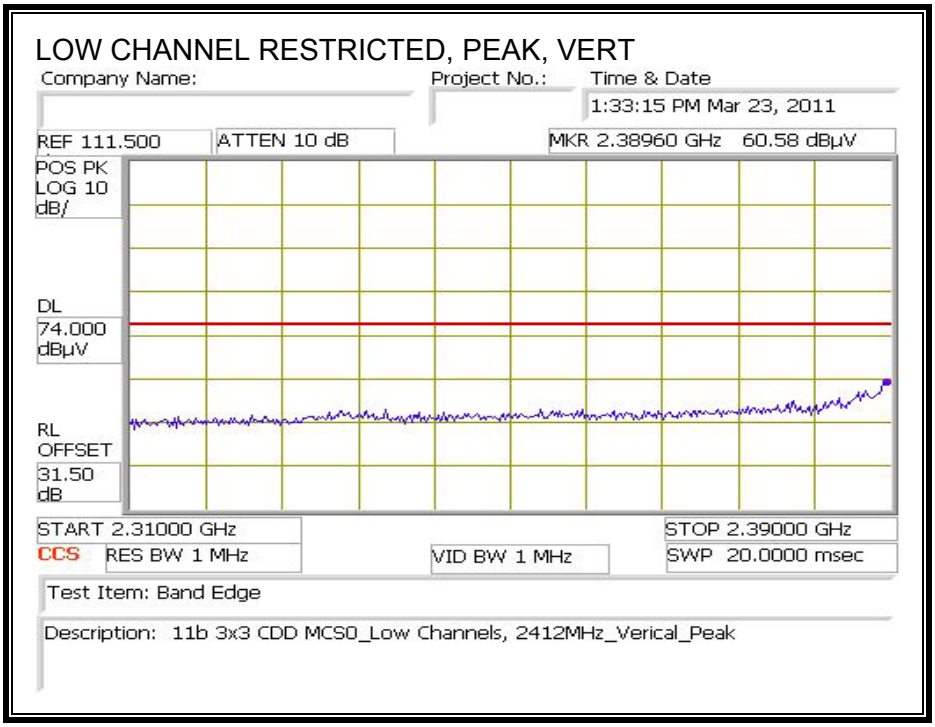
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

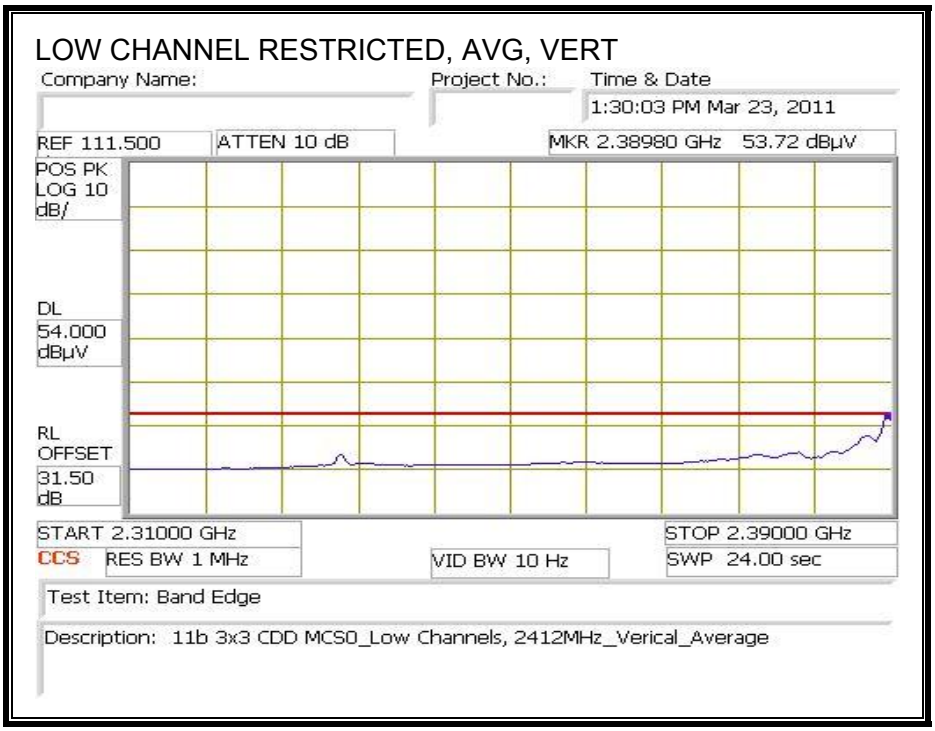
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 8.2. TRANSMITTER ABOVE 1 GHz

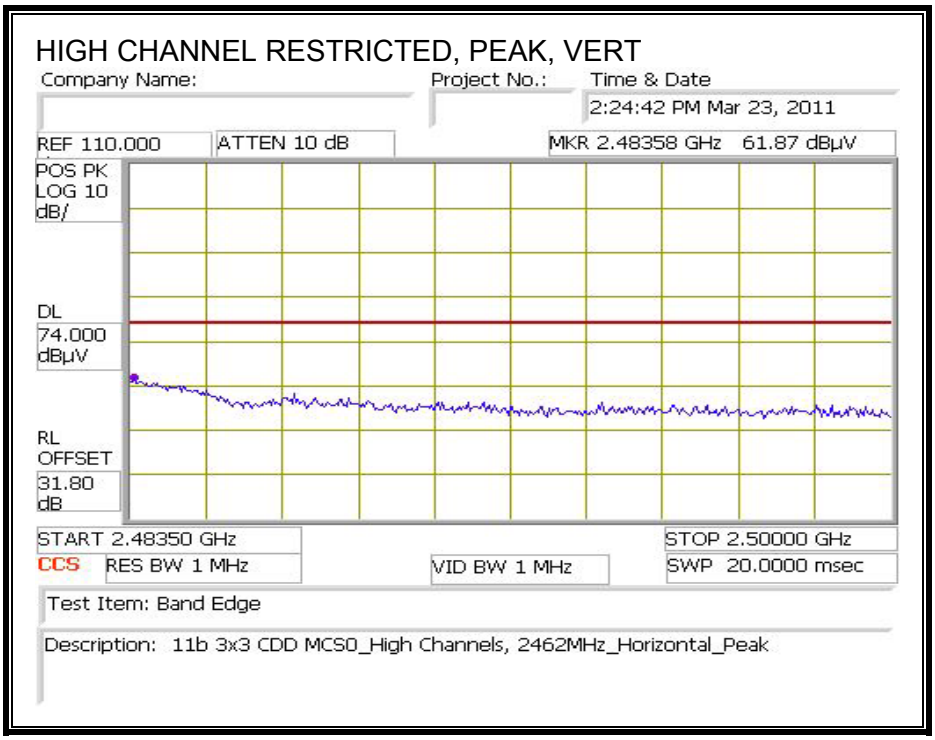
### 8.2.1. 802.11b THREE CHAINS LEGACY MODE IN THE 2.4 GHz BAND

