**FCC CFR47 PART 15 SUBPART C**
**INDUSTRY CANADA RSS-210 ISSUE 7**
**INDUSTRY CANADA RSS-GEN ISSUE 2**

# CERTIFICATION TEST REPORT

**FOR**

**802.11a/b/g/n PCI Module**

**MODEL NUMBER: AR5BMB82**

**FCC ID: PPD-AR5BMB82**

**IC: 4104A-AR5BMB82**

**REPORT NUMBER: 07U11326-2, REVISION B**

**ISSUE DATE: DECEMBER 3, 2007**

*Prepared for*
**ATHEROS COMMUNICATIONS, INC.**
**5480 GREAT AMERICA PARKWAY**
**SANTA CLARA, CA 95054, U.S.A.**

*Prepared by*
**COMPLIANCE CERTIFICATION SERVICES**
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NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 10/29/07 | Initial Issue | F. Ibrahim |
| A | 11/12/07 | Editorial changes. | F. Ibrahim |
| B | 12/3/07 | Clarified multiple transmitting chains and spatial separation of antennas in MPE section | F. Ibrahim |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** ATHEROS COMMUNICATIONS, INC.
5480 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, U.S.A.

**EUT DESCRIPTION:** 802.11a/b/g/n PCI Module

**MODEL:** AR5BMB82

**SERIAL NUMBER:** MB82-031-S0263

**DATE TESTED:** OCTOBER 18 - 24, 2007

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | No Non-Compliance Noted |
| INDUSTRY CANADA RSS-210 Issue 7 | No Non-Compliance Noted |
| INDUSTRY CANADA RSS-GEN ISSUE 2 | No Non-Compliance Noted |

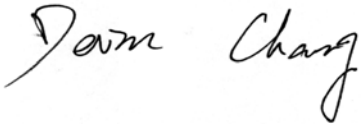
Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**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 Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

FRANK IBRAHIM
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:



DEVIN CHANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

# 2. TEST METHODOLOGY

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

# 3. FACILITIES AND ACCREDITATION

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

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

# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

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

## 4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---|---|
| Radiated Emission, 30 to 200 MHz | +/- 3.3 dB |
| Radiated Emission, 200 to 1000 MHz | +4.5 / -2.9 dB |
| Radiated Emission, 1000 to 2000 MHz | +4.5 / -2.9 dB |
| Power Line Conducted Emission | +/- 2.9 dB |

Uncertainty figures are valid to a confidence level of 95%.

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is a 3x3 802.11a/b/g/n PCI Module.

The radio module is manufactured by ATHEROS COMMUNICATIONS, INC.

## 5.2. MAXIMUM OUTPUT POWER

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

| Frequency Range (MHz) | Mode | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| 2412 - 2462 | 802.11b | 27.75 | 595.66 |
| 2412 - 2462 | 802.11g | 26.78 | 476.43 |
| 2412 - 2462 | 802.11n HT20 | 26.63 | 460.26 |
| 2422 - 2452 | 802.11n HT40 | 27.32 | 539.51 |
| 5745 - 5825 | 802.11a | 24.89 | 308.32 |
| 5745 - 5825 | 802.11n HT20 | 24.79 | 301.30 |
| 5755 - 5795 | 802.11n HT40 | 24.74 | 297.85 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Dipole Antenna, model: TWF-614C-406, with a maximum gain of 3 dBi in the 2.4 GHz bands, and 5 dBi in the 5GHz bands.

## 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was ART revision 0.5 Build # 20, ART_11n.
For TX-related testing, the program puts the EUT in continuous transmitting mode with a duty cycle of 99%, for RX-related testing, the program puts the EUT in continuous receiving mode.

## 5.5. WORST-CASE CONFIGURATION AND MODE

EUT was tested as an external module inserted 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:

802.11b Mode (20 MHz BW operation): 1Mbps, CCK, Spatial Stream 1
802.11g Mode (20 MHz BW operation): 9 Mbps, OFDM, Spatial Stream 1
802.11n MIMO HT20 Mode: MCS0, 6.5Mbps, OFDM, Spatial Stream 1
802.11n MIMO HT40 Mode: MCS0, 13.5Mbps, OFDM, Spatial Stream 1

802.11a Mode (20 MHz BW operation): 9Mbps, OFDM, Spatial Stream 1
802.11n MIMO HT20 Mode: MCS0, 6.5Mbps, OFDM, Spatial Stream 1
802.11n MIMO HT40 Mode: MCS0, 13.5Mbps, OFDM, Spatial Stream 1

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 11b/1Mbps, Mid Channel.

In the 2.4 GHz band:
For each mode, preliminary testing was performed on Low Channel for PPSD and Conducted Spurious for both individual chains and combiner to determine worst-case configuration, and the worst-case configuration was used for mid and high channels for that mode.
For all modes in the 2.4 GHz, it was determined that using a combiner is worst case for PPSD results. For Conducted Spurious, individual chains were worst case for 11b, HT20 and HT40, while combiner was worst case for 11g.

In the 5 GHz bands:
For all modes, worst chain was used for 26 dB BW and 99% BW, that was determined to be Chain 2 from preliminary testing.
For all modes, preliminary testing on Conducted Spurious showed that using combiner is worse than individual chains; therefore, final testing was performed using a combiner.

## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| Laptop PC | LENOVO | T43 | L3-AB1GT | DOC |
| AC/DC Adapter | IBM | 08K8204 | 11S08K8204Z1Z | N/A |
| Cardbus to MINI-PCI | VYTEK | stcbmpi3 | 244 | N/A |

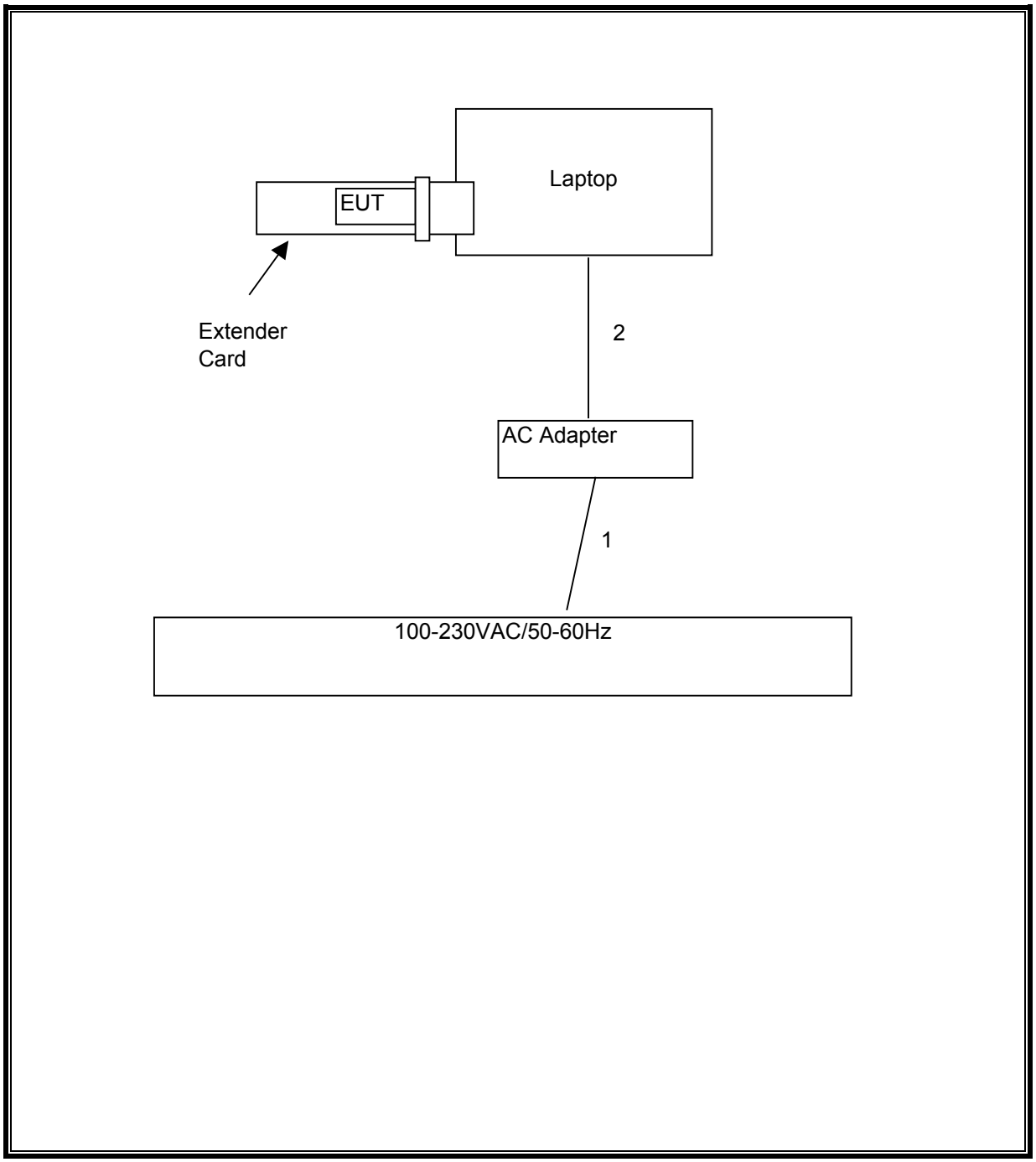
**I/O CABLES**

| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No.** | **Port** | **# of Identical Ports** | **Connector Type** | **Cable Type** | **Cable Length** | **Remarks** |
| 1 | AC | 1 | US 115V | Un-shielded | 0.8m | N/A |
| 2 | DC | 1 | DC | Un-shielded | 1.8m | Ferrite at one end |

**TEST SETUP**

The EUT is connected to a laptop PC via a PCI extension card during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**



# 6. TEST AND MEASUREMENT EQUIPMENT

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

| TEST EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **S/N** | **Cal Due** |
| Power Meter | Agilent / HP | 438A | C01068 | 09/12/08 |
| Power Sensor, 18 GHz | Agilent / HP | 8481A | N02782 | 39560 |
| RF Filter Section | Agilent / HP | 85420E | C00958 | 06/12/08 |
| Harmonic Mixer Cable | Agilent / HP | 5061-5458 | C00627* | CNR |
| Spectrum Analyzer, 44 GHz | Agilent / HP | E4446A | C01012 | 08/07/08 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | C01011 | 09/28/08 |
| Preamplifier, 1300 MHz | Agilent / HP | 8447D | 0 | 05/09/08 |
| Antenna, Horn, 18 GHz | EMCO | 3115 | C00945 | 04/15/08 |
| Preamplifier, 26.5 GHz | Agilent / HP | 8449B | C01052 | 08/03/08 |
| LISN, 30 MHz | FCC | LISN-50/250-25-2 | N02625 | 10/30/08 |
| EMI Test Receiver, 30 MHz | R & S | ESHS 20 | N02396 | 01/27/08 |
| 2.4-2.5 GHz Reject Filter | Micro-Tronics | BRM50702 | 1 | CNR |
| Reject Filter, 5.15-5.35 GHz | Micro-Tronics | BRC13190 | N02679 | CNR |
| Reject Filter, 5.47-5.725 GHz | Micro-Tronics | BRC13191 | N02678 | CNR |
| Reject Filter, 5.725-5.825 GHz | Micro-Tronics | BRC13192 | N02677 | CNR |
| Preamplifier, 40 GHz | Miteq | NSP4000-SP2 | C00990 | 10/11/08 |
| Antenna, Horn, 26.5 GHz | ARA | MWH-1826/B | C00980 | 09/28/08 |
| Antenna, Horn, 40 GHz | ARA | MWH-2640/B | C00981 | 04/11/08 |

# 7. ANTENNA PORT TEST RESULTS

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

### 7.1.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

**TEST PROCEDURE**

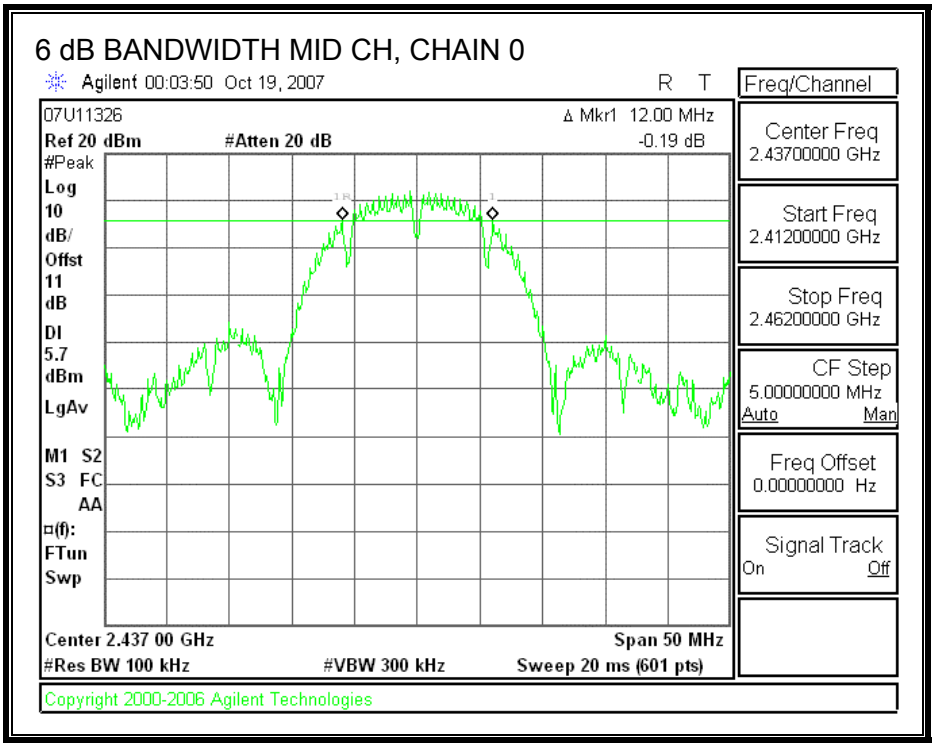
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

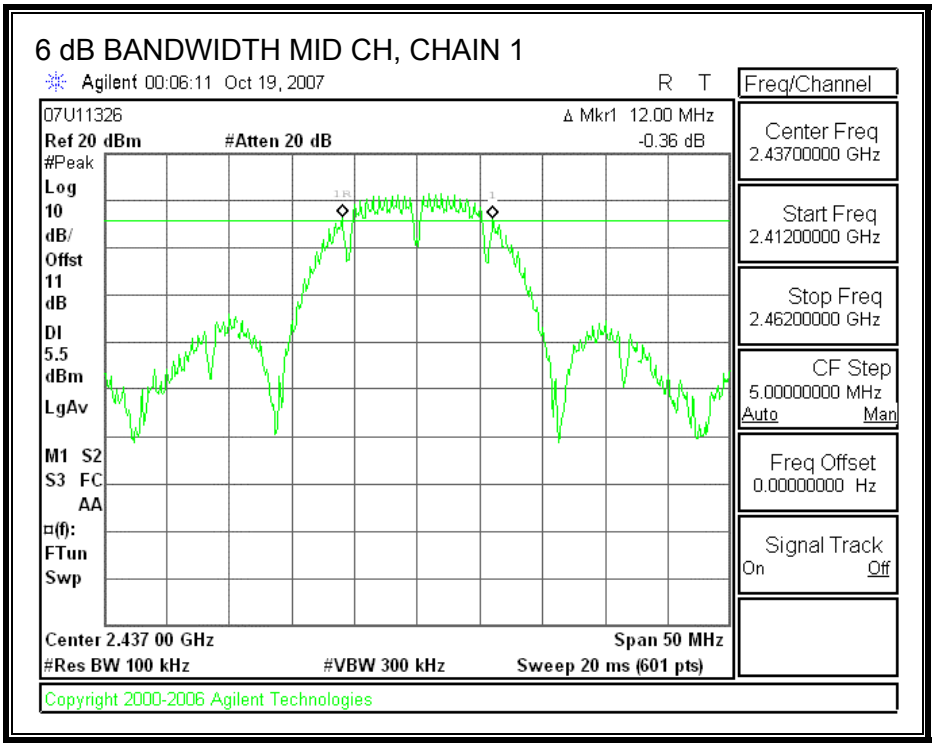
**RESULTS**

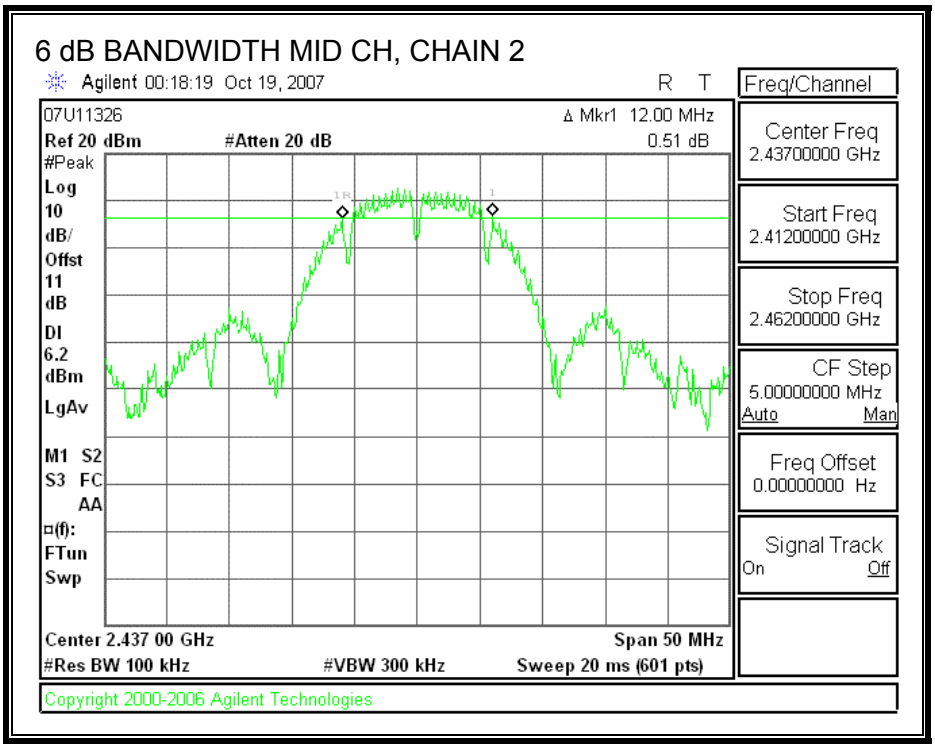
| Channel | Frequency (MHz) | Chain 0 6 dB BW (MHz) | Chain 1 6 dB BW (MHz) | Chain 2 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2412 | 12 | 12 | 12 | 0.5 |
| Middle | 2437 | 12 | 12 | 12 | 0.5 |
| High | 2462 | 12 | 12 | 12 | 0.5 |

Middle Channel plots are included hereafter.

**6 dB BANDWIDTH**





### 7.1.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

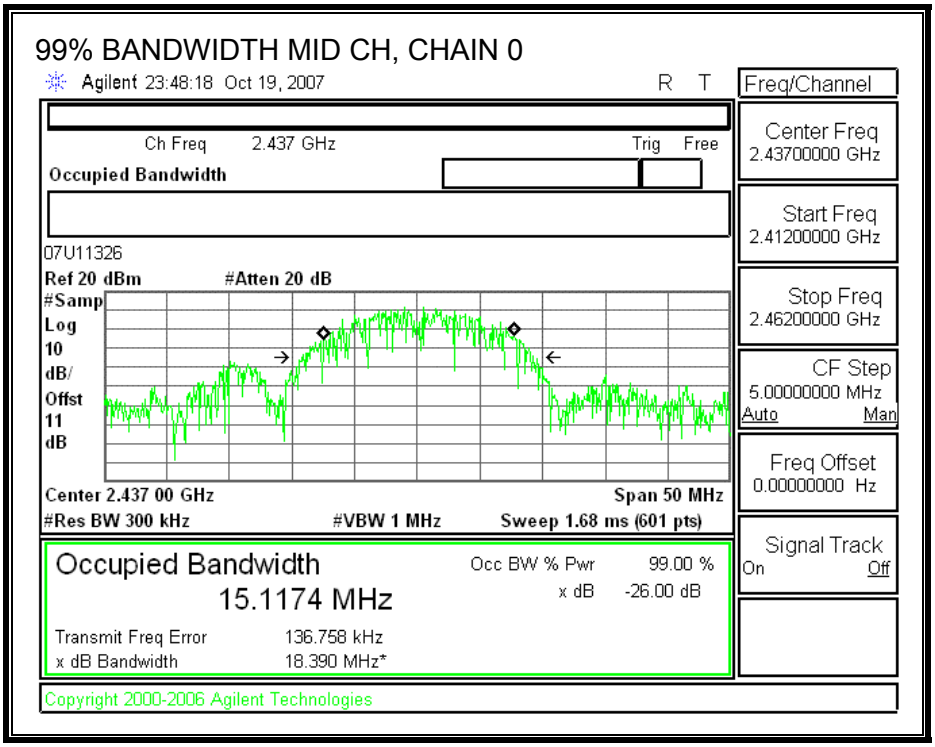
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

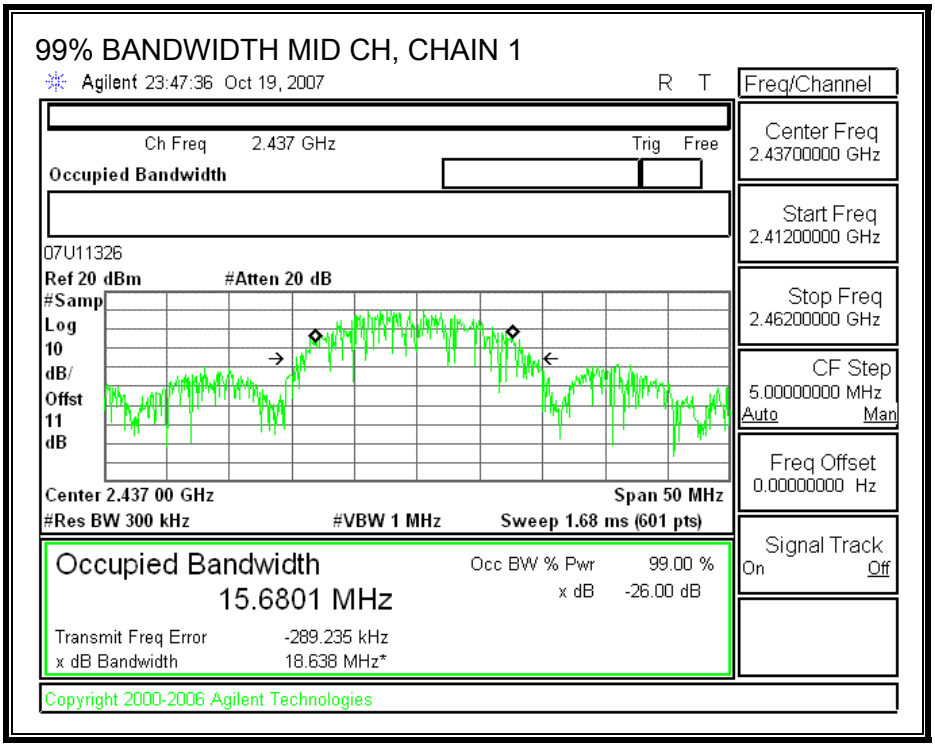
**RESULTS**

| Channel | Frequency (MHz) | Chain 0 99% Bandwidth (MHz) | Chain 1 99% Bandwidth (MHz) | Chain 2 99% Bandwidth (MHz) |
|---|---|---|---|---|
| Low | 2412 | 15.0830 | 15.6301 | 15.6638 |
| Middle | 2437 | 15.1174 | 15.6801 | 15.5809 |
| High | 2462 | 15.5653 | 15.3153 | 15.3969 |

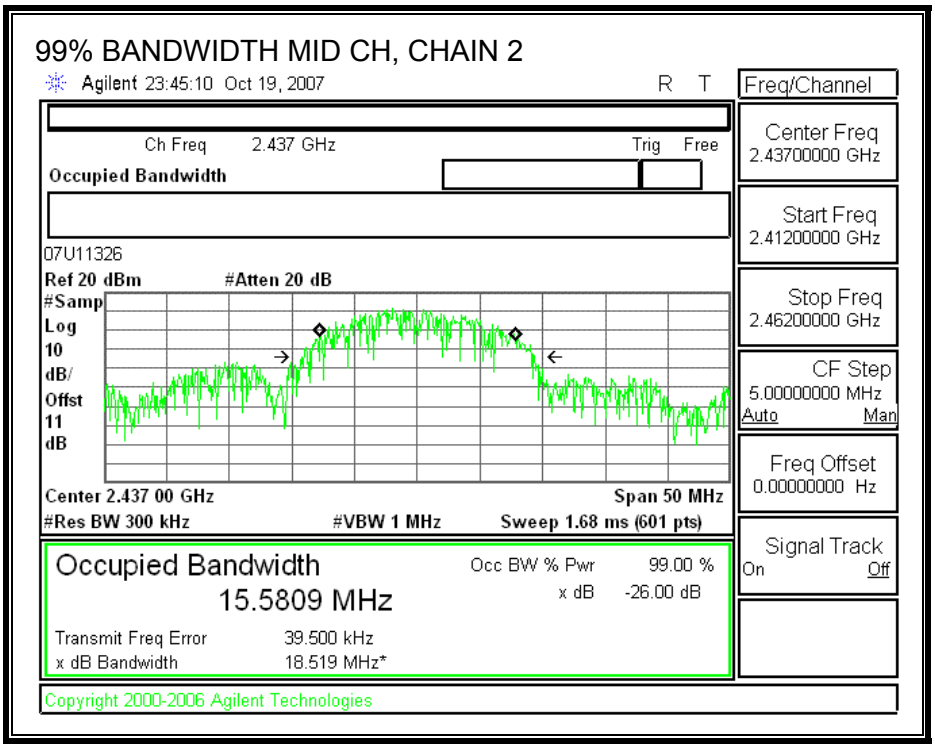
Middle channel plots are included hereafter.

**99% BANDWIDTH**



99% BANDWIDTH MID CH, CHAIN 2



### 7.1.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 4.77 | 7.77 |

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

**TEST PROCEDURE**

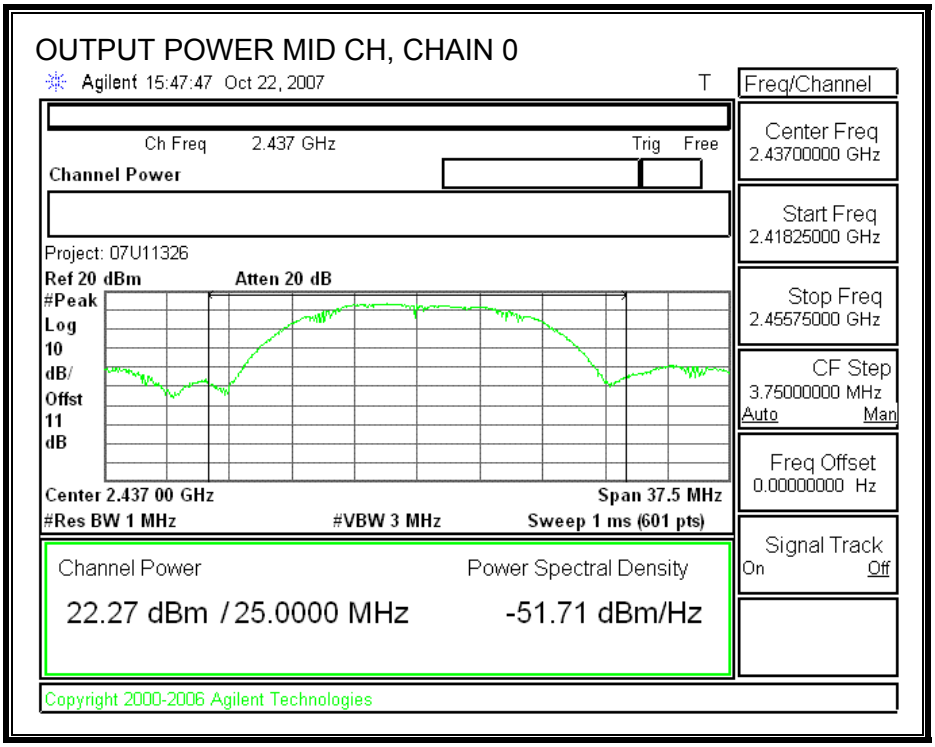
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

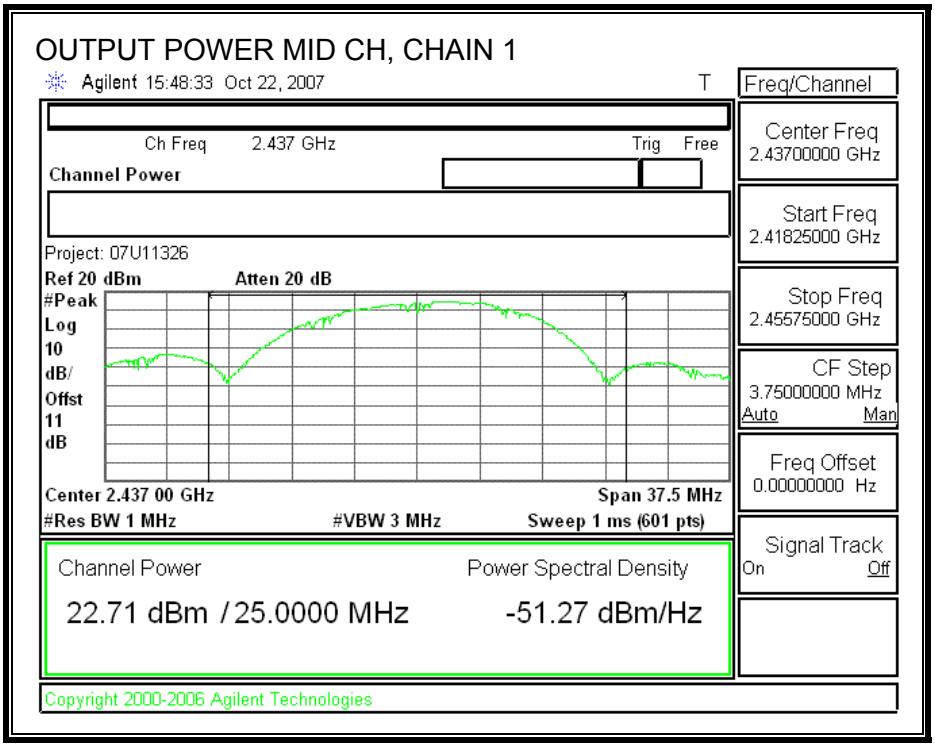
**RESULTS**

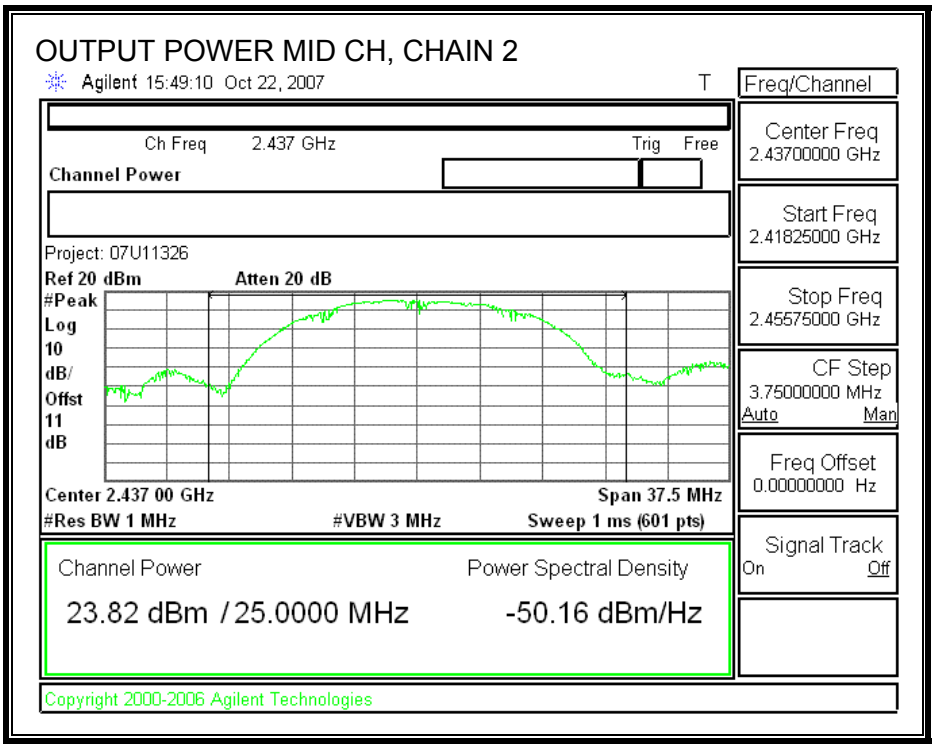
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 22.08 | 21.84 | 22.22 | 26.82 | 28.23 | -1.41 |
| Mid | 2437 | 22.27 | 22.71 | 23.82 | 27.75 | 28.23 | -0.48 |
| High | 2462 | 21.08 | 19.73 | 21.76 | 25.71 | 28.23 | -2.52 |

Middle channel plots are included hereafter.

**OUTPUT POWER**





## 7.1.4. AVERAGE POWER FOR LEGACY 11b MODE (2.4GHz)

**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 0 (dBm) | Chain 1 (dBm) | Chain 2 (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 2412 | 19.44 | 19.23 | 19.64 | 24.21 |
| Middle | 2437 | 19.95 | 19.57 | 19.99 | 24.61 |
| High | 2462 | 18.61 | 17.79 | 18.97 | 23.26 |

## 7.1.5. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

**TEST PROCEDURE**

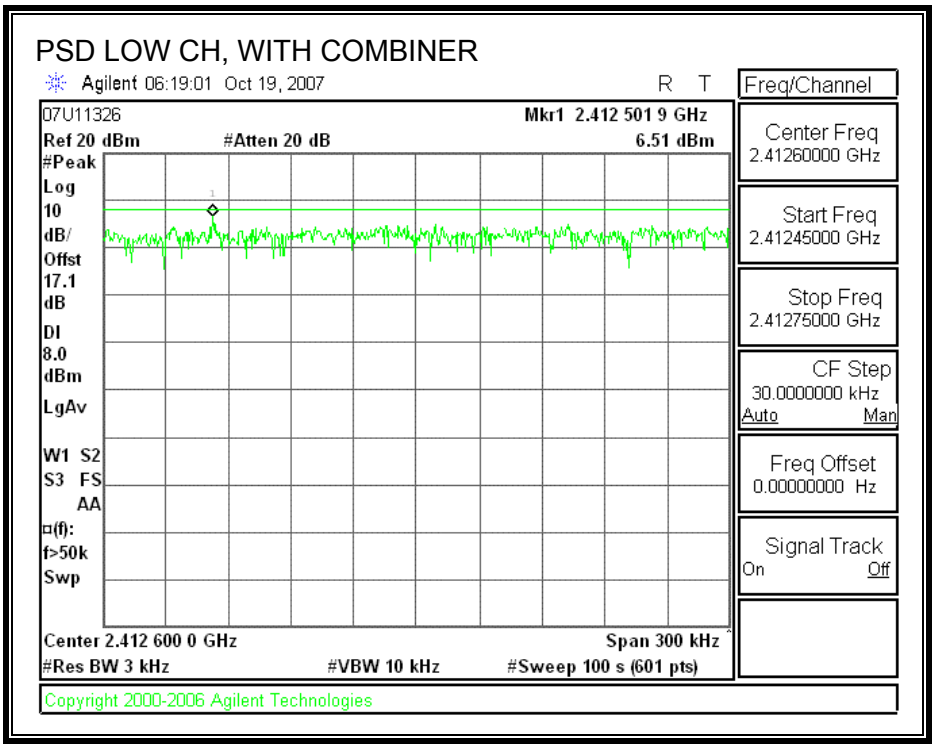
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

**RESULTS**

| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2412 | 6.51 | 8 | -1.49 |
| Middle | 2437 | 6.33 | 8 | -1.67 |
| High | 2462 | 4.36 | 8 | -3.64 |

Low channel plot is included hereafter.

**POWER SPECTRAL DENSITY, WITH COMBINER**



## 7.1.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

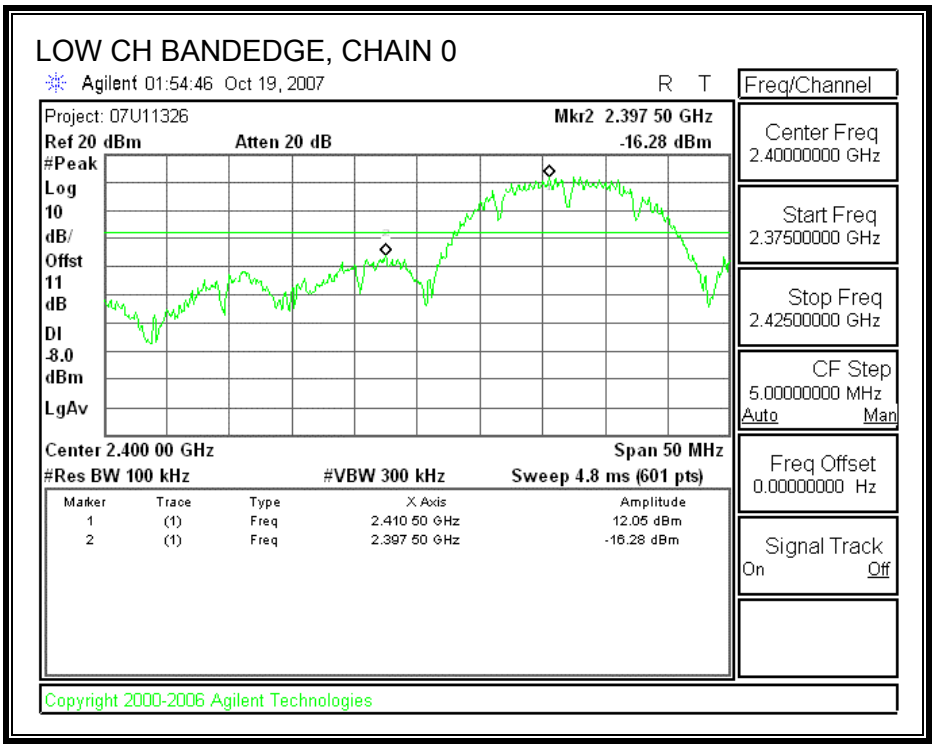
**TEST PROCEDURE**

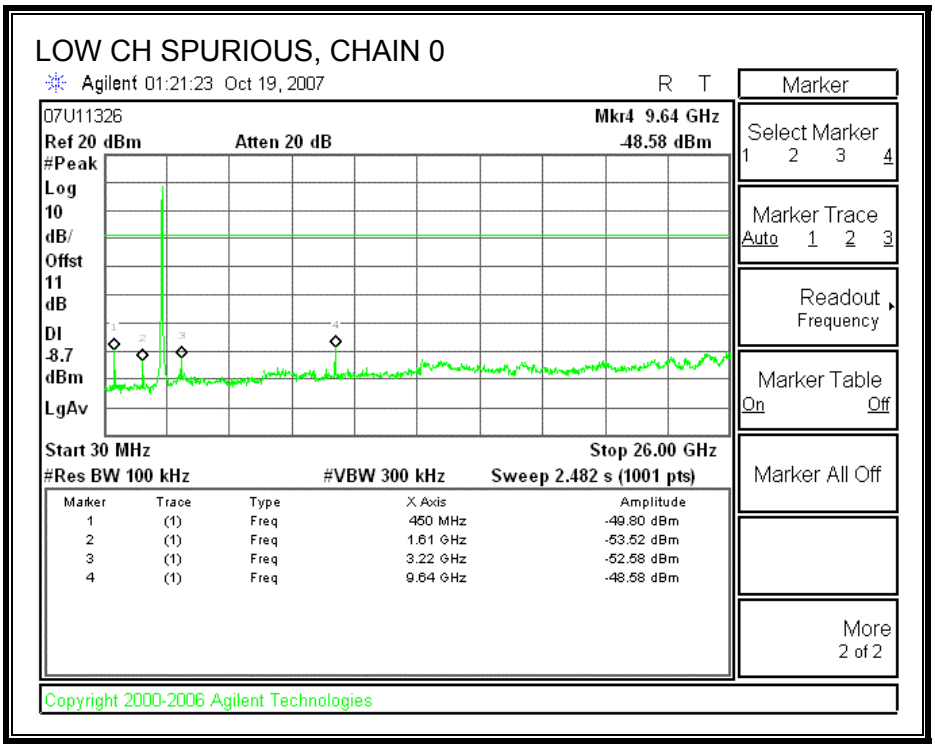
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