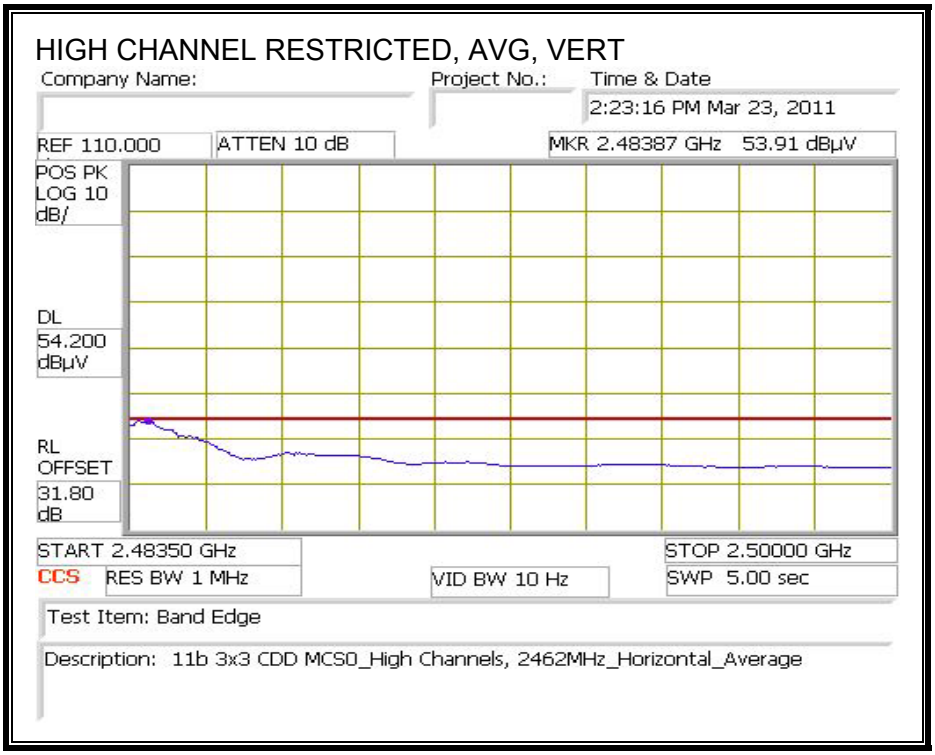
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



## HARMONICS AND SPURIOUS EMISSIONS

**High Frequency Measurement**
**Compliance Certification Services, Fremont 3m Chamber**

**Test Engr:** Vien Tran
**Date:** 03/23/11
**Project #:** 11U13734
**Company:** Broadcom
**Test Target:** FCC Class B
**Mode Oper:** Tx 2.4GHz_11b 3x3 CDD

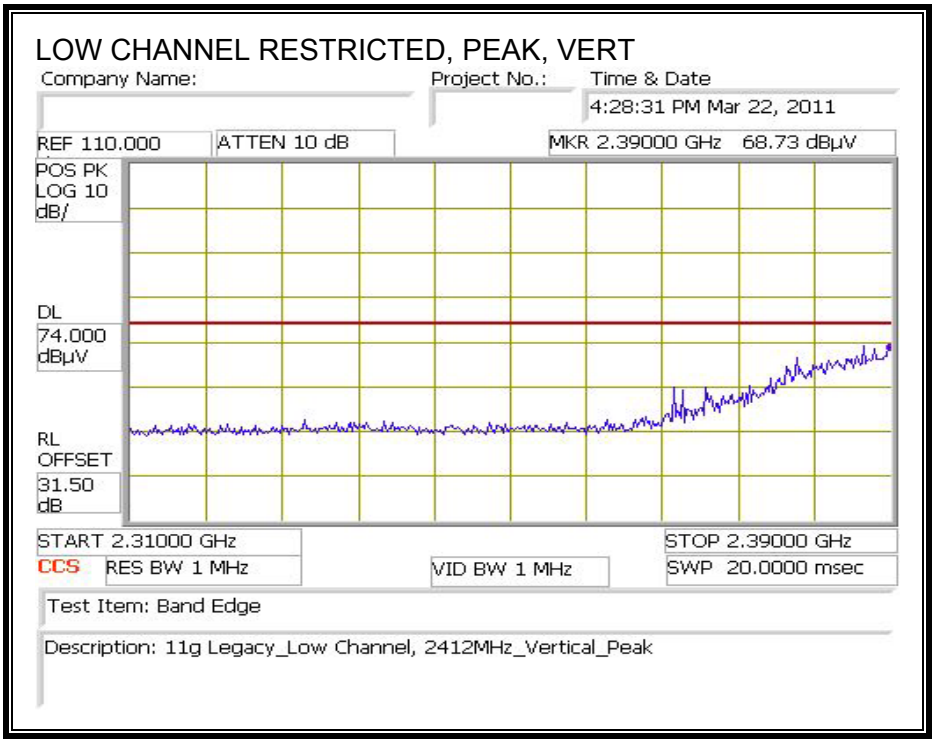
| | | | | | |
|---|---|---|---|---|---|
| f | Measurement Frequency | Amp | Preamp Gain | | Average Field Strength Limit |
| Dist | Distance to Antenna | D Corr | Distance Correct to 3 meters | | Peak Field Strength Limit |
| Read | Analyzer Reading | Avg | Average Field Strength @ 3 m | | Margin vs.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