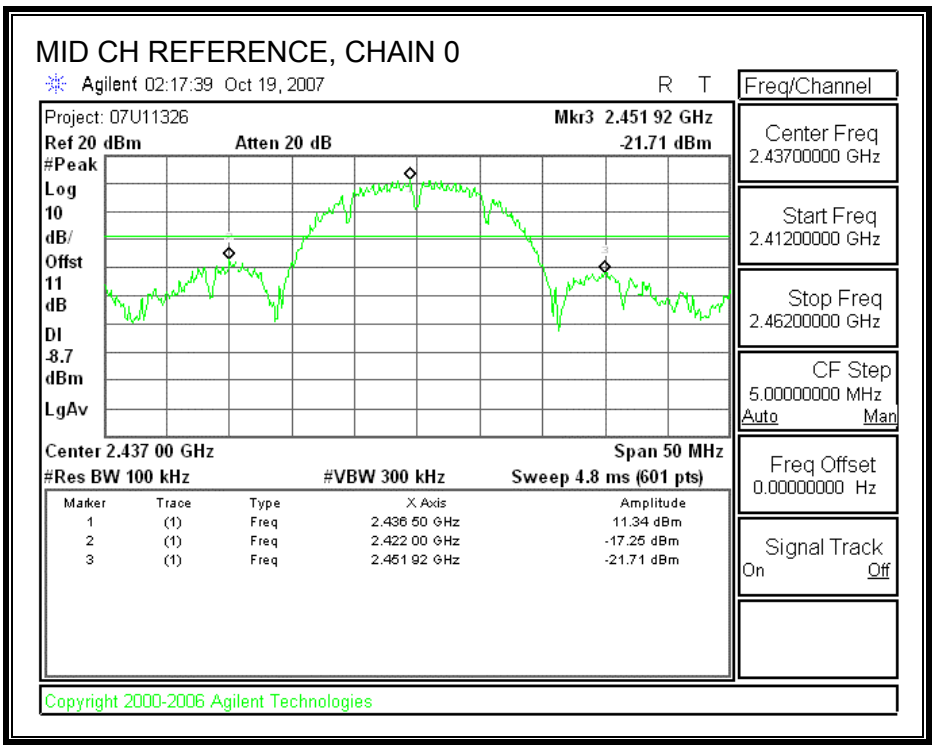
**RESULTS**

**CHAIN 0 SPURIOUS EMISSIONS**

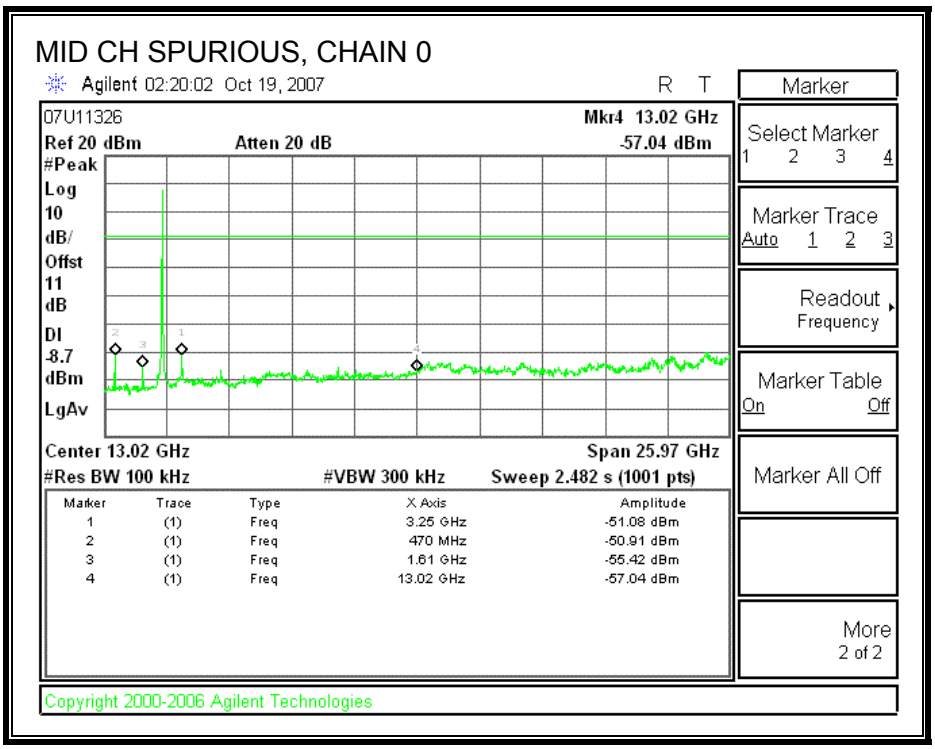


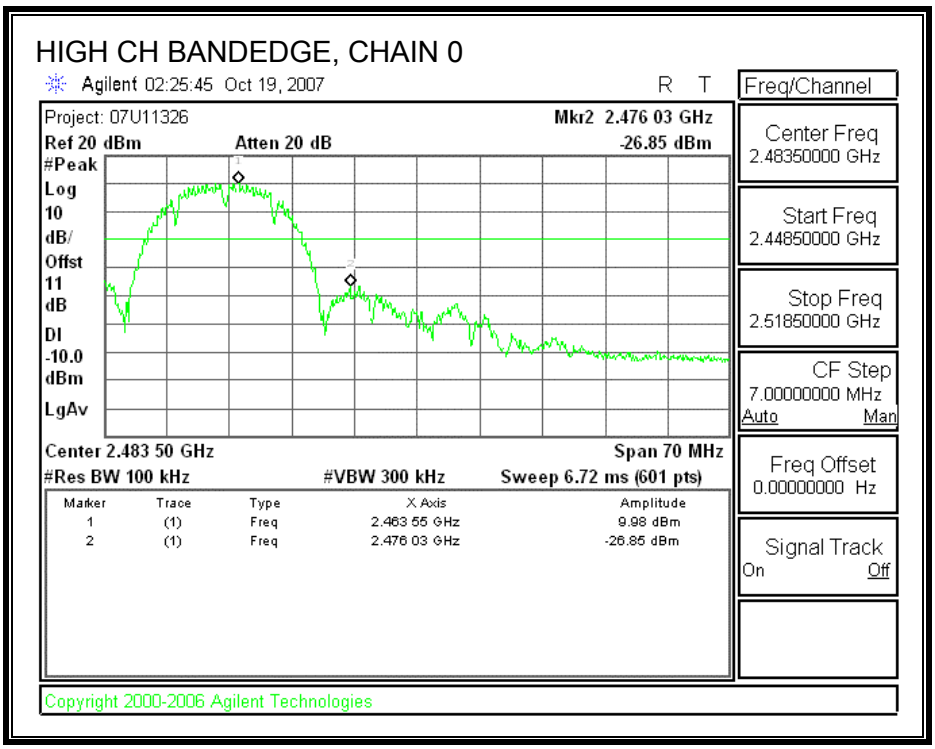



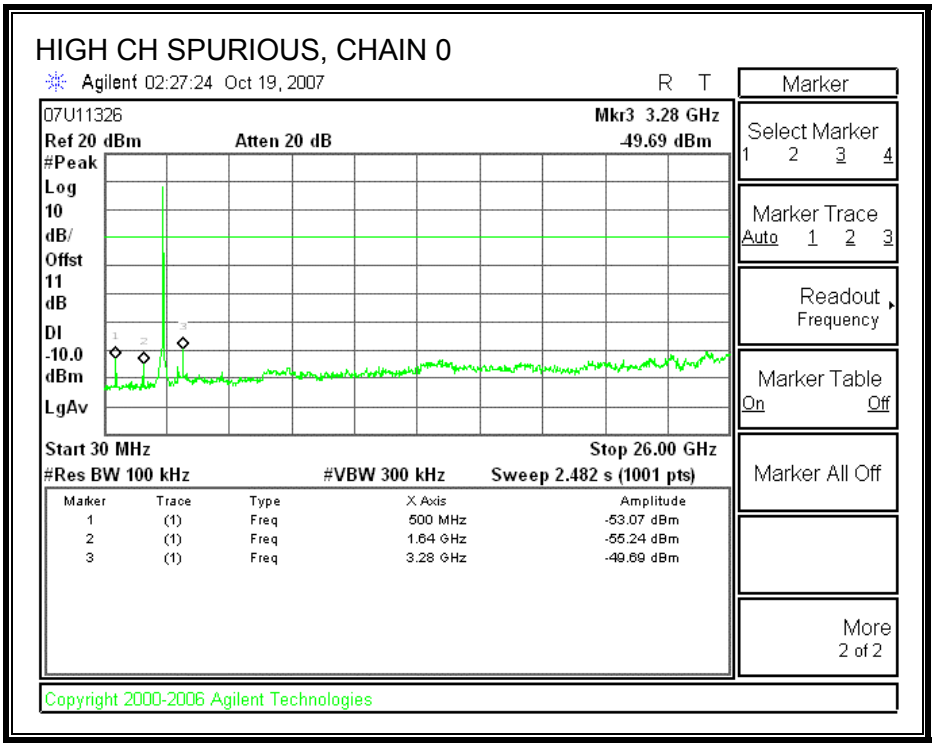
MID CH REFERENCE, CHAIN 0



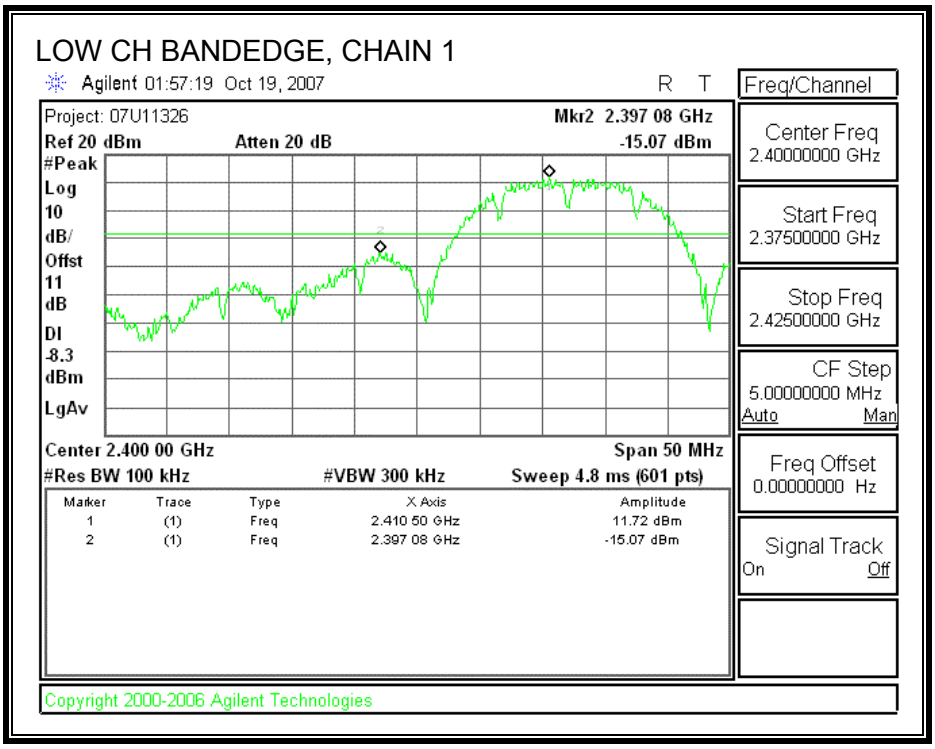

MID CH SPURIOUS, CHAIN 0

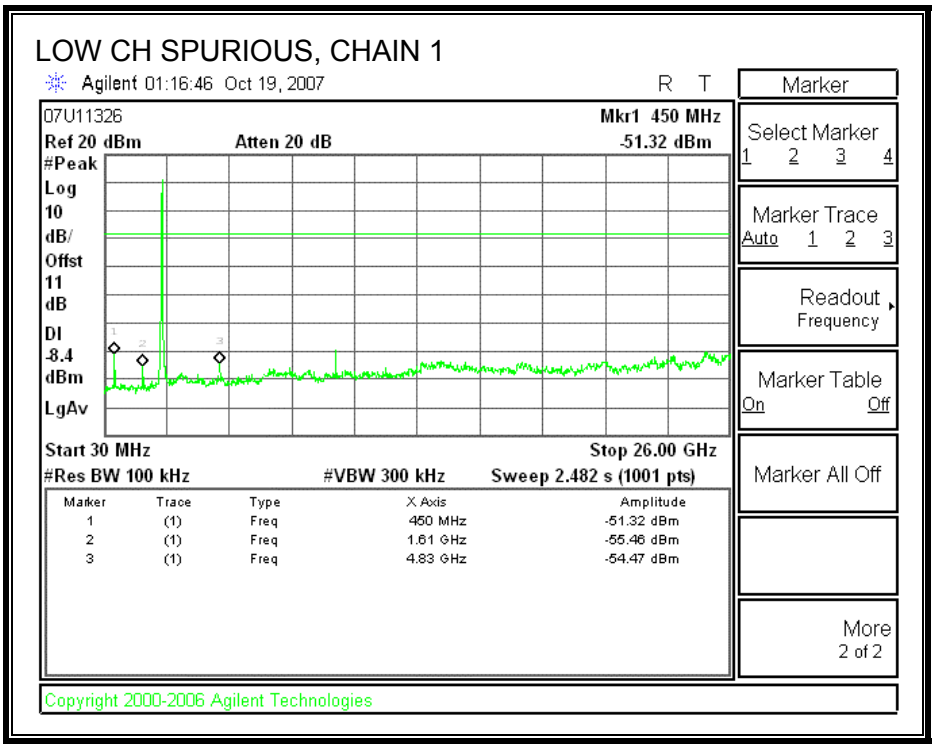




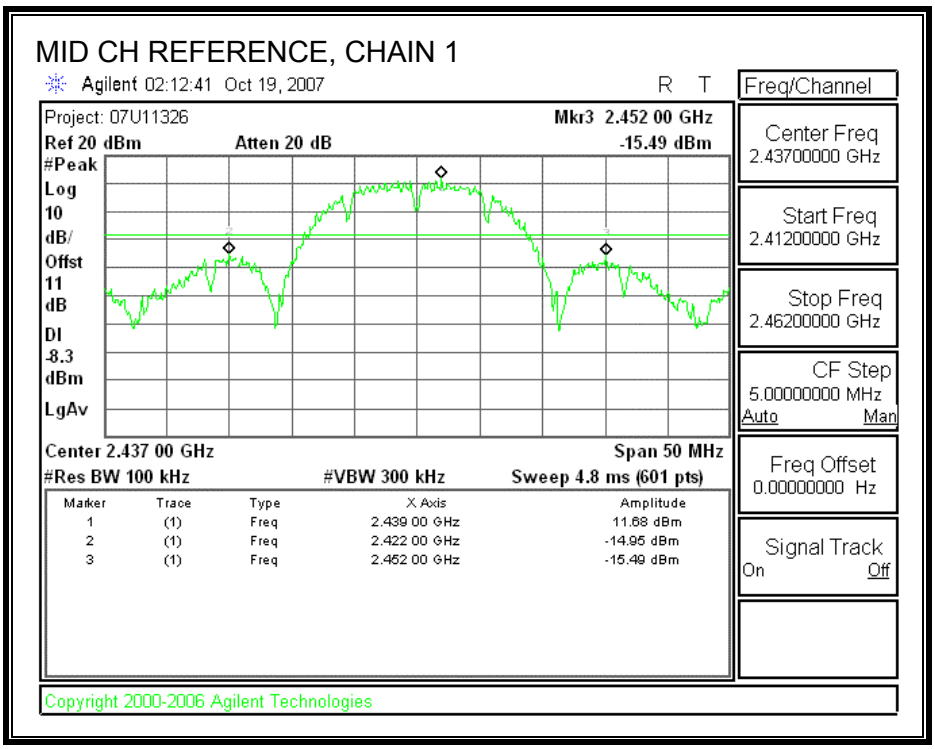



**CHAIN 1 SPURIOUS EMISSIONS**

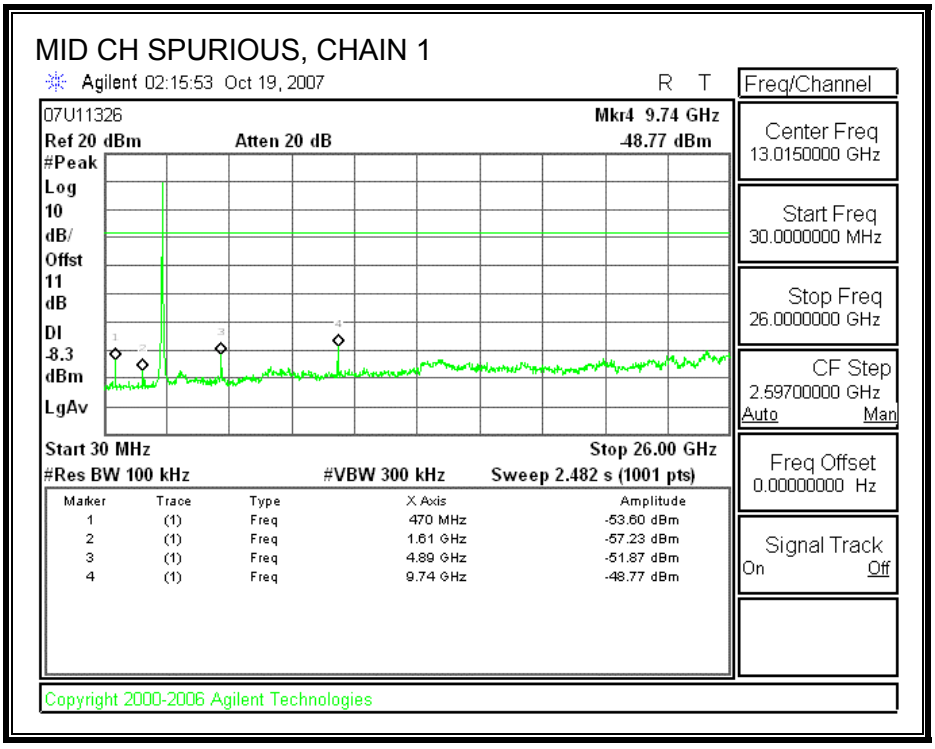


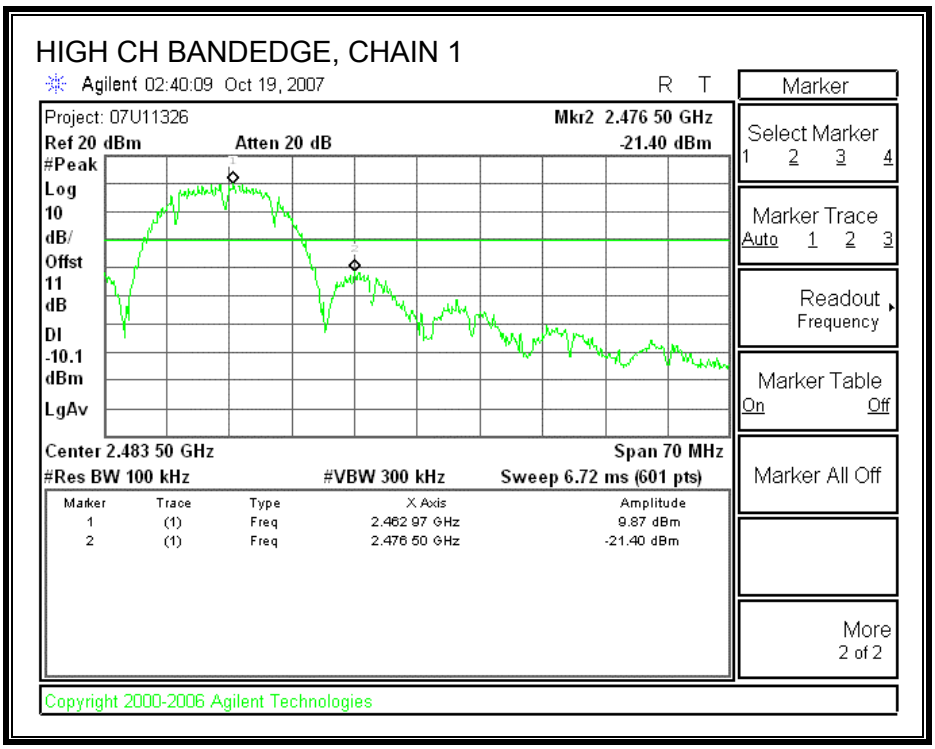
MID CH REFERENCE, CHAIN 1



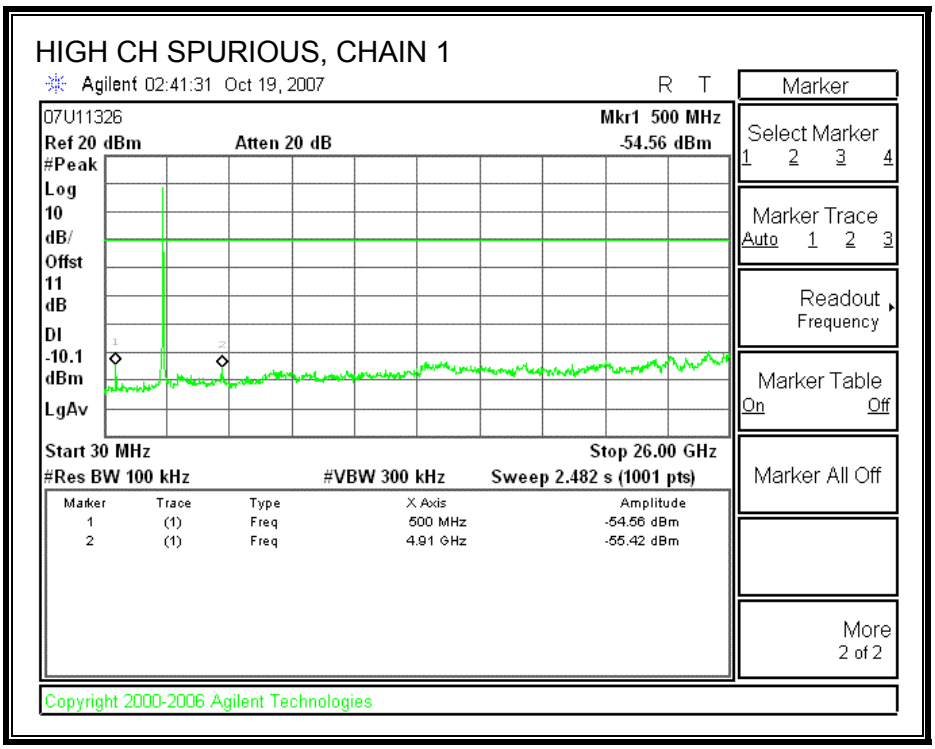

MID CH SPURIOUS, CHAIN 1



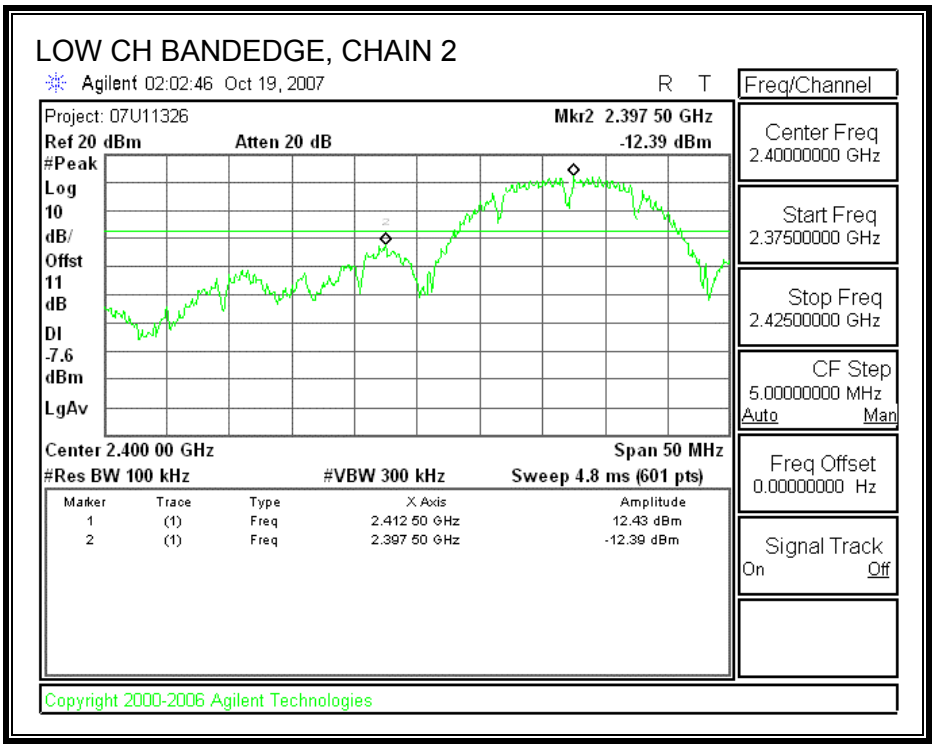
HIGH CH BANDEDGE, CHAIN 1

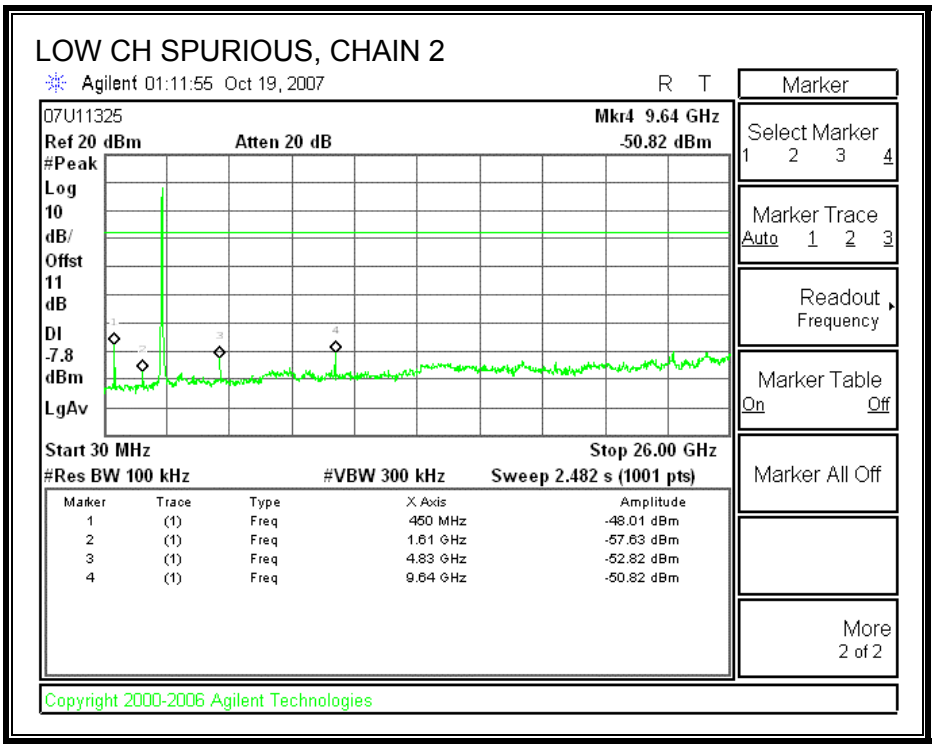



HIGH CH SPURIOUS, CHAIN 1

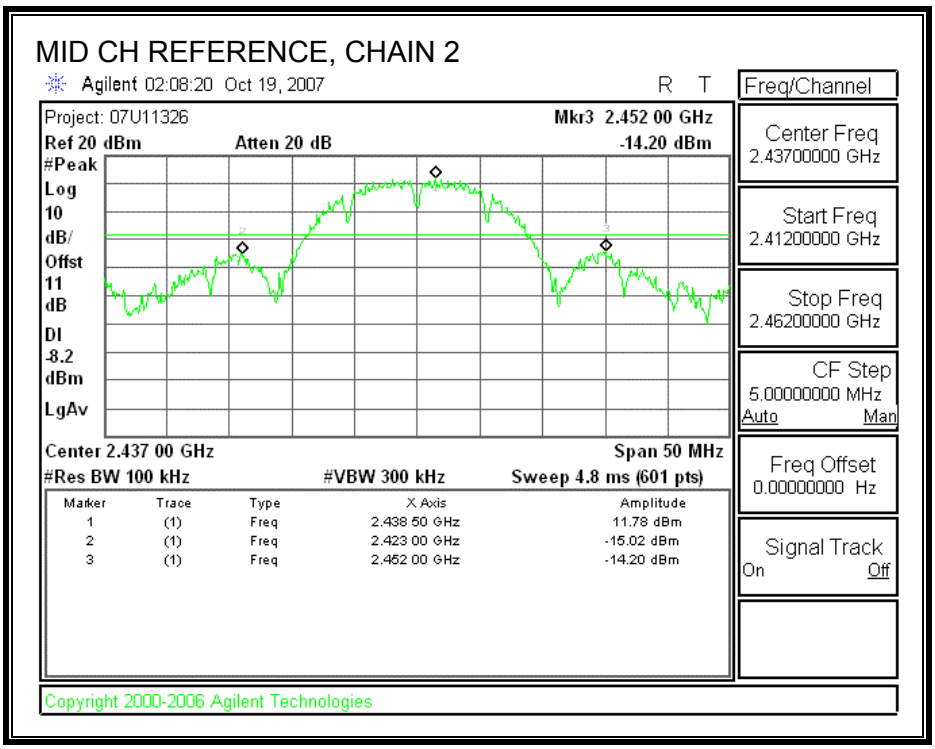


**CHAIN 2 SPURIOUS EMISSIONS**

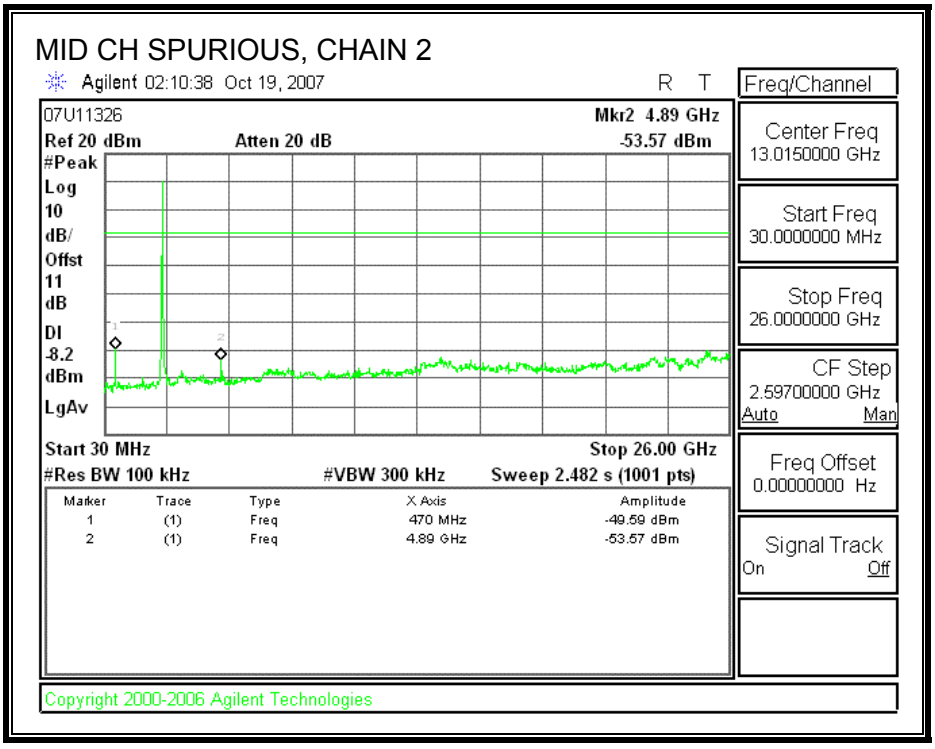


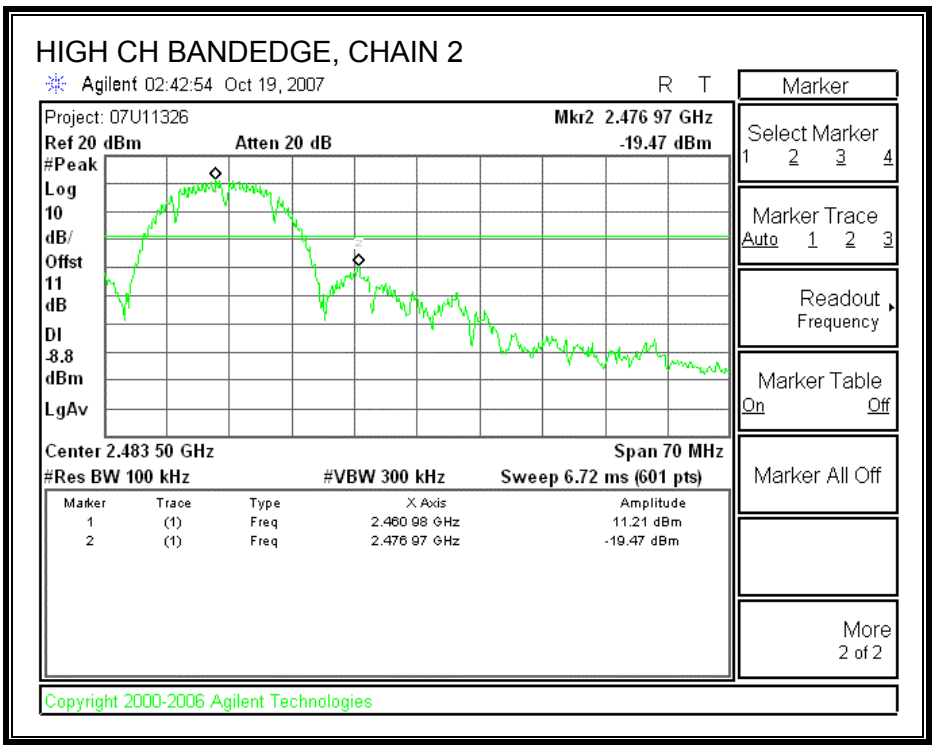
MID CH REFERENCE, CHAIN 2



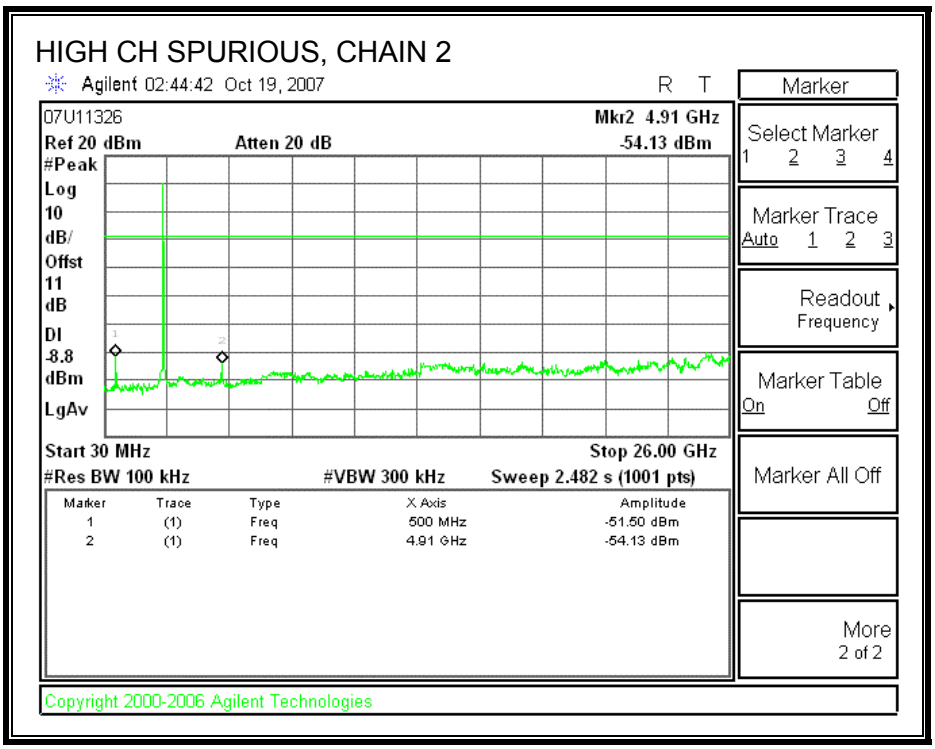

MID CH SPURIOUS, CHAIN 2



HIGH CH BANDEDGE, CHAIN 2




HIGH CH SPURIOUS, CHAIN 2



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

## 7.2.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

**TEST PROCEDURE**

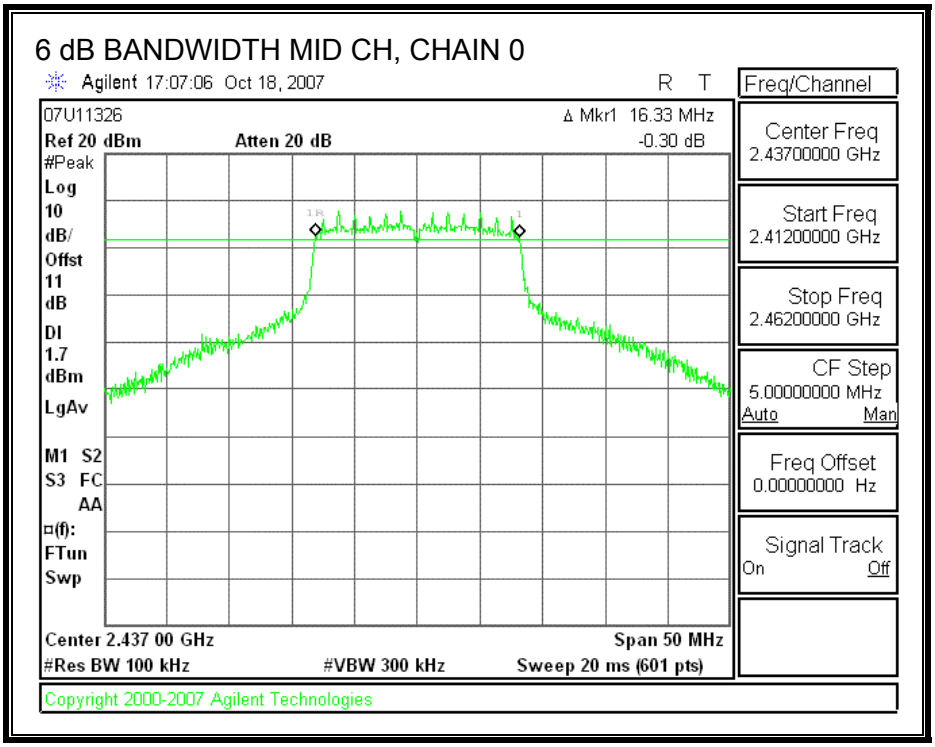
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

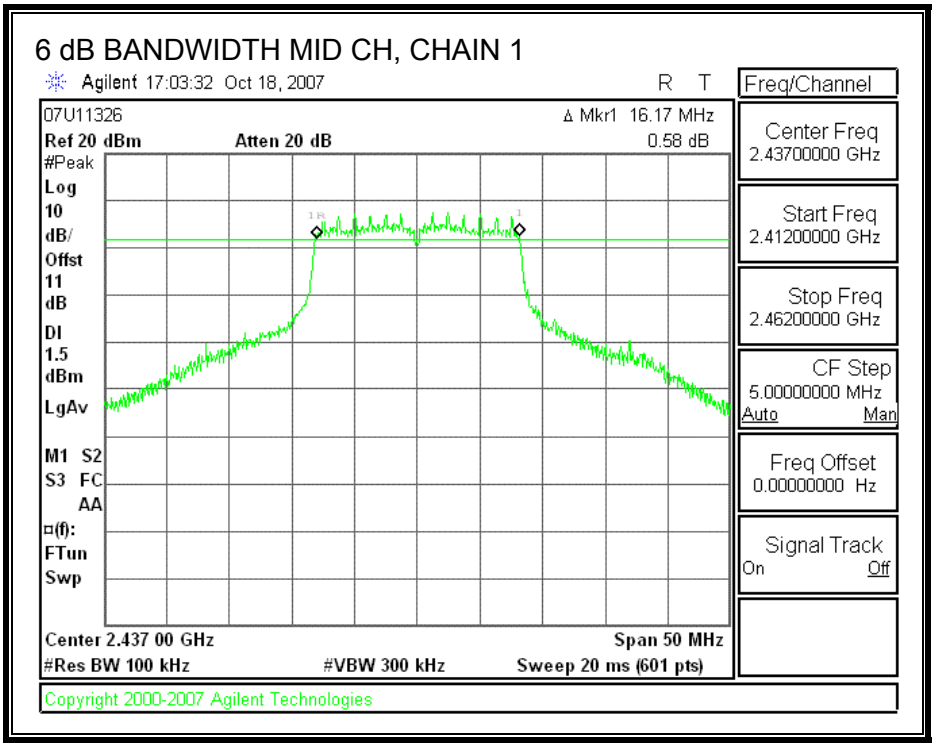
**RESULTS**

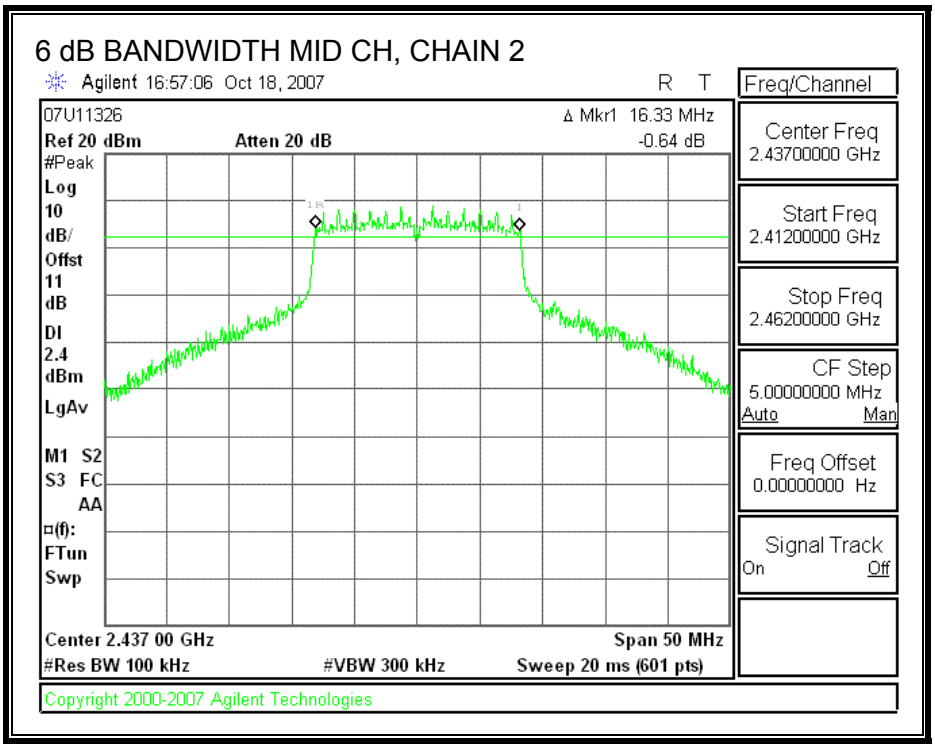
| Channel | Frequency (MHz) | Chain 0 6 dB BW (MHz) | Chain 1 6 dB BW (MHz) | Chain 2 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2412 | 16.08 | 16.25 | 16.00 | 0.5 |
| Middle | 2437 | 16.33 | 16.17 | 16.33 | 0.5 |
| High | 2462 | 16.17 | 16.33 | 16.33 | 0.5 |

Middle channel plots are included hereafter.

**6 dB BANDWIDTH**





### 7.2.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

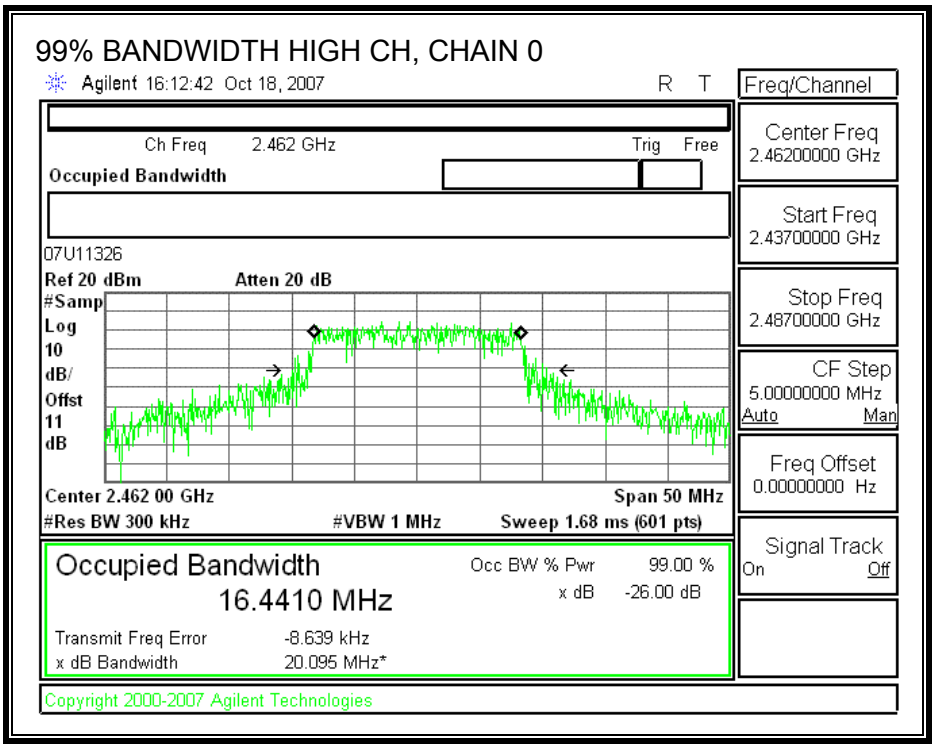
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

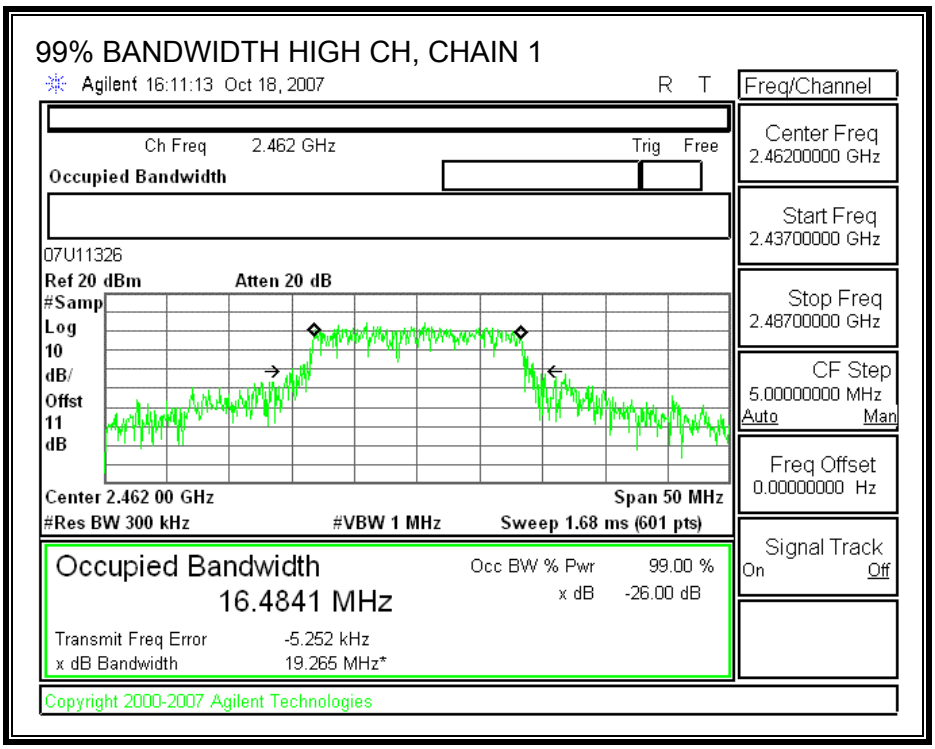
**RESULTS**

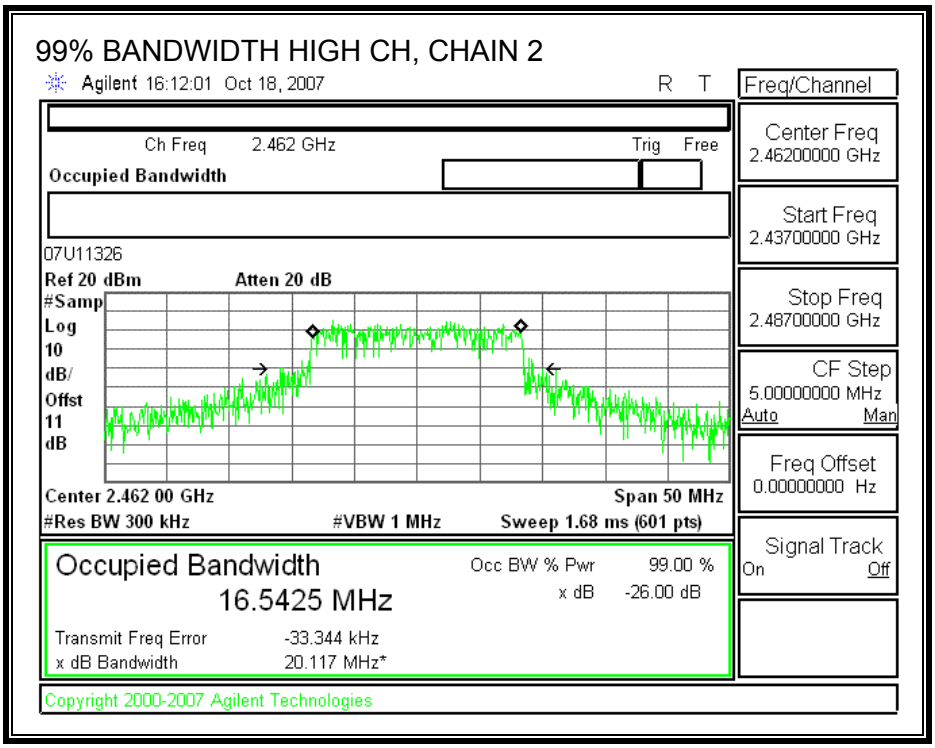
| Channel | Frequency (MHz) | Chain 0 99% Bandwidth (MHz) | Chain 1 99% Bandwidth (MHz) | Chain 2 99% Bandwidth (MHz) |
|---|---|---|---|---|
| Low | 2412 | 16.5424 | 16.4031 | 16.4962 |
| Middle | 2437 | 16.4893 | 16.4363 | 16.4980 |
| High | 2462 | 16.4410 | 16.4841 | 16.5425 |

High channel plots are included hereafter.

**99% BANDWIDTH**





## 7.2.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 3 | 4.77 | 7.77 |

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

**TEST PROCEDURE**

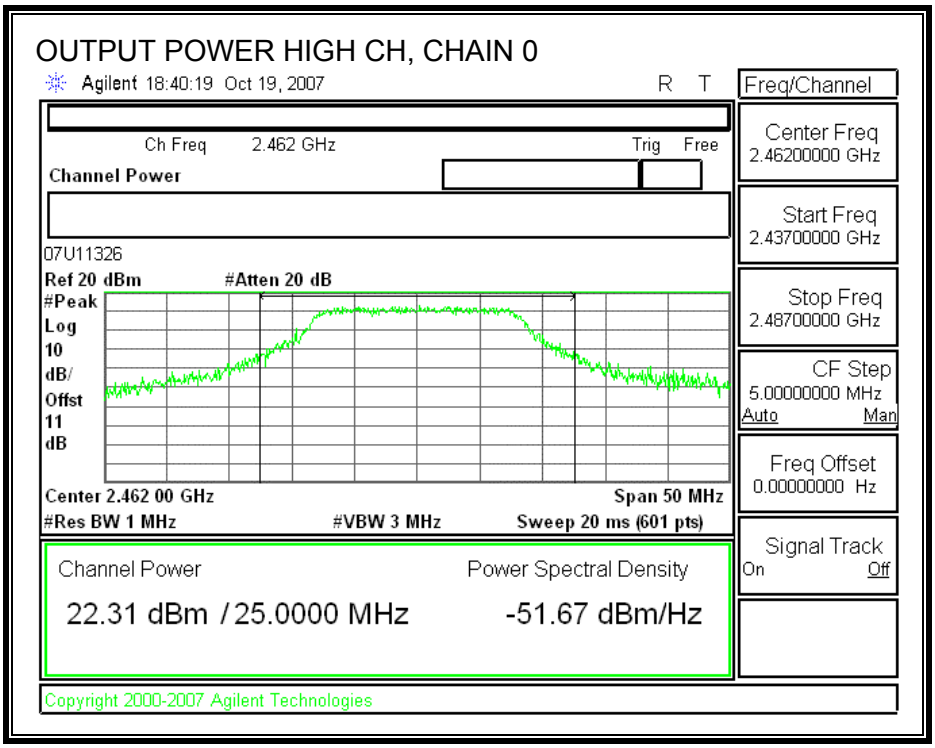
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

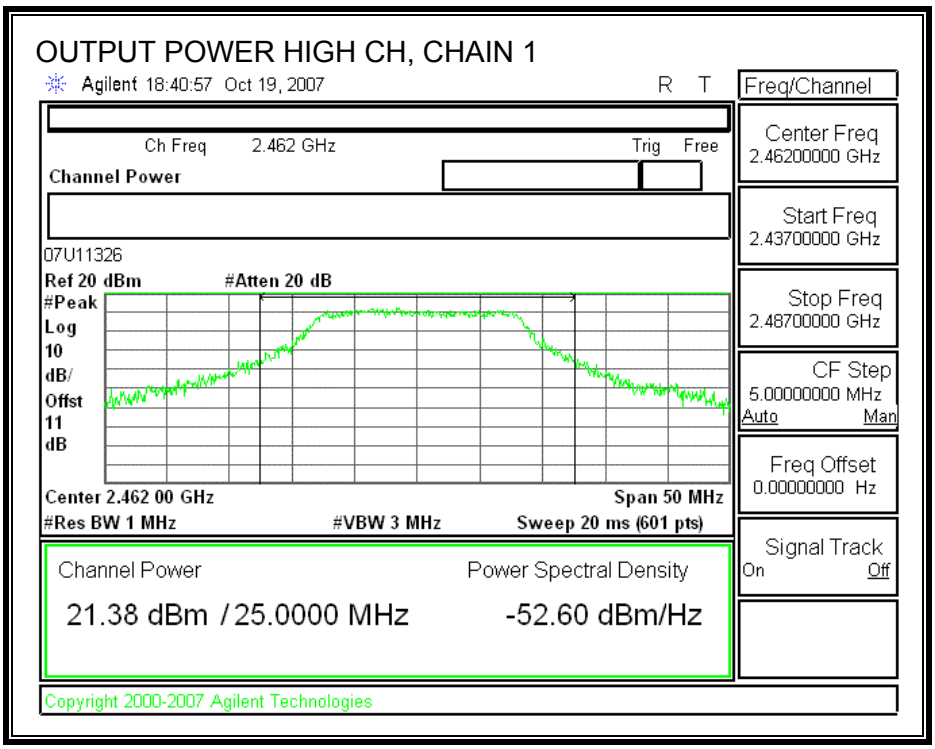
**RESULTS**

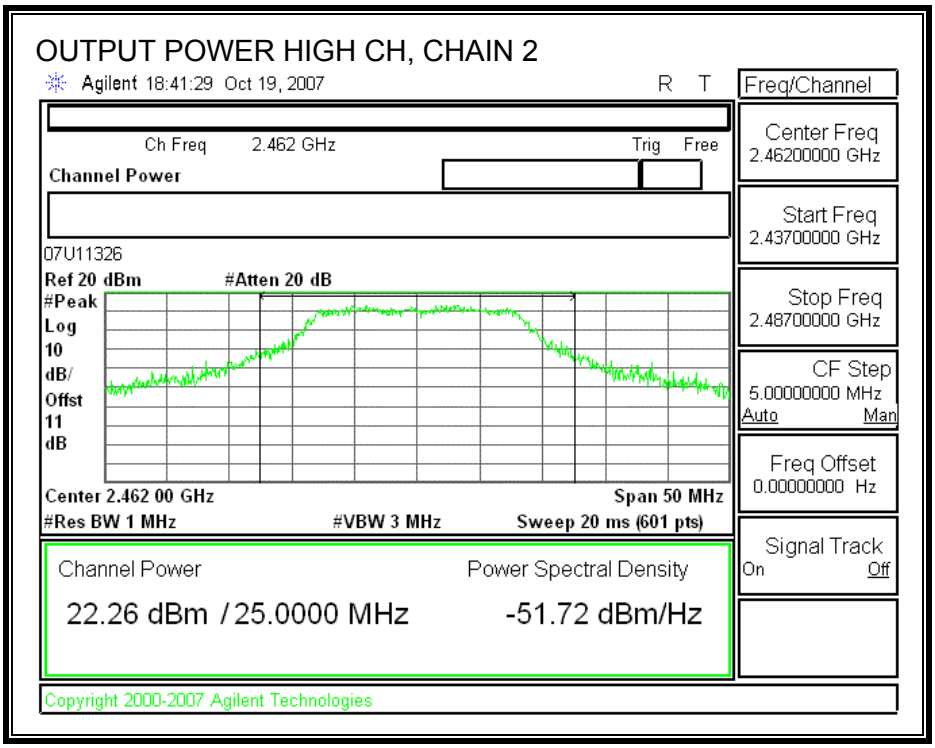
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 20.47 | 20.01 | 20.92 | 25.25 | 28.23 | -2.98 |
| Mid | 2437 | 21.72 | 21.00 | 22.56 | 26.58 | 28.23 | -1.65 |
| High | 2462 | 22.31 | 21.38 | 22.26 | 26.78 | 28.23 | -1.45 |

High channel plots are included hereafter.

**OUTPUT POWER**





## 7.2.4. AVERAGE POWER FOR LEGACY 11g MODE (2.4GHz)

**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 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 2412 | 16.56 | 16.19 | 16.66 | 21.25 |
| Middle | 2437 | 16.84 | 16.15 | 17.81 | 21.76 |
| High | 2462 | 14.44 | 13.54 | 14.68 | 19.02 |

## 7.2.5. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

**TEST PROCEDURE**

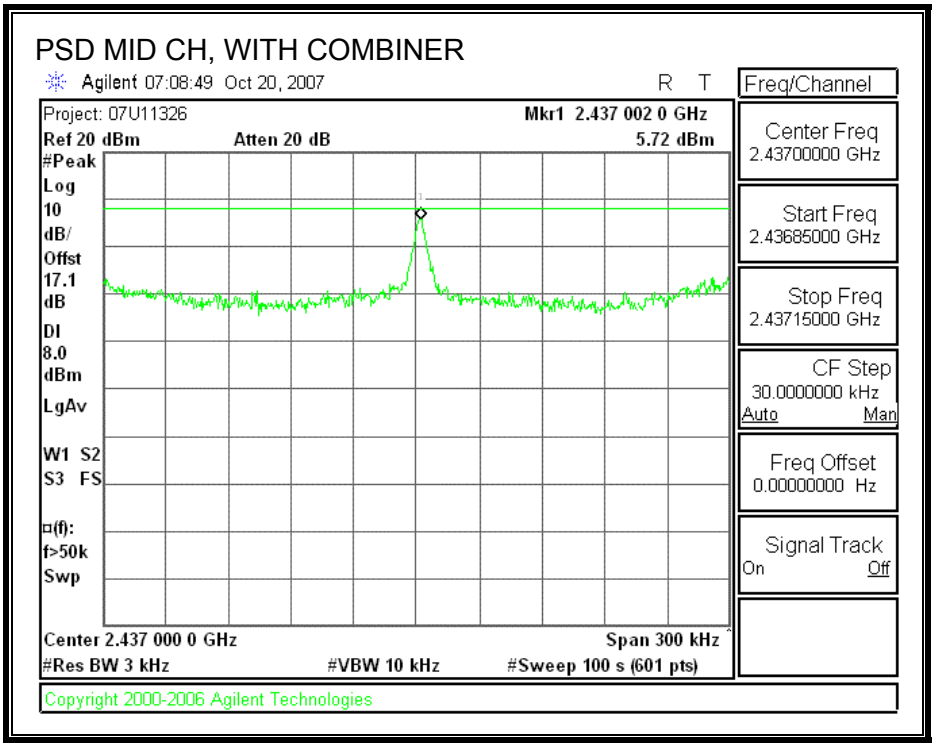
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

**RESULTS**

| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2412 | 4.64 | 8 | -3.36 |
| Middle | 2437 | 5.72 | 8 | -2.28 |
| High | 2462 | 2.77 | 8 | -5.23 |

Middle channel plot is included hereafter.

**POWER SPECTRAL DENSITY, WITH COMBINER**



## 7.2.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

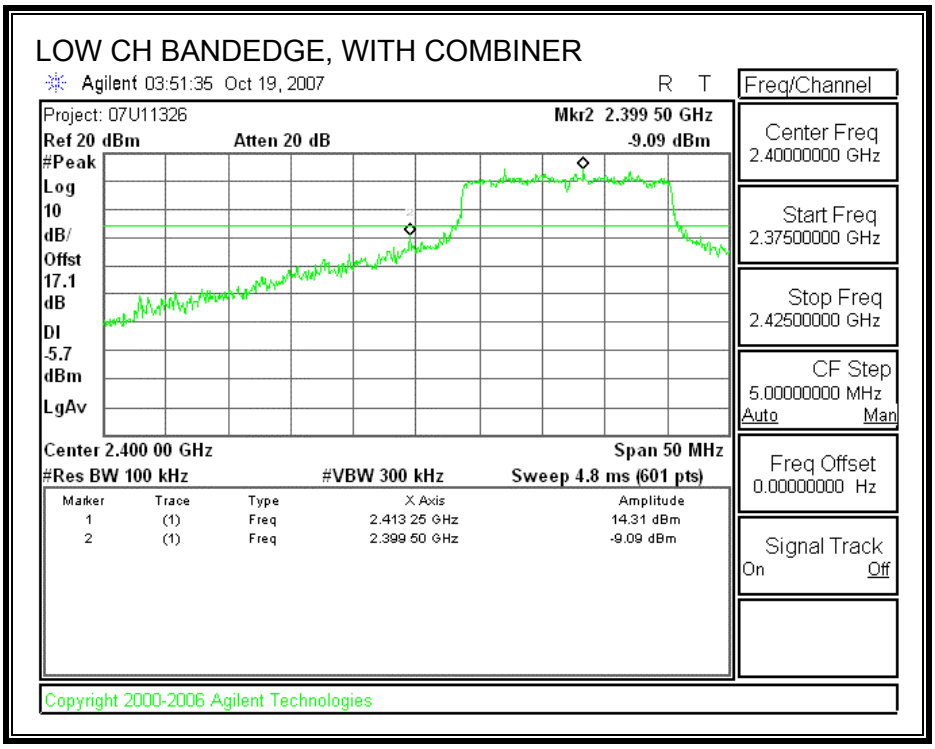
**TEST PROCEDURE**

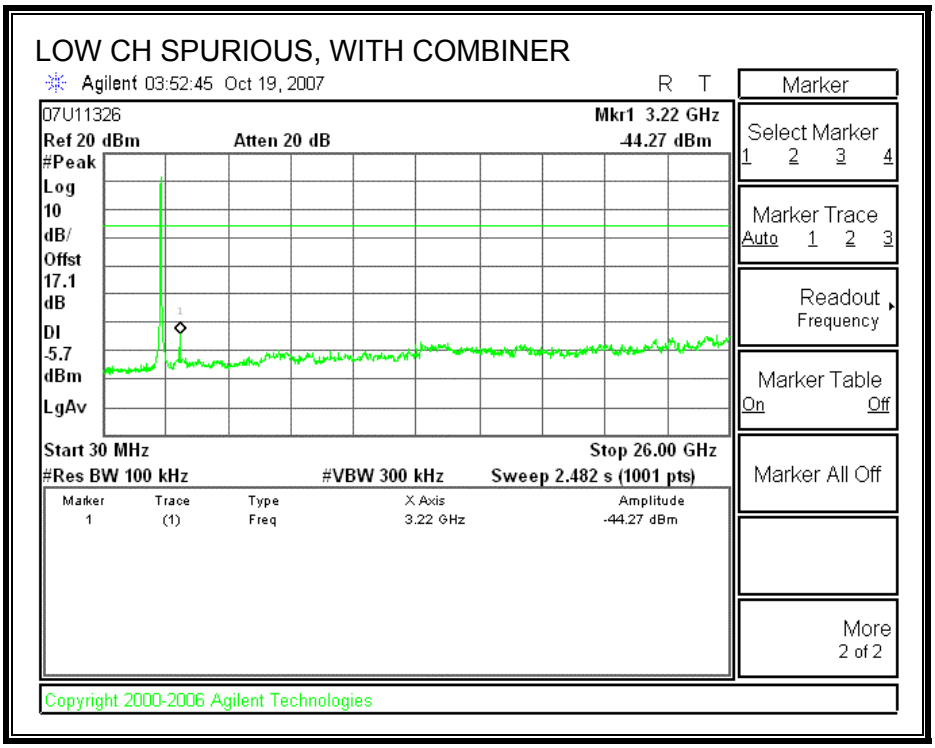
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

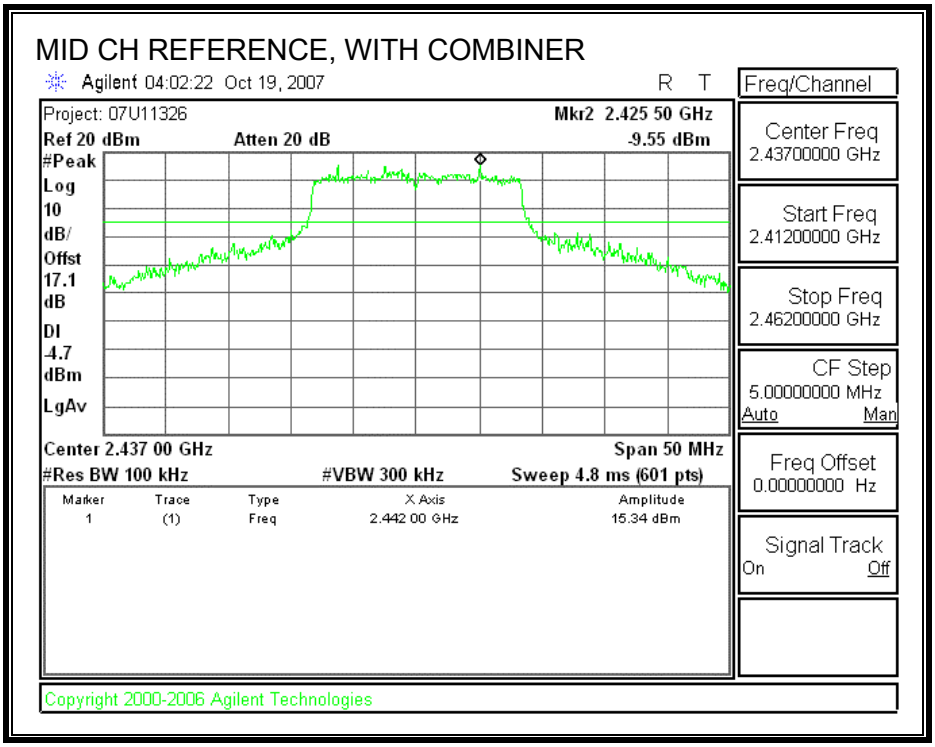
**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**