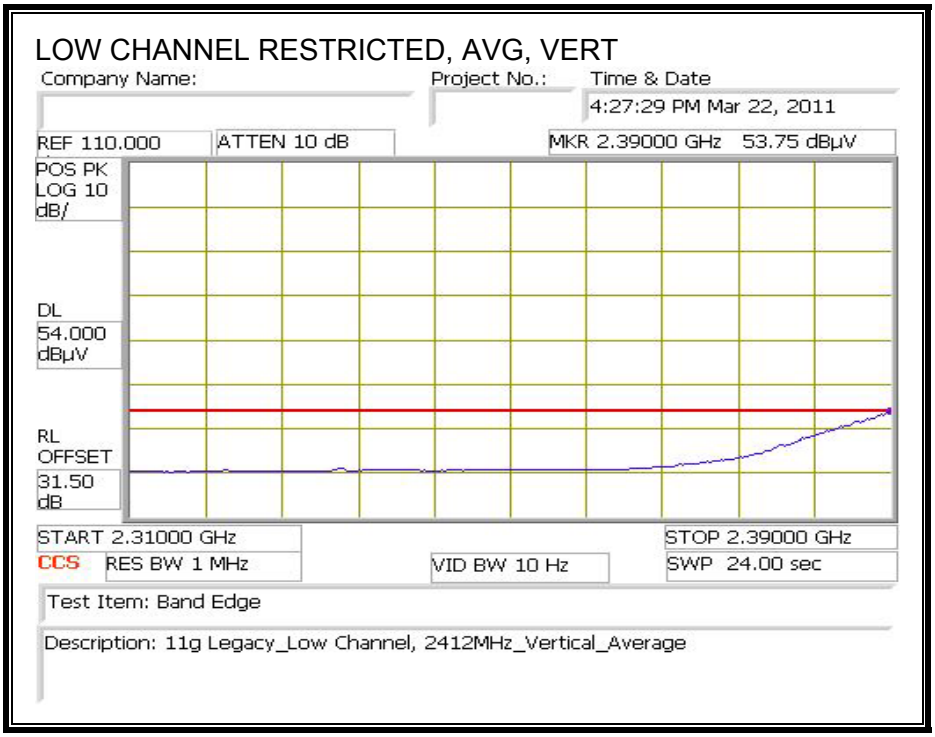
| f GHz | Dist (m) | Read dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Corr. dBuV/m | Limit dBuV/m | Margin dB | Ant. Pol. V/H | Det. P/A/QP | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CHANNEL, 2412MHz | | | | | | | | | | | | | |
| 4.824 | 3.0 | 47.9 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 51.5 | 74.0 | -22.5 | V | P | |
| 4.824 | 3.0 | 45.8 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 49.5 | 54.0 | -4.5 | V | A | |
| 12.060 | 3.0 | 37.9 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 53.7 | 74.0 | -20.3 | V | P | |
| 12.060 | 3.0 | 30.0 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 45.8 | 54.0 | -8.2 | V | A | |
| 14.472 | 3.0 | 36.5 | 39.8 | 10.8 | -32.3 | 0.0 | 0.0 | 54.7 | 74.0 | -19.3 | V | P | |
| 14.472 | 3.0 | 30.7 | 39.8 | 10.8 | -32.3 | 0.0 | 0.0 | 49.0 | 54.0 | -5.0 | V | A | |
| 4.824 | 3.0 | 45.3 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 48.9 | 74.0 | -25.1 | H | P | |
| 4.824 | 3.0 | 42.4 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 46.1 | 54.0 | -7.9 | H | A | |
| 12.060 | 3.0 | 40.1 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 55.9 | 74.0 | -18.1 | H | P | |
| 12.060 | 3.0 | 34.7 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 50.4 | 54.0 | -3.6 | H | A | |
| 14.472 | 3.0 | 35.1 | 39.8 | 10.8 | -32.3 | 0.0 | 0.0 | 53.4 | 74.0 | -20.6 | H | P | |
| 14.472 | 3.0 | 28.2 | 39.8 | 10.8 | -32.3 | 0.0 | 0.0 | 46.5 | 54.0 | -7.5 | H | A | |
| MID CHANNEL, 2437MHz | | | | | | | | | | | | | |
| 4.874 | 3.0 | 48.8 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 52.5 | 74.0 | -21.5 | V | P | |
| 4.874 | 3.0 | 46.8 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 50.5 | 54.0 | -3.5 | V | A | |
| 7.311 | 3.0 | 36.8 | 35.5 | 7.3 | -34.1 | 0.0 | 0.0 | 45.4 | 74.0 | -28.6 | V | P | |
| 7.311 | 3.0 | 26.3 | 35.5 | 7.3 | -34.1 | 0.0 | 0.0 | 35.0 | 54.0 | -19.0 | V | A | |
| 12.185 | 3.0 | 38.2 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 54.0 | 74.0 | -20.0 | V | P | |
| 12.185 | 3.0 | 31.3 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 47.1 | 54.0 | -6.9 | V | A | |
| 4.874 | 3.0 | 47.3 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 51.0 | 74.0 | -23.0 | H | P | |
| 4.874 | 3.0 | 44.4 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 48.1 | 54.0 | -5.9 | H | A | |
| 7.311 | 3.0 | 36.0 | 35.5 | 7.3 | -34.1 | 0.0 | 0.0 | 44.6 | 74.0 | -29.4 | H | P | |
| 7.311 | 3.0 | 24.4 | 35.5 | 7.3 | -34.1 | 0.0 | 0.0 | 33.1 | 54.0 | -20.9 | H | A | |
| 12.185 | 3.0 | 39.1 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 54.9 | 74.0 | -19.1 | H | P | |
| 12.185 | 3.0 | 32.3 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 48.2 | 54.0 | -5.8 | H | A | |
| HIGH CHANNEL, 2462MHz | | | | | | | | | | | | | |
| 4.924 | 3.0 | 46.3 | 32.7 | 5.9 | -34.8 | 0.0 | 0.0 | 50.2 | 74.0 | -23.8 | V | P | |
| 4.924 | 3.0 | 43.8 | 32.7 | 5.9 | -34.8 | 0.0 | 0.0 | 47.6 | 54.0 | -6.4 | V | A | |
| 7.386 | 3.0 | 38.9 | 35.6 | 7.3 | -34.1 | 0.0 | 0.0 | 47.7 | 74.0 | -26.3 | V | P | |
| 7.386 | 3.0 | 31.9 | 35.6 | 7.3 | -34.1 | 0.0 | 0.0 | 40.7 | 54.0 | -13.3 | V | A | |
| 12.310 | 3.0 | 36.5 | 38.5 | 9.9 | -32.5 | 0.0 | 0.0 | 52.4 | 74.0 | -21.6 | V | P | |
| 12.310 | 3.0 | 28.4 | 38.5 | 9.9 | -32.5 | 0.0 | 0.0 | 44.3 | 54.0 | -9.7 | V | A | |
| 4.924 | 3.0 | 45.8 | 32.7 | 5.9 | -34.8 | 0.0 | 0.0 | 49.6 | 74.0 | -24.4 | H | P | |
| 4.924 | 3.0 | 42.8 | 32.7 | 5.9 | -34.8 | 0.0 | 0.0 | 46.6 | 54.0 | -7.4 | H | A | |
| 7.386 | 3.0 | 38.1 | 35.6 | 7.3 | -34.1 | 0.0 | 0.0 | 46.9 | 74.0 | -27.1 | H | P | |
| 7.386 | 3.0 | 30.7 | 35.6 | 7.3 | -34.1 | 0.0 | 0.0 | 39.5 | 54.0 | -14.5 | H | A | |
| 12.310 | 3.0 | 39.7 | 38.5 | 9.9 | -32.5 | 0.0 | 0.0 | 55.6 | 74.0 | -18.4 | H | P | |
| 12.310 | 3.0 | 33.0 | 38.5 | 9.9 | -32.5 | 0.0 | 0.0 | 48.9 | 54.0 | -5.1 | H | A | |

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

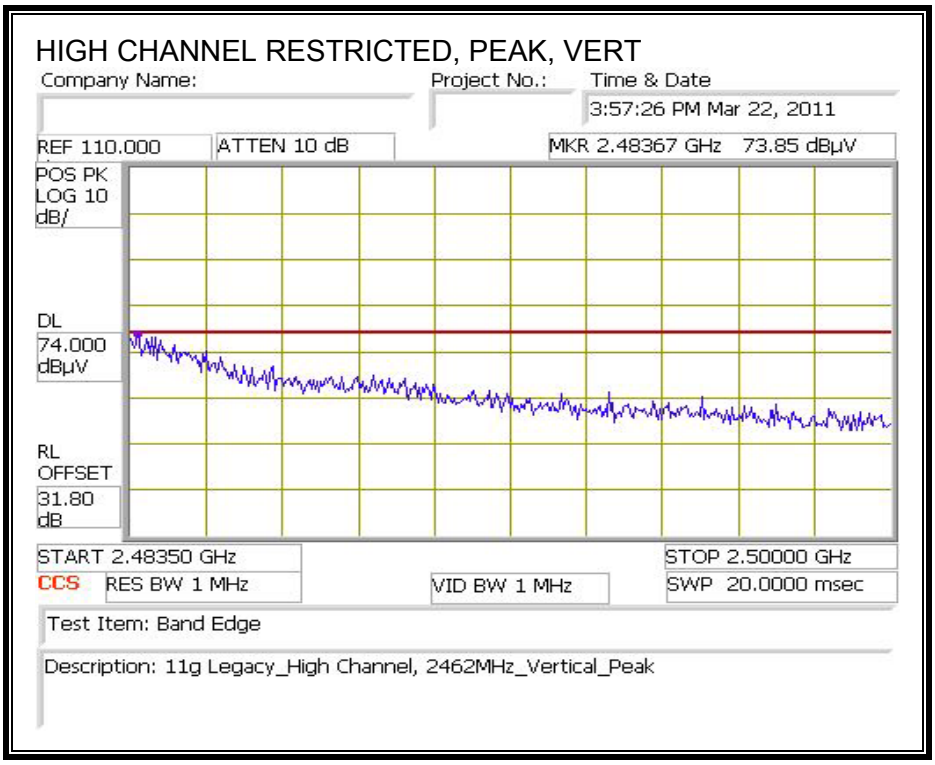
## 8.2.2. 802.11g LEGACY MODE IN THE 2.4 GHz BAND

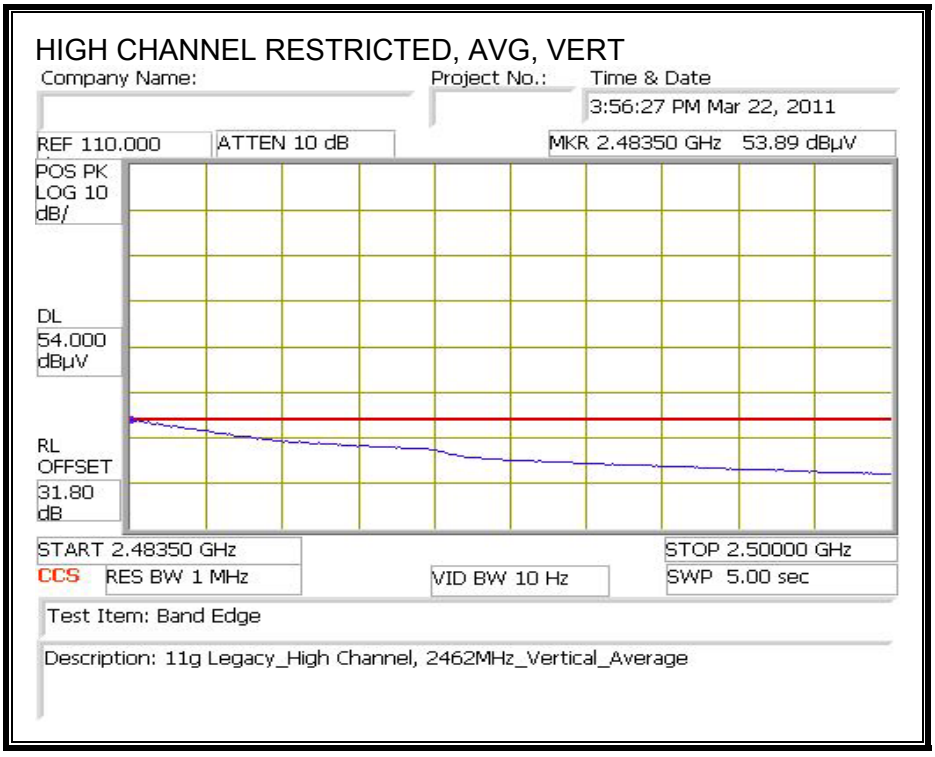
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**ESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



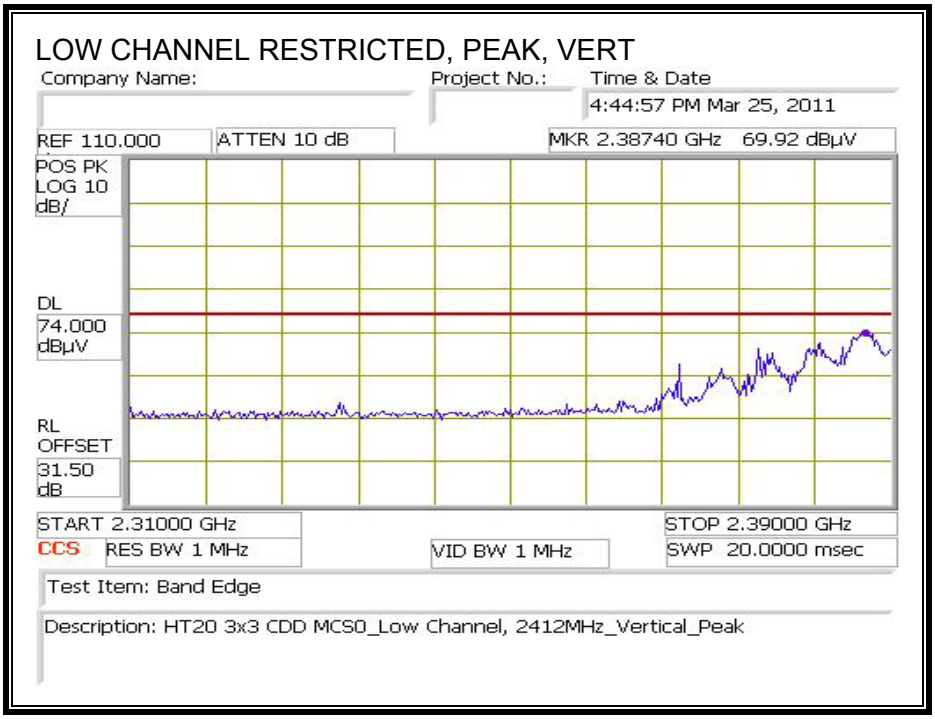



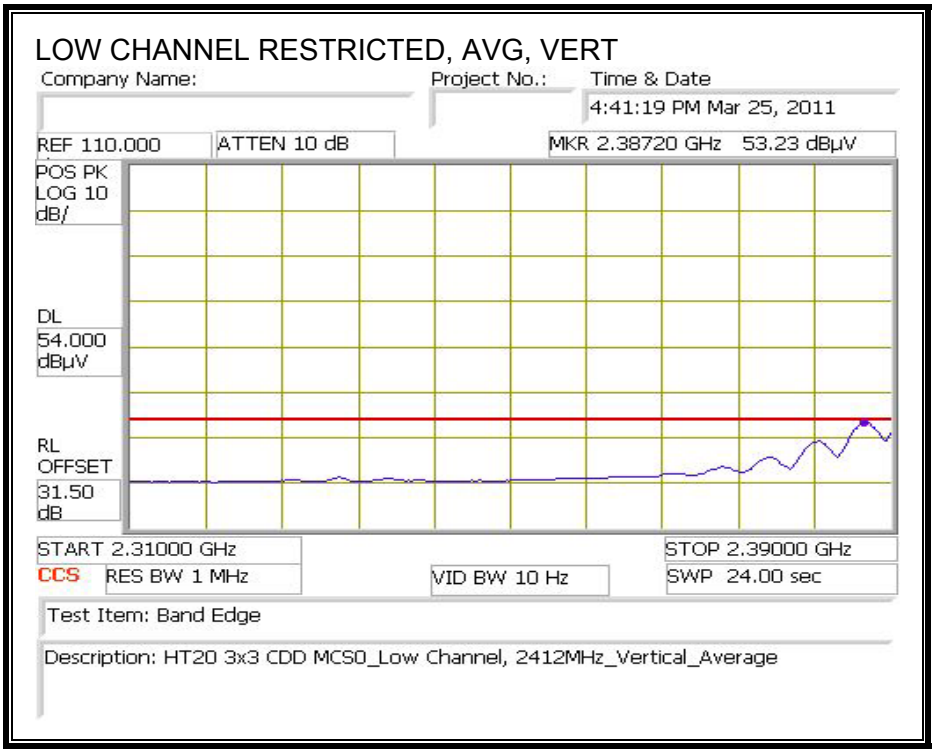
**HARMONICS AND SPURIOUS EMISSIONS**:

Cover by 11n HT20 3x3 CDD which had tested at the worst case of g-mode mid channel output power.