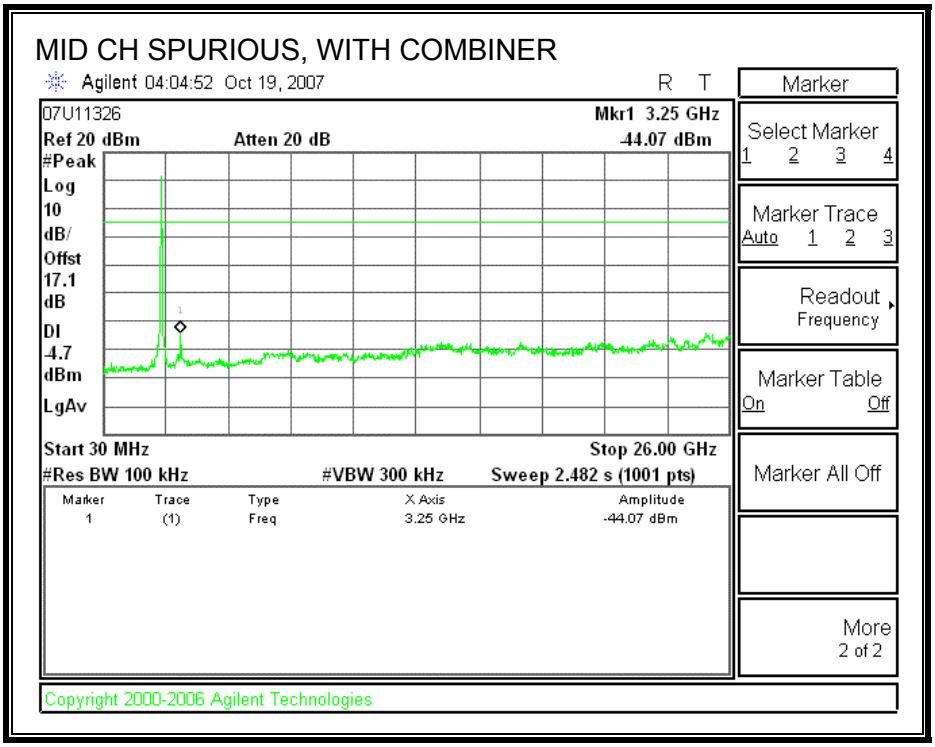


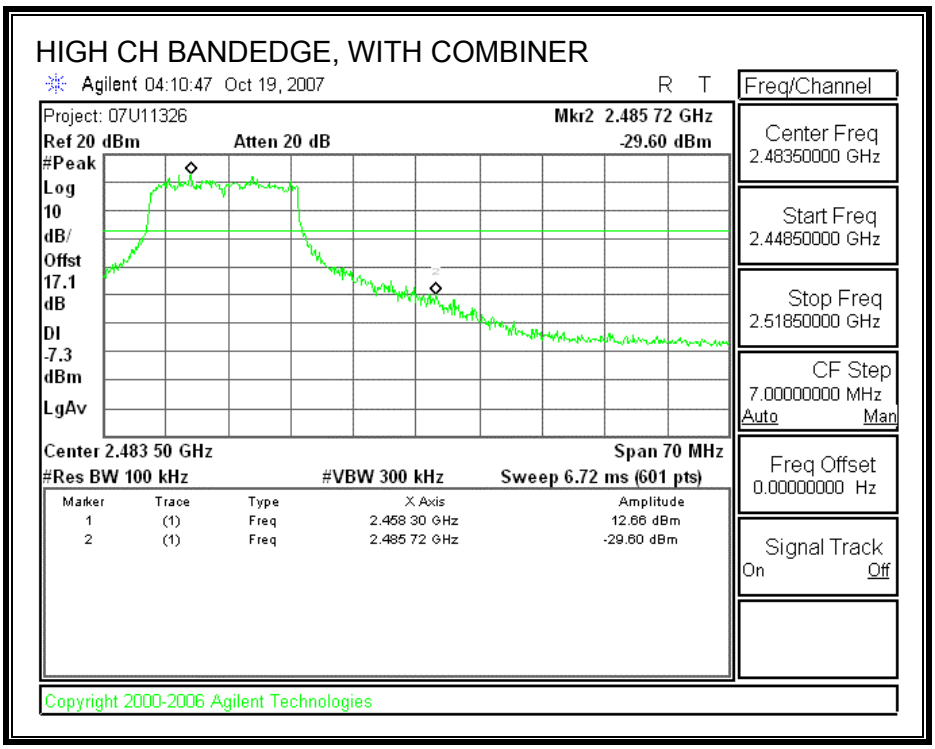
MID CH REFERENCE, WITH COMBINER



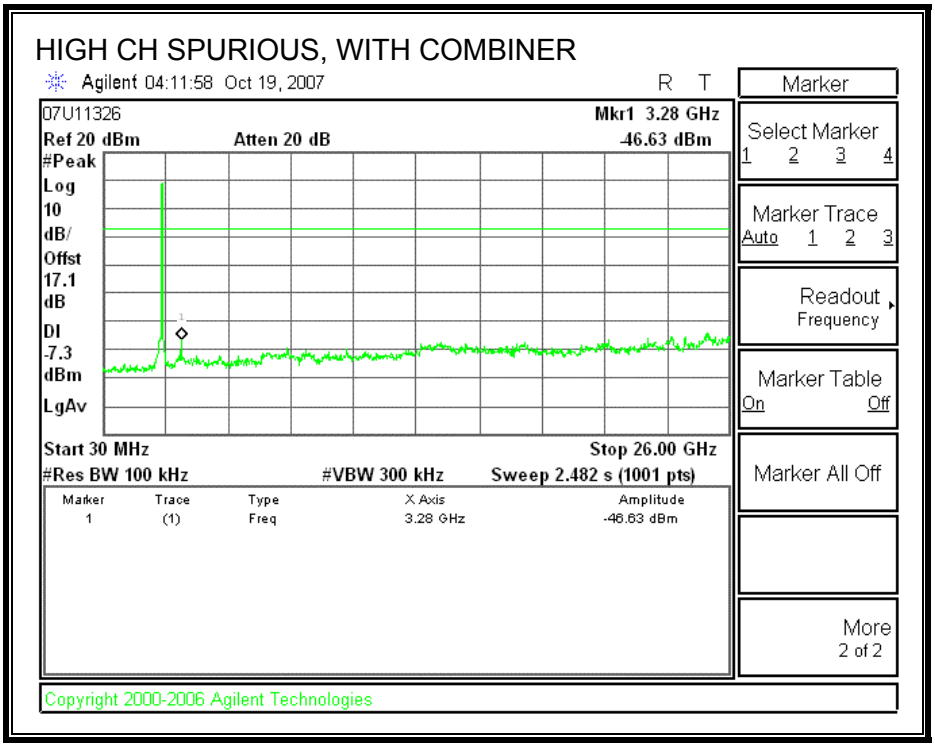

MID CH SPURIOUS, WITH COMBINER



HIGH CH BANDEDGE, WITH COMBINER




HIGH CH SPURIOUS, WITH COMBINER



## 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**

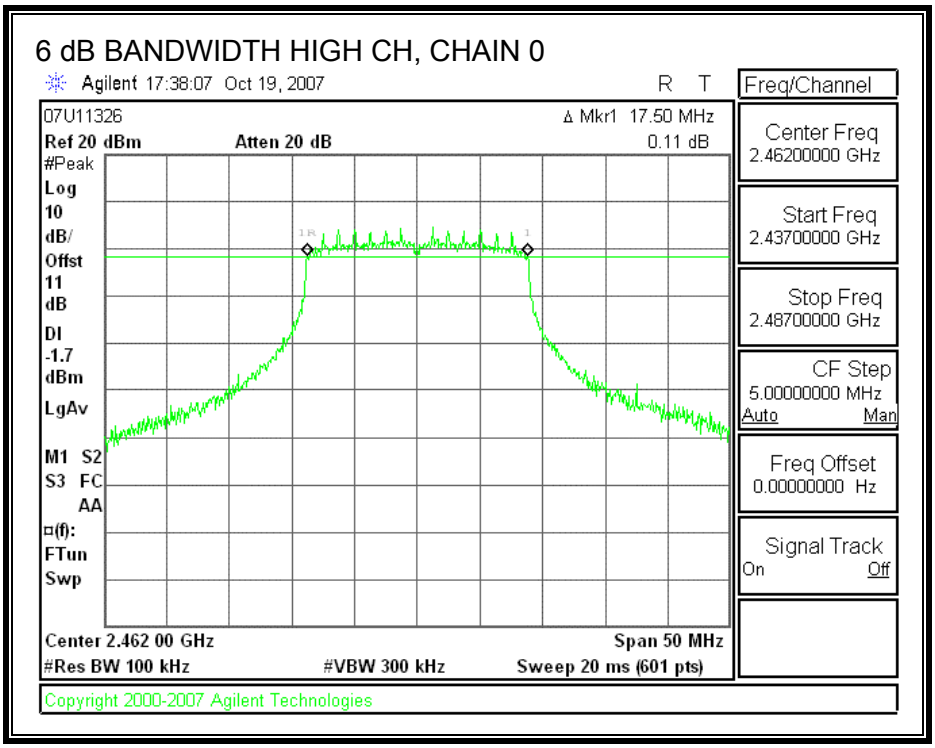
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

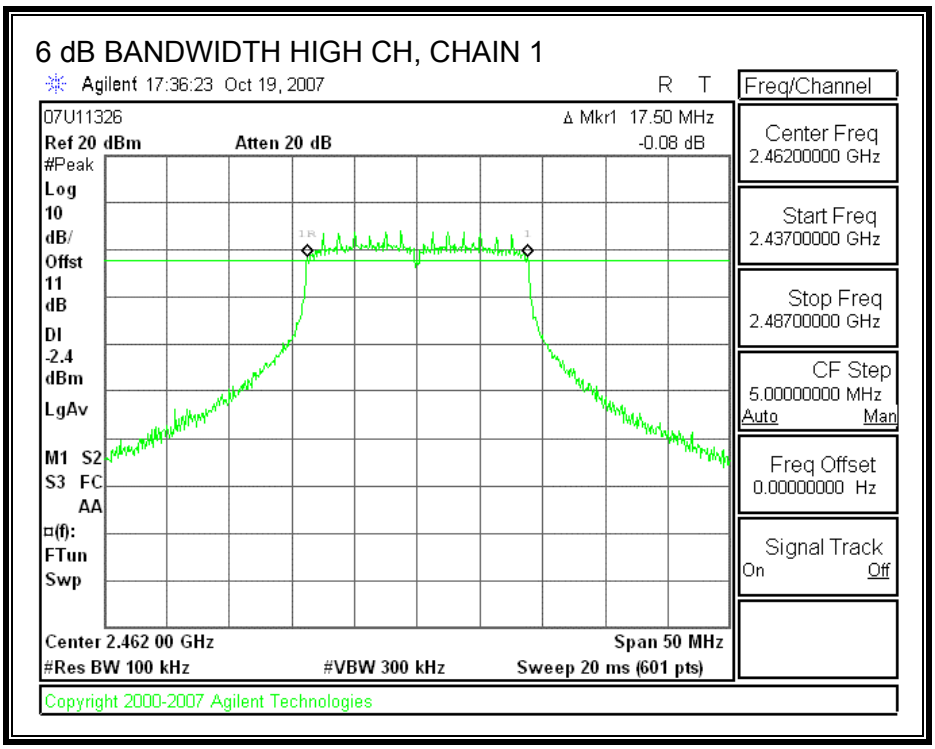
**RESULTS**

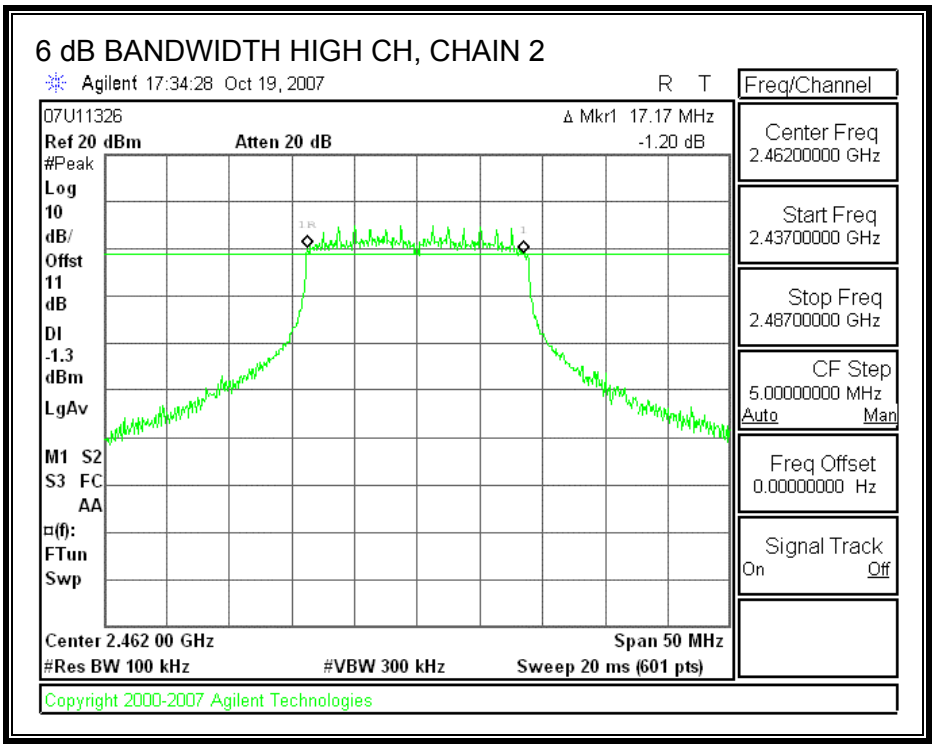
| Channel | Frequency (MHz) | Chain 0 6 dB BW (MHz) | Chain 1 6 dB BW (MHz) | Chain 2 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2412 | 16.33 | 16.67 | 16.25 | 0.5 |
| Middle | 2437 | 16.75 | 16.92 | 16.83 | 0.5 |
| High | 2462 | 17.50 | 17.50 | 17.17 | 0.5 |

High channel plots are included hereafter.

**6 dB BANDWIDTH**





### 7.3.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

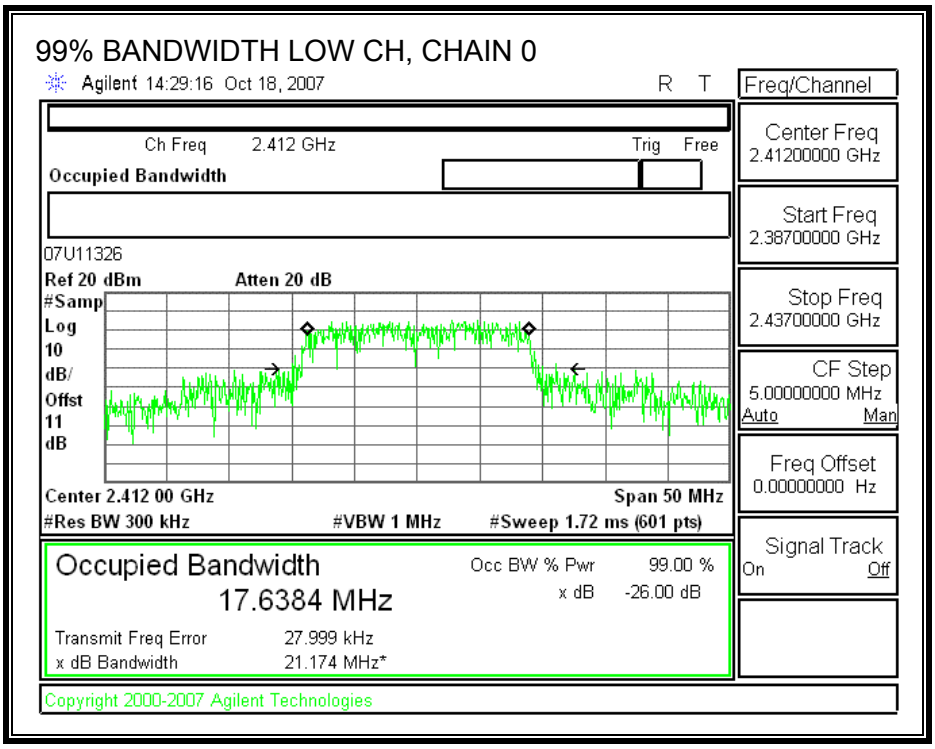
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

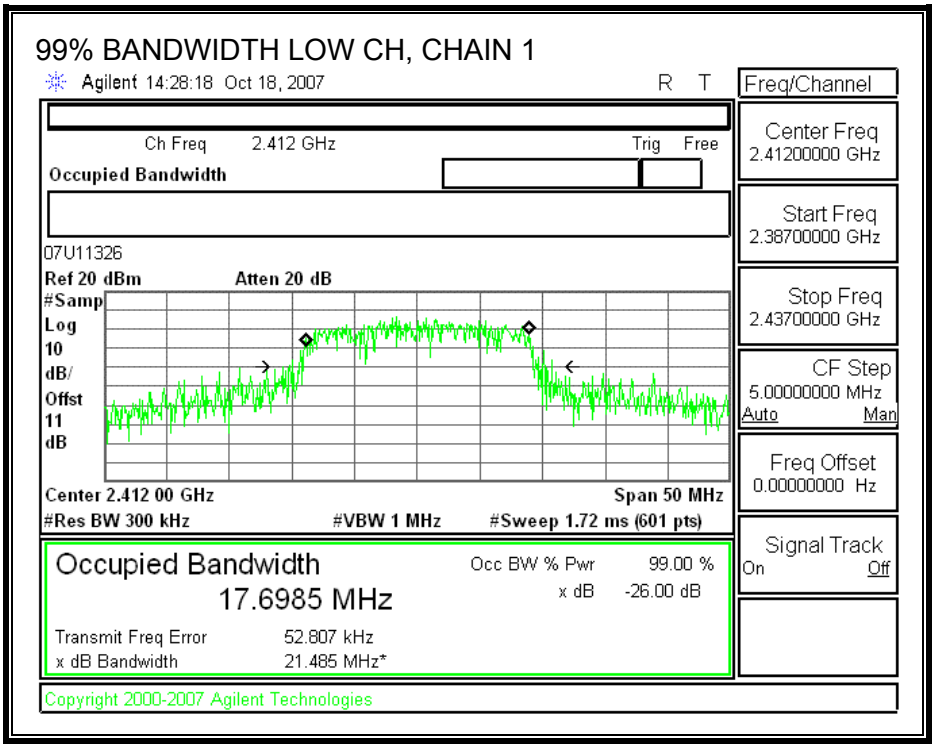
**RESULTS**

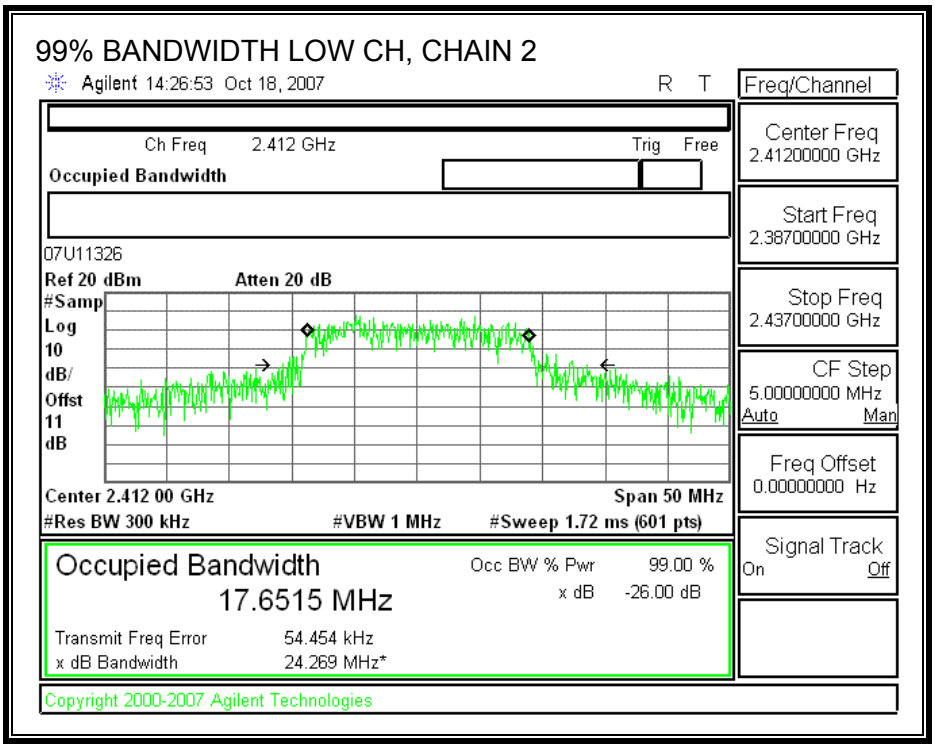
| Channel | Frequency (MHz) | Chain 0 99% Bandwidth (MHz) | Chain 1 99% Bandwidth (MHz) | Chain 2 99% Bandwidth (MHz) |
|---|---|---|---|---|
| Low | 2412 | 17.6384 | 17.6985 | 17.6515 |
| Middle | 2437 | 17.6669 | 17.6552 | 17.6329 |
| High | 2462 | 17.6351 | 16.6333 | 17.6311 |

Low channel plots are included hereafter.

**99% BANDWIDTH**





## 7.3.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is 3 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

**TEST PROCEDURE**

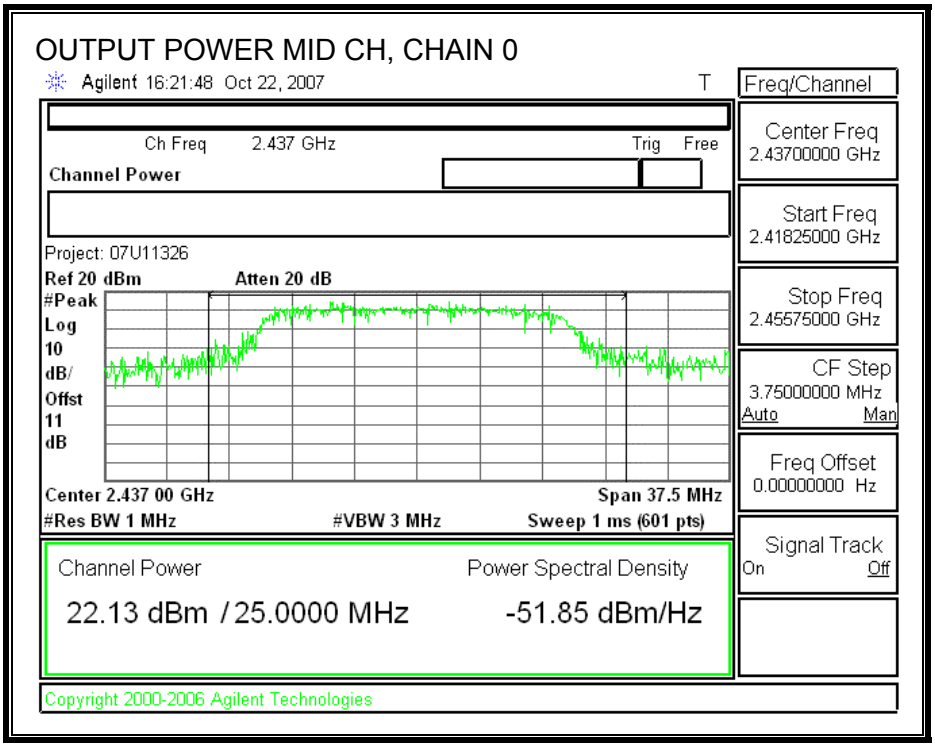
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

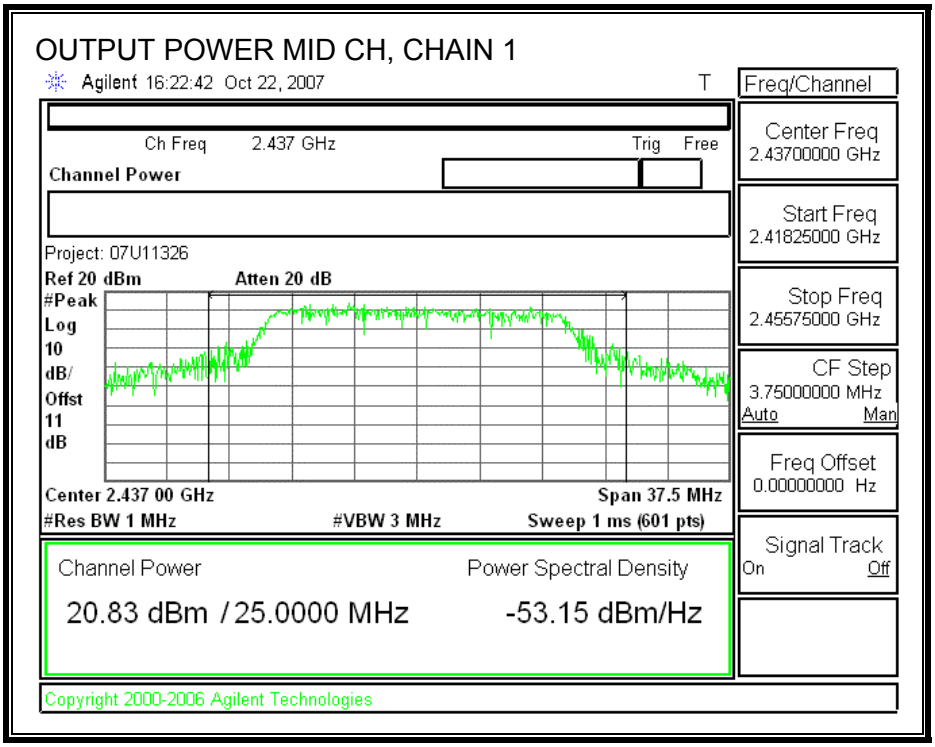
**RESULTS**

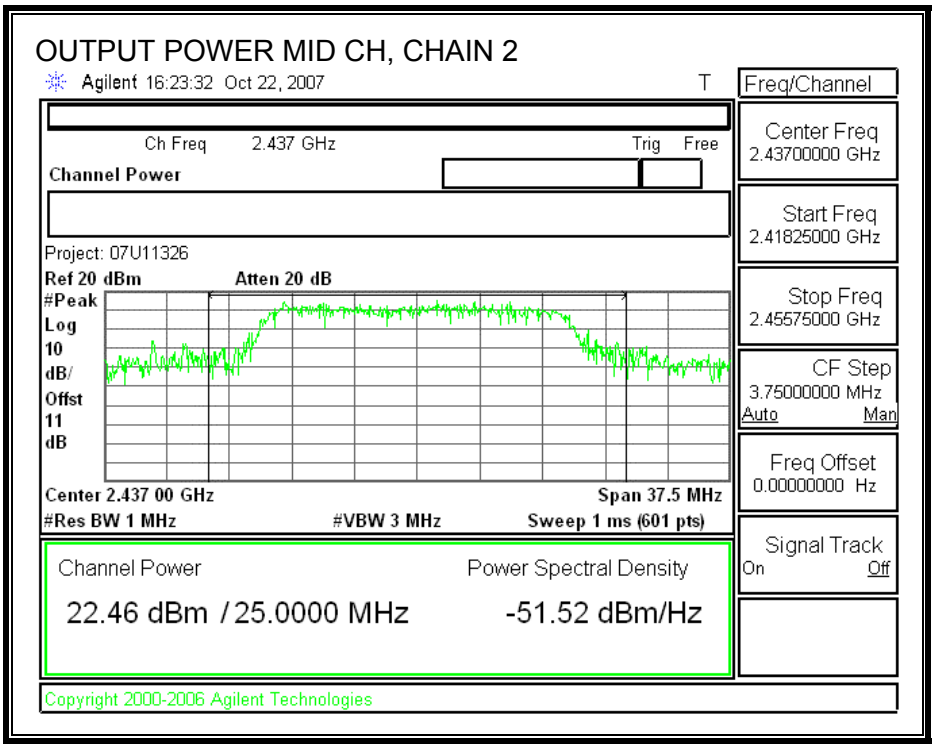
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2412 | 19.82 | 20.04 | 21.03 | 25.10 | 30.00 | -4.90 |
| Mid | 2437 | 22.13 | 20.83 | 22.46 | 26.63 | 30.00 | -3.37 |
| High | 2462 | 21.35 | 21.01 | 22.19 | 26.32 | 30.00 | -3.68 |

Middle channel plots are included hereafter.

**OUTPUT POWER**





## 7.3.4. AVERAGE POWER FOR HT20 MODES (2.4GHz)

**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 0 (dBm) | Chain 1 (dBm) | Chain 2 (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 2412 | 16.36 | 16.03 | 16.72 | 21.15 |
| Middle | 2437 | 17.51 | 17.09 | 18.02 | 22.33 |
| High | 2462 | 14.93 | 14.26 | 14.90 | 19.48 |

## 7.3.5. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

**TEST PROCEDURE**

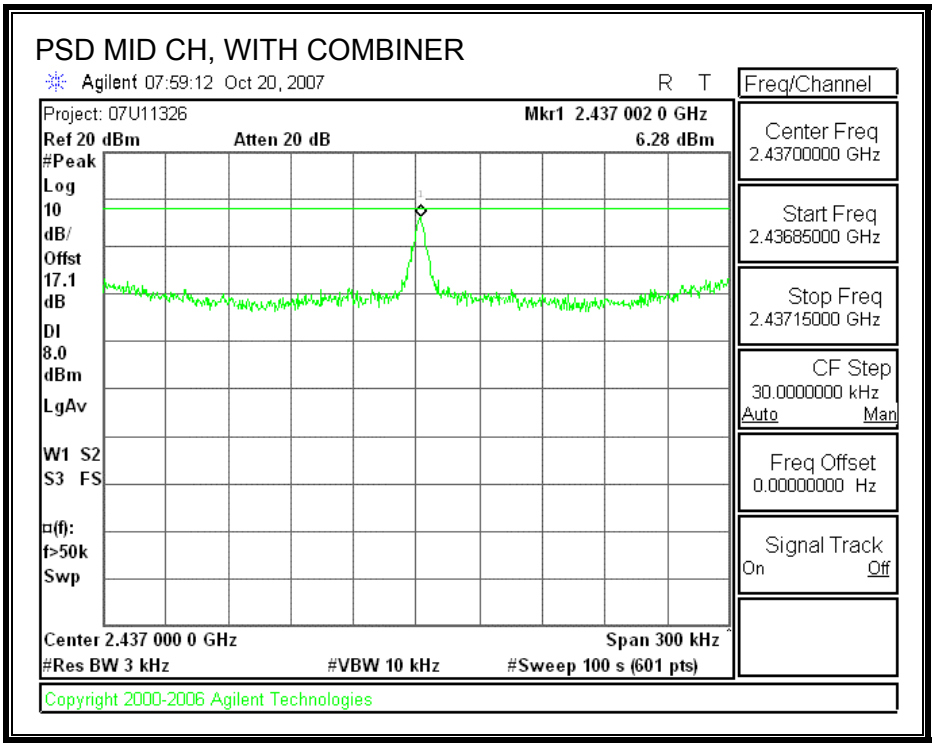
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

**RESULTS**

| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2412 | 4.67 | 8 | -3.33 |
| Middle | 2437 | 6.28 | 8 | -1.72 |
| High | 2462 | 2.60 | 8 | -5.40 |

Middle channel plot is included hereafter.

**POWER SPECTRAL DENSITY, WITH COMBINER**



## 7.3.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

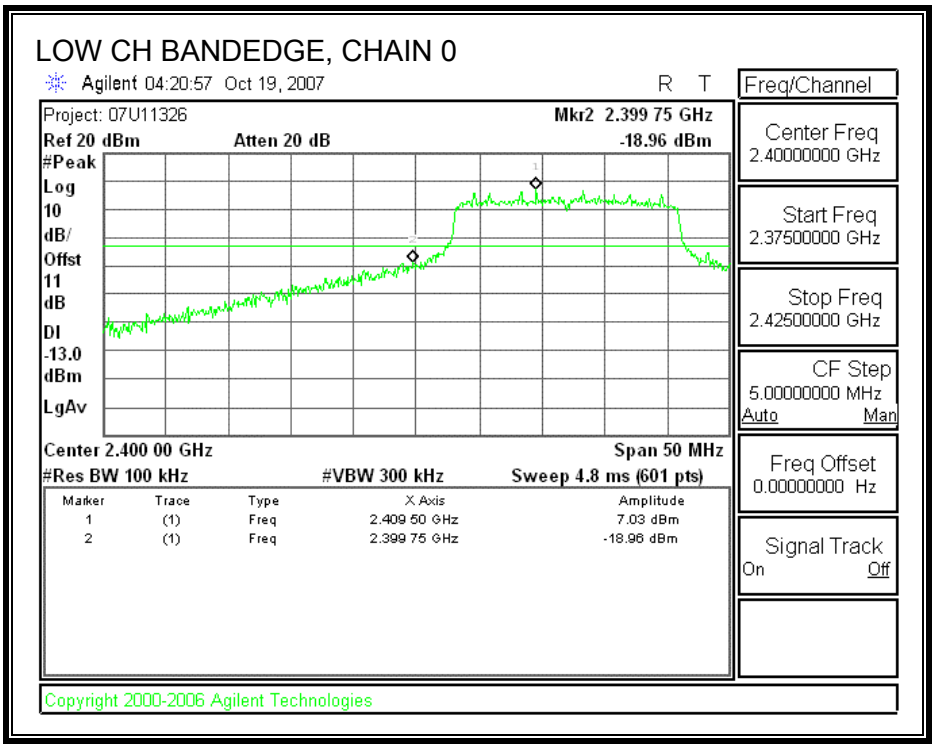
**TEST PROCEDURE**

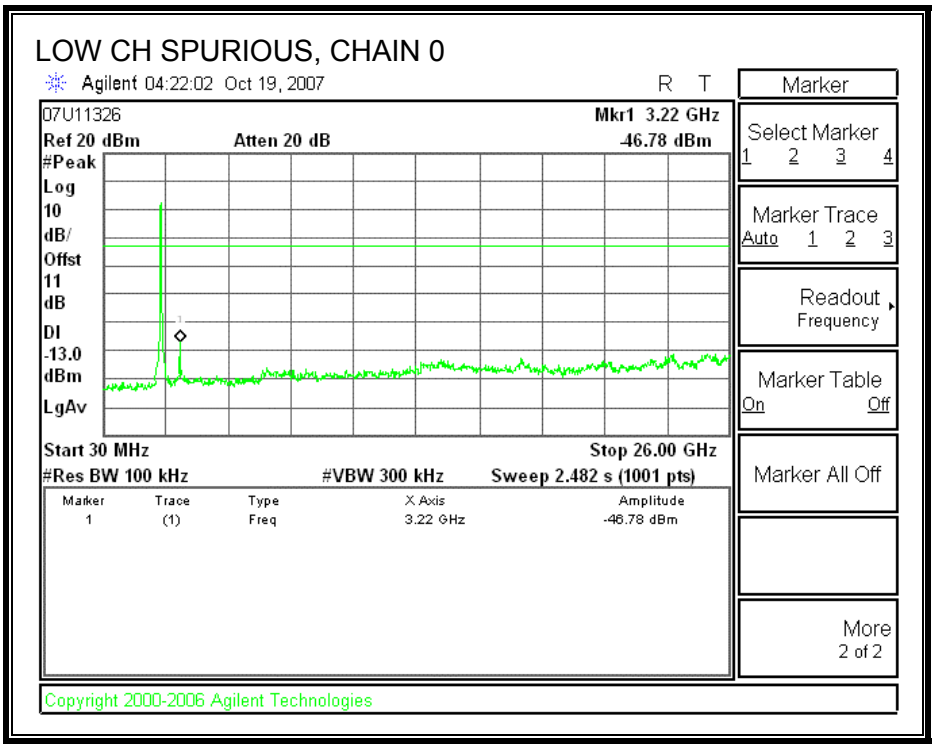
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