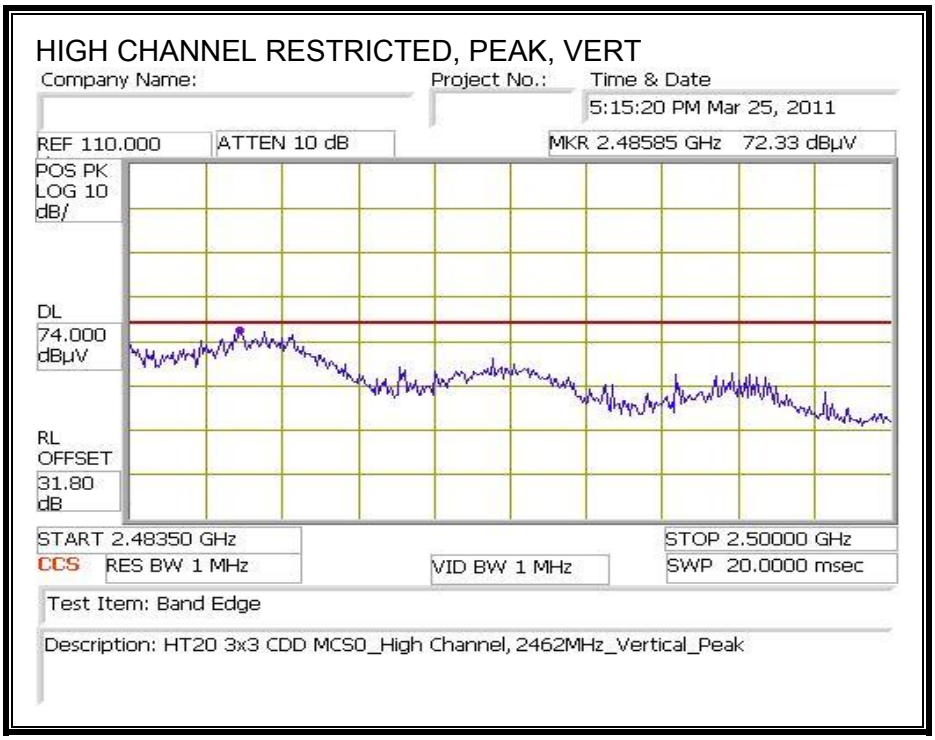
## 8.2.3. 802.11n HT20 THREE CHAINS MIMO MODE IN THE 2.4 GHz BAND

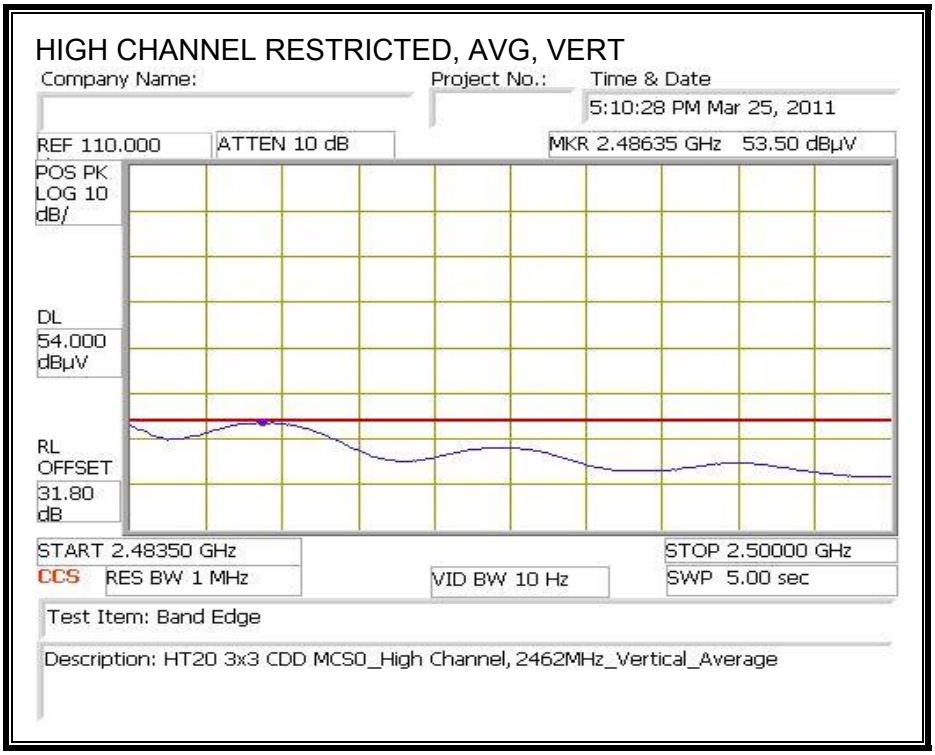
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Company: Broadcom
Project #: 11U13734
Date: 3/18/2011
Test Engineer: Vien Tran
Configuration: EUT / Laptop / Antenna
Mode: Tx 2.4GHz_HT20 CDD MCS0

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T60; S/N: 2238 @3m | T34 HP 8449B | | | FCC 15.209 |

Hi Frequency Cables

| 3' cable 22807700 | 12' cable 22807600 | 20' cable 22807500 | HPF | Reject Filter |
|---|---|---|---|---|
| 3' cable 22807700 | 12' cable 22807600 | 20' cable 22807500 | | R_001 |

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CHANNEL, 2412MHz | | | | | | | | | | | | | | | |
| 4.824 | 3.0 | 48.8 | 37.3 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 52.4 | 40.9 | 74 | 54 | -21.6 | -13.1 | H |
| 7.236 | 3.0 | 36.4 | 24.5 | 35.4 | 7.2 | -34.1 | 0.0 | 0.0 | 44.9 | 33.0 | 74 | 54 | -29.1 | -21.0 | H |
| 9.648 | 3.0 | 34.6 | 23.3 | 37.5 | 8.5 | -33.6 | 0.0 | 0.0 | 47.1 | 35.8 | 74 | 54 | -26.9 | -18.2 | H |
| 12.060 | 3.0 | 48.5 | 34.1 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 64.3 | 49.9 | 74 | 54 | -9.7 | -4.1 | H |
| 4.824 | 3.0 | 51.3 | 38.8 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 54.9 | 42.4 | 74 | 54 | -19.1 | -11.6 | V |
| 7.236 | 3.0 | 36.6 | 24.3 | 35.4 | 7.2 | -34.1 | 0.0 | 0.0 | 45.1 | 32.8 | 74 | 54 | -28.9 | -21.2 | V |
| 9.648 | 3.0 | 35.2 | 23.9 | 37.5 | 8.5 | -33.6 | 0.0 | 0.0 | 47.7 | 36.4 | 74 | 54 | -26.3 | -17.6 | V |
| 12.060 | 3.0 | 43.5 | 29.7 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 59.3 | 45.4 | 74 | 54 | -14.7 | -8.6 | V |
| MID CHANNEL, 2437MHz | | | | | | | | | | | | | | | |
| 4.874 | 3.0 | 47.2 | 36.5 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 51.0 | 40.3 | 74 | 54 | -23.0 | -13.7 | H |
| 7.311 | 3.0 | 40.1 | 25.4 | 35.5 | 7.3 | -34.1 | 0.0 | 0.0 | 48.7 | 34.1 | 74 | 54 | -25.3 | -19.9 | H |
| 9.748 | 3.0 | 35.0 | 22.1 | 37.5 | 8.6 | -33.3 | 0.0 | 0.0 | 47.8 | 34.9 | 74 | 54 | -26.2 | -19.1 | H |
| 12.185 | 3.0 | 49.7 | 34.0 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 65.6 | 49.8 | 74 | 54 | -8.4 | -4.2 | H |
| 4.874 | 3.0 | 50.0 | 36.1 | 32.7 | 5.8 | -34.8 | 0.0 | 0.0 | 53.7 | 39.8 | 74 | 54 | -20.3 | -14.2 | V |
| 7.311 | 3.0 | 40.8 | 25.9 | 35.5 | 7.3 | -34.1 | 0.0 | 0.0 | 49.4 | 34.5 | 74 | 54 | -24.6 | -19.5 | V |
| 9.748 | 3.0 | 34.6 | 24.6 | 37.5 | 8.6 | -33.3 | 0.0 | 0.0 | 47.4 | 37.4 | 74 | 54 | -26.6 | -16.6 | V |
| 12.185 | 3.0 | 43.2 | 31.5 | 38.5 | 9.8 | -32.5 | 0.0 | 0.0 | 59.0 | 47.3 | 74 | 54 | -15.0 | -6.7 | V |
| HIGH CHANNEL, 2462MHz | | | | | | | | | | | | | | | |
| 4.924 | 3.0 | 47.5 | 36.5 | 32.7 | 5.9 | -34.8 | 0.0 | 0.0 | 51.3 | 40.3 | 74 | 54 | -22.7 | -13.7 | H |
| 7.386 | 3.0 | 38.5 | 26.9 | 35.6 | 7.3 | -34.1 | 0.0 | 0.0 | 47.3 | 35.7 | 74 | 54 | -26.7 | -18.3 | H |
| 9.848 | 3.0 | 35.3 | 24.5 | 37.6 | 8.7 | -33.1 | 0.0 | 0.0 | 48.5 | 37.7 | 74 | 54 | -25.5 | -16.3 | H |
| 12.310 | 3.0 | 48.8 | 34.4 | 38.5 | 9.9 | -32.5 | 0.0 | 0.0 | 64.7 | 50.3 | 74 | 54 | -9.3 | -3.7 | H |
| 4.924 | 3.0 | 48.9 | 36.9 | 32.7 | 5.9 | -34.8 | 0.0 | 0.0 | 52.7 | 40.7 | 74 | 54 | -21.3 | -13.3 | V |
| 7.386 | 3.0 | 35.8 | 25.9 | 35.6 | 7.3 | -34.1 | 0.0 | 0.0 | 44.6 | 34.7 | 74 | 54 | -29.4 | -19.3 | V |
| 9.848 | 3.0 | 35.1 | 24.3 | 37.6 | 8.7 | -33.1 | 0.0 | 0.0 | 48.3 | 37.5 | 74 | 54 | -25.7 | -16.5 | V |
| 12.310 | 3.0 | 42.5 | 30.8 | 38.5 | 9.9 | -32.5 | 0.0 | 0.0 | 58.4 | 46.7 | 74 | 54 | -15.6 | -7.3 | V |
| SPUR | | | | | | | | | | | | | | | |
| 1.100 | 3.0 | 51.9 | 37.3 | 24.8 | 2.5 | -38.1 | 0.0 | 0.0 | 41.1 | 26.5 | 74 | 54 | -32.9 | -27.5 | H |
| 1.497 | 3.0 | 54.3 | 35.2 | 26.1 | 2.9 | -37.6 | 0.0 | 0.0 | 45.8 | 26.7 | 74 | 54 | -28.2 | -27.3 | H |
| 1.100 | 3.0 | 50.1 | 35.8 | 24.8 | 2.5 | -38.1 | 0.0 | 0.0 | 39.3 | 25.0 | 74 | 54 | -34.7 | -29.0 | V |
| 1.497 | 3.0 | 47.3 | 31.9 | 26.1 | 2.9 | -37.6 | 0.0 | 0.0 | 38.8 | 23.4 | 74 | 54 | -35.2 | -30.6 | V |

| | | | | | |
|---|---|---|---|---|---|
| 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 | | |

Test with the highest output power of g-mode mid channel as worst case for this mode HT20 3x3 CDD.

## 8.2.4. 802.11n HT20 THREE CHAINS MIMO MODE IN THE 5.8 GHz BAND

**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Company: Broadcom
Project #: 11U13734
Date: 3/21/2011
Test Engineer: Vien Tran
Configuration: EUT / Laptop / Antenna
Mode: Tx 5.8GHz_HT20 CDD MCS0

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T60; S/N: 2238 @3m | T34 HP 8449B | | | FCC 15.205 |

Hi Frequency Cables

| 3' cable 22807700 | 12' cable 22807600 | 20' cable 22807500 | HPF | Reject Filter |
|---|---|---|---|---|
| 3' cable 22807700 | 12' cable 22807600 | 20' cable 22807500 | HPF_7.6GHz | |

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CHANNEL, 5745MHz | | | | | | | | | | | | | | | |
| 11.485 | 3.0 | 38.4 | 28.2 | 38.0 | 9.5 | -32.5 | 0.0 | 0.7 | 54.1 | 43.9 | 74 | 54 | -19.9 | -10.1 | H |
| 11.485 | 3.0 | 38.9 | 29.6 | 38.0 | 9.5 | -32.5 | 0.0 | 0.7 | 54.6 | 45.3 | 74 | 54 | -19.4 | -8.7 | V |
| MID CHANNEL, 5785MHz | | | | | | | | | | | | | | | |
| 11.570 | 3.0 | 36.4 | 26.9 | 38.1 | 9.5 | -32.5 | 0.0 | 0.7 | 52.2 | 42.7 | 74 | 54 | -21.8 | -11.3 | H |
| 11.570 | 3.0 | 38.9 | 30.2 | 38.1 | 9.5 | -32.5 | 0.0 | 0.7 | 54.7 | 46.0 | 74 | 54 | -19.3 | -8.0 | V |
| HIGH CHANNEL, 5825MHz | | | | | | | | | | | | | | | |
| 11.650 | 3.0 | 38.9 | 28.6 | 38.2 | 9.6 | -32.5 | 0.0 | 0.7 | 54.8 | 44.5 | 74 | 54 | -19.2 | -9.5 | H |
| 11.650 | 3.0 | 37.9 | 29.5 | 38.2 | 9.6 | -32.5 | 0.0 | 0.7 | 53.8 | 45.4 | 74 | 54 | -20.2 | -8.6 | V |

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

## 8.2.5. 802.11n HT40 THREE CHAINS MIMO MODE IN THE 5.8 GHz BAND

**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Company: Broadcom
Project #: 11U13734
Date: 3/22/2011
Test Engineer: Vien Tran
Configuration: EUT / Laptop / Antenna
Mode: Tx 5.8GHz_HT40 CDD MCS0

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T60; S/N: 2238 @3m | T34 HP 8449B | | | FCC 15.205 |

Hi Frequency Cables

| 3' cable 22807700 | 12' cable 22807600 | 20' cable 22807500 | HPF | Reject Filter |
|---|---|---|---|---|
| 3' cable 22807700 | 12' cable 22807600 | 20' cable 22807500 | HPF_7.6GHz | |