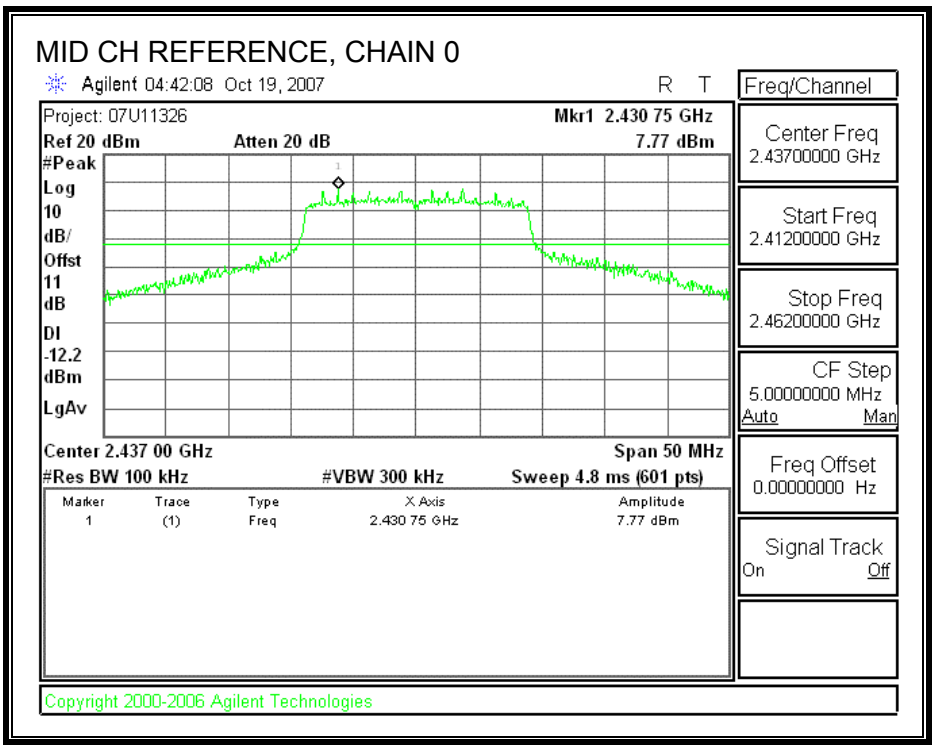
**RESULTS**

**CHAIN 0 SPURIOUS EMISSIONS**

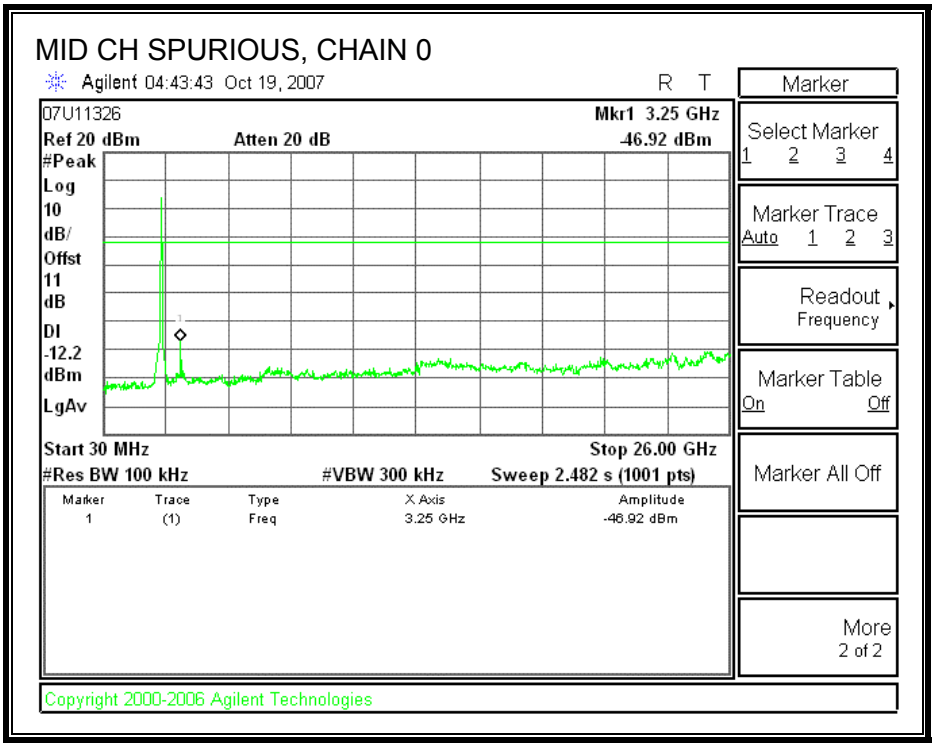


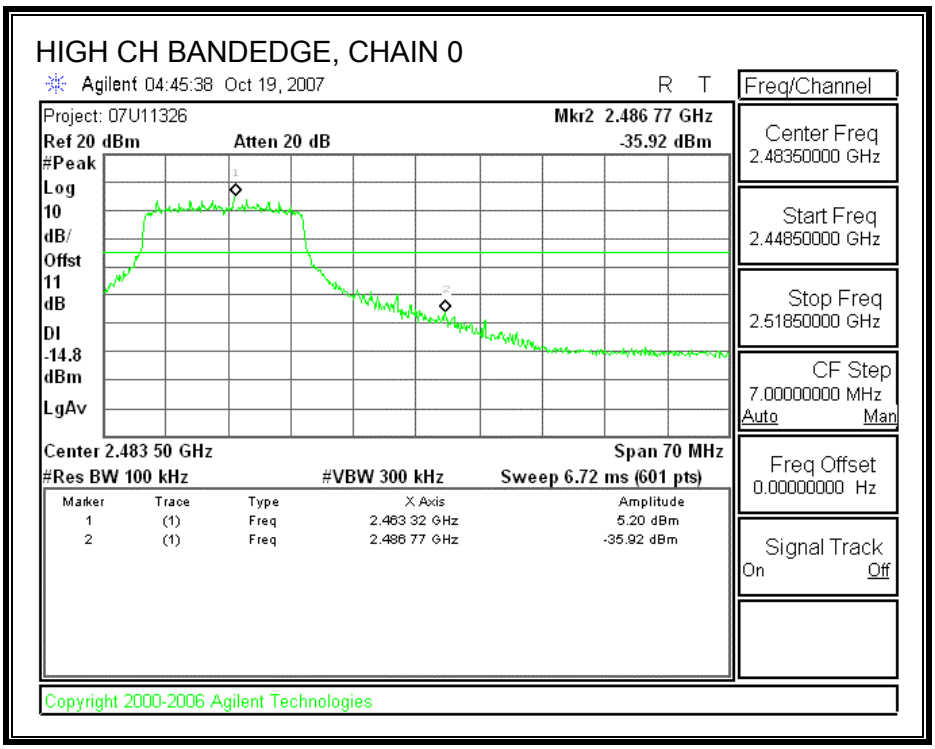



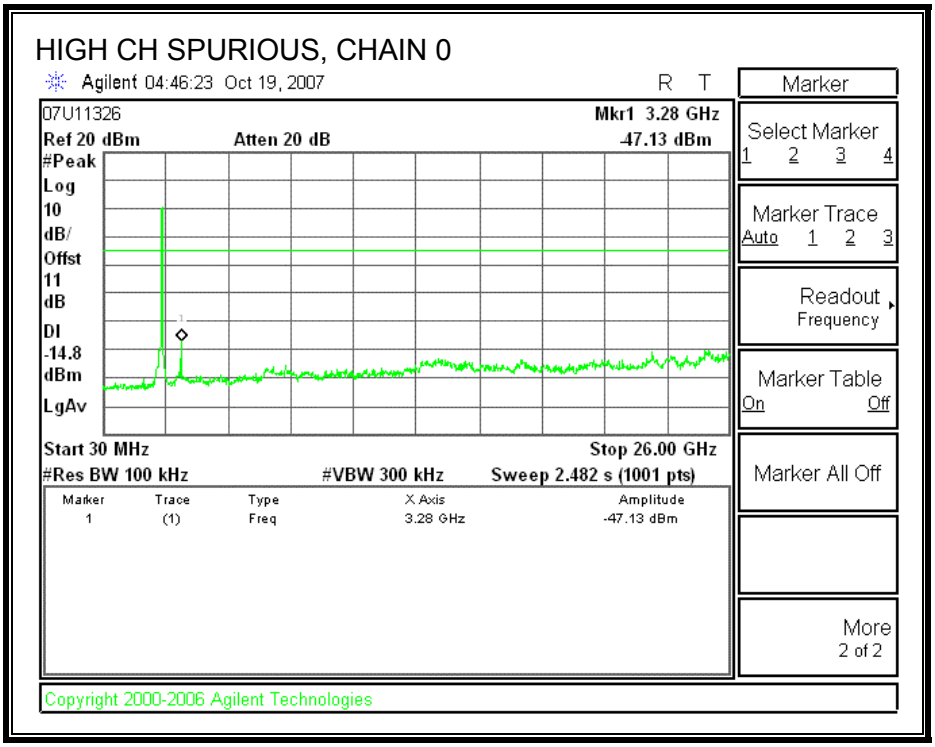
MID CH REFERENCE, CHAIN 0



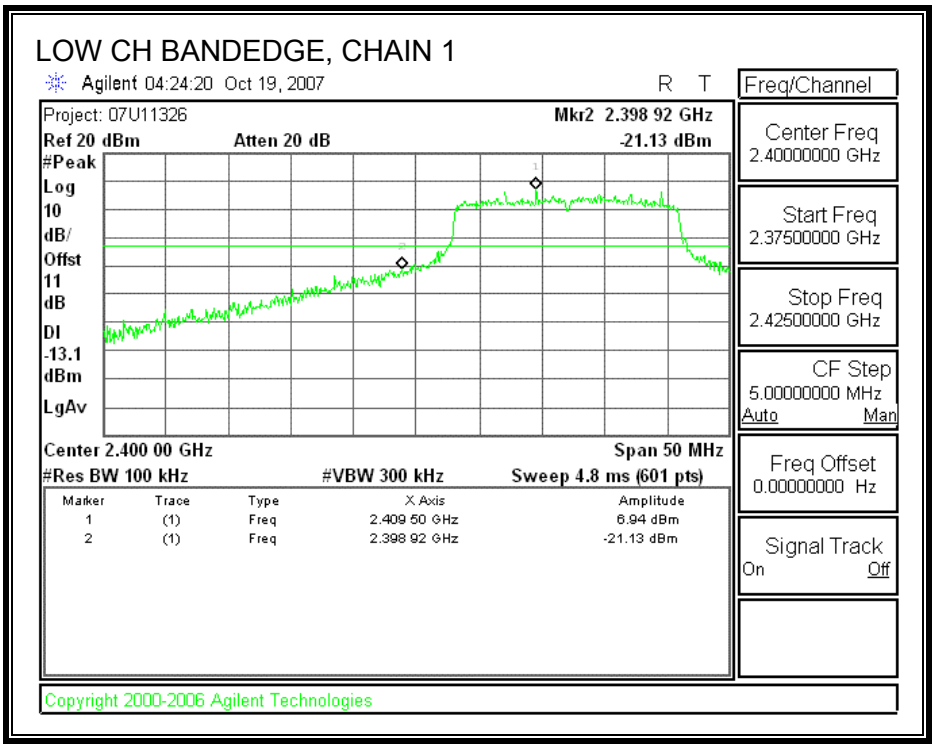

MID CH SPURIOUS, CHAIN 0

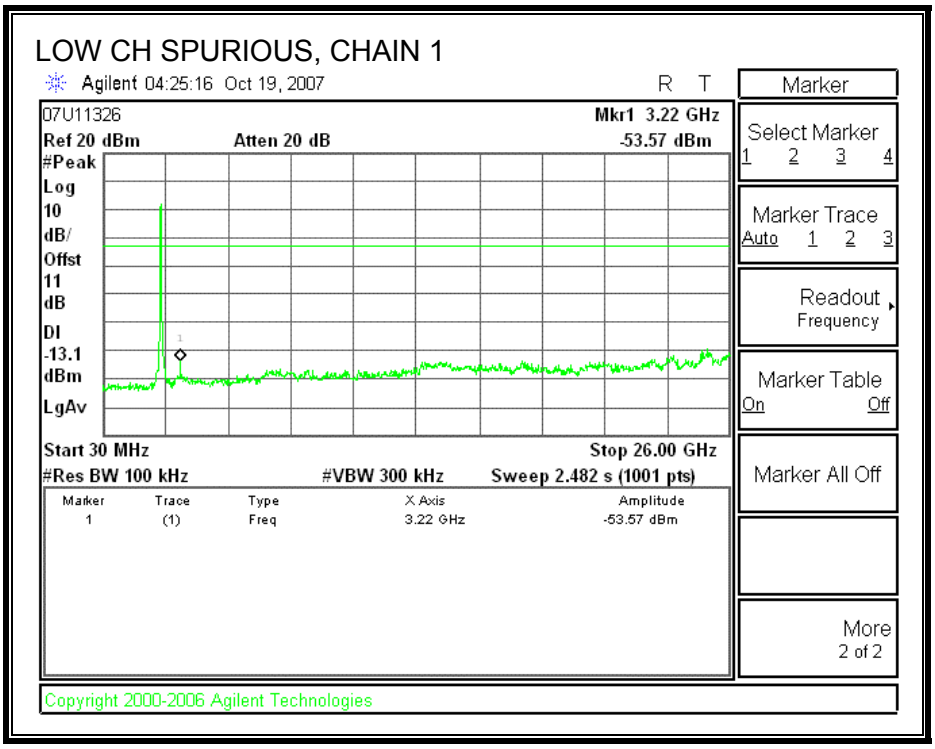




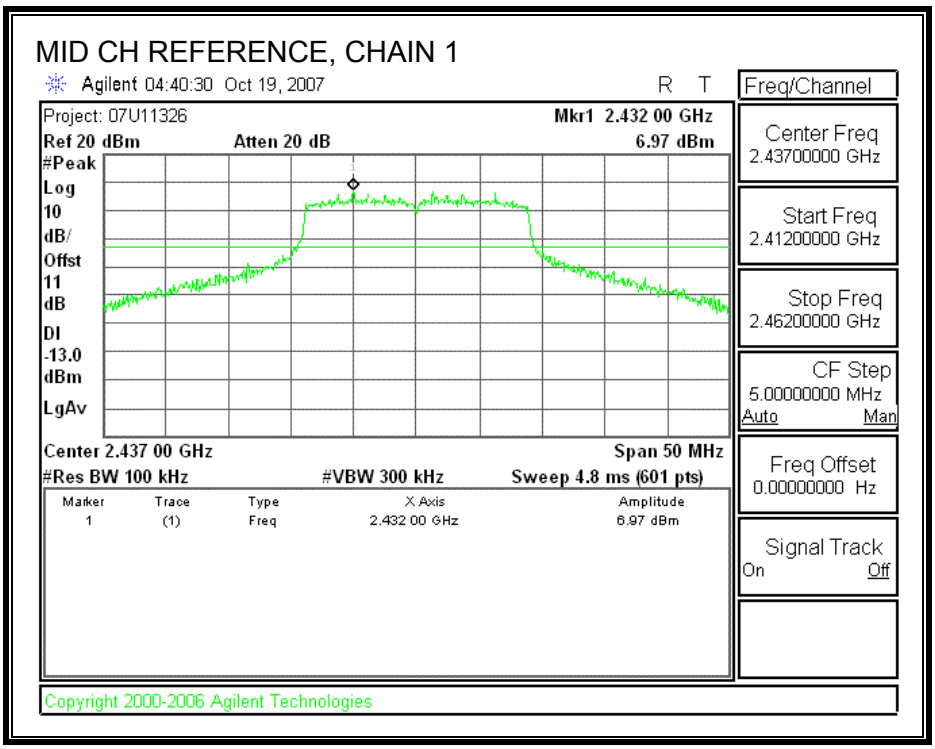



**CHAIN 1 SPURIOUS EMISSIONS**

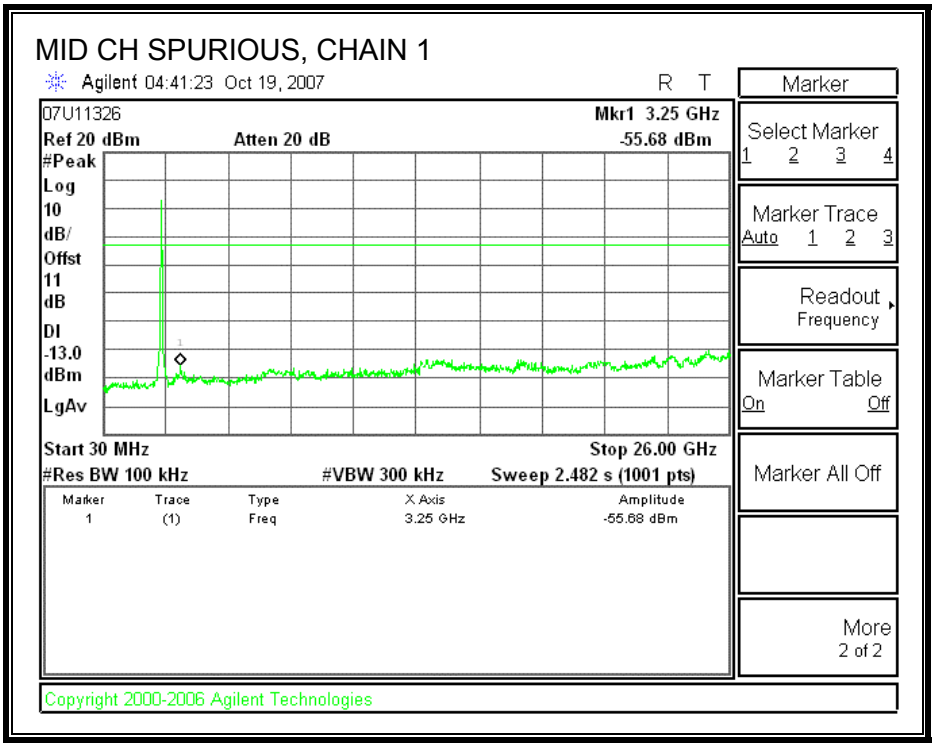


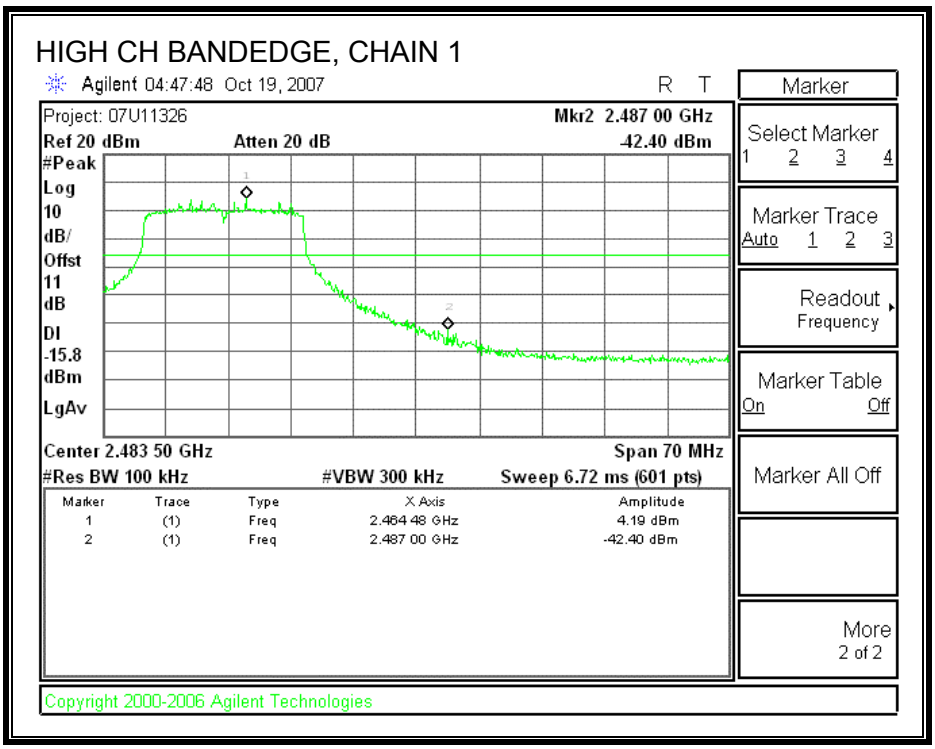
MID CH REFERENCE, CHAIN 1



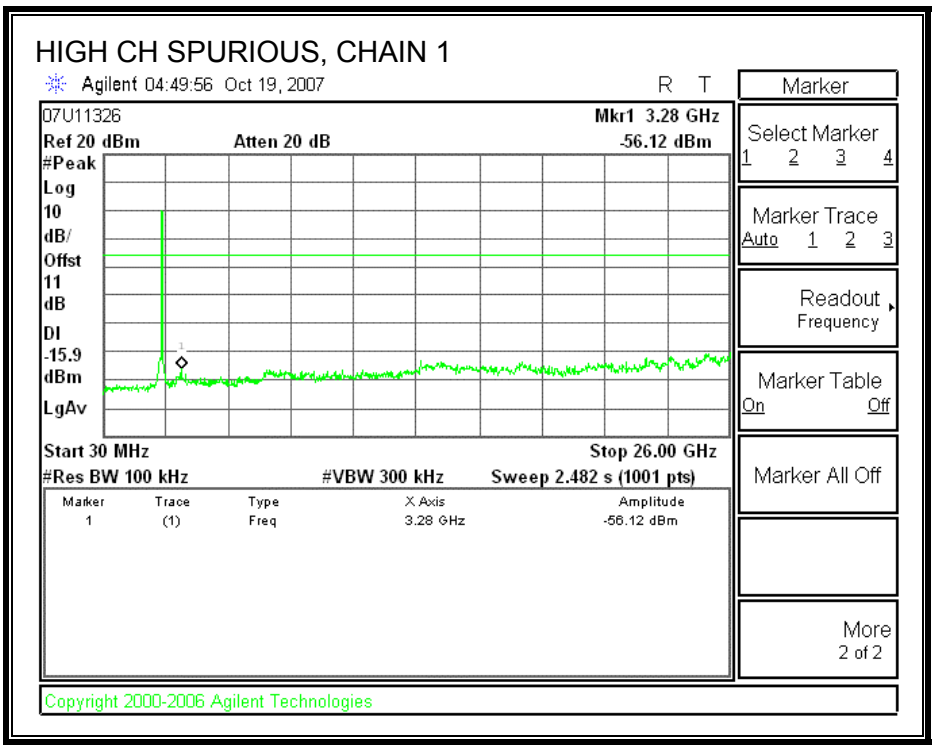

MID CH SPURIOUS, CHAIN 1



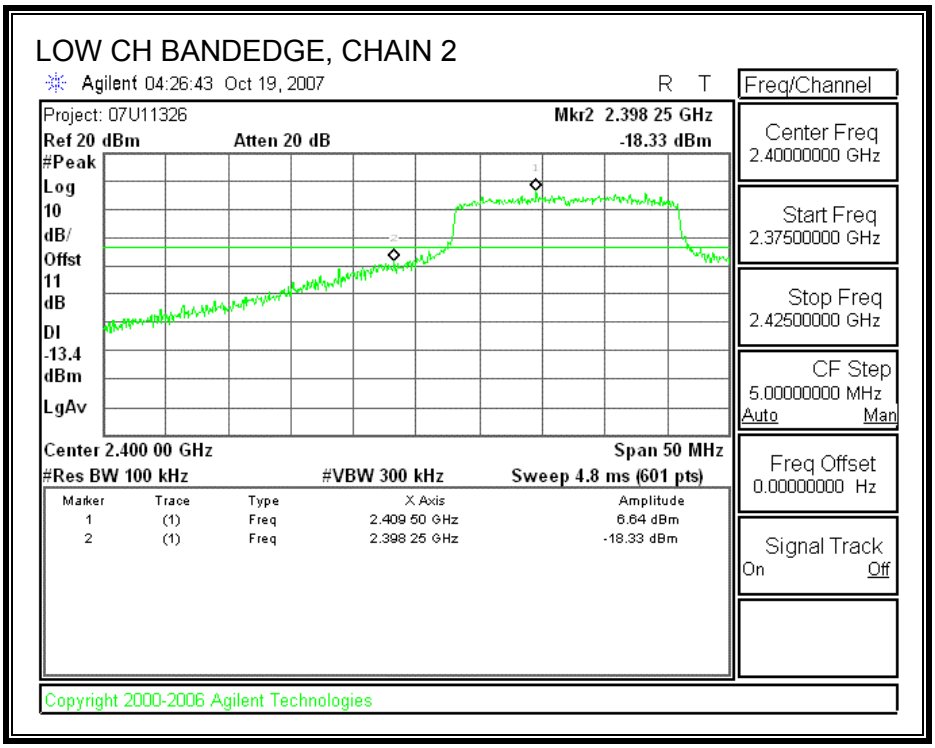
HIGH CH BANDEDGE, CHAIN 1

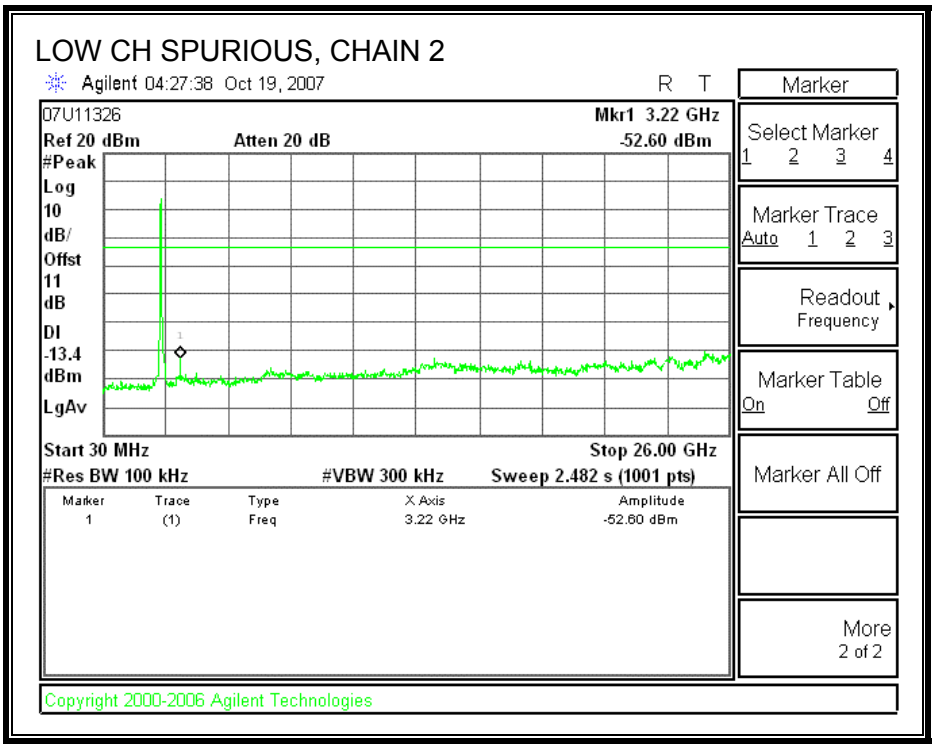



HIGH CH SPURIOUS, CHAIN 1

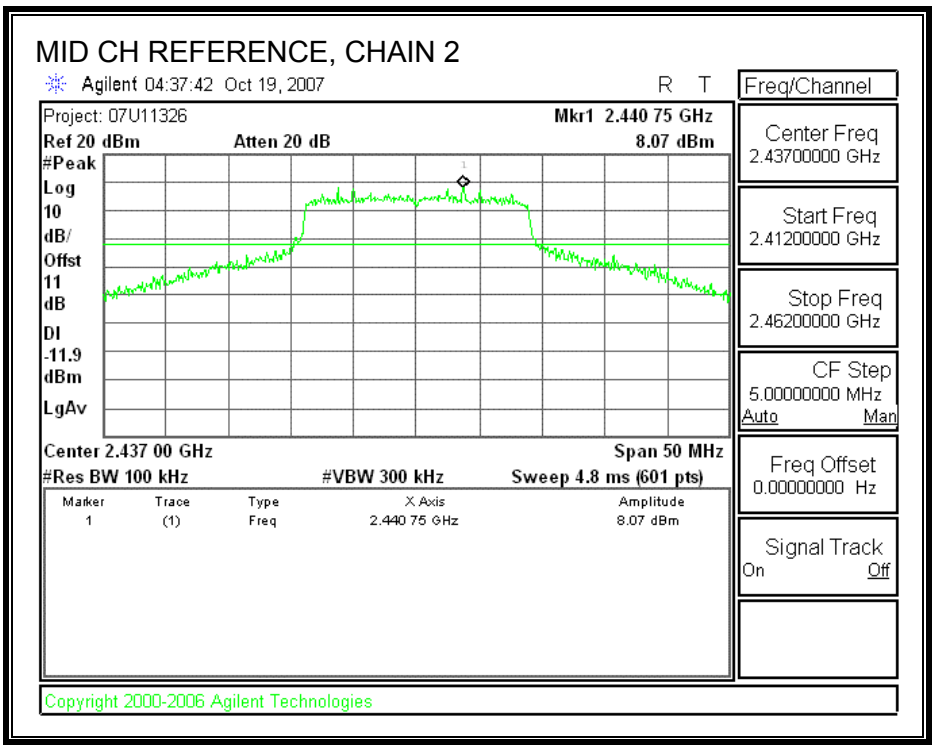


**CHAIN 2 SPURIOUS EMISSIONS**

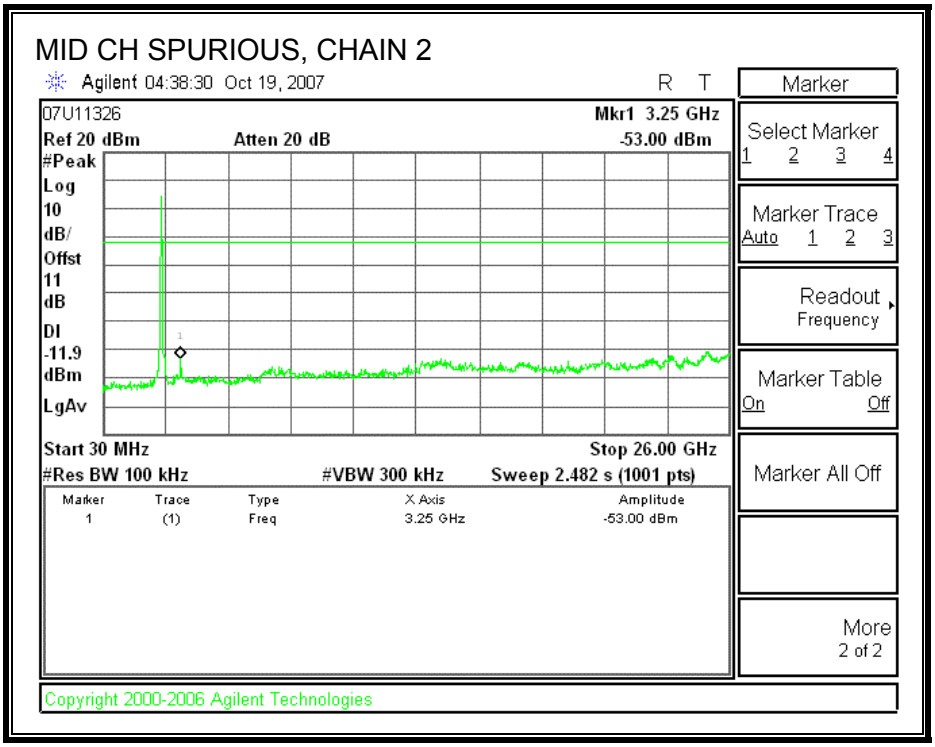


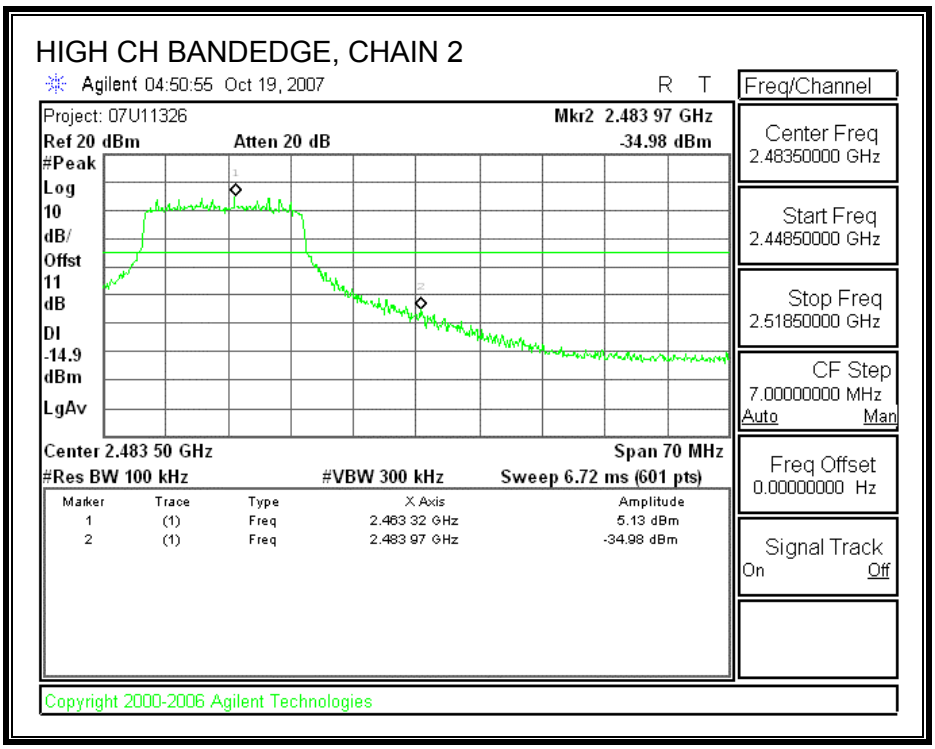
MID CH REFERENCE, CHAIN 2



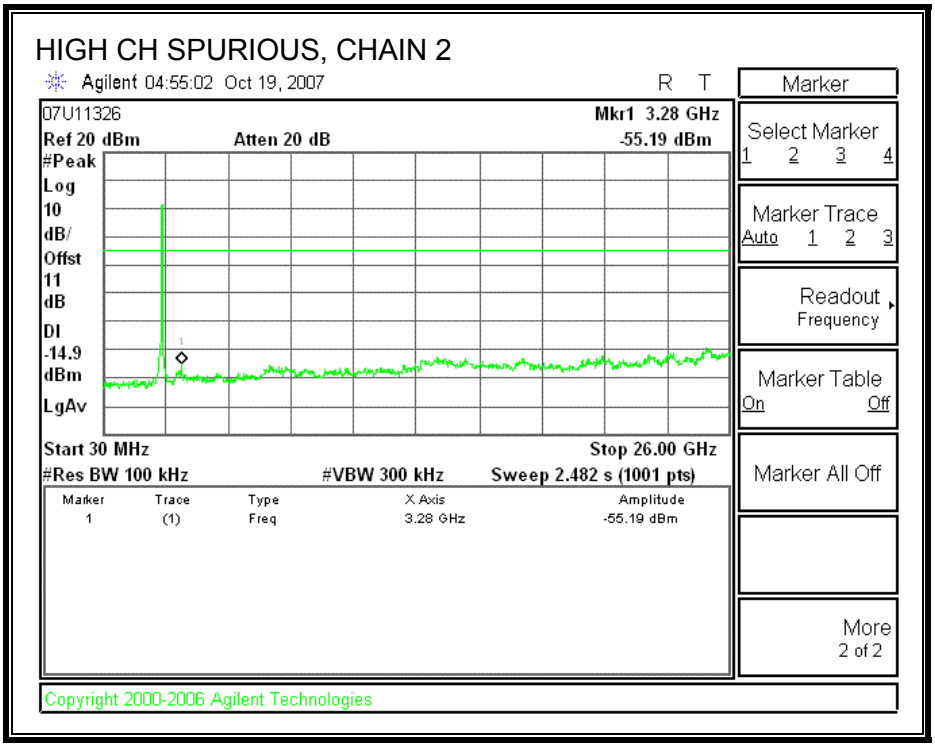

MID CH SPURIOUS, CHAIN 2



HIGH CH BANDEDGE, CHAIN 2




HIGH CH SPURIOUS, CHAIN 2



## 7.4. 802.11n THREE CHAINS HT40 MODE IN THE 2.4 GHz BAND

### 7.4.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

**TEST PROCEDURE**

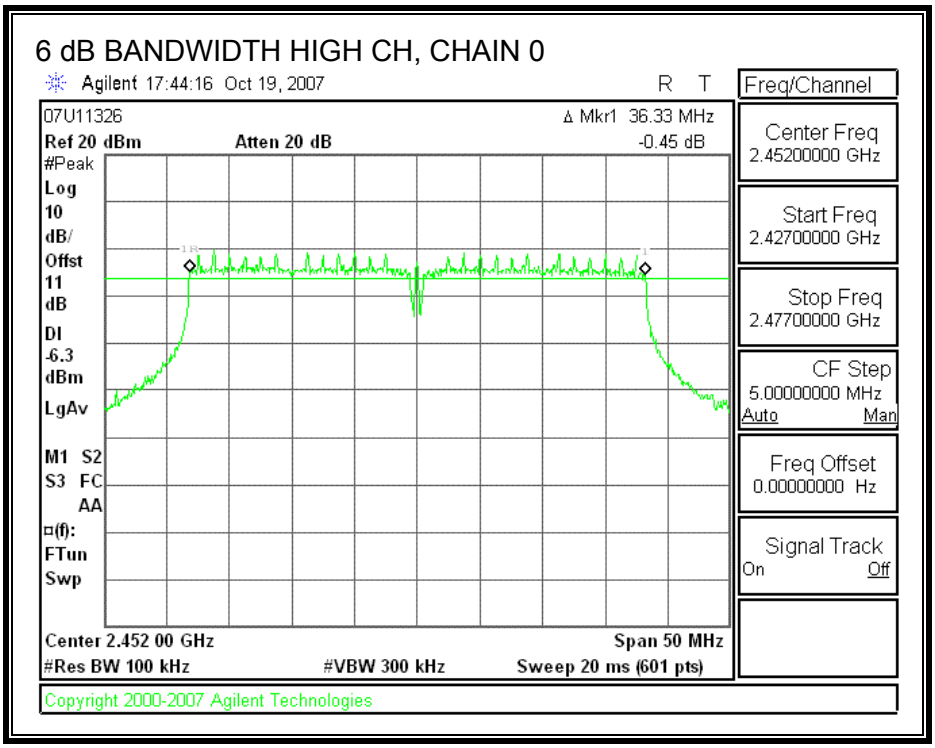
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

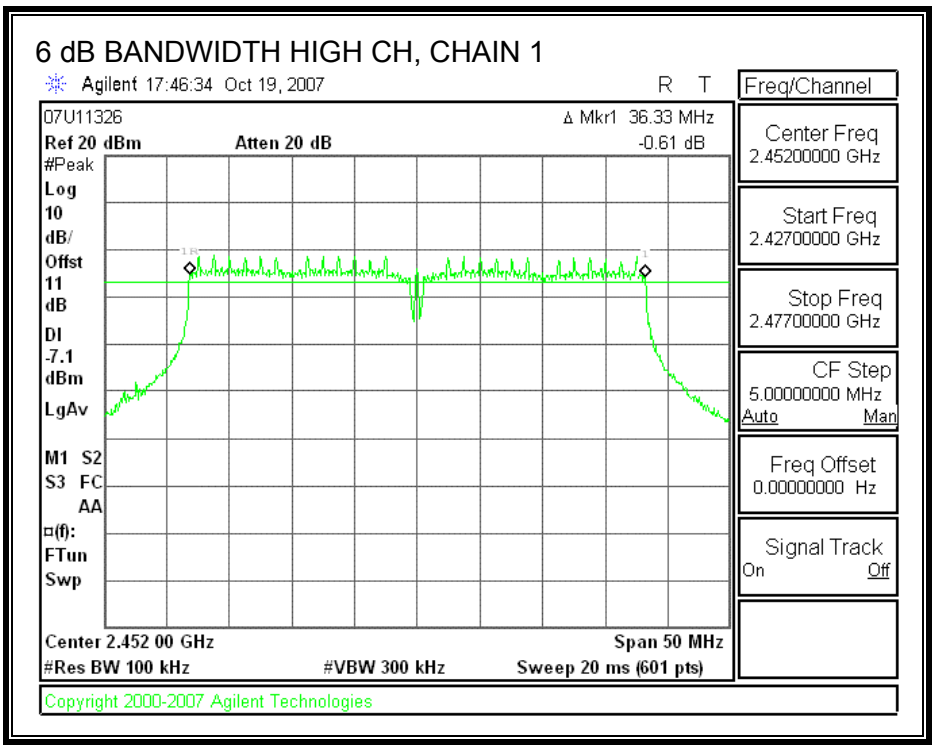
**RESULTS**

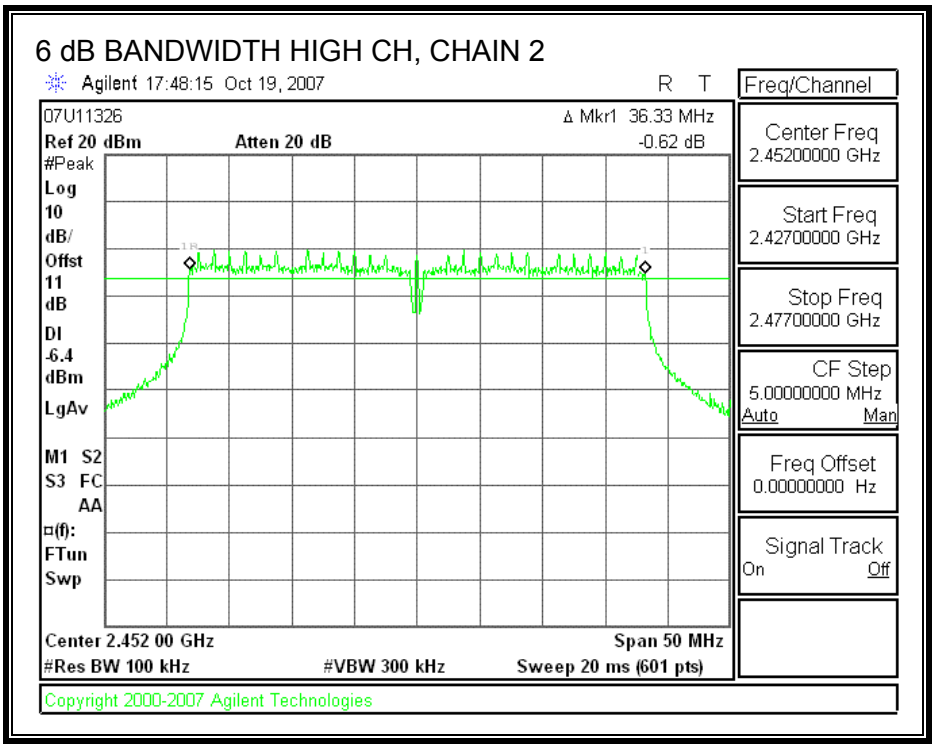
| Channel | Frequency (MHz) | Chain 0 6 dB BW (MHz) | Chain 1 6 dB BW (MHz) | Chain 2 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|---|---|
| Low | 2422 | 36.33 | 36.33 | 36.25 | 0.5 |
| Middle | 2437 | 36.33 | 36.25 | 36.33 | 0.5 |
| High | 2452 | 36.33 | 36.33 | 36.33 | 0.5 |

High channel plots are included hereafter.

**6 dB BANDWIDTH**





### 7.4.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

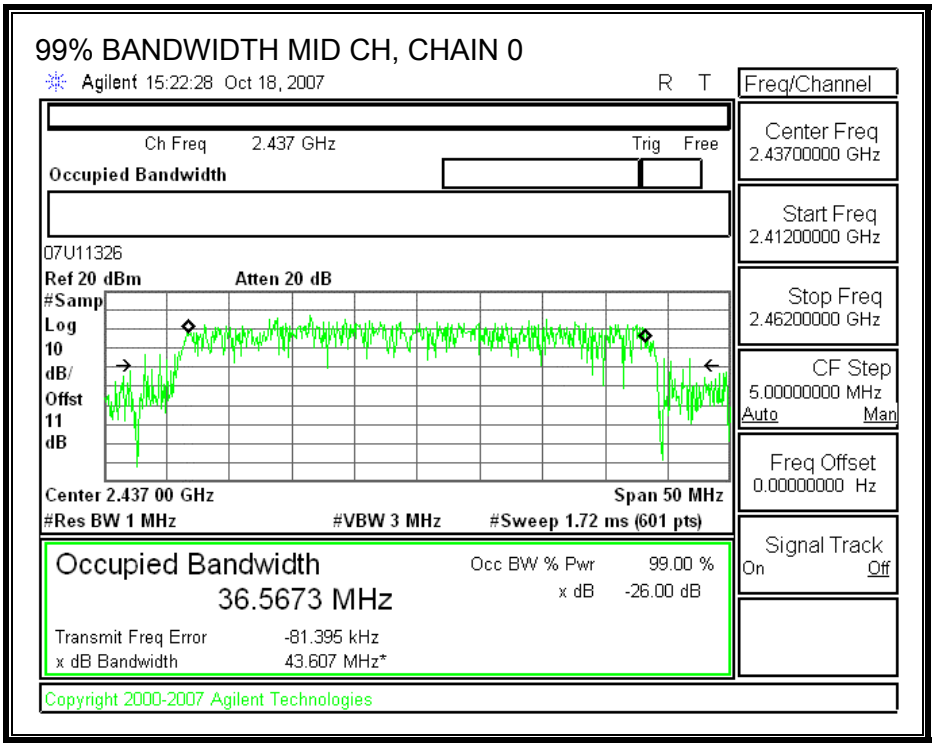
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

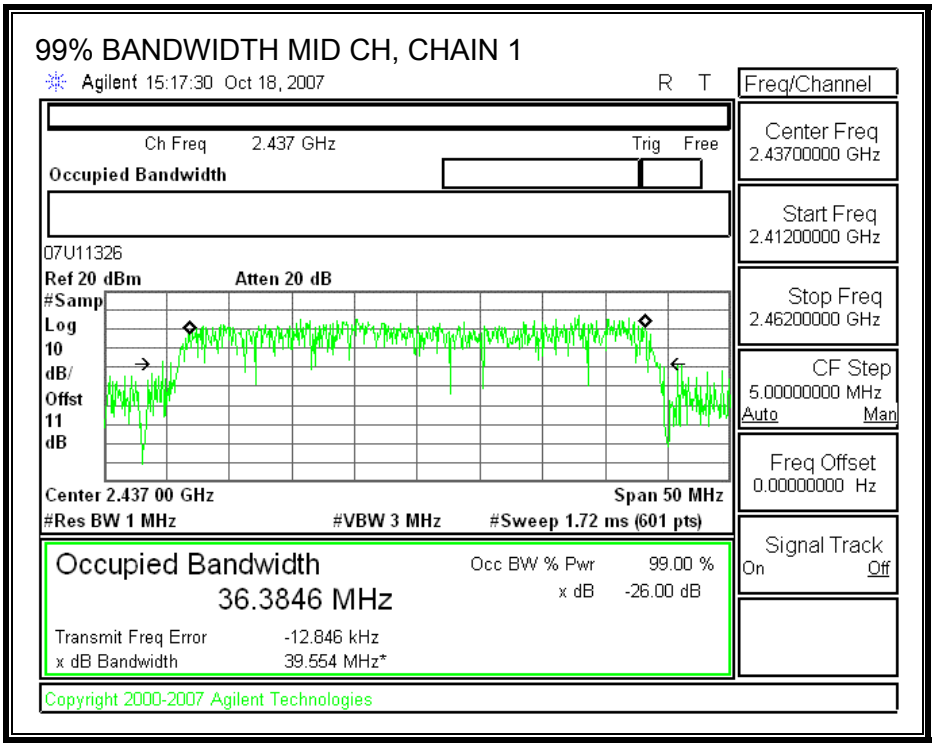
**RESULTS**

| Channel | Frequency (MHz) | Chain 0 99% Bandwidth (MHz) | Chain 1 99% Bandwidth (MHz) | Chain 2 99% Bandwidth (MHz) |
|---|---|---|---|---|
| Low | 2422 | 36.5749 | 36.5185 | 36.4997 |
| Middle | 2437 | 36.5673 | 36.3846 | 36.7400 |
| High | 2452 | 36.5763 | 36.4149 | 36.5138 |

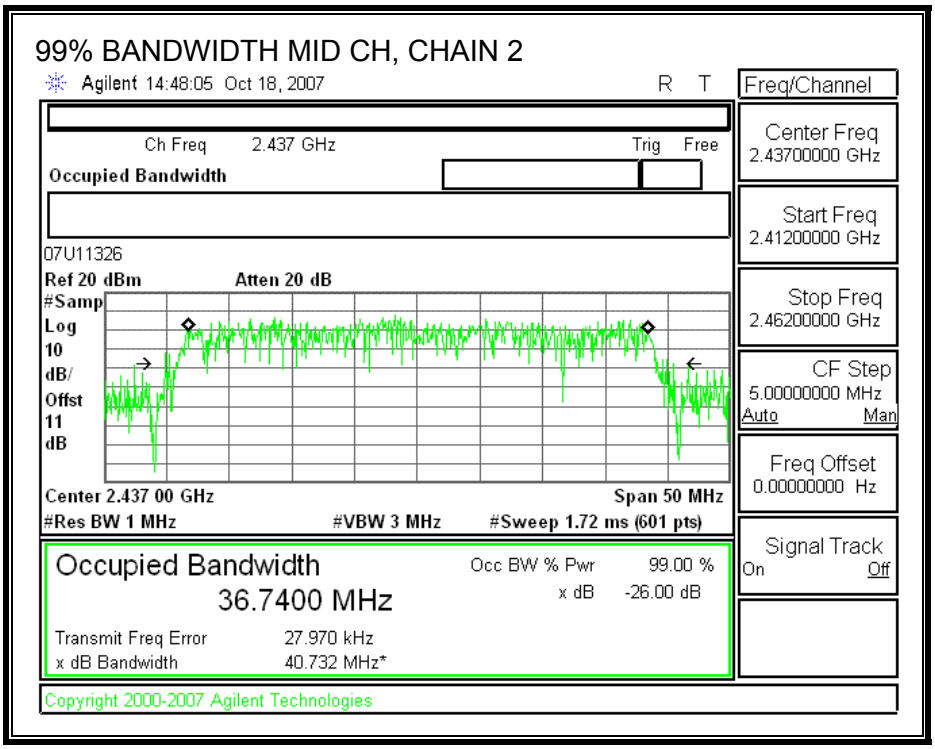
Middle channel plots are included hereafter.

**99% BANDWIDTH**



99% BANDWIDTH MID CH, CHAIN 2



### 7.4.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum effective antenna gain is 3 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

**TEST PROCEDURE**

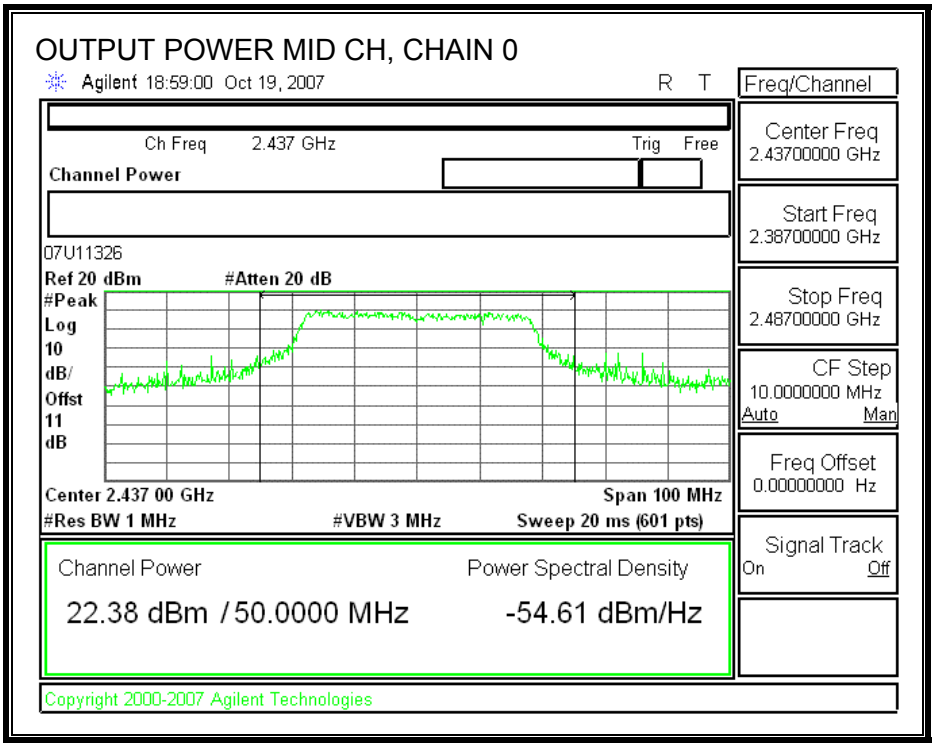
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

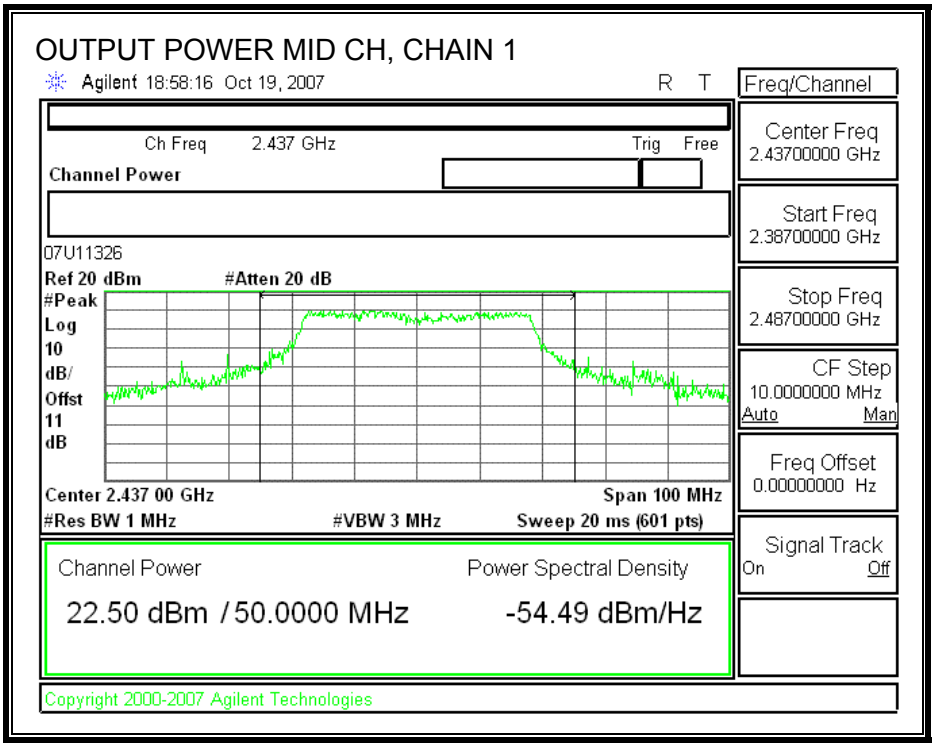
**RESULTS**

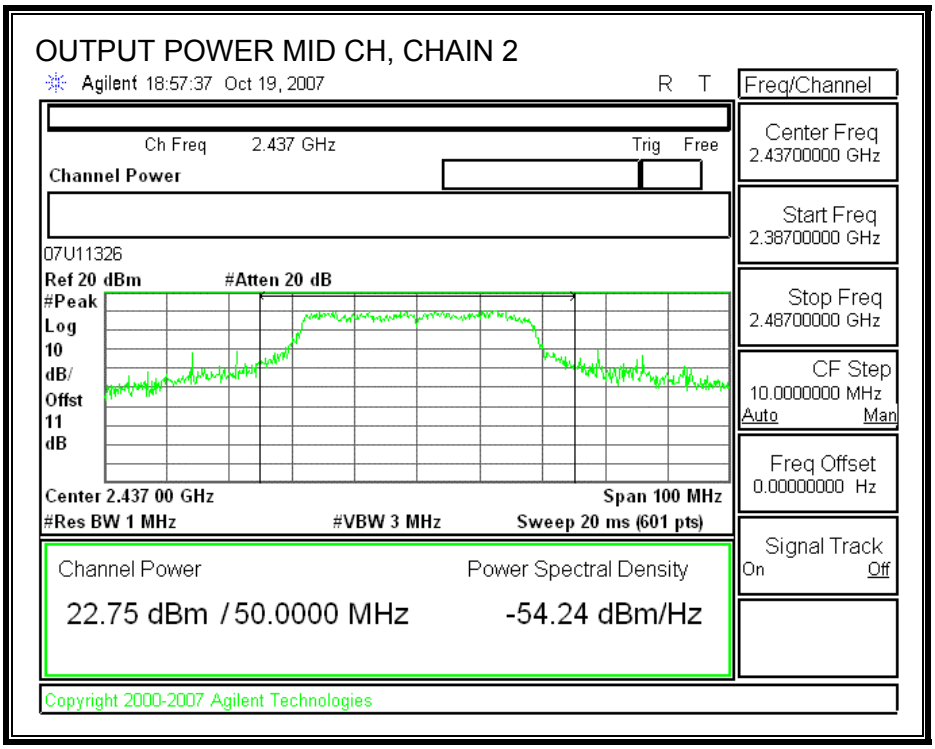
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 2422 | 17.08 | 17.79 | 18.04 | 22.43 | 30.00 | -7.57 |
| Mid | 2437 | 22.38 | 22.50 | 22.75 | 27.32 | 30.00 | -2.68 |
| High | 2452 | 15.65 | 15.73 | 16.32 | 20.68 | 30.00 | -9.32 |

Middle channel plots are included hereafter.

**OUTPUT POWER**





## 7.4.4. AVERAGE POWER FOR HT40 MODES (2.4GHz)

**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 0 (dBm) | Chain 1 (dBm) | Chain 2 (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 2422 | 13.53 | 13.47 | 13.95 | 18.42 |
| Middle | 2437 | 15.81 | 15.64 | 16.31 | 20.70 |
| High | 2452 | 12.07 | 11.65 | 12.51 | 16.86 |

## 7.4.5. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

**TEST PROCEDURE**

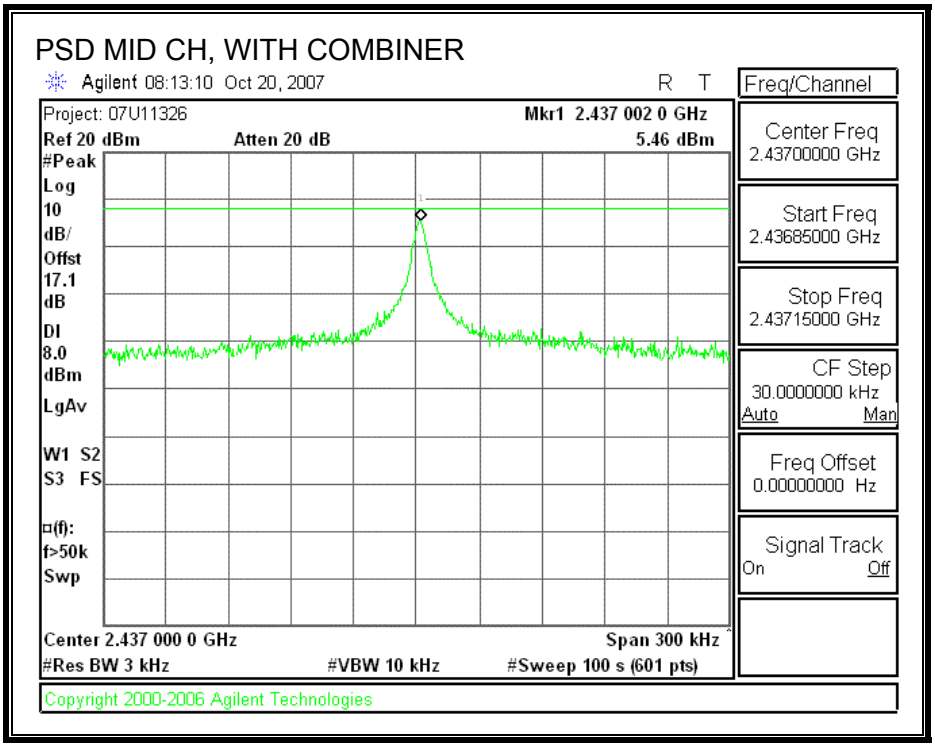
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

**RESULTS**

| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 2422 | 2.94 | 8 | -5.06 |
| Middle | 2437 | 5.46 | 8 | -2.54 |
| High | 2452 | 2.28 | 8 | -5.72 |

Middle channel plot is included hereafter.

**POWER SPECTRAL DENSITY, WITH COMBINER**



## 7.4.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

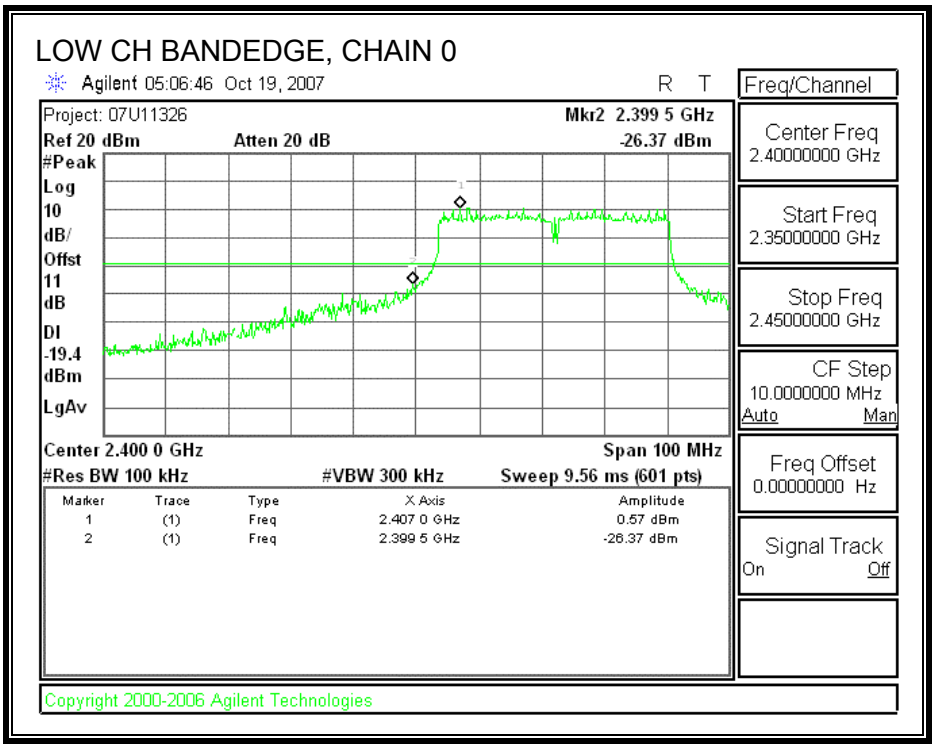
**TEST PROCEDURE**

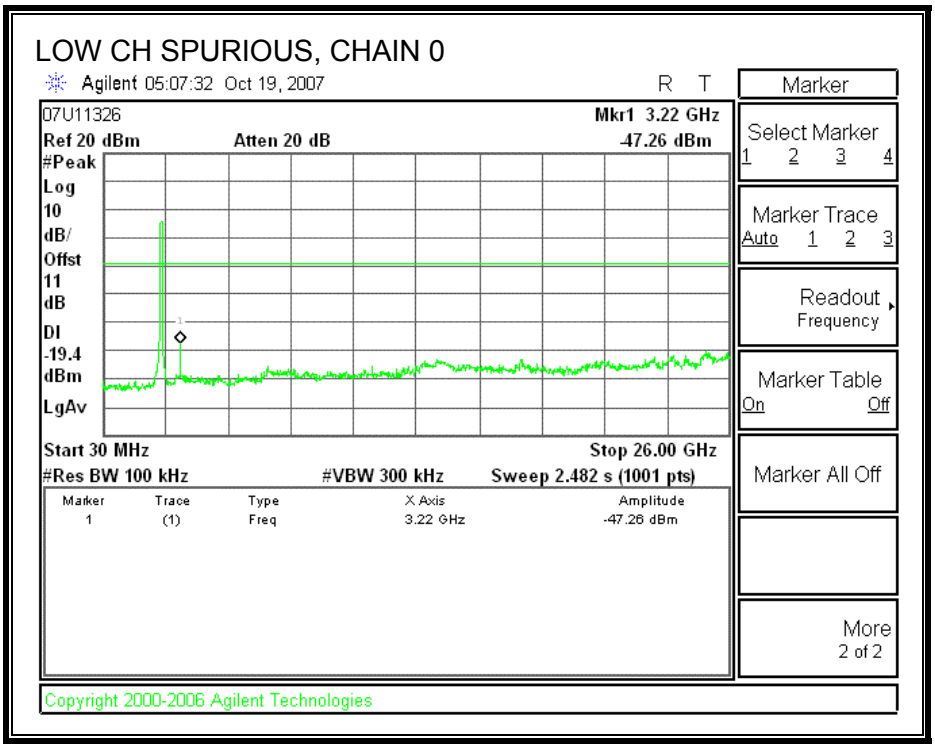
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

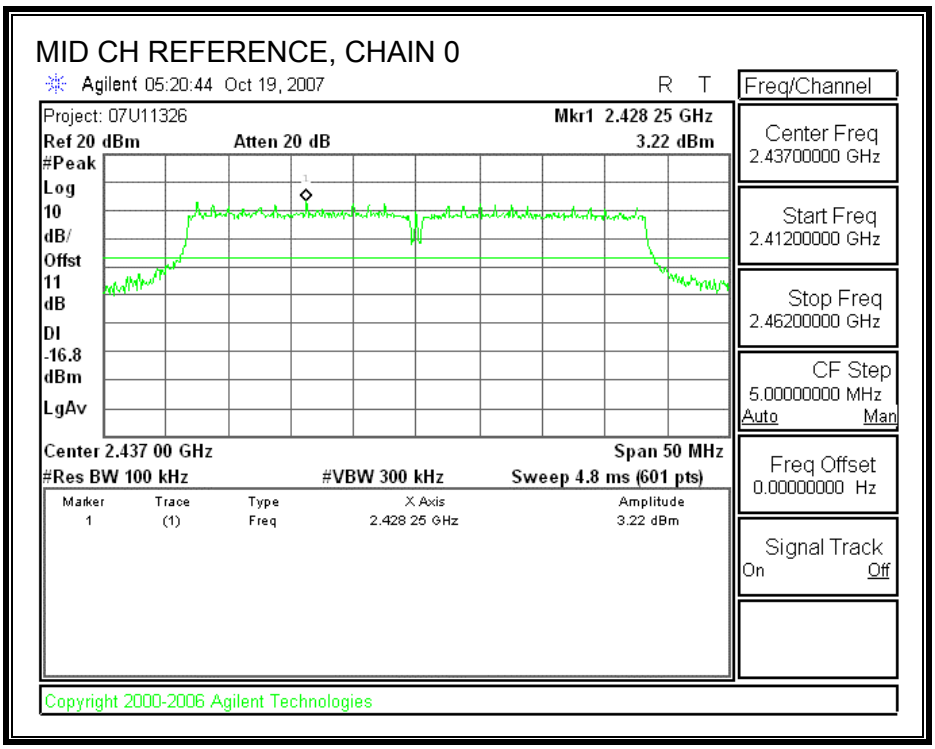
**RESULTS**

**CHAIN 0 SPURIOUS EMISSIONS**

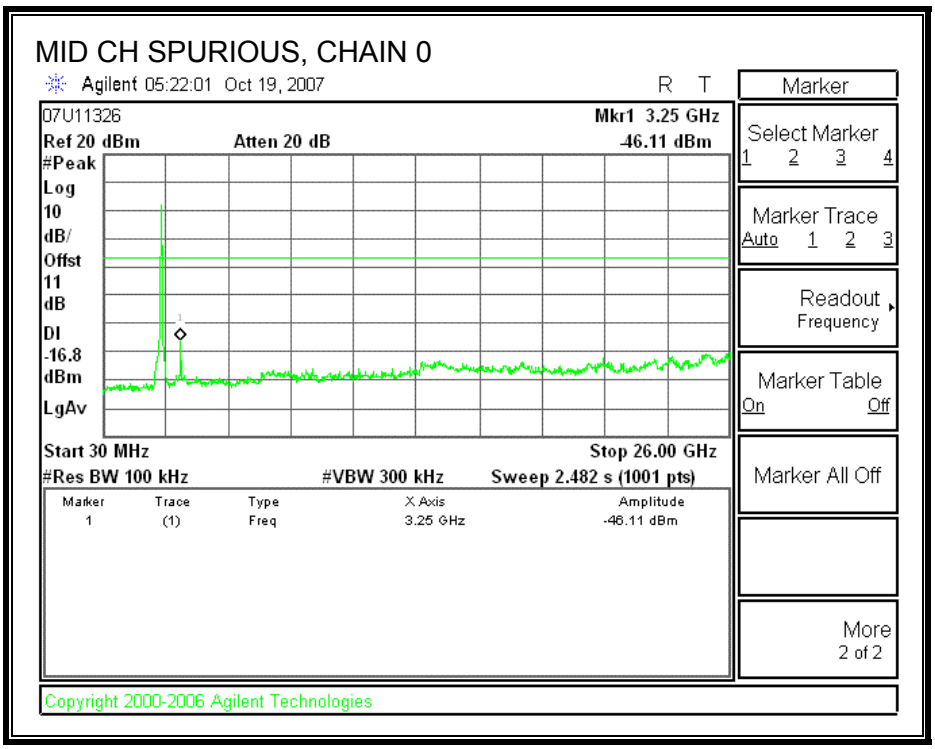


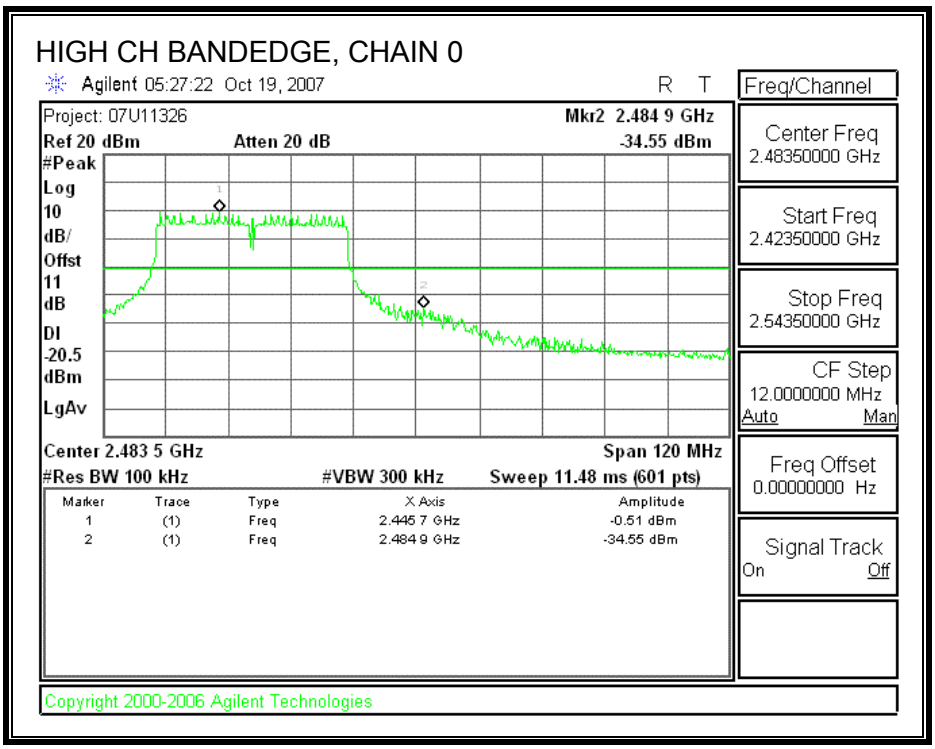



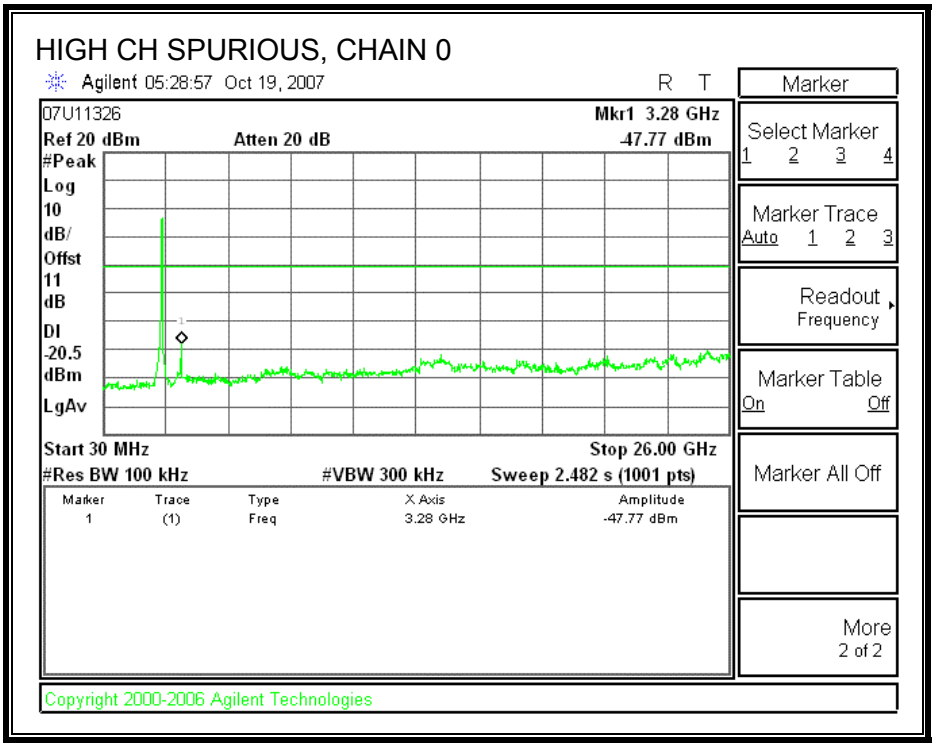
MID CH REFERENCE, CHAIN 0



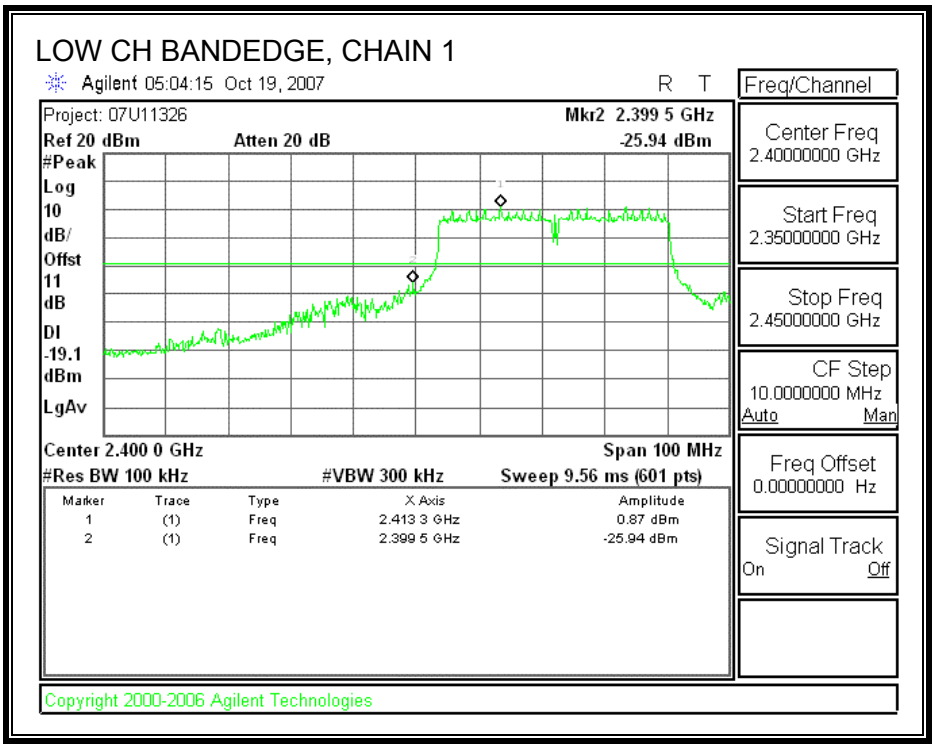

MID CH SPURIOUS, CHAIN 0

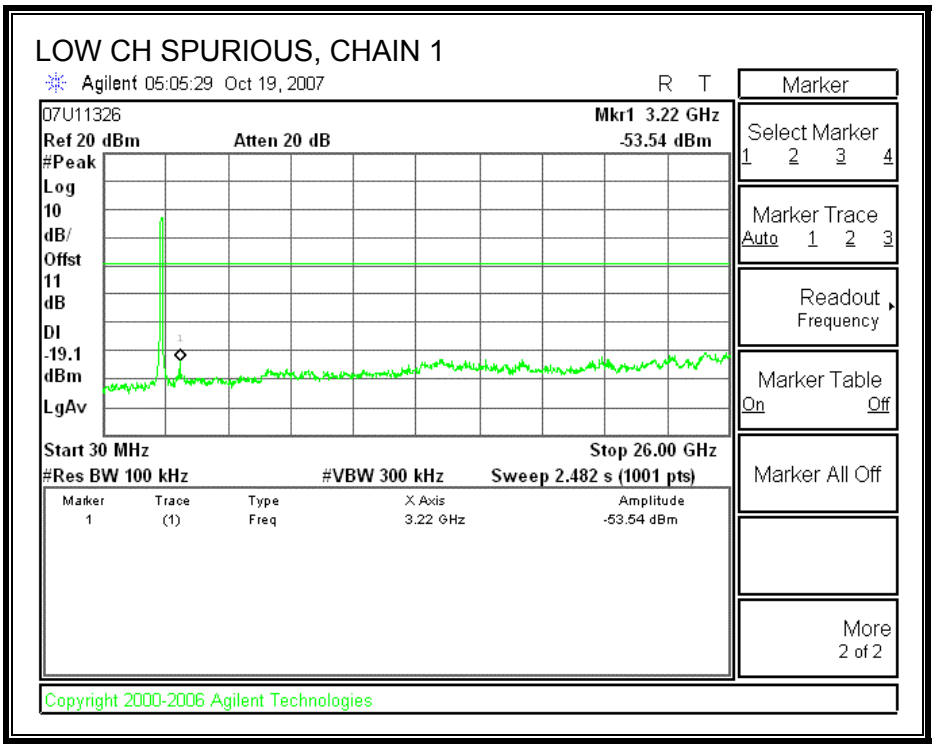




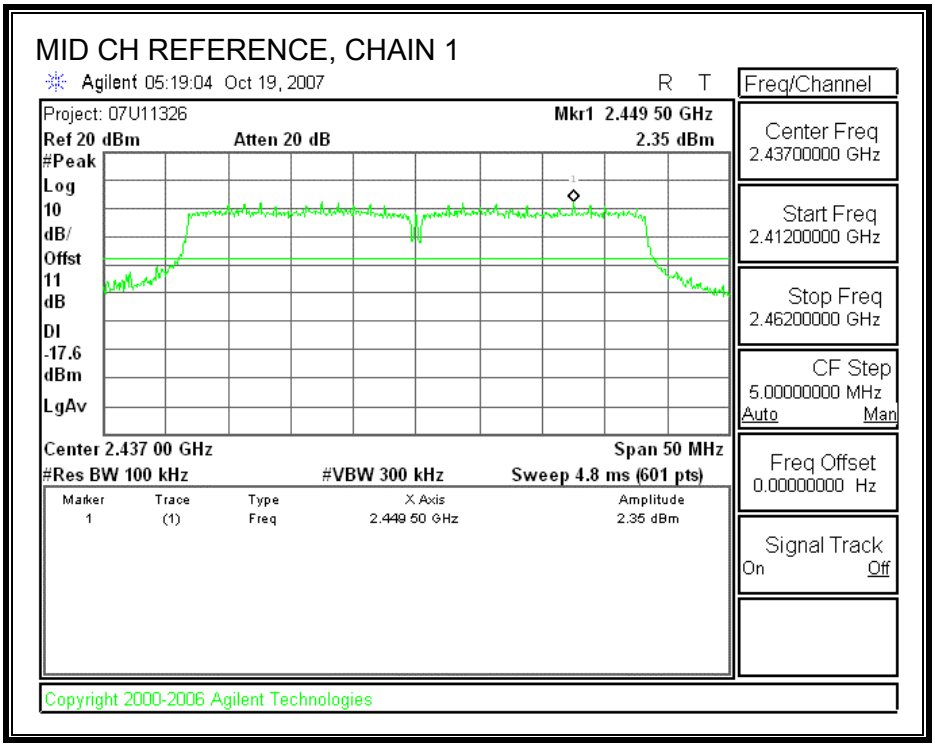



**CHAIN 1 SPURIOUS EMISSIONS**

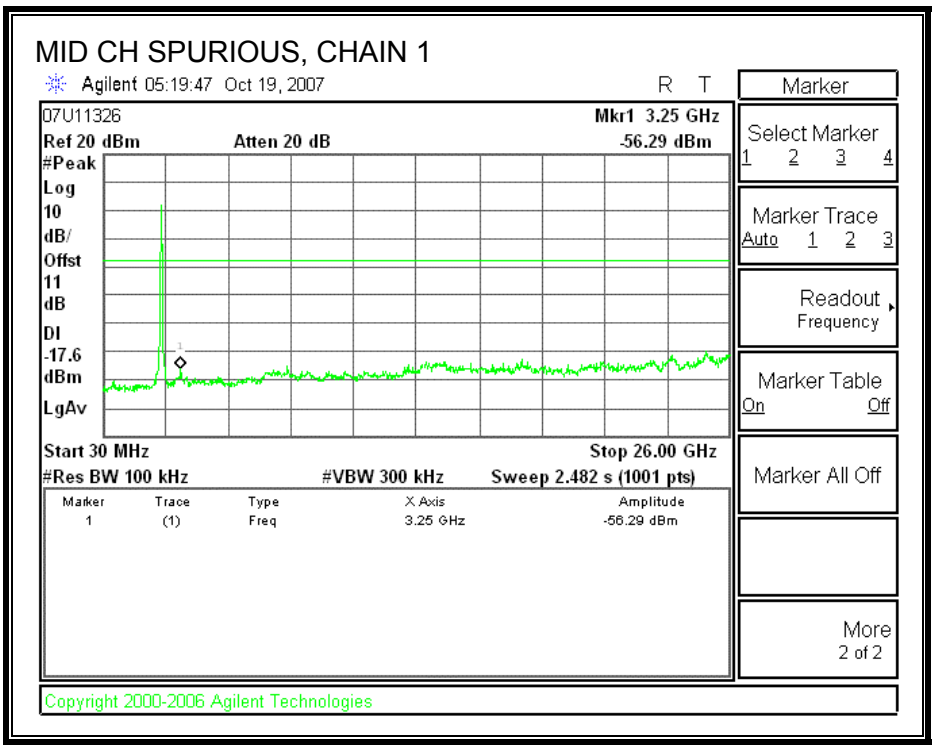


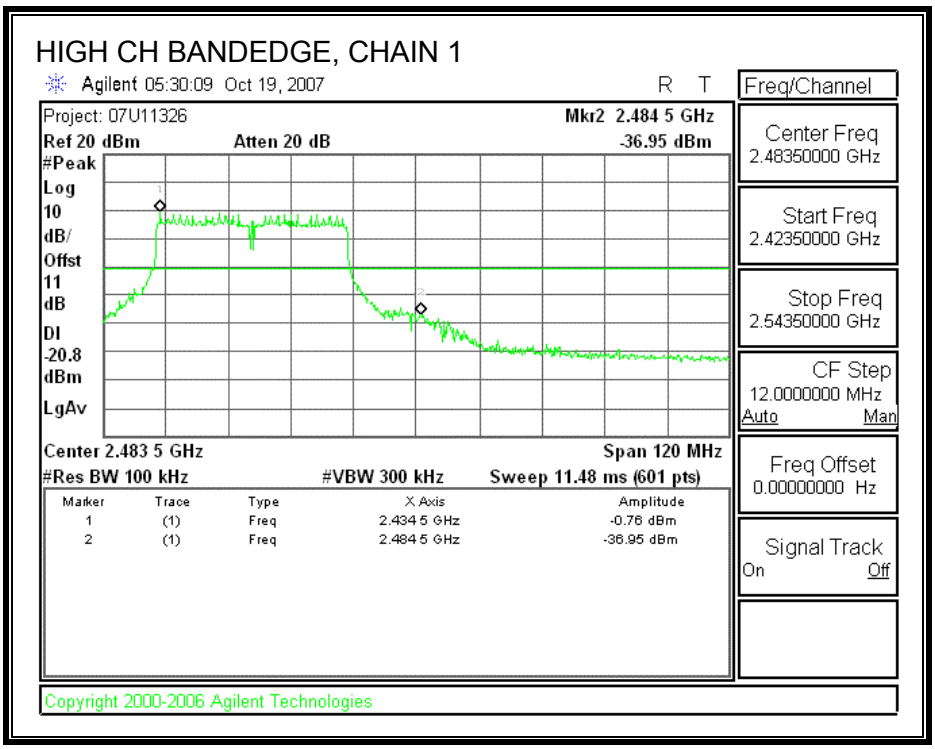



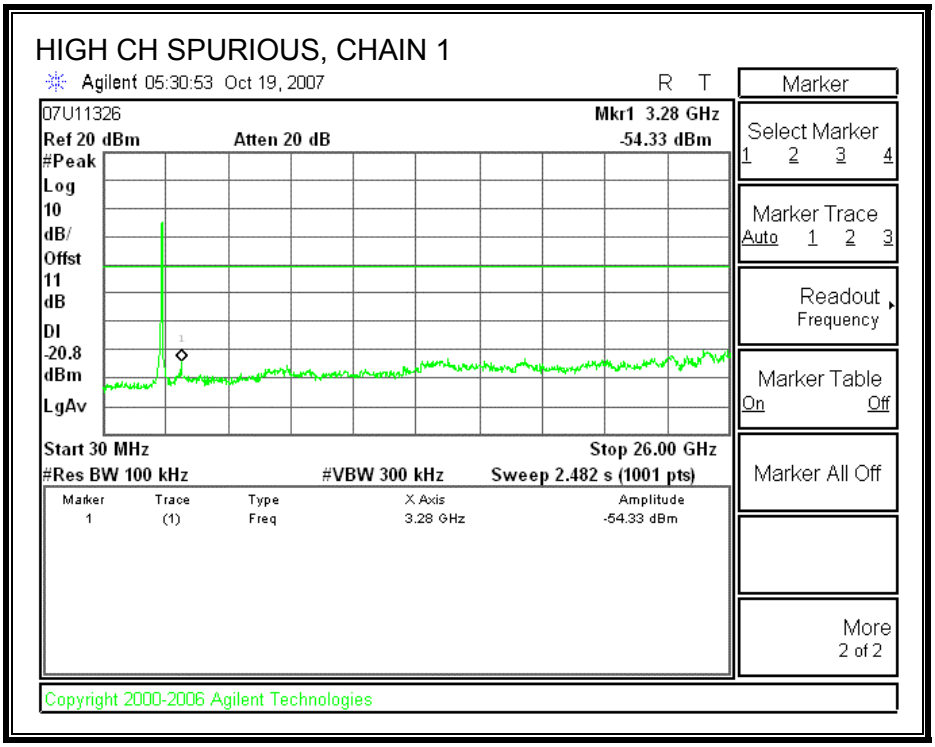
MID CH REFERENCE, CHAIN 1



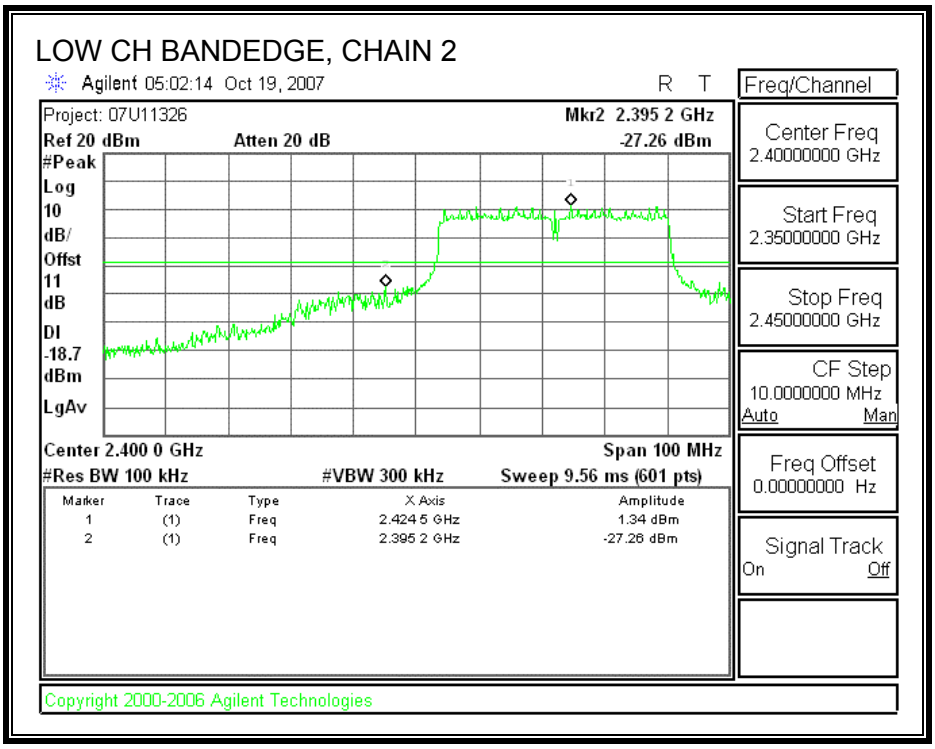

MID CH SPURIOUS, CHAIN 1

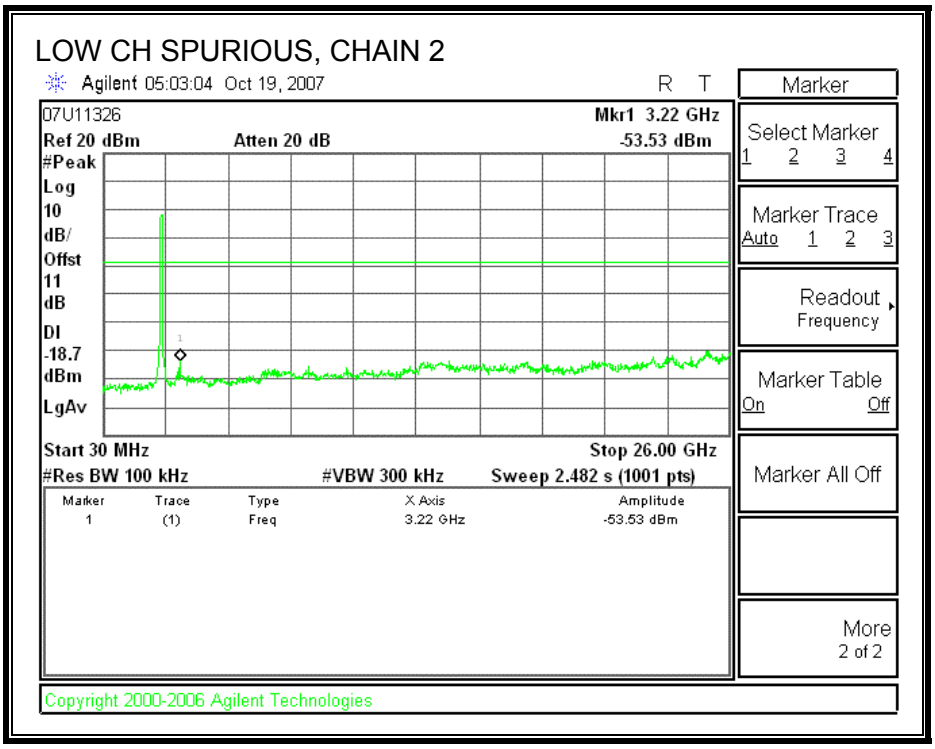




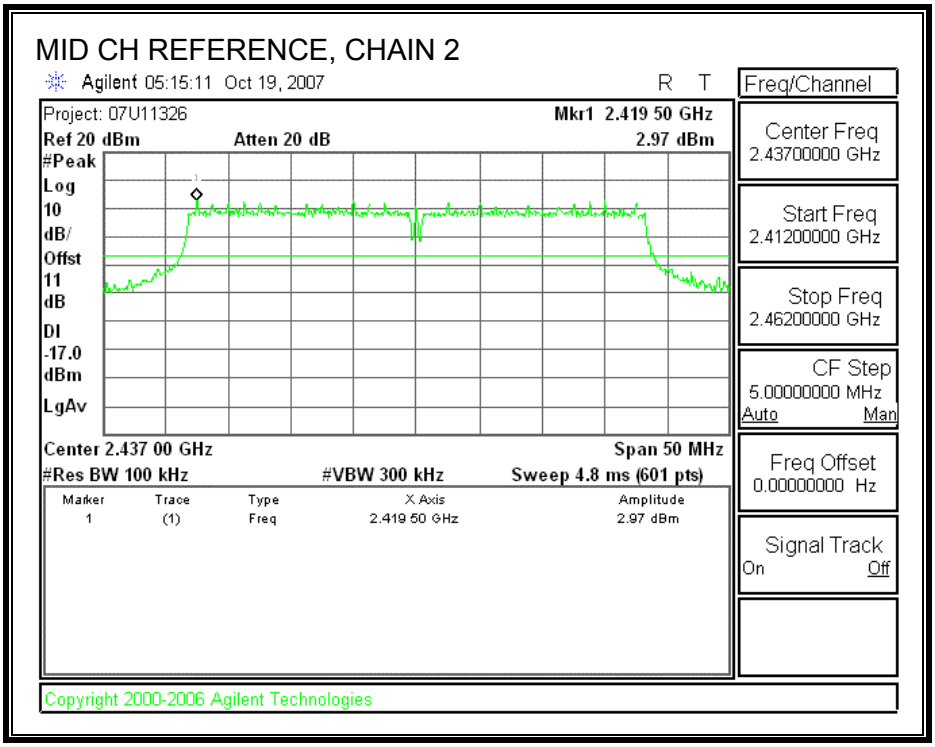



**CHAIN 2 SPURIOUS EMISSIONS**

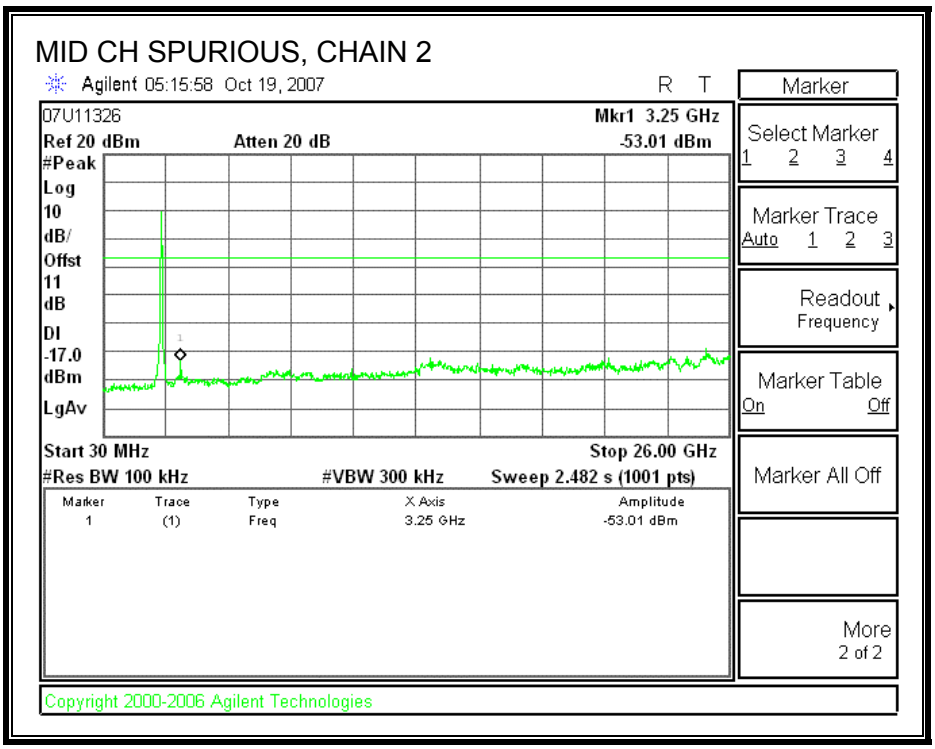


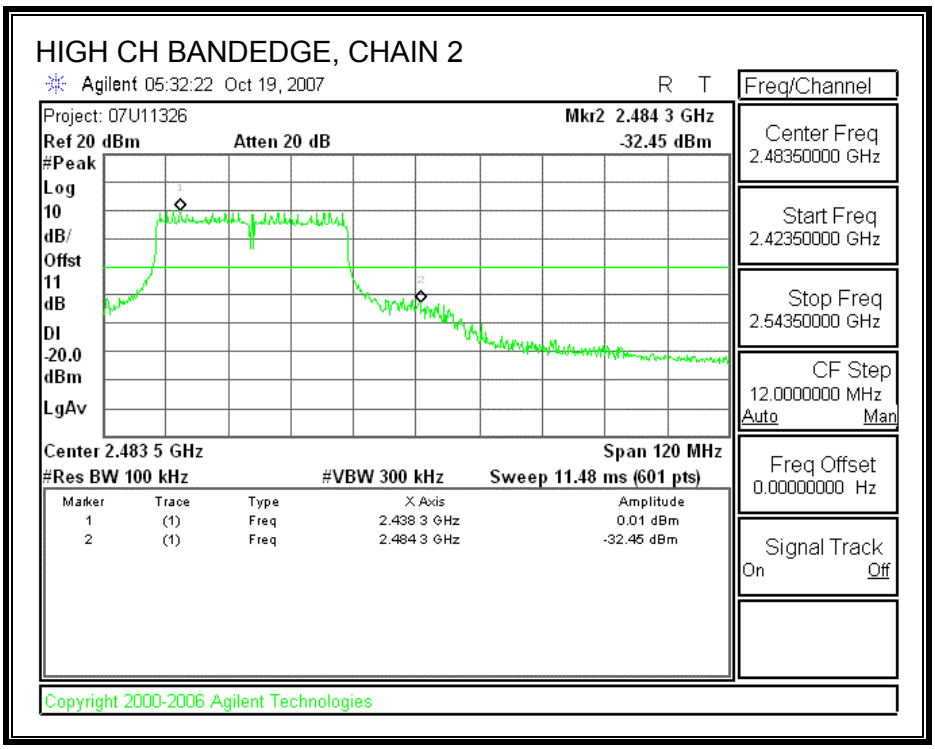
MID CH REFERENCE, CHAIN 2



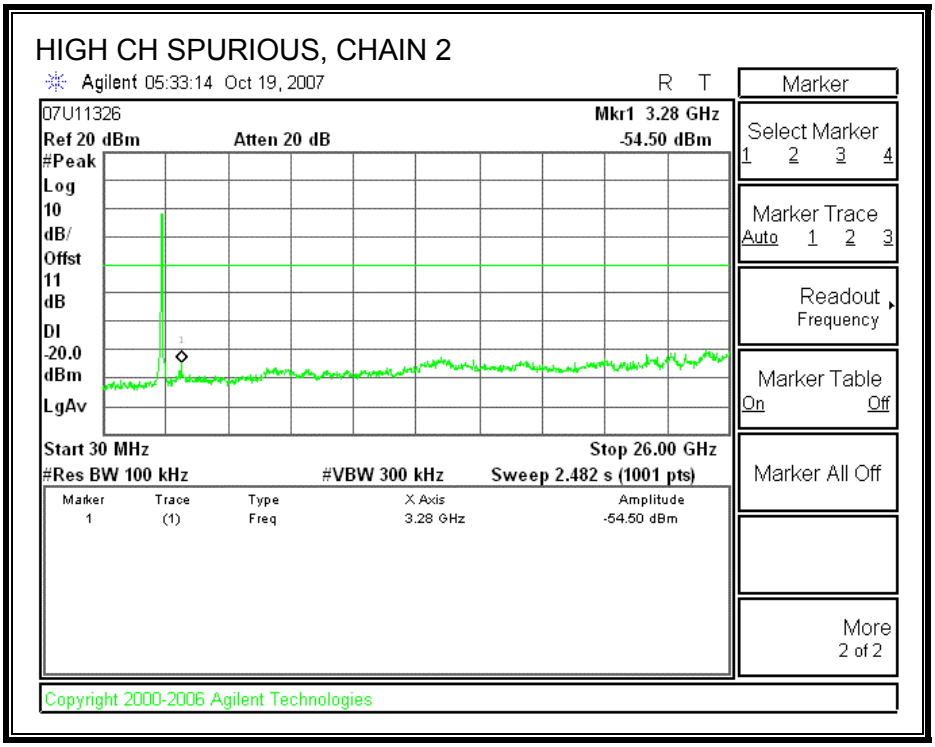

MID CH SPURIOUS, CHAIN 2



HIGH CH BANDEDGE, CHAIN 2




HIGH CH SPURIOUS, CHAIN 2



# 7.5. 802.11a THREE CHAINS 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**

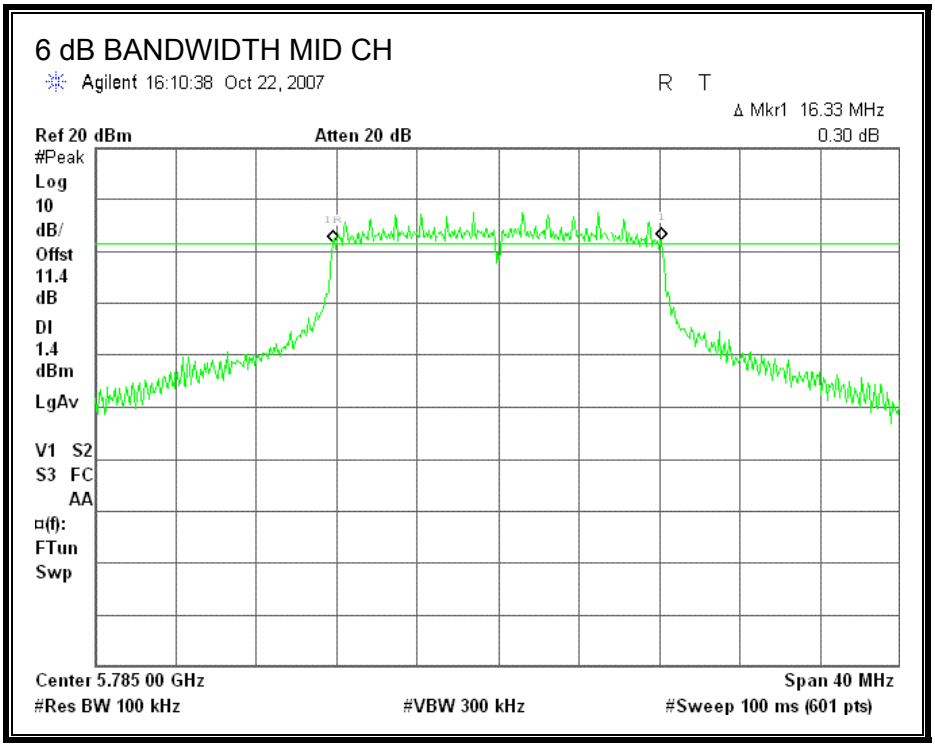
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 5745 | 16.33 | 0.5 |
| Middle | 5785 | 16.33 | 0.5 |
| High | 5825 | 16.33 | 0.5 |

Middle channel plot is included hereafter.

**6 dB BANDWIDTH**



### 7.5.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

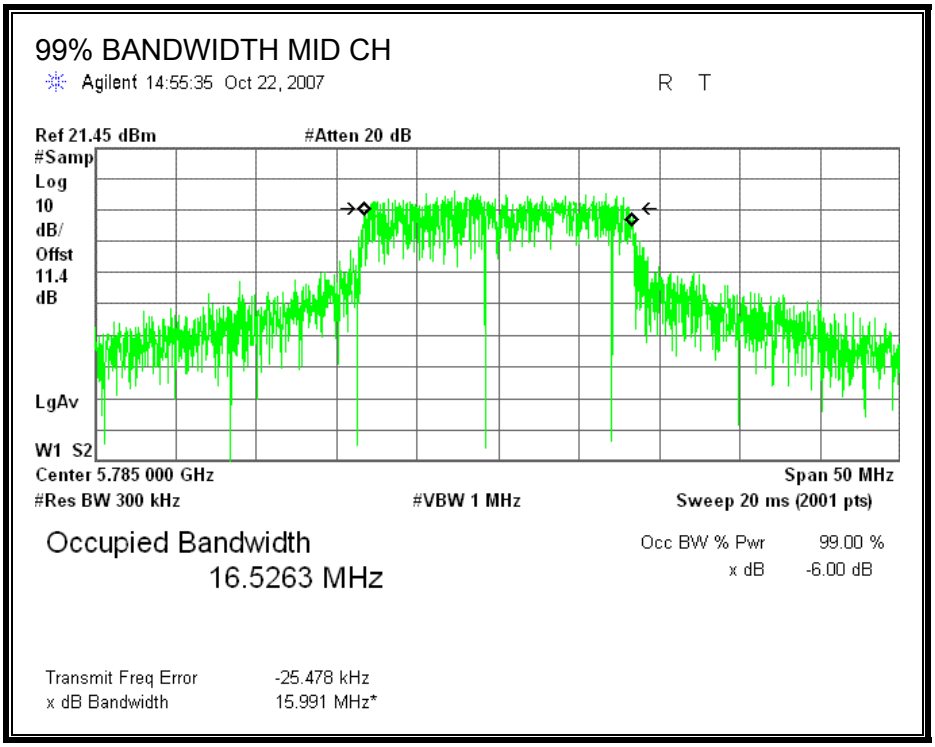
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 5745 | 16.5047 |
| Middle | 5785 | 16.5263 |
| High | 5825 | 16.5226 |

Middle channel plot is included hereafter.

**99% BANDWIDTH**



## 7.5.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

| Antenna Gain (dBi) | 10 Log (# Tx Chains) (dB) | Effective Legacy Gain (dBi) |
|---|---|---|
| 5 | 4.77 | 9.77 |

The maximum effective antenna gain is 9.77 dBi for other than fixed, point-to-point operations, therefore the limit is 26.23 dBm.

**TEST PROCEDURE**

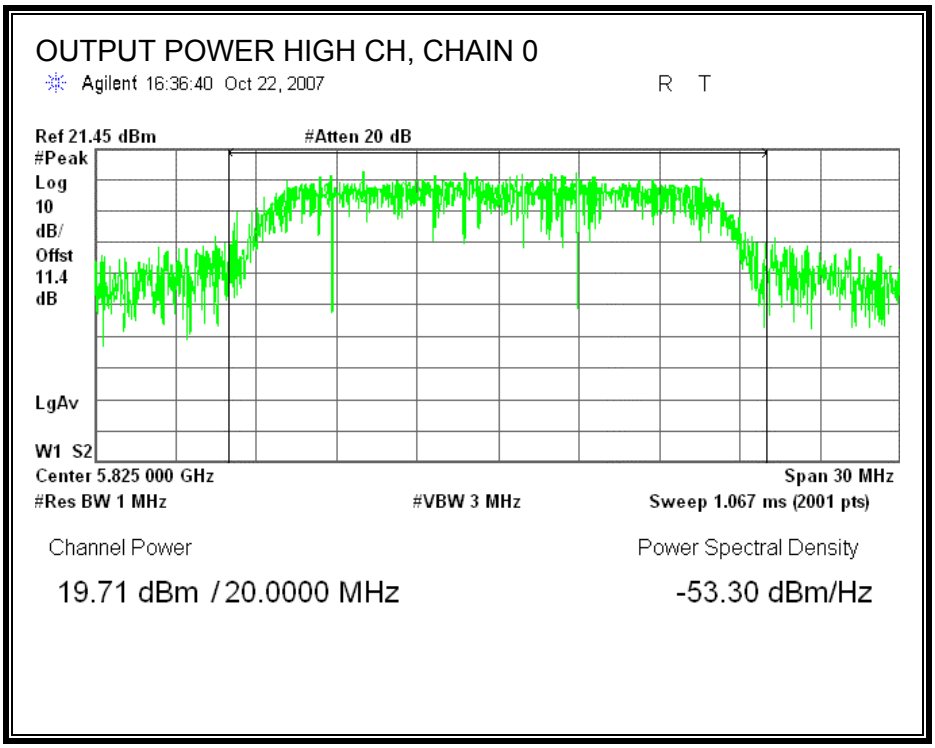
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

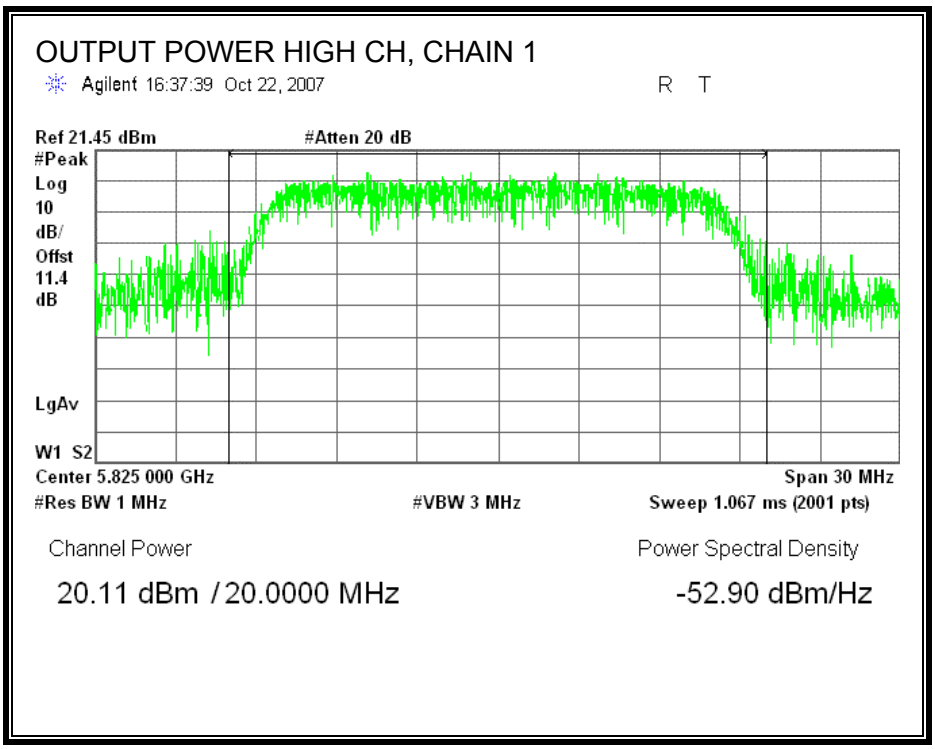
**RESULTS**

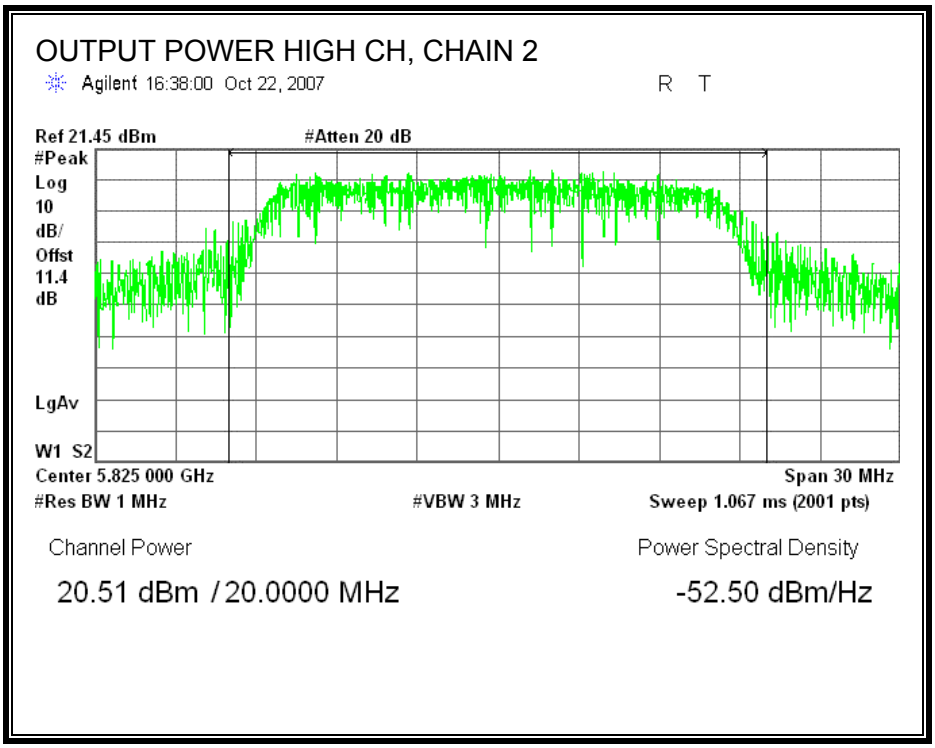
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5745 | 20.14 | 19.98 | 20.05 | 24.83 | 26.23 | -1.40 |
| Mid | 5785 | 19.37 | 20.14 | 20.06 | 24.64 | 26.23 | -1.59 |
| High | 5825 | 19.71 | 20.11 | 20.51 | 24.89 | 26.23 | -1.34 |

High channel plots are included hereafter.

**OUTPUT POWER**





## 7.5.4. AVERAGE POWER FOR LEGACY MODES (5.8GHz)

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Chain 0 (dBm) | Chain 1 (dBm) | Chain 2 (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 5745 | 17.52 | 17.54 | 17.62 | 22.33 |
| Middle | 5785 | 17.46 | 17.98 | 17.67 | 22.48 |
| High | 5825 | 17.65 | 18.02 | 18.23 | 22.74 |

## 7.5.5. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

**TEST PROCEDURE**

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

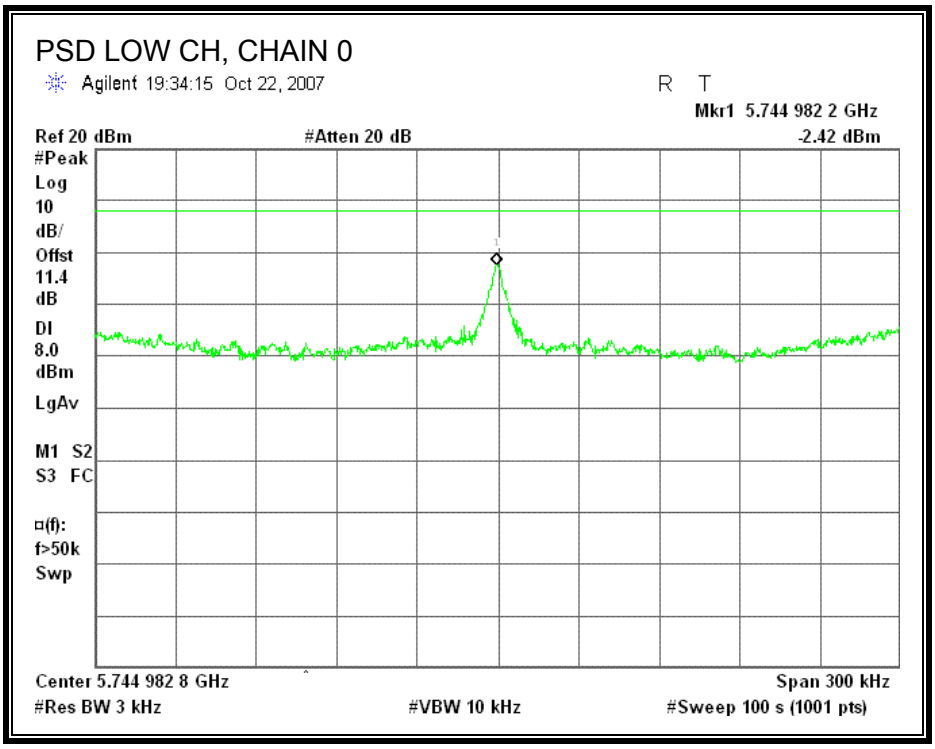
**RESULTS:**

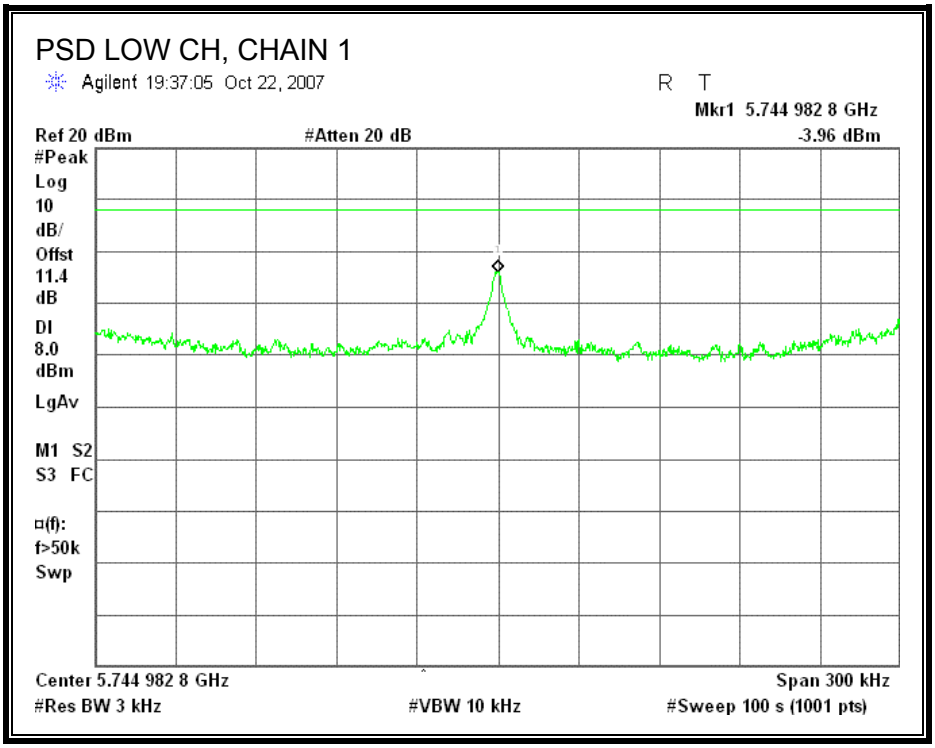
| Channel | Frequency (MHz) | Chain 0 PSD (dBm) | Chain 1 PSD (dBm) | Chain 2 PSD (dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| Low | 5745 | -2.42 | -3.96 | -5.91 | 8 |
| Middle | 5785 | -3.14 | -4.66 | -7.23 | 8 |
| High | 5825 | -4.08 | -4.23 | -4.86 | 8 |

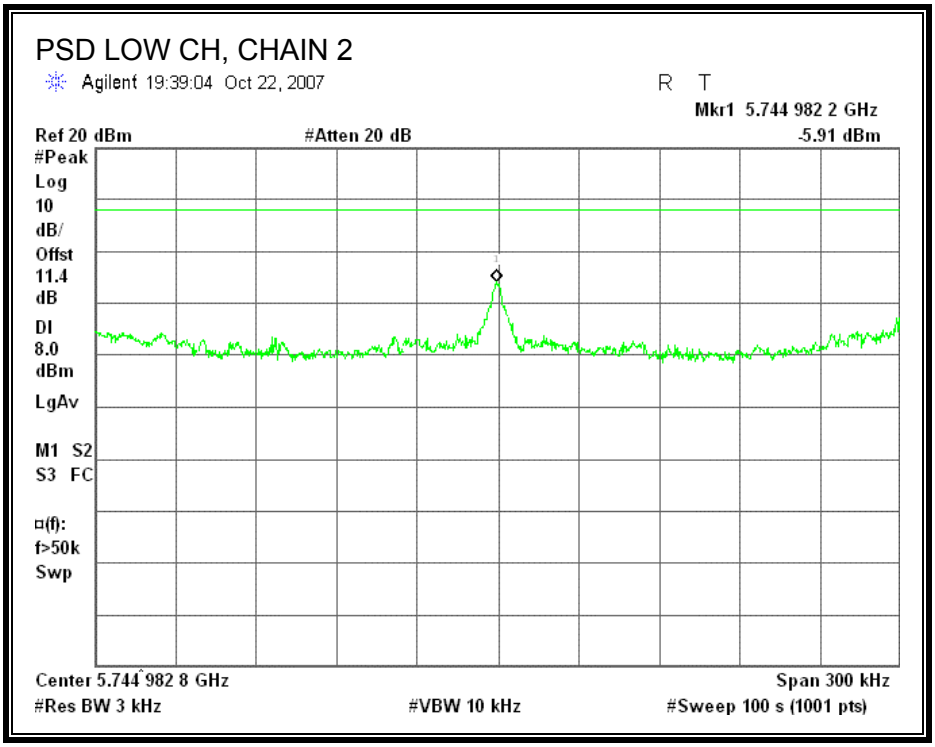
| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5745 | 4.93 | 8 | -3.07 |
| Middle | 5785 | 4.30 | 8 | -3.70 |
| High | 5825 | 3.95 | 8 | -4.05 |

Low channel plots are included hereafter.

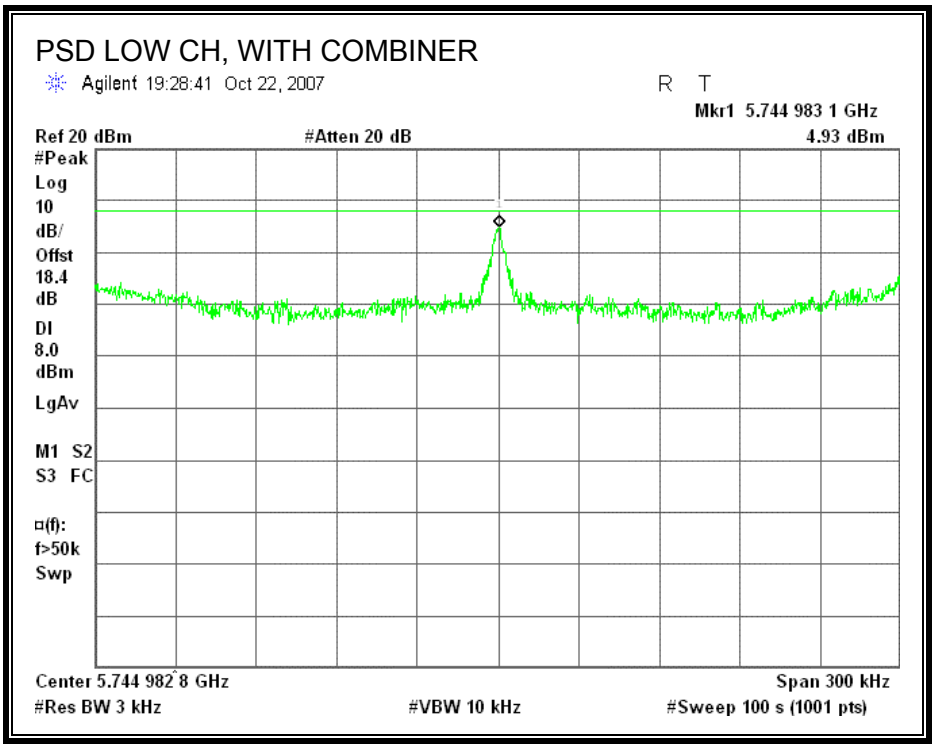
**POWER SPECTRAL DENSITY**





**POWER SPECTRAL DENSITY, WITH COMBINER**



## 7.5.6. CONDUCTED SPURIOUS EMISSIONS

**LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

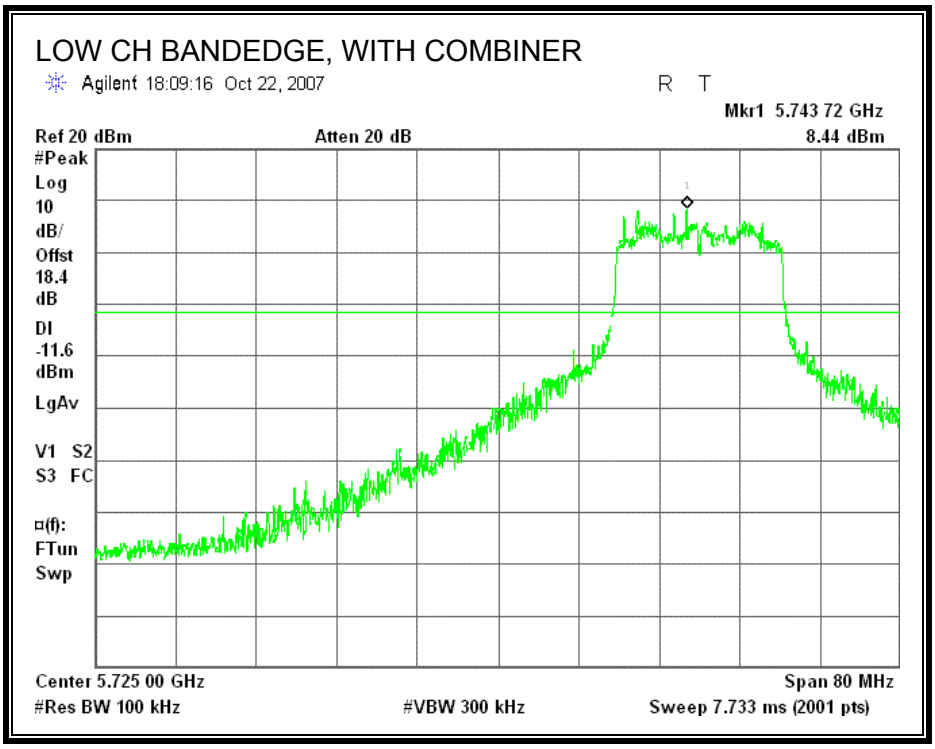
**TEST PROCEDURE**

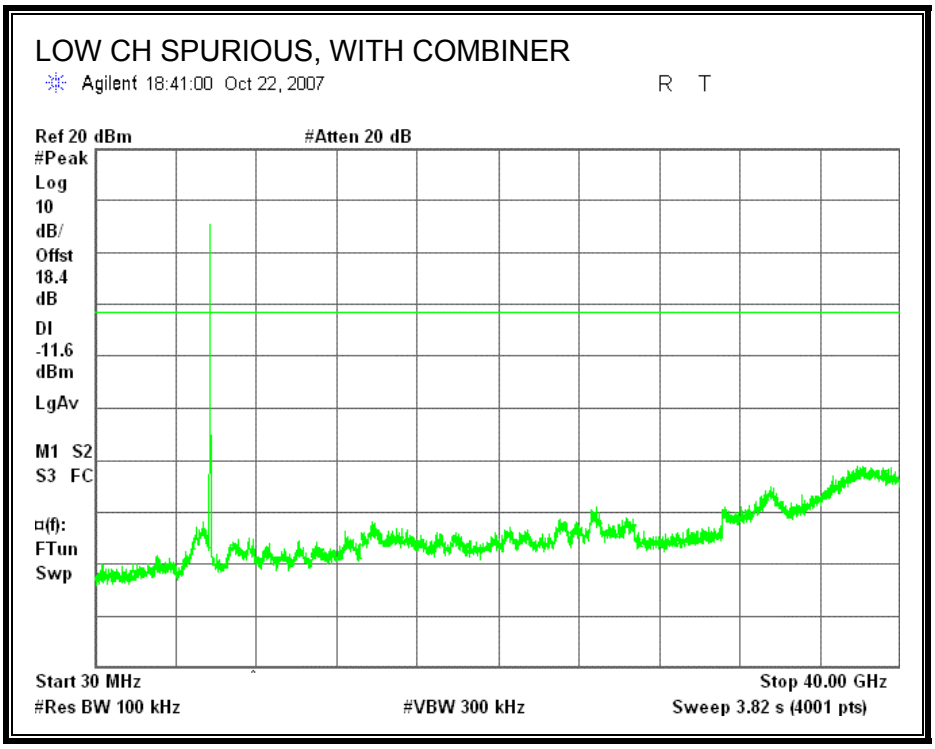
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

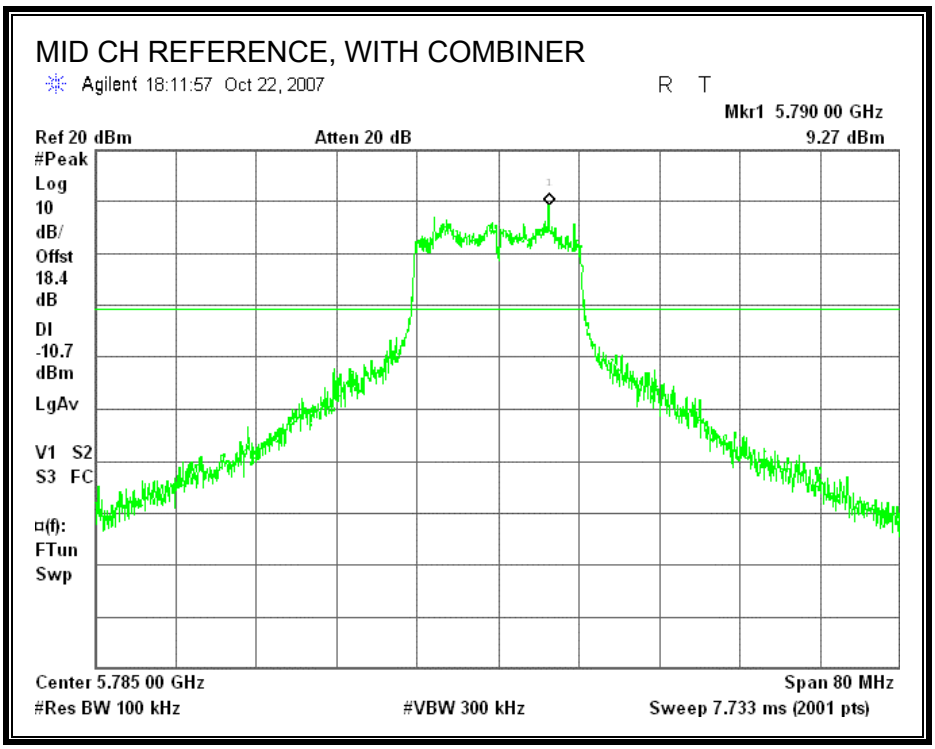
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

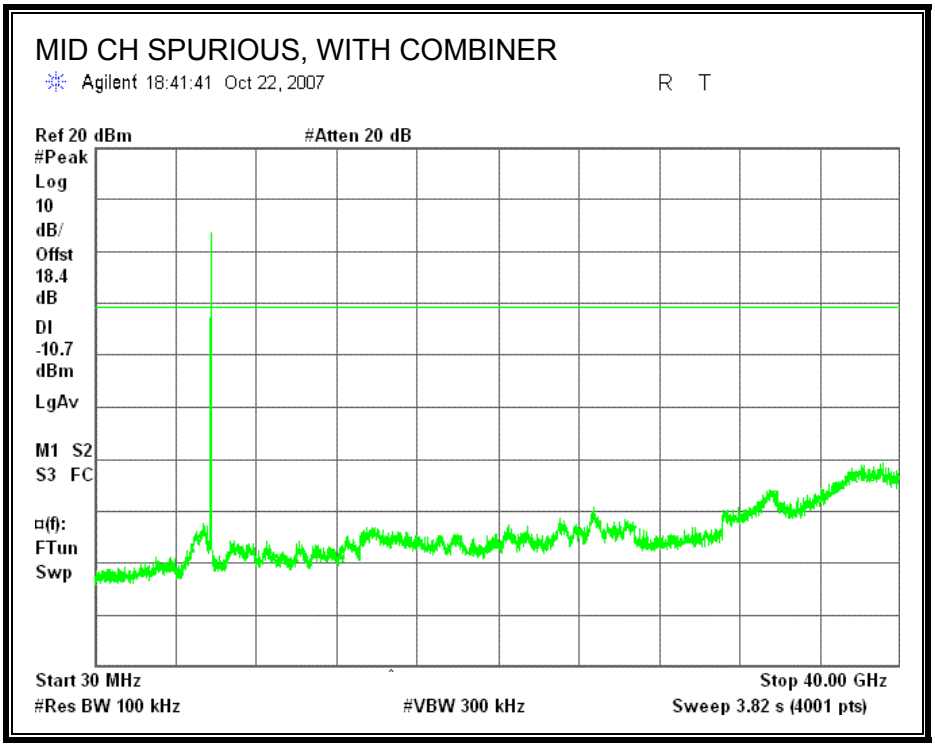
**RESULTS**

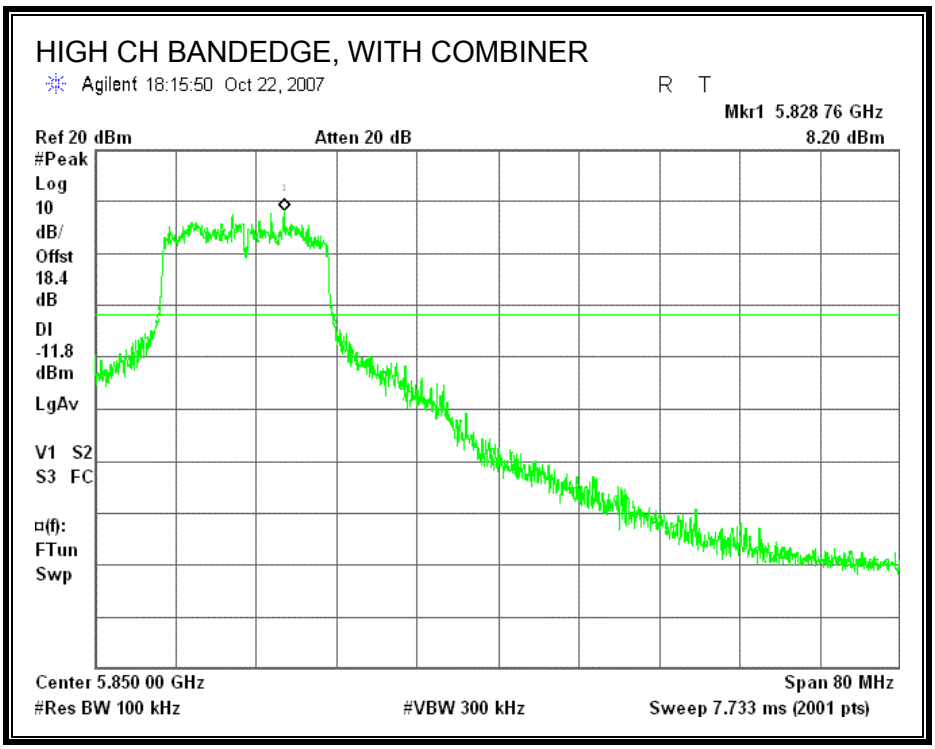
**SPURIOUS EMISSIONS WITH COMBINER**

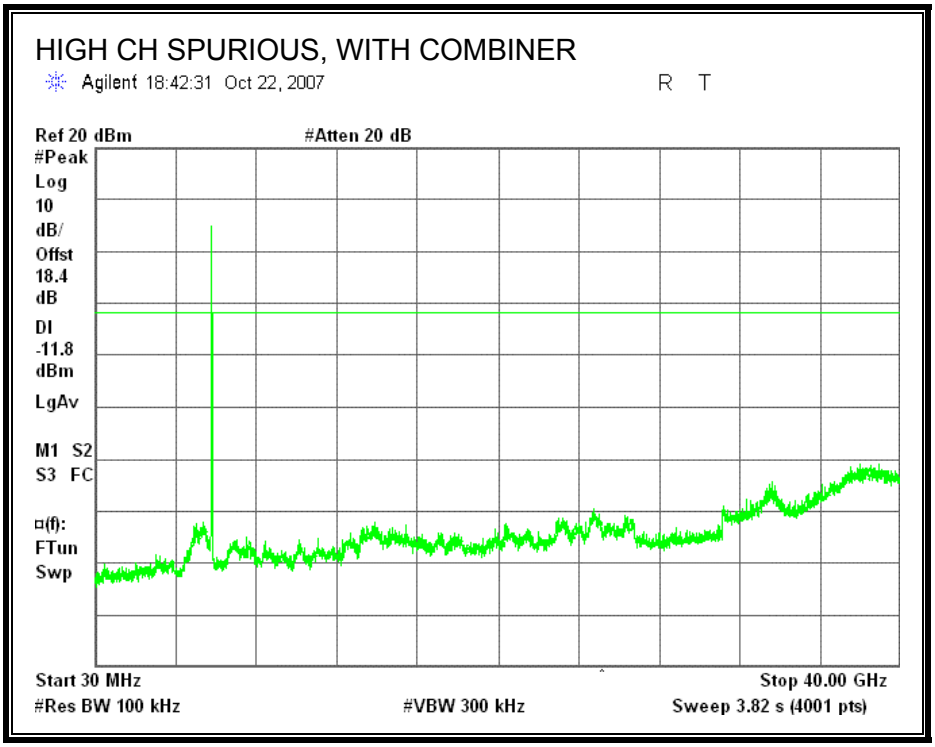






# 7.6. 802.11n THREE CHAINS HT20 MODE IN THE 5.8 GHz BAND

## 7.6.1. 6 dB BANDWIDTH

**LIMITS**

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

**TEST PROCEDURE**

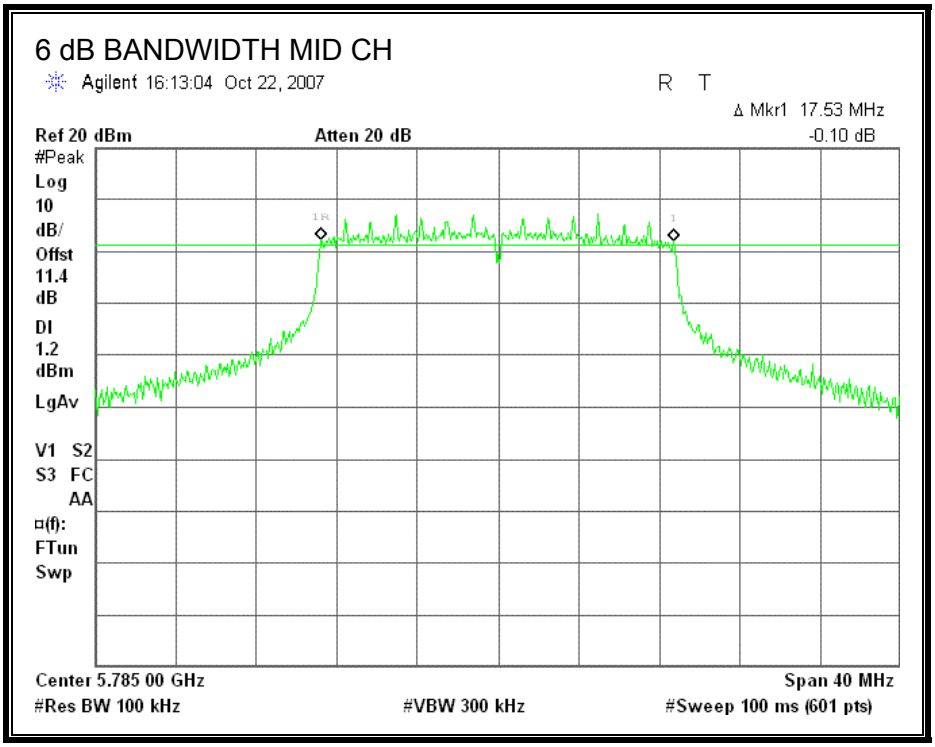
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 5745 | 17.20 | 0.5 |
| Middle | 5785 | 17.53 | 0.5 |
| High | 5825 | 17.20 | 0.5 |

Middle channel plot is included hereafter.