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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOW CHANNEL, 5755MHz | | | | | | | | | | | | | | | |
| 11.510 | 3.0 | 38.9 | 27.9 | 38.1 | 9.5 | -32.5 | 0.0 | 0.7 | 54.6 | 43.6 | 74 | 54 | -19.4 | -10.4 | H |
| 11.510 | 3.0 | 39.4 | 29.8 | 38.1 | 9.5 | -32.5 | 0.0 | 0.7 | 55.1 | 45.5 | 74 | 54 | -18.9 | -8.5 | V |
| HIGH CHANNEL, 5975MHz | | | | | | | | | | | | | | | |
| 11.590 | 3.0 | 38.9 | 28.2 | 38.1 | 9.5 | -32.5 | 0.0 | 0.7 | 54.7 | 44.0 | 74 | 54 | -19.3 | -10.0 | H |
| 11.590 | 3.0 | 39.8 | 28.8 | 38.1 | 9.5 | -32.5 | 0.0 | 0.7 | 55.6 | 44.6 | 74 | 54 | -18.4 | -9.4 | V |
| | | No other emissions were detected above system noise floor | | | | | | | | | | | | | |

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

# 8.3. RECEIVER ABOVE 1 GHz

## 8.3.1. 20 MHz BANDWIDTH

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

| | |
|---|---|
| Company: | Broadcom |
| Project #: | 11U13734 |
| Date: | 04/19/11 |
| Test Engineer: | Vien Tran |
| 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 | | | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.620 | 3.0 | 55.7 | 40.1 | 26.5 | 3.1 | -37.4 | 0.0 | 0.0 | 47.9 | 32.3 | 74 | 54 | -26.1 | -21.7 | H |
| 1.795 | 3.0 | 55.2 | 37.4 | 27.1 | 3.2 | -37.2 | 0.0 | 0.0 | 48.4 | 30.6 | 74 | 54 | -25.6 | -23.4 | H |
| 2.495 | 3.0 | 56.1 | 35.4 | 28.3 | 3.9 | -36.3 | 0.0 | 0.0 | 52.1 | 31.3 | 74 | 54 | -21.9 | -22.7 | H |
| 5.000 | 3.0 | 50.6 | 29.6 | 32.8 | 5.9 | -34.8 | 0.0 | 0.0 | 54.6 | 33.6 | 74 | 54 | -19.4 | -20.4 | H |
| 1.120 | 3.0 | 59.7 | 43.8 | 24.9 | 2.5 | -38.1 | 0.0 | 0.0 | 49.0 | 33.1 | 74 | 54 | -25.0 | -20.9 | V |
| 1.795 | 3.0 | 55.6 | 37.2 | 27.1 | 3.2 | -37.2 | 0.0 | 0.0 | 48.8 | 30.4 | 74 | 54 | -25.2 | -23.6 | V |
| 2.495 | 3.0 | 57.5 | 35.8 | 28.3 | 3.9 | -36.3 | 0.0 | 0.0 | 53.5 | 31.8 | 74 | 54 | -20.5 | -22.2 | V |
| 5.000 | 3.0 | 53.8 | 30.3 | 32.8 | 5.9 | -34.8 | 0.0 | 0.0 | 57.7 | 34.2 | 74 | 54 | -16.3 | -19.8 | V |

No other emissions were detected above system noise floor

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

## 8.3.2. 40 MHz BANDWIDTH

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Company: Broadcom
Project #: 11U13734
Date: 04/19/11
Test Engineer: Vien Tran
Configuration: EUT / Laptop
Mode: Rx Mode_40MHz Bandwidth in 5GHz 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 | | | 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 | 57.4 | 41.6 | 26.5 | 3.0 | -37.4 | 0.0 | 0.0 | 49.5 | 33.7 | 74 | 54 | -24.5 | -20.3 | H |
| 1.795 | 3.0 | 57.0 | 38.8 | 27.1 | 3.2 | -37.2 | 0.0 | 0.0 | 50.2 | 32.0 | 74 | 54 | -23.8 | -22.0 | H |
| 2.490 | 3.0 | 57.4 | 37.1 | 28.3 | 3.9 | -36.3 | 0.0 | 0.0 | 53.3 | 33.1 | 74 | 54 | -20.7 | -20.9 | H |
| 5.000 | 3.0 | 50.3 | 31.2 | 32.8 | 5.9 | -34.8 | 0.0 | 0.0 | 54.3 | 35.2 | 74 | 54 | -19.7 | -18.8 | H |
| 1.655 | 3.0 | 58.5 | 41.3 | 26.7 | 3.1 | -37.4 | 0.0 | 0.0 | 50.9 | 33.7 | 74 | 54 | -23.1 | -20.3 | V |
| 2.125 | 3.0 | 59.8 | 39.4 | 27.9 | 3.6 | -36.7 | 0.0 | 0.0 | 54.6 | 34.2 | 74 | 54 | -19.4 | -19.8 | V |
| 2.490 | 3.0 | 59.0 | 37.3 | 28.3 | 3.9 | -36.3 | 0.0 | 0.0 | 54.9 | 33.2 | 74 | 54 | -19.1 | -20.8 | V |
| 5.000 | 3.0 | 55.2 | 37.5 | 32.8 | 5.9 | -34.8 | 0.0 | 0.0 | 59.2 | 41.5 | 74 | 54 | -14.8 | -12.5 | V |

No other emissions were detected above system noise floor

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

## 8.4. WORST-CASE BELOW 1 GHz

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

HORIZONTAL AND VERTICAL DATA

**30 - 1000 MHz Measurement**
**Compliance Certification Services, Fremont_ Chamber B**

| | |
|---|---|
| **Test Engr:** | **Vien Tran** |
| **Date:** | **04/19/11** |
| **Project #:** | **11U13734** |
| **Company:** | **Broadcom** |
| **Test Target:** | **FCC Class B** |
| **Mode Oper:** | **Tx Worst-Case** |

**30 - 1000MHz - HORIZONTAL**

| Test Frequency | Meter Reading | Detector | Chamber 5B Below 1GHz Cable.TX [dB] | T10 Below 1 GHz PreAmp. TXT [dB] | T130 Bilog Factors. TXT [dB] | dB[uVolts/ meter] | CFR 47 Part 15 Class B 3m | Margin | Height [cm] | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|
| 215.7229 | 54.84 | QP | 2 | -28.9 | 11.9 | 37.6 | 43.5 | -5.90 | 200 | Horz |
| 266.3558 | 53.00 | PK | 2.3 | -28.7 | 12.3 | 38.9 | 46 | -7.10 | 100 | Horz |
| 296.7355 | 54.97 | QP | 2.4 | -28.5 | 13.2 | 39.8 | 46 | -6.20 | 100 | Horz |
| 499.8001 | 57.73 | QP | 3.1 | -29.4 | 16.8 | 41.40 | 46 | -4.60 | 200 | Horz |
| 896.0693 | 51.73 | QP | 4.1 | -28.6 | 21.5 | 41.73 | 46 | -4.27 | 100 | Horz |
| 952.8314 | 50.17 | QP | 4.3 | -28.4 | 22.1 | 41.02 | 46 | -4.98 | 100 | Horz |
| 995.2032 | 52.87 | QP | 4.5 | -28.2 | 22.5 | 47.9 | 54 | -6.10 | 100 | Horz |

**30 - 1000MHz - VERTICAL**

| Test Frequency | Meter Reading | Detector | Chamber 5B Below 1GHz Cable.TX [dB] | T10 Below 1 GHz PreAmp. TXT [dB] | T130 Bilog Factors. TXT [dB] | dB[uVolts/ meter] | CFR 47 Part 15 Class B 3m | Margin | Height [cm] | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|
| 30.8496 | 40.61 | PK | 0.9 | -29.5 | 20 | 32.01 | 40 | -7.99 | 109 | Vert |
| 200.00 | 50.43 | PK | 2 | -28.9 | 12 | 35.53 | 43.5 | -7.97 | 200 | Vert |
| 497.9347 | 54.53 | QP | 3.1 | -29.4 | 16.8 | 41.12 | 46 | -4.88 | 100 | Vert |
| 715.1233 | 45.42 | PK | 3.7 | -29.2 | 19.5 | 39.42 | 46 | -6.58 | 100 | Vert |
| 896.0693 | 43.41 | PK | 4.1 | -28.6 | 21.5 | 40.41 | 46 | -5.59 | 100 | Vert |
| 996.8021 | 44.48 | PK | 4.5 | -28.2 | 22.6 | 43.38 | 54 | -10.62 | 100 | Vert |

PK - Peak detector
QP - Quasi-Peak detector
LnAv - Linear Average detector
LgAv - Log Average detector
Av - Average detector
CAV - CISPR Average detector
RMS - RMS detection
CRMS - CISPR RMS detection
File: RE 30-1000 MHz 3m FCC Class B Full Scan.TST

# 9. AC POWER LINE CONDUCTED EMISSIONS

**LIMITS**

FCC §15.207 (a)

RSS-Gen 7.2.2

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

* Decreases with the logarithm of the frequency.

**TEST PROCEDURE**

ANSI C63.4

**RESULTS**

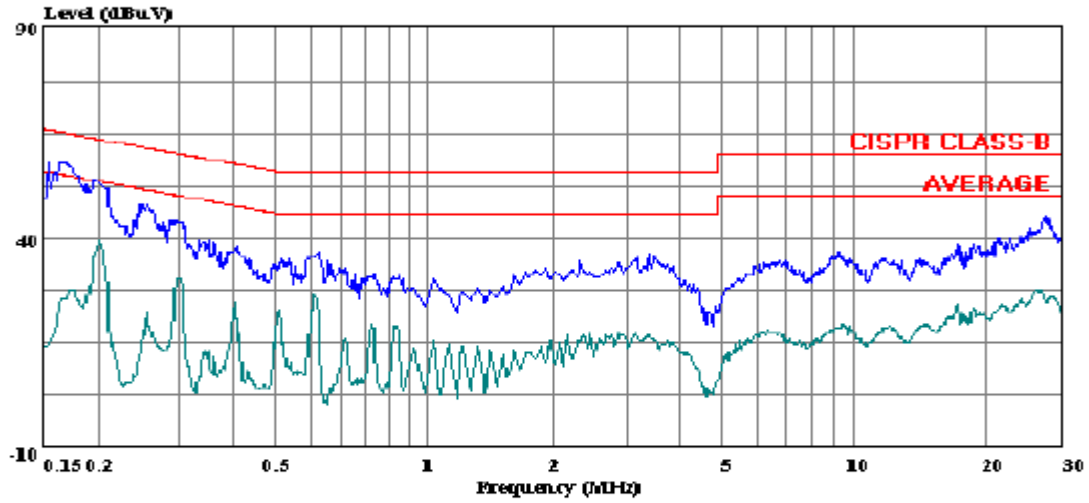
## 6 WORST EMISSIONS

| CONDUCTED EMISSIONS DATA (115VAC 60Hz) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Freq. | Reading | | | Closs | Limit | FCC_B | Margin | | Remark |
| (MHz) | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB) | QP | AV | QP (dB) | AV (dB) | L1 / L2 |
| 0.17 | 57.95 | -- | 27.53 | 0.00 | 65.16 | 55.16 | -7.21 | -27.63 | L1 |
| 0.20 | 53.71 | -- | 38.66 | 0.00 | 63.82 | 53.82 | -10.11 | -15.16 | L1 |
| 27.13 | 44.27 | -- | 27.47 | 0.00 | 60.00 | 50.00 | -15.73 | -22.53 | L1 |
| 0.15 | 57.16 | -- | 26.23 | 0.00 | 65.84 | 55.84 | -8.68 | -29.61 | L2 |
| 0.23 | 47.98 | -- | 38.74 | 0.00 | 62.38 | 52.38 | -14.40 | -13.64 | L2 |
| 27.13 | 43.00 | -- | 26.62 | 0.00 | 60.00 | 50.00 | -17.00 | -23.38 | L2 |
| 6 Worst Data | | | | | | | | | |

**LINE 1 RESULTS**

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

Data#: 7 File#: AC Line Conduction_3x3 (x28).EMI
Date: 03-17-2011 Time: 13:55:28



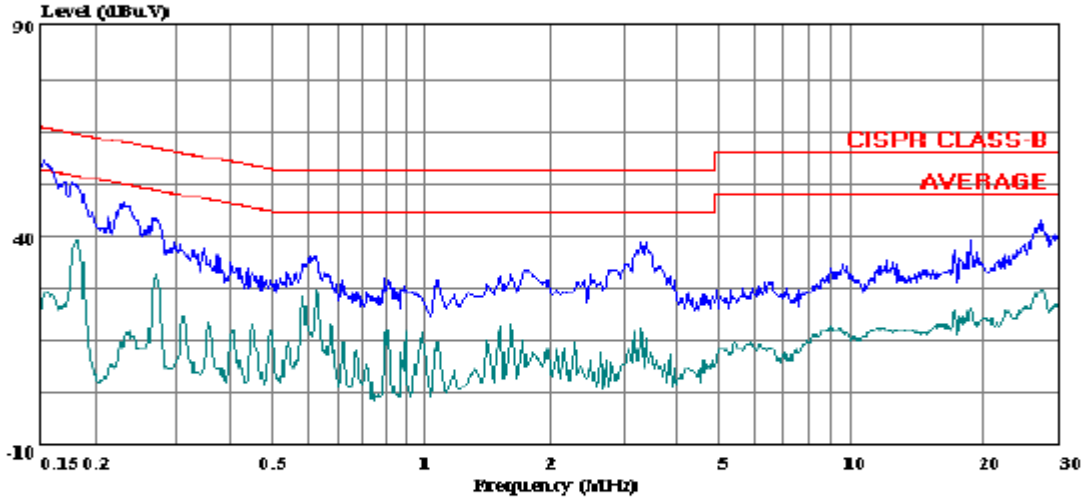

Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 11U13734
Company : Broadcom
Configuration : EUT with Laptop
EUT Description: 802.11agn MIMO WLAN+Bluetooth Combo
Mode : Tx Worst-case
Target : FCC Class B
Voltage : 115V / 60Hz
: L1: Blue (Peak), Green (Average)

**LINE 2 RESULTS**

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

Data#: 21 File#: AC Line Conduction_3x3 (x28).EMI
Date: 03-17-2011 Time: 14:15:32




Trace: 19 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 11U13734
Company : Broadcom
Configuration : EUT with Laptop
EUT Description: 802.11agn MIMO WLAN + Bluetooth Combo
Mode : Tx Worst-Case
Target : FCC Class B
Voltage : 115V / 60Hz
: L2: Blue (Peak), Green (Average)

# 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 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**

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**

| Band (MHz) | Mode | Separation Distance (m) | Output Power (dBm) | Antenna Gain (dBi) | IC Power Density (W/m^2) | FCC Power Density (mW/cm^2) |
|---|---|---|---|---|---|---|
| 2400 to 2483.5 MHz Authorized Band | | | | | | |
| 2412 - 2462 | 802.11b Three Chains CDD Legacy | 0.20 | 23.91 | 8.76 | 3.68 | 0.368 |
| 5725 to 5850 MHz Authorized Band | | | | | | |
| 5745 - 5825 | 802.11n Three Chains 20MHz CDD | 0.20 | 23.97 | 8.40 | 3.44 | 0.344 |