**6 dB BANDWIDTH**



### 7.6.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

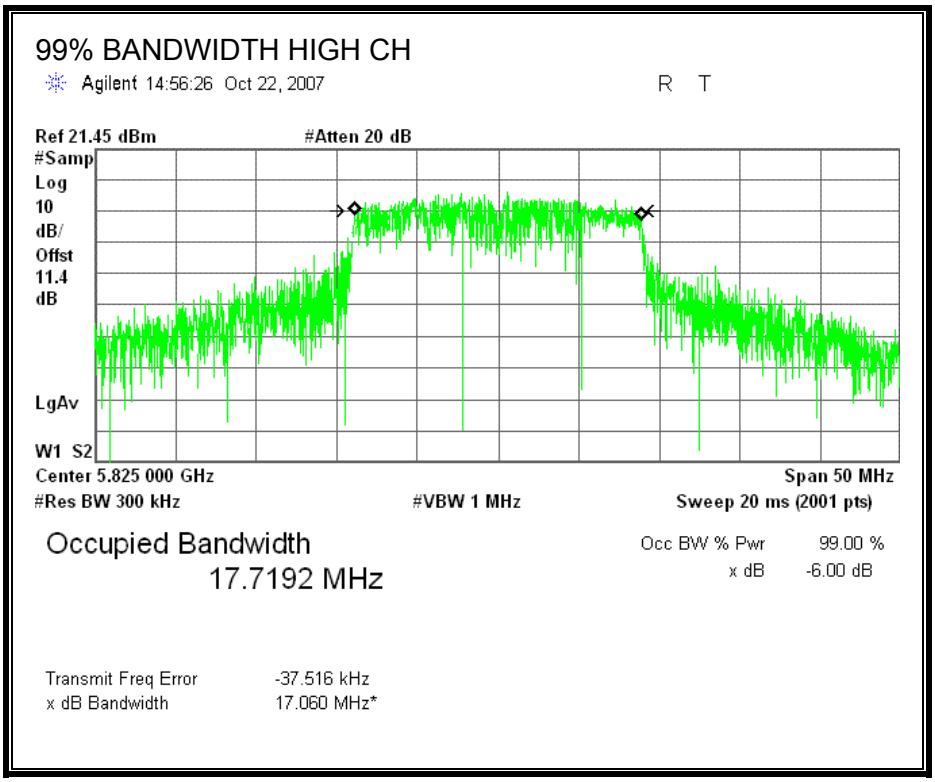
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 5745 | 17.7012 |
| Middle | 5785 | 17.7110 |
| High | 5825 | 17.7192 |

High channel plot is included hereafter.

**99% BANDWIDTH**



## 7.6.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum effective antenna gain is 5 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

**TEST PROCEDURE**

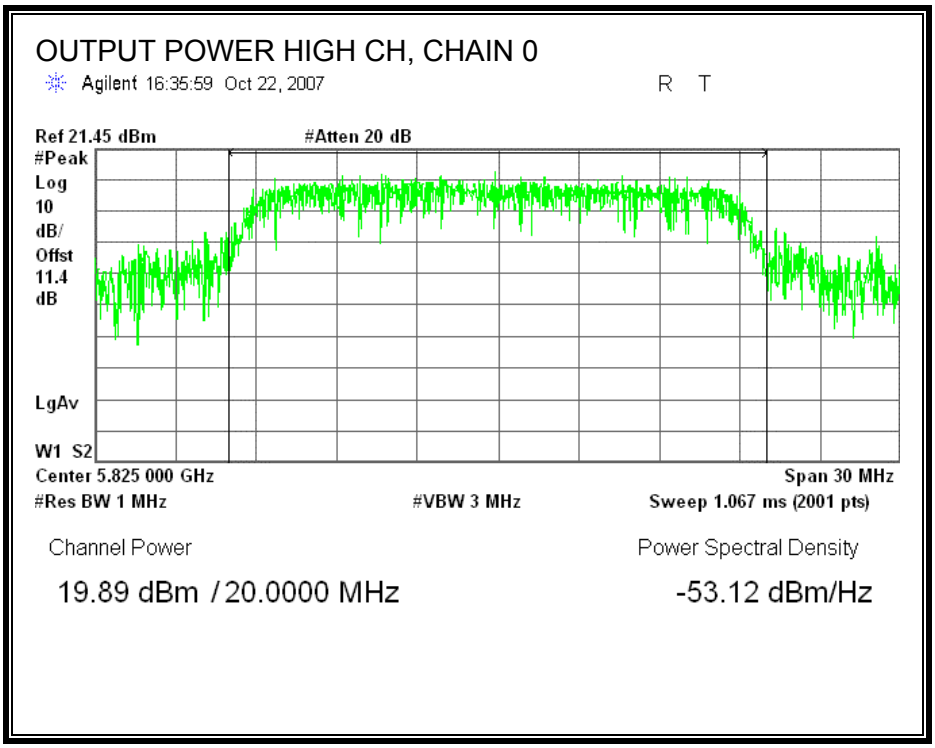
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

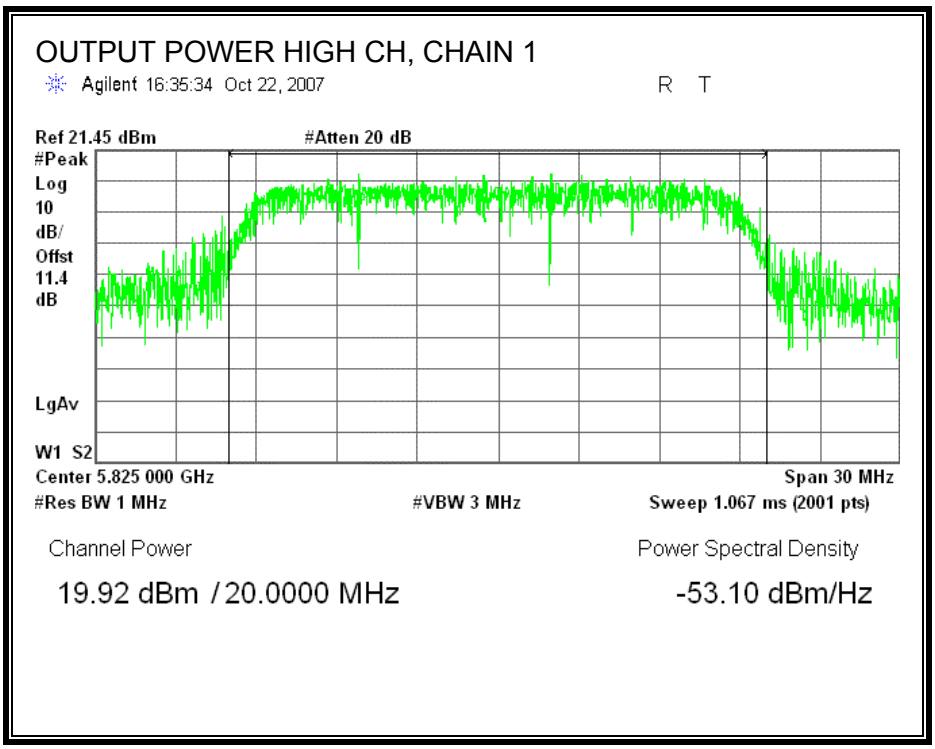
**RESULTS**

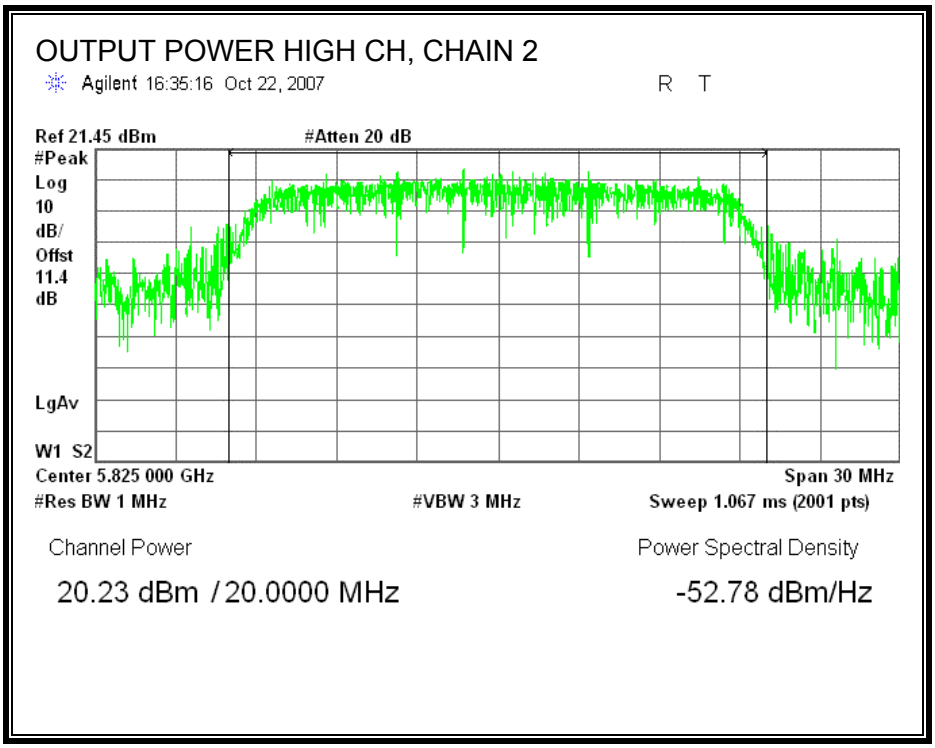
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5745 | 19.85 | 20.40 | 19.73 | 24.77 | 30.00 | -5.23 |
| Mid | 5785 | 19.59 | 19.96 | 19.82 | 24.56 | 30.00 | -5.44 |
| High | 5825 | 19.89 | 19.92 | 20.23 | 24.79 | 30.00 | -5.21 |

High channel plots are included hereafter.

**OUTPUT POWER**





## 7.6.4. AVERAGE POWER FOR HT20 MODES (5.8GHz)

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Chain 0 (dBm) | Chain 1 (dBm) | Chain 2 (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 5745 | 17.41 | 17.50 | 17.50 | 22.24 |
| Middle | 5785 | 17.46 | 17.86 | 17.72 | 22.45 |
| High | 5825 | 17.70 | 17.93 | 18.32 | 22.76 |

## 7.6.5. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

**TEST PROCEDURE**

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

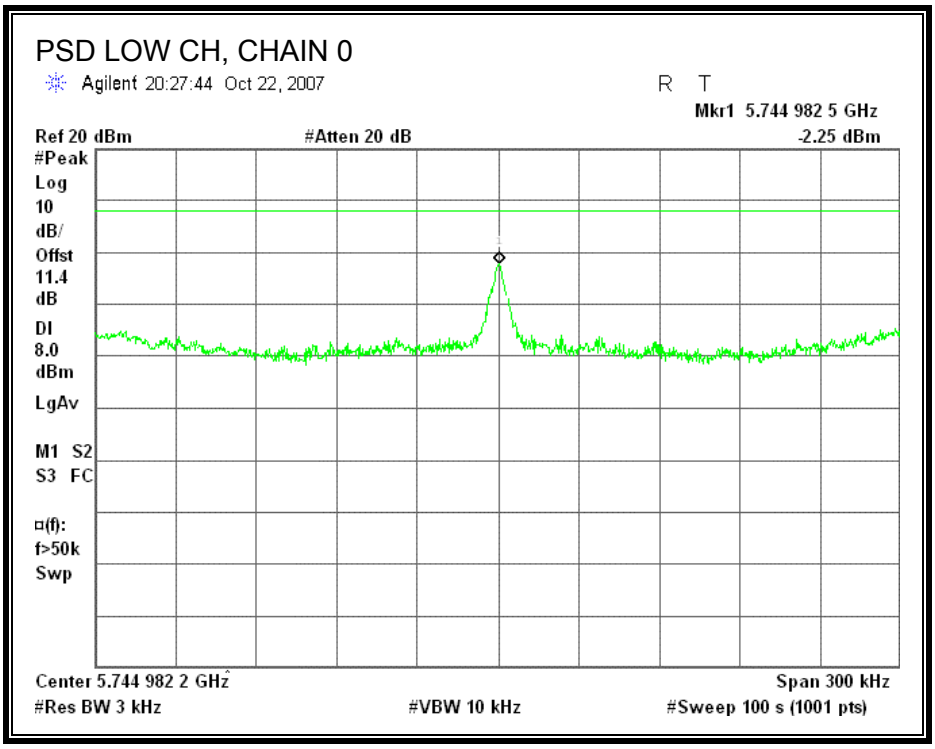
**RESULTS:**

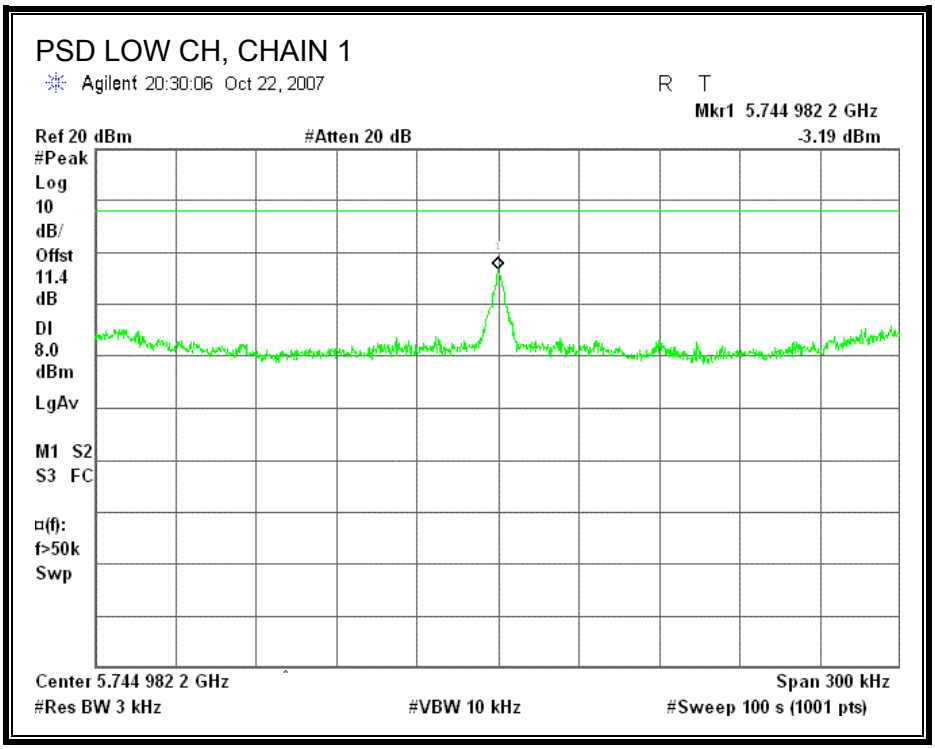
| Channel | Frequency (MHz) | Chain 0 PSD (dBm) | Chain 1 PSD (dBm) | Chain 2 PSD (dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| Low | 5745 | -2.25 | -3.19 | -6.13 | 8 |
| Middle | 5785 | -3.36 | -4.43 | -7.40 | 8 |
| High | 5825 | -3.77 | -3.98 | -5.12 | 8 |

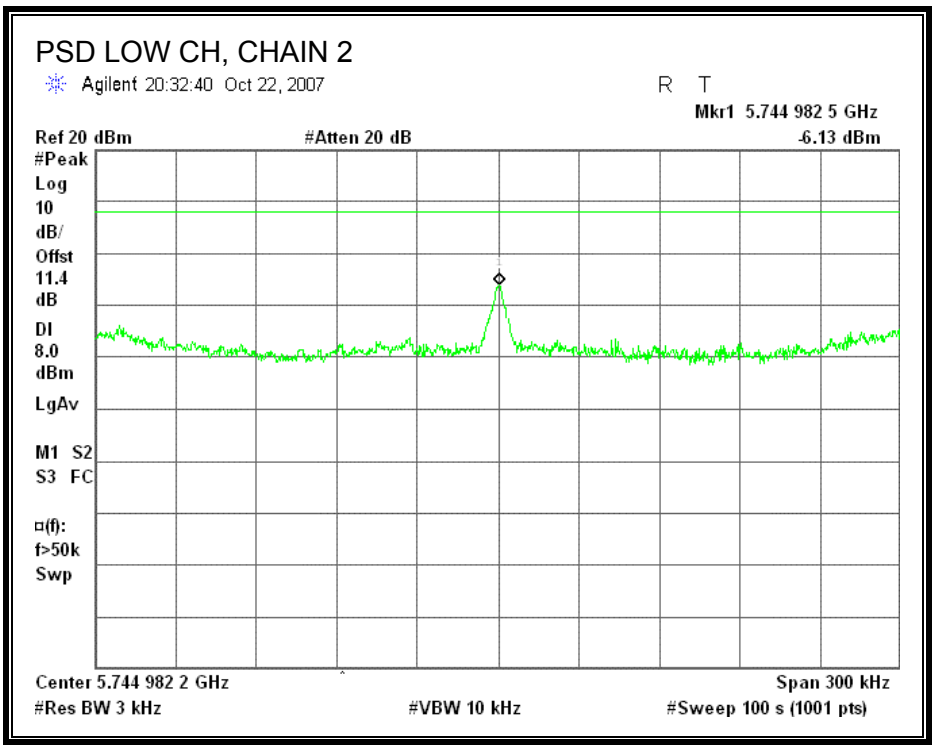
| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5745 | 5.51 | 8 | -2.49 |
| Middle | 5785 | 6.36 | 8 | -1.64 |
| High | 5825 | 5.37 | 8 | -2.63 |

For individual chains Low channel plots are included hereafter.
For combined chains Middle channel plots are included hereafter.

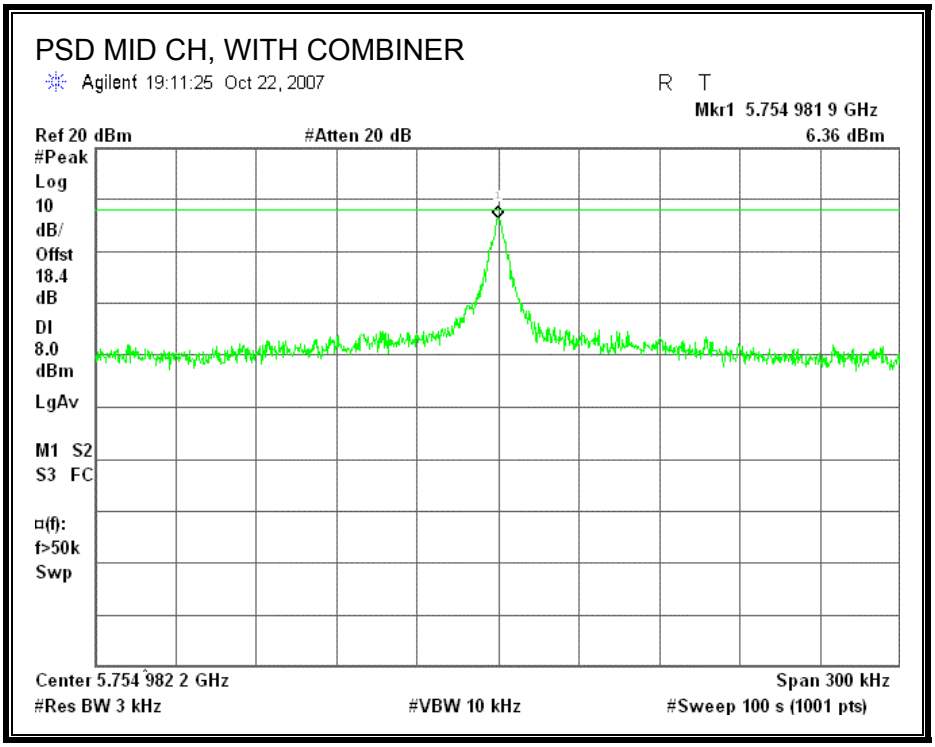
**POWER SPECTRAL DENSITY**





**POWER SPECTRAL DENSITY, WITH COMBINER**



## 7.6.6. 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 20 dB.

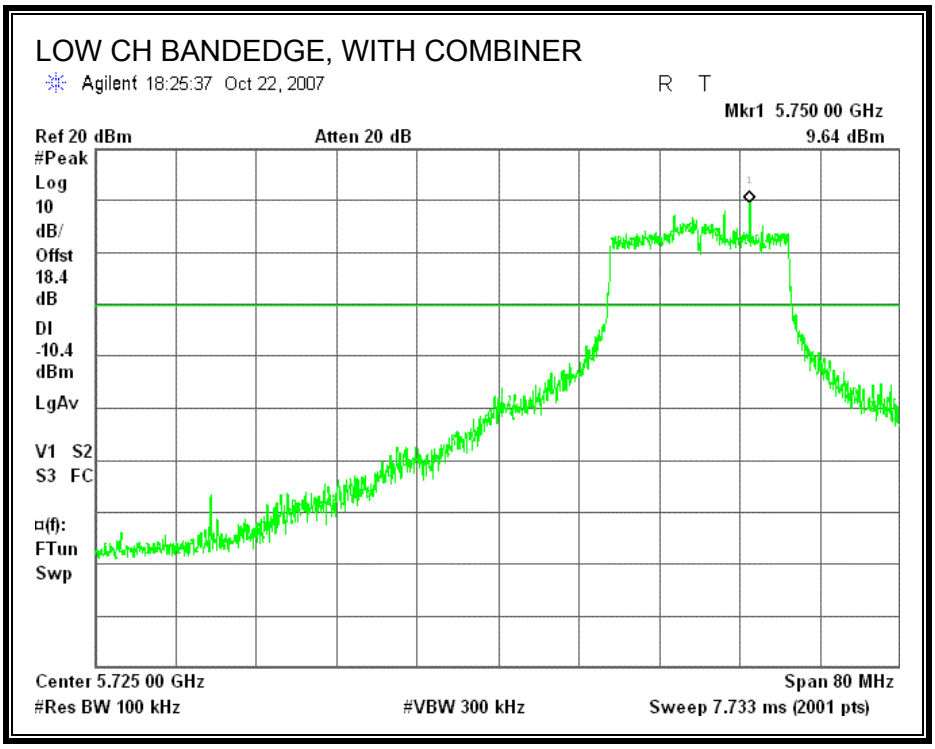
**TEST PROCEDURE**

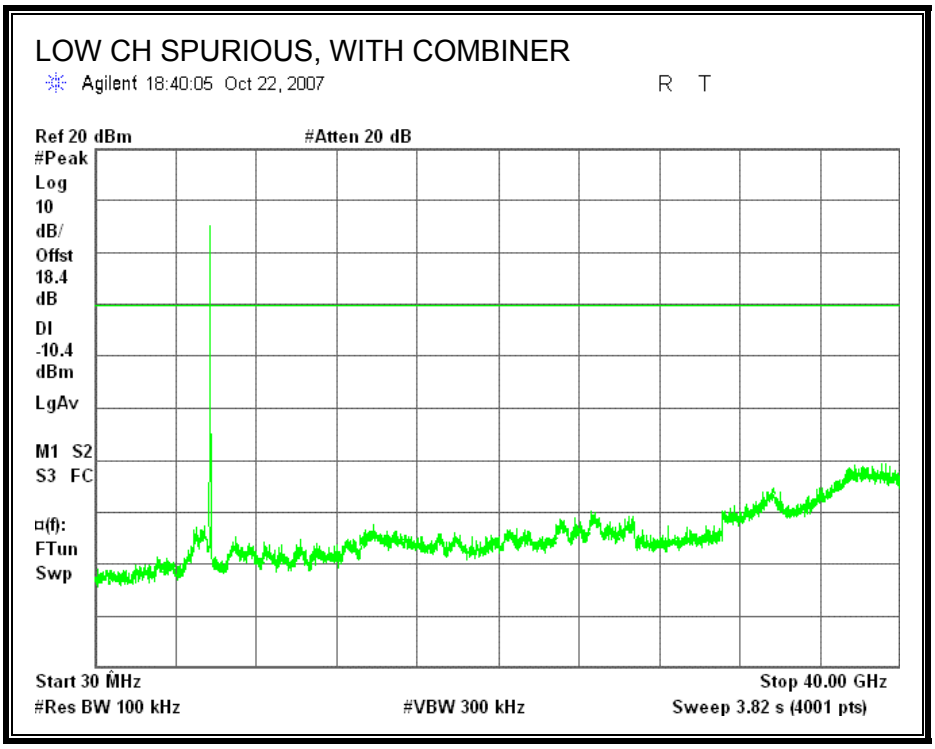
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

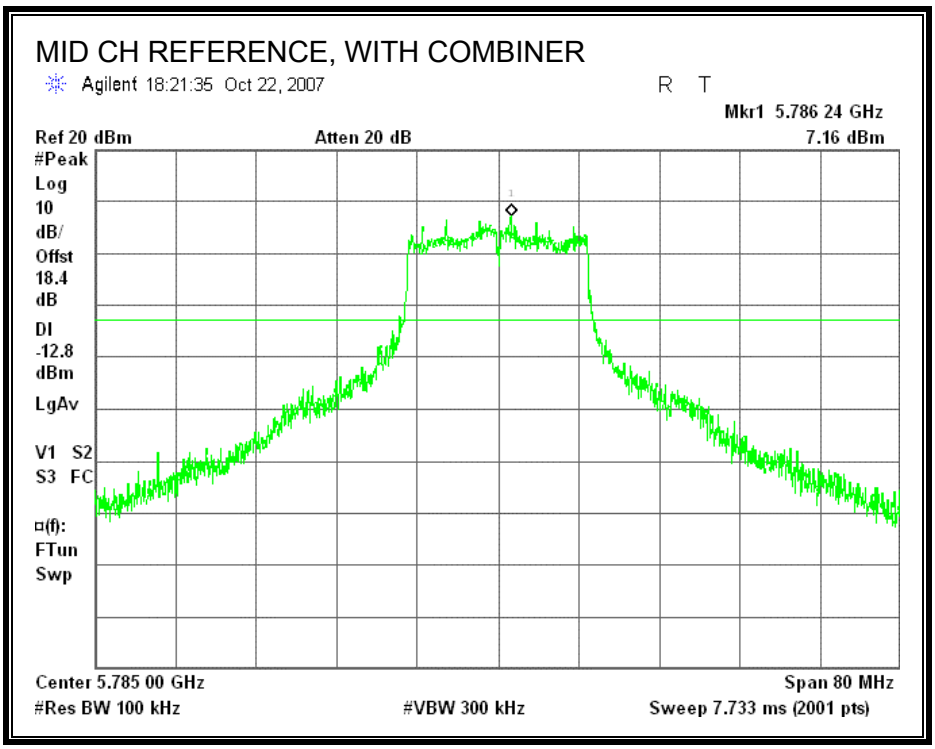
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

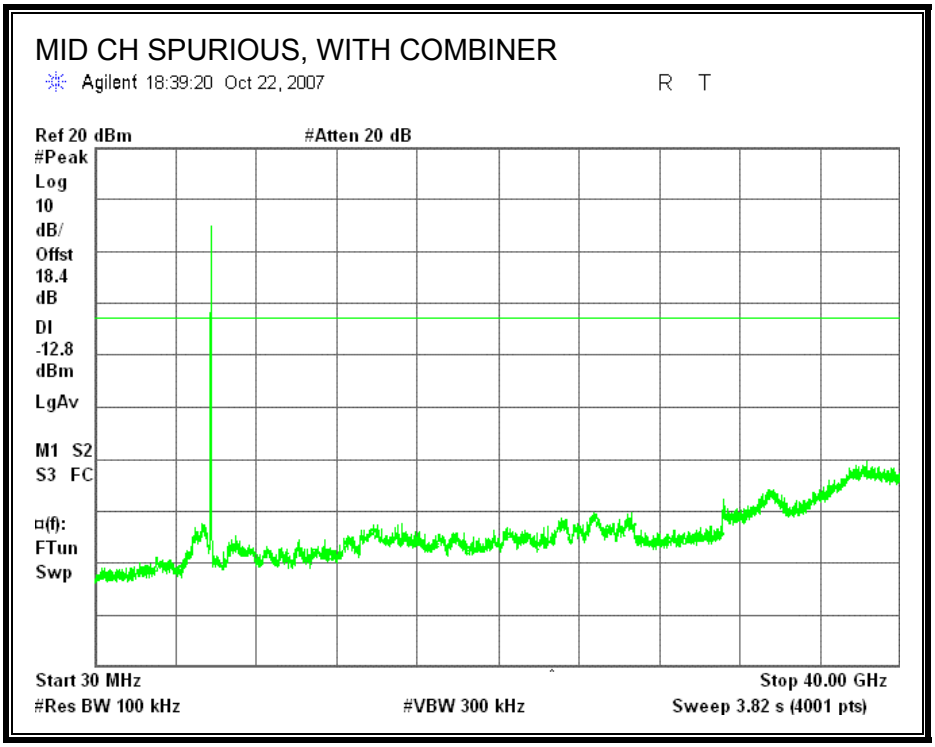
**RESULTS**

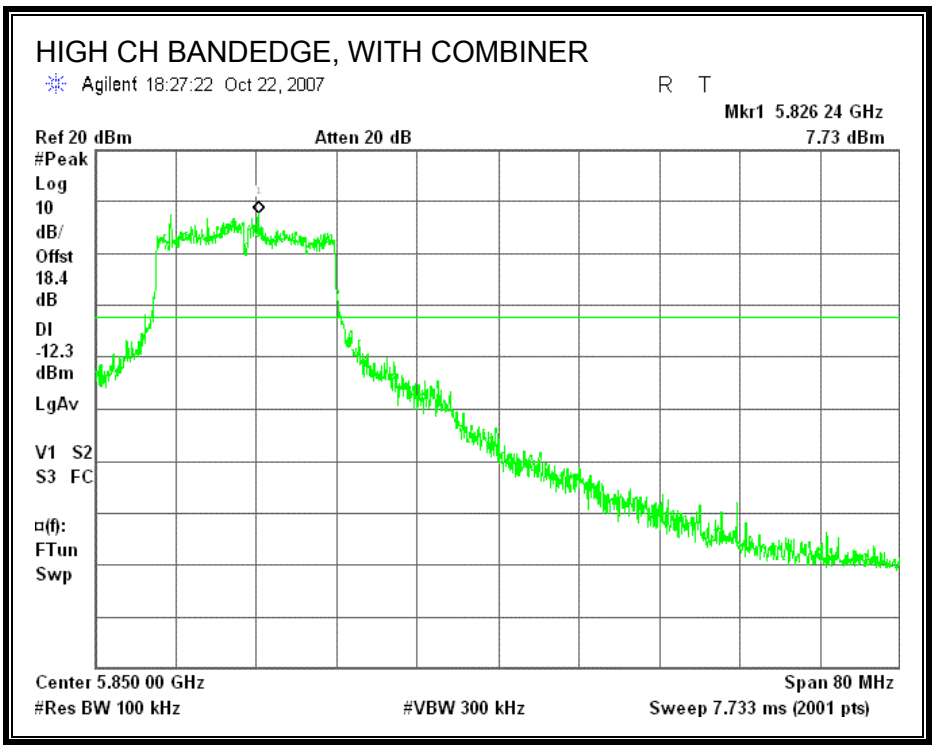
**SPURIOUS EMISSIONS WITH COMBINER**

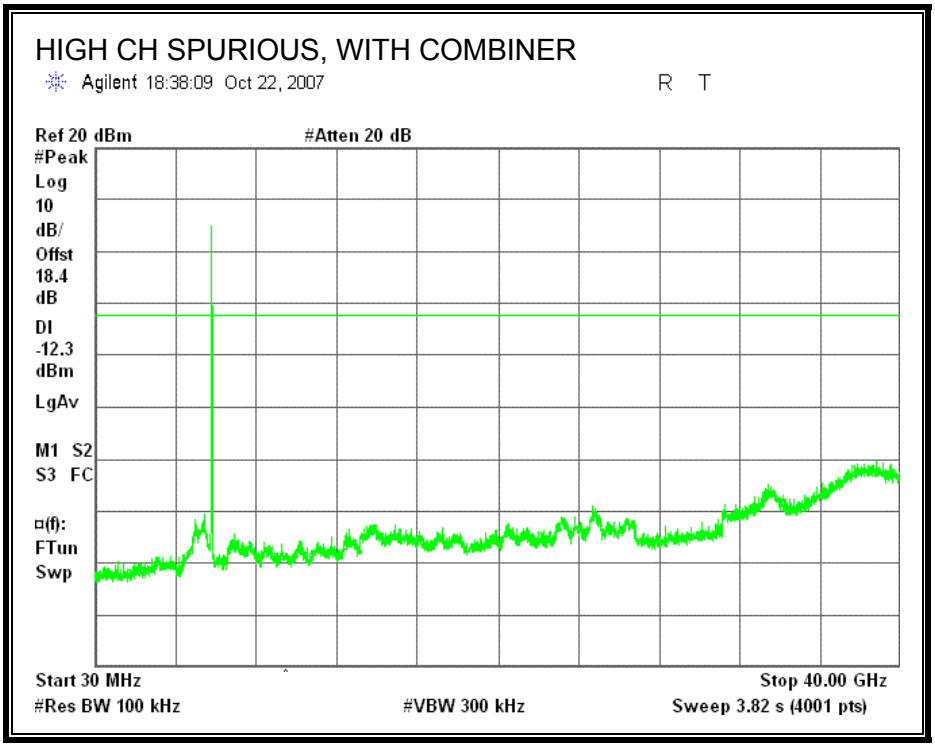






# 7.7. 802.11n THREE CHAINS HT40 MODE IN THE 5.8 GHz BAND

## 7.7.1. 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**

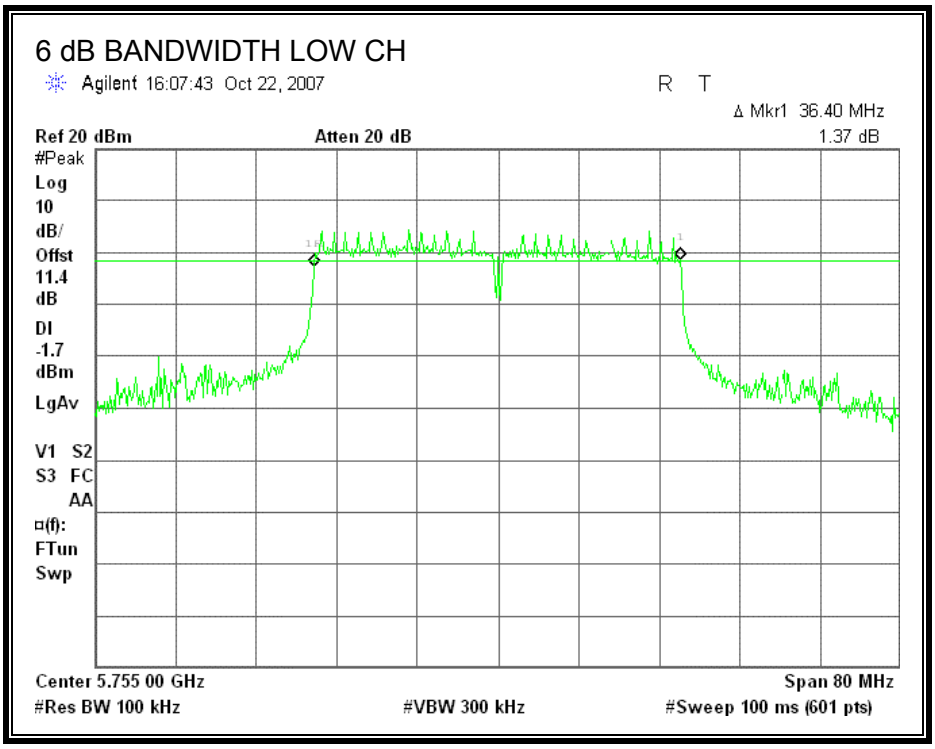
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

**RESULTS**

| Channel | Frequency (MHz) | 6 dB BW (MHz) | Minimum Limit (MHz) |
|---|---|---|---|
| Low | 5755 | 36.4 | 0.5 |
| High | 5795 | 36.4 | 0.5 |

Low channel plot is included hereafter.

**6 dB BANDWIDTH**



### 7.7.2. 99% BANDWIDTH

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

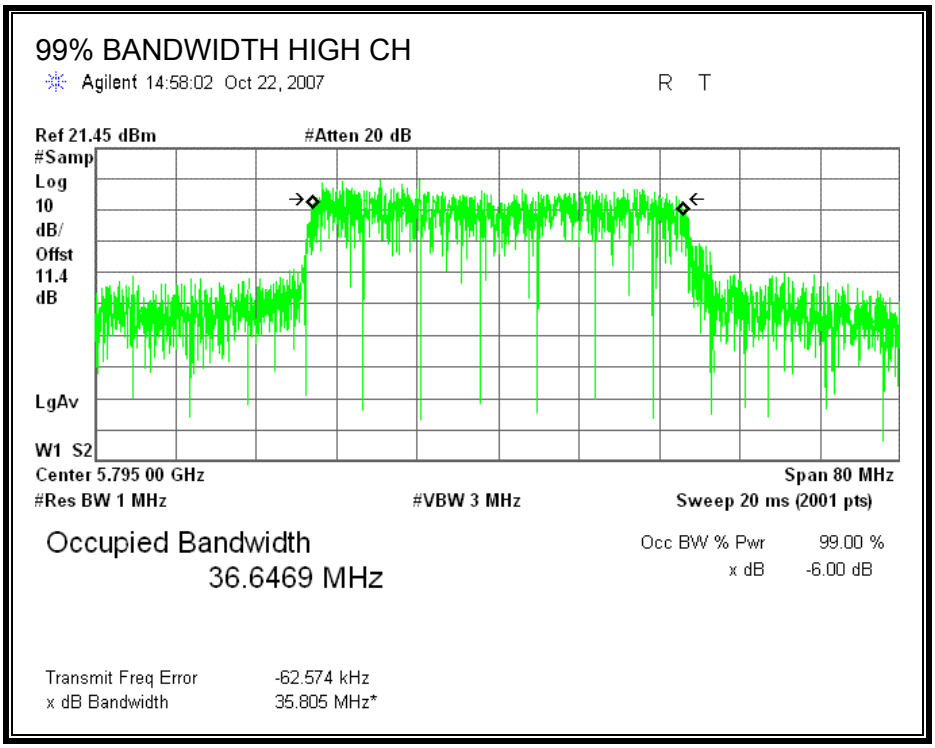
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

**RESULTS**

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Low | 5755 | 36.5837 |
| High | 5795 | 36.6469 |

High channel plot is included hereafter.

**99% BANDWIDTH**



## 7.7.3. OUTPUT POWER

**LIMITS**

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is 5 dBi for other than fixed, point-to-point operations, therefore the limit is 30 dBm.

**TEST PROCEDURE**

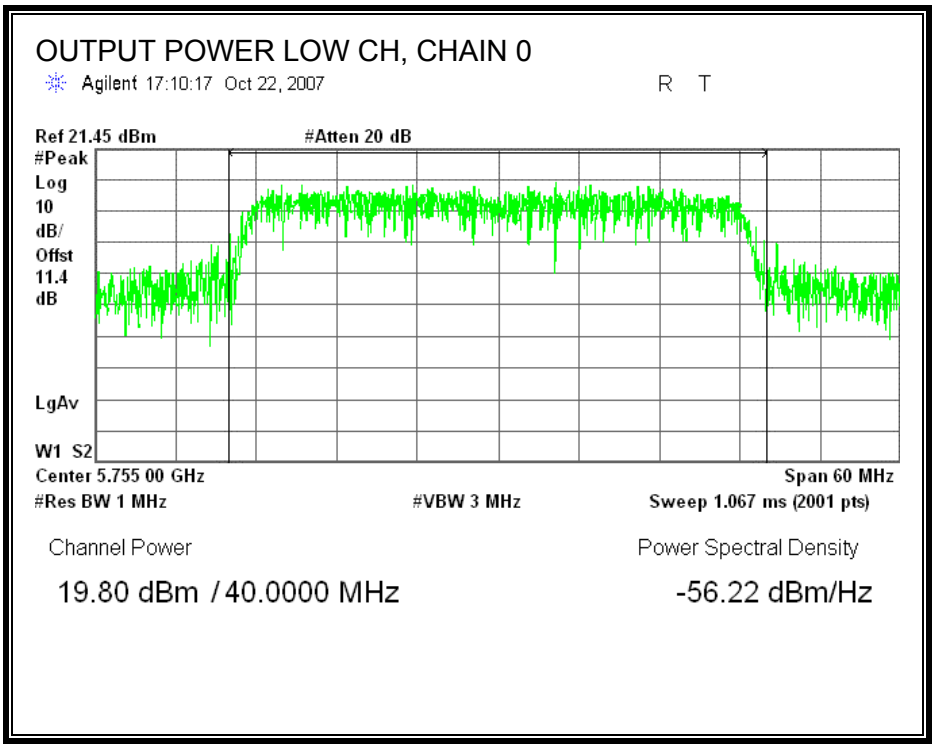
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

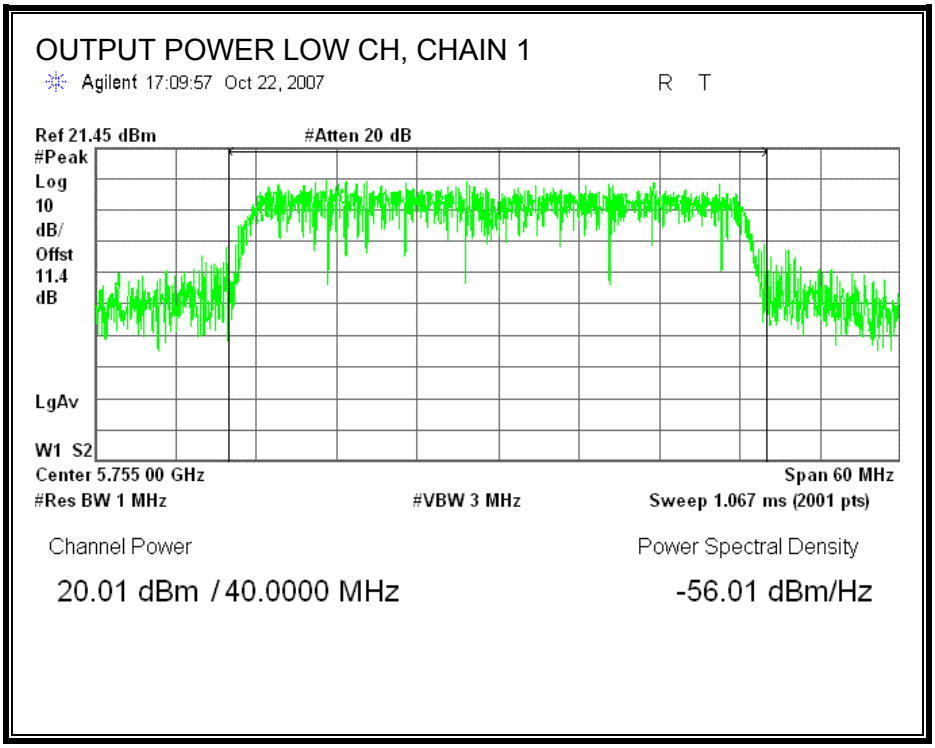
**RESULTS**

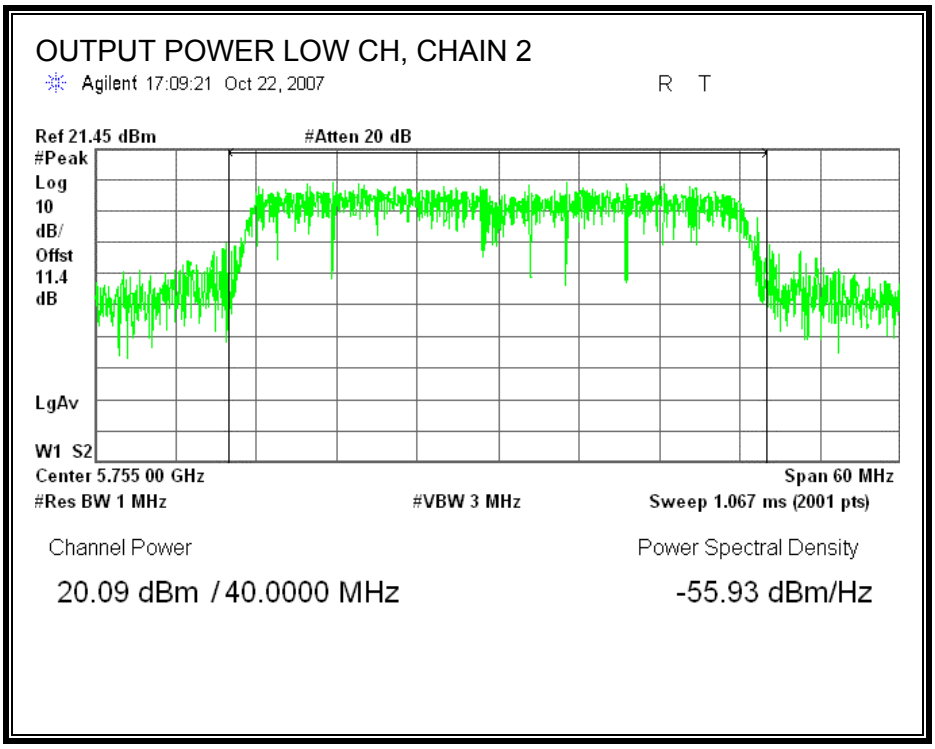
| Channel | Frequency (MHz) | Chain 0 Power (dBm) | Chain 1 Power (dBm) | Chain 2 Power (dBm) | Total Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low | 5755 | 19.80 | 20.01 | 20.09 | 24.74 | 30.00 | -5.26 |
| High | 5795 | 19.76 | 20.15 | 19.77 | 24.67 | 30.00 | -5.33 |

Low channel plots are included hereafter.

**OUTPUT POWER**





## 7.7.4. AVERAGE POWER FOR HT40 MODES (5.8GHz)

**LIMITS**

None; for reporting purposes only.

**TEST PROCEDURE**

The transmitter output is connected to a power meter.

**RESULTS**

The cable assembly insertion loss of 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

| Channel | Frequency (MHz) | Chain 0 (dBm) | Chain 1 (dBm) | Chain 2 (dBm) | Total Power (dBm) |
|---|---|---|---|---|---|
| Low | 5755 | 17.44 | 17.67 | 17.63 | 22.35 |
| High | 5795 | 17.48 | 17.92 | 17.80 | 22.51 |

## 7.7.5. POWER SPECTRAL DENSITY

**LIMITS**

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

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

**TEST PROCEDURE**

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

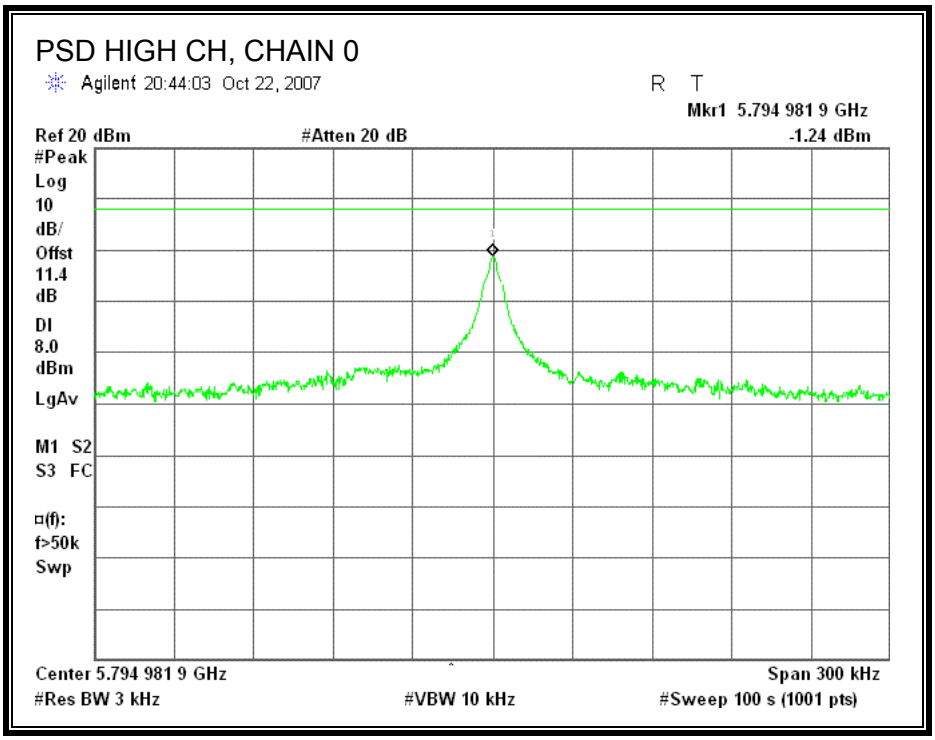
**RESULTS:**

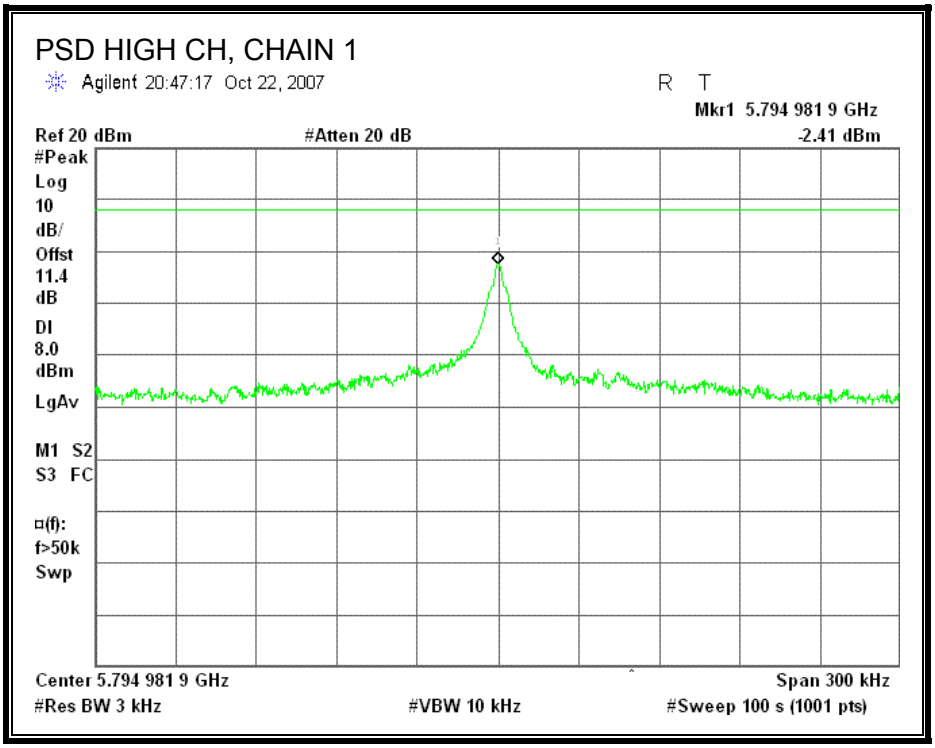
| Channel | Frequency (MHz) | Chain 0 PSD (dBm) | Chain 1 PSD (dBm) | Chain 2 PSD (dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| Low | 5755 | -1.89 | -3.26 | -3.86 | 8 |
| High | 5795 | -1.24 | -2.41 | -4.82 | 8 |

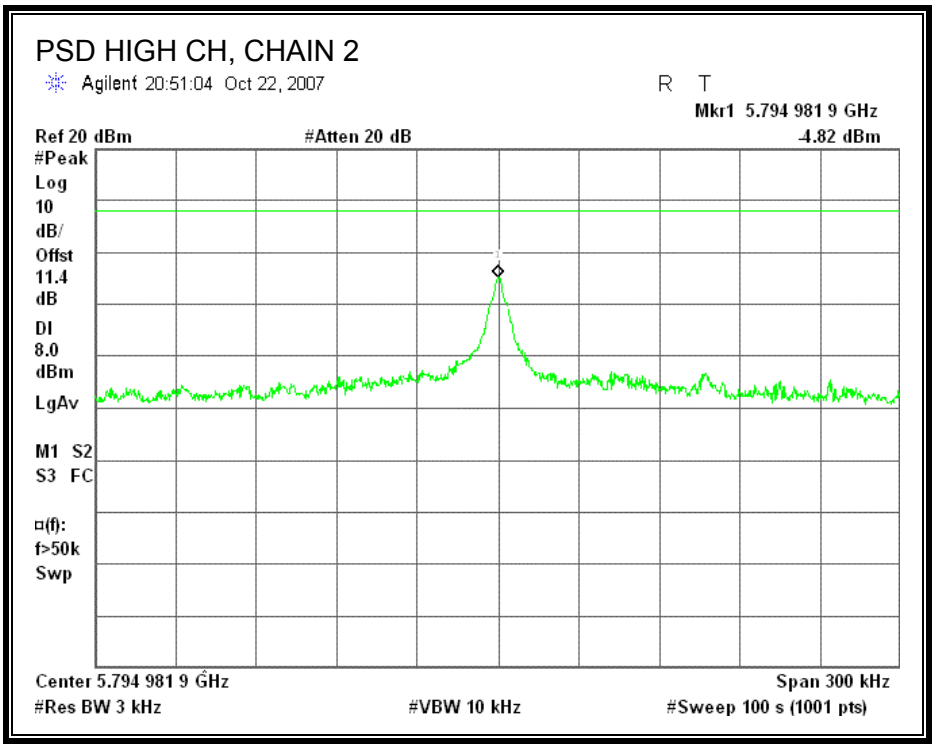
| Channel | Frequency (MHz) | PSD with Combiner (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5755 | 6.36 | 8 | -1.64 |
| High | 5795 | 5.37 | 8 | -2.63 |

For individual chains High channel plots are included hereafter.
For combined chains Low channel plots are included hereafter.

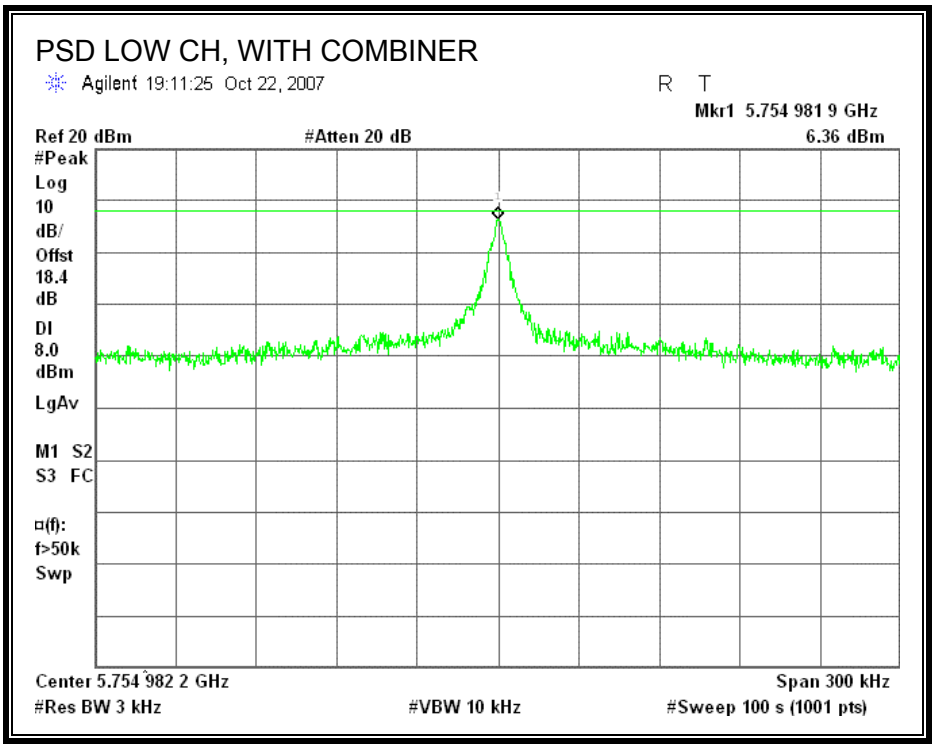
**POWER SPECTRAL DENSITY**





**POWER SPECTRAL DENSITY, WITH COMBINER**



## 7.7.6. 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 20 dB.

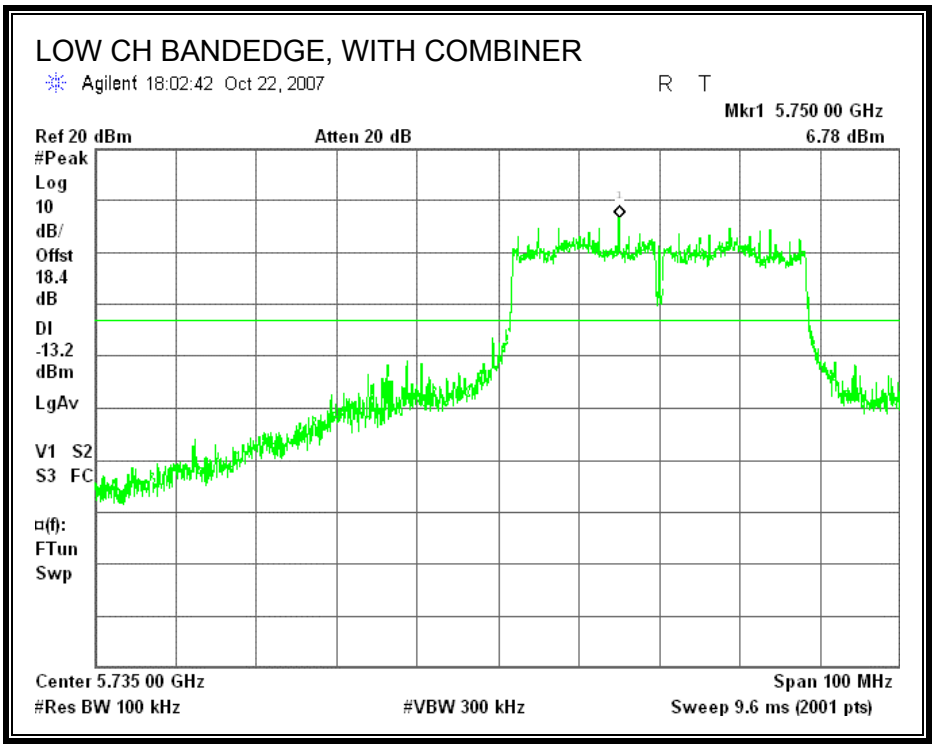
**TEST PROCEDURE**

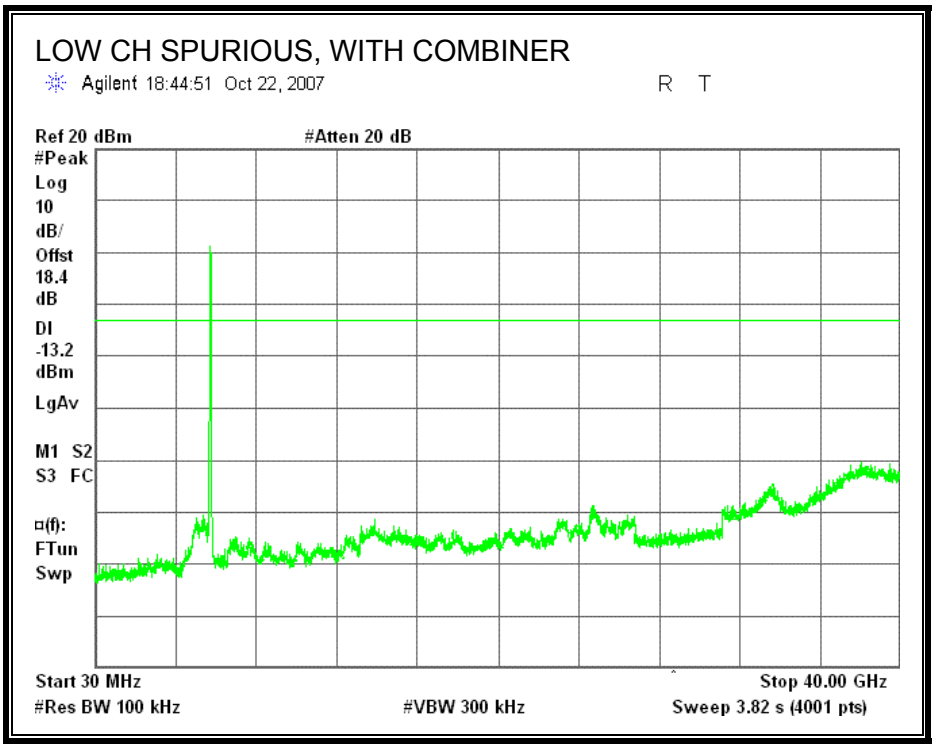
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

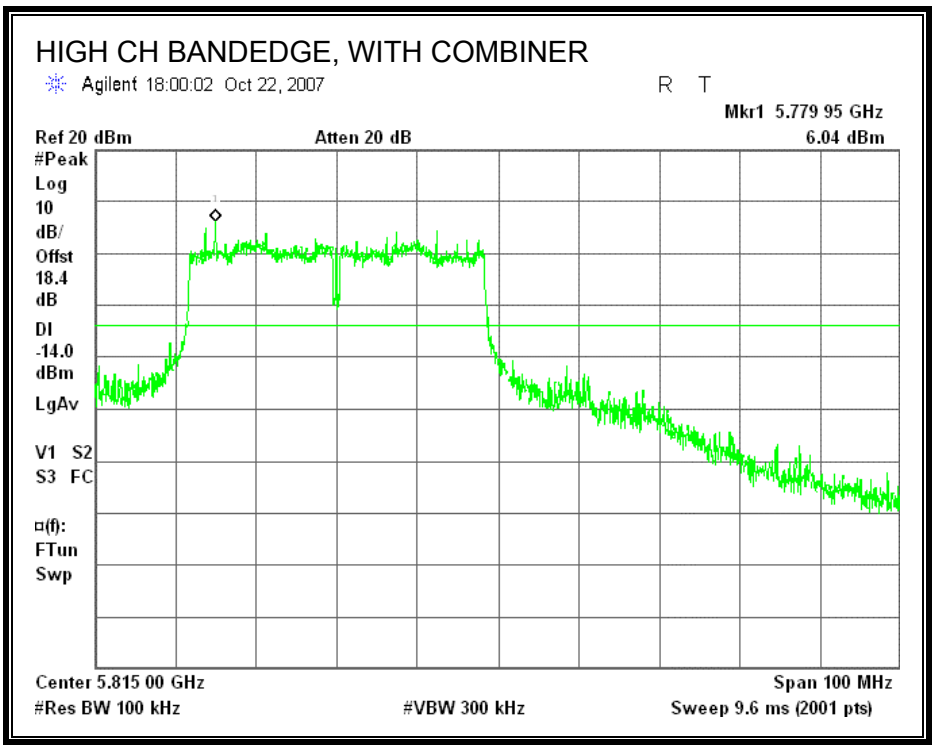
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

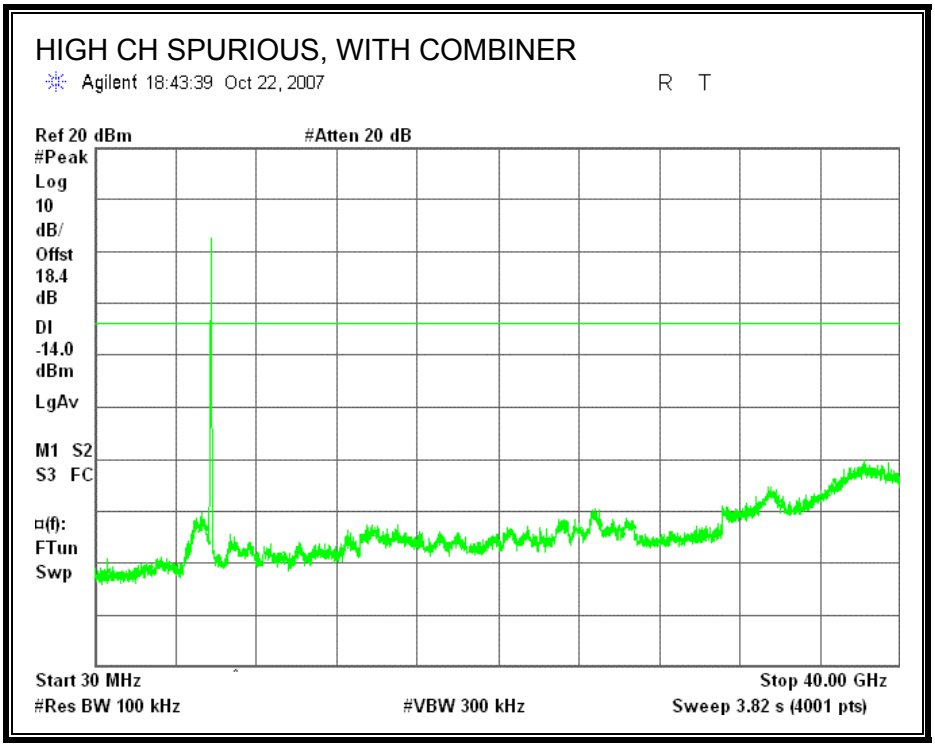
**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**





# 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.

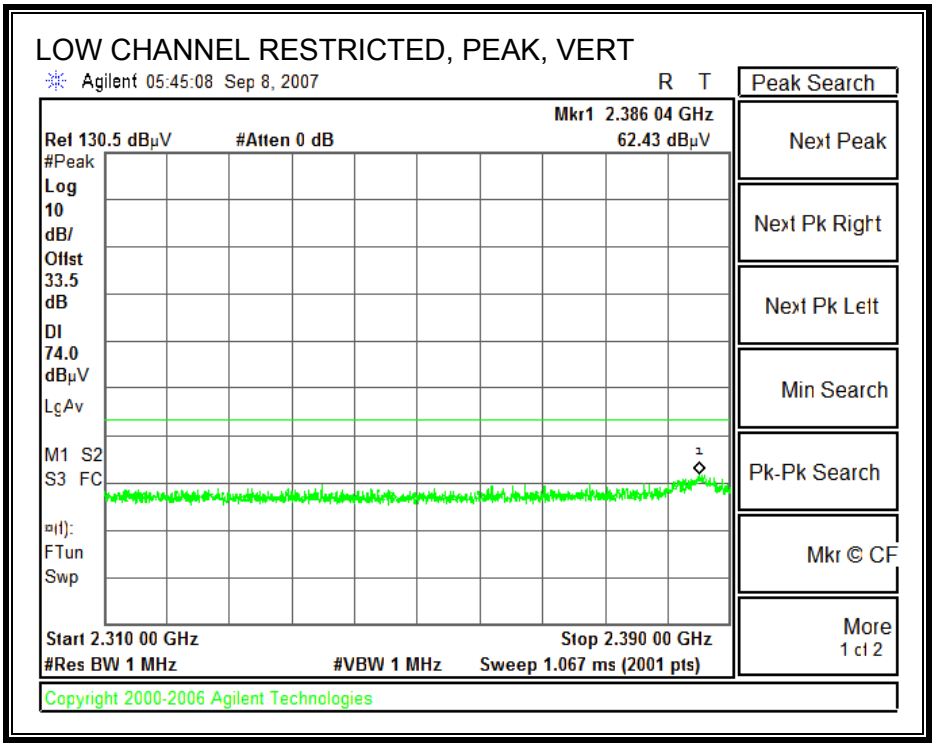
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

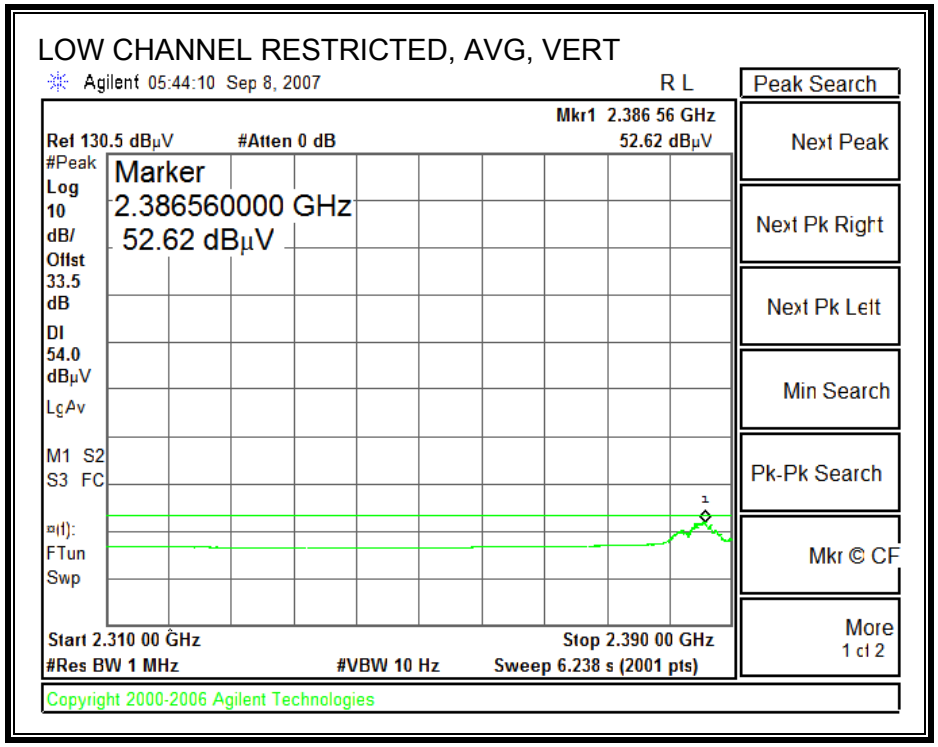
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 8.2. TRANSMITTER ABOVE 1 GHz

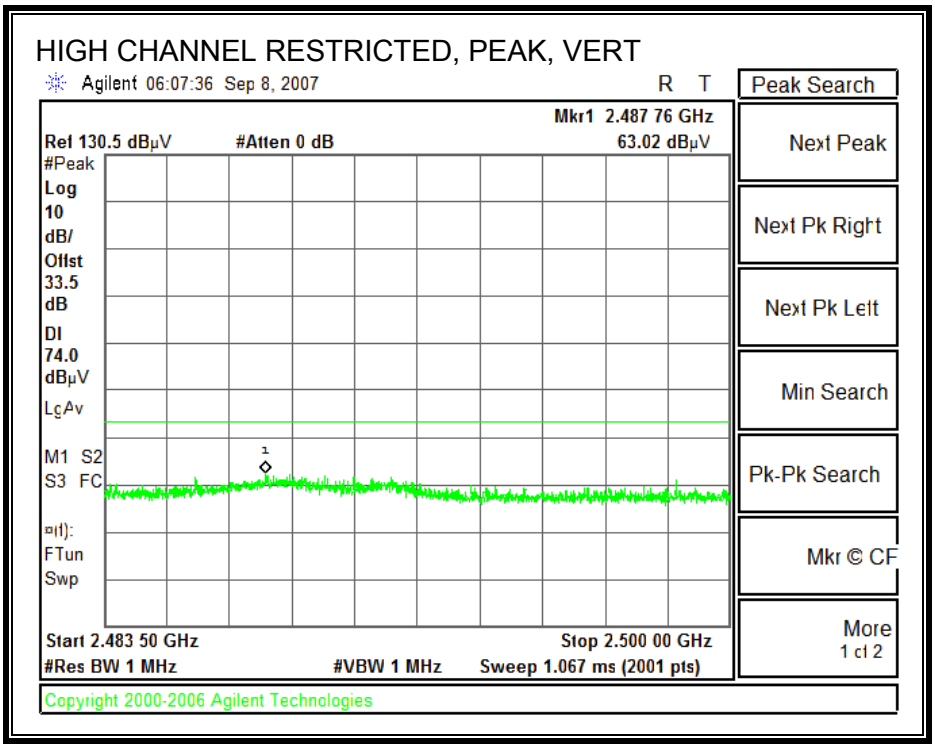
### 8.2.1. TX ABOVE 1 GHz, 802.11b THREE CHAINS LEGACY MODE, 2.4 GHz

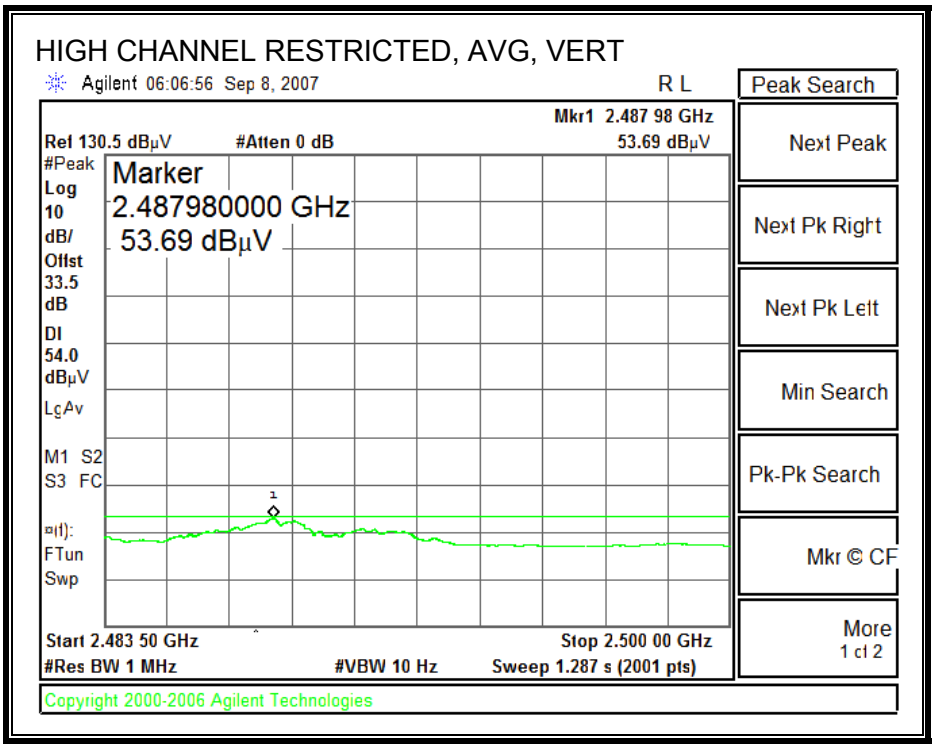
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Atheros Communications, Inc..
Project #: 07U11326
Date: October 24, 2007
Test Engineer: Thanh Nguyen
Configuration: EUT, Laptop, Extender Card.
Mode: Transmit b mode.

Test Equipment:

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | T88 Miteq 26-40GHz | T89; ARA 18-26GHz; S/N:1049 | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | Gordon 203134001 | | |

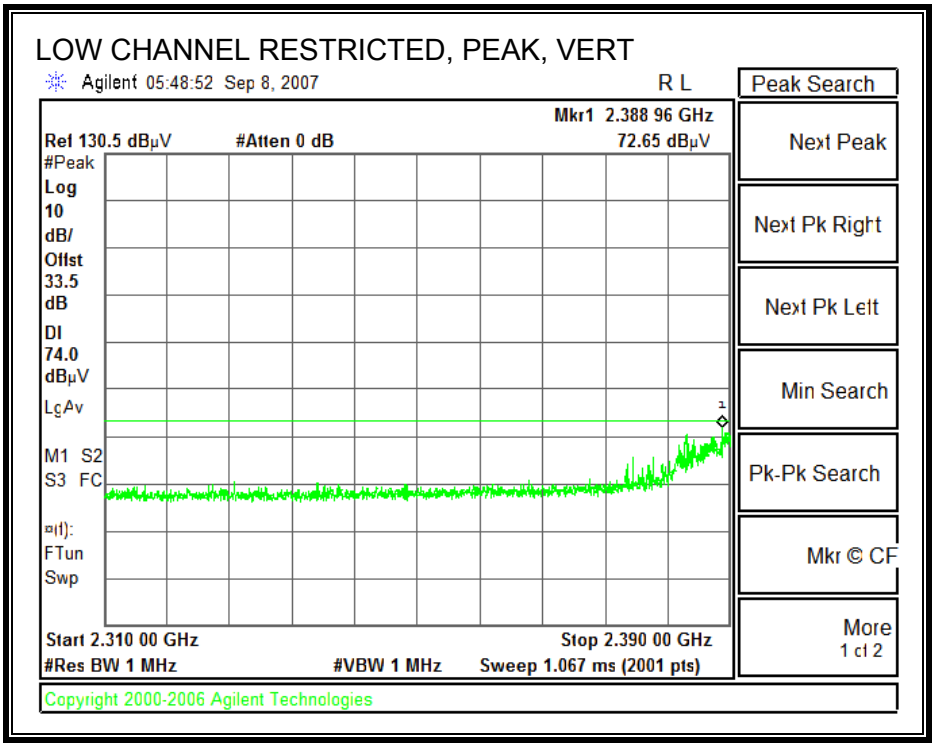
Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

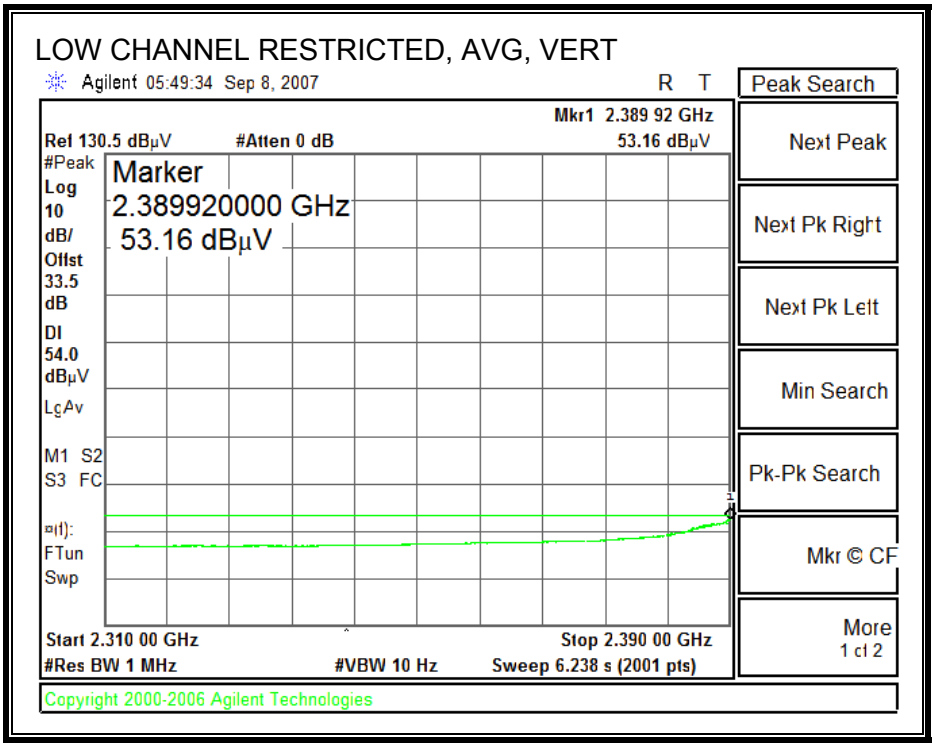
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low CH | | | | | | | | | | | | | | | |
| 4.824 | 3.0 | 48.6 | 46.4 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 52.4 | 50.1 | 74 | 54 | -21.6 | -3.9 | V |
| 7.236 | 3.0 | 38.6 | 25.9 | 34.9 | 8.4 | -36.2 | 0.0 | 0.0 | 45.7 | 33.0 | 74 | 54 | -28.3 | -21.0 | Noise floor |
| 4.824 | 3.0 | 43.8 | 41.2 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 47.6 | 44.9 | 74 | 54 | -26.4 | -9.1 | H |
| 7.236 | 3.0 | 37.3 | 25.2 | 34.9 | 8.4 | -36.2 | 0.0 | 0.0 | 44.4 | 32.3 | 74 | 54 | -29.6 | -21.7 | Noise floor |
| Mid Ch | | | | | | | | | | | | | | | |
| 4.874 | 3.0 | 48.9 | 44.4 | 33.4 | 6.9 | -36.5 | 0.0 | 0.0 | 52.7 | 48.2 | 74 | 54 | -21.3 | -5.8 | V |
| 7.311 | 3.0 | 37.6 | 26.3 | 35.0 | 8.4 | -36.2 | 0.0 | 0.0 | 44.8 | 33.5 | 74 | 54 | -29.2 | -20.5 | Noise floor |
| 4.874 | 3.0 | 39.2 | 37.5 | 33.4 | 6.9 | -36.5 | 0.0 | 0.0 | 43.0 | 41.3 | 74 | 54 | -31.0 | -12.7 | H |
| 7.311 | 3.0 | 38.6 | 26.7 | 35.0 | 8.4 | -36.2 | 0.0 | 0.0 | 45.7 | 33.8 | 74 | 54 | -28.3 | -20.2 | Noise floor |
| High CH | | | | | | | | | | | | | | | |
| 4.924 | 3.0 | 47.7 | 45.3 | 33.4 | 7.0 | -36.5 | 0.0 | 0.0 | 51.6 | 49.2 | 74 | 54 | -22.4 | -4.8 | V |
| 7.386 | 3.0 | 38.6 | 26.1 | 35.0 | 8.4 | -36.2 | 0.0 | 0.0 | 45.8 | 33.4 | 74 | 54 | -28.2 | -20.6 | Noise floor |
| 4.924 | 3.0 | 43.7 | 39.5 | 33.4 | 7.0 | -36.5 | 0.0 | 0.0 | 47.6 | 43.4 | 74 | 54 | -26.4 | -10.6 | H |
| 7.386 | 3.0 | 39.2 | 25.9 | 35.0 | 8.4 | -36.2 | 0.0 | 0.0 | 46.5 | 33.1 | 74 | 54 | -27.5 | -20.9 | Noise floor |
| | | | | | | | | | | | | | | | |
| No other emissions were detected above 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 | | |

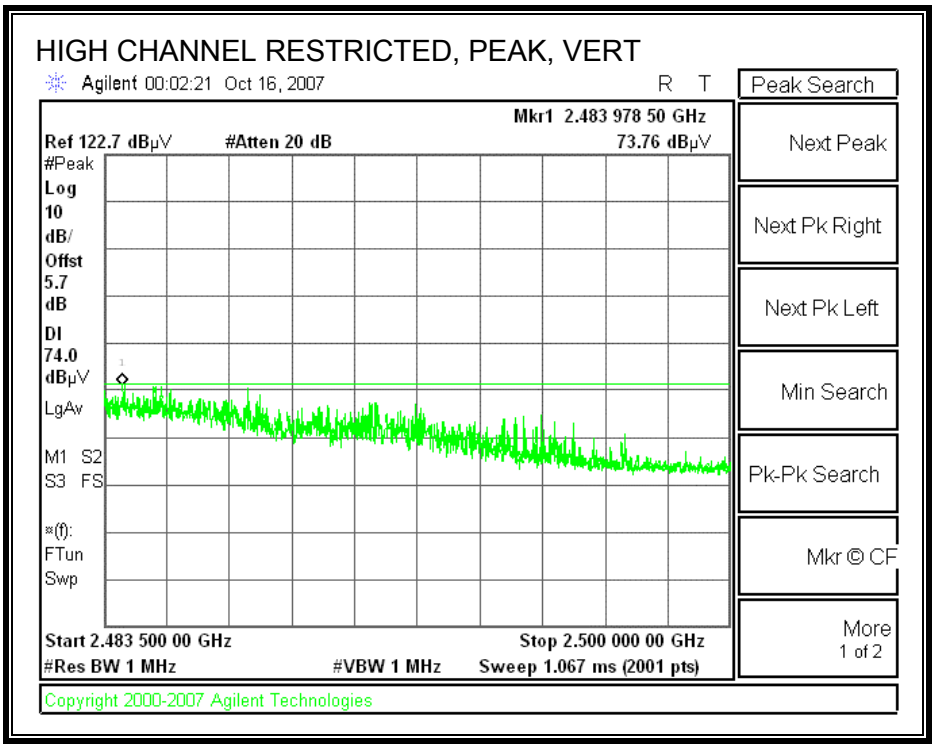
## 8.2.2. TX ABOVE 1 GHz, 802.11g THREE CHAINS LEGACY MODE, 2.4 GHz

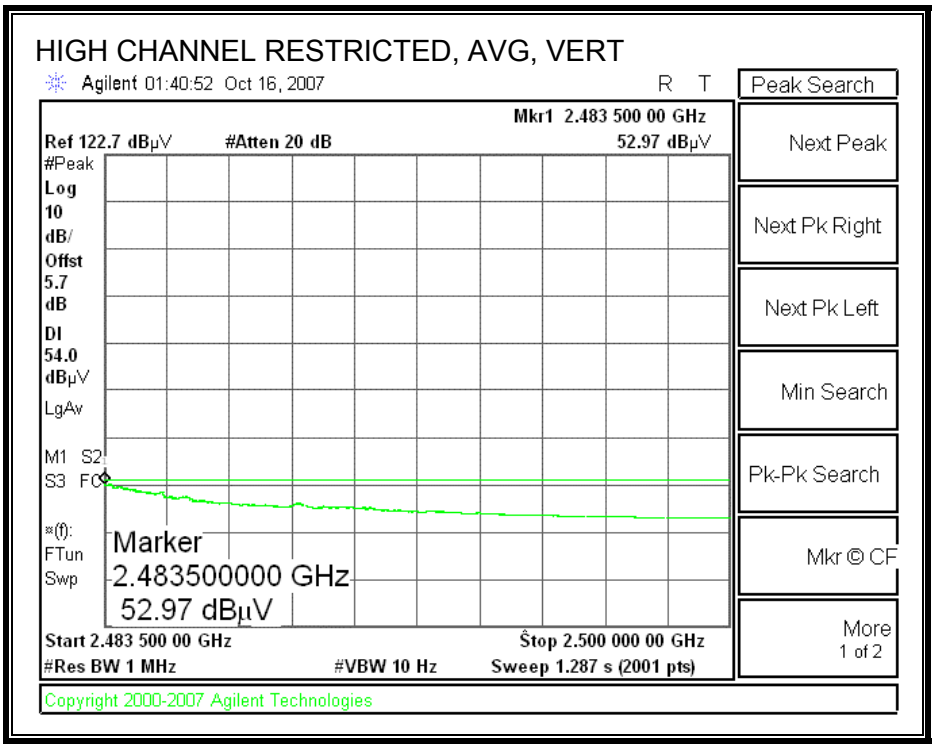
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

**High Frequency Measurement**
**Compliance Certification Services, Fremont 5m Chamber**

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/16/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 2.4GHz, g mode, 6Mb/s

**Test Equipment:** MB82-031-80263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | A-5m Chamber | | R_002 |

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

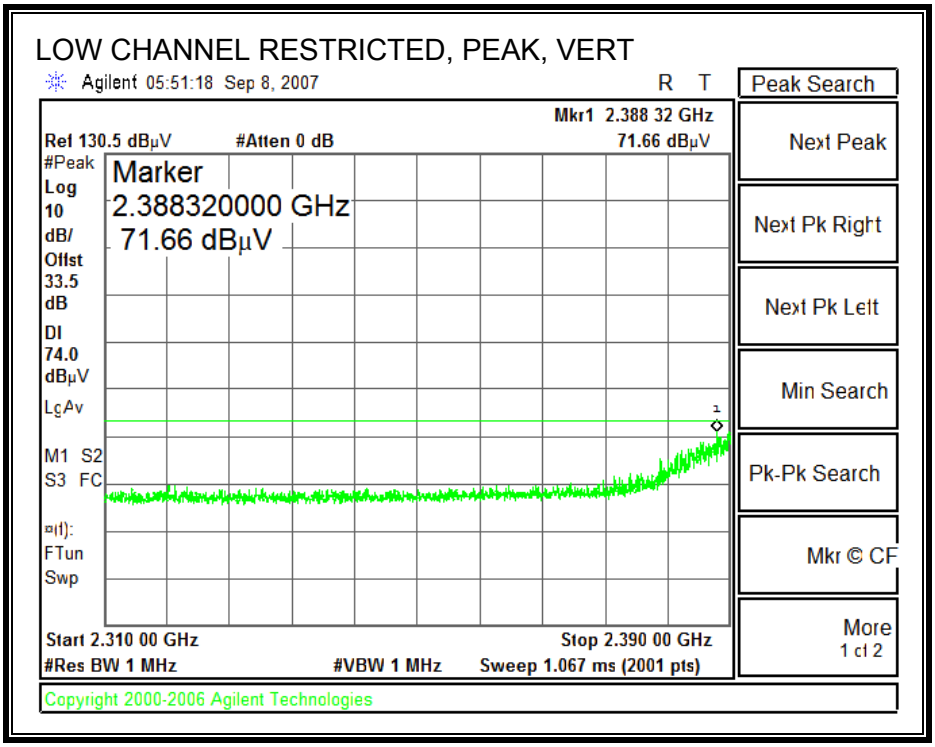
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low Ch. (2412 MHz)** | | | | | | | | | | | | | | | |
| 1.396 | 3.0 | 55.2 | 36.0 | 25.2 | 3.5 | -38.9 | 0.0 | 0.0 | 45.1 | 25.9 | 74 | 54 | -28.9 | -28.1 | V |
| 1.595 | 3.0 | 54.8 | 37.7 | 26.0 | 3.8 | -38.6 | 0.0 | 0.0 | 45.9 | 28.8 | 74 | 54 | -28.1 | -25.2 | V |
| 1.990 | 3.0 | 53.7 | 36.1 | 27.4 | 4.3 | -38.1 | 0.0 | 0.0 | 47.3 | 29.7 | 74 | 54 | -26.7 | -24.3 | V |
| 4.822 | 3.0 | 43.6 | 31.5 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 47.3 | 35.2 | 74 | 54 | -26.7 | -18.8 | V |
| 1.396 | 3.0 | 54.2 | 34.8 | 25.2 | 3.5 | -38.9 | 0.0 | 0.0 | 44.1 | 24.6 | 74 | 54 | -29.9 | -29.4 | H |
| 1.595 | 3.0 | 56.7 | 39.0 | 26.0 | 3.8 | -38.6 | 0.0 | 0.0 | 47.8 | 30.1 | 74 | 54 | -26.2 | -23.9 | H |
| 1.990 | 3.0 | 51.3 | 34.5 | 27.4 | 4.3 | -38.1 | 0.0 | 0.0 | 44.9 | 28.1 | 74 | 54 | -29.1 | -25.9 | H |
| 4.822 | 3.0 | 41.0 | 28.4 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 44.7 | 32.1 | 74 | 54 | -29.3 | -21.9 | H |
| **Mid Ch. (2437 MHz)** | | | | | | | | | | | | | | | |
| 4.876 | 3.0 | 43.2 | 31.2 | 33.4 | 6.9 | -36.5 | 0.0 | 0.0 | 47.0 | 35.0 | 74 | 54 | -27.0 | -19.0 | V |
| 4.876 | 3.0 | 41.3 | 28.3 | 33.4 | 6.9 | -36.5 | 0.0 | 0.0 | 45.1 | 32.1 | 74 | 54 | -28.9 | -21.9 | H |
| **Hi Ch. (2462 MHz)** | | | | | | | | | | | | | | | |
| 4.917 | 3.0 | 41.6 | 29.8 | 33.4 | 7.0 | -36.5 | 0.0 | 0.0 | 45.5 | 33.7 | 74 | 54 | -28.5 | -20.3 | V |
| 4.917 | 3.0 | 40.5 | 28.3 | 33.4 | 7.0 | -36.5 | 0.0 | 0.0 | 44.4 | 32.2 | 74 | 54 | -29.6 | -21.8 | H |

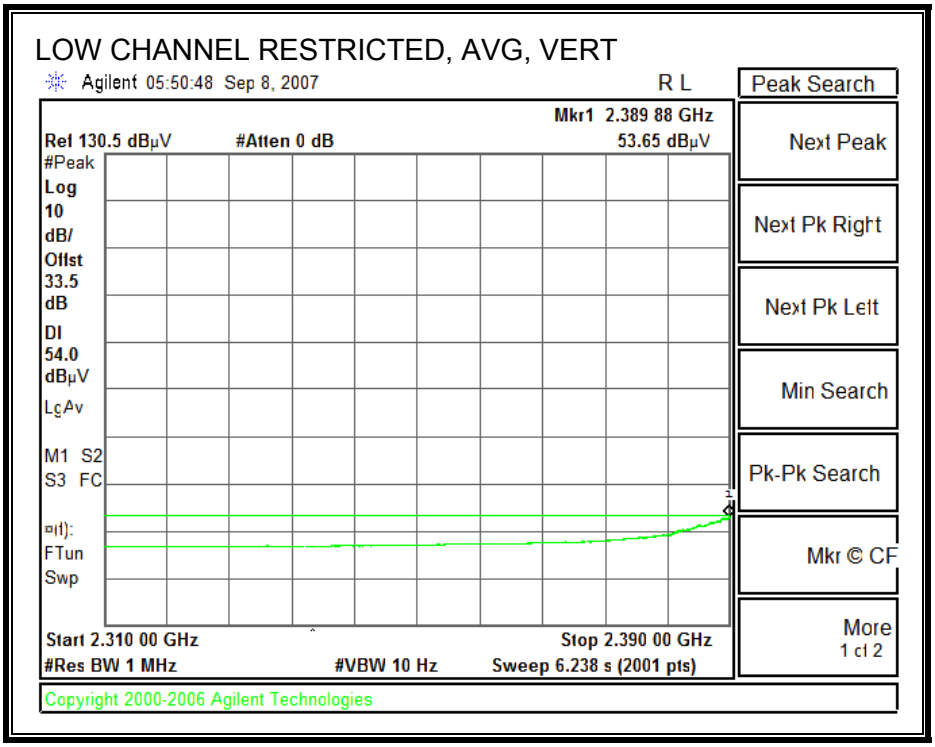
Rev. 4.12.7

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

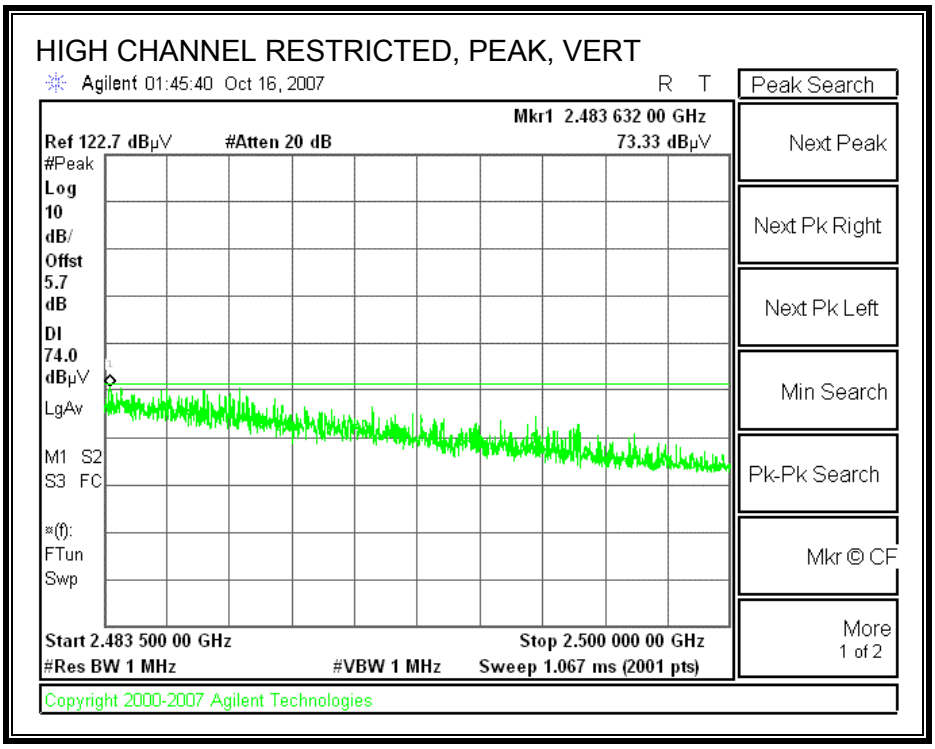
### 8.2.3. TX ABOVE 1 GHz, 802.11n HT20 MODE, 2.4 GHz

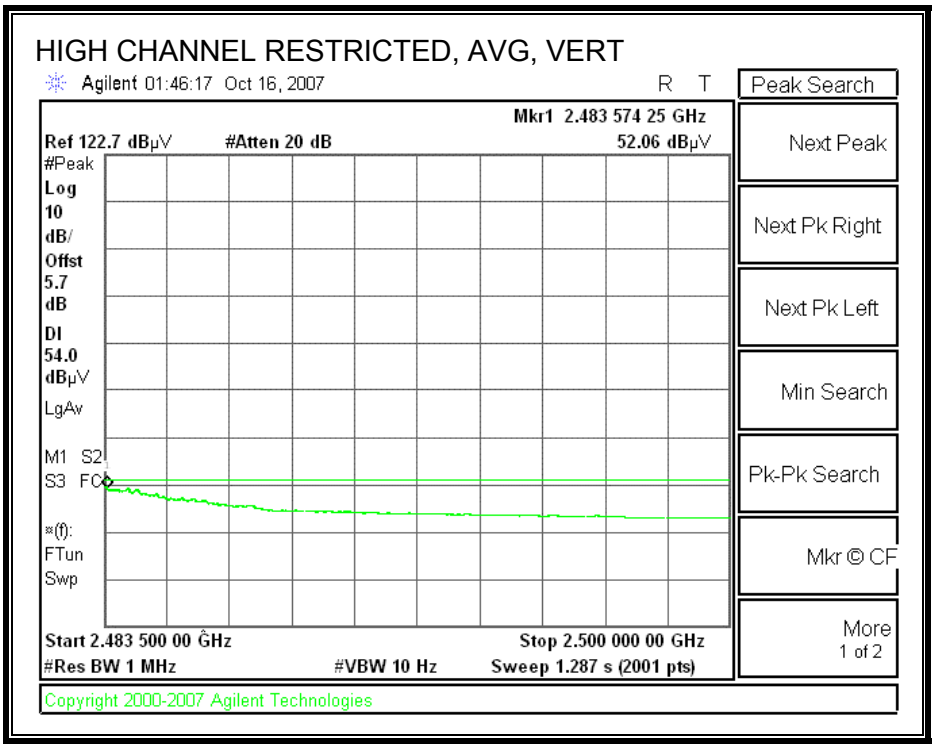
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



## HARMONICS AND SPURIOUS EMISSIONS

**High Frequency Measurement**
**Compliance Certification Services, Fremont 5m Chamber**

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/16/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 2.4GHz, g mode, HT20

**Test Equipment:** MB82-031-S0263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | T89; ARA 18-26GHz; S/N:1049 | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | A-5m Chamber | | R_002 |

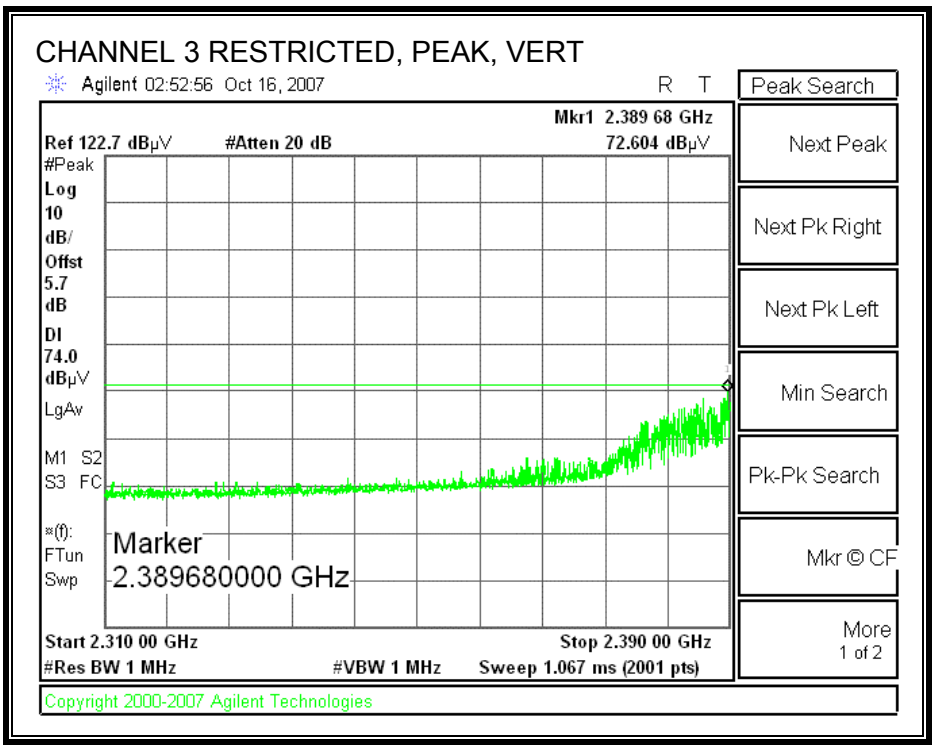
**Peak Measurements**
RBW=VBW=1MHz
**Average Measurements**
RBW=1MHz ; VBW=10Hz

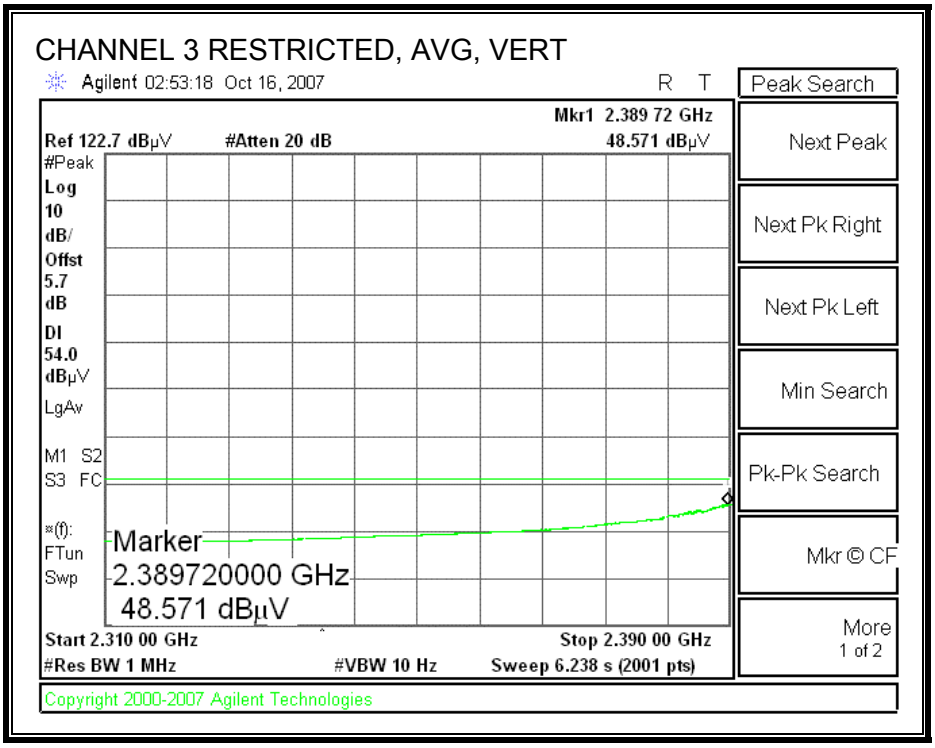
| f GHz | Dist (m) | Read Pk dBuV | Read Avg. dBuV | AF dB/m | CL dB | Amp dB | D Corr dB | Fltr dB | Peak dBuV/m | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB | Avg Mar dB | Notes (V/H) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low Ch. (2412 MHz)** | | | | | | | | | | | | | | | |
| 4.822 | 3.0 | 44.1 | 31.2 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 47.8 | 34.9 | 74 | 54 | -26.2 | -19.1 | V |
| 4.822 | 3.0 | 41.3 | 28.5 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 45.0 | 32.2 | 74 | 54 | -29.0 | -21.8 | H |
| **Mid Ch. (2437 MHz)** | | | | | | | | | | | | | | | |
| 4.851 | 3.0 | 42.8 | 30.5 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 46.6 | 34.2 | 74 | 54 | -27.4 | -19.8 | V |
| 4.851 | 3.0 | 40.9 | 28.4 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 44.7 | 32.2 | 74 | 54 | -29.3 | -21.8 | H |
| **Hi Ch. (2462 MHz)** | | | | | | | | | | | | | | | |
| 4.932 | 3.0 | 42.2 | 29.8 | 33.4 | 7.0 | -36.5 | 0.0 | 0.0 | 46.1 | 33.7 | 74 | 54 | -27.9 | -20.3 | V |
| 4.932 | 3.0 | 41.3 | 28.3 | 33.4 | 7.0 | -36.5 | 0.0 | 0.0 | 45.2 | 32.2 | 74 | 54 | -28.8 | -21.8 | H |

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

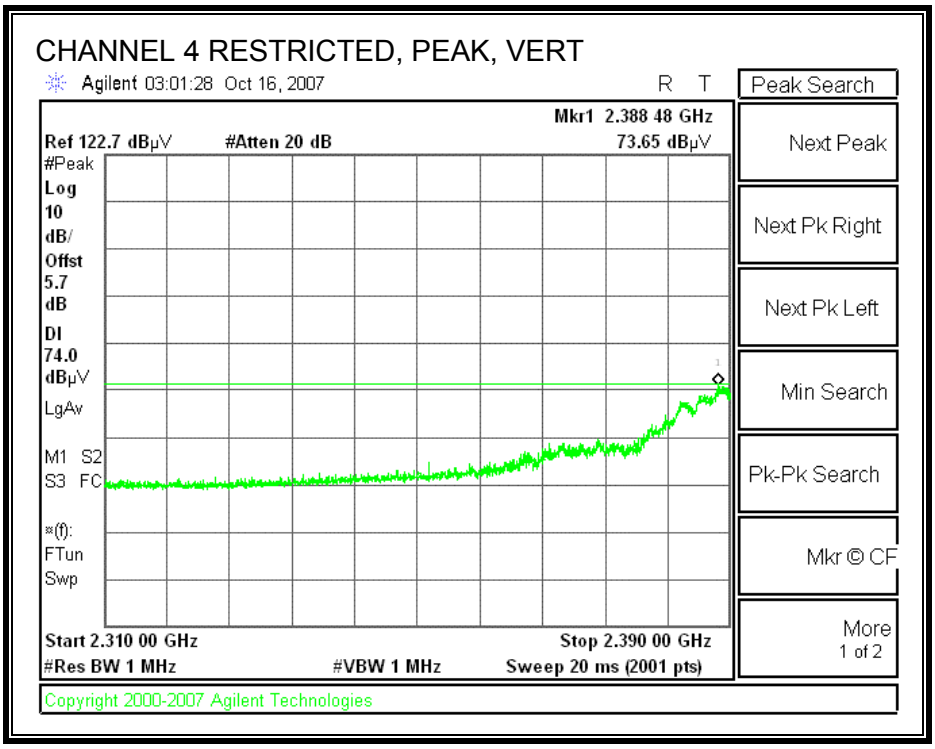
## 8.2.4. TX ABOVE 1 GHz, 802.11n HT40 MODE, 2.4 GHz

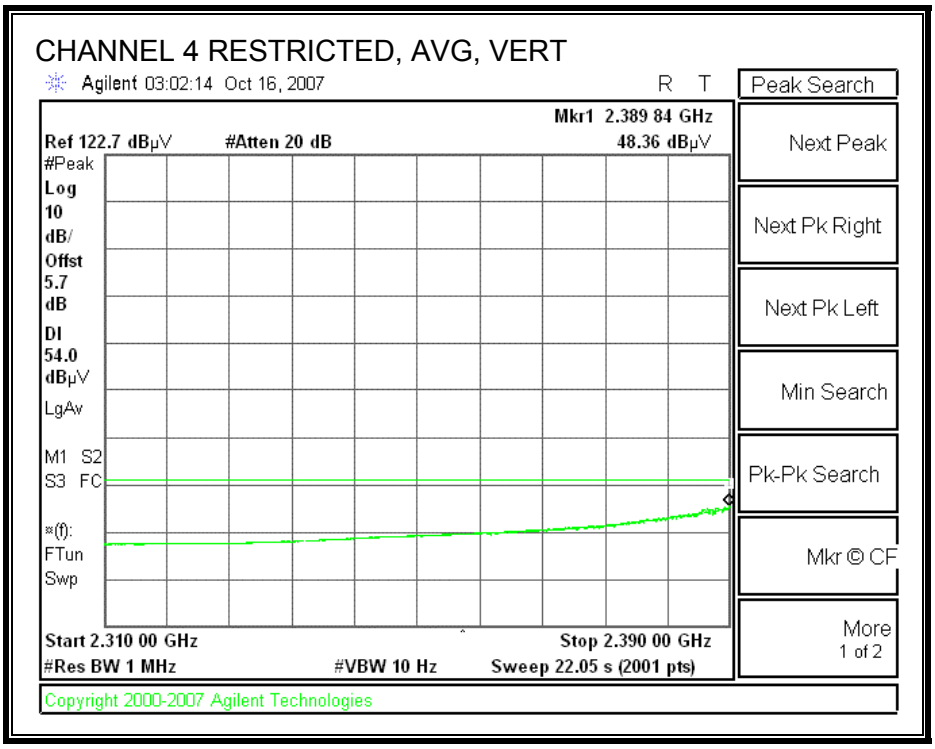
**RESTRICTED LOW BANDEDGE (CHANNEL 3, VERTICAL)**



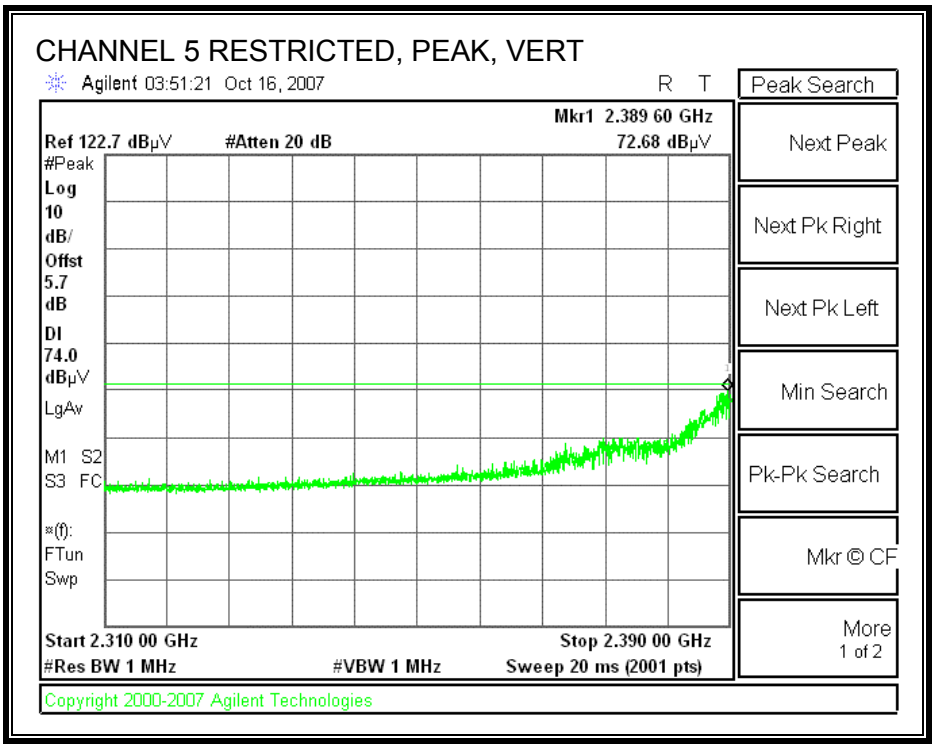



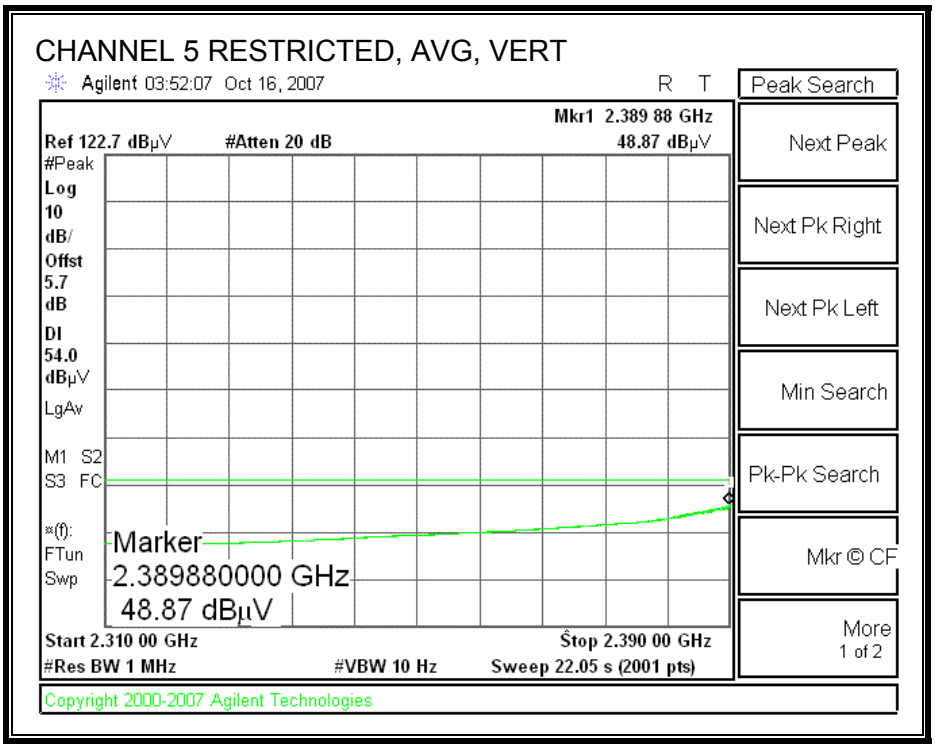
**RESTRICTED LOW BANDEDGE (CHANNEL 4, VERTICAL)**



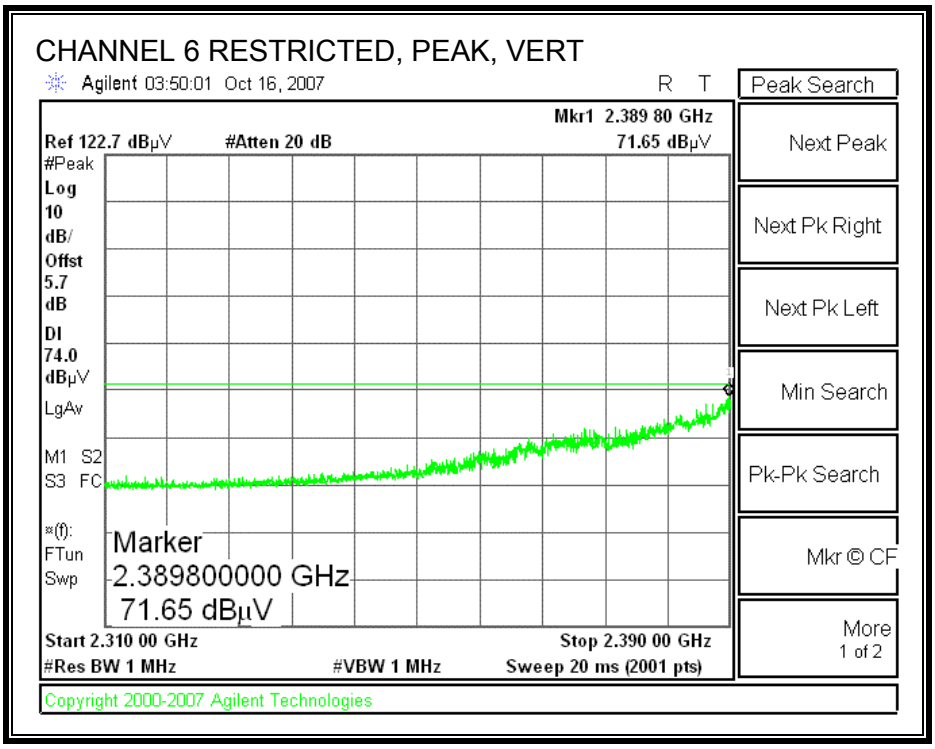



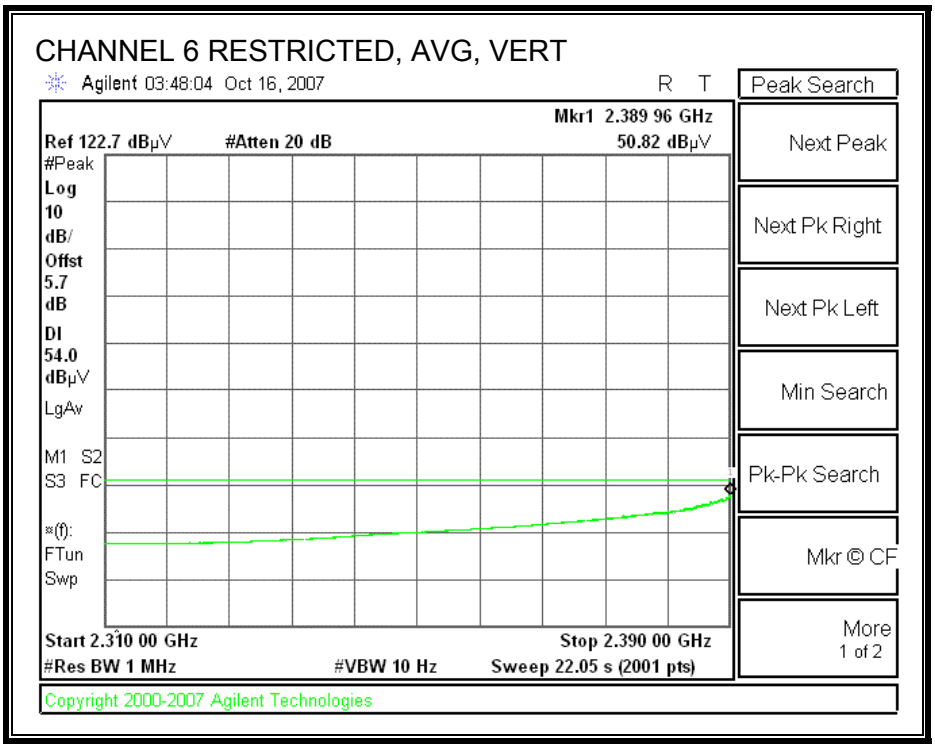
**RESTRICTED LOW BANDEDGE (CHANNEL 5, VERTICAL)**



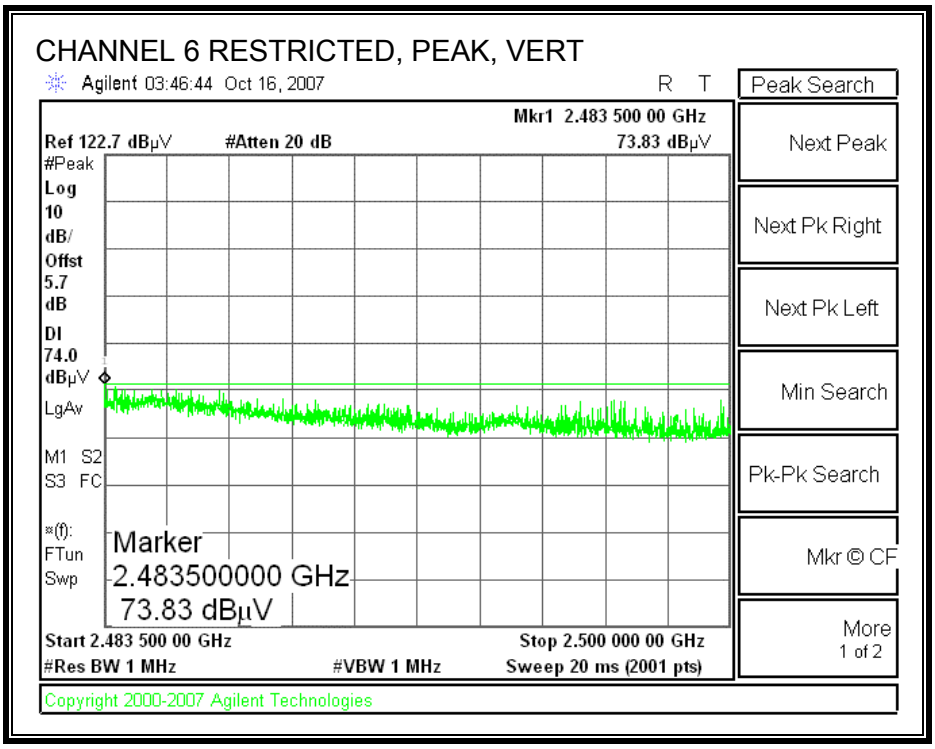



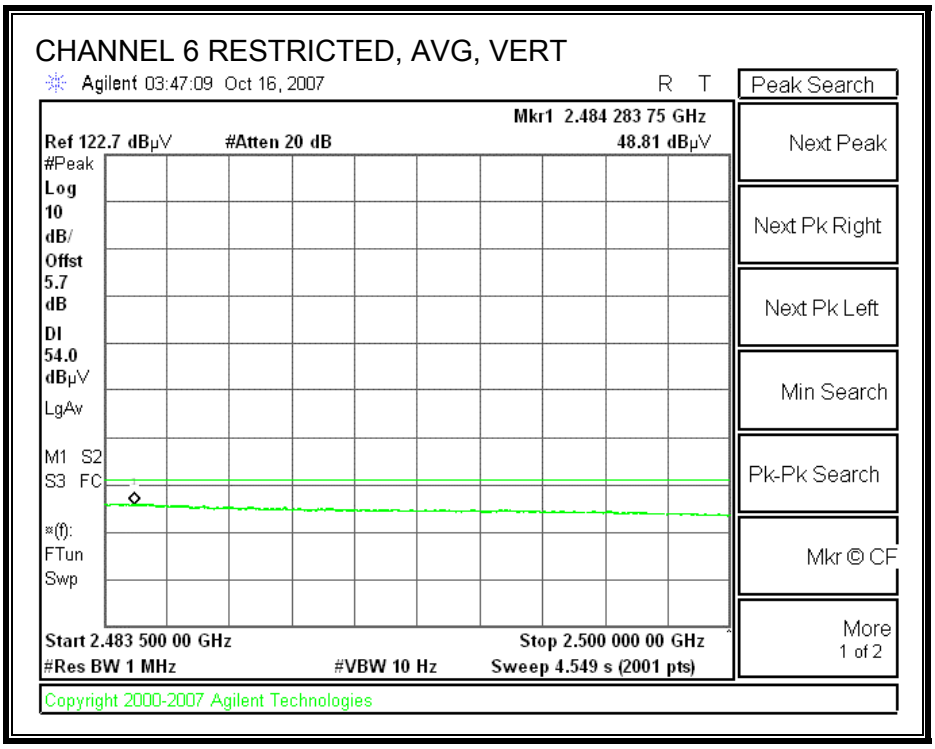
**RESTRICTED LOW BANDEDGE (CHANNEL 6, VERTICAL)**



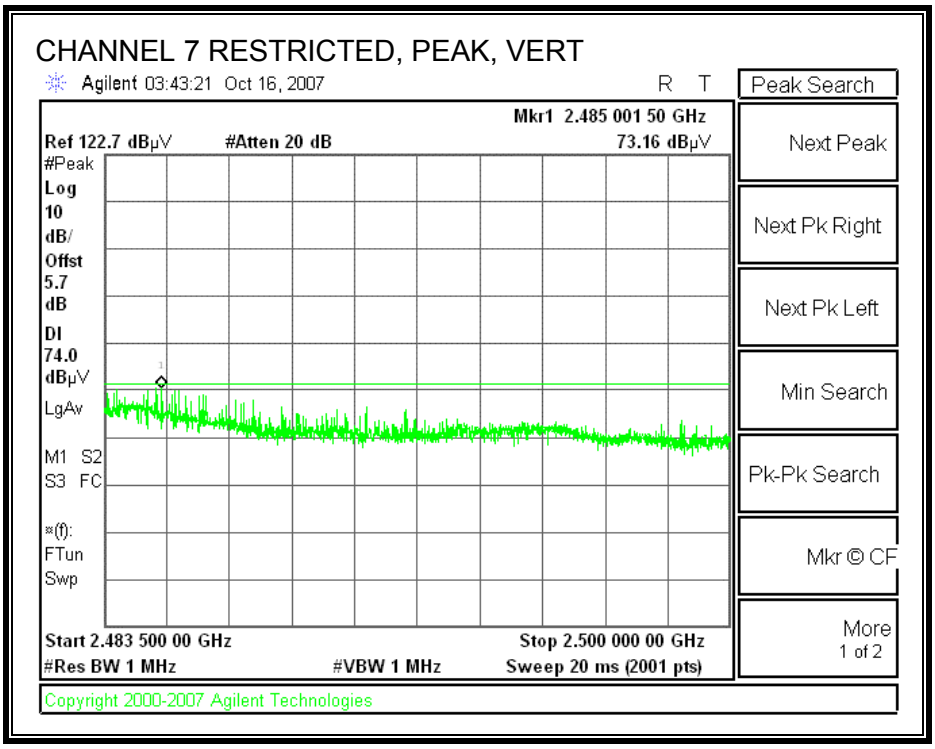



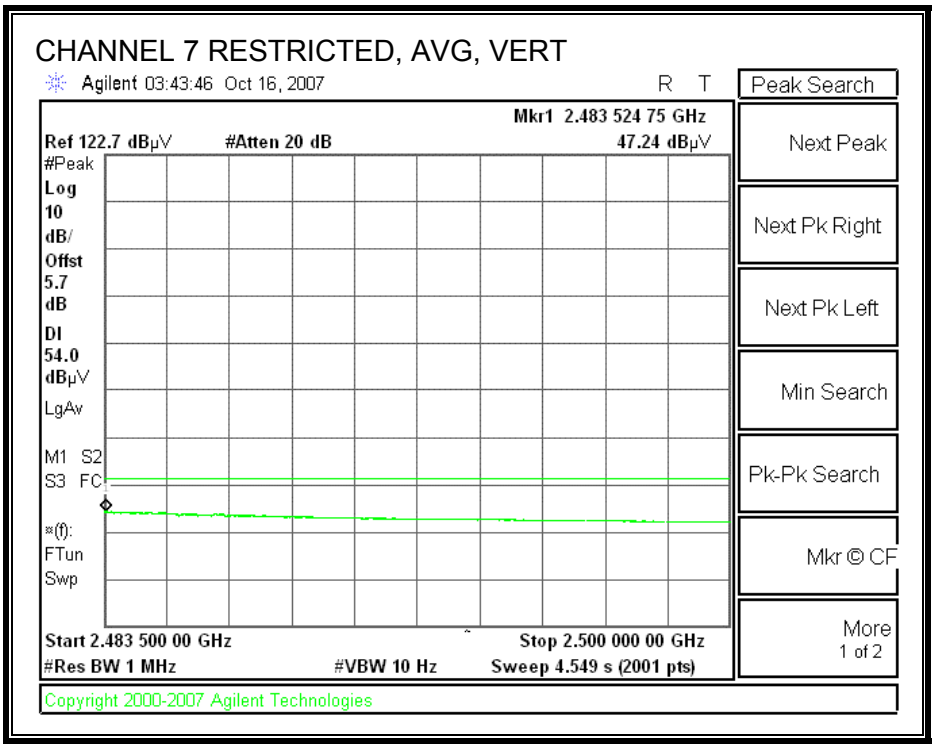
**RESTRICTED HIGH BANDEDGE (CHANNEL 6, VERTICAL)**



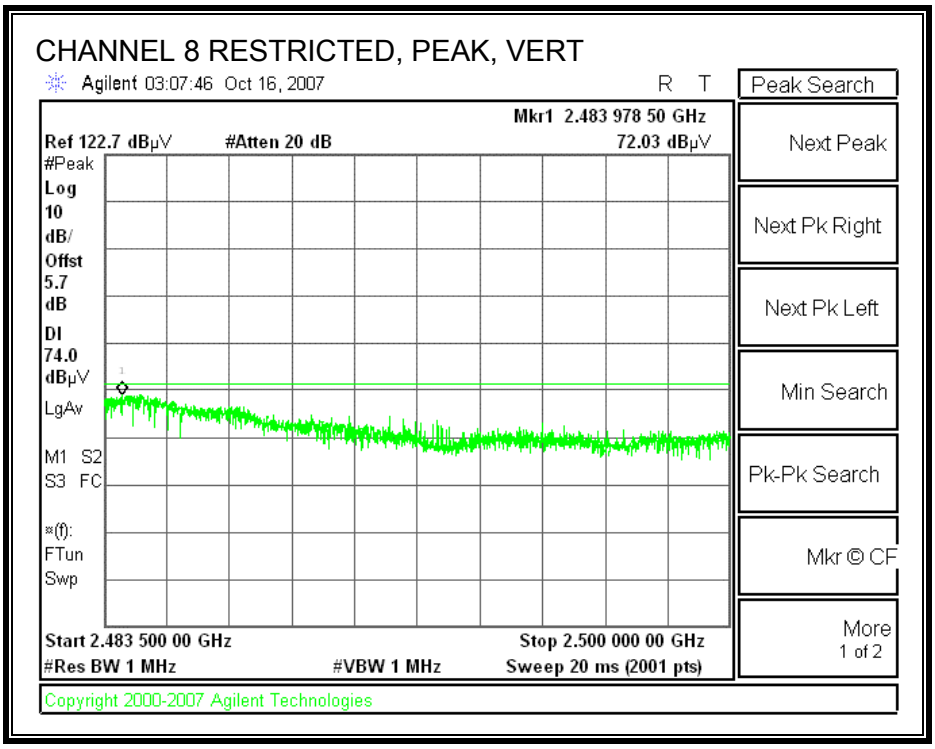



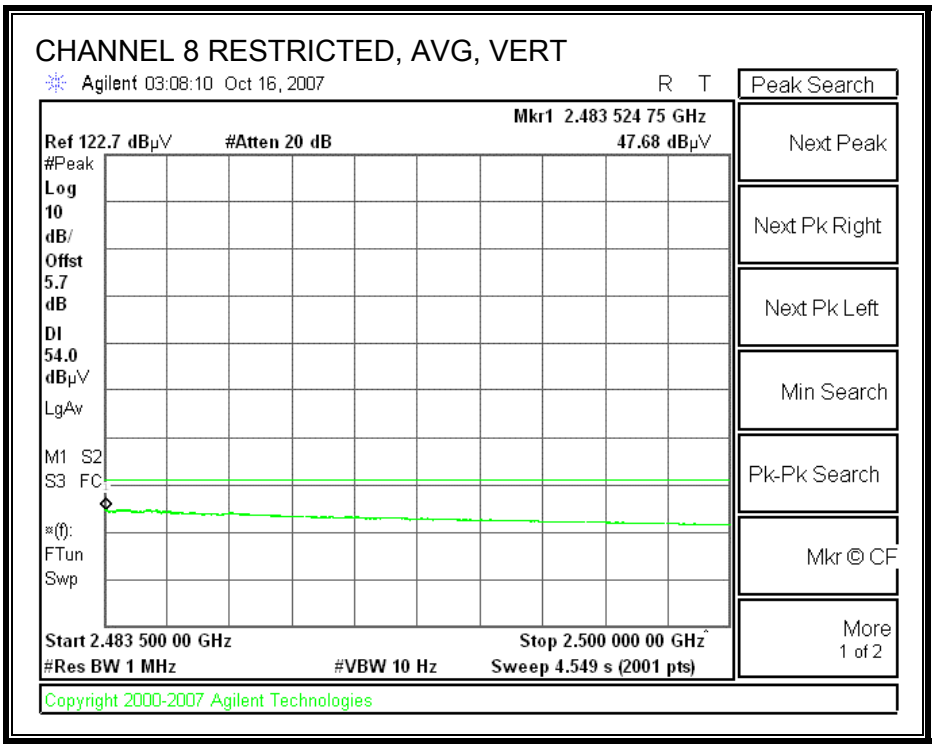
**RESTRICTED HIGH BANDEDGE (CHANNEL 7, VERTICAL)**



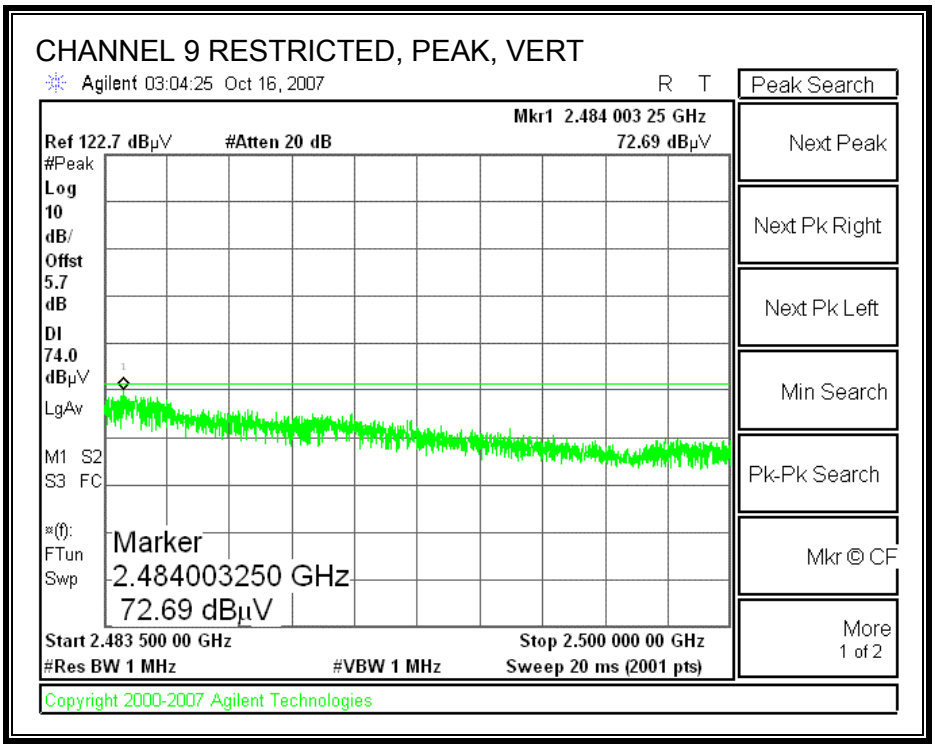



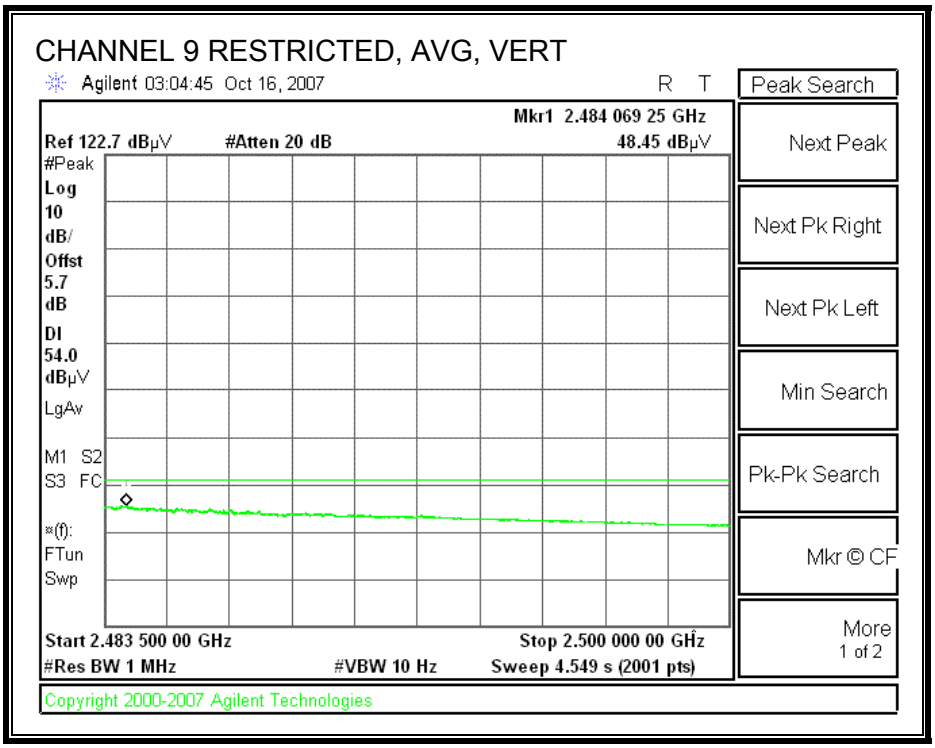
**RESTRICTED HIGH BANDEDGE (CHANNEL 8, VERTICAL)**



**RESTRICTED HIGH BANDEDGE (CHANNEL 9, VERTICAL)**



## HARMONICS AND SPURIOUS EMISSIONS

**High Frequency Measurement**
**Compliance Certification Services, Fremont 5m Chamber**

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/16/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 2.4GHz, g mode, HT40

**Test Equipment:** MB82-031-S0263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | | T89; ARA 18-26GHz; S/N:1049 | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | A-5m Chamber | | R_002 |

**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 Ch. (2422 MHz)** | | | | | | | | | | | | | | | |
| 4.822 | 3.0 | 41.5 | 29.3 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 45.2 | 33.0 | 74 | 54 | -28.8 | -21.0 | V |
| 4.822 | 3.0 | 41.4 | 28.4 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 45.1 | 32.1 | 74 | 54 | -28.9 | -21.9 | H |
| **Mid Ch. (2437 MHz)** | | | | | | | | | | | | | | | |
| 4.851 | 3.0 | 42.4 | 28.4 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 46.1 | 32.1 | 74 | 54 | -27.9 | -21.9 | V |
| 4.851 | 3.0 | 40.8 | 28.4 | 33.3 | 6.9 | -36.5 | 0.0 | 0.0 | 44.6 | 32.2 | 74 | 54 | -29.4 | -21.8 | H |
| **Hi Ch. (2452 MHz)** | | | | | | | | | | | | | | | |
| 4.883 | 3.0 | 41.6 | 28.5 | 33.4 | 6.9 | -36.5 | 0.0 | 0.0 | 45.4 | 32.4 | 74 | 54 | -28.6 | -21.6 | V |
| 4.883 | 3.0 | 41.5 | 28.3 | 33.4 | 6.9 | -36.5 | 0.0 | 0.0 | 45.4 | 32.1 | 74 | 54 | -28.6 | -21.9 | H |

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

## 8.2.5. TX ABOVE 1 GHz, 802.11a THREE CHAINS LEGACY MODE, 5.8 GHz

**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/17/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 5.8GHz, a mode, 6Mb/s

**Test Equipment:** MB82-031-S0263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | T88 Miteq 26-40GHz | T39; ARA 18-26GHz; S/N:1013 | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | B-5m Chamber | 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 Ch. (5745 MHz)** | | | | | | | | | | | | | | | |
| 11.870 | 3.0 | 41.0 | 27.7 | 37.6 | 12.2 | -35.5 | 0.0 | 0.7 | 56.0 | 42.7 | 74 | 54 | -18.0 | -11.3 | V |
| 11.870 | 3.0 | 41.6 | 29.3 | 37.6 | 12.2 | -35.5 | 0.0 | 0.7 | 56.6 | 44.3 | 74 | 54 | -17.4 | -9.7 | H |
| **Mid Ch. (5785 MHz)** | | | | | | | | | | | | | | | |
| 11.584 | 3.0 | 41.5 | 27.8 | 37.5 | 11.9 | -35.8 | 0.0 | 0.7 | 55.9 | 42.2 | 74 | 54 | -18.1 | -11.8 | V |
| 11.584 | 3.0 | 41.4 | 28.0 | 37.5 | 11.9 | -35.8 | 0.0 | 0.7 | 55.8 | 42.4 | 74 | 54 | -18.2 | -11.6 | H |
| **Hi Ch. (5825 MHz)** | | | | | | | | | | | | | | | |
| 11.645 | 3.0 | 41.9 | 28.5 | 37.5 | 12.0 | -35.7 | 0.0 | 0.7 | 56.4 | 43.0 | 74 | 54 | -17.6 | -11.0 | V |
| 11.645 | 3.0 | 41.8 | 28.9 | 37.5 | 12.0 | -35.7 | 0.0 | 0.7 | 56.3 | 43.4 | 74 | 54 | -17.7 | -10.6 | H |

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

## 8.2.6. TX ABOVE 1 GHz, 802.11n HT20 MODE, 5.8 GHz

**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/17/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 5.8GHz, a mode, HT20

**Test Equipment:** MB82-031-S0263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | T88 Miteq 26-40GHz | T39; ARA 18-26GHz; S/N:1013 | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | B-5m Chamber | 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 Ch. (5745 MHz)** | | | | | | | | | | | | | | | |
| 11.493 | 3.0 | 41.0 | 27.7 | 37.5 | 11.8 | -35.9 | 0.0 | 0.7 | 55.1 | 41.9 | 74 | 54 | -18.9 | -12.1 | V |
| 11.493 | 3.0 | 42.0 | 29.2 | 37.5 | 11.8 | -35.9 | 0.0 | 0.7 | 56.2 | 43.4 | 74 | 54 | -17.8 | -10.6 | H |
| **Mid Ch. (5785 MHz)** | | | | | | | | | | | | | | | |
| 11.569 | 3.0 | 40.8 | 27.8 | 37.5 | 11.9 | -35.8 | 0.0 | 0.7 | 55.1 | 42.1 | 74 | 54 | -18.9 | -11.9 | V |
| 11.569 | 3.0 | 40.9 | 27.9 | 37.5 | 11.9 | -35.8 | 0.0 | 0.7 | 55.3 | 42.3 | 74 | 54 | -18.7 | -11.7 | H |
| **Hi Ch. (5825 MHz)** | | | | | | | | | | | | | | | |
| 11.653 | 3.0 | 41.2 | 28.5 | 37.5 | 12.0 | -35.7 | 0.0 | 0.7 | 55.8 | 43.0 | 74 | 54 | -18.2 | -11.0 | V |
| 11.653 | 3.0 | 41.2 | 28.9 | 37.5 | 12.0 | -35.7 | 0.0 | 0.7 | 55.8 | 43.4 | 74 | 54 | -18.2 | -10.6 | H |

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

## 8.2.7. TX ABOVE 1 GHz, 802.11n HT40 MODE, 5.8 GHz

**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/17/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 5.8GHz, a mode, TH40

**Test Equipment:** MB82-031-S0263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | T88 Miteq 26-40GHz | T39; ARA 18-26GHz; S/N:1013 | FCC 15.209 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | B-5m Chamber | 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 Ch. (5755 MHz)** | | | | | | | | | | | | | | | |
| 11.494 | 3.0 | 41.2 | 27.6 | 37.5 | 11.9 | -35.9 | 0.0 | 0.7 | 55.3 | 41.8 | 74 | 54 | -18.7 | -12.2 | V |
| 11.494 | 3.0 | 41.0 | 27.7 | 37.5 | 11.9 | -35.9 | 0.0 | 0.7 | 55.1 | 41.9 | 74 | 54 | -18.9 | -12.1 | H |
| **Hi Ch. (5795 MHz)** | | | | | | | | | | | | | | | |
| 11.598 | 3.0 | 41.3 | 27.8 | 37.5 | 12.0 | -35.8 | 0.0 | 0.7 | 55.7 | 42.2 | 74 | 54 | -18.3 | -11.8 | V |
| 11.598 | 3.0 | 41.0 | 27.8 | 37.5 | 12.0 | -35.8 | 0.0 | 0.7 | 55.4 | 42.2 | 74 | 54 | -18.6 | -11.8 | H |

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| | | | | | |
|---|---|---|---|---|---|
| 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. RX ABOVE 1 GHz, 20 MHz BANDWIDTH, 2.4 GHz

**High Frequency Measurement**
**Compliance Certification Services, Fremont 5m Chamber**

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/17/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 2.4GHz, Rx mode

**Test Equipment:** MB82-031-S0263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | T88 Miteq 26-40GHz | T39; ARA 18-26GHz; S/N:1013 | RX RSS 210 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | B-5m Chamber | | |

**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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 3.0 | 53.0 | 39.4 | 23.8 | 3.2 | -39.5 | 0.0 | 0.0 | 40.5 | 27.0 | 74 | 54 | -33.5 | -27.0 | V |
| 1.600 | 3.0 | 50.7 | 35.4 | 26.0 | 4.0 | -38.6 | 0.0 | 0.0 | 42.0 | 26.8 | 74 | 54 | -32.0 | -27.2 | V |
| 2.000 | 3.0 | 49.1 | 34.6 | 27.4 | 4.5 | -38.1 | 0.0 | 0.0 | 42.9 | 28.5 | 74 | 54 | -31.1 | -25.5 | V |
| 1.000 | 3.0 | 51.9 | 35.6 | 23.8 | 3.2 | -39.5 | 0.0 | 0.0 | 39.4 | 23.1 | 74 | 54 | -34.6 | -30.9 | H |
| 1.600 | 3.0 | 57.6 | 41.5 | 26.0 | 4.0 | -38.6 | 0.0 | 0.0 | 49.0 | 32.8 | 74 | 54 | -25.0 | -21.2 | H |
| 2.000 | 3.0 | 50.2 | 33.9 | 27.4 | 4.5 | -38.1 | 0.0 | 0.0 | 44.1 | 27.8 | 74 | 54 | -29.9 | -26.2 | H |

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

## 8.3.2. RX ABOVE 1 GHz, 20 MHz BANDWIDTH, 5.8 GHz

**High Frequency Measurement**
**Compliance Certification Services, Fremont 5m Chamber**

**Company:** Atheros
**Project #:** 07U11326
**Date:** 10/17/2007
**Test Engineer:** Mengistu Mekuria
**Configuration:** EUT With DELL Laptop
**Mode:** 5.8GHz, Rx mode

**Test Equipment:** MB82-031-S0263

| Horn 1-18GHz | Pre-amplifer 1-26GHz | Pre-amplifer 26-40GHz | Horn > 18GHz | Limit |
|---|---|---|---|---|
| T73; S/N: 6717 @3m | T144 Miteq 3008A00931 | T88 Miteq 26-40GHz | T39; ARA 18-26GHz; S/N:1013 | RX RSS 210 |

Hi Frequency Cables

| 2 foot cable | 3 foot cable | 12 foot cable | HPF | Reject Filter |
|---|---|---|---|---|
| | | B-5m Chamber | | |

**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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 3.0 | 55.1 | 39.8 | 23.8 | 3.2 | -39.5 | 0.0 | 0.0 | 42.6 | 27.3 | 74 | 54 | -31.4 | -26.7 | V |
| 1.600 | 3.0 | 54.3 | 35.8 | 26.0 | 4.0 | -38.6 | 0.0 | 0.0 | 45.6 | 27.2 | 74 | 54 | -28.4 | -26.8 | V |
| 2.000 | 3.0 | 50.2 | 34.2 | 27.4 | 4.5 | -38.1 | 0.0 | 0.0 | 44.1 | 28.1 | 74 | 54 | -29.9 | -25.9 | V |
| 1.000 | 3.0 | 56.0 | 41.0 | 23.8 | 3.2 | -39.5 | 0.0 | 0.0 | 43.5 | 28.5 | 74 | 54 | -30.5 | -25.5 | H |
| 1.600 | 3.0 | 52.8 | 36.2 | 26.0 | 4.0 | -38.6 | 0.0 | 0.0 | 44.1 | 27.6 | 74 | 54 | -29.9 | -26.4 | H |
| 2.000 | 3.0 | 49.9 | 34.2 | 27.4 | 4.5 | -38.1 | 0.0 | 0.0 | 43.8 | 28.0 | 74 | 54 | -30.2 | -26.0 | H |

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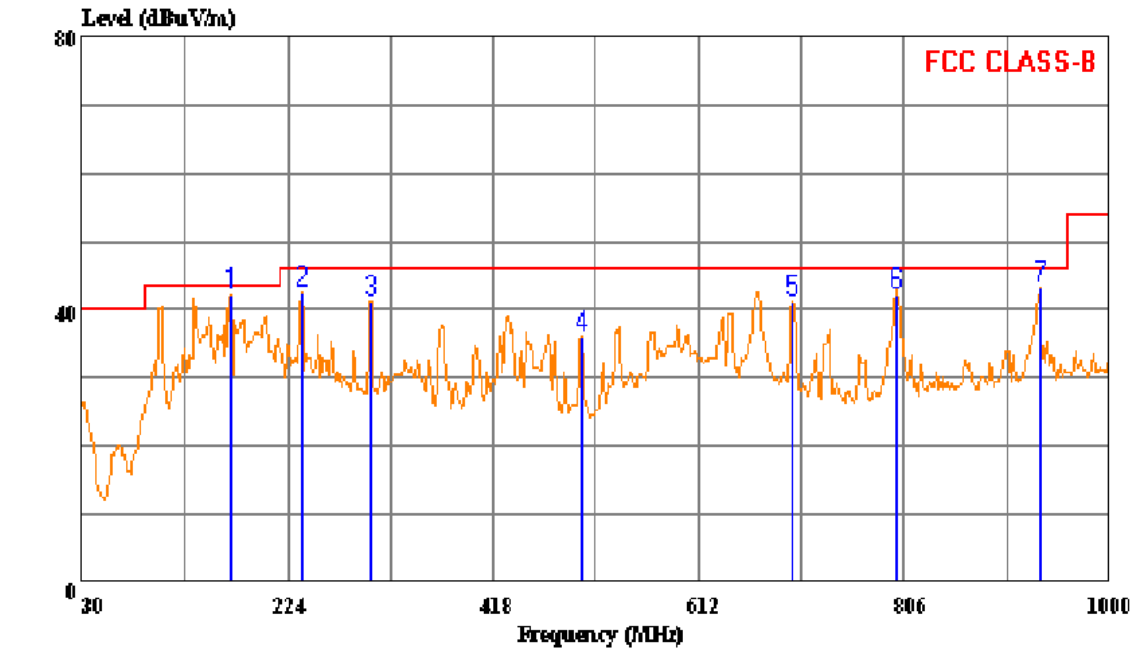
| | | | | | |
|---|---|---|---|---|---|
| f | Measurement Frequency | Amp | Preamp Gain | Avg Lim | Average Field Strength Limit |
| Dist | Distance to Antenna | D Corr | Distance Correct to 3 meters | Pk Lim | Peak Field Strength Limit |
| Read | Analyzer Reading | Avg | Average Field Strength @ 3 m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

## 8.4. WORST-CASE BELOW 1 GHz

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

HORIZONTAL DATA




Trace: 15 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Engineer: : Devin Chang
Company: : ATHEROS
Project #: : 07U11326
Test Configuration:: Laptop with EUT
: MB82-031S0263
Mode of operation: : Tx Worst case mode
Test Target: : FCC Class B

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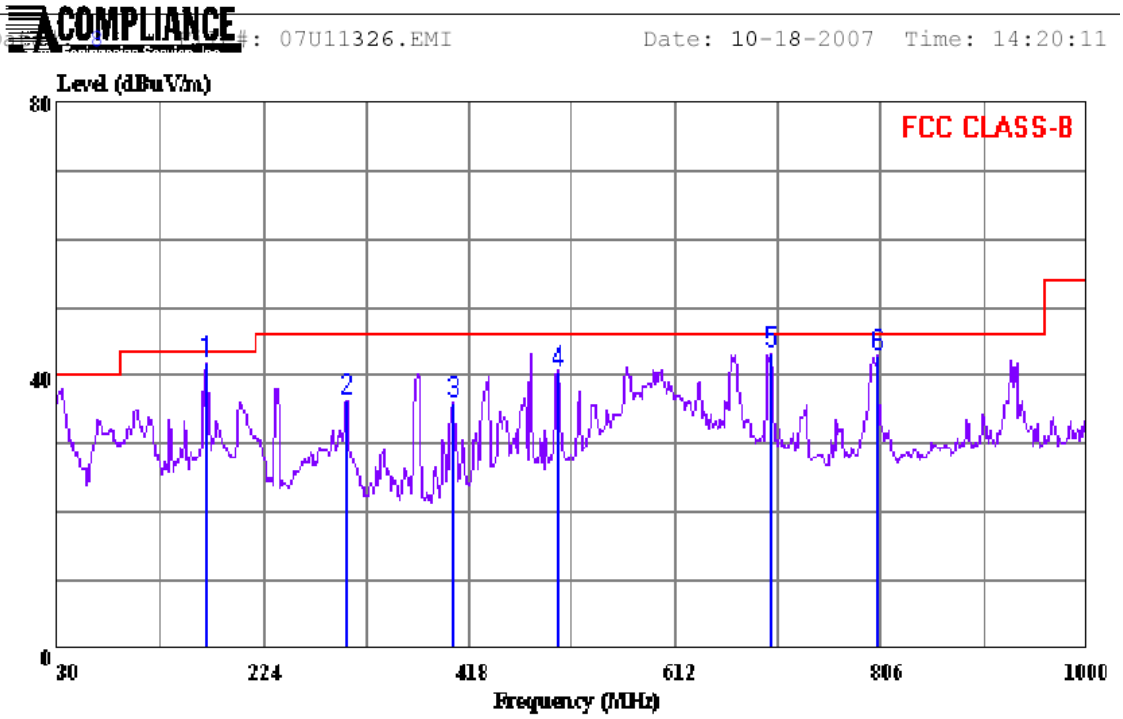
| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 169.680 | 60.29 | -18.11 | 42.18 | 43.50 | -1.32 | Peak Laptop Noise |
| 2 | 237.580 | 60.75 | -18.21 | 42.54 | 46.00 | -3.46 | Peak Laptop Noise |
| 3 | 302.570 | 57.05 | -15.76 | 41.29 | 46.00 | -4.71 | Peak |
| 4 | 502.390 | 47.34 | -11.30 | 36.04 | 46.00 | -9.96 | Peak |
| 5 | 701.240 | 49.66 | -8.47 | 41.19 | 46.00 | -4.81 | Peak |
| 6 | 799.210 | 49.27 | -6.87 | 42.40 | 46.00 | -3.60 | Peak |
| 7 | 934.040 | 47.47 | -4.31 | 43.16 | 46.00 | -2.84 | Peak Laptop Noise |

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

VERTICAL DATA




Trace: 7 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Engineer: : Devin Chang
Company: : ATHEROS
Project #: : 07U11326
Test Configuration:: Laptop with EUT
: MB82-031S0263
Mode of operation: : Tx Worst case mode
Test Target: : FCC Class B

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| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark |
|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 169.680 | 59.86 | -18.11 | 41.75 | 43.50 | -1.75 | Peak Laptop noise |
| 2 | 302.570 | 52.08 | -15.76 | 36.32 | 46.00 | -9.68 | Peak |
| 3 | 402.480 | 49.21 | -13.33 | 35.88 | 46.00 | -10.12 | Peak |
| 4 | 501.420 | 51.94 | -11.31 | 40.63 | 46.00 | -5.37 | Peak |
| 5 | 703.180 | 51.64 | -8.35 | 43.29 | 46.00 | -2.71 | Peak |
| 6 | 803.090 | 49.59 | -6.82 | 42.77 | 46.00 | -3.23 | Peak |

# 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

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

## RESULTS

## 6 WORST EMISSIONS

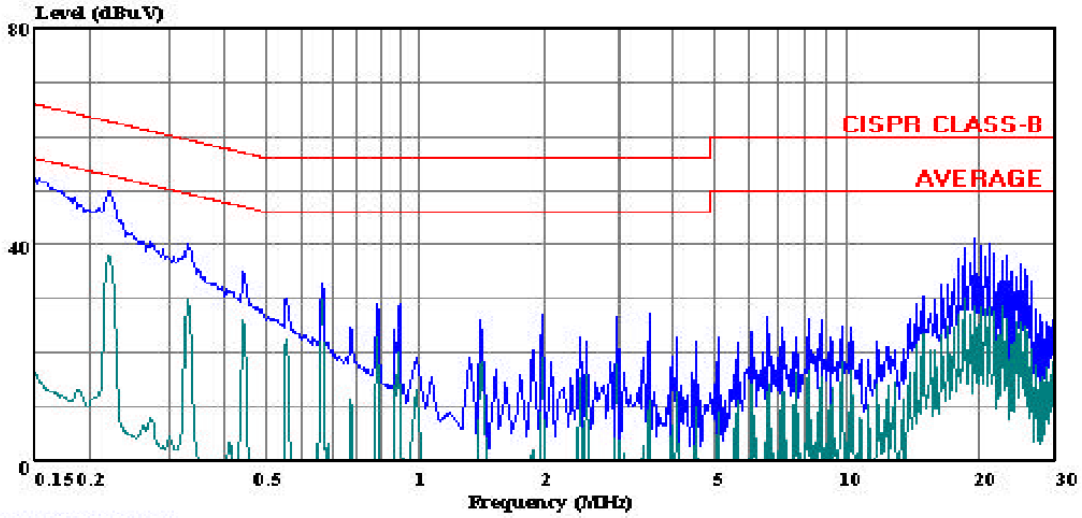
CONDUCTED EMISSIONS DATA (115VAC 60Hz)

| Freq. | Reading | | | Closs | Limit | FCC_B | Margin | | Remark |
|---|---|---|---|---|---|---|---|---|---|
| (MHz) | PK (dBuV) | QP (dBuV) | AV (dBuV) | (dB) | QP | AV | QP (dB) | AV (dB) | L1 / L2 |
| 0.22 | 49.82 | -- | 37.57 | 0.00 | 62.86 | 52.86 | -13.04 | -15.29 | L1 |
| 0.33 | 40.04 | -- | 29.63 | 0.00 | 59.45 | 49.45 | -19.41 | -19.82 | L1 |
| 19.74 | 41.16 | -- | 32.82 | 0.00 | 60.00 | 50.00 | -18.84 | -17.18 | L1 |
| 0.22 | 49.40 | -- | 35.52 | 0.00 | 62.78 | 52.78 | -13.38 | -17.26 | L2 |
| 0.33 | 39.29 | -- | 26.82 | 0.00 | 59.38 | 49.38 | -20.09 | -22.56 | L2 |
| 18.72 | 32.84 | -- | 24.81 | 0.00 | 60.00 | 50.00 | -27.16 | -25.19 | 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#: 38 File#: 07u11326.EMI Date: 10-23-2007 Time: 19:41:47




(Line Conduction)

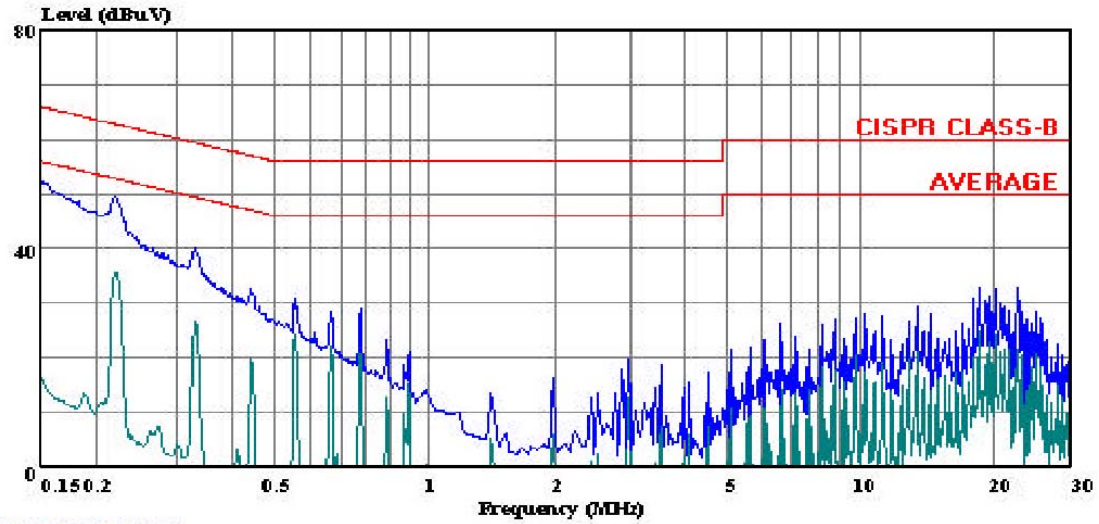
Trace: 36 Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Devin Chang
Project #: : 07U11326
Company: : Atheros
Configuration:: EUT with laptop
Mode: : Worst case mode
Target: : CISPR Class B
Voltage: : 115VAC / 50Hz
: L1: PEAK (Blue); AVG. (Green)

**LINE 2 RESULTS**

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

Data#: 28 File#: 07u11326.EMI Date: 10-23-2007 Time: 19:24:33




(Line Conduction)

Trace: 26 Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Devin Chang
Project #: : 07U11326
Company: : Atheros
Configuration:: EUT with laptop
Mode: : Worst case mode
Target: : CISPR Class B
Voltage: : 115VAC / 50Hz
: L2: PEAK (Blue); AVG. (Green)

# 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).

**CALCULATIONS**

Given

$E = \sqrt{(30 * P * G) / d}$

and

$S = E ^ 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain yields:

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Rearranging terms to calculate the power density at a specific distance yields

$S = 0.0795 * 10 ^ ((P + G) / 10) / (d^2)$

The power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by a factor of 10.

**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**

(MPE distance equals 20 cm)

| Mode | Band | MPE Distance (cm) | Output Power (dBm) | Antenna Gain (dBi) | FCC Power Density (mW/cm^2) | IC Power Density (W/m^2) |
|---|---|---|---|---|---|---|
| 802.11b | 2.4 GHz | 20.0 | 27.75 | 7.77 | 0.71 | 7.08 |
| 802.11g | 2.4 GHz | 20.0 | 26.78 | 7.77 | 0.57 | 5.67 |
| 802.11n H20 | 2.4 GHz | 20.0 | 26.63 | 3.00 | 0.18 | 1.83 |
| 802.11n H40 | 2.4 GHz | 20.0 | 27.32 | 3.00 | 0.21 | 2.14 |

| Mode | Band | MPE Distance (cm) | Output Power (dBm) | Antenna Gain (dBi) | FCC Power Density (mW/cm^2) | IC Power Density (W/m^2) |
|---|---|---|---|---|---|---|
| 802.11a | 5.8 GHz | 20.0 | 24.89 | 9.77 | 0.58 | 5.81 |
| 802.11n H20 | 5.8 GHz | 20.0 | 24.79 | 5.00 | 0.19 | 1.89 |
| 802.11n H40 | 5.8 GHz | 20.0 | 24.74 | 5.00 | 0.19 | 1.87 |

The power level used for MPE calculations is the sum of the power of all transmitter chains. Since the antennas are identical for each transmitter this is equivalent to summing the power density of all transmitters. All three antennas are assumed to be at the same location to give a worst-case estimate of the total power density at a distance of 20 cm from this point. For 802.11abg transmissions the effective legacy mode antenna gain is used (this effective gain assumes that the legacy signals are coherent thus add in voltage). For 802.11n transmissions the signals are not coherent therefore they add in power and the normal antenna gain is applicable.